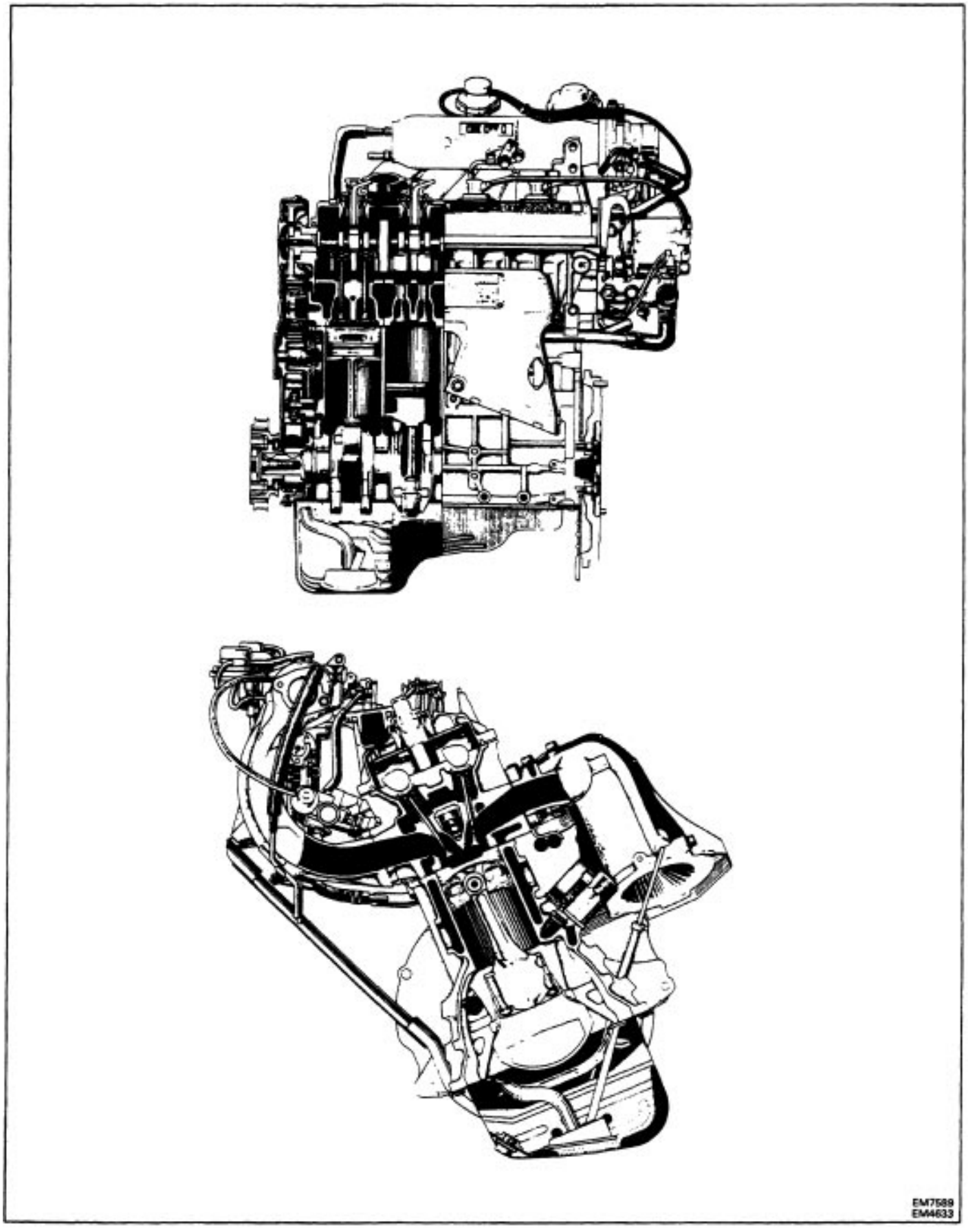
ENGINE MECHANICAL

DESCRIPTION (3S–FE)

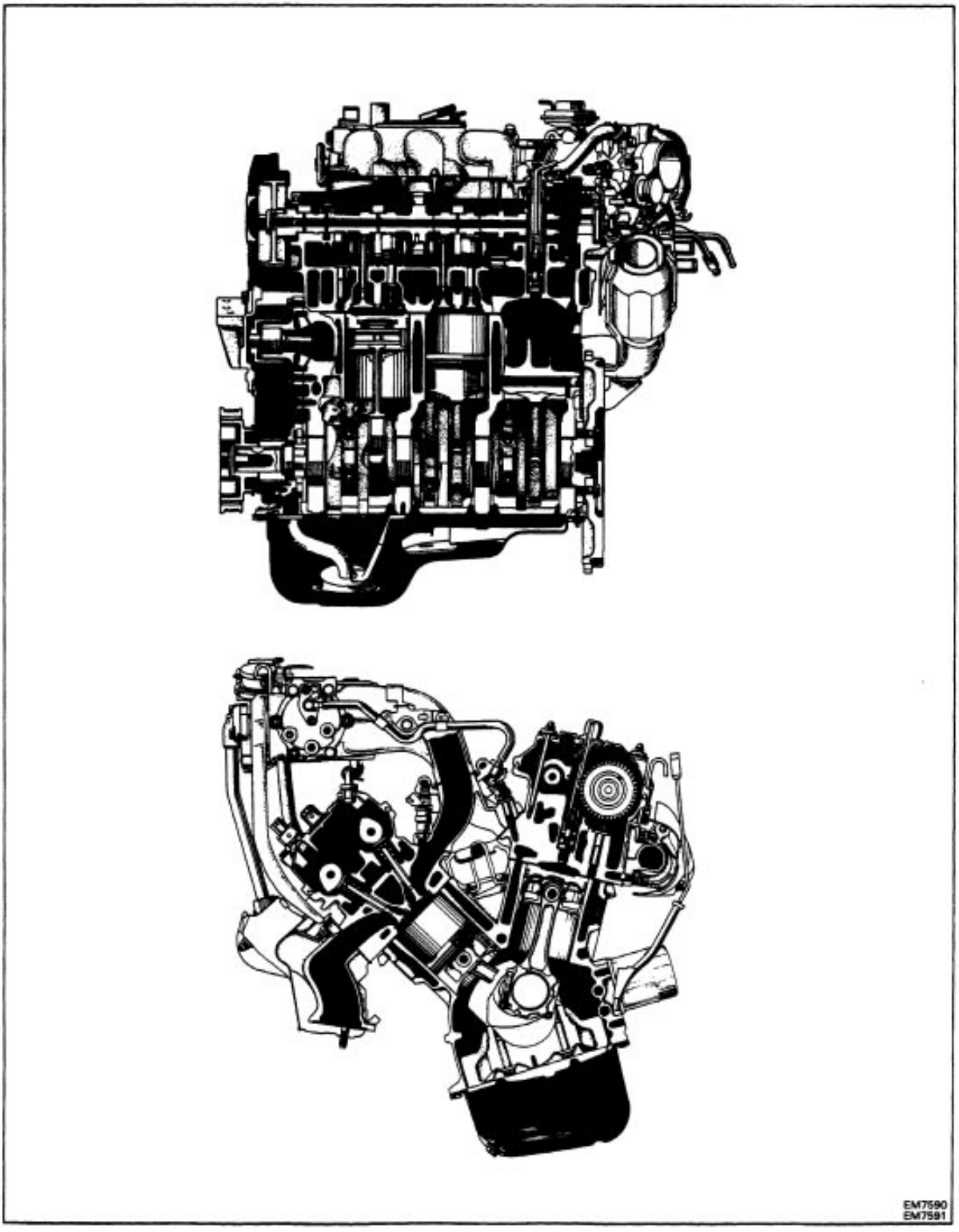
The 3S–FE engine is an in–line 4–cylinder 2.0 liter DOHC 16 valve engine.



The 3S–FE engine is an in–line 4–cylinder engine with the cylinders numbered 1 – 2 – 3 – 4 from the front.
The crankshaft is supported by 5 bearing inside the crankcase. These bearing 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.
This engine's ignition order is 1 – 3 – 4 – 2. The cylinder head is made of aluminum alloy, with a cross flow type intake and exhaust layout and with pent–roof type combustion chambers. The spark plugs are located in the center of the combustion chamber.
The intake manifold has 8 independent long ports and utilizes the inertial supercharging effect to improve engine torque at low and medium speeds.
Exhaust and intake valves are equipped with irregular pitch springs made of special valve spring carbon steel which are capable of functioning no matter what the engine speed.
The intake side camshaft is driven by a timing belt, and a gear on the intake side camshaft engages with a gear on the exhaust side camshaft to drive it. The cam journal is supported at 5 places between the valve lifters of each cylinder and on the front end of the cylinder head. Lubrication of the cam journal and gear is accomplished by oil being supplied through the oiler port in the center of the camshaft.
Adjustment of the valve clearance is done by means of 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 2 pieces. A service hole is provided in the No. 1 belt cover for adjusting the timing belt tension.
Piston 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 fitting, allowing the pistons and pins to float.
The No. 1 compression ring is made of steel and the No. 2 compression ring is made of cast iron. The oil ring is made of a combination of steel and stainless steel. The outer diameter of each piston ring is slightly larger than the diameter of the piston and the flexibility of the rings allows them to hug the cylinder walls when they are mounted on the piston rings No. 1 and No. 2 work to prevent gas leakage from the cylinder and oil ring works to clear oil off the cylinder walls to prevent it from entering the combustion chambers.
The cylinder block is made of cast iron. It has 4 cylinders which are approximately 2 times the length of the piston stroke. The top of the cylinders is closed off by the cylinder head and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In .addition, the cylinder block contains a water jacket, through which coolant is pumped to cool the cylinders.
The oil pan is bolted onto the bottom of the cylinder block. The oil pan is an oil reservoir made of pressed steel shoot. 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 topped suddenly and thus shifting the oil away from the oil pump suction pipe.

DESCRIPTION (2VZ–FE)

The 2VZ–FE engine is a V type 6–cylinder 2.5 liter DOHC 24 valve engine.



EM7590
EM7591

The 2VZ–FE engine has 6 cylinder in a V arrangement at bank of 60˚. From the front of the RH bank cylinders are numbered 1 – 3 – 5, and from the front of the LH bank cylinders are numbered 2 – 4 –r 6. The crankshaft is supported by 4 bearings inside the crankcase. These bearing are made of copper and lead alloy.

The crankshaft is integrated with 5 weights for balance. Oil holes are placed in the center of the crankshaft for supplying oil to the connecting rods, pistons and other components.

This engine's ignition order is 1 – 2 – 3 – 4 – 5 – 6. 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.

At,the front and rear of the intake port of the intake manifold, a water passage has been provided which connects the RH and LH cylinder heads.

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 RH and LH intake camshaft are driven by a single timing belt, and a gear on the intake side camshaft engages with a gear on the exhaust side camshaft to drive it. The cam journal is supported at 5 (intake) or 4 (exhaust) places between the valve liters 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 outer shim type system, in which valve adjusting shims are located above the valve lifters. The permits replacement of the shims without removal of the camshafts.

The timing belt cover is composed of resin type No. 2 and No. 1 above and below the RH mounting bracket.

Piston are made 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 fitting, allowing the pistons and pins to float.

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

The cylinder block is made of cast iron with a bank angle of 60˚. It has 6 cylinders which are approximately 2 times the length of the piston stroke. The top of the cylinders is closed off by the cylinder heads and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder block contains a water jacket, through which coolant is pumped to cool the cylinders.

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

TROUBLESHOOTING

ENGINE OVERHEATING

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

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 • No fuel in tank • Fuel pump no working • Fuel filter clogged • Fuel line clogged or leaking	Troubleshoot EFI system	FI–10
	EFI system problems	Repair as necessary	
	Ignition problems • Ignition coil • Igniter • Distributor	Perform spark test	IG–5, 9
	Spark plug faulty	Inspect plugs	IG–6, 10
	High–tension cord disconnected or broken	Inspect cords	IG–6, 10
	Vacuum leaks • PCV line • EGR line • Intake manifold • Air intake chamber • Throttle body • ISC valve • Brake booster tine	Repair as necessary	
	Pulling in air between air flow meter and throttle body	Repair as necessary	
	Low compression	Check compression	EM–22

ROUGH IDLING

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses	Spark plug faulty	Inspect plugs	IG–6, 10
	High–tension cord faulty	Inspect cords	IG–6, 10
	Ignition problems • Ignition coil • Igniter • Distributor	Inspect coil Inspect igniter Inspect distributor	IG–7, 12 IG–8, 12 IG–7, 12
	Incorrect ignition timing	Reset timing	IG–16, 20
	Vacuum leaks • PCV line • EGR line • Intake manifold	Repair as necessary	

ROUGH IDLING (Cont'd)

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses (Cont'd)	Vacuum leaks (Cont'd) • Air intake chamber • Throttle body • ISC valve • Brake booster line Pulling in air between air flow meter and throttle body Incorrect idle speed Incorrect valve clearance EFI system problems Engine overheats Low compression	 Check ISC system Adjust valve clearance Repair as necessary Check cooling system Check compression	 FI–116, 118 EM–11, 15 CO–4 EM–22

ENGINE HESITATES/POOR ACCELERATION

Problem	Possible cause	Remedy	Page
Engine hesitates/ poor acceleration	Spark plug faulty High–tension cord faulty Vacuum leaks • PCV line • EGR line • Intake manifold • Air intake chamber • Throttle body • ISC valve • Brake booster line Pulling in air between air flow meter and throttle body Incorrect ignition timing Incorrect valve clearance Fuel system clogged Air cleaner clogged EFI system problems Emission control system problem (cold engine) • 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–6, 10 IG–6, 10 IG–16, 20 EM–11, 15 MA–5 EC–8,21 Co–4 EM–22

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–16, 20 EC–8, 21

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 EM system problem Incorrect ignition timing	Check air cleaner Repair as necessary Reset timing	MA–5 IG–16, 20
Engine backfires	EFI system problem Vacuum leak a PCV line • EGR tine • Intake manifold • Air intake chamber • Throttle body • ISC valve • Brake booster fine Pulling in air between air flow meter and throttle body Insufficient fuel flow incorrect ignition timing Incorrect valve clearance Carbon deposits in combustion chambers	Repair as necessary Check hoses and repair as necessary Repair as necessary Troubleshoot fuel system Reset timing Adjust valve clearance Inspect cylinder head	 FI–10 IG –16, 20 EM–11, 15 EM–56, 84

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	 EC–4, 15 EM–123, 156 EM–57,85

EXCESSIVE FUEL CONSUMPTION

Problem	Possible cause	Remedy	Page
Poor gasoline mileage	Fuel leak	Repair as necessary	
	Air cleaner clogged	Check air cleaner	MA–5
	Incorrect ignition timing	Reset timing	IG–16, 20
	EFI system problems	Repair as necessary	
	• Injector faulty		
	• Deceleration fuel cut system faulty		
	Idle speed too high	Check ISC system	
	Spark plug faulty	Inspect plugs	
	EGR system always on	Check EGR system	
	Low compression	Check compression	FI–116,118
	Tires improperly inflated	Inflate tires to proper pressure	IG–6, 10
	Clutch slips	Troubleshoot clutch	EC–8, 21
	Brakes drag	Troubleshoot brakes	EM–22

UNPLEASANT ODOR

Problem	Possible cause	Remedy	Page
Unpleasant odor	Incorrect idle speed	Check ISC system	FI–116, 118
	Incorrect ignition timing	Reset timing	IG–16, 20
	Vacuum leaks	Repair as necessary	
	• PCV line		
	• EGR line		
	• Intake manifold		
	• Air intake chamber		
	• Throttle body		
	• ISC valve		
	• Brake booster line		
	EFI system problems	Repair as necessary	

ENGINE TUNE–UP

INSPECTION OF ENGINE COOLANT

(See steps 1 and 2 on page CO–4)

INSPECTION OF ENGINE OIL

(See steps 1 and 2 on page LU–6)

INSPECTION OF BATTERY

(See steps 1 and 2 on page CH–3)

Standard specific gravity:

1.25 –1.27 when fully charged at 2O˚C (68˚F)

INSPECTION OF AIR FILTER

(See step 3 on page MA–5)

INSPECTION OF HIGH–TENSION CORDS

(See page IG–6 or 10)

Maximum resistance: 25 kΩ per cord

INSPECTION OF SPARK PLUGS (3S–FE)

(See page IG–6)

Correct electrode gap: 1.1 mm (0.043 in.)

Recommended spark plugs:

ND Q16R–U11

NGK BCPR5EY11

INSPECTION OF SPARK PLUGS (2VZ–FE)

(See page IG–10)

Correct electrode gap of new plug:

1.1 mm (0.043 in.)

Maximum electrode gap: 1.3 mm (0.051 in.)

Recommended spark plugs:

ND P020R

NGK BCPR6EP11

INSPECTION OF ALTERNATOR DRIVE BELT

(See step 3 on page CH–3)

Drive belt tension:

3S–FE w/ A/C New belt 175 ±5 lb

Used belt 130 ±10 lb

w/o A/C New belt 125 ±25 lb

Used belt 95 ±20 lb

2VZ–FE New belt 175 ±5 lb

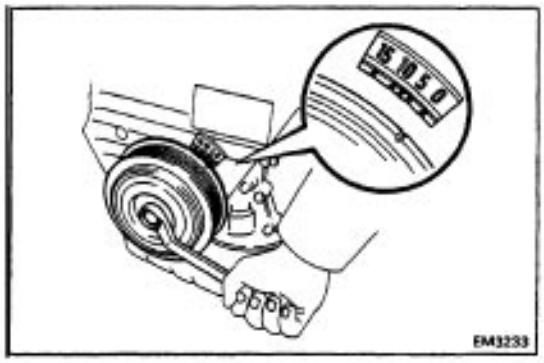
Used belt 115 ±20 lb

ADJUSTMENT OF VALVE CLEARANCE (3S–FE)

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

1. REMOVE CYLINDER HEAD COVER

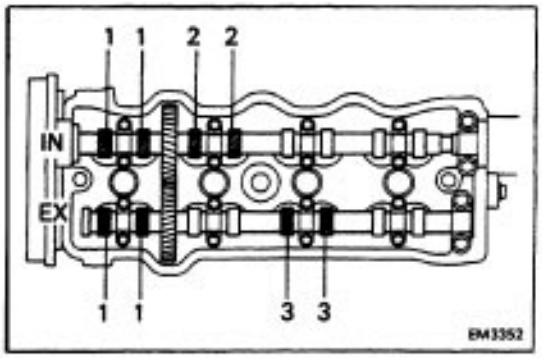
(See step 29 on page EM–52)



2. SET NO.1 CYLINDER TO TDC/COMPRESSION

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

(b) Check that the valve lifters, on the No–1 cylinder are loose and valve lifters on the No.4 are tight.
If not, turn the crankshaft one revolution (360˚) and align the mark as above.



3. ADJUST VALVE CLEARANCE

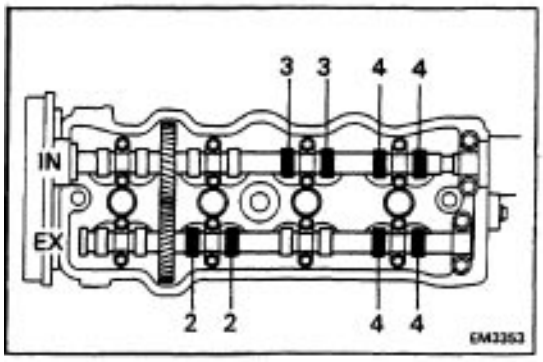
(a) Check the only those valves indicated.

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

Valve clearance (Cold):

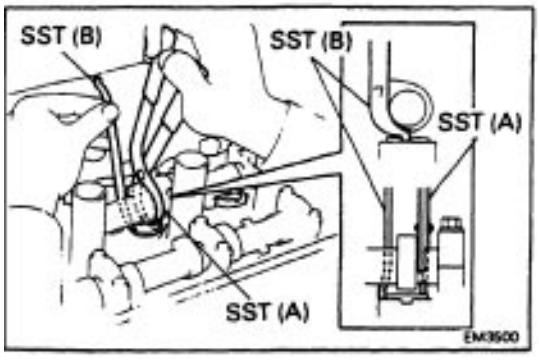
Intake 0.19 – 0.29 mm (0.007 – 0.011 in.)

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



(b) Turn the crankshaft one revolution (360˚) and align the mark as above. (See procedure step 2)

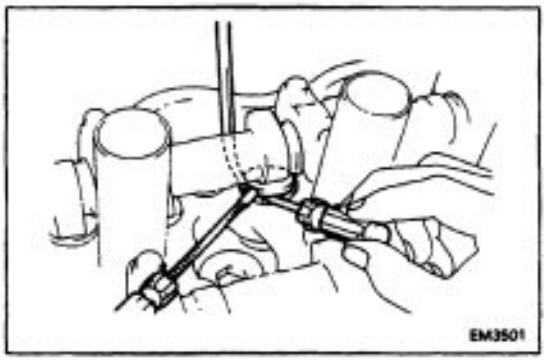
(c) Check only the valves indicated as shown.
Measure the valve clearance. (See procedure step (a))



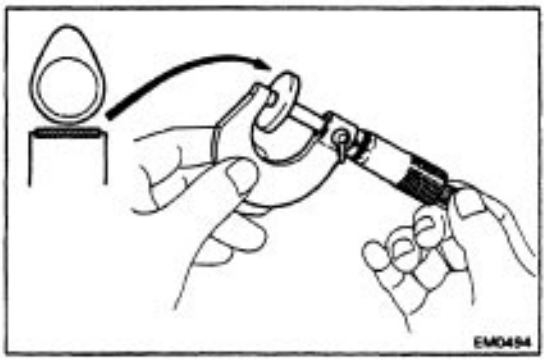
(d) Remove the adjusting shim.

- Turn the crankshaft to position the cam lobe of the camshaft on the adjusting valve upward.
- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter.
Remove SST (A).
SST 09248–55010

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



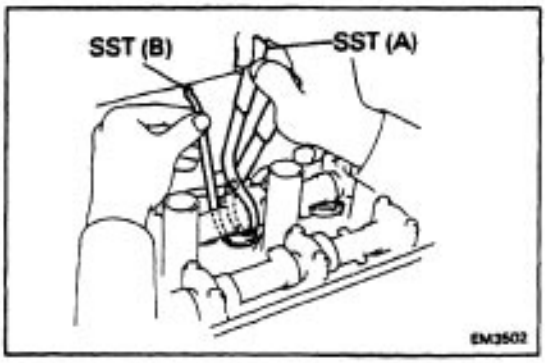
- Remove the adjusting shim with a small screwdriver and magnetic finger.



(e) Determine the replacement adjusting shim size 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 – 0.24 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 valve.

HINT: Shims are available in twenty–seven sizes of mm (0.0020 in.), from 2.50 mm (0.0984 in.) to 3.30 mm A 1299 in.).



(f) Install a new adjusting shim.

- Place a new adjusting shim on the valve lifter.
- Using SST 1Ay, press down the valve lifter and remove SST (B).
  SST 09248–55010

(g) Recheck the valve clearance.

4. REINSTALL CYLINDER HEAD COVER

(See step 5 on page EM–70)

Adjusting Shim Selection Using Chart
INTAKE

Measured clearance (mm)	Installed shim thickness (mm)																																								
	2.500	2.550	2.600	2.620	2.640	2.650	2.660	2.680	2.700	2.720	2.740	2.750	2.760	2.780	2.800	2.820	2.840	2.850	2.860	2.880	2.900	2.920	2.940	2.950	2.960	2.980	3.000	3.020	3.040	3.050	3.060	3.080	3.100	3.120	3.140	3.150	3.160	3.180	3.200	3.250	3.300
0.000–0.025								02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	24
0.026–0.050					02	02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	24	26
0.051–0.075				02	02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	26
0.076–0.100			02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	26	28
0.101–0.125			02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	28
0.126–0.150		02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	28	30
0.151–0.175		02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	30
0.176–0.189		02	04	04	06	06	06	06	08	08	10	10	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	30	32
0.190–0.290																																									
0.291–0.300	04	06	08	10	10	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	
0.301–0.325	04	06	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	
0.326–0.350	06	08	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34		
0.351–0.375	06	08	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34		
0.376–0.400	08	10	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34			
0.401–0.425	08	10	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34				
0.426–0.450	10	12	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34						
0.451–0.475	10	12	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34								
0.476–0.500	12	14	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34									
0.501–0.525	12	14	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34										
0.526–0.550	14	16	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34												
0.551–0.575	14	16	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34														
0.576–0.600	16	18	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34															
0.601–0.625	16	18	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34																
0.626–0.650	18	20	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34																		
0.651–0.675	18	20	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34																				
0.676–0.700	20	22	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34																					
0.701–0.725	20	22	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34																						
0.726–0.750	22	24	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34																								
0.751–0.775	22	24	26	28	28	28	30	30	30	32	32	32	34	34	34																										
0.776–0.800	24	26	28	28	30	30	30	32	32	32	34	34	34	34																											
0.801–0.825	24	26	28	30	30	30	32	32	32	34	34	34	34																												
0.826–0.850	26	28	30	30	32	32	32	34	34	34	34																														
0.851–0.875	26	28	30	32	32	32	34	34	34																																
0.876–0.900	28	30	32	32	34	34	34	34																																	
0.901–0.925	28	30	32	34	34	34	34																																		
0.926–0.950	30	32	34	34	34																																				
0.951–0.975	30	32	34																																						
0.976–1.000	32	34																																							
1.001–1.025	34	34																																							
1.026–1.090	34																																								

New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
02	2.50 (0.0984)	20	2.95 (0.1161)
04	2.55 (0.1004)	22	3.00 (0.1181)
06	2.60 (0.1024)	24	3.05 (0.1201)
08	2.65 (0.1043)	26	3.10 (0.1220)
10	2.70 (0.1063)	28	3.15 (0.1240)
12	2.75 (0.1083)	30	3.20 (0.1260)
14	2.80 (0.1102)	32	3.25 (0.1280)
16	2.85 (0.1122)	34	3.30 (0.1299)
18	2.90 (0.1142)		

Intake valve clearance (Cold):
0.19 – 0.29 mm (0.007 – 0.011 in.)

EXAMPLE: The 2.800 mm 10.1102 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 No. 22 shim.

Adjusting Shim Selection Using Chart

EXHAUST

Measured clearance (mm)	Installed shim thickness (mm)																																							
	2.500	2.550	2.600	2.620	2.640	2.650	2.660	2.680	2.700	2.720	2.740	2.750	2.760	2.780	2.800	2.820	2.840	2.850	2.860	2.880	2.900	2.920	2.940	2.950	2.960	2.980	3.000	3.020	3.040	3.050	3.060	3.080	3.100	3.120	3.140	3.150	3.160	3.180	3.200	3.250	3.300
0.000–0.025													02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	20	22
0.026–0.050											02	02	02	02	02	04	04	04	04	06	06	08	08	08	08	10	10	12	12	12	12	14	14	16	16	16	16	18	18	20	22
0.051–0.075										02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	22	24
0.076–0.100								02	02	02	02	02	02	04	04	06	06	06	06	08	08	10	10	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	24
0.101–0.125							02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	24	26
0.126–0.150					02	02	02	02	02	04	04	04	04	06	06	08	08	08	08	10	10	12	12	12	12	14	14	16	16	16	16	18	18	20	20	20	20	22	22	24	26
0.150–0.175				02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	26	28
0.176–0.200			02	02	02	02	02	04	04	06	06	06	06	08	08	10	10	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	28
0.201–0.225			02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	28	30
0.226–0.250		02	02	04	04	04	04	06	06	08	08	08	08	10	10	12	12	12	12	14	14	16	16	16	16	18	18	20	20	20	20	22	22	24	24	24	24	26	26	28	30
0.251–0.275		02	04	04	04	06	06	08	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	30	32
0.275–0.279		02	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	30	32
0.280–0.380																																									
0.381–0.400	04	06	08	10	10	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	
0.401–0.425	06	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	
0.426–0.450	06	08	10	12	12	12	12	14	14	16	16	16	16	18	18	20	20	20	20	22	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34		
0.451–0.475	08	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34		
0.476–0.500	08	10	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34				
0.501–0.525	10	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34					
0.526–0.550	10	12	14	16	16	16	16	18	18	20	20	20	20	22	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34							
0.551–0.575	12	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34								
0.576–0.600	12	14	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34									
0.601–0.625	14	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34											
0.626–0.650	14	16	18	20	20	20	20	22	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34													
0.651–0.675	16	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34														
0.676–0.700	16	18	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34															
0.701–0.725	18	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34																	
0.726–0.750	18	20	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34																			
0.751–0.775	20	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34																				
0.776–0.800	20	22	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34																					
0.801–0.825	22	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34																							
0.826–0.850	22	24	26	28	28	28	28	30	30	32	32	32	32	34	34	34																									
0.851–0.875	24	26	28	28	28	30	30	30	32	32	32	34	34	34	34																										
0.876–0.900	24	26	28	30	30	30	30	32	32	34	34	34	34	34																											
0.901–0.925	26	28	30	30	30	32	32	32	34	34	34	34																													
0.926–0.950	26	28	30	32	32	32	32	34	34	34																															
0.951–0.975	28	30	32	32	32	34	34	34	34																																
0.976–1.000	28	30	32	34	34	34	34	34																																	
1.001–1.025	30	32	34	34	34	34																																			
1.026–1.050	30	32	34	34																																					
1.051–1.075	32	34	34																																						
1.076–1.100	32	34																																							
1.101–1.125	34	34																																							
1.126–1.180	34																																								

New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
02	2.50 (0.0984)	20	2.95 (0.1161)
04	2.55 (0.1004)	22	3.00 (0.1181)
06	2.60 (0.1024)	24	3.05 (0.1201)
08	2.65 (0.1043)	26	3.10 (0.1220)
10	2.70 (0.1063)	28	3.15 (0.1240)
12	2.75 (0.1083)	30	3.20 (0.1260)
14	2.80 (0.1102)	32	3.25 (0.1280)
16	2.85 (0.1122)	34	3.30 (0.1299)
18	2.90 (0.1142)		

Exhaust valve clearance:

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 No. 18 shim.

ADJUSTMENT OF VALVE CLEARANCE (2VZ–FE)

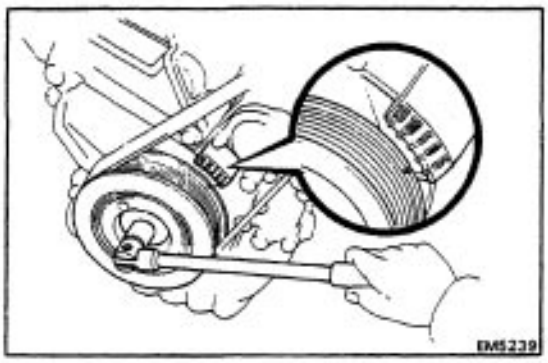
HINT: Adjust the valve clearance while the engine is cold.

1. REMOVE AIR INTAKE CHAMBER

(See steps 1 to 21 on page FI–76 and 77)

2. REMOVE CYLINDER HEAD COVERS

(See step 32 on page EM–80)

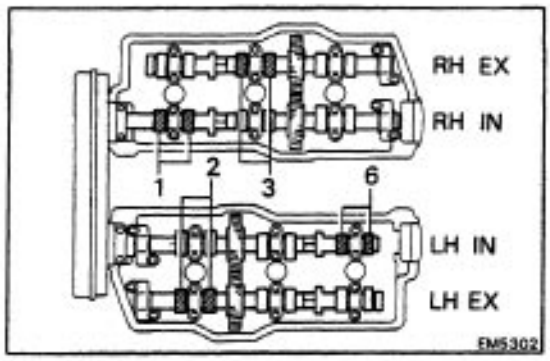


3. SET NO.1 CYLINDER TO TDCI COMPRESSION

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

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

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



4. ADJUST VALVE CLEARANCE

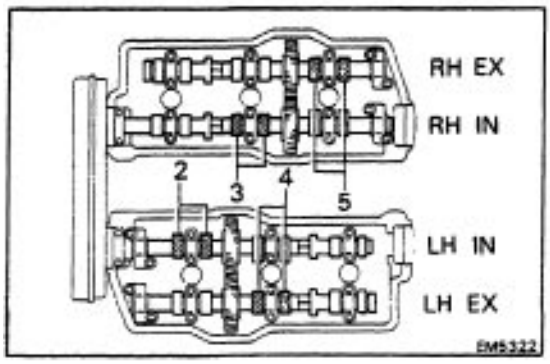
(a) Check only those valves indicated in the figure.

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

Valve clearance (Cold):

Intake 0.13 – 0:23 mm (0.005 – 0.009 in.)

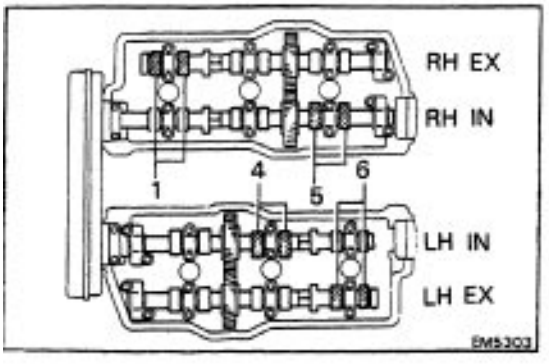
Exhaust 0.27 – 0.37 mm (0.011 – 0.015 in.)



(b) Turn the crankshaft 2/3 of a revolution (240˚), and check only the valves indicated in the figure.

Measure the valve clearance.

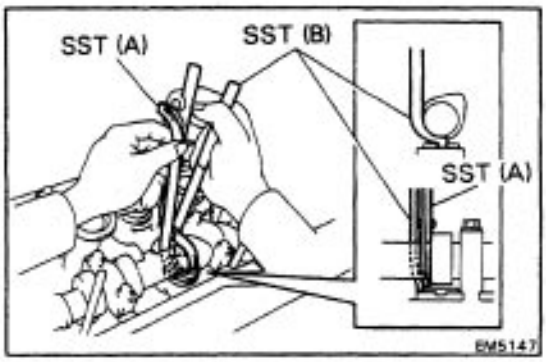
(See procedure step W)



(c) Turn the crankshaft a further 2I3 of a revolution (240˚), and check only the valves indicated in the figure.

Measure the valve clearance.

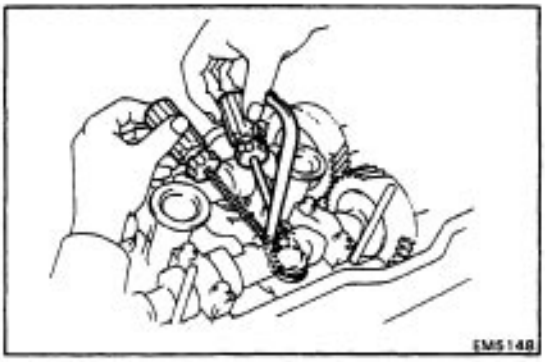
(See procedure step (a))



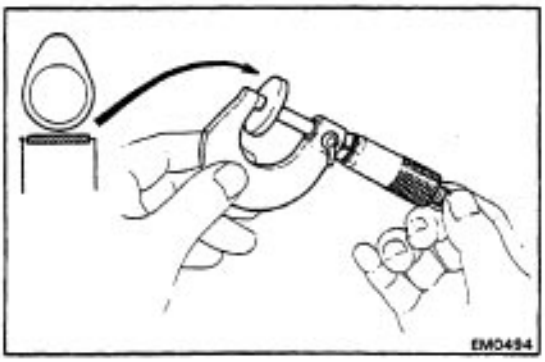
(d) Remove the adjusting shim.

- Turn the crankshaft to position the cam lobe of the camshaft on the adjusting valve upward.
- Press down the valve lifter with SST (A), and place SST (B) between the camshaft and valve lifter. Remove SST (A).
  SST 09248–55010

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



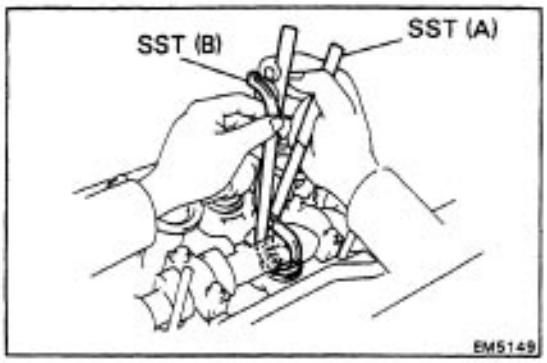
- Remove the adjusting shim with a small screwdriver and magnetic finger.



(e) Determine the replacement adjusting shim size 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 – 0.18 mm (0.007 in.))
  Exhaust N = T + (A – 0.32 mm (0.013 in.))
- Select a new. shim with a thickness as close as possible to the calculated values.

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



(f) Install a new adjusting shim.

- Place a new adjusting shim on the valve lifter.
- Press down the valve lifter with SST (A), and remove SST (B).
  SST 09248–55010

(g) Recheck the valve clearance.

5. REINSTALL CYLINDER HEAD COVERS
(See step 8 on page EM–102)
6. REINSTALL AIR INTAKE CHAMBER
(See steps 18 to 40 pages FI–105 to 106)

Adjusting Shim Selection Using Chart

INTAKE

Measured clearance (mm)	Installed shim thickness (mm)																																												
	2.500	2.525	2.550	2.575	2.600	2.620	2.640	2.650	2.660	2.680	2.700	2.720	2.740	2.750	2.760	2.780	2.800	2.820	2.840	2.850	2.860	2.880	2.900	2.920	2.940	2.950	2.960	2.980	3.000	3.020	3.040	3.050	3.060	3.080	3.100	3.120	3.140	3.150	3.160	3.180	3.200	3.225	3.250	3.275	3.300
0.000 – 0.025						02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	26	26	28
0.026 – 0.050					02	02	02	02	02	04	04	06	06	06	06	08	08	10	10	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	28	28
0.051 – 0.075				02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	28	28	30
0.076 – 0.100			02	02	02	04	04	04	04	06	06	08	08	08	08	10	10	12	12	12	12	14	14	16	16	16	16	18	18	20	20	20	20	22	22	24	24	24	24	26	26	28	28	30	30
0.101 – 0.125		02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	28	28	28	30	30	32
0.126 – 0.129		02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	32
0.130 – 0.230																																													
0.231 – 0.250	04	06	06	08	08	10	10	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	
0.251 – 0.275	06	06	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	
0.276 – 0.300	06	08	08	10	10	12	12	12	12	14	14	16	16	16	16	18	18	20	20	20	20	22	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34	34		
0.301 – 0.325	08	08	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34			
0.326 – 0.350	08	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34	34				
0.351 – 0.375	10	10	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34						
0.376 – 0.400	10	12	12	14	14	16	16	16	16	18	18	20	20	20	20	22	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34	34	34							
0.401 – 0.425	12	12	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34									
0.426 – 0.450	12	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34	34										
0.451 – 0.475	14	14	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34												
0.476 – 0.500	14	16	16	18	18	20	20	20	20	22	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34	34	34													
0.501 – 0.525	16	16	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34															
0.526 – 0.550	16	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34	34																
0.551 – 0.575	18	18	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34																		
0.576 – 0.600	18	20	20	22	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34	34	34																			
0.601 – 0.625	20	20	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34																					
0.626 – 0.650	20	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34	34																						
0.651 – 0.675	22	22	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34																								
0.676 – 0.700	22	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34	34	34																									
0.701 – 0.725	24	24	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34																											
0.726 – 0.750	24	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34																													
0.751 – 0.775	26	26	28	28	30	30	30	32	32	32	34	34	34	34	34																														
0.776 – 0.800	26	28	28	30	30	32	32	32	32	34	34	34	34	34																															
0.801 – 0.825	28	28	30	30	32	32	32	34	34	34	34	34																																	
0.826 – 0.850	28	30	30	32	32	32	34	34	34	34	34																																		
0.851 – 0.875	30	30	32	32	34	34	34	34	34																																				
0.876 – 0.900	30	32	32	34	34	34	34	34																																					
0.901 – 0.925	32	32	34	34	34	34																																							
0.926 – 0.950	32	34	34	34	34																																								
0.951 – 0.975	34	34	34	34																																									
0.976 – 1.000	34	34	34																																										
1.001 – 1.025	34	34																																											
1.026 – 1.030	34																																												

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 (0.1043)	26	3.100 (0.1220)
10	2.700 (0.1063)	28	3.150 (0.1240)
12	2.750 (0.1083)	30	3.200 (0.1260)
14	2.800 (0.1102)	32	3.250 (0.1280)
16	2,850 (0.1122)	34	3.300 (0.1299)
18	2.900 (0.1142)		

Intake valve clearance (Cold):

0.13 – 0.23 mm (0.005 – 0.009 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 No. 24 shim.

Adjusting Shim Selection Using Chart

EXHAUST

Measured clearance (mm)	Installed Shim thickness (mm)																																												
	2.500	2.525	2.550	2.575	2.600	2.620	2.640	2.650	2.660	2.680	2.700	2.720	2.740	2.750	2.760	2.780	2.800	2.820	2.840	2.850	2.860	2.880	2.900	2.920	2.940	2.950	2.960	2.980	3.000	3.020	3.040	3.050	3.060	3.080	3.100	3.120	3.140	3.150	3.160	3.180	3.200	3.225	3.250	3.275	3.300
0.000 – 0.025														02	02	02	02	02	04	04	04	04	06	06	08	08	08	08	10	10	12	12	12	12	14	14	16	16	16	16	18	18	20	20	22
0.026 – 0.050												02	02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	22	22
0.051 – 0.075											02	02	02	02	02	02	04	04	06	06	06	06	08	08	10	10	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	24
0.076 – 0.100										02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	24	24
0.101 – 0.125								02	02	02	02	02	04	04	04	04	06	06	08	08	08	08	10	10	12	12	12	12	14	14	16	16	16	16	18	18	20	20	20	20	22	22	24	24	26
0.126 – 0.150						02	02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	26	26
0.151 – 0.175					02	02	02	02	02	02	04	04	06	06	06	06	08	08	10	10	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	28
0.176 – 0.200				02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	28	28
0.201 – 0.225			02	02	02	02	04	04	04	04	06	06	08	08	08	08	10	10	12	12	12	12	14	14	16	16	16	16	18	18	20	20	20	20	22	22	24	24	24	24	26	26	28	28	30
0.226 – 0.250		02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	30	30
0.251 – 0.269		02	02	02	04	04	06	06	06	06	08	08	10	10	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	32
0.270 – 0.370																																													
0.371 – 0.375	04	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	34	34	34	
0.376 – 0.400	04	06	06	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	
0.401 – 0.425	06	06	08	08	10	10	12	12	12	12	14	14	16	16	16	16	18	18	20	20	20	20	22	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34		
0.426 – 0.450	06	08	08	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34			
0.451 – 0.475	08	08	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34				
0.476 – 0.500	08	10	10	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34					
0.501 – 0.525	10	10	12	12	14	14	16	16	16	16	18	18	20	20	20	20	22	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34	34	34						
0.526 – 0.550	10	12	12	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34								
0.551 – 0.575	12	12	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34										
0.576 – 0.600	12	14	14	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34											
0.601 – 0.625	14	14	16	16	18	18	20	20	20	20	22	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34	34	34												
0.626 – 0.650	14	16	16	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34														
0.651 – 0.675	16	16	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34																
0.676 – 0.700	16	18	18	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34																	
0.701 – 0.725	18	18	20	20	22	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34	34	34																		
0.726 – 0.750	18	20	20	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34																				
0.751 – 0.775	20	20	22	22	24	24	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34	34																						
0.776 – 0.800	20	22	22	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34																							
0.801 – 0.825	22	22	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34	34	34																								
0.826 – 0.850	22	24	24	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34																										
0.851 – 0.875	24	24	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34																												
0.876 – 0.900	24	26	26	28	28	30	30	30	32	32	32	34	34	34	34	34																													
0.901 – 0.925	26	26	28	28	30	30	32	32	32	32	34	34	34	34	34																														
0.926 – 0.950	26	28	28	30	30	32	32	32	34	34	34	34	34																																
0.951 – 0.975	28	28	30	30	32	32	34	34	34	34	34																																		
0.976 – 1.000	28	30	30	32	32	34	34	34	34	34																																			
1.001 – 1.025	30	30	32	32	34	34	34	34	34																																				
1.026 – 1.050	30	32	32	34	34	34	34																																						
1.051 – 1.075	32	32	34	34	34																																								
1.076 – 1.100	32	34	34	34																																									
1.101 – 1.125	34	34	34																																										
1.126 – 1.150	34	34																																											
1.151 – 1.170	34																																												

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 (0.1043)	26	3.100 (0.1220)
10	2.700 (0.1063)	28	3.150 (0.1240)
12	2.750 (0.1083)	30	3.200 (0.1260)
14	2.800 (0.1102)	32	3.250 (0.1280)
16	2.850 (0.1122)	34	3.300 (0.1299)
18	2.900 (0.1142)		

Exhaust valve clearance:

0.27 – 0.37 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 No. 18 shim.

ADJUSTMENT OF IGNITION TIMING

3S–FE (See steps 7 to 10 on pages IG–16 and 17)
2VZ–FE (See steps 6 to 11 on pages IG–20 and 21)
Ignition timing:
10˚BTDC @ idle
(w/ Terminals TE1 and E1 connected)

ADJUSTMENT OF IDLE SPEED (3S–FE)

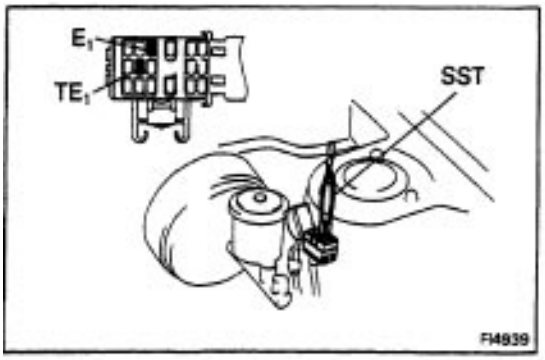
(See HINT on page FI–17)

1. INITIAL CONDITIONS

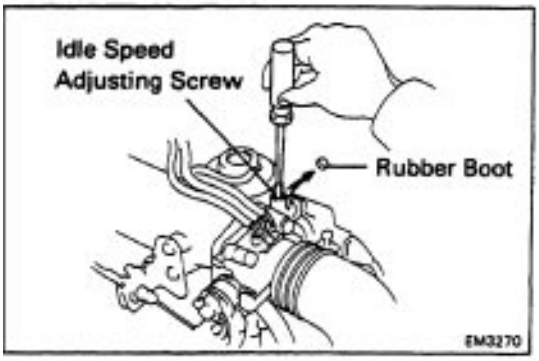
(a) Engine at normal operating temperature
(b) Air cleaner installed
(c) All pipes and hoses of air induction system connected
(d) All vacuum lines connected
HINT: All vacuum hoses for EGR systems, etc. should be properly connected.
(e) EFI system wiring connectors fully plugged
(f) All accessories switched OFF
(g) Transmission in N range

2. CONNECT TACHOMETER (See page IG–16)

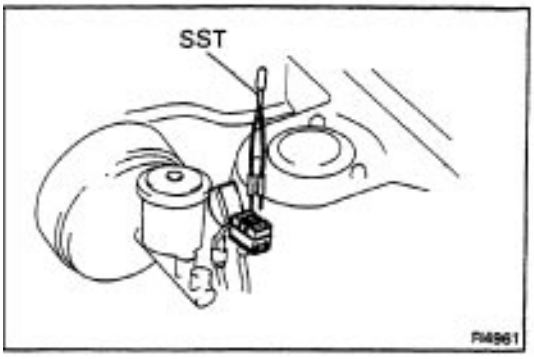
3. ADJUST IDLE SPEED



(a) Using SST, connect terminals TE1 and E1 of the check connector.
SST 09845–18020
HINT: Decrease the rpm after the engine maintains a speed of the 1,000 – 1,300 rpm for 5 seconds.



(b) Check the idle speed.
Idle speed: 660 rpm or more
(c) If the idle speed is not as specified, adjust the idle speed by turning the IDLE SPEED ADJUSTING SCREW.



(d) Remove SST.

4. FURTHER CHECK IDLE SPEED

Idle speed: 700 ± 5O rpm

If the idle speed is not within these values, carry out either of the below listed procedures and then recheck the idle speed.
Carry out a driving test, including stop–go several times at a speed above 10 km/h, or– start the engine, idle for 30 seconds and then turn the engine 'off repeatedly. By doing this, idle data will be stored in the ISC and the idle rpm will be at specified value.

IDLE AND OR 2,500 RPM HC CO CONCENTRATION CHECK METHOD

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

1. INITIAL CONDITIONS

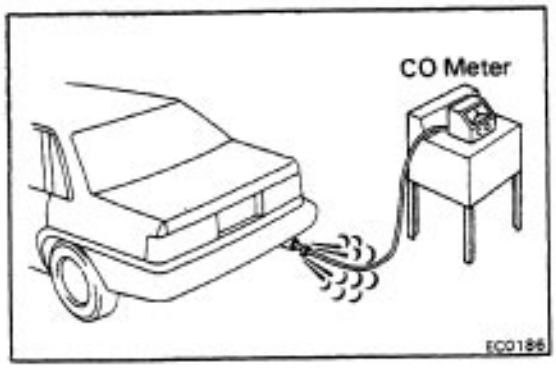
(b) Engine at normal operating temperature
(b) Air cleaner installed
(e) All pipes and hoses of air induction system connected
(d) All operating accessories switched OFF
(e) All vacuum lines properly connected

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

2. START ENGINE

3. RACE ENGINE AT 2,500 RPM FOR APPROX. 2 MINUTES



4. INSERT HC/CO METER TESTING PROBE INTO TAILPIPE AT LEAST 40 cm (1.3 ft)

5. CHECK HC/CO CONCENTRATION AT IDLE

Complete the measuring within three times.

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

If the HC/CO concentration at 2,500 rpm does not comply with 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 HC/CO concentration does not comply with regulations, perform troubleshooting in the order given below.

(a) Check oxygen sensor operation.
(See page FI–129)

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

HC	CO	Problem	Cause
High	Normal	Rough idle	1. Faulty ignition: • Incorrect timing • Fouled, shorted or improperly gapped plugs • Open or crossed high–tension cords • Cracked distributor cap 2. Incorrect valve clearance 3. Leaky EGR valve 4. Leaky intake and exhaust valves 5. Leaky cylinder
High	Low	Rough idle (Fluctuating HC reading)	1. Vacuum leak: • PCV hose • EGR valve • Intake manifold • Air intake chamber • Throttle body • ISC valve • Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Faulty EFI system • Faulty pressure regulator • Clogged fuel return line • Defective water temp. sensor • Defective air temp. sensor • Faulty ECU • Faulty injector • Faulty cold start injector • Faulty throttle position sensor • Air flow meter

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

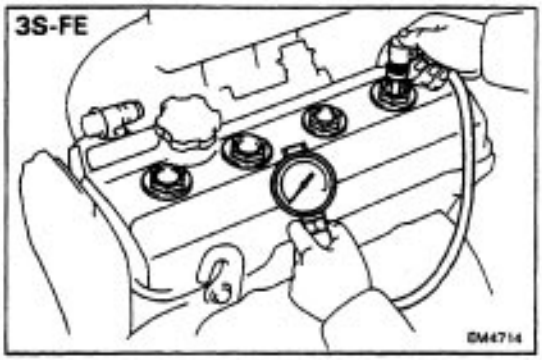
Allow the engine to warm up to normal operating temperature.

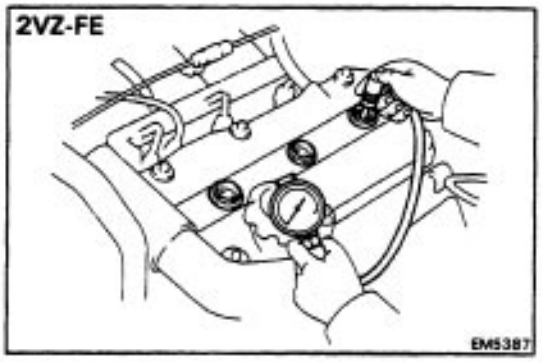
2. DISCONNECT COLD START INJECTOR CONNECTOR

3. DISCONNECT DISTRIBUTOR CONNECTOR

4. REMOVE SPARK PLUGS (See page IG–6 or 11)

5. 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 in as short a time as possible.

Compression pressure:

12.5 kg–cm^2 (178 psi, 1,226 kPa) or more

Minimum pressure:

10.0 kg/cm^2 (142 psi, 981 kPa)

Difference between each cylinder:

1.0 kg/cm^2 (14 psi, 98 kPa) or less

(e) if the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (e) 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.

6. REINSTALL SPARK PLUGS (See page IG–7 or 11)

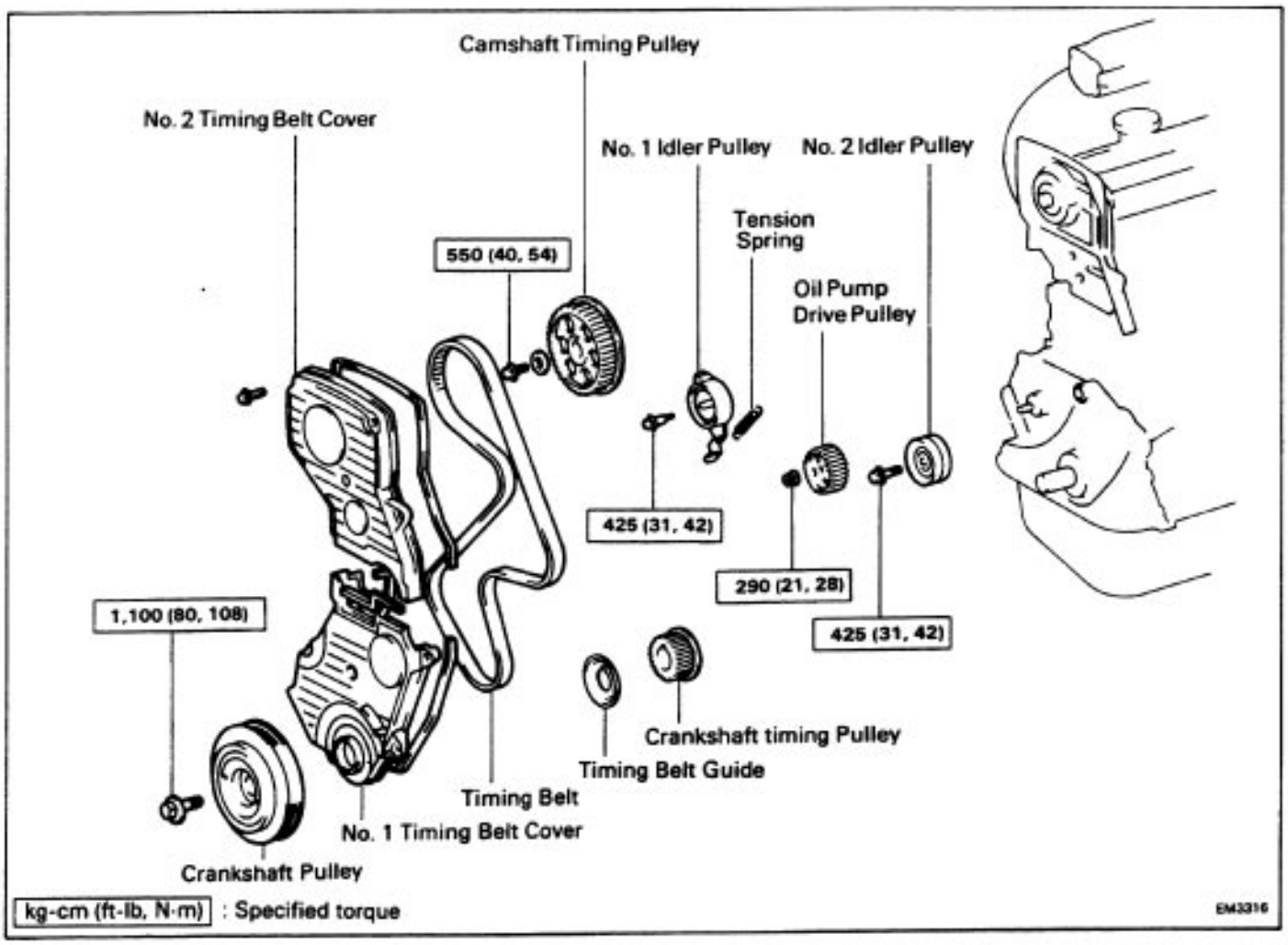
Torque: 180 kg–cm 0 3 ft–lb, 18 N–m)

7. RECONNECT DISTRIBUTOR CONNECTOR

8. RECONNECT COLD START INJECTOR CONNECTOR

TIMING BELT (3S–FE)

COMPONENTS



REMOVAL OF TIMING BELT

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

2. REMOVE RN FRONT WHEEL

3. REMOVE ENGINE RH UNDER COVER

4. REMOVE CRUISE CONTROL ACTUATOR

(See step 9 on page EM–108)

5. REMOVE DRIVE BELTS

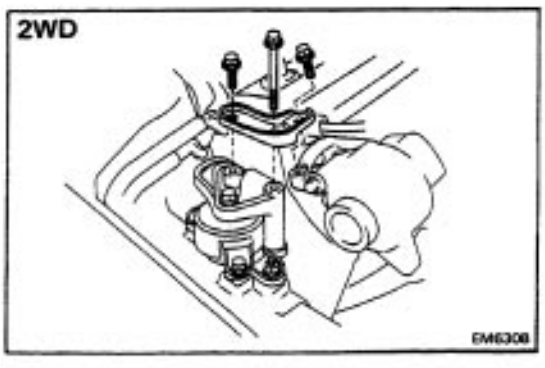
6. REMOVE ALTERNATOR (See page CH–6)

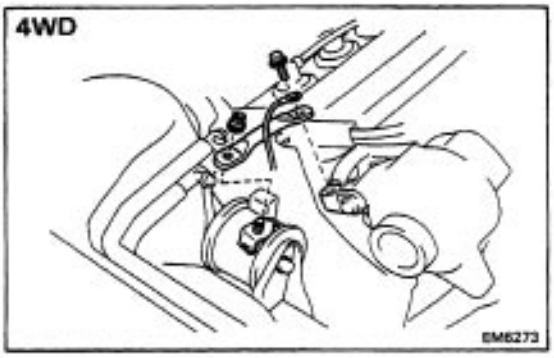
7. REMOVE ALTERNATOR BRACKET

8. REMOVE RH MOUNTING STAY

(2WD)

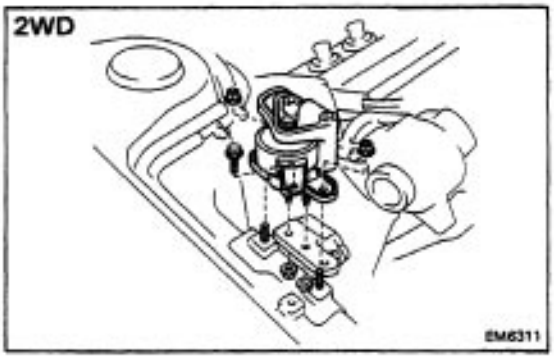
Remove the three bolts and mounting stay.





(4WD)

Remove the bolt, nut, ground strap and mounting stay.



9. SLIGHTLY JACK UP ENGINE

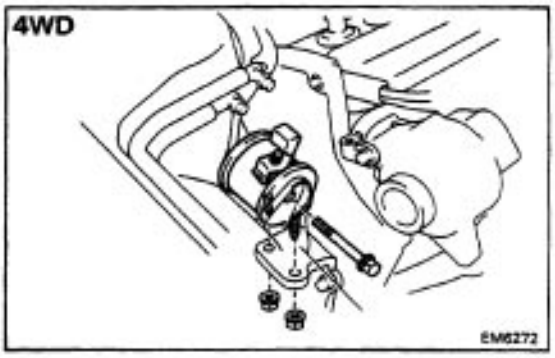
.

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

10. REMOVE ENGINE RH MOUNTING INSULATOR AND BRACKET

(a) (2WD)

Remove the four nuts, bolt and mounting insulator.

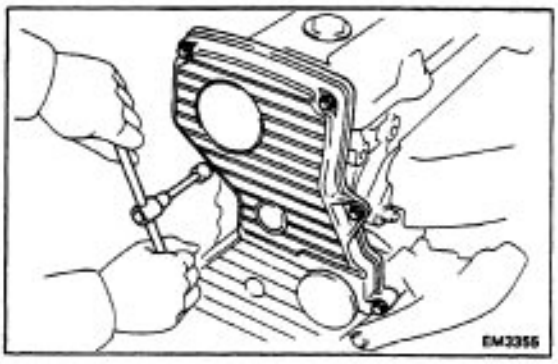


(b) (4WD)

Remove through bolt, two nuts and mounting insulator.

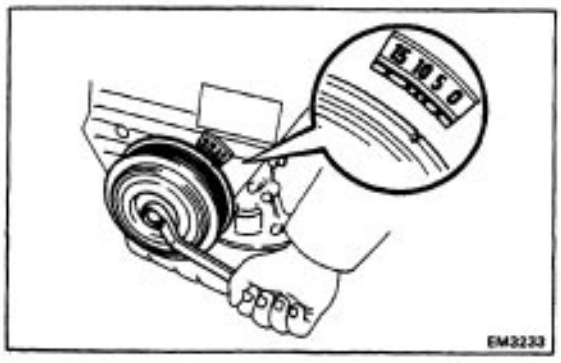
(c) Remove the three bolts and mounting bracket.

11. REMOVE SPARK PLUGS (See page IG–6)



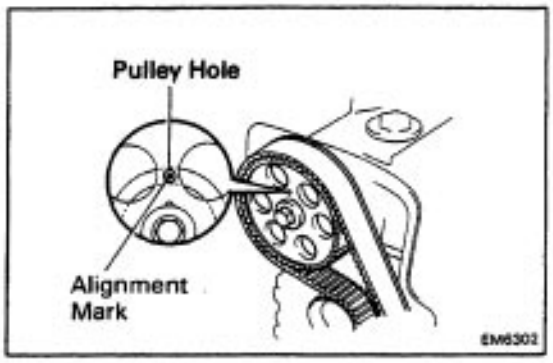
12. REMOVE No.2 TIMING BELT COVER

Remove the five bolts, belt cover and gaskets.

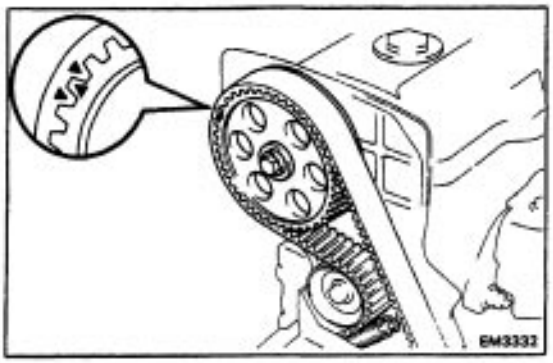


13. SET NO.1 CYLINDER TO TDC/COMPRESSION

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

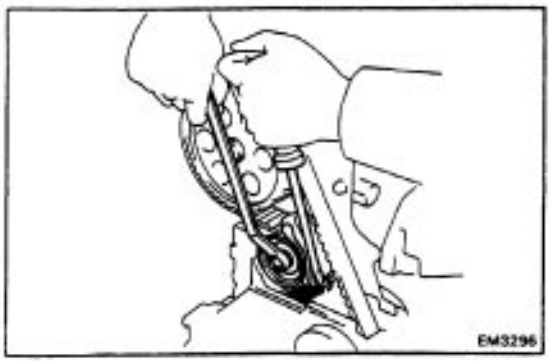


(b) Check that the hole of the camshaft timing pulley is aligned with the alignment mark of the bearing cap.
If not, turn the crankshaft one revolution (360°).

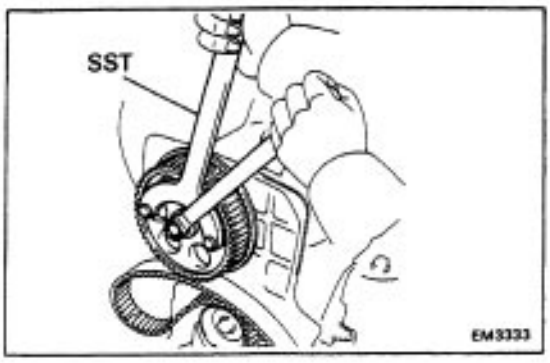


14. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEY

HINT: If reusing the timing belt, place the matchmarks on the timing belt and camshaft timing pulley.

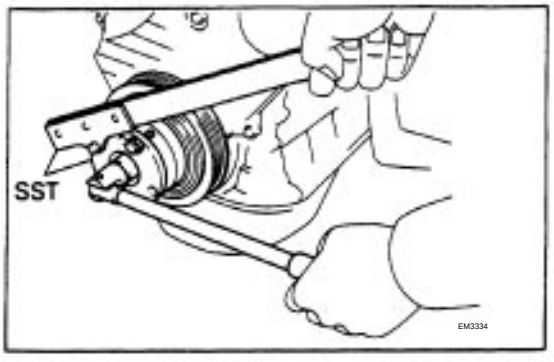


(a) Loosen the mount bolt of the No. 1 idler pulley and shift the pulley toward the left as far as it will go, temporarily tighten it.
(b) Remove the timing belt from the camshaft tinning pulley.



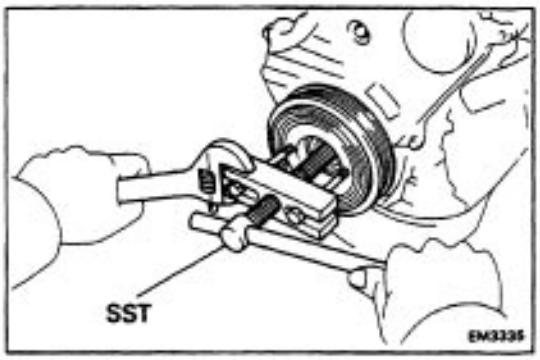
15. REMOVE CAMSHAFT TIMING PULLEY

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

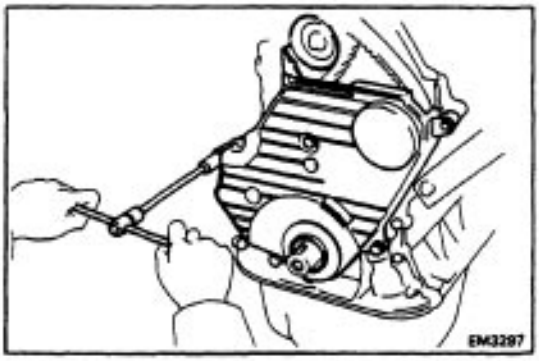


16. REMOVE CRANKSHAFT PULLEY

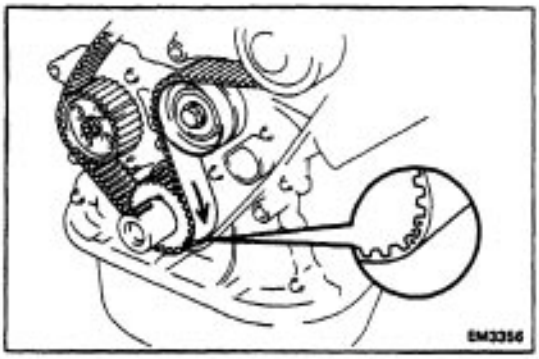
(a) Using SST, remove the pulley mount bolt.
SST 09213–54015 (09214–00030) and 09330–00021



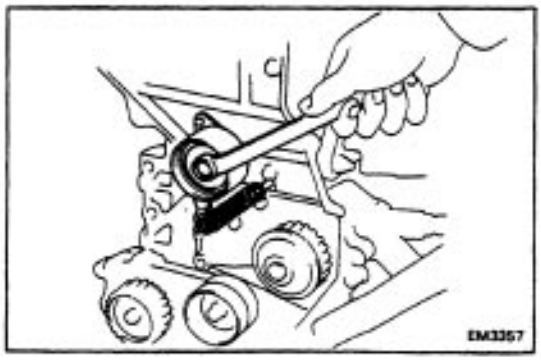
(b) Using SST, remove the pulley.
SST 09213–60017 (09213–00020, 09213–00030 09213–00050)



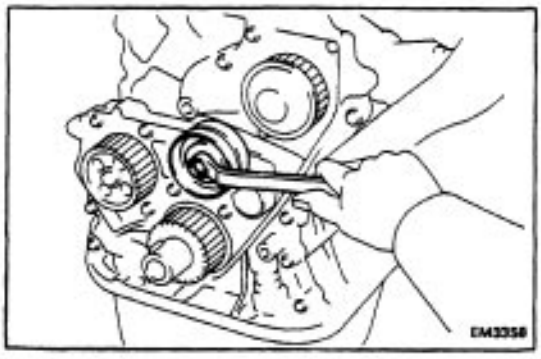
17. REMOVE NO.1 TIMING BELT COVER
Remove the four bolts, belt cover and gasket.



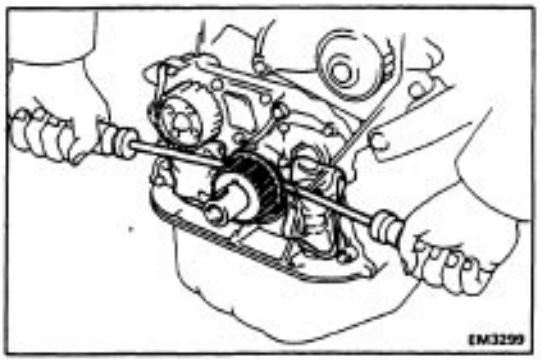
18. REMOVE TIMING BELT AND BELT GUIDE
HINT: If reusing the tinning belt, draw a direction arrow on the timing belt (in direction of engine revolution), and place the matchmarks on the timing belt and crankshaft timing pulley.



19. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING
Remove the bolt, pulley and tension spring.



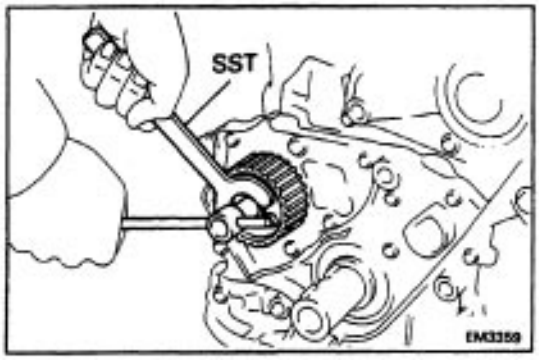
20. REMOVE NO.2 IDLER PULLEY
Remove the bolt and pulley.



21. REMOVE CRANKSHAFT TIMING PULLEY

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

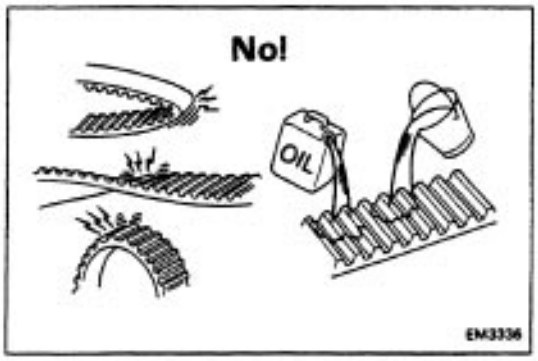
HINT: Position shop rags as shown to prevent damage.



22. REMOVE OIL PUMP PULLEY

Using SST, remove the nut and pulley.

SST 09616–30011

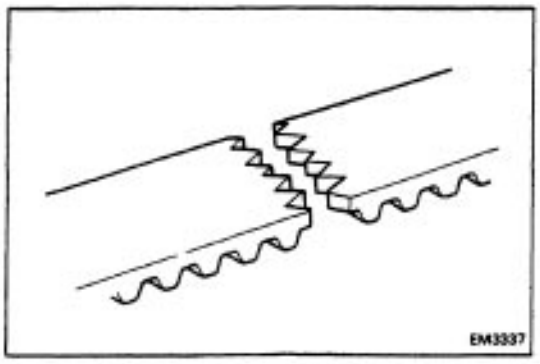


INSPECTION OF TIMING BELT COMPONENTS

1. INSPECT TIMING BELT

NOTICE:

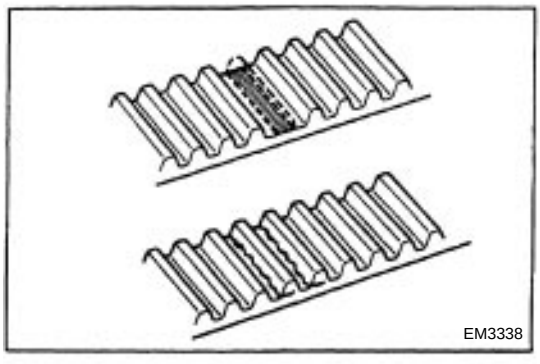
- **Do not bend, twist or turn the timing belt inside out.**
- **Do not allow the timing belt to come into contact with oil, water or steam.**
- **Do not utilize timing belt tension when installing or removing the mount bolt of the camshaft timing pulley.**



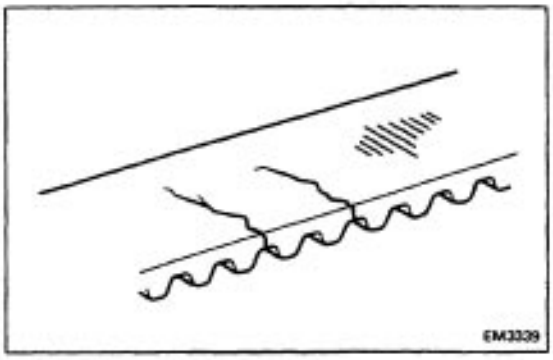
If there are any defects as shown in the figures, check the following points:

(a) Premature parting

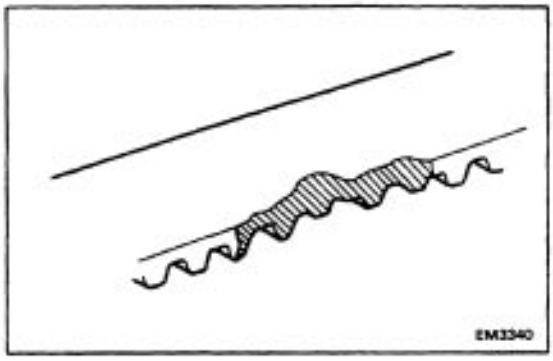
- Check for proper installation.
- Check the timing cover gasket for damage and proper installation.



