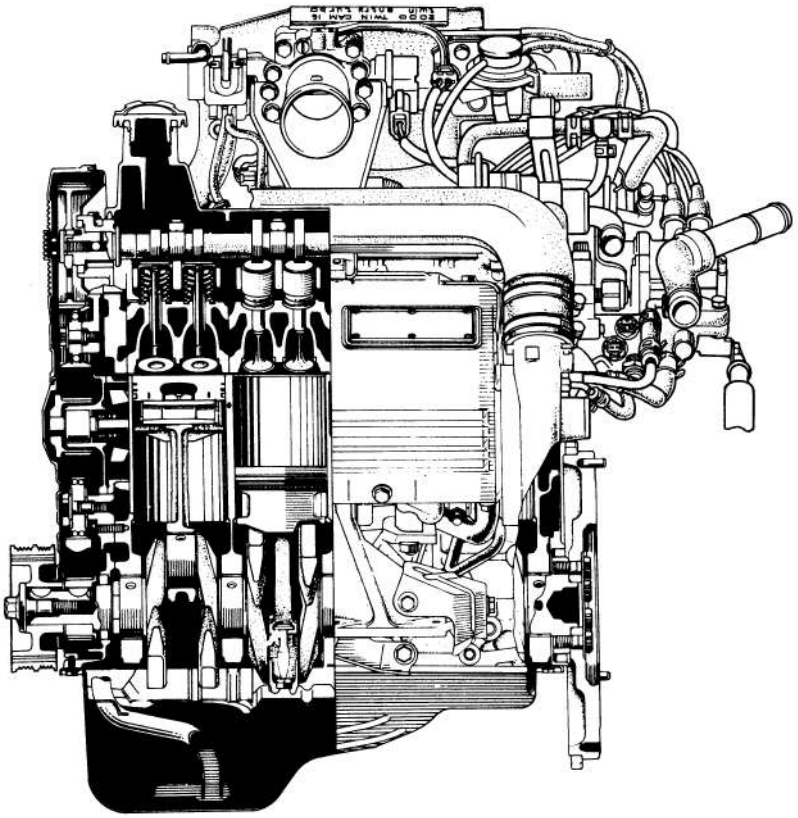
ENGINE MECHANICAL

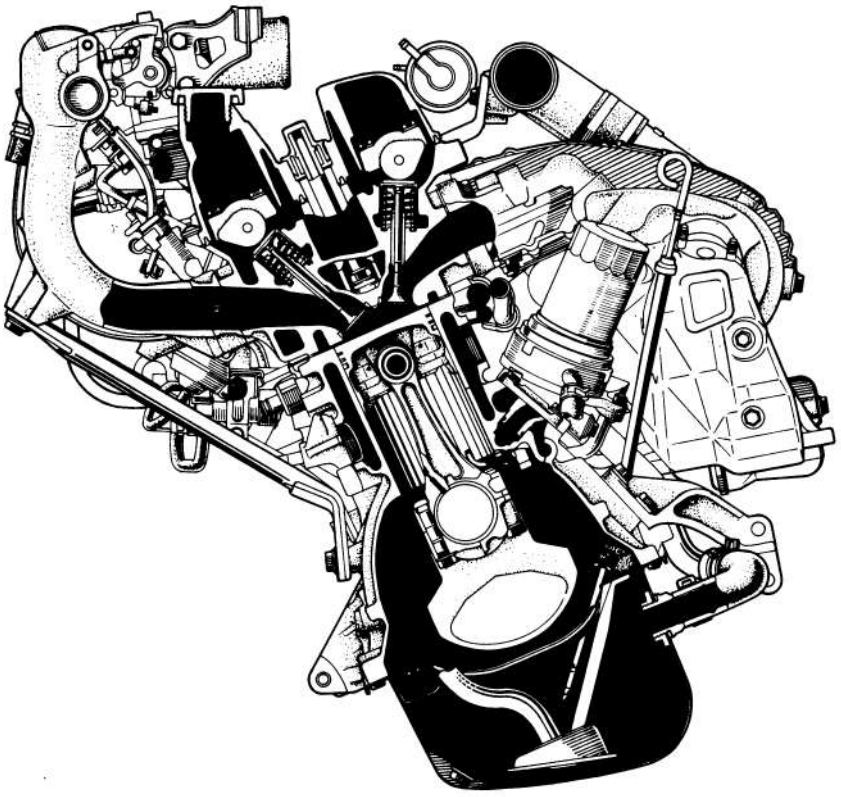
	Page
DESCRIPTION (3S-GTE)	EM-2
DESCRIPTION (5S-FE)	EM-4
TROUBLESHOOTING	EM-6
ENGINE TUNE-UP	EM-10
TOYOTA-VARIABLE INDUCTION SYSTEM (T-VIS)	EM-22
IDLE AND/OR 2,500 RPM HC/CO CONCENTRATION CHECK METHOD	EM-23
COMPRESSION CHECK	EM-25
TIMING BELT (3S-GTE)	EM-26
TIMING BELT (5S-FE)	EM-47
CYLINDER HEAD (3S-GTE)	EM-61
CYLINDER HEAD (5S-FE)	EM-97
CYLINDER BLOCK (3S-GTE)	EM-133
CYLINDER BLOCK (5S-FE)	EM-181

cardiagn.com

DESCRIPTION (3S-GTE)

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





EM9134
EM9135

cardiagn.com

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

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

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

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

Both the intake camshaft and the exhaust camshaft are driven by a single timing belt. The cam journal is supported at 5 places between the valve lifters of each cylinder and on the front end of the cylinder head. Lubrication of the cam journals and cams are accomplis hed by oil supplied through the oiler port in the center of the camshaft.

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

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

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

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

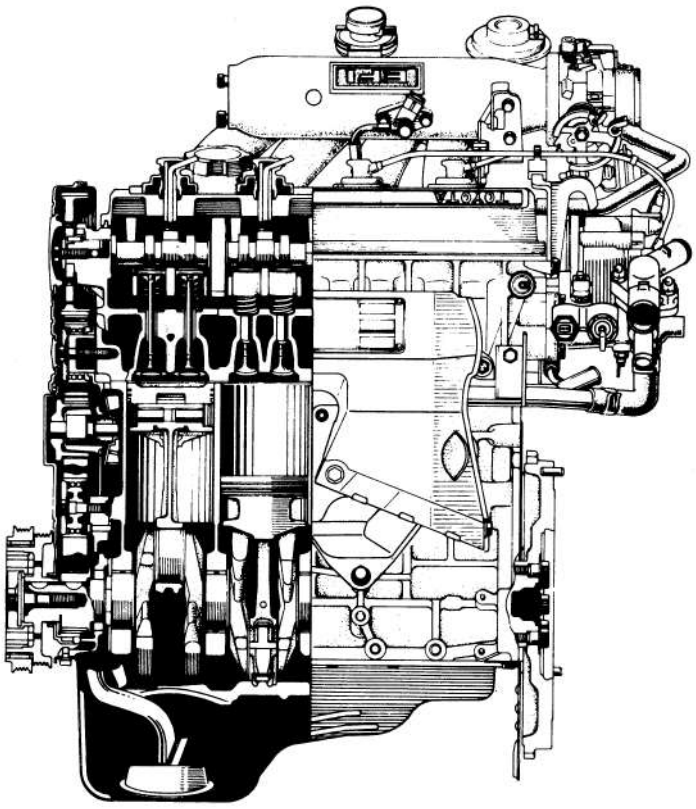
The cylinder block is made of cast iron. It has 4 cylinders which are approximately twice the length of the piston stroke. The top of the cylinders are closed off by the cylinder head and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder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

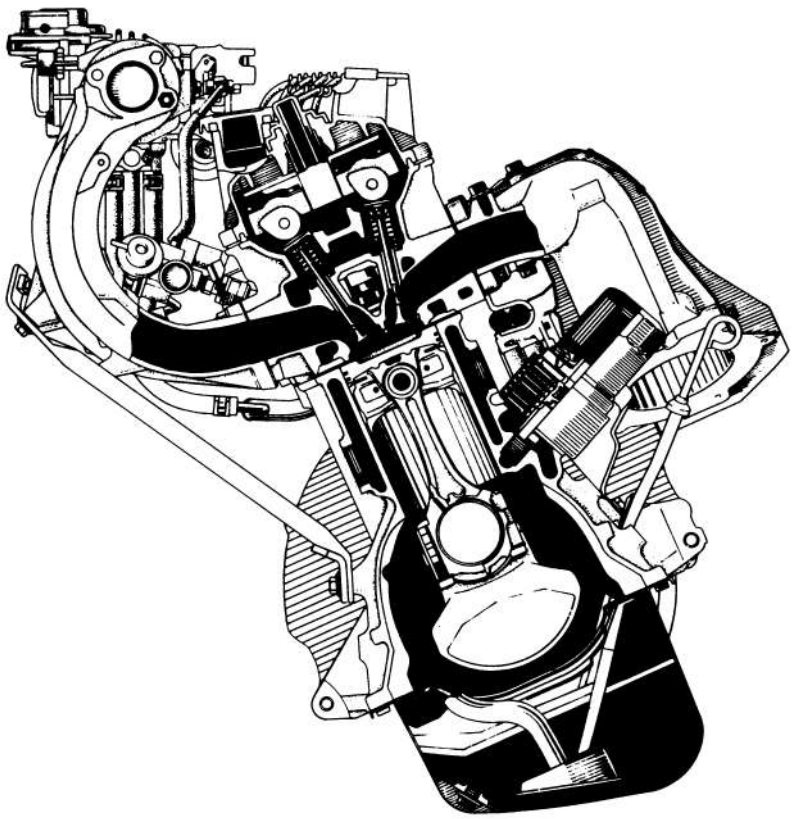
The oil pan is bolted onto the bottom of the cylinder block. The oil pan is an oil reservoir made of pressed steel sheet. A dividing plate is included inside the oil pan to keep sufficient oil in the bottom of the pan even when the vehicle is tilted. This dividing plate also prevents the oil from making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

cardiagn.com

DESCRIPTION (5S-FE)

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





EM9092
EM9093

cardiagn.com

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

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

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

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

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

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

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

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

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

The No.1 compression ring is made of steel and the No.2 compression ring is made of cast iron. The oil ring is made of a combination of steel and stainless steel. The outer diameter of each piston ring is slightly larger than the diameter of the piston and the flexibility of the rings allows them to hug the cylinder walls when they are mounted on the piston. Compression rings No.1 and No.2 work to prevent gas leakage from the cylinder and an 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 twice the length of the piston stroke. The top of the cylinders are closed off by the cylinder head and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder block contains a water jacket, through which coolant is pumped to cool the cylinders.

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

cardiagn.com

TROUBLESHOOTING

ENGINE OVERHEATING

Problem	Possible cause	Remedy	Page
Engine overheats	Cooling system faulty	Troubleshoot cooling system	CO-4
	Incorrect ignition timing	Reset timing	IG-17, 22

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-11
	EFI system problems	Repair as necessary	
	Ignition problems ● Ignition coil ● Igniter ● Distributor	Perform spark test	IG-5, 10
	Spark plug faulty	Inspect plugs	IG-6, 11
	High-tension cords disconnected or broken	Inspect cords	IG-6, 11
	Vacuum leaks ● PCV line ● EGR line ● Intake manifold ● T-VIS valve (3S-GTE) ● Throttle body ● ISC valve ● Brake booster line	Repair as necessary	
	Air suction between air flow meter and throttle body	Repair as necessary	
	Low compression	Check compression	EM-25

ROUGH IDLING

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses	Spark plug faulty	Inspect plugs	IG-6, 11
	High-tension cord faulty	Inspect cords	IG-6, 11
	Ignition problems		
	● Ignition coil	Inspect coil	IG-8, 12
	● Igniter	Inspect igniter	IG-9, 13
	● Distributor	Inspect distributor	IG-9, 13
	Incorrect ignition timing	Reset timing	IG-17, 22
	Vacuum leaks ● PCV line ● EGR line ● Intake manifold	Repair as necessary	

cardiagn.com

ROUGH IDLING (Cont'd)

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses (Cont'd)	• T-VIS valve (3S-GTE) • Throttle body • ISC valve • Brake booster line		
	Air suction between air flow meter and throttle body		
	Incorrect idle speed	Check ISC system	FI-148, 151
	Incorrect valve clearance	Adjust valve clearance	EM-11, 16
	EFI system problems	Repair as necessary	
	Engine overheats	Check cooling system	CO-4
	Low compression	Check compression	EM-25

ENGINE HESITATES/POOR ACCELERATION

Problem	Possible cause	Remedy	Page
Engine hesitates/ poor acceleration	Spark plug faulty	Inspect plug	IG-6, 11
	High-tension cord faulty	Inspect cords	IG-6, 11
	Vacuum leaks • PCV line • EGR line • Intake manifold • T-VIS valve • Throttle body • ISC valve • Brake booster line	Repair as necessary	
	Air suction between air flow meter and throttle body	Repair as necessary	
	Incorrect ignition timing	Reset timing	IG-17, 22
	Incorrect valve clearance	Adjust valve clearance	EM-11, 16
	Fuel system clogged	Check fuel system	
	Air cleaner clogged	Check air cleaner	MA-4
	EFI system probles	Repair as necessary	
	Emission control system problem (cold engine) • EGR system always on	Check EGR system	EC-8, 24
	Engine overheats	Check cooling system	CO-4
	Low compression	Check compression	EM-25

cardiagn.com

ENGINE DIESELING

Problem	Possible cause	Remedy	Page
Engine diesels (runs after ignition switch is tuned off)	EFI system problems	Repair as necessary	
	Incorrect ignition timing	Reset timing	IG-17, 22
	EGR system faulty	Check EGR system	EC-8, 24

AFTER FIRE, BACKFIRE

Problem	Possible	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	Check air cleaner	MA-4
	EFI system problem	Repair as necessary	
	Incorrect ignition timing	Reset timing	IG-17, 22
Engine backfires	EFI system problem	Repair as necessary	
	Vacuum leak • PCV line • EGR line • Intake manifold • T-VIS valve • Throttle body • ISC valve • Brake booster line	Check hoses and repair as necessary	
	Air suction between air flow meter and throttle body	Repair as necessary	
	Insufficient fuel flow	Troubleshoot fuel system	FI-11
	Incorrect ignition timing	Reset timing	IG-17, 22
	Incorrect valve clearance	Adjust valve clearance	EM-11, 16
	Carbon deposits in combustion chambers	Inspect cylinder head	EM-74, 110

EXCESSIVE OIL CONSUMPTION

Problem	Possible cause	Remedy	Page
Excessive oil consumption	Oil leak	Repair as necessary	
	PCV line clogged	Check PCV system	
	Piston ring worn or damaged	Check rings	EM-185, 203
	Valve stem and guide bushing worn	Check valves and guide bushing	EM-75, 111
	Valve stem oil seal worn	Check seals	

cardiagn.com

EXCESSIVE FUEL CONSUMPTION

Problem	Possible cause	Remedy	Page
Poor gasoline mileage	Fuel leak	Repair as necessary	
	Air cleaner clogged	Check air cleaner	MA-4
	Incorrect ignition timing	Reset timing	IG-17, 22
	EFI system problems ● Injector faulty ● Deceleration fuel cut system faulty	Repair as necessary	
	Idle speed too high	Check ISC system	FI-148, 151
	Spark plug faulty	Inspect plugs	IG-6, 11
	EGR suustem always on	Check EGR system	EC-8, 24
	Low compression	Check compression	EM-25
	Tires improperly inflated	Inflate tire to proper pressure	
	Clutch slips	Troubleshoot clutch	
	Brakes drag	Trubleshoot brakes	

UNPLEASANT ODOR

Problem	Possible cause	Remedy	Page
Unpleasant odor	Incorrect idle speed	Check ISC system	FI-148, 151
	Incorrect ignition timing	Reset timing	IG-17, 22
	Vacuum leaks ● PCV line ● EGR line ● Intake manifold ● T-VIS valve ● Throttle body ● ISC valve ● Brake booster line	Repair as necessary	
	EFI system problems	Repair as necessary	

cardiagn.com

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 20°C(68°F)

INSPECTION OF AIR FILTER

(See page MA-4)

INSPECTION OF HIGH-TENSION CORDS

(See page IG-6 or 11)

Maximum resistance: 25 kΩ per cord

INSPECTION OF SPARK PLUGS (5S-FE only)

(See page IG-11)

Correct electrode gap:	**1.1 mm (0.043 in.)**
Recommended spark plugs:	**NDK16R-U11** **NGK BKR5EYA11**

INSPECTION AND ADJUSTMENT OF ALTERNATOR DRIVE BELT

(See step 3 on page CH-3)

Drive belt tension:	**New belt**	**120 ± 20 lb**
	Used belt	**104 ± 20 lb**

cardiagn.com

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

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

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**

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

2. **REMOVE NO.1 AIR INTAKE CONNECTOR**
   (See step 4 on page TC-20)

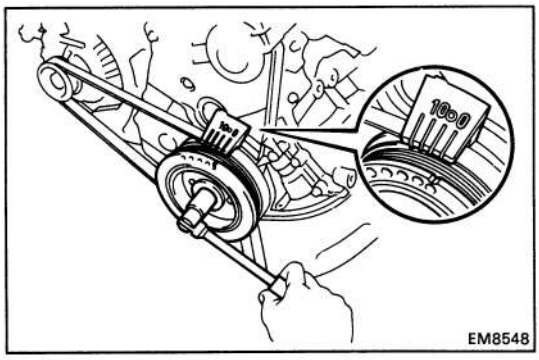
3. **DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS (See page IG-6)**

4. **REMOVE EGR VACUUM MODULATOR AND VSV**
   (See step 22 on page EM-66)

5. **REMOVE THROTTLE BODY**
   (See steps 3, 5 to 8, 10 and 11 on pages FI-135 and 136)

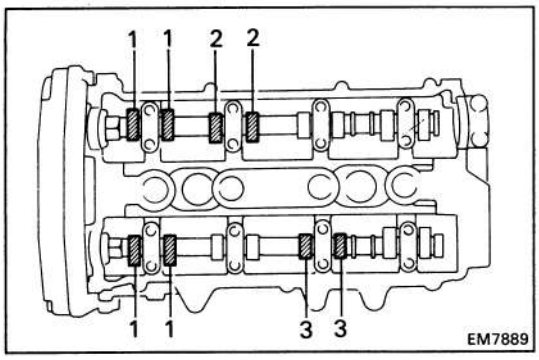
6. **REMOVE HOSE CLAMP AND VTV CLAMP OF AIR BY-PASS VALVE**
   (See steps 15 and 16 on page TC-9)

7. **REMOVE CYLINDER HEAD COVER**
   (See step 35 on page EM-70)



8. **SET NO.1 CYLINDER TO TDC/COMPRESSION**
   (a) Turn the crankshaft pulley and align its groove with timing mark "0" of the No.1 timing belt cover.
   (b) Check that the valve lifters on the No.1 cylinder are loose and valve lifters on No.4 are tight.

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

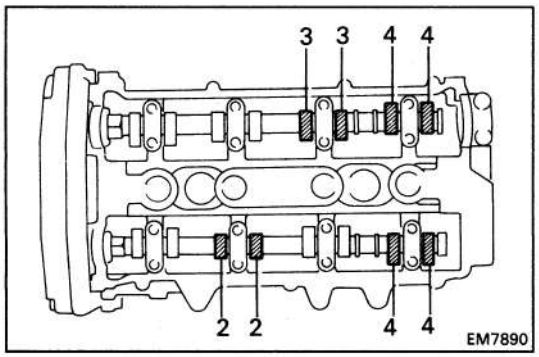


9. **INSPECT VALVE CLEARANCE**
   (a) Check only those valves indicated.
   - Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
   - Record the specicifications of the valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

   Valve clearance (Cold):

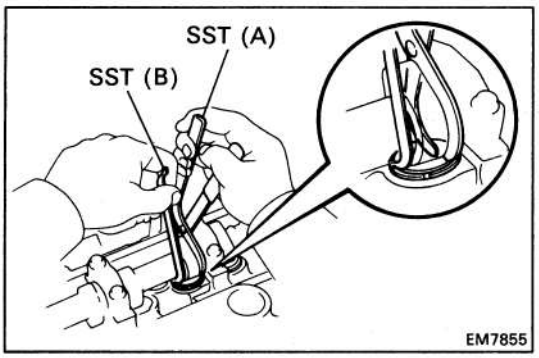
Intake	**0.15 – 0.25 mm (0.006 – 0.010 in.)**
Exhaust	**0.20 – 0.30 mm (0.008 – 0.012 in.)**

cardiagn.com



(b) Turn the crankshaft one revolution (360[) and align the mark as above. (See procedure step 8)

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



10. ADJUST VALVE CLEARANCE

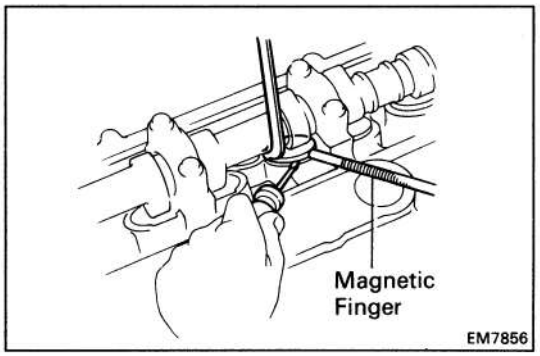
(a) Remove the adjusting shim.

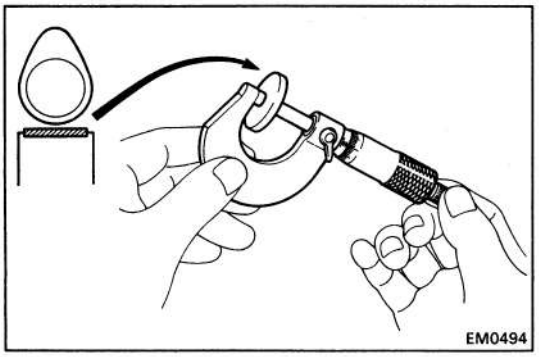
- Turn the crankshaft to position the cam lobe of the camshaft on the adjusting valve upward.
- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

SST 09248-55010

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

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





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

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

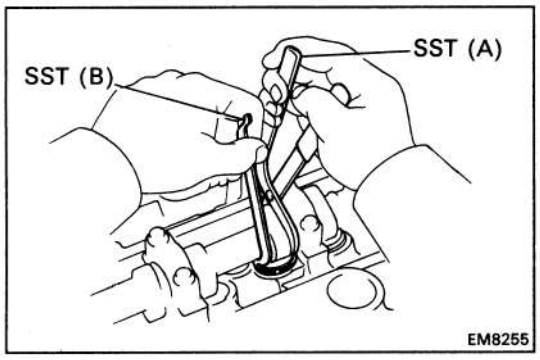
T ..... Thickness of used shim
A ..... Measured valve clearance
N ..... Thickness of new shim

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

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

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

cardiagn.com



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

SST 09248-55010

(d) Recheck the valve clearance.

11. REINSTALL CYLINDER HEAD COVER
(See step 7 on page EM-88)

12. INSTALL HOSE CLAMP AND VTV CLAMP OF AIR BY-PASS VALVE
(See steps 13 and 14 on page TC-19)

13. REINSTALL THROTTLE BODY
(See steps 2, 3, 4 to 8 and 10 on pages FI-138 and 139)

14. REINSTALL EGR VACUUM MODULATOR AND VSV
(See step 20 on page EM-92)

15. RECONNECT HIGH-TENSION CORDS FROM SPARK PLUGS

16. REINSTALL NO.1 AIR INTAKE CONNECTOR
(See step 10 on page TC-25)

17. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

cardiagn.com

Adjusting Shim Selection Using Chart

INTAKE

Measured clearance (mm)	Installed shim thickness (mm)																																																				
	2.000	2.025	2.050	2.075	2.100	2.125	2.150	2.175	2.200	2.225	2.250	2.275	2.300	2.325	2.350	2.375	2.400	2.425	2.450	2.475	2.500	2.525	2.550	2.575	2.600	2.625	2.650	2.675	2.700	2.725	2.750	2.775	2.800	2.825	2.850	2.875	2.900	2.925	2.950	2.975	3.000	3.025	3.050	3.075	3.100	3.125	3.150	3.175	3.200	3.225	3.250	3.275	3.300
0.000 – 0.025							02	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46
0.026 – 0.050						02	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48
0.051 – 0.075					02	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48
0.076 – 0.100				02	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50
0.101 – 0.125			02	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50
0.126 – 0.149		02	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52
0.150 – 0.250																																																					
0.251 – 0.275	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54	
0.276 – 0.300	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54		
0.301 – 0.325	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54			
0.326 – 0.350	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54				
0.351 – 0.375	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54					
0.376 – 0.400	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54						
0.401 – 0.425	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54							
0.426 – 0.450	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54								
0.451 – 0.475	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54									
0.476 – 0.500	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	48	48	48	50	50	52	52	54	54	54										
0.501 – 0.525	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54											
0.526 – 0.550	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54												
0.551 – 0.575	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54													
0.576 – 0.600	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54														
0.601 – 0.625	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54															
0.626 – 0.650	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	38	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																
0.651 – 0.675	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																	
0.676 – 0.700	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	38	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																		
0.701 – 0.725	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																			
0.726 – 0.750	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																				
0.751 – 0.775	24	26	26	26	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																					
0.776 – 0.800	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																						
0.801 – 0.825	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																							
0.826 – 0.850	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																								
0.851 – 0.875	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																									
0.876 – 0.900	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																										
0.901 – 0.925	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																											
0.926 – 0.950	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																												
0.951 – 0.975	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																													
0.976 – 1.000	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																														
1.001 – 1.025	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																															
1.026 – 1.050	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																																
1.051 – 1.075	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																																	
1.076 – 1.100	38	38	40	40	42	42	44	44	46	46	48	46	50	50	52	52	54	54	54																																		
1.101 – 1.125	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																																			
1.126 – 1.150	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																																				
1.151 – 1.175	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																																					
1.176 – 1.200	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																																						
1.201 – 1.225	42	44	44	46	46	48	48	50	50	52	52	54	54	54																																							
1.226 – 1.250	44	44	46	46	48	48	50	50	52	52	54	54	54																																								
1.251 – 1.275	44	46	46	48	48	50	50	52	52	54	54	54																																									
1.276 – 1.300	46	46	48	48	50	50	52	52	54	54	54																																										
1.301 – 1.325	46	48	48	50	50	52	52	54	54	54																																											
1.326 – 1.350	48	48	50	50	52	52	54	54	54																																												
1.351 – 1.375	48	50	50	52	52	54	54	54																																													
1.376 – 1.400	50	50	52	52	54	54	54																																														
1.401 – 1.425	50	52	52	54	54	54																																															
1.426 – 1.450	52	52	54	54	54																																																
1.451 – 1.475	52	54	54	54																																																	
1.476 – 1.500	54	54	54																																																		
1.501 – 1.525	54	54																																																			
1.526 – 1.550	54																																																				

New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
02	2.00 (0.0787)	30	2.70 (0.1063)
04	2.05 (0.0807)	32	2.75 (0.1083)
06	2.10 (0.0827)	34	2.80 (0.1102)
08	2.15 (0.0846)	36	2.85 (0.1122)
10	2.20 (0.0866)	38	2.90 (0.1142)
12	2.25 (0.0886)	40	2.95 (0.1161)
14	2.30 (0.0906)	42	3.00 (0.1181)
16	2.35 (0.0925)	44	3.05 (0.1201)
18	2.40 (0.0945)	46	3.10 (0.1220)
20	2.45 (0.0965)	48	3.15 (0.1240)
22	2.50 (0.0984)	50	3.20 (0.1260)
24	2.55 (0.1004)	52	3.25 (0.1280)
26	2.60 (0.1024)	54	3.30 (0.1299)
28	2.65 (0.1043)		

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

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.). Replace the 2.800 mm (0.1102 in.) shim with a No.44 shim.

carDiagn.com

Adjusting Shim Selection Using Chart

EXHAUST

Installed shim thickness (mm)

Measured clearance (mm)	2.000	2.025	2.050	2.075	2.100	2.125	2.150	2.175	2.200	2.225	2.250	2.275	2.300	2.325	2.350	2.375	2.400	2.425	2.450	2.475	2.500	2.525	2.550	2.575	2.600	2.625	2.650	2.675	2.700	2.725	2.750	2.775	2.800	2.825	2.850	2.875	2.900	2.925	2.950	2.975	3.000	3.025	3.050	3.075	3.100	3.125	3.150	3.175	3.200	3.225	3.250	3.275	3.300
0.000 – 0.025									02	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44
0.026 – 0.050								02	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46
0.051 – 0.075							02	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46
0.076 – 0.100						02	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48
0.101 – 0.125					02	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48
0.126 – 0.150				02	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50
0.151 – 0.175			02	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50
0.176 – 0.199		02	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52
0.200 – 0.300																																																					
0.301 – 0.325	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54	
0.326 – 0.350	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54		
0.351 – 0.375	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54			
0.376 – 0.400	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54				
0.401 – 0.425	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54					
0.426 – 0.450	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54						
0.451 – 0.475	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54							
0.476 – 0.500	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54								
0.501 – 0.525	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54									
0.526 – 0.550	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54										
0.551 – 0.575	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54											
0.576 – 0.600	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54												
0.601 – 0.625	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54													
0.626 – 0.650	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54														
0.651 – 0.675	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54															
0.676 – 0.700	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																
0.701 – 0.725	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																	
0.726 – 0.750	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																		
0.751 – 0.775	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																			
0.776 – 0.800	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																				
0.801 – 0.825	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																					
0.826 – 0.850	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																						
0.851 – 0.875	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																							
0.876 – 0.900	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																								
0.901 – 0.925	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																									
0.926 – 0.950	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																										
0.951 – 0.975	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																											
0.976 – 1.000	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																												
1.001 – 1.025	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																													
1.026 – 1.050	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																														
1.051 – 1.075	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																															
1.076 – 1.100	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																																
1.101 – 1.125	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																																	
1.126 – 1.150	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																																		
1.151 – 1.175	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																																			
1.176 – 1.200	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																																				
1.201 – 1.225	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																																					
1.226 – 1.250	42	42	44	44	46	46	48	48	50	50	52	52	54	54	54																																						
1.251 – 1.275	42	44	44	46	46	48	48	50	50	52	52	54	54	54																																							
1.276 – 1.300	44	44	46	46	48	48	50	50	52	52	54	54	54																																								
1.301 – 1.325	44	46	46	48	48	50	50	52	52	54	54	54																																									
1.326 – 1.350	46	46	48	48	50	50	52	52	54	54	54																																										
1.351 – 1.375	46	48	48	50	50	52	52	54	54	54																																											
1.376 – 1.400	48	48	50	50	52	52	54	54	54																																												
1.401 – 1.425	48	50	50	52	52	54	54	54																																													
1.426 – 1.450	50	50	52	52	54	54	54																																														
1.451 – 1.475	50	52	52	54	54	54																																															
1.476 – 1.500	52	52	54	54	54																																																
1.501 – 1.525	52	54	54	54																																																	
1.526 – 1.550	54	54	54																																																		
1.551 – 1.575	54	54																																																			
1.576 – 1.600	54																																																				

New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
02	2.00 (0.0787)	30	2.70 (0.1063)
04	2.05 (0.0807)	32	2.75 (0.1083)
06	2.10 (0.0827)	34	2.80 (0.1102)
08	2.15 (0.0846)	36	2.85 (0.1122)
10	2.20 (0.0866)	38	2.90 (0.1142)
12	2.25 (0.0886)	40	2.95 (0.1161)
14	2.30 (0.0906)	42	3.00 (0.1181)
16	2.35 (0.0925)	44	3.05 (0.1201)
18	2.40 (0.0945)	46	3.10 (0.1220)
20	2.45 (0.0965)	48	3.15 (0.1240)
22	2.50 (0.0984)	50	3.20 (0.1260)
24	2.55 (0.1004)	52	3.25 (0.1280)
26	2.60 (0.1024)	54	3.30 (0.1299)
28	2.65 (0.1043)		

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

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.). Replace the 2.800 mm (0.1102 in.) shim with a No.42 shim.

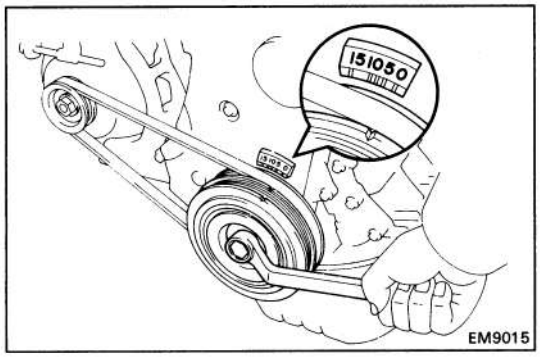
cardiagn.com

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

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

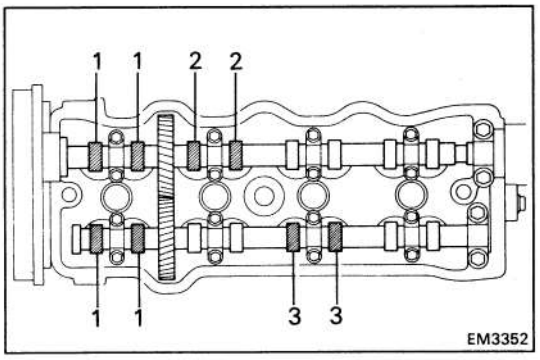
1. **DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS (See page IG-11)**

2. **REMOVE CYLINDER HEAD COVER (See step 32 on page EM-104)**



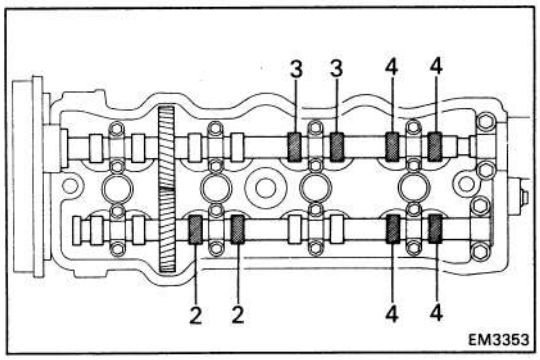
3. **SET NO.1 CYLINDER TO TDC/COMPRESSION**
   (a) Turn the crankshaft pulley and align its groove with timing mark "0" of the No.1 timing belt cover.
   (b) Check that the valve lifters on the No.1 cylinder are loose and valve lifters on the No.4 are tight.

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

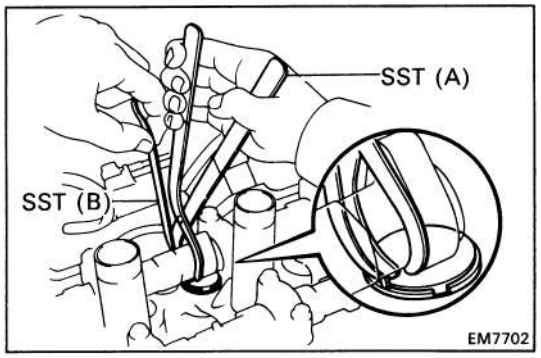


4. **INSPECT VALVE CLEARANCE**
   (a) Check only those valves indicated.
   - Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
   - Record out of the specicification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

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



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

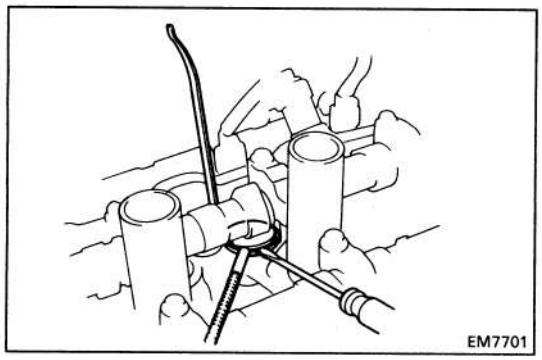


5. **ADJUST VALVE CLEARANCE**
   (a) Remove the adjusting shim.
   - Turn the crankshaft to position the cam lobe of the camshaft on the adjusting valve upward.
   - Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

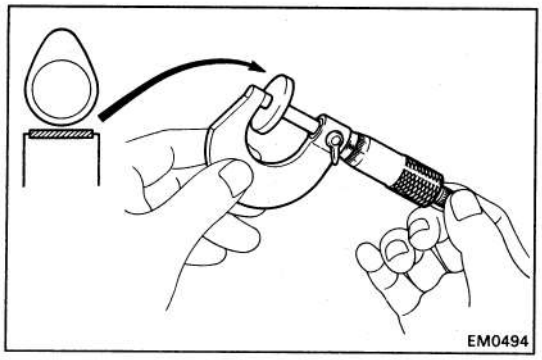
   SST 09248-55010

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

cardiagn.com



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



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

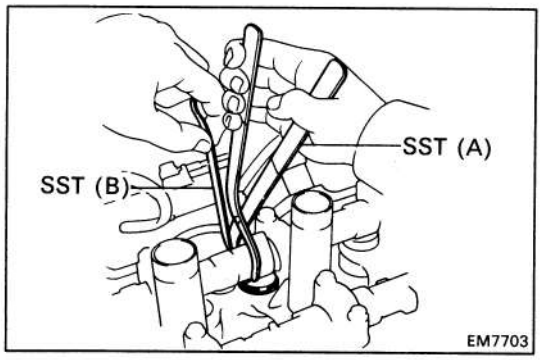
- Using a micrometer, measure the thickness of the removal shim.
- Calculate the thickness of a new shim so that the valve clearance comes within specified value.

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 seventeen sizes of 0.05 mm (0.0020 in.), from 2.50 mm (0.0984 in.) to 3.30 mm (0.1299 in.).



(c) Install a new adjusting shim.

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

SST 09248-55010

(d) Recheck the valve clearance.

6. REINSTALL CYLINDER HEAD COVER
(See step 7 on page EM-126)

7. RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS

cardiagn.com

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 (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.22 shim.

cardiagn.com

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 (Cold):
0.28 – 0.38 mm (0.011 – 0.015 in.)

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.). Replace the 2.800 mm (0.1102 in.) shim with a No.18 shim.

cardiagn.com

INSPECTION AND ADJUSTMENT OF IGNITION TIMING

3S-GTE (See pages IG-17 and 18)
5S-FE (See pages IG-21 and 22)

Ignition timing:
10° BTDC @ idle
(w/ Terminals TE1 and E1 connected)

INSPECTION OF IDLE SPEED (3S-GTE)

INITIAL CONDITIONS

(See Inspection and Adjustment of Idle Speed (5S-FE))

Idle speed: 800 ± 50 rpm

INSPECTION AND ADJUSTMENT OF IDLE SPEED (5S-FE)

(See HINT on page FI-18)

1. INITIAL CONDITIONS

(a) Engine at normal operating temperature

(b) Air cleaner installed

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

(d) All vacuum lines connected

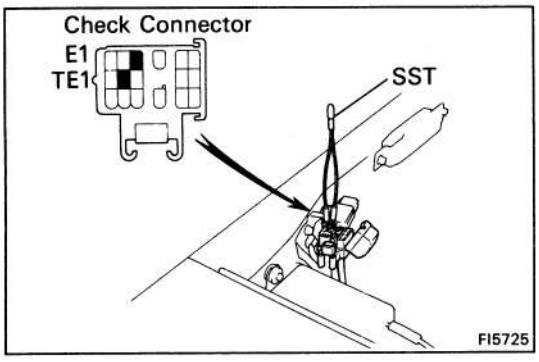
HINT: All vacuum hoses for EGR systems, etc. should be properly connected.

(e) EFI system wiring connectors fully plugged

(f) All operating accessories switched OFF

(g) Transmission in neutral range

2. CHECK ISC SYSTEM (See page FI-151)



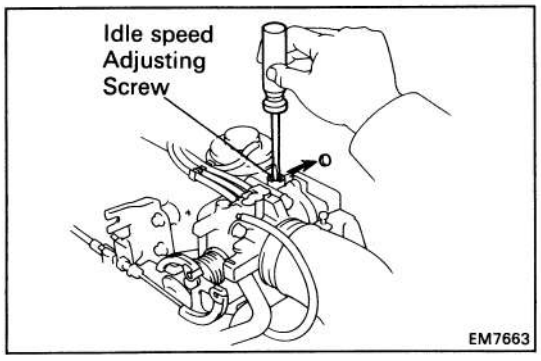
3. CONNECT TACHOMETER (See page IG-21)

4. ADJUST IDLE SPEED

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

SST 09843-18020

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

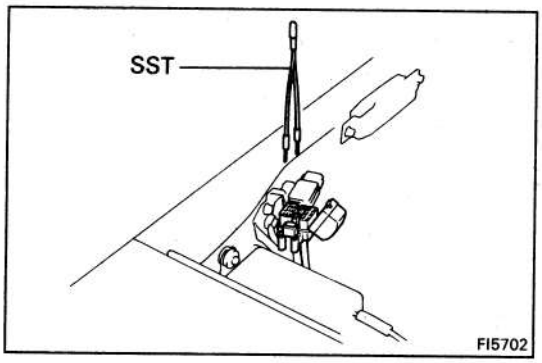


(b) Check the idle speed.

Idle speed: 650 rpm or more

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

cardiagn.com



(d) Remove SST.
SST 09843-18020

5. FURTHER CHECK IDLE SPEED

Idle speed: **750 ± 50 rpm USA M/T**
700 ± 50 rpm USA A/T
850 ± 50 rpm CANADA M/T
750 ± 50 rpm CANADA A/T

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.

cardiagn.com

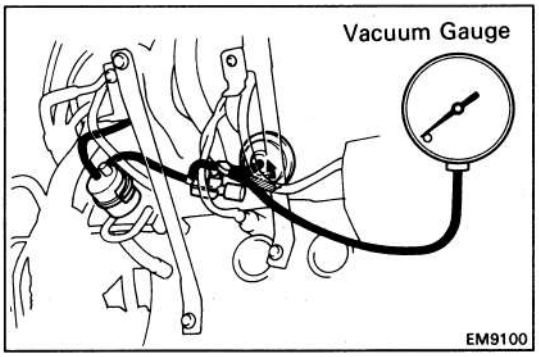
TOYOTA-VARIABLE INDUCTION SYSTEM (T-VIS) (3S-GTE)

INSPECTION OF T-VIS

1. **WARM UP AND STOP ENGINE**

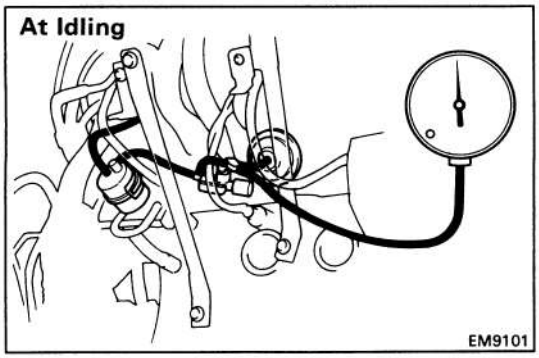
   Allow the engine to warm up to normal operating temperature.

