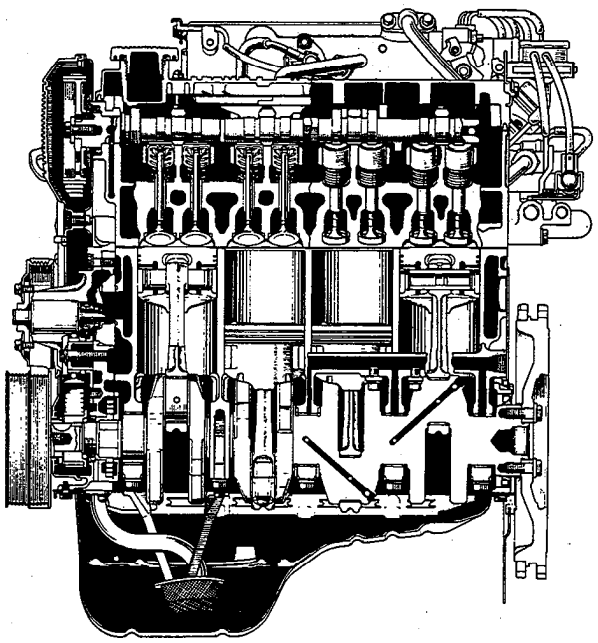
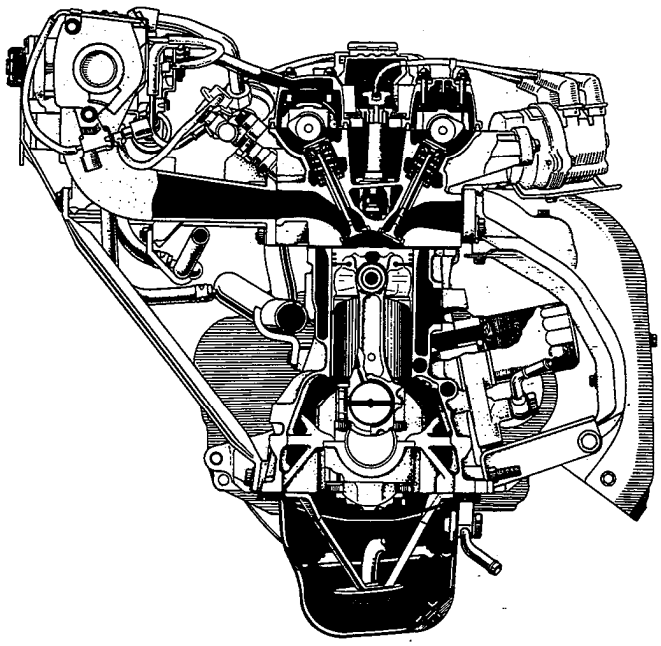
DESCRIPTION

4A-GE ENGINE

The 4A-GE engine is an in-line 4-cylinder 1.6 liter DOHC 16 valve engine.





EM7657
EM7658

The 4A-GE 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 specified bearings inside the crankcase. These bearings are made of aluminum alloy.

The crankshaft is integrated with 8 weights which are cast along with it for balance. 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 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 supercharging 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 cam shaft and the intake side cam shaft 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. Lubrication of the cam journal and cam is accomplished by oil being supplied through the oiler port in the center of the camshaft.

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

The resin timing belt cover is made of 3 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 to 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 at 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 (4A-FE)

ENGINE OVERHEATING

Problem	Possible cause	Remedy	Page
Engine overheats	Cooling system faulty	Troubleshoot cooling system	CO-4
	Incorrect ignition timing	Reset timing	EM-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 carburetor ● No fuel in tank ● Fuel pump not working ● Fuel line clogged or leaking	Troubleshoot EFI system	FI-10
	EFI system problems	Repair as necessary	
	Ignition problems ● Ignition coil ● Igniter ● Distributor (IIA)	Perform spark test	IG-6
	Spark plugs faulty	Inspect plugs	IG-7
	High-tension cords disconnected or broken	Inspect cords	IG-7
	Vacuum leaks ● PCV line ● EGR line (w/ EGR system) ● Intake manifold ● Throttle body ● Brake booster line	Repair as necessary	
	Low compression	Check compression	EM-38

ROUGH IDLING

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses	Spark plugs faulty	Inspect plugs	IG-7
	High-tension cords faulty	Inspect cords	IG-7
	Ignition wiring faulty	Inspect wiring	
	Ignition problems ● Ignition coil ● Igniter ● Distributor (IIA)	 Inspect coil Inspect igniter Inspect IIA	
	Incorrect ignition timing	Reset timing	EM-20
	Incorrect valve clearance	Adjust valve clearance	EM-16
	Vacuum leaks ● PCV line ● EGR line (w/ EGR system) ● Intake manifold ● Throttle body ● Brake booster line	Repair as necessary	
	Incorrect idle speed	Adjust idle speed	EM-22, 23
	EFI system problems	Repair as necessary	
	EGR valve faulty (w/ EGR system)	Check EGR valve	
	Engine overheats	Check cooling system	
	Low compression	Check compression	EM-38

ENGINE HESITATES/POOR ACCELERATION

Problem	Possible cause	Remedy	Page
Engine hesitates/ poor acceleration	Spark plugs faulty	Inspect plugs	IG-7
	High-tension cords faulty	Inspect cords	IG-7
	Vacuum leaks ● PCV line ● EGR line (w/ EGR system) ● Intake manifold ● Throttle body ● Brake booster line	Repair as necessary	
	Incorrect ignition timing	Reset timing	EM-20
	Incorrect valve clearance	Adjust valve clearance	EM-16
	Fuel system clogged	Check fuel system	
	Air cleaner clogged	Check air cleaner	EM-15
	EFI system problems	Repair as necessary	
	Engine overheats	Check cooling system	CO-4
	Low compression	Check compression	EM-38

ENGINE DIESELING

Problem	Possible cause	Remedy	Page
Engine dieseling (runs after ignition switch is turned off)	EFI system problems	Repair as necessary	EM-20
	Incorrect ignition timing	Reset timing	
	EGR system faulty (w/EGR system)	Check EGR system	

AFTER FIRE, BACKFIRE

Problem	Possible cause	Remedy	Page
Muffler explosion (after fire) on deceleration only	Deceleration fuel cut system always off	Check fuel cut system	
	DP system always off	Check DP system	
Muffler explosion (after fire) all the time	Air cleaner clogged	Check air cleaner	EM-15
	EFI system problem	Repair as necessary	
	Incorrect ignition timing	Reset timing	EM-20
	Incorrect valve clearance	Adjust valve clearance	EM-16
Engine backfires	EFI system problem	Repair as necessary	
	Vacuum leak ● PCV hoses ● Intake manifold ● Throttle body ● Brake booster line	Check hoses and repair as necessary	
	Insufficient fuel flow	Troubleshoot fuel system	
	Incorrect ignition timing	Reset timing	EM-20
	Incorrect valve clearance	Adjust valve clearance	EM-16
	Carbon deposits in combustion chambers	Inspect cylinder head	EM-68

EXCESSIVE OIL CONSUMPTION

Problem	Possible cause	Remedy	Page
Excessive oil consumption	Oil leak	Repair as necessary	
	PCV line clogged	Check PCV system	
	Piston ring worn or damaged	Check rings	EM-130
	Valve stem and guide bushing worn	Check valves and guide bushings	EM-70
	Valve stem oil seal worn or damaged	Check oil seals	

POOR GASOLINE MILEAGE

Problem	Possible cause	Remedy	Page
Poor gasoline mileage	Fuel leak	Repair as necessary	
	Air cleaner clogged	Check air cleaner	
	Incorrect ignition timing	Reset timing	EM-20
	EFI system problems ● Injector faulty ● Deceleration fuel cut system faulty	Repair as necessary	
	Idle speed too high	Adjust idle speed	EM-22, 23
	Spark plugs faulty	Inspect plugs	IG-7
	EGR system always on (w/ EGR system)	Check EGR system	
	Low compression	Check compression	EM-38
	Tires improperly inflated	Inflate tires to proper pressure	
	Clutch slips	Troubleshoot clutch	
	Brakes drag	Troubleshoot brakes	

UNPLEASANT ODOR

Problem	Possible cause	Remedy	Page
Unpleasant odor	Incorrect idle speed	Adjust idle speed	EM-22, 23
	Incorrect ignition timing	Reset timing	EM-20
	Vacuum leaks ● PCV line ● EGR line (w/ EGR system) ● Intake manifold ● Throttle body ● Brake booster line	Repair as necessary	
	EFI system problems	Repair as necessary	

TROUBLESHOOTING (4A-GE)

ENGINE OVERHEATING

Problem	Possible cause	Remedy	Page
Engine overheats	Cooling system faulty	Troubleshoot cooling system	CO-4
	Incorrect ignition timing	Reset timing	EM-28

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 (crank OK)	No fuel supply to injector ● No fuel in tank ● Fuel pump not working ● Fuel line clogged or leaking	Troubleshoot EFI system	FI-10
	EFI system problems	Repair as necessary	
	Ignition problems ● Ignition coil ● Igniter ● Distributor	Perform spark test	IG-10
	Spark plug faulty	Inspect plugs	IG-11, 12
	High-tension cord disconnected or broken	Inspect cords	IG-11
	Vacuum leaks ● PCV line ● EGR line (w/ EGR system) ● Intake manifold ● Throttle body ● Brake booster line	Repair as necessary	
	Air suction between air flow meter and throttle body	Repair as necessary	
	Low compression	Check compression	EM-38

ROUGH IDLING

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses	Spark plug faulty	Inspect plugs	IG-11, 12
	High-tension cord faulty	Inspect cords	IG-11
	Ignition wiring faulty	Inspect wiring	
	Ignition problems ● Ignition coil ● Igniter ● Distributor	Inspect coil Inspect igniter Inspect distributor	
	Incorrect ignition timing	Reset timing	EM-28
	Incorrect valve clearance	Adjust valve clearance	EM-26

ROUGH IDLING (Cont'd)

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses (Cont'd)	Vacuum leaks ● PCV line ● EGR line (w/ EGR system) ● Intake manifold ● Throttle body ● Brake booster line	Repair necessary	
	Air suction between air flow meter and throttle body	Repair as necessary	
	Incorrect idle speed	Adjust idle speed	EM-30, 31
	EFI system problems	Repair as necessary	
	EGR valve faulty (w/ EGR system)	Check EGR valve	
	Engine overheats	Check cooling system	CO-4
	Low compression	Check compression	EM-38

ENGINE HESITATES/POOR ACCELERATION

Problem	Possible cause	Remedy	Page
Engine hesitates/ poor acceleration	Spark plug faulty	Inspect plugs	IG-11, 12
	High-tension cord faulty	Inspect cords	IG-11
	Vacuum leaks ● PCV line ● EGR line (w/ EGR system) ● Intake manifold ● Throttle body ● Brake booster line	Repair as necessary	
	Air suction between air flow meter and throttle body	Repair as necessary	
	Incorrect ignition timing	Reset timing	EM-28
	Incorrect valve clearance	Adjust valve clearance	EM-26
	Fuel system clogged	Check fuel system	
	Air cleaner clogged	Check air cleaner	EM-25
	EFI system problems	Repair as necessary	
	Engine overheats	Check cooling system	CO-4
	Low compression	Check compression	EM-38

ENGINE DIESELING

Problem	Possible cause	Remedy	Page
Engine dieseling (turns when ignition switch is turned off)	EFI system problems	Repair as necessary	
	Incorrect ignition timing	Reset timing	EM-28
	EGR system faulty (w/ EGR system)	Check EGR system	

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	
	DP system always off	Check DP system	
Muffler explosion (after fire) all the time	Air cleaner clogged	Check air cleaner	EM-25
	EFI system problem	Repair as necessary	
	Incorrect ignition timing	Reset timing	EM-28
	Incorrect valve clearance	Adjust valve clearance	EM-26
Engine backfires	EFI system problem	Repair as necessary	
	Vacuum leak ● PCV hoses ● Intake manifold ● Throttle body ● Brake booster line	Check hoses and repair as neccessary	
	Air suction between air flow meter and throttle body	Repair as necessary	
	Insufficient fuel flow	Troubleshoot fuel system	
	Incorrect ignition timing	Reset timing	EM-28
	Incorrect valve clearance	Adjust valve clearance	EM-26
	Carbon deposits in combustion chambers	Inspect cylinder head	EM-99

EXCESSIVE OIL CONSUMPTION

Problem	Possible cause	Remedy	Page
Excessive oil consumption	Oil leak	Repair as necessary	
	PCV line clogged	Check PCV system	
	Piston ring worn or damaged	Check rings	EM-130
	Valve stem and guide bushing worn	Check valves and guide bushings	EM-100
	Valve stem oil seal worn or damaged	Check oil seals	

EXCESSIVE FUEL CONSUMPTION

Problem	Possible cause	Remedy	Page
Poor gasoline mileage	Fuel leak	Repair as necessary	
	Air cleaner clogged	Check air cleaner	EM-25
	Incorrect ignition timing	Reset timing	EM-28
	EFI system problems ● Injector faulty ● Deceleration fuel cut system faulty	Repair as necessary	
	Idle speed to high	Adjust idle speed	EM-30, 31
	Spark plug faulty	Inspect plugs	IG-11, 12
	EGR system always on (w/ EGR system)	Check EGR system	
	Low compression	Check compression	EM-38
	Tires improperly inflated	Inflate tires to proper pressure	
	Clutch slips	Troubleshoot clutch	
	Brakes drag	Troubleshoot brakes	

UNPLEASANT ODOR

Problem	Possible cause	Remedy	Page
Unpleasant odor	Incorrect idle speed	Adjust idle speed	EM-30, 31
	Incorrect ignition timing	Reset timing	EM-28
	Vacuum leaks ● PCV line ● EGR line (w/ EGR system) ● Intake manifold ● Throttle body ● Brake booster line	Repair as necessary	
	EFI system problems	Repair as necessary	

ENGINE TUNE-UP (4A-FE)

INSPECTION OF ENGINE COOLANT

(See steps 1 and 2 on page CO-5)

INSPECTION OF ENGINE OIL

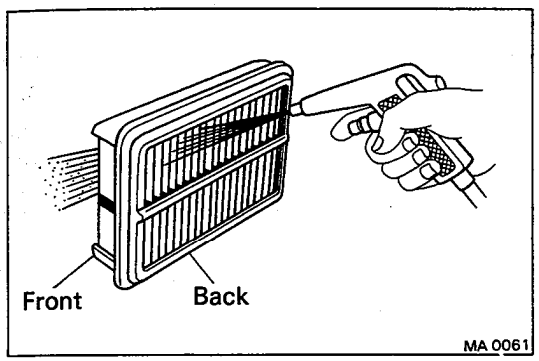
(See steps 1 and 2 on page LU-6)

INSPECTION OF BATTERY

(See page 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



1. INSPECT AIR FILTER

Visually check that the element is not excessively dirty, damaged or oily.

2. CLEAN AIR FILTER

Clean the element with compressed air.
First blow from the back thoroughly. Then blow off the front of the element.

INSPECTION OF HIGH-TENSION CORDS

(See page IG-5)

Maximum resistance: 25 kΩ per cord

INSPECTION OF SPARK PLUGS

(See page IG-6)

Correct electrode gap: 0.8 mm (0.031 in.)
Recommended spark plugs:
ND Q16R-U
NGK BCPR5EY

INSPECTION OF ALTERNATOR DRIVE BELT

(See page 3 on page CH-3)

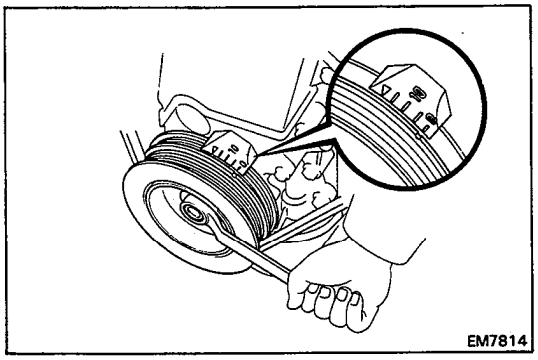
Drive belt deflection:
Used belt 10.0 – 12.0 mm (0.394 – 0.472 in.)
New belt 8.5 – 10.5 mm (0.335 – 0.413 in.)
Drive belt tension (Reference):
Used belt 40 – 55 kg
New belt 60 – 70 kg

INSPECTION AND ADJUSTMENT OF VALVE CLEARANCE

HINT: Inspect and adjust the valve clearance when the engine is cold.

1. DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS

2. REMOVE CYLINDER HEAD COVER (See page EM-62)

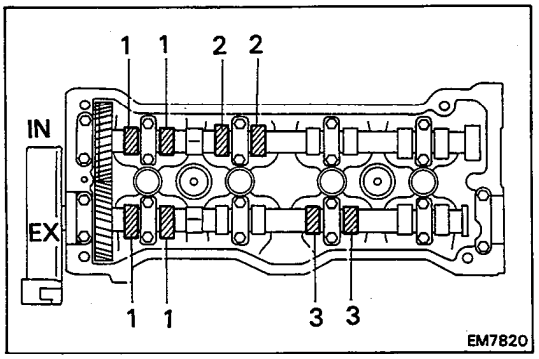


3. SET NO.1 CYLINDER TO TDC/COMPRESSION

(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 cylinder are tight.

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



4. INSPECT VALVE CLEARANCE

(a) Check only those valves indicated in the illustration.

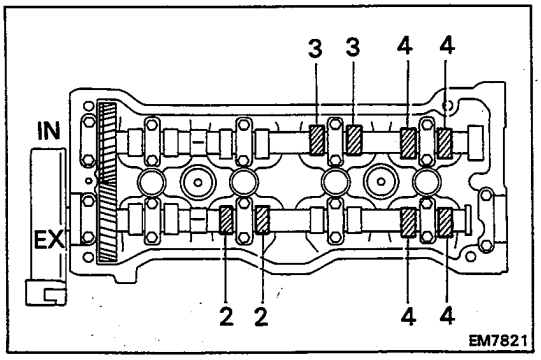
- Using a thickness gauge, measure the clearance between the valve lifter and camshaft.
- Record the valve clearance measurements which are out of specification. They will be used later to determine the required replacement adjusting shim.

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 3)

(c) Check only the valves indicated as shown. Measure the valve clearance. (See procedure step (a)).

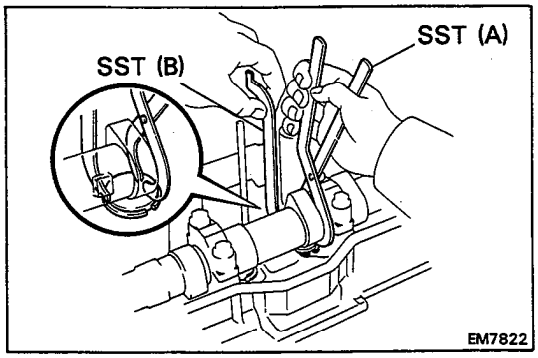


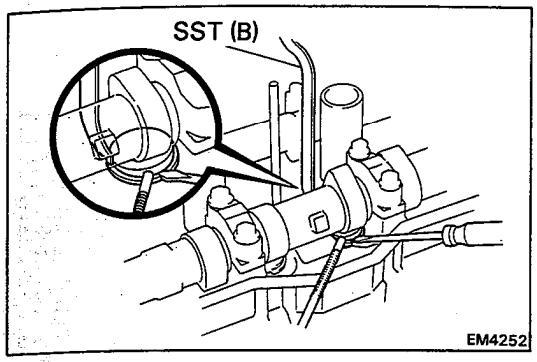
5. ADJUST VALVE CLEARANCE

(a) Remove the adjusting shim.

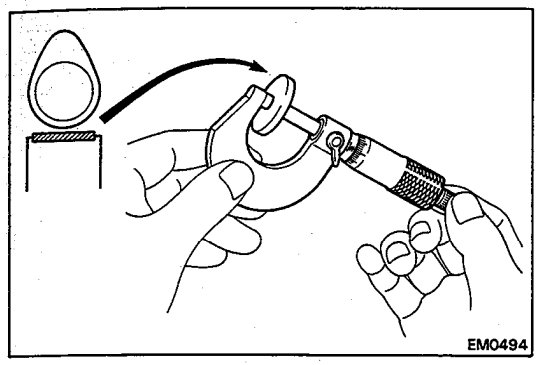
- Turn the crankshaft to position the cam lobe of the camshaft on the adjusting valve upward.
- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

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



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

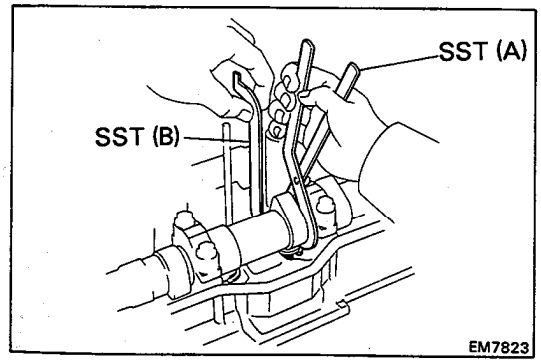
- Using a micrometer, measure the thickness of the shim which was removed.
- Calculate the thickness of the new shim so the valve clearance comes within specified value.

T ..... Thickness of shim used
A ..... Valve clearance measured
N ..... Thickness of new shim

Intake: N = T + (A − 0.20 mm (0.008 in.))
Exhaust: N = T + (A − 0.25 mm (0.010 in.))

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

HINT: 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.).



(c) Install a new adjusting shim.

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

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(d) Recheck the valve clearance.

6. INSTALL CYLINDER HEAD COVER (See page EM-86)

7. CONNECT HIGH-TENSION CORDS TO SPARK PLUGS

Adjusting Shim Selection Chart

INTAKE

Measured Clearance (mm)	Installed Shim Thickness (mm)																																																							
	2.500	2.525	2.550	2.575	2.600	2.620	2.625	2.640	2.650	2.660	2.675	2.680	2.700	2.720	2.725	2.740	2.750	2.760	2.775	2.780	2.800	2.820	2.825	2.840	2.850	2.860	2.875	2.880	2.900	2.920	2.925	2.940	2.950	2.960	2.975	2.980	3.000	3.020	3.025	3.040	3.050	3.060	3.075	3.080	3.100	3.120	3.125	3.140	3.150	3.160	3.175	3.180	3.200	3.225	3.250	3.275	3.300
0.000 – 0.009											02	02	02	04	04	04	04	04	06	06	06	08	08	08	08	08	10	10	10	12	12	12	12	12	14	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	26	26
0.010 – 0.025										02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	26	26
0.026 – 0.029									02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	26	26	28
0.030 – 0.040								02	02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	26	26	28
0.041 – 0.050								02	02	02	02	02	04	04	04	06	06	06	06	06	08	08	08	10	10	10	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	26	26	28
0.051 – 0.070						02	02	02	02	02	04	04	04	06	06	06	06	06	08	08	08	10	10	10	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	28	28
0.071 – 0.075					02	02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	28	28
0.076 – 0.090					02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	28	28	30
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0.101 – 0.120				02	02	04	04	04	04	04	06	06	06	08	08	08	08	08	10	10	10	12	12	12	12	12	14	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	30	30
0.121 – 0.125			02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	30	30
0.126 – 0.140			02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	30	30	32
0.141 – 0.149			02	02	04	04	04	06	06	06	06	06	08	08	08	10	10	10	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	30	30	32
0.150 – 0.250																																																									
0.251 – 0.270	04	06	06	08	08	10	10	10	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34		
0.271 – 0.275	04	06	06	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34		
0.276 – 0.290	06	06	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34			
0.291 – 0.300	06	06	08	08	10	10	10	12	12	12	12	12	14	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34			
0.301 – 0.320	06	08	08	10	10	12	12	12	12	12	14	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34				
0.321 – 0.325	06	08	08	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34				
0.326 – 0.340	08	08	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34					
0.341 – 0.350	08	08	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34						
0.351 – 0.370	08	10	10	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34							
0.371 – 0.375	08	10	10	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34								
0.376 – 0.390	10	10	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34									
0.391 – 0.400	10	10	12	12	14	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34										
0.401 – 0.420	10	12	12	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34												
0.421 – 0.425	10	12	12	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34												
0.426 – 0.440	12	12	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34													
0.441 – 0.450	12	12	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34													
0.451 – 0.470	12	14	14	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34															
0.471 – 0.475	12	14	14	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																
0.476 – 0.490	14	14	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																	
0.491 – 0.500	14	14	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34																		
0.501 – 0.520	14	16	16	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34																				
0.521 – 0.525	14	16	16	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																				
0.526 – 0.540	16	16	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																					
0.541 – 0.550	16	16	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34																					
0.551 – 0.570	16	18	18	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34																							
0.571 – 0.575	16	18	18	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																								
0.576 – 0.590	18	18	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																									
0.591 – 0.600	18	18	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34																										
0.601 – 0.620	18	20	20	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34																												
0.621 – 0.625	18	20	20	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																												
0.626 – 0.640	20	20	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																													
0.641 – 0.650	20	20	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34																													
0.651 – 0.670	20	22	22	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34																															
0.671 – 0.675	20	22	22	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																
0.676 – 0.690	22	22	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																	
0.691 – 0.700	22	22	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34																																		
0.701 – 0.720	22	24	24	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34																																				
0.721 – 0.725	22	24	24	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																				
0.726 – 0.740	24	24	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																					
0.741 – 0.750	24	24	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34																																						
0.751 – 0.770	24	26	26	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34																																							
0.771 – 0.775	24	26	26	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																								
0.776 – 0.790	26	26	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																									
0.791 – 0.800	26	26	28	28	30	30	30	32	32	32	32	32	34	34	34																																										
0.801 – 0.820	26	28	28	30	30	32	32	32	32	32	34	34	34																																												
0.821 – 0.825	26	28	28	30	30	32	32	32	32	34	34	34	34																																												
0.826 – 0.840	28	28	30	30	32	32	32	32	34	34	34	34																																													
0.841 – 0.850	28	28	30	30	32	32	32	34	34	34	34	34																																													
0.851 – 0.870	28	30	30	32	32	34	34	34	34	34																																															
0.871 – 0.875	28	30	30	32	32	34	34	34	34																																																
0.876 – 0.890	30	30	32	32	34	34	34	34																																																	
0.891 – 0.900	30	30	32	32	34	34	34																																																		
0.901 – 0.925	30	32	32	34	34																																																				
0.926 – 0.950	32	32	34	34																																																					
0.951 – 0.975	32	34	34																																																						
0.976 – 1.000	34	34																																																							
1.001 – 1.025	34																																																								

Intake valve clearance (cold):
0.15 – 0.25 mm (0.006 – 0.010 in.)

Example: **A 2.800 mm shim is installed and the measured clearance is 0.450 mm. Replace the 2.800 mm shim with shim No. 24 (3.050 mm).**

Shim thicknesses mm (in.)

Shim No.	Thickness	Shim No.	Thickness
02	2.500 (0.0984)	20	2.950 (0.1161)
04	2.550 (0.1004)	22	3.000 (0.1181)
06	2.600 (0.1024)	24	3.050 (0.1201)
08	2.650 (0.1043)	26	3.100 (0.1220)
10	2.700 (0.1063)	28	3.150 (0.1240)
12	2.750 (0.1083)	30	3.200 (0.1260)
14	2.800 (0.1102)	32	3.250 (0.1280)
16	2.850 (0.1122)	34	3.300 (0.1299)
18	2.900 (0.1142)		

Adjusting Shim Selection Chart

EXHAUST

Measured Clearance (mm)	Installed Shim Thickness (mm)																																																							
	2.500	2.525	2.550	2.575	2.600	2.620	2.625	2.640	2.650	2.660	2.675	2.680	2.700	2.720	2.725	2.740	2.750	2.760	2.775	2.780	2.800	2.820	2.825	2.840	2.850	2.860	2.875	2.880	2.900	2.920	2.925	2.940	2.950	2.960	2.975	2.980	3.000	3.020	3.025	3.040	3.050	3.060	3.075	3.080	3.100	3.120	3.125	3.140	3.150	3.160	3.175	3.180	3.200	3.225	3.250	3.275	3.300
0.000 - 0.009														02	02	02	02	02	04	04	04	06	06	06	06	06	08	08	08	10	10	10	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	24	24
0.010 - 0.025														02	02	02	02	04	04	04	06	06	06	06	06	08	08	08	10	10	10	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	24	26
0.026 - 0.040													02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	24	24	26
0.041 - 0.050												02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	24	24	26
0.051 - 0.070											02	02	02	04	04	04	04	04	06	06	06	08	08	08	08	08	10	10	10	12	12	12	12	12	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	20	22	22	22	24	24	26	26
0.071 - 0.090									02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	26	26	28
0.091 - 0.100								02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	26	26	28
0.101 - 0.120						02	02	02	02	02	04	04	04	06	06	06	06	06	08	08	08	10	10	10	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	28	28
0.121 - 0.140					02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	28	28	30
0.141 - 0.150					02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	28	28	30
0.151 - 0.170				02	02	04	04	04	04	04	06	06	06	08	08	08	08	08	10	10	10	12	12	12	12	12	14	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	30	30
0.171 - 0.190			02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	30	30	32
0.191 - 0.199			02	02	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	30	30	32
0.200 - 0.300																																																									
0.301 - 0.320	04	06	06	08	08	10	10	10	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34		
0.321 - 0.325	04	06	06	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34		
0.326 - 0.340	06	06	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34			
0.341 - 0.350	06	06	08	08	10	10	10	12	12	12	12	12	14	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34			
0.351 - 0.370	06	08	08	10	10	12	12	12	12	12	14	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34				
0.371 - 0.375	06	08	08	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34				
0.376 - 0.390	08	08	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34					
0.391 - 0.400	08	08	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34					
0.401 - 0.420	08	10	10	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34							
0.421 - 0.425	08	10	10	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34								
0.426 - 0.440	10	10	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34									
0.441 - 0.450	10	10	12	12	14	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34										
0.451 - 0.470	10	12	12	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34												
0.471 - 0.475	10	12	12	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34												
0.476 - 0.490	12	12	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34													
0.491 - 0.500	12	12	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34													
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0.676 - 0.690	20	20	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																													
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0.741 - 0.750	22	22	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34																																		
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0.801 - 0.820	24	26	26	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34																																							
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0.826 - 0.840	26	26	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																									
0.841 - 0.850	26	26	28	28	30	30	30	32	32	32	32	32	34	34	34																																										
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0.871 - 0.875	26	28	28	30	30	32	32	32	32	34	34	34	34																																												
0.876 - 0.890	28	28	30	30	32	32	32	32	34	34	34	34																																													
0.891 - 0.900	28	28	30	30	32	32	32	34	34	34	34	34																																													
0.901 - 0.925	28	30	30	32	32	34	34	34	34																																																		
0.926 - 0.950	30	30	32	32	34	34	34																																																				
0.951 - 0.975	30	32	32	34	34																																																						
0.976 - 1.000	32	32	34	34																																																						
1.001 - 1.025	32	34	34																																																							
1.026 - 1.050	34	34																																																								
1.051 - 1.075|34|																																																								

Shim thicknesses mm (in.)

Shim No.	Thickness	Shim No.	Thickness
02	2.500 (0.0984)	20	2.950 (0.1161)
04	2.550 (0.1004)	22	3.000 (0.1181)
06	2.600 (0.1024)	24	3.050 (0.1201)
08	2.650 (0.1043)	26	3.100 (0.1220)
10	2.700 (0.1063)	28	3.150 (0.1240)
12	2.750 (0.1083)	30	3.200 (0.1260)
14	2.800 (0.1102)	32	3.250 (0.1280)
16	2.850 (0.1122)	34	3.300 (0.1299)
18	2.900 (0.1142)		

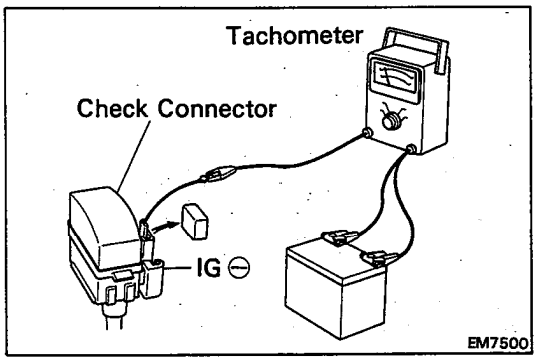
Exhaust valve clearance (cold):
0.20 – 0.30 mm (0.008 – 0.012 in.)

Example: A 2.800 mm shim is installed and the measured clearance is 0.450 mm.
Replace the 2.800 mm shim with shim No. 22 (3.000 mm).

INSPECTION AND ADJUSTMENT OF IGNITION TIMING

1. WARM UP ENGINE

Allow the engine to reach normal operating temperature.



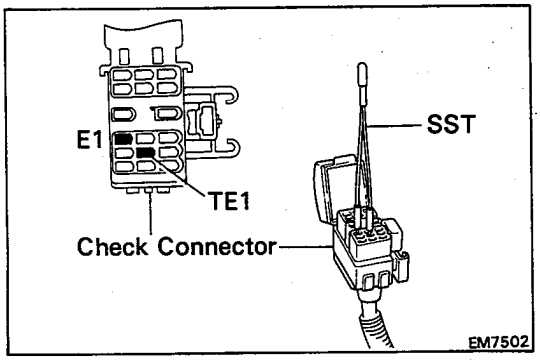
2. CONNECT TACHOMETER

Connect the test probe of a tachometer to terminal IG⊖ of the check connector.

LOCATION: See page FI-133

NOTICE:

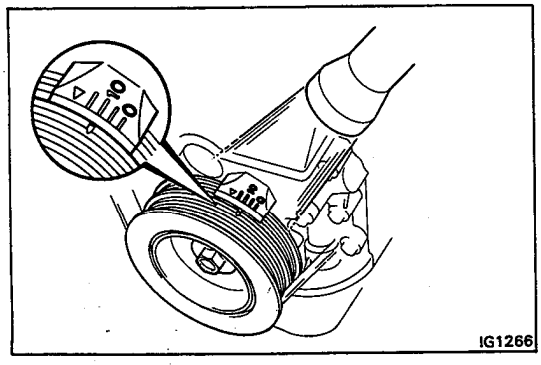
- **NEVER allow the tachometer terminal to touch ground as it could result in damage to the igniter and/or ignition coil.**
- **As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your unit before use.**



3. INSPECT AND ADJUST IGNITION TIMING

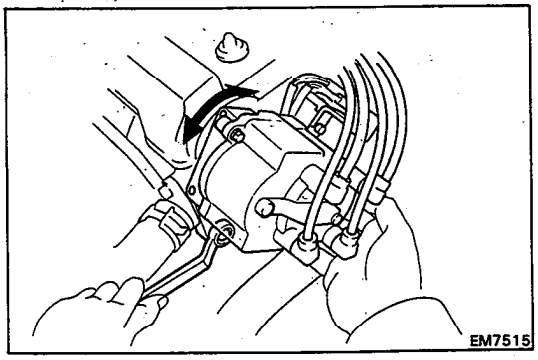
(a) Using SST, connect terminals TE1 and E1 of the check connector.

SST 09843-18020



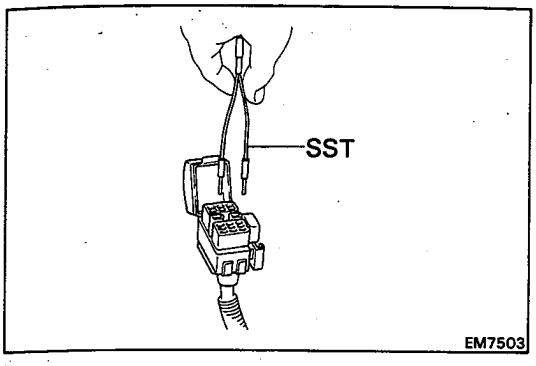
(b) Using a timing light, check the ignition timing.

Ignition timing: 10° BTDC @ idle (Transmission in neutral range)



If necessary, loosen the distributor bolts and turn the distributor. Recheck the timing after tightening the distributor bolts.

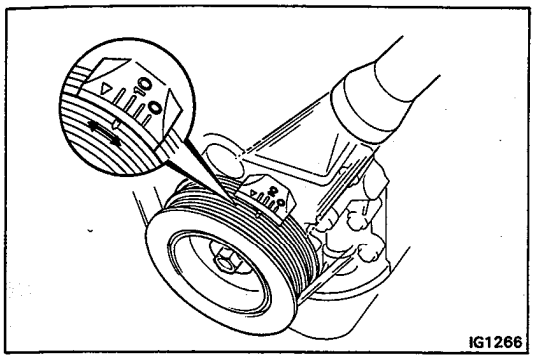
Torque: 200 kg-cm (14 ft-lb, 20 N·m)



4. FURTHER CHECK IGNITION TIMING

(a) Remove SST from the check connector.

SST 09843-18020



(b) Check the ignition timing.

Ignition timing: 5 — 15° BTDC @ idle
(Transmission in neutral range)

HINT: The timing mark move in a range between 5° to 15°.

5. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE

INSPECTION AND ADJUSTMENT OF IDLE SPEED (w/ TWC)

1. **INITIAL CONDITIONS**
   (a) Air clearance installed
   (b) Normal engine operating temperature
   (c) All pipes and hoses of air induction system connected
   (d) All vacuum lines connected

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

   (e) All accessories switched off
   (f) EFI system wiring connectors fully plugged
   (g) Ignition timing set correctly
   (h) Transmission in "neutral" range

2. **WARM UP ENGINE**
   Allow the engine to reach normal operating temperature.

3. **CONNECT TACHOMETER (See page EM-20)**

4. **CHECK AIR VALVE OPERATION (See page FI-131)**

5. **INSPECT AND ADJUST IDLE SPEED**
   (a) Race the engine at 2,500 rpm for about 90 seconds.
   (b) Using SST, connect terminals TE1 and E1 of the check connector.

   SST 09843-18020

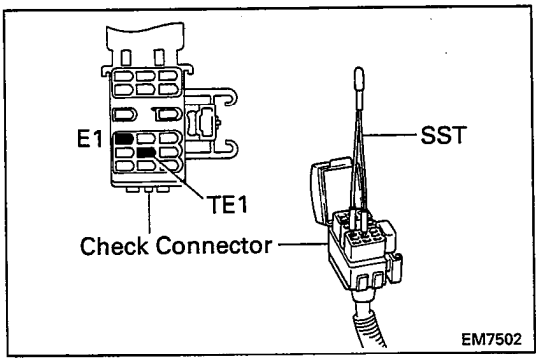
   (c) Check the idle speed.

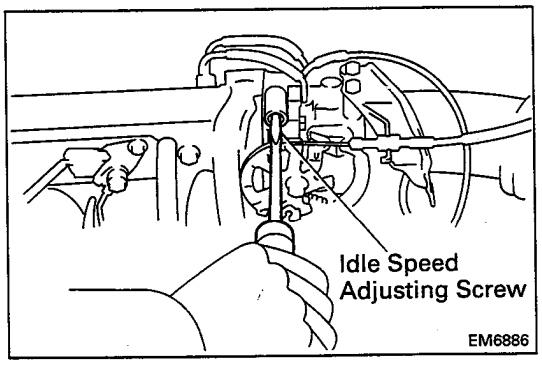
   Idle speed: 800 rpm (w/ Cooling fan OFF)

   If not as specified, adjust the idle speed by turning the IDLE SPEED ADJUSTING SCREW.

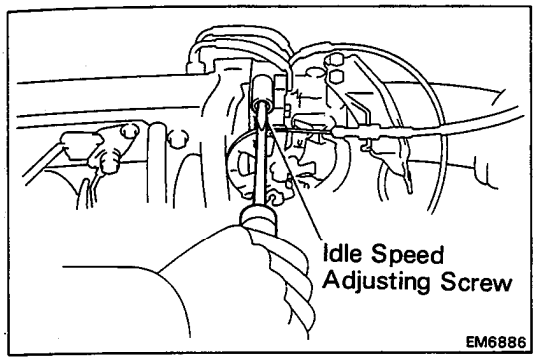
   (d) Remove the tachometer and SST.

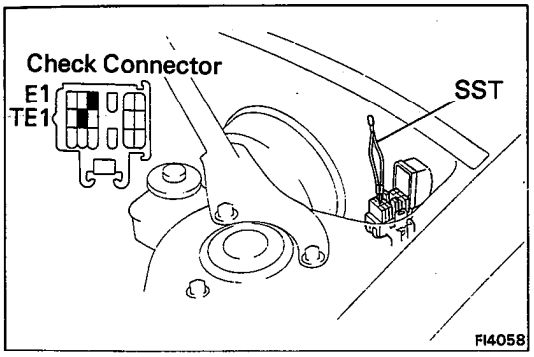
   SST 09843-18020

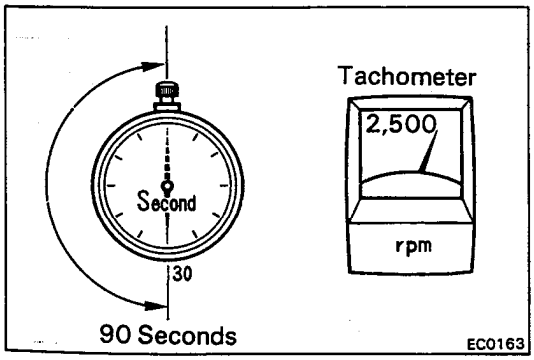


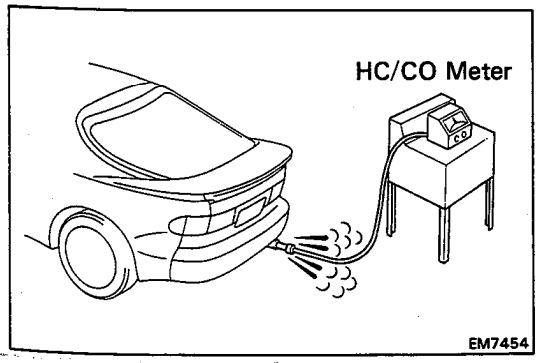


INSPECTION AND ADJUSTMENT OF IDLE SPEED AND IDLE MIXTURE (w/o TWC)









1. INITIAL CONDITIONS

(a) Air cleaner installed

(b) Normal engine operating temperature

(c) All pipes and hoses of air induction system connected

(d) All accessories switched off

(e) EFI system wiring connectors fully plugged

(f) Ignition timing set correctly

(g) Transmission in "neutral" range

(h) HC/CO meter operates normally

2. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

3. CONNECT TACHOMETER (See page EM-20)

4. CHECK AIR VALVE OPERATION (See page FI-131)

5. INSPECT AND ADJUST IDLE SPEED

Idle speed: 800 rpm (w/ Cooling fan OFF)

If not as specified, adjust the idle speed by turning the IDLE SPEED ADJUSTING SCREW.

6. ADJUST IDLE MIXTURE

NOTICE: Always use a HC/CO meter when adjusting the idle mixture. It is not necessary to adjust with the idle mixture adjusting screw in most vehicles if they are in good condition. If a CO meter is not available, DO NOT ATTEMPT TO ADJUST IDLE MIXTURE.

(a) Using SST, connect terminals TE1 and E1 of the check connector.

SST 09843-18020

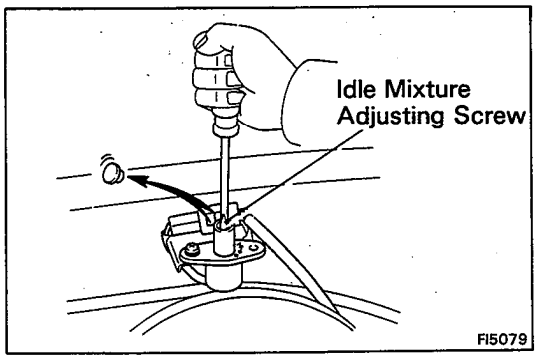
NOTICE: When short-circuiting of the terminal TE1, engine idle speed will be changed. Even so don't adjust engine idle speed.

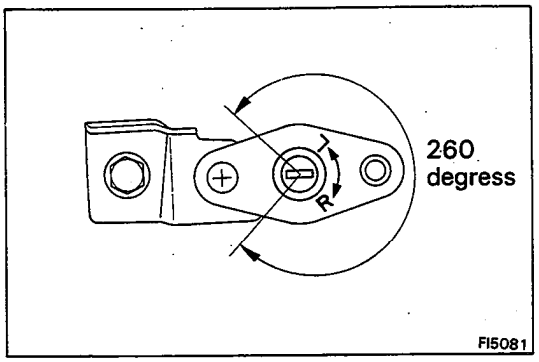
(b) Race the engine at 2,500 rpm for approx. 90 seconds.

(c) Insert a testing probe at least 40 cm (1.3 ft) into the tailpipe.

(d) Measure the concentration 1 – 3 minutes after racing the engine to allow the concentration to stabilize.

Idle CO concentration: 1.5 ± 0.5 % (w/ Cooling fan OFF)





If the CO concentration is not as specified, adjust the idle mixture by turning the IDLE MIXTURE ADJUSTING SCREW in the variable resistor.

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

HINT: Always check the idle speed after turning the idle mixture adjusting screw. If it is incorrect, repeat steps 5 and 6.

Troubleshooting

HC	CO	SYMPTOMS	CAUSES
High	Normal	Rough idle	1. Faulty ignition: ● Incorrect timing ● Fouled, shorted or improperly gapped plugs ● Open or crossed ignition wires ● Cracked IIA cap 2. Incorrect valve clearance 3. Leaky EGR valve (w/ EGR system) 4. Leakt intake and exhaust valves 5. Leaky cylinder
High	Low	Rough idle (Fluctuating HC reading)	1. Vacuum leak: ● Vacuum hose ● EGR valve (w/ EGR system) ● Intake manifold ● PCV line ● Throttle body ● Cylinder head gasket ● Brake booster line 2. Lean mixture causing misfire
HIgh	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged PCV valve 3. Faulty EFI system ● Faulty pressure regulator ● Clogged fuel return line ● Faulty vacuum sensor ● Defective water temp. sensor ● Defective intake air temp. sensor ● Faulty ECU ● Faulty injector ● Faulty cold start injector ● Faulty throttle position sensor

ENGINE TUNE-UP (4A-GE)

INSPECTION OF ENGINE COOLANT

(See steps 1 and 2 page CO-5)

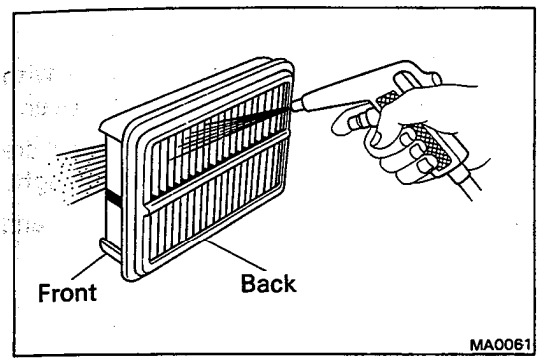
INSPECTION OF ENGINE OIL

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

INSPECTION OF BATTERY

(See steps 1 and 2 page CH-3)

Standard specific gravity:
1.25 — 1.27 when fully charged at 20°C (68°F)



INSPECTION OF AIR FILTER

1. **INSPECT AIR FILTER**

   Visually check that the element is not excessively dirty, damaged or oily.

2. **CLEAN AIR FILTER**

   Clean the element with compressed air.

   First blow from the back thoroughly. Then blow off the front of the element.

INSPECTION OF HIGH-TENSION CORDS

(See page IG-11)

Maximum resistance: 25 kΩ per cord

INSPECTION OF SPARK PLUGS

Conventional Tipped Type
(See page IG-11)

Correct electrode gap: 0.8 mm (0.031 in.)
Recommended spark plugs:
ND K20R-U
NGK BKR6EYA

Platinum Tipped Type
(See page IG-12)

Maximum electrode gap: 1.0 mm (0.039 in.)
Correct electrode gap of new plug:
0.8 mm (0.031 in.)
Recommended spark plugs:
ND PK20R8
NGK BKP6EP8

INSPECTION OF ALTERNATOR DRIVE BELT

(See step 3 page CH-3)

Drive belt deflection:
New belt 4 — 5 mm (0.16 — 0.20 in.)
Used belt 6 — 7 mm (0.24 — 0.28 in.)
Drive belt tension (Reference):
New belt 70 — 80 kg
Used belt 30 — 45 kg

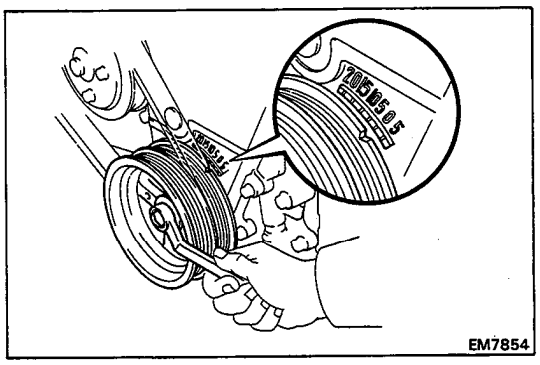
INSPECTION AND ADJUSTMENT OF VALVE CLEARANCE

HINT: Inspect and adjust the valve clearance when the engine is cold.

1. REMOVE PLUG CORD COVER

2. DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS

3. REMOVE CYLINDER HEAD COVERS (See page EM-95)

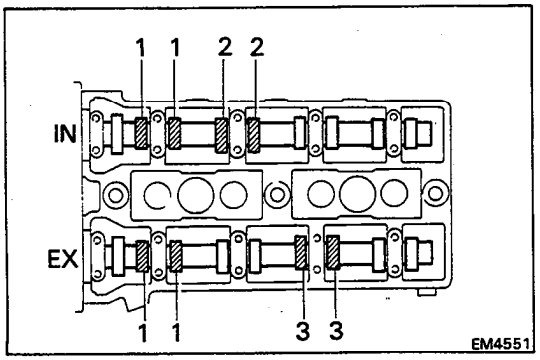


4. SET NO.1 CYLINDER TO TDC/COMPRESSION

(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 cylinder are tight.

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



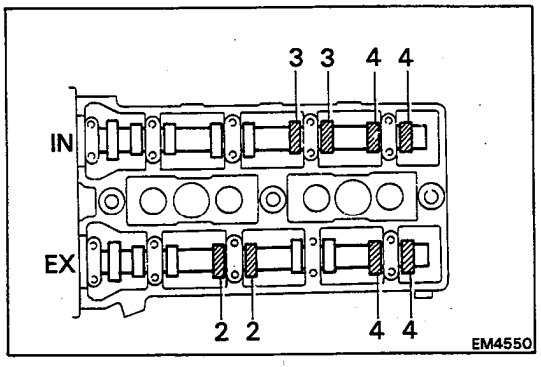
5. INSPECT VALVE CLEARANCE

(a) Check 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.

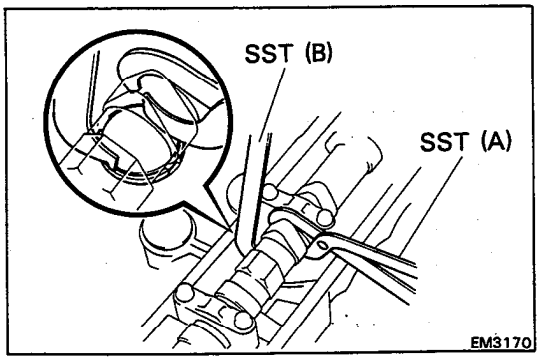
Valve clearance (Cold):

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 4)

(c) Check only the valves indicated as shown. Measure the valve clearance. (See procedure step (a)).

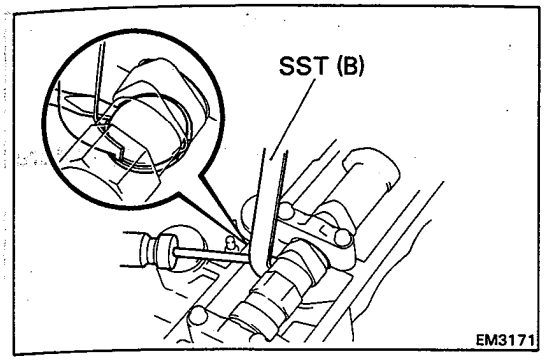


6. ADJUST VALVE CLEARANCE

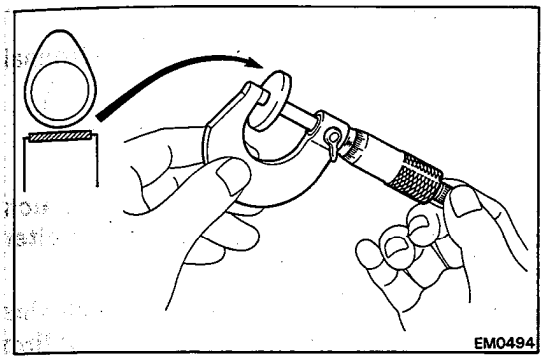
(a) Remove the adjusting shim.

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



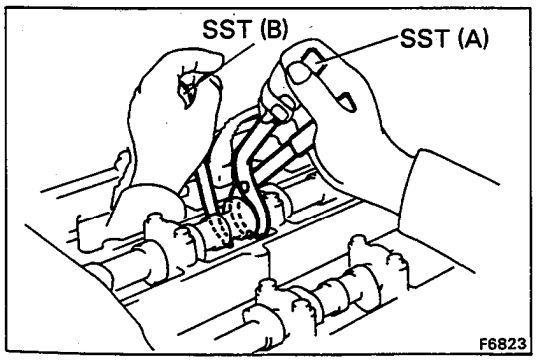
(b) Determine the replacement adjusting shim size by using the following Formula or Charts:
- Using a micrometer, measure the thickness of the shim which was removed.
- Calculate the thickness of a new shim so the valve clearance comes within specified value.

T ..... Thickness of used shim
A ..... Measured valve clearance
N ..... Thickness of new shim

Intake N = T + (A − 0.20 mm (0.008 in.))
Exhaust N = T + (A − 0.25 mm (0.010 in.))

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

HINT: 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.).



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

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(d) Recheck the valve clearance.

7. REINSTALL CYLINDER HEAD COVERS
(See page EM-113)

8. CONNECT HIGH-TENSION CORDS TO SPARK PLUGS

9. REINSTALL PLUG CORD COVER

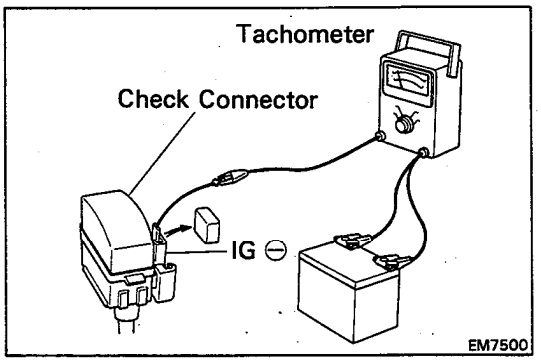
Adjusting Shim Selection Chart

(See pages EM-18 and 19)

INSPECTION AND ADJUSTMENT OF IGNITION TIMING

1. WARM UP ENGINE

Allow the engine to reach normal operating temperature.



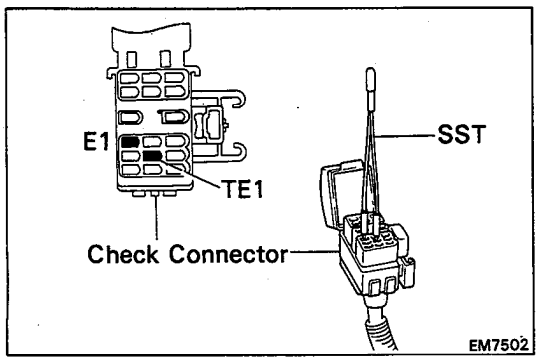
2. CONNECT TACHOMETER

Connect the test probe of a tachometer to terminal IG ⊖ of the check connector.

LOCATION: See page FI-133.

NOTICE:

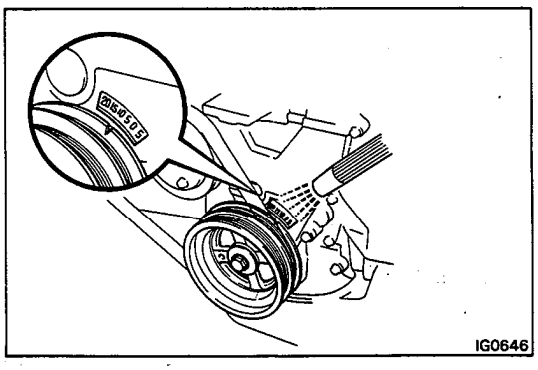
- **NEVER allow the tachometer terminal to touch ground as it could result in damage to the igniter and/or ignition coil.**
- **As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your unit before using.**



3. INSPECT AND ADJUST IGNITION TIMING

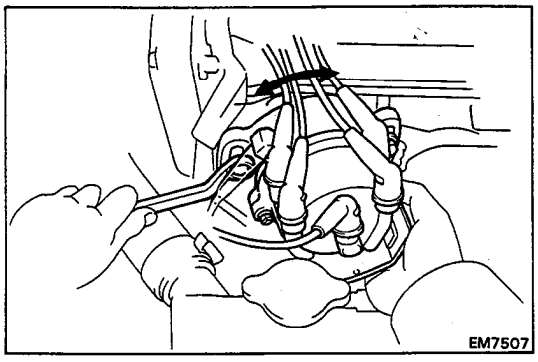
(a) Using SST, connect terminals TE1 and E1 of the check connector.

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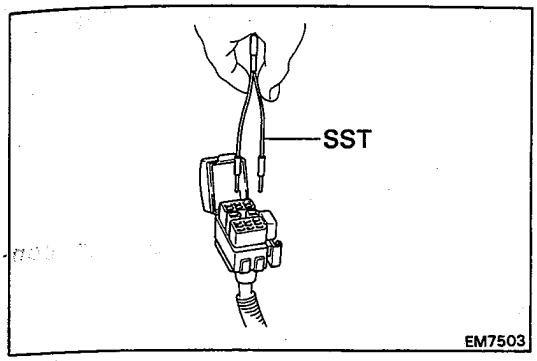
(b) Using a timing light, check the ignition timing.

Ignition timing: 10° BTDC @ idle
(Transmission in neutral range)



If necessary, loosen the distributor bolts and turn the distributor. Recheck the timing after tightening the distributor bolts.

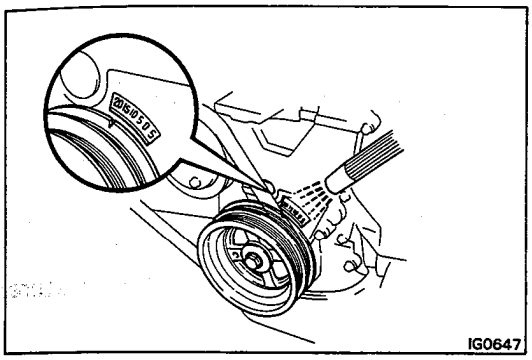
Torque: 200 kg-cm (14 ft-lb, 20 N·m)



4. FURTHER CHECK IGNITION TIMING

(a) Remove SST from the check connector.