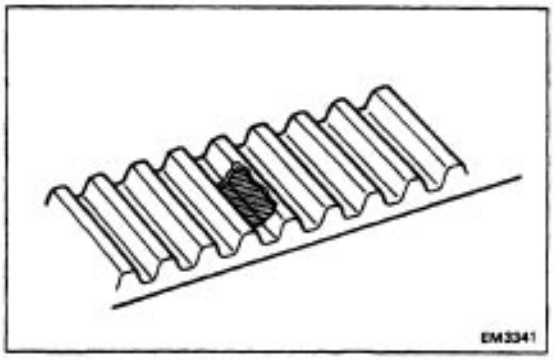
(b) If the belt teeth are cracked or damaged, check to see if either the camshaft, water pump is locked.



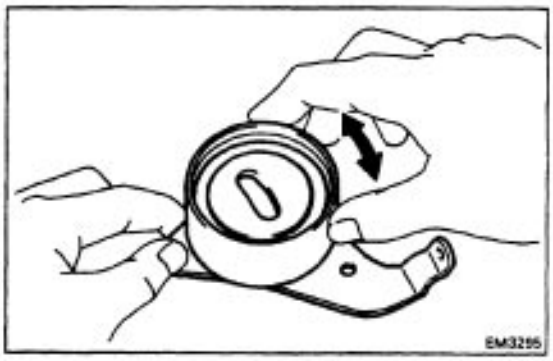
(c) If there are cracks or noticeable wear on the belt face, check to see if there are nicks on the side of the idler pulled lock.



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

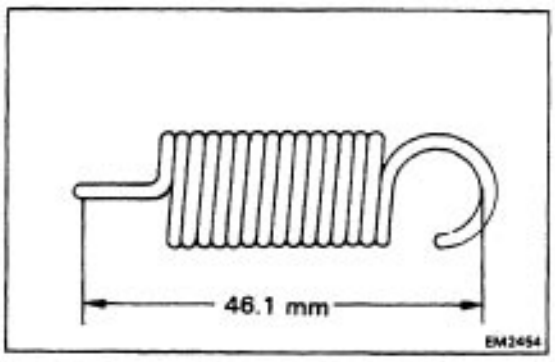


(e) If there is noticeable wear on the belt teeth, check timing cover for damage and check for correct gasket installation. Check for foreign material on the pulley teeth.
If necessary, replace the timing belt.



2. INSPECT IDLER PULLEYS

Check the turning smoothness of the idler pulley.
If necessary, replace the idler pulley.



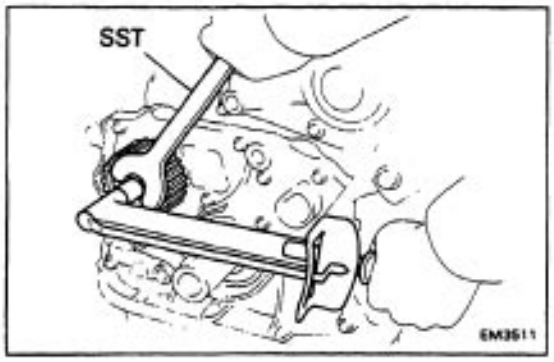
3. INSPECT TENSION SPRING

(a) Measure the free length of tension spring.
Free length: 46.1 mm (1.815 in.)

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

(b) Measure the tension of the tension spring at the specified installed length.
Installed tension:
6.0 – 7.0 kg (13.2 – 15.4 lb, 59 – 69 N–m)
at 50.5 mm (1.988 in.)

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



INSTALLATION OF TIMING BELT

(See page EM–23)

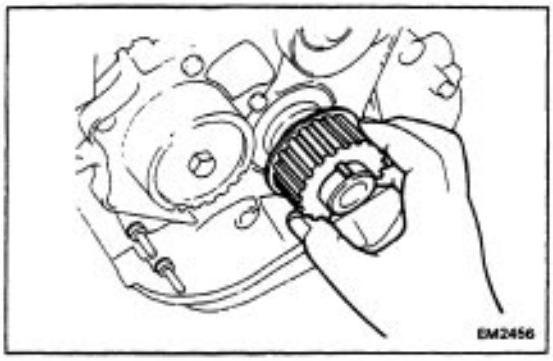
1. INSTALL OIL PUMP PULLEY

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

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

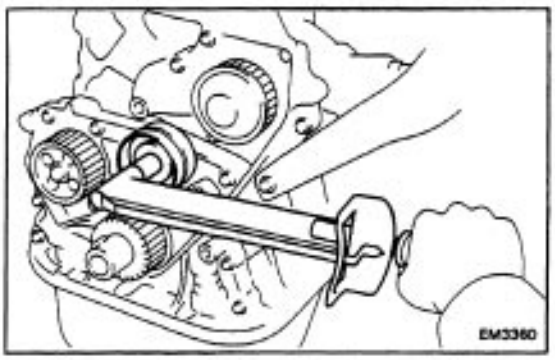
SST 09616–30011

Torque: 290 kg–cm (21 ft–lb, 28 N–m)



2. INSTALL CRANKSHAFT TIMING PULLEY

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



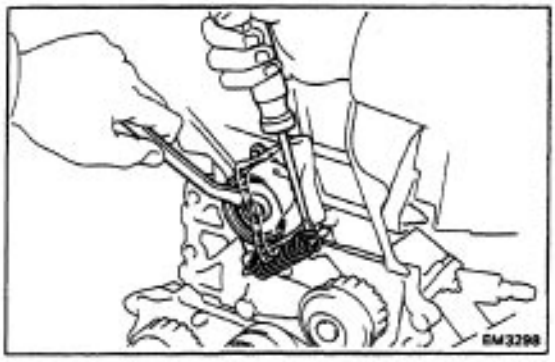
3. INSTALL NO.2 IDLER PULLEY

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

Torque: 425 kg–cm (31 ft–lb, 42 N–m)

(b) Check that the pulley moves smoothly.

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

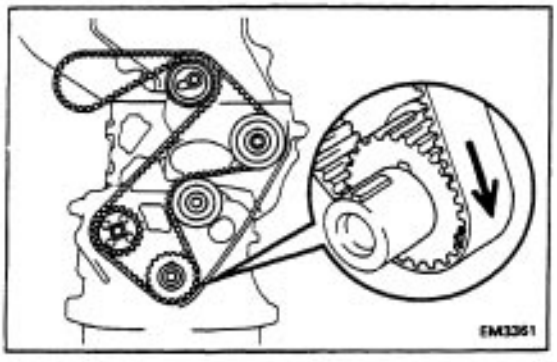


4. TEMPORARILY INSTALL NO.1 IDLER PULLEY AND TENSION SPRING

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

(b) Install the tension spring.

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

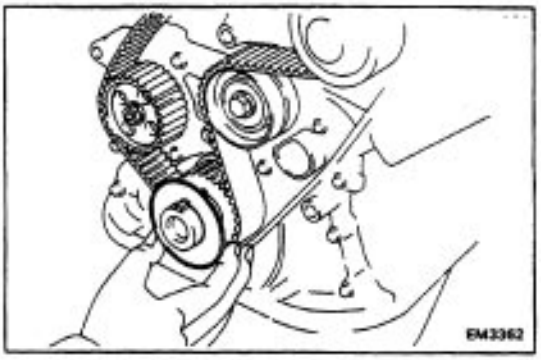


5. TEMPORARILY INSTALL TIMING BELT

NOTICE: The engine should be cold.

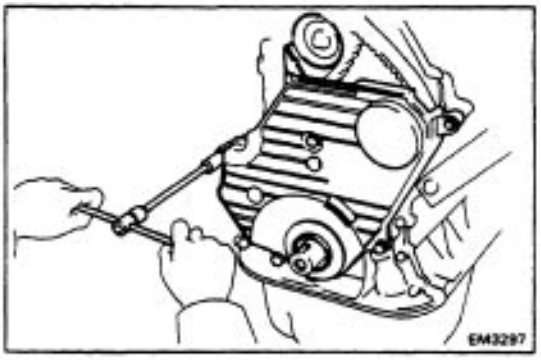
Install the timing belt on the crankshaft timing, oil pump, No–2 idler and water pump pulleys.

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



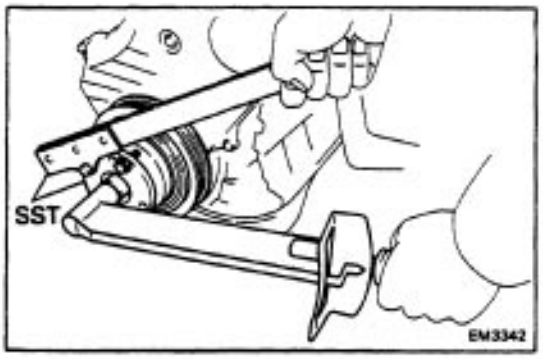
6. INSTALL TIMING BELT GUIDE

Install the guide, facing the cup side outward.



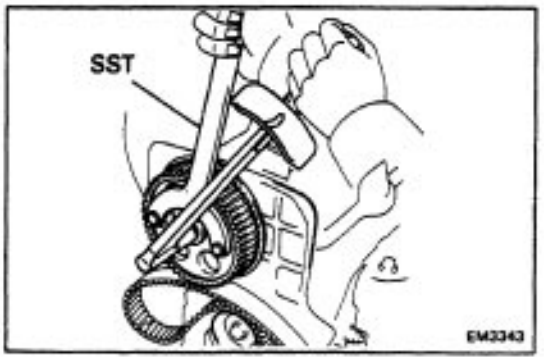
7. INSTALL NO.1 TIMING BELT COVER

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



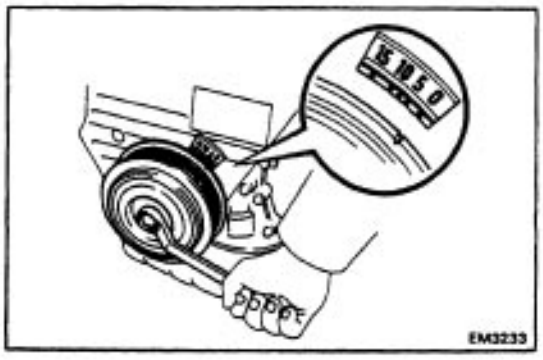
8. INSTALL CRANKSHAFT PULLEY

(a) Align the pulley set key with the key groove of the pulley, slide the pulley.
(b) using SST, install and torque the bolt.
SST 09213–54015 (09213–00030) and 09330– 21
Torque: 1,100 kg–cm (80 ft–lb, 108 N–m)



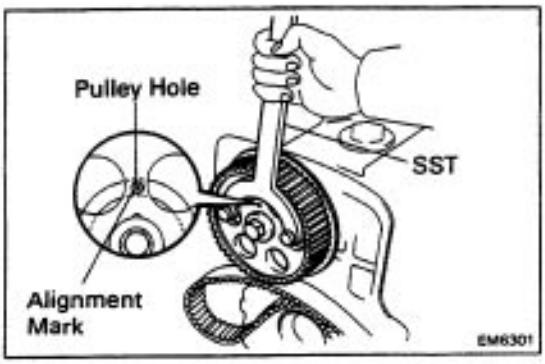
9. INSTALL CAMSHAFT TIMING PULLEY

(a) Align the camshaft knock pin with the knock pin groove of the pulley, and slide the pulley.
(b) Using SST, install the plate washer and bolt.
Torque the bolt.
SST 09278–54012
Torque: 550 kg–cm (40 ft–lb, 54 N–m)

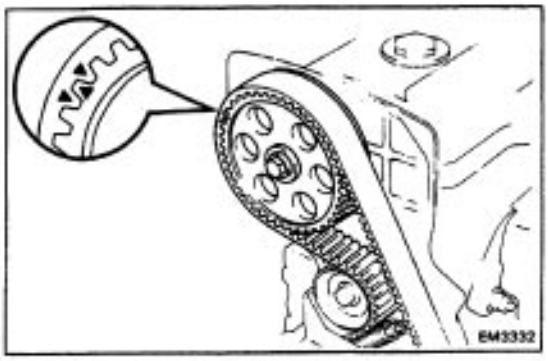


10. SET NO.1 CYLINDER .TO TDC/COMPRESSION

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

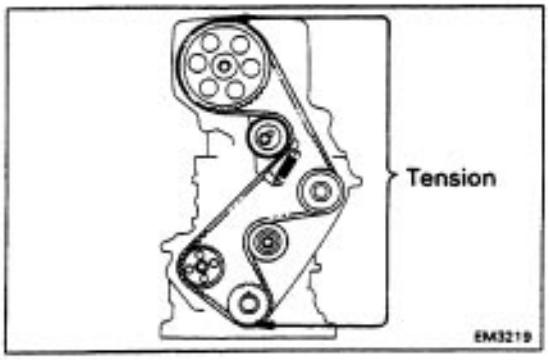


(b) Using SST, turn the camshaft, and align the hole of the camshaft timing pulley with the matchmark of the bearing cap.
SST 09278–54012

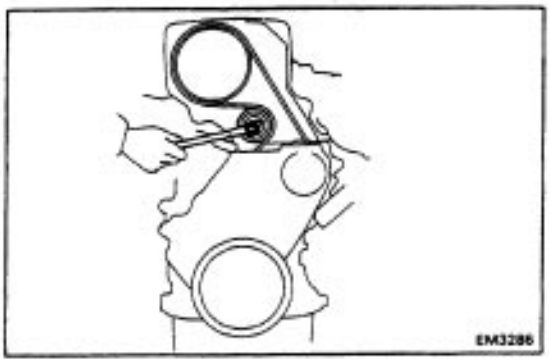


11. INSTALL TIMING BELT

HINT: If reusing the timing belt, first align the rnatchmarks of the timing belt and camshaft timing pulley.

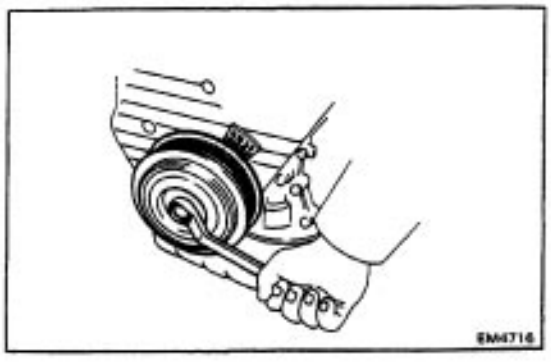


Install the timing belt, insure that there is tension between the crankshaft timing pulley, water pump pulley and camshaft timing pulley.



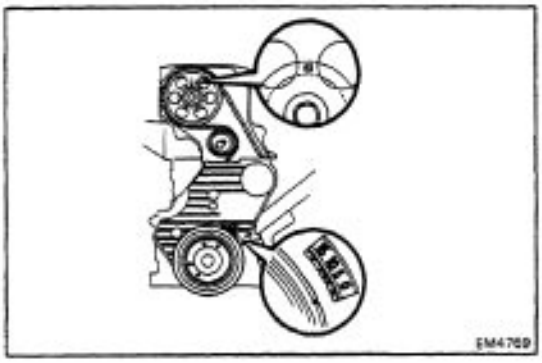
12. CHECK VALVE TIMING

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

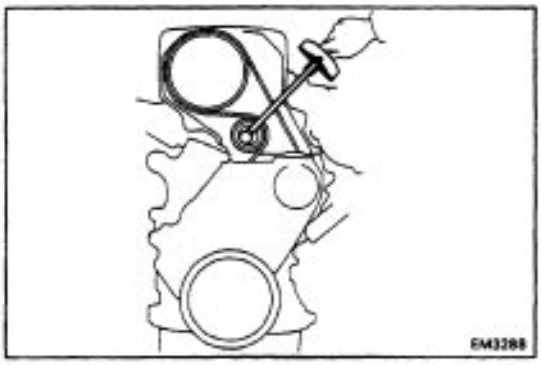


(b) Turn the crankshaft pulley two revolutions from TDC to TDC.

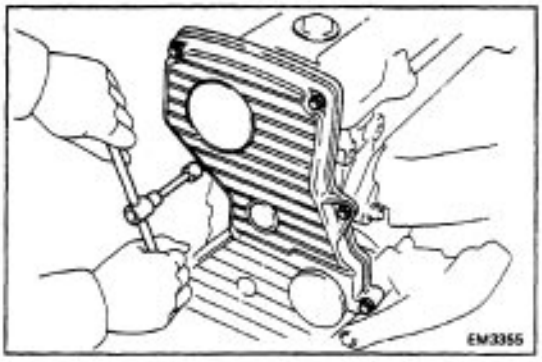
HINT: Always turn the crankshaft clockwise.



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



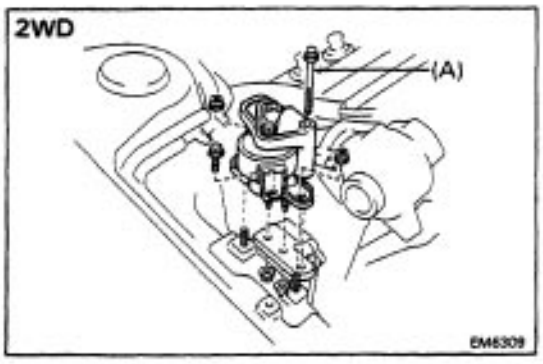
(d) Torque the mount bolt of the No.1 idler pulley.
Torque: 425 kg–cm (31 ft–lb, 42 N–m)



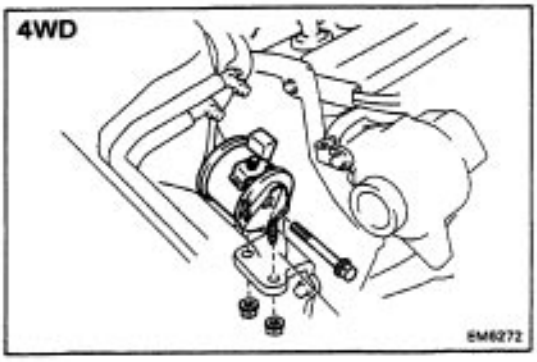
13. INSTALL NO–2 TIMING BELT COVER
(a) Install the two gaskets to the No. 1 and No.2 belt covers.
(b) Install the belt cover with the five bolts.

14. INSTALL SPARK PLUGS (See page IG–7)
Torque: 180 kg–cm (13 ft–lb, 18 N–m)

15. INSTALL ENGINE RH MOUNTING INSULATOR AND BRACKET
(a) Install the bracket with the three bolts. Torque the bolts.
Torque: 530 kg–cm (38 ft–ib, 52 N–m)



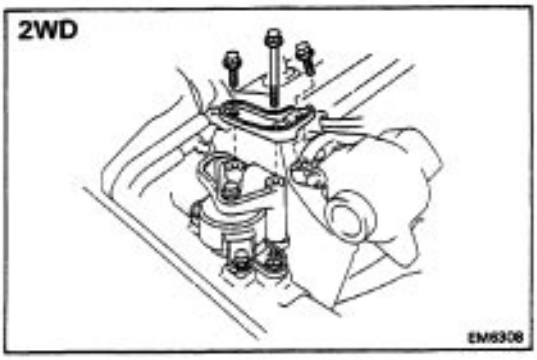
(b) (2WD)
Install the mounting insulator to the mounting bracket and body, and temporarily install the mounting insulator bolt, four nuts and mounting stay bolt (A). Torque the mounting insulator bolt and four nuts. Do not torque the mounting stay bolt (A) yet.
Torque:
Bolt 650 kg–cm (47 ft–lb, 64 N–m)
Nut To bracket 530 kg–cm (38 ft–lb, 52 N–m)
To body 900 kg–cm (65 ft–11b, 88 N–m)



(c) (4WD)
Install the mounting insulator with the through bolt and two nuts. Torque the through bolt and nuts.

Torque:
Through bolt 890 kg–cm (64 ft–lb, 87 N–m)
Nut 530 kg–cm (38 ft–lb, 52 N–m)

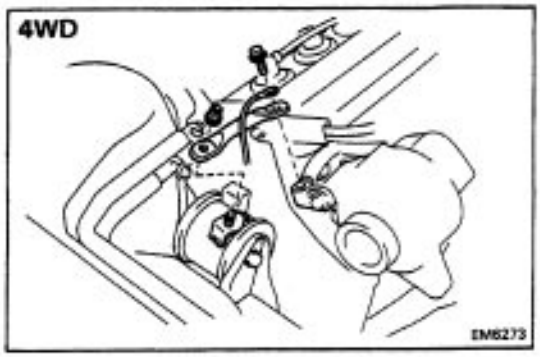
16. LOWER ENGINE



17. INSTALL ENGINE RH MOUNTING STAY (2WD)

Install the mounting stay with the three bolts. Torque the bolts.

Torque: 740 kg–cm (54 ft–lb, 73 N–m)



(4WD)

Install the mounting stay and ground strap with the bolt and nut. Torque the bolt and nut.

Torque: 740 kg–cm (54 ft–lb, 73 N–m)

18. INSTALL ALTERNATOR BRACKET

Torque: 425 kg–cm (31 ft–lb, 42 N–m)

19. INSTALL ALTERNATOR (See page CH–14)

20. INSTALL DRIVE BELTS

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

Drive belt tension:
Alternator w/ A/C . New belt 175 ± 5 lb
Used belt 130 ± 10 lb
w/o, A/C New belt 125 ± 25 lb
Used belt 9 5 ± 20 lb
PS pump New belt 125 ± 10 lb
Used belt 80 ± 20 lb

21. INSTALL CRUISE CONTROL ACTUATOR (See step 26 on page EM–137)

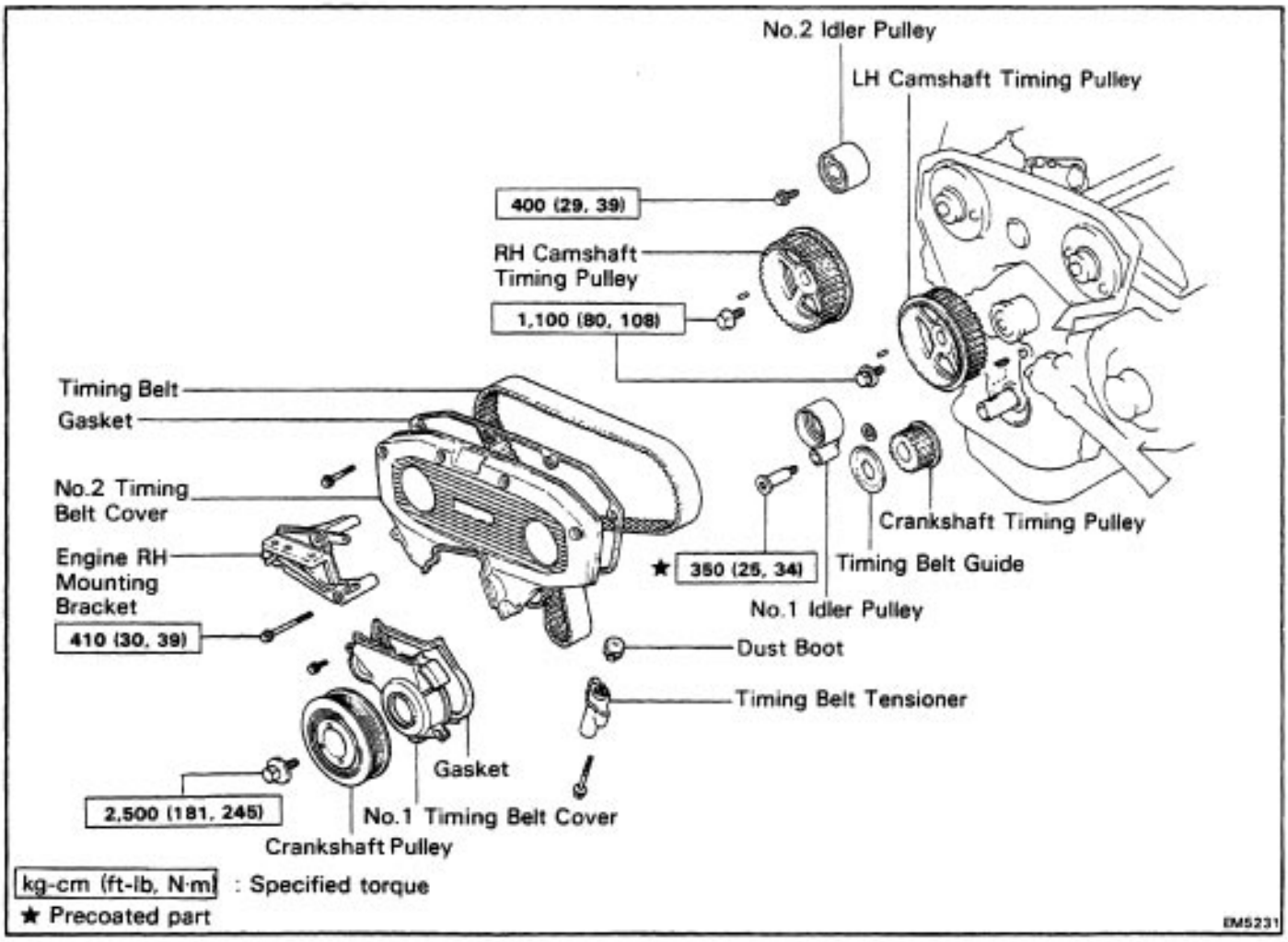
22. INSTALL ENGINE RH UNDER COVER

23. INSTALL RH FRONT WHEEL

24. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

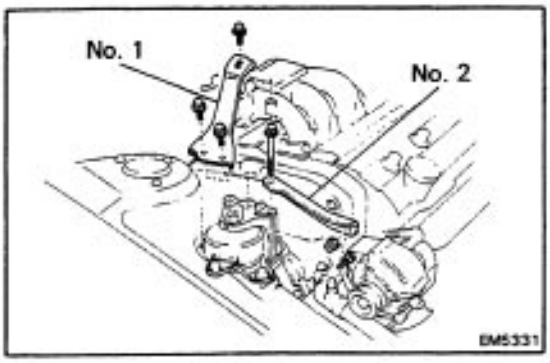
TIMING BELT (2VZ–FE)

COMPONENTS



REMOVAL OF TIMING BELT

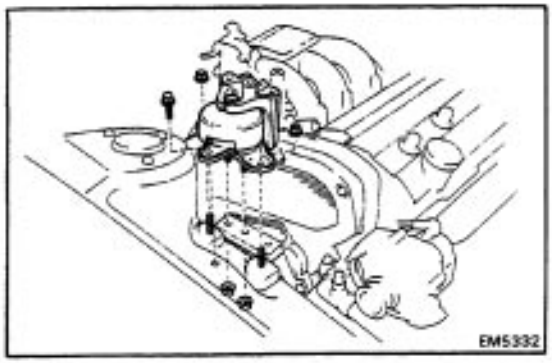
1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY
2. (w/ CRUISE CONTROL SYSTEM)
   REMOVE CRUISE CONTROL ACTUATOR AND VACUUM PUMP
   (See step 14 on page EM–140 or 141)
3. REMOVE PS OIL RESERVOIR TANK WITHOUT DISCONNECTING HOSES
   (See step 35 on page EM–144)
4. REMOVE RH FRONT WHEEL
5. REMOVE ALTERNATOR DRIVE BELT
6. REMOVE RH FENDER APRON SEAL
7. REMOVE PS DRIVE BELT



8. REMOVE ENGINE RH MOUNTING STAYS

(a) Remove the three bolts and No.1 mounting stay.

(b) Remove the bolt, nut and No.2 mounting stay.



9. SLIGHTLY JACK UP ENGINE

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

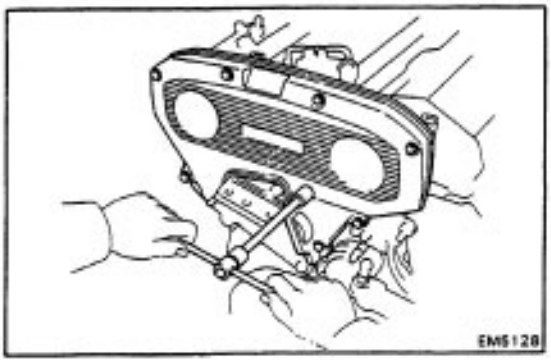
10. REMOVE ENGINE RH MOUNTING INSULATOR

(a) (w/ A.B.S..)

Remove the clamp bolts of the PS oil cooler pipes.

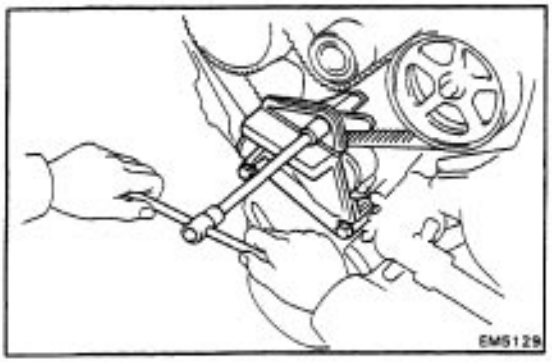
(b) Remove the bolt, four nuts and mounting insulator.

11. REMOVE SPARK PLUGS (See page IG–11)



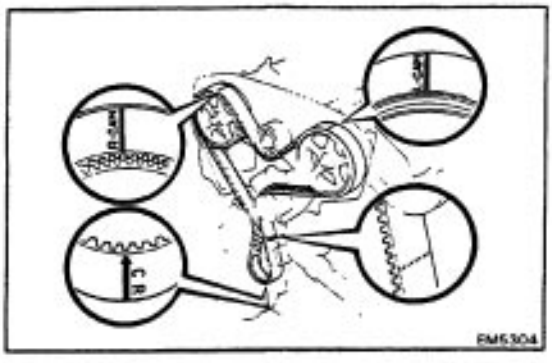
12. REMOVE NO.2 TIMING BELT COVER

Remove the eight bolts, timing belt cover and gasket.



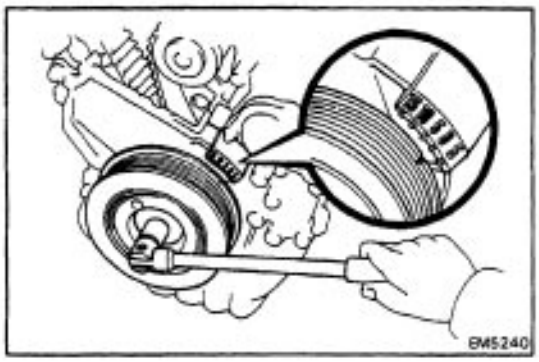
13. REMOVE ENGINE RH MOUNTING BRACKET

Remove the three bolts and mounting bracket.



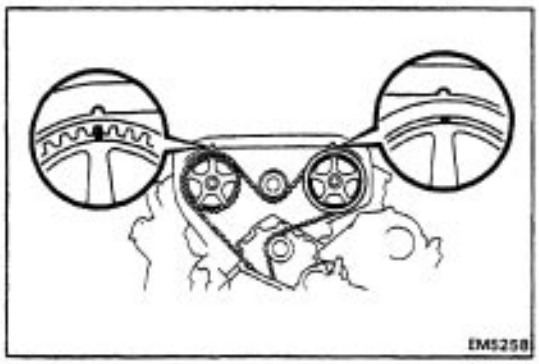
14. IF RE–USING TIMING BELT, CHECK INSTALLATION MARKS ON TIMING BELT

Check that there are four installation marks on the timing belt by turning the crankshaft pulley as shown in the illustration. If the installation marks have disappeared, place a new installation mark on .the timing belt before removing each part.

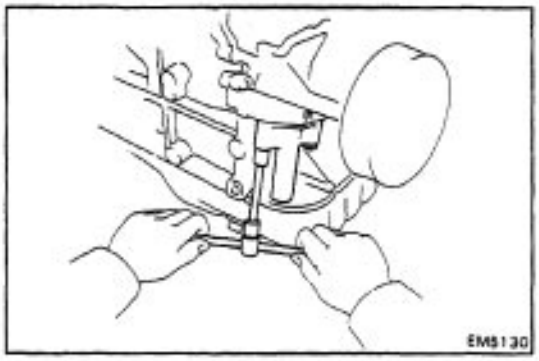


15. SET NO.1 CYLINDER TO TDCI COMPRESSION

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

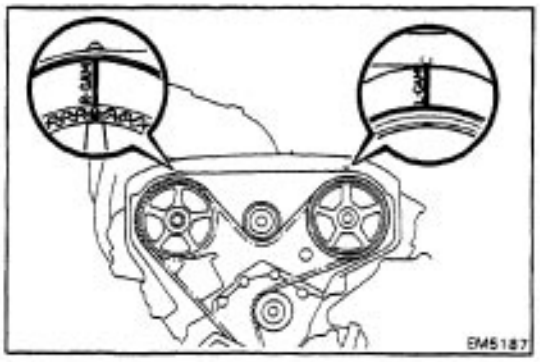


(b) Check that timing marks of the camshaft timing pulleys and No–3 timing belt cover are aligned. If not, turn the crankshaft one revolution (360˚).



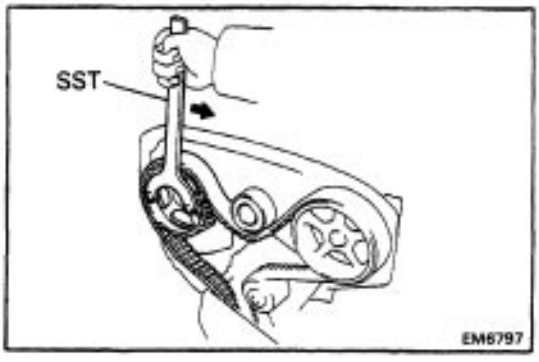
16. REMOVE TIMING BELT TENSIONER

Remove the two bolts, tensioner and dust boot.

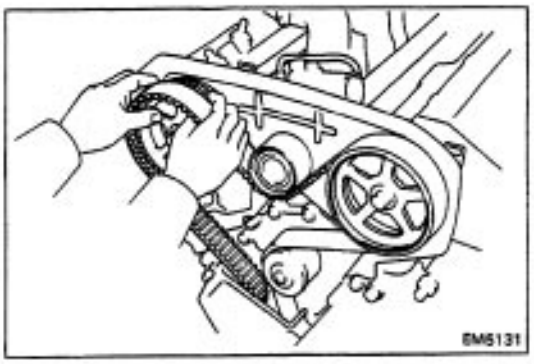


17. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEY

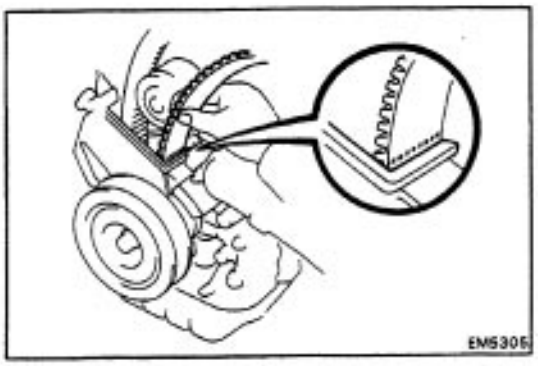
HINT (Re–using timing belt): If the installation marks have disappeared, before removing the timing belt, place new instillation marks on the timing belt to match the timing marks of the camshaft timing pulleys.



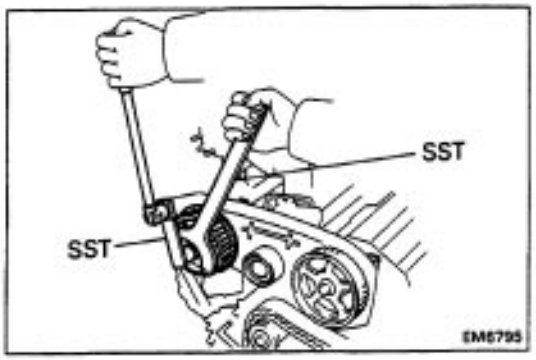
(a) Using SST, loosen– the tension between the LH and RH camshaft timing pulleys by slightly turning the RH camshaft timing pulley clockwise.
SST 09278–54012



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



HINT (Re–using timing belt): If the installation marks have disappeared, after removing the timing belt from the camshaft timing pulleys, place new installation mark on the timing belt to match the end of the No. 1 timing belt cover.



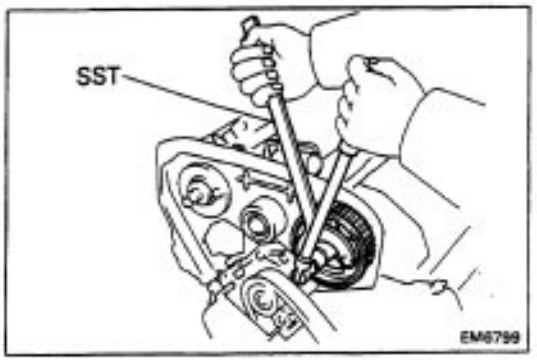
20. REMOVE CAMSHAFT TIMING PULLEYS

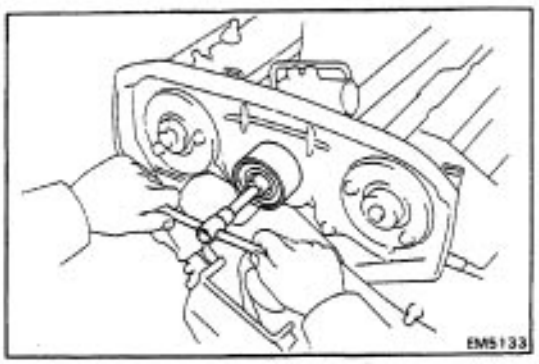
Using SST, remove the bolt, timing pulley and knock pin. Remove the two timing pulleys.

SST R H 09249–63010 and 09278–54012

LH 09278–54012

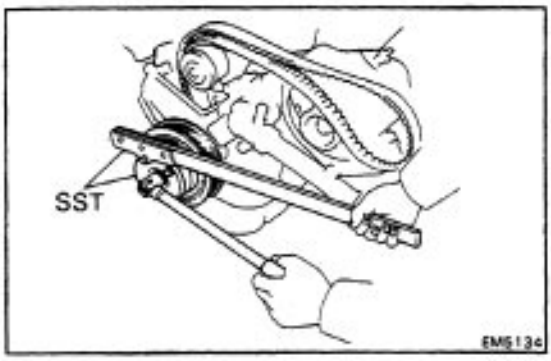
HINT: Arrange the RH and LH pulleys.





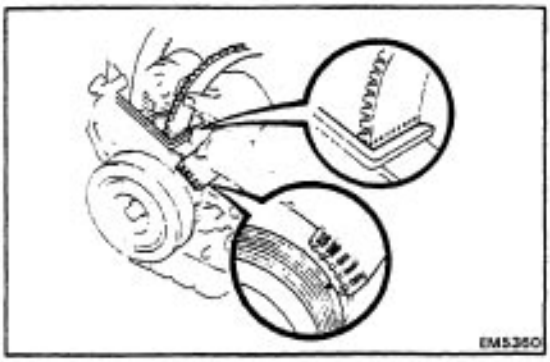
21. REMOVE NO. 2 IDLER PULLEY

Remove the bolt and idler pulley.

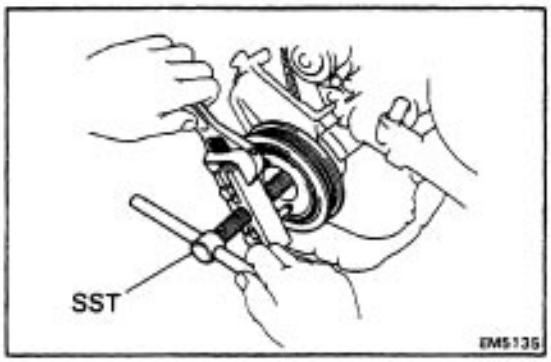


22. REMOVE CRANKSHAFT PULLEY

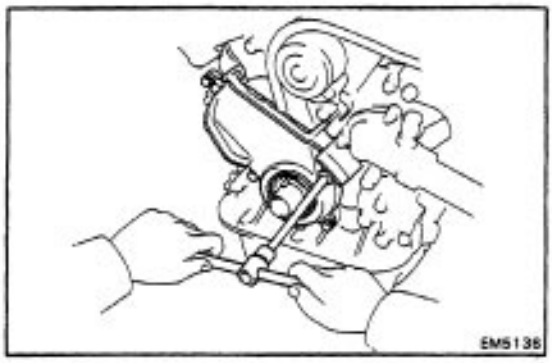
(a) Using SST, remove the pulley bolt.
SST 09213–54014 (Body),
90213–70010 (90105–08076 (Bolt)) and 09330–00021



HINT (Re–using timing belt): When the crankshaft pulley bolt is loosened, the position of the timing mark of the crankshaft pulley and also the installation mark may slip, so check and align them again.

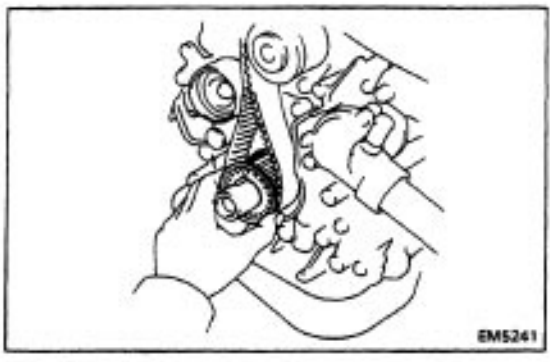


(b) Using SST, remove the pulley.
SST 09213–60017

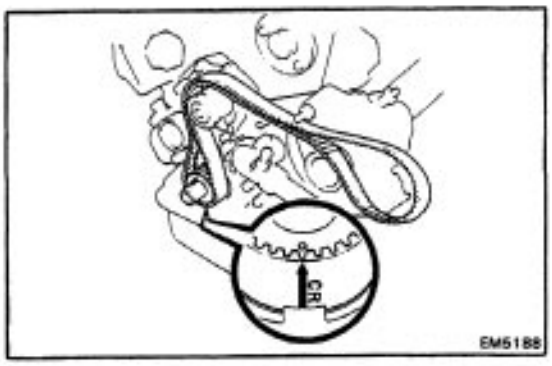


23. REMOVE NO. 1 TIMING BELT COVER

Remove the four bolts, timing belt cover and gasket.

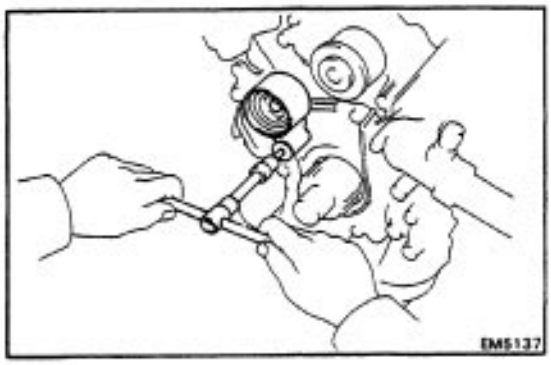


24. REMOVE TIMING BELT GUIDE



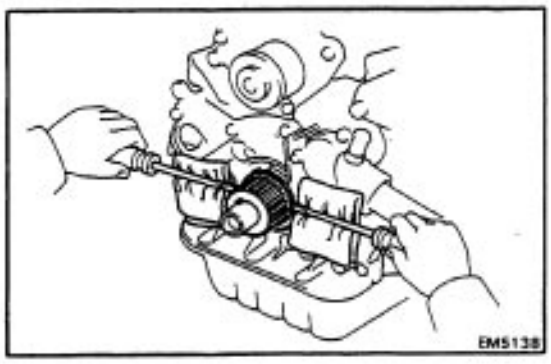
25. REMOVE TIMING BELT

HINT (Re–using timing belt): If the installation marks have disappeared, place new installation mark on the timing belt to match the drilled mark of the crankshaft timing pulley.



26. REMOVE NO. 1 IDLER PULLEY

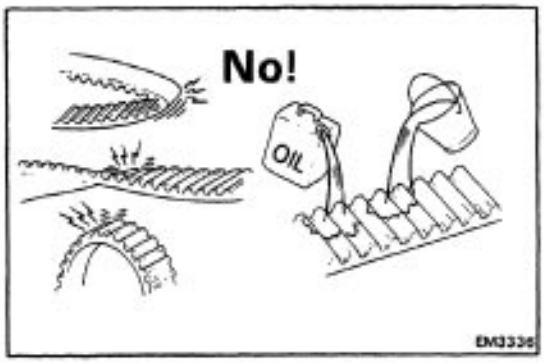
Using a 8 mm hexagon wrench, remove the bolt, idler pulley and plate washer.



27. REMOVE CRANKSHAFT TIMING PULLEY

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

HINT: Position shop rags as shown to prevent damage.



INSPECTION OF TIMING BELT COMPONENTS

1. INSPECT TIMING BELT

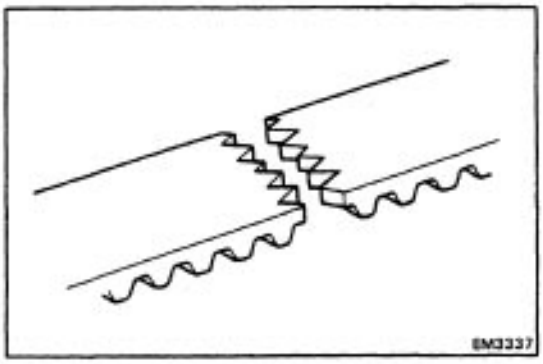
NOTICE:

- 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 mount bolt of the camshaft timing pulley.

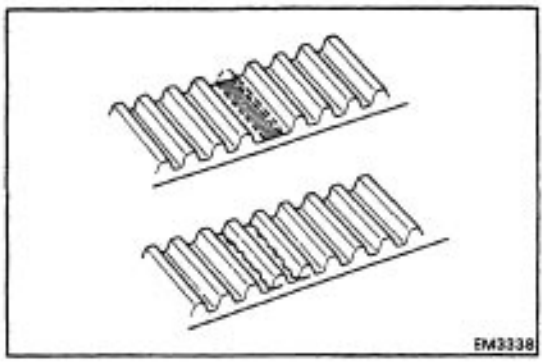
If there are any defects as shown in the figures, check the following points:

(a) Premature parting

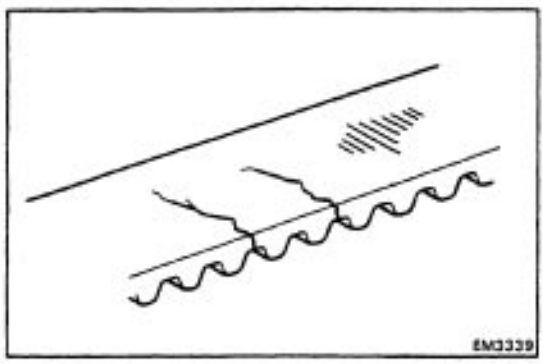
- Check for proper installation.
- Check the timing cover gasket for damage and proper installation.



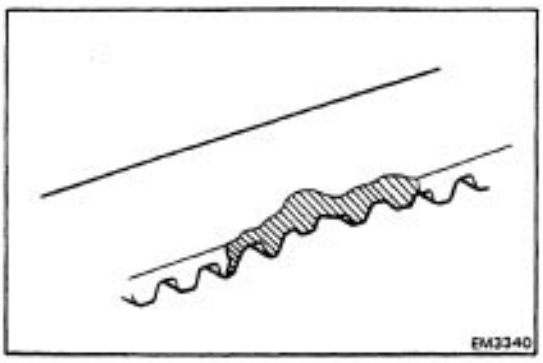
(b) If the belt teeth are cracked or damaged, check to see if either camshaft is locked.

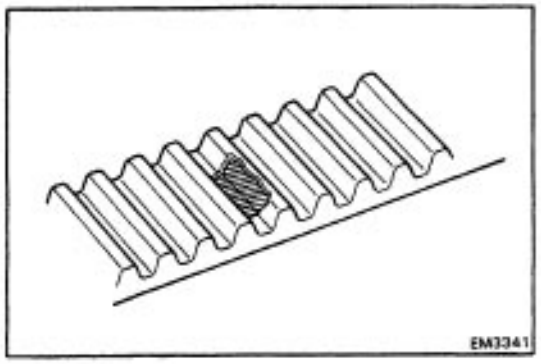


(c) If there are cracks or noticeable wear on the belt face, check to see if there are nicks on the side of the idler pulley lock and water pump.

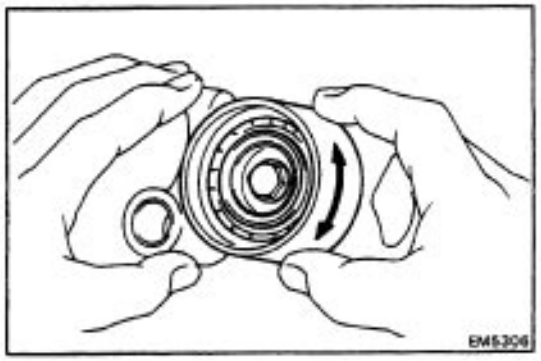


(d) If there is wear or damage on only one side of the belt, check the belt guide 'and the alignment of each pulley.

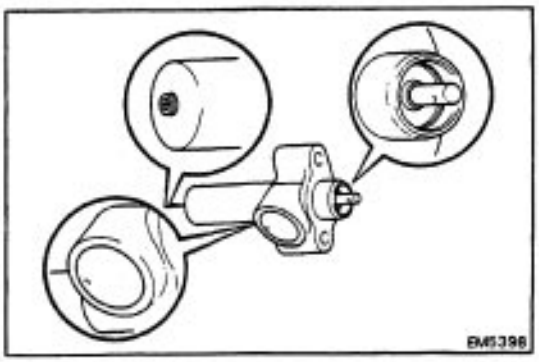




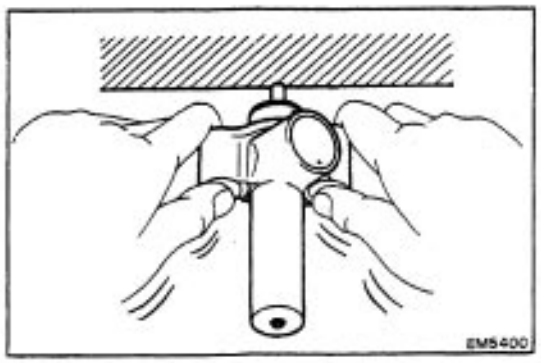
(e) If there is noticeable wear on the belt teeth, check timing cover for damage and check for correct gasket installation. Check for foreign material on the pulley teeth.
If necessary, replace the timing belt.



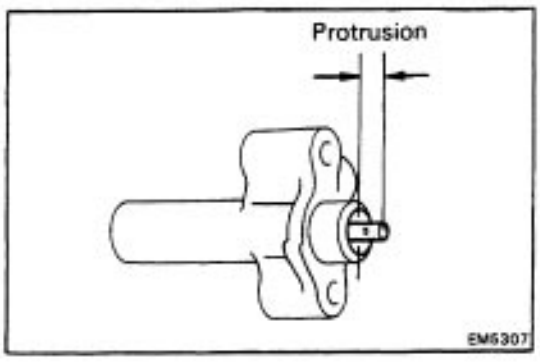
2. INSPECT IDLER PULLEYS
Check the turning smoothness of the idler pulley.
If necessary, replace the idler pulley.



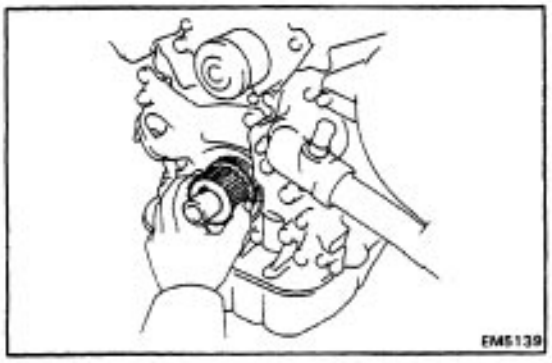
3. INSPECT TIMING BELT TENSIONER
(a) Visually check tensioner for oil leakage.
HINT: If there is only the faintest trace of oil on the seal on the push rod side, the tensioner is all right.
If leakage is found, replace the tensioner.



(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: 10.5 – 11.5 mm (0.413 – 0.453 in.)
If the protrusion is not as specified, replace the tensioner.



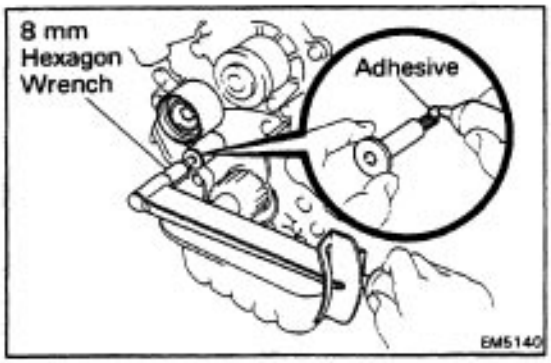
INSTALLATION OF TIMING BELT

(See page EM–34)

1. INSTALL CRANKSHAFT TIMING PULLEY

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

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

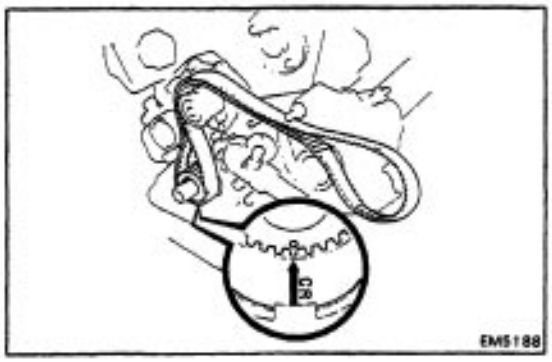


2. INSTALL NO–1 IDLER PULLEY

(a) Apply adhesive to two or three threads of the mount bolt end.
Adhesive: Part No. 08833–00080, THREE BOND 1344, LOCTITE 242 or equivalent

(b) Using a 8 mm hexagon wrench, install the idler pulley with the plate washer and bolt. Torque the bolt.
Torque: 350 kg–cm (25 ft–lb, 34 N–m)

(c) Check that the pulley bracket moves smoothly.



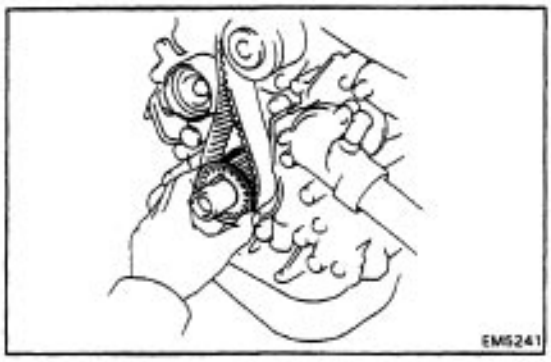
3. TEMPORARILY INSTALL TIMING BELT

NOTICE: The engine should be cold.

(a) Remove any oil or water on the crankshaft timing, No.1 idler and water pump pulleys, and keep them clean.

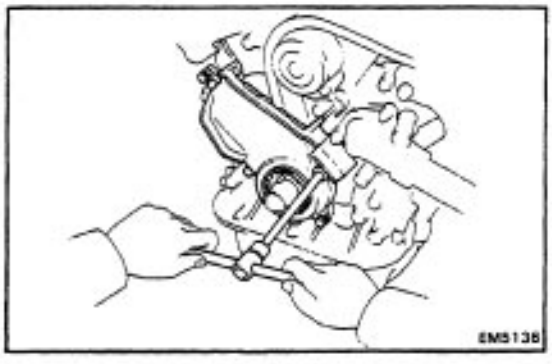
(b) Align the installation mark on the timing belt with the drilled mark of the crankshaft timing pulley.

(c) Install the timing belt on the crankshaft timing, No.1 idler and water pump pulleys.



4. INSTALL TIMING BELT GUIDE

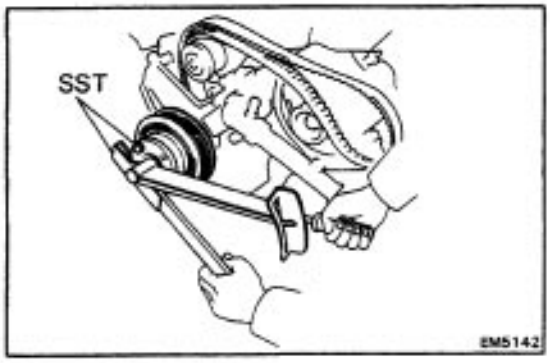
Install the belt guide, facing the cup side outward.



5. INSTALL NO.1 TIMING BELT COVER

(a) Install the gasket to the tinning belt cover.

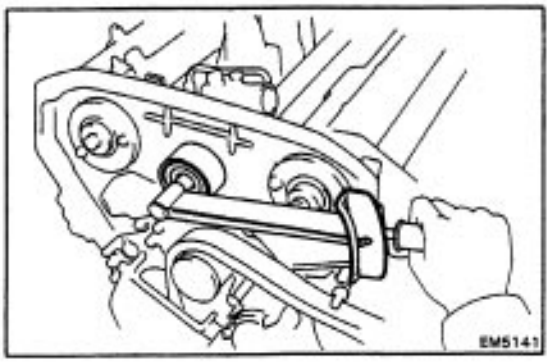
(b) Install the tinning belt cover with the four bolts.



6. INSTALL CRANKSHAFT PULLEY

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

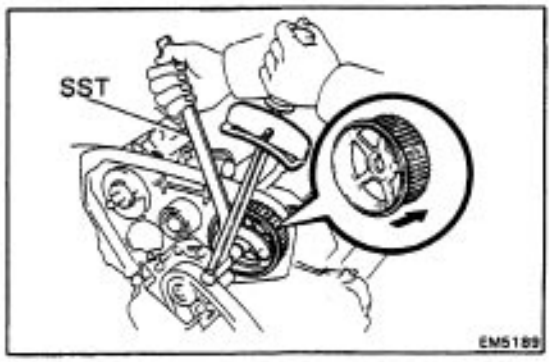
(b) Using SST, install and torque the the bolt.
SST 09213–54014 (Body),
09213–70010 (90105–08076 (Bolt)) and
09330–00021
Torque: 2,500 kg–cm (181 ft–ib, 245 N–m)



7. INSTALL NO.2 IDLER PULLEY

(a) Install the idler pulley with the bolt. Torque the bolt.
Torque: 400 kg–cm (29 ft–lb, 39 N–m)

(b) Check that the idler pulley moves smoothly.

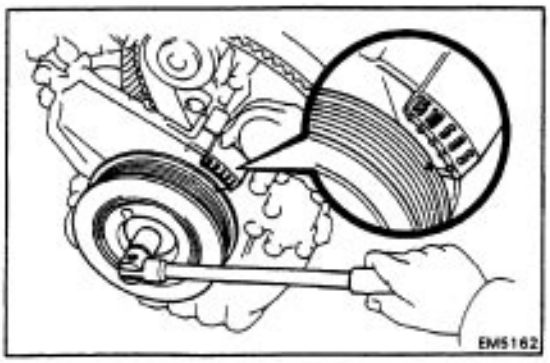


8. INSTALL LH CAMSHAFT TIMING PULLEY

(a) Slide the timing pulley, facing the flange side outward.

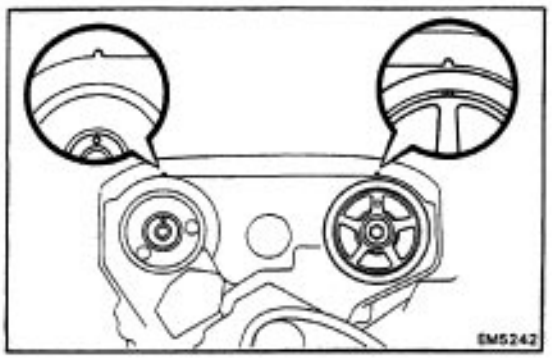
(b) Align the knock pin hole of the camshaft with the knock pin groove of the timing pulley, and install the knock pin.

(c) Using SST, install and torque the bolt.
SST 09278–54012
Torque: 1,100 kg–cm (80 ft–lb, 108 N–m)



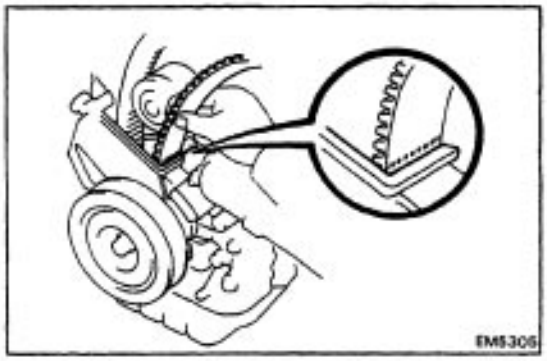
9. SET NO.1 CYLINDER TO TDC/COMPRESSION

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



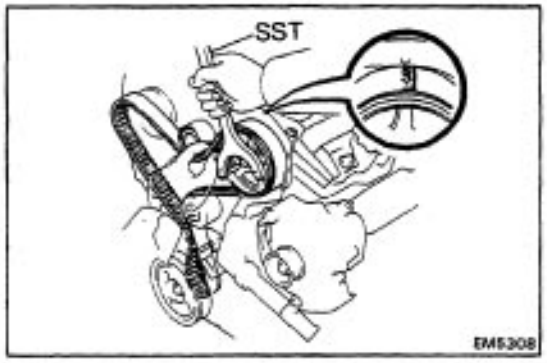
(b) (RH Camshaft Pulley Position)
Turn the camshaft, align the knock pin hole of the camshaft with the timing mark of the No.3 timing belt cover.

(c) (LH Camshaft Pulley Position)
Turn the camshaft timing pulley, align the timing marks of the camshaft timing pulley and No.3 timing belt cover.

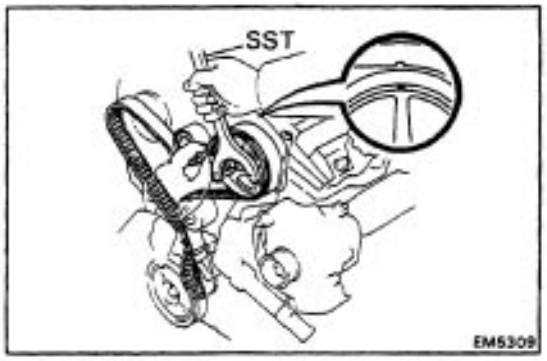


10. INSTALL TIMING BELT TO LH CAMSHAFT TIMING PULLEY

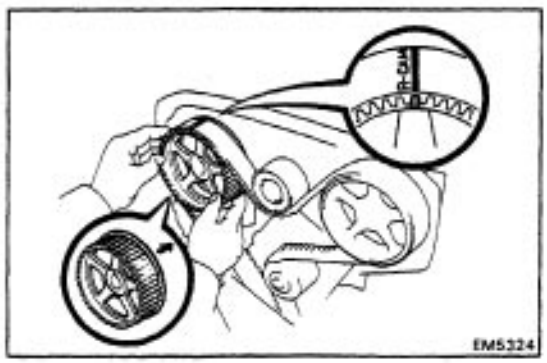
(a) Check that the installation mark on the timing belt matches the end of the No.1 timing belt cover–.
If the installation mark do not align, shift the meshing of the timing belt and crankshaft timing pulley until they align.



(b) Remove any oil or water on the LH camshaft timing pulley, and keep it clean.
(c) Using SST, slightly turn the LH camshaft timing pulley clockwise. Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley, and hang the timing belt on the LH camshaft timing pulley.
SST 09278–54012

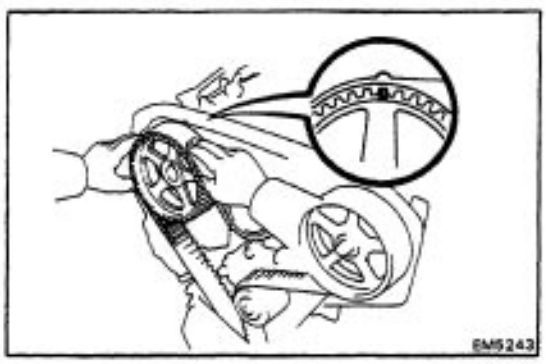


(d) Using SST, align the timing marks of the LH camshaft pulley and No.3 timing belt cover.
SST 09278–54012
(e) Check that the timing belt has tension between the crankshaft timing and LH camshaft timing pulleys.

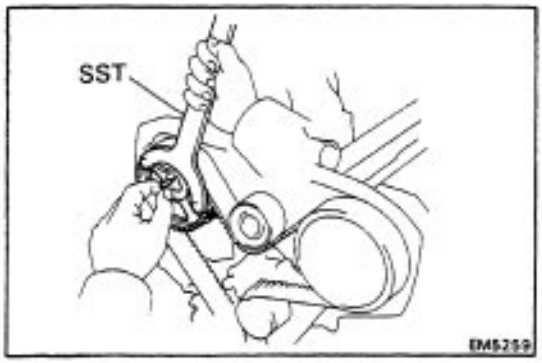


11. INSTALL RH CAMSHAFT TIMING PULLEY AND TIMING BELT

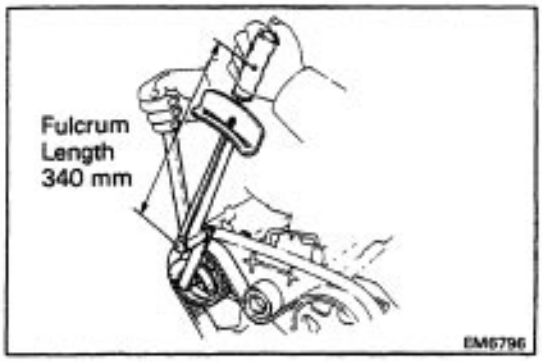
(a) Remove any oil or water on the RH camshaft timing and No–2 idler pulleys, and keep them clean.
(b) Align the installation mark on the timing belt with the timing mark of the RH camshaft timing pulley.
(c) Hang the timing belt on the RH camshaft timing pulley, facing the flange side inward.



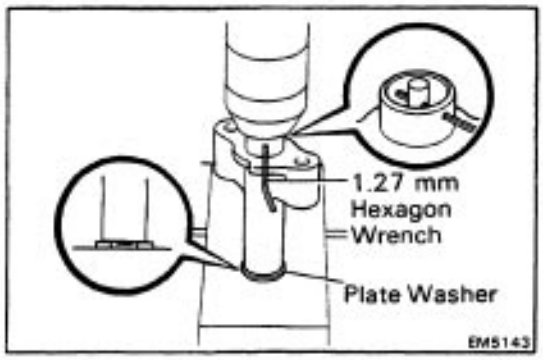
(d) Align the timing .marks of the RH camshaft timing pulley and No.3 timing belt cover.
(e) Slide the RH camshaft timing pulley on the camshaft.



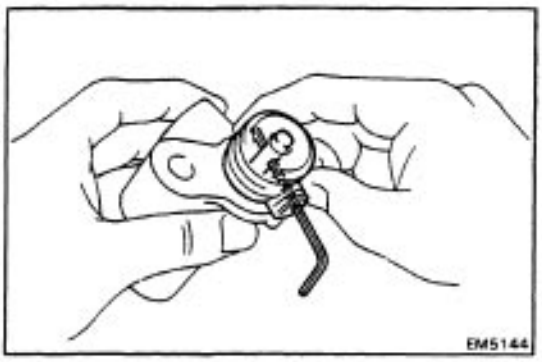
(f) Using SST, align the knock pin hole of the camshaft with the knock pin groove of the pulley and install the knock pin.
SST 09278–54012

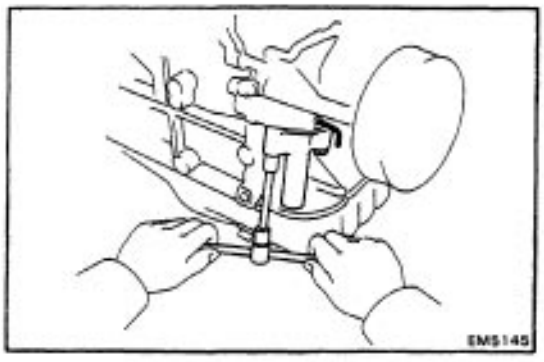


(g) Using SST, install and torque the bolt.
SST09249–63010 and 09278–54012
Torque: 760 kg–cm (55 ft–lb, 75 N–m)
HINT: Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

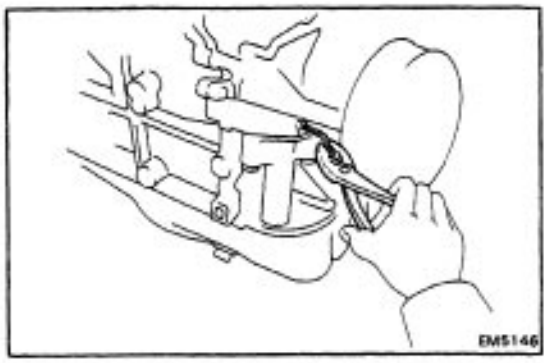


12. SET TIMING BELT TENSIONER
(a) Place a plate washer between the tensioner and a block.
(b) Using a press, slowly press in the push rod using 100 – 1,000 kg (220 – 2,205 ib, 981 – 9,807 N) of pressure.
(c) Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench (sized 1.27 mm) through the holes to keep the setting position of the push rod.
(d) Release the press.
(e) Install the dust boot to the tensioner.

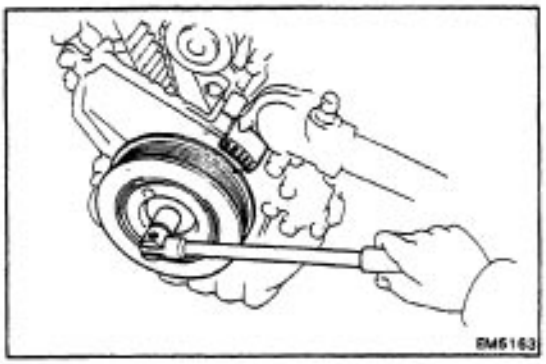




13. INSTALL TIMING BELT TENSIONER
(a) Install the tensioner with the two bolts.
Torque: 270 kg–cm (20 ft–lb, 26 N–m)



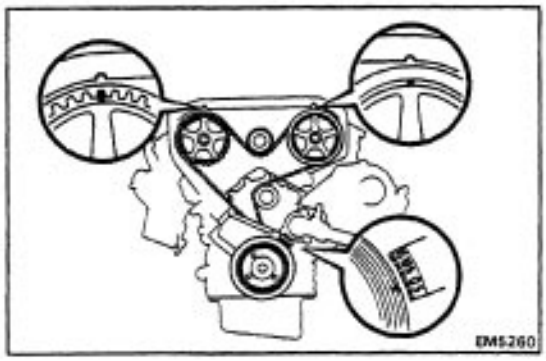
(b) Remove the 1.27 mm hexagon wrench (sized 1.27 mm) from the tensioner.



14. CHECK VALVE TIMING

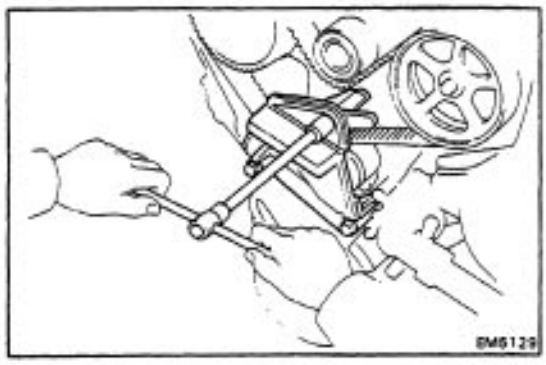
(a) Turn the crankshaft pulley two revolutions from TDC to TDC.

HINT: Always turn the crankshaft clockwise.



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

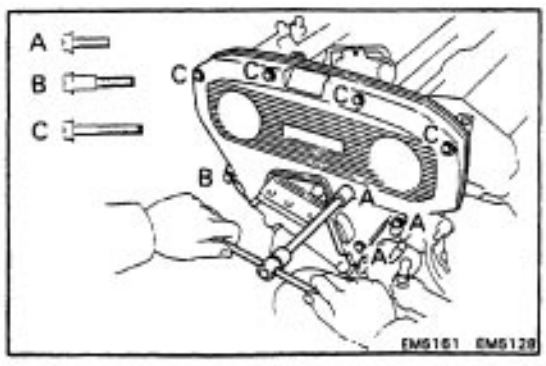
If the marks do not align, remove the timing belt and reinstall it.



15. INSTALL ENGINE RH MOUNTING BRACKET

Install the mounting bracket with the three bolt.

Torque: 410 kg–cm (30 ft–lb, 39 N–m)



16. INSTALL NO.2 TIMING BELT COVER

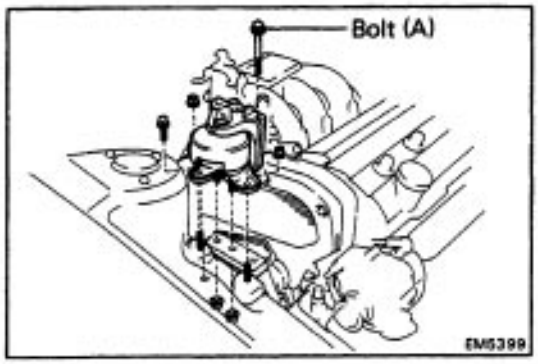
(a) Install the gasket to the timing belt cover.