2. **CONNECT TACHOMETER (See page IG-17)**



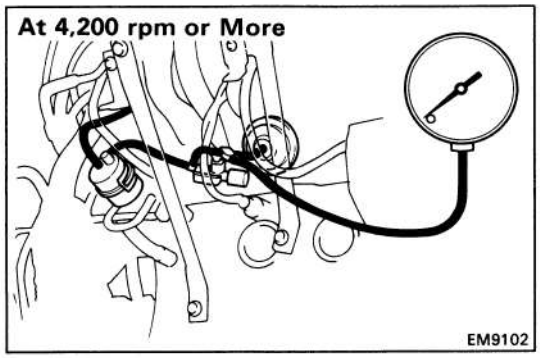
3. **CONNECT VACUUM GAUGE**

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



4. **INSPECT T-VIS OPERATION**

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



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

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

cardiagn.com

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

(a) Engine at normal operating temperature

(b) Air cleaner installed

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

(d) All accessories switched OFF

(e) All vacuum lines properly connected

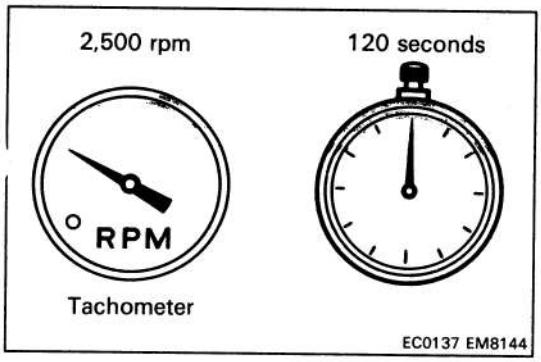
HINT: All vacuum hoses for EGR systems, etc. should be properly connected.

(f) EFI system wiring connectors fully plugged

(g) Ignition timing set correctly

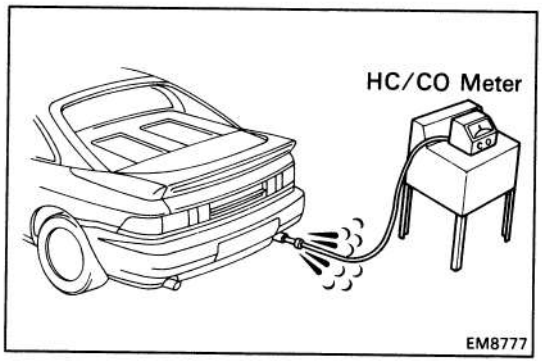
(h) Transmission in neutral

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



2. START ENGINE

3. RACE ENGINE AT 2,500 RPM FOR APPROX. 120 SECOUNDS



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

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

Complete the measuring within three minutes.

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

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

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

cardiagn.com

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-173)

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

HC	CO	Problems	Causes
High	Normal	Rough idle	1. Faulty ignitions ● 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 leaks ● PCV hose ● EGR valve ● Intake manifold ● T-VIS valve (3S-GTE) ● 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 systems ● 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

cardiagn.com

COMPRESSION CHECK

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

1. **WARM UP AND STOP ENGINE**
   Allow the engine to warm up to normal operating temperature.

2. **(3S-GTE)**
   DISCONNECT SOLENOID RESISTOR CONNECTOR

3. **DISCONNECT COLD START INJECTOR CONNECTOR**

4. **DISCONNECT DISTRIBUTOR CONNECTOR**

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

6. **CHECK CYLINDER COMPRESSION PRESSURE**
   (a) Insert a compression gauge into the spark plug hole.
   (b) Fully open the throttle.
   (c) While cranking the engine, measure the compression pressure.

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

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

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

   Compression pressure:
   3S-GTE 11.5 kg/cm² (164 psi, 1,128 kPa) or more
   5S-FE 12.5 kg/cm² (178 psi, 1,226 kPa) or more

   Minimum pressure:
   3S-GTE 9.0 kg/cm² (128 psi, 883 kPa)
   5S-FE 10.0 kg/cm² (142 psi, 981 kPa)

   Difference between each cylinder:
   1.0 kg/cm² (14 psi, 98 kPa) or less

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

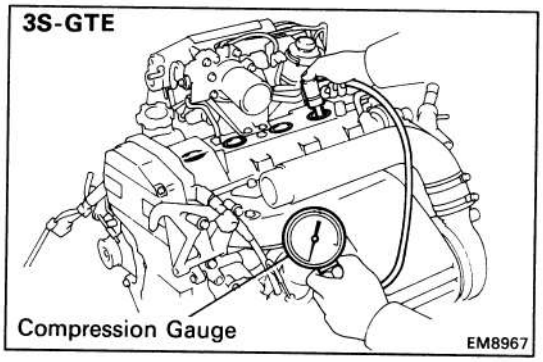
7. **REINSTALL SPARK PLUGS (See page IG-8 or 12)**
   Torque: 180 kg-cm (13 ft-lb, 18 N·m)

8. **RECONNECT DISTRIBUTOR CONNECTOR**

9. **RECONNECT COLD START INJECTOR CONNECTOR**

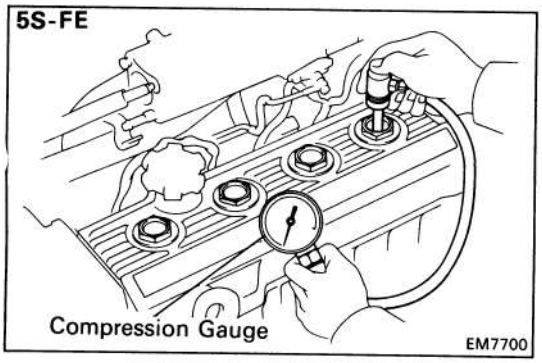
10. **(3S-GTE)**
    RECONNECT SOLENOID RESISTOR CONNECTOR

3S-GTE



Compression Gauge EM8967

5S-FE

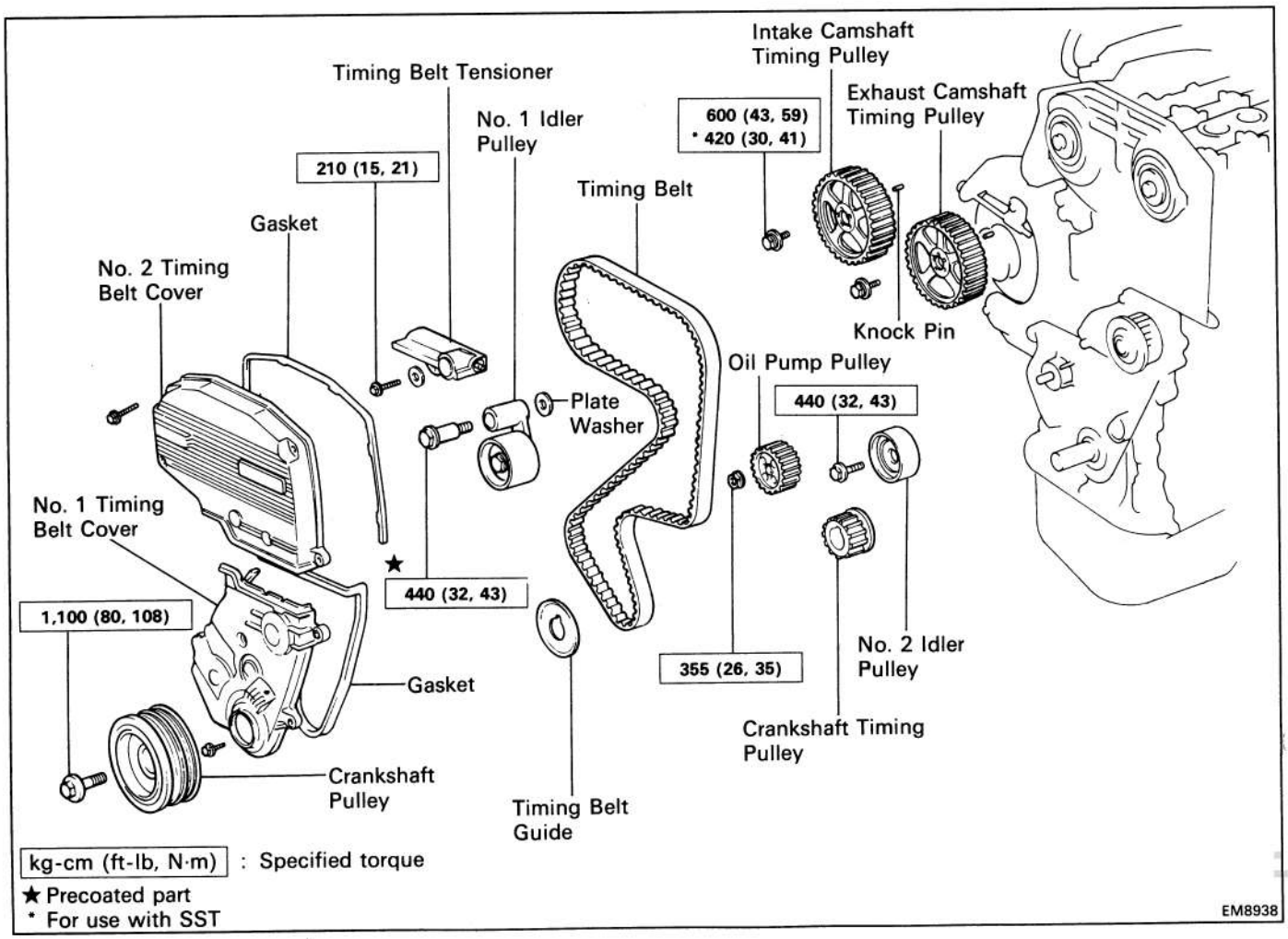


Compression Gauge EM7700

cardiagn.com

TIMING BELT (3S-GTE)

COMPONENTS



REMOVAL OF TIMING BELT

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**

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

2. **REMOVE ENGINE UNDER COVERS**

3. **REMOVE RH ENGINE HOOD SIDE PANEL**

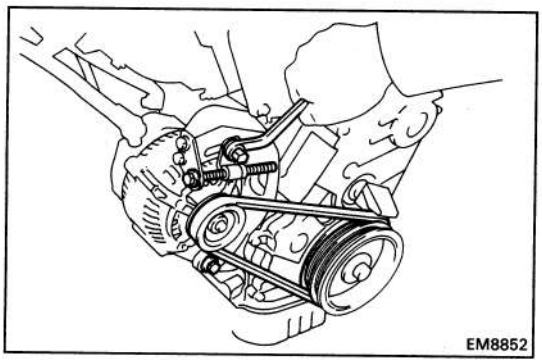
4. **REMOVE SUSPENSION UPPER BRACE**
   (See step 8 on page EM-134)

5. **REMOVE CRUISE CONTROL ACTUATOR (w/ CRUISE CONTROL SYSTEM) AND ACCELERATOR LINKAGE**
   (See step 13 on page EM-135)

6. **REMOVE INTERCOOLER**
   (See steps 4, 5 and 7 to 13 on pages TC-20 to 22)

7. **REMOVE RH FRONT WHEEL**

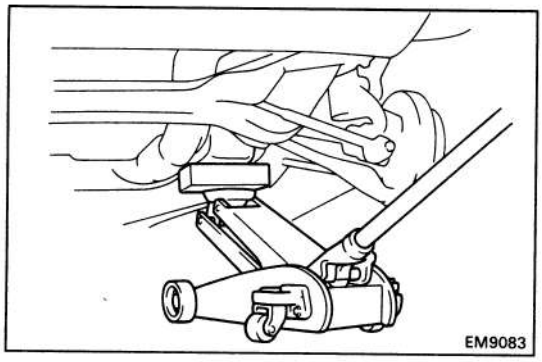
cardiagn.com



8. REMOVE ALTERNATOR DRIVE BELT

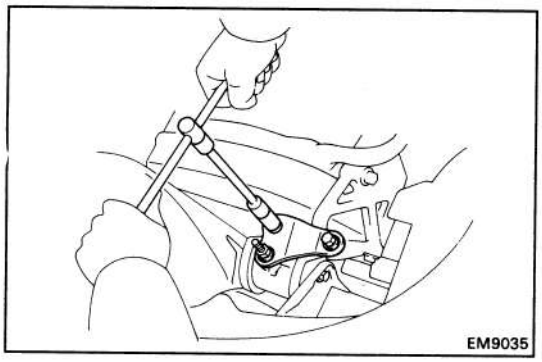
(a) Loosen the pivot and adjusting lock bolts.

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



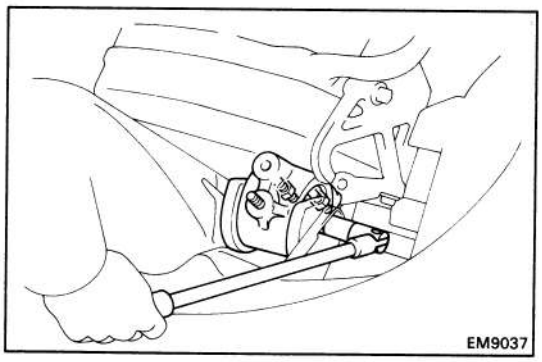
9. SLIGHTLY JACK UP ENGINE

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



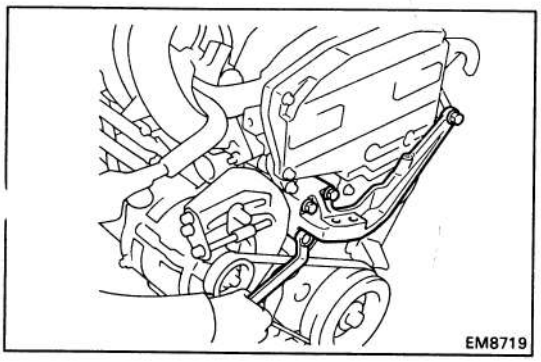
10. REMOVE RH ENGINE MOUNTING STAY

Remove the two bolts, nut and mounting stay.



11. REMOVE RH ENGINE MOUNTING INSULATOR

Remove the through bolt, two nuts and mounting insulator.



12. REMOVE RH ENGINE MOUNTING BRACKET

Remove the three bolts and mounting bracket.

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

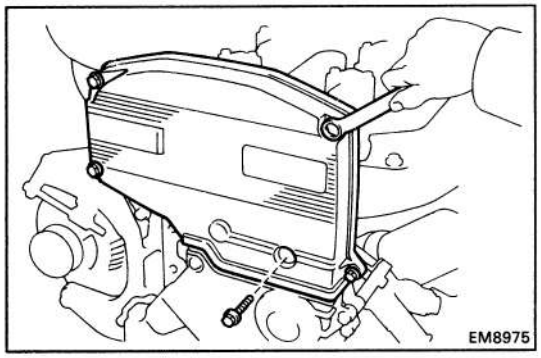
cardiagn.com

13. REMOVE EGR VACUUM MODULATOR AND VSV
(See step 22 on page EM-66)

14. REMOVE THROTTLE BODY
(See steps 5 to 8, 10 and 11 on pages FI-135 and 136)

15. REMOVE HOSE CLAMP AND VTV CLAMP OF AIR BY-PASS VALVE
(See steps 15 and 16 on page TC-9)

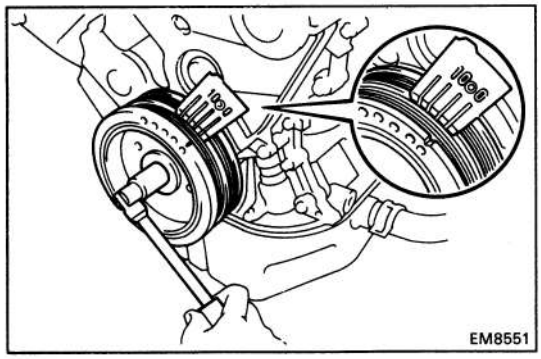
16. REMOVE CYLINDER HEAD COVER
(See step 35 on page EM-70)



17. REMOVE SPARK PLUGS (See page IG-7)

18. REMOVE NO.2 TIMING BELT COVER

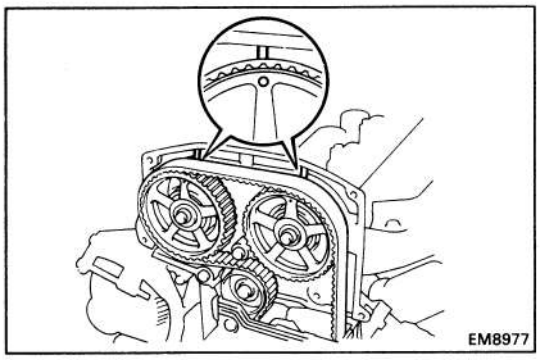
Remove the five screws, timing belt cover and gasket.



19. SET NO.1 CYLINDER TO TDC/COMPRESSION

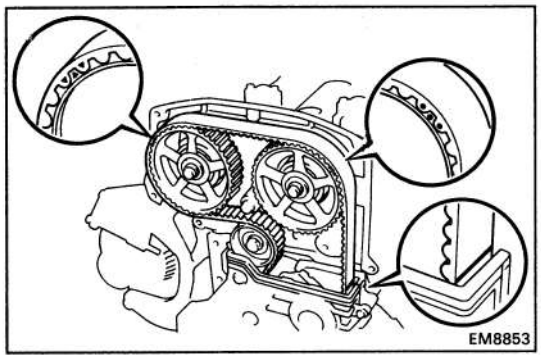
(a) Turn the crankshaft pulley and align its groove with timing mark "0" of the No.1 timing belt cover.

NOTICE: Always turn the crankshaft clockwise.



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

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

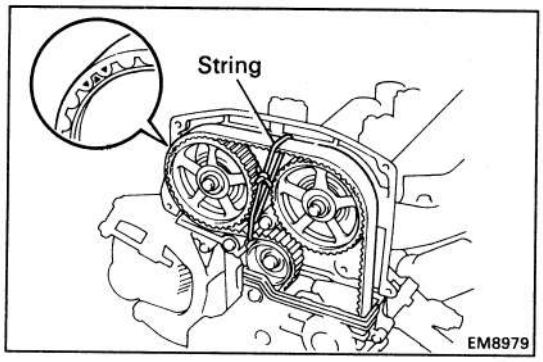


20. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEYS

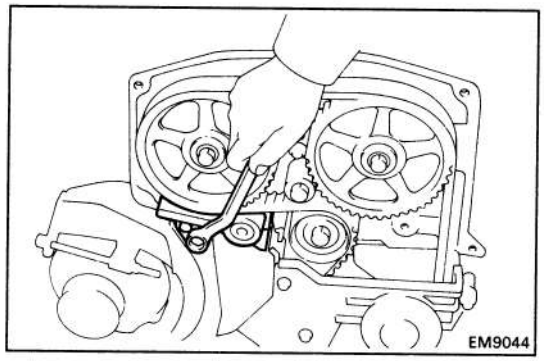
HINT:

- (Re-using timing belt)
  Place matchmarks on the timing belt and camshaft timing pulleys, and place a matchmark on the timing belt to match the end of the No1 timing belt cover.

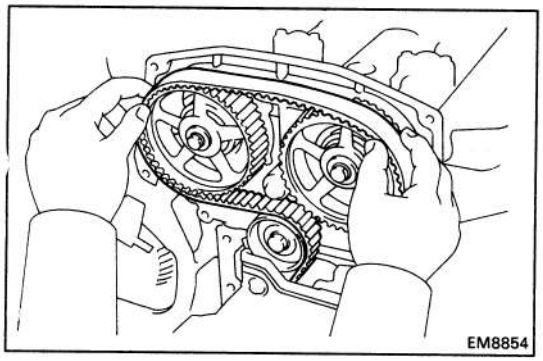
cardiagn.com



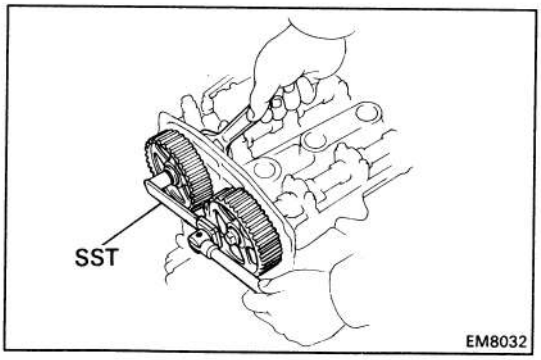
- (When replacing timing belt tensioner only)
  To avoid meshing of the timing belt and timing pulley, secure one with a string. And place the matchmarks on the timing belt and RH camshaft timing pulley.



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



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



21. REMOVE CAMSHAFT TIMING PULLEYS

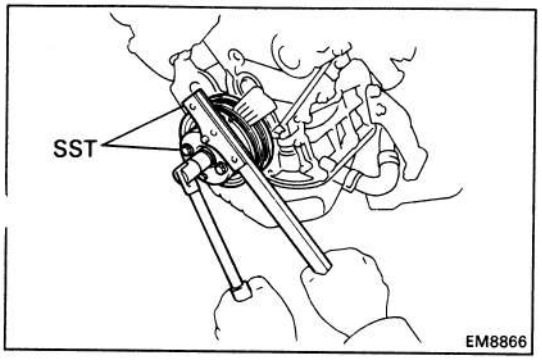
(a) Hold the hexagonal wrench head portion of the camshaft with a wrench, and remove the pulley mount bolts.

HINT (Intake camshaft timing pulley): Use SST.

SST 09249-63010

(b) Remove the camshaft pulleys and pins.

HINT: Arrange the intake and exhaust timing pulleys.

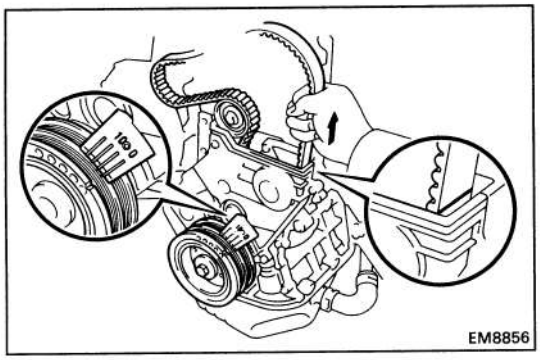


22. REMOVE CRANKSHAFT PULLEY

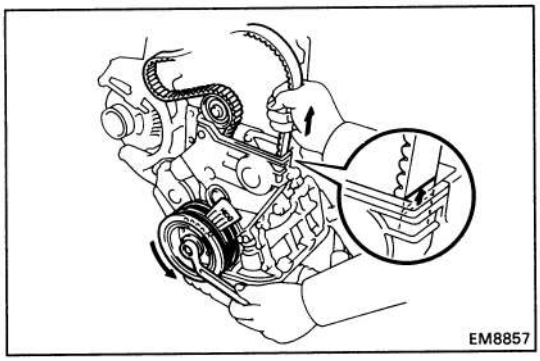
(a) Using SST, remove the pulley bolt.

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

cardiagn.com

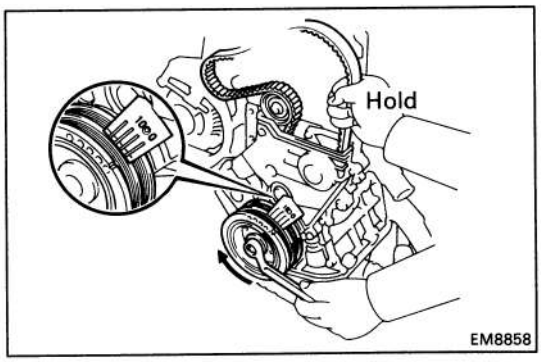


HINT (When re-using timing belt): After loosening the crankshaft pulley bolt, check that the timing belt matchmark aligns with the end of the No.1 timing belt cover when the crankshaft pulley groove is aligned with the timing mark "0" of the No.1 timing belt cover. If the matchmark does not align, align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

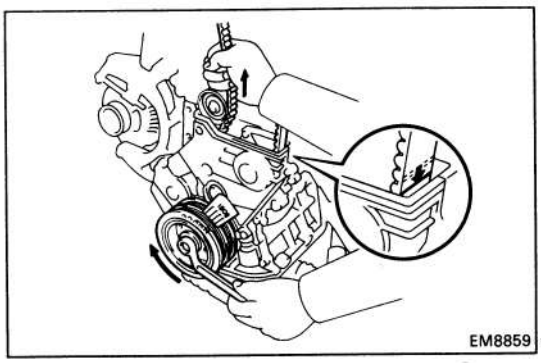


(When matchmark is out of alignment clockwise)

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

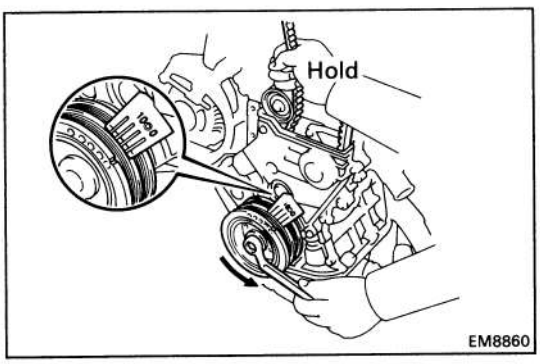


- After aligning the matchmark, hold the timing belt. And turn the crankshaft pulley clockwise, and align its groove with timing mark "0" of the No.1 timing belt cover.



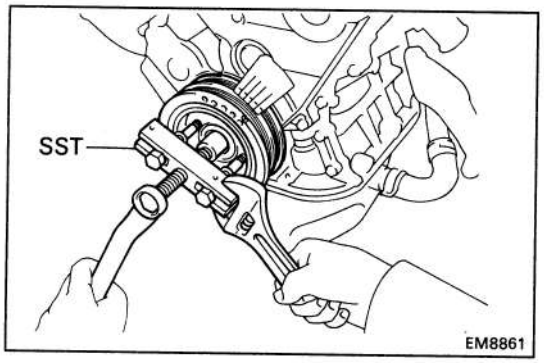
(When matchmark is out of alignment counterclockwise)

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



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

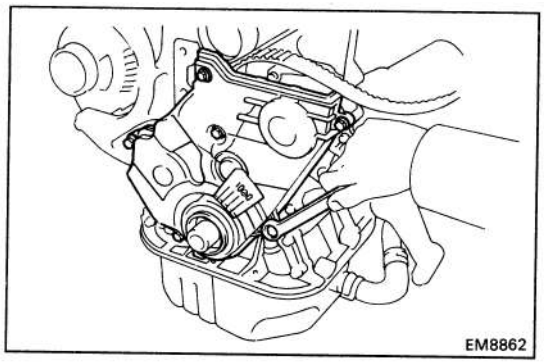
cardiagn.com



(b) Using SST, remove the pulley.

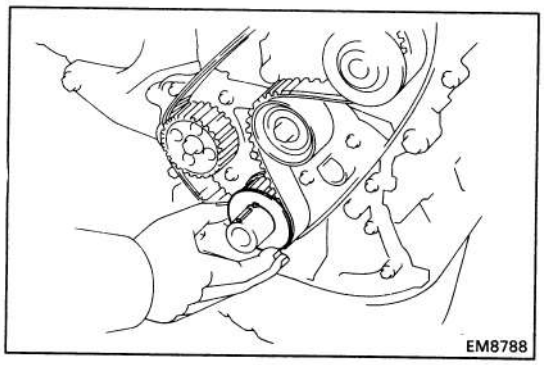
SST 09213-31021

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

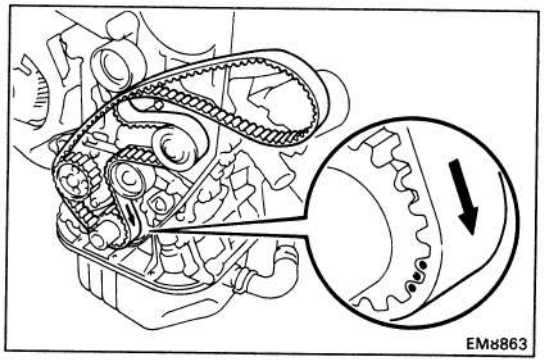


23. REMOVE NO.1 TIMING BELT COVER

Remove the six bolts, timing belt cover and gasket.

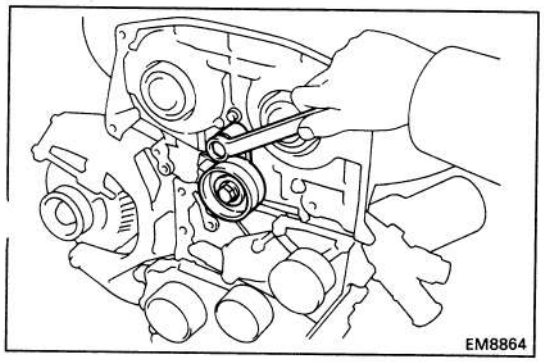


24. REMOVE TIMING BELT GUIDE



25. REMOVE TIMING BELT

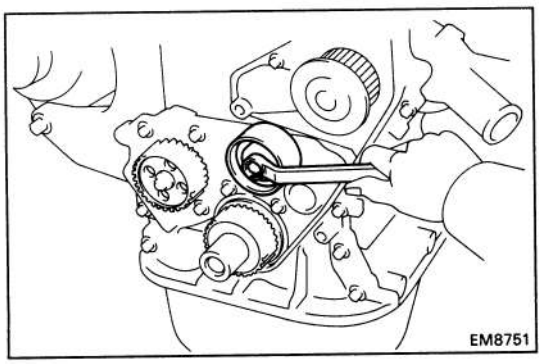
HINT (When re-using timing belt): Draw a direction arrow on the timing belt (in the direction of engine revolution), and place matchmarks on the timing belt and crankshaft timing pulley.



26. REMOVE NO.1 IDLER PULLEY

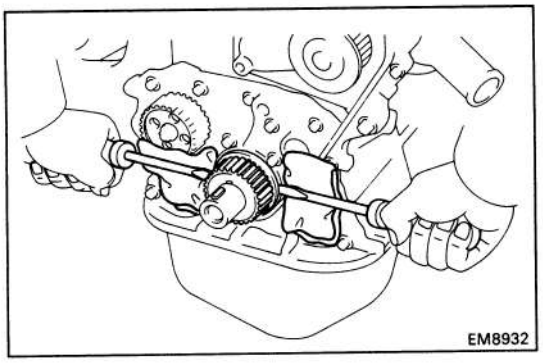
Remove the pivot bolt, pulley and plate washer.

cardiagn.com



27. REMOVE NO.2 IDLER PULLEY

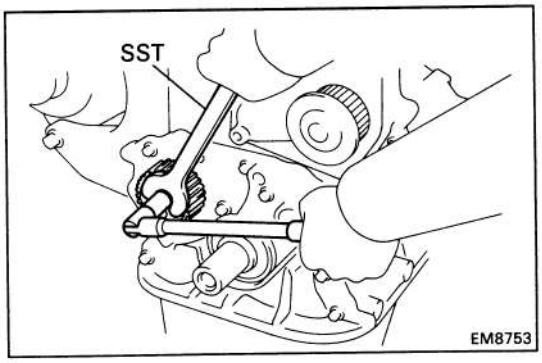
Remove the bolt and pulley.



28. REMOVE CRANKSHAFT TIMING PULLEY

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

HINT: Position shop rags as shown to prevent damage.

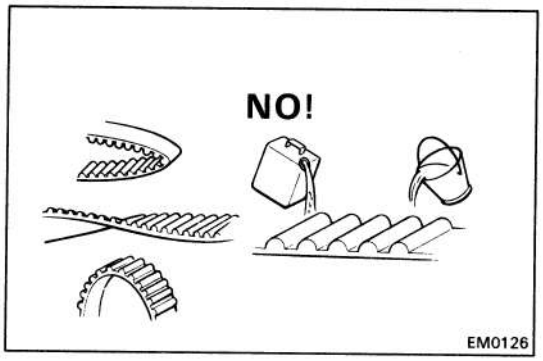


29. REMOVE OIL PUMP PULLEY

Using SST, remove the nut and pulley.

SST 09616-30011

cardiagn.com



INSPECTION OF TIMING BELT COMPONENTS

1. INSPECT TIMING BELT

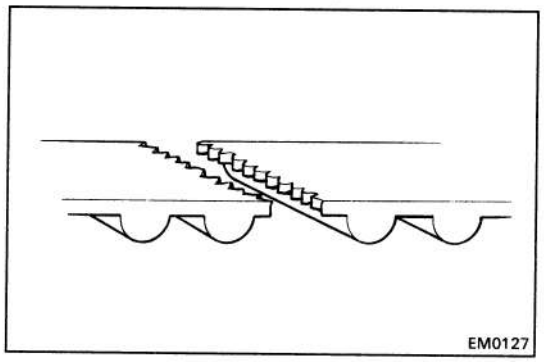
NOTICE:

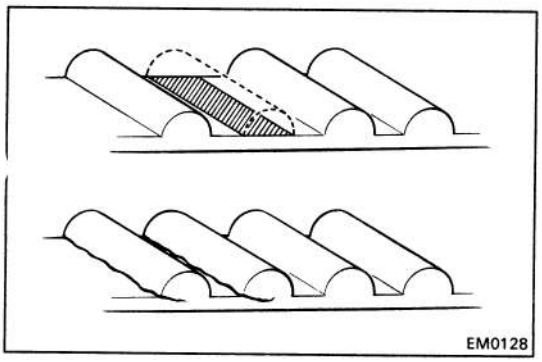
- **Do not bend, twist or turn the timing belt inside out.**
- **Do not allow the timing belt to come into contact with oil, water or steam.**
- **Do not utilize timing belt tension when installing or removing the mount bolt of the camshaft timing pulley.**

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

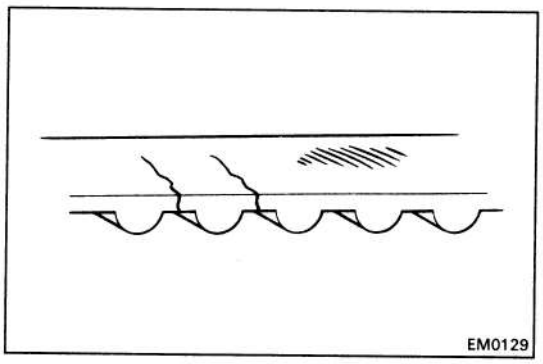
(a) Premature parting

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

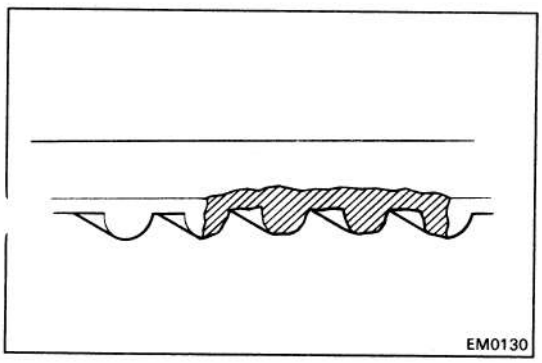




(b) If the belt teeth are cracked or damaged, check to see if either the camshaft or water pump is locked.

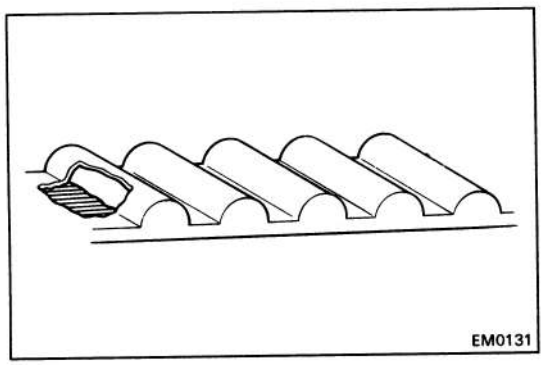


(c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock.



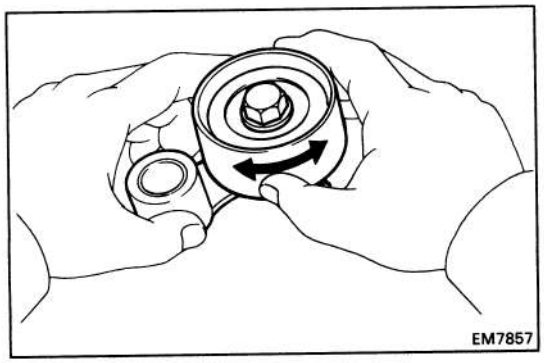
(d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.

cardiagn.com



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

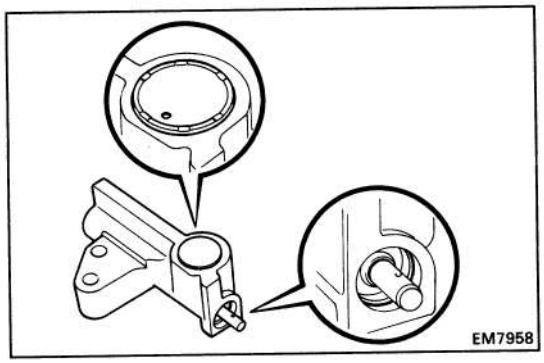
If necessary, replace the timing belt.



2. INSPECT IDLER PULLEYS

Check the turning smoothness of the idler pulley.

If necessary, replace the idler pulley.

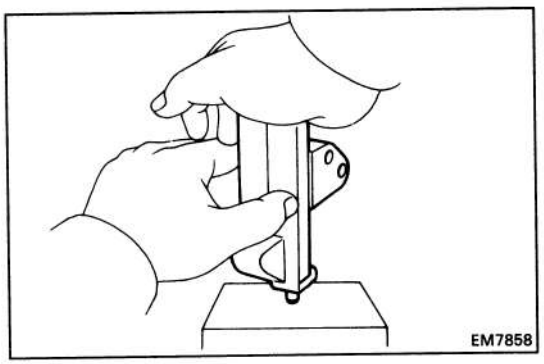


3. INSPECT TIMING BELT TENSIONER

(a) Visually check tensioner for oil leakage.

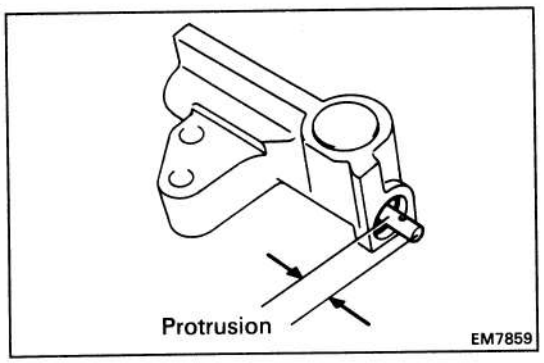
HINT: If there is only a small trace of oil on the seal of the push rod, the tensioner is all right.

If leakage is found, replace the tensioner.



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

If the push rod moves, replace the tensioner.

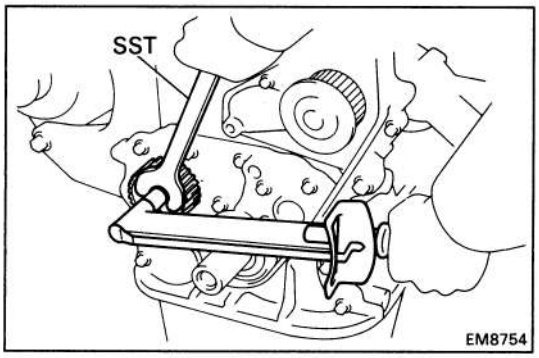


(c) Measure the protrusion of the push rod from the housing end.

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

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

cardiagn.com



INSTALLATION OF TIMING BELT

(See page EM-26)

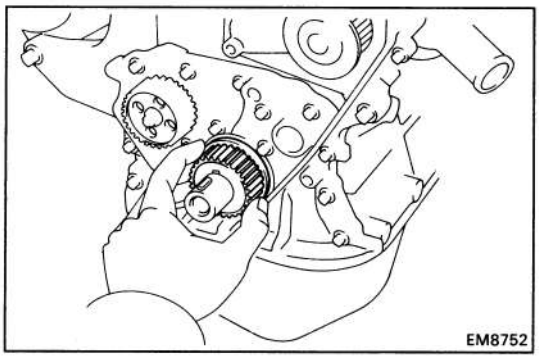
1. INSTALL OIL PUMP PULLEY

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

(b) Using SST, install the nut.

SST 09616-30011

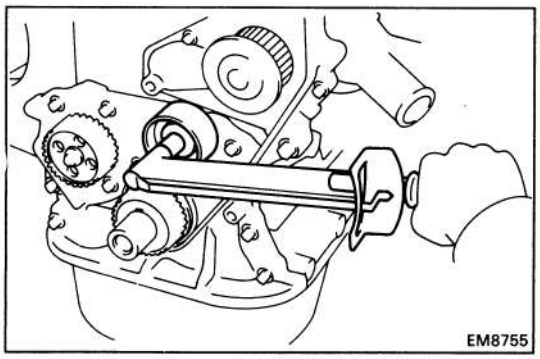
Torque: 355 kg-cm (26 ft-lb, 35 N·m)



2. INSTALL CRANKSHAFT TIMING PULLEY

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

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

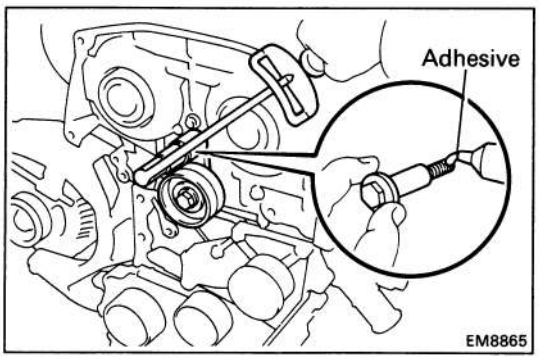


3. INSTALL NO.2 IDLER PULLEY

(a) Install the pulley with the bolt.

Torque: 440 kg-cm (32 ft-lb, 43 N·m)

(b) Check that the idler pulley moves smoothly.



4. INSTALL NO.1 IDLER PULLEY

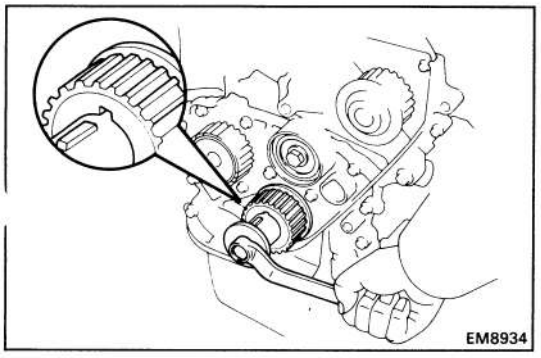
(a) Apply adhesive to two or three threads of the pivot bolt.

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

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

Torque: 440 kg-cm (32 ft-lb, 43 N·m)

(c) Check that the pulley bracket moves smoothly.