SST 09843-18020



(b) Check the ignition timing.

Ignition timing: Approx. 16° BTDC @ idle (Transmission in neutral range)

5. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE

INSPECTION AND ADJUSTMENT OF IDLE SPEED (w/ TWC)

1. INITIAL CONDITIONS

(a) Air cleaner installed

(b) Normal engine operating temperature

(c) All pipes and hoses of air induction system connected

(d) All vacuum lines connected

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

(e) All accessories switched off

(f) EFI system wiring connectors fully plugged

(g) Ignition timing set correctly

(h) Transmission in "neutral" range

2. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

3. CONNECT TACHOMETER (See page EM-28)

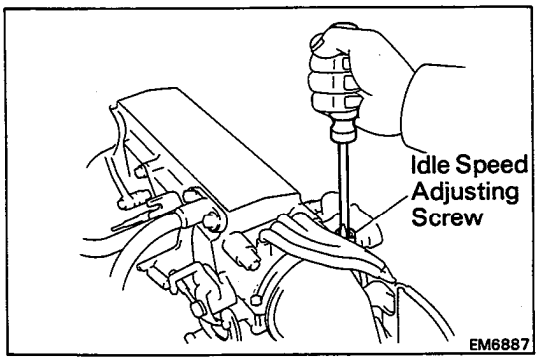
4. CHECK AIR VALVE OPERATION (See page FI-131)

5. INSPECT AND ADJUST IDLE SPEED

(a) Race the engine at 2,500 rpm for a few seconds.

(b) Check the idle speed.

Idle speed: 800 rpm (w/ Cooling fan OFF)



If not as specified, adjust the idle speed by turning the IDLE SPEED ADJUSTING SCREW.

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

1. INITIAL CONDITIONS

(a) Air cleaner installed

(b) Normal engine operating temperature

(c) All pipes and hoses of air induction system connected

(d) All accessories switched off

(e) EFI system wiring connectors fully plugged

(f) Ignition timing set correctly

(g) Transmission in "neutral" range

(h) HC/CO meter operates normally

2. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

3. CONNECT TACHOMETER (See page EM-28)

4. CHECK AIR VALVE OPERATION (See page FI-131)

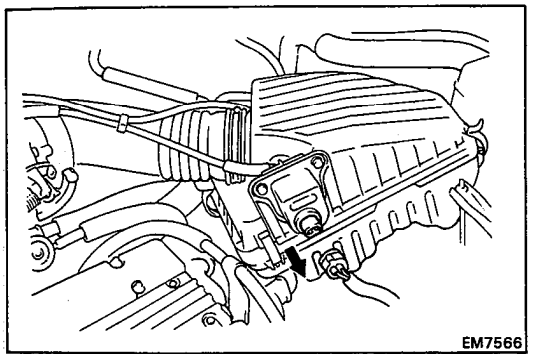
5. INSPECT AND ADJUST IDLE SPEED

(a) Disconnect the ACV connector.

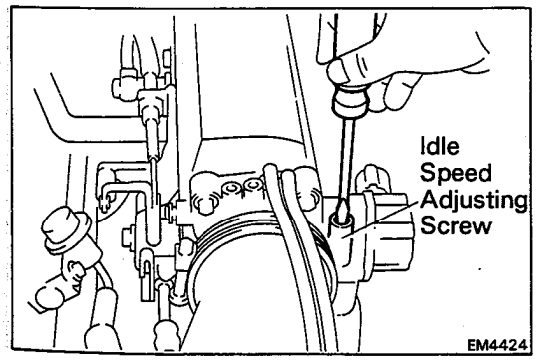
(b) Race the engine at 2,500 rpm for a few seconds.

(c) Check the idle speed.

Idle speed: 800 rpm (w/ Cooling fan OFF)


EM7566

If not as specified, adjust the idle speed by turning the IDLE SPEED ADJUSTING SCREW.



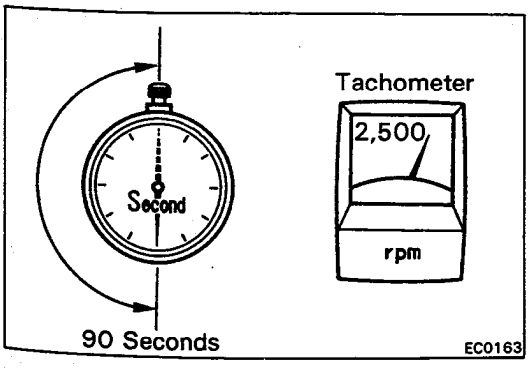
EM4424

(d) Connect the ACV connector.

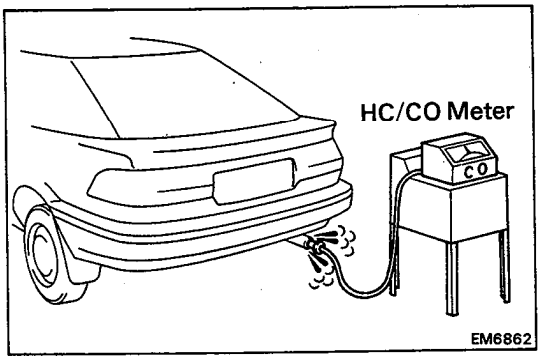
6. ADJUST IDLE MIXTURE

NOTICE: Always use a HC/CO meter when adjusting the idle mixture. It is not necessary to adjust with the idle mixture adjusting screw in most vehicles if they are in good condition. If a HC/CO meter is not available, DO NOT ATTEMPT TO ADJUST IDLE MIXTURE.

(a) Race the engine at 2,500 rpm for approx. 90 seconds.



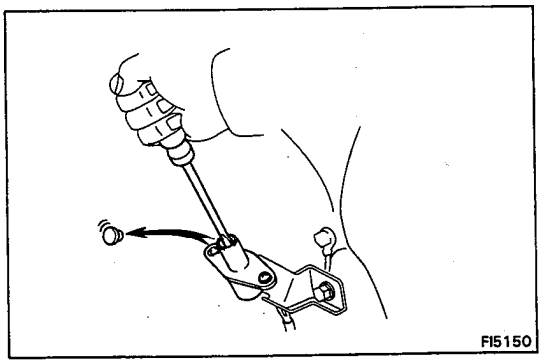
EC0163



(b) Insert a testing probe at least 40 cm (1.3 ft) into the tailpipe.

(c) Measure the concentration 1 – 3 minutes after racing the engine to allow the concentration to stabilize.

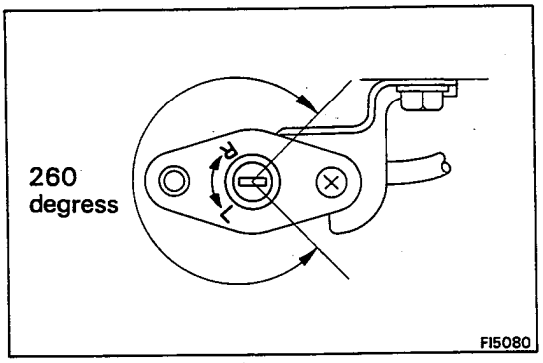
Idle CO concentration: 1.5 ± 0.5 %
(w/ Cooling fan OFF)



If the CO concentration is not as specified, adjust the idle mixture by turning the IDLE MIXTURE ADJUSTING SCREW in the variable resistor.

- If the concentration is within specification, the adjustment is complete.
- If the CO concentration cannot be corrected by idle mixture adjustment, see the table on page EM-34 for other possible causes.

HINT: Always check the idle speed after turning the idle mixture adjusting screw. If it is incorrect, repeat steps 5 and 6.



IDLE HC/CO CONCENTRATION CHECK METHOD (w/ TWC)

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

1. INITIAL CONDITIONS

(a) Engine to reach 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

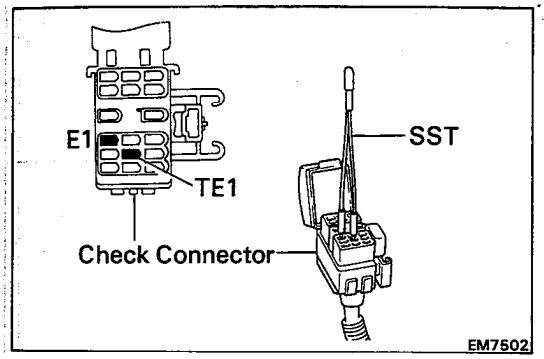
HINT: All vacuum hoses for EGR systems, etc. should be properly connected.

(f) EFI system wiring connectors fully plugged

(g) Ignition timing set correctly

(h) Transmission in neutral range

(i) Tachometer and HC/CO meter calibrated and at hand.



2. START ENGINE

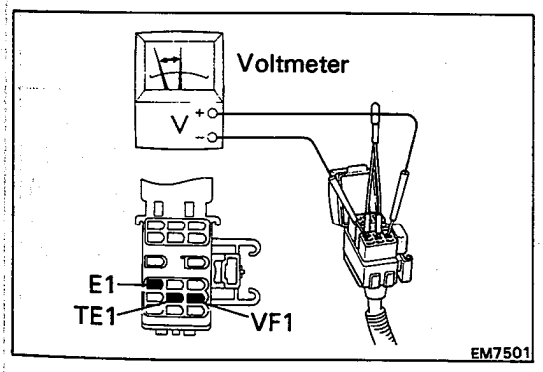
3. CHECK IDLE SPEED

Idle speed: 800 rpm

4. CHECK OXYGEN SENSOR OPERATION

(a) Using SST, connect the terminal TE1 and E1 of the check connector.

SST 09843-18020



(b) Connect the positive (+) probe of a voltmeter to terminal VF1 of the check connector, and negative (−) probe to terminal E1.

(c) Hold the engine speed at 2,500 rpm for approx. 90 seconds to warm up the oxygen sensor.

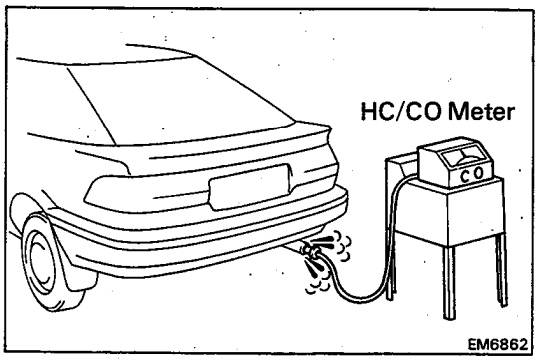
(d) Then, maintaining engine at 2,500 rpm. count how many times the needle of the voltmeter fluctuates between 0 and 5 V.

Minimum needle fluctuation:

4A-FE 8 times for every 10 seconds

4A-GE 6 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 PRM FOR APPROX. 120 SECONDS

6. INSERT CO METER TESTING PROBE INTO TAILPIPE AT LEST 40 cm (1.3 ft)

7. CHECK HC/CO CONCENTRATION AT IDLE

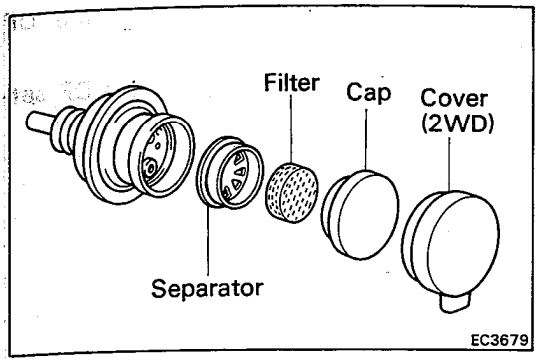
Wait at least one minute before measuring to allow the concentration to stabilize. Complete the measuring within three minutes.

Idle CO concentration: 0 — 0.5 %
(w/ Cooling fan OFF)

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

Troubleshooting

HC	CO	SYMPTOMS	CAUSES
High	Normal	Rough idle	1. Faulty ignition: ● Incorrect timing ● Fouled, shorted or improperly gapped plugs ● Open or crossed ignition wires ● Cracked IIA or distributor cap 2. Incorrect valve clearance 3. Leaky EGR valve (w/ EGR system) 4. Leaky intake and exhaust valves 5. Leaky cylinder
High	Low	Rough idle (Fluctuating HC reading)	1. Vacuum leak: ● Vacuum hose ● EGR valve (w/ EGR system) ● Intake manifold ● PCV line ● Throttle body ● Cylinder head gasket ● Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Clogged air filter 2. Plugged PCV valve (4A-FE) 3. Faulty EFI system ● Faulty pressure regulator ● Clogged fuel return line ● Faulty air flow meter (w/ air flow meter) ● Faulty vacuum sensor (w/o air flow meter) ● Defective water temp. sensor ● Defective intake air temp. sensor ● Faulty ECU ● Faulty injector ● Faulty cold start injector ● Faulty throttle position sensor



INSPECTION AND ADJUSTMENT OF DASH POT (DP) SYSTEM (4A-FE)

1. WARM UP AND STOP ENGINE

Allow the engine to reach normal operating temperature.

2. CHECK IDLE SPEED (See page EM-22, 23)

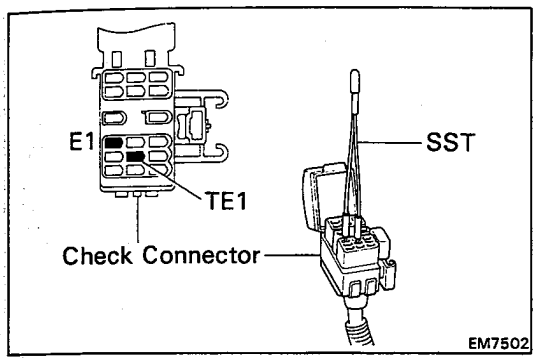
3. REMOVE COVER (2WD), CAP, FILTER AND SEPARATOR FROM DP

4. ADJUST DP SETTING SPEED

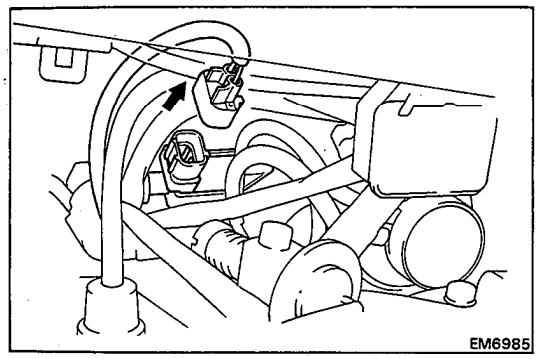
(a) (2WD)
Using SST, connect terminals TE1 and E1 of the check connector.

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LOCATION: See page FI-133

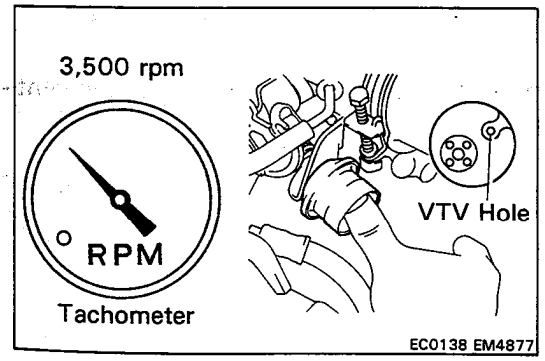


(b) (2WD w/ EGR system)
Disconnect the VSV connector.



(c) Race the engine at 3,500 rpm for a few seconds.

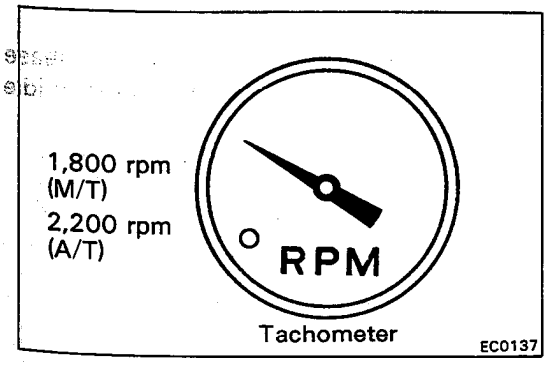
(d) Plug the VTV hole with your finger.

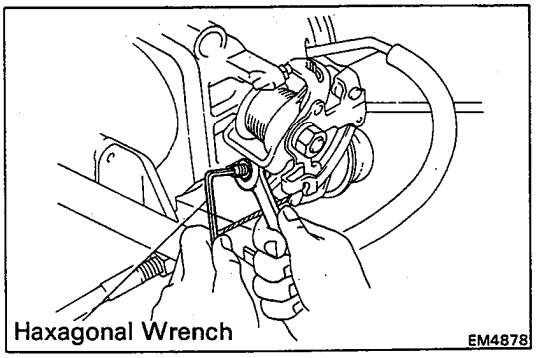


(e) Release the throttle valve.

(f) Check the DP setting speed.

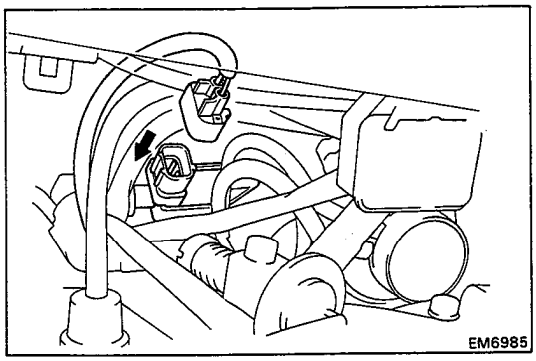
DP setting speed: M/T 1,800 rpm
A/T 2,200 rpm
(w/ Cooling fan OFF)



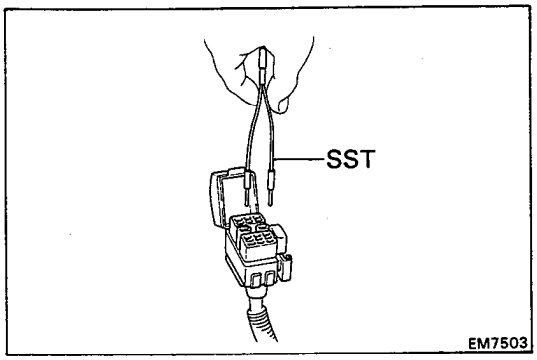


(g) Adjust the DP setting speed by turning the DP ADJUSTING SCREW.

(h) Repeat steps from (c) to (e), and recheck the DP setting speed.

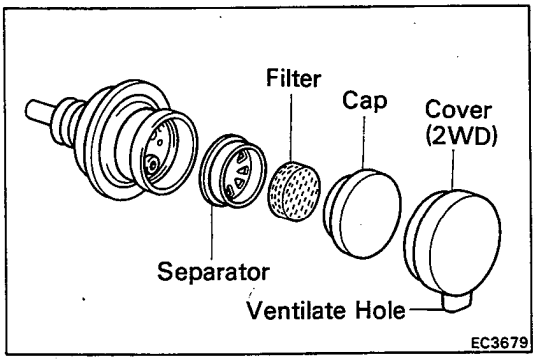


(i) (2WD w/ EGR system)
Connect the VSV connector.



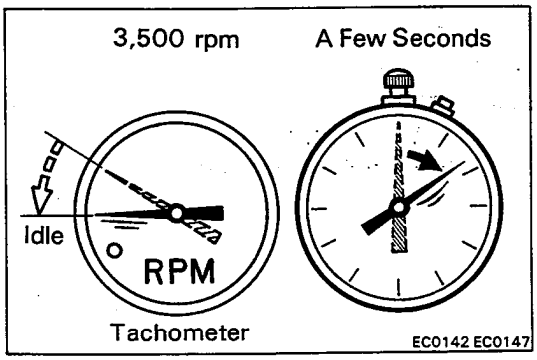
(j) (2WD)
Remove SST from the check connector.

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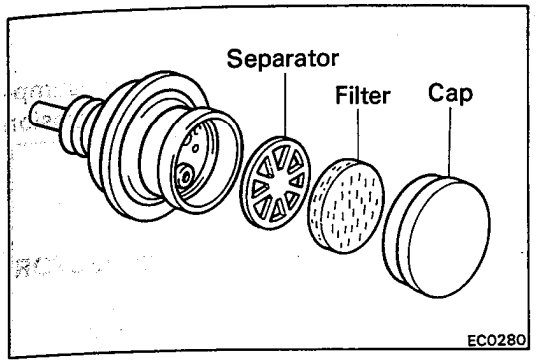
5. REINSTALL DP SEPARATOR, FILTER, CAP AND COVER (2WD)

HINT: When installing the cover, install it with the ventilate holes below.



6. CHECK VTV OPERATION

Race the engine at 3,500 rpm for a few seconds, release the throttle valve and check that the engine returns to idle in a few seconds.



INSPECTION AND ADJUSTMENT OF DASH POT (DP) SYSTEM (4A-GE w/ AIR FLOW METER)

1. WARM UP AND STOP ENGINE

Allow the engine to reach normal operating temperature.

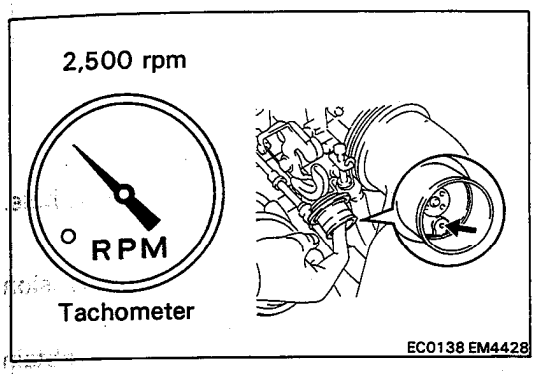
2. CHECK IDLE SPEED (See page EM-30)

3. REMOVE CAP, FILTER AND SEPARATOR FROM DP

4. ADJUST DP SETTING SPEED

(a) Race the engine at 2,500 rpm for a few seconds.

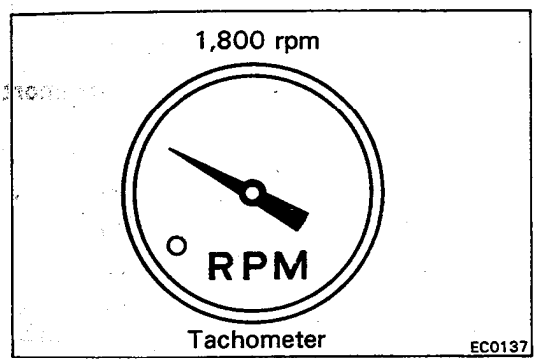
(b) Plug the VTV hole with your finger.



(c) Release the throttle valve.

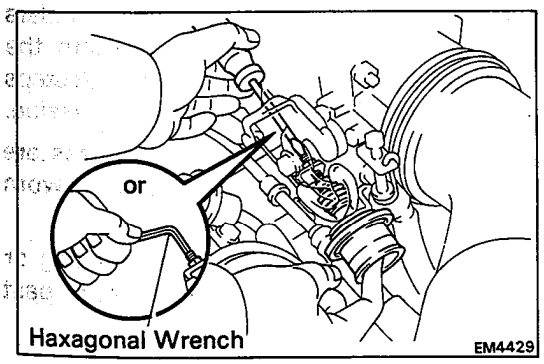
(d) Check the DP setting speed.

DP setting speed: 1,800 rpm (w/ Cooling fan OFF)



(e) Adjust the DP setting speed by turning the DP ADJUSTING SCREW.

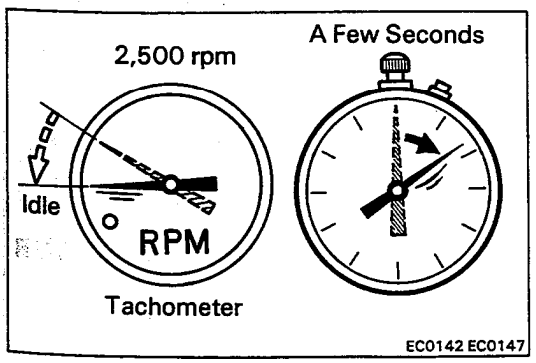
(f) Repeat steps from (a) to (c), and recheck the DP setting speed.



5. REINSTALL DP SEPARATOR, FILTER AND CAP

6. CHECK VTV OPERATION

Race the engine at 2,500 rpm for a few seconds, release the throttle valve and check that the engine returns to idle in a few seconds.



COMPRESSION CHECK

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

1. **WARM UP AND STOP ENGINE**
2. **DISCONNECT COLD START INJECTOR CONNECTOR**
3. **DISCONNECT DISTRIBUTOR CONNECTOR(S)**
4. **(4A-GE)**
   REMOVE PLUG CORD COVER
5. **REMOVE SPARK PLUGS (See page IG-7, 11)**
6. **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.

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

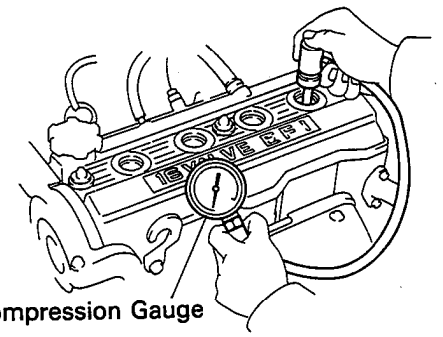
   (d) Repeat steps (a) through (c) for each cylinder.

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

   Compression pressure:
   4A-FE 13.5 kg/cm² (191 psi, 1,320 kPa)
   4A-GE 13.4 kg/cm² (190 psi, 1,314 kPa)
   Minimum pressure:
   10.0 kg/cm² (142 psi, 981 kPa)
   Difference between each cylinder:
   1.0 kg/cm² (14 psi, 98 kPa) or less

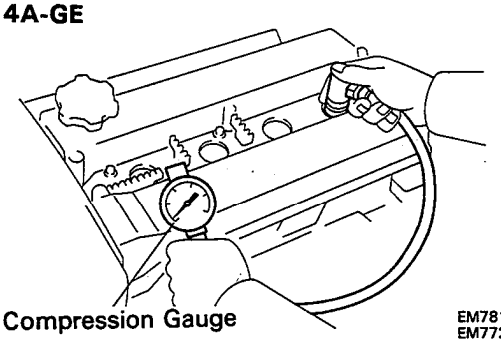
   (e) If the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for the cylinder with low compression.
   - If adding oil helps the compression, chances are that the piston rings and/or cylinder 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.
7. **REINSTALL SPARK PLUGS (See page IG-8, 12)**
   Torque: 180 kg-cm (13 ft-lb, 18 N·m)
8. **(4A-GE)**
   INSTALL PLUG CORD COVER
9. **RECONNECT DISTRIBUTOR CONNECTOR(S)**
10. **RECONNECT COLD START INJECTOR CONNECTOR**

4A-FE



Compression Gauge

4A-GE

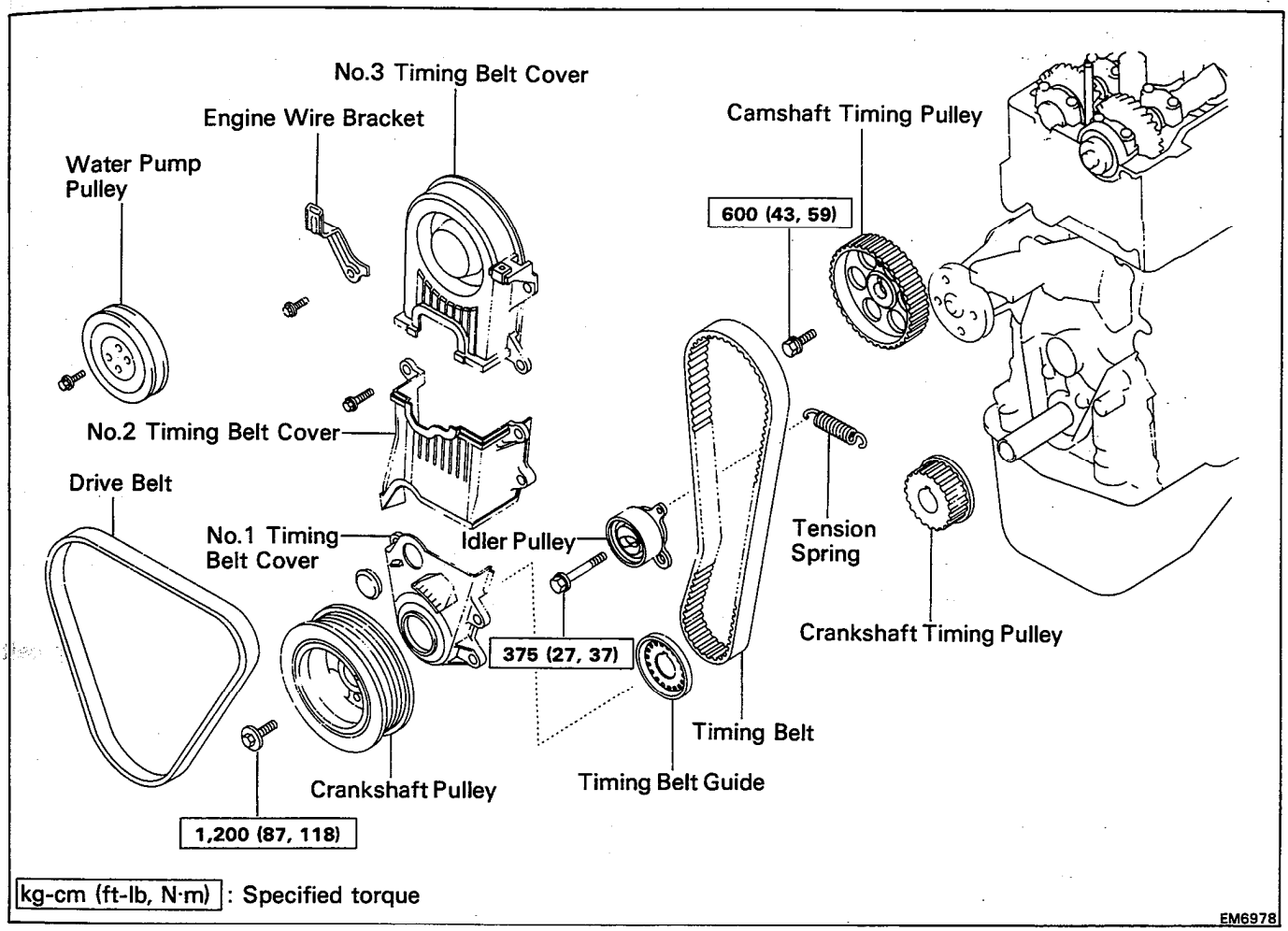


Compression Gauge

EM7816
EM7724

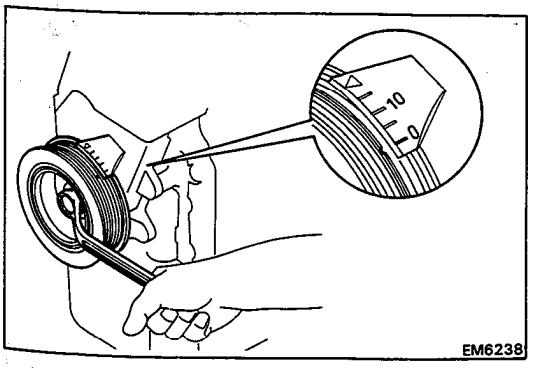
TIMING BELT (4A-FE)

COMPONENT



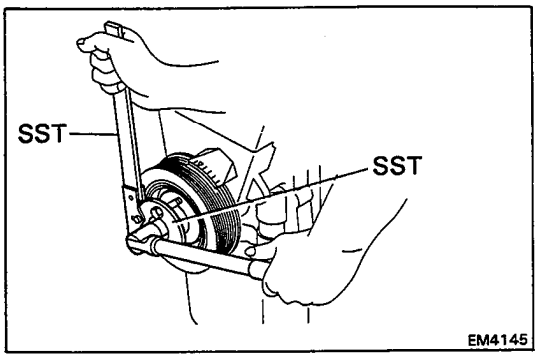
REMOVAL OF TIMING BELT

1. **REMOVE DRIVE BELT AND WATER PUMP PULLEY**
2. **REMOVE SPARK PLUGS (See page IG-7)**
3. **REMOVE CYLINDER HEAD COVER (See steps 8 and 12 on pages EM-60 and 62)**



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 hold of the camshaft timing pulley is aligned with the timing mark of the bearing cap.

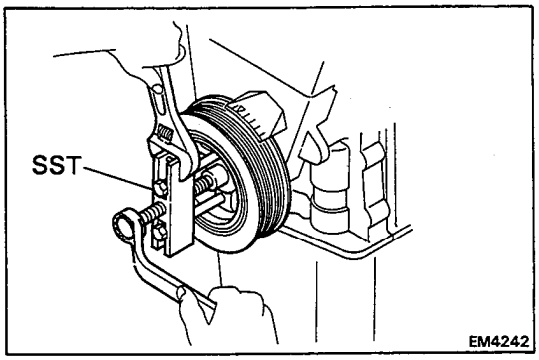
   If not, turn the crankshaft one revolution (360°).



5. REMOVE CRANKSHAFT PULLEY

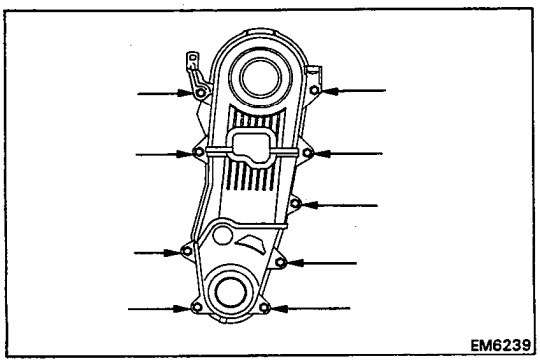
(a) Using SST to hold the crankshaft pulley, remove the pulley bolt.

SST 09213-14010 and 09330-00021



(b) Using SST, remove the pulley.

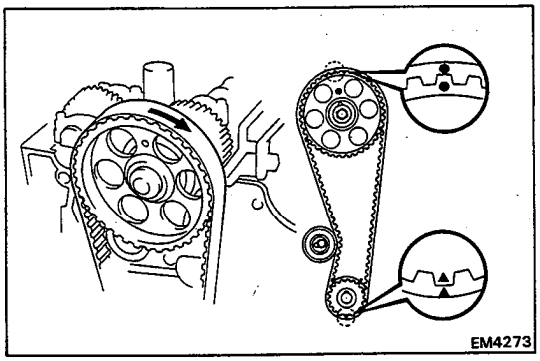
SST 09213-31021 w/o Dynamic Damper
SST 09213-60017 (09213-00020, 09213-00030 09213-00060) w/ Dynamic Damper



6. REMOVE TIMING BELT COVERS

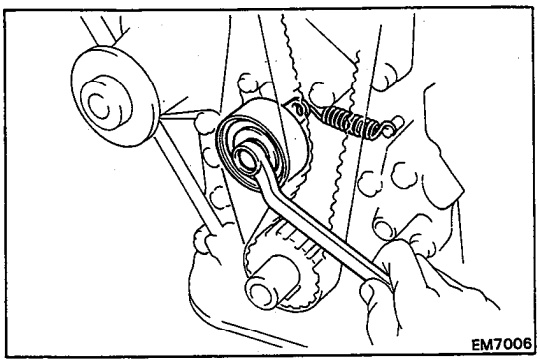
Remove the nine bolts, engine wire bracket and timing belt covers.

7. REMOVE TIMING BELT GUIDE



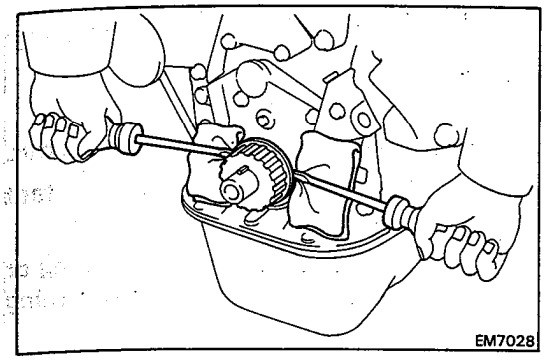
8. REMOVE TIMING BELT AND IDLER PULLEY

HINT: If reusing the timing belt, draw a direction arrow on the belt (in the direction of engine revolution), and place matchmarks on the pulleys and belt as shown in the illustration.



(a) Remove the bolt, idler pulley and tension spring.

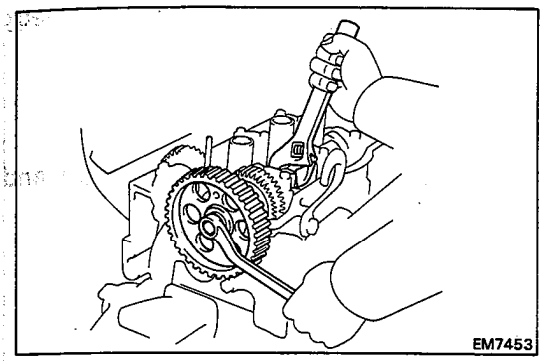
(b) Remove the belt.



9. REMOVE CRANKSHAFT TIMING PULLEY

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

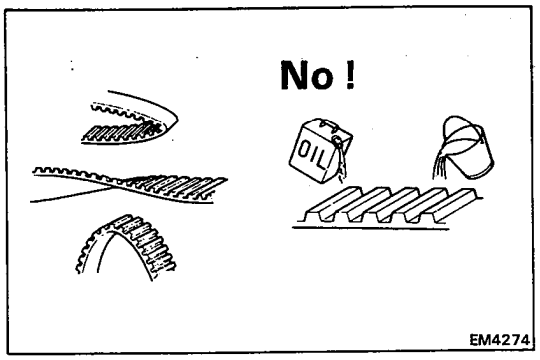
NOTICE: Position shop rags as shown to prevent damage.

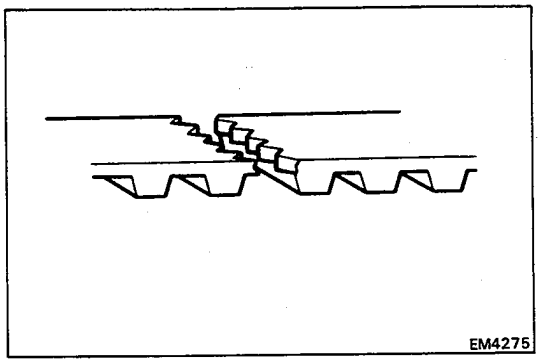


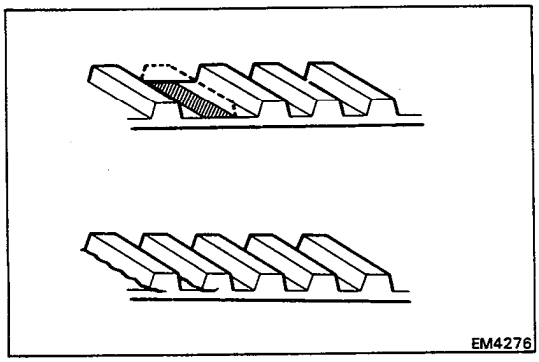
10. REMOVE CAMSHAFT TIMING PULLEY

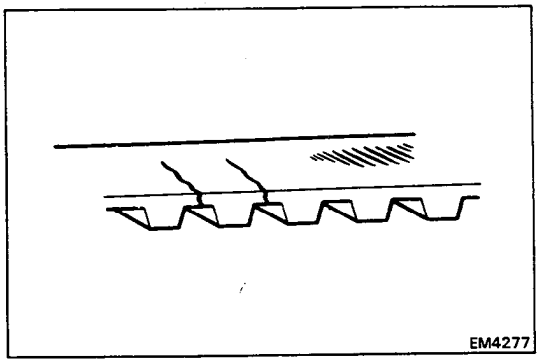
Hold the hexagonal head wrench portion of the camshaft with a wrench, and remove the bolt and timing pulley.

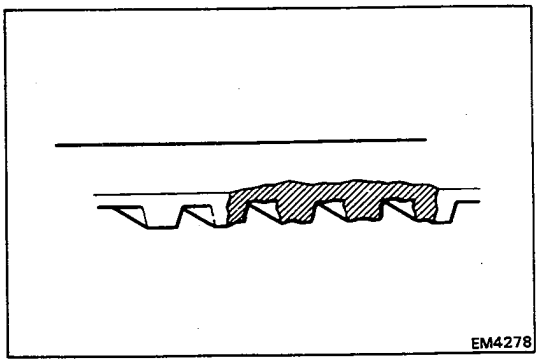
NOTICE: Be careful not to damage the cylinder head with the wrench.











INSPECTION OF TIMING COMPONENTS

1. INSPECT TIMING BELT

NOTICE:

- **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 any defects as shown in the illustrations, check the following points:

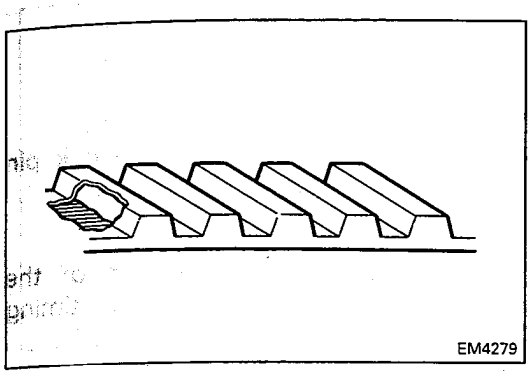
(a) Premature splitting

- Check the 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 camshaft or water pump is locked.

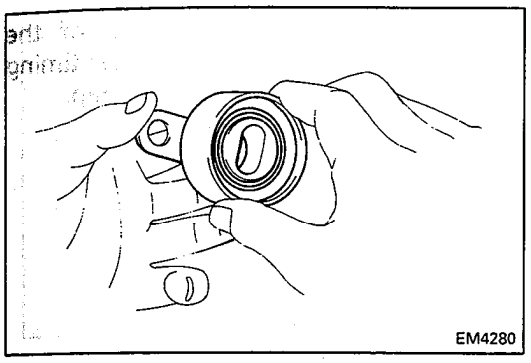
(c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on one side of the idler pulley lock.

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


EM4279

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

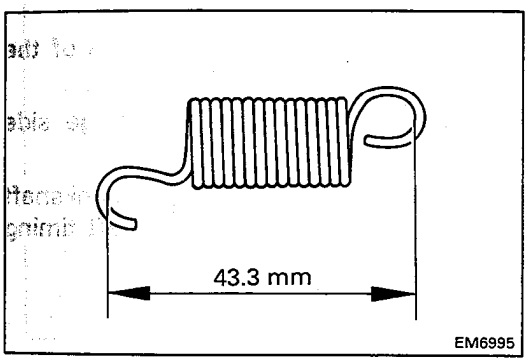
If necessary, replace the timing belt.


EM4280

2. **INSPECT IDLER PULLEY**

Check the turning smoothness of the idler pulley.

If necessary, replace the idler pulley.



EM6995

3. **INSPECT TENSION SPRING**

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

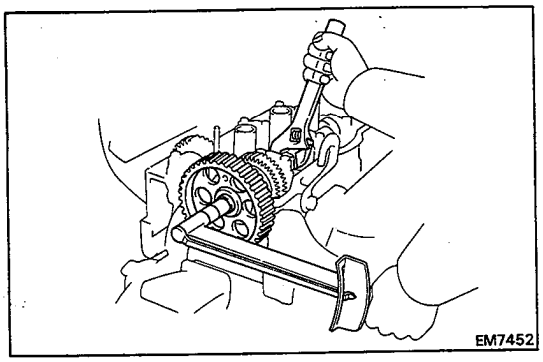
Free length: 43.3 mm (1.705 in.)

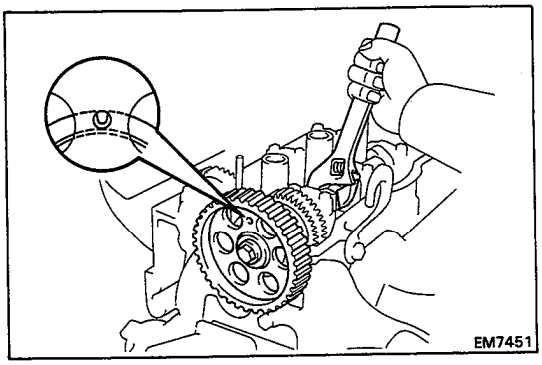
If the free length is not as specified, replace the tension spring.

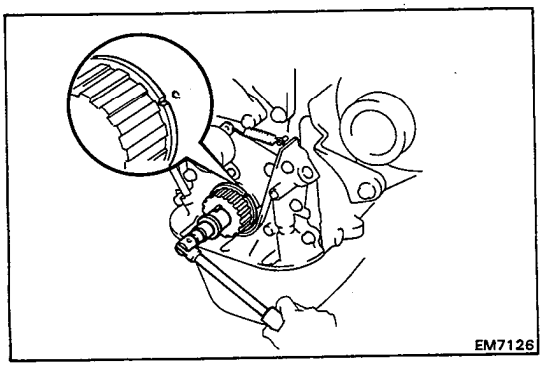
(b) Measure the tension of the tension spring at the specified installed length.

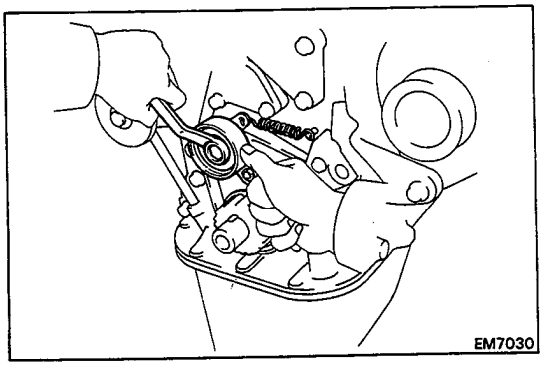
Installed tension:
65 – 73 N (6.6 – 7.4 kgf, 14.6 – 16.3 lbf)
at 50.2 mm (1.976 in.)

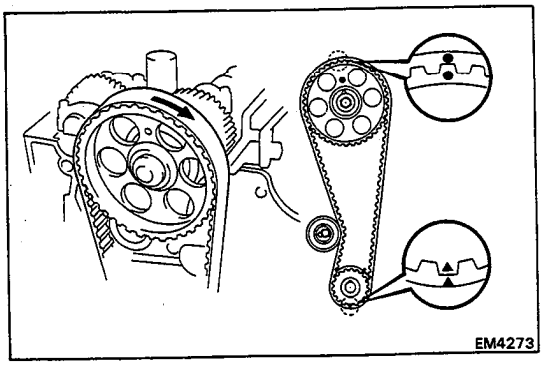
If the tension is not as specified, replace the tension spring.











INSTALLATION OF TIMING BELT

(See page EM-39)

1. INSTALL CAMSHAFT TIMING PULLEY

(a) Align the camshaft knock pin with the knock pin groove of the pulley, and slide on the pulley.

(b) Temporarily install the timing pulley bolt.

(c) Hold the hexagonal wrench head portion of the camshaft with a wrench, and tighten the timing pulley bolt.

Torque: 600 kg-cm (43 ft-lb, 59 N·m)

(d) Turn the hexagonal wrench head portion of the camshaft, and align the hole of the camshaft timing pulley with the timing mark of the bearing cap.

2. INSTALL CRANKSHAFT TIMING PULLEY

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

(b) Slide on the timing pulley, facing the flange side inward.

(c) Using the crankshaft pulley bolt, turn the crankshaft and align the timing marks of the crankshaft timing pulley and oil pump body.

3. TEMPORARILY INSTALL IDLER PULLEY AND TENSION SPRING

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

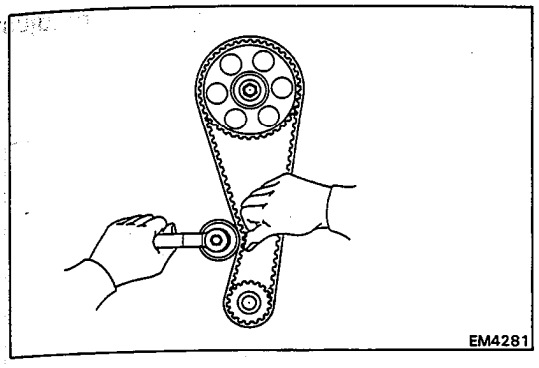
(b) Install the tension spring.

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

4. INSTALL TIMING BELT

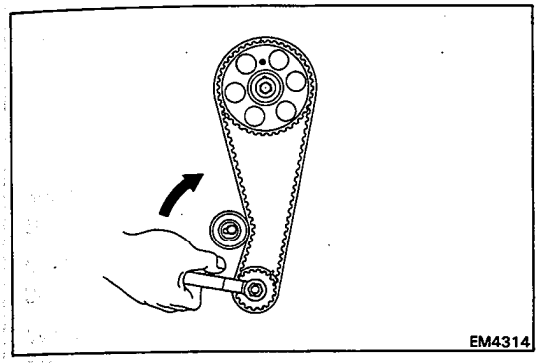
NOTICE: The engine should be cold.

HINT: 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.



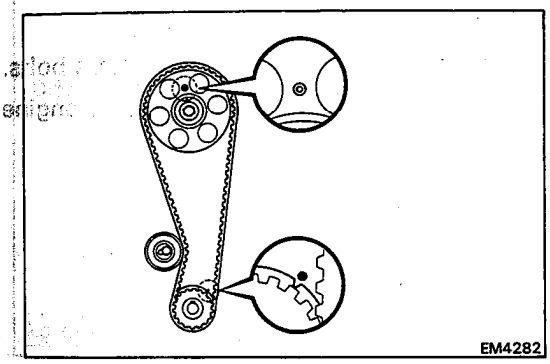
5. CHECK VALVE TIMING AND TIMING BELT TENSION

(a) Loosen the idler pulley bolt.

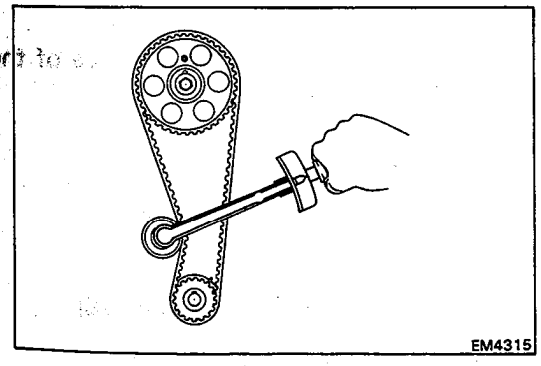


(b) Temporarily install the crank pulley bolt and turn the crankshaft two revolutions from TDC to TDC.

HINT: Always turn the crankshaft clockwise.



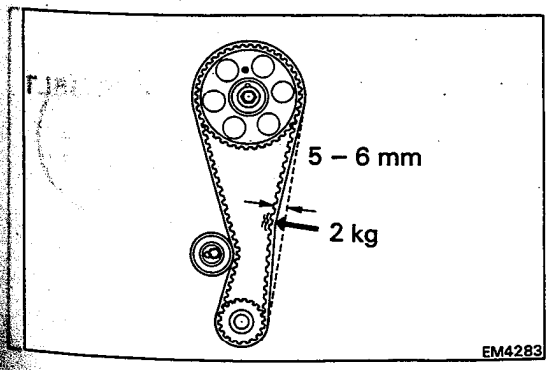
(c) Check the valve timing.
Ensure that each pulley aligns with the marks as shown in the illustration.



(d) Tighten the timing belt idler pulley mount bolt.

Torque: 375 kg-cm (27 ft-lb, 37 N·m)

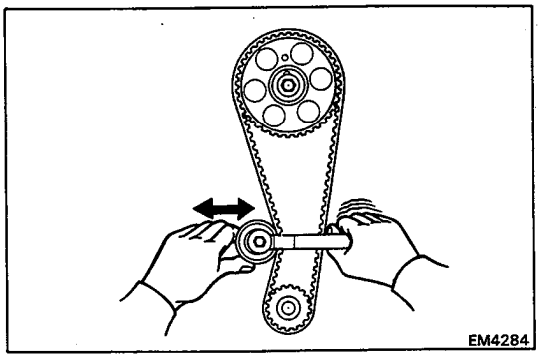
(e) Remove the temporarily installed crank pulley bolt.



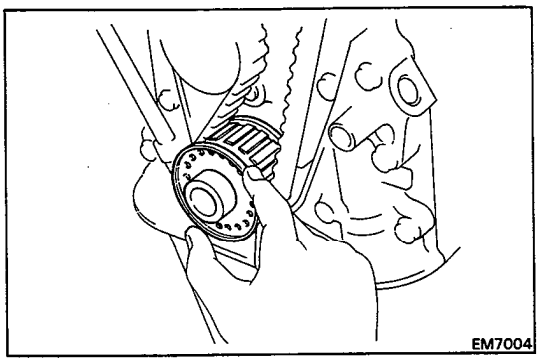
(Reference)

(a) Measure the timing belt deflection as shown in the illustration.

Deflection: 5 – 6 mm (0.20 – 0.24 in.) at 2 kg (4.4 lb, 20 N)

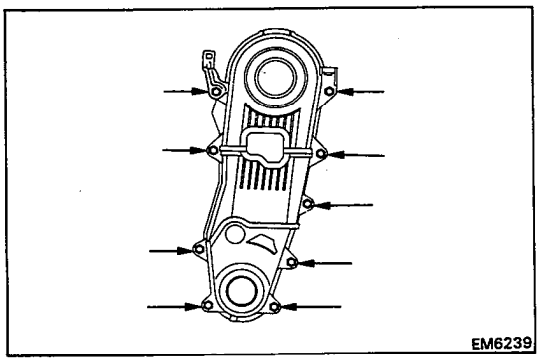


(b) If the measured value is not within standard, readjust with the idler pulley.



6. INSTALL TIMING BELT GUIDE

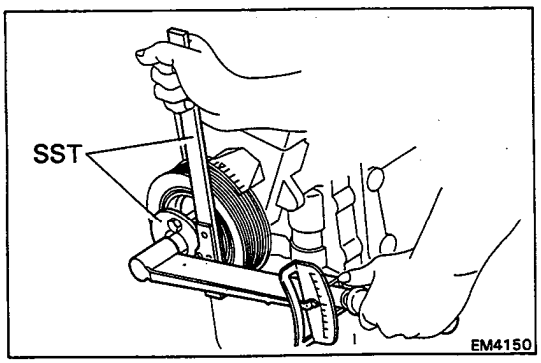
Install the guide, facing the cup side outward.



7. INSTALL TIMING BELT COVERS

(a) Install the No.1 timing belt cover with the three bolts.

(b) Install the No.2, No.3 timing belt covers and engine wire bracket with the six bolts.



8. INSTALL CRANKSHAFT PULLEY

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

(b) Temporarily install the pulley bolt.

SST 09213-14010 and 09330-00021

Torque: 1,200 kg-cm (87 ft-lb, 118 N·m)

9. INSTALL CYLINDER HEAD COVER
(See steps 14 and 18 on pages EM-86 and 88)

10. INSTALL SPARK PLUGS (See page IG-8)

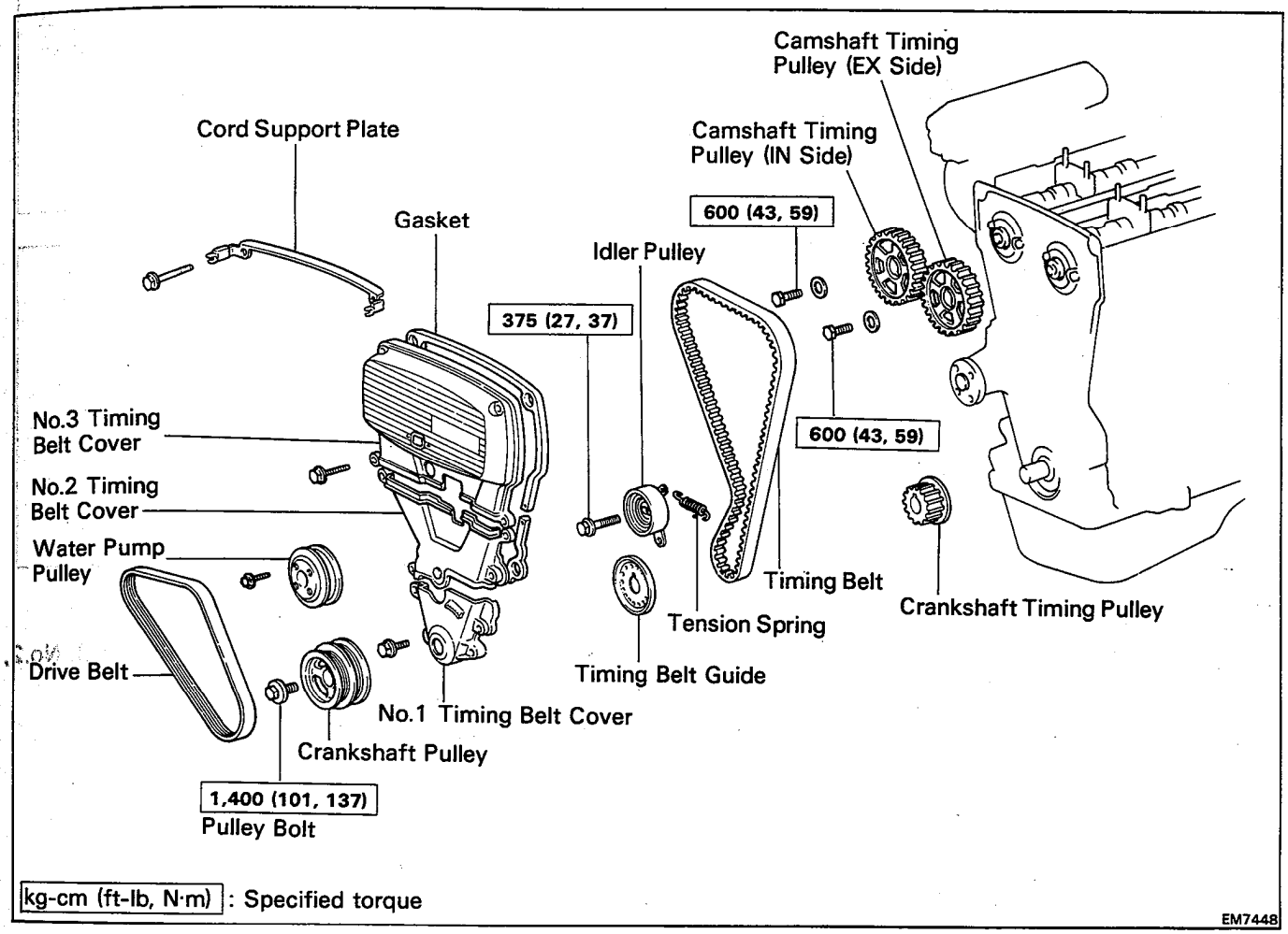
Torque: 180 kg-cm (13 ft-lb, 18 N·m)

11. INSTALL WATER PUMP PULLEY AND DRIVE BELT

12. CHECK AND ADJUST DRIVE BELT
(See step 3 on pages CH-3 and 4)

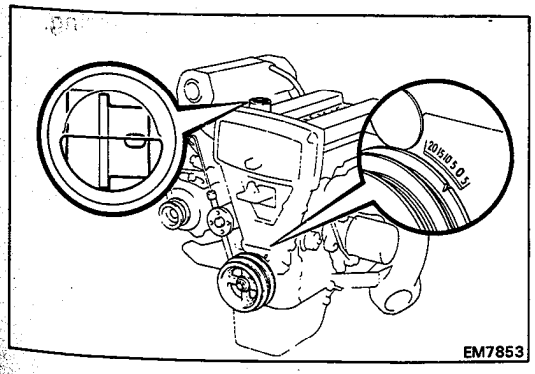
TIMING BELT (4A-GE)

COMPONENTS



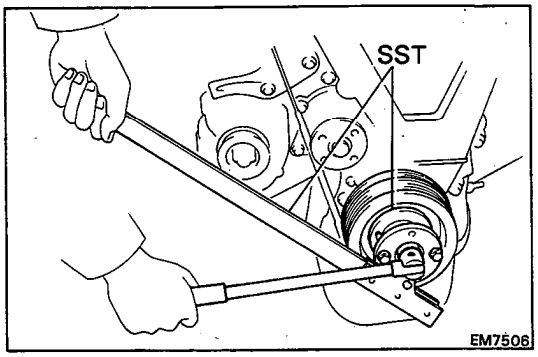
REMOVAL OF TIMING BELT

1. **REMOVE WATER PUMP PULLEY AND DRIVE BELT**
2. **DISCONNECT ENGINE WIRE FROM NO.4 TIMING BELT COVER**
   (See step 2 on page EM-93)
3. **REMOVE PLUG CORD COVER**
4. **REMOVE SPARK PLUGS (See page IG-11)**



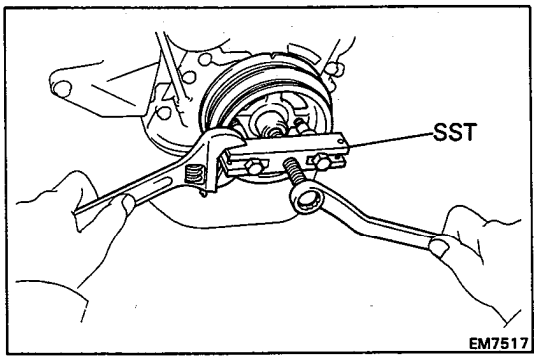
5. **SET NO.1 CYLINDER TO TDC/COMPRESSION**
   (a) Turn the crankshaft pulley and align its groove with the timing mark "O" of the No. 1 timing belt cover.
   (b) Remove the oil filler cap and check that you can see the cavity in the camshaft.

