

# ENGINE MECHANICAL

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**EM**

The 3S-FE engine is an in-line 4-cylinder engine with the cylinders numbered 1 – 2 – 3 – 4 from the front. The crankshaft is supported by 5 bearings specified by the inside of the crankcase. These bearings are made of aluminum alloy.

The crankshaft is integrated with 8 weights which are cast with it for balancing. Oil holes are made in the center of the crankshaft to supply oil to the connecting rods, bearings, pistons and other components.

The ignition order is 1 – 3 – 4 – 2. 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 chamber.

The intake manifold has 8 independent long ports and utilizes the inertial supercharging effect to improve engine torque at low and medium speeds.

Exhaust and intake valves are equipped with irregular pitch springs made of special valve spring carbon steel which are capable of following no matter what the engine speed.

The intake side camshaft is driven by a timing belt, and a gear on the intake side camshaft engages with a gear on the exhaust side camshaft to drive it. The cam journal is supported at 5 places between the valve lifters of each cylinder and on the front end of the cylinder head. Lubrication of the cam journal and gear 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 composed of 2 pieces. A service hole is provided in the No. 1 belt cover for adjusting the timing belt tension.

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

Piston pins are the semi-floating type, with the pins fastened to the connecting rods by pressure fitting, allowing the pistons and pins to float.

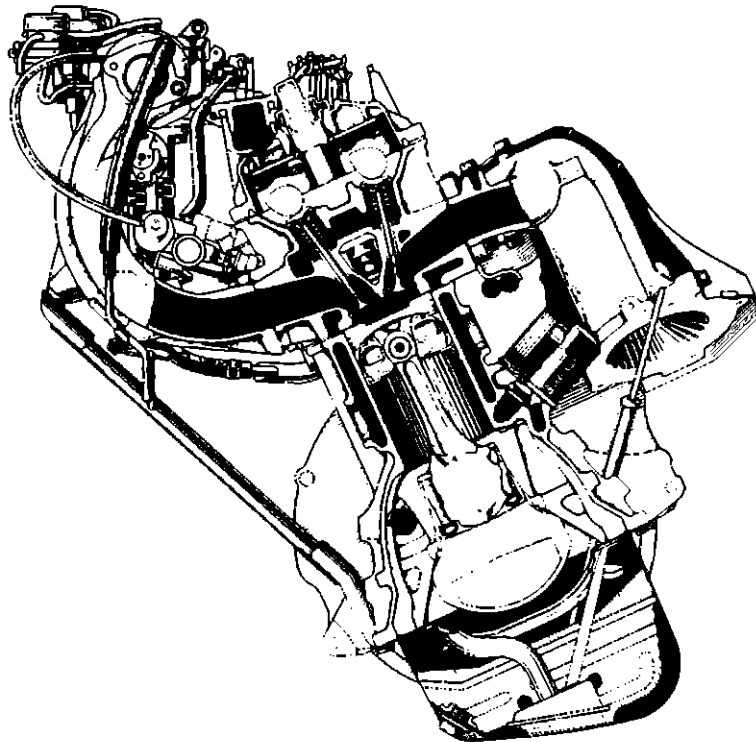
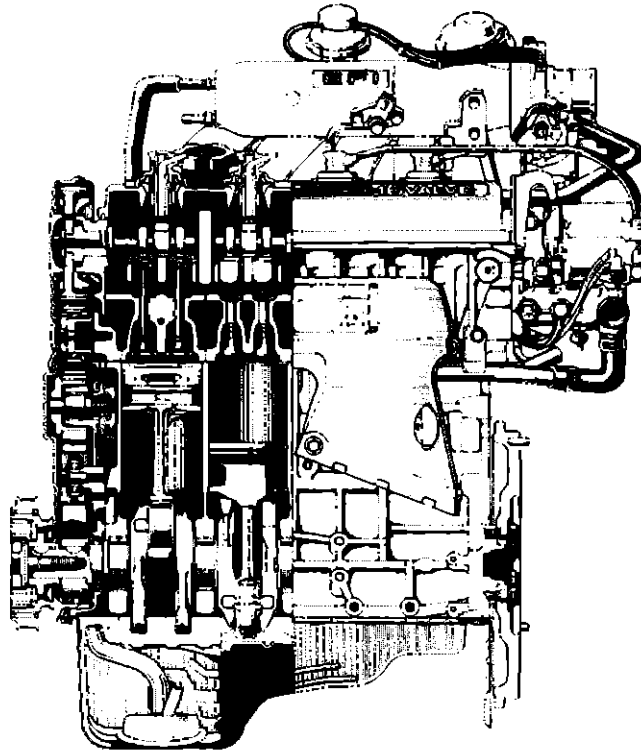
The No. 1 compression ring is made of steel and the No. 2 compression ring is made of cast iron. The oil ring is made of a combination of steel and stainless steel. The outer diameter of each piston ring is slightly larger than the diameter of the piston and the flexibility of the rings allows them to 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 oil ring works to scrape oil off the cylinder walls to prevent it from entering the combustion chambers.

The cylinder block is made of cast iron. It has 4 cylinders which are approximately 2 times the length of the piston stroke. The top of the cylinders 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 cylinder.

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.

## DESCRIPTION (3S-FE)

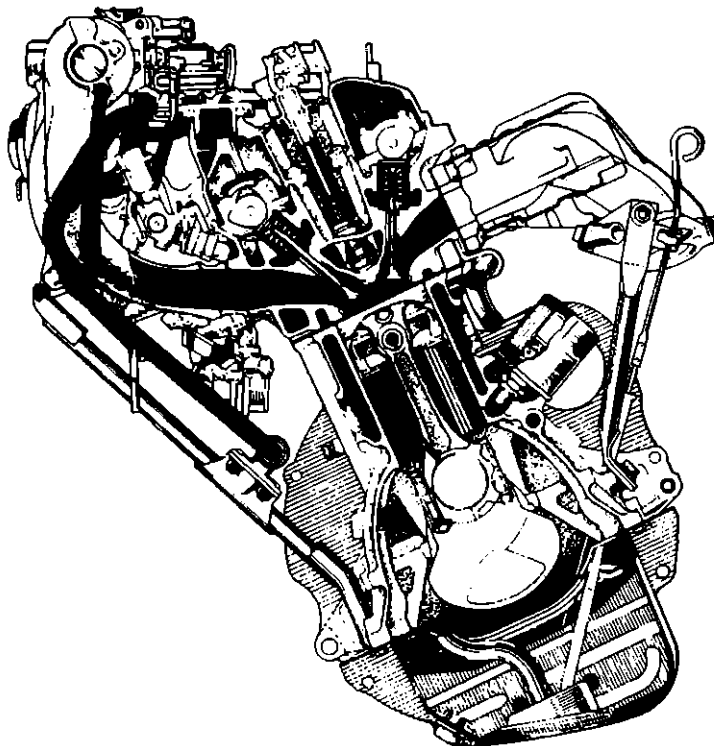
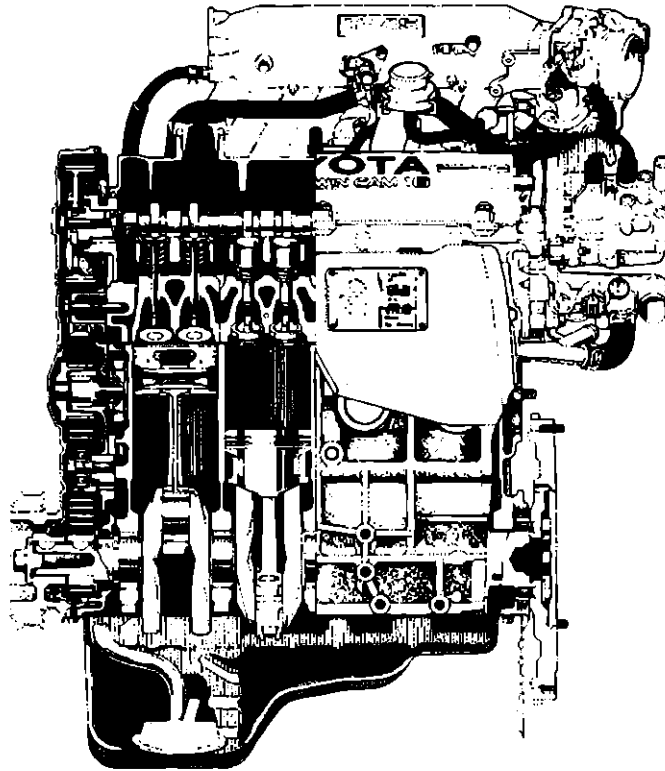
The 3S-FE engine is an in-line 4-cylinder 2.0 liter DOHC 16 valve engine.



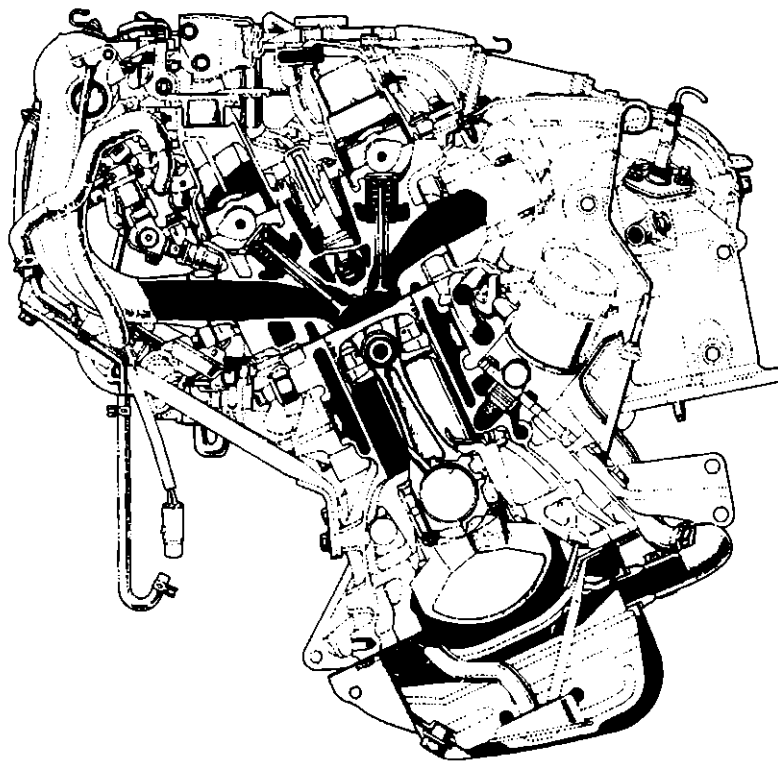
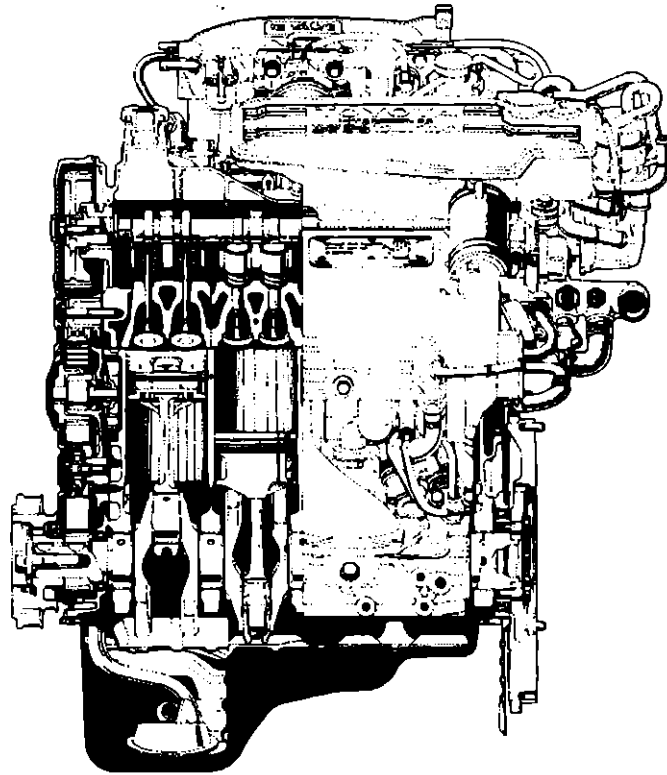
# DESCRIPTION (3S-GE and 3S-GTE)

The 3S-GE and 3S-GTE engines are an in-line 4-cylinder 2.0 liter DOHC 16 valve engine.

3S-GE



3S-GTE



The 3S-GE and 3S-GTE engines are an in-line 4-cylinder engine with the cylinders numbered 1 — 2 — 3 — 4 from the front. The crankshaft is supported by 5 bearings specified by the inside of the crankcase. These bearings are made of aluminum alloy.

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

This engine's ignition order is 1 — 3 — 4 — 2. 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.

The intake manifold has 8 independent long ports and utilizes the inertial super-charging effect to improve engine torque at low and medium speeds.

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

Both the exhaust side camshaft and the intake side camshaft are driven by a single timing belt. The cam journal is supported at 5 places between the valve lifters of each cylinder and on the front end of 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 composed of 2 pieces. A service hole is provided in the No.2 belt cover for adjusting the timing belt tension.

Pistons are made of highly temperature-resistant aluminum alloy, and a depression is 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 steel and the No.2 compression ring is made of cast iron. The oil ring is made of a combination of steel and 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 4 cylinders which are approximately 2 times the length of the piston stroke. The top of the cylinders 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****ENGINE OVERHEATING**

Problem	Possible cause	Remedy	Page
Engine overheats	Cooling system faulty Incorrect ignition timing	Troubleshoot cooling system Reset timing	CO-5 IG-17, 20

**HARD STARTING**

Problem	Possible cause	Remedy	Page
Engine will not crank or cranks slowly	Starting system faulty	Troubleshoot starting system	ST-2
Engine will not start/hard to start (cranks OK)	No fuel supply to injector <ul style="list-style-type: none"> <li>● No fuel in tank</li> <li>● Fuel pump no working</li> <li>● Fuel filter clogged</li> <li>● Fuel line clogged or leaking</li> </ul> EFI system problems Ignition problems <ul style="list-style-type: none"> <li>● Ignition coil</li> <li>● Igniter</li> <li>● Distributor</li> </ul> Spark plug faulty High-tension cords disconnected or broken Vacuum leaks <ul style="list-style-type: none"> <li>● PCV line</li> <li>● EGR line</li> <li>● Intake manifold</li> <li>● Air intake chamber</li> <li>● Intake air control valve (3S-GE and 3S-GTE)</li> <li>● Throttle body</li> <li>● ISC valve (3S-FE and 3S-GTE)</li> <li>● Brake booster line</li> </ul> Pulling in air between air flow meter and throttle body Low compression	Troubleshoot EFI system  Repair as necessary Perform spark test  Inspect plugs Inspect cords Repair as necessary  Repair as necessary  Check compression	FI-11  IG-5, 9  IG-6, 10 IG-6, 10  EM-25

**ROUGH IDLING**

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses	Spark plug faulty High-tension cord faulty Ignition problems <ul style="list-style-type: none"> <li>● Ignition coil</li> <li>● Igniter</li> <li>● Distributor</li> </ul> Incorrect ignition timing Vacuum leaks <ul style="list-style-type: none"> <li>● PCV line</li> <li>● EGR line</li> <li>● Intake manifold</li> </ul>	Inspect plugs Inspect cords  Inspect coil Inspect igniter Inspect distributor Reset timing Repair as necessary	IG-6, 10 IG-6, 10  IG-7, 12 IG-8, 12 IG-7, 12 IG-17, 20

**ENGINE DIESELING**

Problem	Possible cause	Remedy	Page
Engine diesels (runs after ignition switch is turned off)	EFI system problems Incorrect ignition timing EGR system faulty	Repair as necessary Reset timing Check EGR system	IG-17, 20 EC-8,19,30

**AFTER FIRE, BACKFIRE**

Problem	Possible cause	Remedy	Page
Muffler explosion (after fire) on deceleration only	Deceleration fuel cut system always off	Check EFI (fuel cut) system	
Muffler explosion (after fire) all the time	Air cleaner clogged EFI system problem Incorrect ignition timing	Check air cleaner Repair as necessary Reset timing	MA-5 IG-17, 20
Engine backfires	EFI system problem Vacuum leak <ul style="list-style-type: none"> <li>● PCV line</li> <li>● EGR line</li> <li>● Intake manifold</li> <li>● Air intake chamber</li> <li>● Intake air control valve (3S-GE and 3S-GTE)</li> <li>● Throttle body</li> <li>● ISC valve (3S-FE and 3S-GTE)</li> <li>● Brake booster line</li> </ul> Pulling in air between air flow meter and throttle body Insufficient fuel flow Incorrect ignition timing Incorrect valve clearance Carbon deposits in combustion chambers	Repair as necessary Check hoses and repair as necessary  Repair as necessary  Troubleshoot fuel system Reset timing Adjust valve clearance Inspect cylinder head	     FI-11 IG-17, 20 EM-12, 16 EM-63, 95

**EXCESSIVE OIL CONSUMPTION**

Problem	Possible cause	Remedy	Page
Excessive oil consumption	Oil leak PCV line clogged Piston ring worn or damaged Valve stem and guide bushing worn Valve stem oil seal worn	Repair as necessary Check PCV system Check rings Check valves and guide bushing Check seals	EM-119 EM-64, 96



**ROUGH IDLING (Cont'd)**

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses (Cont'd)	<ul style="list-style-type: none"> <li>● Air intake chamber</li> <li>● Intake air control valve (3S-GE and 3S-GTE)</li> <li>● Throttle body</li> <li>● ISC valve (3S-FE and 3S-GTE)</li> <li>● Brake booster line</li> </ul> Pulling in air between air flow meter and throttle body Incorrect idle speed  Incorrect valve clearance EFI system problems Engine overheats Low compression	Check ISC system (3S-FE and 3S-GTE) Adjust idle speed (3S-GE) Adjust valve clearance Repair as necessary Check cooling system Check compression	FI-127, 129  MA-7 EM-12, 16 CO-5 EM-25

**ENGINE HESITATES/POOR ACCELERATION**

Problem	Possible cause	Remedy	Page
Engine hesitates/poor acceleration	Spark plug faulty High-tension cord faulty Vacuum leaks <ul style="list-style-type: none"> <li>● PCV line</li> <li>● EGR line</li> <li>● Intake manifold</li> <li>● Air intake chamber</li> <li>● Intake air control valve (3S-GE and 3S-GTE)</li> <li>● Throttle body</li> <li>● ISC valve (3S-FE and 3S-GTE)</li> <li>● Brake booster line</li> </ul> Pulling in air between air flow meter and throttle body Incorrect ignition timing Incorrect valve clearance Fuel system clogged Air cleaner clogged EFI system problems Emission control system problem (cold engine) <ul style="list-style-type: none"> <li>● EGR system always on</li> </ul> Engine overheats Low compression	Inspect plugs Inspect cords Repair as necessary  Repair as necessary  Reset timing Adjust valve clearance Check fuel system Check air cleaner Repair as necessary  Check EGR system Check cooling system Check compression	IG-6, 10 IG-6, 10  IG-17, 20 EM-12, 16  MA-5  EC-8, 19, 30 CO-5 EM-25

**EXCESSIVE FUEL CONSUMPTION**

<b>Problem</b>	<b>Possible cause</b>	<b>Remedy</b>	<b>Page</b>
Poor gasoline mileage	Fuel leak	Repair as necessary	MA-5 IG-17, 20
	Air cleaner clogged	Check air cleaner	
	Incorrect ignition timing	Reset timing	
	EFI system problems	Repair as necessary	FI-127, 129
	<ul style="list-style-type: none"> <li>● Injector faulty</li> <li>● Deceleration fuel cut system faulty</li> </ul>		
	Idle speed too high	Check ISC system (3S-FE and 3S-GTE)	MA-7
		Adjust idle speed (3S-GE)	IG-6, 10
	Spark plug faulty	Inspect plugs	EC-8, 19, 30
	EGR system always on	Check EGR system	EM-25
	Low compression	Check compression	
Tires improperly inflated	Inflate tires to proper pressure		
Clutch slips	Troubleshoot clutch		
Brakes drag	Troubleshoot brakes		

**UNPLEASANT ODOR**

<b>Problem</b>	<b>Possible cause</b>	<b>Remedy</b>	<b>Page</b>
Unpleasant odor	Incorrect idle speed	Check ISC system (3S-FE and 3S-GTE)	FI-127, 129
		Adjust idle speed (3S-GE)	MA-7
	Incorrect ignition timing	Reset timing	IG-17, 20
	Vacuum leaks	Repair as necessary	
	<ul style="list-style-type: none"> <li>● PCV line</li> <li>● EGR line</li> <li>● Intake manifold</li> <li>● Air intake chamber</li> <li>● Intake air control valve (3S-GE and 3S-GTE)</li> <li>● Throttle body</li> <li>● ISC valve (3S-FE and 3S-GTE)</li> <li>● Brake booster line</li> </ul>		
	EFI system problems	Repair as necessary	

## ENGINE TUNE-UP

### INSPECTION OF ENGINE COOLANT

(See steps 1 and 2 on page CO-6)

### INSPECTION OF ENGINE OIL

(See steps 1 and 2 on page LU-6)

### INSPECTION OF BATTERY

(See steps 1 and 2 on page CH-3)

Standard specific gravity:

1.25 — 1.27 when fully charged at 20°C (68°F)

### INSPECTION OF AIR FILTER

(See step 3 on page MA-5)

### INSPECTION OF HIGH-TENSION CORDS

(See page IG-6 or 10)

Maximum resistance: 25 k $\Omega$  per cord

### INSPECTION OF SPARK PLUGS (3S-FE)

(See page IG-6)

Correct electrode gap: 1.1 mm (0.043 in.)

Recommended spark plugs:

ND Q16R-U11  
NGK BCPR5EY11

### INSPECTION OF SPARK PLUGS (3S-GE)

(See page IG-10)

Correct electrode gap of new plug:

1.1 mm (0.043 in.)

Maximum electrode gap: 1.3 mm (0.051 in.)

Recommended spark plugs:

ND PQ16R  
NGK BCPR5EP11

### INSPECTION OF SPARK PLUGS (3S-GTE)

(See page IG-10)

Correct electrode gap of new plug:

0.8 mm (0.031 in.)

Maximum electrode gap: 1.0 mm (0.039 in.)

Recommended spark plugs:

ND PQ16R8  
NGK BCPR5EP8

### INSPECTION OF ALTERNATOR DRIVE BELT

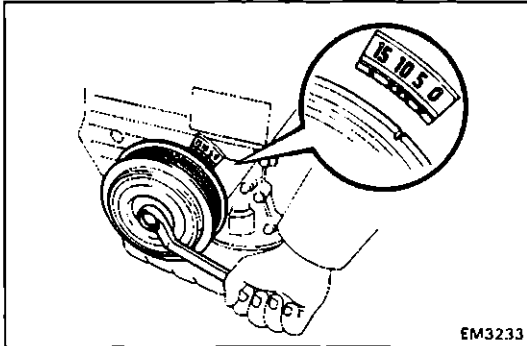
(See step 3 on page CH-3)

Drive belt tension:

3S-FE	w/ Air con.	New belt	175 $\pm$ 5 lb
		Used belt	130 $\pm$ 10 lb
	w/o Air con.	New belt	125 $\pm$ 25 lb
		Used belt	95 $\pm$ 20 lb
3S-GE and 3S-GTE	w/ Air con.	New belt	175 $\pm$ 5 lb
		Used belt	115 $\pm$ 20 lb
	w/o Air con.	New belt	150 $\pm$ 25 lb
		Used belt	130 $\pm$ 25 lb

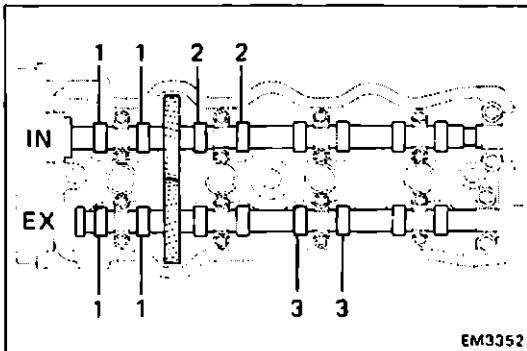
**ADJUSTMENT OF VALVE CLEARANCE (3S-FE)**

NOTE: Adjust the valve clearance while the engine is cold.

**1. REMOVE CYLINDER HEAD COVER (See page EM-58)****2. SET NO.1 CYLINDER TO TDC/COMPRESSION**

- Turn the crankshaft pulley and align its groove with the timing mark "0" of the No.1 timing belt cover.
- Check that the valve lifters on the No.1 cylinder are loose and valve lifters on the No.4 are tight.

If not, turn the crankshaft one revolution (360°) and align the mark as above.

**3. ADJUST VALVE CLEARANCE**

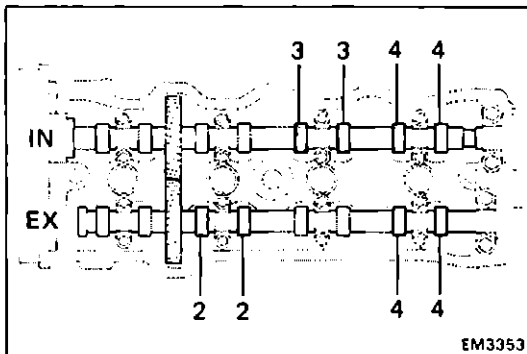
- Check the only those valves indicated as shown.
  - Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
  - Record the valve clearance measurements which are out of specification. they will be used later to determine the required replacement adjusting shim.

**Valve clearance (Cold):**

Intake 0.19 – 0.29 mm (0.007 – 0.011 in.)

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

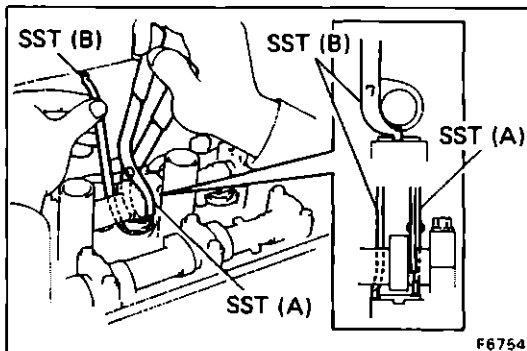
- Turn the crankshaft one revolution (360°) and align the mark as above. (See procedure step 2)
- Check only the valves indicated as shown. Measure the valve clearance. (See procedure step (a))

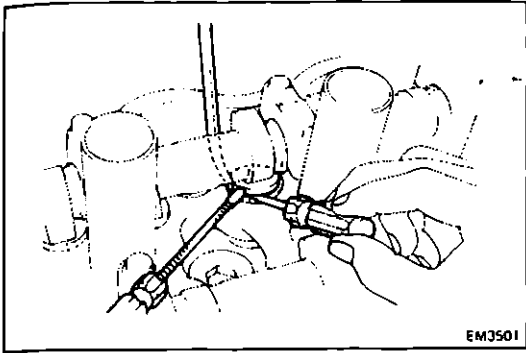
**(d) Remove the adjusting shim.**

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

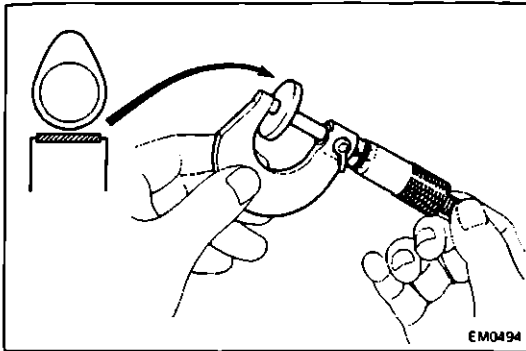
SST 09248-55010

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





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



- (e) Determine the replacement adjusting shim size following Formula or Charts:

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

T ..... Thickness of used shim

A ..... Measured valve clearance

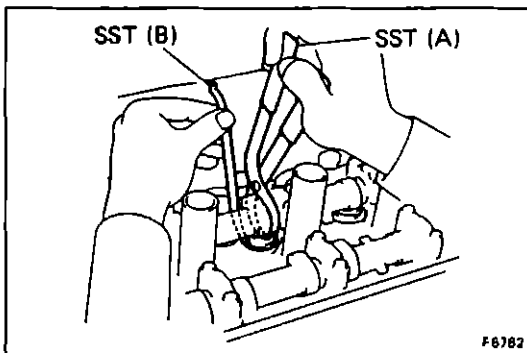
N ..... Thickness of new shim

**Intake**     $N = T + (A - 0.24 \text{ mm (0.009 in.)})$

**Exhaust**    $N = T + (A - 0.33 \text{ mm (0.013 in.)})$

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

NOTE: Shims are available in seventeen sizes of 0.05 mm (0.0020 in.), from 2.50 mm (0.0984 in.) to 3.30 mm (0.1299 in.).



- (f) 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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- (g) Recheck the valve clearance.

#### 4. REINSTALL CYLINDER HEAD COVER (See page EM-76)

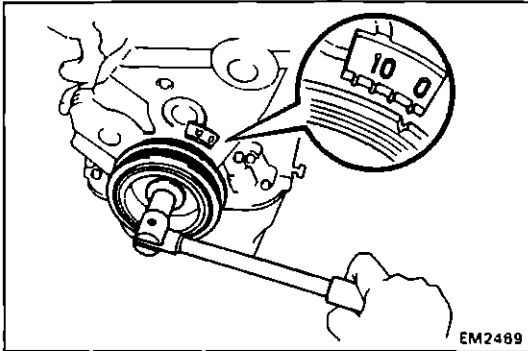




## ADJUSTMENT OF VALVE CLEARANCE (3S-GE and 3S-GTE)

NOTE: Adjust the valve clearance while the engine is cold.

1. (3S-GTE)  
REMOVE THROTTLE BODY  
(See steps 1 to 10 on page FI-124)
2. (3S-GTE)  
REMOVE NO.2 TIMING BELT COVER  
(See step 13 on page EM-39)
3. REMOVE CYLINDER HEAD COVER(S)  
3S-GE (See step 37 on page EM-86)  
3S-GTE (See step 40 on page EM-92)



### 4. SET NO.1 CYLINDER TO TDC/COMPRESSION

- (a) Turn the crankshaft pulley and align its groove with the timing mark "0" of the No.1 timing belt cover.
- (b) Check that the valve lifters on the No.1 cylinder are loose and valve lifters on the No.4 are tight.

If not, turn the crankshaft one revolution (360°) and align the mark as above.

### 5. ADJUST VALVE CLEARANCE

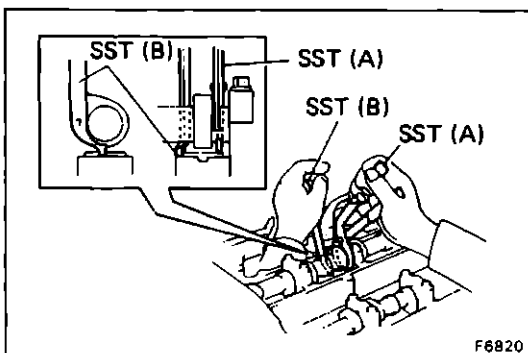
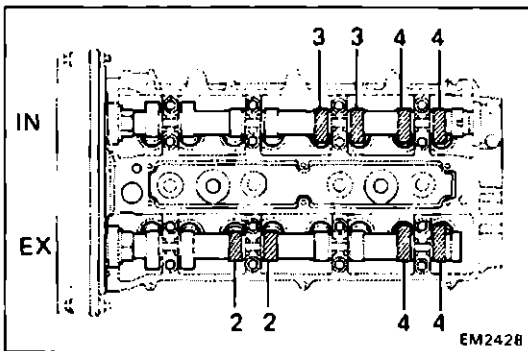
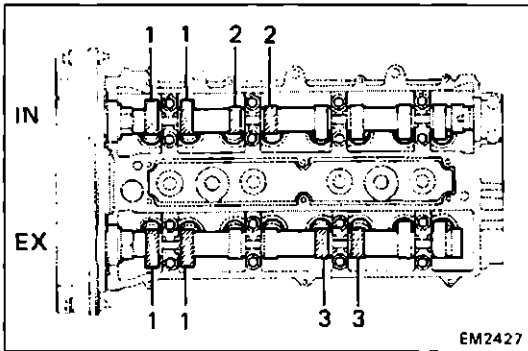
- (a) Check the only those valves indicated as shown.
  - Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
  - Record the valve clearance measurements which are out of specification. They will be used later to determine the required replacement adjusting shim.

#### Valve clearance (Cold):

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

Exhaust 0.20 – 0.30 mm (0.008 – 0.012 in.)

- (b) Turn the crankshaft one revolution (360°) and align the mark as above. (See procedure step 2)
- (c) Check only the valves indicated as shown.  
Measure the valve clearance. (See procedure step (a))



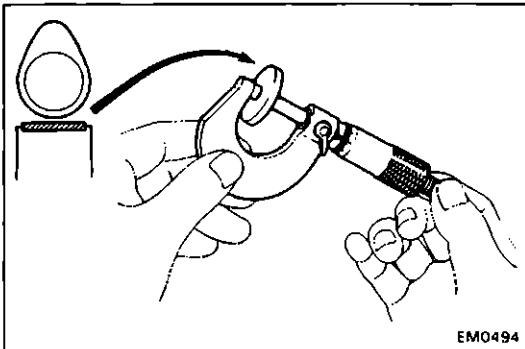
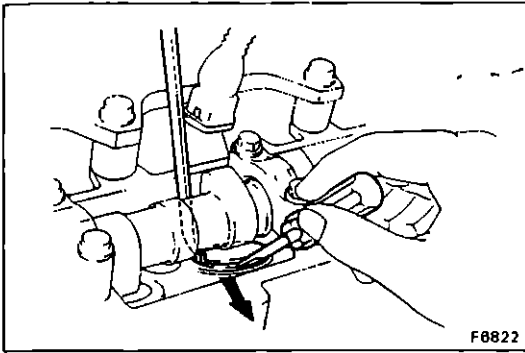
### (d) Remove the adjusting shim.

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

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





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

(e) Determine the replacement adjusting shim size following Formula or Charts:

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

T ..... Thickness of used shim

A ..... Measured valve clearance

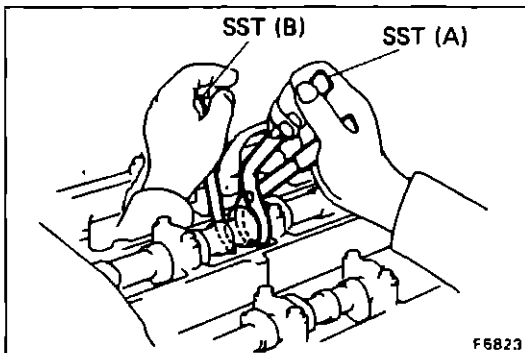
N ..... Thickness of new shim

**Intake**     $N = T + (A - 0.20 \text{ mm (0.008 in.)})$

**Exhaust**    $N = T + (A - 0.25 \text{ mm (0.010 in.)})$

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

**NOTE:** Shims are available in twenty-seven sizes of 0.05 mm (0.0020 in.), from 2.00 mm (0.0787 in.) to 3.30 mm (0.1299 in.).



(f) 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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(g) Recheck the valve clearance.

## 6. REINSTALL CYLINDER HEAD COVER(S)

3S-GE (See step 9 on page EM-108)

3S-GTE (See step 7 on page EM-115)

## 7. (3S-GTE)

REINSTALL NO.2 TIMING BELT COVER

(See step 14 on page EM-48)

## 8. (3S-GTE)

REINSTALL THROTTLE BODY

(See steps 2 to 12 on page FI-126)





**ADJUSTMENT OF IGNITION TIMING**

3S-FE (See steps 7 to 10 on pages IG-16 and 17)  
 3S-GE and 3S-GTE

(See steps 8 to 11 on pages IG-19 and 20)

Ignition timing:

10° BTDC @ idle

(w/ Terminals T or TE1 and E1 connected)

**ADJUSTMENT OF IDLE SPEED (3S-FE)**

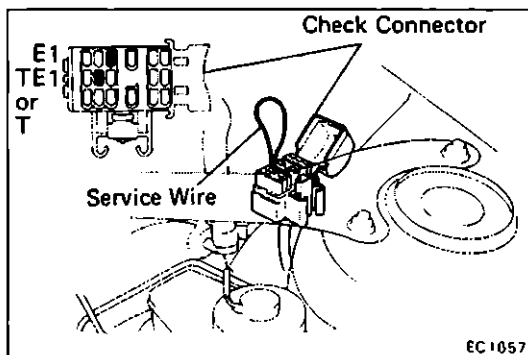
(See NOTE on page FI-18)

**1. INITIAL CONDITIONS**

- (a) Engine at normal operating temperature
- (b) Air cleaner installed
- (c) All pipes and hoses of air induction system connected
- (d) All vacuum lines connected

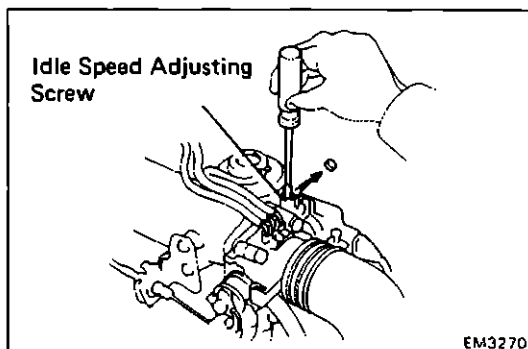
NOTE: All vacuum hoses for EGR systems, etc. should be properly connected.

- (e) EFI system wiring connectors fully plugged
- (f) All accessories switched OFF
- (g) Transmission in N range

**2. CHECK ISC VALVE SYSTEM (See page FI-127)****3. CONNECT TACHOMETER (See page IG-16)****4. ADJUST IDLE SPEED**

- (a) Using a service wire, connect terminals TE1 (CALIF.) or T (others) and E1 of the check connector.

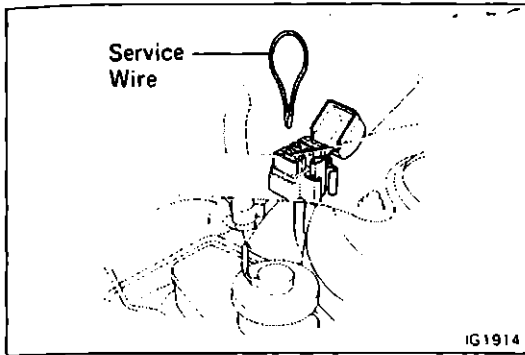
NOTE: Decrease the rpm after the engine maintains a speed of the 1,000 – 1,300 rpm for 5 seconds.



- (b) Check the idle speed.

**Idle speed: 650 ± 50 rpm**

- (c) If the idle speed is not as specified, adjust the idle speed by turning the IDLE SPEED ADJUSTING SCREW.



(d) Remove the service wire.

## 5. FURTHER CHECK IDLE SPEED

**Idle speed: 700 ± 50 rpm**

If the idle speed is not within these values, carry out either of the belowlisted procedures and then recheck the idle speed.

Carry out a driving test, including stop-go several times at a speed above 10 km/h, or start the engine, idle for 30 seconds and then turn the engine off repeatedly. By doing this, idle data will be stored in the ISC and the idle rpm will be at specified value.

## ADJUSTMENT OF IDLE SPEED (3S-GE)

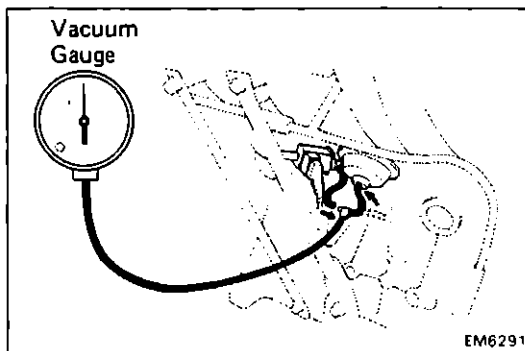
(See page MA-7)

**Idle speed: 750 rpm**

## INSPECTION OF IDLE SPEED (3S-GTE)

(See page FI-129)

**Idle speed: 750 ± 50 rpm**



## INSPECTION OF TOYOTA-VARIABLE INDUCTION SYSTEM (T-VIS) (3S-GE)

### 1. WARM UP AND STOP ENGINE

Allow the engine to normal operating temperature.

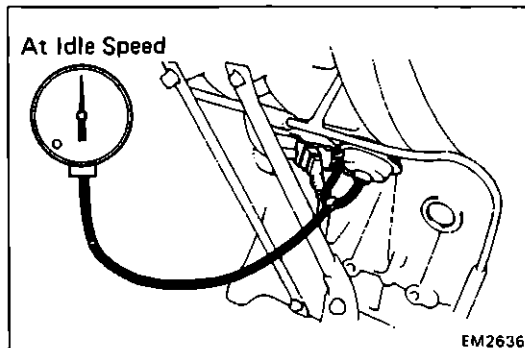
### 2. CONNECT TACHOMETER (See page IG-20)

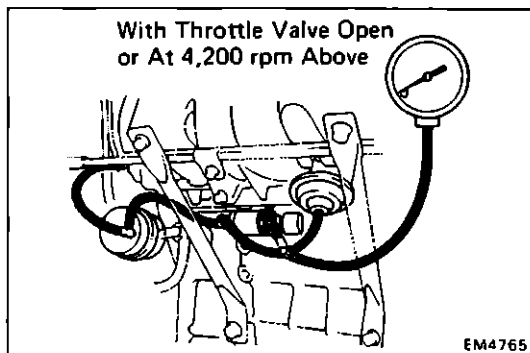
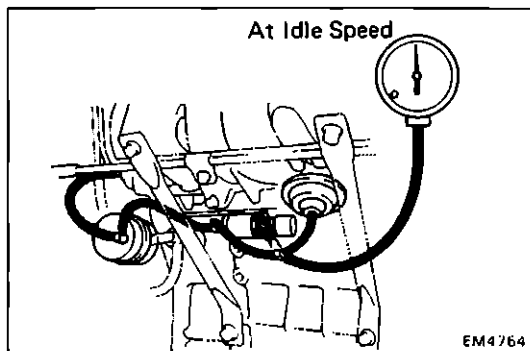
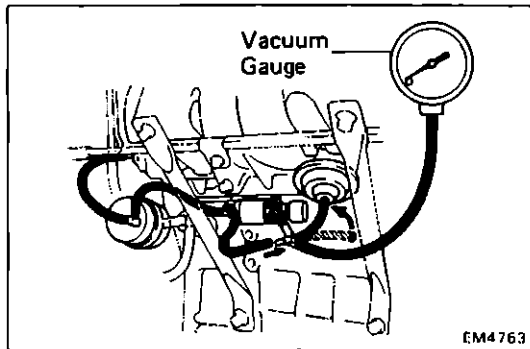
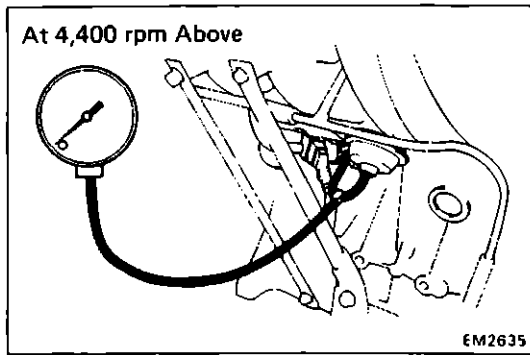
### 3. CONNECT VACUUM GAUGE

Using a 3-way connector, connect the vacuum gauge to the hose between the VSV and actuator.

### 4. INSPECT T-VIS OPERATION

(a) Check that the vacuum gauge indicates vacuum at idle speed.





- (b) Check that the vacuum gauge indicates zero at 4,400 rpm above.

### INSPECTION OF TOYOTA-VARIABLE INDUCTION SYSTEM (T-VIS) (3S-GTE)

#### 1. WARM UP AND STOP ENGINE

Allow the engine to normal operating temperature.

#### 2. CONNECT TACHOMETER (See page IG-20)

#### 3. CONNECT VACUUM GAUGE

Using a 3-way connector, connect the vacuum gauge to the hose between the VSV and actuator.

#### 4. INSPECT T-VIS OPERATION

- (a) Connect that the vacuum gauge indicates vacuum at idle speed.

- (b) (w/ Regular Gasoline)  
Check that the vacuum gauge indicates zero with throttle valve open.

- (c) (w/ Premium Gasoline)  
Check that the vacuum gauge indication zero at 4,200 rpm above.

## IDLE HC/CO CONCENTRATION CHECK METHOD

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

### 1. INITIAL CONDITIONS

- (a) Engine at normal operating temperature
- (b) Air cleaner installed
- (c) All pipes and hoses of air induction system connected
- (d) All accessories switched OFF
- (e) All vacuum lines properly connected

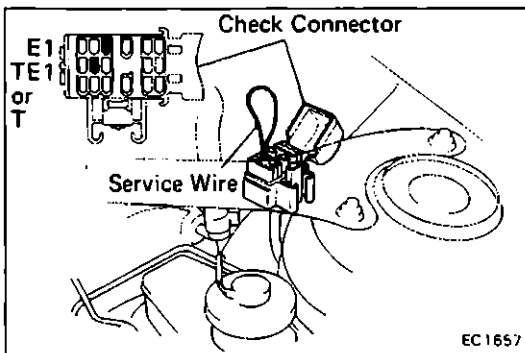
NOTE: All vacuum hoses for EGR systems, etc. should be properly connected.

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

### 2. START ENGINE

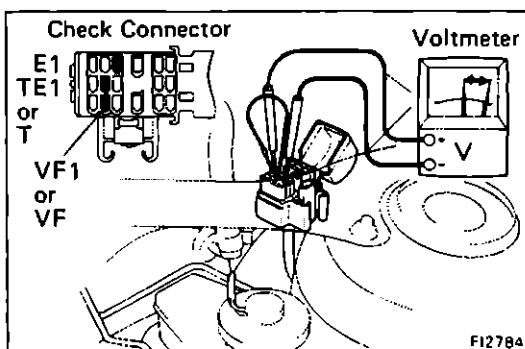
### 3. CHECK IDLE SPEED

Idle speed: 3S-FE 700 ± 50 rpm  
 3S-GE 750 rpm  
 3S-GTE 750 ± 50 rpm



### 4. CHECK OXYGEN SENSOR OPERATION

- (a) Using a service wire, connect the terminals TE1 (3S-FE (CALIF.)) or T (others) and E1 of the check connector.

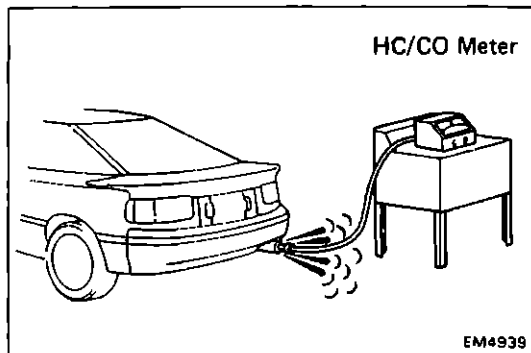


- (b) Connect the positive (+) probe of a voltmeter to terminal VF1 (3S-FE (CALIF.)) or VF (others) of the check connector, and negative (-) probe to terminal E1.
- (c) Hold the engine speed at 2,500 rpm for 90 seconds.
- (d) Then, maintaining engine at 2,500 rpm, count how many times needle of voltmeter 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. If necessary, see EFI SYSTEM.



5. **RACE ENGINE AT 2,500 RPM FOR APPROX. 90 SECONDS**
6. **INSERT HC/CO METER TESTING PROBE INTO TAILPIPE AT LEAST 40 cm (1.3 ft)**
7. **CHECK HC/CO CONCENTRATION AT IDLE**

Wait at least one minute before measuring to allow the concentration to stabilize. Complete the measuring within three minutes.

If the HC/CO concentration does not conform to regulations, see the table below for possible causes.

## Troubleshooting

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



## COMPRESSION CHECK

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

### 1. WARM UP AND STOP ENGINE

Allow the engine to normal operating temperature.

### 2. (3S-GTE)

#### REMOVE INTERCOOLER

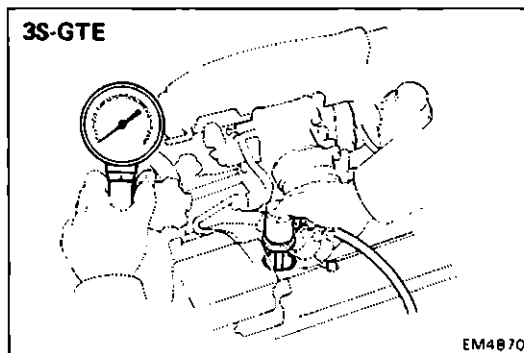
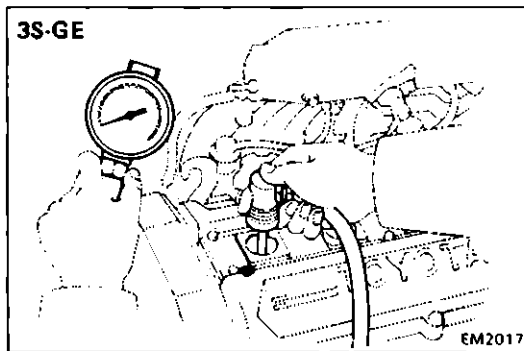
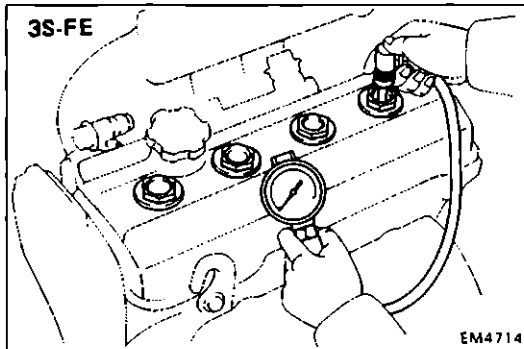
(See steps 3 and 7 on pages TC-9 and 10)

### 3. DISCONNECT SOLENOID RESISTOR CONNECTOR

### 4. DISCONNECT COLD START INJECTOR CONNECTOR

### 5. DISCONNECT DISTRIBUTOR CONNECTOR

### 6. REMOVE SPARK PLUGS (See page IG-6 or 11)



### 7. CHECK CYLINDER COMPRESSION PRESSURE

(a) Insert a compression gauge into the spark plug hole.

(b) Fully open the throttle.

(c) While cranking the engine, measure the compression pressure.

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

(d) Repeat steps (a) through (c) for each cylinder.

**CAUTION:** This measurement must be done in as short a time as possible.

**Compression pressure:**

12.5 kg/cm<sup>2</sup> (178 psi, 1,226 kPa) or more

**Minimum pressure:**

3S-FE and 3S-GE

10.0 kg/cm<sup>2</sup> (142 psi, 981 kPa)

3S-GTE 9.0 kg/cm<sup>2</sup> (128 psi, 883 kPa)

**Difference between each cylinder:**

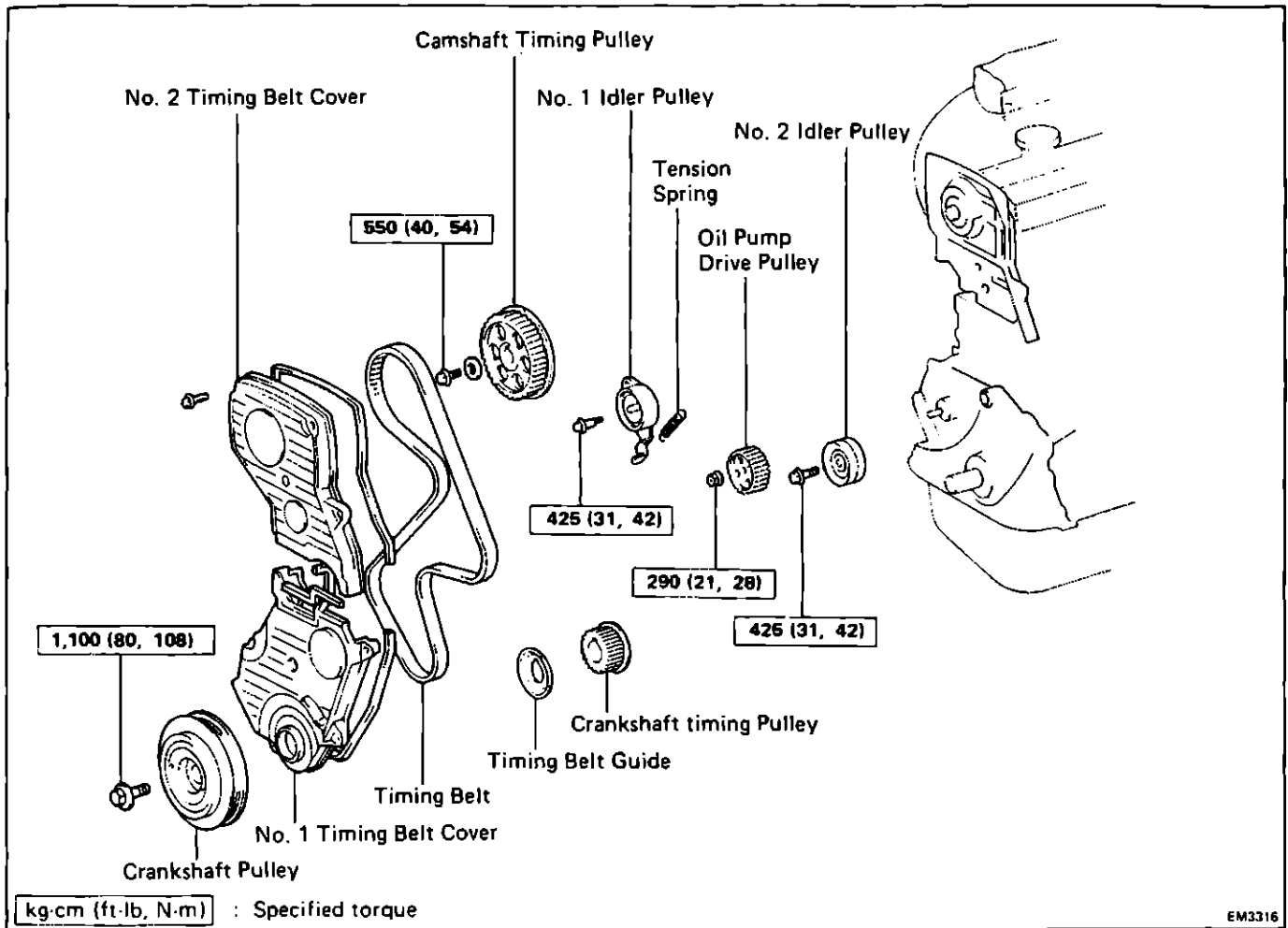
1.0 kg/cm<sup>2</sup> (14 psi, 98 kPa) or less

(e) If the 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 (c) for the cylinder with low compression.

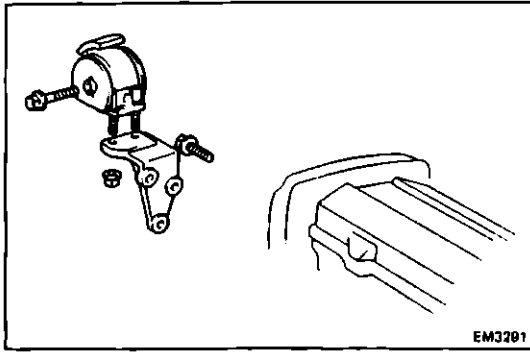
- If adding oil helps the compression chances are that the piston rings and/or cylinder bore are worn or damaged.

- If pressure stays low, a valve may be sticking or seating improperly, or there may be leakage past the gasket.

8. **REINSTALL SPARK PLUGS** (See page IG-7 or 11)  
Torque: 180 kg-cm(13 ft-lb, 18 N·m)
9. **RECONNECT DISTRIBUTOR CONNECTOR**
10. **RECONNECT COLD START INJECTOR CONNECTOR**
11. **RECONNECT SOLENOID RESISTOR CONNECTOR**
12. **(3S-GTE)**  
**REINSTALL INTERCOOLER** ●  
(See steps 11, 16 and 18 on page TC-14)

**TIMING BELT (3S-FE)****COMPONENTS****REMOVAL OF TIMING BELT**

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY
2. REMOVE RH FRONT WHEEL
3. REMOVE ENGINE RH UNDER COVER
4. (w/ CRUISE CONTROL SYSTEM)  
REMOVE CRUISE CONTROL ACTUATOR  
(See step 9 on page EM-122)
5. REMOVE DRIVE BELTS
6. REMOVE ALTERNATOR (See page CH-6)
7. REMOVE ALTERNATOR BRACKET

**8. SLIGHTLY JACK UP ENGINE**

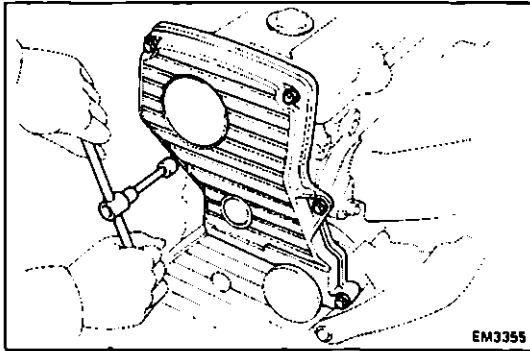
Raise the engine enough to remove the weight from the engine mounting on the right side.

**9. REMOVE ENGINE RH MOUNTING INSULATOR AND BRACKET**

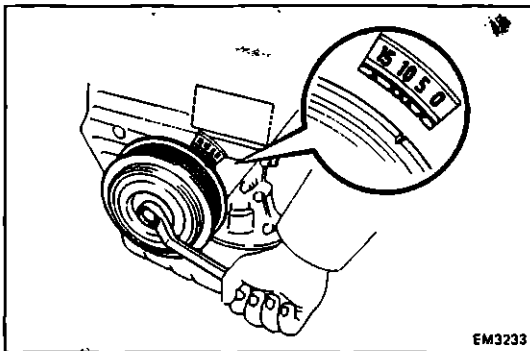
- (a) Remove the through bolt, two nuts and mounting insulator.
- (b) Remove the three bolts and bracket.

**10. REMOVE SPARK PLUGS (See page IG-6)****11. REMOVE NO.2 TIMING BELT COVER**

Remove the five bolts, belt cover and gaskets.

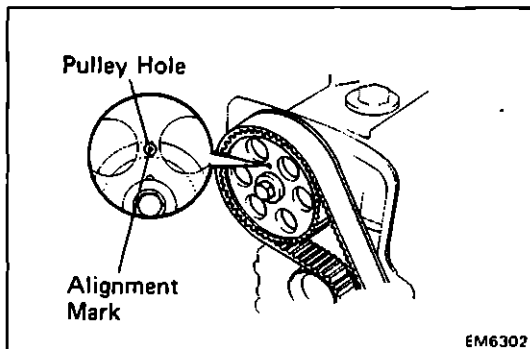
**12. SET NO.1 CYLINDER TO TDC/COMPRESSION**

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

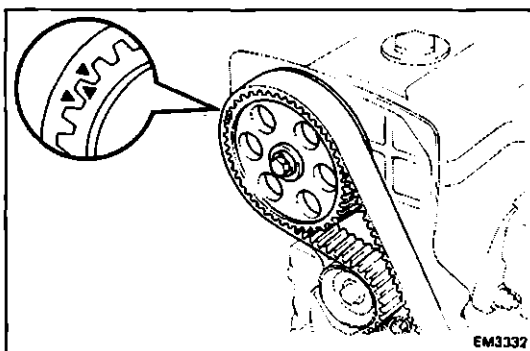


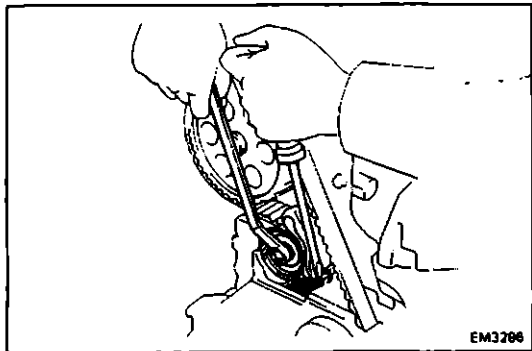
- (b) Check that the hole of the camshaft timing pulley is aligned with the alignment mark of the bearing cap.

If not, turn the crankshaft one revolution (360°).

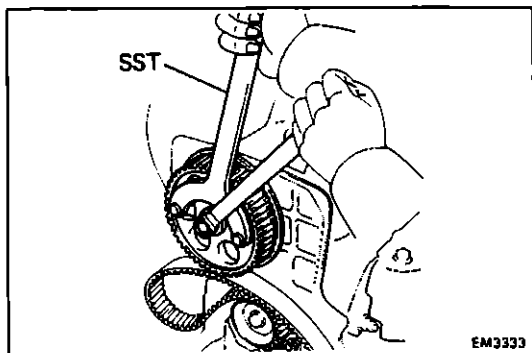
**13. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEY**

**NOTE:** If reusing the timing belt, place the matchmark on the timing belt and camshaft timing pulley.



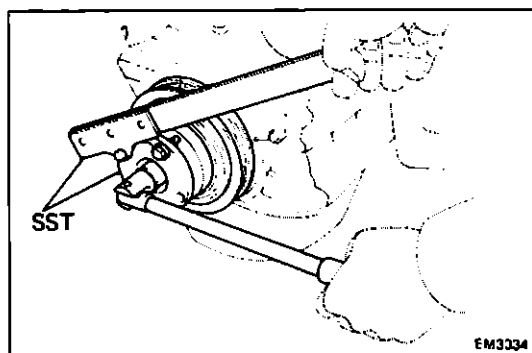


- (a) Loosen the mount bolt of the No. 1 idler pulley and shift the pulley toward the left as far as it will go, temporarily tighten it.
- (b) Remove the timing belt from the camshaft timing pulley.