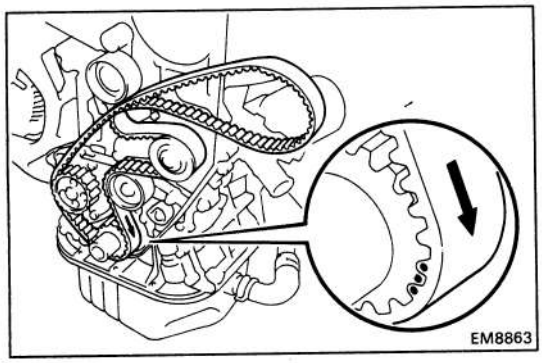


5. TEMPORARILY INSTALL TIMING BELT

NOTICE: The engine should be cold.

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

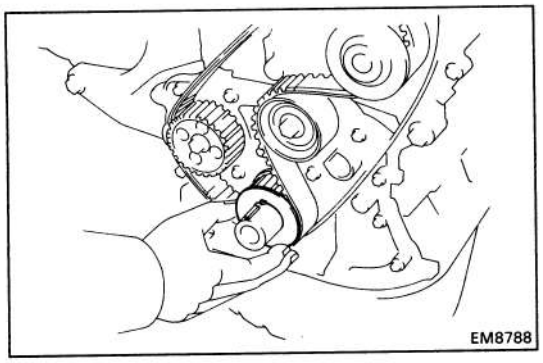
cardiagn.com



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

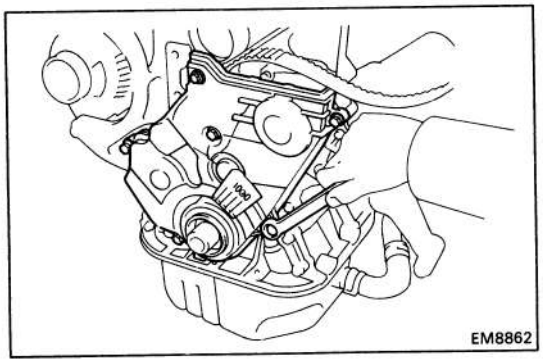
(c) Install the timing belt on the crankshaft timing pulley, oil pump pulley, No.2 idler pulley, water pump pulley and No.1 idler pulley.

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



6. INSTALL TIMING BELT GUIDE

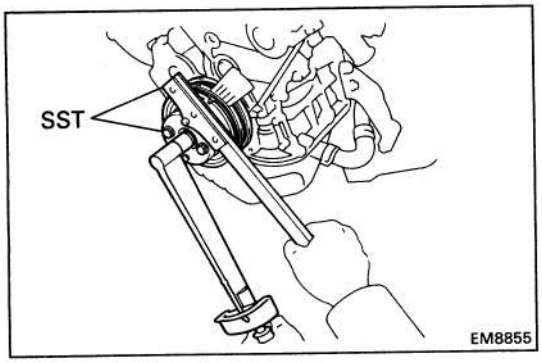
Install the guide, facing the cup side outward.



7. INSTALL NO.1 TIMING BELT COVER

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

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



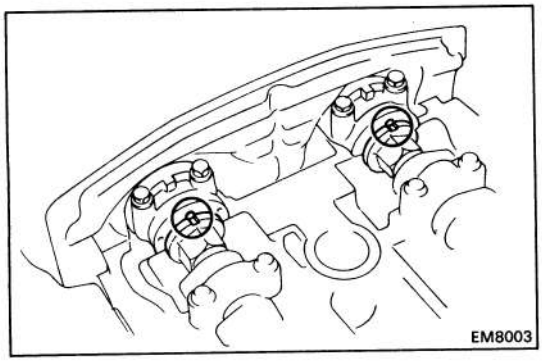
8. INSTALL CRANKSHAFT PULLEY

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

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

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

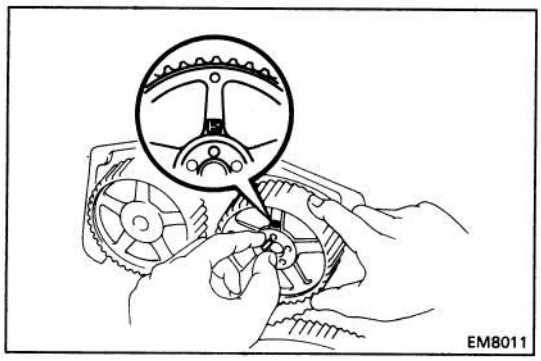
Torque: 1,100 kg-cm (80 ft-lb, 108 N·m)



9. INSTALL CAMSHAFT TIMING PULLEYS

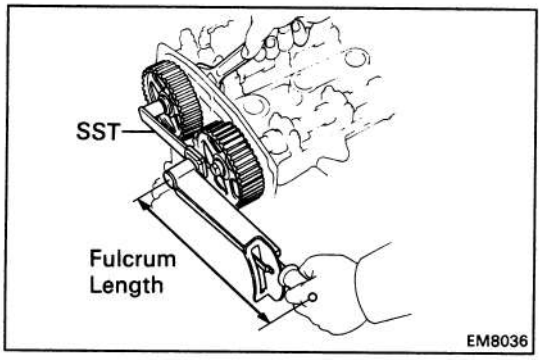
(a) Using a wrench, turn and align the groove of the camshaft with the drilled mark of the No.1 camshaft bearing cap.

Cardiagn.com



(b) Slide the timing pulley onto the camshaft, facing mark "S" upward.

(c) Align the pin holes of the camshaft and timing pulley, insert the knock pin.



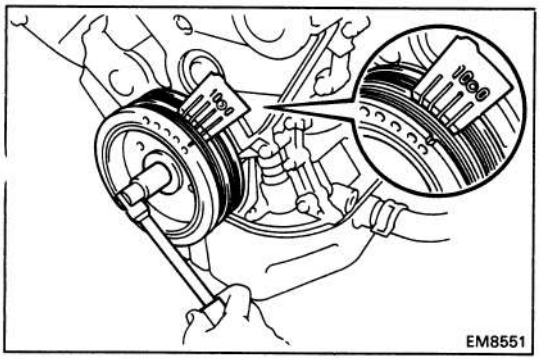
(d) Hold the hexagonal wrench head portion of the camshaft with a wrench, and tighten the bolts.

Torque: 600 kg-cm (43 ft-lb, 59 N·m)
420 kg-cm (30 ft-lb, 41 N·m) for SST

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

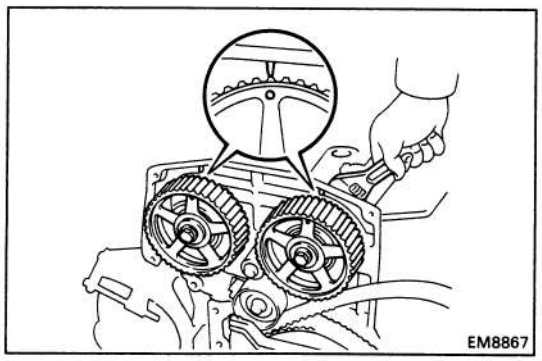
SST 09249-63010

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

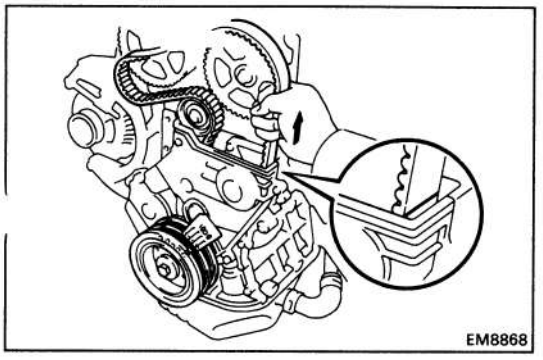


10. SET NO.1 CYLINDER TO TDC/COMPRESSION

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



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

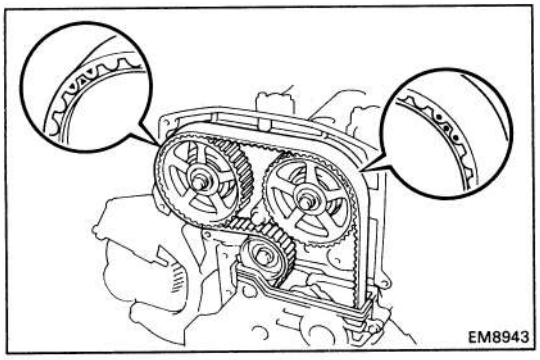


11. INSTALL TIMING BELT

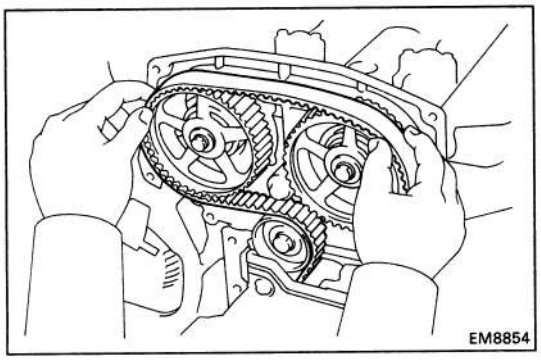
HINT (When re-using timing belt):
- Check that the matchmark on the timing belt matches the end of the No.1 timing belt cover.

If the matchmark does not align, shift the meshing of the timing belt and crankshaft timing pulley until they align. (See page EM-23)

cardiagn.com

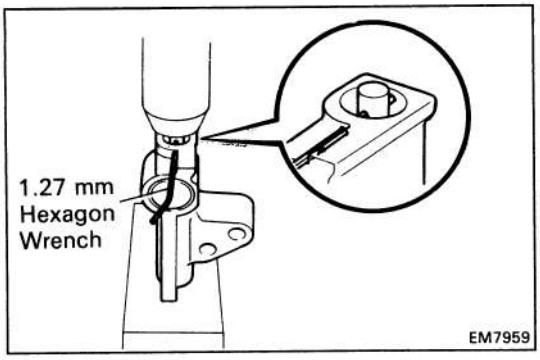


- Align the matchmarks of the timing belt and camshaft timing pulleys.



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

(b) Install the timing belt, insure that there is tension between the crankshaft timing pulley and intake camshaft timing pulley.

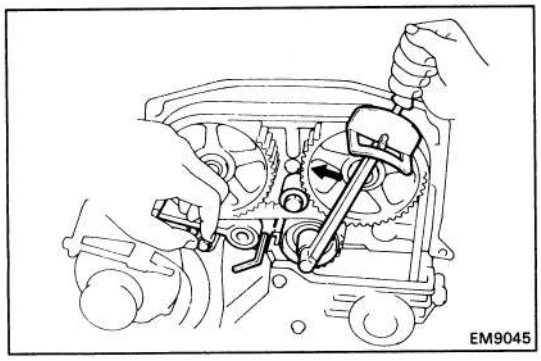


12. SET TIMING BELT TENSIONER

(a) Using a press, slowly press in the push rod using 100 – 1,000 kg (220 – 2,205 lb, 981 – 9,807 N) of pressure.

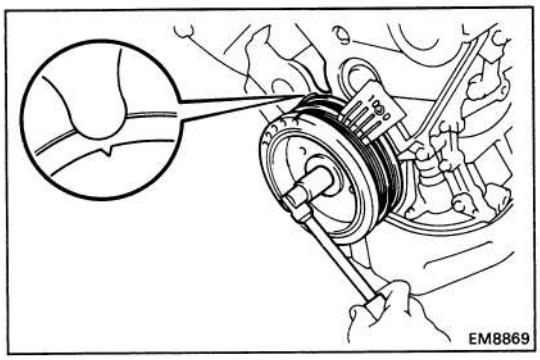
(b) Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.

(c) Release the press.



13. INSTALL TIMING BELT TENSIONER

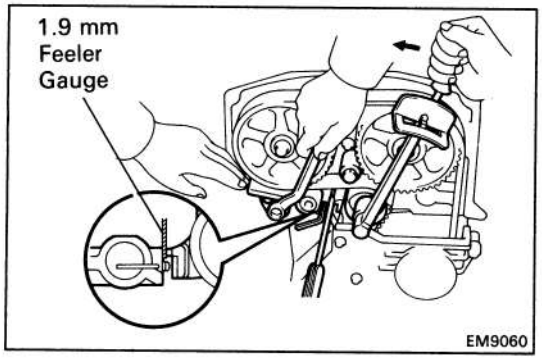
(a) Turn the No.1 idler pulley bolt counterclockwise obtain the specified torque toward the left as far as No.1 idler pulley will go, and temporarily install the tensioner with the two bolts.



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

NOTICE: Always turn the crankshaft clockwise.

cardiagn.com



(c) Insert a 1.90 mm (0.075 in.) feeler gauge between the tensioner body and No.1 idler pulley stopper.

(d) Turn the No.1 idler pulley bolt counterclockwise to obtain the specified torque.

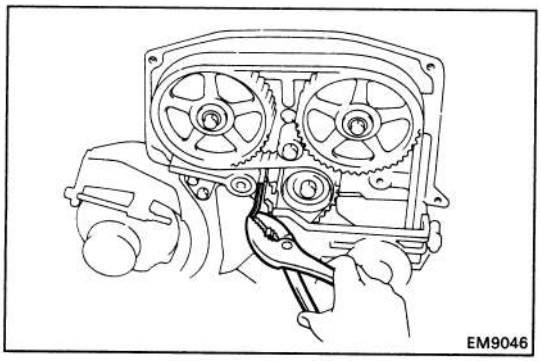
Torque: 180 kg-cm (13 ft-lb, 18 N·m)

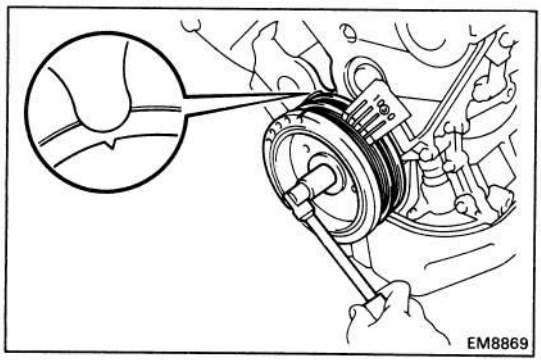
NOTICE: To apply the correct torque, apply the torque wrench along the axis through the bolts of the No.1 idler pulley and exhaust camshaft timing pulley.

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

Torque: 210 kg-cm (15 ft-lb, 21 N·m)

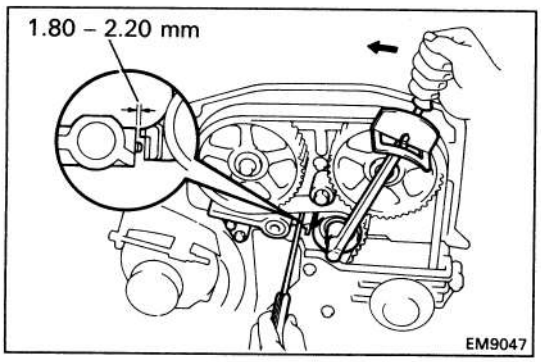
(f) Remove the 1.27 mm hexagon wrench from the tensioner.





(g) Slowly turn the crankshaft pulley one revolution, and align its groove with the ATDC 60° mark of the No.1 timing belt cover.

NOTICE: Always turn the crankshaft clockwise.



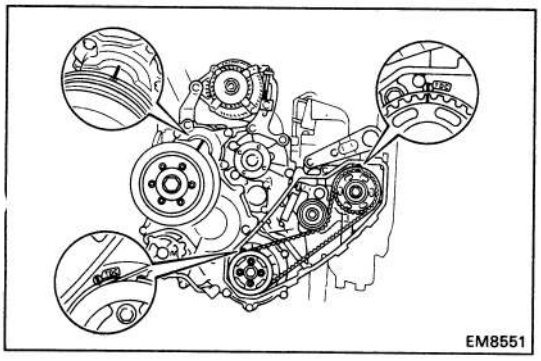
(h) Turn the No.1 idler pulley bolt counterclockwise to obtain the specified torque.

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

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

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

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

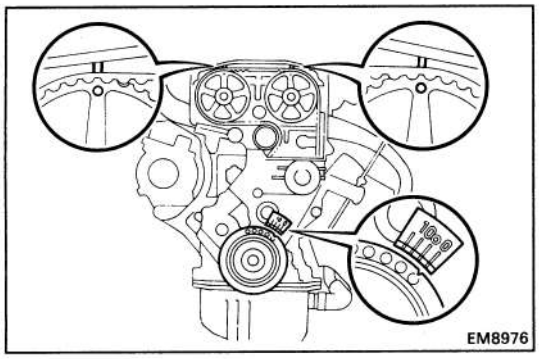


14. CHECK VALVE TIMING

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

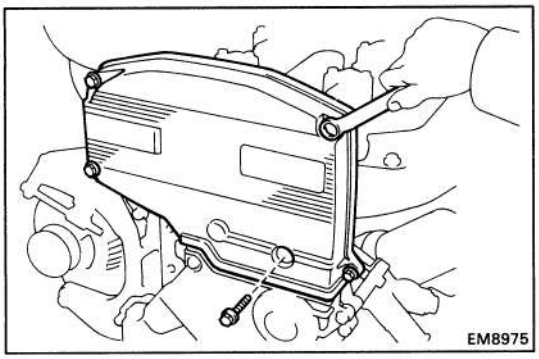
NOTICE: Always turn the crankshaft clockwise.

cardiagn.com



(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 NO.2 TIMING BELT COVER

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

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

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

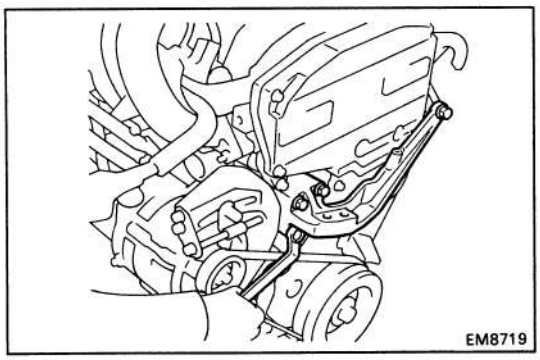
Torque: 180 kg-cm (13 ft-lb, 18 N·m)

17. INSTALL HOSE CLAMP AND VTV CLAMP OF AIR BY-PASS VALVE
(See steps 13 and 14 on pages TC-19)

18. INSTALL CYLINDER HEAD COVER
(See step 7 on page EM-88)

19. INSTALL THROTTLE BODY
(See steps 2, 3 and 5 to 8 on pages FI-138 and 139)

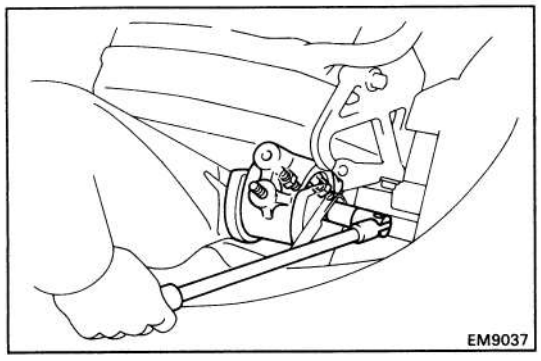
20. INSTALL EGR VACUUM MODULATOR AND VSV
(See step 20 on page EM-92)



21. INSTALL RH ENGINE MOUNTING BRACKET

Install the mounting bracket with the three bolts.

Torque: 530 kg-cm (38 ft-lb, 52 N·m)



22. INSTALL RH ENGINE MOUNTING INSULATOR

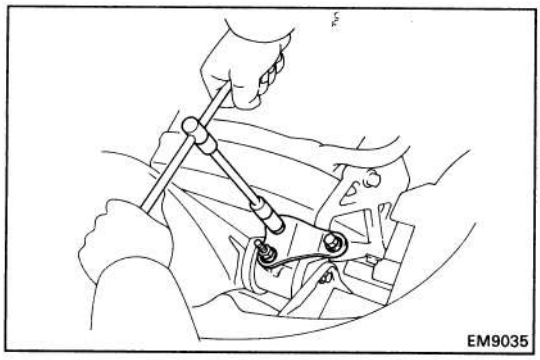
Install the mounting insulator with the through bolt and two nuts.

Torque:

Nut	**530 kg-cm (38 ft-lb, 52 N·m)**
Through bolt	**800 kg-cm (58 ft-lb, 78 N·m)**

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

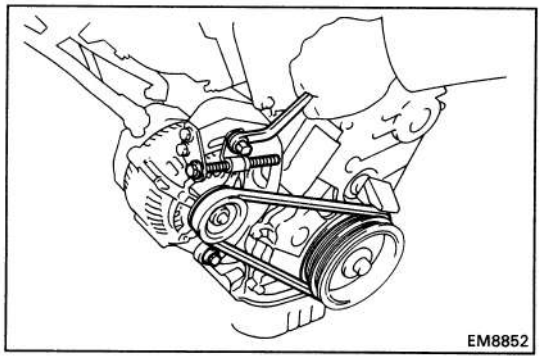
cardiagn.com


EM9035

23. INSTALL RH ENGINE MOUNTING STAY

Install the mounting stay with the two bolts and nut.

Torque: 740 kg-cm (54 ft-lb, 73 N·m)


EM8852

24. INSTALL ALTERNATOR DRIVE BELT

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

25. INSTALL RH FRONT WHEEL

26. INSTALL INTERCOOLER
(See steps 2 to 8, 10 and 11 on pages TC-23 to 25)

27. INSTALL CRUISE CONTROL ACTUATOR (w/ CRUISE CONTROL SYSTEM) AND ACCELERATOR LINKAGE
(See step 36 pages EM-178)

28. INSTALL SUSPENSION UPPER BRACE
(See step 41 pages EM-179)

29. INSTALL RH ENGINE HOOD SIDE PANEL

30. INSTALL ENGINE UNDER COVERS

31. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

32. CHECK AND ADJUST DRIVE BELTS

(a) Adjust the alternator drive belt.
(See page CH-3)

Drive belt tension: New belt 120 ± 20 lb
Used belt 104 ± 20 lb

(b) Adjust the A/C drive belt.

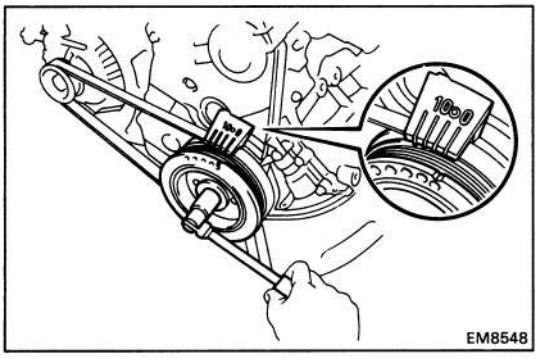
Drive belt tension: New belt 160 ± 20 lb
Used belt 100 ± 20 lb

cardiagn.com

ADJUSTMENT OF VALVE TIMING

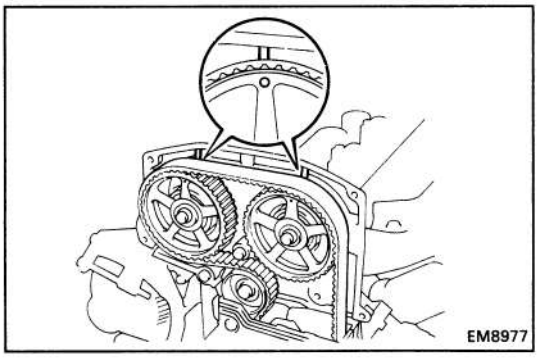
1. **REMOVE NO.2 TIMING BELT COVER**
   (See steps 1 to 6 and 9 to 12 on pages EM-26 to 28)

2. **REMOVE SPARK PLUGS (See page IG-7)**

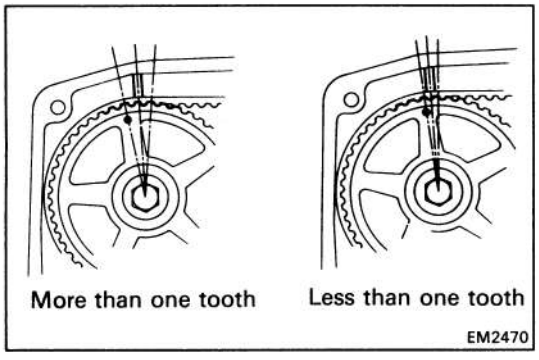


3. **CHECK CAMSHAFT TIMING PULLEY MARKS**
   (a) Turn the crankshaft pulley, and align its groove with timing mark "0" of the No.1 timing belt cover.

   NOTICE: Always turn the crankshaft clockwise.



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



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

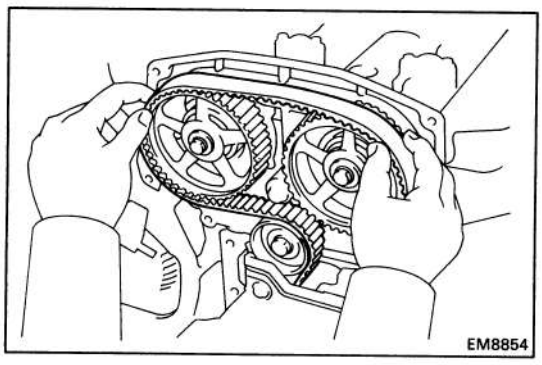
4. **REMOVE EGR VACUUM MODULATOR AND VSV**
   (See step 22 on page EM-66)

5. **REMOVE THROTTLE BODY**
   (See steps 5 to 8 and 9 to 11 on pages FI-135 and 136)

6. **REMOVE HOSE CLAMP AND VTV CLAMP OF AIR BY-PASS VALVE**
   (See steps 15 and 16 on page TC-9)

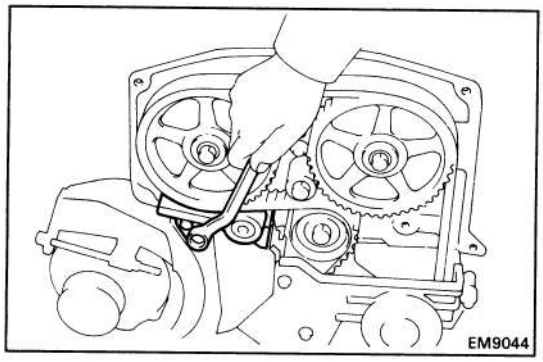
7. **REMOVE CYLINDER HEAD COVER**
   (See step 35 on page EM-70)

cardiagn.com

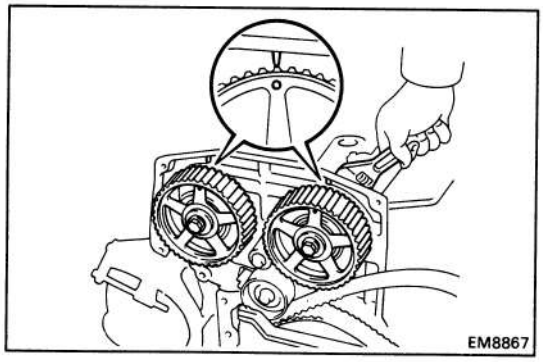


8. ADJUST CAMSHAFT TIMING PULLEY TIMING MARKS

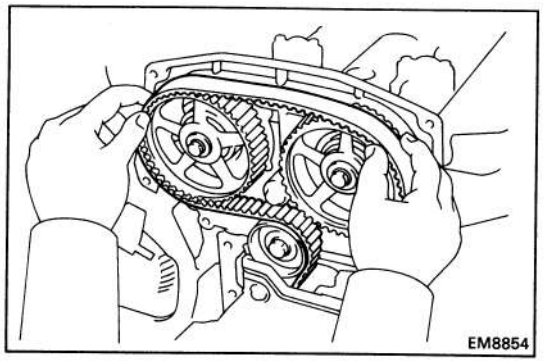
(a) Remove the two bolts and timing belt tensioner.



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

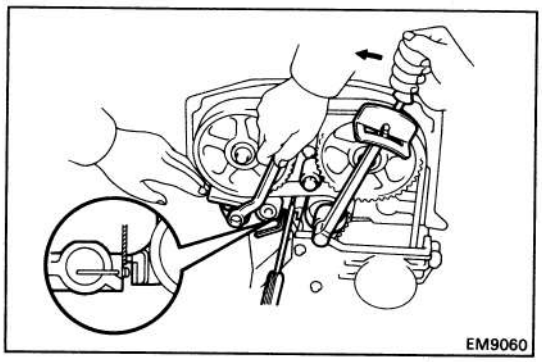


(c) Rotate the camshaft with a wrench and align the alignment marks of the camshaft timing pulley and No.3 timimg belt cover.



(d) Reinstall the timing belt, insure that there is tension between the crankshaft timing pulley and intake camshaft timing pulley.

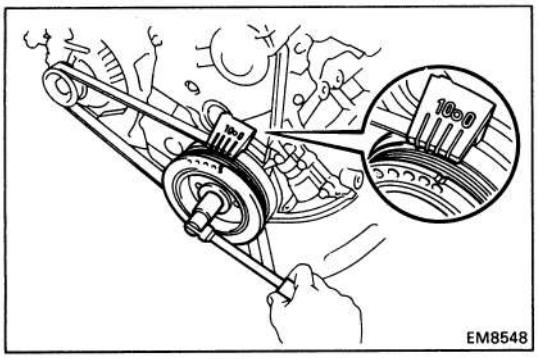
NOTICE: Install the timing belt when the engine is cold.



(e) Install the timing belt tensioner with the two bolts. (See steps 12 and 13 on pages EM-38 and 39)

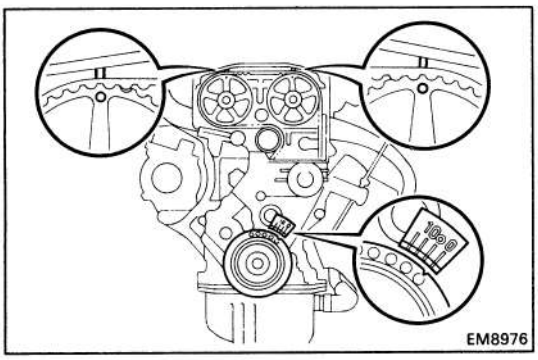
Torque: 210 kg-cm (15 ft-lb, 21 N·m)

cardiagn.com

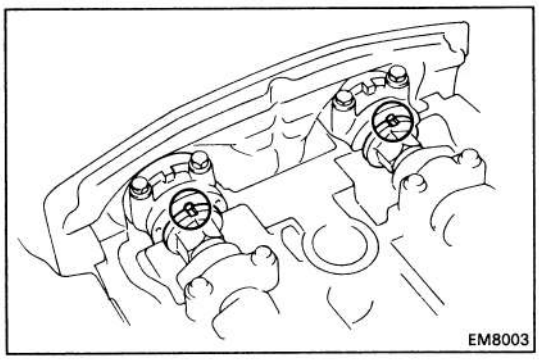


(f) Turn the crankshaft pulley two revolutions from TDC to TDC.

NOTICE: Always turn the crankshaft clockwise.



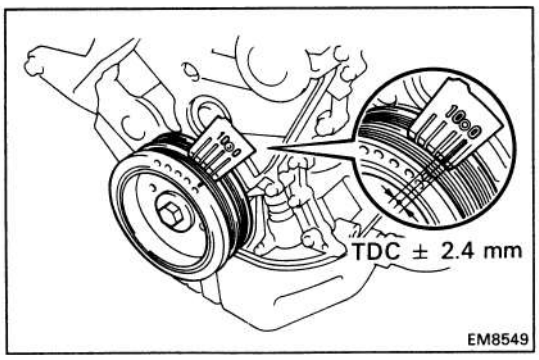
(g) Check that each pulley aligns with the timing marks as shown in the figure.



9. CHECK VALVE TIMING

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

NOTICE: Always turn the crankshaft clockwise.

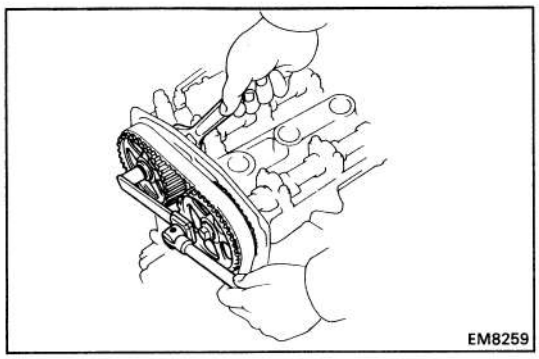


(b) Next make a note of the crankshaft pulley angle on the No.1 timing belt cover.

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

If the crankshaft pulley movement is within ± 2.4 mm (0.094 in.) of TDC, it is correct.

If it is greater than 2.4 mm (0.094 in.), go back to step 8.



10. ADJUST VALVE TIMING

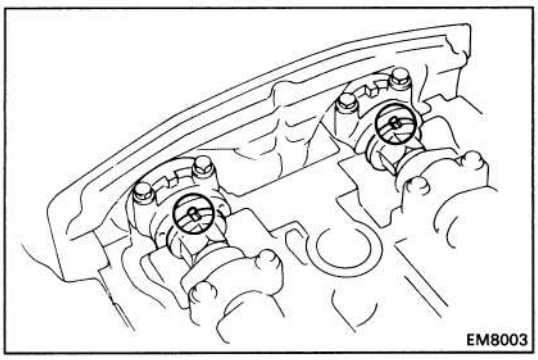
(a) Hold the hexagonal wrench head portion of the camshaft with a wrench, and remove the two camshaft timing pulley bolts.

HINT (Intake camshaft timing pulley): Use SST.

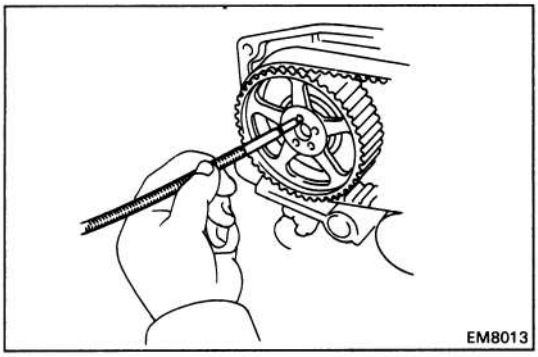
SST 09249-63010

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

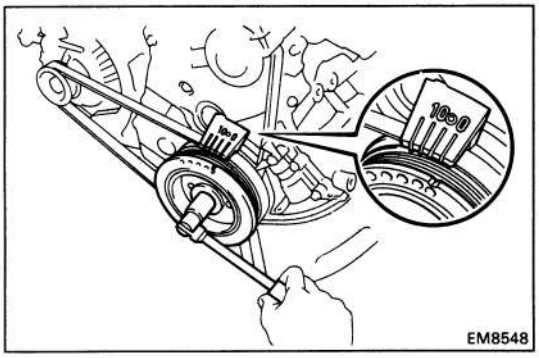
cardiagn.com



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

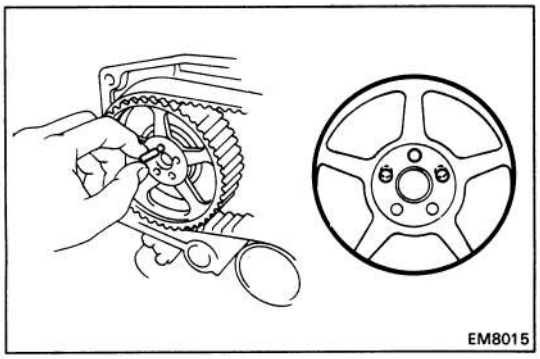


(c) Using a magnetic finger, remove the knock pin from the pin hole of the camshaft timing pulley.



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

NOTICE: Always turn the crankshaft clockwise.



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

HINT:

- If there is no overlapped hole, rotate the crankshaft a little and insert the pin into the nearly overlapped hole.
- By changing the pin hole to the next one, the crankshaft pulley angle can be adjusted by approx. 2°.
- By changing the pin hole to the next two, the crankshaft pulley angle can be adjusted by approx. 5°.

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

Torque: 600 kg-cm (43 ft-lb, 59 N·m)
420 kg-cm (30 ft-lb, 41 N·m) for SST

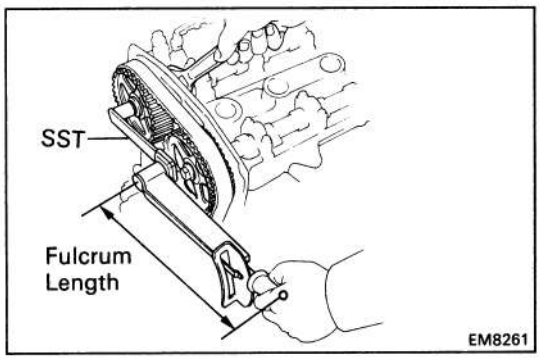
HINT (Intake camshaft timing pulley):

- Use SST.

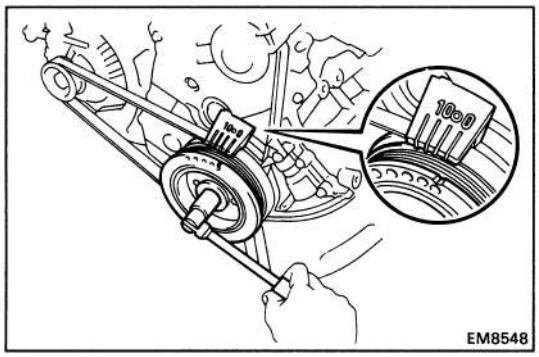
SST 09249-63010

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

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



cardiagn.com



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

(h) Recheck the valve timing.
(See step 9 on page EM-44)

11. REINSTALL CYLINDER HEAD COVER
(See step 7 on pages EM-88)

12. REINSTALL HOSE CLAMP AND VTV CLAMP OF AIR BY-PASS VALVE
(See steps 13 and 14 on page TC-19)

13. REINSTALL THROTTLE BODY
(See steps 2, 3 and 5 to 8 on pages FI-138 and 139)

14. REINSTALL EGR VACUUM MODULATOR AND VSV
(See step 20 on page EM-92)

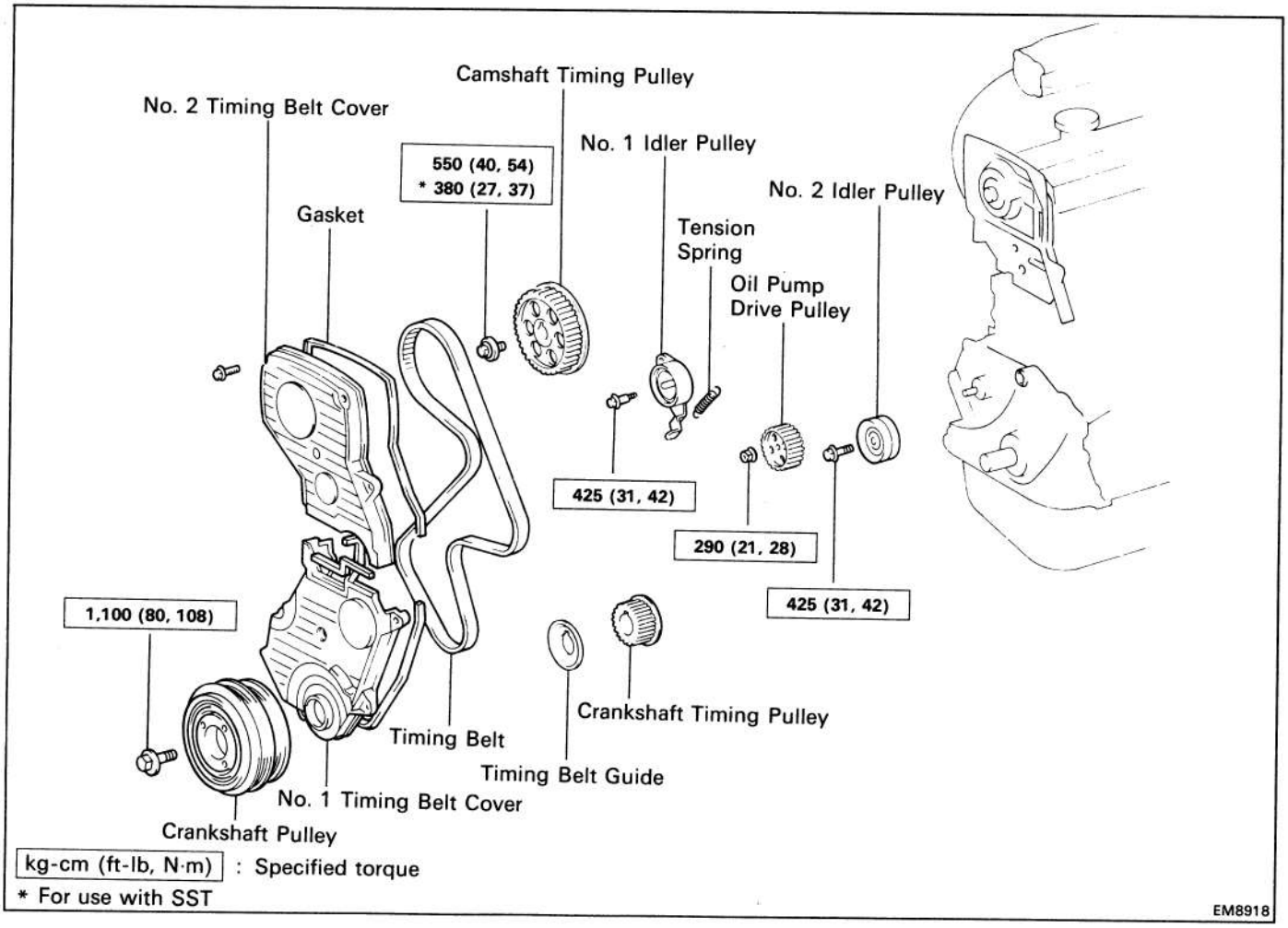
15. REINSTALL SPARK PLUGS (See page IG-8)
Torque: 180 kg-cm (13 ft-lb, 18 N·m)

16. REINSTALL NO.2 TIMING BELT COVER
(See steps 15, 21 to 23 and 26 to 30 pages EM-40 and 41)

cardiagn.com

TIMING BELT (5S-FE)

COMPONENTS



REMOVAL OF TIMING BELT

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**

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

2. **REMOVE ENGINE UNDER COVERS**

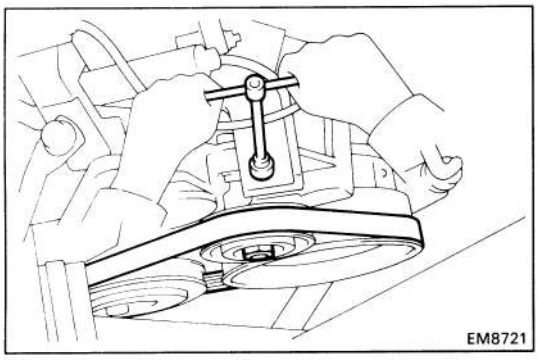
3. **REMOVE RH ENGINE HOOD SIDE PANEL**

4. **REMOVE SUSPENSION UPPER BRACE**
   (See steps 8 on page EM-182)

5. **REMOVE CRUISE CONTROL ACTUATOR (w/ CRUISE CONTROL SYSTEM) AND ACCELERATOR LINKAGE**
   (See step 11 on page EM-182)

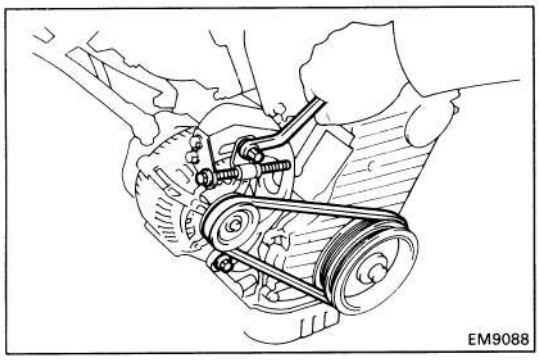
6. **REMOVE RH FRONT WHEEL**

cardiagn.com



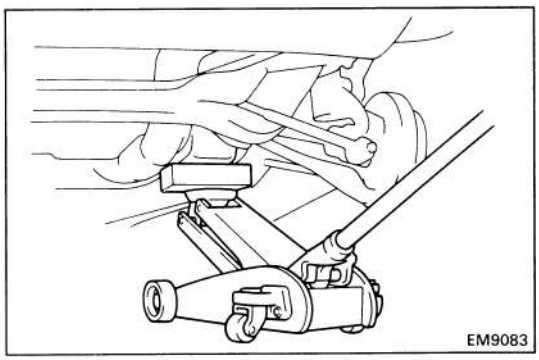
7. REMOVE A/C DRIVE BELT

Loosen the idler pulley bolt and adjusting bolt, and remove the drive belt.