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

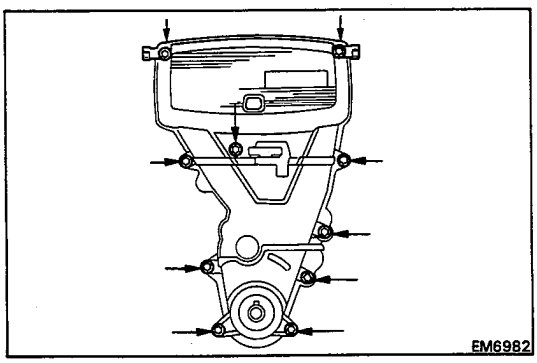


6. REMOVE CRANKSHAFT PULLEY

(a) Using SST, remove the pulley mount bolt.
SST 09213-70010 and 09330-00021



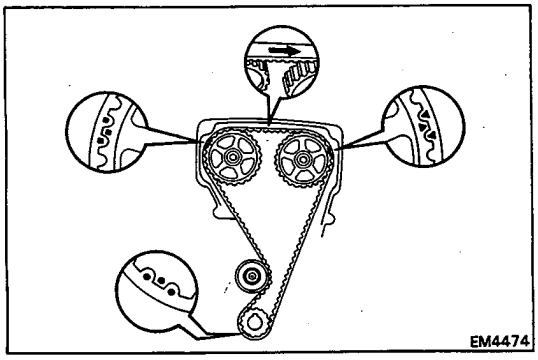
(b) Using SST, remove the pulley.
SST 09213-31021



7. REMOVE TIMING BELT COVERS

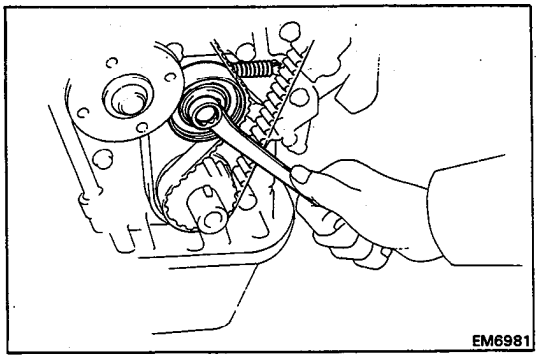
Remove the ten bolts, cord support plate, the No.3, No.2, No.1 belt covers and gaskets.

8. REMOVE TIMING BELT GUIDE



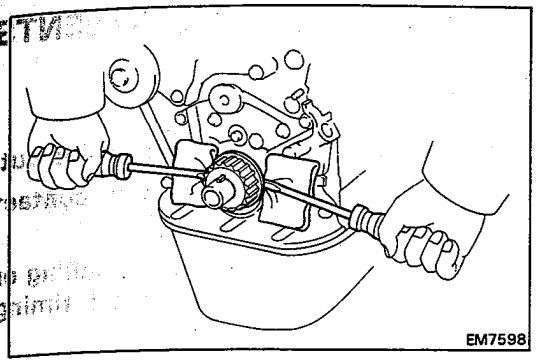
9. REMOVE TIMING BELT AND IDLER PULLEY

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



(a) Remove the bolt, idler pulley and tension spring.

(b) Remove the belt.

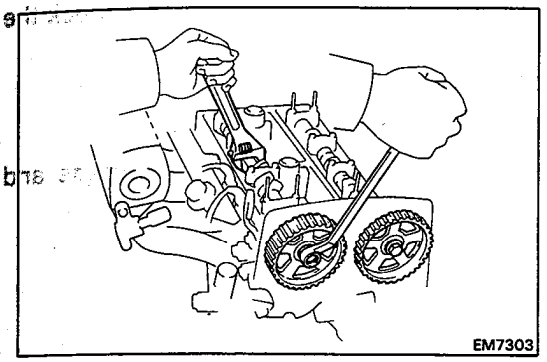

EM7598

10. REMOVE CRANKSHAFT TIMING PULLEY

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

NOTICE: Position shop rags as shown to prevent damage.

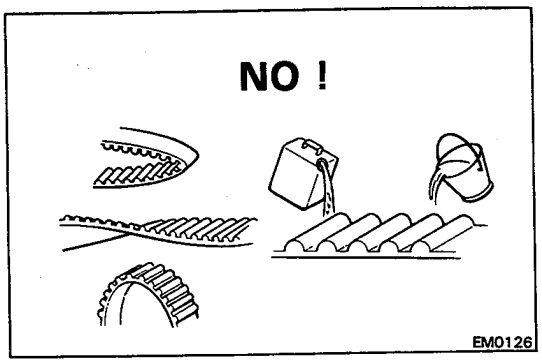
11. REMOVE CYLINDER HEAD COVERS
(See step 16 on page EM-95)

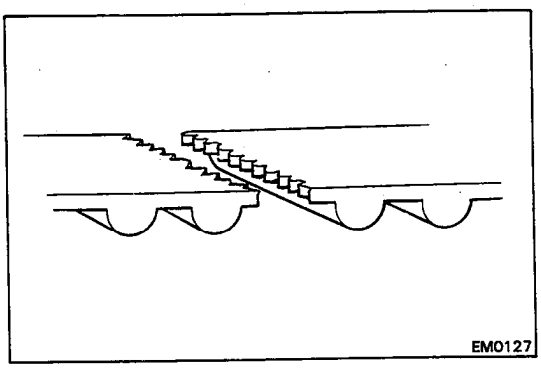

EM7303

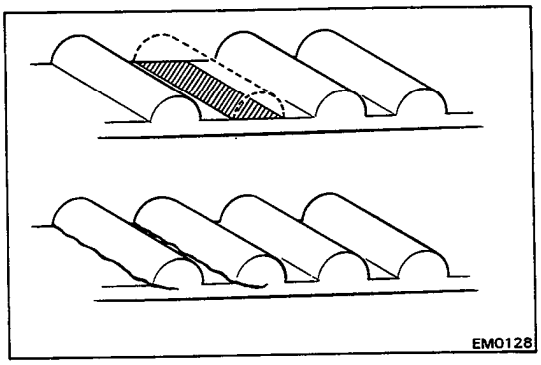
12. REMOVE CAMSHAFT TIMING PULLEYS

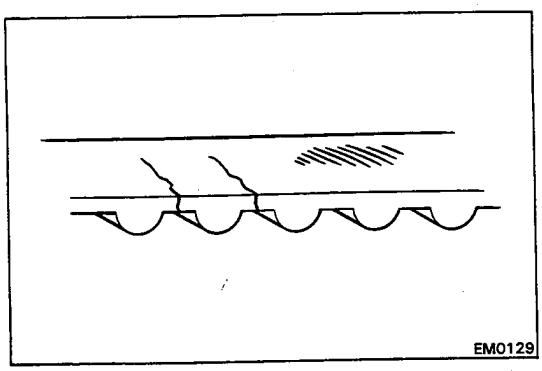
Hold the hexagonal head wrench portion of the camshaft with a wrench, and remove the bolt and timing pulley.

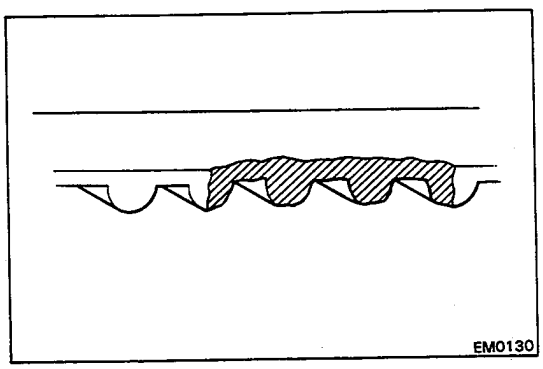
NOTICE: Be careful not to damage the cylinder head with the wrench.











INSPECTION OF TIMING BELT COMPONENTS

1. INSPECT TIMING BELT

NOTICE:

- **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 defects as shown in the illustrations, check the following points:

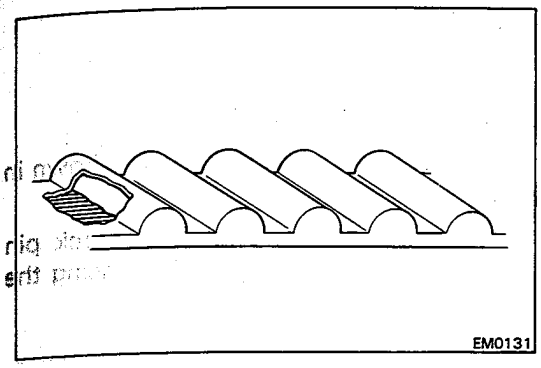
(a) Premature splitting

- 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 or water pump is locked.

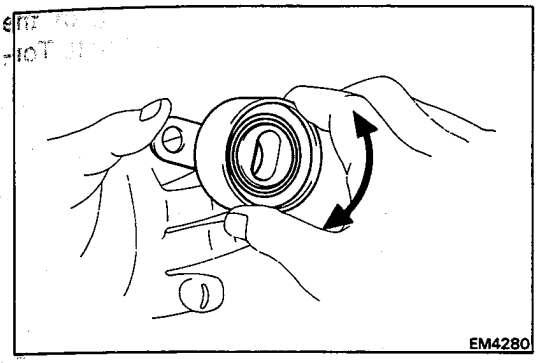
(c) If there is noticeable wear or cracks on the belt face check to see if there are nicks on one side of the idle pulley lock.

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



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

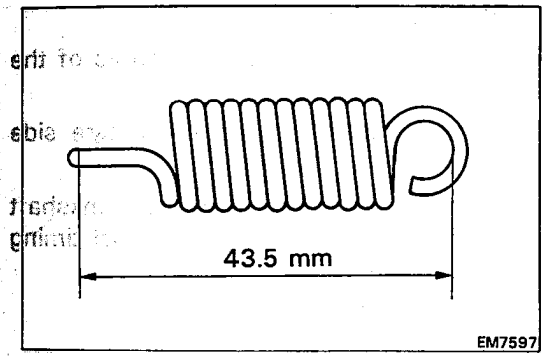
If necessary, replace the timing belt.



2. INSPECT IDLER PULLEY

Check the turning smoothness of the idler pulley.

If necessary, replace the idler pulley.



3. INSPECT TENSION SPRING

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

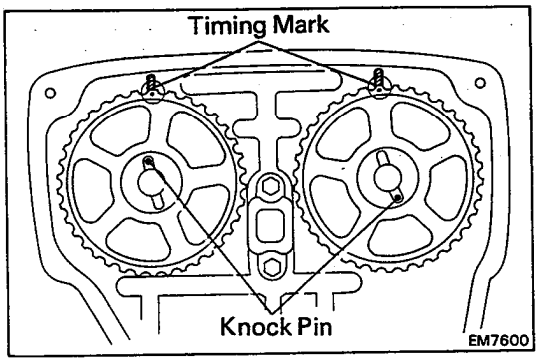
Free length: 43.5 mm (1.713 in.)

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:
9.47 – 10.47 kg (20.9 – 23.11 lb, 93 – 103 N) at 50.2 mm (1.976 in.)

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



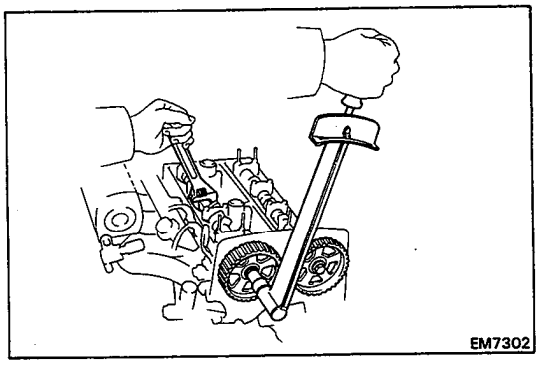
INSTALLATION OF TIMING BELT

(See page EM-47)

1. INSTALL CAMSHAFT TIMING PULLEYS

(a) Position the knock pin of the camshafts as shown in the illustration.

(b) Align the camshaft knock pin with the knock pin groove of the pulley, and slide the pulley, facing the timing mark upward.

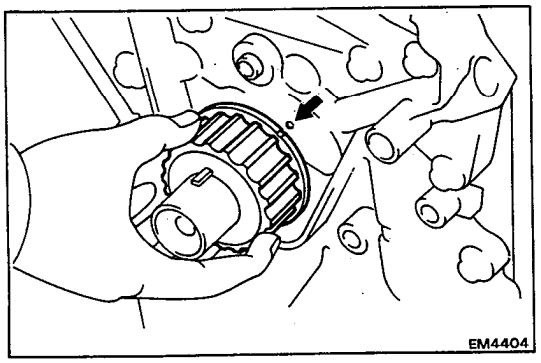


(c) Secure the hexagonal wrench head portion of the camshaft, and install the plate washer and bolt. Torque the bolt.

Torque: 600 kg-cm (43 ft-lb, 59 N·m)

2. INSTALL CYLINDER HEAD COVERS

(See step 12 on page EM-113)

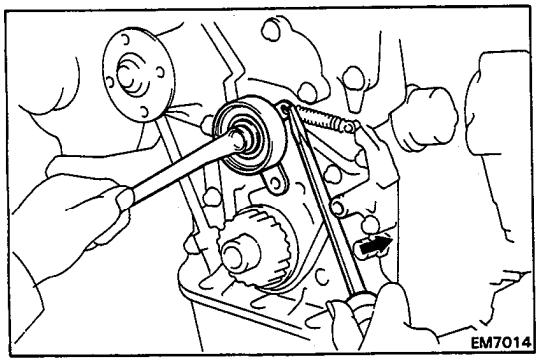


3. INSTALL CRANKSHAFT TIMING PULLEY

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

(b) Slide on the timing pulley, facing the flange side inward.

(c) Using the crankshaft pulley bolt, turn the crankshaft and align the timing marks of the crankshaft timing pulley and oil pump body.

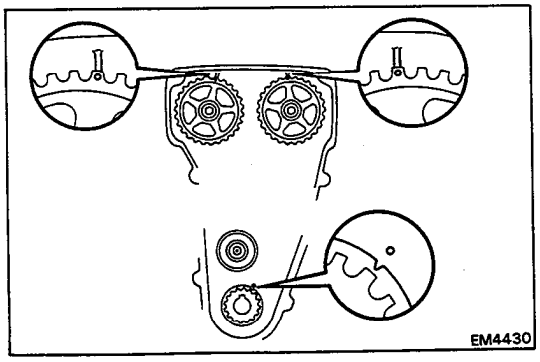


4. TEMPORARILY INSTALL IDLER PULLEY AND TENSION SPRING

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

(b) Install the tension spring.

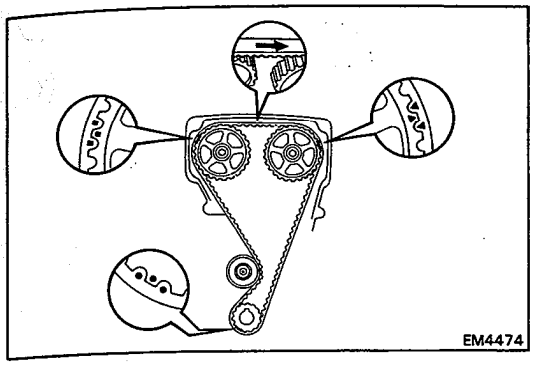
(c) Pry the pulley toward the left as far as it will go and tighten the bolt.



5. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Align the timing marks of the camshaft timing pulleys and No.4 timing belt cover by turning the camshafts.

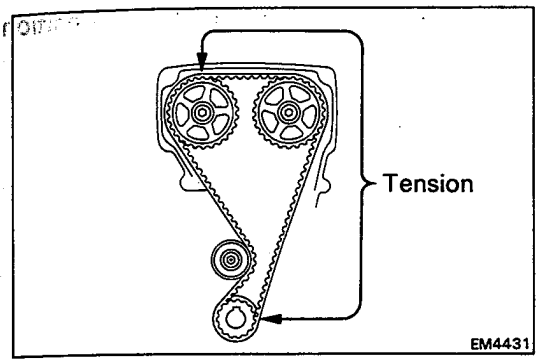
(b) Align the timing marks of the crankshaft timing pulley and oil pump body by turning the crankshaft.



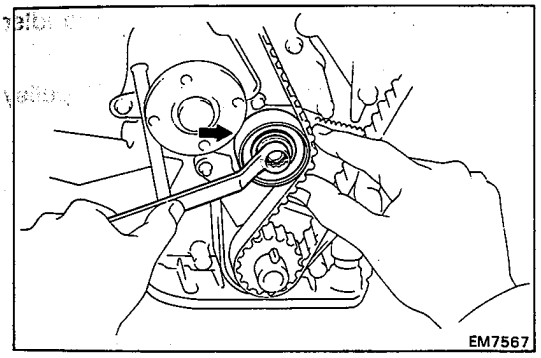
6. INSTALL TIMING BELT

NOTICE: The engine should be cold.

HINT: 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.

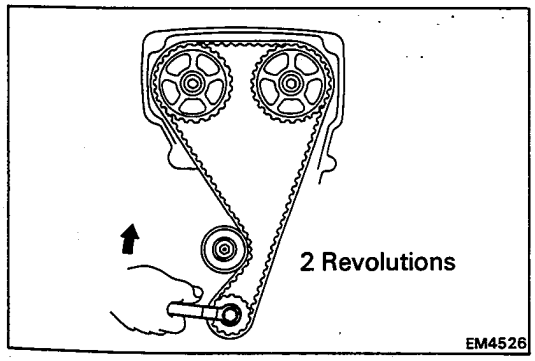


Install the timing belt, insuring the tension between the intake camshaft and crankshaft timing pulleys.



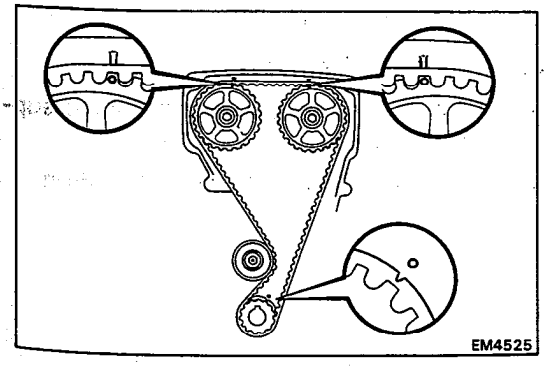
7. CHECK VALVE TIMING AND TIMING BELT TENSION

(a) Slowly loosen the idler pulley bolt.



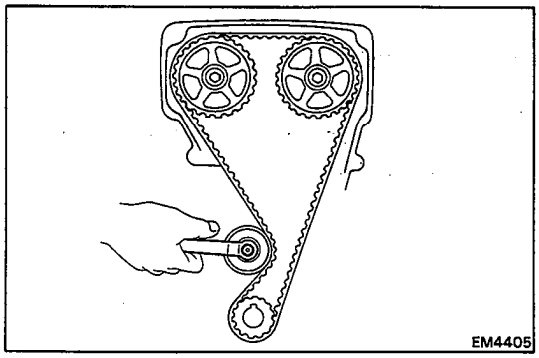
(b) Temporarily install the crankshaft pulley bolt, and turn the crankshaft pulley two revolutions from TDC to TDC.

HINT: Always turn the crankshaft clockwise.



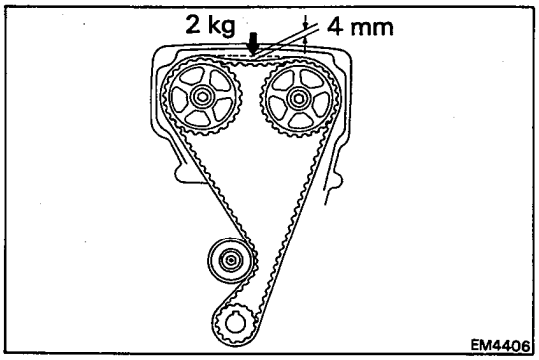
(c) Check that each pulley aligns with the timing marks as shown in the illustration.

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



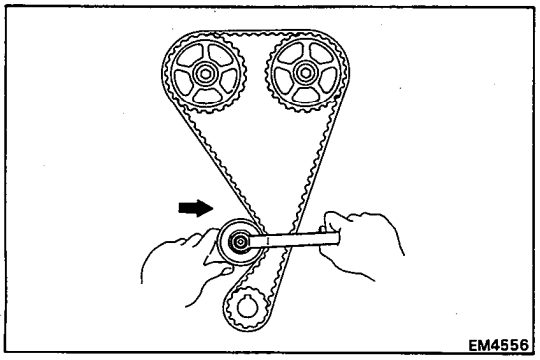
(d) Torque the idler pulley bolt.

Torque: 375 kg-cm (27 ft-lb, 37 N·m)



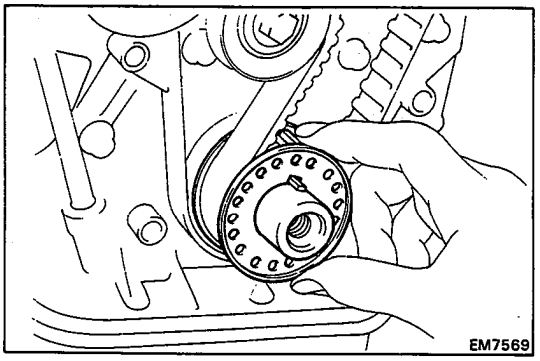
(e) Check that there is belt deflection at the position indicated in the illustration.

Deflection: 4 mm (0.16 in.)
at 2 kg (4.4 lb, 20 N)



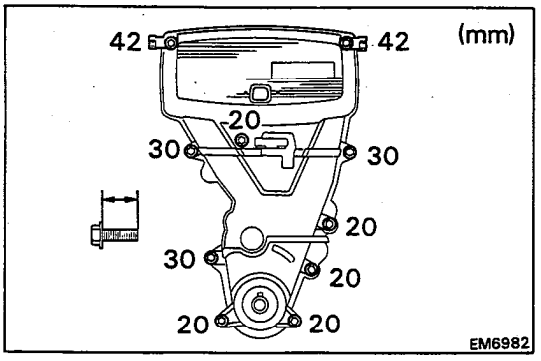
If the deflection is not as specified, adjust with the idler pulley.

(f) Remove the temporarily installed crankshaft pulley bolt.



8. INSTALL TIMING BELT GUIDE

Install the guide, facing the cup side outward.

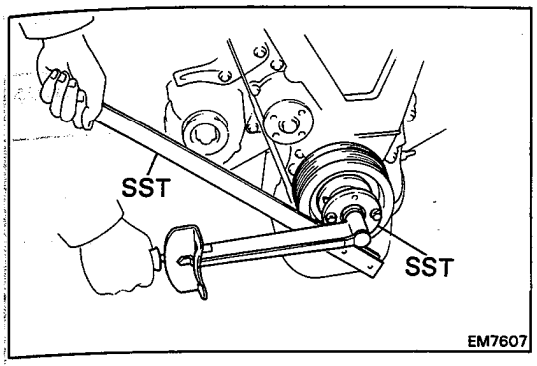


9. INSTALL TIMING BELT COVERS

(a) Install the gaskets to the belt covers.

(b) Install the No.1, No.2, No.3 belt cover and cord support plate with the ten bolts.

HINT: Each bolt length is indicated in the illustration.



10. 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 09213-70010 and 09330-00021

Torque: 1,400 kg-cm (101 ft-lb, 137 N·m)

11. INSTALL SPARK PLUGS (See page IG-12)

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

12. INSTALL PLUG CORD COVER

13. CONNECT ENGINE WIRE TO TIMING BELT COVER NO.4
(See step 26 on page EM-116)

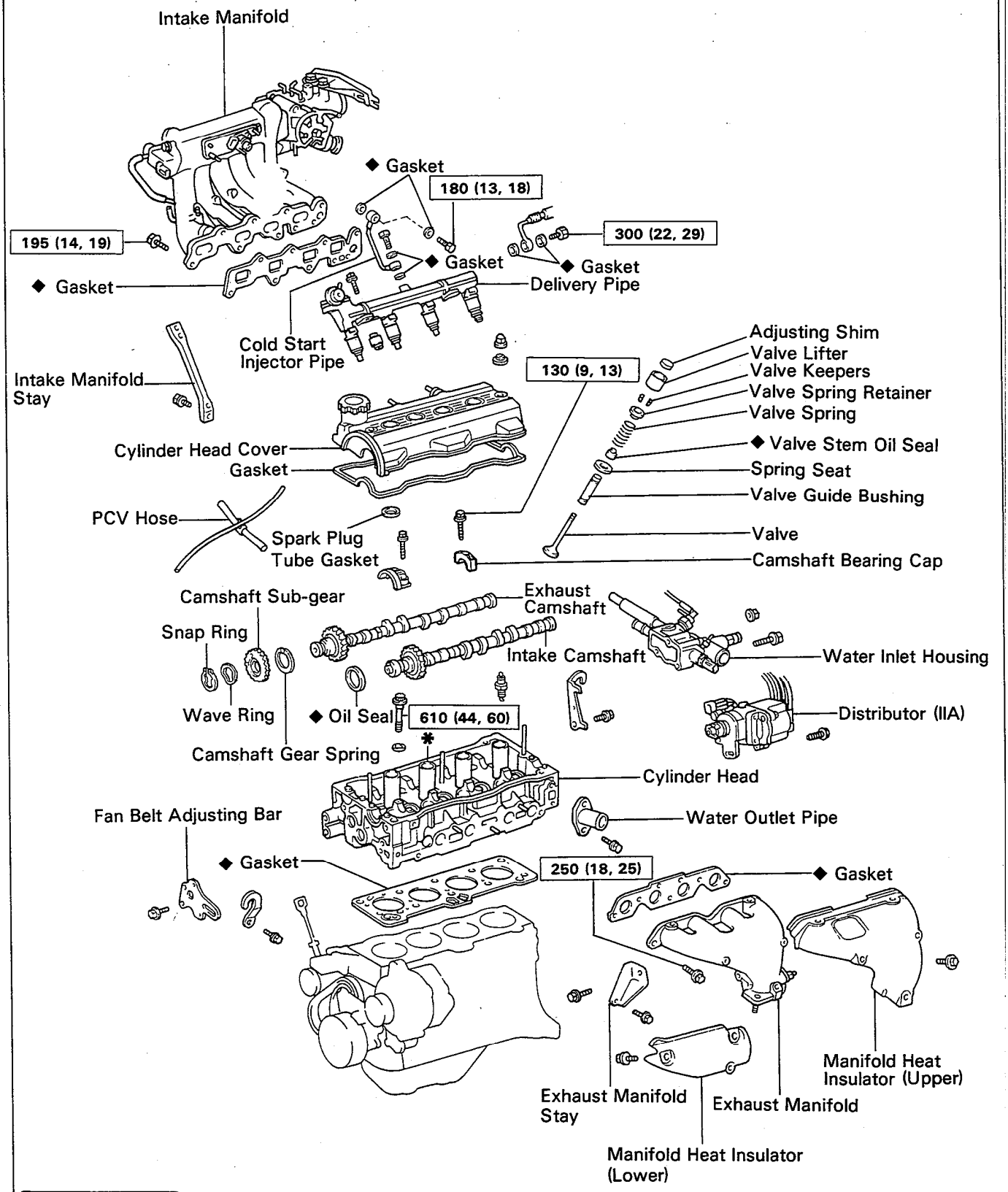
14. INSTALL WATER PUMP PULLEY AND DRIVE BELT

15. CHECK AND ADJUST DRIVE BELT
(See step 3 on pages CH-3 and 4)

CYLINDER HEAD (4A-FE)

COMPONENTS

2WD



kg-cm (ft-lb, N·m) : Specified torque

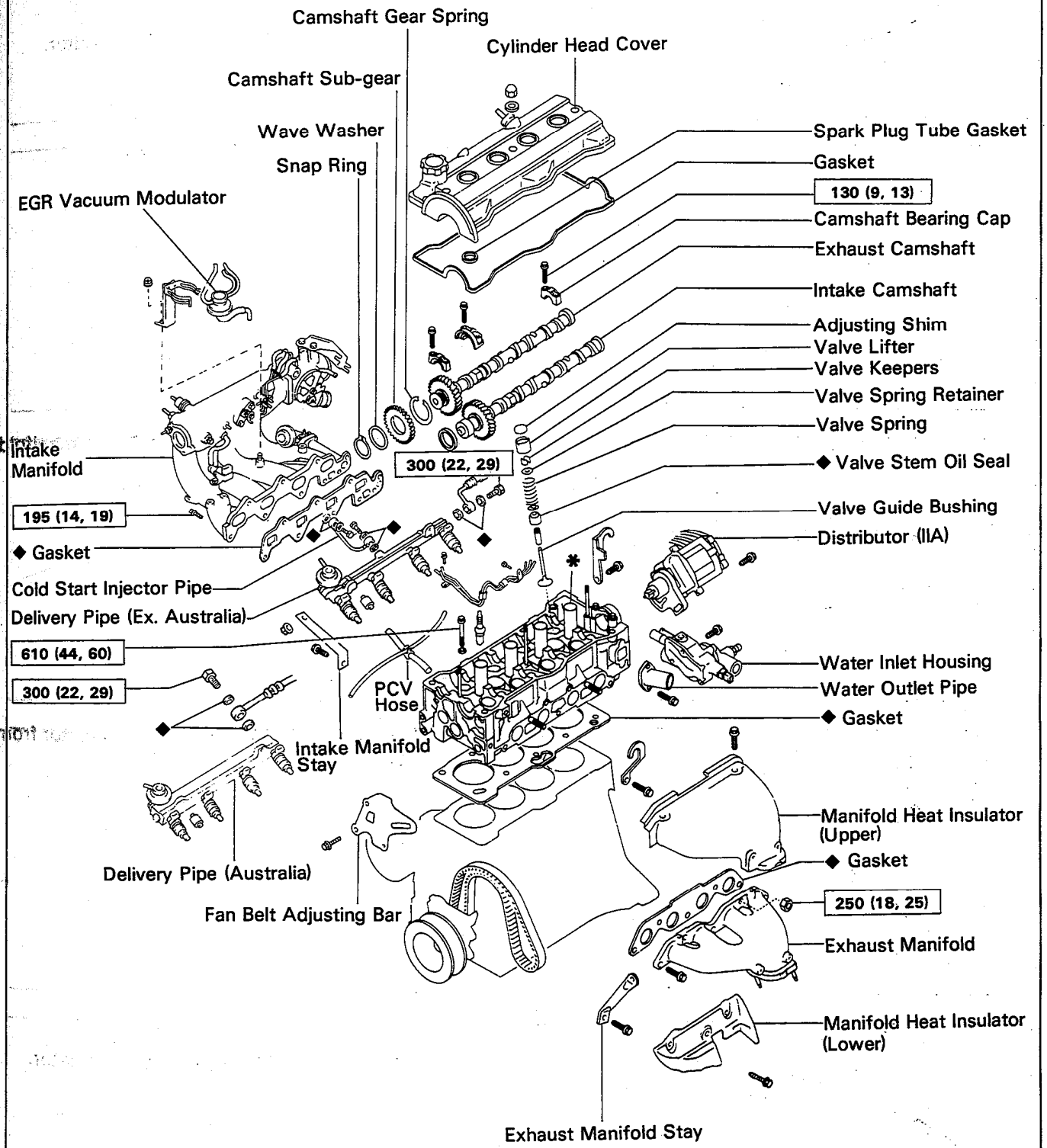
◆ Non-reusable part

*: Must not remove the spark plug tube

EM7577

COMPONENTS (Cont'd)

4WD

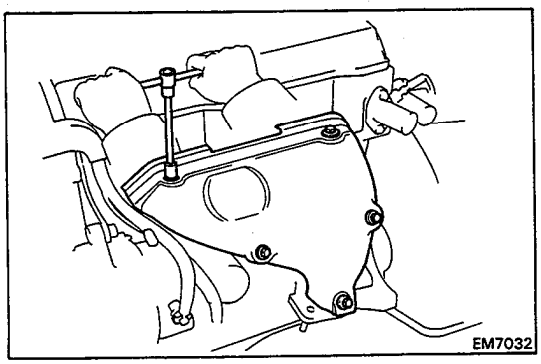


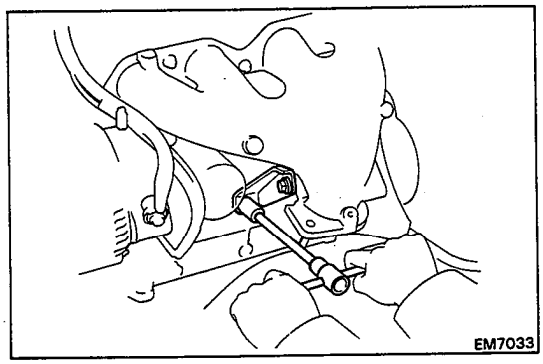
kg-cm (ft-lb, N·m) : Specified torque

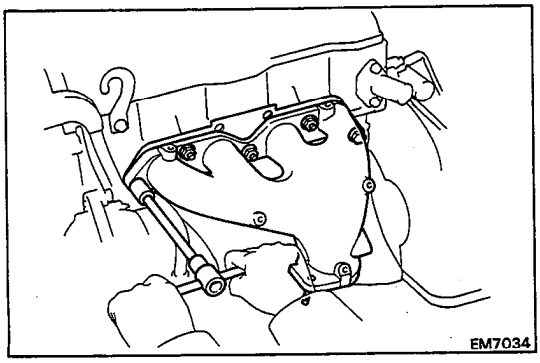
◆ Non-reusable part

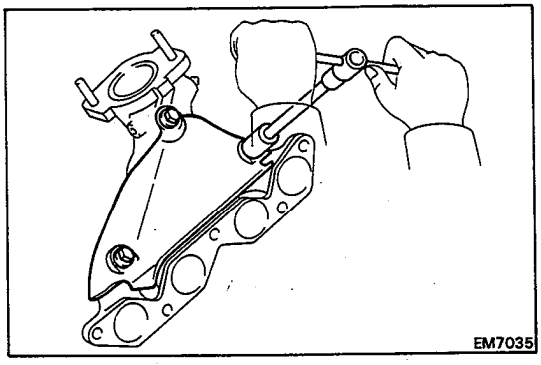
✱ : Must not remove the spark plug tube

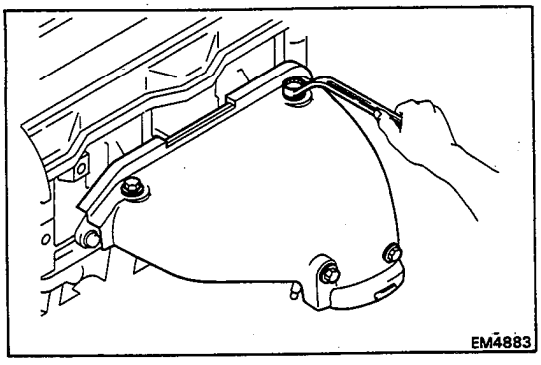
EM6979











REMOVAL OF CYLINDER HEAD

(See pages EM-56, 57)

1. REMOVE IIA

2. REMOVE EXHAUST MANIFOLD (2WD)

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

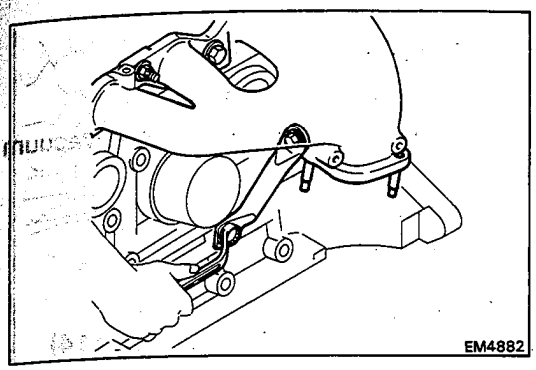
(b) Remove the two bolts and manifold stay.

(c) Remove the two bolts, three nuts, exhaust manifold and gasket.

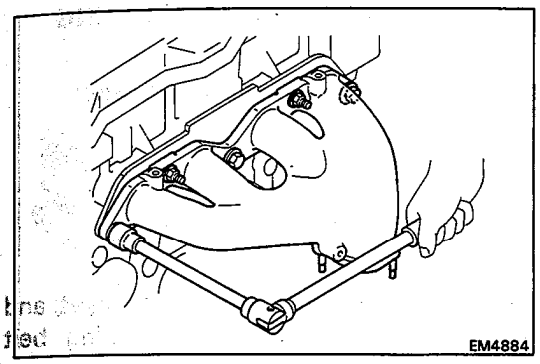
(d) Remove the three bolts and lower heat insulator from the exhaust manifold.

(4WD)

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

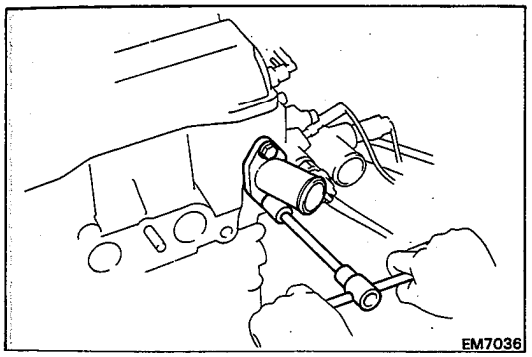


(b) Remove the two bolts and manifold stay.



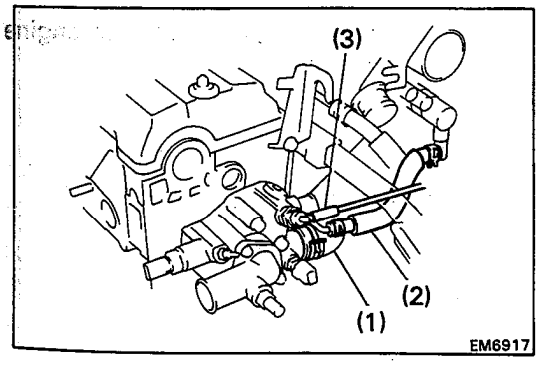
(c) Remove the three bolts, two nuts, manifold and gasket.

(d) Remove the three bolts and lower heat insulator from the exhaust manifold.



3. REMOVE WATER OUTLET

Remove the two bolts and water outlet.

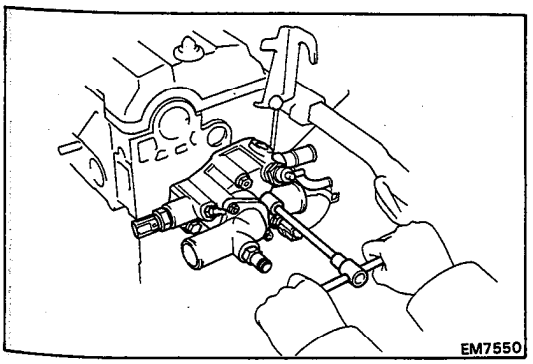


4. REMOVE WATER INLET AND INLET HOUSING

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

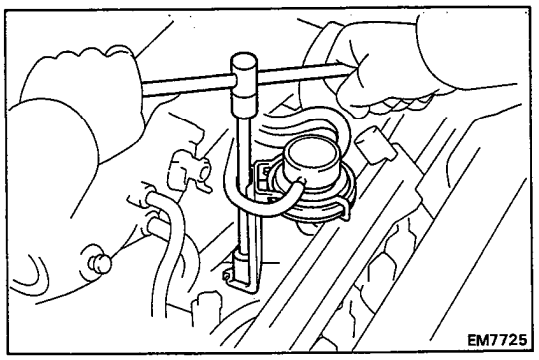
(b) Disconnect the following hoses:
(1) Inlet water hose
(2) Water by-pass hose
(3) BVSV vacuum hose(s)

(c) Remove the bolt, two nuts, the water inlet and inlet housing assembly.



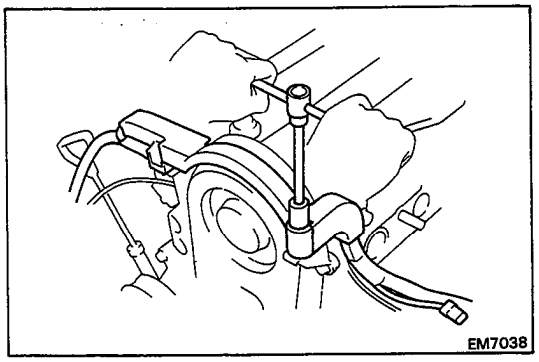
5. REMOVE COLD START INJECTOR PIPE

(See step 3 on page FI-105)


EM7725

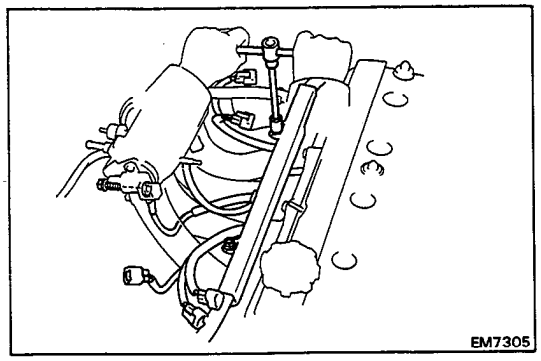
6. (4WD)
REMOVE EGR VACUUM MODULATOR
(a) Disconnect the four vacuum hoses.
(1) Three port vacuum hoses of the EGR vacuum modulator.
(2) EGR valve hose.
(b) Remove the nut and vacuum modulator.

7. REMOVE DELIVERY PIPE AND INJECTORS
(See steps 3 to 6 and 8 on pages FI-113 and 114)


EM7038

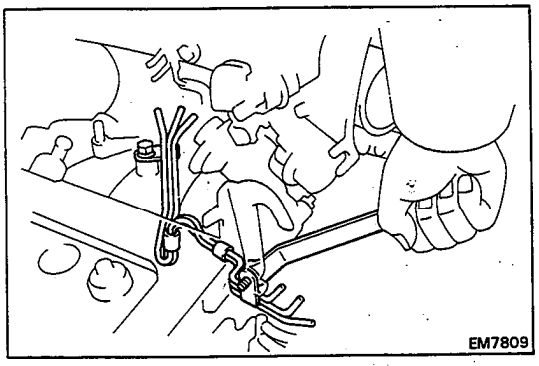
8. DISCONNECT ENGINE WIRE FROM NO.3 TIMING BELT COVER
(a) Disconnect the following connectors and wire:
- Alternator connector
- Alternator wire
- Oil pressure switch connector

(b) Remove the bolt.
(c) Disconnect the wire clamp from the wire bracket, and disconnect the engine wire from the timing belt cover.

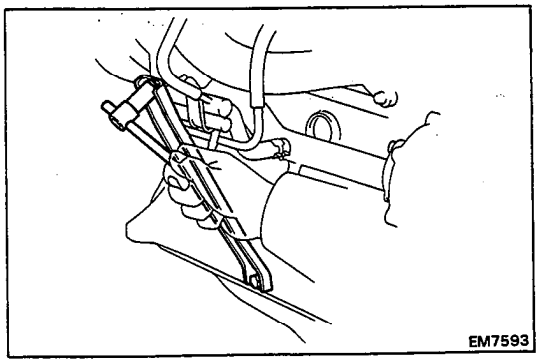

EM7305

9. DISCONNECT ENGINE WIRE FROM INTAKE MANIFOLD
(a) Disconnect the following connectors:
- Throttle position sensor connector
- ISC valve connector
- (2WD w/ EGR system)
  EGR VSV connector
- Cold start injector connector

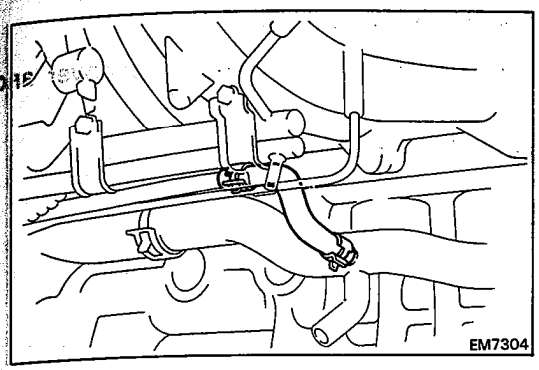
(b) Disconnect the wire clamp from the vacuum pipe.
(c) Remove the three bolts, and disconnect the engine wire from the intake manifold.


EM7809

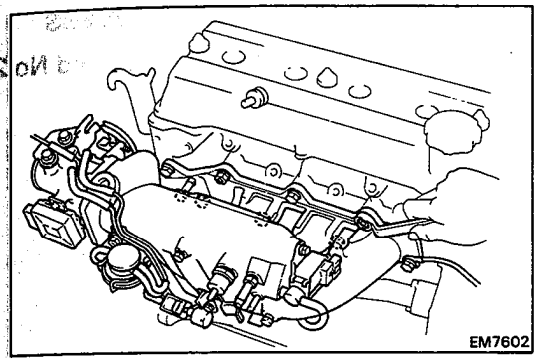
10. (4WD)
REMOVE VACUUM PIPE
(a) Disconnect the three vacuum hoses.
(b) Remove the two bolts and vacuum pipe.


EM7593

11. REMOVE INTAKE MANIFOLD
(2WD)
(a) Remove the two bolts and manifold stay.

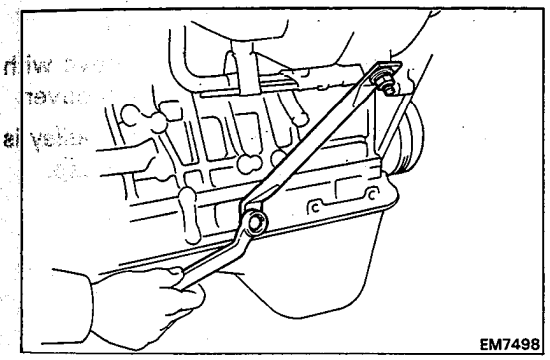


(b) Disconnect the water by-pass hose from the air pipe.

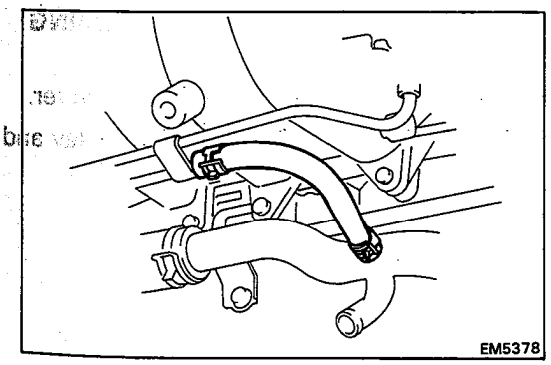


(c) Remove the seven bolts, ground strap, intake manifold and gasket.

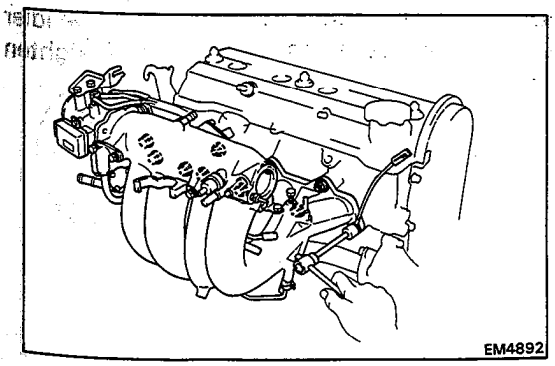
(4WD)



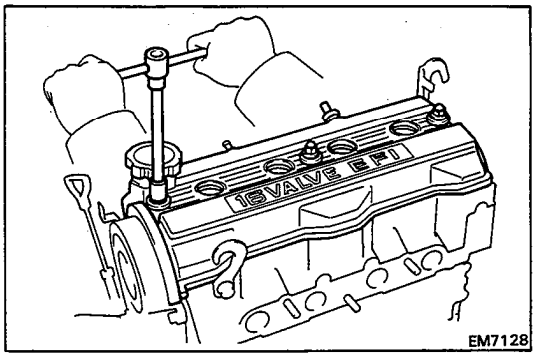
(a) Remove the bolt, nut and manifold stay.



(b) Disconnect the water by-pass hose from the air pipe.



(c) Remove the seven bolts, ground strap, intake manifold and gasket.

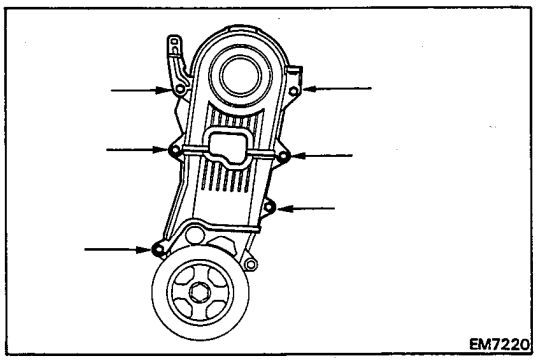


EM7128

12. REMOVE CYLINDER HEAD COVER

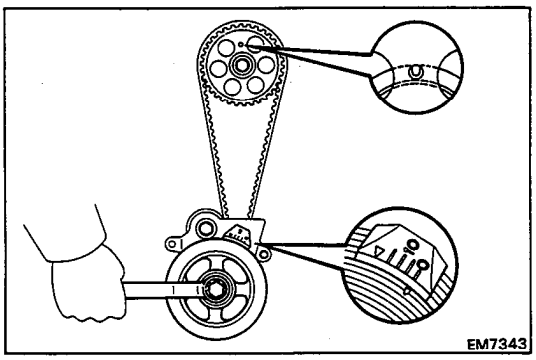
Remove the three cap nuts, grommets, head cover an gasket.

13. REMOVE SEMI-CIRCULAR PLUG


EM7220

14. REMOVE NO.3 AND NO.2 TIMING BELT COVERS

Remove the six bolts, engine wire bracket, No.3 and No. timing belt covers.

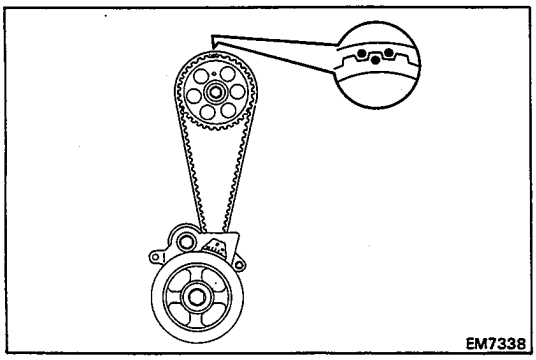

EM7343

15. SET NO.1 CYLINDER TO TDC/COMPRESSION

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

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

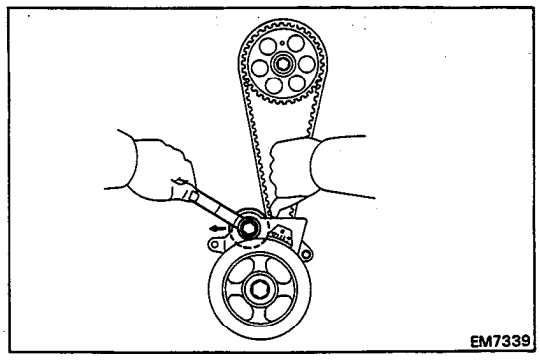
If not, turn the crankshaft one revolution (360°).


EM7338

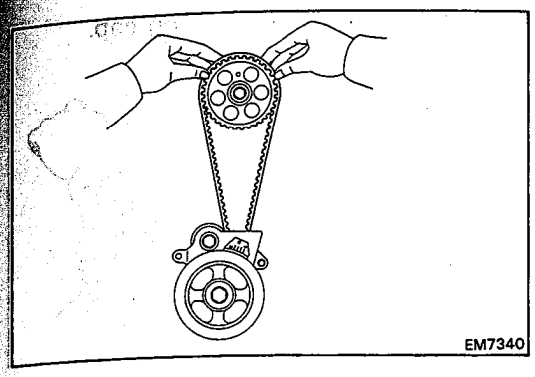
16. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEY

(a) Remove the plug from the No.1 timing belt cover.

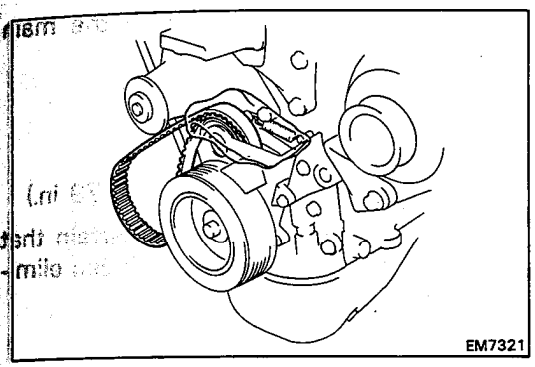
(b) Place matchmarks on the camshaft timing pulley ar belt.


EM7339

(c) Loosen the idler pulley mount bolt and push the idl pulley toward the left as far as it will go, then tighte it temporarily.



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



NOTICE:

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

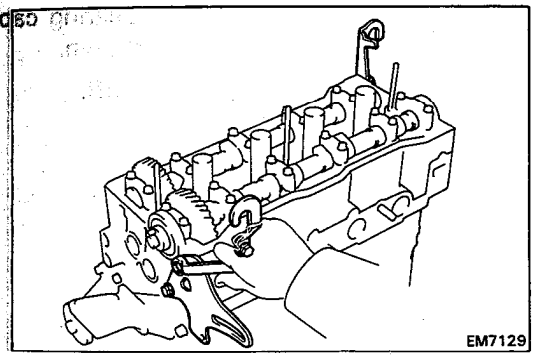
17. REMOVE CAMSHAFT TIMING PULLEY
(See step 10 on page EM-41)

18. REMOVE FAN BELT ADJUSTING BAR

Remove the two bolts and adjusting bar.

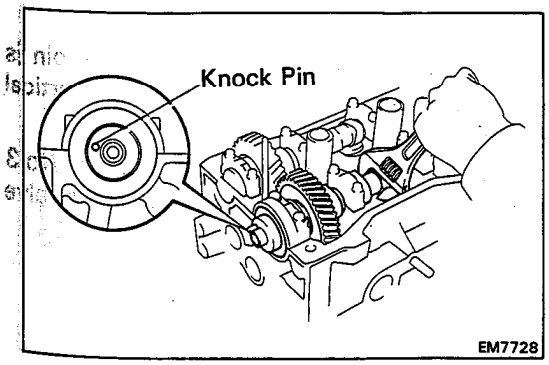
19. REMOVE ENGINE HANGERS

Remove the two bolts and engine hangers.



20. REMOVE CAMSHAFTS

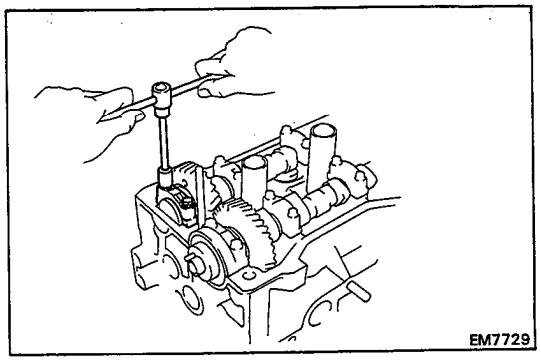
NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following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



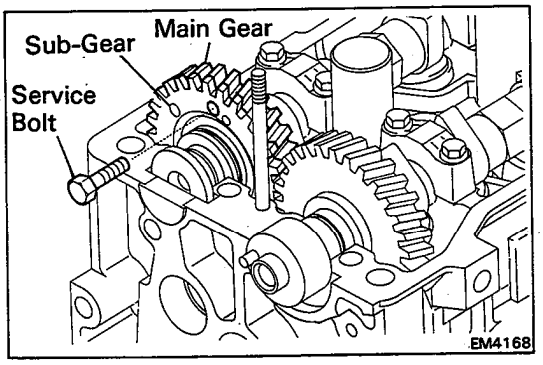
A. Remove intake camshaft

(a) Set the exhaust camshaft so the knock pin is slightly above the top of the cylinder head.

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



(b) Remove the two bolts and front bearing cap.

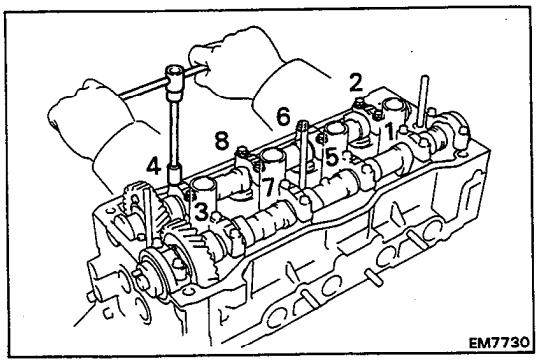


(c) Secure the intake camshaft sub-gear to the main gear with a service bolt.