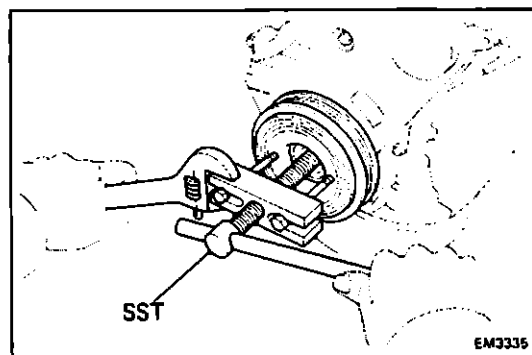
#### 14. REMOVE CAMSHAFT TIMING PULLEY

- Using SST, remove the bolt, plate washer and pulley.  
SST 09278-54012

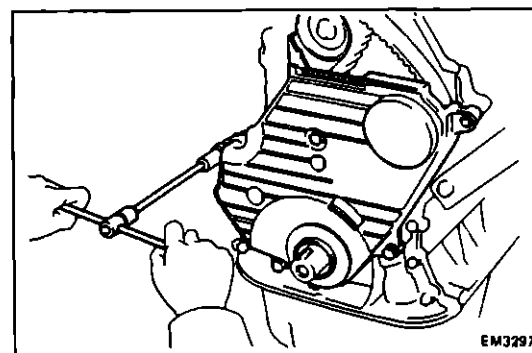


#### 15. REMOVE CRANKSHAFT PULLEY

- (a) Using SST, remove the pulley mount bolt.  
SST 09213-54015 (09214-00030) and 09330-00021

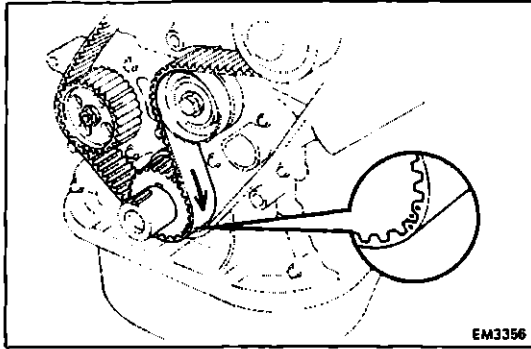


- (b) Using SST, remove the pulley.  
SST 09213-60017 (09213-00020, 09213-00030, 09213-00050)

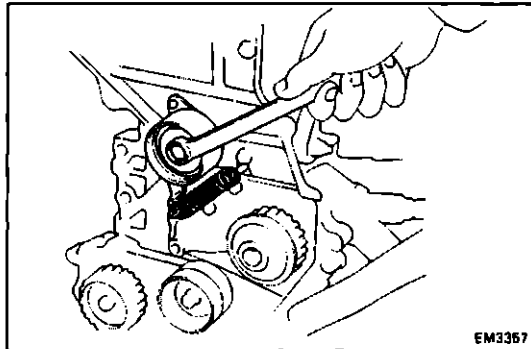


#### 16. REMOVE NO. 1 TIMING BELT COVER

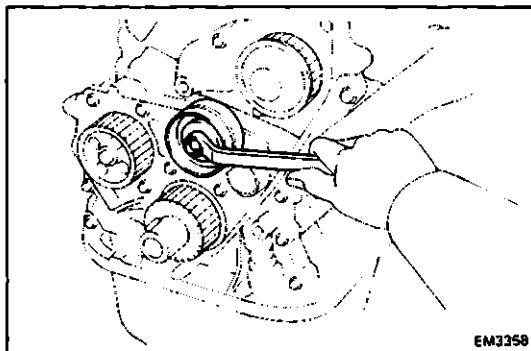
- Remove the four bolt, belt cover and gasket.

**17. REMOVE TIMING BELT AND BELT GUIDE**

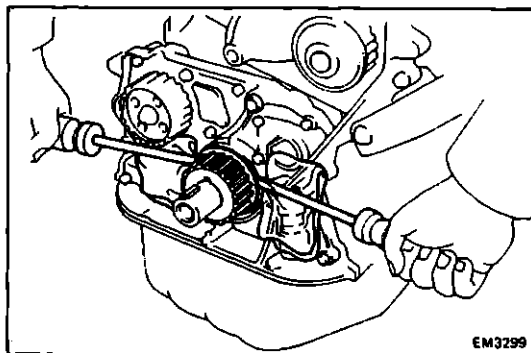
**NOTE:** If reusing the timing belt, draw a direction arrow on the timing belt (in direction of engine revolution), and place the matchmarks on the timing belt and crankshaft timing pulley.

**18. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING**

Remove the bolt, pulley and tension spring.

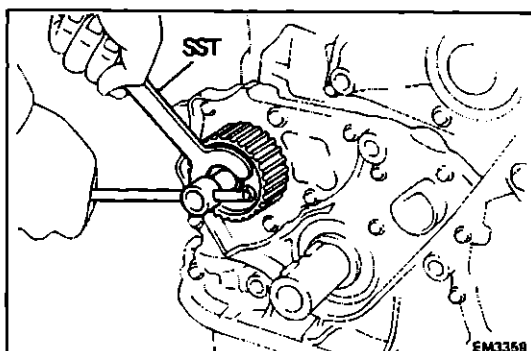
**19. REMOVE NO.2 IDLER PULLEY**

Remove the bolt and pulley.

**20. REMOVE CRANKSHAFT TIMING PULLEY**

If the pulley cannot be removed by hand, use two screwdrivers.

**NOTE:** Position shop rags as shown to prevent damage.

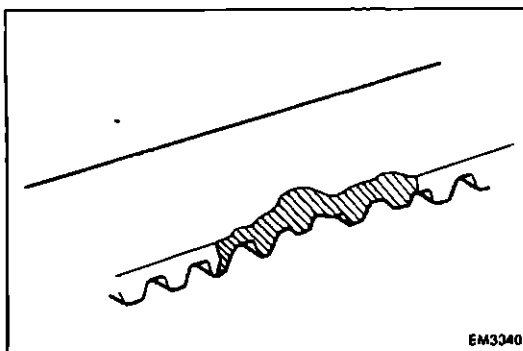
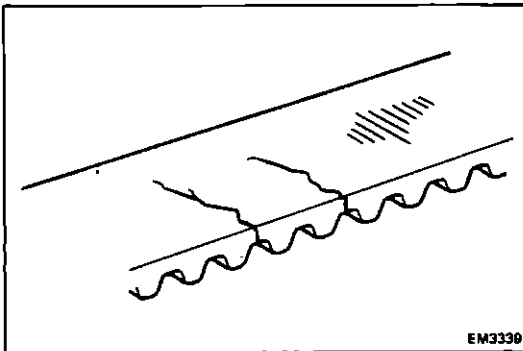
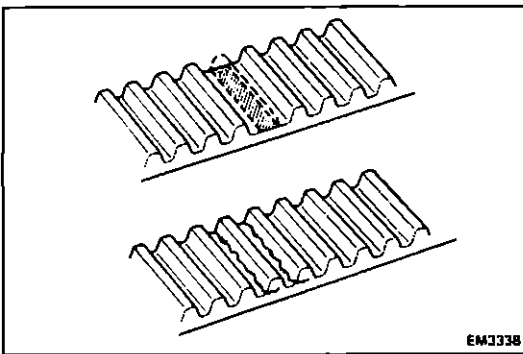
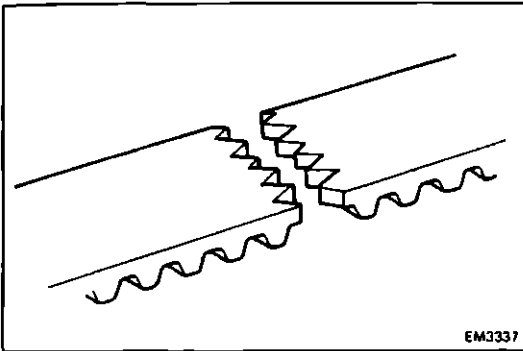
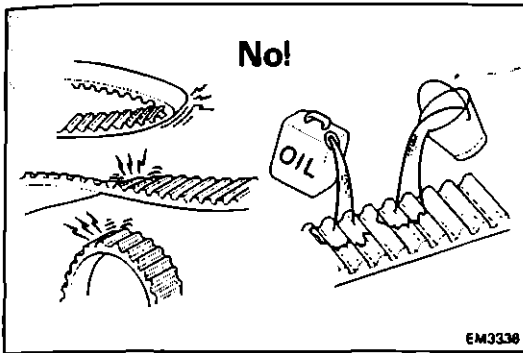
**21. REMOVE OIL PUMP PULLEY**

Using SST, remove the nut and pulley.

SST 09616-30011

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

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

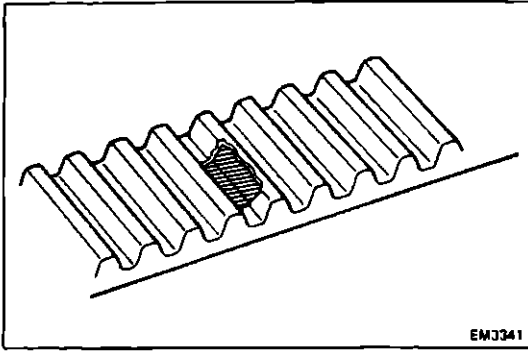


If there are defect as shown in the figures, check the following points:

**(a) Premature parting**

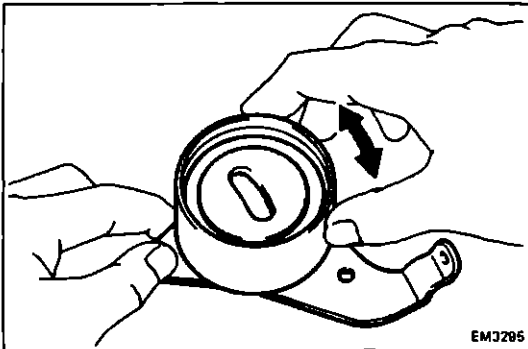
- Check for proper installation.
- Check the timing cover gasket for damage and proper installation.

**(b) If the belt teeth are cracked or damaged, check to see if either the camshaft, water pump or oil pump is locked.****(c) If there are cracks or noticeable wear on the belt face, check to see if there are nicks on the 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 timing cover for damage and check for correct gasket installation. Check for foreign material on the pulley teeth.

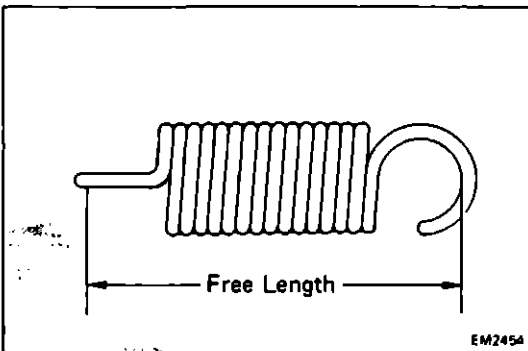
If necessary, replace the timing belt.



## 2. INSPECT IDLER PULLEYS

Check the turning smoothness of the idler pulley.

If necessary, replace the idler pulley.



## 3. INSPECT TENSION SPRING

- (a) Measure the free length of tension spring.

**Free length: 46.1 mm (1.815 in.)**

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

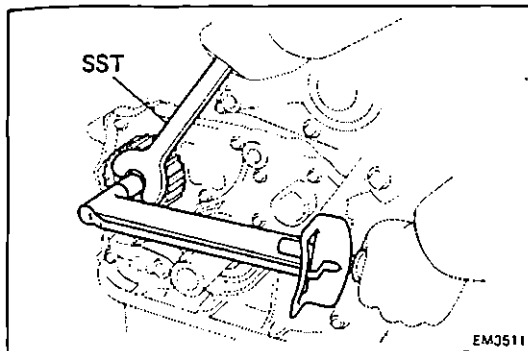
- (b) Measure the tension of the tension spring at the specified installed length.

**Installed tension:**

**6.0 – 7.0 kg (13.2 – 15.4 lb, 59 – 69 N·m)  
at 50.5 mm (1.988 in.)**

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





## INSTALLATION OF TIMING BELT

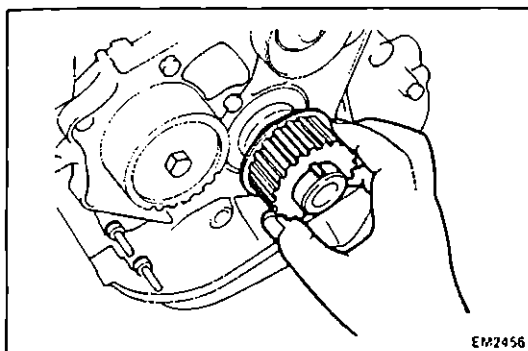
(See page EM-27)

### 1. INSTALL OIL PUMP PULLEY

- (a) Align the cutouts of the pulley and shaft, and slide the pulley.
- (b) Using SST, install and torque the nut.

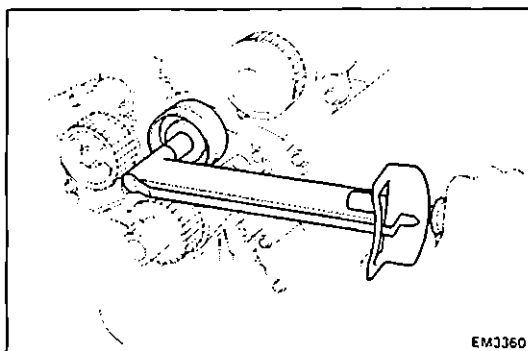
SST 09616-30011

Torque: 290 kg-cm (21 ft-lb, 28 N·m)



### 2. INSTALL CRANKSHAFT TIMING PULLEY

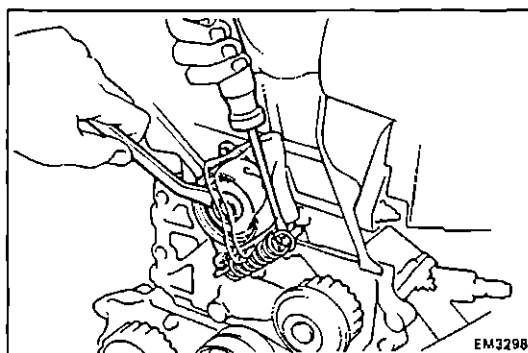
Align the pulley set key with the key groove of the pulley, and slide the pulley.



### 3. INSTALL NO.2 IDLER PULLEY

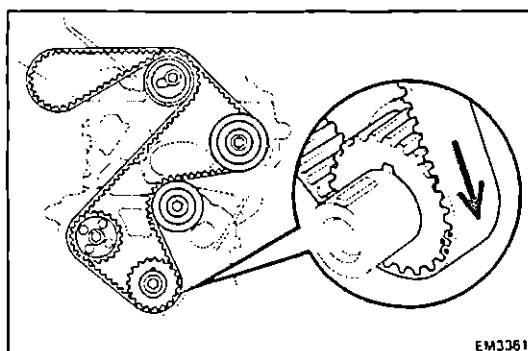
- (a) Install the pulley with the bolt. Torque the bolt.
- (b) Check that the pulley moves smoothly.

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



### 4. TEMPORARILY INSTALL NO.1 IDLER PULLEY AND TENSION SPRING

- (a) Install the pulley with the bolt. Do not tighten the bolt yet.
- (b) Install the tension spring.
- (c) Pry the pulley toward the left as far as it will go and tighten the bolt.

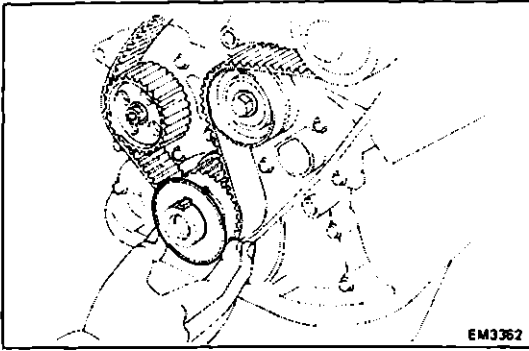


### 5. TEMPORARILY INSTALL TIMING BELT

**CAUTION:** The engine should be cold.

Install the timing belt on the crankshaft timing, oil pump, No.2 idler and water pump pulleys.

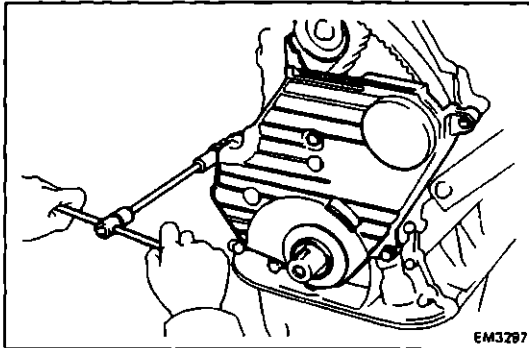
NOTE: If reusing the timing belt, align the points marked during removal, and install the belt with the arrow pointing in the direction of engine revolution.



EM3362

## 6. INSTALL TIMING BELT GUIDE

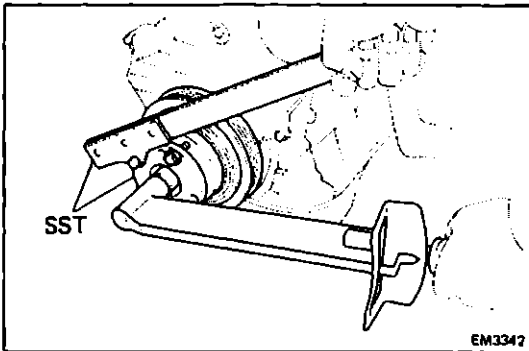
Install the guide, facing the cup side outward.



EM3297

## 7. INSTALL NO.1 TIMING BELT COVER

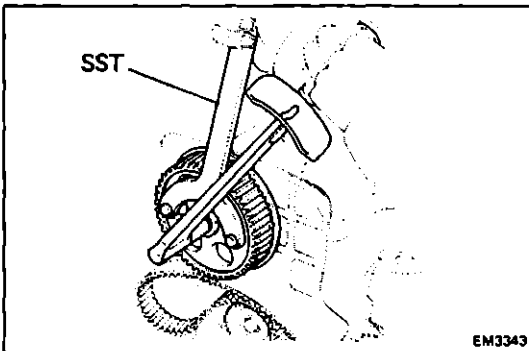
- (a) Install the gasket to the belt cover.
- (b) Install the belt cover with the four bolts.



EM3342

## 8. INSTALL CRANKSHAFT PULLEY

- (a) Align the pulley set key with the key groove of the pulley, slide the pulley.
  - (b) Using SST, install and torque the the bolt.
- SST 09213-54015 (09214-00030) and 09330-00021  
 Torque: 1.100 kg-cm (80 ft-lb, 108 N·m)



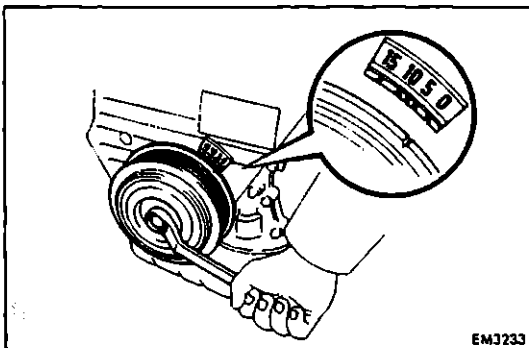
EM3343

## 9. INSTALL CAMSHAFT TIMING PULLEY

- (a) Align the camshaft knock pin with the knock pin groove of the pulley, and slide the pulley.
  - (b) Using SST, install the plate washer and bolt.
- Torque the bolt.

SST 09278-54012

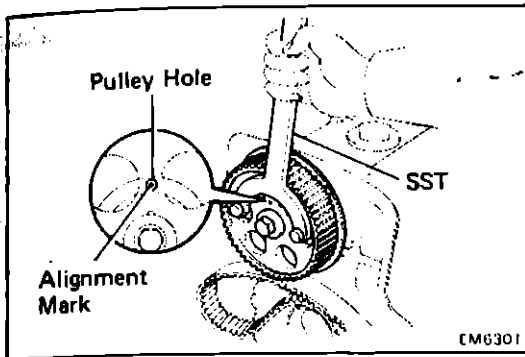
Torque: 550 kg-cm (40 ft-lb, 54 N·m)



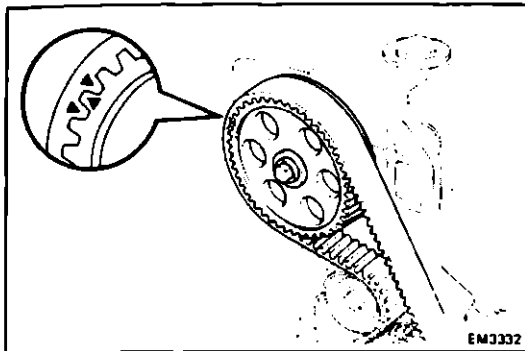
EM3233

## 10. SET NO.1 CYLINDER TO TDC/COMPRESSION

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

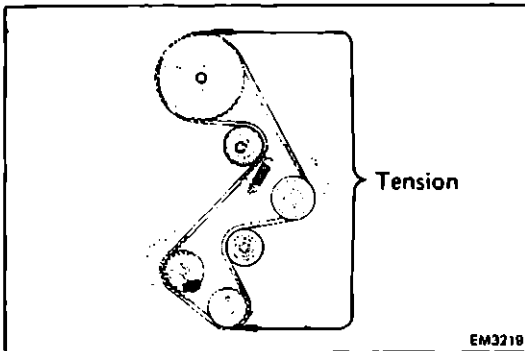


- (b) Using SST, turn the camshaft timing pulley and align the hole of it with the alignment mark of the bearing cap.

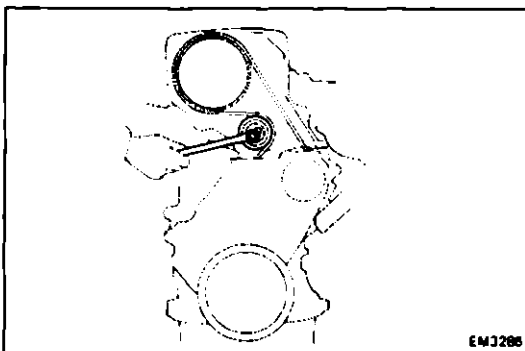


## 11. INSTALL TIMING BELT

**NOTE:** If reusing the timing belt, first align the matchmarks of the timing belt and camshaft timing pulley.

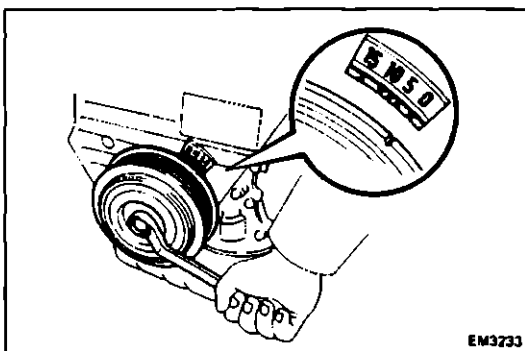


Install the timing belt, insuring the tension between the crankshaft timing pulley, water pump pulley and camshaft timing pulley.



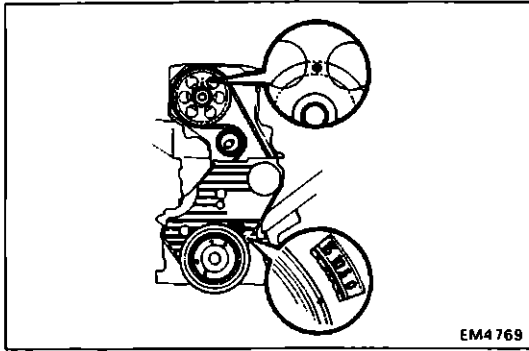
## 12. CHECK VALVE TIMING

- (a) Loosen the No.1 idler pulley mount bolt 1/2 turn.



- (b) Turn the crankshaft pulley two revolutions from TDC to TDC.

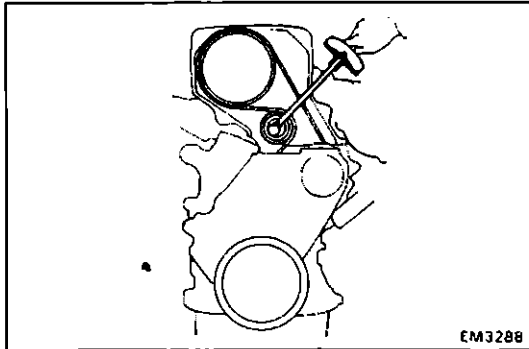
**NOTE:** Always turn the crankshaft clockwise.



EM4769

- (c) Check that each pulley aligns with the timing marks as shown in the figure.

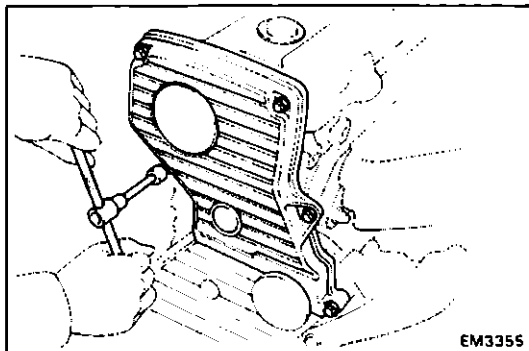
If the marks do not align, remove the timing belt and reinstall it.



EM3288

- (d) Torque the mount bolt of the No.1 idler pulley.

**Torque: 425 kg-cm (31 ft-lb, 42 N·m)**



EM3355

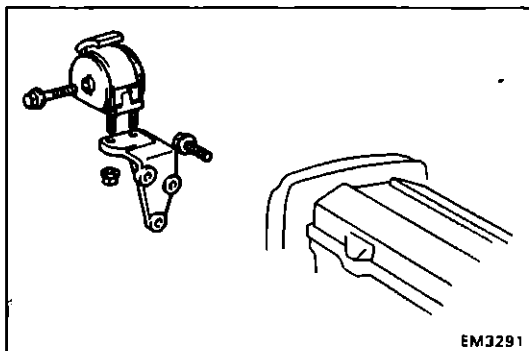
### 13. INSTALL NO.2 TIMING BELT COVER

- (a) Install the two gaskets to the No.1 and No.2 belt covers.

- (b) Install the belt cover with the five bolts.

### 14. INSTALL SPARK PLUGS (See page IG-7)

**Torque: 180 kg-cm (13 ft-lb, 18 N·m)**



EM3291

### 15. INSTALL ENGINE RH MOUNTING INSULATOR AND BRACKET

- (a) Install the bracket with the three bolts. Torque the bolts.

**Torque: 530 kg-cm (38 ft-lb, 52 N·m)**

- (b) Install the mounting insulator with the two nuts and through bolt.

**Torque:**

**Bolt 800 kg-cm (58 ft-lb, 78 N·m)**

**Nut 530 kg-cm (38 ft-lb, 52 N·m)**

### 16. LOWER ENGINE

### 17. INSTALL ALTERNATOR BRACKET

**Torque: 425 kg-cm (31 ft-lb, 42 N·m)**

### 18. INSTALL ALTERNATOR (See page CH-15)

**19. INSTALL DRIVE BELTS**

Adjust the drive belts. (See page CH-3)

**Drive belt tension:****Alternator**

<b>w/ A/C</b>	<b>New belt</b>	<b>175 ± 5 lb</b>
	<b>Used belt</b>	<b>130 ± 10 lb</b>

<b>w/o A/C</b>	<b>New belt</b>	<b>125 ± 25 lb</b>
	<b>Used belt</b>	<b>95 ± 20 lb</b>

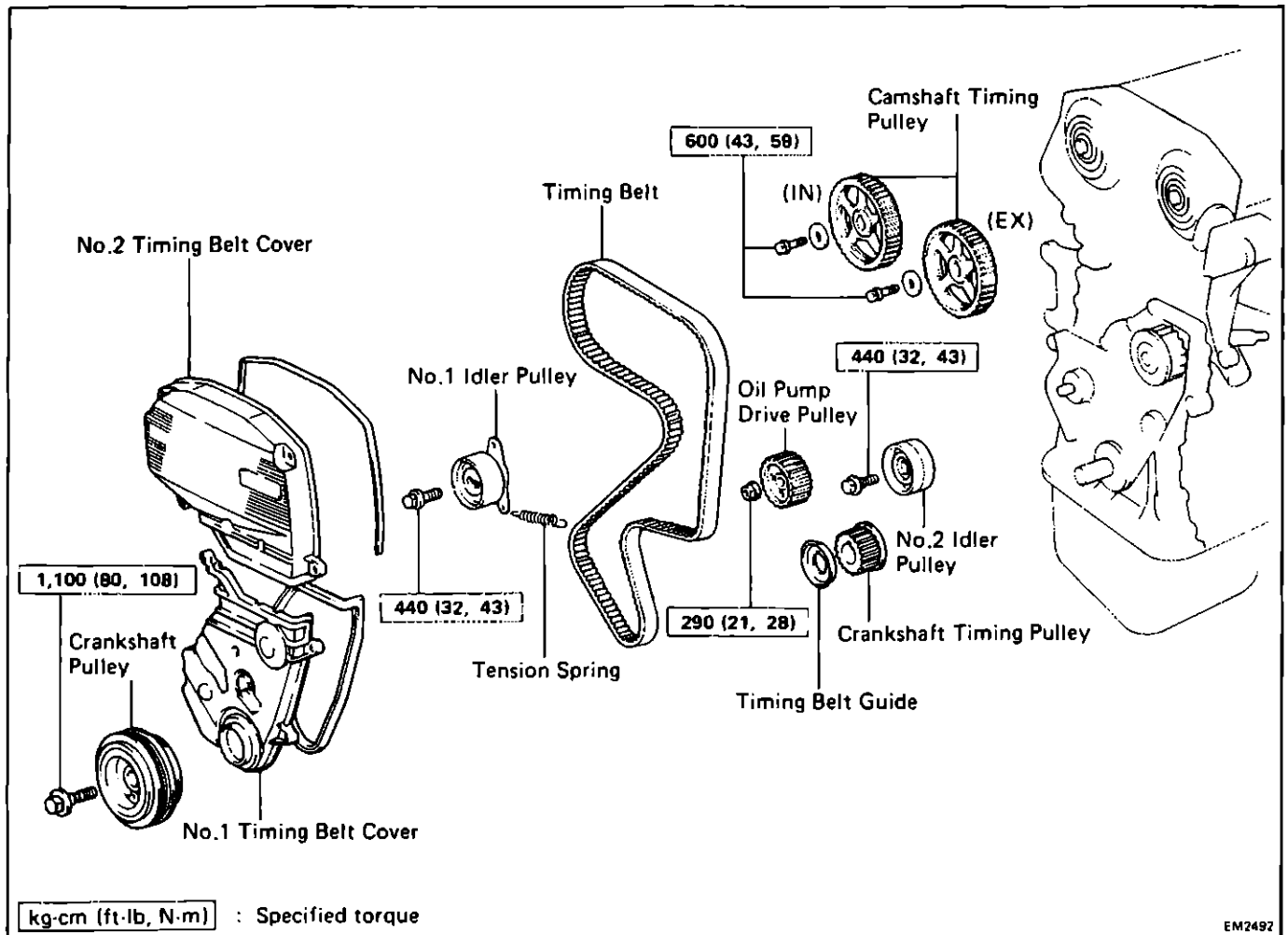
<b>PS pump</b>	<b>New belt</b>	<b>125 ± 10 lb</b>
	<b>Used belt</b>	<b>80 ± 20 lb</b>

**20. (w/ CRUISE CONTROL SYSTEM)****INSTALL CRUISE CONTROL ACTUATOR**

(See step 32 on page EM-155)

**21. INSTALL ENGINE RH UNDER COVER****22. INSTALL RH FRONT WHEEL****23. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**

## TIMING BELT (3S-GE and 3S-GTE) COMPONENTS



NOTE: The camshaft will either have two or five holes. The camshaft timing pulley will have either one or five holes, fine adjustment of the valve timing is possible only when the five hole camshaft and camshaft timing pulley are used together. For fine adjustment of valve timing (See page EM-49).

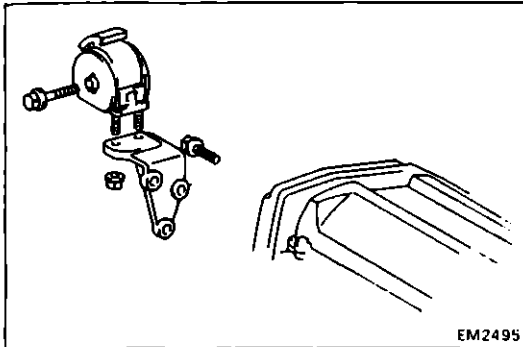
### REMOVAL OF TIMING BELT

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY
2. REMOVE RH FRONT WHEEL
3. REMOVE ENGINE RH UNDER COVER
4. REMOVE RADIATOR RESERVOIR TANK
5. (w/ CRUISE CONTROL SYSTEM (w/o A.B.S.))  
REMOVE CRUISE CONTROL ACTUATOR  
(See step 9 on page EM-122)
6. LOOSEN POWER STEERING OIL RESERVOIR TANK  
Remove the two bolts without disconnecting the hoses.

7. REMOVE DRIVE BELTS
8. REMOVE ALTERNATOR
9. REMOVE ALTERNATOR BRACKETS  
3S-GE (See step 11 on page EM-83)  
3S-GTE (See step 16 on page EM-89)

10. JACK UP ENGINE SLIGHTLY

Raise the engine enough to remove the weight from the engine mounting on the right side.



11. REMOVE ENGINE RH MOUNTING INSULATOR AND BRACKET

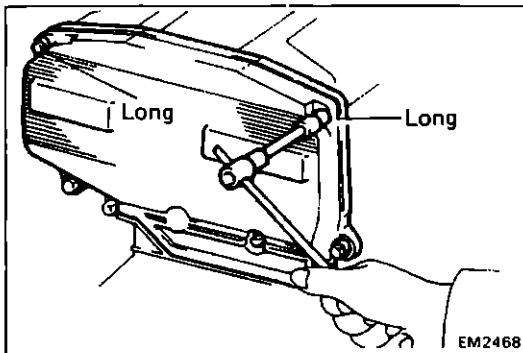
- (a) Remove the through bolt, two nuts and mounting insulator.
- (b) Remove the three bolts and bracket.

12. REMOVE THROTTLE BODY  
(See steps 1 to 10 on page FI-124)

13. REMOVE NO.2 TIMING BELT COVER

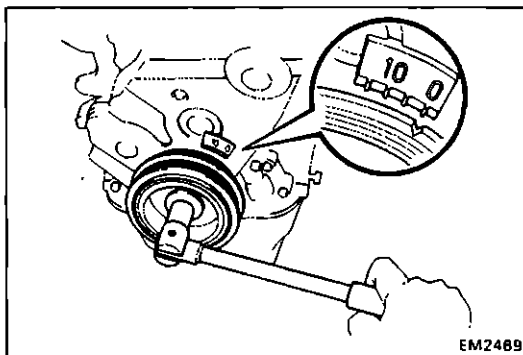
Remove the five screws, belt cover and gasket.

14. REMOVE SPARK PLUGS (See page IG-11)

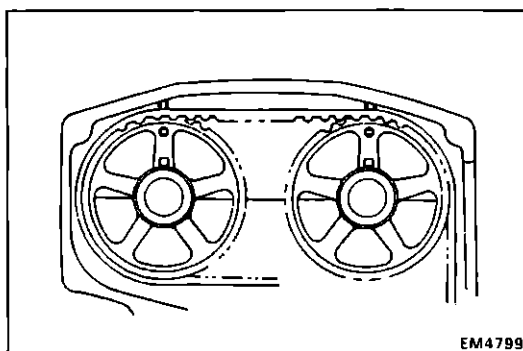


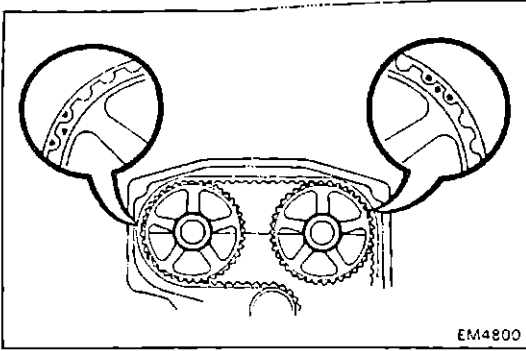
15. SET NO.1 CYLINDER TO TDC/COMPRESSION

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



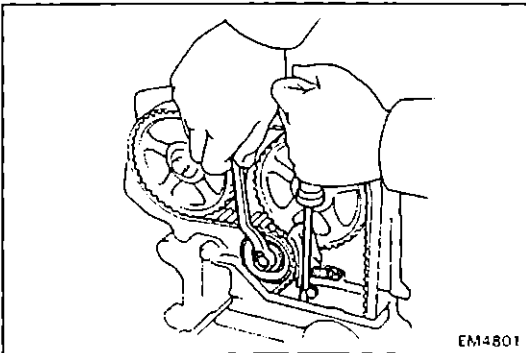
- (b) Check that the alignment marks of the camshaft timing pulleys and No.3 timing belt cover are aligned. If not, turn the crankshaft one revolution (360°).





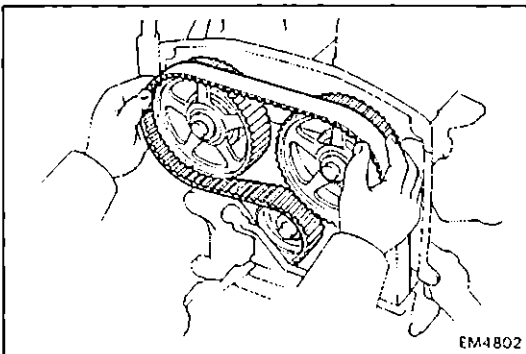
## 16. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEYS

NOTE: If reusing the timing belt, place matchmarks on the camshaft timing pulleys and belt.



(a) Loosen the No. 1 idler pulley bolt and shift it left as far as it will go.

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



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

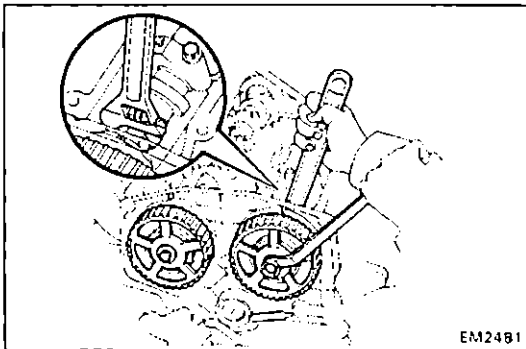
### NOTE:

- 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.

## 17. REMOVE CYLINDER HEAD COVER(S)

3S-GE (See step 37 on page EM-86)

3S-GTE (See step 40 on page EM-92)

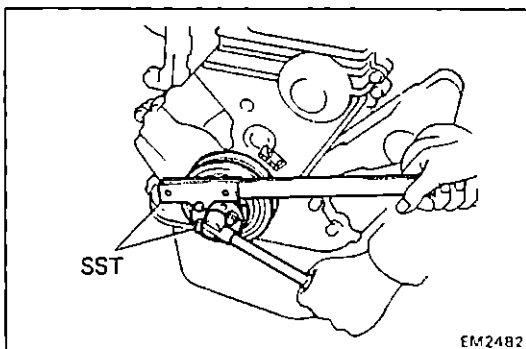


## 18. REMOVE CAMSHAFT TIMING PULLEYS

(a) Hold the hexagonal wrench head portion of the camshaft with a wrench, and remove the pulley mount bolts.

(b) Remove the camshaft pulleys and pins.

NOTE: Arrange the intake and exhaust pulleys.

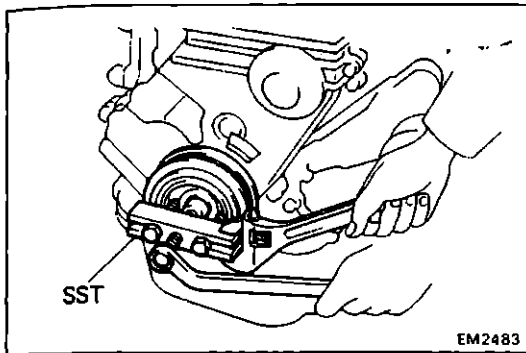


## 19. REMOVE CRANKSHAFT PULLEY

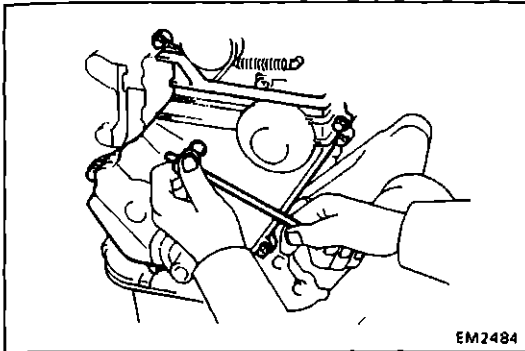
(a) Using SST, remove the pulley bolt.

SST 09213-14010 and 09330-00021





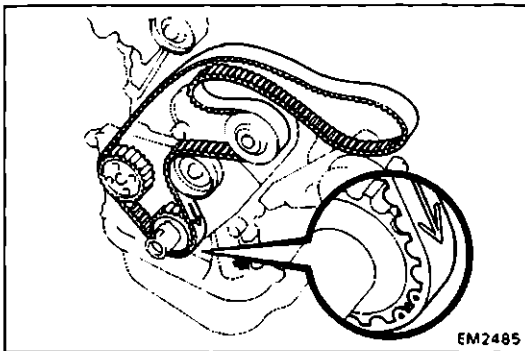
(b) Using SST, remove the pulley.  
SST 09213-31021



#### 20. REMOVE NO.1 TIMING BELT COVERS

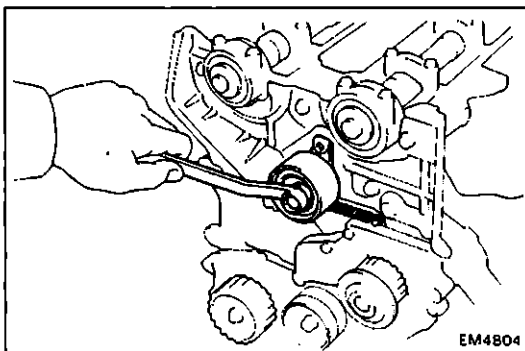
Remove the six bolts, belt cover and gaskets.

#### 21. REMOVE TIMING BELT GUIDE



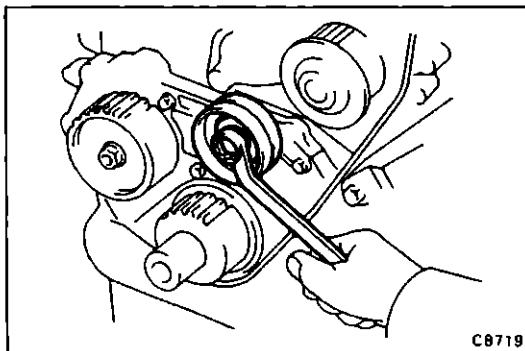
#### 22. REMOVE TIMING BELT

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



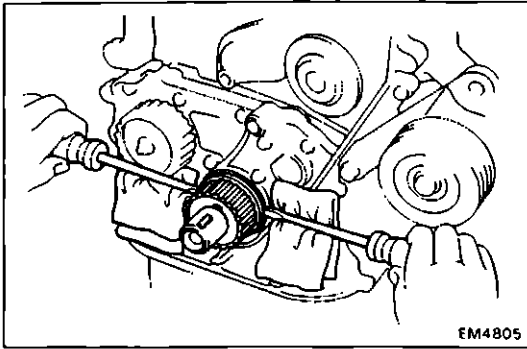
#### 23. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING

Remove the bolt, pulley and tension spring.



#### 24. REMOVE NO.2 IDLER PULLEY

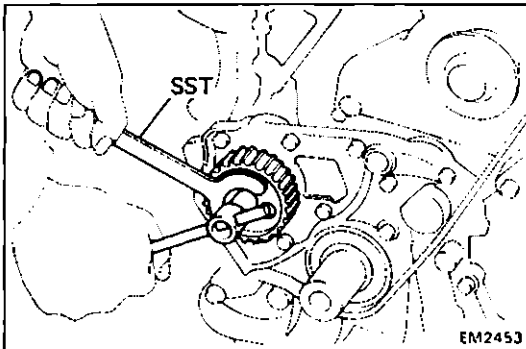
Remove the bolt and pulley.



## 25. REMOVE CRANKSHAFT TIMING PULLEY

If the pulley cannot be removed by hand, use two screwdrivers.

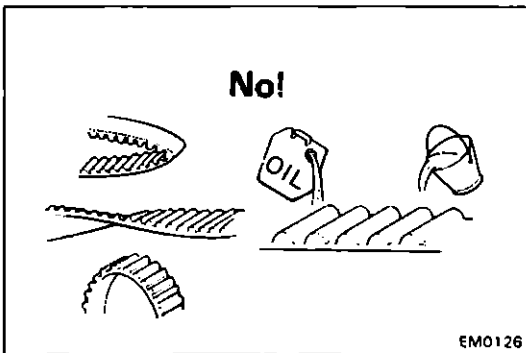
NOTE: Position shop rags as shown to prevent damage.



## 26. REMOVE OIL PUMP PULLEY

Using SST, remove the nut and pulley.

SST 09616-30011

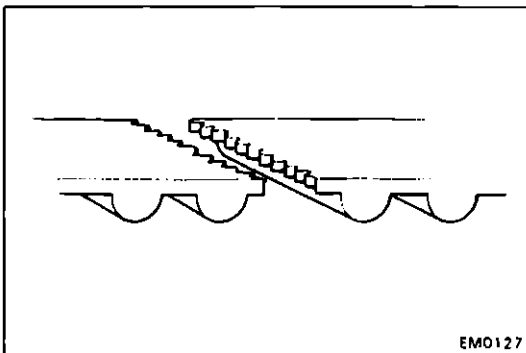


## INSPECTION OF COMPONENTS

### 1. INSPECT TIMING BELT

#### CAUTION:

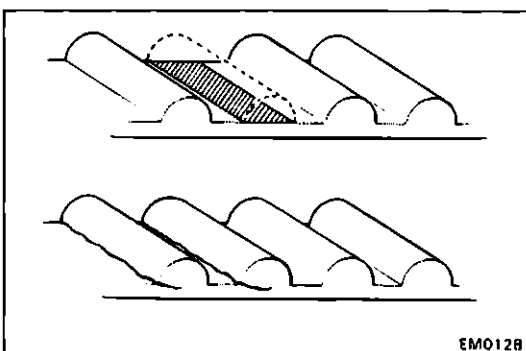
- Do not bend, twist or turn the timing belt inside out.
- Do not allow the timing belt to come into contact with oil, water or steam.
- Do not utilize timing belt tension when installing or removing the mount bolt of the camshaft timing pulley.



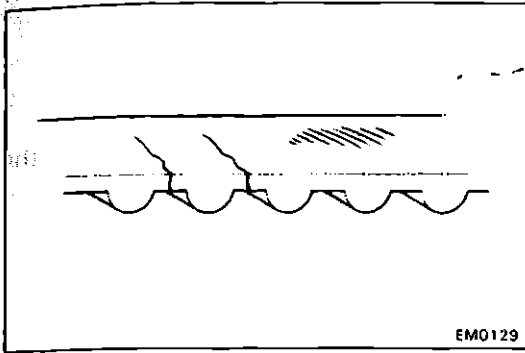
If there are defect as shown in the figures, check the following points:

#### (a) Premature parting

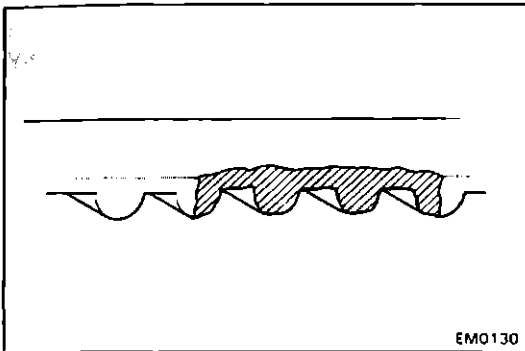
- Check for proper installation.
- Check the timing cover gasket for damage and proper installation.



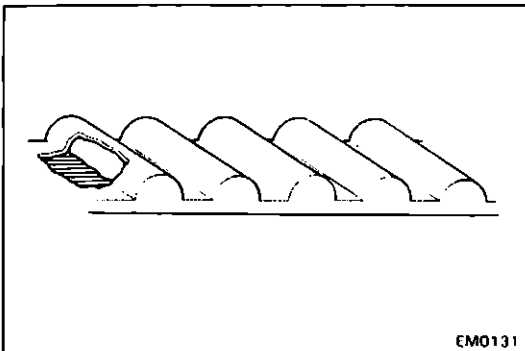
- #### (b) If the belt teeth are cracked or damaged, check to see if either the camshaft, water pump or oil pump is locked.



- (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.

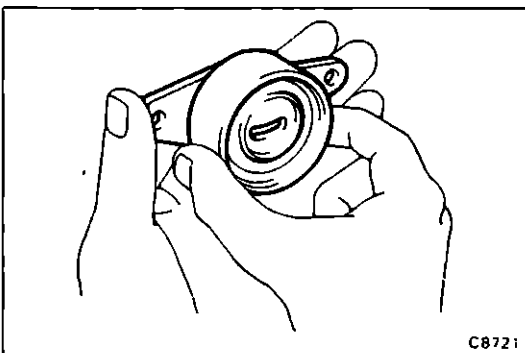


- (d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.



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

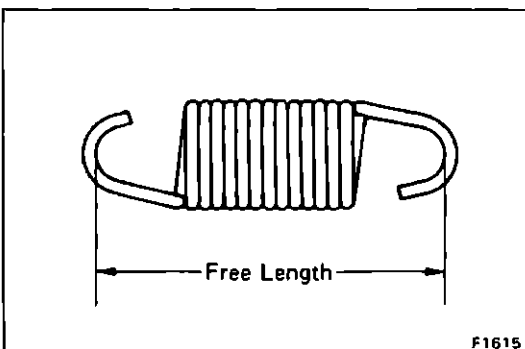
If necessary, replace the timing belt.



## 2. INSPECT IDLER PULLEYS

Check the turning smoothness of the idler pulley.

If necessary, replace the idler pulley.



## 3. INSPECT TENSION SPRING

- (a) Check the free length of the spring.

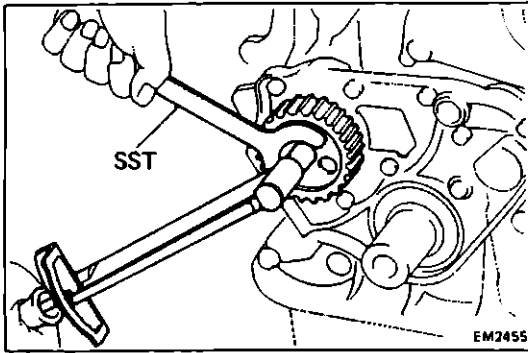
**Free length: 43.8 mm (1.724 in.)**

- (b) Check the tension of the spring at the specified installed length.

**Installed tension:**

**7.54 kg (16.6 lb, 74 N) at 51.86 mm (2.0417 in.)**

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



## INSTALLATION OF TIMING BELT

(See page EM-38)

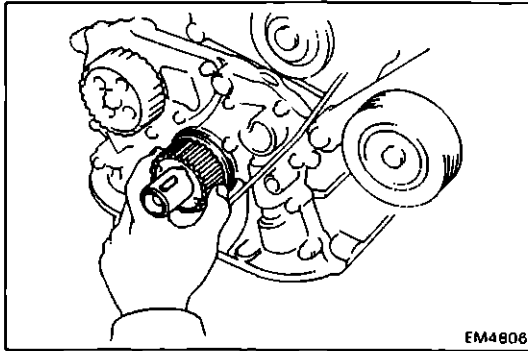
### 1. INSTALL OIL PUMP PULLEY

(a) Align the cutouts of the pulley and shaft, and slide the pulley.

(b) Using SST, install and torque the nut.

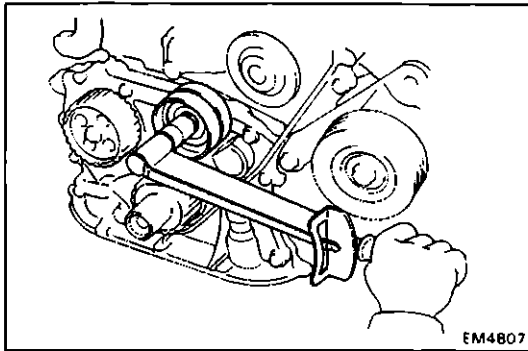
SST 09616-30011

**Torque: 290 kg-cm (21 ft-lb, 28 N·m)**



### 2. INSTALL CRANKSHAFT TIMING PULLEY

Align the pulley set key with the key groove of the pulley, slide the pulley.

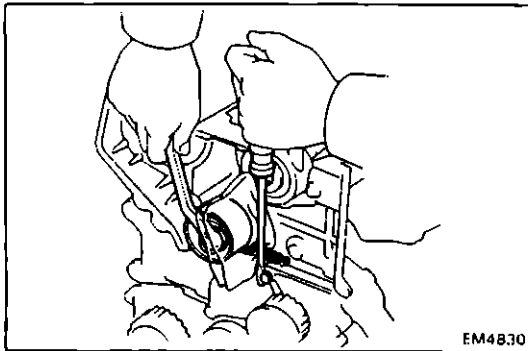


### 3. INSTALL NO.2 IDLER PULLEY

(a) Install the pulley with the bolt. Torque the bolt.

**Torque: 440 kg-cm (32 ft-lb, 43 N·m)**

(b) Check that the pulley moves smoothly.



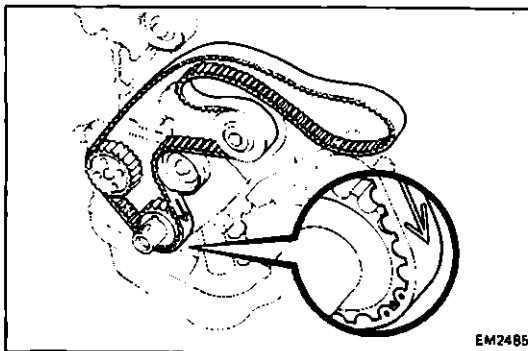
### 4. TEMPORARILY INSTALL NO.1 IDLER PULLEY AND TENSION SPRING

(a) Install the pulley with the bolt. Do not tighten the bolt yet.

(b) Install the tension spring.

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

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

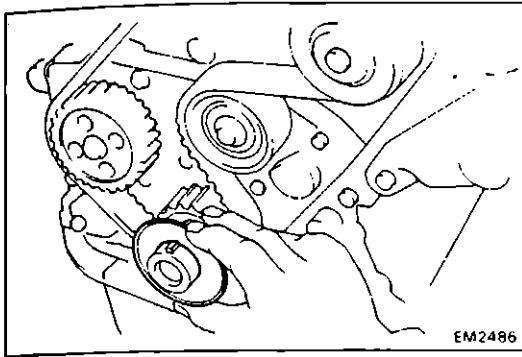


### 5. TEMPORARILY INSTALL TIMING BELT

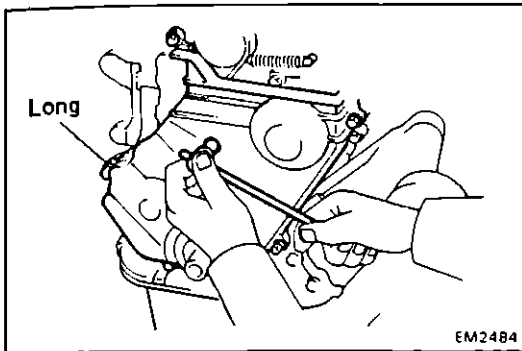
**CAUTION:** The engine should be cold.

Install the timing belt on the crankshaft timing, oil pump, No.2 idler and water pump pulleys.

**NOTE:** If reusing the timing belt, align the points marked during removal, and install the belt with the arrow pointing in the direction of engine revolution.

**6. INSTALL TIMING BELT GUIDE**

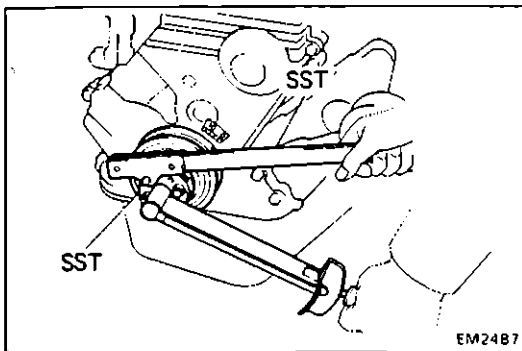
Install the guide, facing the cup side outward.

**7. INSTALL NO.1 TIMING BELT COVER**

(a) Install the gasket to the belt cover.

(b) Install the belt cover with the six bolts.

**Torque: 90 kg-cm (78 in.-lb, 8.8 N·m)**

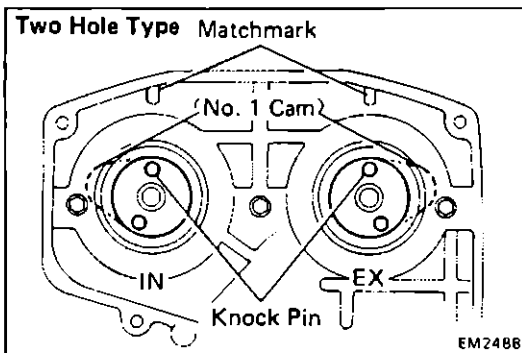
**8. INSTALL CRANKSHAFT PULLEY**

(a) Align the pulley set key with the key groove of the pulley, slide the pulley.

(b) Using SST, install and torque the bolt.

SST 09213-14010 and 09330-00021

**Torque: 1,100 kg-cm (80 ft.-lb, 108 N·m)**

**9. INSTALL CAMSHAFT TIMING PULLEYS**

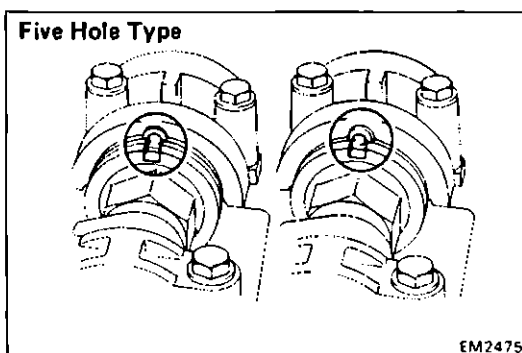
**NOTE:** There are two types of camshafts, one with two holes on the timing pulley contact surface and one with five holes on the timing pulley contact surface. All replacement camshaft have five holes.

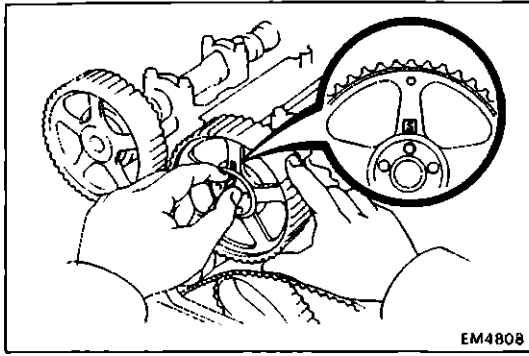
(a) (Two Hole Type)

Using a wrench, turn the camshafts so that the camshaft knock pin aligns with the matchmark of the No.3 timing belt cover. And the No.1 cam of the camshaft is as shown in the figure.

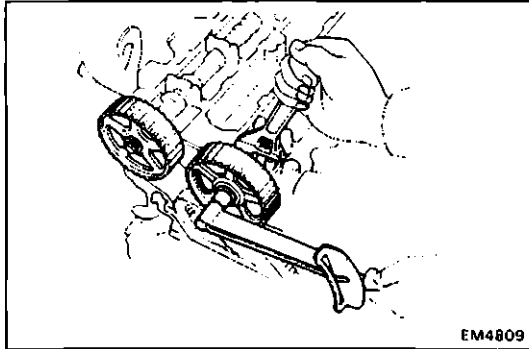
(b) (Five Hole Type)

Using a wrench, turn and align the groove of the camshaft with the drilled mark of the No.1 camshaft bearing cap.





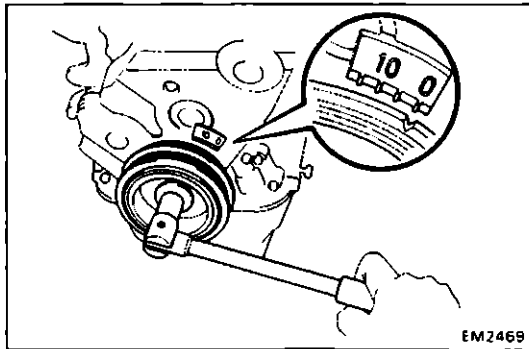
- (c) Slide the timing pulley onto the camshaft, facing mark "S" upward.
- (d) Align the pin holes of the camshaft and timing pulley, insert the knock pin.



- (e) Hold the hexagonal wrench head portion of the camshaft with a wrench, and tighten the bolts.

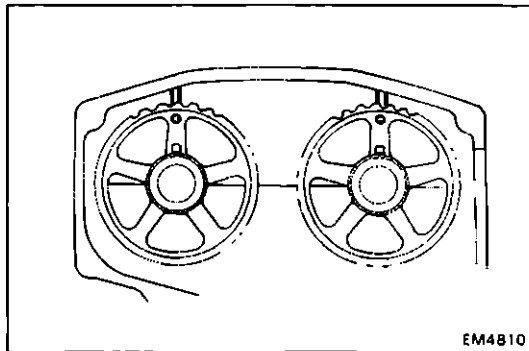
Torque: 600 kg-cm (43 ft-lb, 59 N·m)

- 10. INSTALL CYLINDER HEAD COVER(S)**  
 3S-GE (See step 9 on page EM-108)  
 3S-GTE (See step 7 on page EM-115)

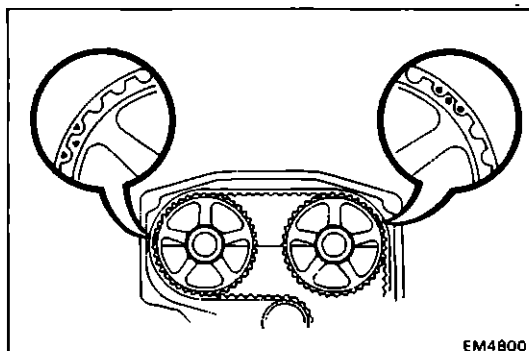


**11. SET NO.1 CYLINDER TO TDC/COMPRESSION**

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

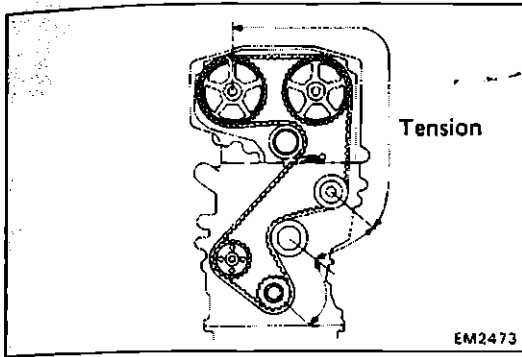


- (b) Turn the camshaft, and align the alignment marks of the camshaft timing pulley and cylinder head cover.