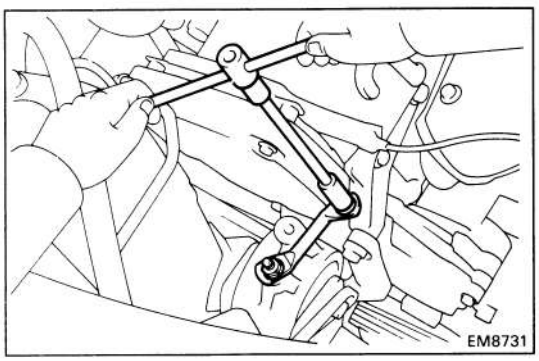
8. REMOVE ALTERNATOR DRIVE BELT

Loosen the pivot bolt, adjusting lock bolt and adjusting bolt, and remove the drive belt.



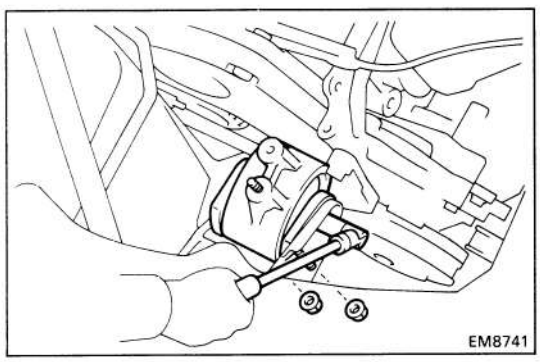
9. SLIGHTLY JACK UP ENGINE

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



10. REMOVE RH ENGINE MOUNTING STAY

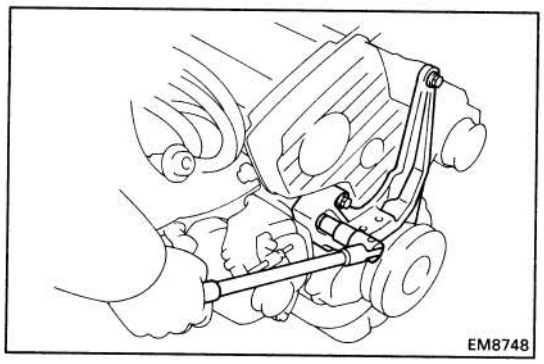
Remove the bolt, nut and mounting stay.



11. REMOVE RH ENGINE MOUNTING INSULATOR

Remove the through bolt, two nuts and mounting insulator.

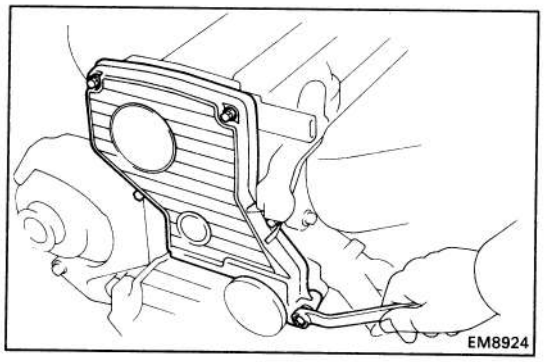
cardiagn.com



12. REMOVE RH ENGINE MOUNTING BRACKET

Remove the three bolts and mounting bracket.

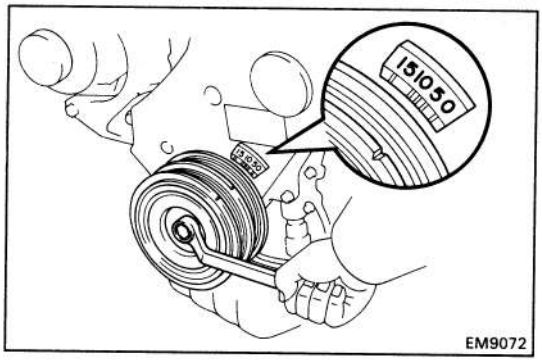
HINT: Lower the jack and perform the operation with the engine fully up.



13. REMOVE NO.2 TIMING BELT COVER

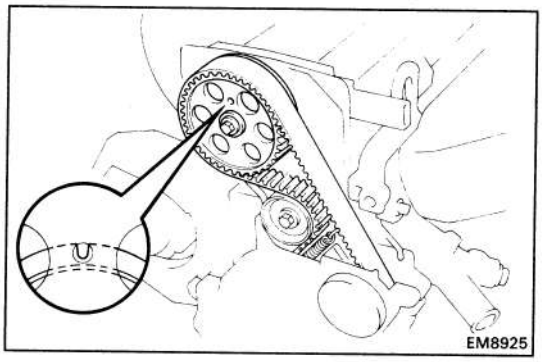
Remove the five bolts, timing belt cover and two gaskets.

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



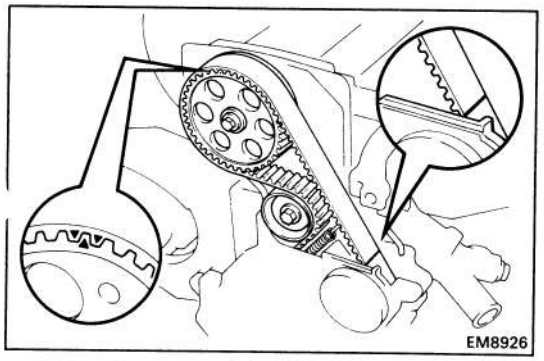
15. SET NO.1 CYLINDER TO TDC/COMPRESSION

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



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

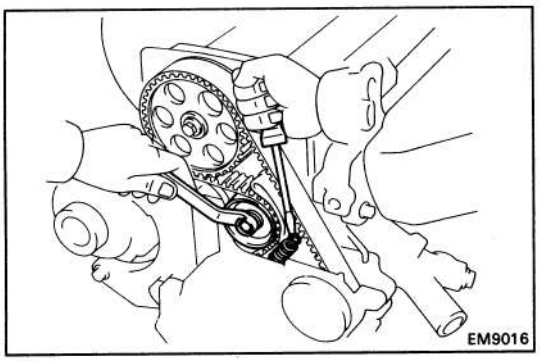
If not, turn the crankshaft one revolution (360°).



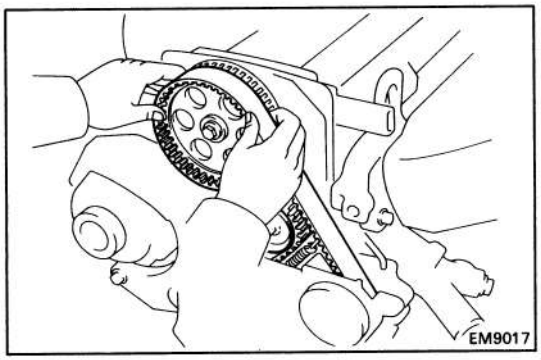
16. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEY

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

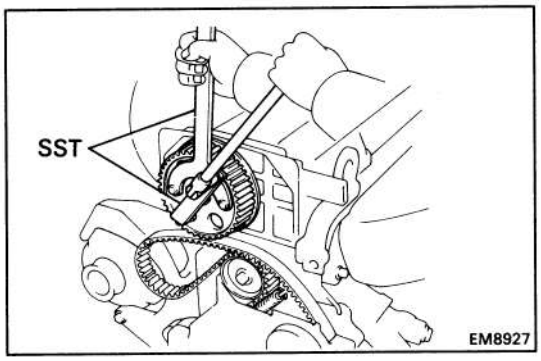
cardiagn.com



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



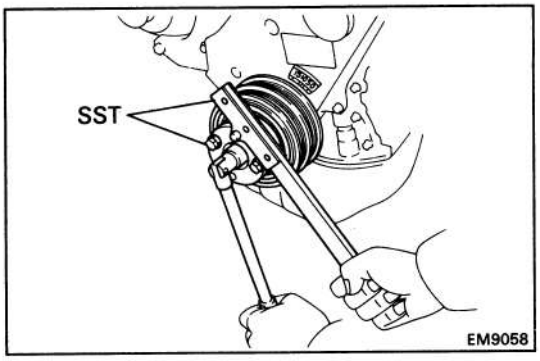
(b) Remove the timing belt from the camshaft timing pulley.



17. REMOVE CAMSHAFT TIMING PULLEY

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

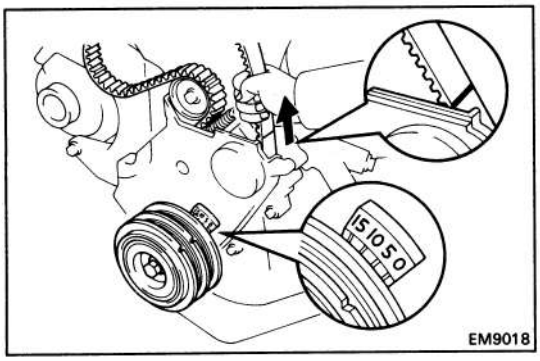
SST 09249-63010 and 09278-54012



18. REMOVE CRANKSHAFT PULLEY

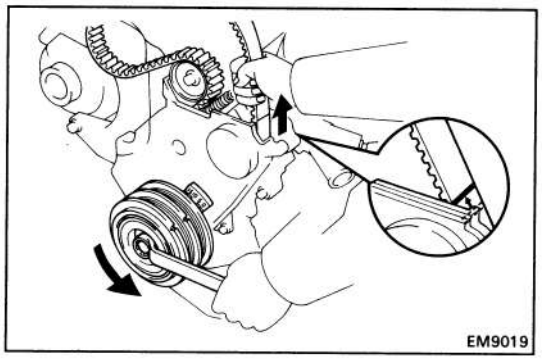
(a) Using SST, remove the pulley bolt.

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



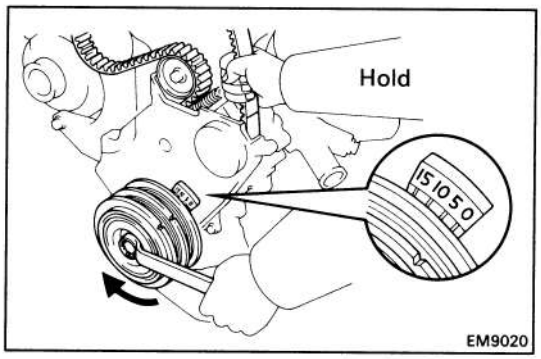
HINT (When re-using timing belt): After loosening the crankshaft pulley bolt, check that the timing belt matchmark aligns with the end of the No.1 timing belt cover when the crankshaft pulley groove is aligned with the timing mark "0" of the No.1 timing belt cover. If the matchmark does not align, align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

cardiagn.com

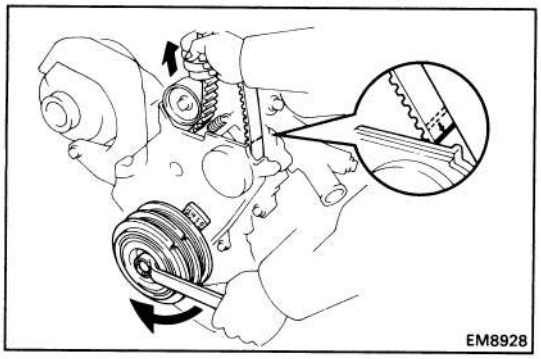


(When matchmark is out of alignment clockwise)

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

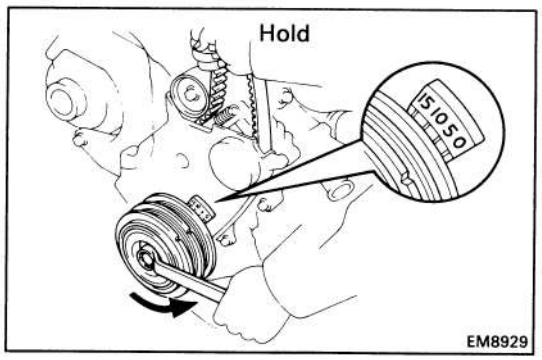


- After aligning the matchmark, hold the timing belt. And turn the crankshaft pulley clockwise, and align its groove with timing mark "0" of the No.1 timing belt cover.

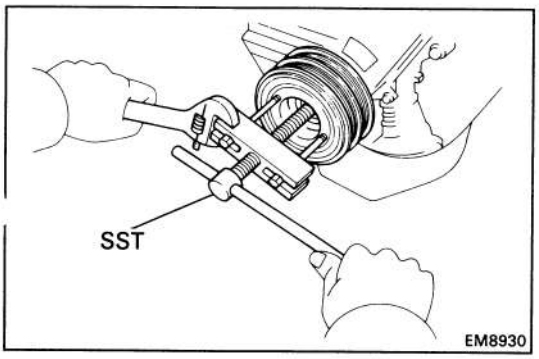


(When matchmark is out of alignment counter-clockwise)

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



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

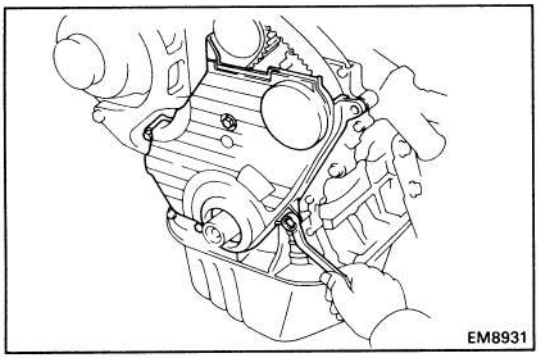


(b) Using SST, remove the pulley.

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

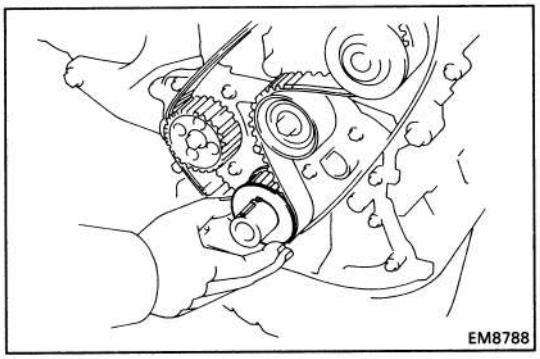
HINT (When re-using timing belt): Remove the pulley without turning it.

cardiagn.com

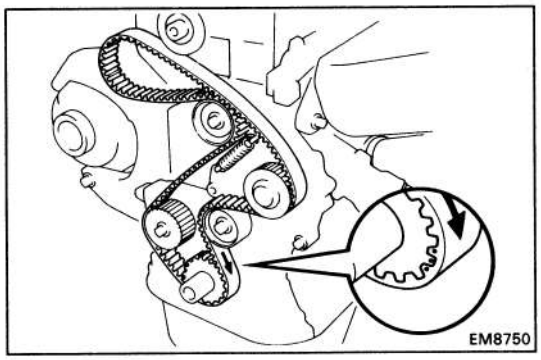


19. REMOVE NO.1 TIMING BELT COVER

Remove the four bolts, timing belt cover and gasket.

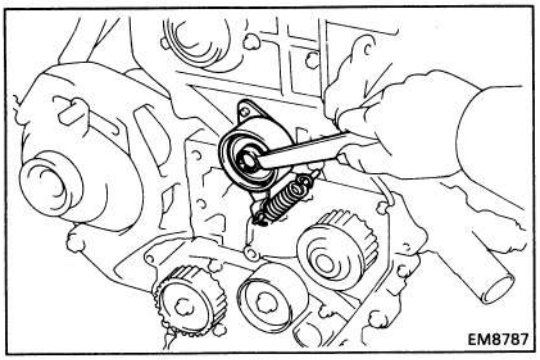


20. REMOVE TIMING BELT GUIDE



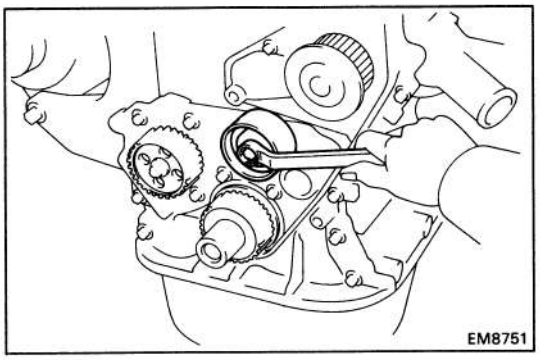
21. REMOVE TIMING BELT

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



22. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING

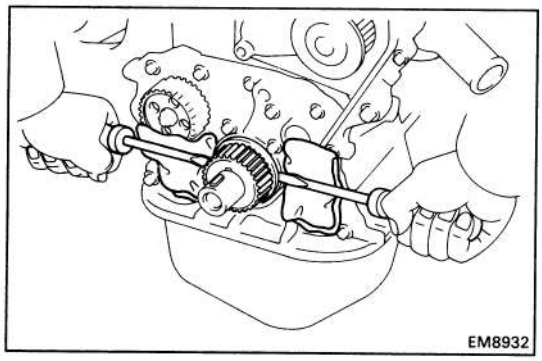
Remove the bolt, pulley and tension spring.



23. REMOVE NO.2 IDLER PULLEY

Remove the bolt and pulley.

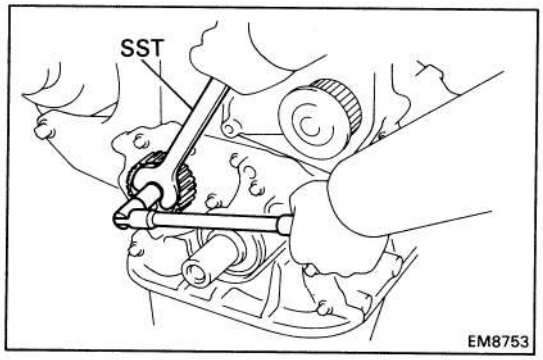
cardiagn.com



24. REMOVE CRANKSHAFT TIMING PULLEY

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

HINT: Position shop rags as shown to prevent damage.



25. REMOVE OIL PUMP PULLEY

Using SST, remove the nut and pulley.

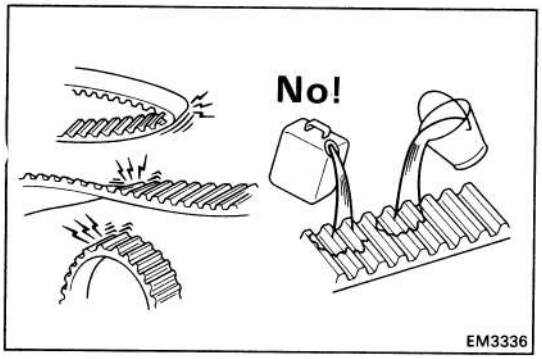
SST 09616-30011

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.**

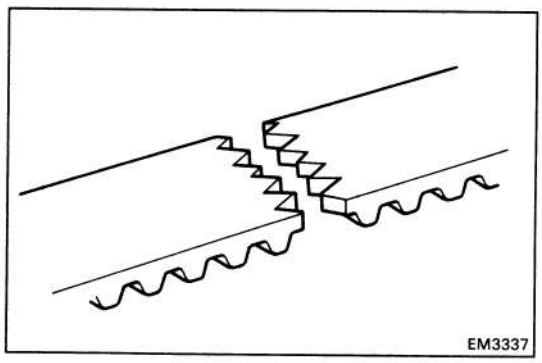


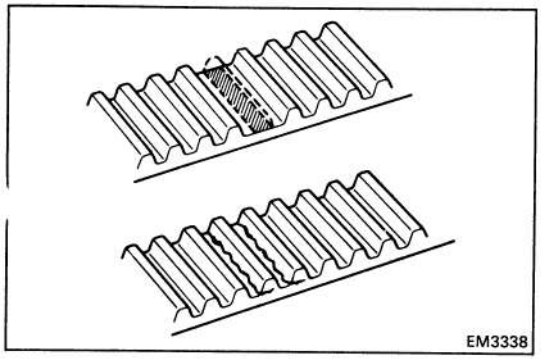
If there are any defects as shown in the illustrations, check the following points:

(a) Premature parting

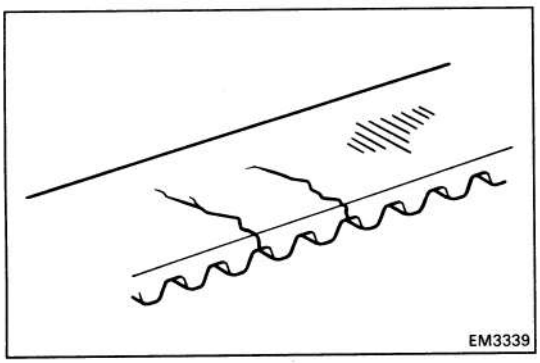
- Check for proper installation.
- Check the timing cover gasket for damage and proper installation.

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

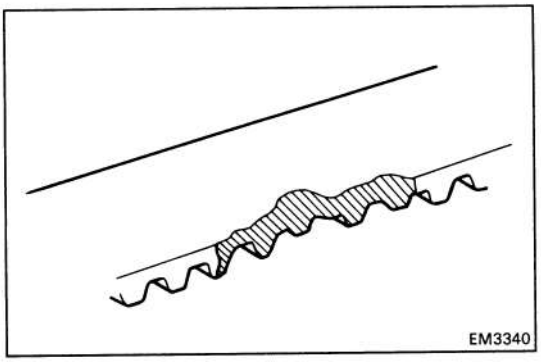




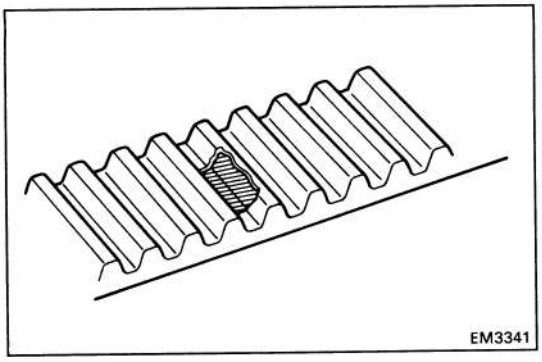
cardiagn.com



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

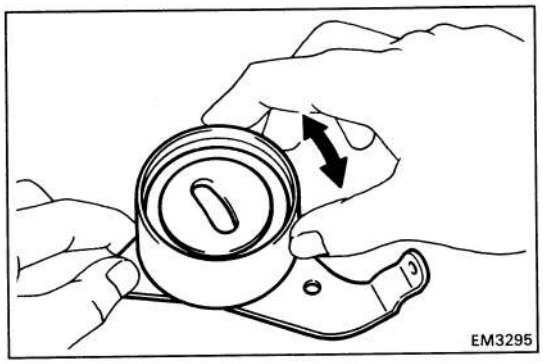


(d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.



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

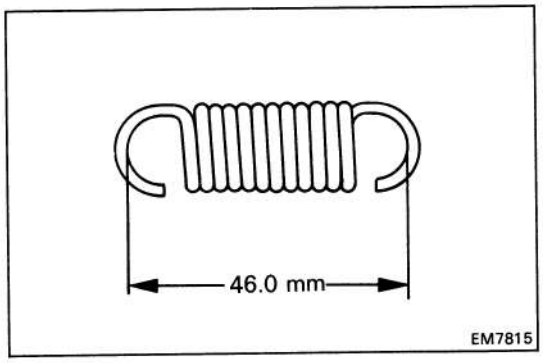
If necessary, replace the timing belt.



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 the tension spring.

Free length: 46.0 mm (1.811 in.)

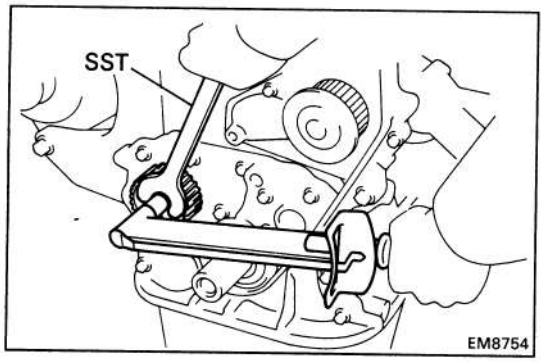
If the free length is not as specified, replace the tension spring.

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

Installed tension:
4.75 – 5.25 kg (10.5 – 11.6 lb, 47 – 52 N·m)
at 50.5 mm (1.988 in.)

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

cardiagn.com



INSTALLATION OF TIMING BELT

(See page EM-47)

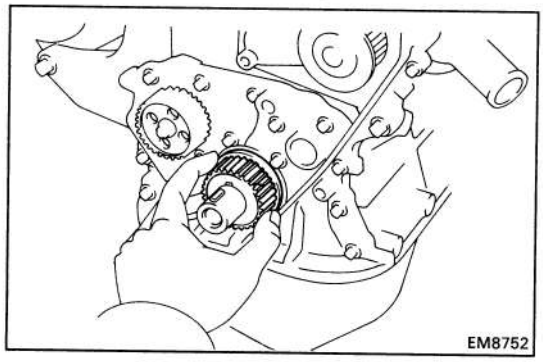
1. INSTALL OIL PUMP PULLEY

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

(b) Using SST, install the nut.

SST 09616-30011

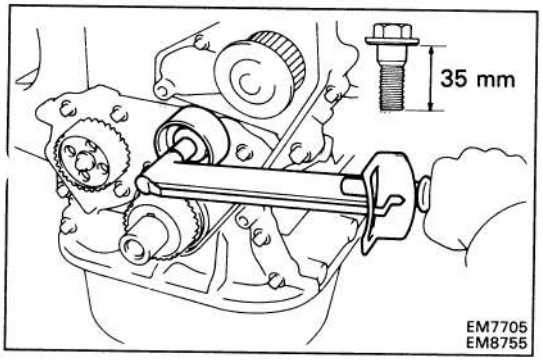
Torque: 290 kg-cm (21 ft-lb, 28 N·m)



2. INSTALL CRANKSHAFT TIMING PULLEY

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

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



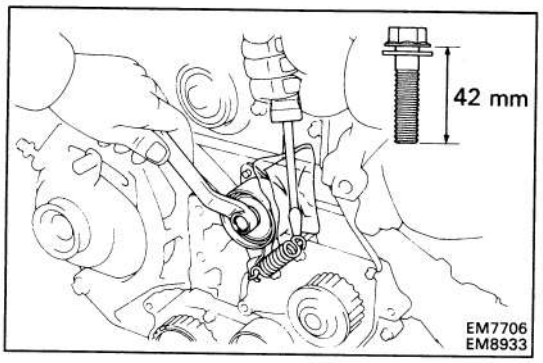
3. INSTALL NO.2 IDLER PULLEY

(a) Install the pulley with the bolt.

Torque: 425 kg-cm (31 ft-lb, 42 N·m)

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

(b) Check that the idler pulley moves smoothly.



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

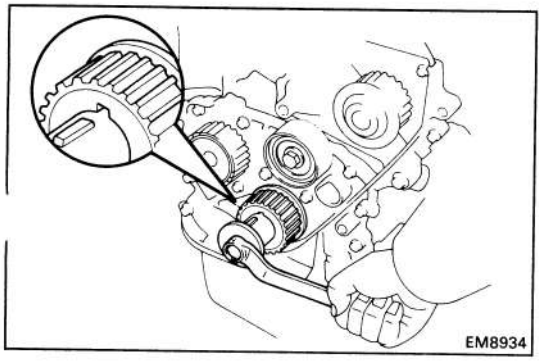
(a) Install the pulley with the bolt. Do not tighten the bolt yet.

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

(b) Install the tension spring.

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

(d) Check that the idler pulley moves smoothly.

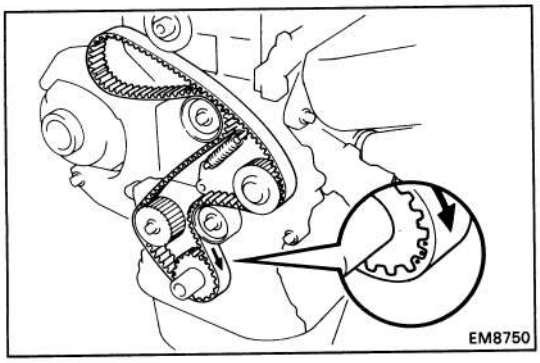


5. TEMPORARILY INSTALL TIMING BELT

NOTICE: The engine should be cold.

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

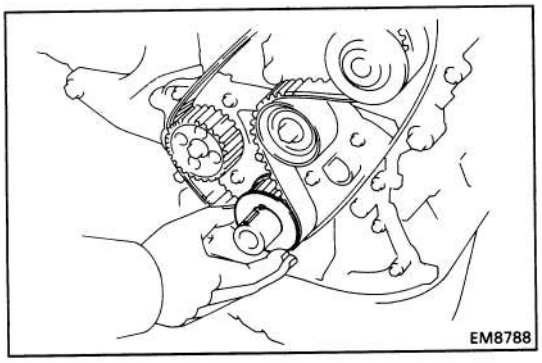
cardiagn.com



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

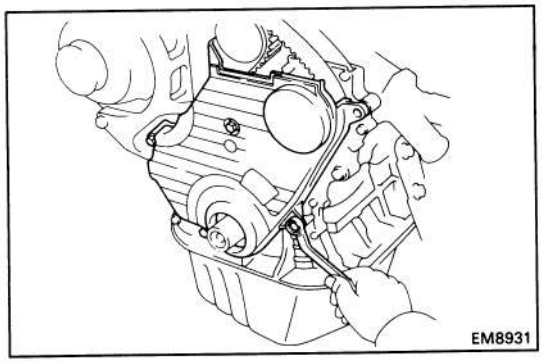
(c) Install the timing belt on the crankshaft timing, oil pump pulley, No.2 idler pulley, water pump pulley and No.2 idler pulley.

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



6. INSTALL TIMING BELT GUIDE

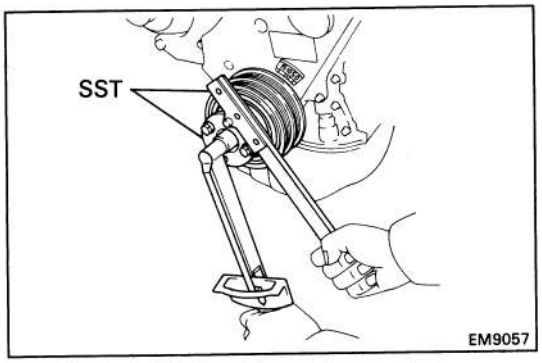
Install the guide, facing the cup side outward.



7. INSTALL NO.1 TIMING BELT COVER

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

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



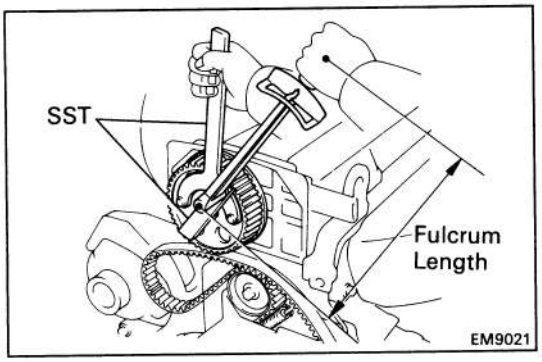
8. INSTALL CRANKSHAFT PULLEY

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

(b) Using SST, install the pulley bolt.

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

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 on the timing pulley.

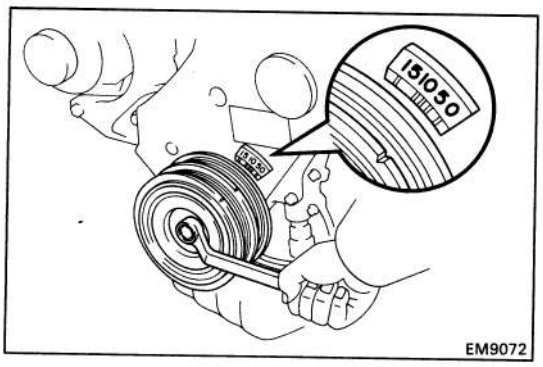
(b) Using SST, install the plate washer and bolt.

SST 09249-63010 and 09278-54012

Torque: 380 kg-cm (27 ft-lb, 37 N·m)

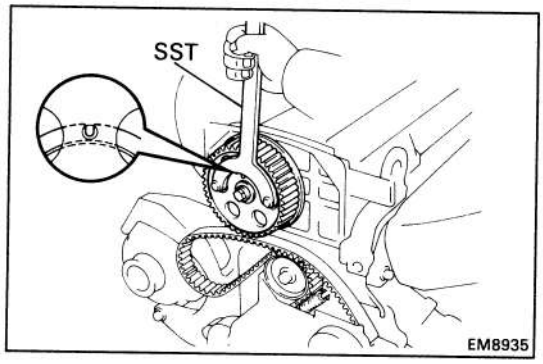
HINT: Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

cardiagn.com



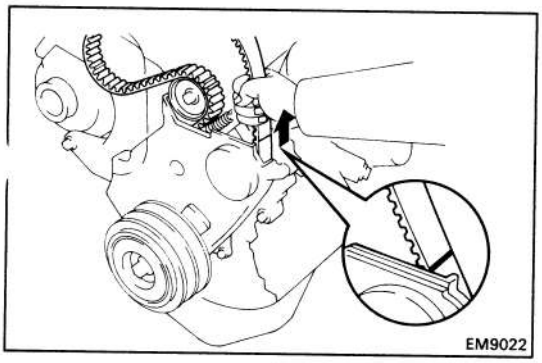
10. SET NO.1 CYLINDER TO TDC/COMPRESSION

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



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

SST 09278-54012

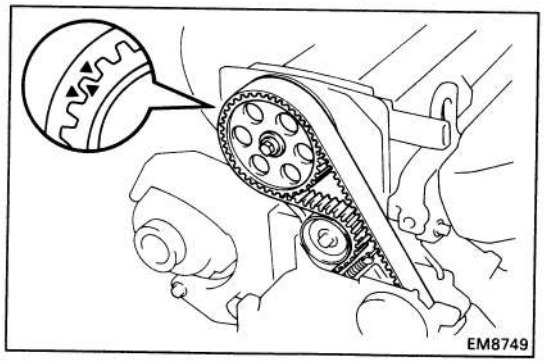


11. INSTALL TIMING BELT

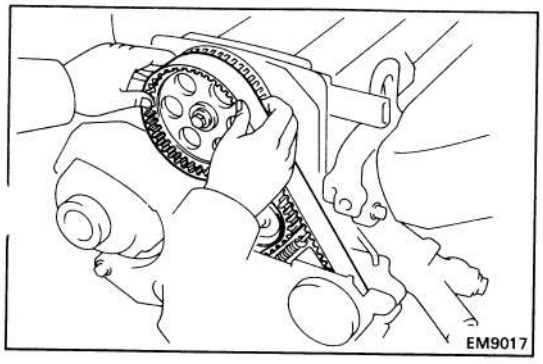
HINT (When re-using timing belt):

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

If the matchmark does not align, shift the meshing of the timing belt and crankshaft timing pulley until they align. (See page EM-51)



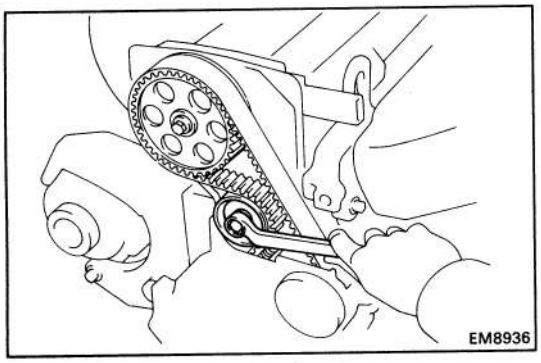
- Align the matchmarks of the timing belt and camshaft timing pulley.



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

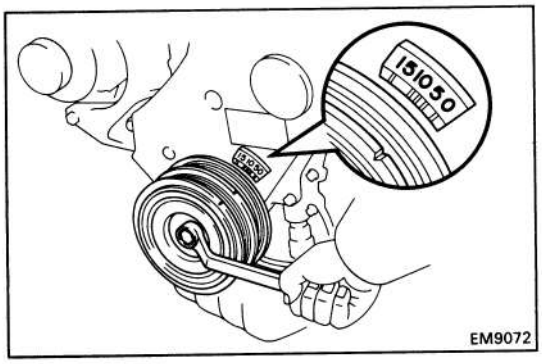
(b) Install the timing belt, insure that there is tension between the crankshaft timing pulley and camshaft timing pulley.

cardiagn.com



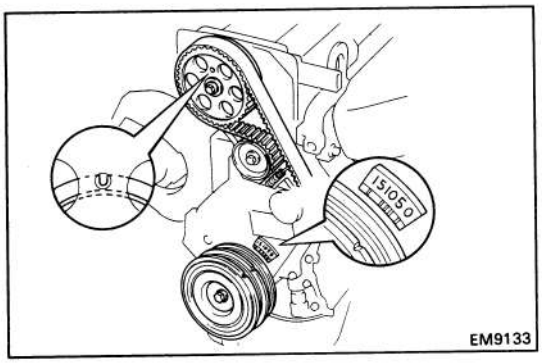
12. CHECK VALVE TIMING

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



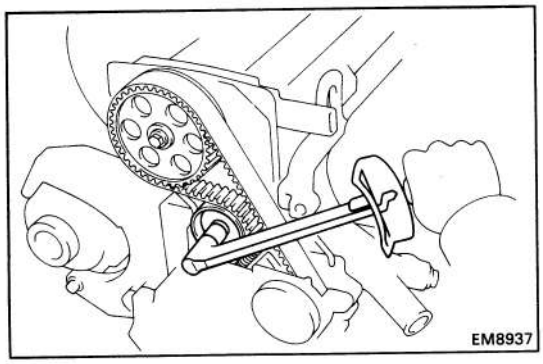
(b) Turn the crankshaft pulley two revolutions from TDC to TDC.

NOTICE: Always turn the crankshaft clockwise.



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

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

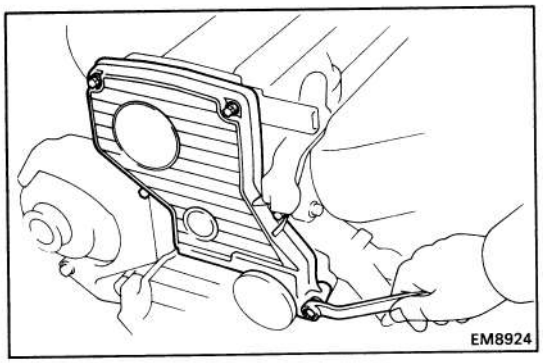


(d) Torque the mount bolt of the No.1 idler pulley.

Torque: 425 kg-cm (31 ft-lb, 42 N·m)

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

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

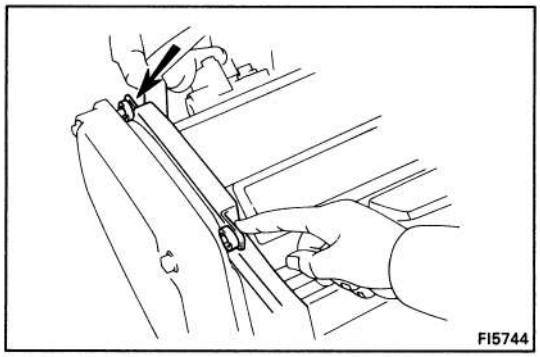


14. INSTALL NO.2 TIMING BELT COVER

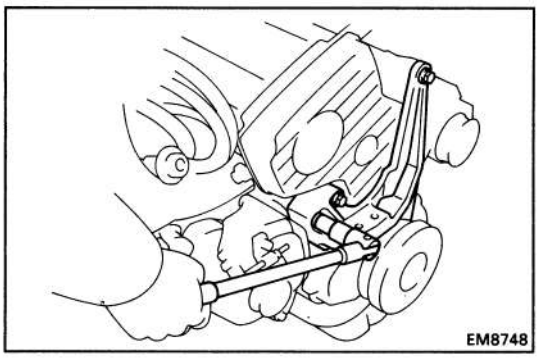
(a) Install the two gaskets to the No.1 and No.2 belt covers.

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

cardiagn.com



(c) Install the two clamps of the engine wire to each bolt.

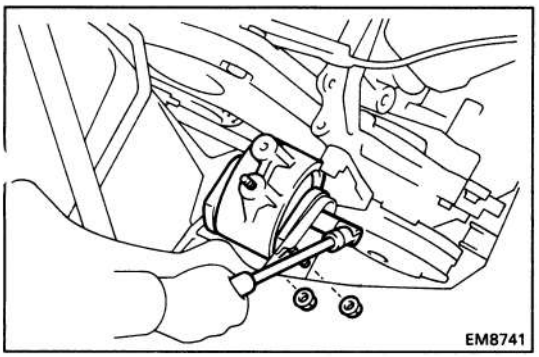


15. INSTALL RH ENGINE MOUNTING BRACKET

Install the bracket with the three bolts.