Recommended service bolt:

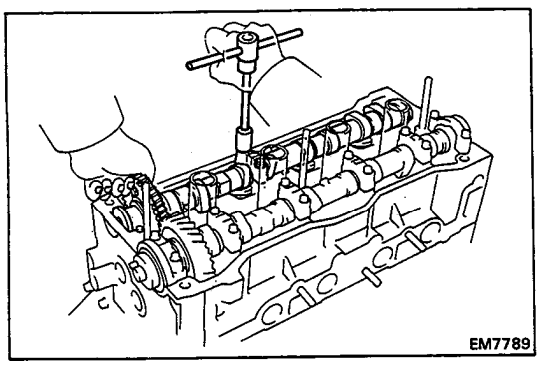
Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 – 20 mm (0.63 – 0.79 in.)

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



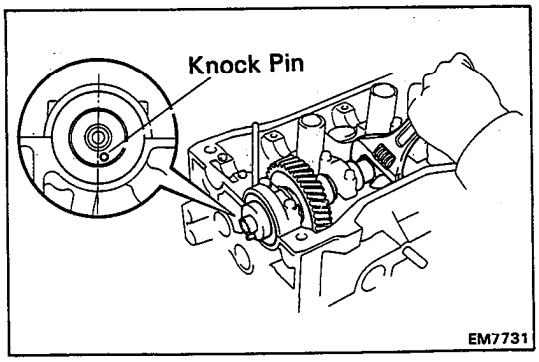
(d) Uniformly loosen and remove the eight bearing cap bolts in several passes in the sequence shown.

(e) Remove the four bearing caps and camshaft.



HINT: If the camshaft is not being lifted out straight and level, reinstall the bearing cap with the two bolts. Then alternately loosen and remove the bearing cap bolts with the camshaft gear pulled up.

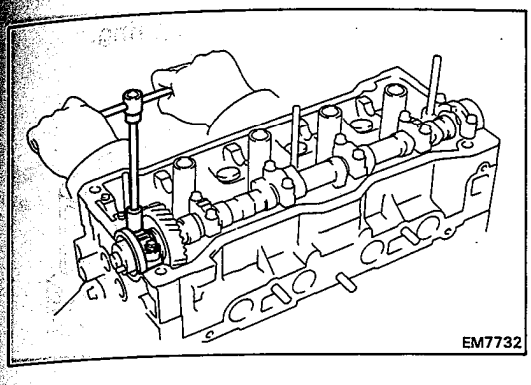
NOTICE: Do not pry on or attempt to force the camshaft with a tool or other objects.



B. Remove exhaust camshaft

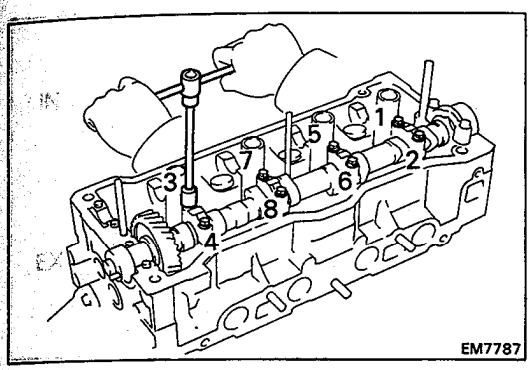
(a) Set the exhaust camshaft so that the knock pin is located slightly counterclockwise from the vertical axis of the camshaft.

HINT: The above angle allows the No.1 and No.4 cylinder cam loves of exhaust camshaft to push their valve lifters evenly.



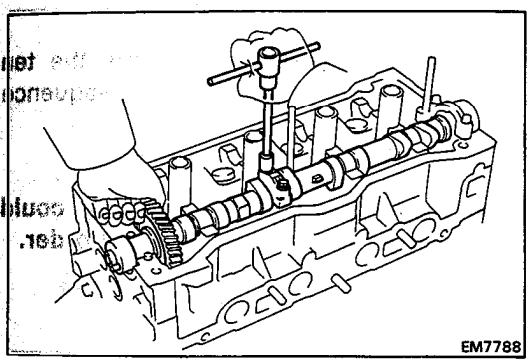
(b) Remove the two bolts, front bearing cap and oil seal.

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



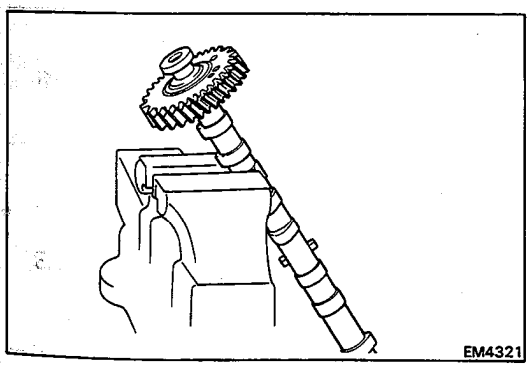
(c) Uniformly loosen and remove the eight bearing cap bolts in several passes in the sequence shown.

(d) Remove the four bearing caps and camshaft.



HINT: If the camshaft is not being lifted out straight and level, reinstall the No.3 bearing cap with the two bolts. Then alternately loosen and remove the two bearing cap bolts with the camshaft gear pulled up.

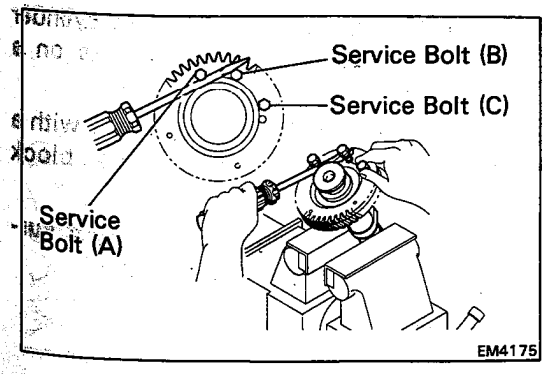
NOTICE: Do not pry on or attempt to force the camshaft with a tool or other objects.



21. DISASSEMBLE INTAKE CAMSHAFT

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

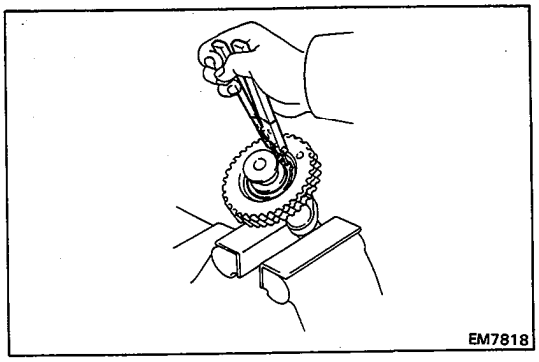
NOTICE: Be careful not to damage the camshaft.



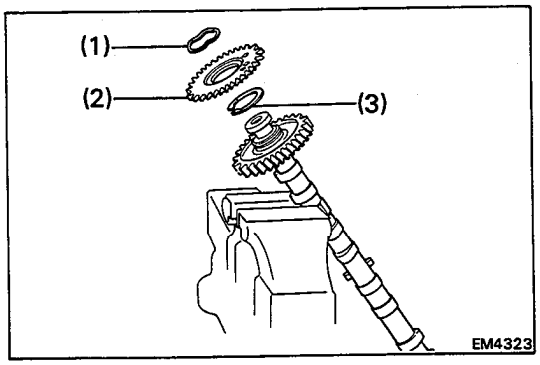
(b) Insert service bolts (A) and (B) into the service holes of the camshaft sub-gear.

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

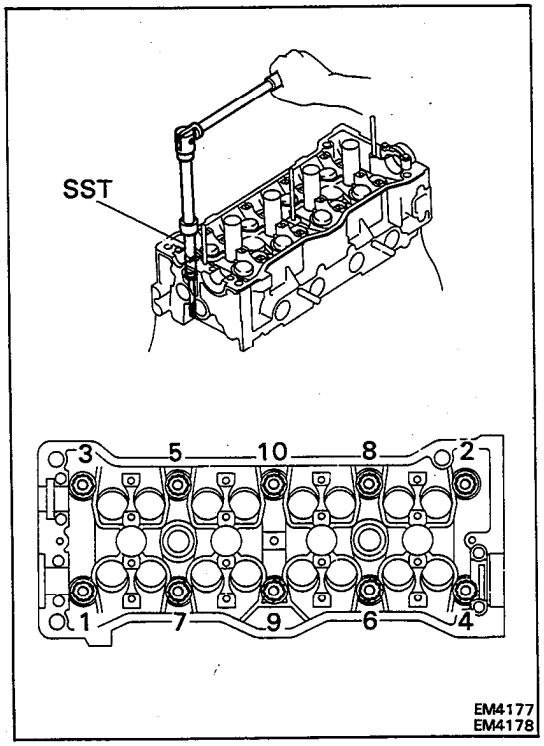
NOTICE: Be careful not to damage the camshaft.



(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

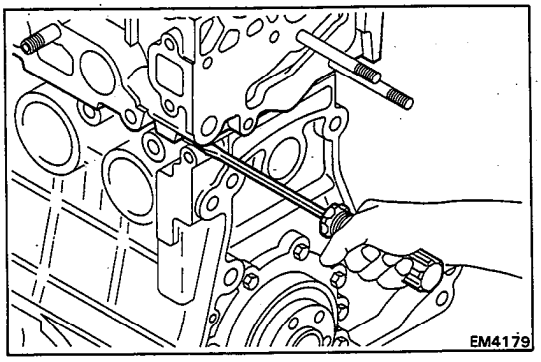


22. REMOVE CYLINDER HEAD

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

SST 09205-16010

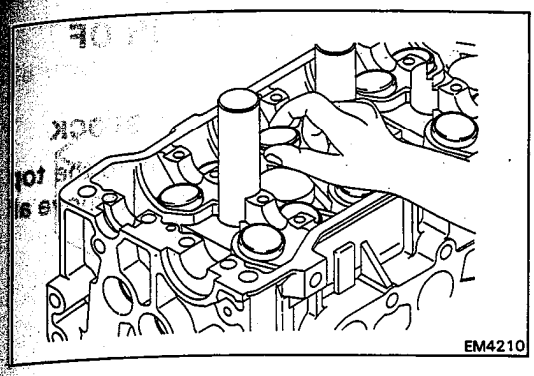
NOTICE: Cylinder head warpage or cracking coul result from removing the bolts in an incorrect order.



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

HINT: If the cylinder head is difficult to lift off, pry with screwdriver between the cylinder head and bloc saliences.

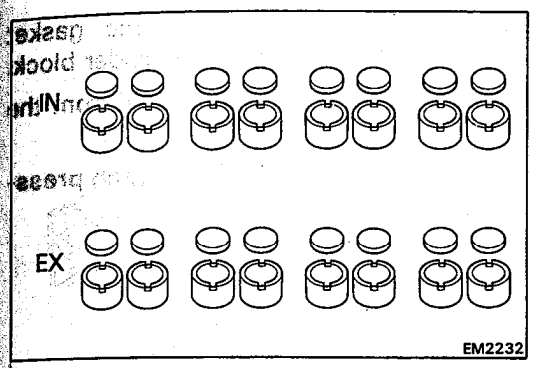
NOTICE: Be careful not to damage the contact su faces of the cylinder head and cylinder block.


EM4210

DISASSEMBLY OF CYLINDER HEAD

(See pages EM-56, 57)

1. REMOVE VALVE LIFTERS AND SHIMS



EM2232

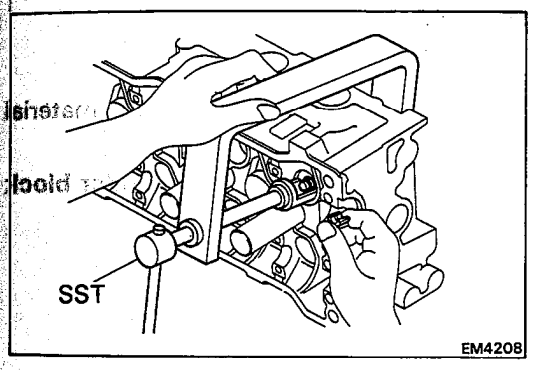
HINT: Arrange the valve lifters and shims in correct order.

2. REMOVE VALVES

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

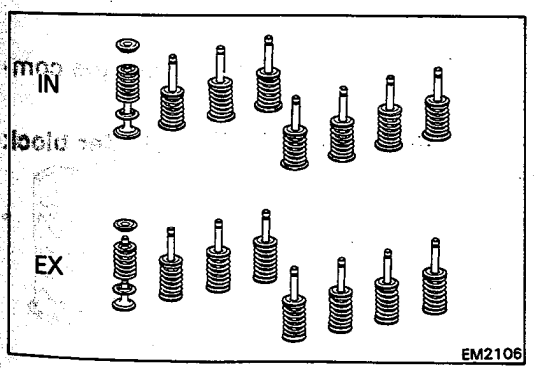
SST 09202-70010

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



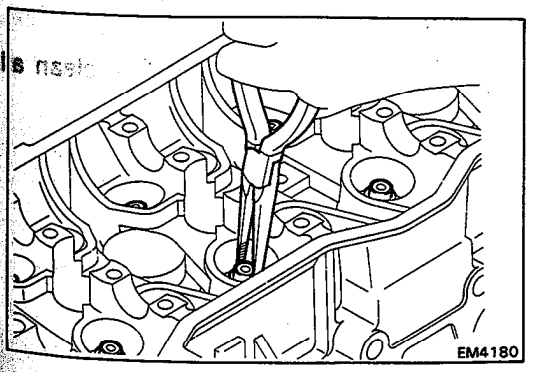
EM4208

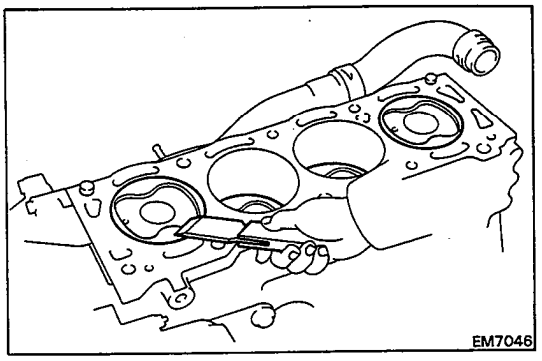
HINT: Arrange the valves, valve springs, spring seats and spring retainers in correct order.



EM2106

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

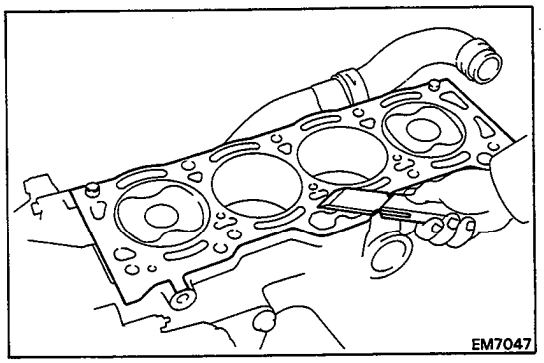

EM4180


EM7046

INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS

1. CLEAN TOP SURFACES OF PISTONS AND BLOCK

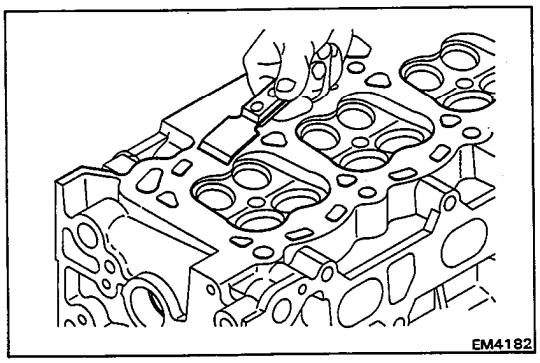
(a) Turn the crankshaft and bring each piston to the top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.


EM7047

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

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

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

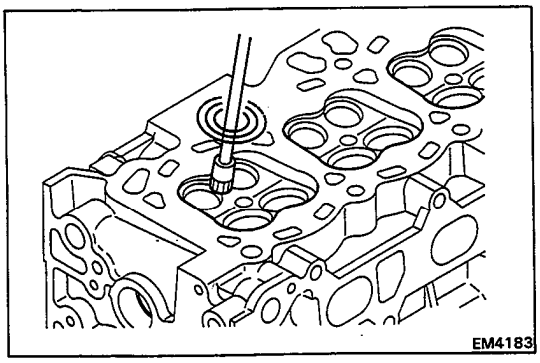

EM4182

2. CLEAN CYLINDER HEAD

A. Remove gasket material

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

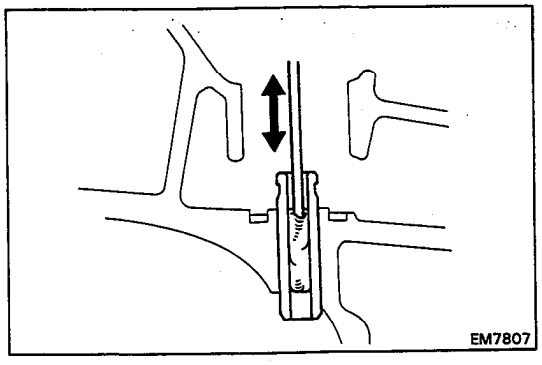
NOTICE: Be careful not to scratch the cylinder block contact surface.


EM4183

B. Clean combustion chambers

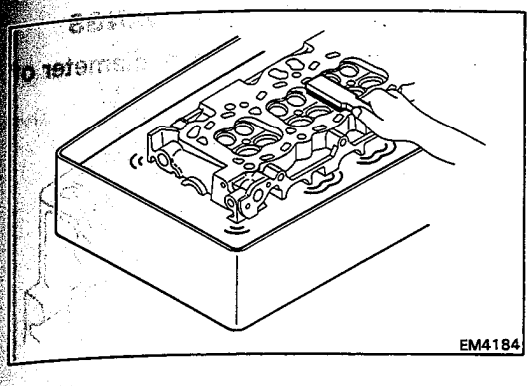
Using a wire brush, remove all the carbon from the combustion chambers.

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


EM7807

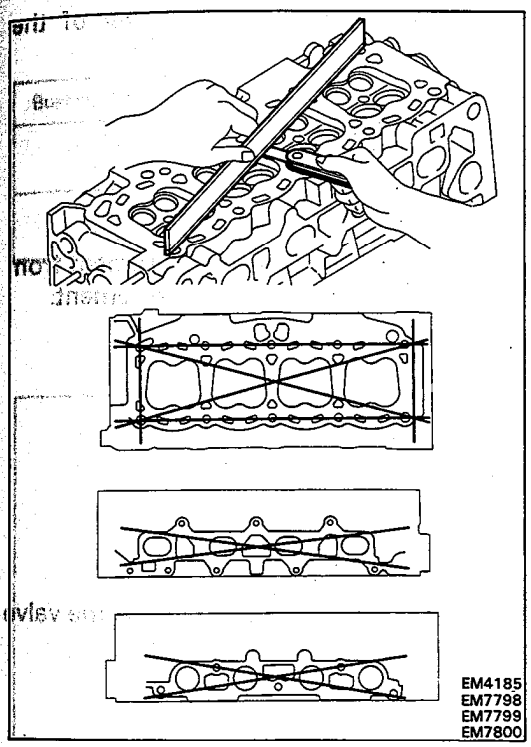
C. Clean valve guide bushings

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


EM4184

D. Clean cylinder head

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


EM4185
EM7798
EM7799
EM7800

3. INSPECT CYLINDER HEAD

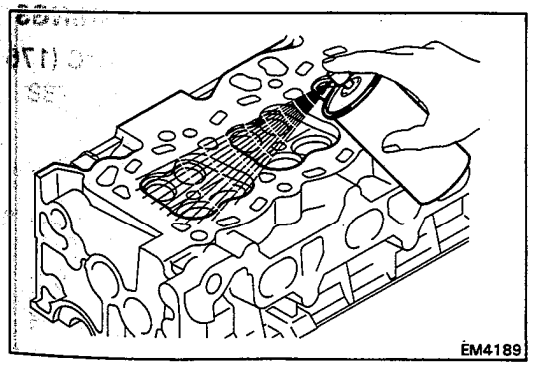
A. Inspect for flatness

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

Maximum warpage:

Cylinder block side	**0.05 mm (0.0021 in.)**
Manifold side	**0.10 mm (0.0039 in.)**

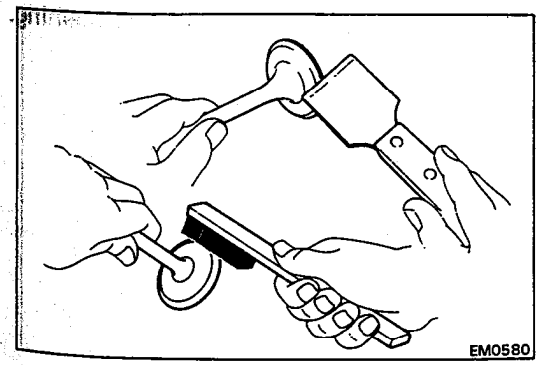
If warpage is greater than maximum, replace the cylinder head.


EM4189

B. Inspect for cracks

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

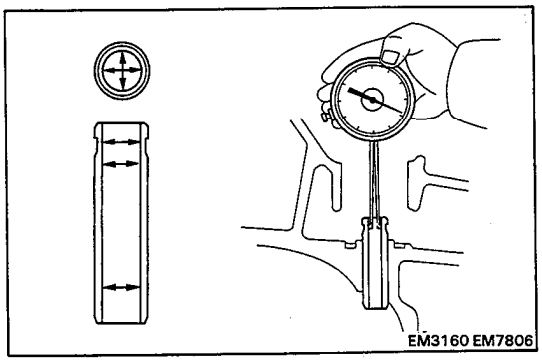
If cracked, replace the cylinder head.


EM0580

4. CLEAN VALVES

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

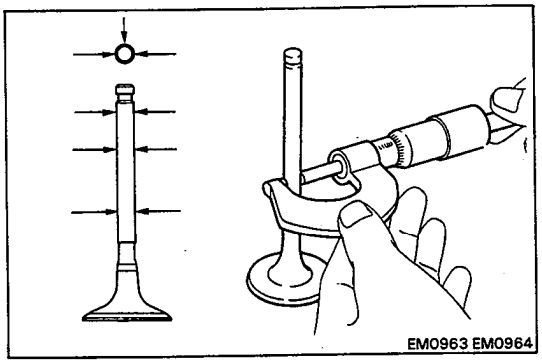
(b) Using a wire brush, thoroughly clean the valve.



5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:
6.01 – 6.03 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.

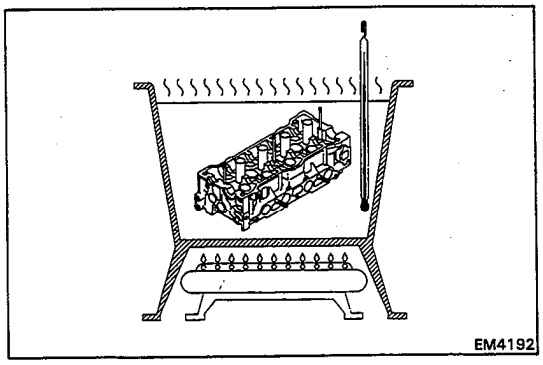
Standard oil clearance:

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:

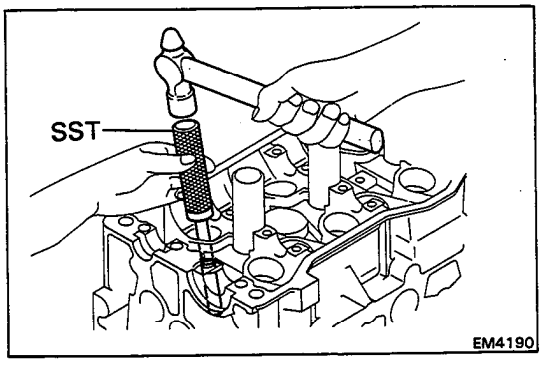
Intake	**0.08 mm (0.0031 in.)**
Exhaust	**0.10 mm (0.0039 in.)**

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



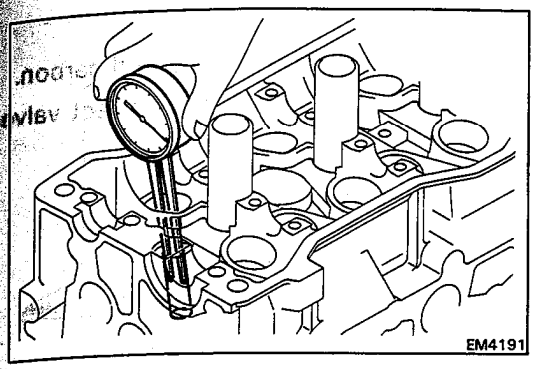
6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

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



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

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

Standard valve guide bore (cold):
11.000 – 11.027 mm (0.4331 – 0.4341 in.)

Both intake and exhaust

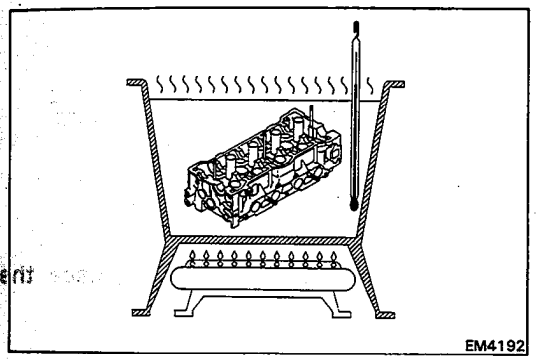
Bushing bore diameter mm (in.)	Bushing size
11.000 – 11.027 (0.4331 – 0.4341)	Used STD
11.050 – 11.077 (0.4350 – 0.4361)	Used O/S 0.05

(d) Select a new guide bushing (STD size or O/S 0.05)

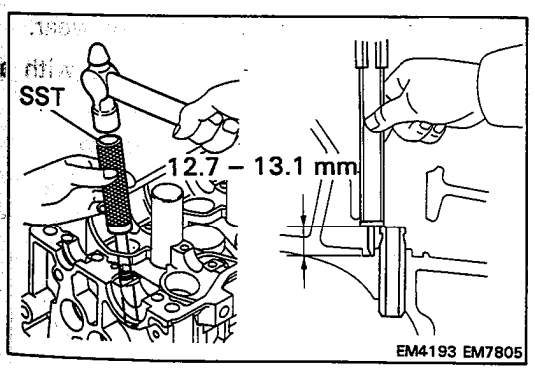
If the bushing bore diameter of the cylinder head is greater than 11.027 mm (0.4341 in.), machine the bushing bore to the following dimensions:

Rebored cylinder head bushing bore dimesion
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.

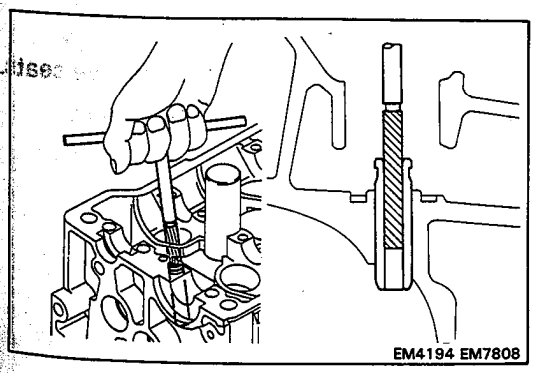


(e) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F)

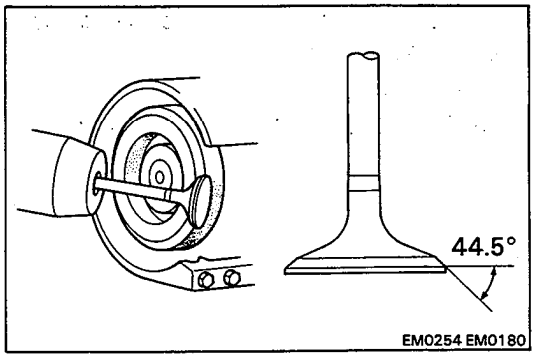


(f) Using SST and a hammer, tap in a new guide bushing to where 12.7 – 13.1 mm (0.500 – 0.516 in.) protruding from the cylinder head.

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(g) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page EM-70) between the guide bushing and valve stem.

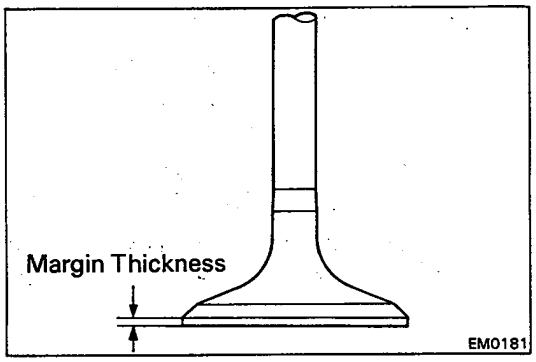


7. INSPECT AND GRIND VALVES

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

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

Valve face angle: 44.5°

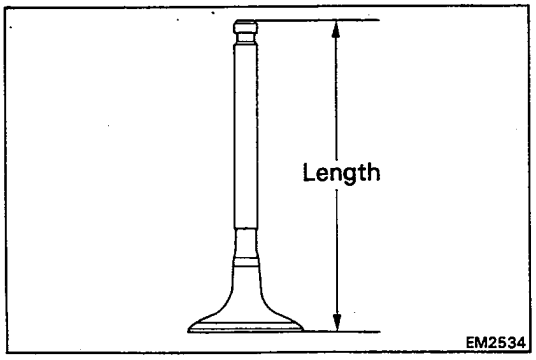


(c) Check the valve head margin thickness.

Standard margin thickness:
Intake 1.05 – 1.45 mm (0.0413 – 0.0571 in.)
Exhaust 1.19 – 1.59 mm (0.0469 – 0.0626 in.)

Minimum margin thickness: 0.5 mm (0.020 in.)

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

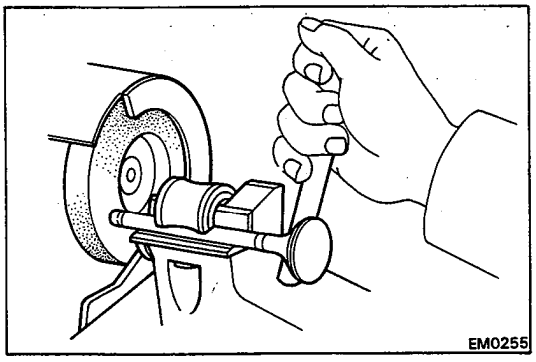


(d) Check the valve overall length.

Standard overall length:
Intake 91.45 mm (3.6004 in.)
Exhaust 91.90 mm (3.6181 in.)

Minimum overall length:
Intake 90.95 mm (3.5807 in.)
Exhaust 91.40 mm (3.5984 in.)

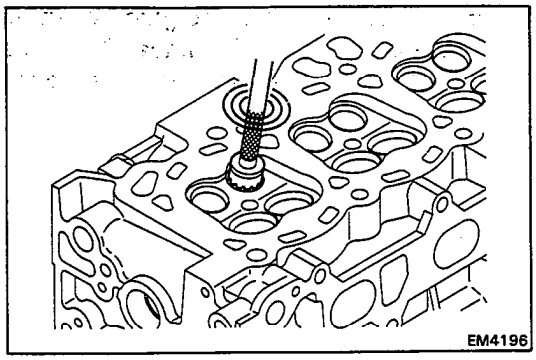
If the overall length is less than minimum, replace the valve.



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

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

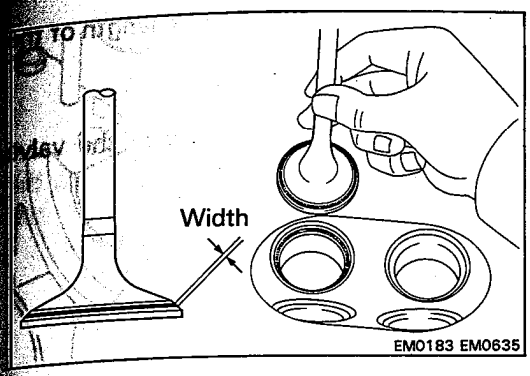
NOTICE: Do not grind off more than minimum.



8. INSPECT AND CLEAN VALVE SEATS

(a) Using a 45° carbide cutter, resurface the valve seat.

Remove only enough metal to clean the seats.



(b) Check the valve seating position.

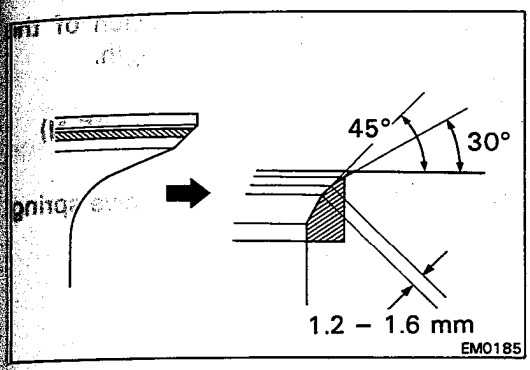
Apply a thin coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate the valve.

(c) Check the valve face and seat for the following:

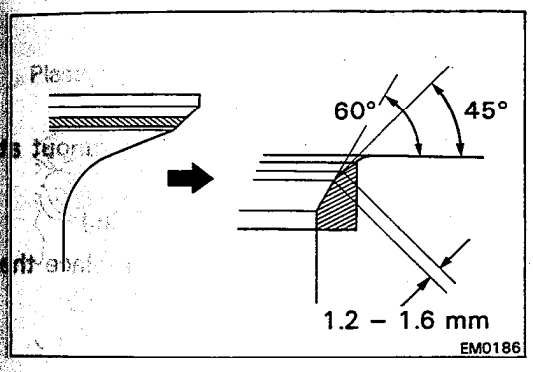
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with the following width:

1.2 – 1.6 mm (0.047 – 0.063 in.)

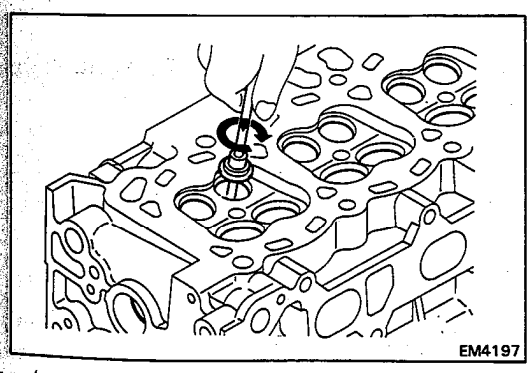
If not, correct the valve seats as follows:



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

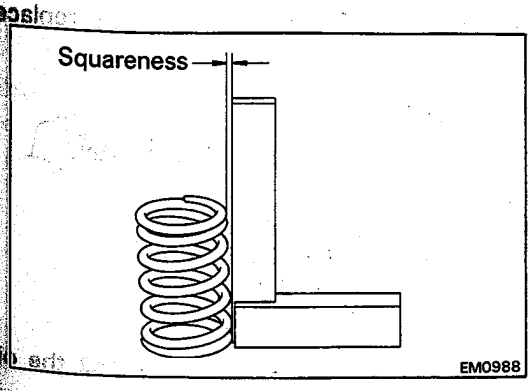


(2) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.



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

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

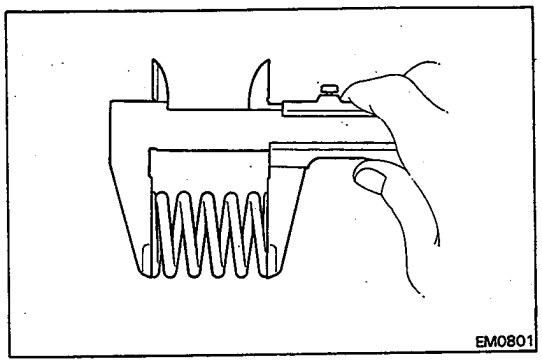


9. INSPECT VALVE SPRINGS

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

Maximum squareness: 2.0 mm (0.075 in.)

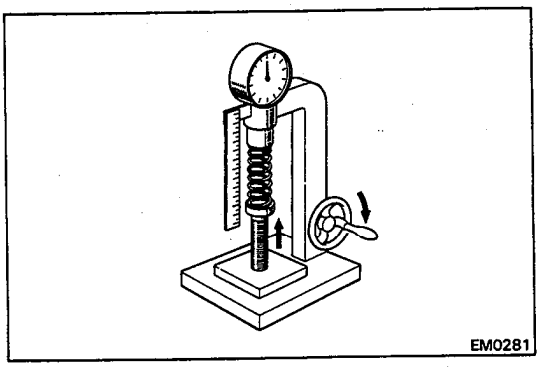
If squareness is greater than maximum, replace the valve spring.



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

Free length: 43.8 mm (1.724 in.)

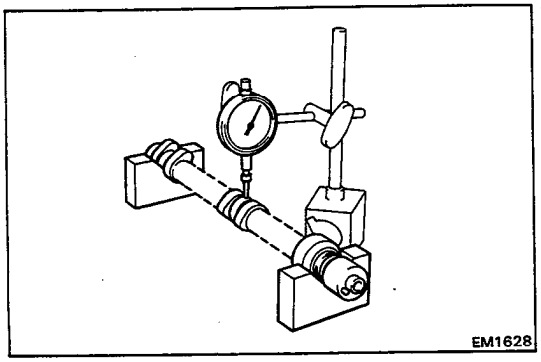
If the free length is not as specified, replace the valve spring.



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

Installed tension:
14.6 — 15.8 kg (32.3 — 34.8 lb, 143 — 155 N) at 34.7 mm (1.366 in.)

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



10. INSPECT CAMSHAFTS AND BEARINGS

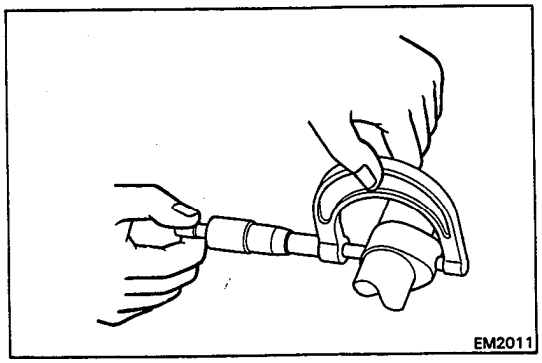
A. Inspect camshaft for runout

(a) Place the camshaft on V-blocks.

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

Maximum circle runout: 0.04 mm (0.0016 in.)

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



B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

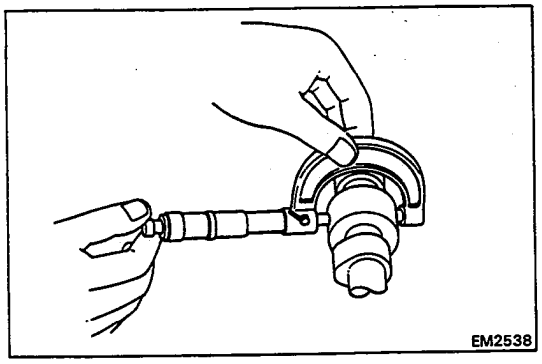
Standard cam lobe height:

Intake	**35.21 — 35.31 mm (1.3862 — 1.3092 in.)**
Exhaust	**34.91 — 35.01 mm (1.3744 — 1.3783 in.)**

Minimum cam lobe height:

Intake	**34.81 mm (1.3705 in.)**
Exhaust	**34.51 mm (1.3587 in.)**

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



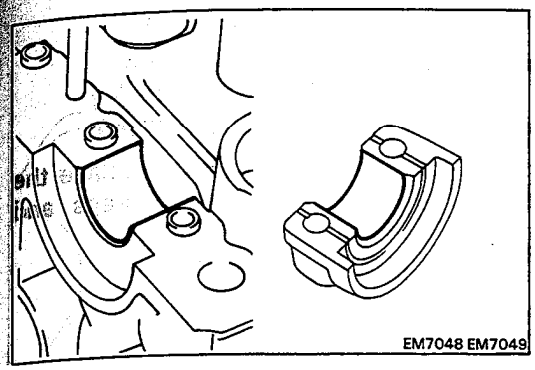
C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

Journal diameter:

Exhaust No.1	**24.949 — 24.965 mm (0.9822 — 0.9829 in.)**
Others	**22.949 — 22.965 mm (0.9035 — 0.9041 in.)**

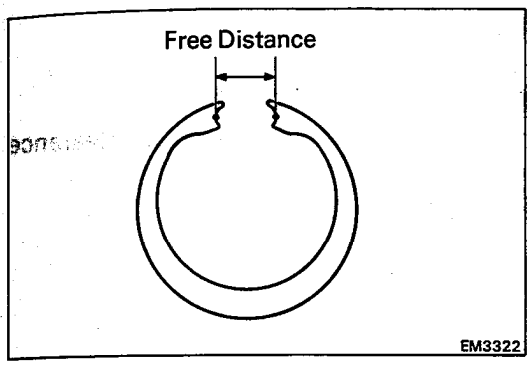
If the journal diameter is not as specified, check the oil clearance.



D. Inspect camshaft bearings

Check the bearings for flaking and scoring.

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

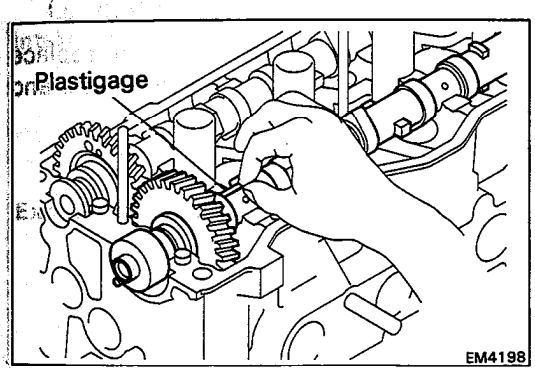


E. Inspect camshaft gear spring

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

Free distance: 17.1 – 17.5 mm (0.673 – 0.689 in.)

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

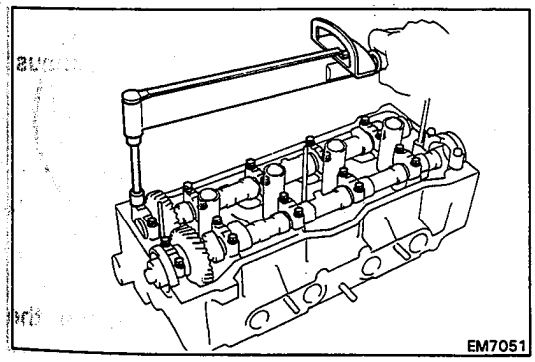


F. Inspect camshaft journal oil clearance

(a) Clean the bearing caps and camshaft journals.

(b) Place the camshafts on the cylinder head.

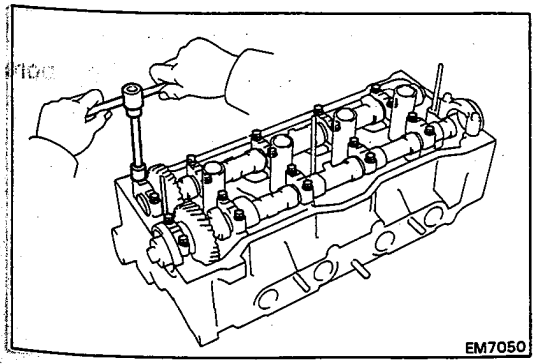
(c) Lay a strip of Plastigage across each of the camshaft journals.



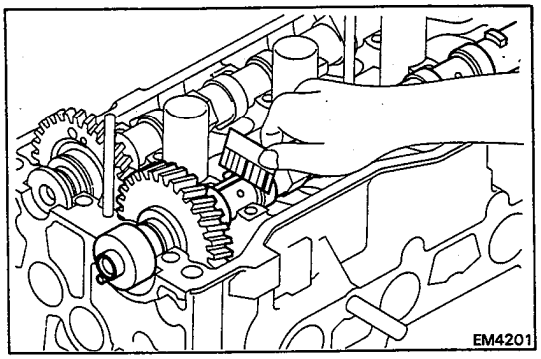
(d) Install the bearing caps.
(See step 3 on pages EM-81 to 83)

Torque: 130 kg-cm (9 ft-lb, 13 N·m)

NOTICE: Do not turn the camshaft.



(e) Remove the bearing caps.



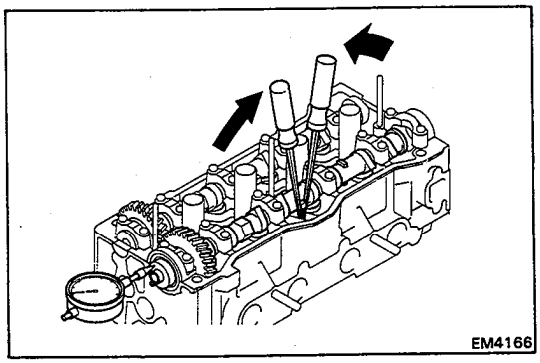
(f) Measure the Plastigage at its widest point.

Standard oil clearance: 0.035 – 0.072 mm (0.0014 – 0.0028 in.)

Maximum oil clearance: 0.10 mm (0.0039 in.)

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

(g) Completely remove the Plastigage.



G. Inspect camshaft thrust clearance

(a) Install the camshaft.
(See step 3 on pages EM-81 to 83)

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

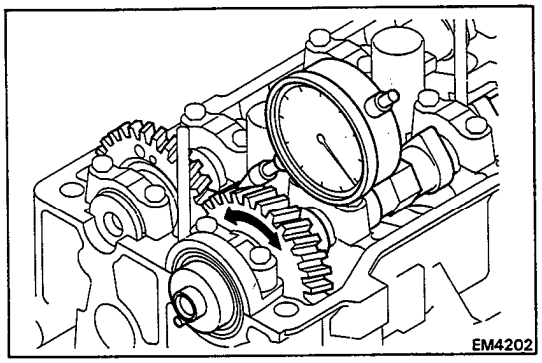
Standard thrust clearance:

Intake 0.030 – 0.085 mm (0.0012 – 0.0033 in.)

Exhaust 0.035 – 0.090 mm (0.0014 – 0.0035 in.)

Maximum thrust clearance: 0.11 mm (0.0043 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

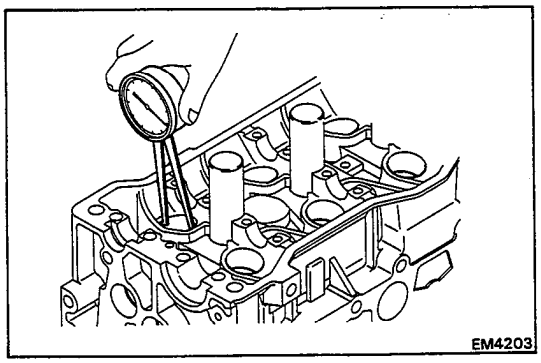
(a) Install the camshafts without installing the exhaust camshaft sub-gear.
(See step 3 on page EM-81 to 83)

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

Standard back lash: 0.020 – 0.200 mm (0.0008 – 0.0079 in.)

Maximum back lash: 0.30 mm (0.0188 in.)

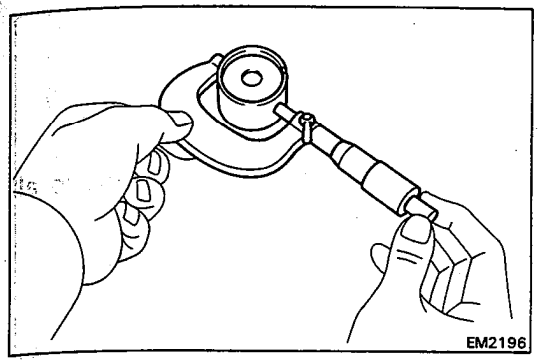
If the backlash is greater than maximum, replace the camshafts.



11. INSPECT VALVE LIFTERS AND LIFTER BORES

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

Lifter bore diameter: 28.005 – 28.006 mm (1.1026 – 1.1034 in.)



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

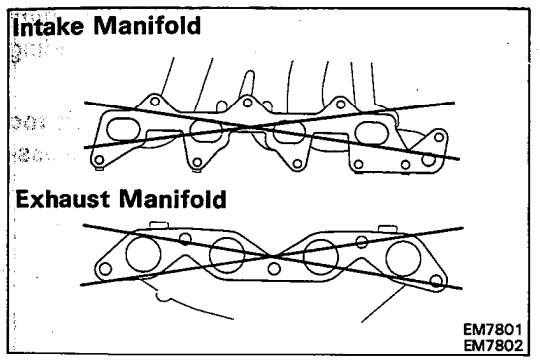
Lifter diameter: 27.975 – 27.985 mm (1.1014 – 1.1018 in.)

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

Standard oil clearance: 0.020 – 0.051 mm (0.0008 – 0.0020 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.



12. INSPECT INTAKE AND EXHAUST MANIFOLDS

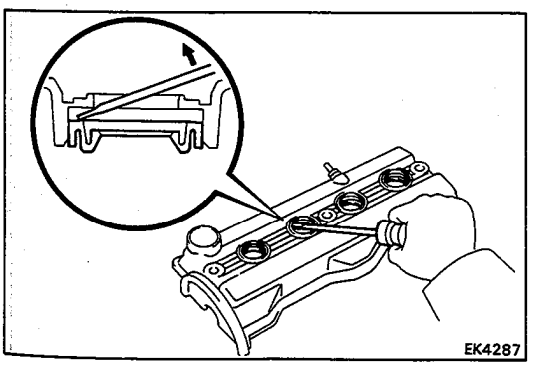
Using precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.

Maximum warpage:

Intake 0.20 mm (0.0079 in.)

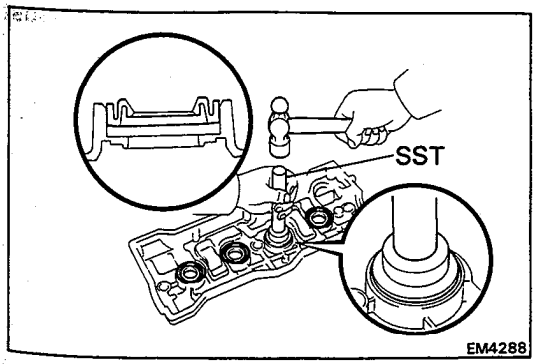
Exhaust 0.30 mm (0.0118 in.)

If warpage is greater than maximum, replace the manifold.



13. IF NECESSARY, REPLACE SPARK PLUG TUBE GASKET

(a) Using a screwdriver, pry out the gasket.



(b) Using SST, tap in a new gasket until its surface is flush with the upper edge of the cylinder head cover.

SST 09950-10012 (09552-10010, 09560-10010)

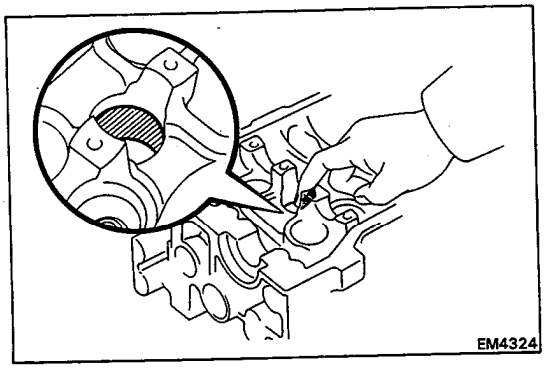
(c) Apply a light coat of MP grease to the gasket lip.

ASSEMBLY OF CYLINDER HEAD

(See pages EM-56, 57)

HINT:

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

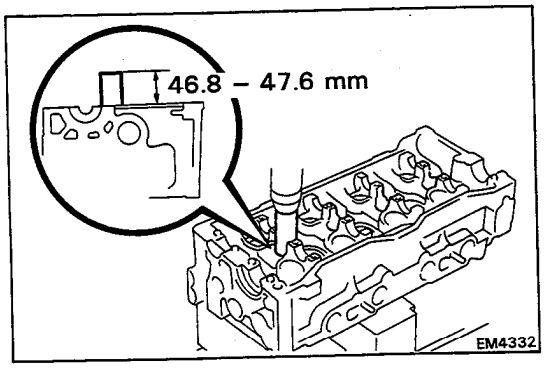


1. INSTALL SPARK PLUG TUBES

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

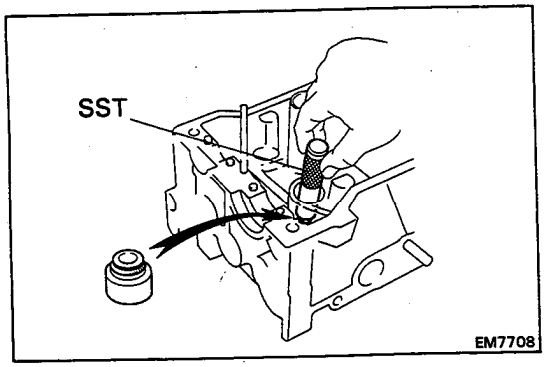
(a) Apply adhesive to the spark plug tube hole of the cylinder head.

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



(b) Using a press, press in a new spark plug tube until 46.8 – 47.6 mm (1.843 – 1.874 in.) is protruding from the cylinder head.

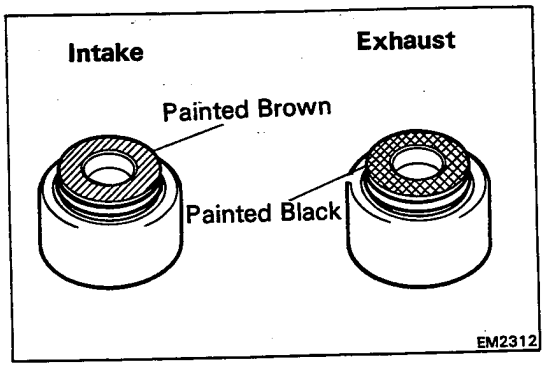
NOTICE: Avoid tapping a new spark plug tube in too far by measuring the amount of protrusion while pressing.



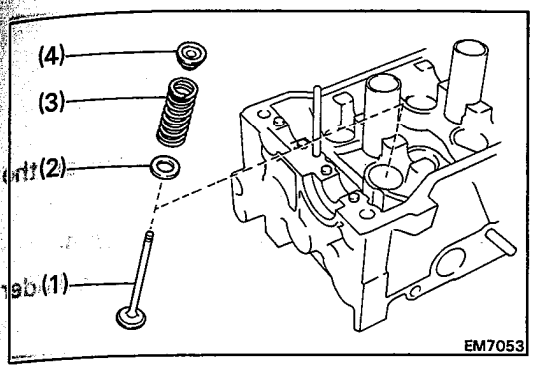
2. INSTALL VALVES

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

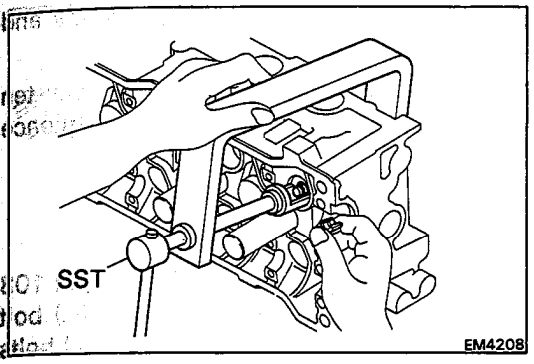
SST 09201-41020



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

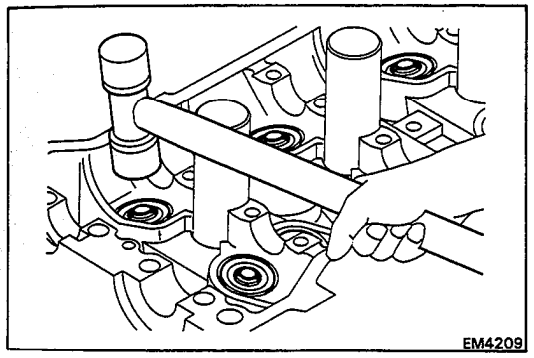


(b) Install the following parts:
(1) Valve
(2) Spring seat
(3) Valve spring
(4) Spring retainer

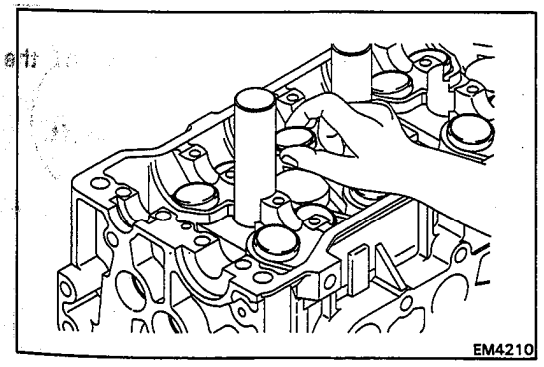


(c) Using SST, compress the valve spring and place the two keepers around the valve stem.

SST 09202-70010



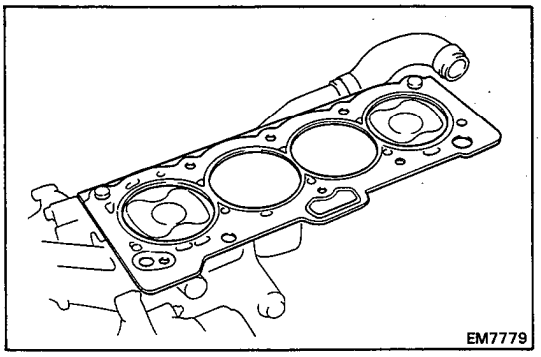
(d) Using a plastic-faced hammer, lightly tap the valve stem tip to assure proper fit.



3. INSTALL VALVE LIFTERS AND SHIMS

(a) Install the valve lifter and shim.

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



INSTALLATION OF CYLINDER HEAD

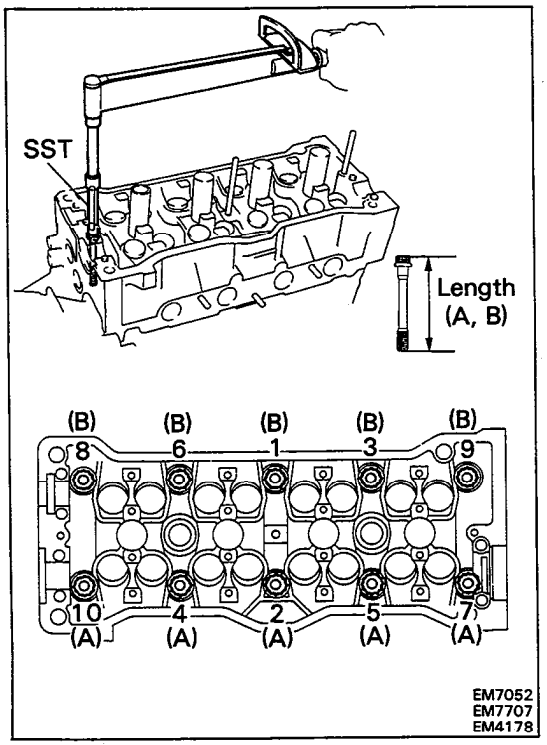
(See page EM-56, 57)

1. INSTALL CYLINDER HEAD

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

NOTICE: Be careful of the installation direction.

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



(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 passed in the sequence shown.