(b) Install the timing belt cover with the eight bolts.

HINT: Use the bolts indicated by A, B and C.

17. INSTALL SPARK PLUGS (See page IG–11)

Torque: 180 k9–cm (13 ft–lb, 18 N–m)



18. INSTALL ENGINE RH MOUNTING INSULATOR

(a) Attach the mounting insulator to the mounting bracket and body, and temporarily install the mounting insulator bolt, four nuts and the mounting stay bolt (A).

(b) Torque the mounting insulator bolt and four nuts. Do not torque the mounting stay bolt (A) yet.

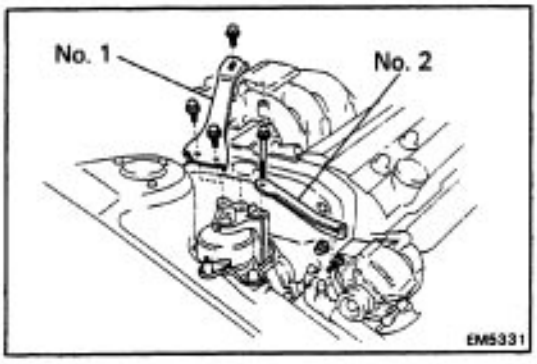
Torque:

Bolt	**650 kg–cm (47 ft–lb, 64 N–m)**
Nut To bracket	**530 kg–cm (38 ft–lb, 52 N–m)**
To body	**900 kg–cm (65 ft–lb, 88 N–m)**

(c) (w/ A.B.S..)

Install the two clamp bolts of the PS oil cooler pipes.

19. LOWER ENGINE



20. INSTALL ENGINE RH MOUNTING STAYS

(a) Install the No–1 mounting stay with the three bolts. Torque the bolts.

Torque: 530 kg–cm (38 ft–lb, 52 N–m)

(b) Install the No.2 mounting stay with the bolt and nut. Torque the bolt and nut.

Torque:

Bolt 670 kg–cm (48 ft–lb, 66 N–m)
Nut 530 kg–cm (38 ft–lb, 52 N–m)

21. INSTALL PS PUMP DRIVE BELT

Adjust the drive belt.

Drive belt tension: New belt 125 ± 20 lb
Used belt 80 ± 25 lb

22. INSTALL ALTERNATOR DRIVE BELT

Adjust the drive belt. (See page CH–3)

Drive belt tension: New belt 175 ± 5 lb
Used belt 115 ± 20 lb

23. INSTALL RH FRONT FENDER APRON SEAL

24. INSTALL RH FRONT WHEEL

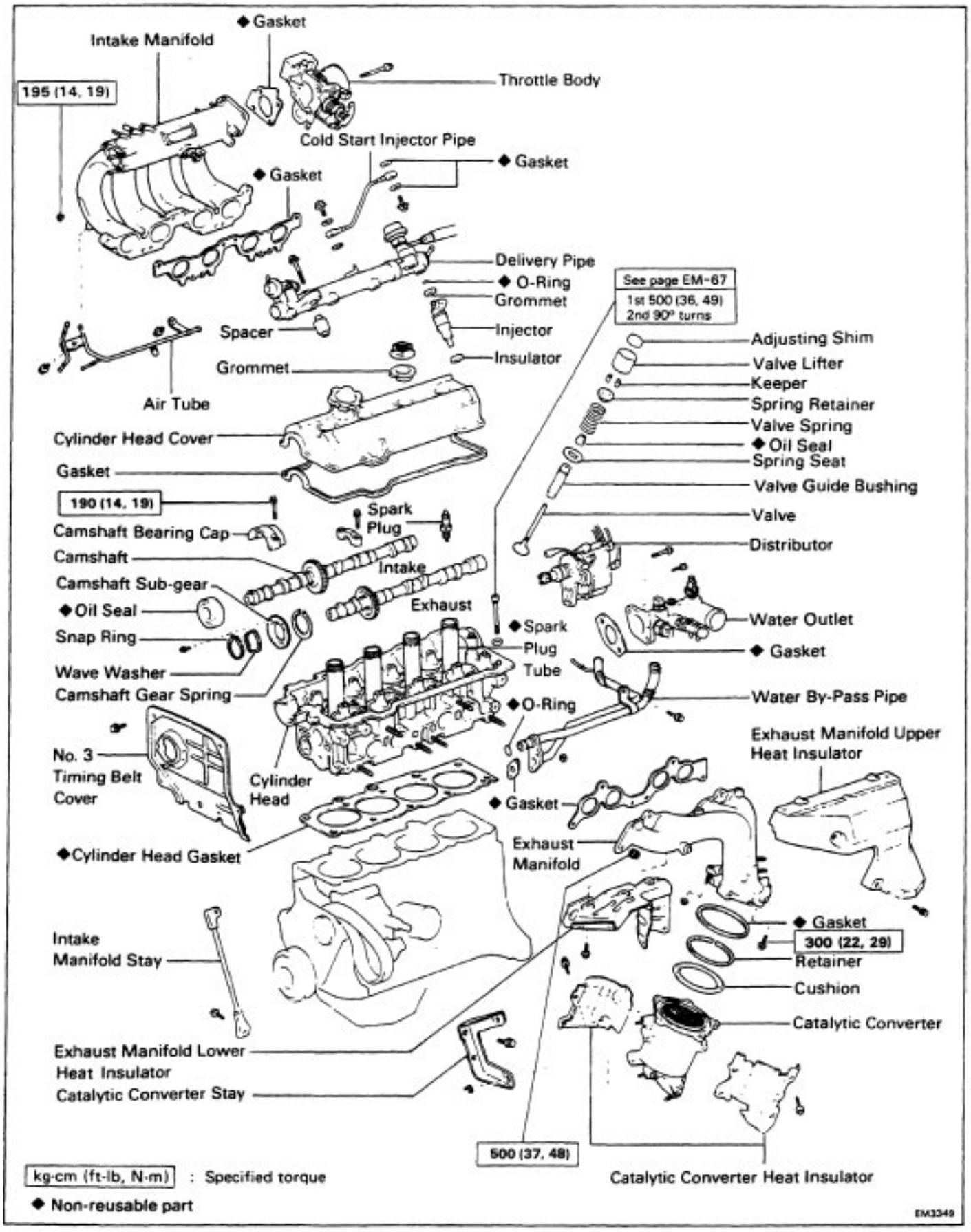
25. INSTALL PS OIL RESERVOIR TANK
(See step 6 on page EM–170)

26. (w/ CRUISE CONTROL SYSTEM)
INSTALL CRUISE CONTROL ACTUATOR AND VACUUM PUMP (See step 27 on page EM–173)

27. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

CYLINDER HEAD (3S–FE)

COMPONENTS



REMOVAL OF CYLINDER HEAD

(See page EM–48)

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

2. DRAIN ENGINE COOLANT (See page CO–4)

3. (A/T)

DISCONNECT THROTTLE CABLE AND BRACKET FROM THROTTLE BODY

4. DISCONNECT ACCELERATOR CABLE AND BRACKET FROM THROTTLE BODY AND AIR INTAKE CHAMBER

5. REMOVE CRUISE CONTROL ACTUATOR
(See step 9 on page EM–108)

6. REMOVE AIR CLEANER HOSE

7. REMOVE ALTERNATOR (See page CH–6)

8. REMOVE OIL PRESSURE SWITCH, ENGINE HANGERS AND ALTERNATOR UPPER BRACKET

9. RAISE VEHICLE
NOTICE: Be sure the vehicle is securely supported.

10. REMOVE RH FRONT WHEEL

11. REMOVE ENGINE RH UNDER COVER

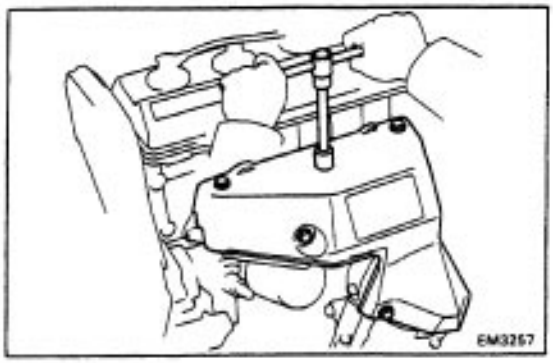
12. REMOVE SUSPENSION LOWER CROSSMEMBER
(See step 20 on page EM–109)

13. DISCONNECT FRONT EXHAUST PIPE FROM CATALYTIC CONVERTER
(See step 25 on page EM–110)

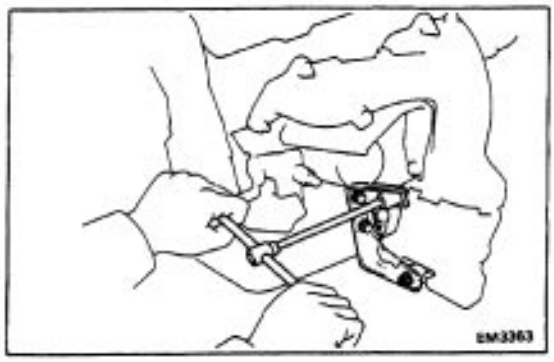
14. REMOVE EXHAUST MANIFOLD AND CATALYTIC CONVERTER ASSEMBLY

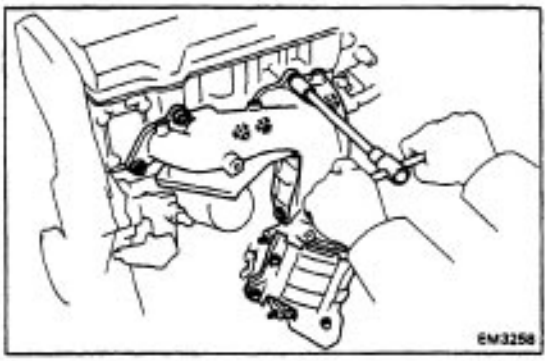
(a) Disconnect the oxygen sensor connector(s).

(b) Remove the six bolts and manifold upper heat insulator.

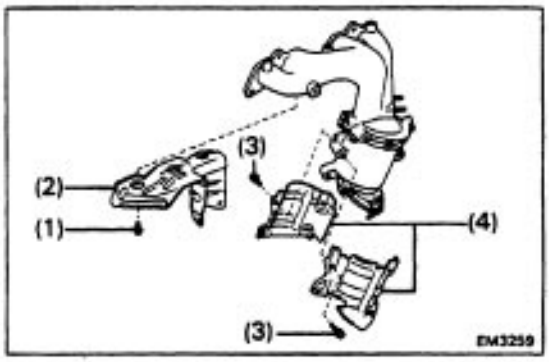


(c) Remove the two–bolts, two nuts and catalytic converter stay.



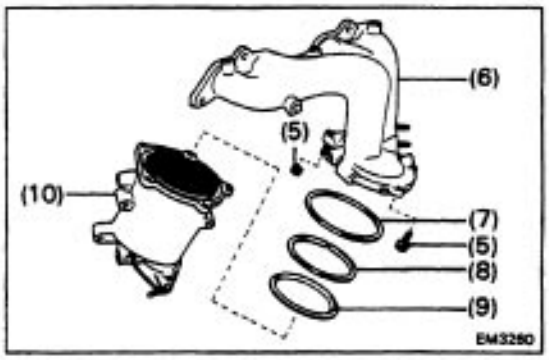


(d) Remove the six nuts, the exhaust manifold and catalytic converter assembly.



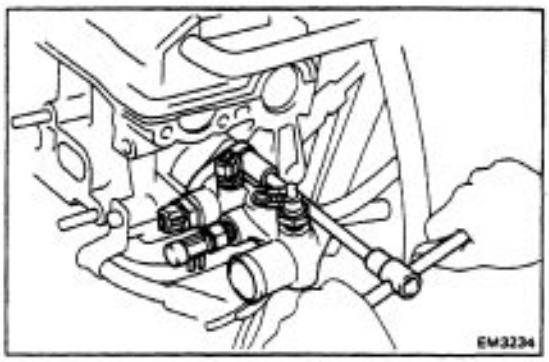
15. SEPARATE EXHAUST MANIFOLD AND CATALYTIC CONVERTER

Remove the following parts:
(1) Five bolts
(2) Manifold lower heat insulator
(3) Eight bolts
(4) Two catalytic converter heat insulators



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

16. REMOVE DISTRIBUTOR (Seepage IG–13)



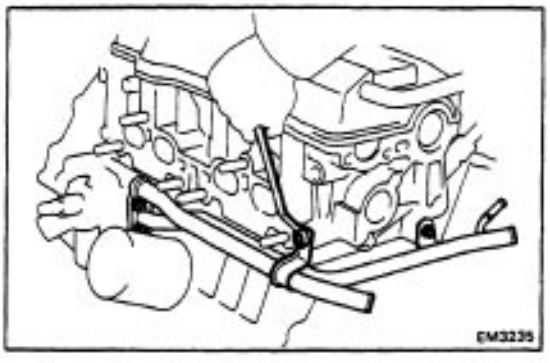
17. REMOVE WATER OUTLET

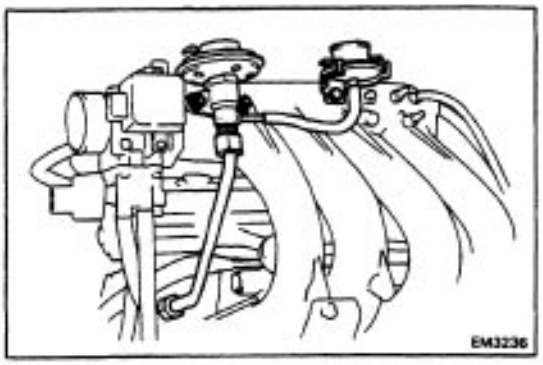
(a) Disconnect the following connectors and hoses:
(1) Water temperature sender gauge connector
(2) Water temperature sensor connector
(3) Cold start injector time switch connector
(4) Radiator upper hose
(5) Water hoses
(6) Emission control vacuum hoses

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

18. REMOVE WATER BY–PASS PIPE

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

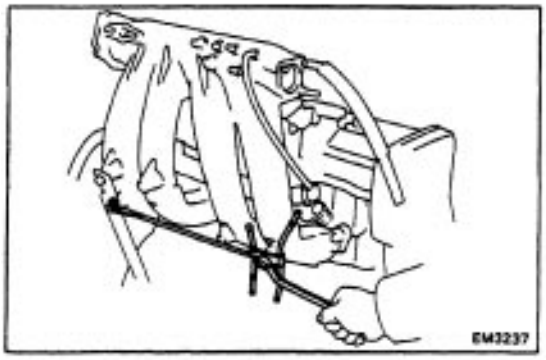




19. REMOVE EGR VALVE AND MODULATOR

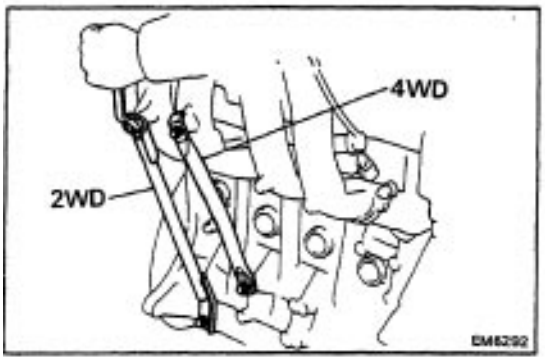
(a) Remove the vacuum hoses.
(b) Loosen the union nut of the EGR pipe, and remove two bolts, EGR modulator and gasket.
(c) Remove the bolt and EGR valve.

20. REMOVE THROTTLE BODY
(See steps 5 to 7 on page FI–107)
21. REMOVE COLD START INJECTOR PIPE
(See step 3 on page FI–78)



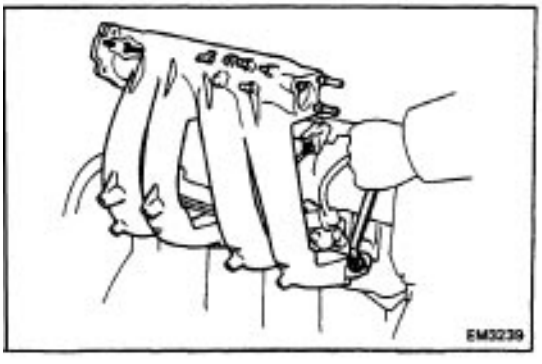
22. REMOVE AIR TUBE

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



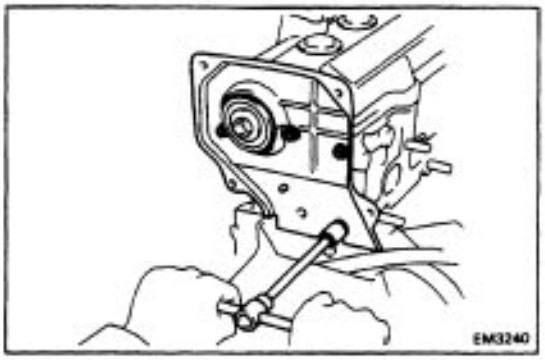
23. REMOVE INTAKE MANIFOLD

(a) Remove the two bolts and manifold stay.

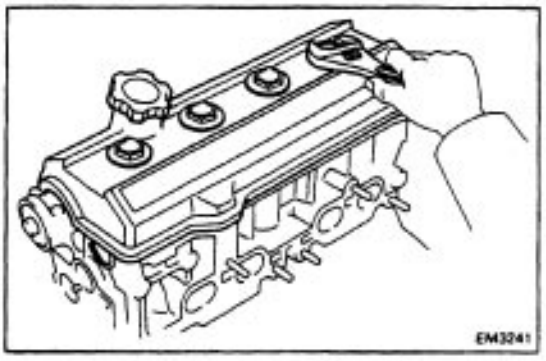


(b) Disconnect the vacuum sensing hose.
(c) Remove the six bolts, two nuts, intake manifold and gasket.

24. REMOVE DELIVERY PIPE AND INJECTORS
(See steps 3 and 7 on page FI–89)
25. REMOVE SPARK PLUGS (See page IG–6)
26. REMOVE CAMSHAFT TIMING PULLEY
(See steps 2 to 14 on pages EM–23 and 25)
27. REMOVE NO. 1 IDLER PULLEY AND TENSION SPRING
(See step 18 on page FI–26)

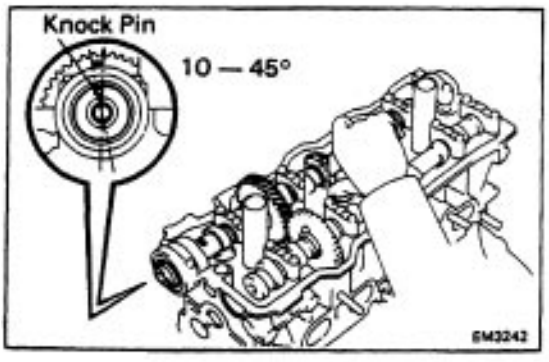


28. REMOVE NO. 3 TIMING BELT COVER
Remove the four bolts and belt cover.
HINT:
- Support the belt so the meshing of the crankshaft timing pulley and timing belt does not shift.
- Be careful not to drop anything inside the timing belt cover.
- Do not allow the belt to come into contact with oil, water or dust.

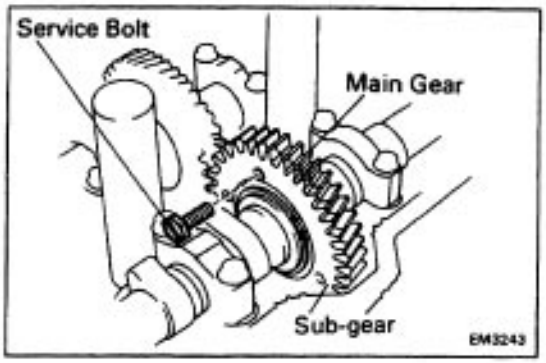


29. REMOVE CYLINDER HEAD COVER
Remove the four nuts, grommets, head cover and gasket.
HINT: Arrange the grommets in correct order, so that they can be reinstalled into their original positions. This minimizes any possibility of oil leakage due to reuse of grommets.

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



A. Remove exhaust camshaft
(a) Set the knock pin of the intake camshaft at 10 – 450 BTDC of camshaft angle.
HINT: The above angle helps to lift the exhaust camshaft level and evenly by pushing No. 2 and No. 4 cylinder cam lobes of the exhaust camshaft to their valve lifters.



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

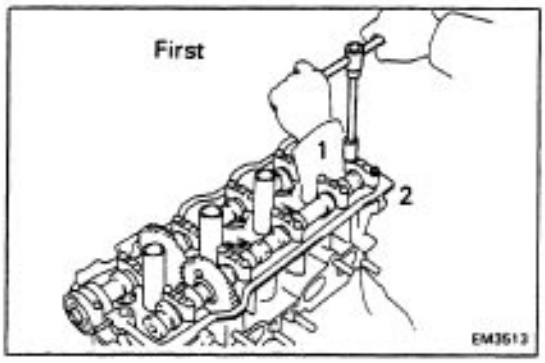
Recommended service bolt:

Thread diameter6 mm

Thread pitch 1.0 mm

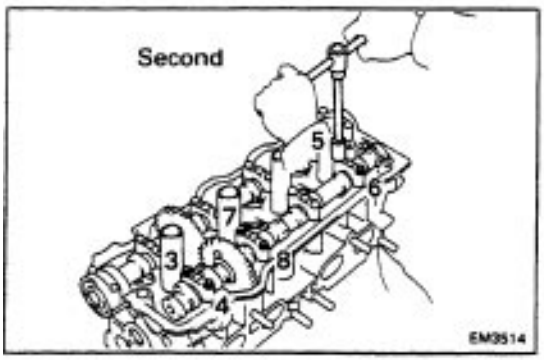
Bolt length 16 – 20 mm (O.63 – 0.79 in.)

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



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

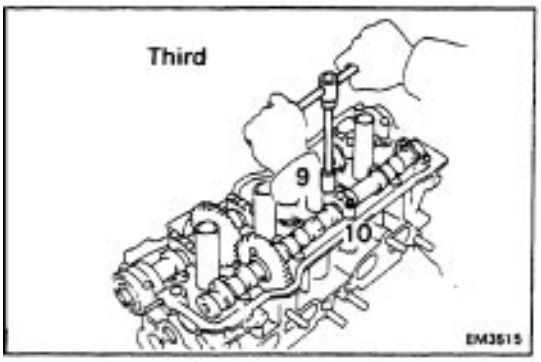
(d) Remove the rear bearing cap.



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

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

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

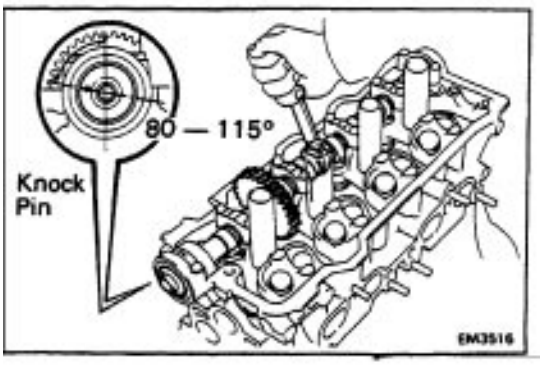


Alternately loosen and remove No. 3 bearing cap bolts 9 and 10.

HINT:

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

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

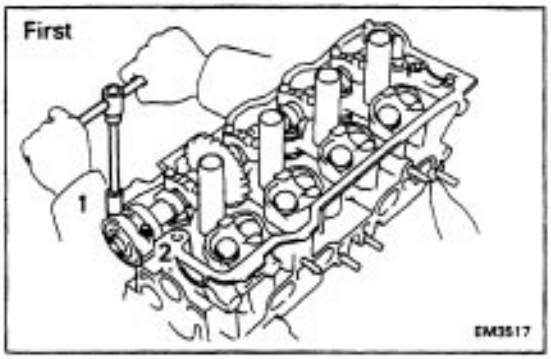


(h) Remove the No. 3 bearing cap and exhaust camshaft.

B. Remove intake camshaft

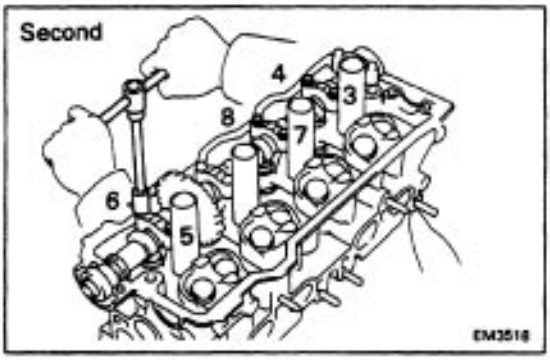
(a) Set the knock pin of the intake camshaft at 80 – 115° BTDC of camshaft angle.

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



(b) Remove the front bearing cap bolts i and 2.
(e) Remove the front bearing cap and oil seal.

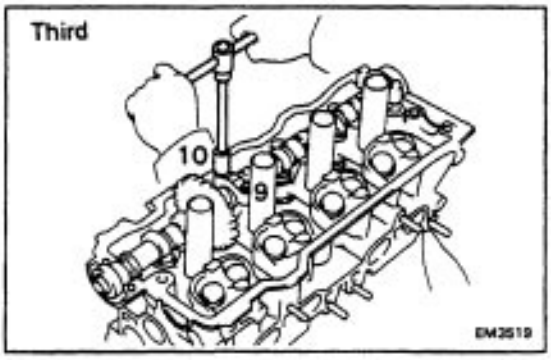
NOTICE: If the front bearing cap is not removable by hand, do not try to remove by force but leave as it is without bolts.



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

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

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



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

HINT:

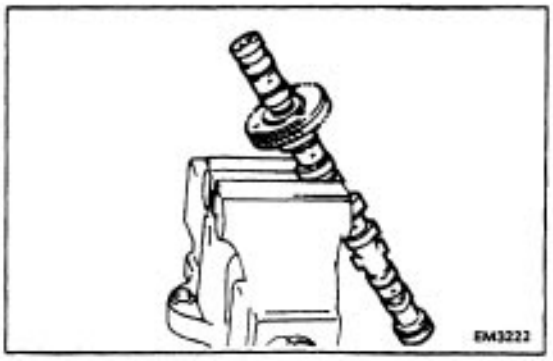
- As bearing cap bolts 9 and 10 are loosened, check that the camshaft is being lifted out straight and level, after breaking adhesion on the front bearing cap.
- If the camshaft is not being lifted out straight and level, re-tighten bearing cap bolts 9 and 10. Reverse the order of above steps from (f)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

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

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

31. DISASSEMBLE EXHAUST CAMSHAFT

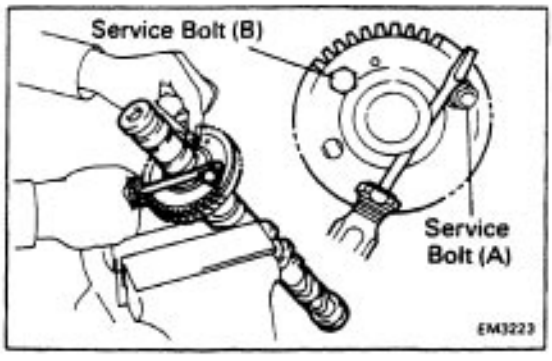
(a) Mount the hexagonal wrench head portion of the camshaft in a vise.

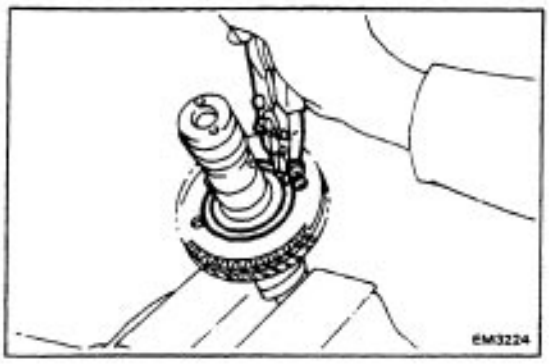


(b) Insert service bolt (A) into the service hole of the camshaft sub–gear.

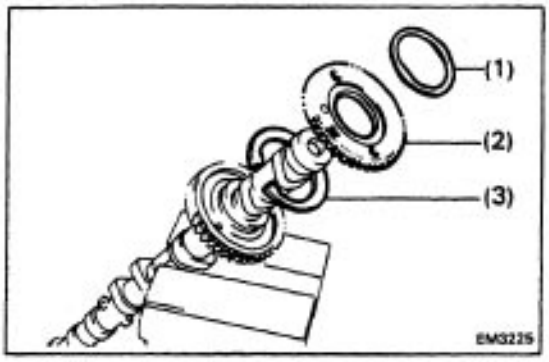
(c) Using a screwdriver, turn the sub–gear clockwise, and remove the service bolt (B).

NOTICE: Be careful not to damage the camshaft.





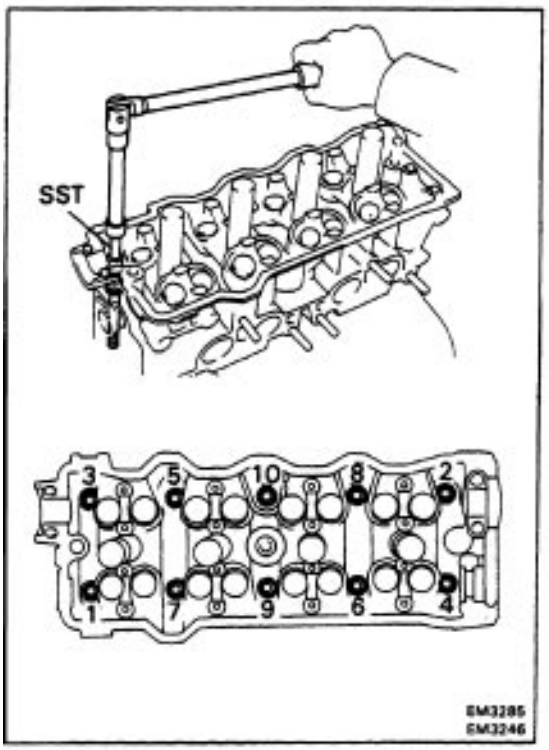
(d) Using snap ring pliers, remove the snap ring.



(e) Remove the following parts:
(1) Wave washer
(2) Camshaft sub–gear
(3) Camshaft gear spring

32. IF NECESSARY, REMOVE SPARK PLUG TUBES

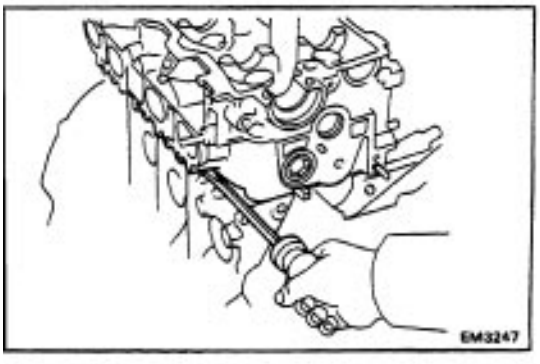
Using a pipe wrench, remove the four spark tubes.



33. REMOVE CYLINDER HEAD

(a) Using SST, uniformly loosen and remove the ten cylinder head bolts in several passes in the sequence shown.
SST 09043–88010

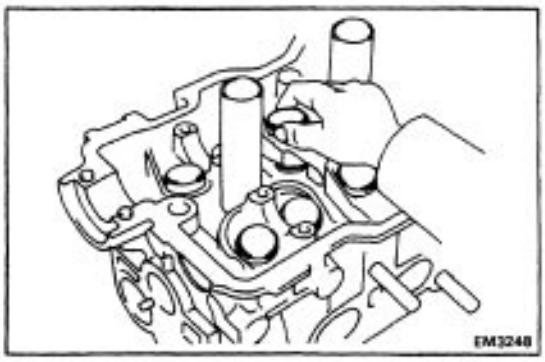
NOTICE: Head warpage or cracking could result from removing bolts in incorrect order.



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

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

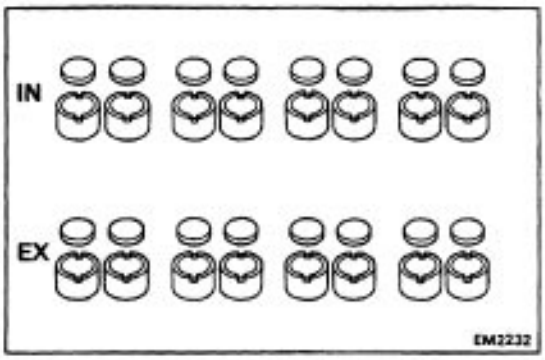
NOTICE: Be careful not to damage the cylinder head and cylinder block surfaces of cylinder head gasket side.



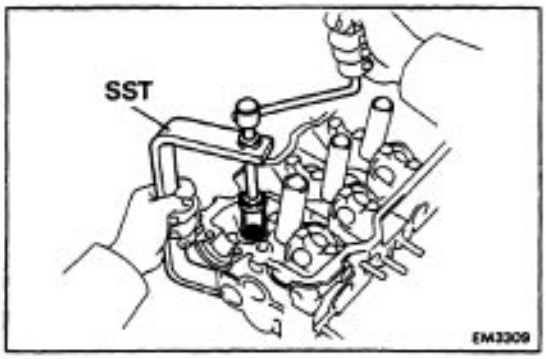
DISASSEMBLY OF CYLINDER HEAD

(See page EM–47)

1. REMOVE VALVE LIFTERS AND SHIMS



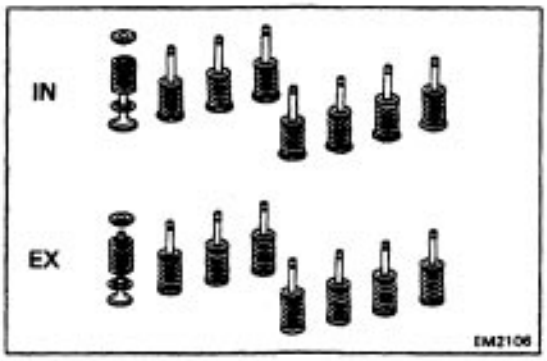
HINT: Arrange the valve lifters and shims in correct order.



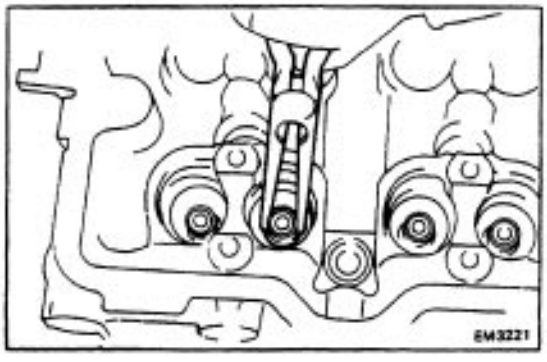
2. REMOVE VALVES

(a) Using SST, compress the valve spring and remove the two keepers.
SST 09202–70010

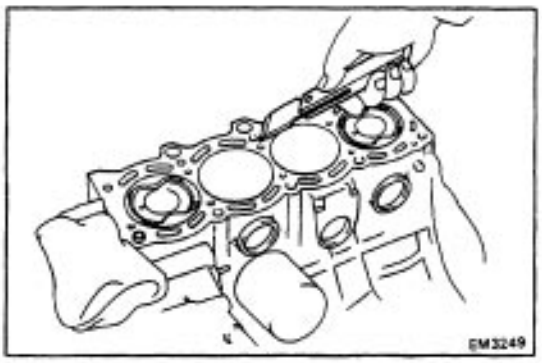
(b) Remove the spring retainer, valve spring, valve and spring seat.



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



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

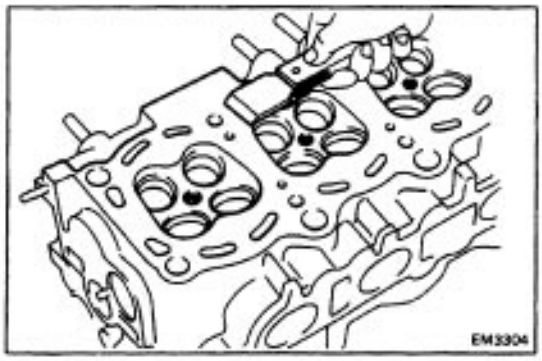


INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS

1. CLEAN TOP OF PISTONS AND TOP OF BLOCK

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

CAUTION: Protect your eyes when using high pressure air.



2. REMOVE GASKET MATERIAL

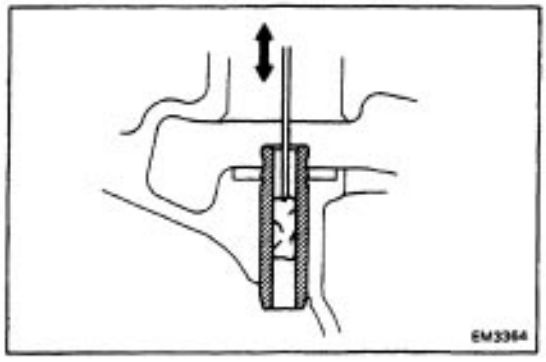
Using a gasket scraper, remove all the gasket material from the manifold and cylinder head surface.

NOTICE: Be careful not to scratch the surfaces.

3. CLEAN COMBUSTION CHAMBERS

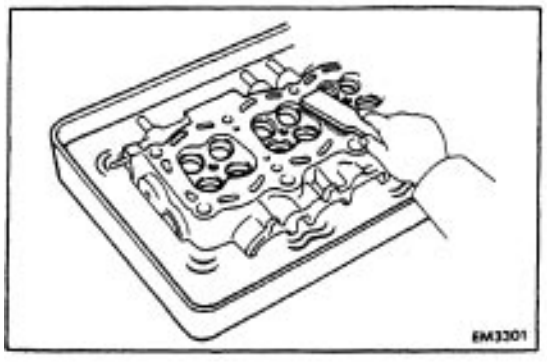
Using a soft brush, remove all the carbon from the combustion chambers.

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



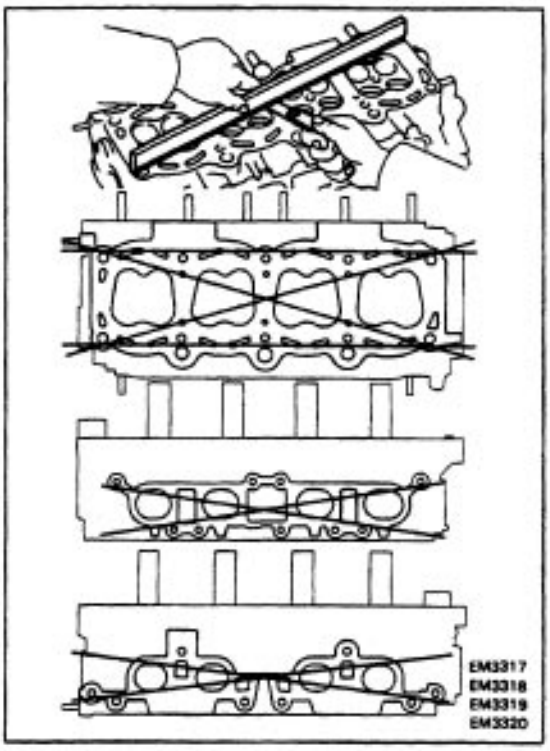
4. CLEAN VALVE GUIDE BUSHINGS

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



5. CLEAN CYLINDER HEAD

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



6. INSPECT CYLINDER HEAD FOR FLATNESS

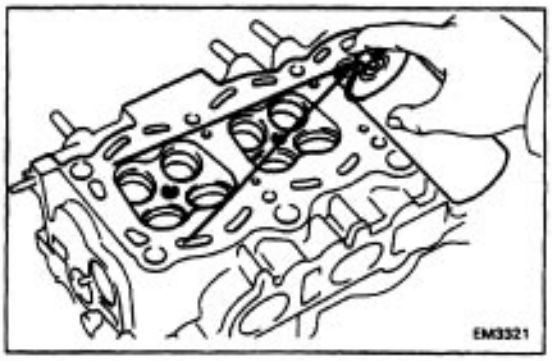
Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder block manifolds for warpage.

Maximum warpage:

Cylinder block side 0.05 mm (0.0020 in.)

Manifold side 0.08 mm (0.0031 in.)

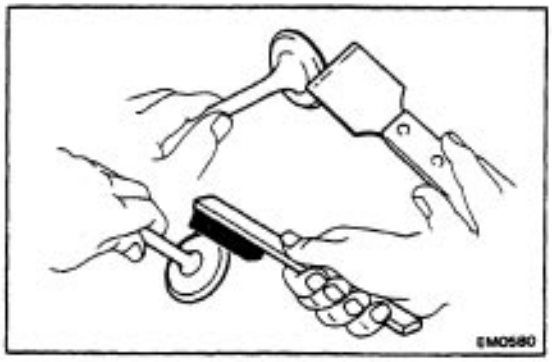
If warpage is greater than maximum, replace the cylinder head.



7. INSPECT CYLINDER HEAD FOR CRACKS

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

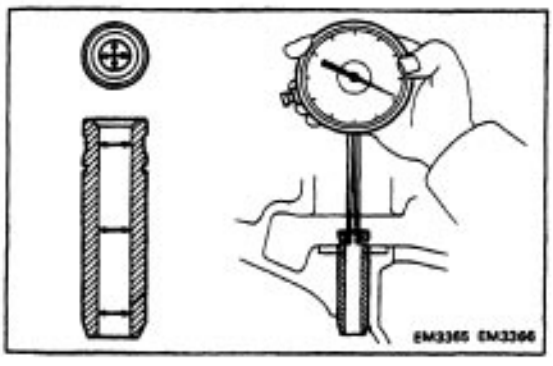
If cracked, replace the cylinder head.



8. CLEAN VALVES

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

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

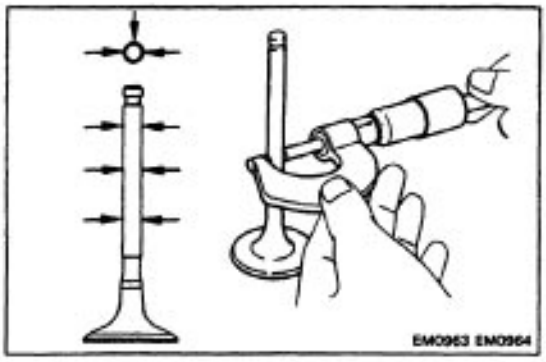


9. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:

6.010 – 6.030 mm (0.2366 – 4.2374 in.)



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

Valve stem diameter:

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

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

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

Standard oil clearance:

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

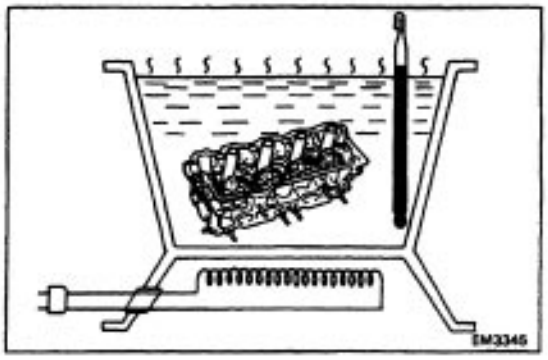
Exhaust 0.030 – 0.065 mm
(0.0012 – 0.0026 in.)

Maximum oil clearance:

Intake 0.08 mm (0.0031 in.)

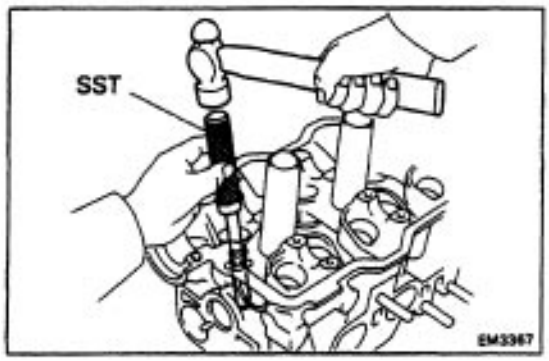
Exhaust 0.10 mm (0.0039 in.)

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

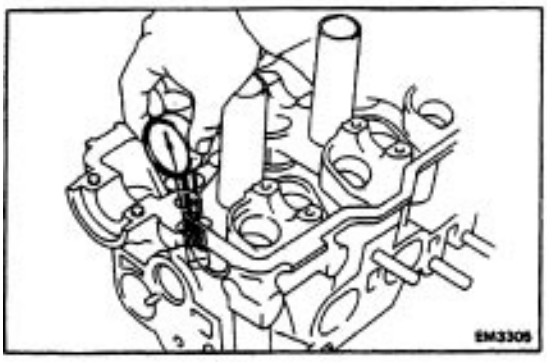


10. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

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



(b) Using SST and a hammer, tap out the guide bushing.
SST 09201 –700 10



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

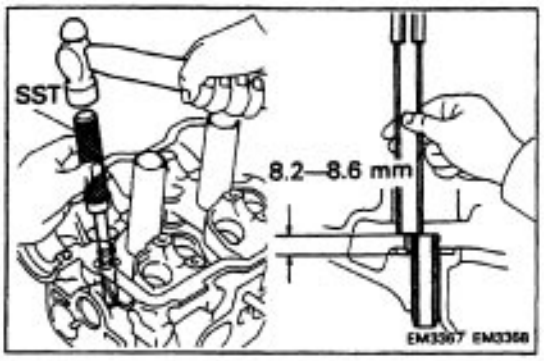
Both intake and exhaust

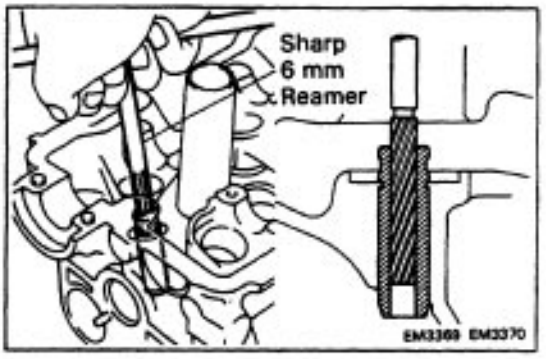
Bushing bore diameter mm (in.)	Bushing size
11.000 — 11.027 (0.4331 — 0.4342)	Use STD
11.050 — 11.077 (0.4350 — 0.4361)	Use O/S 0.05

(d) Select a new guide bushing (STD size or 0/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 11.027 mm (0.4341 in.), machine the bushing bore to the following dimension:
Rebored cylinder head bushing bore dimension:
11. 050 – 11.077 mm (0.4350 – 0.4361 in.)
If the bushing bore diameter of the cylinder head is greater than 11.077 mm (0.4361 in.), replace the cylinder head.

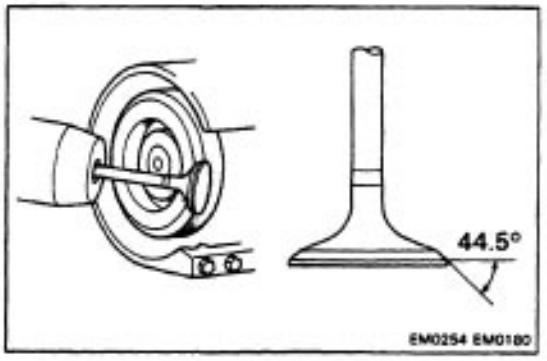
(e) Gradually heat the cylinder head to 80 100˚C (176 – 212˚F).

(f) Using SST and a hammer, tap in a newguide bushing to where there is 8.2 – 8.6 mm (0.303 0.339 in.) protruding from the cylinder head.
SST 09201–70010





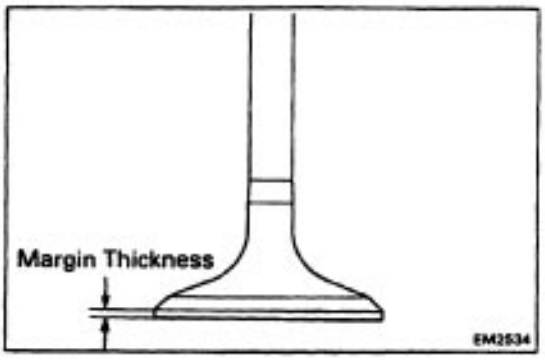
Using a sharp 8 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page EM–58) between the guide bushing and valve stem.



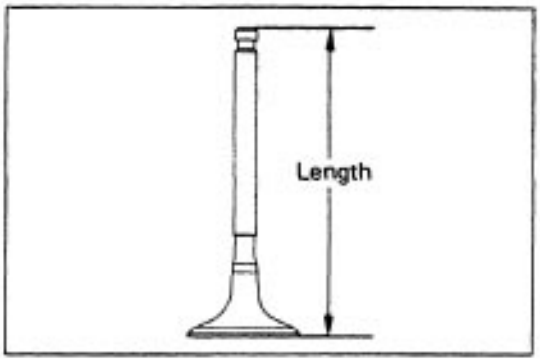
11. INSPECT AND GRIND VALVES

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

(b) Check that the valve is ground to the correct valve face angle.
Valve face angle: 44.5˚



(c) Check the valve head margin thickness.
Standard margin thickness: 0.8 –1.2 mm
(0.031 0.047 in.)
Minimum margin thickness: 0.5 mm (0.020 in.)
If the margin thickness is less than minimum, replace the valve.



(d) Check the valve overall length.

Standard overall length:

Intake 100.60 mm (3.9606 in.)

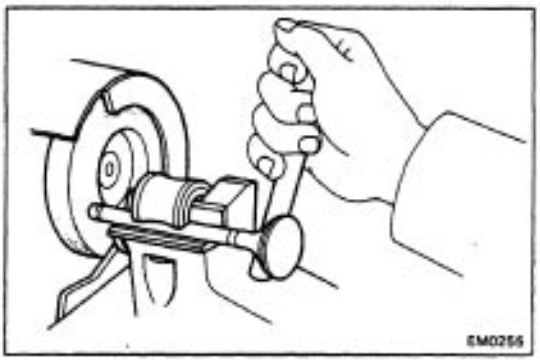
Exhaust 100.45 mm (3.9547 in.)

Minimum overall length:

Intake 100.1 mm (3.941 in.)

Exhaust 100.0 mm (3.937 in.)

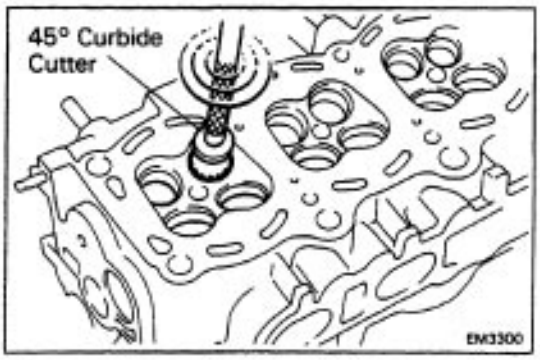
If the overall length is less than minimum, replace the valve.



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

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

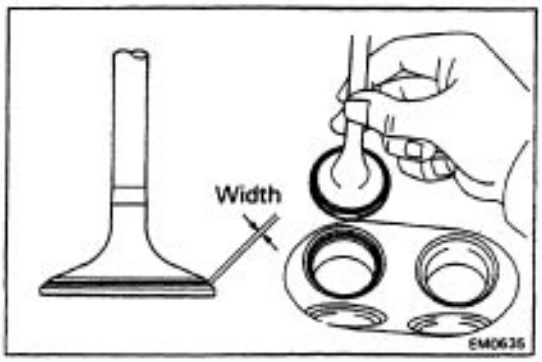
NOTICE: Do not grind off more than the minimum.



12. INSPECT AND CLEAN VALVE SEATS

(a) Using a 45˚ carbide cutter, resurface the valve seats.

Remove only enough metal to clean the seats.



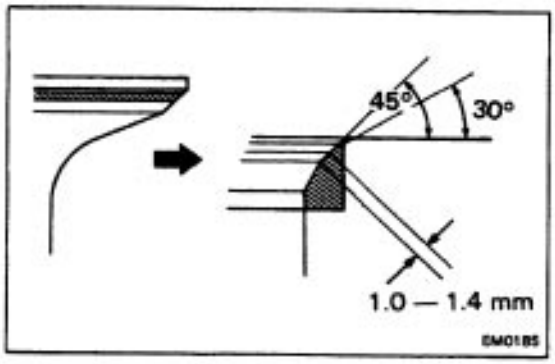
(b) Check the valve seating position.

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

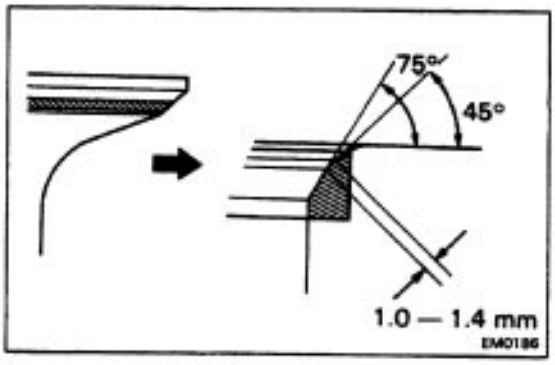
(c) Check the valve face and seat for the following:

- If blue appears 360˚ around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360˚ around the valve seat, the guide and 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.)

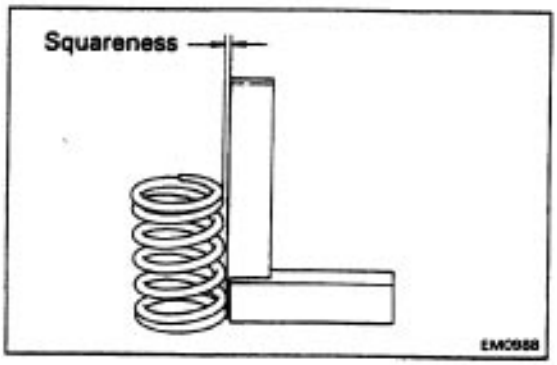


If not, correct the valve seats as follows:
(1) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.

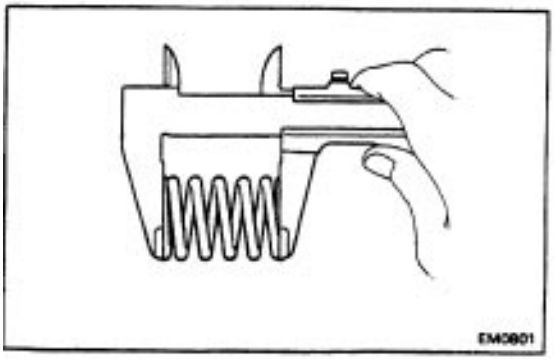


(2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.

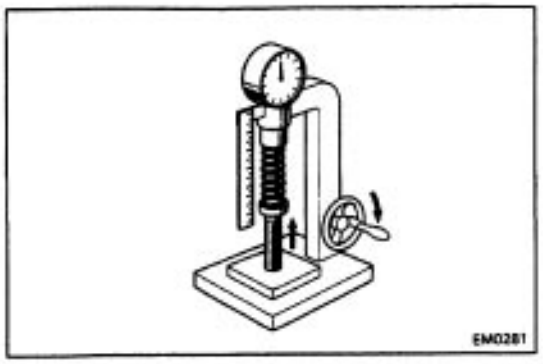
(d) Hand–lap the valve and valve seat with an abrasive compound.
(e) After hand–lapping, clean the valve and valve seat.



13. INSPECT VALVE SPRINGS
(a) Using a steel square, measure the squareness of the valve spring.
Maximum squareness: 2.0 mm (0.075 in.)
If squareness is greater than maximum, replace the valve spring.



(b) Using calipers, measure the free length of the valve spring.
Free length: 45.0 mm (1.772 in.)
If the free length is not as specified, replace the valve spring.



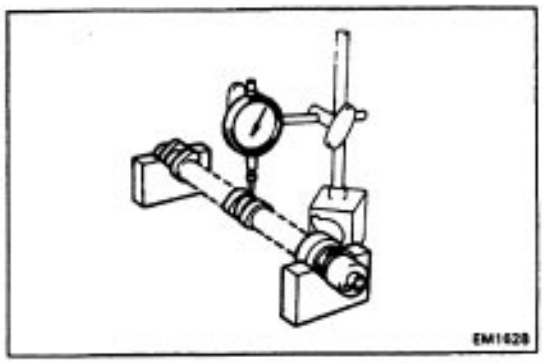
(c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

16.7 19.3 kg (36.8 42.5 lb, 164 189 N)

at 34.7 mm (0.000 in.)

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



14. INSPECT CAMSHAFTS AND BEARINGS

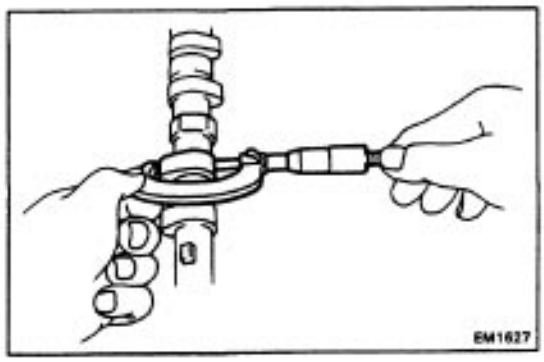
A. Inspect camshaft for runout

(a) Place the camshaft on V–blocks.

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

Maximum circle runout: 0.04 mm (0.0016 in.)

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



B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

Intake 34.910 – 35 .010 mm

(1.3744 – 1.3783 in.)

Exhaust 35.560 – 35.660 mm

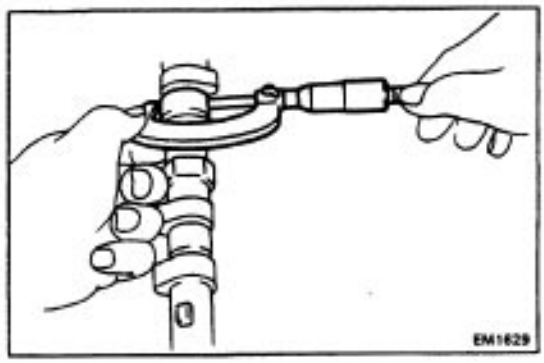
(1.4000 – 1.4039 in.)

Minimum cam lobe height:

Intake 34.80 mm (1.3701 in.)

Exhaust 35.45 mm (1 .3957 in.)

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



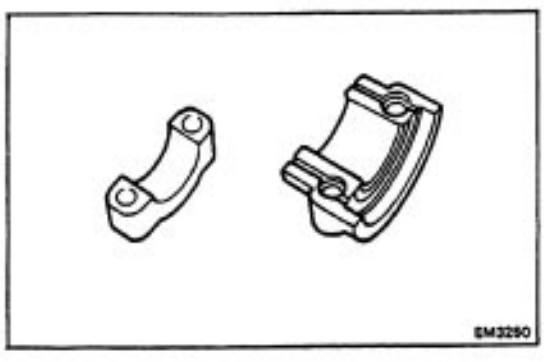
C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

Journal diameter: 26.959 – 26.975 mm

0.0614 – 1.0620 in.)

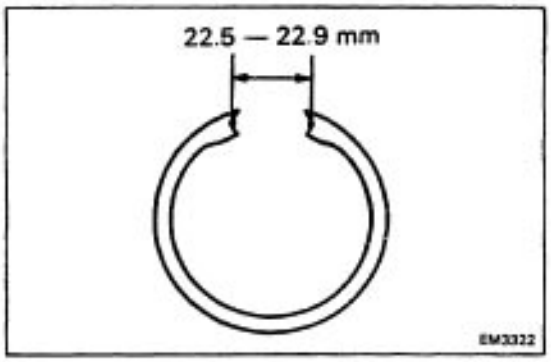
If the journal diameter is not as specified, check the oil clearance.



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.

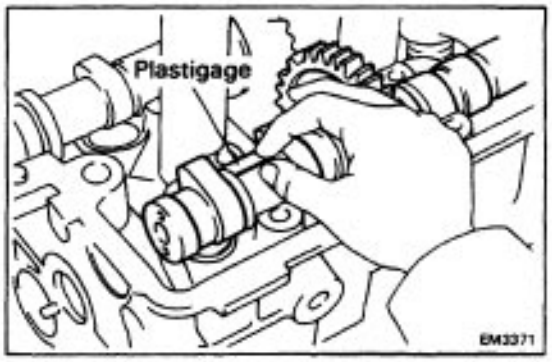


E. Inspect camshaft gear spring

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

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

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



F. Inspect camshaft journal oil clearance

(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–68 and 69)

Torque: 190 kg–cm (14 ft–lb, 19 N–m)

HINT: Do not turn the camshaft.

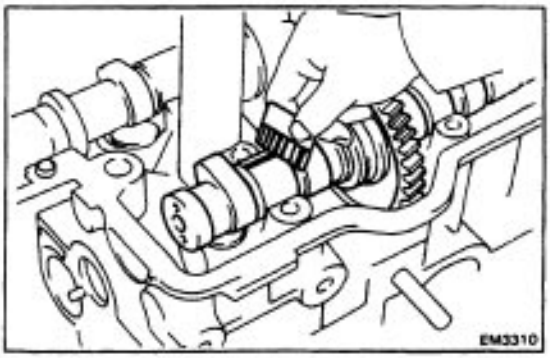
(e) Remove the bearing caps.

(f) Measure the Plastigage at its widest point.

Standard oil clearance: 0.025 – 0.062 (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–67 and 69)

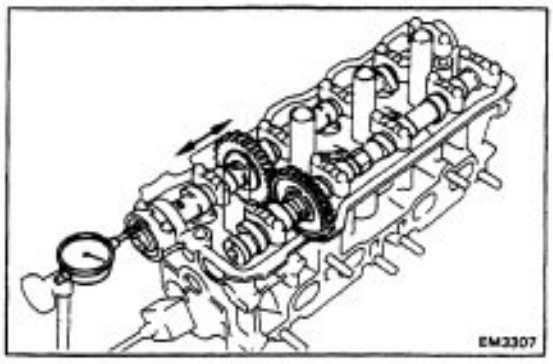
(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance:

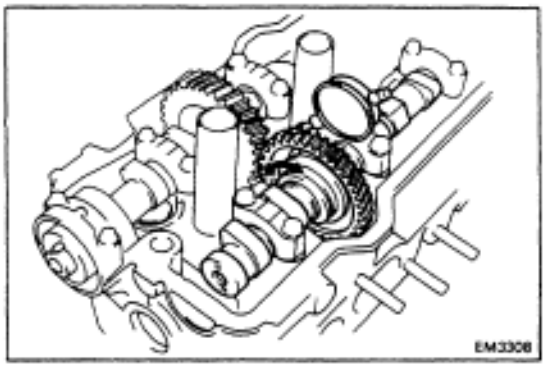
Intake	**0.045 – 0.100 mm (0.0018 – 0.0039 in.)**
Exhaust	**0.030 – 0.085 mm (0.0012 – 0.0033 in.)**

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

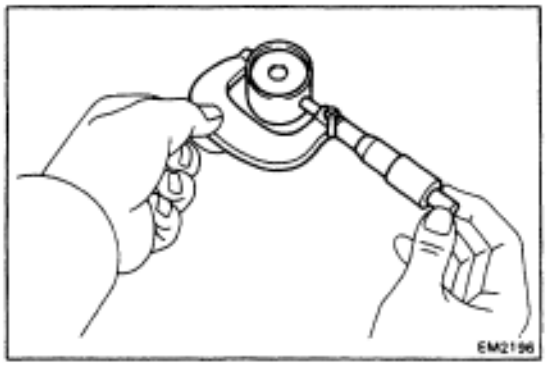
(a) Install the camshafts without installing the exhaust cam sub–gear.
(See step 4 o n page EM–68 to 70)

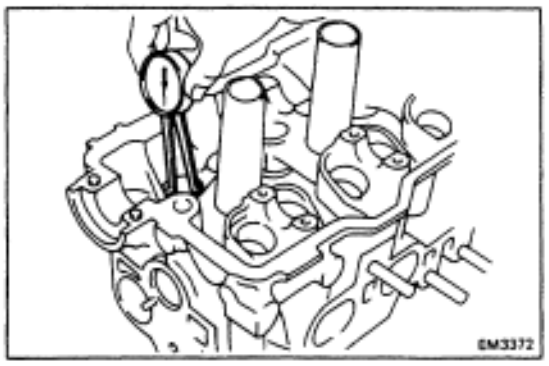
(b) Using a dial indicator, measure the backlash.
Standard backlash: 0.020 – 0.200 mm (0.0008 – 0.0079 in.)
Maximum backlash 0.30 mm (0.0188 in.)

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

15. INSPECT VALVE LIFTERS AND LIFTER BORES

(a) Using a micrometer, measure the lifter diameter.
Lifter diameter: 27.975 – 27.985 mm (1.1014 – 1.1018 in.)

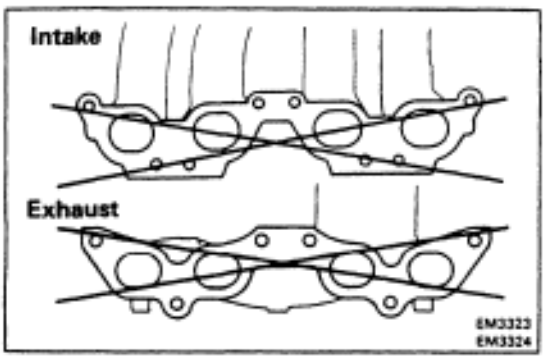




(b) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.
Lifter bore diameter: 28.000 – 28.021 mm (1.1024 – 1.1032 in.)

(c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.
Standard oil clearance: 0.015 – 0.046 mm (0.0005 – 0.0018 in.)
Maximum oil clearance: 0.07 mm (0.0028 in.)

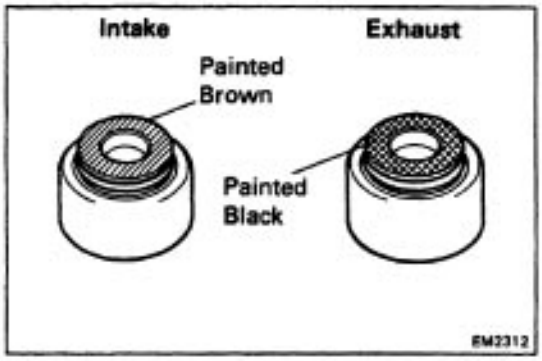
If the oil clearance is greater than maximum, replace the lifter. If necessary, replace the cylinder head.



16. INSPECT INTAKE AND EXHAUST MANIFOLDS

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.
Maximum warpage: 0.30 mm (0.0118 in.)

If warpage is greater than maximum, replace the manifold.



ASSEMBLY OF CYLINDER HEAD

(See page EM–48)

HINT:

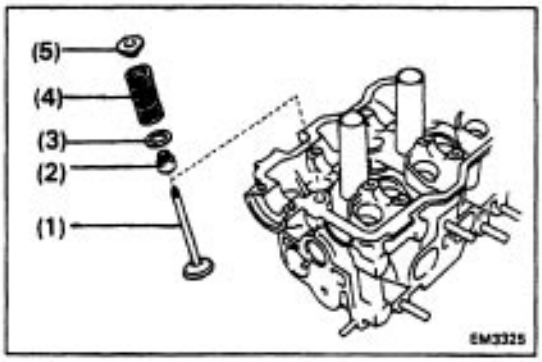
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.

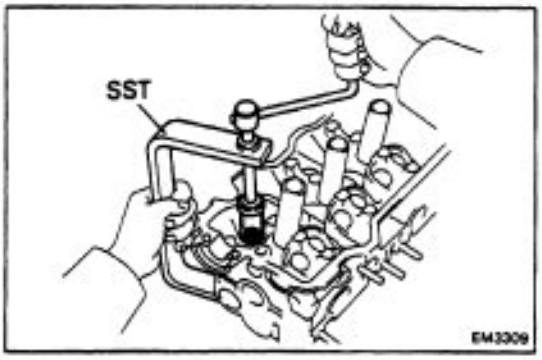
1. INSTALL VALVES

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

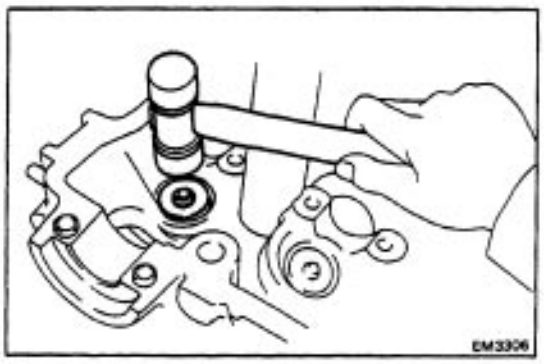
(a) Install the following parts:

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

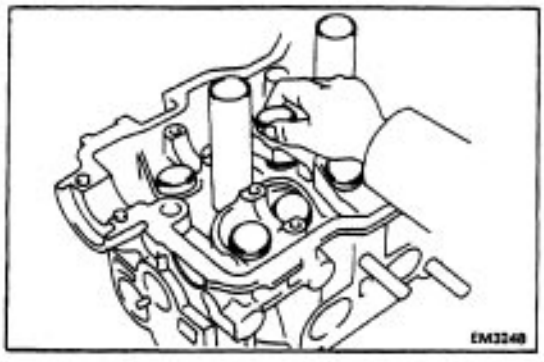




(b) Using SST, compress the valve spring and place the two keepers around the valve stem.
SST 09202–70010

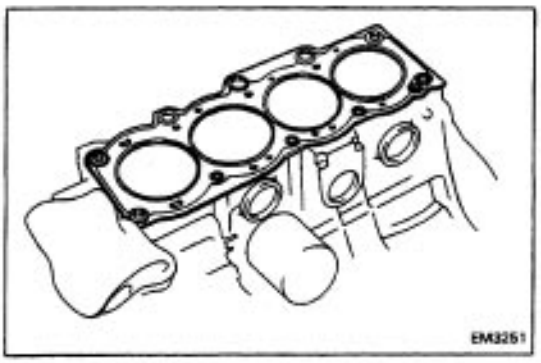


(c) Using a plastic–faced hammer, lightly tap the valve stem tip to assure proper fit.



2. INSTALL VALVE LIFTERS AND SHIMS

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



INSTALLATION OF CYLINDER HEAD

(See page EM–48)

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.

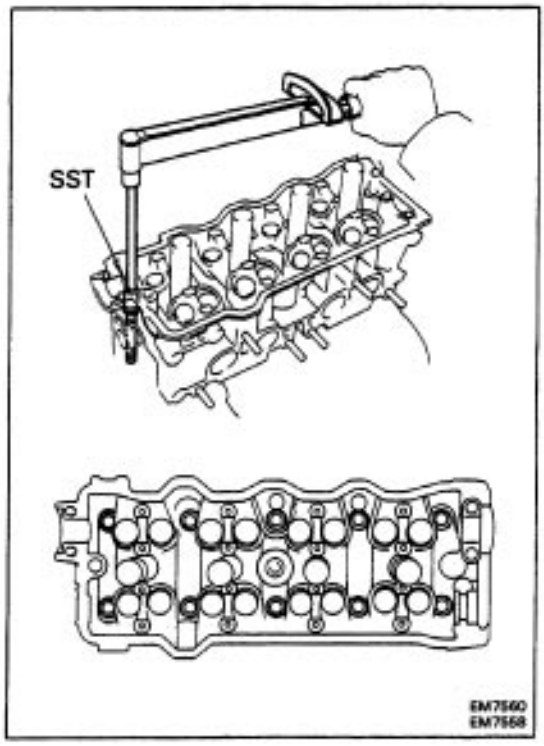
(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

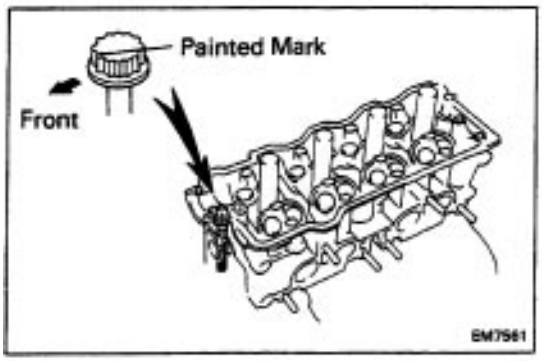
(b) First, using SST, install and uniformly tighten the ten cylinder head bolts in several passes in the sequence shown.

SST 09011–38121

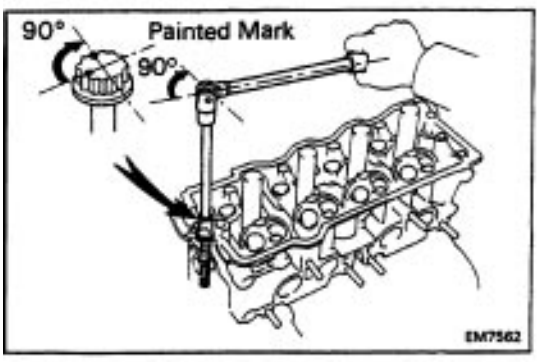
Torque: 500 kg–cm (36 ft–lb, 49 N–m)

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



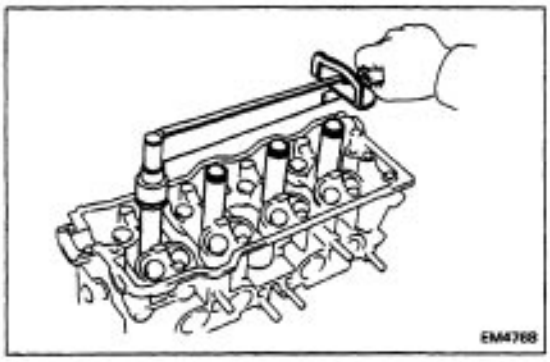


(c) Mark the front of the cylinder head bolt head with paint. .



(d) 2nd, retighten the cylinder head bolts 90˚ in the numerical order shown.

(e) Check that the painted mark is now at a 90˚ angle to front.