Torque: 530 kg-cm (38 ft-lb, 52 N·m)

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

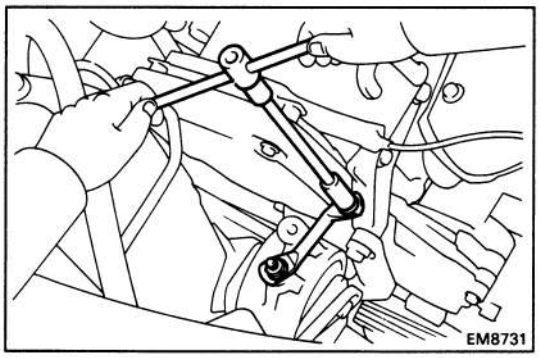


16. INSTALL RH ENGINE MOUNTING INSULATOR

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

Torque:

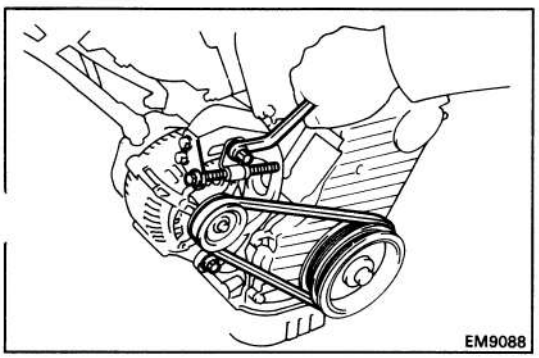
Nut	**530 kg-cm (38 ft-lb, 52 N·m)**
Through bolt	**800 kg-cm (58 ft-lb, 78 N·m)**



17. INSTALL RH ENGINE MOUNTING STAY

Install the mounting stay with the bolt and nut.

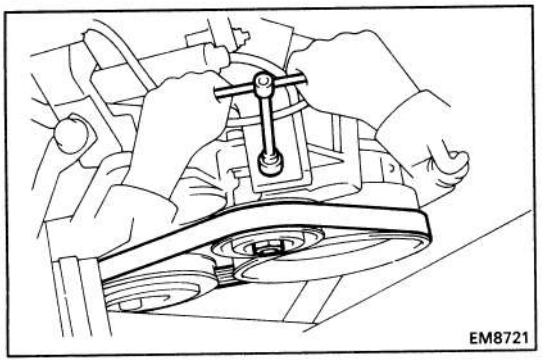
Torque: 740 kg-cm (54 ft-lb, 73 N·m)



18. INSTALL ALTERNATOR DRIVE BELT

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

cardiagn.com



19. INSTALL A/C DRIVE BELT

Install the drive belt with the adjusting bolt and idler pulley bolt.

20. INSTALL RH FRONT WHEEL

21. INSTALL CRUISE CONTROL ACTUATOR (w/ CRUISE CONTROL SYSTEM) AND ACCELERATOR LINKAGE
(See step 33 pages EM-225)

22. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

23. CHECK AND ADJUST DRIVE BELTS

(a) Adjust the alternator drive belt.
(See page CH-3)

Drive belt tension: New belt 120 ± 20 lb
Used belt 104 ± 20 lb

(b) Adjust the A/C drive belt.

Drive belt tension: New belt 160 ± 20 lb
Used belt 100 ± 20 lb

24. INSTALL SUSPENSION UPPER BRACE
(See step 36 on page EM-226)

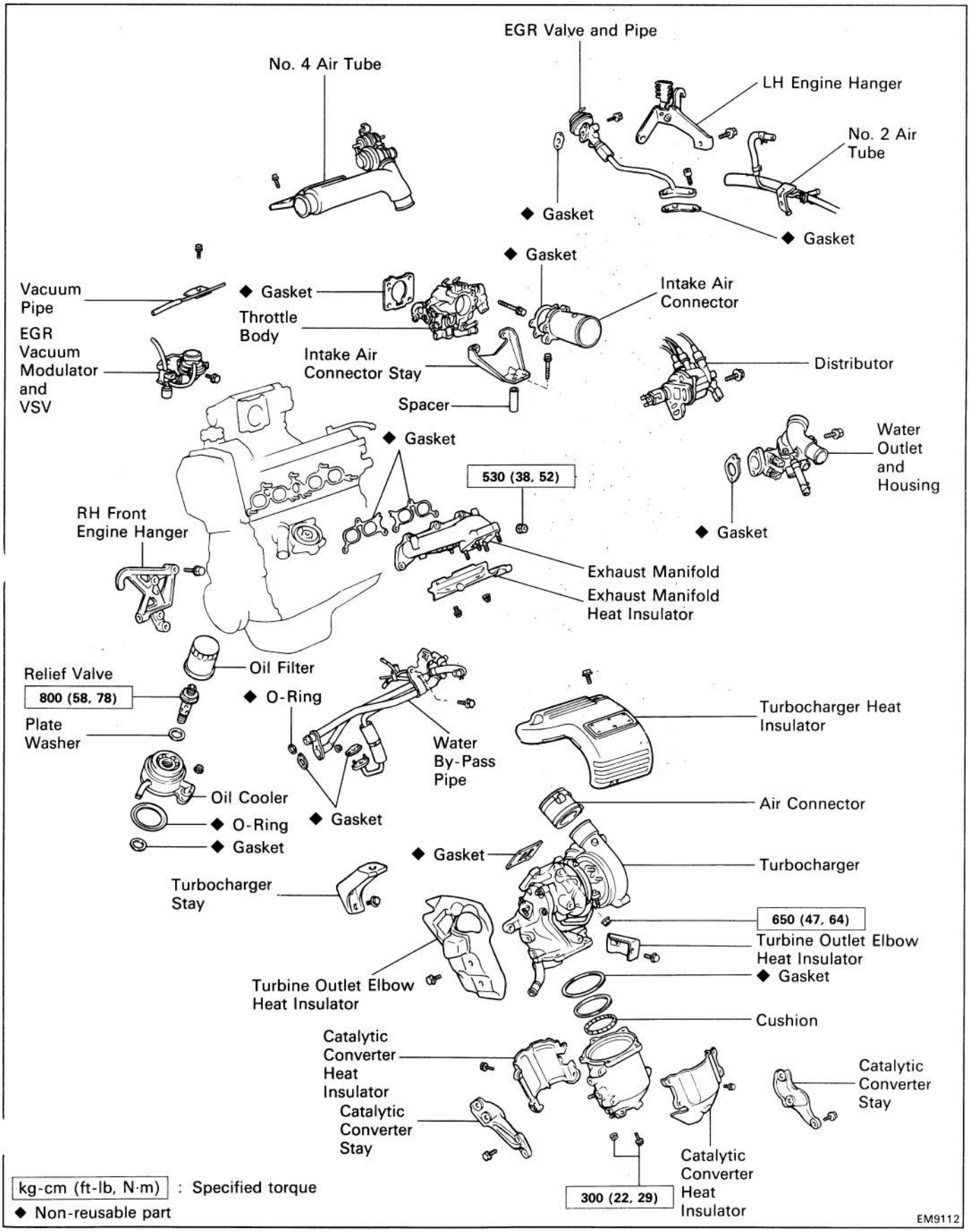
25. INSTALL RH ENGINE HOOD SIDE PANEL

26. INSTALL ENGINE UNDER COVERS

cardiagn.com

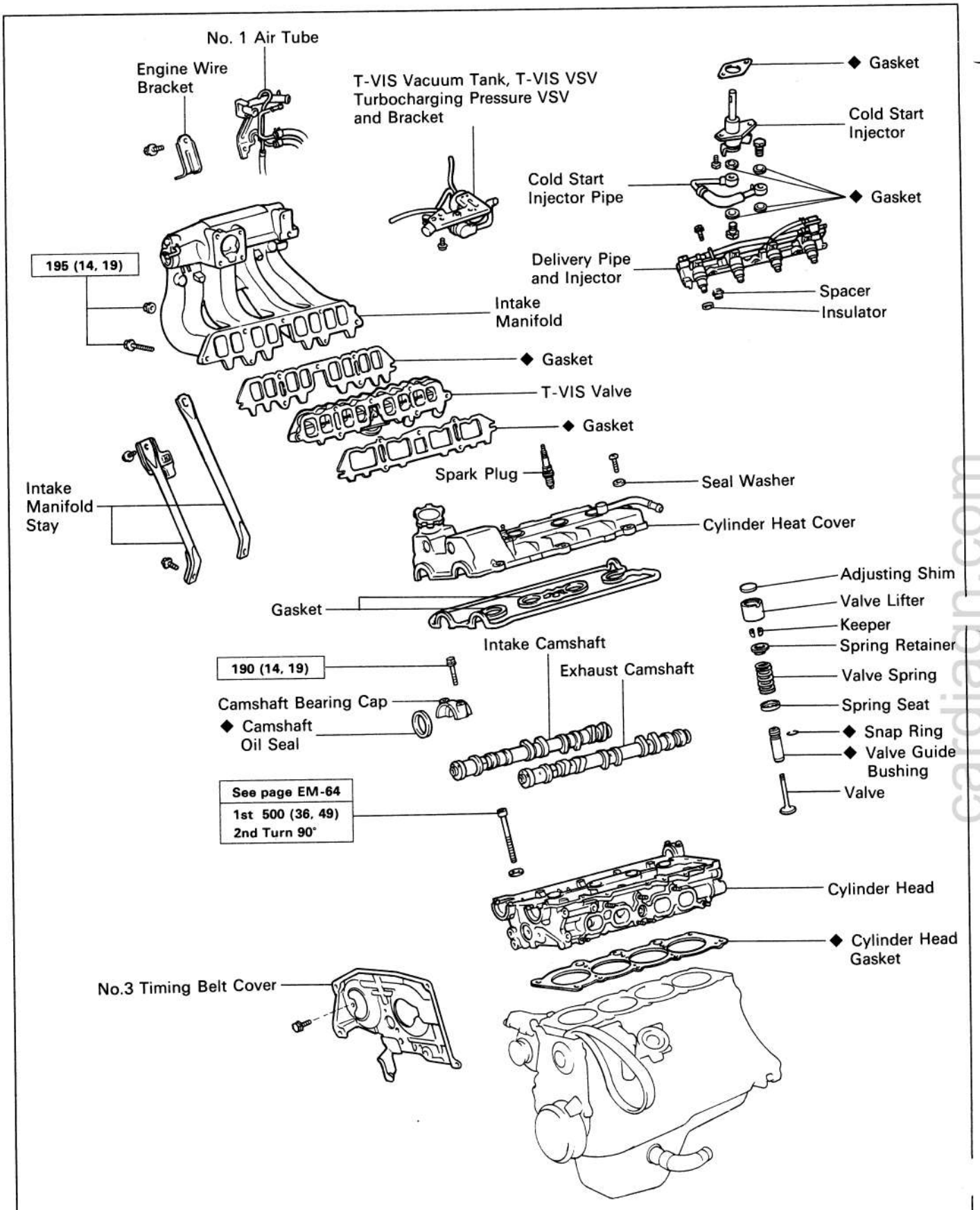
CYLINDER HEAD (3S-GTE)

COMPONENTS



cardiagn.com

COMPONENTS (Cont'd)



kg-cm (ft-lb, N·m) : Spedified torque

◆ Non-reusable part

EM9113

cardiagn.com

REMOVAL OF CYLINDER HEAD

(See pages EM-61 and 62)

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**

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

2. **DRAIN ENGINE COOLANT (See page CO-6)**

3. **REMOVE ENGINE UNDER COVERS**

4. **REMOVE ENGINE HOOD SIDE PANELS**

5. **REMOVE SUSPENSION UPPER BRACE (See step 8 on page EM-134)**

6. **DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY**

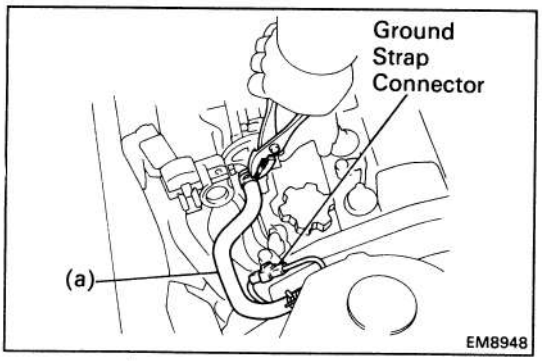
7. **REMOVE CRUISE CONTROL ACTUATOR (w/ CRUISE CONTROL SYSTEM) AND ACCELERATOR LINKAGE (See step 13 on page EM-135)**

8. **REMOVE AIR CLEANER CAP (See step 9 on page EM-134)**

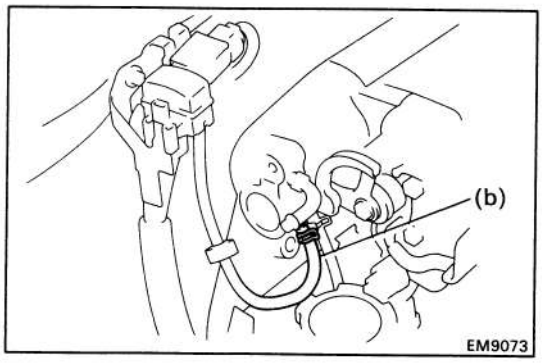
9. **DISCONNECT GROUND STRAP CONNECTOR**

10. **DISCONNECT HOSES**

    (a) Brake booster vacuum hose from intake manifold

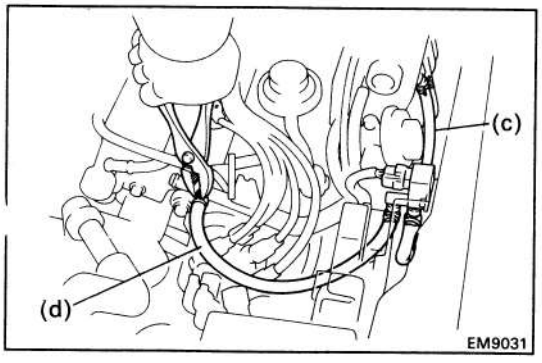


    (b) Turbocharging pressure sensor hose from intake manifold

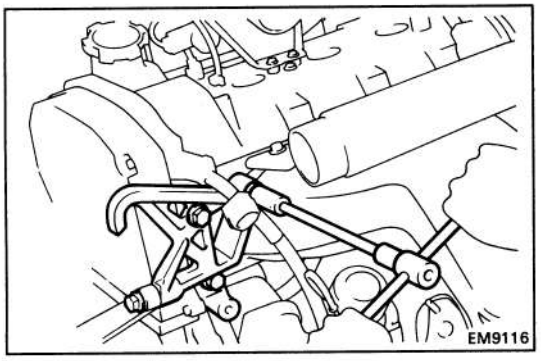


    (c) A/C VSV vacuum hose from intake manifold

    (d) A/C VSV air hose from No.2 air tube



cardiagn.com



11. REMOVE RH FRONT ENGINE HANGER

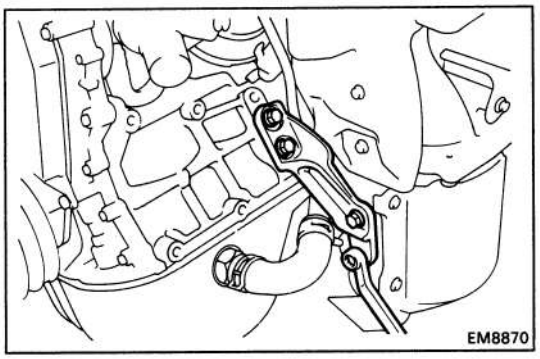
Remove the three bolts and engine hanger.

12. REMOVE INTERCOOLER

(See steps 4, 5, 7, 8 and 10 to 13 on pages TC-20 to 22)

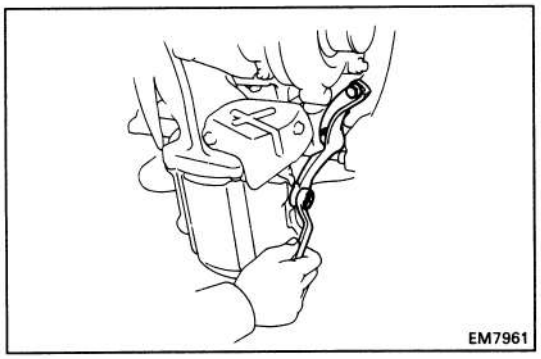
13. REMOVE FRONT EXHAUST PIPE

(See step 30 and 31 on pages EM-138 and 139)

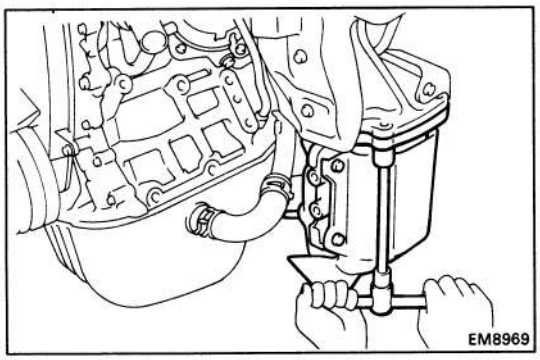


14. REMOVE CATALYTIC CONVERTER

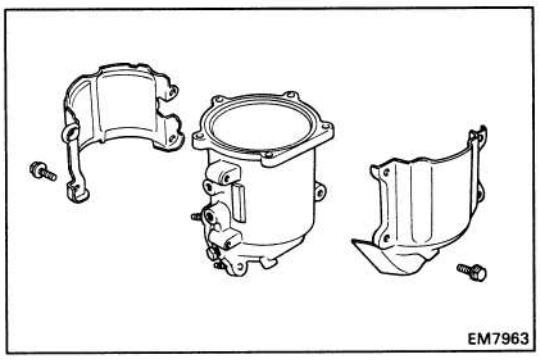
(a) Remove the four bolts and RH converter stay.



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



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



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

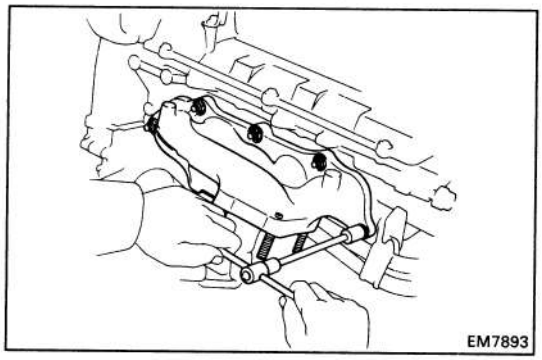
(e) Remove the four bolts and rear heat insulator.

cardiagn.com

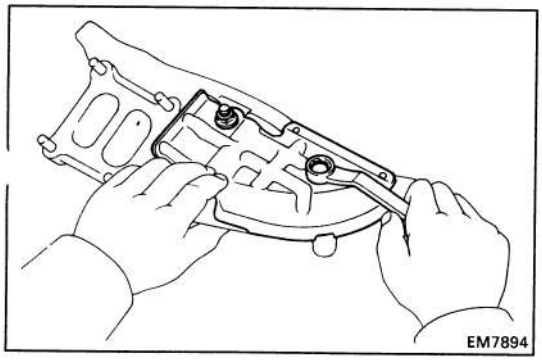
15. **REMOVE TURBOCHARGER**
(See steps 8, 11, 12 and 18 to 24 on pages TC-9 and 12)

16. **REMOVE THROTTLE BODY**
(See steps 5 to 8, 10 and 11 on pages FI-135 and 136)

17. **REMOVE COLD START INJECTOR**
(See steps 2 to 4 on pages FI-99 and 100)

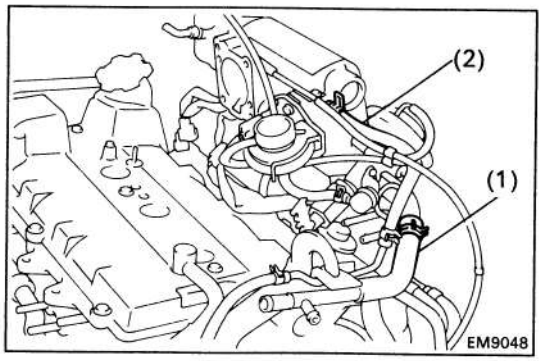


18. **REMOVE EXHAUST MANIFOLD**
(a) Remove the seven nuts, exhaust manifold and gasket.

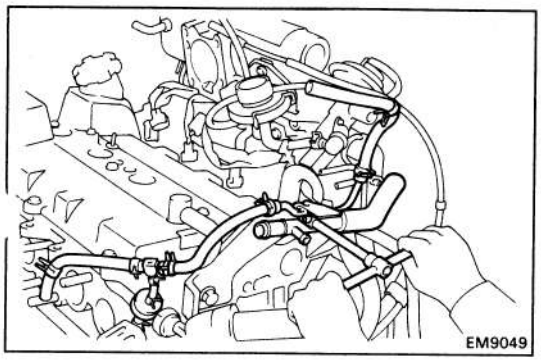


(b) Remove the bolt, nut and heat insulator.

19. **REMOVE DISTRIBUTOR (See pages IG-14 and 15)**

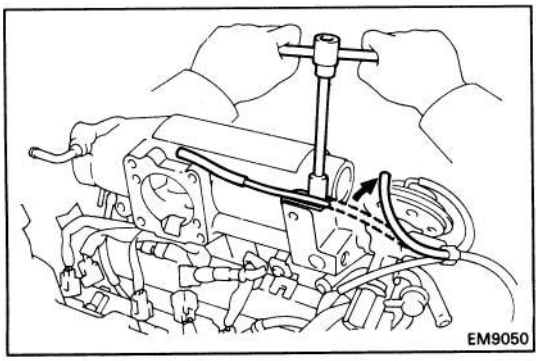


20. **REMOVE NO.2 AIR TUBE**
(a) Disconnect the following hose:
(1) Air hose from No.1 air tube
(2) Air hose from intake manifold



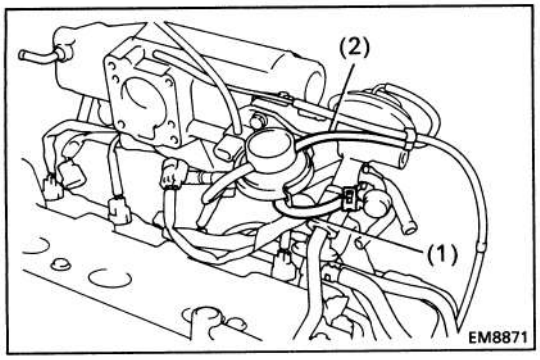
(b) Remove the bolt and No.2 air tube.

cardiagn.com



21. REMOVE LH ENGINE HANGER

Remove the two bolts and engine hanger.



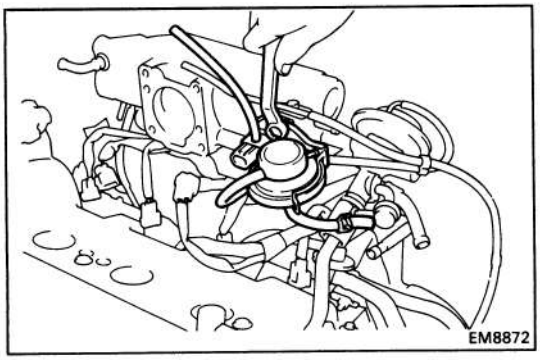
22. REMOVE EGR VACUUM MODULATOR AND VSV

(a) Disconnect the EGR VSV connector.

(b) Disconnect the following hoses:

(1) Vacuum hose from EGR valve

(2) Vacuum hose from EGR vacuum modulator



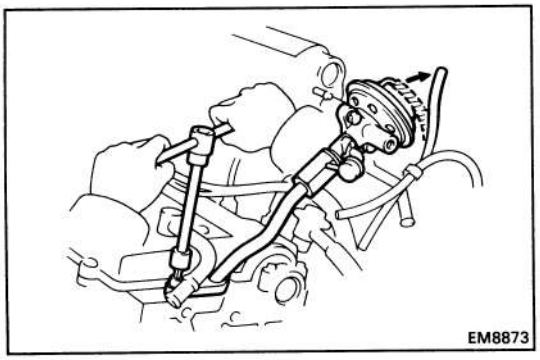
(c) Remove the bolt, vacuum modulator and VSV assembly.



23. REMOVE VACUUM PIPE

(a) Disconnect the vacuum hose from the vacuum pipe.

(b) Remove the bolt and vacuum pipe.

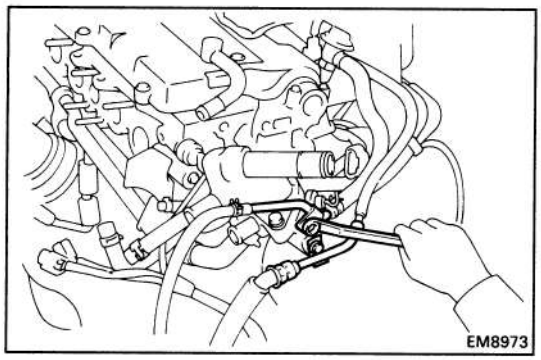


24. REMOVE EGR VALVE AND PIPE

(a) Disconnect the vacuum hose from the EGR valve.

(b) Remove the four bolts, the EGR valve, pipe assembly and two gaskets.

cardiagn.com

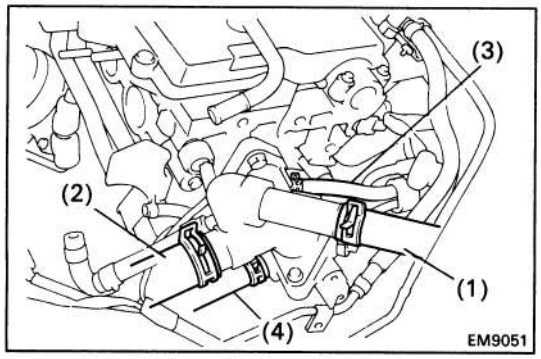


25. REMOVE WATER OUTLET AND HOUSING

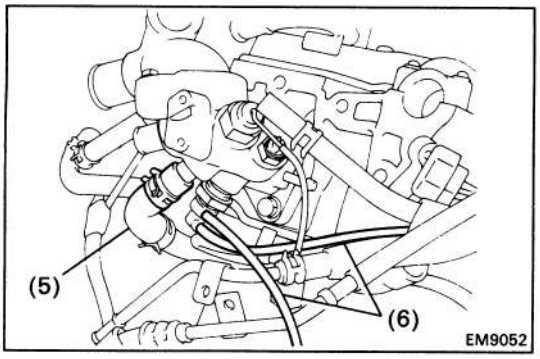
(a) Disconnect the following connectors:
- Water temperature sender gauge connector
- Water temperature sensor
- Cold start injector time switch connector

(b) Remove the bolt, and disconnect the fuel inlet hose.

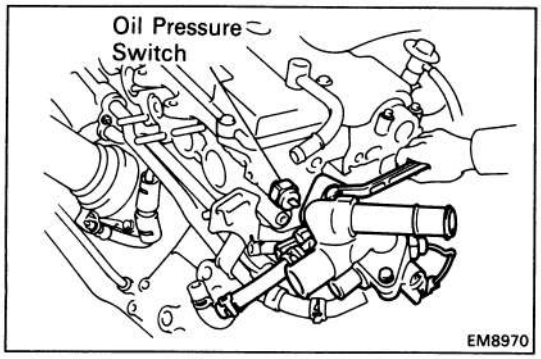
(c) Remove the bolt, and disconnect the fuel return hose.



(d) Disconnect the following hoses:
(1) Water filler hose
(2) Radiator hose
(3) Water by-pass pipe hose from ISC valve
(4) Heater water hose



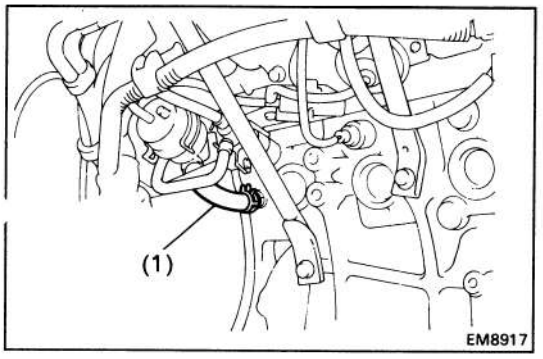
(5) Water by-pass hose from water by-pass pipe
(6) Two EVAP VSV vacuum hoses



(e) Remove the two bolts, the water outlet, housing assembly and gasket.

26. REMOVE OIL PRESSURE SWITCH

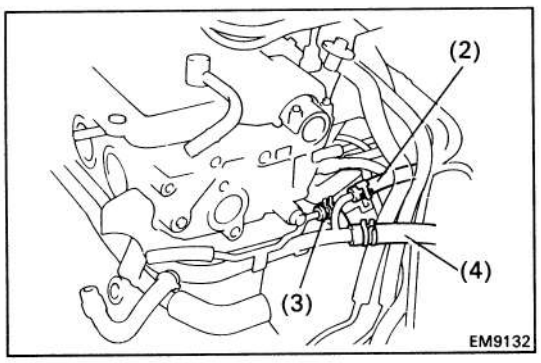
27. REMOVE OIL COOLER
(See steps 7 to 10 on pages LU-18 and 19)



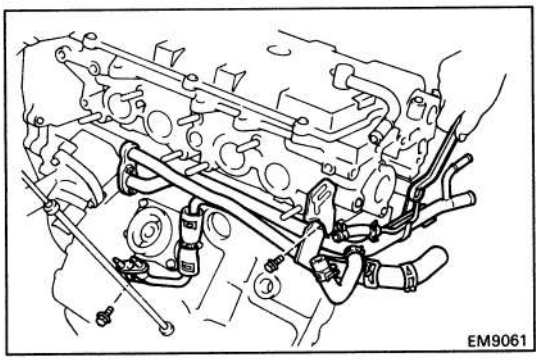
28. REMOVE WATER BY-PASS PIPE

(a) Disconnect the following hoses:
(1) Water by-pass hose from cylinder block

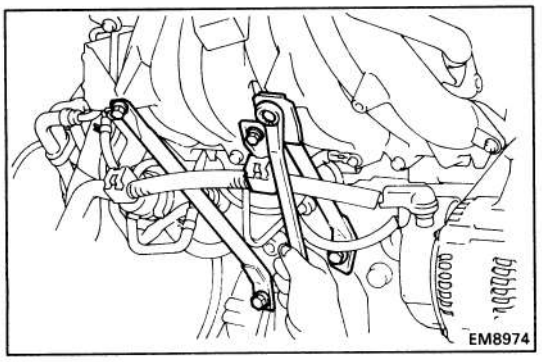
cardiagn.com



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

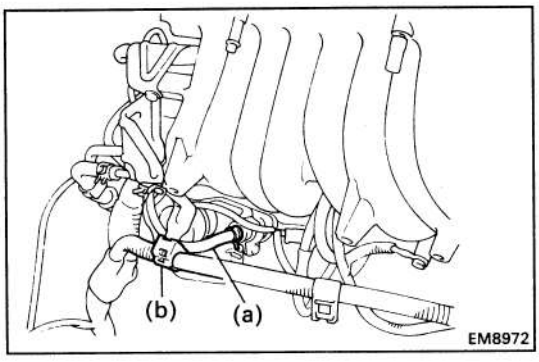


(b) Remove the two bolts, two nuts, water by-pass pipe, gasket and O-ring.



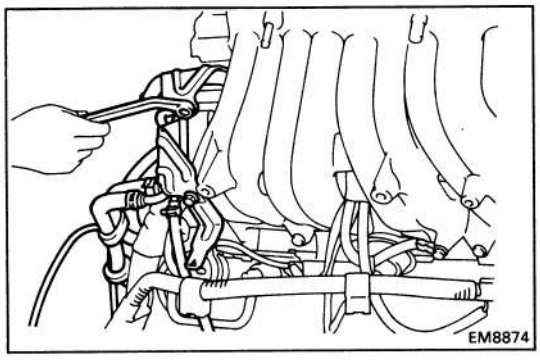
29. REMOVE INTAKE MANIFOLD STAYS

(a) Disconnect the alternator wire clamp from the wire bracket.
(b) Remove the two bolts and manifold stay. Remove the two manifold stays



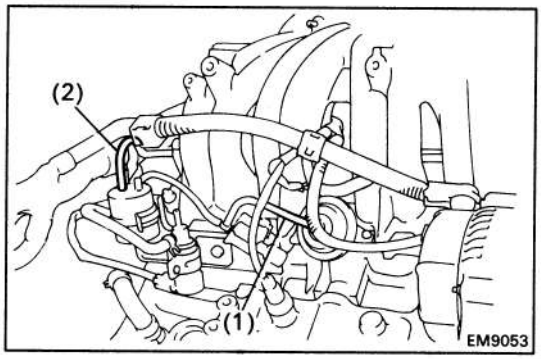
30. REMOVE NO.1 AIR TUBE

(a) Disconnect the Vacuum hose from the turbocharging pressure VSV.
(b) Disconnect the alternator wire clamp from the wire bracket.



(c) Remove the two bolts, wire bracket and air tube.

cardiagn.com

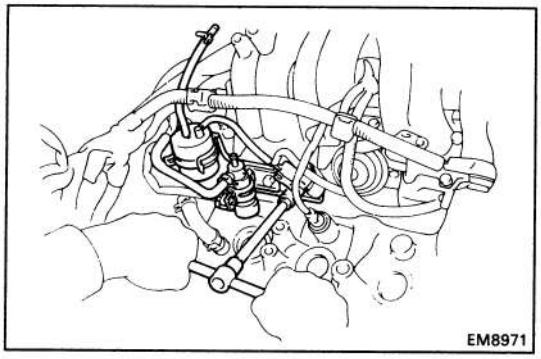


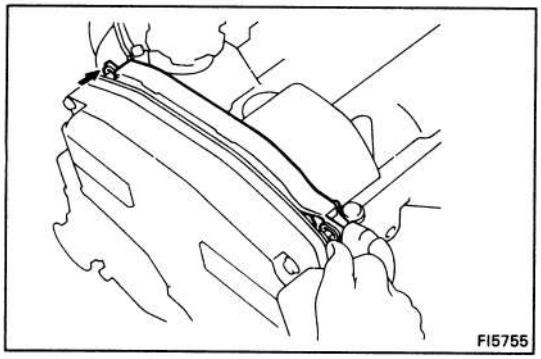
31. REMOVE T-VIS VACUUM TANK, T-VIS VSV, TURBOCHARGING PRESSURE VSV AND BRACKET

(a) Disconnect the following connectors:
- T-VIS VSV connector
- Turbocharging pressure VSV connector

(b) Disconnect the following hoses:
(1) Vacuum hose (from T-VIS VSV) from T-VIS actuator
(2) Vacuum hose (from T-VIS vacuum tank) from intake manifold

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

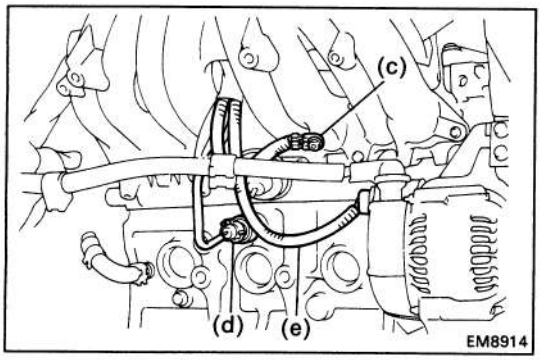




32. DISCONNECT ENGINE WIRE FROM INTAKE MANIFOLD

(a) Disconnect the two engine wire clamps from the mount bolts on the No.2 timing belt covers.

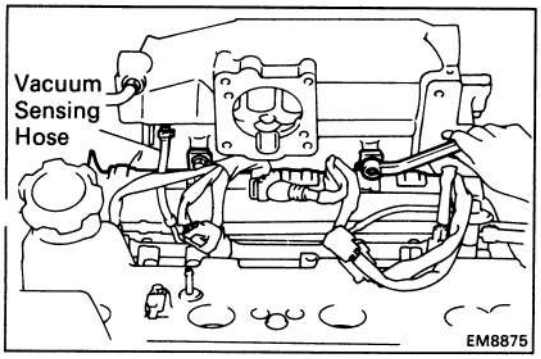
(b) Disconnect the injector connector.



(c) Remove the bolt, and disconnect the ground strap.

(d) Disconnect the knock sensor connector.

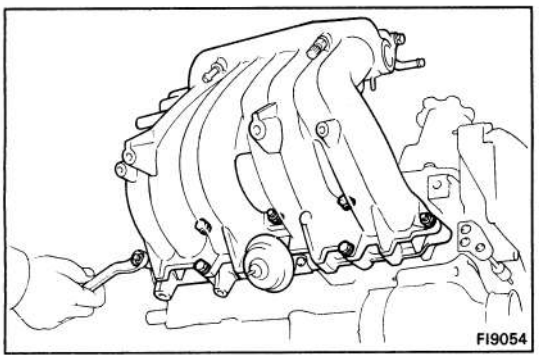
(e) Disconnect the alternator connector.



(f) Disconnect the vacuum sensing hose from the intake manifold.

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

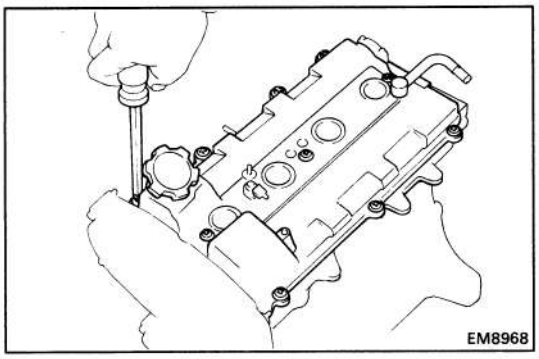
cardiagn.com



33. REMOVE INTAKE MANIFOLD AND T-VIS VALVE

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

34. REMOVE DELIVERY PIPE AND INJECTORS
(See steps 9, 13 to 15 on pages FI-111 and 112)

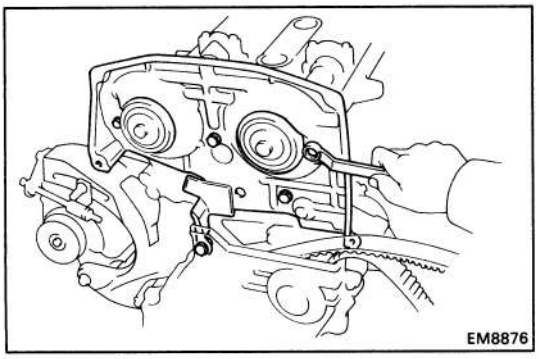


35. REMOVE CYLINDER HEAD COVER

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

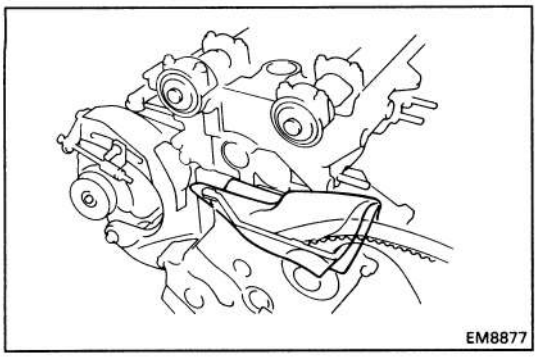
36. REMOVE CAMSHAFT TIMING PULLEYS
(See steps 9 to 21 on pages EM-27 to 29)

37. REMOVE NO.1 IDLER PULLEY
(See step 26 on page EM-31)



38. REMOVE NO.3 TIMING BELT COVER

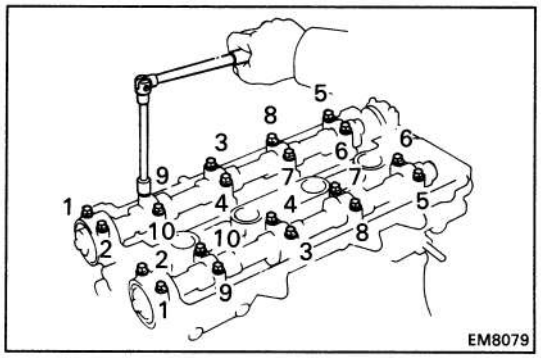
Remove the five bolts and timing belt cover.



