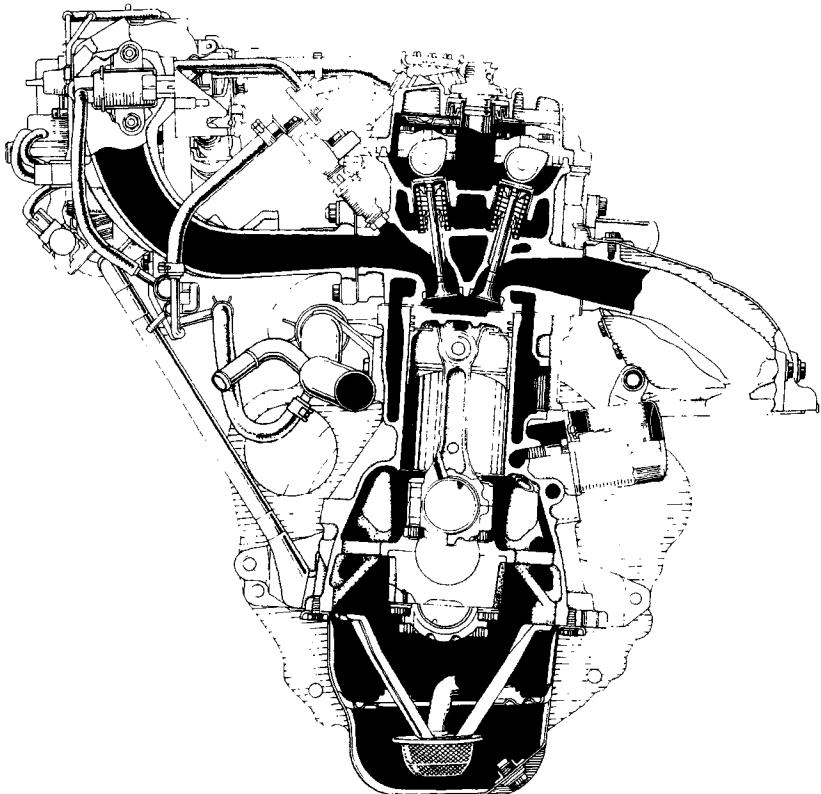
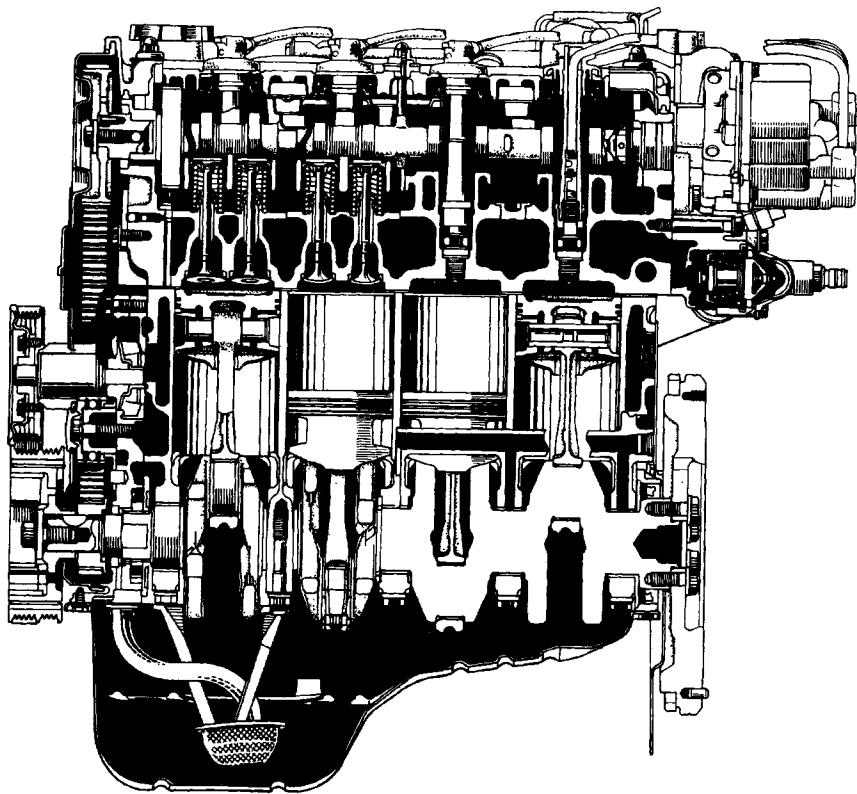


ENGINE MECHANICAL

DESCRIPTION (4A-FE)

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



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

The crankshaft is integrated with 8 weights for balance. Oil holes are placed in the center of the crankshaft to supply oil to the connecting rods, bearing, pistons and other components.

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

The intake manifold has 4 independent long ports and utilizes the inertial supercharging effect to improve engine torque at low and medium speeds.

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

The exhaust camshaft is driven by a timing belt, and a gear on the exhaust camshaft engages with a gear on the intake camshaft to drive it. The cam journal is supported at 5 places between the valve lifters of each cylinder and on the front end of the cylinder head. Lubrication of the cam journals and gears 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.1 belt cover for adjusting the timing belt tension.

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

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

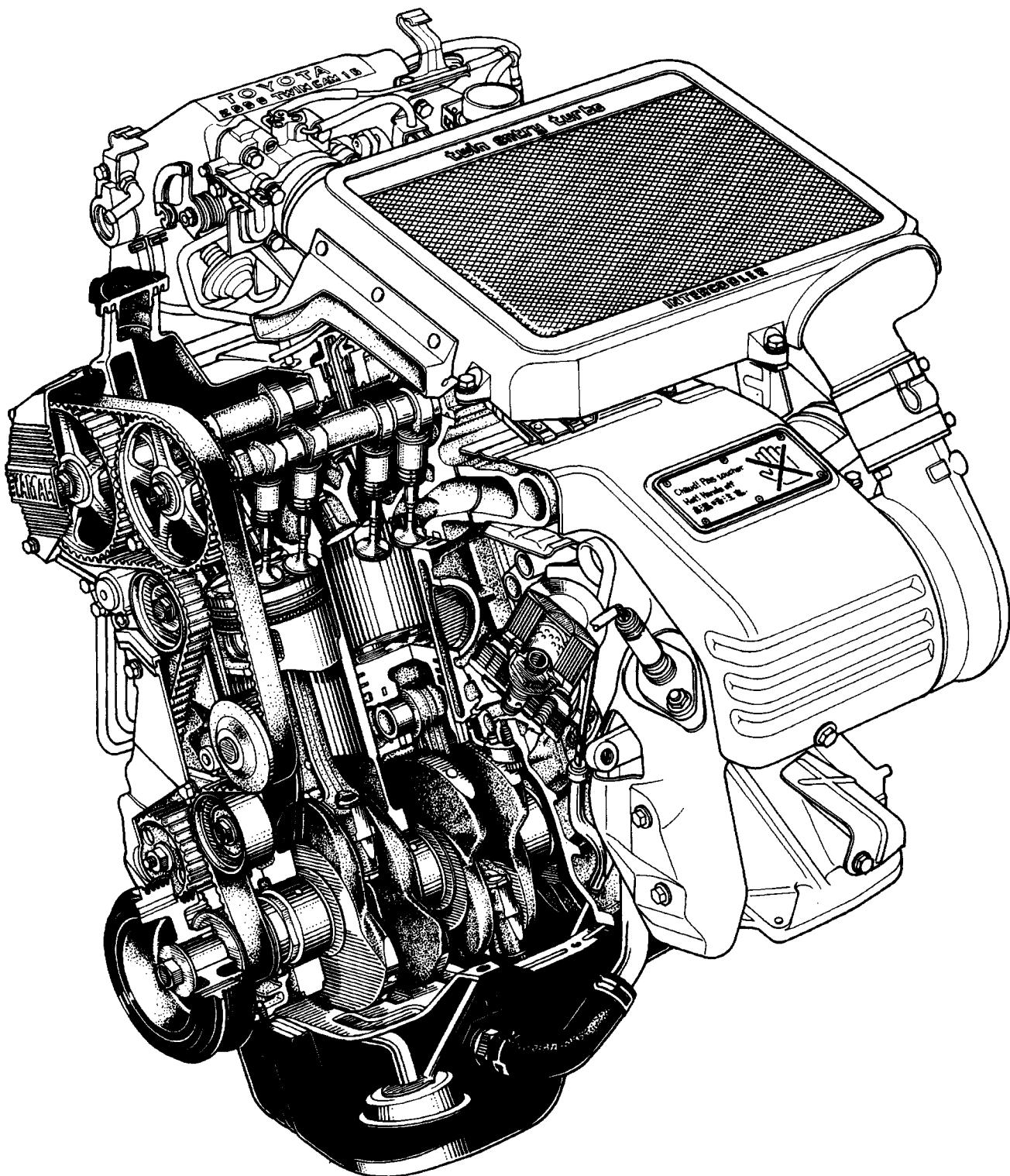
The No.1 compression ring is made of stainless steel and the No.2 compression ring is made of cast iron. The oil ring is made of a combination of steel and stainless steel. The outer diameter of each piston ring is slightly larger than the diameter of the piston and the flexibility of the rings allows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

The cylinder block is made of cast iron. It has 4 cylinders which are approximately twice the length of the piston stroke. The top of each cylinder is closed off by the cylinder head and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder block contains a water jacket, through which coolant is pumped to cool the cylinders.

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

DESCRIPTION (3S-GTE)

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



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

The crankshaft is integrated with 8 weights for balance. Oil holes are placed in the center of the crankshaft to supply oil to the connecting rods, bearing, pistons and other components.

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

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

Both the intake camshaft and the exhaust camshaft are driven by a single timing belt. The cam journal is supported at 5 places between the valve lifters of each cylinder and on the front end of the cylinder head. Lubrication of the cam journals and cams 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.

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

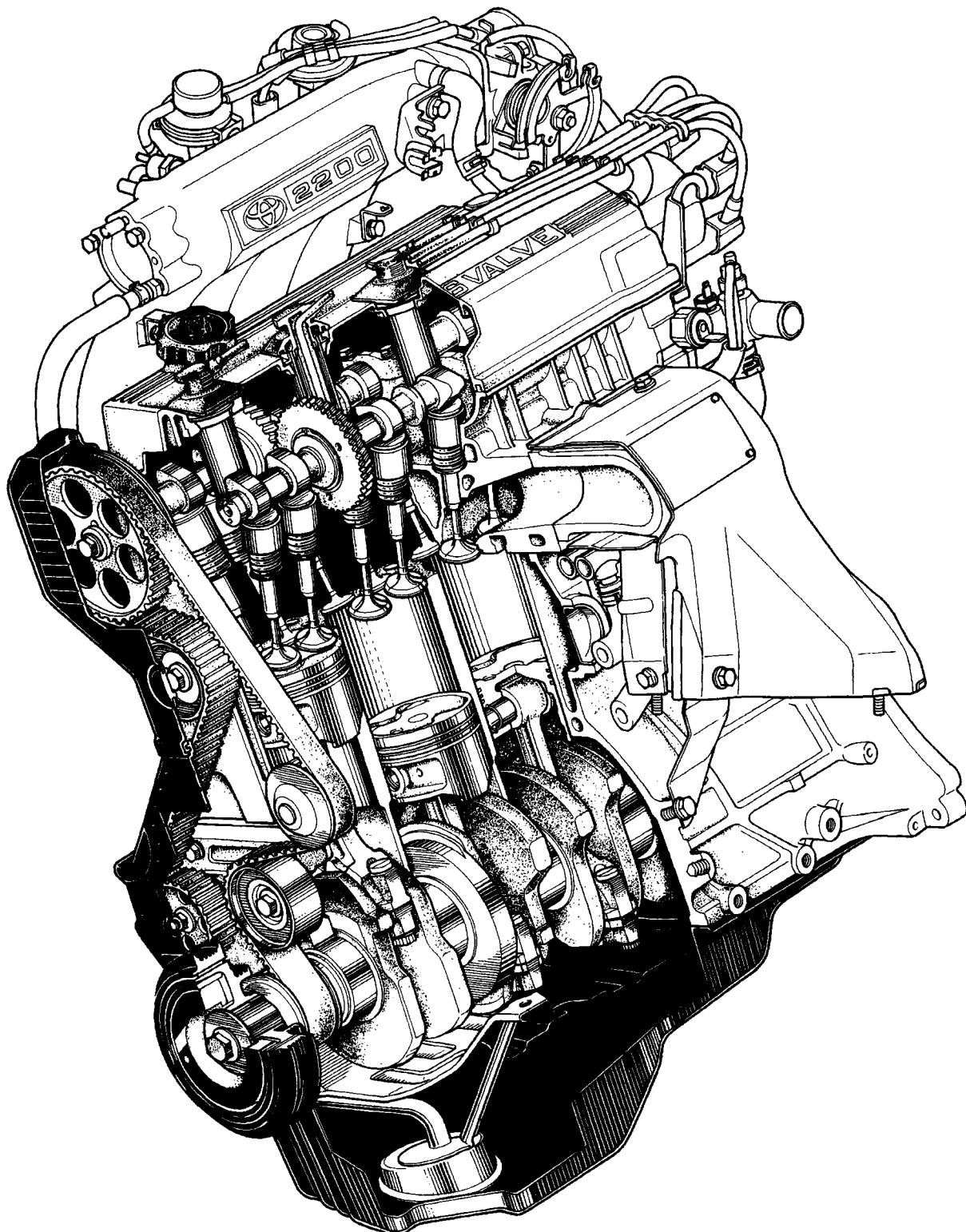
The No.1 compression ring is made of steel and the No.2 compression ring is made of cast iron. The oil ring is made of a combination of steel and stainless steel. The outer diameter of each piston ring is slightly larger than the diameter of the piston and the flexibility of the rings allows them to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

The cylinder block is made of cast iron. It has 4 cylinders which are approximately twice the length of the piston stroke. The top of each cylinder is closed off: by the cylinder head and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder block contains a water jacket, through which coolant is pumped to cool the cylinders.

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

DESCRIPTION (5S-FE)

The 5S-FE engine is an in-line, 4-cylinder, 2.2 liter DOHC 16-valve engine.



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

The crankshaft is integrated with 8 weights for balance. Oil holes are placed in the center of the crankshaft to supply oil to the connecting rods, bearing, pistons and other components.

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

The intake manifold has 4 independent long ports and utilizes the inertial supercharging effect to improve engine torque at low and medium speeds.

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

The intake camshaft is driven by a timing belt, and a gear on the intake camshaft engages with a gear on the exhaust camshaft to drive it. The cam journal is supported at 5 places between the valve lifters of each cylinder and on the front end of the cylinder head. Lubrication of the cam journals and gears 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.

Pistons are made of high temperature-resistant aluminum alloy, and a depression is built into the piston head to prevent interference with the 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 gas leakage from the cylinder and the oil ring works to scrape oil off the cylinder walls to prevent it from entering the combustion chambers.

The cylinder block is made of cast iron. It has 4 cylinders which are approximately twice the length of the piston stroke. The top of each cylinder is closed off by the cylinder head and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder block contains a water jacket, through which coolant is pumped to, cool the cylinders.

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

TROUBLESHOOTING ENGINE OVERHEATING

Problem	Possible cause	Remedy	Page
Engine overheats	Cooling system faulty Incorrect ignition timing	Troubleshoot cooling system Reset timing	CO-5 IG-25 , 29, 37

HARD STARTING

Problem	Possible cause	Remedy	Page
Engine will not crank or cranks slowly	Starting system faulty	Troubleshoot starting system	ST-2
Engine will not start/hard to start (cranks OK)	No fuel supply to injector: <ul style="list-style-type: none"> • No fuel in tank • Fuel pump not working • Fuel filter clogged • Fuel line clogged or leaking EFI system problems Ignition problems: <ul style="list-style-type: none"> • Ignition coil • Igniter • Distributor Spark plug faulty High-tension cords disconnected or broken Vacuum leaks: <ul style="list-style-type: none"> • PCV line • EGR line • Intake manifold • T-VIS valve (3S-GTE) • Throttle body • ISC valve (3S-GTE and 5S-FE) • Brake booster line Air suction between air flow meter and throttle body (3S-GTE) Low compression	Troubleshoot EFI system Repair as necessary Perform spark test Inspect plugs Inspect cords Repair as necessary Repair as necessary Check compression	FI-13 IG-6 , 10, 15 IG-7 , 11, 16 IG-7 , 11, 16 EM-31

ROUGH IDLING

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses	Spark plug faulty High-tension cord faulty Ignition problems: <ul style="list-style-type: none"> • Ignition coil • Igniter • Distributor Incorrect ignition timing Vacuum leaks: <ul style="list-style-type: none"> • PCV line • EGR line • Intake manifold 	Inspect plugs Inspect cords Inspect coil Inspect igniter Inspect distributor Reset timing Repair as necessary	IG-7 , 11, 16 IG-7 , 11, 16 IG-8 , 13, 17 IG-9 , 14, 19 IG-9 , 13, 18 IG-25 , 29, 37

ROUGH IDLING (Cont'd)

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses (Cont'd)	Vacuum leaks (cont'd): <ul style="list-style-type: none"> • T-VIS valve (3S-GTE) • Throttle body • ISC valve (5S-FE and 3S-GTE) • Brake booster line Air suction between air flow meter and throttle body (3S-GTE) Incorrect idle speed Incorrect valve clearance EFI system problems Engine overheats Low compression	Check ISC system (3S-GTE and 5S-FE) Adjust idle speed (4A-FE) Adjust valve clearance Repair as necessary Check cooling system Check compression	FI-208 , 211 MA-8 EM-13,17,22 CO-5 EM-31

ENGINE HESITATES/POOR ACCELERATION

Problem	Possible cause	Remedy	Page
Engine hesitates/poor acceleration	Spark plug faulty High-tension cord faulty Vacuum leaks: <ul style="list-style-type: none"> • PCV line • EGR line • Intake manifold • T-VIS valve (3S-GTE) • Throttle body • ISC valve (3S-GTE and 5S-FE) • Brake booster line Air suction between air flow meter and throttle body (3S-GTE) Incorrect ignition timing Incorrect valve clearance Fuel system clogged Air cleaner clogged EFI system problems Emission control system problems: (cold engine) <ul style="list-style-type: none"> • EGR system always on Engine overheats Low compression	Inspect plugs Inspect cords Repair as necessary Repair as necessary Reset timing Adjust valve clearance Check fuel system Check air cleaner Repair as necessary Check EGR system Check cooling system Check compression	IG-7 , 11, 16 IG-7 , 11, 16 IG-25 , 29, 37 EM-13,17,22 MA-5 EC-9 , 22, 38 CO-5 EM-31

ENGINE DIESELING

Problem	Possible cause	Remedy	Page
Engine diesels (runs after ignition switch is turned off)	EFI system problems Incorrect ignition timing EGR system faulty	Repair as necessary Reset timing Check EGR system	IG-25 , 29, 37 EC-9 , 22, 38

AFTER FIRE, BACKFIRE

Problem	Possible cause	Remedy	Page
Muffler explosion (after fire) on deceleration only	Deceleration fuel cut system always off	Check EFI (fuel cut) system	
Muffler explosion (after fire) all the time	Air cleaner clogged EFI system problems Incorrect ignition timing	Check air cleaner Repair as necessary Reset timing	MA-5 IG-25 , 29, 37
Engine backfires	EFI system problems Vacuum leaks: <ul style="list-style-type: none">• PCV line• EGR line• Intake manifold• T-VIS valve (3S-GTE)• Throttle body• ISC valve (3S-GTE and 5S-FE)• Brake booster line Air suction between air flow meter and throttle body (3S-GTE) Insufficient fuel flow Incorrect ignition timing Incorrect valve clearance Carbon deposits in combustion chambers	Repair as necessary Check hoses and repair as necessary Repair as necessary Troubleshoot fuel system Reset timing Adjust valve clearance Inspect cylinder head	FI-13 IG-25 , 29, 37 EM-13 , 17, 22 EM-92 , 127, 161

EXCESSIVE OIL CONSUMPTION

Problem	Possible cause	Remedy	Page
Excessive oil consumption	Oil leak PCV line clogged Piston ring worn or damaged Valve stem and guide bushing worn Valve stem oil seal worn	Repair as necessary Check PCV system Check rings Check valves and guide bushing Check seals	EM-204 , 244, 289 EM-94 , 129, 163

EXCESSIVE FUEL CONSUMPTION

Problem	Possible cause	Remedy	Page
Poor gasoline mileage	Fuel leak Air cleaner clogged Incorrect ignition timing ER system problems: <ul style="list-style-type: none"> • Injector faulty • Deceleration fuel cut system faulty Idle speed too high Spark plug faulty EG R system always on Low compression Tires improperly inflated Clutch slips Brakes drag	Repair as necessary Check air cleaner Reset timing Repair as necessary Check ISC system (3S-GTE and 5S-FE) Adjust idle speed (4A-FE) Inspect plugs Check EGR system Check compression Inflate tires to proper pressure Troubleshoot clutch Troubleshoot brakes	MA-5 IG-25 , 29, 37 FI-208 , 211 MA-8 IG-7 , 11, 16 EC-9 , 22, 38 EM-31

UNPLEASANT ODOR

Problem	Possible cause	Remedy	Page
Unpleasant odor	Incorrect idle speed Incorrect ignition timing Vacuum leaks: <ul style="list-style-type: none"> • PCV line • EGR line • Intake manifold • T-VIS valve (3S-GTE) • Throttle body • ISC valve (3S-GTE and 5S-FE) • Brake booster line EFI system problems	Check ISC system (3S-GTE and 5S-FE) Adjust idle Speed (4A-FE) Reset timing Repair as necessary Repair as necessary	FI-208 , 211 MA-8 IG-25 , 29, 37

ENGINE TUNE-UP

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-5](#))

INSPECTION OF BATTERY

(See steps 1 and 2 on page [CH-2](#))

Standard specific gravity:

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

INSPECTION OF AIR FILTER

(See step 3 on page [MA-5](#))

INSPECTION OF HIGH-TENSION CORDS

(See page [IG-7](#), 11 or 16)

Maximum resistance: 25 kΩ per cord

INSPECTION OF SPARK PLUGS

(Conventional Type only (4A-FE))

(See page [IG-7](#))

Correct electrode gap: 0.8 mm (0.031 in.)

Recommended spark plugs: ND Q16R-U

NGK BCPRSEY

INSPECTION OF ALTERNATOR DRIVE BELT

(See step 3 on page [CH-3](#))

Drive belt tension:

4A-FE New belt 160 ±20 lbf

Used belt 130 ±20 lbf

3S-GTE w/ A/C New belt 165 ±10 lbf

Used belt 84 ±15 lbf

 w/o A/C New belt 150 ±25 lbf

Used belt 130 ±25 lbf

5S-FE w/ A/C New belt 165 ±10 lbf

Used belt 110 ±10 lbf

 w/o A/C New belt 125 + 25 lbf

Used belt 95 ±20 lbf

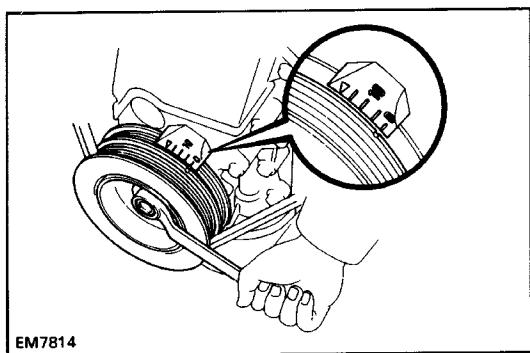
INSPECTION AND ADJUSTMENT OF VALVE CLEARANCE (4A-FE)

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

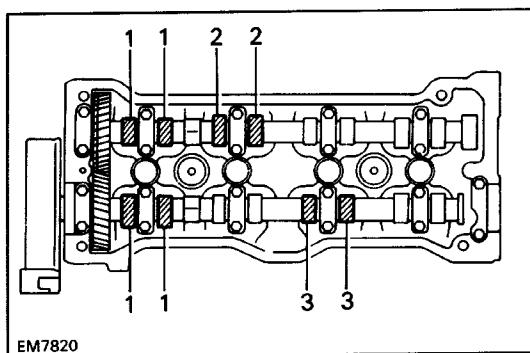
(See steps 18 and 24 on pages [EM-85](#) and [87](#))



3. SET NO.1 CYLINDER TO TDC/COMPRESSION

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

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



4. INSPECT VALVE CLEARANCE

- (a) Check only the valves indicated.

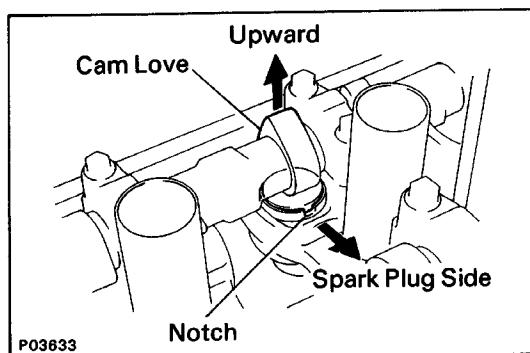
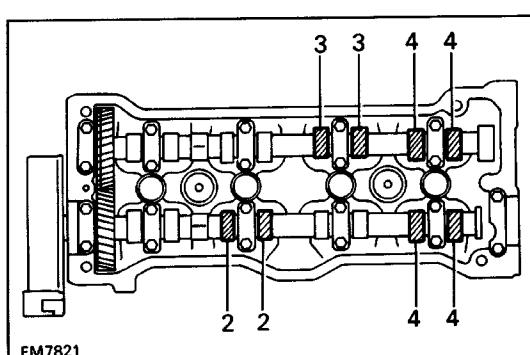
- Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
- Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

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.)

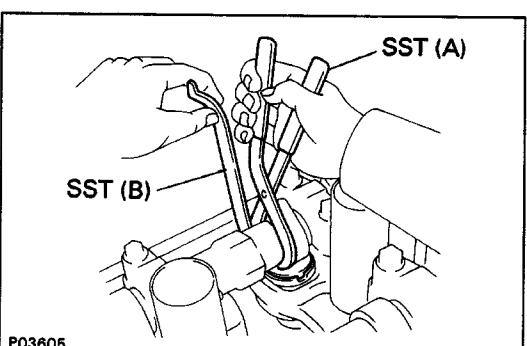
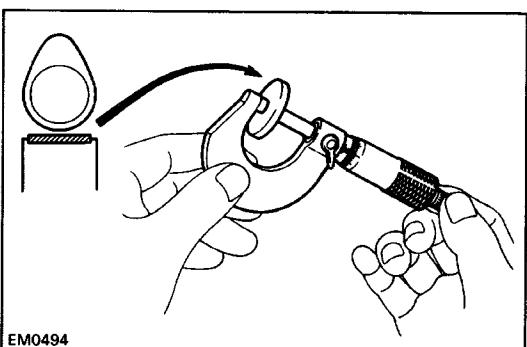
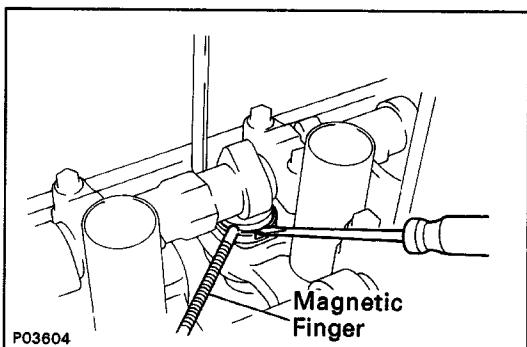
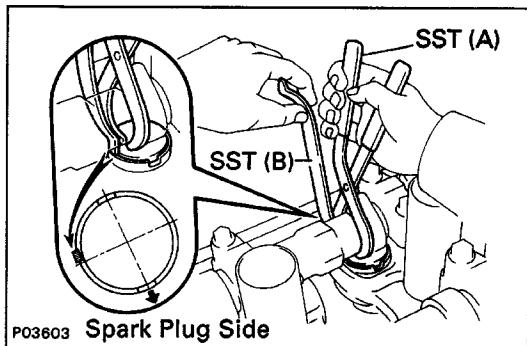
- (b) Turn the crankshaft one revolution (360°) and align the mark as above. (See procedure in step 3)
- (c) Check only the valves indicated as shown. Measure the valve clearance. (See procedure in step (a))



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.
- Position the notch of the valve lifter facing the spark plug side.



- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

SST 09248-55020 (09248-05011 (A), 09248-05021 (B))

HINT: Apply SST (B) on the side marked with "7", at the position shown in the illustration.

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

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

- Using a micrometer, measure the thickness of the removed shim.
- Calculate the thickness of a new shim so that 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 new shim with a thickness as close as possible to the calculated value.

HINT: Shims are available in seventeen sizes in increments 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).

SST 09248-55020 (09248-05011 (A), 09248-05021 (B))

(d) Recheck the valve clearance.

6. REINSTALL CYLINDER HEAD COVER

(See steps 11 and 17 on pages EM-109 and 111)

7. RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS

Adjusting Shim Selection Chart (Intake)

Installed shim thickness mm (in.)		Measured clearance mm (in.)																												New shim thickness mm (in.)	
		0.000 - 0.020 (0.0000 - 0.0008)																													
0.021 - 0.040 (0.0008 - 0.0016)		0.021 - 0.040 (0.0008 - 0.0016)																												0.250 (0.0984)	
0.041 - 0.060 (0.0016 - 0.0024)		0.041 - 0.060 (0.0016 - 0.0024)																											2.525 (0.0994)		
0.061 - 0.080 (0.0024 - 0.0031)		0.061 - 0.080 (0.0024 - 0.0031)																											2.550 (0.1004)		
0.081 - 0.100 (0.0032 - 0.0039)		0.081 - 0.100 (0.0032 - 0.0039)																											2.575 (0.1014)		
0.101 - 0.120 (0.0040 - 0.0047)		0.101 - 0.120 (0.0040 - 0.0047)																											2.600 (0.1024)		
0.121 - 0.140 (0.0048 - 0.0055)		0.121 - 0.140 (0.0048 - 0.0055)																											2.650 (0.1043)		
0.141 - 0.149 (0.0056 - 0.0059)		0.141 - 0.149 (0.0056 - 0.0059)																											2.680 (0.1055)		
0.150 - 0.250 (0.0059 - 0.0098)		0.150 - 0.250 (0.0059 - 0.0098)																											2.750 (0.1083)		
0.251 - 0.260 (0.0099 - 0.0102)		0.251 - 0.260 (0.0099 - 0.0102)																											2.850 (0.1118)		
0.261 - 0.280 (0.0103 - 0.0110)		0.261 - 0.280 (0.0103 - 0.0110)																											2.880 (0.1126)		
0.281 - 0.300 (0.0111 - 0.0118)		0.281 - 0.300 (0.0111 - 0.0118)																											2.880 (0.1126)		
0.301 - 0.320 (0.0119 - 0.0126)		0.301 - 0.320 (0.0119 - 0.0126)																											2.880 (0.1134)		
0.321 - 0.340 (0.0126 - 0.0134)		0.321 - 0.340 (0.0126 - 0.0134)																											2.900 (0.1142)		
0.341 - 0.360 (0.0134 - 0.0142)		0.341 - 0.360 (0.0134 - 0.0142)																											2.900 (0.1150)		
0.361 - 0.380 (0.0142 - 0.0150)		0.361 - 0.380 (0.0142 - 0.0150)																											2.920 (0.1157)		
0.381 - 0.400 (0.0150 - 0.0157)		0.381 - 0.400 (0.0150 - 0.0157)																											2.940 (0.1161)		
0.401 - 0.420 (0.0158 - 0.0165)		0.401 - 0.420 (0.0158 - 0.0165)																											2.950 (0.1165)		
0.421 - 0.440 (0.0166 - 0.0173)		0.421 - 0.440 (0.0166 - 0.0173)																											2.950 (0.1173)		
0.441 - 0.460 (0.0174 - 0.0181)		0.441 - 0.460 (0.0174 - 0.0181)																											2.950 (0.1181)		
0.461 - 0.480 (0.0181 - 0.0189)		0.461 - 0.480 (0.0181 - 0.0189)																											2.950 (0.1189)		
0.481 - 0.500 (0.0189 - 0.0197)		0.481 - 0.500 (0.0189 - 0.0197)																											2.950 (0.1197)		
0.501 - 0.520 (0.0197 - 0.0205)		0.501 - 0.520 (0.0197 - 0.0205)																											2.950 (0.1201)		
0.521 - 0.540 (0.0205 - 0.0213)		0.521 - 0.540 (0.0205 - 0.0213)																											2.950 (0.1205)		
0.541 - 0.560 (0.0213 - 0.0220)		0.541 - 0.560 (0.0213 - 0.0220)																											2.950 (0.1213)		
0.561 - 0.580 (0.0221 - 0.0228)		0.561 - 0.580 (0.0221 - 0.0228)																											2.950 (0.1228)		
0.581 - 0.600 (0.0229 - 0.0236)		0.581 - 0.600 (0.0229 - 0.0236)																											2.950 (0.1236)		
0.601 - 0.620 (0.0237 - 0.0244)		0.601 - 0.620 (0.0237 - 0.0244)																											2.950 (0.1243)		
0.621 - 0.640 (0.0244 - 0.0252)		0.621 - 0.640 (0.0244 - 0.0252)																											2.950 (0.1252)		
0.641 - 0.660 (0.0252 - 0.0260)		0.641 - 0.660 (0.0252 - 0.0260)																											2.950 (0.1260)		
0.661 - 0.680 (0.0260 - 0.0268)		0.661 - 0.680 (0.0260 - 0.0268)																											2.950 (0.1270)		
0.681 - 0.700 (0.0268 - 0.0276)		0.681 - 0.700 (0.0268 - 0.0276)																													

Adjusting Shim Selection Chart (Exhaust)

P03514

		New shim thickness 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 (4.1043)	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: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.). Replace the 2.800 mm (0.1102 in.) shim with a new No.22 shim.

INSPECTION AND ADJUSTMENT OF VALVE CLEARANCE (3S-GTE)

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

1. REMOVE INTERCOOLER

(See steps 13 to 15 on pages [TC-9](#) and [10](#))

2. DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS

3. REMOVE EGR VACUUM MODULATOR AND VSV

(See step 20 on page [EM-121](#))

4. REMOVE EGR VALVE AND PIPE

(See step 21 on page [EM-121](#))

5. REMOVE THROTTLE BODY

(See steps 2, 3, 5 to 8, 10 and 11 on pages [FI-194](#) and [195](#))

6. REMOVE CYLINDER HEAD COVER

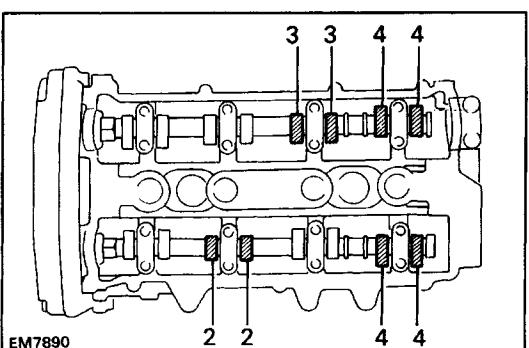
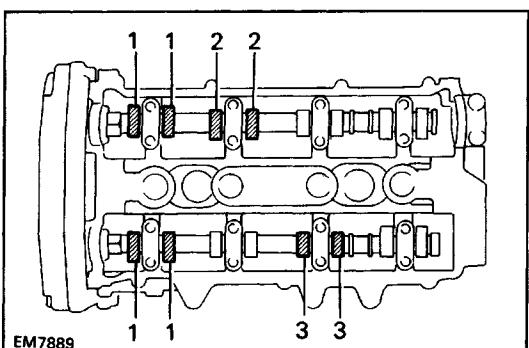
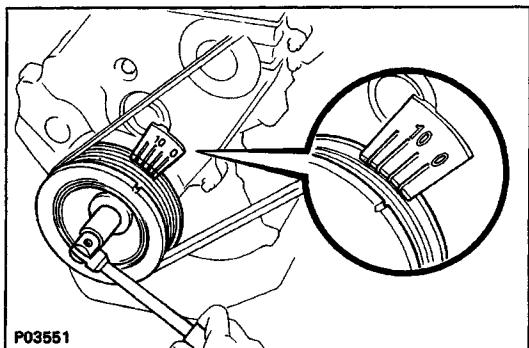
(See step 33 on page [EM-124](#))

7. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley and align its groove with 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 No.4 are tight.

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



8. INSPECT VALVE CLEARANCE

(a) Check only the valves indicated.

- Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
- Record the out-of-specification valve clearance measurements. 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.)

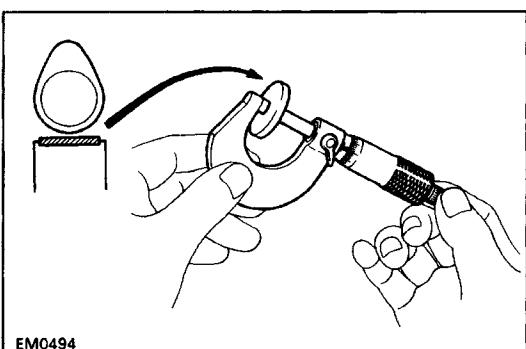
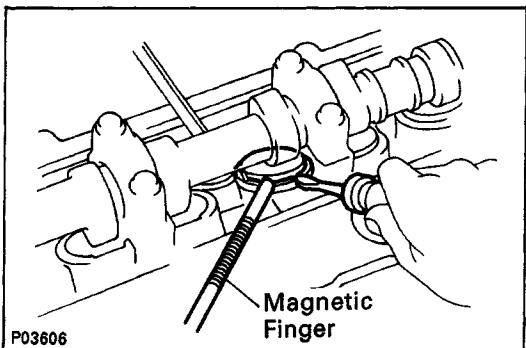
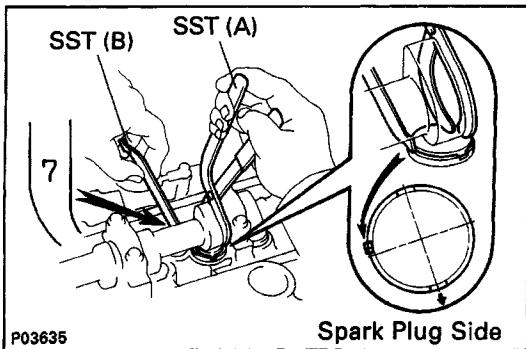
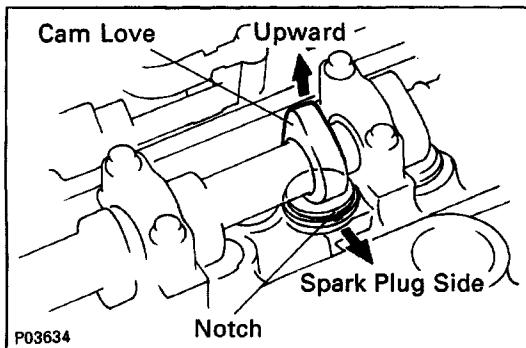
Exhaust 0.28 – 0.38 mm (0.071 – 0.015 in.)

(b) Turn the crankshaft one revolution (360°) and align the mark as above. (See procedure in step 7)

(c) Check only the valves indicated as shown.

Measure the valve clearance.

(See procedure in step (a))



9. ADJUST VALVE CLEARANCE

(a) Remove the adjusting shim.

- Turn the crankshaft to position the cam lobe of the camshaft on the adjusting valve upward.
- Position the notch of the valve lifter facing the spark plug side.

- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

SST 09248-55020 (09248-05011 (A), 09248-05021 (B))

HINT: Apply SST (B) at a slight angle on the side marked with "7", at the position shown in the illustration.

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

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

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

$$T \dots\dots\dots \text{Thickness of used shim}$$

$$A \dots\dots\dots \text{Measured valve clearance}$$

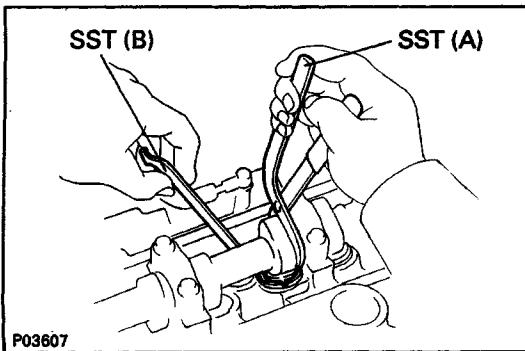
$$N \dots\dots\dots \text{Thickness of new shim}$$

Intake N = T + (A - 0.20 mm (0.008 in.))

Exhaust N = T + (A - 0.33 mm (0.013 in.))

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

HINT: Shims are available in seventeen sizes in increments 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).

SST 09248-55020 (09248-05011 (A), 09248-05021 (B))

(d) Recheck the valve clearance.

10. REINSTALL CYLINDER HEAD COVER

(See step 7 on pages [EM-143](#) and 144)

11. REINSTALL THROTTLE BODY

(See steps 2, 3, 5 to 8, 10 and 11 on pages [FI-197](#) and 198)

12. REINSTALL EGR VALVE AND PIPE

(See step 19 on page [EM-145](#))

13. REINSTALL EGR VACUUM MODULATOR AND VSV

(See step 20 on page [EM-146](#))

14. RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS

15. REINSTALL INTERCOOLER

(See steps 11 to 13 on page [TC-17](#))

Adjusting Shim Selection Chart (Intake)

Measured clearance mm (in.)	Installed shim thickness mm (in.)																New shim thickness mm (in.)																																			
	0.000 – 0.020 (0.0000 – 0.0008)	2.000 (0.0787)	2.225 (0.0979)	2.050 (0.0807)	2.175 (0.0827)	2.125 (0.0837)	2.150 (0.0846)	2.175 (0.0856)	2.200 (0.0866)	2.225 (0.0876)	2.250 (0.0886)	2.225 (0.0896)	2.300 (0.0905)	2.325 (0.0915)	2.350 (0.0925)	2.375 (0.0935)	2.400 (0.0945)	2.425 (0.0955)	2.450 (0.0965)	2.475 (0.0974)	2.500 (0.1084)	2.525 (0.0994)	2.550 (0.1004)	2.575 (0.1014)	2.600 (0.1024)	2.625 (0.1033)	2.650 (0.1043)	2.675 (0.1053)	2.700 (0.1063)	2.725 (0.1073)	2.750 (0.1083)	2.775 (0.1093)	2.800 (0.1102)	2.825 (0.1112)	2.850 (0.1122)	2.875 (0.1132)	2.900 (0.1142)	2.925 (0.1152)	2.950 (0.1161)	2.975 (0.1171)	3.000 (0.1181)	3.025 (0.1191)	3.050 (0.1201)	3.075 (0.1211)	3.100 (0.1220)	3.125 (0.1230)	3.150 (0.1240)	3.175 (0.1250)	3.200 (0.1260)	3.225 (0.1270)	3.250 (0.1280)	3.275 (0.1289)
0.021 – 0.040 (0.0008 – 0.0016)	2.050 (0.0797)	2.275 (0.0987)	2.100 (0.0827)	2.150 (0.0837)	2.175 (0.0846)	2.200 (0.0856)	2.225 (0.0866)	2.250 (0.0876)	2.275 (0.0886)	2.300 (0.0896)	2.325 (0.0905)	2.350 (0.0915)	2.375 (0.0925)	2.400 (0.0935)	2.425 (0.0945)	2.450 (0.0955)	2.475 (0.0965)	2.500 (0.0974)	2.525 (0.1084)	2.550 (0.0994)	2.575 (0.1004)	2.600 (0.1014)	2.625 (0.1023)	2.650 (0.1032)	2.675 (0.1042)	2.700 (0.1052)	2.725 (0.1062)	2.750 (0.1072)	2.775 (0.1082)	2.800 (0.1092)	2.825 (0.1102)	2.850 (0.1112)	2.875 (0.1122)	2.900 (0.1132)	2.925 (0.1142)	2.950 (0.1152)	2.975 (0.1162)	3.000 (0.1172)	3.025 (0.1182)	3.050 (0.1192)	3.075 (0.1202)	3.100 (0.1212)	3.125 (0.1222)	3.150 (0.1232)	3.175 (0.1242)	3.200 (0.1252)	3.225 (0.1262)	3.250 (0.1272)	3.275 (0.1282)	3.300 (0.1292)		
0.041 – 0.060 (0.0016 – 0.0024)	2.100 (0.0807)	2.325 (0.0997)	2.150 (0.0837)	2.200 (0.0846)	2.225 (0.0856)	2.250 (0.0866)	2.275 (0.0876)	2.300 (0.0886)	2.325 (0.0896)	2.350 (0.0905)	2.375 (0.0915)	2.400 (0.0925)	2.425 (0.0935)	2.450 (0.0945)	2.475 (0.0955)	2.500 (0.0965)	2.525 (0.0974)	2.550 (0.1084)	2.575 (0.0994)	2.600 (0.1004)	2.625 (0.1014)	2.650 (0.1024)	2.675 (0.1033)	2.700 (0.1043)	2.725 (0.1053)	2.750 (0.1063)	2.775 (0.1073)	2.800 (0.1083)	2.825 (0.1093)	2.850 (0.1103)	2.875 (0.1113)	2.900 (0.1123)	2.925 (0.1133)	2.950 (0.1143)	2.975 (0.1153)	3.000 (0.1163)	3.025 (0.1173)	3.050 (0.1183)	3.075 (0.1193)	3.100 (0.1203)	3.125 (0.1213)	3.150 (0.1223)	3.175 (0.1233)	3.200 (0.1243)	3.225 (0.1253)	3.250 (0.1263)	3.275 (0.1273)	3.300 (0.1283)				
0.061 – 0.080 (0.0024 – 0.0031)	2.150 (0.0817)	2.375 (0.1007)	2.200 (0.0846)	2.250 (0.0856)	2.275 (0.0866)	2.300 (0.0876)	2.325 (0.0886)	2.350 (0.0896)	2.375 (0.0905)	2.400 (0.0915)	2.425 (0.0925)	2.450 (0.0935)	2.475 (0.0945)	2.500 (0.0955)	2.525 (0.0965)	2.550 (0.0974)	2.575 (0.1084)	2.600 (0.0994)	2.625 (0.1004)	2.650 (0.1014)	2.675 (0.1024)	2.700 (0.1033)	2.725 (0.1043)	2.750 (0.1053)	2.775 (0.1063)	2.800 (0.1073)	2.825 (0.1083)	2.850 (0.1093)	2.875 (0.1103)	2.900 (0.1113)	2.925 (0.1123)	2.950 (0.1133)	2.975 (0.1143)	3.000 (0.1153)	3.025 (0.1163)	3.050 (0.1173)	3.075 (0.1183)	3.100 (0.1193)	3.125 (0.1203)	3.150 (0.1213)	3.175 (0.1223)	3.200 (0.1233)	3.225 (0.1243)	3.250 (0.1253)	3.275 (0.1263)	3.300 (0.1273)						
0.081 – 0.100 (0.0032 – 0.0039)	2.200 (0.0827)	2.425 (0.1017)	2.250 (0.0856)	2.300 (0.0866)	2.325 (0.0876)	2.350 (0.0886)	2.375 (0.0896)	2.400 (0.0905)	2.425 (0.0915)	2.450 (0.0925)	2.475 (0.0935)	2.500 (0.0945)	2.525 (0.0955)	2.550 (0.0965)	2.575 (0.0974)	2.600 (0.0984)	2.625 (0.0994)	2.650 (0.1004)	2.675 (0.1014)	2.700 (0.1024)	2.725 (0.1033)	2.750 (0.1043)	2.775 (0.1053)	2.800 (0.1063)	2.825 (0.1073)	2.850 (0.1083)	2.875 (0.1093)	2.900 (0.1103)	2.925 (0.1113)	2.950 (0.1123)	2.975 (0.1133)	3.000 (0.1143)	3.025 (0.1153)	3.050 (0.1163)	3.075 (0.1173)	3.100 (0.1183)	3.125 (0.1193)	3.150 (0.1203)	3.175 (0.1213)	3.200 (0.1223)	3.225 (0.1233)	3.250 (0.1243)	3.275 (0.1253)	3.300 (0.1263)								
0.101 – 0.120 (0.0040 – 0.0047)	2.250 (0.0837)	2.475 (0.1027)	2.300 (0.0866)	2.350 (0.0876)	2.375 (0.0886)	2.400 (0.0896)	2.425 (0.0905)	2.450 (0.0915)	2.475 (0.0925)	2.500 (0.0935)	2.525 (0.0945)	2.550 (0.0955)	2.575 (0.0965)	2.600 (0.0974)	2.625 (0.0984)	2.650 (0.0994)	2.675 (0.1004)	2.700 (0.1014)	2.725 (0.1023)	2.750 (0.1033)	2.775 (0.1043)	2.800 (0.1053)	2.825 (0.1063)	2.850 (0.1073)	2.875 (0.1083)	2.900 (0.1093)	2.925 (0.1103)	2.950 (0.1113)	2.975 (0.1123)	3.000 (0.1133)	3.025 (0.1143)	3.050 (0.1153)	3.075 (0.1163)	3.100 (0.1173)	3.125 (0.1183)	3.150 (0.1193)	3.175 (0.1203)	3.200 (0.1213)	3.225 (0.1223)	3.250 (0.1233)	3.275 (0.1243)	3.300 (0.1253)										
0.121 – 0.140 (0.0048 – 0.0055)	2.300 (0.0847)	2.525 (0.1037)	2.350 (0.0876)	2.400 (0.0886)	2.425 (0.0896)	2.450 (0.0905)	2.475 (0.0915)	2.500 (0.0925)	2.525 (0.0935)	2.550 (0.0945)	2.575 (0.0955)	2.600 (0.0965)	2.625 (0.0974)	2.650 (0.0984)	2.675 (0.0994)	2.700 (0.1004)	2.725 (0.1014)	2.750 (0.1024)	2.775 (0.1033)	2.800 (0.1043)	2.825 (0.1053)	2.850 (0.1063)	2.875 (0.1073)	2.900 (0.1083)	2.925 (0.1093)	2.950 (0.1103)	2.975 (0.1113)	3.000 (0.1123)	3.025 (0.1133)	3.050 (0.1143)	3.075 (0.1153)	3.100 (0.1163)	3.125 (0.1173)	3.150 (0.1183)	3.175 (0.1193)	3.200 (0.1203)	3.225 (0.1213)	3.250 (0.1223)	3.275 (0.1233)	3.300 (0.1243)												
0.141 – 0.149 (0.0056 – 0.0059)	2.350 (0.0857)	2.575 (0.1047)	2.400 (0.0886)	2.450 (0.0896)	2.475 (0.0905)	2.500 (0.0915)	2.525 (0.0925)	2.550 (0.0935)	2.575 (0.0945)	2.600 (0.0955)	2.625 (0.0965)	2.650 (0.0974)	2.675 (0.0984)	2.700 (0.0994)	2.725 (0.1004)	2.750 (0.1014)	2.775 (0.1024)	2.800 (0.1033)	2.825 (0.1043)	2.850 (0.1053)	2.875 (0.1063)	2.900 (0.1073)	2.925 (0.1083)	2.950 (0.1093)	2.975 (0.1103)	3.000 (0.1113)	3.025 (0.1123)	3.050 (0.1133)	3.075 (0.1143)	3.100 (0.1153)	3.125 (0.1163)	3.150 (0.1173)	3.175 (0.1183)	3.200 (0.1193)	3.225 (0.1203)	3.250 (0.1213)	3.275 (0.1223)	3.300 (0.1233)														
0.150 – 0.250 (0.0059 – 0.0098)	2.400 (0.0867)	2.625 (0.1057)	2.450 (0.0896)	2.500 (0.0905)	2.525 (0.0915)	2.550 (0.0925)	2.575 (0.0935)	2.600 (0.0945)	2.625 (0.0955)	2.650 (0.0965)	2.675 (0.0974)	2.700 (0.0984)	2.725 (0.0994)	2.750 (0.1004)	2.775 (0.1014)	2.800 (0.1024)	2.825 (0.1033)	2.850 (0.1043)	2.875 (0.1053)	2.900 (0.1063)	2.925 (0.1073)	2.950 (0.1083)	2.975 (0.1093)	3.000 (0.1103)	3.025 (0.1113)	3.050 (0.1123)	3.075 (0.1133)	3.100 (0.1143)	3.125 (0.1153)	3.150 (0.1163)	3.175 (0.1173)	3.200 (0.1183)	3.225 (0.1193)	3.250 (0.1203)	3.275 (0.1213)	3.300 (0.1223)																
0.251 – 0.260 (0.0099 – 0.0102)	2.450 (0.0876)	2.675 (0.1066)	2.500 (0.0905)	2.550 (0.0915)	2.575 (0.0925)	2.600 (0.0935)	2.625 (0.0945)	2.650 (0.0955)	2.675 (0.0965)	2.700 (0.0974)	2.725 (0.0984)	2.750 (0.0994)	2.775 (0.1004)	2.800 (0.1014)	2.825 (0.1024)	2.850 (0.1033)	2.875 (0.1043)	2.900 (0.1053)	2.925 (0.1063)	2.950 (0.1073)	2.975 (0.1083)	3.000 (0.1093)	3.025 (0.1103)	3.050 (0.1113)	3.075 (0.1123)	3.100 (0.1133)	3.125 (0.1143)	3.150 (0.1153)	3.175 (0.1163)	3.200 (0.1173)	3.225 (0.1183)	3.250 (0.1193)	3.275 (0.1203)	3.300 (0.1213)																		
0.261 – 0.280 (0.0103 – 0.0110)	2.500 (0.0886)	2.725 (0.1076)	2.550 (0.0915)	2.600 (0.0925)	2.625 (0.0935)	2.650 (0.0945)	2.675 (0.0955)	2.700 (0.0965)	2.725 (0.0974)	2.750 (0.0984)	2.775 (0.0994)	2.800 (0.1004)	2.825 (0.1014)	2.850 (0.1024)	2.875 (0.1033)	2.900 (0.1043)	2.925 (0.1053)	2.950 (0.1063)	2.975 (0.1073)	3.000 (0.1083)	3.025 (0.1093)	3.050 (0.1103)	3.075 (0.1113)	3.100 (0.1123)	3.125 (0.1133)	3.150 (0.1143)	3.175 (0.1153)	3.200 (0.1163)	3.225 (0.1173)	3.250 (0.1183)	3.275 (0.1193)	3.300 (0.1203)																				
0.281 – 0.300 (0.0111 – 0.0118)	2.550 (0.0896)	2.775 (0.1086)	2.600 (0.0925)	2.650 (0.0935)	2.675 (0.0945)	2.700 (0.0955)	2.725 (0.0965)	2.750 (0.0974)	2.775 (0.0984)	2.800 (0.0994)	2.825 (0.1004)	2.850 (0.1014)	2.875 (0.1024)	2.900 (0.1033)	2.925 (0.1043)	2.950 (0.1053)	2.975 (0.1063)	3.000 (0.1073)	3.025 (0.1083)	3.050 (0.1093)	3.075 (0.1103)	3.100 (0.1113)	3.125 (0.1123)	3.150 (0.1133)	3.175 (0.1143)	3.200 (0.1153)	3.225 (0.1163)	3.250 (0.1173)	3.275 (0.1183)	3.300 (0.1193)																						
0.301 – 0.320 (0.0119 – 0.0126)	2.600 (0.0906)	2.825 (0.1096)	2.650 (0.0935)	2.700 (0.0945)	2.725 (0.0955)	2.750 (0.0965)	2.775 (0.0974)	2.800 (0.0984)	2.825 (0.0994)	2.850 (0.1004)	2.875 (0.1014)	2.900 (0.1024)	2.925 (0.1033)	2.950 (0.1043)	2.975 (0.1053)	3.000 (0.1063)	3.025 (0.1073)	3.050 (0.1083)	3.075 (0.1093)	3.100 (0.1103)	3.125 (0.1113)	3.150 (0.1123)	3.175 (0.1133)	3.200 (0.1143)	3.225 (0.1153)	3.250 (0.1163)	3.275 (0.1173)	3.300 (0.1183)																								
0.321 – 0.340 (0.0127 – 0.0134)	2.650 (0.0916)	2.875 (0.1106)	2.700 (0.0945)	2.750 (0.0955)	2.775 (0.0965)	2.800 (0.0974)	2.825 (0.0984)	2.850 (0.0994)	2.875 (0.1004)	2.900 (0.1014)	2.925 (0.1024)	2.950 (0.1033)	2.975 (0.1043)	3.000 (0.1053)	3																																					

HINT: New shims have the thickness in millimeters imprinted on the face.

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

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.). Replace the 2.800 mm (0.1102 in.) shim with a new No. 12 shim.

Adjusting Shim Selection Chart (Exhaust)

Measured clearance mm (in.)	Installed shim thickness mm (in.)	Shim No.	Thickness mm (in.)
0.000 - 0.020 (0.0000 - 0.0008)	2.000 (0.0787)	1	2.500 (0.0984)
0.021 - 0.040 (0.0008 - 0.0016)	2.025 (0.0797)	2	2.550 (0.1004)
0.041 - 0.060 (0.0016 - 0.0024)	2.050 (0.0807)	3	2.600 (0.1024)
0.061 - 0.080 (0.0024 - 0.0031)	2.100 (0.0827)	4	2.650 (0.1043)
0.081 - 0.100 (0.0032 - 0.0039)	2.125 (0.0846)	5	2.700 (0.1063)
0.101 - 0.120 (0.0040 - 0.0047)	2.175 (0.0866)	6	2.750 (0.1083)
0.121 - 0.140 (0.0048 - 0.0055)	2.200 (0.0886)	7	2.800 (0.1102)
0.141 - 0.160 (0.0056 - 0.0063)	2.225 (0.0896)	8	2.850 (0.1122)
0.161 - 0.180 (0.0063 - 0.0071)	2.250 (0.0896)	9	2.900 (0.1142)
0.181 - 0.200 (0.0071 - 0.0079)	2.275 (0.0896)	10	2.950 (0.1161)
0.201 - 0.220 (0.0079 - 0.0087)	2.300 (0.0895)	11	3.000 (0.1181)
0.221 - 0.240 (0.0087 - 0.0094)	2.325 (0.0895)	12	3.050 (0.1201)
0.241 - 0.260 (0.0095 - 0.0102)	2.350 (0.0895)	13	3.075 (0.1211)
0.261 - 0.279 (0.0103 - 0.0110)	2.375 (0.0895)	14	3.100 (0.1220)
0.280 - 0.380 (0.0110 - 0.0150)	2.400 (0.0895)	15	3.125 (0.1230)
0.381 - 0.400 (0.0150 - 0.0157)	2.425 (0.0895)	16	3.150 (0.1240)
0.401 - 0.420 (0.0158 - 0.0165)	2.450 (0.0895)	17	3.175 (0.1250)
0.421 - 0.440 (0.0166 - 0.0173)	2.475 (0.0895)	18	3.200 (0.1260)
0.441 - 0.460 (0.0174 - 0.0181)	2.500 (0.0894)	19	3.225 (0.1270)
0.461 - 0.480 (0.0181 - 0.0189)	2.525 (0.0894)	20	3.250 (0.1280)
0.481 - 0.500 (0.0189 - 0.0197)	2.550 (0.0894)	21	3.280 (0.1299)
0.501 - 0.520 (0.0197 - 0.0205)	2.575 (0.0894)	22	3.300 (0.1299)
0.521 - 0.540 (0.0205 - 0.0213)	2.600 (0.0894)		
0.541 - 0.560 (0.0213 - 0.0220)	2.625 (0.0893)		
0.561 - 0.580 (0.0221 - 0.0228)	2.650 (0.0893)		
0.581 - 0.600 (0.0229 - 0.0236)	2.675 (0.0893)		
0.601 - 0.620 (0.0237 - 0.0244)	2.700 (0.0893)		
0.621 - 0.640 (0.0244 - 0.0252)	2.725 (0.0893)		
0.641 - 0.660 (0.0252 - 0.0260)	2.750 (0.0893)		
0.661 - 0.680 (0.0260 - 0.0268)	2.775 (0.0893)		
0.681 - 0.700 (0.0268 - 0.0276)	2.800 (0.0893)		
0.701 - 0.720 (0.0276 - 0.0283)	2.825 (0.0893)		
0.721 - 0.740 (0.0284 - 0.0291)	2.850 (0.0893)		
0.741 - 0.760 (0.0292 - 0.0299)	2.875 (0.0893)		
0.761 - 0.780 (0.0300 - 0.0307)	2.900 (0.0893)		
0.781 - 0.800 (0.0307 - 0.0315)	2.925 (0.0893)		
0.801 - 0.820 (0.0315 - 0.0322)	2.950 (0.0893)		
0.821 - 0.840 (0.0323 - 0.0331)	2.975 (0.0893)		
0.841 - 0.860 (0.0331 - 0.0339)	3.000 (0.0893)		
0.861 - 0.880 (0.0339 - 0.0346)	3.025 (0.0893)		
0.881 - 0.900 (0.0347 - 0.0354)	3.050 (0.0893)		
0.901 - 0.920 (0.0355 - 0.0362)	3.075 (0.0893)		
0.921 - 0.940 (0.0363 - 0.0370)	3.100 (0.0893)		
0.941 - 0.960 (0.0370 - 0.0378)	3.125 (0.0893)		
0.961 - 0.980 (0.0378 - 0.0386)	3.150 (0.0893)		
0.981 - 1.000 (0.0386 - 0.0394)	3.175 (0.0893)		
1.001 - 1.020 (0.0394 - 0.0402)	3.200 (0.0893)		
1.021 - 1.040 (0.0402 - 0.0409)	3.225 (0.0893)		
1.041 - 1.060 (0.0410 - 0.0417)	3.250 (0.0893)		
1.061 - 1.080 (0.0418 - 0.0425)	3.275 (0.0893)		
1.081 - 1.100 (0.0426 - 0.0433)	3.300 (0.0893)		
1.101 - 1.120 (0.0433 - 0.0441)	3.325 (0.0893)		
1.121 - 1.140 (0.0441 - 0.0449)	3.350 (0.0893)		
1.141 - 1.160 (0.0449 - 0.0457)	3.375 (0.0893)		
1.161 - 1.180 (0.0457 - 0.0465)	3.400 (0.0893)		
1.181 - 1.200 (0.0465 - 0.0472)	3.425 (0.0893)		
1.201 - 1.220 (0.0473 - 0.0480)	3.450 (0.0893)		
1.221 - 1.240 (0.0481 - 0.0488)	3.475 (0.0893)		
1.241 - 1.260 (0.0489 - 0.0496)	3.500 (0.0893)		
1.261 - 1.280 (0.0496 - 0.0504)	3.525 (0.0893)		
1.281 - 1.300 (0.0504 - 0.0512)	3.550 (0.0893)		
1.301 - 1.320 (0.0512 - 0.0520)	3.575 (0.0893)		
1.321 - 1.340 (0.0520 - 0.0528)	3.600 (0.0893)		
1.341 - 1.360 (0.0528 - 0.0535)	3.625 (0.0893)		
1.361 - 1.380 (0.0536 - 0.0543)	3.650 (0.0893)		
1.381 - 1.400 (0.0544 - 0.0551)	3.675 (0.0893)		
1.401 - 1.420 (0.0552 - 0.0559)	3.700 (0.0893)		
1.421 - 1.440 (0.0559 - 0.0567)	3.725 (0.0893)		
1.441 - 1.460 (0.0567 - 0.0575)	3.750 (0.0893)		
1.461 - 1.480 (0.0575 - 0.0583)	3.775 (0.0893)		
1.481 - 1.500 (0.0583 - 0.0591)	3.800 (0.0893)		
1.501 - 1.520 (0.0591 - 0.0598)	3.825 (0.0893)		
1.521 - 1.540 (0.0599 - 0.0606)	3.850 (0.0893)		
1.541 - 1.560 (0.0607 - 0.0614)	3.875 (0.0893)		
1.561 - 1.580 (0.0615 - 0.0622)	3.900 (0.0893)		
1.581 - 1.600 (0.0622 - 0.0630)	3.925 (0.0893)		
1.601 - 1.620 (0.0630 - 0.0638)	3.950 (0.0893)		
1.621 - 1.640 (0.0638 - 0.0646)	3.975 (0.0893)		
1.641 - 1.660 (0.0646 - 0.0654)	4.000 (0.0893)		
1.661 - 1.680 (0.0654 - 0.0661)	4.025 (0.0893)		

New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
1	2.500 (0.0984)	10	2.950 (0.1161)
2	2.550 (0.1004)	11	3.000 (0.1181)
3	2.600 (0.1024)	12	3.050 (0.1201)
4	2.650 (0.1043)	13	3.075 (0.1211)
5	2.700 (0.1063)	14	3.100 (0.1220)
6	2.750 (0.1083)	15	3.125 (0.1230)
7	2.800 (0.1102)	16	3.150 (0.1240)
8	2.850 (0.1122)	17	3.175 (0.1250)
9	2.900 (0.1142)		3.200 (0.1260)

HINT: New shims have the thickness in millimeters imprinted on the face.

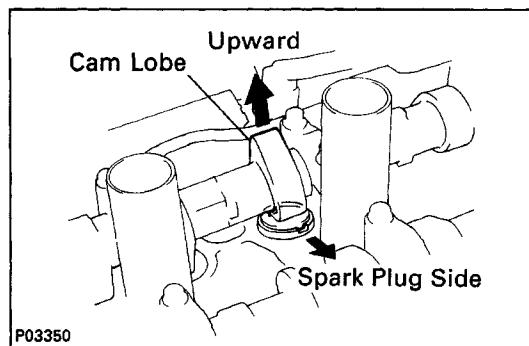
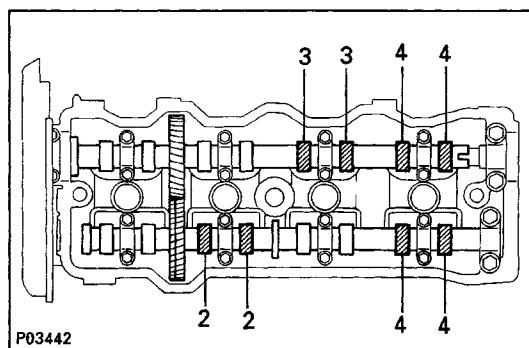
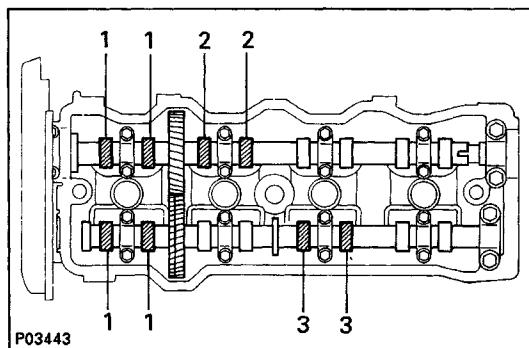
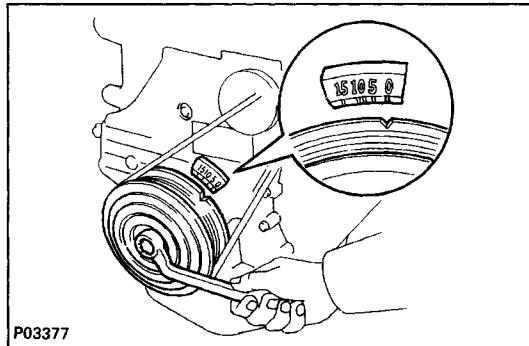
Exhaust valve clearance (Cold): 0.28 - 0.38 mm (0.011 - 0.015 in.)

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.). Replace the 2.800 mm (0.1102 in.) shim with a new No.9 shim.

INSPECTION AND ADJUSTMENT OF VALVE CLEARANCE (5S-FE)

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

1. REMOVE ACCELERATOR BRACKET
2. DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS
3. DISCONNECT ENGINE WIRE PROTECTOR BETWEEN CYLINDER HEAD COVER AND NO.3 TIMING BELT COVER
4. REMOVE CYLINDER HEAD COVER
(See step 33 on page EM-156)
5. SET NO.1 CYLINDER TO TDC/COMPRESSION



- (a) Turn the crankshaft pulley and align its groove with timing mark "0" of the No.1 timing belt cover.
- (b) Check that the valve lifters on the No.1 cylinder are loose and valve lifters on the No.4 are tight. If not, turn the crankshaft one revolution (360°) and align the mark as above.
6. INSPECT VALVE CLEARANCE

(a) Check only the valves indicated.

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

Valve clearance (Cold):

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

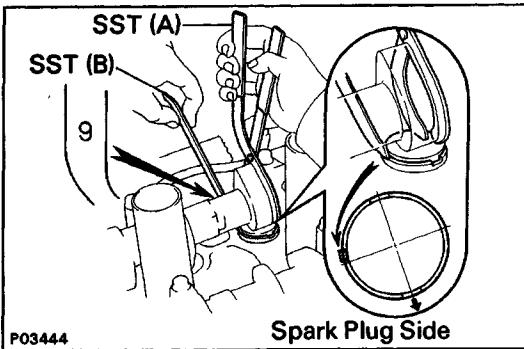
Exhaust 0.28 – 0.38 mm (0.011 – 0.015 in.)

- (b) Turn the crankshaft one revolution (360°) and align the mark as above. (See procedure in step 3)
- (c) Check only the valves indicated as shown. Measure the valve clearance. (See procedure in step (a))

7. ADJUST VALVE CLEARANCE

- (a) Remove the adjusting shim.

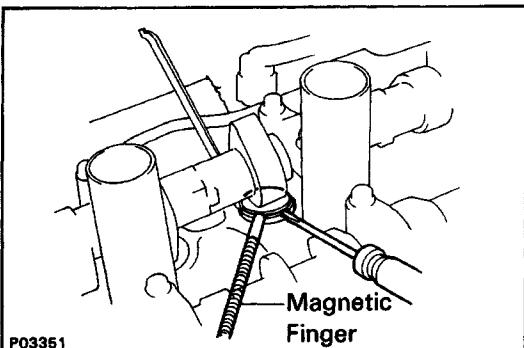
- Turn the crankshaft to position the cam lobe of the camshaft on the adjusting valve upward. Position the notch of the valve lifter facing the spark plug side.



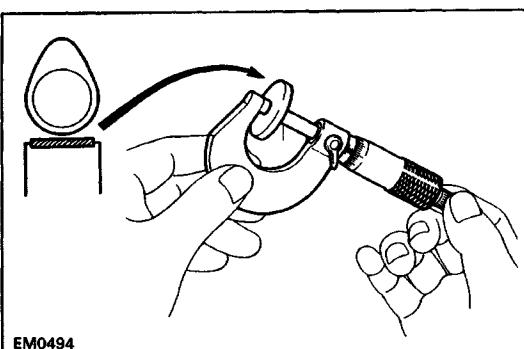
- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

SST 09248–55020 (09248–05011 (A), 09248–05021 (B))

HINT: Apply SST (B) at a slight angle on the side marked with "9", at the position shown in the illustration.



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



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

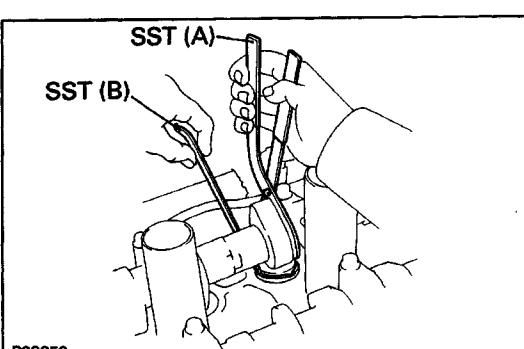
- Using a micrometer, measure the thickness of the removed shim.
- Calculate the thickness of a new shim so that the valve clearance comes within specified value.
T Thickness of used shim
A Measured valve clearance
N Thickness of new shim

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

Exhaust N = T ± (A - 0.33 mm (0.013 in.))

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

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



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 (13).

SST 09248-55020 (09248-05011 (A) 09248-05021 (B))

(d) Recheck the valve clearance.

8. REINSTALL CYLINDER HEAD COVER

(See step 8 on page EM-178)

9. INSTALL ENGINE WIRE PROTECTOR BETWEEN CYLINDER HEAD COVER AND NO.3 TIMING BELT COVER

10. RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS

11 INSTALL ACCELERATOR BRACKET

Installed shim thickness mm (in.)		Measured clearance mm (in.)		New shim thickness mm (in.)	
0.000 - 0.020	(0.0000 - 0.0008)	2.500	(0.0984)	2.520	(0.0982)
0.021 - 0.040	(0.0008 - 0.0016)	2.540	(0.1000)	2.550	(0.1004)
0.041 - 0.060	(0.0016 - 0.0024)	2.580	(0.1008)	2.580	(0.1016)
0.061 - 0.080	(0.0024 - 0.0031)	2.600	(0.1024)	2.620	(0.1031)
0.081 - 0.100	(0.0032 - 0.0039)	2.640	(0.1039)	2.650	(0.1043)
0.101 - 0.120	(0.0040 - 0.0047)	2.670	(0.1051)	2.680	(0.1055)
0.121 - 0.140	(0.0048 - 0.0055)	2.700	(0.1063)	2.690	(0.1059)
0.141 - 0.160	(0.0056 - 0.0063)	2.710	(0.1067)	2.700	(0.1063)
0.161 - 0.180	(0.0063 - 0.0071)	2.720	(0.1071)	2.730	(0.1075)
0.181 - 0.199	(0.0071 - 0.0074)	2.740	(0.1079)	2.740	(0.1079)
0.190 - 0.290	(0.0075 - 0.0114)	2.770	(0.1091)	2.780	(0.1094)
0.291 - 0.300	(0.0115 - 0.0118)	2.77	3	3	3
0.301 - 0.320	(0.0119 - 0.0126)	3	3	3	3
0.321 - 0.340	(0.0126 - 0.0134)	3	3	4	4
0.341 - 0.360	(0.0134 - 0.0142)	4	4	4	4
0.361 - 0.380	(0.0142 - 0.0150)	4	4	5	5
0.381 - 0.400	(0.0150 - 0.0157)	4	5	5	5
0.401 - 0.420	(0.0158 - 0.0165)	4	5	6	6
0.421 - 0.440	(0.0166 - 0.0173)	5	6	6	6
0.441 - 0.460	(0.0174 - 0.0181)	5	6	6	7
0.461 - 0.480	(0.0181 - 0.0189)	6	6	7	7
0.481 - 0.500	(0.0189 - 0.0197)	6	7	7	8
0.501 - 0.520	(0.0197 - 0.0205)	6	7	7	8
0.521 - 0.540	(0.0205 - 0.0213)	7	7	8	8
0.541 - 0.560	(0.0213 - 0.0220)	7	8	8	9
0.561 - 0.580	(0.0221 - 0.0228)	8	8	9	9
0.581 - 0.600	(0.0229 - 0.0236)	8	8	9	10
0.601 - 0.620	(0.0237 - 0.0244)	8	9	9	10
0.621 - 0.640	(0.0244 - 0.0252)	9	10	10	11
0.641 - 0.660	(0.0252 - 0.0260)	9	10	10	11
0.661 - 0.680	(0.0260 - 0.0268)	10	10	11	11
0.681 - 0.700	(0.0268 - 0.0276)	10	11	11	12
0.701 - 0.720	(0.0276 - 0.0283)	11	11	11	12
0.721 - 0.740	(0.0284 - 0.0291)	11	12	12	12
0.741 - 0.760	(0.0292 - 0.0299)	11	12	12	13
0.761 - 0.780	(0.0300 - 0.0307)	12	12	13	13
0.781 - 0.800	(0.0307 - 0.0315)	12	13	13	14
0.801 - 0.820	(0.0315 - 0.0323)	12	13	13	14
0.821 - 0.840	(0.0323 - 0.0331)	13	13	14	14
0.841 - 0.860	(0.0331 - 0.0339)	13	14	14	14
0.861 - 0.880	(0.0339 - 0.0346)	14	14	15	15
0.881 - 0.900	(0.0347 - 0.0354)	14	14	15	16
0.901 - 0.920	(0.0355 - 0.0362)	14	15	15	16
0.921 - 0.940	(0.0363 - 0.0370)	15	15	16	16
0.941 - 0.960	(0.0370 - 0.0378)	15	16	16	17
0.961 - 0.980	(0.0378 - 0.0386)	16	16	17	17
0.981 - 1.000	(0.0386 - 0.0394)	16	17	17	17
1.001 - 1.020	(0.0394 - 0.0402)	16	17	17	17
1.021 - 1.040	(0.0402 - 0.0409)	17	17	17	17
1.041 - 1.060	(0.0410 - 0.0417)	17	17	17	17
1.061 - 1.080	(0.0418 - 0.0425)	17	17	17	17
1.081 - 1.090	(0.0426 - 0.0429)	17			

Intake valve clearance (Cold):

0.19 – 0.29 mm (0.007 – 0.011 in.)

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.).

Replace the 2.800 mm (0.1102 in.) shim with a new No. 11 shim.

New shim thickness		mm (in.)	
Shim No.	Thickness	Shim No.	Thickness
1	2.500 (0.0984)	10	2.950 (0.1161)
2	2.550 (0.1004)	11	3.000 (0.1181)
3	2.600 (0.1024)	12	3.050 (0.1201)
4	2.650 (0.1043)	13	3.100 (0.1220)
5	2.700 (0.1063)	14	3.150 (0.1240)
6	2.750 (0.1083)	15	3.200 (0.1260)
7	2.800 (0.1102)	16	3.250 (0.1280)
8	2.850 (0.1122)	17	3.300 (0.1299)
9	2.900 (0.1142)		

HINT: New shims have the thickness in millimeters imprinted on the face.

Intake valve clearance (Cold):

0.28 – 0.38 mm (0.011 – 0.015 in.)

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.).

Replace the 2.800 mm (0.1102 in.) shim with a new No.9 shim.

New Shim thickness mm (in.)			
Shim No.	Thickness	Shim No.	Thickness
1	2.500 (0.0984)	10	2.950 (0.1161)
2	2.550 (0.1004)	11	3.000 (0.1181)
3	2.600 (0.1024)	12	3.050 (0.1201)
4	2.650 (0.1043)	13	3.100 (0.1220)
5	2.700 (0.1063)	14	3.150 (0.1240)
6	2.750 (0.1083)	15	3.200 (0.1260)
7	2.800 (0.1102)	16	3.250 (0.1280)
8	2.850 (0.1122)	17	3.300 (0.1299)
9	2.900 (0.1142)		

HINT: New shims have the thickness in millimeters imprinted on the face.

INSPECTION AND ADJUSTMENT OF IGNITION TIMING

4A-FE (See page [IG-25](#))

3S-GTE (See page [IG-29](#))

5S-FE (See page [IG-37](#))

Ignition timing:

10° BTDC @ idle

(w/ Terminals TE1 and E1 connected)

INSPECTION AND ADJUSTMENT OF IDLE SPEED (4A-FE)

(See page [MA-8](#))

Idle speed: 800 rpm

INSPECTION OF IDLE SPEED (5S-FE and 3S-GTE)

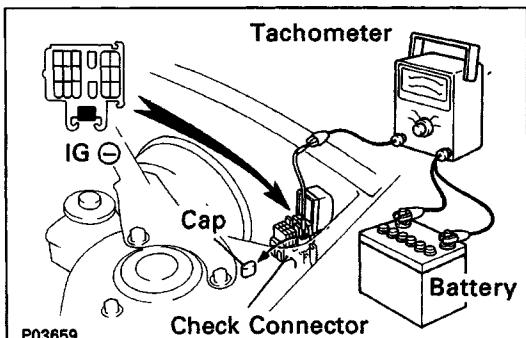
HINT (5S-FE): Disconnecting the battery will cause the idling speed data in the ISC to be returned to the initial idling speed, causing the idling speed to rise above 750 rpm. Should this happen, either carry out a driving test, including stop-go several times at a speed above 10 km/h (6 mph), or start the engine, idle for 30 seconds and then turn the engine off repeatedly. By doing this, idle data will be stored in the ISC and the idle rpm will be at specified value.

1. INITIAL CONDITIONS

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

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

- (e) EFI system wiring connectors fully plugged
- (f) All operating accessories switched OFF
- (g) Transmission in neutral position

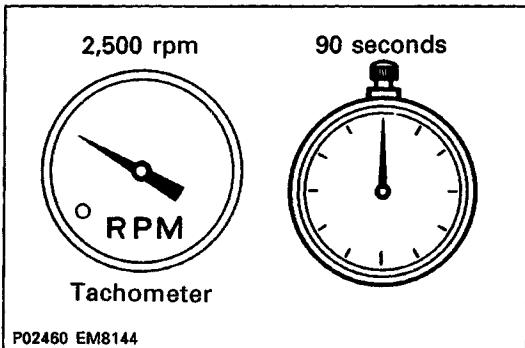


2. CONNECT TACHOMETER

Connect the test probe of a tachometer to terminal IG (-) of the check connector.

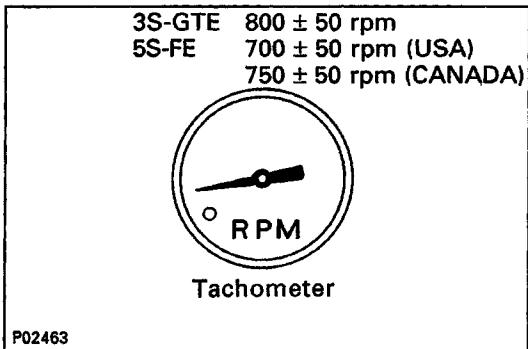
NOTICE:

- 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 IDLE SPEED

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



(b) Check the idle speed.

Idle speed:

3S-GTE 800 ± 50 rpm

5S-FE 700 ± 50 rpm USA

750 ± 50 rpm CANADA

If the idle speed is not as specified, check the ISC system.

4. DISCONNECT TACHOMETER

TOYOTA–VARIABLE INDUCTION SYSTEM (T–VIS)

INSPECTION OF T–VIS

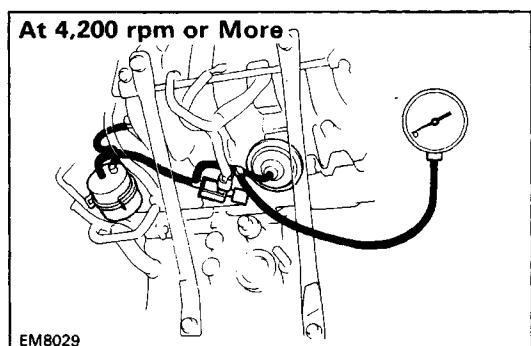
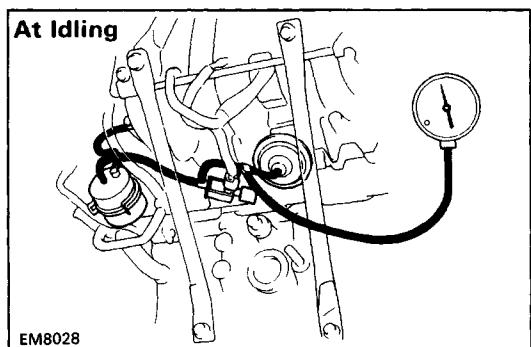
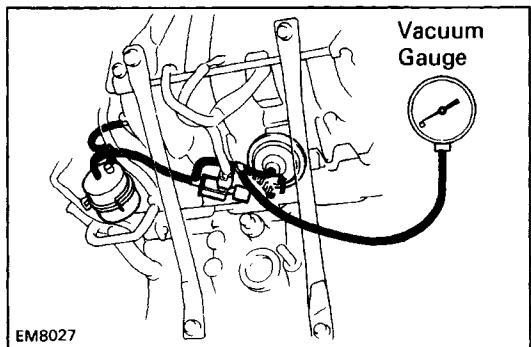
1. WARM UP AND STOP ENGINE

Allow the engine to warm up to normal operating temperature.

2. CONNECT TACHOMETER (See page EM–26)

3. CONNECT VACUUM GAUGE

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



4. INSPECT T–VIS OPERATION

(a) Check that the vacuum gauge indicates vacuum at idling.

(b) Check that the vacuum gauge indicates zero at 4,200 rpm or more.

HINT: If regular unleaded gasoline is used, the vacuum gauge also indicates zero below 4,200 rpm.

IDLE AND OR 2500 RPM CO HC CHECK

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

1. INITIAL CONDITIONS

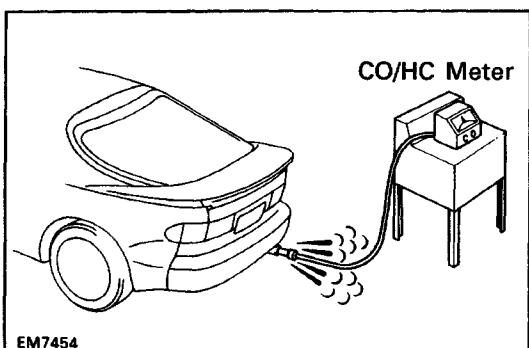
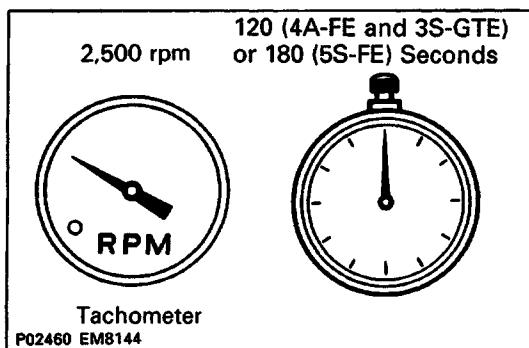
- (a) Engine at normal operating temperature
- (b) Air cleaner installed
- (c) All pipes and hoses of air induction system connected
- (d) All accessories switched OFF
- (e) All vacuum lines properly connected

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 position
- (i) Tachometer and CO/HC meter calibrated by hand.

2. START ENGINE

3. RACE ENGINE AT 2,500 RPM FOR APPROX. 120 (4A-FE AND 3S-GTE) OR 180 (5S-FE) SECONDS



4. INSERT CO/HC METER TESTING PROBE INTO TAILPIPE AT LEAST 40 cm 0.3 ft) DURING IDLING

5. IMMEDIATELY CHECK CO/HC CONCENTRATION AT IDLE AND/OR 2,500 RPM

Complete the measuring within three minutes.

HINT: When performing the 2 mode (2,500 rpm and idle) test, follow the measurement order prescribed by the applicable local regulations.

(4A-FE and 3S-GTE)

If the CO/HC concentration at 2,500 rpm does not conform to regulations, try the following procedure.

Race the engine again at 2,500 rpm for approx. 1 minute and quickly repeat steps 4 and 5 above. This may correct the problem.

Troubleshooting

If the CO/HC concentration does not comply with regulations, perform troubleshooting in the order given below.

(a) Check oxygen sensor operation.

(See page [FI-237](#))

(b) See the table below for possible causes, and then inspect and correct the applicable causes if necessary.

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

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

Allow the engine to warm up to normal operating temperature.

2. (3S-GTE)

REMOVE INTERCOOLER

(See steps 13 to 15 on pages [TC-9](#) and [10](#))

3. (3S-GTE)

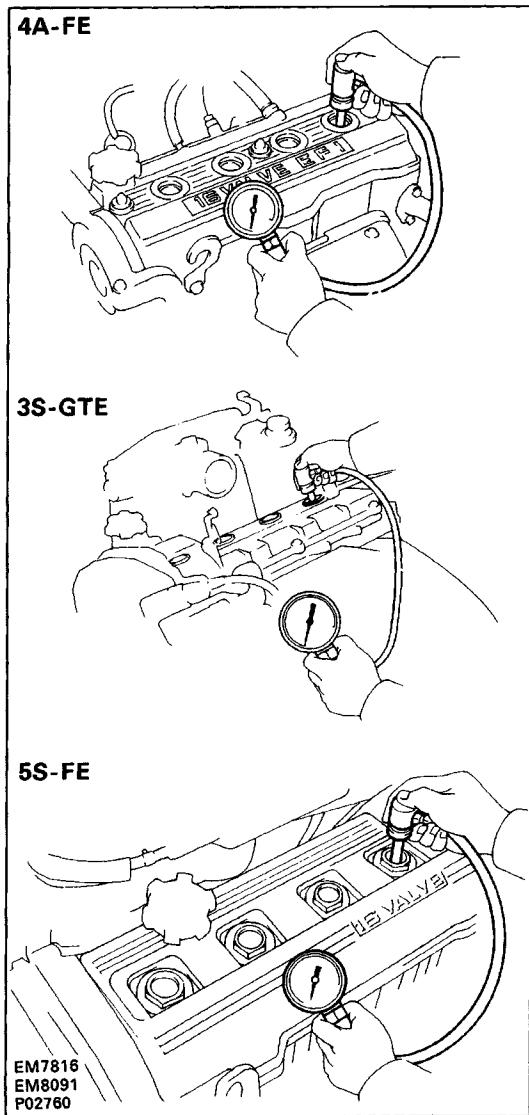
DISCONNECT SOLENOID RESISTOR CONNECTOR

4. (3S-GTE)

DISCONNECT COLD START INJECTOR CONNECTOR

5. DISCONNECT DISTRIBUTOR CONNECTOR(S)

6. REMOVE SPARK PLUGS



7. CHECK CYLINDER COMPRESSION PRESSURE

- (a) Insert a compression gauge into the spark plug hole.
- (b) Fully open the throttle.
- (c) While cranking the engine, measure the compression pressure.

HINT: Always use a fully charged battery to obtain engine speed 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 1,320 kPa (13.5 kgf/cm², 191 psi) or more

3S-GTE 1,128 kPa (11.5 kgf/cm², 164 psi)
or more

5S-FE 1,226 kPa (12.5 kgf/cm², 178 psi)
or more

Minimum pressure:

4A-FE and 5S-FE

981 kPa (10.0 kgf /cm², 142 psi)

3S-GTE 883 kPa (9.0 kgf/cm², 128 psi)

Difference between each cylinder:

98 kPa (1.0 kgf/cm², 14 psi) 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 cylinders 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 is improper, or there may be leakage past the gasket.

8. REINSTALL SPARK PLUGS

Torque: 18 N·m (180 kgf·cm, 13 ft-lbf)

9. RECONNECT DISTRIBUTOR CONNECTOR(S)

10. (3S-GTE)

RECONNECT COLD START INJECTOR CONNECTOR

11. (3S-GTE)

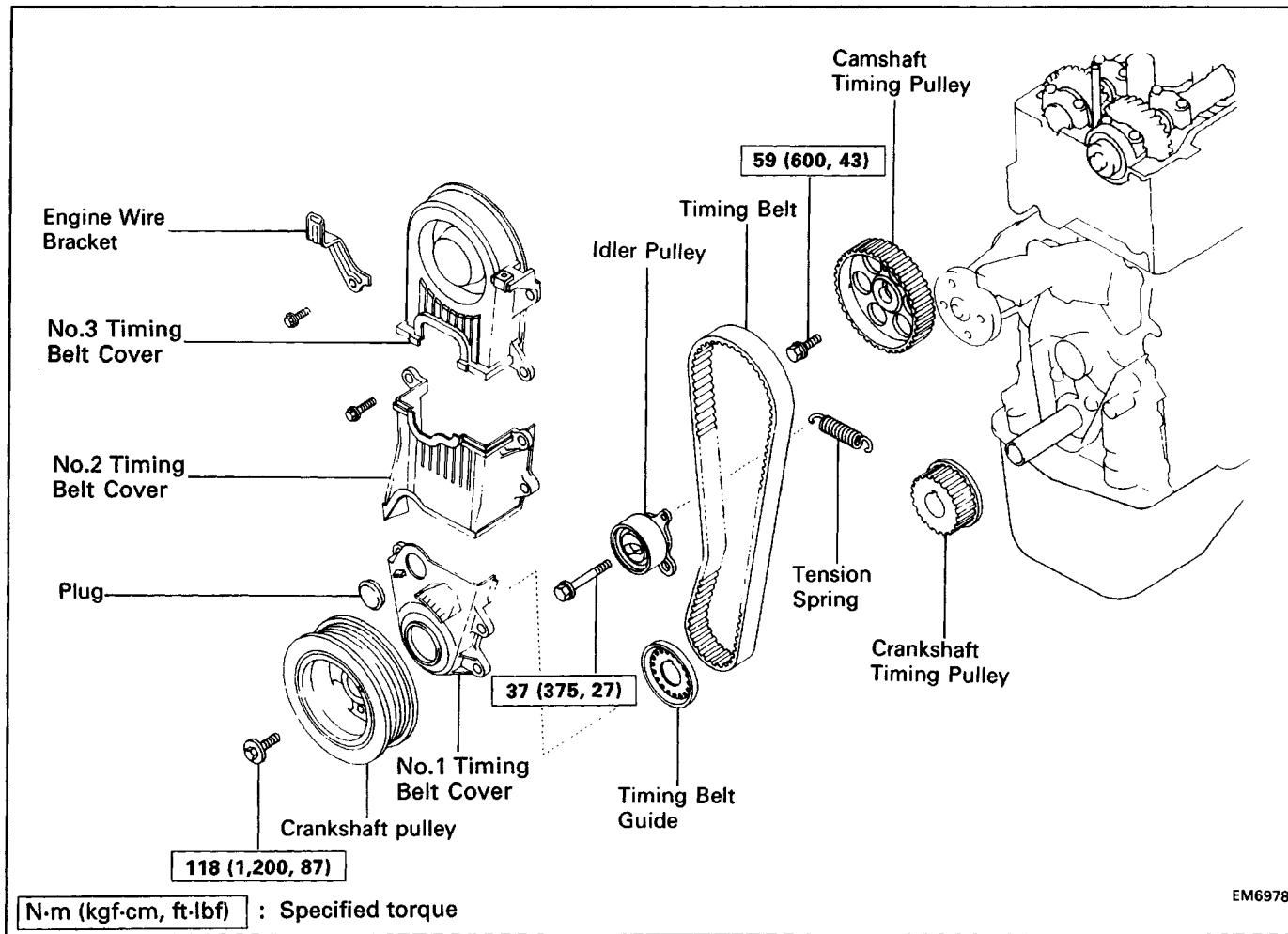
RECONNECT SOLENOID RESISTOR CONNECTOR

12. (3S-GTE)

REINSTALL INTERCOOLER

(See steps 11 to 13 on page [TC-17](#))

TIMING BELT (4A-FE) COMPONENTS



REMOVAL OF TIMING BELT

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

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

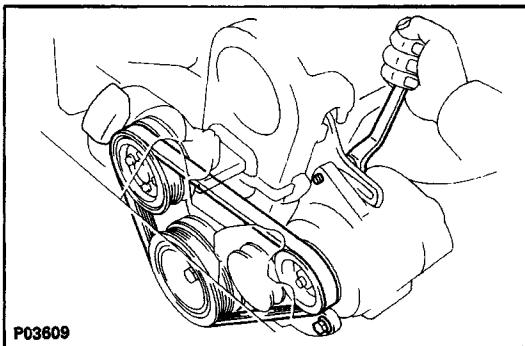
2. REMOVE RH FRONT WHEEL

3. REMOVE RH ENGINE UNDER COVER

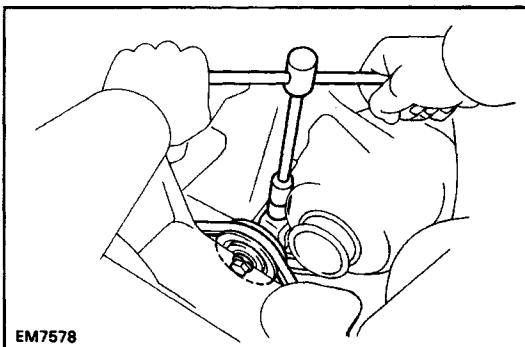
4. REMOVE ALTERNATOR DRIVE BELT

- (a) Loosen the four water pump pulley bolts.



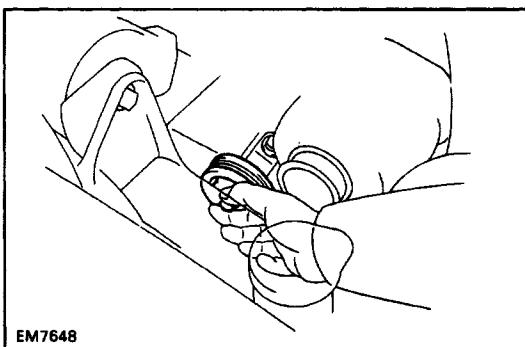


(b) Loosen the pivot nut and adjusting bolt, and remove the drive belt.

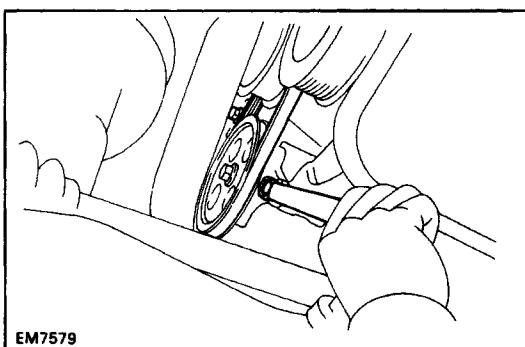


5. REMOVE A/C COMPRESSOR DRIVE BELT AND A/C IDLER PULLEY

(a) Loosen the idler pulley mounting nut and adjusting bolt, and remove the drive belt.

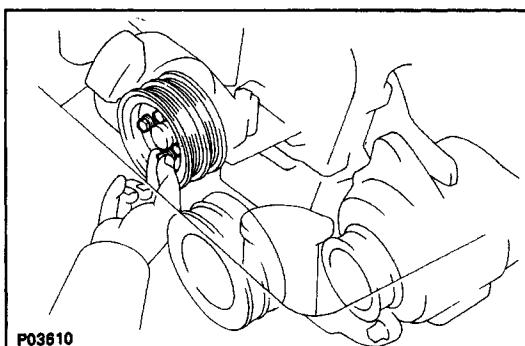


(b) Remove the nut and idler pulley.

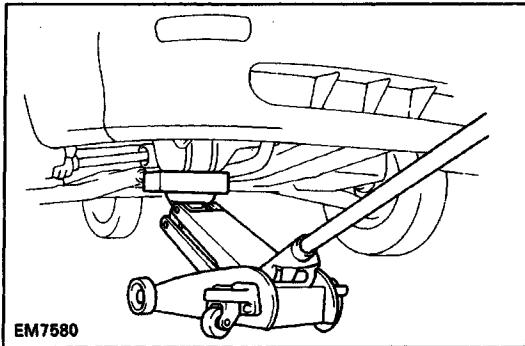


6. REMOVE PS PUMP DRIVE BELT, AND DISCONNECT WATER PUMP PULLEY FROM WATER PUMP

(a) Loosen the pivot bolt and adjusting bolt, and remove the drive belt.

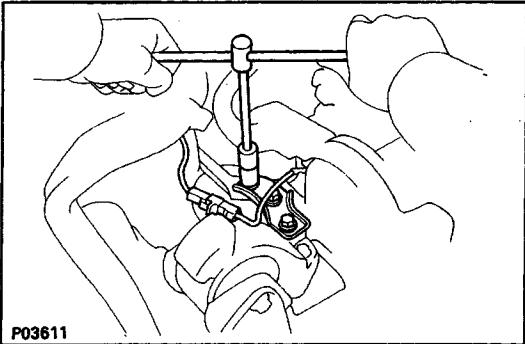


(b) Remove the four bolts, and disconnect the water pump pulley from the water pump.



7. SLIGHTLY JACK UP ENGINE

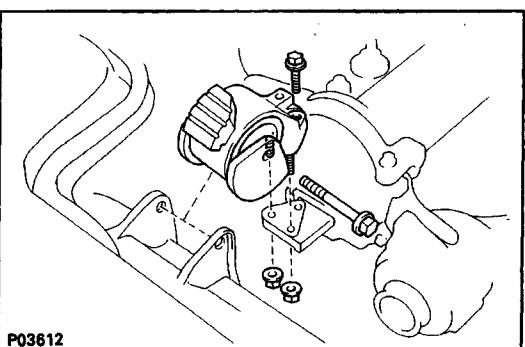
Raise the engine enough to remove the weight from the engine mounting on the right side.



8. DISCONNECT CONNECTOR FROM GROUND WIRE ON RH FENDER APRON

9. REMOVE RH ENGINE MOUNTING STAY

Remove the three bolts and mounting stay.



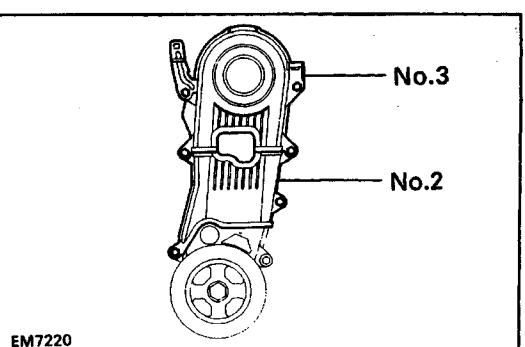
10. REMOVE RH ENGINE MOUNTING INSULATOR

Remove the bolt, two nuts, through bolt and mounting insulator.

11. REMOVE SPARK PLUGS

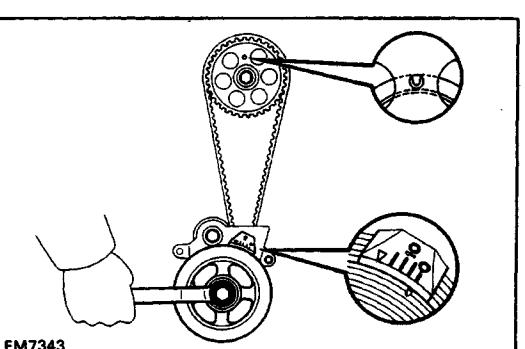
12. REMOVE CYLINDER HEAD COVER

(See steps 18 and 24 on pages [EM-85](#) and 87)



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

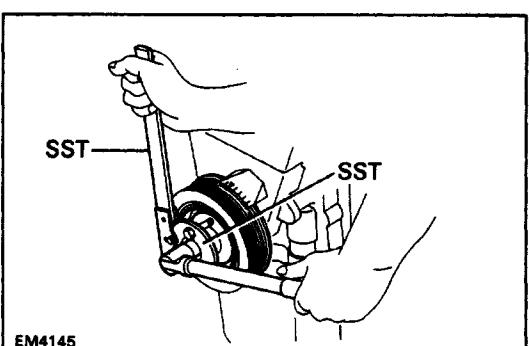
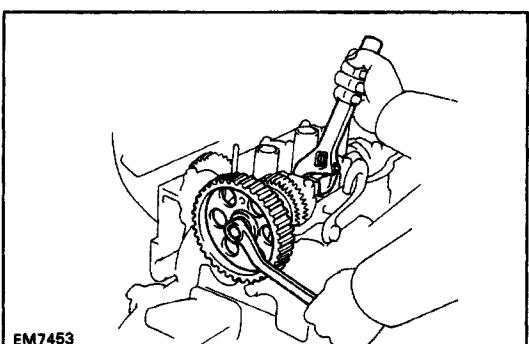
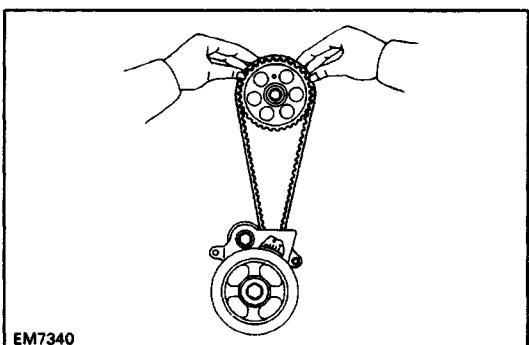
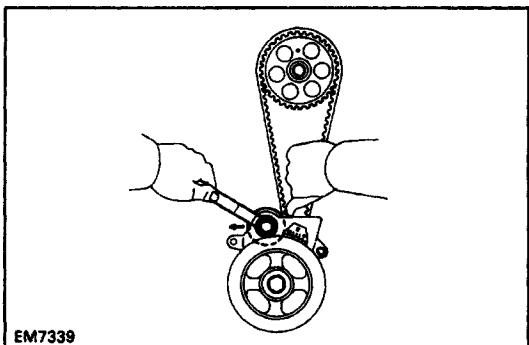
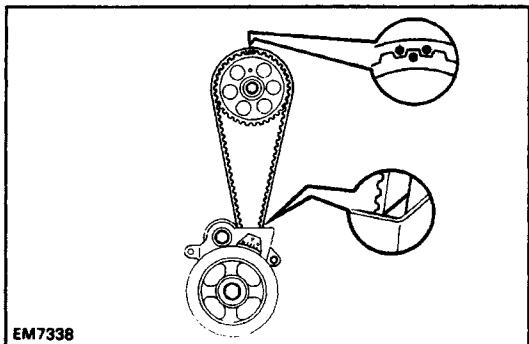
Remove the six bolts, engine wire bracket, No.3 and No.2. timing belt covers.



14. SET NO.1 CYLINDER TO TDC/COMPRESSION

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

(b) Check that the hole of the camshaft timing pulley is aligned with the timing mark of the bearing cap. If not, turn the crankshaft one revolution (360°).



15. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEY

HINT (When re-using timing belt): Place the matchmarks on the timing belt and camshaft timing pulley, and matchmark on the timing belt to match the end of the No.1 timing belt cover.

- Remove the grommet from the No.1 timing belt cover.
- Loosen the mounting bolt of the No.1 idler pulley and push the pulley toward the left as far as it will go, and temporarily tighten it.

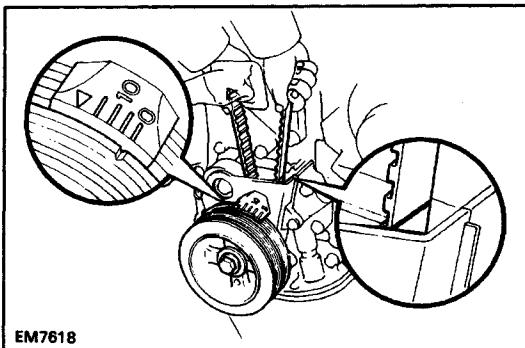
- Remove the timing belt from the camshaft timing pulley.

16. REMOVE CAMSHAFT TIMING PULLEY

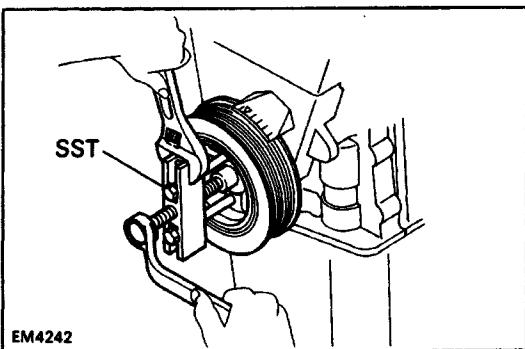
Hold the hexagon wrench head portion of the camshaft with a wrench, and remove the bolt and timing pulley.

17. REMOVE CRANKSHAFT PULLEY

- Using SST, remove the pulley bolt.
SST 09213-14010 and 09330-00021



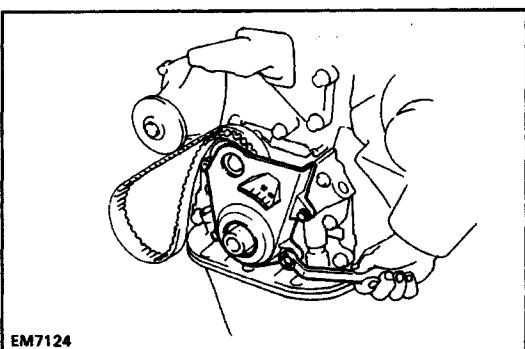
HINT (When re-using timing belt) : After loosening the crankshaft pulley bolt, check that the timing belt matchmark aligns with the end of the No.1 timing belt cover when the crankshaft pulley groove is aligned with the timing mark "o" of the No.1 timing belt cover. If the matchmark does not align, shift the meshing of the timing belt and crankshaft timing pulley until they align.



(b) Using SST, remove the pulley.

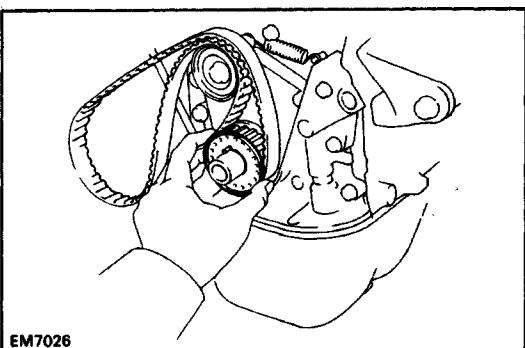
SST 09213-31021

HINT (When re-using timing belt): Remove the pulley without turning it.

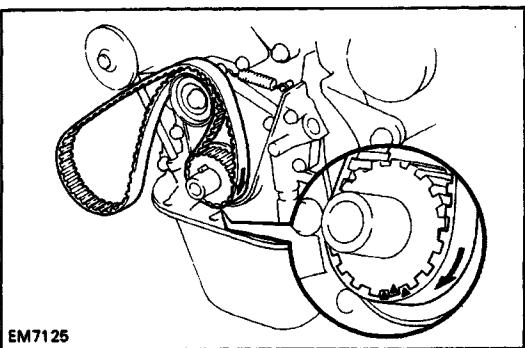


18. REMOVE NO.1 TIMING BELT COVER

Remove the three bolts and timing belt cover.

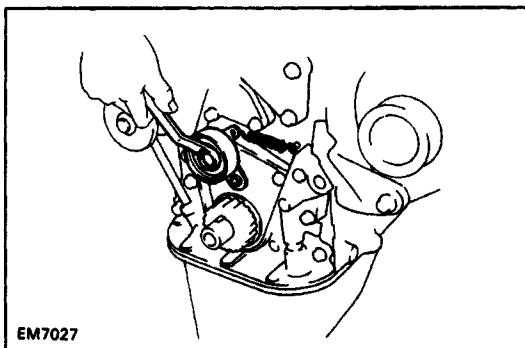


19. REMOVE TIMING BELT GUIDE



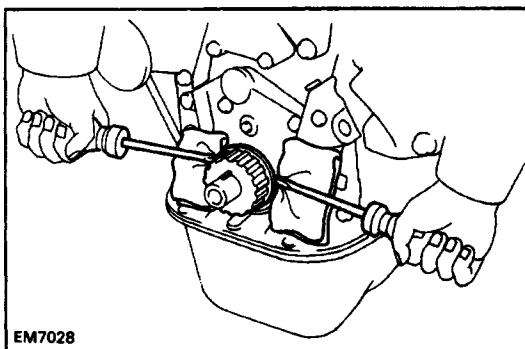
20. REMOVE TIMING BELT

HINT (When re-using timing belt): Draw a direction arrow on the timing belt (in the direction of engine revolution), and place matchmarks on the timing belt and crankshaft timing pulley.



21. REMOVE IDLER PULLEY AND TENSION SPRING

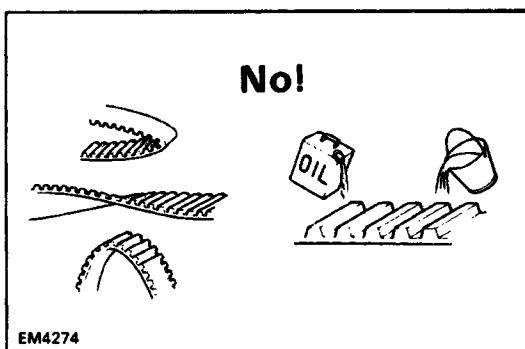
Remove the bolt, idler pulley and tension spring.



22. REMOVE CRANKSHAFT TIMING PULLEY

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

NOTICE: Position shop rags as shown to prevent damage.



INSPECTION OF TIMING BELT COMPONENTS

1. INSPECT TIMING BELT

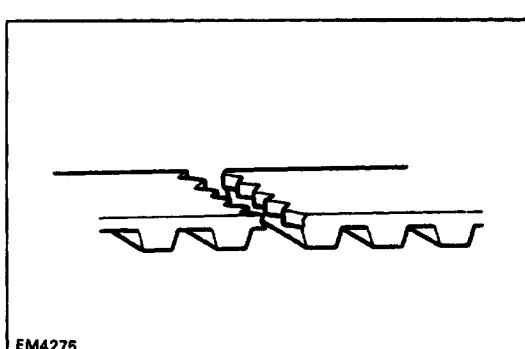
NOTICE:

- 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 mounting bolt of the camshaft timing pulley.

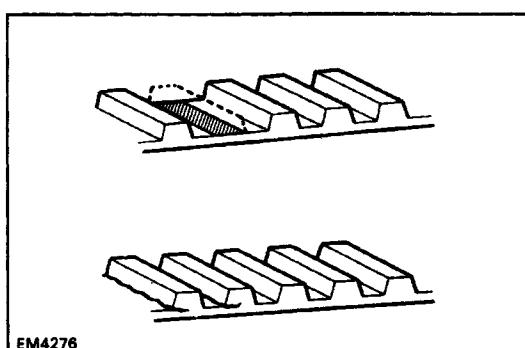
If there are any defects as shown in the illustrations, check the following points:

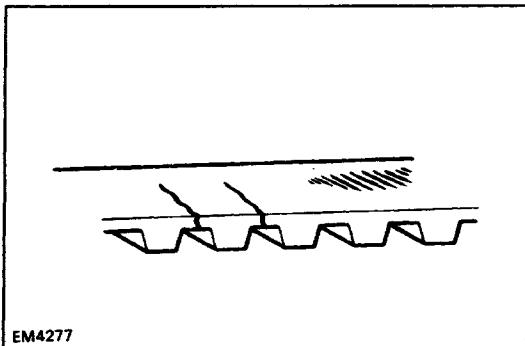
(a) Premature parting

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

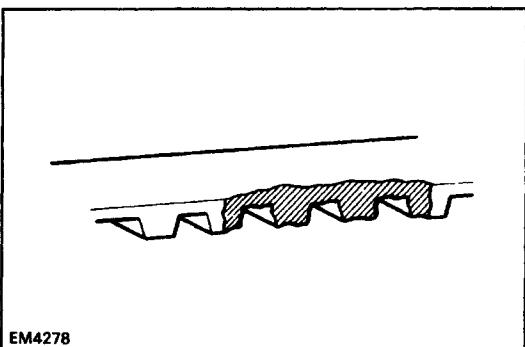


(b) If the belt teeth are cracked or damaged, check to see if either camshaft or water pump is locked.

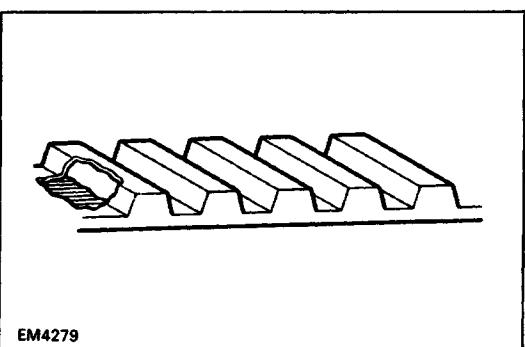




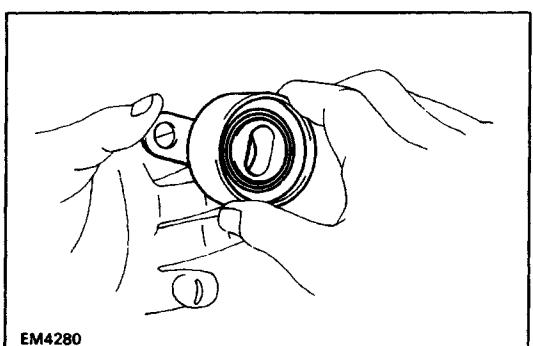
- (c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock.



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

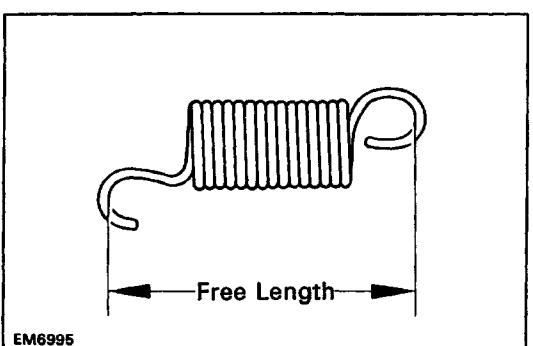


- (e) If there is noticeable wear on the belt teeth, check the timing cover for damage, correct gasket installation, and the foreign material on the pulley teeth. If necessary, replace the timing belt.



2. INSPECT IDLER PULLEY

Check that the idler pulley turns smoothly. If necessary, replace the idler pulley.



3. INSPECT TENSION SPRING

- (a) Measure the free length of tension spring.
Free length: 38.4 mm (1.512 in.)

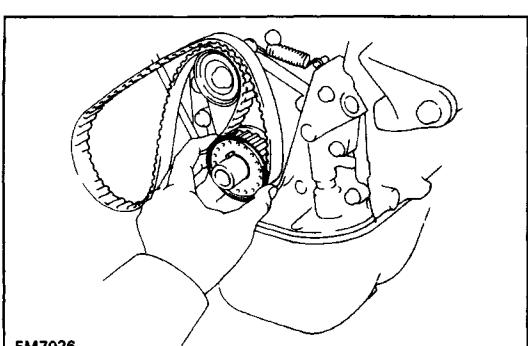
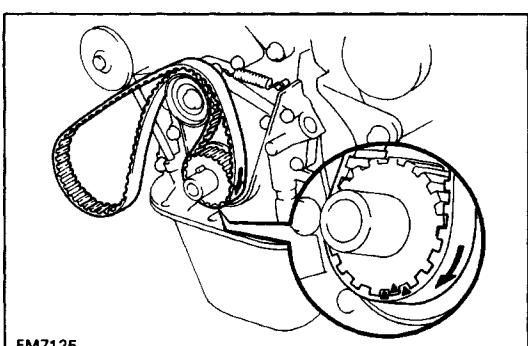
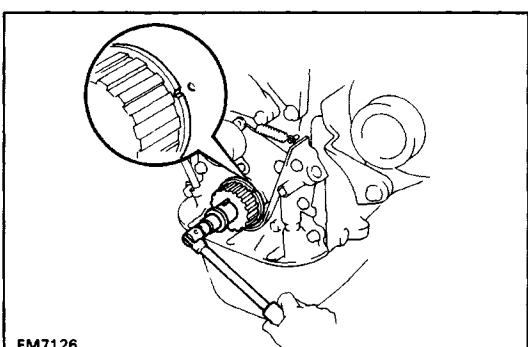
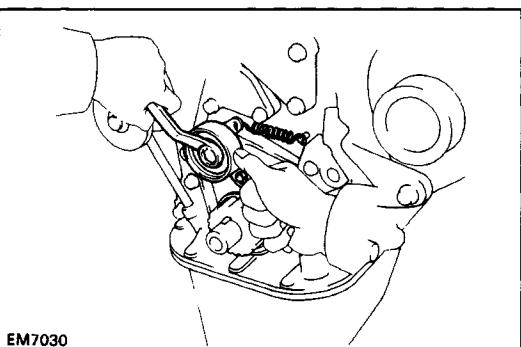
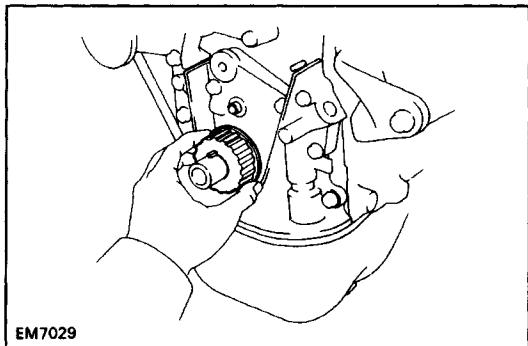
If the free length is not as specified, replace the tension spring.

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

Installed tension:

**35 – 39 N (3.6 – 4.0 kgf, 7.9 – 8.8 lbf)
at 50.2 mm (1.976 in.)**

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



INSTALLATION OF TIMING BELT

(See page [EM-33](#))

1. 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.

2. 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.

3. TEMPORARILY INSTALL TIMING BELT

NOTICE: The engine should be cold.

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

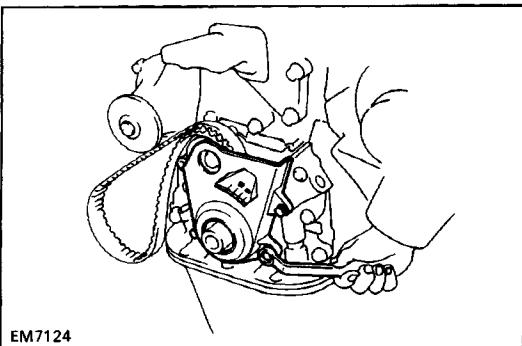
- (b) Remove any oil or water on the crankshaft timing pulley and idler pulley, and keep them clean.

- (c) Install the timing belt on the crankshaft timing pulley and idler pulley.

HINT (When re-using timing belt): Align the matchmarks of the crankshaft timing pulley and timing belt, and install the belt with the arrow pointing in the direction of engine revolution.

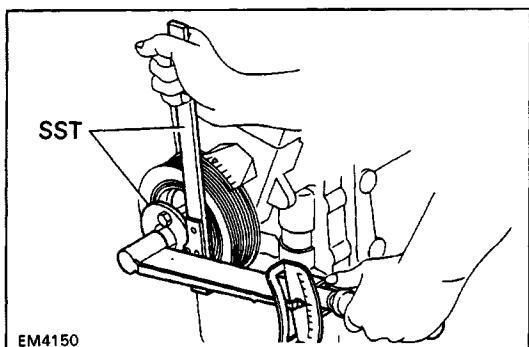
4. INSTALL TIMING BELT GUIDE

Slide on the timing belt guide, facing the cup side outward.



5. INSTALL NO.1 TIMING BELT COVER

Install the timing belt cover with the three bolts.

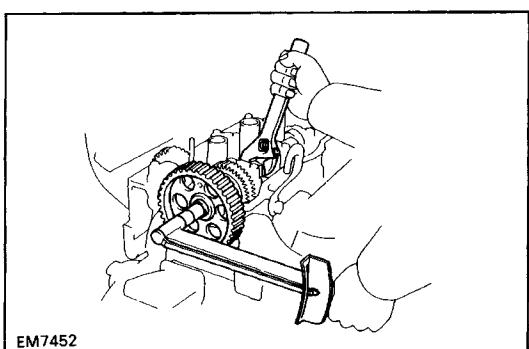


6. INSTALL CRANKSHAFT PULLEY

- Align the pulley set key with the key groove of the pulley, and slide on the pulley.
- Temporarily install the pulley bolt.
- Using SST, install the pulley bolt.

SST 09213-14010 and 09330-00021

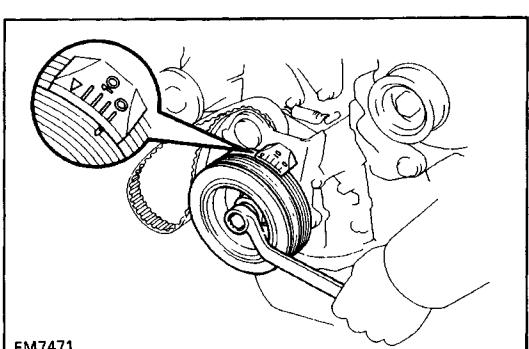
Torque: 118 N·m (7,200 kgf·cm, 87 ft-lbf)



7. INSTALL CAMSHAFT TIMING PULLEY

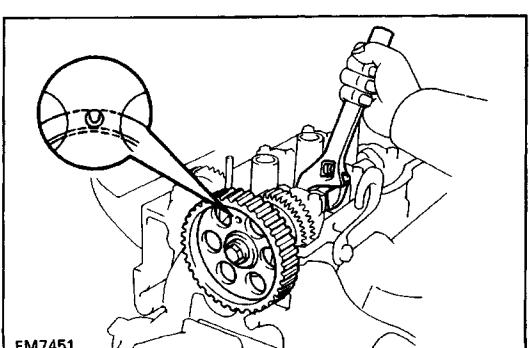
- Align the camshaft knock pin with the knock pin groove of the pulley, and slide on the pulley.
- Temporarily install the timing pulley bolt.
- Hold the hexagon wrench head portion of the camshaft with a wrench, and tighten the timing pulley bolt.

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

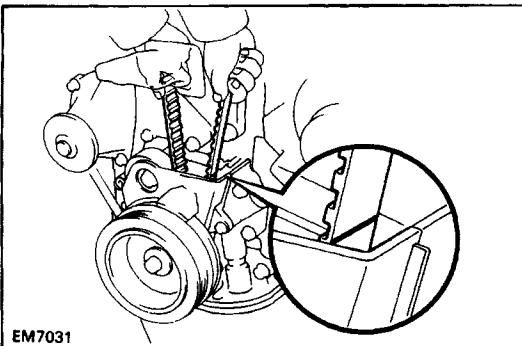


8. SET NO.1 CYLINDER TO TDC/COMPRESSION

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



- Turn the hexagon wrench head portion of the camshaft, and align the hole of the camshaft timing pulley with the timing mark of the bearing cap.

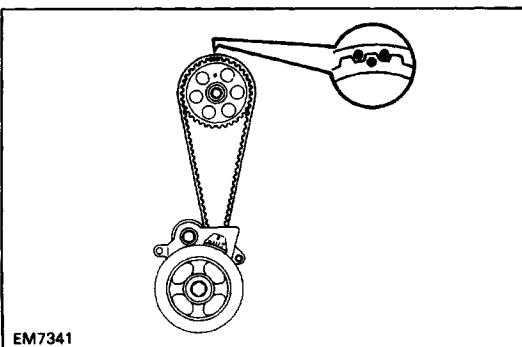


9. INSTALL TIMING BELT

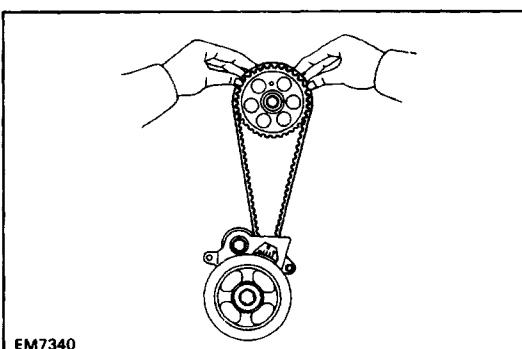
HINT (When re-using timing belt):

- Check that the matchmark on the timing belt matches the end of the No.1 timing belt cover.

If the matchmark does not align, shift the meshing of the timing belt and crankshaft timing pulley until they align.

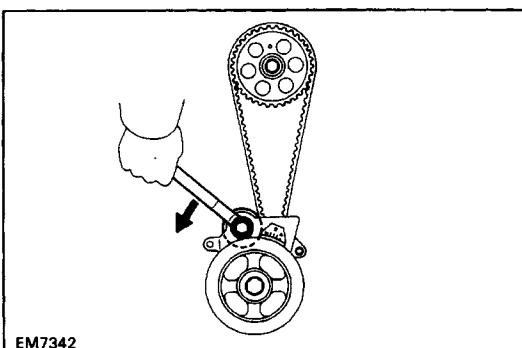


- Align the matchmarks of the timing belt and camshaft timing pulley.



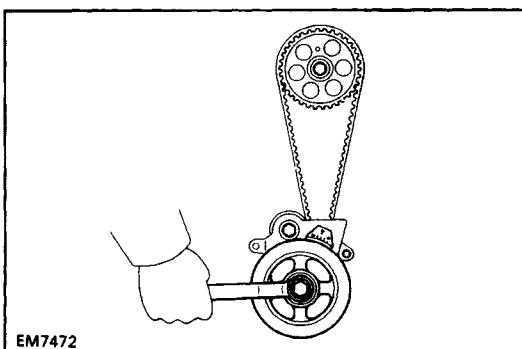
(a) Remove any oil or water on the camshaft timing pulley, and keep it clean.

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



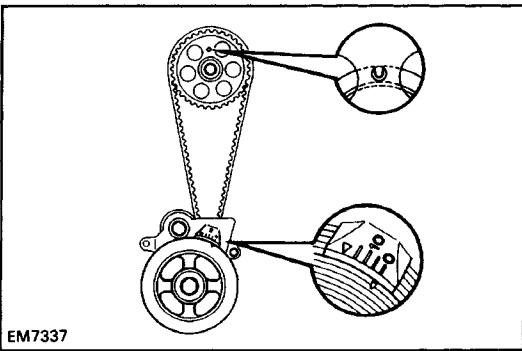
10. CHECK VALVE TIMING

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

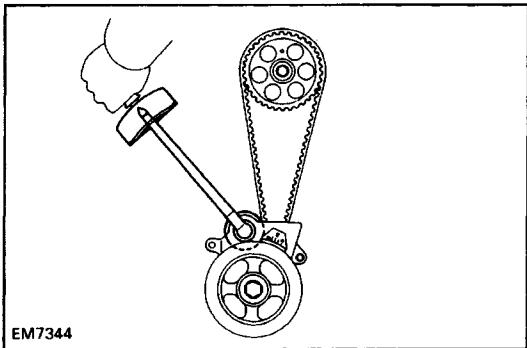


(b) Slowly turn the crankshaft pulley two revolutions from TDC to TDC.