SST 09205-16010

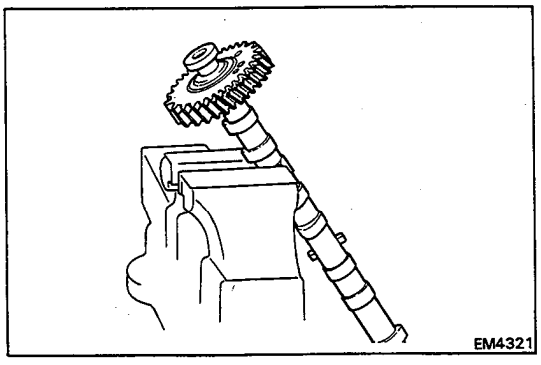
Torque: 610 kg-cm (44 ft-lb, 60 N·m)

HINT: Cylinder head bolts are 90 mm (3.54 in.) and 108 mm (4.25 in.) in length. Install the 90 mm (3.54 in.) bolt (A) in RH side positions. Install the 108 mm (4.25 in.) bolts (B) in LH side position.

2. ASSEMBLE INTAKE CAMSHAFT

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

NOTICE: Be careful not to damage the camshaft.

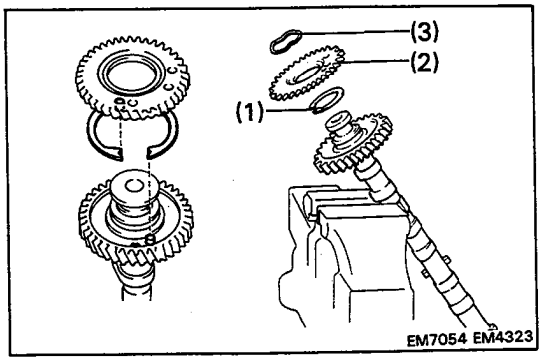


(b) Install the following parts:

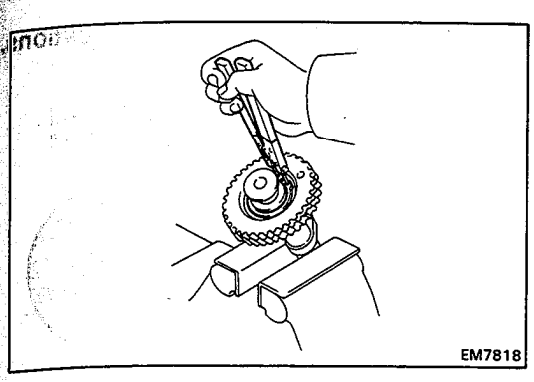
(1) Camshaft gear spring.

(2) Camshaft sub-gear

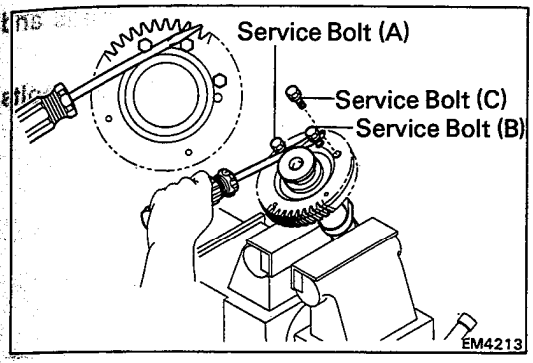
(3) Wave washer



HINT: Align the pins on the gears with the gear spring ends.



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



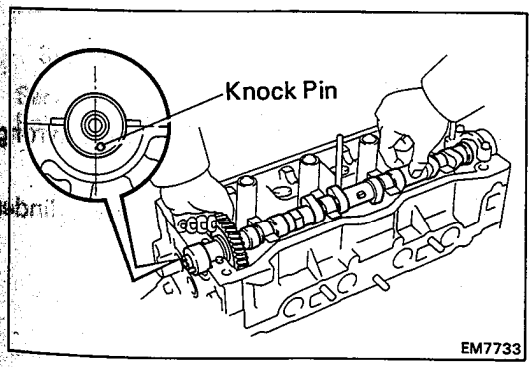
(d) Insert service bolts (A) and (B) into the service hole of the camshaft sub-gear.

(e) Using a screwdriver, align the holes of the camshaft main gear and sub-gear by turning the camshaft sub-gear clockwise, and install a service bolt (C).

NOTICE: Be careful not to damage the camshaft.

3. INSTALL CAMSHAFTS

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

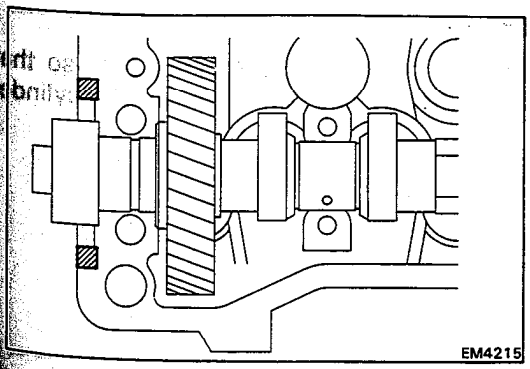


A. Install exhaust camshaft

(a) Apply MP grease to the thrust portion of the camshaft.

(b) Place the intake camshaft at so the knock pin is located slightly counterclockwise from the vertical axis of the camshaft.

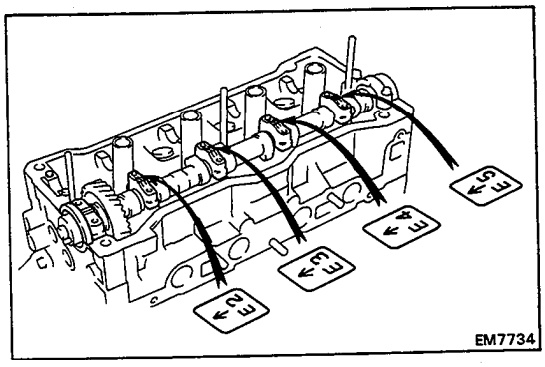
HINT: The above angle allows the No.1 and No.3 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.



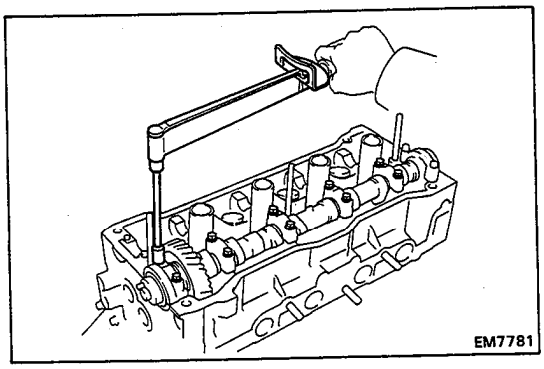
(c) Remove the old packing (FIPG) material.

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

Seal packing: Part No. 08826-00080 or equivalent



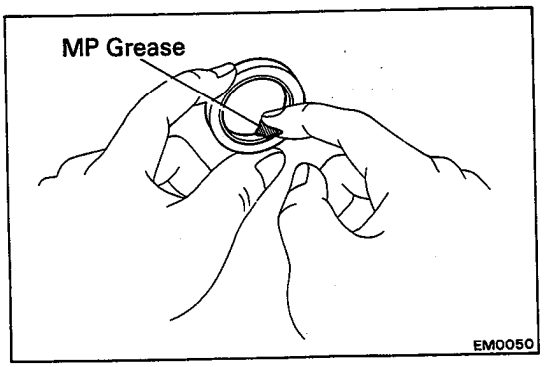
(e) Install the five bearing caps in their proper locations.



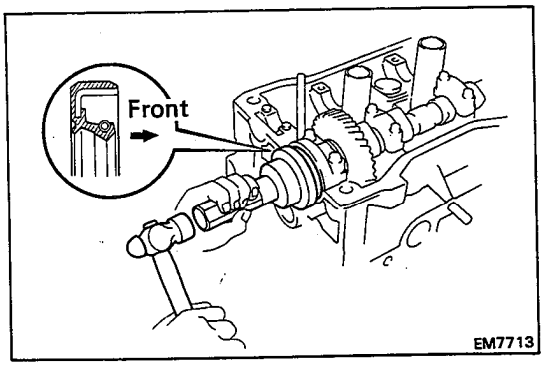
(f) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

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

Torque: 130 kg-cm (9 ft-lb, 13 N·m)



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

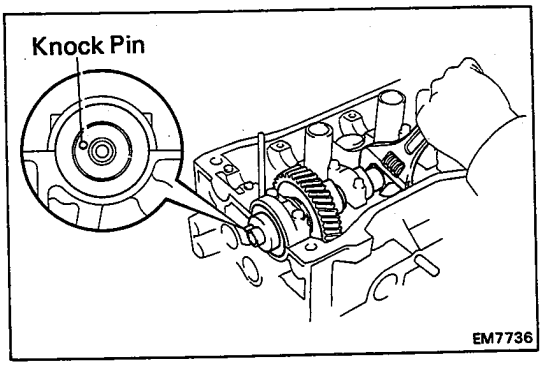


(i) Using SST, tap in the oil seal.

SST 09223-46011

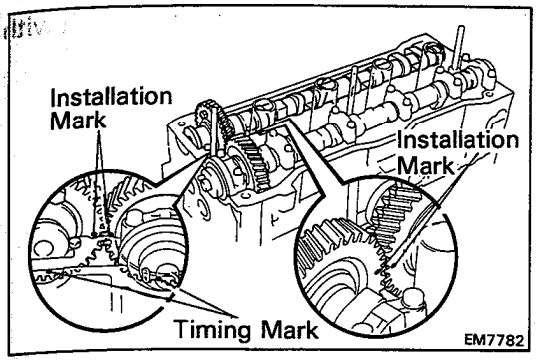
HINT:

- Do not install the oil seal with the lip facing the wron direction.
- Insert the oil seal into the deepest part of the cylinde head.



B. Install intake camshaft

(a) Set the knock pin of the exhaust camshaft so tha the knock pin is slightly above the top of the cylinde head.



(b) Apply MP grease to the thrust portion of the camshaft.

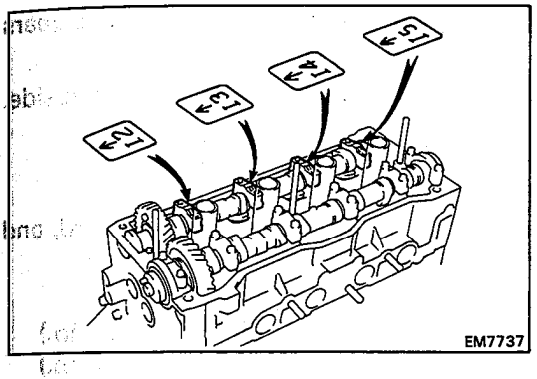
(c) Engage the intake camshaft gear to the exhaust camshaft gear by matching the assembly installation marks on each gear.

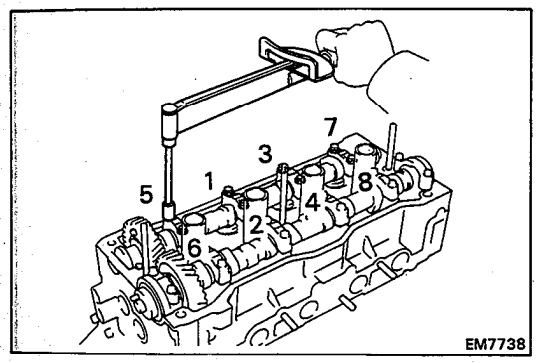
NOTICE: There are also timing marks (for TDC) on each gear as shown in the illustration. Do not use these marks.

(d) Roll down the intake camshaft onto the bearing journals while engaging gears with each other.

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

(e) Instale the four bearing caps in their proper locations.

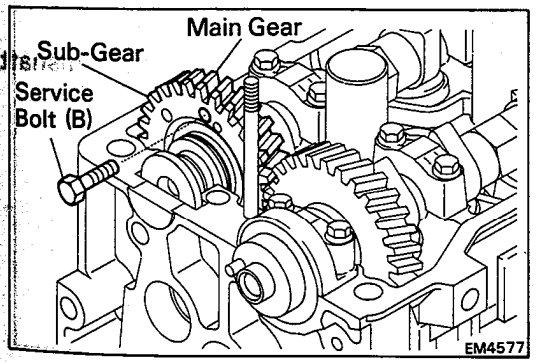




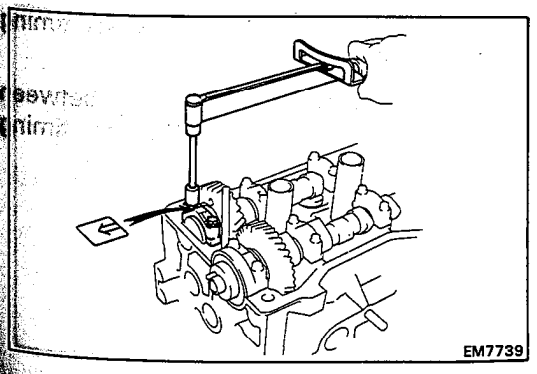
(f) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

(g) Install and uniformly tighten the eight bearing cap bolts in several passes in the sequence shown.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)



(h) Remove the service bolt (B).



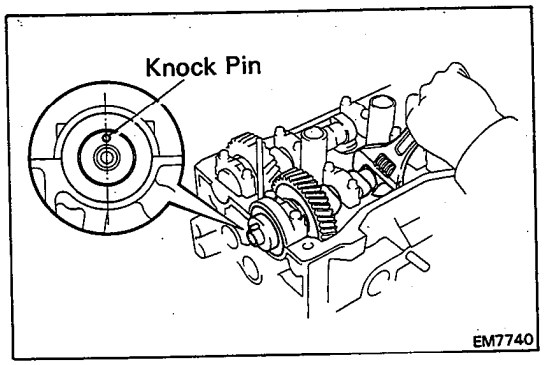
(i) Install the No. 1 bearing cap with the arrow mark facing forward.

NOTICE: If the bearing cap does not fit properly, push the camshaft gear backwards by prying apart the cylinder head and camshaft gear with a screwdriver.

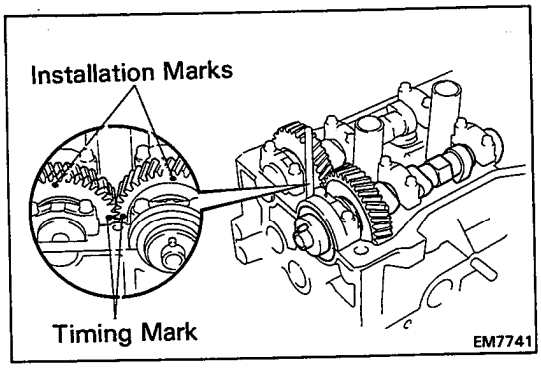
(j) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

(k) Install and alternately tighten the two bolts in several passes.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)



(l) Turn the exhaust camshaft clockwise, and set it with the knock pin facing upward.



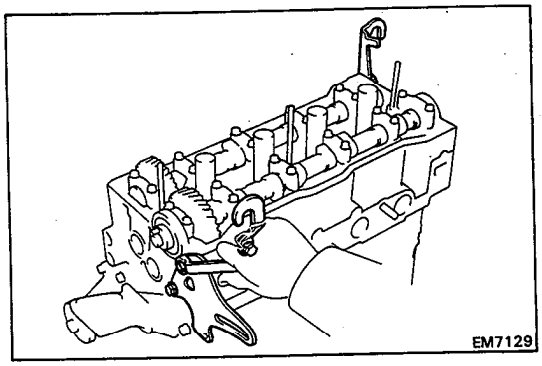
(m) Check that the timing marks of the camshaft gears are aligned.

HINT: The assembly installation marks are on the upside.

4. CHECK AND ADJUST VALVE CLEARANCE
(See page EM-16)

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

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.)



5. INSTALL ENGINE HANGERS

Install the two engine hangers with the two bolts.

Torque: 280 kg-cm (20 ft-lb, 27 N·m)

6. INSTALL FAN BELT ADJUSTING BAR

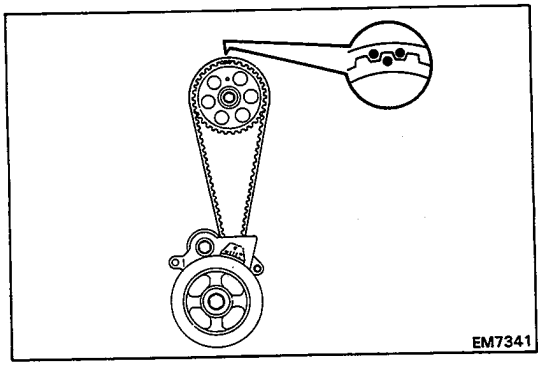
Install the adjusting bar with the two bolts.

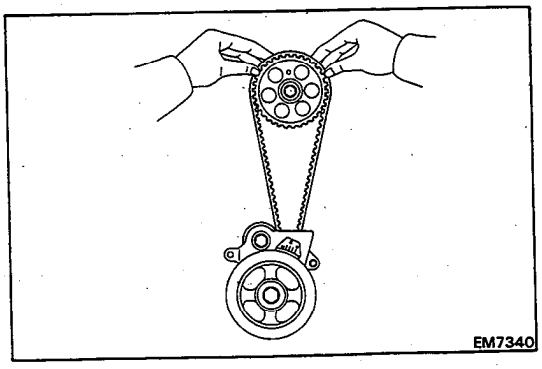
Torque: 200 kg-cm (14 ft-lb, 20 N·m)

7. INSTALL CAMSHAFT TIMING PULLEY
(See step 1 on page EM-44)

8. INSTALL TIMING BELT

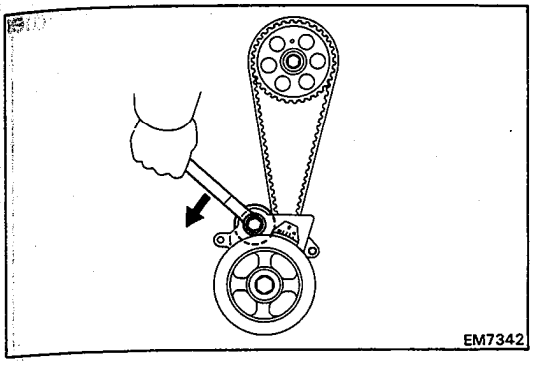
Align the matchmarks of the timing belt and camshaft timing pulley.





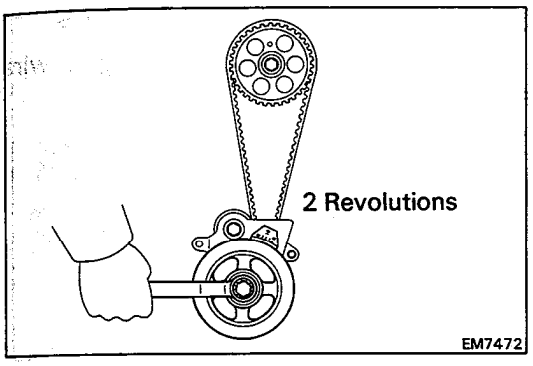
(a) Remove any oil or water on the camshaft timing pulley, and keep it clean.

(b) Install the timing belt, insuring the tension between the crankshaft timing pulley and camshaft timing pulley.



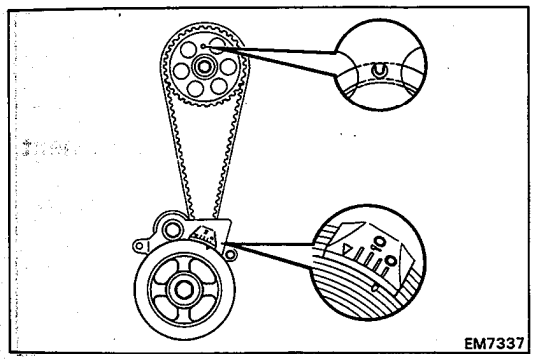
9. INSTALL VALVE TIMING

(a) Loosen the idler pulley bolt 1/2 turn.



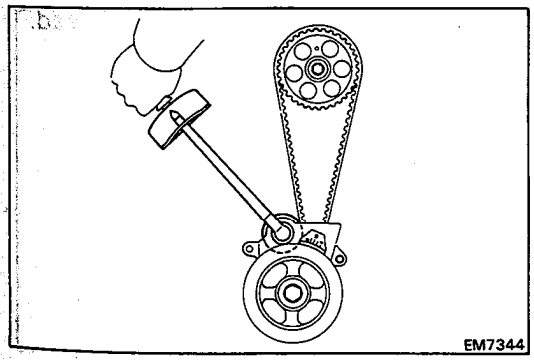
(b) Turn the crankshaft pulley two revolutions from TDC to TDC.

NOTICE: Always turn the crankshaft clockwise.



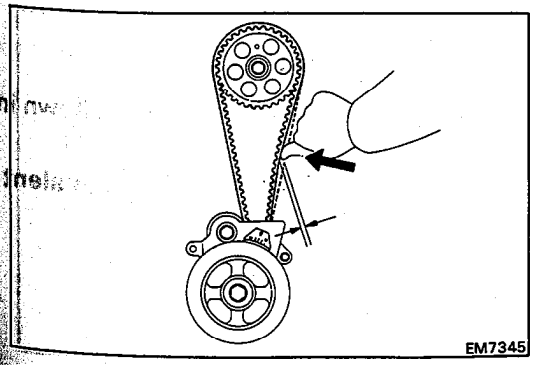
(c) Check that each pulley aligns with the timing marks as shown in the illustration.

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



(d) Tighten the idler pulley bolt.

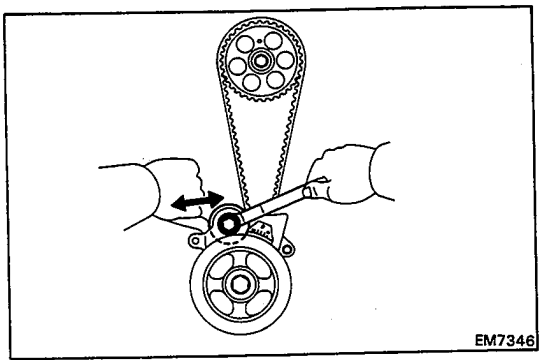
Torque: 375 kg-cm (27 ft-lb, 37 N·m)



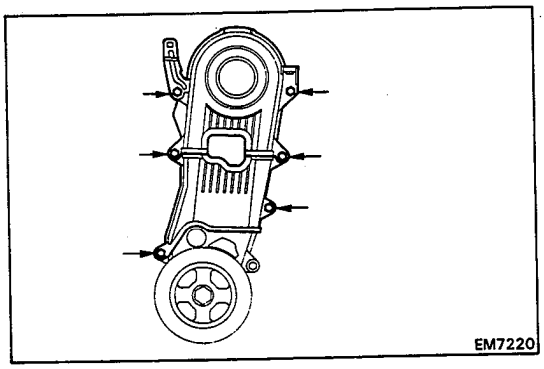
10. (REFERENCE)
INSTALL TIMING BELT TENSION

Check that there is belt tension at the portion indicated in the illustration.

Deflection: 5 – 6 mm (0.20 – 0.24 in.)
at 2 kg (4.4 lb, 20 N)



If the deflection is not as specified, adjust with the idler pulley.

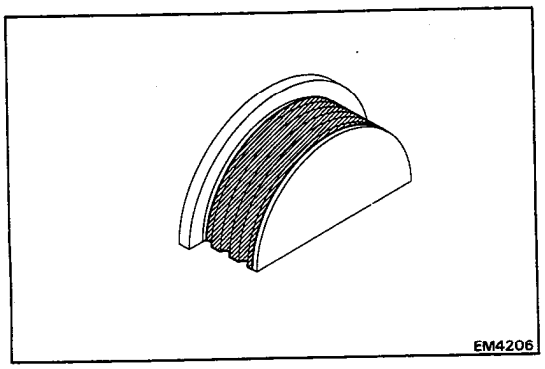


11. INSTALL NO.2 AND NO.3 TIMING BELT COVERS

Install the No.2, No.3 timing belt covers and engine wire bracket with the six bolts.

12. INSTALL SPARK PLUGS (See page IG-8)

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

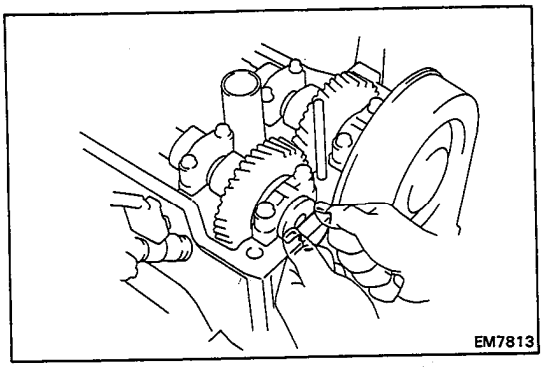


13. INSTALL SEMI-CIRCULAR PLUG

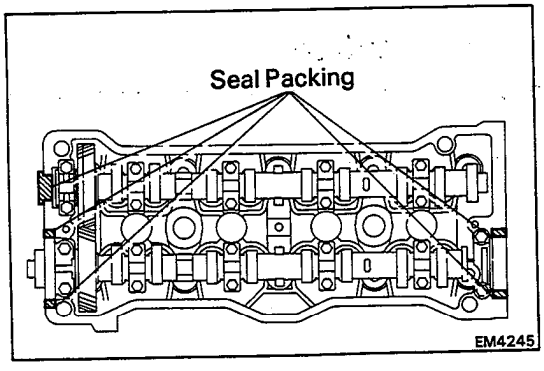
(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the circular plug.

Seal packing: Part No. 08826-00080 or equivalent



(c) Install the semi-circular plug to the cylinder head.

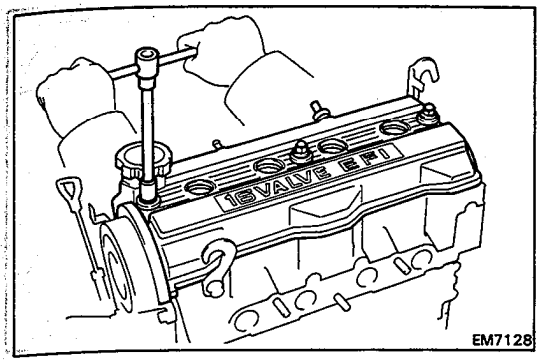


14. INSTALL CYLINDER HEAD COVER

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

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

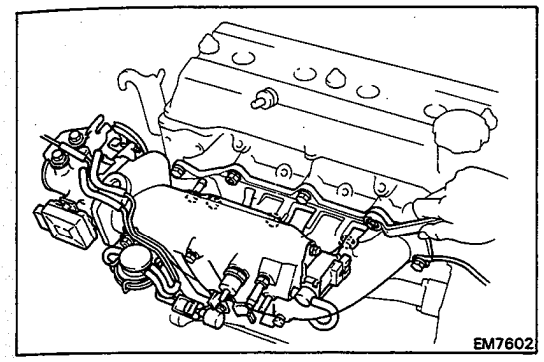
Seal packing: Parts No. 08826-00080 or equivalent



(c) Install the gasket to the head cover.

(d) Install the head cover with the three grommets and cap nuts.

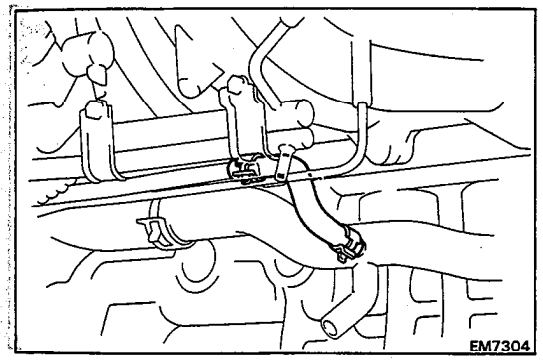
Torque: 80 kg-cm (69 in.-lb, 7.8 N·m)



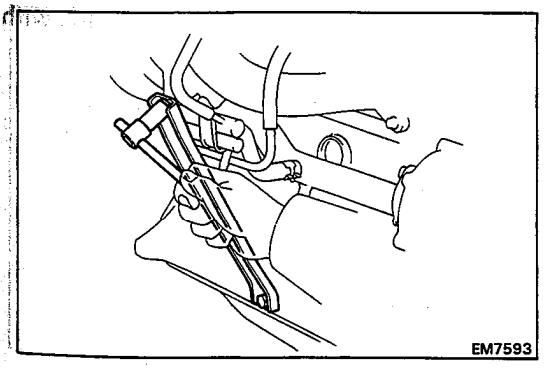
15. INSTALL INTAKE MANIFOLD (2WD)

(a) Install a new gasket and the intake manifold with the seven bolts, ground strap and two nuts.

Torque: 195 kg-cm (14 ft-lb, 19 N·m)



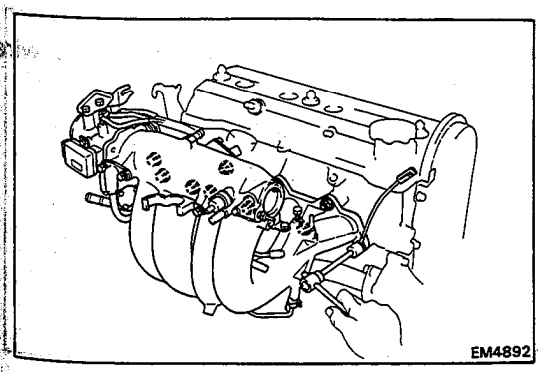
(b) Connect the water by-pass hose to the air pipe.



(c) Install the manifold stay with the two bolts.

Torque:

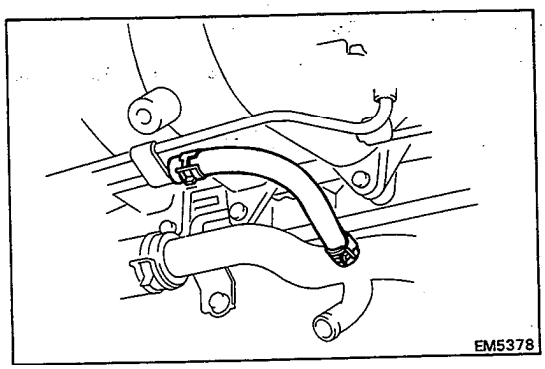
12 mm bolt head	**195 kg-cm (14 ft-lb, 19 N·m)**
14 mm bolt head	**400 kg-cm (29 ft-lb, 39 N·m)**



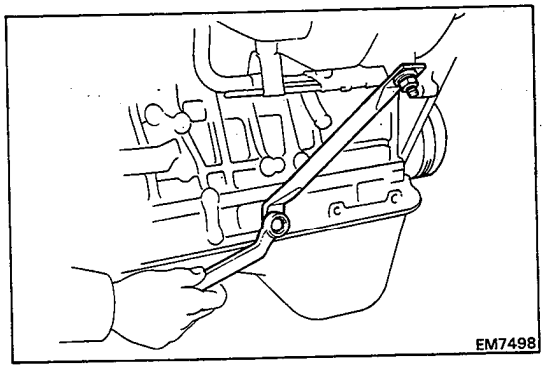
(4WD)

(a) Install a new gasket and the intake manifold with the seven bolts, ground strap and two nuts.

Torque: 195 kg-cm (14 ft-lb, 19 N·m)

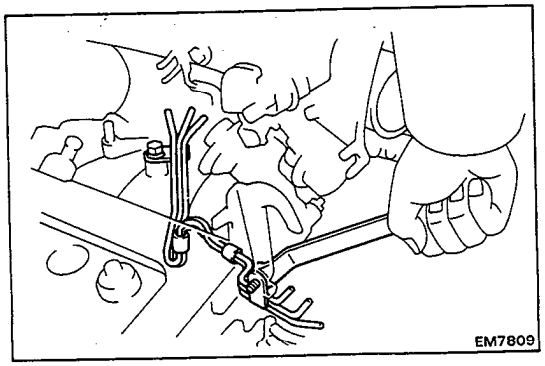


(b) Connect the water by-pass hose to the air pipe.



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

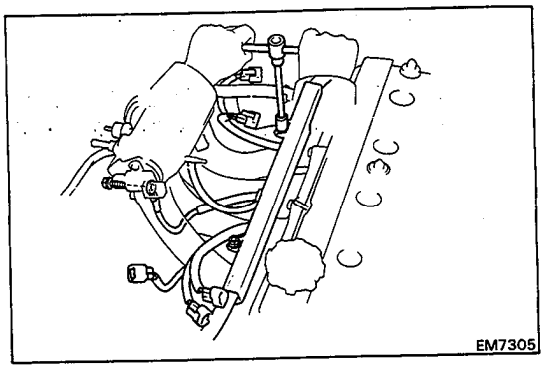
Torque: 195 kg-cm (14 ft-lb, 19 N·m)



16. (4WD)
INSTALL VACUUM PIPE

(a) Install the vacuum pipe with the two bolts.

(b) Connect the three vacuum hoses.



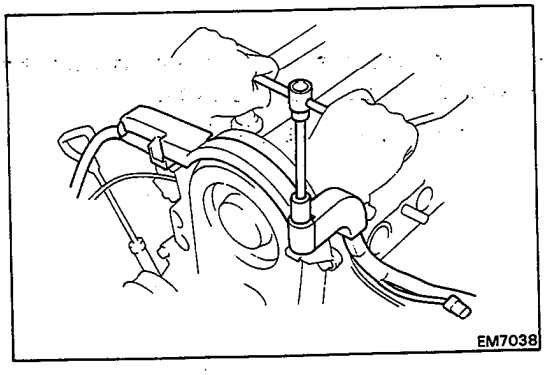
17. INSTALL ENGINE WIRE TO INTAKE MANIFOLD

(a) Install the engine wire with the three bolts.

(b) Install the engine wire the engine to vacuum pipe with the wire clamp.

(c) Connect the following connectors:

- Throttle position sensor connector
- ISC valve connector
- (2WD w/ EGR system) EGR VSV connector
- Cold start injector connector



18. INSTALL ENGINE WIRE TO NO.3 TIMING BELT COVER

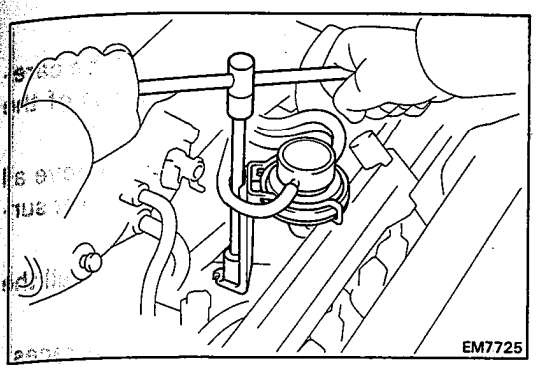
(a) Install the wire clamp on engine wire to the wire bracket.

(b) Install the engine wire with the bolt.

(c) Connect the following connectors and wire:

- Alternator connector
- Alternator wire
- Oil pressure switch connector

19. INSTALL INJECTORS AND DELIVERY PIPE
(See steps 1 and 3 to 6 on pages FI-116 to 119)


EM7725

20. (4WD)
INSTALL EGR VACUUM MODULATOR

(a) Install the vacuum modulator and nut.

(b) Connect the four vacuum hoses.

(1) EGR valve hose.

(2) Three port vacuum hoses from the EGR vacuum modulator.

21. INSTALL COLD START INJECTOR PIPE
(See step 2 on page FI-108)

22. INSTALL WATER INLET AND INLET HOUSING

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the inlet housing and cylinder head.

- Using a razor blade and gasket scraper, remove all the oil packing (FIPG) material from the gasket surfaces and sealing groove.
- Thoroughly clean all components to remove all the loose material.
- Using a non-residue, clean both sealing surfaces.

(b) Apply seal packing to the inlet housing groove.

Seal packing: Part No. 08826-00100 or equivalent

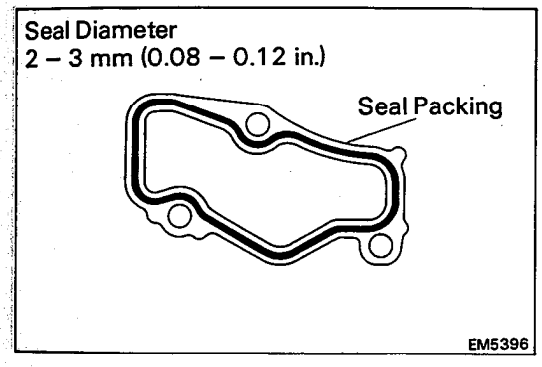
- Install a nozzle that has been cut with a 2 – 3 mm (0.08 – 0.12 in.) opening.

HINT: Avoid applying an excessive amount to the surface.

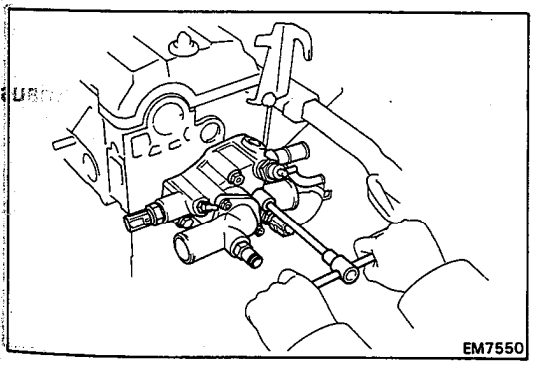
- Parts must be assembled within 15 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

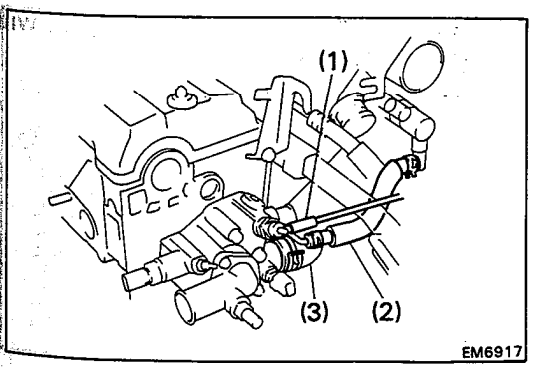
(c) Install the water inlet and inlet housing assembly with the bolt and two nuts.

Torque: 200 kg-cm (14 ft-lb, 20 N·m)



EM5396


EM7550



EM6917

(d) Connect the following hoses:

(1) BVSV vacuum hose(s)

(2) Water by-pass hose

(3) Inlet water hose

(e) Connect the following connectors:

- Water temperature sender gauge connector
- Water temperature sensor connector
- Start injector time switch connector

23. INSTALL WATER OUTLET

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the water outlet cylinder head.

- Using a razor blade and gasket scraper, remove all the oil packing (FIPG) material from the gasket surfaces and sealing groove.
- Thoroughly clean all components to remove all the loose material.
- Using a non-residue, clean both sealing surfaces.

(b) Apply seal packing to the water outlet groove.

Seal packing: Part No. 08826-00100 or equivalent

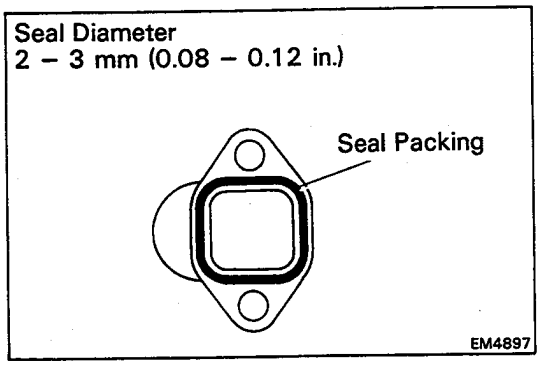
- Install a nozzle that has been cut with a 2 – 3 mm (0.08 – 0.12 in.) opening.

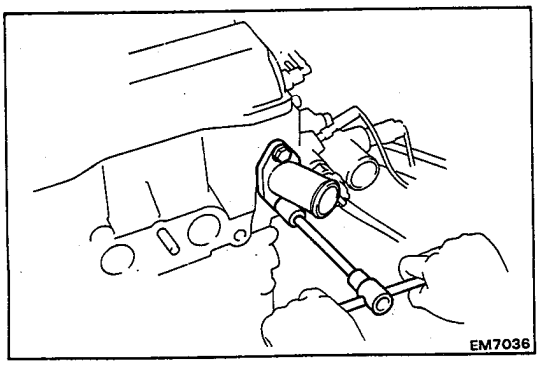
HINT: Avoid applying an excessive amount to the surface.

- Parts must be assembled within 15 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

(c) Install the water outlet with the two bolts.

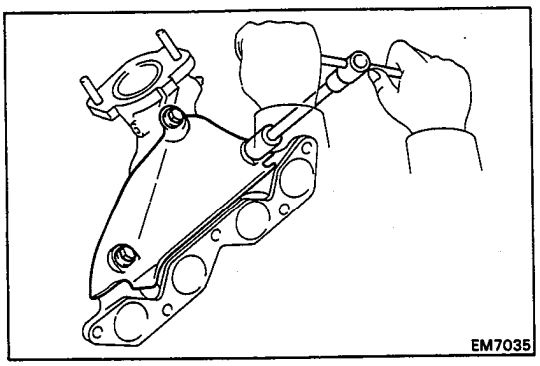
Torque: 150 kg-cm (11 ft-lb, 15 N·m)





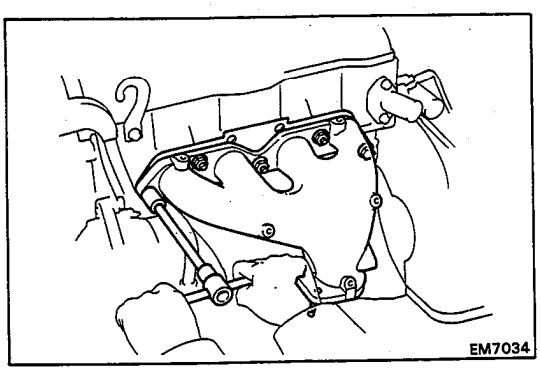
24. INSTALL EXHAUST MANIFOLD (2WD)

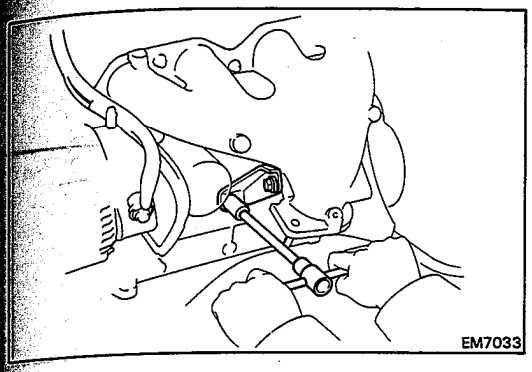
(a) Install the lower heat insulator to the exhaust manifold with the three bolts.



(b) Install a new gasket and the exhaust manifold with the two bolts and three nuts.

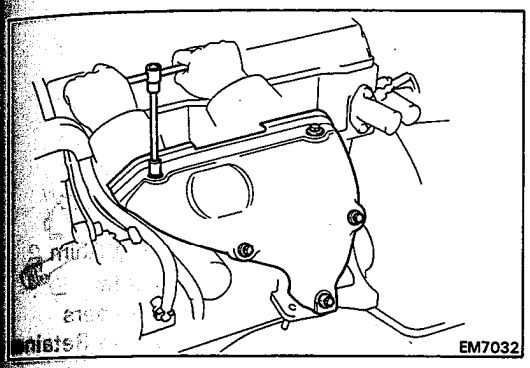
Torque: 250 kg-cm (18 ft-lb, 25 N·m)





(c) Install the manifold stay with the two bolts.

Torque: 400 kg-cm (29 ft-lb, 39 N·m)



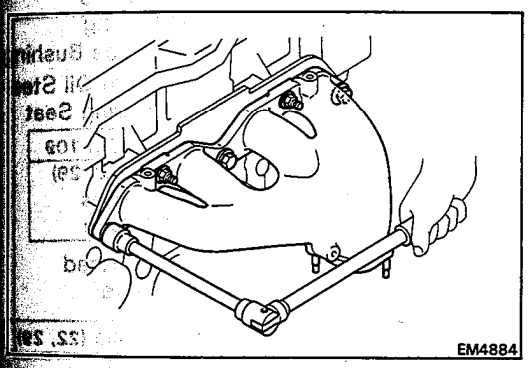
(d) Install the upper heat insulator with the five bolts.

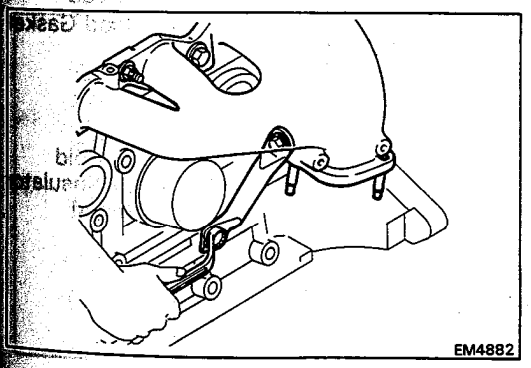
(4WD)

(a) Install the lower heat insulator to the exhaust manifold with the three bolts.

(b) Install a new gasket and the exhaust manifold with the two new nuts and three bolts.

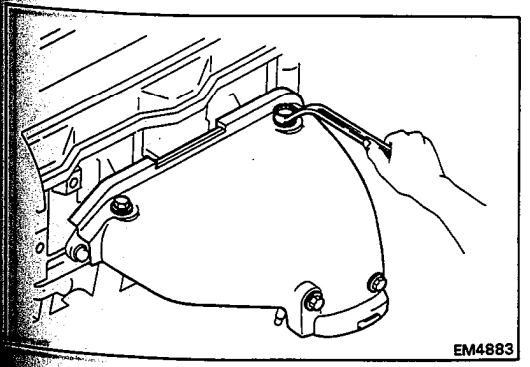
Torque: 250 kg-cm (18 ft-lb, 25 N·m)





(c) Install the manifold stay with the two bolts.

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

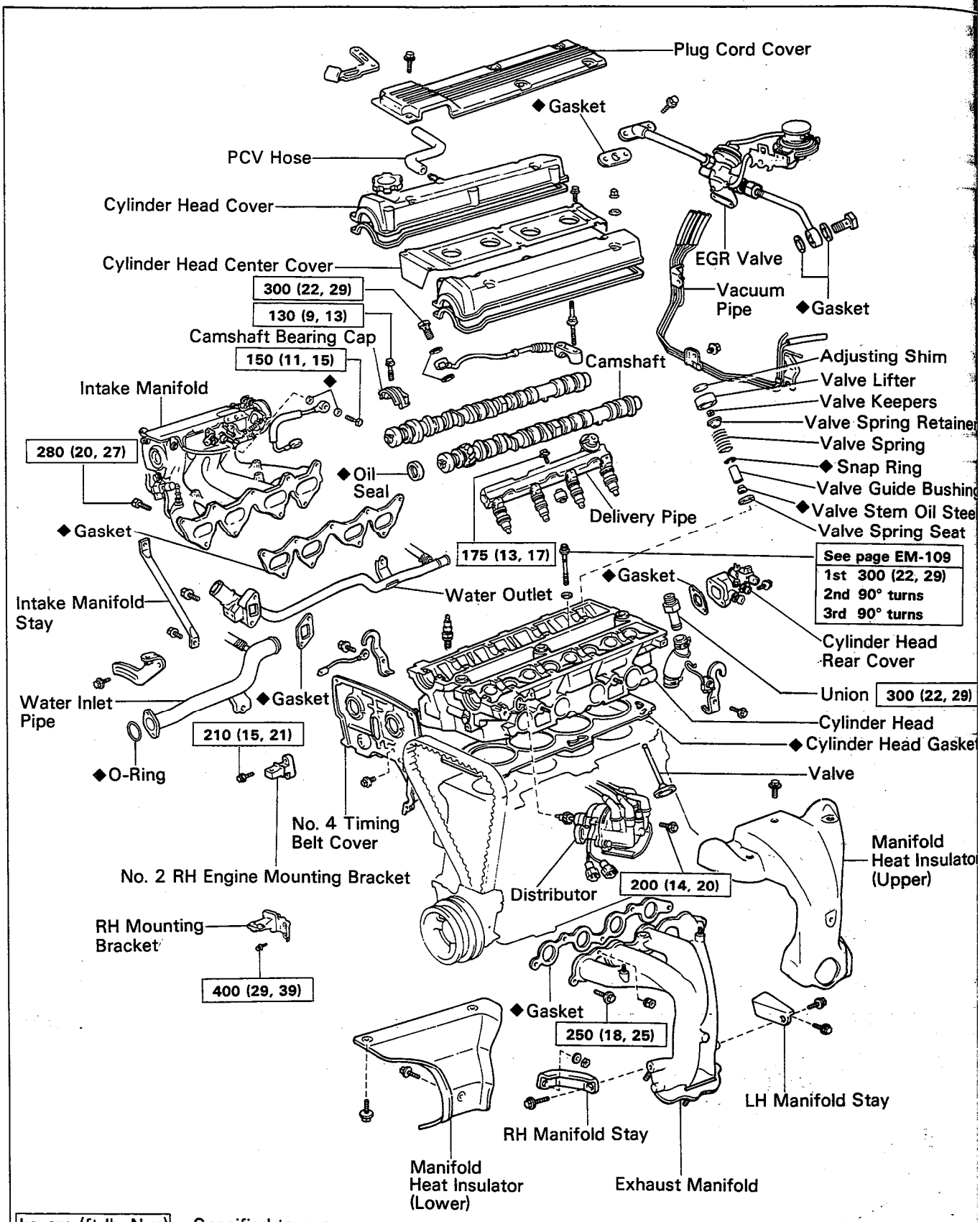


(d) Install the upper heat insulator with the four bolts.

25. INSTALL IIA (See page IG-18)

CYLINDER HEAD (4A-GE)

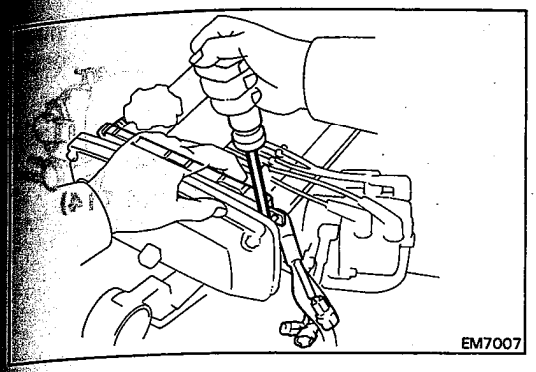
COMPONENTS

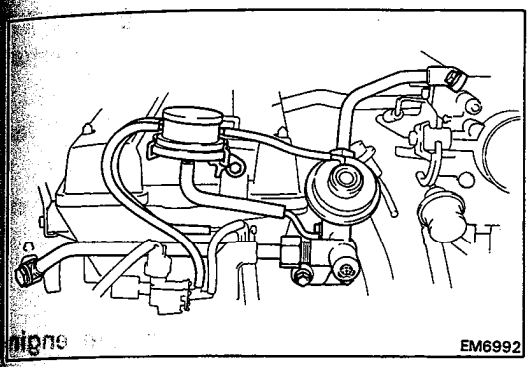


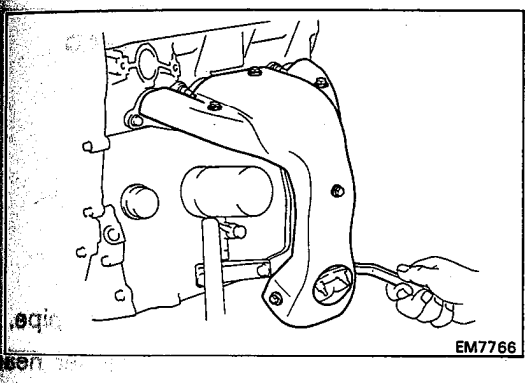
kg-cm (ft-lb, N·m) : Specified torque

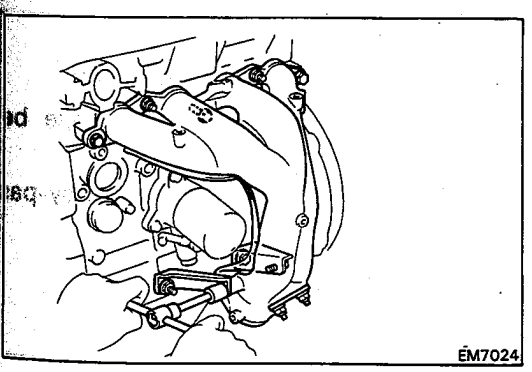
◆ Non-reusable part

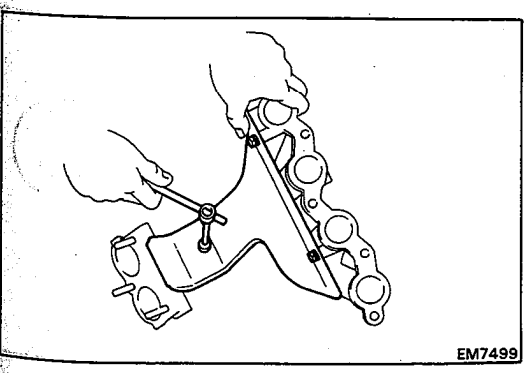
EM755











REMOVAL OF CYLINDER HEAD

(See page EM-92)

1. **DRAIN ENGINE COOLANT (See page CO-5)**

2. **DISCONNECT ENGINE WIRE FROM NO.4 TIMING BELT COVER**
   (a) Disconnect the following connectors:
   - Distributor wire connectors
   - Oil pressure sender gauge connector

   (b) Disconnect the engine wire from the timing belt cover.

3. **REMOVE DISTRIBUTOR**

4. **(w/ EGR SYSTEM)**
   REMOVE EGR VALVE AND MODULATOR
   (a) Disconnect the vacuum hoses from the vacuum pipe.
   (b) Remove the bolt and EGR vacuum modulator.
   (c) Remove the union bolt, four bolts, the EGR valve, pipes assembly and gaskets.

5. **REMOVE EXHAUST MANIFOLD**
   (a) Remove the six bolts and upper heat insulator.

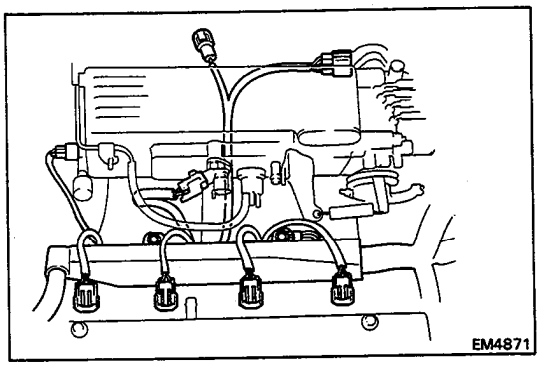
   (b) Remove the three bolts, nut, RH and LH manifold stays.
   (c) Remove the three bolts, two nuts exhaust manifold and gasket.

   (d) Remove the three bolts and lower heat insulator.

6. REMOVE PCV HOSE

7. REMOVE COLD START INJECTOR PIPE
(See step 3 on page FI-105)

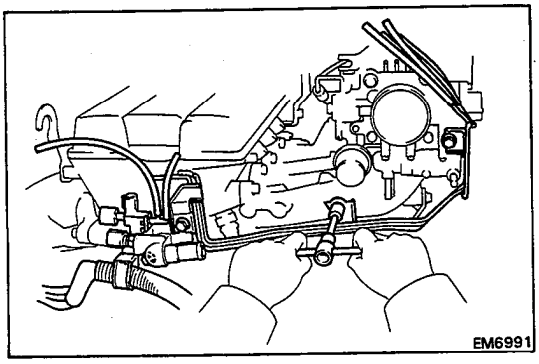
9. REMOVE DELIVERY PIPE AND INJECTORS
(See steps 3 to 6 and 8 on page FI-113 and 114)



9. DISCONNECT ENGINE WIRE FROM INTAKE MANIFOLD

(a) Disconnect the following connectors:
- Knock sensor connector
- Throttle position sensor connector
- Cold start injector connector
- (Europe)
  Fuel pressure VSV connector

(b) Remove the two bolts, and disconnect the engine wire from the intake manifold.

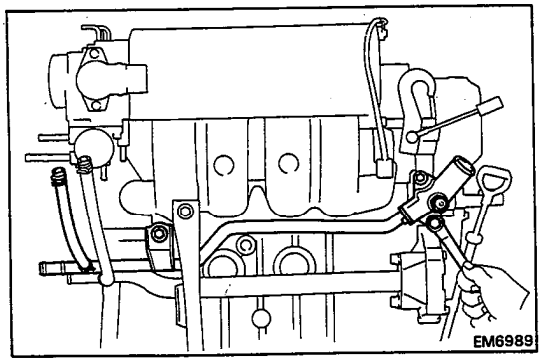


10. REMOVE VACUUM PIPE AND CYLINDER HEAD REAR COVER

(a) Disconnect the following connectors:
- Start injector time switch connector
- Water temp. sensor connector
- (w/ EGR system)
  EGR VSV connector

(b) Remove the vacuum hoses from the vacuum pipe.

(c) Remove the four bolts, vacuum pipe, cylinder head rear cover and wire clamp.

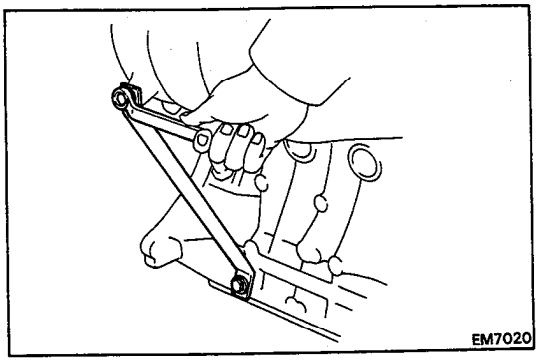


11. REMOVE WATER OUTLET AND BY-PASS PIPE

(a) Remove the three bolts and alternator drive belt adjusting bar.

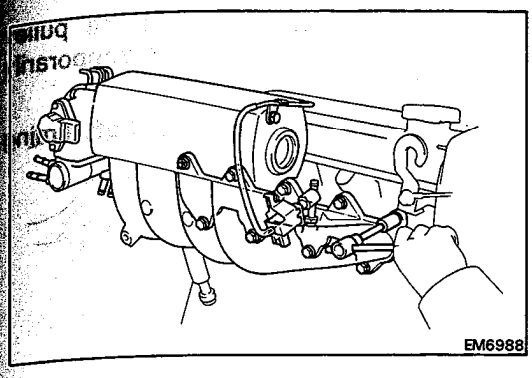
(b) Remove the three bolts, the water outlet, by-pass pipe assembly and gasket.

12. REMOVE WATER INLET PIPE
(See step 4 on page CO-6)

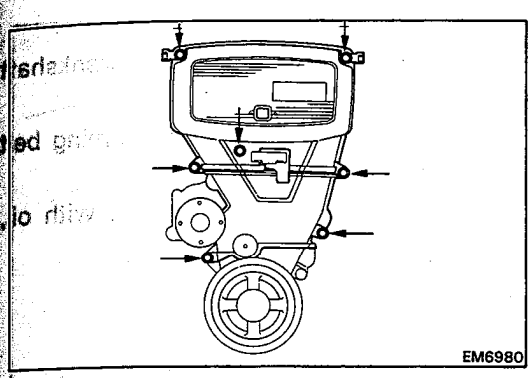


13. REMOVE INTAKE MANIFOLD

(a) Remove the two bolts and manifold stay.