HINT:

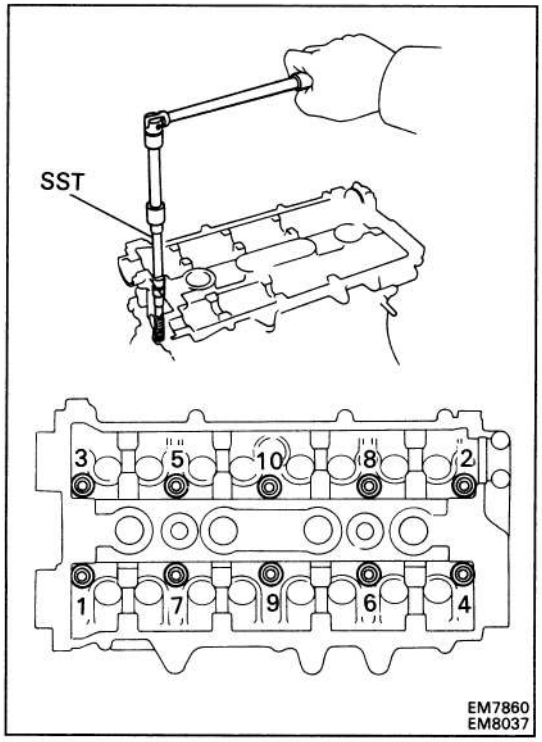
- Support the timing belt, so that the meshing of the crankshaft timing pulley and timing belt does not shift.
- Be careful not to drop anything inside the timing belt cover.
- Do not allow the timing belt to come into contact with oil, water or dust.

cardiagn.com



39. REMOVE CAMSHAFTS

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

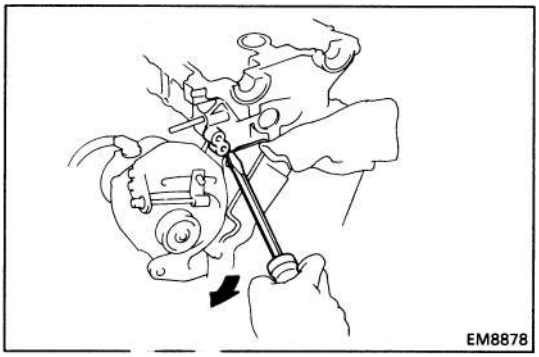


40. REMOVE CYLINDER HEAD

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

SST 09043-38100

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

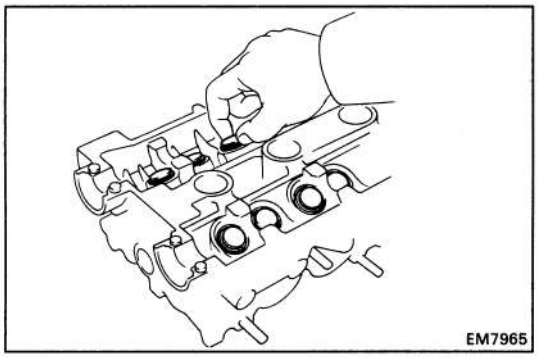


(b) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

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

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

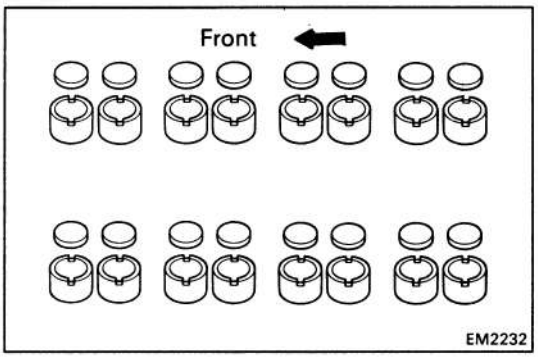
cardiagn.com


EM7965

DISASSEMBLY OF CYLINDER HEAD

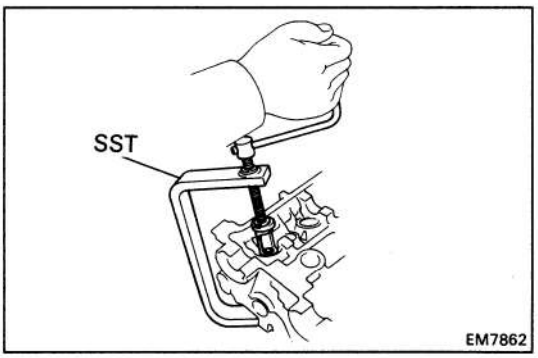
(See pages EM-61 and 62)

1. REMOVE VALVE LIFTERS AND SHIMS



EM2232

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



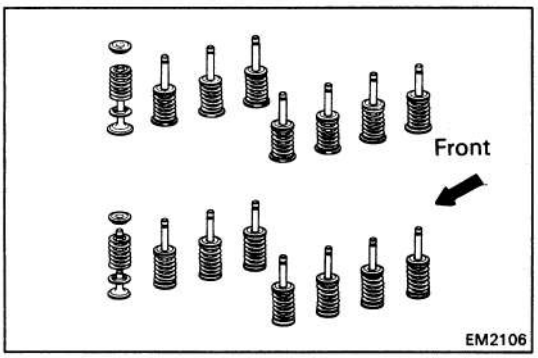
EM7862

2. REMOVE VALVES

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

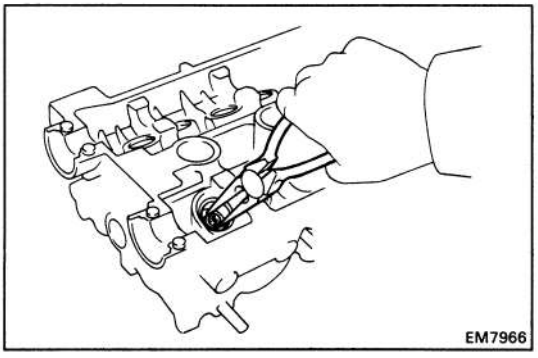
SST 09202-70010

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



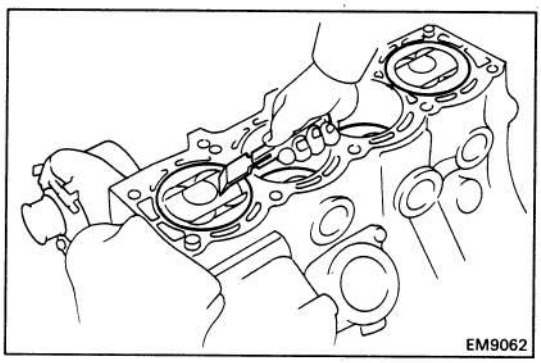
EM2106

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


EM7966

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

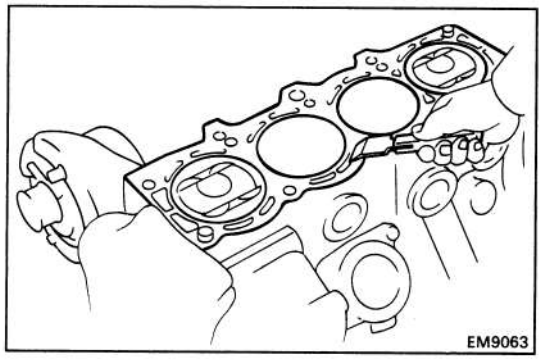
cardiagn.com


EM9062

INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

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


EM9063

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

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

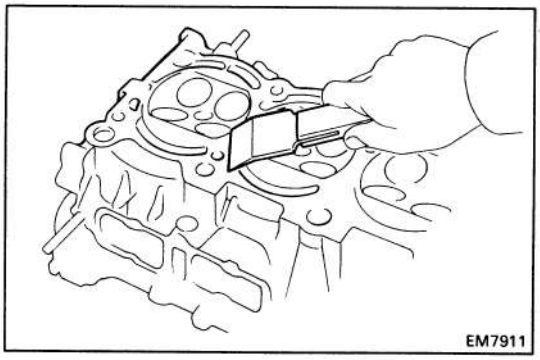
CAUTION: Protect your eyes when using high-compressed air.

2. CLEAN CYLINDER HEAD

A. Remove gasket material

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

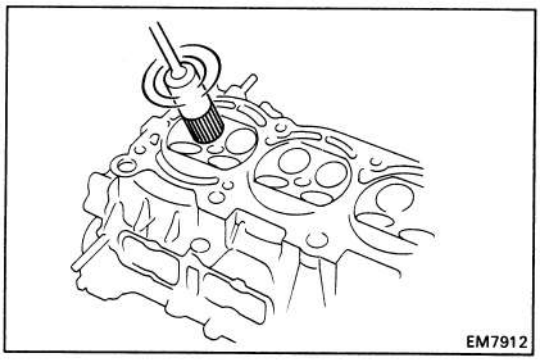
NOTICE: Be careful not to scratch the cylinder block contact surface.


EM7911

B. Clean combustion chambers

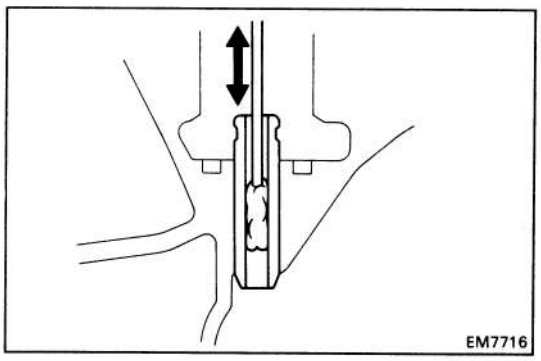
Using a wire brush, remove all the carbon from the combustion chambers.

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

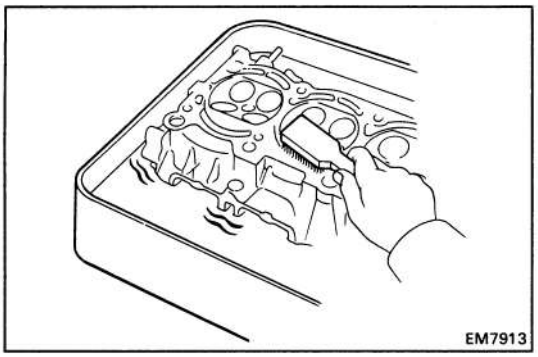

EM7912

C. Clean valve guide bushings

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

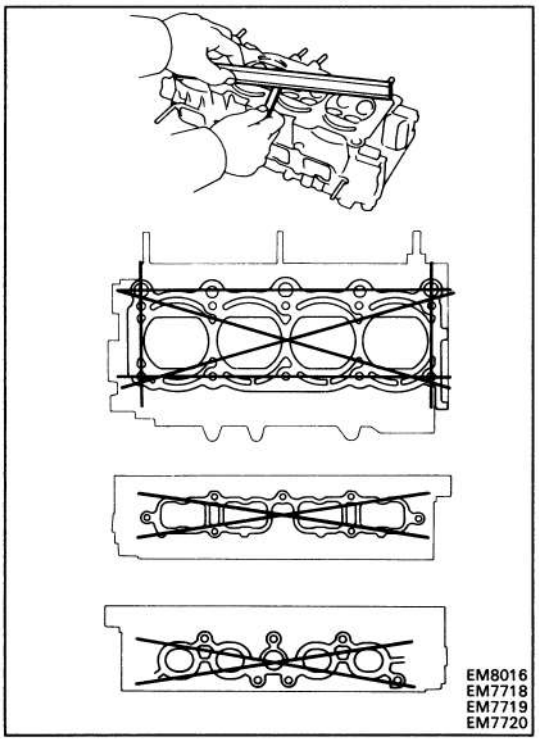

EM7716

cardiagn.com



D. Clean cylinder head

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



3. INSPECT CYLINDER HEAD

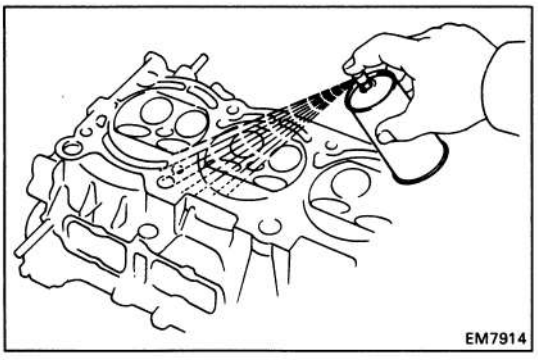
A. Inspect for flatness

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

Maximum warpage:

Cylinder block side	**0.20 mm (0.0079 in.)**
T-VIS valve side	**0.20 mm (0.0079 in.)**
Exhaust manifold side	**0.30 mm (0.0118 in.)**

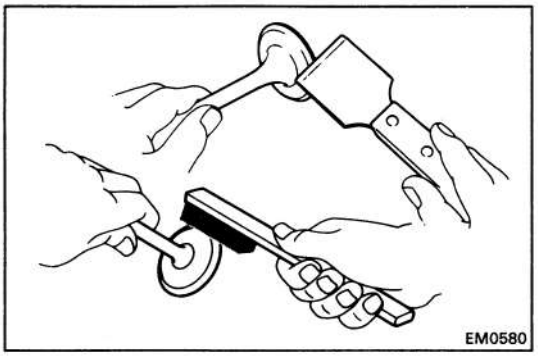
If warpage is greater than maximum, replace the cylinder head.



B. Inspect for cracks

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

If cracked, replace the cylinder head.

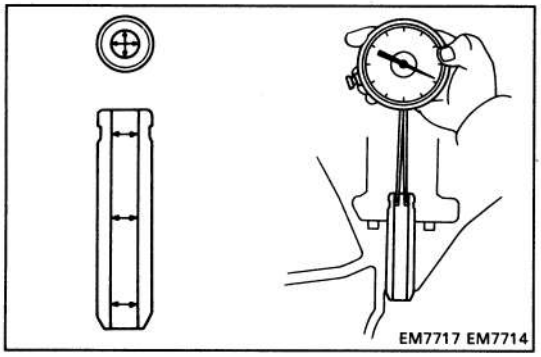


4. CLEAN VALVES

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

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

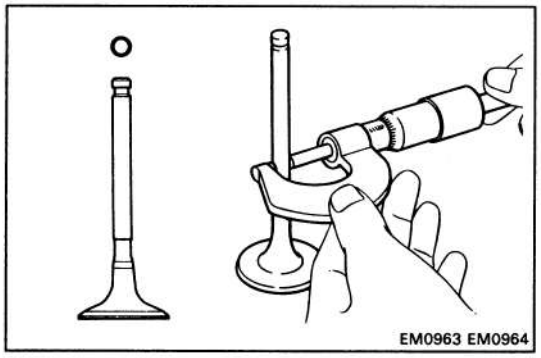
cardiagn.com


EM7717 EM7714

5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:
6.000 – 6.018 mm (0.2362 – 0.2369 in.)


EM0963 EM0964

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

Valve stem diameter:

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

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

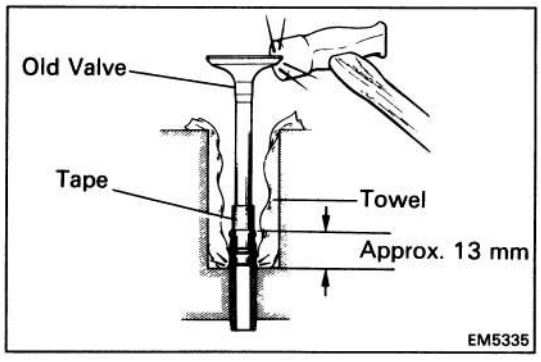
Standard oil clearance:

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

Maximum oil clearance:

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

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



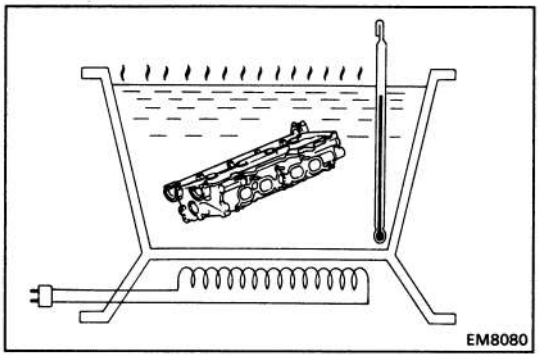
EM5335

6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

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

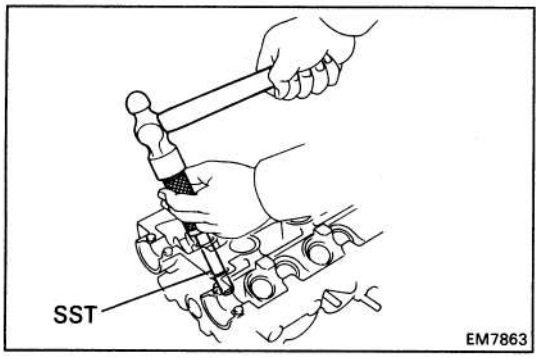
HINT: Wrap the tape approx. 13 mm (0.51 in.) from the valve stem end.

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


EM8080

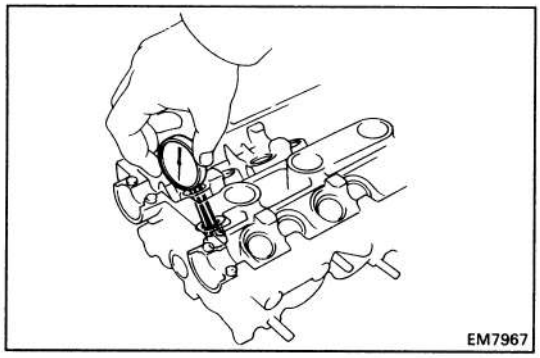
(b) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F).

cardiagn.com



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

SST 09201-70010



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

Both intake and exhaust

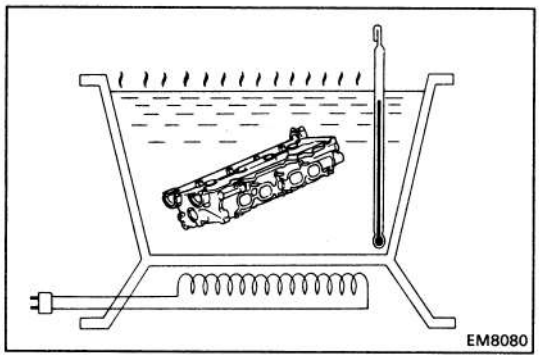
Bushing bore diameter mm(in.)	Bushing size
10.988 – 11.006 (0.4326 – 0.4333)	Use STD
11.038 – 11.056 (0.4346 – 0.4353)	Use O/S 0.05

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

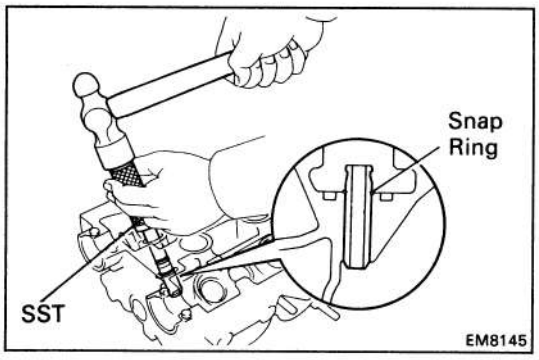
If the bushing bore diameter of the cylinder head is greater than 11.006 mm (0.4333 in.), machine the bushing bore to the following dimension:

11.038 – 11.056 mm (0.4346 – 0.4353 in.)

If the bushing bore diameter of the cylinder head is greater than 11.056 mm (0.4353 in.), replace the cylinder head.



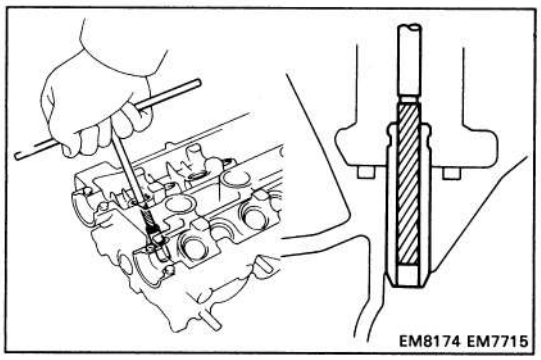
(f) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F).



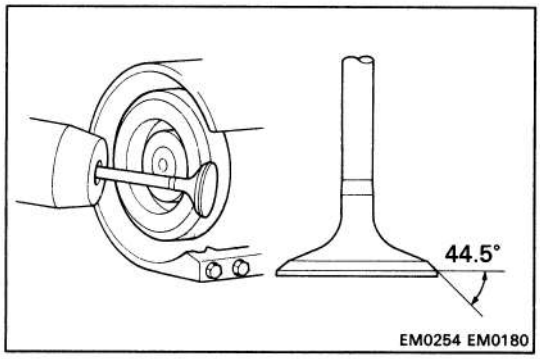
(g) Using SST and a hammer, tap in a new guide bushing until the snap ring makes contact with the cylinder head.

SST 09201-70010

cardiagn.com



(h) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page EM-75) between the guide bushing and valve stem.

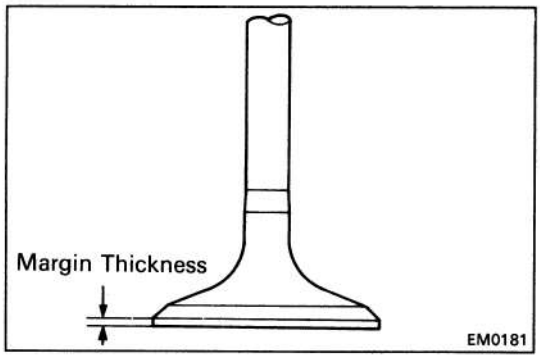


7. INSPECT AND GRIND VALVES

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

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

Valve face angle: 44.5°

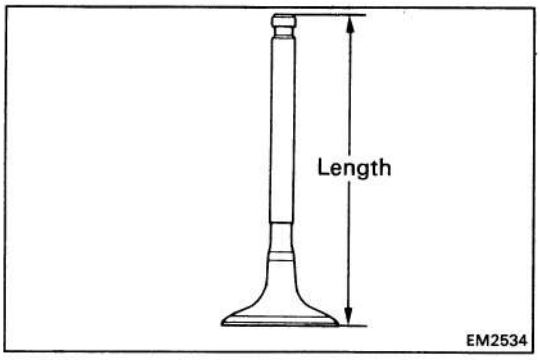


(c) Check the valve head margin thickness.

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

Minimum margin thickness: 0.5 mm (0.020 in.)

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



(d) Check the valve overall length.

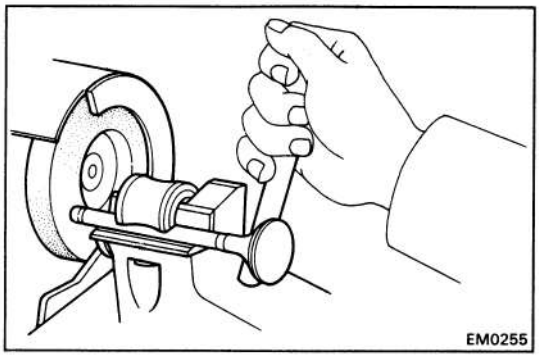
Standard overall length:

Intake 105.50 mm (4.1535 in.)
Exhaust 99.55 mm (3.9193 in.)

Minimum overall length:

Intake 104.80 mm (4.1260 in.)
Exhaust 98.85 mm (3.8917 in.)

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

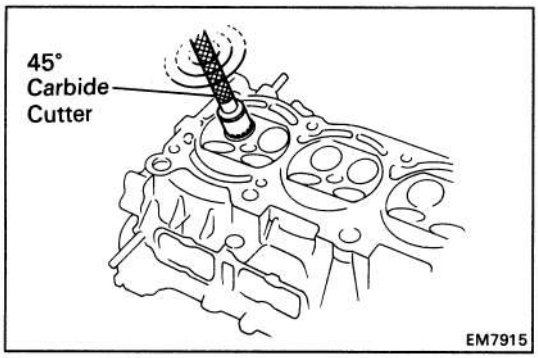


(e) Check the surface of the valve stem tip for wear.

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.

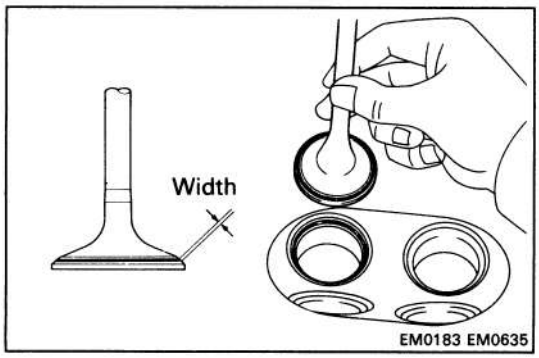
cardiagn.com



8. INSPECT AND CLEAN VALVE SEATS

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

Remove only enough metal to clean the seats.



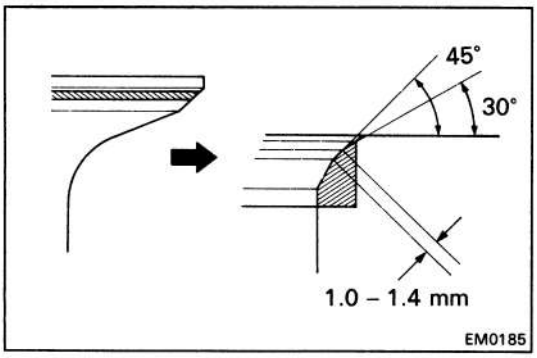
(b) Check the valve seating position.

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

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

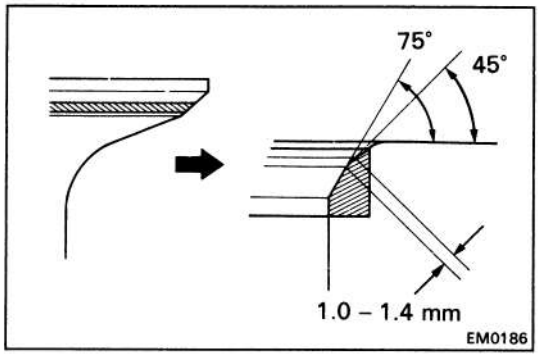
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with the following width:

1.0 – 1.4 mm (0.039 – 0.055 in.)



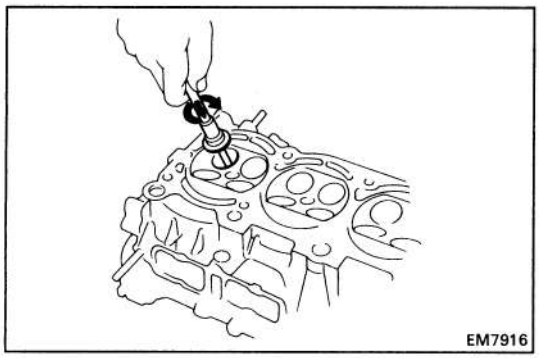
If not, correct the valve seats as follows:

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



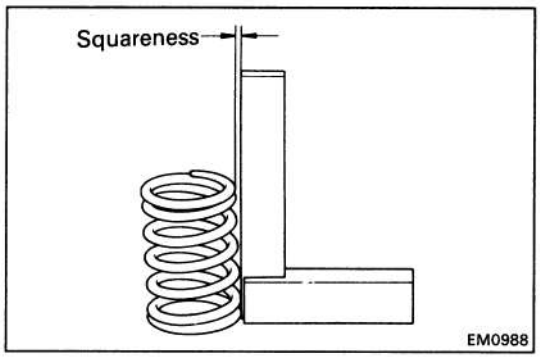
(2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.

cardiagn.com



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

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

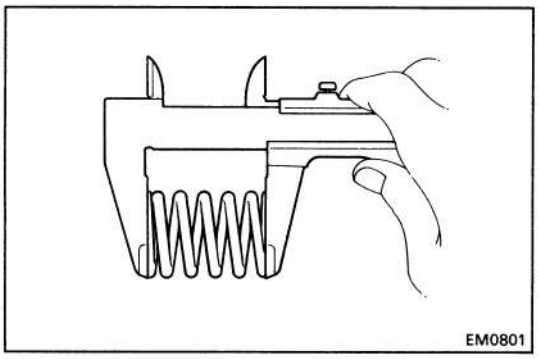


9. INSPECT VALVE SPRINGS

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

Maximum squareness: 2.0 mm (0.079 in.)

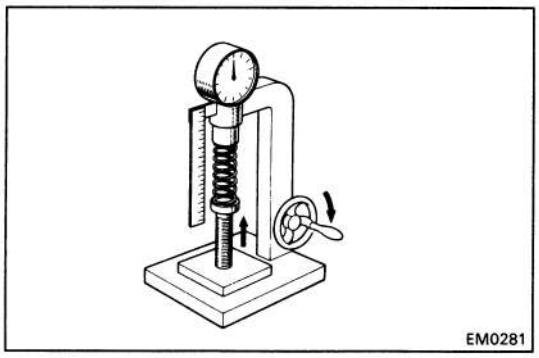
If squareness is greater than maximum, replace the valve spring.



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

Free length: 44.43 mm (1.7492 in.)

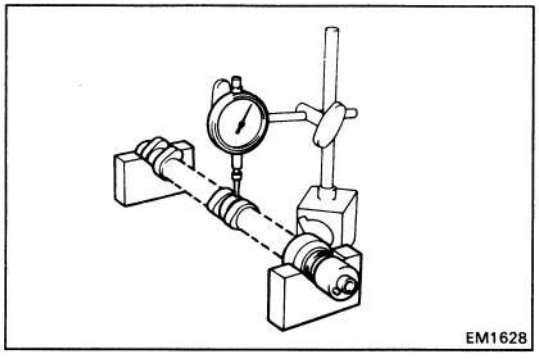
If the free length is not as specified, replace the valve spring.



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

Installed tension:
20.5 – 24.1 kg (45.2 – 53.1 lb, 201 – 236 N)
at 34.4 mm (1.354 in.)

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



10. INSPECT CAMSHAFTS AND BEARINGS

A. Inspect camshaft for runout

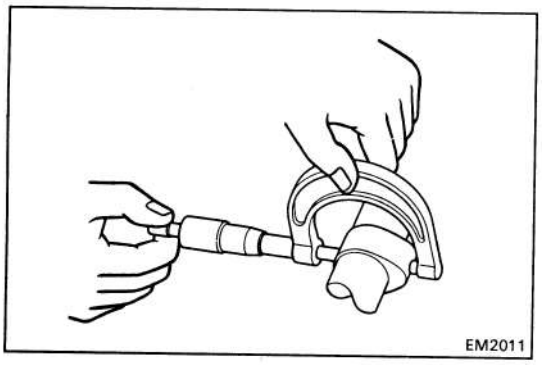
(a) Place the camshaft on V-blocks.

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

Maximum circle runout: 0.06 mm (0.0024 in.)

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

cardiagn.com



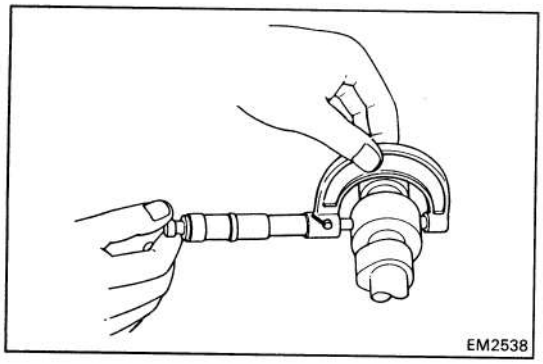
B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

Standard cam lobe height: 41.010 – 41.110 mm (1.6146 – 1.6185 in.)

Minimum cam lobe height: 39.90 mm (1.5709 in.)

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

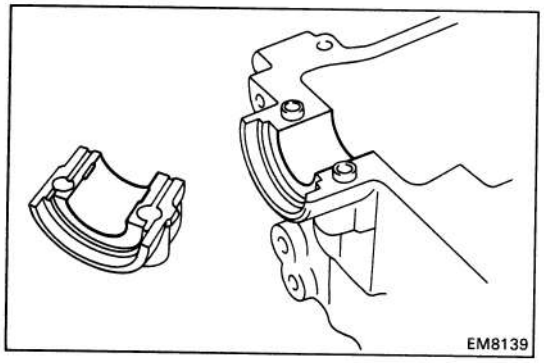


C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

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

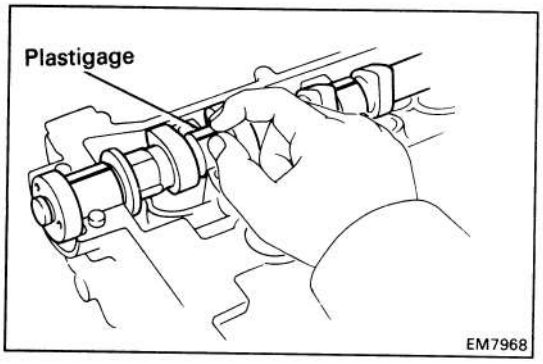
If the journal diameter is not as specified, check the oil clearance.



D. Inspect camshaft bearings

Check the bearings for flaking and scoring.

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

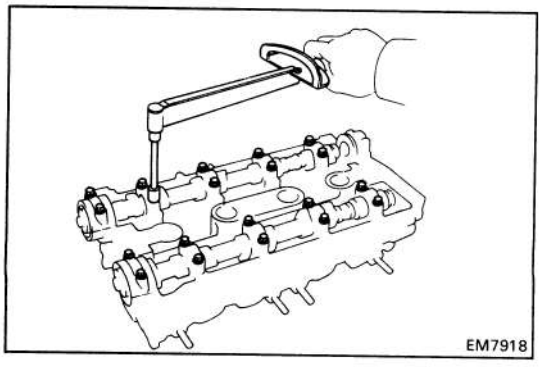


E. Inspect camshaft journal oil clearance

(a) Clean the bearing caps and camshaft journals.

(b) Place the camshafts on the cylinder head.

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

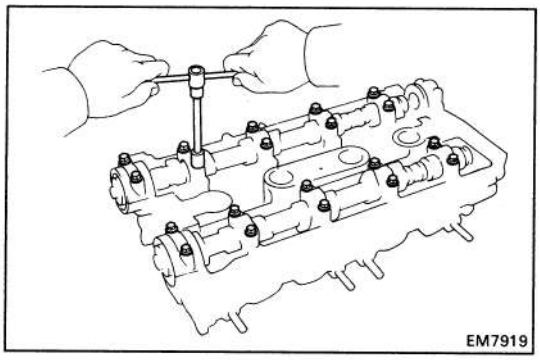


(d) Install the bearing caps.
(See step 2 on page EM-87)

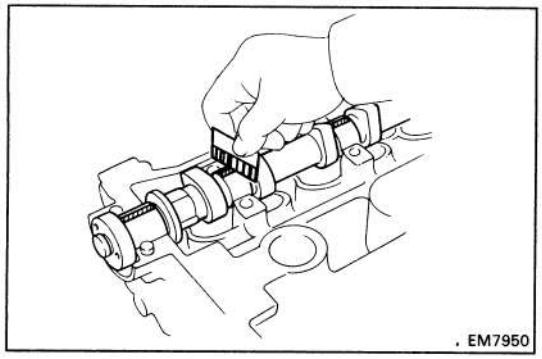
Torque: 190 kg-cm (14 ft-lb, 19 N·m)

NOTICE: Do not turn the camshaft.

cardiagn.com



(e) Remove the bearing caps.



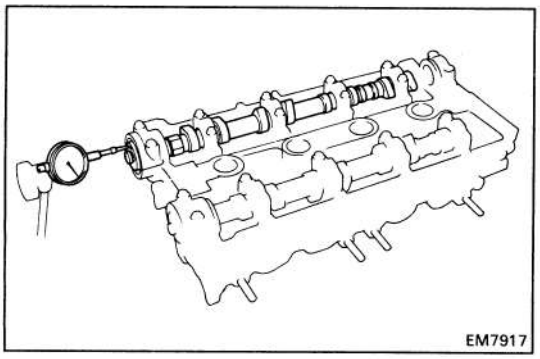
(f) Measure the Plastigage at its widest point.

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

Maximum oil clearance: 0.08 mm (0.0031 in.)

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

(g) Completely remove the Plastigage.



F. Inspect camshaft thrust clearance

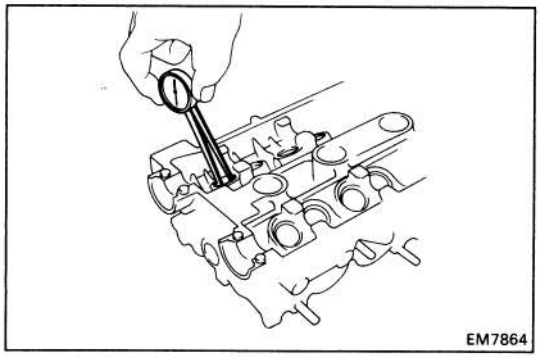
(a) Install the camshafts.
(See step 2 on page EM-87)

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

Standard thrust clearance: 0.120 – 0.240 mm (0.0047 – 0.0094 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

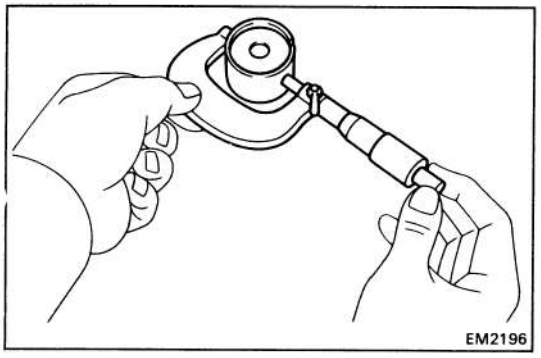
If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.



11. INSPECT VALVE LIFTERS AND LIFTER BORES

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

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



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

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

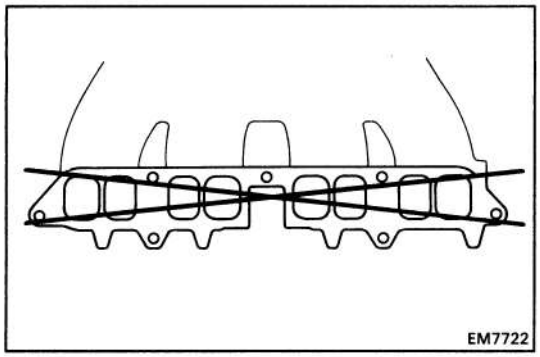
cardiagn.com

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

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

Maximum oil clearance: 0.07 mm (0.0028 in.)

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



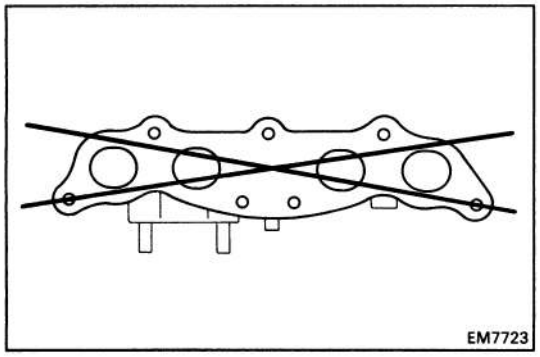
12. INSPECT INTAKE AND EXHAUST MANIFOLDS

(Intake manifold)

Using precision straight edge and feeler gauge, measure the surface contacting the T-VIS valve for warpage.

Maximum warpage: 0.20 mm (0.0079 in.)

If warpage is greater than maximum, replace the intake manifold.



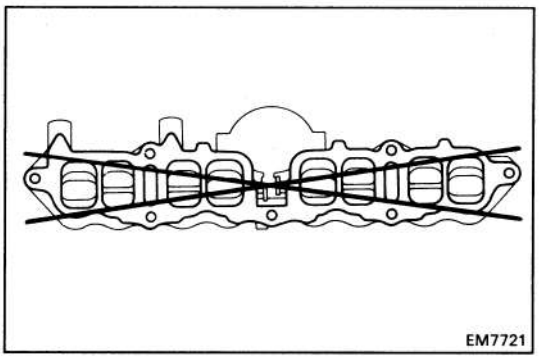
(Exhaust manifold)

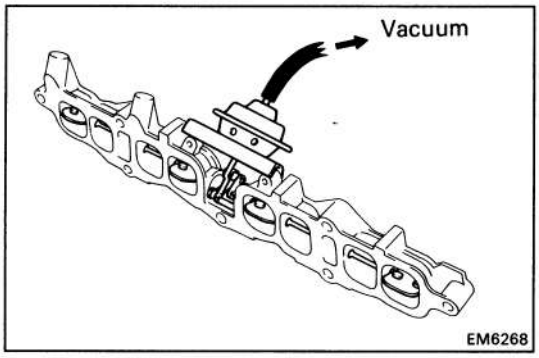
Using precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.

Maximum warpage: 0.20 mm (0.0079 in.)

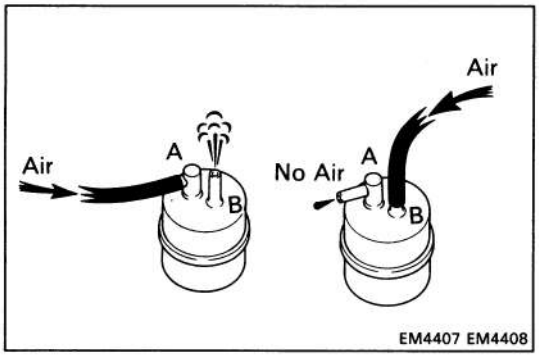
If warpage is greater than maximum, replace the exhaust manifold.

cardiagn.com

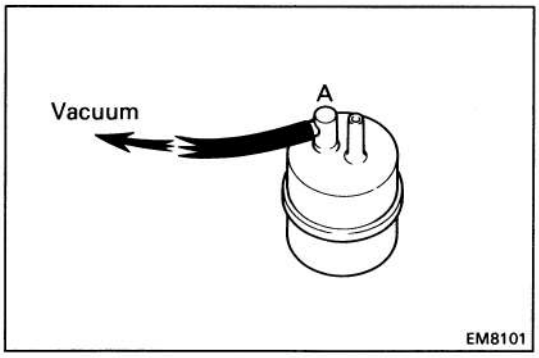

EM7721



EM6268



EM4407 EM4408



EM8101

INSPECTION OF TOYOTA – VARIABLE INDUCTION SYSTEM (T- VIS) COMPONENTS

1. INSPECT T-VIS VALVE

A. Inspect for flatness

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

Maximum warpage: 0.20 mm (0.0079 in.)

If warpage is greater than maximum, replace the T-VIS valve.

B. Inspect for operation

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

(b) With the vacuum released, check that the control valve fully opens quickly.

If operation is not as specified, replace the T-VIS valve.

2. INSPECT VACUUM TANK

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

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

(c) Apply 500 mmHg (19.69 ib.Hg, 66.7 kPa) of vacuum to port A, and check hat there is no change in vacuum after one minuite.

If operation is not as specified, replace the vacuum tank.

3. INSPECT T-VIS VSV (See page FI-163)

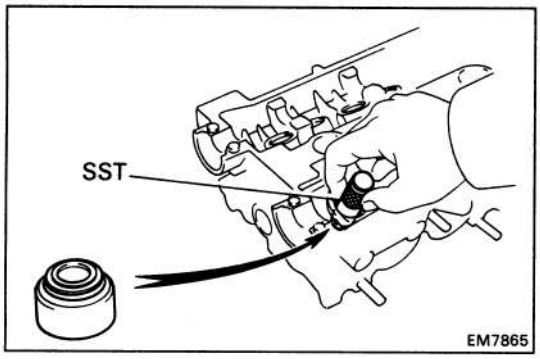
cardiagn.com

ASSEMBLY OF CYLINDER HEAD

(See pages EM-61 and 62)

HINT:

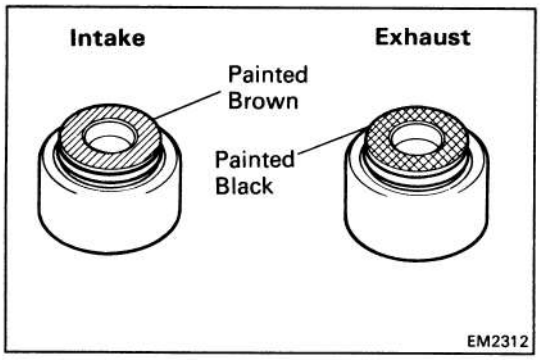
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.



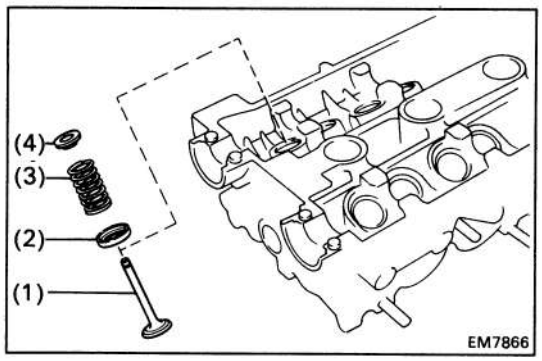
1. INSTALL VALVES

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

SST 09201-41020

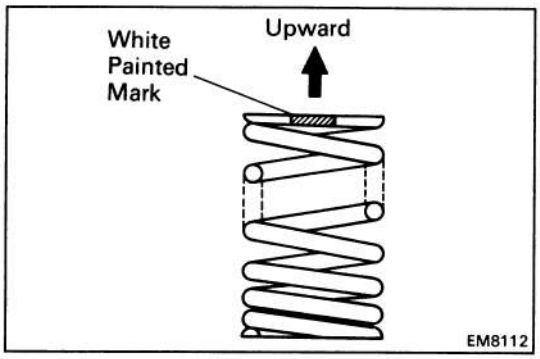


HINT: The intake valve oil seal is brown and the exhaust valve oil seal is black.