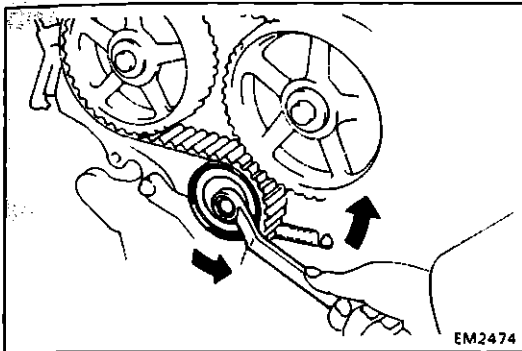


**12. INSTALL TIMING BELT**

**NOTE:** If reusing the timing belt, first align the match-marks of the camshaft timing pulleys and belt.



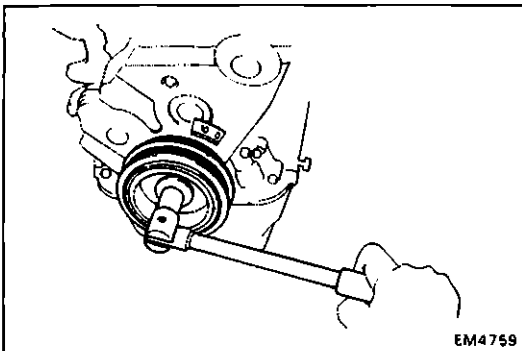
Install the timing belt, insuring the tension between the crankshaft and intake camshaft timing pulleys.



### 13. CHECK VALVE TIMING

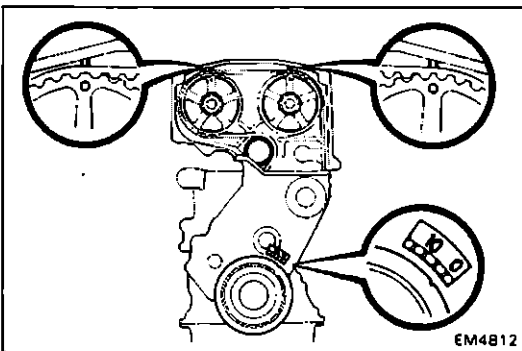
(a) Loosen the No. 1 idler pulley bolt and stretch the timing belt.

NOTE: Do not loosen the pulley bolt further than the point where the idler returns.



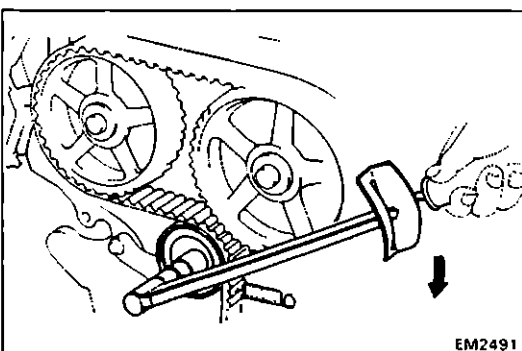
(b) Slowly turn the crankshaft pulley two revolutions from TDC to TDC.

NOTE: Always turn the crankshaft clockwise.



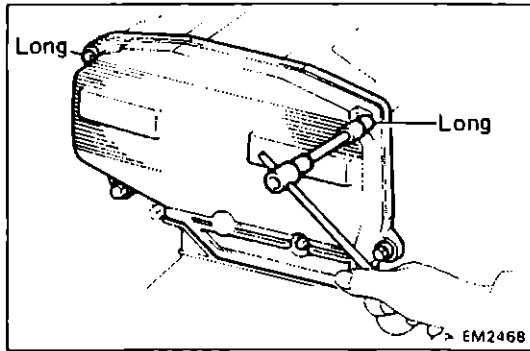
(c) Check that each pulley aligns with the timing marks as shown in the figure.

If the marks do not align, remove the timing belt and reinstall it.



(d) Torque the No. 1 idler pulley bolt.

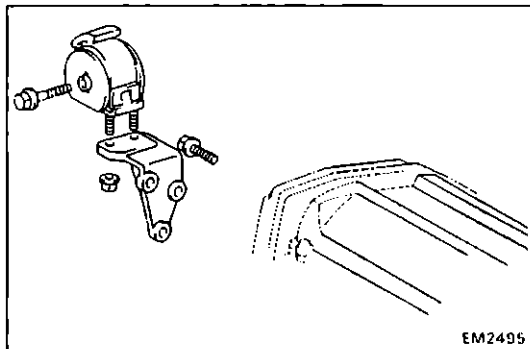
Torque: 440 kg-cm (32 ft-lb, 43 N·m)



14. **INSTALL NO.2 TIMING BELT COVER**  
 (a) Install the gasket to the belt cover.  
 (b) Install the belt cover with the five bolts.

15. **INSTALL SPARK PLUGS (See page IG-11)**  
 Torque: 180 kg-cm (13 ft-lb, 18 N·m)

16. (3S-GTE)  
**INSTALL THROTTLE BODY**  
 (See steps 2 to 12 on page FI-126)



17. **INSTALL ENGINE RH MOUNTING INSULATOR AND BRACKET**

- (a) Install the bracket with the three bolts.  
 Torque the bolts.

Torque: 530 kg-cm (38 ft-lb, 52 N·m)

- (b) Install the mounting insulator with the two nuts and through bolt.

Torque:

Bolt 800 kg-cm (58 ft-lb, 78 N·m)

Nut 530 kg-cm (38 ft-lb, 52 N·m)

18. **LOWER ENGINE**

19. **INSTALL POWER STEERING PUMP**

20. **INSTALL ALTERNATOR BRACKETS**

3S-GE (See step 34 on page EM-111)

3S-GTE (See step 31 on page EM-119)

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

21. **INSTALL ALTERNATOR**

22. **INSTALL DRIVE BELTS**

Adjust the drive belts. (See page CH-3)

Drive belt tension:

Alternator

w/ A/C New belt 175 ± 5 lb

Used belt 115 ± 20 lb

w/o A/C New belt 150 ± 25 lb

Used belt 130 ± 25 lb

PS pump New belt 125 ± 25 lb

Used belt 80 ± 20 lb

23. **INSTALL POWER STEERING OIL RESERVOIR TANK**

24. (w/ CRUISE CONTROL SYSTEM (w/o A.B.S.))  
**INSTALL CRUISE CONTROL ACTUATOR**  
 (See step 32 on page EM-155)

25. **INSTALL RADIATOR RESERVOIR TANK**

26. **INSTALL ENGINE RH UNDER COVER**

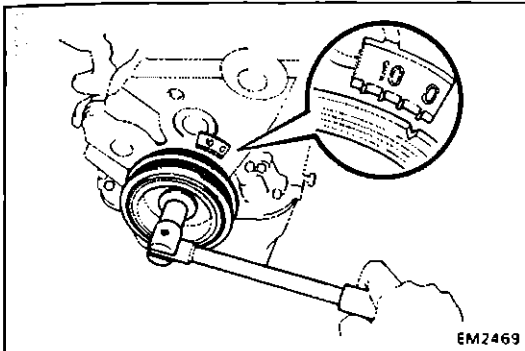
27. **INSTALL RH FRONT WHEEL**

28. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**

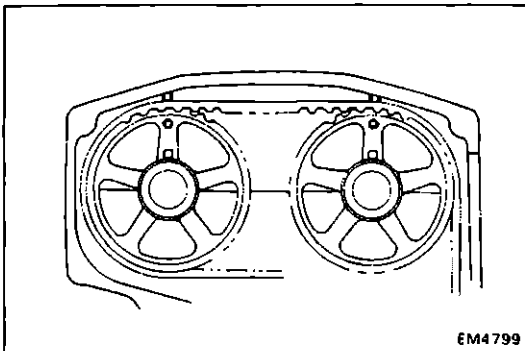


**ADJUSTMENT OF VALVE TIMING**

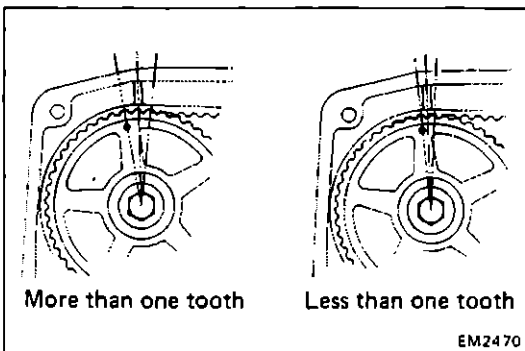
1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY
2. REMOVE RH FRONT WHEEL
3. REMOVE ENGINE RH UNDER COVER
4. REMOVE SPARK PLUGS (See page IG-11)
5. (3S-GTE)  
REMOVE INTERCOOLER  
(See steps 3 and 7 on pages TC-9 and 10)
6. REMOVE NO.2 TIMING BELT COVER  
(See step 13 on page EM-39)
7. CHECK CAMSHAFT TIMING PULLEY MARKS



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



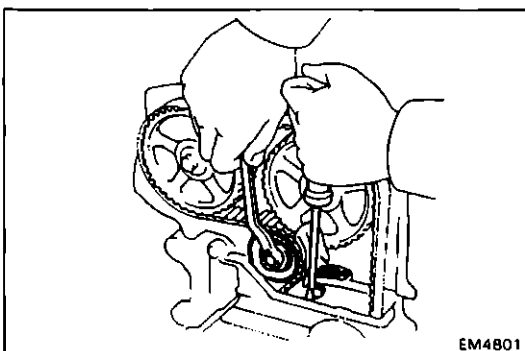
- (b) Check that the alignment marks of the camshaft timing pulleys are aligned with the those of the No.3 timing belt cover.

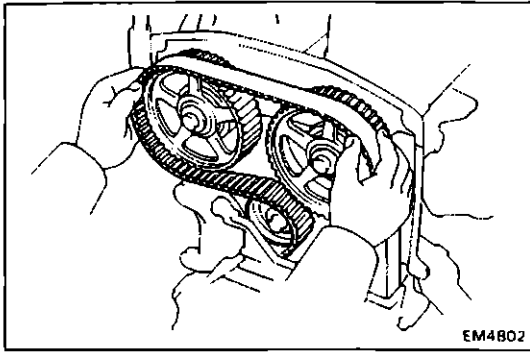


- If there is more than one timing pulley tooth between the alignment marks, realign the alignment marks in accordance with step 8.
- If the alignment marks are aligned or the difference is less than one timing pulley tooth, proceed to step 9.

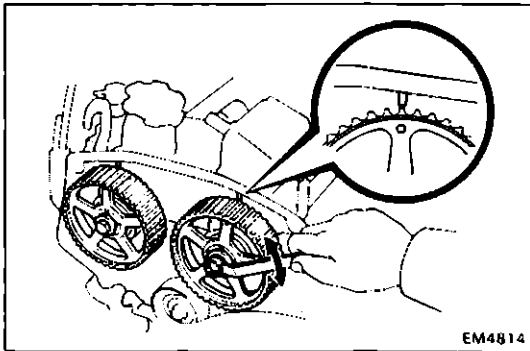
8. ADJUST CAMSHAFT TIMING PULLEY ALIGNMENT MARKS

- (a) Loosen the No.1 idler pulley bolt and shift the pulley toward the left as far as it will go, and temporarily tighten it.

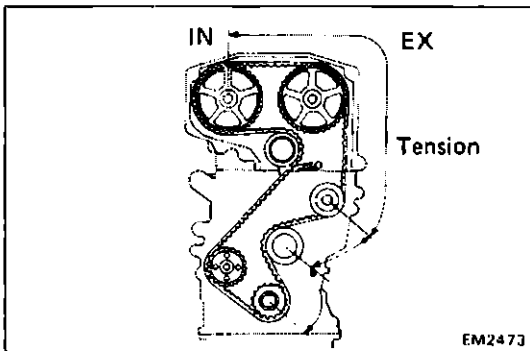




- (b) Remove the timing belt from the camshaft timing pulleys.

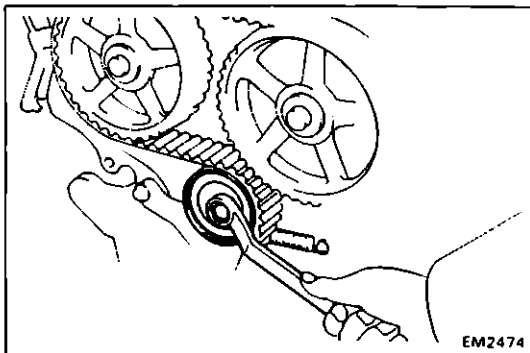


- (c) Rotate the camshaft with a wrench and align the alignment marks of the camshaft and cylinder head cover.



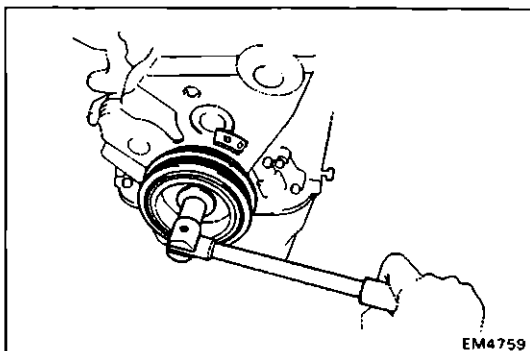
- (d) Install the timing belt, insuring the tension between the crankshaft and intake camshaft timing pulleys.

**CAUTION:** Install the timing belt when the engine is cold.



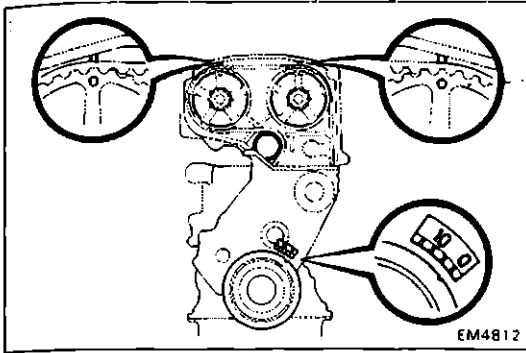
- (e) Loosen the No. 1 idler pulley bolt and stretch the timing belt.

**NOTE:** Do not loosen the bolt further than the point where the idler returns.

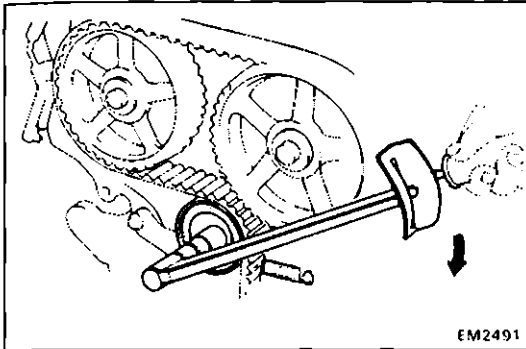


- (f) Turn the crankshaft pulley two revolutions from TDC to TDC.

**NOTE:** Always turn the crankshaft clockwise.



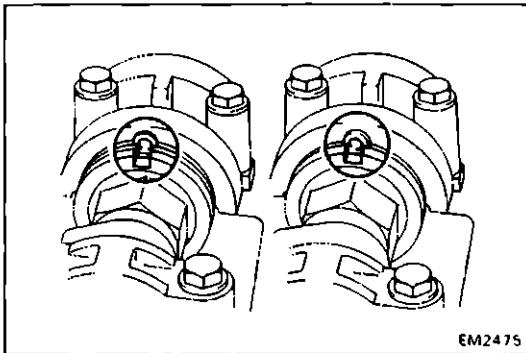
- (g) Check that each pulleys with the timing marks as shown in the figure.



- (h) Tighten the No.1 idler pulley bolt.  
Torque: 440 kg-cm (32 ft-lb, 43 N·m)

9. (3S-GTE)  
**REMOVE THROTTLE BODY**  
(See steps 1 to 10 on page FI-124)

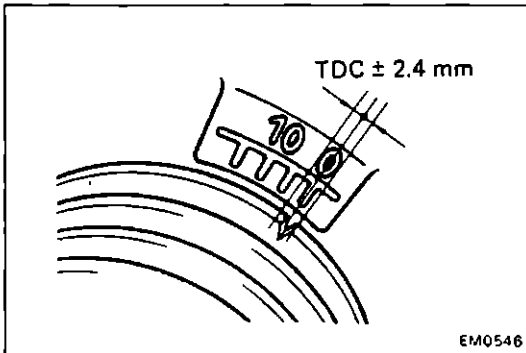
10. **REMOVE CYLINDER HEAD COVER(S)**  
3S-GE (See step 37 on page EM-86)  
3S-GTE (See step 40 on page EM-92)



11. **CHECK VALVE TIMING**

- (a) Using a wrench, turn and align the groove of the camshaft with the drilled mark of the No.1 camshaft bearing cap.

NOTE: Always turn the crankshaft clockwise.

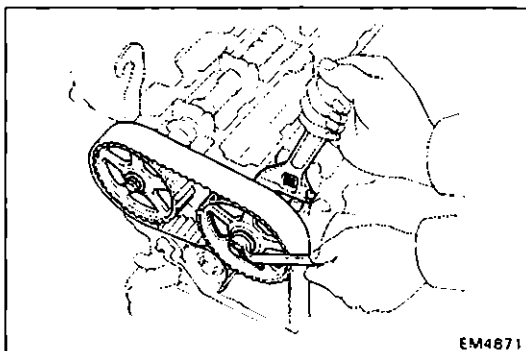


- (b) Next make a note of the crankshaft pulley angle on the No.1 timing belt cover.

NOTE: Perform this check separately for the IN and EX sides.

If the crankshaft pulley movement is within  $\pm$  2.4 mm (0.094 in.) of TDC it is correct.

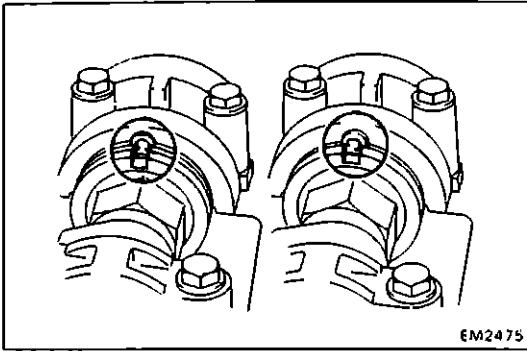
If it is greater than 2.4 mm (0.094 in.), go back to step 7.



12. **ADJUST VALVE TIMING**

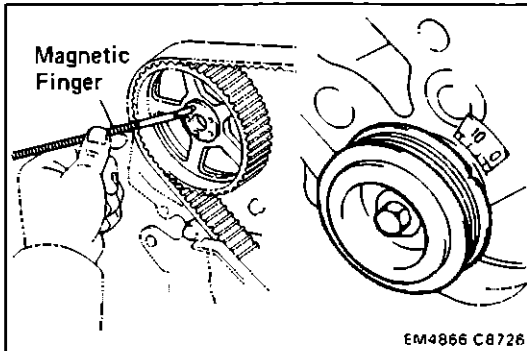
- (a) Hold the of the hexagonal wrench head portion of the camshaft with a wrench, and remove the pulley mount bolts.

**CAUTION:** Do not make use of the timing belt tension when loosening the bolt.



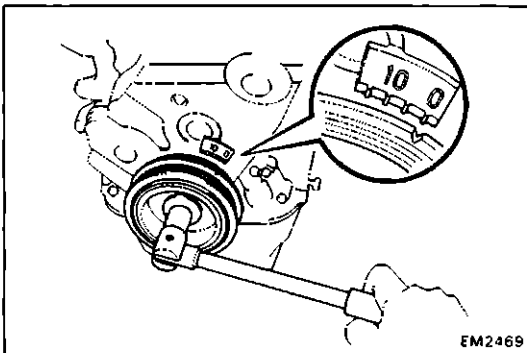
EM2475

- (b) Check that the camshaft grooves are aligned with the drilled mark of the No.1 camshaft bearing cap.



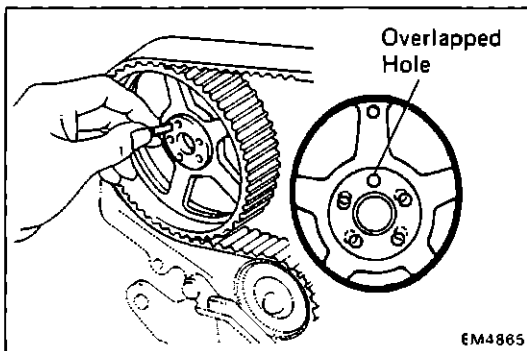
EM4866 C8726

- (c) Using a magnetic finger, remove the knock pin from the pin hole of camshaft timing pulley.



EM2469

- (d) Turn the crankshaft pulley and align its groove with mark "O" of the No.1 timing belt cover.



EM4865

- (e) There are five pin holes of the camshaft and timing pulley.  
Select one overlapped hole and insert the match pin into it.

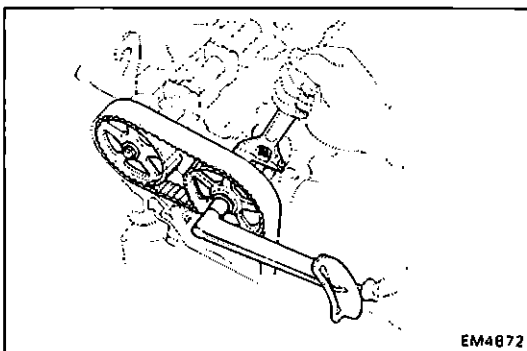
**NOTE:**

- If there is not an overlapped hole, rotate the crankshaft a little and insert the pin into the hole nearly overlapped.
- By changing the pin hole to the next one, the crankshaft pulley angle can be adjusted by approx.  $2^{\circ}$ .
- By changing the pin hole to the next two, the crankshaft pulley angle can be adjusted by approx.  $5^{\circ}$ .

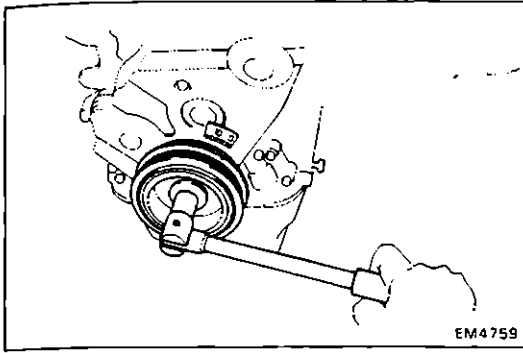
- (f) Hold the hexagonal wrench head portion of the camshaft with a wrench, and install the pulley bolt.

**Torque: 600 kg-cm (43 ft-lb, 59 N·m)**

**CAUTION: Do not make use of the timing belt tension when tightening the bolt.**



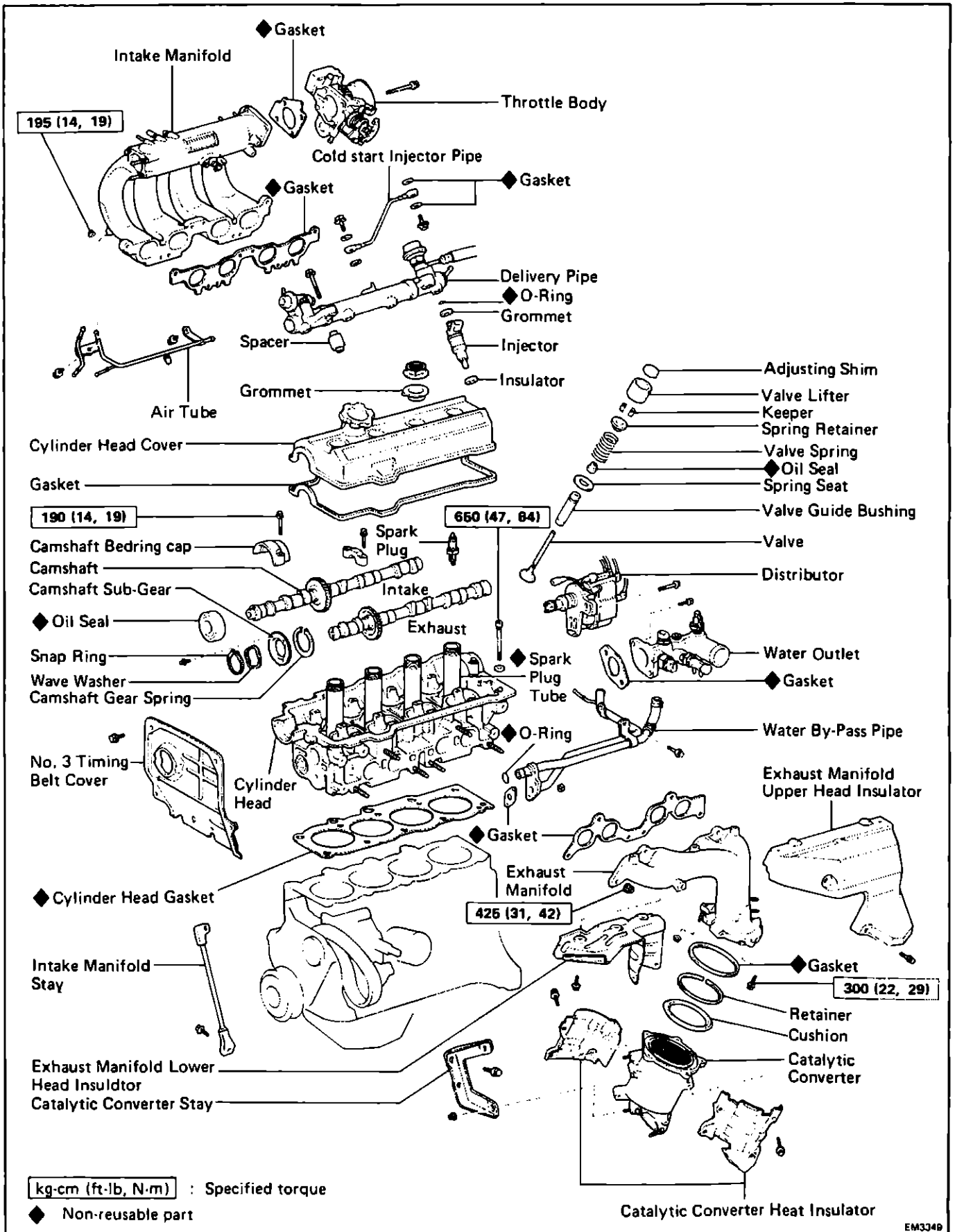
EM4872



- (g) Turn the crankshaft clockwise two revolutions from TDC to TDC.
- (h) Recheck the valve timing.  
(See step 11 on page EM-51)

13. **REINSTALL NO.2 TIMING BELT COVER**  
(See step 14 page EM-48)
14. **REINSTALL SPARK PLUGS** (See page IG-11)  
Torque: 180 kg-cm (13 ft-lb, 18 N·m)
15. **REINSTALL CYLINDER HEAD COVER(S)**  
3S-GE (See step 9 on page EM-108)  
3S-GTE (See step 7 on page EM-115)
16. (3S-GTE)  
**REINSTALL THROTTLE BODY**  
(See steps 2 to 12 on page FI-126)
17. **REINSTALL ENGINE RH UNDER COVER**
18. **REINSTALL RH FRONT WHEEL**
19. **RECONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**

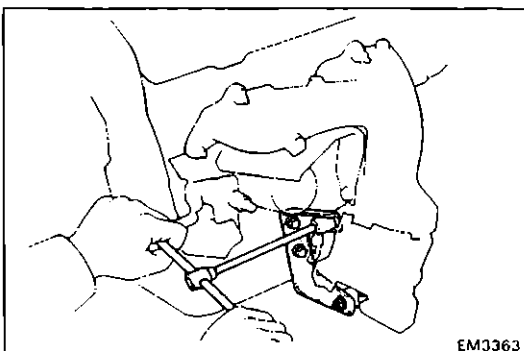
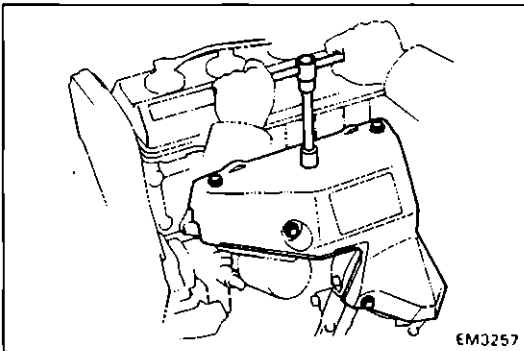
# CYLINDER HEAD (3S-FE) COMPONENTS

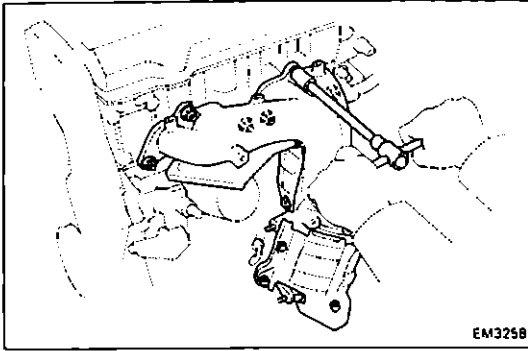


**REMOVAL OF CYLINDER HEAD**

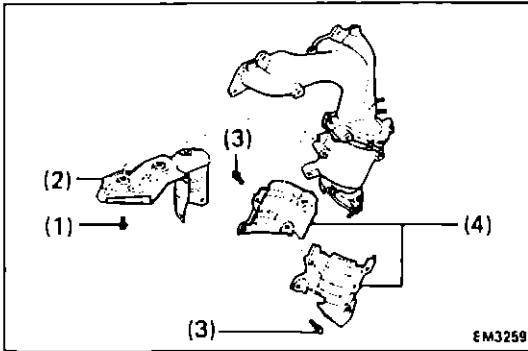
(See page EM-54)

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
2. **DRAIN ENGINE COOLANT** (See page CO-6)
3. **REMOVE SUSPENSION UPPER BRACE**  
(See step 10 on page EM-122)
4. (A/T)  
**DISCONNECT THROTTLE CABLE AND BRACKET FROM THROTTLE BODY**
5. **DISCONNECT ACCELERATOR CABLE AND BRACKET FROM THROTTLE BODY AND AIR INTAKE CHAMBER**
6. **REMOVE RADIATOR RESERVOIR TANK**
7. (w/ CRUISE CONTROL SYSTEM)  
**REMOVE CRUISE CONTROL ACTUATOR**  
(See step 9 on page EM-122)
8. **REMOVE AIR CLEANER ASSEMBLY**  
(See step 11 on page EM-123)
9. **REMOVE ALTERNATOR** (See page CH-6)
10. **REMOVE OIL PRESSURE SENDER GAUGE, ENGINE HANGERS AND ALTERNATOR UPPER BRACKET**
11. **RAISE VEHICLE**  
**CAUTION:** Be sure the vehicle is securely supported.
12. **REMOVE RH FRONT WHEEL**
13. **REMOVE ENGINE RH UNDER COVER**
14. **REMOVE SUSPENSION LOWER CROSSMEMBER**  
(See step 26 on page EM-124)
15. **DISCONNECT EXHAUST FRONT PIPE FROM CATALYTIC CONVERTER**  
(See step 31 on page EM-125)
16. **REMOVE EXHAUST MANIFOLD AND CATALYTIC CONVERTER ASSEMBLY**
  - (a) Disconnect the oxygen sensor connector(s).
  - (b) Remove the six bolts and manifold upper heat insulator.
  - (c) Remove the two bolts, two nuts and catalytic converter stay.





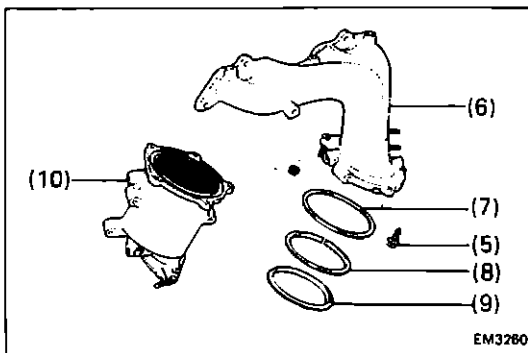
- (d) Remove the six nuts, the exhaust manifold and catalytic converter assembly.



### 17. SEPARATE EXHAUST MANIFOLD AND CATALYTIC CONVERTER

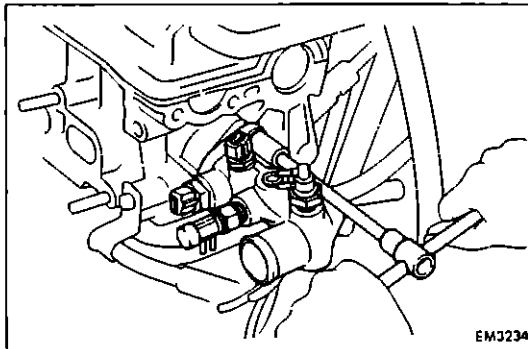
Remove the following parts:

- (1) Five bolts
- (2) Manifold lower heat insulator
- (3) Eight bolts
- (4) Two catalytic converter heat insulators



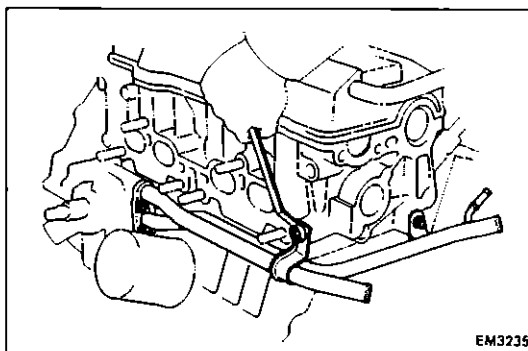
- (5) Three bolts and two nuts
- (6) Exhaust manifold
- (7) Gasket
- (8) Retainer
- (9) Cushion
- (10) Catalytic converter

### 18. REMOVE DISTRIBUTOR (See page IG-13)



### 19. REMOVE WATER OUTLET

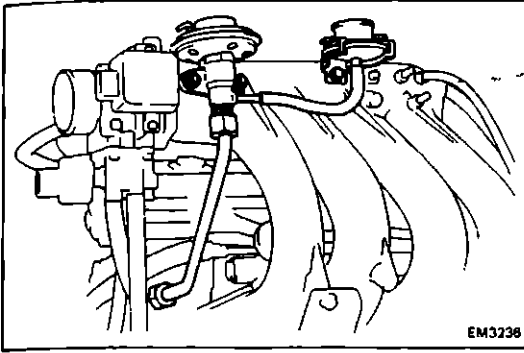
- (a) Disconnect the following connectors and hoses:
  - (1) Water temperature sender gauge connector
  - (2) Water temperature sensor connector
  - (3) Cold start injector time switch connector
  - (4) Radiator upper hose
  - (5) Water hoses
  - (6) Emission control vacuum hoses
- (b) Remove the two bolts, water outlet and gasket.



### 20. REMOVE WATER BY-PASS PIPE

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



**21. REMOVE EGR VALVE AND MODULATOR**

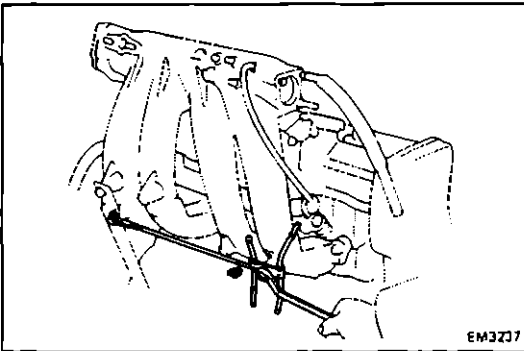
- (a) Remove the vacuum hoses.
- (b) Loosen the union nut of the EGR pipe, and remove two bolts, EGR modulator and gasket.
- (c) Remove the bolt and EGR valve.

**22. REMOVE THROTTLE BODY**

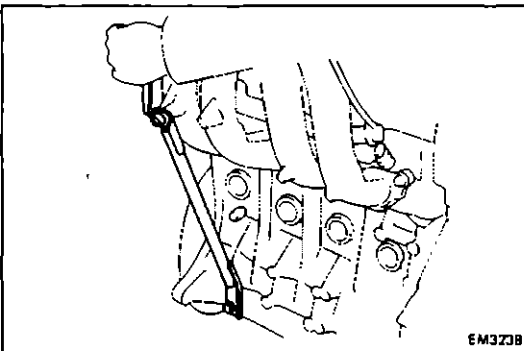
(See steps 5 to 7 on page FI-116)

**23. REMOVE COLD START INJECTOR PIPE**

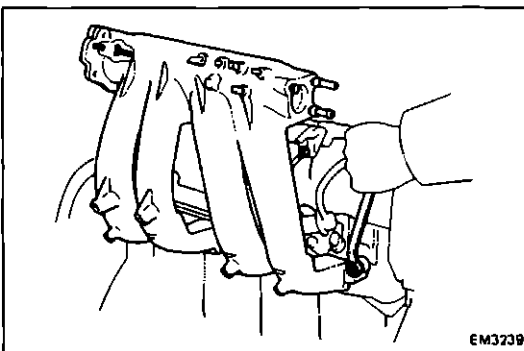
(See steps 2 and 3 on page FI-80)

**24. REMOVE AIR TUBE**

- (a) Disconnect the following air hoses:
  - (1) Air intake chamber air hose
  - (2) Throttle body air hose
  - (3) (w/ PS)  
PS pump air hoses
- (b) Remove the two bolts and air tube.

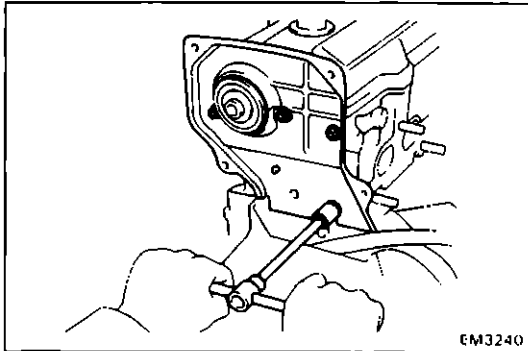
**25. REMOVE INTAKE MANIFOLD**

- (a) Remove the two bolts and manifold stay.



- (b) Disconnect the vacuum sensing hose.
- (c) Remove the six bolts, two nuts, intake manifold and gasket.

26. REMOVE DELIVERY PIPE AND INJECTORS  
(See steps 3 to 7 on page FI-96)
27. REMOVE SPARK PLUGS (See page IG-6)
28. REMOVE CAMSHAFT TIMING PULLEY  
(See steps 11 to 14 on pages EM-28 and 29)
29. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING  
(See step 18 on page EM-30)

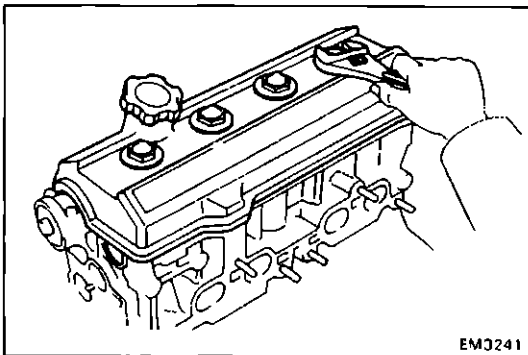


30. REMOVE NO.3 TIMING BELT COVER

Remove the four bolts and belt cover.

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 or dust.



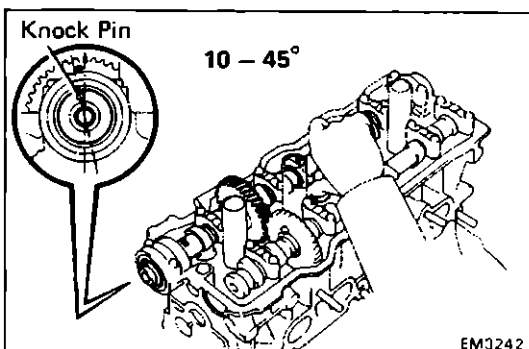
31. REMOVE CYLINDER HEAD COVER

Remove the four nut, grommet, head cover and gasket.

NOTE: Arrange the grommets in correct order, so that they can be reinstalled into their original positions. This minimizes any possibility of oil leakage due to reuse of grommets.

32. REMOVE CAMSHAFTS

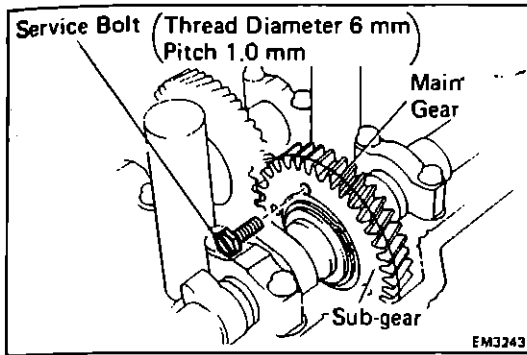
NOTE: Since the thrust clearance of the camshaft is small, the camshaft must be held level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following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



A. Remove exhaust camshaft

- (a) Set the knock pin of the intake camshaft at 10 – 45° of BTDC camshaft angle.

NOTE: The above position helps to lift the exhaust camshaft in level and evenly by pushing No.2 and No.4 cylinder cam lobes of the exhaust camshaft to their valve lifters.

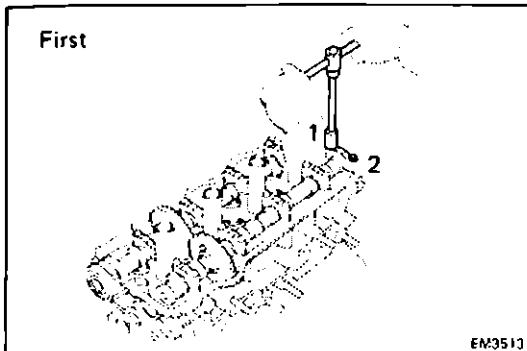


- (b) Secure the exhaust camshaft sub-gear to main gear with a service bolt.

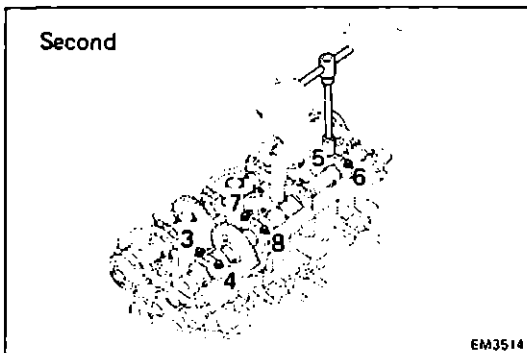
**Recommended service bolt:**

Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 – 20 mm (0.63 – 0.79 in.)

NOTE: When removing the camshaft, make certain that the torsional spring force of the sub-gear has been eliminated by the above operation.



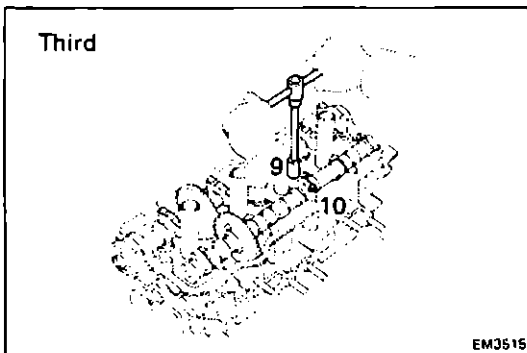
- (c) Remove rear bearing cap bolts 1 and 2.  
(d) Remove the rear bearing cap.



- (e) Uniformly loosen and remove bearing cap bolts 3 to 8 in several passes in the sequence shown.

NOTE: Do not remove No. 3 bearing cap bolts at this stage.

- (f) Remove the No. 1, No. 2 and No. 4 bearing cap.



- (g) Alternately loosen and remove No. 3 bearing cap bolts 9 and 10.

**NOTE:**

- As bearing cap bolts 9 and 10 are loosened, check that the camshaft being lifted out straight and level.
- If the camshaft is not being lifted out straight and level, tighten bearing cap bolts 9 and 10. Then reverse the order of above steps from (f) to (a) and reset the knock pin of the intake camshaft at 10–45° BTDC, and repeat steps from (b) to (g) once again.

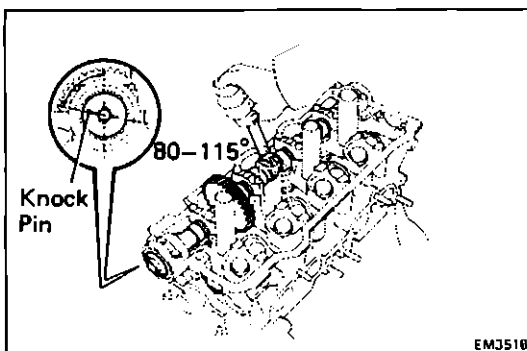
**CAUTION:** Do not pry on or attempt to force the camshaft with a tool or other object.

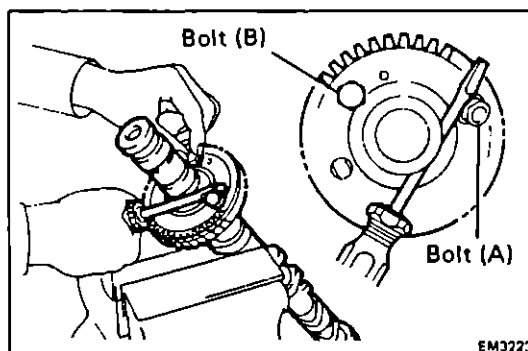
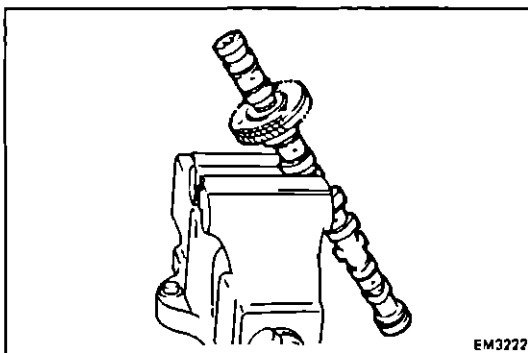
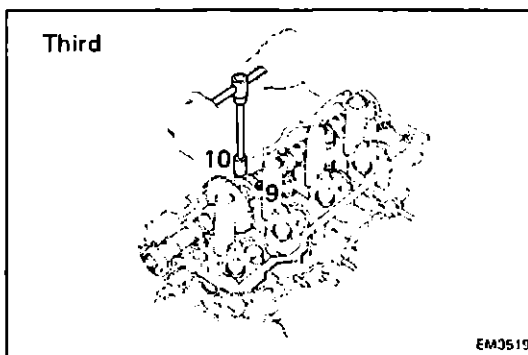
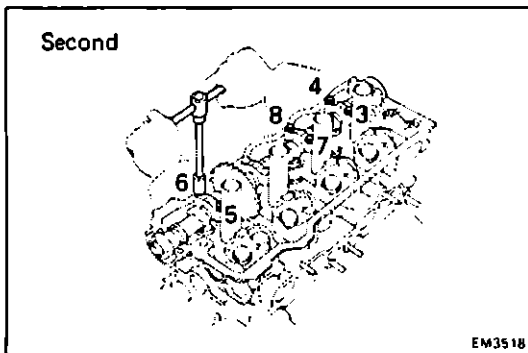
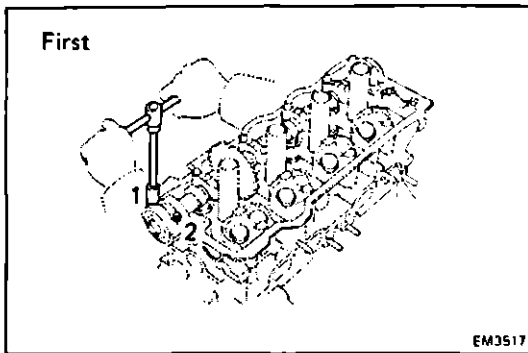
- (h) Remove the No. 3 bearing cap and exhaust camshaft.

**B. Remove intake camshaft**

- (a) Set the knock pin of the intake camshaft 80–115° BTDC of camshaft angle.

NOTE: The above angle allows No. 1 and No. 3 cylinder cam lobes of intake camshaft to push their valve lifters evenly.





(b) Remove the front bearing cap bolts 1 and 2.

(c) Remove the front bearing cap and oil seal.

**CAUTION:** If the front bearing cap is not removable by hand, do not try to remove by force but leave as it is without bolts.

(d) Uniformly loosen and remove bearing cap bolts 3 to 8 in several pass in the sequence shown.

**NOTE:** Do not remove the No. 2 bearing cap bolts at this stage.

(e) Remove the No. 1, No. 3 and No. 4 bearing caps.

(f) Alternately loosen and remove No. 2 bearing cap bolts 9 and 10.

**NOTE:**

- As bearing cap bolts 9 and 10 are loosened, check that the camshaft is being lifted out straight and level, after breaking adhesion on the front bearing cap.
- If the camshaft is not being lifted out straight and level, retighten bearing cap bolts 9 and 10. Reverse the order of above steps from (f) to (a) and reset the knock pin of the intake camshaft at 80–115° BTDC, and repeat steps from (b) to (f) once again.

**CAUTION:** Do not pry or attempt to force the camshaft with a tool or other object.

(g) Remove the No. 2 bearing cap and camshaft.

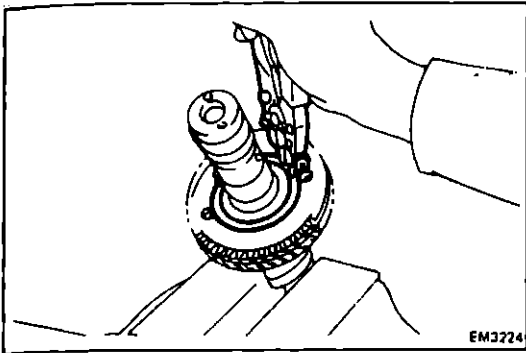
### 33. DISASSEMBLE EXHAUST CAMSHAFT

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

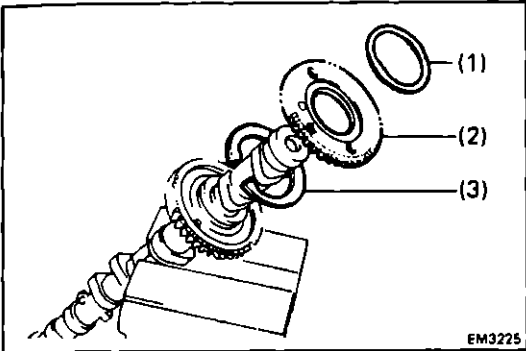
(b) Insert bolt (A) into the service hole of the camshaft sub-gear.

(c) Using a screwdriver, turn the sub-gear clockwise, and remove the bolt (B).

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



(d) Using snap ring pliers, remove the snap ring.

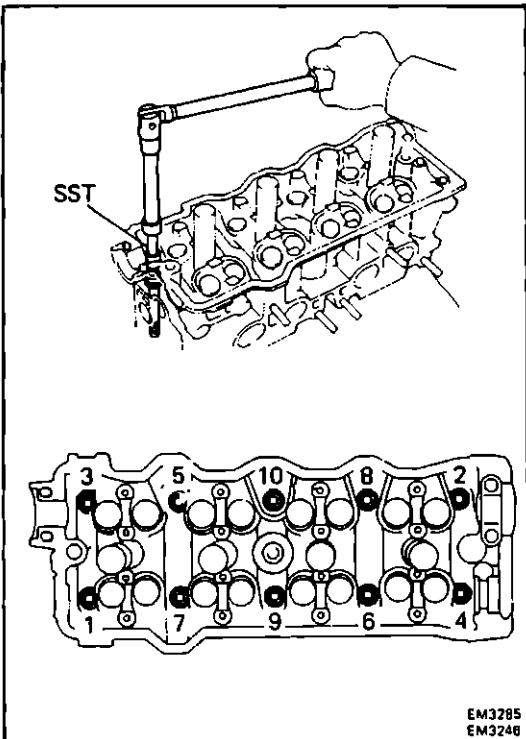


(e) Remove the following parts:

- (1) Wave washer
- (2) Camshaft sub-gear
- (3) Camshaft gear spring

### 34. IF NECESSARY, REMOVE SPARK PLUG TUBES

Using a pipe wrench, remove the four spark tubes.

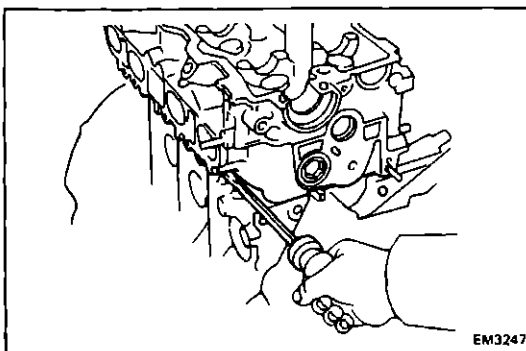


### 35. REMOVE CYLINDER HEAD

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

SST 09043-88010

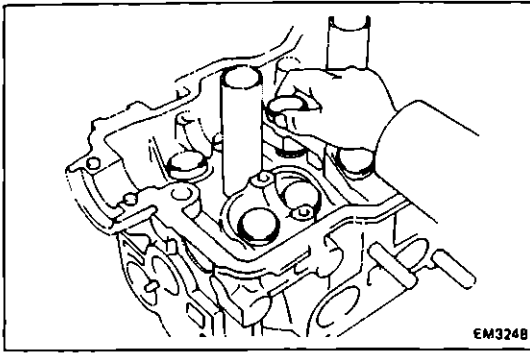
**CAUTION:** Head warpage or cracking could result from removing bolts in incorrect order.



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

**NOTE:** If the cylinder head is difficult to lift off, pry with a screwdriver between the cylinder head and block saliences.

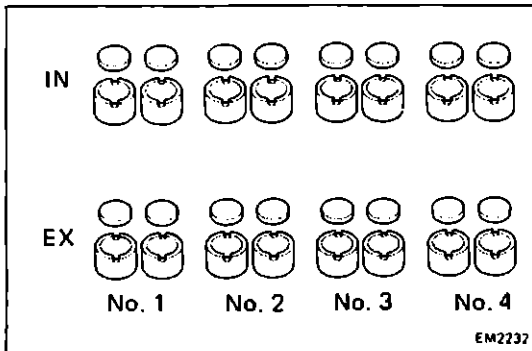
**CAUTION:** Be careful not to damage the cylinder head and cylinder block surfaces of cylinder head gasket side.



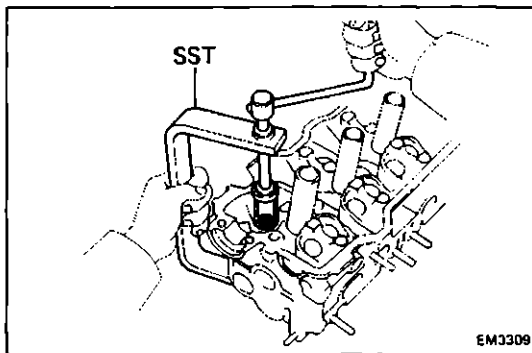
## DISASSEMBLY OF CYLINDER HEAD

(See page EM-54)

### 1. REMOVE VALVE LIFTERS AND SHIMS



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

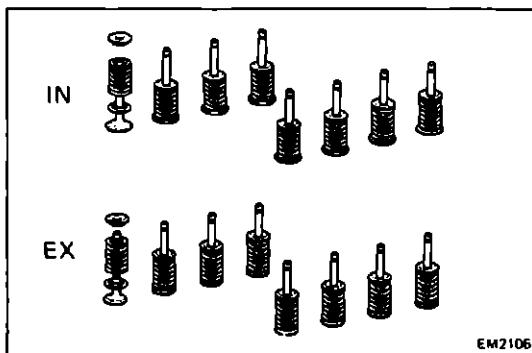


### 2. REMOVE VALVES

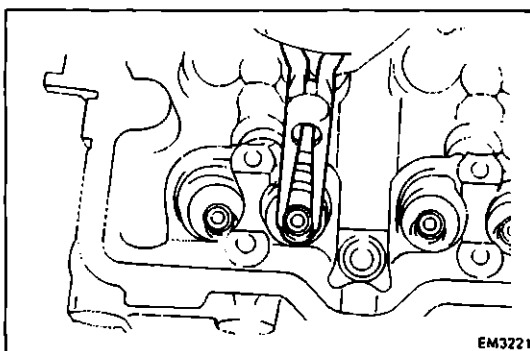
(a) Using SST, compress the valve spring and remove the two keepers.

SST 09202-70010

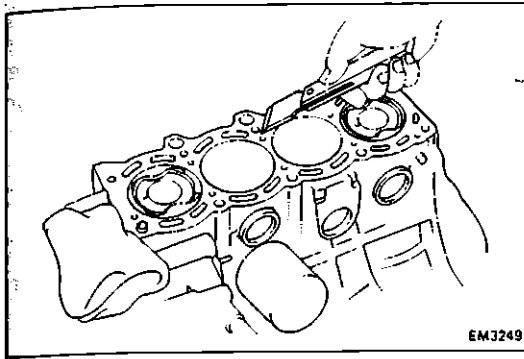
(b) Remove the spring retainer, valve spring, valve and spring seat.



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



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



## INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS

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

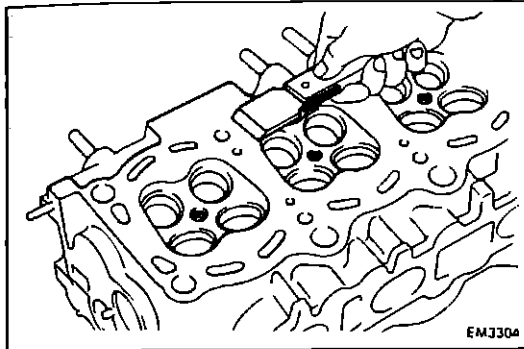
- (a) Turn the crankshaft and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top.
- (b) Remove all the gasket material from the top of the cylinder block.
- (c) Using compressed air, blow carbon and oil from the bolt holes.

**WARNING:** Protect your eyes when using high pressure air.

### 2. REMOVE GASKET MATERIAL

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

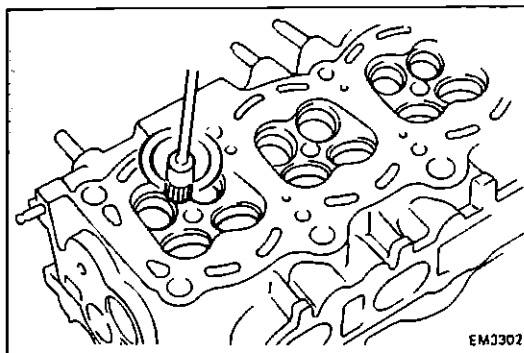
**CAUTION:** Be careful not scratch the surfaces.



### 3. CLEAN COMBUSTION CHAMBERS

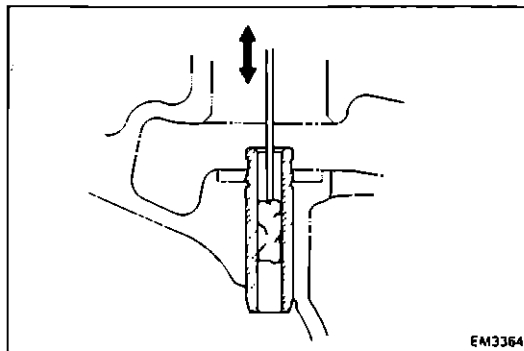
Using a wire brush, remove all the carbon from the combustion chambers.

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



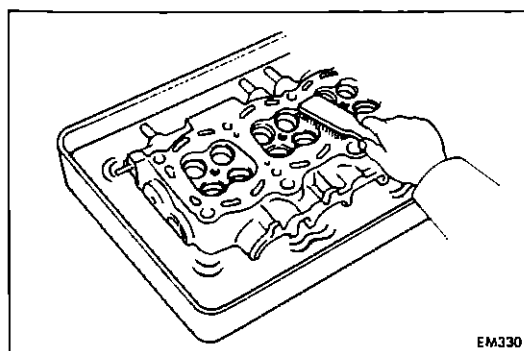
### 4. CLEAN VALVE GUIDE BUSHINGS

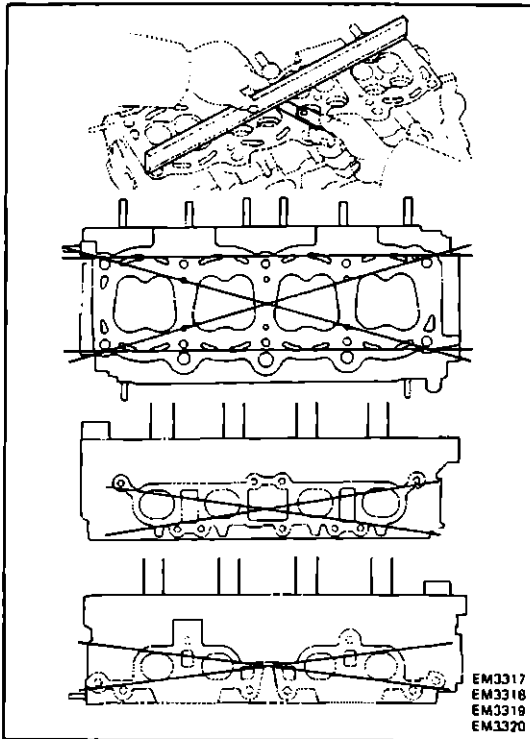
Using a valve guide bushing brush and solvent, clean all the guide bushings.



### 5. CLEAN CYLINDER HEAD

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





## 6. INSPECT CYLINDER HEAD FOR FLATNESS

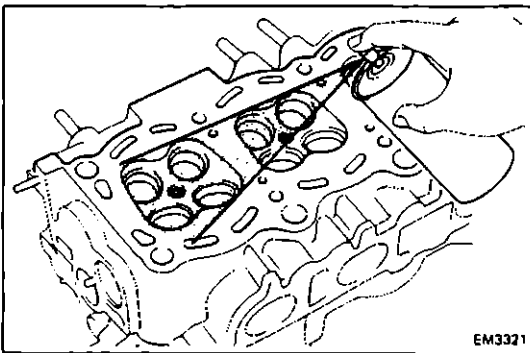
Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder block manifolds for warpage.

**Maximum warpage:**

**Cylinder block side** 0.05 mm (0.0020 in.)

**Manifold side** 0.08 mm (0.0031 in.)

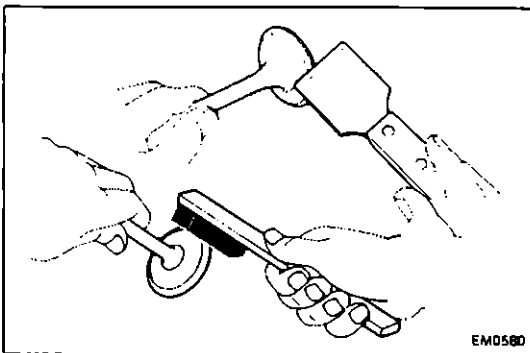
If warpage is greater than maximum, replace the cylinder head.



## 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.

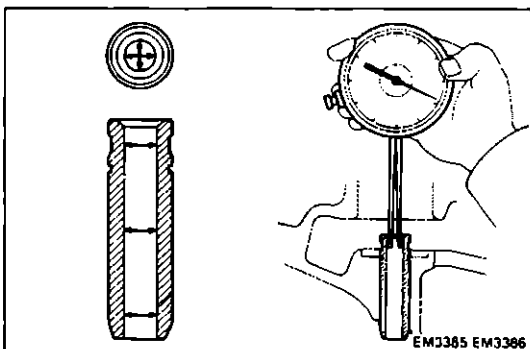
If cracked, replace the cylinder head.