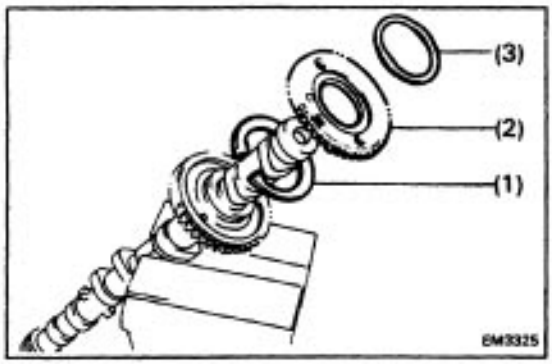
2. INSTALL SPARK PLUG TUBES

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

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

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

Torque: 400 kg–cm (29 ft–lb, 39 N–m)

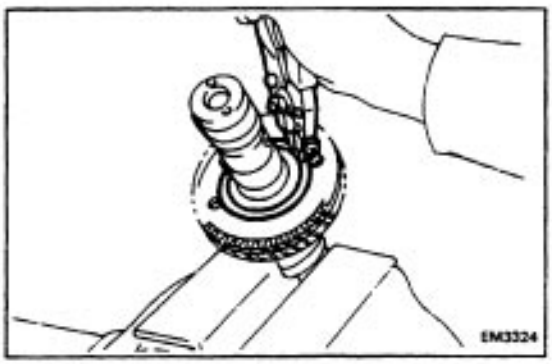


3. ASSEMBLE EXHAUST CAMSHAFT

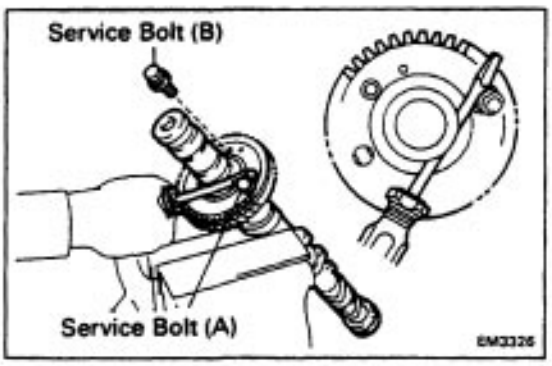
(a) Mount the hexagonal wrench head portion of the camshaft in a vice.

(b) Install the following parts:

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



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



(d) Insert a service bolt (A) into the service hole of the camshaft sub–gear.

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

NOTICE: Be careful not damage the camshaft.

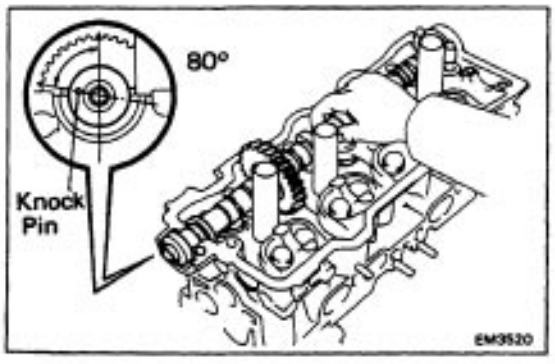
4. INSTALL CAMSHAFTS

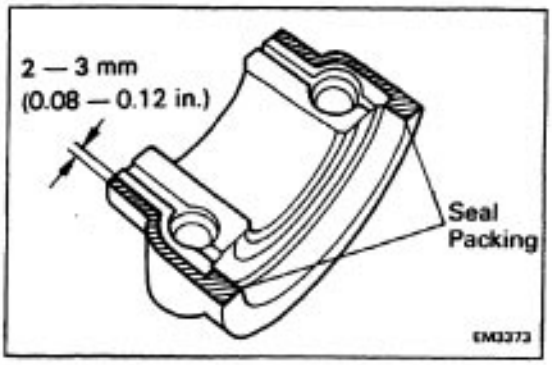
HINT: Since the thrust clearance of the camshaft is small, the camshaft must be held level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following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

A. Install intake camshaft

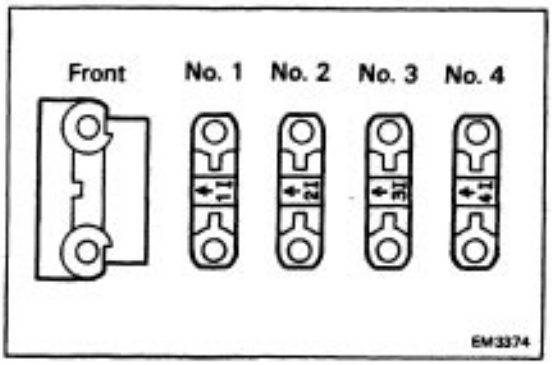
(a) Apply MP grease to the thrust portion of the camshaft.

(b) Place the intake camshaft at 80˚ BTDC of camshaft angle on the cylinder head.

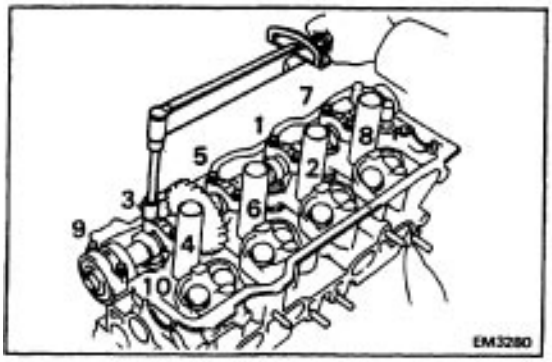




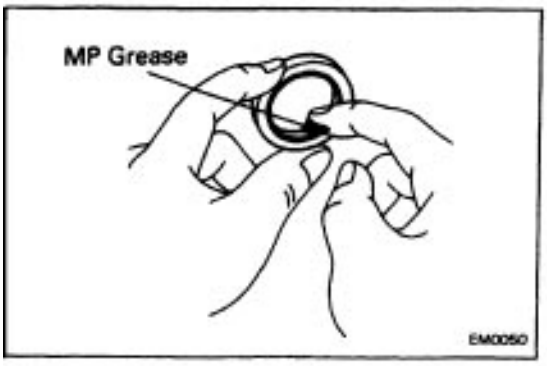
(c) Apply seal packing to the front bearing cap as shown.
Seal packing: Part No. 08826–00080 or equivalent



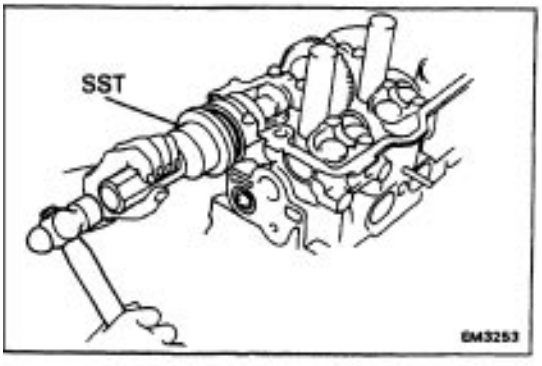
(d) Install the bearing caps in their proper locations.



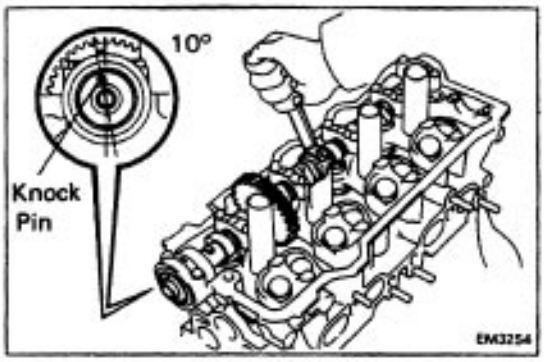
(e) Apply alight coat of engine oil on the threads and under the heads of the bearing cap bolts.
(f) Install and uniformly tighten the ten bearing cap bolts in several passes in the sequence shown.
Torque: 190 kg–cm (14 ft–lb, 19 N–m)



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

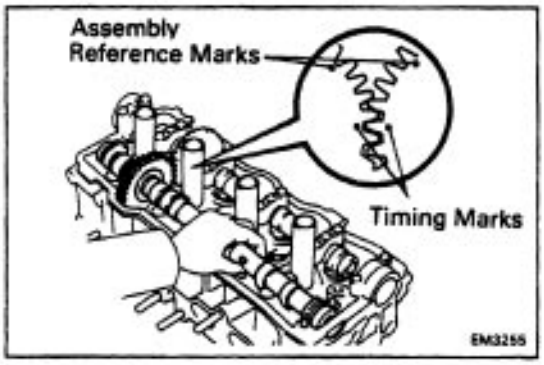


(h) Using SST, tap in the oil seal.
SST 09223–46011



B. Install exhaust camshaft

(a) Set the knock pin of the intake camshaft at 100 BTDC of camshaft angle.

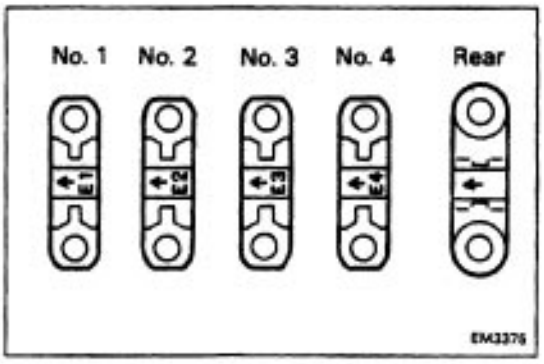


(b) Apply MP grease to the thrust portion of the camshaft.

(c) Engage the exhaust camshaft gear 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.

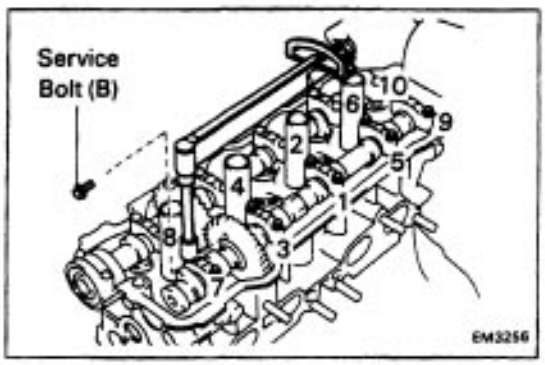
NOTICE: There are also assembly reference marks on each gear as shown in the illustration. Do not use these marks.



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

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

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

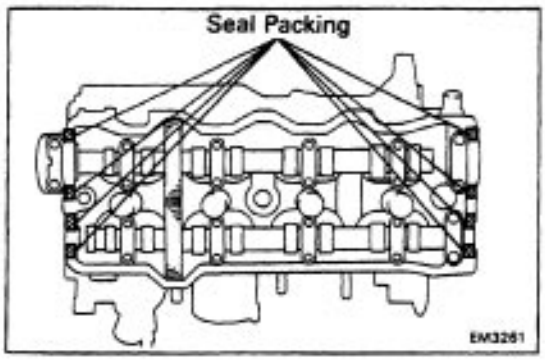


(g) Apply alight coat of engine oil on the threads and under the heads of bearing cap bolts.

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

Torque: 190 kg–cm (14 ft–lb, 19 N–m)

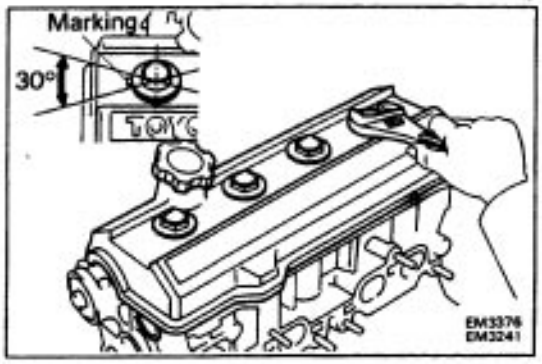
(i) Remove the service bolt (8).



5. INSTALL CYLINDER HEAD COVER

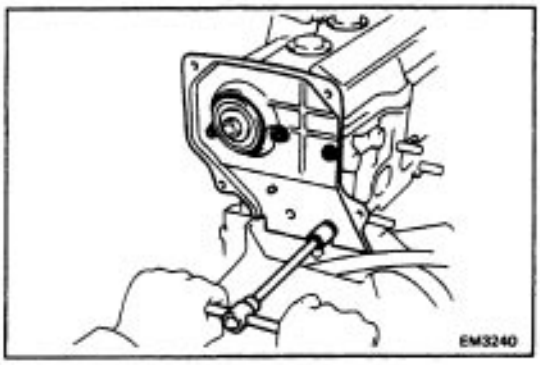
(a) Apply seal packing to the cylinder head as shown in the figure.

Seal packing: Part No.08826–00080 or equivalent



(b) Install the gasket to the head cover.
(c) Install the head cover with the four grommets and nuts.
Torque: 230 kg–cm (17 ft–lb, 23 N–m)

HINT: Install the grommets so that it's markings are as shown in the illustration. Then install the grommet to its original position.



6. INSTALL N0.3 TIMING BELT COVER

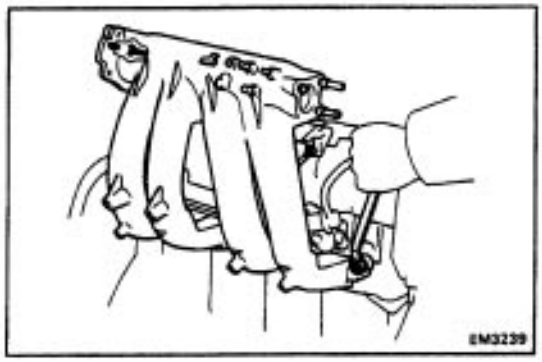
Install the timing belt cover with the four bolts.

7. INSTALL NO.1 IDLER PULLEY AND TENSION SPRING
(See step 4 on page EM–29)

8. INSTALL CAMSHAFT TIMING PULLEY
(See steps 9 to 13 on pages EM–30 to 32)

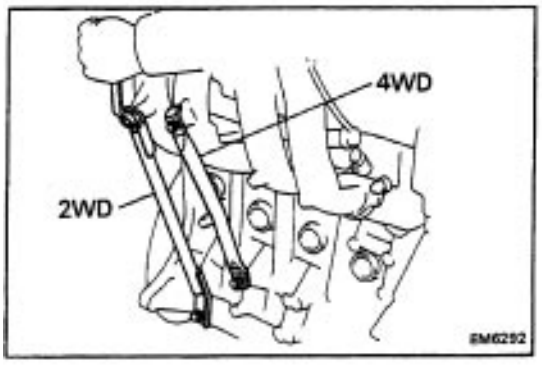
9. INSTALL SPARK PLUGS (See page IG–7)
Torque: 180 kg–cm (13 ft–lb, 18 N–m)

10. INSTALL INJECTOR AND DELIVERY PIPE
(See steps 1 and 5 on pages FI–91 to 92)



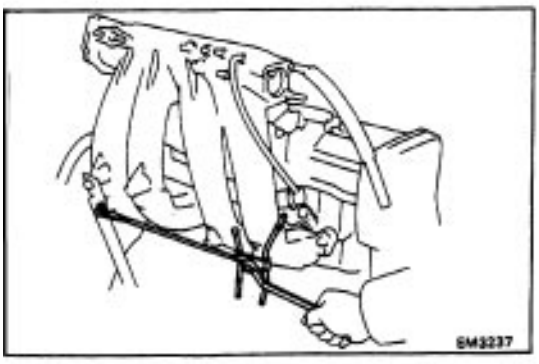
11. INSTALL INTAKE MANIFOLD

(a) Install a new gasket and the intake manifold with the six bolts and two nuts.
Torque: 195 kg–cm (14 ft–lb, 19 N–m)



(b) Install the two manifold stay with the four bolts.
Torque:
12 mm bolt head 195 kg–cm (14 ft–I b, 19 N–m)
14 mm bolt head 425 kg–cm (31 ft–lb, 42 N–m)

(c) Connect the vacuum sensing hose.

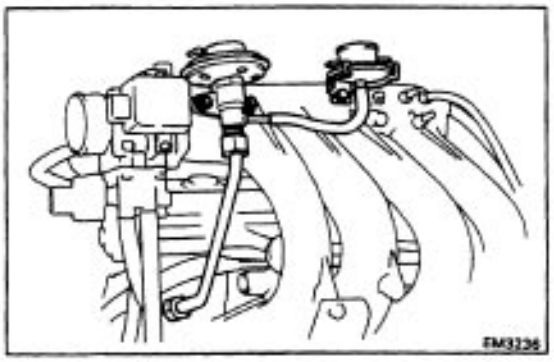


12. INSTALL AIR TUBE

(a) Install the air tube with the two bolts.
lbf Connect the following air hoses:
(1) Air intake chamber air hose
(2) Throttle body air hose
(3) (w/ PS)
PS pump air hose

13. INSTALL COLD START INJECTOR PIPE
(See steps 2 and 3 on page FI–80)

14. INSTALL THROTTLE BODY
(See steps 2 and 4 on page FI–109)



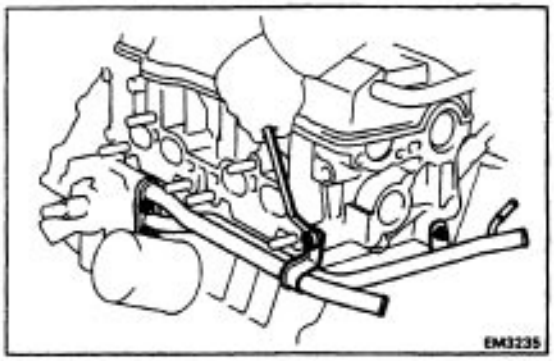
15. INSTALL EGR VALVE AND MODULATOR

(a) Install the EGR modulator with the bolt.

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

Torque:
Union nut 600 kg–cm (43 ft–lb, 59 N–m)
Bolt and nut 130 kg–cm (9 fit–lb, 13 N–m)

(c) Install the vacuum hoses.



16. INSTALL WATER BY–PASS PIPE

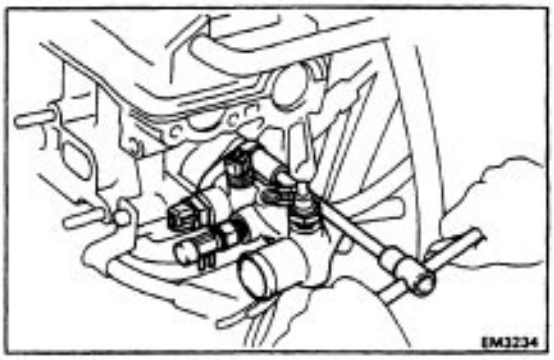
(a) Install a new O–ring to the by–pass pipe.

(b) Apply a light of engine oil on the 0–ring.

(c) Install a new gasket and the by–pass pipe with the two nuts and two bolts.

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

(d) Connect the water hoses.



17. INSTALL WATER OUTLET

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

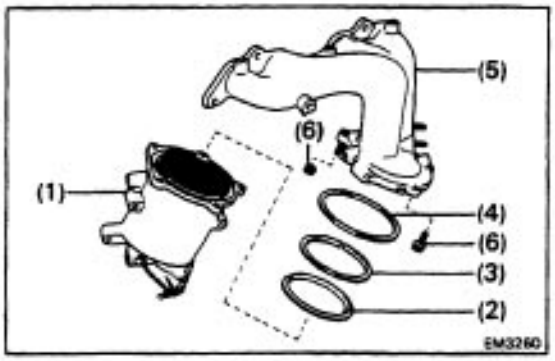
Torque: 150 kg–cm (11 ft–lb, 15 N–m)

(b) Connect the following hoses and connectors:

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

18. INSTALL DISTRIBUTOR

(See steps 1 and 4 on page IG–16)



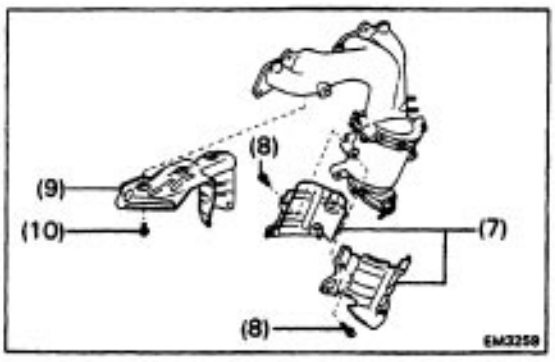
19. ASSEMBLE EXHAUST MANIFOLD AND CATALYTIC CONVERTER

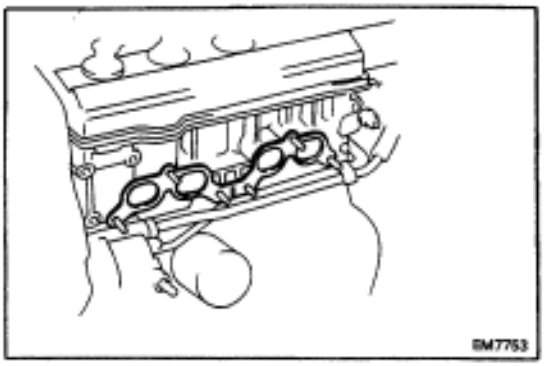
Assemble the following parts:

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

Torque: 300 kg–cm (22 ft–lb, 29 N–m)

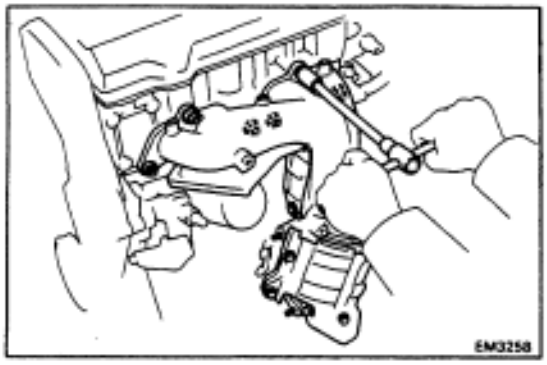
(7) Two catalytic converter heat insulators
(8) Eight bolts
(9) Manifold lower heat insulator
(10) Five bolts



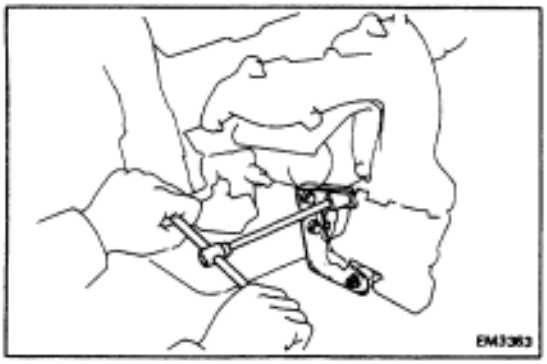


20. INSTALL EXHAUST MANIFOLD AND CATALYTIC CONVERTER ASSEMBLY

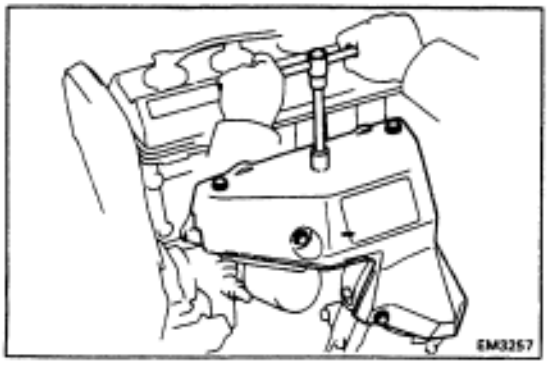
(a) Install a gasket.



(b) Install the exhaust manifold and catalytic converter assembly with new six nuts.
Torque: 500 kg–cm (37 ft–lb, 48 N–m)



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



(d) Install the manifold lower heat insulator with the six bolts.
(e) Connect the oxygen sensor connector(s).

21. CONNECT FRONT EXHAUST PIPE TO CATALYTIC CONVERTER
(See step 12 on page EM–136)
22. INSTALL SUSPENSION LOWER CROSSMEMBER
(See step 17 on page EM–136)
23. INSTALL ENGINE RH UNDER COVER
24. INSTALL RH FRONT WHEEL
25. LOWER VEHICLE

26. INSTALL OIL PRESSURE SWITCH, ENGINE HANGERS AND ALTERNATOR BRACKET

Torque the bolts.

Torque: 500 kg–cm (37 ft–lb, 48 N–m)

27. INSTALL ALTERNATOR (See page CH–14)

28. INSTALL AIR CLEANER HOSE

29. INSTALL CRUISE CONTROL ACTUATOR (See step 26 on page EM–137)

30. INSTALL RADIATOR RESERVOIR TANK

31. INSTALL ACCELERATOR CABLE, AND ADJUST IT

32. (A/T)

CONNECT THROTTLE CABLE, AND ADJUST IT

33. FILL WITH ENGINE COOLANT (See page CO–5)

Capacity (w/ Heater):
M/T 6.4 liters (6.8 US qts, 5.6 Imp. qts)
A/T (2WD) 6.3 liters (6.7 US qts, 5.5 Imp. qts)
A/T (4WD) 6.8 liters (7.2 US qts, 6.0 Imp. qts)

34. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

35. START ENGINE AND CHECK FOR LEAKS

36. PERFORM ENGINE ADJUSTMENT

(a) Adjust the valve clearance. (See page EM–11)

Valve clearance (Cold):
Intake 0.19 – 0.29 mm (0.007 – 0.011 in.)
Exhaust 0.28 – 0.38 mm (0.011 – 0.015 in.)

(b) Adjust the ignition timing.

(See steps 7 to 10 on pages IG–16 and 17)

Ignition timing:
10° BTDC @ idle
(w/ Terminals TE 1 and E 1 connected)

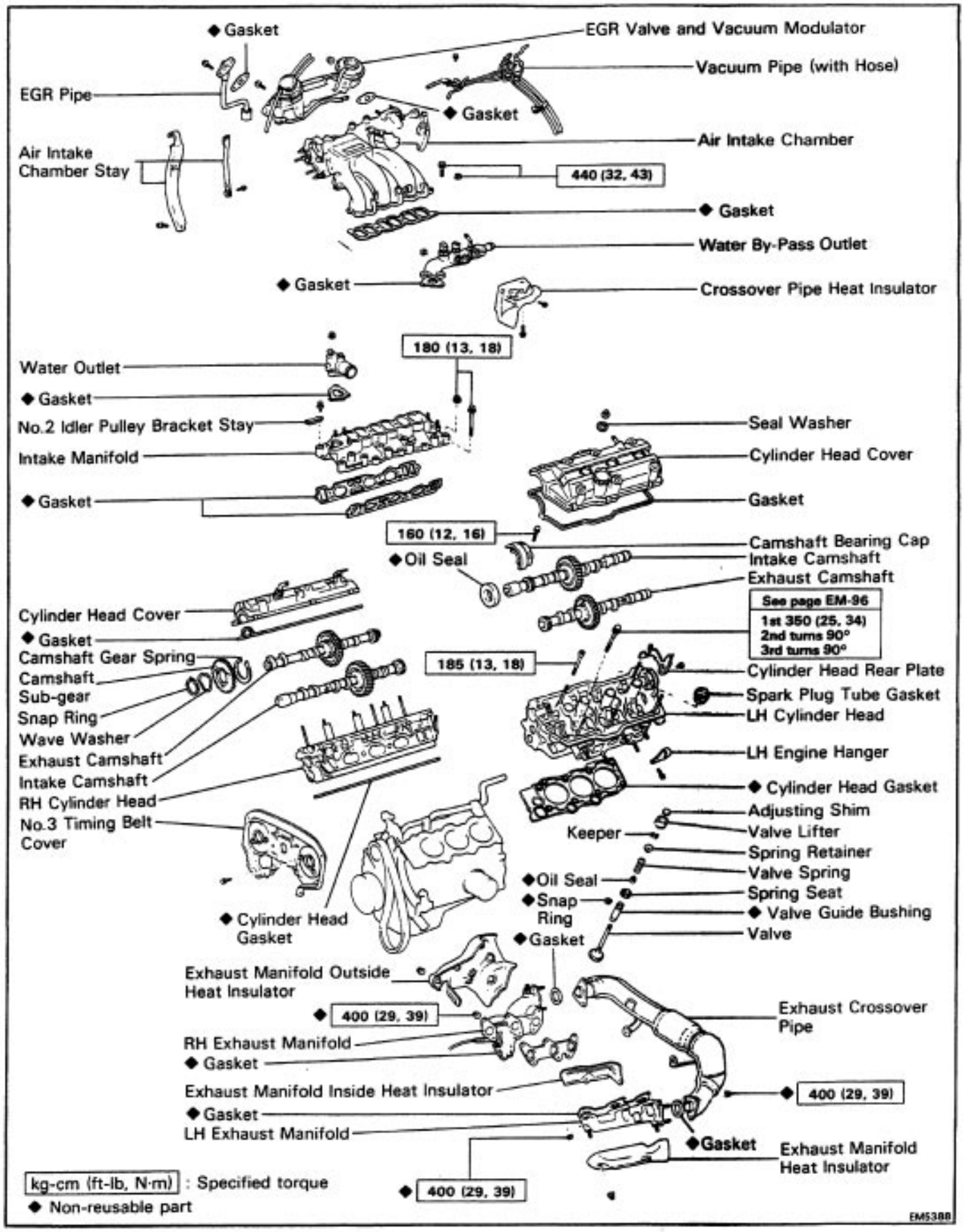
37. CHECK TOE–IN (See page FA–5)

38. PERFORM ROAD TEST

Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

39. RECHECK ENGINE COOLANT LEVEL AND OIL LEVEL

CYLINDER HEADS (2VZ–FE) COMPONENTS



REMOVAL OF CYLINDER HEADS

(See page EM–75)

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

2. DRAIN ENGINE COOLANT (See page CO–5)

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 AND VACUUM PUMP (See step 74 on page EM–140)

6. REMOVE AIR CLEANER HOSE

(a) Disconnect the following hoses:

(1) RSC valve air hose

(2) Vacuum pipe hose

(b) Remove the air cleaner hose.

7. RAISE VEHICLE

NOTICE: Be sure the vehicle is securely supported.

8. REMOVE ENGINE RH UNDER COVER

9. REMOVE SUSPENSION LOWER CROSSMEMBER

(See step 26 on page EM–142)

10. REMOVE FRONT EXHAUST PIPE

(See step 27 on page EM–142)

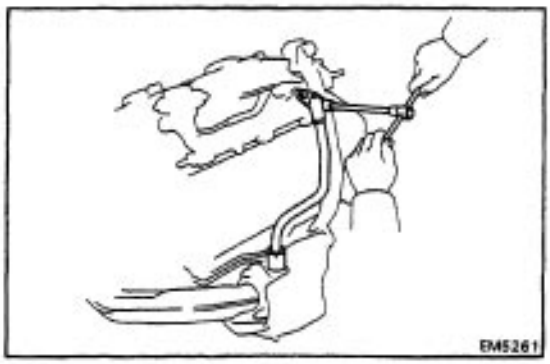
11. REMOVE ALTERNATOR (See page CH–7)

12. REMOVE ISC VALVE

(See steps 2 to 4 on pages FI–118 and 119)

13. REMOVE THROTTLE BODY

(See steps 5 to 6 on page FI–113)



14. REMOVE EGR PIPE

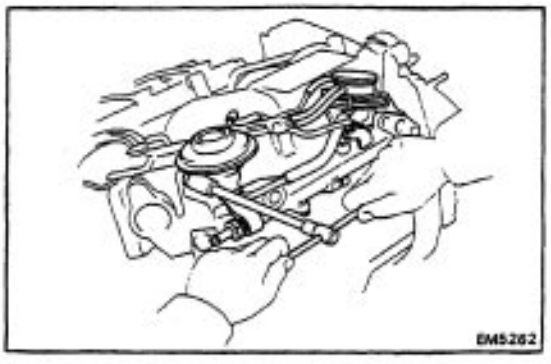
(a) Loosen the union nut.

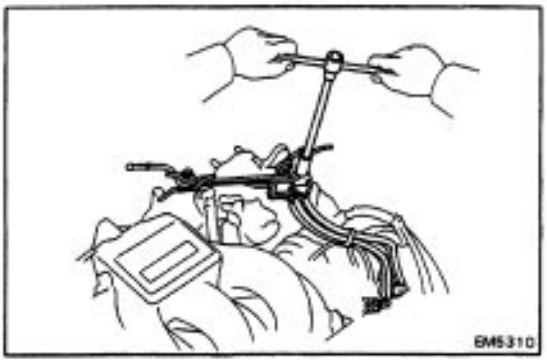
(b) Remove the two bolts, EGR pipe and gasket.

15. REMOVE EGR VALVE– AND VACUUM MODULATOR

(a) Disconnect the four vacuum pipe hoses.

(b) Remove the two bolts, two nuts, the EGR valve, vacuum modulator assembly and gasket.



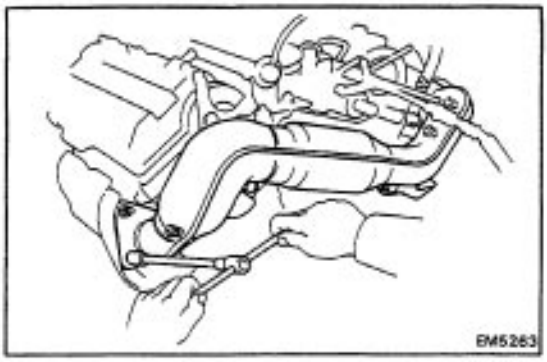


16. REMOVE VACUUM PIPE

(a) Disconnect the following hoses:
  (1) Four– BVSV vacuum hoses
  (2) Fuel pressure control VSV hose
  (3) A/C control valve vacuum hose

(b) Remove the two bolts and vacuum pipe.

17. REMOVE DISTRIBUTOR (See page IG–18)



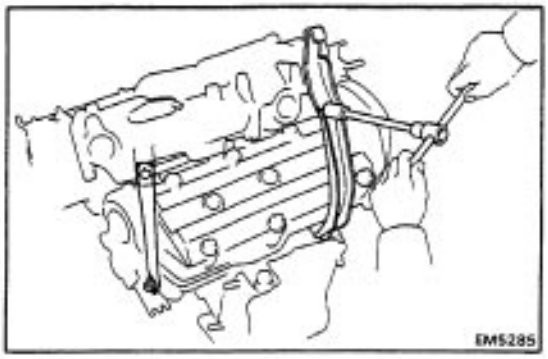
18. REMOVE EXHAUST CROSSOVER PIPE

Remove the six nuts, two bolts, crossover pipe and two gaskets.

19. DISCONNECT COLD START INJECTOR CONNECTOR

20. REMOVE COLD START INJECTOR TUBE

(See step 3 on page FI–81)

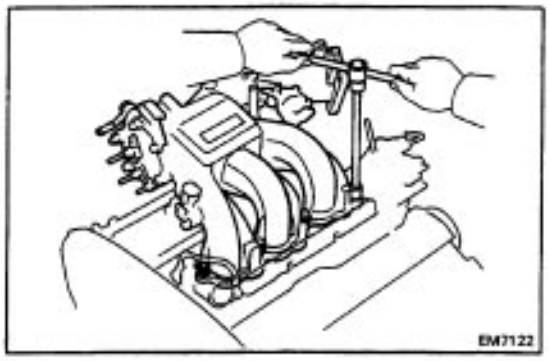


21. REMOVE AIR INTAKE CHAMBER

(a) Disconnect the following hoses:
  (1) PCV hose
  (2) Vacuum sensing hose
  (3) Fuel pressure control VSV
  (4) (Calif. only)
  EGR gas temperature sensor connector
  (5) A/C control valve vacuum hose

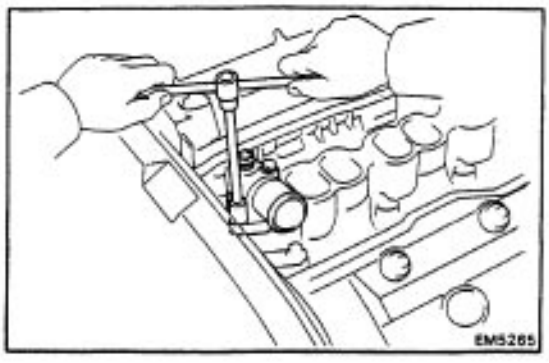
(b) Remove the four bolts and two intake chamber stays.

(c) Remove the two bolts, two nuts, intake chamber and two gaskets.



22. REMOVE DELIVERY PIPES AND INJECTORS

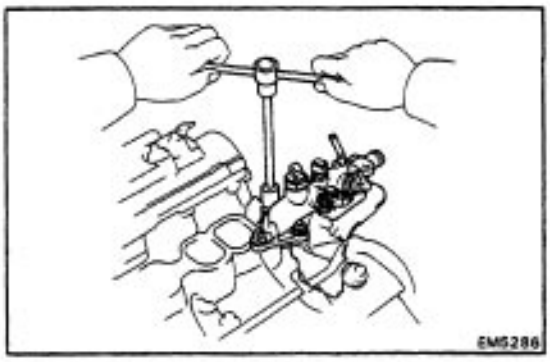
(See steps 15 to 19 on pages FI–95 and 96)



23. REMOVE WATER OUTLET

(a) Disconnect the following connector and hose:
  (1) Water temperature sensor connector
  (2) Radiator upper hose

(b) Remove the three nuts, water outlet and gasket.



24. REMOVE WATER BY–PASS OUTLET

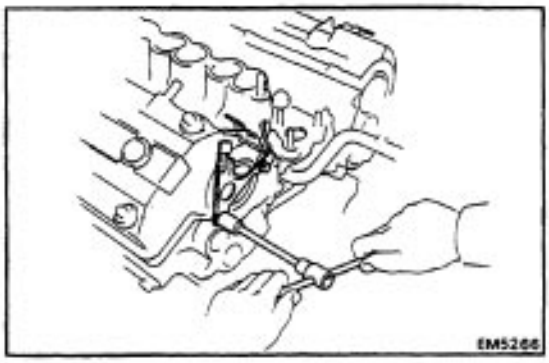
(a) Disconnect the following connectors and hose:
  (1) Cold start injector time switch connector
  (2) Water temperature sensor connector
  (3) Heater water by–pass hose

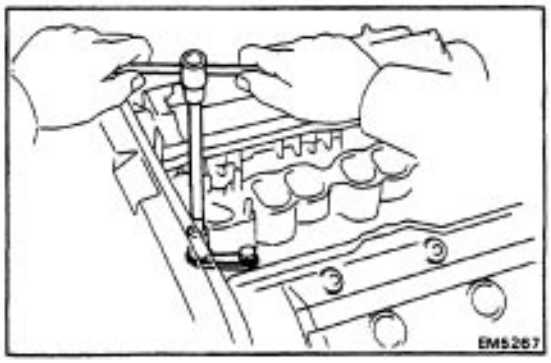
(b) Remove the three nuts, water by–pass outlet and gasket.

(c) Remove the two bolts and crossover pipe heat insulator from the water by–pass outlet.

25. REMOVE CYLINDER HEAD REAR PLATE

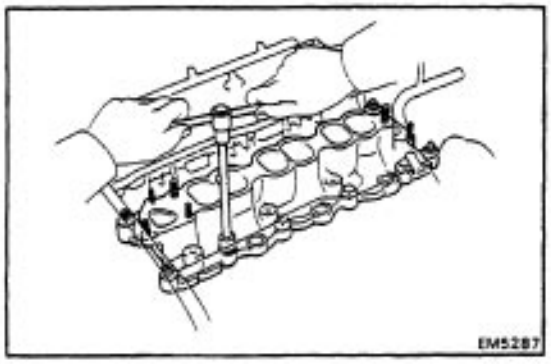
Remove the two bolts and rear plate.



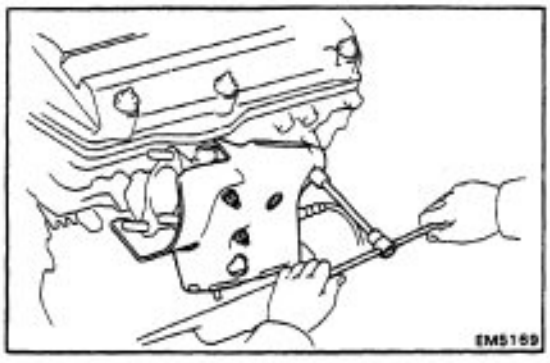


26. REMOVE INTAKE MANIFOLD

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



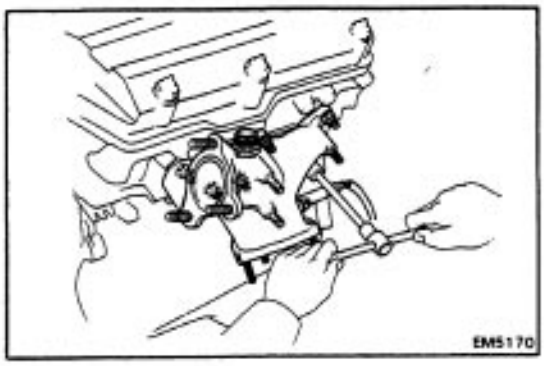
(b) Remove the eight bolts, four nuts, intake manifold and two gaskets.



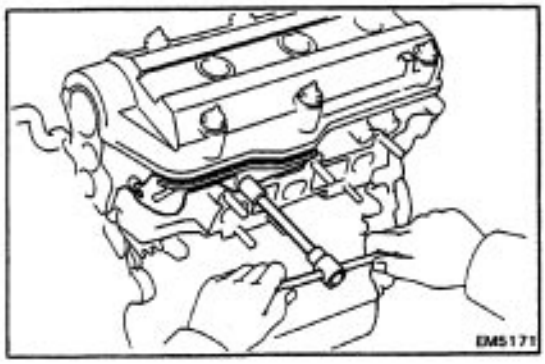
27. REMOVE RH EXHAUST MANIFOLD

(a) Disconnect the oxygen sensor connector.

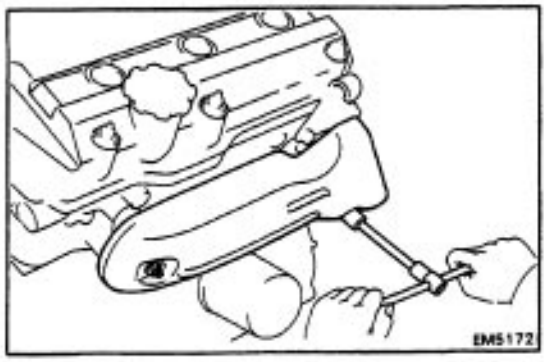
(b) Remove the three. nuts and outside heat insulator.



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

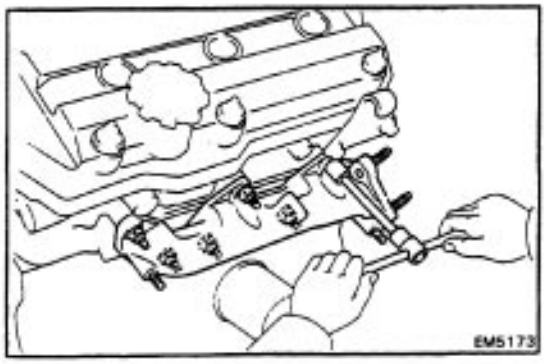


(d) Remove the bolt and inside heat insulator.



28. REMOVE LH EXHAUST MANIFOLD

(a) Remove the two nuts and heat insulator.

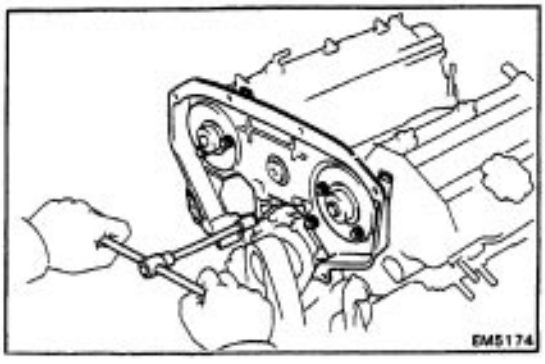


(b) Remove the six nuts, exhaust manifold and gasket.

29. REMOVE SPARK PLUGS (See page IG–11)

30. REMOVE TIMING BELT, CAMSHAFT TIMING PULLEYS AND No.2 IDLER PULLEY

(See steps 3 to 19 on pages EM–34 to 37)

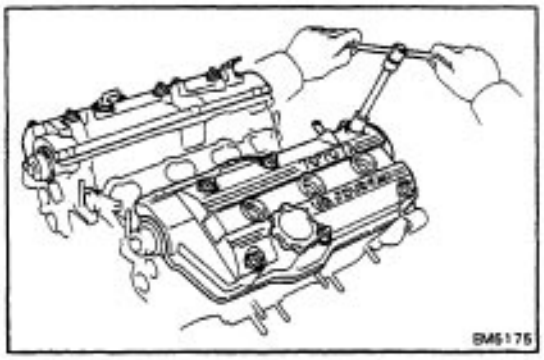


31. REMOVE NO.3 TIMING BELT COVER

Remove the six bolts and timing belt cover.

NOTICE:

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



32. REMOVE CYLINDER HEAD COVERS

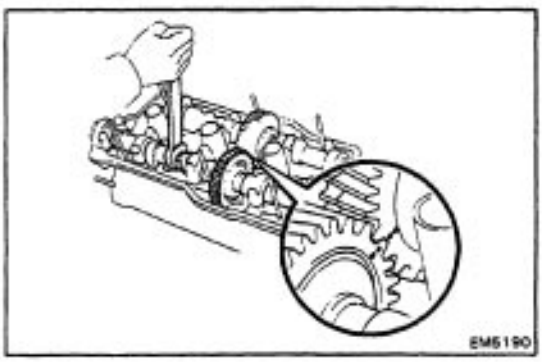
Remove the six nuts, seal washers, cylinder head cover and gasket. Remove the two cylinder head covers.

33. REMOVE SPARK PLUG TUBE GASKETS

Remove the six tube gaskets.

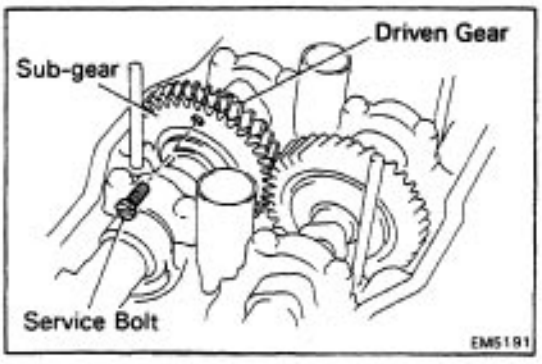
34. REMOVE CAMSHAFTS

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



A. Remove exhaust camshaft of RH cylinder head

(a) Align the timing marks (two pointed marks) of the camshaft drive and driven gears by turning the camshaft with a wrench.



(b) Secure the exhaust camshaft sub–gear to the driven gear with a service bolt.

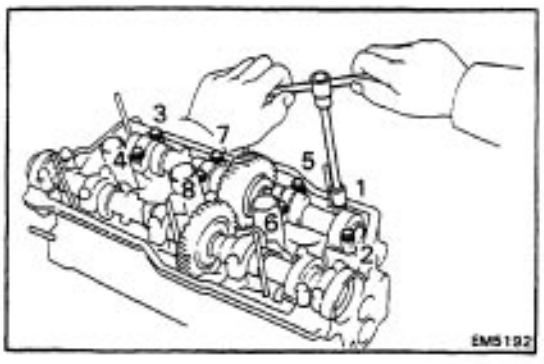
Recommended service bolt:

Thread diameter 6 mm

Thread pitch 1.0 mm

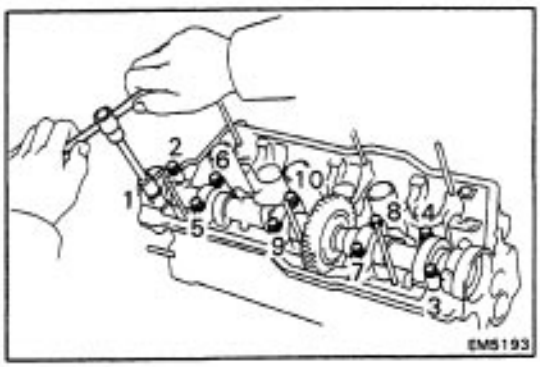
Bolt length 16 – 20 mm (0.63 – 0.79 in.)

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



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

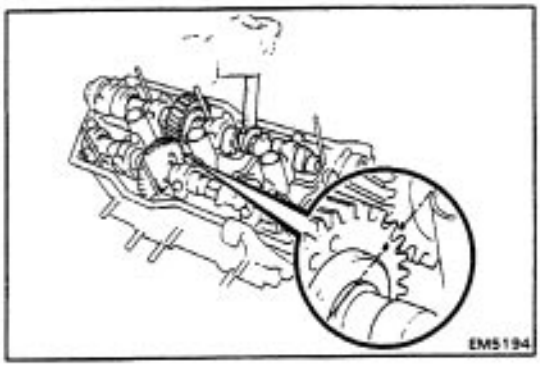
(d) Remove the four bearing caps and exhaust camshaft.



B. Remove intake camshaft of RH cylinder head

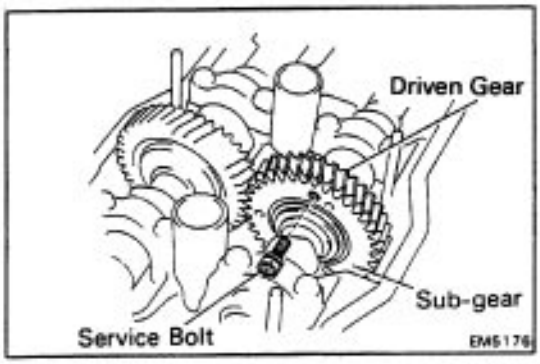
(a) Uniformly loosen and remove the ten bearing cap bolts in several passes in the sequence shown.

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



C. Remove exhaust camshaft of LH cylinder head

(a) Align the timing marks (one pointed mark) of the camshaft drive and driven gears by turning the camshaft with a wrench.



(b) Secure the exhaust camshaft sub–gear to the driven gear with a service bolt.

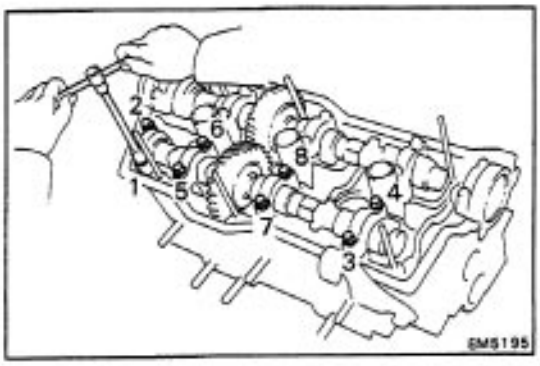
Recommended service bolt:

Thread diameter 6 mm

Thread pitch 1.0 mm

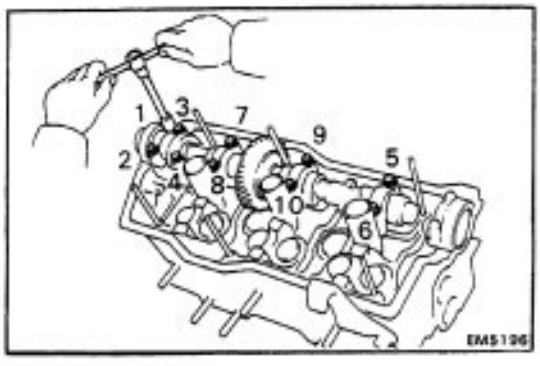
Bolt length 16 – 20 mm (0.63 – 0.79 in.)

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



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

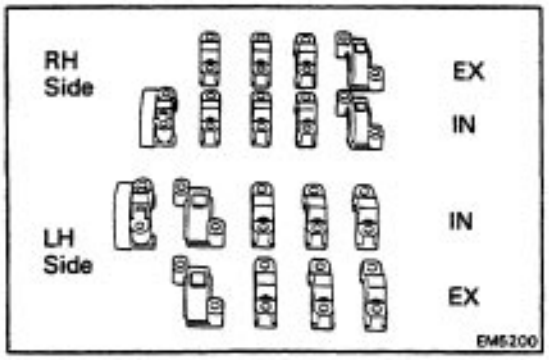
(d) Remove the four bearing caps and exhaust camshaft.



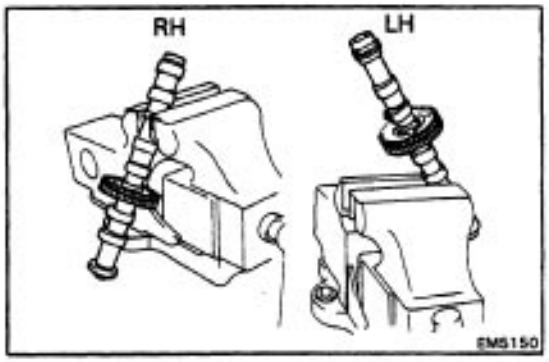
D. Remove intake camshaft of LH cylinder head

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

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



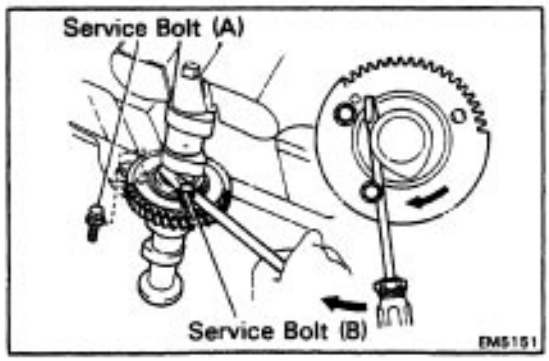
HINT: Arrange the bearing caps incorrect order.



35. DISASSEMBLE EXHAUST CAMSHAFTS

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

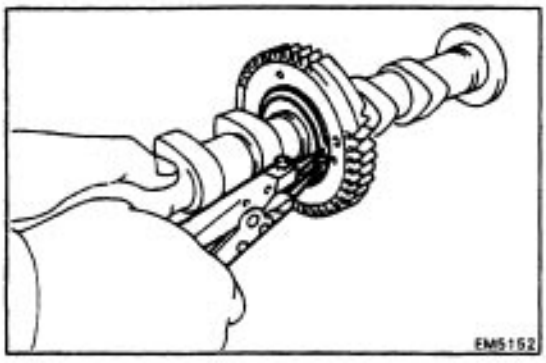
NOTICE: Be careful not to damage the camshaft.



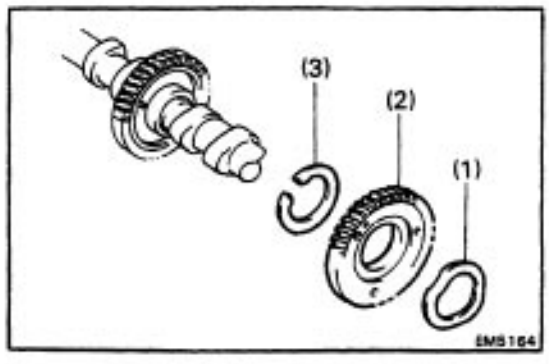
(b) Insert service bolt (A) into the service hole of the camshaft sub–gear.

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

NOTICE: Be careful not to damage the camshaft.



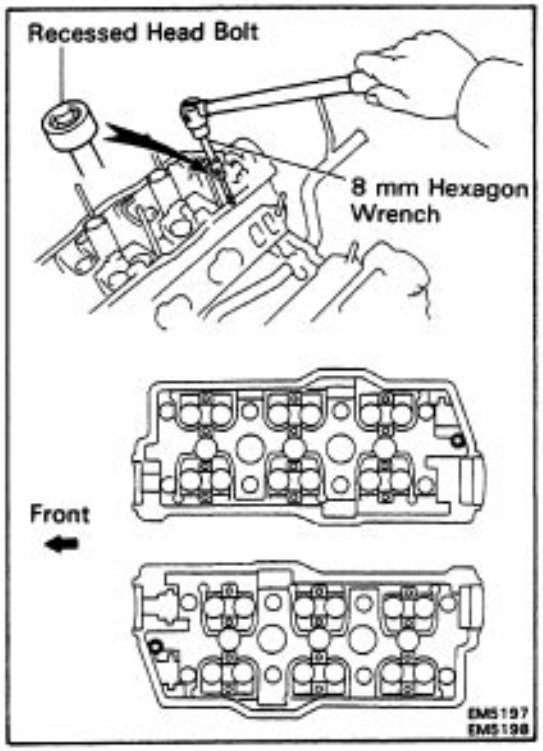
(d) Using snap ring pliers, remove the snap ring.



(e) Remove the following parts:

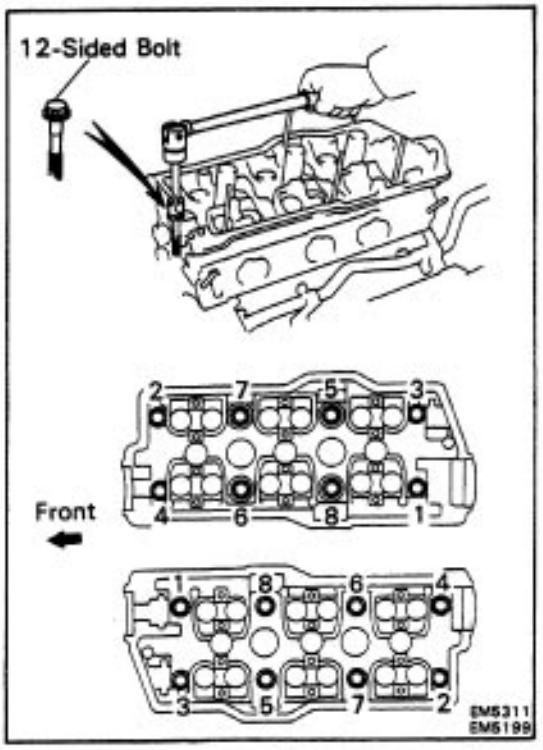
(1) Wave washer
(2) Camshaft sub–gear
(3) Camshaft gear spring

HINT: Arrange the camshaft sub–gears and gear springs (RH and LH).

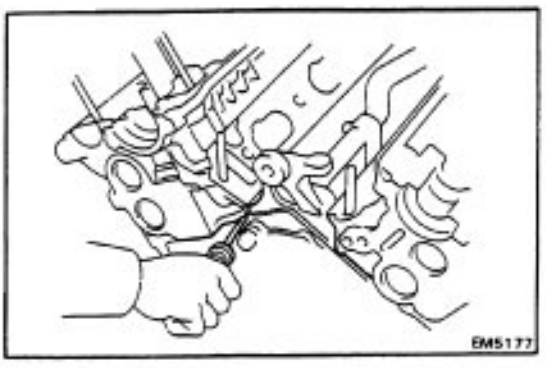


36. REMOVE CYLINDER HEADS

(a) Using a 8 mm hexagon wrench, remove the cylinder head (recessed head) bolts.



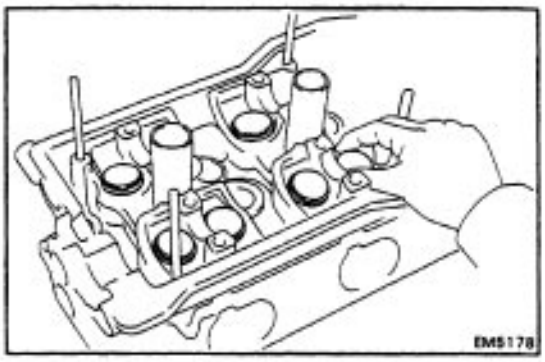
(b) Uniformly loosen and remove the cylinder head (12–sided) bolts in several passes in the sequence shown.
NOTICE: Head warpage or cracking could result from removing bolts in incorrect order.



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

HINT:

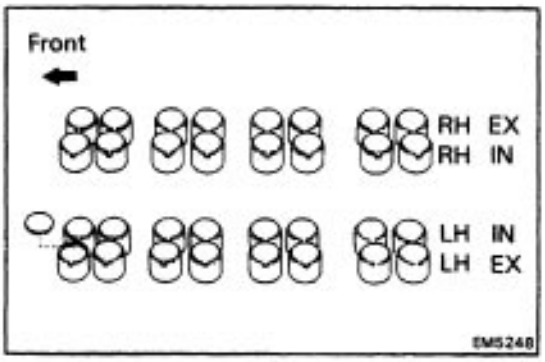
- If the cylinder head is difficult to lift off, pry with a screwdriver between the cylinder head and block.
- Arrange the RH and LH cylinder heads.
  NOTICE: Be careful not to damage the cylinder head and cylinder block surfaces of cylinder head gasket side.



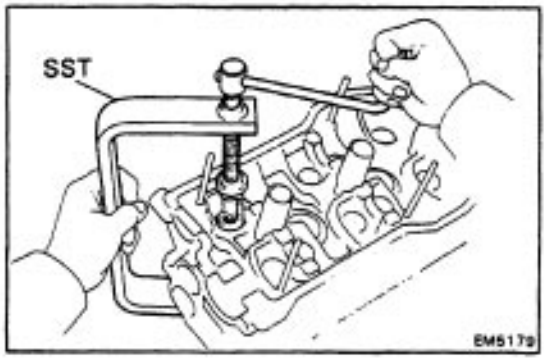
DISASSEMBLY OF CYLINDER HEADS

(See page EM–75)

1 . REMOVE VALVE LIFTERS AND SHIMS



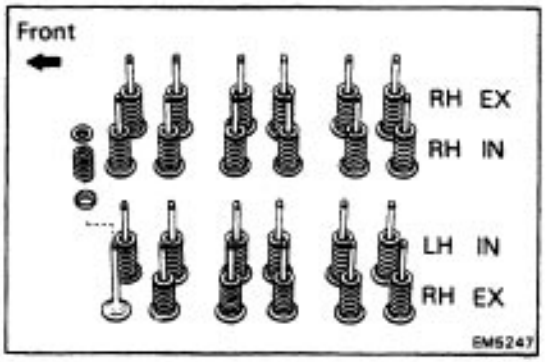
HINT: Arrange the valve lifters and shims in correct order.



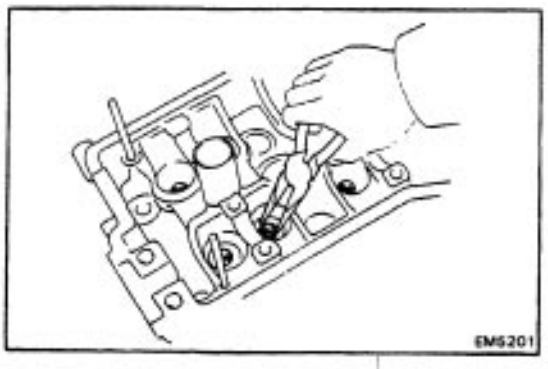
2. REMOVE VALVES

(a) Using SST, compress the valve spring and remove the two keepers.
SST 09202–70010

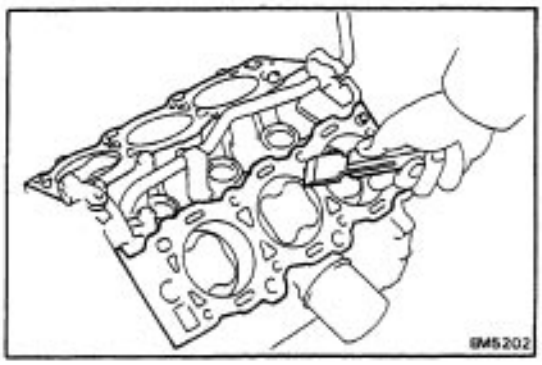
(b) Remove the spring retainer, valve spring, valve and spring seat.



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 OF PISTONS AND TOP OF BLOCK

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

(b) Remove all the gasket material from the top of the cylinder block.

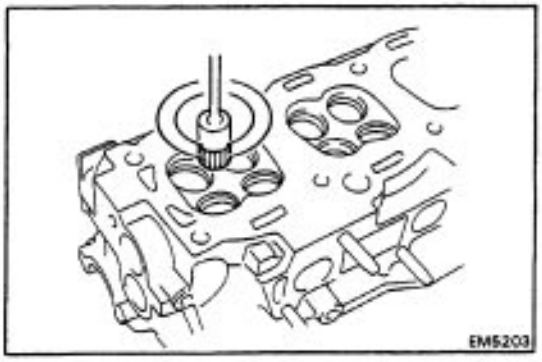
(c) Using compressed air, blow carbon and oil from the bolt holes.

CAUTION: Protect your eyes when using high pressure air.

2. REMOVE GASKET MATERIAL

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

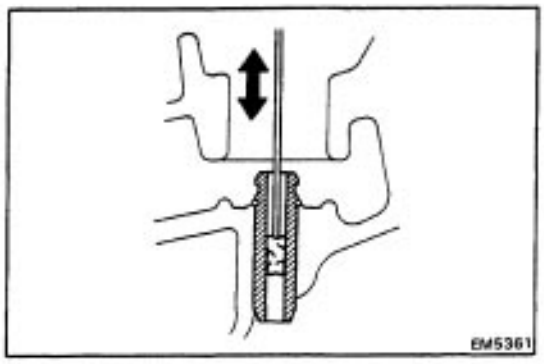
NOTICE: Be careful not to scratch the surfaces.



3. CLEAN COMBUSTION CHAMBERS

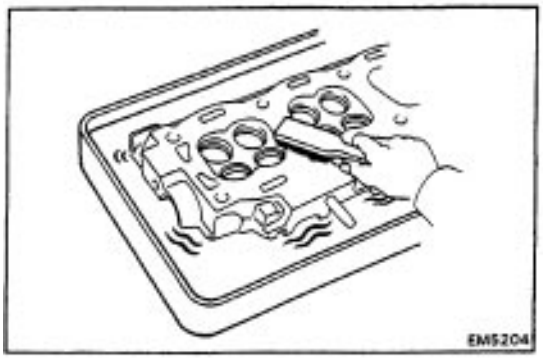
Using a wire brush, remove all the carbon from the combustion chambers.

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



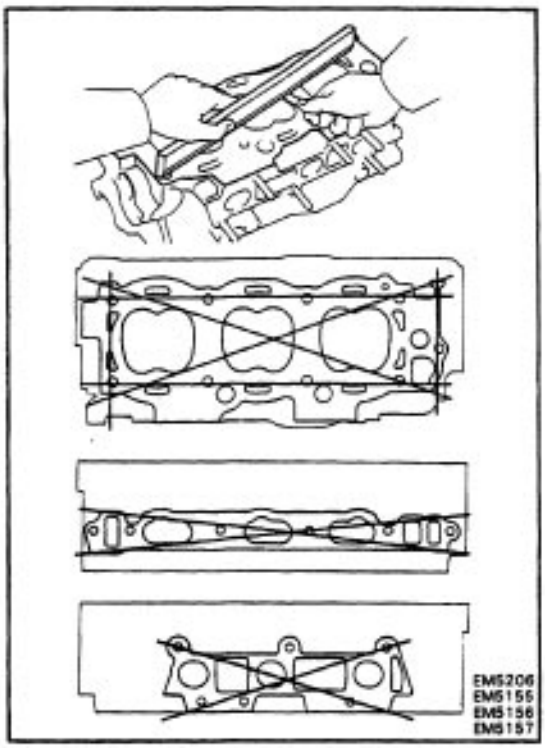
4. CLEAN VALVE GUIDE BUSHINGS

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



5. CLEAN CYLINDER HEADS

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

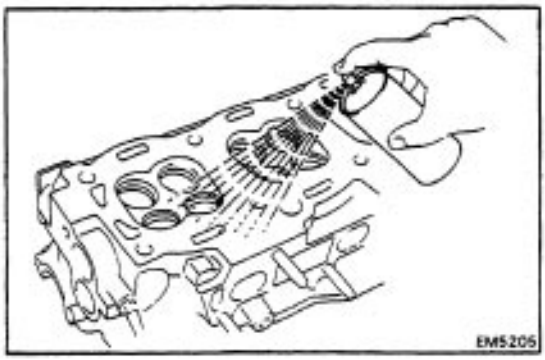


6. INSPECT CYLINDER HEADS FOR FLATNESS

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

Maximum warpage: 0.10 mm (0.0039 in.)

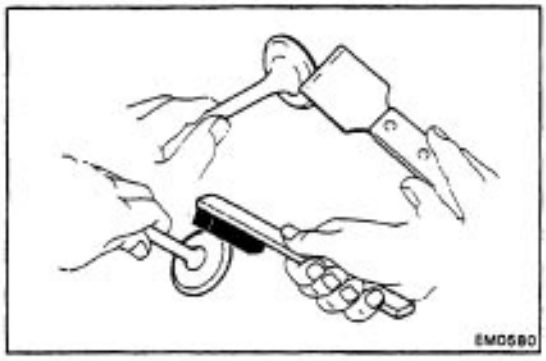
If warpage is greater than maximum, replace the cylinder head.



7. INSPECT CYLINDER HEAD FOR CRACKS

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

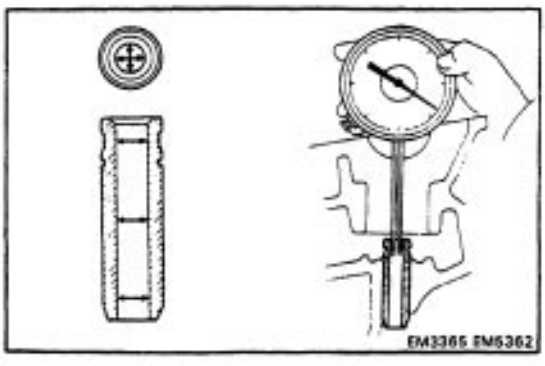
If cracked, replace the cylinder head.



8. CLEAN VALVES

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

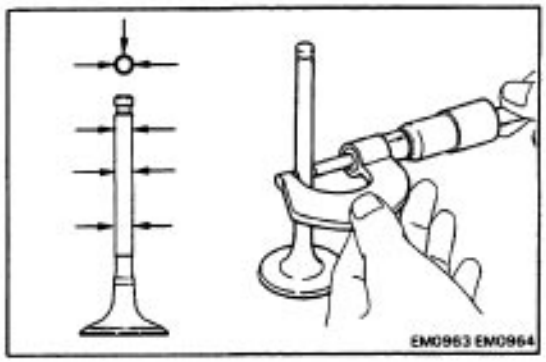
(b) Using a wire brush, thoroughly clean the valve.



9. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

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



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

Valve stem diameter:

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

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

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

Standard oil clearance:

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

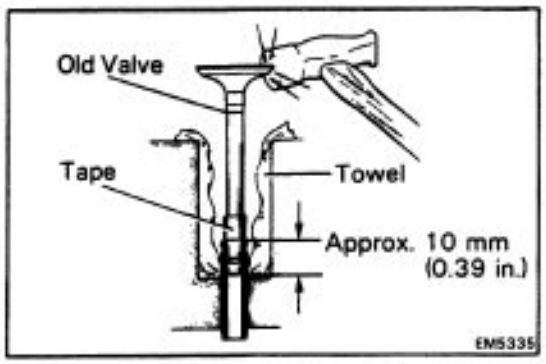
Exhaust 0.030 – 0.065 mm (0.0012 – 0.0026 in.)

Maximum oil clearance:

Intake 0.08 mm (0.0031 in.)

Exhaust 0.10 mm (0.0039 in.)

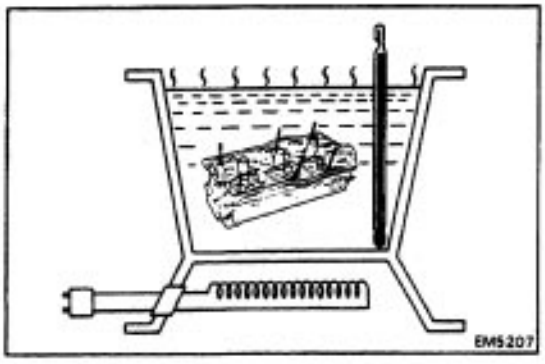
If the clearance is greater than maximum, replace the valve and guide bushing.



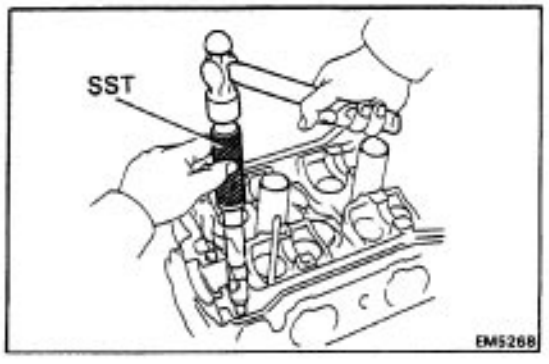
10. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

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

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

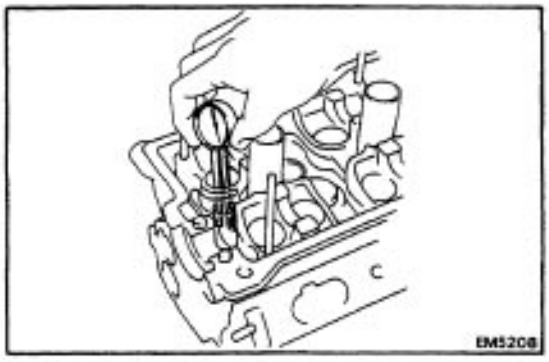


(b) Gradually heat the cylinder head to 80 –100˚C (176 – 212˚F).