EM6988

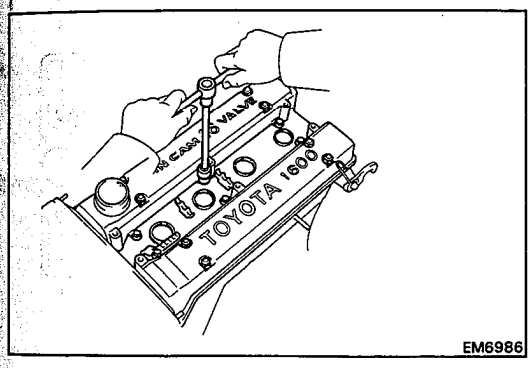
(b) Remove the seven bolts, two nuts and intake manifold.


EM6980

14. REMOVE WATER PUMP PULLEY AND DRIVE BELT

15. REMOVE NO.3 AND NO.2 TIMING BELT COVERS

Remove the seven bolts, cord support plate, No.3, No.2 belt covers and gaskets.



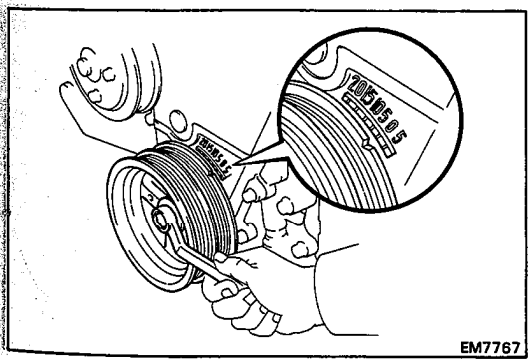
EM6986

16. REMOVE CYLINDER HEAD COVERS

(a) Remove the six bolts, center cover and gasket.

(b) Remove the eight cap nuts, seal washers, two head covers and gaskets.

17. REMOVE SPARK PLUGS (See page IG-12)

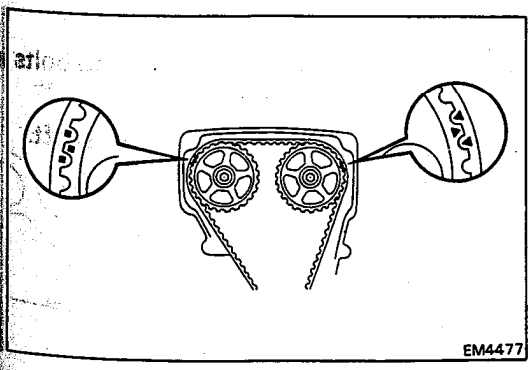

EM7767

18. 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.

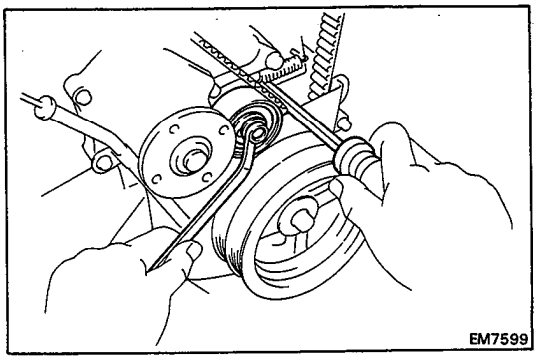
(b) Check that the valve lifters on the No.1 cylinder are loose and valve lifters on the No.4 cylinder are tight.

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


EM4477

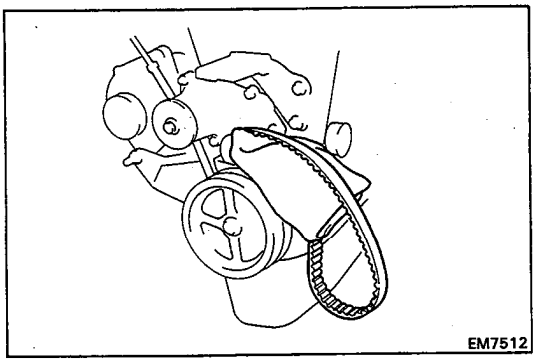
19. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEYS

(a) Place matchmarks on the camshaft timing pulleys and timing belt.



(b) Loosen the idler pulley bolt and shift the pulley toward the left as for as it will go, and temporarily tighten it.

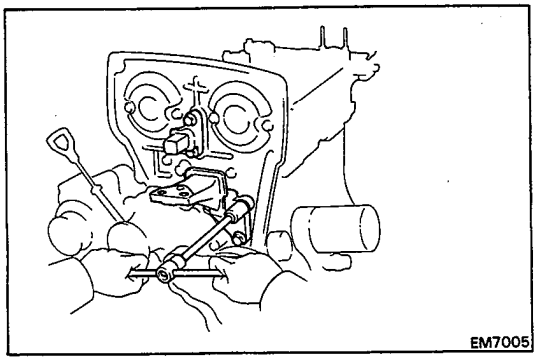
(c) Remove the timing belt from the camshaft timing pulleys.



HINT:

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

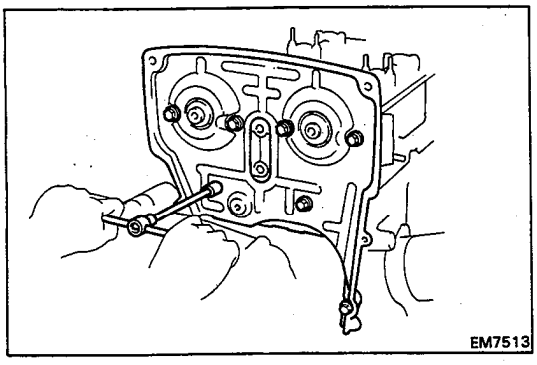
20. REMOVE CAMSHAFT TIMING PULLEYS
(See step 12 on page EM-49)



21. REMOVE RH MOUNTING BRACKETS

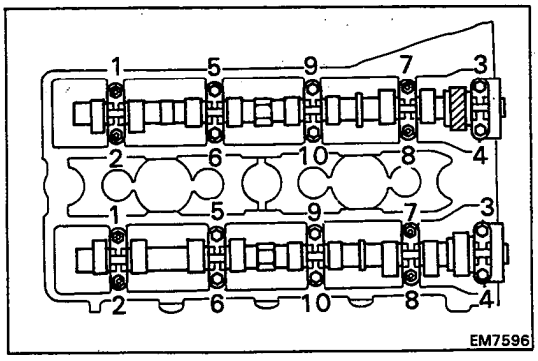
(a) Remove the two bolts and No.2 bracket.

(b) Remove the three bolts and bracket.



22. REMOVE NO.4 TIMING BELT COVER

Remove the seven bolts and belt cover.

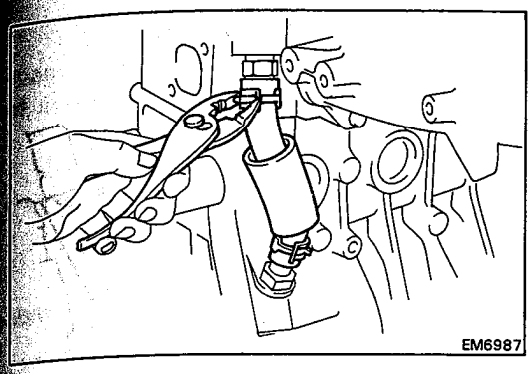


23. REMOVE CAMSHAFTS

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

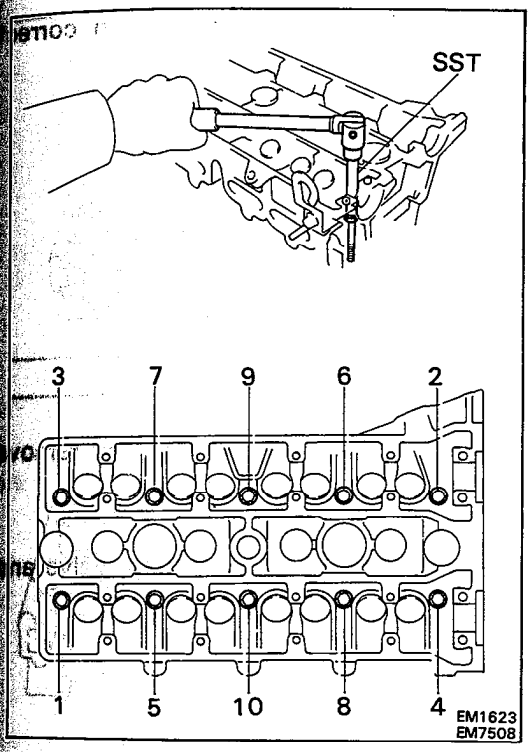
(b) Remove the bearing caps, oil seal and camshaft.

HINT: Arrange the intake and exhaust camshafts.



24. REMOVE PCV HOSE

Remove the two clamps, and disconnect the PCV hose from the cylinder head.

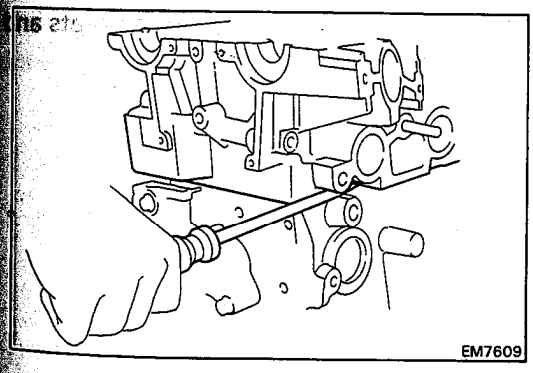


25. REMOVE CYLINDER HEAD

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

SST 09205-16010

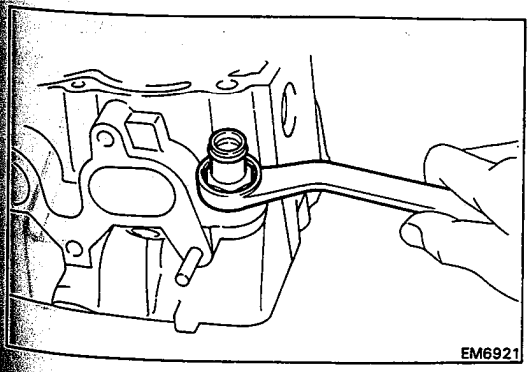
NOTICE: Head warpage or cracks could result from removing bolts in an incorrect order.



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

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

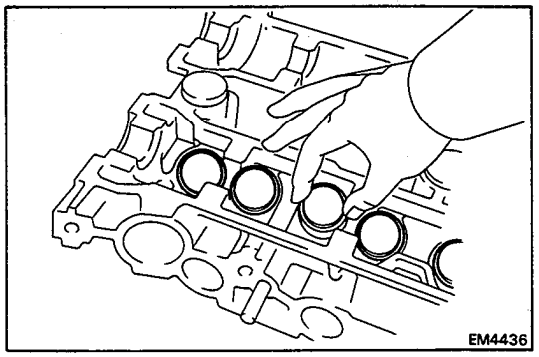
NOTICE: Be careful not to damage the cylinder head and cylinder block surfaces of the cylinder head gasket side.



26. REMOVE ENGINE HANGERS

Remove the two bolts, ground strap and two engine hangers.

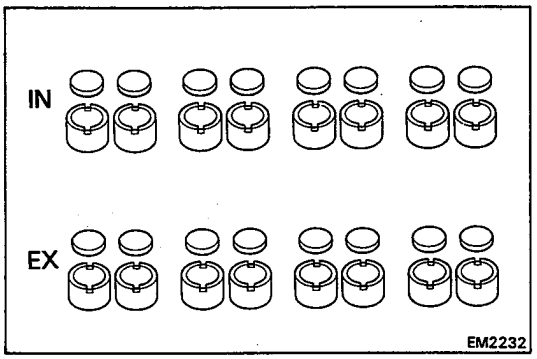
27. REMOVE UNION



DISASSEMBLY OF CYLINDER HEAD

(See page EM-92)

1. REMOVE VALVE LIFTERS AND SHIMS



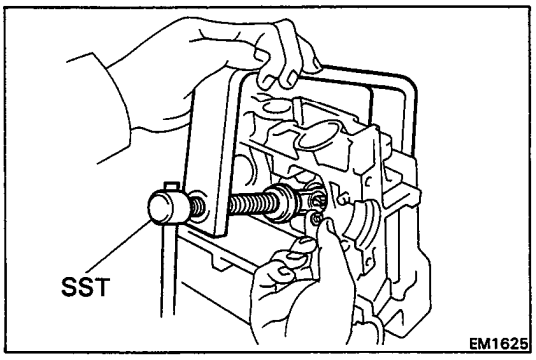
HINT: Arrange the valve lifters and shims in corre order.

2. REMOVE VALVES

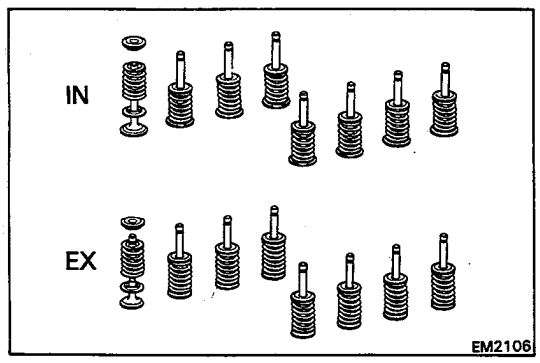
(a) Using SST, compress the valve spring and remov the two keepers.

SST 09202-70010

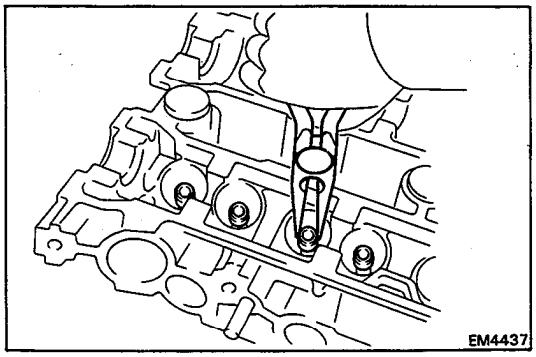
(b) Remove the spring retainer, valve spring, valve an spring seat.

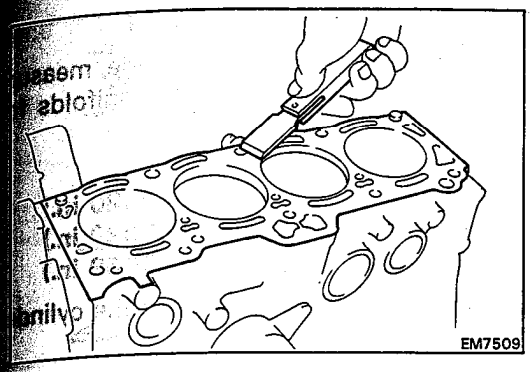


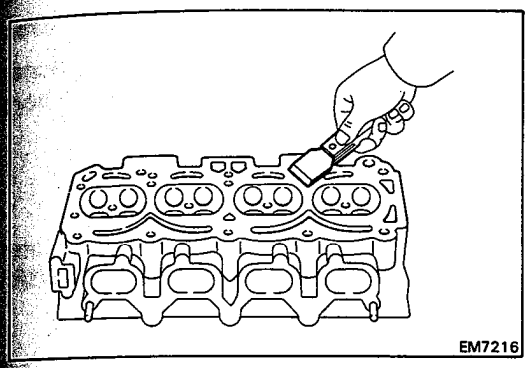
HINT: Arrange the valves, valve springs, spring seats an spring retainers in correct order.

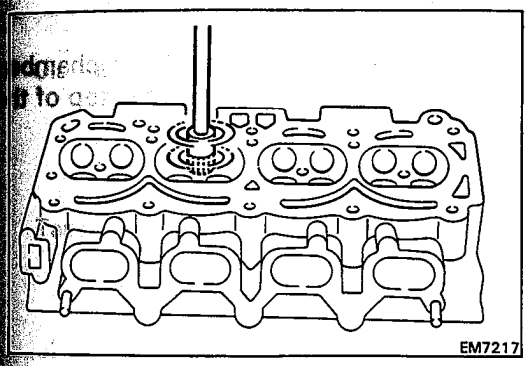


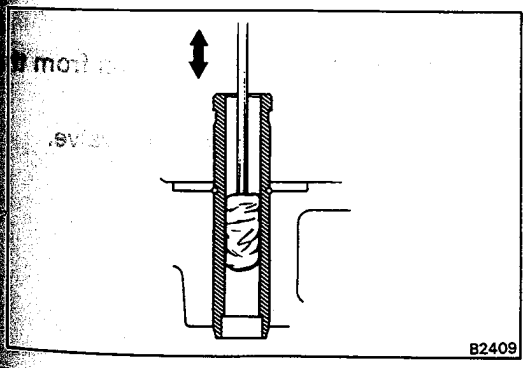
(c) Using needle-nose pliers, remove the oil seal.

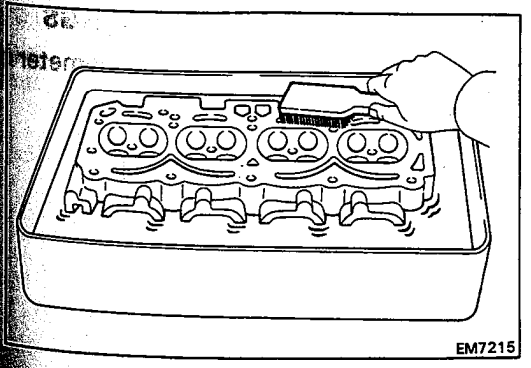



EM7509


EM7216


EM7217


B2409


EM7215

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 hoees.

CAUTION: 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.

NOTICE: Be careful not scratch the surfaces.

3. CLEAN COMBUSTION CHAMBERS

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

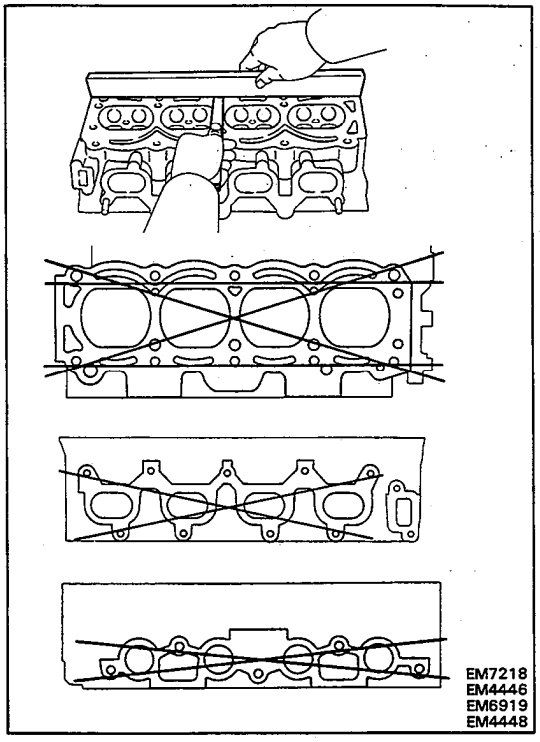
NOTICE: Be careful not to scratch the head gasket contact surface.

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 the cylinder head.


EM7218
EM4446
EM6919
EM4448

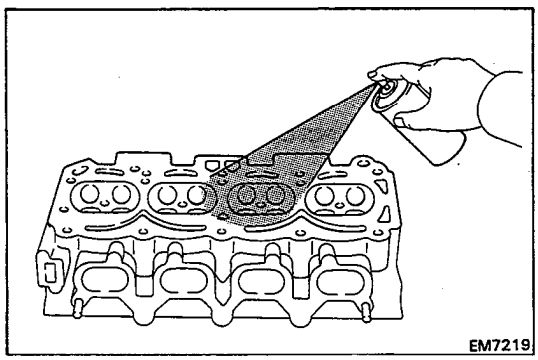
6. INSPECT CYLINDER HEAD FOR FLATNESS

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

Maximum warpage:

Cylinder block side	**0.05 mm (0.0020 in.)**
Intake manifold side	**0.05 mm (0.0020 in.)**
Exhaust manifold side	**0.10 mm (0.0039 in.)**

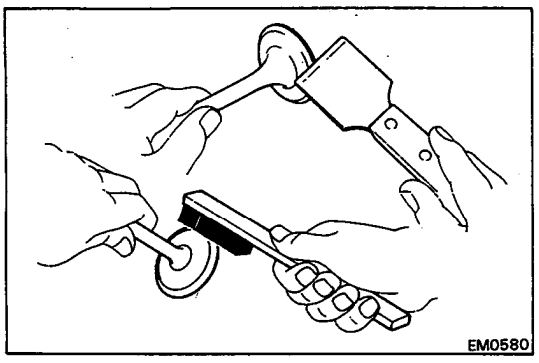
If warpage is greater than maximum, replace the cylinc head.


EM7219

7. INSPECT CYLINDER HEAD FOR CRACKS

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

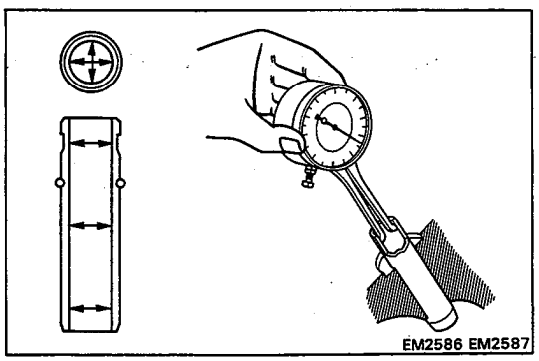
If cracked, replace the cylinder head.


EM0580

8. CLEAN VALVES

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

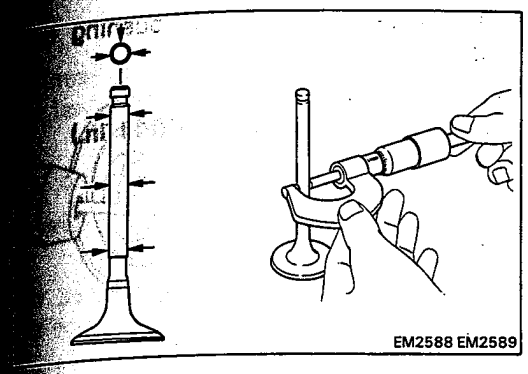
(b) Using a wire brush, thoroughly clean the valve.


EM2586 EM2587

9. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:
6.01 – 6.03 mm (0.2366 – 0.2374 in.)


EM2588 EM2589

(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.

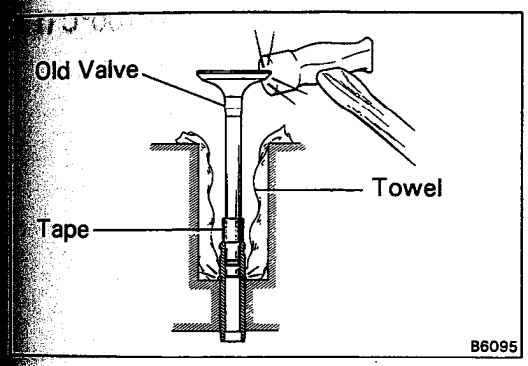
Standard oil clearance:

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.

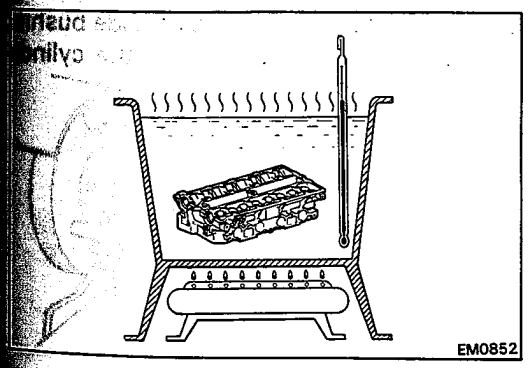


B6095

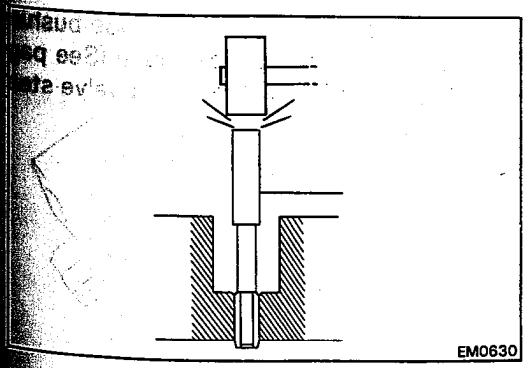
10. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

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

NOTICE: Be careful not to damage the lifter hole.

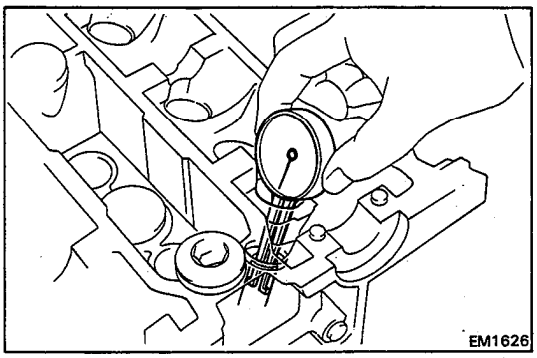

EM0852

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


EM0630

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

SST 09201-70010



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

Standard valve guide bore (cold):
11.000 – 11.027 mm (0.4331 – 0.4341 in.)

Both intake and exhaust

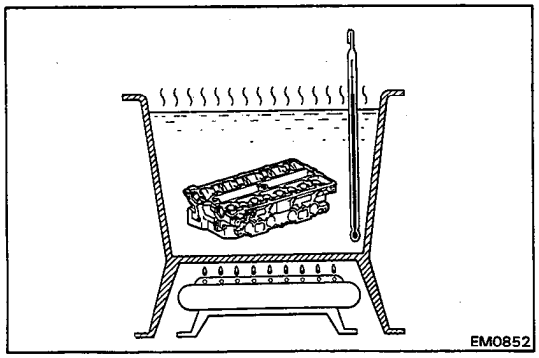
Bushing bore diameter mm (in.)	Bushing size
11.000 – 11.027 (0.4331 – 0.4341)	Used STD
11.050 – 11.077 (0.4350 – 0.4361)	Used O/S 0.05

(e) Select a new guide bushing (STD size or O/S 0.0

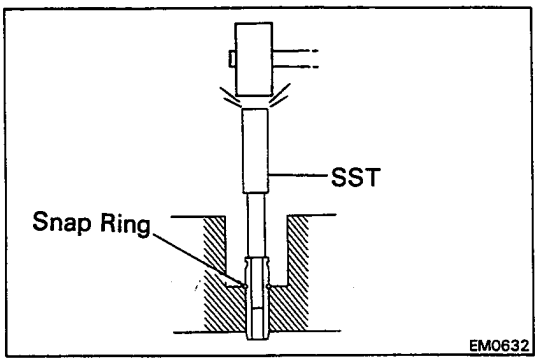
If the bushing bore diameter of the cylinder head is great than 11.027 mm (0.4341 in.), machine the bushing bo to the following dimension:

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 great than 11.077 mm (0.4361 in.), replace the cylinder hea

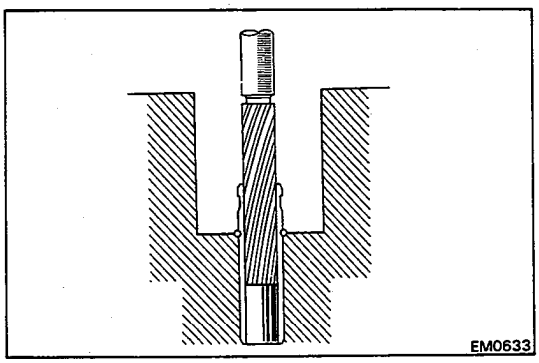


(f) Gradually heat the cylinder head to 80 – 100°C (1 – 212°F).

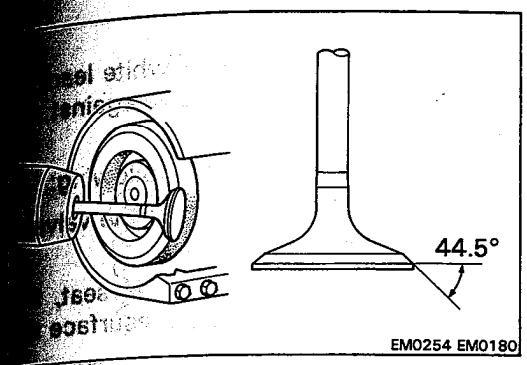


(g) Using SST and a hammer, tap in a new guide bushi until the snap ring makes contact with the cylin head.

SST 09201-70010



(h) Using a sharp 6 mm reamer, ream the guide bush to obtain the standard specified clearance (See pa EM-101) between the guide bushing and valve st

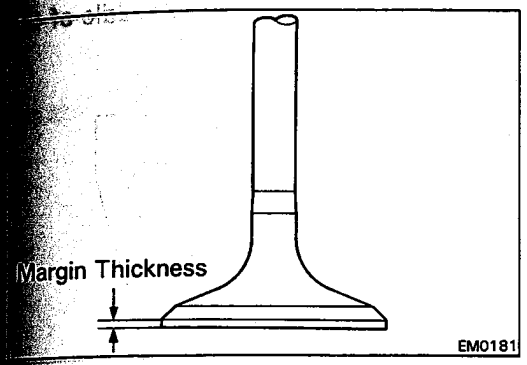


11. INSPECT AND GRIND VALVES

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

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

Valve face angle: 44.5°

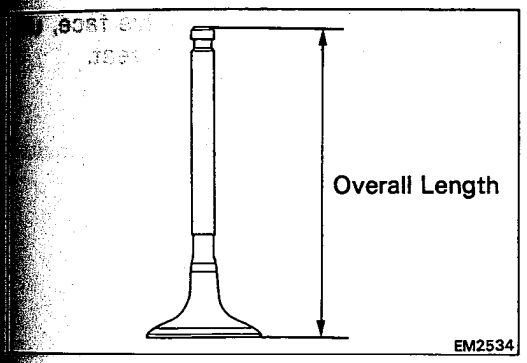


(c) Check the valve head margin thickness.

Standard margin thickness: 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 99.60 mm (3.9213 in.)

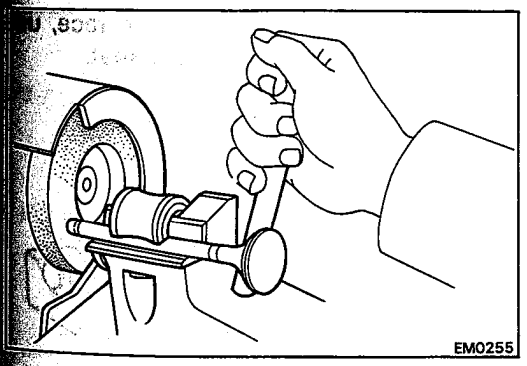
Exhaust 99.75 mm (3.9272 in.)

Minimum overall length:

Intake 99.10 mm (3.9016 in.)

Exhaust 99.25 mm (3.9075 in.)

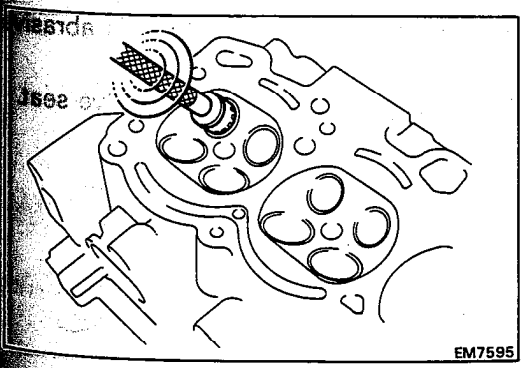
If the overall length is less than minimum, replace the valve.



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

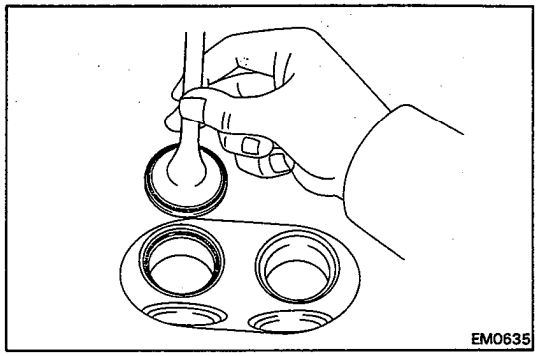
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

NOTICE: Do not grind off more than 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.

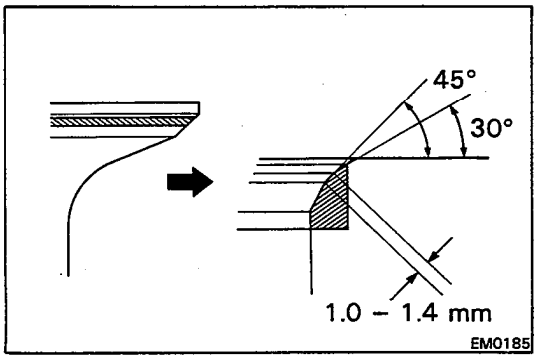
Apply a thin coat of prussian blue (or white lead) t the valve face. Lightly press to the valve against th seat. Do not rotate the valve.

(c) Check the valve face and seat for the following:

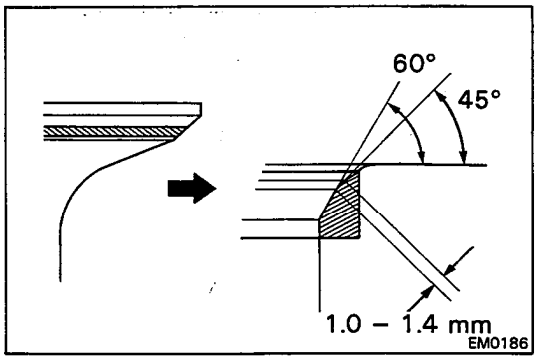
- If blue appears 360° around the face, the valve concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, th guide and seat are concentric. If not, resurface th seat.
- Check that the seat contact is in the middle of th valve face with the following width.

1.0 – 1.4 mm (0.039 – 0.055 in.)

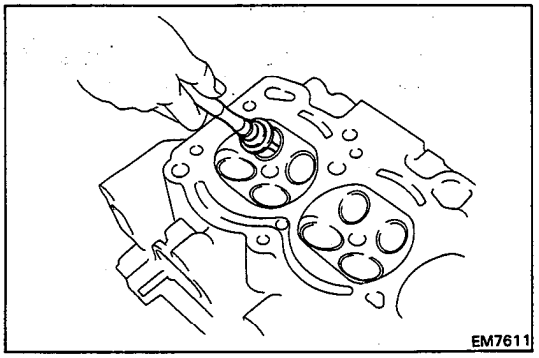
If not, correct the valve seats as follows:



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

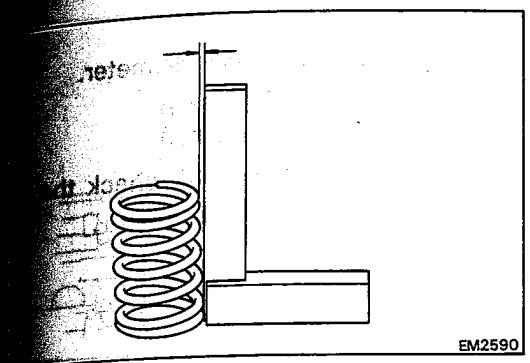


(2) If the seating is too low on the valve face, us 60° and 45° cutters to correct the seat.



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

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

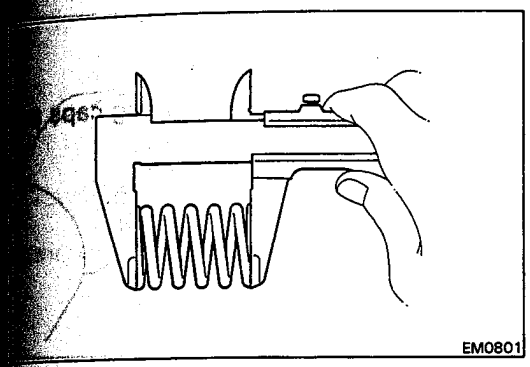

EM2590

13. INSPECT VALVE SPRINGS

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

Maximum squareness: 1.8 mm (0.071 in.)

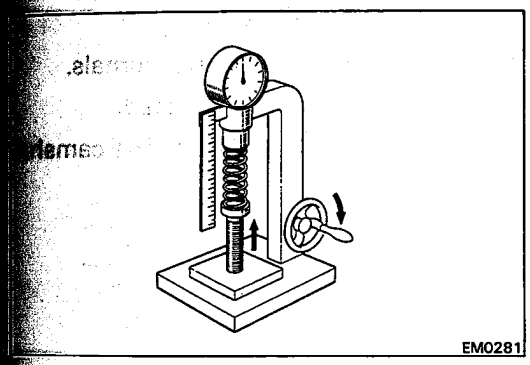
If squareness is greater maximum, replace the valve spring.


EM0801

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

Free length: 41.09 mm (1.6177 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:
14.6 — 15.8 kg (32.3 — 34.8 lb, 143 — 155 N) at 34.7 mm (1.366 in.)

If the tension is less than minimum, replace the valve spring.

14. INSPECT CAMSHAFTS AND BEARINGS

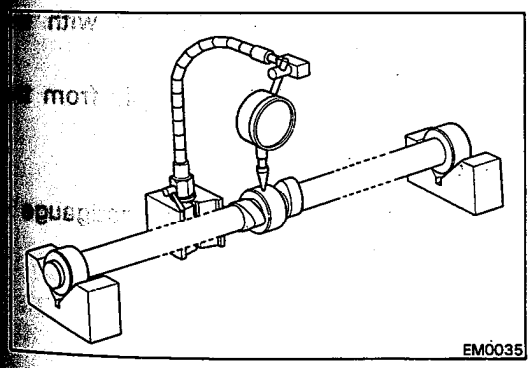
A. Inspect camshaft for runout

(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.


EM0035

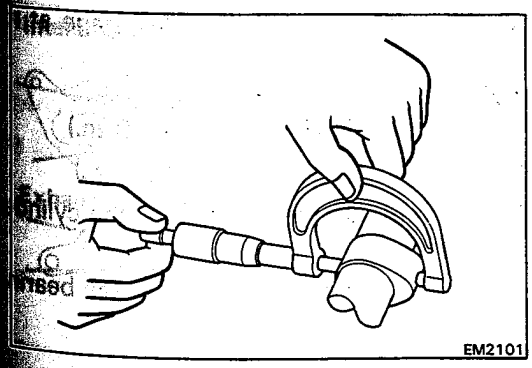
B. Inspect cam lobes

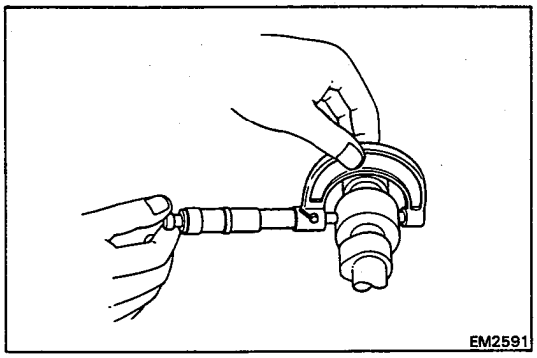
Using a micrometer, measure the cam lobe height.

Standard cam lobe height: 35.410 — 35.510 mm (1.3941 — 1.3980 in.)

Minimum cam lobe height: 35.11 mm (1.3823 in.)

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


EM2101

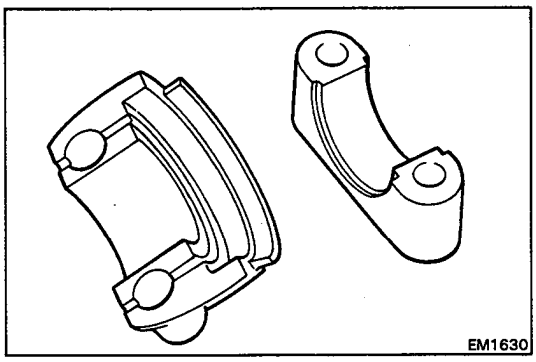

EM2591

C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

Journal diameter: 26.949 – 26.965 mm (1.0610 – 10.616 in.)

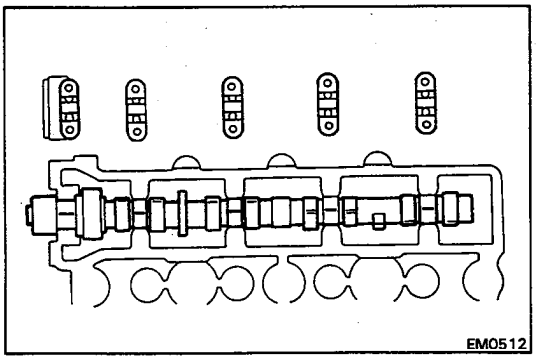
If the journal diameter is not as specified, check the clearance.


EM1630

D. Inspect camshaft bearings

Check the bearings for flaking and scoring.

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

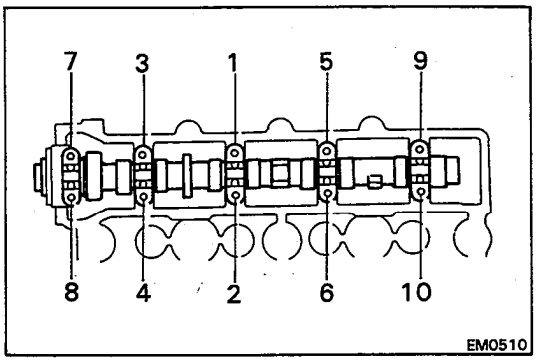

EM0512

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 camsh journal.



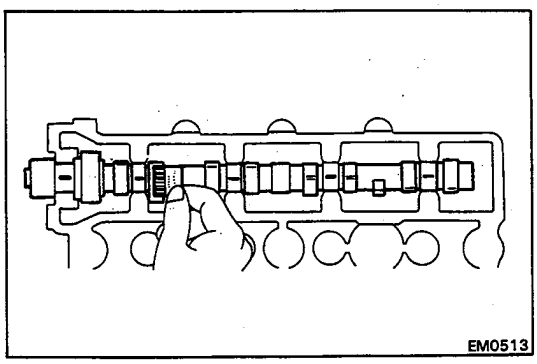
EM0510

(d) Place the bearing caps on each journal with t arrows pointing toward the front.

(e) Install and torque the cap bolts gradually from t inside in three passes.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)

HINT: Do not turn the camshaft while the Plastigauge in place.


EM0513

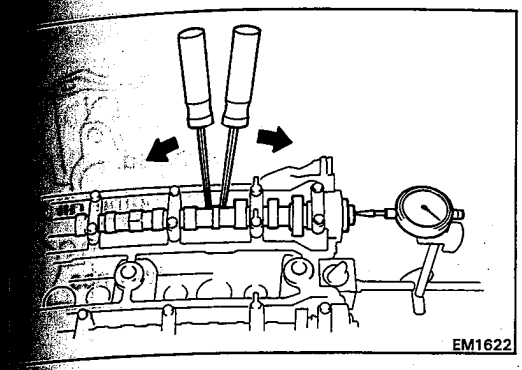
(f) Remove the caps and measure the Plastigage at widest point.

Standard oil clearance: 0.035 – 0.072 mm (0.0014 – 0.0028 in.)

Maximum oil clearance: 0.10 mm (0.0039 in.)

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

(g) Clean out the pieces of Plastigauge from the bear caps and journals.


EM1622

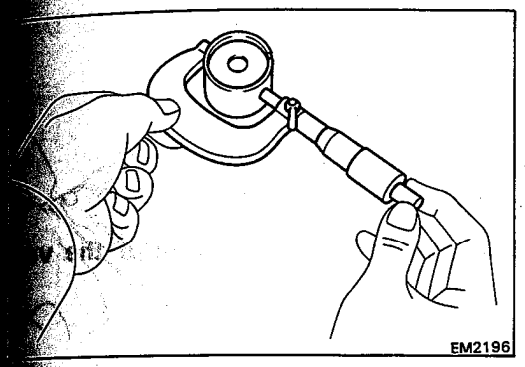
F. Inspect camshaft thrust clearance

(a) Install the camshafts.
(See step 5 on pages EM-110 and 111)

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

Standard thrust clearance: 0.080 — 0.190 mm (0.0031 — 0.0075 in.)
Maximum thrust clearance: 0.25 mm (0.0098 in.)

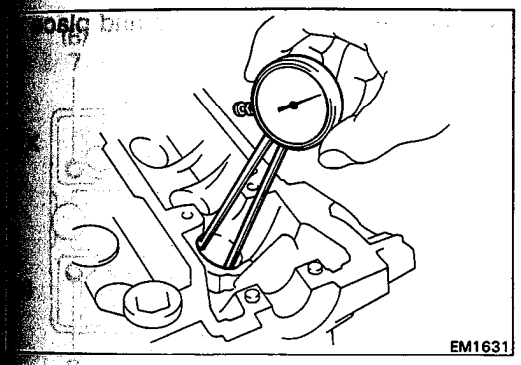
If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.


EM2196

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.)


EM1631

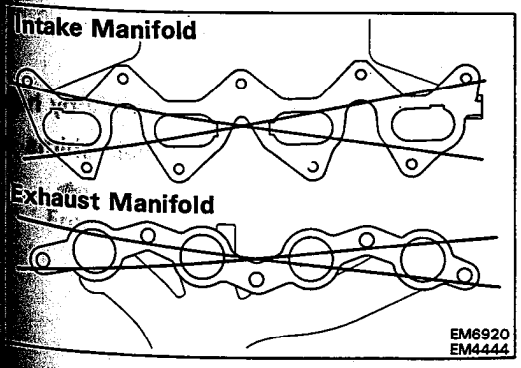
(b) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

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 (0.0006 — 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.



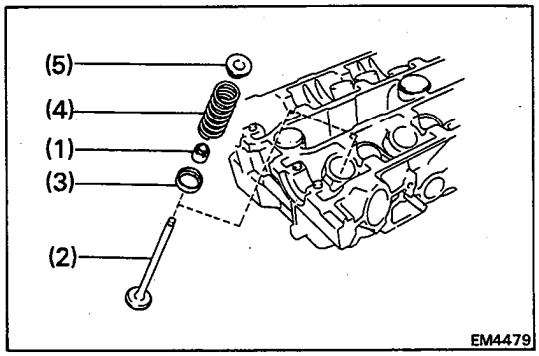
EM6920
EM4444

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:
Intake manifold 0.05 mm (0.0020 in.)
Exhaust manifold 0.30 mm (0.0118 in.)

If warpage is greater maximum, replace the manifold.



ASSEMBLY OF CYLINDER HEAD

(See page EM-92)

HINT:

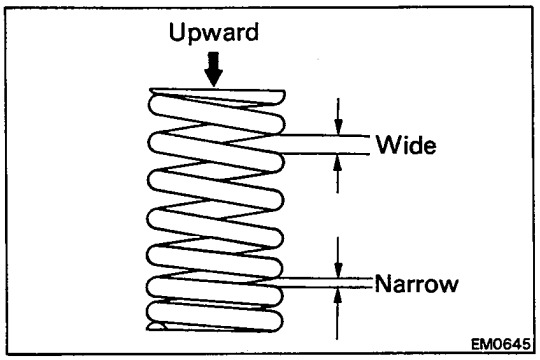
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.

1. INSTALL VALVES

(a) Install the following parts:

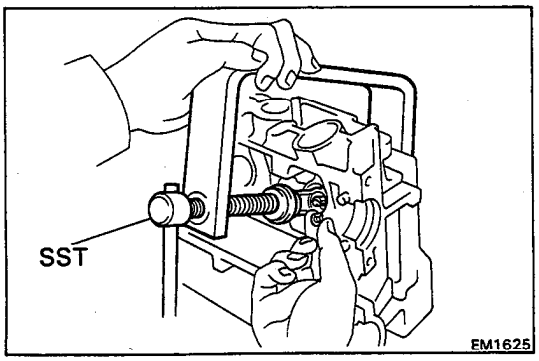
(1) New oil seal
(2) Valve
(3) Spring seat
(4) Valve spring
(5) Spring retainer

NOTICE: Confirm the correct direction of the va spring.

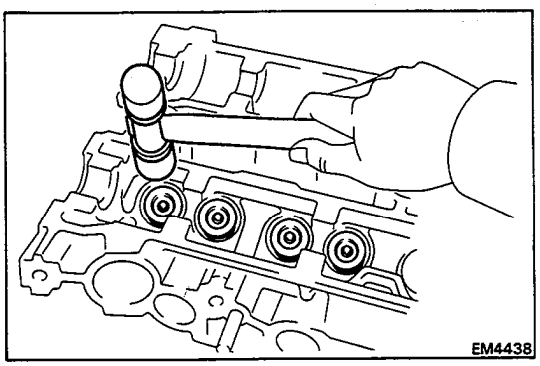


(b) Using SST, compress the valve spring and place two keepers around the valve stem.

SST 09202-70010



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

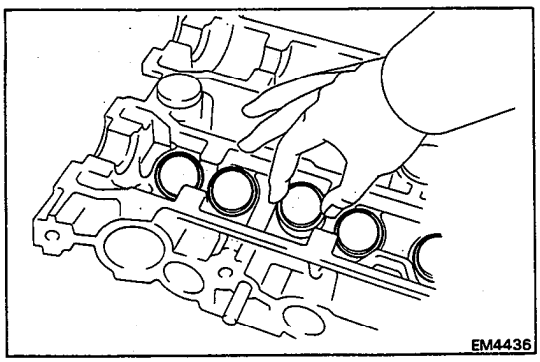


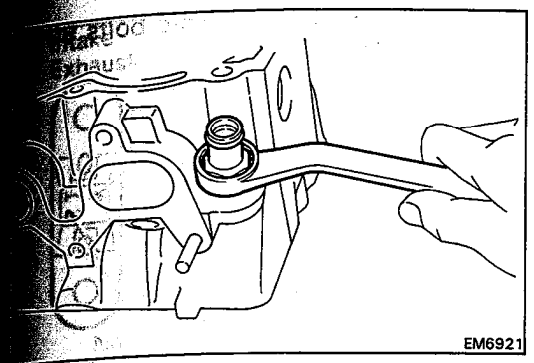
2. INSTALL VALVE LIFTERS AND SHIMS

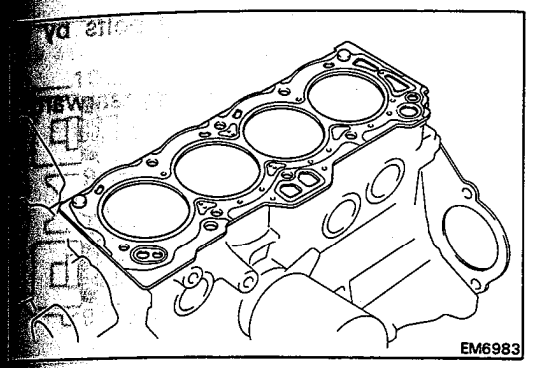
(a) Install the valve lifter and shim.

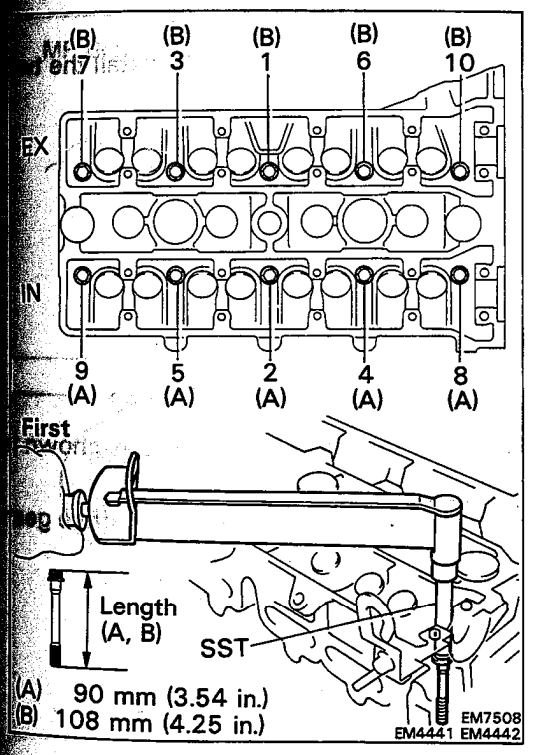
(b) Check that the valve lifter rotates smoothly by h

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

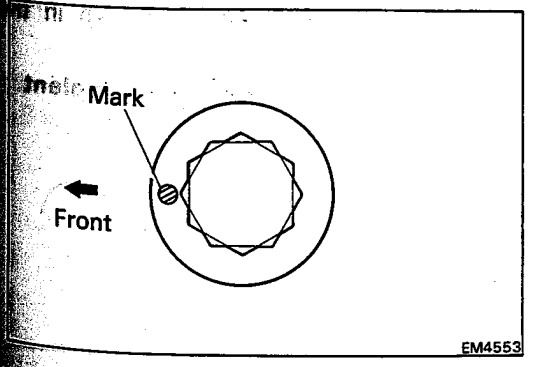



EM6921


EM6983



EM7508 EM4441 EM4442



EM4553

INSTALLATION OF CYLINDER HEAD

(See page EM-92)

1. INSTALL UNION

(a) Apply adhesive to two or three threads.

Adhesive: Part No.08833-00080, THREE BOND 1344 LOCTITE 242 or equivalent

(b) Install and torque the union.

Torque: 300 kg-cm (22 ft-lb, 29 N·m)

2. INSTALL ENGINE HANGERS

Install the two engine hangers and ground strap with the two bolts.

Torque: 250 kg-cm (18 ft-lb, 25 N·m)

3. INSTALL CYLINDER HEAD

HINT:

- The cylinder head bolts are tighten in three progressive steps.
- If any of bolts break or defrom, replace them.

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

NOTICE: Be careful of the installation direction.

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

HINT: Apply a light coating of engine oil on the bolt threads and under the bolt head before installing.

(c) First, using SST, install and uniformly tighten the ten cylinder head bolts in several passes in the sequence shown.

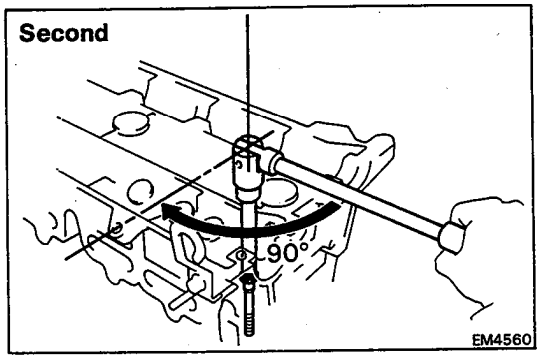
SST 09205-16010

Torque: 300 kg-cm (22 ft-lb, 29 N·m)

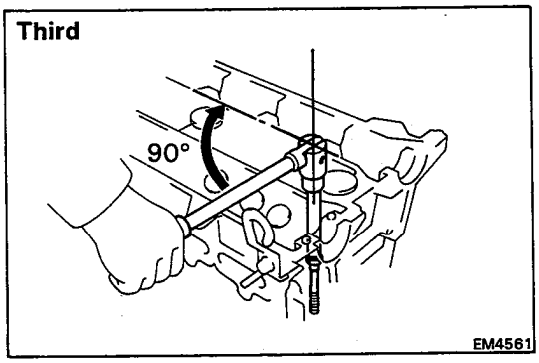
HINT: Each bolt length is indicated in the illustration.

If any one of the bolts dose not meet the torque specification, replace the bolt.

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

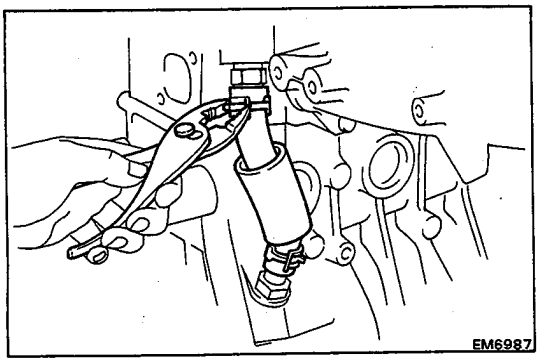


(e) Second, retighten the ten cylinder head bolts 90° the numerical order shown.



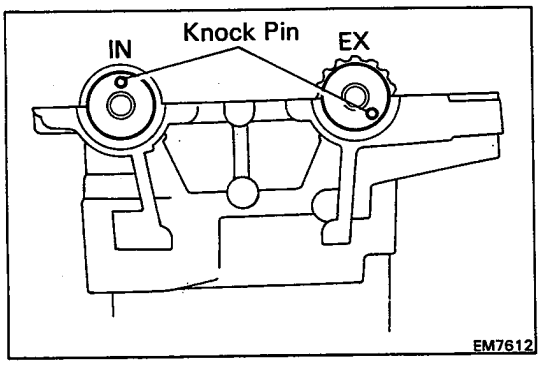
(f) Third, retighten the ten cylinder head bolts by additional 90°.

(g) Check that the paint mark is now facing rearward



4. INSTALL NO.2 PCV HOSE

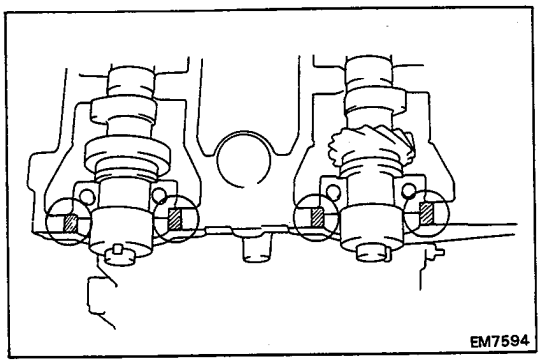
Connect the PCV hose to the cylinder head. Install the clamps.



5. INSTALL CAMSHAFTS AND BEARING CAPS

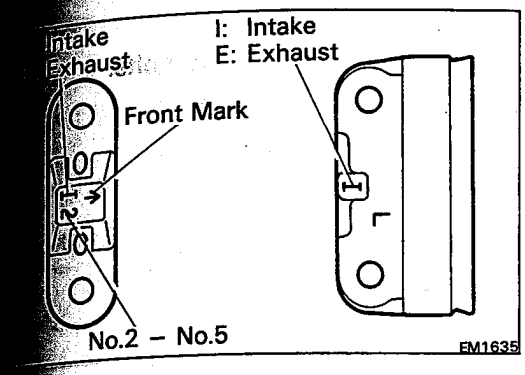
(a) Place the camshaft on the cylinder head as show the illustration.

HINT: The exhaust camshaft has a distributor drive g

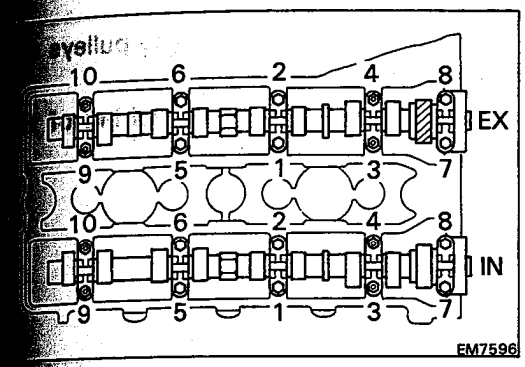


(b) Apply seal packing to the head as shown in illustration.