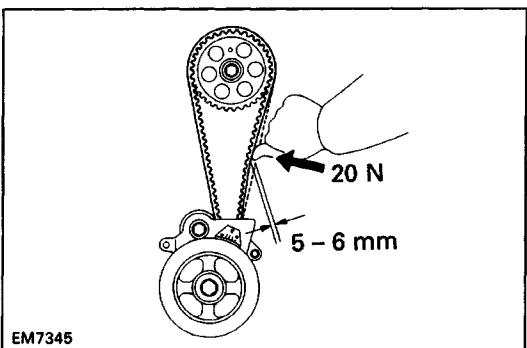
NOTICE: Always turn the crankshaft clockwise.



(c) Check that each pulley aligns with the timing marks as shown in the illustration.
If the timing marks do not align, remove the timing belt and reinstall it.



(d) Tighten the idler pulley bolt.
Torque: 37 N·m (375 kgf·cm, 27 ft-lbf)

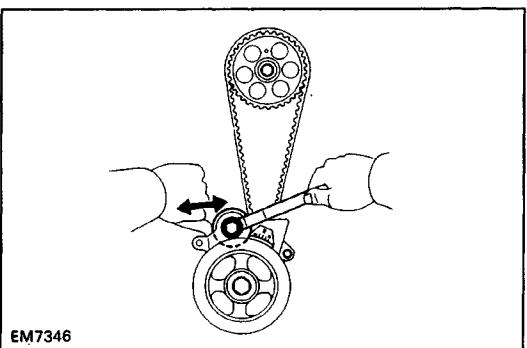


11. (REFERENCE)

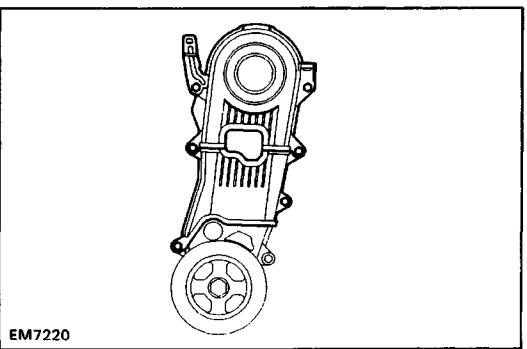
INSTALL TIMING BELT DEFLECTION

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

**Deflection: 5 – 6 mm (0.20 – 0.24 in.)
at 20 N (2 kgf, 4.4 lbf)**



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



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

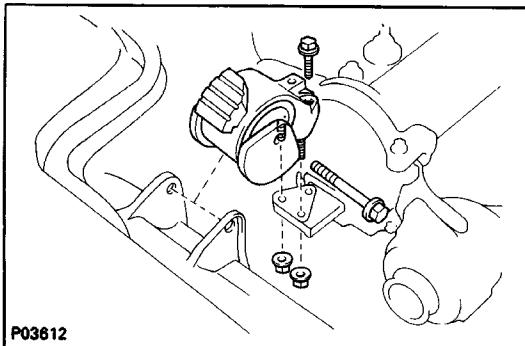
Install the No.2, No.3 timing belt covers and engine wire bracket with the six bolts.

13. INSTALL CYLINDER HEAD COVER

(See steps 11 and 17 on pages **EM-109** and **111**)

14. INSTALL SPARK PLUGS

Torque: 18 N·m (180 kgf·cm, 13 ft-lbf)



15. INSTALL RH ENGINE MOUNTING INSULATOR

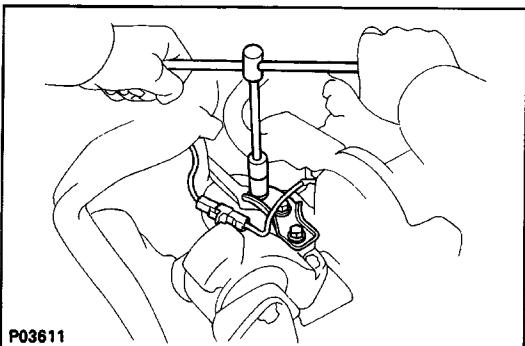
Install the mounting insulator with the through bolt, bolt and two nuts.

Torque:

Through bolt 87 N·m (890 kgf·cm, 64 ft-lbf)

Bolt 64 N·m (650 kgf·cm, 47 ft-lbf)

Nut 52 N·m (530 kgf·cm, 38 ft-lbf)

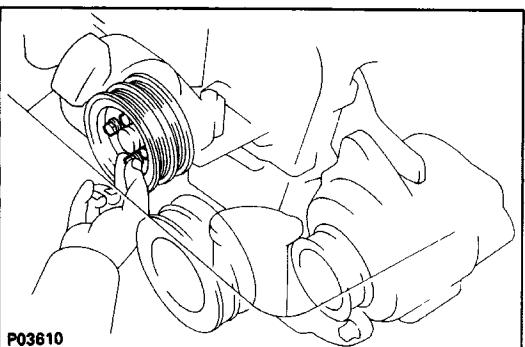


16. INSTALL RH ENGINE MOUNTING STAY

Install the mounting stay with the three bolts.

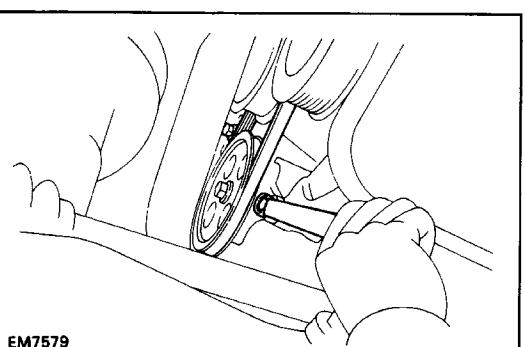
Torque: 42 N·m (430 kgf·cm, 31 ft-lbf)

17. CONNECT GROUND CONNECTOR TO GROUND WIRE ON RH FENDER APRON

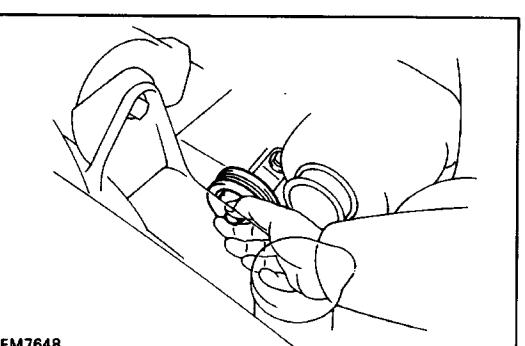


18. INSTALL WATER PUMP PULLEY AND PS PUMP DRIVE BELT

(a) Temporarily install the water pump pulley with the four bolts.

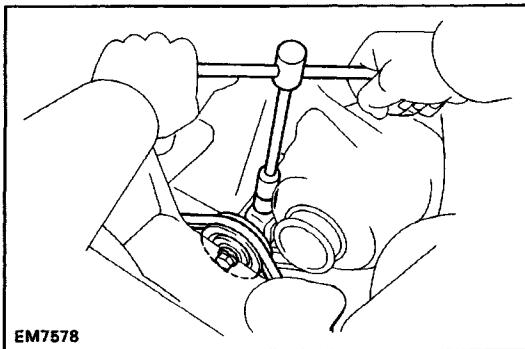


(b) Install the drive belt with the pivot bolt and adjusting bolt.

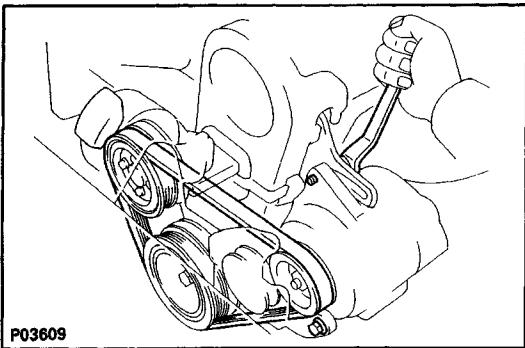


19. INSTALL A/C IDLER PULLEY AND A/C DRIVE BELT

(a) Temporarily install the idler pulley with the nut.

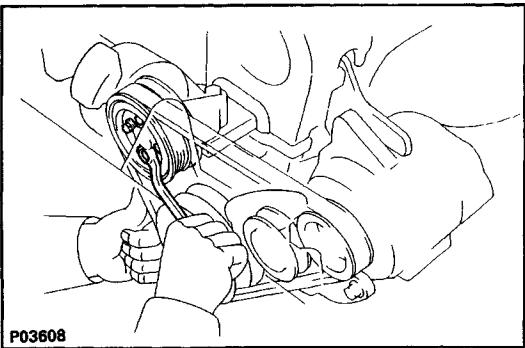


(b) Install the drive belt with the idler pulley nut and adjusting bolt.



20. INSTALL ALTERNATOR DRIVE BELT

(a) Install the drive belt with the pivot nut and adjusting bolt.



(b) Tighten the four water pump pulley bolts.

21. INSTALL RH FRONT WHEEL

22. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

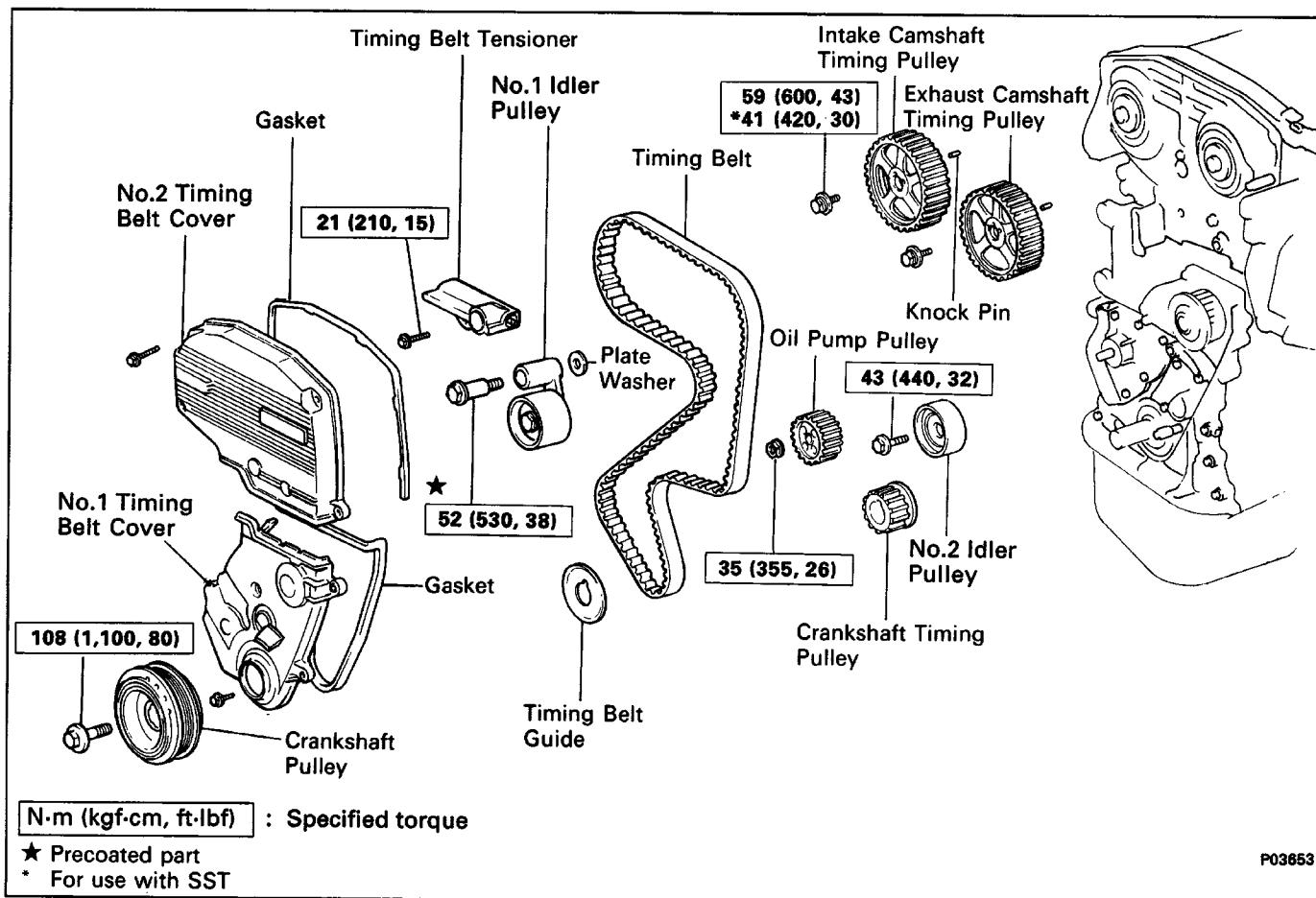
23. CHECK AND ADJUST DRIVE BELTS

Drive belt tension:

Alternator	New belt 160 ± 20 lbf Used belt 130 ± 20 lbf
PS pump	New belt 125 ± 25 lbf Used belt 80 ± 20 lbf
A/C compressor	New belt 160 ± 25 lbf Used belt 100 ± 20 lbf

24. INSTALL RH ENGINE UNDER COVER

TIMING BELT (3S-GTE) COMPONENTS



REMOVAL OF TIMING BELT

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

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

2. REMOVE RH FRONT WHEEL

3. REMOVE RH ENGINE UNDER COVER

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

5. REMOVE INTERCOOLER

(See steps 13 to 15 on pages [TC-9](#) and 10)

6. REMOVE EGR VACUUM MODULATOR AND VSV

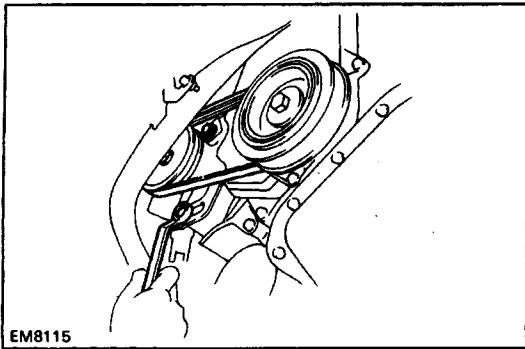
(See step 20 on page [EM-121](#))

7. REMOVE EGR VALVE AND PIPE

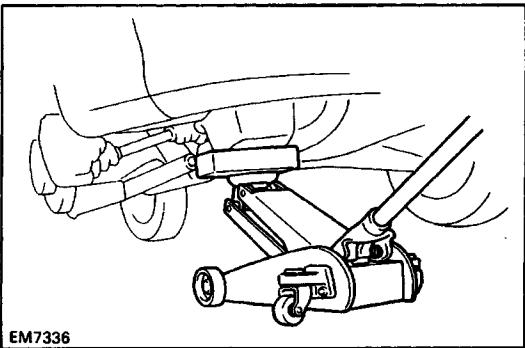
(See step 21 on page [EM-121](#))

8. REMOVE THROTTLE BODY

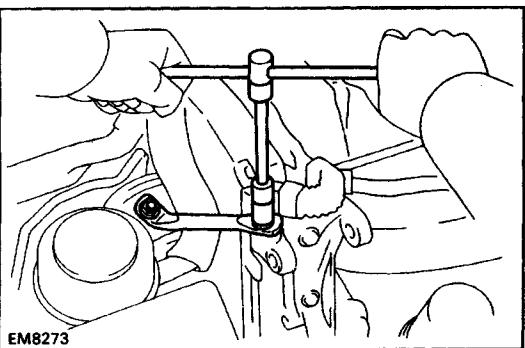
(See steps 2, 3, 5 to 8, 10 and 11 on pages [FI-194](#) and 195)

**9. REMOVE PS DRIVE BELT**

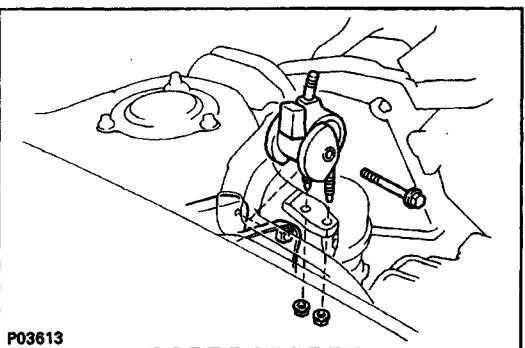
Loosen the two bolts, and remove the drive belt.

**10. SLIGHTLY JACK UP ENGINE**

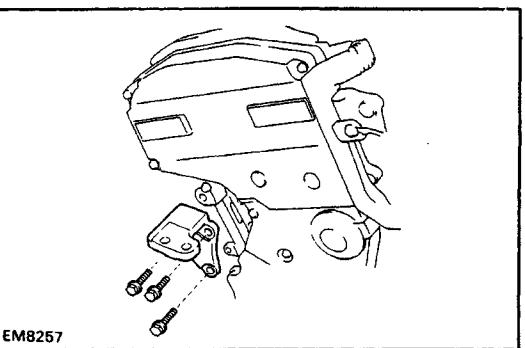
Raise the engine enough to remove the weight from the engine mounting on the right side.

**11. REMOVE RH ENGINE MOUNTING STAY**

Remove the bolt, nut and mounting stay.

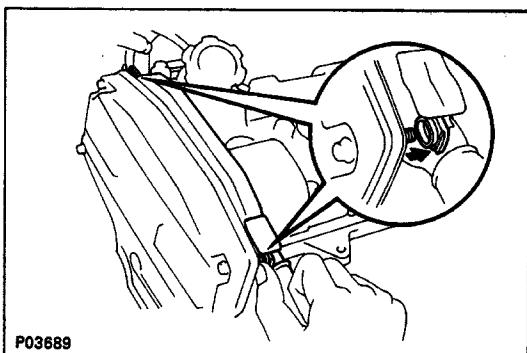
**12. REMOVE RH ENGINE MOUNTING INSULATOR**

Remove the through bolt, two nuts and mounting insulator.

**13. REMOVE RH ENGINE MOUNTING BRACKET**

Remove the three bolts and mounting bracket.

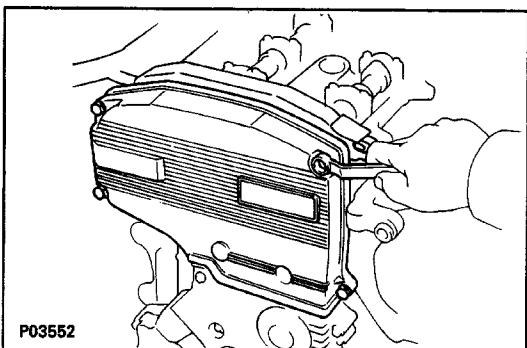
HINT: Lower the jack and perform the operation with the engine fully down.



14. REMOVE CYLINDER HEAD COVER

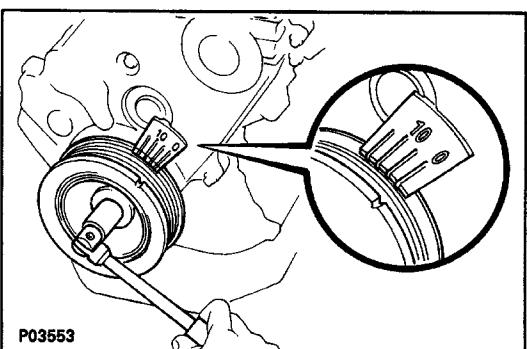
- Disconnect the engine wire protector between the cylinder head cover and No.3 timing belt cover.
- Remove the cylinder head cover.
(See step 33 on page [EM-124](#))

15. REMOVE SPARK PLUGS



16. REMOVE NO.2 TIMING BELT COVER

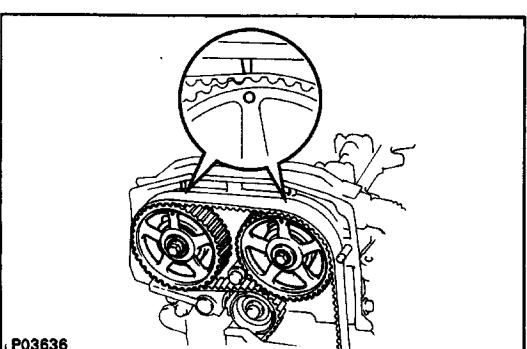
Remove the five screws, timing belt cover and gasket.



17. SET NO.1 CYLINDER TO TDC/COMPRESSION

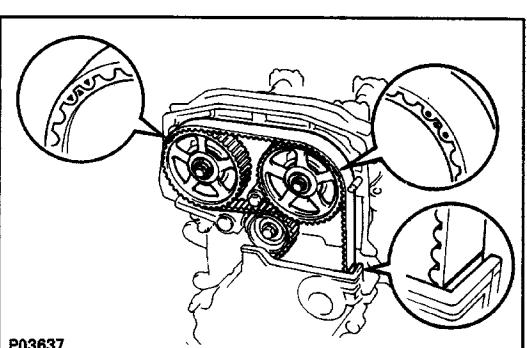
- Turn the crankshaft pulley and align its groove with timing mark "0" of the No.1 timing belt cover.

NOTICE: Always turn the crankshaft clockwise.



- Check that the timing marks of the camshaft timing pulleys are aligned with the timing marks of the No.3 timing belt cover.

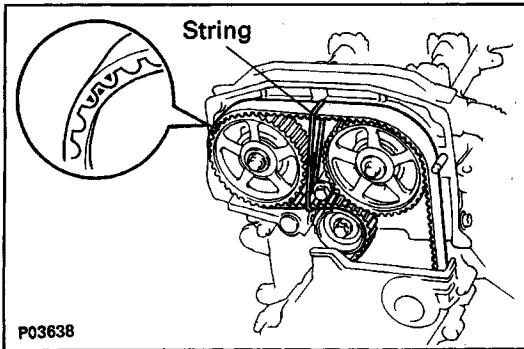
If not, turn the crankshaft one revolution (360°).



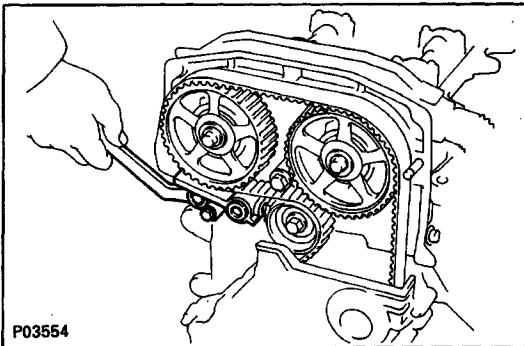
18. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEYS

HINT:

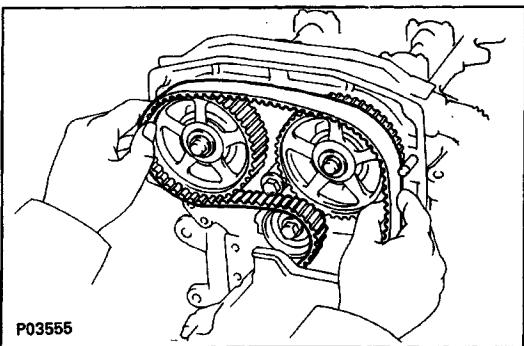
- (Re-using timing belt)
Place matchmarks on the timing belt and camshaft timing pulleys, and place a matchmark on the timing belt to match the end of the No.1 timing belt cover.



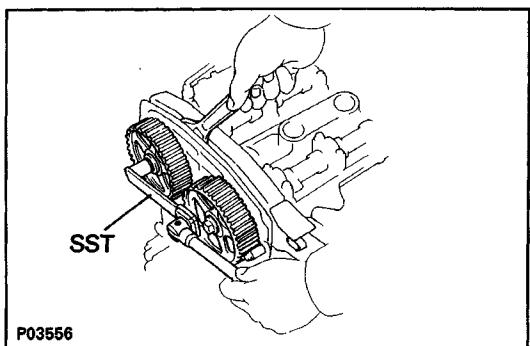
- (When replacing timing belt tensioner only)
To avoid meshing of the timing belt and timing pulley, secure one with a string. And place the matchmarks on the timing belt and RH camshaft timing pulley.



(a) Remove the two bolts and timing belt tensioner.



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



19. REMOVE CAMSHAFT TIMING PULLEYS

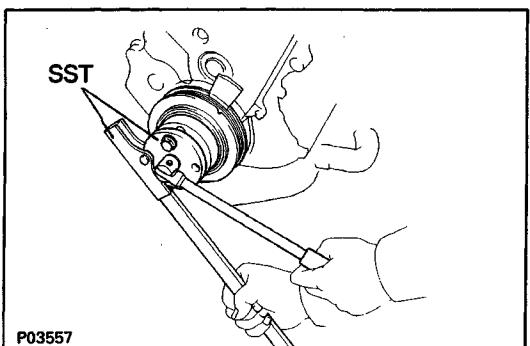
(a) Hold the hexagon wrench head portion of the camshaft with a wrench, and remove the pulley mounting bolts.

HINT (Intake camshaft timing pulley): Use SST.

SST 09249-63010

(b) Remove the camshaft pulleys and pins.

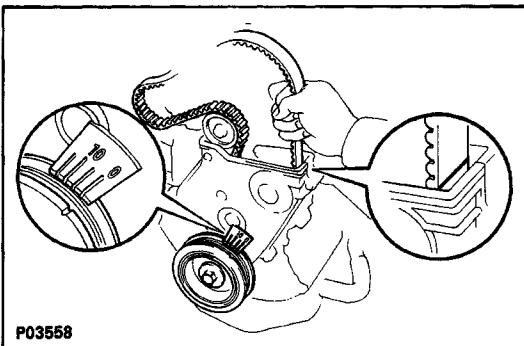
HINT: Arrange the intake and exhaust timing pulleys.



20. REMOVE CRANKSHAFT PULLEY

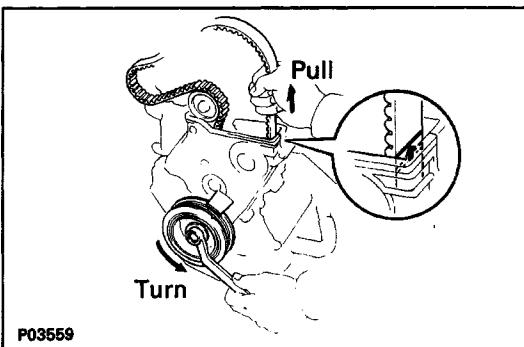
(a) Using SST, remove the pulley bolt.

SST 09213-54015 (90119-08216) and 09330-00021



P03558

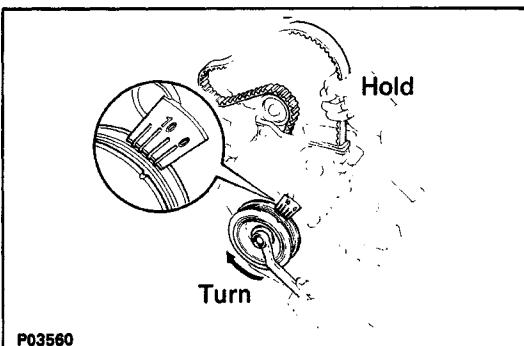
HINT (When re-using timing belt): After loosening the crankshaft pulley bolt, check that the timing belt matchmark aligns with the end of the No.1 timing belt cover when the crankshaft pulley groove is aligned with the timing mark "0" of the No.1 timing belt cover. If the matchmark does not align, align as follows:



P03559

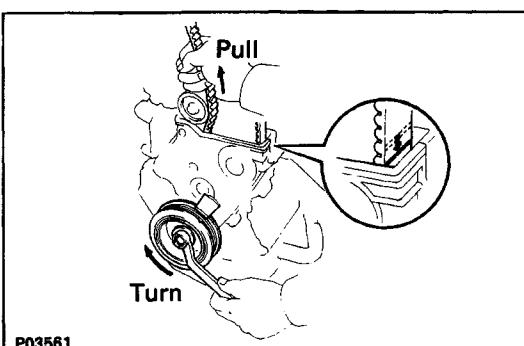
(When matchmark is out of alignment clockwise)

- Align the matchmark by pulling the timing belt up on the water pump pulley side while turning the crankshaft pulley counter-clockwise.



P03560

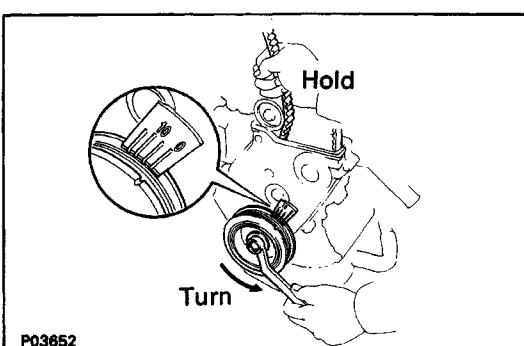
- After aligning the matchmark, hold the timing belt. And turn the crankshaft pulley clockwise, and align its groove with timing mark "0" of the No.1 timing belt cover.



P03561

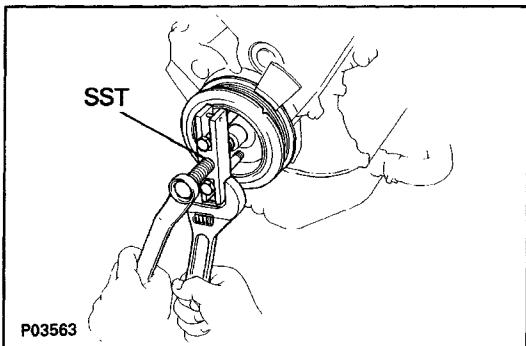
(When matchmark is out of alignment counter-clockwise)

- Align the matchmark by pulling the timing belt up on the No.1 idler pulley side while turning the crankshaft pulley clockwise.



P03652

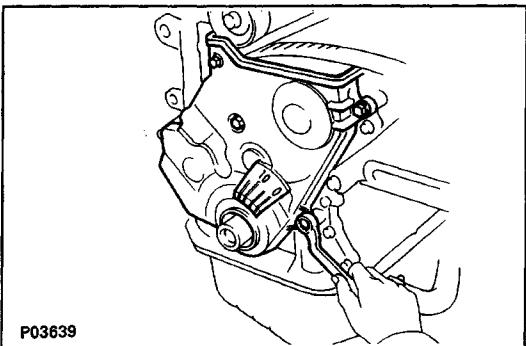
- After aligning the matchmark, hold the timing belt. And turn the crankshaft pulley counter-clockwise, and align its groove with timing mark "0" of the N o-1 timing belt cover.



(b) Using SST, remove the pulley.

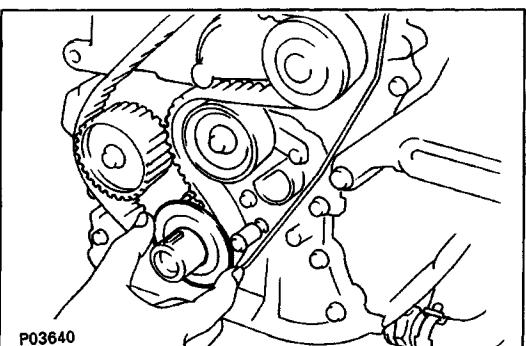
SST 09213-31021

HINT (When re-using timing belt): Remove the pulley without turning it.

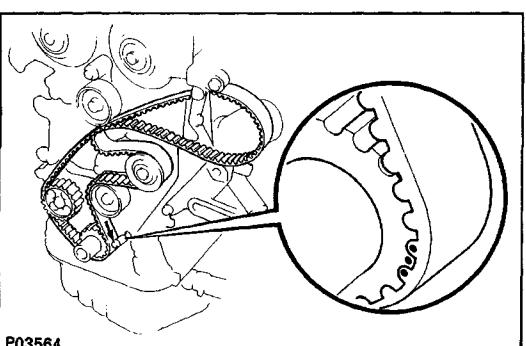


21. REMOVE NO.1 TIMING BELT COVER

Remove the six bolts, timing belt cover and gasket.

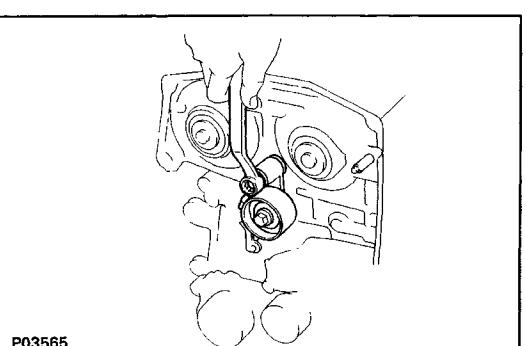


22. REMOVE TIMING BELT GUIDE



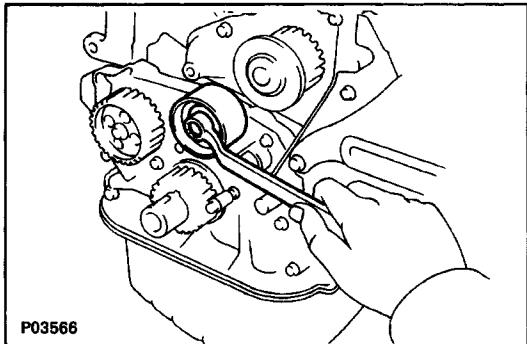
23. REMOVE TIMING BELT

HINT (When re-using timing belt): Draw a direction arrow on the timing belt (in the direction of engine revolution), and place matchmarks on the timing belt and crankshaft timing pulley.

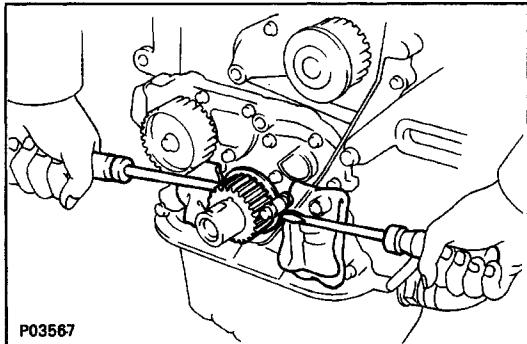


24. REMOVE NO.1 IDLER PULLEY

Remove the pivot bolt, pulley and plate washer.

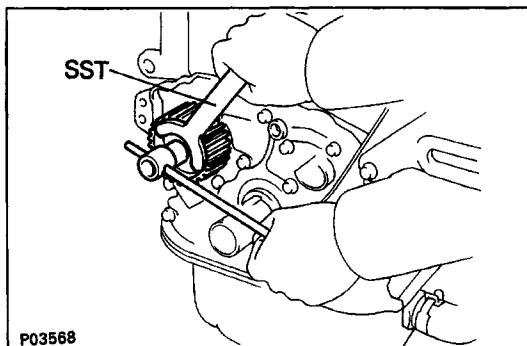
**25. REMOVE NO.2 IDLER PULLEY**

Remove the bolt and pulley.

**26. REMOVE CRANKSHAFT TIMING PULLEY**

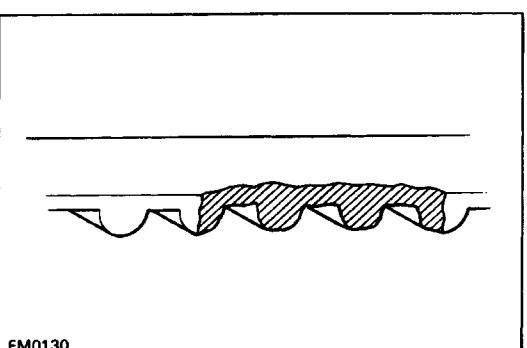
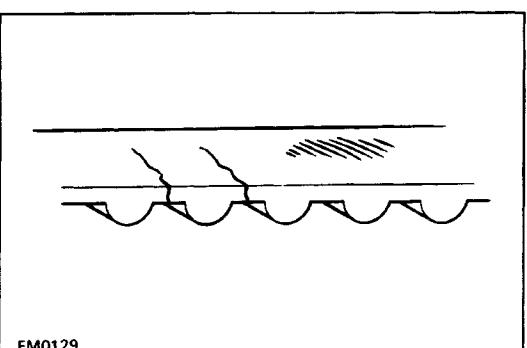
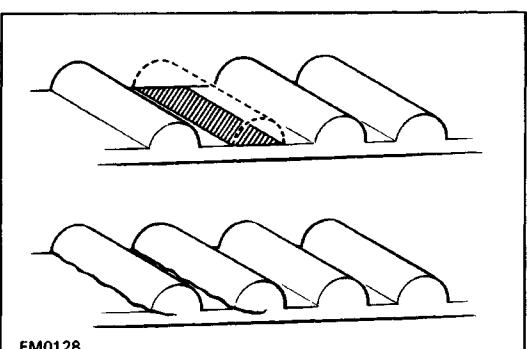
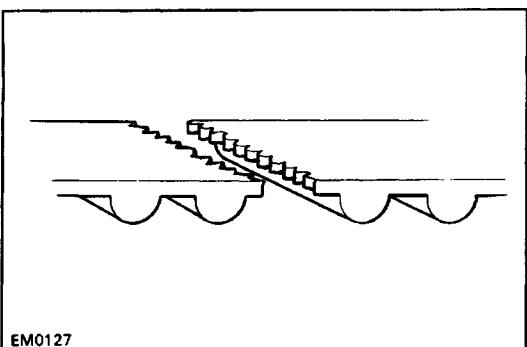
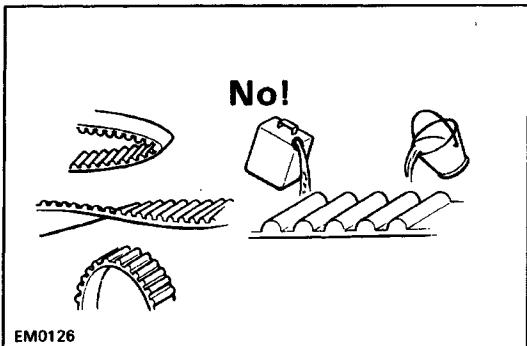
If the pulley cannot be removed by hand, use two screwdrivers.

HINT: Position shop rags as shown to prevent damage.

**27. REMOVE OIL PUMP PULLEY**

Using SST, remove the nut and pulley.

SST 09616-30011



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 mounting bolt of the camshaft timing pulley.

If there are any defects as shown in the illustrations, check the following points:

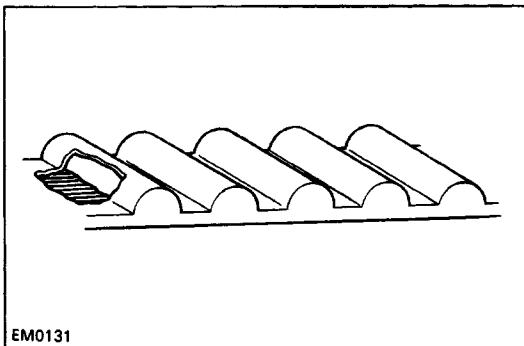
(a) Premature parting

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

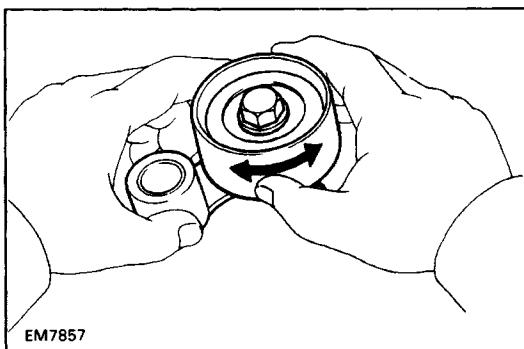
(b) If the belt teeth are cracked or damaged, check to see if either the camshaft or water pump is locked.

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

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

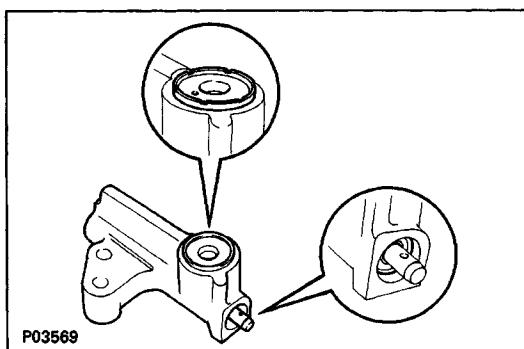


(e) If there is noticeable wear on the belt teeth, check the timing cover for damage, correct gasket installation and the foreign material on the pulley teeth. If necessary, replace the timing belt.



2. INSPECT IDLER PULLEYS

Check that the idler pulley turns smoothly. If necessary, replace the idler pulley.

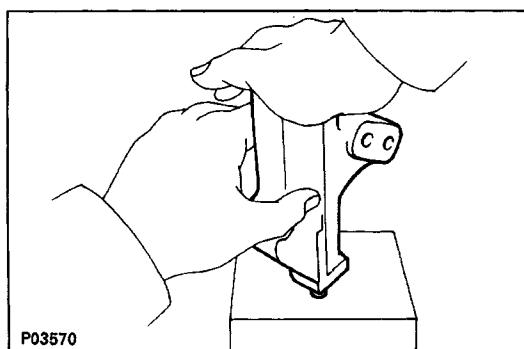


3. INSPECT TIMING BELT TENSIONER

(a) Visually check tensioner for oil leakage.

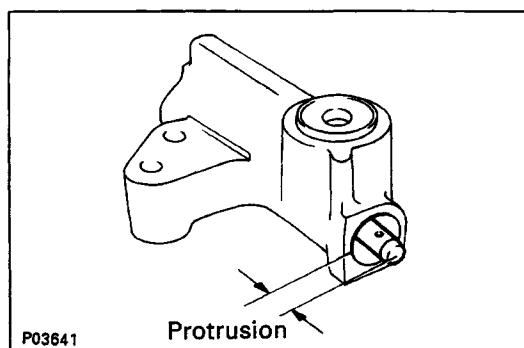
HINT: If there is only a small trace of oil on the seal of the push rod, the tensioner is all right.

If leakage is found, replace the tensioner.



(b) Hold the tensioner with both hands, and push the push rod strongly against the floor or wall to check that it doesn't move.

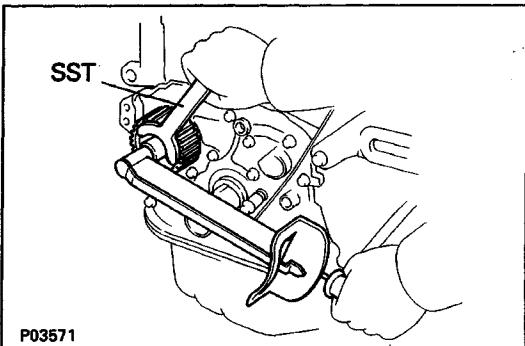
If the push rod moves, replace the tensioner.



(c) Measure the protrusion of the push rod from the housing end.

Protrusion: 8.5 – 9.5 mm (0.335 – 0.374 in.)

If the protrusion is not as specified, replace the tensioner.



INSTALLATION OF TIMING BELT

(See page [EM-46](#))

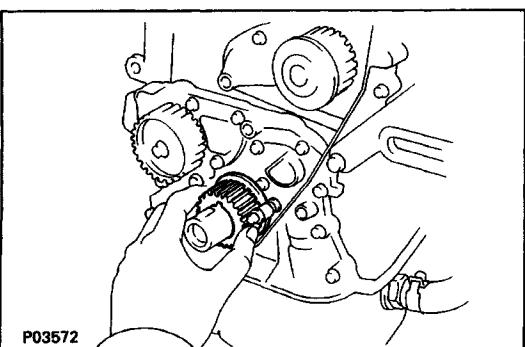
1. INSTALL OIL PUMP PULLEY

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

(b) Using SST, install the nut.

SST 09616-30011

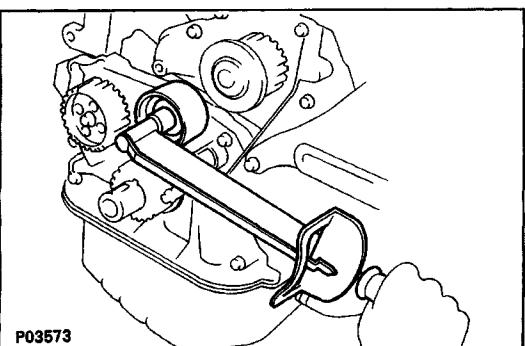
Torque: 35 N·m (355 kgf·cm, 26 ft-lbf)



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.

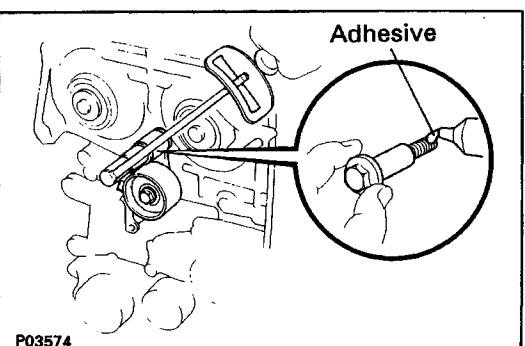


3. INSTALL NO.2 IDLER PULLEY

(a) Install the pulley with the bolt.

Torque: 43 N·m (440 kgf·cm, 32 ft-lbf)

(b) Check that the idler pulley moves smoothly.



4. INSTALL NO.1 IDLER PULLEY

(a) Apply adhesive to two or three threads of the pivot bolt.

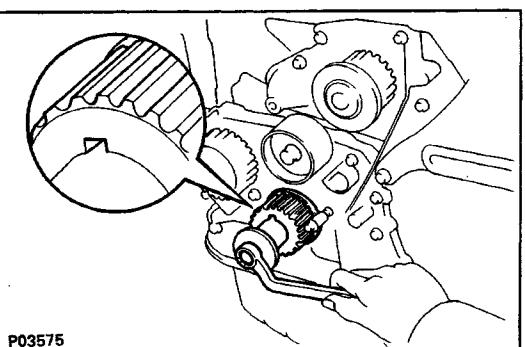
Adhesive: Part No. 08833-00080, THREE BOND 1344,

LOCTITE 242 or equivalent

(b) Install the plate washer and pulley with the pivot bolt.

Torque: 52 N·m (530 kgf·cm, 38 ft-lbf)

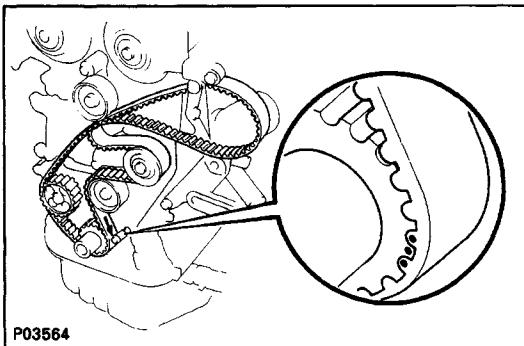
(c) Check that the pulley bracket moves smoothly.



5. TEMPORARILY INSTALL TIMING BELT

NOTICE: The engine should be cold.

(a) Using the crankshaft pulley bolt, turn the crankshaft and face the key groove of the crankshaft timing pulley upward.



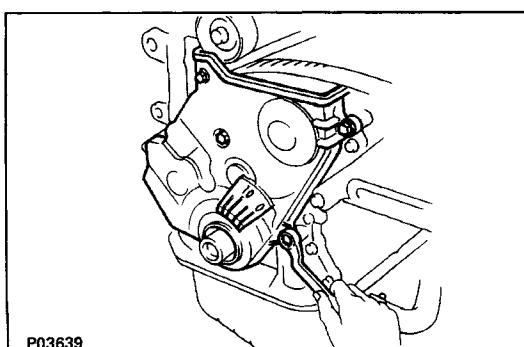
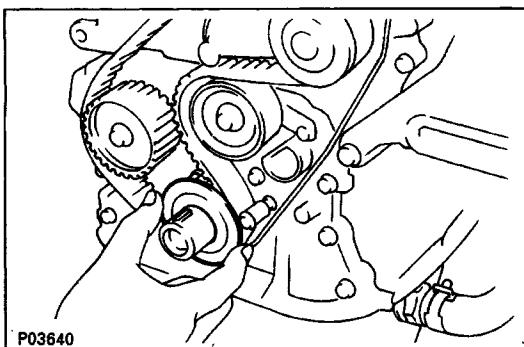
- (b) Remove any oil or water on the crankshaft pulley, oil pump pulley, water pump pulley, No.1 idler pulley and No.2 idler pulley, and keep them clean.

- (c) Install the timing belt on the crankshaft timing pulley, oil pump pulley, No.2 idler pulley, water pump pulley and No.1 idler pulley.

HINT (when re-using timing belt) : Align the matchmarks of the crankshaft timing pulley and timing belt, and install the belt with the arrow pointing in the direction of engine revolution.

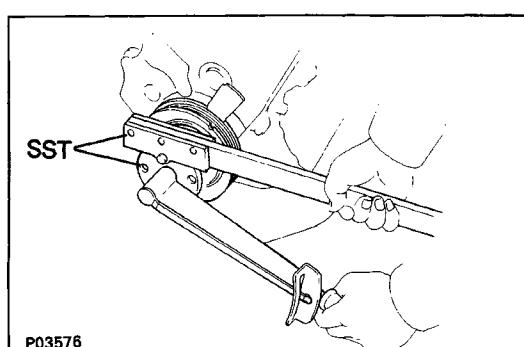
6. INSTALL TIMING BELT GUIDE

Install the guide, facing the cup side outward.



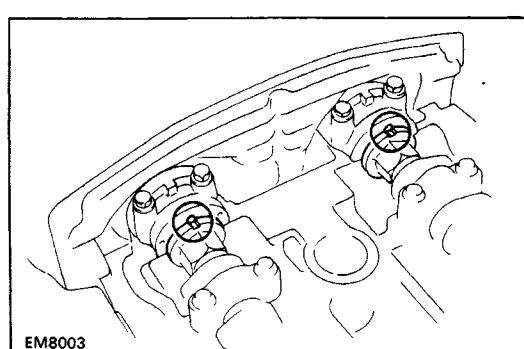
7. INSTALL NO.1 TIMING BELT COVER

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



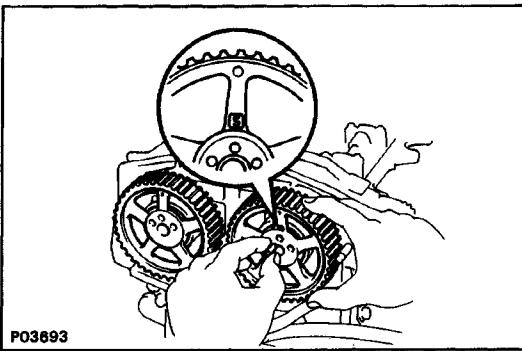
8. INSTALL CRANKSHAFT PULLEY

- (a) Align the pulley set key with the key groove of the pulley, and slide on the pulley.
- (b) Using SST, install and torque the bolt.
SST 09213-54015 (90119-08216) and 09330-00021
Torque: 108 N·m (1,100 kgf·cm, 80 ft-lbf)

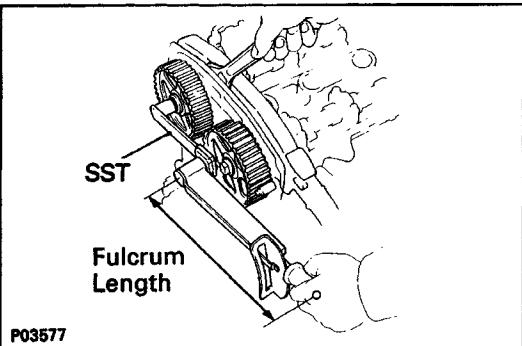


9. INSTALL CAMSHAFT TIMING PULLEYS

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



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



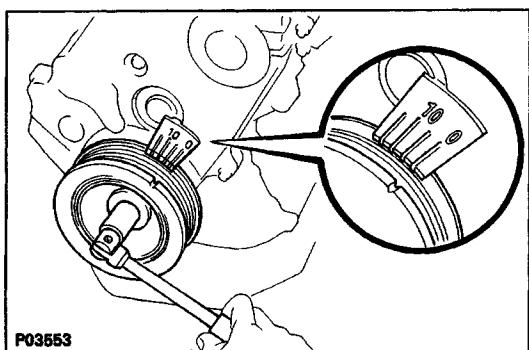
- (d) Hold the hexagon wrench head portion of the camshaft with a wrench, and tighten the bolts.

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

41 N·m (420 kgf·cm, 30 ft·lbf)

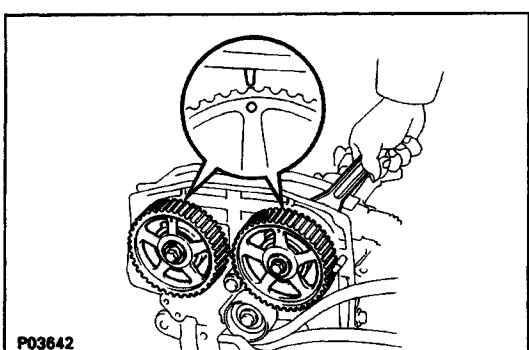
HINT (intake. camshaft timing pulley):

- Use SST.
SST 09249-63010
- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

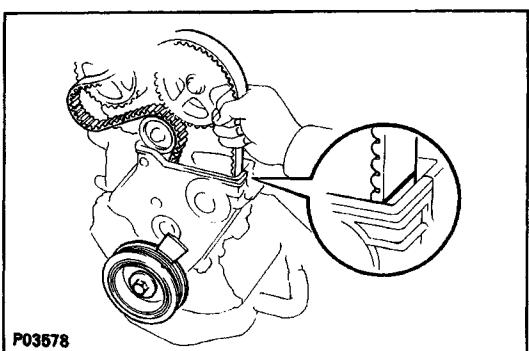


10. SET NO.1 CYLINDER TO TDC/COMPRESSION

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



- (b) Turn the camshaft, and align the timing marks of the camshaft timing pulleys and No.3 timing belt cover.

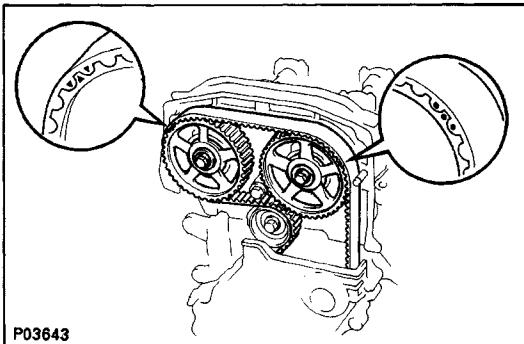


11. INSTALL TIMING BELT

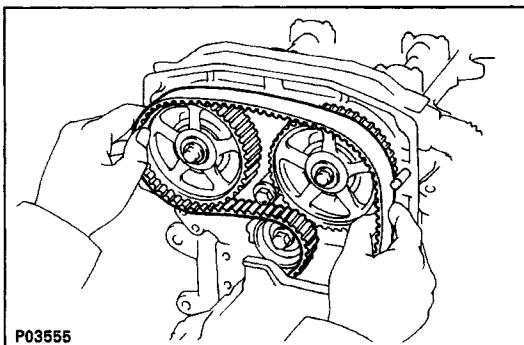
HINT (When re-using timing belt):

- Check that the matchmark on the timing belt matches the end of the No.1 timing belt cover.

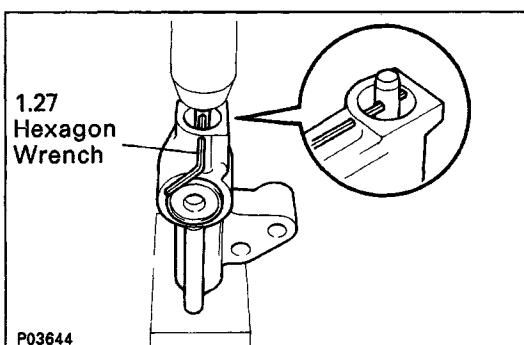
If the matchmark does not align, shift the meshing of the timing belt and crankshaft timing pulley until they align.
(See page [EM-50](#))



- Align the matchmarks of the timing belt and camshaft timing pulleys.

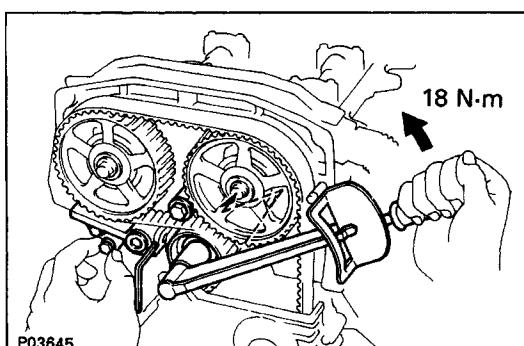


- Remove any oil or water on the camshaft timing pulley, and keep it clean.
- Install the timing belt, checking the tension between the crankshaft timing pulley and intake camshaft timing pulley.



12. SET TIMING BELT TENSIONER

- Using a press, slowly press in the push rod using 100 – 1,000 kg (220 – 2,205 lb, 981 – 9,807 N) of pressure.
- Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.
- Release the press.



13. INSTALL TIMING BELT TENSIONER

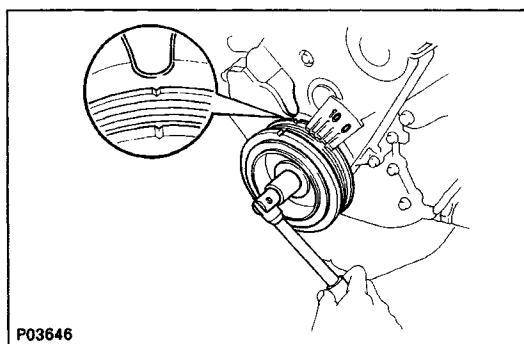
- Turn the No.1 idler pulley bolt counterclockwise to obtain the specified torque toward the left as far as the No.1 idler pulley will go, and temporarily install the tensioner with the two bolts.

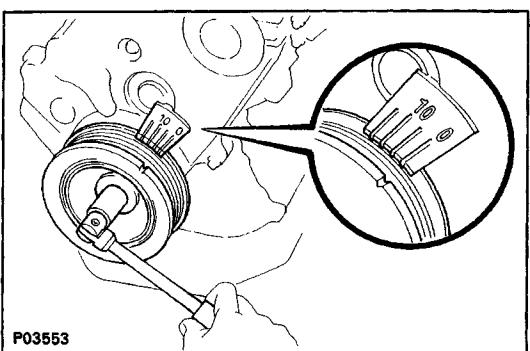
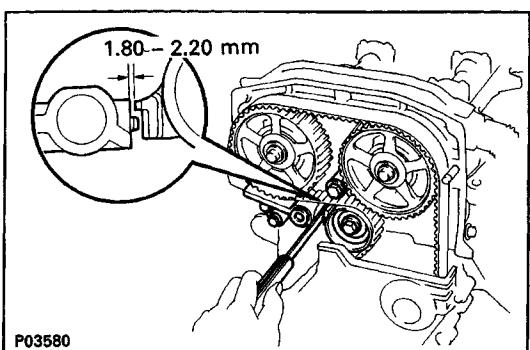
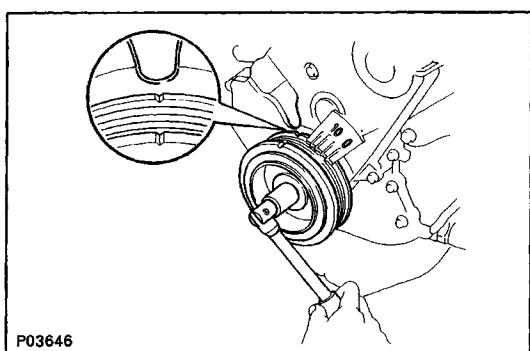
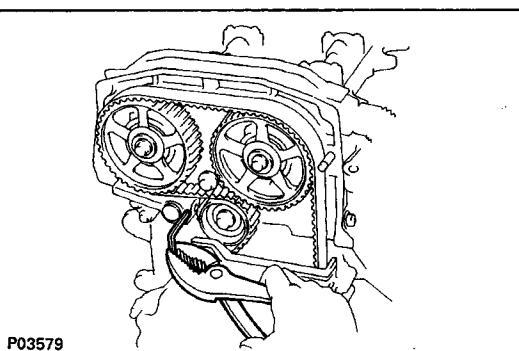
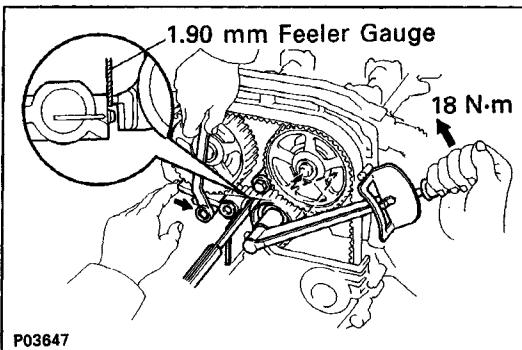
Torque: 18 N·m (180 kgf·cm, 13 ft-lbf)

NOTICE: To apply the correct torque, apply the torque wrench along the axis through the bolts of the No.1 idler pulley and exhaust camshaft timing pulley.

- Slowly turn the crankshaft pulley 5/6 revolution, and align its groove with the ATDC 60° mark of the No.1 timing belt cover.

NOTICE: Always turn the crankshaft clockwise.





- (c) Insert a 1.90 mm (0.075 in.) feeler gauge between the tensioner body and No.1 idler pulley stopper.
- (d) Turn the No.1 idler pulley bolt counterclockwise to obtain the specified torque.

Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)

NOTICE: To apply the correct torque, apply the torque wrench along the axis through the bolts of the No.1 idler pulley and exhaust camshaft timing pulley.

- (e) While pushing the tensioner, alternately tighten the two bolts.

Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

- (f) Remove the 1.90 mm (0.075 in.) feeler gauge.
- (g) Remove the 1.27 mm hexagon wrench from the tensioner.

- (h) Slowly turn the crankshaft pulley one revolution, and align its groove with the ATDC 60° mark of the

No.1 timing belt cover.

NOTICE: Always turn the crankshaft clockwise.

- (i) Using a feeler gauge, check the specified clearance between the tensioner body and No.1 idler pulley stopper.

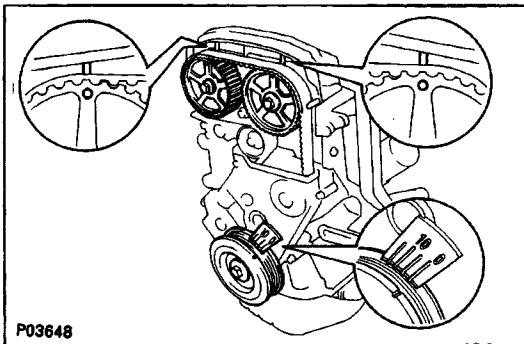
Clearance: 1.80 – 2.20 mm (0.071 – 0.087 in.)

If the clearance is not as specified, remove the tensioner and reinstall it.

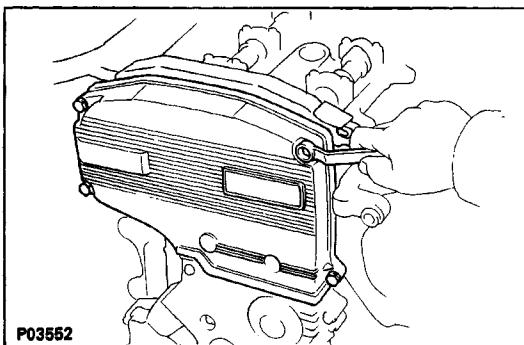
14. CHECK VALVE TIMING

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

NOTICE: Always turn the crankshaft clockwise.



(b) 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.



15. INSTALL NO.2 TIMING BELT COVER

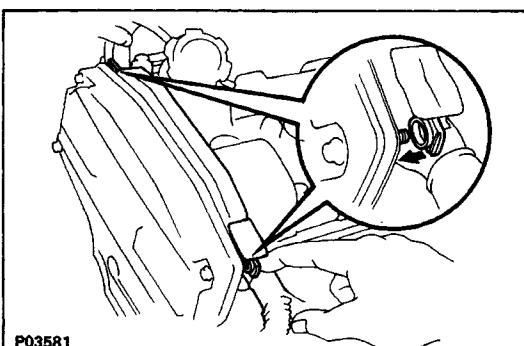
(a) Install the gasket to the timing belt cover.
(b) Install the belt cover with the five bolts.

16. INSTALL SPARK PLUGS (See page [IG-13](#))

Torque: 18 N·m (180 kgf·cm, 13 ft-lbf)

17. INSTALL CYLINDER HEAD COVER

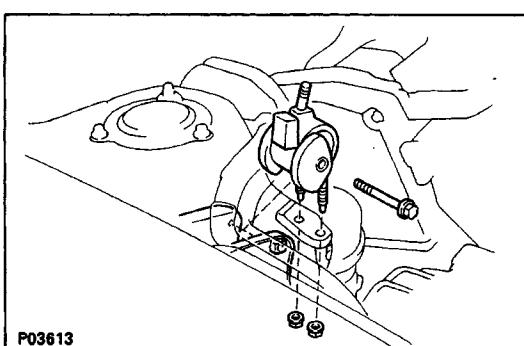
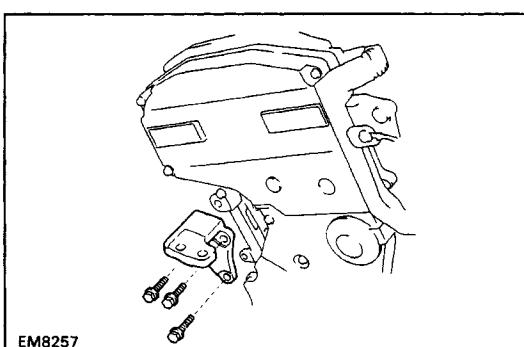
(a) Install the cylinder head cover.
(See step 7 on pages [EM-143](#) and 144)
(b) Install the engine wire protector between the cylinder head cover and No.3 timing belt cover.



18. INSTALL RH ENGINE MOUNTING BRACKET

Install the mounting bracket with the three bolts.

Torque: 52 N·m (530 kgf·cm, 38 ft-lbf)



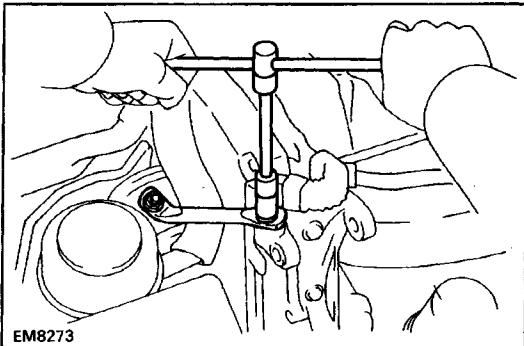
19. INSTALL RH ENGINE MOUNTING INSULATOR

Install the mounting insulator with the through bolt and two nuts.

Torque:

Nut **52 N·m (530 kgf·cm, 38 ft-lbf)**

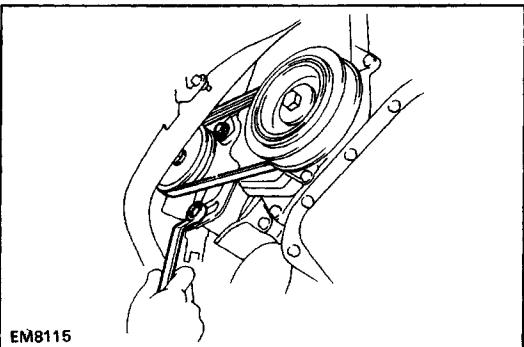
Through bolt **87 N·m (890 kgf·cm, 64 ft-lbf)**



20. INSTALL RH ENGINE MOUNTING STAY

Install the mounting stay with the bolt and nut.

Torque: 73 N·m (740 kgf·cm, 54 ft-lbf)



21. INSTALL PS DRIVE BELT

Install the drive belt with the pivot bolt and adjusting bolt.

22. INSTALL THROTTLE BODY

(See steps 2, 3, 5 to 8, 10 and 11 on pages [FI-197](#) and [198](#))

23. INSTALL EGR VALVE AND PIPE

(See step 19 on page [EM-145](#))

24. INSTALL EGR VACUUM MODULATOR AND VSV

(See step 20 on page [EM-146](#))

25. INSTALL INTERCOOLER

(See steps 11 to 13 on page [TC-17](#))

26. INSTALL ALTERNATOR (See page [CH-23](#))

27. INSTALL RH ENGINE UNDER COVER

28. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

29. CHECK AND ADJUST DRIVE BELTS

(a) Adjust the alternator drive belt.

Drive belt tension:

w/ A/C	New belt	165 \pm 10 lbf
	Used belt	84 \pm 15 lbf
w/o A/C	New belt	150 \pm 25 lbf
	Used belt	130 \pm 20 lbf

(b) Adjust the PS drive belt.

Drive belt tension: New belt 125 \pm 25 lbf

Used belt 80 \pm 20 lbf

30. INSTALL RH FRONT WHEEL

ADJUSTMENT OF VALVE TIMING

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

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

2. REMOVE RH FRONT WHEEL

3. REMOVE RH ENGINE UNDER COVER

4. REMOVE ALTERNATOR (See page **CH-7**)

5. REMOVE INTERCOOLER

(See steps 13 to 15 on pages **TC-9** and **10**)

6. REMOVE SPARK PLUGS

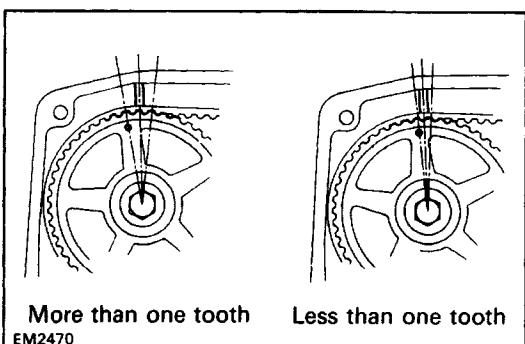
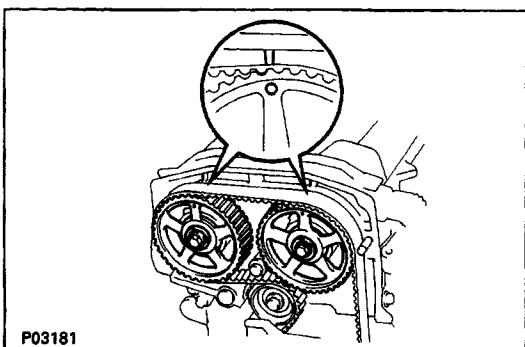
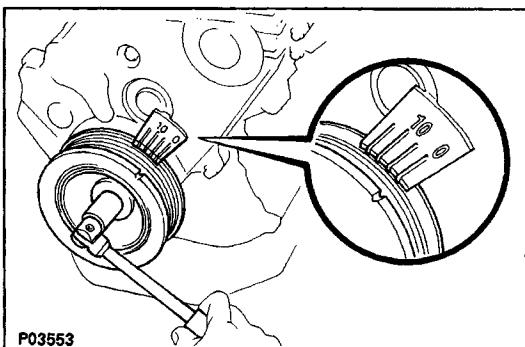
7. REMOVE NO.2 TIMING BELT COVER

(See step 16 on page **EM-48**)

8. CHECK CAMSHAFT TIMING PULLEY MARKS

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

NOTICE: Always turn the crankshaft clockwise.



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

- If there is more than one timing pulley tooth between the timing marks, realign the timing marks in accordance with step 13.
- If the timing marks are aligned or the difference is less than one timing pulley tooth, proceed to step 14.

9. REMOVE EGR VACUUM MODULATOR AND VSV

(See step 20 on page [EM-121](#))

10. REMOVE EGR VALVE AND PIPE

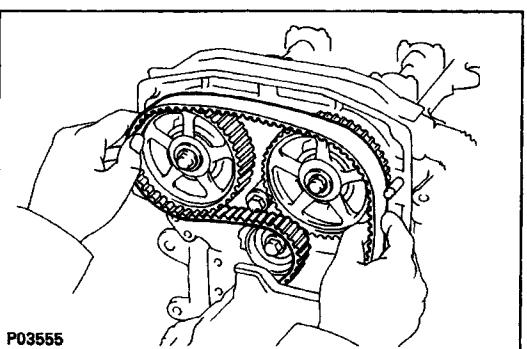
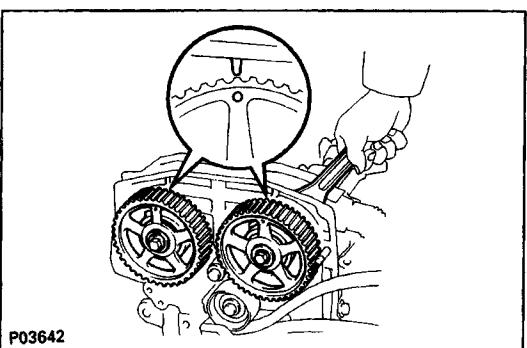
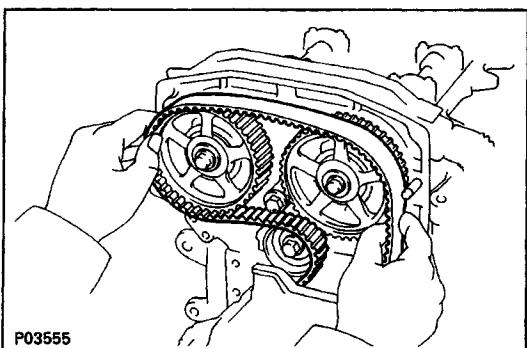
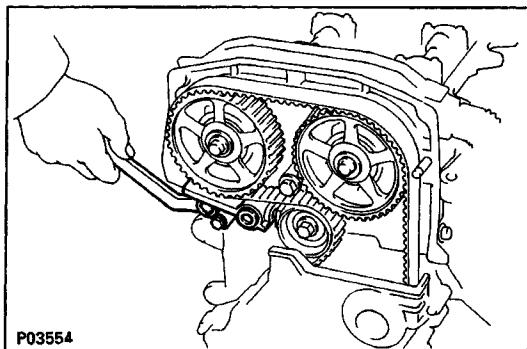
(See step 21 on page [EM-121](#))

11. REMOVE THROTTLE BODY

(See steps 2, 3, 5 to 8, 10 and 11 on pages [FI-194](#) and [195](#))

12. REMOVE CYLINDER HEAD COVER

(See step 33 on page. [EM-124](#))

**13. ADJUST CAMSHAFT TIMING PULLEY TIMING MARKS**

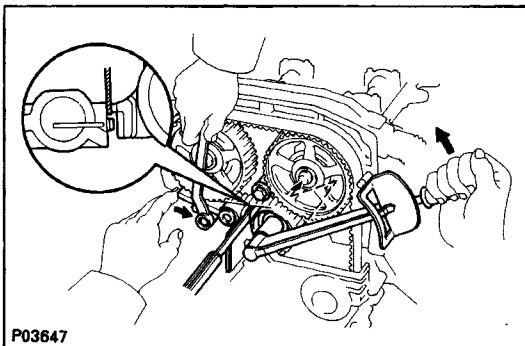
(a) Remove the two bolts and timing belt tensioner.

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

(c) Rotate the camshaft with a wrench and align the alignment marks of the camshaft timing pulley and No.3 timing belt cover.

(d) Reinstall the timing belt, checking the tension between the crankshaft timing pulley and intake camshaft timing pulley.

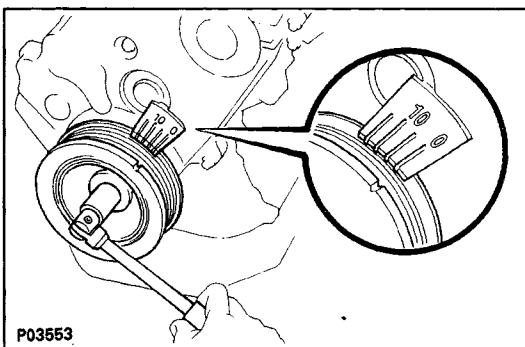
NOTICE: Install the timing belt when the engine is cold.



(e) Install the timing belt tensioner with the two bolts.

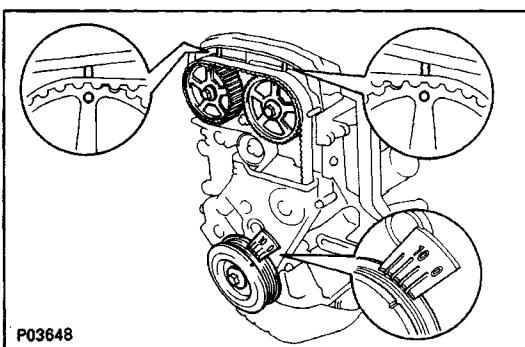
(See steps 12 and 13 on page [EM-58](#))

Torque: 21 N·m (210 kgf·cm, 15 ft-lbf)

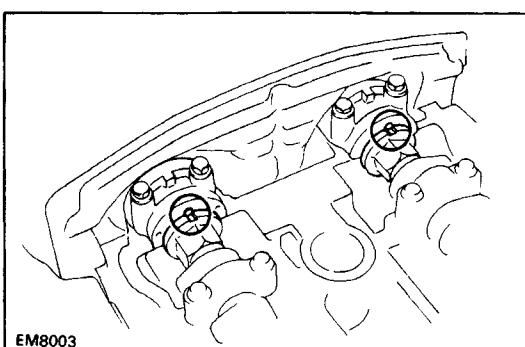


(f) Turn the crankshaft pulley two revolutions from TDC to TDC.

NOTICE: Always turn the crankshaft clockwise.



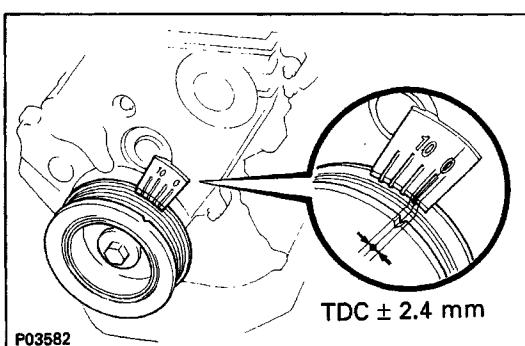
(g) Check that each pulley aligns with the timing marks as shown in the illustration.



14. CHECK VALVE TIMING

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

NOTICE: Always turn the crankshaft clockwise.

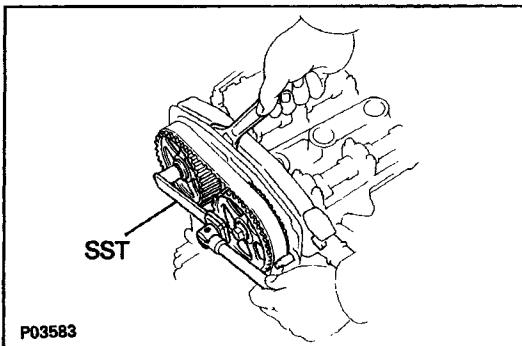


(b) Next make a note of the crankshaft pulley angle on the No.1 timing belt cover.

HINT: Perform this check separately for the intake and exhaust sides.

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

If it is greater than 2.4 mm (0.094 in.), go back to step 11.

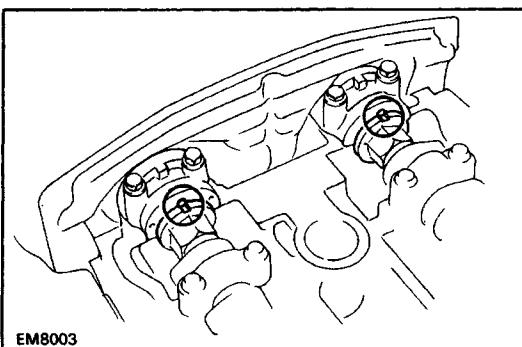


15. ADJUST VALVE TIMING

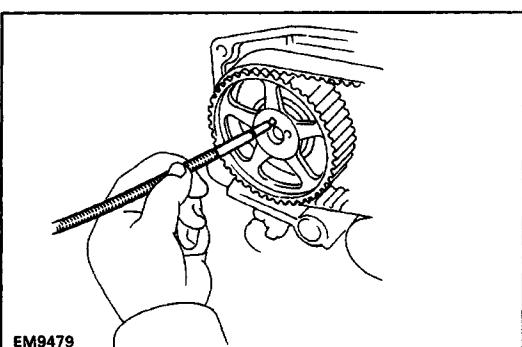
(a) Hold the hexagon wrench head portion of the camshaft with a wrench, and remove the two camshaft timing pulley bolts.

HINT (Intake camshaft timing pulley): Use SST.
SST 09249-63010

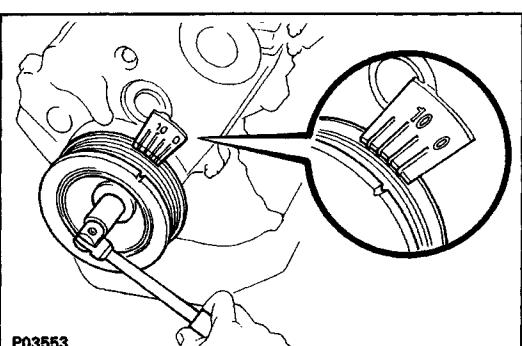
NOTICE: Do not make use of the timing belt tension when loosening the pulley bolts.



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

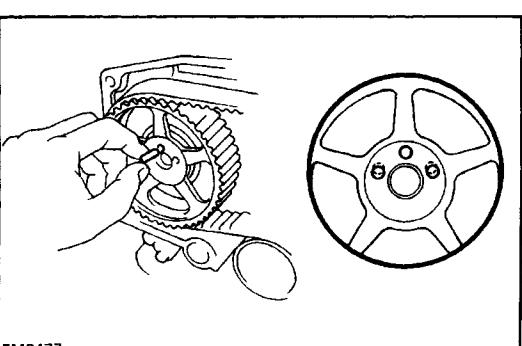


(c) Using a magnetic finger, remove the knock pin from the pin hole of the camshaft timing pulley.



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

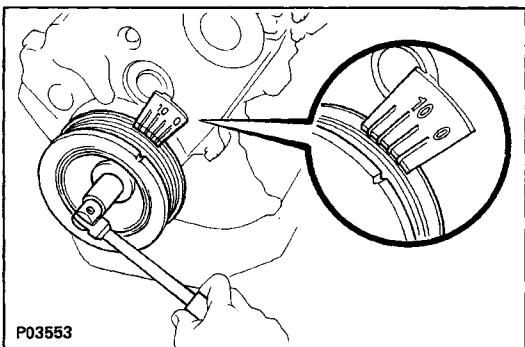
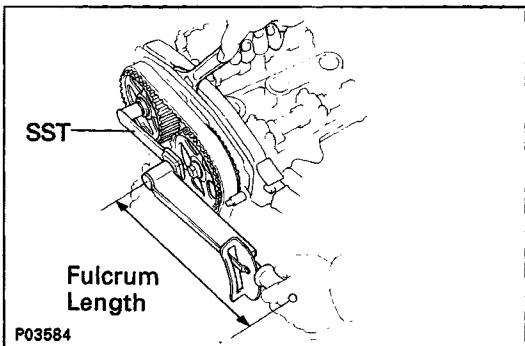
NOTICE: Always turn the crankshaft clockwise.



(e) Select one overlapped hole of the camshaft and timing pulley, and insert the match pin into it.

HINT:

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



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

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

41 N·m (420 kgf·cm, 30 ft-lbf) for SST

HINT (Intake camshaft timing pulley):

- Use SST.
SST 09249-63010
- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

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

(g) Turn the crankshaft clockwise two revolutions from TDC to TDC.

(h) Recheck the valve timing.

(See step 14 on page [EM-64](#))

16. REINSTALL NO.2 TIMING BELT COVER

(See step 15 on page [EM-60](#))

17. REINSTALL SPARK PLUGS (See page [IG-13](#))

Torque: 180 kg·cm (13 ft-lb, 18 N·m)

18. REINSTALL CYLINDER HEAD COVER

(See step 7 on pages [EM-143](#) and 144)

19. REINSTALL THROTTLE BODY

(See steps 2, 3, 5 to 8, 10 and 11 on pages [FI-197](#) and 198)

20. REINSTALL EGR VALVE AND PIPE

(See step 19 on page [EM-145](#))

21. REINSTALL EGR VACUUM MODULATOR AND VSV

(See step 20 on page [EM-146](#))

22. REINSTALL INTERCOOLER

(See steps 11 to 13 on page [TC-17](#))

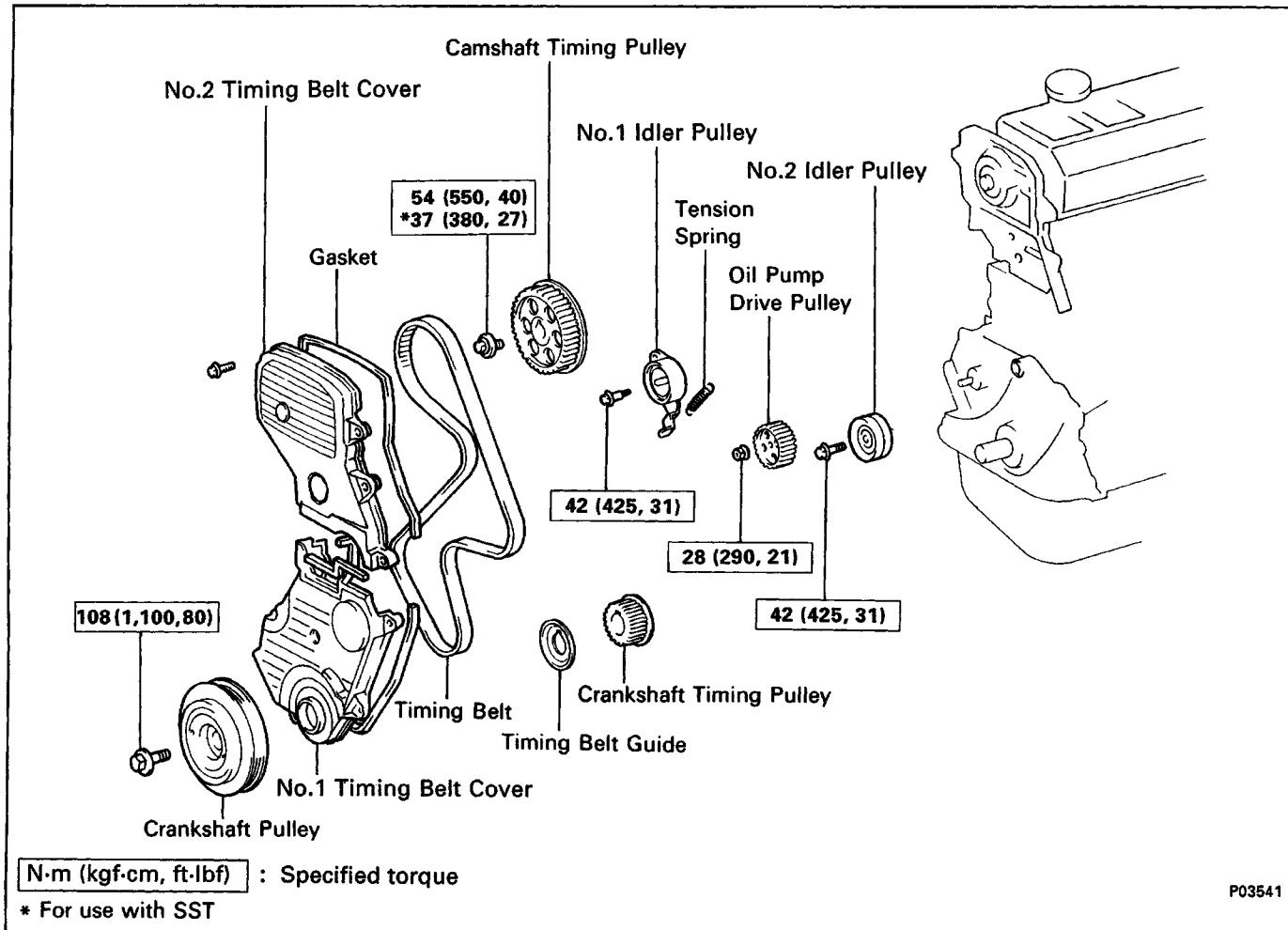
23. REINSTALL ALTERNATOR (See page [CH-23](#))

24. REINSTALL RH ENGINE UNDER COVER

25. REINSTALL RH FRONT WHEEL

26. RECONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

TIMING BELT (5S-FE) COMPONENTS



REMOVAL OF TIMING BELT

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

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

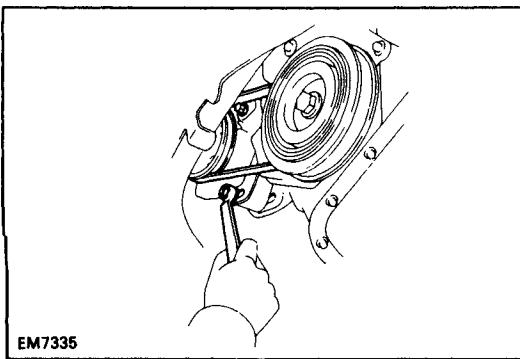
2. REMOVE RH FRONT WHEEL

3. REMOVE RH ENGINE UNDER COVER

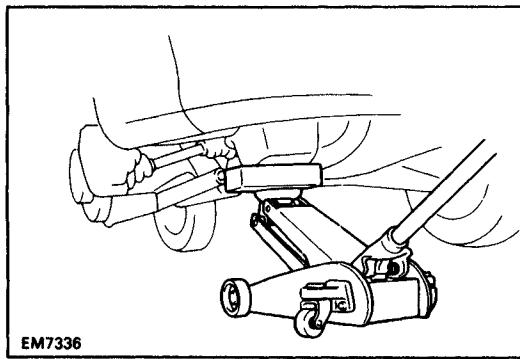
4. (w/ CRUISE CONTROL SYSTEM (w/o ABS))

REMOVE CRUISE CONTROL ACTUATOR
(See page 11 on page [EM-270](#))

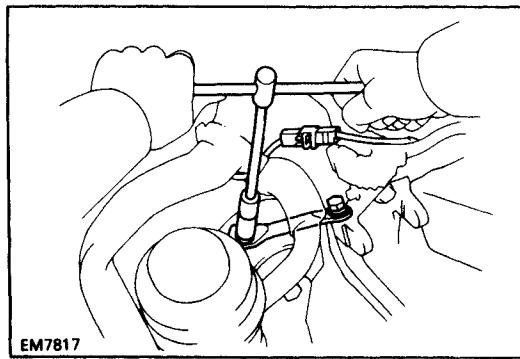
5. REMOVE ALTERNATOR (See page [CH-9](#))

**6. REMOVE PS DRIVE BELT**

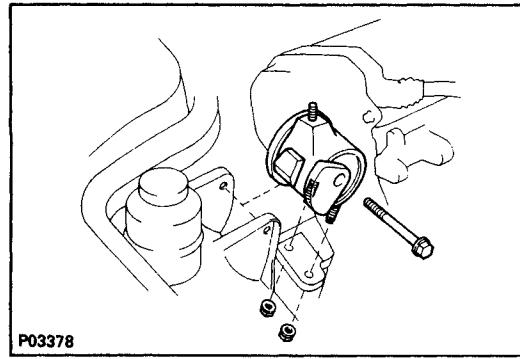
Loosen the two bolts, and remove the drive belt.

**7. SLIGHTLY JACK UP ENGINE**

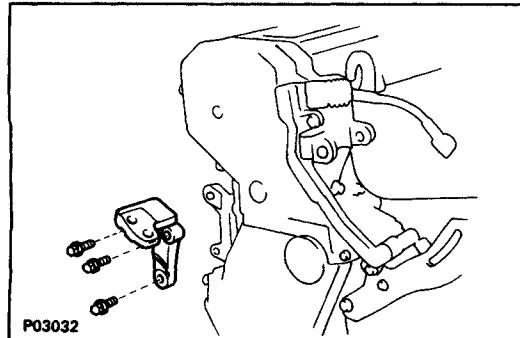
Raise the engine enough to remove the weight from the engine mounting on the right side.

**8. DISCONNECT CONNECTOR FROM GROUND WIRE
ON RH FENDER APRON****9. REMOVE RH ENGINE MOUNTING STAY**

Remove the bolt, nut and mounting stay.

10. DISCONNECT PS RESERVOIR TANK FROM BRACKET**11. REMOVE RH ENGINE MOUNTING INSULATOR**

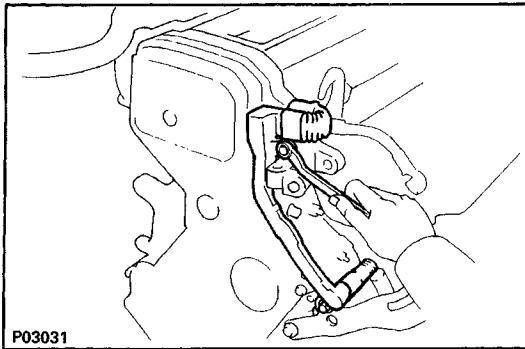
Remove the through bolt, two nuts and mounting insulator.

**12. REMOVE RH ENGINE MOUNTING BRACKET**

Remove the three bolts and mounting bracket.

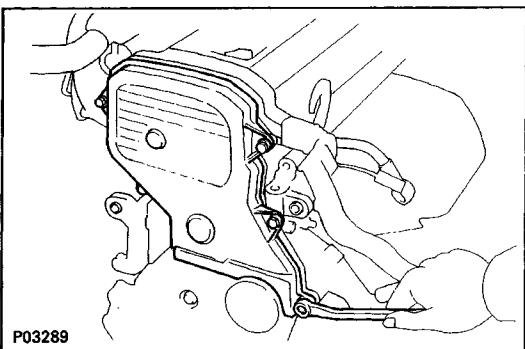
HINT: Lower the jack and perform the operation with the engine fully down.

13. REMOVE SPARK PLUGS



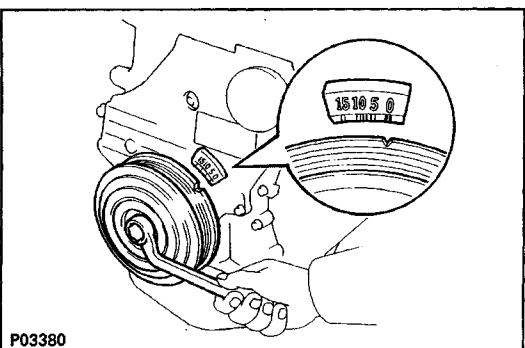
14. DISCONNECT ENGINE WIRE FROM ALTERNATOR BRACKET AND ADJUSTING BAR

Remove the two bolts, and disconnect the engine wire from the alternator bracket and adjusting bar.



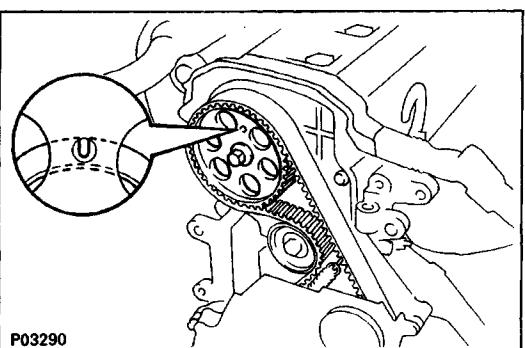
15. REMOVE NO.2 TIMING BELT COVER

Remove the five bolts, timing belt cover and two gaskets.

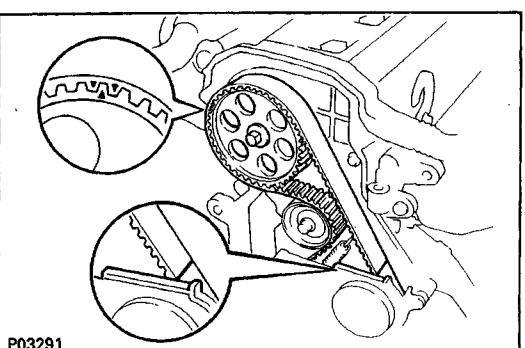


16. SET NO.1 CYLINDER TO TDC/COMPRESSION

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

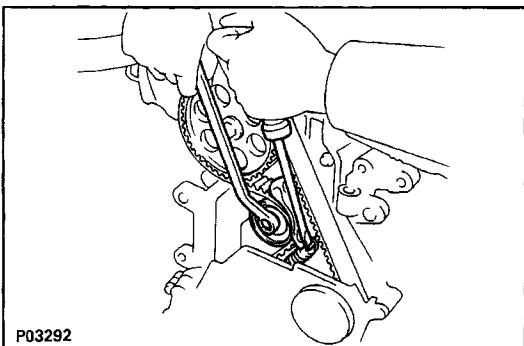


(b) Check that the hole of the camshaft timing pulley is aligned with the timing mark of the bearing cap. If not, turn the crankshaft one revolution (360°).

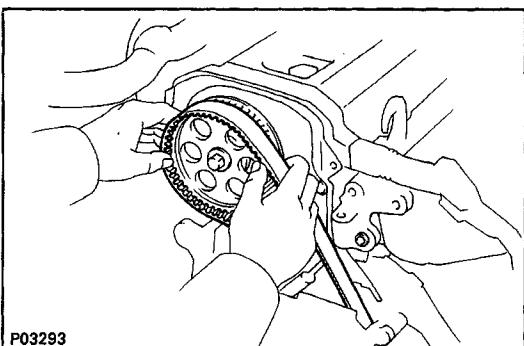


17. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEY

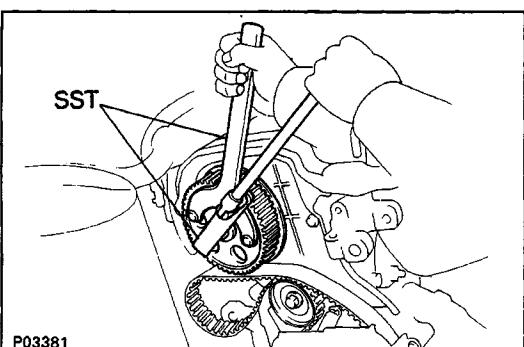
HINT (When re-using timing belt): Place the matchmarks on the timing belt and camshaft timing pulley, and place matchmark on timing belt to match the end of the No.1 timing belt cover.



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



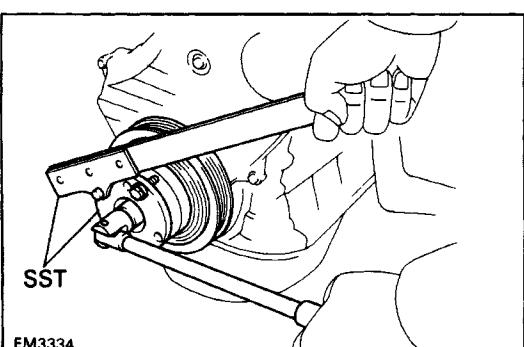
(b) Remove the timing belt from the camshaft timing pulley.



18. REMOVE CAMSHAFT TIMING PULLEY

Using SST, remove the bolt, plate washer and timing pulley.

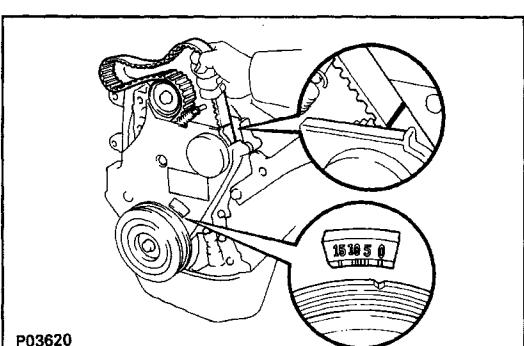
SST 09249-63010 and 09278-54012



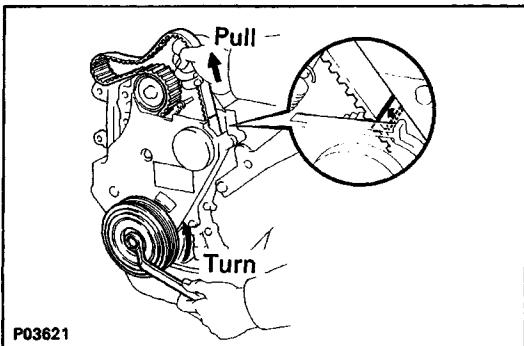
19. REMOVE CRANKSHAFT PULLEY

(a) Using SST, remove the pulley bolt.

SST 09213-54015 (09214-00030) and 09330-00021

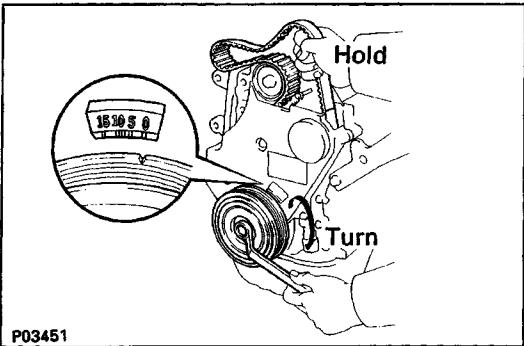


HINT (When re-using timing belt): After loosening the crankshaft pulley bolt, check that the timing belt matchmark aligns with the end of the No.1 timing belt cover when the crankshaft pulley groove is aligned with the timing mark "0" of the No.1 timing belt cover. If the matchmark does not align, align as follows:

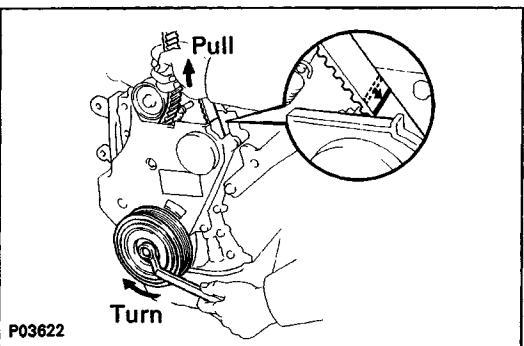


(When matchmark is out of alignment on clockwise)

- Align the matchmark by pulling the timing belt up on the water pump pulley side while turning the crankshaft pulley counterclockwise.

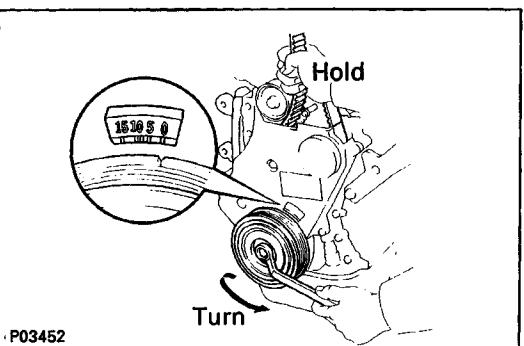


- After aligning the matchmark, hold the timing belt. And turn the crankshaft pulley clockwise, and align its groove with timing mark "0" of the No.1 timing belt cover.

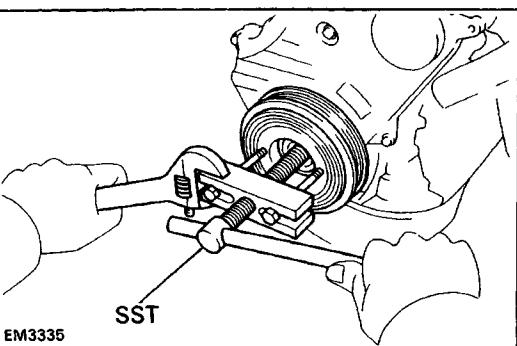


(When matchmark is out of alignment on counter-clockwise)

- Align the matchmark by pulling the timing belt up on the No.1 idler pulley side while turning the crankshaft pulley clockwise.



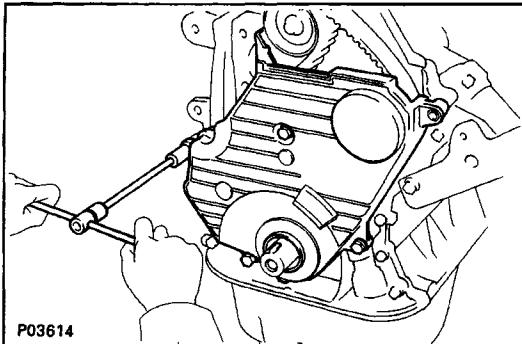
- After aligning the matchmark, hold the timing belt. And turn the crankshaft pulley counterclockwise, and align its groove with timing mark "0" of the No.1 timing belt cover.



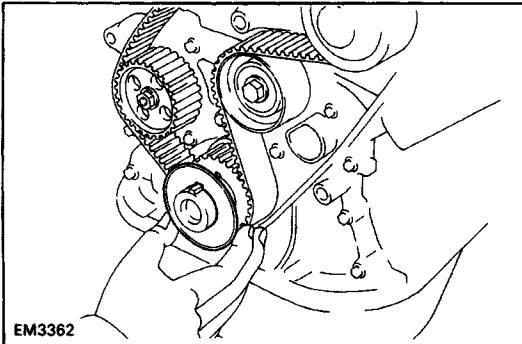
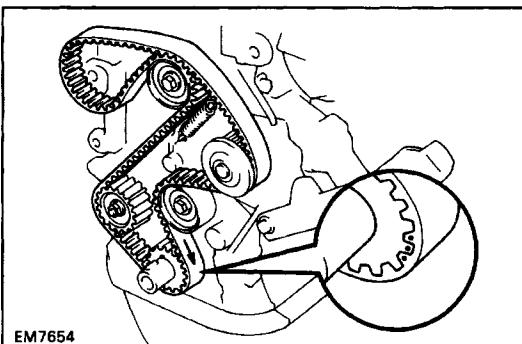
(b) Using SST, remove the pulley.

SST 09213-60017 (09213-00020, 09213-00030, 09213-00050)

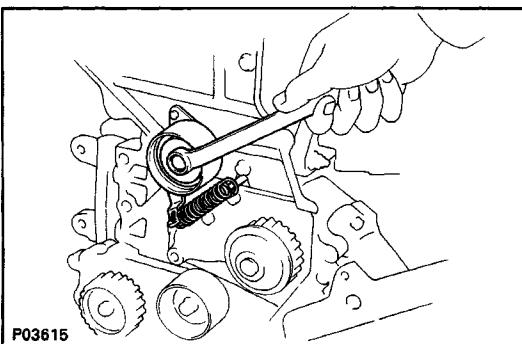
HINT (When re-using timing belt): Remove the pulley without turning it.

**20. REMOVE NO.1 TIMING BELT COVER**

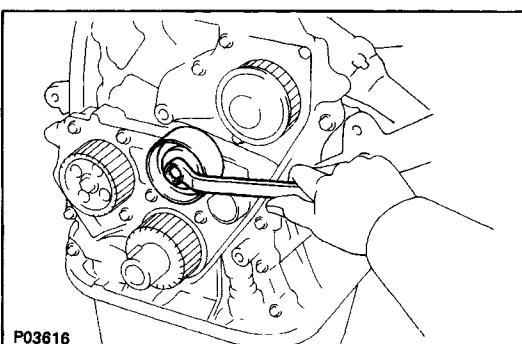
Remove the four bolts, timing belt cover and gasket.

**21. REMOVE TIMING BELT GUIDE****22. REMOVE TIMING BELT**

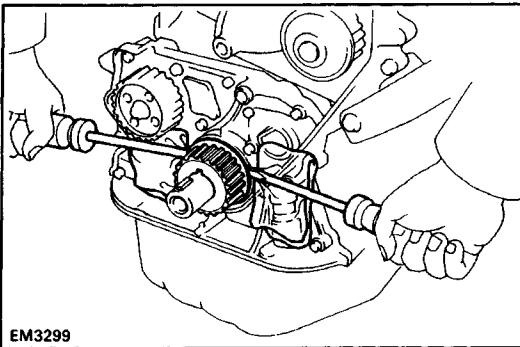
HINT (When re-using timing belt): Draw a direction arrow on the timing belt (in the direction of engine revolution), and place matchmarks on the timing belt and crankshaft timing pulley.

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

Remove the bolt, pulley and tension spring.

**24. REMOVE NO.2 IDLER PULLEY**

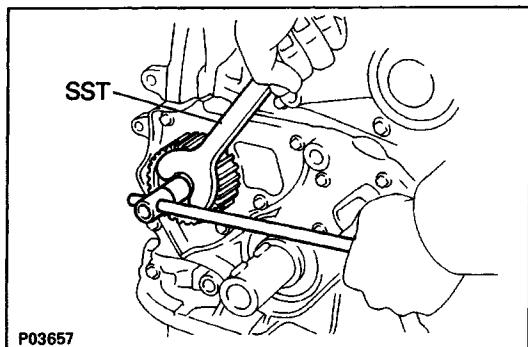
Remove the bolt and pulley.



25. REMOVE CRANKSHAFT TIMING PULLEY

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

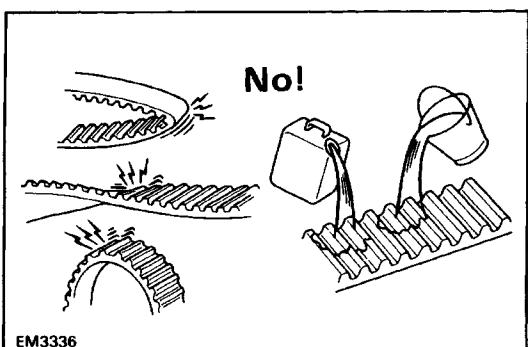
HINT: Position shop rags as shown to prevent damage.



26. REMOVE OIL PUMP PULLEY

Using SST, remove the nut and pulley.

SST 09616-30011



INSPECTION OF TIMING BELT COMPONENTS

1. INSPECT TIMING BELT

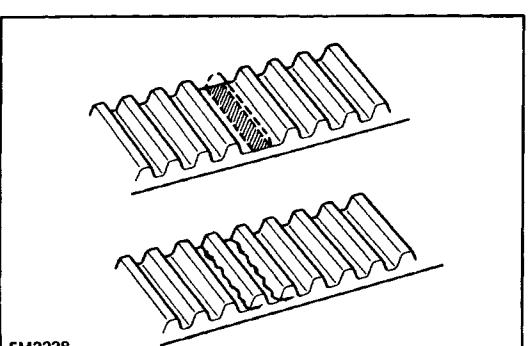
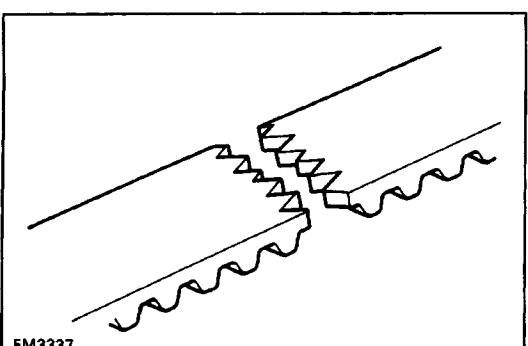
NOTICE:

- 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 mounting bolt of the camshaft timing pulley.

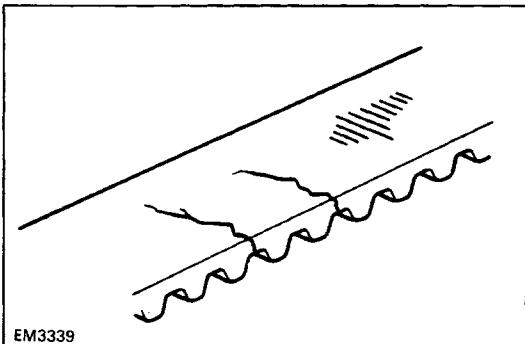
If there are any defects as shown in the illustrations, check the following points:

(a) Premature parting

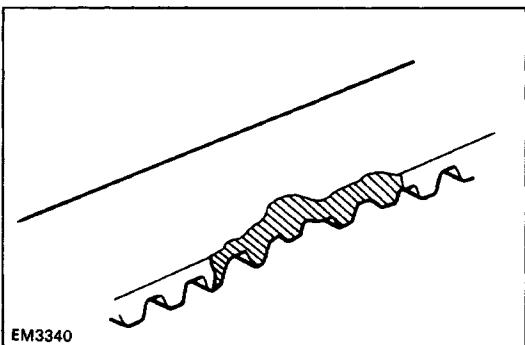
- Check the proper installation.
- Check the timing cover gasket for damage and proper installation.



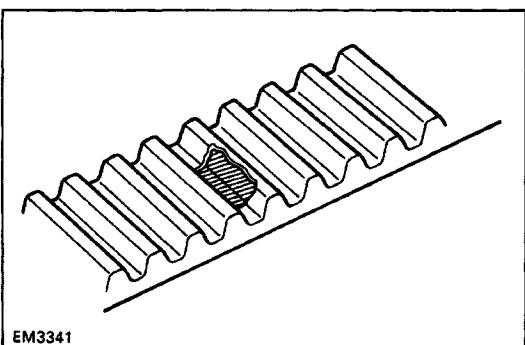
(b) If the belt teeth are cracked or damaged, check to see if either camshaft or water pump is locked.



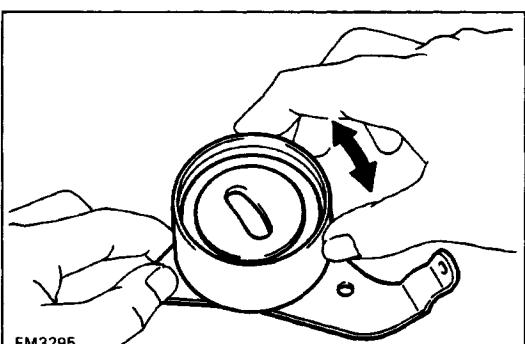
(c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock.



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

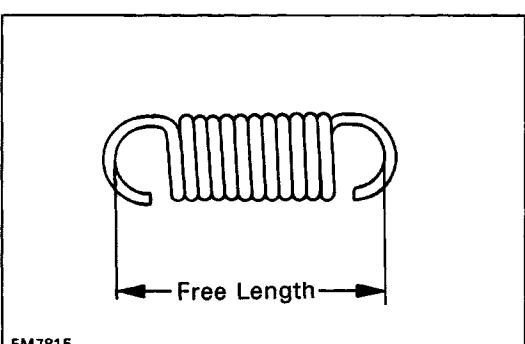


(e) If there is noticeable wear on the belt teeth, check the timing cover for damage, correct gasket installation, and the foreign material on the pulley teeth. If necessary, replace the timing belt.



2. INSPECT IDLER PULLEYS

Check that the idler pulley turns smoothly.



3. INSPECT TENSION SPRING

(a) Measure the free length of tension spring.

Free length: 46.0 mm (1.811 in.)

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

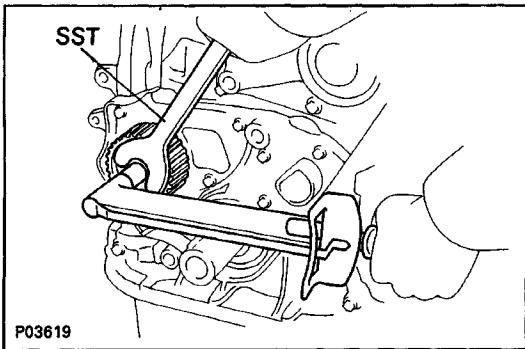
(b) Measure the tension of the tension spring at the specified installed length.

Installed tension:

32 – 37 N (3.25 – 3.75 kgf, 7.2 – 8.3 lbf)

at 50.5 mm (1.988 in.)

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



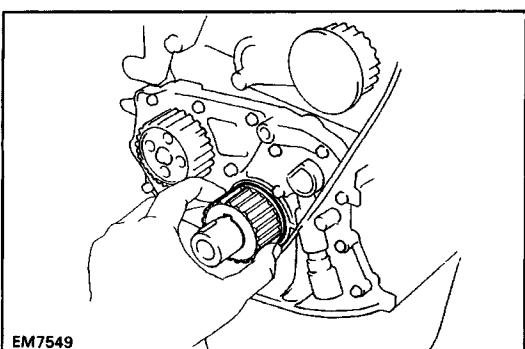
INSTALLATION OF TIMING BELT

(See page [EM-67](#))

1. INSTALL OIL PUMP PULLEY

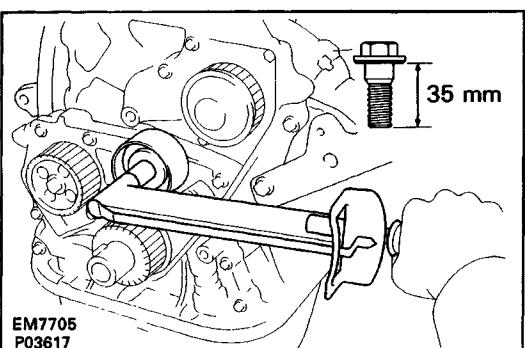
- Align the cutouts of the pulley and shaft, and slide on the pulley.
- Using SST, install the nut.
SST 09616-30011

Torque: 28 N·m (290 kgf·cm, 21 ft·lbf)



2. INSTALL CRANKSHAFT TIMING PULLEY

- Align the timing pulley set key with the key groove of the pulley.
- Slide on the timing pulley, facing the flange side inward.



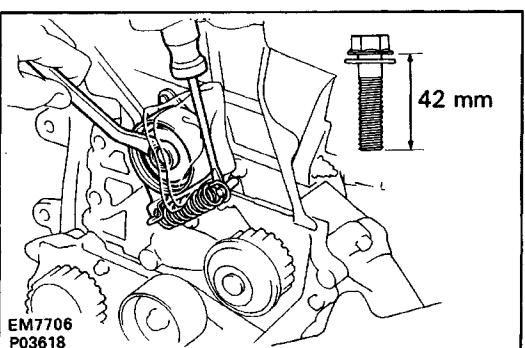
3. INSTALL NO.2 IDLER PULLEY

- Install the pulley with the bolt.

Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)

HINT: Use bolt 35 mm (1.38 in.) in length.

- Check that the idler pulley moves smoothly.



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

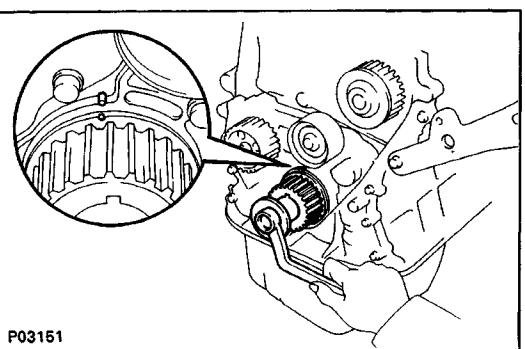
- Install the pulley with the bolt. Do not tighten the bolt yet.

HINT: Use bolt 42 mm (1.65 in.) in length.

- Install the tension spring.

- Pry the pulley toward the left as far as it will go and tighten the bolt.

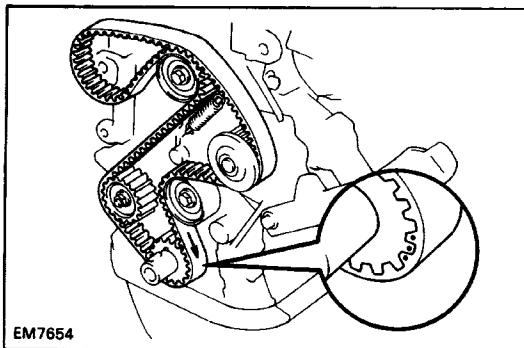
- Check that the idler pulley moves smoothly.



5. TEMPORARILY INSTALL TIMING BELT

NOTICE: The engine should be cold.

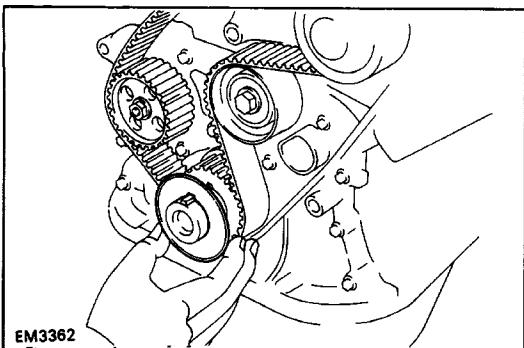
- Using the crankshaft pulley bolt, turn the crankshaft and align the timing marks of the crankshaft timing pulley and oil pump body.



- (b) Remove any oil or water on the crankshaft pulley, oil pump pulley, water pump pulley, No.1 idler pulley, No.2 idler pulley, and keep them clean.

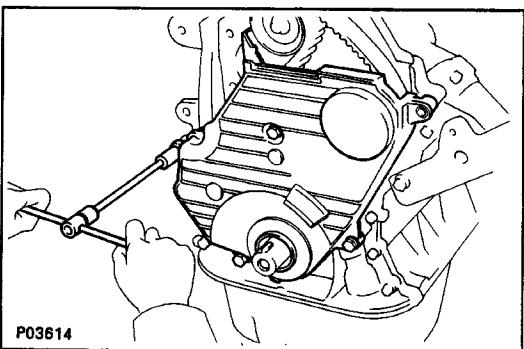
- (c) Install the timing belt on the crankshaft timing pulley, oil pump pulley, No.1 idler pulley, water pump pulley and No.2 idler pulley.

HINT (When re-using timing belt): Align the points marked during removal, and install the belt with the arrow pointing in the direction of engine revolution.



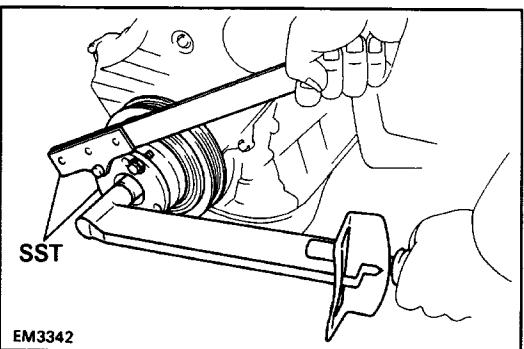
6. INSTALL TIMING BELT GUIDE

Install the guide, facing the cup side outward.



7. INSTALL NO.1 TIMING BELT COVER

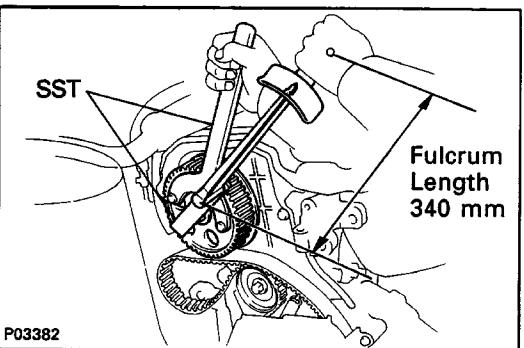
- (a) Install the gasket to the timing belt cover.
- (b) Install the timing belt cover with the four bolts.



8. INSTALL CRANKSHAFT PULLEY

- (a) Align the pulley set key with the key groove of the pulley, and slide on the pulley.
- (b) Using SST, install the pulley bolt.
SST 09213-54015 (09214-00030) and 09330-00021

Torque: 108 N·m (1,100 kgf·cm, 80 ft-lbf)



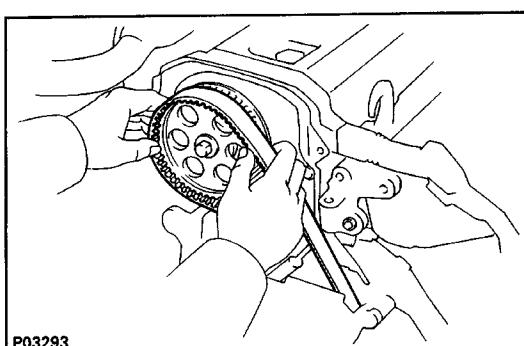
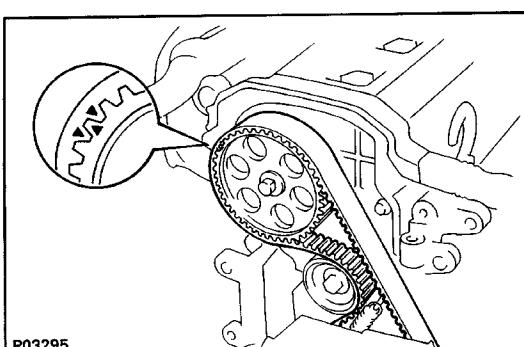
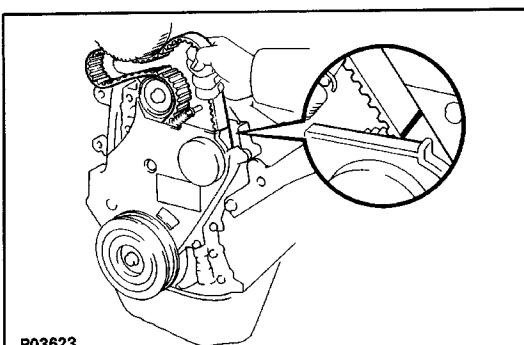
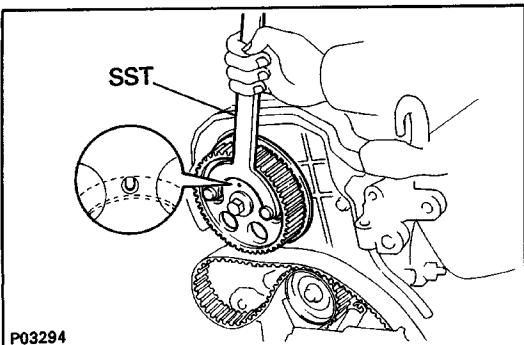
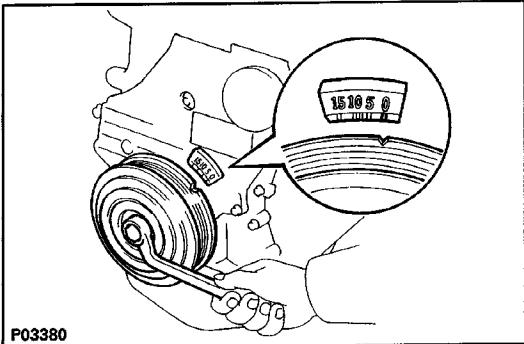
9. INSTALL CAMSHAFT TIMING PULLEY

- (a) Align the camshaft knock pin with the knock pin groove of the pulley, and slide on the timing pulley.
- (b) Using SST, install the plate washer and bolt.
SST 09249-63010 and 09278-54012

Torque: 54 N·m (550 kgf·cm, 40 ft-lbf)

37 N·m (380 kgf·cm, 27 ft-lbf) for SST

HINT: Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).



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

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

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

SST 09278-54012

11. INSTALL TIMING BELT

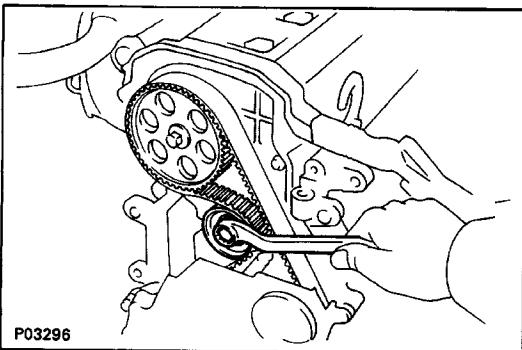
HINT (When re-using timing belt):

- Check that the matchmark on the timing belt matches the end of the No.1 timing belt cover.
If the matchmark does not align, shift the meshing of the timing belt and crankshaft timing pulley until they align.
(See page [EM-71](#))

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

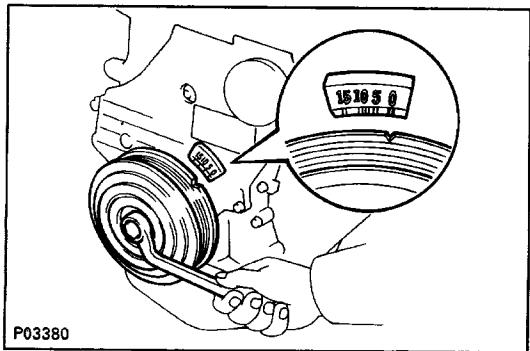
(a) Remove any oil or water on the camshaft timing pulley, and keep it clean.

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



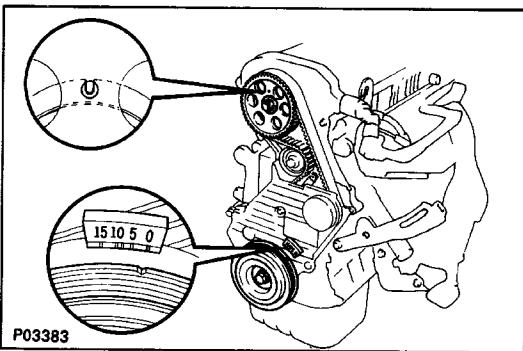
12. CHECK VALVE TIMING

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



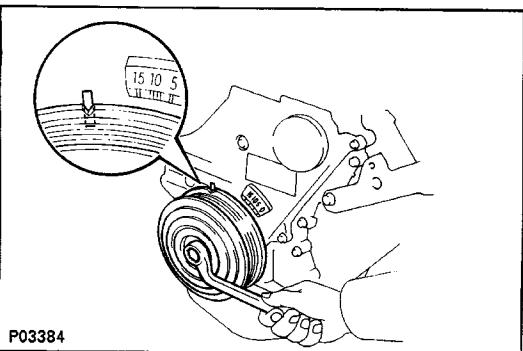
(b) Slowly turn the crankshaft pulley two revolutions from TDC to TDC.