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

SST 09201– 70010

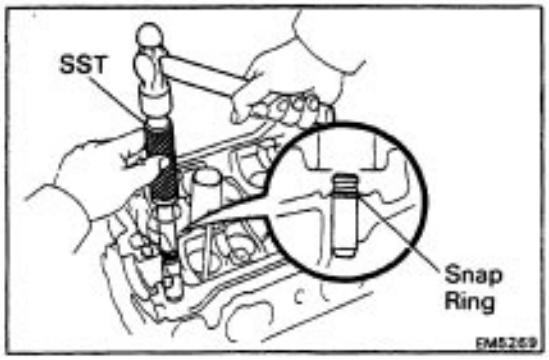


(d) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

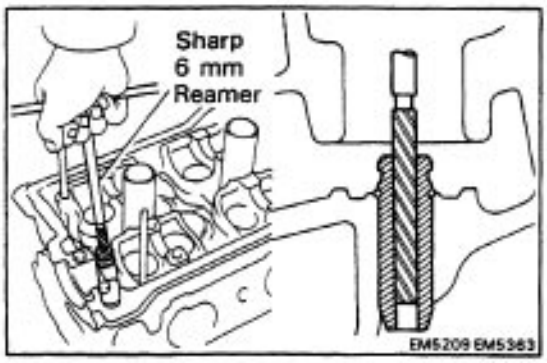
Both intake and exhaust

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

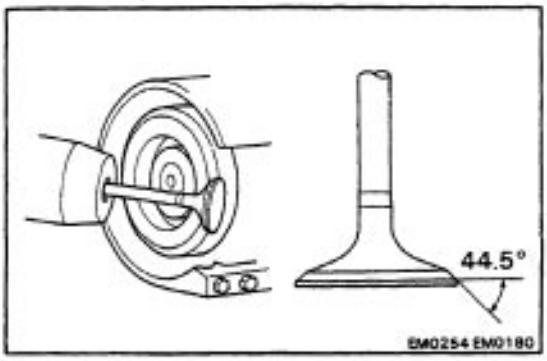
(e) Select a new guide bushing (STD size or O/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 11.027 mm (0.4341 in.), machine the bushing bore to the following dimension:
Rebored cylinder head bushing bore dimension:
11.050 – 11.077 mm (0.4350 – 0.4361 in.)
If the bushing bore diameter of the cylinder head is greater than 11.077 mm (0.4361 in.), replace the cylinder head.



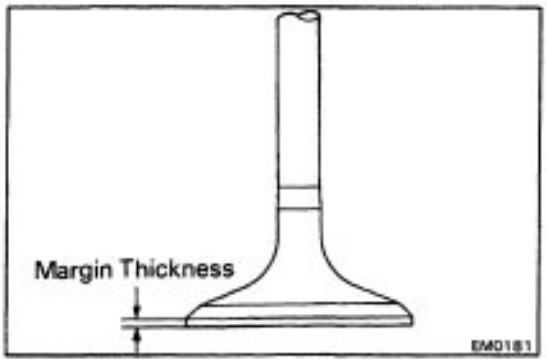
(f) Gradually heat the cylinder head to 80 –100°C 076 – 212°F).
(g) Using SST and a hammer, tap in a new guide bushing until the snap ring makes contact with the cylinder head.
SST 09201–70010



(h) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page EM–86) between the guide bushing and valve stem.



11. INSPECT AND GRIND VALVES
(a) Grind the valve enough to remove pits and carbon.
(b) Check that the valve is ground to the correct valve face angle.
Valve face angle: 44.5°



(c) Check the valve head margin thickness.

Standard margin thickness: 1.0 mm (0.039 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 96.1 mm (3.783 in.)
Exhaust 96.2 mm (3.787 in.)
Minimum overall length:
Intake 95.6 mm (3.754 in.)
Exhaust 95.7 mm (3.768 in.)

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

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

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

NOTICE: Do not grind off more than the minimum.

12. INSPECT AND CLEAN VALVE SEATS

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

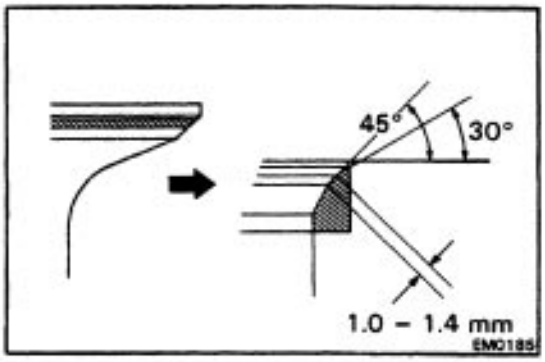
Remove only enough metal to clean the seats.

(b) Check the valve seating position.

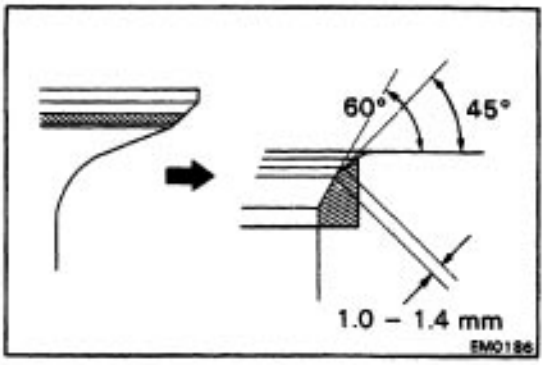
Apply a thin coat of Prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate the valve.

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

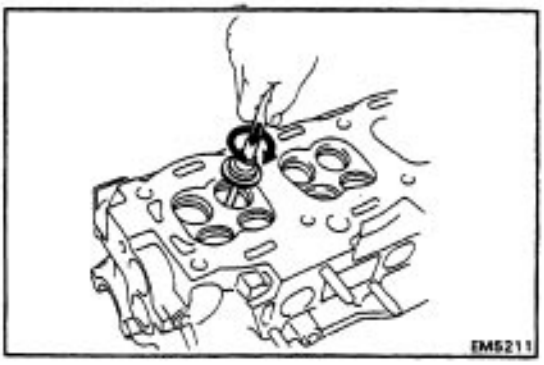
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with the following width:
  1.0 – 1.4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



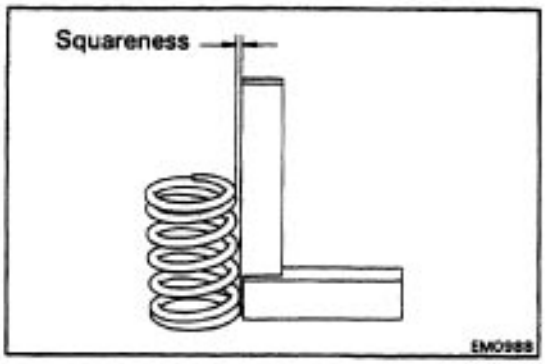
If not, correct the valve seats as follows:
111 If the seating is too high on the valve face, use 30˚ and 45˚ cutters to correct the seat.



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

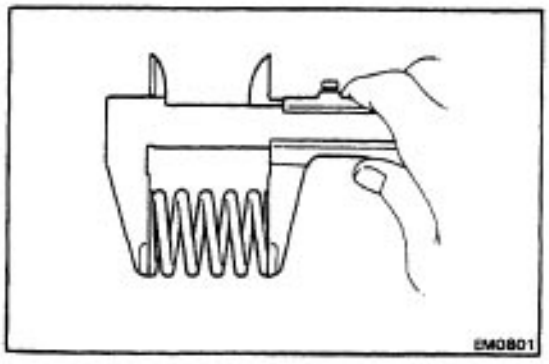


(d) Hand–lap the valve and valve seat with an abrasive compound.
After hand–lapping, clean the valve and valve seat.

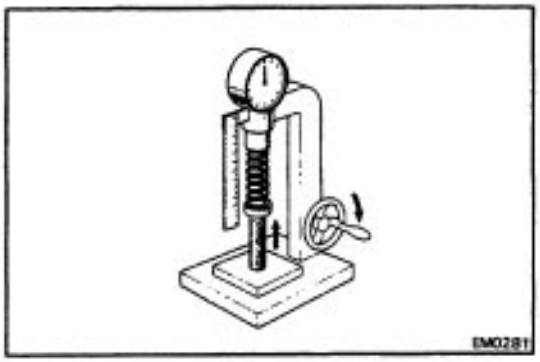


13. INSPECT VALVE SPRINGS

(a) Using a steel square, measure the squareness of the valve spring.
Maximum squareness: 2.0 mm (0.075 in.)
if squareness is greater than maximum, replace the valve spring.



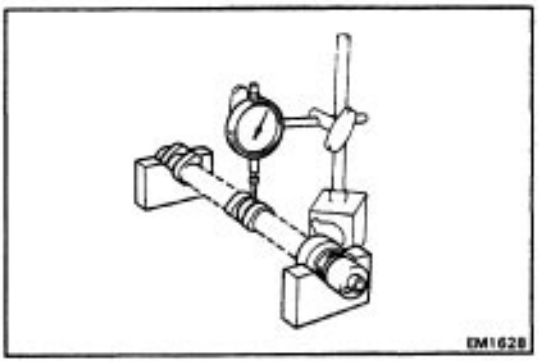
(b) Using calipers, measure the free length of the valve spring.
Free length: 42.6 mm (1.677 in.)
If the free length is not as specified, replace the valve spring.



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

Installed tension:
18.6 – 21.4 kg (41.0 – 47.2 1b, 182 – 210 N)
at 33.8 mm (1.331 in.)

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



14. INSPECT CAMSHAFTS AND BEARINGS

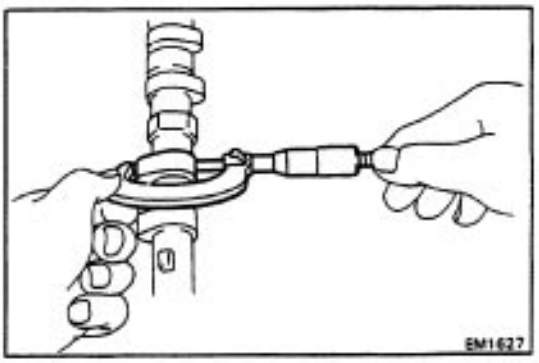
A. Inspect camshaft for runout

(a) Place the camshaft on V–blocks.

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

Maximum circle runout: 0.06 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.

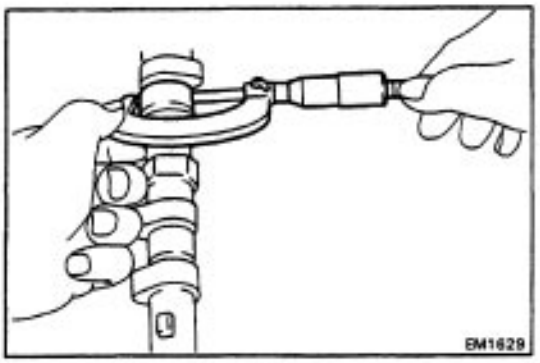
Standard cam lobe height:

Intake	**39.510 – 39.610 mm (1.5555 – 1.5594 in.)**
Exhaust	**38.960 – 39.060 mm (1.5339 – 1.5378 in.)**

Minimum cam lobe height:

Intake	**39.36 mm (1.5496 in.)**
Exhaust	**38.81 mm (1.5279 in.)**

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

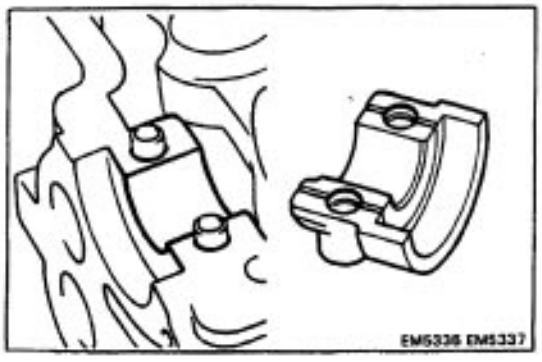


C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

Journal diameter: 26.949 – 26.965 mm (1.0610 – 1.0616 in.)

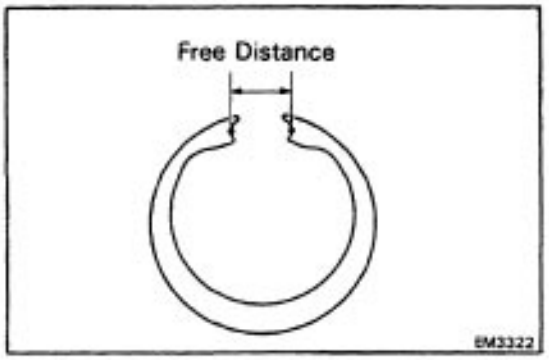
If the journal diameter is not as specified, check the oil clearance.



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.

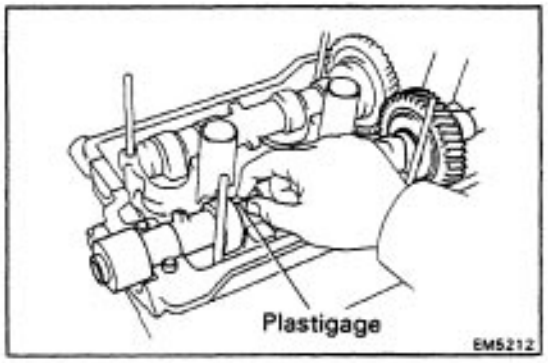


E. Inspect camshaft gear spring

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

Free distance: 18.2 – 18.8 mm (0.712 – 0.740 in.)

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

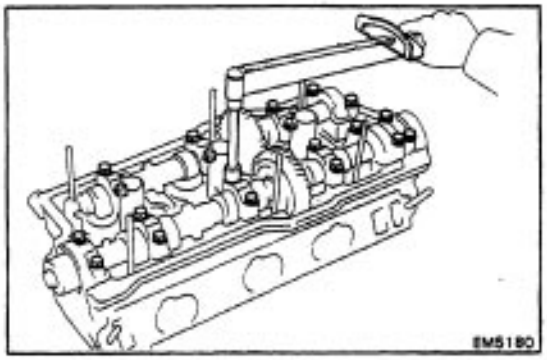


F. Inspect camshaft journal oil clearance

(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.

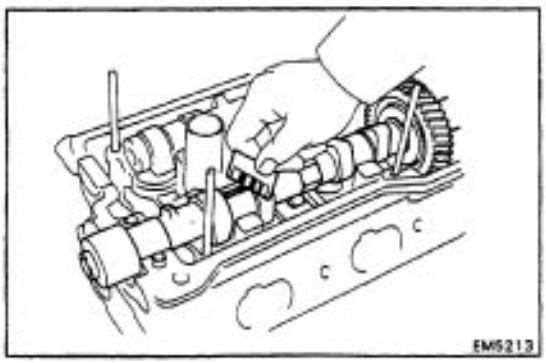


(c) Install the bearing caps.

(See step 4 on pages EM–97 to 99)

Torque: 160 kg–cm (12 ft–1b, 16 N–m)

NOTICE: Do not turn the camshaft.



(e) Remove the bearing caps.

(f) Measure the Plastigage at its widest point.

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

Maximum oil clearance: 0.10 mm (0.0039 in.)

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

(g) Completely remove the Plastigage.

G. Inspect camshaft thrust clearance

(a) Install the camshafts.

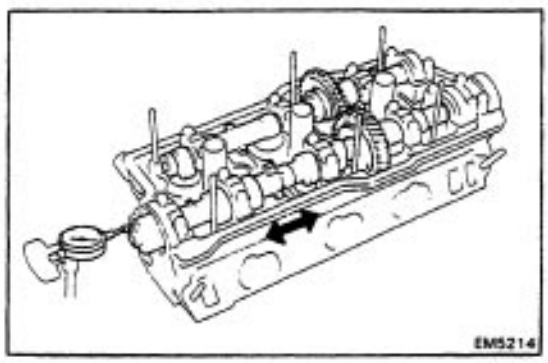
(See step 4 on pages EM–98)

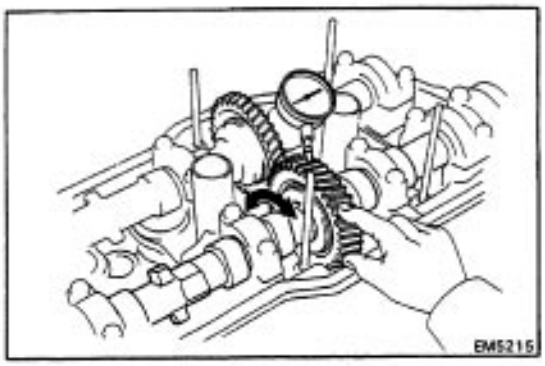
(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance: 0.030 – 0.080 mm (0.0012 – 0.0031 in.)

Maximum thrust clearance: 0.12 mm (0.0047 in.)

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





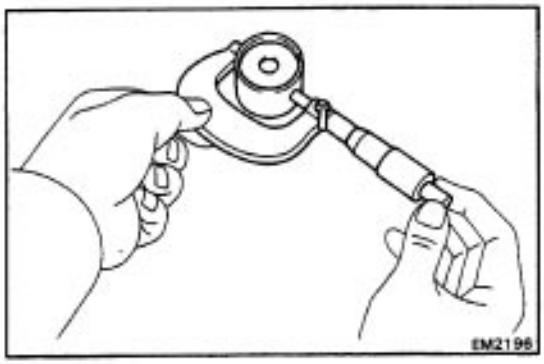
H. Inspect camshaft gear backlash

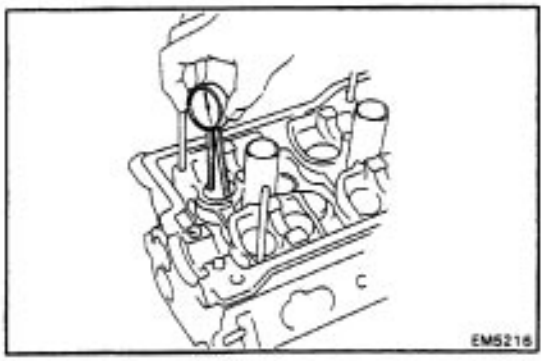
(a) Install the camshafts without installing the exhaust camshaft sub–gear.
(See step 4 on pages EM–96 to 99)

(b) Using a dial indicator, measure the backlash.
Standard backlash: 0.020 – 0.200 mm (0.0008 – 0.0079 in.)
Maximum backlash: 0.30 mm (0.0188 in.)
If the backlash is greater than maximum, replace the camshafts.

15. INSPECT VALVE LIFTERS AND LIFTER BORES

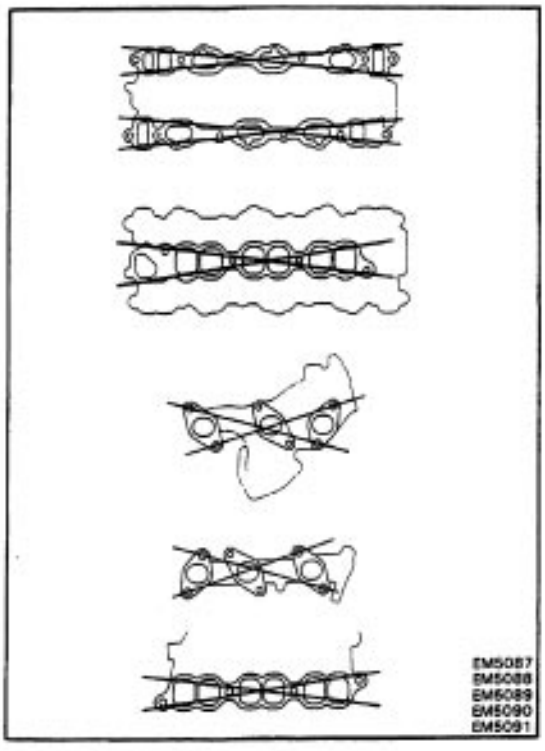
(a) Using a micrometer, measure the lifter diameter.
Lifter diameter: 27.975 – 27.985 mm (1.1014 – 1.1018 in.)





(b) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.
Lifter bore diameter: 28.000 – 28.021 mm (1.1024 – 1.1032 in.)

(c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.
Standard oil clearance: 0.015 – 0.046 mm (0.0005 – 0.0018 in.)
Maximum oil clearance: 0.07 mm (0.0028 in.)
If the oil clearance is greater than maximum, replace the lifter. If necessary, replace the cylinder head.



16. INSPECT INTAKE, EXHAUST MANIFOLDS AND AIR INTAKE CHAMBER

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head, intake manifold or air intake chamber for warpage.

Maximum warpage:
Intake manifold 0.10 mm (0.0039 in.)
Exhaust manifold 1.00 mm (0.0394 in.)
Air intake chamber 0.10 mm (0.0039 in.)

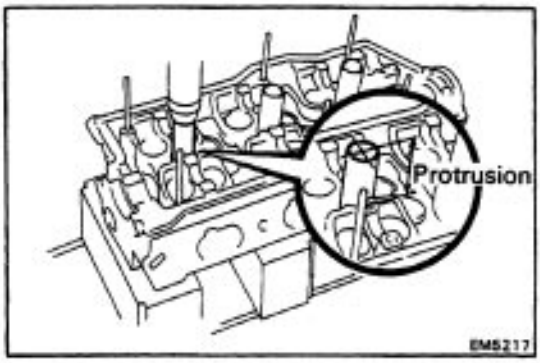
If warpage is greater than maximum, replace the manifold.

ASSEMBLY OF CYLINDER HEADS

(See page EM–75)

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.

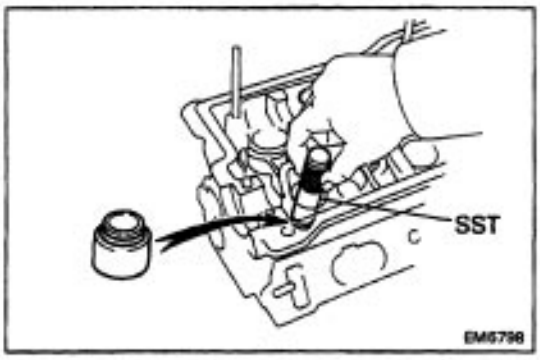


1. INSTALL SPARK PLUG TUBES

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

Using a press, in a new spark plug tube until there is 45.5–45.9 mm (1.791–1.807 in.) protruding from the camshaft bearing cap installation surface of the cylinder head.

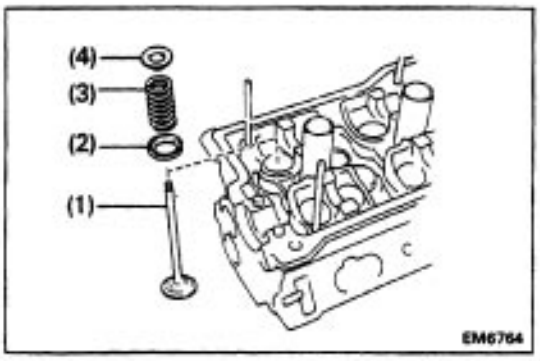
NOTICE: Avoid. pressing a new spark plug tube in too far by measuring the amount of protrusion while pressing.



2. INSTALL VALVES

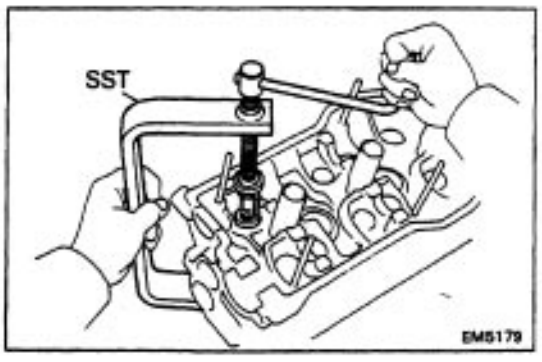
(a) Using SST, push in a new oil seal.

SST 09201–41020



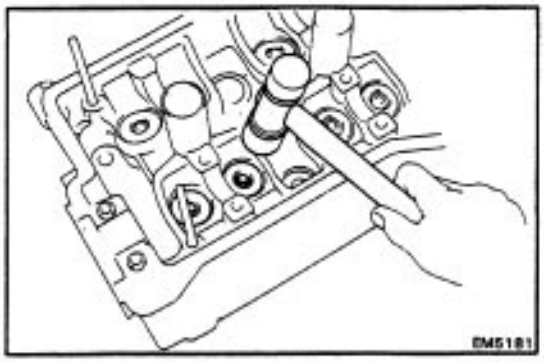
(b) Install the following parts:

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

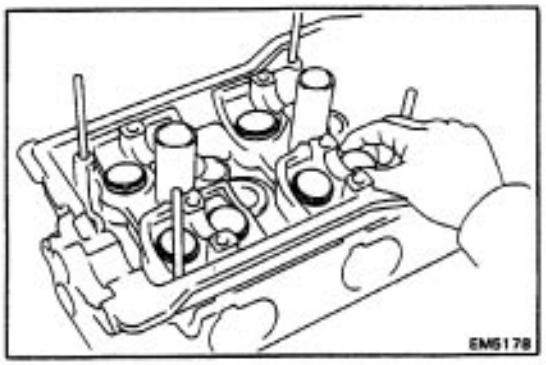


(c) Using SST, compress the valve spring and place the two keepers around the valve stem.

SST 09202–70010

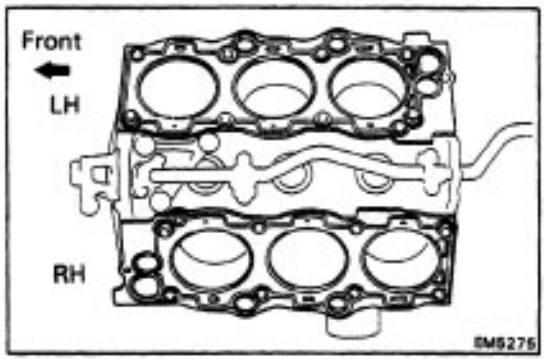


(c) Using a plastic–faced hammer, lightly tap the valve stern tip to assure proper fit.



3. INSTALL VALVE LIFTERS AND SHIMS

Check the valve lifter rotates smoothly by hand.



INSTALLATION OF CYLINDER HEADS

(See page EM–75)

1. INSTALL CYLINDER HEADS

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 (12–sided) bolts

HINT:

- The cylinder head bolts are tightened in three progres–

sive steps (steps (b), (d) and (e)).

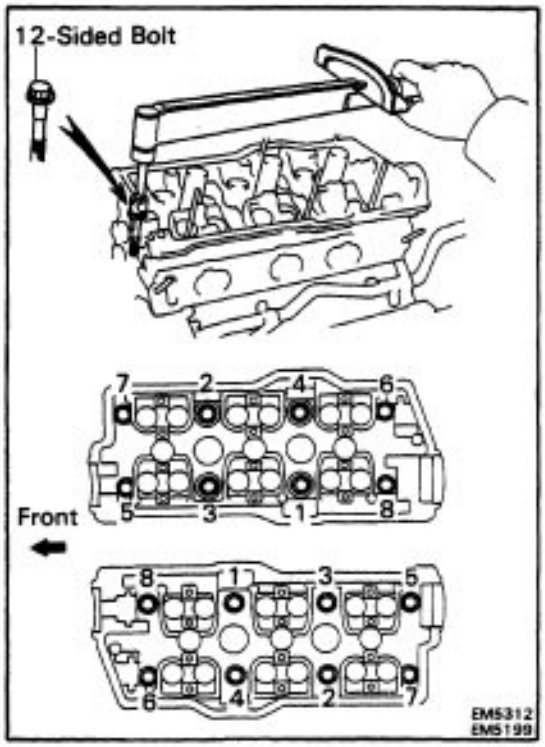
- If any bolts is broken or deformed, replace them.

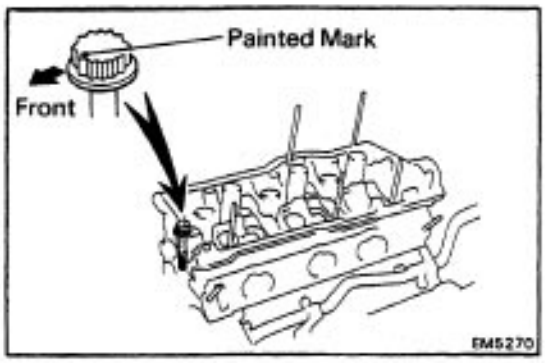
(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

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

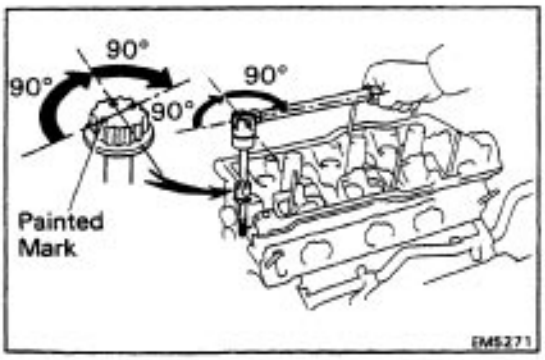
Torque: 350 kg–cm (25 ft–lb, 34 N–m)

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





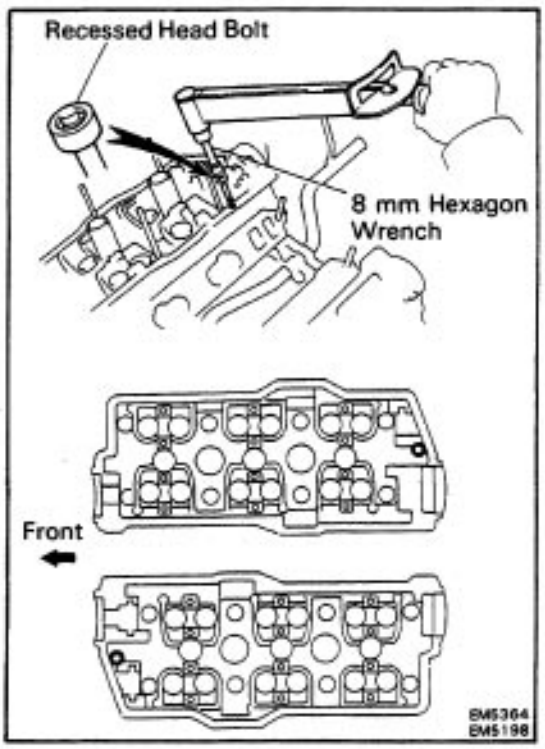
(c) Mark the front of the cylinder head bolt head with paint.



(d) Retighten the cylinder head bolts 90˚ in the numerical order shown.

(e) Retighten cylinder head bolts by an additional 90˚.

(f) Check that the painted mark is now facing rearward.



c. Install cylinder head (recessed head) bolts

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

(b) Using a 8 mm hexagon wrench, install the cylinder head bolts.

Torque: 185 kg–cm (13 ft–lb, 18 N–m)

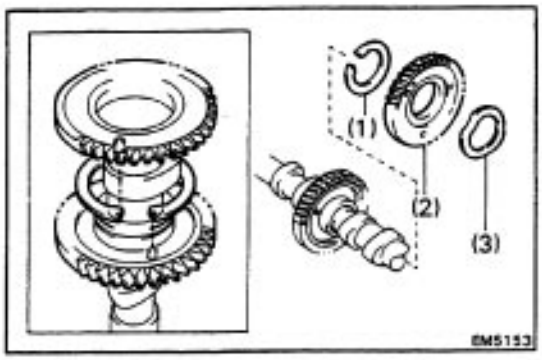
2. INSTALL LH ENGINE HANGER

Torque: 380 kg–cm (27 ft–lb, 37 N–m)

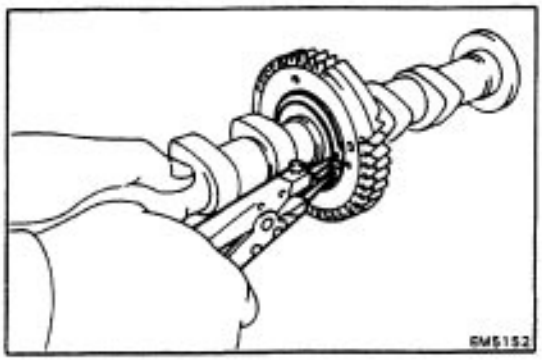
3. ASSEMBLE EXHAUST CAMSHAFTS

(a) Install the following parts:

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

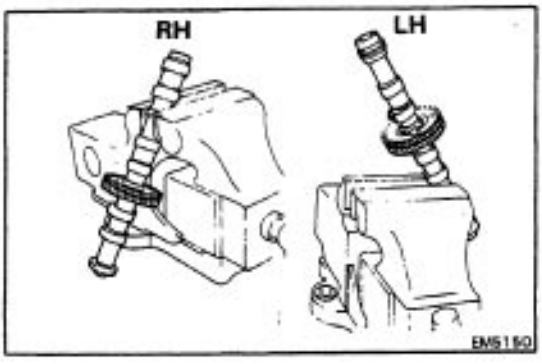


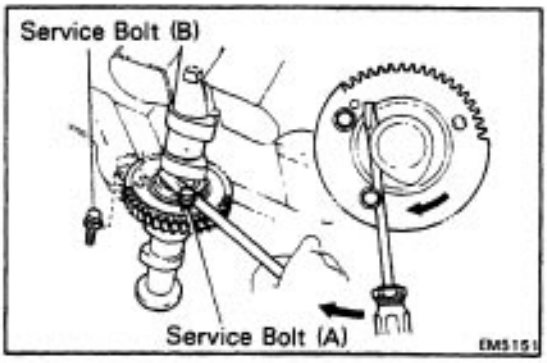
(b) Using snap ring pliers, install the snap ring.



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

NOTICE: Be careful not to damage the camshaft.

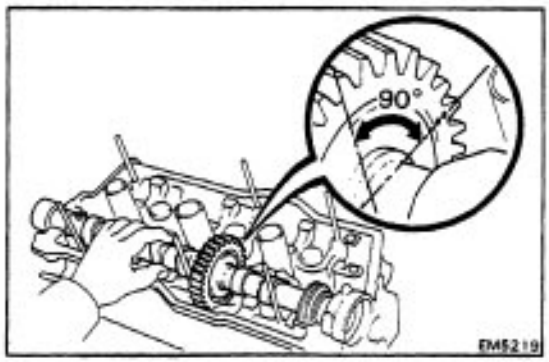




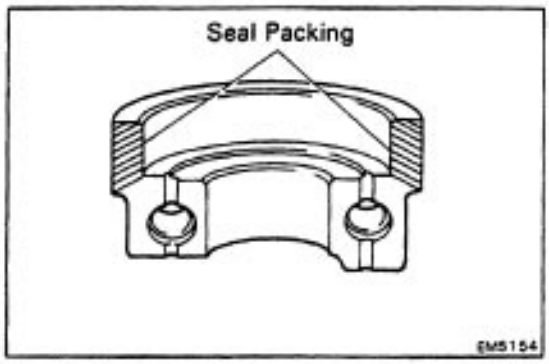
(d) Insert a service bolt (A) into the service hole of the camshaft sub–gear.
(e) Using a screwdriver, align the holes of the camshaft driven gear and sub–gear by turning camshaft sub-gear clockwise, and install a service bolt (B).
NOTICE: Be careful not to damage the camshaft.

4. INSTALL CAMSHAFTS

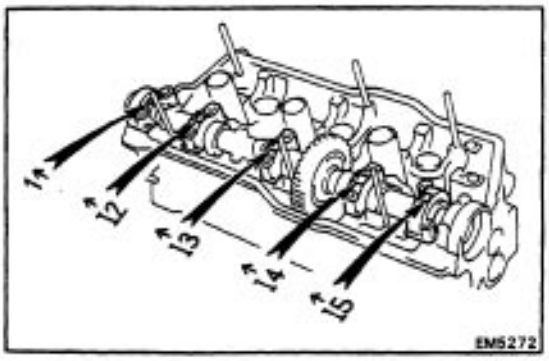
NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be held level white it is being installed. If the camshaft is not level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following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



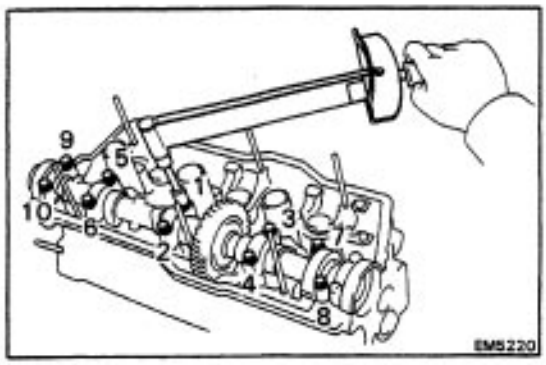
A. Install intake camshaft of R H cylinder head
(a) Apply MP grease to the thrust portion of the camshaft.
(b) Place the intake camshaft at 90° angle of timing mark (two pointed marks) on the cylinder head.



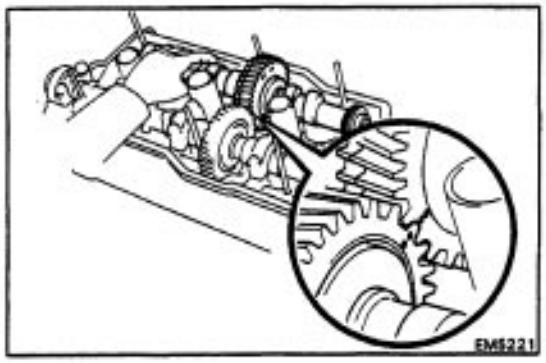
(c) Apply seal packing to the No. 1 bearing cap as shown.
Seal packing: Part No. 08826–00080 or equivalent



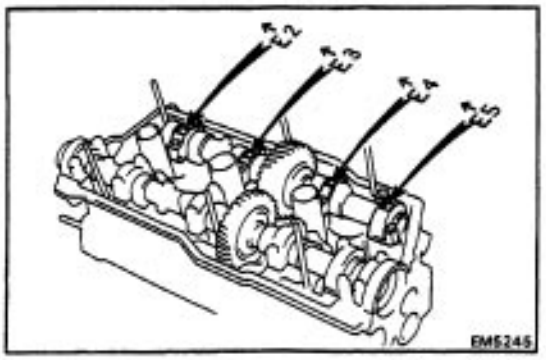
(d) Install the five bearing caps in their proper locations.



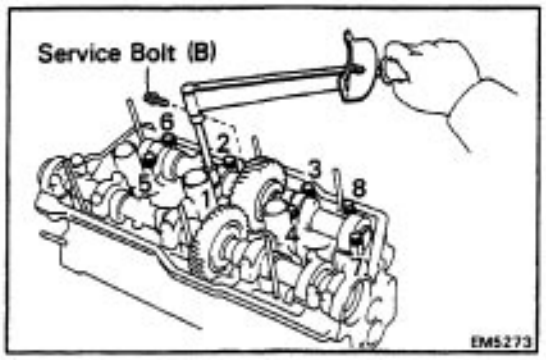
(e) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
(f) Install and uniformly tighten the ten bearing cap bolts in several passes in the sequence shown.
Torque: 160 kg–cm (12 ft–lb, 16 N–m)



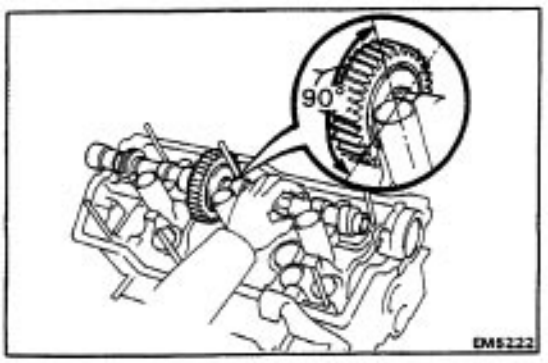
6. Install exhaust camshaft of RH cylinder head
(a) Apply MP grease to the thrust portion of the camshaft.
(b) Align the timing marks (two pointed marks) of the camshaft drive and driven gears.
(c) Place the exhaust camshaft on the cylinder head.



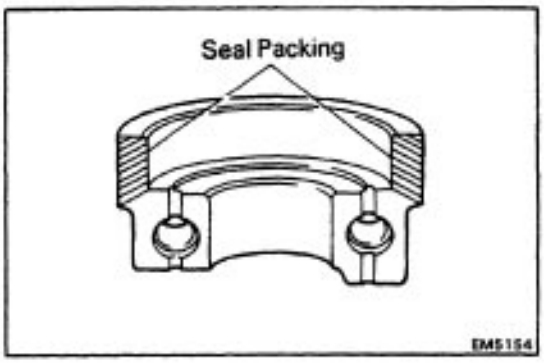
(d) Install the four bearing caps in their proper location.



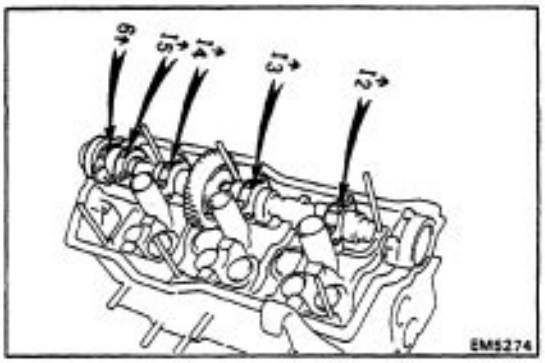
(e) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
(f) Install and uniformly tighten the eight bearing cap bolts in several passes in the sequence shown.
Torque: 16o kg–cm (12 ft–lb, 16 N–m)
(g) Remove the service bolt (6).



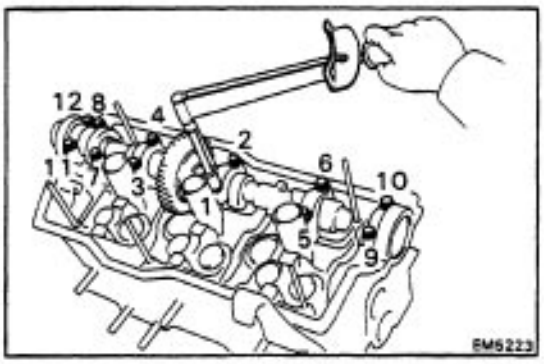
C. Install intake camshaft of LH cylinder head
(a) Apply MP grease to the thrust portion of the camshaft.
(b) Place the intake camshaft at 90° angle of timing mark (one pointed mark) on the cylinder head.



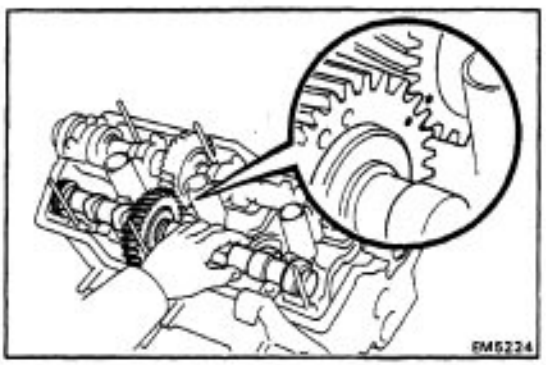
(c) Apply seal packing to the No. 1 bearing cap as shown.
Seal packing: Part No. 08826–00080 or equivalent



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

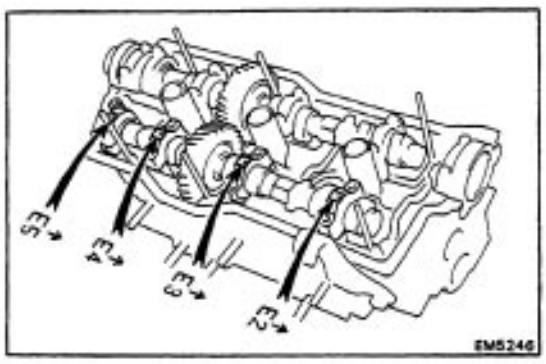


(e) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
M Install and uniformly tighten the ten bearing cap bolts in several passes in the sequence shown.
Torque: 160 kg–cm (12 ft–lb, 16 N–m)

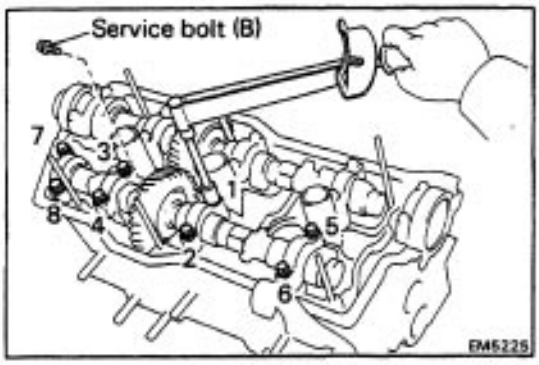


D. Install exhaust camshaft of LH cylinder head

(a) Apply MP grease to the thrust portion of the camshaft.
(b) Align the timing marks (one pointed mark) of the camshaft drive and driven gears.
(c) Place the intake camshaft on the cylinder head.

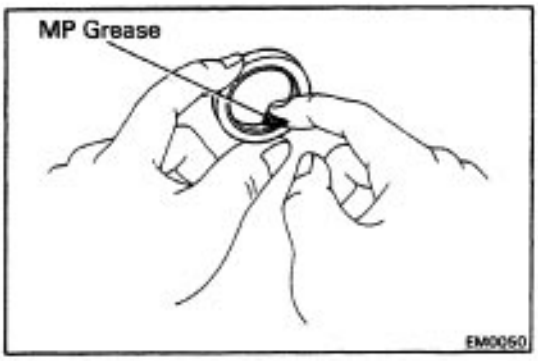


(d) Install the four bearing caps in their proper location.

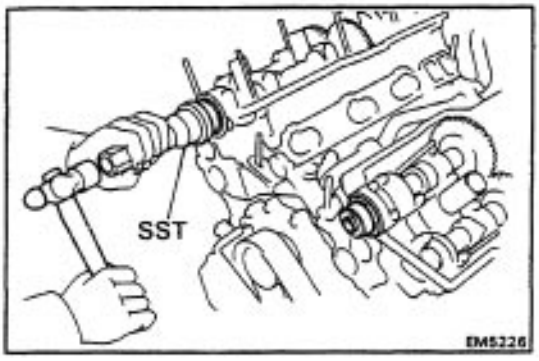


(e) Apply a light coat of engine oil on the threads and under the heads of bearing cap bolts.
(f) Install and uniformly tighten the eight bearing cap bolts in several passes in the sequence shown.
Torque: 160 kg–cm (12 ft–lb, 16 N–m)
Remove the service bolt (6).

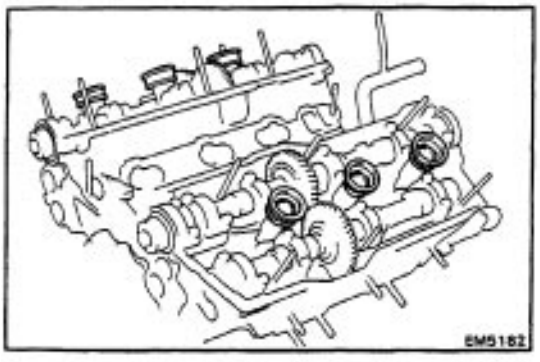
5. CHECK AND ADJUST VALVE CLEARANCE
(See page EM–9)
Turn the camshaft and position the cam lobe upward, check and adjust the valve clearance.
Valve clearance (Cold):
Intake 0.13 – 0.23 mm (0.005 – 0.009 in.)
Exhaust 0.27 – 0.37 mm (0.011 – 0.015 in.)



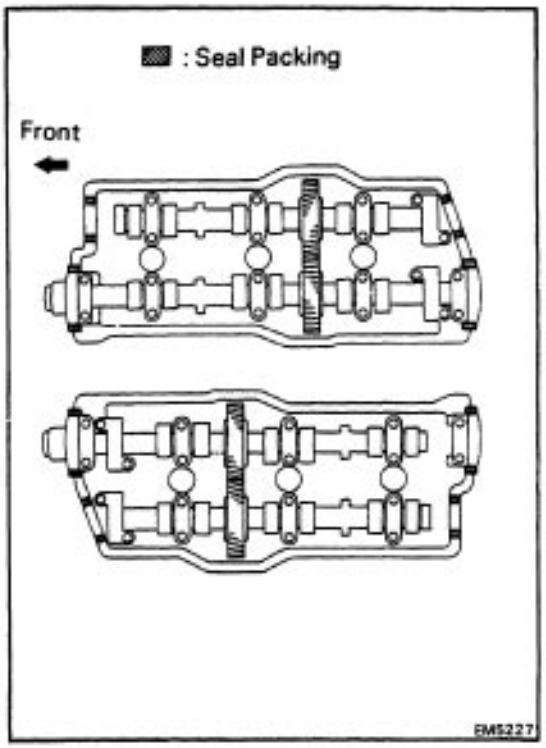
6. INSTALL CAMSHAFT OIL SEALS
(a) Apply MP grease to a new oil seal lip.



(b) Using SST, tap in the oil seals.
SST 09223–46011

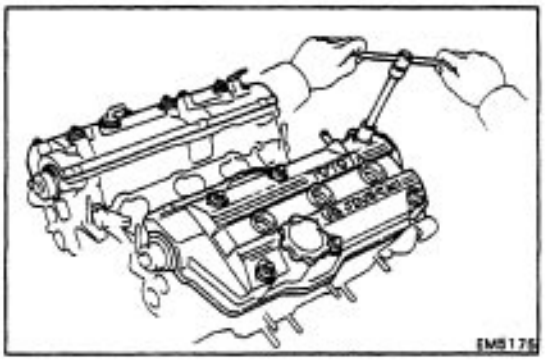


7. INSTALL SPARK PLUG TUBE GASKETS
Install the six tube gaskets.

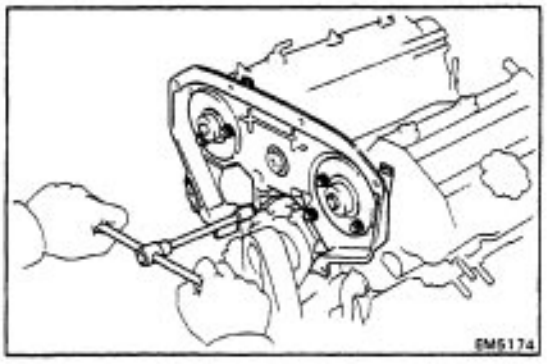


8. INSTALL CYLINDER HEAD COVERS

(a) Apply seal packing to the cylinder heads as shown in the figure.
Seal packing: Part No.08826–00080 or equivalent



(b) Install the gasket to the cylinder head cover.
(c) Install the cylinder head cover with the six seal washers and nuts. Install the two cylinder head covers.
Torque: 60 kg–cm (5Z in.–lb, 5.9 N–m)

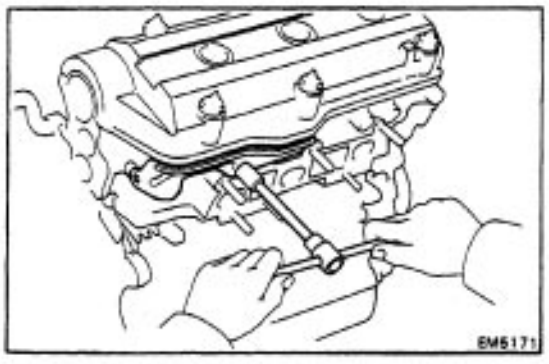


9. INSTALL NO.3 TIMING BELT COVER

Install the timing belt cover. with the six bolts.
Torque: 75 kg–cm (65 in.–lb, 7.4 N–m)

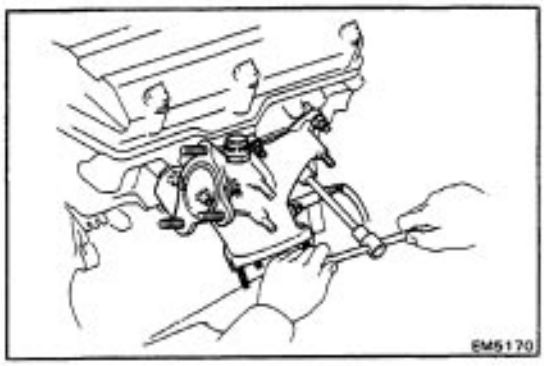
10. INSTALL NO.2 IDLER PULLEY, CAMSHAFT TIMING PULLEYS AND TIMING BELT
(See steps 7 to 26 on pages EM–43 to 47)

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

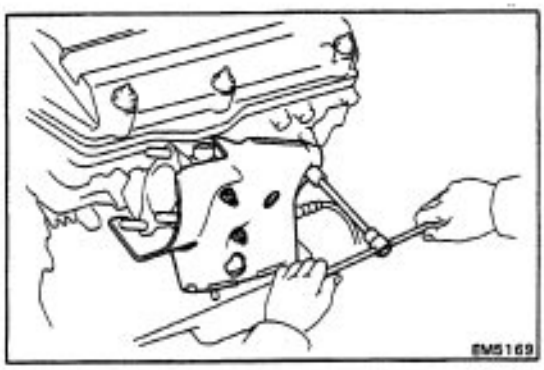


12. INSTALL RH EXHAUST MANIFOLD

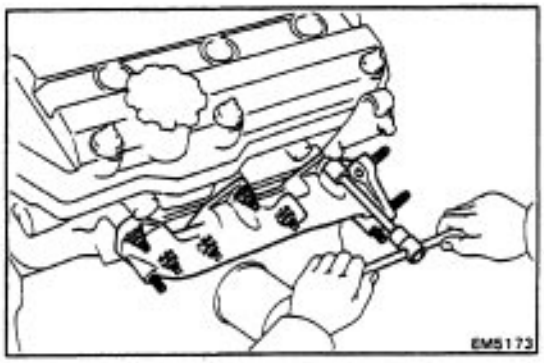
(a) Install the inside heat insulator with the bolt.



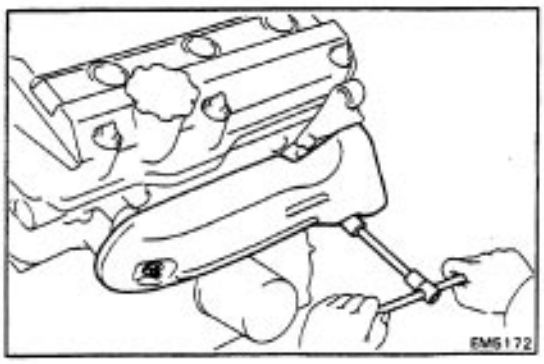
(b) Install a new gasket and the exhaust manifold with new six nuts.
Torque: 400 kg–cm (29 ft–lb, 39 N–m)



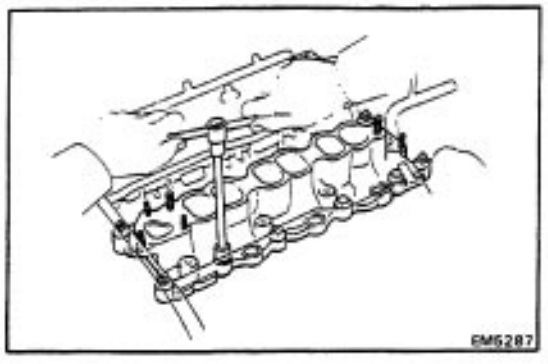
(c) Install the outside heat insulator with the three nuts.
(d) Connect the oxygen sensor connector.



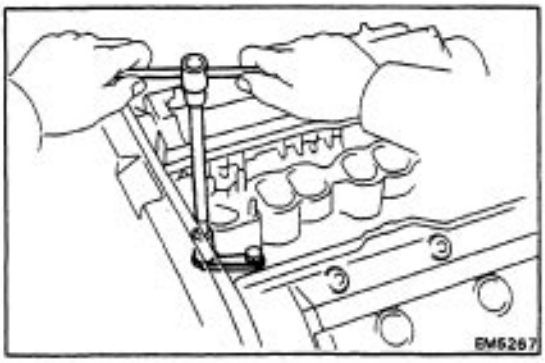
13. INSTALL LH EXHAUST MANIFOLD
(a) Install a new gasket and the exhaust manifold with new six nuts.
Torque: 400 kg–cm (29 ft–lb, 39 N–m)



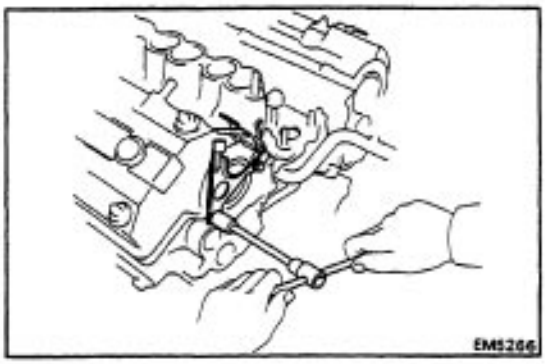
(b) Install the heat insulator with the two nuts.



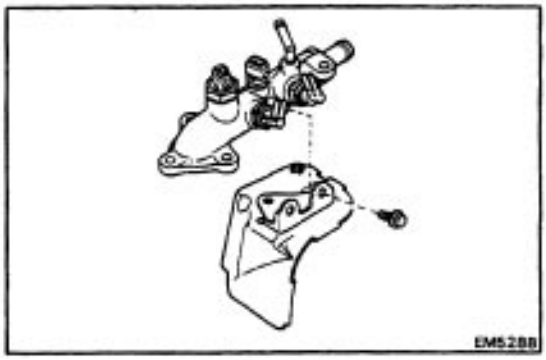
12. INSTALL INTAKE MANIFOLD
(a) Install two new gaskets and the intake manifold with the eight bolts and four nuts.
Torque: 180 kg–cm (13 ft–lb, 18 N–m)



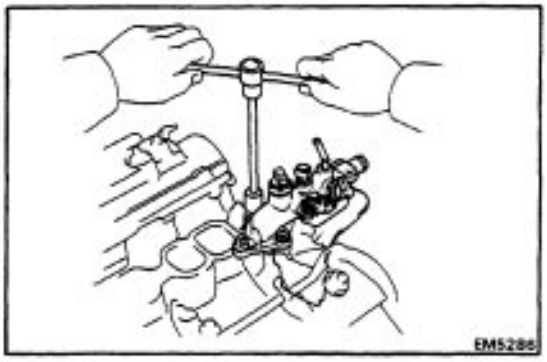
(b) Install the No.2 idler pulley bracket stay with the two bolts.
Torque: 185 kg–cm (13 ft–tb. 18 N–m)



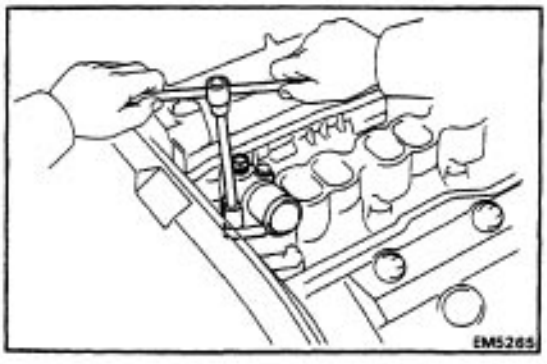
14. INSTALL CYLINDER HEAD REAR PLATE
Install the rear plate with the two bolts.



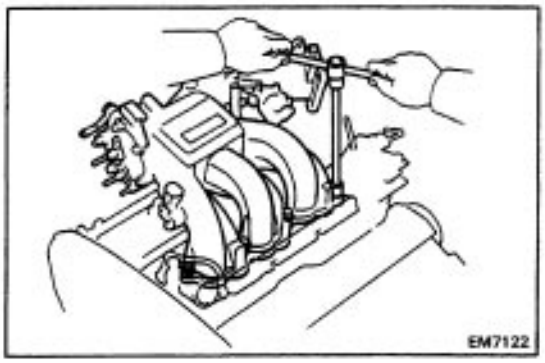
15. INSTALL WATER BY–PASS OUTLET
(a) Install the crossover pipe heat insulator with the two bolts.



(b) Install a new gasket and the water by–pass outlet with the three nuts.
Torque: 200 kg–cm (14 ft–tb, 20 N–m)
(c) Connect the following connectors and hose:
(1) Heater water by–pass hose
(2) Cold start injector time switch connector
(3) Water temperature switch



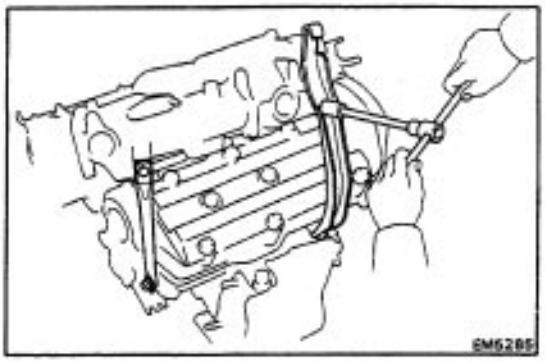
16. INSTALL WATER OUTLET
(a) Connect the following hose and connector:
(1) Radiator upper hose
(2)Water temperature sensor connector
(b) Install a new gasket and the water outlet with the three nuts.
Torque: 85 kg–cm (73 in.–lb, 8.3 N–m)
17. INSTALL INJECTORS AND DELIVERY PIPES
(See steps 1 to 5 on pages FI–98 and 99)



18. INSTALL AIR INTAKE CHAMBER

(a) Install two new gaskets and the intake chamber with the two bolts and two nuts.

Torque: 440 kg–cm (32 ft–lb, 43 N–m)



(b) Install the two intake chamber stays with the four bolts.

Torque: 380 kg–cm (27 ft–lb, 37 N–m)

(c) Connect the following hoses:

(1) PCV hose
(2) Vacuum sensing hose
(3) (CALIF. only)
EGR gas temperature sensor connector
(4) A/C control valve air hose

19. INSTALL COLD START INJECTOR TUBE

(See step 2 on page FI–83)

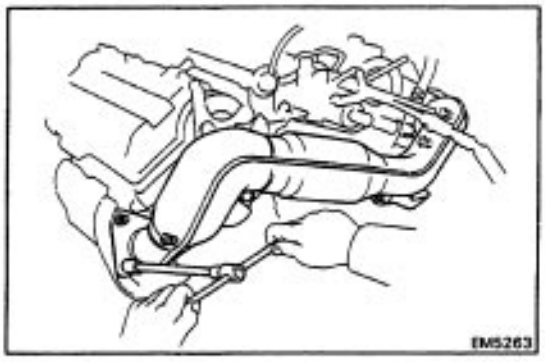
20. CONNECT COLD START INJECTOR CONNECTOR

21. INSTALL EXHAUST CROSSOVER PIPE

(a) Install two new gaskets to the RH and LH exhaust manifolds.

(b) install the crossover pipe with the six nuts and two bolts.

Torque:
Nut 400 kg–cm (29 ft–lb, 39 N–m)
Bolt 350 kg–cm (25 ft–lb, 34 N–m)



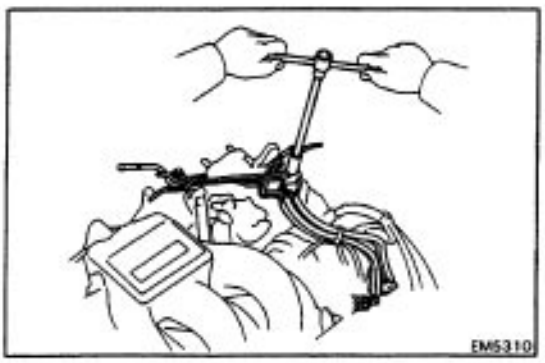
22. INSTALL DISTRIBUTOR (Seepage IG–19)

23. INSTALL VACUUM PIPE

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

(b) Connect the following hoses:

(1) Four BVSV vacuum hoses
(2) A/C control valve vacuum hose

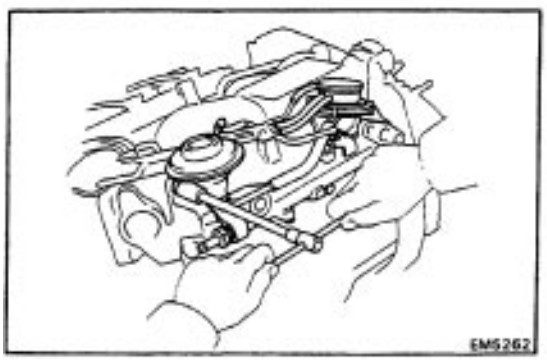


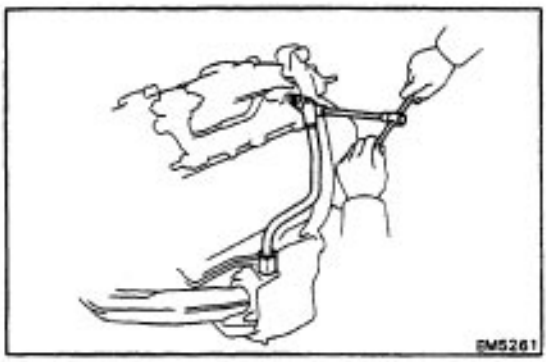
24. INSTALL EGR VALVE AND VACUUM MODULATOR

(a) Install a new gasket and the EGR valve and vacuum modulator with the two bolts and two nuts.

Torque: 185. kg–cm (13 ft–lb, 18 N–m)

(b) Install the four vacuum pipe hoses.





25. INSTALL EGR PIPE

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

Torque:

Bolt 185 kg–cm (13 f t–lb, 18 N–m)

Nut 800 kg–cm (58 ft–lb, 78 N–m)

26. INSTALL THROTTLE BODY

(See steps 1 and 2 on page FI–115)

27. INSTALL ISC VALVE

(See steps 1 to 3 on page FI–119)

28. INSTALL ALTERNATOR (See page CH–15)

29. INSTALL FRONT EXHAUST PIPE

(See step 14 on page EM–172)

30. INSTALL ENGINE RH UNDER COVER

31. INSTALL AIR CLEANER HOSE

32. INSTALL CRUISE CONTROL ACTUATOR

(See step 27 on page EM–173)

33. INSTALL ACCELERATOR CABLE, AND ADJUST IT

34. (A/T)

CONNECT THROTTLE CABLE, AND ADJUST IT

35. FILL WITH ENGINE COOLANT (See page CO–5)

Capacity (w/ Heater):

M/T 9.5 liters (110.0 US qts, 8.4 Imp. qts)

A/T 9.4 liters (9.9 US qts, 8.3 Imp. qts)

36. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

37. START ENGINE AND CHECK FOR LEAKS

38. ADJUST IGNITION TIMING (See on page IG–21)

Ignition timing:

10˚ BTDC @ idle

(w/ Terminals TE1 and E1 connected)

39. PERFORM ROAD TEST

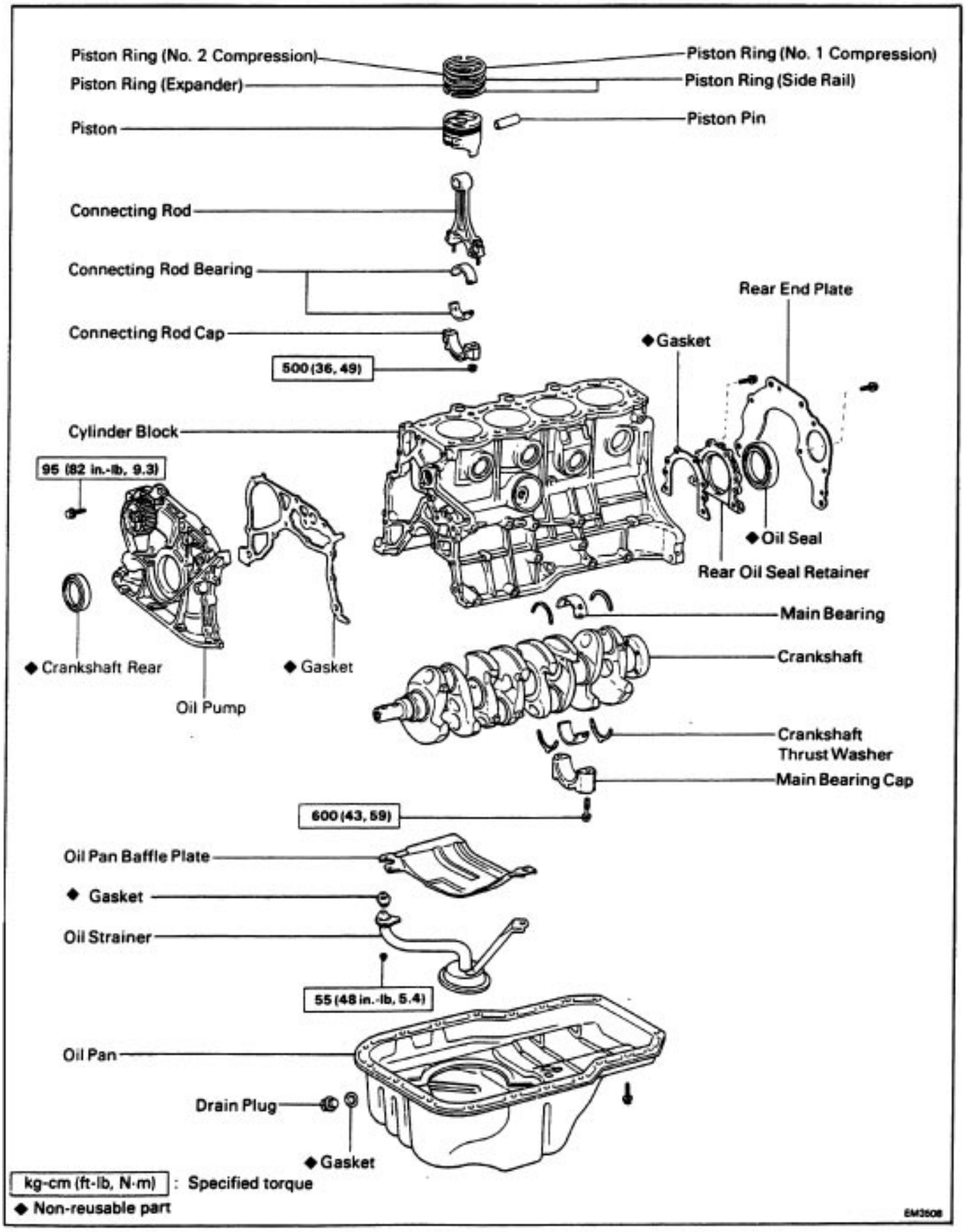
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

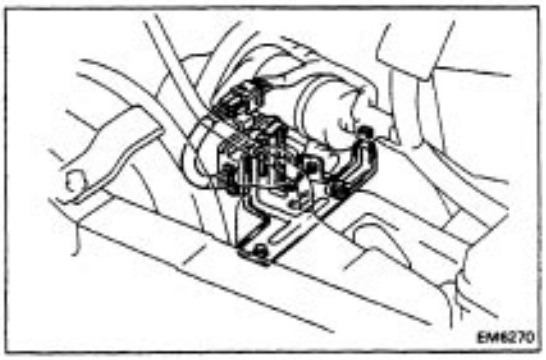
40. RECHECK ENGINE COOLANT LEVEL AND OIL LEVEL

,

CYLINDER BLOCK (3S–FE)

COMPONENTS





REMOVAL OF ENGINE

1. REMOVE BATTERY

2. DRAIN ENGINE COOLANT (See page CO–4)

3. REMOVE HOOD

4. REMOVE IGNITER AND BRACKET ASSEMBLY

(a) Disconnect the igniter connector.

(b) Disconnect the ground strap from the bracket.

(c) Remove the two bolts, the igniter and bracket assembly.

5. REMOVE RADIATOR (See page CO–16)

6. REMOVE RADIATOR RESERVOIR TANK

7. (A/T)

DISCONNECT THROTTLE CABLE FROM THROTTLE BODY

8. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY

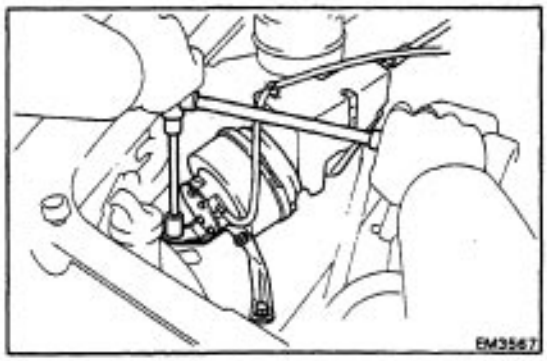
9. (w/ CRUISE CONTROL SYSTEM)

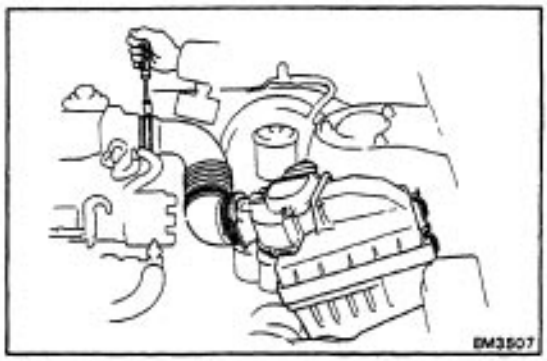
REMOVE CRUISE CONTROL ACTUATOR

(a) Disconnect the actuator vacuum hose.

(b) Disconnect the actuator connector.

(c) Remove the bolts, actuator and bracket.





10. REMOVE AIR CLEANER ASSEMBLY

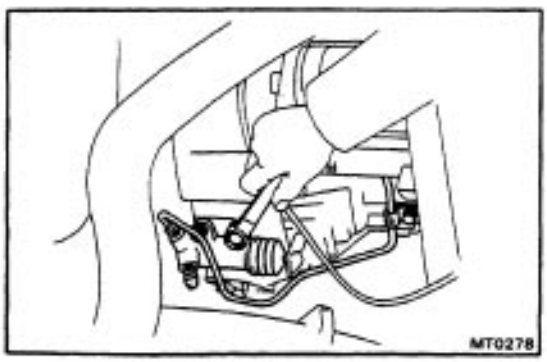
(a) Disconnect the air flow meter connector.

(b) Disconnect the four air cleaner cap clips.

(c) Disconnect the air cleaner hose, and air flow meter assembly.

(d) Remove the air cleaner element.

(e) Remove the three bolts and air cleaner case.

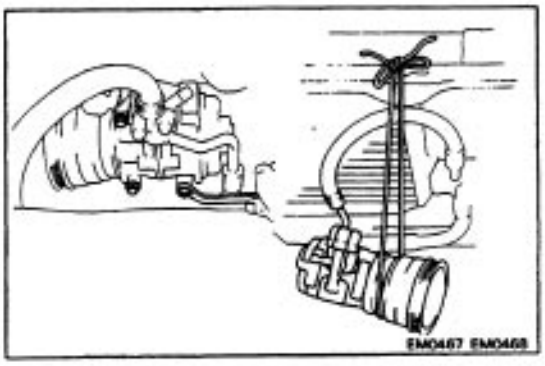


11. (M/T)

REMOVE CLUTCH RELEASE CYLINDER AND TUBE BRACKET WITHOUT DISCONNECTING TUBE

12. DISCONNECT SPEEDOMETER CABLE

13. DISCONNECT TRANSAXLE CONTROL CABLES



14. (w/ A/C)

REMOVE A/C COMPRESSOR WITHOUT DISCONNECTING HOSES

(a) Disconnect the two connectors.