## 8. CLEAN VALVES

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

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



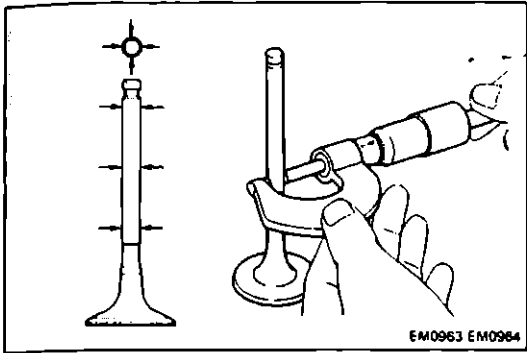
## 9. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

**Bushing inside diameter:**

6.010 — 6.030 mm (0.2366 — 0.2374 in.)





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

**Valve stem diameter:**

Intake	5.970 – 5.985 mm (0.2350 – 0.2356 in.)
Exhaust	5.965 – 5.980 mm (0.2348 – 0.2354 in.)

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

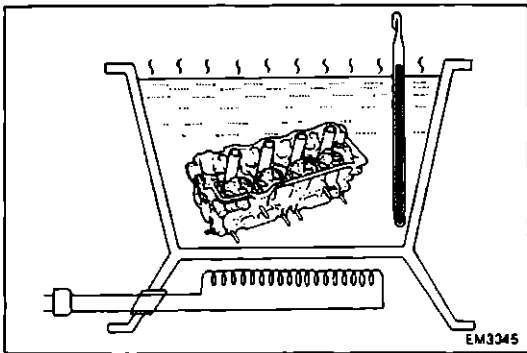
**Standard oil clearance:**

Intake	0.025 – 0.060 mm (0.0010 – 0.0024 in.)
Exhaust	0.030 – 0.065 mm (0.0012 – 0.0026 in.)

**Maximum oil clearance:**

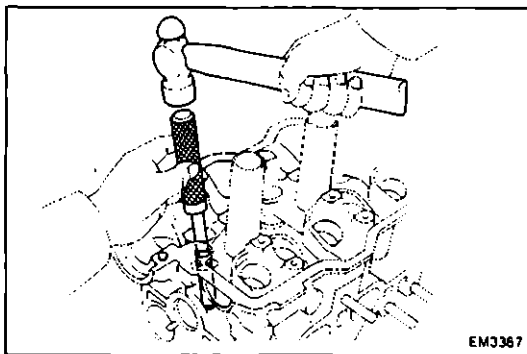
Intake	0.08 mm (0.0031 in.)
Exhaust	0.10 mm (0.0039 in.)

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

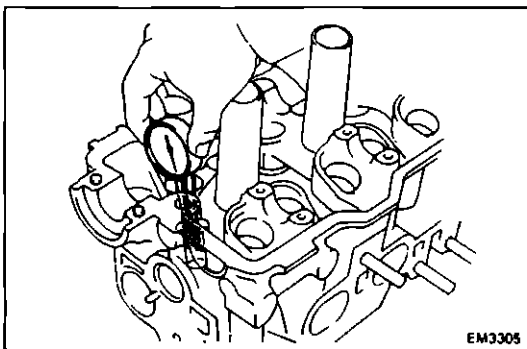


**10. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS**

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



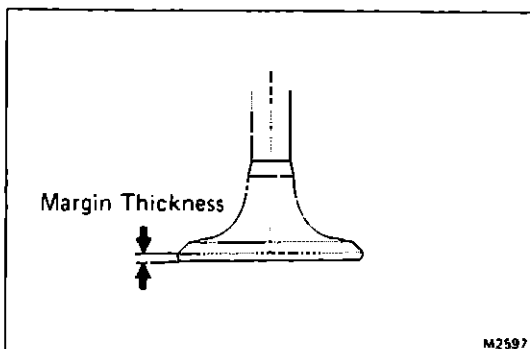
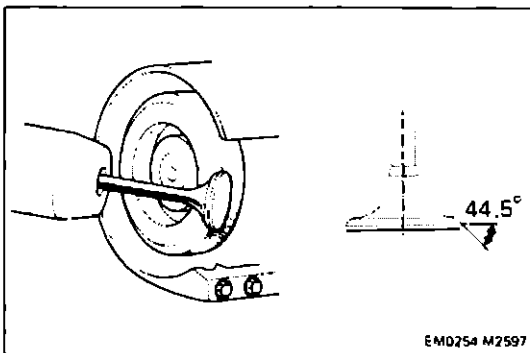
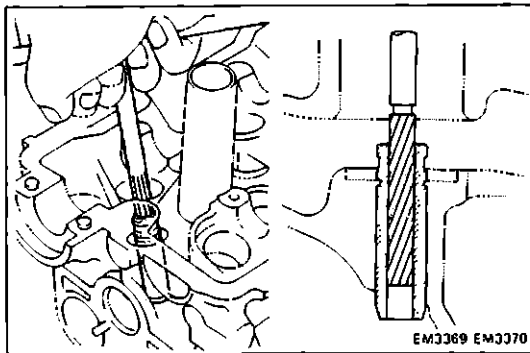
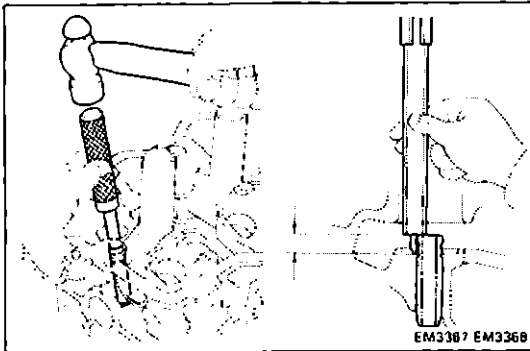
- (b) Using SST and a hammer, tap out the guide bushing.  
SST 09201-70010



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

Both intake and exhaust

Bushing bore diameter mm (in.)	Bushing size
11.000 – 11.027 (0.4331 – 0.4342)	Use STD
11.050 – 11.077 (0.4350 – 0.4361)	Use O/S 0.05



(d) Select a new guide bushing (STD size or O/S 0.05). If the bushing bore diameter of the cylinder head is greater than 11.027 mm (0.4341 in.), machine the bushing bore to the following dimension:

**Rebored cylinder head bushing bore dimension:**

**11.050 – 11.077 mm (0.4350 – 0.4361 in.)**

If the bushing bore diameter of the cylinder head is greater than 11.077 mm (0.4361 in.), replace the cylinder head.

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

(f) Using SST and a hammer, tap in a new guide bushing to where there is 8.2 – 8.6 mm (0.303 – 0.339 in.) protruding from the cylinder head.

SST 09201-70010

(g) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page EM-65) between the guide bushing and valve stem.

## 11. INSPECT AND GRIND VALVES

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

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

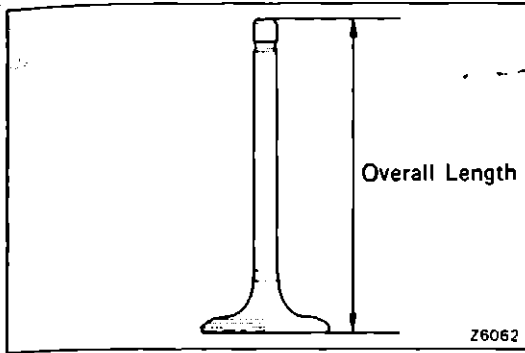
**Valve face angle: 44.5°**

(c) Check the valve head margin thickness.

**Standard margin thickness: 0.8 – 1.2 mm  
(0.031 – 0.047 in.)**

**Minimum margin thickness: 0.5 mm (0.020 in.)**

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



(d) Check the valve overall length.

**Standard overall length:**

Intake 100.60 mm (3.9606 in.)

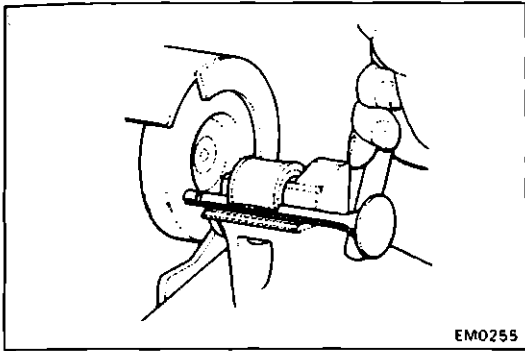
Exhaust 100.45 mm (3.9547 in.)

**Minimum overall length:**

Intake 100.1 mm (3.941 in.)

Exhaust 100.0 mm (3.937 in.)

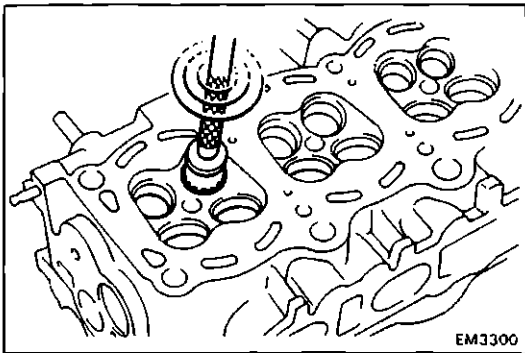
If the overall length is less than minimum, replace the valve.



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

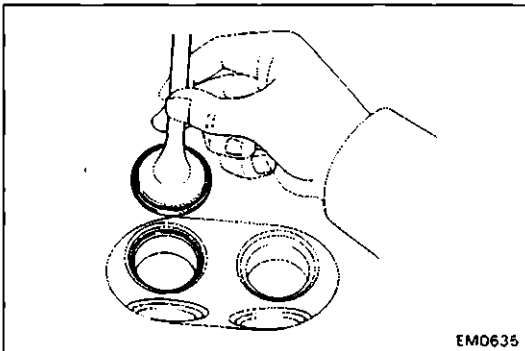
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

**CAUTION:** Do not grind off more than the minimum overall length.



## 12. INSPECT AND CLEAN VALVE SEATS

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



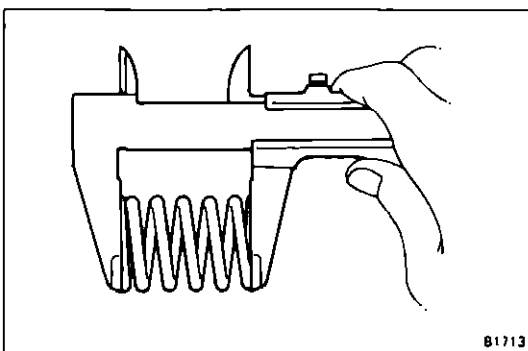
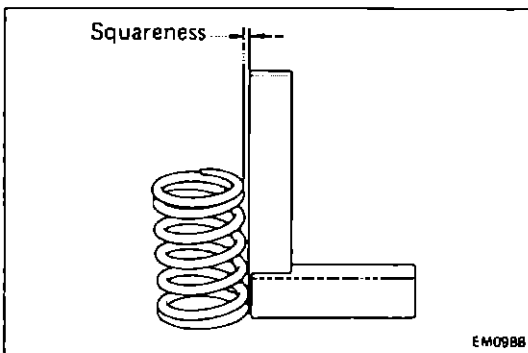
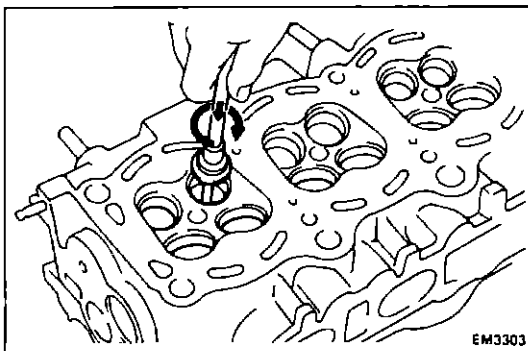
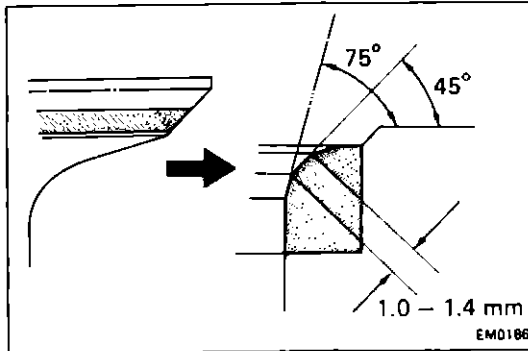
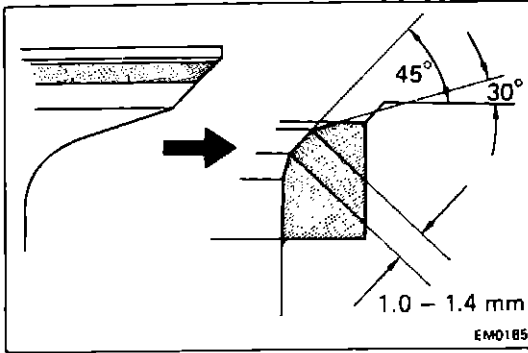
(b) Check the valve seating position.

Apply a thin coat of prussian blue (or white lead) to the valve face. 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 seats as follows:

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

(2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.

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

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

### 13. INSPECT VALVE SPRINGS

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

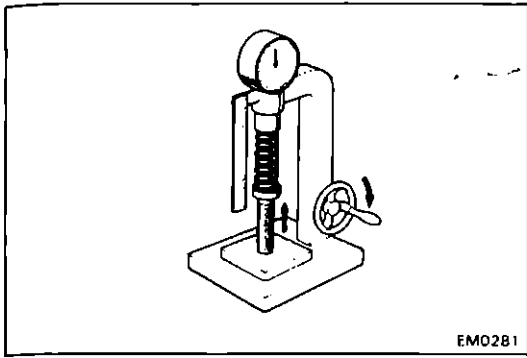
**Maximum squareness: 2.0 mm (0.075 in.)**

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

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

**Free length: 45.0 mm (1.772 in.)**

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



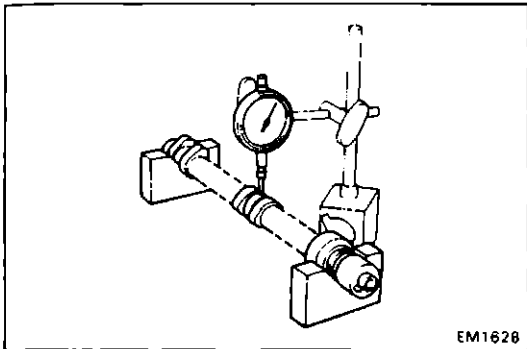
EM0281

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

**Installed tension:**

**16.7 – 19.3 kg (36.8 – 42.5 lb, 164 – 189 N)  
at 34.7 mm (1.366 in.)**

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



EM1628

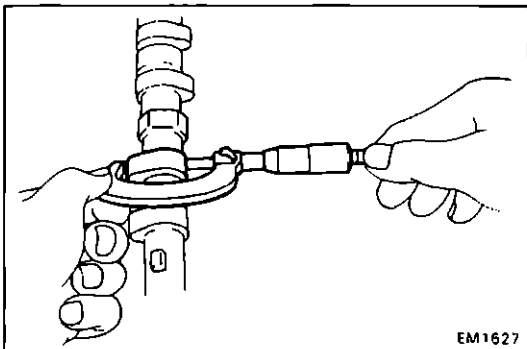
#### 14. INSPECT CAMSHAFTS AND BEARINGS

##### A. Inspect camshaft for runout

- (a) Place the camshaft on V-blocks.  
(b) Using a dial indicator, measure the circle runout at the center journal.

**Maximum circle runout: 0.04 mm (0.0016 in.)**

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



EM1627

##### B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

**Standard cam lobe height:**

**Intake 34.910 – 35.010 mm  
(1.3744 – 1.3783 in.)**

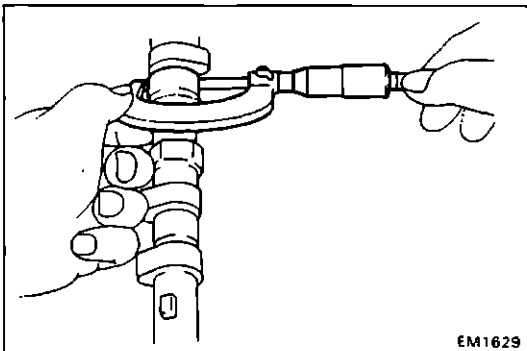
**Exhaust 35.560 – 35.660 mm  
(1.4000 – 1.4039 in.)**

**Minimum cam lobe height:**

**Intake 34.80 mm (1.3701 in.)**

**Exhaust 35.45 mm (1.3957 in.)**

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



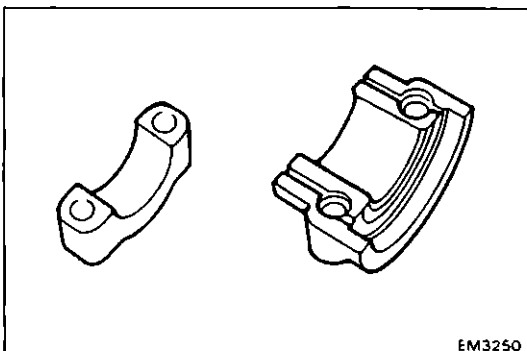
EM1629

##### C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

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

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

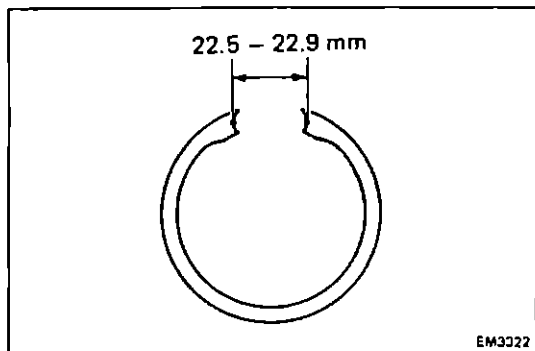


EM3250

##### D. Inspect camshaft bearings

Check the bearings for flaking and scoring.

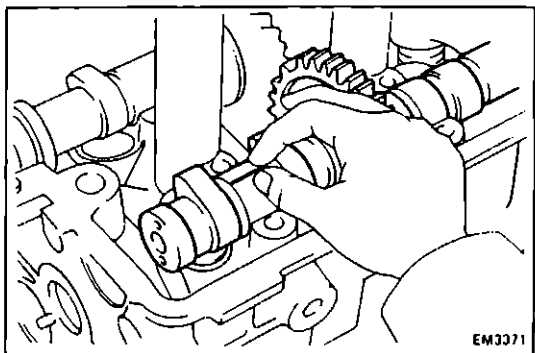
If the bearings are damaged, replace the bearing caps and cylinder head as a set.

**E. Inspect camshaft gear spring**

Using calipers, measure the free distance between the spring end.

**Free distance: 22.5 – 22.9 mm (0.886 – 0.902 in.)**

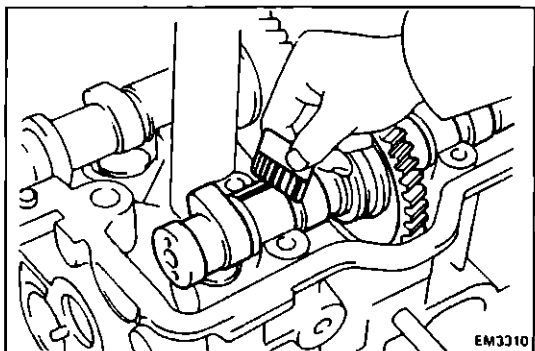
If the free distance is not as specified, replace the gear spring.

**F. Inspect camshaft journal oil clearance**

- Clean the bearing caps and camshaft journals.
- Place the camshafts on the cylinder head.
- Lay a strip of Plastigage across each of the camshaft journal.
- Install the bearing caps.  
(See step 4 on pages EM-74 to 76)

**Torque: 190 kg-cm (14 ft-lb, 19 N-m)**

**NOTE:** Do not turn the camshaft.



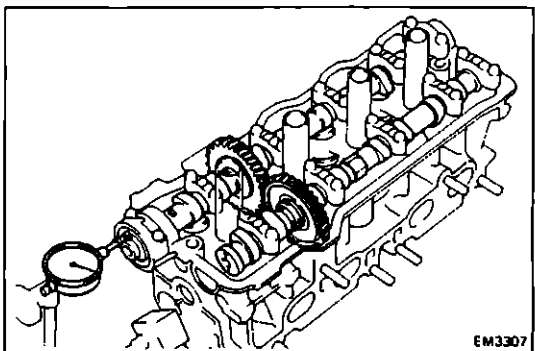
- Remove the bearing caps.
- Measure the Plastigage at its widest point.

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

**Maximum oil clearance: 0.10 mm (0.0039 in.)**

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

- Completely remove the Plastigage.

**G. Inspect camshaft thrust clearance**

- Install the camshafts.  
(See step 4 on pages EM-74 to 76)
- Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

**Standard thrust clearance:**

**Intake 0.045 – 0.100 mm  
(0.0018 – 0.0039 in.)**

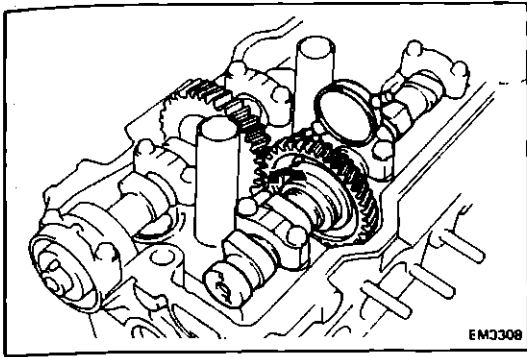
**Exhaust 0.030 – 0.085 mm  
(0.0012 – 0.0033 in.)**

**Maximum thrust clearance:**

**Intake 0.12 mm (0.0047 in.)**

**Exhaust 0.10 mm (0.0039 in.)**

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

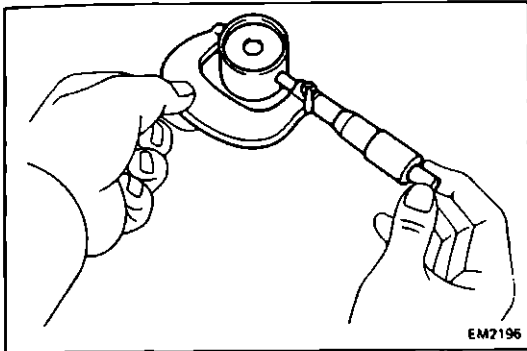
**H. Inspect camshaft gear backlash**

- (a) Install the camshafts.  
(See step 4 on pages EM-74 and 76)
- (b) Using a dial indicator, measure the backlash.

**Standard backlash:** 0.020 – 0.200 mm  
(0.0008 – 0.0079 in.)

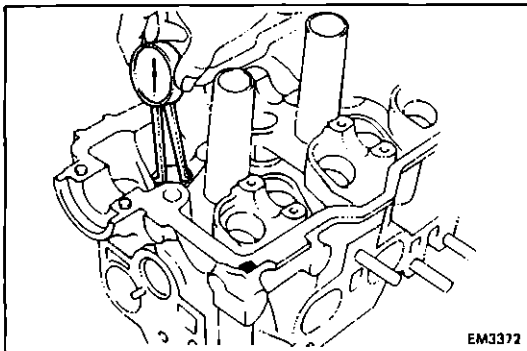
**Maximum backlash:** 0.30 mm (0.0188 in.)

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

**15. INSPECT VALVE LIFTERS AND LIFTER BORES**

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

**Lifter diameter:** 27.975 – 27.985 mm  
(1.1014 – 1.1018 in.)



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

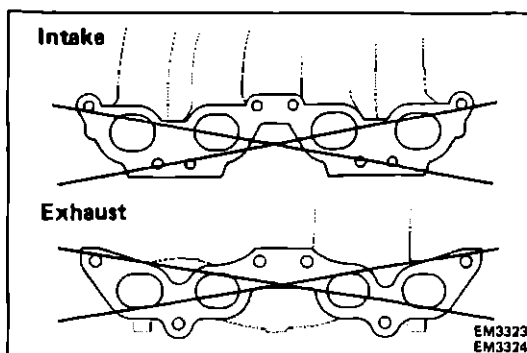
**Lifter bore diameter:** 28.000 – 28.021 mm  
(1.1024 – 1.1032 in.)

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

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

**Maximum oil clearance:** 0.07 mm (0.0028 in.)

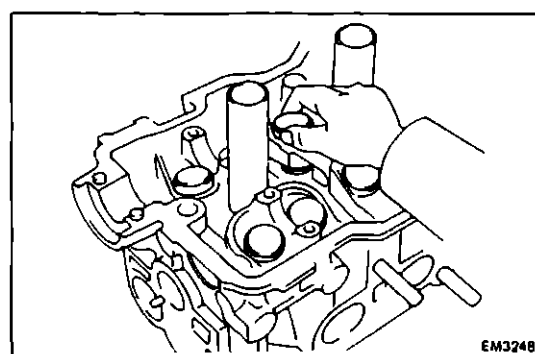
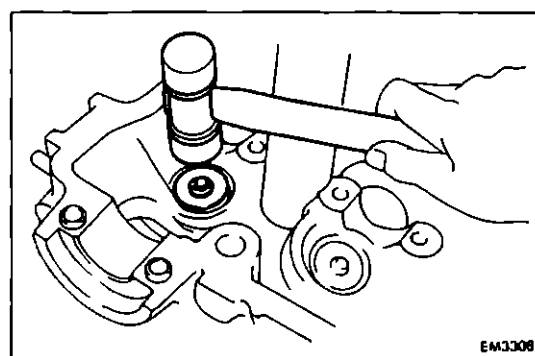
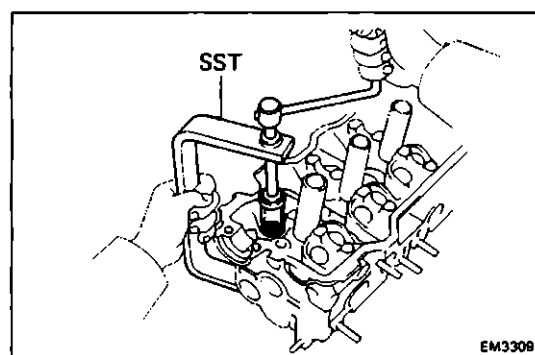
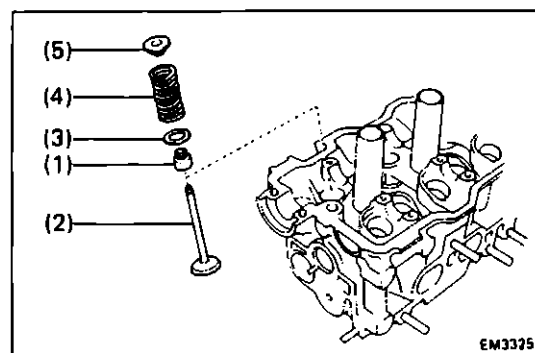
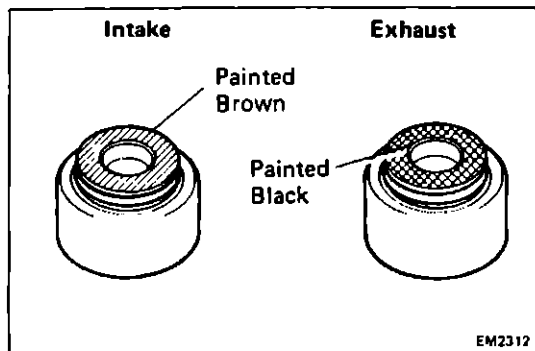
If the thrust clearance is greater than maximum, replace the lifter. If necessary, replace the cylinder head.

**16. INSPECT INTAKE AND EXHAUST MANIFOLDS**

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

**Maximum warpage:** 0.30 mm (0.0118 in.)

If warpage is greater than maximum, replace the manifold.



## ASSEMBLY OF CYLINDER HEAD

(See page EM-54)

### 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

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

(a) Install the following parts:

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

(b) Using SST, compress the valve spring and place the two keepers around the valve stem.

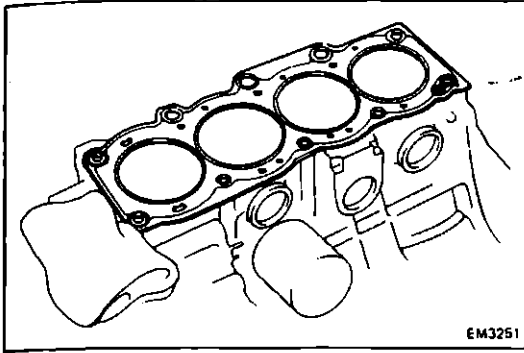
SST 09202-70010

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

### 2. INSTALL VALVE LIFTERS AND SHIMS

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





## INSTALLATION OF CYLINDER HEAD

(See page EM-54)

### 1. INSTALL CYLINDER HEAD

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

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

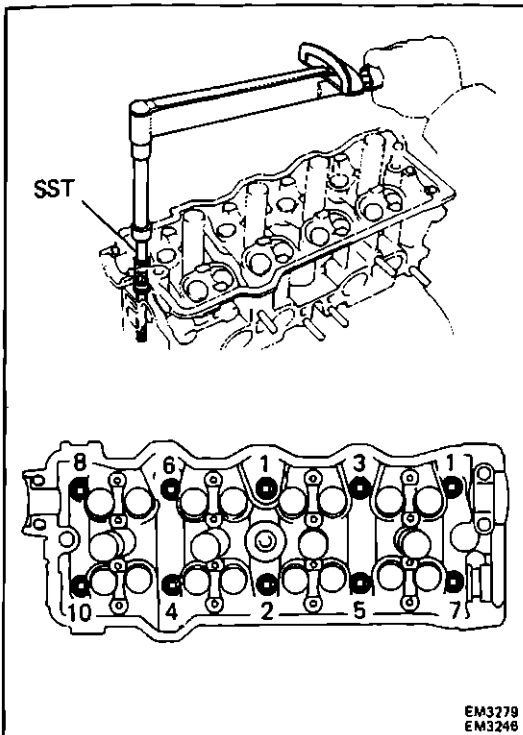
- (b) Place the cylinder head in position on the cylinder head gasket.

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

- (d) Using SST, install and uniformly tighten the ten cylinder head bolts in several passes in the sequence shown.

SST 09043-88010

**Torque:** 650 kg-cm (47 ft-lb, 64 N·m)



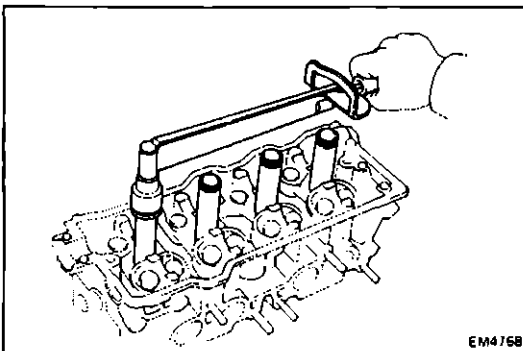
### 2. INSTALL SPARK PLUG TUBES

- (a) Clean the cylinder head tube holes of any residual adhesive, oil foreign particles. Remove any oil with kerosene or gasoline.

- (b) Screw the threads of the spark plug tube coated with adhesive into the cylinder head.

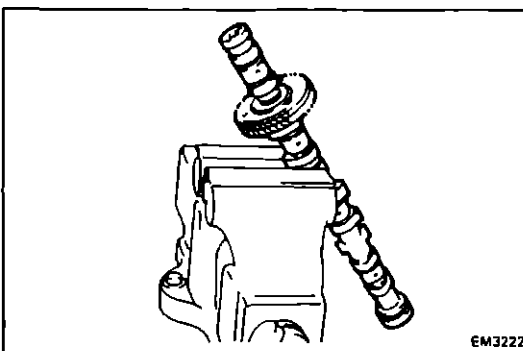
- (c) Install the spark plug tube nut and using a 30 mm socket wrench, torque the nuts.

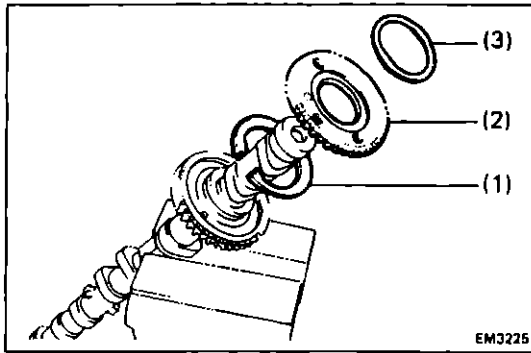
**Torque:** 400 kg-cm (29 ft-lb, 39 N·m)



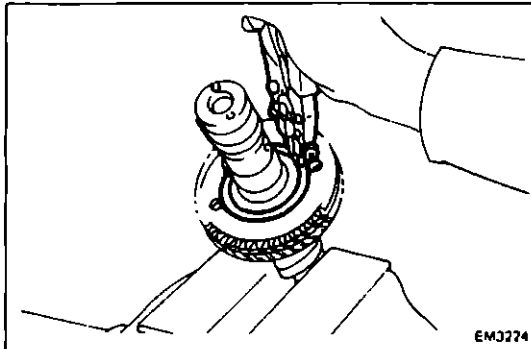
### 3. ASSEMBLE EXHAUST CAMSHAFT

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

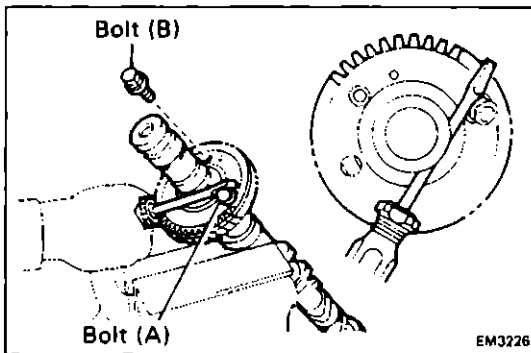




- (b) Install the following parts:
- (1) Camshaft gear spring
  - (2) Camshaft sub-gear
  - (3) Wave washer



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



- (d) Insert a bolt (A) into the service hole of the camshaft sub-gear.
- (e) Using a screwdriver, align the holes of the camshaft main gear and sub-gear by turning camshaft sub-gear clockwise, and install a bolt (B).

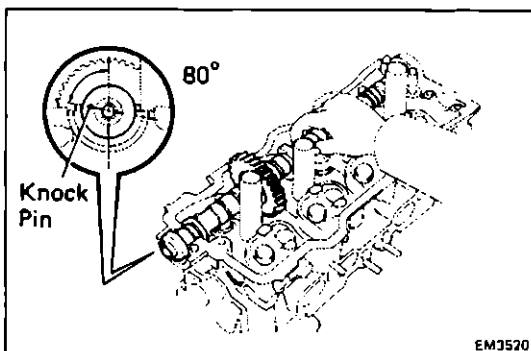
**CAUTION:** Be careful not to damage the camshaft.

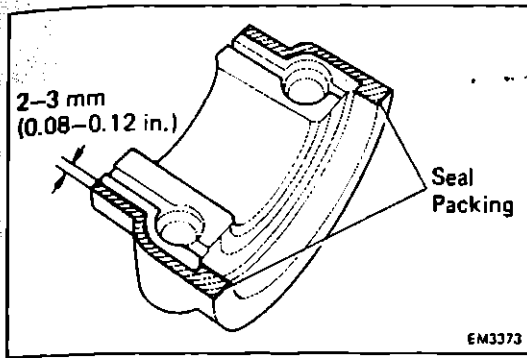
#### 4. INSTALL CAMSHAFTS

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

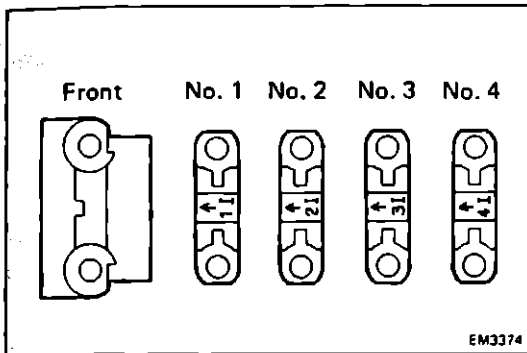
##### A. Install intake camshaft

- (a) Apply MP grease to the thrust portion of the camshaft.
- (b) Place the intake camshaft at 80° BTDC of camshaft angle on the cylinder head.

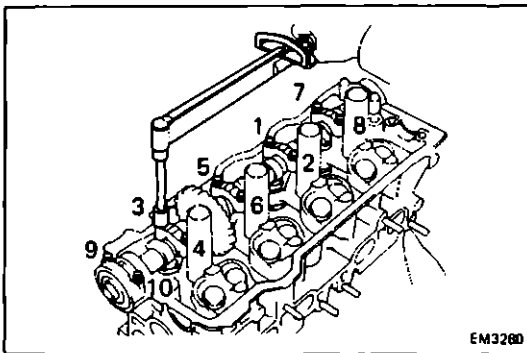




- (c) Apply seal packing to the No. 1 bearing cap as shown.  
**Seal packing: Part No. 08826-00080 or equivalent**

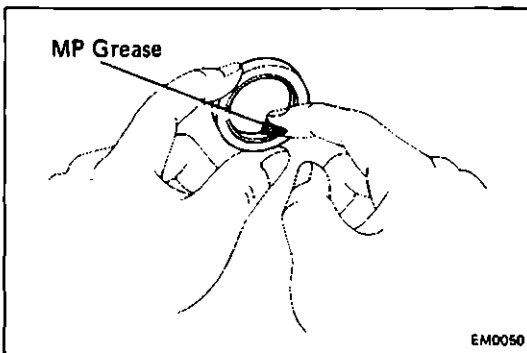


- (d) Install the bearing caps in their proper locations.

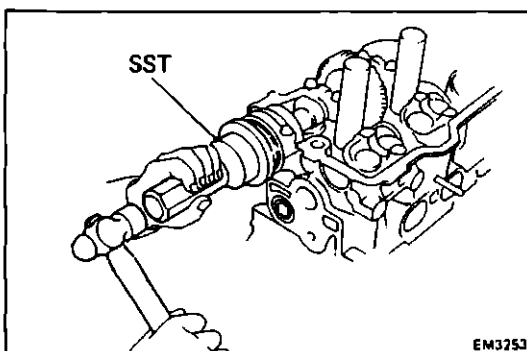


- (e) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.  
 (f) Install and uniformly tighten the ten bearing cap bolts in several passes in the sequence shown.

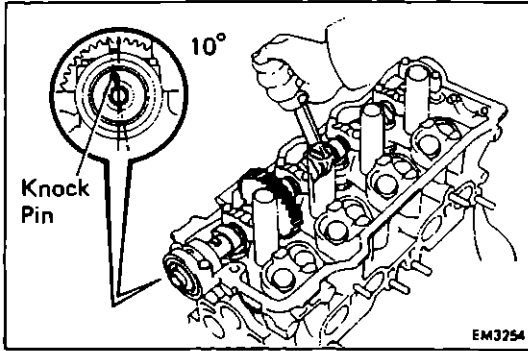
**Torque: 190 kg-cm (14 ft-lb, 19 N·m)**



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

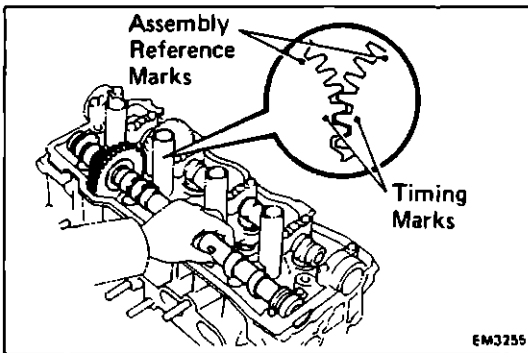


- (h) Using SST, tap in the oil seal.  
**SST 09223-46011**



## B. Install exhaust camshaft

- (a) Set the knock pin of the intake camshaft at 10° BTDC of camshaft angle.



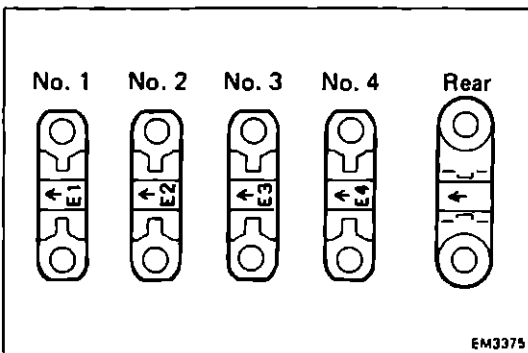
- (b) Apply MP grease to the thrust portion of the camshaft.  
 (c) Engage the exhaust camshaft gear to the intake camshaft gear by matching the timing mark marks on each gear.  
 (d) Roll down the exhaust camshaft onto the bearing journals while engaging gears each other.

**CAUTION:** There are also assembly reference marks on each gear as shown in the illustration. Do not use these marks.

- (e) Turn the intake camshaft clockwise or counterclockwise little by little until the exhaust camshaft sits in the bearing journals evenly without rocking the camshaft on the bearing journals.

**CAUTION:** This is very important to replace the camshaft in the bearing journals evenly while tightening bearing caps in the subsequent steps.

- (f) Install the bearing caps in their proper location.

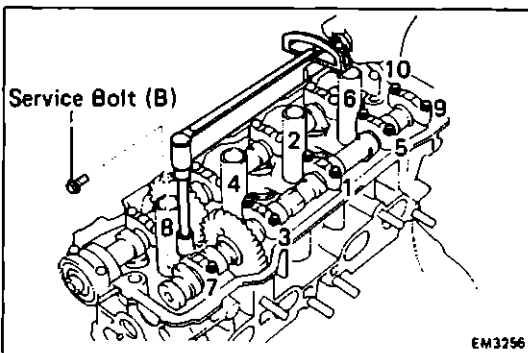


- (g) Apply a light coat of engine oil on the threads and under the heads of bearing cap bolts.

- (h) Install and uniformly tighten the ten bearing cap bolts in several passes in the sequence shown.

**Torque: 190 kg-cm (14 ft-lb, 19 N·m)**

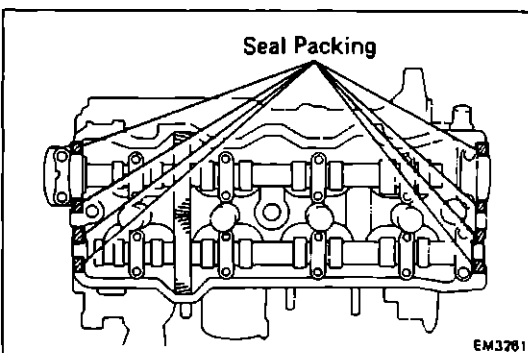
- (i) Remove the service bolt (B).

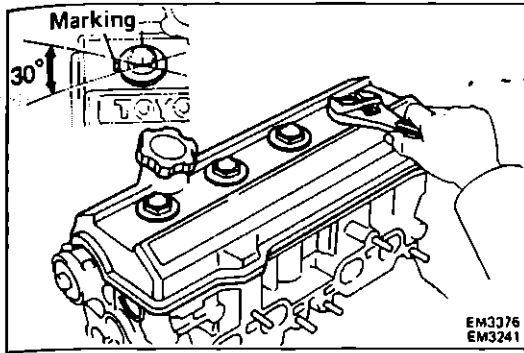


## 5. INSTALL CYLINDER HEAD COVER

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

**Seal packing: Part No. 08826-00080 or equivalent**

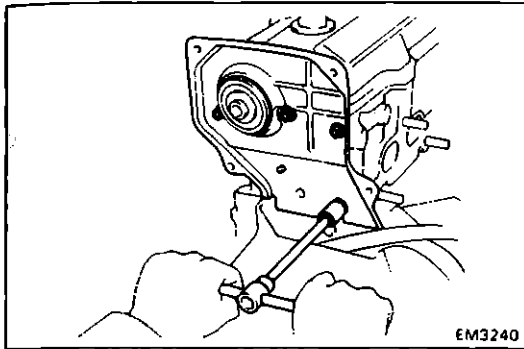




- (b) Install the gasket to the head cover.  
 (c) Install the head cover with the four grommet and nuts.

**Torque: 230 kg-cm (17 ft-lb, 23 N·m)**

**NOTE:** Install the grommets so that the markings are as shown in the illustration. Then install the grommet to its original position.



#### 6. INSTALL NO.3 TIMING BELT COVER

Install the timing belt cover with the four bolts.

#### 7. INSTALL NO.1 IDLER PULLEY AND TENSION SPRING (See step 4 on page EM-33)

#### 8. INSTALL CAMSHAFT TIMING PULLEY (See steps 9 to 13 on pages EM-34 to 36)

#### 9. INSTALL SPARK PLUGS (See page IG-7)

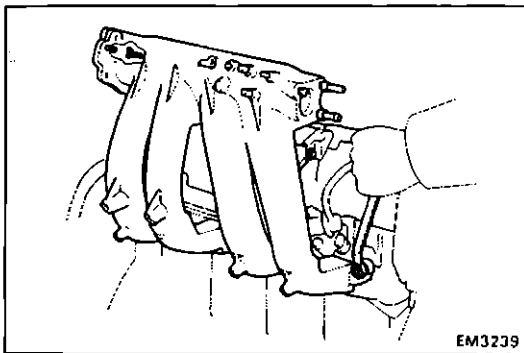
**Torque: 180 kg-cm (13 ft-lb, 18 N·m)**

#### 10. INSTALL INJECTOR AND DELIVERY PIPE (See steps 1 to 4 on pages FI-98 and 99)

#### 11. INSTALL INTAKE MANIFOLD

- (a) Install a new gasket and the intake manifold with the two bolts and six nuts.

**Torque: 195 kg-cm (14 ft-lb, 19 N·m)**



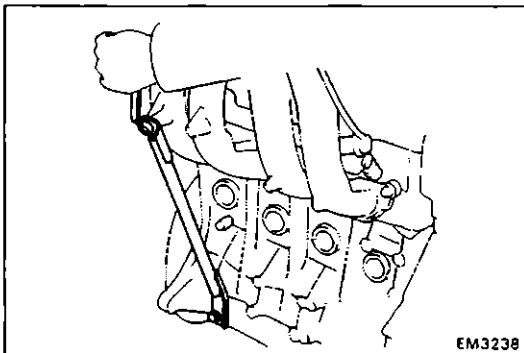
- (b) Install the two manifold stay with the four bolts.

**Torque:**

**12 mm bolt head 195 kg-cm (14 ft-lb, 19 N·m)**

**14 mm bolt head 425 kg-cm (31 ft-lb, 42 N·m)**

- (c) Connect the vacuum sensing hose.



#### 12. INSTALL AIR TUBE

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

- (b) Connect the following air hoses:

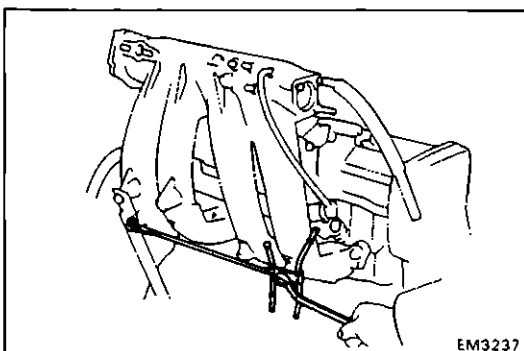
(1) Air intake chamber air hose

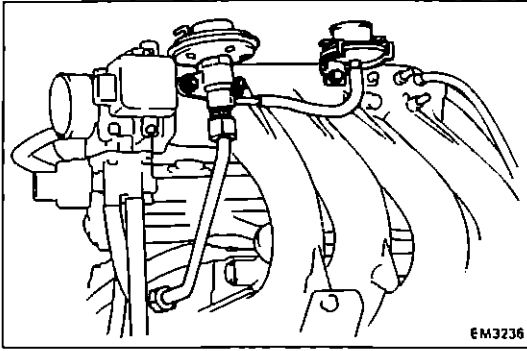
(2) Throttle body air hose

(3) (w/ PS)  
PS pump air hose

#### 13. INSTALL COLD START INJECTOR PIPE (See steps 2 and 3 on page FI-82)

#### 14. INSTALL THROTTLE BODY (See steps 2 to 4 on page FI-118)



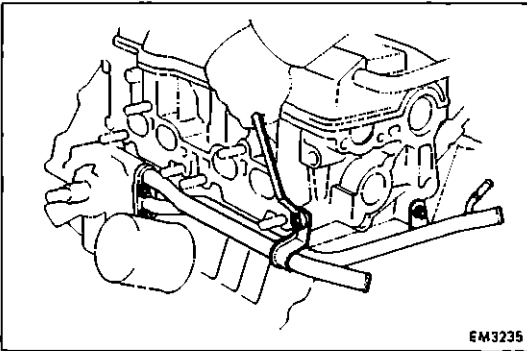
**15. INSTALL EGR VALVE AND MODULATOR**

- (a) Install the EGR modulator with the bolt.
- (b) Install a new gasket and the EGR valve with the union nut and two bolts.

**Torque:**

**Union nut** 600 kg-cm (43 ft-lb, 59 N·m)  
**Bolt** 130 kg-cm (9 ft-lb, 13 N·m)

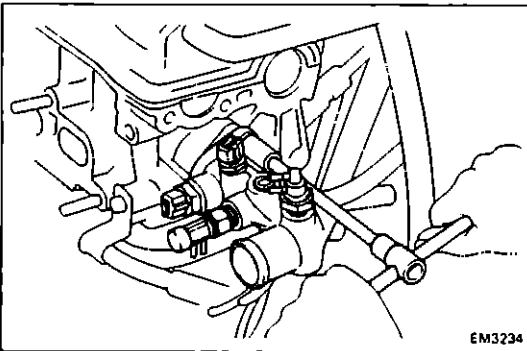
- (c) Install the vacuum hoses.

**16. INSTALL WATER BY-PASS PIPE**

- (a) Install a new O-ring to the by-pass pipe.
- (b) Apply a light of engine oil on the O-ring.
- (c) Install a new gasket and the by-pass pipe with the two nuts and two bolts.

**Torque (Nut):** 95 kg-cm (82 in.-lb, 9.3 N·m)

- (d) Connect the water hoses.

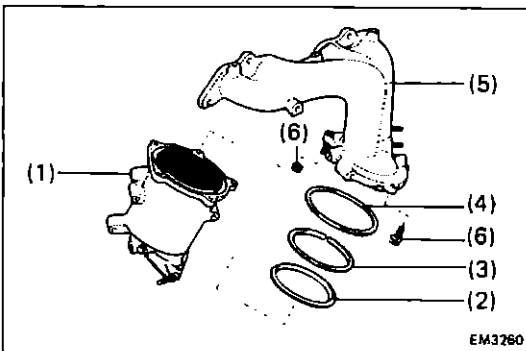
**17. INSTALL WATER OUTLET**

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

**Torque:** 150 kg-cm (11 ft-lb, 15 N·m)

- (b) Connect the following hoses and connectors:

- (1) Radiator upper hose
- (2) Water hoses
- (3) Emission control vacuum hoses
- (4) Water temperature sender gauge connector
- (5) Water temperature sensor connector
- (6) Cold start injector time switch connector

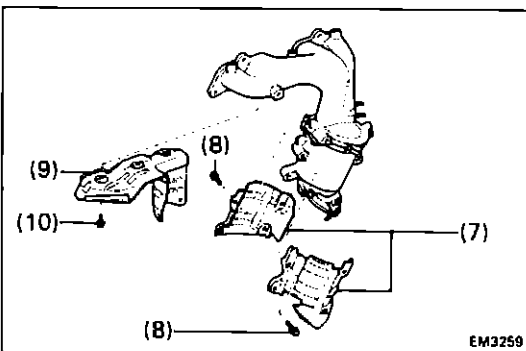
**18. INSTALL DISTRIBUTOR (See page IG-14)****19. ASSEMBLE EXHAUST MANIFOLD AND CATALYTIC CONVERTER**

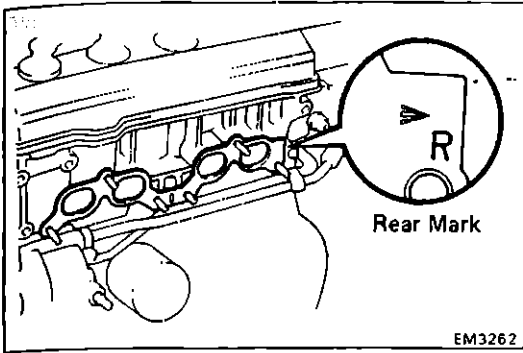
Assemble the following parts:

- (1) Catalytic converter
- (2) Cushion
- (3) Retainer
- (4) Gasket
- (5) Exhaust manifold
- (6) Three bolts and two nuts

**Torque:** 300 kg-cm (22 ft-lb, 29 N·m)

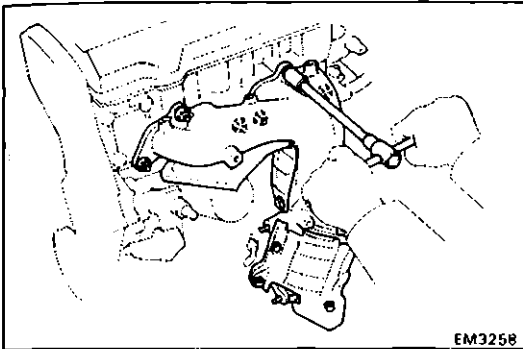
- (7) Two converter heat insulator
- (8) Eight bolt
- (9) Manifold lower heat insulator
- (10) Five bolts





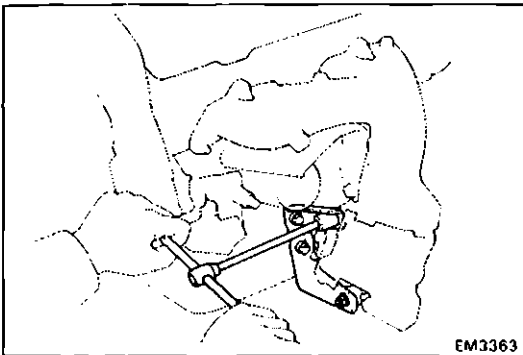
## 20. INSTALL EXHAUST MANIFOLD AND CATALYTIC CONVERTER ASSEMBLY

- (a) Place a new gasket so that the rear mark is toward the back.

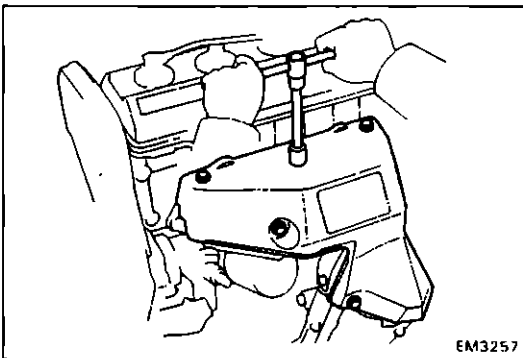


- (b) Install the exhaust manifold and catalytic converter assembly with the two bolts and six nuts.

**Torque: 425 kg-cm (31 ft-lb, 42 N·m)**



- (c) Install the catalytic converter stay with the two bolts and two nuts.



- (d) Install the manifold upper heat insulator with the six bolts.

- (e) Connect the oxygen sensor connector(s).

## 21. CONNECT EXHAUST FRONT PIPE TO CATALYTIC CONVERTER (See step 10 on page EM-152)

## 22. INSTALL SUSPENSION LOWER CROSSMEMBER (See step 15 on page EM-153)

## 23. INSTALL RH ENGINE HANGER

## 24. INSTALL RH FRONT WHEEL

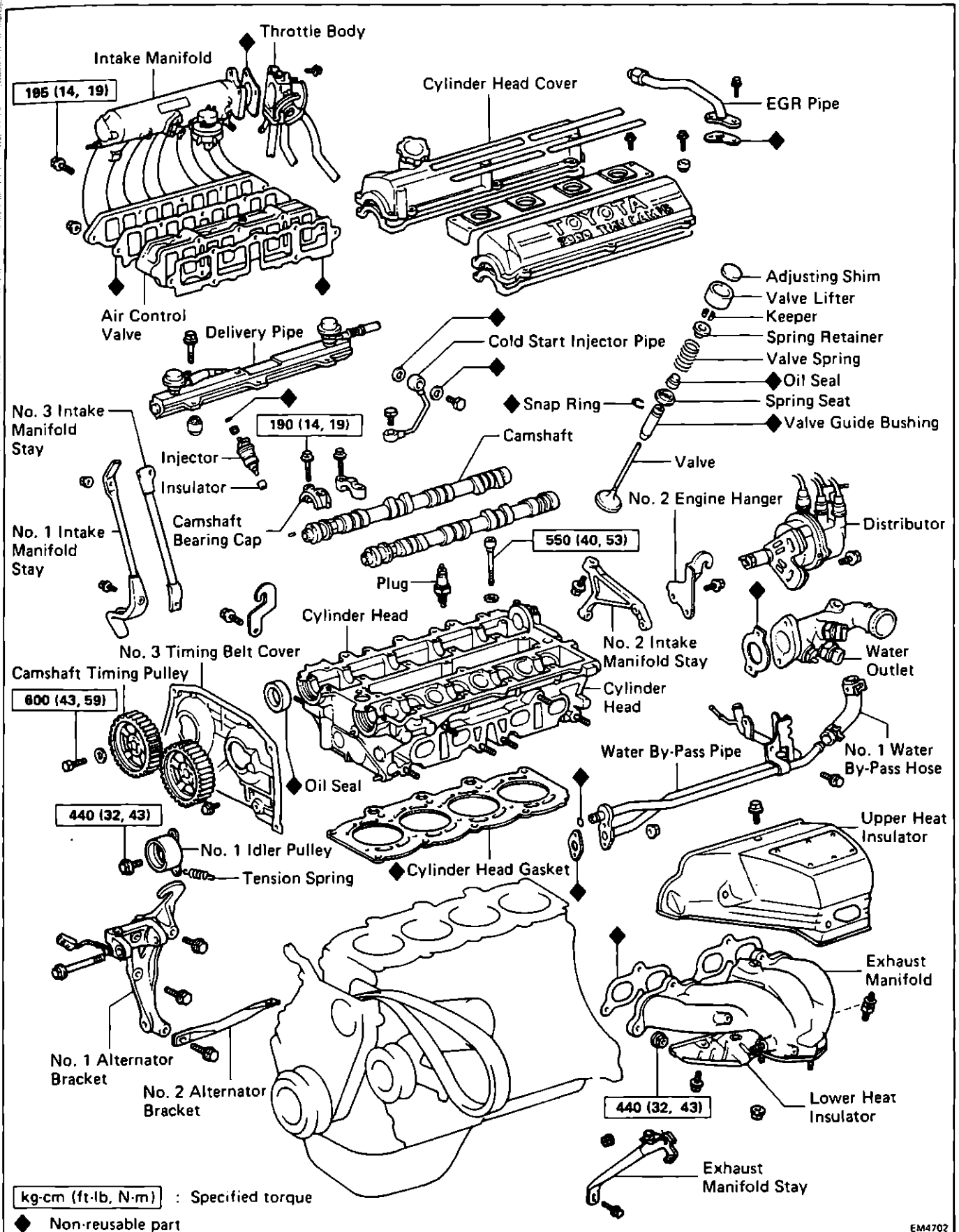
## 25. LOWER VEHICLE

26. **INSTALL OIL PRESSURE SENDER GAUGE, ENGINE HANGERS AND ALTERNATOR BRACKET**  
Torque: 425 kg-cm (31 ft-lb, 42 N·m)
27. **INSTALL ALTERNATOR (See page CH-15)**
28. **INSTALL AIR CLEANER ASSEMBLY**  
(See step 30 on page EM-155)
29. **INSTALL CRUISE CONTROL ACTUATOR**  
(See page 32 on page EM-155)
30. **INSTALL RADIATOR RESERVOIR TANK**
31. **INSTALL ACCELERATOR CABLE AND ADJUST IT**
32. (A/T)  
**INSTALL THROTTLE CABLE AND BRACKET AND ADJUST IT**
33. **INSTALL SUSPENSION UPPER BRACE**  
(See page 31 on page EM-155)
34. **FILL WITH ENGINE COOLANT (See page CO-6)**  
Capacity (w/ Heater):  
M/T 6.3 liters (6.7 US qts, 5.5 Imp. qts)  
A/T 6.2 liters (6.6 US qts, 5.5 Imp. qts)
35. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**
36. **START ENGINE AND CHECK FOR LEAKS**
37. **PERFORM ENGINE ADJUSTMENT**
  - (a) Adjust the valve clearance. (See page EM-12)  
**Valve clearance (Cold):**  
Intake 0.19 – 0.29 mm (0.007 – 0.011 in.)  
Exhaust 0.28 – 0.38 mm (0.011 – 0.015 in.)
  - (b) Adjust the ignition timing.  
(See steps 7 to 10 on pages IG-16 and 17)  
**Ignition timing:**  
10° BTDC @ idle  
(w/ Terminals T or TE1 and E1 connected)
38. **CHECK TOE-IN**
39. **PERFORM ROAD TEST**  
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.
40. **RECHECK ENGINE COOLANT LEVEL AND OIL LEVEL**



# CYLINDER HEAD (3S-GE and 3S-GTE)

## COMPONENTS (3S-GE)

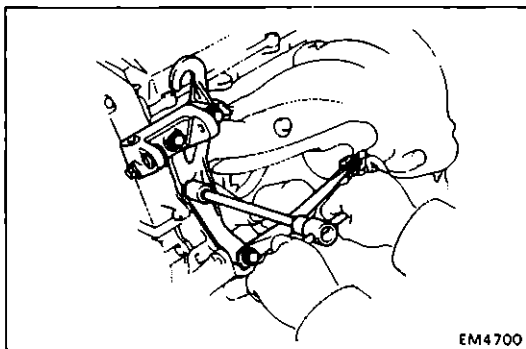
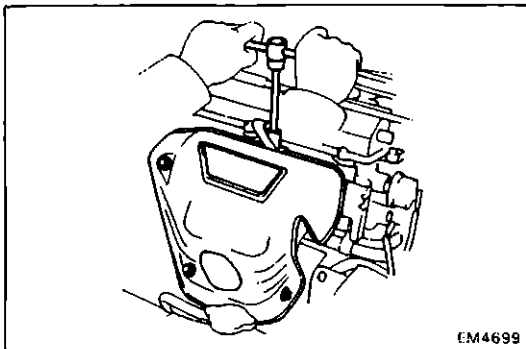




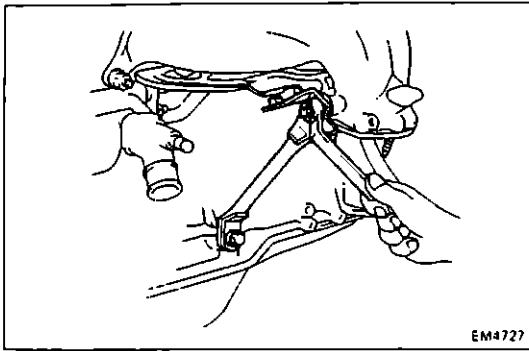
**REMOVE OF CYLINDER HEAD (3S-GE)**

(See page EM-81)

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
2. **DRAIN COOLANT** (See page CO-6)
3. **REMOVE SUSPENSION UPPER BRACE**  
(See step 10 on page EM-122)
4. (A/T)  
**DISCONNECT THROTTLE CABLE AND BRACKET FROM THROTTLE BODY**
5. **DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY AND AIR INTAKE CHAMBER**
6. **REMOVE RADIATOR RESERVOIR TANK**
7. (w/ CRUISE CONTROL SYSTEM)  
**REMOVE CRUISE CONTROL ACTUATOR**  
(See step 9 on page EM-122)
8. **REMOVE AIR CLEANER ASSEMBLY**  
(See step 11 on page EM-123)
9. **REMOVE EXHAUST MANIFOLD UPPER HEAT INSULATOR**  
Remove the four bolts and heat insulator.