NOTICE: Always turn the crankshaft clockwise.



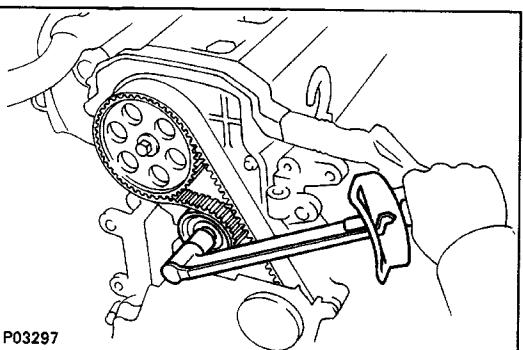
(c) Check that each pulley aligns with the timing marks as shown in the illustration.

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



(d) Slowly turn the crankshaft pulley 1 7/8 revolutions, and align its groove with the mark at BTDC 45° (for No.1 cylinder) of the No.1 timing belt cover.

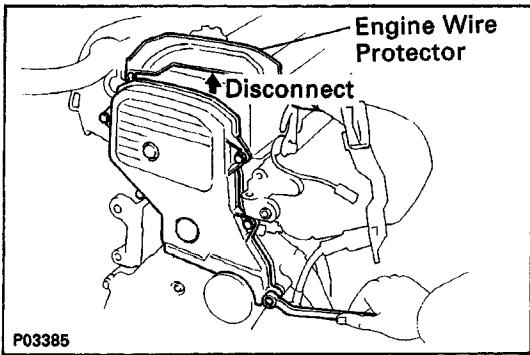
NOTICE: Always turn the crankshaft clockwise.



(e) Torque the mounting bolt of the No.1 idler pulley.

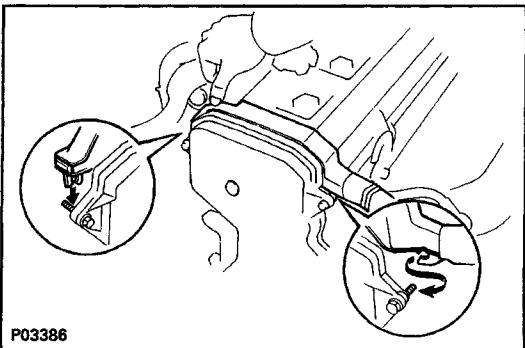
Torque: 42 N·m (425 kgf·cm, 31 ft-lbf)

(f) Recheck the valve timing.

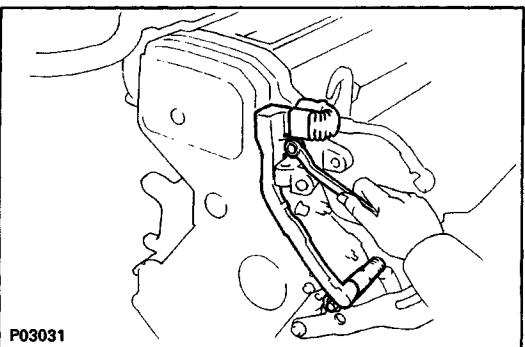


13. INSTALL NO.2 TIMING BELT COVER

- Disconnect the engine Wire protector between the No.3 timing belt cover and cylinder head cover.
- Install the two gaskets to the No.1 and No.2 belt covers.
- Install the belt cover with the five bolts.



- Install the two clamps of the engine wire protector to each bolt.

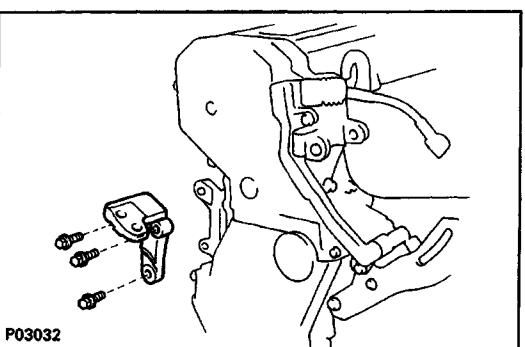


14. INSTALL ENGINE WIRE TO ALTERNATOR BRACKET AND ADJUSTING BAR

Install the engine wire with the two bolts.

15. INSTALL SPARK PLUGS

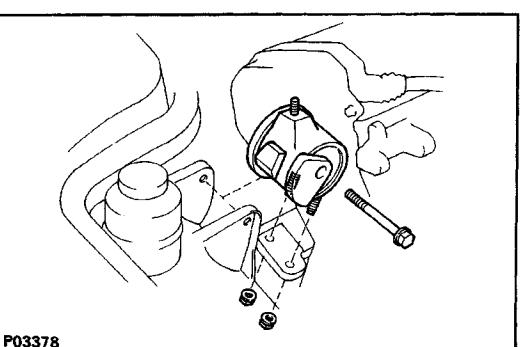
Torque: 18 N·m (180 kgf·cm, 13 ft-lbf)



16. INSTALL RH ENGINE MOUNTING BRACKET

Install the bracket with the three bolts.

Torque: 52 N·m (530 kgf·cm, 38 ft-lbf)



17. INSTALL RH ENGINE MOUNTING INSULATOR

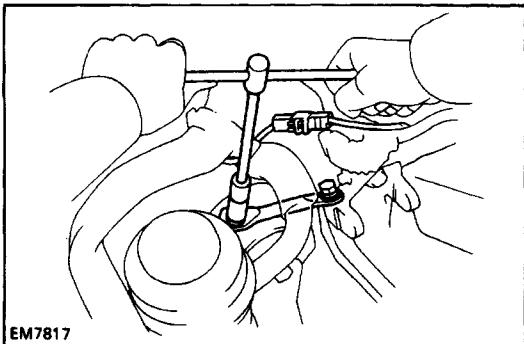
Install the mounting insulator with the through bolt and two nuts.

Torque:

Nut 52 N·m (530 kgf·cm, 38 ft-lbf)

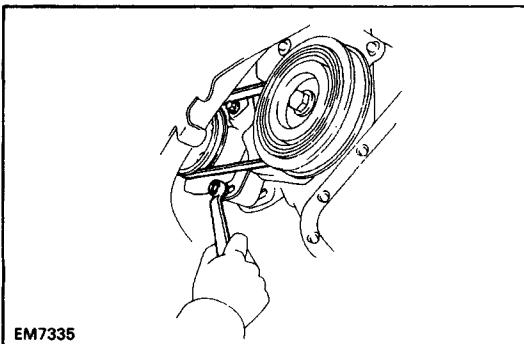
Through bolt 87 N·m (890 kgf·cm, 64 ft-lbf)

18. INSTALL PS RESERVOIR TANK TO BRACKET

**19. INSTALL RH ENGINE MOUNTING STAY**

Install the mounting stay with the bolt and nut.

Torque: 73 N·m (740 kgf·cm, 54 ft-lbf)

20. CONNECT GROUND CONNECTOR TO GROUND WIRE ON RH FENDER APRON**21. INSTALL PS DRIVE BELT**

Install the drive belt with the pivot bolt and adjusting bolt.

22. INSTALL ALTERNATOR (See page CH-25)**23. (w/ CRUISE CONTROL SYSTEM (w/o ABS)****INSTALL CRUISE CONTROL ACTUATOR**

(See step 33 on page [EM-309](#))

24. INSTALL RH FRONT WHEEL**25. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY****26. CHECK AND ADJUST DRIVE BELTS**

Adjust the drive belts.

Drive belt tension:**Alternator**

w/ A/C New belt 165 ± 10 lbf

Used belt 110 ± 10 lbf

w/o A/C New belt 125 ± 25 lbf

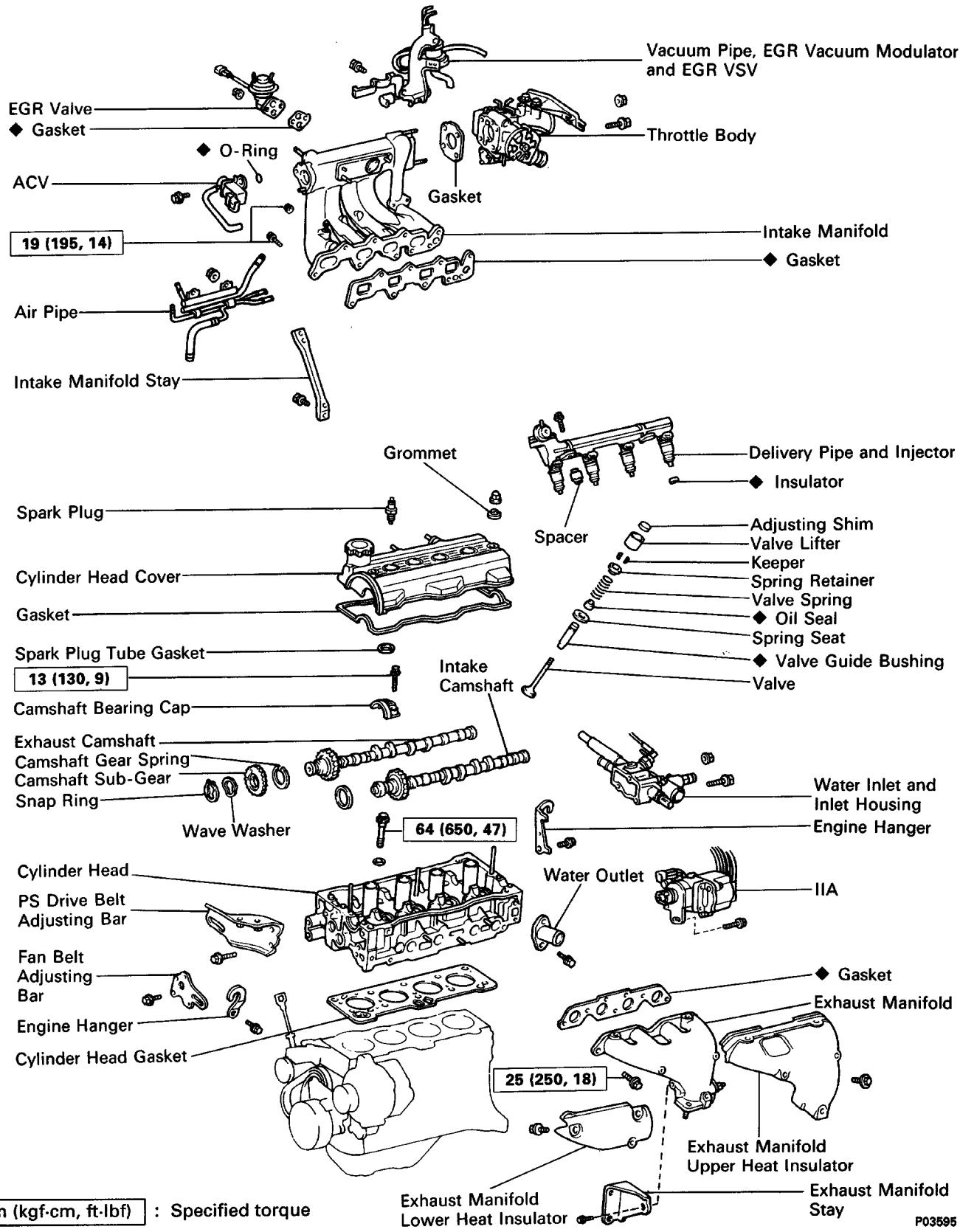
Used belt 95 ± 20 lbf

PS pump New belt 125 ± 10 lbf

Used belt 80 ± 20 lbf

27. INSTALL RH ENGINE UNDER COVER

CYLINDER HEAD (4A-FE) COMPONENTS



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

◆ Non-reusable part

P03595

REMOVAL OF CYLINDER HEAD

(See page [EM-81](#))

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

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

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

3. (A/T)

DISCONNECT THROTTLE CABLE FROM THROTTLE BODY

4. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY

5. REMOVE AIR CLEANER CAP AND HOSE

(See step 6 on page [EM-185](#))

6. REMOVE ENGINE UNDER COVERS

7. REMOVE SUSPENSION LOWER CROSMEMBER

(See step 24 on page [EM-189](#))

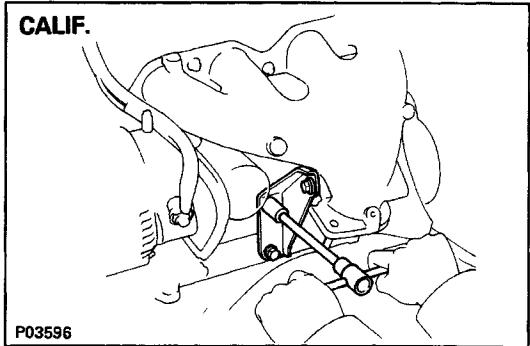
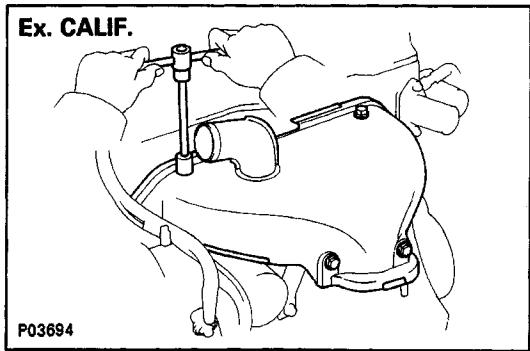
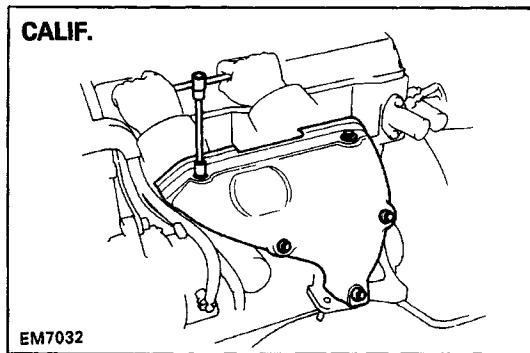
8. REMOVE FRONT EXHAUST PIPE

(See step 25 on page [EM-189](#))

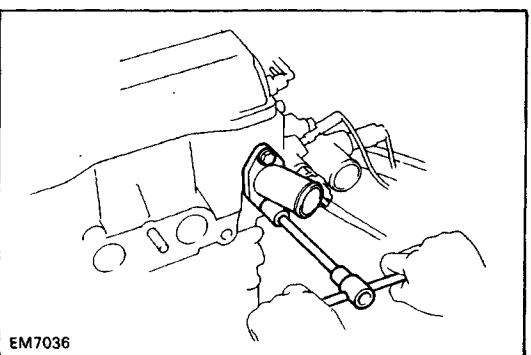
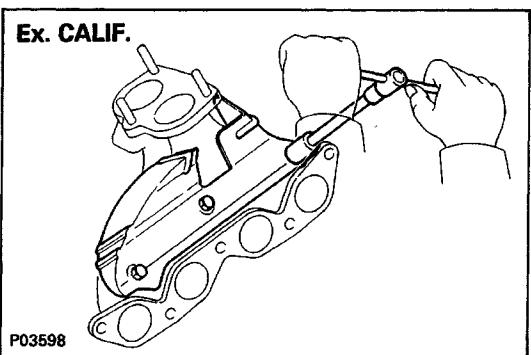
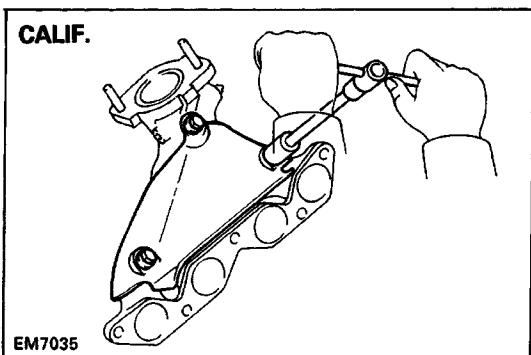
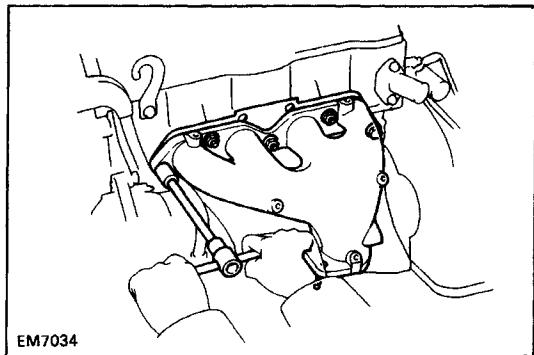
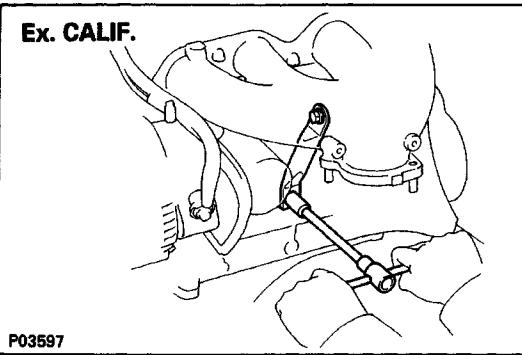
9. REMOVE DISTRIBUTOR (See page [IG-20](#))

10. REMOVE EXHAUST MANIFOLD

(a) Remove the five (CALIF.) or four (Ex. CALIF.) bolts and upper heat insulator.



(b) Remove the three (CALIF.) or two (Ex. CALIF.) bolts and manifold stay.

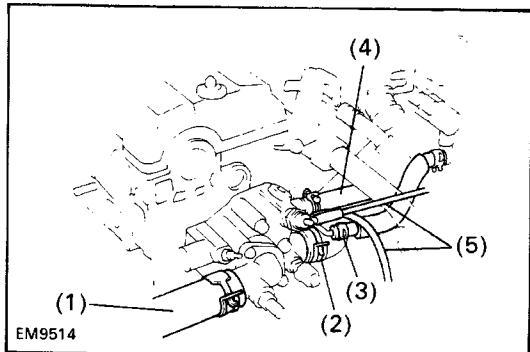


(c) Remove the two bolts, three nuts, exhaust manifold and gasket.

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

11. REMOVE WATER OUTLET

- Disconnect the upper radiator hose from the water outlet.
- Remove the two bolts and water outlet.



12. REMOVE WATER INLET AND INLET HOUSING

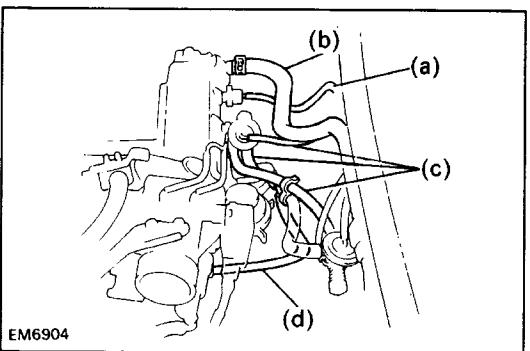
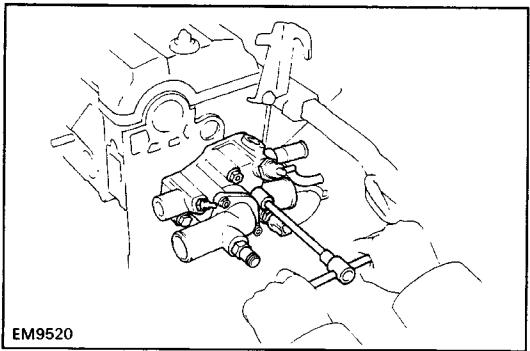
(a) Disconnect the following connectors:

- Water temperature sender gauge connector
- Water temperature sensor connector

(b) Disconnect the following hoses:

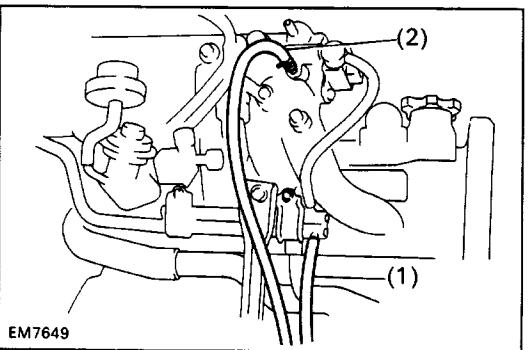
- (1) Lower radiator hose
- (2) Inlet pipe water hose
- (3) Auxiliary air valve water by-pass hose
- (4) Heater water hose
- (5) Two EVAP BVSV vacuum hoses

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



13. DISCONNECT VACUUM HOSES

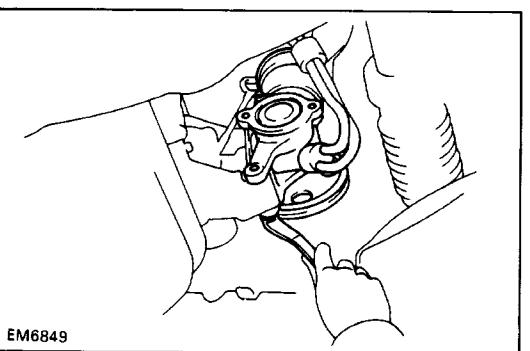
- (a) Vacuum sensor hose from gas filter on intake manifold
- (b) Brake booster vacuum hose from intake manifold
- (c) Three A/C vacuum hoses from ASV on intake manifold
- (d) A/C vacuum hose from air pipe



14. REMOVE PS PUMP WITHOUT DISCONNECTING HOSES

(a) Disconnect the following hoses:

- (1) Air hose from air pipe
- (2) Air hose from intake manifold



(b) Loosen the bolt holding the PS pump to the PS pump bracket.

(c) Remove the bolt holding the PS pump to the PS drive belt adjusting strut, and disconnect the drive belt from the PS pump pulley.

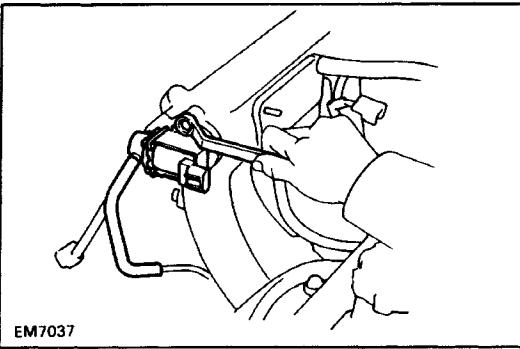
(d) Disconnect the PS pump from the adjusting strut.

15. REMOVE THROTTLE BODY

(See steps 6, 8 and 9 on pages FI-188 and 189)

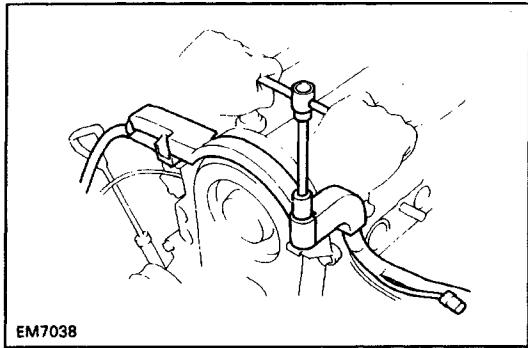
16. REMOVE DELIVERY PIPE AND INJECTORS

(See steps 2 to 6 on page FI-156)



17. REMOVE ACV

- Disconnect the air hose from the air pipe.
- Remove the bolt, nut and ACV.
- Remove the O-ring from the ACV.



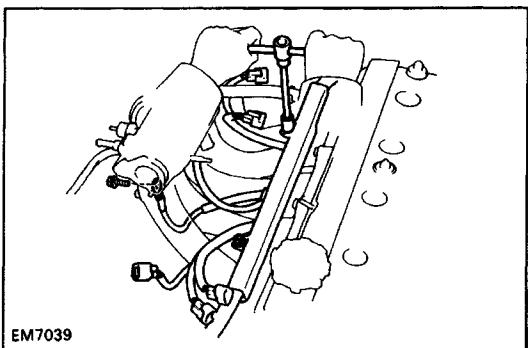
18. DISCONNECT ENGINE WIRE FROM NO.3 TIMING BELT COVER

- Disconnect the following connectors and wire:

- Alternator connector
- Alternator wire
- Oil pressure switch connector
- A/C compressor connector

- Remove the bolt.

- Disconnect the wire clamp from the wire bracket, and disconnect the engine wire from the timing belt cover.



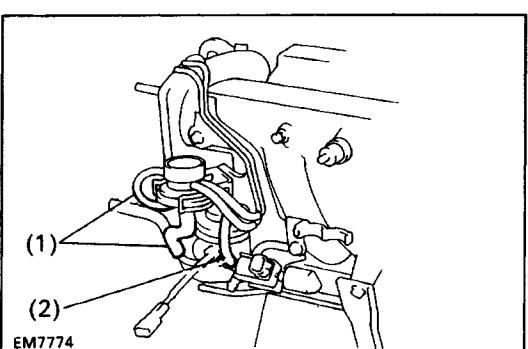
19. DISCONNECT ENGINE WIRE FROM INTAKE MANIFOLD

- Disconnect the following connectors:

- EGR VSV connector
- (CALIF. only)
EGR gas temperature sensor connector
- Vacuum sensor connector

- Disconnect the wire clamp from the vacuum pipe.

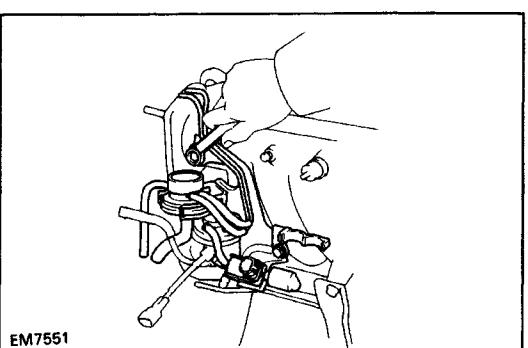
- Remove the three bolts, and disconnect the engine wire from the intake manifold.



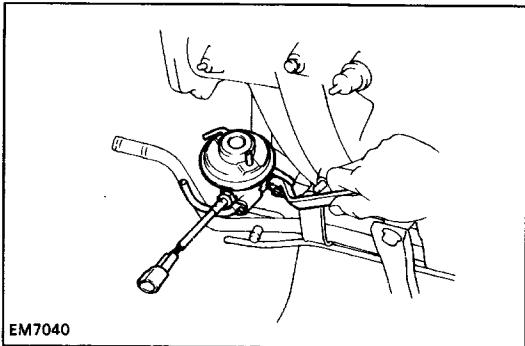
20. REMOVE VACUUM PIPE, EGR VACUUM MODULATOR AND EGR VSV

- Disconnect the following hoses:

- Two vacuum hoses from EGR valve
- Vacuum hose from EGR VSV

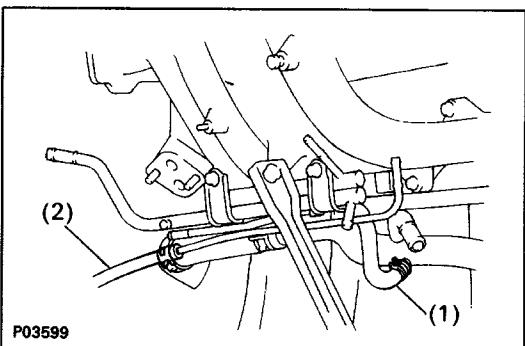


- Remove the two nuts, the vacuum pipe, vacuum modulator and VSV assembly.



21. REMOVE EGR VALVE

Remove the two nuts, EGR valve and gasket.

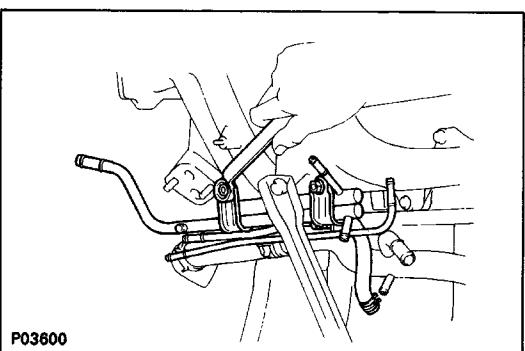


22. REMOVE AIR PIPE

(a) Disconnect the following hoses:

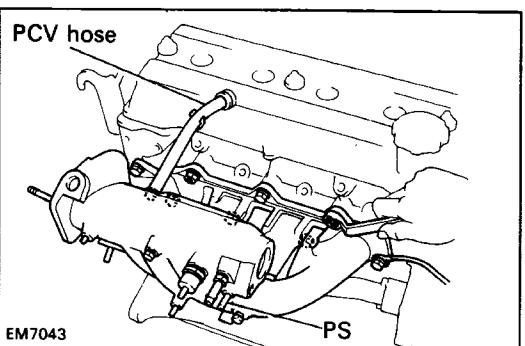
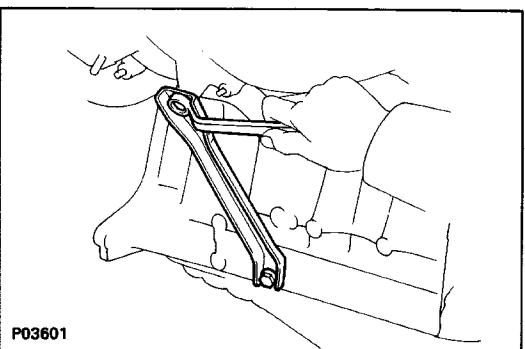
- (1) Water inlet pipe hose
- (2) Fuel return hose (from fuel filter)

(b) Remove the two nuts and air pipe.



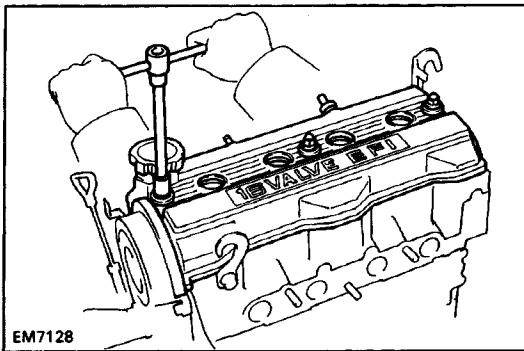
23. REMOVE INTAKE MANIFOLD

(a) Remove the two bolts and manifold stay.



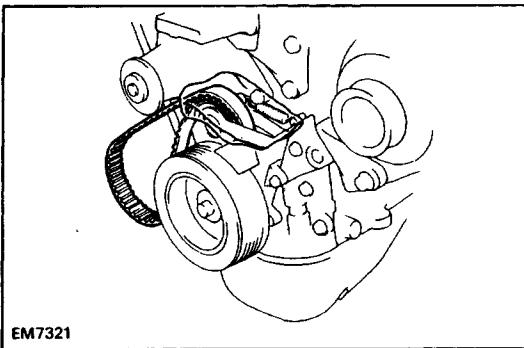
(b) Disconnect the PCV hose from the PCV valve on the cylinder head.

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



24. REMOVE CYLINDER HEAD COVER

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

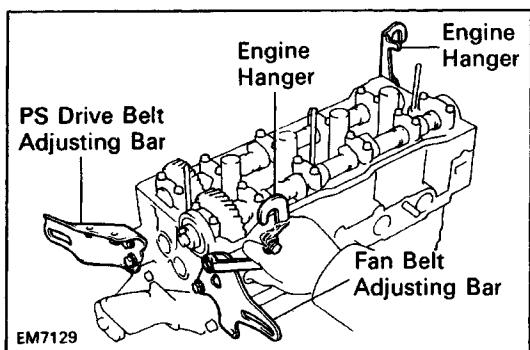


25. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEY

(See steps 2 and 4 to 15 on pages [EM-33](#) to [36](#))

NOTICE:

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



26. REMOVE CAMSHAFT TIMING PULLEY

(See step 16 on page [EM-36](#))

27. REMOVE FAN BELT ADJUSTING BAR

Remove the two bolts and adjusting bar.

28. REMOVE ENGINE HANGERS

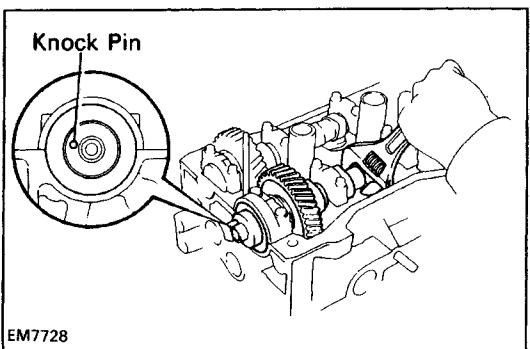
Remove the bolt and engine hanger. Remove the two engine hangers.

29. REMOVE PS DRIVE BELT ADJUSTING STRUT

Remove the two bolts and adjusting strut.

30. REMOVE CAMSHAFTS

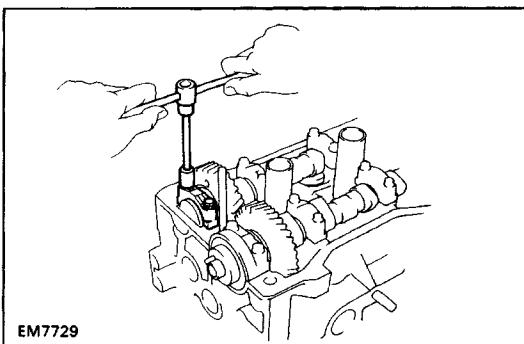
NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following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



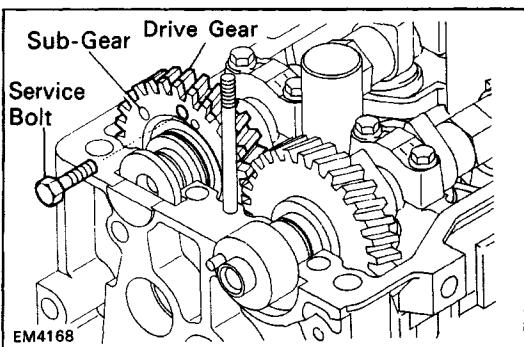
A. Remove intake camshaft

- (a) Set the intake 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 drive gear with a service bolt.

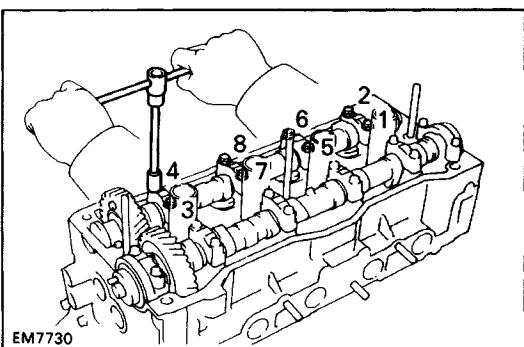
Recommended service bolt:

Thread diameter 6 mm

Thread pitch 1.0 mm

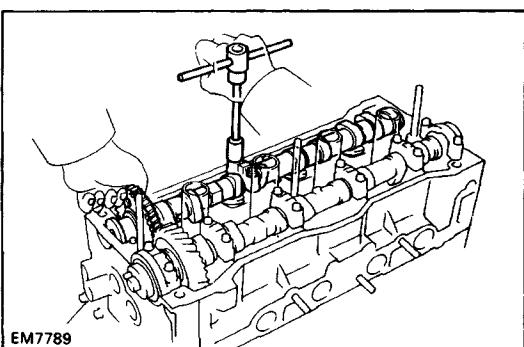
Bolt length 16 – 20 mm (0.63 – 0.79 in.)

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



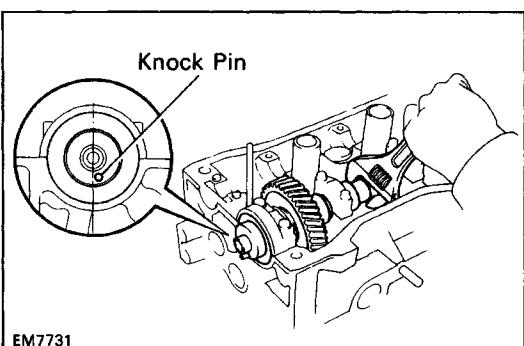
(d) Uniformly loosen and remove the eight bearing cap bolts in several passes in the sequence shown.

(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.

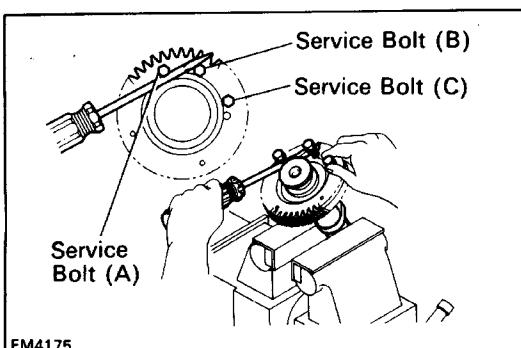
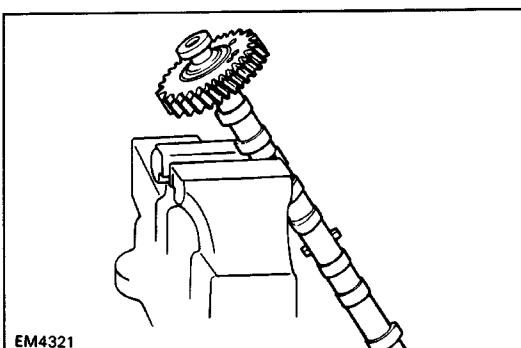
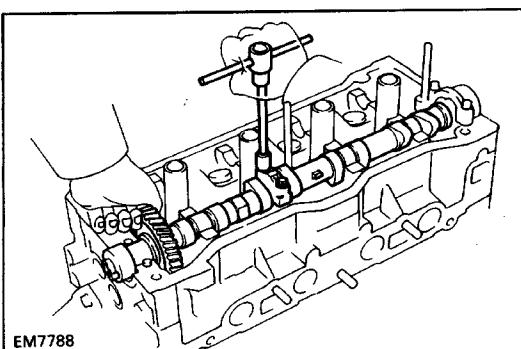
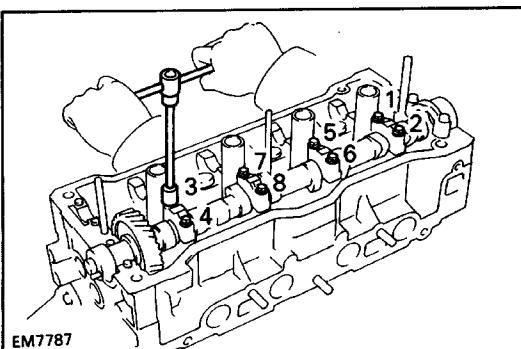
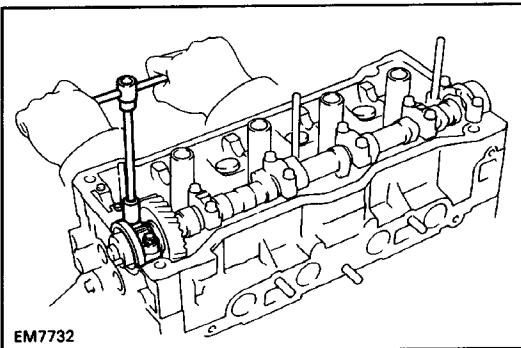
NOTICE: Do not pry on or attempt to force the camshaft with a tool or other object.



B. Remove exhaust camshaft

(a) Set the intake camshaft 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 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 object.

31. DISASSEMBLE EXHAUST CAMSHAFT

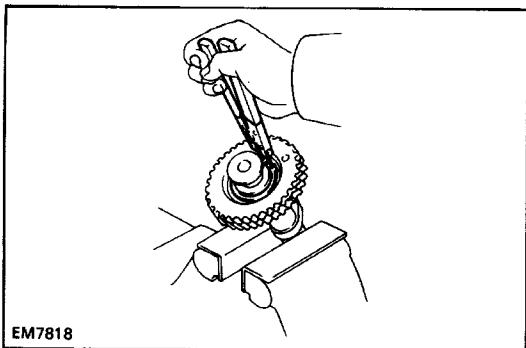
(a) Mount the hexagon wrench head portion of the camshaft in a vise.

NOTICE: Be careful not to damage the camshaft.

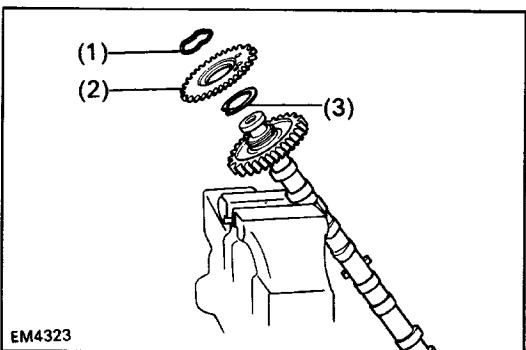
(b) Insert service bolts (A) and (B) into the service holes of the camshaft sub-gear.

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

NOTICE: Be careful not to damage the camshaft.



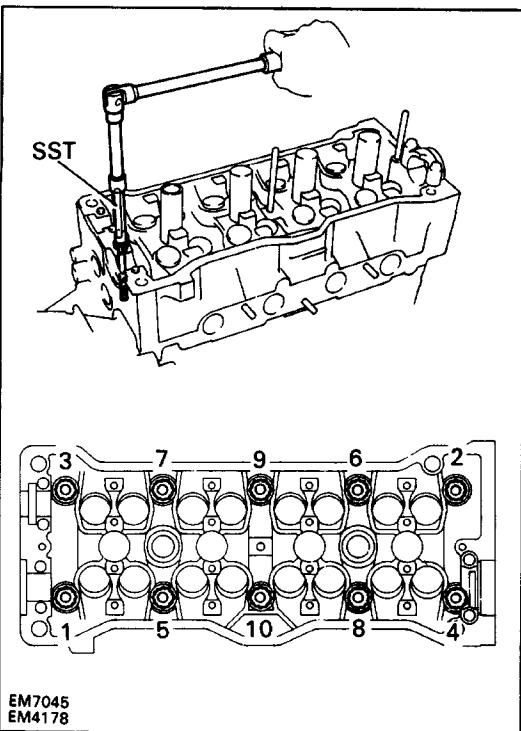
(d) Using snap ring pliers, remove the snap ring.



(e) Remove the following parts:

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

32. REMOVE SEMI-CIRCULAR PLUG



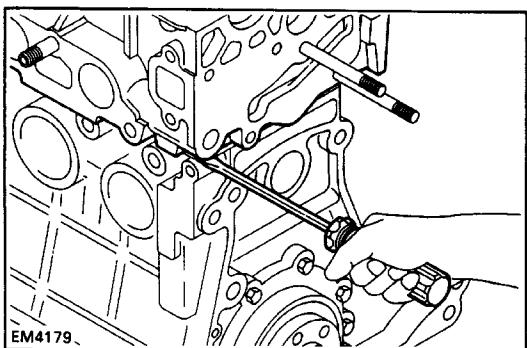
33. REMOVE CYLINDER HEAD

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

SST 09205-16010

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

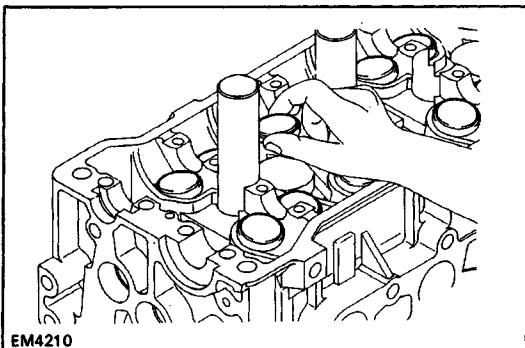
(b) Remove the ten plate washers.



(c) Lift the cylinder head from the dowels on 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.

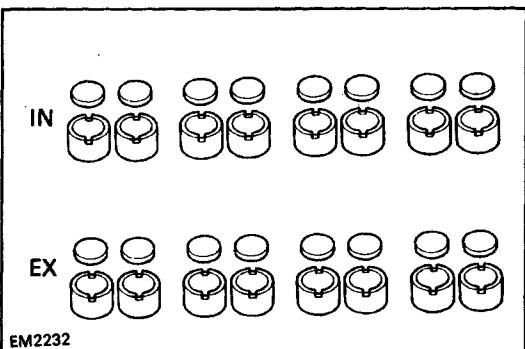
NOTICE: Be careful not to damage the contact surfaces of the cylinder head and cylinder block.



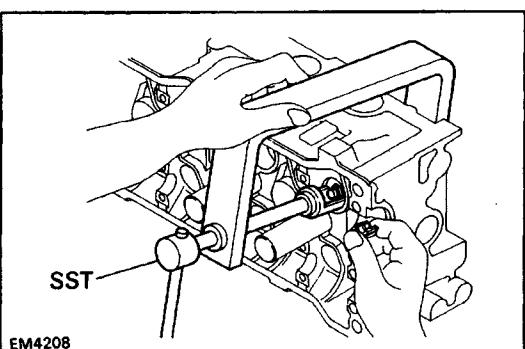
DISASSEMBLY OF CYLINDER HEAD

(See page [EM-81](#))

1. REMOVE VALVE LIFTERS AND SHIMS



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

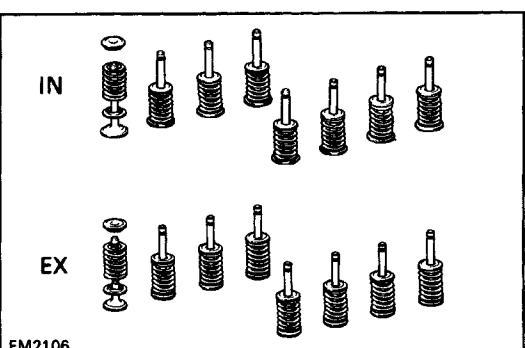


2. REMOVE VALVES

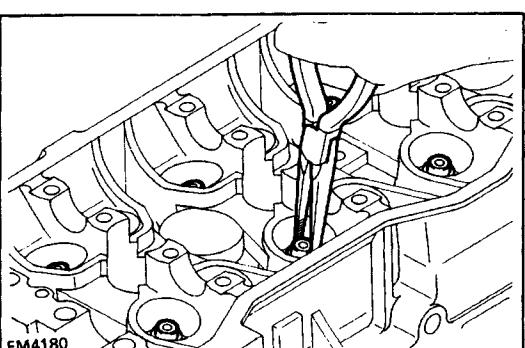
(a) Using SST, compress the valve spring and remove the two keepers.

SST 09202-70010

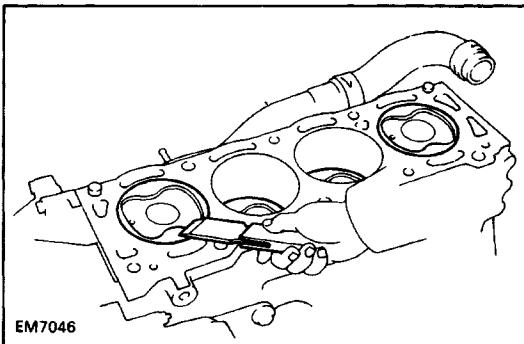
(b) Remove the spring retainer, valve spring, valve and spring seat.



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



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



INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS

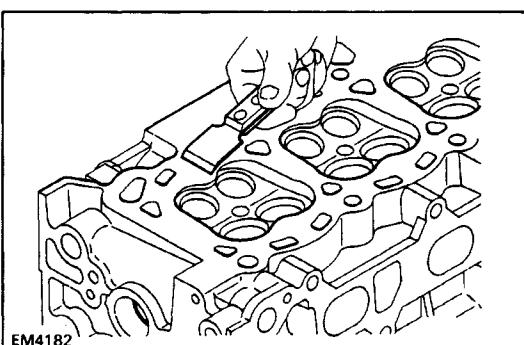
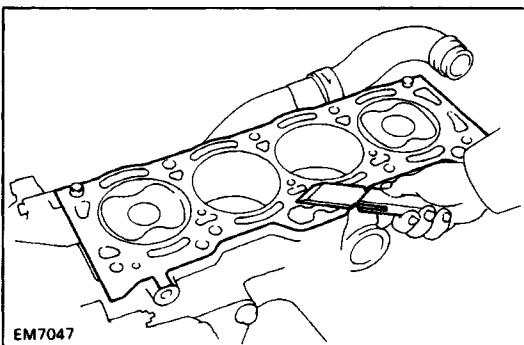
1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

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

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

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

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

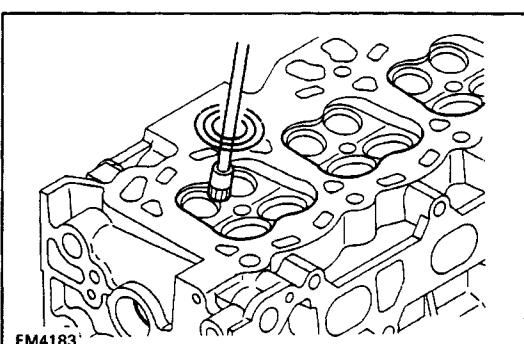


2. CLEAN CYLINDER HEAD

A. Remove gasket material

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

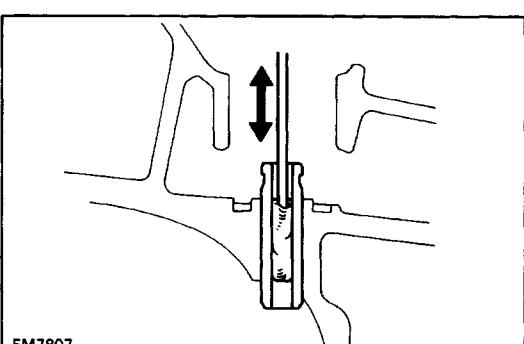
NOTICE: Be careful not to scratch the cylinder block contact surface.



B. Clean combustion chambers

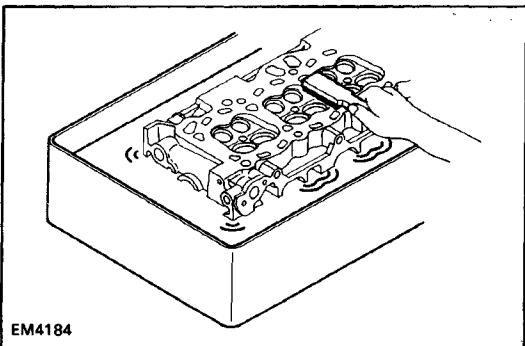
Using a wire brush, remove all the carbon from the combustion chambers.

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



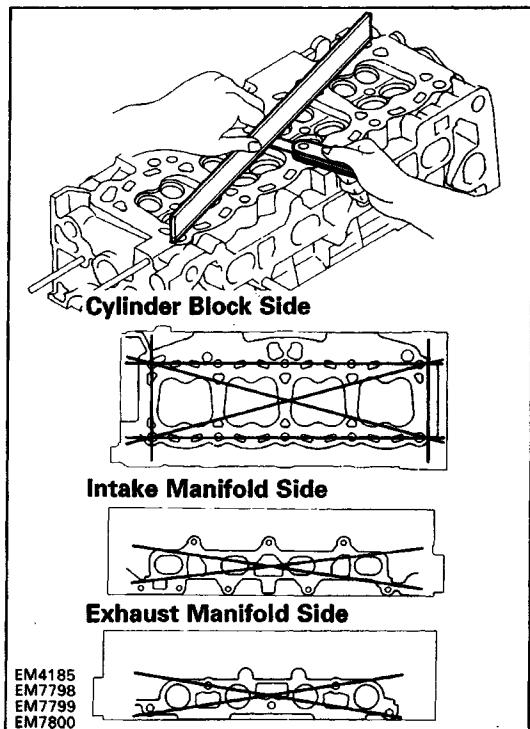
C. Clean valve guide bushings

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



D. Clean cylinder head

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



3. INSPECT CYLINDER HEAD

A. Inspect for flatness

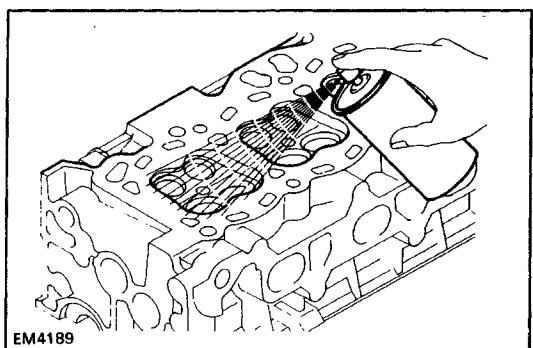
Using precision straight edge and feeler gauge, measure the surfaces contacting the cylinder block and manifolds for warpage.

Maximum warpage:

Cylinder block side 0.05 mm (0.0020 in.)

Manifold side 0.10 mm (0.0039 in.)

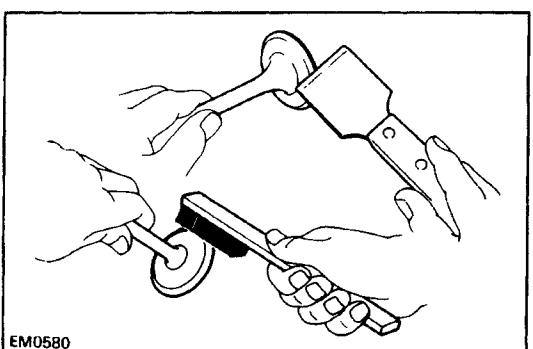
If warpage is greater than maximum, replace the cylinder head.



B. Inspect for cracks

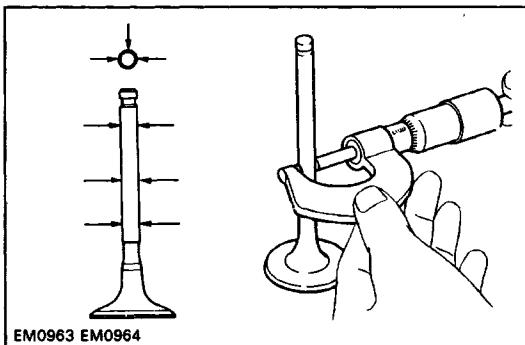
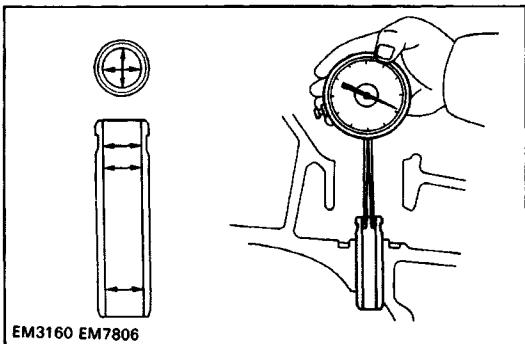
Using a dye penetrant, check the combustion chambers, intake ports, exhaust ports and cylinder block surface for cracks.

If cracked, replace the cylinder head.



4. CLEAN VALVES

- Using a gasket scraper, chip off any carbon from the valve head.
- 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:

6.010 – 6.030 mm (0.2366 – 0.2374 in.)

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

Valve stem diameter:

**Intake 5.970 – 5.985 mm
(0.2350 – 0.2356 in.)**

**Exhaust 5.965 – 5.980 mm
(0.2348 – 0.2354 in.)**

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

Standard oil clearance:

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

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

Maximum oil clearance:

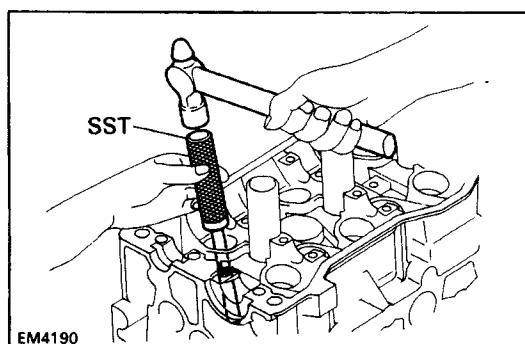
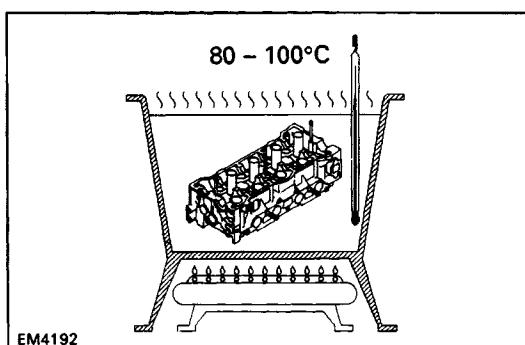
Intake 0.08 mm (0.0031 in.)

Exhaust 0.10 mm (0.0039 in.)

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

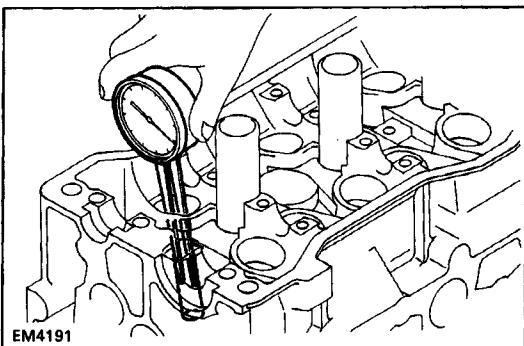
6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

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



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

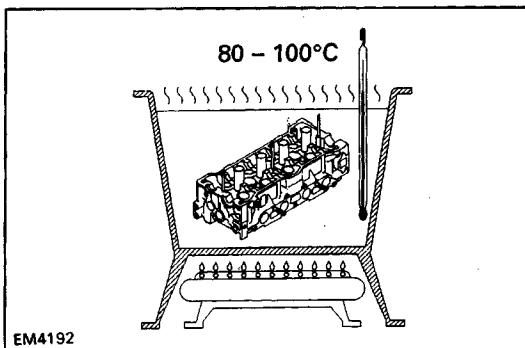
SST 09201-70010



Both intake and exhaust

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

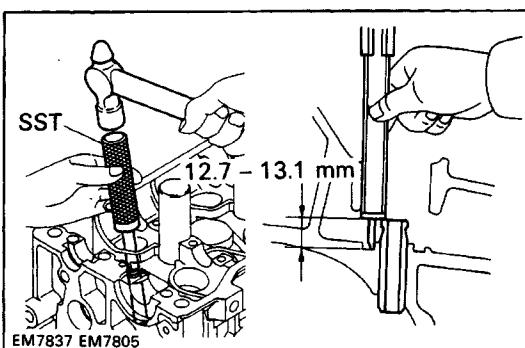
(c) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.



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

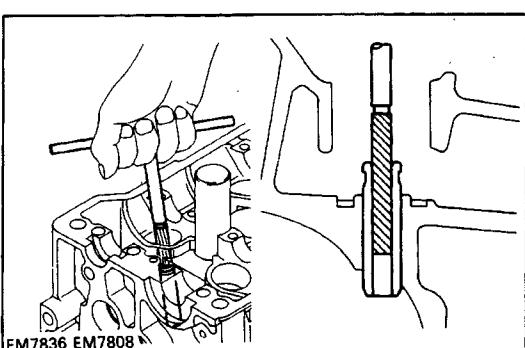
11.050 – 11.077 mm (0.4350 – 0.4361 in.)

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).

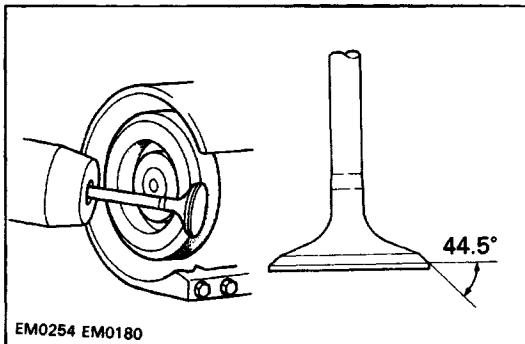
SST 09201-70010



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

SST 09201-70010

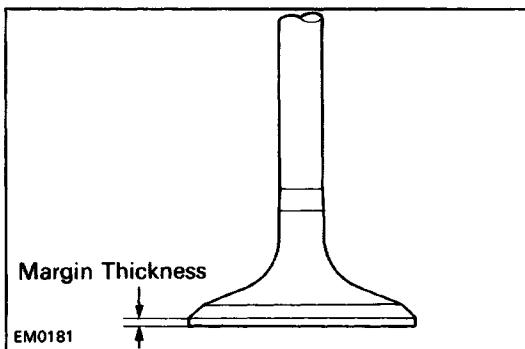
(g) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page EM-94) between the guide bushing and valve stem.



7. INSPECT AND GRIND VALVES

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

Valve face angle: 44.5°



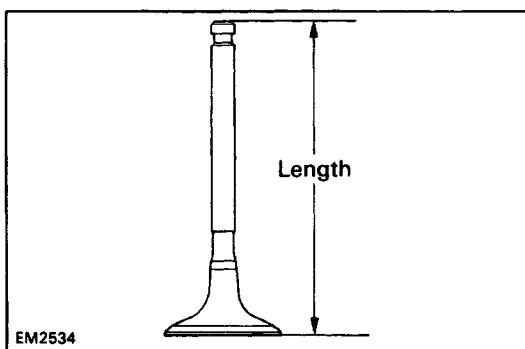
- Check the valve head margin thickness.

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.



- Check the valve overall length.

Standard overall length:

Intake 91.45 mm (3.6004 in.)

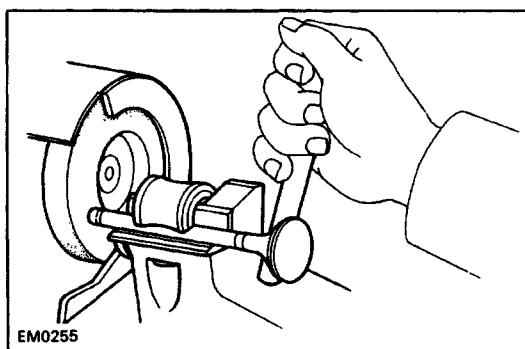
Exhaust 91.90 mm (3.6181 in.)

Minimum overall length:

Intake 90.95 mm (3.5807 in.)

Exhaust 91.40 mm (3.5984 in.)

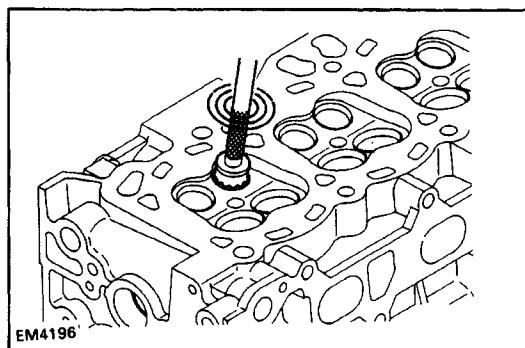
If the overall length is less than minimum, replace the valve.



- Check the surface of the valve stem tip for wear.

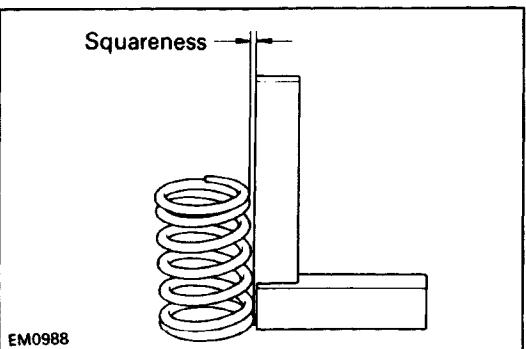
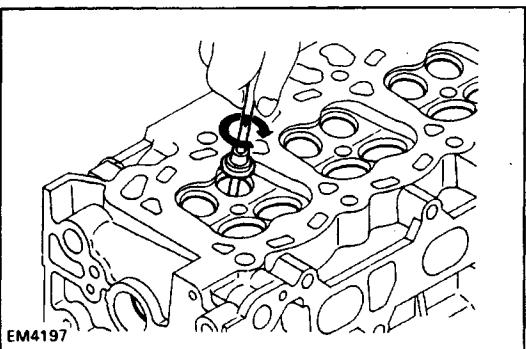
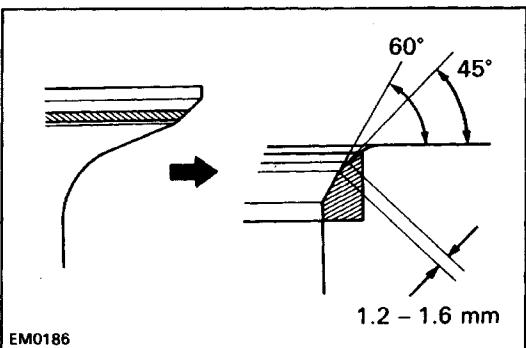
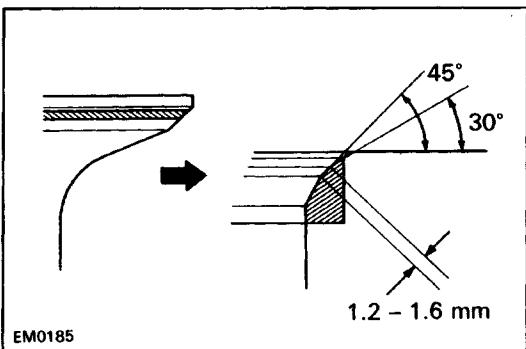
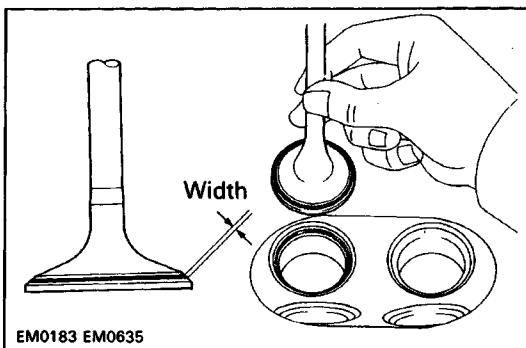
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

NOTICE: Do not grind off more than minimum.



8. INSPECT AND CLEAN VALVE SEATS

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



(b) Check the valve seating position.

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

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

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

1. 2 –11.6 mm (6.047 – 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.

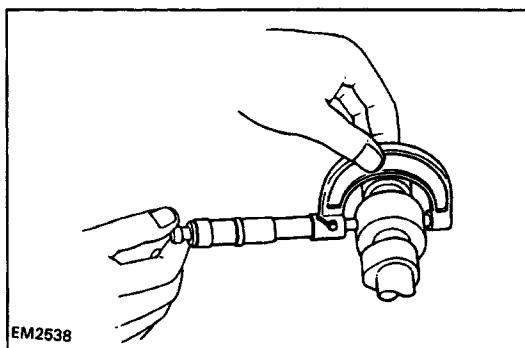
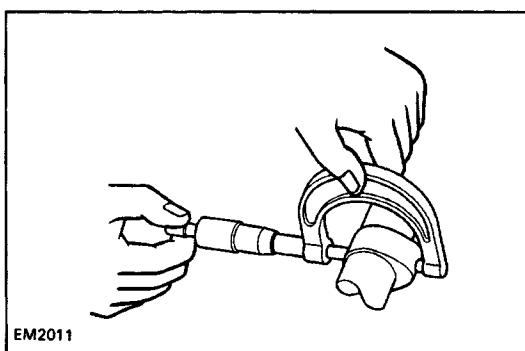
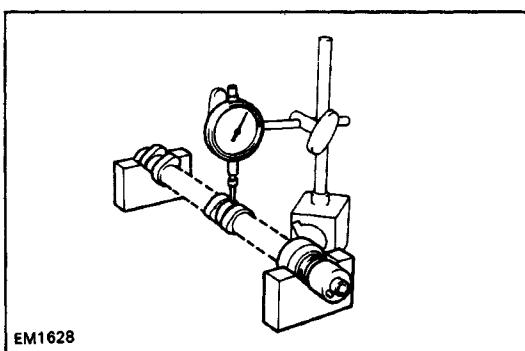
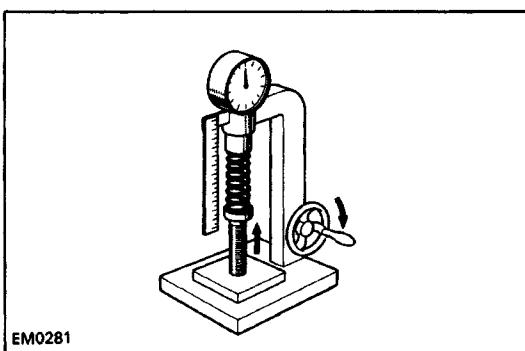
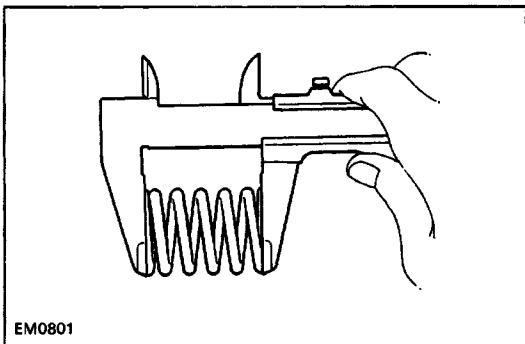
(e) After hand-lapping, clean the valve and valve seat.

9. INSPECT VALVE SPRINGS

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

Maximum squareness: 2.0 mm (0.079 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:

**143 – 155 N (14.6 – 15.8 kgf, 32.2 – 34.8 lbf)
at 34.7 mm (1.366 in.)**

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

10. INSPECT CAMSHAFTS AND BEARINGS

A. Inspect camshaft for runout

(a) Place the camshaft on V-blocks.

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

Maximum circle runout: 0.04 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 35.210 – 35.310 mm
(1.3862 – 1.3902 in.)**

**Exhaust 34.910 – 35.010 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 less than minimum, replace the camshaft.

C. Inspect camshaft journals

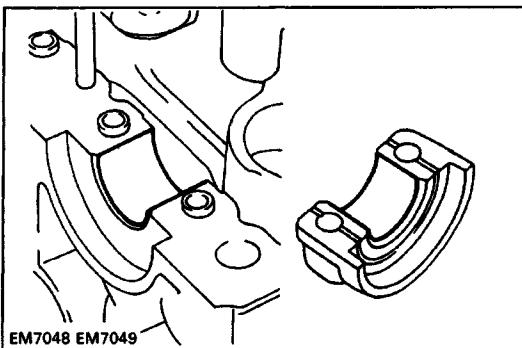
Using a micrometer, measure the journal diameter.

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.)**

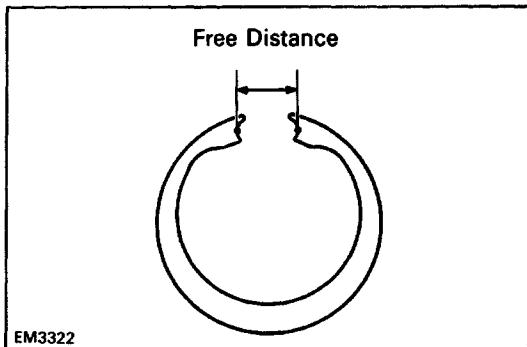
If the journal diameter is not as specified, check the oil clearance.



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.

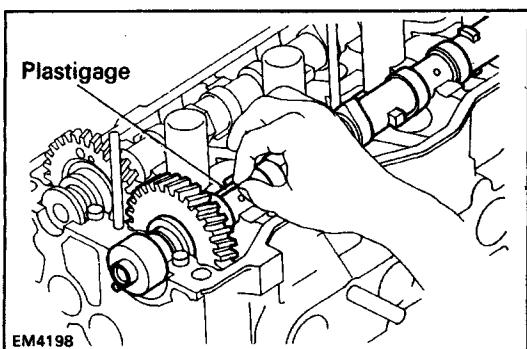


E. Inspect camshaft gear spring

Using a vernier caliper, measure the free distance between the spring ends.

Free distance: 17.0 –17.6 mm (0.669 – 0.693 in.)

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

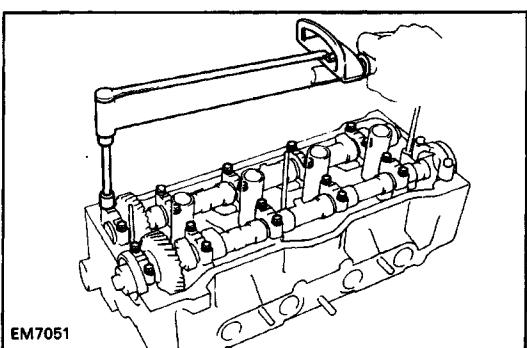


F. Inspect camshaft journal oil clearance

(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.

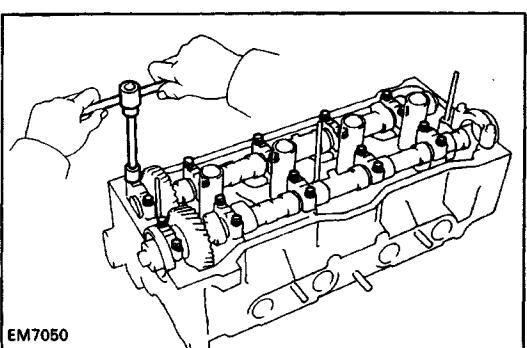


(d) Install the bearing caps.

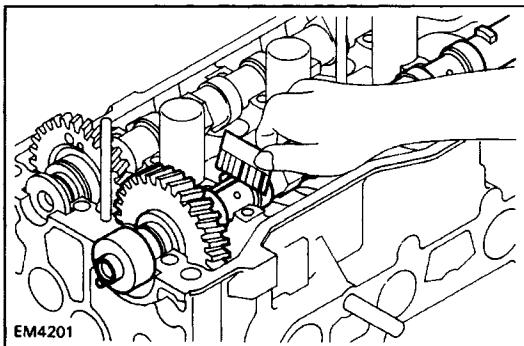
(See step 3 on pages [EM-105](#) to 107)

Torque: 13 N·m (130 kgf·cm, 9 ft-lbf)

NOTICE: Do not turn the camshaft.



(e) Remove the bearing caps.



(f) Measure the Plastigage at its widest point.

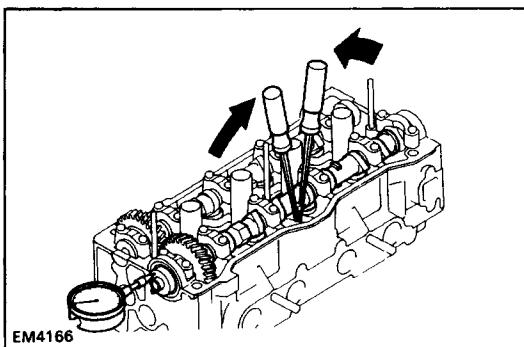
Standard oil clearance: 0.035 – 0.072 mm

(0.0014 – 0.0028 in.)

Maximum oil clearance: 0.10 mm (0.0039 in.)

If the oil clearance is greater than 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 camshafts.

(See step 3 on pages [EM-105](#) to 107)

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

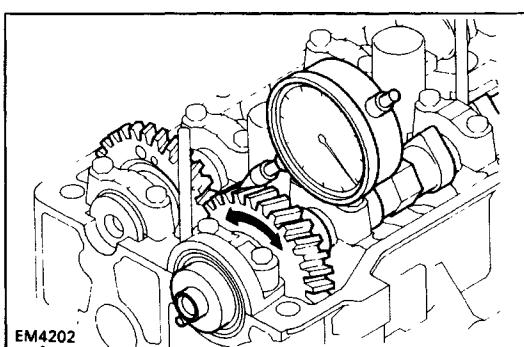
Standard thrust clearance:

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 pages [EM-105](#) to 107)

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

Standard backlash: 0.020 – 0.200 mm

(0.0008 – 0.0079 in.)

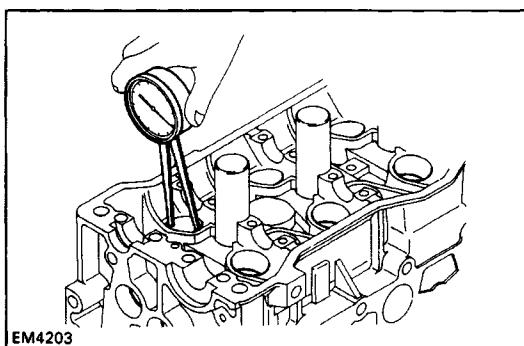
Maximum backlash: 0.30 mm (0.0118 in.)

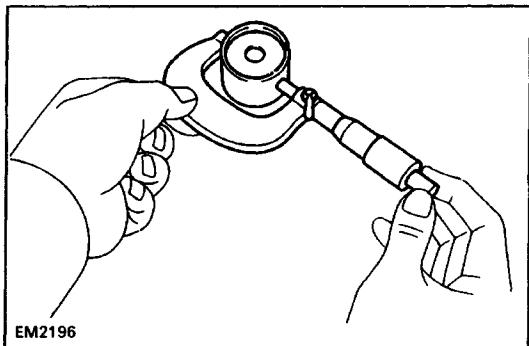
If the backlash is greater than maximum, replace the camshafts.

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 – 28.026 mm
(1.1026 – 1.1034 in.)





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

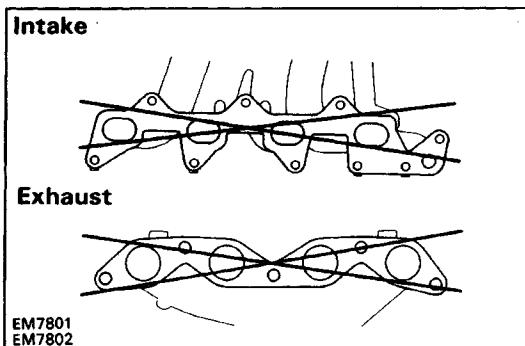
**Lifter diameter: 27.975 – 27.985 mm
(1.1014 – 1.1018 in.)**

(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

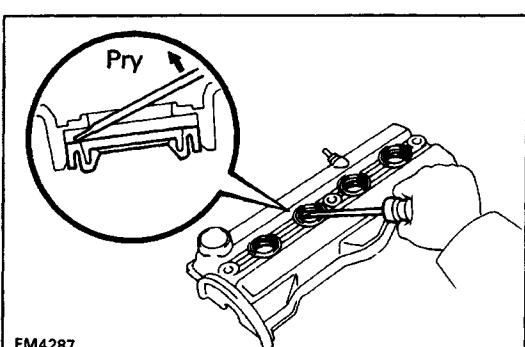
Using precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.

Maximum warpage:

Intake 0.20 mm (0.0079 in.)

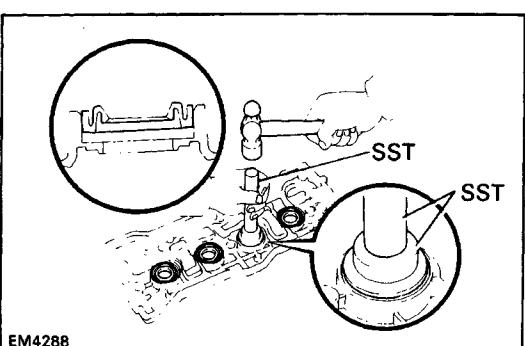
Exhaust 0.30 mm (0.0118 in.)

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 09550-10012 (09552-10010, 09560-10010)

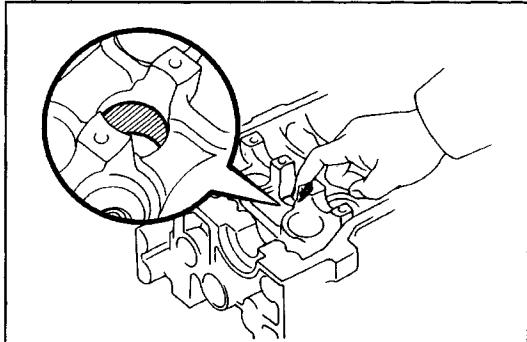
(c) Apply a light coat of IMP grease to the gasket lip.

ASSEMBLY OF CYLINDER HEAD

(See page [EM-81](#))

HINT:

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

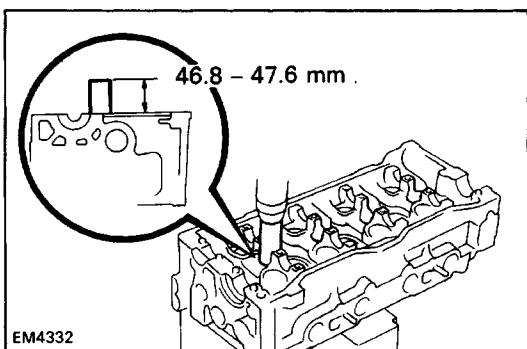


1. INSTALL SPARK PLUG TUBES

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

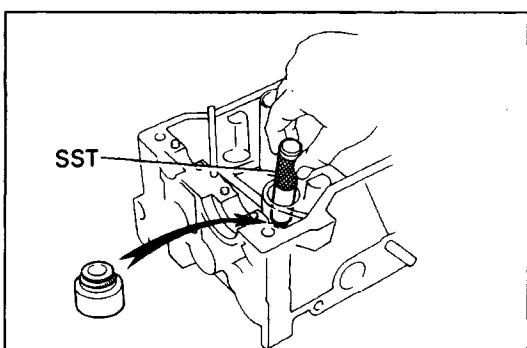
(a) Apply adhesive to the spark plug tube hole of the cylinder head.

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



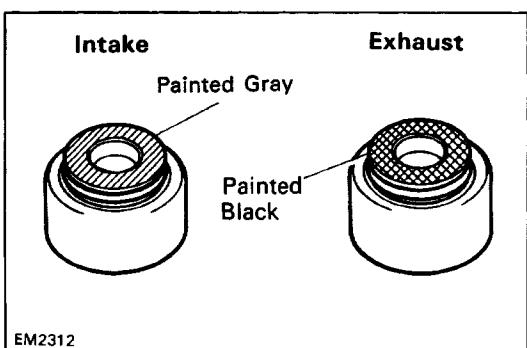
(b) Using a press, press in a new spark plug tube until there is 46.8 – 47.6 mm (1.843 – 1.874 in.) protruding from the cylinder head.

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

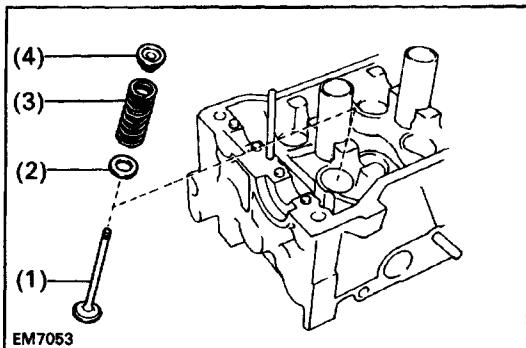


2. INSTALL VALVES

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

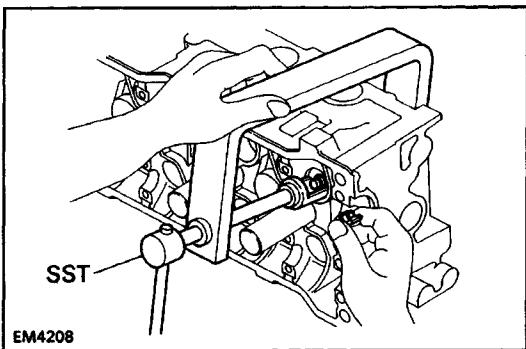


HINT: The intake valve oil seal is brown and the exhaust valve oil seal is black.



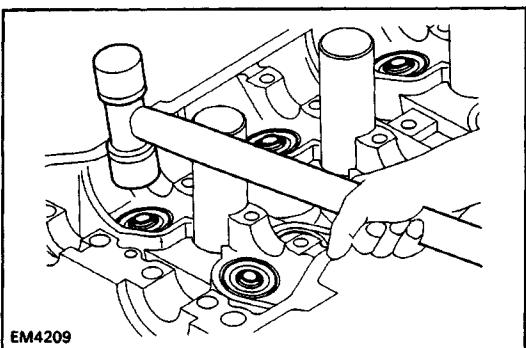
(b) Install the following parts:

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

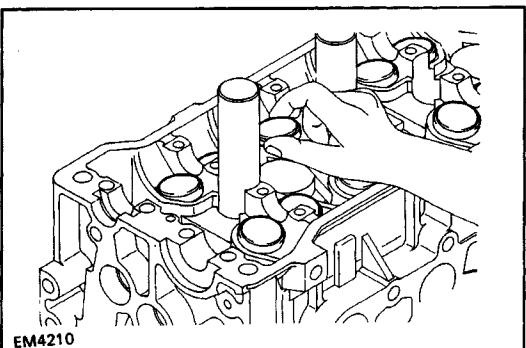


(c) Using SST, compress the valve spring and place the two keepers around the valve stem.

SST 09202-70010



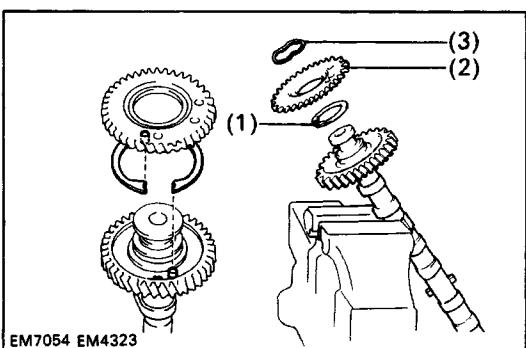
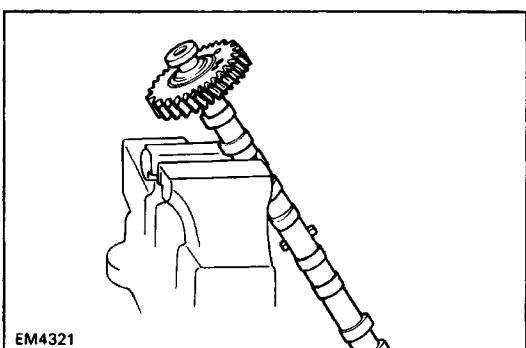
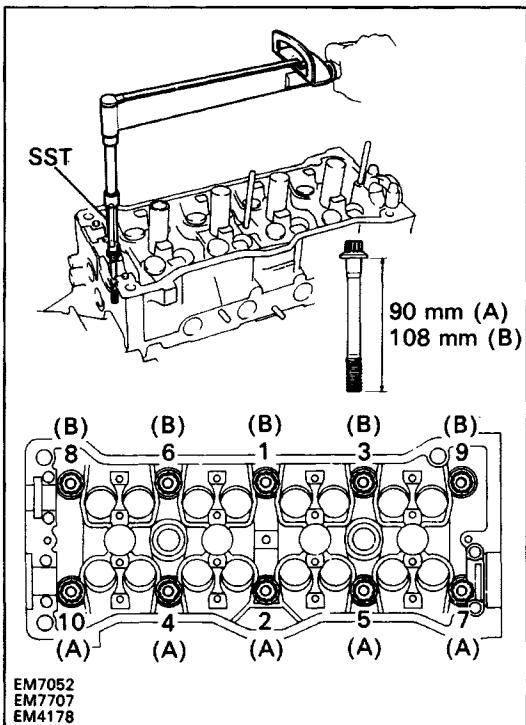
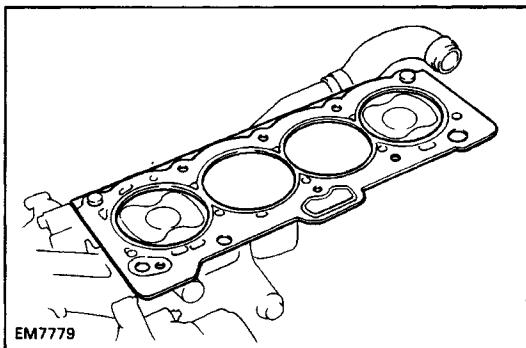
(d) Using a plastic-faced hammer, lightly tap the valve stem tip to assure proper fit.



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-81](#))

1. INSTALL CYLINDER HEAD

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

NOTICE: Be careful of the installation direction.

- Place the cylinder head in position on the cylinder head gasket.

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

- Install the plate washer to each cylinder head bolt.

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

SST 09205-16010

Torque: 60 N·m (610 kgf·cm, 44 ft-lbf)

HINT: Cylinder head bolts are in length of 90 mm (3.54 in.) and 108 mm (4.25 in.). Install the 90 mm (3.54 in.) bolts (A) in intake manifold side positions. Install the 108 mm (4.25 in.) bolts (B) in exhaust manifold side positions.

2. ASSEMBLE EXHAUST CAMSHAFT

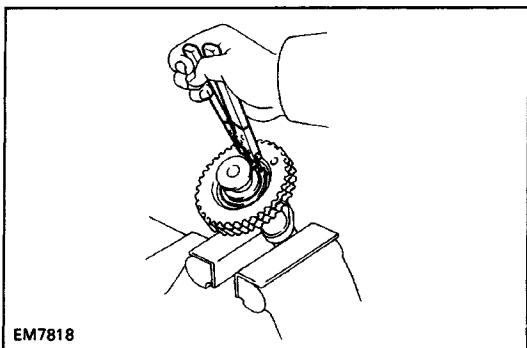
- Mount the hexagon wrench head portion of the camshaft in a vise.

NOTICE: Be careful not to damage the camshaft.

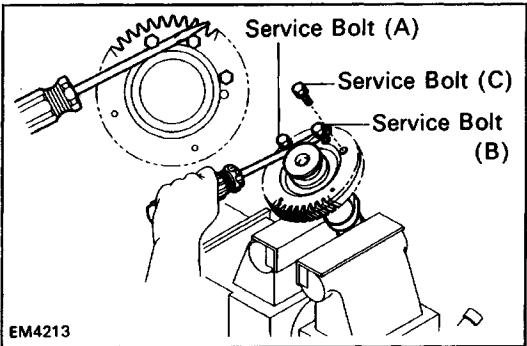
- Install the following parts:

- Camshaft gear spring
- Camshaft sub-gear
- Wave washer

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



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

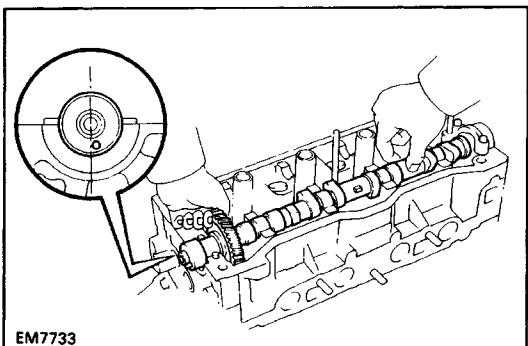


- (d) Insert service bolts (A) and (13) into the service hole of the camshaft sub-gear.
- (e) Using a screwdriver, align the holes of the camshaft drive gear and sub-gear by turning camshaft sub-gear clockwise, and install a service bolt (C).

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.



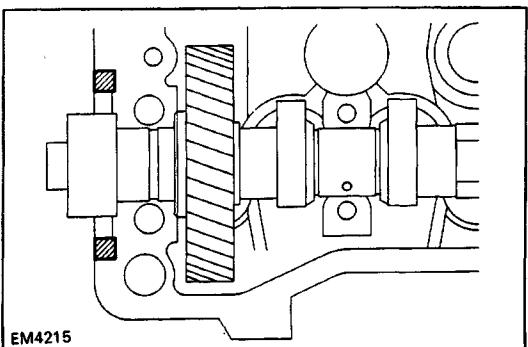
A. Install exhaust camshaft

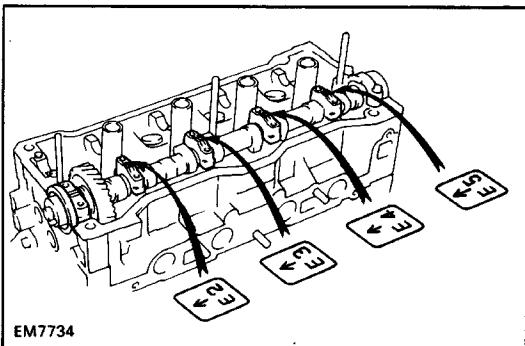
- (a) Apply MP grease to the thrust portion of the camshaft.
- (b) Place the intake camshaft so the knock pin is located slightly counterclockwise from the vertical axis of the camshaft.

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

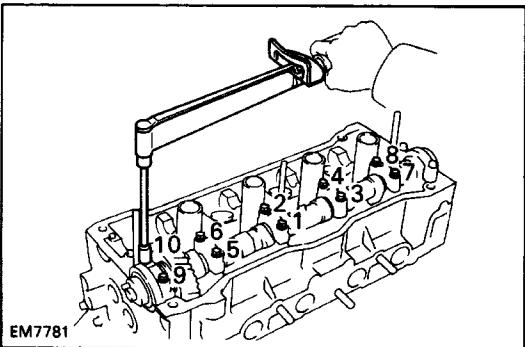
- (c) Remove any old packing (FIPG) material.
- (d) Apply seal packing to the cylinder head as shown in the illustration.

Seal packing: Part No. 08826-00080 or equivalent





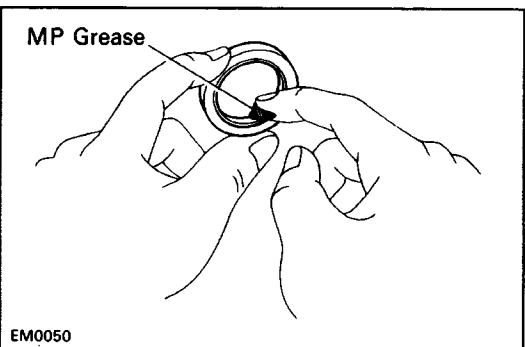
(e) Install the five bearing caps in their proper locations.



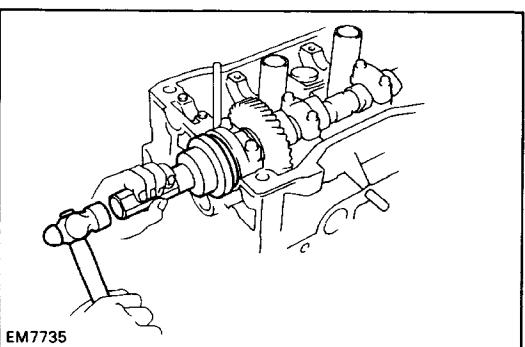
(f) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

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

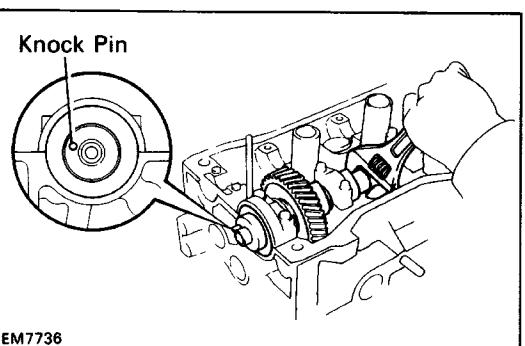
Torque: 13 N·m (130 kgf·cm, 9 ft-lbf)



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

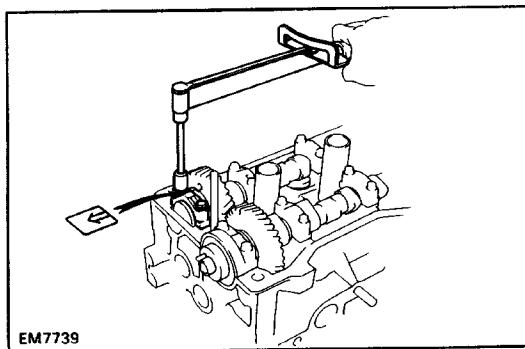
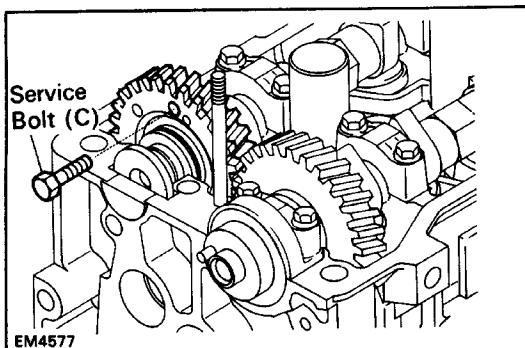
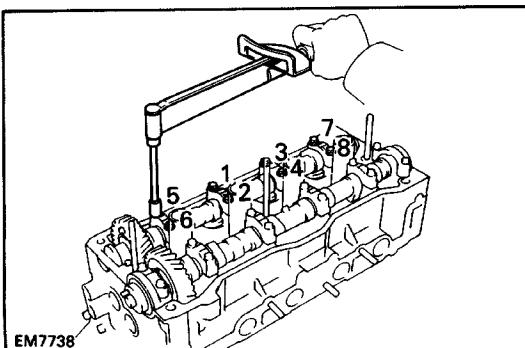
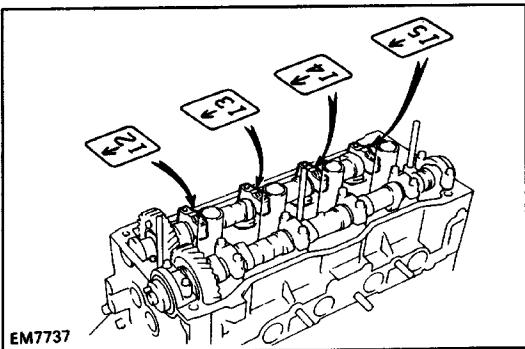
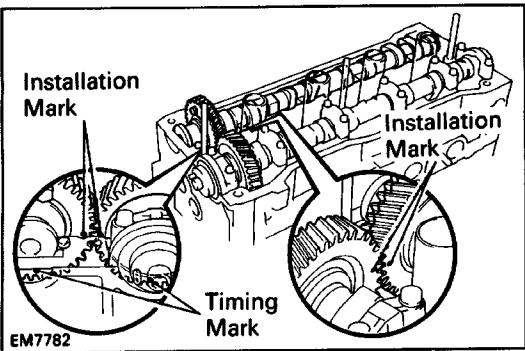


(i) Using SST, tap in the oil seal.
SST 09223-46011



B. Install intake camshaft

(a) Set the intake camshaft so the knock pin is slightly above the top of the cylinder 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) Install 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: 13 N·m (130 kgf·cm, 9 ft·lbf)

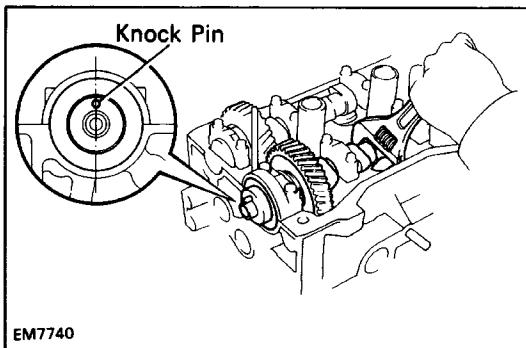
- (h) Remove the service bolt (C).

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

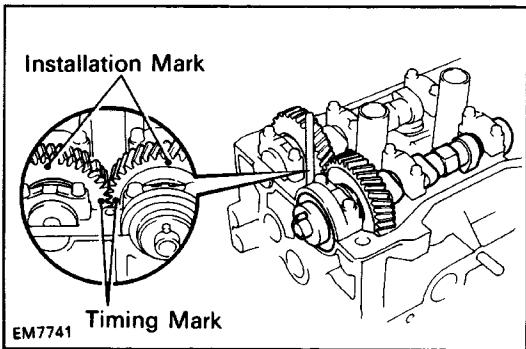
NOTICE: If the No.1 bearing cap does not fit properly, push the camshaft gear backwards by prying apart the cylinder head and camshaft gear with a screwdriver.

- (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: 13 N·m (130 kgf·cm, 9 ft·lbf)



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



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

HINT: The assembly installation marks are on upside.

4. CHECK AND ADJUST VALVE CLEARANCE

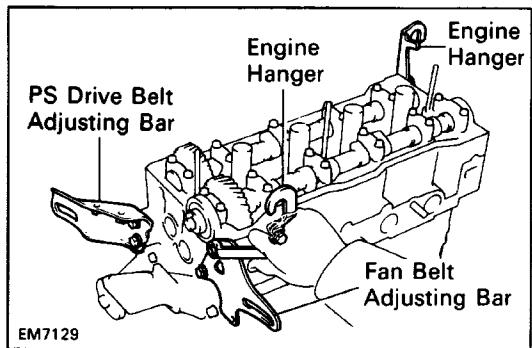
(See page [EM-13](#))

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 PS DRIVE BELT ADJUSTING STRUT

Install the adjusting strut with the two bolts.

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

6. INSTALL ENGINE HANGERS

Install the engine hanger with the bolt. Install the two engine hangers.

Torque: 27 N·m (280 kgf·cm, 20 ft-lbf)

7. INSTALL FAN BELT ADJUSTING BAR

Install the adjusting bar with the two bolts.

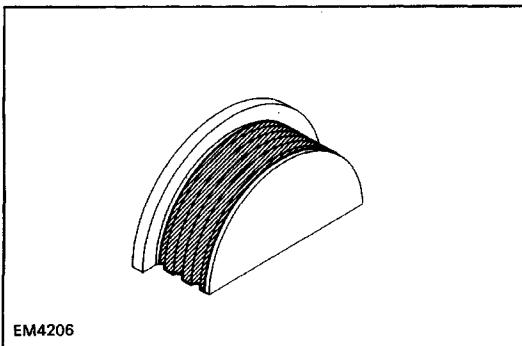
Torque: 20 N·m (200 kgf·cm, 14 ft-lbf)

8. INSTALL CAMSHAFT TIMING PULLEY

(See step 7 on page [EM-41](#))

9. INSTALL TIMING BELT

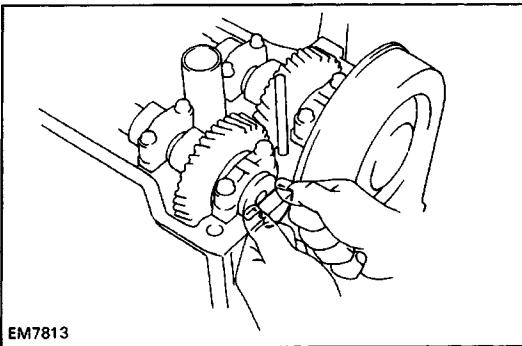
(See steps 8 to 13, 15 to 17, 19 to 22 on pages [EM-41](#) to [45](#))



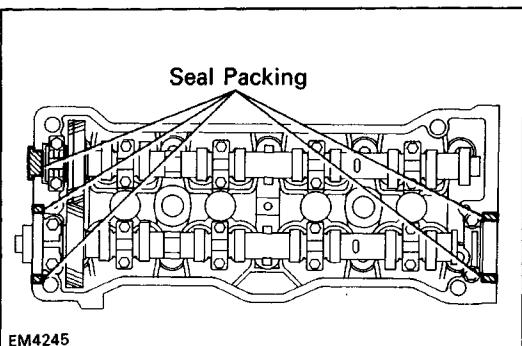
10. INSTALL SEMI-CIRCULAR PLUG

- (a) Remove any old packing (FIPG) material.
- (b) Apply seal packing to the circular plug.

Seal packing: Part No. 08826-00080 or equivalent



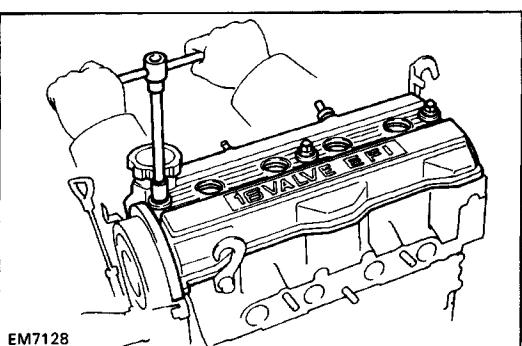
- (c) Install the semi-circular plug to the cylinder head.



11. INSTALL CYLINDER HEAD COVER

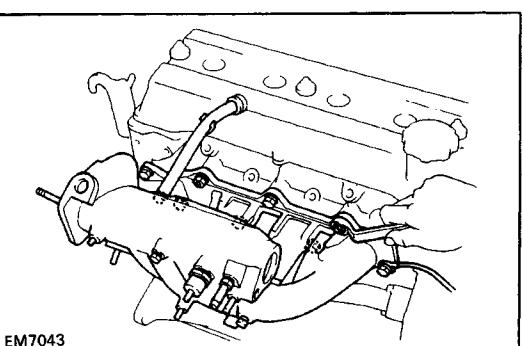
- (a) Remove any old packing (FIPG) material.
- (b) Apply seal packing to the cylinder head as shown in the illustration.

Seal packing: Part 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. Uniformly tighten the nuts in several passes.

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

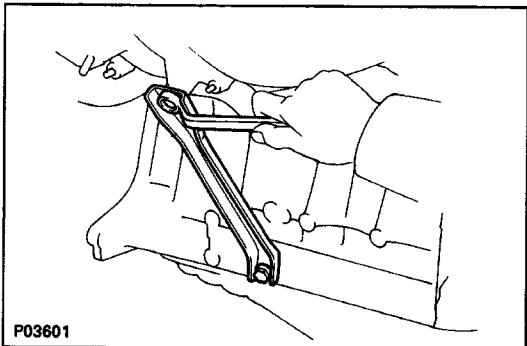


12. INSTALL INTAKE MANIFOLD

- (a) Install a new gasket and the intake manifold with the seven bolts and two nuts. Uniformly tighten the bolts and nuts in several passes.

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

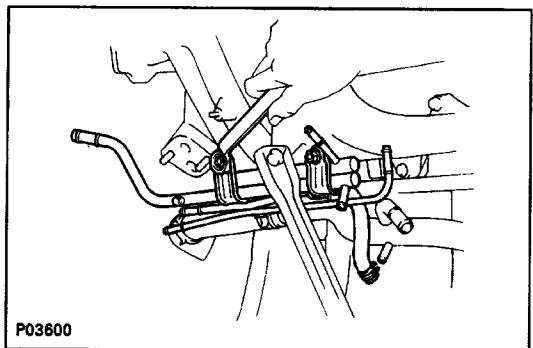
- (b) Connect the PCV hose to PCV valve on the cylinder head.



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

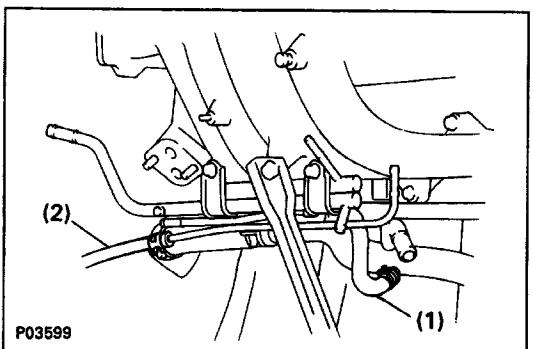
Torque:

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



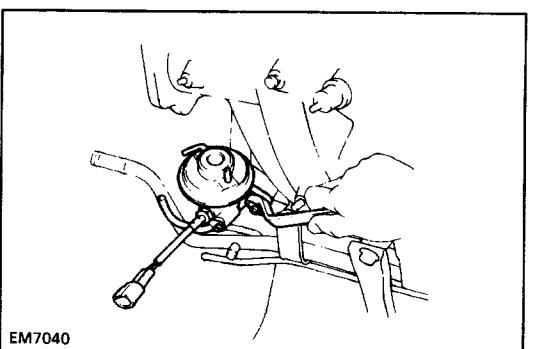
13. INSTALL AIR PIPE

(a) Install the air pipe with the two nuts.



(b) Connect the following hoses:

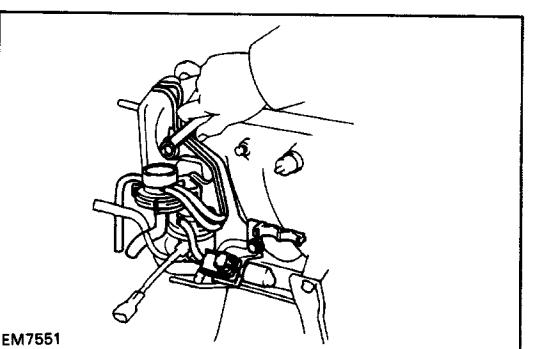
- (1) Water inlet pipe water by-pass hose
- (2) Fuel return hose (from fuel filter)



14. INSTALL EGR VALVE

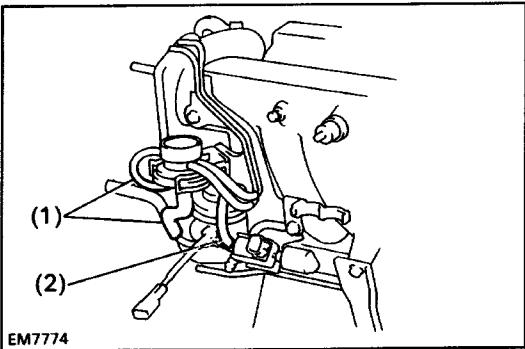
Install the EGR valve with the two nuts.

Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)



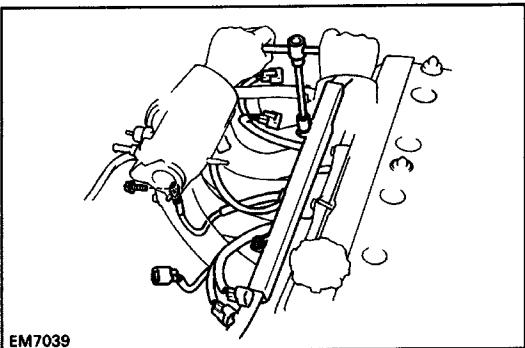
15. INSTALL VACUUM PIPE, EGR VACUUM MODULATOR AND EGR VSV

(a) Install the vacuum pipe, vacuum modulator and VSV assembly with the two nuts.



(b) Connect the following hoses:

- (1) Two vacuum hoses (from EGR vacuum modulator) to EGR valve
- (2) Vacuum hose (from EGR VSV) to EGR valve



16. INSTALL ENGINE WIRE TO INTAKE MANIFOLD

- (a) Install the engine wire with the three bolts.
- (b) Install the engine wire on the engine to vacuum pipe with the wire clamp.
- (c) Connect the following connectors:
 - EGR VSV connector
 - (CALIF. only)
EGR gas temperature sensor connector
 - Vacuum sensor connector

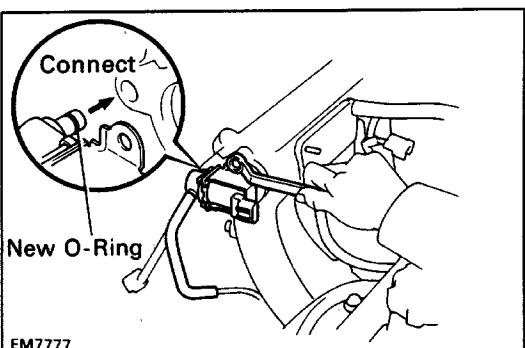
17. INSTALL ENGINE WIRE TO No.3 TIMING BELT COVER

- (a) Install the wire clamp on the 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
 - A/C compressor connector

18. INSTALL ACV

- (a) Install a new O-ring to the ACV.
- (b) Apply soapy water to the O-ring.
- (c) Install the ACV with the bolt and nut.
- (d) Connect the air hose to the air pipe.

Torque: 13 N·m (130 kgf·cm, 9 ft-lbf)

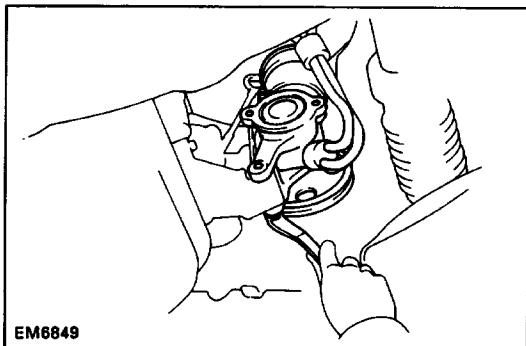


19. INSTALL INJECTORS AND DELIVERY PIPE

(See steps 1 to 5 on pages **FI-158** and **159**)

20. INSTALL THROTTLE BODY

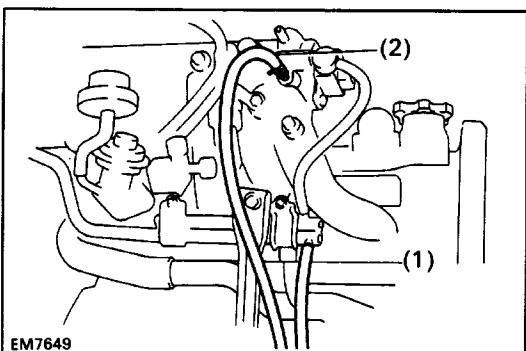
(See steps 2 to 5 on page **FI-191**)



21. INSTALL PS PUMP

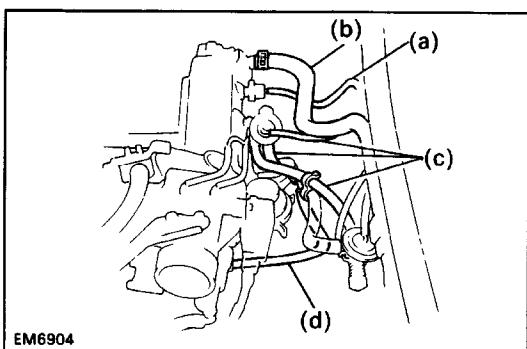
(a) Install the PS pump and drive belt with the two bolts.

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



(b) Connect the following hoses:

- (1) Air hose to air pipe
- (2) Air hose to intake manifold



22. CONNECT VACUUM HOSES

- (a) Vacuum sensor hose to Tegas filter on intake manifold
- (b) Brake booster vacuum hose to intake manifold
- (c) Three A/C vacuum hoses to ASV on intake manifold
- (d) A/C vacuum hose to air pipe

23. 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.

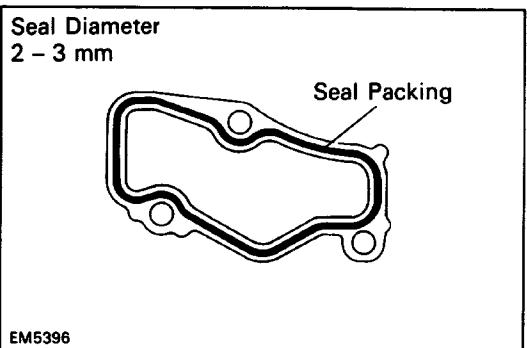
(b) Apply seal packing to the inlet housing groove.

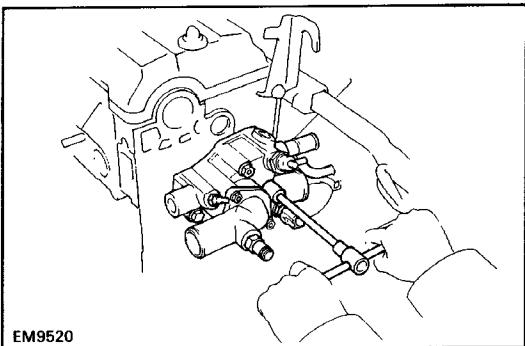
Seal packing: Part No. 08826-00100 or equivalent

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

HINT: Avoid applying an excessive amount to the surface.

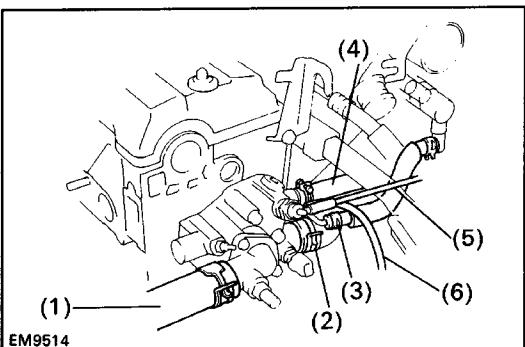
- Parts must be assembled within 15 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.





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

Torque: 20 N·m (200 kgf·cm, 14 ft-lbf)



(d) Connect the following hoses: ,

- (1) Lower radiator hose
- (2) Water inlet pipe hose
- (3) Auxiliary air valve water by-pass hose
- (4) Heater water hose
- (5) EVAP BSV vacuum hose (from port P of throttle body)
- (6) EVAP BSV vacuum hose (from charcoal canister)

(e) Connect the following connectors:

- Water temperature sender gauge connector
- Water temperature sensor connector

24. 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 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 water outlet groove.

Seal packing: Part No. 08826-00100 or equivalent

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

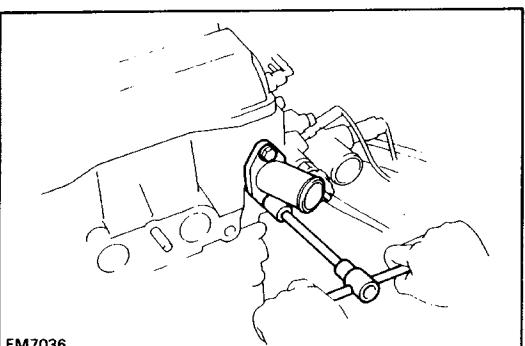
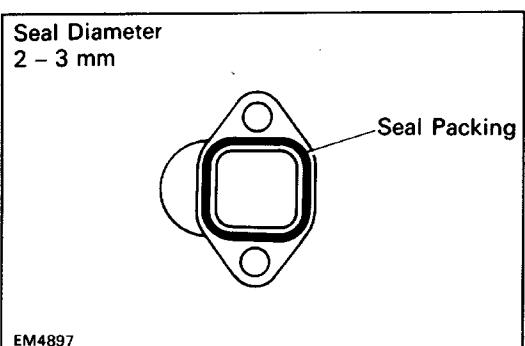
HINT: Avoid applying an excessive amount to the surface.

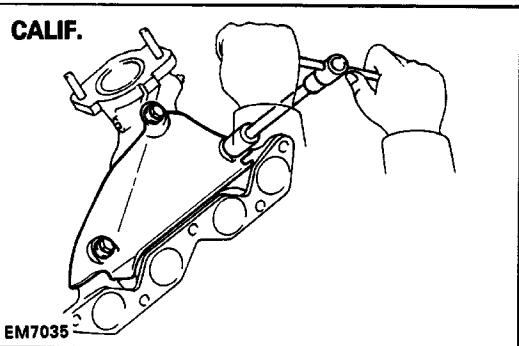
- Parts must be assembled within 15 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

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

Torque: 15 N·m (150 kgf·cm, 11 ft-lbf)

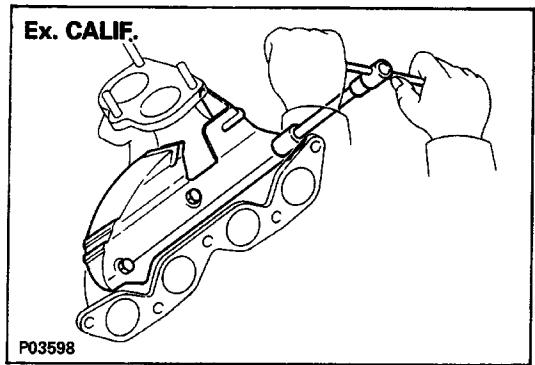
(d) Connect the upper radiator hose to the water outlet.





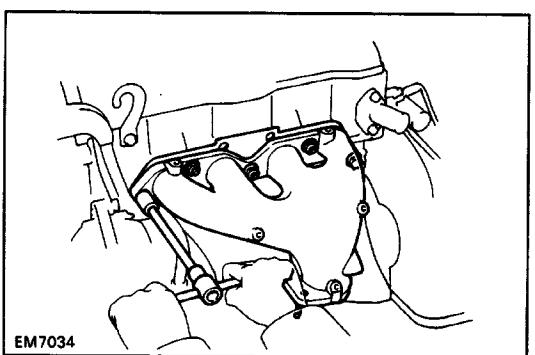
25. INSTALL EXHAUST MANIFOLD

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



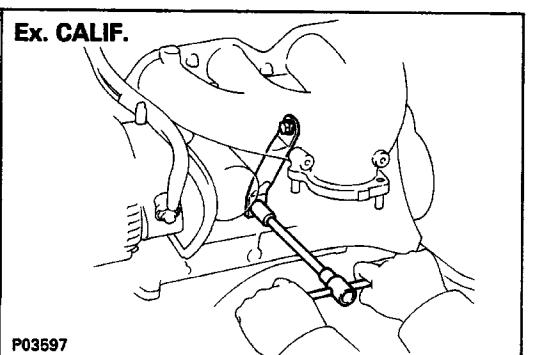
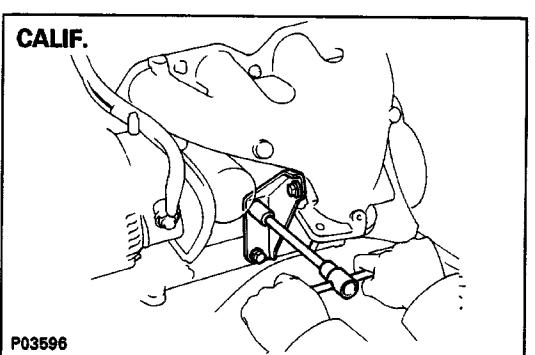
(b) Install a new gasket and the exhaust manifold with the two bolts and three new nuts. Uniformly tighten the bolts and nuts in several passes.

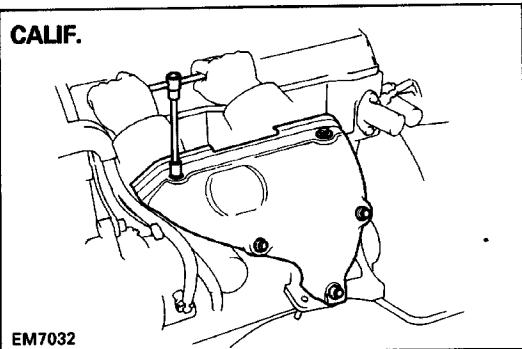
Torque: 25 N·m (250 kgf·cm, 18 ft-lbf)



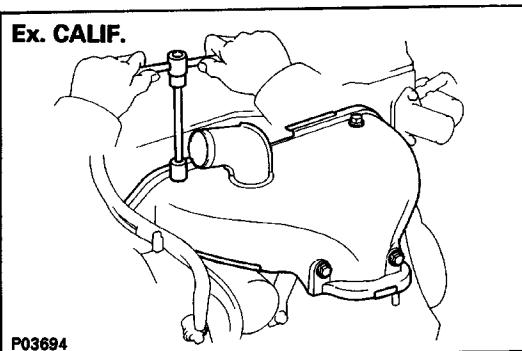
(c) Install the manifold stay with the three (CALIF.) or two (Ex. CALIF.) bolts. Alternately tighten the bolts.

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



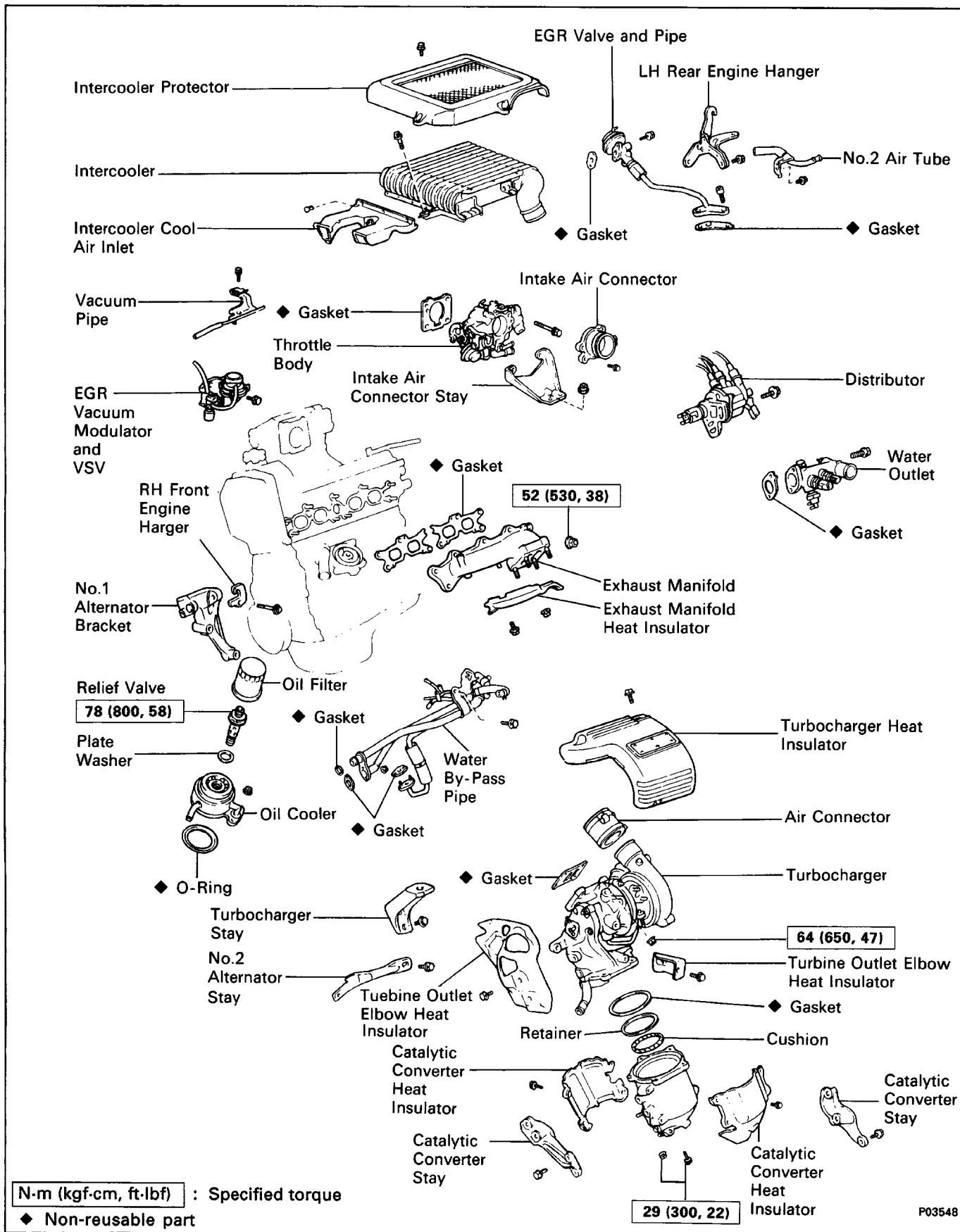


(d) Install the upper heat insulator with the five (CALIF.) or four (Ex. CALIF.) bolts.