(b) Remove the four compressor bolts.

HINT: Put aside the compressor, and suspend it to the radiator support with a string.

15. DISCONNECT HOSES

(a) Two heater water by–pass hoses

(b) Two fuel hoses

NOTICE: Catch leaking fuel in a container.

(c) Brake booster vacuum hose

(d) A/C control valve vacuum hoses

(e) Charcoal canister vacuum hose

16. DISCONNECT WIRES AND CONNECTORS

(a) Check connector

(b) Ground straps from LH fender apron

(e) Connectors from relay box

(d) Engine room wire connector

17. RAISE VEHICLE

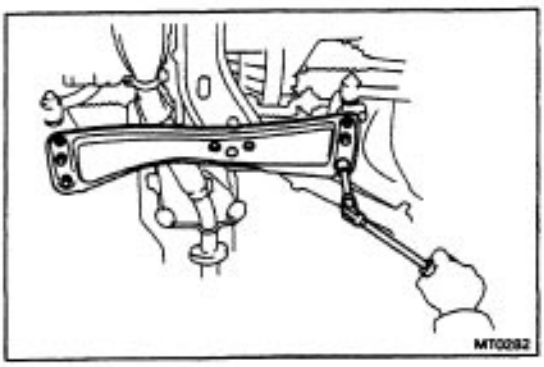
NOTICE: Be sure the vehicle is securely supported.

18. REMOVE ENGINE UNDER COVERS

19. DRAIN ENGINE OIL (See page LU–7)

20. REMOVE SUSPENSION LOWER CROSSMEMBER

Remove the four bolts, two nuts and crossmember.



21. REMOVE DRIVE SHAFTS

22. (4WD) .

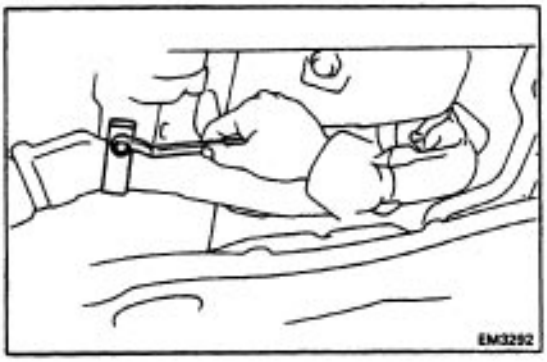
REMOVE PROPELLER SHAFT

23. (4WD)

REMOVE DEFECTOR FROM TRANSFER EXTENSION HOUSING

24. REMOVE PS PUMP WITHOUT DISCONNECTING HOSES

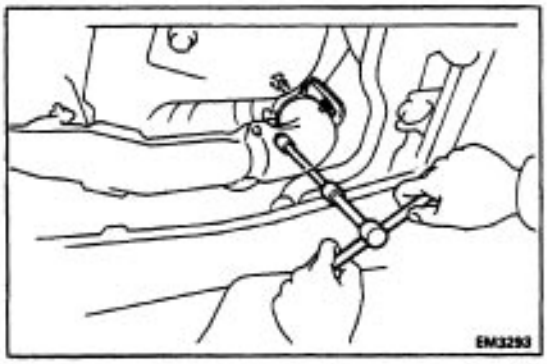
HINT: Put aside the pump and suspend it to the cowl with a string.



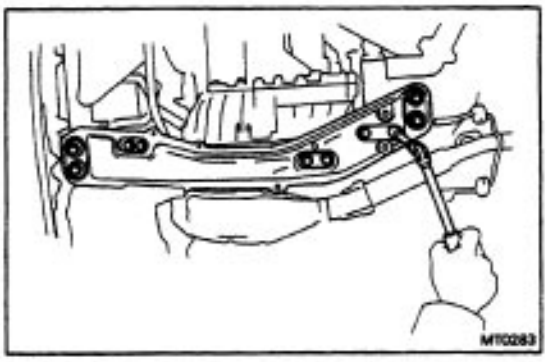
25. REMOVE FRONT EXHAUST PIPE

(a) Loosen the bolt, and disconnect the clamp from the bracket.

(b) Remove the two bolts and nuts, and disconnect the front pipe from the center pipe. Remove the gasket.



(c) Remove the three nuts, front pipe and gasket.



26. REMOVE ENGINE MOUNTING CENTER MEMBER (2WD)

Remove the eight bolts, two nuts and center member.

(4WD)

Remove the eight bolts, two nuts and center member.

27. REMOVE ENGINE FRONT MOUNTING INSULATOR AND BRACKET

28. (2WD)

REMOVE ENGINE CENTER MOUNTING INSULATOR AND BRACKET ASSEMBLY

29. REMOVE ENGINE REAR MOUNTING INSULATOR AND BRACKET

30. LOWER VEHICLE

31. DISCONNECT ENGINE WIRE

(a) Remove the glove compartment box.

(b) Disconnect the following connectors:

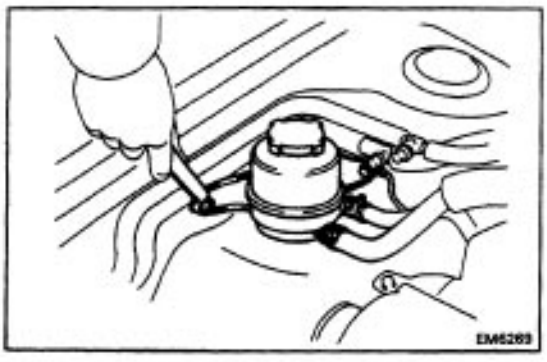
(1) Three TCCS ECU connectors

(2) Circuit opening relay connector

(3) Cowl wire connector

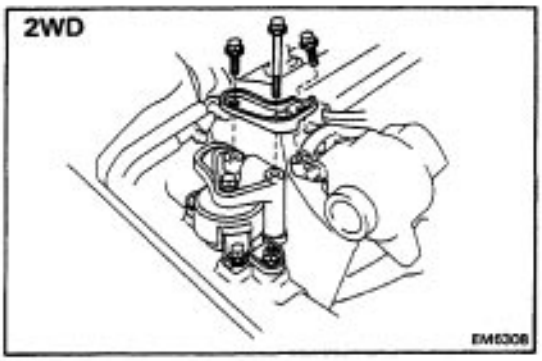
(4) Instrument panel wire connector

(c) Pull out the engine wire from the cowl panel.



32. REMOVE PS OIL RESERVOIR TANK WITHOUT DISCONNECTING HOSES

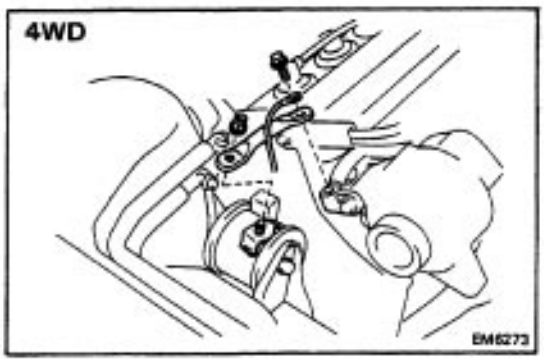
Remove the two bolts.



33. REMOVE RH MOUNTING STAY

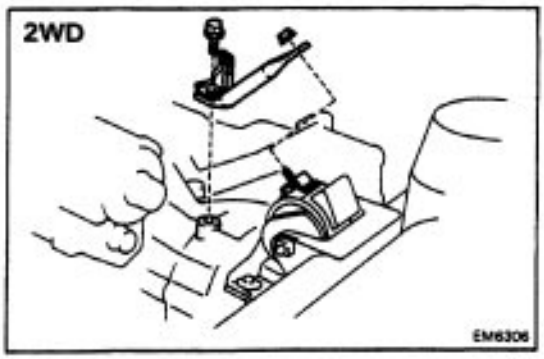
(2WD)

Remove the three bolts and mounting stay.



(4WD)

Remove the bolt, nut, ground strap and mounting stay.

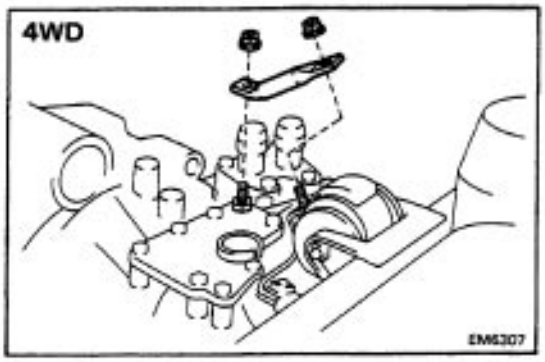


34. (A/T)

REMOVE LH MOUNTING STAY

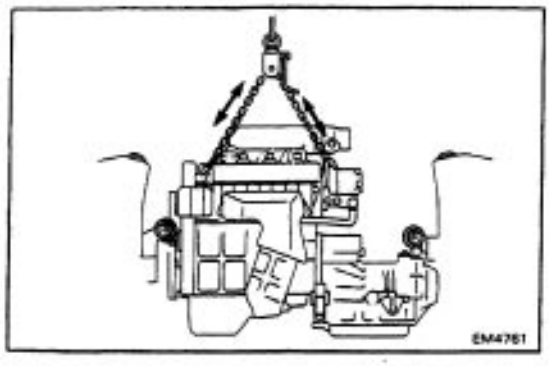
(2WD)

Remove the bolt, nut and mounting stay.



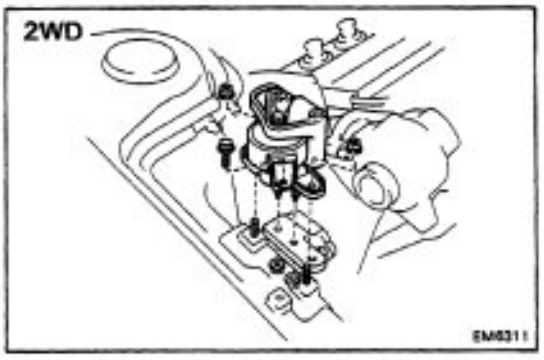
(4WD)

Remove the two nuts and mounting stay.

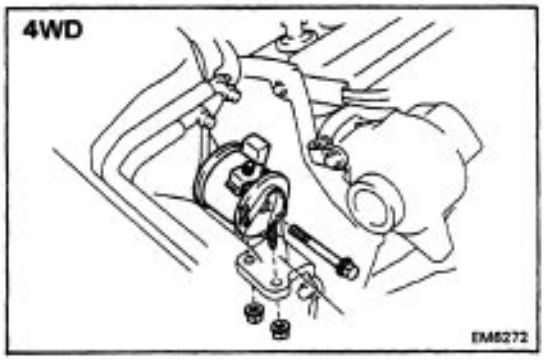


35. REMOVE ENGINE AND TRANSAXLE ASSEMBLY FROM VEHICLE

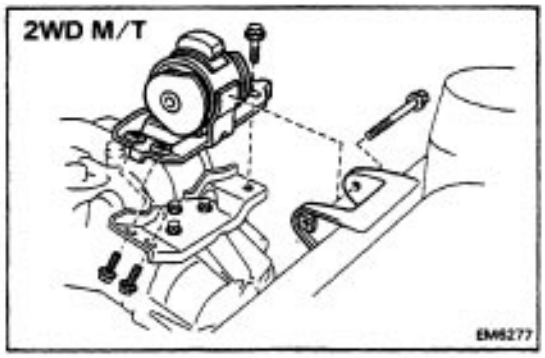
(a) Attach the engine hoist chain to the engine hangers.



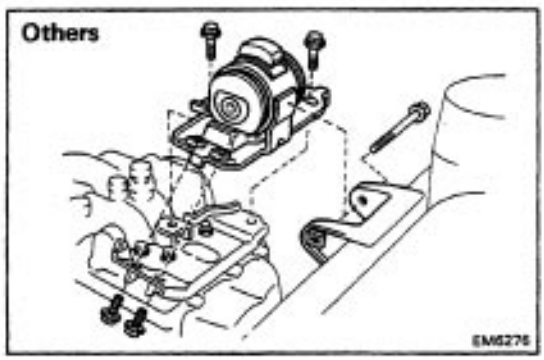
(b) (2WD)
Remove the bolt, four nuts and RH mounting insulator.

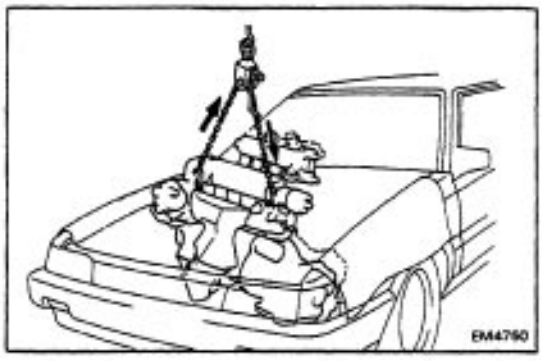


(c) (4WD)
Remove the through bolt, two nuts and RH mounting insulator.



(d) Remove the through bolt, three bolts (2WD, M/T), four bolts (Others) and LH mounting insulator.
(e) Remove the three bolts and LH mounting bracket.



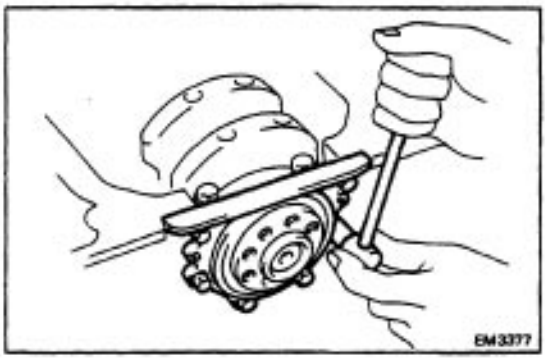


(f) Lift the engine out of the vehicle slowly and carefully.
NOTICE: Be careful not to hit the PS gear housing or neutral start switch.
(g) Make sure the engine is clear of all wiring, hoses and cables.
(h) Place the engine and transaxle assembly onto the stand.

36. SEPARATE ENGINE AND TRANSAXLE

PREPARATION FOR DISASSEMBLY

1. (M /T)
REMOVE CLUTCH COVER AND DISC
2. (M /T)
REMOVE FLYWHEEL
3. 1A/T)
REMOVE DRIVE PLATE
4. REMOVE REAR END PLATE
5. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY
6. REMOVE ALTERNATOR (See page CH–6)
7 REMOVE DISTRIBUTOR (See page IG–13)
8. REMOVE TIMING BELT AND PULLEYS (See page EM–23)
9. REMOVE CYLINDER HEAD (See page EM–48)
10. REMOVE WATER PUMP (See page CO–6)
11. REMOVE OIL PAN AND OIL PUMP (See page LU–9)

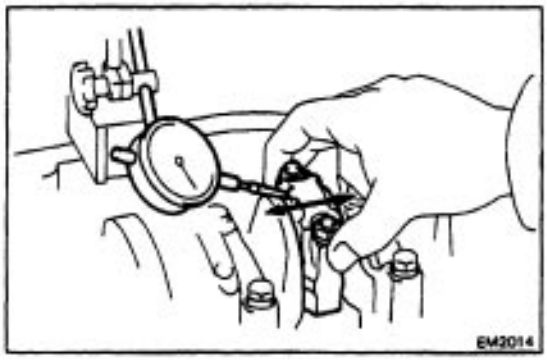


DISASSEMBLY OF CYLINDER BLOCK

(See page EM–107)

1. REMOVE REAR OIL SEAL RETAINER

Remove the six bolts, retainer and gasket.



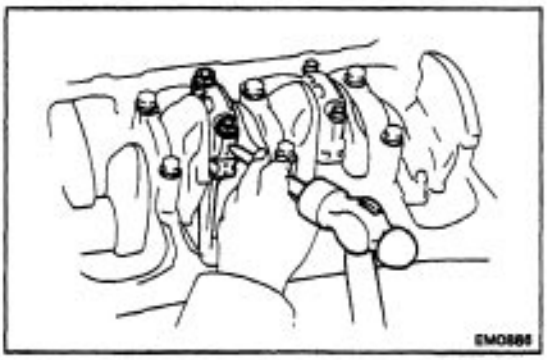
2. CHECK CONNECTING ROD THRUST CLEARANCE

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.)

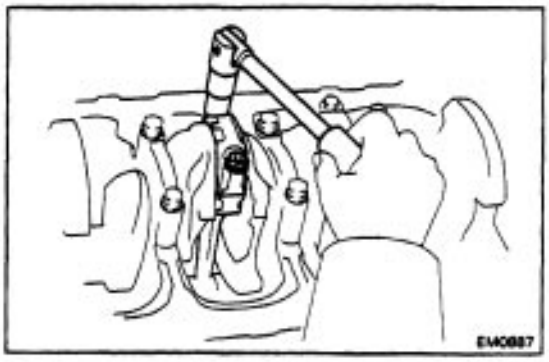
Maximum thrust clearance: 0.35 mm (0.0138 in.)

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

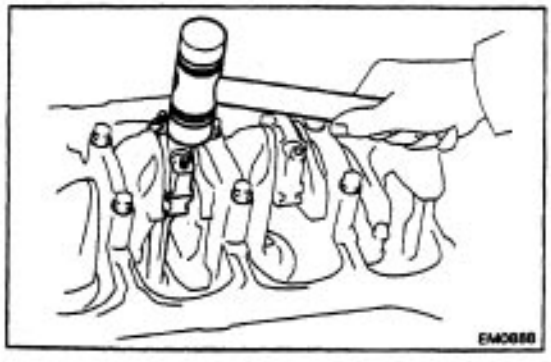


3. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

(a) Using a punch or numbering stamp, place the match–marks on the connecting rod and cap to ensure correct reassembly.

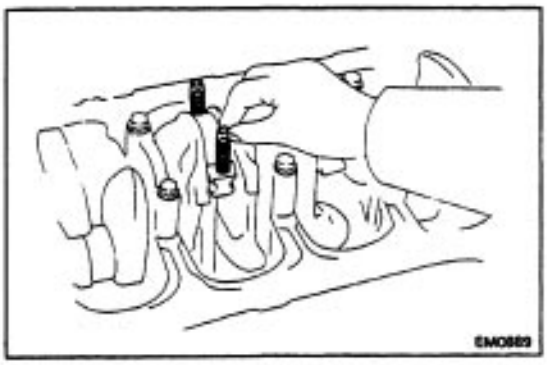


(b) Remove the connecting rod cap nuts.

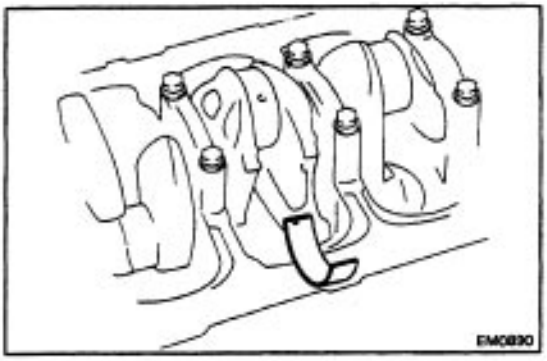


(c) Using a plastic–faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

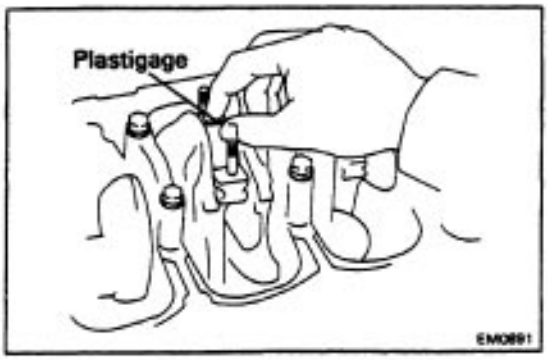
HINT: Keep the lower bearing inserted with the connecting cap.



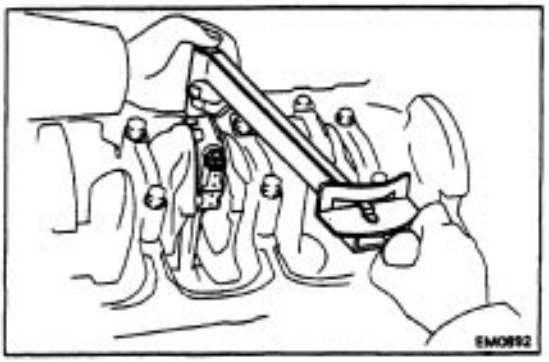
(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



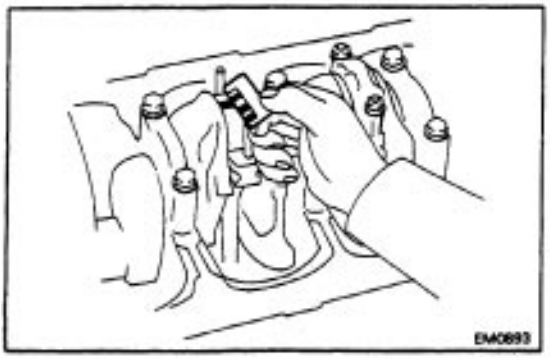
(e) Clean crank pin and bearing.
(f) Check the crank pin and bearing for pitting and scratches.
If the crank pin or bearing are damaged, replace the bearings.
If necessary, replace the crankshaft.



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



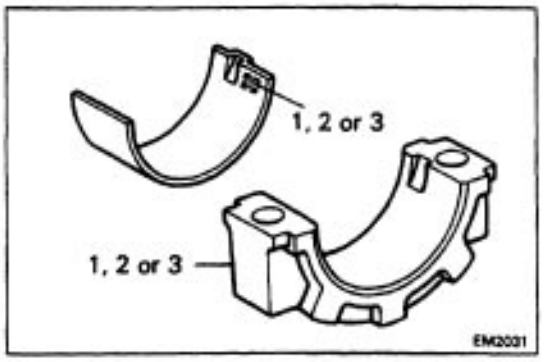
(h) Install the connecting rod cap.
(See step 6 on page EM–129)
Torque: 500 kg–cm (36 ft–lb. 49 N–m)
HINT: Do not turn the crankshaft.



(i) Remove the connecting rod cap.
(j) Measure the Plastigage at widest point.
Standard oil clearance:

STD	**0.024 – 0.055 mm (0.0009 – 0.0022 in.)**
U/S	**0.25 0.023 – 0.069 mm (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, replace the crankshaft.



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

(Reference)

Standard sized bearing thickness (at center wall):

Mark "1 "	**1.484 – 1.488 mm (0.0584 – 0.0586 in.)**
Mark "2"	**1.488 – 1.492 :N» (0.0586 – 0.0587 in.)**
Mark "3"	**1.492 – 1.496 mm (0.0587 – 0.0589 in.)**

(k) Completely remove the Plastigage.

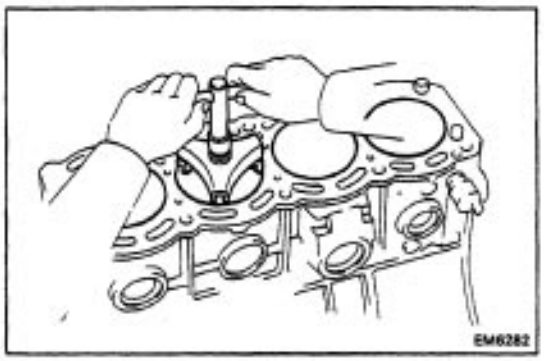
4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

(a) Remove the ail carbon from the piston ring ridge.

(b) Cover the connecting rod bolts.

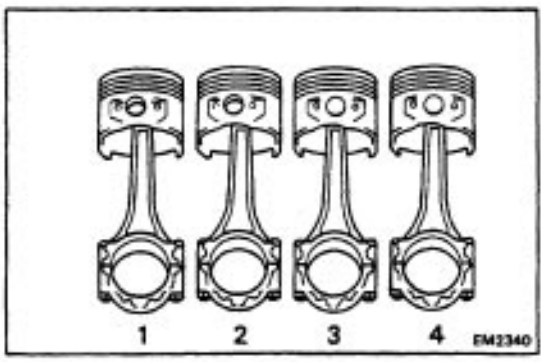
(See page EM–115)

(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.

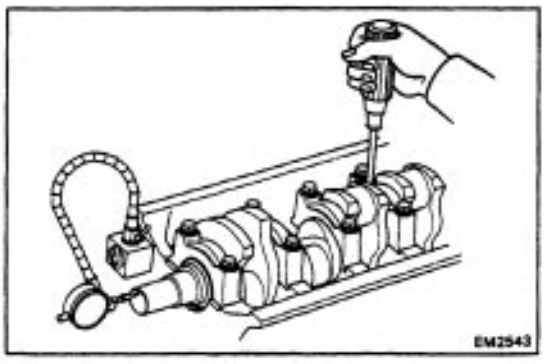
Standard thrust clearance: 0.020 – 0.220 mm (0.0008 – 0.0087 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

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

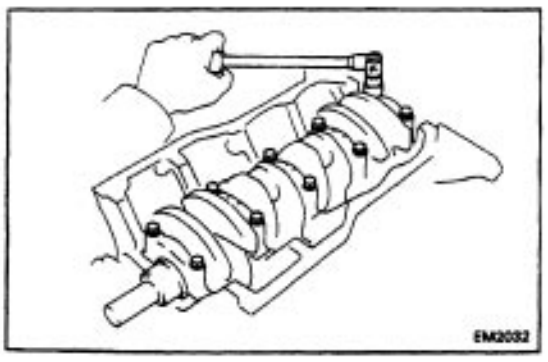
Thrust washer thickness (STD size only):

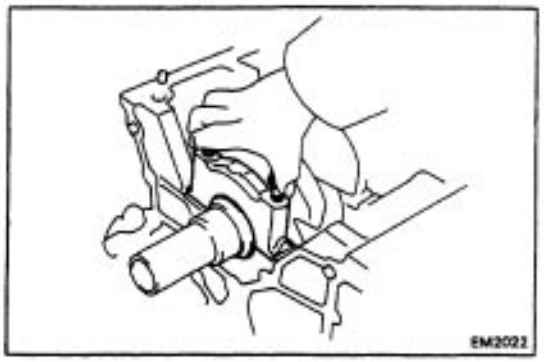
2.440 – 2.490 mm (0.0961 – 0.0980 in.)



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:

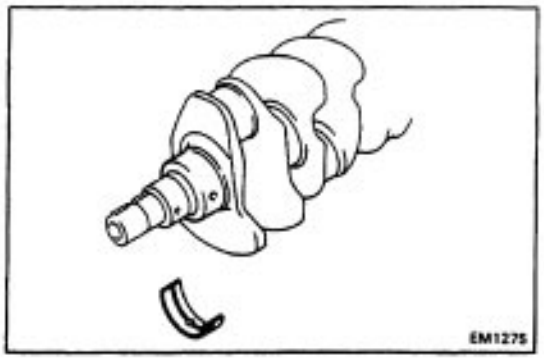
- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in correct order.

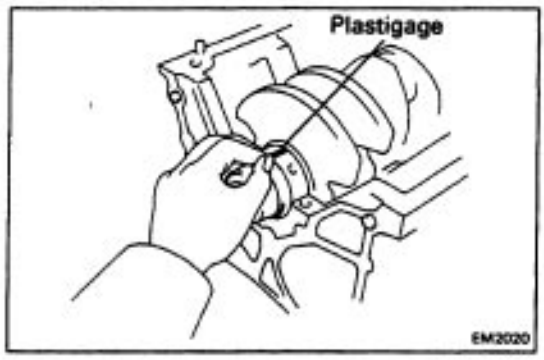
(c) Lift out the crankshaft.

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, replace the crankshaft.





(f) Place the crankshaft on the cylinder block.
Lay a strip of Plastigage across each journal.

(h) Install the main bearing caps.
(See step 4 on page EM–128)
Torque: 600 kg–cm (43 ft–tb, 59 N–m)

HINT: Do not turn the crankshaft

(i) Remove the main bearing caps.

(j) Measure the Plastigage at its widest point.

Standard oil clearance:

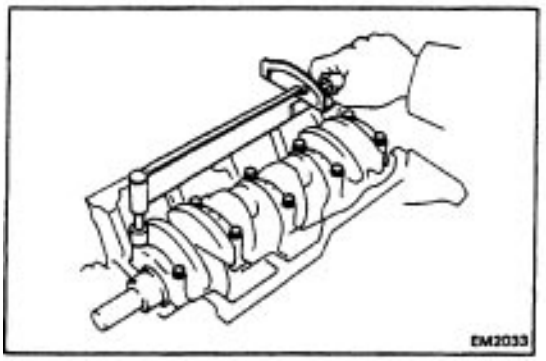
No. 3	**STD**	**0.025 0.044mm (0.0010 .– 0.0017 in.)**
	U /S	**0.25 0.027 – 0.067 mm (0. 0011 – 0. 0026 in.)**
Others	**STD**	**0.015 0.034 mm (0.0006 – 0.0013 in.)**
	U/S	**0.25 0. 019 – 0.059 mm (0.0007 0.0023 in.)**

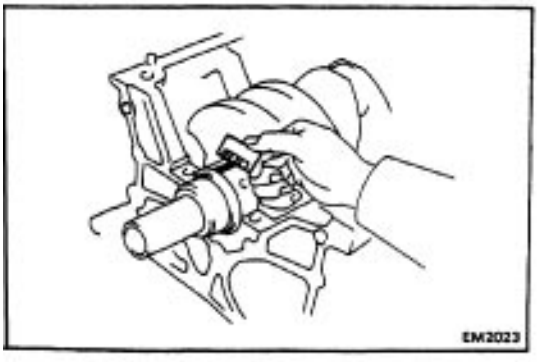
Maximum oil clearance: 0.08 mm (0.0031 in.)

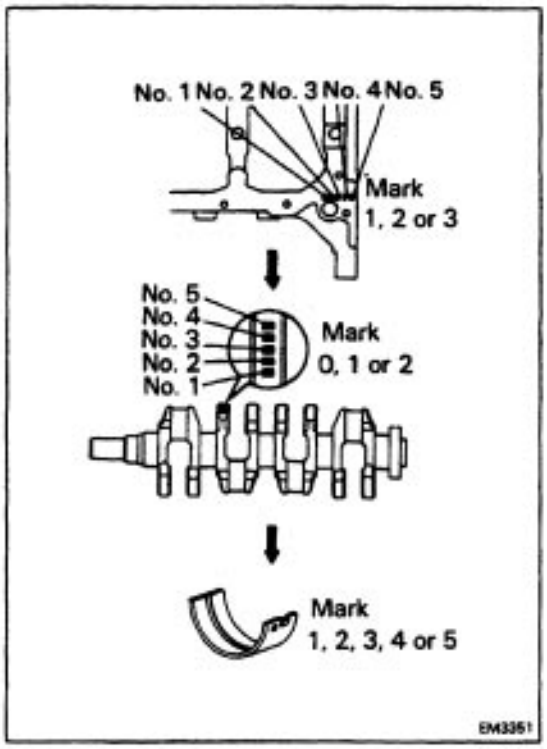
HINT: If replacing the cylinder block subassembly, the bearing standard clearance will be:

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, replace the crankshaft.







HINT: If using a standard bearing, replace with one having the same number. If the number of the bearing de determined, select a bearing from the table below according to the numbers imprinted on the cylinder block and crankshaft. There are five sizes of standard bearings, marked “1,” “2,” “3,” “4,” and “5.”

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

EXAMPLE: Cylinder block ”2” + Crankshaft ”1” = Bearing ”3”

(Reference)

Cylinder block main journal bore diameter:

Mark ”1 ” 59.020 – 59.026 mm (2.3236 – 2.3239 in.)

Mark ”2” 59.026 – 29.032 mm (2.3239 – 2.3241 in.)

Mark ”3” 59.032 – 59.038 mm (2.3241 – 2.3243 in.)

Crankshaft journal diameter:

Mark ”0” 54.998 – 55.003 mm (2.1653 – 2.1655 in.)

Mark ”1” 54.993 – 54.998 mm (2.1651 – 2.1653 in.)

Mark ”2” 54.988 – 54.993 mm (2.1649 – 2.1651 in.)

Standard sized bearing thickness tat center wall):

No. 3 Mark ”1 ” 1.992 – 1.995 mm (0.0784 – 0.0785 in.)

Mark ”2” 1.995 – 1.998 mm (0.0785 – 0.0787 in.)

Mark ”3” 1.998 – 2.001 mm (0.0787 – 0.0788 in.)

Mark ”4” 2.00 1 – 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.)

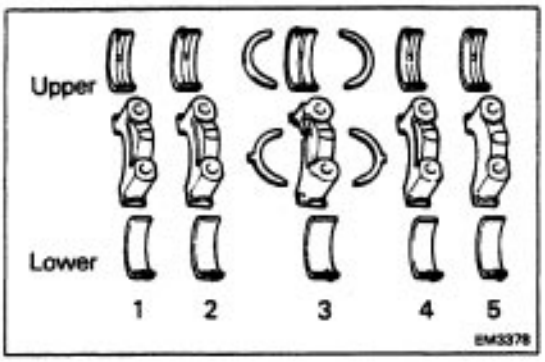
Mark ”2’ 2.000 – 2.003 mm (0.0787 – 0.0789 in.)

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.

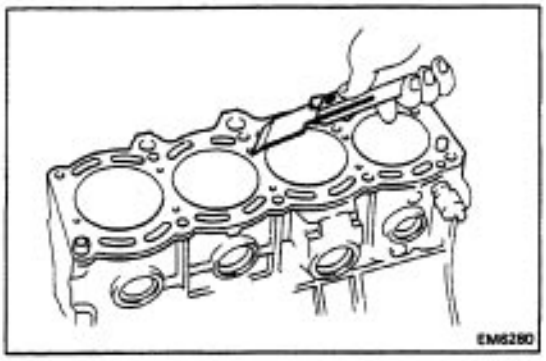


7. REMOVE CRANKSHAFT

(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. .



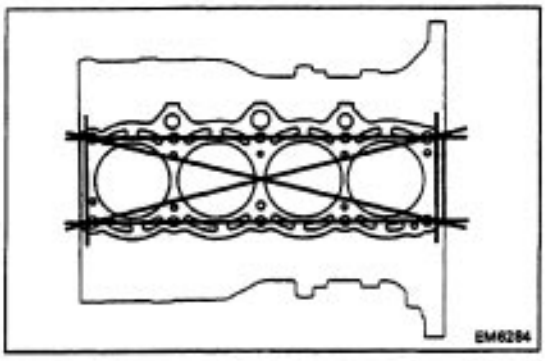
INSPECTION OF CYLINDER BLOCK

1. REMOVE GASKET MATERIAL

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

2. CLEAN CYLINDER BLOCK

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

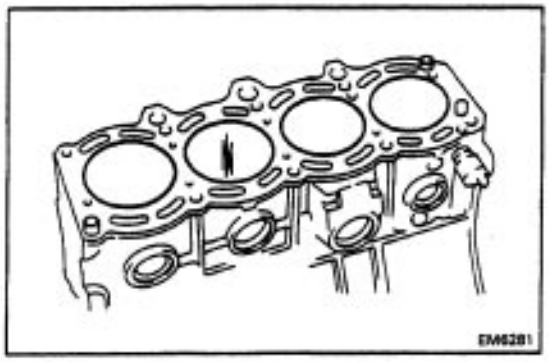


3. INSPECT TOP OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage: 0.05 mm (0.0020 in.)

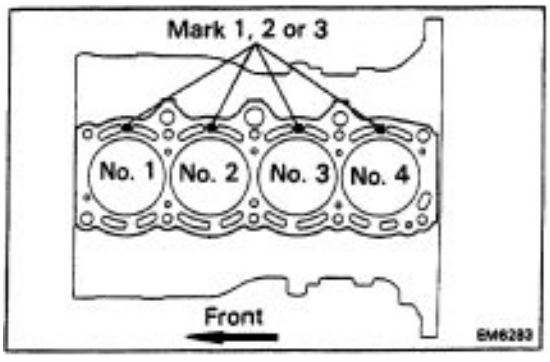
if warpage is greater than maximum, replace the cylinder block.



4. INSPECT CYLINDER FOR VERTICAL SCRATCHES

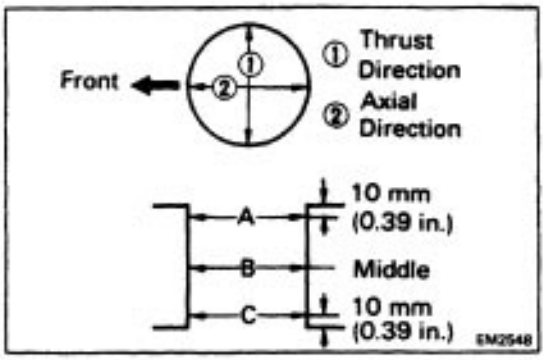
Visually check the cylinder for vertical scratches.

If deep scratches are present, replace the cylinder block.



5. INSPECT CYLINDER BORE DIAMETER

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



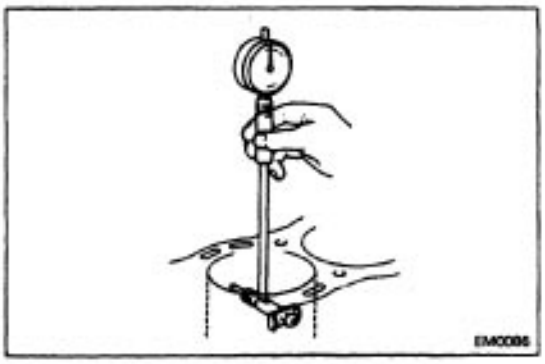
Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust axial directions.

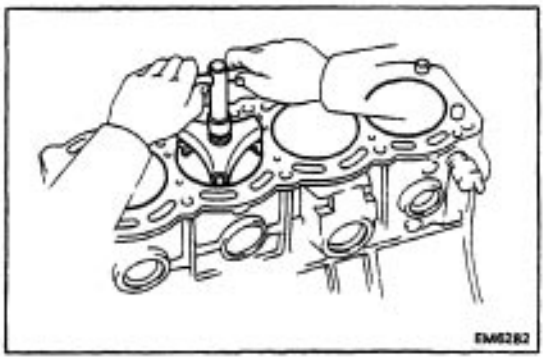
Standard diameter:

Mark ”1 ”	**86.000 – 86.010 mm (3.3858 – 3.3862 in.)**
Mark ”2”	**86.010 86.020 mm (3.3862 – 3.3866 in.)**
Mark ”3”	**86.020 – 86.030 mm (3.3866 3.3870 in.)**

Maximum diameter: 86.23 mm (3.3949 in.)

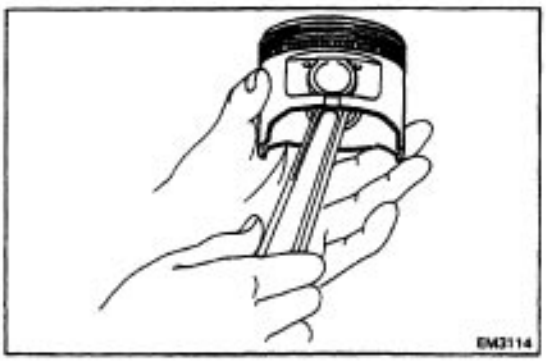
If the diameter is greater than maximum, replace the cylinder block.





6. REMOVE CYLINDER RIDGE

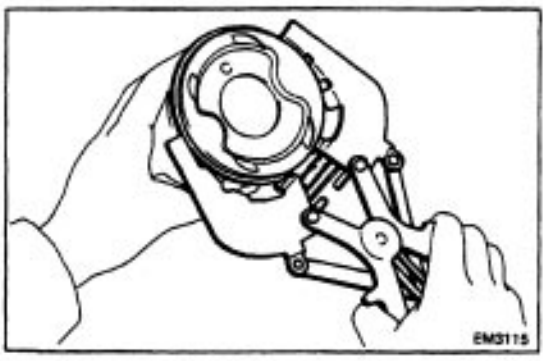
If the wear is less than 0.2 mm (0.008 in.), use a ridge reamer to machine the piston ring ridge at the top of the cylinder.



DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

1. CHECK FIT BETWEEN PISTON AND PISTON PIN

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

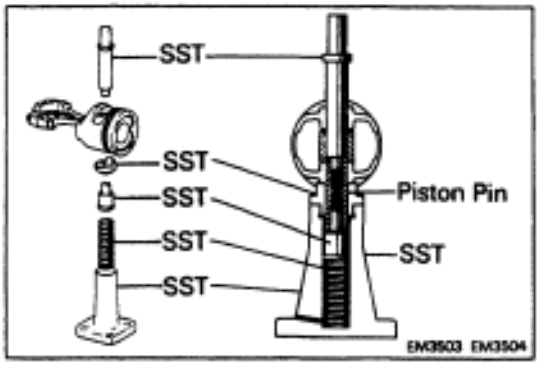


2. REMOVE PISTON RINGS

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

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

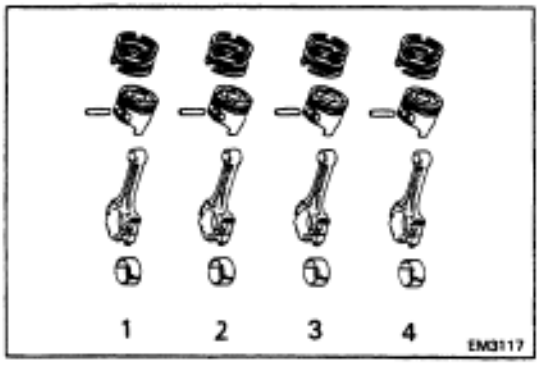
HINT: Arrange the rings in correct order only.



3. DISCONNECT CONNECTING ROD FROM PISTON

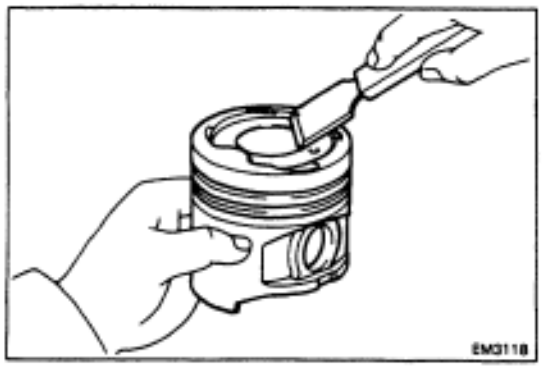
Using SST, press out the piston pin from the piston.

SST 09221–25024 (09221–00020,09221–00030, 09221–00060,09221–00160,09221–00170)



HINT:

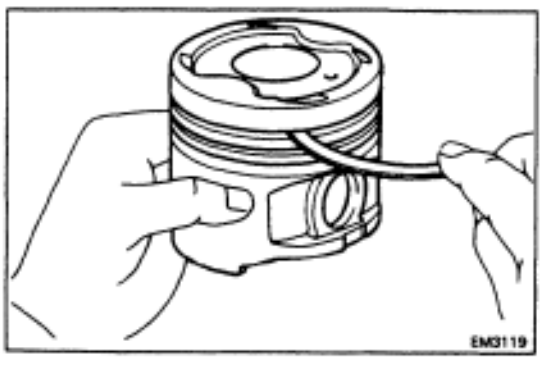
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in correct order.



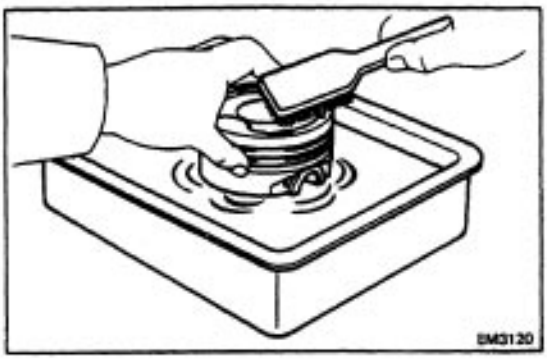
INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLIES

1. CLEAN PISTON

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

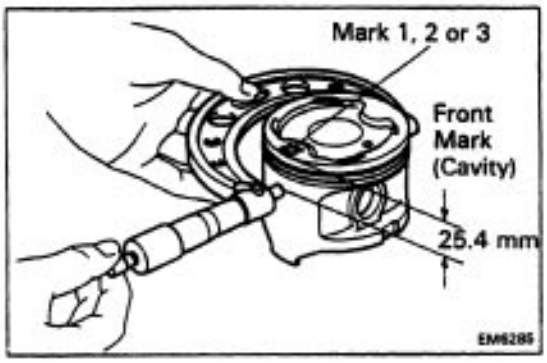


(b) Using a groove cleaning broken ring, clean the piston ring grooves.



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

NOTICE: Do not use a wire brush.



2. INSPECT PISTON DIAMETER AND OIL CLEARANCE

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

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 25.4 mm 1.000 in.) from the piston head.

Piston diameter Mark ”1” 85.945 – 85.955 mm (3.3836 – 3.3840 in.)
Mark ”2” 85.955 – 85.965 mm (3.3840 – 3.3844 in.)
Mark ”3” 85.965 – 85.975 mm (3.3844 3.3848 in.)

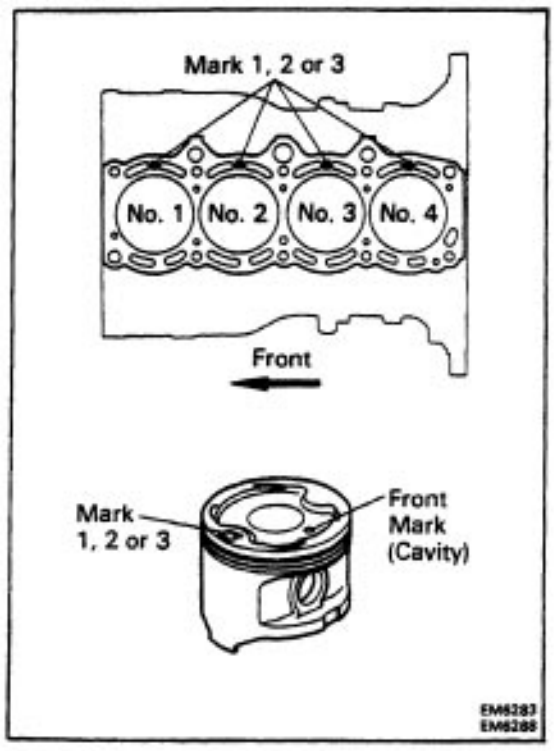
(b) Measure the cylinder bore diameter in the thrust directions.
(See step 5 on page EM–118)

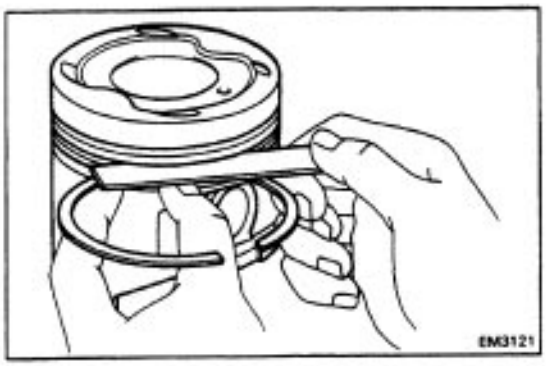
(e) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance: 0.045 – 0.065 mm (0.0018 – 0.0026 in.)
Maximum oil clearance: 0.085 mm (0.0033 in.)

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

HINT: (Use cylinder block subassembly): When installing a standard piston, install one with the same number mark as the standard bore diameter mark on the cylinder block.



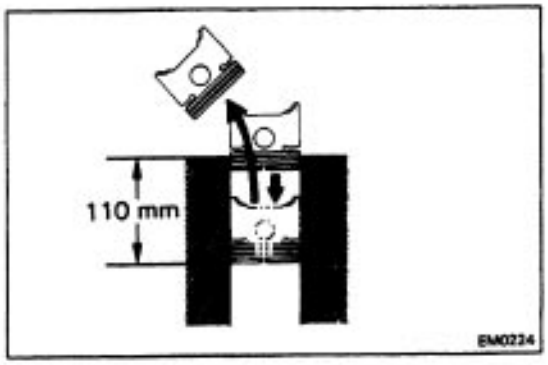


3. INSPECT CLEARANCE BETWEEN WALL OF RING GROOVE AND NEW PISTON RING

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

Ring groove clearance: 0.030 – 0.070 mm (0.0012 – 0.0028 in.)

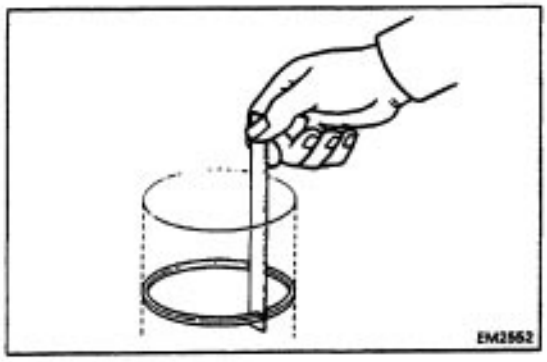
If the clearance is greater than maximum, replace the piston.



4. INSPECT PISTON RING END GAP

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

(b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 114 mm (4:33 in.) from the top of the cylinder block.



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

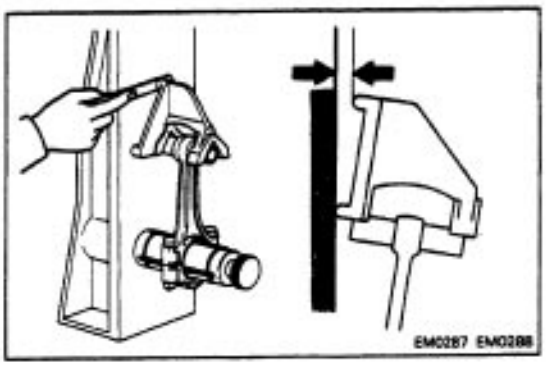
Standard end gap:

No–1	**0.270 – 0.500 mm (0.0106 – 0.0197 in.)**
No. 2	**0.270 – 0.510 m m (0.0106 – 0.0201 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	**1.11 mm (0.0437 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, replace the cylinder block.



5. INSPECT CONNECTING ROD

Using a rod aligner, check the connecting rod alignment.

- Check for bending.

Maximum bending:

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

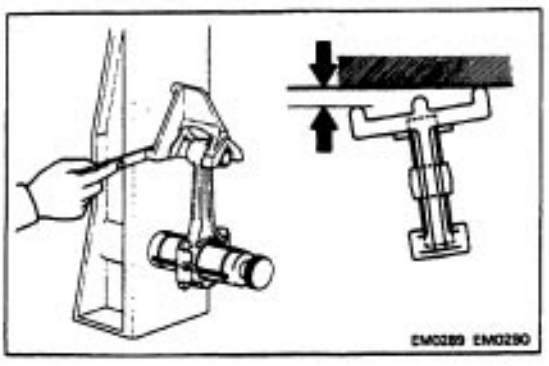
If bent is greater than maximum, replace the connecting rod assembly.

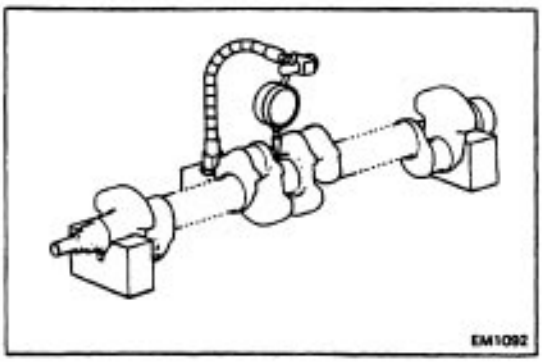
- Check for twist.

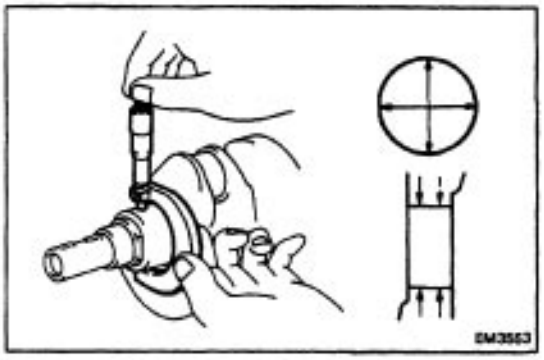
Maximum twist:

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

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







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 size 54.988 – 55.003 mm (2.1649 – 2.1655 in.)

U/S 0.25 54.745 – 54.755 mm (2.1553 – 2.1557 in.)

Crank pin diameter:

STD size 47.985 – 48.000 mm (1.8892 –1. 8898 in.)

U/S 0.25 47.745 – 47.755 mm» (1.8797 – 1.8801 in.)

If the diameter is not as specified, check the oil clearance (See pages EM–114 to 117).

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

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

If the taper and out–of–round is greater than maximum, grind or replace the crankshaft.

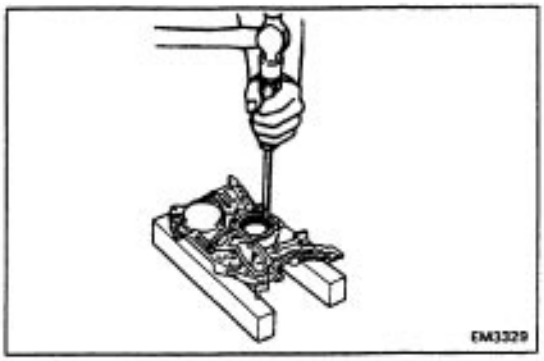
3. IF NECESSARY, GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS

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

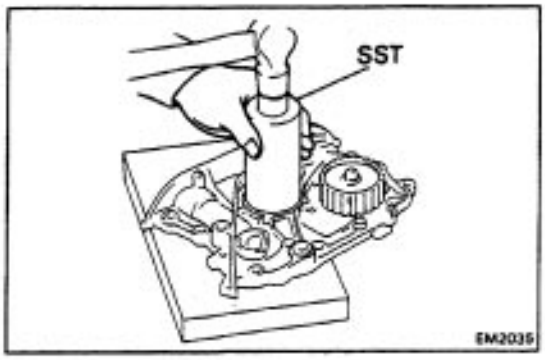
HINT: There are two methods (A and B) to replace the oil seal as follows:



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

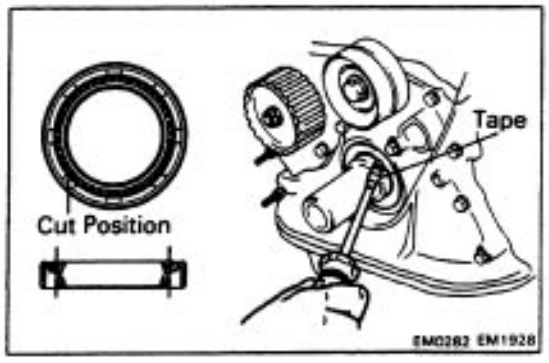
(c) Apply MP grease to the oil seal lip.

B. If oil pump is installed to the cylinder block:

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

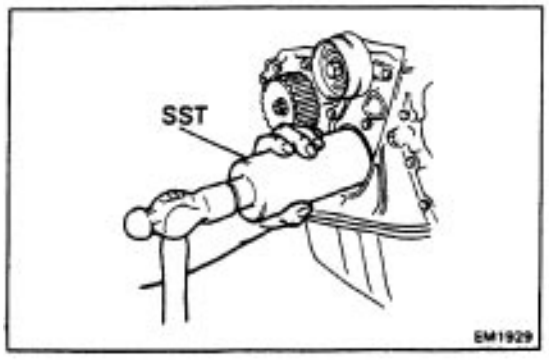
(b) Using a screwdriver, pry out the oil seal.

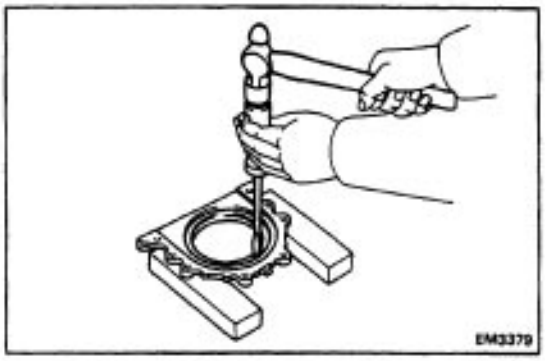
CAUTION: Be careful not to damage the crankshaft. Tape the screwdriver tip.



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

(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump case edge.
SST 09226–10010

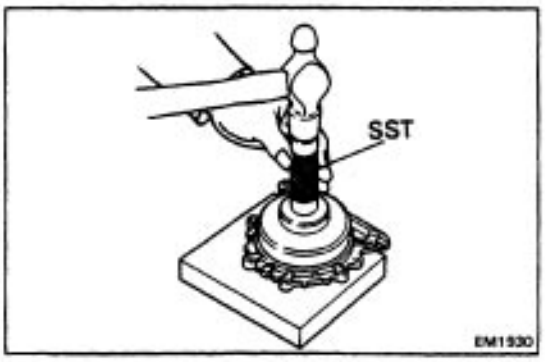




2. REPLACE CRANKSHAFT REAR OIL SEAL

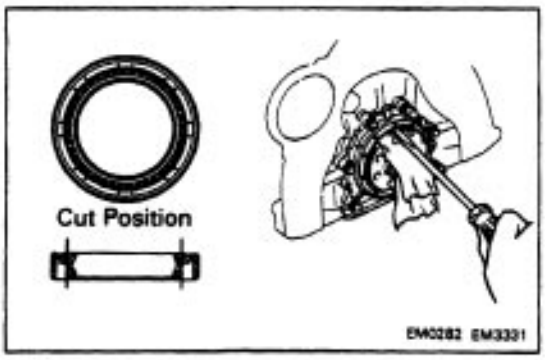
A. If rear oil seal retainer is removed from cylinder block:

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



(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal edge.
SST 09223–63010

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

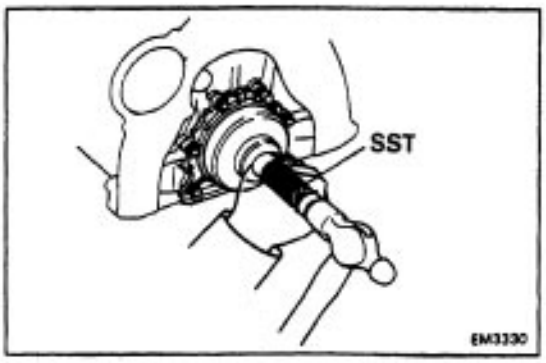


B. If near oil seal retainer is installed to cylinder block:

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

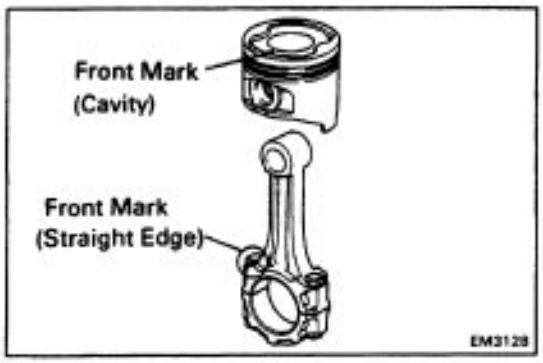
(b) Using a screwdriver, pry out the oil seat.

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



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

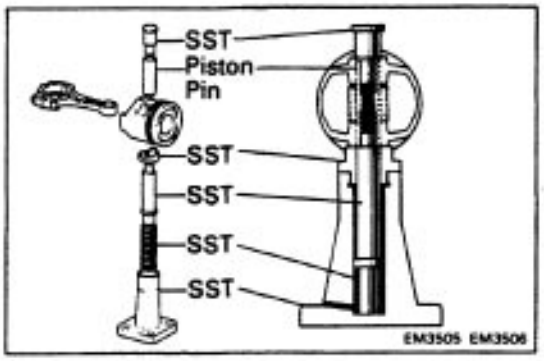
(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223–63010



ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

1. ASSEMBLE PISTON AND CONNECTING ROD

(a) Align the front marks of the piston and connecting rod.



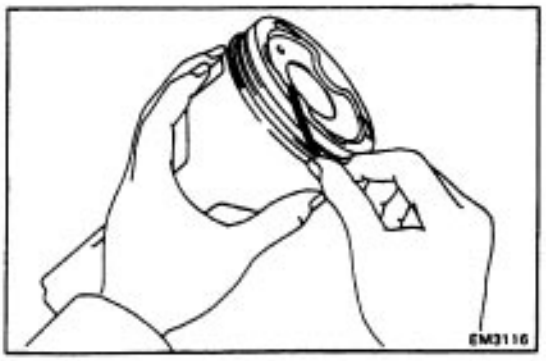
(b) Coat the piston pin and piston hole of the piston with engine oil.

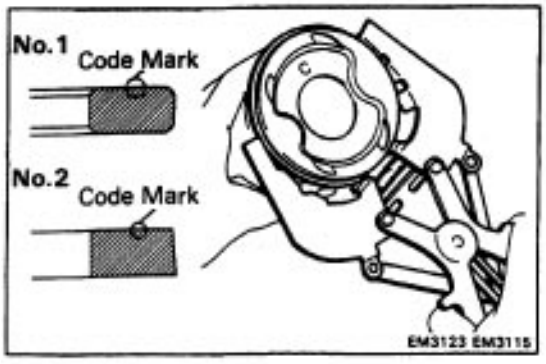
(c) Using SST, press in the piston pin.
SST 09221–25024 (09221–00020,09221–00030, 09221–00060,09221–00160,09221–00170)

(d) Check that the piston smoothly moves back and forth on the piston pin.

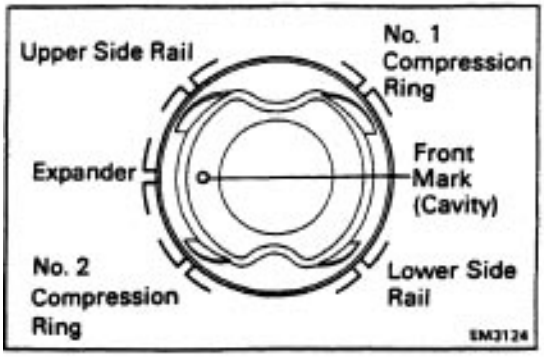
2. INSTALL PISTON RINGS

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

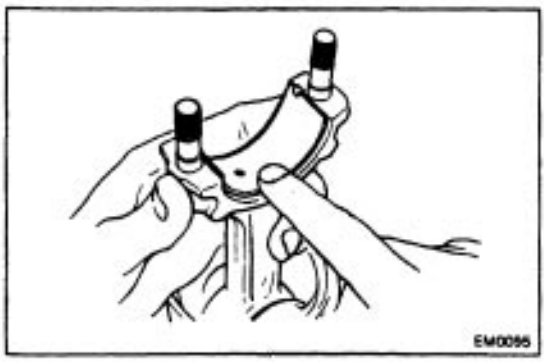




(b) Using a piston ring expander, install the two compression rings with the code mark facing upward.
Code mark: No. 11T or 1N
No. 2 2T or 2N



(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.

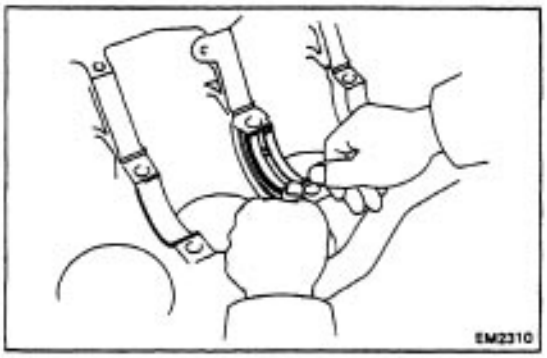
NOTICE: Install the bearing with the oil hole in the connecting rod.

ASSEMBLY OF CYLINDER BLOCK

(See page EM–107)

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 pants.

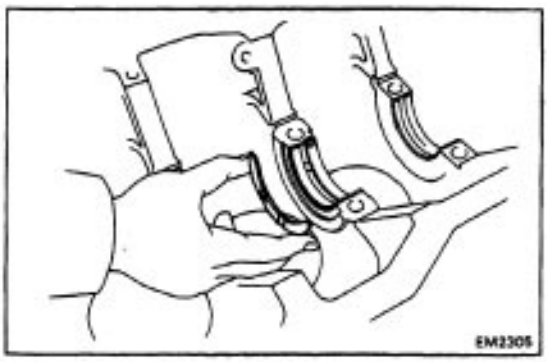


1. INSTALL MAIN BEARINGS

(a) Align the bearing claw with the claw groove of the main bearing cap or cylinder block.

(b) Install the bearings in the cylinder block and main bearing caps.

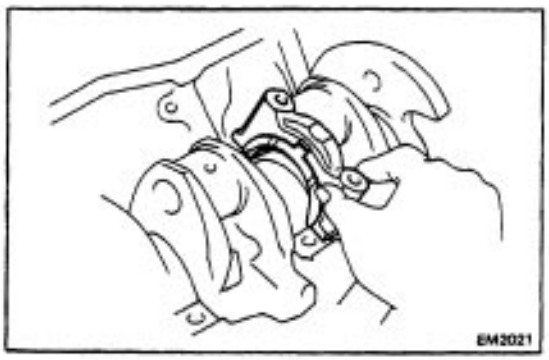
NOTICE: Install the bearing with the oil hole in the cylinder block.



2. INSTALL UPPER THRUST WASHERS

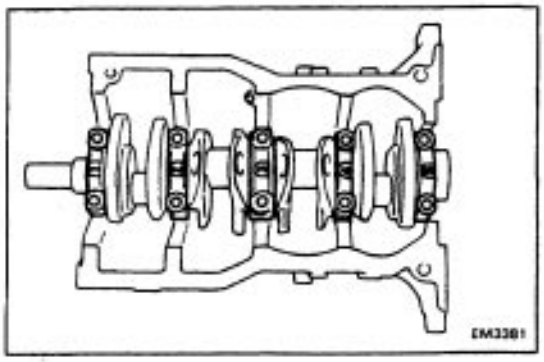
Install the thrust washers under the No. 3 main bearing cap position of the block with the oil grooves facing outward.

3. PLACE CRANKSHAFT ON CYLINDER BLOCK

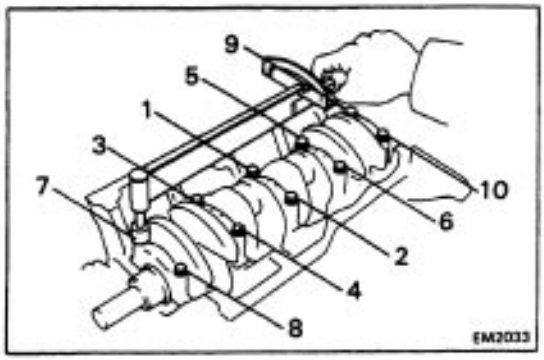


4. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

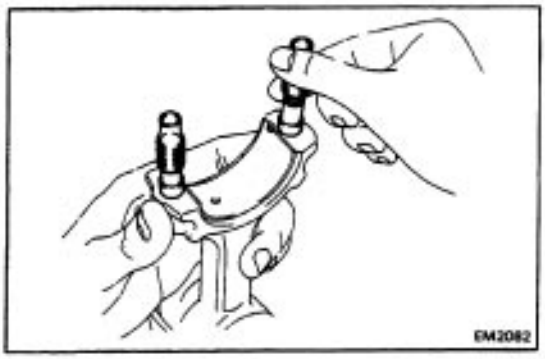
(a) Install the thrust washers on the No. 3 bearing cap with the grooves facing outward.



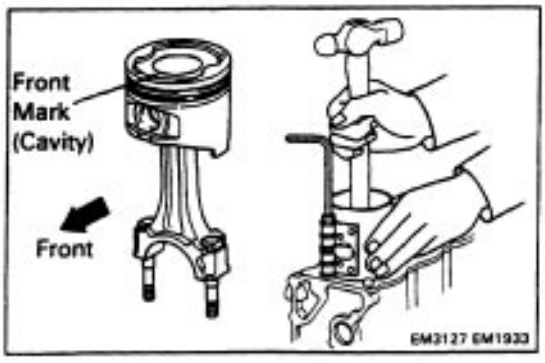
(b) Install the main bearing caps in their proper location.
HINT: Each bearing cap has a number and front mark.



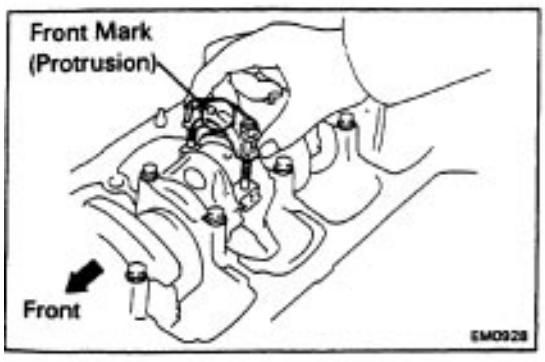
(c) Apply alight coat of engine oil on the threads and under the heads of the main bearing caps.
(d) Install and uniformly tighten the ten bolts of the main bearing caps in several passes in the sequence shown.
Torque: 600 kg–cm (43 ft–ib, 59 N–m)
(e) Check that the crankshaft turns smoothly.
(f) Check the crankshaft thrust clearance.
(See step 5 –on page EM–116)



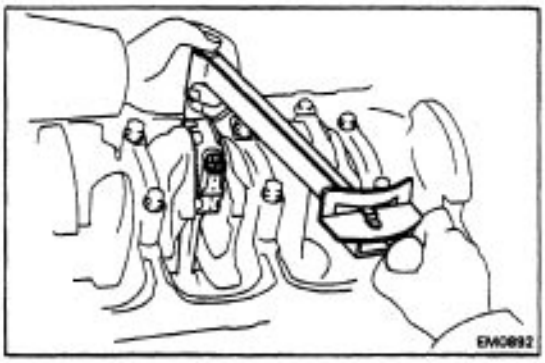
5. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES
(a) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



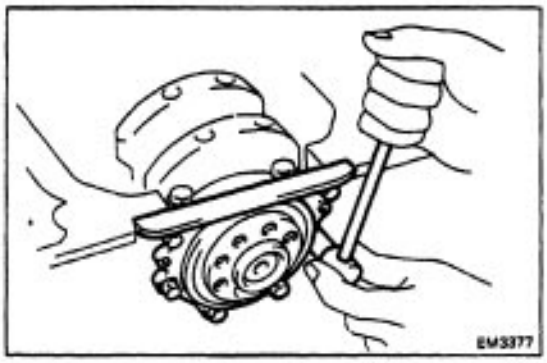
(b) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.



6. INSTALL CONNECTING ROD CAPS
(a) Match the numbered connecting rod cap with the connecting rod.
(b) Install the connecting rod cap with the front mark facing forward.



(c) Apply a light of engine oil on the threads and under the nuts of the connecting rod cap.
(d) Install and alternately tighten the nuts of the connecting rod cap in several passes.
Torque: 500 kg–cm (36 ft–lb, 49 N–m)
(e) Check that the crankshaft turns smoothly.
M Check the connecting rod thrust clearance.
(See step 2 on page EM–114)

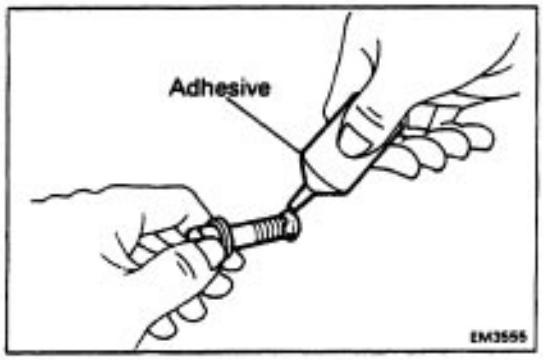


7. INSTALL REAR OIL SEAL RETAINER

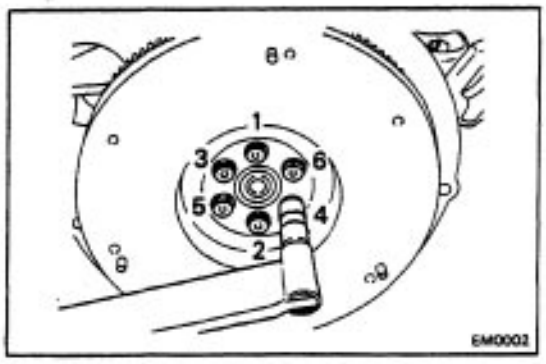
Install a new gasket and the retainer with the six bolts.
Torque: 95 kg–cm (82 in.–lb, 9.3 N–m)

POST ASSEMBLY

1. INSTALL OIL PUMP AND OIL PAN
(See page LU–14)
2. INSTALL WATER PUMP (See page CO–7)
3. INSTALL CYLINDER HEAD (See page EM–67)
4. INSTALL PULLEYS AND TIMING BELT
(See page EM–29)
5. INSTALL ALTERNATOR (See page CH–14)
6. INSTALL DISTRIBUTOR (See page IG–16)
7. REMOVE ENGINE STAND
8. INSTALL REAR END PLATE
Torque: 95 kg–cm (82 ft–lb, 9.3 N–m)

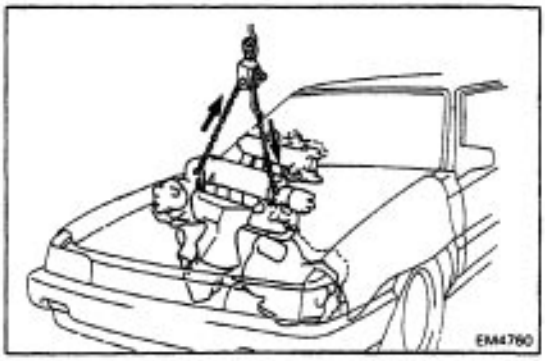


9. (M/T)
INSTALL FLYWHEEL
(a) Apply adhesive to two or three threads of the mount bolt end.
Adhesive: Part No.08833–00070, THREE BOND 1324 or equivalent



(b) Install the flywheel on the crankshaft.
(c) Install and uniformly tighten the mount bolts in several passes in the sequence shown.
Torque: 900 kg–cm (65 ft–lb. 88 N–m)

10. (A/T)
INSTALL DRIVE PLATE
(See procedure step 9)
Torque: 850 kg–cm (61 ft–lb, 83 N–m)
11. (M/T)
INSTALL CLUTCH DISC AND COVER



INSTALLATION VF ENGINE

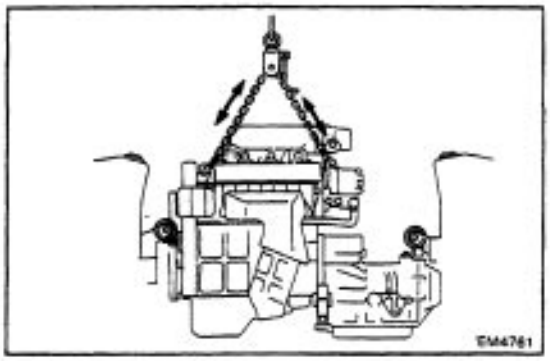
1. ASSEMBLE ENGINE AND TRANSAXLE

2. INSTALL ENGINE AND TRANSAXLE ASSEMBLY IN VEHICLE

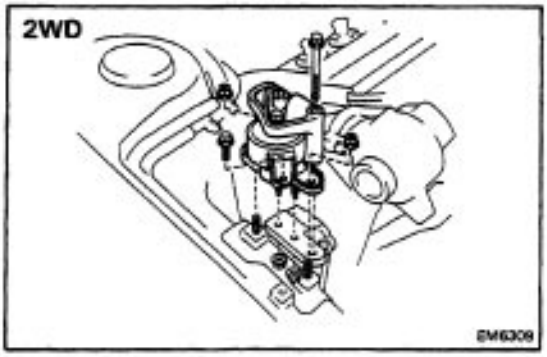
(a) Attach the engine hoist chain to the engine hangers.