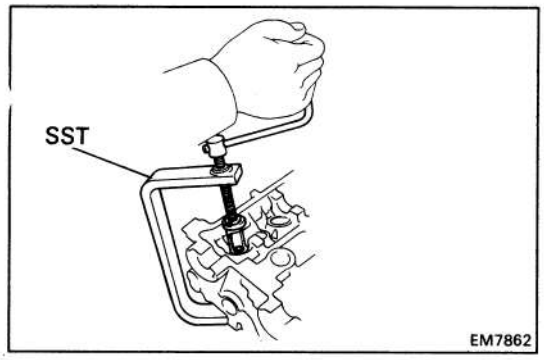
(b) Install the following parts:

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



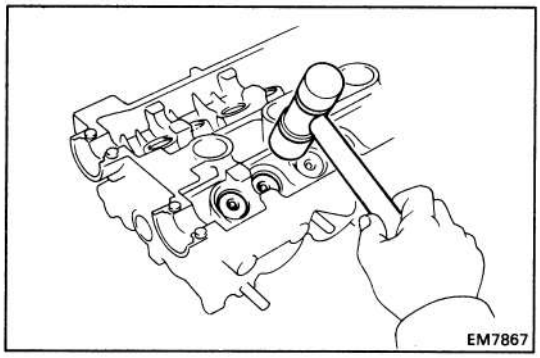
HINT: Install the valve spring, facing the white painted mark upward.

cardiagn.com

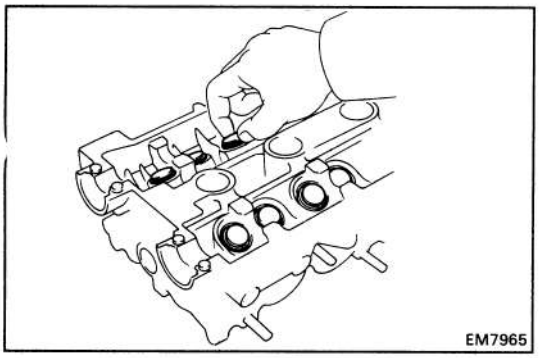


(c) Using SST, compress the valve spring and place the two keepers around the valve stem.

SST 09202-70010



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

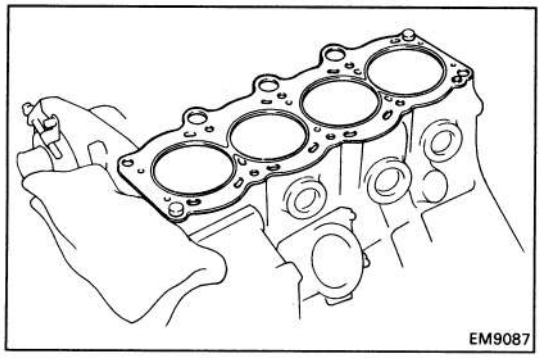


2. INSTALL VALVE LIFTERS AND SHIMS

(a) Install the valve lifter and shim.

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

cardiagn.com


EM9087

INSTALLATION OF CYLINDER HEAD

(See pages EM-61 and 62)

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.

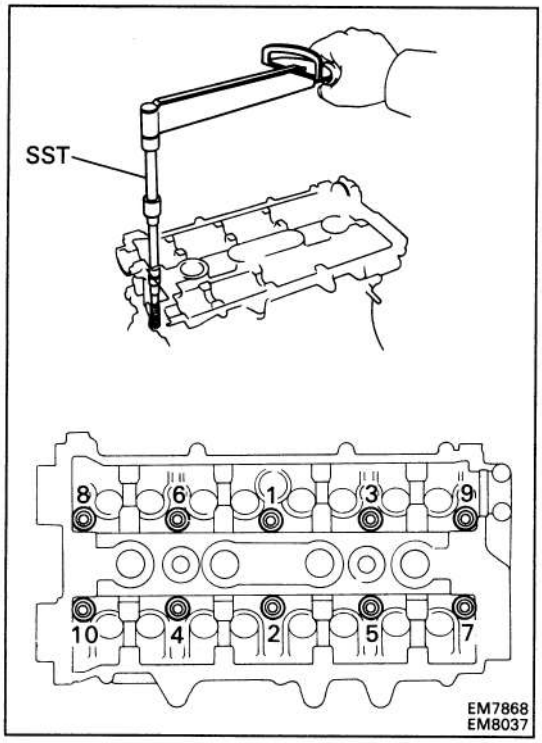
(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

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

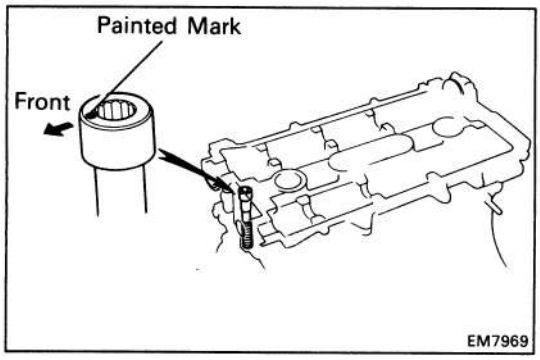
SST 09043-38100

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.

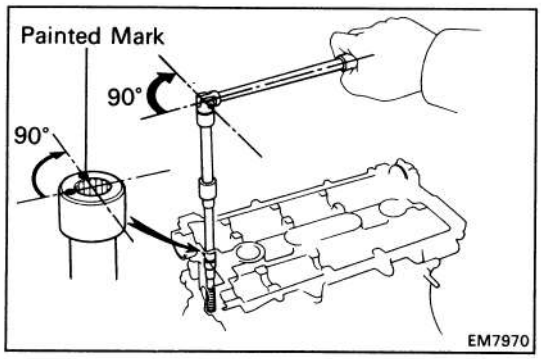


EM7868
EM8037



EM7969

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

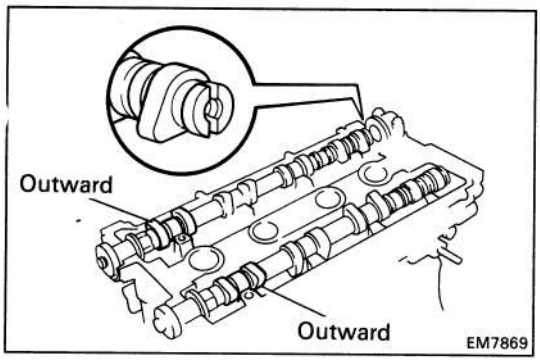


EM7970

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

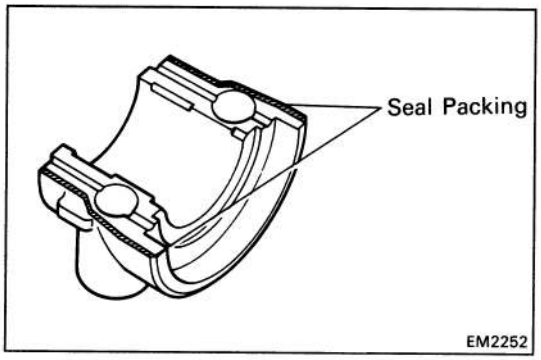
(e) Check that the painted mark is now at a 90° angle to front.

cardiagn.com



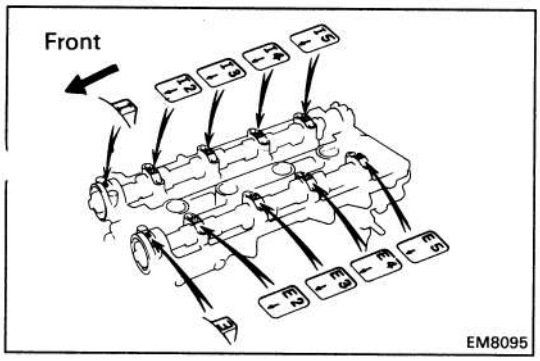
2. INSTALL CAMSHAFTS

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



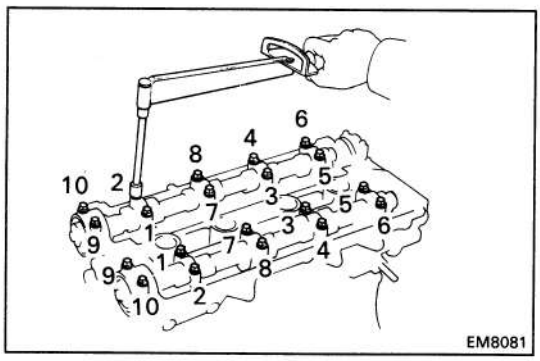
(b) Apply seal packing to the No.1 bearing cap as shown.

Seal packing: Part No. 08826-00080 or equivalent



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

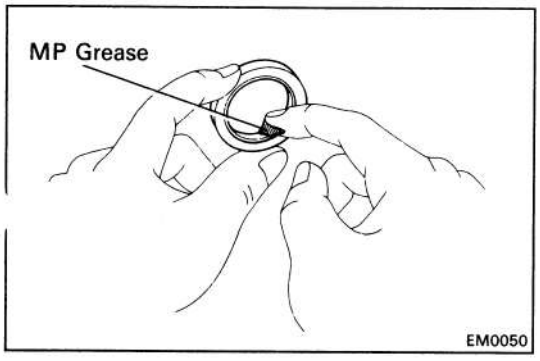
HINT: Each bearing cap has a number and front mark.



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

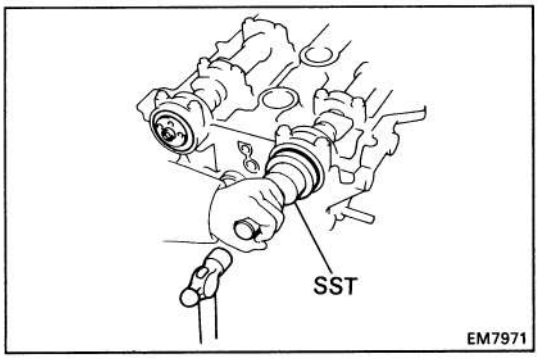
(e) Install and uniformly tighten the ten bearing cap bolts on one side in several passes in the sequence shown.

Torque: 190 kg-cm (14 ft-lb, 19 N·m)



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

cardiagn.com

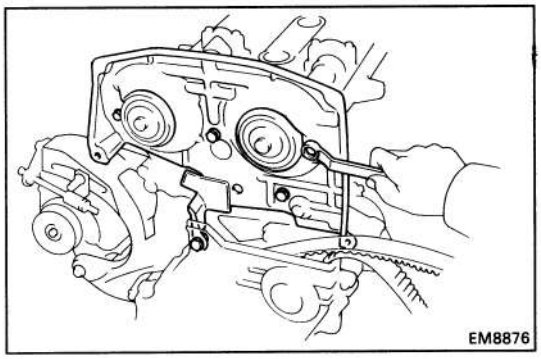


(g) Using SST, tap in the two camshaft oil seals.
SST 09223-50010

3. **ADJUST VALVE CLEARANCE (See page EM-11)**

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

Valve clearance (Cold):
Intake 0.15 – 0.25 mm (0.006 – 0.010 in.)
Exhaust 0.20 – 0.30 mm (0.008 – 0.012 in.)



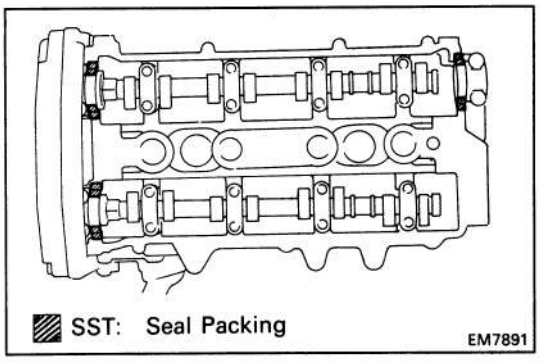
4. **INSTALL NO.3 TIMING BELT COVER**

Install the No.3 belt cover with the five bolts.

Torque: 90 kg-cm (78 in.-lb, 8.8 N·m)

5. **INSTALL NO.1 IDLER PULLEY**
(See step 4 on page EM-35)

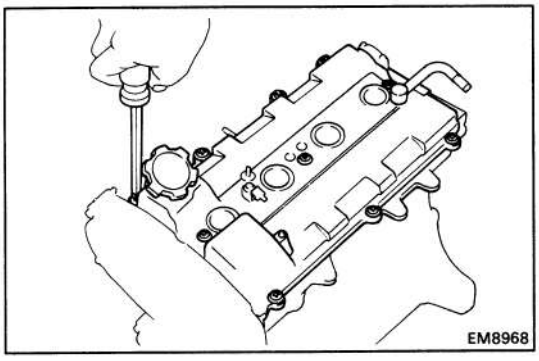
6. **INSTALL CAMSHAFT TIMING PULLEYS**
(See steps 9 to 23 on pages EM-36 to 41)



7. **INSTALL CYLINDER HEAD COVER**

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

Seal packing: Part No. 08826-00080 or equivalent



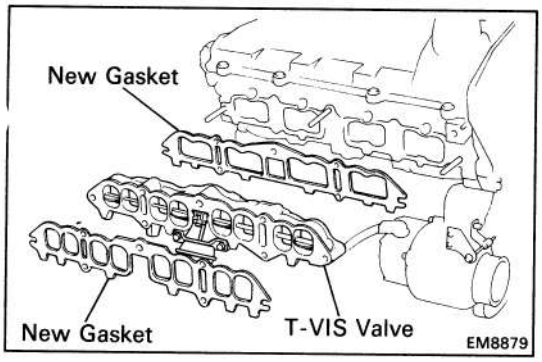
(b) Install the two gaskets to the head cover.

(c) Install the head cover with the twelve seal washers and screws. Uniformly tighten the screw in several passes.

Torque: 25 kg-cm (21 in.-lb, 2.5 N·m)

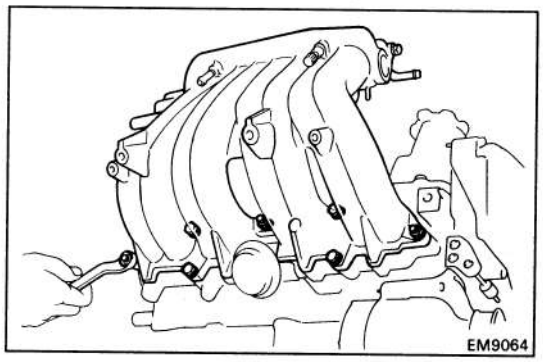
8. **INSTALL DELIVERY PIPE AND INJECTORS**
(See steps 2 to 5 on pages FI-117 and 118)

cardiagn.com



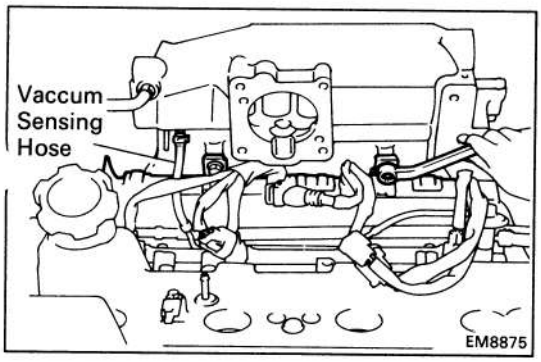
9. INSTALL T-VIS VALVE AND INTAKE MANIFOLD

(a) Place a new gasket, the T-VIS valve and the other new gasket on the cylinder head.



(b) Install the intake manifold with the four bolts and three nuts. Uniformly tighten the bolts and nuts in several passes.

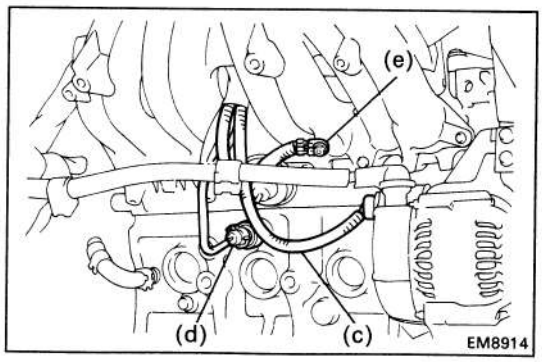
Torque: 195 kg-cm (14 ft-lb, 19 N·m)



10. INSTALL ENGINE WIRE TO INTAKE MANIFOLD

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

(b) Connect the vacuum sensing hose to the intake manifold.

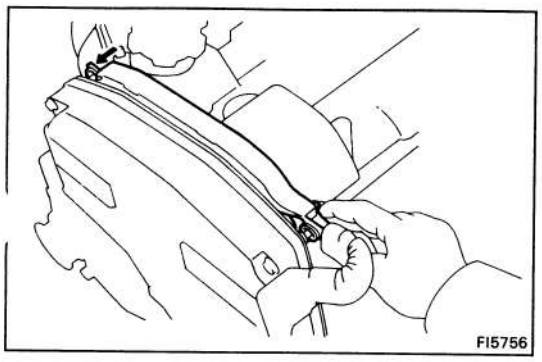


(c) Connect the alternator connector.

(d) Connect the knock sensor connector.

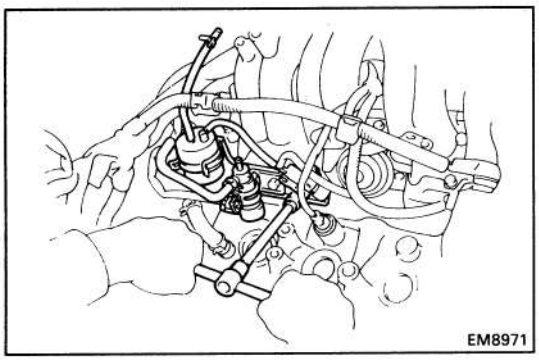
(e) Connect the ground strap with the bolt.

(f) Connect the injector connectors.
(See step 6 on page FI-119)



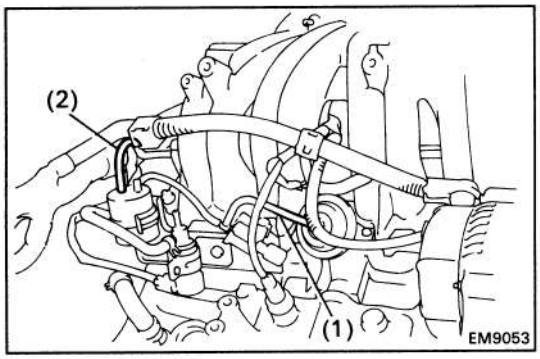
(g) Install the two wire clamps to the mount bolts of the No.2 timing belt cover.

cardiagn.com



11. INSTALL T-VIS VACUUM TANK, T-VIS VSV, TURBOCHARGING PRESSURE VSV AND BRACKET

(a) Install the T-VIS vacuum tank, T-VIS VSV, turbocharging pressure VSV and bracket assembly with the two bolts.



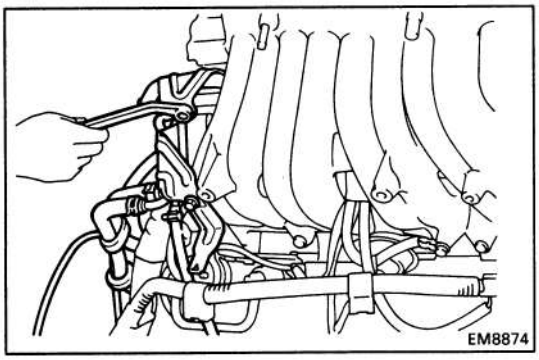
(b) Connect the following hoses:

(1) Vacuum hose (from T-VIS VSV) from T-VIS actuator

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

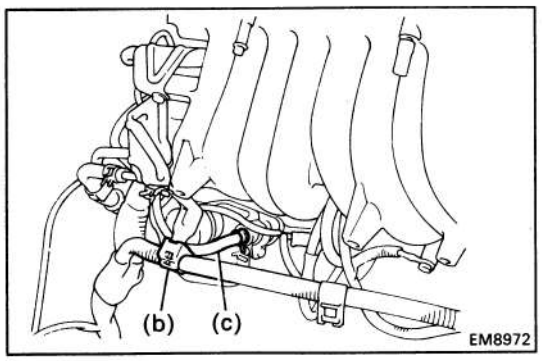
(c) Connect the following connectors:

- T-VIS VSV connector
- Turbocharging pressure VSV connector



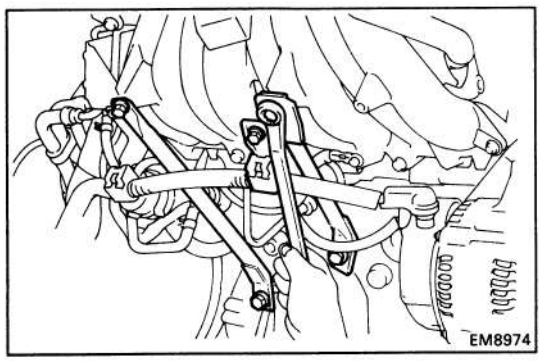
12. INSTALL NO.1 AIR TUBE

(a) Install the air tube and wire bracket with the two bolts.



(b) Install the alternator wire clamp to the wire bracket.

(c) Connect the vacuum hose to turbocharging pressure VSV



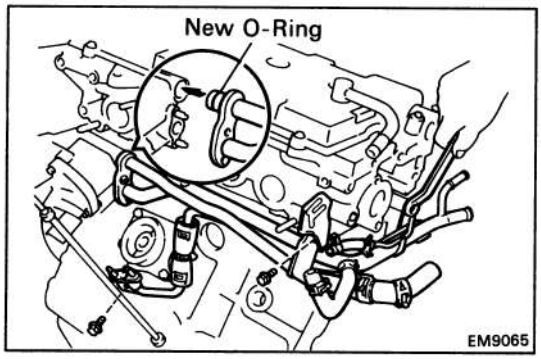
13. INSTALL INTAKE MANIFOLD STAYS

(a) Install the manifold stay with the two bolts. Install the two manifold stays

Torque: 260 kg-cm (19 ft-lb, 25 N·m)

(b) Install the alternator wire clamp to the wire bracket.

Cardiagn.com



14. INSTALL WATER BY-PASS PIPE

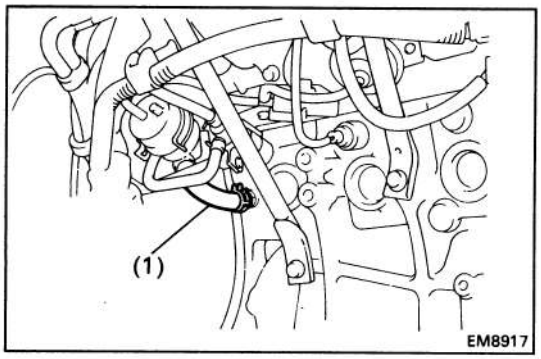
(a) Install a new O-ring to the pipe.

(b) Apply soapy water on the O-ring.

(c) Install a new gasket to the water pump.

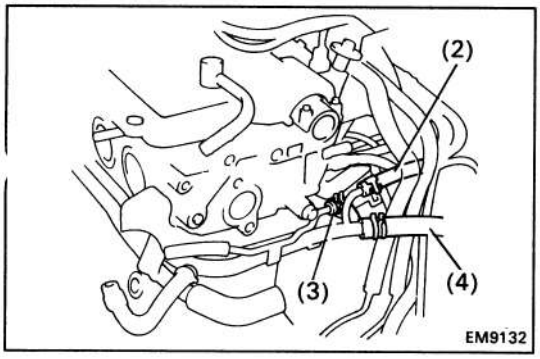
(d) Install the water by-pass pipe with the two nuts and two bolts.

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



(e) Connect the following hoses:

(1) Water by-pass hose from cylinder block

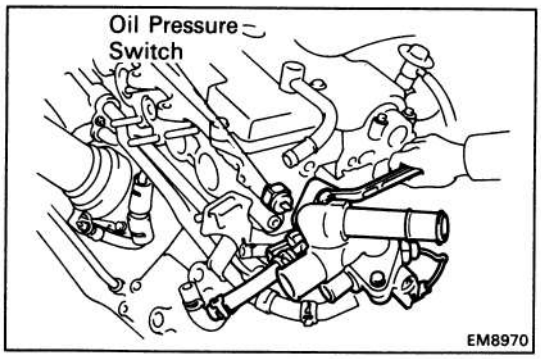


(2) Water by-pass hoses from No.1 air tube

(3) Vacuum hose from turbocharging pressure VSV

(4) Heater water hose

15. INSTALL OIL COOLER
(See steps 2 to 4 on pages LU-21 and 22)



16. INSTALL OIL PRESSURE SWITCH

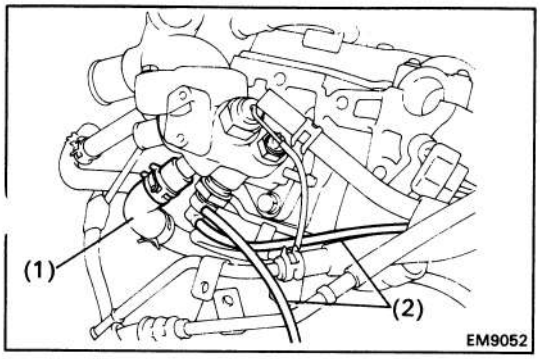
Apply adhesive to two or three threads.

Adhesive: Part No. 08833-00080, THREE BOND 1324 or equivalent

17. INSTALL WATER OUTLET AND HOUSING

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

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

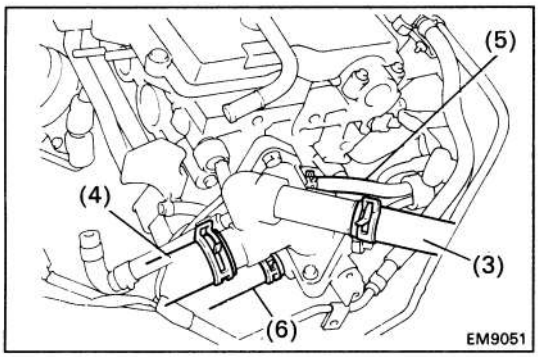


(b) Connect the following hoses:

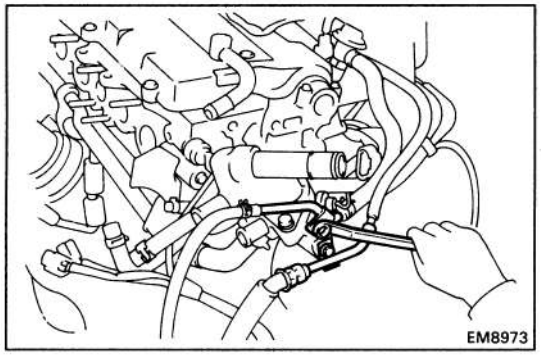
(1) Water by-pass hose from water by-pass pipe

(2) Two EVAP VSV vacuum hoses

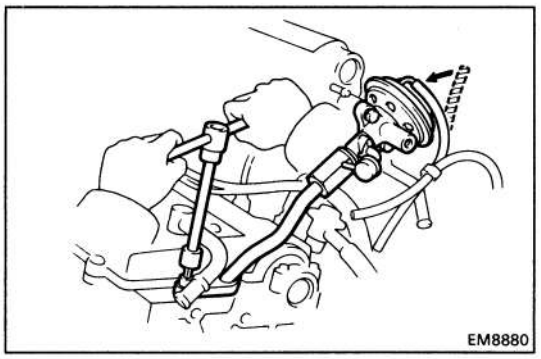
cardiagn.com



(3) Water filler hose
(4) Radiator hose
(5) Water by-pass pipe hose from ISC valve
(6) Heater water hose



(c) Install the fuel inlet hose with the bolt.
(d) Install the fuel return hose with the bolt.
(e) Connect the following connectors:
- Water temperature sender gauge connector
- Water temperature sensor
- Cold start injector time switch connector

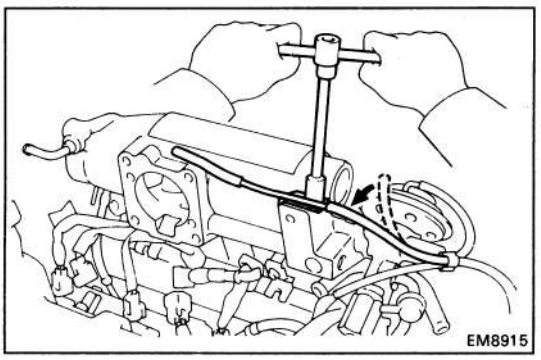


18. INSTALL EGR VALVE AND PIPE

(a) Install two new gaskets, the EGR valve and pipe assembly with the four bolts.

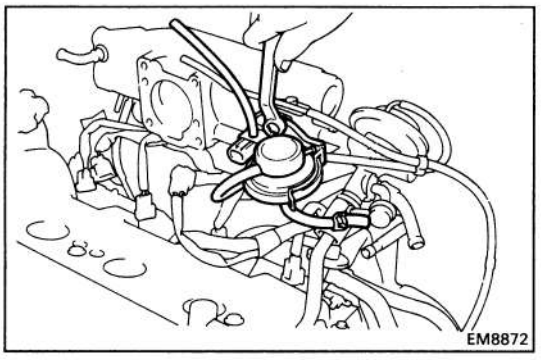
Torque:
Intake manifold side
195 kg-cm (14 ft-lb, 19 N·m)
Cylinder head side
260 kg-cm (19 ft-lb, 25 N·m)

(b) Connect the vacuum hose to the EGR valve.



19. INSTALL VACUUM PIPE

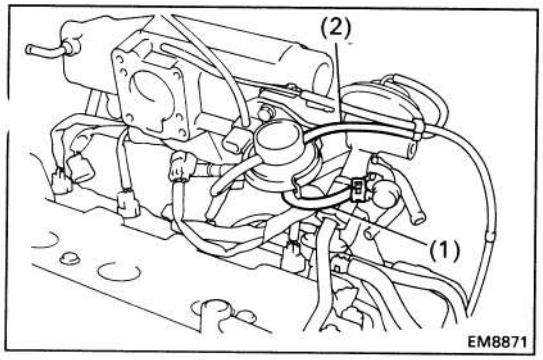
(a) Install the vacuum pipe with the bolt.
(b) Connect the vacuum hose to the vacuum pipe.



20. INSTALL EGR VACUUM MODULATOR AND VSV

(a) Install the EGR vacuum modulator and VSV assembly with the bolt.

cardiagn.com



(b) Connect the following hoses:
(1) Vacuum hose from EGR valve
(2) Vacuum hose from EGR vacuum modulator

(c) Connect the EGR VSV connector.

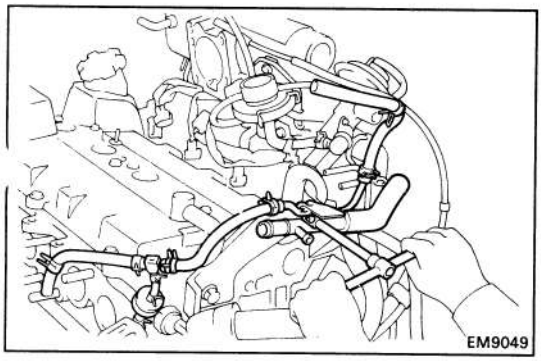


21. INSTALL LH ENGINE HANGER

Install the LH engine hanger with the two bolts.

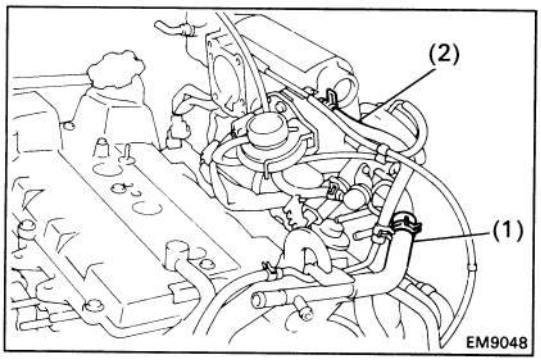
Torque:

12 mm head bolt	**130 kg-cm (9 ft-lb, 13 N·m)**
14 mm head bolt	**195 kg-cm (14 ft-lb, 19 N·m)**



22. INSTALL NO.2 AIR TUBE

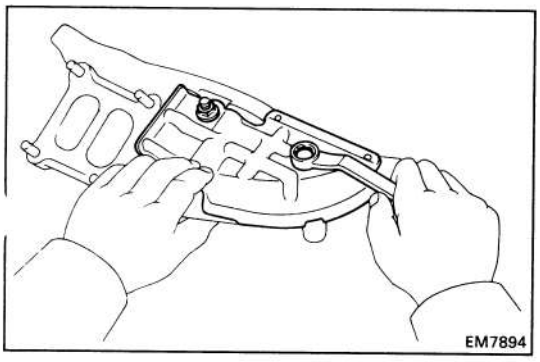
(a) Install the No.2 air tube with the bolt.



(b) Connect the following hoses:
(1) Air hose from No.1 air tube
(2) Air hose from intake manifold

23. INSTALL DISTRIBUTOR

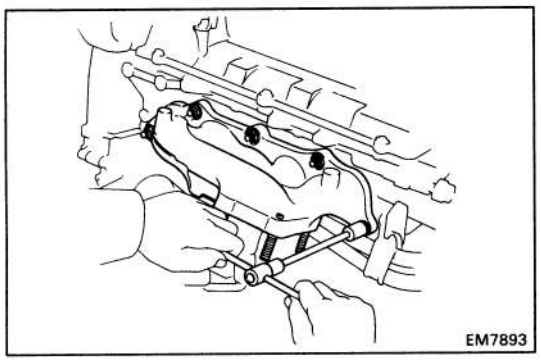
(See steps 1 to 7 on pages IG-16 and 17)



24. INSTALL EXHAUST MANIFOLD

(a) Install the heat insulator with the bolt and nut.

cardiagn.com



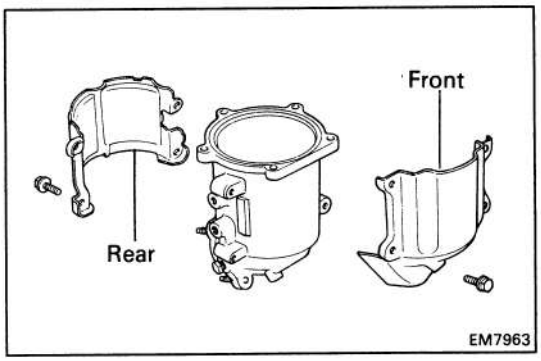
(b) Install a new gasket and the exhaust manifold with the seven nuts. Uniformly tighten the nuts in several passes.

Torque: 530 kg-cm (38 ft-lb, 52 N·m)

25. INSTALL COLD START INJECTOR
(See steps 1 to 3 on page FI-101)

26. INSTALL THROTTLE BODY
(See steps 2, 3 and 4 to 8 on pages FI-138 and 139)

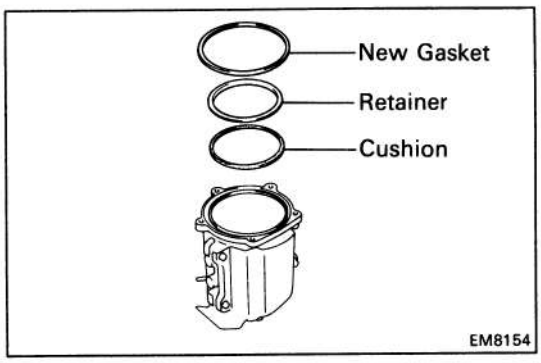
27. INSTALL TURBOCHARGER
(See steps 5 to 11, 17, 18 and 21 on pages TC-16 to 19)



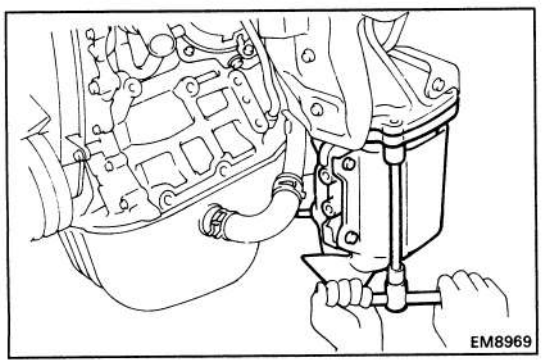
28. INSTALL CATALYTIC CONVERTER

(a) Install the front heat insulator with the five bolts.

(b) Install the rear heat insulator with the four bolts.



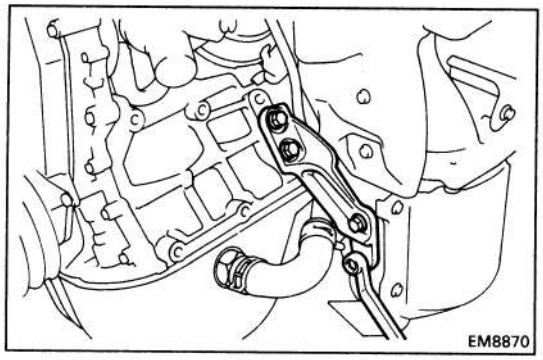
(c) Place the cushion, retainer and a new gasket on the catalytic converter.



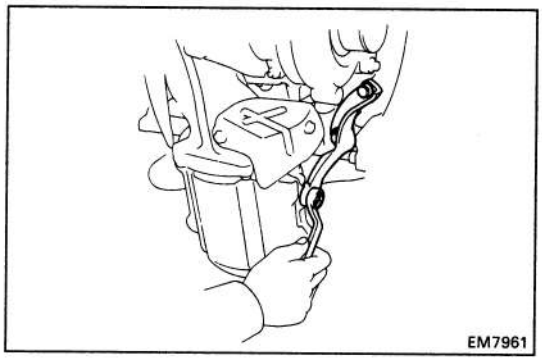
(d) Install the catalytic converter with the three bolts and two nuts.