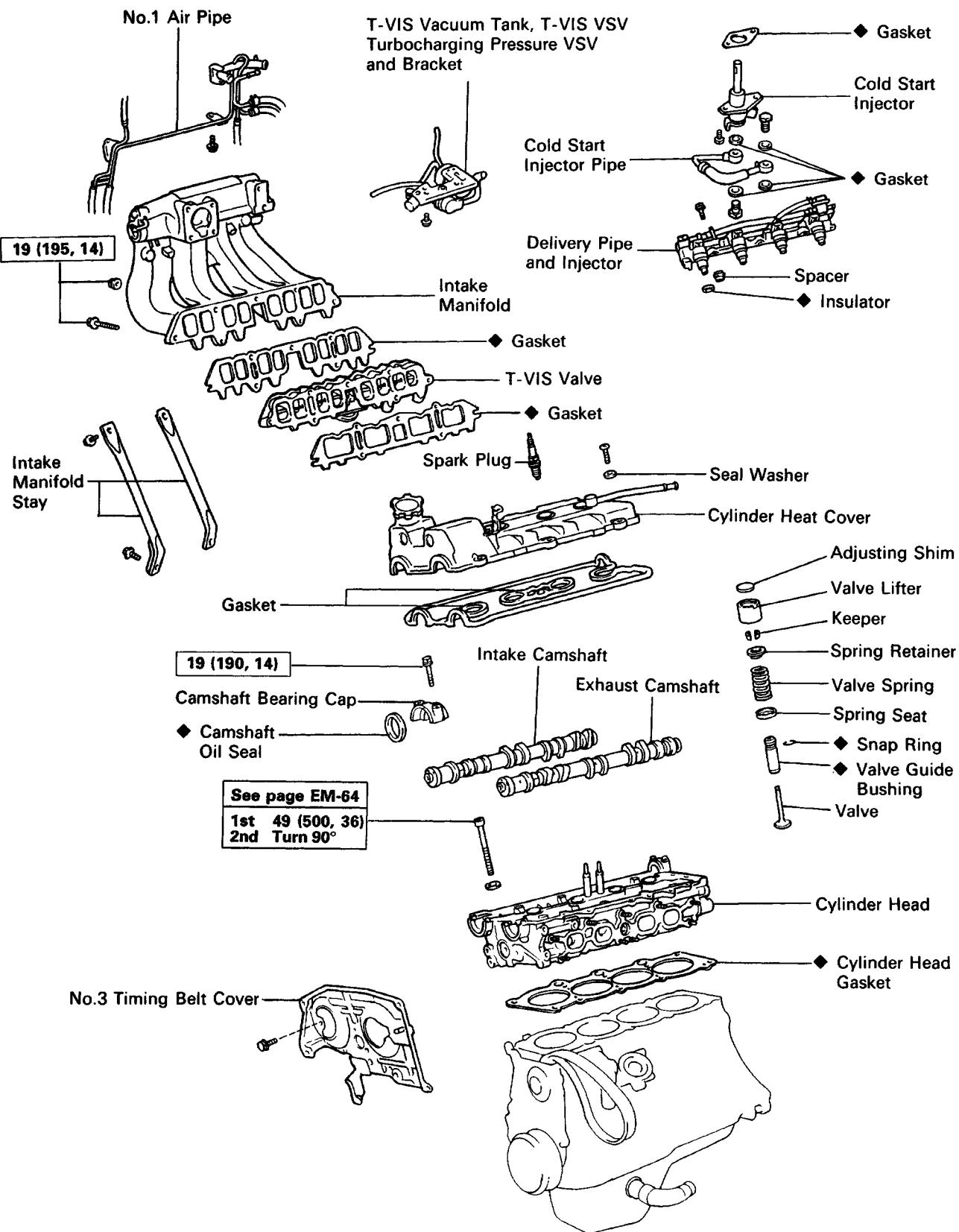


26. INSTALL DISTRIBUTOR (See page [IG-24](#))
27. INSTALL FRONT EXHAUST PIPE
(See step 17 on page [EM-217](#))
28. INSTALL SUSPENSION LOWER CROSSM EM BER
(See page 18 on page [EM-218](#))
29. INSTALL ENGINE UNDER COVERS
30. INSTALL AIR CLEANER
31. INSTALL ACCELERATOR CABLE, AND ADJUST IT
32. (A/T)
CONNECT THROTTLE CABLE, AND ADJUST IT
33. FILL WITH ENGINE COOLANT (See page [CO-6](#))
Capacity (w/ Heater):
M/T 5.2 liters (5.5 US qts, 4.6 Imp. qts)
A/T 5.6 liters (5.9 US qts, 4.9 Imp. qts)
34. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY
35. START ENGINE AND CHECK FOR LEAKS
36. PERFORM ENGINE ADJUSTMENT
 - (a) Adjust the ignition timing. (See page [IG-25](#))
Ignition timing:
10° BTDC idle
(w/ Terminals TE1 and E1 connected)
 - (b) Adjust the idle speed. (See page [MA-8](#))
Idle speed: 800 rpm (w/ Cooling fan OFF)
37. PERFORM ROAD TEST
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.
38. RECHECK ENGINE COOLANT LEVEL AND OIL LEVEL

CYLINDER HEAD (3S-GTE) COMPONENTS



COMPONENTS (Cont'd)



REMOVAL OF CYLINDER HEAD

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

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

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

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

3. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY

4. REMOVE AIR CLEANER CAP

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

5. REMOVE INTERCOOLER

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

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

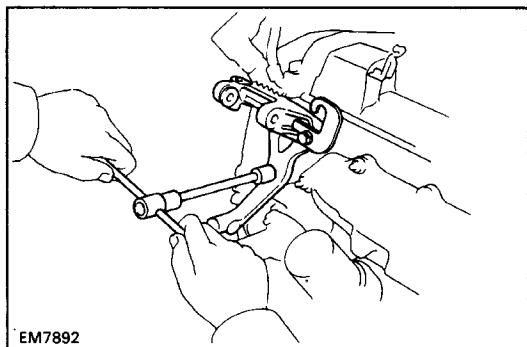
7. REMOVE ENGINE UNDER COVER

8. REMOVE SUSPENSION LOWER CROSMEMBER

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

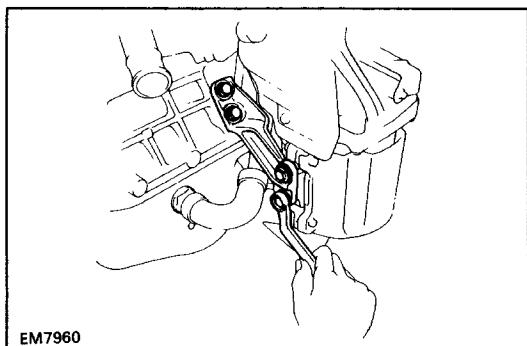
9. REMOVE FRONT EXHAUST PIPE

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



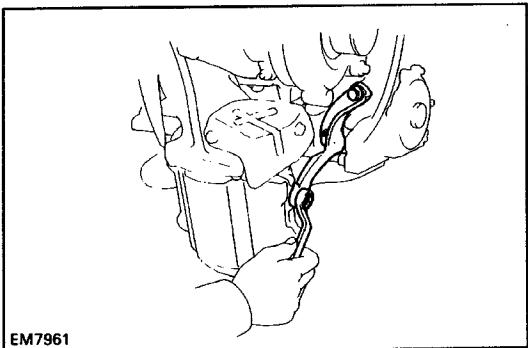
10. REMOVE RH FRONT ENGINE HANGER AND NO.1 ALTERNATOR BRACKET

Remove the three bolts, engine hanger and alternator bracket.

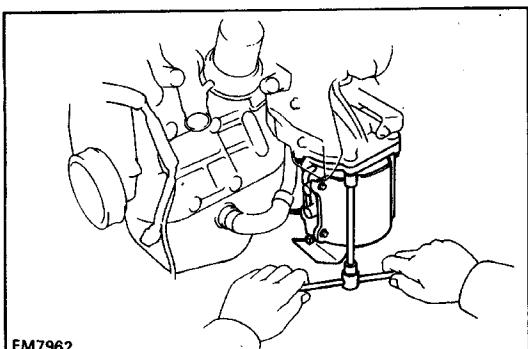


11. REMOVE CATALYTIC CONVERTER

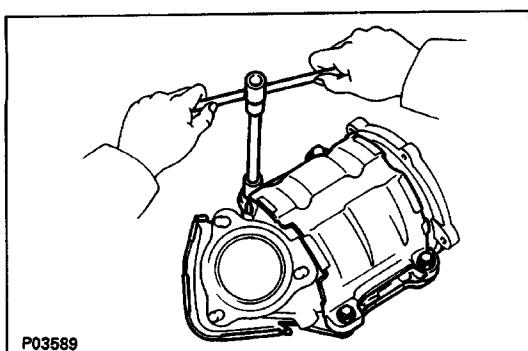
(a) Remove the four bolts and RH converter stay.



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



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



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

12. REMOVE TURBOCHARGER

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

13. REMOVE THROTTLE BODY

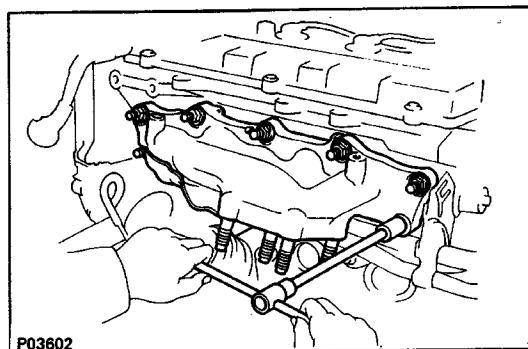
(See steps 5 to 8, 10 and 11 on pages [FI-194](#) and [195](#))

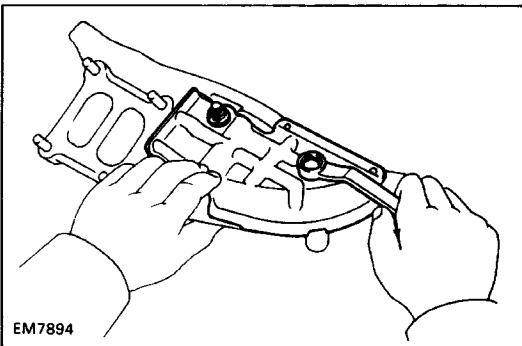
14. REMOVE COLD START INJECTOR

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

15. REMOVE EXHAUST MANIFOLD

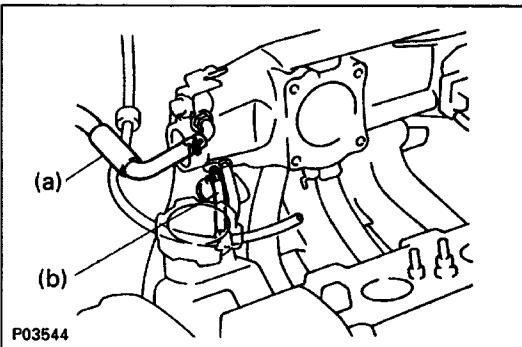
(a) Remove the nine nuts, exhaust manifold and gas ket.





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

16. REMOVE DISTRIBUTOR (See page [IG-26](#))

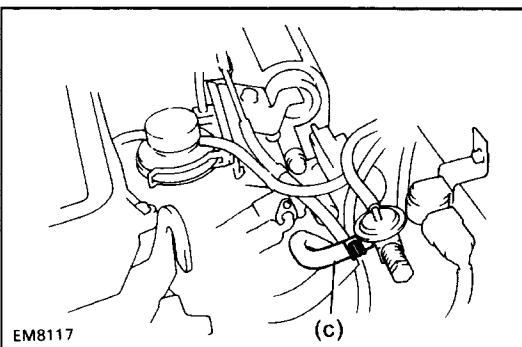


17. DISCONNECT HOSES

(a) Brake booster vacuum hose from intake manifold

(b) Turbocharging pressure sensor hose from intake manifold

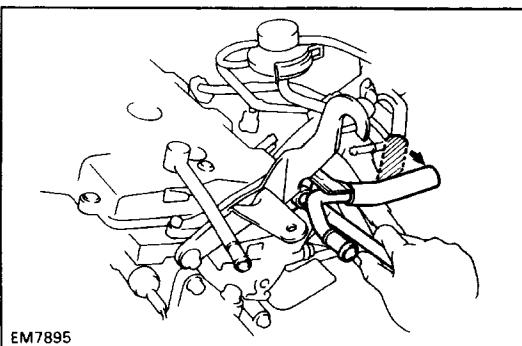
(c) A/C ASV air hose from No.1 air tube



18. REMOVE NO.2 AIR TUBE

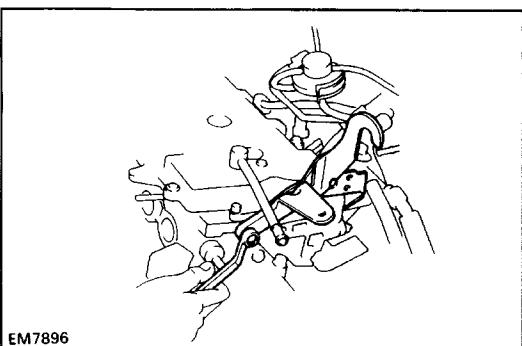
(a) Disconnect the air hose from the No.1 air tube.

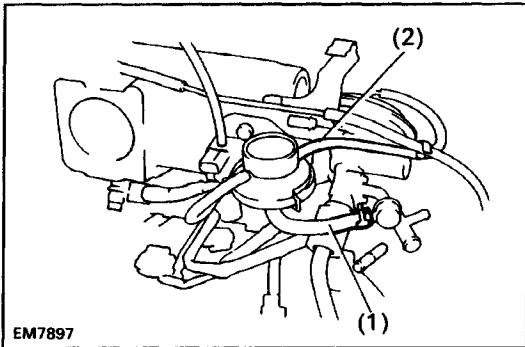
(b) Remove the bolt and No.1 air tube.



19. REMOVE LH ENGINE HANGER

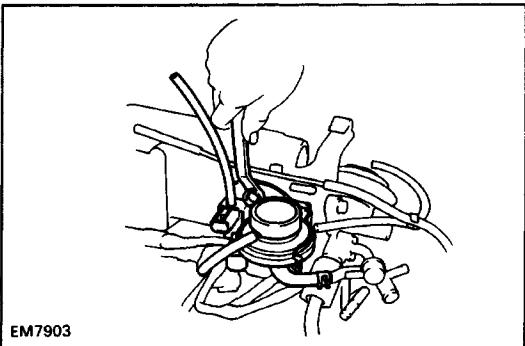
Remove the two bolts and engine hanger.



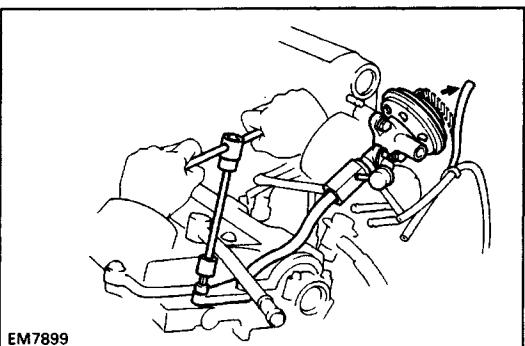


20. REMOVE EGR VACUUM MODULATOR AND VSV

- Disconnect the EGR VSV connector.
- Disconnect the following hoses:
 - Vacuum hose from EGR valve
 - Vacuum hose from EGR vacuum modulator

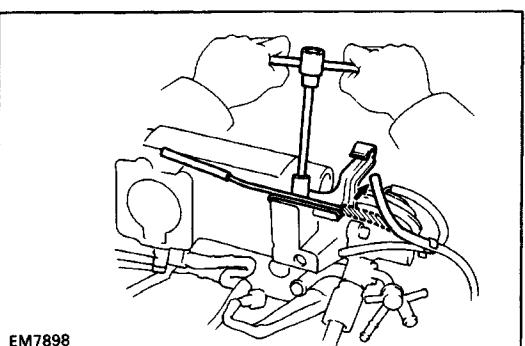


- Remove the bolt, vacuum modulator and VSV assembly.



21. REMOVE EGR VALVE AND PIPE

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

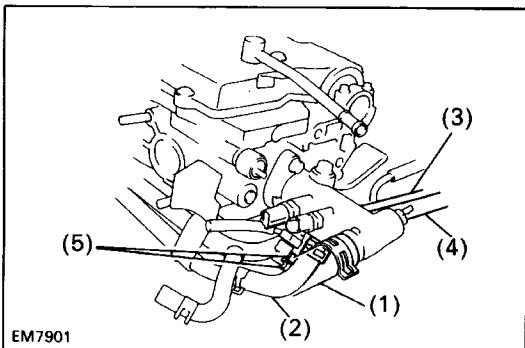


22. REMOVE VACUUM PIPE

- Disconnect the vacuum hose from the vacuum pipe.
- Remove the bolt and vacuum pipe.

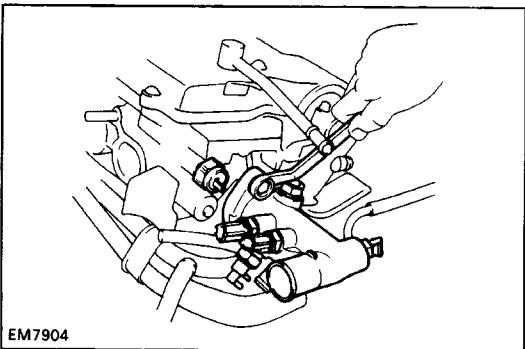
23. REMOVE WATER OUTLET

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



(b) Disconnect the following hoses:

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

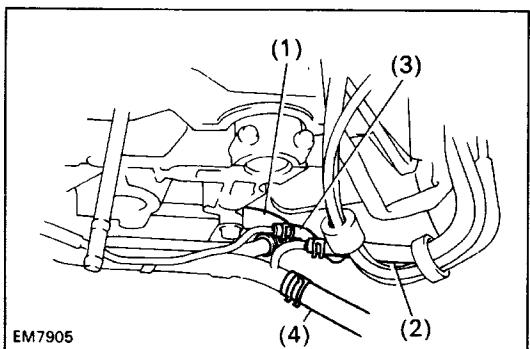


(c) Remove the two bolts, water outlet and gasket.

24. REMOVE OIL PRESSURE SWITCH

25. REMOVE OIL COOLER

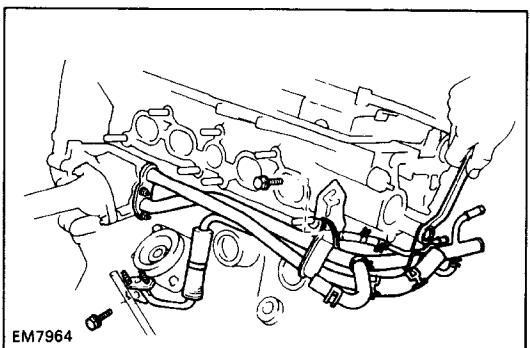
(See steps 4 to 6 on pages [LU-24](#) and [25](#))



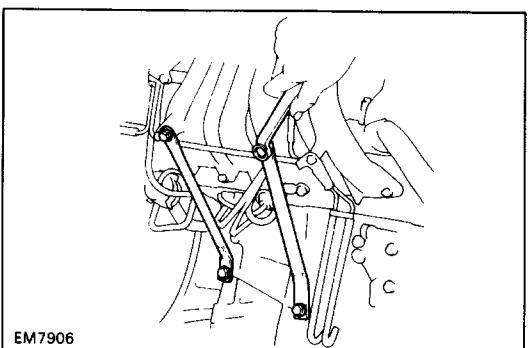
26. REMOVE WATER BY-PASS PIPE

(a) Disconnect the following hoses:

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

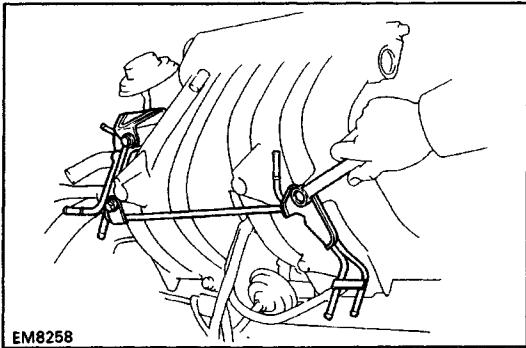
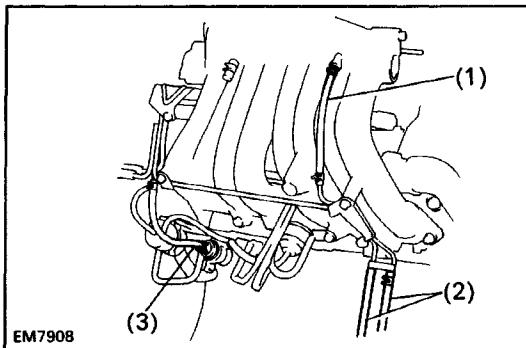


(b) Remove the two bolts, two nuts, water by-pass pipe, gasket and O-ring.



27. REMOVE INTAKE MANIFOLD STAYS

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

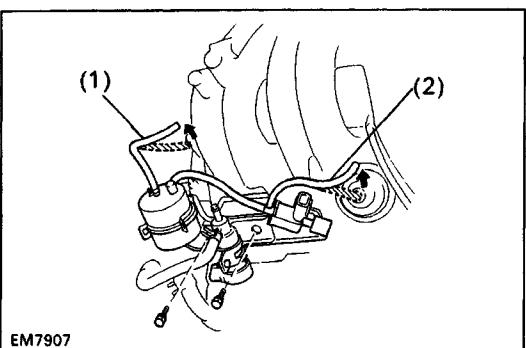


28. REMOVE NO.1 AIR TUBE

(a) Disconnect the following hoses:

- (1) Vacuum hose from intake manifold
- (2) Two PS vacuum hoses
- (3) Vacuum hose from turbocharging pressure VSV

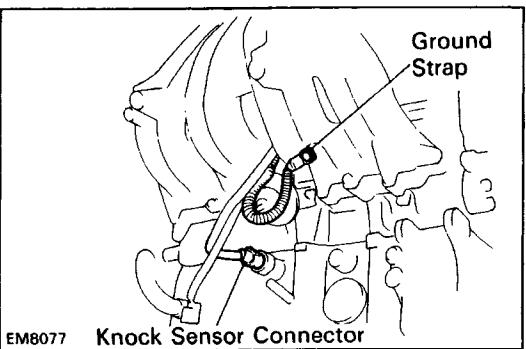
(b) Remove the three bolts and air tube.



(b) Disconnect the following hoses:

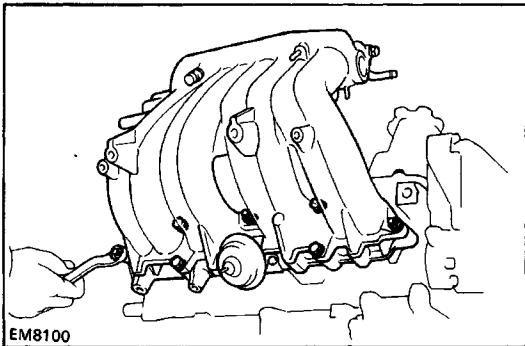
- (1) Vacuum hose (from T-VIS VSV) from T-VIS actuator
- (2) Vacuum hose (from T-VIS vacuum tank) from intake manifold

(c) Remove the two bolts, the T-VIS vacuum tank, T-VIS VSV, turbocharging pressure VSV and bracket assembly.



30. REMOVE INTAKE MANIFOLD AND T-VIS VALVE

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



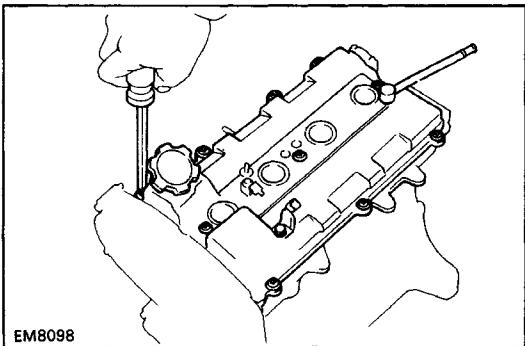
(c) Remove the four bolts, three nuts, intake manifold, T-VIS VSV and two gaskets.

31. REMOVE CHARCOAL CANISTER

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

32. REMOVE DELIVERY PIPE AND INJECTORS

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



33. REMOVE CYLINDER HEAD COVER

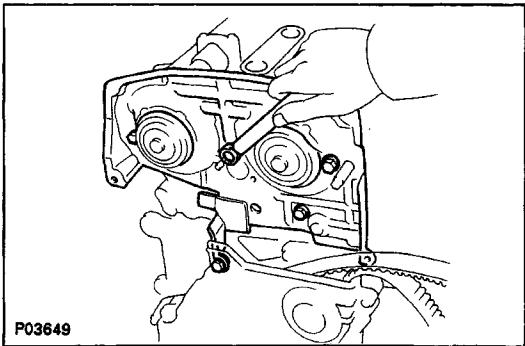
Remove the ten screws, seal washers, head cover and two gaskets.

34. REMOVE CAMSHAFT TIMING PULLEYS

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

35. REMOVE NO.1 IDLER PULLEY

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

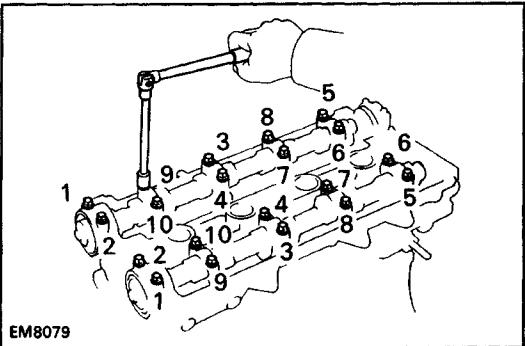


36. REMOVE NO.3 TIMING BELT COVER

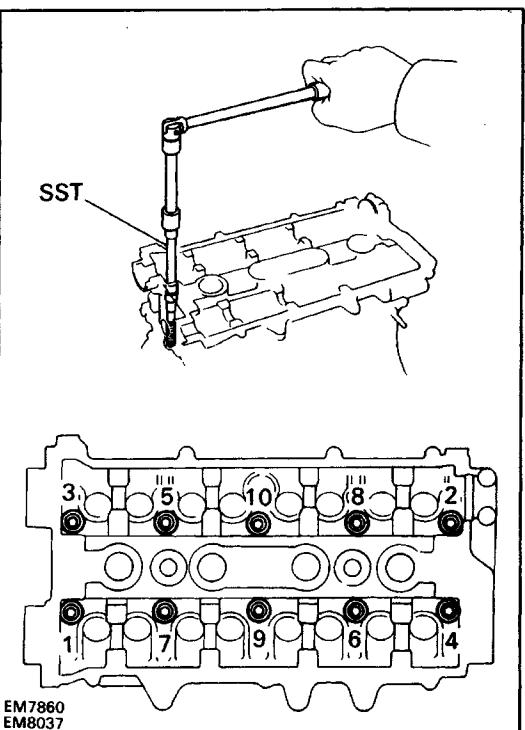
Remove the five bolts and timing belt cover.

**NOTICE:**

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

**37. REMOVE CAMSHAFTS**

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

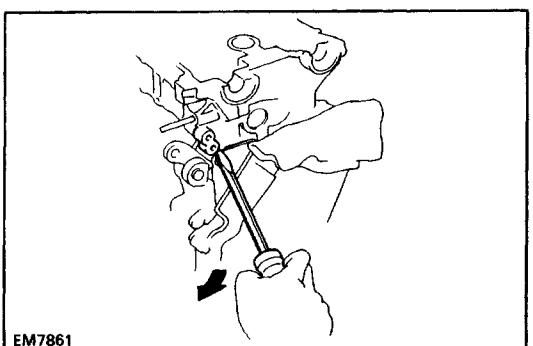
**38. REMOVE CYLINDER HEAD**

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

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

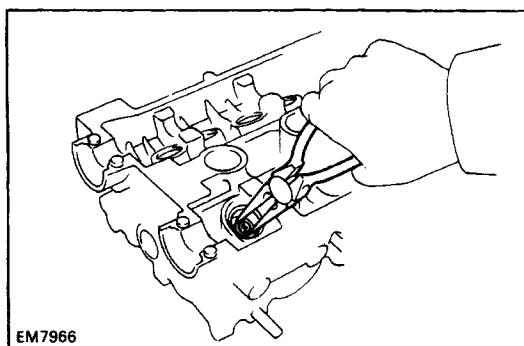
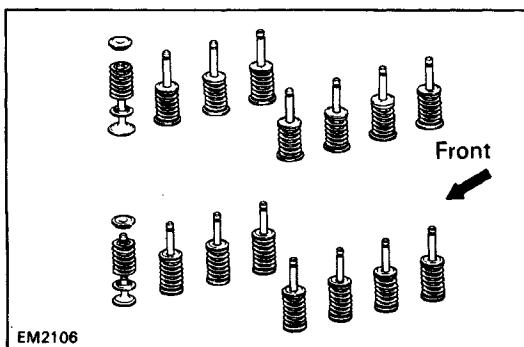
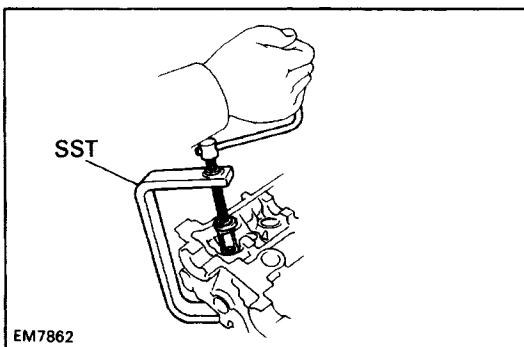
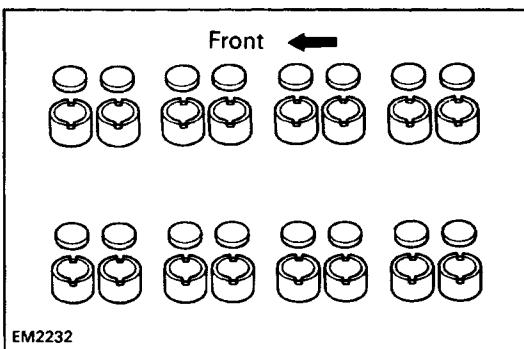
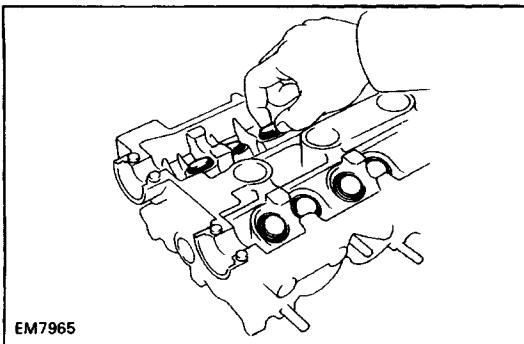
(b) Remove the ten plate washers.



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

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

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



DISASSEMBLY OF CYLINDER HEAD

(See page EM-117)

1. REMOVE VALVE LIFTERS AND SHIMS

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

2. REMOVE VALVES

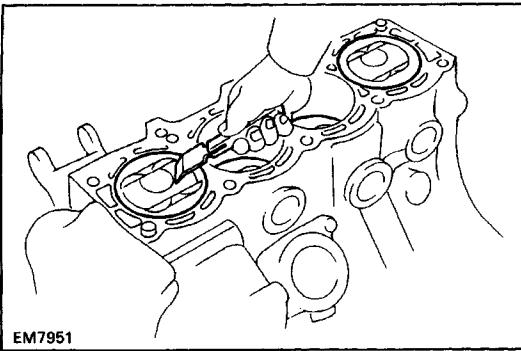
(a) Using SST, compress the valve spring and remove the two keepers.

SST 09202-70010

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

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

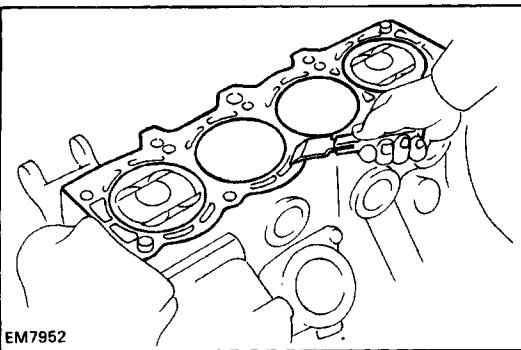
(c) Using needle-nose pliers, remove the oil seal.



INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

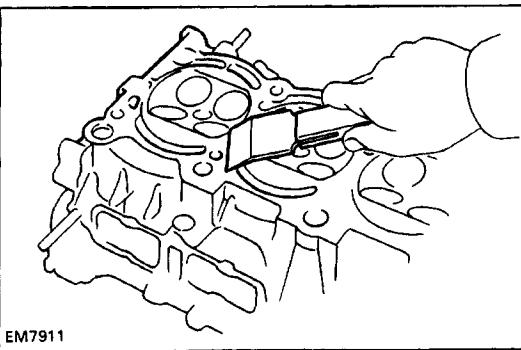
(a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.



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

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

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

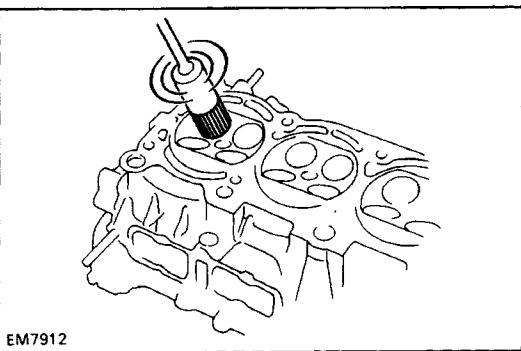


2. CLEAN CYLINDER HEAD

A. Remove gasket material

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

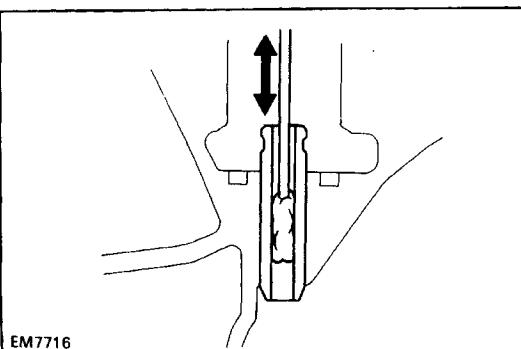
NOTICE: Be careful not to scratch the cylinder block contact surface.



6. Clean combustion chambers

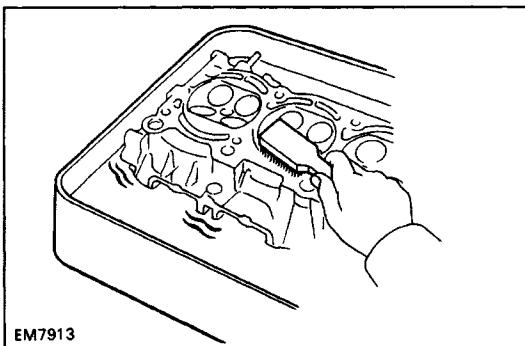
Using a wire brush, remove all the carbon from the combustion chambers.

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



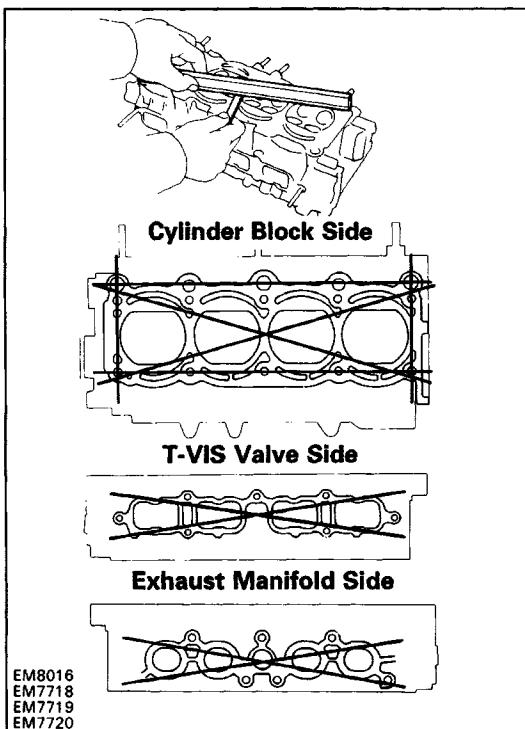
C. Clean valve guide bushings .

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



D. Clean cylinder head

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



3. INSPECT CYLINDER HEAD

A. Inspect for flatness

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

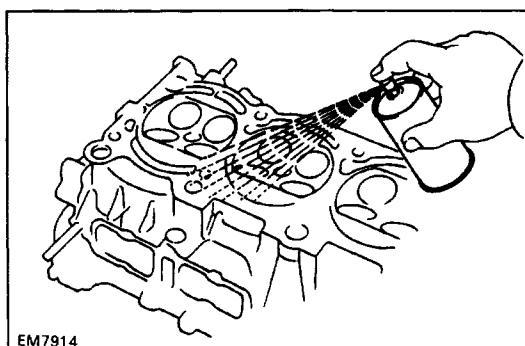
Maximum warpage:

Cylinder block side 0.20 mm (0.0079 in.)

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

Exhaust manifold side 0.30 mm (0.0118 in.)

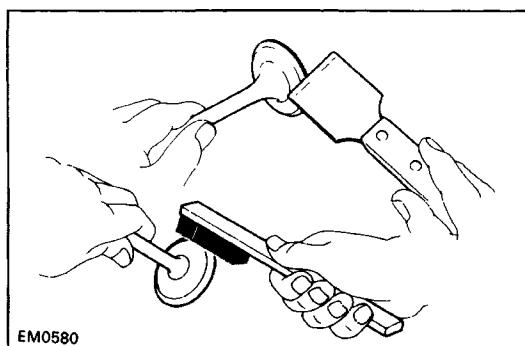
If warpage is greater than maximum, replace the cylinder head.



B. Inspect for cracks

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

If cracked, replace the cylinder head.



4. CLEAN VALVES

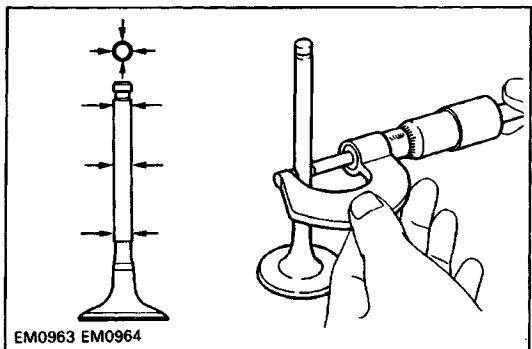
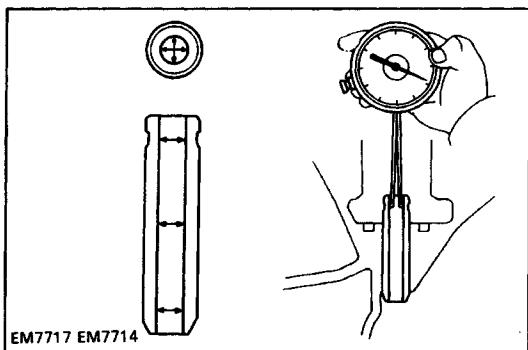
- (a) Using a gasket scraper, chip off any carbon from the valve head.
- (b) Using a wire brush, thoroughly clean the valve.

5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:

6.000 – 6.018 mm (0.2362 – 0.2369 in.)



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

Valve stem diameter:

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

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

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

Standard oil clearance:

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

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

Maximum oil clearance:

Intake 0.08 mm (0.0031 in.)

Exhaust 0.10 mm (0.0039 in.)

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

6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

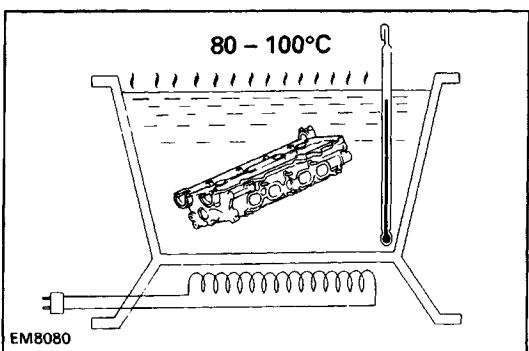
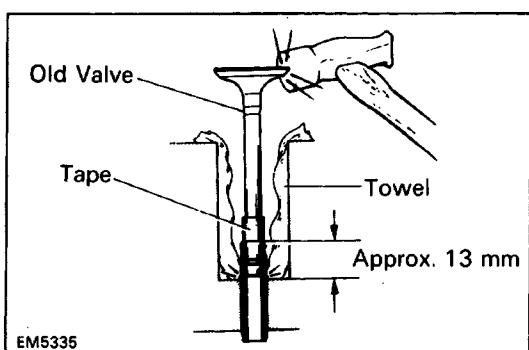
(a) (w/ Snap Ring)

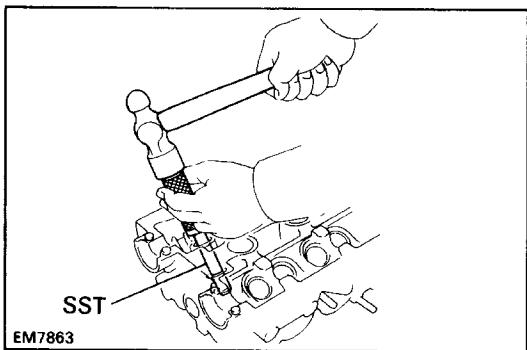
Insert an old valve wrapped with tape into the valve guide bushing, and break off the valve guide bushing by hitting it with a hammer. Remove the snap ring.

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

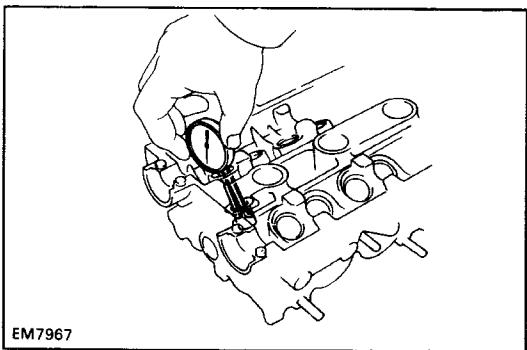
NOTICE: Be careful not to damage the valve lifter hole.

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





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

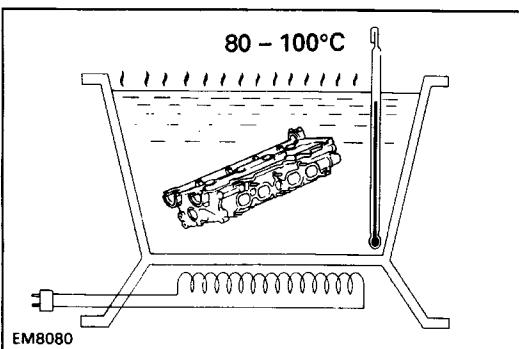


(d) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

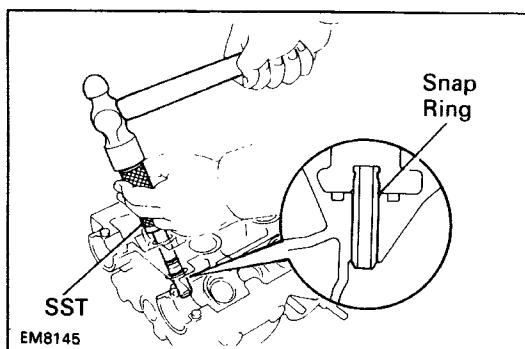
Bushing bore diameter mm* (in.)	Bushing size
10.988 – 11.006 (0.4326 – 0.4333)	Use STD
11.038 – 11.056 (0.4346 – 0.4353)	Use O/S 0.05

Both intake and exhaust

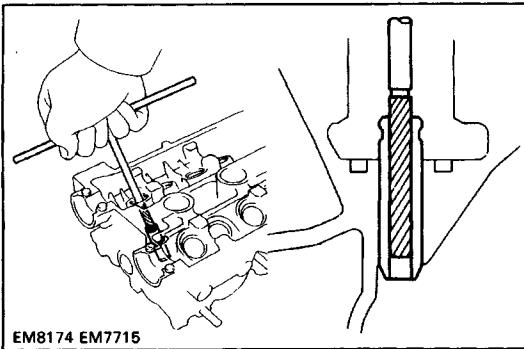
(e) Select a new guide bushing (STD or O/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 11.006 mm (0.4333 in.), machine the bushing bore to the following dimension:
11.038 – 11.056 mm (0.4346 – 0.4353 in.)
If the bushing bore diameter of the cylinder head is greater than 11.056 mm (0.4353 in.), replace the cylinder head.



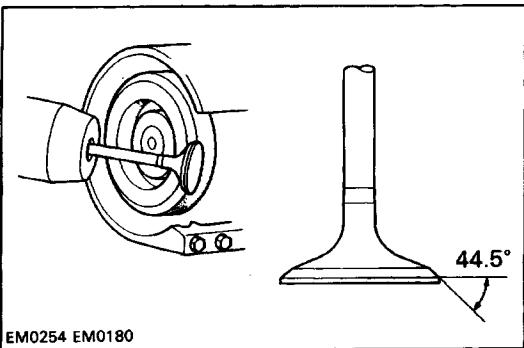
(f) Gradually heat the cylinder head to 80–100°C (176–212 °F).



(g) Using SST and a hammer, tap in a new guide bushing until the snap ring makes contact with the cylinder head.
SST 09201-70010



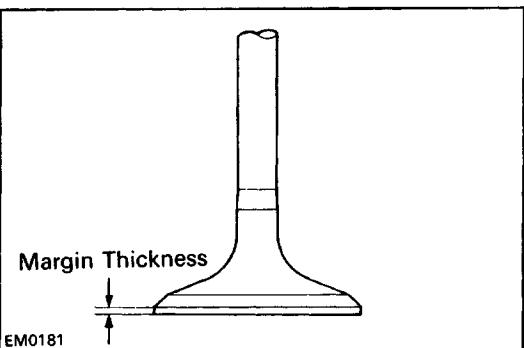
(h) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page EM-129) between the guide bushing and valve stem.



7. INSPECT AND GRIND VALVES

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

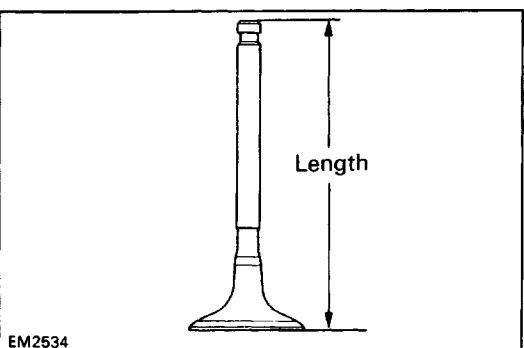
Valve face angle: 44.5°



(c) Check the valve head margin thickness.

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

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



(d) Check the valve overall length.

Standard overall length:

Intake 100.50 mm (3.9567 in.)

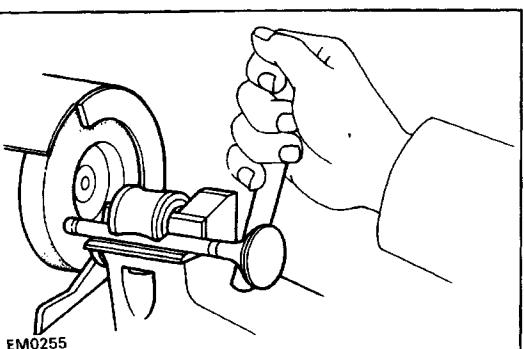
Exhaust 99.55 mm (3.9193 in.)

Minimum overall length:

Intake 99.80 mm (3.9291 in.)

Exhaust 98.85 mm (3.8977 in.)

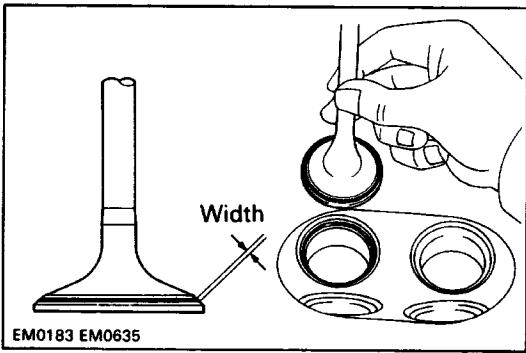
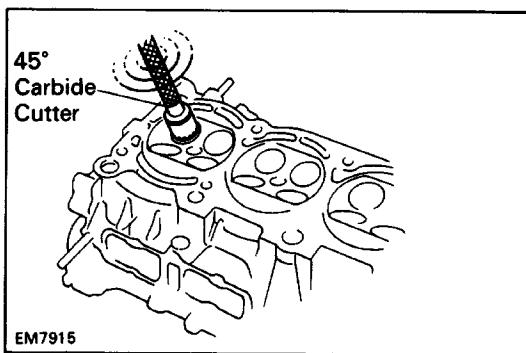
If the overall length is less than minimum, replace the valve.



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

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

NOTICE: Do not grind off more than minimum.



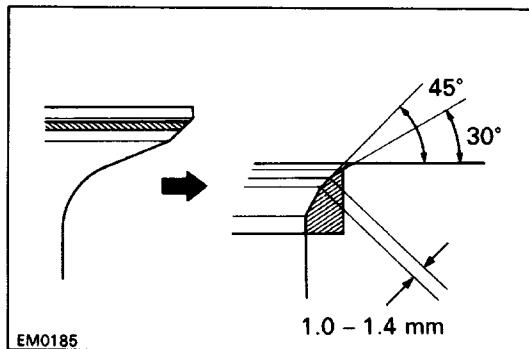
8. INSPECT AND CLEAN VALVE SEATS

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

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

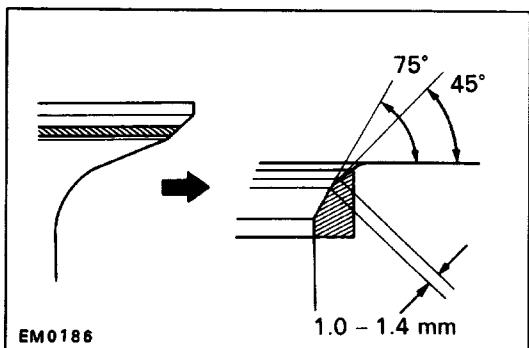
(c) Check the valve face and seat for the following:

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

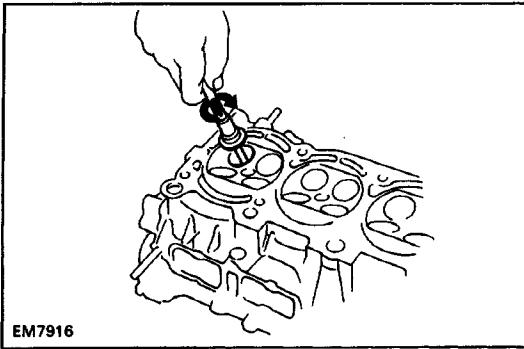


If not, correct the valve seats as follows:

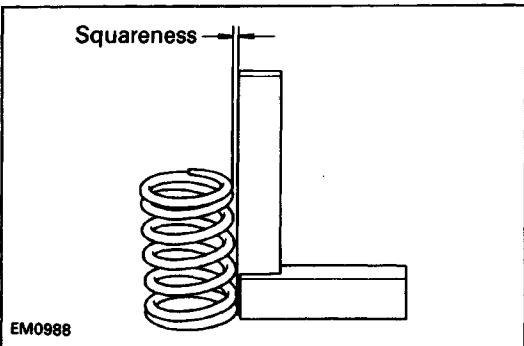
(1) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.



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



- (d) Hand-lap the valve and valve seat with an abrasive compound.
- (e) After hand-lapping, clean the valve and valve seat.

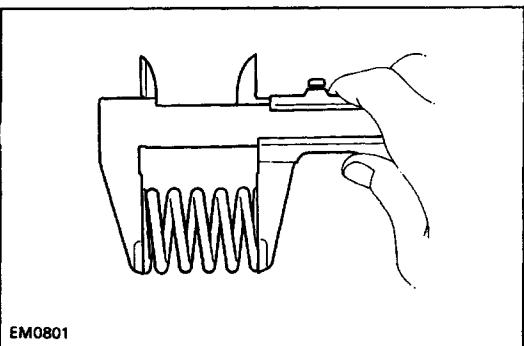


9. INSPECT VALVE SPRINGS

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

Maximum squareness: 2.0 mm (0.079 in.)

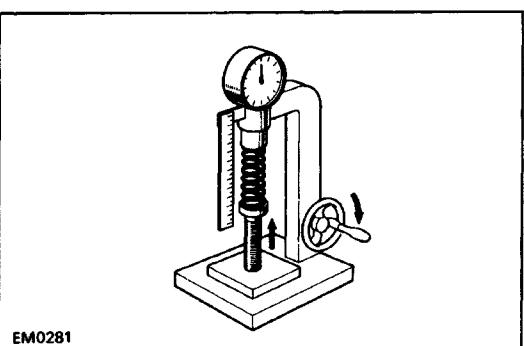
If the squareness is greater than maximum, replace the valve spring.



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

Free length: 44.43 mm (1.7492 in.)

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

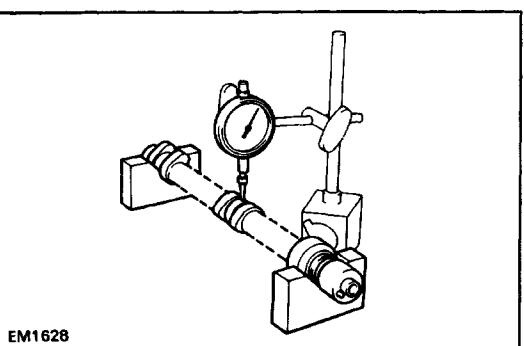


- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

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

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



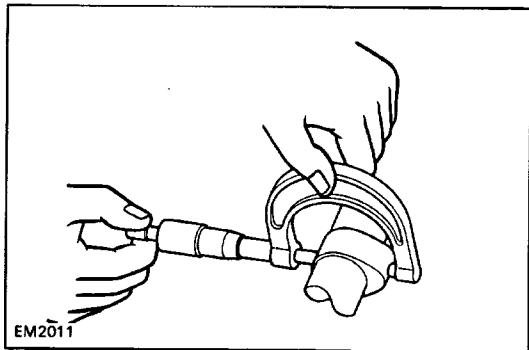
10. INSPECT CAMSHAFTS AND BEARINGS

A. Inspect camshaft for runout

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

Maximum circle runout: 0.06 mm (0.0024 in.)

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



B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

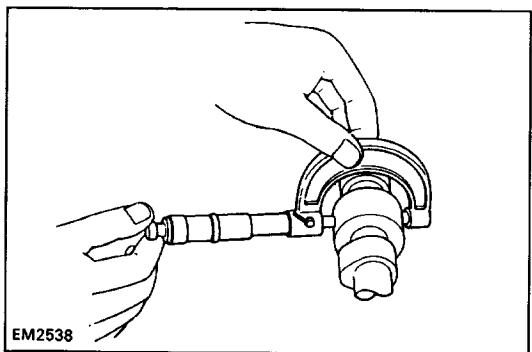
Intake 41.010 – 41.110 mm
(1.6146 – 1.6185 in.)

Exhaust 41.090 – 41.190 mm
(1.6177 – 1.6217 in.)

Minimum cam lobe height:

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

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

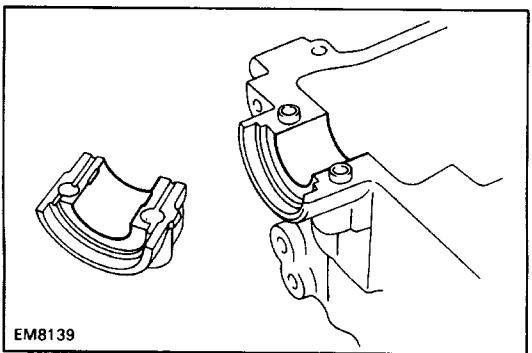


C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

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

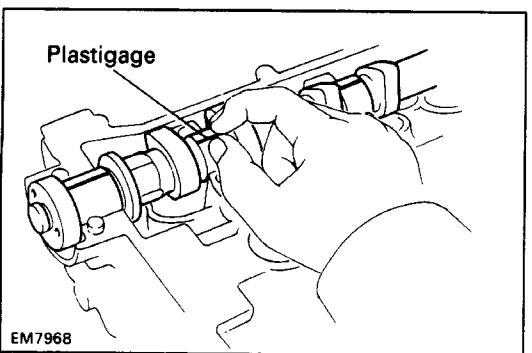
If the journal diameter is not as specified, check the oil clearance.



D. Inspect camshaft bearings

Check the bearings for flaking and scoring.

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



E. Inspect camshaft journal oil clearance

(a) Clean the bearing caps and camshaft journals.

(b) Place the camshafts on the cylinder head.

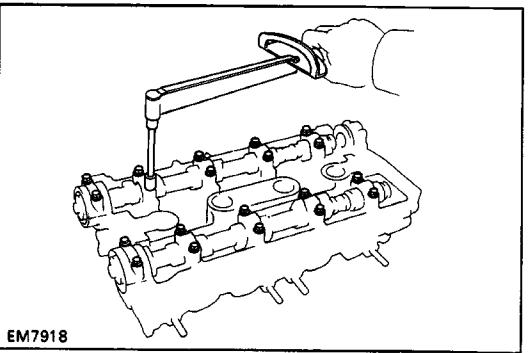
(c) Lay a strip of Plastigage across each of the camshaft journals.

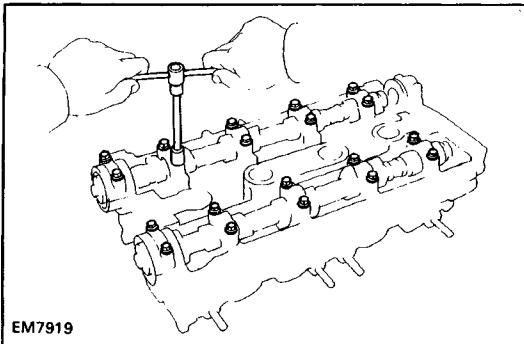
(d) Install the bearing caps.

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

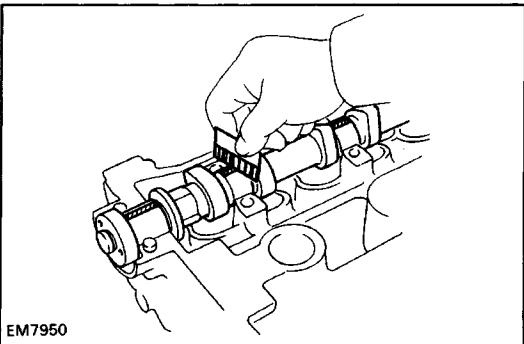
Torque: 19 N·m (190 kgf·cm, 14 ft-lbf)

NOTICE: Do not turn the camshaft.





(e) Remove the bearing caps.



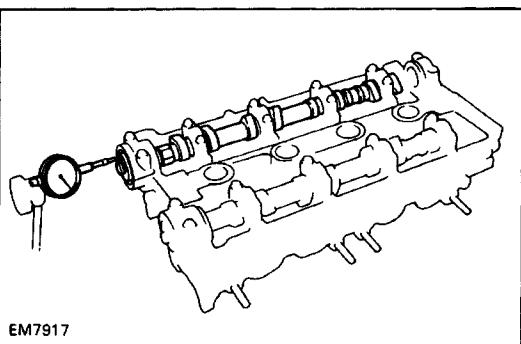
(f) Measure the Plastigage at its widest point.

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

Maximum oil clearance: 0.08 mm (0.0031 in.)

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

(g) Completely remove the Plastigage.



F. Inspect camshaft thrust clearance

(a) Install the camshafts.

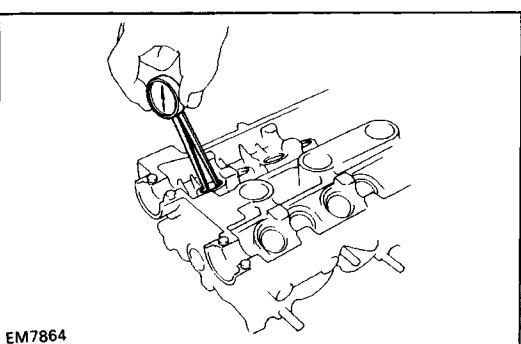
(See step 2 on page [EM-141](#))

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

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

Maximum thrust clearance: 0.30 mm (0.0118 in.)

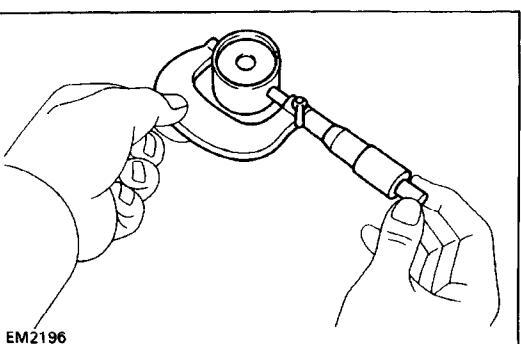
If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.



11. INSPECT VALVE LIFTERS AND LIFTER BORES

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

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



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

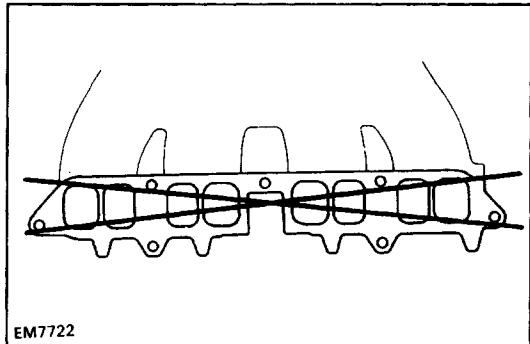
**Lifter diameter: 30.975 – 30.985 mm
0.2195 – 1.2199 in.)**

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

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

Maximum oil clearance: 0.07 mm (0.0028 in.)

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



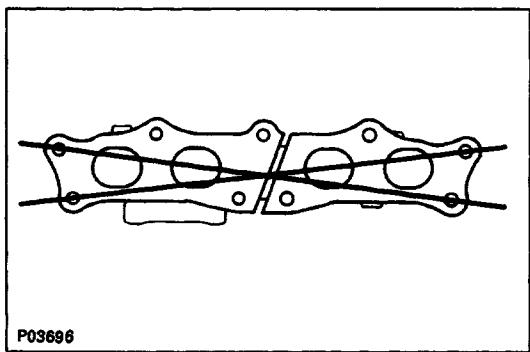
12. INSPECT MANIFOLDS

(Intake manifold)

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

Maximum warpage: 0.20 mm (0.0079 in.)

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

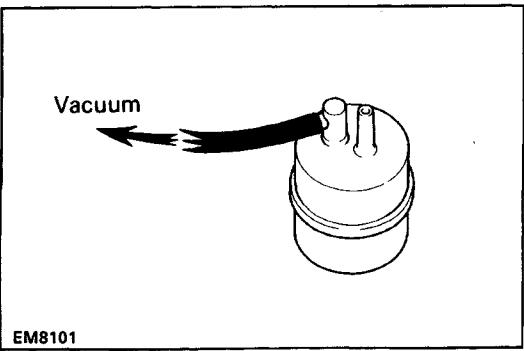
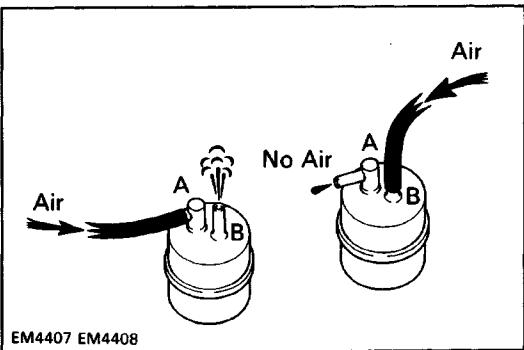
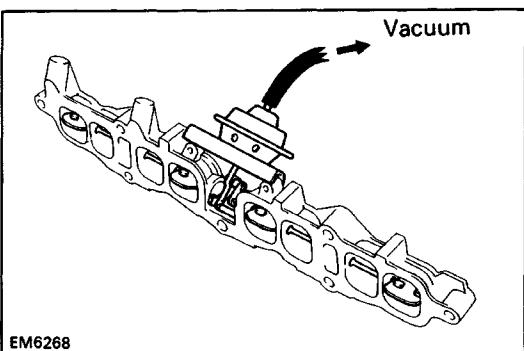
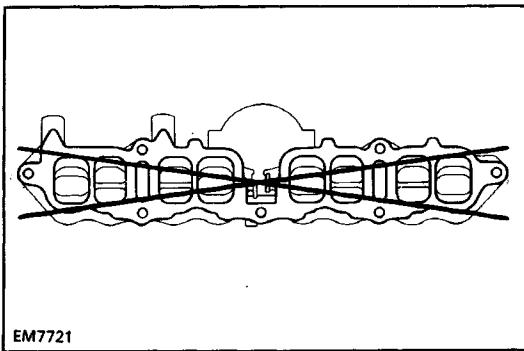


(Exhaust manifold)

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

Maximum warpage: 0.20 mm (0.0079 in.)

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



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

1. INSPECT T–VIS VALVE

A. Inspect for flatness

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

Maximum warpage: 0.20 mm (0.0079 in.)

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

B. Inspect for operation

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

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

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

2. INSPECT VACUUM TANK

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

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

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

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

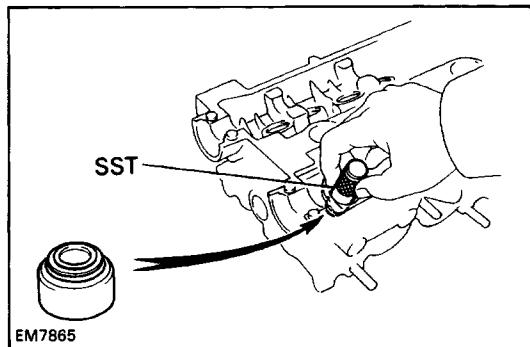
3. INSPECT T–VIS VSV (See page [FI-203](#))

ASSEMBLY OF CYLINDER HEAD

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

HINT:

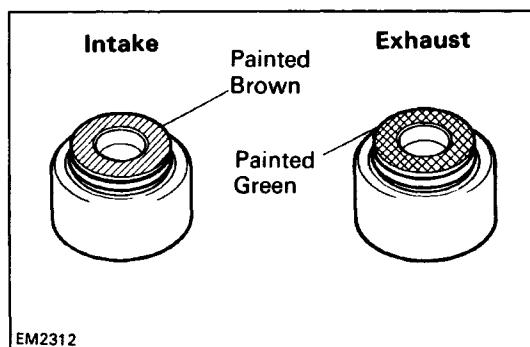
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.



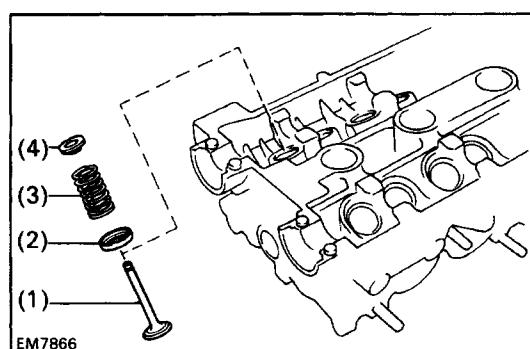
1. INSTALL VALVES

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

SST 09201-41020

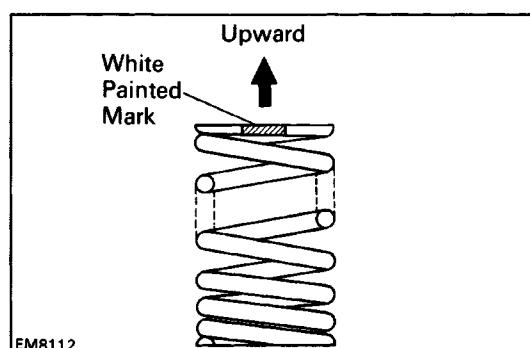


HINT: The intake valve oil seal is brown and the exhaust valve oil seal is black.

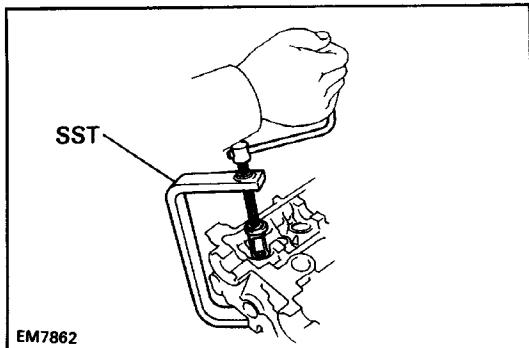


(b) Install the following parts:

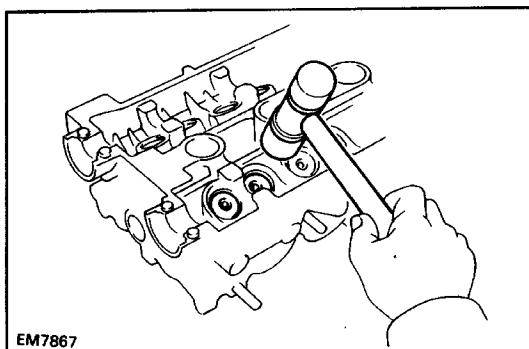
- (1) Valve
- (2) Spring seat
- (3) Valve spring
- (4) Spring retainer



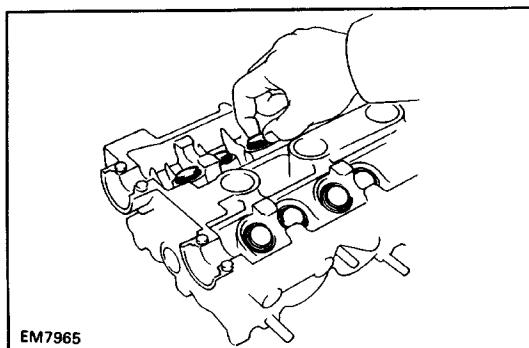
HINT: Install the valve spring, facing the white painted mark upward.



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

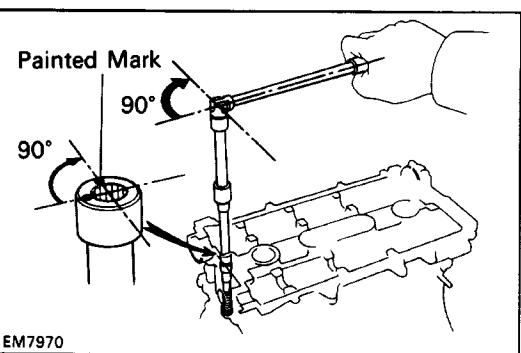
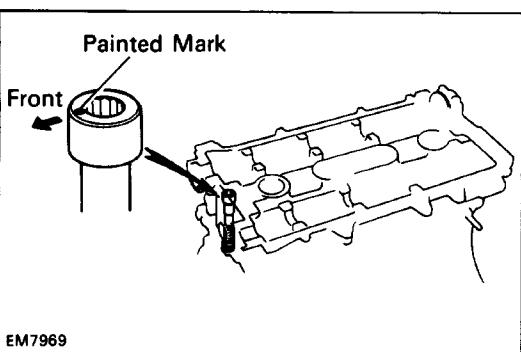
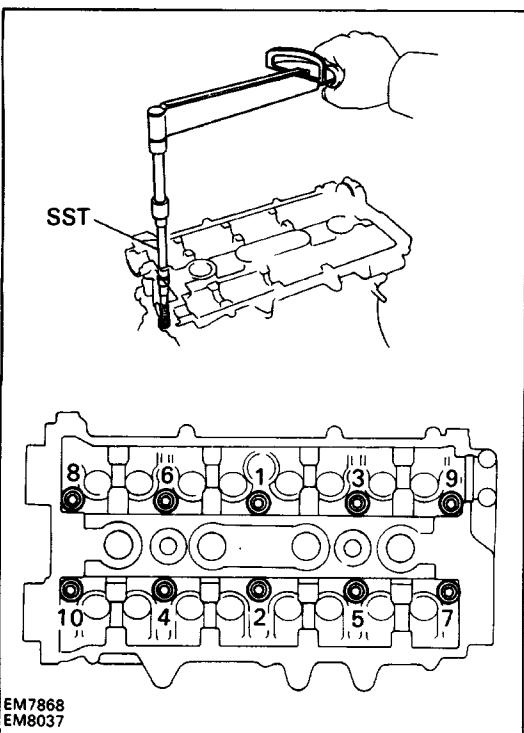
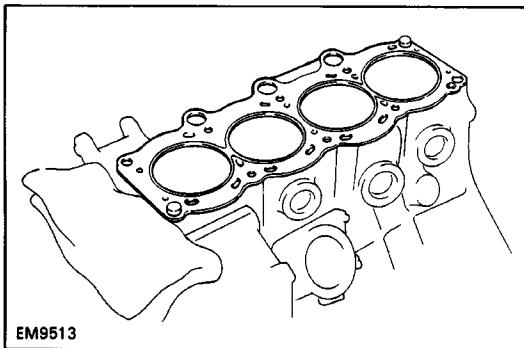


(d) Using a plastic-faced hammer, lightly tap the valve stem tip to assure proper fit.



2. INSTALL VALVE LIFTERS AND SHIMS

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



INSTALLATION OF CYLINDER HEAD

(See pages **EM-116** and 117)

1. INSTALL CYLINDER HEAD

A. Place cylinder head on cylinder block

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

NOTICE: Be careful of the installation direction.

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

B. Install cylinder head bolts

HINT:

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

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

(b) Install the plate washer to each cylinder head bolt.

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

SST 09043-38100

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

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

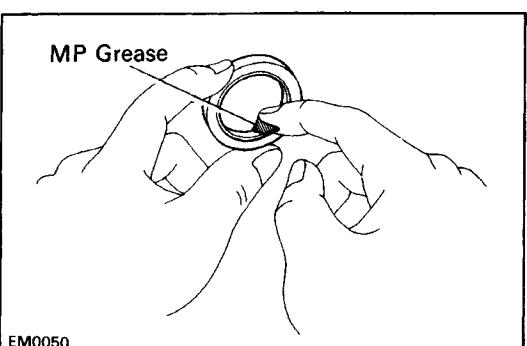
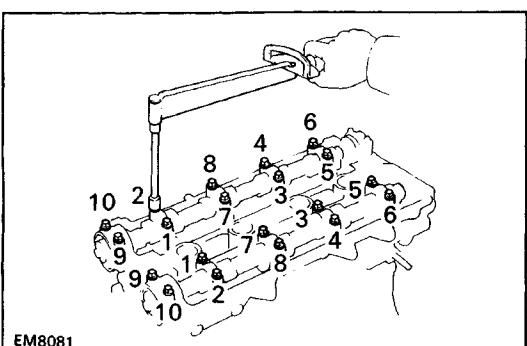
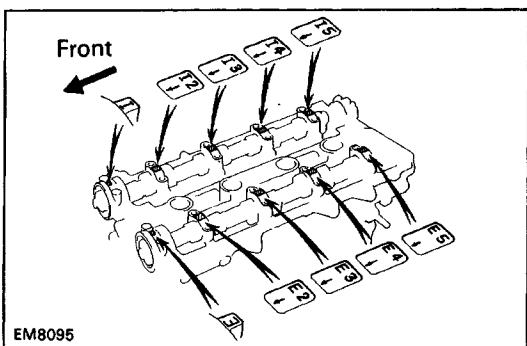
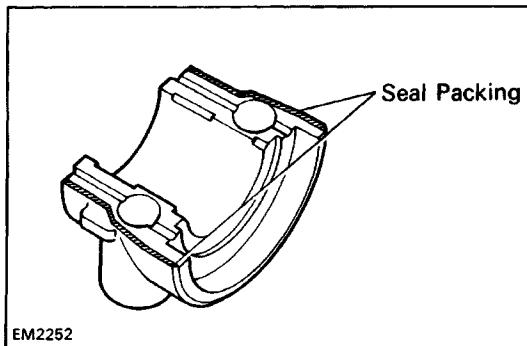
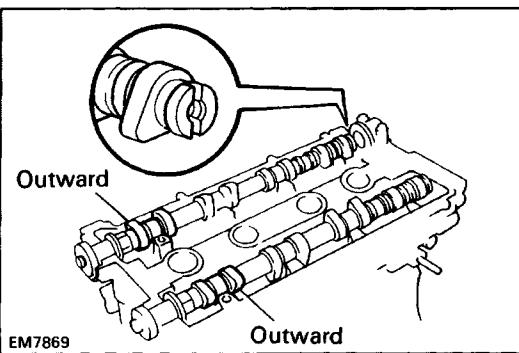
(d) Mark the front of the cylinder head bolt head with paint.

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

(f) Check that the painted mark is now at a 90° angle to front.

2. INSTALL CAMSHAFTS

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



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

Seal packing: Part No. 08826-00080 or equivalent

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

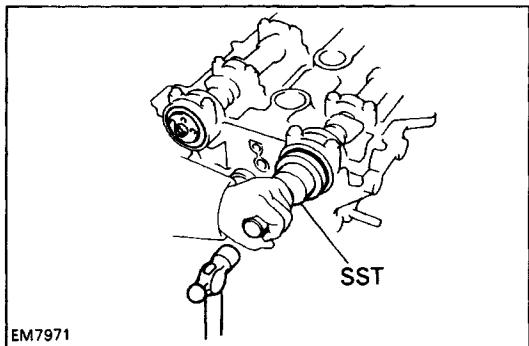
HINT: Each bearing cap has a number and front mark.

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

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

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

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



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

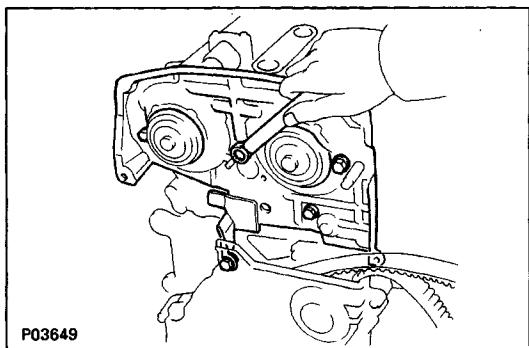
3. ADJUST VALVE CLEARANCE (See page [EM-17](#))

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

Valve clearance (Cold):

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

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



4. INSTALL NO.3 TIMING BELT COVER

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

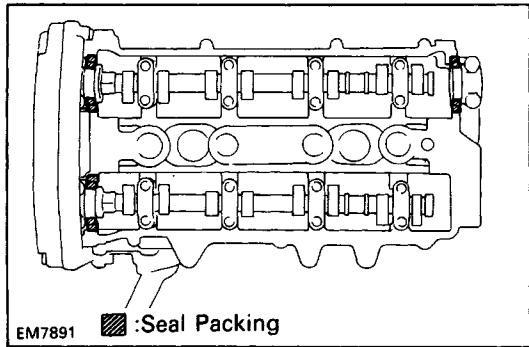
Torque: 8.8 N·m (90 kgf·cm, 78 in-lbf)

5. INSTALL NO.1 IDLER PULLEY

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

6. INSTALL CAMSHAFT TIMING PULLEYS

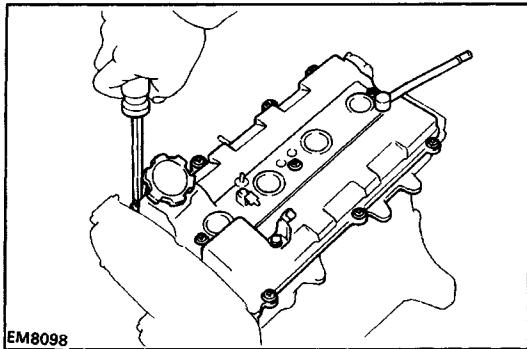
(See steps 9 to 15 on pages [EM-56](#) to [60](#))



7. INSTALL CYLINDER HEAD COVER

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

Seal packing: Part No. 08826-00080 or equivalent



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

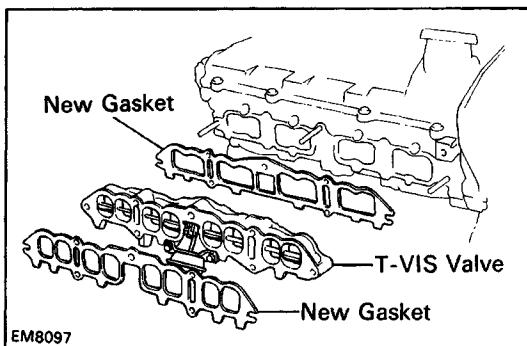
Torque: 2.5 N·m (25 kgf·cm, 21 in·lbf)

8. INSTALL DELIVERY PIPE AND INJECTORS

(See steps 2 to 8 on pages **FI-166** to **168**)

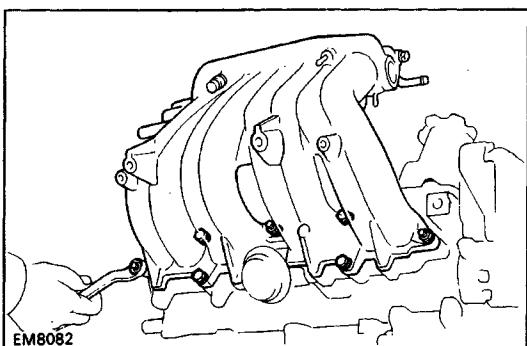
9. INSTALL CHARCOAL CANISTER

(See step 32 on page **EM-264**)



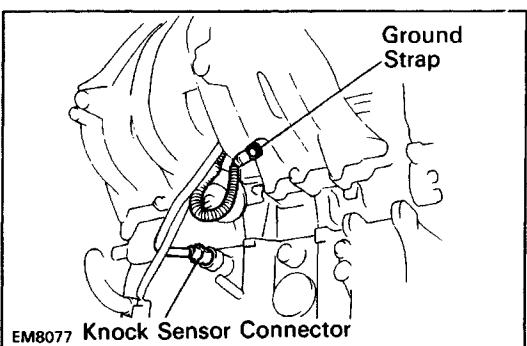
10. INSTALL T-VIS VALVE AND INTAKE MANIFOLD

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

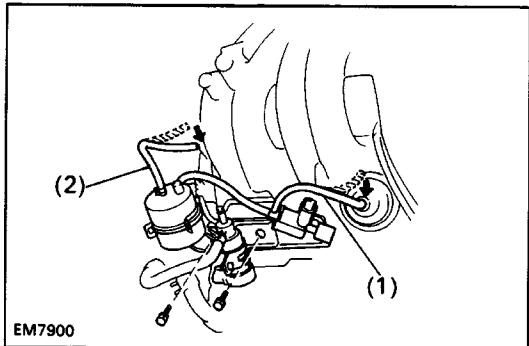


- (b) Install the intake manifold with the four bolts and three nuts. Uniformly tighten the bolts and nuts in several passes.

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

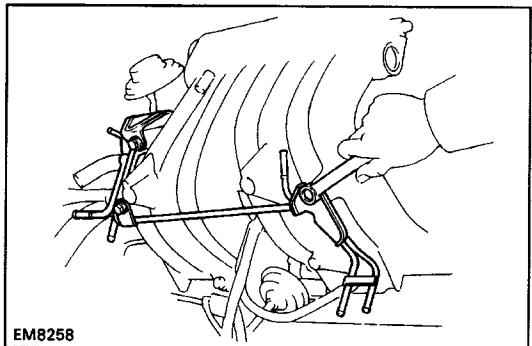


- (c) Connect the knock sensor connector.
- (d) Connect the ground strap with the bolt.



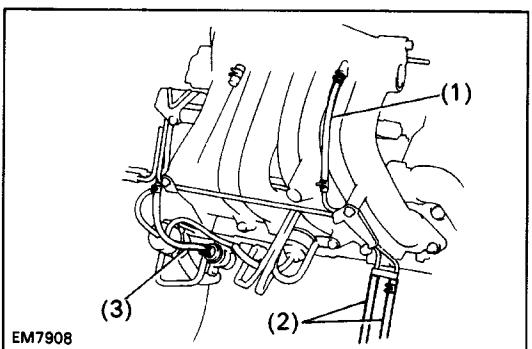
11. INSTALL T-VIS VACUUM TANK, T-VIS VSV, TURBOCHARGING PRESSURE VSV AND BRACKET

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



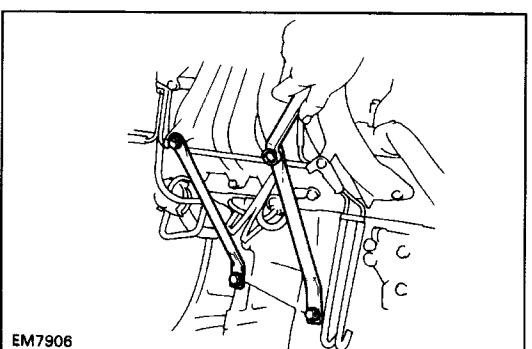
12. INSTALL NO.1 AIR TUBE

- Install the air tube with the three bolts.



- Connect the following hoses:

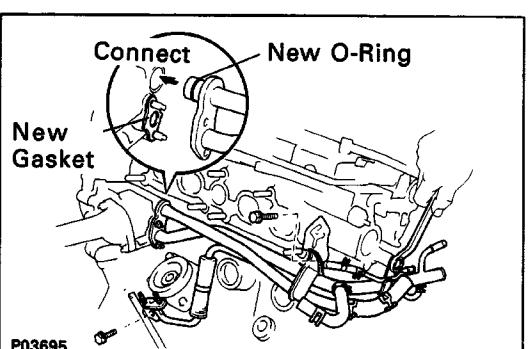
- Vacuum hose to intake manifold
- Two PS vacuum hoses
- Vacuum hose to turbocharging pressure VSV



13. INSTALL INTAKE MANIFOLD STAYS

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

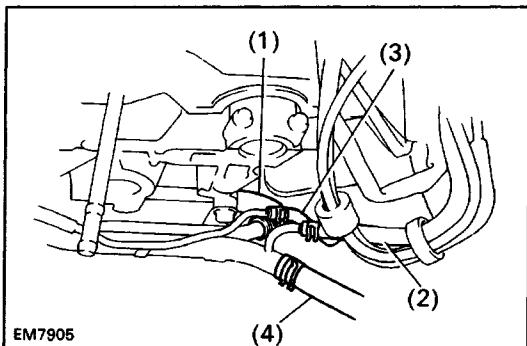
Torque: 25 N·m (260 kgf·cm, 19 ft-lbf)



14. INSTALL WATER BY-PASS PIPE

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

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

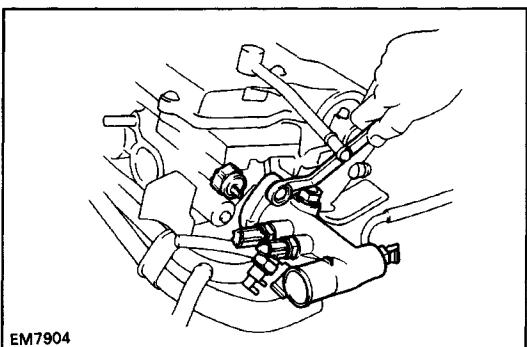


(e) Connect the following hoses:

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

15. INSTALL OIL COOLER

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



16. INSTALL OIL PRESSURE SWITCH

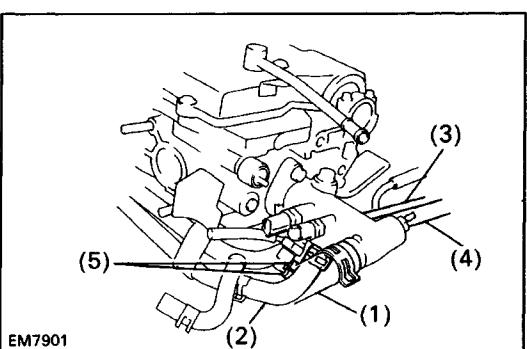
Apply adhesive to two or three threads.

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

17. INSTALL WATER OUTLET

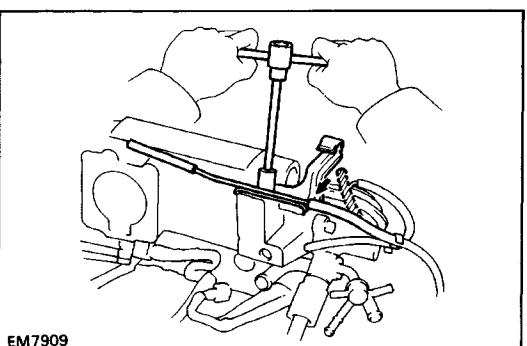
- (a) Install a new gasket and the water outlet with the two bolts.

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



(b) Connect the following hoses:

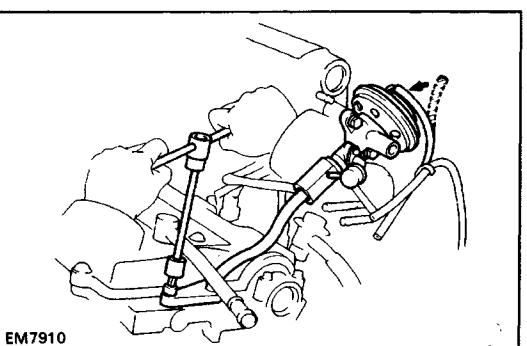
- (1) Upper radiator hose
- (2) Water by-pass hose to water by-pass pipe
- (3) Water by-pass pipe hose to ISC valve
- (4) Heater water hose
- (5) Two EVAP VSV vacuum hoses



18. INSTALL VACUUM PIPE

- (a) Install the vacuum pipe with the bolt.

- (b) Connect the vacuum hose to the vacuum pipe.



19. INSTALL EGR VALVE AND PIPE

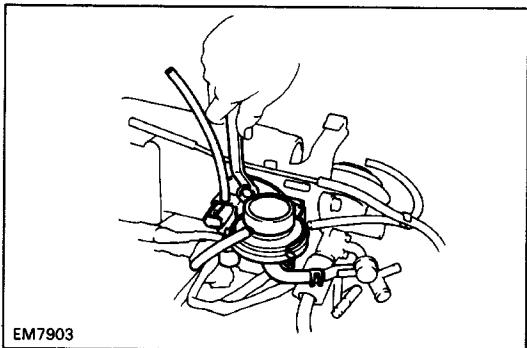
- (a) Install two new gaskets, the EGR valve and pipe assembly with the four bolts. Alternately tighten the bolts.

Torque:

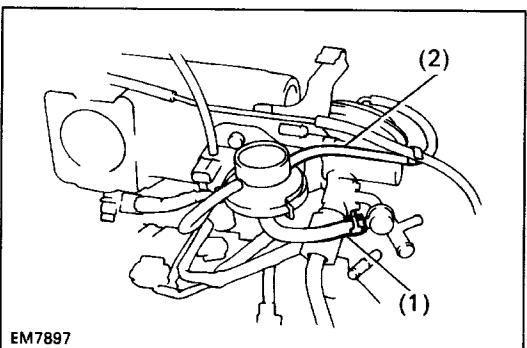
To cylinder head 25 N·m (260 kgf·cm, 19 ft-lbf)

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

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

**20. INSTALL EGR VACUUM MODULATOR AND VSV**

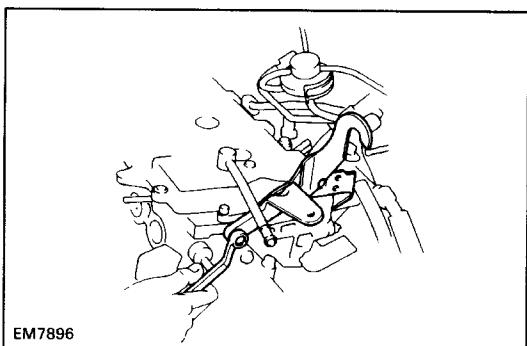
(a) Install the EGR vacuum modulator and VSV assembly with the bolt.



(b) Connect the following hoses:

(1) Vacuum hose to EGR valve
(2) Vacuum hose to EGR vacuum modulator

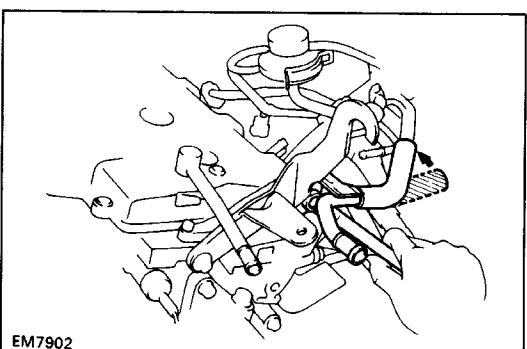
(c) Connect the EGR VSV connector.

**21. INSTALL LH ENGINE HANGER**

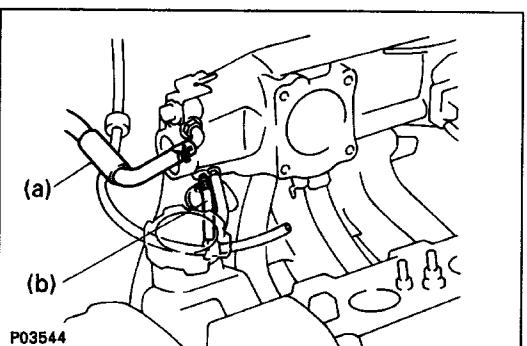
Install the LH engine hanger and reservoir tank with the two bolts. Alternately tighten the bolts.

Torque:

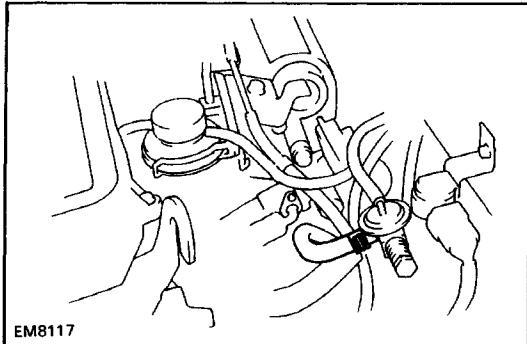
12 mm head bolt 19 N·m (195 kgf·cm, 14 ft·lbf)
14 mm head bolt 39 N·m (400 kgf·cm, 29 ft·lbf)

**22. INSTALL NO.2 AIR TUBE**

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

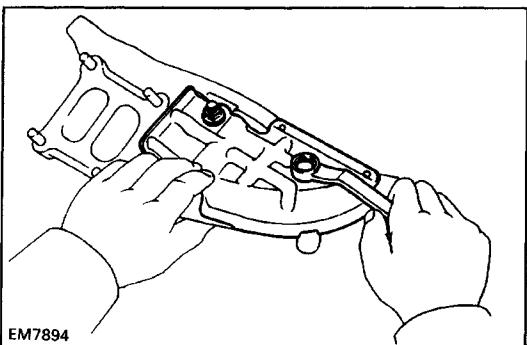
**23. CONNECT HOSES**

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



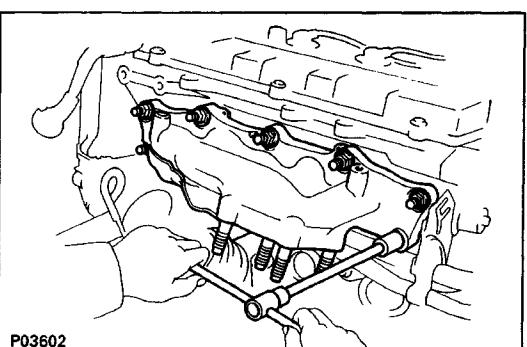
(c) A/C ASV air hose to No.1 air tube

24. INSTALL DISTRIBUTOR (See page [IG-28](#))



25. INSTALL EXHAUST MANIFOLD

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



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

Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)

26. INSTALL COLD START INJECTOR

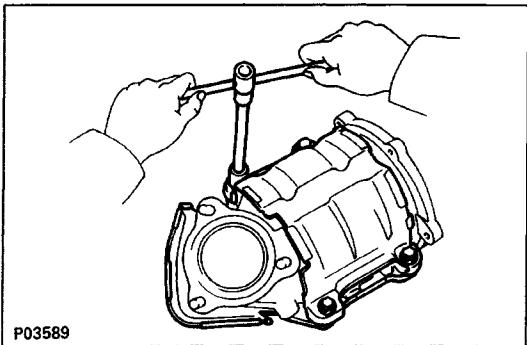
(See steps 1 to 3 on page [FI-148](#))

27. INSTALL THROTTLE BODY

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

28. INSTALL TURBOCHARGER

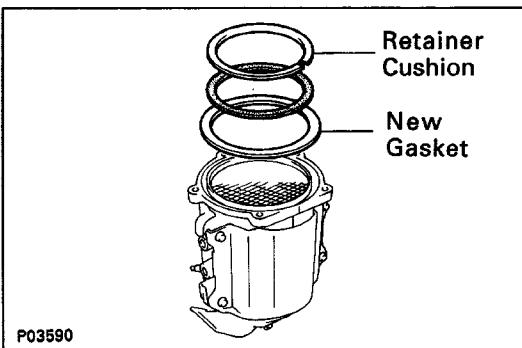
(See steps 5 to 10 on pages [TC-15](#) to [17](#))



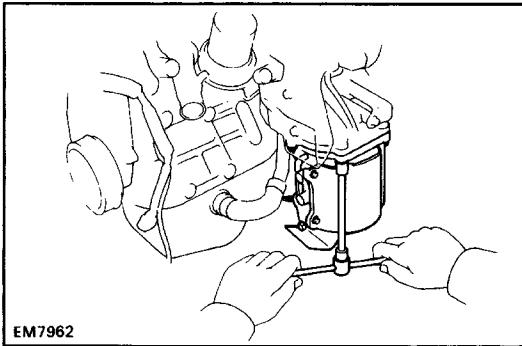
29. INSTALL CATALYTIC CONVERTER

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

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

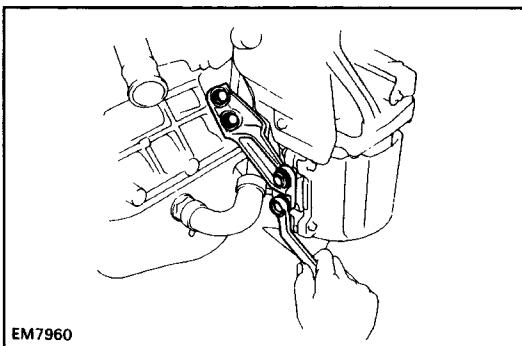


(c) Place a new gasket, the cushion and retainer on the catalytic converter.



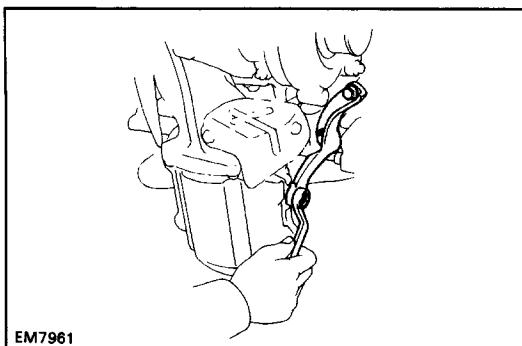
(d) Install the catalytic converter with the three bolts and two nuts.

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



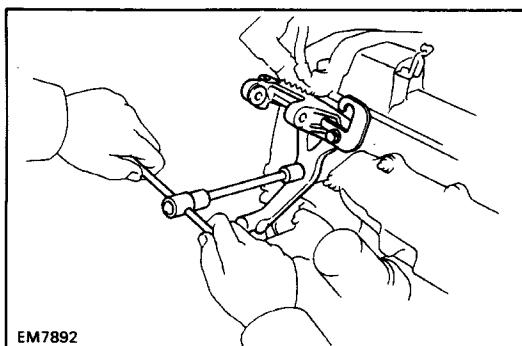
(e) Install the RH converter stay with the four bolts.
Alternately tighten the bolts.

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



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

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



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

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

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

31. INSTALL FRONT EXHAUST PIPE

(See step 18 on page [EM-261](#))

32. INSTALL SUSPENSION LOWER CROSMEMBER

(See step 19 on page [EM-262](#))

33. INSTALL ALTERNATOR (See page [CH-23](#))**34. INSTALL INTERCOOLER**

(See steps 11 to 13 on page [TC-17](#))

35. INSTALL AIR CLEANER CAP

(See step 44 on page [EM-117](#))

36. INSTALL ACCELERATOR CABLE, AND ADJUST IT**37. FILL WITH ENGINE COOLANT (See page [CO-6](#))**

Capacity (w/ Heater):

6.5 liters (6.9 US qts, 5.7 Imp. qts)

38. START ENGINE AND CHECK FOR LEAKS**39. ADJUST IGNITION TIMING (See page [IG-29](#))**

Ignition timing:

10° BTDC @ idle

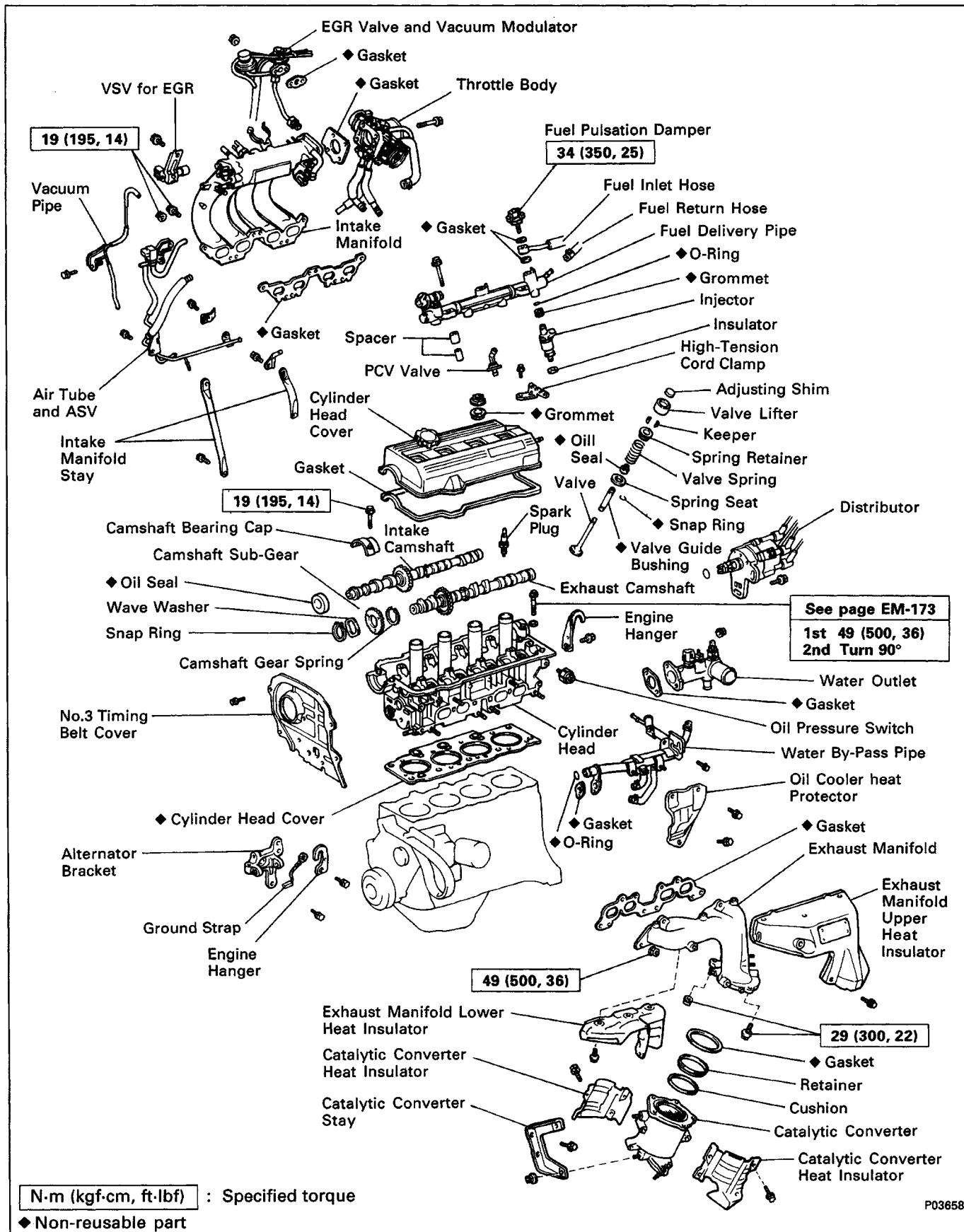
(w/ Terminals TO and E1 connected)

40. PERFORM ROAD TEST

Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

41. RECHECK ENGINE COOLANT AND OIL LEVELS

CYLINDER HEAD (5S-FE) COMPONENTS



REMOVAL OF CYLINDER HEAD

(See page [EM-150](#))

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

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

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

3. (A/T)

DISCONNECT THROTTLE CABLE FROM THROTTLE BODY

4. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY

5. (w/ CRUISE CONTROL SYSTEM)

REMOVE CRUISE CONTROL ACTUATOR

(See step 11 on page [EM-270](#))

6. REMOVE AIR CLEANER CAP

(See step 6 on page [EM-269](#))

7. REMOVE ALTERNATOR (See page [CH-9](#))

8. REMOVE DISTRIBUTOR (See page [IG-30](#))

9. REMOVE ENGINE UNDER COVERS

10. REMOVE SUSPENSION LOWER CROSMEMBER

(See step 28 on page [EM-274](#))

11. REMOVE FRONT EXHAUST PIPE

(See step 29 on page [EM-274](#))

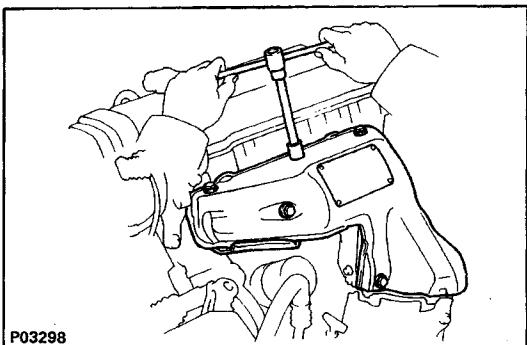
12. REMOVE OXYGEN SENSOR (MAIN)

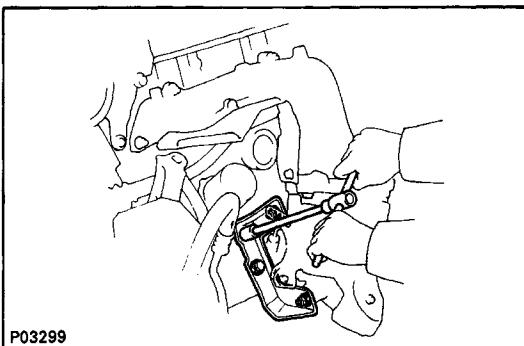
13. (CALIF. ONLY)

REMOVE SUB-OXYGEN SENSOR

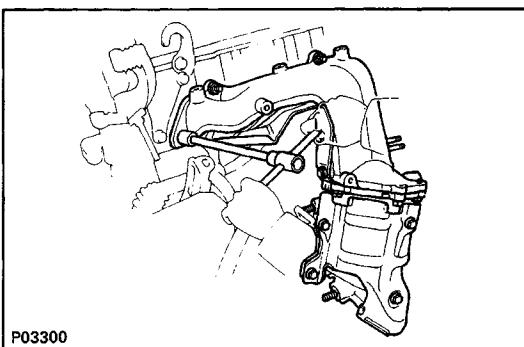
14. REMOVE EXHAUST MANIFOLD AND CATALYTIC CONVERTER ASSEMBLY

(a) Remove the six bolts and manifold upper heat insulator.

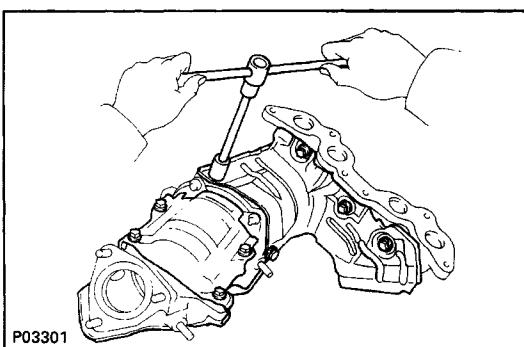




(b) Remove the two bolts, two nuts and catalytic converter stay.

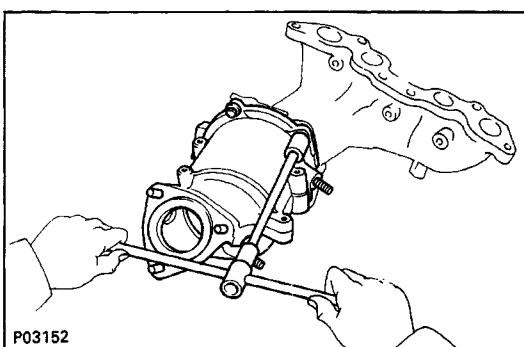


(c) Remove the six nuts, the exhaust manifold and catalytic converter assembly.

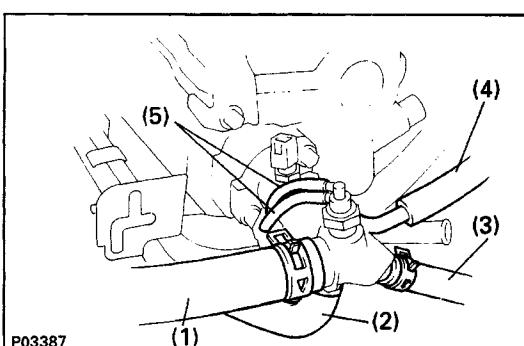


15. SEPARATE EXHAUST MANIFOLD AND CATALYTIC CONVERTER

(a) Remove the five bolts and lower manifold heat insulator.
 (b) Remove the eight bolts and two catalytic converter heat insulator.



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



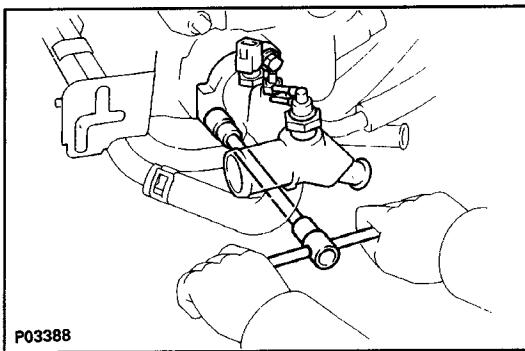
16. REMOVE WATER OUTLET

(a) Disconnect the following connectors:

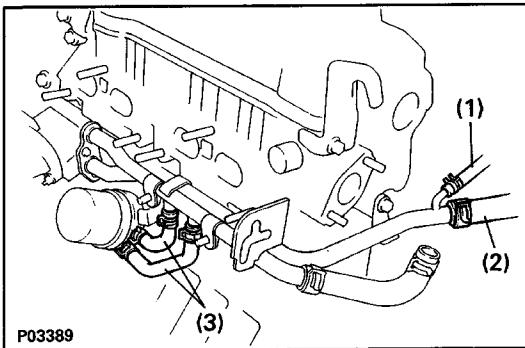
- Water temperature sender gauge connector
- Water temperature sensor connector

(b) Disconnect the following hoses:

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



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



17. REMOVE WATER BY-PASS PIPE

(a) (w/ Oil Cooler)

Remove the water by-pass hose heat protector.
(See step 8 on page [LU-29](#))

(b) Disconnect the following hoses:

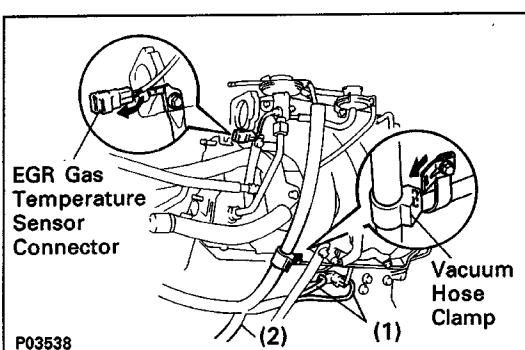
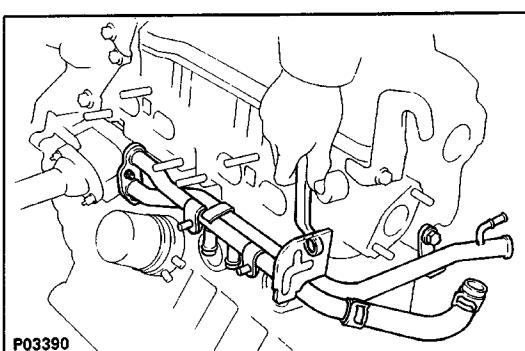
- (1) ISC water by-pass hose
- (2) Heater water hose
- (3) (w/ Oil Cooler)
Two oil cooler water by-pass hoses

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

(d) Remove the O-ring from the water by-pass hose.

18. REMOVE THROTTLE BODY

(See steps 6 to 9 on pages [FI-201](#) and [202](#))



19. REMOVE EGR VALVE AND VACUUM MODULATOR

(a) (CALIF. only)

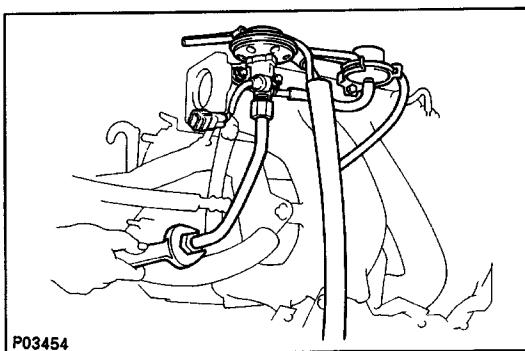
Disconnect EGR gas temperature sensor connector, and disconnect the connector from the bracket.

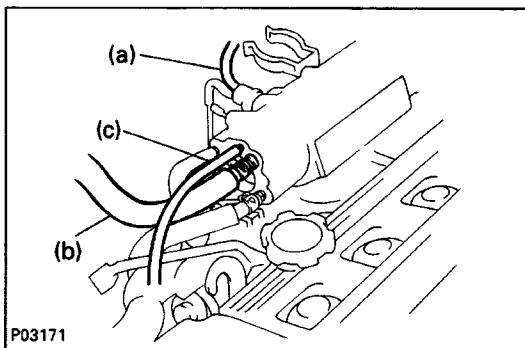
(b) Remove the following hoses:

- (1) Two vacuum hoses from EGR VSV
- (2) Vacuum hose from charcoal canister

(c) Disconnect the vacuum hose clamp from the bracket.

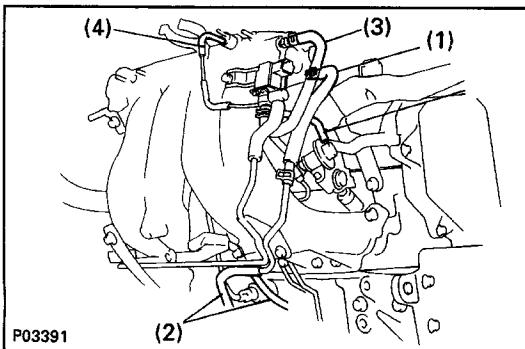
(d) Loosen the union nut of the EGR pipe, and remove two nuts the EGR valve, vacuum modulator, vacuum hoses assembly and gasket.





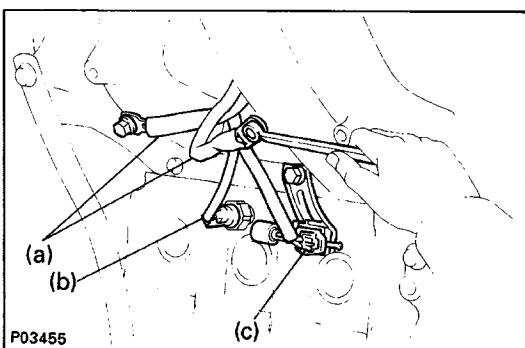
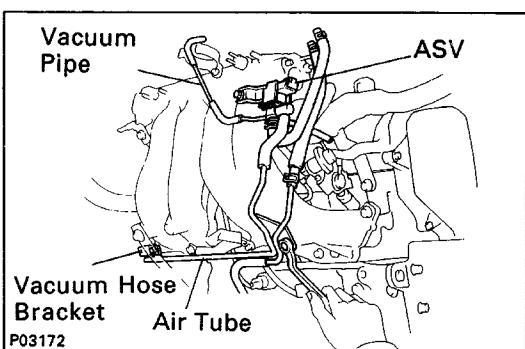
20. DISCONNECT VACUUM HOSES

- (a) Vacuum sensor hose from gas filter
- (b) Brake booster vacuum hose from intake manifold
- (c) (w/ Cruise Control System (w/o ABS))
Actuator vacuum hose from intake manifold



21. REMOVE AIR TUBE, ASV (FOR A/C) AND VACUUM PIPE

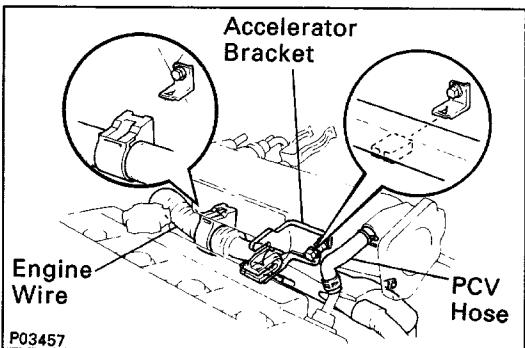
- (a) (w/ A/C)
Disconnect the ASV connector.
- (b) Disconnect the following hoses:
 - (1) PS air hose from intake manifold
 - (2) Two air hoses from air tube
 - (3) (w/ A/C)
Air– hose from intake manifold
 - (4) Vacuum hose from gas filter
 - (5) Vacuum hose from fuel pressure regulator
- (c) Remove the four bolts, vacuum hose bracket, the air tube and ASV assembly.
- (d) Remove the bolt and vacuum pipe.



22. DISCONNECT ENGINE WIRE GROUND STRAPS AND CONNECTORS

- (a) Two engine ground straps from intake manifold
- (b) Knock sensor connector
- (c) VSV connector for EGR

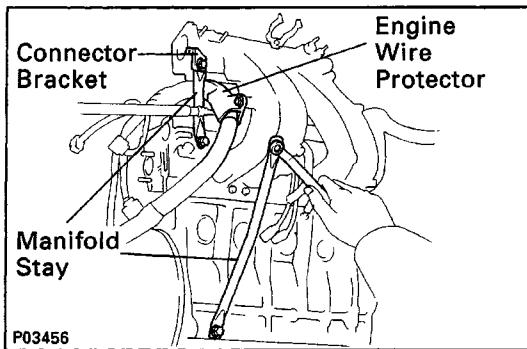
23. REMOVE VSV FOR EGR



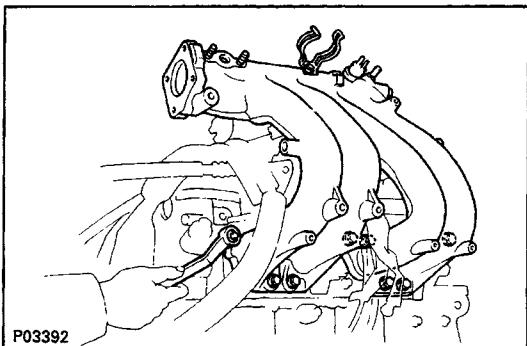
24. REMOVE ACCELERATOR BRACKET

25. REMOVE INTAKE MANIFOLD

- (a) Disconnect the PCV hose from the PCV valve.
- (b) Disconnect the two wire clamps from the wire brackets.



- (c) Remove the bolt, and disconnect the engine wire protector from the intake manifold.
- (d) Remove the four bolts, connector bracket (CALIF. only) and two manifold stays.



- (e) Remove the six bolts, two nuts, intake manifold and gasket.

26. REMOVE DELIVERY PIPE AND INJECTORS

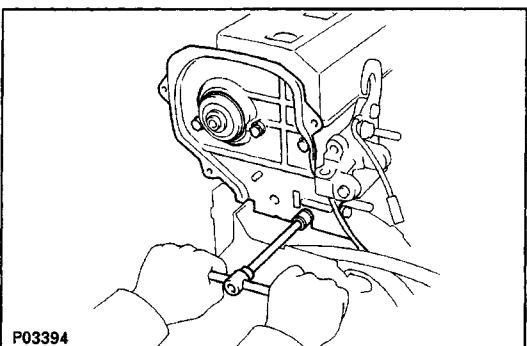
(See steps 16 and 17 on page [FI-173](#))

27. REMOVE CAMSHAFT TIMING PULLEY

(See steps 2 and 6 to 17 on pages [EM-67](#) to [70](#))

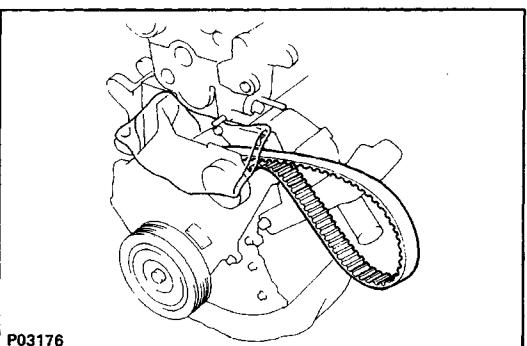
28. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING

(See step 23 on page [EM-72](#))



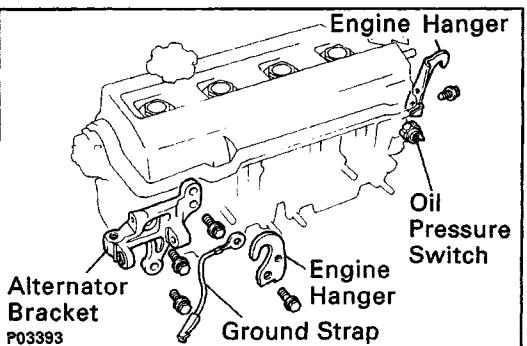
29. REMOVE NO.3 TIMING BELT COVER

Remove the four bolts and timing belt cover.



NOTICE:

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



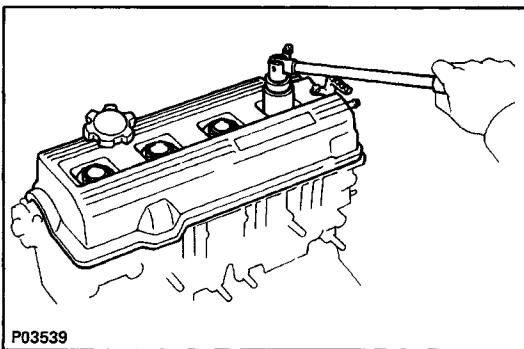
30. REMOVE ENGINE HANGERS

Remove the bolt and engine hanger. Remove the two engine hangers. Remove the ground strap.

31. REMOVE ALTERNATOR BRACKET

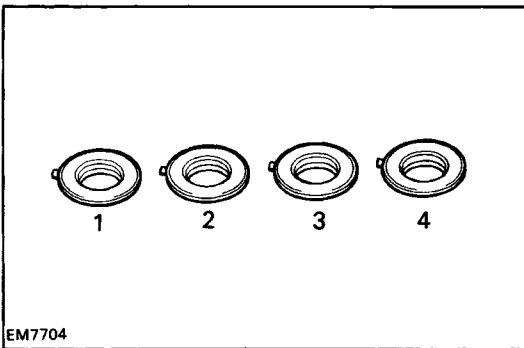
Remove the three bolts and alternator bracket.

32. REMOVE OIL PRESSURE SWITCH

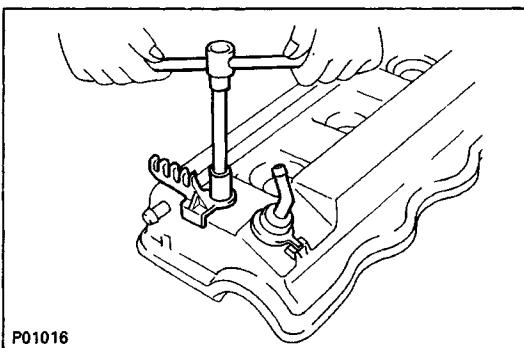


33. REMOVE CYLINDER HEAD COVER

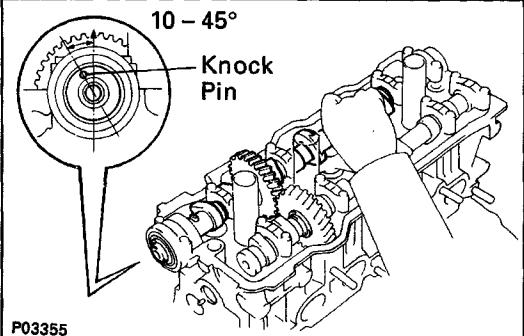
Remove the four nuts, grommets, head cover and gasket.



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



34. REMOVE HIGH-TENSION CORD CLAMP AND PCV VALVE FROM CYLINDER HEAD COVER



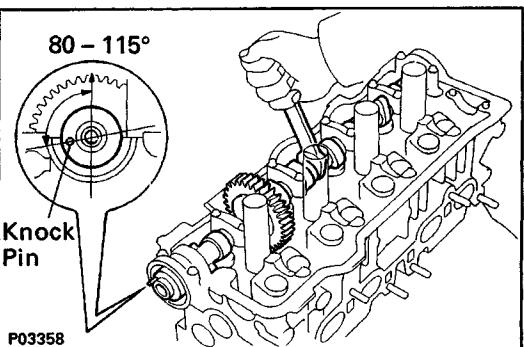
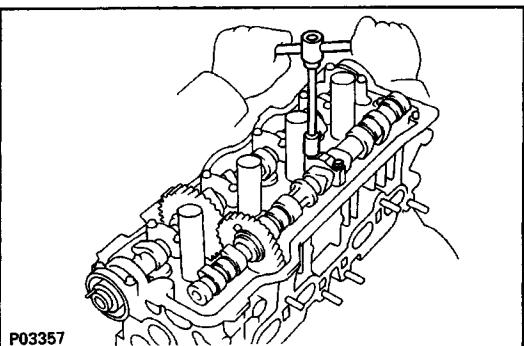
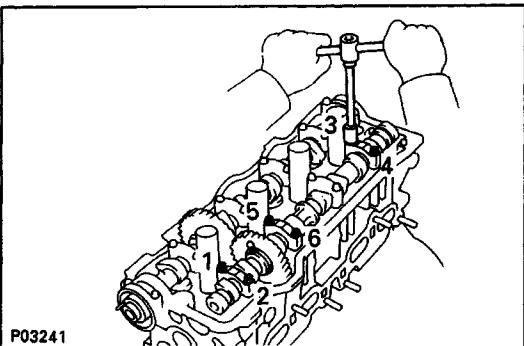
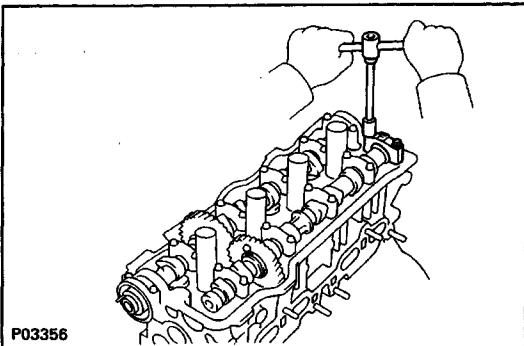
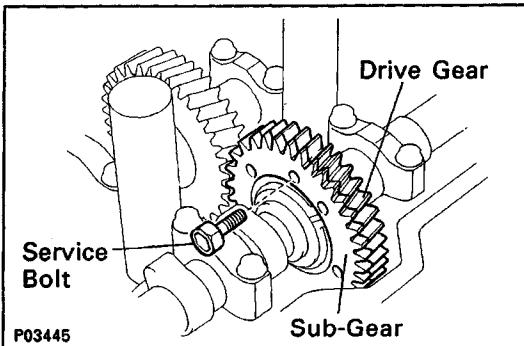
35. REMOVE CAMSHAFTS

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 exhaust camshaft

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

HINT: The above angle allows No.2 and No.4 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.



(b) Secure the exhaust camshaft sub-gear to drive 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 sure that the torsional spring force of the sub-gear has been eliminated by the above operation.

(c) Remove the two bolts and rear bearing cap.

(d) Uniformly loosen and remove the six bolts on the No.1, No. 2 and No.4 bearing caps in several passes in the sequence shown.

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

(e) Remove the No.1, No.2 and No.4 bearing caps.

(f) Alternately loosen and remove the two bolts on the No.3 bearing cap.

HINT:

- As the two No.3 bearing cap bolts are loosened, make sure that the camshaft is lifted out straight and level.
- If the camshaft is not being lifted out straight and level, retighten the two No.3 bearing cap bolts. Then reverse the order of above steps from (f) to (a) and reset the knock pin of the intake camshaft at 10 – 45° BTDC, and repeat steps from (b) to (f) once again.

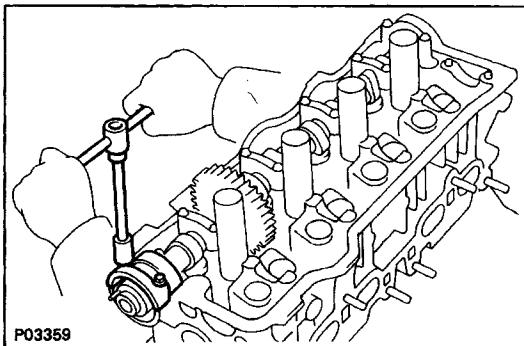
NOTICE: Do not pry on or attempt to force the cam-shaft with a tool or other object.

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

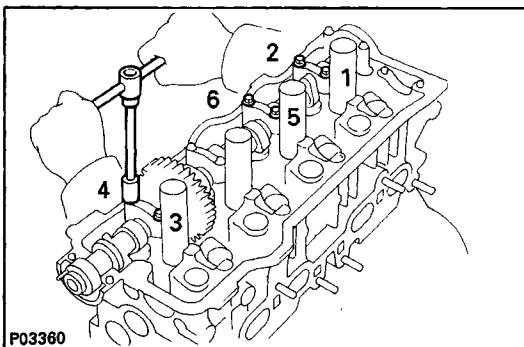
B. Remove intake camshaft

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

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



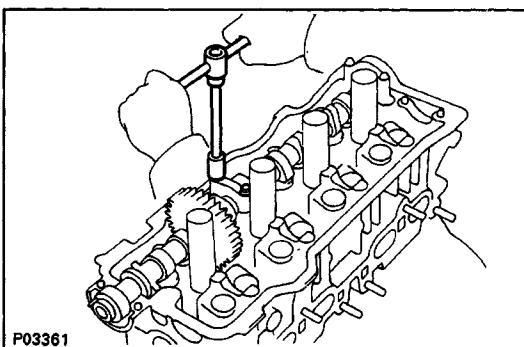
(b) Remove the two bolts, front bearing cap and oil seal.



(c) Uniformly loosen and remove the bolts on the No.1, No.3 and No.4 bearing caps in several passes in the sequence shown.

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

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



(e) Alternately loosen and remove the two bolts on the No.2 bearing cap.