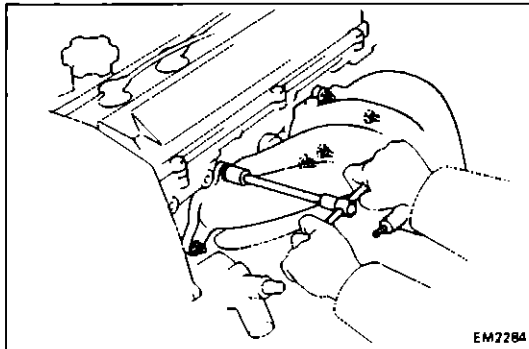


10. **REMOVE ALTERNATOR** (See page CH-6)
11. **REMOVE ALTERNATOR BRACKETS**
  - (a) Disconnect the ground strap connector.
  - (b) Remove the five bolts, No. 1 and No. 2 alternator brackets.
12. **RAISE VEHICLE**  
**CAUTION:** Be sure the vehicle is securely supported.
13. **REMOVE RH FRONT WHEEL**
14. **REMOVE ENGINE RH UNDER COVER**
15. **REMOVE SUSPENSION LOWER CROSSMEMBER**  
(See step 26 on page EM-124)
16. **DISCONNECT EXHAUST PIPE FROM EXHAUST MANIFOLD**  
(See step 31 on page EM-125)

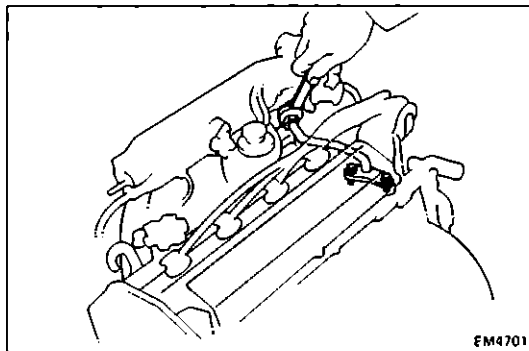


### 17. REMOVE EXHAUST MANIFOLD AND LOWER HEAT INSULATOR

(a) Remove the bolt, nut and manifold stay.



(b) Remove the six nuts, exhaust manifold with the lower heat insulator and gasket.

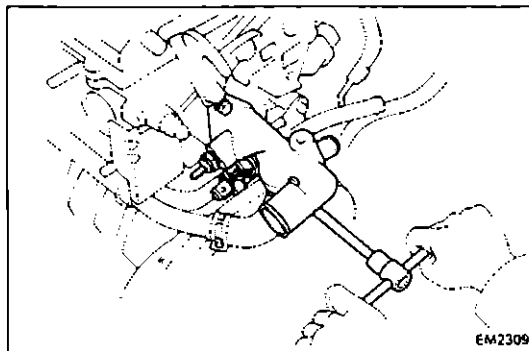


### 18. REMOVE EGR PIPE

Remove the two bolts, union nut, EGR pipe and gasket.

### 19. REMOVE DISTRIBUTOR (See page IG-18)

### 20. DISCONNECT OIL PRESSURE SENDER GAUGE CONNECTOR



### 21. REMOVE WATER OUTLET

(a) Disconnect the following connectors and hoses:

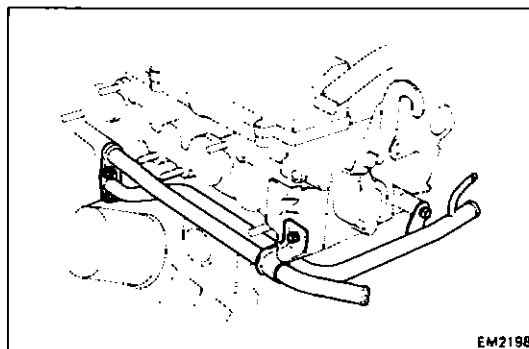
- (1) Water temperature switch connector
- (2) Water temperature sender gauge connector
- (3) Cold start injector time switch connector
- (4) Radiator upper hose
- (5) Water by-pass hoses
- (6) Emission control vacuum hoses

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

### 22. REMOVE WATER BY-PASS PIPE

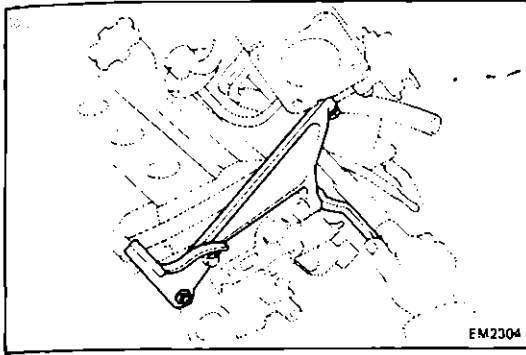
(a) Disconnect the water hoses.

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



### 23. REMOVE THROTTLE BODY

(See steps 5 to 6 on page FI-120)



**24. REMOVE NO.2 ENGINE HANGER AND NO.2 INTAKE MANIFOLD STAY**

Remove the three bolts, engine hanger and intake manifold stay.

**25. DISCONNECT COLD START INJECTOR CONNECTOR**

**26. REMOVE COLD START INJECTOR PIPE**  
(See step 3 on page FI-83)

**27. REMOVE EGR VACUUM MODULATOR**

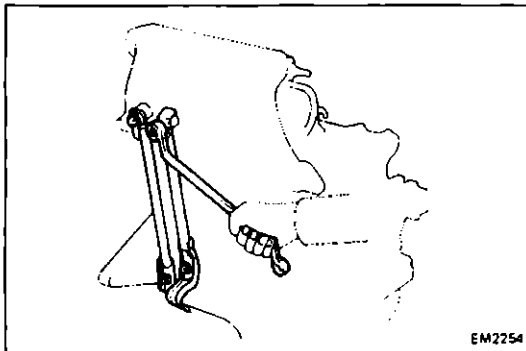
**28. DISCONNECT HOSES**

- (a) Brake booster vacuum hose
- (b) Cruise control actuator vacuum hose
- (c) A/C idle-up hose
- (d) Vacuum hose for vacuum tank
- (e) Vacuum hose for VSV of V-ISC
- (f) Vacuum sensing hose

**29. DISCONNECT INJECTOR CONNECTORS**

**30. DISCONNECT FUEL HOSES**

- (a) Disconnect the inlet hose from the fuel filter.
- (b) Disconnect the fuel return hose from the fuel return pipe.



**31. REMOVE NO.1 AND NO.3 INTAKE MANIFOLD STAYS**

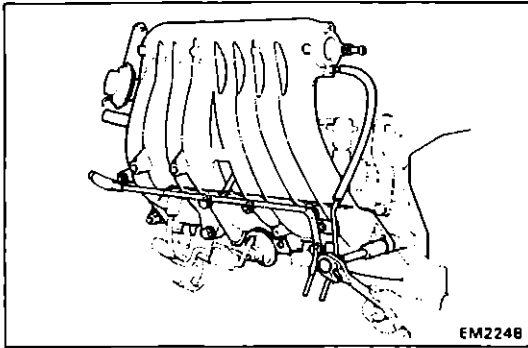
**32. DISCONNECT GROUND STRAP**

Remove the bolt, and disconnect the ground strap.

**33. DISCONNECT VSV CONNECTORS**

Disconnect the two connectors.

**34. DISCONNECT POWER STEERING VACUUM HOSES**

**35. REMOVE INTAKE MANIFOLD AND AIR CONTROL VALVE**

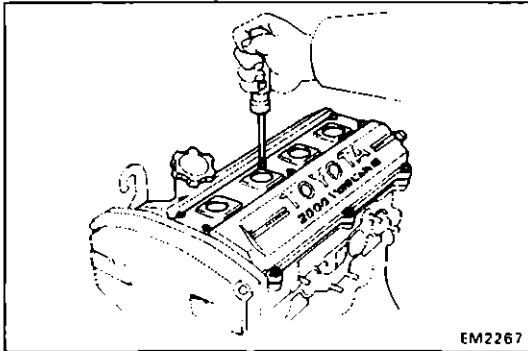
- (a) Remove the four bolts and three nuts holding the intake manifold to the cylinder head.
- (b) Disconnect the three wire harness clamp.
- (c) Remove the intake manifold and the gasket.
- (d) Remove the air control valve.

**36. REMOVE DELIVERY PIPE AND INJECTORS**  
(See step 11 on page FI-101)

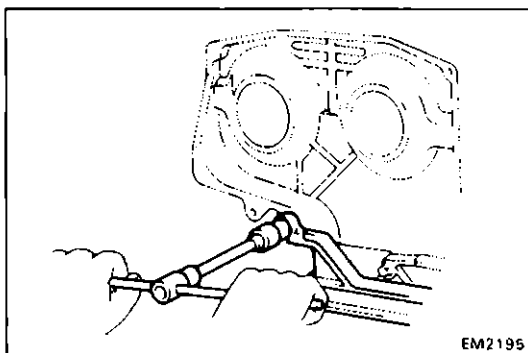
**CAUTION:** When removing the delivery pipe, be careful not to drop the injectors.

**37. REMOVE CYLINDER HEAD COVERS**

Remove the screws, center cover, cylinder head cover and gaskets.

**38. REMOVE NO.1 ENGINE HANGER****39. REMOVE POWER STEERING OIL RESERVOIR TANK WITHOUT DISCONNECTING HOSES****40. REMOVE SPARK PLUGS** (See page IG-11)**41. REMOVE CAMSHAFT TIMING PULLEYS**  
(See steps 13 and 15 to 17 on pages EM-39 and 40)**42. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING**  
(See step 23 on page EM-41)**43. REMOVE NO.3 TIMING BELT COVER**

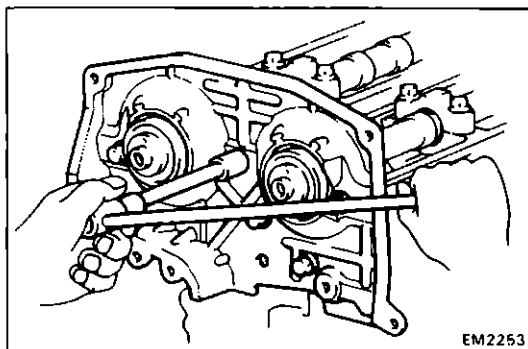
- (a) Remove the bolt holding the No.2 timing belt cover to the No.3 timing belt cover.

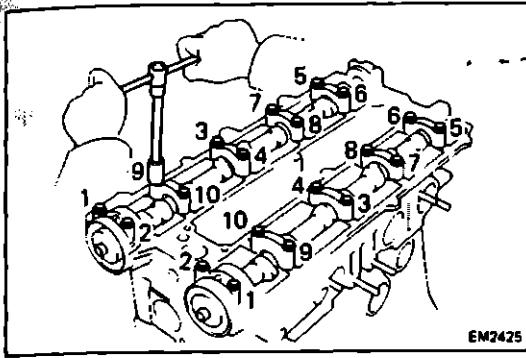


- (b) Remove the four bolts and No.3 timing belt cover.

**NOTE:**

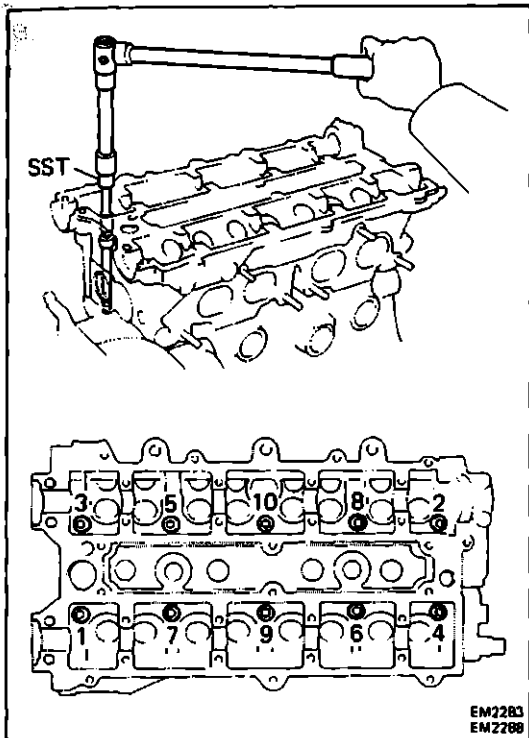
- Support the belt so the meshing of the crankshaft timing pulley and timing belt does not shift.
- Be careful not to drop anything inside the timing belt cover.
- Do not allow the belt to come into contact with oil, water or dust.



**44. REMOVE CAMSHAFTS**

- (a) Uniformly loosen and remove the twenty bearing cap bolts in several passes in the sequence shown.
- (b) Remove the ten bearing caps, two oil seal and two camshafts.

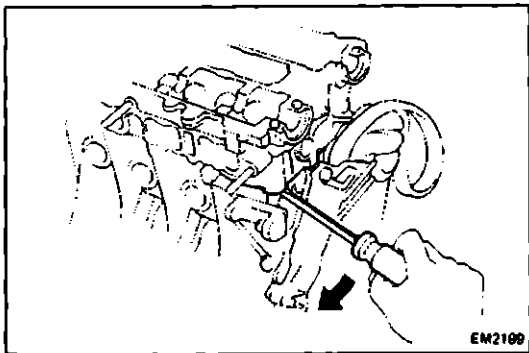
**NOTE:** Arrange the intake and exhaust camshafts.

**45. REMOVE CYLINDER HEAD**

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

SST 09043-88010

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



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

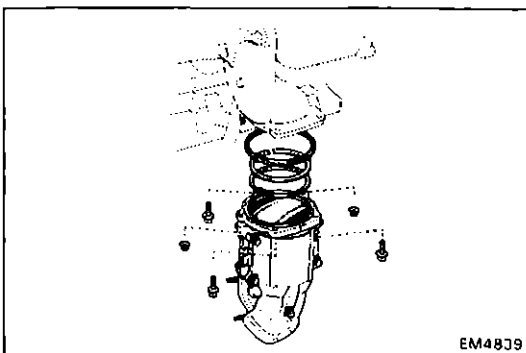
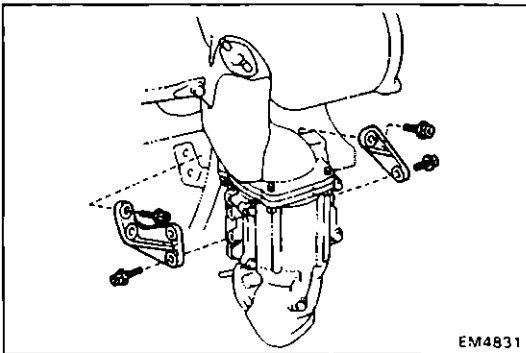
**NOTE:** If the cylinder head is difficult to lift off, pry with a screwdriver between the cylinder head and block saliences.

**CAUTION:** Be careful not to damage the cylinder head and block surface on the cylinder and head gasket sides.

**REMOVE OF CYLINDER HEAD (3S-GTE)**

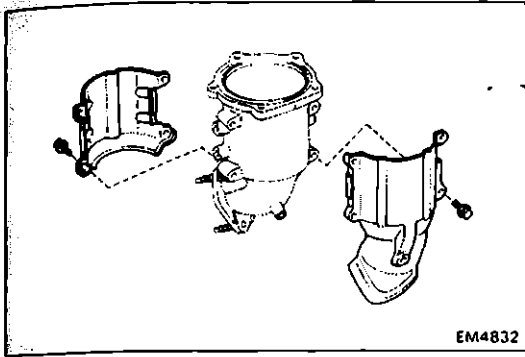
(See page EM-82)

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY
2. DRAIN ENGINE COOLANT (See page CO-6)
3. DRAIN INTERCOOLER COOLANT (See page TC-7)
4. REMOVE SUSPENSION UPPER BRACE  
(See step 10 on page EM-122)
5. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY
6. REMOVE RADIATOR RESERVOIR TANK
7. (w/ CRUISE CONTROL SYSTEM)  
REMOVE CRUISE CONTROL ACTUATOR  
(See step 9 on page EM-122)
8. REMOVE AIR CLEANER ASSEMBLY  
(See step 11 on page EM-123)
9. REMOVE ALTERNATOR
10. RAISE VEHICLE  
CAUTION: Be sure the vehicle is securely supported.
11. REMOVE RH FRONT WHEEL
12. REMOVE ENGINE UNDER COVERS
13. REMOVE SUSPENSION LOWER CROSSMEMBER  
(See step 10 on page EM-122)
14. REMOVE EXHAUST FRONT PIPE  
(See step 31 on page EM-125)
15. REMOVE CATALYTIC CONVERTER
  - (a) Remove the six bolts and two converter stays.

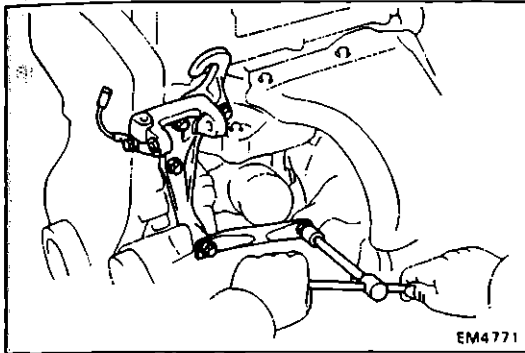


- (b) Remove the three bolts, two nuts and catalytic converter. Remove the gasket, retainer and cushion.





(c) Remove the nine bolts and two heat insulators.

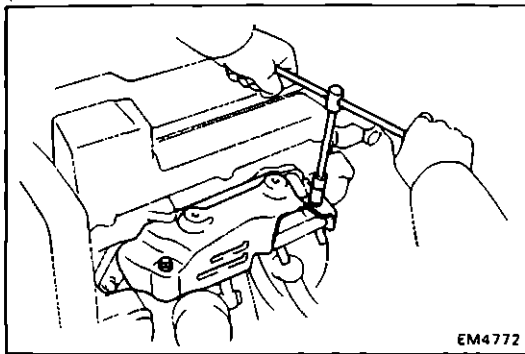


#### 16. REMOVE ALTERNATOR BRACKETS

Remove the five bolts, No.1 and No.2 brackets.

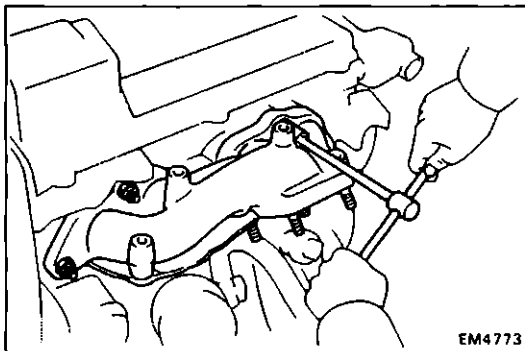
#### 17. REMOVE TURBOCHARGER

(See steps 6, 7 to 14 on pages TC-9 to 11)

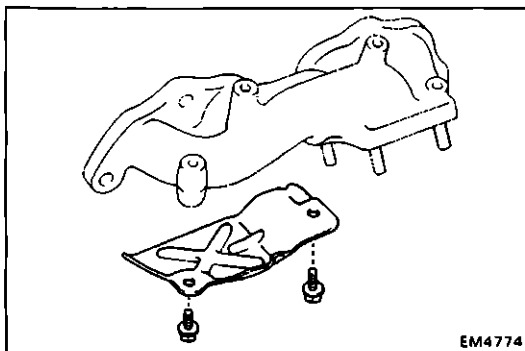


#### 18. REMOVE EXHAUST MANIFOLD

(a) Remove the two bolts and upper heat insulator.

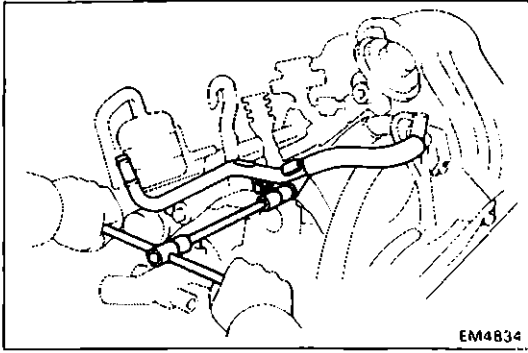


(b) Remove the six nuts, exhaust manifold and two gasket.

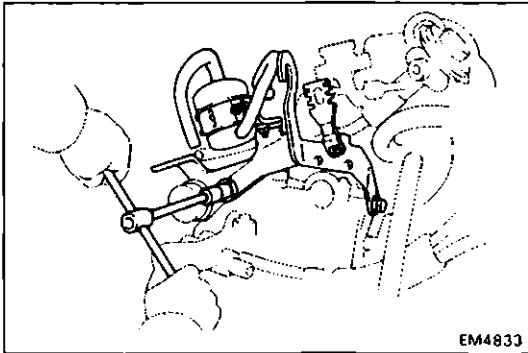


(c) Remove the two bolts and lower heat insulator.

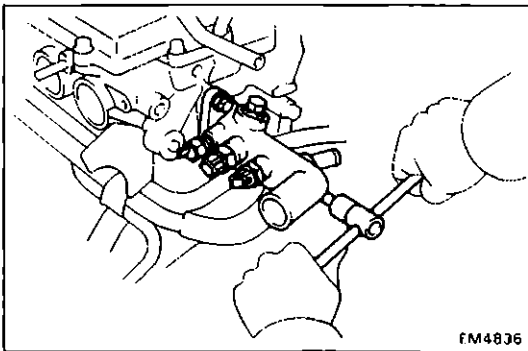
#### 19. REMOVE DISTRIBUTOR (See page IG-18)

**20. REMOVE NO.2 AIR PIPE**

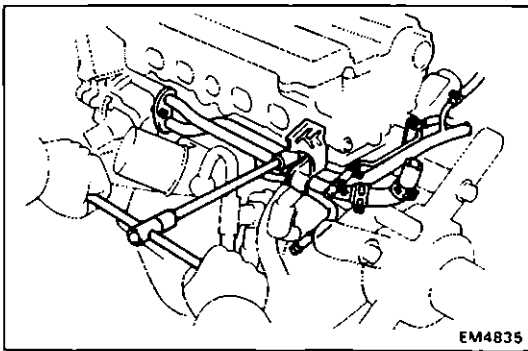
- (a) Disconnect the air hose.
- (b) Remove the two bolts and air pipe.

**21. REMOVE LH ENGINE HANGER**

Remove the two bolts and engine hanger together with the reservoir tank.

**22. REMOVE OIL PRESSURE SENDER GAUGE****23. REMOVE WATER OUTLET**

- (a) Disconnect the following connectors and hoses:
  - (1) Water temperature sender gauge connector
  - (2) Water temperature sensor connector
  - (3) Cold start injector time switch connector
  - (4) No.1 air pipe water by-pass hose
  - (5) Radiator upper hose
  - (6) Water by-pass pipe hose
  - (7) Heater water by-pass hose
  - (8) Emission control vacuum hoses
- (b) Remove the two bolts, water outlet and gasket.

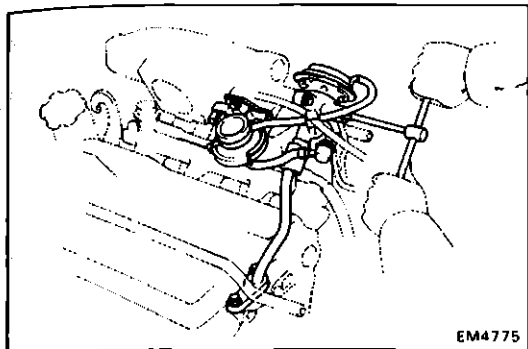
**24. REMOVE WATER BY-PASS PIPE**

- (a) Disconnect the following hoses:
  - (1) Oil cooler water by-pass hoses
  - (2) Heater water by-pass hose
  - (3) No.1 air pipe water by-pass hose
  - (4) Water by-pass hose from cylinder block
  - (5) Turbocharging pressure VSV vacuum hose
- (b) Remove the two bolts, nuts, water by-pass pipe, gasket and O-ring.

**25. REMOVE THROTTLE BODY**

(See steps 6 to 10 on page FI-124)

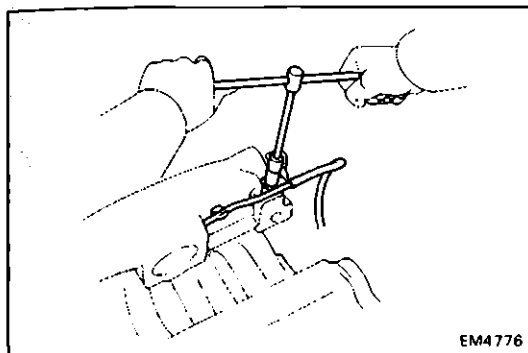
**26. DISCONNECT COLD START INJECTOR CONNECTOR**



**27. REMOVE EGR VALVE, VACUUM MODULATOR AND EGR CONTROL VSV**

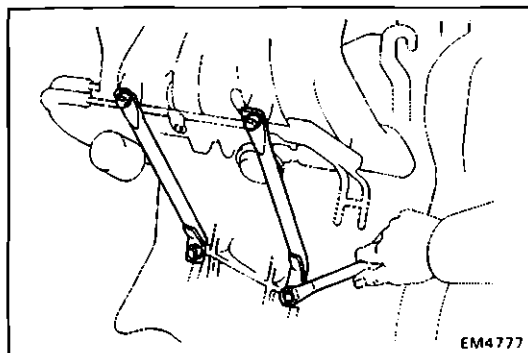
Remove the five bolts, the EGR valve, pipe, vacuum modulator and control VSV assembly.

**28. REMOVE DELIVERY PIPE AND INJECTORS**  
(See steps 4 to 7 on page FI-106)



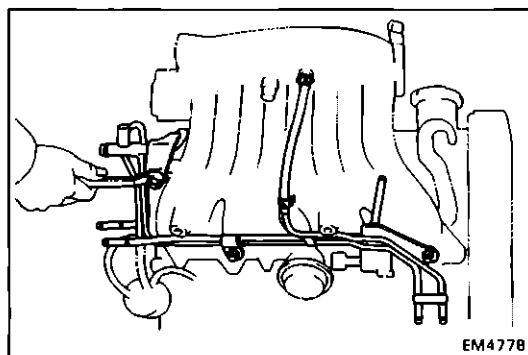
**29. REMOVE VACUUM PIPE**

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



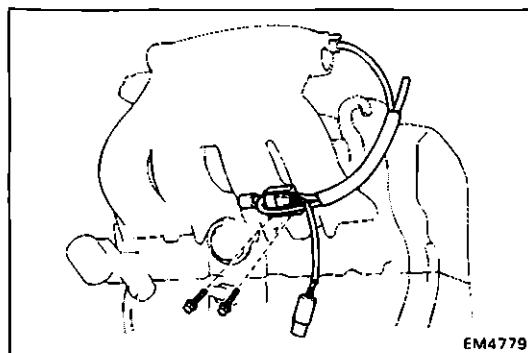
**30. REMOVE INTAKE MANIFOLD STAYS**

Remove the four bolts and two manifold stays.



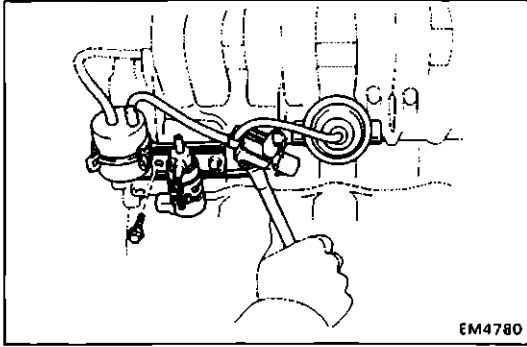
**31. REMOVE NO:1 AIR PIPE**

- (a) Disconnect the following hoses:
  - (1) Intake manifold vacuum hose
  - (2) Turbocharging pressure VSV vacuum hose
  - (3) Two PS pump vacuum hoses
- (b) Remove the three bolts and air pipe.



**32. REMOVE FUEL PRESSURE VSV**

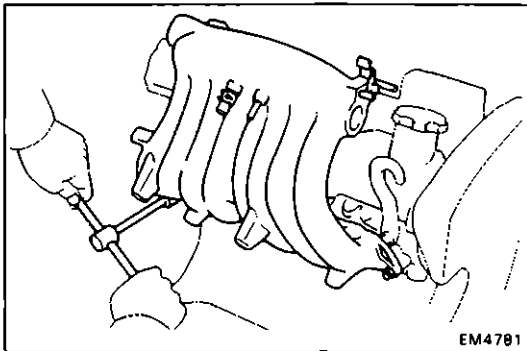
- (a) Disconnect the vacuum hose from the intake manifold.
- (b) Remove the two bolts and VSV together with hoses.



EM4780

### 33. REMOVE T-VIS VSV, VACUUM TANK AND TURBOCHARGING PRESSURE VSV

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



EM4781

### 34. REMOVE INTAKE MANIFOLD AND AIR CONTROL VALVE

Remove the four bolts and three nuts, intake manifold, gasket, air control valve and gasket.

### 35. REMOVE POWER STEERING OIL RESERVOIR TANK WITHOUT DISCONNECTING HOSES

### 36. REMOVE SPARK PLUGS (See page IG-11)

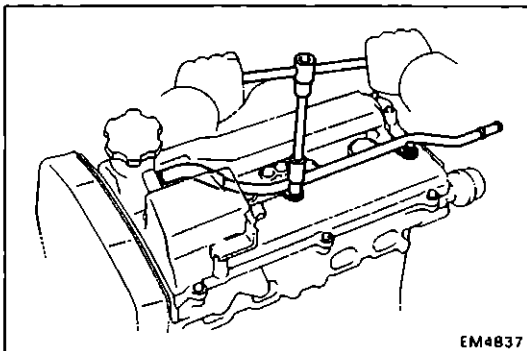
### 37. REMOVE NO.2 TIMING BELT COVER (See step 13 on page EM-39)

### 38. REMOVE TIMING BELT

(See steps 15 and 16 on pages EM-39 and 40)

### 39. REMOVE PCV PIPE

- (a) Disconnect the air hose from the cylinder head cover.
- (b) Remove the two bolts and PCV pipe.



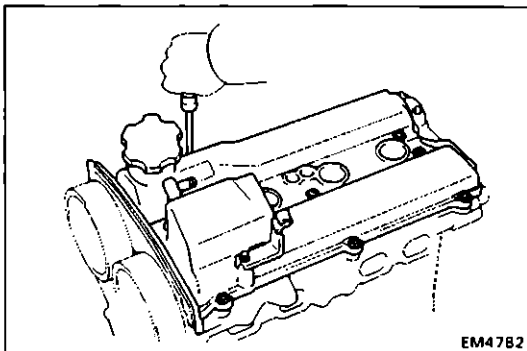
EM4837

### 40. REMOVE CYLINDER HEAD COVER

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

### 41. REMOVE CAMSHAFT TIMING PULLEYS (See step 18 on page EM-40)

### 42. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING (See step 23 on page EM-41)



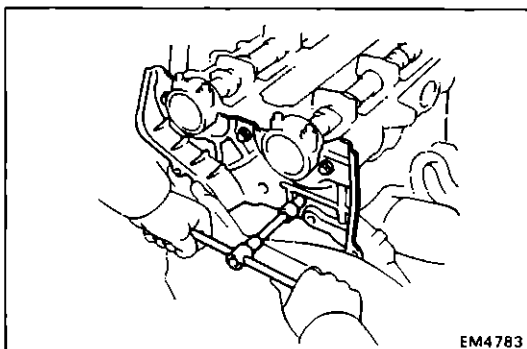
EM4782

### 43. REMOVE NO.3 TIMING BELT COVER

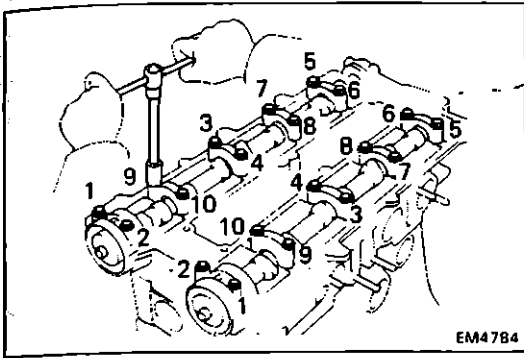
Remove the five bolts and timing belt cover.

#### 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 or dust.



EM4783

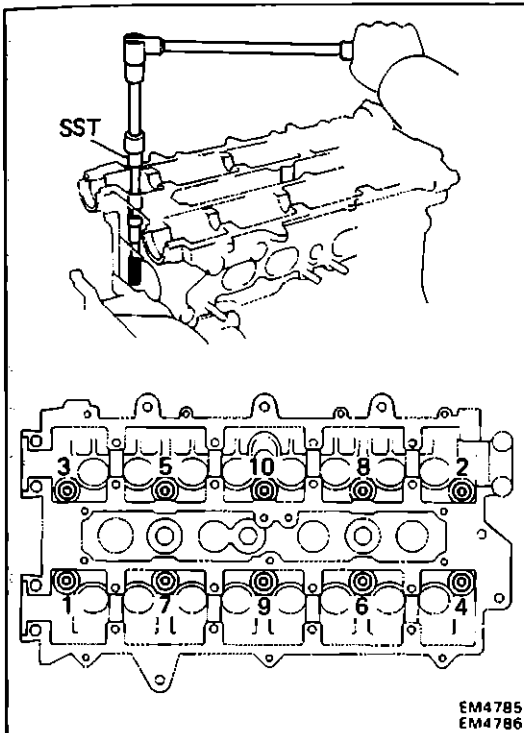


EM4784

**44. REMOVE CAMSHAFTS**

- (a) Uniformly loosen and remove the twenty bearing cap bolts in several passes in the sequence shown.
- (b) Remove the ten bearing caps, two oil seal and two camshafts.

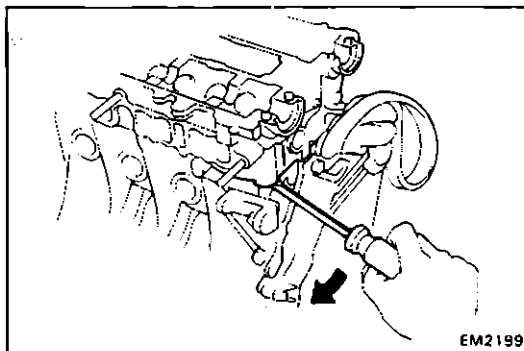
NOTE: Arrange the intake and exhaust camshafts.

**45. REMOVE RH REAR ENGINE HANGER**EM4785  
EM4786**46. REMOVE CYLINDER HEAD**

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

SST 09043-38100

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

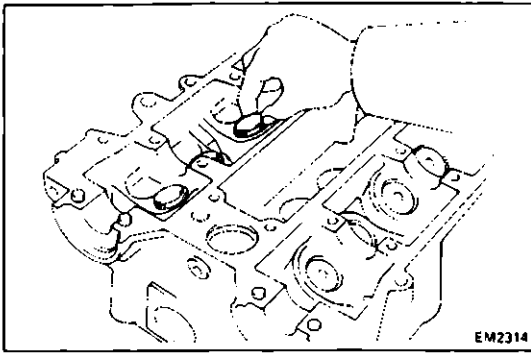


EM2199

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

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

**CAUTION:** Be careful not to damage the cylinder head and block surface on the cylinder and head gasket sides.

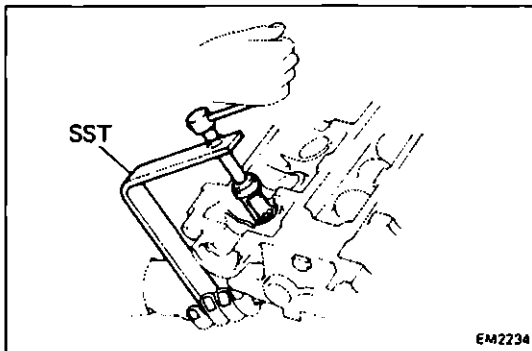
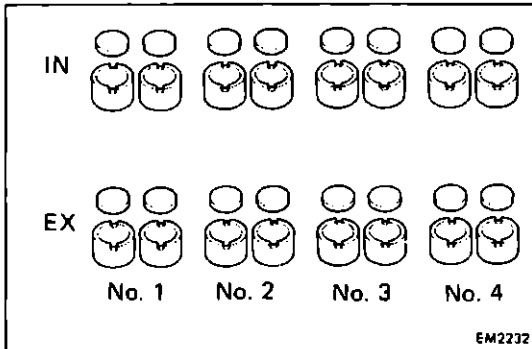


## DISASSEMBLY OF CYLINDER HEAD

(See page EM-81 or 82)

### 1. REMOVE VALVE LIFTERS WITH SHIMS

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



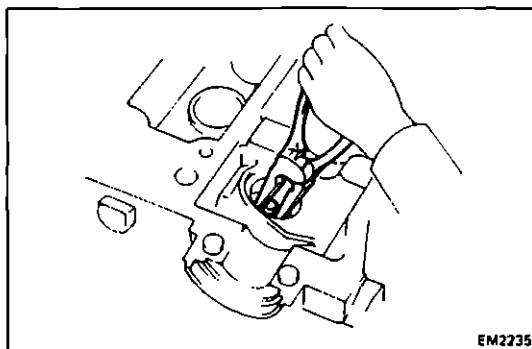
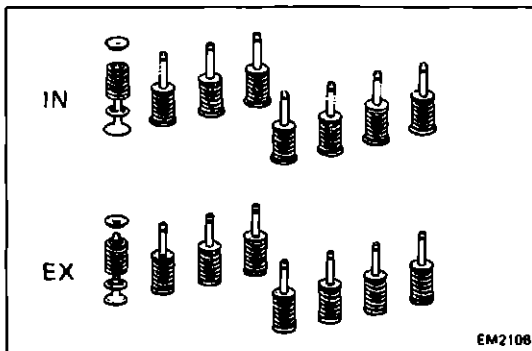
### 2. REMOVE VALVES

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

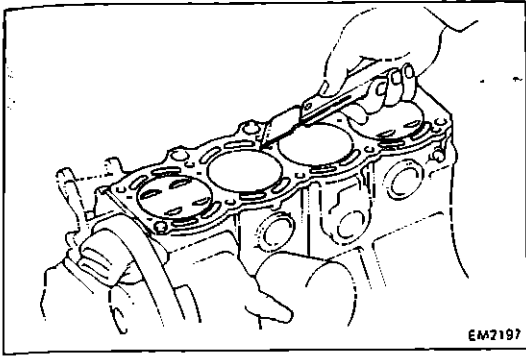
SST 09202-70010

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

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



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



EM2197

## INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS

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

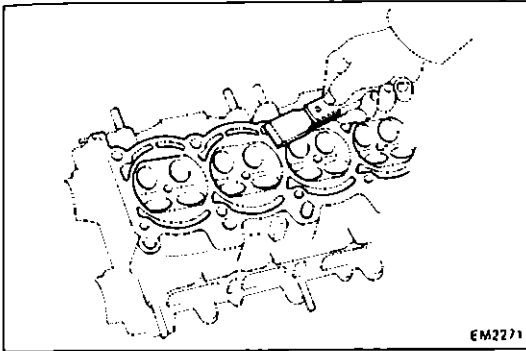
- (a) Turn the crankshaft and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top.
- (b) Remove all the gasket material from the top of the cylinder block.
- (c) Using compressed air, blow carbon and oil from the bolt holes.

**WARNING:** Protect your eyes when using high pressure air.

### 2. REMOVE GASKET MATERIAL

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

**CAUTION:** Be careful not to scratch the surfaces.

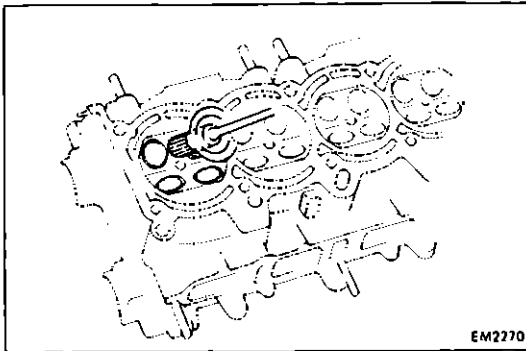


EM2271

### 3. CLEAN COMBUSTION CHAMBERS

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

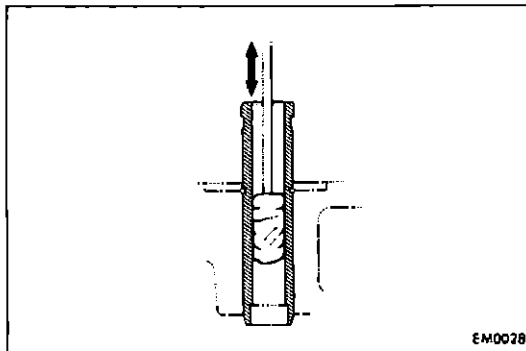
**CAUTION:** Be careful not to scratch the head gasket contact surface.



EM2270

### 4. CLEAN VALVE GUIDE BUSHINGS

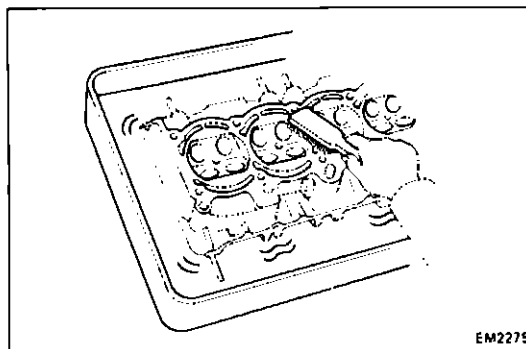
Using a valve guide bushing brush and solvent, clean all the guide bushings.



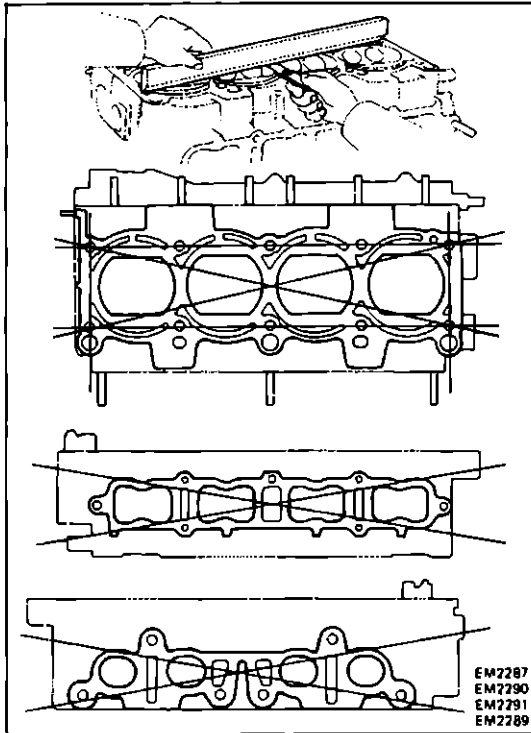
EM0028

### 5. CLEAN CYLINDER HEAD

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



EM2275



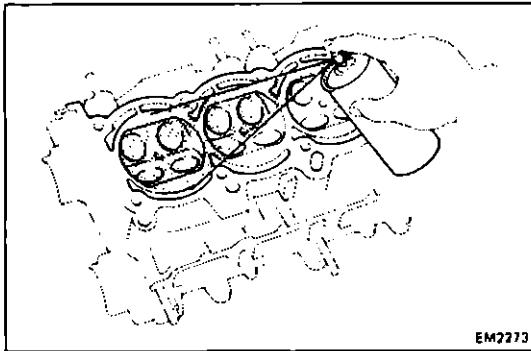
## 6. INSPECT CYLINDER HEAD FOR FLATNESS

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

### Maximum warpage:

Cylinder block side	0.2 mm (0.008 in.)
Intake manifold side	0.2 mm (0.008 in.)
Exhaust manifold side	0.3 mm (0.012 in.)

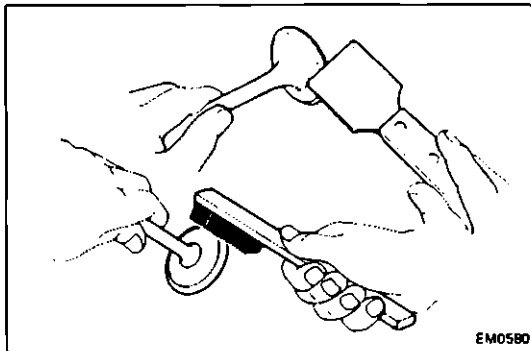
If warpage is greater than maximum, replace the cylinder head.



## 7. INSPECT CYLINDER HEAD FOR CRACKS

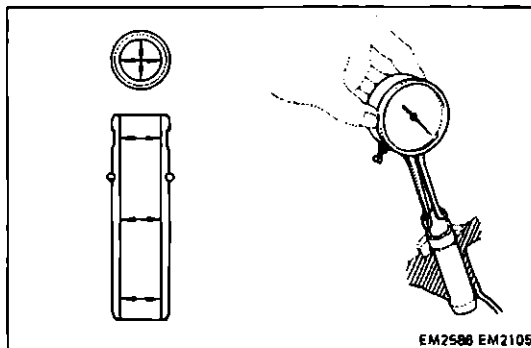
Using a dye penetrant, check the combustion chamber, intake and exhaust ports, head surface and the top of the head for cracks.

If cracked, replace the cylinder head.



## 8. CLEAN VALVES

- Use a gasket scraper, chip any carbon from the valve head.
- Using a wire brush, thoroughly clean the valve.



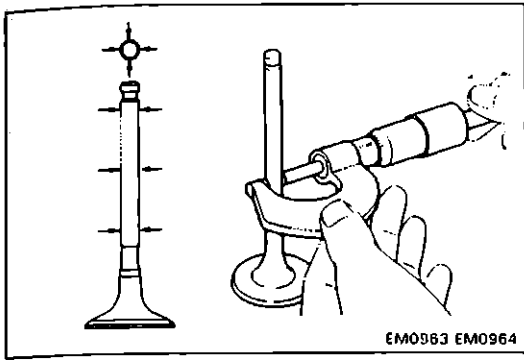
## 9. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

### Bushing inside diameter:

6.000 — 6.018 mm (0.2362 — 0.2369 in.)





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

**Valve stem diameter:**

Intake	5.960 — 5.975 mm (0.2346 — 0.2352 in.)
Exhaust	5.955 — 5.970 mm (0.2344 — 0.2350 in.)

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

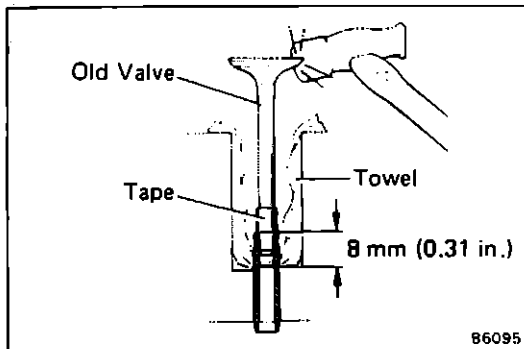
**Standard oil clearance:**

Intake	0.025 — 0.058 mm (0.0010 — 0.0023 in.)
Exhaust	0.030 — 0.063 mm (0.0012 — 0.0025 in.)

**Maximum oil clearance:**

Intake	0.08 mm (0.0031 in.)
Exhaust	0.10 mm (0.0039 in.)

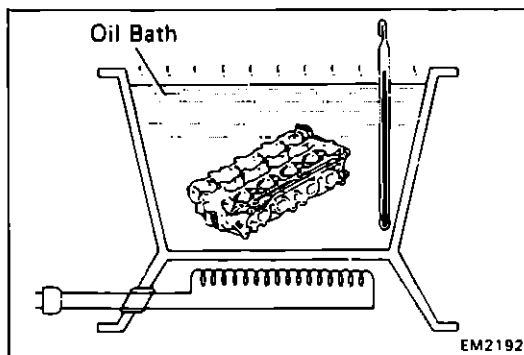
If the oil clearance is greater than maximum, replace the valve and guide bushing.



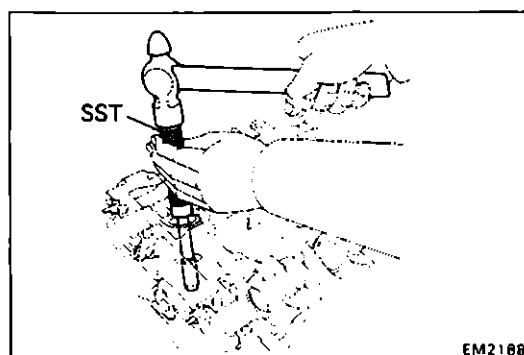
**10. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS**

- (a) Insert an old valve wrapped with tape into the guide bushing and break off the guide bushing by hitting it with a hammer.

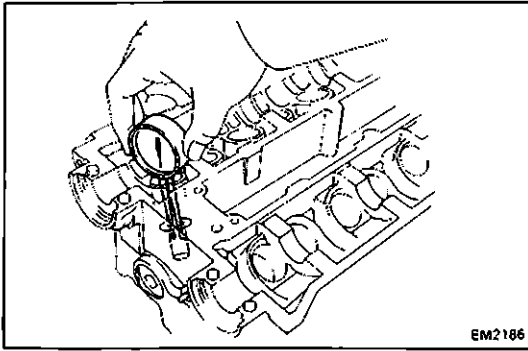
**CAUTION:** Be careful not to damage the lifter hole.



- (b) Gradually heat the cylinder head to 110 — 130°C (230 — 266°F).

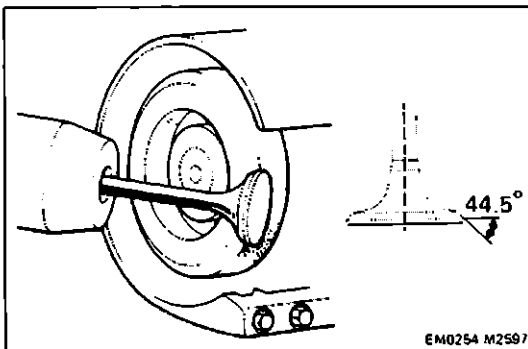
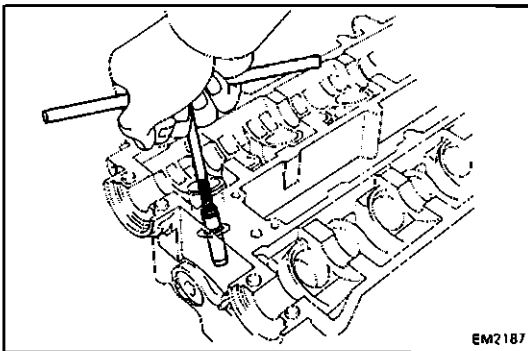
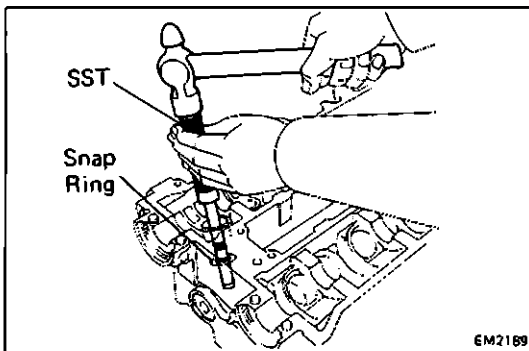


- (c) Using SST and a hammer, tap out the guide bushing.  
SST 09201-70010



Both intake and exhaust

Bushing bore diameter mm (in.)	Bushing size
11.000 – 11.028 (0.4331 – 0.4342)	Use STD
11.050 – 11.078 (0.4350 – 0.4361)	Use O/S 0.05



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

(e) Select a new guide bushing (STD size or O/S 0.05). If the bushing bore diameter of the cylinder head is greater than 11.028 mm (0.4342 in.), machine the bushing bore to the following dimension:

**Rebored cylinder head bushing bore dimension:**

**11.050 – 11.078 mm (0.4350 – 0.4361 in.)**

If the bushing bore diameter of the cylinder head is greater than 11.078 mm (0.4361 in.), replace the cylinder head.

(f) Gradually heat the cylinder head to 110 – 130°C (230 – 266°C).

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

SST 09201-70010

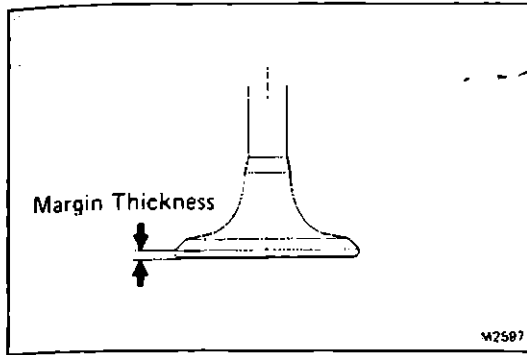
(h) Using a sharp 6 mm reamer, ream the guide bushing to obtain the specified clearance (See page EM-97) between the guide bushing and the valve stem.

## 11. INSPECT AND GRIND VALVES

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

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

**Valve face angle: 44.5°**

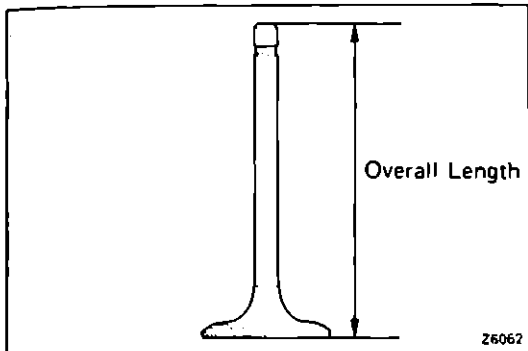


(c) Check the valve head margin thickness.

**Standard margin thickness:** 0.8 – 1.2 mm  
(0.031 – 0.047 in.)

**Minimum margin thickness:** 0.5 mm (0.020 in.)

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



(d) Check the valve overall length.

**Standard overall length:**

Intake 102.85 mm (4.0492 in.)

Exhaust 101.90 mm (4.0118 in.)

**Minimum overall length:**

Intake 102.15 mm (4.0216 in.)

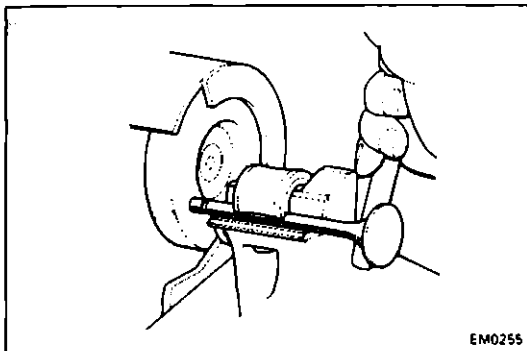
Exhaust 101.20 mm (3.9842 in.)

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

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

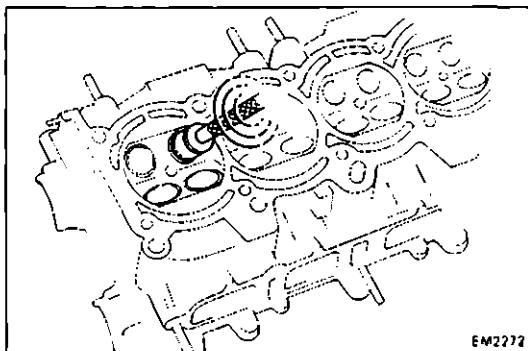
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

**CAUTION:** Do not grind off more than the minimum overall length.



## 12. INSPECT AND CLEAN VALVE SEATS

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



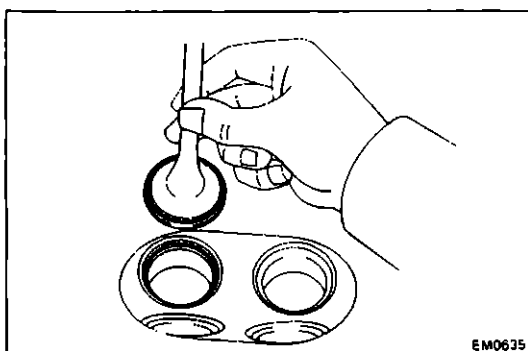
(b) Check the valve seating position.

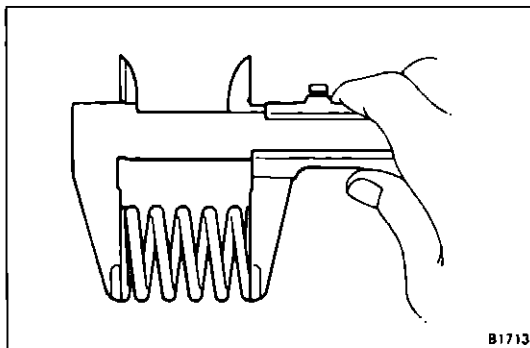
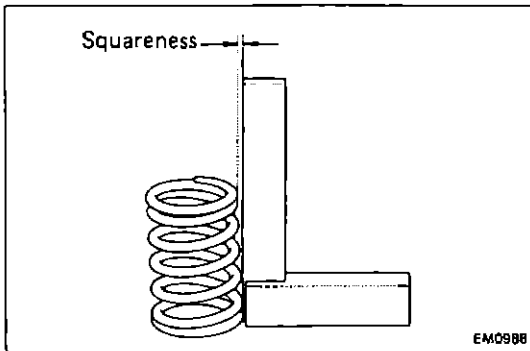
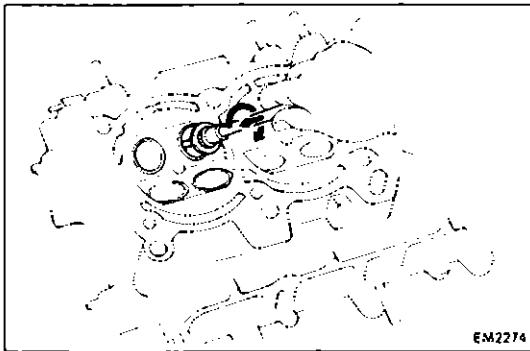
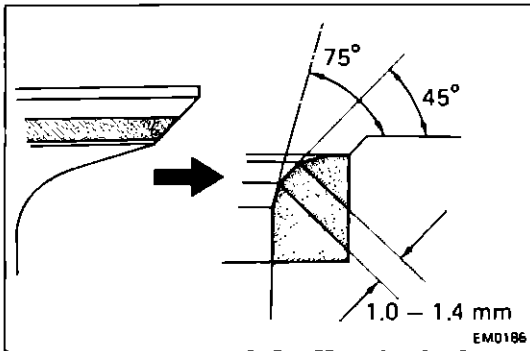
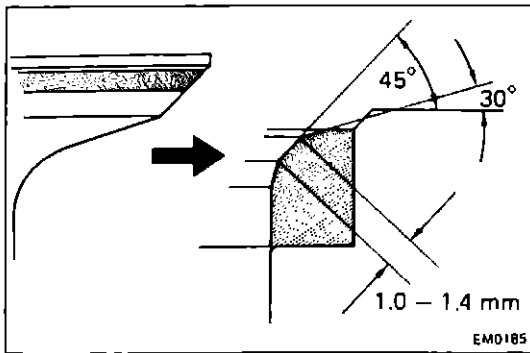
Apply a thin coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate the valve.

(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 seats as follows:

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

(2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.

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

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

### 13. INSPECT VALVE SPRINGS

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

**Maximum squareness: 2.0 mm (0.079 in.)**

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

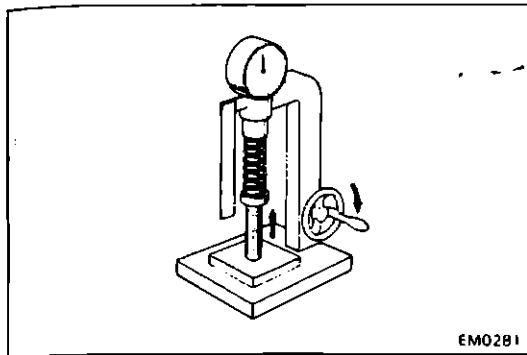
(b) Using calipers, measure the free length of the valve spring.

**Free length:**

**3S-GE 42.62 mm (1.6779 in.)**

**3S-GTE 45.30 mm (1.7835 in.)**

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



EM0281

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

Installed tension at 34.7 mm (1.366 in.):

3S-GE	16.1 – 18.9 kg (35.5 – 41.7 lb, 158 – 185 N)
3S-GTE	18.4 – 21.6 kg (40.6 – 47.6 lb, 180 – 212 N)

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

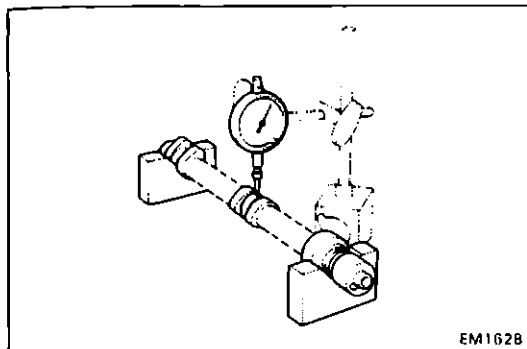
#### 14. INSPECT CAMSHAFTS AND BEARINGS

##### A. Inspect camshaft for runout

- Place the camshaft on V-blocks.
- Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.06 mm (0.0024 in.)

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



EM1628

##### B. Inspect cam lobes

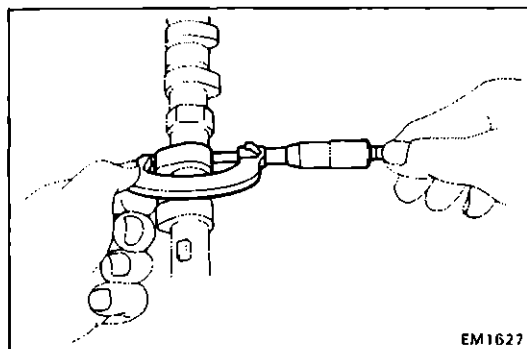
Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

3S-GE	35.510 – 35.610 mm (1.3980 – 1.4020 in.)
3S-GTE	35.460 – 35.560 mm (1.3961 – 1.4000 in.)

Minimum cam lobe height: 35.40 mm (1.3937 in.)