Seal packing: Part No.08826-00080 or equivale



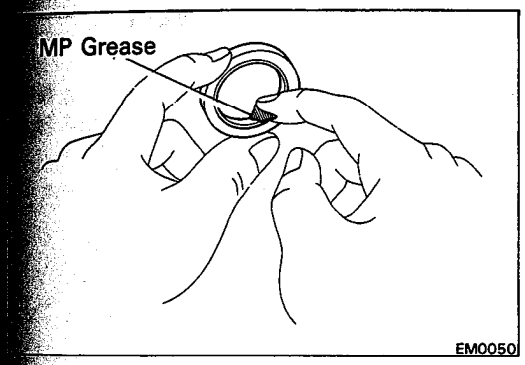
(c) Install the bearing caps in their proper locations.



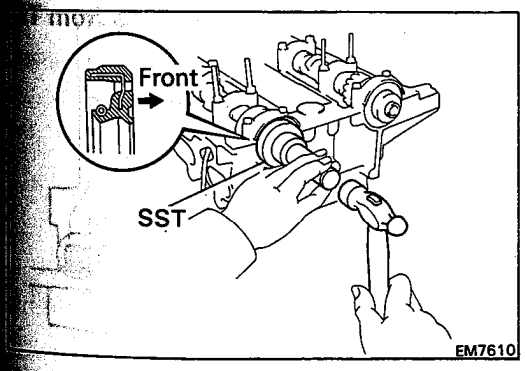
(d) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

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

Torque: 130 kg-cm (9 ft-lb, 13 N·m)



(f) Apply MP grease to new camshaft oil seals lip.

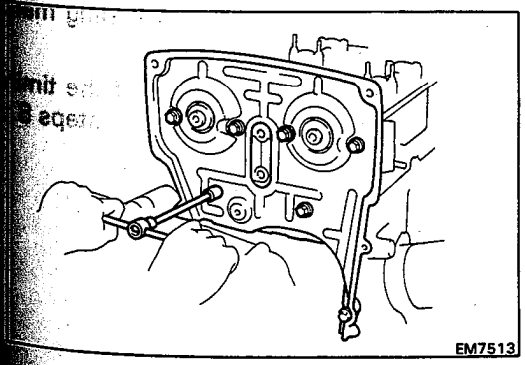


(g) Using SST, tap in new camshaft oil seals.

SST 09223-50010

HINT:

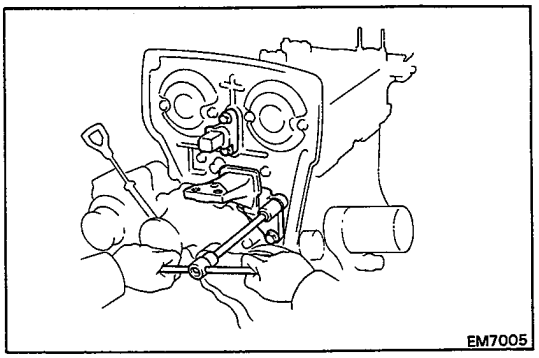
- Do not install the oil seal with the lip facing the wrong direction.
- Insert the oil seal into the deepest part of the cylinder head.



6. INSTALL NO.4 TIMING BELT COVER

Install the belt cover with the seven bolts.

Torque: 95 kg-cm (82 in-lb, 9.3 N·m)


EM7005

7. INSTALL RH MOUNTING BRACKETS

(a) Install the No.2 bracket with the two bolts.

Torque: 210 kg-cm (15 ft-lb, 21 N·m)

(b) Install the bracket with the three bolts.

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

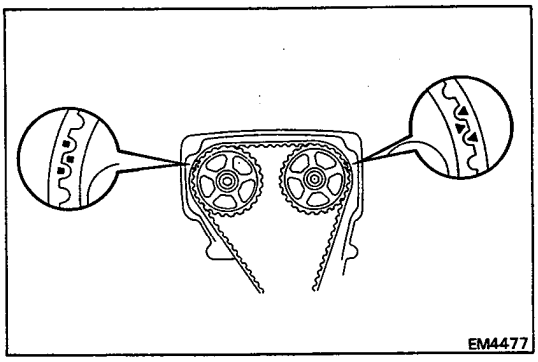
8. INSTALL CAMSHAFT TIMING PULLEYS (See step 1 on page EM-52)

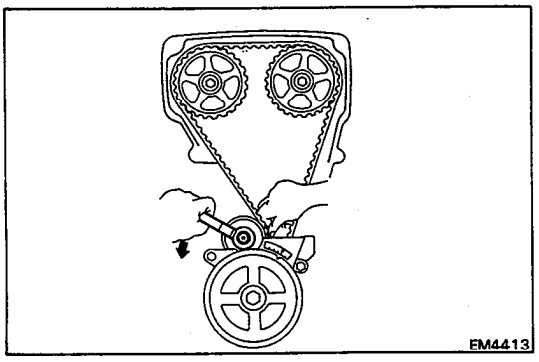
Torque: 600 kg-cm (43 ft-lb, 59 N·m)

9. INSTALL TIMING BELT

Align the matchmarks of the camshaft timing pulleys a timing belt, and install the timing belt.

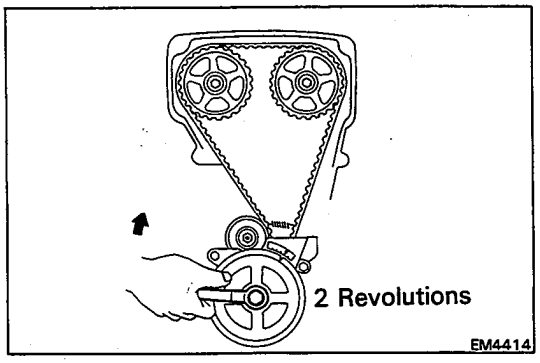
NOTICE: Be careful not to shift the meshing of t crankshaft timing pulley and timing belt.


EM4477


EM4413

10. CHECK VALVE TIMING AND TIMING BELT TENSION

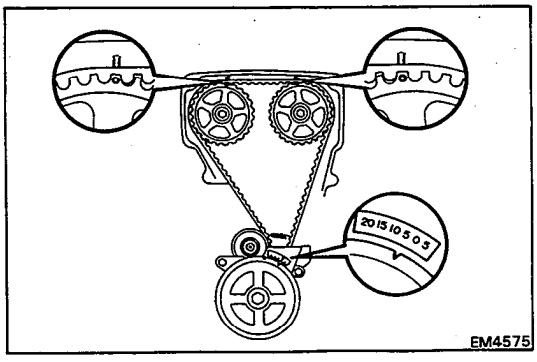
(a) Slowly loosen the idler pulley bolt.



EM4414

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

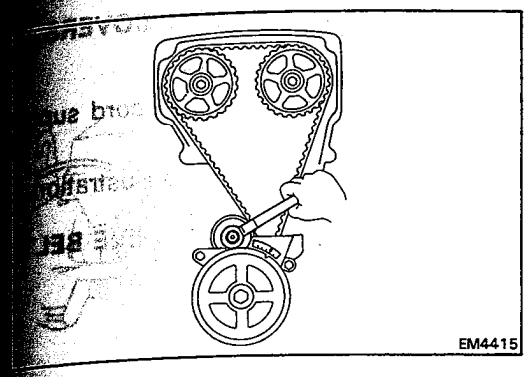
HINT: Always turn the crankshaft clockwise.



EM4575

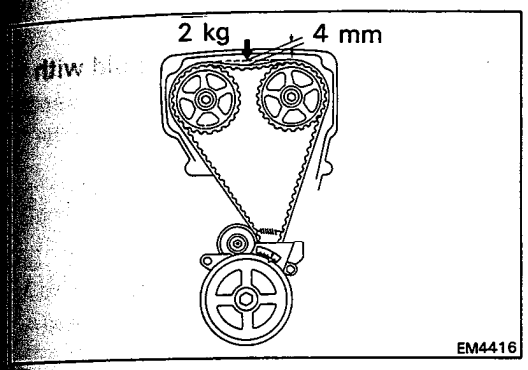
(c) Check that each pulley aligns with the timing ma as shown in the illustration.

If the marks do not align, shift the meshing of the tin belt and timing pulley and readjust according to steps 10.


EM4415

(d) Torque the idler pulley bolt.

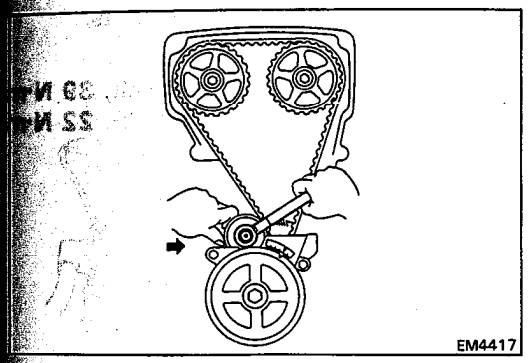
Torque: 375 kg-cm (27 ft-lb, 37 N·m)



EM4416

(e) Check that there is belt deflection at the position indicated in the illustration.

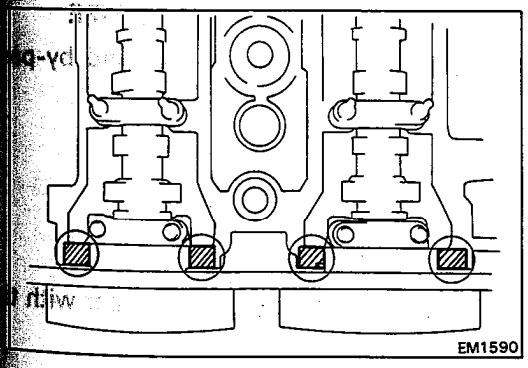
Deflection: 4 mm (0.16 in.)
at 2 kg (4.4 lb, 20 N)


EM4417

If the deflection is not as specified, adjust with the idler pulley.

11. INSTALL SPARK PLUGS (See page IG-12)

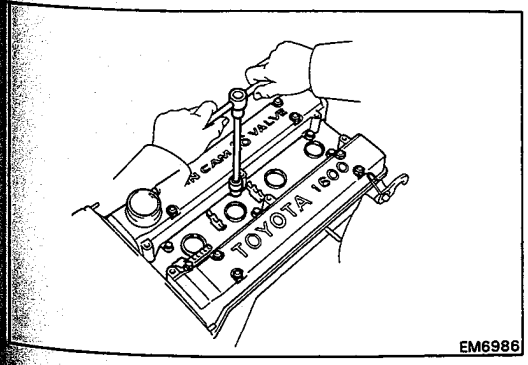
Torque: 180 kg-cm (13 ft-lb, 18 N·m)


EM1590

12. INSTALL CYLINDER HEAD COVERS

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

Seal packing: Part No.08826-00080 or equivalent



EM6986

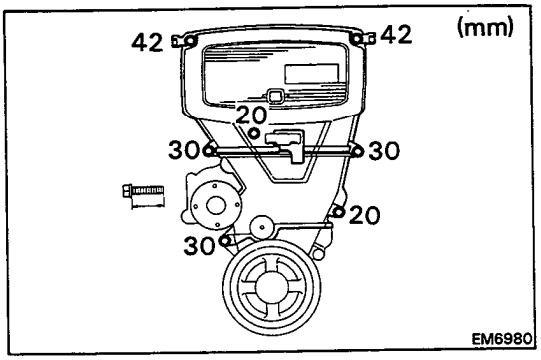
(b) Install the gaskets to the head covers.

(c) Install the two head covers with the four seal washers and cap nuts.

Torque: 80 kg-cm (5.8 ft-lb, 7.8 N·m)

(d) Install the gasket to the center cover.

(e) Install the center cover with the six bolts.



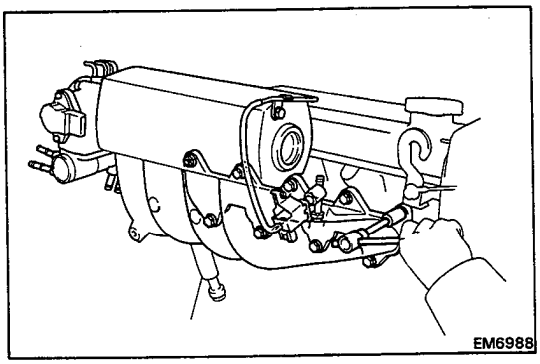
13. INSTALL NO.2 AND NO.3 TIMING BELT COVERS

(a) Install the gaskets to the belt covers.

(b) Install the No.2, No.3 belt covers and cord supp plate with the seven bolts.

HINT: Each bolt length is indicated in the illustration.

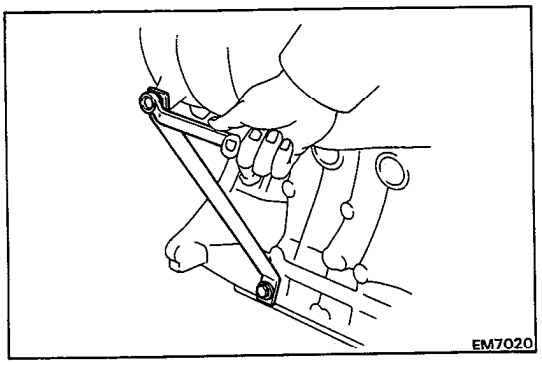
14. INSTALL WATER PUMP PULLEY AND DRIVE BELT



15. INSTALL INTAKE MANIFOLD

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

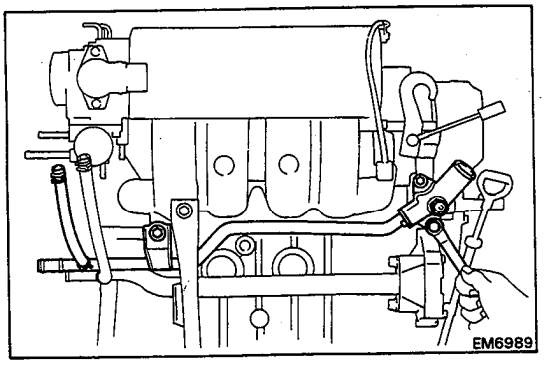
Torque: 280 kg-cm (20 ft-lb, 27 N·m)



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

Torque:
14 mm bolt head 400 kg-cm (29 ft-lb, 39 N·
12 mm bolt head 220 kg-cm (16 ft-lb, 22 N·

16. INSTALL WATER INLET PIPE
(See step 3 on page CO-11)



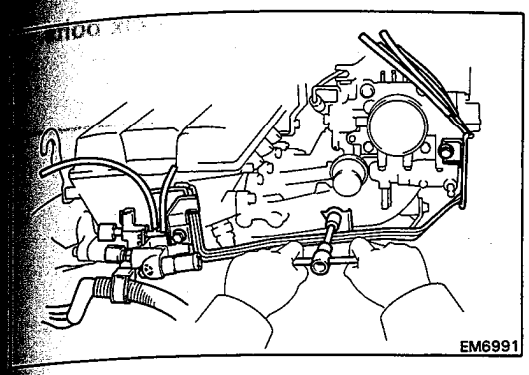
17. INSTALL WATER OUTLET AND BY-PASS PIPE

(a) Install a new gasket, the water outlet and by-p pipe assembly with the three bolts.

Torque:
Cylinder head side
280 kg-cm (20 ft-lb, 27 N·m)
Intake manifold side
130 kg-cm (9 ft-lb, 13 N·m)

(b) Install the alternator drive belt adjusting bar with three bolts.

Torque: 185 kg-cm (13 ft-lb, 18 N·m)



18. INSTALL CYLINDER HEAD REAR COVER AND VACUUM PIPE (w/ EGR SYSTEM)

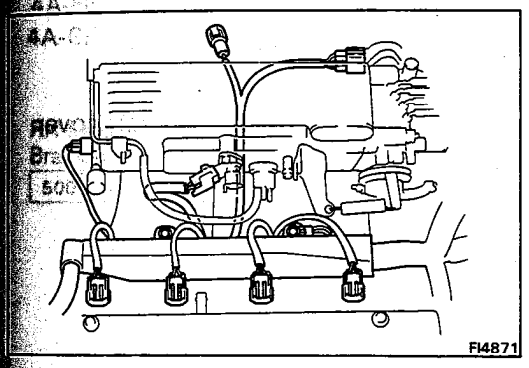
(a) (w/o EGR system)
Install a new gasket and rear cover with the two bolts.

(b) (w/ EGR system)
Install a new gasket, rear cover and vacuum pipe with the four bolts.

(c) (w/ EGR system)
Connect the vacuum hoses.

(d) Connect the following connectors:

- Start injector time switch connector
- Water temp. sensor connector
- (w/ EGR system)
  EGR VSV connector



19. CONNECT ENGINE WIRE TO INTAKE MANIFOLD

(a) Connect the engine wire to the intake manifold with the two bolts.

(b) Connect the following connectors:

- (Europe)
  Fuel pressure VSV connector
- Cold start injector connector
- Throttle position sensor connector
- Knock sensor connector

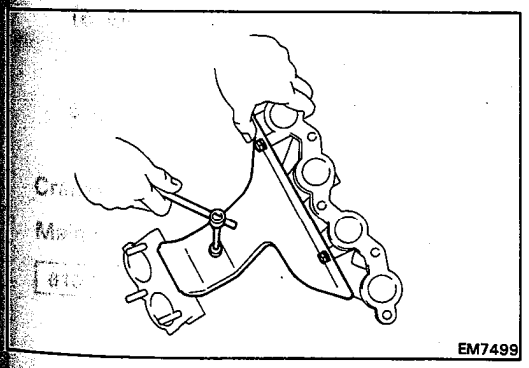
20. INSTALL INJECTOR AND DELIVERY PIPE
(See steps 1 and 3 to 6 on pages FI-116 to 119)

21. INSTALL COLD START INJECTOR PIPE
(See step 2 on page FI-108)

22. INSTALL PCV HOSE

23. INSTALL EXHAUST MANIFOLD

(a) Install the lower heat insulator to the manifold with the three bolts.

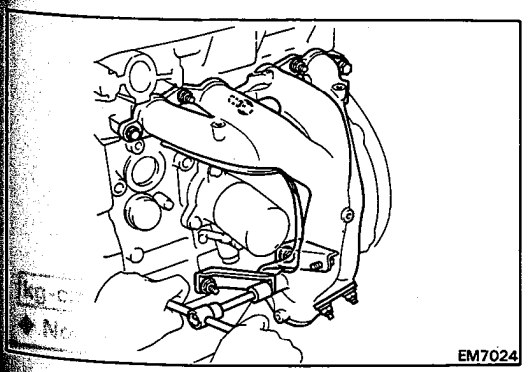


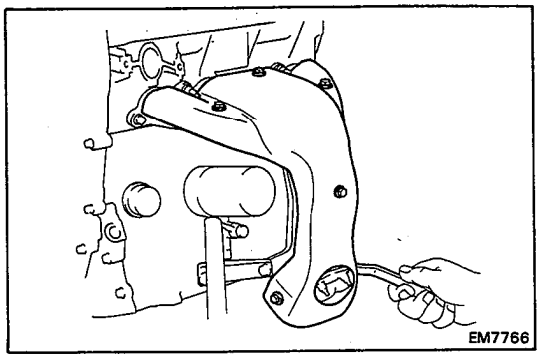
(b) Install a new gasket and the manifold with the three bolts and two nuts.

Torque: 250 kg-cm (18 ft-lb, 25 N·m)

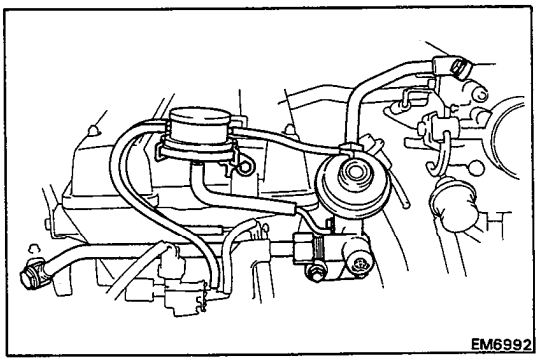
(c) Install the RH and LH manifold stay with the three bolts and nut.

Torque: 400 kg-cm (29 ft-lb, 39 N·m)





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



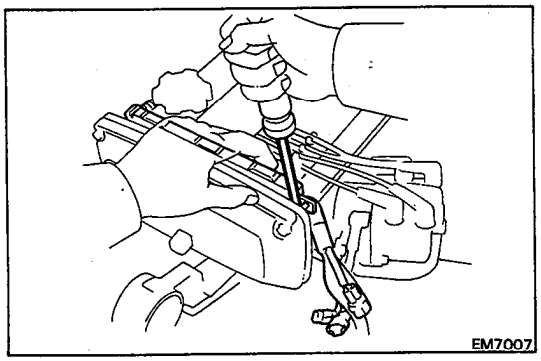
24. (w/ EGR SYSTEM) INSTALL EGR VALVE AND MODULATOR

(a) Install a new gasket, the EGR valve and pipes assembly with the four bolts.

Torque:
Union bolt 700 kg-cm (51 ft-lb, 69 N·m)
Bolt 190 kg-cm (14 ft-lb, 19 N·m)

(b) Install the EGR vacuum modulator with the bolt.

(c) Install the vacuum hoses.



25. INSTALL DISTRIBUTOR (See page IG-19)

26. CONNECT ENGINE WIRE TO NO.4 TIMING BELT COVER

(a) Connect the engine wire to the timing belt cover.

(b) Connect the following connectors:

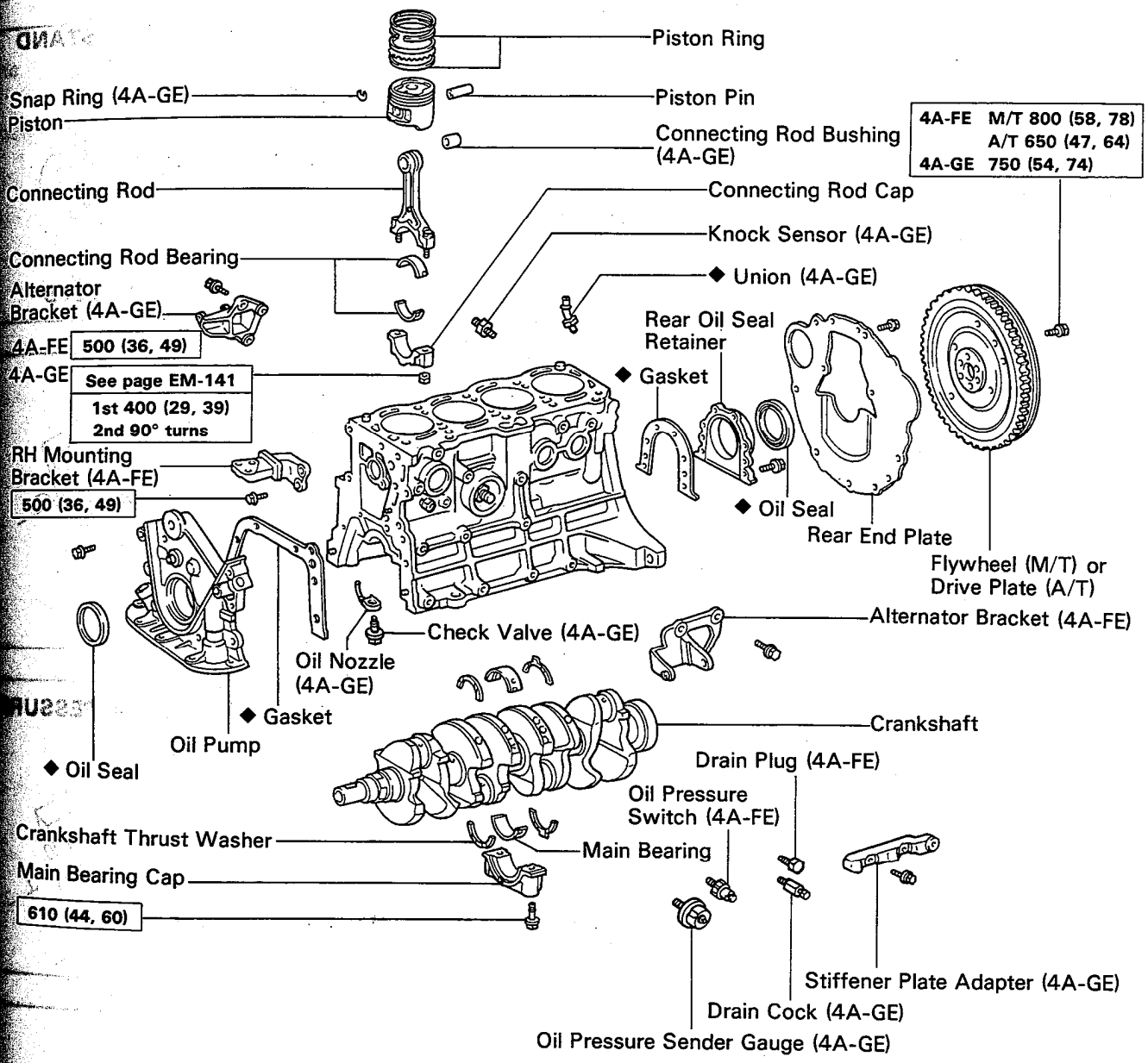
- Oil pressure sender gauge connector
- Distributor wire connectors

27. FILL WITH ENGINE COOLANT (See page CO-5)

Capacity (w/ Heater):
6.0 liters (6.3 US qts, 5.3 Imp. qts)

CYLINDER BLOCK

COMPONENTS

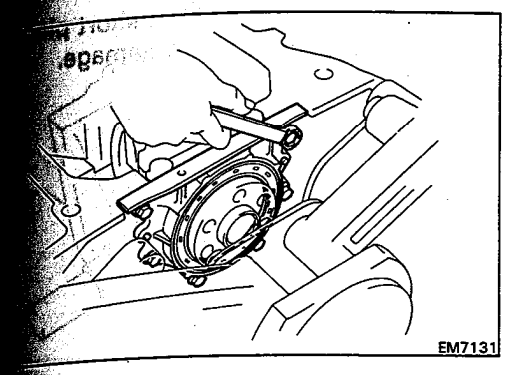


kg-cm (ft-lb, N·m) : Specified torque
◆ Non-reusable part

EM7519

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 ASSEMBLY TO ENGINE STAND
   FOR DISASSEMBLY
6. REMOVE IIA OR DISTRIBUTOR
7. REMOVE ALTERNATOR AND BRACKET
8. (4A-FE)
   REMOVE RH MOUNTING BRACKET
9. REMOVE TIMING BELT AND TIMING PULLEYS
   4A-FE (See page EM-39)
   4A-GE (See page EM-47)
10. REMOVE CYLINDER HEAD
    4A-FE (See pages EM-56, 57)
    4A-GE (See page EM-92)
11. REMOVE WATER PUMP (See page CO-4)
12. REMOVE OIL PAN AND OIL PUMP
    (See page LU-9)
13. REMOVE OIL FILTER BRACKET
    (See page LU-17)
14. REMOVE OIL PRESSURE SWITCH OR OIL PESSU
    SENDER GAUGE
    (See page LU-6)
15. (4A-GE)
    REMOVE KNOCK SENSOR
16. (4A-GE)
    REMOVE STIFFENER PLATE ADAPTER

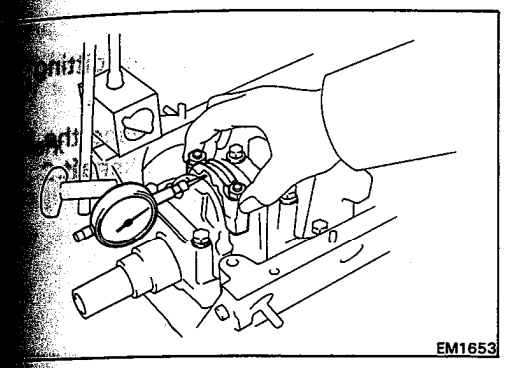

EM7131

DISASSEMBLY OF CYLINDER BLOCK

(See page EM-117)

1. REMOVE REAR OIL SEAL RETAINER

Remove the six bolts, retainer and gasket.


EM1653

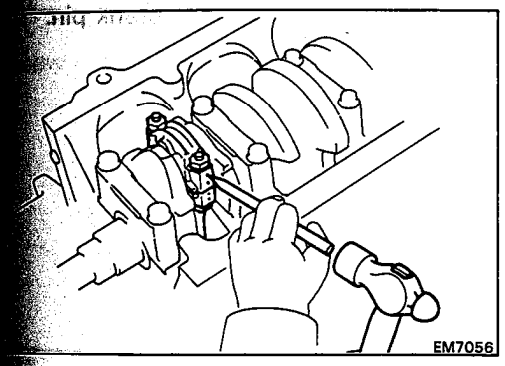
2. CHECK CONNECTING ROD THRUST CLEARANCE

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

Standard thrust clearance: 0.150 — 0.250 mm (0.0059 — 0.0098 in.)

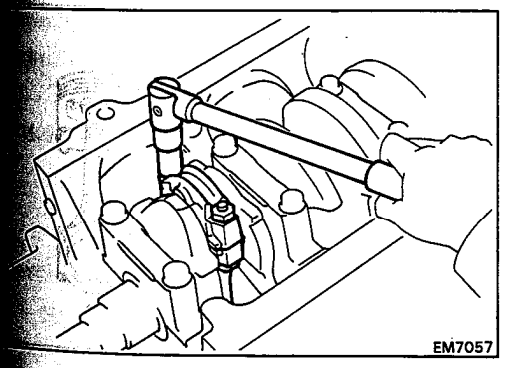
Maximum thrust clearance: 0.30 mm (0.0118 in.)

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

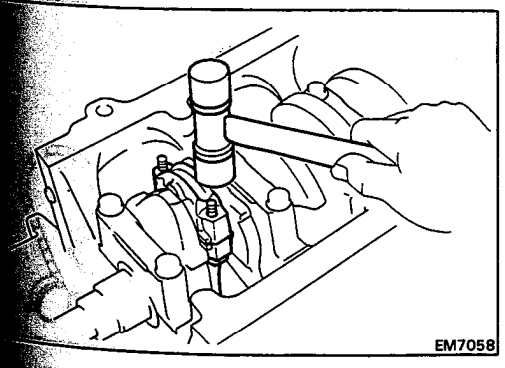

EM7056

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.

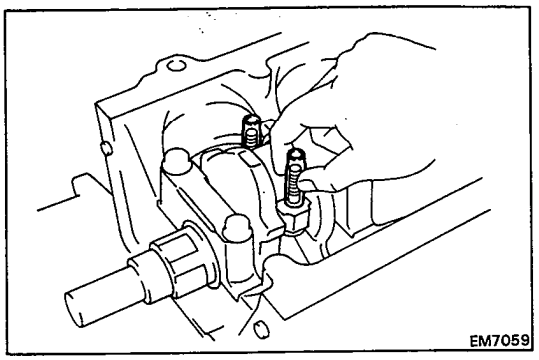

EM7057

(b) Remove the connecting rod cap nuts.

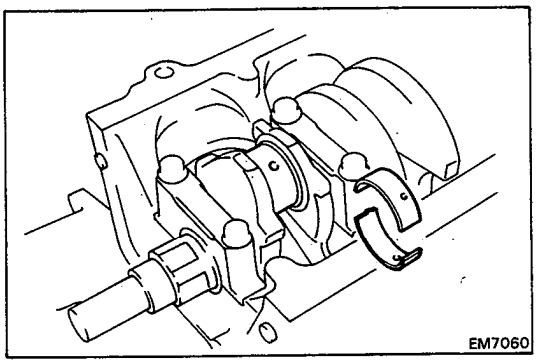

EM7058

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

HINT: Keep the lower bearing inserted with the connecting cap.



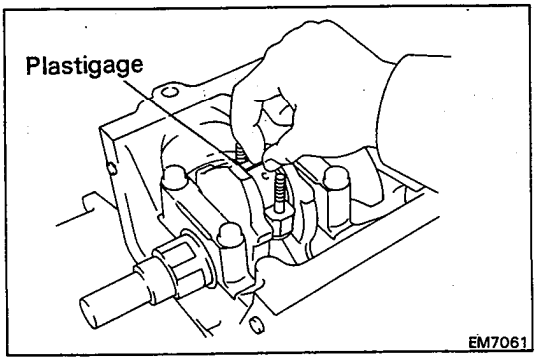
(d) Cover the connecting rod bolts with a short piece hose to protect the crankshaft from damage.



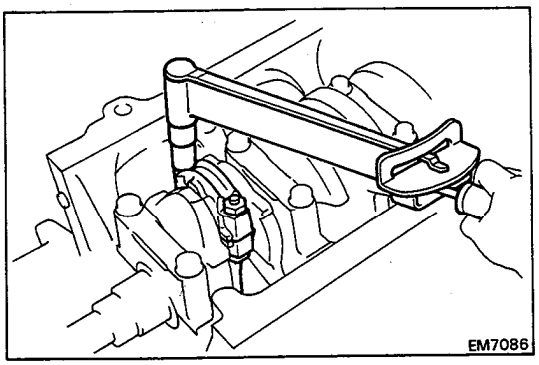
(e) Clean the crank pin and bearing.

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

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

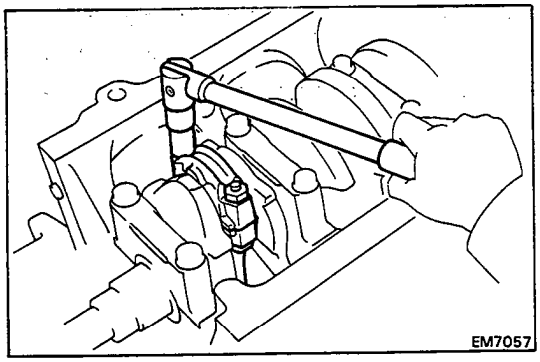


(g) Lay a strip of Plastigage across the crank pin.

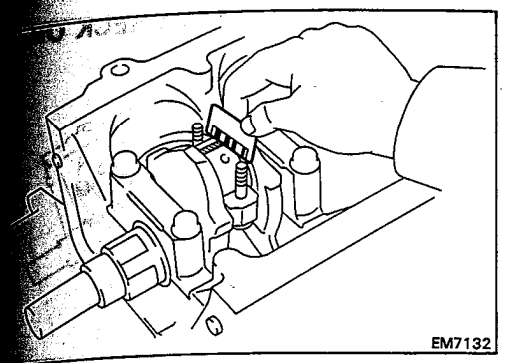


(h) Install the connecting rod cap.
(See step 7 on page EM-141)

NOTICE: Do not turn the crankshaft.



(i) Remove the connecting rod cap.
(See procedures (b) and (c) above)


EM7132

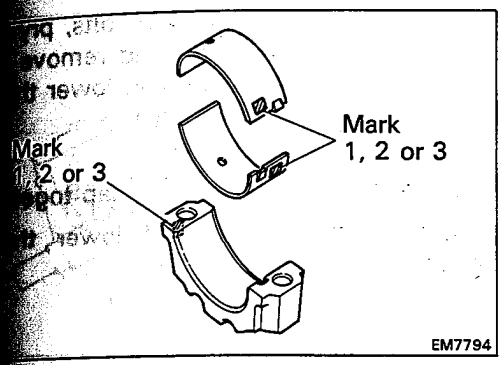
(j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD	**0.020 – 0.051 mm (0.0008 – 0.0020 in.)**
U/S 0.25	**0.019 – 0.065 mm (0.0007 – 0.0026 in.)**

Maximum oil clearance: 0.08 mm (0.0031 in.)

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



EM7794

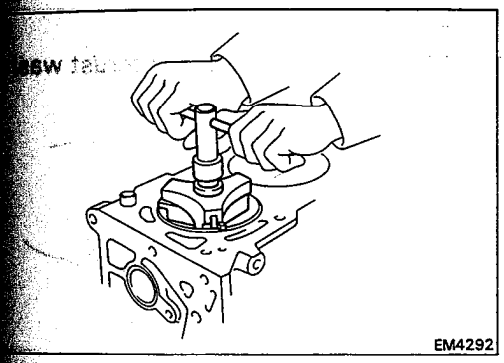
HINT: If using a standard bearing, replace with it one having the same number marked on the connecting rod cap. There are three sizes of standard bearings, marked "1", "2" and "3" accordingly.

(Reference)

Standard sized bearing center wall thickness:

Mark "1"	**1.486 – 1.490 mm (0.0585 – 0.0587 in.)**
Mark "2"	**1.490 – 1.494 mm (0.0587 – 0.0588 in.)**
Mark "3"	**1.494 – 1.498 mm (0.0588 – 0.0590 in.)**

(k) Completely remove the Plastigage.


EM4292

4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

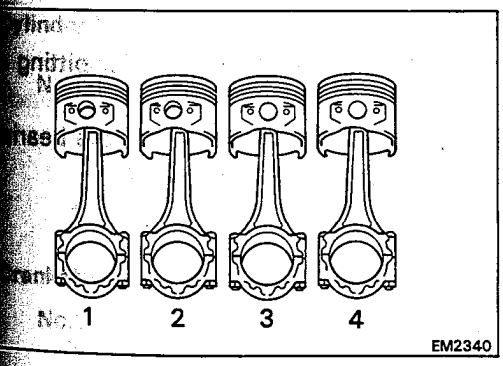
(a) Using a ridge reamer, remove all the carbon from the top of the cylinder.

(b) Cover the connecting rod bolts.
(See page EM-120)

(c) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:

- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in correct order.



EM2340

5. CHECK CRANKSHAFT THRUST CLEARANCE

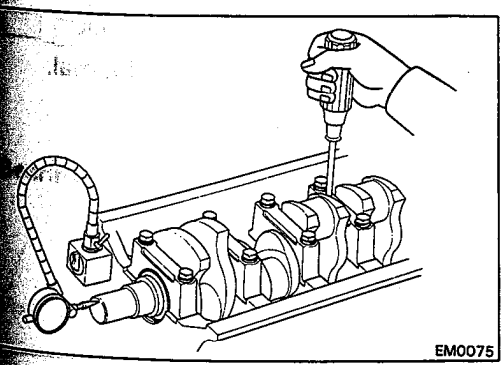
Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

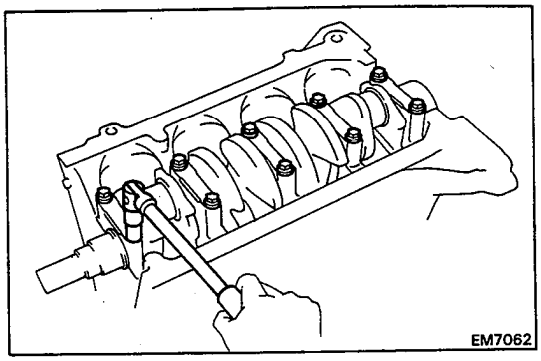
Standard thrust clearance: 0.020 – 0.220 mm (0.0008 – 0.0087 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

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

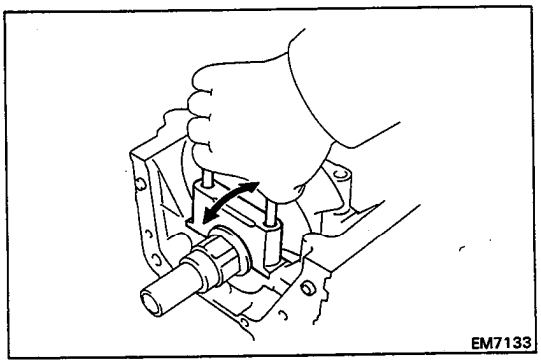
Thrust washer thickness: 2.440 – 2.490 mm (0.0961 – 0.0980 in.)


EM0075


EM7062

6. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

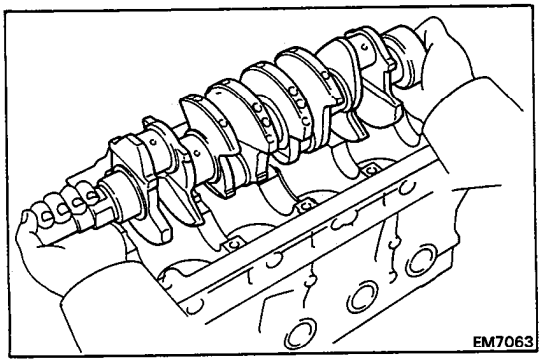
(a) Remove the main bearing cap bolts.


EM7133

(b) Using the removed main bearing cap bolts, pry main bearing cap back and forth, and remove main bearing caps, lower bearings and lower th washers (No.3 main bearing cap only.)

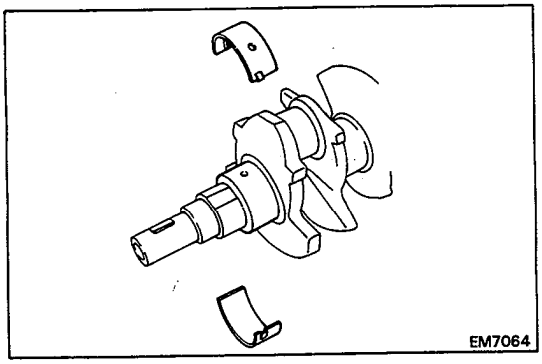
HINT:

- Keep the lower bearing and main bearing cap toget
- Arrange the main bearing caps and lower th washers in correct order.


EM7063

(c) Lift out the crankshaft.

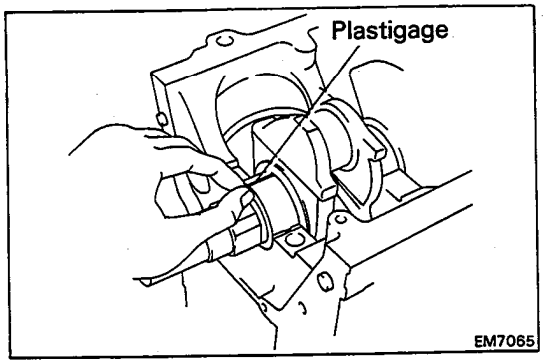
HINT: Keep the upper bearing and upper thrust was together with the cylinder block.


EM7064

(d) Clean each main journal and bearing.

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

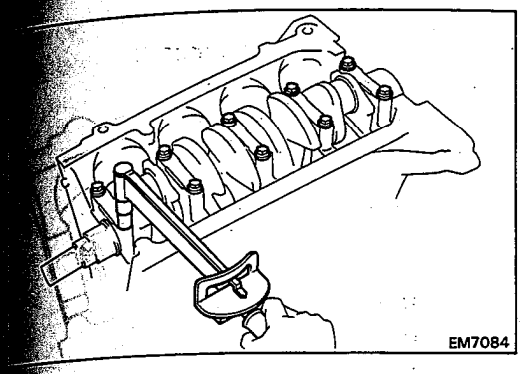
If the journal or bearing is damaged, replace the bear If necessary, grind or replace the crankshaft.



EM7065

(f) Place the crankshaft on the cylinder block.

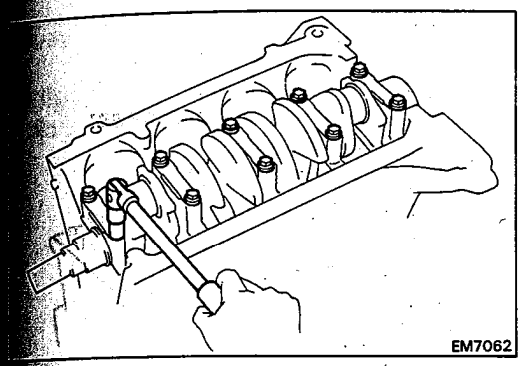
(g) Lay a strip of Plastigage across each journal.


EM7084

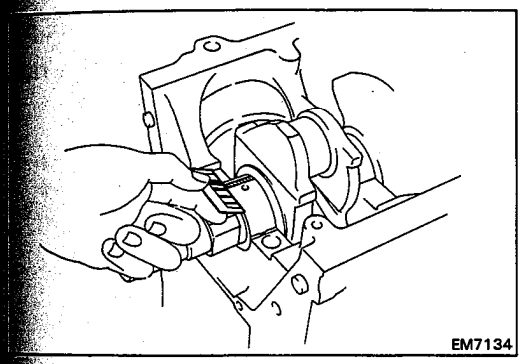
(h) Install the main bearing caps.
(See step 5 on page EM-140)

Torque: 610 kg-cm (44 ft-lb, 60 N·m)

NOTICE: Do not turn the crankshaft.


EM7062

(i) Remove the main bearing caps.
(See procedure (a) and (b) above)


EM7134

(j) Measure the Plastigage at its widest point.

Standard clearance:

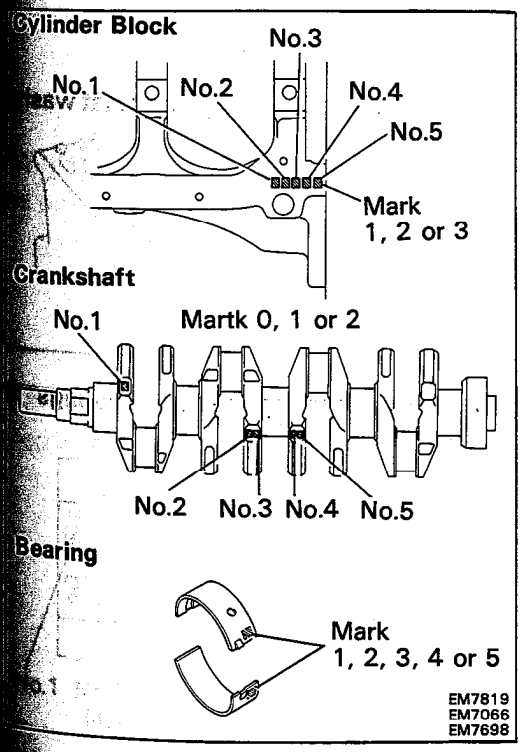
STD	**0.015 – 0.033 mm (0.0006 – 0.0013 in.)**
U/S 0.25	**0.018 – 0.056 mm (0.0007 – 0.0022 in.)**
Maximum clearance:	**0.10 mm (0.0039 in.)**

HINT: If replacing the cylinder block subassembly, the bearing standard clearance will be:

0.015 – 0.045 mm (0.0006 – 0.0018 in.)

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

HINT: If using a standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then select the bearing with the same number as the total. There are five sizes of standard bearings, marked "1", "2", "3", "4" and "5" accordingly.



EM7819
EM7066
EM7698

	Number marked								
Cylinder block	1			2			3		
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"	52.025 – 52.031 mm (2.0482 – 2.0485 in.)
Mark "2"	52.031 – 52.037 mm (2.0485 – 2.0487 in.)
Mark "3"	52.037 – 52.043 mm (2.0487 – 2.0489 in.)

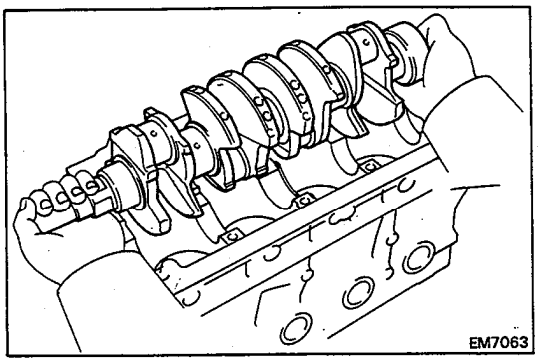
Crankshaft journal diameter:

Mark "0"	47.994 – 48.000 mm (1.8895 – 1.8898 in.)
Mark "1"	47.988 – 47.994 mm (1.8893 – 1.8895 in.)
Mark "2"	47.982 – 47.988 mm (1.8891 – 1.8893 in.)

Standard sized bearing center wall thickness:

Mark "1"	2.002 – 2.005 mm (0.0788 – 0.0789 in.)
Mark "2"	2.005 – 2.008 mm (0.0789 – 0.0791 in.)
Mark "3"	2.008 – 2.011 mm (0,0791 – 0.0792 in.)
Mark "4"	2.011 – 2.014 mm (0.0792 – 0.0793 in.)
Mark "5"	2.014 – 2.017 mm (0.0793 – 0.0794 in.)

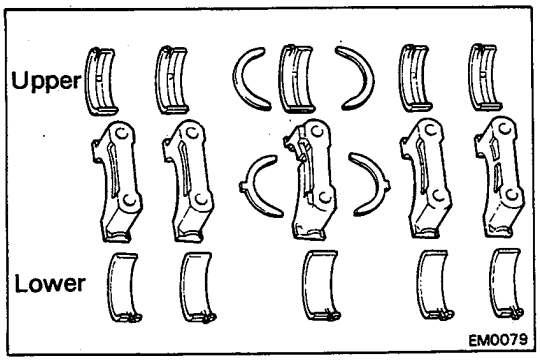
(k) Completely remove the Plastigage.



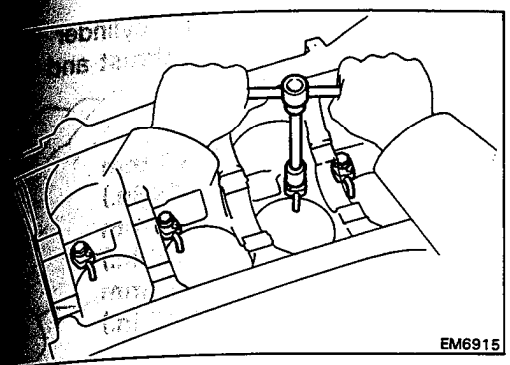
7. REMOVE CRANKSHAFT

(a) Lift out the crankshaft.

(b) Remove the upper bearings and upper thrust was from cylinder block.



HINT: Arrange the main bearing caps, bearings thrust washers in correct order.



8. (4A-GE)
REMOVE CHECK VALVES AND OIL NOZZLES

Remove the four check valves and oil nozzles.

INSPECTION OF CYLINDER BLOCK

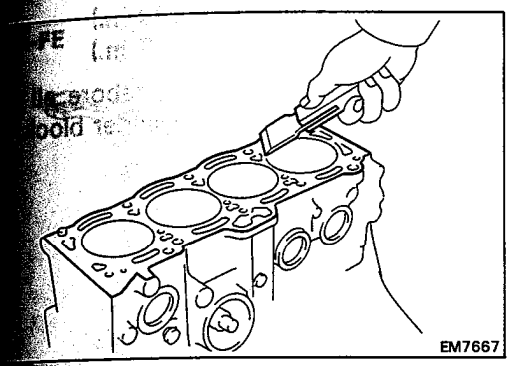
1. CLEAN CYLINDER BLOCK

A. Remove gasket material

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

B. Clean cylinder block

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

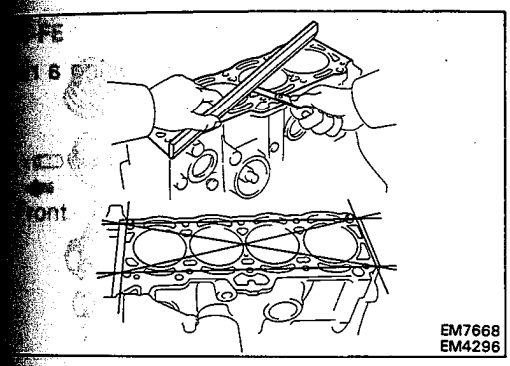


2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

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

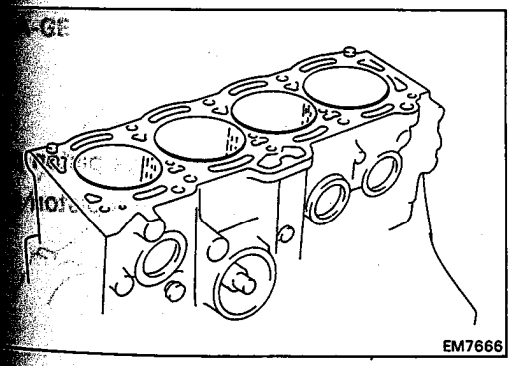
Maximum warpage: 0.05 mm (0.0020 in.)

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



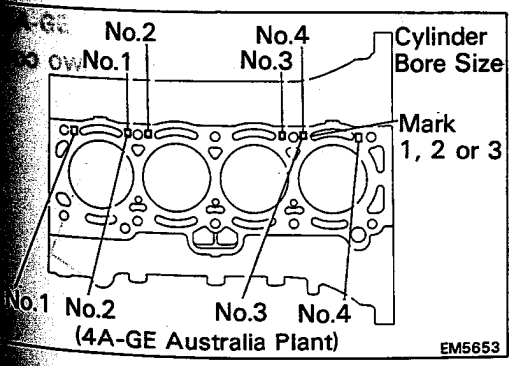
3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

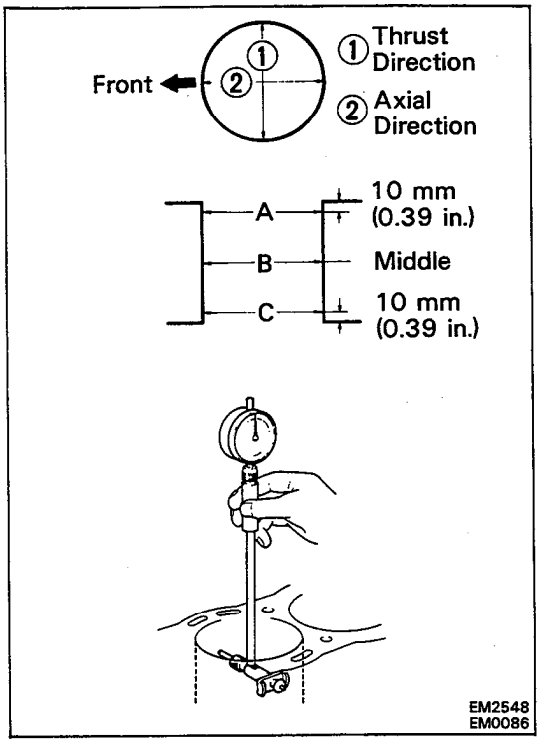
Visually check the cylinder for vertical scratches. If deep scratches are present, rebore all the four cylinders. If necessary, replace the cylinder block.



4. INSPECT CYLINDER BORE DIAMETER

HINT: There are three sizes of the standard cylinder bore diameter, marked "1", "2" and "3" accordingly. The mark is stamped on top of the cylinder block.





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

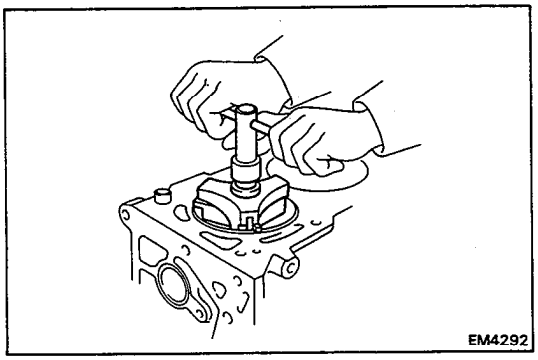
Standard diameter:

STD	**Mark "1"**	**81.000 – 81.010 mm (3.1890 – 3.1894 in.)**
	Mark "2"	**81.010 – 81.020 mm (3.1894 – 3.1898 in.)**
	Mark "3"	**81.020 – 81.030 mm (3.1898 – 3.1902 in.)**

Maximum diameter:

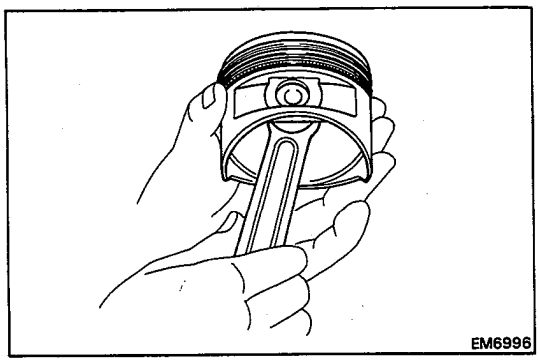
STD	**81.23 mm (3.1980 in.)**
O/S 0.50	**81.73 mm (3.2177 in.)**

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



5. REMOVE CYLINDER RIDGE

If the wear is less than 0.2 mm (0.008 in.), using a ri reamer, grind the top of the cylinder.

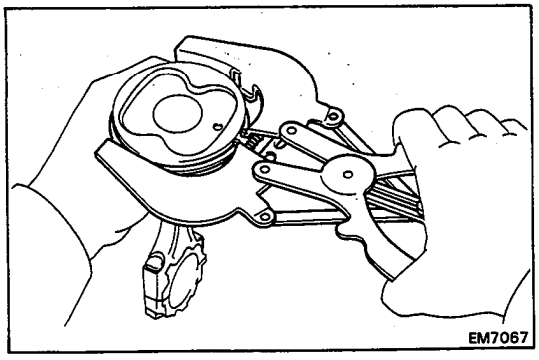


DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

1. CHECK FIT BETWEEN PISTON PIN

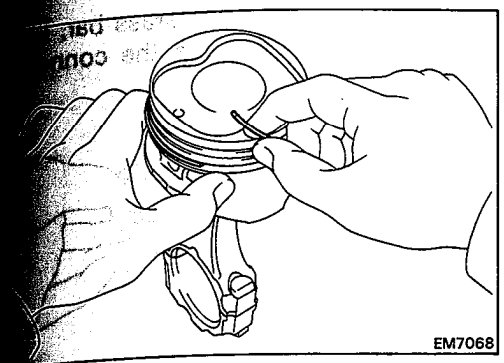
Try to move the piston back and forth on the piston

If the piston does not move at all, replace the piston pin as a set.



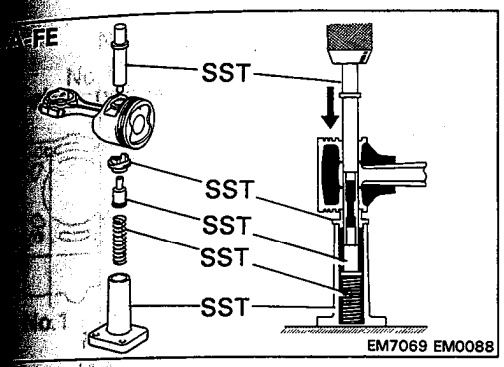
2. REMOVE PISTON RINGS

(a) Using a piston ring expander, remove the two c pression rings.



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

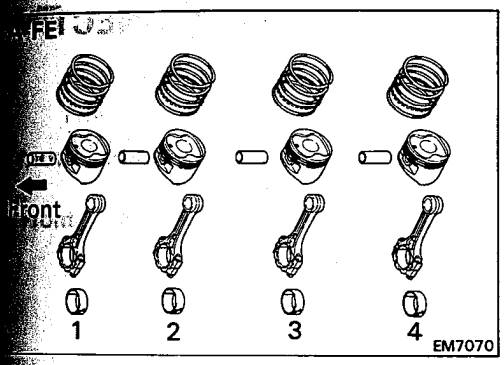
HINT: Arrange the rings in correct order only.