HINT:

- As the two No.2 bearing cap bolts are loosened, make sure that the camshaft is lifted out straight and level, after breaking adhesion on the front bearing cap.
- If the camshaft is not being lifted out straight and level, retighten the two No.2 bearing cap bolts. Reverse the order of above steps from (e) to (a) and reset the knock pin of the intake camshaft at 80 – 115° BTDC, and repeat steps from (b) to (e) once again.

NOTICE: Do not pry on or attempt to force the cam-shaft with a tool or other object.

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

36. DISASSEMBLE EXHAUST CAMSHAFT

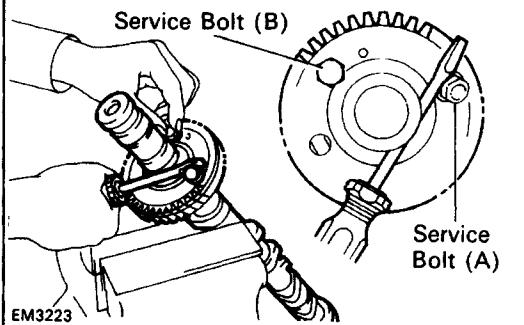
(a) Mount the hexagon wrench head portion of the cam-shaft in a vise.

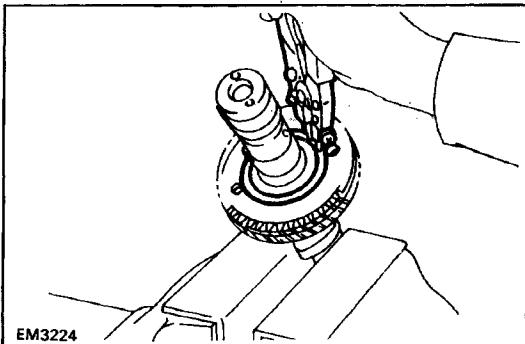
NOTICE: Be careful not to damage the camshaft.

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

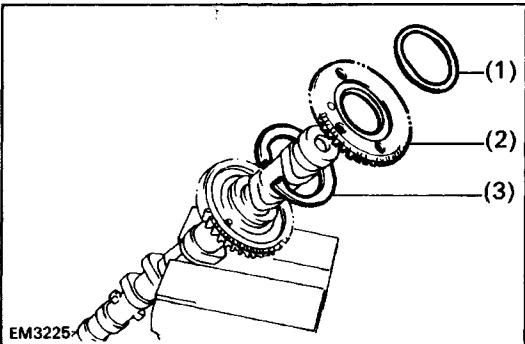
(c) Using a screwdriver, turn the sub-gear clockwise, and remove the service bolt (B).

NOTICE: Be careful not to damage the camshaft.



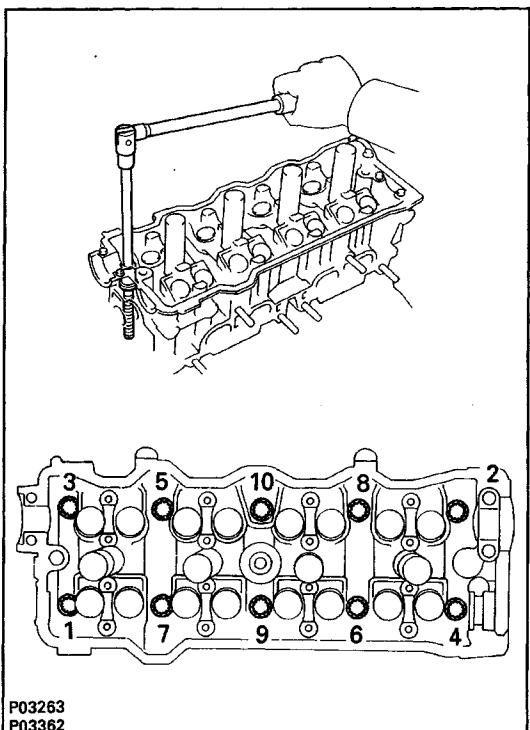


(d) Using snap ring pliers, remove the snap ring.



(e) Remove the following parts:

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

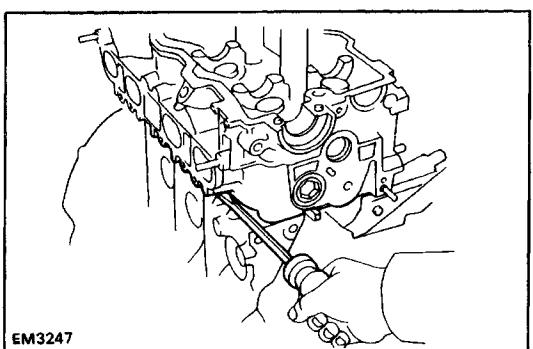


37. REMOVE CYLINDER HEAD

- (a) Uniformly loosen and remove the ten cylinder head bolts in several passes in the sequence shown.

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

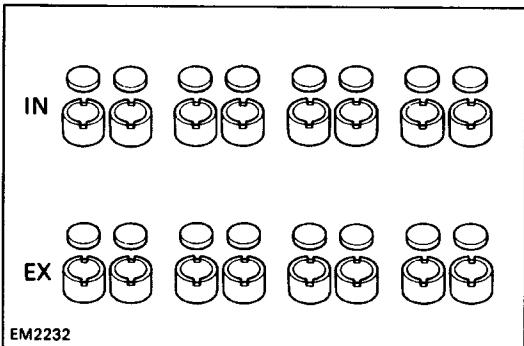
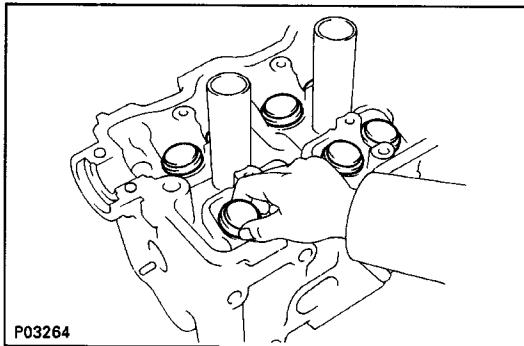
- (b) Remove the ten plate washers.



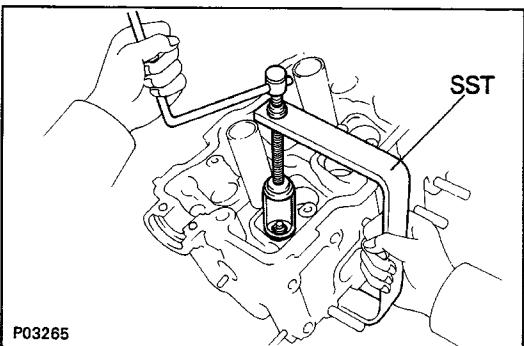
- (c) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

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

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

DISASSEMBLY OF CYLINDER HEAD(See page [EM-150](#))**1. REMOVE VALVE LIFTERS AND SHIMS**

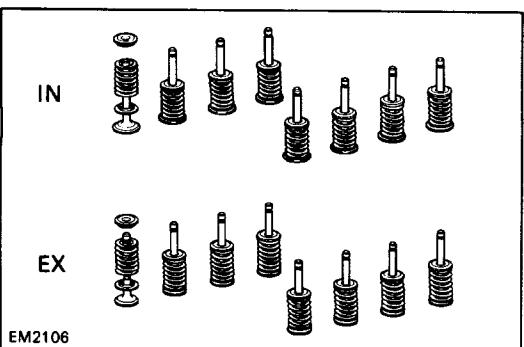
HINT: Arrange the valve lifters and shims in correct order.

**2. REMOVE VALVES**

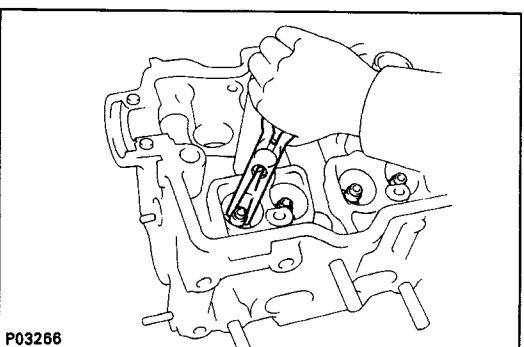
- Using SST, compress the valve spring and remove the two keepers.

SST 09202-70010

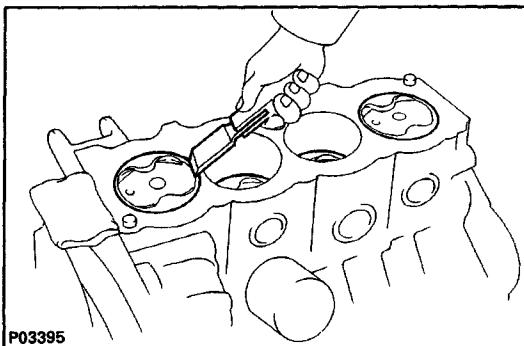
- Remove the spring retainer, valve spring, valve and spring seat.



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



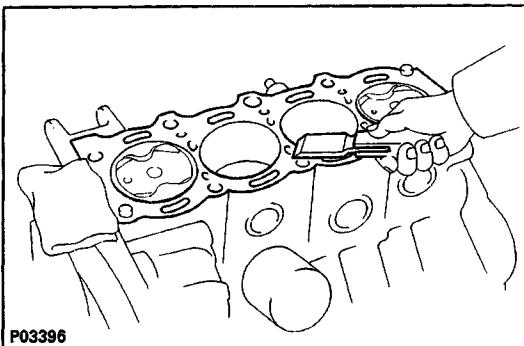
- Using needle-nose pliers, remove the oil seal.



INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

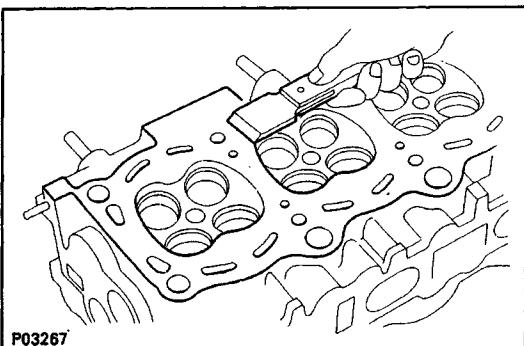
(a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.



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

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

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

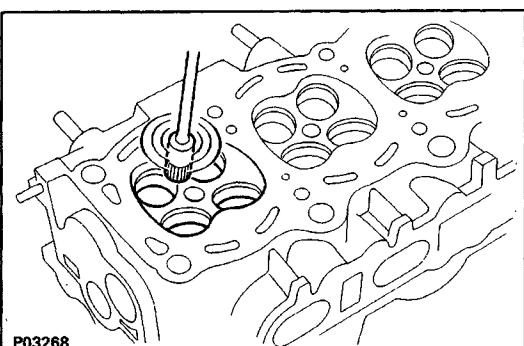


2. CLEAN CYLINDER HEAD

A. Remove gasket material

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

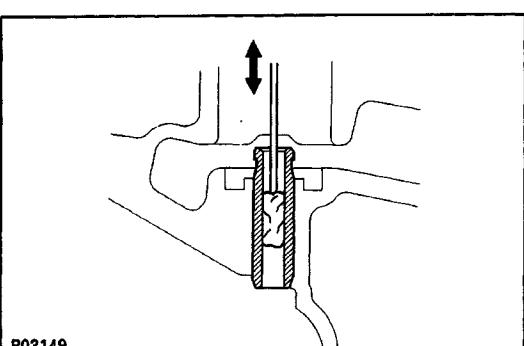
NOTICE: Be careful not to scratch the cylinder block contact surface.



B. Clean combustion chambers

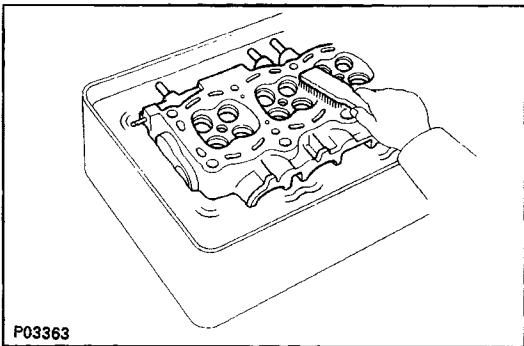
Using a wire brush, remove all the carbon from the combustion chambers.

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



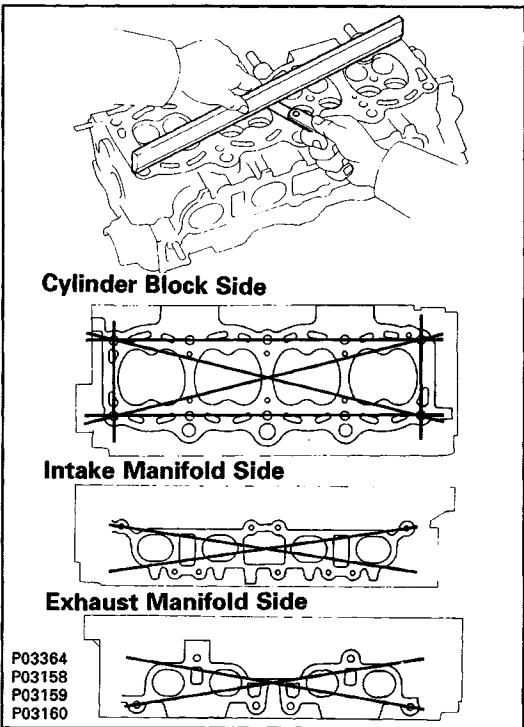
C. Clean valve guide bushings

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



D. Clean cylinder head

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



3. INSPECT CYLINDER HEAD

A. Inspect for flatness

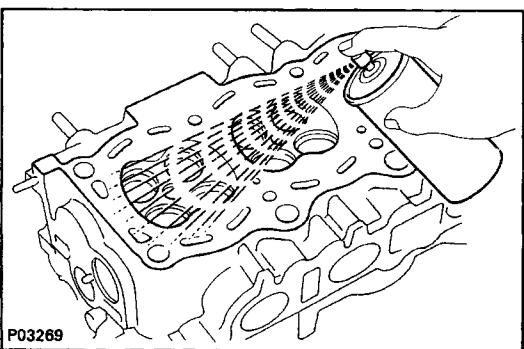
Using precision straight edge and feeler gauge, measure the surfaces contacting the cylinder block and manifold for warpage.

Maximum warpage:

Cylinder block side 0.05 mm (0.0020 in.)

Manifold side 0.08 mm (0.0031 in.)

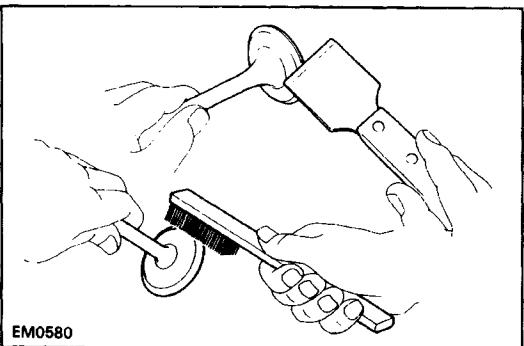
If warpage is greater than maximum, replace the cylinder head.



B. Inspect for cracks

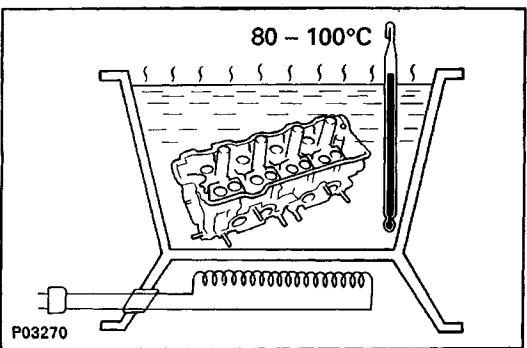
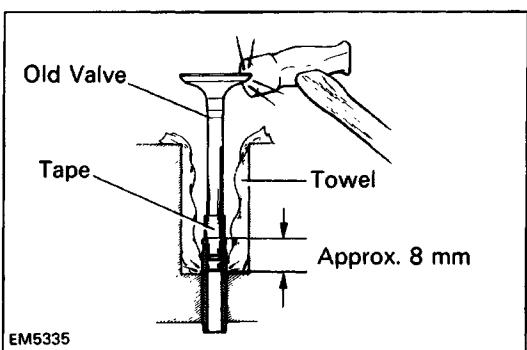
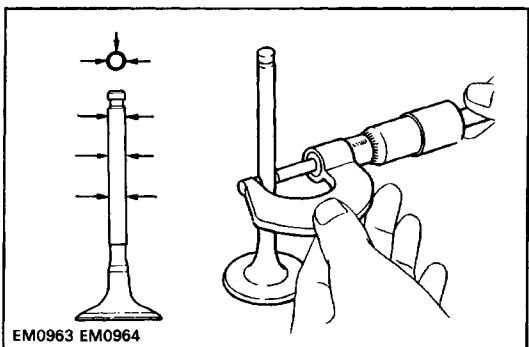
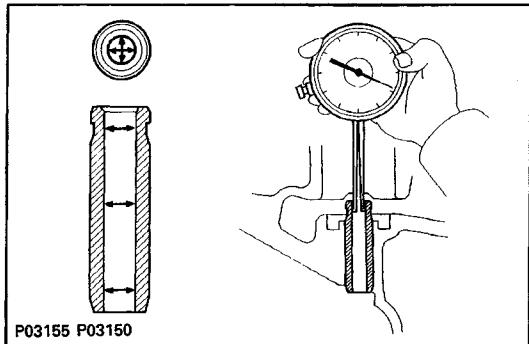
Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

If cracked, replace the cylinder head.



4. CLEAN VALVES

- Using a gasket scraper, chip off any carbon from the valve head.
- 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:

6.010 – 6.030 mm (0.2366 – 0.2374 in.)

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

Valve stem diameter:

**Intake 5.970 – 5.985 mm
(0.2350 – 0.2356 in.)**

**Exhaust 5.965 – 5.980 mm
(0.2348 – 0.2354 in.)**

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

Standard oil clearance:

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

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

Maximum oil clearance:

Intake 0.08 mm (0.0031 in.)

Exhaust 0.10 mm (0.0039 in.)

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

6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

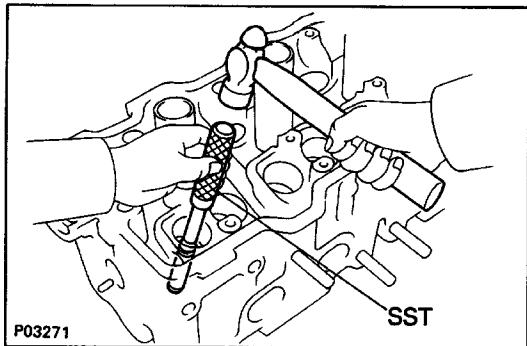
(a) (Exhaust w/ Snap Ring))

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

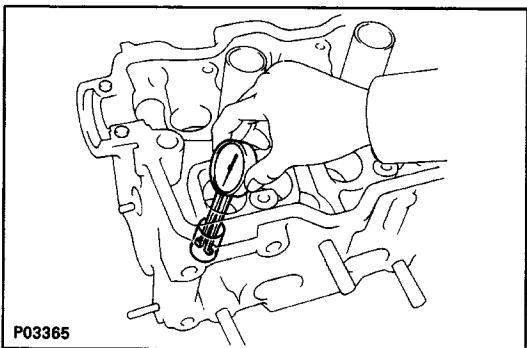
HINT: Wrap the tape approx. 8 mm (0.31 in.) from the valve stem end.

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

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



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

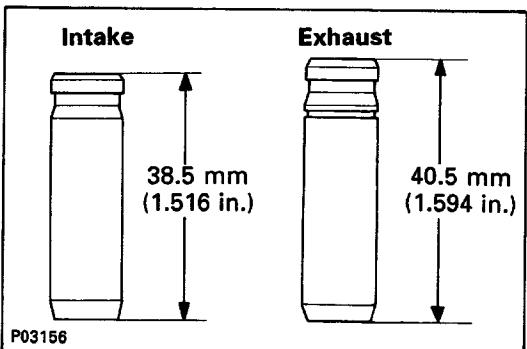


(d) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

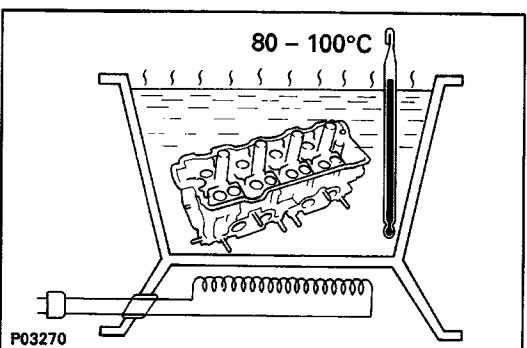
Both intake and exhaust

Bushing bore diameter mm (in.)	Bushing size
10.985 – 11.012 (0.4325 – 0.4335)	Use STD
11.035 – 11.062 (0.4344 – 0.4355)	Use O/S 0.05

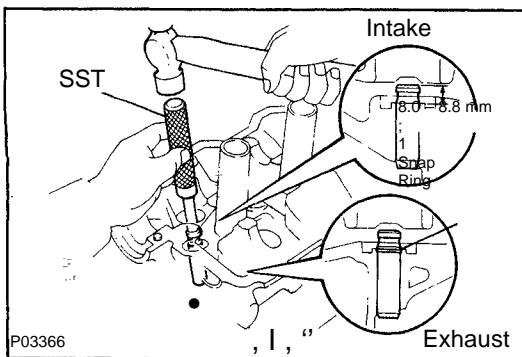
(e) Select a new guide bushing (STD or O/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 11.012 mm (0.4335 in.), machine the bushing bore to the following dimension:
11.035 – 11.062 mm (0.4344 – 0.4355 in.)
If the bushing bore diameter of the cylinder head is greater than 11.062 mm (0.4355 in.), replace the cylinder head.



HINT: Different the bushings are used for the intake and exhaust.



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



(g) (Intake)

Using SST and a hammer, tap in a new guide bushing until there is 8.0 – 8.8 mm (0.315 – 0.346 in.) protruding from the cylinder head.

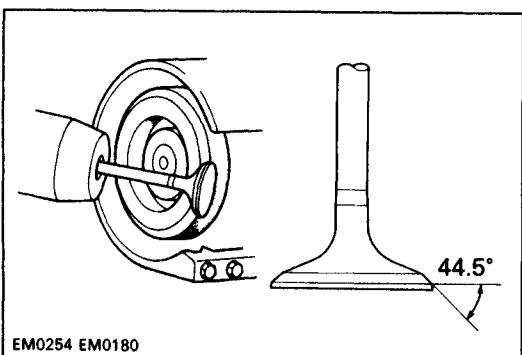
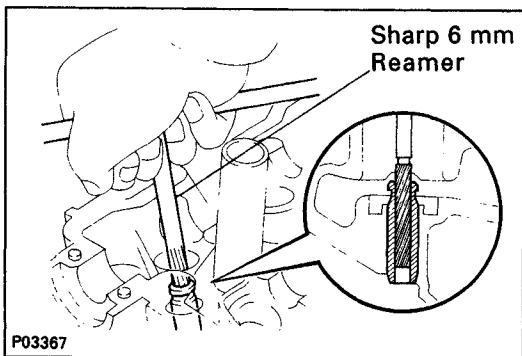
SST 09201-70010

(h) (Exhaust)

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

SST 09201-70010

(h) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page EM-163) between the guide bushing and valve stem.



7. INSPECT AND GRIND VALVES

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

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

Valve face angle: 44.5°

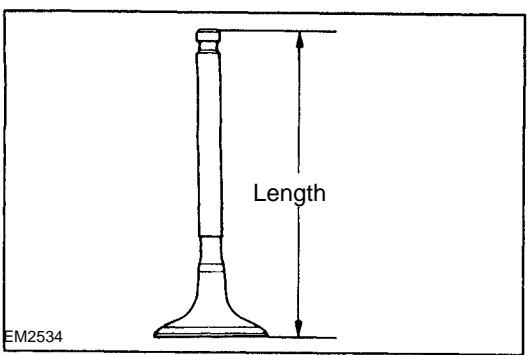
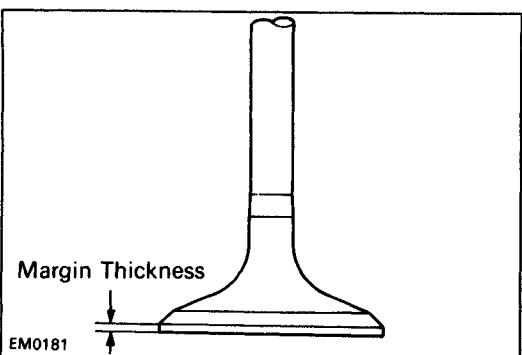
(c) Check the valve head margin thickness.

Standard margin thickness: 0.8 – 1.2 mm

(0.031 – 0.047 in.)

Minimum margin thickness: 0.5 mm (0.020 in.)

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



(d) Check the valve overall length.

Standard overall length:

Intake 97.60 mm (3.8425 in.)

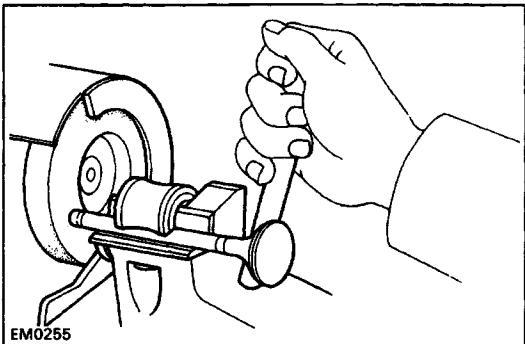
Exhaust 98.45 mm (3.8760 in.)

Minimum overall length:

Intake 97.1 mm (3.823 in.)

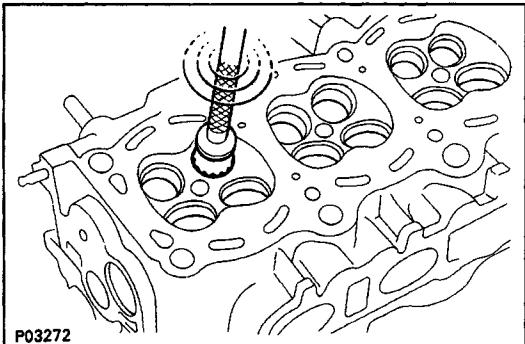
Exhaust 98.0 mm (3.858 in.)

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



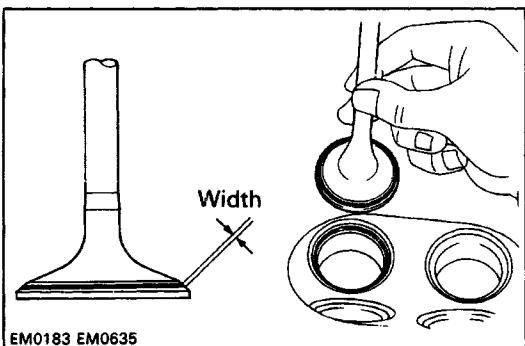
(e) Check the surface of the valve stem tip for wear. If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

NOTICE: Do not grind off more than minimum.



8. INSPECT AND CLEAN VALVE SEATS

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



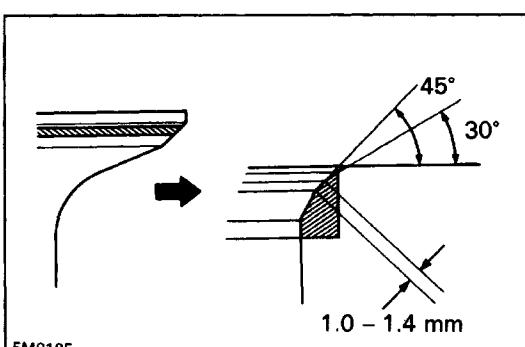
(b) Check the valve seating position. Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.

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

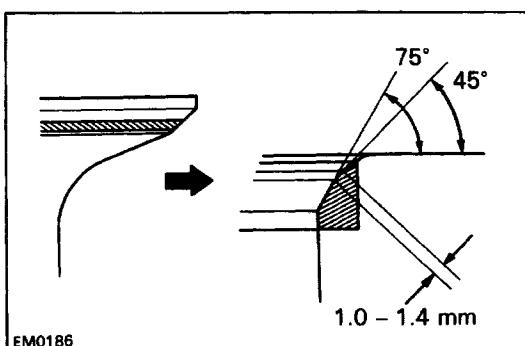
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with the following width: **1.0 – 1.4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

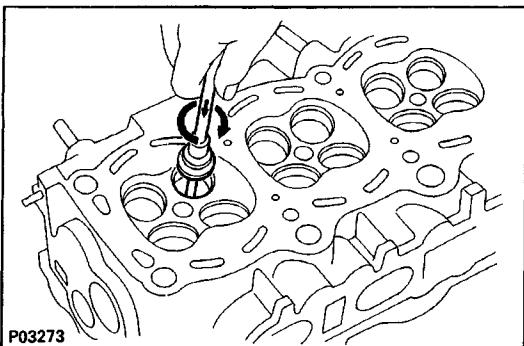
If not, correct the valve seats as follows:

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

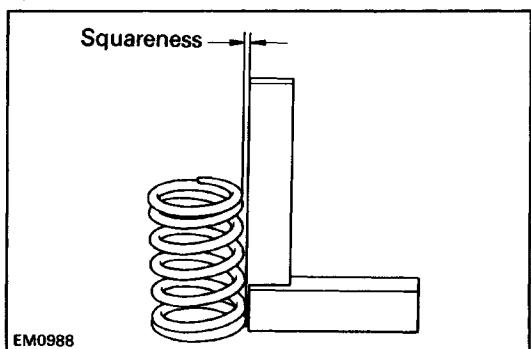


(2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.





- (d) Hand-lap the valve and valve seat with an abrasive compound.
- (e) After hand-lapping, clean the valve and valve seat.

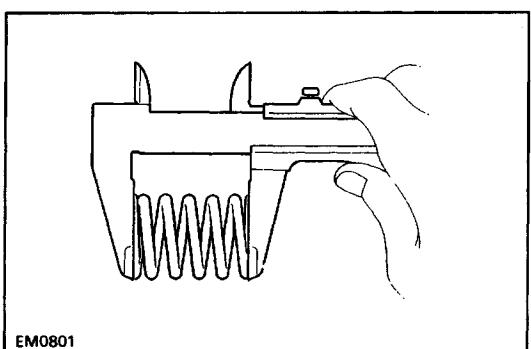


9. INSPECT VALVE SPRINGS

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

Maximum squareness: 2.0 mm (0.079 in.)

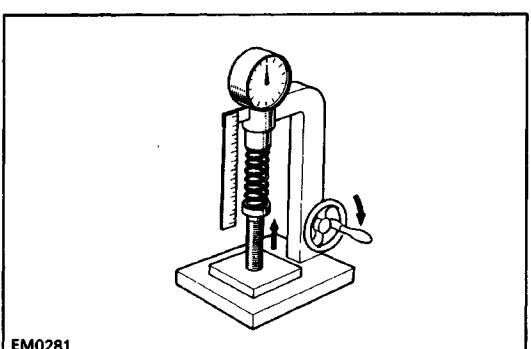
If the squareness is greater than maximum, replace the valve spring.



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

Free length: 41.96 – 41.99 mm (1.6520 – 1.6531 in.)

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

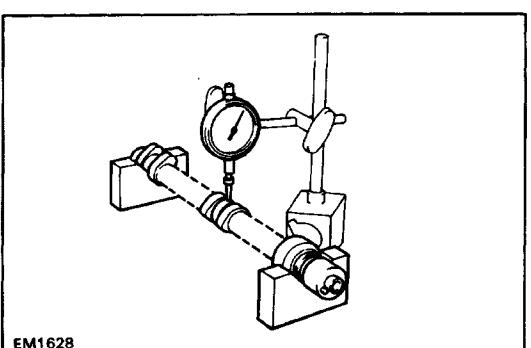


- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

**164 – 189 N (16.7 – 19.3 kgf, 36.8 – 42.5 lbf)
at 34.7 mm 0.366 in.)**

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



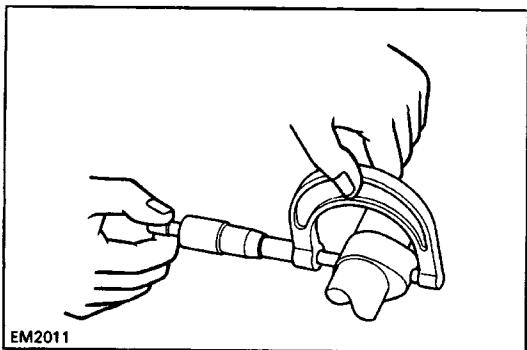
10. INSPECT CAMSHAFTS AND BEARINGS

A. Inspect camshaft for runout

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

Maximum circle runout: 0.04 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 42.010 – 42.110 mm

(1.6539 – 1.6579 in.)

Exhaust 40.060 – 40.160 mm

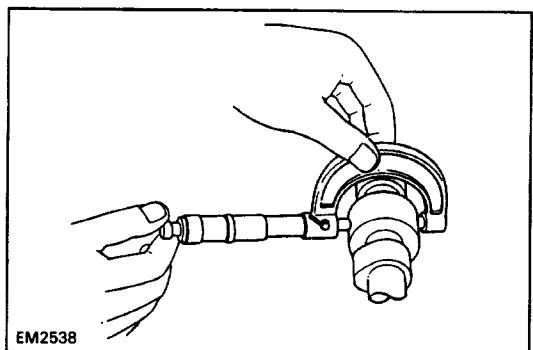
(1.5772 – 1.5811 in.)

Minimum cam lobe height:

Intake 41.90 mm (1.6496 in.)

Exhaust 39.95 mm (1.5728 in.)

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



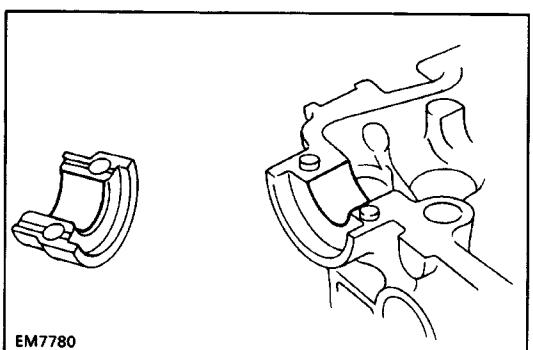
C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

Journal diameter: 26.959 – 26.975 mm

(1.0614 – 1.0620 in.)

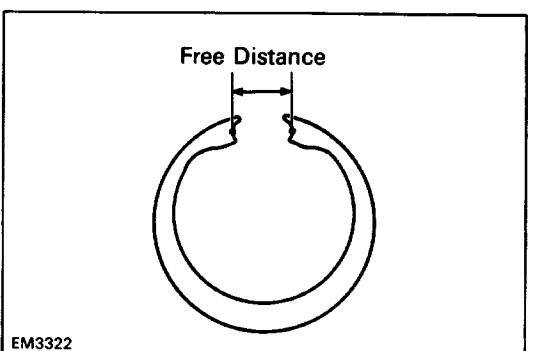
If the journal diameter is not as specified, check the oil clearance.



D. Inspect camshaft bearings

Check the bearings for flaking and scoring.

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

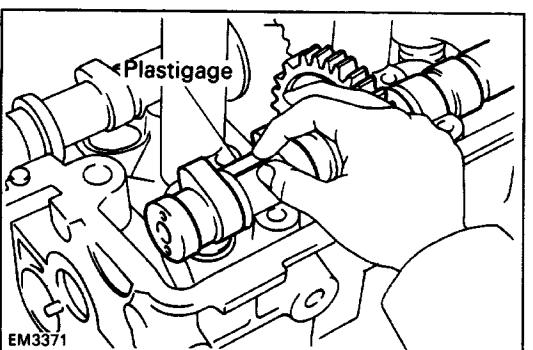


E. Inspect camshaft gear spring

Using a vernier caliper, measure the free distance between the spring ends.

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

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

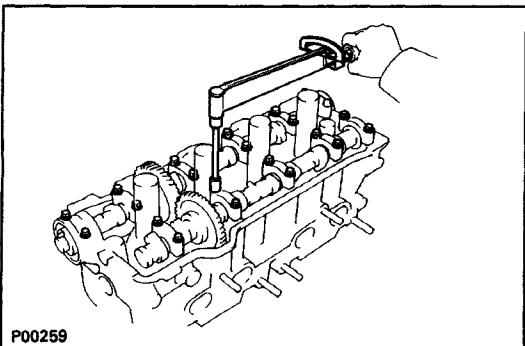


F. Inspect camshaft journal oil clearance

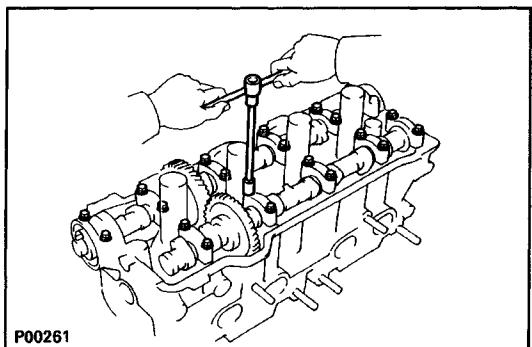
(a) Clean the bearing caps and camshaft journals.

(b) Place the camshafts on the cylinder head.

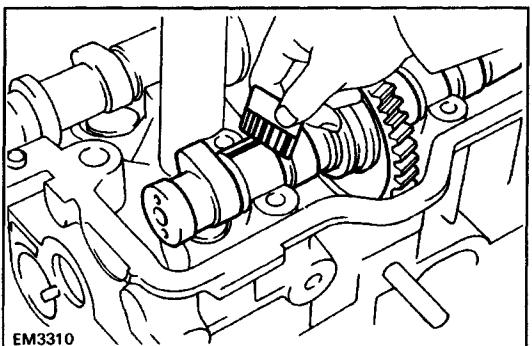
(c) Lay a strip of Plastigage across each of the camshaft journals.



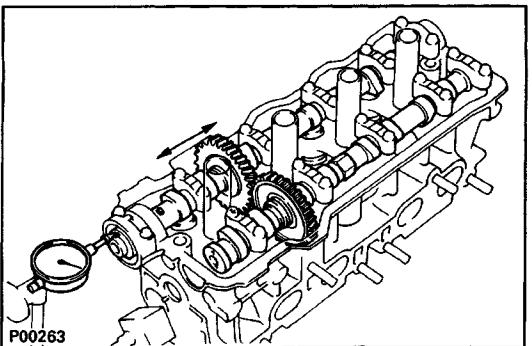
(d) Install the bearing caps.
 (See step 4 on pages [EM-175](#) to 177)
Torque: 19 N·m (190 kgf·cm, 94 ft-lbf)
NOTICE: Do not turn the camshaft.



(e) Remove the bearing caps.



(f) Measure the Plastigage at its widest point.
Standard oil clearance: 0.025 – 0.062 mm (0.0010 – 0.0024 in.)
Maximum oil clearance: 0.10 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.



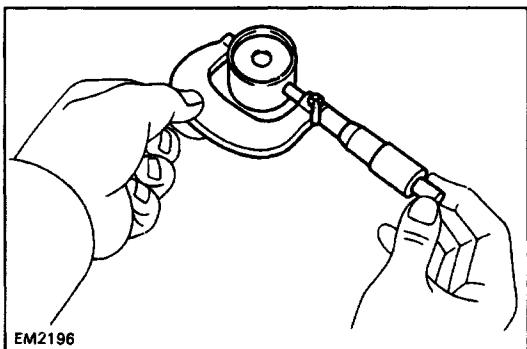
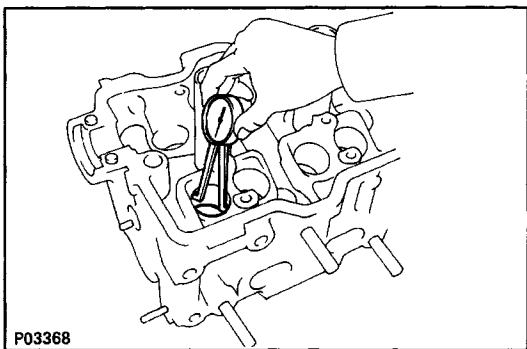
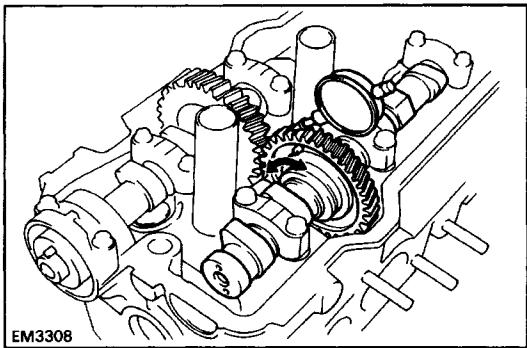
G. Inspect camshaft thrust clearance

(a) Install the camshafts.
 (See step 4 on pages [EM-175](#) to 177)
 (b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.
Standard thrust clearance:
Intake 0.045 – 0.100 mm (0.0018 – 0.0039 in.)
Exhaust 0.030 – 0.085 mm (0.0012 – 0.0033 in.)

Maximum thrust clearance:

Intake 0.12 mm (0.0047 in.)
Exhaust 0.10 mm (0.0039 in.)

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



H. Inspect camshaft gear backlash

(a) Install the camshafts without installing the exhaust cam sub-gear.

(See step 4 on pages EM-175 to 177)

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

Standard backlash: 0.020 – 0.200 mm

(0.0008 – 0.0079 in.)

Maximum backlash: 0.30 mm (0.0118 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: 31.000 – 31.018 mm

(1.2205 – 1.2213 in.)

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

Lifter diameter: 30.966 – .976 mm

(1.2191 – 1.2195 in.)

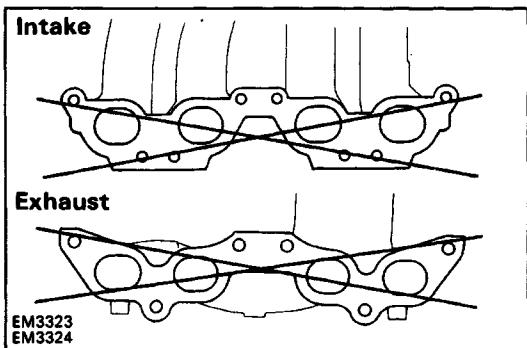
(c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.

Standard oil clearance: 0.024 – 0.052 mm

(0.0009 – 0.0020 in.)

Maximum oil clearance: 0.07 mm (0.0028 in.)

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



12. INSPECT MANIFOLDS

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

Maximum warpage: 0.30 mm (0.0118 in.)

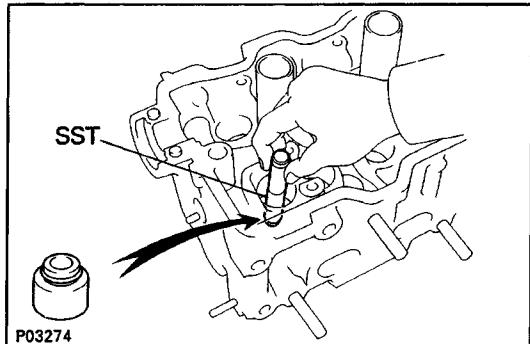
If warpage is greater than maximum, replace the manifold.

ASSEMBLY OF CYLINDER HEAD

(See page [EM-150](#))

HINT:

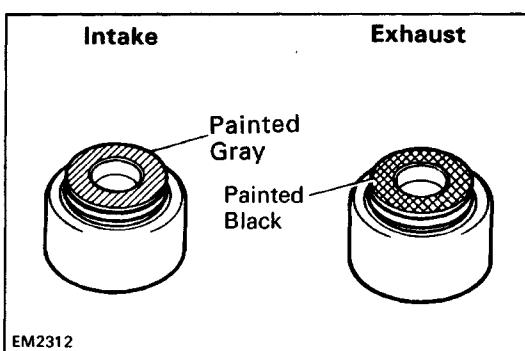
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.



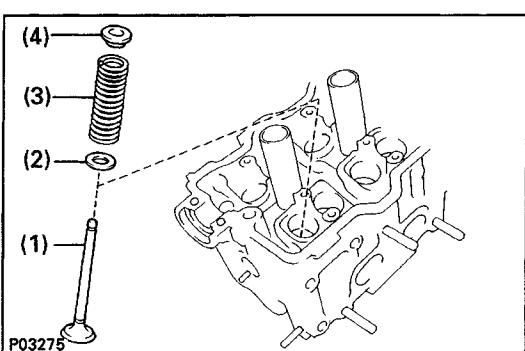
1. INSTALL VALVES

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

SST 09201-41020

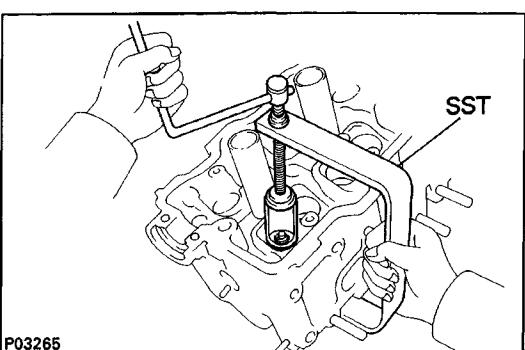


HINT: The intake valve oil seal is brown and the exhaust valve oil seal is black.



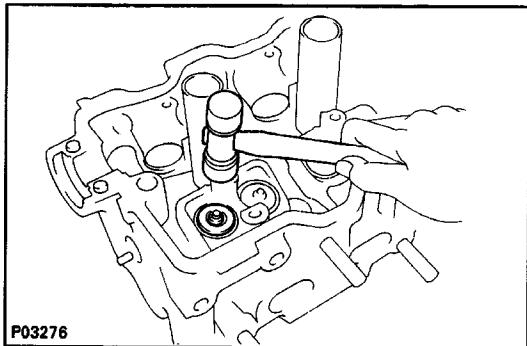
(b) Install the following parts:

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

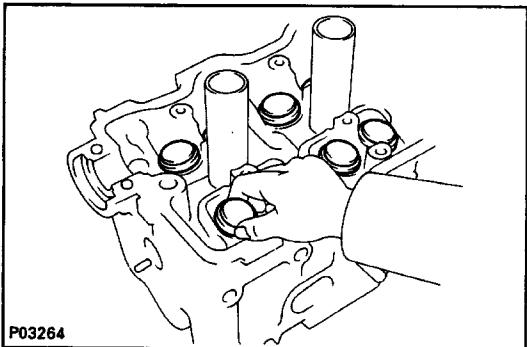


(c) Using SST, compress the valve spring and place the two keepers around the valve stem.

SST 09202-70010

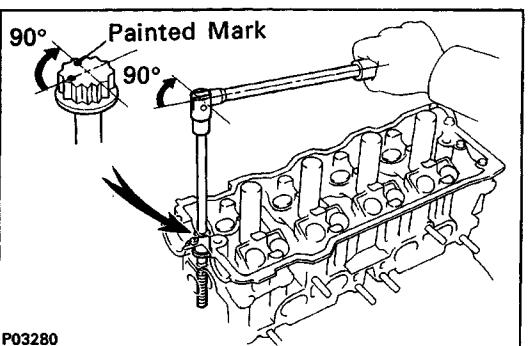
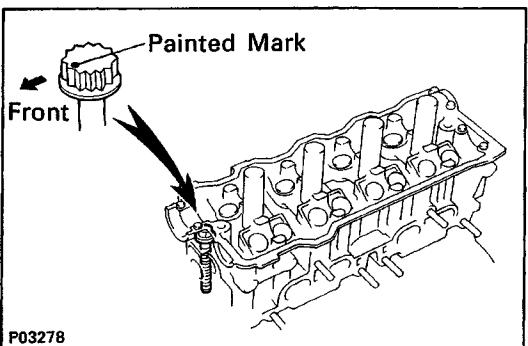
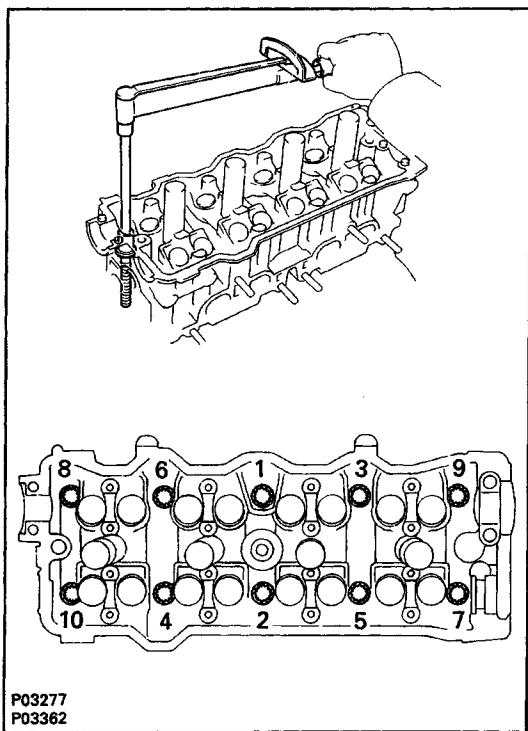
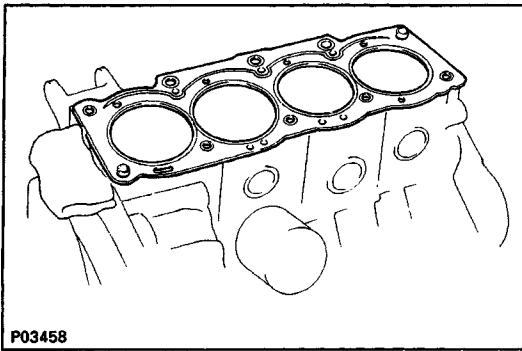


(d) Using a plastic-faced hammer, lightly tap the valve stem tip to assure proper fit.



2. INSTALL VALVE LIFTERS AND SHIMS

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



INSTALLATION OF CYLINDER HEAD

(See page EM-150)

1. INSTALL CYLINDER HEAD

A. Place cylinder head on cylinder block

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

NOTICE: Be careful of the installation direction.

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

B. Install cylinder head bolts

HINT:

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

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

(b) Install the plate washer to each cylinder head bolt.

(c) Install and uniformly tighten the ten cylinder head bolts in several passes in the sequence shown.

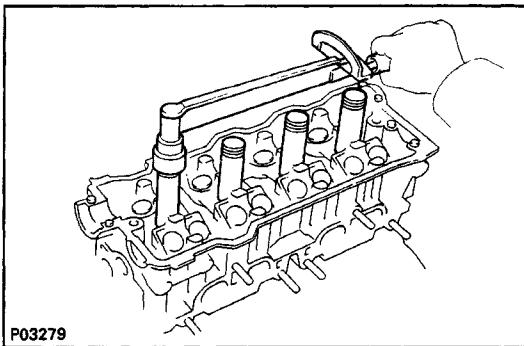
Torque: 49 N·m (500 kgf·cm, 36 ft-lbf)

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

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

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

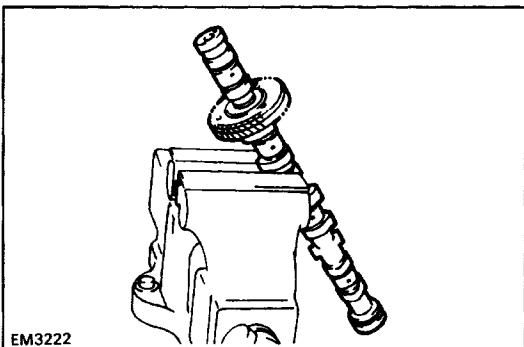
(f) Check that the painted mark is now at a 90° angle to front.



2. INSTALL SPARK PLUG TUBES

- Clean the cylinder head tube holes of any residual adhesive, oil or foreign particles. Remove any oil with kerosene or gasoline.
- Screw the threads of the spark plug tube coated with adhesive into the cylinder head.
- Using the spark plug tube nut and a 30 mm socket wrench, tighten the spark plug tubes.

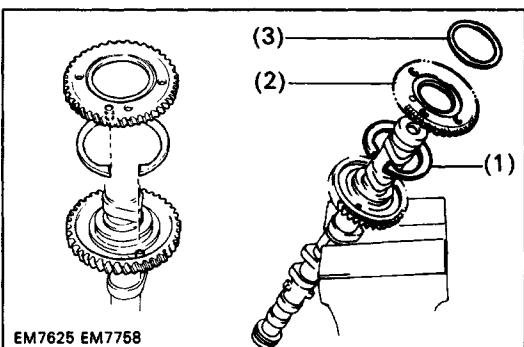
Torque: 39 N·m (400 kgf·cm, 29 ft-lbf)



3. ASSEMBLE EXHAUST CAMSHAFT

- Mount the hexagon wrench head portion of the camshaft in a vise.

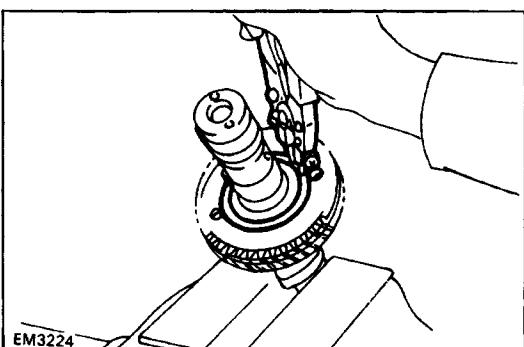
NOTICE: Be careful not to damage the camshaft.



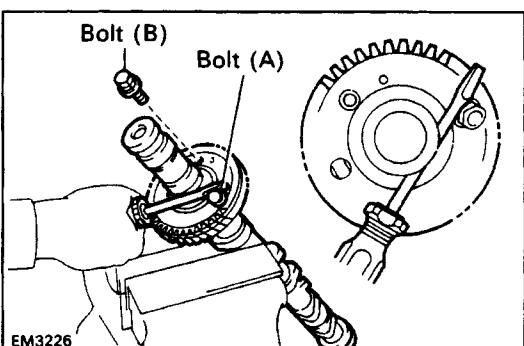
- Install the following parts:

- Camshaft gear spring
- Camshaft sub-gear
- Wave washer

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



- Using snap ring pliers, install the snap ring.



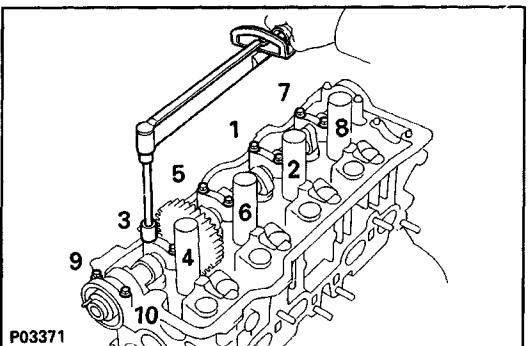
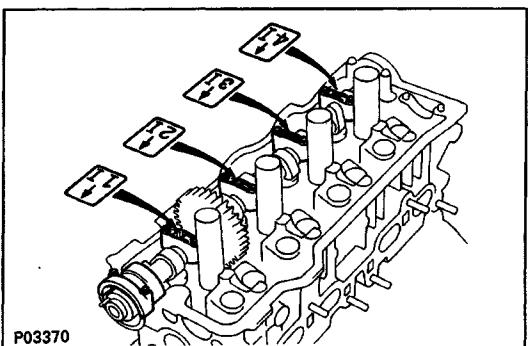
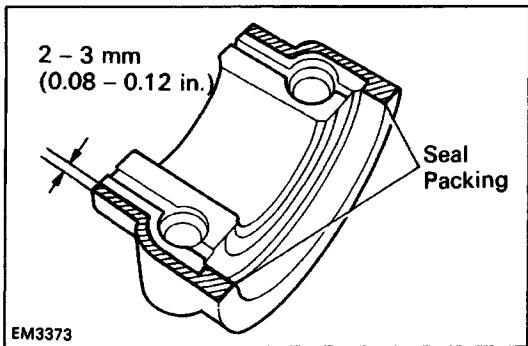
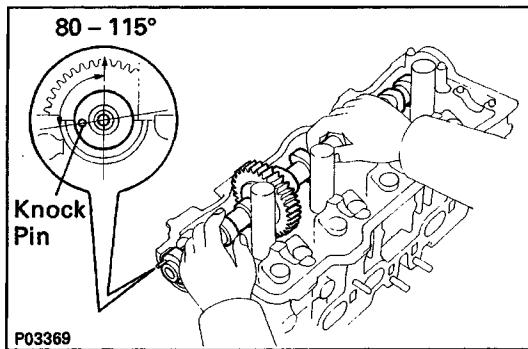
- Insert a service bolt (A) into the service hole of the camshaft sub-gear.

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

NOTICE: Be careful not to damage the camshaft.

4. 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 intake camshaft

- Apply MP grease to the thrust portion of the camshaft.
- Place the intake camshaft at 80 – 115° BTDC of camshaft angle on 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.

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

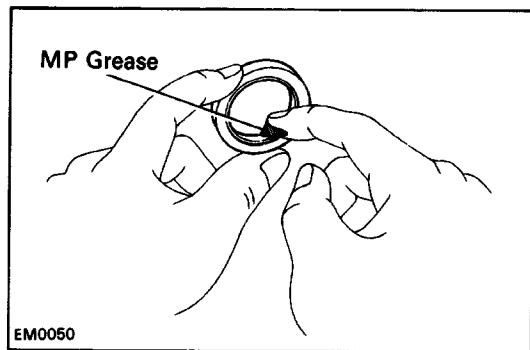
Seal packing: Part No. 08826–00080 or equivalent

- Install the bearing caps in their proper locations.

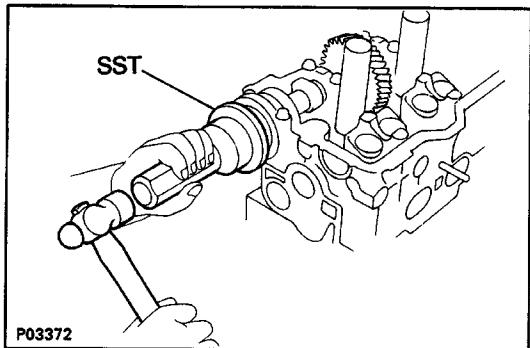
- Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

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

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

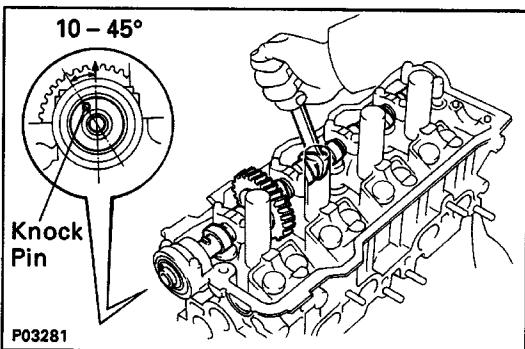


(g) Apply MP grease to a new oil seal lip.



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

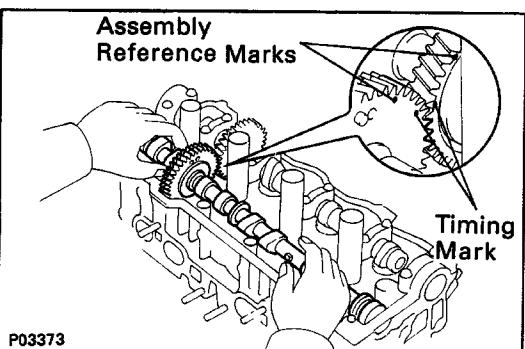
SST 09223-46011



B. Install exhaust camshaft

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

HINT: The above angle allows the No.2 and No.4 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.



(b) Apply MP grease to the thrust portion of the cam-shaft.

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

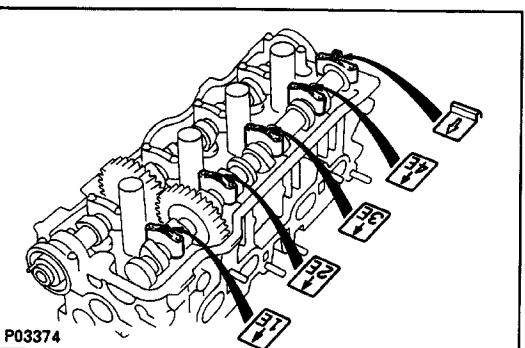
(d) Roll down the exhaust camshaft onto the bearing journals while engaging gears with each other.

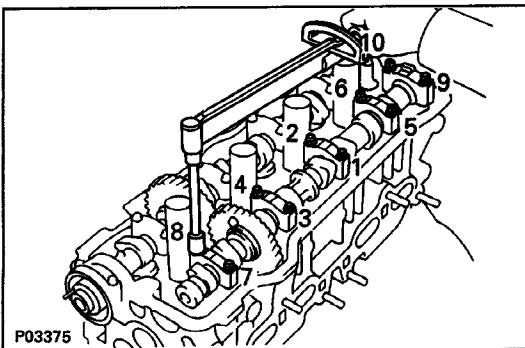
NOTICE: There are also assembly reference marks on each gear as shown in the illustration. Do not use these marks.

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

NOTICE: It is very important to replace the cam-shaft in the bearing journals evenly while tightening bearing caps in the subsequent steps.

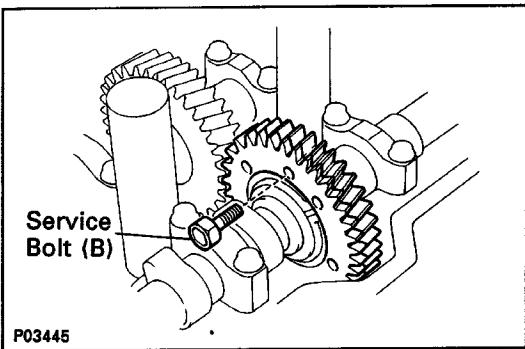
(f) Install the bearing caps in their proper locations.





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

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



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

5. CHECK AND ADJUST VALVE CLEARANCE

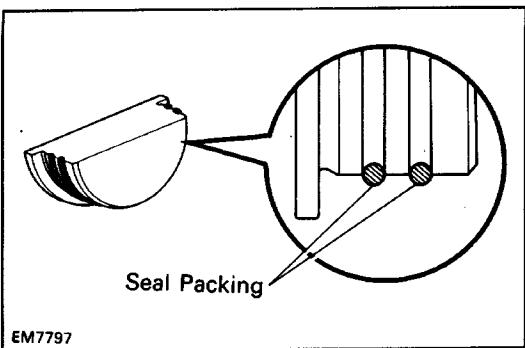
(See page [EM-22](#))

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

Valve clearance (Cold):

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

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

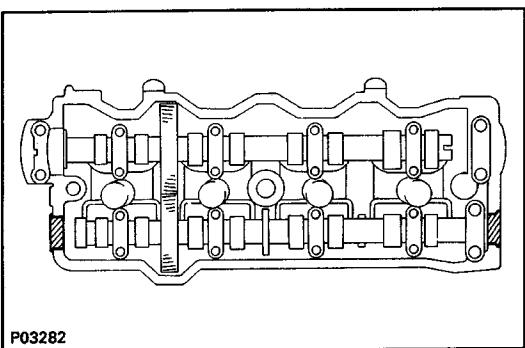


6. INSTALL SEMI-CIRCULAR PLUGS

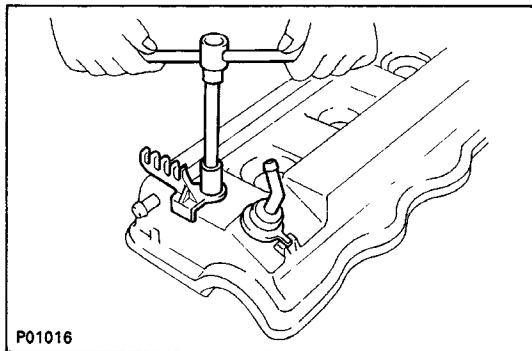
(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the semi-circular plug grooves.

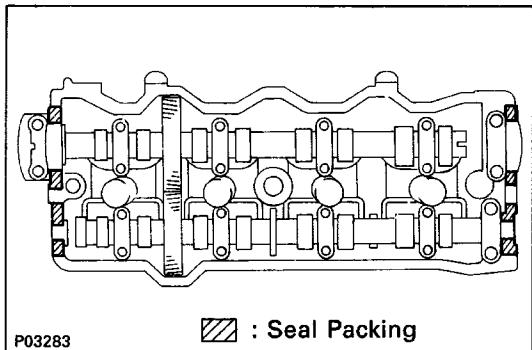
Seal packing: Part No. 08826-00080 or equivalent



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



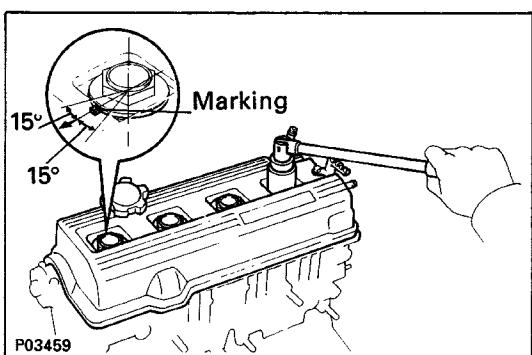
7. INSTALL HIGH-TENSION CORD CLAMP AND PCV VALVE



8. INSTALL CYLINDER HEAD COVER

- Remove any old packing (FIPG) material.
- Apply seal packing to the cylinder head as shown in the illustration.

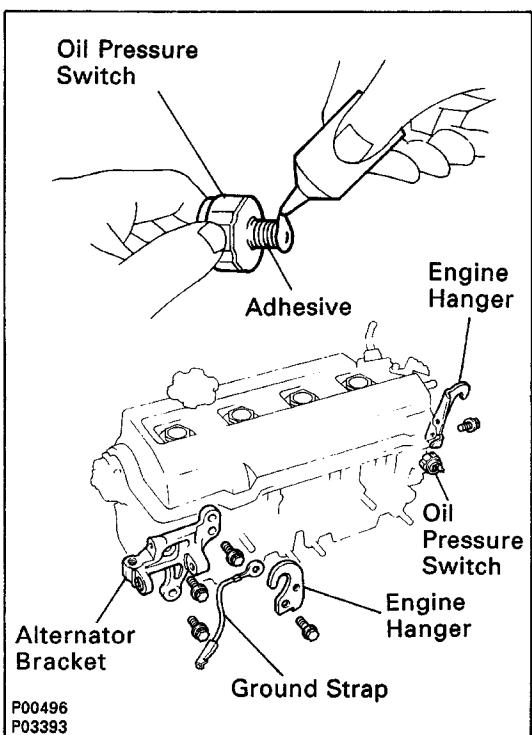
Seal packing: Part No. 08826-00080 or equivalent



- Install the gasket to the head cover.
- Install the head cover with the four grommets and nuts. Uniformly tighten the nuts in several passes.

Torque: 23 N·m (230 kgf·cm, 17 ft·lbf)

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



9. INSTALL OIL PRESSURE SWITCH

Apply adhesive to two or three threads.

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

10. INSTALL ALTERNATOR BRACKET

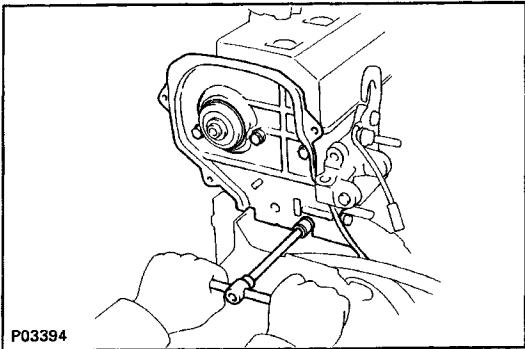
Install the alternator bracket with the three bolts.

Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)

11. INSTALL ENGINE HANGERS

Install the engine hanger with the bolt. Install the two engine hangers. Install the ground strap.

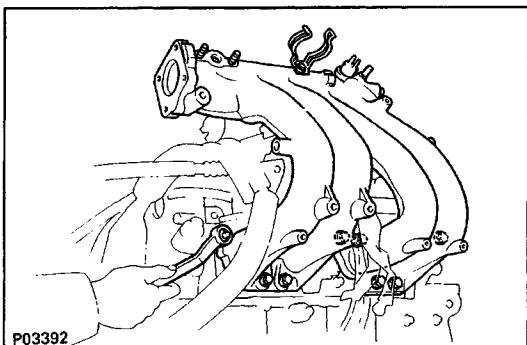
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)



12. INSTALL No.3 TIMING BELT COVER

Install the timing belt cover with the four bolts.

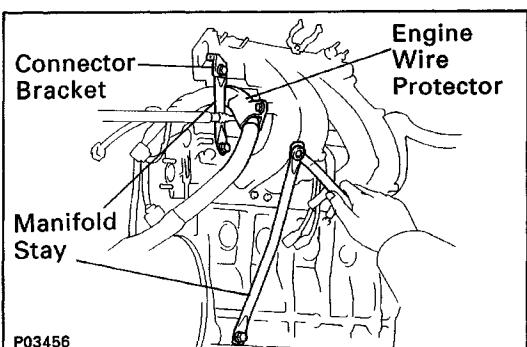
Torque: 7.8 N·m (80 kgf·cm, 69 in-lbf)



16. INSTALL INTAKE MANIFOLD

(a) Install a new gasket and the intake manifold with the six bolts and two nuts. Uniformly tighten the bolts and nuts in several passes.

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



(b) Install the two manifold stays with the four bolts.

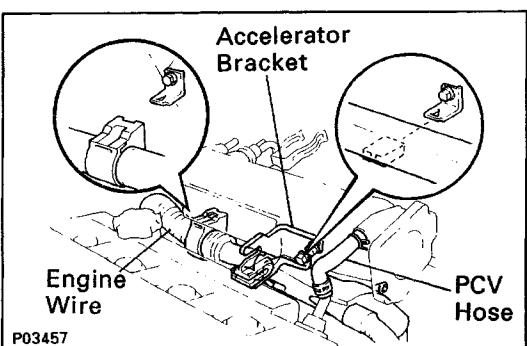
Alternately tighten the bolts. Install the connector bracket (CALIF. only).

Torque:

12 mm. head bolt 22 N·m (220 kgf·cm, 16 ft-lbf)

14 mm head bolt 42 N·m (425 kgf·cm, 31 ft-lbf)

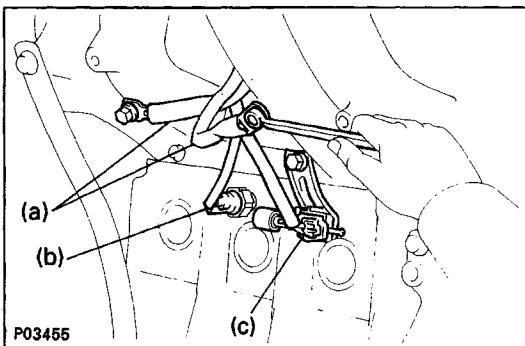
(c) Install the engine wire protector with the bolt.



(d) Connect the two wire clamps to the wire brackets.

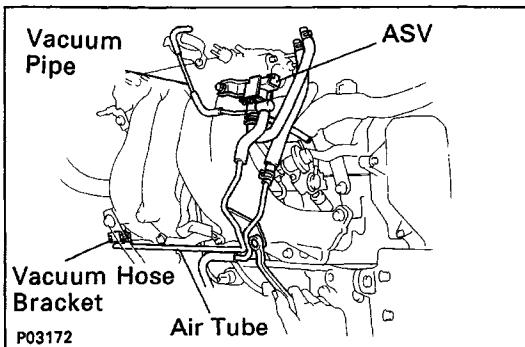
(e) Connect the PCV hose to the PVC valve.

17. INSTALL ACCELERATOR BRACKET



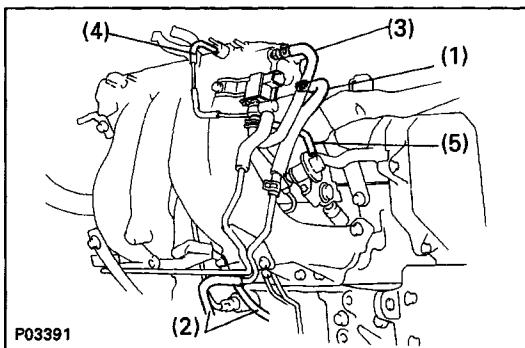
18. INSTALL VSV FOR EGR
19. CONNECT ENGINE WIRE GROUND STRAPS AND CONNECTORS

- (a) Two engine ground straps to intake manifold
- (b) Knock sensor connector
- (c) VSV connector for EGR



20. INSTALL AIR TUBE, ASV (FOR A/C) AND VACUUM PIPE

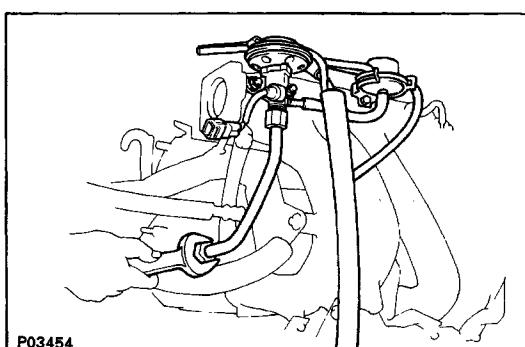
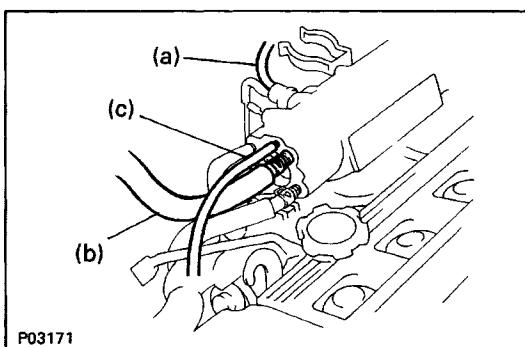
- (a) Install the air tube, ASV assembly and the vacuum hose bracket with the four bolts.
- (b) Install the vacuum pipe with the bolt.



- (c) Connect the following hoses:
 - (1) PS air hose to intake manifold
 - (2) Two air hoses to air tube
 - (3) (w/ A/C) Air hose to intake manifold
 - (4) Vacuum hose to gas filter
 - (5) Vacuum hose to fuel pressure regulator
- (d) (w/ A/C) Connect the ASV connector.

21. CONNECT VACUUM HOSES

- (a) Vacuum sensor hose to gas filter
- (b) Brake booster vacuum hose to intake manifold
- (c) (w/ Cruise Control System (w/o ABS)) Actuator vacuum hose to intake manifold



22. INSTALL EGR VALVE AND VACUUM MODULATOR

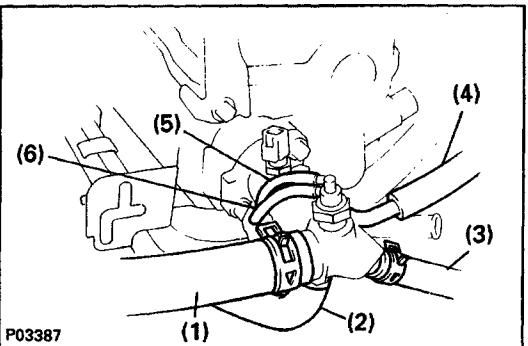
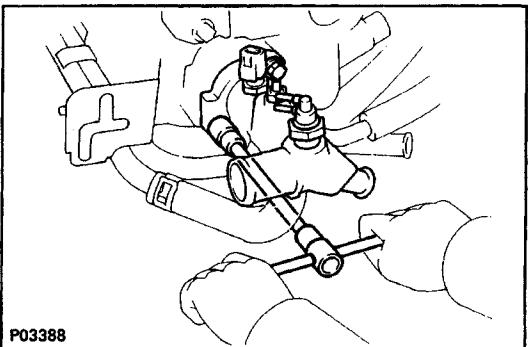
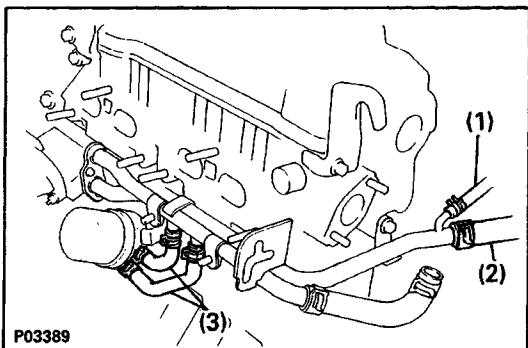
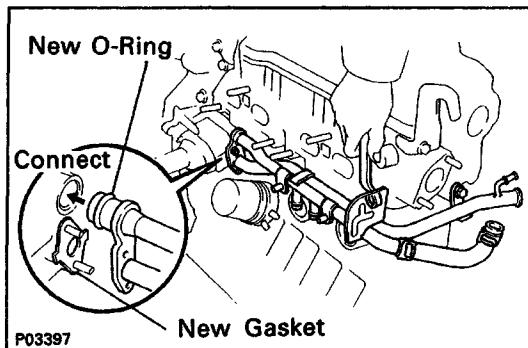
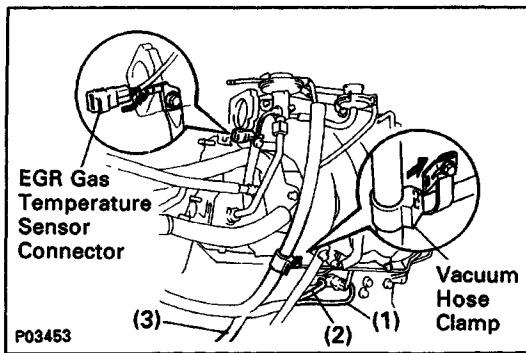
- (a) Install a new gasket and the EGR valve with the union nut and two nuts.

Torque:

Union nut 59 N·m (600 kgf·cm, 43 ft·lbf)

Bolt 13 N·m (130 kgf·cm, 9 ft·lbf)

- (b) Install the EGR modulator– to the clamp.



(c) Connect the following hoses:

- (1) Vacuum hose (from port Q of EGR vacuum modulator) to port G of VSV for EGR
- (2) Vacuum hose (from EGR valve) to port E of VSV for EGR
- (3) Vacuum hose to charcoal canister

(d) Install the vacuum hose clamp to the bracket.

(e) (CALIF. only)

Install the connector to the bracket. Connect the EGR gas temperature sensor connector.

23. INSTALL THROTTLE BODY

(See steps 2 to 5 on pages [FI-204](#) and [205](#))

24. INSTALL WATER BY-PASS PIPE

(a) Install a new O-ring to the by-pass pipe.

(b) Apply soapy water on the O-ring.

(c) Install a new gasket and the by-pass pipe with the two nuts and two bolts.

Torque(Nut): 9.3 N·m (95 kgf·cm, 82 in-lbf)

(d) Connect the following hoses:

- (1) ISC water by-pass hose
- (2) Heater water hose
- (3) (w/ Oil Cooler)

Two oil cooler water by-pass hoses

(e) (w / Oil Cooler)

Install the water by-pass hose heat protector.

(See step 3 on page [LU-30](#))

25. INSTALL WATER OUTLET

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

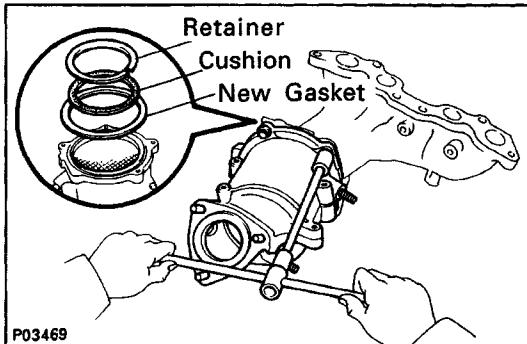
Torque: 15 N·m (150 kgf·cm, 11 ft-lbf)

(b) Connect the following hoses:

- (1) Upper radiator hose
- (2) Water by-pass pipe hose
- (3) Heater water hose
- (4) ISC water by-pass hose
- (5) EVAP BSV vacuum hose (from port P of throttle body)
- (6) EVAP BSV vacuum hose (from charcoal canister)

(c) Connect the following connectors:

- Water temperature sender gauge connector
- Water temperature sensor connector

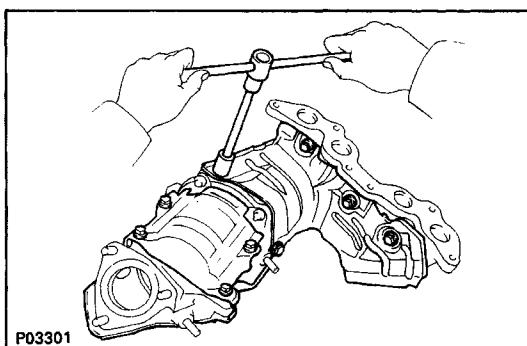


26. ASSEMBLE EXHAUST MANIFOLD AND CATALYTIC CONVERTER

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

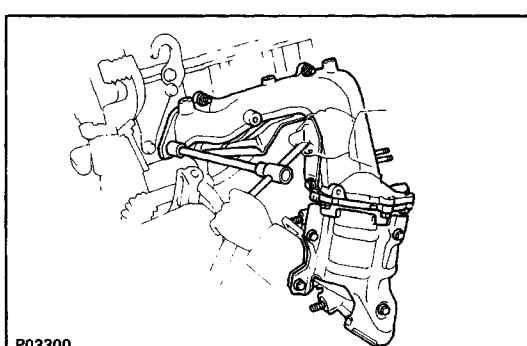
(b) Install the catalytic converter to the exhaust manifold with the three bolts and two nuts.

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



(c) Install the lower manifold head insulator with the five bolts.

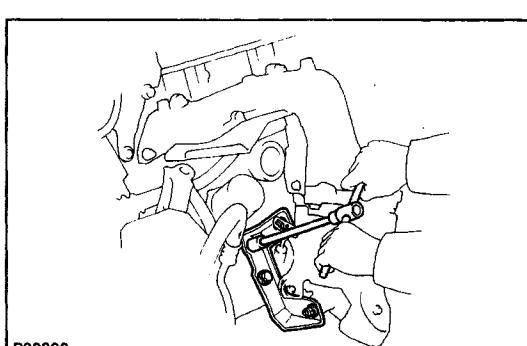
(d) Install the two catalytic converter heat insulators with the eight bolts.



27. INSTALL EXHAUST MANIFOLD AND CATALYTIC CONVERTER ASSEMBLY

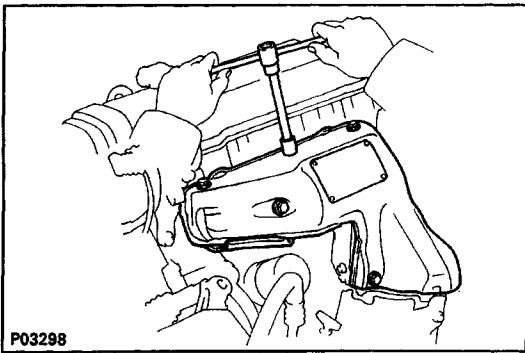
(a) Install a new gasket, the exhaust manifold and catalytic converter assembly with the six new nuts. Uniformly tighten the nuts in several passes.

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



(b) Install the catalytic converter stay with the two bolts and two new nuts. Alternately tighten the bolts and nut.

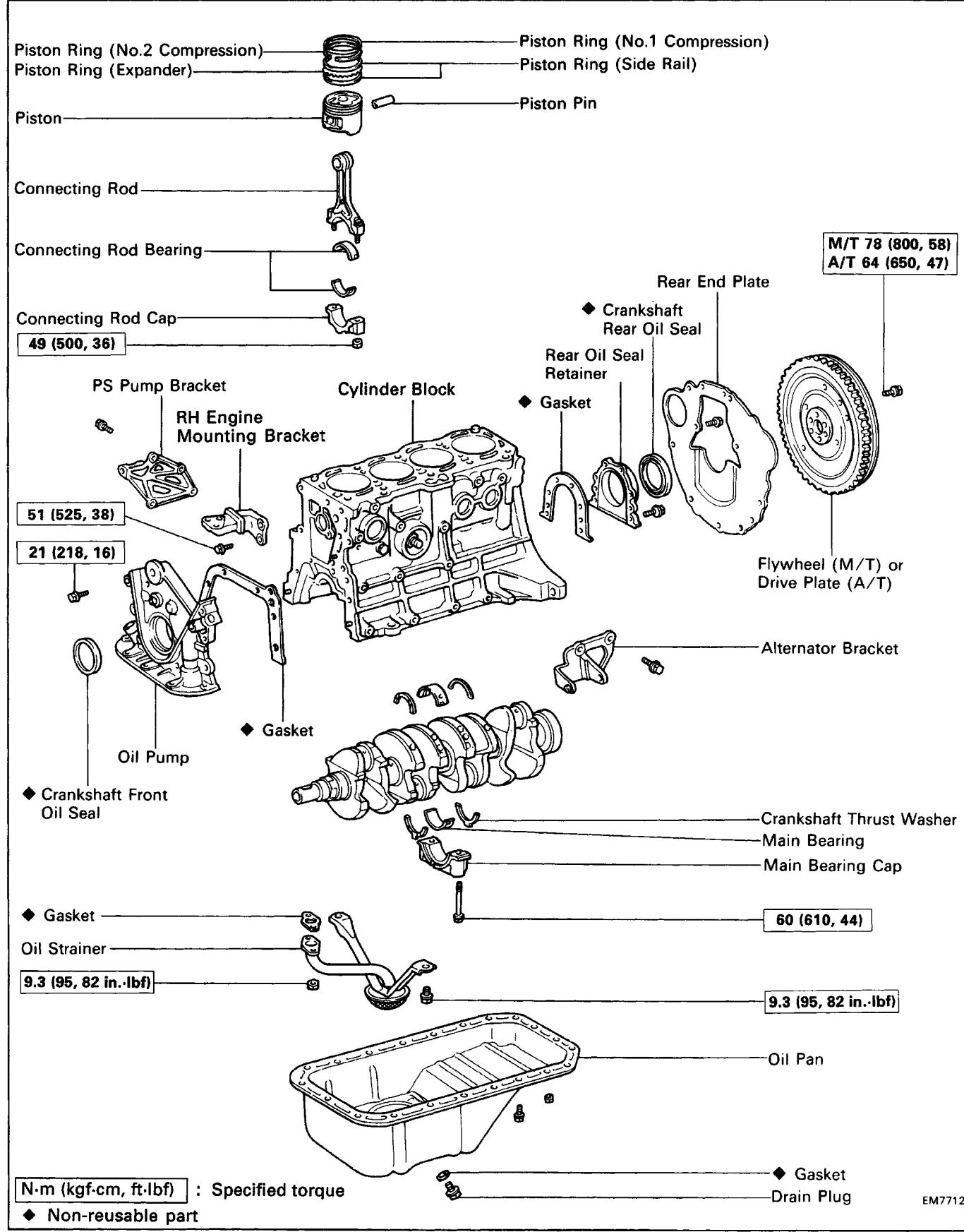
Torque: 42 N·m (425 kgf·cm, 31 ft-lbf)



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

- 28. (CALIF. ONLY)**
INSTALL SUB-OXYGEN SENSOR
- 29. INSTALL OXYGEN SENSOR (MAIN)**
- 10. INSTALL FRONT EXHAUST PIPE**
(See step 15 on page [EM-305](#))
- 31. INSTALL SUSPENSION LOWER CROSMEMBER**
(See page 16 on page [EM-306](#))
- 32. INSTALL ENGINE UNDER COVERS**
- 33. INSTALL DISTRIBUTOR** (See page [IG-35](#))
- 34. INSTALL ALTERNATOR** (See page [CH-24](#))
- 35. INSTALL AIR CLEANER CAP AND HOSE**
(See step 38 on page [EM-310](#))
- 36. (w/ CRUISE CONTROL SYSTEM)**
INSTALL CRUISE CONTROL ACTUATOR
(See step 33 on page [EM-309](#))
- 37. INSTALL ACCELERATOR CABLE, AND ADJUST IT**
- 38. (A/T)**
CONNECT THROTTLE CABLE, AND ADJUST IT
- 39. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**
- 40. FILL WITH ENGINE COOLANT** (See page [CO-6](#))
Capacity (w/ Heater):
M/T 6.2 liters (6.6 US qts, 5.5 Imp. qts)
A/T 6.1 liters (6.4 US qts, 5.4 Imp. qts)
- 41. START ENGINE AND CHECK FOR LEAKS**
- 42. ADJUST IGNITION TIMING** (See page [IG-37](#))
Ignition timing:
10° BTDC), idle
(w/ Terminals TE1 and E1 connected)
- 43. PERFORM ROAD TEST**
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.
- 44. RECHECK ENGINE COOLANT LEVEL AND OIL LEVEL**

CYLINDER BLOCK (4A-FE) COMPONENTS



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

◆ Non-reusable part

REMOVAL OF ENGINE

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

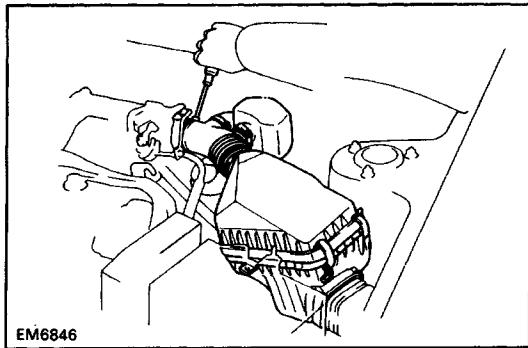
CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (-) terminal cable is disconnected from the battery.

2. REMOVE HOOD

3. REMOVE ENGINE UNDER COVER

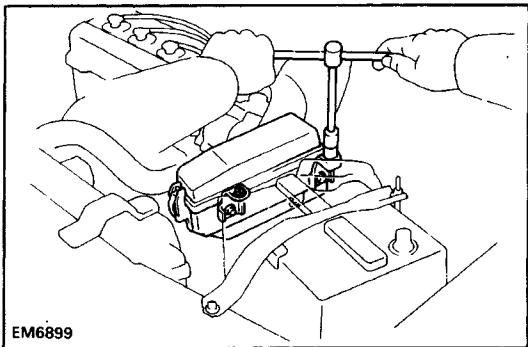
4. DRAIN ENGINE COOLANT (See page [CO-6](#))

5. DRAIN ENGINE OIL (See page [LU-7](#))



6. REMOVE AIR CLEANER

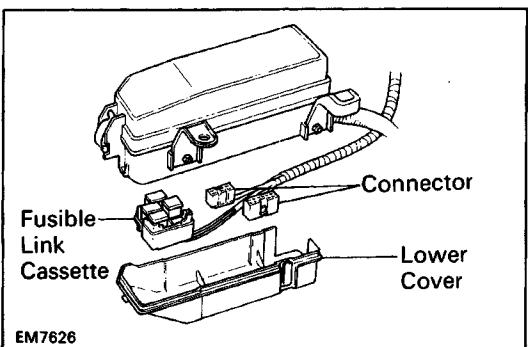
- Disconnect the intake air temperature sensor connector.
- Disconnect the accelerator cable from the bracket on the air cleaner cap.
- Disconnect the four air cleaner cap clips.
- Disconnect the air hose from the air pipe.
- Disconnect the air cleaner hose from the throttle body, and remove the air cleaner cap and element.
- Remove the three bolts and air cleaner case.



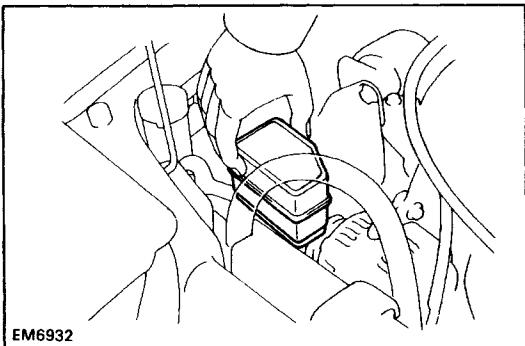
7. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY

8. REMOVE ENGINE RELAY BOX, AND DISCONNECT ENGINE WIRE CONNECTORS

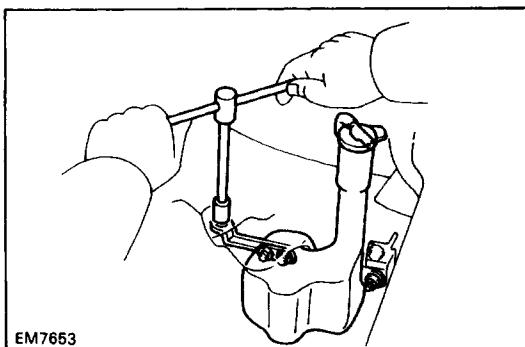
- Remove the two nuts, and disconnect the relay box from the battery.



- Remove the lower cover from the relay box.
- Disconnect the fusible link cassette and two connectors of the engine wire from the relay box.



9. REMOVE A/C RELAY BOX FROM BRACKET
10. REMOVE BATTERY
11. REMOVE RADIATOR (See page CO-23)

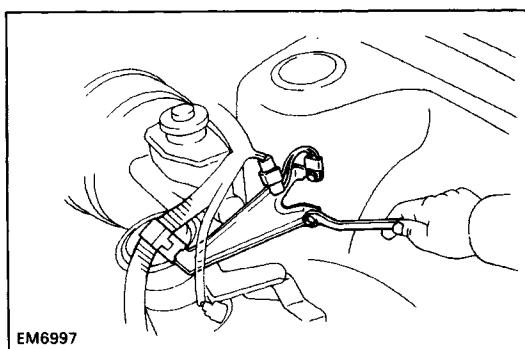


12. REMOVE RADIATOR RESERVOIR TANK

Remove the bolt, nut and reservoir tank.

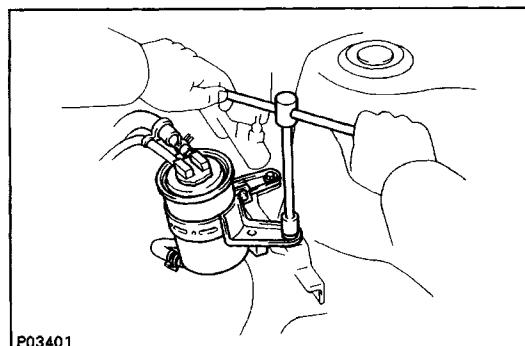
13. DISCONNECT WIRES AND CONNECTORS

- (a) Check connector
- (b) Vacuum sensor connector
- (c) Ground strap from LH fender apron



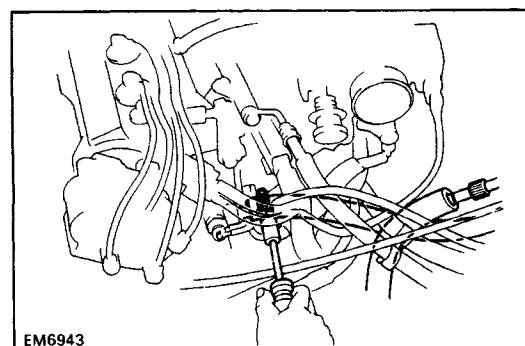
14. REMOVE ENGINE WIRE BRACKET

- (a) Disconnect the wire clamp from the wire bracket.
- (b) Remove the two bolts and wire bracket. Disconnect the noise filter.



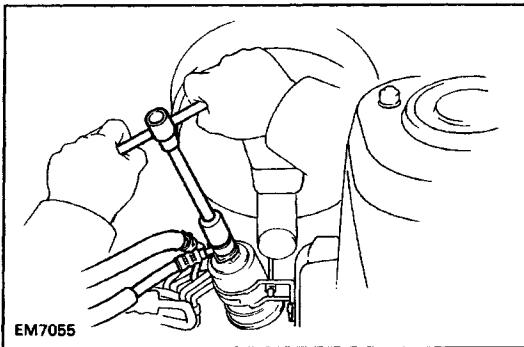
15. REMOVE CHARCOAL CANISTER

- (a) Disconnect the three hoses.
- (b) Remove the two bolts and charcoal canister.



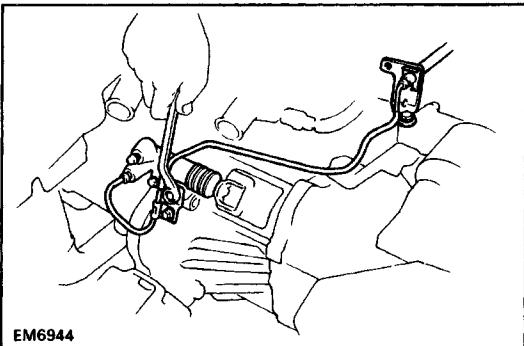
16. DISCONNECT HEATER HOSE FROM WATER INLET

17. DISCONNECT SPEEDOMETER CABLE



18. DISCONNECT FUEL HOSES

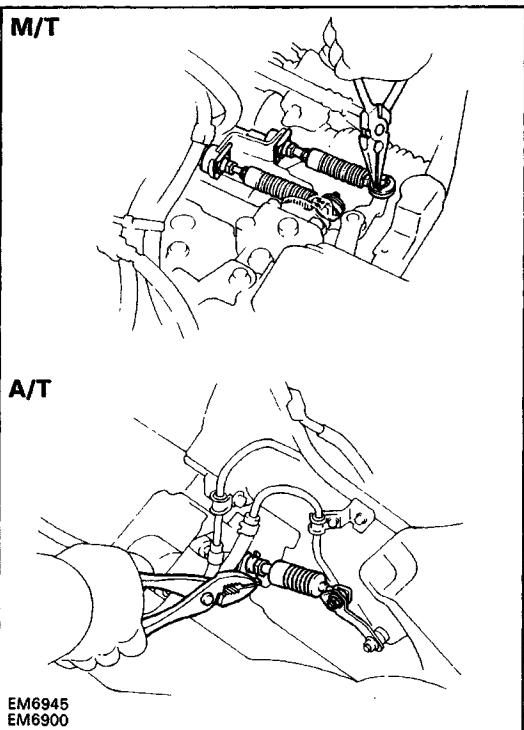
CAUTION: Catch leaking fuel in a container.



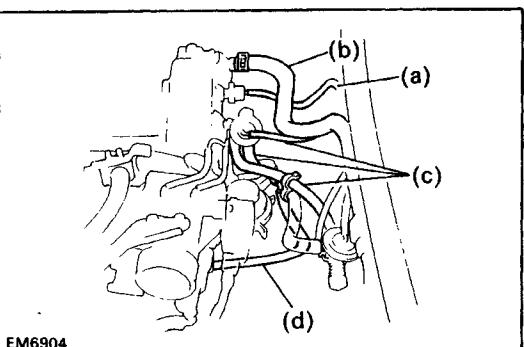
19. (M/T)

REMOVE CLUTCH RELEASE CYLINDER WITHOUT DISCONNECTING TUBE

Remove the three bolts, release cylinder and tube from the transaxle.



20. DISCONNECT TRANSAXLE CONTROL CABLE(S) FROM TRANSAXLE



21. DISCONNECT VACUUM HOSES

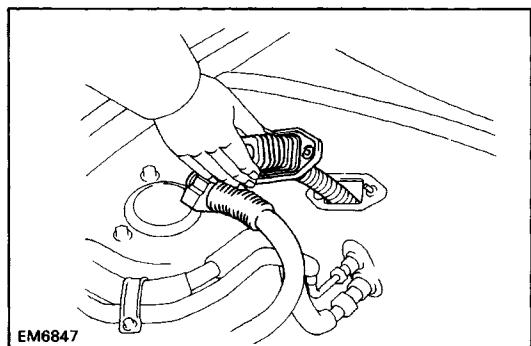
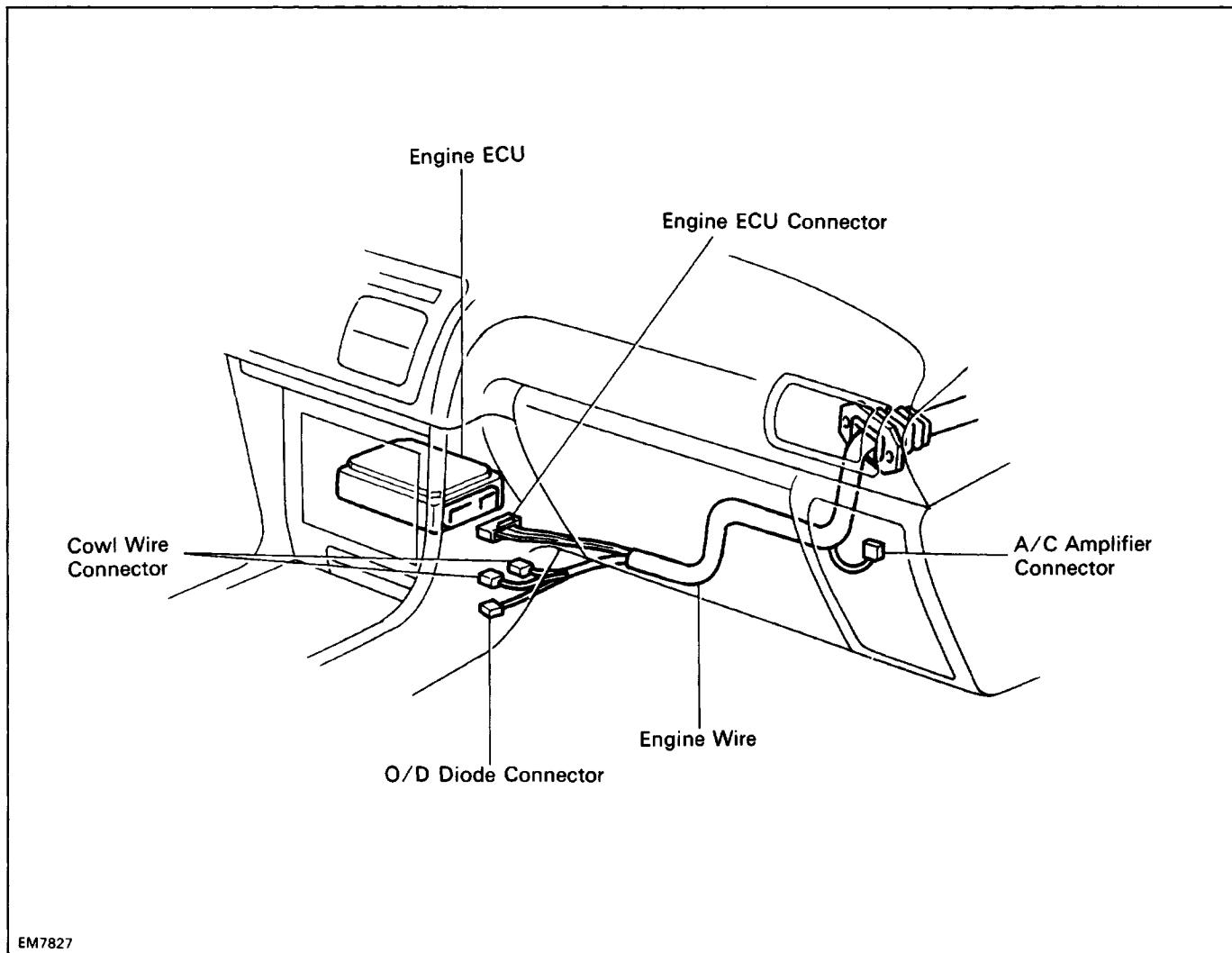
- (a) Vacuum sensor hose from gas filter on air intake chamber
- (b) Brake booster vacuum hose from air intake chamber
- (c) Three A/C vacuum hoses from ASV on air intake chamber
- (d) A/C vacuum hose from air pipe

22. DISCONNECT ENGINE WIRE

- (a) Engine wire clamp from wire bracket on RH fender apron
- (b) Two cowl wire connectors

23. DISCONNECT ENGINE WIRE FROM CABIN

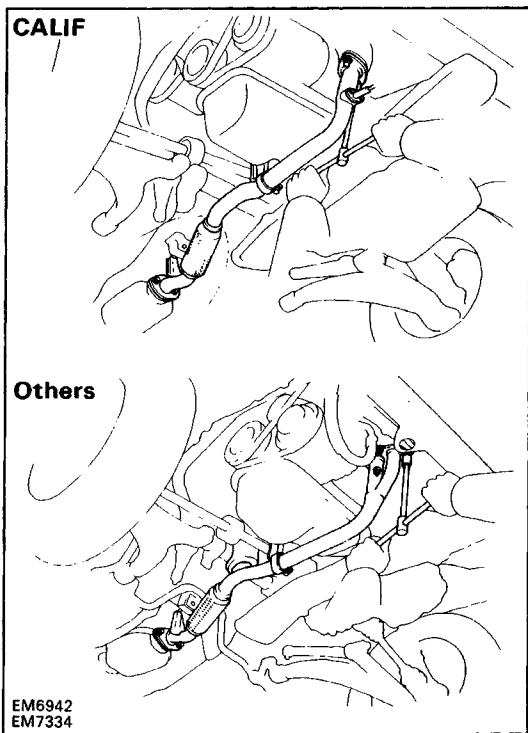
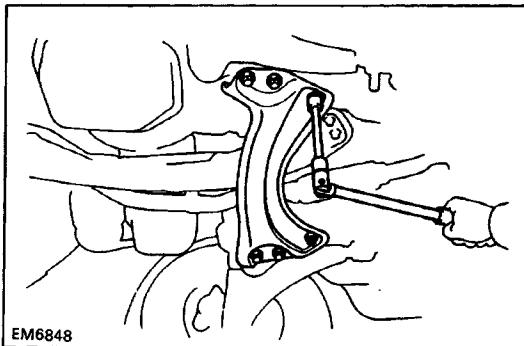
- (a) Disconnect the following connectors:
 - (1) Engine ECU connector
 - (2) Two cowl wire connectors
 - (3) A/C amplifier connector
 - (4) O/D diode connector



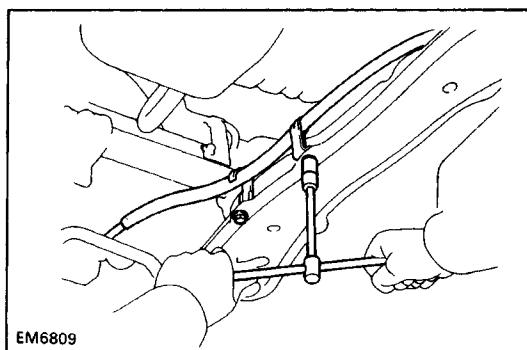
- (b) Remove the two nuts, and pull out the engine wire from the cowl panel.

24. REMOVE SUSPENSION LOWER CROSSMEMBER

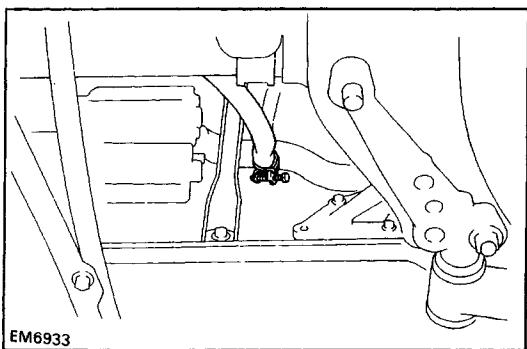
Remove the four bolts, two nuts and lower crossmember.

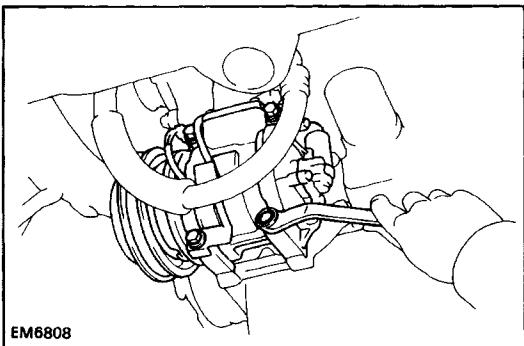
**25. REMOVE FRONT EXHAUST PIPE**

- Disconnect the oxygen sensor connector.
- Loosen the bolt, and disconnect the clamp from the support bracket.
- Remove the two bolts and nuts holding the front exhaust pipe to the catalytic converter.
- Using a 14 mm deep socket wrench, remove the two nuts (CALIF.) or three nuts (others) holding the front exhaust pipe to the catalytic converter.
- Disconnect the support hook on the front exhaust pipe from the support bracket, and remove the front exhaust pipe and two (CALIF.) or three (others) gaskets.

**26. (A/T)**

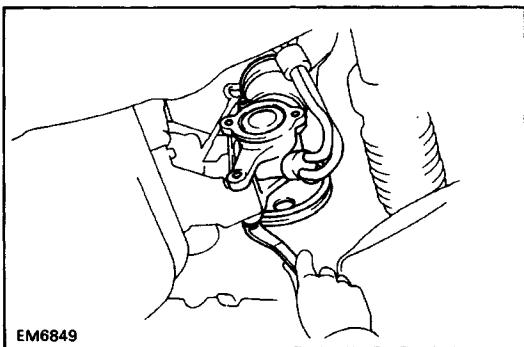
**DISCONNECT TRANSAXLE CONTROL CABLE FROM
ENGINE MOUNTING CENTER MEMBER**

27. REMOVE DRIVE SHAFTS (See SA section)**28. DISCONNECT HEATER HOSE FROM WATER INLET
PIPE**

**29. (w/ A/C)****REMOVE A/C COMPRESSOR WITHOUT DISCONNECTING HOSES**

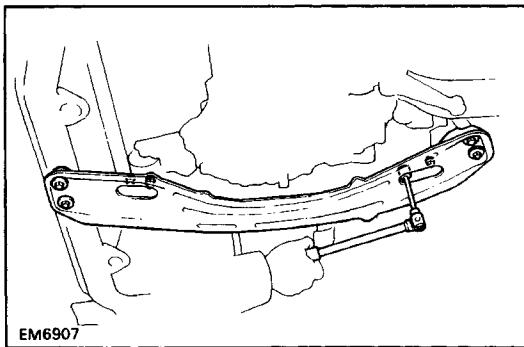
- Disconnect the A/C compressor connector.
- Remove the drive belt.
- Remove the four bolts, and disconnect the A/C compressor.

HINT: Put aside the compressor, and suspend it to the radiator support with a string.

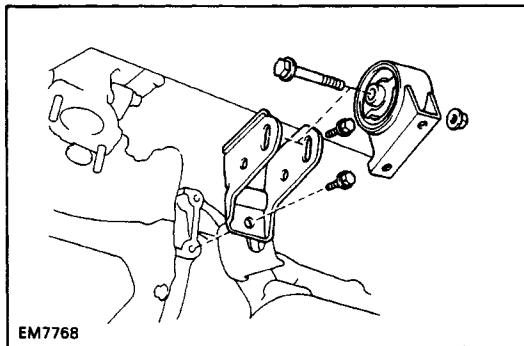
**30. REMOVE PS PUMP WITHOUT DISCONNECTING HOSES**

- Disconnect the air hose from the air pipe.
- Disconnect the air hose from the intake manifold.
- Remove the PS drive belt.
- Remove the two bolts, and disconnect the PS pump from the engine.

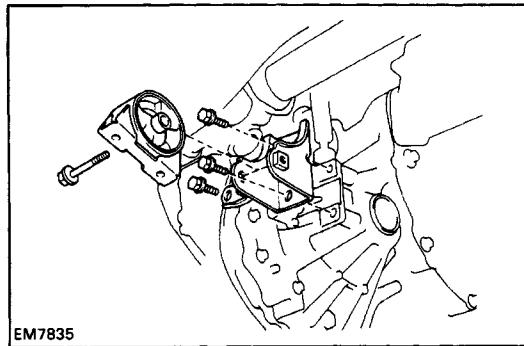
HINT: Put aside the pump and suspend it from the cowl with a string.

**31. REMOVE ENGINE MOUNTING CENTER MEMBER**

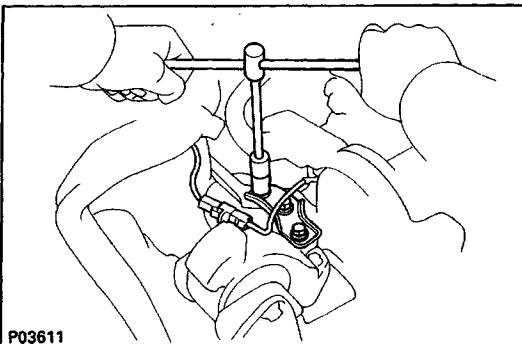
Remove the eight bolts and center member.

**32. REMOVE FRONT ENGINE MOUNTING INSULATOR AND BRACKET**

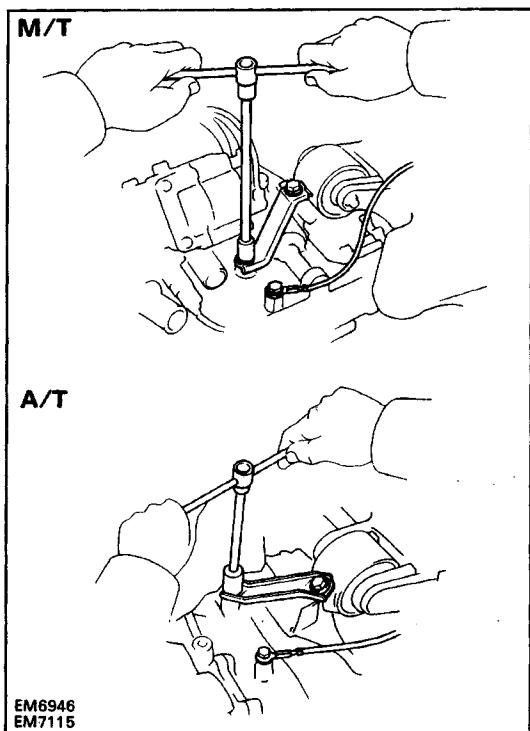
- Remove the through bolt, nut and mounting insulator.
- Remove the two bolts and mounting bracket.

**33. REMOVE REAR ENGINE MOUNTING INSULATOR AND BRACKET**

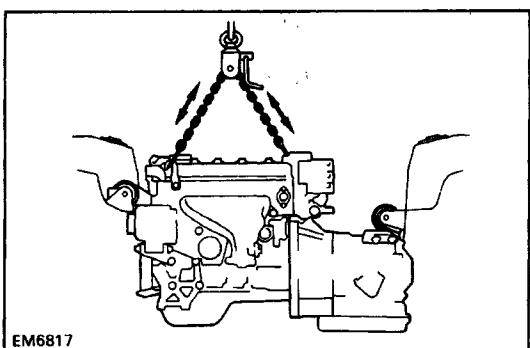
- Remove the through bolt and mounting insulator.
- Remove the three bolts and mounting bracket.



- 34. REMOVE CONNECTOR FROM GROUND WIRE ON RH FENDER APRON**
- 35. REMOVE RH ENGINE MOUNTING STAY**
Remove the three bolts and mounting stay.

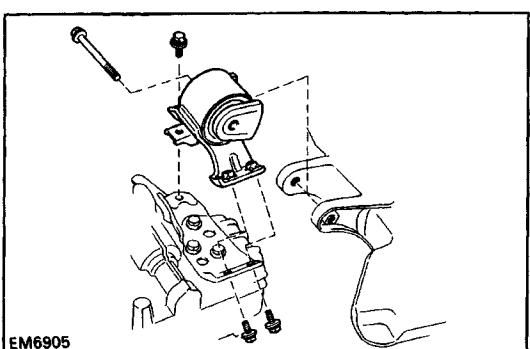


- 36. REMOVE LH ENGINE MOUNTING STAY**
Remove the two bolts and mounting stay.
- 37. REMOVE GROUND STRAP FROM TRANSAXLE**

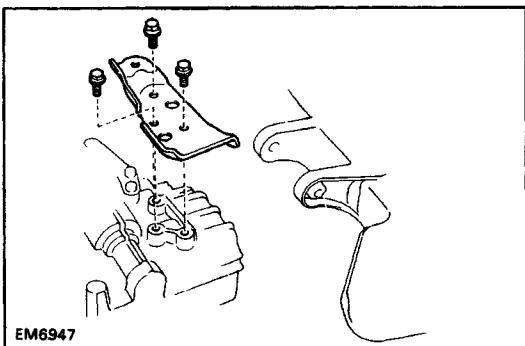


- 38. REMOVE ENGINE AND TRANSAXLE ASSEMBLY FROM VEHICLE**

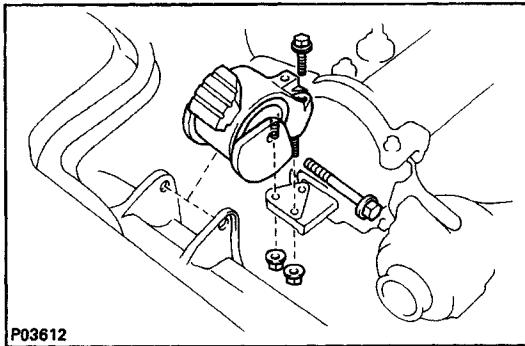
(a) Attach the engine chain hoist to the engine hangers.



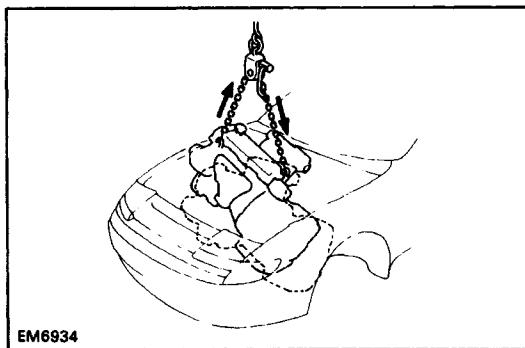
(b) Remove the through bolt, three bolts and LH mounting insulator.



(c) Remove the three bolts and LH mounting bracket.



(d) Remove the through bolt, two nuts and RH mounting insulator.



(e) Lift the engine out of the vehicle slowly and carefully.

NOTICE: Be careful not to hit the PS gear housing or neutral start switch (A/T).

(f) Make sure the engine is clear of all wiring, hoses and cables.

(g) Place the engine and transaxle assembly onto the stand.

39. REMOVE STARTER (See page ST-3)

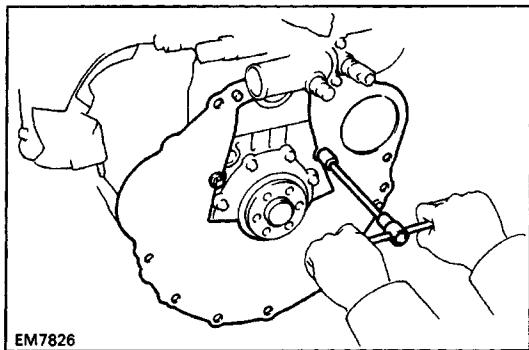
40. SEPARATE ENGINE AND TRANSAKLE

M/T (See MT section)

A/T (See AT section)

PREPARATION FOR DISASSEMBLY

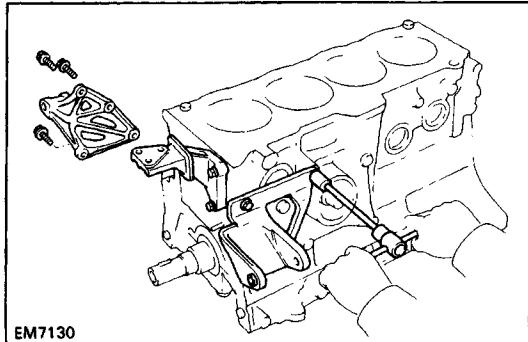
1. (M/T)
REMOVE CLUTCH COVER AND DISC
2. (M/T)
REMOVE FLYWHEEL
3. (A/T)
REMOVE DRIVE PLATE



4. REMOVE REAR END PLATE

Remove the two bolts and end plate.

5. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY
6. REMOVE ALTERNATOR (See page [CH-6](#))
7. REMOVE DISTRIBUTOR (See page [IG-20](#))
8. REMOVE TIMING BELT AND PULLEYS
(See pages [EM-35](#) to 38)
9. REMOVE CYLINDER HEAD (See pages [EM-82](#) to 90)
10. REMOVE WATER PUMP (See page [CO-8](#))
11. REMOVE OIL PAN AND OIL PUMP
(See pages [LU-10](#) and 11)
12. REMOVE OIL FILTER (See page [LU-7](#))



13. REMOVE ALTERNATOR BRACKET

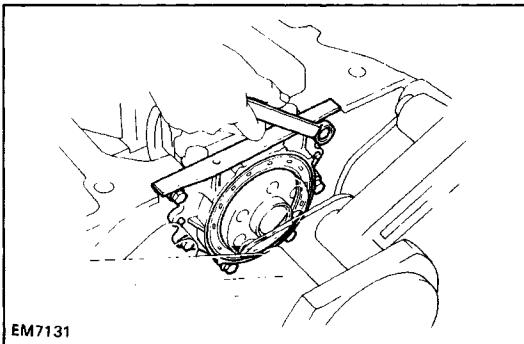
Remove the three bolts and alternator bracket.

14. REMOVE RH ENGINE MOUNTING BRACKET

Remove the three bolts and mounting bracket.

15. REMOVE PS PUMP BRACKET

Remove the three bolts and PS pump bracket.

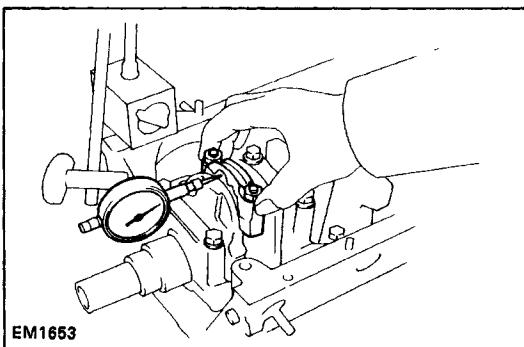


DISASSEMBLY OF CYLINDER BLOCK

(See page **EM-184**)

1. REMOVE REAR OIL SEAL RETAINER

Remove the six bolts, retainer and gasket.



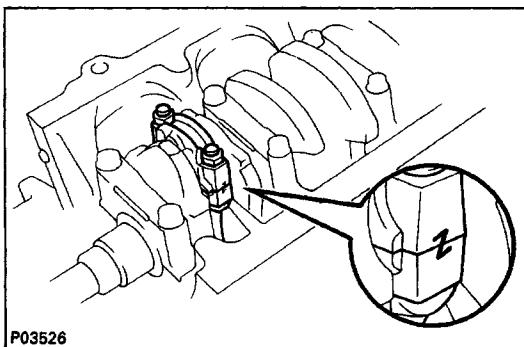
2. CHECK CONNECTING ROD THRUST CLEARANCE

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.)**

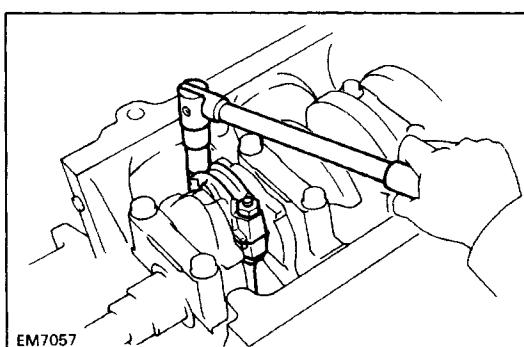
Maximum thrust clearance: 0.30 mm (0.0118 in.)

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

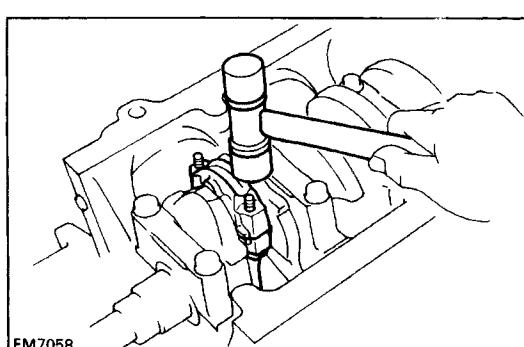


3. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

(a) Check the matchmarks on the connecting rod and cap to ensure correct reassembly.

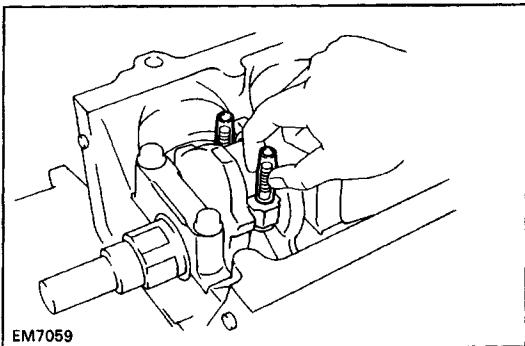


(b) Remove the connecting rod cap nuts.

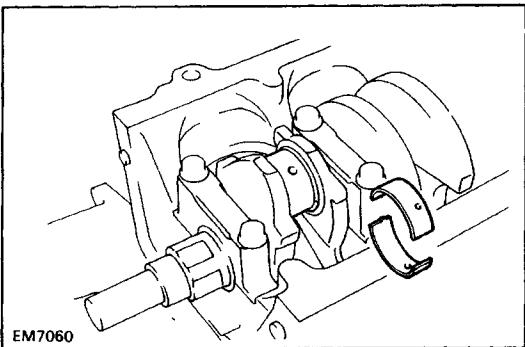


(c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

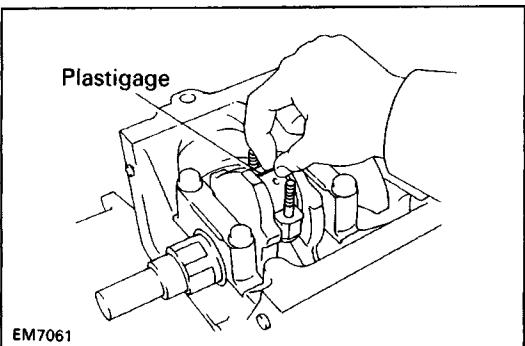
HINT: Keep the lower bearing inserted with the connecting cap.



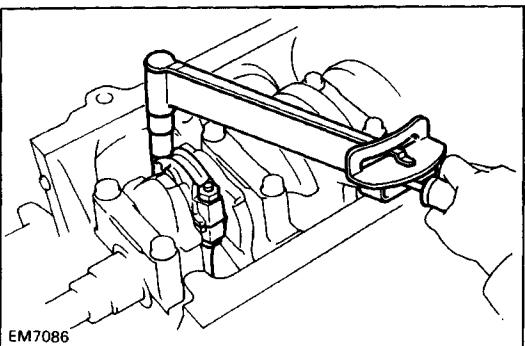
(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



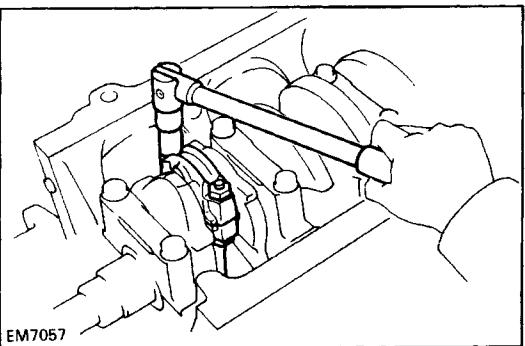
(e) Clean the crank pin and bearing.
(f) Check the crank pin and bearing for pitting and scratches.
If the crank pin or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



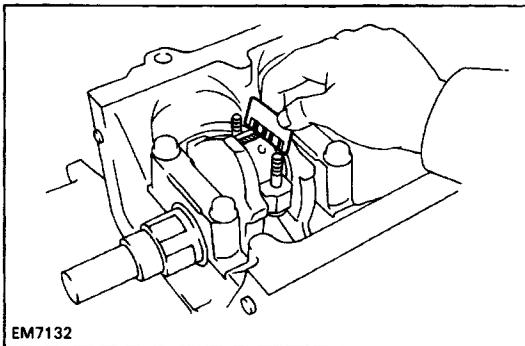
(g) Lay a strip of Plastigage across the crank pin.



(h) Install the connecting rod cap.
(See step 6 on page [EM-212](#))
Torque: 49 N·m (500 kgf·cm, 36 ft-lbf)
NOTICE: Do not turn the crankshaft.



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



(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.

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

(Reference)

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.

4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

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

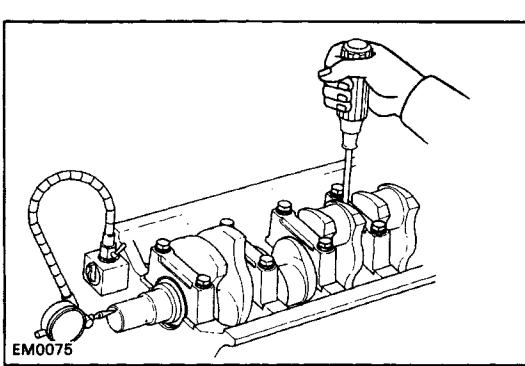
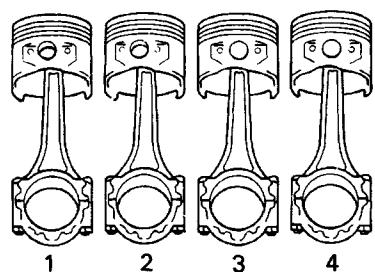
(b) Cover the connecting rod bolts.