(b) Lower the engine into the engine compartment. Tilt the transaxle downward, lower the engine and clear the LH mounting.

NOTICE: Be careful not to hit the PS gear housing or neutral start switch.



(c) Keep the engine level, and align RH and LH mounting with the body bracket.

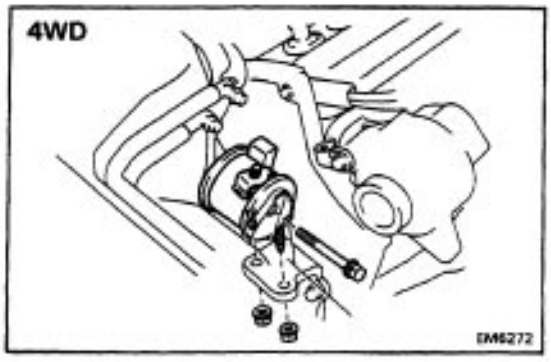


(d) (2WD)

Attach the RH mounting insulator to the mounting bracket and body, and temporarily install the bolt and nut.

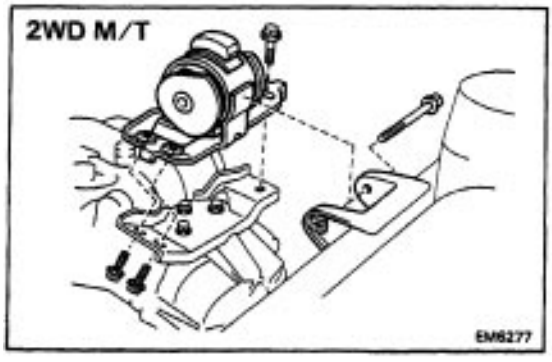
(e) (2WD)

Temporarily install the mounting stay bolt (A).



(f) (4WD)

Attach the RN mounting insulator to the mounting bracket and body, and temporarily install the through bolt and two nuts.



(g) Install the LH mounting bracket to the transaxle case with the three bolts. Torque the bolts.

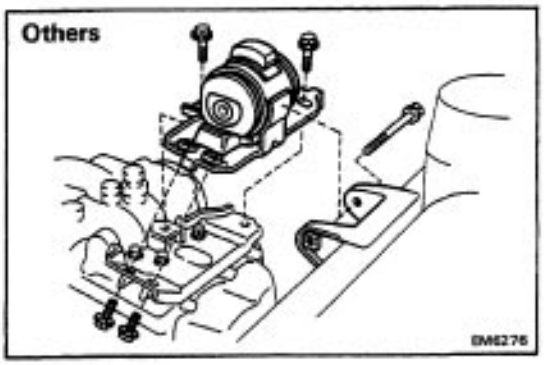
Torque: 530 kg–cm (38 ft–tb, 52 N–m)

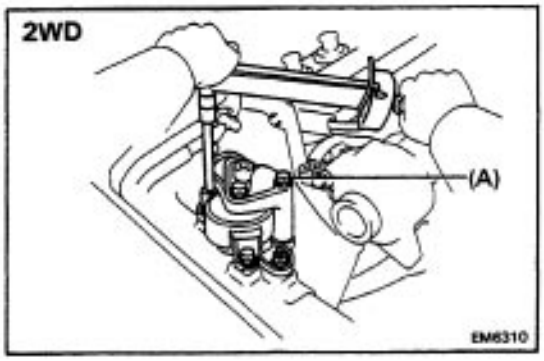
(h) Attach the LH mounting insulator to the mounting bracket and body with the through bolt and three bolts (2WD M/T) or four bolts (Others), and install and torque the bolts.

Torque:

Bolt 530 kg–cm (38 ft–Ib, 52 N–m)

Through bolt 890 kg–cm (64 ft–lb, 87 N–m)





(i) (2WD)

Torque the bolt and four nuts of the RH mounting insulator. Do not torque the bolt (A) yet.

Torque:

Nut To bracket 530 kg–cm (38 ft–lb, 52 N–m)

To body 900 kg–cm (65 ft–lb, 88 N–m)

Bolt 650 kg–cm (47 ft–lb, 64 N–m)

(j) (4WD)

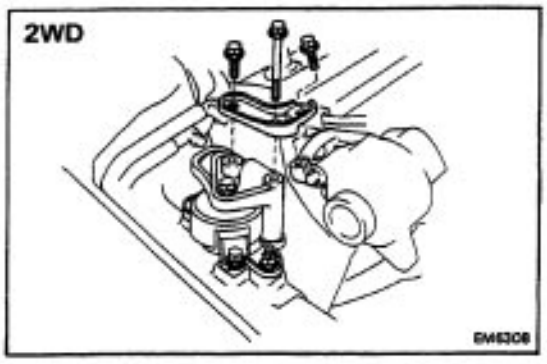
Torque the through bolt and two nuts of the RH mounting insulator.

Torque:

Nut 530 kg–cm (38 ft–lb, 62 N–m)

Through bolt 890 kg–cm (64 ft–lb, 87 N–m)

(k) Remove the engine hoist chain from the engine.

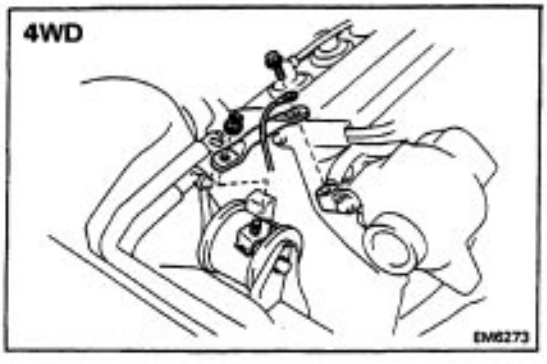


3. INSTALL ENGINE RH MOUNTING STAY

(2WD)

Install the mounting stay with the three botts. Torque the bolts.

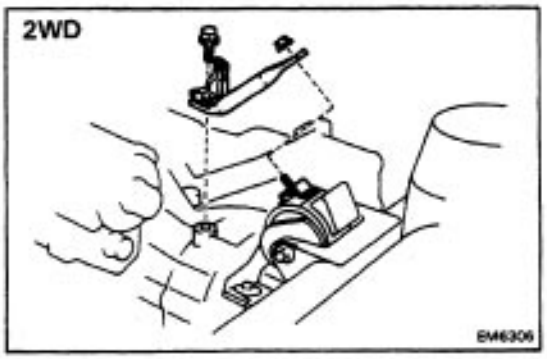
Torque: 740 kg–cm (54 ft–lb, 73 N–m)



(4WD)

Install the mounting stay with the bolt and nut. Torque the bolt and nut.

Torque: 740 kg–cm (54 ft–lb, 73 N–m)

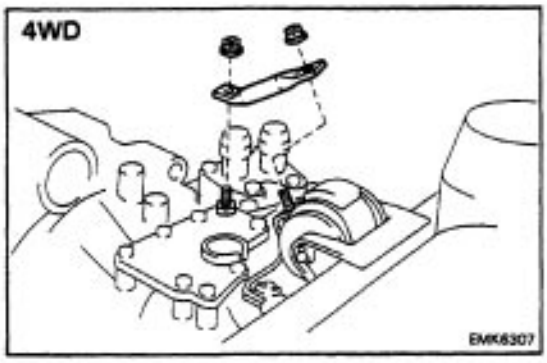


4. (A/T)

INSTALL ENGINE LH MOUNTING STAY (2WD)

Install the mounting stay with the bolt and nut. Torque the bolt and nut.

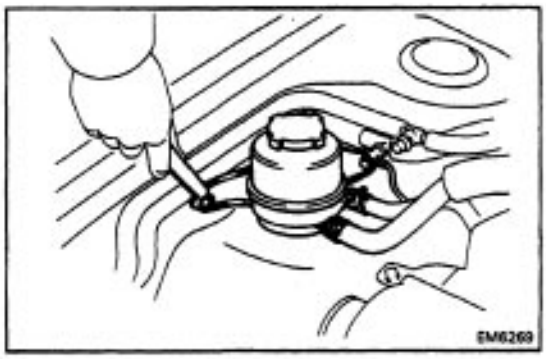
Torque: 210 kg–cm (15 ft–lb, 21 N–m)



(4WD)

Install the mounting stay with the two nuts.

Torque: 210 kg–cm (15 ft–lb. 21 N–m)



5. INSTALL PS OIL RESERVOIR TANK

Install the two bolts.

6. CONNECT ENGINE WIRE

(a) Push in the engine wire through the cowl panel.

(b) Connect the following connectors.

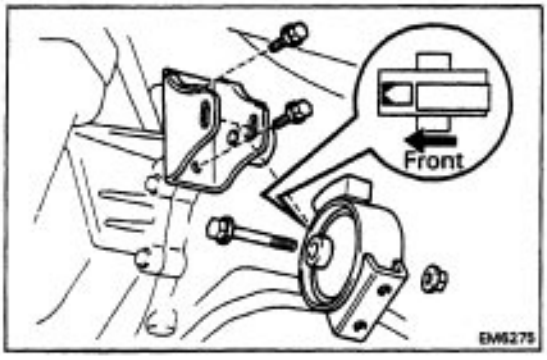
(1) Three TCCS ECU connectors

(2) Circuit opening relay connector

(3) Cowl wire connector

(4) Instrument panel wire connector

(c) Install the glove compartment box.



7. RAISE VEHICLE

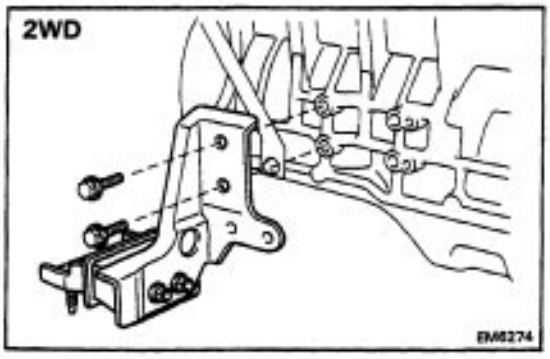
NOTICE: Be sure vehicle is securely supported.

8. INSTALL ENGINE FRONT MOUNTING BRACKET AND INSULATOR

(a) Install the mounting bracket with the two bolts. Torque the bolts.

Torque: 790 kg–cm (57 ft–lb, 77 N–m)

(b) Temporarily install the mounting insulator with the through bolt and nut.

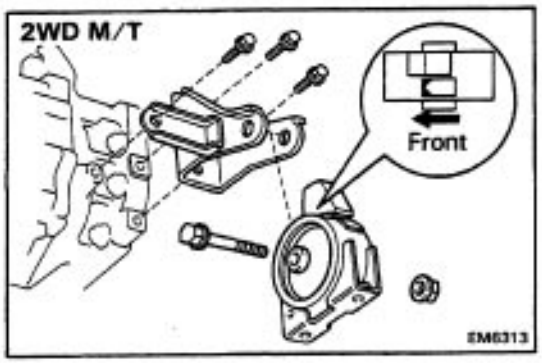


9. (2WD)

INSTALL ENGINE CENTER MOUNTING BRACKET AND INSULATOR ASSEMBLY

Install the mounting bracket and insulator assembly with the two bolts. Torque the bolts.

Torque: 490 kg–cm (35 ft–lb, 48 N–m)

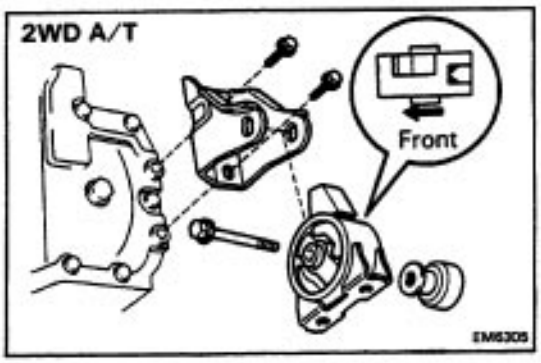


10. INSTALL ENGINE REAR MOUNTING BRACKET AND INSULATOR

(M/T)

(a) Install the mounting bracket with the three bolts. Torque the bolts.
Torque: 790 kg–cm (57 ft–lb, 77 N–m)

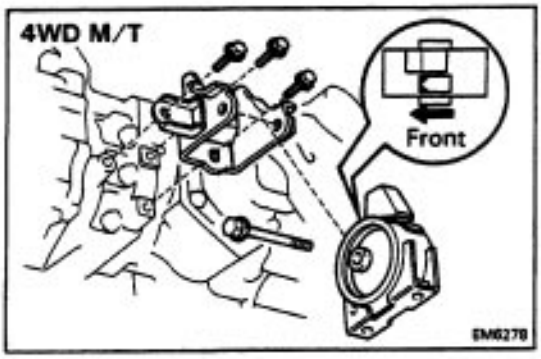
(b) Temporarily install the mounting insulator with the through bolt and nut:



(2WD A/T)

(a) Install the mounting bracket with the two bolts. Torque the bolts.
Torque: 790 kg–cm (57ft–lb, 77 N–m)

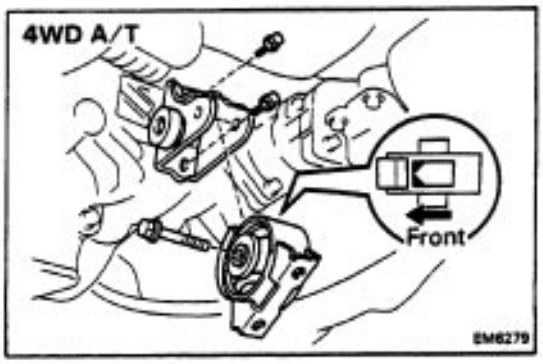
(b) Temporarily install the mounting insulator with the through bolt and nut (damper).



(4WD M/T)

(a) Install the mounting bracket with the three bolts. Torque the bolts.
Torque: 790 kg–cm (57 ft–tb, 77 N–m)

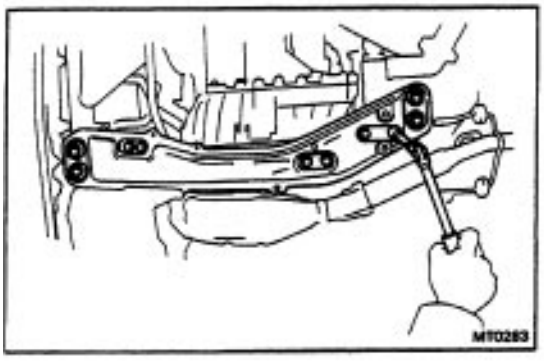
(b) Temporarily install the mounting insulator with the through bolt.



(4WD A/T)

(a) Install the mounting bracket with the two bolts. Torque the bolts.
Torque: 790 kg–cm (57 ft–lb, 77 N–m)

(b) Temporarily install the mounting insulator with the through bolt.

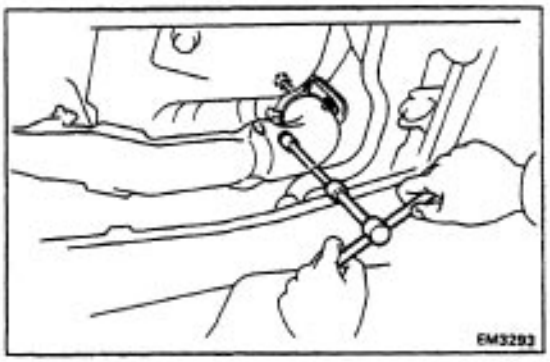


11. INSTALL ENGINE MOUNTING CENTER MEMBER

(a) Install the engine mounting center member with the four bolts. Torque the bolts.
Torque: 400 kg–cm (29 ft–lb, 39 N–m)

(b) Install and torque the four bolts and two nuts (2WD) holding the mounting insulators to the center member.
Torque: Nut 490 kg–cm (35 ft–lb, 48 N–m)
Bolt 740 kg–cm (54 ft–1b, 73 N–m)

(c) Torque the mounting insulator through bolts (front and rear.)
Torque: 890 kg–cm (64 ft–lb, 87 N–m)



12. INSTALL FRONT EXHAUST PIPE

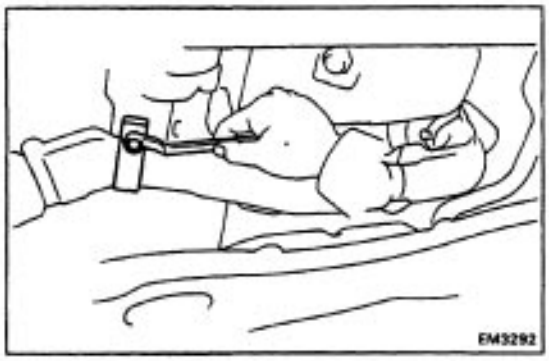
(a) Place two new gaskets on the front and rear of the front pipe.

(b) Install the front pipe with the two bolts and new five nuts. Torque the nuts.

Torque:

To manifold: 830 kg–cm (46ft–lb, 62 N–m)

To converter: 440 kg–cm (32ft–lb, 43 N–m)



(c) Install the clamp with the bolt.

13. INSTALL PS PUMP

14. (4WD)

INSTALL DEFLECTOR TO TRANSFER EXTENSION HOUSING

15. (411VD)

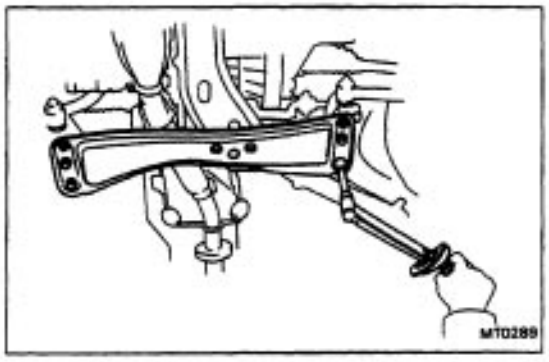
INSTALL PROPELLER SHAFT

16. INSTALL DRIVE SHAFTS

17. INSTALL SUSPENSION LOWER CROSSMEMBER

(a) Install the crossmember with the two bolts and two nuts. Torque the bolts and nuts.

Torque: 2,100 kg–cm (153 ft–lb, 207 N–m)



(b) Install the two bolts holding the crossmember to the center member. Torque the bolts.

Torque: 400 kg–cm (29 ft–lb, 39 N–m)

18. INSTALL ENGINE UNDER COVERS

19. CONNECT WIRES AND CONNECTORS

(a) Check connector

(b) Ground straps from LH fender apron

(c) Connectors from relay box

(d) Engine room wire connector

20. CONNECT HOSES

(a) Two heater water by–pass hoses

(b) Two fuel hoses

(c) Brake booster vacuum hoses

(d) A/C idle–up vacuum hoses

(e) Charcoal canister vacuum hose

21. (w/ A/C)

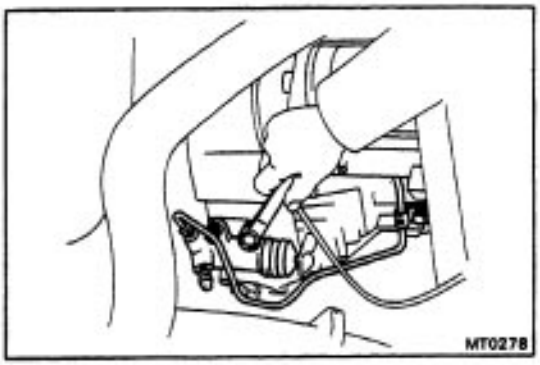
INSTALL A/C COMPRESSOR

(a) Install the compressor with the four bolts.

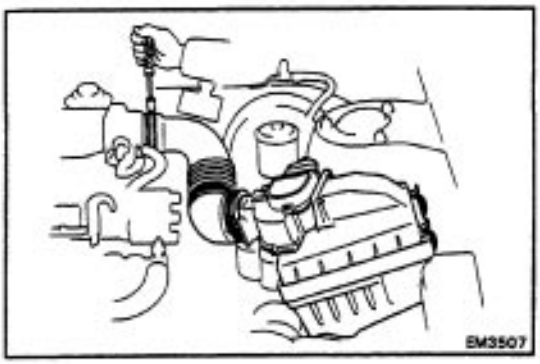
(b) Connect the two connectors.

22. CONNECT TRANSAXLE CONTROL CABLE

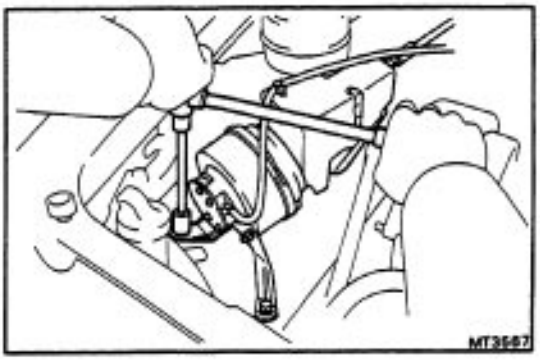
23. CONNECT SPEEDOMETER CABLE



24. (M/T)
INSTALL CLUTCH RELEASE CYLINDER AND TUBE CLAMP

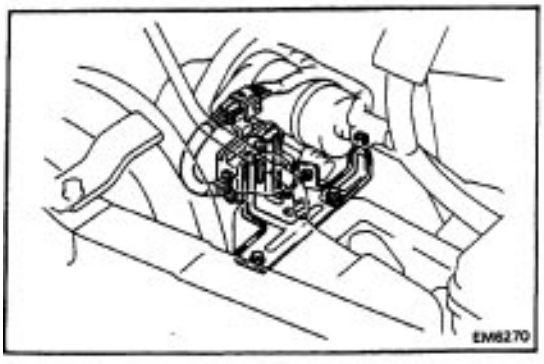


25. INSTALL AIR CLEANER ASSEMBLY
(a) Install the air cleaner case with the three bolts.
(b) Install the air cleaner element.
(c) Connect the air cleaner hose, and Install the air cleaner cap and air flow meter assembly with the four clips.
(d) Connect the air flow meter connector.



26. (w/ CRUISE CONTROL SYSTEM)
INSTALL CRUISE CONTROL ACTUATOR
(a) Install the actuator and bracket with the bolts.
(b) Connect the actuator connector.
(c) Connect the actuator vacuum hose.

27. (A/T)
INSTALL THROTTLE CABLE, AND ADJUST IT
28. INSTALL ACCELERATOR CABLE, AND ADJUST IT
29. INSTALL RADIATOR RESERVOIR TANK
30. INSTALL RADIATOR (See page CO–19)



31. INSTALL IGNITER AND BRACKET ASSEMBLY
(a) Install the igniter and bracket assembly with the two bolts.
(b) Connect the igniter connector.
(c) Connect the ground strap.

32. INSTALL BATTERY

33. FILL WITH ENGINE COOLANT (See page CO–5)

Capacity (w/ Heater):
M/T 6.4 liters (6.8 US qts, 5.6 Imp. qts)
A/T (2WD) 6.3 liters (6.7 US qts, 5.5 Imp. qts)
A/T (4WD) 6.8 liters (7.2 US qts, 6.0 Imp. qts)

34. 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
3.7 liters (3.9 US qts, 3.3 Imp. qts)
Dry fill 4.3 liters (4.5 US qts, 3.8 Imp. qts)

35. START ENGINE AND CHECK FOR LEAKS

36. PERFORM ENGINE ADJUSTMENT

(a) Adjust the alternator drive belt.
(See page CH–3)
Drive belt tension:

w/ A/C	**New belt 175 ± 5 lb**
	Used belt 130 ± 10 lb
w/o A/C	**New belt 125 ± 25 lb**
	Used belt 95 ± 20 lb

(b) Adjust the PS drive belt.
Drive belt tension: New belt 125 ± 25 lb
Used belt 80 ± 20 lb

(c) Adjust the ignition timing.
(See steps 7 to 10 on pages IG–16 and 17)
Ignition timing:
10° BTDC @ idle
(w/ Terminals TE 1 and E1 connected)

(d) Adjust the valve. clearance. (See page EM–11)
Valve clearance:
Intake 0.19 – 0.29 mm (0.007 – 0.011 in.)
Exhaust 0.28 – 0.38 mm (0.011 – 0.015 in.)

37. INSTALL HOOD

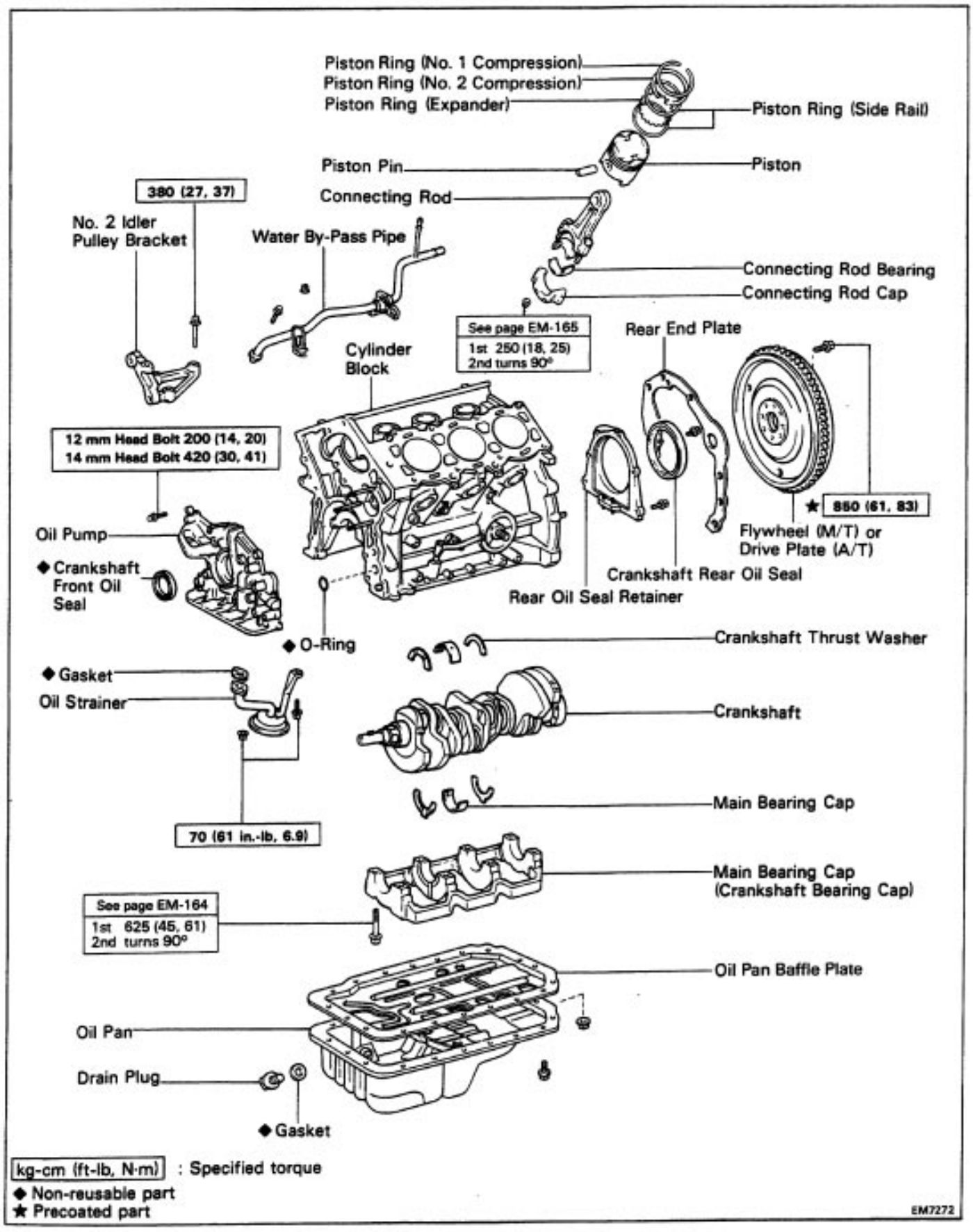
38. PERFORM ROAD TEST

Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

39. RECHECK ENGINE COOLANT AND ENGINE OIL LEVELS

CYLINDER BLOCK (2VZ–FE)

COMPONENTS



REMOVAL OF ENGINE

1. REMOVE BATTERY

Disconnect the grand strap.

2. DRAIN ENGINE COOLANT (See page CO–5)

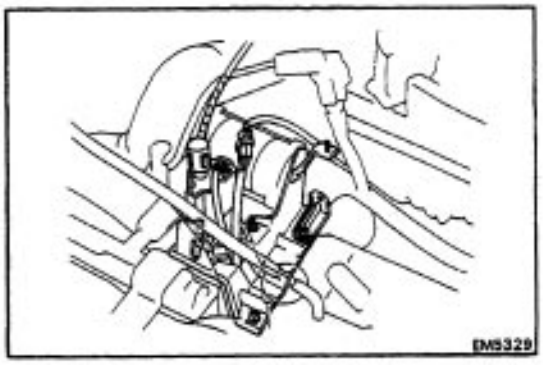
3. REMOVE HOOD

4. REMOVE ENGINE UNDER COVERS

5. DRAIN ENGINE COOLANT (See page CO–5)

6. DRAIN ENGINE OIL

7. REMOVE IGNITION COIL, IGNITER AND BRACKET ASSEMBLY



(a) Disconnect the following cord and connectors:
  (1) Igniter connector
  (2) Noise filter connector
  (3) High–tension cord

(b) Remove the two bolts, the ignition coil, igniter and bracket assembly.

8. REMOVE RADIATOR (See page CO–16)

9. REMOVE ALTERNATOR (See page CH–6)

10. REMOVE ALTERNATOR BELT ADJUSTING BAR

11. REMOVE RADIATOR RESERVOIR TANK

12. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY

13. (A/T)

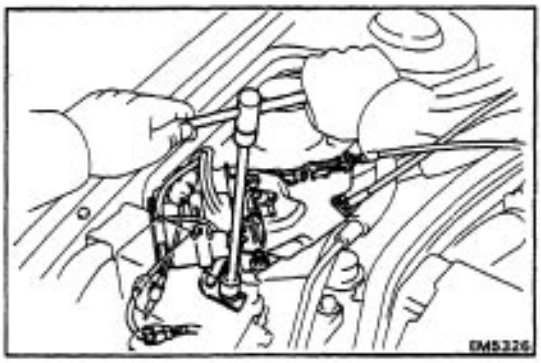
DISCONNECT THROTTLE CABLE FROM THROTTLE BODY

14. (w/ CRUISE CONTROL SYSTEM)

REMOVE CRUISE CONTROL ACTUATOR AND VACUUM PUMP

(w/A.B.S..)

(a) Remove the dust cover.

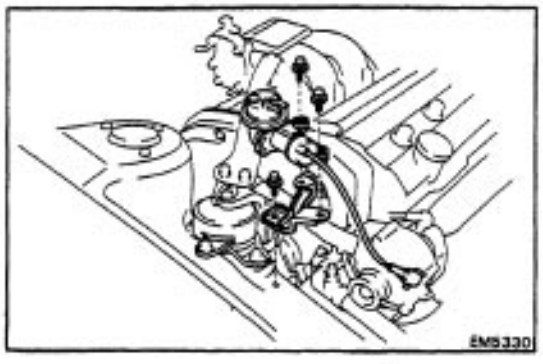


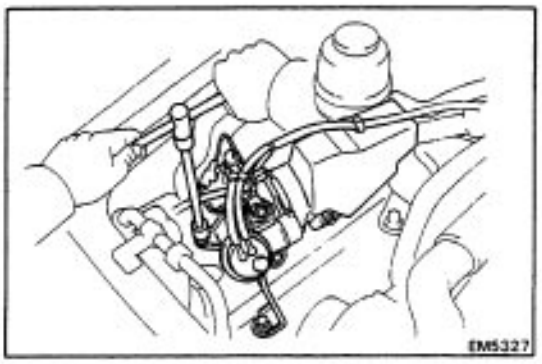
(b) Disconnect the following hoses and connector:
  (1) Actuator vacuum hoses
  (2) Actuator connector

(c) Remove the four bolts, actuator and bracket.

(d) Disconnect the vacuum pump connector.

(e) Remove the three bolts, vacuum pump and bracket.

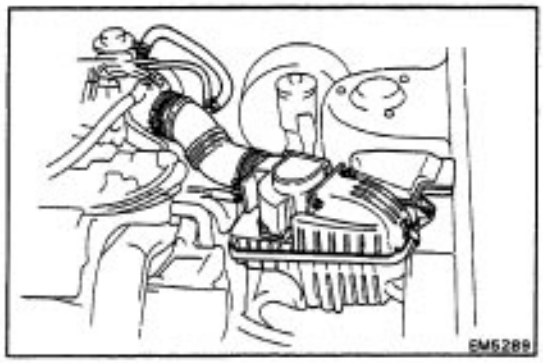




(w/o A.B.S..)

(a) Disconnect the following the hose and connectors:
  (1) Actuator vacuum hose from air intake chamber
  (2) Actuator connector
  (3) Vacuum pump connector
  (4) Vacuum switch connector

(b) Remove the three bolts, the actuator, vacuum pump and vacuum switch assembly.



15. REMOVE AIR CLEANER ASSEMBLY

(a) Disconnect the following connector and hoses:
  (1) Air flow meter connector
  (2) ISC valve air hose
  (3) Vacuum pipe air hose

(b) Disconnect the four air cleaner cap clips.

(c) Disconnect–the air cleaner hose, and remove the air cleaner cap, hoses, and air flow meter assembly.

(d) Remove the air cleaner element.

(e) Remove the three bolts and air cleaner case.

16. DISCONNECT WIRES AND CONNECTORS

(a) Check connector

(b) Ground straps from LH fender apron

(c) Connectors from relay box

(d) Engine room wire connecter

17. DISCONNECT VACUUM HOSES

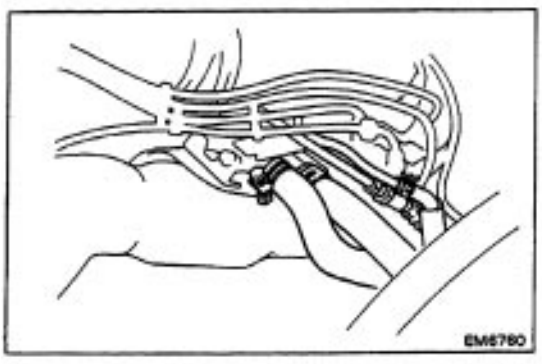
(a) Brake booster vacuum hose from air intake chamber

(b) A/C control valve vacuum hose from air intake chamber

(c) A/C control valve vacuum hose from vacuum pipe (on air intake chamber)

(d) Charcoal canister vacuum hose from vacuum pipe (on air intake chamber)

18. DISCONNECT GROUND STRAP FROM TRANSAXLE



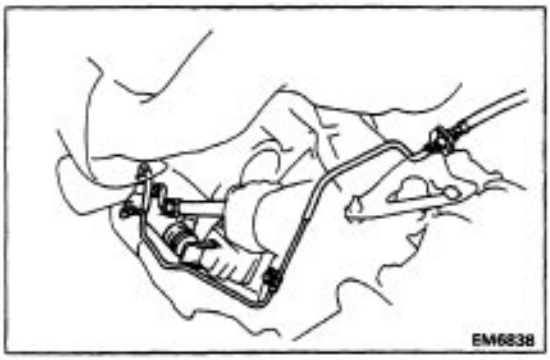
19. DISCONNECT HEATER HOSES

20. DISCONNECT FUEL HOSE

CAUTION: Catch leaking fuel in a container.

(M/T)

21. REMOVE STARTER



22. (M /T)
REMOVE CLUTCH RELEASE CYLINDER AND TUBE CLAMP WITHOUT DISCONNECTING TUBE

23. DISCONNECT SPEEDOMETER CABLE

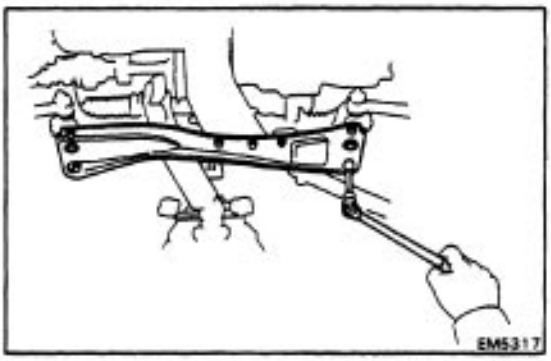
24. DISCONNECT TRANSAXLE CONTROL CABLE(S)

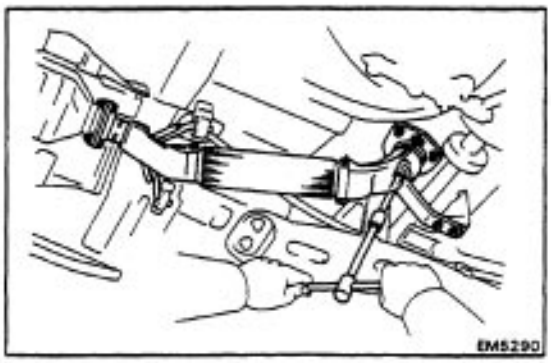
25. DISCONNECT ENGINE WIRE FROM CABIN

(a) Remove the under cover.
(b) Remove the glove compartment box.
(c) Disconnect the following connectors:
(1) Three engine & ECT ECU connectors
(2) Circuit opening relay connector
(3) Cowl wire connector
(4) Instrument panel wire connector
(d) Pull out the engine wire from the cowl panel.

26. REMOVE SUSPENSION LOWER CROSSMEMBER

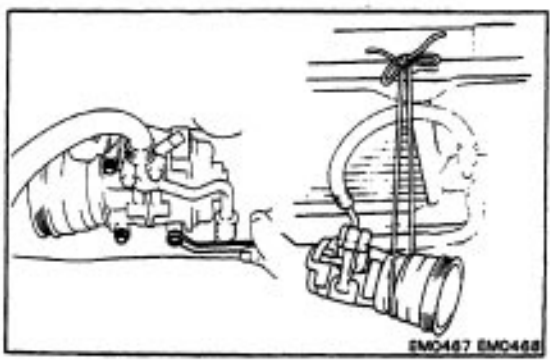
Remove the two bolts, two nuts and crossmember.





27. REMOVE FRONT EXHAUST PIPE

(a) Remove the two pipe stay bolts.
(b) Remove the two bolts and nuts, and disconnect the front pipe from the center pipe. Remove the gasket.
(c) Remove the three nuts, front pipe and gasket.



28. REMOVE A/C COMPRESSOR WITHOUT DISCONNECTING HOSES

(a) Disconnect the two connectors.
(b) Remove the four compressor bolts.

HINT: Put aside the compressor, and suspend it to the radiator support with a string.

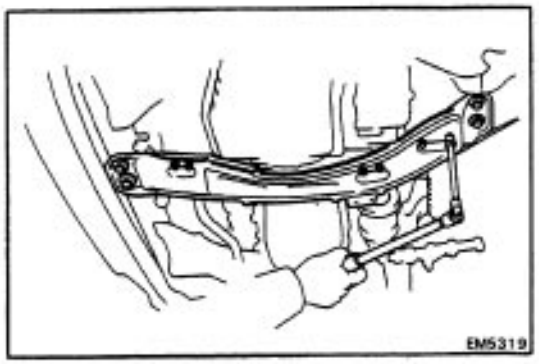
29. REMOVE DRIVE SHAFTS

30. REMOVE PS PUMP WITHOUT DISCONNECTING HOSES

HINT: Put aside the pump and suspend it to the cowl with a string.

31. REMOVE ENGINE MOUNTING CENTER MEMBER

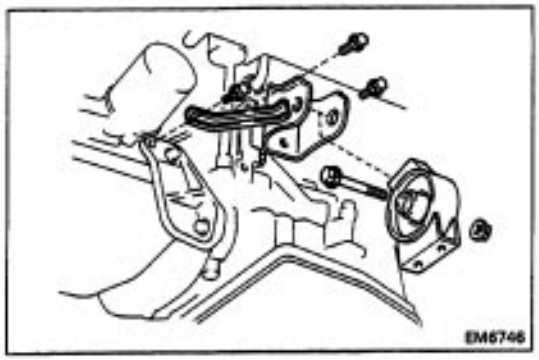
Remove the eight bolts, two nuts and center member.



32. REMOVE FRONT ENGINE MOUNTING INSULATOR AND BRACKET

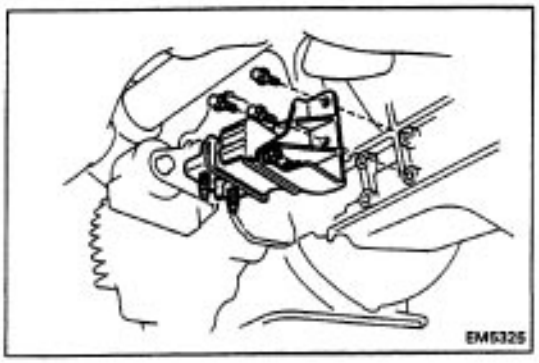
(a) Remove the nut, through bolt and mounting insulator.

(b) Remove the three bolts and mounting bracket.



33. REMOVE CENTER ENGINE MOUNTING INSULATOR AND BRACKET ASSEMBLY

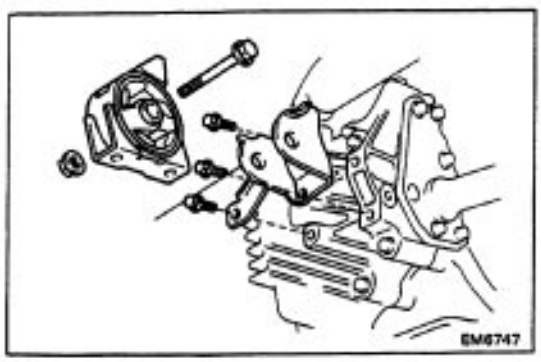
Remove the three bolts, the mounting bracket and insulator assembly.

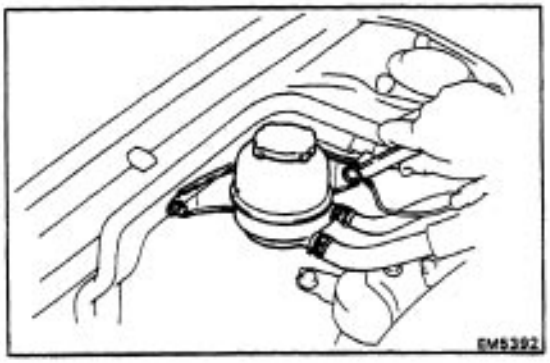


34. REMOVE REAR ENGINE MOUNTING INSULATOR AND BRACKET

(a) Remove the nut, through bolt and mounting insulator.

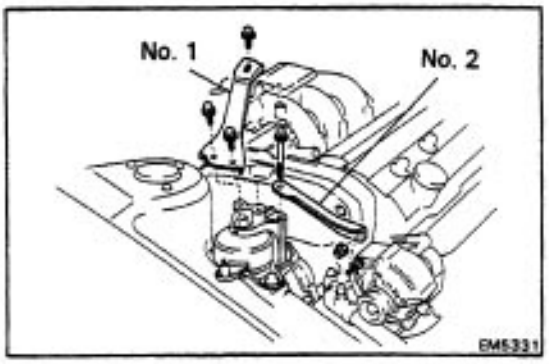
(b) Remove the three bolts and mounting bracket.





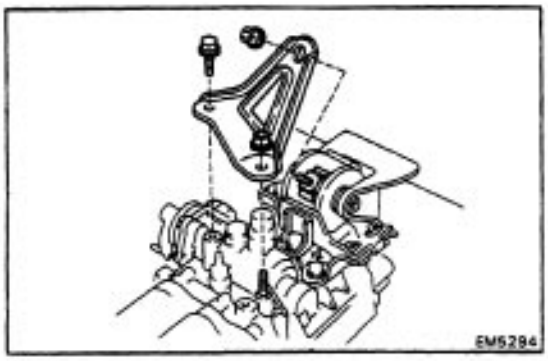
35. REMOVE PS OIL RESERVOIR TANK WITHOUT DISCONNECTING HOSES

Remove the two bolts and reservoir tank. Disconnect the ground strap.



36. REMOVE ENGINE RH MOUNTING STAYS

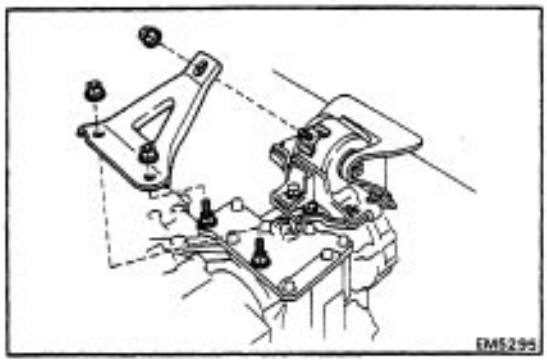
(a) Remove the three bolts and No. 1 mounting stay.
(b) Remove the bolt, nut and No. 2 mounting stay.



37. REMOVE ENGINE LH MOUNTING STAY

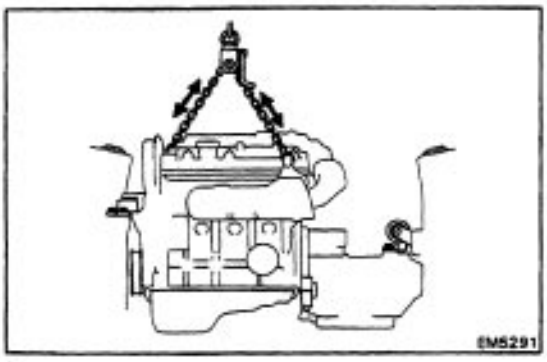
(M/T)

Remove the bolt, two nuts and mounting stay.



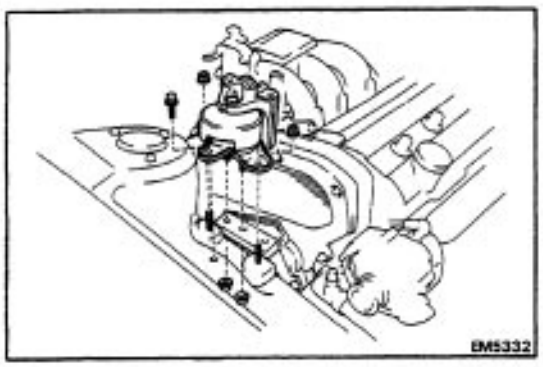
(A/T)

Remove the three nuts and mounting stay.

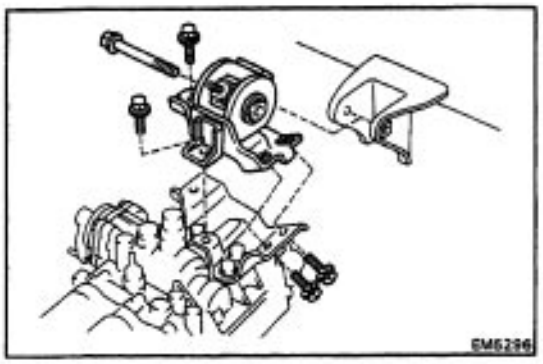


38. REMOVE ENGINE AND TRANSAXLE ASSEMBLY FROM VEHICLE

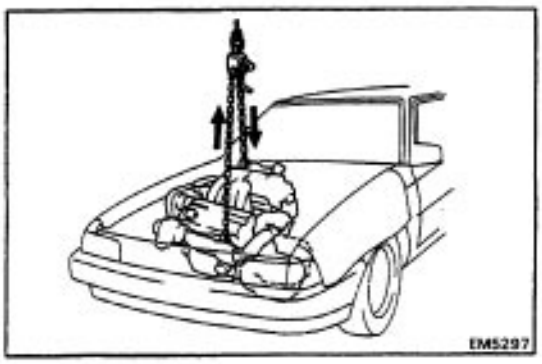
(a) Attach the engine hoist chain to the engine hangers.



(b) (w/ A.B.S.)
Remove the clamp bolts of the PS oil cooler pipes.
(c) Remove the bolt, four nuts and RH mounting insulator.



(d) Remove the through bolt, nut, four bolts and LH mounting insulator.
(e) Remove the three bolts and LH mounting bracket.

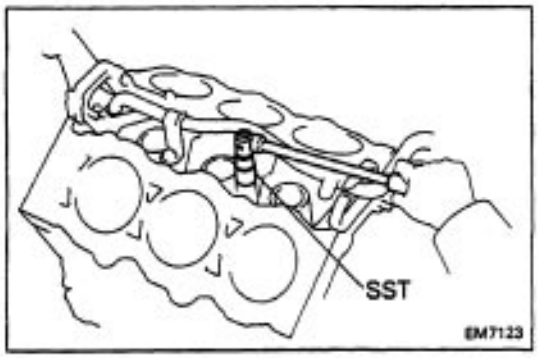


(f) Lift the engine out of the vehicle slowly and carefully.
NOTICE: Be careful not to hit the PS gear housing or neutral start switch.
(g) Make sure the engine is clear of all wiring, hoses and cables.
(h) Place the engine. and transaxle assembly onto the stand.

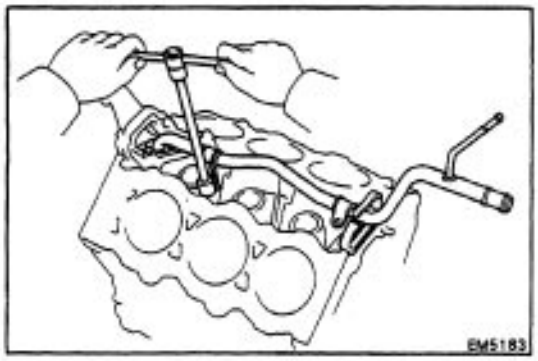
39. (A/T)
REMOVE STARTER
40. SEPARATE ENGINE AND TRANSAXLE

PREPARATION FOR DISASSEMBLY

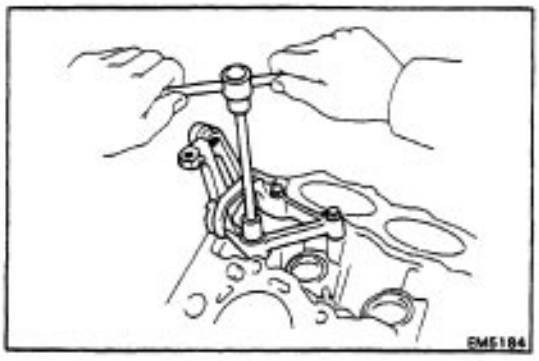
1. (M/T)
REMOVE CLUTCH COVER AND DISC
2. (M/T)
REMOVE FLYWHEEL
3. (A/T)
REMOVE DRIVE PLATE
4 REMOVE REAR END PLATE
Remove the bolt and end plate.
5. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY
6. REMOVE DISTRIBUTOR (See page IG–18)
7. REMOVE TIMING BELT AND PULLEYS (See page EM–34)
8. REMOVE CYLINDER HEADS (See page EM–76)
9. REMOVE WATER PUMP (See page CO–9)
10. REMOVE OIL PAN AND OIL PUMP (See page LU–17)
11. REMOVE OIL FILTER (See page LU–7)
12. REMOVE KNOCK SENSOR
Using SST, remove the knock sensor.
SST 09816–30010

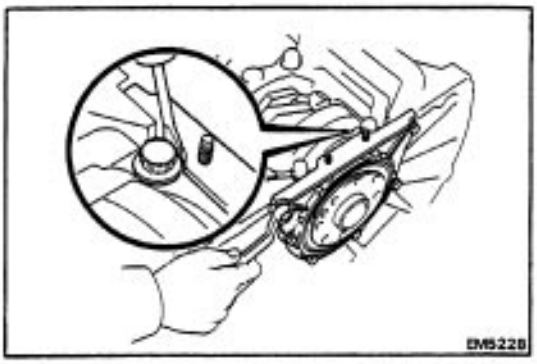


13. REMOVE WATER BY–PASS PIPE
Remove the two bolts, two nuts and by–pass pipe.



14. REMOVE NO.2 IDLER PULLEY BRACKET
Remove the three bolts and mounting bracket.



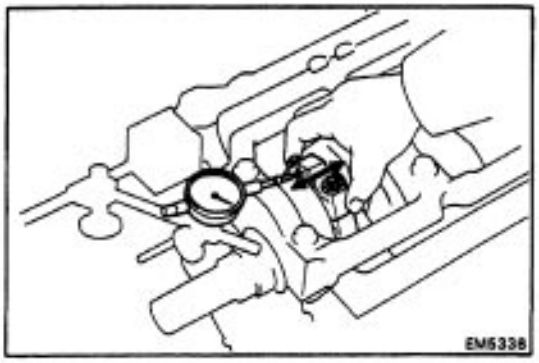


DISASSEMBLY OF CYLINDER BLOCK

(See page EM–139)

1. REMOVE REAR OIL SEAL RETAINER

Remove the six bolts and retainer.



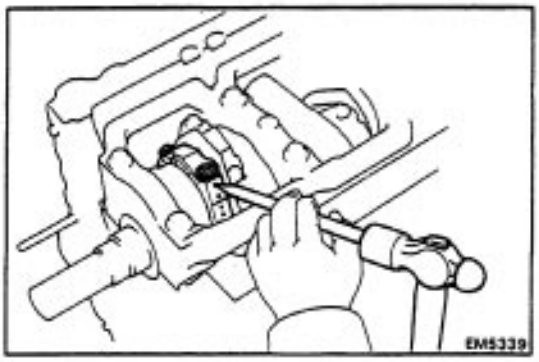
2. CHECK CONNECTING ROD THRUST CLEARANCE

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

Standard thrust clearance: 0.150 – 0.330 mm (0.0059 – 0.0130 in.)

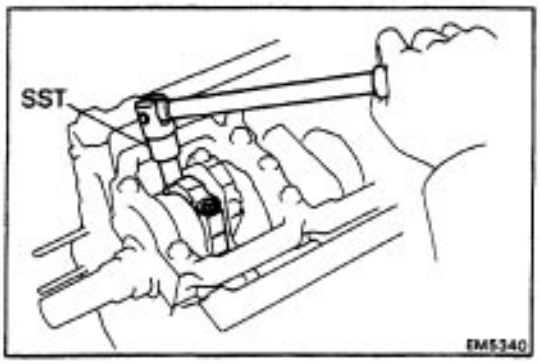
Maximum thrust clearance: 0.38 mm (0.0150 in.)

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

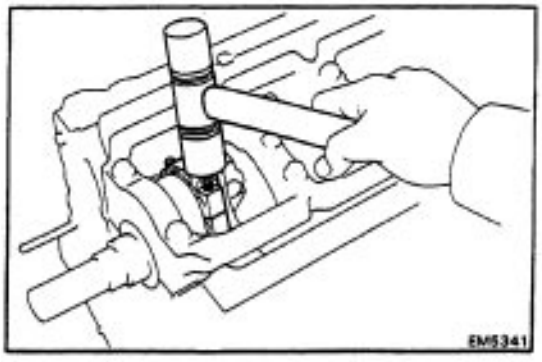


3. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

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

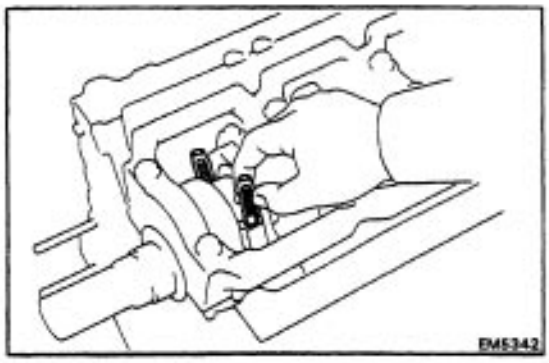


(b) Using SST, remove the connecting rod cap nuts.
SST 09011–38121

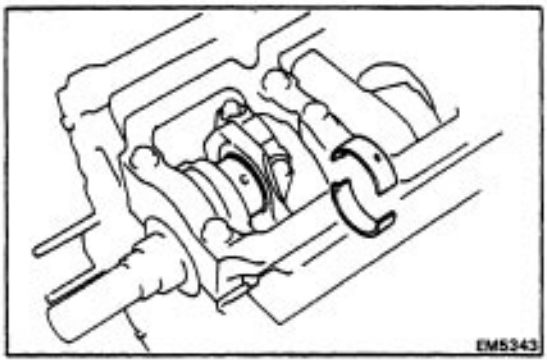


(c) Using a plastic–faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

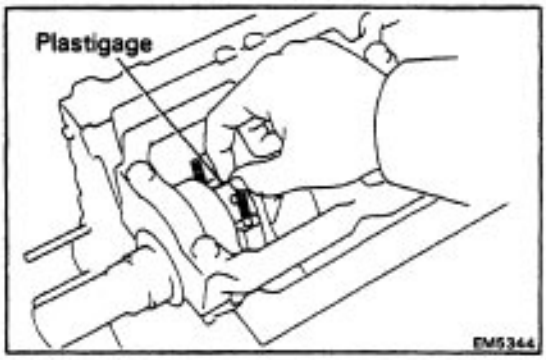
HINT: Keep the lower bearing inserted with the connecting cap.



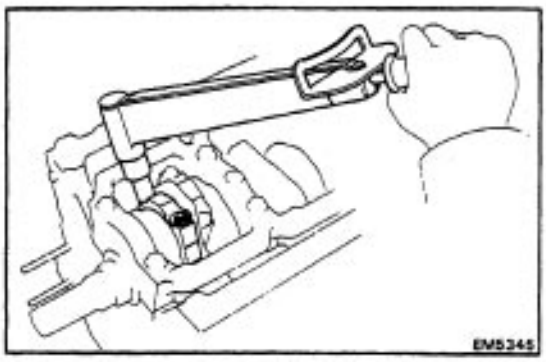
(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



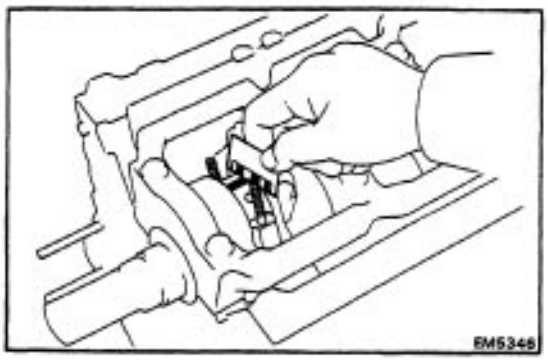
(e) Clean the crank pin and bearing.
(f) Check the crank pin and bearing for pitting and scratches.
If the crank pin or bearing is damaged, replace the bearing.
If necessary, grind or replace the crankshaft.



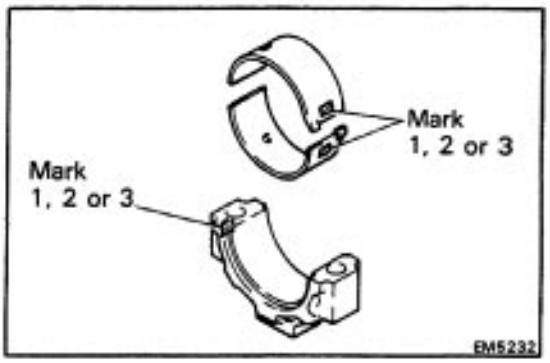
(g) Lay a strip of Plastigage across the crank pin.

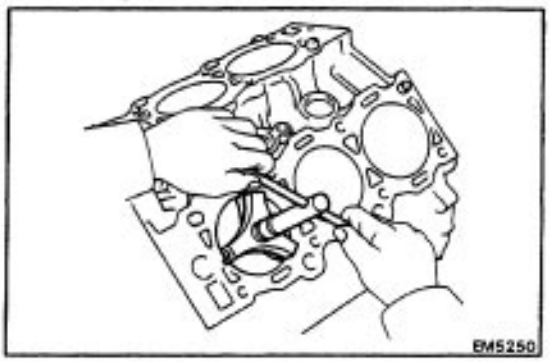


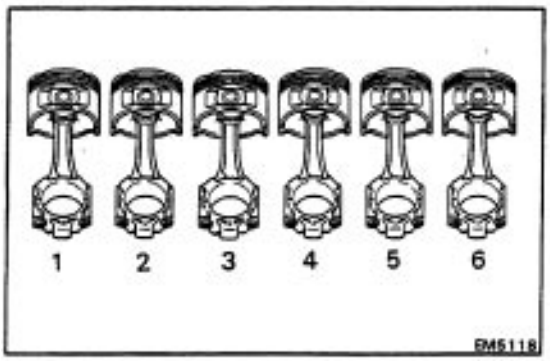
(h) Install the connecting rod cap.
(See step 6 on page EM–165)
Torque: 1st 250 kg–cm (18 ft–ib, 25 N–m)
2nd turns 90°
NOTICE: Do not turn the crankshaft



(i) Remove the connecting rod cap.
(j) Measure the Plastigage at widest point.
Standard oil clearance:
STD 0.028 – 0.065 mm
(0.0011 – 0.0026 in.)
U/S 0.25 0.027 – 0.080 mm
(0.0011 – 0.0031 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 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) Remove the all carbon from the piston ring ridge.

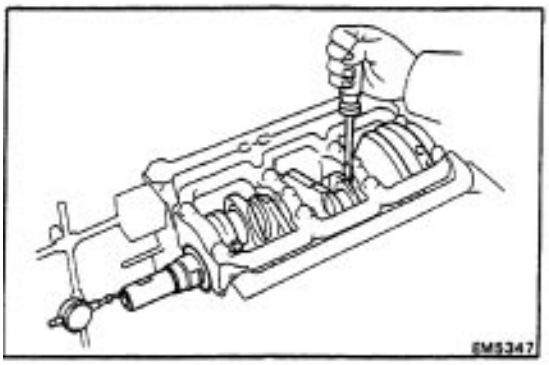
(b)Cover the connecting rod bolts.

(See page EM–145)

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

HINT:

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



5. CHECK CRANKSHAFT THRUST CLEARANCE

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

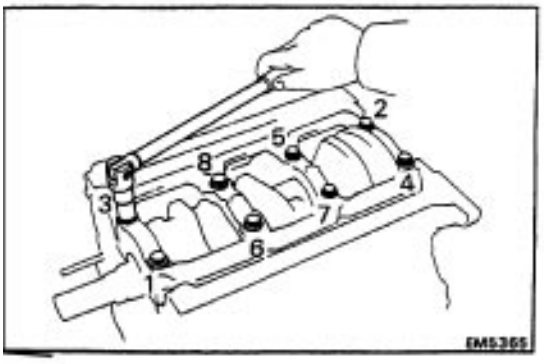
Standard thrust clearance: 0.020 – 0.220 mm (0.0008 – 0.0087 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

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

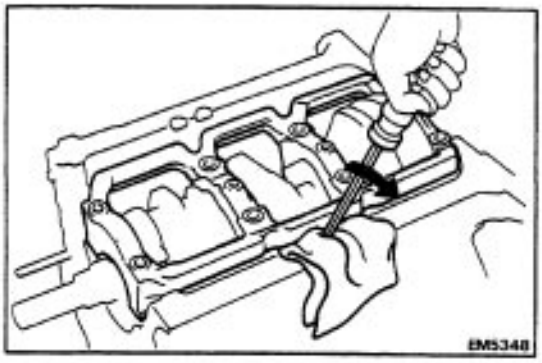
Thrust washer thickness (STD size only):

2.440 – 2.490 mm (0.0961 – 0.0980 in.)



6. REMOVE MAIN BEARING CAP AND CHECK OIL CLEARANCE

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

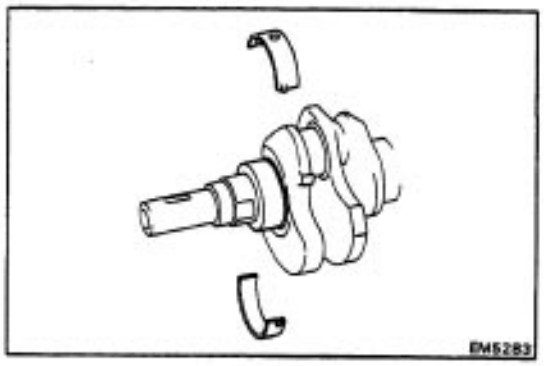


(b) Using a screwdriver, pry up the main bearing cap, and remove the main bearing cap, lower main bearings and lower thrust washers (No. 2 journal position of main bearing cap only).

HINT: Keep the lower main bearings and lower thrust washers together with the main bearing cap.

(c) Lift out the crankshaft.

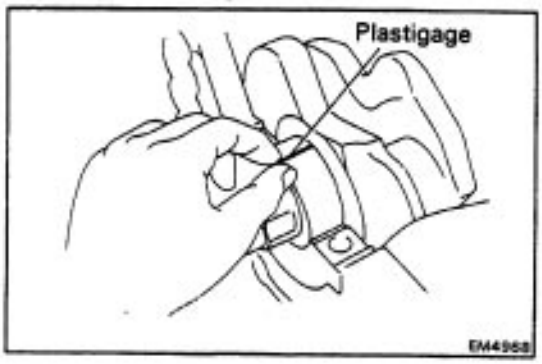
NOTE: Keep the upper main bearings and upper thrust washers together with the cylinder block.



(d) Clean each main journal and bearing.

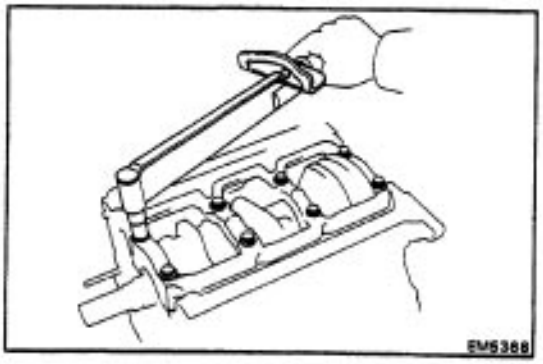
(e) Check each main journal and bearing for pitting and scratches.

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



(f) Place the crankshaft on the cylinder block.

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



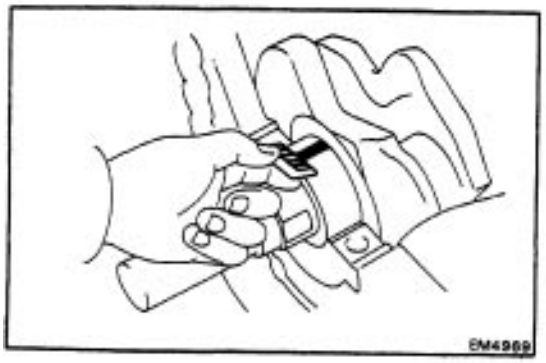
(h) Install the main bearing cap.

(See step 4 on page EM–164)

Torque: 1 st 625 kg–cm (45 ft–lb, 61 N–m)

2nd turns 90°

NOTICE: Do not turn the crankshaft



(i) Remove the main bearing cap.

(j) Measure the Plastigage at its widest point.

Standard clearance:

STD 0.029 – 0.056 mm
(0.0011 – 0.0022 in.)

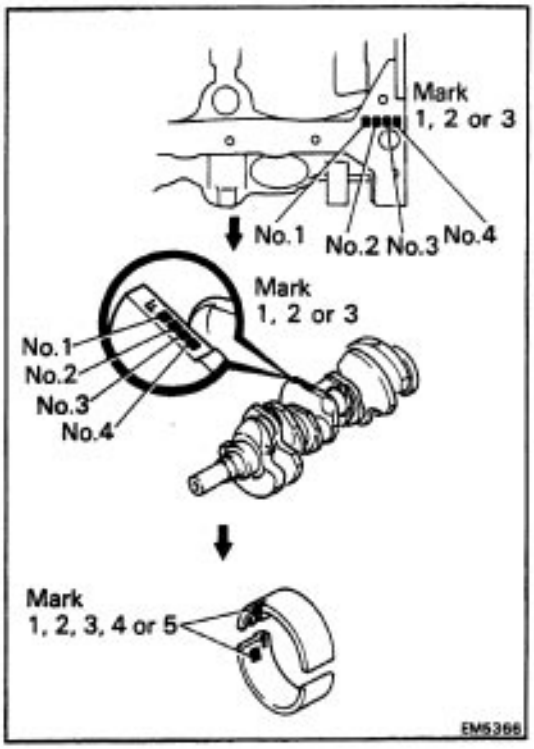
U/S 0.25 0.028 – 0.080 mm
(0.0011 – 0.0031 in.)

Maximum clearance: 0.08 mm (0.0031 in.)

HINT: If replacing the cylinder block sub–assembly, the bearing standard clearance will be:

0.031 0.067 mm
(0.0012 – 0.0026 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 with one having the same number. If the number of the bearing be determined, select a bearing from the table below according to the numbers imprinted on the cylinder block and crankshaft. There are five sizes of standard bearings, marked ”1 ”, ”2”, ”3”, “4,“ and ”5” accordingly.

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

EXAMPLE: Cylinder block ”2” + Crankshaft ”1”
= Bearing ”T’

(Reference)

Cylinder block main journal bore diameter:

Mark ”1 ” 68.010 – 68.0 16 mm
(2.6776 – 2.6778’in.)
Mark ”2” 68.016 – 68.022 mm
(2.6778 – 2.6780 in.)
Mark ”3” 68.022 – 68.028 mm
(2.6780 – 2.6783 in.)

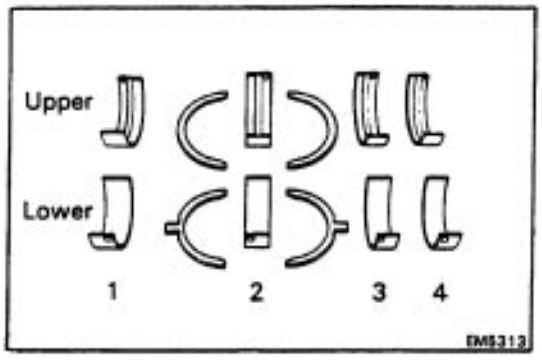
Crankshaft journal diameter:

Mark ”0” 63.996 – 64.000 mm
(2.5195 – 2.5197 in.)
Mark ”1” 63.990 – 63.996 mm
(2.5193 – 2.5195 in.)
Mark ”2” 63.985 – 63.990 mm
(2.5191 – 2.5193 in.)

Standard sized bearing center wall thickness:

Mark ”1 ” 1.989 – 1.992 mm
(0.0783 – 0.0784 in.)
Mark ”2” 1.992 – 1.995 mm
(0.0784 – 0.0785 in.)
Mark ”3” 1.995 – 1.998 mm
(0.0785 – 0.0787 in.)
Mark ”4” 1.998 – 2.001 mm
(0.0787 – 0.0788 in.)
Mark ”5” 2.001 – 2.004 mm
(0.0788 – 0.0789 in.)

(k) Completely remove the Plastigage.

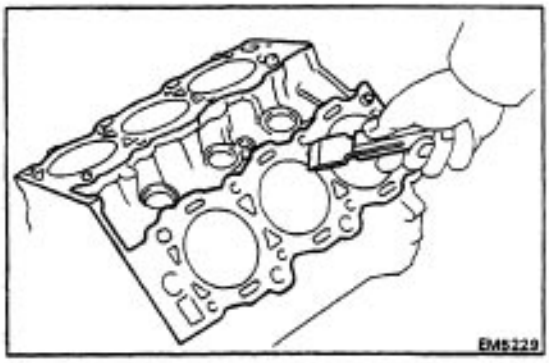


7. REMOVE CRANKSHAFT

(a) Lift out the crankshaft.

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

HINT: Arrange the main bearings and thrust washers in correct order.