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



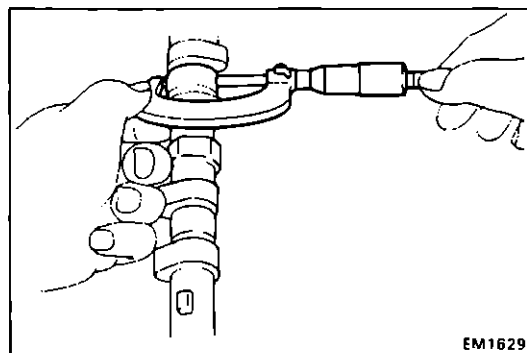
EM1627

##### C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

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

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

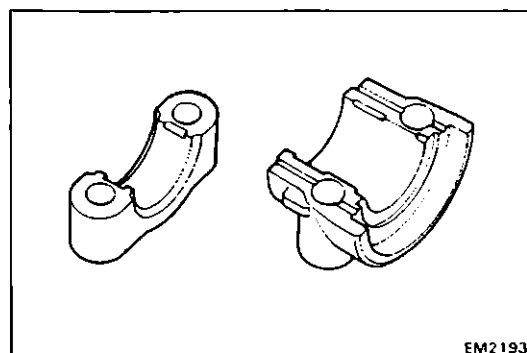


EM1629

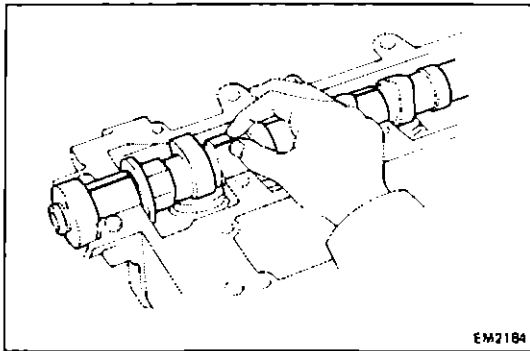
##### D. Inspect camshaft bearings

Check the bearings for flaking or scoring.

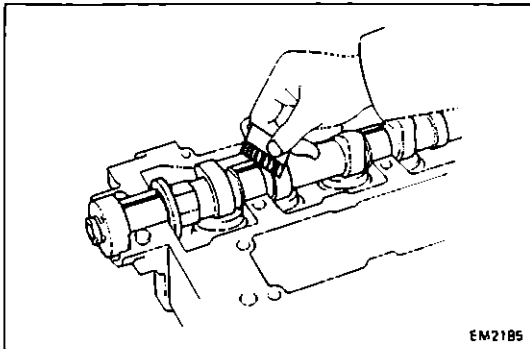
If bearings are damaged, replace the the bearing caps and cylinder head as a set.



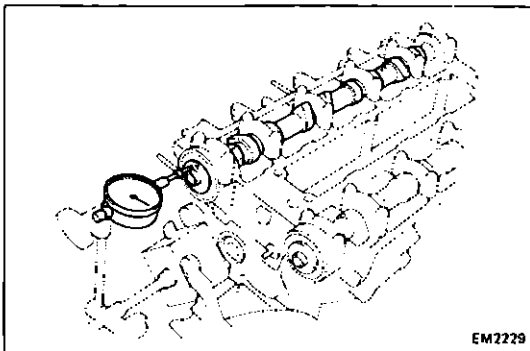
EM2193



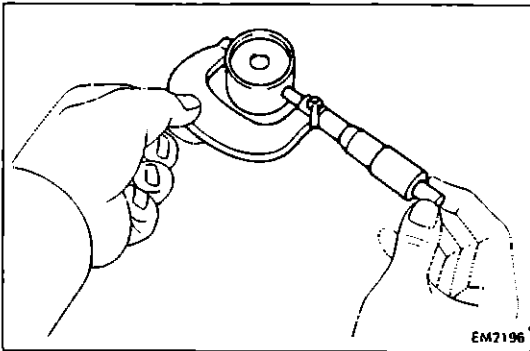
EM2184



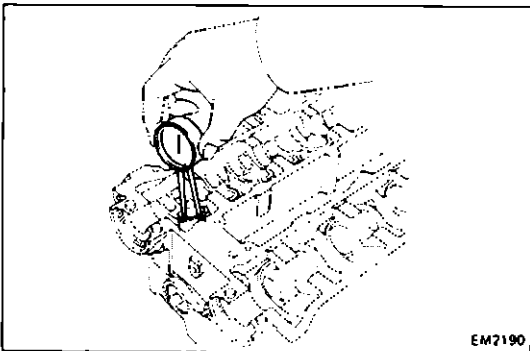
EM2185



EM2229



EM2196



EM2190

**E. Inspect camshaft journal oil clearance.**

- (a) Clean the bearing caps and camshaft journals.
- (b) Place the camshafts on the cylinder head.
- (c) Lay a strip of Plastigage across each of the camshaft journal.
- (d) Install the bearing caps.  
(See step 2 on pages EM-106 and 107 (or 114))

**Torque: 190 kg-cm (14 ft-lb, 19 N-m)**

**NOTE:** Do not turn the camshaft.

- (e) Remove the bearing caps.
- (f) Measure the Plastigage at its widest point.

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

**Maximum oil clearance: 0.08 mm (0.0031 in.)**

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

- (g) Completely remove the Plastigage.

**F. Inspect camshaft thrust clearance**

- (a) Install the camshafts.  
(See step 2 on pages EM-106 and 107 (or 114))
- (b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

**Standard thrust clearance: 0.120 – 0.290 mm  
(0.0047 – 0.0114 in.)**

**Maximum thrust clearance: 0.30 mm (0.0118 in.)**

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

**15. INSPECT VALVE LIFTERS AND LIFTER BORES**

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

**Lifter diameter: 27.975 – 27.985 mm  
(1.1014 – 1.1018 in.)**

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

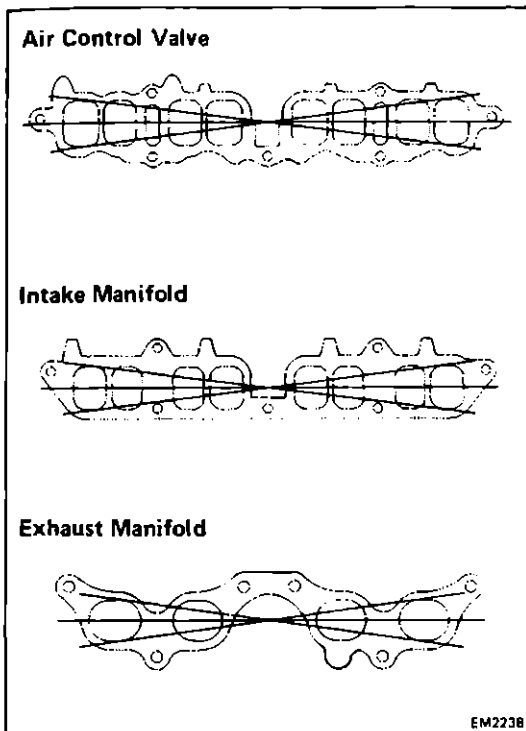
**Lifter bore diameter: 28.000 – 28.021 mm  
(1.1024 – 1.1032 in.)**

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

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

**Maximum oil clearance:** 0.07 mm (0.0028 in.)

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



## 16. INSPECT INTAKE, EXHAUST MANIFOLDS AND AIR CONTROL VALVE

Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder head or air control valve for warpage.

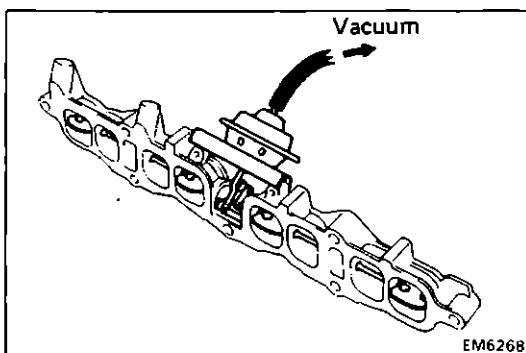
**Maximum warpage:**

Air control valve 0.2 mm (0.008 in.)

Intake manifold 0.3 mm (0.012 in.)

Exhaust manifold 1.0 mm (0.039 in.)

If the warpage is greater than maximum, replace the manifold or air control valve.



## INSPECTION OF TOYOTA — VARIABLE INDUCTION SYSTEM (T-VIS)

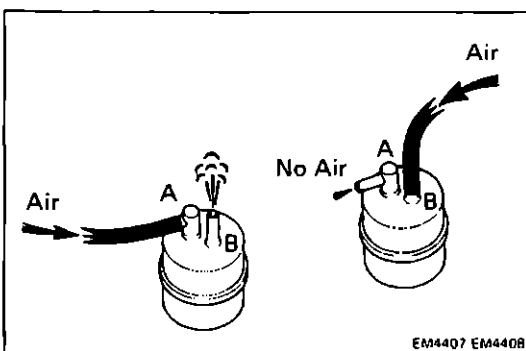
### 1. INSPECT AIR CONTROL VALVE

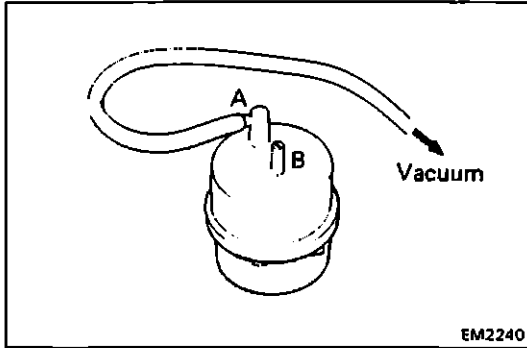
- With 400 mmHg (15.75 in.Hg, 53.3 kpa) of vacuum applied to the actuator, check that the control valve moves smoothly to the fully closed position.
- With the vacuum released, check that the valve fully opens quickly.

If abnormal, replace the valve.

### 2. INSPECT VACUUM TANK

- Check that air flows from pipes A to B.
- Check that air does not flow from pipes B to A.





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

If there is change, replace the vacuum tank.

### 3. INSPECT VACUUM SWITCHING VALVE (VSV)

3S-GE (See page FI-141)

3S-GTE (See page FI-142)

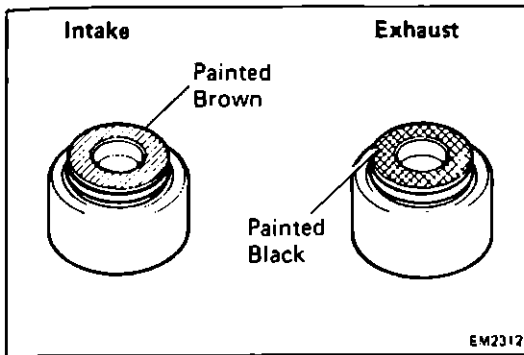


**ASSEMBLY OF CYLINDER HEAD**

(See page EM-81 or 82)

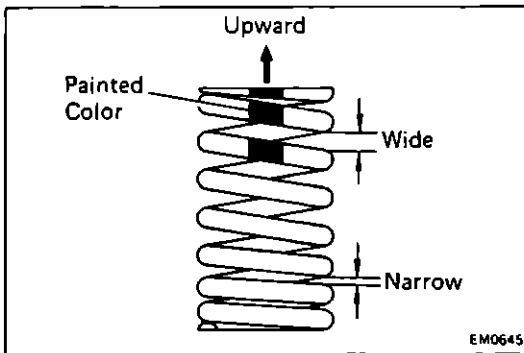
**NOTE:**

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

**1. INSTALL VALVES**

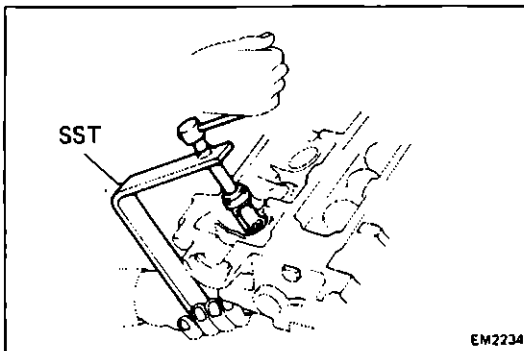
- (a) Install a new oil seal.

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



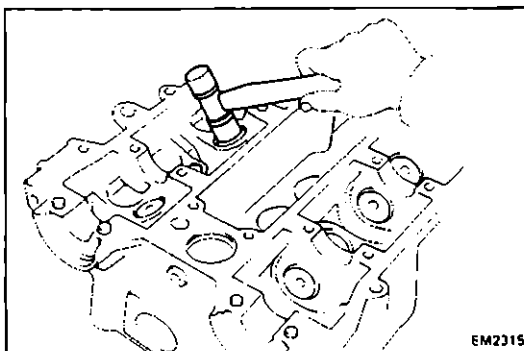
- (b) Install the valve, spring seat, spring and spring retainer.

**NOTE:** Install the spring with the correct direction as shown.

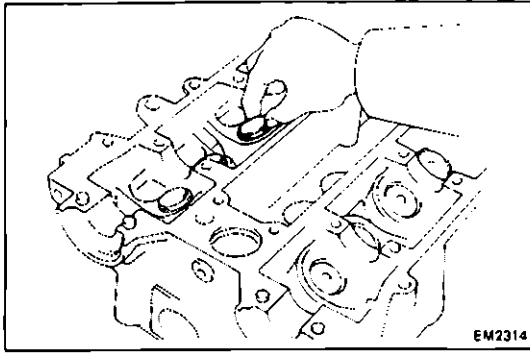


- (c) Using SST, compress the valve spring and place the two keepers around the valve stem.

SST 09202-70010



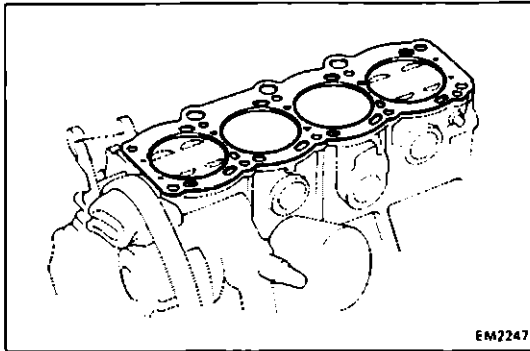
- (d) Using a plastic-faced hammer, lightly tap the valve stem tip to assure proper fit.



EM2314

## 2. INSTALL VALVE LIFTERS AND SHIMS

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



EM2247

## INSTALLATION OF CYLINDER HEAD (3S-GE)

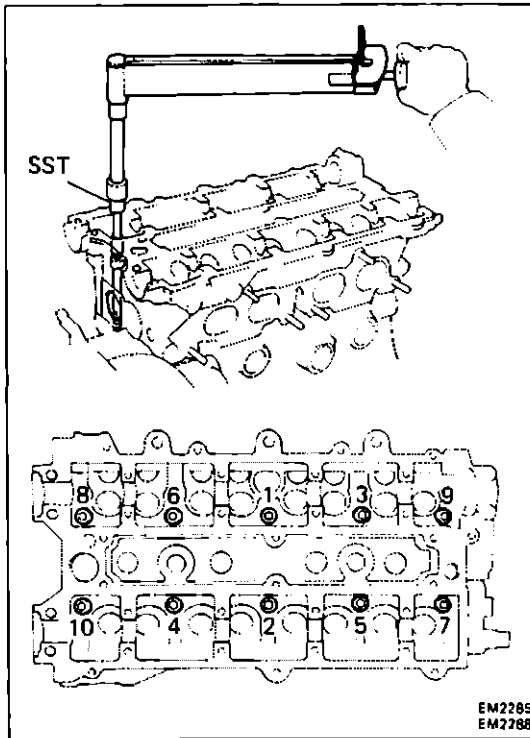
(See page EM-81)

### 1. INSTALL CYLINDER HEAD

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

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

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

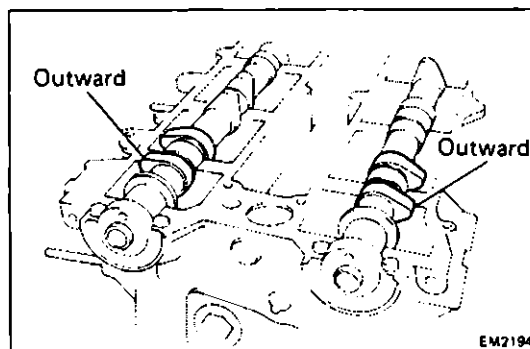
EM2285  
EM2788

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

- (d) Using SST, install and uniformly tighten the ten cylinder head bolts in several passes in the sequence shown.

SST 09043-88010

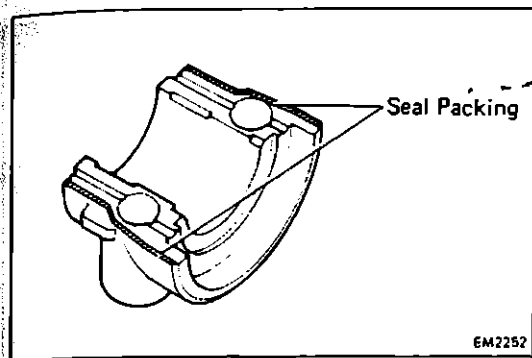
**Torque:** 550 kg-cm (40 ft-lb, 53 N·m)



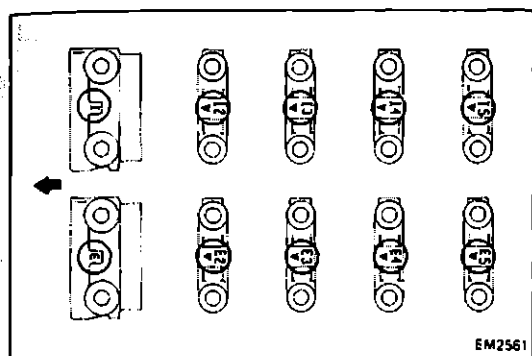
EM2194

### 2. INSTALL CAMSHAFTS

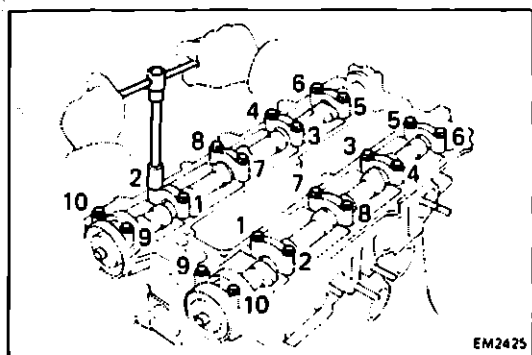
- (a) Place the camshaft on the cylinder head with the No. 1 cam lobe facing outward as shown.



- (b) Apply seal packing to the No. 1 bearing cap as shown.  
**Seal packing: Part No.08826-00080 or equivalent**

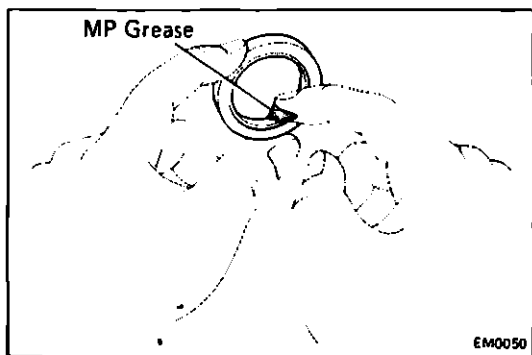


- (c) Install the bearing caps in their proper locations.  
**NOTE: Each bearing cap has a number and front mark.**

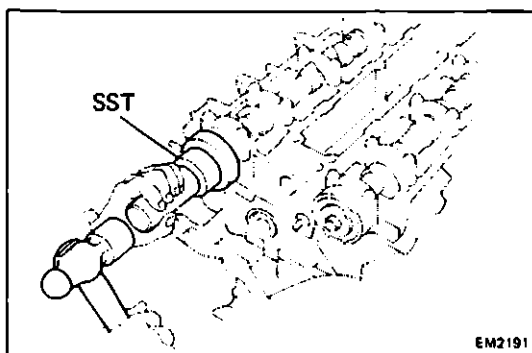


- (d) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.  
 (e) Install and uniformly tighten the twenty bearing cap bolts in several passes in the sequence shown.

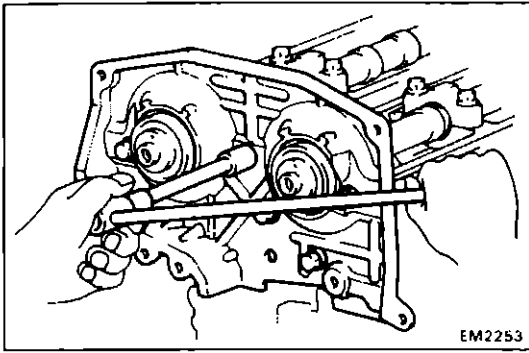
**Torque: 190 kg-cm (14 ft-lb, 19 N·m)**



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

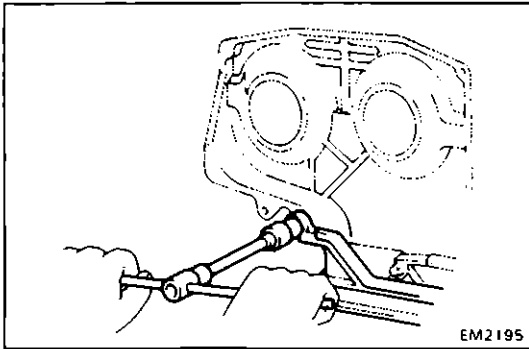


- (g) Using SST, tap in the two camshaft oil seals.  
**SST 09223-50010**



### 3. INSTALL NO.3 TIMING BELT COVER

(a) Install the No.3 belt cover with the four bolts.



(b) Install the bolt holding the No.1 belt cover to the No.3 belt cover.

### 4. INSTALL NO.1 IDLER PULLEY AND TENSION SPRING (See step 4 on page EM-44)

### 5. INSTALL CAMSHAFT TIMING PULLEYS AND TIMING BELT (See steps 9 to 14 on pages EM-45 to 48)

### 6. INSTALL SPARK PLUGS (See page IG-11) Torque: 180 kg-cm (13 ft-lb, 18 N·m)

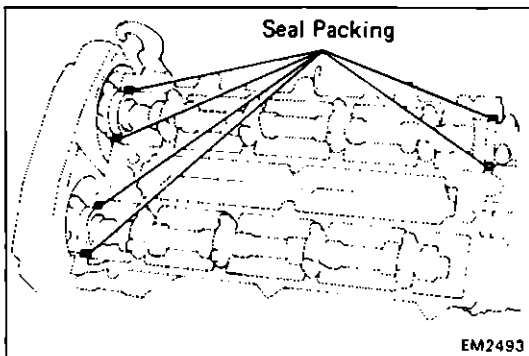
### 7. INSTALL POWER STEERING OIL RESERVOIR TANK

### 8. INSTALL NO.1 ENGINE HANGER

### 9. INSTALL CYLINDER HEAD COVERS

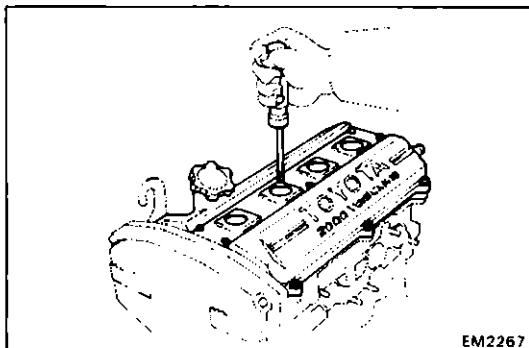
(a) Apply seal packing to the cylinder head as shown in the figure.

**Seal packing: Part No.08826-00080 or equivalent**

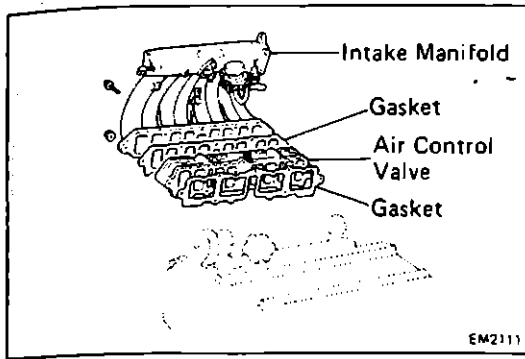


(b) Install the gasket and two head covers with the screws.

(c) Install the and gasket center cover with the screws.  
Torque: 55 kg-cm (48 in.-lb, 5.4 N·m)



### 10. INSTALL DELIVERY PIPE AND INJECTORS (See step 1 on pages FI-103 and 104)

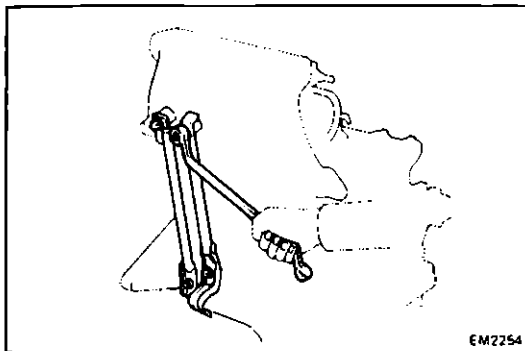
**11. INSTALL AIR CONTROL VALVE AND INTAKE MANIFOLD**

- (a) Position new gaskets, air control valve and intake manifold on the cylinder head.
- (b) Connect the three wire harness clamps.
- (c) Install the air control valve and intake manifold with the four bolts and three nuts.

**Torque: 195 kg-cm (14 ft-lb, 19 N·m)**

**12. CONNECT POWER STEERING VACUUM HOSES****13. CONNECT VSV CONNECTORS**

Connect the two connectors.

**14. CONNECT GROUND STRAP****15. INSTALL NO.1 AND NO.3 INTAKE MANIFOLD STAYS**

Install the manifold stays with the three bolts and nut.

**Torque:**

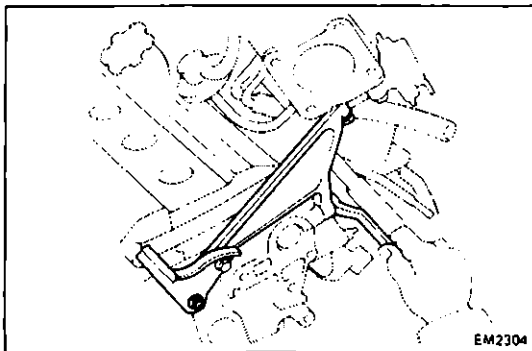
<b>Intake manifold side</b>	<b>195 kg-cm</b> <b>(14 ft-lb, 19 N·m)</b>
<b>Cylinder block side</b>	<b>260 kg-cm</b> <b>(19 ft-lb, 25 N·m)</b>

**16. CONNECT FUEL HOSES****17. CONNECT INJECTOR CONNECTORS****18. CONNECT HOSES**

- (a) Brake booster vacuum hose
- (b) Cruise control actuator vacuum hose
- (c) A/C idle-up vacuum hose
- (d) Vacuum hose for vacuum tank
- (e) Vacuum hose for VSV of V-ISC
- (f) Vacuum sensing hose

**19. INSTALL EGR VACUUM MODULATOR****20. INSTALL COLD START INJECTOR PIPE**

(See steps 2 and 3 on page FI-85)



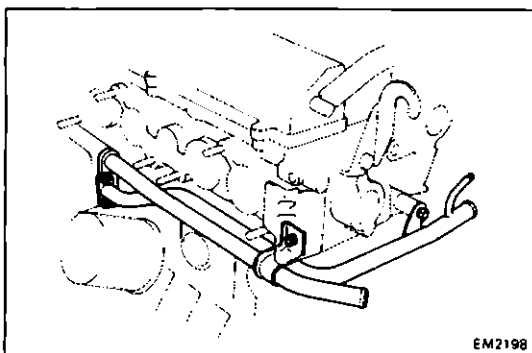
### 21. INSTALL NO.2 ENGINE HANGER AND NO.2 INTAK MANIFOLD STAY

Install the engine hanger and intake manifold stay with th three bolts.

#### Torque:

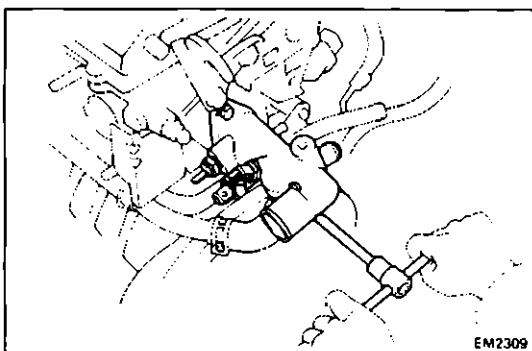
12 mm bolt head 195 kg-cm (14 ft-lb, 19 N·m)  
14 mm bolt head 400 kg-cm (29 ft-lb, 39 N·m)

### 22. INSTALL THROTTLE BODY (See steps 2 to 3 on page FI-122)



### 23. INSTALL WATER BY-PASS PIPE

- Install a new O-ring to the pipe.
- Install a new gasket to the water pump.
- Install the pipe with the two bolts and nuts.
- Connect the water hoses.



### 24. INSTALL WATER OUTLET

- Install a new gasket and water outlet with the tw bolts.

#### Torque: 130 kg-cm (9 ft-lb, 13 N·m)

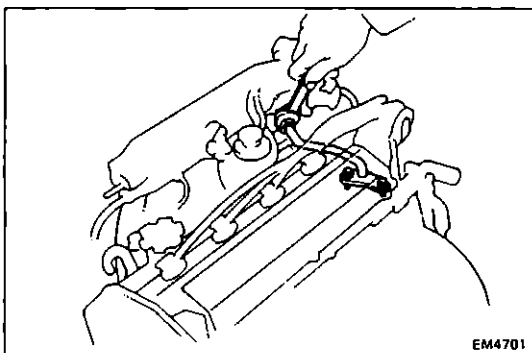
- Connect the following connectors and hoses:
  - Water temperature switch connector
  - Water temperature sender gauge connector
  - Cold start injector time switch connector
  - Radiator upper hose
  - Water hoses
  - Emission control vacuum hoses

### 25. CONNECT OIL PRESSURE SENDER GAUGE CONNECTO

### 26. INSTALL DISTRIBUTOR (See page IG-19)

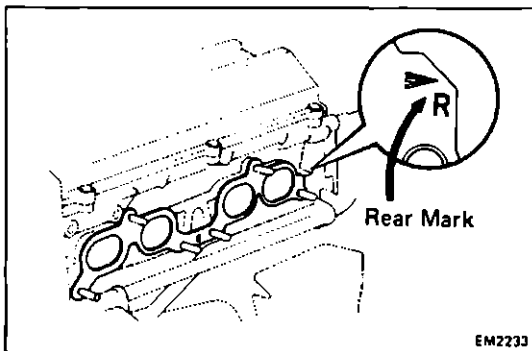
### 27. INSTALL EGR PIPE

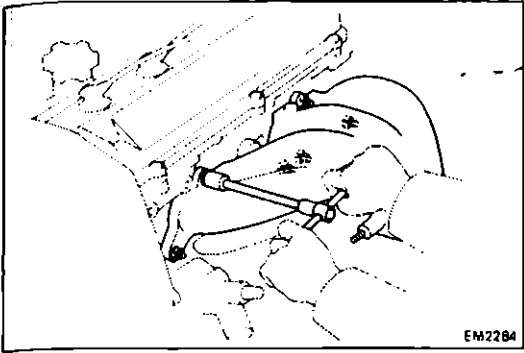
Install a new gasket and the EGR pipe with the two bolt and union nut.



### 28. INSTALL EXHAUST MANIFOLD

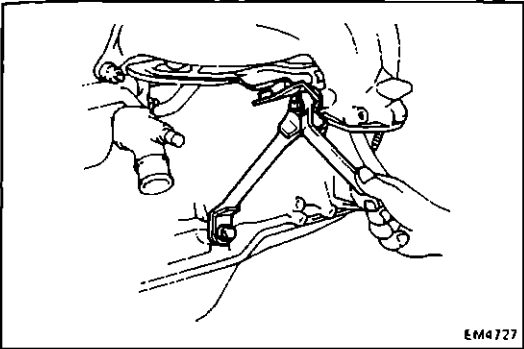
- Place a new gasket so that the rear mark is toward the back.





- (b) Install the exhaust manifold and the lower heat insulator assembly with the six nuts.

**Torque: 440 kg-cm (32 ft-lb, 43 N·m)**



- (c) Install the manifold stay with the bolt and nut.

**Torque:**

**Bolt 400 kg-cm (29 ft-lb, 39 N·m)**

**Nut 440 kg-cm (32 ft-lb, 43 N·m)**

- 29. INSTALL EXHAUST FRONT PIPE TO EXHAUST MANIFOLD**  
(See step 10 on page EM-152)

- 30. INSTALL SUSPENSION LOWER CROSSMEMBER**  
(See step 15 on page EM-153)

- 31. INSTALL ENGINE RH UNDER COVER**

- 32. INSTALL RH FRONT WHEEL**

- 33. LOWER VEHICLE**

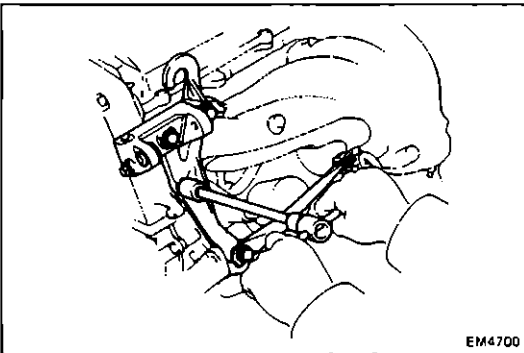
- 34. INSTALL ALTERNATOR BRACKETS**

- (a) Install the No. 1 and No. 2 alternator brackets with the five bolts.

**Torque: 400 kg-cm (29 ft-lb, 39 N·m)**

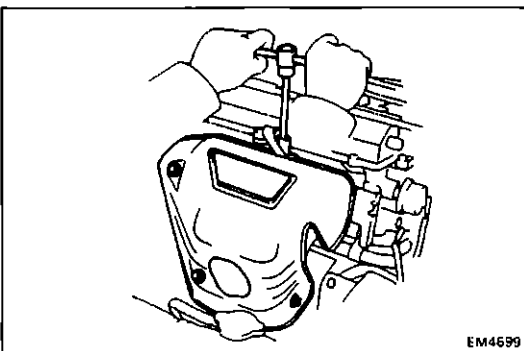
- (b) Connect the ground strap connector.

- 35. INSTALL ALTERNATOR (See page CH-15)**



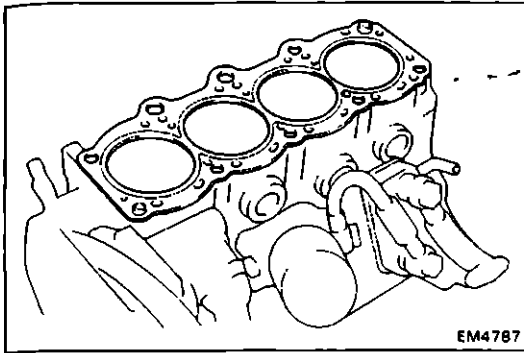
- 36. INSTALL EXHAUST MANIFOLD UPPER HEAT INSULATOR**

Install the heat insulator with the four bolts.



37. **INSTALL AIR CLEANER ASSEMBLY**  
(See step 30 on page EM-155)
38. (w/ CRUISE CONTROL SYSTEM)  
**INSTALL CRUISE CONTROL ACTUATOR**  
(See step 32 on page EM-155)
39. **INSTALL RADIATOR RESERVOIR TANK**
40. **INSTALL ACCELERATOR CABLE AND ADJUST IT**
41. (A/T)  
**INSTALL THROTTLE CABLE AND BRACKET AND ADJUST IT**
42. **INSTALL SUSPENSION UPPER BRACE**  
(See step 31 on page EM-155)
43. **FILL ENGINE COOLANT** (See page CO-6)  
Total capacity (w/ Heater):  
M/T 6.2 liters (6.6 US qts, 5.5 Imp. qts)  
A/T 6.1 liters (6.4 US qts, 5.4 Imp. qts)
44. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**
45. **START ENGINE AND CHECK FOR LEAKS**
46. **PERFORM ENGINE ADJUSTMENT**
  - (a) Adjust the valve clearance. (See page EM-16)  
**Valve clearance (Cold):**  
Intake 0.15 — 0.25 mm (0.006 — 0.010 in.)  
Exhaust 0.20 — 0.30 mm (0.008 — 0.012 in.)
  - (b) Adjust the ignition timing.  
(See steps 8 to 11 on pages IG-19 and 20)  
**Ignition timing:**  
10° BTDC @ idle  
(w/ Terminals T and E1 connected)
  - (c) Adjust the idle speed. (See page MA-7)  
**Idle speed: 750 rpm**
47. **CHECK TOE-IN**
48. **PERFORM ROAD TEST**  
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.
49. **RECHECK ENGINE COOLANT AND OIL LEVELS**





## INSTALLATION OF CYLINDER HEAD (3S-GTE)

(See page EM-82)

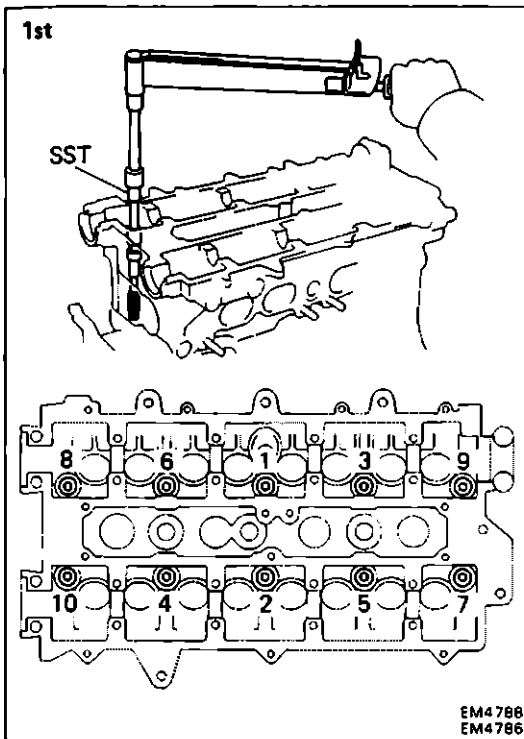
### 1. INSTALL CYLINDER HEAD

#### A. Place cylinder head on cylinder block

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

**CAUTION:** Be careful of the installation.

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



#### B. Tighten cylinder head bolts

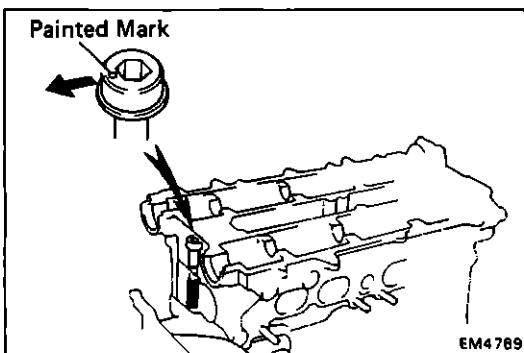
NOTE:

- The cylinder head bolts are tightened in two progressive steps.
  - If any of bolts break or deform, replace them.
- (a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
- (b) First, using SST, install and uniformly tighten the ten cylinder head bolts in several passes in the sequence shown.

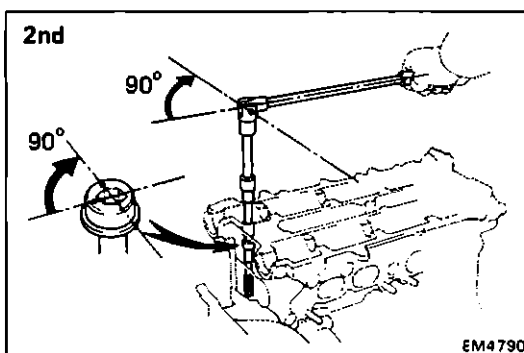
SST 09043-38100

**Torque: 550 kg-cm (40 ft-lb, 54 N·m)**

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



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

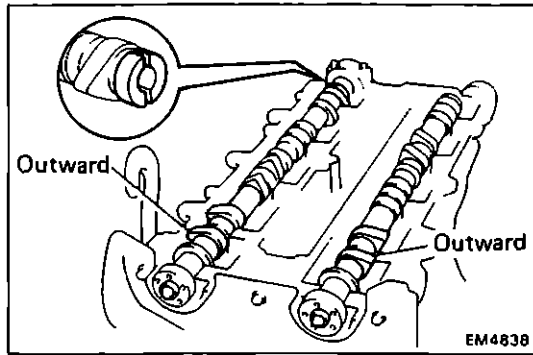


- (d) Second, retighten the ten cylinder head bolts 90° in the numerical order shown.

- (e) Check that the painted mark is now at a 90° angle to the front.

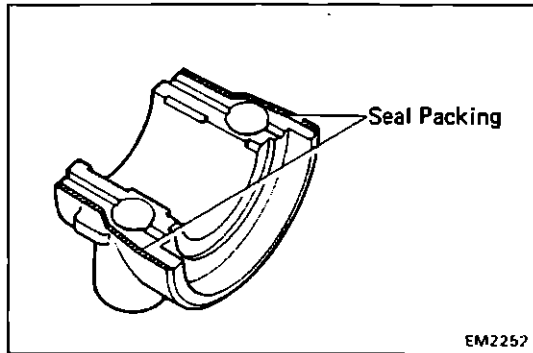
### 2. INSTALL RH REAR ENGINE HANGER

**Torque: 195 kg-cm (14 ft-lb, 19 N·m)**

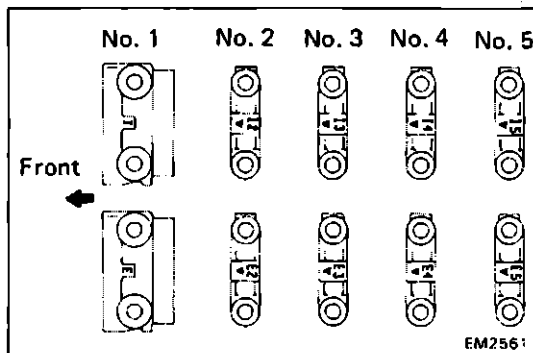


### 3. INSTALL CAMSHAFTS

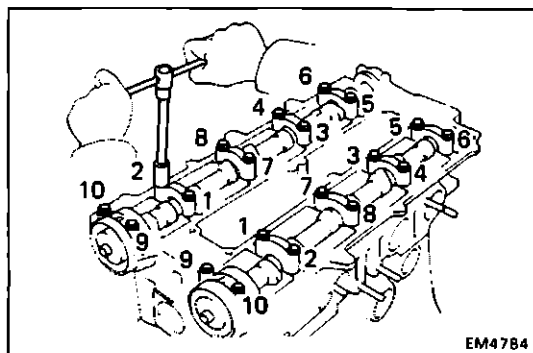
- (a) Place the camshaft on the cylinder head with the No. 1 cam lobe facing outward as shown.



- (b) Apply seal packing to the No. 1 bearing cap as shown.  
**Seal packing: Part No. 08826-00080 or equivalent**

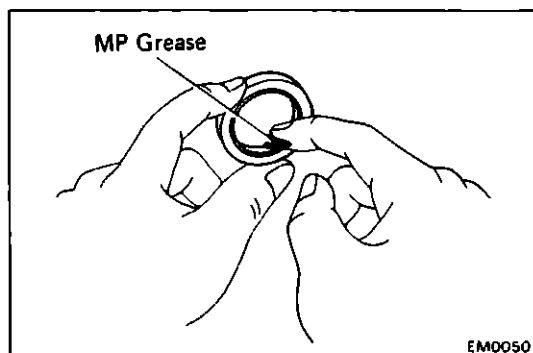


- (c) Install the bearing caps in their proper locations.  
**NOTE: Each bearing cap has a number and front mark.**

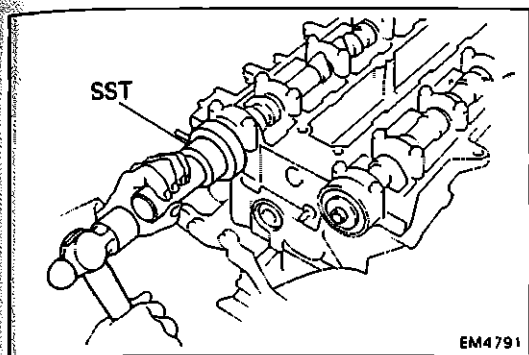


- (d) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.  
 (e) Install and uniformly tighten the twenty bearing cap bolts in several passes in the sequence shown.

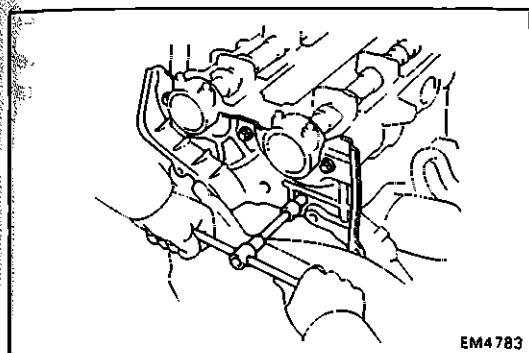
**Torque: 190 kg-cm (14 ft-lb, 19 N·m)**



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



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

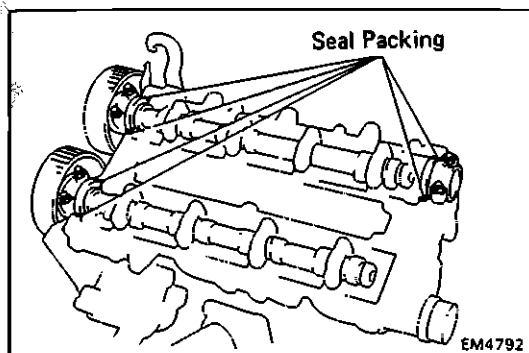


**4. INSTALL NO.3 TIMING BELT COVER**

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

**5. INSTALL NO.1 IDLER PULLEY AND TENSION SPRING**  
(See step 4 on page EM-44)

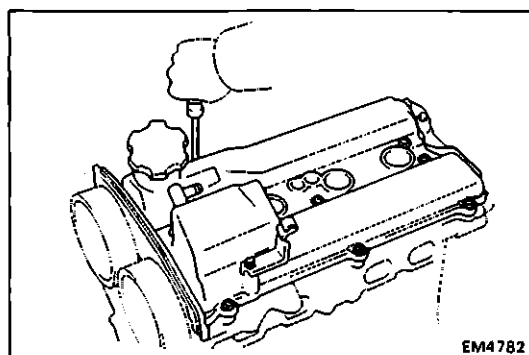
**6. INSTALL CAMSHAFT TIMING PULLEYS**  
(See step 9 on pages EM-45 and 46)



**7. INSTALL CYLINDER HEAD COVER**

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

Seal packing: Part No. 08826-00080 or equivalent



(b) Install the two gaskets to the head cover.

(c) Install the head cover with the twelve seal washers and screws.

Torque: 25 kg-cm (21 in.-lb, 2.5 N·m)

**8. INSTALL TIMING BELT**

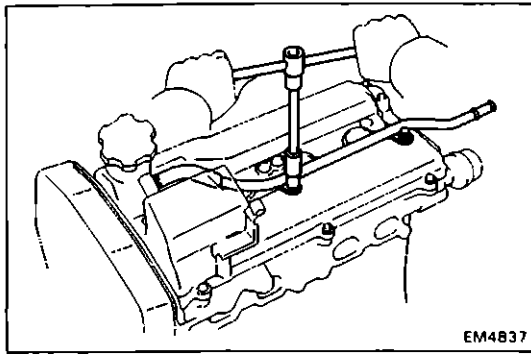
(See steps 11 to 13 on pages EM-46 and 47)

**9. INSTALL NO.2 TIMING BELT COVER**  
(See page 14 on page EM-48)

**10. INSTALL SPARK PLUGS** (See page IG-11)

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

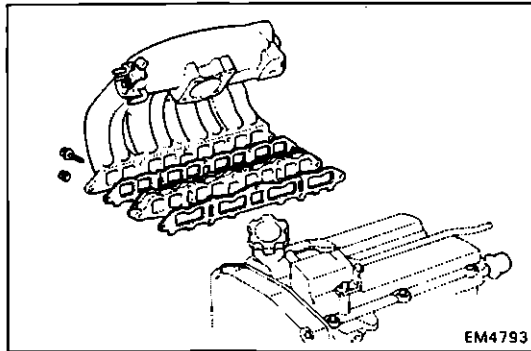
**11. INSTALL POWER STEERING OIL RESERVOIR TANK**



EM4837

**12. INSTALL PCV PIPE**

- (a) Connect the hose to the cylinder head cover.
- (b) Install the PCV pipe with the two bolts.

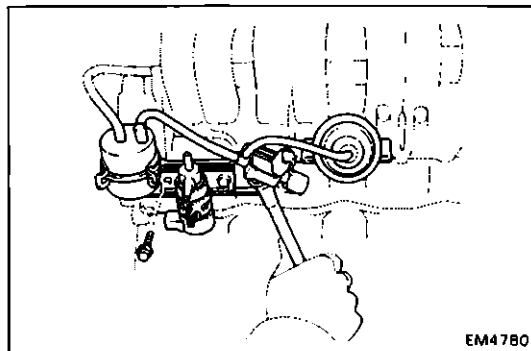


EM4793

**13. INSTALL AIR CONTROL VALVE AND INTAKE MANIFOLD**

Install a new gasket, the air control valve, a new gasket and the intake manifold with the four bolts and three nuts.

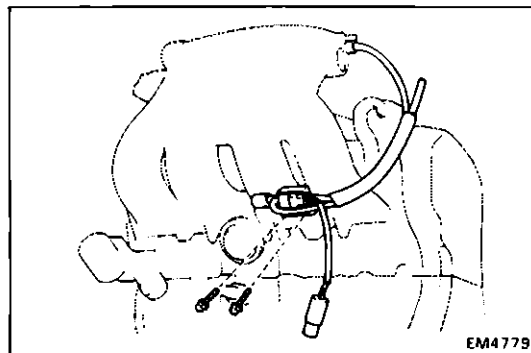
**Torque: 195 kg-cm (14 ft-lb, 19 N·m)**



EM4780

**14. INSTALL T-VIS VSV, VACUUM TANK AND TURBOCHARGING PRESSURE VSV**

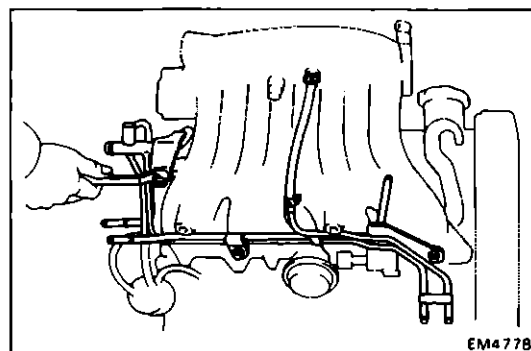
- (a) Install the T-VIS, vacuum tank and turbocharging pressure VSV assembly with the two bolts.
- (b) Connect the hoses:
  - (1) Intake manifold vacuum hose
  - (2) T-VIS actuator vacuum hose



EM4779

**15. INSTALL FUEL PRESSURE VSV**

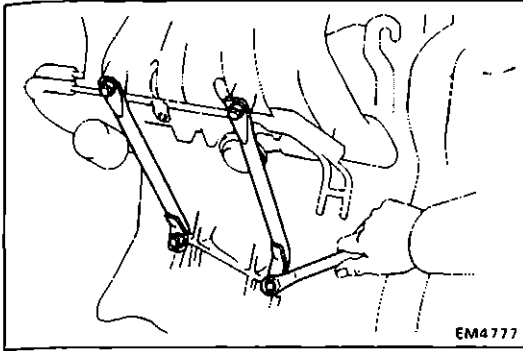
- (a) Install the VSV with the two bolts.
- (b) Connect the vacuum hose to the intake manifold:



EM4778

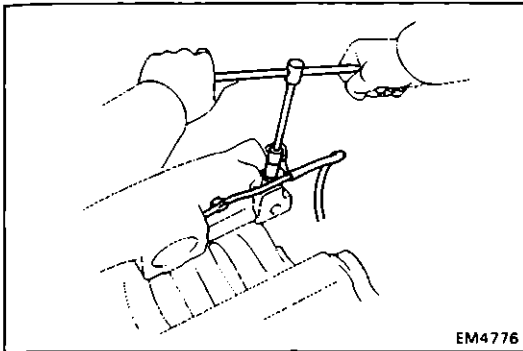
**16. INSTALL NO.1 AIR PIPE**

- (a) Install the air pipe with the two bolts.
- (b) Connect the hose:
  - (1) Intake manifold vacuum hose
  - (2) Turbocharging pressure VSV vacuum hose
  - (3) Two PS pump vacuum hoses

**17. INSTALL INTAKE MANIFOLD STAYS**

Install the two manifold stays with the four bolts.

**Torque:** 260 kg-cm (19 ft-lb, 25 N·m)

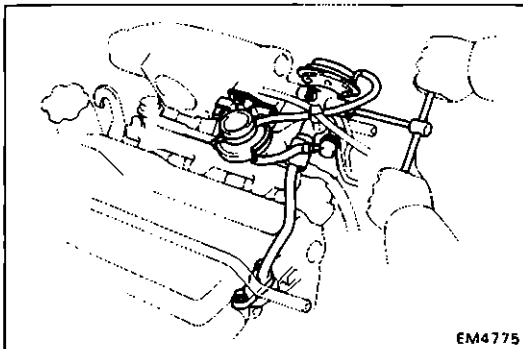
**18. INSTALL VACUUM PIPE**

(a) Install the vacuum pipe with the bolt.

(b) Connect the vacuum hose to the EGR vacuum modulator.

**19. INSTALL DELIVERY PIPE AND INJECTORS**

(See steps 2 to 4 on pages FI-108 and 109)

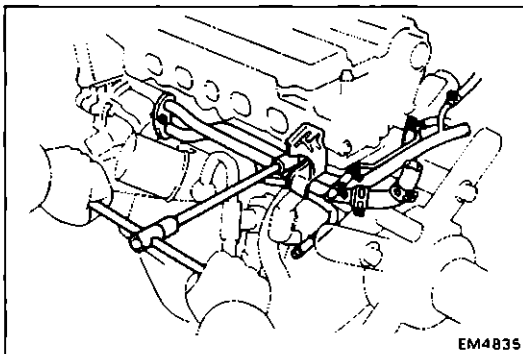
**20. INSTALL EGR VALVE, VACUUM MODULATOR AND EGR CONTROL VSV**

Install the EGR valve, pipe, vacuum modulator and control VSV assembly with the five bolts.

**Torque:** 195 kg-cm (14 ft-lb, 19 N·m)

**21. CONNECT COLD START INJECTOR CONNECTOR****22. INSTALL THROTTLE BODY**

(See steps 2 to 6 on page FI-126)

**23. INSTALL WATER BY-PASS PIPE**

(a) Install a new O-ring to the pipe.

(b) Install a new gasket to the water pump.

(c) Install the water by-pass pipe with the two bolts and nuts.

(d) Connect the following hoses:

(1) Oil cooler water by-pass hoses

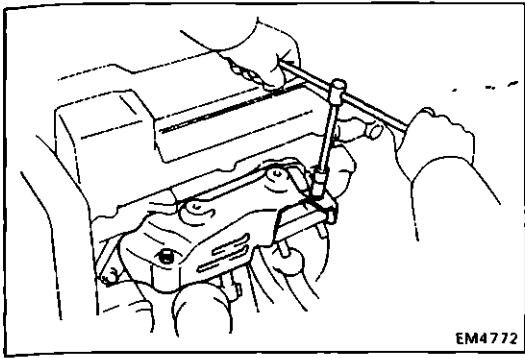
(2) Heater water by-pass hose

(3) No.1 air pipe water by-pass hose

(4) Water by-pass hose to cylinder block

(5) Turbocharging pressure VSV vacuum hose

**Torque (Nuts):** 80 kg-cm (69 in.-lb, 7.8 N·m)

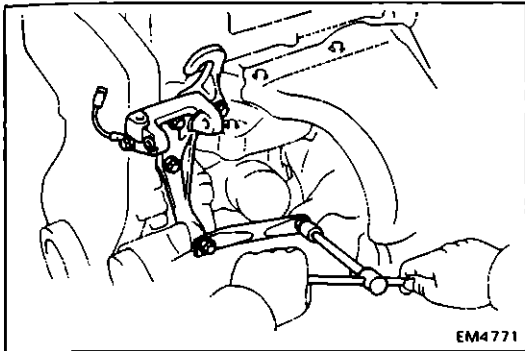


EM4772

(c) Install the upper heat insulator with the two bolts.

### 30. INSTALL TURBOCHARGER

(See steps 4 to 11 on pages TC-13 and 14)



EM4771

### 31. INSTALL ALTERNATOR BRACKETS

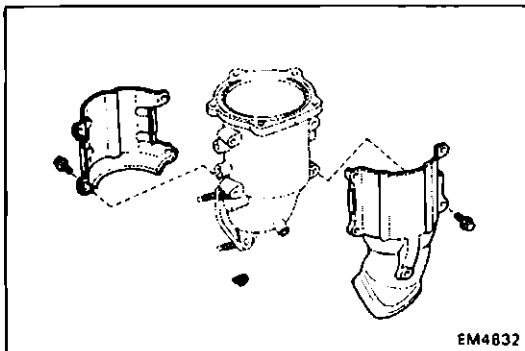
Install the No.1 and No.2 brackets with the five bolts.

Torque:

To turbine outlet elbow

440 kg-cm (32 ft-lb, 43 N·m)

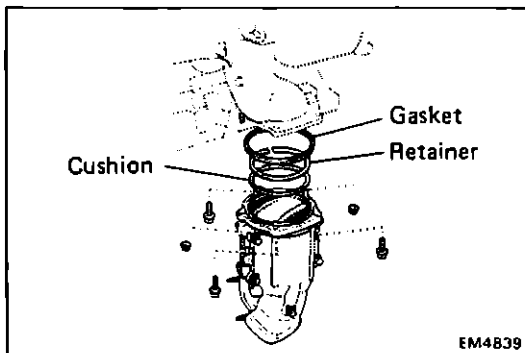
Others 400 kg-cm (29 ft-lb, 39 N·m)



EM4832

### 32. INSTALL CATALYTIC CONVERTER

(a) Install the two heat insulator with the nine bolts.

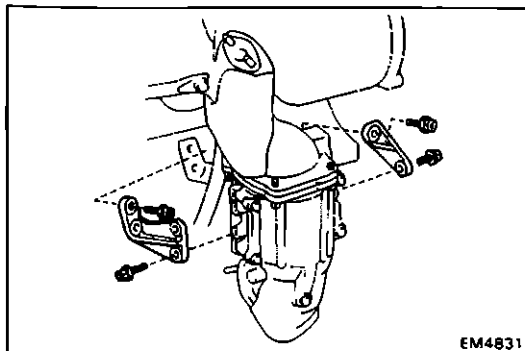


EM4839

(b) Install new cushion, the retainer and gasket to the catalytic converter.

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

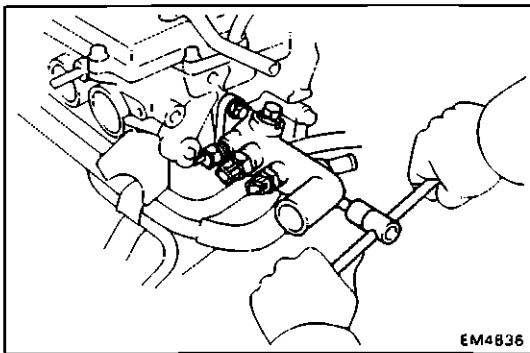
Torque: 300 kg-cm (22 ft-lb, 29 N·m)



EM4831

(d) Install the two converter stays with the six bolts.

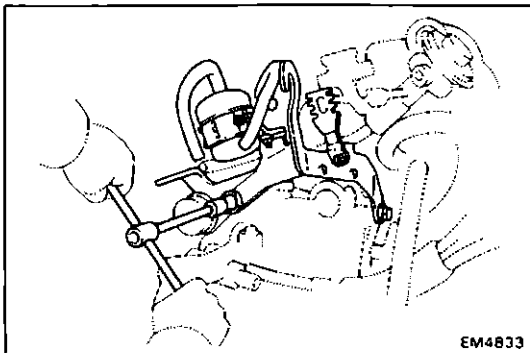
Torque: 650 kg-cm (47 ft-lb, 64 N·m)

**24. INSTALL WATER OUTLET**

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

**Torque: 130 kg-cm (9 ft-lb, 13 N·m)**

- (b) Connect the following connectors and hoses:
- (1) Water temperature sender gauge connector
  - (2) Water temperature sensor connector
  - (3) Cold start injector time switch connector
  - (4) No.1 air pipe water by-pass hose
  - (5) Radiator upper hose
  - (6) Water by-pass pipe hose
  - (7) Heater water by-pass hose
  - (8) Emission control vacuum hoses

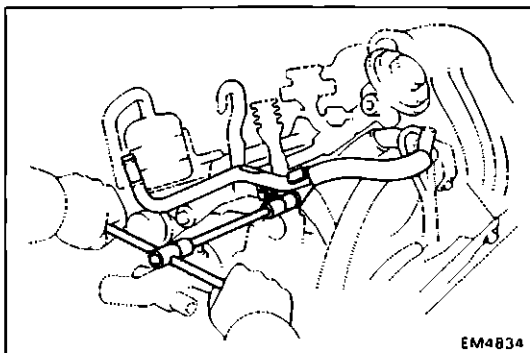
**25. INSTALL OIL PRESSURE SENDER GAUGE****26. INSTALL LH ENGINE HANGER**

Install the engine hanger and reservoir tank with the two bolts.

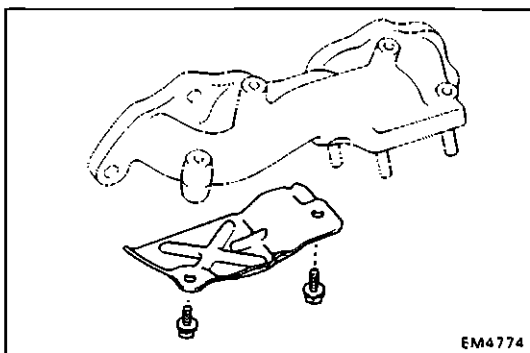
**Torque:**

12 mm bolt head 130 kg-cm (9 ft-lb, 13 N·m)

14 mm bolt head 195 kg-cm (14 ft-lb, 19 N·m)

**27. INSTALL NO.2 AIR PIPE**

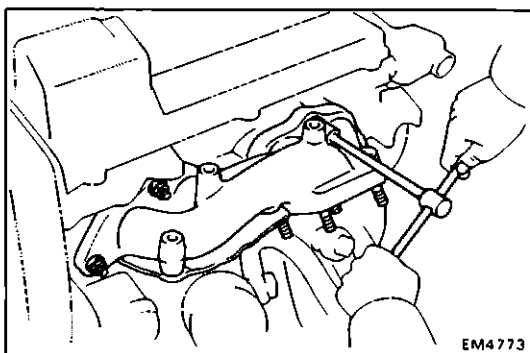
- (a) Install the air pipe with the two bolts.  
 (b) Connect the air hose.

**28. INSTALL DISTRIBUTOR (See page IG-19)****29. INSTALL EXHAUST MANIFOLD**

- (a) install the lower heat insulator with the two bolts.