(See page [EM-195](#))

(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.



5. CHECK CRANKSHAFT THRUST CLEARANCE

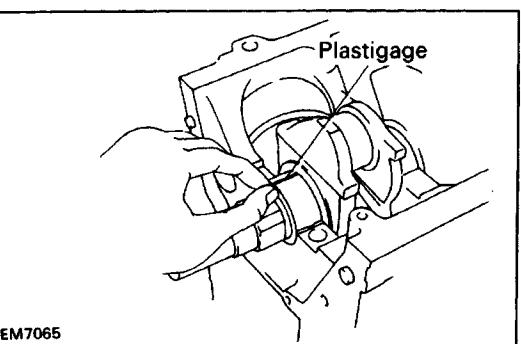
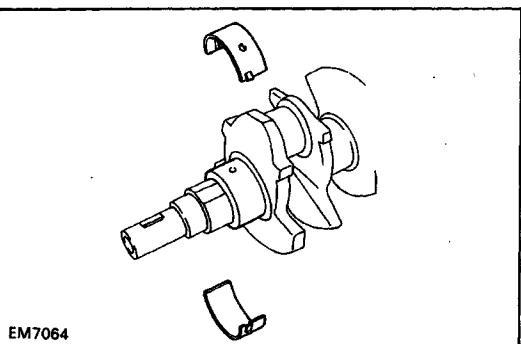
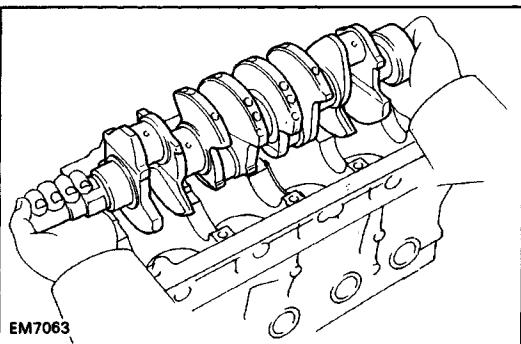
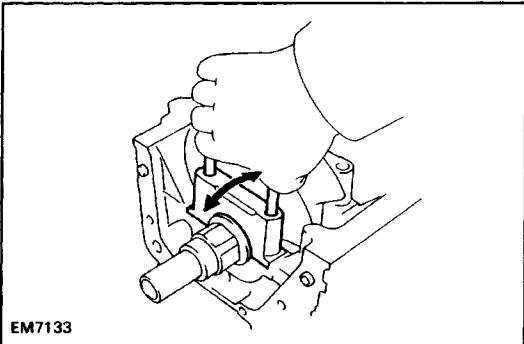
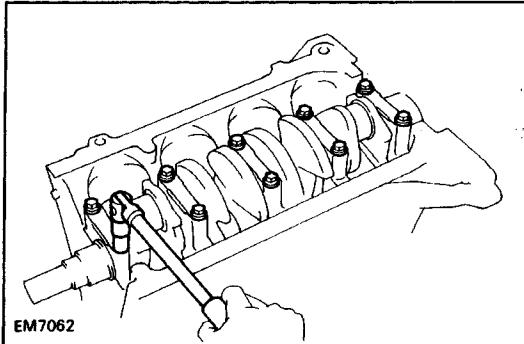
Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

**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)**



6. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

(a) Remove the main bearing cap bolts.

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

HINT:

- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in correct order.

(c) Lift out the crankshaft.

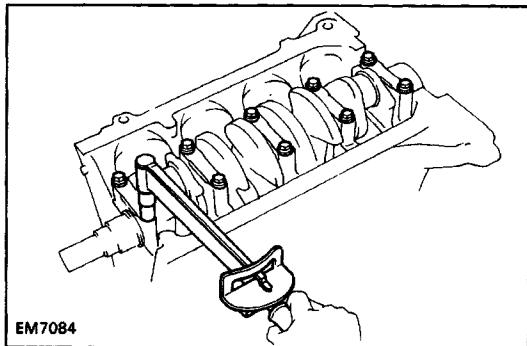
HINT: Keep the upper bearing and upper thrust washers together with the cylinder block.

(d) Clean each main journal and bearing.

(e) Check each main journal and bearing for pitting and scratches. If the journal or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.

(f) Place the crankshaft on the cylinder block.

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

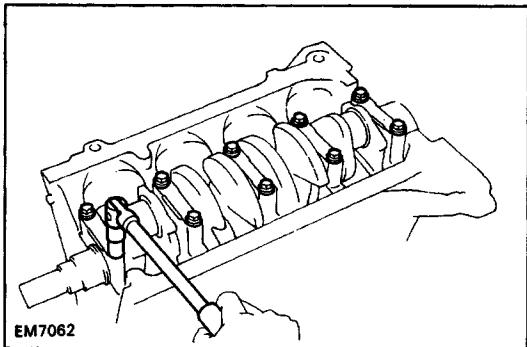


(h) Install the main bearing caps.

(See step 4 on page [EM-211](#))

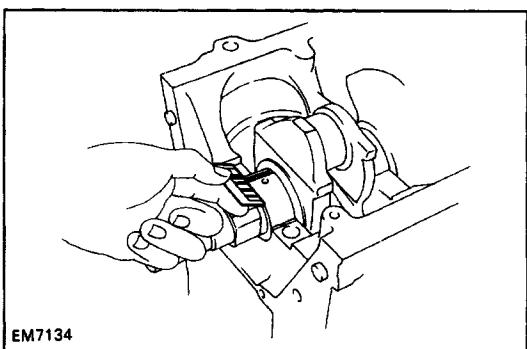
Torque: 60 N·m (610 kgf·cm, 44 ft-lbf)

NOTICE: Do not turn the crankshaft.



(i) Remove the main bearing caps.

(See procedure (a) and (b) above)



(j) Measure the Plastigage at its widest point.

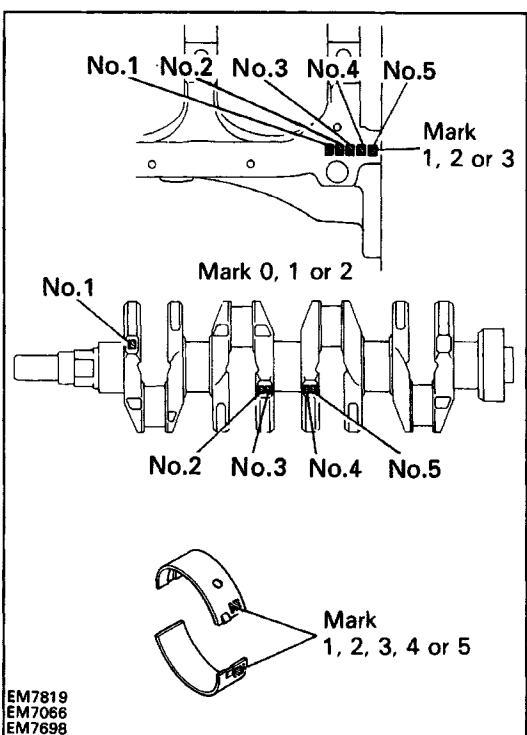
Standard clearance:

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 selecting the bearing with the same number as the total. There are five sizes of standard bearings, marked "1", "2", "3", "4" and "5" accordingly.

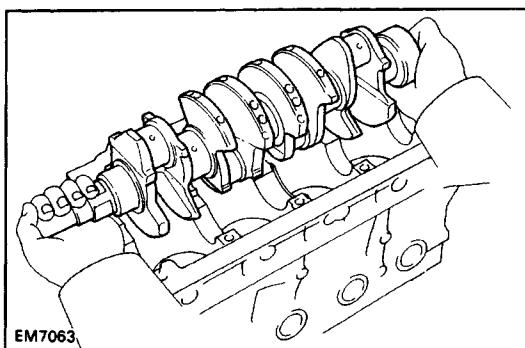


	Number marked								
	1		2		3				
Cylinder block	0	1	2	0	1	2	0	1	2
Crankshaft	1	2	3	2	3	4	3	4	5
Bearing	1	2	3	2	3	4	3	4	5

EXAMPLE: Cylinder block "2" + Crankshaft "1" = Bearing "3"

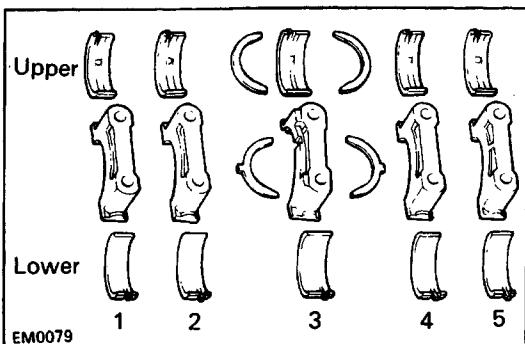
(Reference)**Cylinder block main journal bore diameter:****Mark "1" 52.025 – 52.031 mm****(2.0482 – 2.0485 in.)****Mark "2" 52.031 – 52.037 mm****(2.0485 – 2.0487 in.)****Mark "3" 52.037 – 52.043 mm****(2.0487 – 2.0489 in.)****Crankshaft journal diameter:****Mark "0" 47.994 – 48.000 mm****(1.8895 – 1.8898 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.

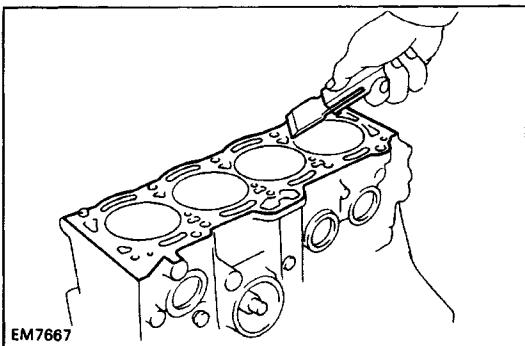
**7. REMOVE CRANKSHAFT**

(a) Lift out the crankshaft.

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



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



INSPECTION OF CYLINDER BLOCK

1. CLEAN CYLINDER BLOCK

A. Remove gasket material

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

B. Clean cylinder block

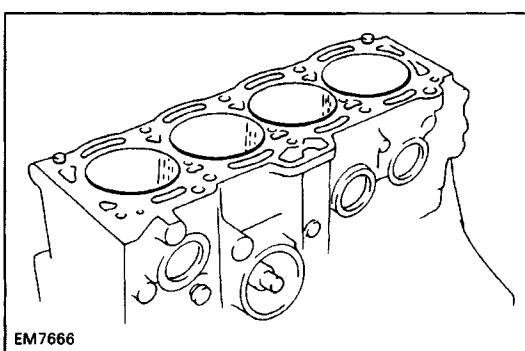
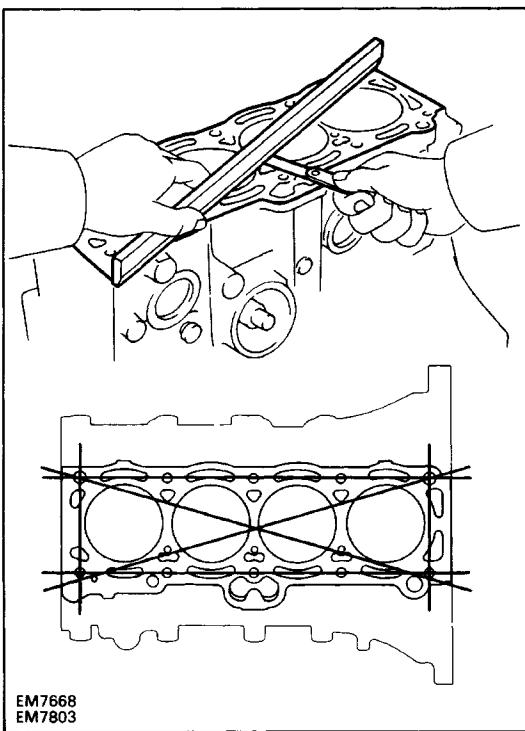
Using a soft brush and solvent, thoroughly clean the cylinder block.

2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage: 0.05 mm (0.0020 in.)

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

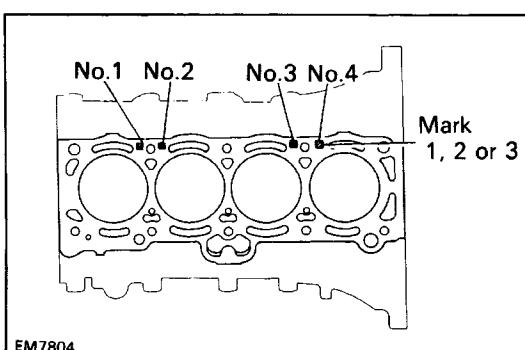


3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

Visually check the cylinder for vertical scratches.

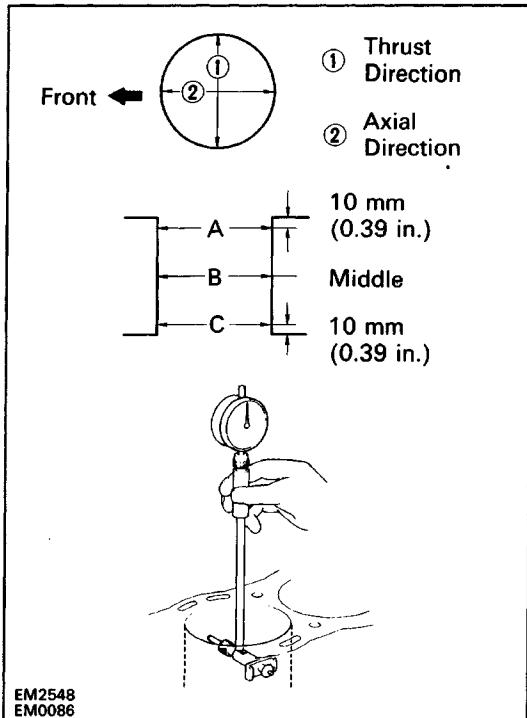
If deep scratches are present, re bore all the four cylinders.

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 the top of the cylinder block.



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

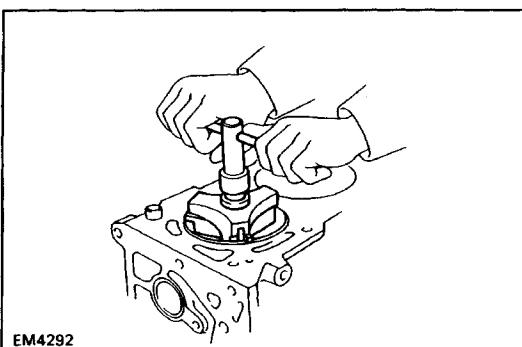
(3.1898 – 3.1902 in.)

Maximum diameter:

STD 81.23 mm (3.1980 in.)

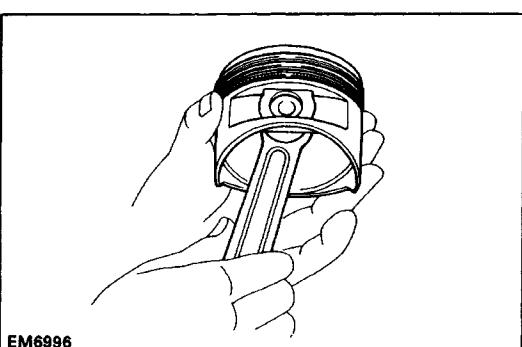
O/S 0.50 81.73 mm (3.2177 in.)

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



5. REMOVE CYLINDER RIDGE

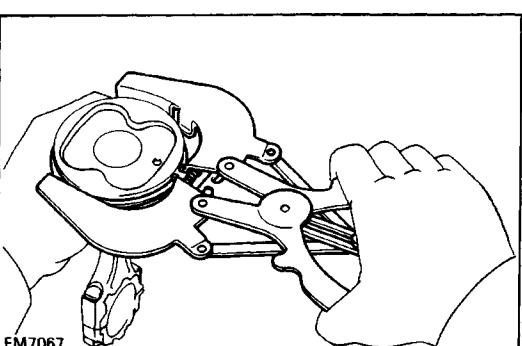
If the wear is less than 0.2 mm (0.008 in.), using a ridge reamer, grind the top of the cylinder.



DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

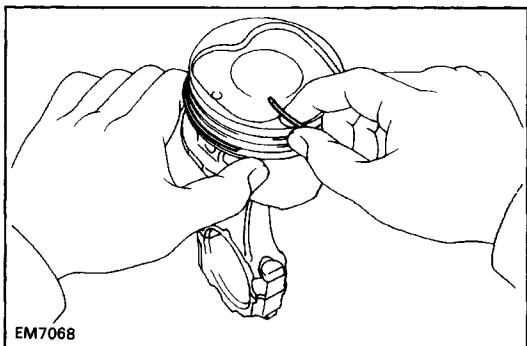
1. CHECK FIT BETWEEN PISTON AND PISTON PIN

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



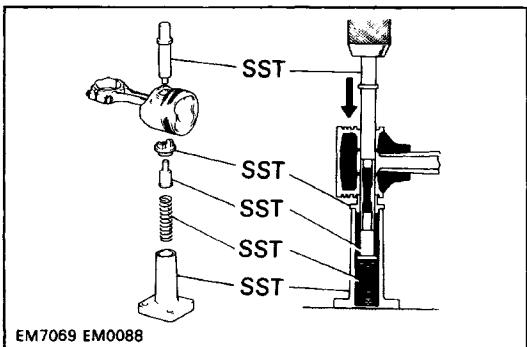
2. REMOVE PISTON RINGS

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



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

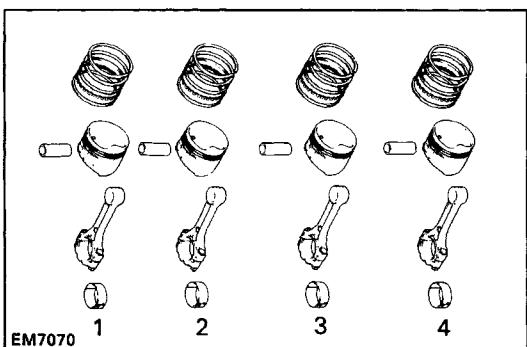
HINT: Arrange the rings in correct order only.



3. DISCONNECT CONNECTING ROD FROM PISTON

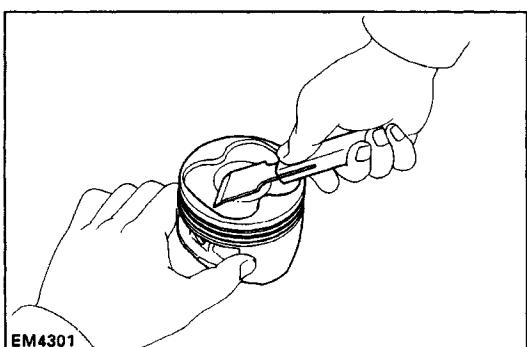
Using SST, press out the piston pin from the piston. Remove the connecting rod.

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



HINT:

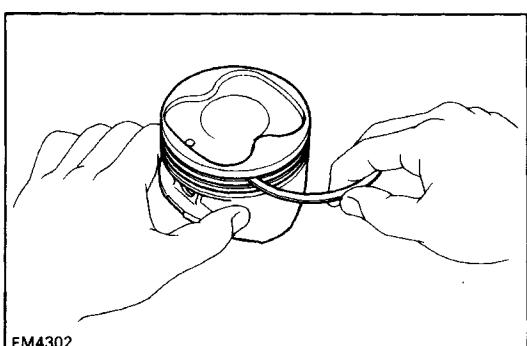
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in correct order.



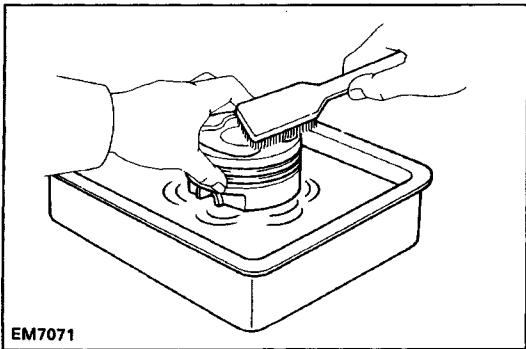
INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLIES

1. CLEAN PISTON

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

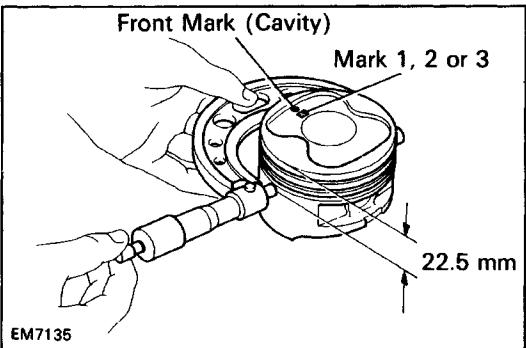


(b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.



(c) Using solvent and a brush, thoroughly clean the 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, measure the piston diameter at right angles to the piston pin center line, 22.5 mm (0.886 in.) from the piston head.

Piston diameter:

STD Mark "1" 80–930 – 80. 940 mm
(3.1862 – 3.1866 in.)

Mark "2" 80.940 – 80. 950 mm
(3.1866 – 3.1870 in.)

Mark "3" 80.950 – 80.960 mm
(3.1870 – 3.1874 in.)

O/S 0.50 81.430 – 81.460 mm
(3.2059 – 3.2071 in.)

(b) Measure the cylinder bore diameter in the thrust directions. (See step 4 on page [EM-201](#))

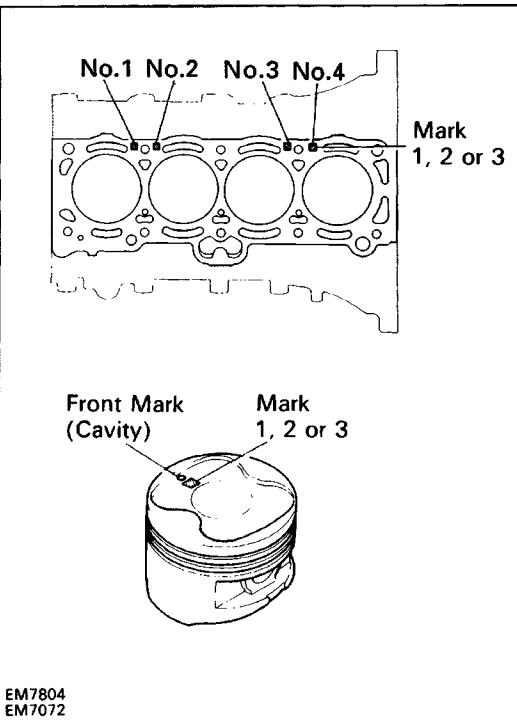
(c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

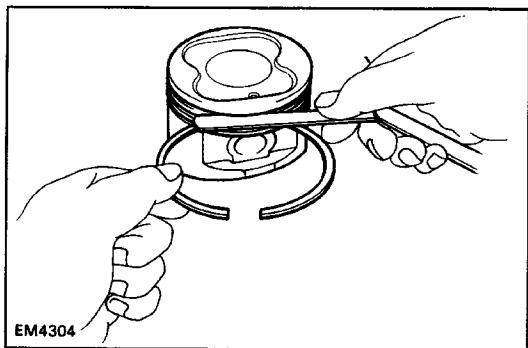
Standard oil clearance: 0.060 – 0.080 mm
(0.0024 – 0.0031 in.)

Maximum oil clearance: 0.10 mm (0.0039 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.





B. Inspect piston ring groove clearance

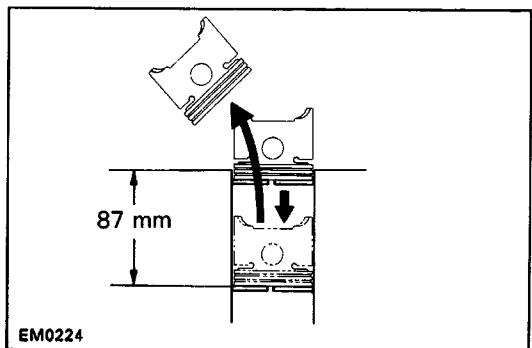
Using a feeler gauge, measure the clearance between new piston ring and the wall of the piston ring groove.

Ring groove clearance:

No .10.040 – 0.081 mm (0.0016 – 0.0032 in.)

No .20.030 – 0.070 mm (0.0012 – 0.0028 in.)

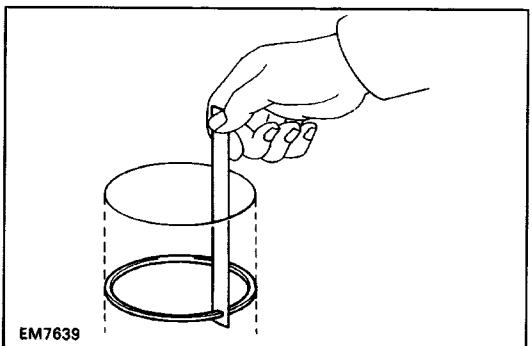
If the clearance is greater than maximum, replace the piston.



C. Inspect piston ring end gap

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

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



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

Standard end gap:

No.1	0.250 – 0.450 mm (0.0098 – 0.0177 in.)
No.2	0.150 – 0.400 mm (0.0059 – 0.0157 in.)
Oil (Side rail)	0.100 – 0.700 mm (0.0039 – 0.0276 in.)

Maximum end gap:

No.1	1.05 mm (0.0413 in.)
No.2	1.00 mm (0.0394 in.)
Oil (Side rail)	1.30 mm (0.0512 in.)

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

3. INSPECT CONNECTING ROD

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

- Check for bending.

Maximum bending:

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

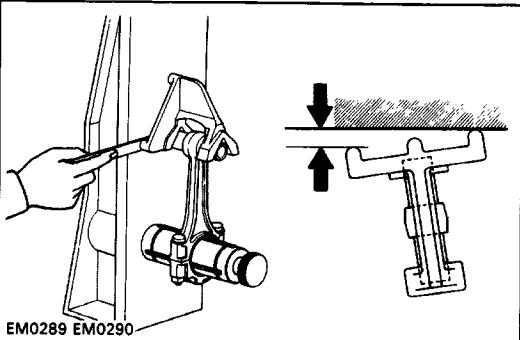
If bend is greater than maximum, replace the connecting rod and connecting rod cap as a set.

- 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.



BORING OF CYLINDERS

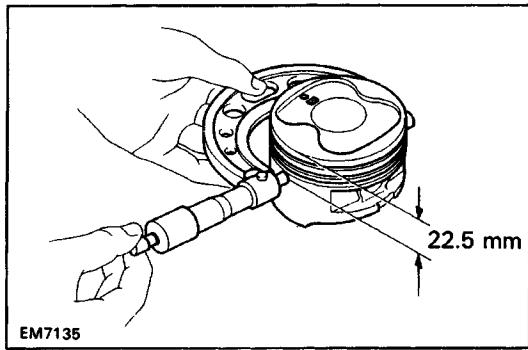
HINT:

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

1. KEEP OVERSIZED PISTONS

Oversized piston diameter:

O/S 0.50 81.430 – 81.460 mm
(3.2059 – 3.2071 in.)



2. CALCULATE AMOUNT TO BORE CYLINDERS

- Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 22.5 mm (0.886 in.) from the piston head.
- Calculate the amount each cylinder is to be rebored as follows:

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

P = Piston diameter

C = Piston clearance

0.060 – 0.080 mm (0.0024 – 0.0031 in.)

H = Allowance for honing

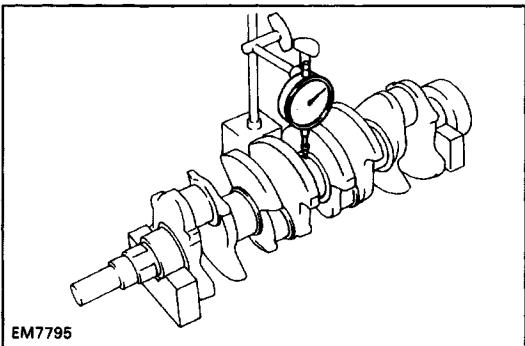
0.02 mm (0.0008 in.) or less

3. BORE AND HONE CYLINDERS TO CALCULATED

DIMENSIONS

Maximum honing: 0.02 mm (0.0008 in.)

NOTICE: Excess honing will destroy the finished roundness.



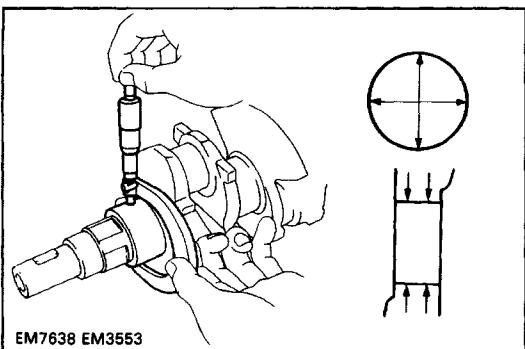
INSPECTION AND REPAIR OF CRANKSHAFT

1. INSPECT CRANKSHAFT FOR RUNOUT

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

Maximum circle runout: 0.06 mm (0.0024 in.)

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



2. INSPECT MAIN JOURNALS AND CRANK PINS

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

Main journal diameter:

STD	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:

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.)

If the diameter is not as specified, check the oil clearance (See pages EM-194 to 198). If necessary, grind or replace the crankshaft.

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

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

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

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

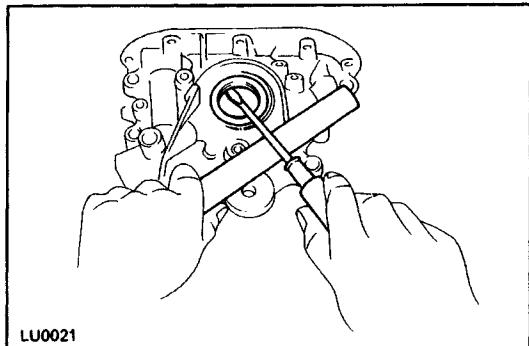
Grind and hone the main journals and/or crank pins to the finished undersized diameter.

(See procedure step 2 above).

Install new main journal and/or crank pin undersized bearings.

REPLACEMENT OF CRANKSHAFT OIL SEALS

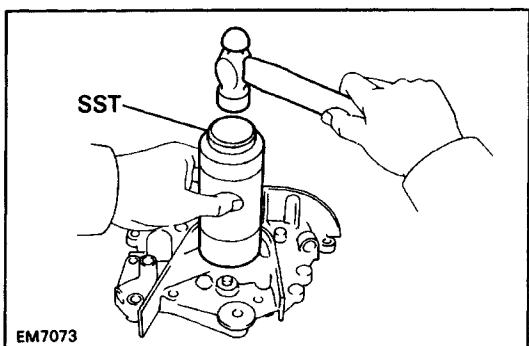
HINT: There are two methods (A and B) to replace the oil seal which are as follows:



1. REPLACE CRANKSHAFT FRONT OIL SEAL

A. If oil pump is removed from cylinder block:

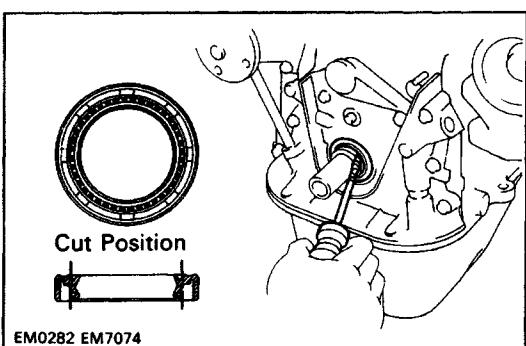
(a) Using a screwdriver, pry out the oil seal.



(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.



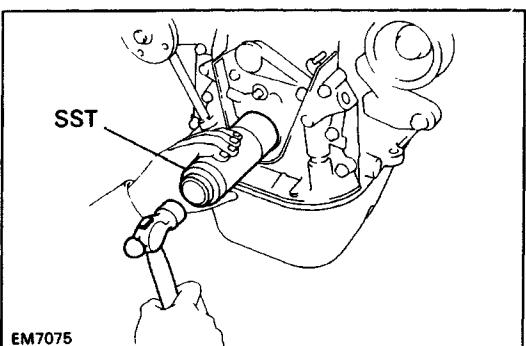
B. If oil pump is installed to the cylinder block:

(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.

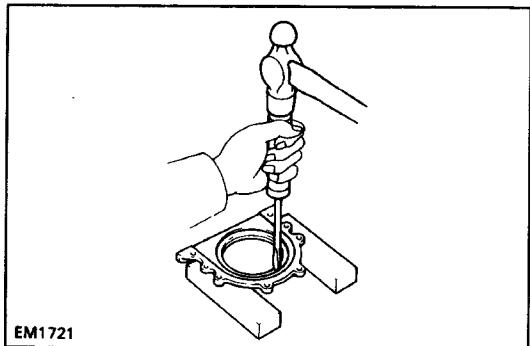
Tape the screwdriver tip.



(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.

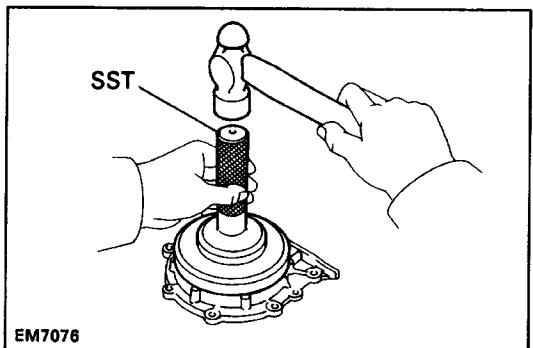
SST 09309-37010



2. REPLACE CRANKSHAFT REAR OIL SEAL

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

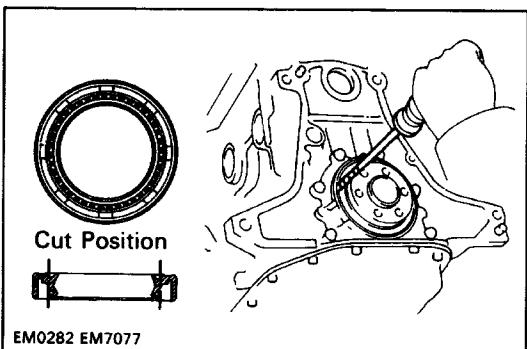
- Using screwdriver and hammer, tap out the oil seal.



- Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal edge.

SST 09223-41020

- Apply MP grease to the oil seal lip.

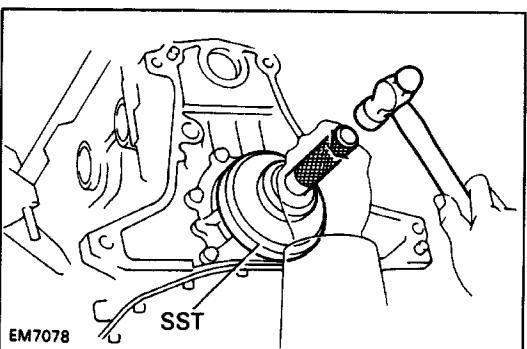


B. If rear oil seal retainer is installed to cylinder block:

- Using a knife, cut off the oil seal lip.

- Using a screwdriver, pry out the oil seal.

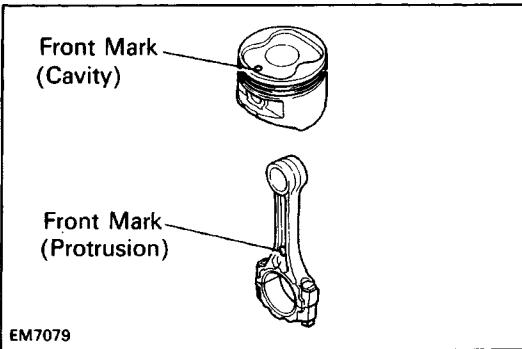
NOTICE: Be careful not to damage the crankshaft. Tape the screwdriver tip.



- Apply MP grease to a new oil seal lip.

- Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

SST 09223-41020



ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

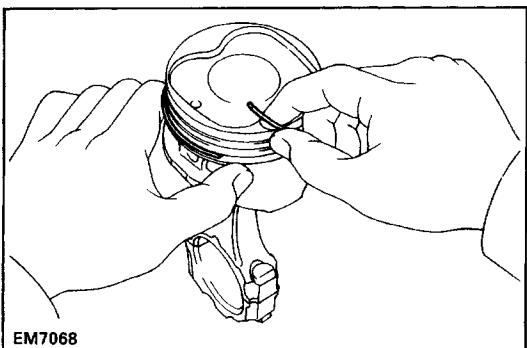
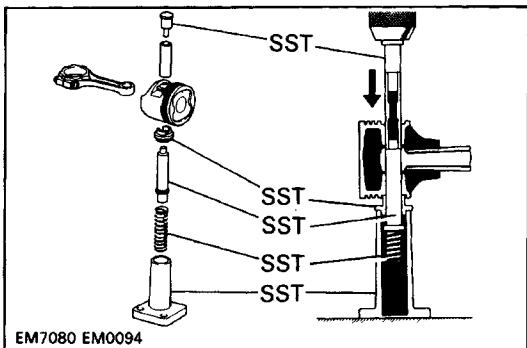
1. ASSEMBLE PISTON AND CONNECTING ROD

(a) Coat the piston pin and pin holes of the piston with engine oil.

(b) Align the front marks of the piston and connecting rod.

(c) Using SST, press in the piston pin.

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

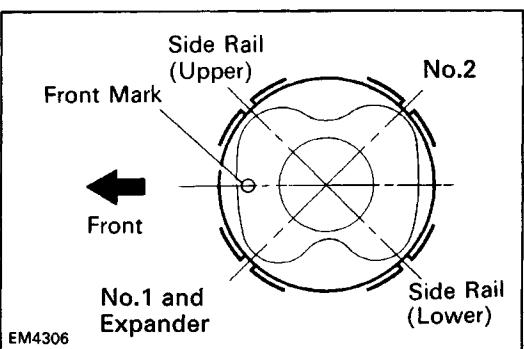
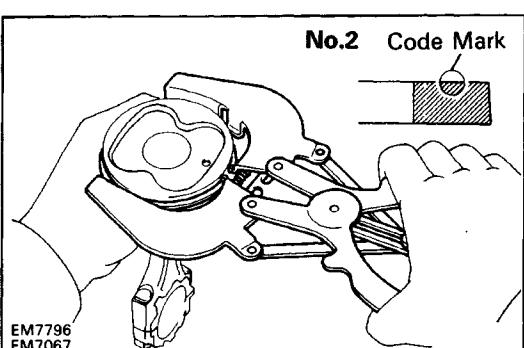


2. INSTALL PISTON RINGS

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

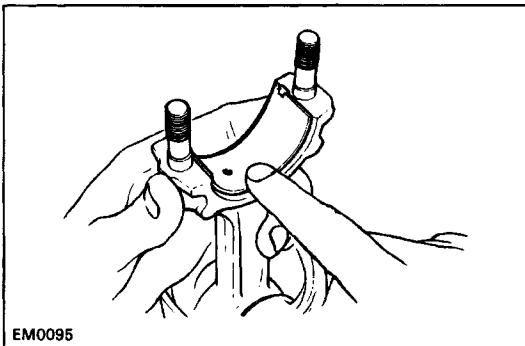
(b) Using a piston ring expander, install the two compression rings with the code mark facing upward (No.2 compression ring only).

Code mark (No.2 compression ring only): R or T



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

NOTICE: Do not align the ring ends.



3. INSTALL BEARINGS

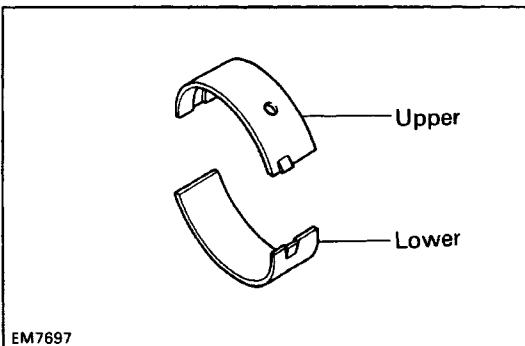
- Align the bearing claw with the groove of the connecting rod or connecting cap.
- Install the bearings in the connecting rod and connecting rod cap.

ASSEMBLY OF CYLINDER BLOCK

(See page [EM-184](#))

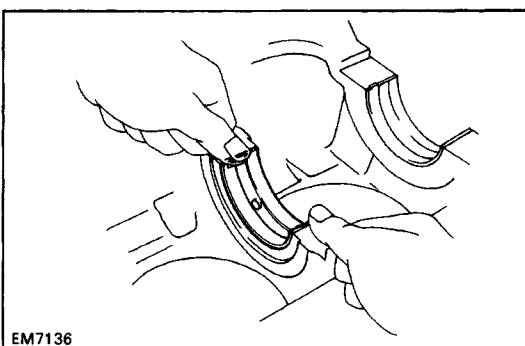
HINT:

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

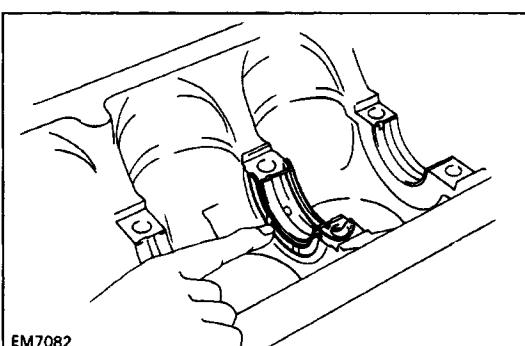


1. INSTALL MAIN BEARINGS

HINT: Upper bearings have an oil groove and oil holes; lower bearings do not.

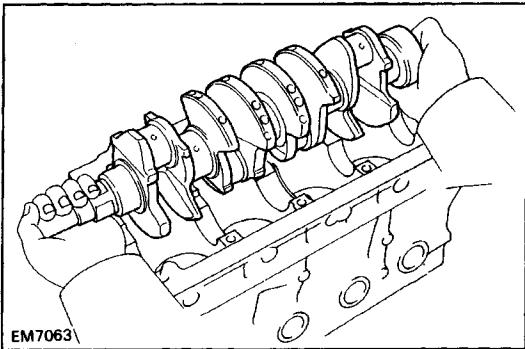


- Align the bearing claw with the claw groove of the main bearing cap or cylinder block.
- Install the bearings in the cylinder block and main bearing caps.

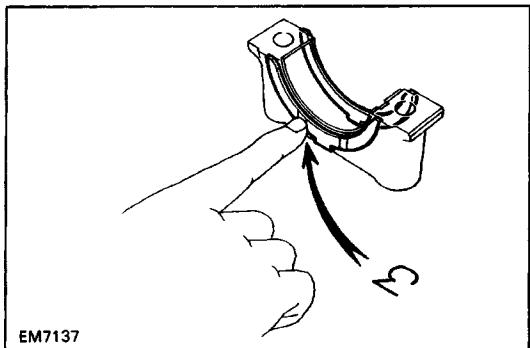


2. INSTALL UPPER THRUST WASHERS

Install the thrust washers under the No.3 main bearing cap position of the block with the oil grooves facing outward.

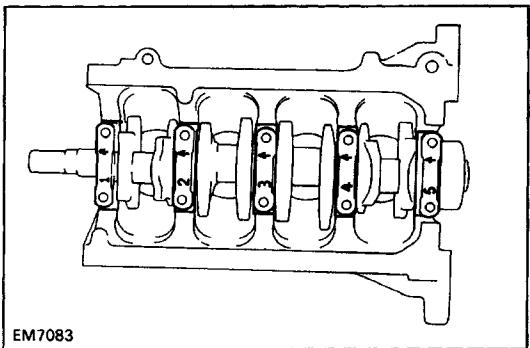


3. PLACE CRANKSHAFT ON CYLINDER BLOCK



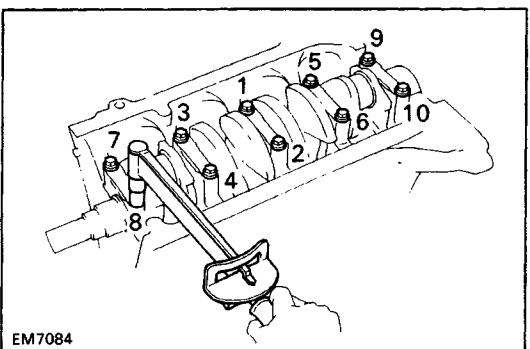
4. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

- (a) Install the thrust washers on the No.3 bearing cap with the grooves facing outward.



- (b) Install the five main bearing caps in their proper locations.

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



- (c) Apply a light coat of engine oil on the threads and under the heads of the main bearing caps.

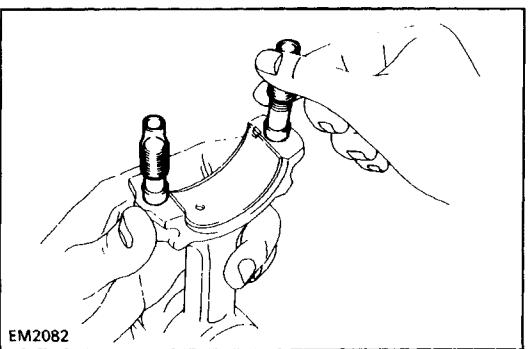
- (d) Install and uniformly tighten the ten bolts of the main bearing caps in several passes in the sequence shown.

Torque: 60 N·m (610 kgf·cm, 44 ft-lbf)

- (e) Check that the crankshaft turns smoothly.

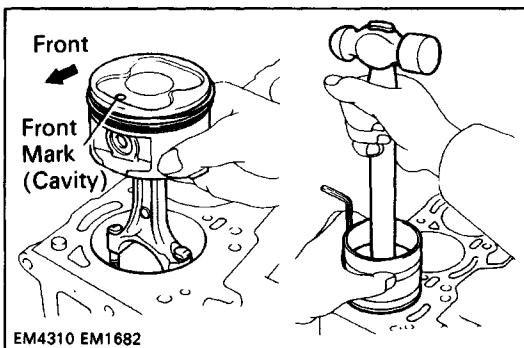
- (f) Check the crankshaft thrust clearance.

(See step 5 on page [EM-196](#))

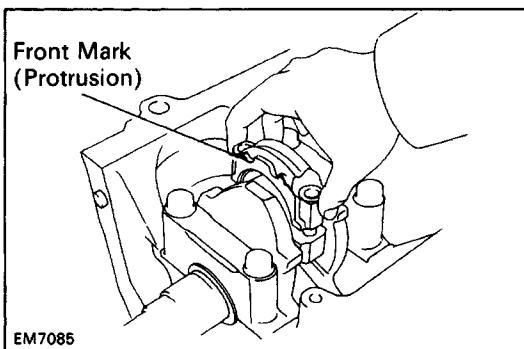


5. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

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

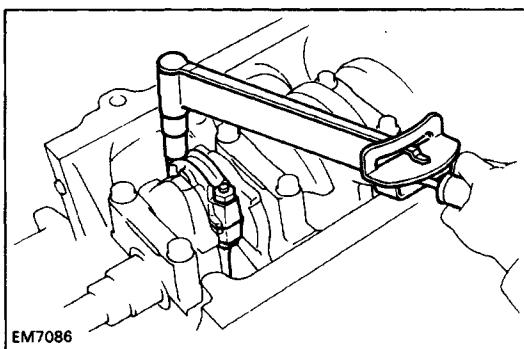


(b) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.



6. INSTALL CONNECTING ROD CAPS

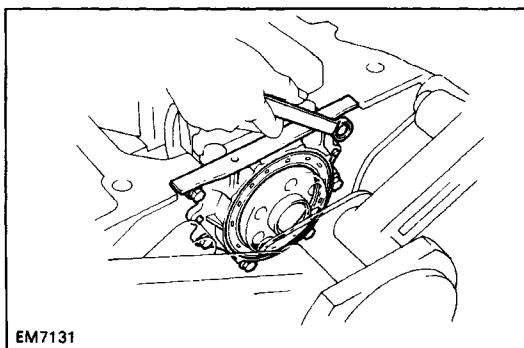
(a) Match the numbered connecting rod cap with the connecting rod.
 (b) Install the connecting rod cap with the front mark facing forward.



(c) Apply a light 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: 49 N·m (500 kgf·cm, 36 ft-lbf)

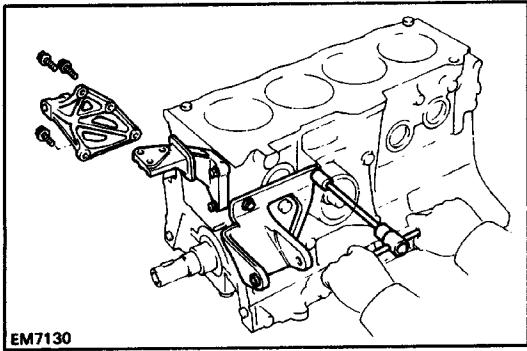
(e) Check that the crankshaft turns smoothly.
 (f) Check the connecting rod thrust clearance.
 (See step 2 on page [EM-194](#))



7. INSTALL REAR OIL SEAL RETAINER

Install a new gasket and the retainer with the six bolts.

Torque: 9.3 N·m (95 kgf·cm, 82 in.-lbf)



POST ASSEMBLY

1. INSTALL PS PUMP BRACKET

Install the PS pump bracket with the three bolts.

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

2. INSTALL RH ENGINE MOUNTING BRACKET

Install the mounting bracket with the three bolts.

Torque: 51 N·m (525 kgf·cm, 38 ft-lbf)

3. INSTALL ALTERNATOR BRACKET

Install the alternator bracket with the three bolts.

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

4. INSTALL OIL FILTER (See page [LU-7](#))

5. INSTALL OIL PUMP AND OIL PAN

(See pages [LU-14](#) and [15](#))

6. INSTALL WATER PUMP (See pages [CO-9](#) and [10](#))

7. INSTALL CYLINDER HEAD (See pages [EM-104](#) to [114](#))

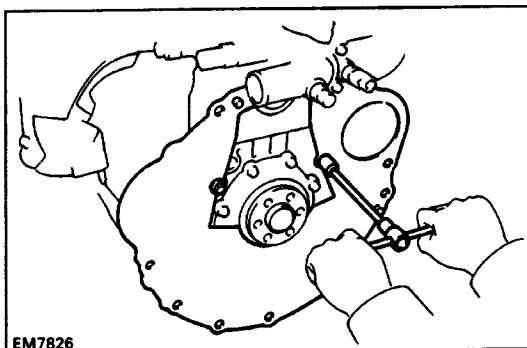
8. INSTALL PULLEYS AND TIMING BELT

(See pages [EM-40](#) to [43](#))

9. INSTALL ALTERNATOR (See page [CH-23](#))

10. INSTALL DISTRIBUTOR (See page [IG-24](#))

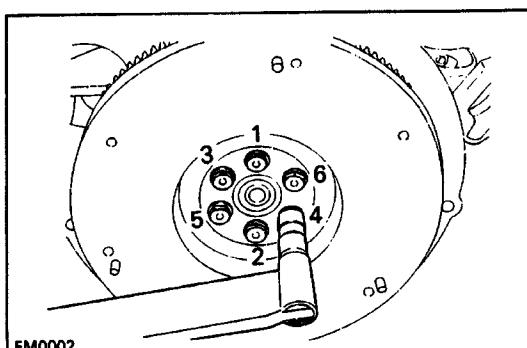
11. REMOVE ENGINE STAND



12. INSTALL REAR END PLATE

Install the end plate with the two bolts.

Torque: 9.3 N·m (95 kgf·cm, 82 in-lbf)



13. (M/T)

INSTALL FLYWHEEL

(a) Install the flywheel on the crankshaft.

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

Torque: 78 N·m (800 kgf·cm, 58 ft-lbf)

14. (A/T)

INSTALL DRIVE PLATE (See procedure in step 13)

Torque: 64 N·m (650 kgf·cm, 47 ft-lbf)

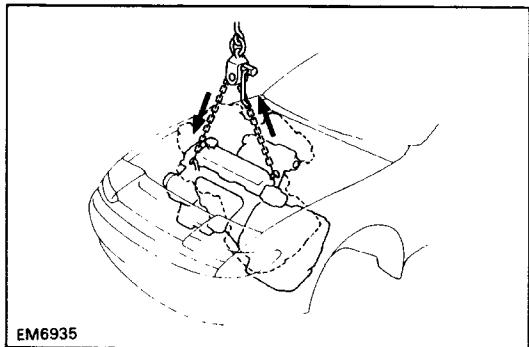
15. (M/T)

INSTALL CLUTCH DISC AND COVER

(See CL section)

INSTALLATION OF ENGINE

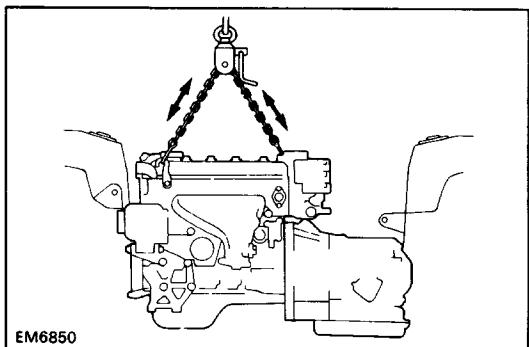
1. ASSEMBLE ENGINE AND TRANSAXLE
 - M/T (See MT section)
 - A/T (See AT section)
2. INSTALL STARTER (See page [ST-22](#))



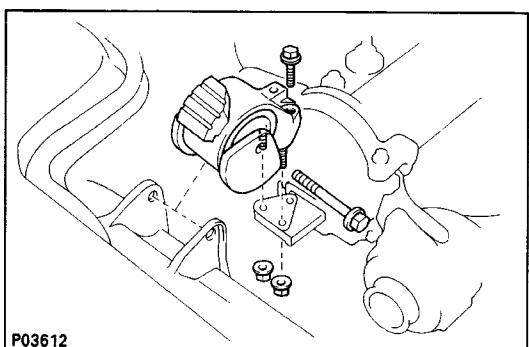
3. INSTALL ENGINE AND TRANSAXLE ASSEMBLY IN VEHICLE

- (a) Attach the engine chain hoist to the engine hangers.
- (b) Lower the engine into the engine compartment.
Tilt the transaxle downward, lower the engine and clear the LH mounting.

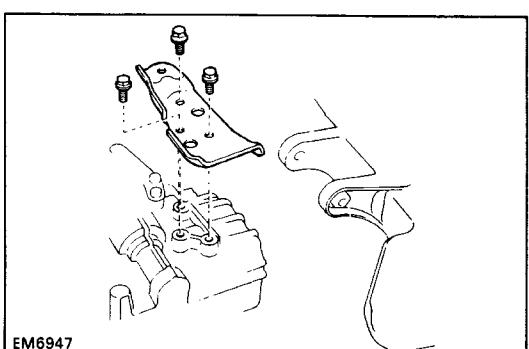
NOTICE: Be careful not to hit the PS gear housing or neutral start switch (A/T).



- (c) Keep the engine level, and align RH and LH mountings with the body bracket.

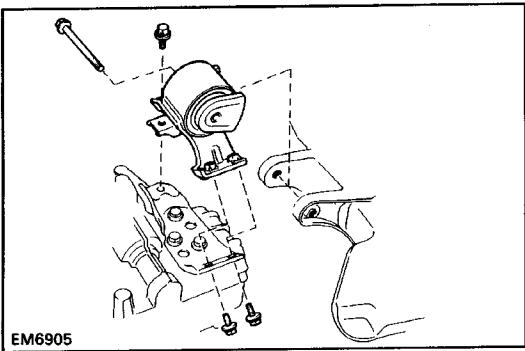


- (d) Attach the RH mounting insulator to the mounting bracket and body, and temporarily install the through bolt and two nuts.



- (e) Install the LH mounting bracket to the transaxle case with the three bolts.

Torque: 52 N·m (530 kgf·cm, 38 ft-lbf)



(f) Attach the LH mounting insulator to the mounting bracket and body with the through bolt and three bolts. Torque the bolts.

Torque:

Bolt 48 N·m (490 kgf·cm, 35 ft-lbf)

Through bolt 87 N·m (890 kgf·cm, 64 ft-lbf)

(g) Torque the two nuts, bolt and through bolt of the RH mounting insulator.

Torque:

Nut 52 N·m (530 kgf·cm, 38 ft-lbf)

Bolt 64 N·m (650 kgf·cm, 47 ft-lbf)

Through bolt 87 N·m (890 kgf·cm, 64 ft-lbf)

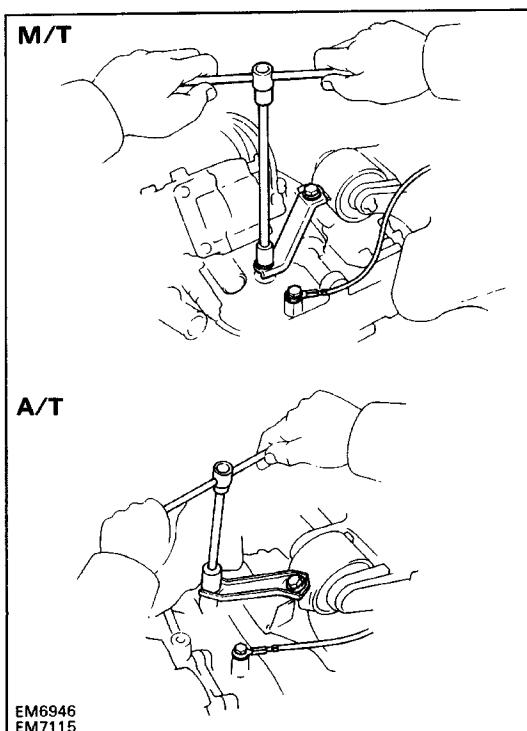
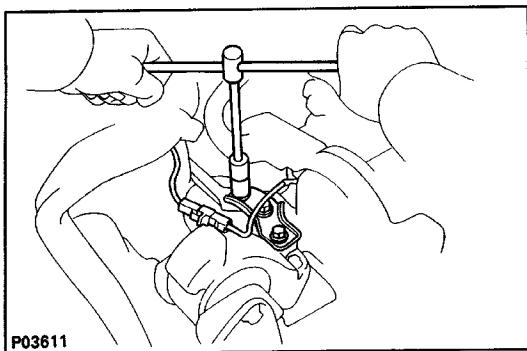
(h) Remove the engine chain hoist from the engine.

4. INSTALL RH ENGINE MOUNTING STAY

Install the mounting stay with the three bolts.

Torque: 42 N·m (430 kgf·cm, 31 ft-lbf)

5. INSTALL CONNECTOR TO GROUND WIRE ON RH FENDER APRON



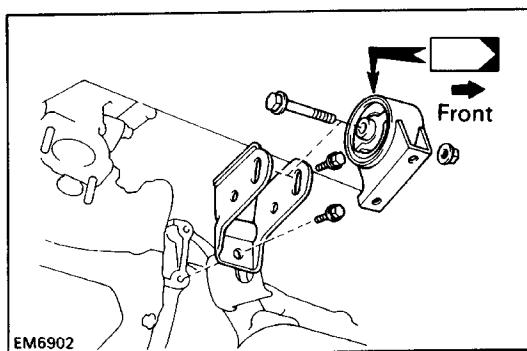
EM6946
EM7115

6. INSTALL LH ENGINE MOUNTING STAY

Install the mounting stay with the bolt and nut. Connect the ground strap.

Torque: 21 N·m (210 kgf·cm, 15 ft-lbf)

7. CONNECT GROUND WIRE TO TRANSAXLE

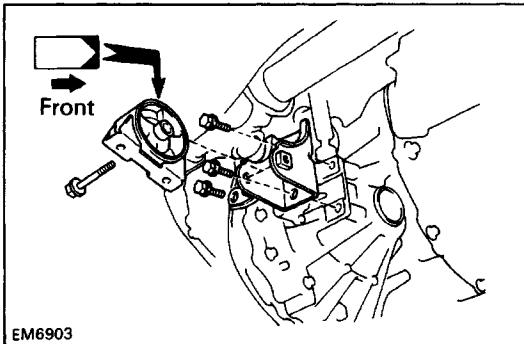


8. INSTALL FRONT ENGINE MOUNTING BRACKET AND INSULATOR

(a) Install the mounting bracket with the two bolts.

Torque: 77 N·m (790 kgf·cm, 57 ft-lbf)

(b) Temporarily install the mounting insulator with the through bolt.

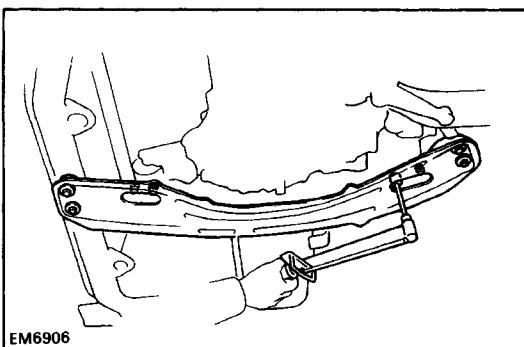


9. INSTALL REAR ENGINE MOUNTING BRACKET AND INSULATOR

(a) install the mounting bracket with the three bolts.

Torque: 77 N·m (790 kgf·cm, 57 ft-lbf)

(b) Temporarily install the mounting insulator with the through bolt.



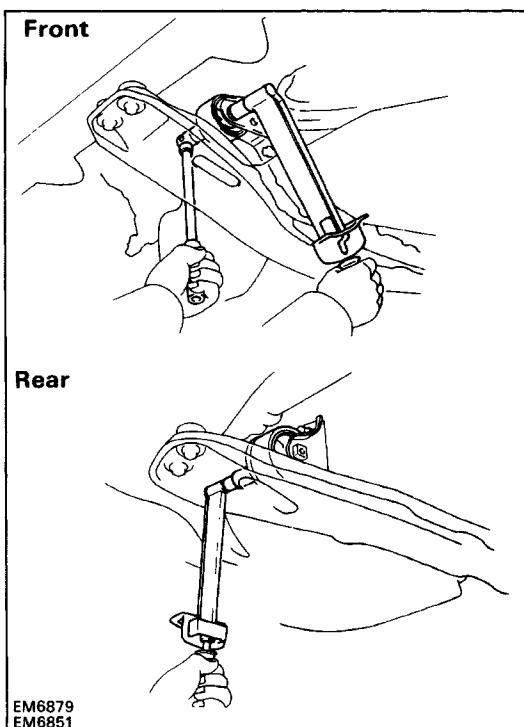
10. INSTALL ENGINE MOUNTING CENTER MEMBER

(a) Install the engine mounting center member with the four bolts.

Torque: 52 N·m (530 kgf·cm, 38 ft-lbf)

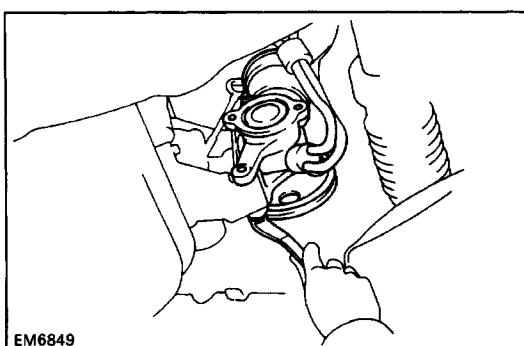
(b) Install and torque the four bolts holding the insulators to the center member.

Torque: 64 N·m (650 kgf·cm, 47 ft-lbf)



11. TIGHTEN FRONT AND REAR ENGINE MOUNTING THROUGH BOLTS

Torque: 87 N·m (890 kgf·cm, 64 ft-lbf)



12. INSTALL PS PUMP

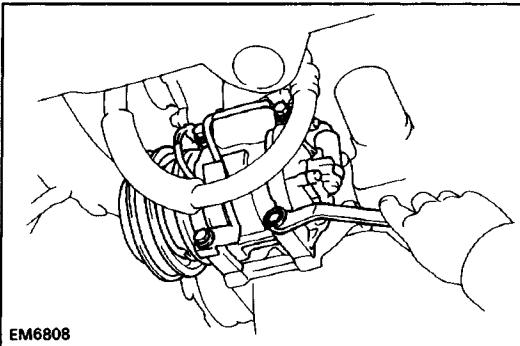
(a) Install the PS pump with the two bolts.

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

(b) Install the drive belt.

(c) Connect the air hose to the air pipe.

(d) Connect the air hose to the air intake chamber.



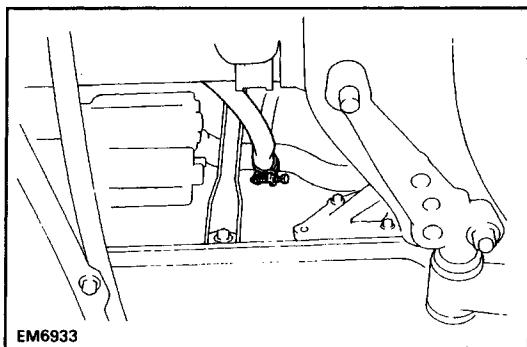
13. (w/ A/C)

INSTALL A/C COMPRESSOR

- Install the compressor with the four bolts.

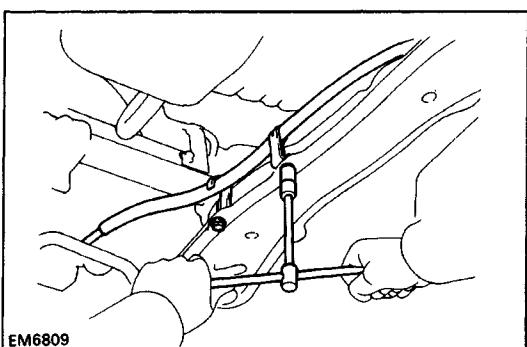
Torque: 25 N·m (250 kgf·cm, 18 ft-lbf)

- Connect the two connectors.
- Connect the A/C compressor connector.



14. CONNECT HEATER HOSE TO WATER INLET PIPE

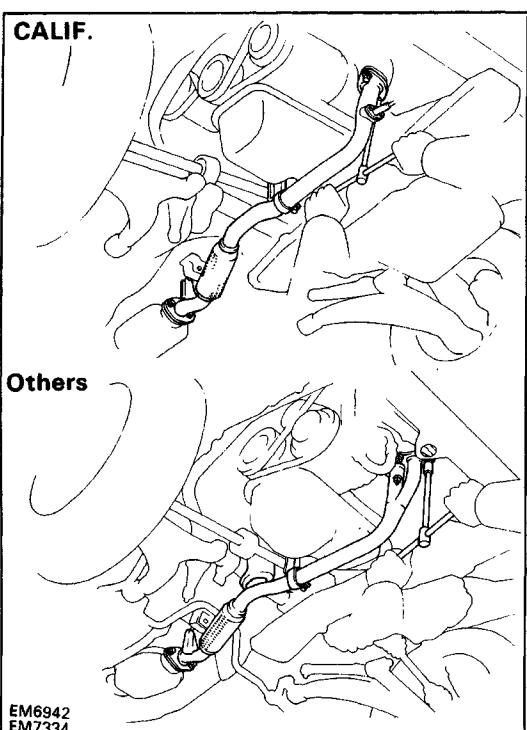
15. INSTALL DRIVE SHAFTS (See SA section)



16. (A/T)

INSTALL TRANSAXLE CONTROL CABLE TO ENGINE MOUNTING CENTER MEMBER

Install the control cable with the two clamps and bolts.



17. INSTALL FRONT EXHAUST PIPE

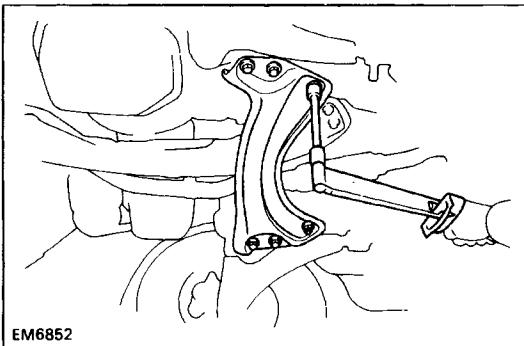
- Install the support hook on the front exhaust pipe to the support bracket.
- Place two (CALIF.) or three (others) new gaskets on the front and rear of the front exhaust pipe.
- Temporarily install the two bolts and new nuts holding the front exhaust pipe to the catalytic converter.
- Using a 14 mm deep socket wrench, install the two (CALIF.) or three (others) new nuts holding the front exhaust pipe to the exhaust manifold.

Torque: 62 N·m (630 kgf·cm, 46 ft-lbf)

- Tighten the two bolts and nuts holding the front exhaust pipe to the catalytic converter.

Torque: 43 N·m (440 kgf·cm, 32 ft-lbf)

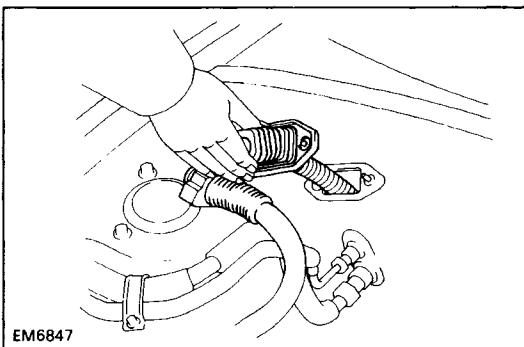
- Install the clamp with the bolt.
- Connect the oxygen sensor connector.



18. INSTALL SUSPENSION LOWER CROSSMEMBER

Install the lower crossmember with the four bolts and two nuts.

Torque: 152 N·m (1,550 kgf·cm, 112 ft-lbf)

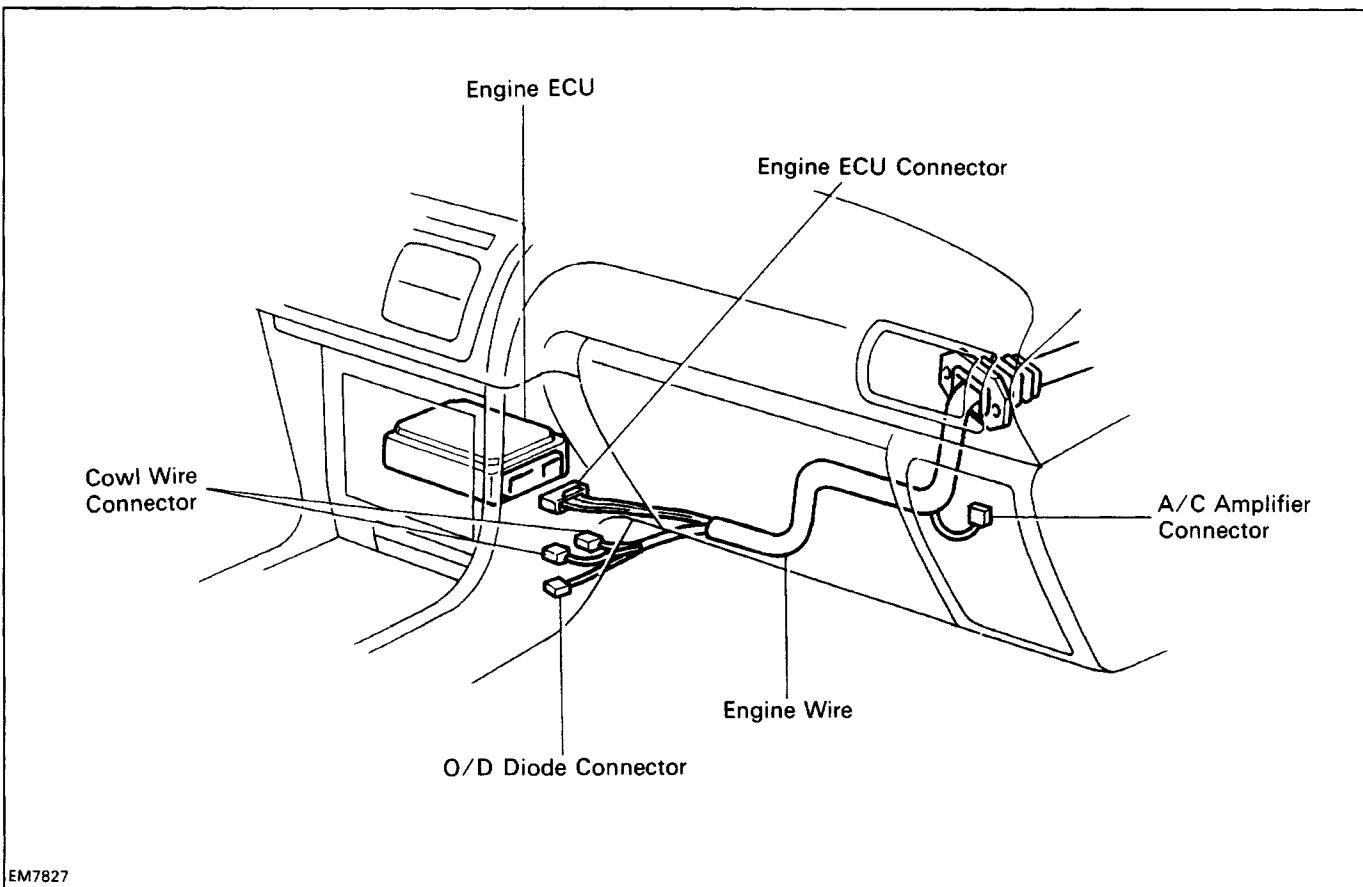


19. CONNECT ENGINE WIRE TO CABIN

- Push in the engine wire through the cowl panel.
Install the two nuts.

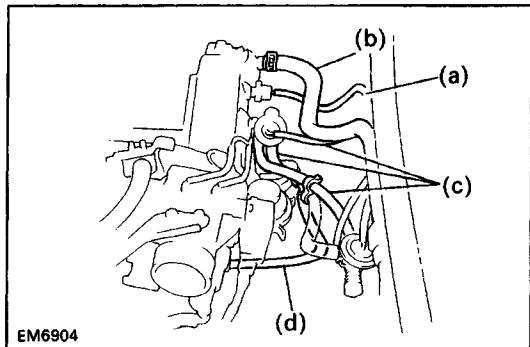
- Connect the following connectors:

- Engine ECU connector
- Two cowl wire connectors
- A/C amplifier connector
- O/D diode connector

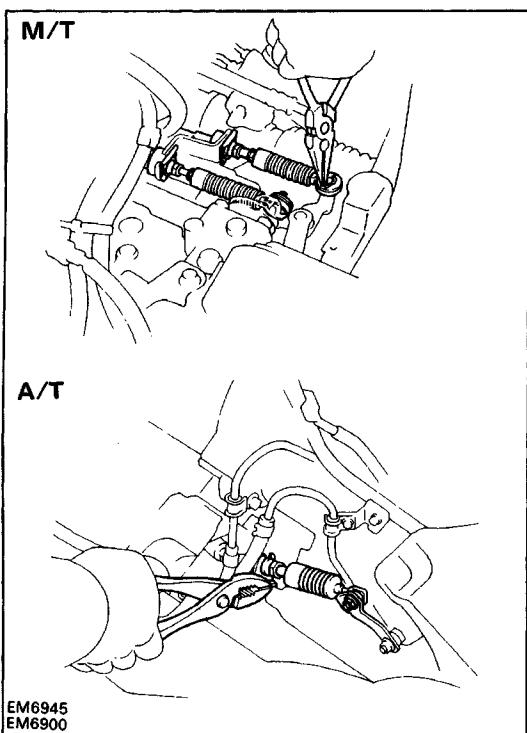
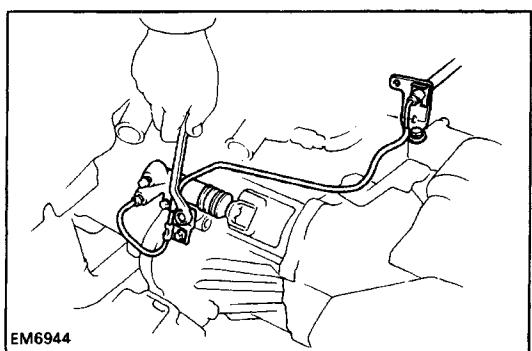


20. CONNECT ENGINE WIRE

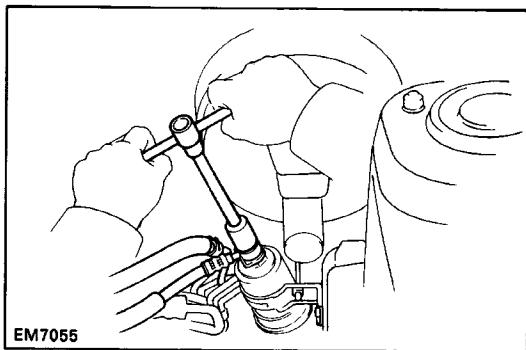
- (a) Engine wire clamp to wire bracket on RH fender apron
- (b) Two cowl wire connectors

**21. CONNECT VACUUM HOSES**

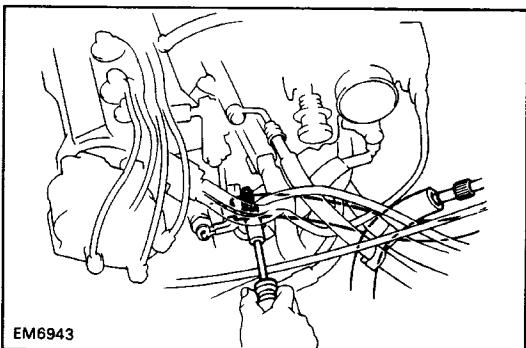
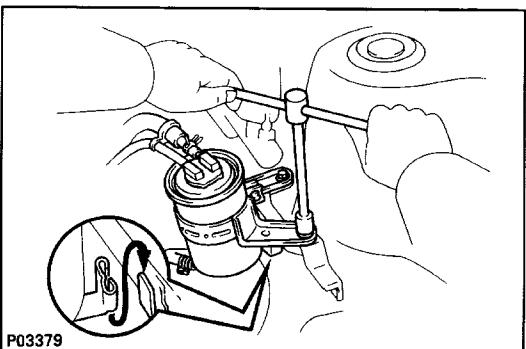
- (a) Vacuum sensor hose to gas filter on air intake chamber
- (b) Brake booster vacuum hose to air intake chamber
- (c) Three A/C idle-up vacuum hoses to ASV on air intake chamber
- (d) A/C vacuum hose to air pipe

**22. CONNECT TRANSAXLE CONTROL CABLE(S) TO TRANSAXLE****23. (M/T)****INSTALL CLUTCH RELEASE CYLINDER**

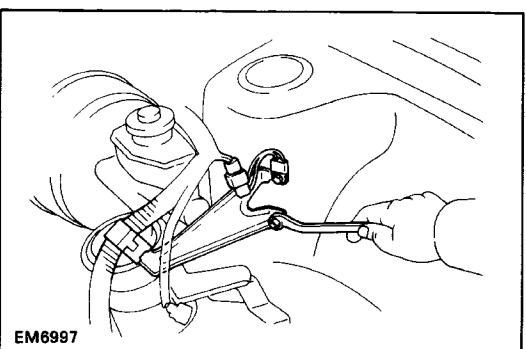
Install the release cylinder and tube with the four bolts.

**24. CONNECT FUEL HOSES**

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

**25. CONNECT SPEEDOMETER CABLE****26. CONNECT HEATER HOSE TO WATER INLET****27. INSTALL CHARCOAL CANISTER**

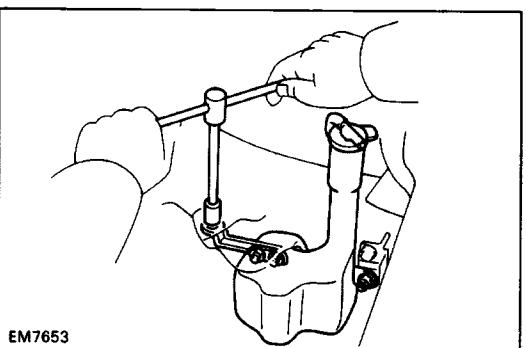
- Install the charcoal canister with the two bolts.
- Connect the three hoses.

**28. INSTALL ENGINE WIRE BRACKET**

- Install the wire bracket with the two bolts. Install the noise filter.
- Install the wire clamp to the wire bracket.

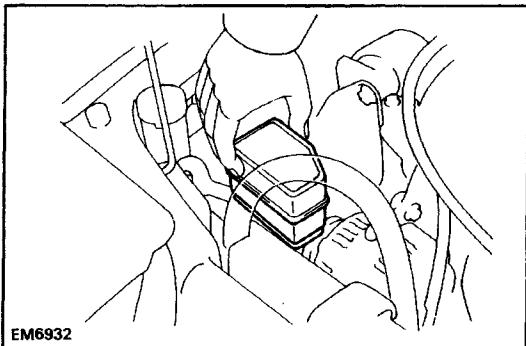
29. CONNECT WIRES AND CONNECTORS

- Check connector
- Vacuum sensor connector
- Ground straps from LH fender apron

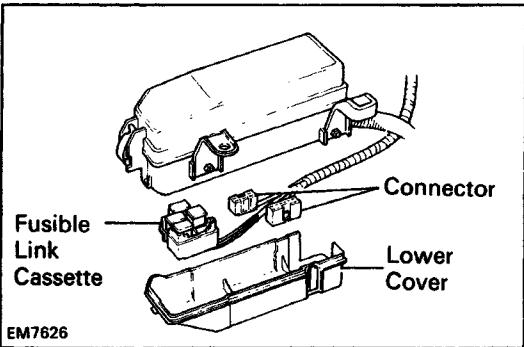
**30. INSTALL RADIATOR RESERVOIR TANK**

Install the reservoir tank with the two nuts.

31. INSTALL RADIATOR (See pages CO-24 and 25)**32. INSTALL BATTERY**

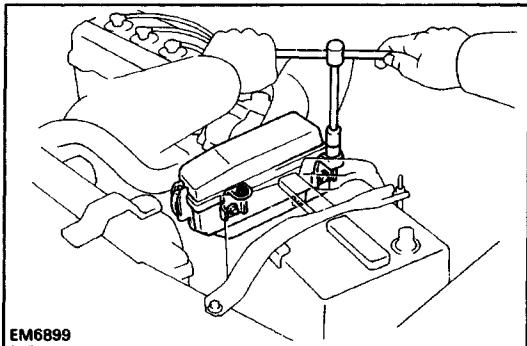


33. INSTALL A/C RELAY BOX



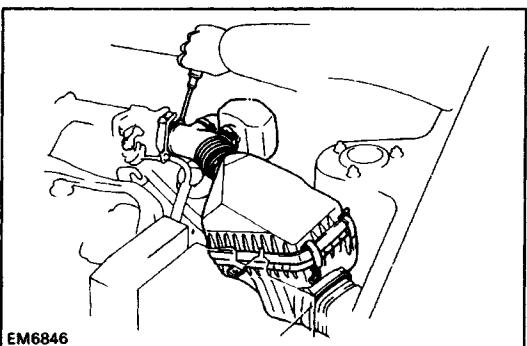
34. CONNECT ENGINE WIRE, AND INSTALL ENGINE RELAY BOX

- (a) Connect the cassette and two connectors of the engine wire to the relay box.
- (b) Install the lower cover to the relay box.



- (c) Install the relay box with the two nuts.

35. INSTALL ACCELERATOR CABLE, AND ADJUST IT



36. INSTALL AIR CLEANER

- (a) Install the air cleaner case with the three bolts.
- (b) Install the air cleaner element.
- (c) Connect the air cleaner hose to the throttle body.
- (d) Connect the air hose to the air pipe.
- (e) Install the air cleaner cap.
- (f) Connect the intake air temperature sensor connector

37. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

38. FILL WITH ENGINE COOLANT (See page CO-6) Capacity (w/ Heater):

M/T 5.2 liters (5.5 US qts, 4.6 Imp. qts)

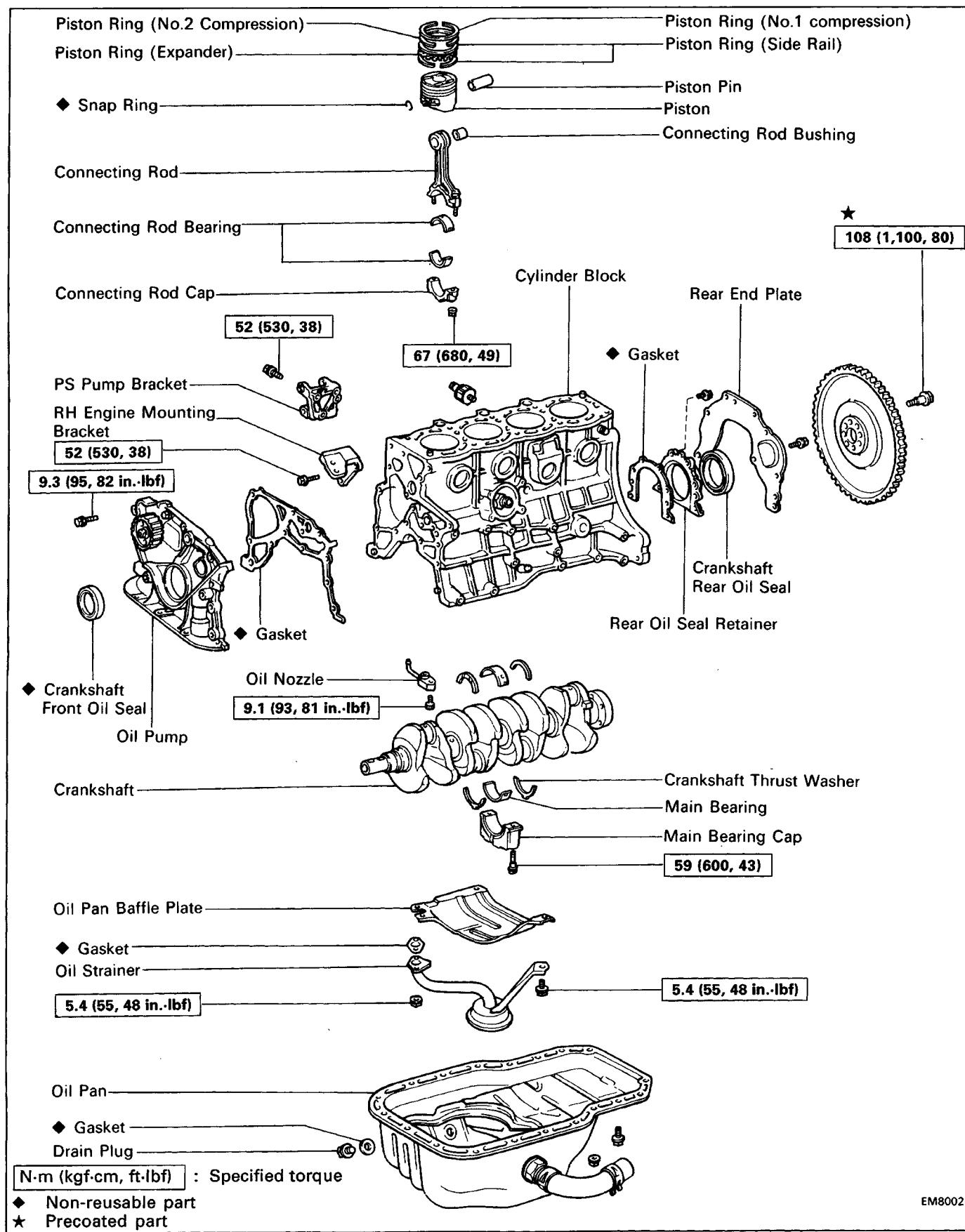
A/T 5.6 liters (5.9 US qts, 4.9 Imp. qts)

39. FILL WITH ENGINE OIL (See page [LU-8](#))**Capacity:****Drain and refill****w/ Oil filter– change****3.2 liters (3.3 US qts, 2.8 Imp. qts)****w/o Oil filter change****3.0 liters (3.1 US qts, 2.6 Imp. qts)****Dry fill 3.7 liters (3.9 US qts, 3.3 Imp. qts)****40. START ENGINE AND CHECK FOR LEAKS****41. PERFORM ENGINE ADJUSTMENT****(a) Adjust the alternator drive belt.****Drive belt tension: New belt 160 ± 20 lbf****Used belt 130 ± 20 lbf****(b) Adjust the PS drive belt. (See page [SR-38](#))****Drive belt tension: New belt 125 ± 25 lbf****Used belt 80 ± 20 lbf****(c) Adjust the A/C drive belt.****Drive belt tension: New belt 160 ± 25 lbf****Used belt 100 ± 20 lbf****(d) Adjust the ignition timing. (See page [IG-25](#))****Ignition timing:** **10° BTDC (w/ Terminals TE1 and E1 connected)****42. INSTALL ENGINE UNDER COVERS****43. INSTALL HOOD****44. PERFORM ROAD TEST**

Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

45. RECHECK ENGINE COOLANT AND ENGINE OIL LEVELS

CYLINDER BLOCK (3S-GTE) COMPONENTS



REMOVAL OF ENGINE

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

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

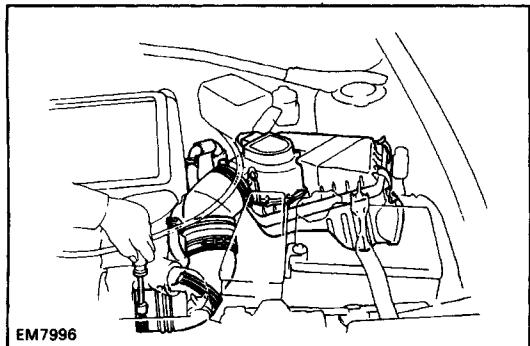
2. REMOVE HOOD

3. REMOVE ENGINE UNDER COVERS

4. DRAIN ENGINE COOLANT (See page CO-6)

5. DRAIN ENGINE OIL (See page LU-7)

6. DRAIN TRANSAXLE OIL



7. REMOVE AIR CLEANER

(a) Disconnect the air flow meter connector.

(b) Disconnect the four air cleaner cap clips.

(c) Disconnect the following hoses:

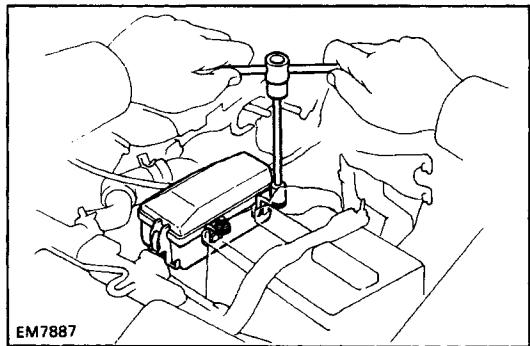
(1) Air cleaner hose from turbocharger

(2) PCV hose from cylinder head cover

(3) Air hose from air tube

(d) Remove the air cleaner cap, air flow meter assembly and element.

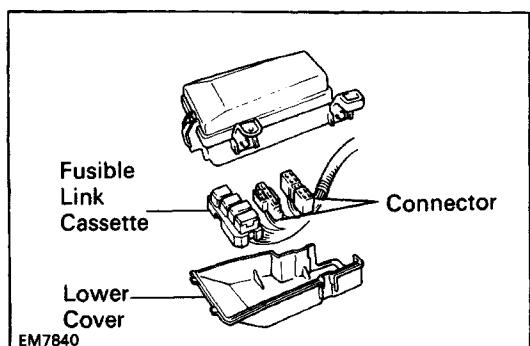
(e) Remove the three bolts and air cleaner case.



8. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY

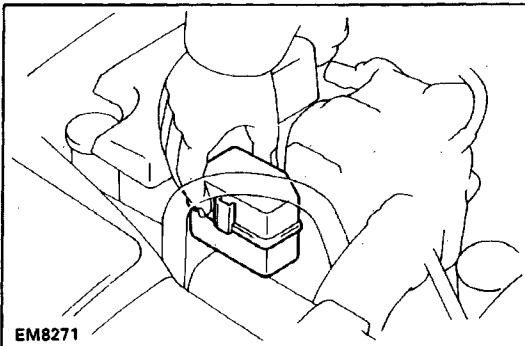
9. REMOVE ENGINE RELAY BOX, AND DISCONNECT ENGINE WIRE CONNECTORS

(a) Remove the two nuts, and disconnect the relay box from the battery.

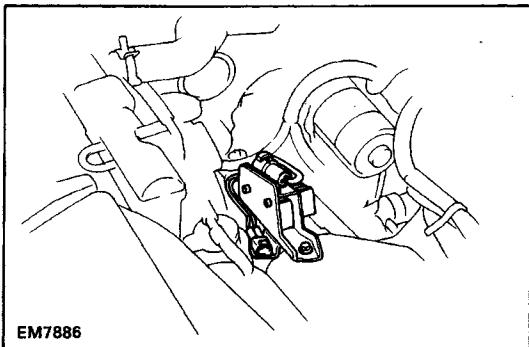


(b) Remove the lower cover from the relay box.

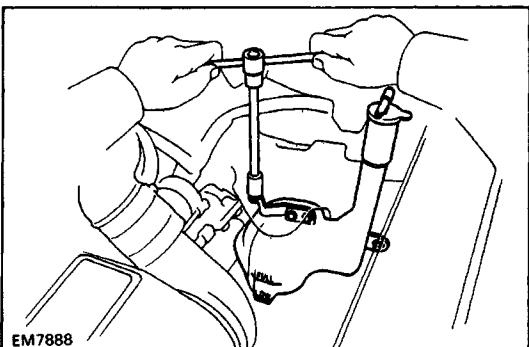
(c) Disconnect the fusible link cassette and two connectors of the engine wire from the relay box.

**10. REMOVE A/C RELAY BOX FROM BRACKET**

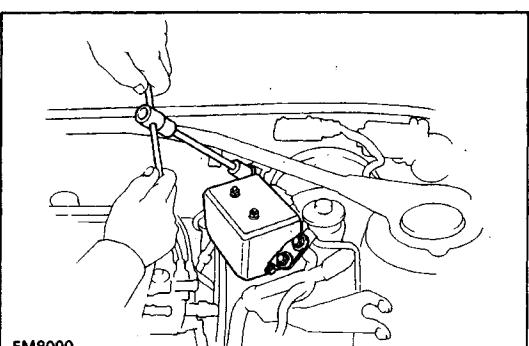
Remove the A/C relay box from the bracket.

11. REMOVE BATTERY**12. REMOVE INJECTOR SOLENOID RESISTOR AND FUEL PUMP RESISTOR'**

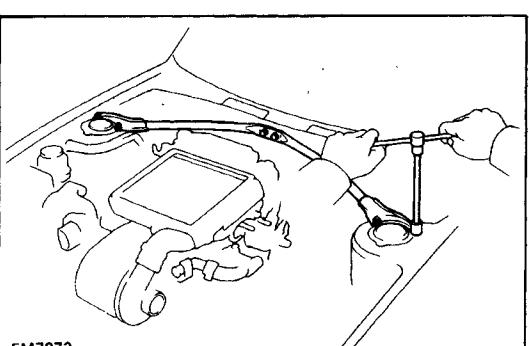
- Disconnect the two connectors.
- Remove the bolt, the solenoid resistor and fuel pump resistor assembly.

13. REMOVE RADIATOR (See pages CO-22 and 23)**14. REMOVE RADIATOR RESERVOIR TANK**

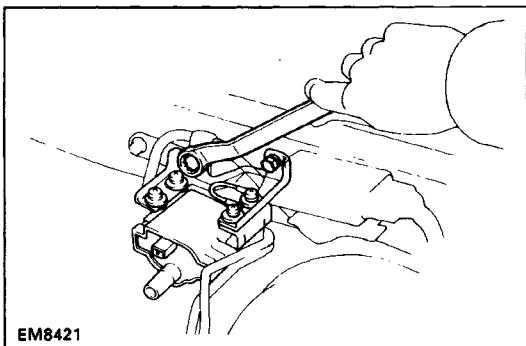
Remove the two nuts and reservoir tank.

**15. (w/ CRUISE CONTROL SYSTEM)****REMOVE CRUISE CONTROL ACTUATOR**

- Remove the two nuts and actuator cover.
- Remove the three bolts, and disconnect the actuator.
- Disconnect the actuator connector
- Disconnect the cable from the actuator.

**16. REMOVE SUSPENSION UPPER BRACE**

- Remove the two wiper arms.
- Remove the outside lower windshield moulding.
- Remove the two bolts, four nuts and upper brace.

**17. REMOVE IGNITION COIL**

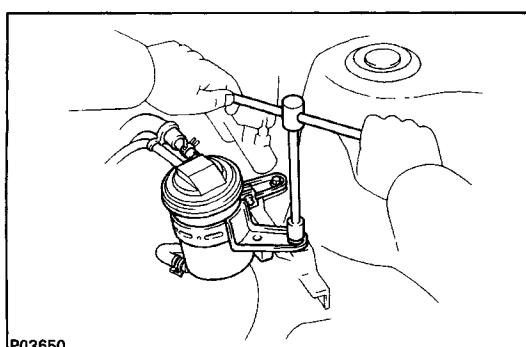
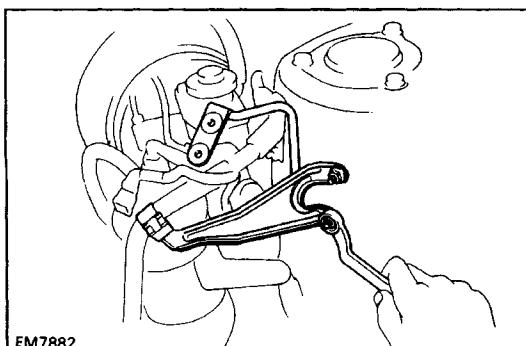
- (a) Disconnect the ignition coil connector.
- (b) Disconnect the high-tension cord.
- (c) Remove the two bolts and ignition coil.

18. DISCONNECT WIRES AND CONNECTORS

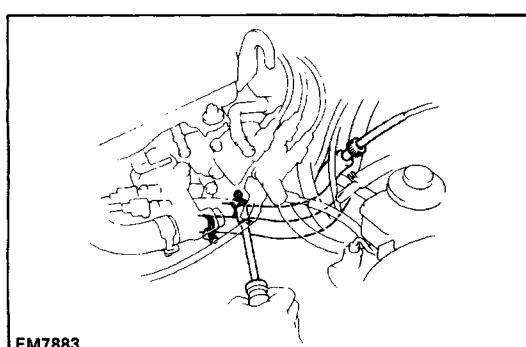
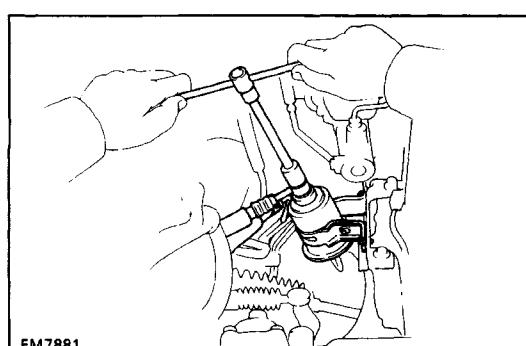
- (a) Check connector
- (b) Igniter connector
- (c) Ground strap from LH fender apron

19. REMOVE ENGINE WIRE BRACKET

- (a) Disconnect the wire clamp from the wire bracket.
- (b) Remove the two bolts and wire bracket.

**20. REMOVE CHARCOAL CANISTER**

- (a) Disconnect the three hoses from the charcoal canister.
- (b) Remove the two bolts and charcoal canister.

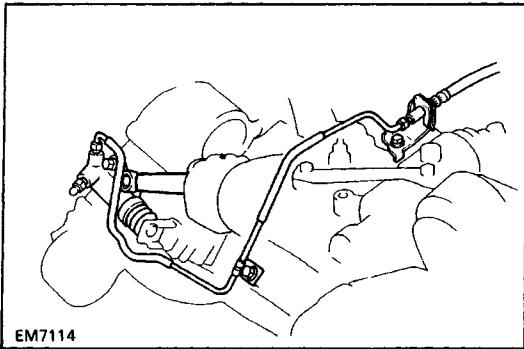
**21. DISCONNECT HEATER HOSES****22. DISCONNECT SPEEDOMETER CABLE****23. DISCONNECT FUEL HOSES**

CAUTION: Catch leaking fuel in a container.

24. DISCONNECT CONNECTORS

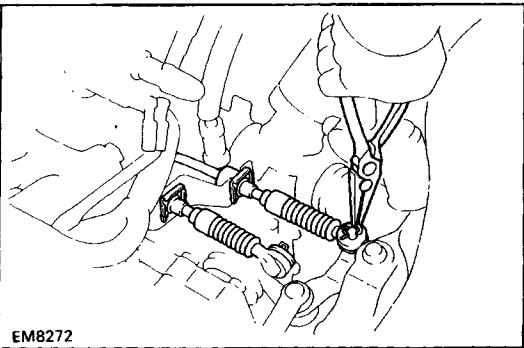
- (a) Engine room wire connector.
- (b) Noise filter connector.

25. REMOVE STARTER (See page ST-4)

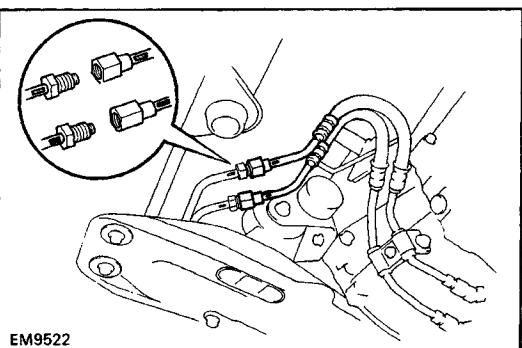


26. REMOVE CLUTCH RELEASE CYLINDER WITHOUT DISCONNECTING TUBE

Remove the four bolts, release cylinder and tube from the transaxle.

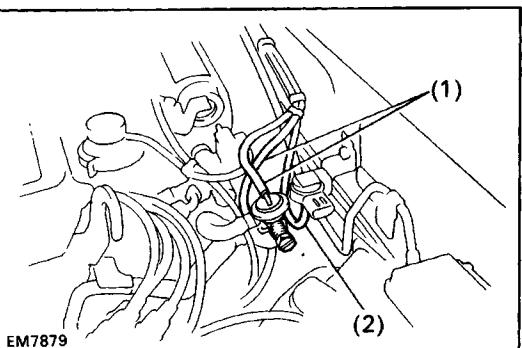


27. DISCONNECT TRANSAXLE CONTROL CABLES FROM TRANSAXLE



28. DISCONNECT TRANSAXLE OIL COOLER HOSES

- (a) Place matchmarks on the oil cooler hoses and tubes.
- (b) Disconnect the two oil cooler hoses from the tube.



29. DISCONNECT TURBOCHARGING PRESSURE SENSOR AND A/C ASV FROM BODY

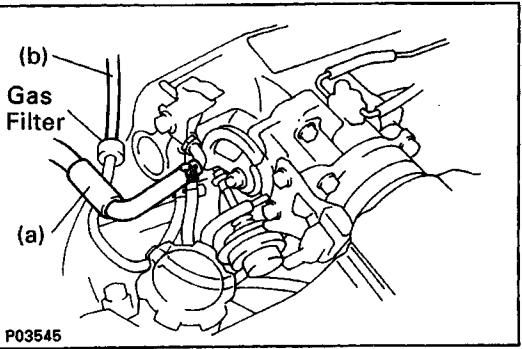
- (a) Disconnect the turbocharging pressure sensor.
- (b) Disconnect the following hoses:
 - (1) Two vacuum hoses from A/C ASV
 - (2) Vacuum hose from turbocharging pressure sensor
- (c) Remove the bolt, and disconnect the turbocharging pressure sensor and A/C ASV from the body.

30. DISCONNECT HOSES

- (a) Brake booster vacuum hose from intake manifold
- (b) Turbocharging pressure sensor hose from gas filter

31. DISCONNECT ENGINE WIRE

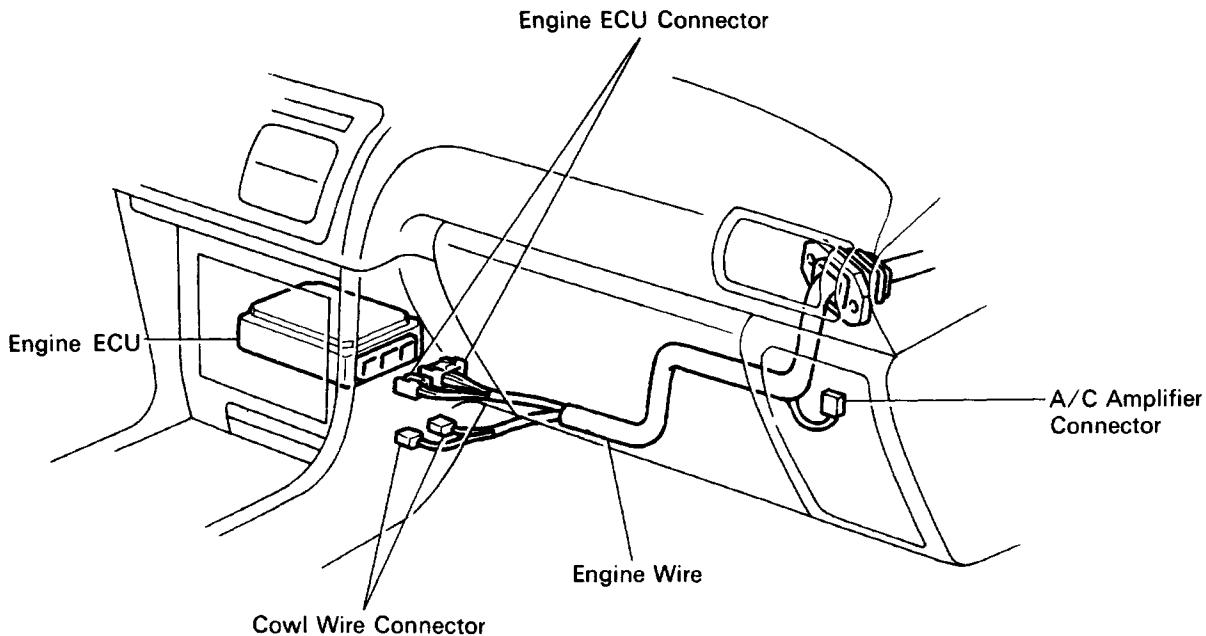
- (a) Engine wire clamp from wire bracket on RH fender apron
- (b) Two cowl wire connectors



32. DISCONNECT ENGINE WIRE FROM CABIN

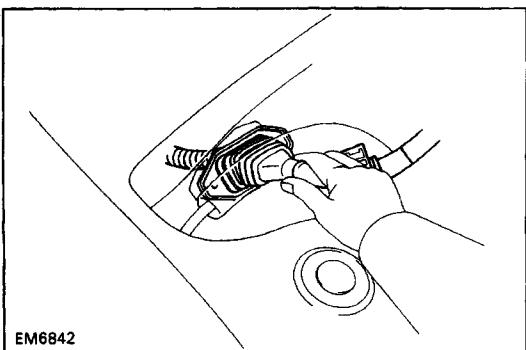
(a) Disconnect the following connectors:

- (1) Two engine ECU connectors
- (2) Two cowl wire connectors
- (3) A/C amplifier connector



EM7828

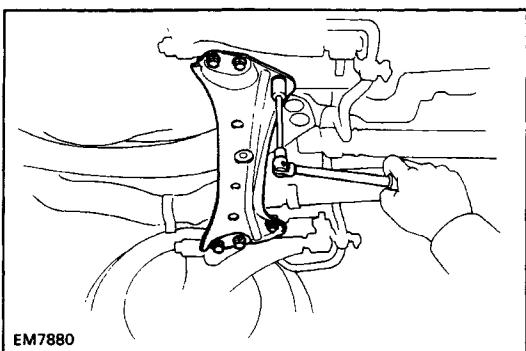
(b) Remove the two nuts, and pull out the engine wire from the cowl panel.



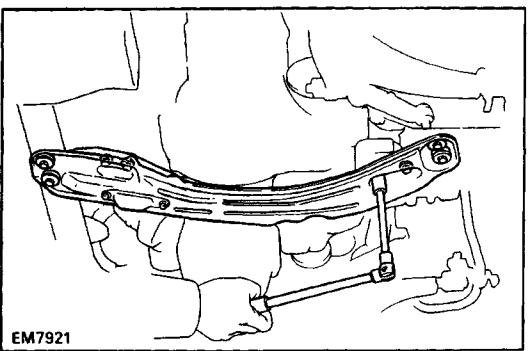
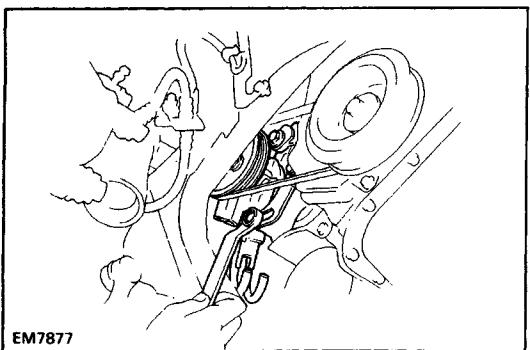
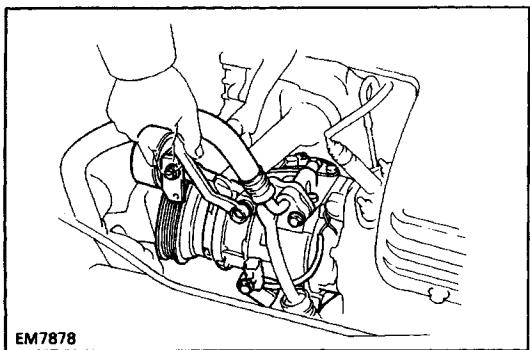
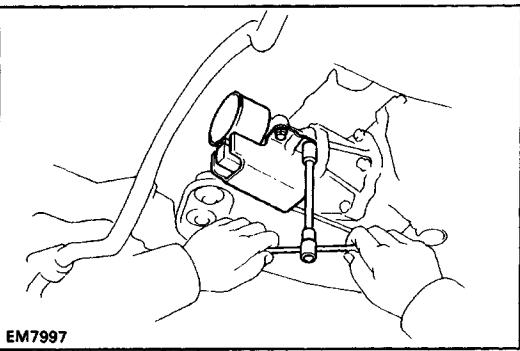
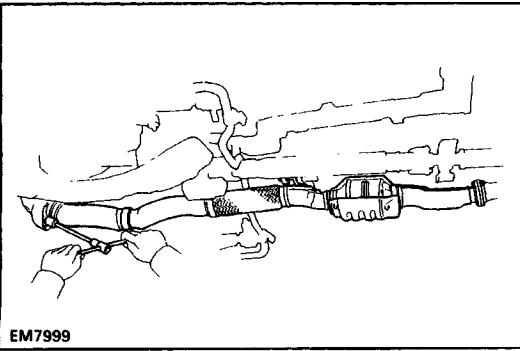
EM6842

33. REMOVE SUSPENSION LOWER CROSMEMBER

Remove the four bolts, two nuts and lower crossmember.



EM7880



34. REMOVE FRONT EXHAUST PIPE

- Loosen the bolt, and disconnect the clamp from the bracket.
- Remove the two bolts and nuts holding the front exhaust pipe to the center exhaust pipe.
- Using a 14 mm deep socket wrench, remove the three nuts holding the front exhaust pipe to the catalytic converter.
- Disconnect the support hook on the front exhaust pipe from the support bracket, and remove the front exhaust pipe and two gaskets.

35. REMOVE DRIVE SHAFTS (See SA section)

36. REMOVE FRONT PROPELLER SHAFT (See PR section)

37. REMOVE DEFLECTOR FROM TRANSFER EXTENSION HOUSING

38. REMOVE DYNAMIC DAMPER FROM TRANSFER EXTENSION HOUSING

39. REMOVE ALTERNATOR (See page CH-7)

40. REMOVE IDLER PULLEY BRACKET AND A/C COMPRESSOR WITHOUT DISCONNECTING HOSES

- Disconnect the A/C compressor connector.
- Remove the four bolts and idler pulley bracket, and disconnect the A/C compressor.

HINT: Put aside the compressor, and suspend it to the radiator support with a string.

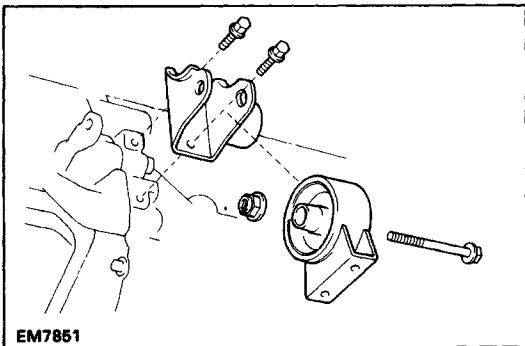
41. REMOVE PS PUMP WITHOUT DISCONNECTING HOSES

- Disconnect the two air hoses from the air pipe.
- Remove the PS drive belt.
- Remove the four bolts, and disconnect the PS pump from the engine.

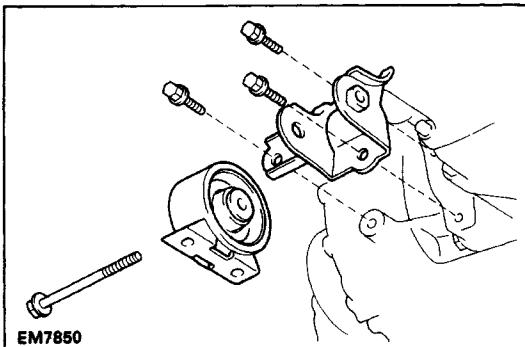
HINT: Put aside the pump and suspend it to the cowl with a string.

42. REMOVE ENGINE MOUNTING CENTER MEMBER

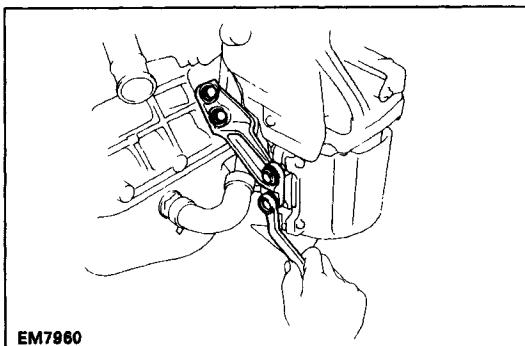
Remove the eight bolts and center member.

**43. REMOVE FRONT ENGINE MOUNTING INSULATOR AND BRACKET**

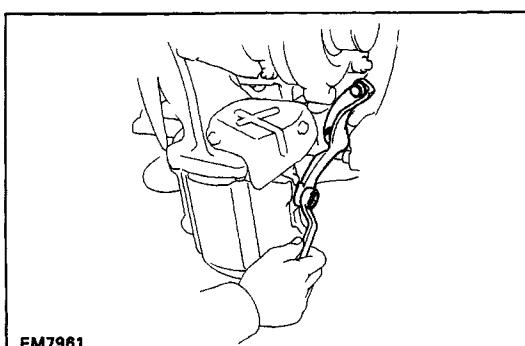
- (a) Remove the through bolt, nut and mounting insulator.
- (b) Remove the two bolts and mounting bracket.

**44. REMOVE REAR ENGINE MOUNTING INSULATOR AND BRACKET**

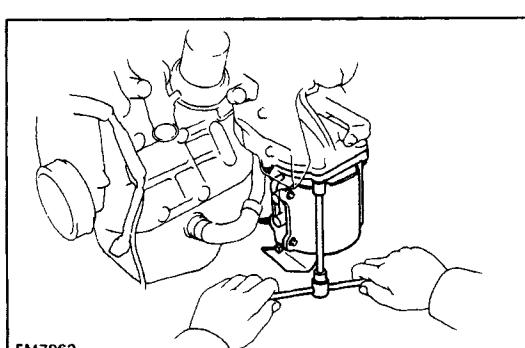
- (a) Remove the through bolt and mounting insulator.
- (b) Remove the three bolts and mounting bracket.

**45. REMOVE CATALYTIC CONVERTER**

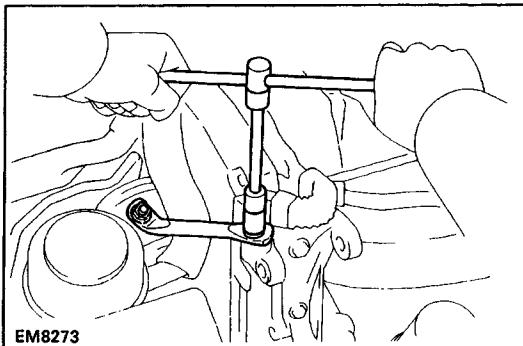
- (a) Remove the four bolts and RH converter stay.



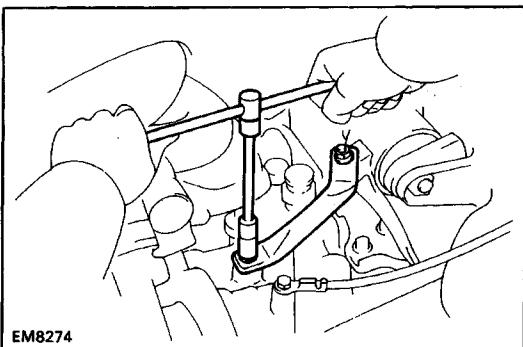
- (b) Remove the three bolts and LH converter stay.



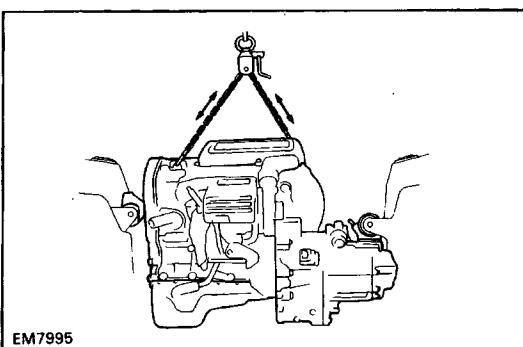
- (c) Remove the three bolts, two nuts, catalytic converter, cushion, retainer and gasket.

**46. REMOVE RH ENGINE MOUNTING STAY**

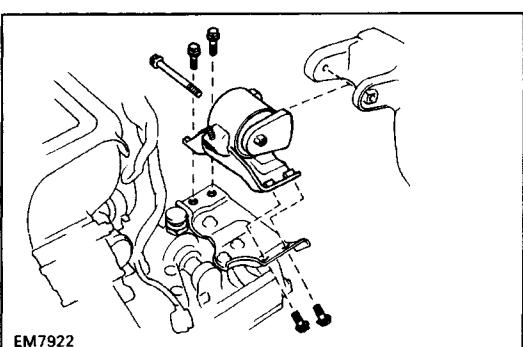
Remove the bolt, nut and mounting stay.

**47. REMOVE LH ENGINE MOUNTING STAY**

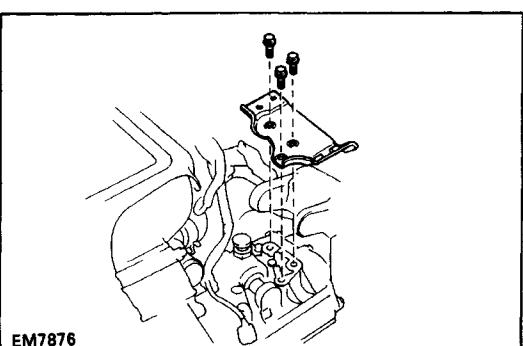
- Remove the bolt, nut and mounting stay.
- Remove the bolt, and disconnect the ground strap.

**48. REMOVE ENGINE AND TRANSAXLE ASSEMBLY FROM VEHICLE**

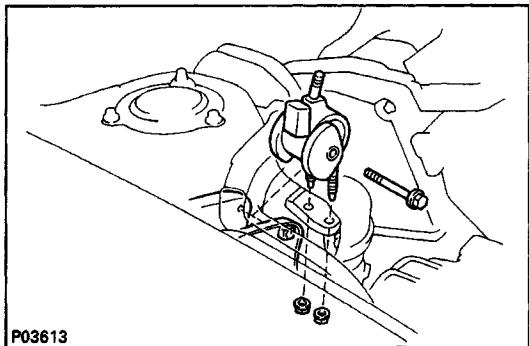
- Attach the engine chain hoist to the engine hangers.



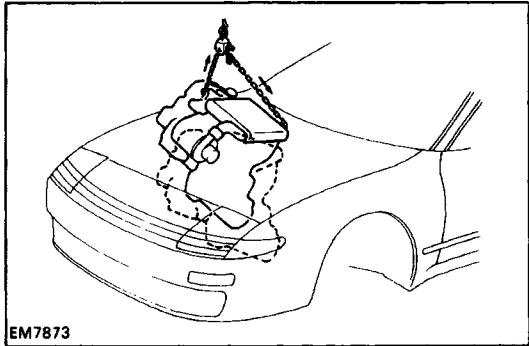
- Remove the through bolt, four bolts and LH mounting insulator.



- Remove the three bolts and LH mounting bracket.



(d) Remove the through bolt, two nuts and RH mounting insulator.



(e) Lift the engine out of the vehicle slowly and carefully.

NOTICE: Be careful not to hit the PS gear housing.

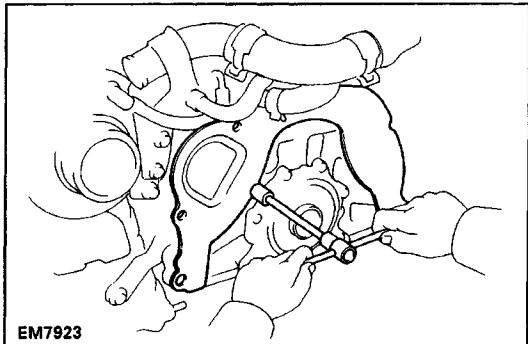
(f) Make sure the engine is clear of all wiring, hoses and cables.

(g) Place the engine and transaxle assembly onto the stand.

49. SEPARATE ENGINE AND TRANSAXLE (See MT section)

PREPARATION FOR DISASSEMBLY

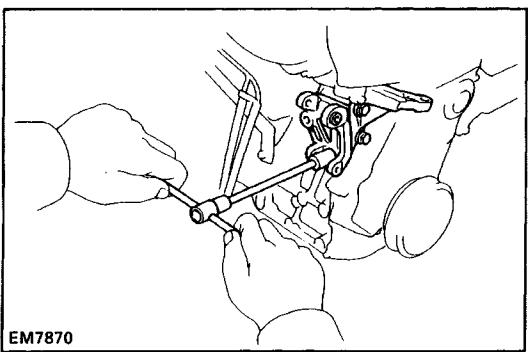
1. REMOVE CLUTCH COVER AND DISC
2. REMOVE FLYWHEEL



3. REMOVE REAR END PLATE

Remove the bolt and end plate.

4. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY



5. REMOVE RH ENGINE MOUNTING BRACKET

Remove the three bolts and mounting bracket.

6. REMOVE PS PUMP BRACKET

Remove the three bolts and PS pump bracket.

7. REMOVE TIMING BELT AND PULLEYS

(See pages [EM-48](#) to 52)

8. REMOVE TURBOCHARGER (See pages [TC-9](#) to 11)

9. REMOVE CYLINDER HEAD

(See pages [EM-118](#) to 125)

10. REMOVE WATER PUMP AND IDLER PULLEY

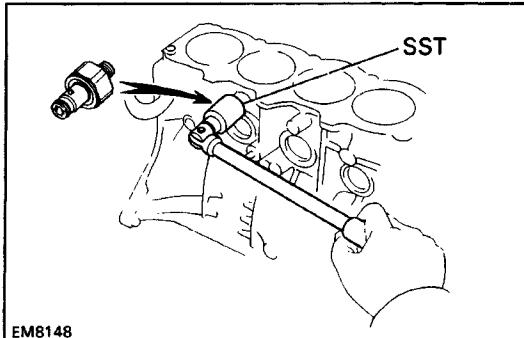
BRACKET (See pages [CO-12](#) and 13)

11. REMOVE OIL PAN AND OIL PUMP

(See pages [LU-17](#) and 18)

12. REMOVE OIL FILTER (See page [LU-7](#))

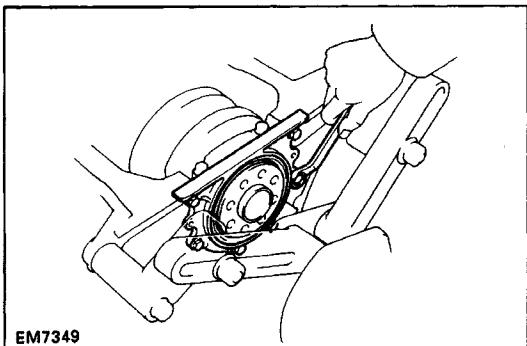
13. REMOVE OIL COOLER (See pages [LU-24](#) and 25)



14. REMOVE KNOCK SENSOR

Using SST, remove the knock sensor.

SST 09816-30010

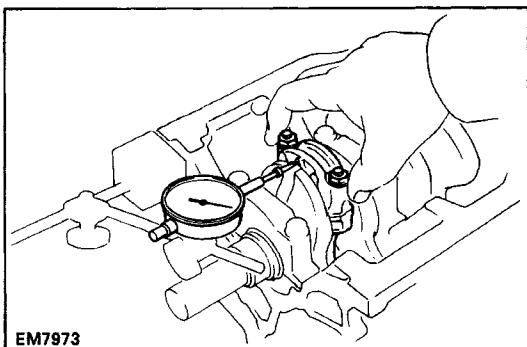


DISASSEMBLY OF CYLINDER BLOCK

(See page EM-223)

1. REMOVE REAR OIL SEAL RETAINER

Remove the six bolts, retainer and gasket.



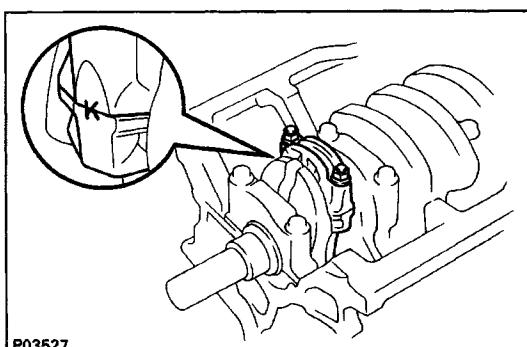
2. CHECK CONNECTING ROD THRUST CLEARANCE

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

**Standard thrust clearance: 0.160 – 0.312 mm
(0.0063 – 0.0123 in.)**

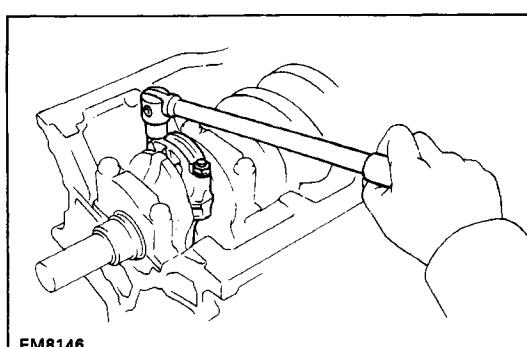
Maximum thrust clearance: 0.35 mm (0.0138 in.)

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

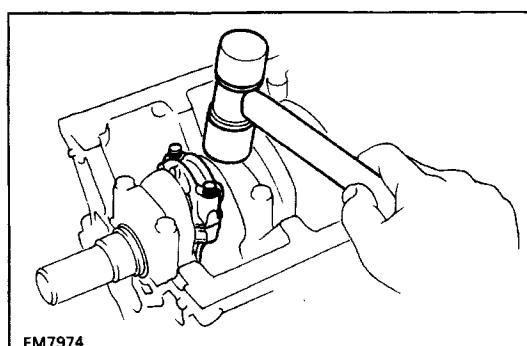


3. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

(a) Check the matchmarks on the connecting rod and cap to ensure correct reassembly.

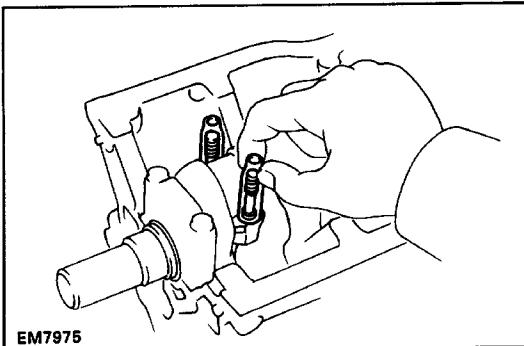


(b) Remove the connecting rod cap nuts.

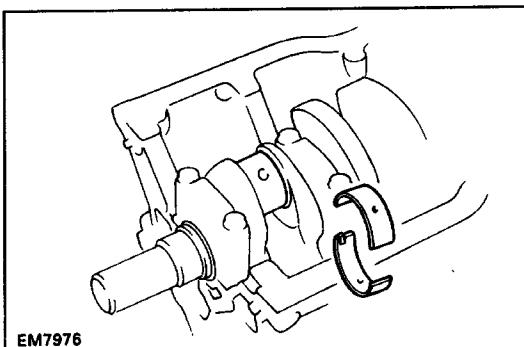


(c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

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

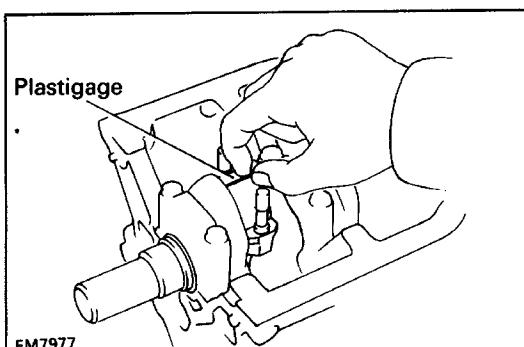


(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.