3. DISCONNECT CONNECTING ROD FROM PISTON (4A-FE)

Using SST, press out the piston pin from the piston. Remove the connecting rod.

SST 09221-25024 (09221-00020, 09221-00030, 09221-00050, 09221-00130, 09221-00140)

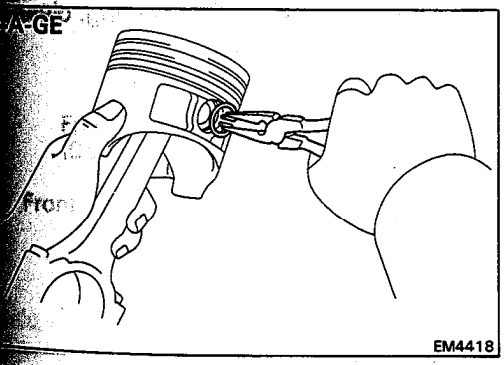


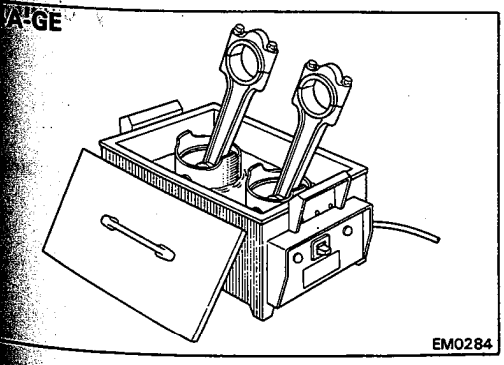
HINT:

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

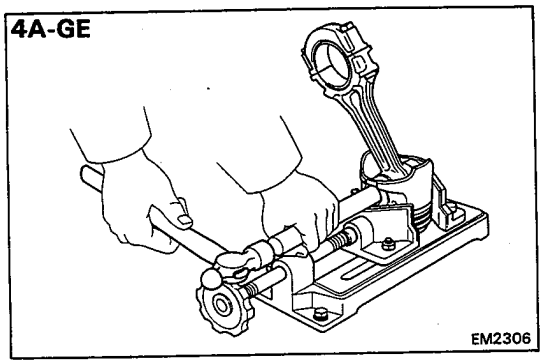
(4A-GE)

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

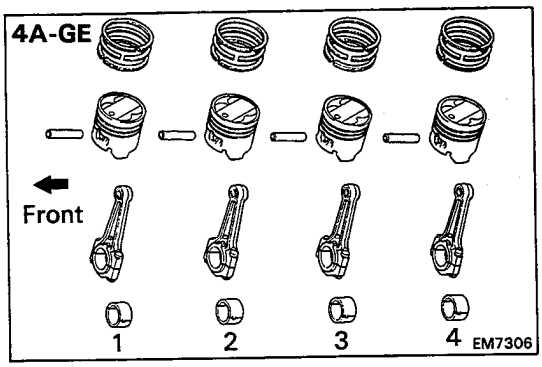




(b) Gradually heat the piston to 70 – 80°C (158 – 176°F).



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

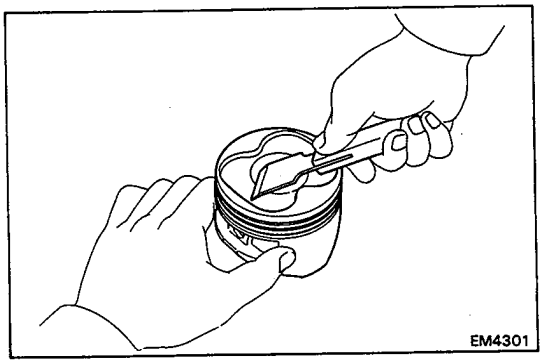


HINT:
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods bearings in correct order.

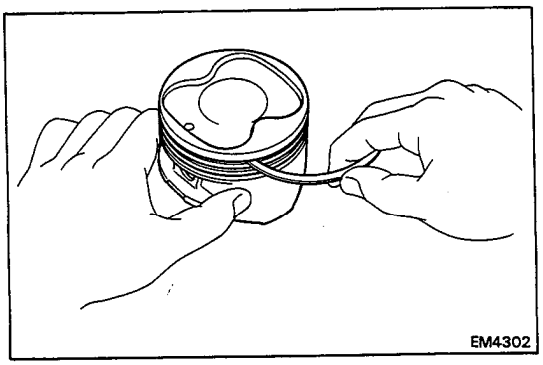
INSPECTION OF PISTON AND CONNECTIN ROD ASSEMBLIES

1. CLEAN PISTON

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

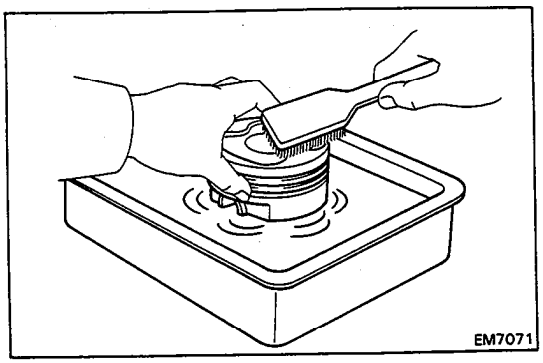


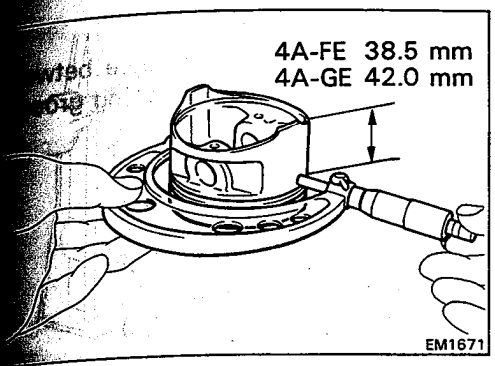
(b) Using a groove cleaning tool or broken ring, clea piston ring grooves.

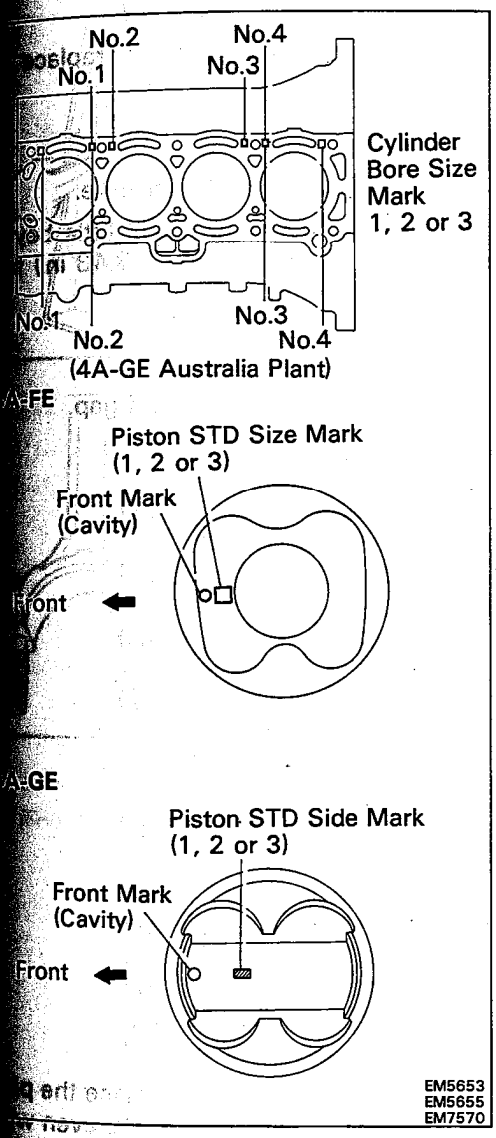


(c) Using solvent and a brush, thoroughly clean piston.

NOTICE: Do not use a wire brush.







2. INSPECT PISTON

A. Inspect piston oil clearance

HINT: There are three sizes of the standard piston diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the piston top.

(a) Using a micrometer and with the piston upside down, measure the piston diameter at a right angle to the piston pin hole center line, the indicated distance from the skirt of the bottom edge.

4A-FE 38.5 mm (1.576 in.)
4A-GE 42.0 mm (1.654 in.)

Piston diameter:

4A-FE

STD	**Mark "1"**	**80.93 – 80.94 mm (3.1862 – 3.1866 in.)**
	Mark "2"	**80.94 – 80.950 mm (3.1866 – 3.187 in.)**
	Mark "3"	**80.95 – 80.96 mm (3.1870 – 3.1874 in.)**
O/S 0.50		**81.43 – 81.46 mm (3.2059 – 3.2071 in.)**

4A-GE

STD	**Mark "1"**	**80.89 – 80.90 mm (3.1846 – 3.1850 in.)**
	Mark "2"	**80.90 – 80.91 mm (3.1850 – 3.1854 in.)**
	Mark "3"	**80.91 – 80.92 mm (3.1854 – 3.1858 in.)**
O/S 0.50		**81.39 – 81.42 mm (3.2043 – 3.2055 in.)**

(b) Measure the cylinder bore diameter in the thrust directions. (See step 4 on page EM-125)

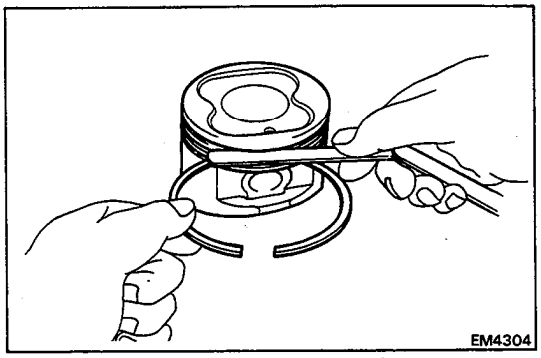
(c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

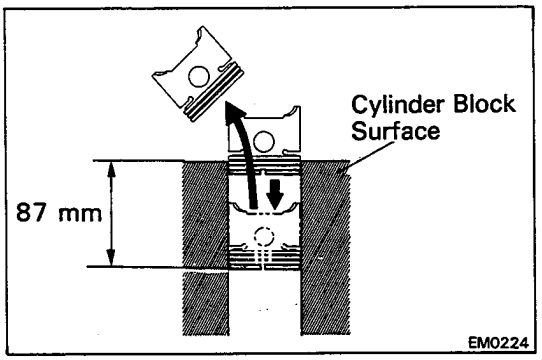
Standard oil clearance:
4A-FE 0.06 – 0.08 mm (0.0024 – 0.031 in.)
4A-GE 0.10 – 0.12 mm (0.0039 – 0.0047 in.)

Maximum oil clearance:
4A-FE 0.10 mm (0.0039 in.)
4A-GE 0.15 mm (0.0059 in.)

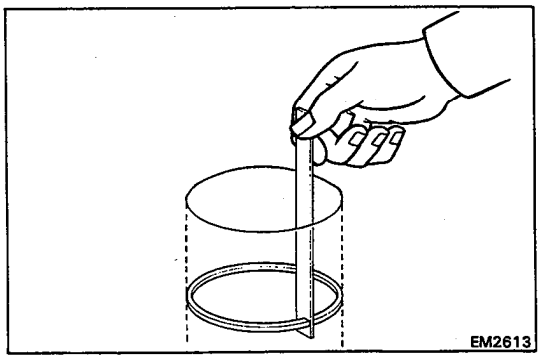
If the oil clearance is greater than maximum, replace all the four pistons and rebore all the four cylinders. If necessary, replace the cylinder block.

HINT: (Use new cylinder block): Use a piston with the same number mark as the cylinder bore diameter marked on the cylinder block.


EM4304



EM0224


EM2613

B. Inspect piston ring groove clearance.

Using a feeler gauge, measure the clearance betwee new piston ring and the wall of the piston ring groove

Ring groove clearance:

4A-FE	No.1	0.04 – 0.08 mm (0.0016 – 0.0031 in.)
	No.2	0.03 – 0.07 mm (0.0012 – 0.0028 in.)
4A-GE	No.1	0.03 – 0.08 mm (0.0012 – 0.0031 in.)
	No.2	0.03 – 0.07 mm (0.0012 – 0.0028 in.)

If the clearance is greater than maximum, replace piston.

C. Inspect piston ring end gap

(a) Inspect the piston ring in the cylinder bore.

(b) Using a piston, push the piston ring a little beyo the bottom of the ring travel, 87 mm (3.43 in.) fr the top of the cylinder block.

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

Standard piston ring end gap:

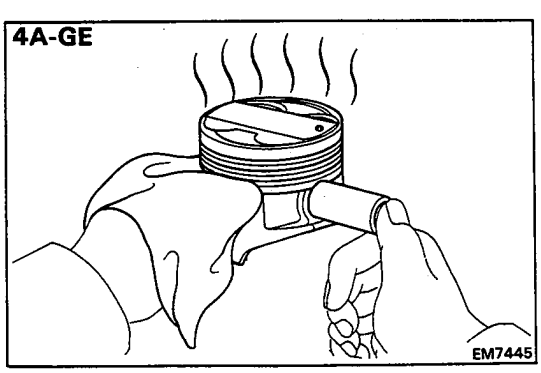
4A-FE	No.1	0.25 – 0.45 mm (0.0098 – 0.0177 in.)
	No.2	0.15 – 0.40 mm (0.0059 – 0.0157 in.)
	Oil	0.10 – 0.70 mm (0.0039 – 0.0276 in.)
4A-GE	No.1	0.25 – 0.47 mm (0.0098 – 0.0185 in.)
	No.2	0.20 – 0.42 mm (0.0079 – 0.0165 in.)
	Oil	0.15 – 0.52 mm (0.0059 – 0.0205 in.)

Maximum piston ring end gap:

4A-FE	No.1	1.05 mm (0.0413 in.)
	No.2	1.00 mm (0.0394 in.)
	Oil	1.30 mm (0.0512 in.)
4A-GE	No.1	1.07 mm (0.0421 in.)
	No.2	1.02 mm (0.0402 in.)
	Oil	1.12 mm (0.0441 in.)

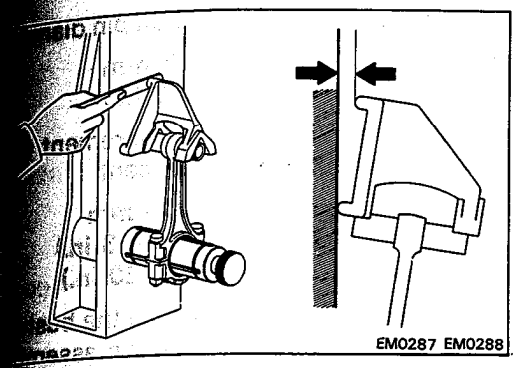
If the end gap is greater than maximum, replace the pis ring. If the end gap is greater than maximum, even wit new piston ring, rebore all the four cylinders or replace cylinder block.

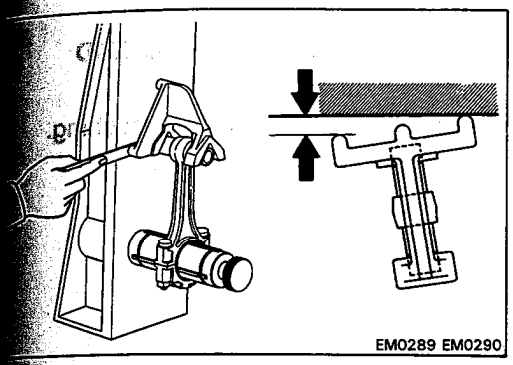
4A-GE

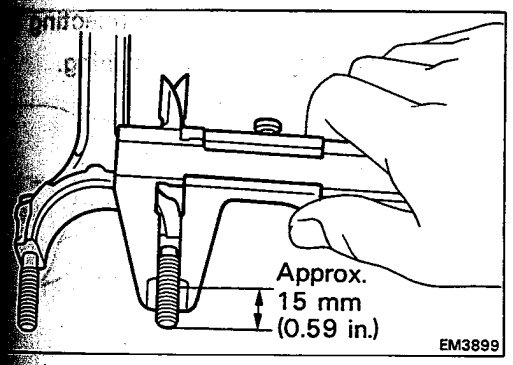

EM7445

3. (4A-GE)
INSPECT PISTON PIN FIT

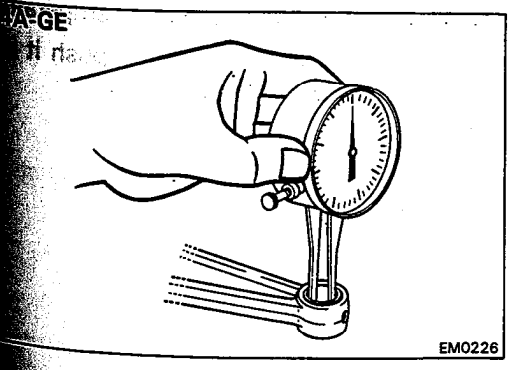
At 80°C (176°F), you should be able to push the pis pin into the piston pin hole with your thumb.


EM0287 EM0288


EM0289 EM0290



EM3899


EM0226

4. INSPECT CONNECTING ROD

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

- Check for bending.

Maximum bend:

4A-FE	**0.05 mm (0.0020 in.) per 100 mm (3.94 in.)**
4A-GE	**0.03 mm (0.0012 in.) per 100 mm (3.94 in.)**

If bend is greater than maximum, replace the connecting rod and connecting rod cap as a set.

- Check for twist.

Maximum twist:

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

If twist is greater than maximum, replace the connecting rod and connecting rod cap as a set.

(4A-GE)

(b) Inspect connecting rod bolts.

- Fix a nut to each of the connecting rod bolts and check that the nut can be turned by hand to the end of the thread.
- If a nut cannot be moved all the way down the thread, measure the compressed thread outer diameter with a measuring gauge.
- If the location of this area cannot be judged by visual inspection, use the dimension locations in the illustration and measure the outer diameter.

Standard diameter: **8.860 – 9.000 mm (0.3488 – 0.3543 in.)**

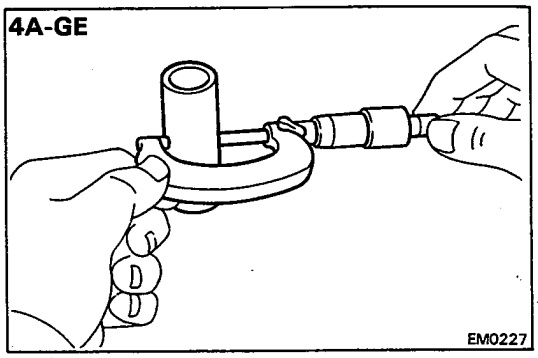
Minimum diameter: **8.600 mm (0.3386 in.)**

If the diameter is not within specifications, replace the nut and connecting rod bolt.

5. (4A-GE)
INSPECT PISTON PIN OIL CLEARANCE

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

Bushing inside diameter: **20.012 – 20.022 mm (0.7879 – 0.7883 in.)**



(b) Using a micrometer, measure the piston pin diame

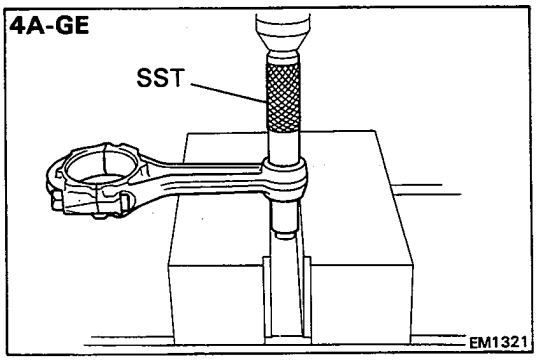
Piston pin diameter: 20.006 – 20.016 mm (0.7876 – 0.7880 in.)

(c) Subtract the piston pin diameter measurement fr the bushing inside diameter measurement.

Standard oil clearance: 0.004 – 0.008 mm (0.0002 – 0.0003 in.)

Maximum oil clearance: 0.05 mm (0.0020 in.)

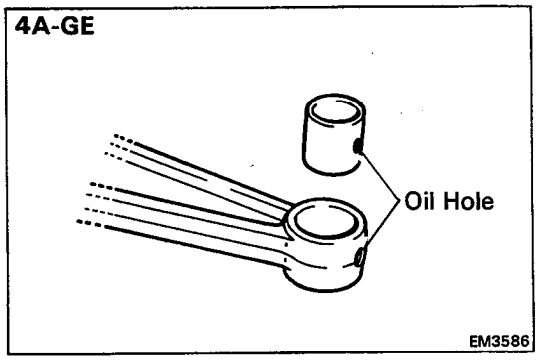
If clearance is greater than maximum, replace the bushi If necessary, replace the piston and piston pin assemb



6. **(4A-GE)**
IF NECESSARY, REPLACE CONNECTING ROD BUSHINGS

(a) Using SST and a press, push out the bushing.

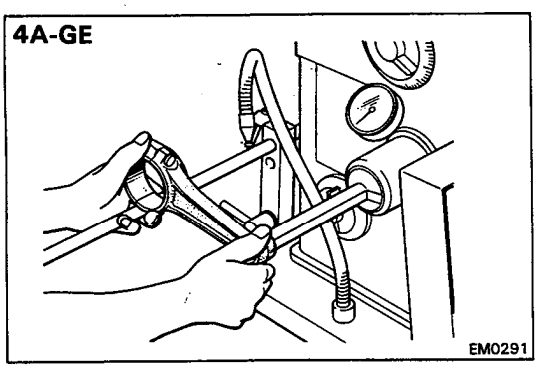
SST 09222-30010



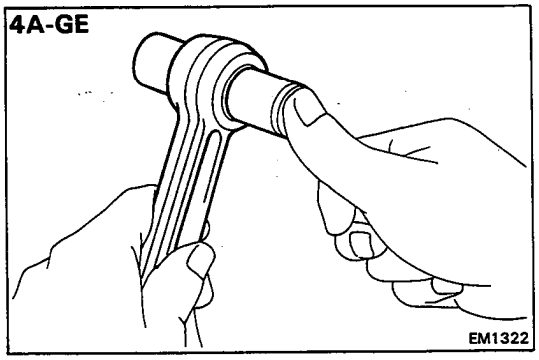
(b) Align the oil holes of the bushing and connecting r

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

SST 09222-30010



(d) Using a pin hole grinder, hone the bushing to ob the standard specified clearance (See procedure s 5) between the bushing and piston pin.



(e) Check the piston pin fit at normal room temperat

Coat the piston pin with engine oil and push it the connecting rod with your thumb.

BORING OF CYLINDERS

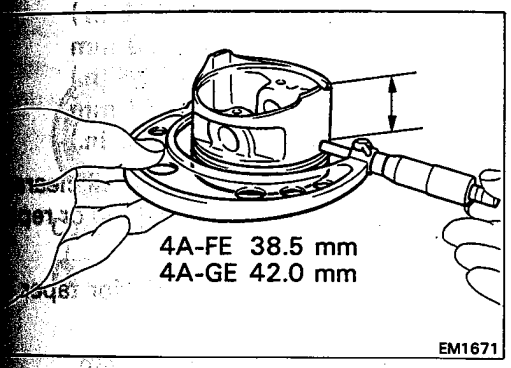
HINT:

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

1. KEEP OVERSIZED PISTON

Oversized piston diameter:

4A-FE	**O/S 0.50**	**81.43 – 81.46 mm (3.2059 – 3.2071 in.)**
4A-GE	**O/S 0.50**	**81.39 – 81.42 mm (3.2043 – 3.2055 in.)**



2. CALCULATE AMOUNT TO BORE CYLINDER

(a) Using a micrometer and with the piston upside down, measure the piston diameter at a right angle to the piston pin hole center line, the indicated distance from the skirt of the bottom edge.

4A-FE 38.5 mm (1.576 in.)
4A-GE 42.0 mm (1.654 in.)

(b) Calculate the amount each cylinder is to be rebored as follows:

Size to be rebored = P + C – H

P = Piston diameter

C = Piston clearance

4A-FE	**0.06 – 0.08 mm (0.0024 – 0.0031 in.)**
4A-GE	**0.10 – 0.12 mm (0.0039 – 0.0047 in.)**

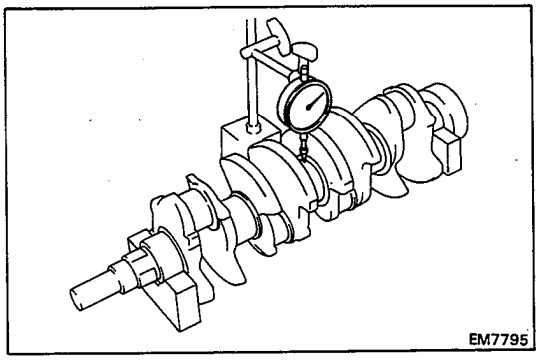
H = Allowance for honing

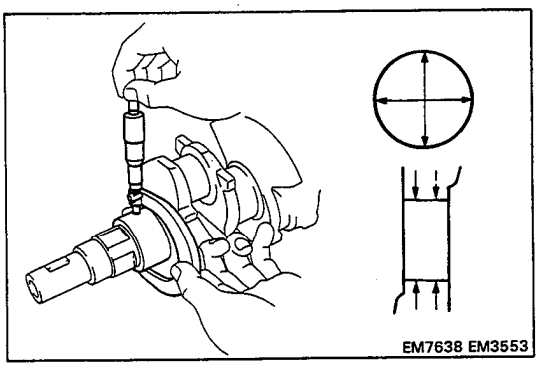
Less than 0.02 mm (0.0008 in.)

3. BORE AND HONE CYLINDERS TO CALCULATED DIMENSIONS

Amount of honing: 0.02 mm (0.0008 in.) maximum

NOTICE: Excess honing will destroy the finished roundness.


EM7795


EM7638 EM3553

INSPECTION AND REPAIR OF CRANKSHA

1. INSPECT CRANKSHAFT FOR RUNOUT

(a) Place the crankshaft on V-blocks.

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

Maximum circle runout: 0.06 mm (0.0024 in.)

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

2. INSPECT MAIN JOURNALS AND CRANK PINS

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

Main journal diameter:

STD	**47.982 – 48.000 mm (1.8891 – 1.8898 in.)**
U/S 0.25	**47.745 – 47.755 mm (1.8797 – 1.8881 in.)**

Crank pin diameter:

4A-FE	**STD**	**39.985 – 40.000 mm (1.5742 – 1.5748 in.)**
	U/S 0.25	**39.745 – 39.755 mm (1.5648 – 1.5652 in.)**
4A-GE	**STD**	**41.989 – 42.000 mm (1.6529 – 1.6535 in.)**
	U/S 0.25	**41.745 – 41.755 mm (1.6435 – 1.6439 in.)**

If the diameter is not as specified, check the oil clear (See pages EM-119 to 123). If necessary, grind or re the crankshaft.

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

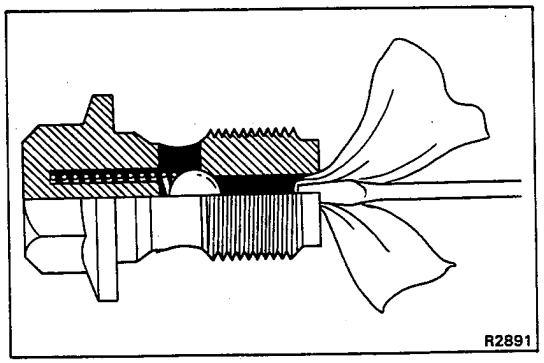
Maximum taper and out-of-round: 0.02 mm (0.0008 in.)

If the taper and out-of-round is greater than maxi replace the crankshaft.

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

Grind and hone the main journal and/or crank pins t finished diameter.
(See procedure step 2 above).

Install new main journal and/or crank pin undersized ing.


R2891

INSPECTION OF CHECK VALVES AND OI NOZZLES (4A-GE)

1. INSPECT CHECK VALVES

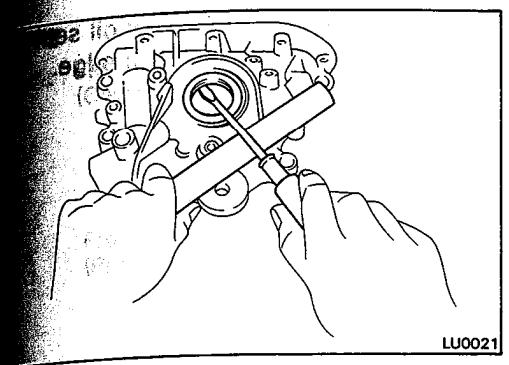
Push the valve with a screwdriver to check if it is s

If stuck, replace the check valve.

2. INSPECT OIL NOZZLES

Check the oil nozzles for damage or clogging.

If necessary, replace the oil nozzle.


LU0021

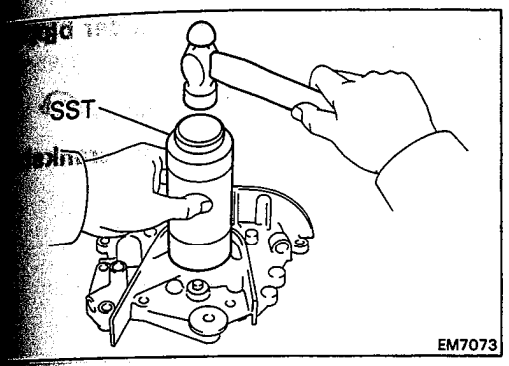
REPLACEMENT OF CRANKSHAFT OIL SEALS

HINT: There are two methods (A and B) to replace the oil seal which are as follows:

1. REPLACE CRANKSHAFT FRONT OIL SEAL

A. If oil pump is removed from cylinder block:

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



EM7073

(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump case edge.

SST 09309-37010

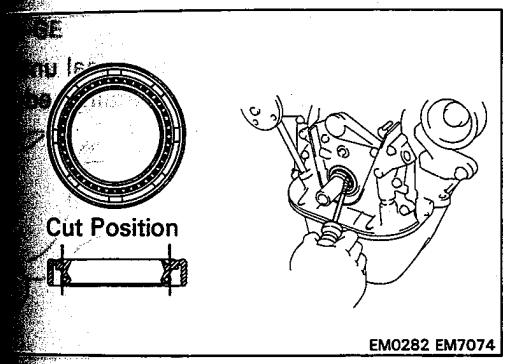
(c) Apply MP grease to the oil seal lip.

B. If oil pump is installed to the cylinder block:

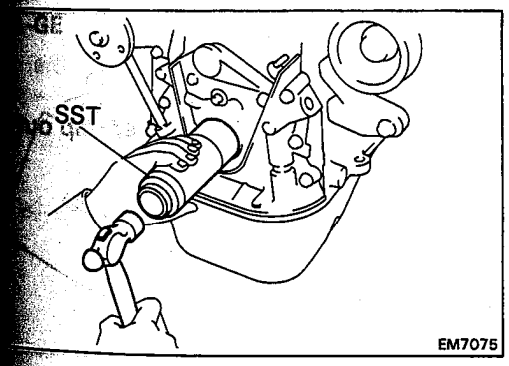
(a) Using a knife, cut off the oil seal lip

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

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



EM0282 EM7074



EM7075

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

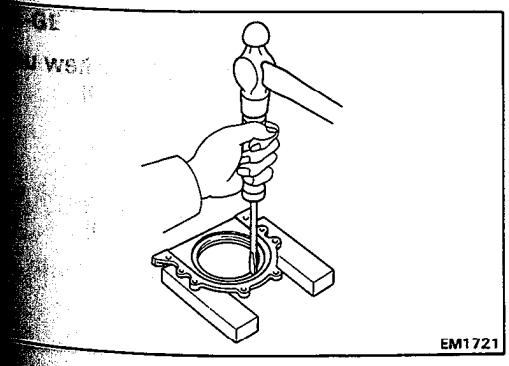
(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump case edge.

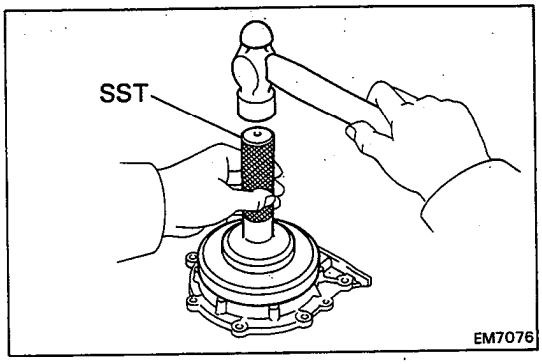
SST 09309-37010

2. REPLACE CRANKSHAFT REAR OIL SEAL

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

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

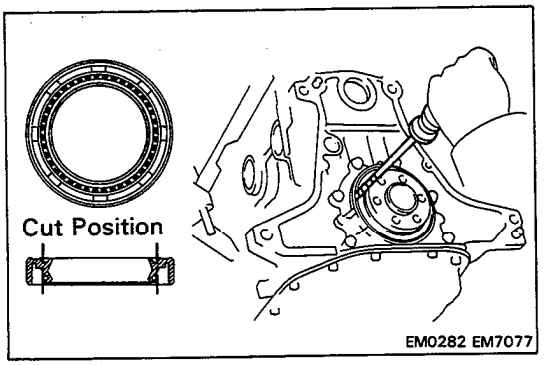

EM1721



(b) Using SST and a hammer, tap in a new oil seal u its surface is flush with the rear oil seal edge.

SST 09223–41020

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

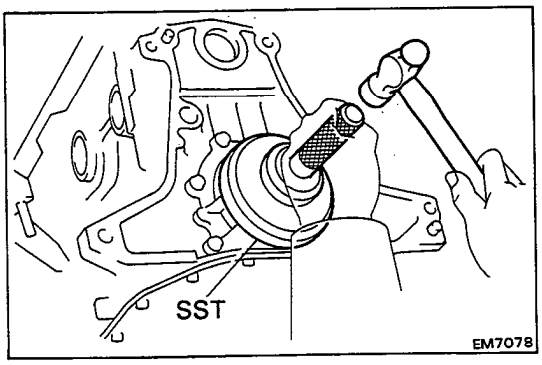


B. If rear oil seal retainer is installed to cylinder block

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

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

NOTICE: Be careful not to damage the cranksh Tape the screwdriver tip.



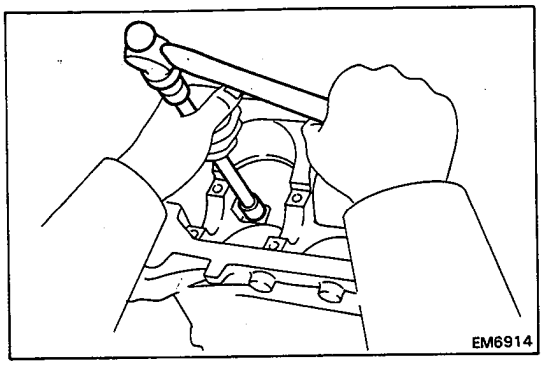
(c) Apply MP grease to a new oil seal lip.

(d) Using SST and a hammer, tap in the oil seal unti surface is flush with the rear oil seal retainer edg

SST 09223-41020

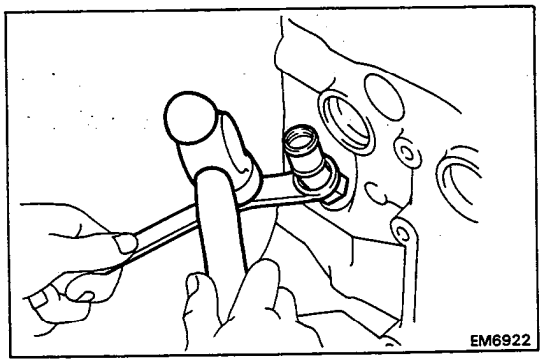
REPLACEMENT OF UNION (4A-GE)

1. REMOVE UNION

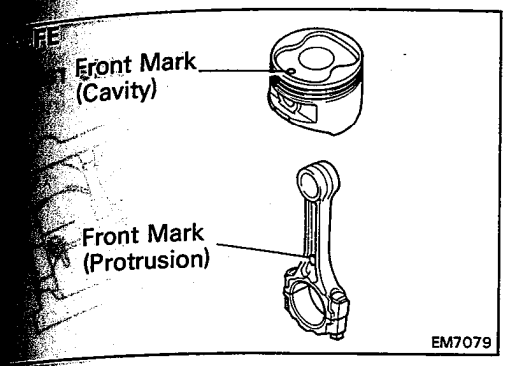


Using a 12 mm socket wrench and a hammer, tap out union.

2. INSTALL UNION



Using an offset wrench and a hammer, tap in a new u

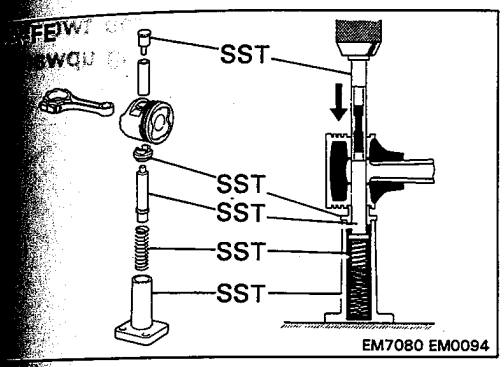


ASSEMBLY OF PISTON AND CONNECTING ROD

(See page EM-117)

1. ASSEMBLE PISTON AND CONNECTING ROD

(a) Align the front marks of the piston and connecting rod.



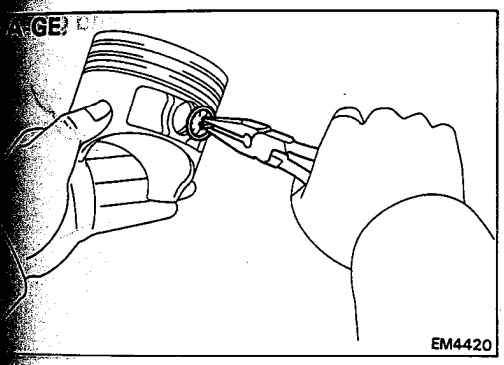
(b) Coat the piston pin and piston hole of the piston with engine oil.

(c) Using SST, press in the piston pin.

SST 09221-25024 (09221-00020, 09221-00030, 09221-00050, 09221-00130, 09221-00140)

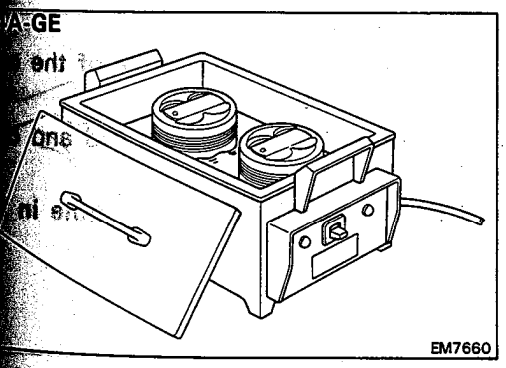
(d) Check that the piston moves smoothly back and forth on the piston pin.

(e) Check that the connecting rod and piston pin are positioned in the middle of the piston.

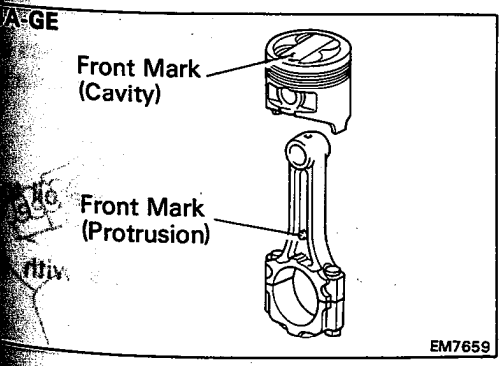


(4A-GE)

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



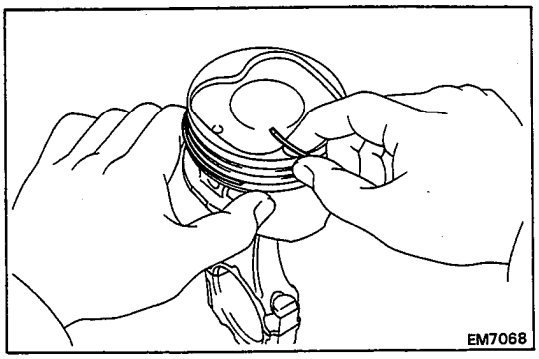
(b) Gradually heat the piston to 70 – 80°C (158 – 176°F)



(c) Coat the piston pin with engine oil.

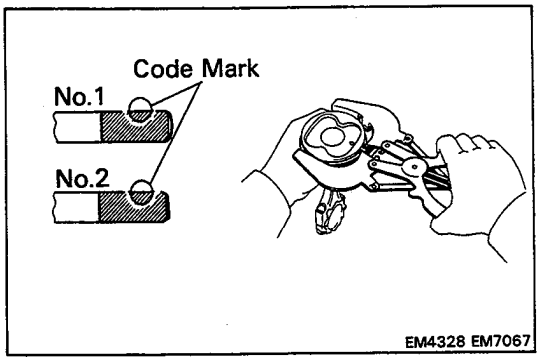
(d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.

(e) Install a new snap ring on the other side of the piston pin hole.



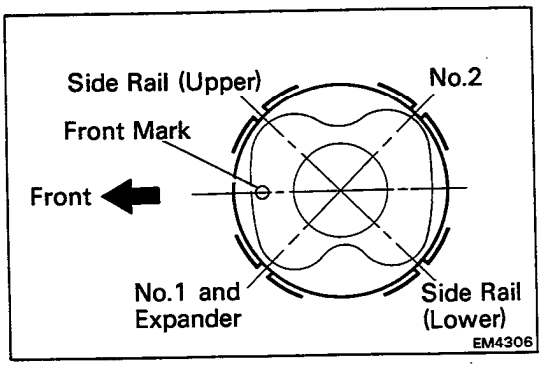
2. INSTALL PISTON RINGS

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



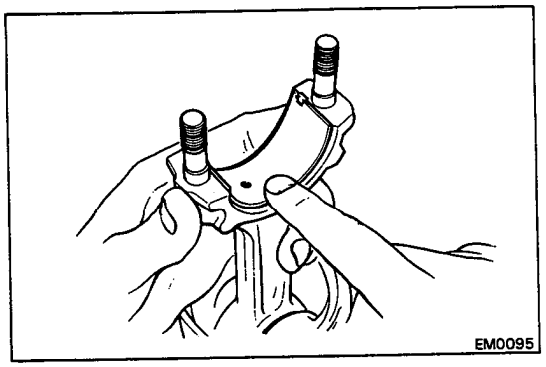
(b) Using a piston ring expander, install the two c pression rings with the code mark facing upwar

Code mark: No.1 R or T (4A-GE only)
No.2 R or T



(C) Position the piston rings so that the ring end gap as shown.

NOTICE: Do not align the end gaps.



3. INSTALL CONNECTING ROD BEARINGS

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

(b) Install the bearings in the connecting rod and necting rod cap.

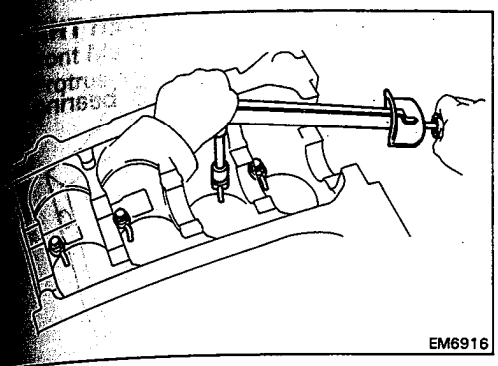
NOTICE: Install the bearing with the oil hole i connecting rod.

ASSEMBLY OF CYLINDER BLOCK

(See page EM-117)

HINT:

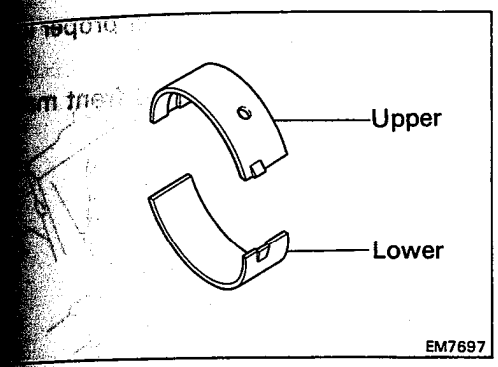
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with parts.



1. **(4A-GE)**
INSTALL OIL NOZZLES AND CHECK VALVES

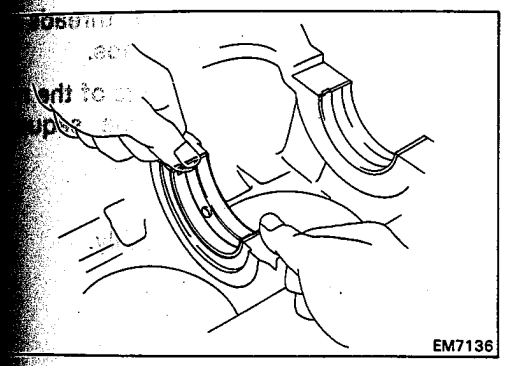
Install the nozzle with the bolt. Install the four oil nozzles. Torque the bolts.

Torque: 250 kg-cm (18 ft-lb, 25 N·m)



2. **INSTALL MAIN BEARINGS**

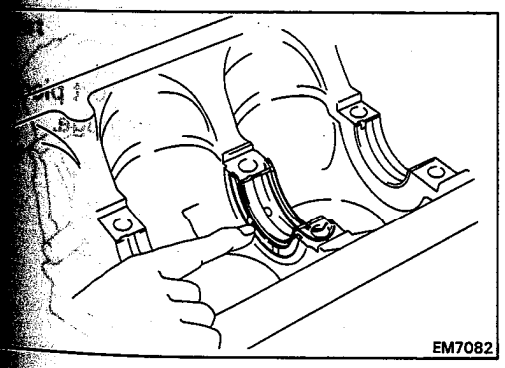
HINT: Upper bearings have an oil groove and oil holes; lower bearings do not.



(a) Align the bearing claw with the claw groove of the main bearing cap or cylinder block.

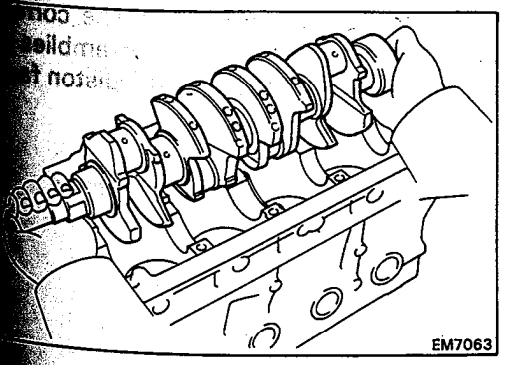
(b) Install the bearings in the cylinder block and main bearing caps.

NOTICE: Install the bearing with the oil hole in the cylinder block.

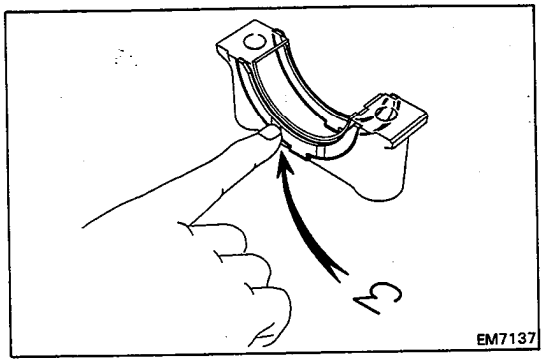


3. **INSTALL UPPER THRUST WASHERS**

Install the thrust washers under the No.3 main bearing cap position of the block with the oil grooves facing outward.

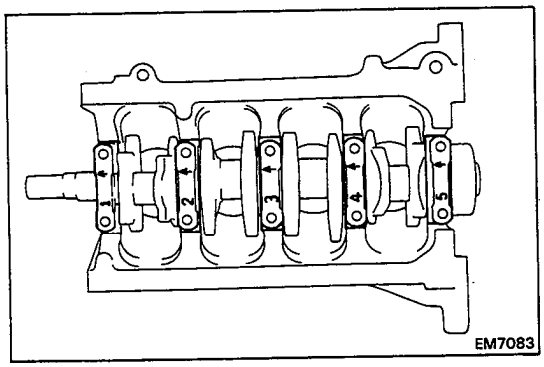


4. **PLACE CRANKSHAFT ON CYLINDER BLOCK**



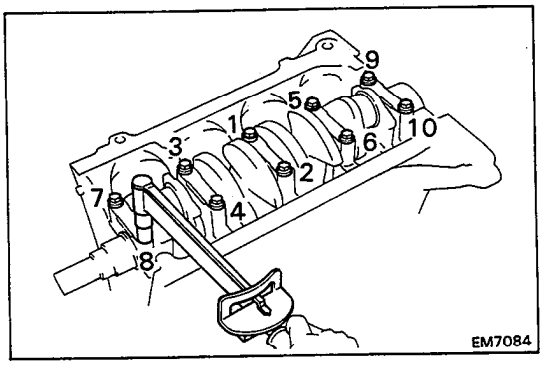
5. INSTALL MAIN BEARING CAPS AND LOWER THRU WASHERS

(a) Install the thrust washers on the No.3 bearing with the grooves facing outward.



(b) Install the five main bearing caps in their proper l tions.

HINT: Each bearing cap has a number and front ma



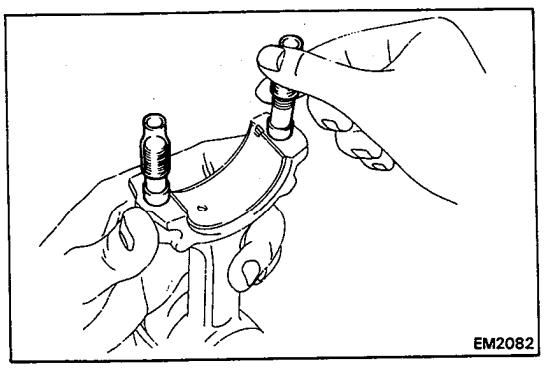
(c) Apply a light coat of engine oil on the threads under the heads of the main bearing caps.

(d) Install and uniformly tighten the ten bolts of the bearing caps in several passes in the sequ shown.

Torque: 610 kg-cm (44 ft-lb, 60 N·m)

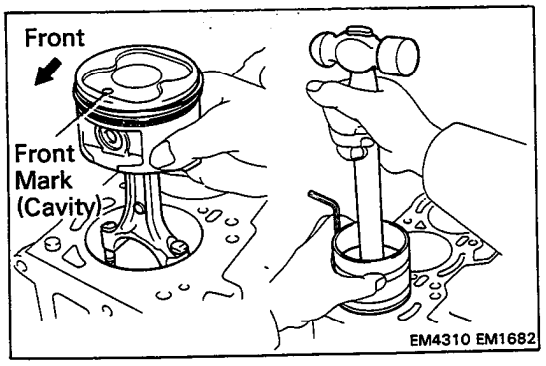
(e) Check that the crankshaft turns smoothly.

(f) Check the crankshaft thrust clearance. (See step 5 on page EM-121)

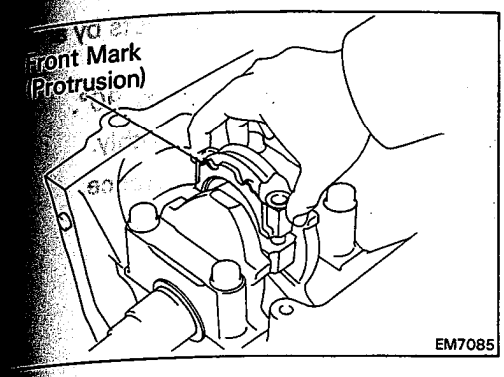


6. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

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



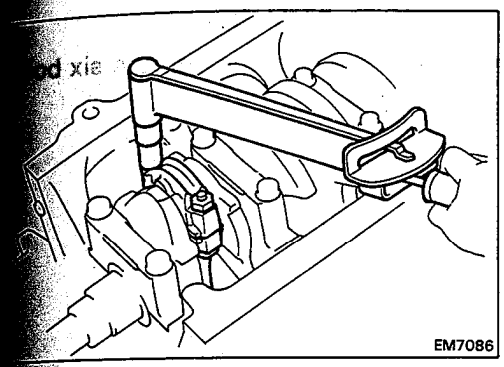
(b) Using a piston ring compressor, push the cor numbered piston and connecting rod assemblie each cylinder with the front mark of the piston f forward.



7. 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.



(4A-FE)

(c) Apply a light coat of engine oil on the threads and under the cap nuts.

(d) Install and alternately tighten the connecting rod cap nuts in several passes.

Torque: 500 kg-cm (36 ft-lb, 49 N·m)

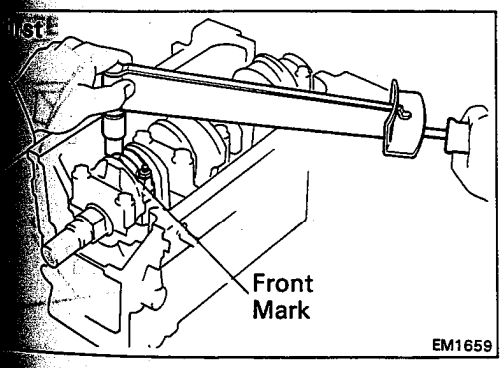
(e) Check that the crankshaft turns smoothly.

(f) Check the connecting rod thrust clearance. (See step 2 on page EM-119)

(4A-GE)

HINT:

- The connecting rod cap nuts are tightened in two progressive steps.
- If any of the cap bolts break or deform, replace them.

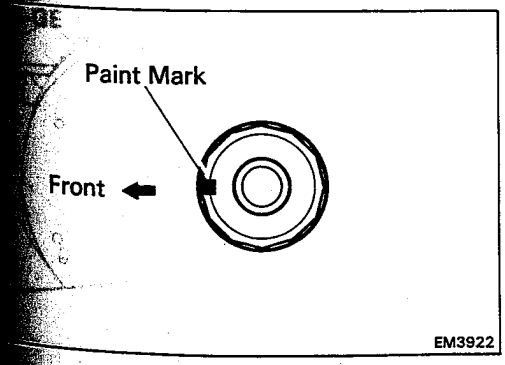


(c) Apply a light coat of engine oil on the threads and under the nuts of the connecting rod cap.

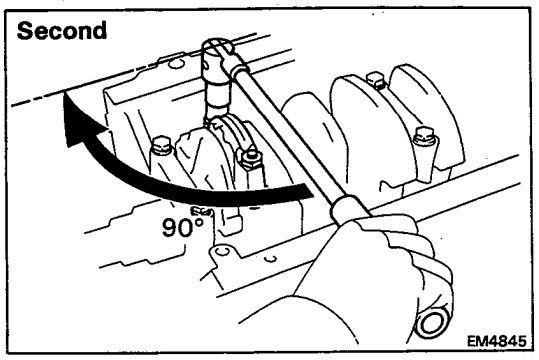
(d) First, alternately tighten the cap nuts in several passes.

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

If any one of the nuts does not meet the torque specification, replace the bolt.



(e) Mark the front side of the top of cap nut with paint.

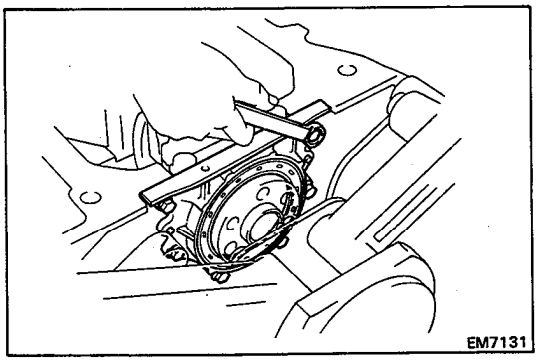


(f) Second, alternately retighten the cap nuts by an a tional 90°.

(g) Check that the paint mark is turned by 90°.

(h) Check that the crackshaft turns smoothly.

(i) Check the connecting rod thrust clearance. (See step 5 on page EM-121)



8. INSTALL REAR OIL SEAL RETAINER

Install a new gasket and the retainer with the six bol

Torque: 95 kg-cm (82 in.-lb, 9.3 N·m)

ASSEMBLY OF ENGINE

1. (4A-GE)
   INSTALL STIFFENER PLATE ADPTER
   Torque: 400 kg-cm (29 ft-lb, 39 N·m)

2. (4A-GE)
   INSTALL KNOCK SENSOR

3. INSTALL OIL PRESSURE SWITCH OR OIL PRESSURE SENDER GAUGE
   (See page LU-6)

4. INSTALL OIL FILTER BRACKET
   (See page LU-17)

5. INSTALL OIL PAN AND OIL PUMP
   (See page LU-15)

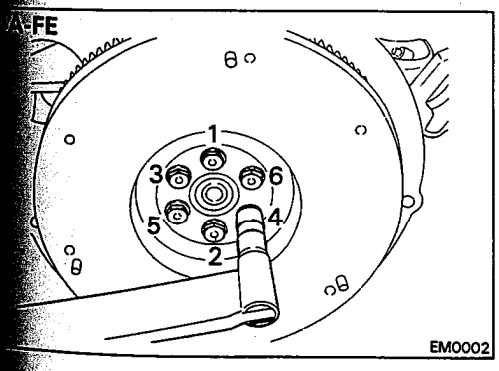
6. INSTALL WATER PUMP (See page CO-11)

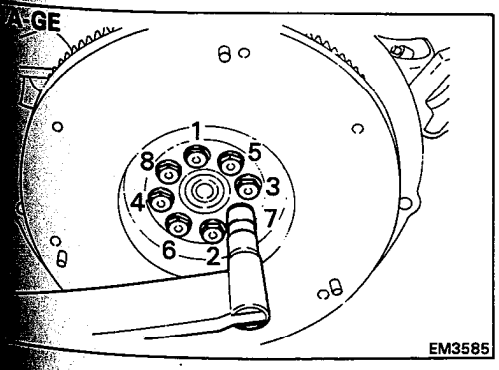
7. INSTALL CYLINDER HEAD
   4A-FE (See pages EM-56, 57)
   4A-GE (See page EM-92)

8. INSTALL TIMING PULLEYS AND TIMING BELT
   4A-FE (See page EM-39)
   4A-GE (See page EM-47)

9. (4A-FE)
   INSTALL RH MOUNTING BRACKET
   Torque: 500 kg-cm (36 ft-lb, 49 N·m)

10. INSTALL BRACKET AND ALTERNATOR
    Torque (Bracket): 500 kg-cm (36 ft-lb, 49 N·m)





11. INSTALL IIA OR DISTRIBUTOR

12. REMOVE ENGINE ASSEMBLY FROM ENGINE STAND

13. INSTALL REAR END PLATE

14. INSTALL FLYWHEEL (M/T) OR DRIVE PLATE (A/T)
    Install the flywheel or drive plate on the crankshaft. Tighten the bolts to the specified torque in two or three passes in the sequence shown.
    Torque:

Flywheel	4A-FE	800 kg-cm (58 ft-lb, 78 N·m)
	4A-GE	750 kg-cm (54 ft-lb, 74 N·m)
Drive plate (4A-FE)		650 kg-cm (47 ft-lb, 64 N·m)

15. (M/T)
    INSTALL CLUTCH DISC AND COVER
    HINT: If necessary, inspect the clutch unit before installation.