- (b) Install new two gaskets and the exhaust manifold with the six nuts.

**Torque: 530 kg-cm (38 ft-lb, 52 N·m)**

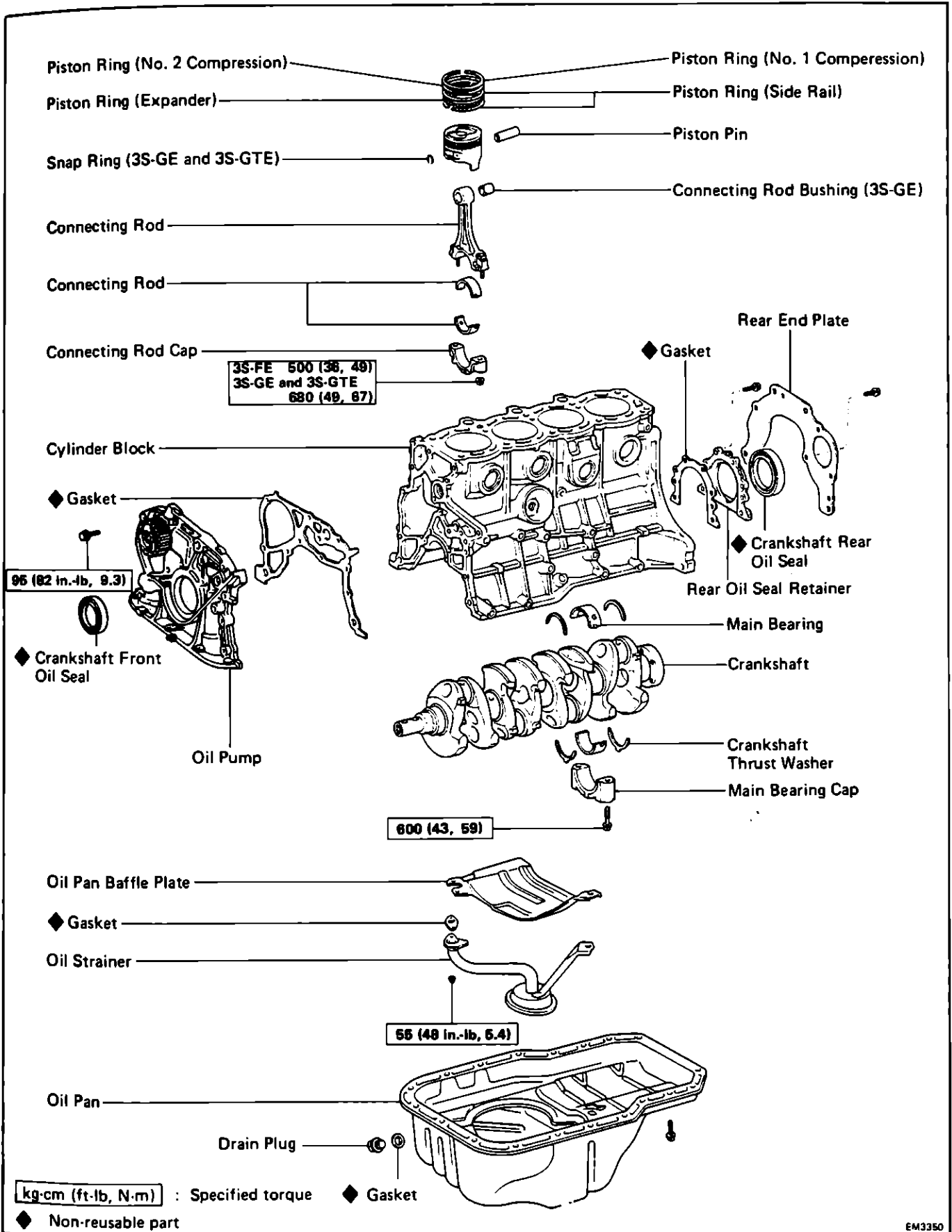


33. **INSTALL EXHAUST FRONT PIPE**  
(See step 10 on page EM-152)
34. **INSTALL SUSPENSION LOWER CROSSMEMBER**  
(See step 15 page EM-153)
35. **INSTALL ENGINE UNDER COVER**
36. **INSTALL RH FRONT WHEEL**
37. **LOWER VEHICLE**
38. **INSTALL ALTERNATOR**
39. **INSTALL AIR CLEANER ASSEMBLY**  
(See step 30 on page EM-155)
40. **(w/ CRUISE CONTROL SYSTEM)**  
**INSTALL CRUISE CONTROL ACTUATOR**  
(See step 32 on page EM-155)
41. **INSTALL RADIATOR RESERVOIR TANK**
42. **INSTALL ACCELERATOR CABLE AND ADJUST IT**
43. **INSTALL SUSPENSION UPPER BRACE**  
(See step 31 on page EM-155)
44. **FILL ENGINE WITH COOLANT (See page CO-6)**  
Capacity (w/ Heater):  
6.4 liters (6.8 US qts, 5.6 Imp. qts)
45. **FILL INTERCOOLER WITH COOLANT (See page TC-7)**  
Capacity:  
1.6 liters (1.7 US qts, 1.4 Imp. qts)
46. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**
47. **START ENGINE AND FOR LEAKS**
48. **PERFORM ENGINE ADJUSTMENT**
  - (a) Adjust the valve clearance. (See page EM-16)  
Valve clearance (Cold):

Intake	0.15 — 0.25 mm (0.006 — 0.010 in.)
Exhaust	0.20 — 0.30 mm (0.008 — 0.012 in.)
  - (b) Adjust the ignition timing.  
(See steps 8 to 11 on pages IG-19 and 20)  
Ignition timing:  
10° BTDC @ idle  
(w/ Terminals T and E1 connected)
49. **CHECK TOE-IN**
50. **PERFORM ROAD TEST**  
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.
51. **RECHECK ENGINE, INTERCOOLER COOLANT AND OIL LEVELS**

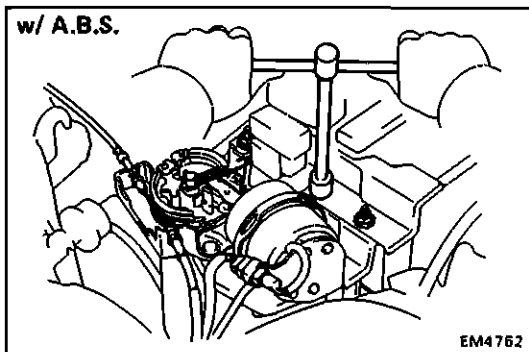


# CYLINDER BLOCK COMPONENTS

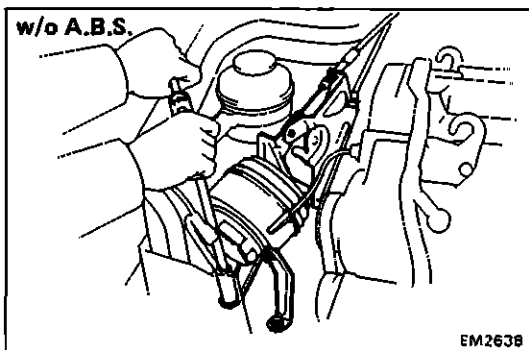


**REMOVAL OF ENGINE**

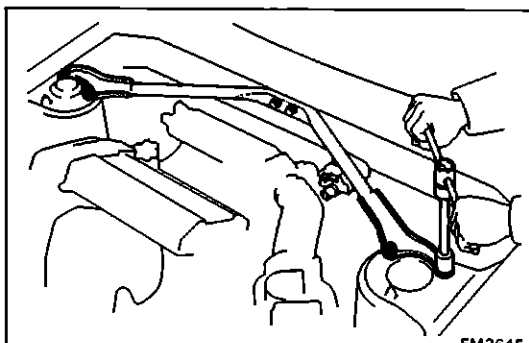
1. REMOVE BATTERY
2. DRAIN ENGINE COOLANT (See page CO-6)
3. (3S-GTE)  
DRAIN INTERCOOLER COOLANT (See page TC-7)
4. REMOVE HOOD
5. (A/T)  
DISCONNECT THROTTLE CABLE FROM THROTTLE BODY
6. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY
7. REMOVE RADIATOR RESERVOIR TANK
8. REMOVE RADIATOR (See page CO-12)



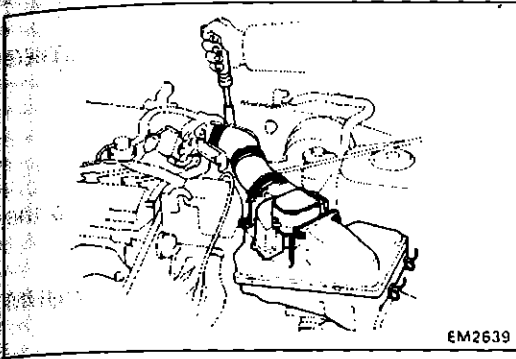
9. (w/ CRUISE CONTROL SYSTEM)  
REMOVE CRUISE CONTROL ACTUATOR  
(w/ A.B.S.)
  - (a) Disconnect the actuator connector.
  - (b) Remove the actuator and bracket.



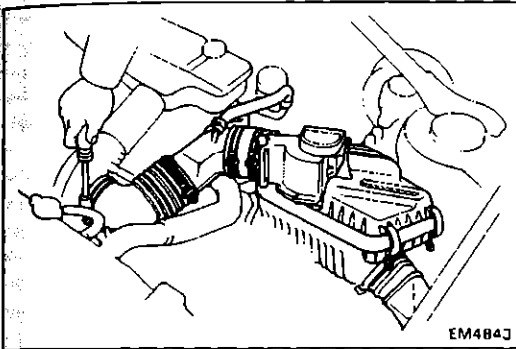
- (w/o A.B.S.)
- (a) Disconnect the ground strap connector.
  - (b) Remove the actuator cover.
  - (c) Disconnect the actuator vacuum hose.
  - (d) Disconnect the actuator connector.
  - (e) Remove the actuator and bracket.



10. REMOVE SUSPENSION UPPER BRACE
  - (a) (3S-GE and 3S-GTE)  
Disconnect the ignition coil connector and high-tension cord from the ignition coil.
  - (b) Remove the four bolts, two nuts and suspension upper brace.



EM2639



EM484J

**11. REMOVE AIR CLEANER ASSEMBLY****(3S-FE and 3S-GE)**

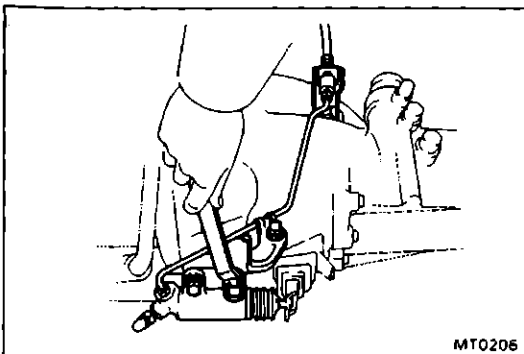
- (a) Disconnect the air flow meter connector.
- (b) Disconnect the four air cleaner cap clips.
- (c) Loosen the hose clamp and disconnect the air cleaner hose from the throttle body.
- (d) (3S-GE)  
Disconnect the air hose from the vacuum limiter.
- (e) Remove the air cleaner cap and element.
- (f) Remove the three bolts and air cleaner case.

**(3S-GTE)**

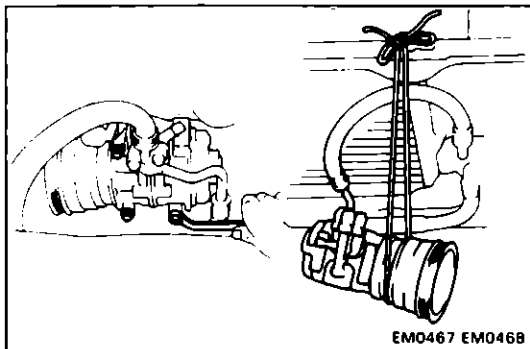
- (a) Disconnect the air flow meter connector.
- (b) Disconnect the two air hoses.
- (c) Disconnect the four air cleaner cap clips.
- (d) Loosen the hose clamp and disconnect the air cleaner hose from the turbocharger.
- (e) Remove the air cleaner cap and element.
- (f) Remove the three bolts and air cleaner case.

**12. REMOVE AIR CLEANER BRACKET****13. REMOVE IGNITER****14. DISCONNECT HEATER HOSES****15. DISCONNECT FUEL HOSES**

**CAUTION:** Catch leaking fuel in a container.

**16. DISCONNECT SPEEDOMETER CABLE****17. (3S-GTE)****DISCONNECT INTERCOOLER HOSES****18. DISCONNECT TRANSAXLE CONTROL CABLES****19. (3S-GTE)****REMOVE ALTERNATOR****20. (M/T)****REMOVE CLUTCH RELEASE CYLINDER AND TUBE BRACKET WITHOUT DISCONNECTING TUBE**

MT0205



**21. (w/ A/C)  
REMOVE A/C COMPRESSOR WITHOUT DISCONNECTING HOSES**

- (a) Disconnect the two connectors.
- (b) Remove the four compressor bolts.

**NOTE:** Put aside the compressor, and suspend it to the radiator support with a string.

**22. DISCONNECT WIRES, CONNECTORS AND VACUUM HOSES**

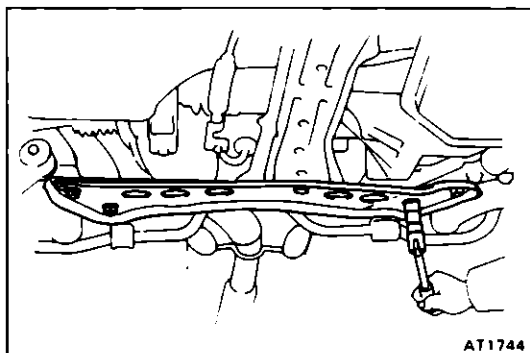
- (a) Check connector
- (b) Ground straps from LH fender apron
- (c) Connectors from relay box
- (d) Brake booster vacuum hose
- (e) A/C control valve vacuum hoses
- (f) Charcoal canister vacuum hose
- (g) (3S-GTE)  
Solenoid resistor connector
- (h) (3S-GTE)  
Fuel pump relay connector
- (i) (3S-GTE)  
Fuel pump resistor connector

**23. RAISE VEHICLE**

**CAUTION:** Be sure the vehicle is securely supported.

**24. DRAIN ENGINE OIL (See page LU-7)**

**25. REMOVE ENGINE UNDER COVERS**



**26. REMOVE SUSPENSION LOWER CROSSMEMBER**

Remove the six bolts and crossmember.

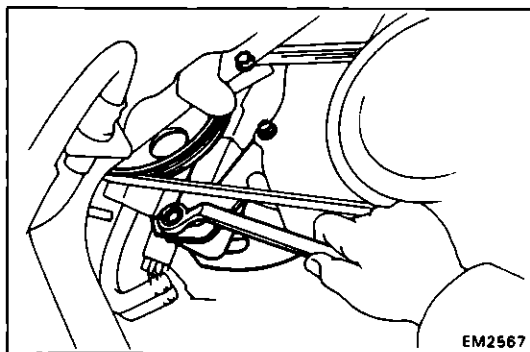
**27. REMOVE FRONT DRIVE SHAFTS**

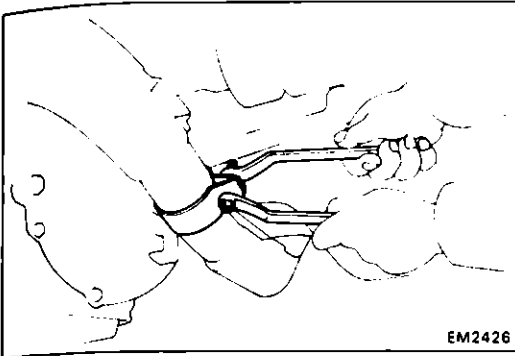
**28. (4WD)  
REMOVE PROPELLER SHAFT**

**29. (4WD)  
REMOVE DEFLECTOR FROM TRANSFER EXTENSION HOUSING**

**30. REMOVE PS PUMP WITHOUT DISCONNECTING HOSES**

**NOTE:** Put a side the pump and suspend it to the cowl with a string.

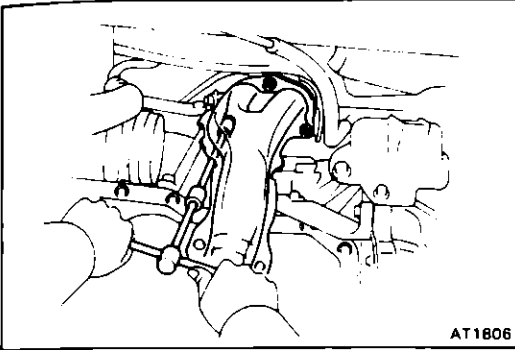




EM2426

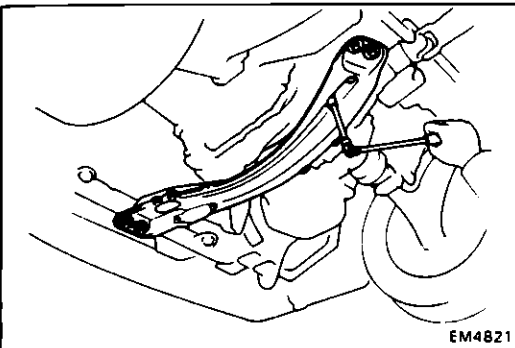
**31. REMOVE EXHAUST FRONT PIPE**

- (a) (3S-GE)  
Disconnect the oxygen sensor connector.
- (b) Loosen the bolt, and disconnect the clamp from the bracket.



AT1806

- (c) Remove the five bolts, two nuts, and front pipe.



EM4821

**32. REMOVE ENGINE MOUNTING CENTER MEMBER**

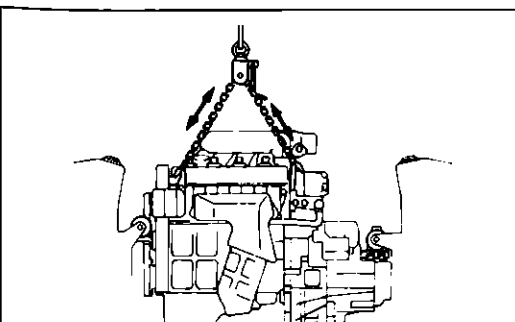
Remove the eight bolts and center member.

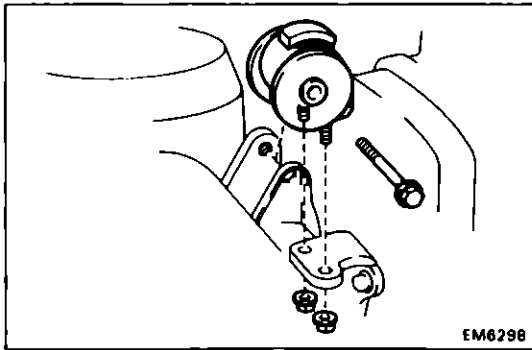
**33. REMOVE ENGINE FRONT MOUNTING INSULATOR AND BRACKET****34. REMOVE ENGINE REAR MOUNTING INSULATOR AND BRACKET****35. LOWER VEHICLE****36. DISCONNECT ENGINE WIRE**

- (a) Remove the glove compartment box.
- (b) Disconnect the following connectors:
  - (1) Three TCCS ECU connectors
  - (2) Circuit opening relay connector
  - (3) Cowl wire connector
  - (4) Instrument panel wire connector
- (c) Pull out the engine wire from the cowl panel.

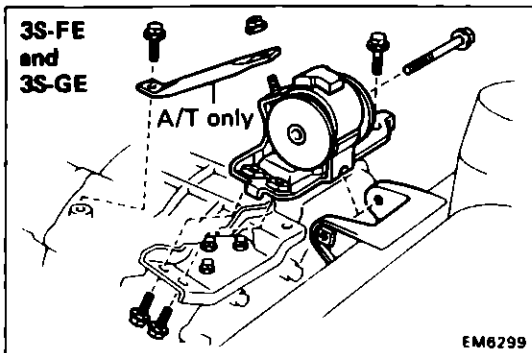
**37. REMOVE PS PUMP RESERVOIR TANK MOUNTING BOLTS****38. REMOVE ENGINE AND TRANSAXLE ASSEMBLY FROM VEHICLE**

- (a) Attach the engine hoist chain to the engine hangers.

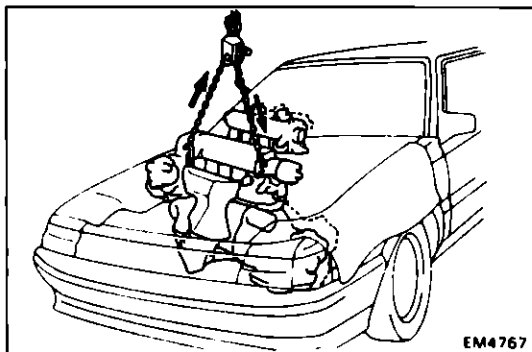
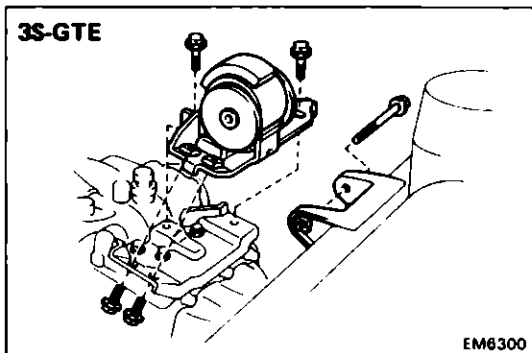




- (b) Remove the through bolt, two nuts and RH mounting insulator.



- (c) (A/T)  
Remove the bolt, nut and LH mounting stay.
- (d) Remove the through bolt, three bolts (3S-FE and 3S-GE), four bolts (3S-GTE) and LH mounting insulator.
- (e) Remove the three bolts and LH mounting bracket.



- (f) Lift the engine out of the vehicle slowly and carefully.  
**CAUTION:** Be careful not to hit the PS gear housing or neutral start switch.
- (g) Make sure the engine is clear of all wiring, hoses and cables.
- (h) Place the engine and transaxle assembly onto the stand.

### 39. SEPARATE ENGINE AND TRANSAXLE

**PREPARATION FOR DISASSEMBLY**

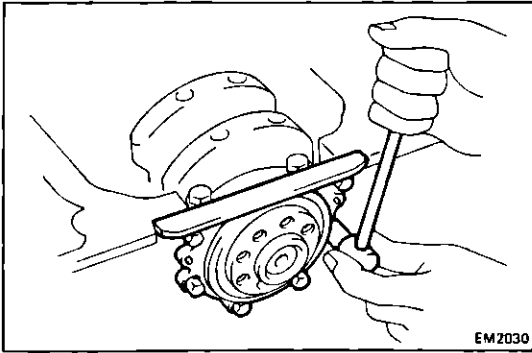
1. (M/T)  
REMOVE CLUTCH COVER AND DISC
2. (M/T)  
REMOVE FLYWHEEL
3. (A/T)  
REMOVE DRIVE PLATE
4. REMOVE REAR END PLATE
5. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY
6. (3S-FE AND 3S-GTE)  
REMOVE ALTERNATOR (See page CH-6)
7. (3S-GTE)  
REMOVE TURBOCHARGER (See page TC-9)
8. REMOVE DISTRIBUTOR  
3S-FE (See page IG-13)  
3S-GE and 3S-GTE (See page IG-18)
9. REMOVE TIMING BELT AND PULLEYS  
3S-FE (See page EM-27)  
3S-GE and 3S-GTE (See page EM-38)
10. REMOVE CYLINDER HEAD  
3S-FE (See page EM-55)  
3S-GE (See page EM-83)  
3S-GTE (See page EM-88)
11. REMOVE WATER PUMP  
(See page CO-7)
12. REMOVE OIL PAN AND OIL PUMP  
(See page LU-10)

**DISASSEMBLY OF CYLINDER BLOCK**

(See page EM-121)

**1. REMOVE REAR OIL SEAL RETAINER**

Remove the six bolts, retainer and gasket.



EM2030

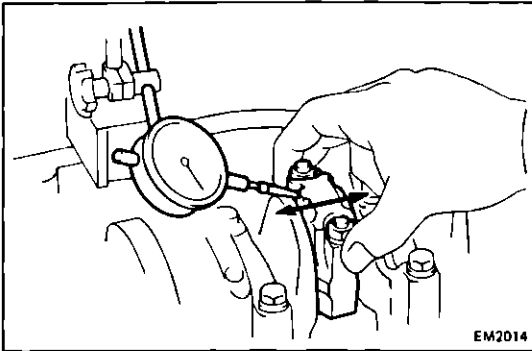
**2. CHECK CONNECTING ROD THRUST CLEARANCE**

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

Standard thrust clearance: 0.160 – 0.312 mm  
(0.0063 – 0.0123 in.)

Maximum thrust clearance: 0.35 mm (0.0138 in.)

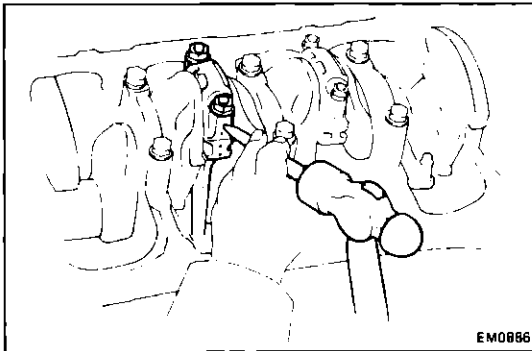
If the thrust clearance is greater than maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.



EM2014

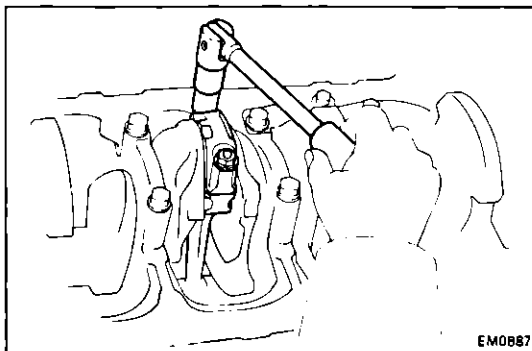
**3. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE**

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



EM0886

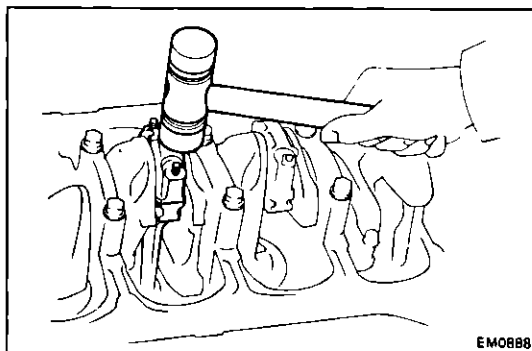
(b) Remove the connecting rod cap nuts.



EM0887

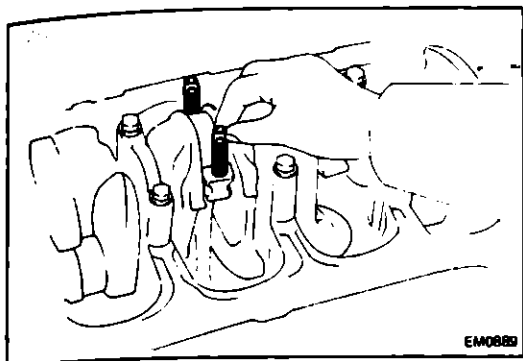
(c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

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

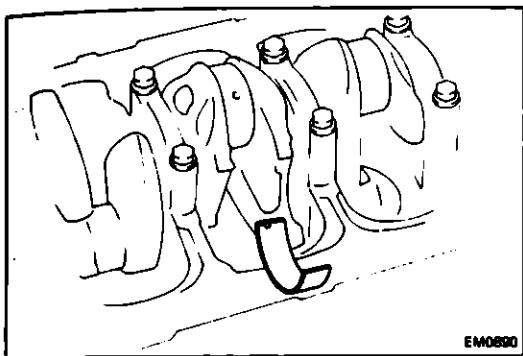


EM0888



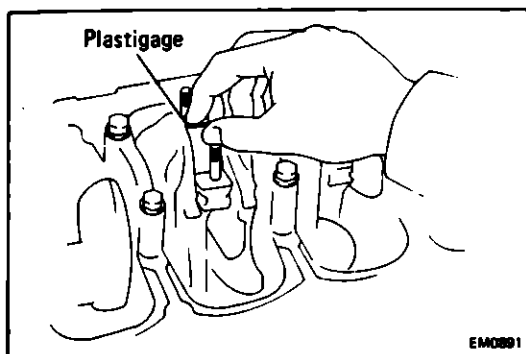


- (d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.

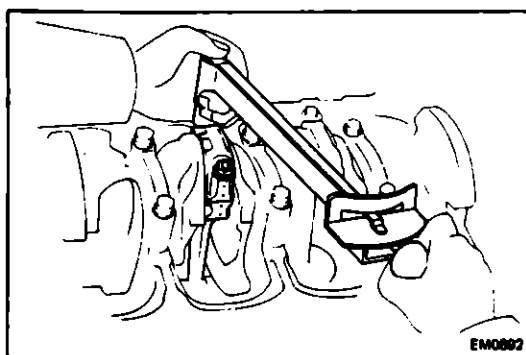


- (e) Clean crank pin and bearing.  
 (f) Check the crank pin and bearing for pitting and scratches.

If the crank pin or bearing are damaged, replace the bearings. If necessary, grind (3S-FE) or replace the crankshaft.



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



- (h) Install the connecting rod cap.  
 (See step 6 on pages EM-147 and 148)

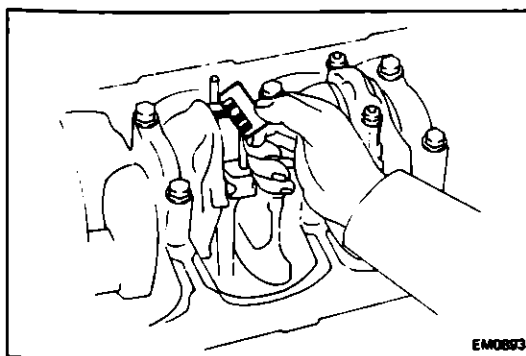
**Torque:**

**3S-FE 500 kg-cm (36 ft-lb, 49 N-m)**

**3S-GE and 3S-GTE**

**680 kg-cm (49 ft-lb, 67 N-m)**

**NOTE:** Do not turn the crankshaft.



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

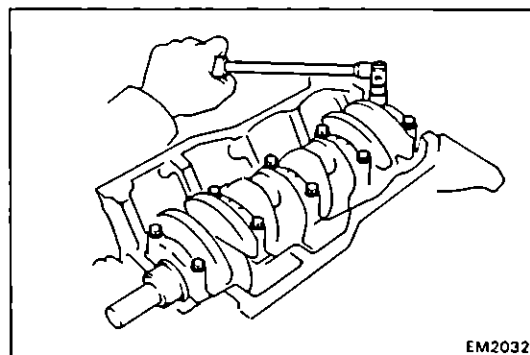
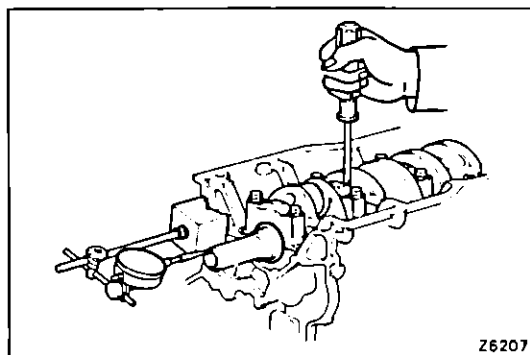
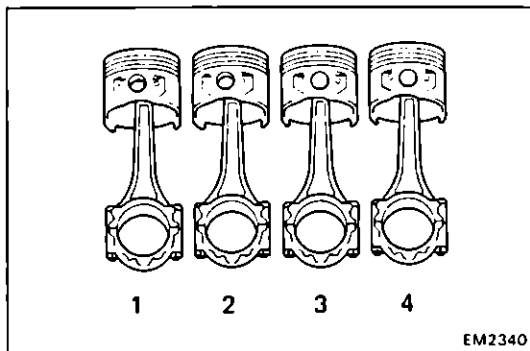
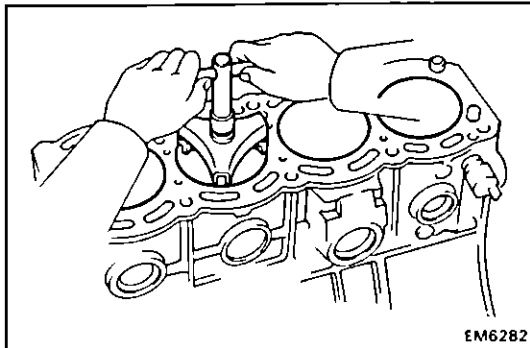
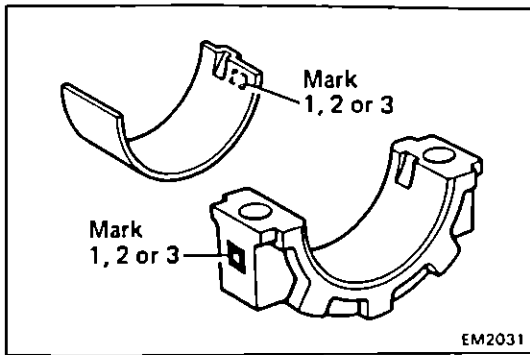
**Standard oil clearance:**

**STD 0.024 — 0.055 mm**  
**(0.0009 — 0.0022 in.)**

**U/S 0.25 0.023 — 0.069 mm**  
**(3S-FE only) (0.0009 — 0.0027 in.)**

**Maximum oil clearance: 0.08 mm (0.0031 in.)**

If the oil clearance is greater than maximum, replace the bearings. If necessary, grind (3S-FE) or replace the crankshaft.



NOTE: (If using a standard bearing, replace with one having the same number marked on the connecting rod cap. There are three sizes of standard bearings, marked "1", "2" and "3" accordingly.)

(Reference) six

Standard sized bearing thickness (at center wall):

Mark "1"	1.484 — 1.488 mm (0.0584 — 0.0586 in.)
Mark "2"	1.488 — 1.492 mm (0.0586 — 0.0587 in.)
Mark "3"	1.492 — 1.496 mm (0.0587 — 0.0589 in.)

(k) Completely remove the Plastigage.

#### 4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

- Remove the all carbon from the piston ring ridge.
- Cover the connecting rod bolts.  
(See page EM-129)
- Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

NOTE:

- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in correct order.

#### 5. 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: 0.020 — 0.220 mm  
(0.0008 — 0.0087 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

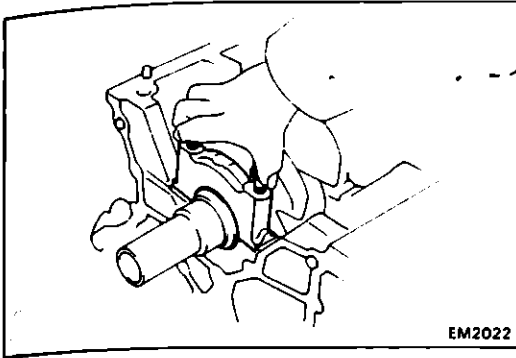
If the thrust clearance is greater than maximum, replace the thrust washers as a set.

Thrust washer thickness (STD size only):

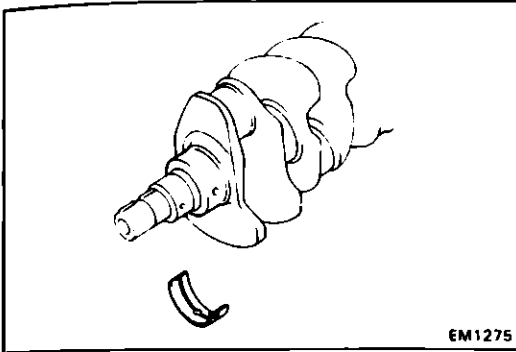
2.440 — 2.490 mm (0.0961 — 0.0980 in.)

#### 6. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

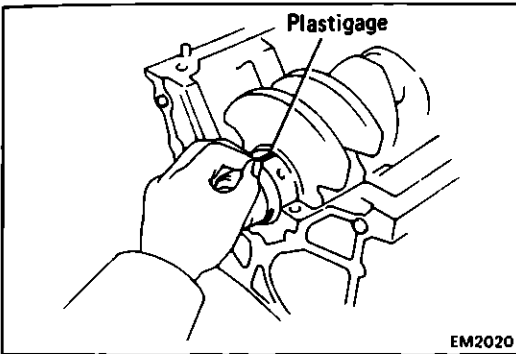
- Remove the main bearing cap bolts.



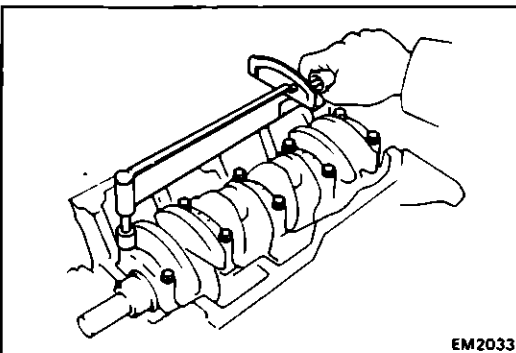
EM2022



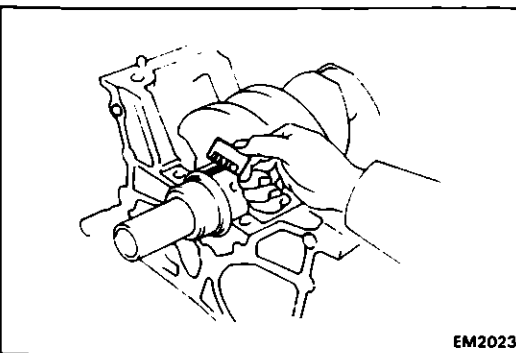
EM1275



EM2020



EM2033



EM2023

- (b) Using the removed main bearing cap bolts, pry the main bearing cap back and forth, and remove the main bearing caps, lower bearings and lower thrust washers (No.3 main bearing cap only).

**NOTE:**

- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in correct order.

- (c) Lift out the crankshaft.

**NOTE:** Keep the upper bearing and upper thrust washers together with the cylinder block.

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

If the journal or bearing are damaged, replace the bearings. If necessary, grind (3S-FE) 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 4 on pages EM-146 and 147)

**Torque: 600 kg-cm (43 ft-lb, 59 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:**

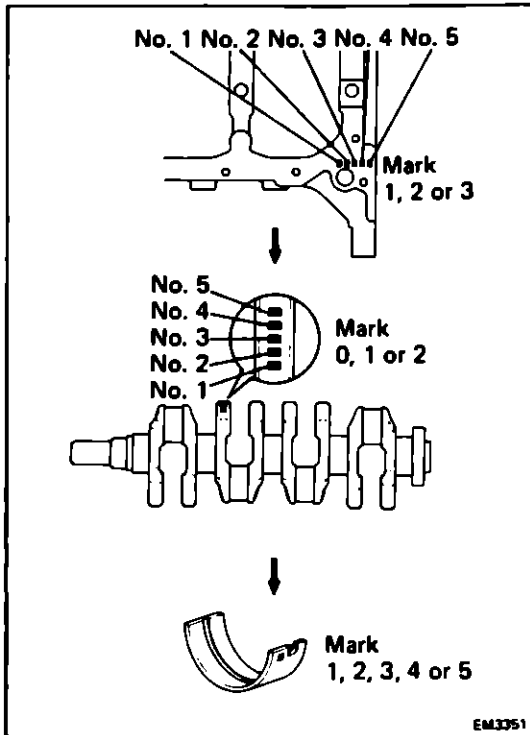
<b>No.3</b>	<b>STD</b>	<b>0.025 – 0.044 mm</b> (0.0010 – 0.0017 in.)
	<b>U/S 0.25</b> (3S-FE only)	<b>0.027 – 0.067 mm</b> (0.0011 – 0.0026 in.)
<b>Others</b>	<b>STD</b>	<b>0.015 – 0.034 mm</b> (0.0006 – 0.0013 in.)
	<b>U/S 0.25</b> (3S-FE only)	<b>0.019 – 0.059 mm</b> (0.0007 – 0.0023 in.)

**Maximum oil clearance: 0.08 mm (0.0031 in.)**

**NOTE:** If replacing the cylinder block subassembly the bearing standard clearance will be:

<b>No.3</b>	<b>0.027 – 0.054 mm (0.0011 – 0.0021 in.)</b>
<b>Others</b>	<b>0.017 – 0.044 mm (0.0007 – 0.0017 in.)</b>

If the oil clearance is greater than maximum, replace the bearings. If necessary, grind (3S-FE) or replace the crankshaft.



NOTE: If using a standard bearing, replace with one having the same number. If the number of the bearing 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			Crankshaft			Bearing		
	1	2	3	0	1	2	0	1	2
Cylinder block									
Crankshaft	0	1	2	0	1	2	0	1	2
Bearing	1	2	3	2	3	4	3	4	5

EXAMPLE: Cylinder block "2" + Crankshaft "1"  
= Bearing "3"

#### (Reference)

##### Cylinder block main journal bore diameter:

Mark "1"	59.020 – 59.026 mm (2.3236 – 2.3239 in.)
Mark "2"	59.026 – 59.032 mm (2.3239 – 2.3241 in.)
Mark "3"	59.032 – 59.038 mm (2.3241 – 2.3243 in.)

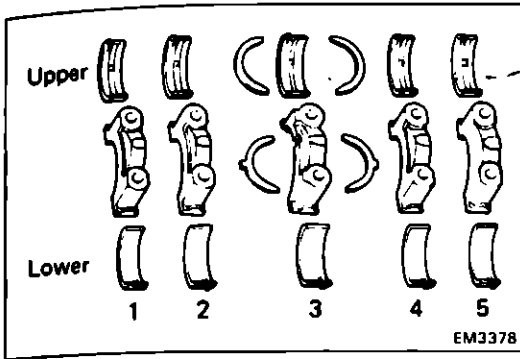
##### Crankshaft journal diameter:

Mark "0"	54.998 – 55.003 mm (2.1653 – 2.1655 in.)
Mark "1"	54.993 – 54.998 mm (2.1651 – 2.1653 in.)
Mark "2"	54.988 – 54.993 mm (2.1649 – 2.1651 in.)

##### Standard sized bearing thickness (at center wall):

No. 3	Mark "1"	1.992 – 1.995 mm (0.0784 – 0.0785 in.)
	Mark "2"	1.995 – 1.998 mm (0.0785 – 0.0787 in.)
	Mark "3"	1.998 – 2.001 mm (0.0787 – 0.0788 in.)
	Mark "4"	2.001 – 2.004 mm (0.0788 – 0.0789 in.)
	Mark "5"	2.004 – 2.007 mm (0.0789 – 0.0790 in.)
Others	Mark "1"	1.997 – 2.000 mm (0.0786 – 0.0787 in.)
	Mark "2"	2.000 – 2.003 mm (0.0787 – 0.0789 in.)
	Mark "3"	2.003 – 2.006 mm (0.0789 – 0.0790 in.)
	Mark "4"	2.006 – 2.009 mm (0.0790 – 0.0791 in.)
	Mark "5"	2.009 – 2.012 mm (0.0791 – 0.0792 in.)

(k) Completely remove the Plastigage.



## 7. REMOVE CRANKSHAFT

- (a) Lift out the crankshaft.
- (b) Remove the upper bearings and upper thrust washers from cylinder block.

NOTE: Arrange the main bearing caps, bearings and thrust washers in correct order.

## 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 cylinder block.

### 3. INSPECT TOP OF CYLINDER BLOCK FOR FLATNESS

Using a precision straight edge and feeler 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.

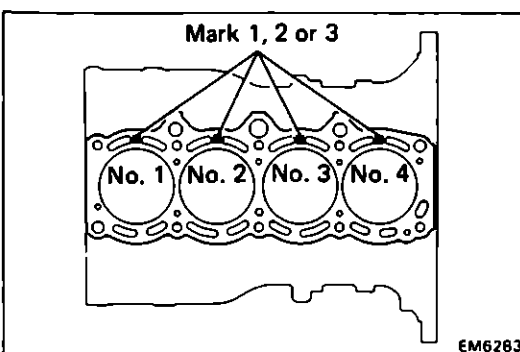
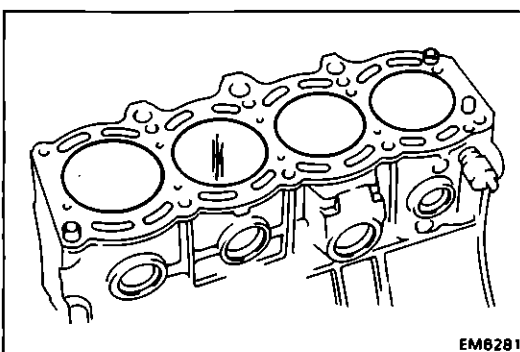
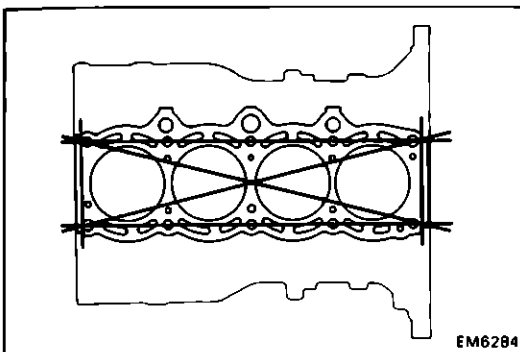
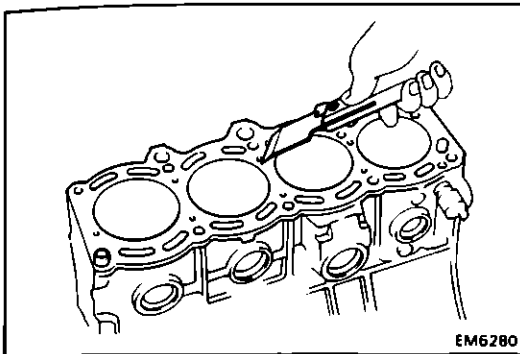
### 4. INSPECT CYLINDER FOR VERTICAL SCRATCHES

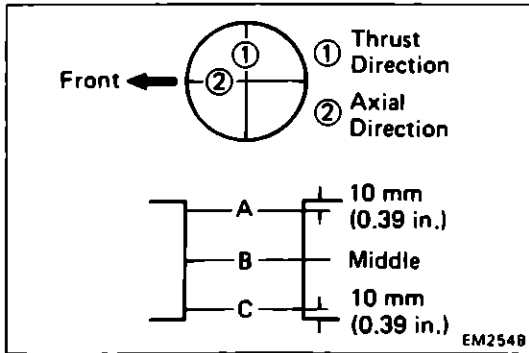
Visually check the cylinder for vertical scratches.

If deep scratches are present, replace the cylinder block.

### 5. INSPECT CYLINDER BORE DIAMETER

NOTE: There are three sizes of the standard cylinder bore diameter, marked "1", "2" and "3" accordingly. The marked is standard on the top of the cylinder block.





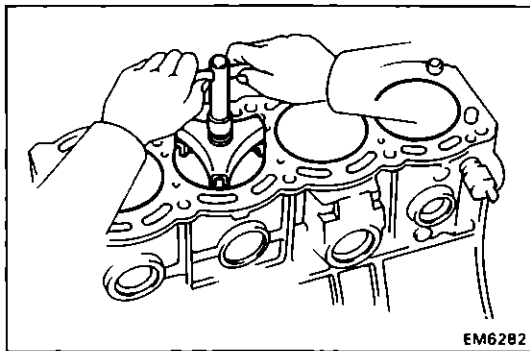
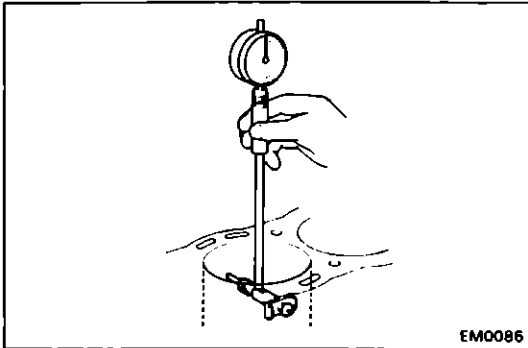
Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust axial directions.

**Standard diameter:**

Mark "1"	86.000 – 86.010 mm (3.3858 – 3.3862 in.)
Mark "2"	86.010 – 86.020 mm (3.3862 – 3.3866 in.)
Mark "3"	86.020 – 86.030 mm (3.3866 – 3.3870 in.)

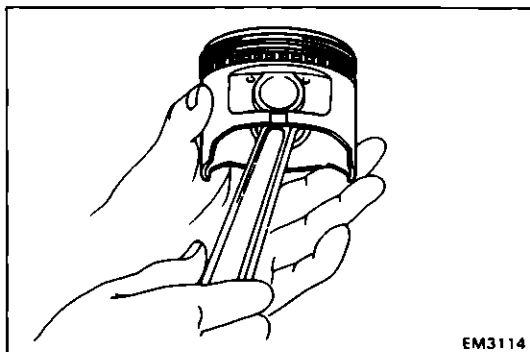
**Maximum diameter:** 86.23 mm (3.3949 in.)

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



**6. REMOVE CYLINDER RIDGE**

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



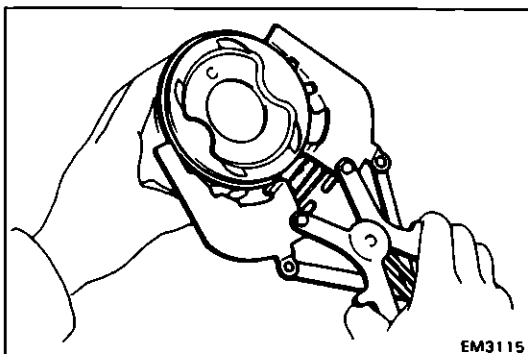
**DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES**

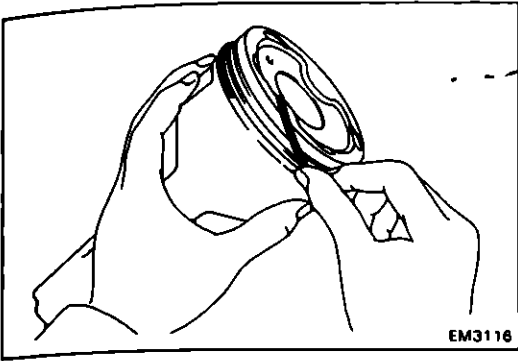
**1. CHECK FIT BETWEEN PISTON AND PISTON PIN**

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**

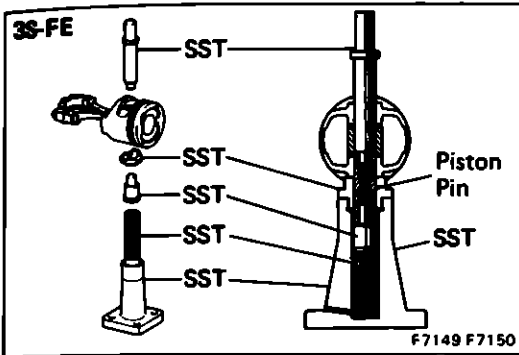
(a) Using a piston ring expander, remove the two compression rings.





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

NOTE: Arrange the rings in correct order only.

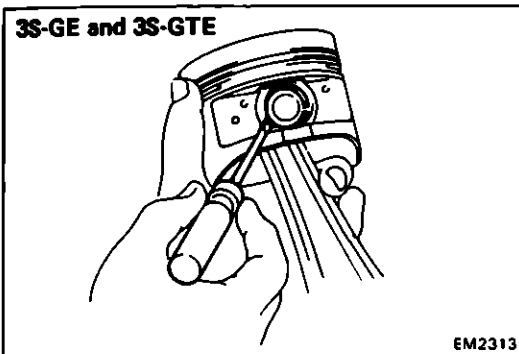


### 3. DISCONNECT CONNECTING ROD FROM PISTON

- (a) (3S-FE)

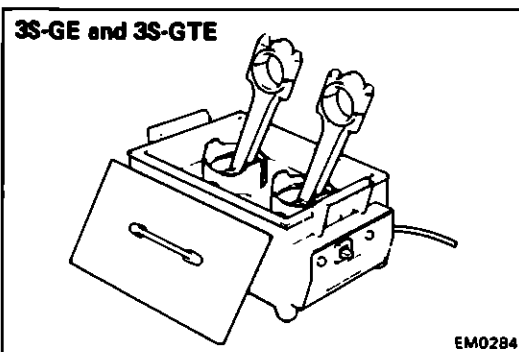
Using SST, press out the piston pin from the piston.

SST 09221-25024 (09221-00020, 09221-00030, 09221-00060, 09221-00160, 09221-00170)



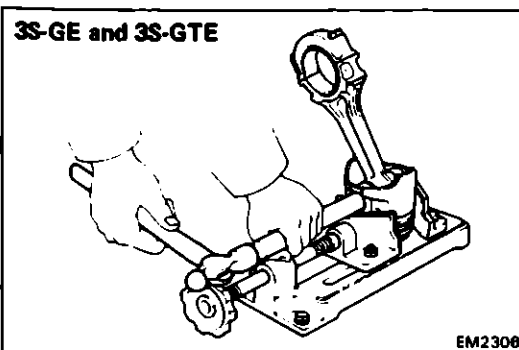
- (b) (3S-GE and 3S-GTE)

Using small screwdriver, remove the snap ring.



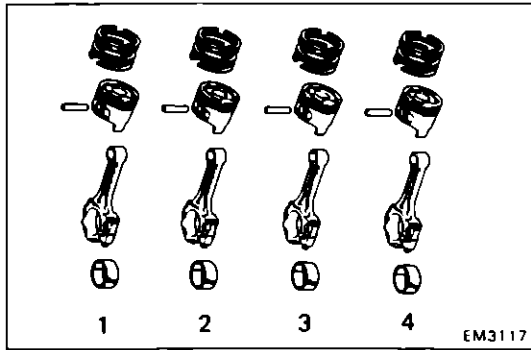
- (c) (3S-GE and 3S-GTE)

Gradually heat the piston to 80 – 90°C (176 – 194°F).



- (d) (3S-GE and 3S-GTE)

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



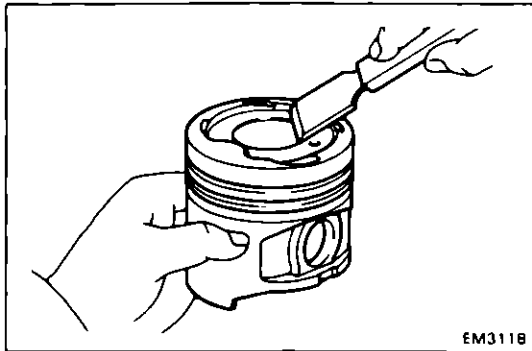
## NOTE:

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

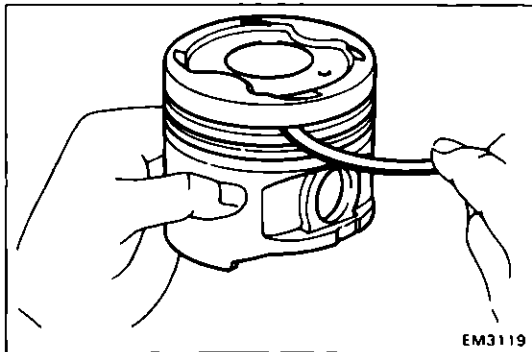
## INSPECTION AND REPAIR OF PISTON AND CONNECTING ROD ASSEMBLIES

### 1. CLEAN PISTON

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

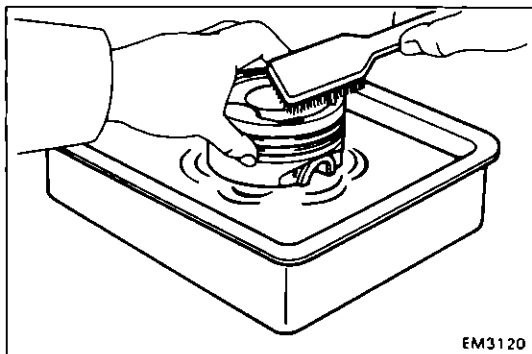


- (b) Using a groove cleaning or broken ring, clean the piston ring grooves.



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

**CAUTION:** Do not use a wire brush.





## 2. INSPECT PISTON DIAMETER AND OIL CLEARANCE

**NOTE:** There are three sizes of the standard piston diameter, marked "1", "2" and "3" accordingly. The marked is stamped on the piston.

- (a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 25.4 mm (1.000 in.), 24 mm (0.94 in.) or 29.1 mm (1.146 in.) from the piston head.

**Piston diameter:**

**3S-FE** Mark "1" 85.945 — 85.955 mm  
(3.3836 — 3.3840 in.)

Mark "2" 85.955 — 85.965 mm  
(3.3840 — 3.3844 in.)

Mark "3" 85.965 — 85.975 mm  
(3.3844 — 3.3848 in.)

**3S-GE and 3S-GTE**

Mark "1" 85.960 — 85.970 mm  
(3.3842 — 3.3846 in.)

Mark "2" 85.970 — 85.980 mm  
(3.3846 — 3.3850 in.)

Mark "3" 85.980 — 85.990 mm  
(3.3850 — 3.3854 in.)

- (b) Measure the cylinder bore diameter in the thrust directions. (See step 5 on page EM-134)
- (c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

**Standard oil clearance:**

**3S-FE** 0.045 — 0.065 mm  
(0.0018 — 0.0026 in.)

**3S-GE and 3S-GTE** 0.030 — 0.050 mm  
(0.0012 — 0.0020 in.)

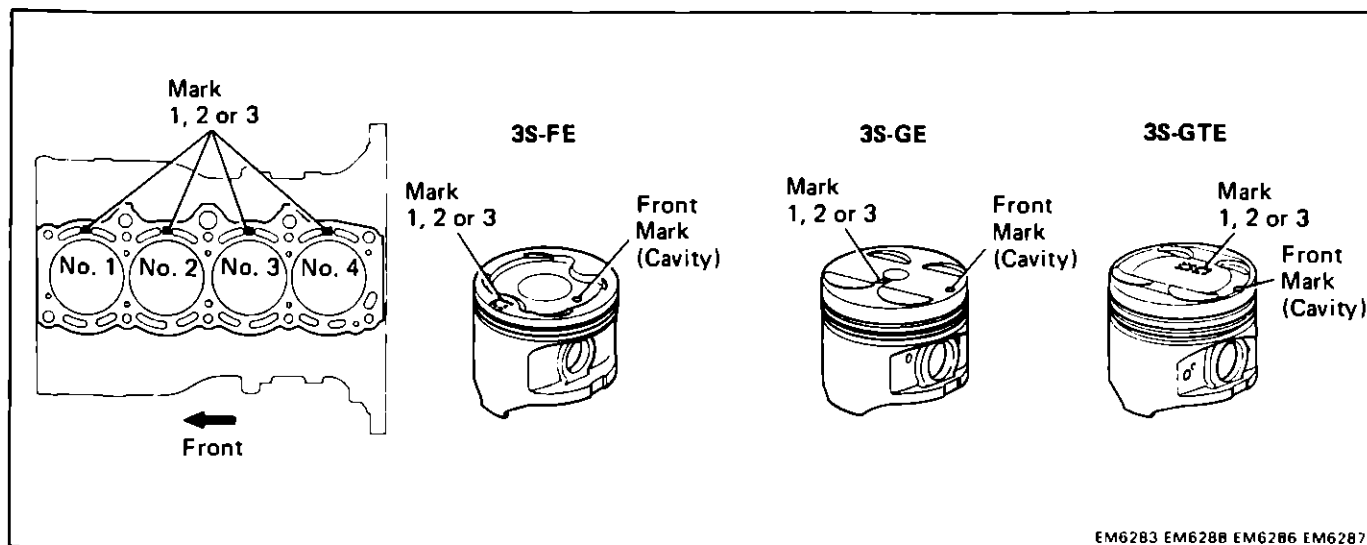
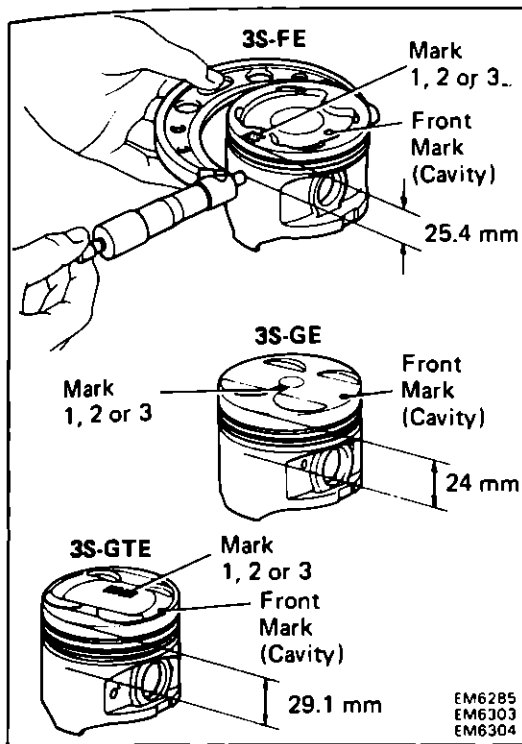
**Maximum oil clearance:**

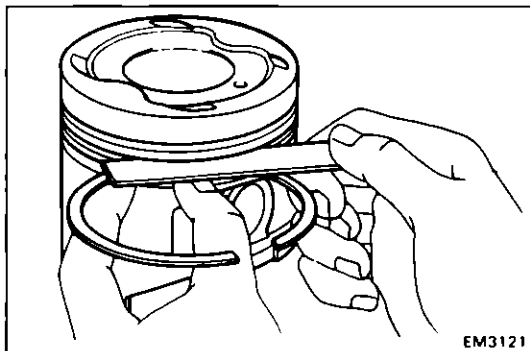
**3S-FE** 0.085 mm (0.0033 in.)

**3S-GE and 3S-GTE** 0.07 mm (0.0028 in.)

If the oil clearance is greater than maximum, replace all four pistons. If necessary, replace the cylinder block.

**NOTE** (Use cylinder block subassembly): When installing a standard piston, install one with the same number mark as the standard bore diameter mark on the cylinder block.