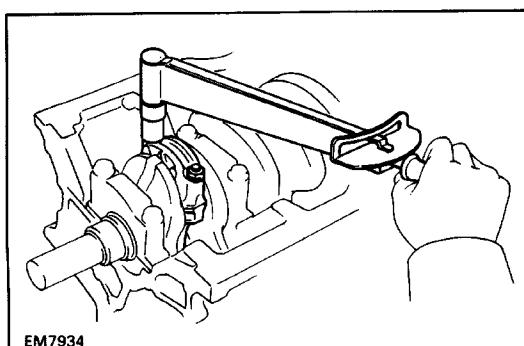


(e) Clean the crank pin and bearing.
(f) Check the crank pin and bearing for pitting and scratches.

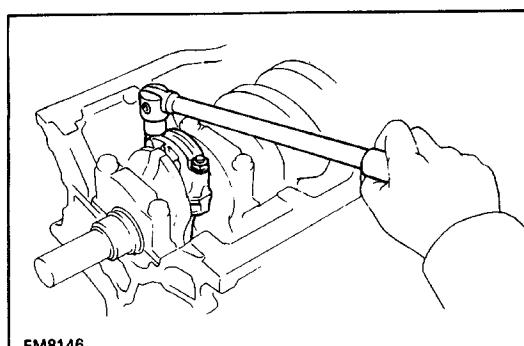
If the crank pin or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



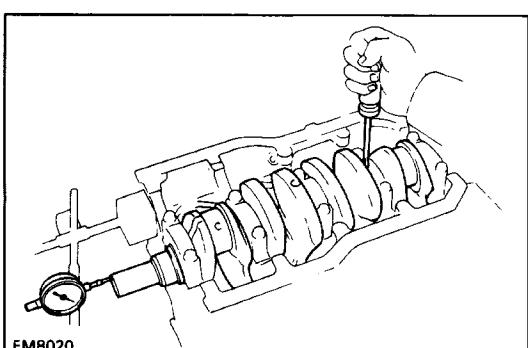
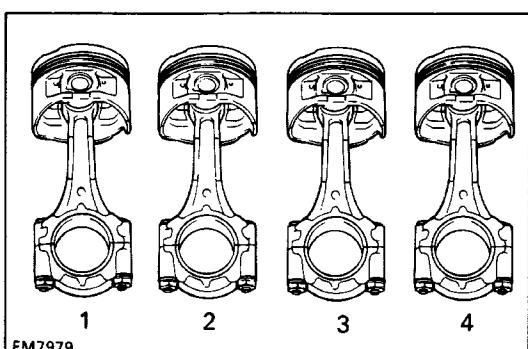
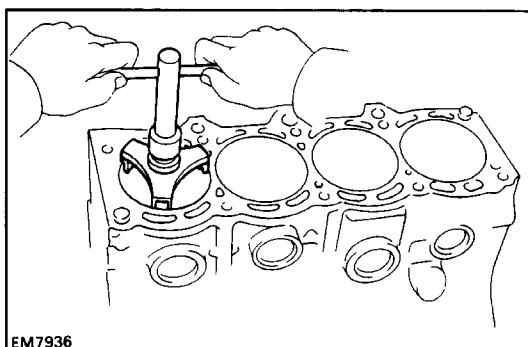
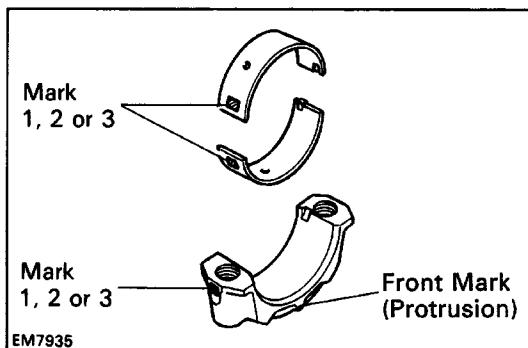
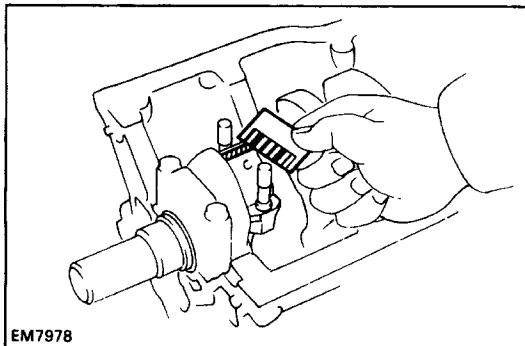
(g) Lay a strip of Plastigage across the crank pin.



(h) Install the connecting rod cap.
(See step 7 on page [EM-255](#))
Torque: 67 N·m (680 kgf·cm, 49 ft-lbf)
NOTICE: Do not turn the crankshaft.



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



(j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD	0.024 – 0.055 mm (0.0009 – 0.0022 in.)
U/S	0.25 0.023 – 0.069 mm (0.0009 – 0.0027 in.)

Maximum oil clearance: 0.08 mm (0.0031 in.)

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

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

“1” “2” and “3” accordingly.

Standard sized bearing center wall thickness:

Mark "1"	1.484 – 1.488 mm (0.0584 – 0.0586 in.)
Mark "2"	1.488 – 1.492 mm (0.0586 – 0.0587 in.)
Mark "3"	1.492 – 1.496 mm (0.0587 – 0.0589 in.)

(k) Completely remove the Plastigage.

4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

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

(b) Cover the connecting rod bolts.

(See page [EM-235](#))

(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.

5. CHECK CRANKSHAFT THRUST CLEARANCE

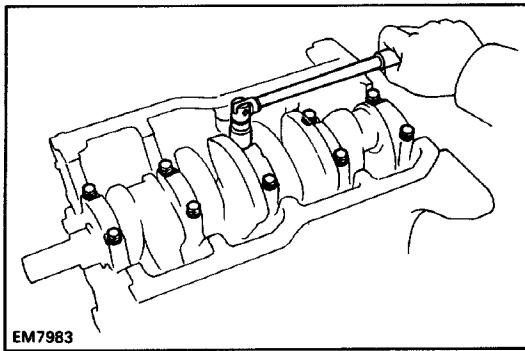
Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

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

Maximum thrust clearance: 0.30 mm (0.0118 in.)

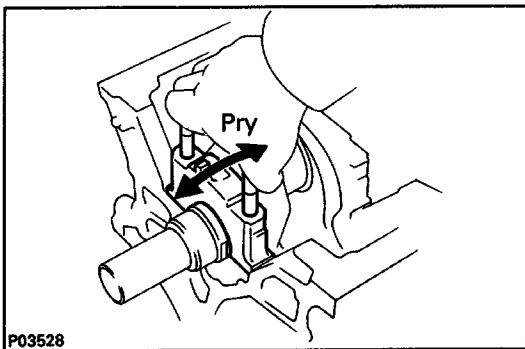
If the thrust clearance is greater than maximum, replace the thrust washers as a set.

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



6. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

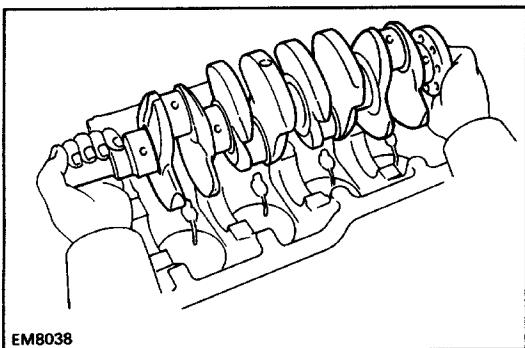
(a) Remove the main bearing cap bolts.



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

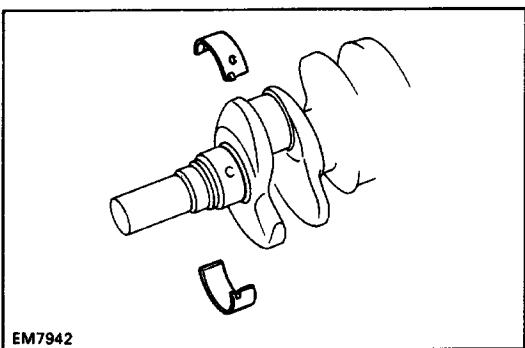
HINT:

- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in correct order.



(c) Lift out the crankshaft.

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

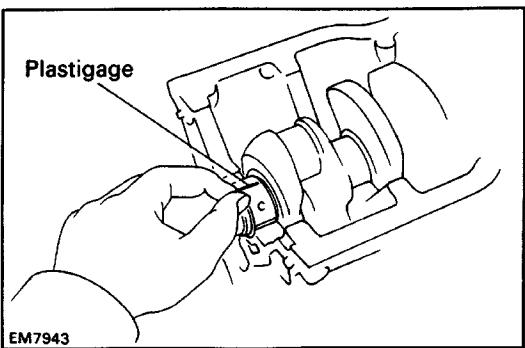


(d) Clean each main journal and bearing.

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

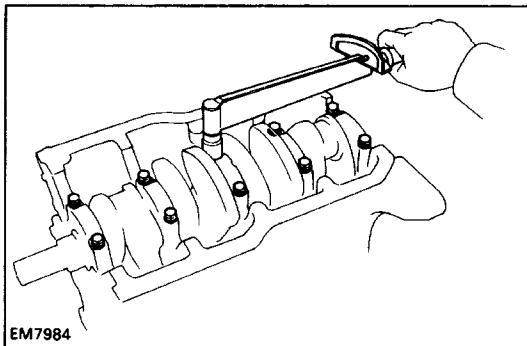
If the journal or bearing is damaged, replace the bearings.

If necessary, grind or replace the crankshaft.



(f) Place the crankshaft on the cylinder block.

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

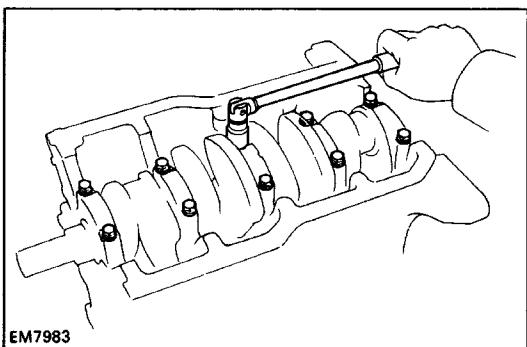


(h) Install the main bearing caps.

(See step 5 on page [EM-254](#))

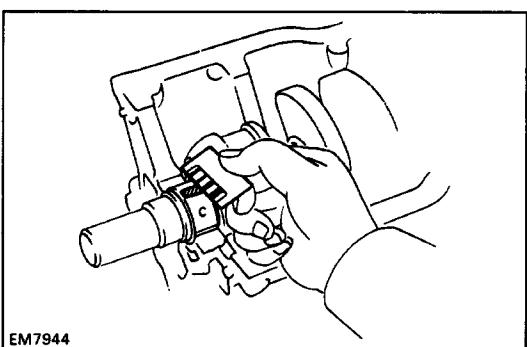
Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)

NOTICE: Do not turn the crankshaft.



(i) Remove the main bearing caps.

(See procedures (a) and (b) above)



(j) Measure the Plastigage at its widest point.

Standard clearance:

No.3 STD 0.025 – 0.044 mm
(0.0010 – 0.0017 in.)

U/S 0.25 0.021 – 0.061 mm
(0.0008 – 0.0024 in.)

Others STD 0.015 – 0.034 mm
(0.0006 – 0.0013 in.)

U/S 0.25 0.029 – 0.069 mm
(0.0011 – 0.0027 in.)

Maximum clearance: 0.08 mm (0.0031 in.)

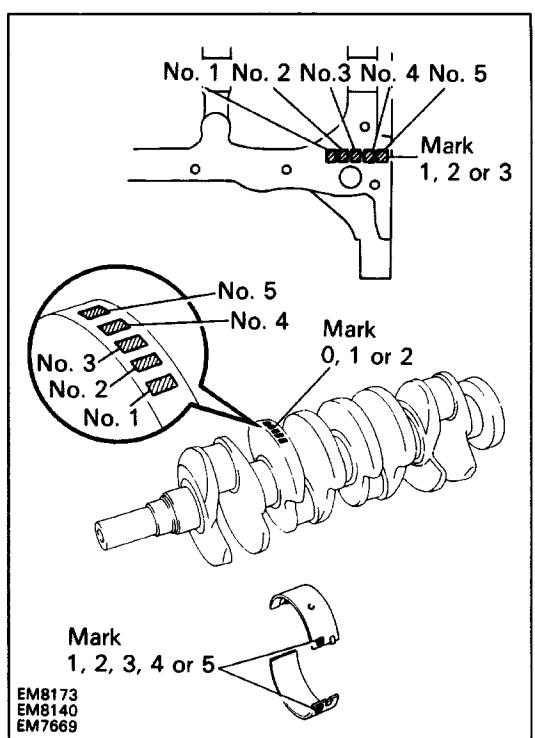
HINT: If replacing the cylinder block subassembly, the bearing standard clearance will be:

No.3 0.027 – 0.054 mm
(0.0011 – 0.0021 in.)

Others 0.017 – 0.044 mm
(0.0007 – 0.0017 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.



	Number marked							
	1		2		3			
Cylinder block	1	2	0	1	2	0	1	2
Crankshaft	0	1	2	0	1	2	0	1
Bearing	1	2	3	2	3	4	3	4

EXAMPLE: Cylinder block "2" + Crankshaft "1" = Bearing "3"

(Reference)

Cylinder block main journal bore diameter:

Mark "1" 59.020 – 59.026 mm

(2.3236 – 2.3239 in.)

Mark "2" 59.026 – 59.032 mm

(2.3239 – 2.3241 in.)

Mark "3" 59.032 – 59.038 mm

(2.3241 – 2.3243 in.)

Crankshaft journal diameter:

Mark "0" 54.998 – 55.003 mm

(2.1653 – 2.1655 in.)

Mark "1" 54.993 – 54.998 mm

(2.1651 – 2.1653 in.)

Mark "2" 54.988 – 54.993 mm

(2.1649 – 2.1651 in.)

Standard sized bearing center wall thickness:

No.3 Mark "1" 1.992 – 1.995 mm

(0.0784 – 0.0785 in.)

Mark "2" 1.995 – 1.998 mm

(0.0785 – 0.0787 in.)

Mark "3" 1.998 – 2.001 mm

(0.0787 – 0.0788 in.)

Mark "4" 2.001 – 2.004 mm

(0.0788 – 0.0789 in.)

Mark "5" 2.004 – 2.007 mm

(0.0789 – 0.0790 in.)

Others Mark "1" 1.997 – 2.000 mm

(0.0786 – 0.0787 in.)

Mark "2" 2.000 – 2.003 mm

(0.0787 – 0.0789 in.)

Mark "3" 2.003 – 2.006 mm

(0.0789 – 0.0790 in.)

Mark "4" 2.006 – 2.009 mm

(0.0790 – 0.0791 in.)

Mark "5" 2.009 – 2.012 mm

(0.0791 – 0.0792 in.)

(k) Completely remove the Plastigage.

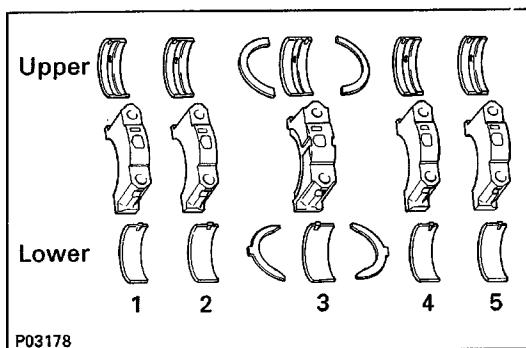
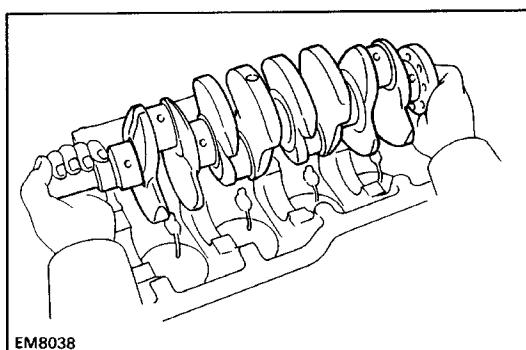
7. REMOVE CRANKSHAFT

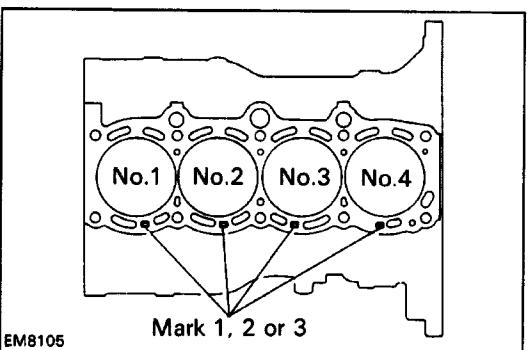
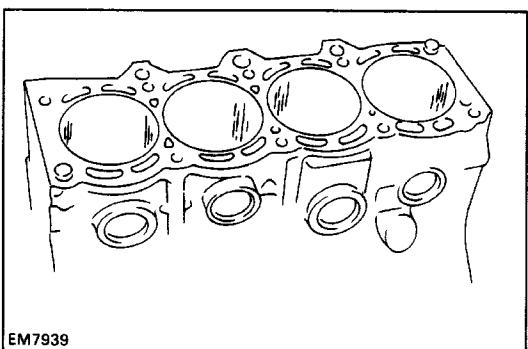
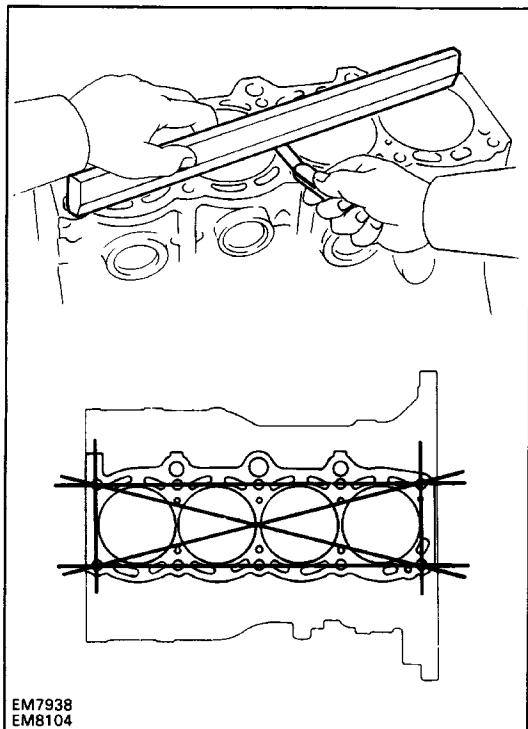
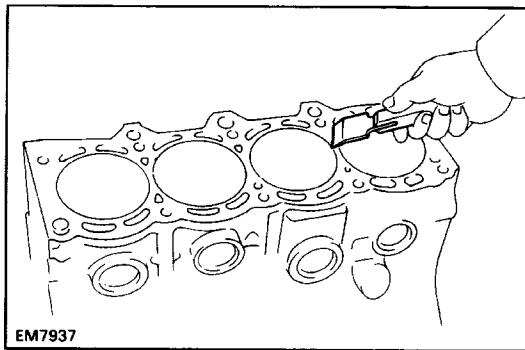
(a) Lift out the crankshaft.

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

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

8. REMOVE OIL NOZZLES (See page LU-31)





INSPECTION OF CYLINDER BLOCK

1. CLEAN CYLINDER BLOCK

A. Remove gasket material

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

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 surface contacting the cylinder head for warpage.

Maximum warpage: 0.05 mm (0.0020 in.)

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

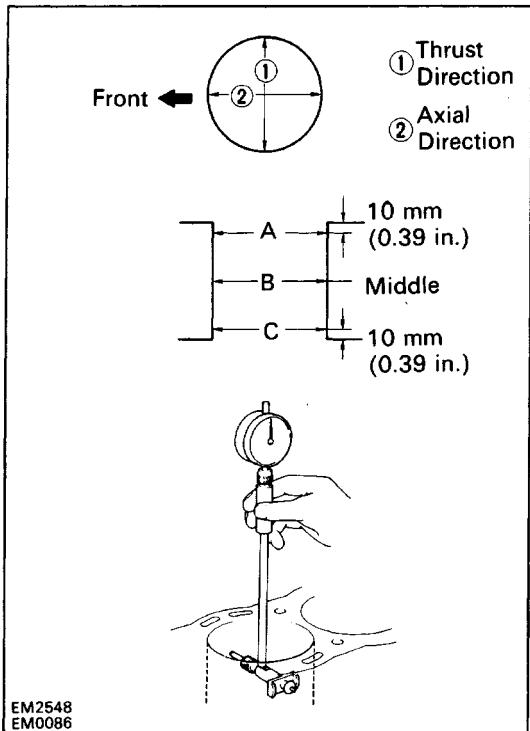
3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

Visually check the cylinder for vertical scratches.

If deep scratches are present, 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 the top of the cylinder block.



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

Standard diameter:

Mark 1" 86 . 000 – 86-010 mm

(3.3858 – 3.3862 in.)

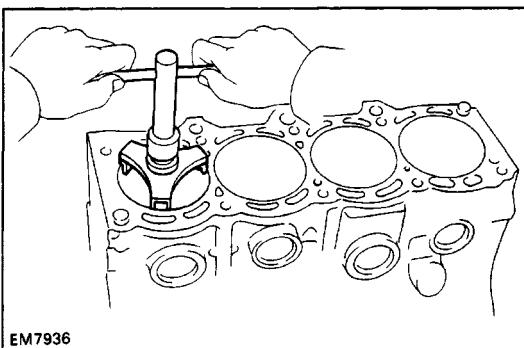
Mark "2" 86.010 – 86.020 mm

(3.3862 – 3.3866 in.)

Mark "3" 86.020 – 86.030 mm

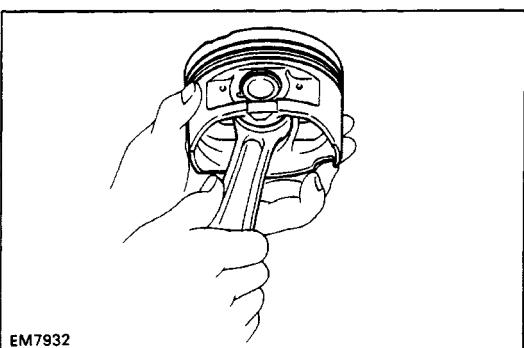
Maximum diameter: 86.23 mm (3.3949 in.)

If the diameter is greater than maximum, replace the cylinder block



5. REMOVE CYLINDER RIDGE

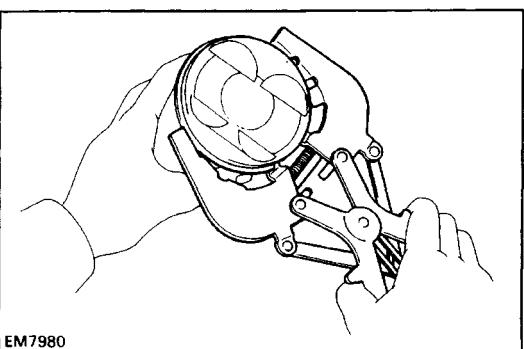
If the wear is less than 0.2 mm (0.008 in.), using a ridge reamer, grind the top of the cylinder.



DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

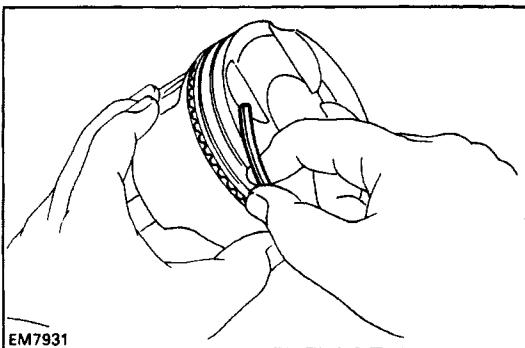
1. CHECK FIT BETWEEN PISTON AND PISTON PIN

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



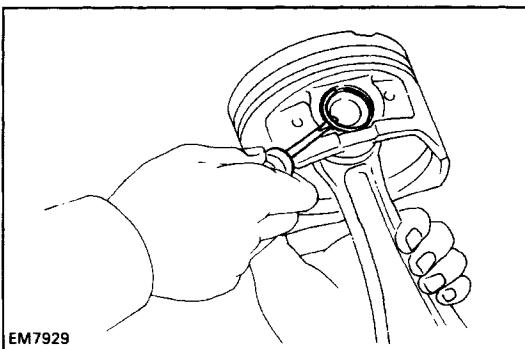
2. REMOVE PISTON RINGS

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



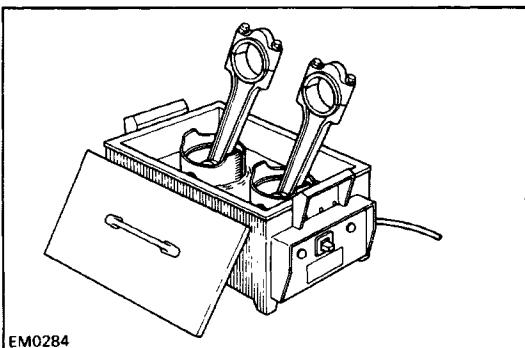
(b) Remove the two side rails and oil ring expander by hand.

HINT: Arrange the rings in correct order only.

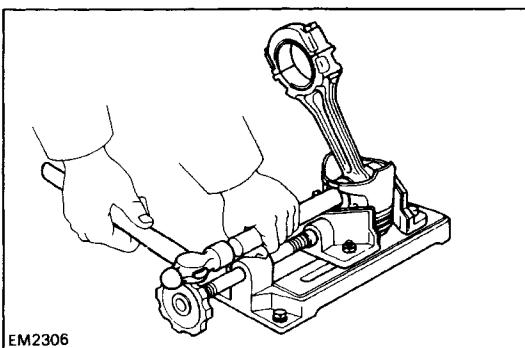


3. DISCONNECT CONNECTING ROD FROM PISTON

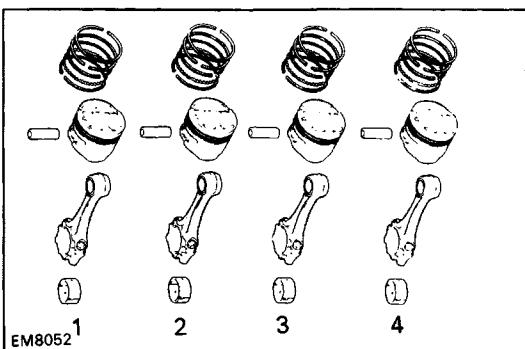
(a) Using a small screwdriver, pry out the two snap rings.



(b) Gradually heat the piston to 80 – 90°C (176 – 194°F).

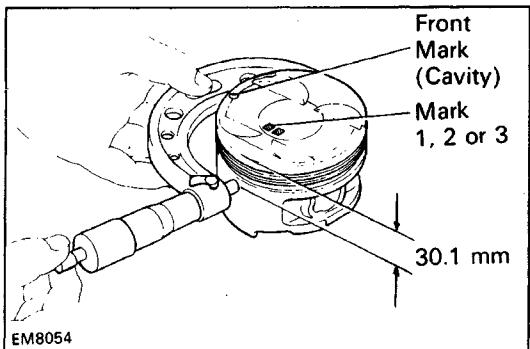
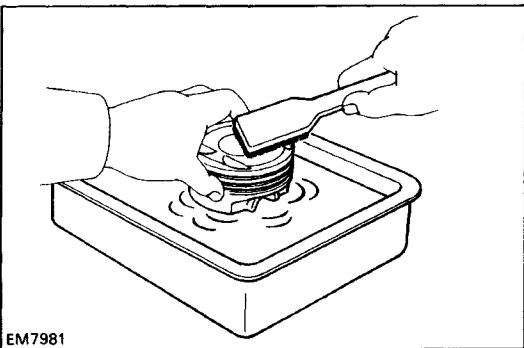
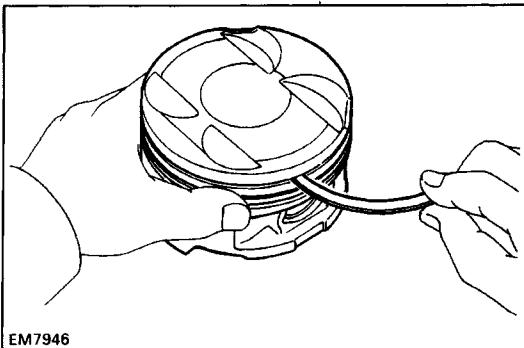
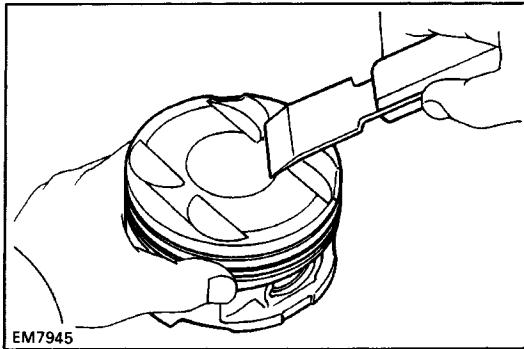


(c) Using plastic-faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.



HINT:

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



INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLIES

1. CLEAN PISTON

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

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

(c) Using solvent and a brush, thoroughly clean the 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, measure the piston diameter at right angles to the piston pin center line, 30.1 mm (1.185 in.) from the piston head.

Piston diameter:

**Mark "1" 85-920 – 85.930 mm
(3-3827 – 3.3831 in.)**

**Mark "2" 85-930 – 85 . 940 mm
(3-3831 – 3.3835 in.)**

**Mark "3" 85.940 – 85.950 mm
(3.3835 – 3.3839 in.)**

- (b) Measure the cylinder bore diameter in the thrust directions. (See step 4 on page **EM-241**)
- (c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

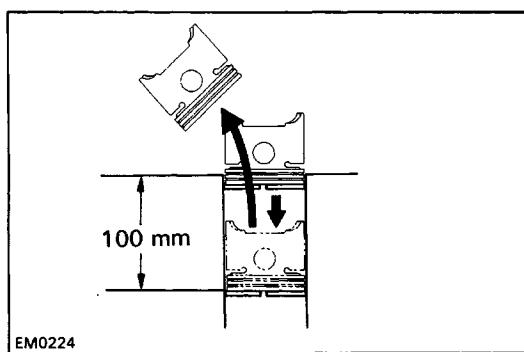
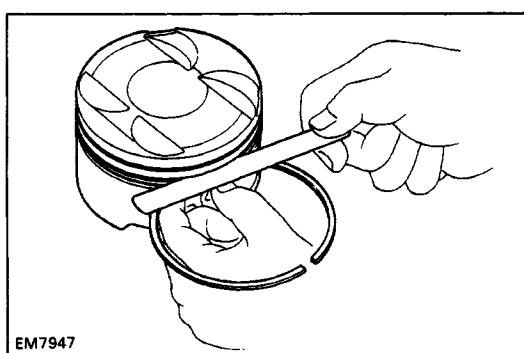
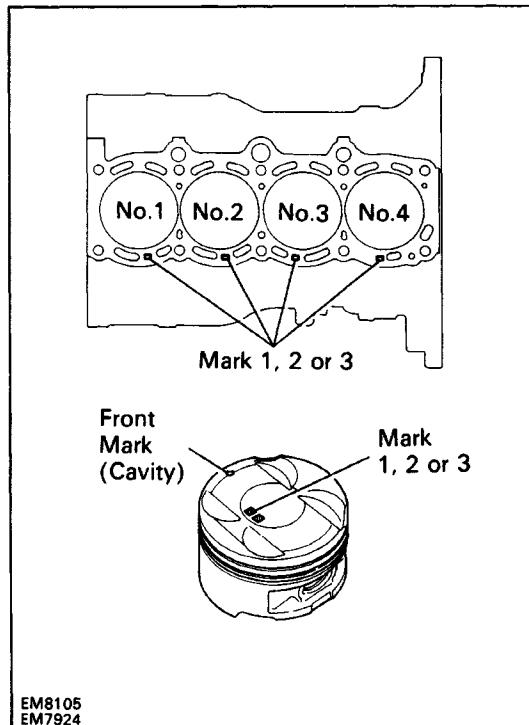
Standard oil clearance: 0.070 – 0.090 mm

(0.0028 – 0.0035 in.)

Maximum oil clearance: 0.110 mm (0.0043 in.)

If the oil clearance is greater than maximum, replace all the four pistons. 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.



B. Inspect piston ring groove clearance

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

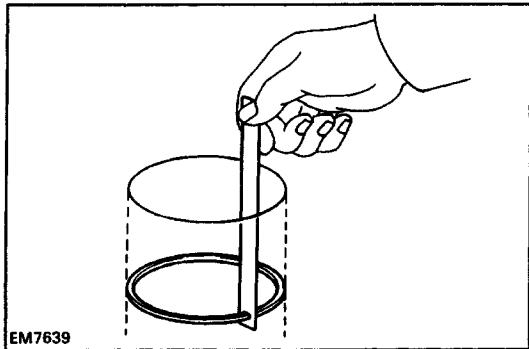
Ring groove clearance:

- No.1 0.040 – 0.080 mm**
(0.0016 – 0.0031 in.)
- No.2 0.030 – 0.070 mm**
(0.0012 – 0.0028 in.)

If the clearance is greater than maximum, replace the piston.

C. Inspect piston ring end gap

- (a) Insert the piston ring into the cylinder bore.
- (b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 100 mm (3.94 in.) from the top of the cylinder block.



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

Standard end gap:

No.1 0.330 – 0.550 mm

(0.0130 – 0.0217 in.)

No.2 0.450 – 0.670 mm

(0.0177 – 0.0264 in.)

Oil (Side rail) 0.200 – 0.600 mm

(0.0079 – 0.0236 in.)

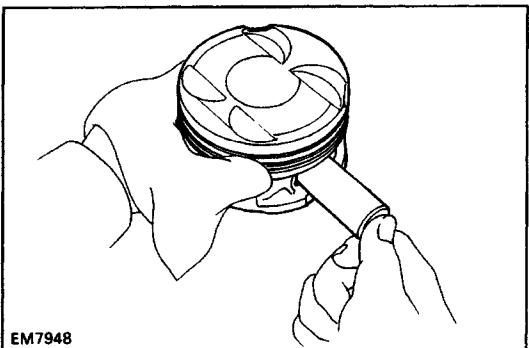
Maximum end gap:

No.1 0.85 mm (0.0335 in.)

No. 2 0.97 mm (0.0382 in.)

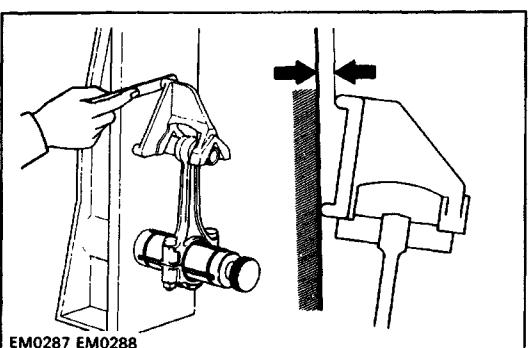
Oil (Side rail) 0.90 mm (0.0354 in.)

If the end gap is greater than maximum, replace the piston ring. If the end gap is greater than maximum, even with a new piston ring, replace the cylinder block.



D. Inspect piston pin fit

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



A. Inspect connecting rod alignment

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

- Check for bending.

Maximum bending:

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

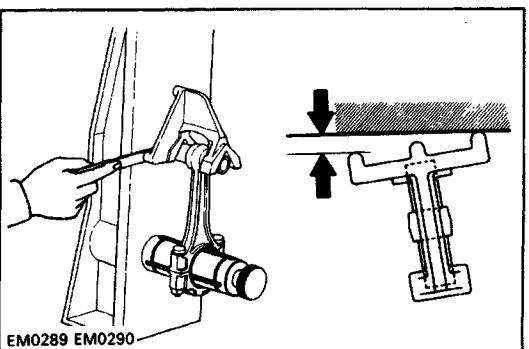
If bend is greater than maximum, replace the connecting rod assembly.

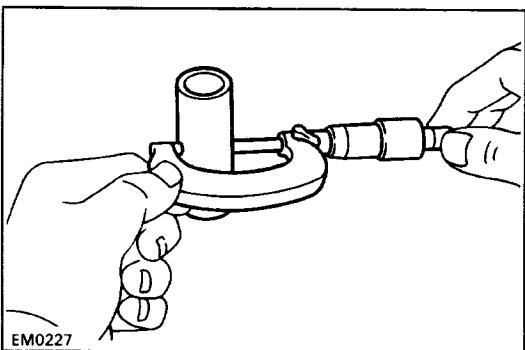
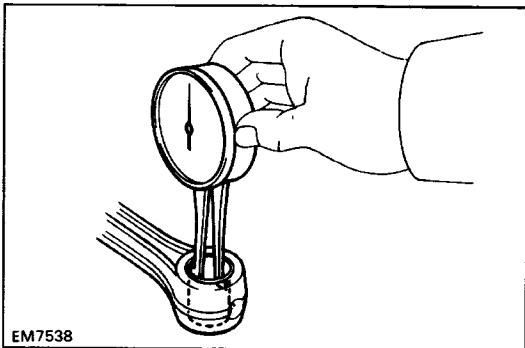
- Check for twist.

Maximum twist:

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

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





B. Inspect piston pin oil clearance

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

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

(b) Using a micrometer, measure the piston pin diameter.

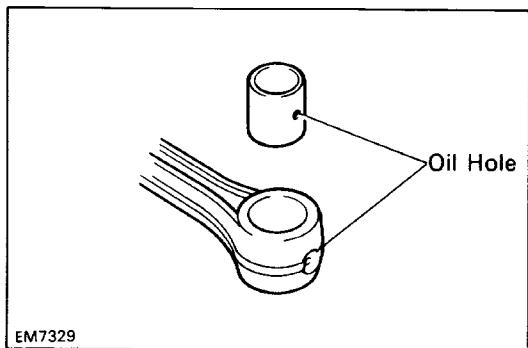
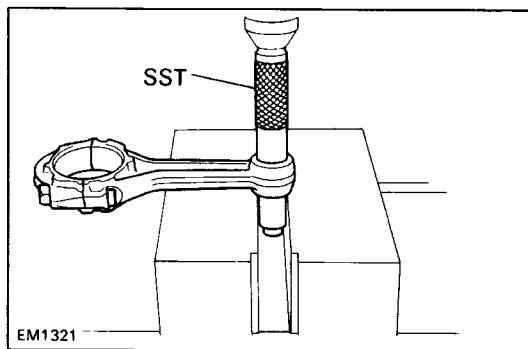
**Piston pin diameter: 21.997 – 22.009 mm
(0.8660 – 0.8665 in.)**

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

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

Maximum oil clearance: 0.05 mm (0.0020 in.)

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

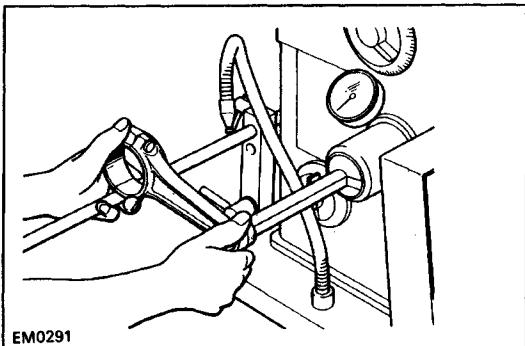


C. If necessary, replace connecting rod bushing

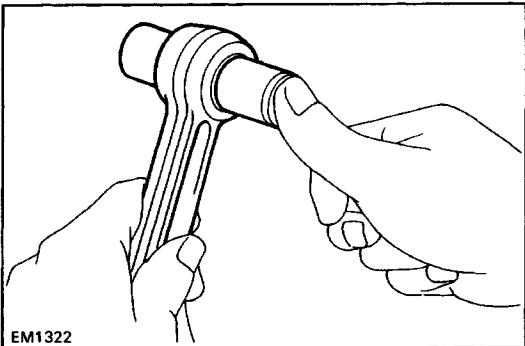
(a) Using SST and a press, press out the bushing.
SST 09222-30010

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

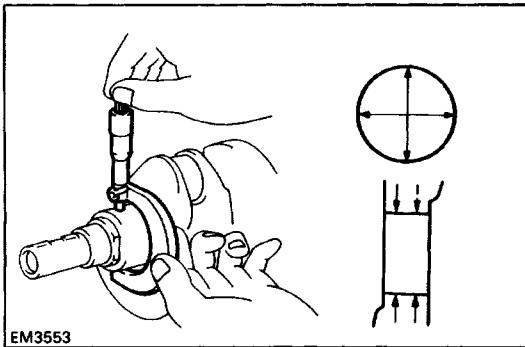
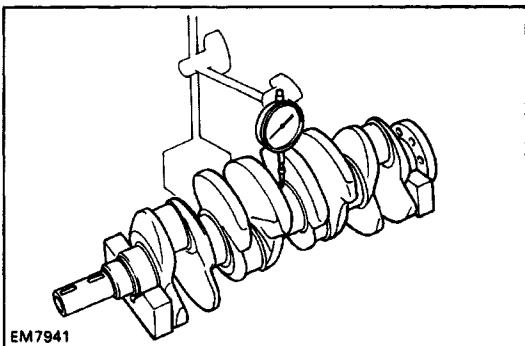
(c) Using SST and a press, press in the bushing.
SST 09222-30010



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



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



INSPECTION AND REPAIR OF CRANKSHAFT

1. INSPECT CRANKSHAFT FOR RUNOUT

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

Maximum circle runout: 0.06 mm (0.0024 in.)

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

2. INSPECT MAIN JOURNALS AND CRANK PINS

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

Main journal diameter:

STD	54.988 – 55.003 mm (2.1653 – 2.1655 in.)
U/S 0.25	54.745 – 54.755 mm (2.1553 – 2.1557 in.)

Crank pin diameter:

STD	47.985 – 48.000 mm (1.8892 – 1.8898 in.)
U/S 0.25	47.745 – 47.755 mm (1.8797 – 1.8801 in.)

If the diameter is not as specified, check the oil clearance (See pages EM-234 to 238). If necessary, grind or replace the crankshaft.

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

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

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

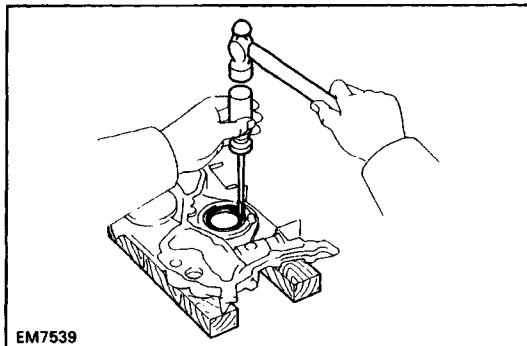
3. IF NECESSARY, GRIND AND HONE MAIN JOURNALS AND/ OR CRANK PINS

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

Install new main journal and/or crank pin undersized bearings.

REPLACEMENT OF CRANKSHAFT OIL SEALS

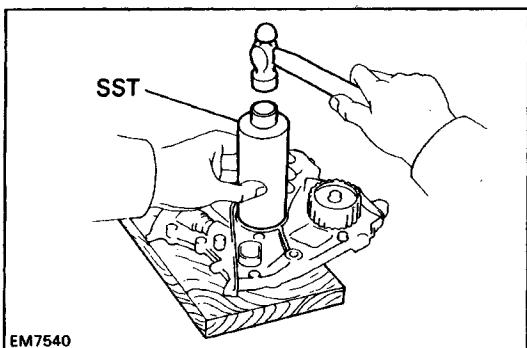
HINT: There are two methods (A and B) to replace the oil seal which are as follows:



1. REPLACE CRANKSHAFT FRONT OIL SEAL

A. If oil pump is removed from cylinder block:

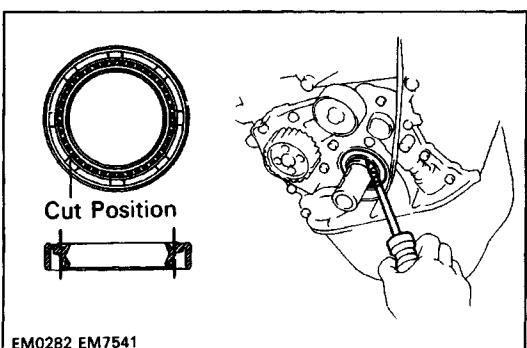
(a) Using screwdriver and hammer, tap out the oil seal.



(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump case edge.

SST 09226-10010

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



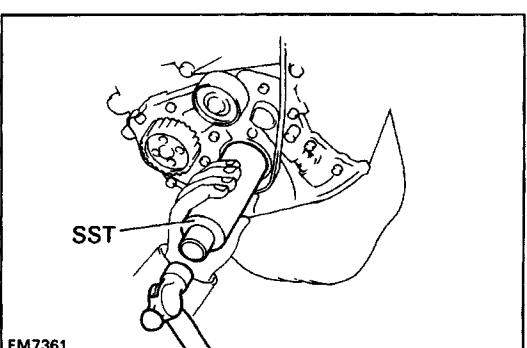
B. If oil pump is installed to the cylinder block:

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

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

NOTICE: Be careful not to damage the crankshaft.

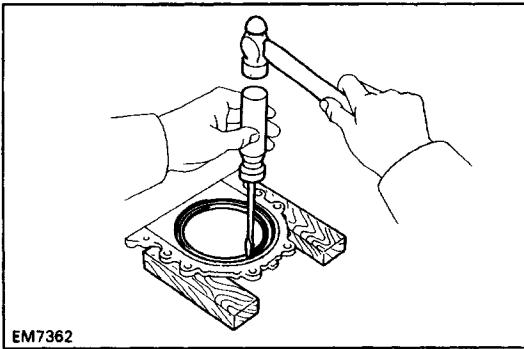
Tape the screwdriver tip.



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

(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump case edge.

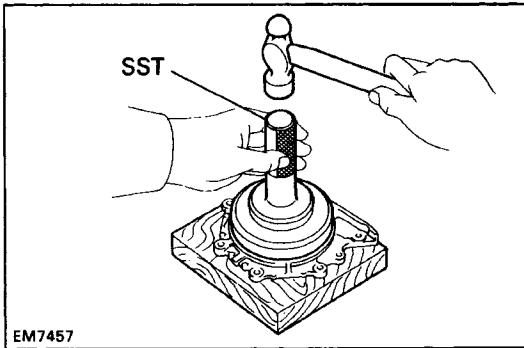
SST 09226-10010



2. REPLACE CRANKSHAFT REAR OIL SEAL

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

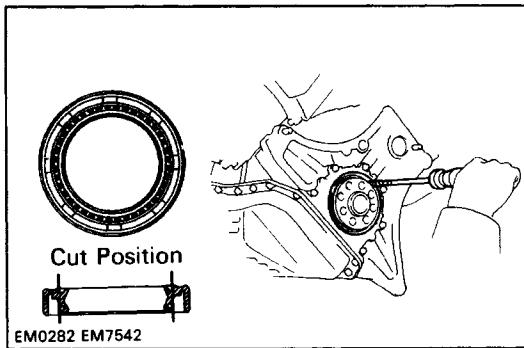
- Using screwdriver and hammer, tap out the oil seal.



- Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal edge.

SST 09223-63010

- Apply MP grease to the oil seal lip.



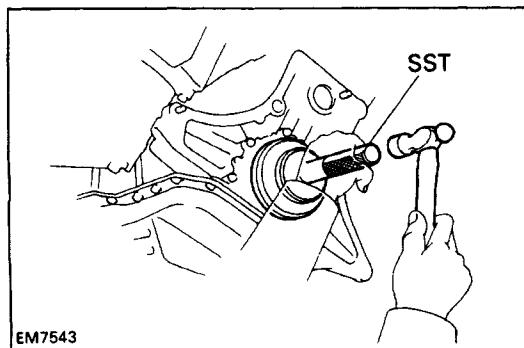
B. If rear oil seal retainer is installed to cylinder block:

- Using a knife, cut off the oil seal lip.

- Using a screwdriver, pry out the oil seal.

NOTICE: Be careful not to damage the crankshaft.

Tape the screwdriver tip.



- Apply M P grease to a new oil seal lip.

- Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

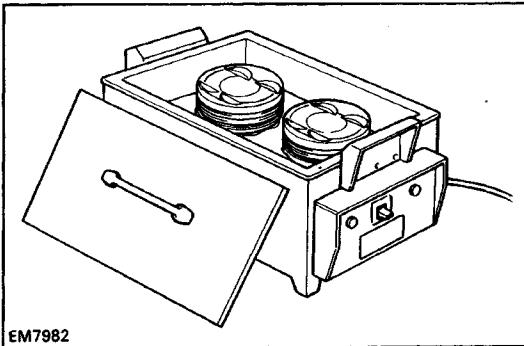
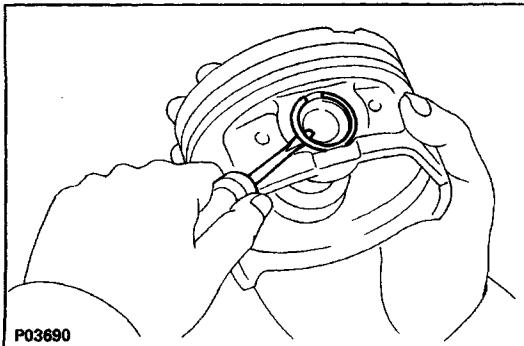
SST 09223-63010

ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

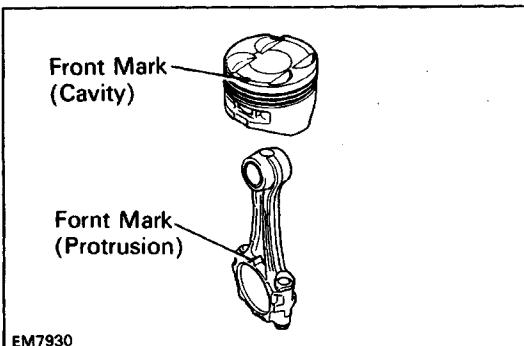
1. ASSEMBLE PISTON AND CONNECTING ROD

(a) Using a small screwdriver, install a new snap ring on one side of the piston pin hole.

HINT: Be sure that end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.

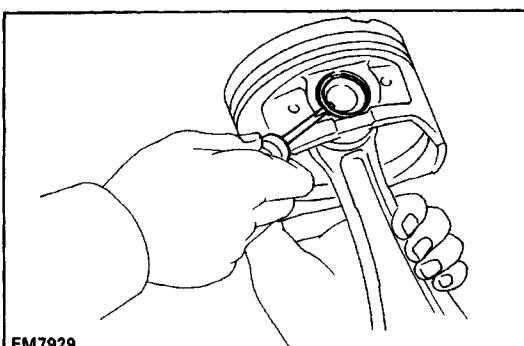


(b) Gradually heat the piston to 80 – 90°C (176 – 194°F).



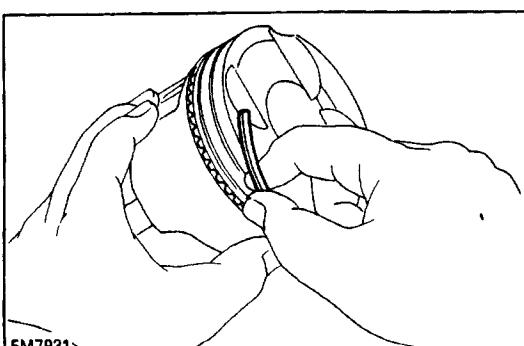
(c) Coat the piston pin with engine oil.

(d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.



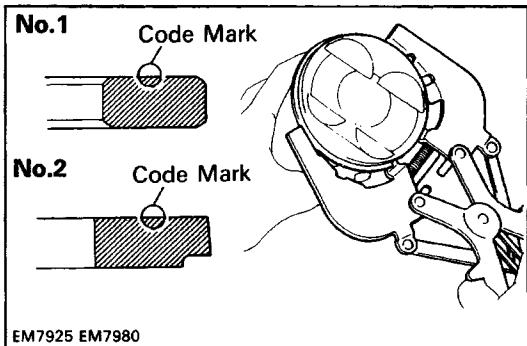
(e) Using a small screwdriver, install a new snap ring on the other side of the piston pin hole.

HINT: Be sure that end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.



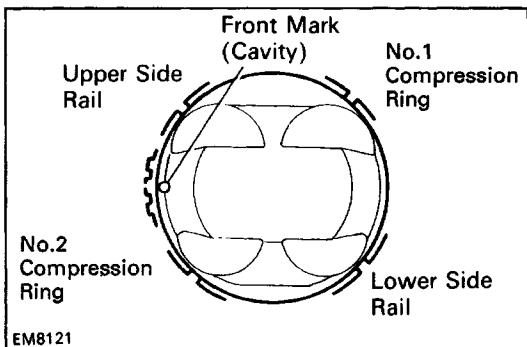
2. INSTALL PISTON RINGS

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



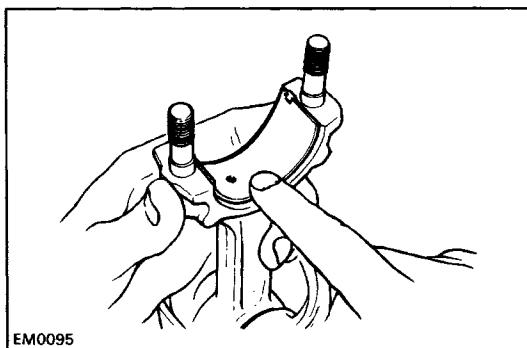
(b) Using a piston ring expander, install the two compression rings with the code mark facing upward.

Code mark: R



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

NOTICE: Do not align the ring ends.



3. INSTALL BEARINGS

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

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

ASSEMBLY OF CYLINDER BLOCK

(See page [EM-223](#))

HINT:

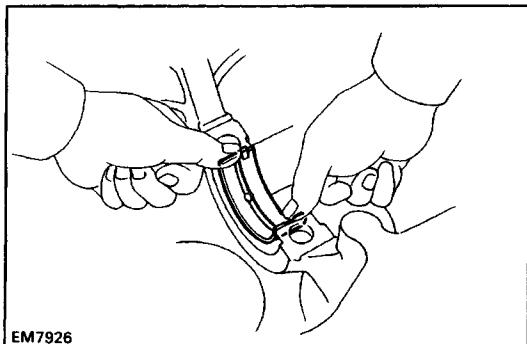
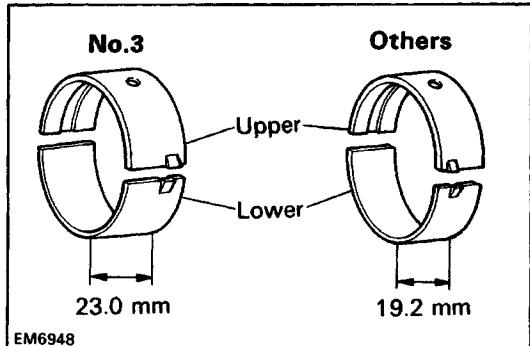
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

1. INSTALL OIL NOZZLES (See page [LU-31](#))

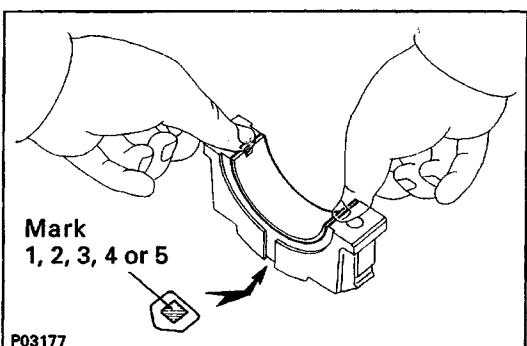
2. INSTALL MAIN BEARINGS

HINT:

- Main bearings come in widths of 19.2 mm (0.756 in.) and 23.0 mm (0.906 in.). Install the 23.0 mm (0.906 in.) bearings in the No.3 cylinder block journal position with the main bearing cap. Install the 19.2 mm (0.756 in.) bearings in the other positions.
- Upper bearings have an oil groove and oil holes; lower bearings do not.

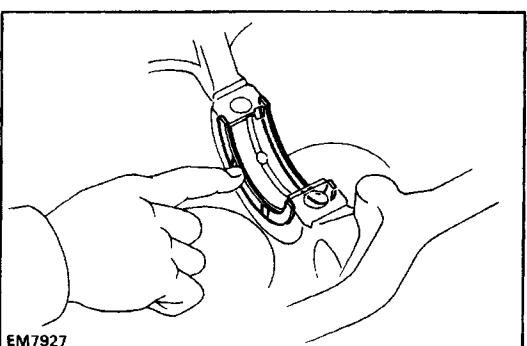


(a) Align the bearing claw with the claw groove of the cylinder block, and push in the five upper bearings.



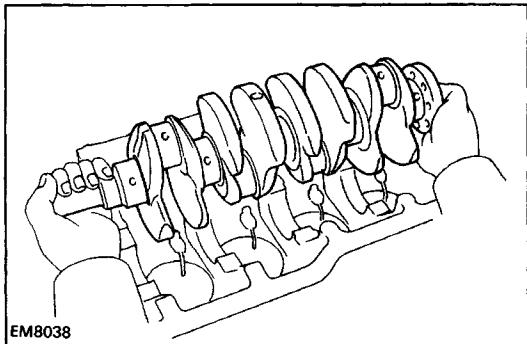
(b) Align the bearing claw with the claw groove of the main bearing cap, and push in the five lower bearings.

HINT: A number is marked on each main bearing cap to indicate the installation position.

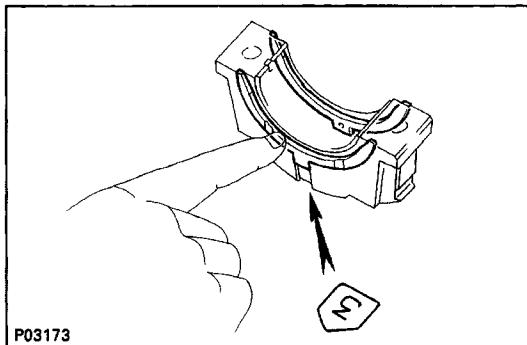


3. INSTALL UPPER THRUST WASHERS

Install the two thrust washers under the No.3 journal position of the cylinder block with the oil grooves facing outward.

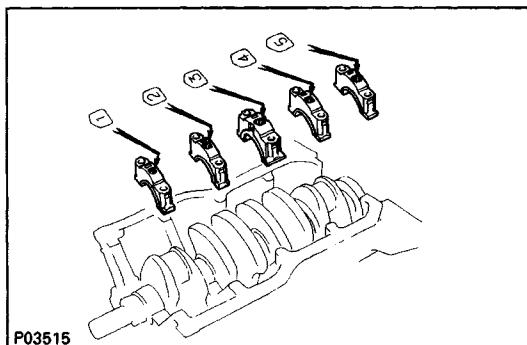


4. PLACE CRANKSHAFT ON CYLINDER BLOCK



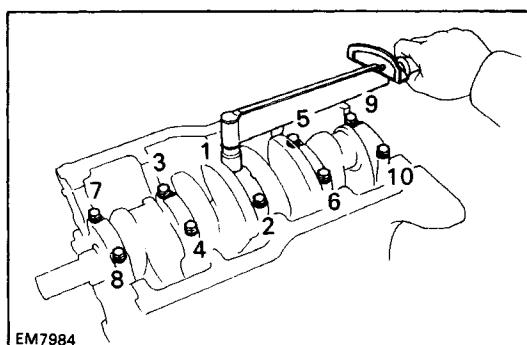
5. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

- Install the two thrust washers on the No.3 bearing cap with the grooves facing outward.



- Install the five main bearing caps in their proper locations.

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

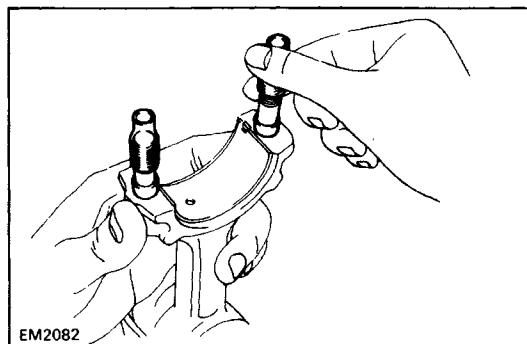


- Apply a light coat of engine oil on the threads and under the heads of the main bearing caps.

- Install and uniformly tighten the ten bolts of the main bearing caps in several passes in the sequence shown.

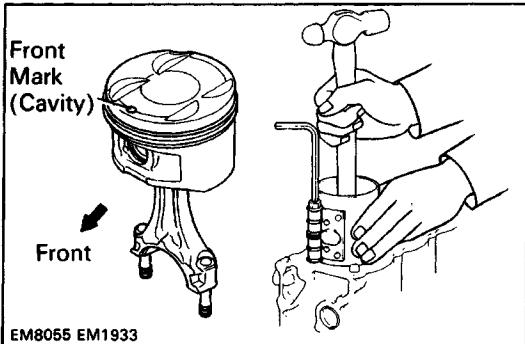
Torque: 59 N·m (600 kgf·cm, 43 ft-lbf)

- Check that the crankshaft turns smoothly.
- Check the crankshaft thrust clearance.
(See step 5 on page [EM-236](#))

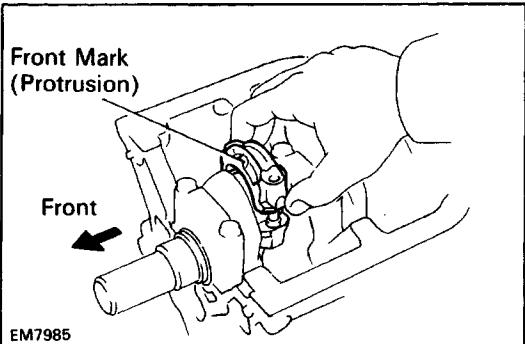


6. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

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



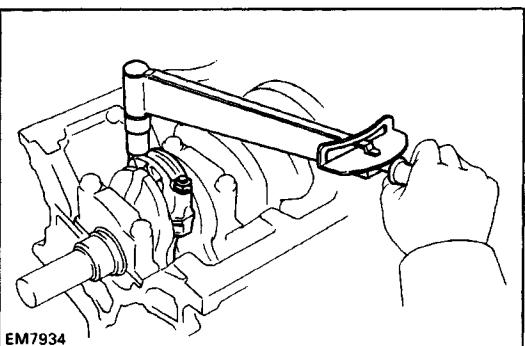
(b) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.



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.



(c) Apply a light coat of engine oil on the threads and under the cap nuts.

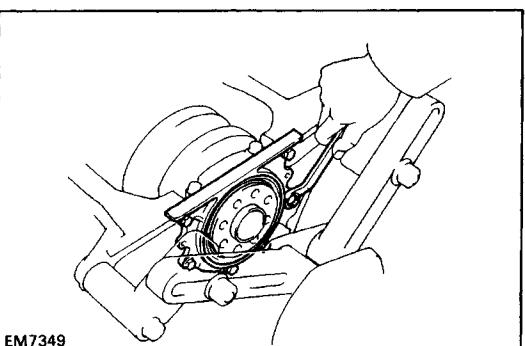
(d) Using SST, install and alternately tighten the cap nuts in several passes.

Torque: 67 N·m (680 kgf·cm, 49 ft-lbf)

(e) Check that the crankshaft turns smoothly.

(f) Check the connecting rod thrust clearance.

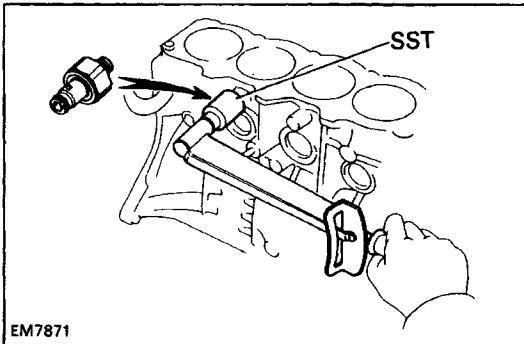
(See step 2 on page [EM-234](#))



8. INSTALL REAR OIL SEAL RETAINER

Install a new gasket and the retainer with the six bolts.

Torque: 9.3 N·m (95 kgf·cm, 82 in-lbf)



EM7871

POST ASSEMBLY

1. INSTALL KNOCK SENSOR

Using SST, install the knock sensor.

SST 09816-30010

Torque: 44 N·m (450 kgf·cm, 33 ft-lbf)

2. INSTALL OIL COOLER (See pages [LU-26](#) and 27)

3. INSTALL OIL FILTER (See page [LU-7](#))

4. INSTALL OIL PUMP AND OIL PAN

(See pages [LU-21](#) to 23)

5. INSTALL WATER PUMP AND IDLER PULLEY BRACKET (See pages [CO-14](#) and 15)

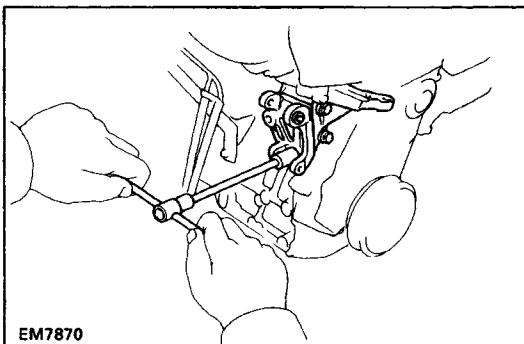
6. INSTALL CYLINDER HEAD

(See pages [EM-140](#) to 148)

7. INSTALL TURBOCHARGER (See pages [TC-15](#) to 17)

8. INSTALL PULLEYS AND TIMING BELT

(See pages [EM-55](#) to 60)



EM7870

9. INSTALL RH ENGINE MOUNTING BRACKET

Install the mounting bracket with the three bolts.

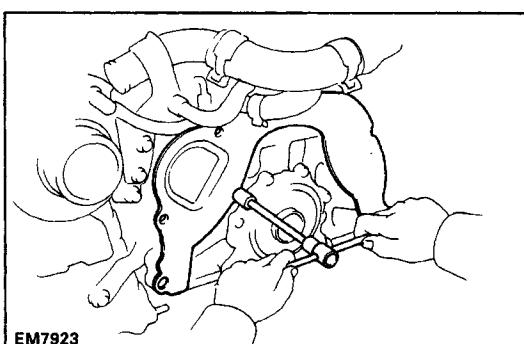
Torque: 52 N·m (530 kgf·cm, 38 ft-lbf)

10. INSTALL PS PUMP BRACKET

Install the PS pump bracket with the three bolts.

Torque: 43 N·m (440 kgf·cm, 32 ft-lbf)

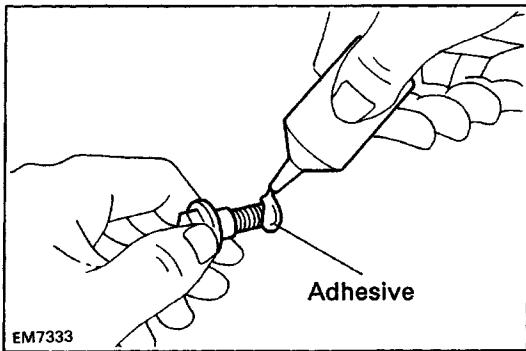
11. REMOVE ENGINE STAND



EM7923

12. INSTALL REAR END PLATE

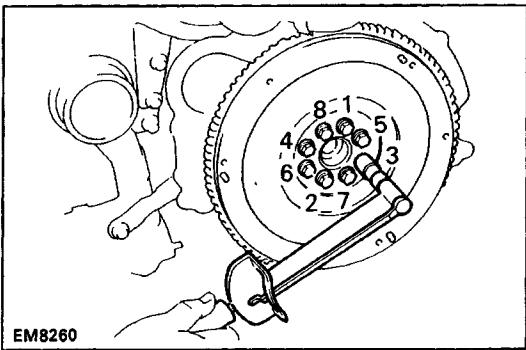
Torque: 9.3 N·m 195 kgf·cm, 82 in-lbf)



13. INSTALL FLYWHEEL

- Apply adhesive to two or three threads of the mounting bolt end.

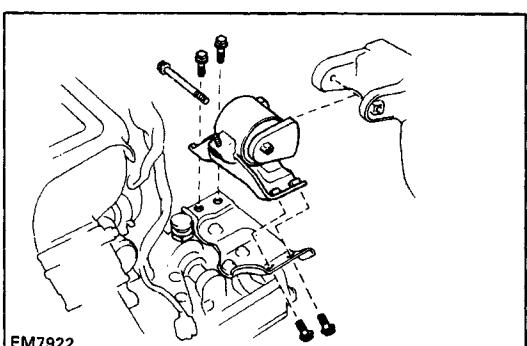
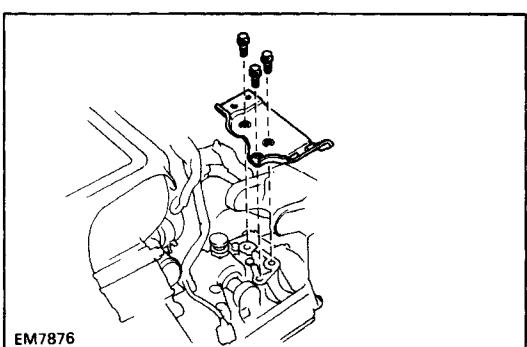
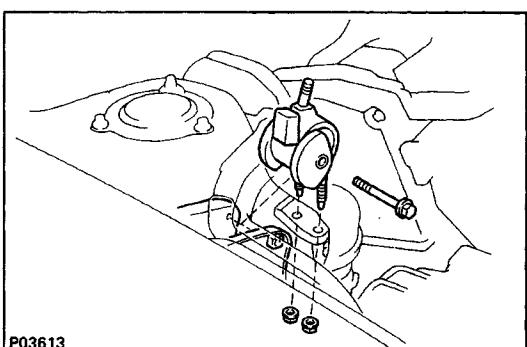
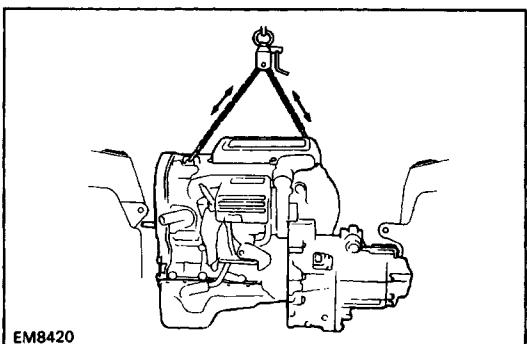
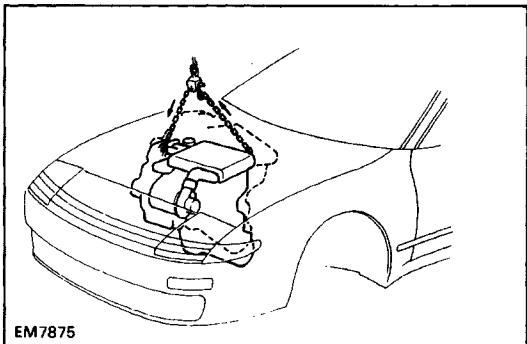
Adhesive: Part No. 08833-00070, THREE BOND 1324 or equivalent



- Install the flywheel on the crankshaft.
- Install and uniformly tighten the mounting bolts in several passes in the sequence shown.

Torque: 108 N·m (1,100 kgf·cm, 80 ft-lbf)

14. INSTALL CLUTCH DISC AND COVER (See CL section)



INSTALLATION OF ENGINE

1. ASSEMBLE ENGINE AND TRANSAXLE (See MT section)

2. INSTALL ENGINE AND TRANSAXLE ASSEMBLY IN VEHICLE

- (a) Attach the engine chain hoist to the engine hangers.
- (b) Lower the engine into the engine compartment. Tilt the transaxle downward, lower the engine and clear the LH mounting.

NOTICE: Be careful not to hit the PS gear housing.

- (c) Keep the engine level, and align RH and LH mountings with the body bracket.

- (d) Attach the RH mounting insulator to the mounting bracket and body, and temporarily install the through bolt and two nuts.

- (e) Install the LH mounting bracket to the transaxle case with the three bolts.

Torque: 52 N·m (530 kgf·cm, 38 ft-lbf)

- (f) Attach the LH mounting insulator to the mounting bracket and body with the through bolt and four bolts. Tighten the bolts.

Torque:

Bolt 63 N·m (650 kgf·cm, 47 ft-lbf)

Through bolt 87 N·m (890 kgf·cm, 64 ft-lbf)

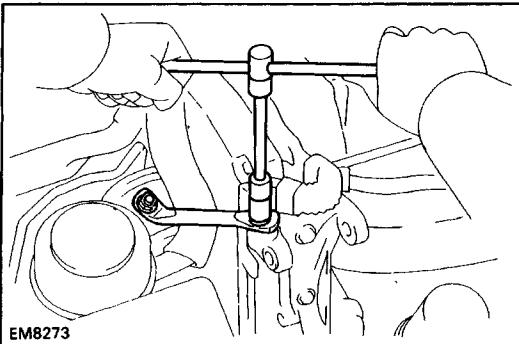
- (g) Tighten the through bolt and two nuts of the RH mounting insulator.

Torque:

Nut 52 N·m (530 kgf·cm, 38 ft-lbf)

Through bolt 87 N·m (890 kgf·cm, 64 ft-lbf)

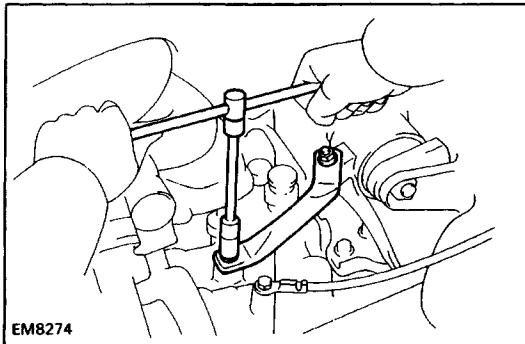
- (h) Remove the engine chain hoist from the engine.



3. INSTALL RH ENGINE MOUNTING STAY

Install the mounting stay with the bolt and nut.

Torque: 73 N·m (740 kgf·cm, 54 ft-lbf)



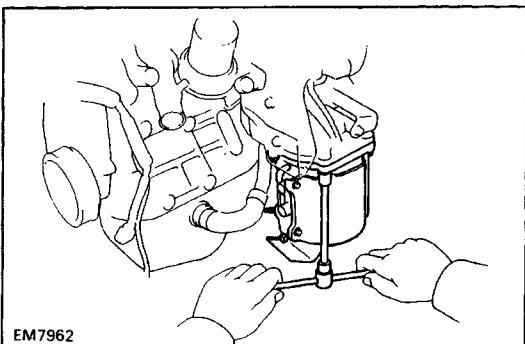
4. INSTALL LH ENGINE MOUNTING STAY

Install the mounting stay with the bolt and nut.

Torque: 21 N·m (210 kgf·cm, 15 ft-lbf)

5. CONNECT GROUND STRAP

Connect the ground strap to the transaxle with the bolt.

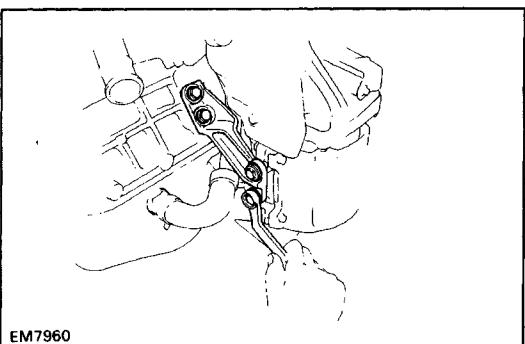


6. INSTALL CATALYTIC CONVERTER

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

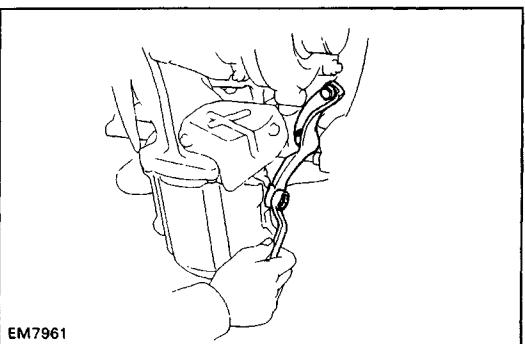
(b) Install the catalytic converter with the three bolts and two nuts.

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



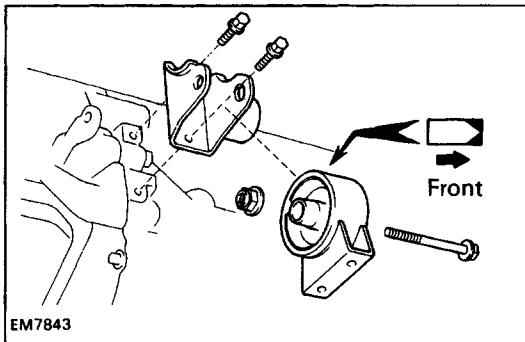
(c) Install the RH converter stay with the four bolts.

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



(d) Install the LH converter stay with the three bolts.

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

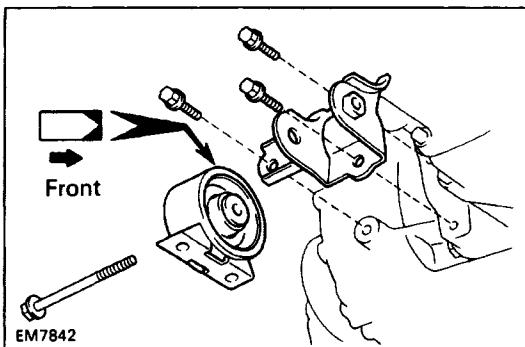


7. INSTALL FRONT ENGINE MOUNTING BRACKET AND INSULATOR

(a) Install the mounting bracket with the two bolts.

Torque: 77 N·m (790 kgf·cm, 57 ft·lbf)

(b) Temporarily install the mounting insulator with the through bolt and nut.

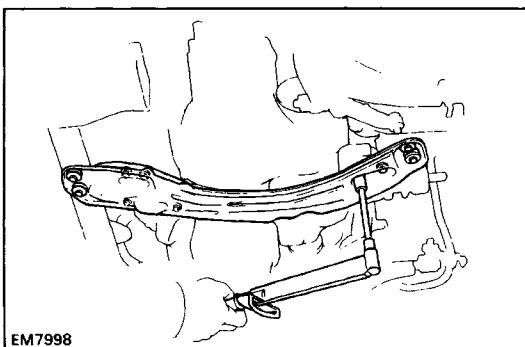


8. INSTALL REAR ENGINE MOUNTING BRACKET AND INSULATOR

(a) Install the mounting bracket with the three bolts.

Torque: 77 N·m (790 kgf·cm, 57 ft·lbf)

(b) Temporarily install the mounting insulator with the through bolt.



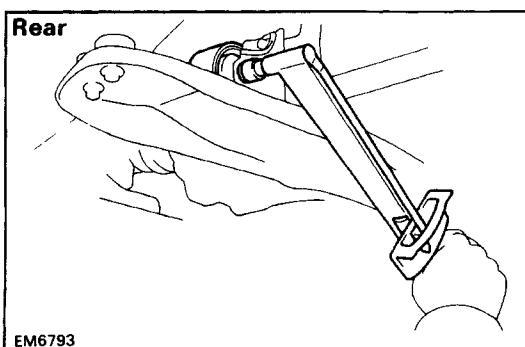
9. INSTALL ENGINE MOUNTING CENTER MEMBER

(a) Install the engine mounting center member with the four bolts.

Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)

(b) Install and torque the four bolts holding the insulators to the center member.

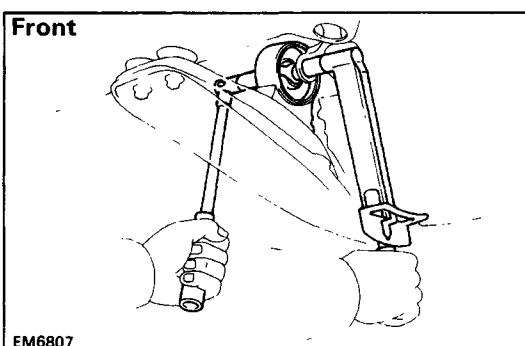
Torque: 73 N·m (740 kgf·cm, 54 ft·lbf)



10. TIGHTEN FRONT AND REAR ENGINE MOUNTING THROUGH BOLTS

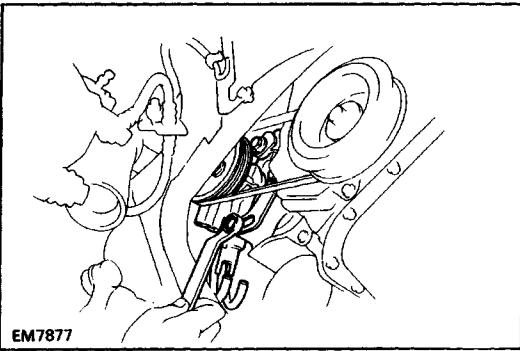
(a) Tighten the rear through bolt.

Torque: 87 N·m (890 kgf·cm, 64 ft·lbf)



(b) Tighten the front through bolt.

Torque: 87 N·m (890 kgf·cm, 64 ft·lbf)



11. INSTALL PS PUMP

(a) Install the PS pump with the four bolts.

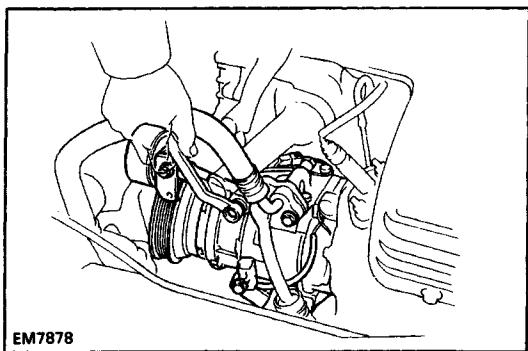
Torque:

Adjusting bolt 39 N·m (400 kgf·cm, 29 ft·lbf)

Others 43 N·m (440 kgf·cm, 32 ft·lbf)

(b) Install the drive belt.

(c) Connect the two air hoses to the air pipe.



12. INSTALL A/C COMPRESSOR AND IDLER PULLEY BRACKET

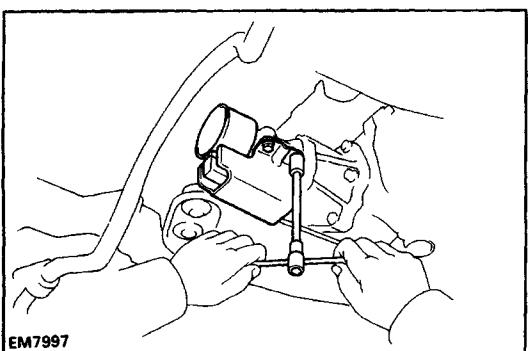
(a) Install the compressor and idler pulley bracket with the four bolts.

Torque: 27 N·m (280 kgf·cm, 20 ft·lbf)

(b) Connect the two connectors.

(c) Connect the A/C compressor connector.

13. INSTALL ALTERNATOR (See page CH-23)

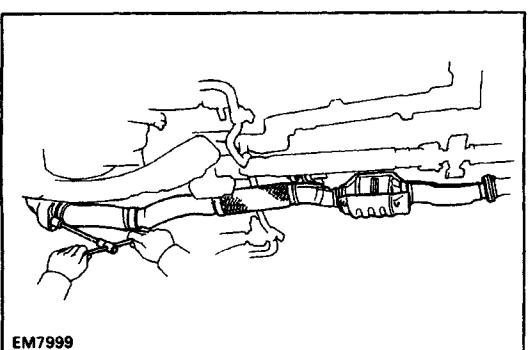


14. INSTALL DEFLECTOR TO TRANSFER EXTENSION HOUSING

15. INSTALL DYNAMIC DAMPER TO TRANSFER EXTENSION HOUSING

16. INSTALL FRONT PROPELLER SHAFT (See PR section)

17. INSTALL DRIVE SHAFTS (See SA section)



18. INSTALL FRONT EXHAUST PIPE

(a) Install the support hook on the front exhaust pipe to the support bracket.

(b) Place two new gaskets on the front and rear of the front exhaust pipe.

(c) Temporarily install the two bolts and new nuts holding the exhaust pipe to the center exhaust pipe.

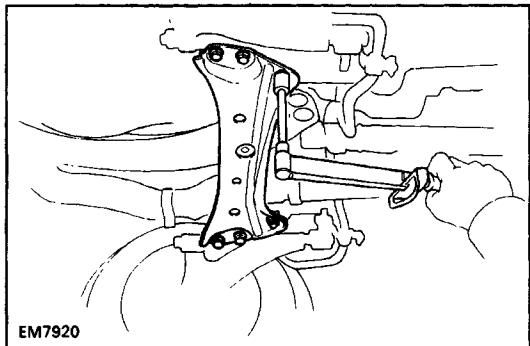
(d) Using a 14 mm deep socket wrench, install the three new nuts holding the exhaust pipe to the catalytic converter.

Torque: 62 N·m (630 kgf·cm, 46 ft·lbf)

(e) Tighten the two bolts and nuts holding the exhaust pipe to the center exhaust pipe.

Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)

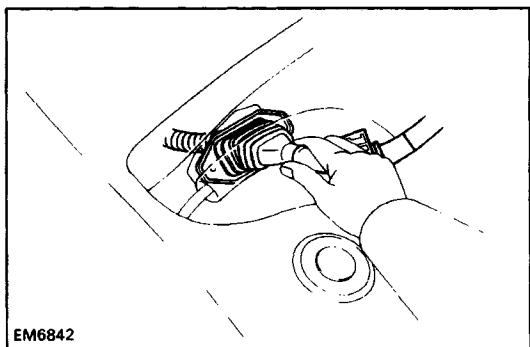
(f) Install the clamp with the bolt.



19. INSTALL SUSPENSION LOWER CROSSMEMBER

Install the lower crossmember with the four bolts and two nuts.

Torque: 152 N·m (1,550 kgf·cm, 112 ft·lbf)

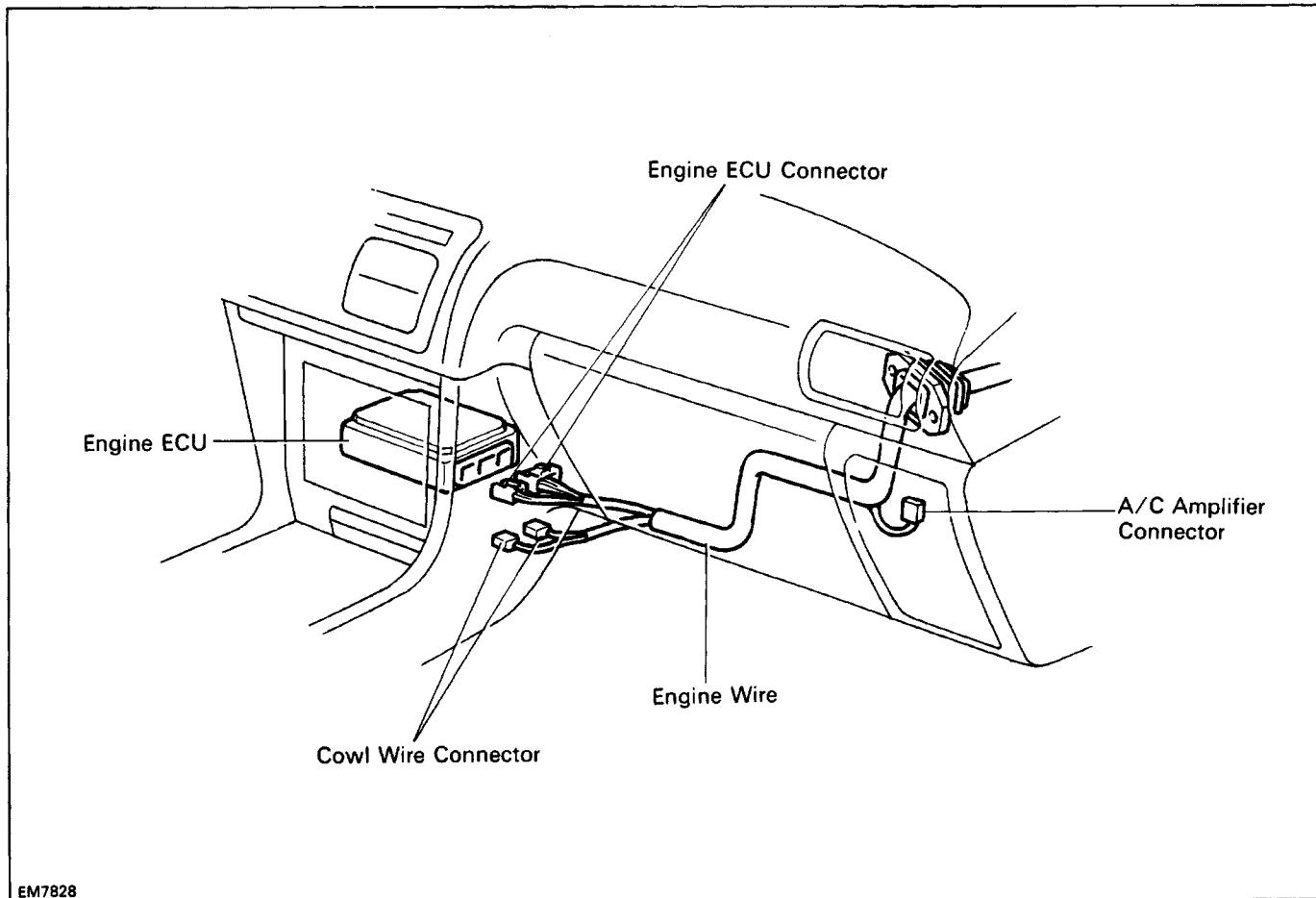


20. CONNECT ENGINE WIRE TO CABIN

(a) Push in the engine wire through the cowl panel.
Install the two nuts.

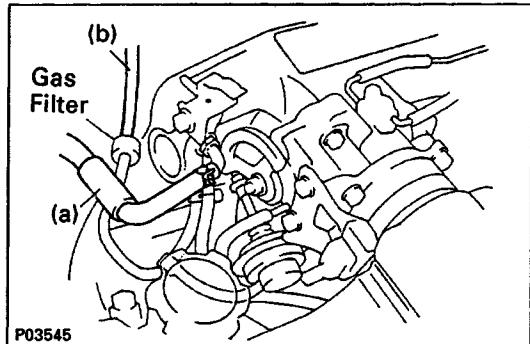
(b) Connect the following connectors.

- (1) Two engine ECU connectors
- (2) Two cowl wire connectors
- (3) A/C amplifier connector

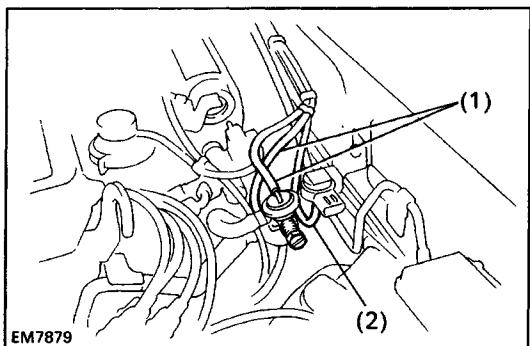


21. CONNECT ENGINE WIRE

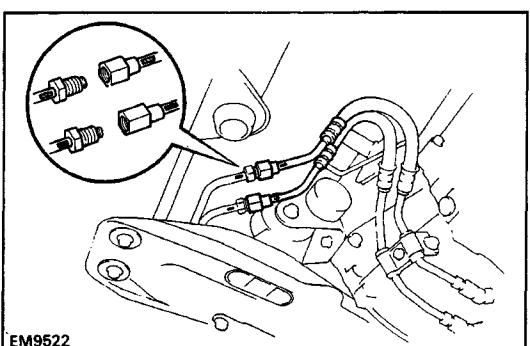
- (a) Engine wire clamp to wire bracket on RH fender apron
- (b) Two cowl wire connectors

**22. CONNECT HOSES**

- (a) Brake booster vacuum hose from intake manifold
- (b) Turbocharging pressure sensor hose from gas filter

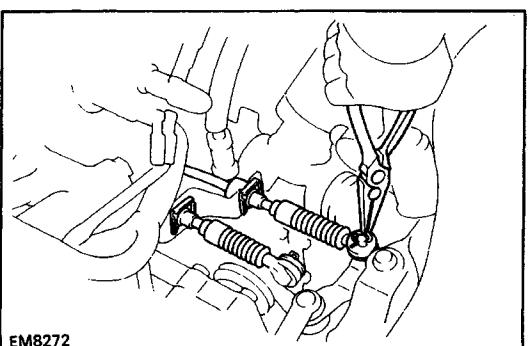
**23. INSTALL TURBOCHARGING PRESSURE SENSOR AND A/C ASV**

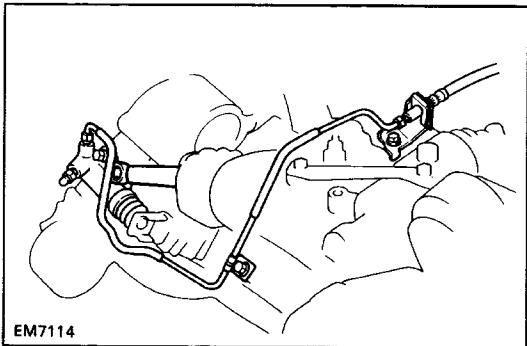
- (a) Install the turbocharging pressure sensor and A/C ASV with the bolt.
- (b) Connect the following hoses:
 - (1) Two vacuum hoses to ASV (from A/C ASV)
 - (2) Vacuum hose to ASV (from turbocharging pressure sensor)
- (c) Connect turbocharging pressure sensor connector.

**24. CONNECT TRANSAXLE OIL COOLER TUBE**

- (a) Align the matchmarks on the oil cooler hoses and tubes.
- (b) Connect the two oil cooler hoses.

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

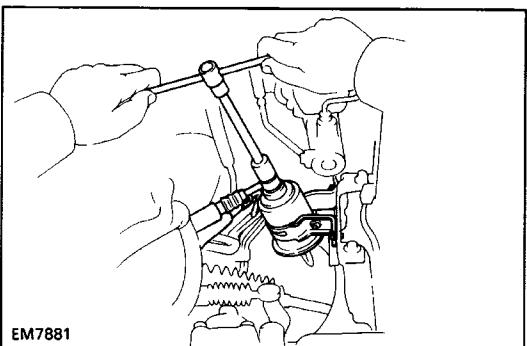
**25. CONNECT TRANSAXLE CONTROL CABLES TO TRANSAXLE**

**26. INSTALL CLUTCH RELEASE CYLINDER**

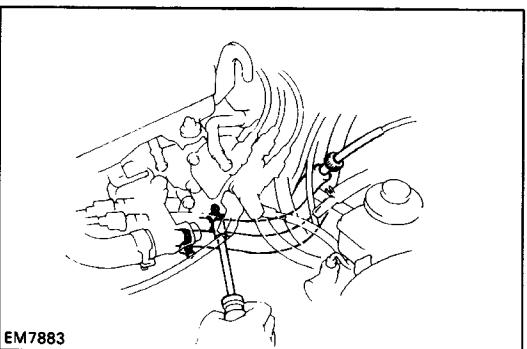
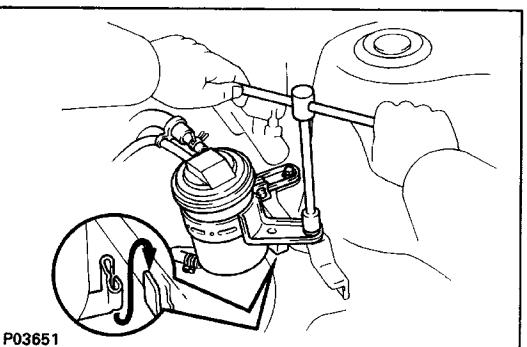
Install the release cylinder and tube with the four bolts.

27. INSTALL STARTER (See page ST-22)**28. CONNECT CONNECTORS**

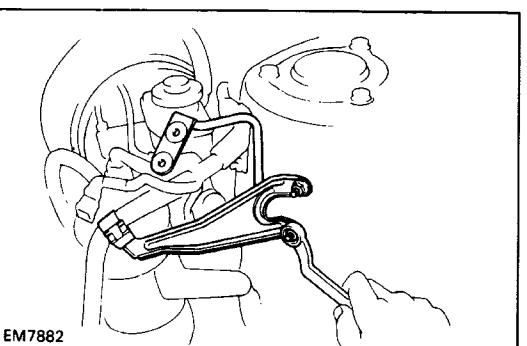
- (1) Engine room wire connector
- (2) Noise filter connector

**29. CONNECT FUEL HOSES**

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

**30. CONNECT SPEEDOMETER CABLE****31. CONNECT HEATER HOSES****32. INSTALL CHARCOAL CANISTER**

- (a) Install the charcoal canister with the two bolts.
- (b) Connect the three hoses.

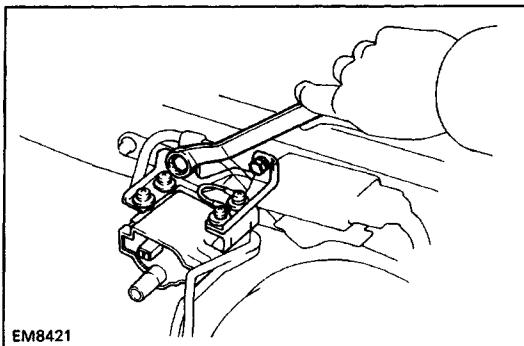
**33. INSTALL ENGINE WIRE BRACKET**

- (a) Install the wire bracket with the two bolts. Install the noise filter.

- (b) Install the wire clamp to the wire bracket.

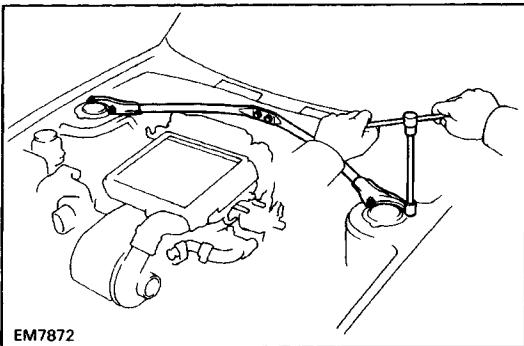
34. CONNECT WIRES AND CONNECTORS

- (a) Check connector
- (b) Igniter connector
- (c) Ground strap from LH fender apron



35. INSTALL IGNITION COIL

- (a) Install the ignition coil with the two bolts.
- (b) Connect the high-tension cord.
- (c) Connect the ignition coil connector.

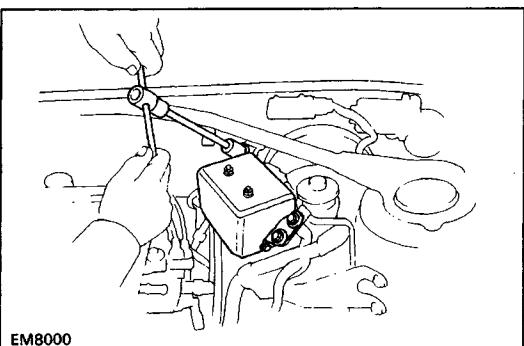


36. INSTALL SUSPENSION UPPER BRACE

- (a) Install the suspension upper brace with the two bolts and four bolts.

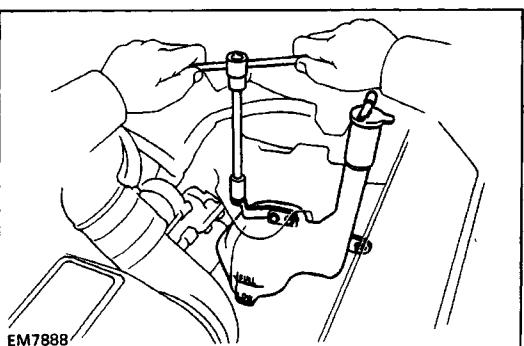
Torque: Bolt 21 N·m (210 kgf·cm, 15 ft-lbf)
Nut 64 N·m (650 kgf·cm, 47 ft-lbf)

- (b) Install the outside lower windshield moulding.
- (c) Install the two wiper arms.



37. (w/ CRUISE CONTROL SYSTEM) INSTALL CRUISE CONTROL ACTUATOR

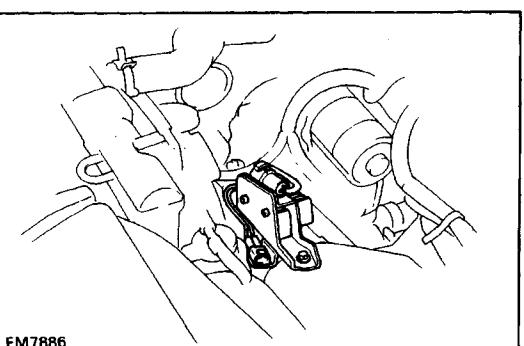
- (a) Connect the cable to the actuator.
- (b) Connect the actuator connector
- (c) install the actuator with the three bolts.
- (d) Install the actuator cover with the two nuts.



38. INSTALL RADIATOR RESERVOIR TANK

Install the reservoir tank with the two nuts.

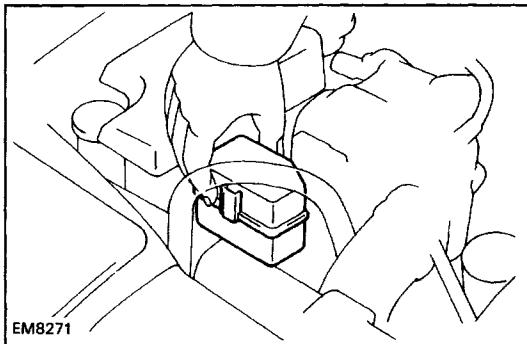
39. INSTALL RADIATOR (See pages [CO-24](#) and [25](#))



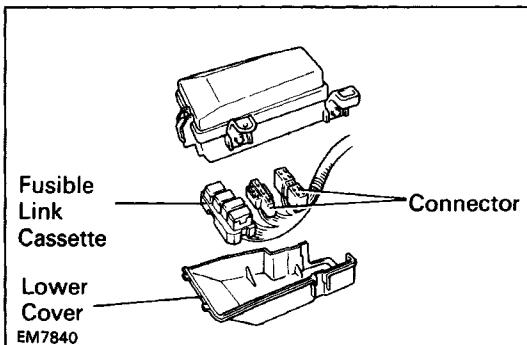
40. INSTALL INJECTOR SOLENOID RESISTOR AND FUEL PUMP RESISTOR

- (a) Install the solenoid resistor and fuel pump resistor with the bolt.
- (b) Connect the two connectors.

41. INSTALL BATTERY

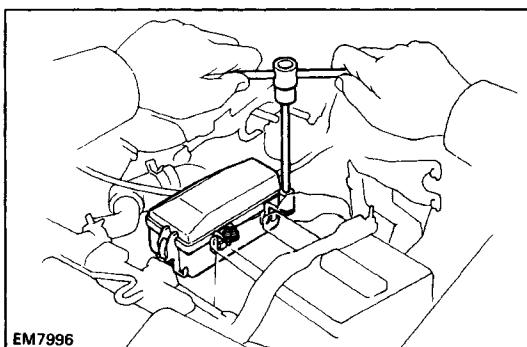


42. INSTALL A/C RELAY BOX



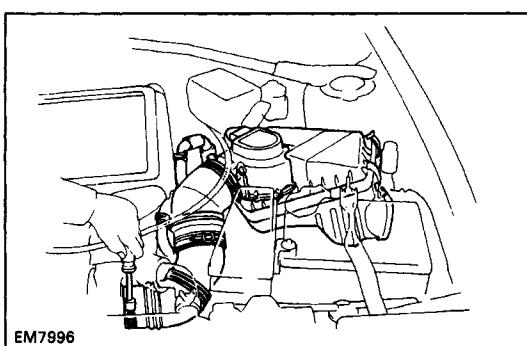
43. CONNECT ENGINE WIRE, AND INSTALL ENGINE RELAY BOX

- Connect the fusible link cassette and two connectors of the engine wire to the relay box.
- Install the lower cover to the relay box.



- Install the relay box with the two nuts.

44. INSTALL ACCELERATOR CABLE, AND ADJUST IT



45. INSTALL AIR CLEANER

- Install the air cleaner case with the three bolts.
- Install the air cleaner element.
- Connect the following hoses:
 - Air cleaner hose to turbocharger
 - PCV hose to cylinder head cover
 - Air hose to air pipe
- Install the air cleaner cap and air flow meter.
- Connect the air flow meter connector.

46. FILL WITH TRANSAXLE OIL (See. page [MA-14](#))

Capacity: 5.2 liters (5.1 US qts, 4.6 Imp. qts)

47. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

48. FILL WITH ENGINE COOLANT (See page [CO-6](#))

Capacity (w/ Heater):

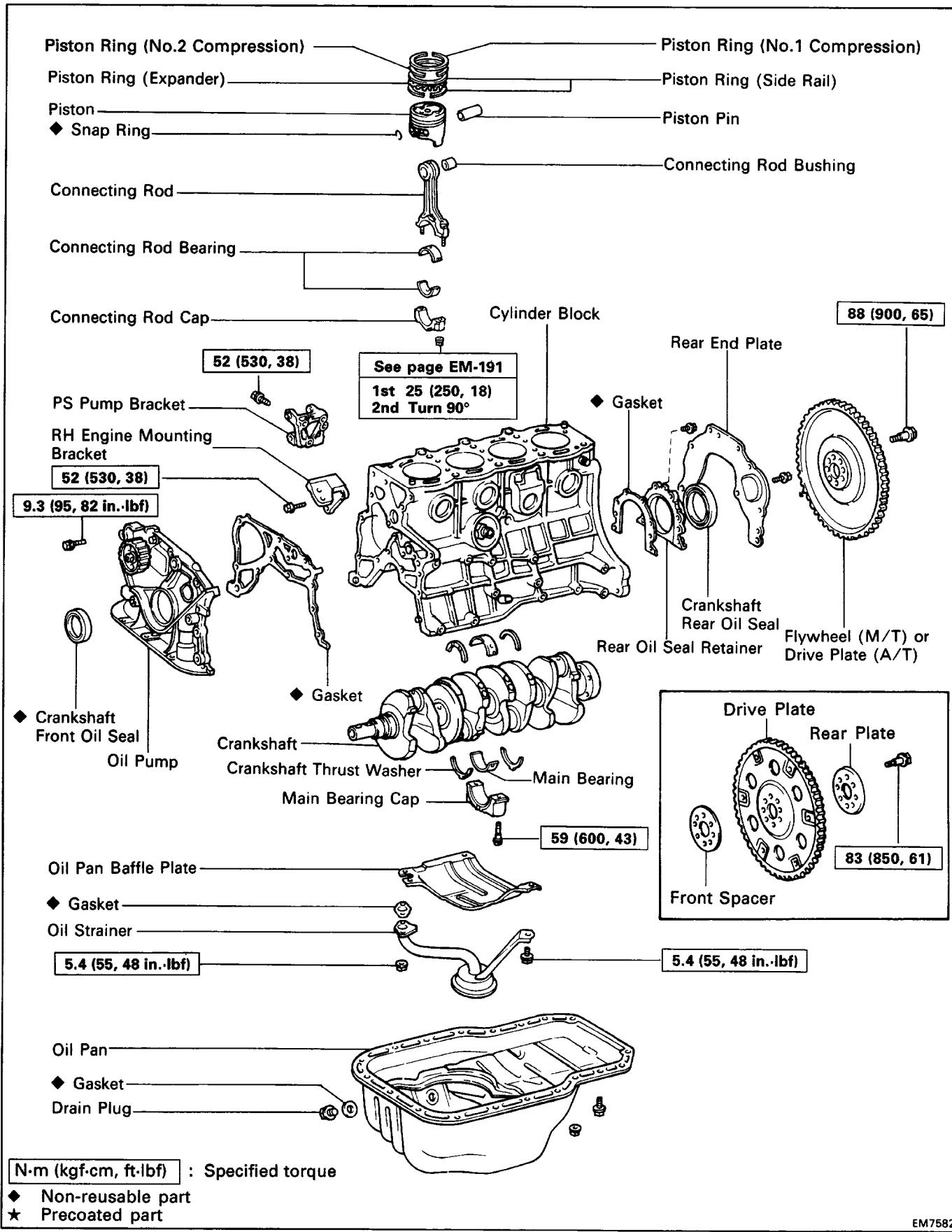
6.5 liters (6.9 US qts, 5.7 Imp. qts)

49. FILL WITH ENGINE OIL (See page [LU-8](#))**Capacity:****Drain and refill .****w/ Oil filter change****3.9 liters (4.1 US qts, 3.4 Imp. qts)****w/o Oil filter change****3.6 liters (3.8 US qts, 3.2 Imp. qts)****Dry fill 4.3 liters (4.5 US qts, 3.8 Imp. qts)****50. START ENGINE AND CHECK FOR LEAKS****51. PERFORM ENGINE ADJUSTMENT****(a) Adjust the alternator drive belt.****Drive belt tension:****w/ A/C New belt 165 ± 10 lbf****Used belt 84 ± 15 lbf****w/o A/C New belt 150 ± 25 lbf****Used belt 130 ± 20 lbf****(b) Adjust the PS drive belt.****Drive belt tension: New belt 125 ± 25 lbf****Used belt 80 ± 20 lbf****(c) Adjust the ignition timing. (See page [IG-29](#))****Ignition timing:** **10° BTDC @ idle****(w/ Terminals TO and E1 connected)****52. INSTALL ENGINE UNDER COVERS****53. INSTALL HOOD****54. PERFORM ROAD TEST**

Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

55. RECHECK ENGINE COOLANT AND OIL LEVELS

CYLINDER BLOCK (5S-FE) COMPONENTS



REMOVAL OF ENGINE

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

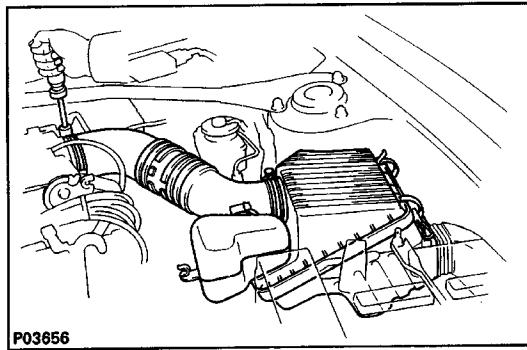
CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (-) terminal cable is disconnected from the battery.

2. REMOVE HOOD

3. REMOVE ENGINE UNDER COVERS

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

5. DRAIN ENGINE OIL (See page [LU-7](#))



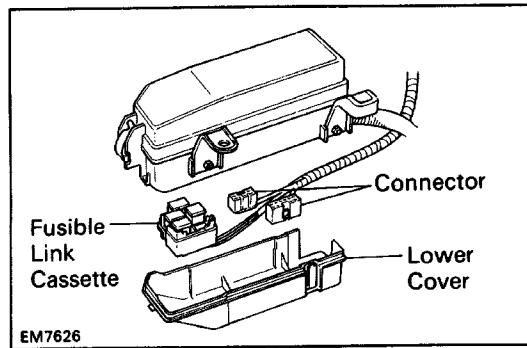
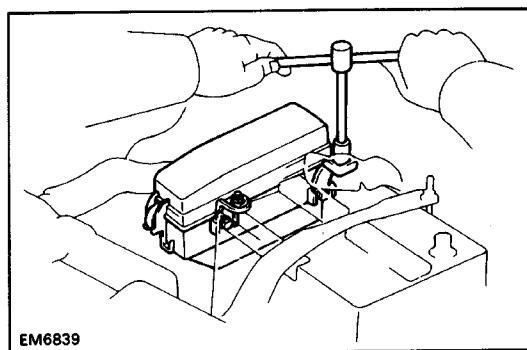
6. REMOVE AIR CLEANER

- (a) Disconnect the air intake temperature sensor connector.
- (b) Disconnect the four air cleaner cap clips.
- (c) Disconnect the air cleaner hose from the throttle body, and remove the air cleaner cap and element.
- (d) Remove the three bolts and air cleaner case.

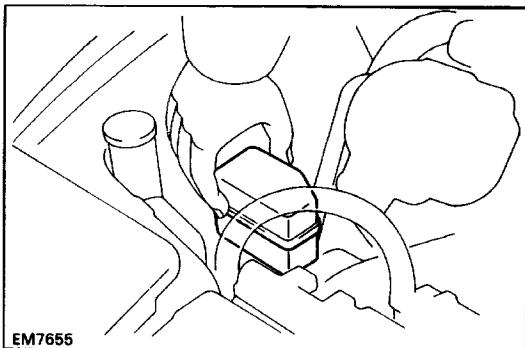
7. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY

8. REMOVE ENGINE RELAY BOX, AND DISCONNECT ENGINE WIRE CONNECTORS

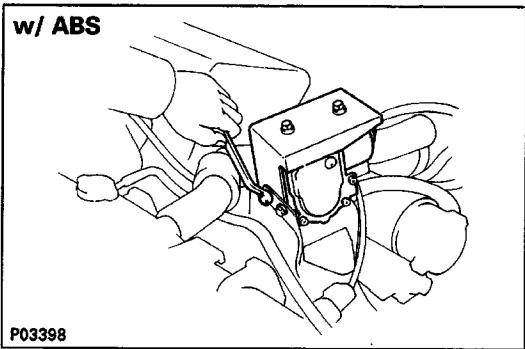
- (a) Remove the two nuts, and disconnect the relay box from the battery.



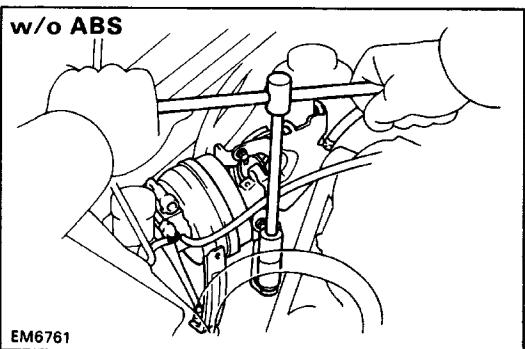
- (b) Remove the lower cover from the relay box.
- (c) Disconnect the fusible link cassette and two connectors of the engine wire from the relay box.

**9. REMOVE A/C RELAY BOX FROM BRACKET**

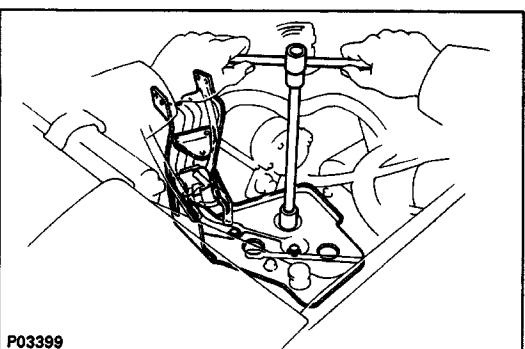
Remove the A/C relay box from the bracket.

10. REMOVE BATTERY**11. (w/ CRUISE CONTROL SYSTEM)****REMOVE CRUISE CONTROL ACTUATOR****(w/ ABS)**

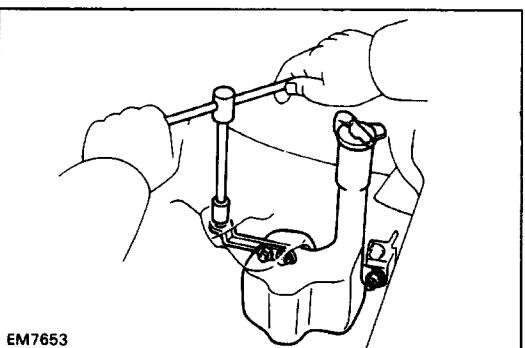
- Disconnect the actuator connector.
- Remove the four bolts, and disconnect the actuator from the bracket.

**(w/o ABS)**

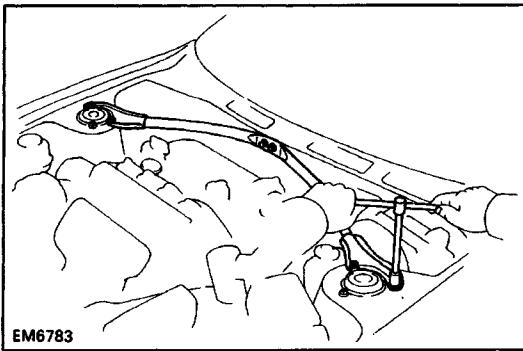
- Remove the actuator cover.
- Disconnect the actuator vacuum hose from the air intake chamber.
- Disconnect the actuator connector.
- Disconnect the cable from the actuator.
- Remove the three bolts and actuator.

**12. (w/ CRUISE CONTROL SYSTEM (w/ ABS))****REMOVE CRUISE CONTROL ACTUATOR BRACKET**

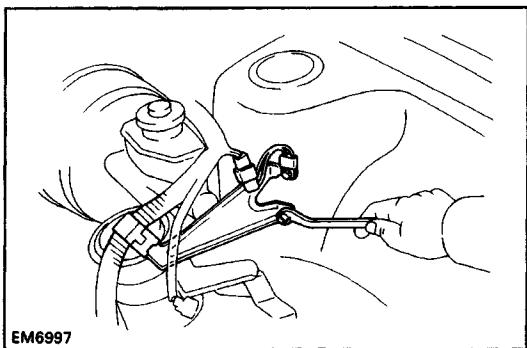
- Remove the two bolts and nut.
- Disconnect the actuator connector from the bracket.
- Remove the actuator bracket.

13. REMOVE RADIATOR (See pages CO-22 and 23)**14. REMOVE RADIATOR RESERVOIR TANK**

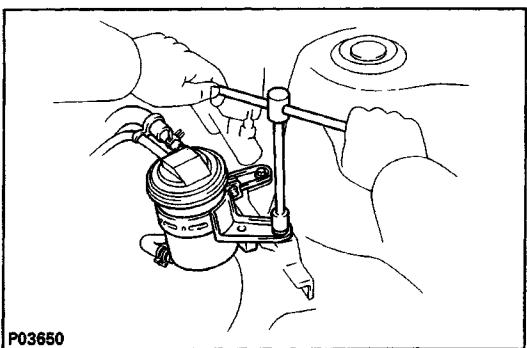
Remove the two nuts and reservoir tank.

**15. REMOVE SUSPENSION UPPER BRACE**

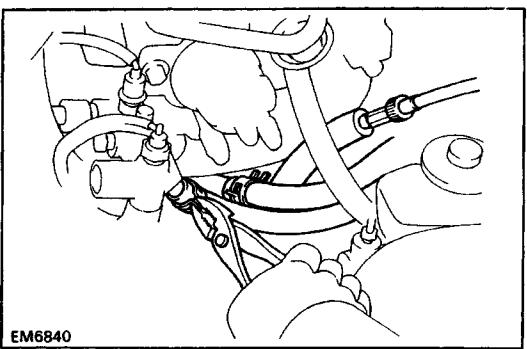
- (a) Remove the two wiper arms.
- (b) Remove outside lower windshield moulding.
- (c) Remove the two bolts, four nuts and upper brace.

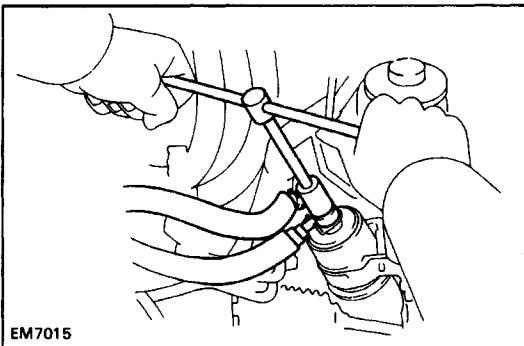
**17. REMOVE ENGINE WIRE BRACKET**

- (a) Disconnect the wire clamp from the wire bracket.
- (b) Remove the two bolts and wire bracket. Disconnect the noise filter.

**18. REMOVE CHARCOAL CANISTER**

- (a) Disconnect the three hoses from the charcoal canister.
- (b) Remove the two bolts and charcoal canister.

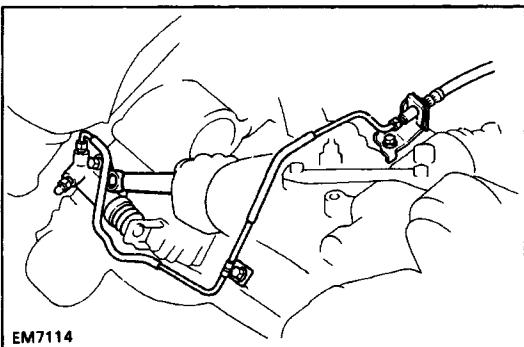
**19. DISCONNECT HEATER HOSES****20. DISCONNECT SPEEDOMETER CABLE**

**21. DISCONNECT FUEL HOSES**

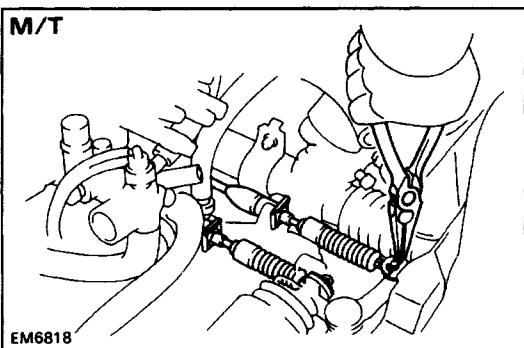
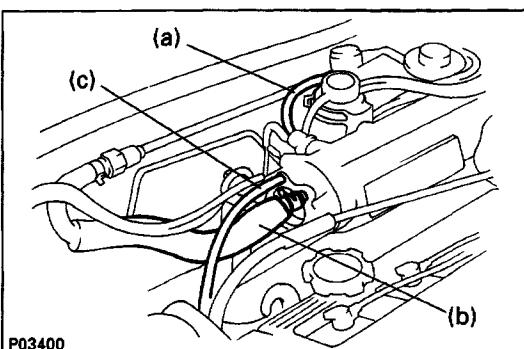
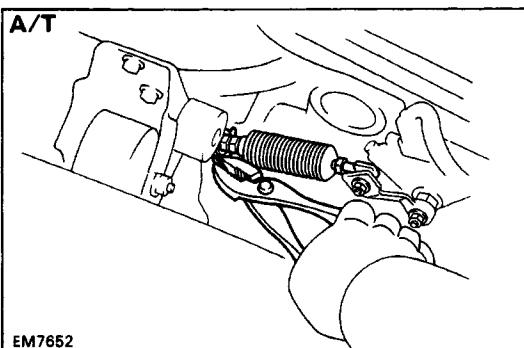
CAUTION: Catch leaking fuel in a container.

22. (M/T)

REMOVE STARTER (See page ST-5)

**23. (M/T)****REMOVE CLUTCH RELEASE CYLINDER WITHOUT
DISCONNECTING TUBE**

Remove the four bolts, release cylinder and tube from the transaxle.

**24. DISCONNECT TRANSAXLE CONTROL CABLE(S)
FROM TRANSAXLE****25. DISCONNECT VACUUM HOSES**

(a) Vacuum sensor hose from gas filter

(b) Brake booster vacuum hose from intake manifold

(c) (w/ Cruise Control System (w/o ABS))

Actuator vacuum hose from intake manifold

26. DISCONNECT ENGINE WIRE

(a) Engine wire clamp from wire bracket on RH fender apron

(b) Two cowl wire connectors

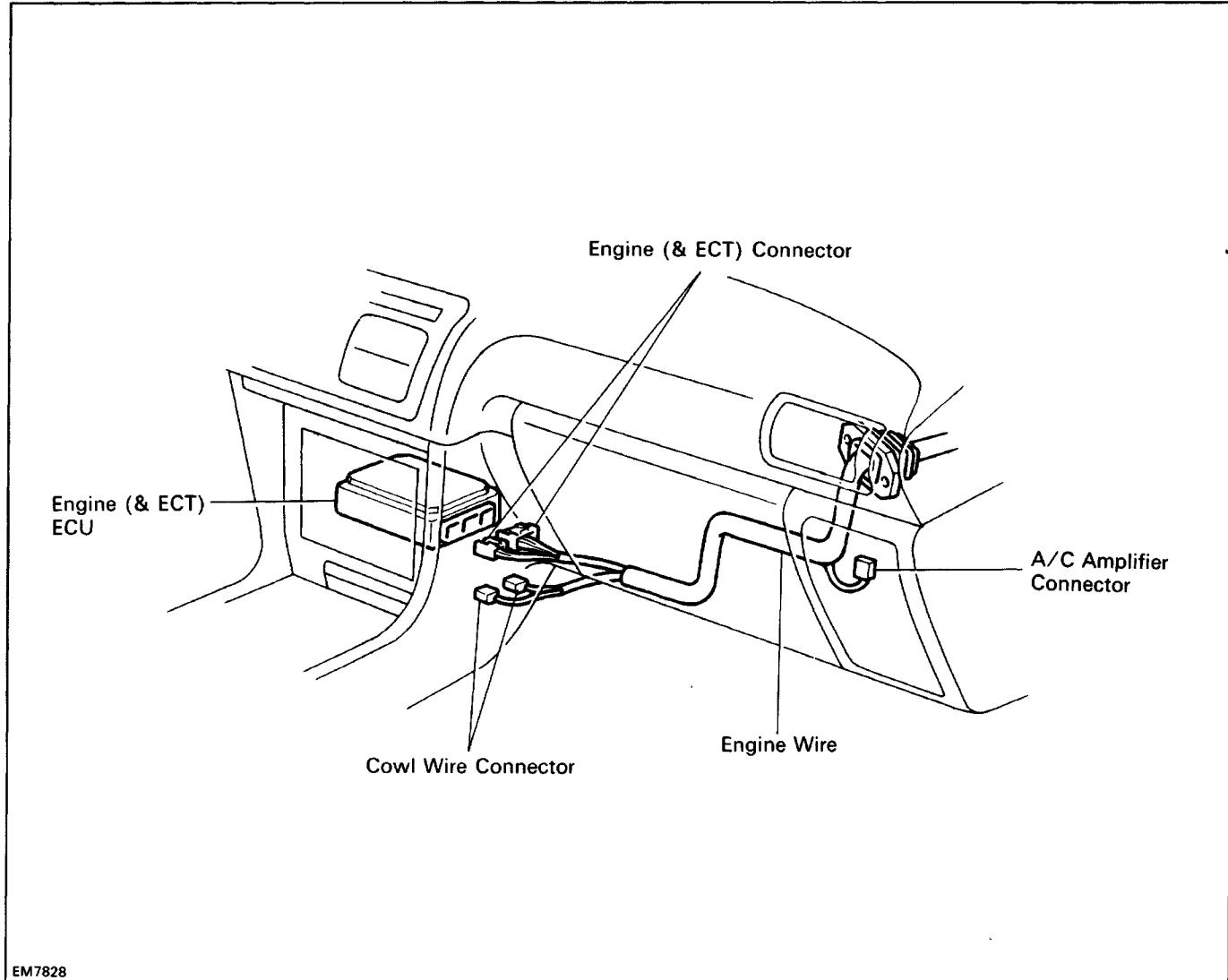
27. DISCONNECT ENGINE WIRE FROM CABIN

(a) Disconnect the following connectors:

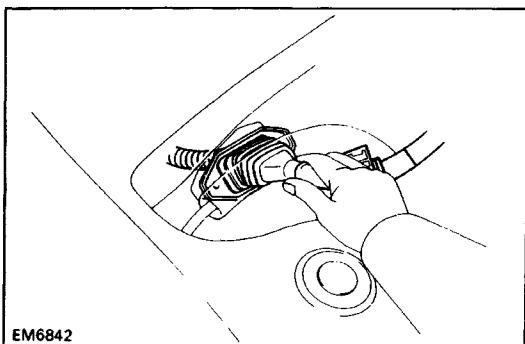
(1) Two engine (& ECT) ECU connectors

(2) Two cowl wire connectors

(3) A/C amplifier connector

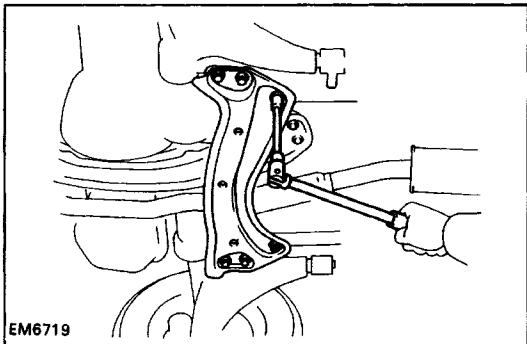


EM7828



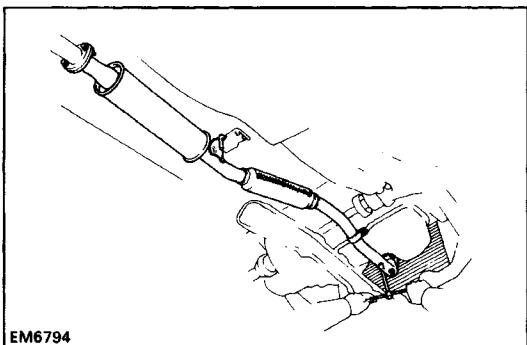
EM6842

(b) Remove the two nuts, and pull out the engine wire from the cowl panel.