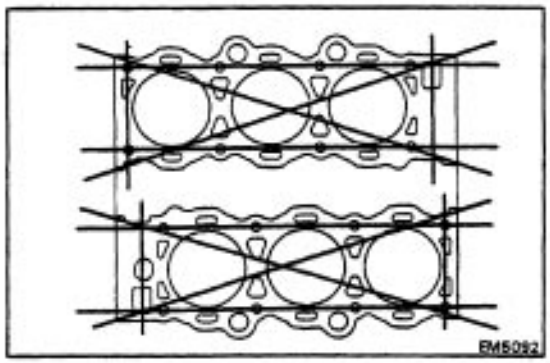
INSPECTION OF CYLINDER BLOCK

1. REMOVE GASKET MATERIAL

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

2. CLEAN CYLINDER BLOCK

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

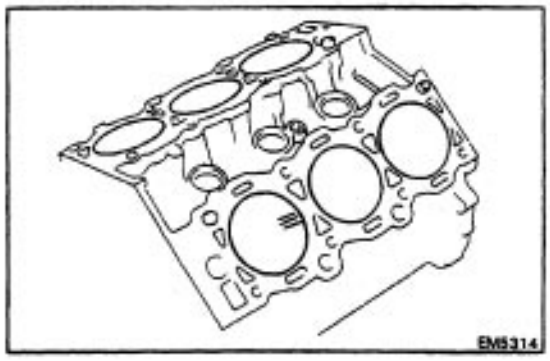


3. INSPECT TOP OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage: 0.05 mm (0.0020 in.)

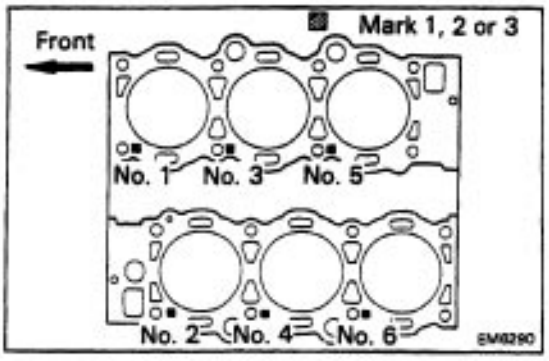
If warpage is greater than maximum, replace the cylinder block.



4. INSPECT CYLINDER FOR VERTICAL SCRATCHES

Visually check the cylinder for vertical scratches.

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



5. 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 axial directions.

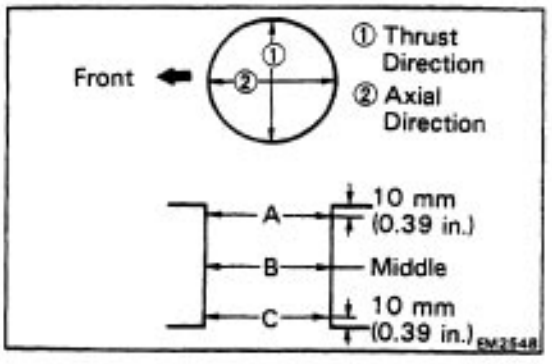
Standard diameter:

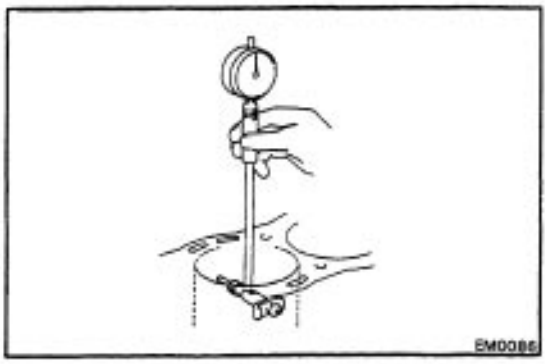
STD mark ”1 ”	**87.500 – 87.510 mm (3.4449 – 3.4453 in.)**
STD mark ”2”	**87.510 – 87.520 mm (3.4453 – 3.4457 in.)**
STD mark ”3”	**87.520 – 87.530 mm (3.4457 – 3.4461 in.)**

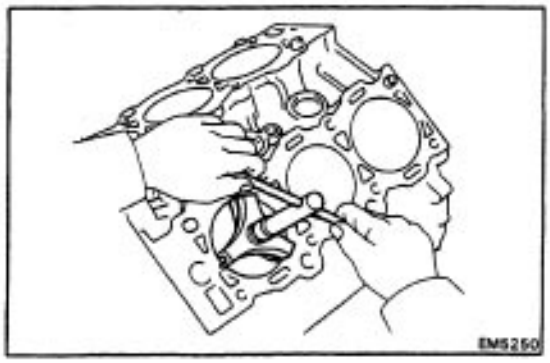
Maximum diameter:

STD	**87.73 mm (3.4539 in.)**
O/S 0.50	**88.23 mm (3.4736 in.)**

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

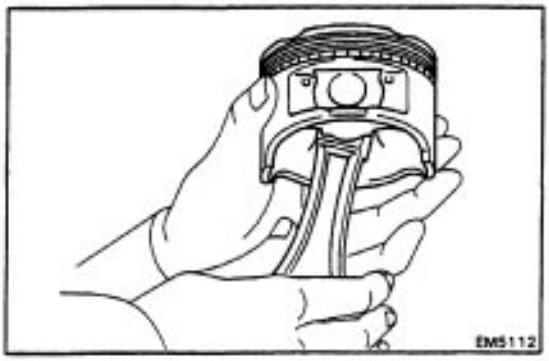






6. REMOVE CYLINDER RIDGE

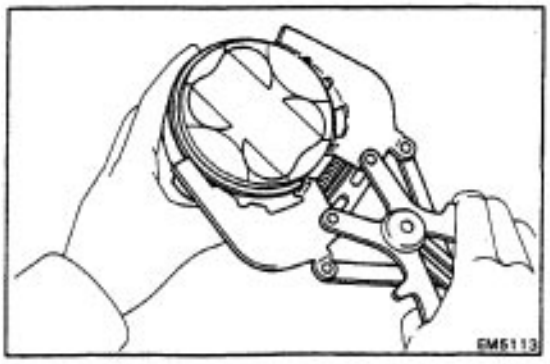
If the wear is less than 0.2 mm (0.008 in.), use a ridge reamer to machine the piston ring ridge at the top of the cylinder.



DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

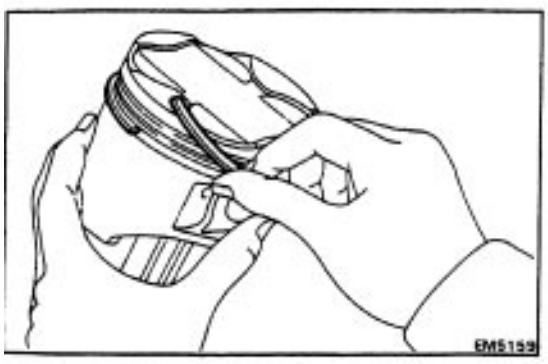
1. CHECK FIT BETWEEN PISTON AND PISTON PIN

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



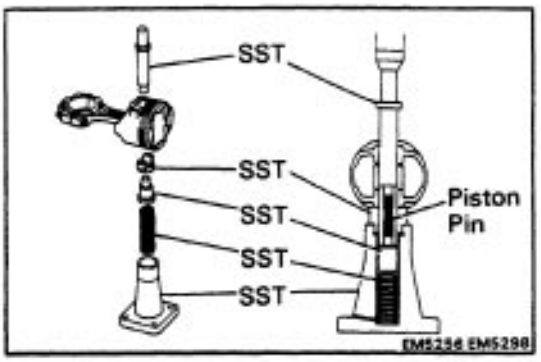
2. REMOVE PISTON RINGS

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



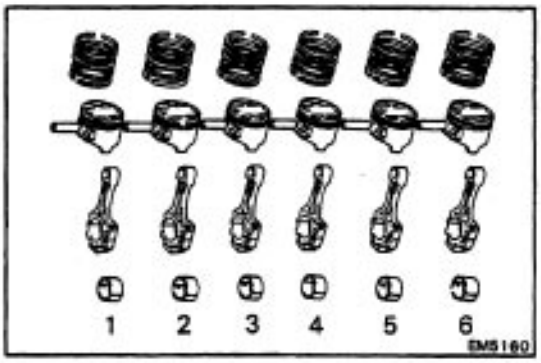
(b) Remove the two side rails and oil ring expander by hand.

HINT: Arrange the rings in correct order only.



3. DISCONNECT CONNECTING ROD FROM PISTON

Using SST, press out the piston pin from the piston.
SST 09221–25024 (09221–00020, 09221–00030, 09221–00181, 09221–00190, 09221–00200)



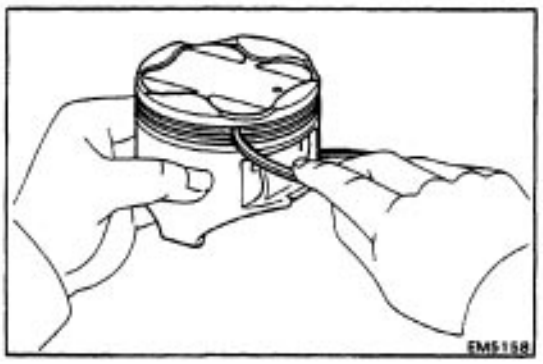
HINT:

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

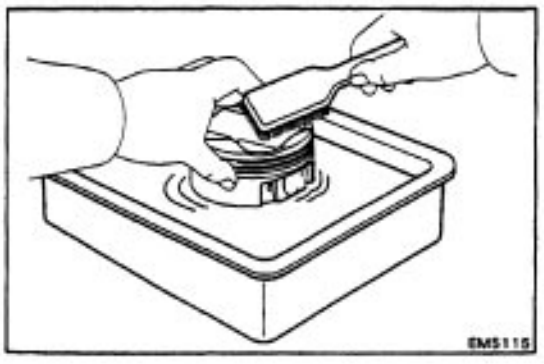
INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLIES

1. CLEAN PISTON

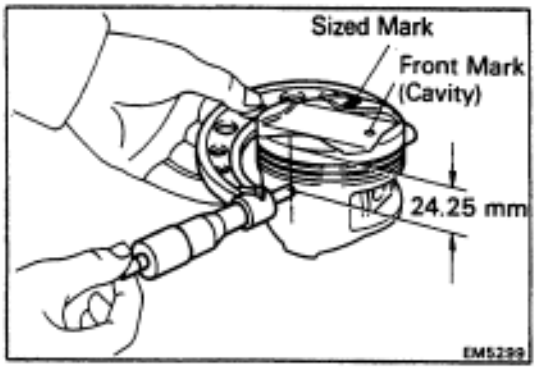
(a) Using a gasket scraper, remove the carbon from the piston top.



(b) Using a groove cleaning 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 DIAMETER AND OIL CLEARANCE

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

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 24.25 mm (0.9547 in.) from the piston head.

Piston diameter:

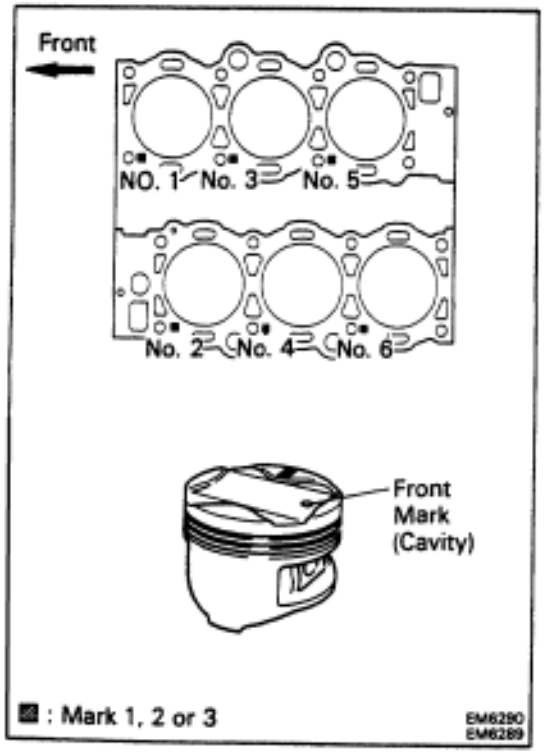
STD mark 87.445 87.455 mm
(3.4427 – 3.4431 in.)
STD mark ”2” 87.455 87.465 mm
(3.4431 – 3.. 5 in.)
STD mark ”3” 87.465 – 87.475 mm
(3.4435 – 3.4439 in.)
O/S 0.50 87.945 – 87.975 mm
(3.4624 – 14636 in.)

(b) Measure the cylinder bore diameter in the thrust directions. (See step 5 on page EM–149)

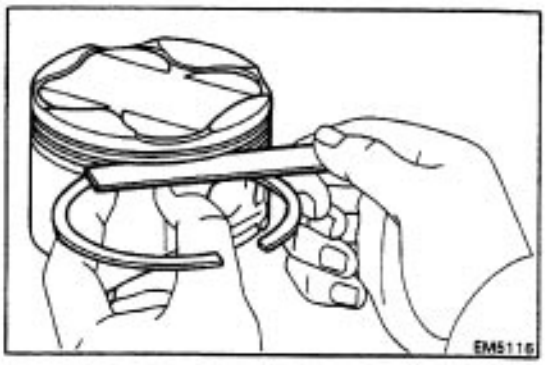
(c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance: 0.045 – 0.065 mm
(0.0018 – 0.0026 in.)
Maximum oil clearance: 0.085 mm (0.0033 in.)

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



HINT (Use cylinder block subassembly): when installing a standard piston, install one with the same number mark as the standard bore diameter marked on the cylinder block.



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

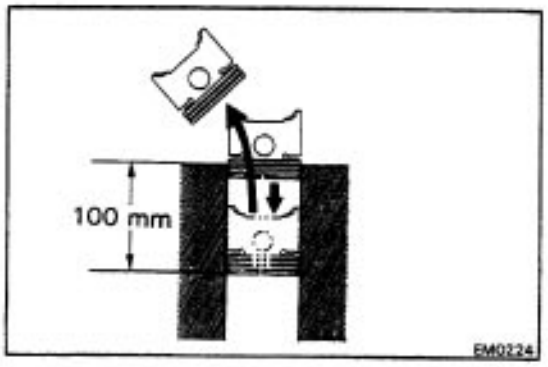
Using a feeler gauge, measure the clearance between new piston ring and the wall of the piston ring groove.

Ring groove clearance:

No.1 0.010 – 0.080 mm (0.0004 – 0.0031 in.)

No.2 0.030 – 0.070 mm (0.0012 – 0.0028 in.)

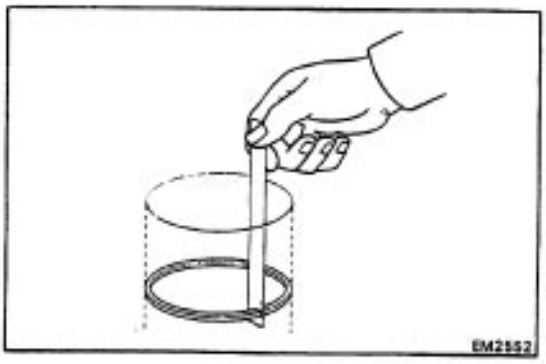
If the clearance is greater than maximum, replace the piston.



4. INSPECT PISTON RING END GAP

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

(b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 100 mm (3.94 in.) from the top of the cylinder block.



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

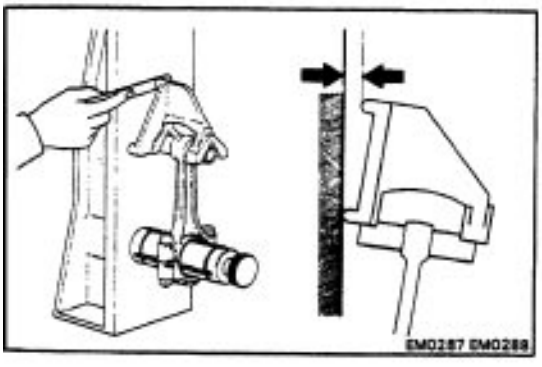
Standard end gap:

No.1	**0.300 0.520 mm (0.0118 – 0.0205 in.)**
No.2	**0.350 – 0.600 (0.0138 0.0236 in.)**
Oil (Slide rail)	**0.200 0.550 mm (0.0079 0.0217 in.)**

Maximum end gap:

No.1	**1.12 mm (0.0441 in.)**
No.2	**1.20 mm (0.0472 in.)**
Oil (Slide 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 six cylinders or replace the cylinder block.



5. INSPECT CONNECTING ROD

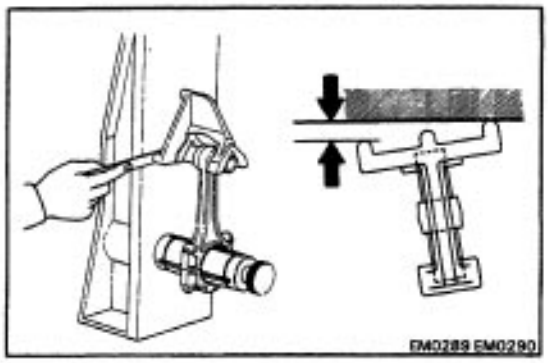
Using a rod aligner, check the connecting rod alignment.

- Check for bending.

Maximum bending:

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

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

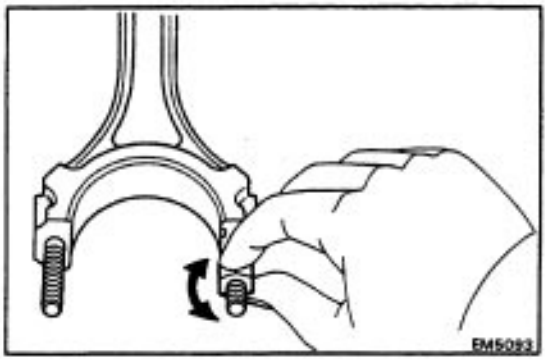


- Check for twist.

Maximum twist:

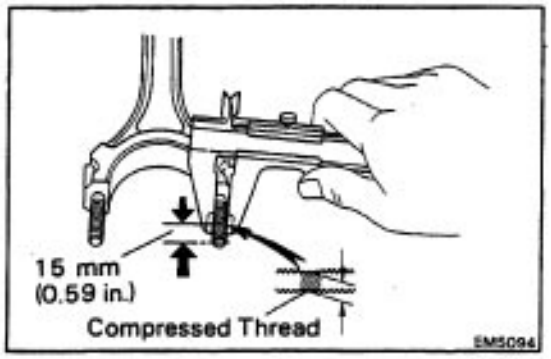
0.15 mm (0.0059 in.) per 100 mm (3–94 in.)

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



6. 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 outer diameter of the compressed thread with calipers.

Standard outer diameter: 7.860 – 8.000 mm
(0.3094 – 0.3150 in.)

Minimum outer 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 outer diameter is less than minimum, replace the connecting rod bolt and cap nut as a set.

BORING OF CYLINDERS

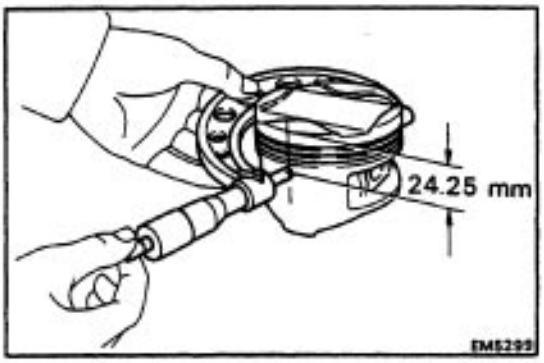
HINT:

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

1. KEEP OVERSIZED PISTONS

Oversized piston diameter:

O/S 0.50 87.945 – 87.975 mm
(3.4624 – 3.4636 in.)



2. CALCULATE AMOUNT TO BORE CYLINDER

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 24.25 mm (0.9547 in.) from the piston head.

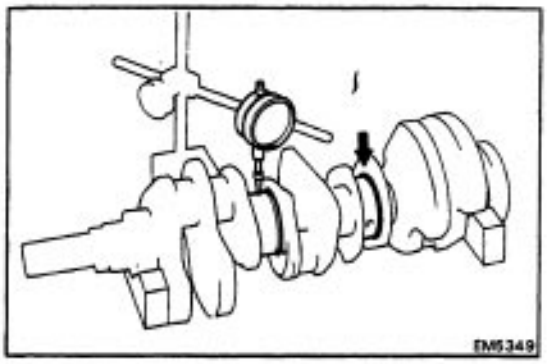
(b) Calculate the amount each cylinder is to be rebored as follows:

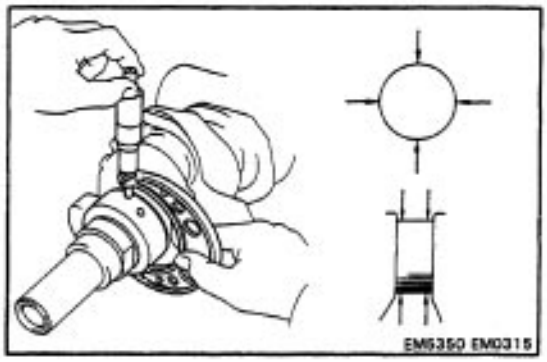
Size to be .rebored = P + C – H
P= Piston diameter
C = Piston oil clearance
0.045 – 0.065 mm (0.0018 – 0.0026 in.)
H = Allowance for honing
0.02 mm (0.0008 in.) or less

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 63.985 – 64.000 mm
(2.5191 – 2.5197 in.)
U/S 0.25 63.745 – 63.755 mm
(2.5096 – 2.5100 in.)

Crank pin diameter:

STD 47.987 – 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–147 to 150).

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

Maximum taper and out–of–round: 0.42 mm (0.0008 in.)

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

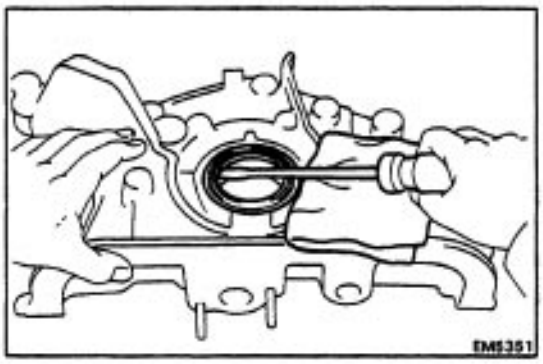
3. IF NECESSARY, GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS

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

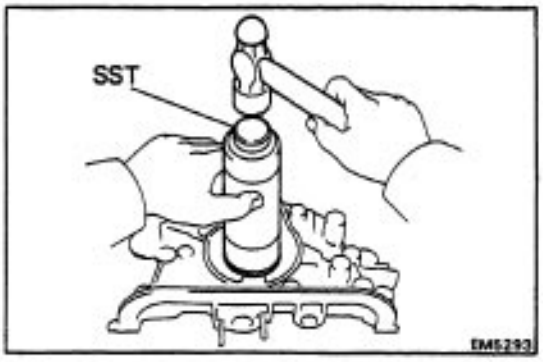
HINT: There are two methods (A an B) to replace the oil seal as follows:



1. REPLACE CRANKSHAFT FRONT OIL SEAL

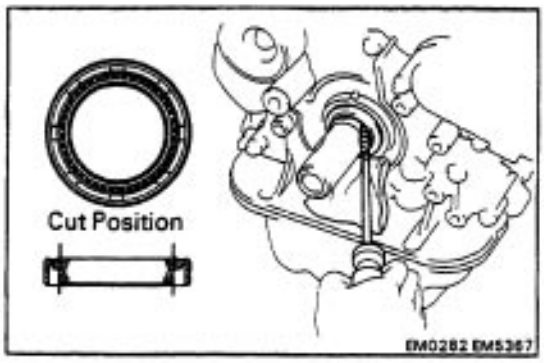
A. If Oil Pump 1s removed from cylinder block:

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



(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump case edge.
SST 09309–37010

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

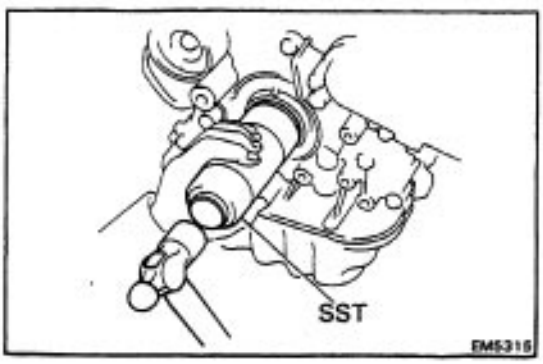


B. If oil pump is installed to the cylinder block:

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

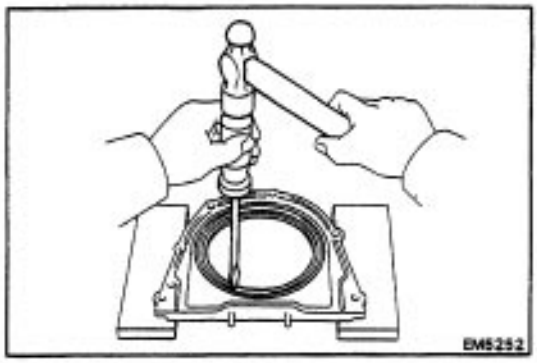
(b) Using a screwdriver, pry out the oil seal.

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



(c) Apply IMP grease to a new oil seal lip.

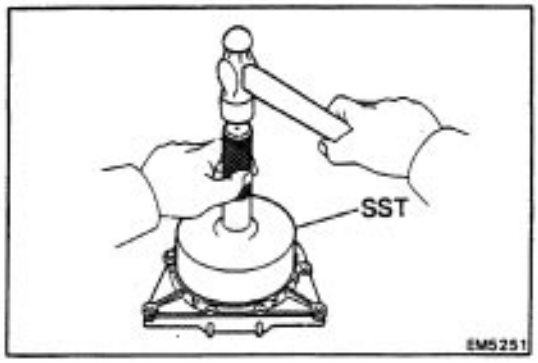
(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump case edge.
SST 09309–37010



2. REPLACE CRANKSHAFT REAR OIL SEAL

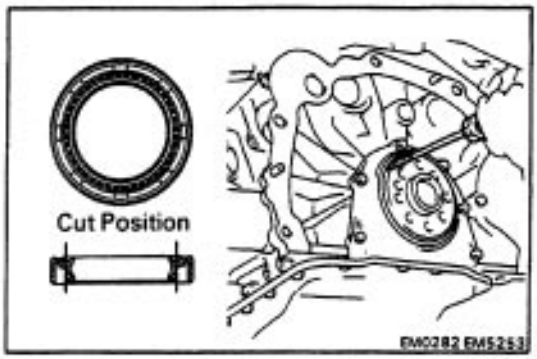
A. If rear oil seal retainer is removed from cylinder block:

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



(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal edge.
SST 09223–56010

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

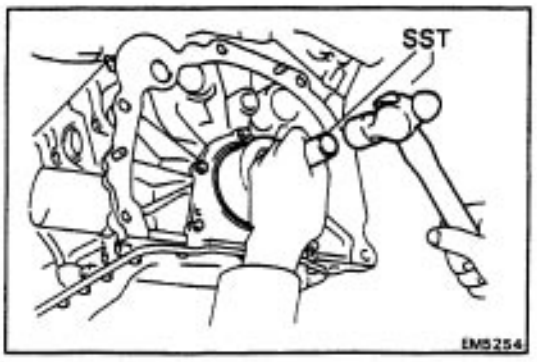


6. If rear oil seal retainer is installed to cylinder block:

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

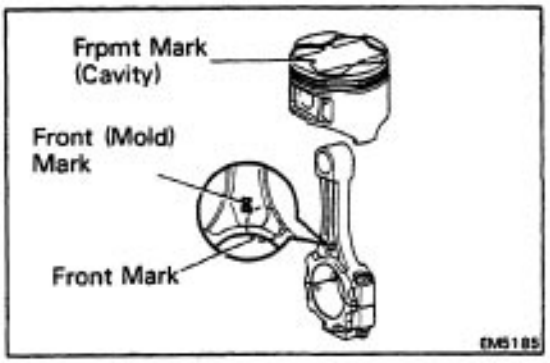
(b) Using a screwdriver, pry out the oil seal.

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



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

(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223–56010

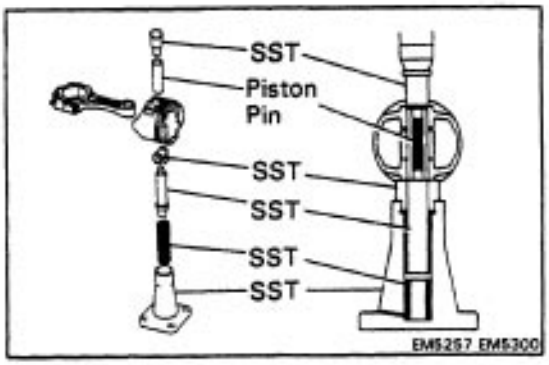


ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

1. ASSEMBLE PISTON AND CONNECTING ROD

(a) Align the front marks of the piston and connecting rod.

Connecting rod front (mold) mark:
B6, 1 B, 8A, C3 or etc.



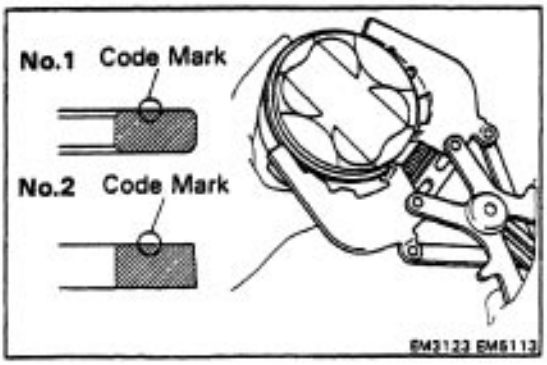
(b) Coat the piston pin and piston hole of the piston with engine oil. .

(c) Using SST, press in the piston pin.
SST 09221–25024 (09221–00020, 09221–00030, 09221–00181, 09221–00190, 09221–00200)

(d) Check that the piston smoothly moves back and forth on the piston pin.

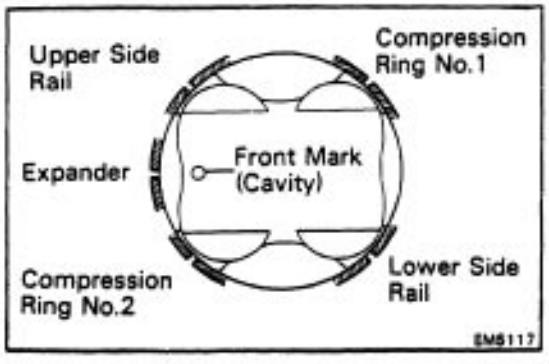
2. INSTALL PISTON RINGS

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



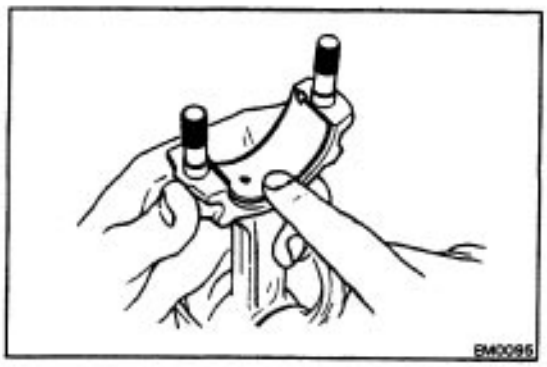
(b) Using a piston ring expander, install the two compression rings with the code mark facing upward.

Code mark: No.1 T or 1R
No.2 T2 or 2R



(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.

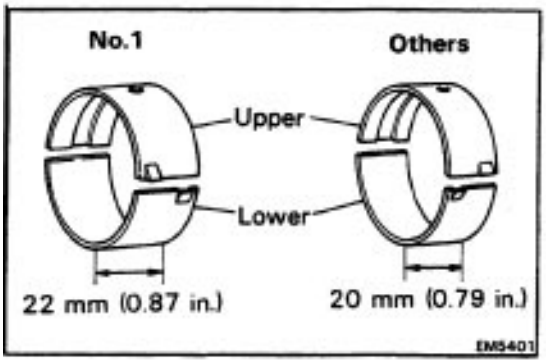
NOTICE: Install the bearing with the oil hole in the connecting rod.

ASSEMBLY OF CYLINDER BLOCK

(See page EM–139**)**

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. 0–rings and oil seals with new parts.



1. INSTALL MAIN BEARINGS

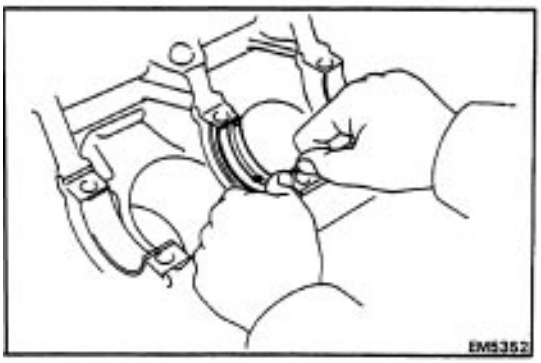
HINT:

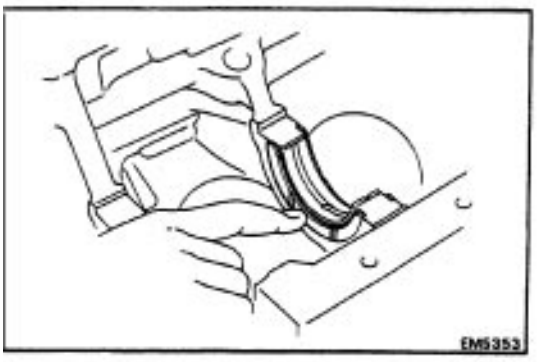
- Main bearings come in widths of 20 mm (0.79 in.) and 22 mm (0.87 in.). Install the 22 mm (0.87 in.) bearings in the No. 1 cylinder block journal position with the main bearing caps. Install the 20 mm (0.79 in.) bearings in the other positions.
- Upper bearings have on oil groove and oil holes; lower bearings do not.

(a) Align the bearing claw with the claw groove of the main bearing cap or cylinder block.

(b) Install the bearings in the cylinder block and main bearing cap.

NOTICE: Install the bearing with the oil hole in the cylinder block.

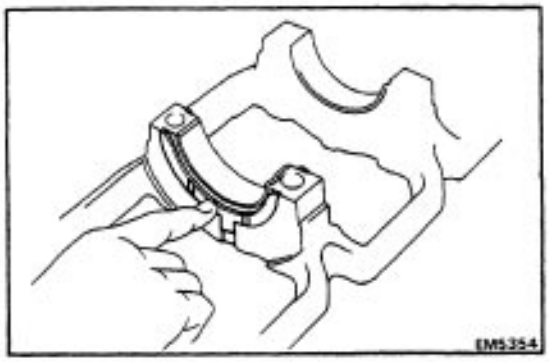




2. INSTALL UPPER THRUST WASHERS

Install the thrust washers under the No.2 journal position of the block with the oil grooves facing outward.

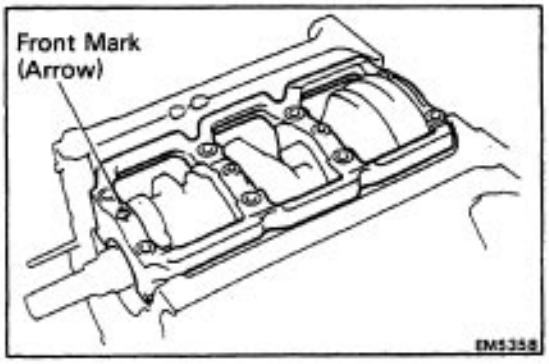
3. PLACE CRANKSHAFT ON CYLINDER BLOCK



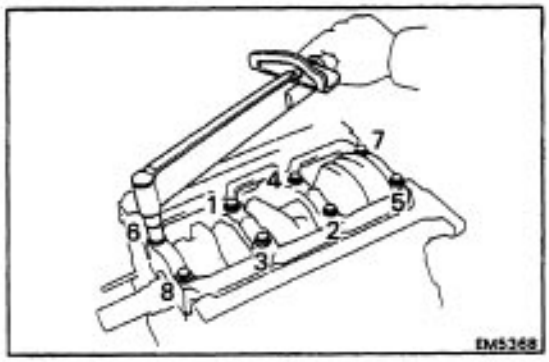
4. INSTALL MAIN SEARING CAP AND LOWER THRUST WASHERS

A. Place main bearing cap and lower thrust washers on cylinder block.

(a) Install the thrust washers on the No. 2 journal position of the bearing cap with the grooves facing outward.



(b) Install the main bearing cap with the front mark facing forward.



6. Install main bearing cap bolts

HINT:

- The main bearing cap bolts are tightened in two progressive steps.
- If any the main bearing cap bolt is broken or deformed, replace it.

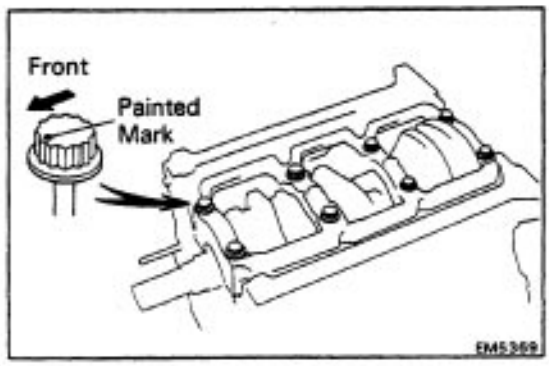
(a) Apply a light coat of engine oil on the threads and under the heads of the main bearing caps.

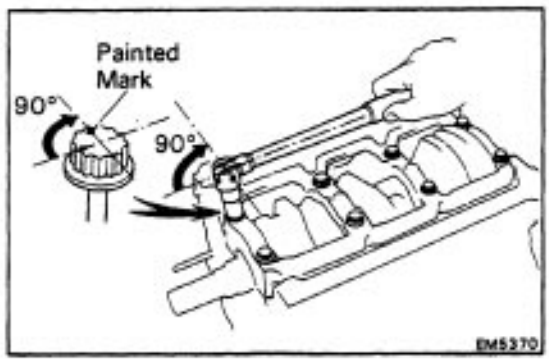
(b) 1st, install and uniformly tighten the eight main bearing cap bolts in several passes in the sequence shown.

Torque: 625 kg–cm (45 ft–lb, 61 N–m)

If any one of the main bearing cap bolts does not meet the torque specification, replace the cap bolt.

(c) Mark the front of the connecting rod cap nut with paint.



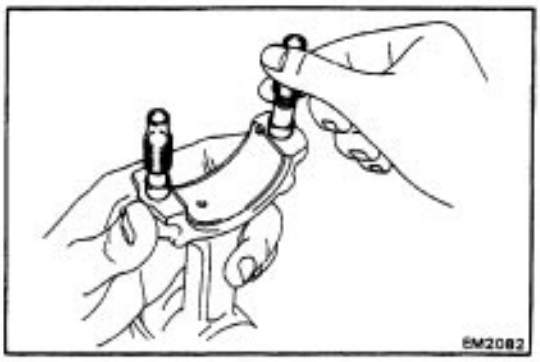


(c) 2nd, retighten the main bearing cap bolts 90° and angle to the front.

(f) Check that the crankshaft turns smoothly.

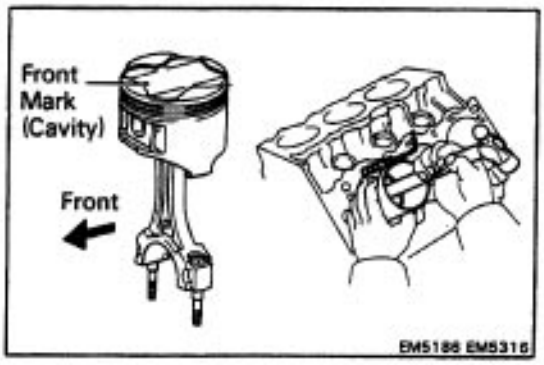
(g) Check the crankshaft thrust clearance.

(See step 5 on page EM–149)

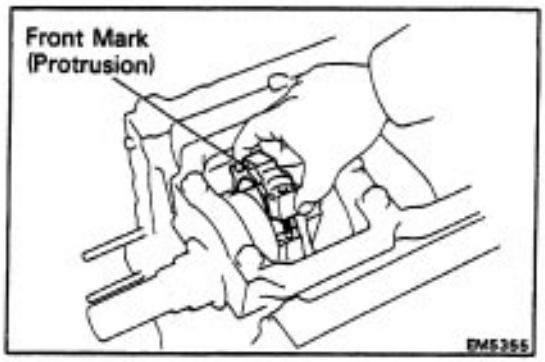


5. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

(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.

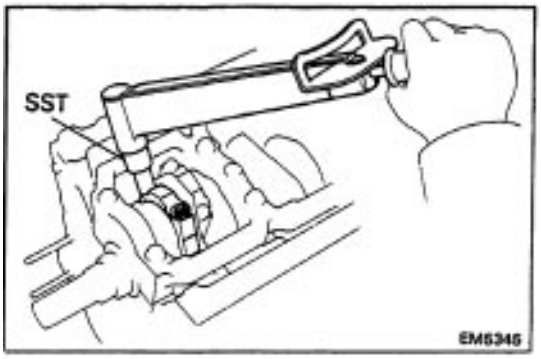


6. INSTALL CONNECTING ROD CAPS

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.



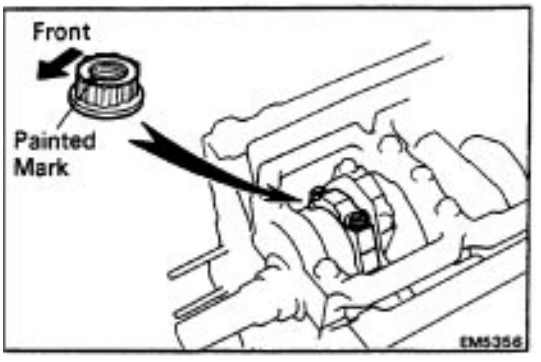
B. Install connecting rod cap nuts

HINT:

- The connecting rod cap nuts are tightened in two progressive steps.
- If any the connecting rod bolt is broken or deformed, replace them.

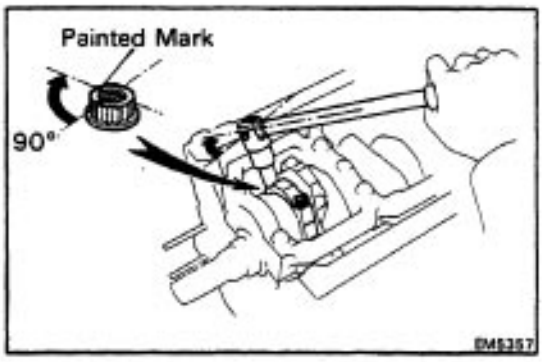
(a) Apply a light of engine oil on the threads and under the nuts of the connecting rod cap.

(b) 1st, using SST, install and alternately tighten the nuts of the connecting rod cap in several passes.
SST 09011–38121
Torque: 250 kg–cm(18 ft–lb, 25 N–m)



If any one of the connecting rod cap nuts does not meet the torque specification, replace the cap nut.

(c) Mark the front of the connecting rod cap nut with paint.

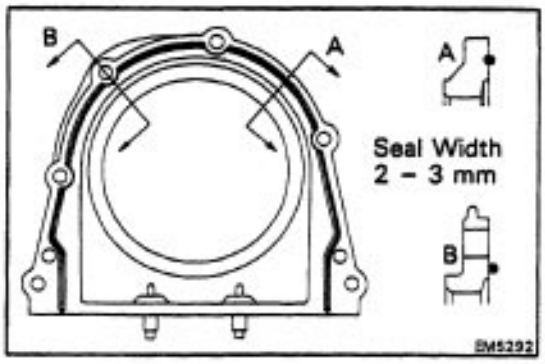


(d) 2nd, retighten the connecting rod cap nuts 90° in the numerical order shown.
(e) Check that the painted mark is now at a 90° angle to the front.
(f) Check that the crankshaft turns smoothly.
(g) Check the connecting rod thrust clearance.
(See step 2 on page EM–147)

7. INSTALL REAR OIL SEAL RETAINER

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surface of the retainer and cylinder block.

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



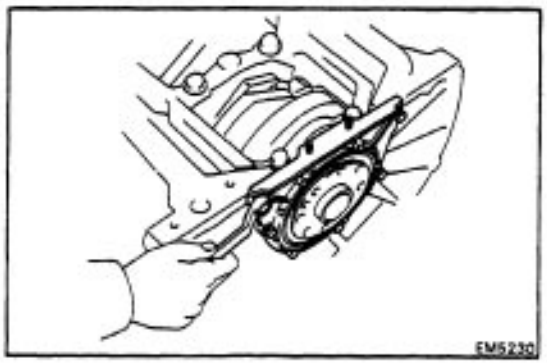
(b) Apply seal packing to the retainer as shown in the figure.
Seal packing: Part No. 08826–00080 or equivalent

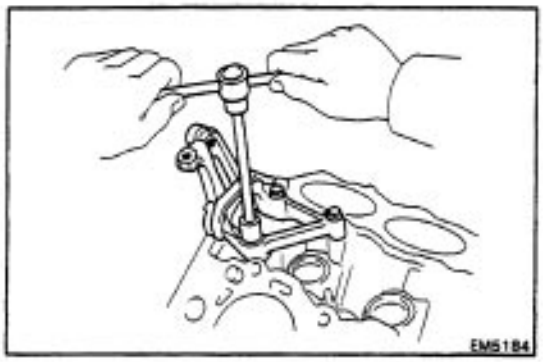
- Install a nozzle that has been cut to a 2 – 3 mm (0.08 – 0.12 in.) opening.

HINT: Avoid applying an excessive amount to the surface.

- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

(c) Install the retainer with the six bolts.
Torque: 80 kg–cm (69 in.–lb, 7.8 N–m)





POST ASSEMBLY

1. INSTALL NO. 2 IDLER PULLEY BRACKET

Install the pulley bracket with the three bolts. Torque the bolts.

Torque: 380 kg–cm (27 ft–lb, 37 N–m)

2. INSTALL WATER BY–PASS PIPE

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the bypass pipe and cylinder block.

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

(b) Apply seal packing to the groove of the by–pass pipe.

Seal packing: Part No. 08826–00100 or equivalent

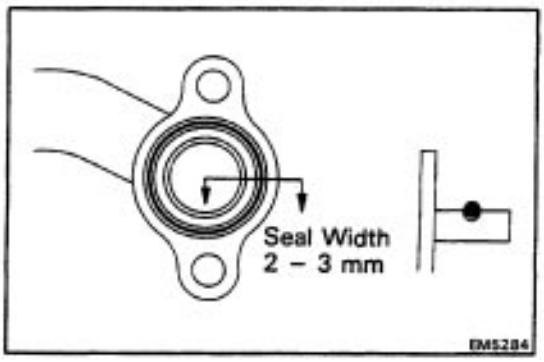
- Install a nozzle that has been cut to a 2 – 3 mm (0.08 0.12 in.) opening.

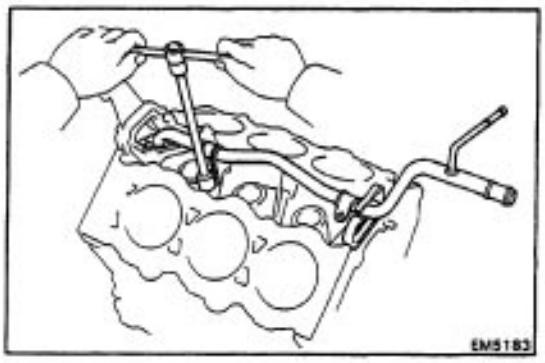
HINT: Avoid applying an excessive amount to the surface.

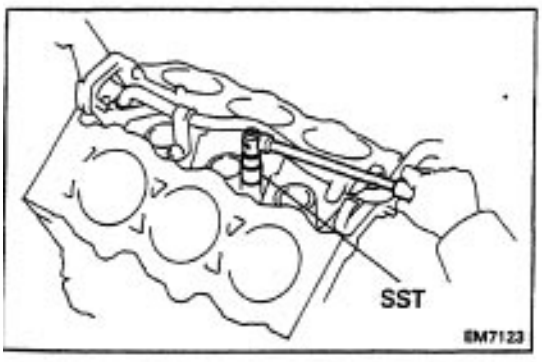
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

(c) Install the by–pass pipe with the two bolts and two nuts.

Torque: 85 kg–cm (74 in.–lb, 8.3 N–m)







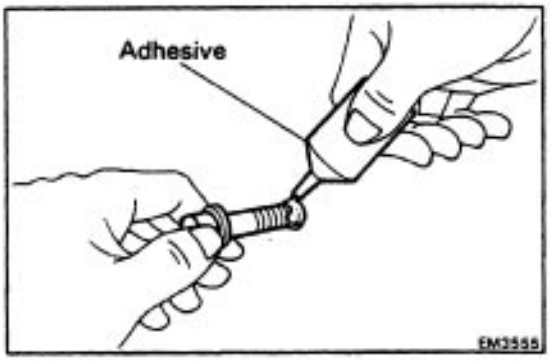
3. INSTALL KNOCK SENSOR

Using SST, install the knock sensor.

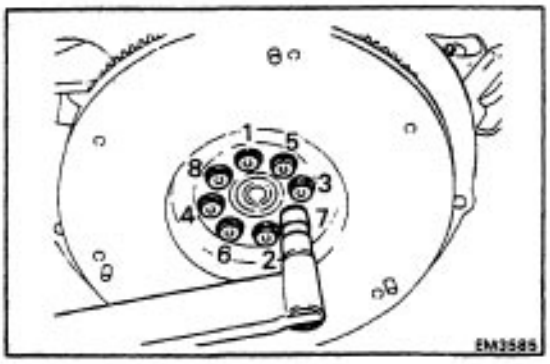
SST 09816–30010

Torque: 450 kg–cm (33 ft–lb, 44 N–m)

4. INSTALL OIL FILTER (See page LU–7)
5. INSTALL OIL PUMP AND OIL PAN
(See page LU–14)
6. INSTALL WATER PUMP (See page CO–6)
7. INSTALL CYLINDER HEADS
(See pages EM–96 to 106)
8. INSTALL PULLEYS AND TIMING BELT
(See pages EM–42 to 47)
9. INSTALL DISTRIBUTOR (See page IG–19)
10. REMOVE ENGINE STAND
11. INSTALL REAR END PLATE
Install the end plate with the bolt.
Torque: 75 kg–cm (65 in.–lb, 7.4 N–m)



12. (M/T)
INSTALL FLYWHEEL
(a) Apply adhesive to two or three threads of the mount bolt end.
Adhesive: Part No. 08833–00070, THREE BOND 1324 or equivalent



(b) Install the flywheel on the crankshaft.
(c) Install and uniformly tighten the eight mount bolts in several passes, in the sequence shown.
Torque: 850 kg–cm (61 ft–lb, 83 N–m)

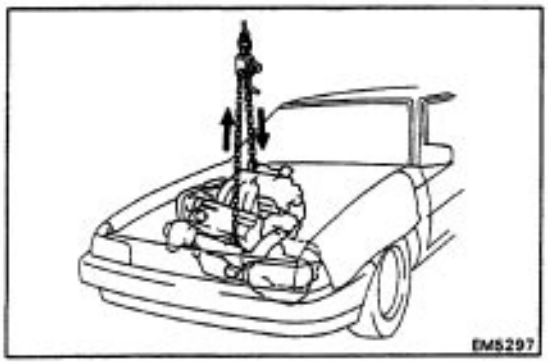
13. (A/T)
INSTALL DRIVE PLATE (See procedure step 12)
Torque: 854 kg–cm (61 ft–lb, 83 N–m)
14. (M/T)
INSTALL CLUTCH DISC AND COVER

INSTALLATION OF ENGINE

1. ASSEMBLE ENGINE AND TRANSAXLE

2. (A/T)

INSTALL STARTER



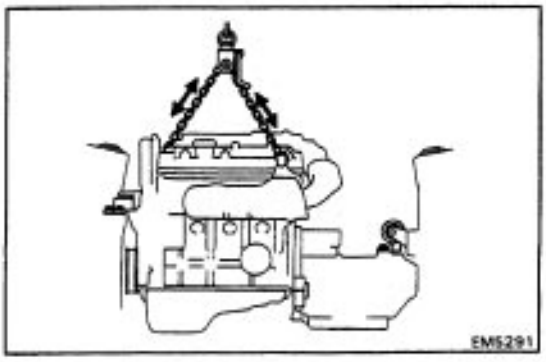
3. INSTALL ENGINE AND TRANSAXLE ASSEMBLY IN VEHICLE

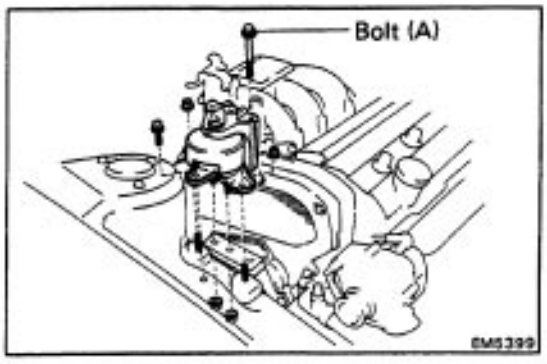
(a) Attach the engine chain hoist to the engine hangers.

(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.

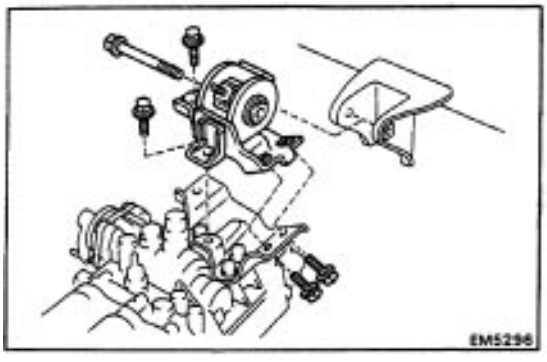
(c) Keep the engine level, and align RH and LH mounting with the body bracket.





(d) Attach the RH mounting insulator to the mounting bracket and body, and temporarily install the bolt and four nuts.

(e) Temporarily install the No. 2 mounting stay bolt (A).



M Install the LH mounting bracket to the transaxle case with the three bolts. Torque the bolts.

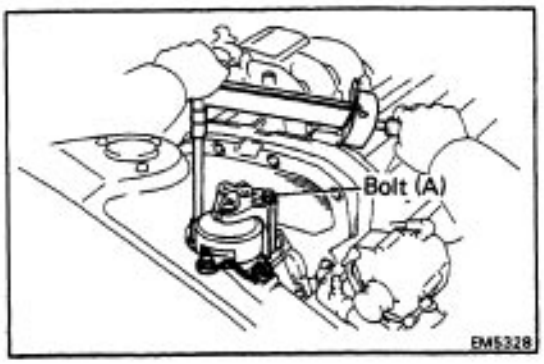
Torque: 530 kg–cm (38 ft–lb, 52 N–m)

Attach the LH mounting insulator to the mounting bracket with the three bolts, and install and torque the four bolts and through bolt.

Torque:

Bolt 530 kg–cm (38 ft–lb, 52 N–m)

Through bolt 890 kg–cm (64 ft–lb, 87 N–m)



(h) Torque the bolt and four nuts of the RH mounting insulator. Do not torque the bolt (A) yet.

Torque:

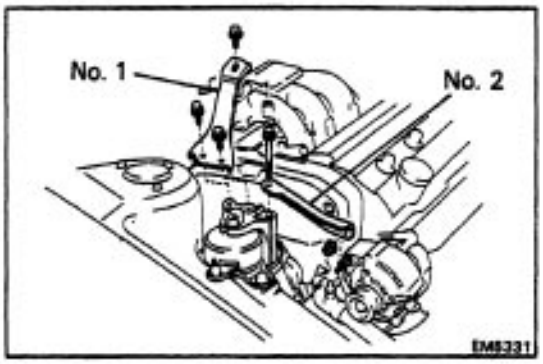
Bolt– 650 kg–cm (47 ft–lb, 64 N–m)

Nut To bracket 530 kg–cm (38 ft–lb, 52 N–m)

To body 900 kg–cm (65 ft–lb, 88 N–m)

(i) Remove the engine hoist chain from the engine. (w/ A.B.S..)

Install the two clamp bolts of the PS oil cooler pipes.



4. INSTALL ENGINE RH MOUNTING STAYS

(a) Install the No. 1 mounting stay with the three bolts. Torque the bolts.

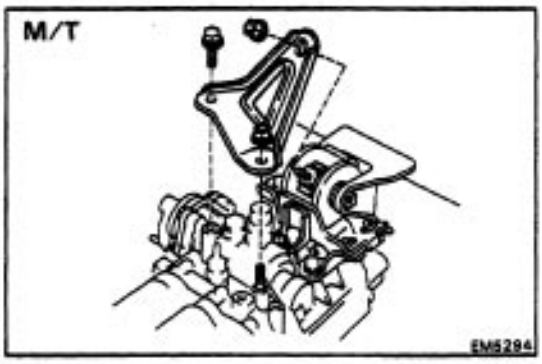
Torque: 530 kg–cm (38 ft–lb, 52 N–m)

(b) Install the No. 2 mounting stay with the bolt and nut. Torque the bolt and nut.

Torque:

Bolt 670 kg–cm (48 ft–lb, 66 N–m)

Nut 530 kg–cm (38 ft–lb, 52 N–m)



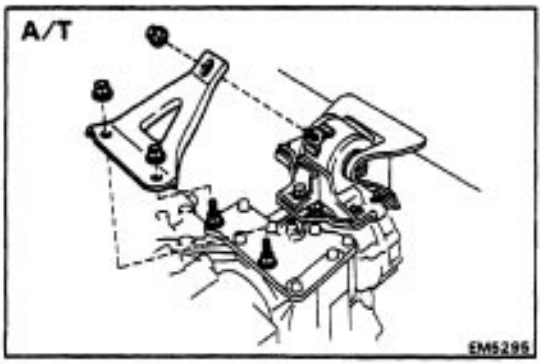
5. INSTALL ENGINE LH MOUNTING STAY

(M /T)

Install the mounting stay with the bolt and two nuts. Torque the bolt and nuts.

Torque: Nut 530 kg–cm (38 ft–1b, 52 N–m)

Bolt 195 kg–cm (14 ft–lb, 19 N–m)

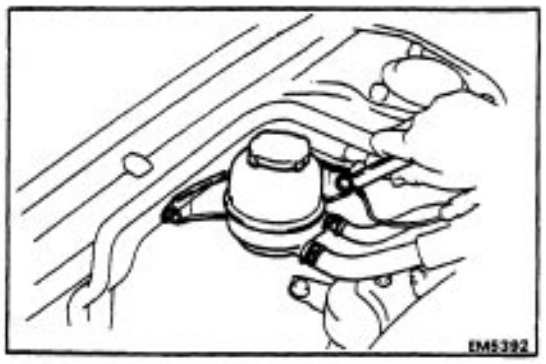


(A/T)

Install the mounting stay with the three nuts. Torque the nuts.

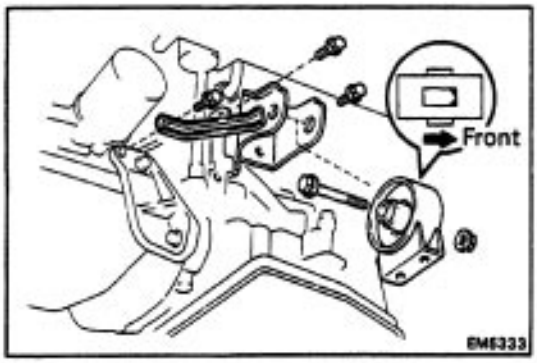
Torque: 12 mm nut 210 kg–cm (15 ft–lb, 21 N–m)

14 mm nut 530 kg–cm (38 ft–lb, 52 N–m)



6. INSTALL PS OIL RESERVOIR TANK

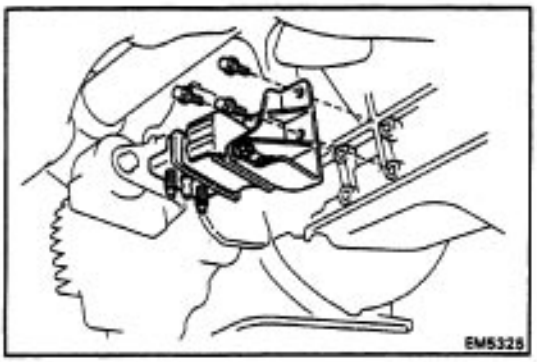
Install the reservoir tank with the two bolts. Connect the ground strap.



7. INSTALL FRONT ENGINE MOUNTING BRACKET AND INSULATOR

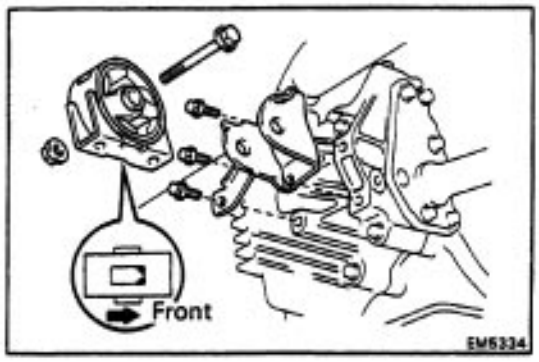
(a) Install the mounting bracket with the three bolts.
Torque the bolts.
Torque: 790 kg–cm (57 ft–lb, 77 N–m)

(b) Temporarily install the mounting insulator with the through bolt and a new nut.



8. INSTALL CENTER ENGINE MOUNTING BRACKET AND INSULATOR ASSEMBLY

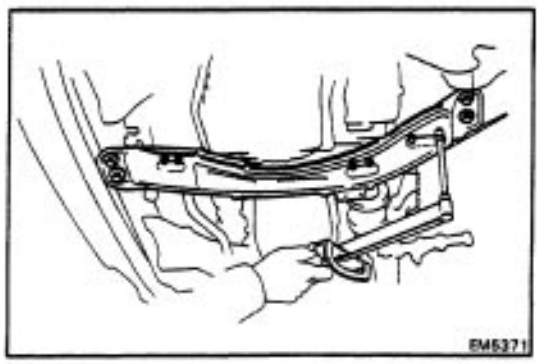
Install the mounting bracket and insulator assembly with the three bolts. Torque the bolts.
Torque: 530 kg–cm (38 ft–lb, 61 N–m)



9. INSTALL REAR ENGINE MOUNTING BRACKET AND INSULATOR

(a) Install the mounting bracket with the three bolts.
Torque the bolts.
Torque: 790 kg–cm (57 ft–lb, 77 N–m)

(b) Temporarily install the mounting insulator with the through bolt and a new nut.



10. INSTALL ENGINE MOUNTING CENTER MEMBER

(a) Install the engine mounting center member with the four bolts. Torque the bolts.
Torque: 400 kg–cm (29 ft–lb, 39 N–m)

(b) Install and torque the four bolts and two nuts holding the insulators (front, center and rear) to the center member.
Torque: 740 kg–cm (54 ft–lb, 73 N–m)

(c) Torque the mounting insulator through bolts (front and rear).
Torque: 895 kg–cm–(64 ft–lb, 87 N–m)

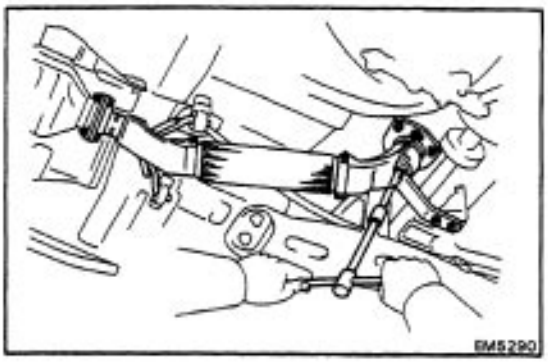
11. INSTALL PS PUMP

12. INSTALL DRIVE SHAFTS

13. (w/ A/C)
INSTALL A/C COMPRESSOR

(a) Install the compressor with the four bolts.

(b) Connect the two connectors.



14. INSTALL FRONT EXHAUST PIPE

(a) Place two new gaskets on the front pipe.

(b) Install the front pipe with the two bolts and five new nuts.

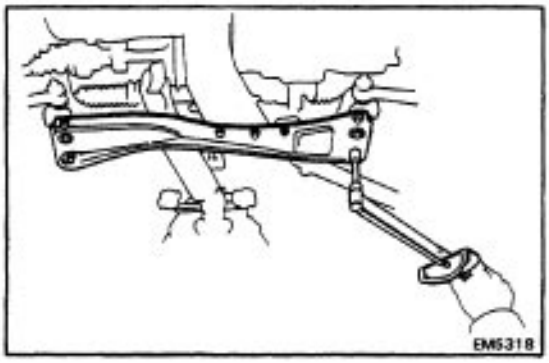
Torque the nuts.

Torque:

To manifold 630 kg–cm (46 ft–lb, 62 N–m)

To converter 440 kg–cm (32 t–lb, 43 N–m)

(c) Install the two pipe stay bolts.



15. INSTALL SUSPENSION LOWER CROSSMEMBER

Install the crossmember with the two bolts and two nuts.

Torque the bolts and nuts.

Torque: 2,120 kg–cm (153 ft–lb, 207 N–m)

16. CONNECT ENGINE WIRE TO CABIN

(a) Push in the engine wire through the cowl panel.

(b) Connect the following connectors.

(1) Three TCCS ECU connectors

(2) Circuit opening relay connector

(3) Cowl wire connector

(4) Instrument panel wire connector

(c) Install the glove compartment box.

(d) Install the under cover.

17. CONNECT TRANSAXLE CONTROL CABLE(S)

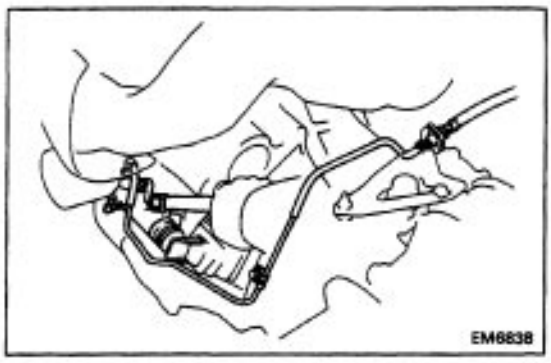
18. CONNECT SPEEDOMETER CABLE

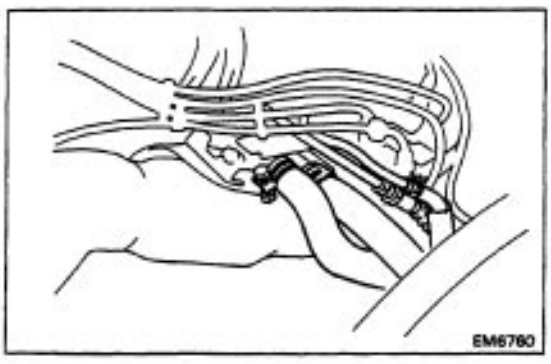
19. (M /T)

INSTALL CLUTCH RELEASE CYLINDER AND TUBE CLAMP

20. (M /T)

INSTALL STARTER





21. CONNECT FUEL HOSES

22. CONNECT HEATER HOSES

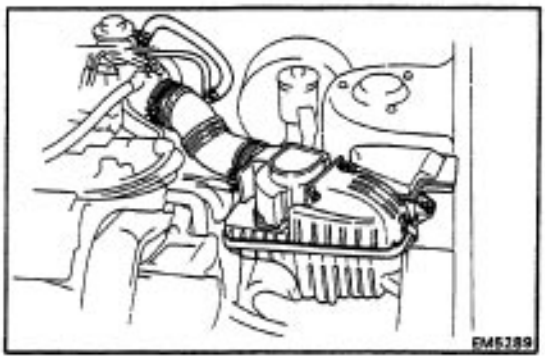
23. CONNECT GROUND STRAP TO TRANSAXLE

24. CONNECT VACUUM HOSES

(a) Brake booster vacuum hose to air intake chamber
(b) A/C idle–up vacuum hose to air intake chamber
(c) A/C idle–up vacuum hose to vacuum pipe (on air intake chamber)
(d) Charcoal canister vacuum hose to vacuum pipe (on air intake chamber)

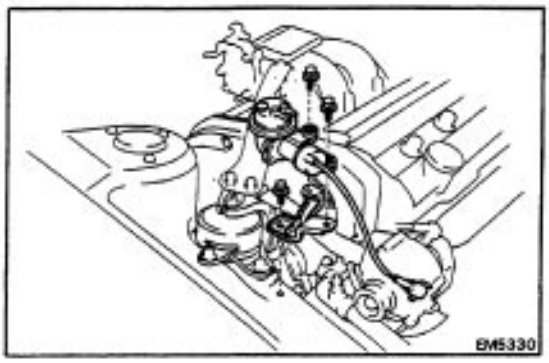
25. CONNECT WIRES AND CONNECTORS

(a) Check connector
(b) Ground straps from OH fender apron
(c) Connectors from relay box
(d) Engine room wire connector



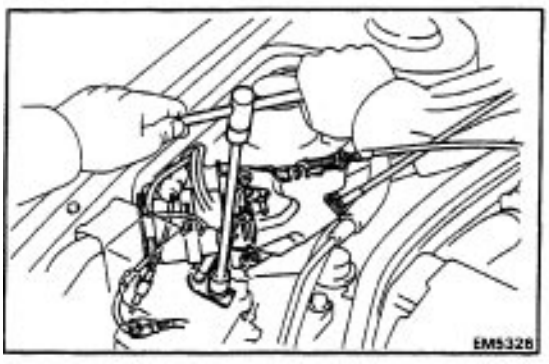
26. INSTALL AIR CLEANER ASSEMBLY

(a) Install the air cleaner case with the three bolts.
(b) Install the air cleaner element.
(c) Connect the air cleaner hose, and Install the air cleaner cap and air flow meter assembly with the four clips.
(d) Connect the following connector and hoses:
  (1) Air flow meter connector
  (2) ISC valve air hose
  (3) Vacuum pipe air hose

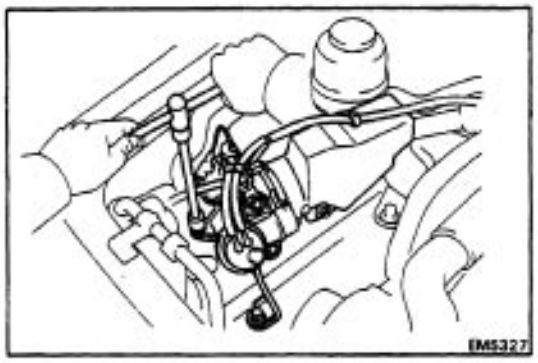


27. (w/ CRUISE CONTROL SYSTEM)
INSTALL CRUISE CONTROL ACTUATOR
(w/ A. B. S.)

(a) Install the vacuum pump and bracket with the three bolts.
(b) Connect the vacuum pump connector.



(c) Install the actuator and bracket with the four bolts.
(d) Connect the following hoses and connector:
  (1) Actuator vacuum hoses
  (2) Actuator connector
  (3) Install the dust cover.



(w/o A.B.S..)

(a) Install the actuator, vacuum pump and vacuum switch assembly with the three bolts.

(b) Connect the following the hose and connectors:

(1) Actuator vacuum hose from air intake chamber
(2) Actuator connector
(3) Vacuum pump connector
(4) Vacuum switch connector

28. (A/T)
INSTALL THROTTLE CABLE, AND ADJUST IT

29. INSTALL ACCELERATOR CABLE, AND ADJUST IT

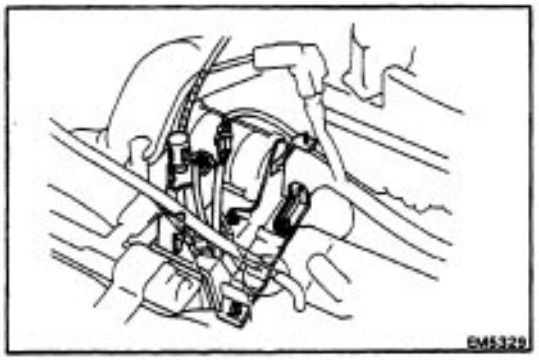
30. INSTALL RADIATOR RESERVOIR TANK

31. INSTALL ALTERNATOR BELT ADJUSTING BAR

32. INSTALL ALTERNATOR (See page CH–15)

33. INSTALL RADIATOR (See page CO–20)

34. INSTALL IGNITION COIL, IGNITER AND BRACKET ASSEMBLY



(a) Install the ignition coil, igniter and bracket assembly with the two bolts.

(b) Connect the following cord and connectors:

(1) Igniter connector
(2) Noise filter connector
(3) High–tension cord

35. INSTALL BATTERY

Connect the grand strap.

36. FILL WITH ENGINE COOLANT (See page CO–5)
Capacity (w/ Heater):
M /T 9.5 liters (10.0 US qts, 8.4 Imp. qts)
A/T 9.4 liters (9.9 US qts, 8.3 Imp. qts)

37. 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
3.7 liters (3.9 US qts, 3.3 Imp. qts)
Dry fill 4.6 liters (4.8 US qts, 4.0 Imp. qts)

38. START ENGINE AND CHECK FOR LEAKS

39. PERFORM ENGINE ADJUSTMENT

(a) Adjust the alternator drive belt.

(See page CH–3)

Drive belt tension: New belt 175 ± 5 lb

Used belt 115 ± 20 lb

(b) Adjust PS pump drive belt.

Drive belt tension: New belt 125 ± 25 lb

Used belt 80 ± 20 lb

(c) Adjust the ignition timing.

(See page IG–21)

Ignition timing:

10˚BTDC @ idle

(w/ Terminals TE1 and E1 connected)

(d) Adjust the valve clearance.

Valve clearance:

Intake 0.13 – 0.23 mm (0. 005 – 0.009 in.)

Exhaust 0.27 – 0.37 mm l0.011 – 0.015 in.)

40. INSTALL HOOD

41. PERFORM ROAD TEST

Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

42. RECHECK ENGINE COOLANT AND ENGINE OIL LEVELS