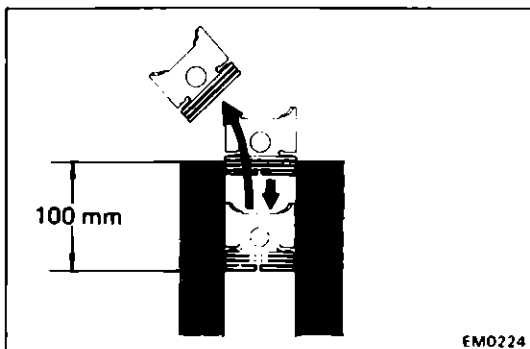
### 3. INSPECT CLEARANCE BETWEEN WALL OF RING GROOVE AND NEW PISTON RING

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

Ring groove clearance:

<b>3S-FE</b>		<b>0.030 – 0.070 mm</b> (0.0012 – 0.0028 in.)
<b>3S-GE</b>	<b>No.1</b>	<b>0.030 – 0.070 mm</b> (0.0012 – 0.0028 in.)
	<b>No.2</b>	<b>0.020 – 0.060 mm</b> (0.0008 – 0.0024 in.)
<b>3S-GTE</b>	<b>No.1</b>	<b>0.040 – 0.080 mm</b> (0.0016 – 0.0031 in.)
	<b>No.2</b>	<b>0.030 – 0.070 mm</b> (0.0012 – 0.0028 in.)

If the clearance is greater than maximum, replace the piston.



### 4. INSPECT PISTON RING END GAP

- Insert the piston ring into the cylinder bore.
- Using a piston, push the piston ring a little beyond the bottom of the ring travel, 100 mm (3.94 in.) from the top of the cylinder block.
- Using a feeler gauge, measure the end gap.

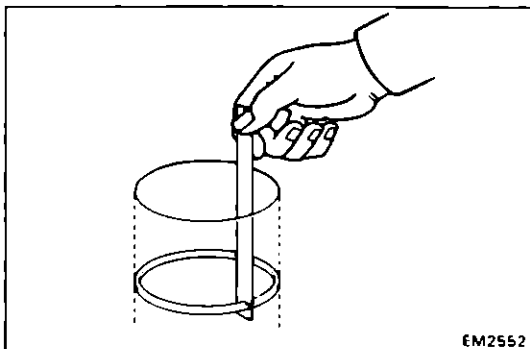
Standard end gap:

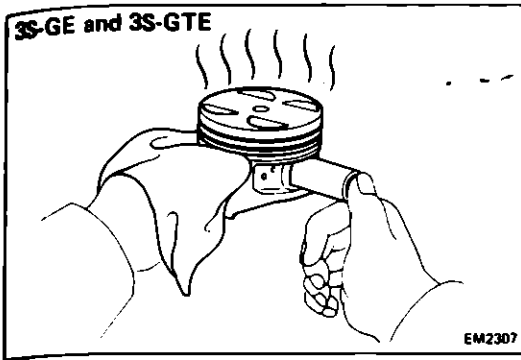
<b>3S-FE</b>	<b>No.1</b>	<b>0.270 – 0.500 mm</b> (0.0106 – 0.0197 in.)
	<b>No.2</b>	<b>0.270 – 0.510 mm</b> (0.0106 – 0.0201 in.)
	<b>Oil (Side rail)</b>	<b>0.200 – 0.550 mm</b> (0.0079 – 0.0217 in.)
<b>3S-GE</b>	<b>No.1</b>	<b>0.330 – 0.550 mm</b> (0.0130 – 0.0217 in.)
	<b>No.2</b>	<b>0.450 – 0.700 mm</b> (0.0177 – 0.0276 in.)
	<b>Oil (Side rail)</b>	<b>0.200 – 0.600 mm</b> (0.0079 – 0.0236 mm)
<b>3S-GTE</b>	<b>No.1</b>	<b>0.330 – 0.550 mm</b> (0.0130 – 0.0217 in.)
	<b>No.2</b>	<b>0.450 – 0.670 mm</b> (0.0177 – 0.0264 in.)
	<b>Oil (Side rail)</b>	<b>0.200 – 0.600 mm</b> (0.0079 – 0.0236 in.)

Maximum end gap:

<b>3S-FE</b>	<b>No.1</b>	<b>1.10 mm (0.0433 in.)</b>
	<b>No.2</b>	<b>1.11 mm (0.0437 in.)</b>
	<b>Oil (Side rail)</b>	<b>1.15 mm (0.0453 in.)</b>
<b>3S-GE</b>	<b>No.1</b>	<b>0.85 mm (0.0335 in.)</b>
	<b>No.2</b>	<b>1.00 mm (0.0394 in.)</b>
	<b>Oil (Side rail)</b>	<b>0.90 mm (0.0354 in.)</b>
<b>3S-GTE</b>	<b>No.1</b>	<b>0.85 mm (0.0335 in.)</b>
	<b>No.2</b>	<b>0.97 mm (0.0382 in.)</b>
	<b>Oil (Side rail)</b>	<b>0.90 mm (0.0354 in.)</b>

If the end gap is greater than maximum, replace the piston ring. If the end gap is greater than maximum, even with a new piston ring, replace the cylinder block.

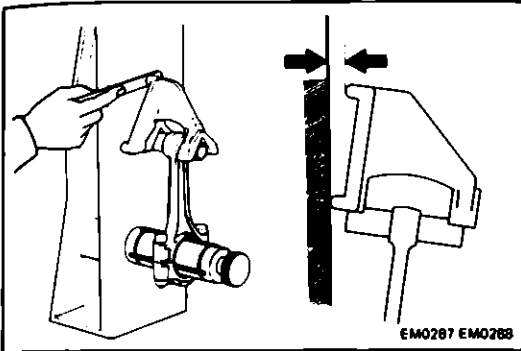




**5. (3S-GE AND 3S-GTE)  
INSPECT PISTON PIN FIT**

At 80°C (176°F) you should be able to push the piston pin into the piston pin hole with your thumb.

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



**6. INSPECT CONNECTING ROD**

**A. Inspect connecting rod alignment**

Using a rod aligner, check the connecting rod alignment.

- Check for bending.

**Maximum bending:**

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

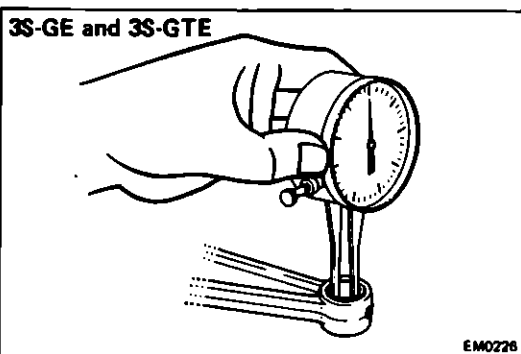
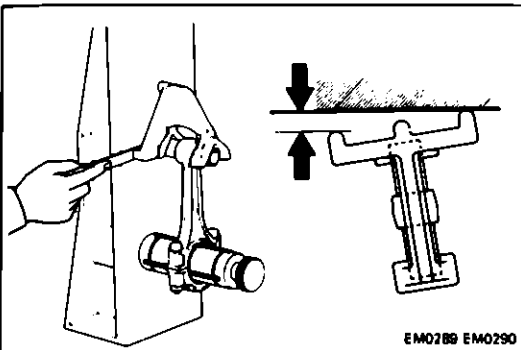
If bent is greater than maximum, replace the connecting rod assembly.

- 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. (3S-GE AND 3S-GTE)**

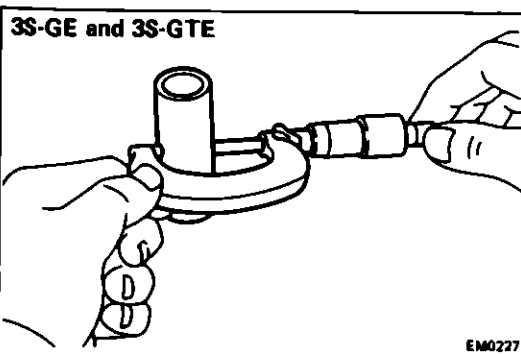
**Inspect piston pin oil clearance**

(a) 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.)**

(b) Using a micrometer, measure the piston pin diameter.

**Piston pin diameter: 21.997 – 22.009 mm  
(0.8660 – 0.8665 in.)**



- (c) 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:** 0,05 mm (0,0020 in.)

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

7. (3S-GE AND 3S-GTE)  
IF NECESSARY, REPLACE CONNECTING ROD BUSHINGS

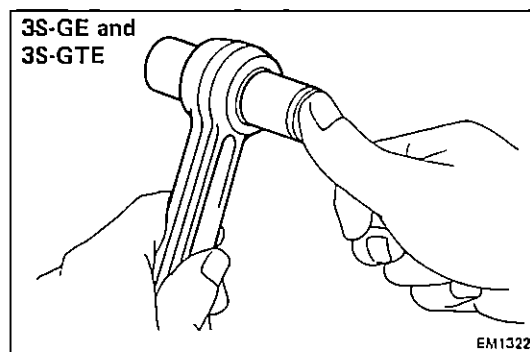
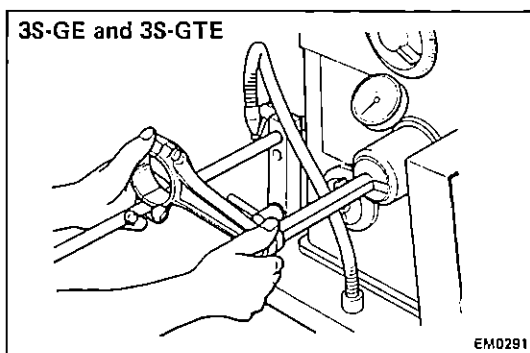
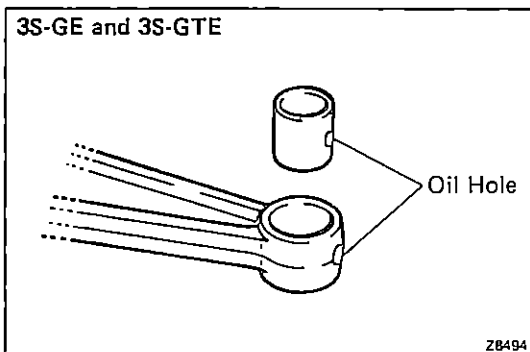
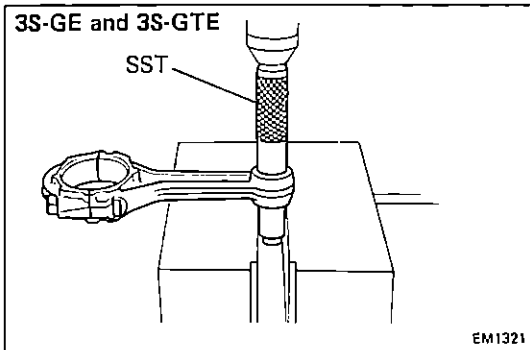
- (a) Using SST and a press, press out the bushing.  
SST 09222-30010

- (b) Align the oil holes of the 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 standard specified clearance (See step 6) 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.

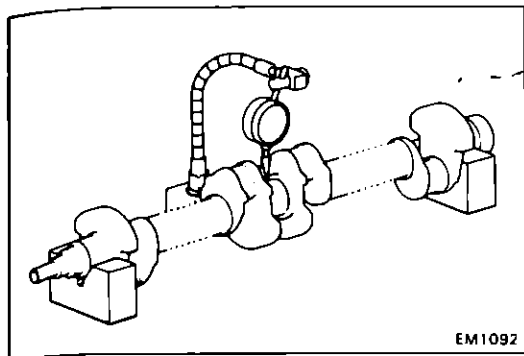


**INSPECTION AND REPAIR OF CRANKSHAFT****1. INSPECT CRANKSHAFT FOR RUNOUT**

- (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.



EM1092

**2. INSPECT MAIN JOURNALS AND CRANK PINS**

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

**Main journal diameter:**

**STD size 54.988 — 55.003 mm**  
(2.1649 — 2.1655 in.)

**U/S 0.25 54.745 — 54.755 mm 3S-FE only**  
(2.1553 — 2.1557 in.)

**Crank pin diameter:**

**STD size 47.985 — 48.000 mm**  
(1.8892 — 1.8898 in.)

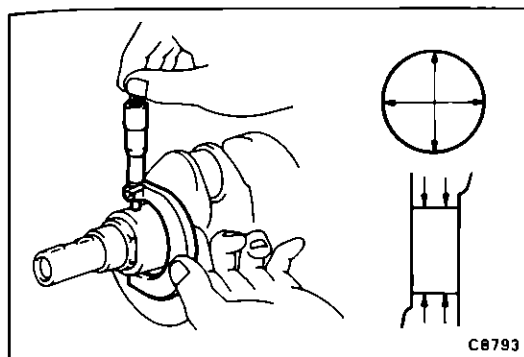
**U/S 0.25 47.745 — 47.755 mm 3S-FE only**  
(1.8797 — 1.8801 in.)

If the diameter is not as specified, check the oil clearance. (See page EM-128 or 130).

- (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 the taper and out-of-round is greater than maximum, grind or replace the crankshaft.



CB793

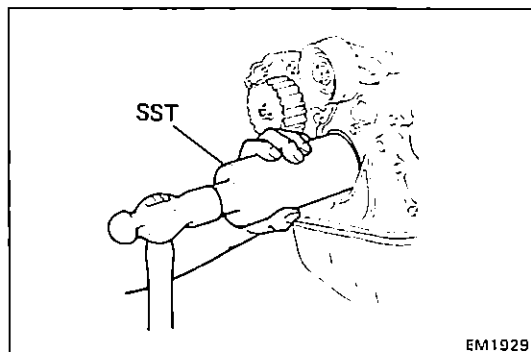
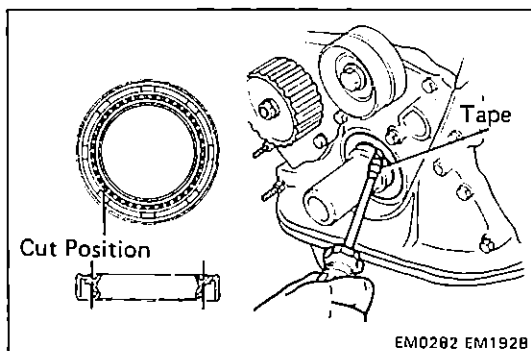
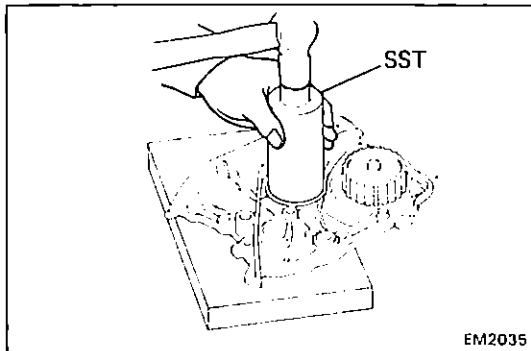
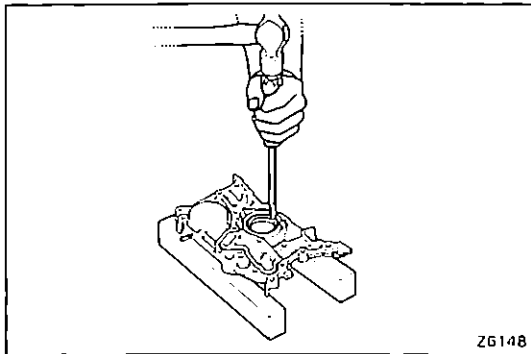
**3. (3S-FE)****IF NECESSARY, GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS**

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.

## REPLACEMENT OF CRANKSHAFT OIL SEAL

NOTE: There are two methods (A and B) to replace the oil seal as follows:



### 1. REPLACE CRANKSHAFT FRONT OIL SEAL

#### A. If oil pump is removed from 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 until its surface is flush with the oil pump case edge.

SST 09226-10010

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

#### B. If oil pump is installed to the cylinder block:

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

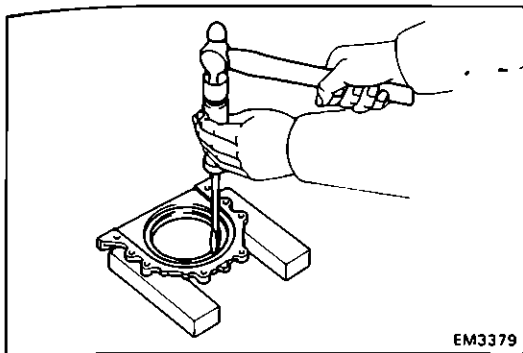
(b) Using a screwdriver, pry out the oil seal.

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

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

(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump case edge.

SST 09226-10010



## 2. REPLACE CRANKSHAFT REAR OIL SEAL

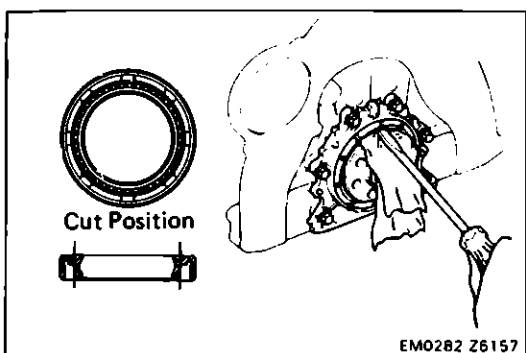
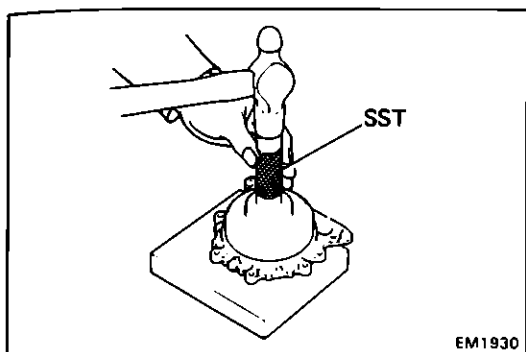
### A. If rear oil seal retainer is removed from cylinder block:

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

(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal edge.

SST 09223-63010

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



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

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

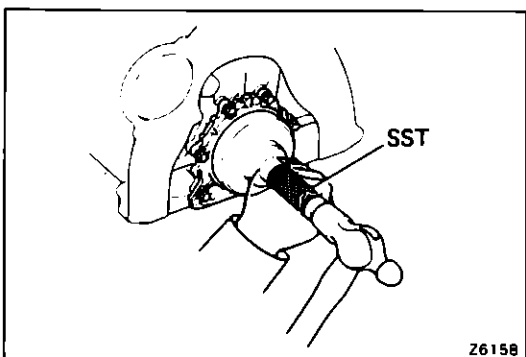
(b) Using a screwdriver, pry out the oil seal.

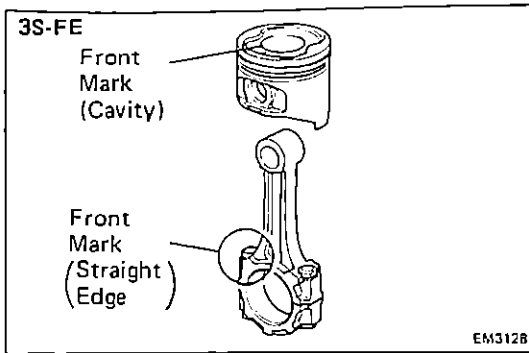
**CAUTION:** Be careful not to damage the crankshaft. Tape the screwdriver tip.

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

(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

SST 09223-63010





## ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

### 1. ASSEMBLE PISTON AND CONNECTING ROD

#### (3S-FE)

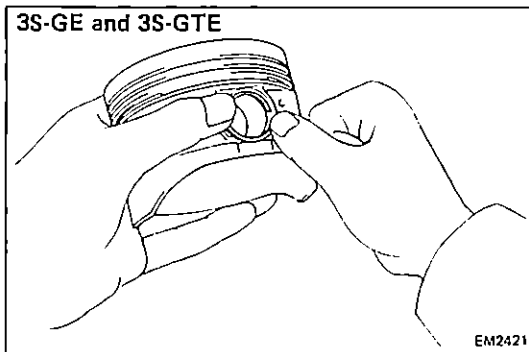
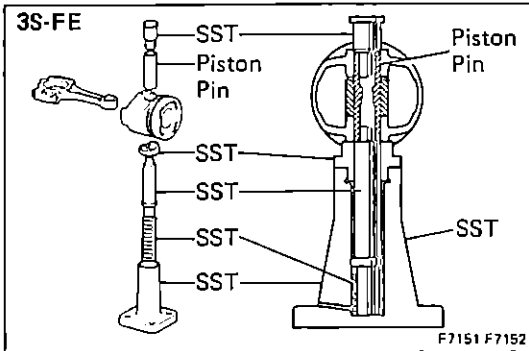
(a) Align the front marks of the piston and connecting rod.

(b) Coat the piston pin and piston hole of the piston with engine oil.

(c) Using SST, press in the piston pin.

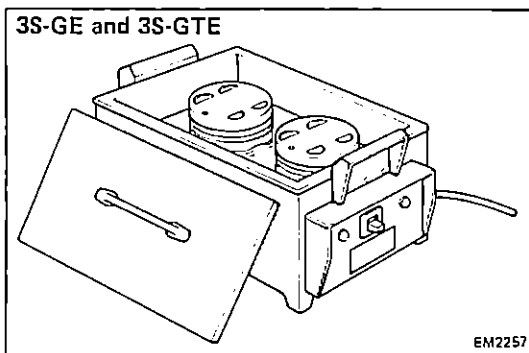
SST 09221-25024 (09221-00020, 09221-00030, 09221-00060, 09221-00160, 09221-00170)

(d) Check that the piston smoothly moves back and forth on the piston pin.

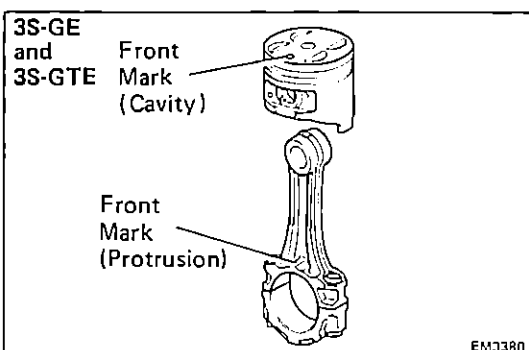


#### (3S-GE and 3S-GTE)

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



(b) Gradually heat the piston to 80 — 90°C (176 — 194°F).



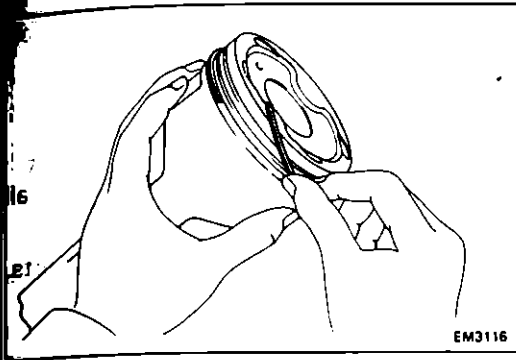
(c) Coat the piston pin with engine oil.

(d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.



**2. INSTALL PISTON RINGS**

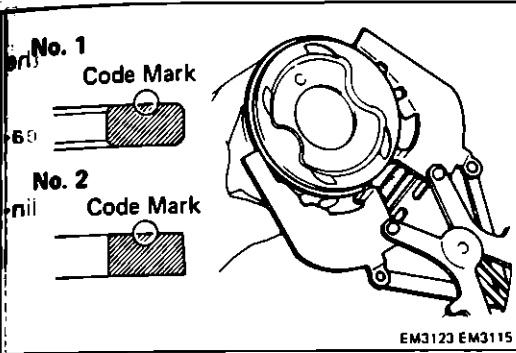
(a) Install the oil ring expander and two side rails by hand.



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

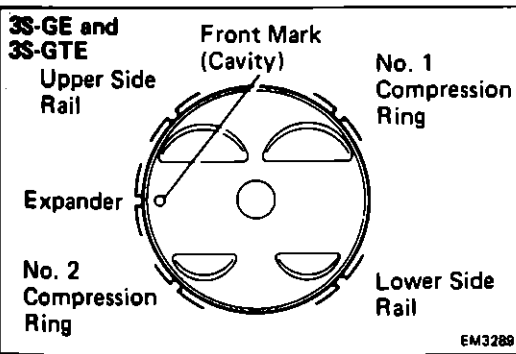
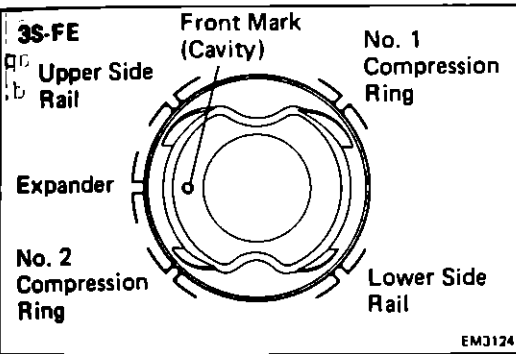
Code mark:

<b>3S-FE</b>	No.1	T1 or 1N
	No.2	2T or 2N
<b>3S-GE</b>		T or R
<b>3S-GTE</b>		R



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

**CAUTION: Do not align the ring ends.**

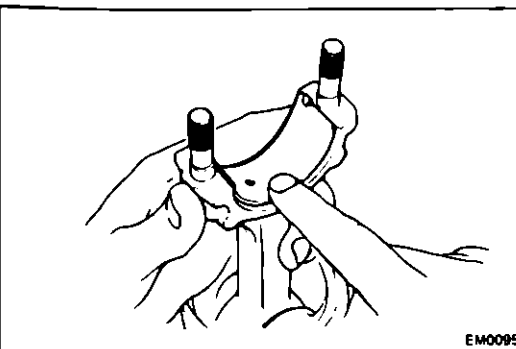


**3. INSTALL BEARINGS**

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

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

**CAUTION: Install the bearing with the oil hole in the connecting rod.**

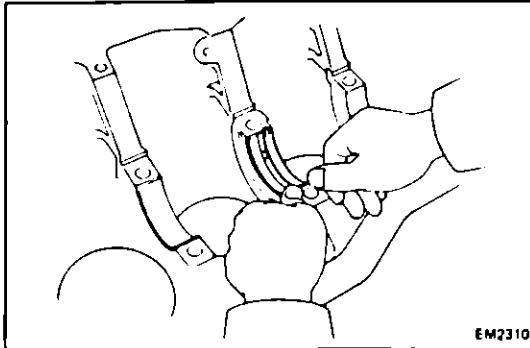


**ASSEMBLY OF CYLINDER BLOCK**

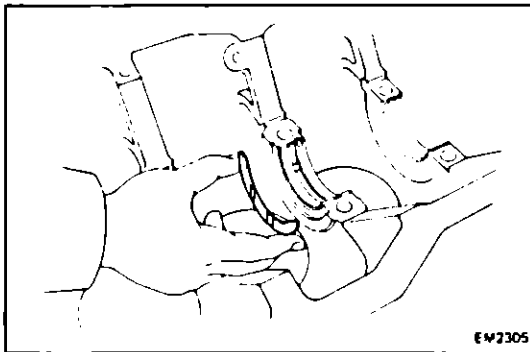
(See page EM-121)

**NOTE:**

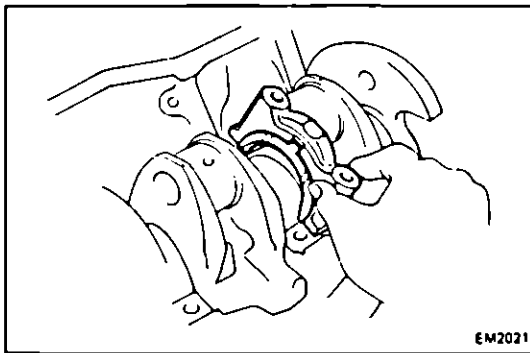
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.



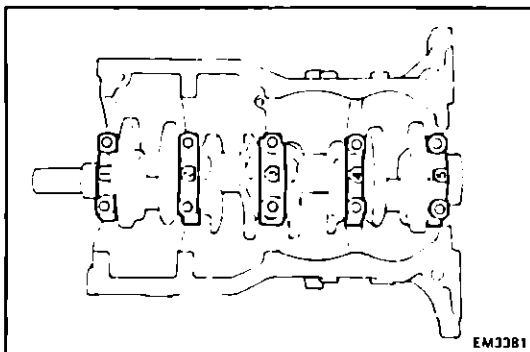
EM2310



EM2305



EM2021



EM3381

**1. INSTALL MAIN BEARINGS**

- Align the bearing claw with the claw groove of the main bearing cap or cylinder block.
- Install the bearings in the cylinder block and main bearing caps.

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

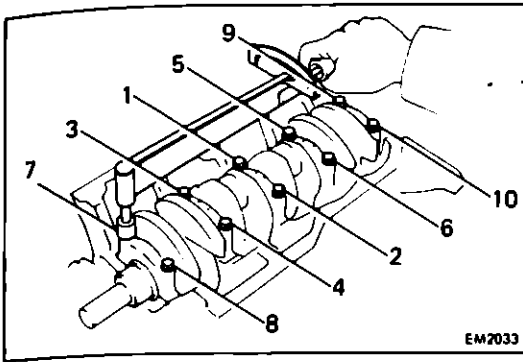
**2. INSTALL UPPER THRUST WASHERS**

Install the thrust washers under the No.3 main bearing cap position of the block with the oil grooves facing outward.

**3. PLACE CRANKSHAFT ON CYLINDER BLOCK****4. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS**

- Install the thrust washers on the No.3 bearing cap with the grooves facing outward.

- Install the main bearing caps in their proper location.
- NOTE:** Each bearing cap has a number and front mark.



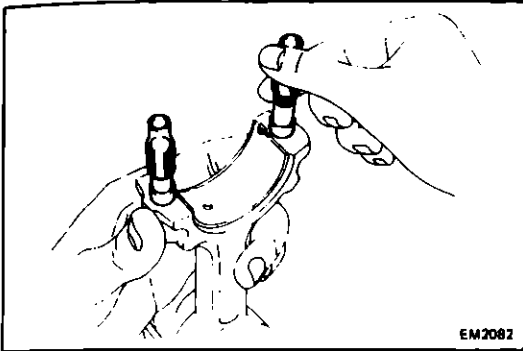
- (c) Apply a light coat of engine oil on the threads and under the heads of the main bearing caps.
- (d) Install and uniformly tighten the ten bolts of the main bearing caps in several passes in the sequence shown.

**Torque: 600 kg-cm (43 ft-lb, 59 N·m)**

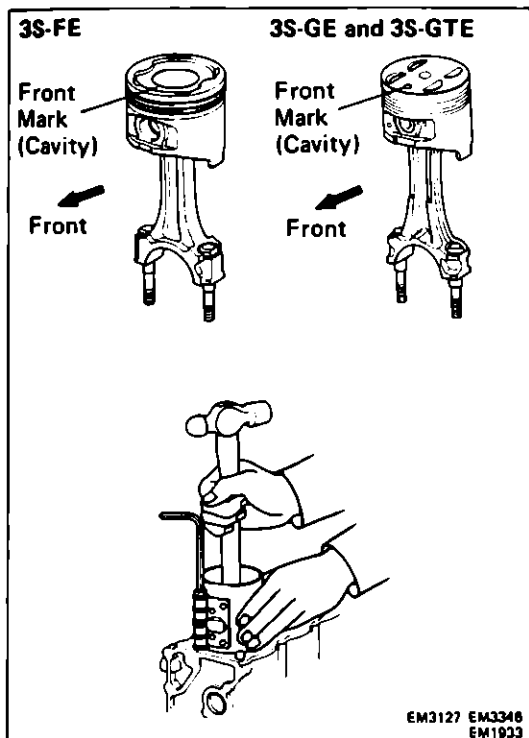
- (e) Check that the crankshaft turns smoothly.
- (f) Check the crankshaft thrust clearance.  
(See step 5 on page EM-130)

## 5. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

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

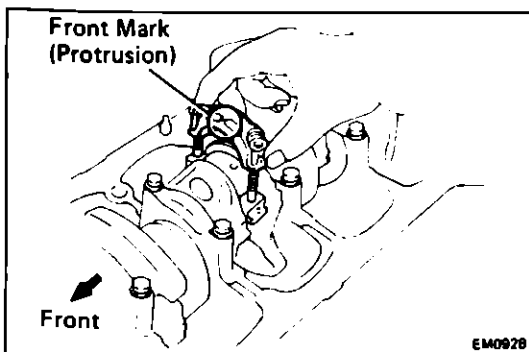


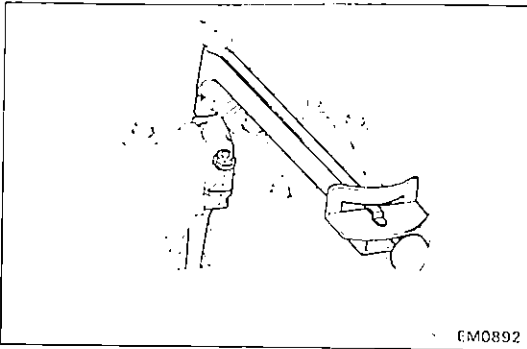
- (b) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.



## 6. INSTALL CONNECTING ROD CAPS

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





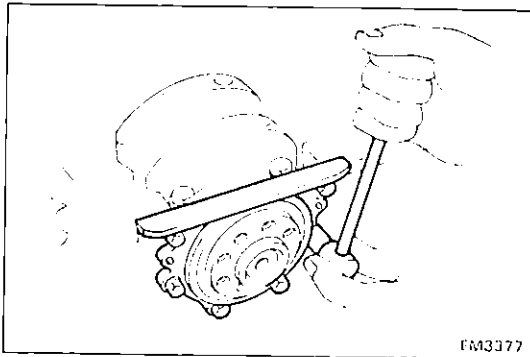
- (c) Apply a light of engine oil on the threads and under the nuts of the connecting rod cap.
- (d) Install and alternately tighten the nuts of the connecting rod cap in several passes.

**Torque:**

**3S-FE 500 kg-cm (36 ft-lb, 49 N·m)**

**3S-GE 680 kg-cm (49 ft-lb, 67 N·m)**

- (e) Check that the crankshaft turns smoothly.
- (f) Check the connecting rod thrust clearance.  
(See step 2 on page EM-128)



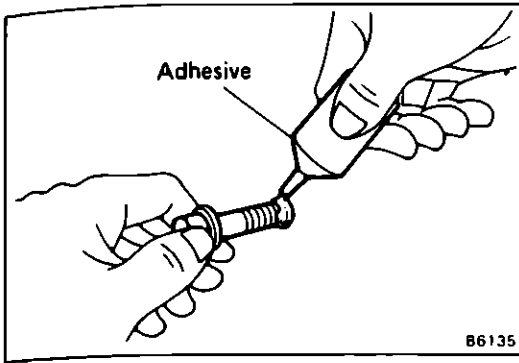
**7. INSTALL REAR OIL SEAL RETAINER**

Install a new gasket and the retainer with the six bolts.

**Torque: 95 kg-cm (82 in.-lb, 9.3 N·m)**

**POST ASSEMBLY**

1. **INSTALL OIL PUMP AND OIL PAN** (See page LU-14)
2. **INSTALL WATER PUMP** (See page CO-9)
3. **INSTALL CYLINDER HEAD**  
3S-FE (See page EM-73)  
3S-GE (See page EM-106)  
3S-GTE (See page EM-113)
4. **INSTALL PULLEYS AND TIMING BELT**  
3S-FE (See page EM-31)  
3S-GE (See page EM-42)
5. **INSTALL DISTRIBUTOR**  
3S-FE (See page IG-16)  
3S-GE and 3S-GTE (See page IG-19)
6. **INSTALL ALTERNATOR** (See page CH-15)
7. **REMOVE ENGINE STAND**
8. **INSTALL REAR END PLATE**  
**Torque: 95 kg-cm (82 ft-lb, 9.3 N·m)**



9. (M/T)  
INSTALL FLYWHEEL

- (a) Apply adhesive to two or three threads of the mount bolt end.

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

- (b) Install the flywheel on the crankshaft.  
(c) Install and uniformly tighten the mount bolts in several passes in the sequence shown.

**Torque:**

**3S-FE** 1,000 kg-cm (72 ft-lb, 98 N·m)

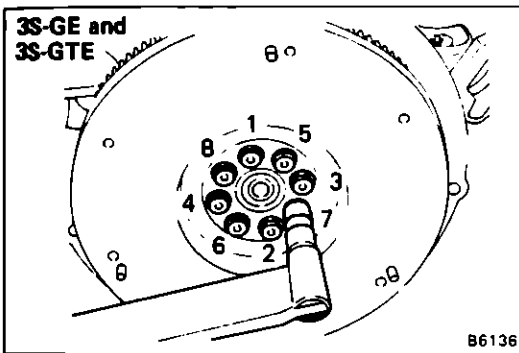
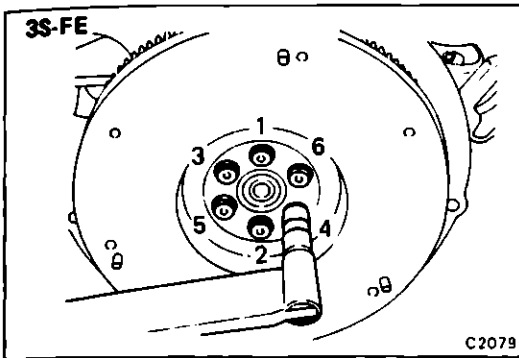
**3S-GE and 3S-GTE**

**New bolt**

900 kg-cm (65 ft-lb, 88 N·m)

**Reused bolt**

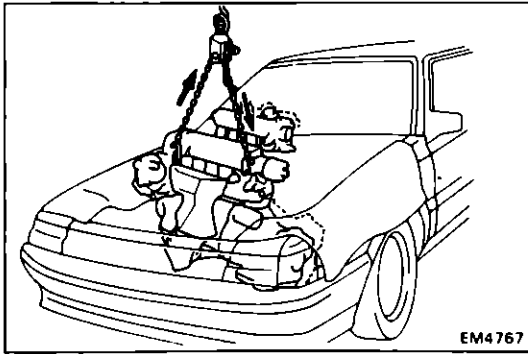
950 kg-cm (69 ft-lb, 93 N·m)



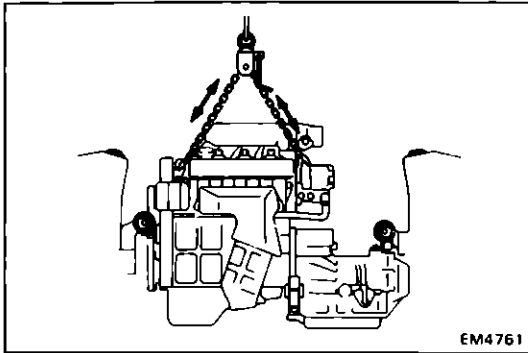
10. (A/T)  
INSTALL DRIVE PLATE  
(See procedure step 9)

**Torque:** 850 kg-cm (61 ft-lb, 83 N·m)

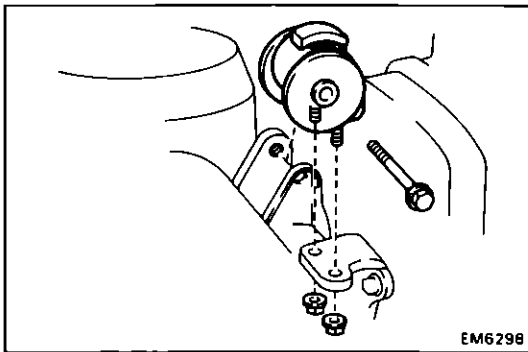
11. (M/T)  
INSTALL CLUTCH DISC AND COVER



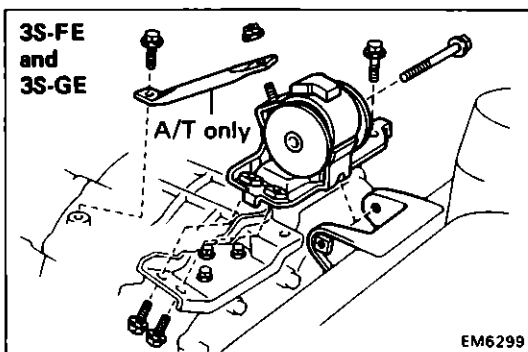
EM4767



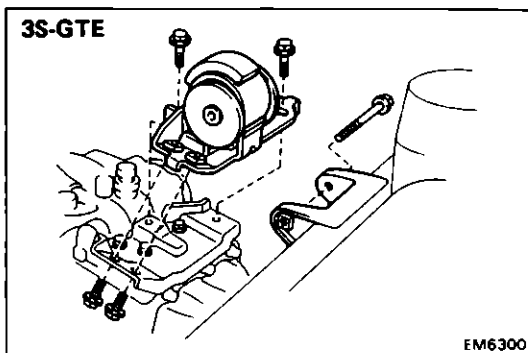
EM4761



EM6298



EM6299



EM6300

## INSTALLATION OF ENGINE

1. ASSEMBLE ENGINE AND TRANSAXLE
2. INSTALL ENGINE AND TRANSAXLE ASSEMBLY IN VEHICLE

- (a) Attach the engine hoist chain to the engine hangers.
- (b) Lower the engine into the engine compartment. Tilt the transaxle downward, lower the engine and clear the LH mounting.

**CAUTION:** Be careful not to hit the PS gear housing or neutral start switch.

- (c) Keep the engine level, and align RH and LH mounting with the body bracket.

- (d) Attach the RH mounting insulator to the mounting bracket and body, and temporarily install the through bolt and two nuts.

- (e) Install the LH mounting bracket to the transaxle case with the three bolts. Torque the bolts.

**Torque:** 530 kg-cm (38 ft-lb, 52 N·m)

- (f) Attach the LH mounting insulator to the mounting bracket and body with the through bolt and three (3S-FE and 3S-GE) or four (3S-GTE) bolts, and install and torque the bolts.

**Torque:**

**Bolt** 530 kg-cm (38 ft-lb, 52 N·m)

**Through bolt** 800 kg-cm (58 ft-lb, 74 N·m)

- (g) (A/T)  
Install the LH mounting stay with the bolt and nut.  
Torque the bolt and nut.

**Torque:** 210 kg-cm (15 ft-lb, 21 N·m)

- (h) Torque the through bolt and two nuts of the RH mounting insulator.

**Torque:**

**Bolt** 530 kg-cm (38 ft-lb, 52 N·m)

**Through bolt** 800 kg-cm (58 ft-lb, 74 N·m)

- (i) Remove the engine hoist chain from the engine.

**3. INSTALL PS PUMP RESERVOIR TANK MOUNTING BOLTS****4. CONNECT ENGINE WIRE**

- (a) Push in the engine wire through the cowl panel.
- (b) Connect the following connectors:
  - (1) Three TCCS ECU connectors
  - (2) Circuit opening relay connector
  - (3) Cowl wire connector
  - (4) Instrument panel wire connector
- (c) Install the glove compartment box.

**5. RAISE VEHICLE**

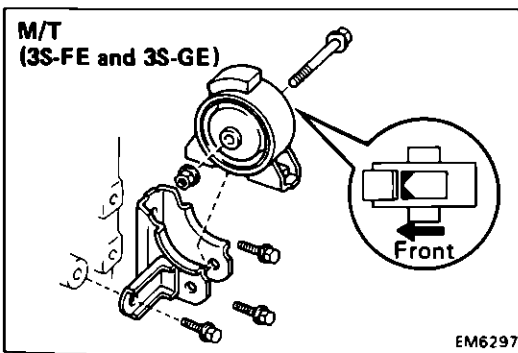
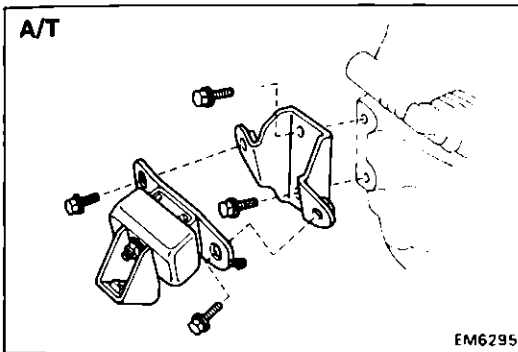
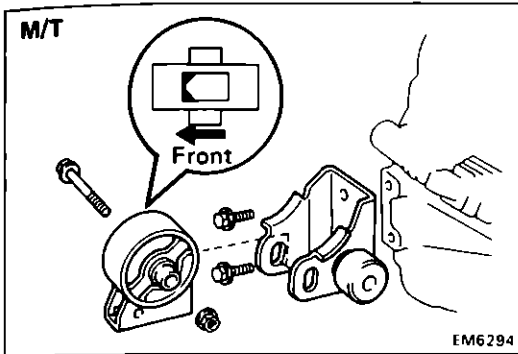
**CAUTION:** Be sure the vehicle is securely supported.

**6. INSTALL ENGINE FRONT MOUNTING BRACKET AND INSULATOR**

- (a) Install the mounting bracket with the two bolts. Torque the bolts.

**Torque:** 530 kg-cm (38 ft-lb, 52 N·m)

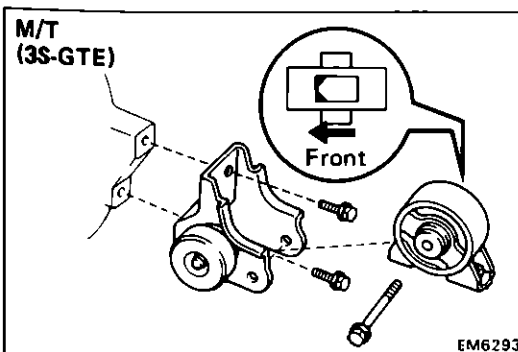
- (b) (M/T)  
Temporarily install the mounting insulator with the through bolt and nut.
- (c) (A/T)  
Temporarily install the mounting insulator with the two bolts.

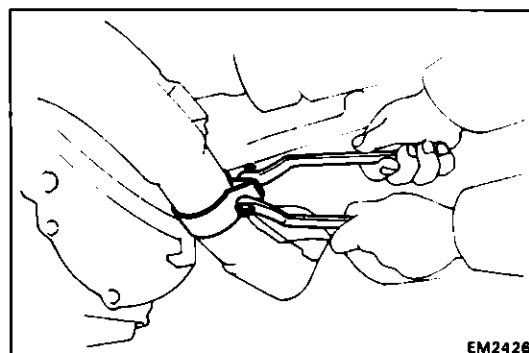
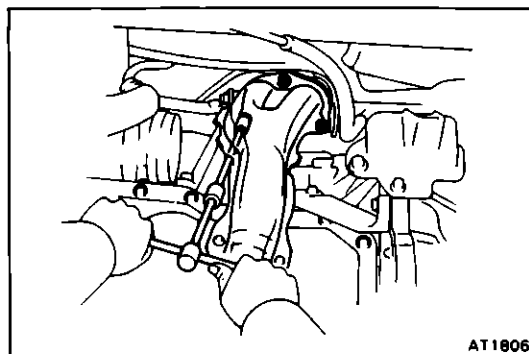
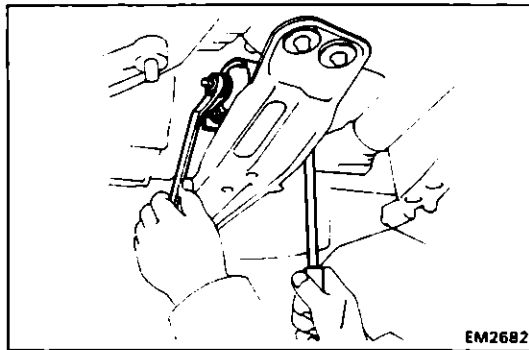
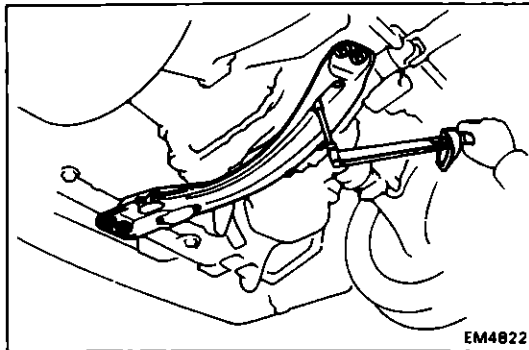
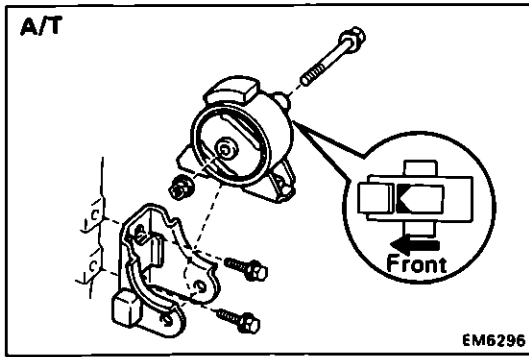
**7. INSTALL ENGINE REAR MOUNTING BRACKET AND INSULATOR**

- (a) Install the mounting bracket with the three (M/T (3S-FE and 3S-GE)) or two (others) bolts. Torque the bolts.

**Torque:** 530 kg-cm (38 ft-lb, 52 N·m)

- (b) Temporarily install the mounting insulator with the through bolt and nut (3S-FE and 3S-GE).





## 8. INSTALL ENGINE MOUNTING CENTER MEMBER

- (a) Install the engine mounting center member with the four bolts. Torque the bolts.

**Torque: 400 kg-cm (29 ft-lb, 39 N·m)**

- (b) Install and torque the four bolts holding the insulators to the center member.

**Torque: 400 kg-cm (29 ft-lb, 39 N·m)**

## 9. TIGHTEN ENGINE REAR MOUNTING THROUGH BOLT

**Torque: 800 kg-cm (58 ft-lb, 78 N·m)**

## 10. INSTALL EXHAUST FRONT PIPE

- (a) Place new two gaskets on the front and rear of the front pipe.

- (b) Install the front pipe with the two bolts and new five nuts. Torque the nuts.

**Torque:**

To converter (3S-FE and 3S-GTE)  
630 kg-cm (46 ft-lb, 62 N·m)

To converter (3S-GE)  
440 kg-cm (32 ft-lb, 43 N·m)

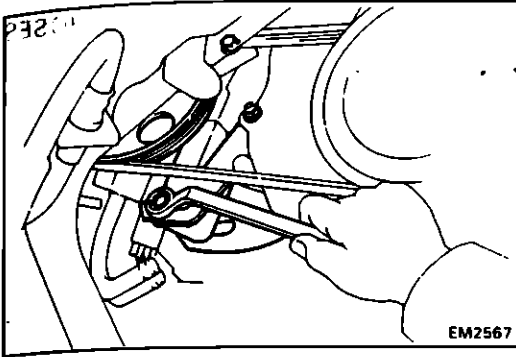
To exhaust manifold (3S-GE)  
630 kg (46 ft-lb, 62 N·m)

To exhaust center pipe (3S-FE and 3S-GTE)  
440 kg-cm (32 ft-lb, 43 N·m)

- (c) (3S-GE)

Install the clamp with the bolt.

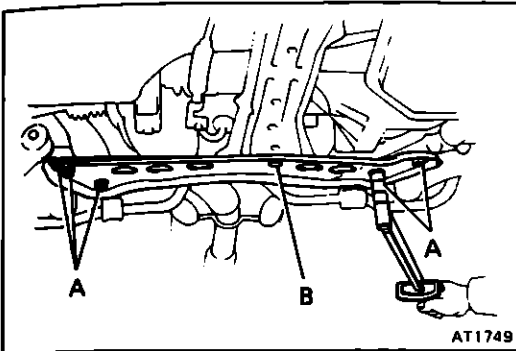


**11. INSTALL PS PUMP**

**12. (4WD)  
INSTALL DEFLECTOR TO TRANSFER EXTENSION HOUSING**

**13. (4WD)  
INSTALL PROPELLER SHAFT**

**14. INSTALL DRIVE SHAFTS**

**15. INSTALL SUSPENSION LOWER CROSSMEMBER**

(a) Install the crossmember with the five bolts. Torque the bolts and nuts.

**Torque: 2,125 kg-cm (154 ft-lb, 208 N·m)**

(b) Install the bolt holding the crossmember to the center member. Torque the bolts.

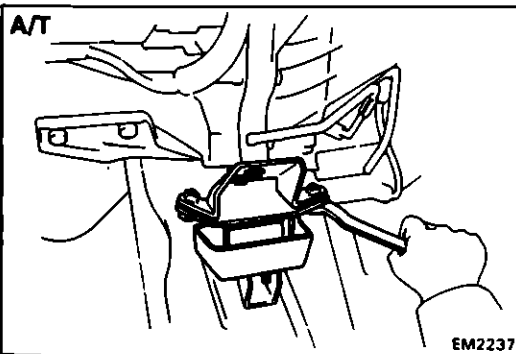
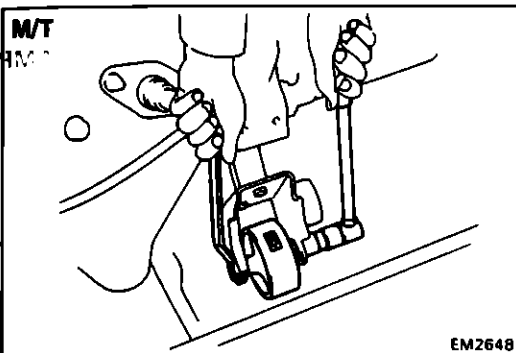
**Torque: 400 kg-cm (29 ft-lb, 39 N·m)**

**16. INSTALL ENGINE UNDER COVERS****17. LOWER VEHICLE**

**18. TIGHTEN THROUGH BOLT (M/T) BOLTS (A/T) ENGINE FRONT MOUNTING**

**Torque: M/T 800 kg-cm (58 ft-lb, 78 N·m)**

**A/T 490 kg-cm (35 ft-lb, 48 N·m)**

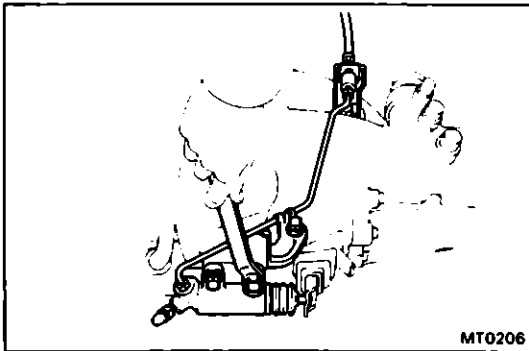


**19. CONNECT WIRES, CONNECTORS AND VACUUM HOSES**

- (a) Check connector
- (b) Ground straps from LH fender apron
- (c) Connectors from relay box
- (d) Brake booster vacuum hose
- (e) A/C idle-up vacuum hoses
- (f) Charcoal canister vacuum hose
- (g) (3S-GTE)  
Solenoid resistor connector
- (h) (3S-GTE)  
Fuel pump relay connector
- (i) (3S-GTE)  
Fuel pump resistor connector

**20. (w/ A/C)****INSTALL A/C COMPRESSOR**

- (a) Install the compressor with the four bolts.
- (b) Connect the two connectors.

**21. (M/T)****INSTALL CLUTCH RELEASE SYLINDER AND TUBE CLAMP****22. (3S-GTE)****INSTALL ALTERNATOR (See page CH-15)****23. CONNECT TRANSAXLE CONTROL CABLE****24. (3S-GTE)****INSTALL INTERCOOLER WATER HOSES****25. CONNECT SPEEDOMETER CABLE****26. CONNECT FUEL HOSES****27. CONNECT HEATER HOSES****28. INSTALL IGNITER****29. INSTALL AIR CLEANER BRACKET**

**30. INSTALL AIR CLEANER ASSEMBLY****(3S-FE and 3S-GE)**

- (a) Install the air cleaner case with the three bolts.
- (b) Install the air cleaner element.
- (c) Connect the air cleaner hose.
- (d) Install the air cleaner cap and air flow meter.
- (e) Connect the air flow meter connector
- (f) (3S-GE)  
Connect the vacuum limiter hose

**(3S-GTE)**

- (a) Install the air cleaner case with the three bolts.
- (b) Install the air cleaner element.
- (c) Install the air cleaner cap, air flow meter, air connector pipe and air cleaner hoses.
- (d) Connect the air flow meter connector

**31. INSTALL SUSPENSION UPPER BRACE**

Install the suspension upper brace with the two bolts and four bolts.

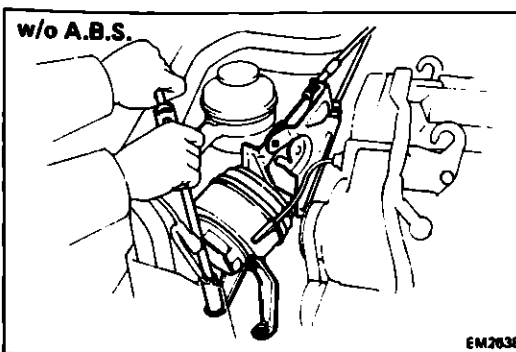
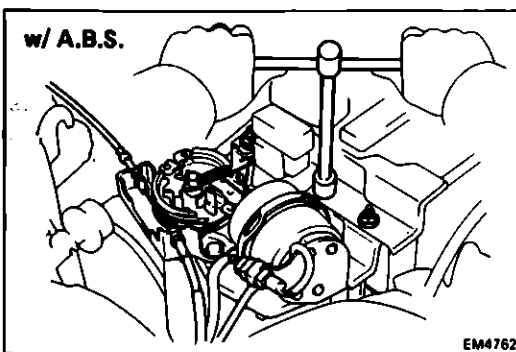
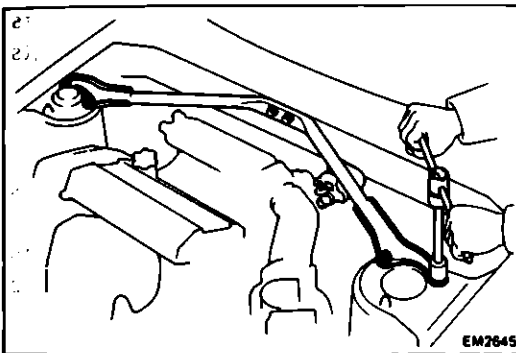
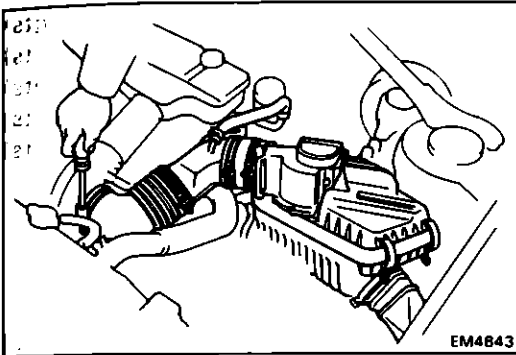
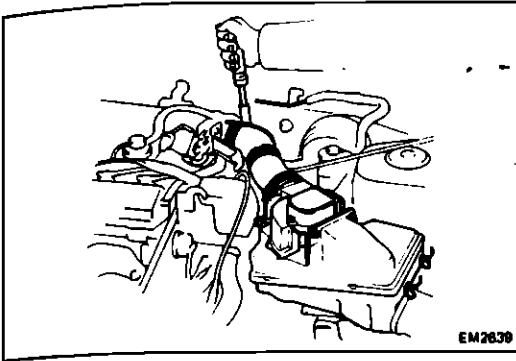
**Torque:** Bolt 210 kg-cm (15 ft-lb, 21 N·m)  
Nut 375 kg-cm (27 ft-lb, 37 N·m)

**32. (w/ CRUISE CONTROL SYSTEM)  
INSTALL CRUISE CONTROL ACTUATOR****(w/ A.B.S.)**

- (a) Install the actuator and bracket.
- (b) Connect the actuator connector.

**(w/o A.B.S.)**

- (a) Install the actuator and bracket with the three bolts.
- (b) Connect the actuator connector
- (c) Connect the actuator vacuum hose
- (d) Install the actuator cover.
- (e) Connect the ground strap connector.



33. INSTALL RADIATOR (See page CO-16)
34. INSTALL RADIATOR RESERVOIR TANK
35. (A/T)  
INSTALL THROTTLE CABLE, AND ADJUST IT
36. INSTALL ACCELERATOR CABLE, AND ADJUST IT
37. INSTALL BATTERY
38. FILL WITH ENGINE COOLANT (See page CO-6)

## Capacity (w/ Heater):

3S-FE	M/T	6.3 liters (6.7 US qts, 5.5 Imp. qts)
	A/T	6.2 liters (6.6 US qts, 5.5 Imp. qts)
3S-GE	M/T	6.2 liters (6.6 US qts, 5.5 Imp. qts)
	A/T	6.1 liters (6.4 US qts, 5.4 Imp. qts)
3S-GTE		6.4 liters (6.8 US qts, 5.6 Imp. qts)

39. FILL WITH ENGINE OIL (See page LU-8)

## Capacity (3S-FE):

## Drain and refill

w/ Oil filter change

3.9 liters (4.1 US qts, 3.4 Imp. qts)

w/o Oil filter change

3.7 liters (3.9 US qts, 3.3 Imp. qts)

Dry fill

4.3 liters (4.5 US qts, 3.8 Imp. qts)

## Capacity (3S-GE):

## Drain and refill

w/ Oil filter change

3.9 liters (4.1 US qts, 3.4 Imp. qts)

w/o Oil filter change

3.6 liters (3.8 US qts, 3.2 Imp. qts)

Dry fill

4.3 liters (4.5 US qts, 3.8 Imp. qts)

## Capacity (3S-GTE):

## Drain and refill

w/ Oil filter change

3.6 liters (3.8 US qts, 3.2 Imp. qts)

w/o Oil filter change

3.3 liters (3.6 US qts, 2.9 Imp. qts)

Dry fill

4.6 liters (4.9 US qts, 4.0 Imp. qts)

40. START ENGINE AND CHECK FOR LEAKS

41. PERFORM ENGINE ADJUSTMENT

(a) Adjust the alternator drive belt.

(See page CH-3)

## Drive belt tension (3S-FE):

w/ A/C	New belt	175 ± 5 lb
	Used belt	130 ± 10 lb
w/o A/C	New belt	125 ± 25 lb
	Used belt	95 ± 20 lb

## Drive belt tension (3S-GE and 3S-GTE):

w/ A/C	New belt	175 ± 5 lb
	Used belt	130 ± 20 lb
w/o A/C	New belt	150 ± 25 lb
	Used belt	130 ± 25 lb

(b) Adjust the PS drive belt.

**Drive belt tension:**   **New belt**   **125 ± 25 lb**  
                                  **Used belt**   **80 ± 20 lb**

(c) Adjust the ignition timing.  
(See page IG-17 or 20)

**Ignition timing:**

**10° BTDC @ idle**

**(w/ Terminals T or TE1 and E1 connected)**

(d) Adjust the valve clearance.  
(See page EM-12 or 16)

**Valve clearance:**

**3S-FE Intake**   **0.19–0.29 mm**  
                                  **(0.007–0.011 in.)**

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

**3S-GE and 3S-GTE**

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

**Exhaust**   **0.20–0.30 mm**  
                                  **(0.008–0.012 in.)**

(e) (3S-GE)

Adjust idle speed. (See page MA-7)

**Idle speed: 750 rpm**

#### **42. INSTALL HOOD**

#### **43. PERFORM ROAD TEST**

Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

#### **44. RECHECK ENGINE COOLANT AND ENGINE OIL LEVELS**