28. REMOVE SUSPENSION LOWER CROSSM EM BER

Remove the four bolts, two nuts and lower crossmember.



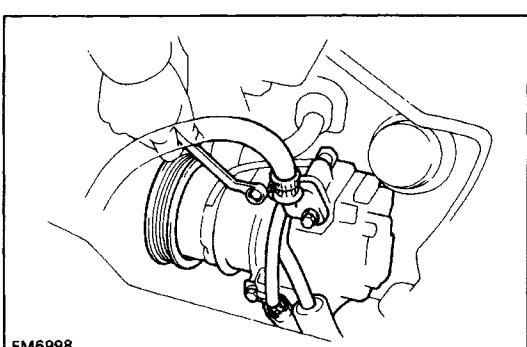
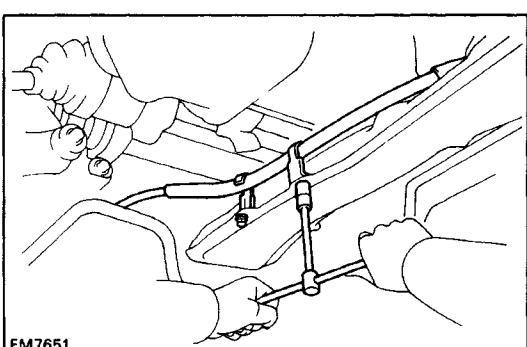
29. REMOVE FRONT EXHAUST PIPE

- Loosen the bolt, and disconnect the clamp from the bracket.
- Remove the two bolts and nuts holding the front exhaust pipe to the center exhaust pipe.
- Using a 14 mm deep socket wrench, remove the three nuts holding the front exhaust pipe to the catalytic converter.
- Disconnect the support hook on the front exhaust pipe from the support bracket, and remove the front exhaust pipe and two gaskets.

30. (A/T)

DISCONNECT TRANSAXLE CONTROL CABLE FROM ENGINE MOUNTING CENTER MEMBER

31. REMOVE DRIVE SHAFTS (See SA section)

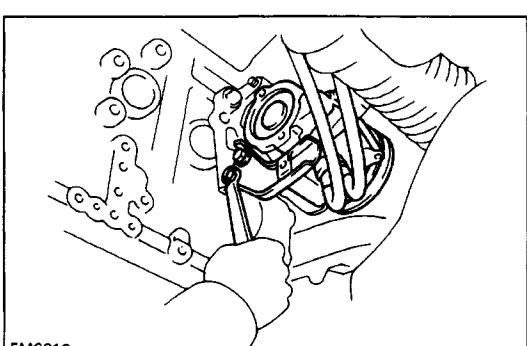


32. (w/ A/C)

REMOVE A/C COMPRESSOR WITHOUT DISCONNECTING HOSES

- Disconnect the A/C compressor connector.
- Remove the drive belt.
- Remove the three bolts, and disconnect the A/C compressor.

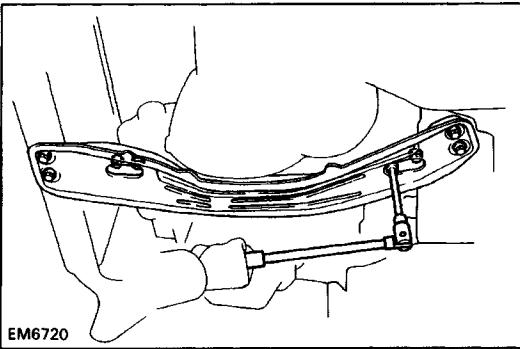
HINT: Put aside the compressor, and suspend it to the radiator support with a string.



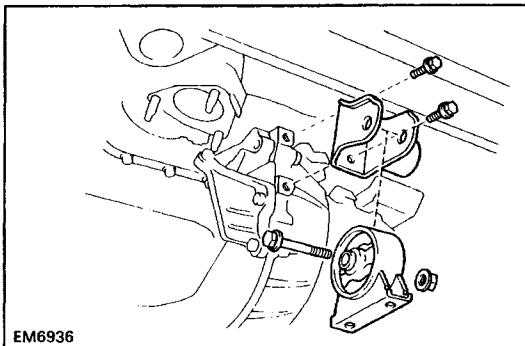
33. REMOVE PS PUMP WITHOUT DISCONNECTING HOSES

- Disconnect the two air hoses from the air pipe.
- Remove the PS drive belt.
- Remove the four bolts, and disconnect the PS pump from the engine.

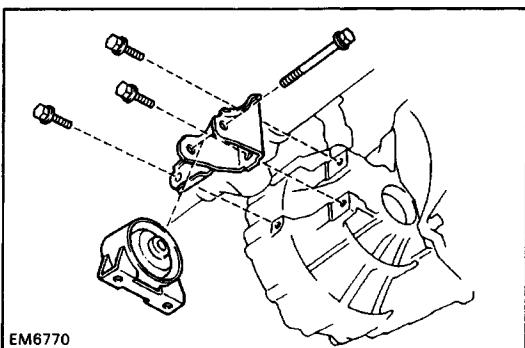
HINT: Put aside the pump and suspend it to the cowl with a string.

**34. REMOVE ENGINE MOUNTING CENTER MEMBER**

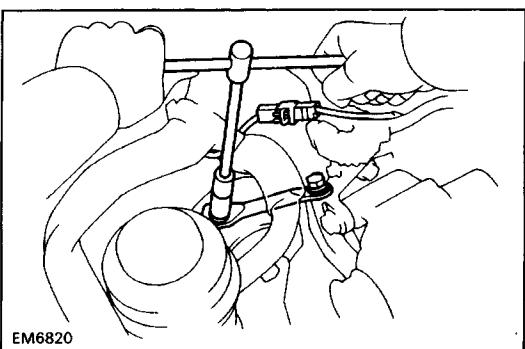
Remove the eight bolts and center member.

**35. REMOVE FRONT ENGINE MOUNTING INSULATOR AND BRACKET**

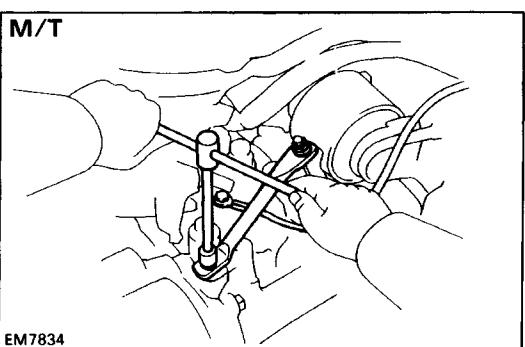
- Remove the through bolt, nut and mounting insulator.
- Remove the two bolts and mounting bracket.

**36. REMOVE REAR ENGINE MOUNTING INSULATOR AND BRACKET**

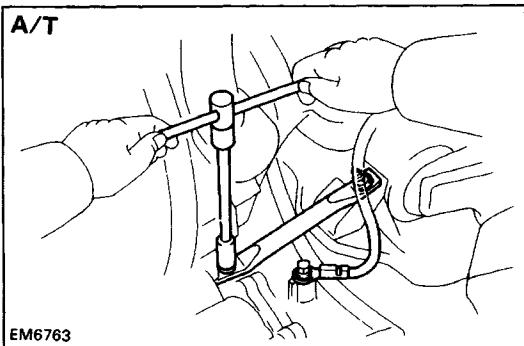
- Remove the through bolt and mounting insulator.
- Remove the three bolts and mounting bracket.

**37. REMOVE CONNECTOR FROM GROUND WIRE ON RH FENDER APRON****38. REMOVE RH ENGINE MOUNTING STAY**

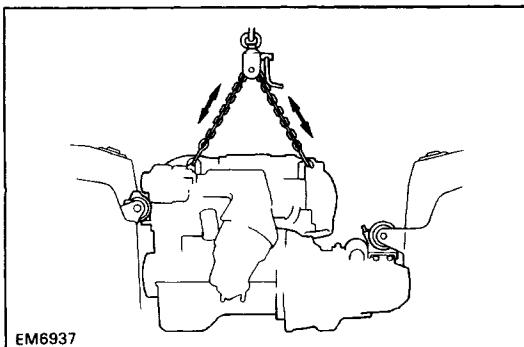
Remove the bolt, nut and mounting stay.

**39. REMOVE LH ENGINE MOUNTING STAY (M/T)**

- Remove the two nuts and mounting stay.
- Remove the bolt, and disconnect the ground strap.

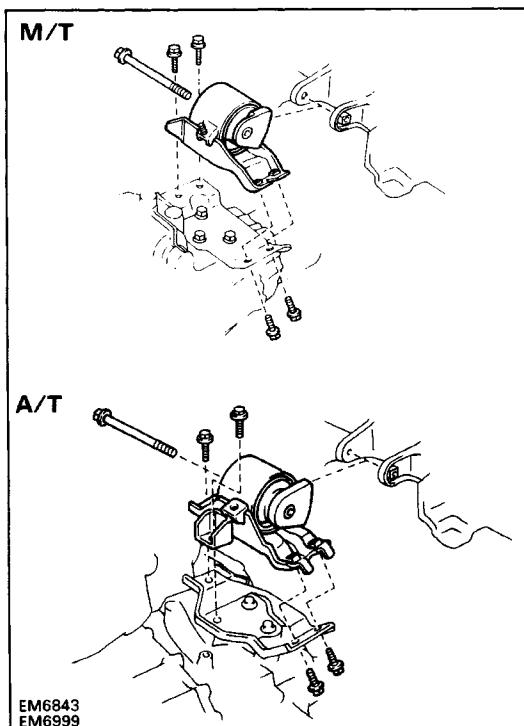
**(A/T)**

- Remove the bolt, nut and mounting stay.
- Remove the bolt, and disconnect the ground strap.

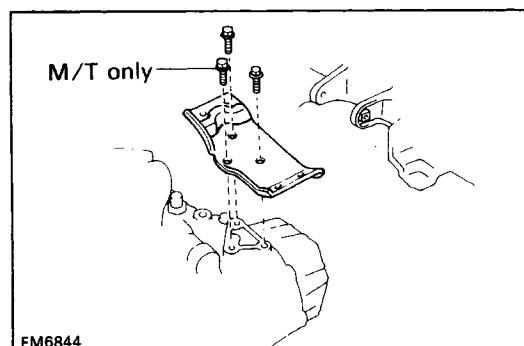


40. REMOVE ENGINE AND TRANSAXLE ASSEMBLY FROM VEHICLE

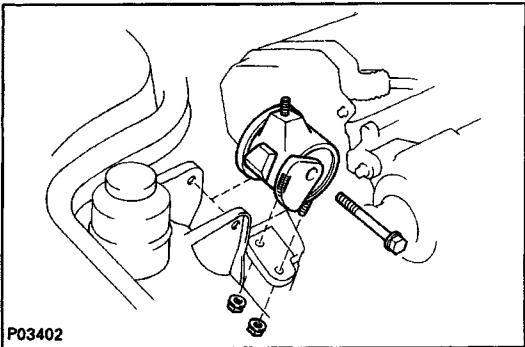
- Attach the engine chain hoist to the engine hangers.



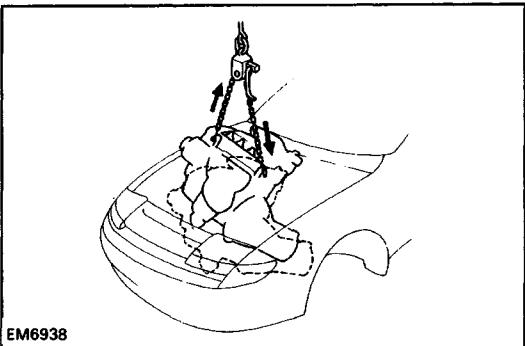
- Remove the through bolt, four bolts and LH mounting insulator.



- Remove the three (M/T) or two (A/T) bolts and LH mounting bracket.



(d) Remove the through bolt, two nuts and RH mounting insulator.



(e) Lift the engine out of the vehicle slowly and carefully.

NOTICE: Be careful not to hit the PS gear housing or neutral start switch (A/T).

(f) Make sure the engine is clear of all wiring, hoses and cables.

(g) Place the engine and transaxle assembly onto the stand.

41. (A/T) REMOVE STARTER (See page [ST-5](#))

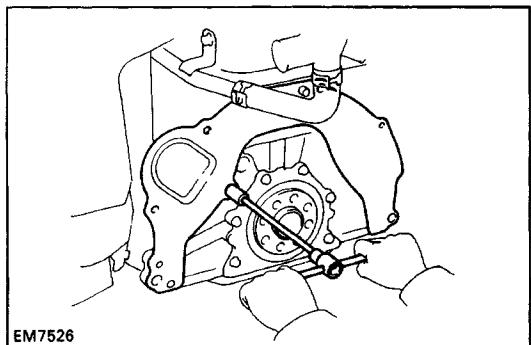
42. SEPARATE ENGINE AND TRANSAXLE

M/T (See MT section)

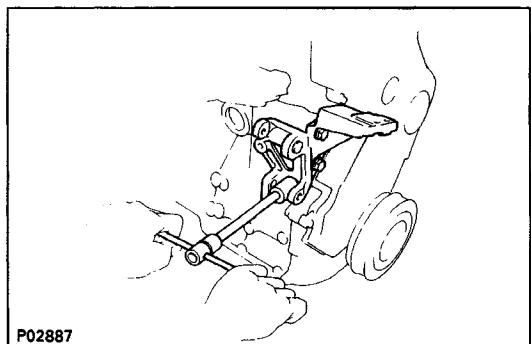
A/T (See AT section)

PREPARATION FOR DISASSEMBLY

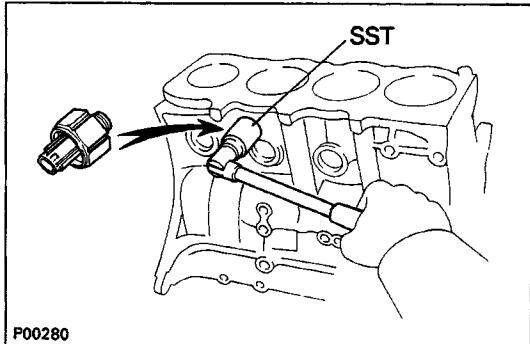
1. (M/T)
REMOVE CLUTCH COVER AND DISC
2. (M/T)
REMOVE FLYWHEEL
3. (A/T)
REMOVE DRIVE PLATE



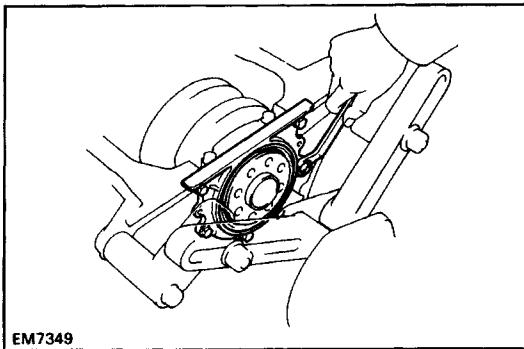
4. REMOVE REAR END PLATE
Remove the bolt and end plate.
5. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY
6. REMOVE ALTERNATOR (See page [CH-9](#))
7. REMOVE DISTRIBUTOR (See page [IG-31](#))



8. REMOVE RH ENGINE MOUNTING BRACKET
Remove the three bolts and mounting bracket.
9. REMOVE PS PUMP BRACKET
Remove the three bolts and PS pump bracket.
10. REMOVE TIMING BELT AND PULLEYS
(See pages [EM-69](#) to [73](#))
11. REMOVE CYLINDER HEAD
(See pages [EM-151](#) to [159](#))
12. REMOVE WATER PUMP AND ALTERNATOR
ADJUSTING BAR (See pages [CO-12](#) and [13](#))
13. REMOVE OIL PAN AND OIL PUMP
(See pages [LU-17](#) and [18](#))
14. REMOVE OIL FILTER (See page [LU-7](#))
15. (w/ OIL COOLER)
REMOVE OIL COOLER (See page [LU-29](#))



16. REMOVE KNOCK SENSOR
Using SST, remove the knock sensor.
SST 09816-30010

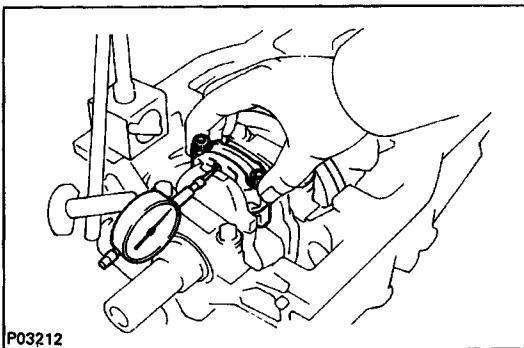


DISASSEMBLY OF CYLINDER BLOCK

(See page EM-268)

1. REMOVE REAR OIL SEAL RETAINER

Remove the six bolts, retainer and gasket.



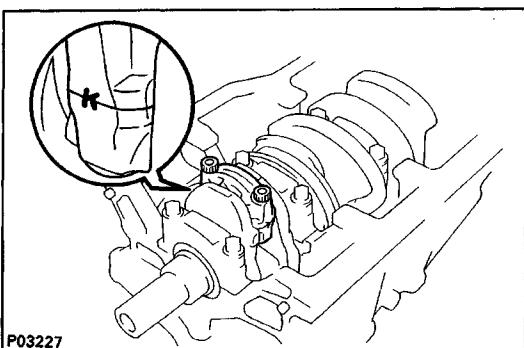
2. CHECK CONNECTING ROD THRUST CLEARANCE

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

**Standard thrust clearance: 0.160 – 0.312 mm
(0.0063 – 0.0123 in.)**

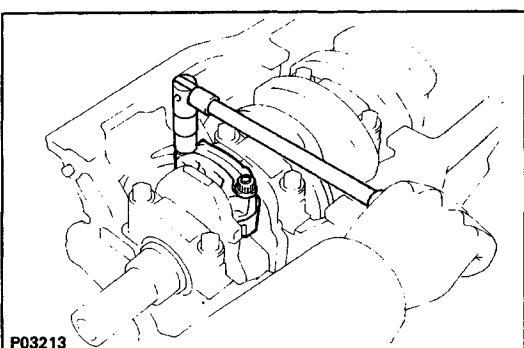
Maximum thrust clearance: 0.35 mm (0.0138 in.)

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

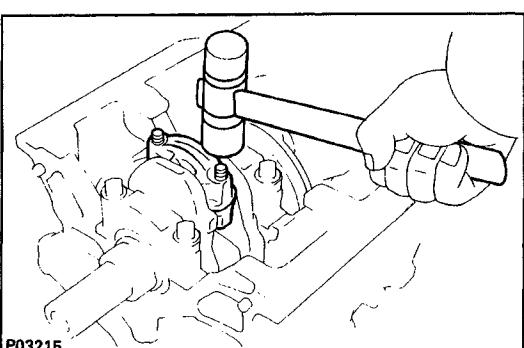


3. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

(a) Check the matchmarks on the connecting rod and cap to ensure correct reassembly.

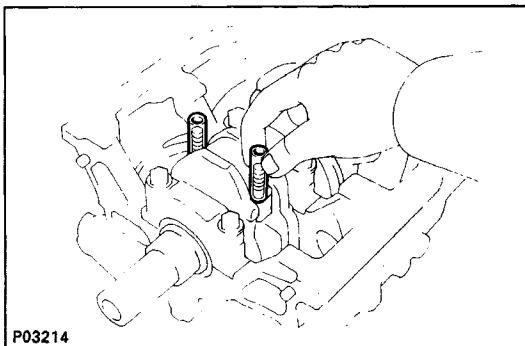


(b) Using SST, remove the connecting rod cap nuts.
SST 09011-38121

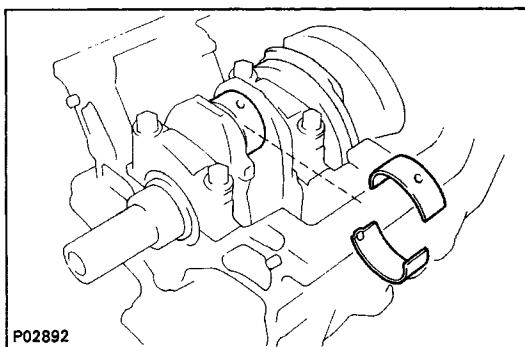


(c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

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

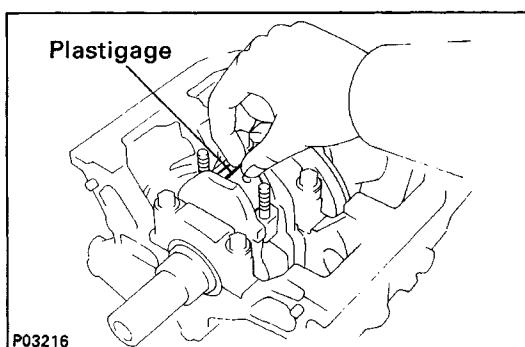


(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.

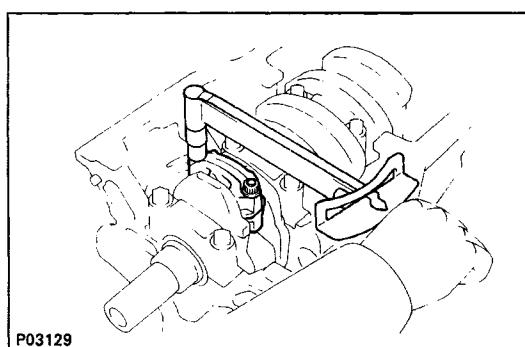


(e) Clean the crank pin and bearing.
(f) Check the crank pin and bearing for pitting and scratches.

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

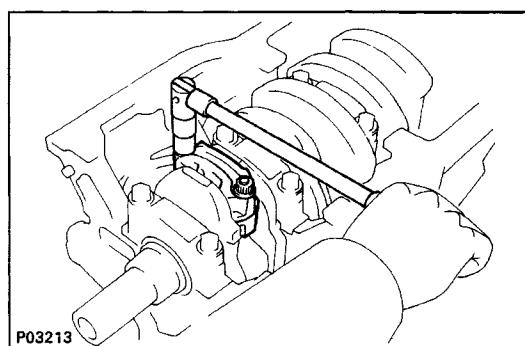


(g) Lay a strip of Plastigage across the crank pin.

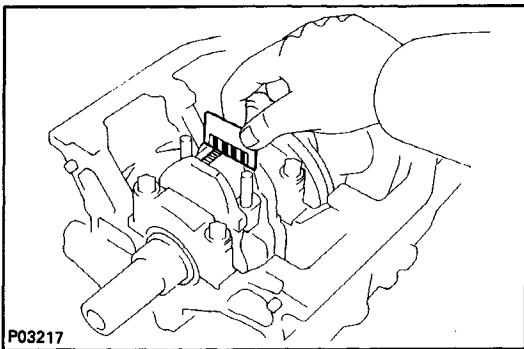


(h) Install the connecting rod cap.
(See step 6 on pages [EM-299](#) and 300)
Torque: 1st 25 N·m (250 kgf·cm, 18 ft-lbf)
2nd Turn 90°

NOTICE: Do not turn the crankshaft.



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



(j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD	0.024 – 0.055 mm, (0.0009 – 0.0022 in.)
U /S 0.25	0.023 – 0.069 mm (0.0009 – 0.0027 in.)

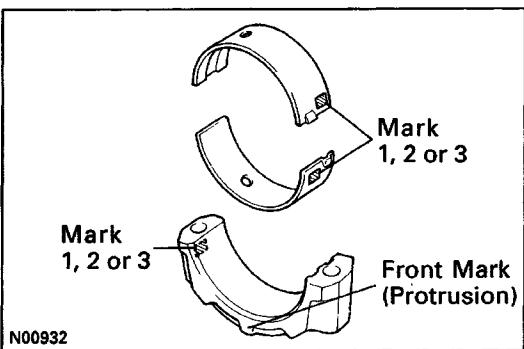
Maximum oil clearance: 0.08 mm (0.0031 in.)

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

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

(Reference)

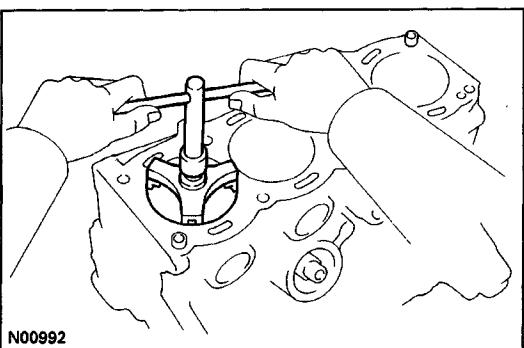
Standard sized bearing center wall thickness:



Mark "1"	1.484 – 1.488 mm (0.0584 – 0.0586 in.)
Mark "2"	1.488 – 1.492 mm (0.0586 – 0.0587 in.)
Mark "3"	1.492 – 1.496 mm (0.0587 – 0.0589 in.)

(k) Completely remove the Plastigage.

4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES



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

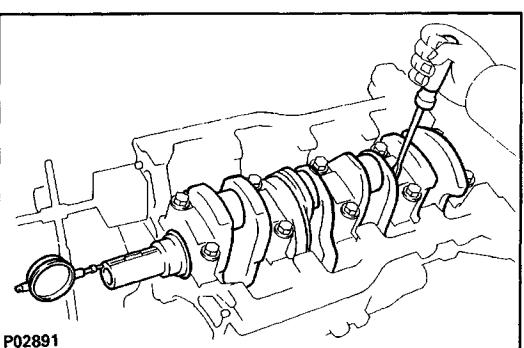
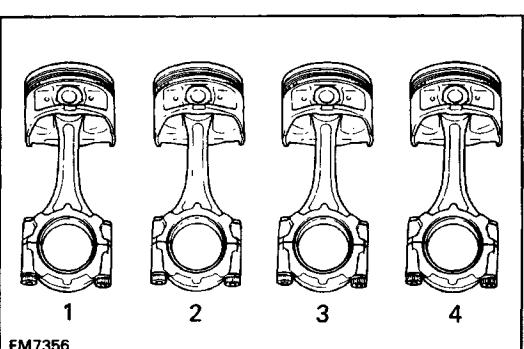
(b) Cover the connecting rod bolts.

(See page [EM-280](#))

(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.



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

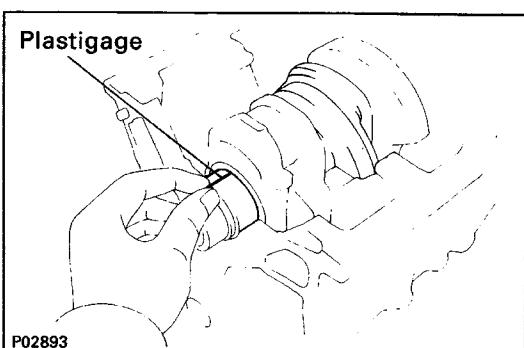
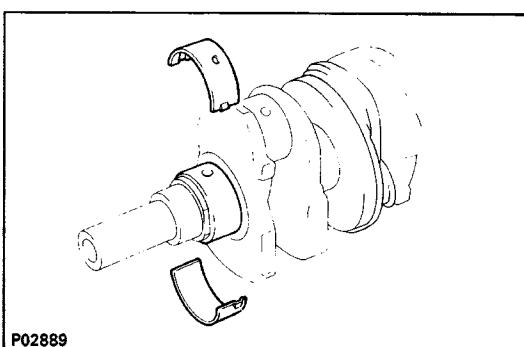
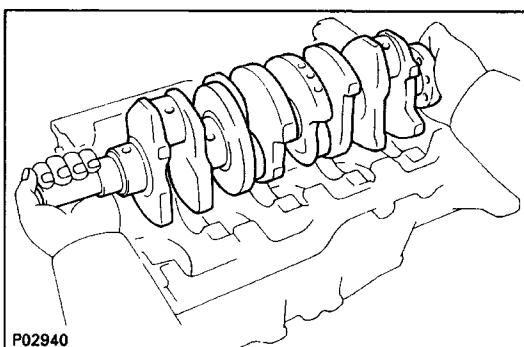
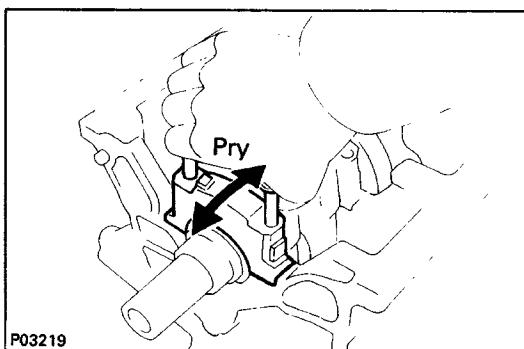
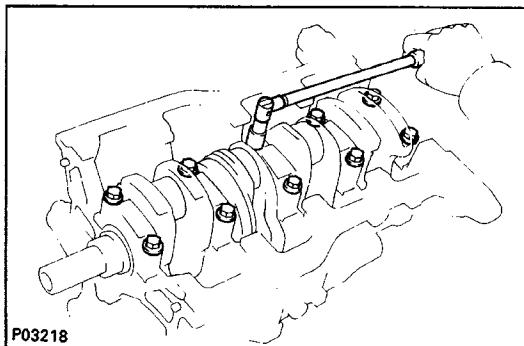
(0.0008 – 0.0087 in.)

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.)



6. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

(a) Remove the main bearing cap bolts.

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

HINT:

- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers – in correct order.

(c) Lift out the crankshaft.

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

(d) Clean each main journal and bearing.

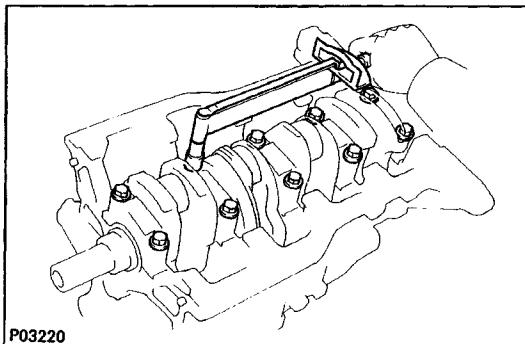
(e) Check each main journal and bearing for pitting and scratches.

If the journal or bearing is damaged, replace the bearings.

If necessary, grind or replace the crankshaft.

(f) Place the crankshaft on the cylinder block.

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

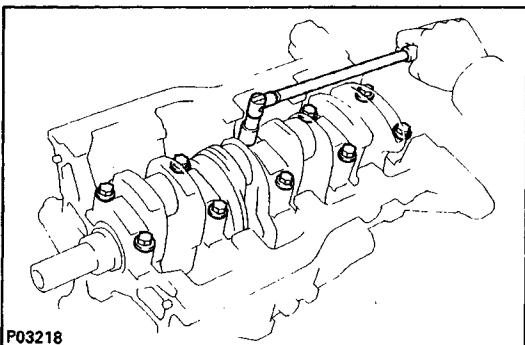


(h) Install the main bearing caps.

(See step 4 on page [EM-298](#))

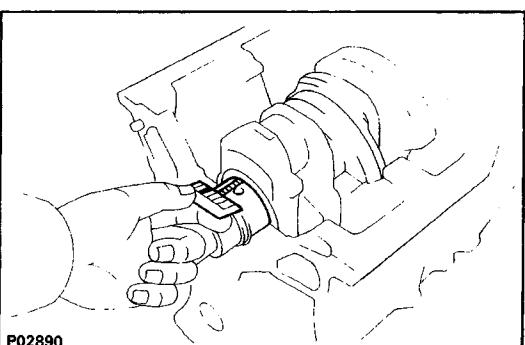
Torque: 59 N·m (600 kgf·cm, 43 ft-lbf)

NOTICE: Do not turn the crankshaft.



(i) Remove the main bearing caps.

(See procedure (a) and (b) above)



(j) Measure the Plastigage at its widest point.

Standard clearance:

No.3 STD 0.025 – 0.044 mm
(0.0010 – 0.0017 in.)

U /S 0.25 0.027 – 0.067 mm
(0.0011 – 0.0026 in.)

Others STD 0.015 – 0.034 mm
(0.0006 – 0.0013 in.)

U /S 0.25 0.019 – 0.059 mm
(0.0007 – 0.0023 in.)

Maximum clearance: 0.08 mm (0.0031 in.)

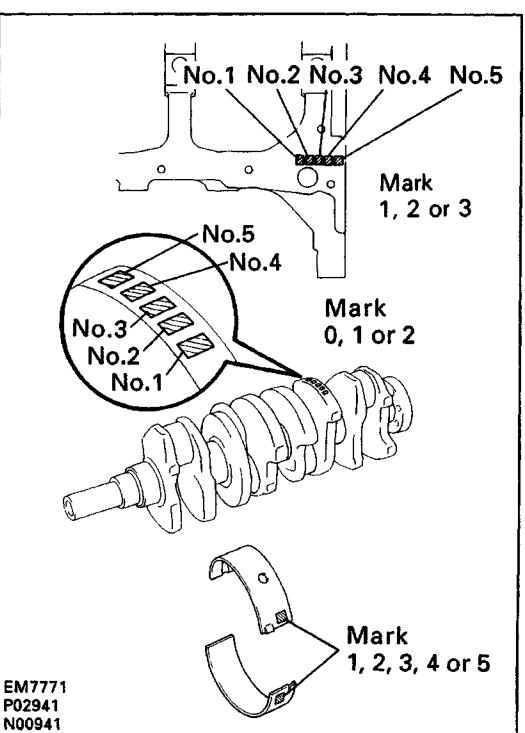
HINT: If replacing the cylinder block subassembly, the bearing standard clearance will be:

No.3 0.027 – 0.054 mm
(0.0011 – 0.0021 in.)

Others 0.017 – 0.044 mm
(0.0007 – 0.0017 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 selecting the bearing with the same number as the total. There are five sizes of standard bearings, marked "1", "2", "3", "4" and "5" accordingly.



	Number marked							
	1	2	3	4	5	6	7	8
Cylinder block								
Crankshaft	0	1	2	0	1	2	0	1
Bearing	1	2	3	2	3	4	3	4

EXAMPLE: Cylinder block "2" + Crankshaft "1"
= Bearing "3"

(Reference)

Cylinder block main journal bore diameter:

Mark "1"	59.020 – 59.026 mm (2.3236 – 2.3239 in.)
Mark "2"	59.026 – 59.032 mm (2.3239 – 2.3241 in.)
Mark "3"	59.032 – 59.038 mm (2.3241 – 2.3243 in.)

Crankshaft journal diameter:

Mark "0"	54.998 – 55.003 mm (2.1653 – 2.1655 in.)
Mark "'1"	54.993 – 54.998 mm (2.1651 – 2.1653 in.)
Mark "2"	54.988 – 54.993 mm (2.1649 – 2.1651 in.)

Standard sized bearing center wall thickness:

No.3	Mark "'1"	1.992 – 1.995 mm (0.0784 – 0.0785 in.)
	Mark "2"	1.995 – 1.998 mm (0.0785 – 0.0787 in.)
	Mark "3"	1.998 – 2.001 mm (0.0787 – 0.0788 in.)
	Mark "4"	2.001 – 2.004 mm (0.0788 – 0.0789 in.)
	Mark "5"	2.004 – 2.007 mm (0.0789 – 0.0790 in.)
Others	Mark "1"	1.997 – 2.000 mm (0.0786 – 0.0787 in.)
	Mark "2"	2.000 – 2.003 mm (0.0787 – 0.0789 in.)
	Mark "3"	2.003 – 2.006 mm (0.0789 – 0.0790 in.)
	Mark "4"	2.006 – 2.009 mm (0.0790 – 0.0791 in.)
	Mark "5"	2.009 – 2.012 mm (0.0791 – 0.0792 in.)

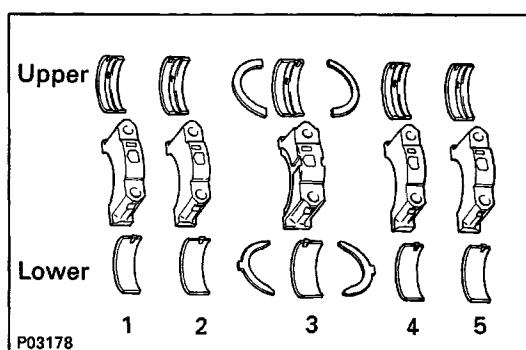
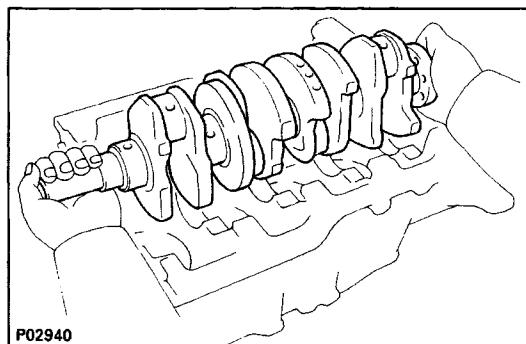
(k) Completely remove the Plastigage.

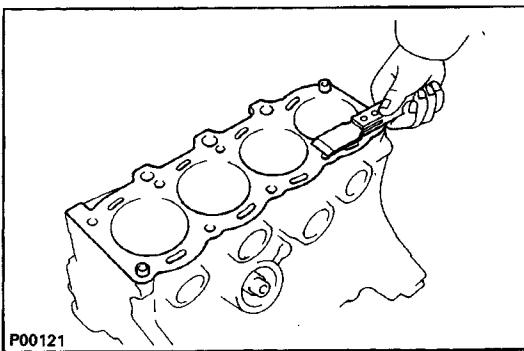
7. REMOVE CRANKSHAFT

(a) Lift out the crankshaft.

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

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





INSPECTION OF CYLINDER BLOCK

1. CLEAN CYLINDER BLOCK

A. Remove gasket material

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

B. Clean cylinder block

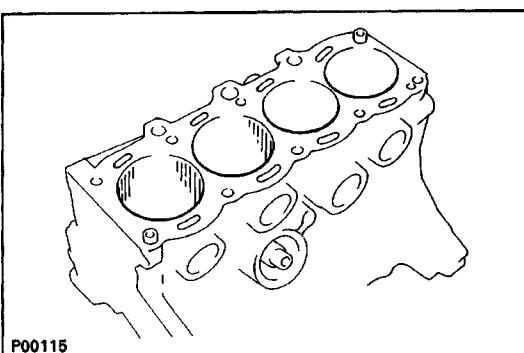
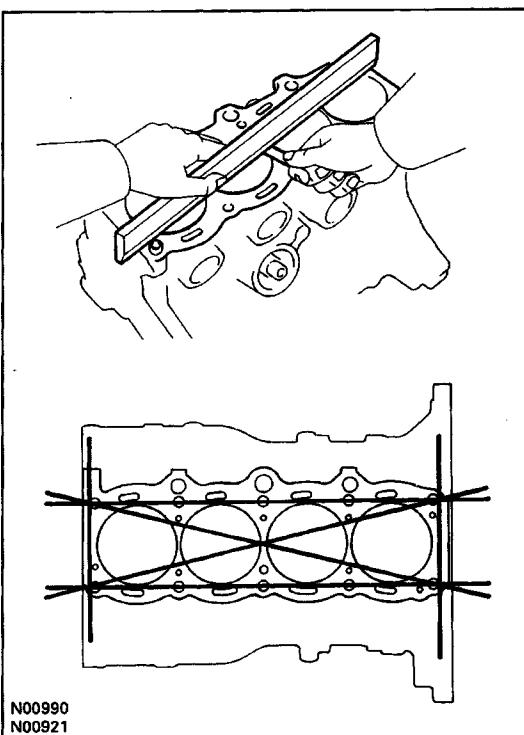
Using a soft brush and solvent, thoroughly clean the cylinder block.

2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage: 0.05 mm (0.0020 in.)

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

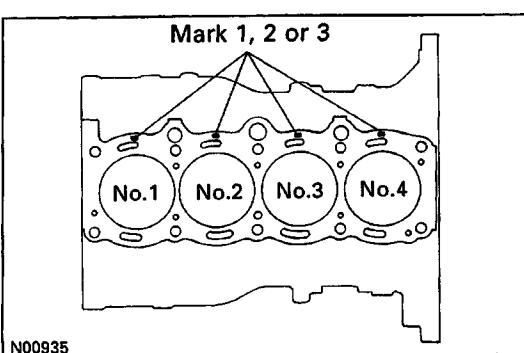


3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

Visually check the cylinder for vertical scratches.

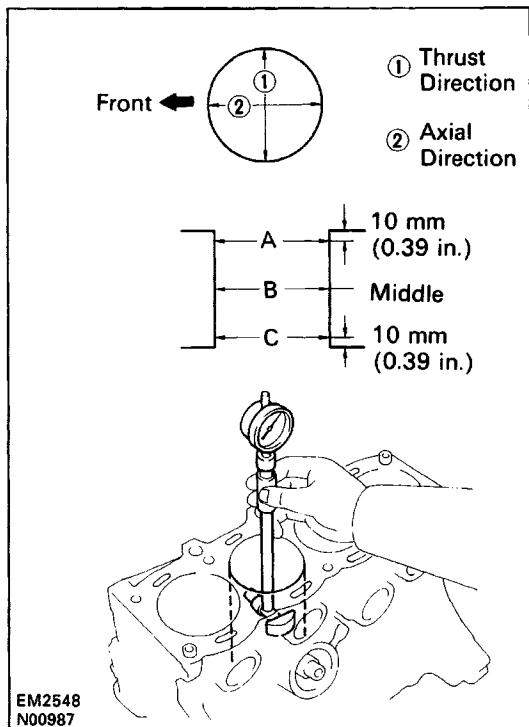
If deep scratches are present, rebore all the four cylinders.

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 the top of the cylinder block.



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

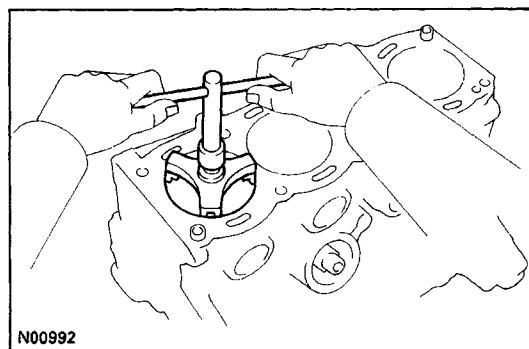
Standard diameter:

STD	Mark "1"	87.000 – 87.010 mm (3.4252 – 3.4256 in.)
	Mark "2"	87.010 – 87.020 mm (3.4256 – 3.4260 in.)
	Mark "3"	87.020 – 87.030 mm (3.4260 – 3.4264 in.)

Maximum diameter:

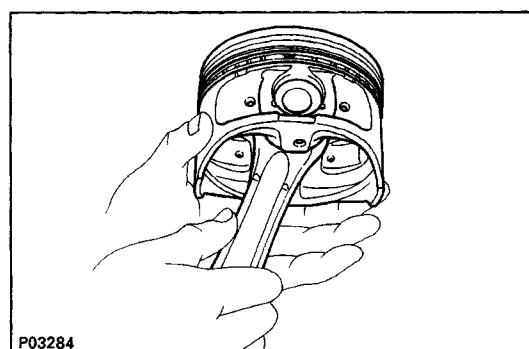
STD	87.23mm(3.4342 in.)
O/S 0.50	87.73 mm (3.4350 in.)

If the diameter is greater than maximum, rebore all the 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 ridge reamer, grind the top of the cylinder.

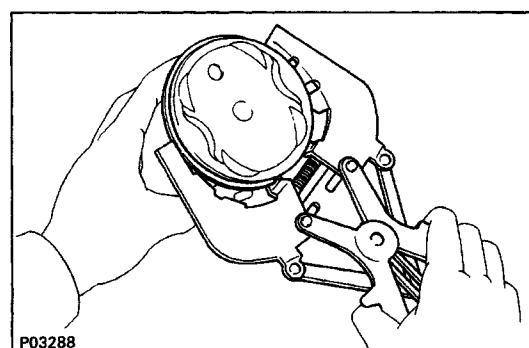


DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

1. CHECK FIT BETWEEN PISTON AND PISTON PIN

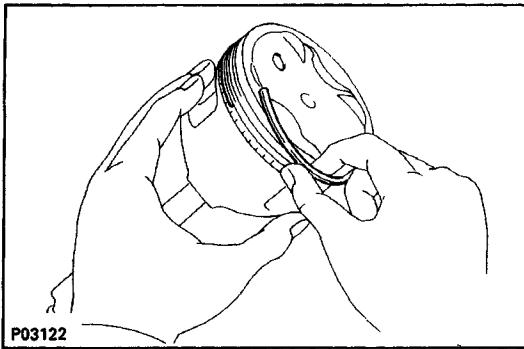
Try to move the piston back and forth on the piston pin.

If any movement is felt, replace the piston and pin as a set.



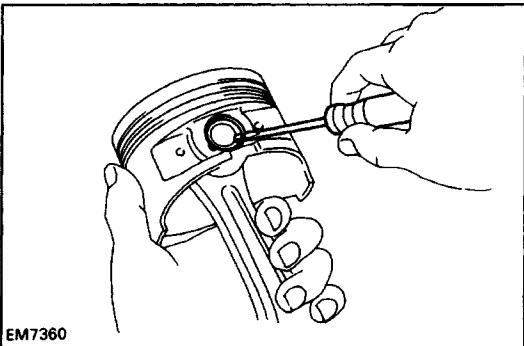
2. REMOVE PISTON RINGS

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



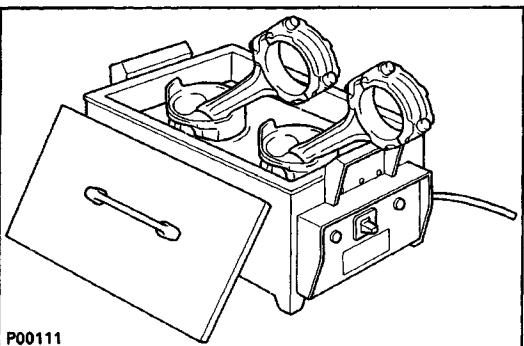
(b) Remove the two side rails and oil ring expander by hand.

HINT: Arrange the rings in correct order only.

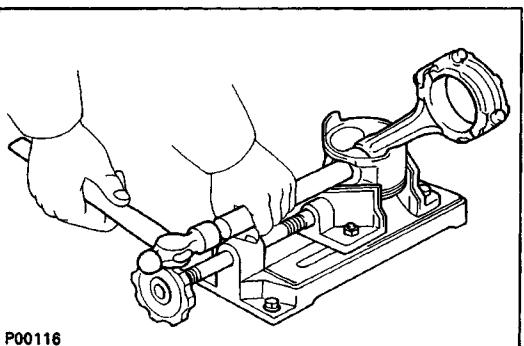


3. DISCONNECT CONNECTING ROD FROM PISTON

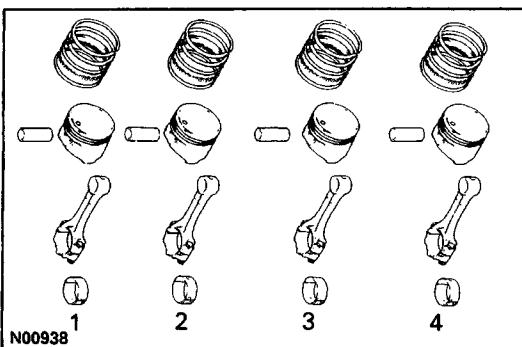
(a) Using a small screwdriver, pry out the two snap rings.



(b) Gradually heat the piston to 80 – 90°C (176 – 194°F).

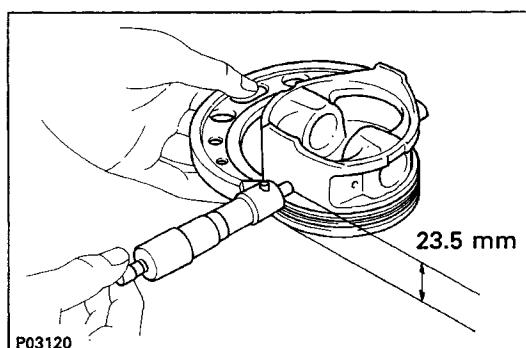
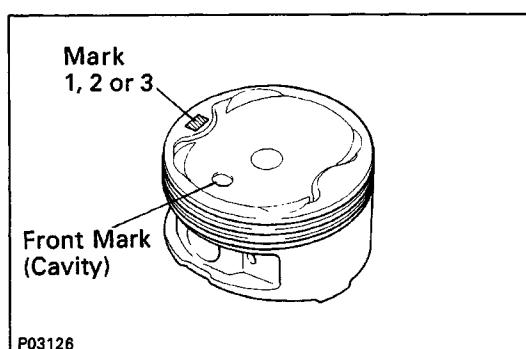
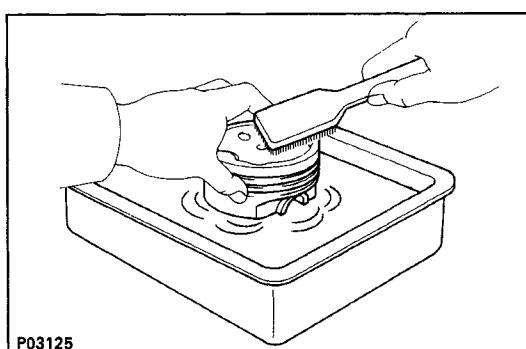
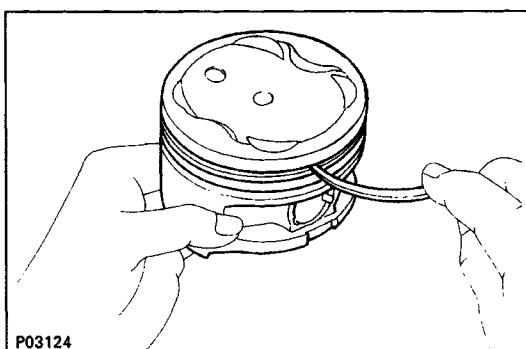
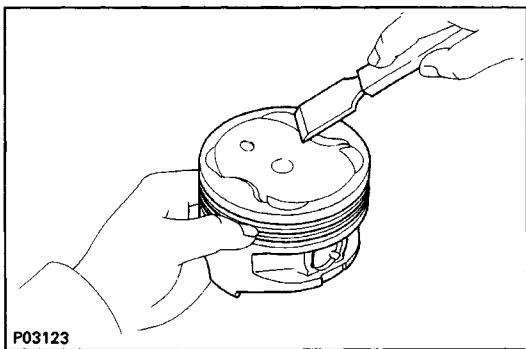


(c) Using plastic-faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod .



HINT:

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



INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLIES

1. CLEAN PISTON

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

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

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

NOTICE: Do not use a wire brush.

2. INSPECT PISTON

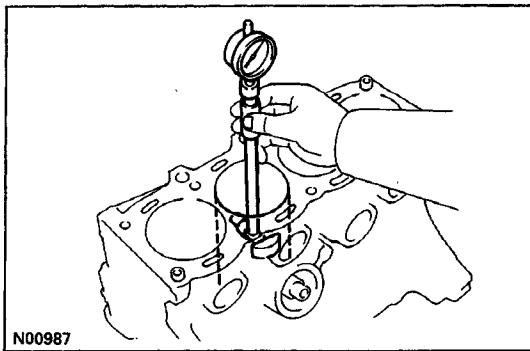
A. Inspect piston oil clearance

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, measure the piston diameter at right angles to the piston pin center line, 23.5 mm (0.925 in.) from the piston head.

Piston diameter:

STD	Mark "1"	86.850 – 86.860 mm (3.4193 – 3.4197 in.)
	Mark "2"	86.860 – 86.870 mm (3.4197 – 3.4201 in.)
	Mark "3"	86.870 – 86.880 mm (3.4201 – 3.4205 in.)
O/S 0.50		87.350 – 87.380 mm (3.4390 – 3.4402 in.)



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

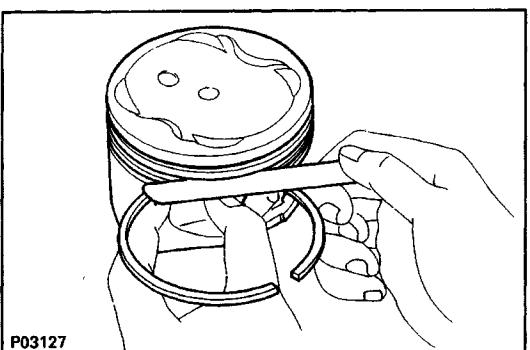
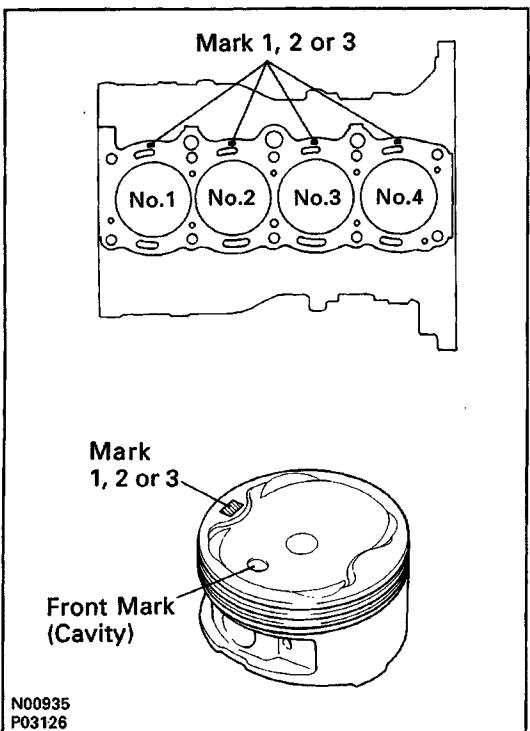
(See step 4 on page [EM-286](#))

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

**Standard oil clearance: 0.140 – 0.160 mm
(0.0055 – 0.0063 in.)**

Maximum oil clearance: 0.18 mm (0.0071 in.)

If the oil clearance is greater than maximum, replace all the four pistons and re bore 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.



B. Inspect piston ring groove clearance

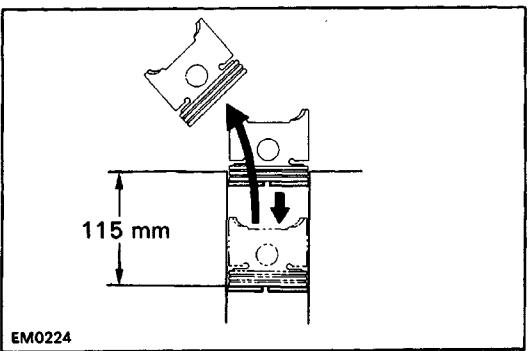
Using a feeler gauge, measure the clearance between new piston ring and the wall of the piston ring groove.

Ring groove clearance:

No.10.040 – 0.080 mm. (0.0016 – 0.0031 in.)

No.20.030 – 0.070 mm (0.0012 – 0.0028 in.)

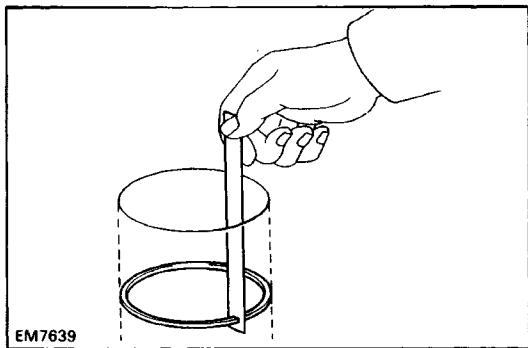
If the clearance is greater than maximum, replace the piston.



C. Inspect piston ring end gap

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

(b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 115 mm (4.53 in.) from the top of the cylinder block.



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

Standard end gap:

No.1 0.270 – 0.500 mm
(0.0106 – 0.0197 in.)

No.2 0.350 – 0.600 mm
(0.0138 – 0.0234 in.)

Oil (Side rail) 0.200 – 0.550 mm
(0.0079 – 0.0217 in.)

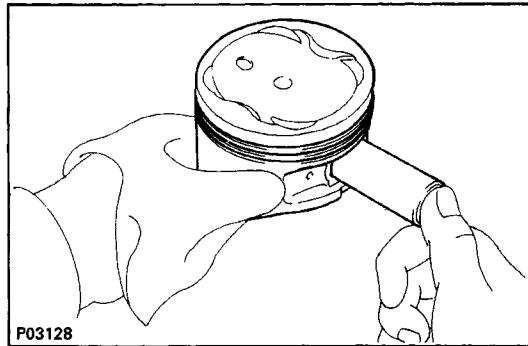
Maximum end gap:

No.1 1.10 mm (0.0433 in.)

No.2 1.20 mm (0.0472 in.)

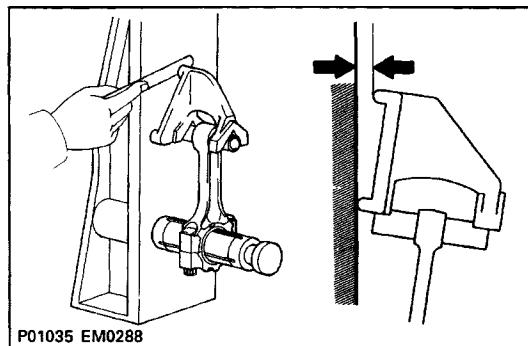
Oil (Side rail) 1.15 mm (0.0453 in.)

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



D. Inspect piston pin fit

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



3. INSPECT CONNECTING ROD

A. Inspect connecting rod alignment

Using rod aligner and feeler gauge, check the connecting rod alignment.

- Check for bending.

Maximum bending:

0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

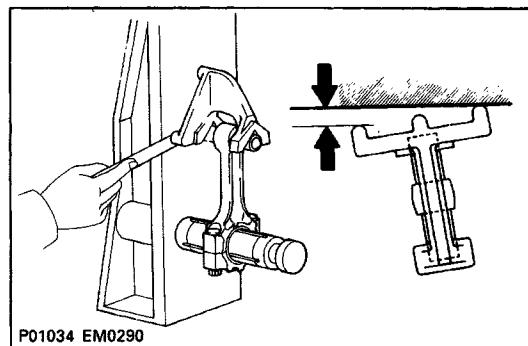
If bend is greater than maximum, replace the connecting rod assembly.

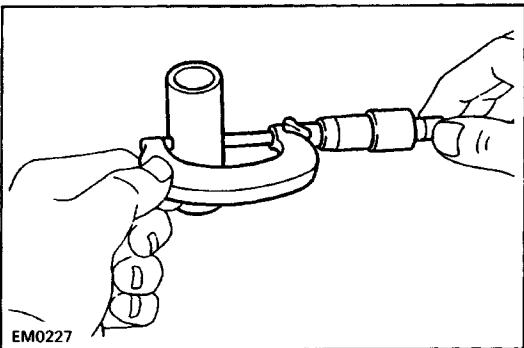
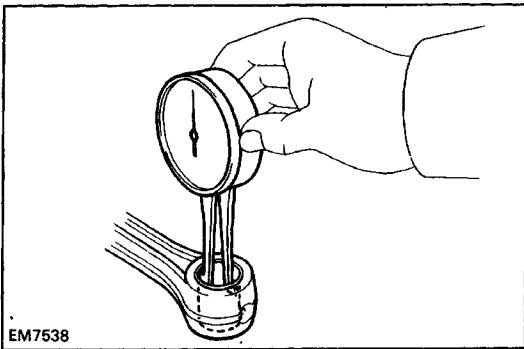
- Check for twist.

Maximum twist:

0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

If twist is greater than maximum, replace the connecting rod assembly.





B. Inspect piston pin oil clearance

(a) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

**Bushing inside diameter: 22.005 – 22.017 mm
(0.8663 – 0.8668 in.)**

(b) Using a micrometer, measure the piston pin diameter.

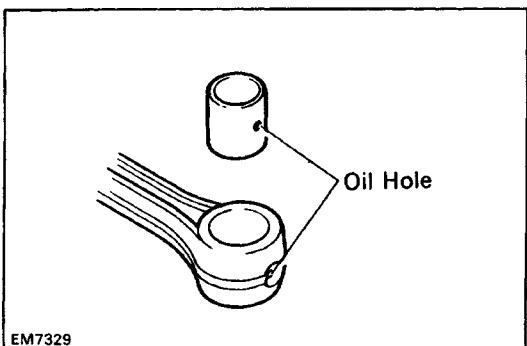
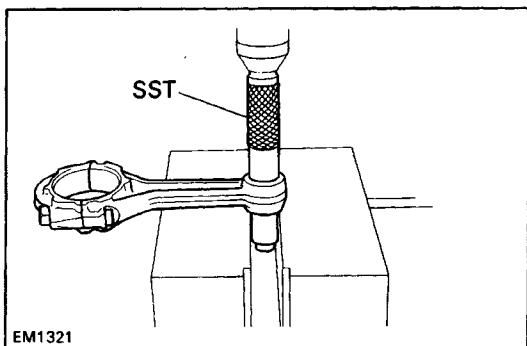
**Piston pin diameter: 21.997 – 22.009 mm
(0.8660 – 0.8665 in.)**

(c) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

**Standard oil clearance: 0.005 – 0.011 mm
(0.0002 – 0.0004 in.)**

Maximum oil clearance: 0.05 mm (0.0020 in.)

If the oil clearance is greater than maximum, replace the bushing: If necessary, replace the piston and piston pin as a set.

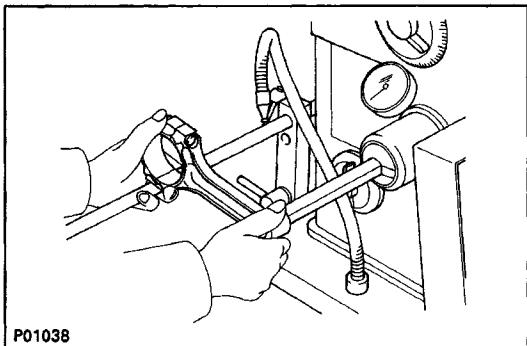


C. If necessary, replace connecting rod bushing

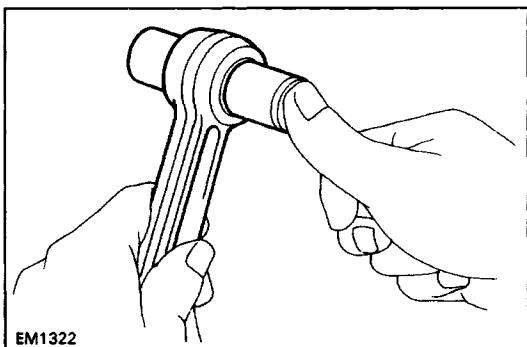
(a) Using SST and a press, press out the bushing.
SST 09222-30010

(b) Align the oil holes of a new bushing and the connecting rod.

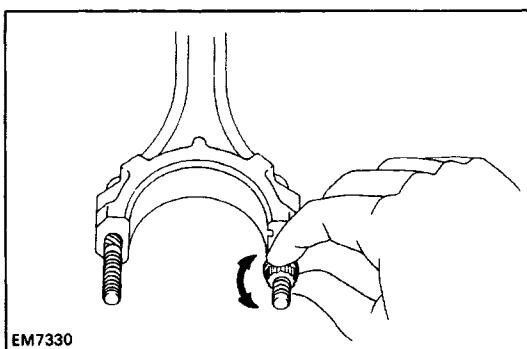
(c) Using SST and a press, press in the bushing.
SST 09222-30010



(d) Using a pinhole grinder, hone the bushing to obtain the standard specified clearance (see step B above) between the bushing and piston pin.

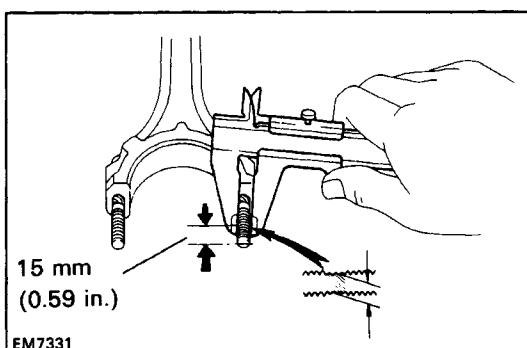


(e) Check the piston pin fit at normal room temperature. Coat the piston pin with engine oil, and push it into the connecting rod with your thumb.



D. Inspect connecting rod bolts

(a) Install the cap nut to the connecting rod bolt. Check that the cap nut can be turned easily by hand to the end of the thread.



(b) If the cap nut cannot be turned easily, measure the outside diameter of the connecting rod bolt with a vernier caliper.

**Standard diameter: 7.860 – 8.000 mm
(0.3094 – 0.3150 in.)**

Minimum diameter: 7.60 mm (0.2992 in.)

HINT: If the location of this area cannot be judged by visual inspection, measure the outer diameter at the location shown in the illustration. If the outside diameter is less than minimum, replace the connecting rod bolt and cap nut as a set.

BORING OF CYLINDERS

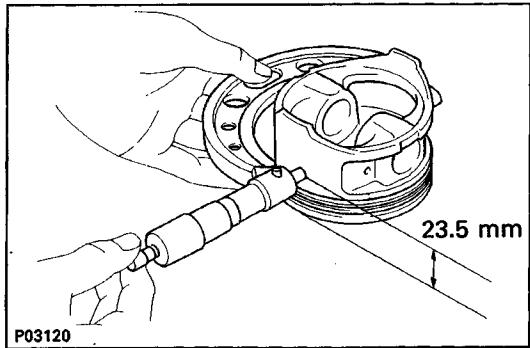
HINT:

- Bore all the four cylinders for the oversized piston outside diameter.
- Replace all the piston rings with ones to match the oversized pistons.

1. KEEP OVERSIZED PISTONS

Oversized piston diameter:

O/S 0.50 87.350 – 87.380 mm
(3.4390 – 3.4402 in.)



2. CALCULATE AMOUNT TO BORE CYLINDERS

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 23.5 mm (0.925 in.) from the piston head.

(b) Calculate the amount each cylinder is to be rebored as follows:

$$\text{Size to be rebored} = P + C - H$$

P = Piston diameter

C = Piston clearance

$$0.140 – 0.160 \text{ mm (0.0055 – 0.0063 in.)}$$

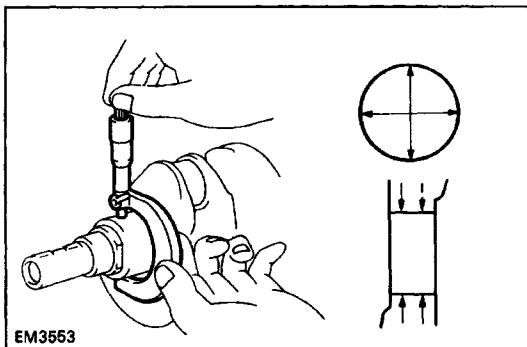
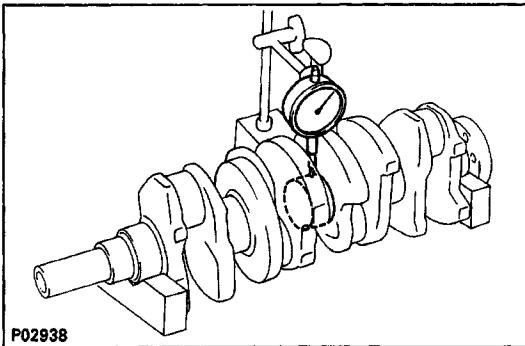
H = Allowance for honing

$$0.02 \text{ mm (0.0008 in.) or less}$$

3. BORE AND HONE CYLINDERS TO CALCULATED DIMENSIONS

Maximum honing: 0.02 mm (0.0008 in.)

NOTICE: Excess honing will destroy the finished roundness.



INSPECTION AND REPAIR OF CRANKSHAFT

1. INSPECT CRANKSHAFT FOR RUNOUT

- Place the crankshaft on V-blocks.
- Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.06 mm (0.0024 in.)

If the circle runout is greater than maximum, replace the crankshaft.

2. INSPECT MAIN JOURNALS AND CRANK PINS

- Using a micrometer, measure the diameter of each main journal and crank pin.

Main journal diameter:

STD	54.998 – 55.003 mm (2.1653 – 2.1655 in.)
U/S 0.25	54.745 – 54.755 mm (2.1553 – 2.1557 in.)

Crank pin diameter:

STD	51.985 – 52.000 mm (2.0466 – 2.0472 in.)
U/S 0.25	51.745 – 51.755 mm (2.0372 – 2.0376 in.)

If the diameter is not as specified, check the oil clearance (See pages [EM-279](#) to 283). If necessary, grind or replace the crankshaft.

- Check each main journal and crank pin for taper and out-of-round as shown.

Maximum taper and out-of-round: 0.02 mm (0.0008 in.)

If the taper and out-of-round is greater than maximum, replace the crankshaft.

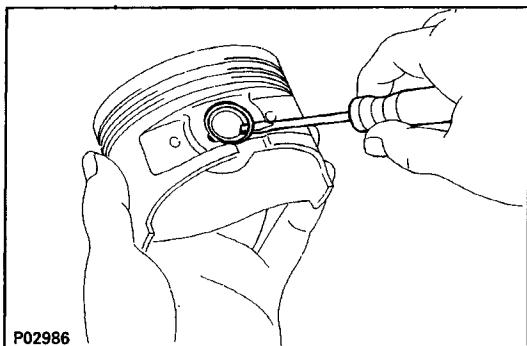
3. IF NECESSARY, GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS

Grind and hone the main journals and/or crank pins to the finished undersized diameter (See procedure in step 2).

Install new main journal and/or crank pin undersized bearings.

REPLACEMENT OF CRANKSHAFT OIL SEALS

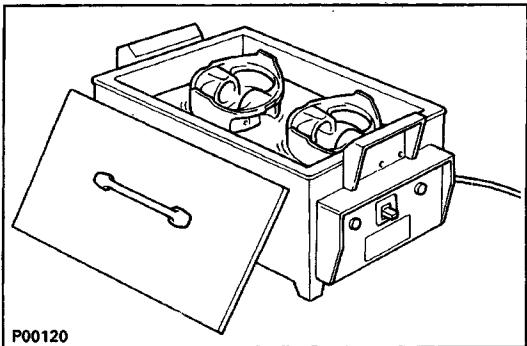
(See pages [EM-249](#) and 250)



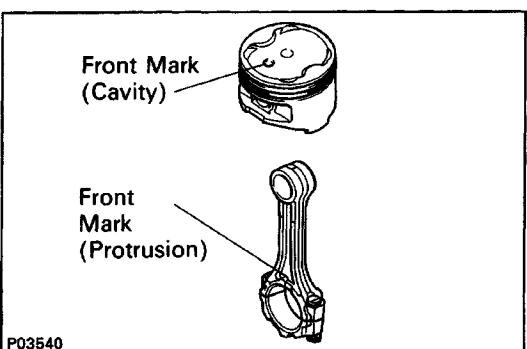
ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

1. ASSEMBLE PISTON AND CONNECTING ROD

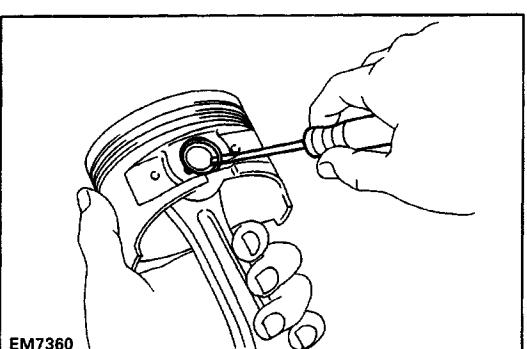
- Using a small screwdriver, install a new snap ring on one side of the piston pin hole.



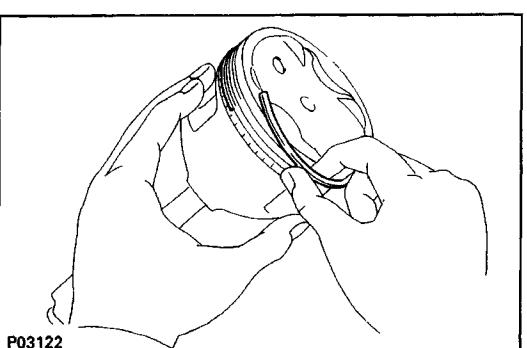
- Gradually heat the piston to 80 – 90°C (176 – 194°F).



- Coat the piston pin with engine oil.
- Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.

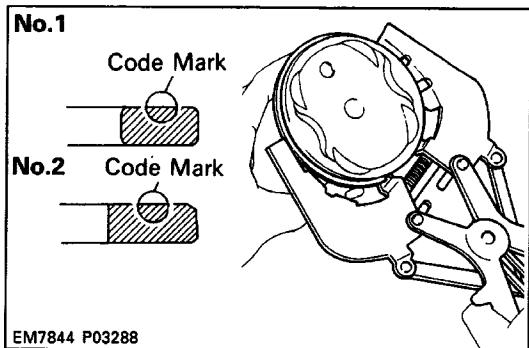


- Using a small screwdriver, install a new snap ring on the other side of the piston pin hole.



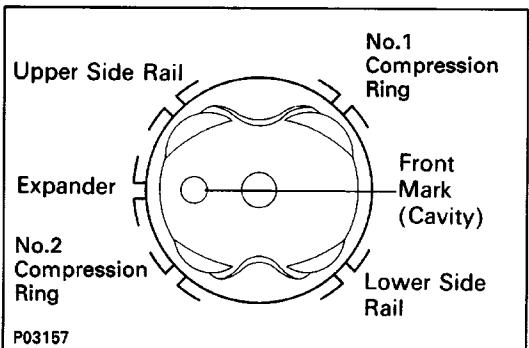
2. INSTALL PISTON RINGS

- Install the oil ring expander and two side rails by hand.



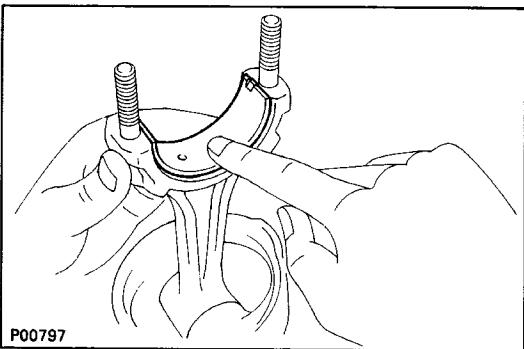
(b) Using a piston ring expander, install the two compression rings with the code mark facing upward.

**Code mark: No.1 1N or T
No.2 2N or 2T**



(c) Position the piston rings so that the ring ends are as shown.

NOTICE: Do not align the ring ends.



3. INSTALL BEARINGS

(a) Align the bearing claw with the groove of the connecting rod or connecting cap.

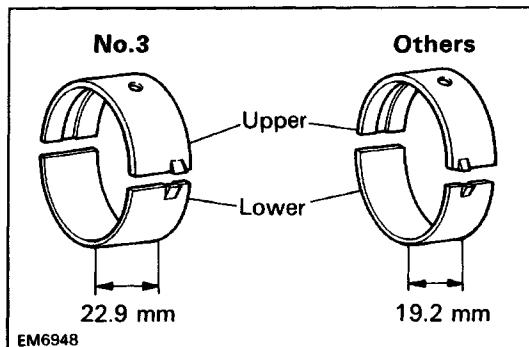
(b) Install the bearings in the connecting rod and connecting rod cap.

ASSEMBLY OF CYLINDER BLOCK

(See page EM-268)

HINT:

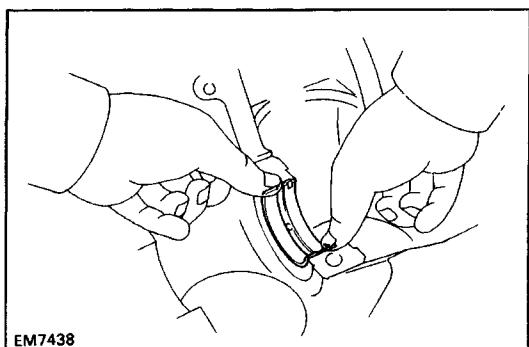
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.



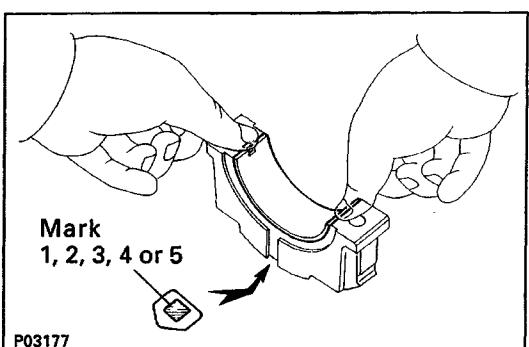
1. INSTALL MAIN BEARINGS

HINT:

- Main bearings come in widths of 19.2 mm (0.756 in.) and 22.9 mm (0.902 in.). Install the 22.9 mm (0.902 in.) bearings in the No.3 cylinder block journal position with the main bearing cap. Install the 19.2 mm (0.756 in.) bearings in the other positions.
- Upper bearings have an oil groove and oil holes; lower bearings do not.

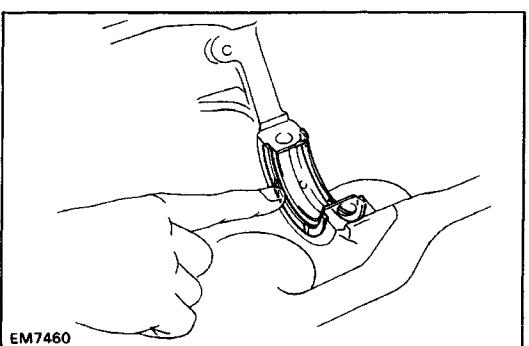


(a) Align the bearing claw with the claw groove of the cylinder block, and push in the five upper bearings.



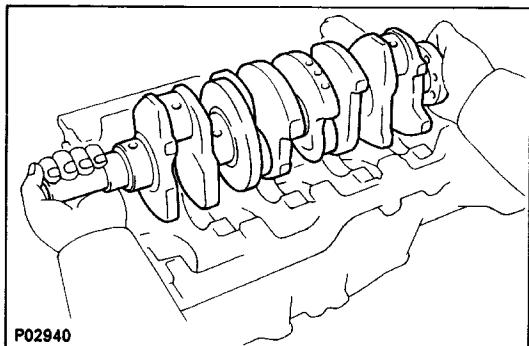
(b) Align the bearing claw with the claw groove of the main bearing cap, and push in the five lower bearings.

HINT: A number is marked on each main bearing cap to indicate the installation position.

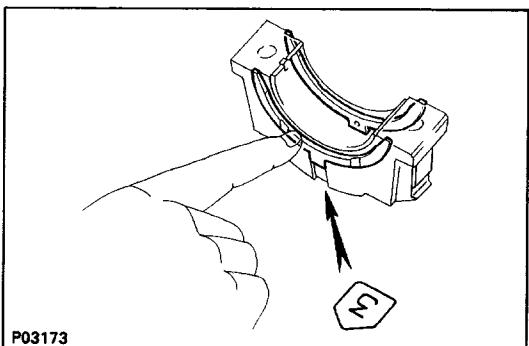


2. INSTALL UPPER THRUST WASHERS

Install the two thrust washers under the No.3 journal position of the cylinder block with the oil grooves facing outward.

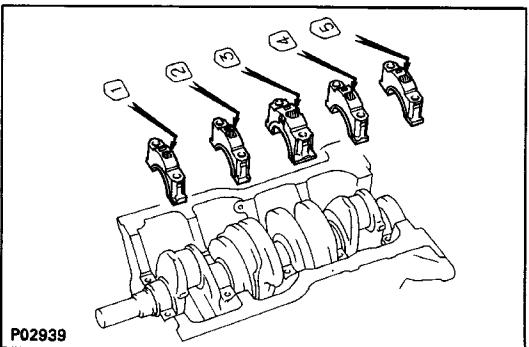


3. PLACE CRANKSHAFT ON CYLINDER BLOCK



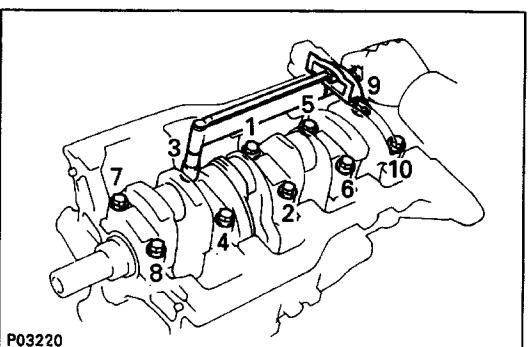
4. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

(a) Install the two thrust washers on the No.3 bearing cap with the grooves facing outward.



(b) Install the five main bearing caps in their proper locations.

HINT: Each bearing cap has a number and front mark.



(c) Apply a light coat of engine oil on the threads and under the heads of the main bearing caps.

(d) Install and uniformly tighten the ten bolts of the main bearing caps in several passes in the sequence shown.

Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)

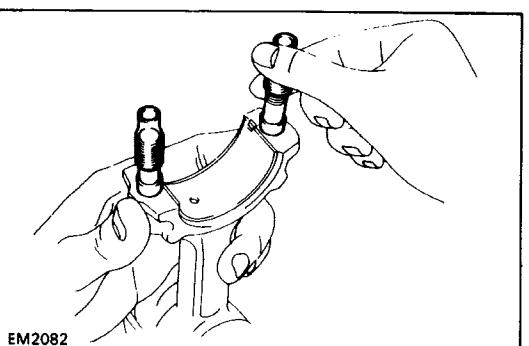
(e) Check that the crankshaft turns smoothly.

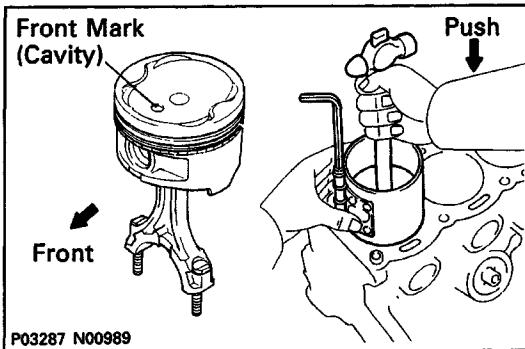
(f) Check the crankshaft thrust clearance.

(See step 5 on page [EM-281](#))

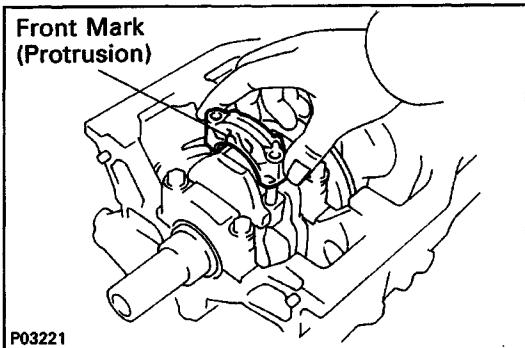
5. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

(a) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.





(b) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.



6. INSTALL CONNECTING ROD CAPS

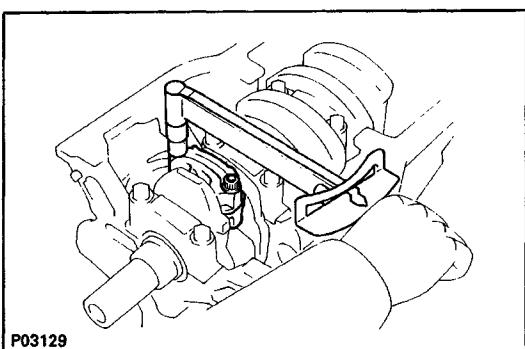
A. Place connecting rod cap on connecting rod

(a) Match the numbered connecting rod cap with the connecting rod.
 (b) Install the connecting rod cap with the front mark facing forward.

B. Install connecting rod cap nuts

HINT:

- The cap nuts are tightened in two progressive steps (steps (b) and (d)).
- If any one of the connecting rod bolts is broken or deformed, replace it.



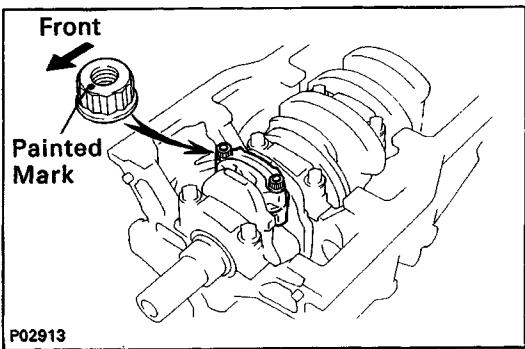
(a) Apply a light coat of engine oil on the threads and under the cap nuts.

(b) Using SST, install and alternately tighten the cap nuts in several passes.

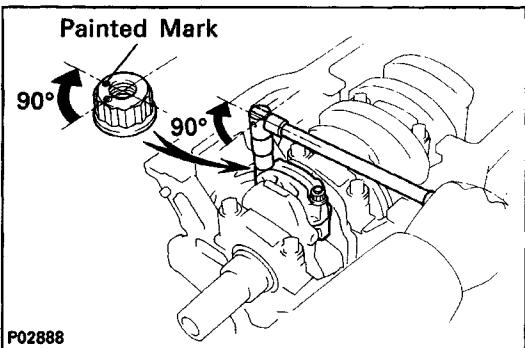
SST 09011-38121

Torque: 25 N·m (250 kgf·cm, 18 ft-lbf)

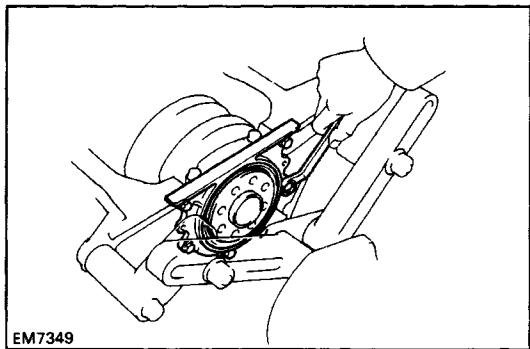
If any one of the cap nuts does not meet the torque specification, replace the connecting rod bolt and cap nut as a set.



(c) Mark the front of the cap nut with the paint.



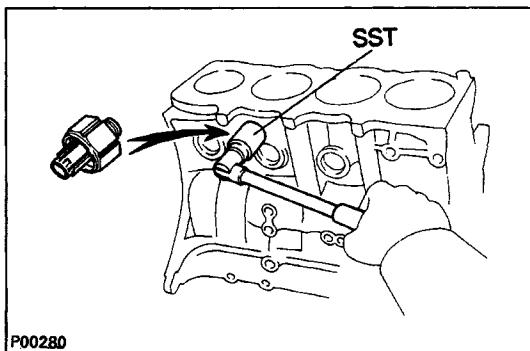
- (d) Retighten the cap nuts 90° in the numerical order shown.
- (e) Check that the painted mark is now at a 90° angle to the front.
- (f) Check that the crankshaft turns smoothly.
- (g) Check the connecting rod thrust clearance. (See step 2 on page [EM-279](#))



7. INSTALL REAR OIL SEAL RETAINER

Install a new gasket and the retainer with the six bolts.

Torque: 9.3 N·m (95 kgf·cm, 82 in.-lbf)



POST ASSEMBLY

1. INSTALL KNOCK SENSOR

Using SST, install the knock sensor.

SST 09816-30010

Torque: 37 N·m (380 kgf·cm, 27 ft-lbf)

2. (w/ OIL COOLER)

INSTALL OIL COOLER (See page [LU-30](#))

3. INSTALL OIL FILTER (See page [LU-7](#))

4. INSTALL OIL PUMP AND OIL PAN

(See pages [LU-21](#) and [22](#))

5. INSTALL WATER PUMP AND ALTERNATOR

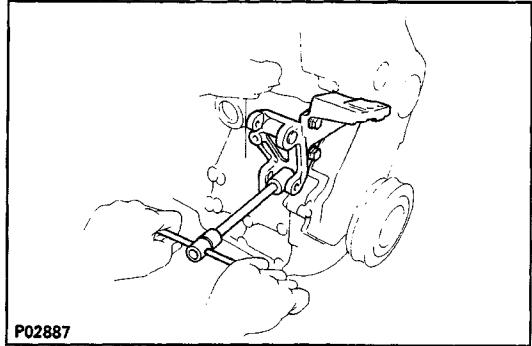
ADJUSTING BAR (See pages [CO-14](#) and [15](#))

6. INSTALL CYLINDER HEAD

(See pages [EM-173](#) to [182](#))

7. INSTALL PULLEYS AND TIMING BELT

(See pages [EM-75](#) to [79](#))



8. INSTALL RH ENGINE MOUNTING BRACKET

Install the mounting bracket with the three bolts.

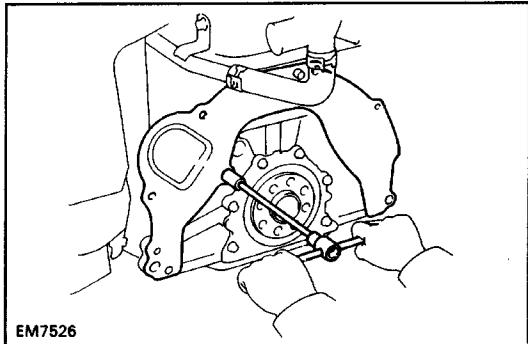
Torque: 52 N·m (530 kgf·cm, 38 ft-lbf)

9. INSTALL PS PUMP BRACKET

Install the PS pump bracket with the three bolts.

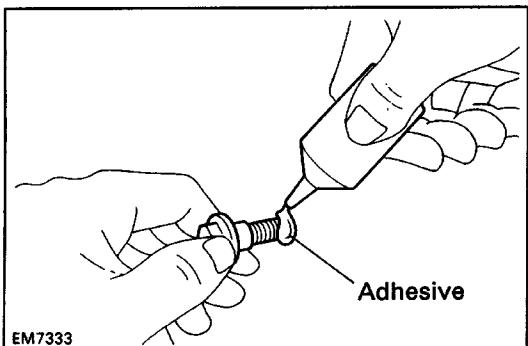
Torque: 43 N·m (440 kgf·cm, 32 ft-lbf)

10. INSTALL ALTERNATOR (See page [CH-25](#))
11. INSTALL DISTRIBUTOR (See page [IG-35](#))
12. REMOVE ENGINE STAND



13. INSTALL REAR END PLATE

Torque: 9.3 N·m (95 kgf·cm, 82. in.-lbf)

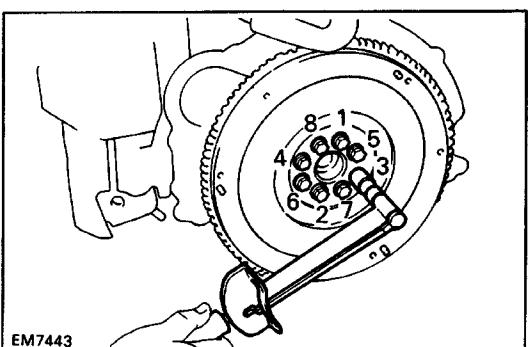


14. (M/T)

INSTALL FLYWHEEL

- (a) Apply adhesive to two or three threads of the mounting bolt end.

Adhesive: Part No. 08833-00070, THREE BOND 1324 or equivalent



- (b) Install the flywheel on the crankshaft.

- (c) Install and uniformly tighten the mounting bolts in several passes in the sequence shown.

Torque: 88 N·m (900 kgf·cm, 65 ft-lbf)

15. (A/T)

INSTALL DRIVE PLATE (See procedure in step 14)

Torque: 83 N·m (850 kgf·cm, 61 ft-lbf)

16. (M/T)

INSTALL CLUTCH DISC AND COVER

(See CL section)

INSTALLATION OF ENGINE

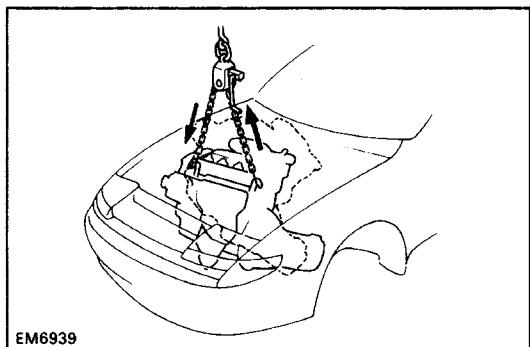
1. ASSEMBLE ENGINE AND TRANSAXLE

M/T (See MT section)

A/T (See AT section)

2. (A/T)

INSTALL STARTER (See page [ST-23](#))

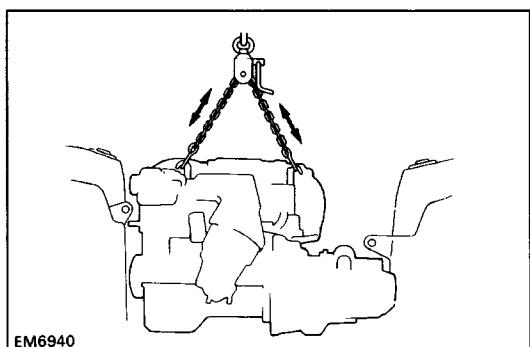


3. INSTALL ENGINE AND TRANSAXLE ASSEMBLY IN VEHICLE

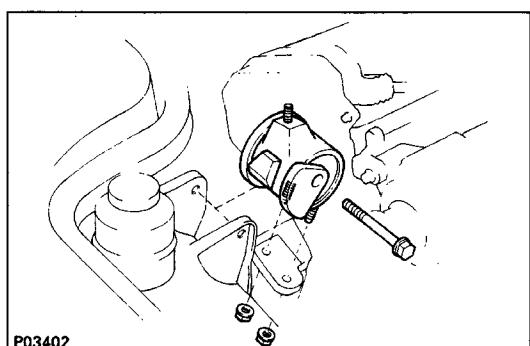
- Attach the engine chain hoist to the engine hangers,
- Lower the engine into the engine compartment.

Tilt the transaxle downward, lower the engine and clear the LH mounting.

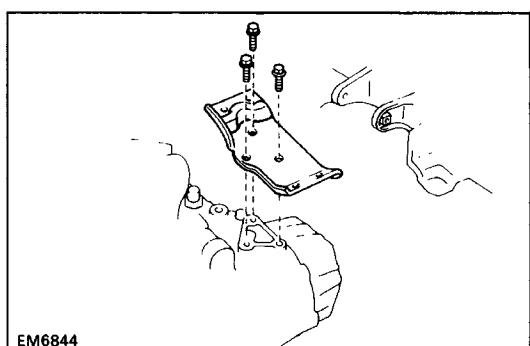
NOTICE: Be careful not to hit the PS gear housing or neutral start switch (A/T).



- Keep the engine level, and align RH and LH mountings with the body bracket.

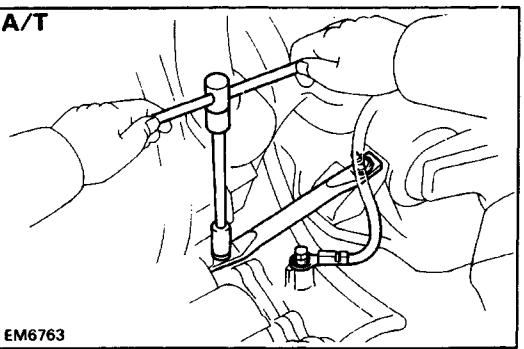
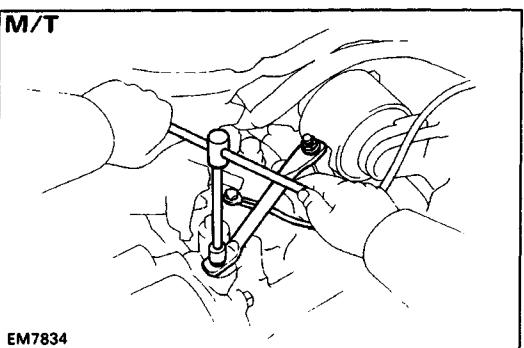
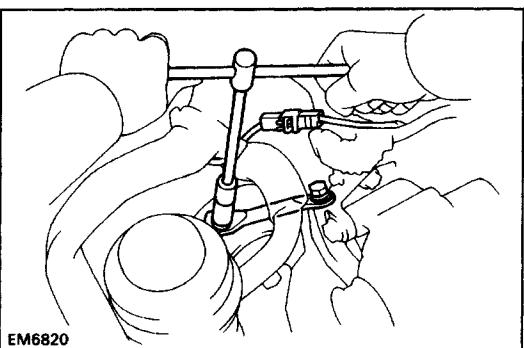
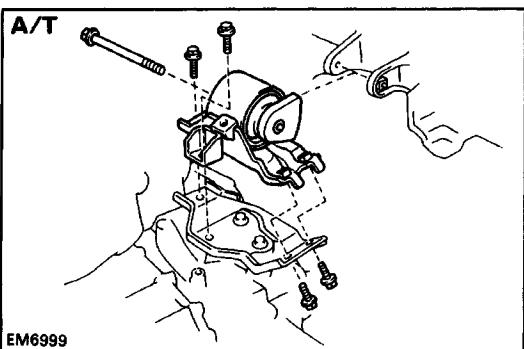
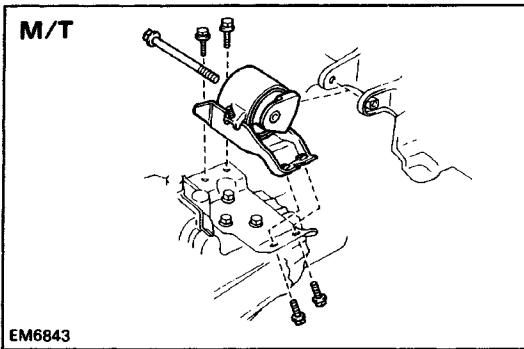


- Attach the RH mounting insulator to the mounting bracket and body, and temporarily install the through bolt and two nuts.



- Install the LH mounting bracket to the transaxle case with the three bolts.

Torque: 52 N·m (530 kgf·cm, 38 ft-lbf)



(f) Attach the LH mounting insulator to the mounting bracket and body with the through bolt and four bolts. Torque the bolts.

Torque:

Bolt 63 N·m (650 kgf·cm, 47 ft·lbf)

Through bolt 87 N·m (890 kgf·cm, 64 ft·lbf)

(g) Torque the through bolt and two nuts of the RH mounting insulator.

Torque:

Nut 52 N·m (530 kgf·cm, 38 ft·lbf)

Through bolt 87 N·m (890 kgf·cm, 64 ft·lbf)

(h) Remove the engine chain hoist from the engine.

4. INSTALL RH ENGINE MOUNTING STAY

Install the mounting stay with the bolt and nut.

Torque: 73 N·m (740 kgf·cm, 54 ft·lbf)

5. CONNECT GROUND CONNECTOR TO GROUND WIRE ON RH FENDER APRON

6. INSTALL LN ENGINE MOUNTING STAY

(M/T)

(a) Install the mounting stay with the two nuts.

(b) Connect the ground strap.

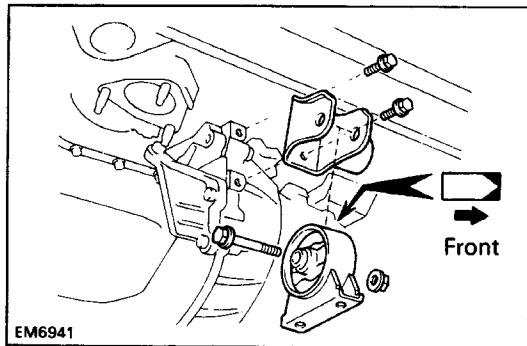
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

(A/T)

(a) Install the mounting stay with the bolt and nut.

Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

(b) Connect the ground strap to the transaxle with the bolt.

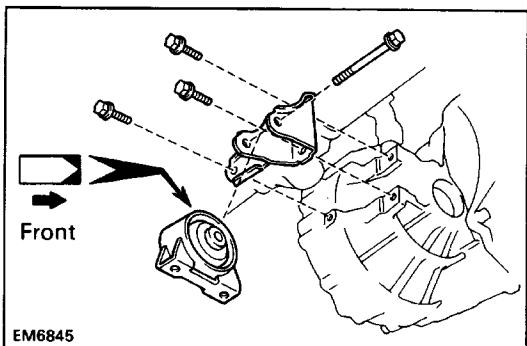


7. INSTALL FRONT ENGINE MOUNTING BRACKET AND INSULATOR

(a) Install the mounting bracket with the two bolts.

Torque: 77 N·m (790 kgf·cm, 57 ft-lbf)

(b) Temporarily install the mounting insulator with the through bolt and nut.

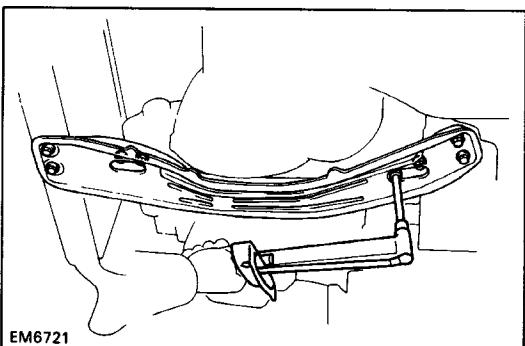


8. INSTALL REAR ENGINE MOUNTING BRACKET AND INSULATOR

(a) Install the mounting bracket with the three bolts.

Torque: 77 N·m (790 kgf·cm, 57 ft-lbf)

(b) Temporarily install the mounting insulator with the through bolt.



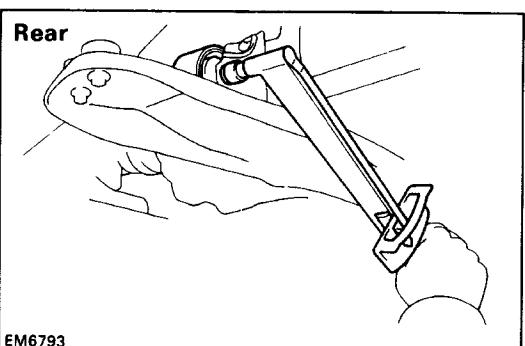
9. INSTALL ENGINE MOUNTING CENTER MEMBER

(a) Install the engine mounting center member with the four bolts.

Torque: 52 N·m (530 kgf·cm, 38 ft-lbf)

(b) Install and torque the four bolts holding the insulators to the center member.

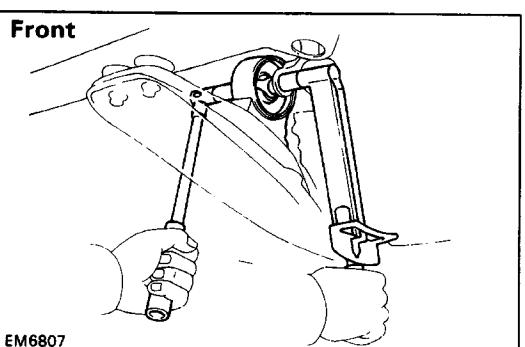
Torque: 73 N·m (740 kgf·cm, 54 ft-lbf)



10. TIGHTEN FRONT AND REAR ENGINE MOUNTING THROUGH BOLTS

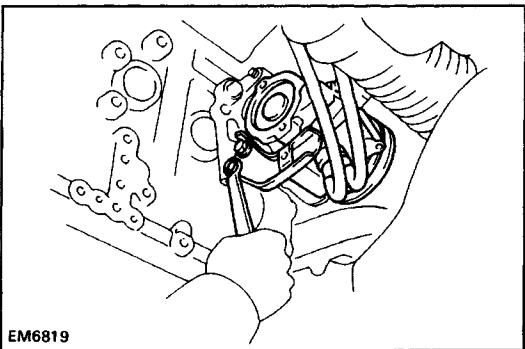
(a) Tighten the rear through bolt.

Torque: 87 N·m (890 kgf·cm, 64 ft-lbf)



(b) Tighten the front through bolt.

Torque: 87 N·m (890 kgf·cm, 64 ft-lbf)



11. INSTALL PS PUMP

(a) Install the PS pump with the four bolts.

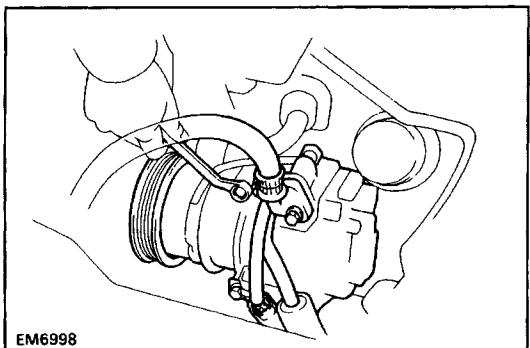
Torque:

Adjusting bolt 39 N·m (400 kgf·cm, 29 ft-lbf)

Others 43 N·m (440 kgf·cm, 32 ft-lbf)

(b) Install the drive belt.

(c) Connect the two air hoses to the air pipe.



12. (w/ A/C)

INSTALL A/C COMPRESSOR

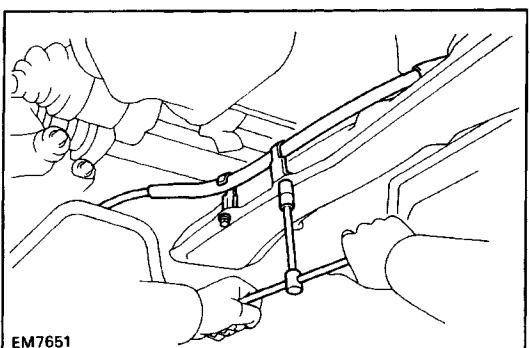
(a) Install the compressor with the three bolts.

Torque: 27 N·m (280 kgfc 20 ft-lbf)

(b) Connect the two connectors.

(c) Connect the A/C compressor connector.

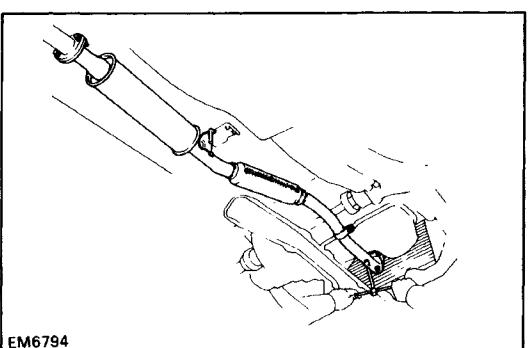
13. INSTALL DRIVE SHAFTS (See SA section)



14. (A/T)

INSTALL TRANSAXLE CONTROL CABLE TO ENGINE MOUNTING CENTER MEMBER

Install the control cable with the two clamps and bolts.



15. INSTALL FRONT EXHAUST PIPE

(a) Install the support hook on the front exhaust pipe to the support bracket.

(b) Place two new gaskets on the front and rear of the front exhaust pipe.

(c) Temporarily install the two bolts and new nuts holding the exhaust pipe to the center exhaust pipe.

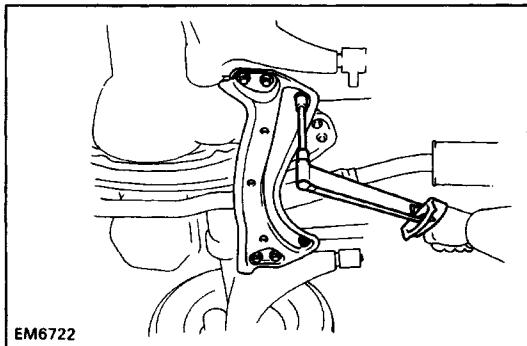
(d) Using a 14 mm deep socket wrench, install the three new nuts holding the exhaust pipe to the catalytic converter.

Torque: 62 N·m (630 kgf·cm, 46 ft-lbf)

(e) Tighten the two bolts and nuts holding the exhaust pipe to the center exhaust pipe.

Torque: 43 N·m (440 kgf·cm, 32 ft-lbf)

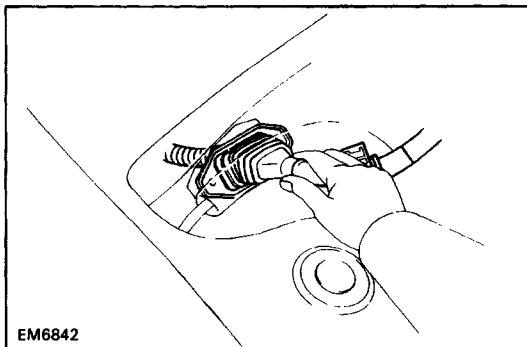
(f) Install the clamp with the bolt.



16. INSTALL SUSPENSION LOWER CROSSM EM BER

Install the lower crossmember with the four bolts and two nuts.

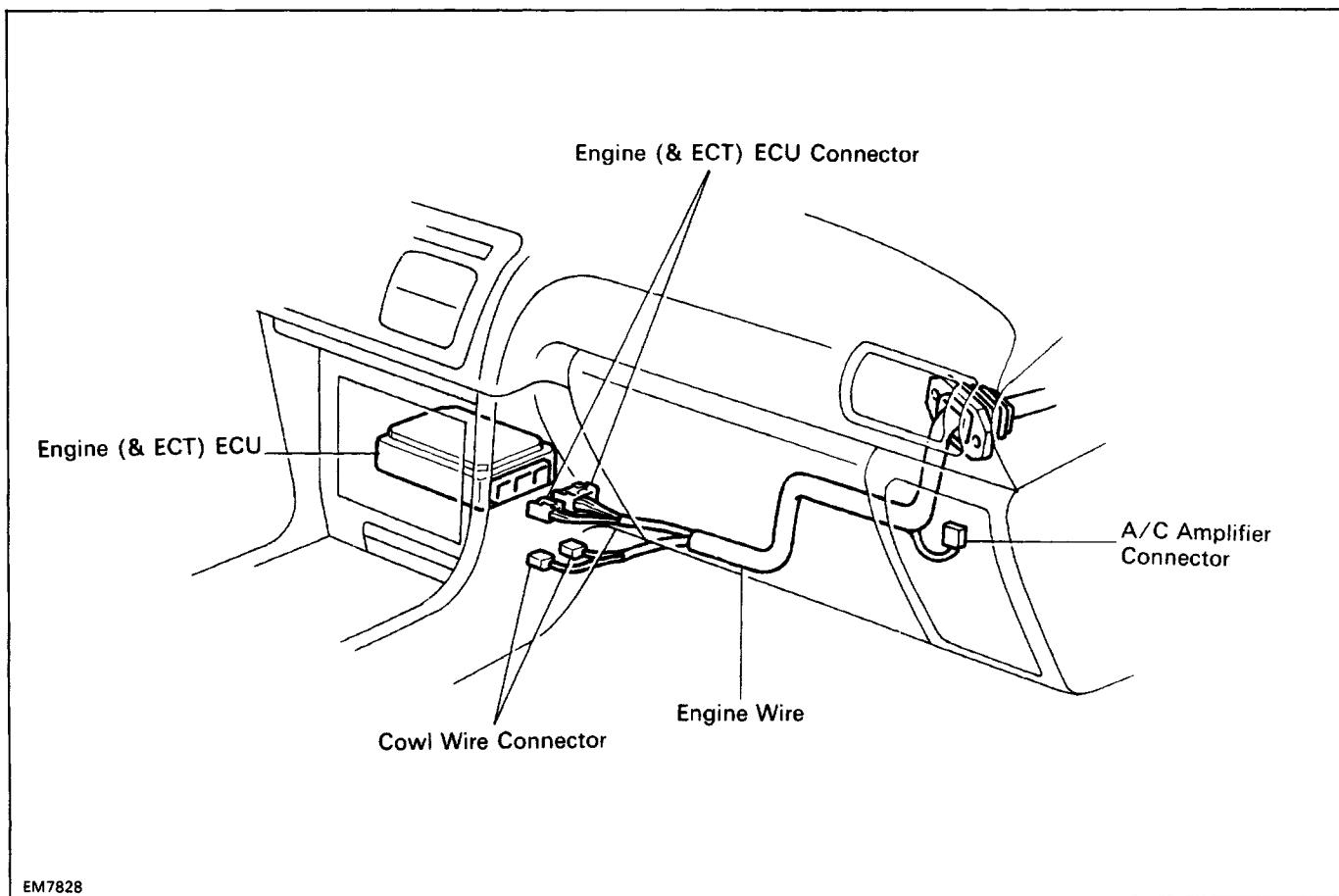
Torque: 152 N·m (1,554 kgf·cm, 112 ft-lbf)



17. CONNECT ENGINE WIRE TO CABIN

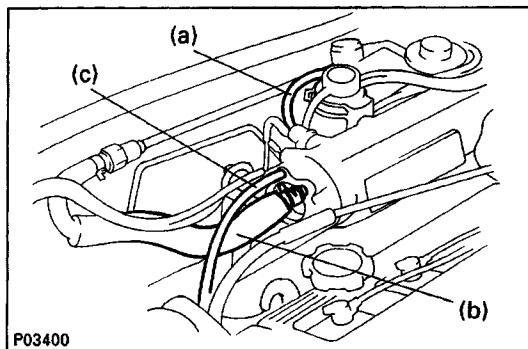
(a) Push in the engine wire through the cowl panel.
Install the two nuts.

(b) Connect the following connectors:
(1) Two engine (& ECT) ECU connectors
(2) Two cowl wire connectors
(3) A/C amplifier connector

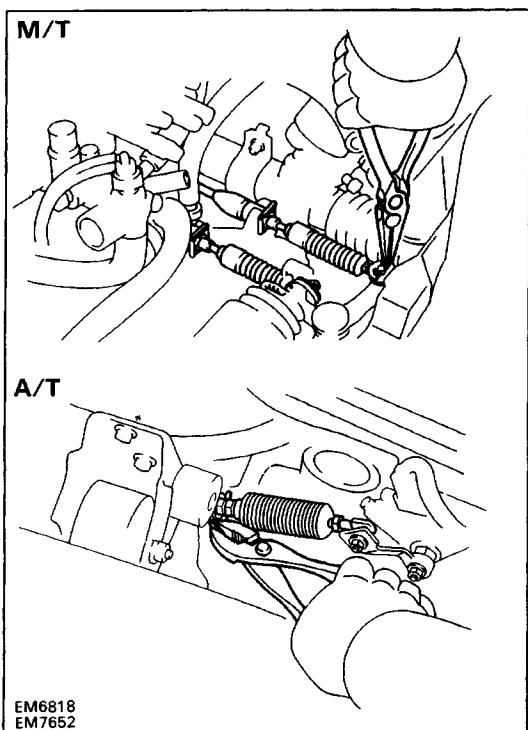


18. CONNECT ENGINE WIRE

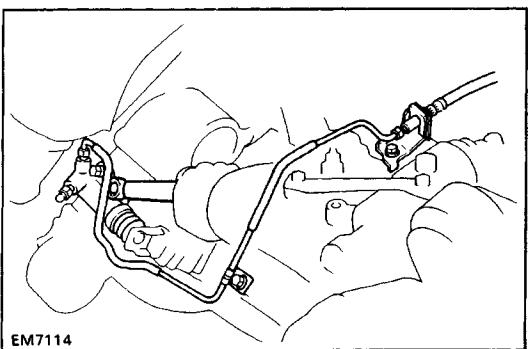
- (a) Engine wire clamp to wire bracket on RH fender apron
- (b) Two cowl wire connectors

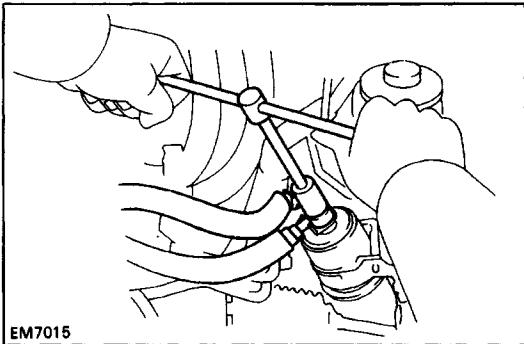
**19. CONNECT VACUUM HOSES**

- (a) Vacuum sensor hose to gas filter
- (b) Brake booster vacuum hose to intake manifold
- (c) (w/ Cruise Control System (w/o ABS))
Actuator vacuum hose to intake manifold

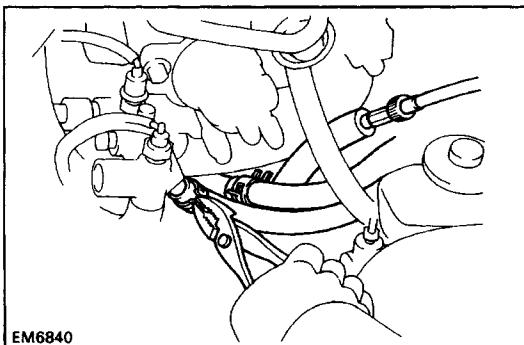
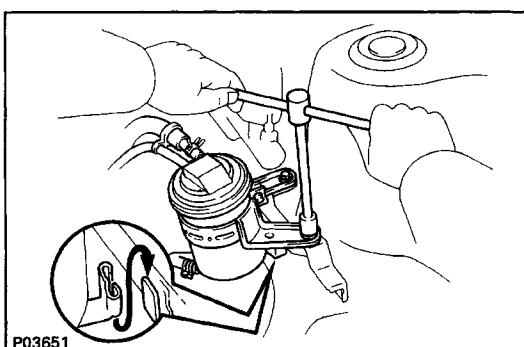
**21. (M/T)****INSTALL CLUTCH RELEASE CYLINDER**

Install the release cylinder and tube with the four bolts.

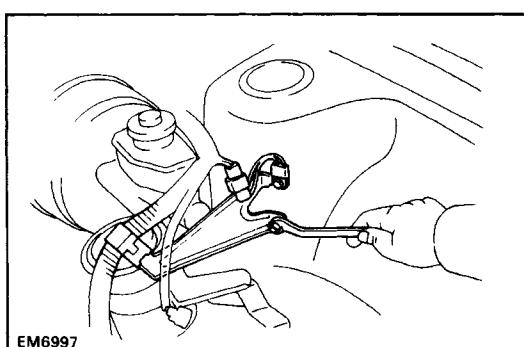
22. (M/T)**INSTALL STARTER (See page ST-23)**

**23. CONNECT FUEL HOSES**

Torque (Union bolt): 29 N·m (300 kgf·cm, 22 ft-lbf)

**24. CONNECT SPEEDOMETER CABLE****25. CONNECT HEATER HOSES****26. INSTALL CHARCOAL CANISTER**

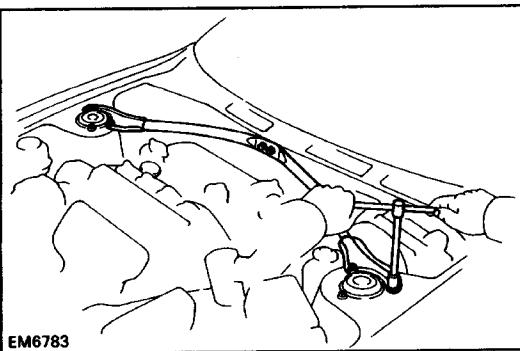
- Install the charcoal canister with the two bolts.
- Connect the three hoses.

**27. INSTALL ENGINE WIRE BRACKET**

- Install the wire bracket with the two bolts. Install the noise filter.
- Install the wire clamp to the wire bracket.

28. CONNECT WIRES AND CONNECTORS

- Check connector
- Igniter connector
- Vacuum sensor connector
- Ground straps from LH fender apron



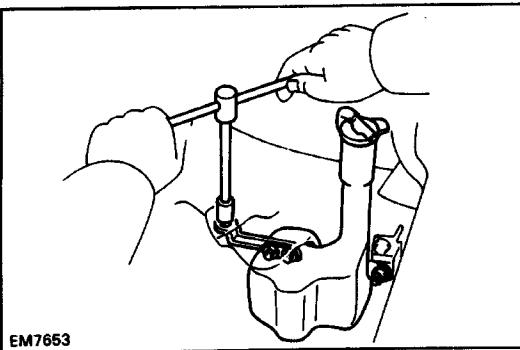
29. INSTALL SUSPENSION UPPER BRACE

- (a) Install the suspension upper brace with the two bolts and four nuts.

Torque: Bolt 21 N·m (210 kgf·cm, 15 ft-lbf)

Nut 64 N·m (650 kgf·cm, 47 ft-lbf)

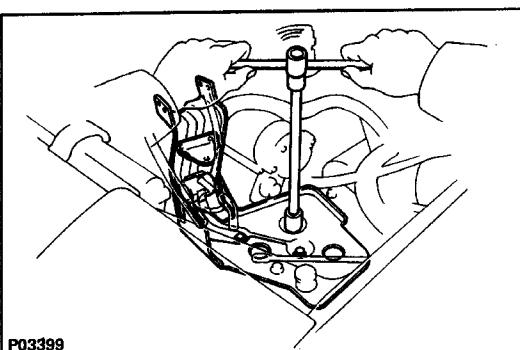
- (b) Install the outside lower windshield moulding.
- (c) Install the two wiper arms.



30. INSTALL RADIATOR RESERVOIR TANK

Install the reservoir tank with the two nuts.

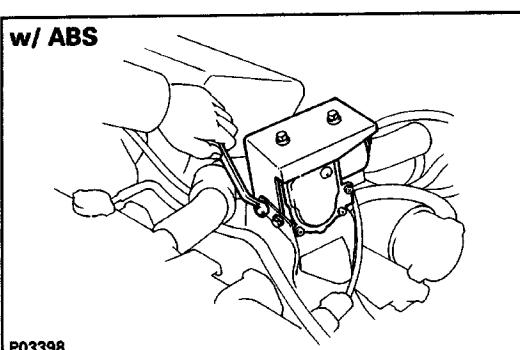
31. INSTALL RADIATOR (See pages CO-24 and 25)



32. (w/ CRUISE CONTROL SYSTEM (w/ ABS))

INSTALL CRUISE CONTROL ACTUATOR BRACKET

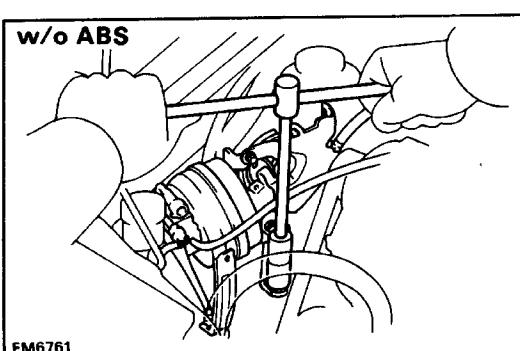
- (a) Install the actuator bracket with the two bolts and nut.
- (b) Install the actuator connector to the bracket.



33. (w/ CRUISE CONTROL SYSTEM)

INSTALL CRUISE CONTROL ACTUATOR (w/ ABS)

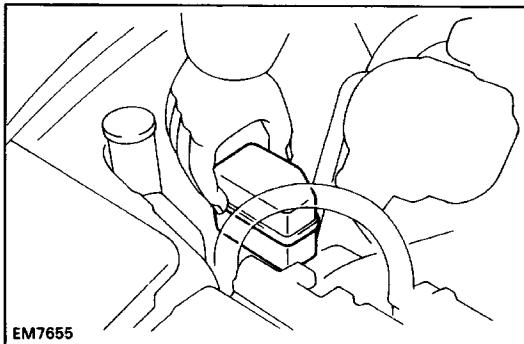
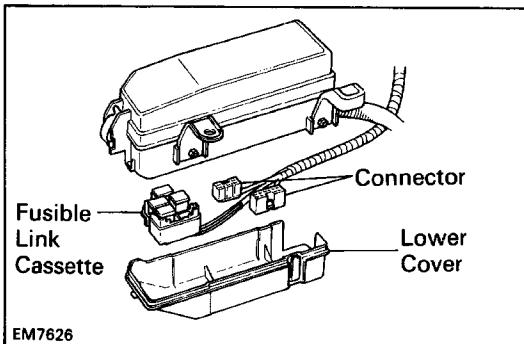
- (a) Install the actuator with the four bolts.
- (b) Connect the actuator connector.



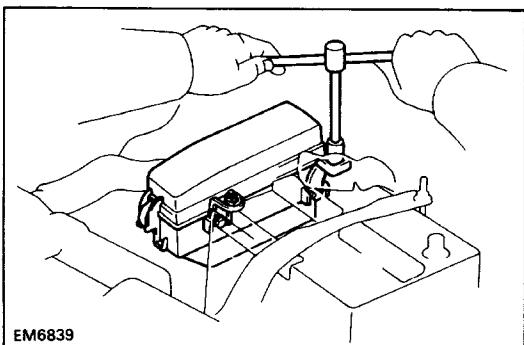
(w/o ABS)

- (a) Install the actuator with the three bolts.
- (b) Connect the cable to the actuator.
- (c) Connect the actuator connector.
- (d) Connect the actuator vacuum hose.
- (e) Install the actuator cover.

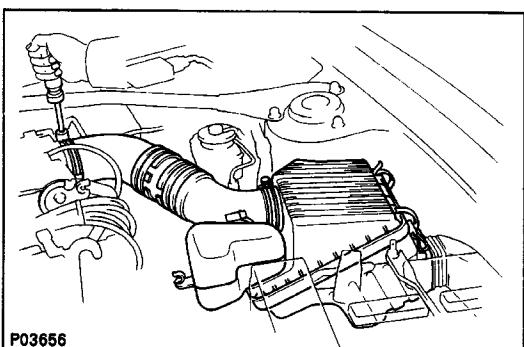
34. INSTALL BATTERY

**35. INSTALL A/C RELAY BOX****36. CONNECT ENGINE WIRE, AND INSTALL ENGINE RELAY BOX**

- Connect the fusible link cassette and two connectors of the engine wire to the relay box.
- Install the lower cover to the relay box.



- Install the relay box with the two nuts.

37. INSTALL ACCELERATOR CABLE, AND ADJUST IT**38. INSTALL AIR CLEANER ASSEMBLY**

- Install the air cleaner case with the three bolts.
- Install the air cleaner element.
- Connect the air cleaner hose to the throttle body.
- Install the air cleaner cap.
- Connect the intake air temperature sensor connector.

39. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**40. FILL WITH ENGINE COOLANT (See page CO-6)**
Capacity (w/ Heater):

M/T 6.2 liters (6.6 US qts, 5.5 Imp. qts)

A/T 6.1 liters (6.4 US qts, 5.4 Imp. qts)

41. FILL WITH ENGINE OIL (See page [LU-8](#))**Capacity (w/ Oil cooler):****Drain and refill****w/ Oil filter change****4.2 liters (4.4 US qts, 3.7 Imp. qts)****w/o Oil filter change****3.8 liters (4.0 US qts, 3.3 Imp. qts)****Dry fill 4.6 liters (4.9 US qts, 4.0 Imp. qts)****Capacity (w/ Oil cooler):****Drain and refill****w/ Oil filter change****4.1 liters (4.3 US qts, 3.6 Imp. qts)****w/o Oil filter change****3.7 liters (3.9 US qts, 3.3 Imp. qts)****Dry fill 4.5 liters (4.8 US qts, 4.0 Imp. qts)****42. START ENGINE AND CHECK FOR LEAKS****43. PERFORM ENGINE ADJUSTMENT****(a) Adjust the alternator drive belt.****(See page [CH-3](#))****Drive belt tension:****w/ A/C New belt 165 ± 10 lbf****Used belt 110 ± 10 lbf****w/o A/C New belt 125 ± 25 lbf****Used belt 95 ± 20 lbf****(b) Adjust the PS drive belt. (See page [SR-38](#))****Drive belt tension: New belt 125 ± 25 lbf****Used belt 80 ± 20 lbf****(c) Adjust the ignition timing. (See page [IG-37](#))****Ignition timing:** **10° BTDC @ idle****(w/ Terminals TE1 and E1 connected)****44. INSTALL ENGINE UNDER COVERS****45. INSTALL HOOD****46. PERFORM ROAD TEST**

Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

47. RECHECK ENGINE COOLANT AND ENGINE OIL LEVELS