Torque: 300 kg-cm (22 ft-lb, 29 N·m)

cardiagn.com



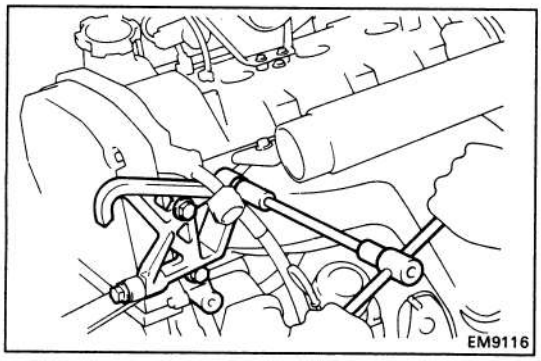
(e) Install the RH converter stay with the four bolts.
Torque: 600 kg-cm (43 ft-lb, 59 N·m)



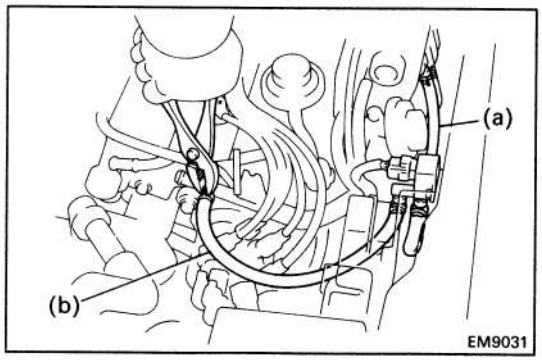
(f) Install the LH converter stay with the three bolts.
Torque: 600 kg-cm (43 ft-lb, 59 N·m)

29. INSTALL FRONT EXHAUST PIPE
(See steps 18 and 19 on pages EM-174 and 175)

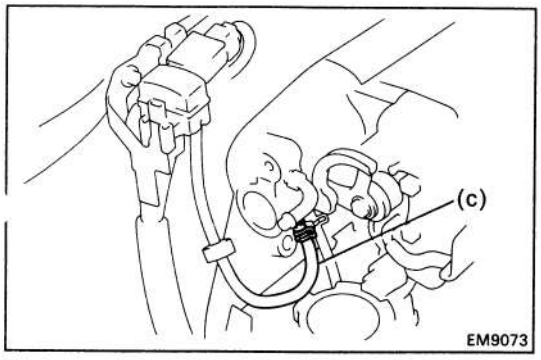
30. INSTALL INTERCOOLER
(See steps 2 to 5, 7, 8, 10 and 11 on pages TC-23 to 25)



31. INSTALL RH FRONT ENGINE HANGER
Install the engine hanger with the three bolts.
Torque: 400 kg-cm (29 ft-lb, 39 N·m)

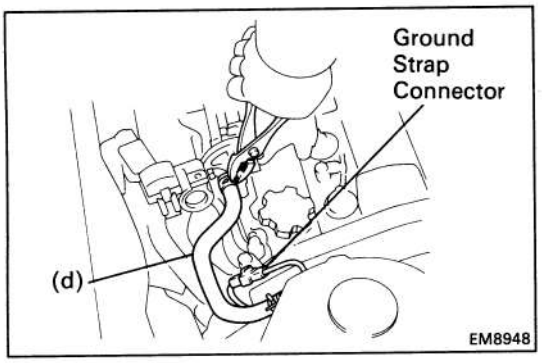


32. CONNECT HOSES
(a) A/C VSV vacuum hose from intake manifold
(b) A/C VSV air hose from No.2 air tube



(c) Turbocharging pressure sensor hose from intake manifold

cardiagn.com



(d) Brake booster vacuum hose from intake manifold

33. CONNECT GROUND STRAP CONNECTOR

34. INSTALL AIR CLEANER CAP
(See step 40 on pages EM-179)

35. INSTALL CRUISE CONTROL ACTUATOR (w/ CRUISE CONTROL SYSTEM) AND ACCELERATOR LINKAGE
(See step 36 on pages EM-178)

36. INSTALL ACCELERATOR CABLE, AND ADJUST IT

37. INSTALL SUSPENSION UPPER BRACE
(See step 41 on page EM-179)

38. FILL ENGINE WITH COOLANT (See page CO-7)

Capacity (w/ Heater):
13.6 liters (14.4 US qts, 12.0 Imp. qts)

39. START ENGINE AND CHECK FOR LEAKS

40. ADJUST IGNITION TIMING
(See steps 9 to 13 on pages IG-17 and 18)

Ignition timing:
10° BTDC] idle
(w/ Terminals TE1 and E1 connected)

41. INSTALL ENGINE HOOD SIDE PANELS

42. INSTALL ENGINE UNDER COVERS

43. PERFORM ROAD TEST

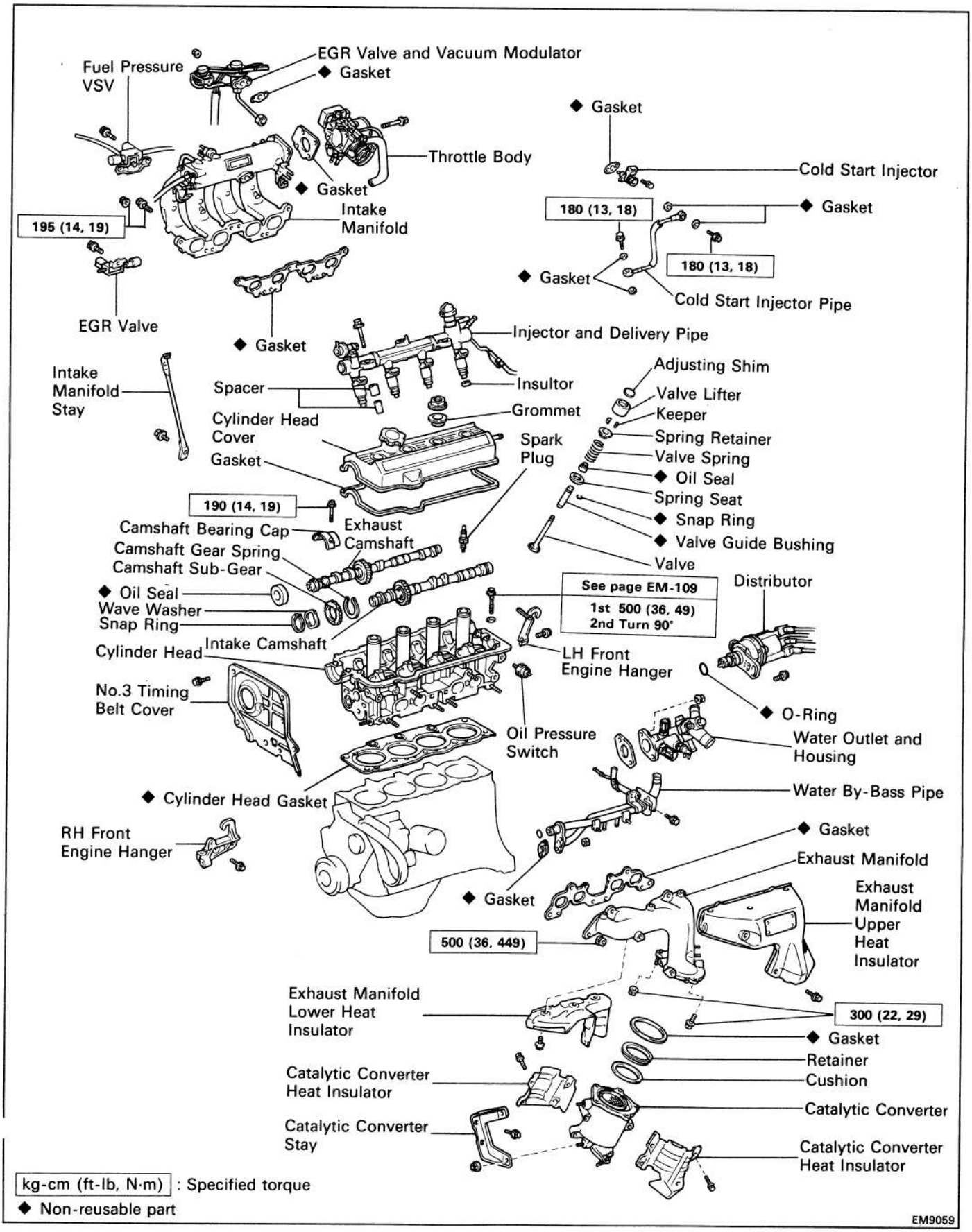
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

44. RECHECK ENGINE COOLANT AND OIL LEVELS

cardiagn.com

CYLINDER HEAD (5S-FE)

COMPONENTS



cardiagn.com

REMOVAL OF CYLINDER HEAD

(See page EM-97)

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**

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

2. **DRAIN ENGINE COOLANT (See page CO-6)**

3. **REMOVE ENGINE UNDER COVERS**

4. **REMOVE ENGINE HOOD SIDE PANELS**

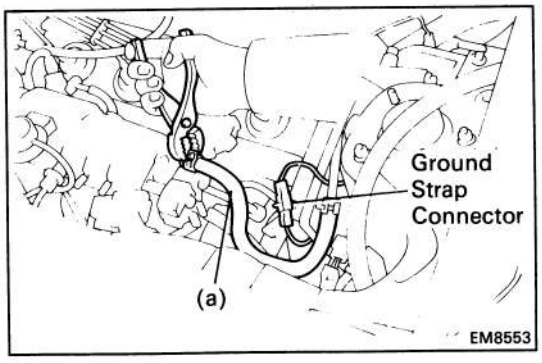
5. **REMOVE SUSPENSION UPPER BRACE**

6. **(A/T)**
   DISCONNECT THROTTLE CABLE FROM THROTTLE BODY

7. **DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY**

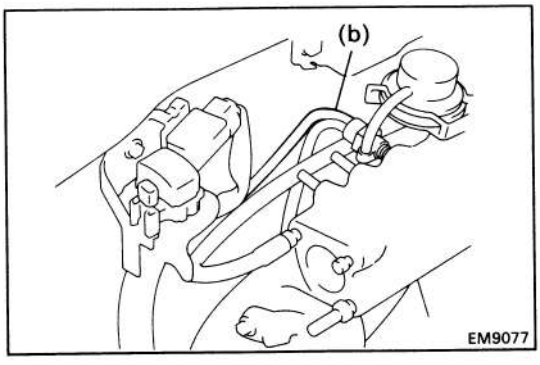
8. **REMOVE CRUISE CONTROL ACTUATOR (w/ CRUISE CONTROL SYSTEM) AND ACCELERATOR LINKAGE (See step 11 on page EM-182)**

9. **REMOVE AIR CLEANER CAP (See step 9 on page EM-182)**



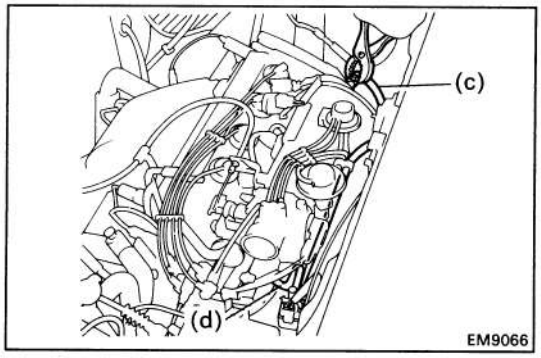
10. **DISCONNECT GROUND STRAP CONNECTOR**

11. **DISCONNECT VACUUM HOSES**
    (a) Brake booster vacuum hose from intake manifold



(b) Vacuum sensor hose from intake manifold

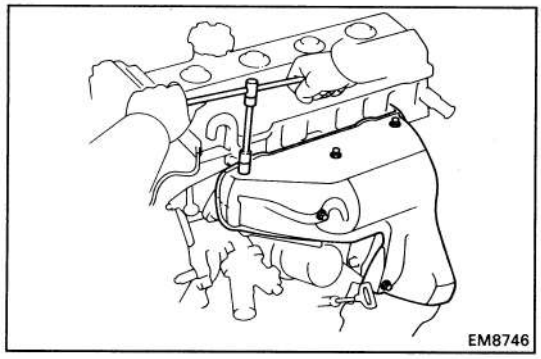
cardiagn.com



(c) A/C VSV vacuum hose from intake manifold
(d) A/C VSV air hose from ISC valve

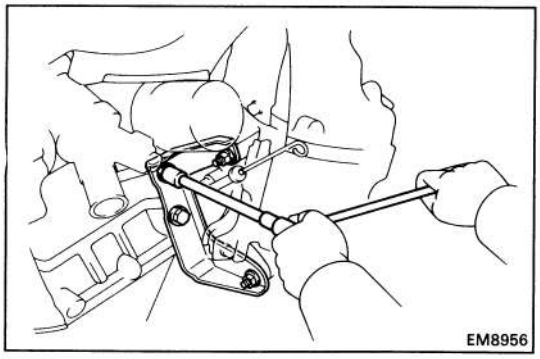
12. REMOVE DISTRIBUTOR (See pages IG-19 and 20)

13. REMOVE FRONT EXHAUST PIPE (See step 29 on page EM-187)

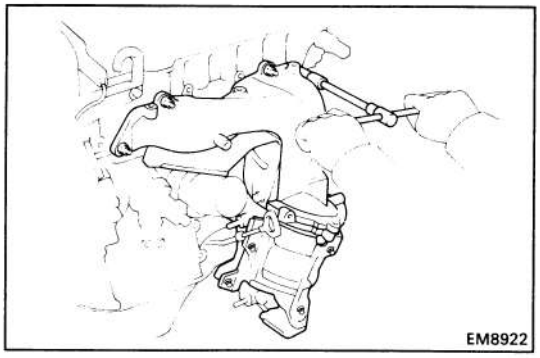


14. REMOVE EXHAUST MANIFOLD AND CATALYTIC CONVERTER ASSEMBLY

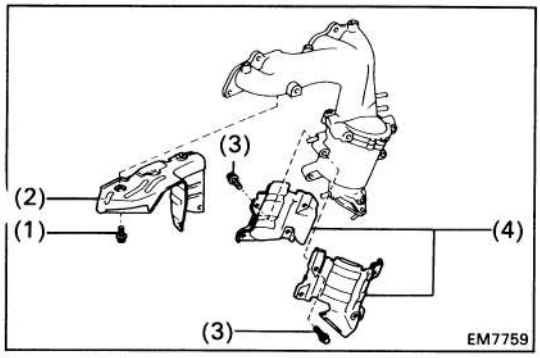
(a) Disconnect the oxygen sensor (main) connector.
(b) (CALIF. only)
Disconnect the sub-oxygen sensor connector.
(c) Remove the six bolts and manifold upper heat insulator.



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



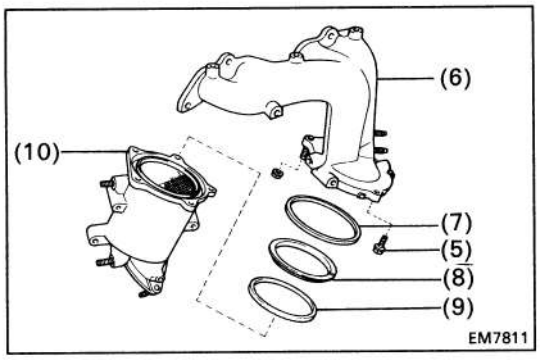
(e) Remove the six nuts, the exhaust manifold and catalytic converter assembly.



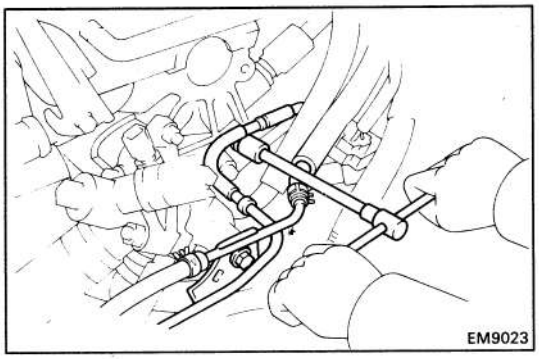
15. SEPARATE EXHAUST MANIFOLD AND CATALYTIC CONVERTER

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

cardiagn.com



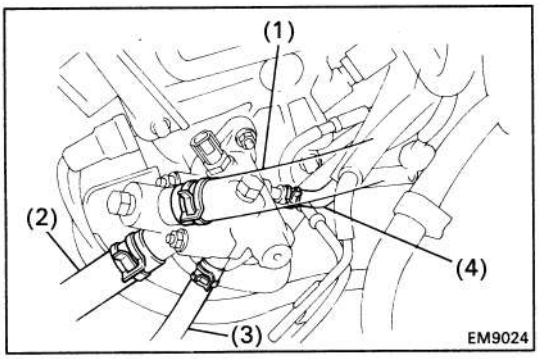
(5) Three bolts and two nuts
(6) Exhaust manifold
(7) Gasket
(8) Retainer
(9) Cushion
(10) Catalytic converter



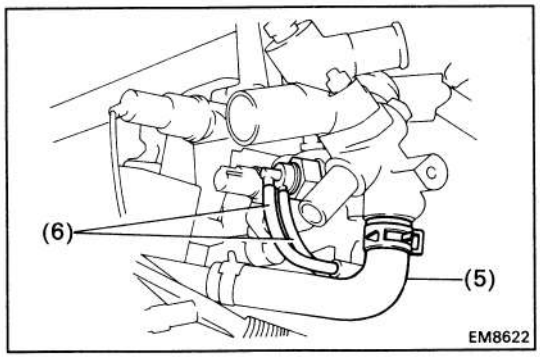
16. REMOVE WATER OUTLET AND HOUSING

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

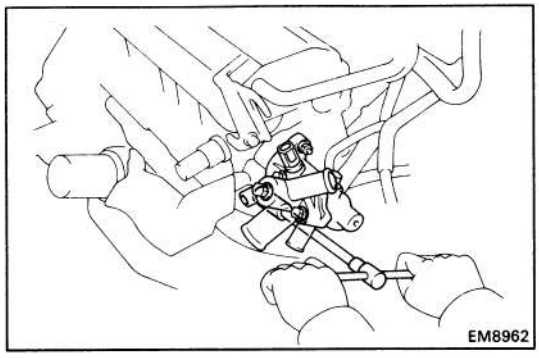
(b) Remove the two bolts, and disconnect the fuel inlet hose (with the fuel return tube) from the water outlet and cylinder head.



(c) Disconnect the following hoses:
(1) Water filler hose
(2) Radiator hose
(3) Heater water hose
(4) ISC water by-pass hose

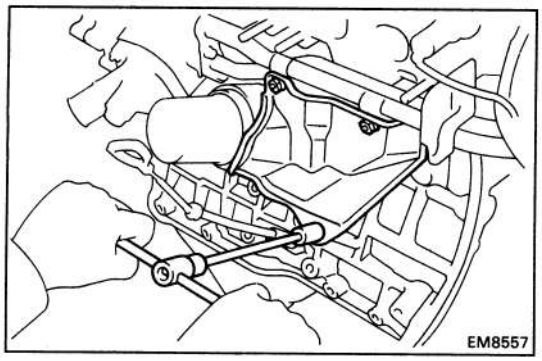


(5) Water by-pass pipe hose
(6) Two EVAP BVSV vacuum hoses



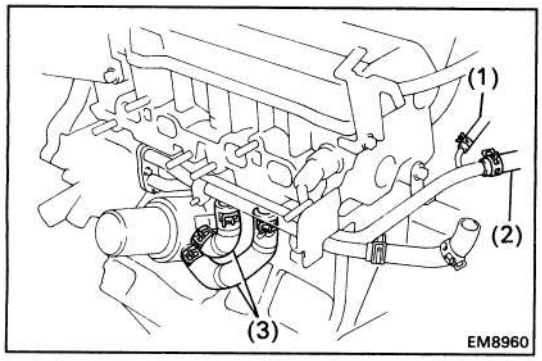
(d) Remove the two bolts, the water outlet, housing assembly and gasket.

cardiagn.com

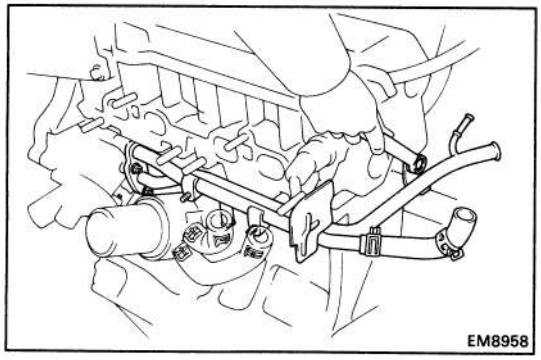


17. REMOVE WATER BY-PASS PIPE

(a) Remove the bolt, two nut and oil cooler heat protector



(b) Disconnect the following hoses:
(1) ISC water by-pass hose
(2) Heater water hose
(3) Two oil cooler water by-pass hoses

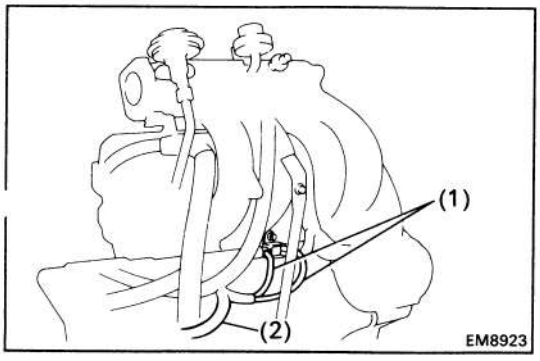


(c) Remove the two bolts, two nuts, water by-pass pipe and gasket.
(d) Remove the O-ring from the water by-pass hose.

18. REMOVE THROTTLE BODY
(See steps 7 to 10 on page FI-143)

19. REMOVE COLD START INJECTOR PIPE
(See step 3 on page FI-102)

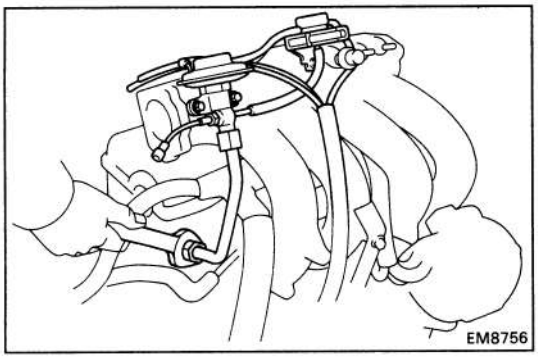
20. REMOVE COLD START INJECTOR
(See steps 2 and 4 on pages FI-102 and 103)



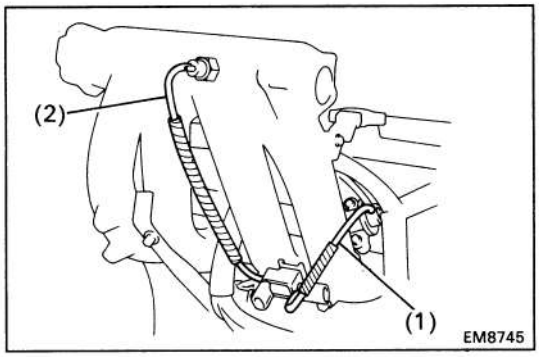
21. REMOVE EGR VALVE AND VACUUM MODULATOR

(a) (CALIF. only)
Disconnect EGR gas temperature sensor connector.
(b) Remove the following hoses:
(1) Two vacuum hoses from EGR VSV
(2) Vacuum hose from charcoal canister

cardiagn.com



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



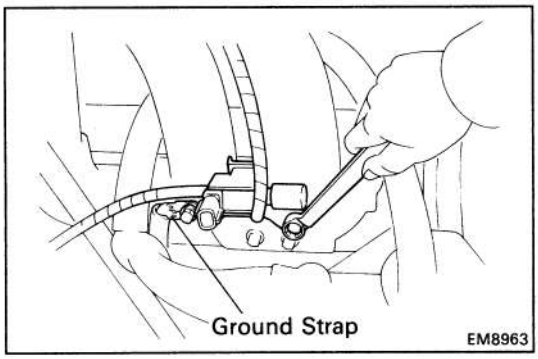
22. REMOVE FUEL PRESSURE VSV

(a) Disconnect the VSV connector.

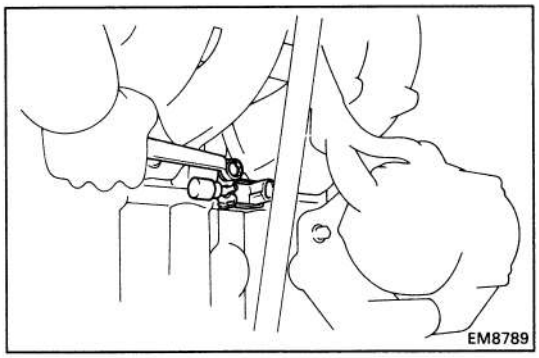
(b) Disconnect the following hoses:

(1) Vacuum hose from fuel pressure regulator

(2) Vacuum hose from intake manifold



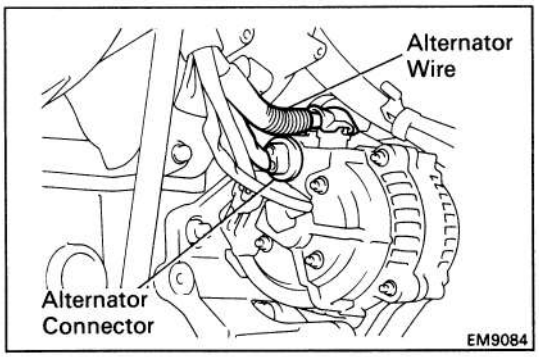
(c) Remove the two bolts and VSV. Disconnect the ground strap.



23. REMOVE EGR VSV

(a) Disconnect the VSV connector.

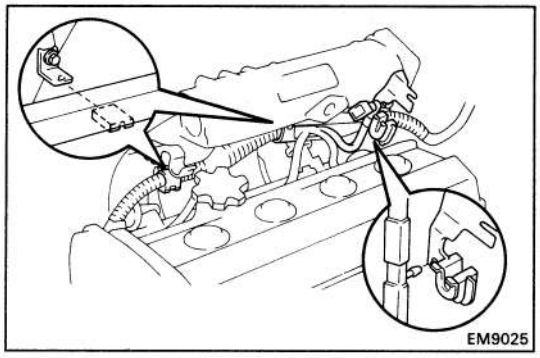
(b) Remove the bolt and VSV.



24. REMOVE INTAKE MANIFOLD

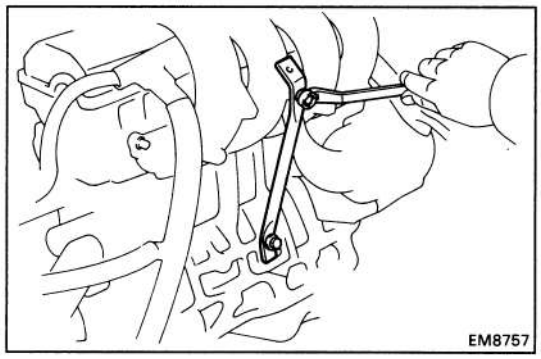
(a) Disconnect the alternator connector and wire.

cardiagn.com

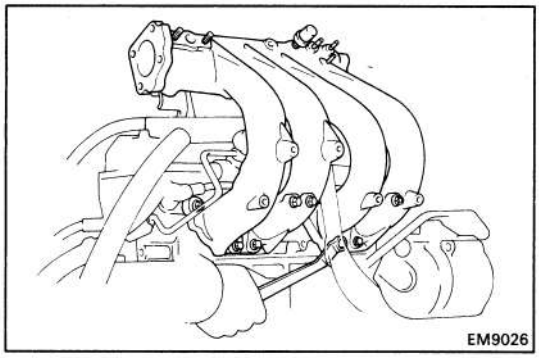


(b) Disconnect the two wire clamps from the wire brackets.

(c) Disconnect the clip of the engine wire from the LH accelerator bracket.



(d) Remove the two bolts and manifold stay.

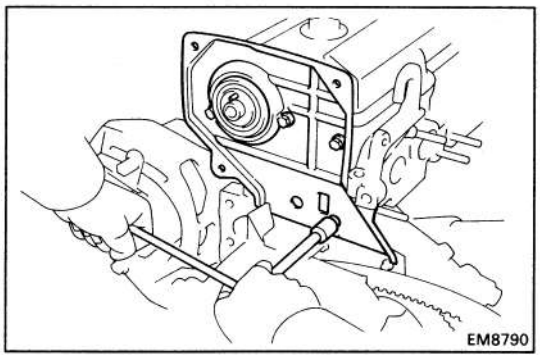


(e) Remove the six bolts, two nuts, intake manifold and gasket.

25. REMOVE DELIVERY PIPE AND INJECTORS
(See steps 7 to 10 and 12 on pages FI-122 and 123)

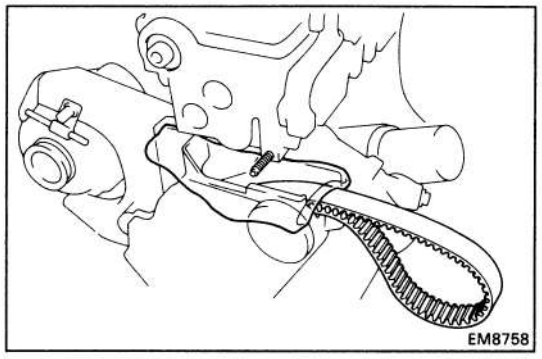
26. REMOVE CAMSHAFT TIMING PULLEY
(See steps 9 to 17 on pages EM-48 to 50)

27. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING
(See step 22 on page EM-52)



28. REMOVE NO.3 TIMING BELT COVER

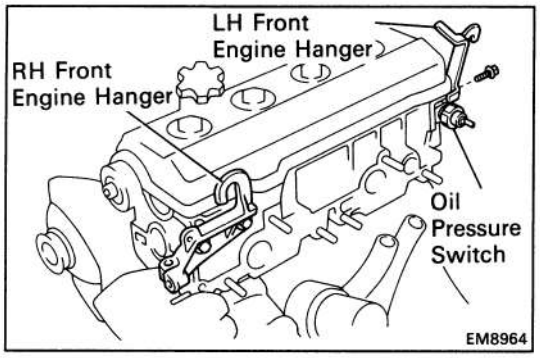
Remove the four bolts and timing belt cover.



NOTICE:

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

cardiagn.com



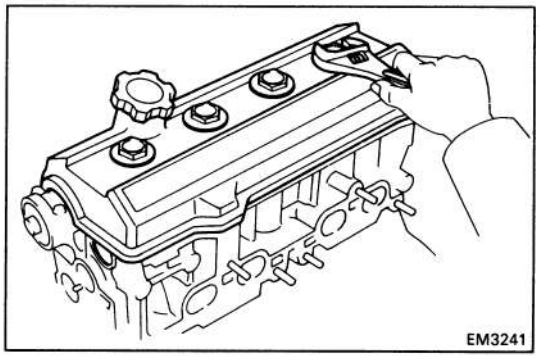
29. REMOVE RH FRONT ENGINE HANGER

Remove the two bolts and engine hanger.

30. REMOVE LH FRONT ENGINE HANGER

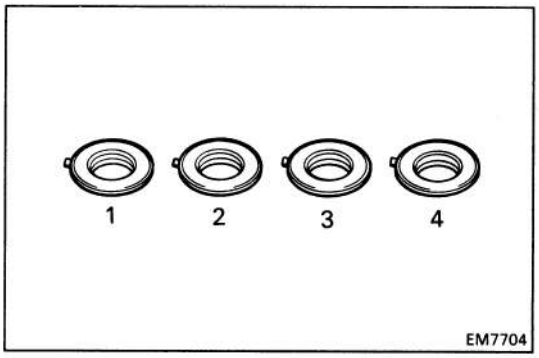
Remove the bolt and engine hanger.

31. REMOVE OIL PRESSURE SWITCH



32. REMOVE CYLINDER HEAD COVER

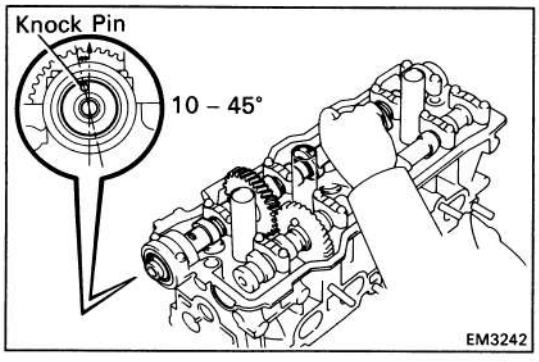
Remove the four nuts, grommets, head cover and gasket.



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

33. REMOVE CAMSHAFTS

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

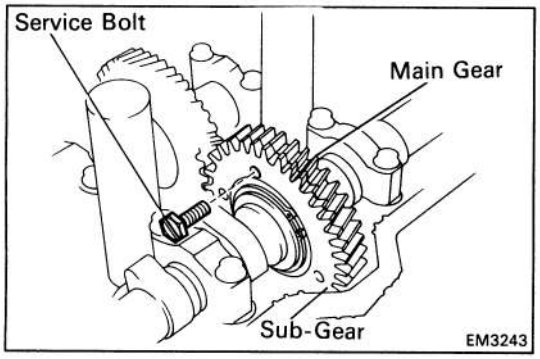


A. Remove exhaust camshaft

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

HINT: The above angle allows No.2 and No.4 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.

cardiagn.com

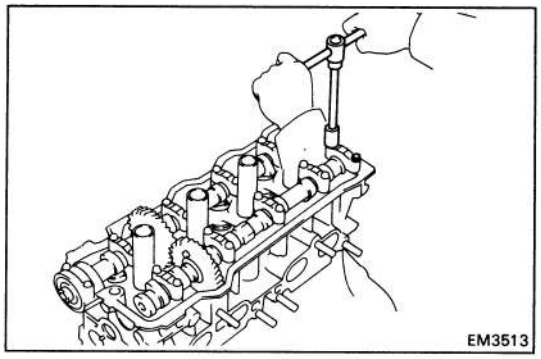


(b) Secure the exhaust camshaft sub-gear to drive gear with a service bolt.

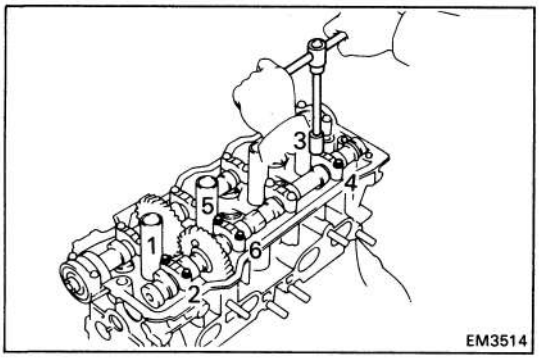
Recommended service bolt:

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

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



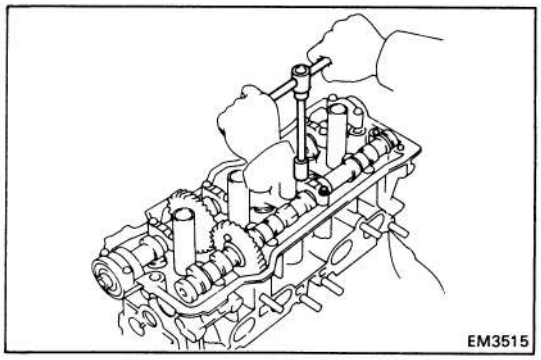
(c) Remove the two bolts and rear bearing cap.



(d) Uniformly loosen and remove the six bolts on the No.1, No.2 and No.4 bearing cap in several passes in the sequence shown.

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

(e) Remove the No.1, No.2 and No.4 bearing caps.



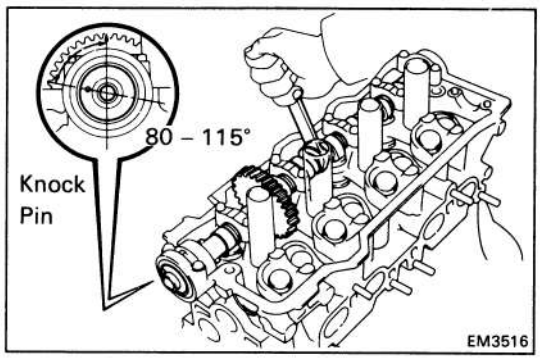
(f) Alternately loosen and remove the two bolts on the No.3 bearing cap.

HINT:

- As two No.3 bearing cap bolts are loosened, check that the camshaft is being lifted out straight and level.
- If the camshaft is not being lifted out straight and level, retighten the two No.3 bearing cap bolts. Then reverse the order of above steps from (f) to (a) and reset the knock pin of the intake camshaft at 10 – 45° BTDC, and repeat steps from (b) to (f) once again.

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

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

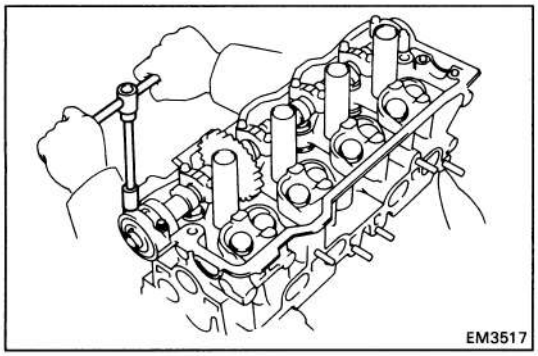


B. Remove intake camshaft

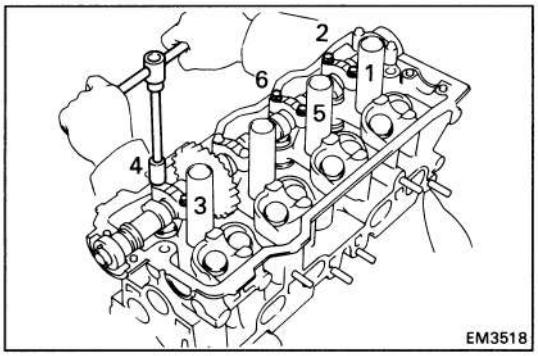
(a) Set the knock pin of the intake camshaft at 80 – 115° BTDC of camshaft angle.

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

cardiagn.com



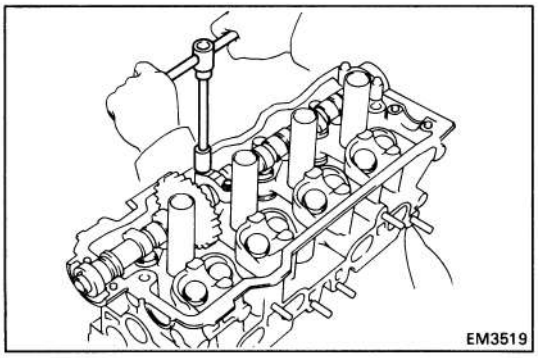
(b) Remove the two bolts, front bearing cap and oil seal.



(c) Uniformly loosen and remove the bolts on the No.1, No.3 and No.4 bearing cap in several passes in the sequence shown.

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

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



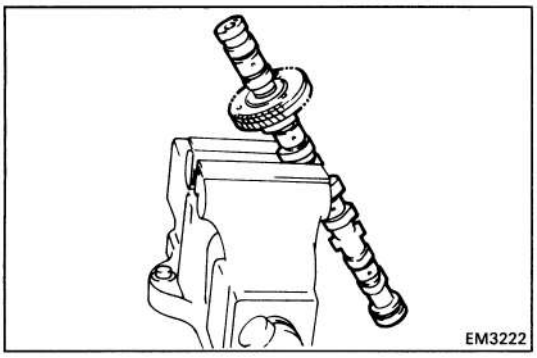
(e) Alternately loosen and remove the two bolts on the No.2 bearing cap.

HINT:

- As two No.2 bearing cap bolts are loosened, check that the camshaft is being lifted out straight and level, after breaking the adhesion on the front bearing cap.
- If the camshaft is not being lifted out straight and level, retighten the two No.2 bearing cap bolts. Reverse the order of above steps from (e) to (a) and reset the knock pin of the intake camshaft at 80 – 115° BTDC, and repeat steps from (b) to (e) once again.

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

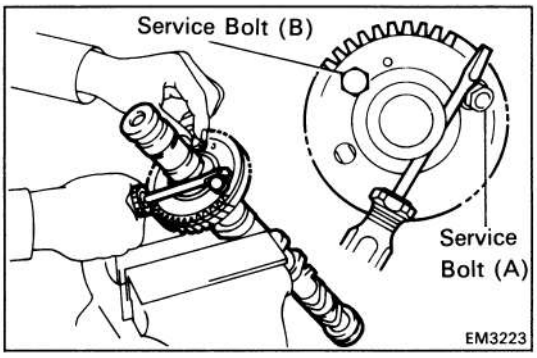
(f) Remove the No.2 bearing cap and camshaft.



34. DISASSEMBLE EXHAUST CAMSHAFT

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

NOTICE: Be careful not to damage the camshaft.

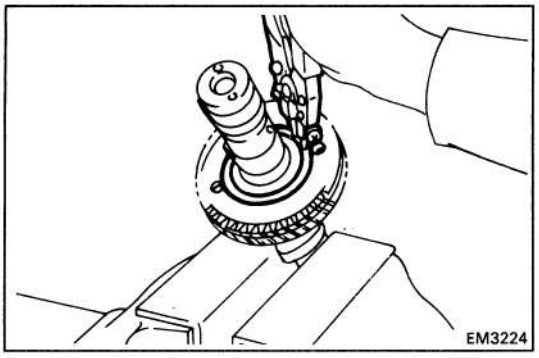


(b) Insert a service bolt (A) into the service hole of the camshaft sub-gear.

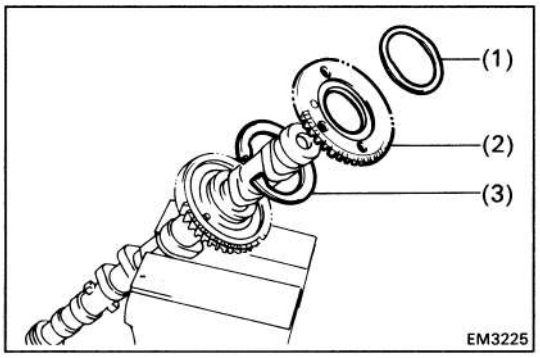
(c) Using a screwdriver, turn the sub-gear clockwise, and remove the service bolt (B).

NOTICE: Be careful not to damage the camshaft.

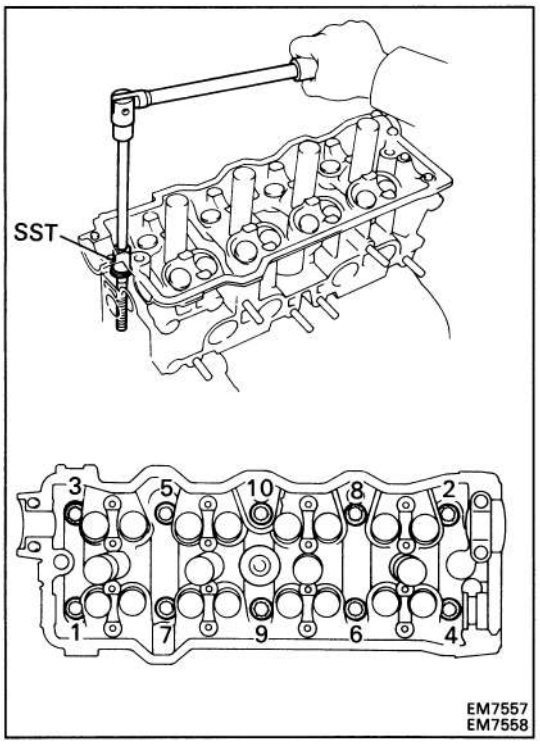
cardiagn.com



(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

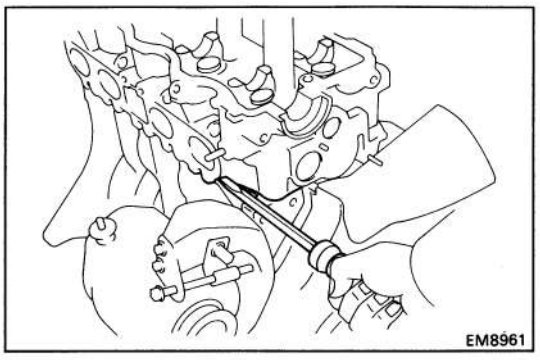


35. REMOVE CYLINDER HEAD

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

SST 09011-38121

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

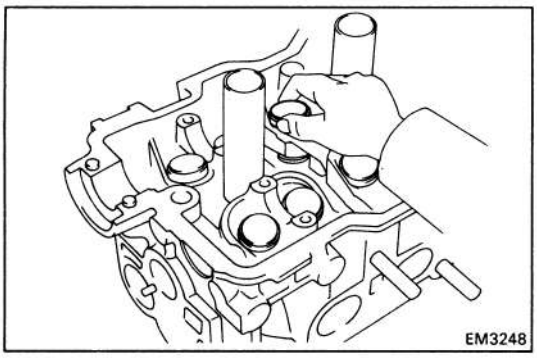


(b) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

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

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

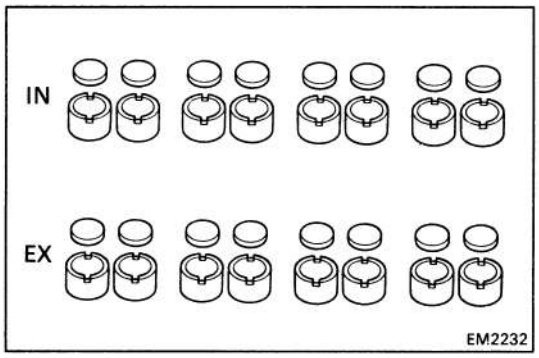
cardiagn.com



DISASSEMBLY OF CYLINDER HEAD

(See page EM-97)

1. REMOVE VALVE LIFTERS AND SHIMS



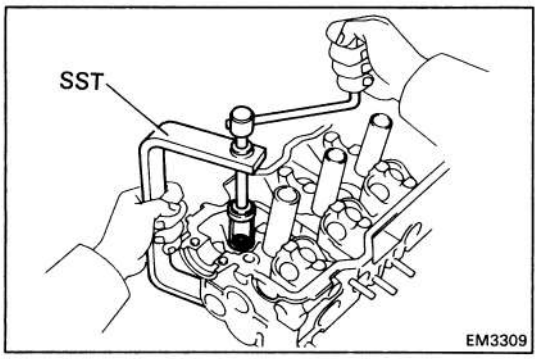
HINT: Arrange the valve lifters and shims in correct order.

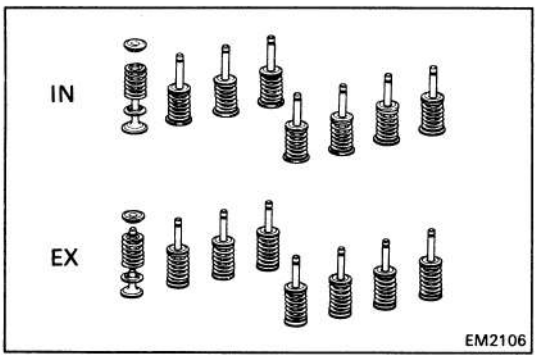
2. REMOVE VALVES

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

SST 09202-70010

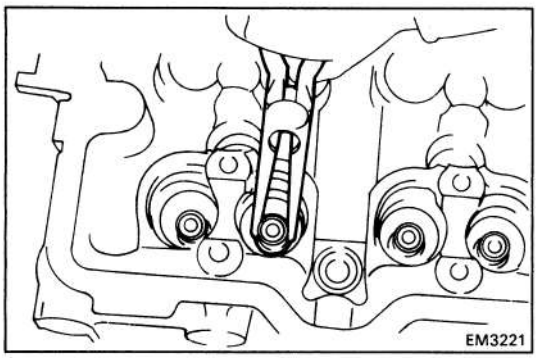
(b) Remove the spring retainer, valve spring, valve and spring seat.



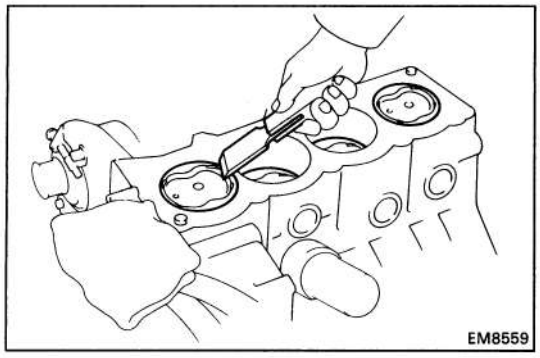


HINT: Arrange the valves, valve springs, spring seats and spring retainers in correct order.

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



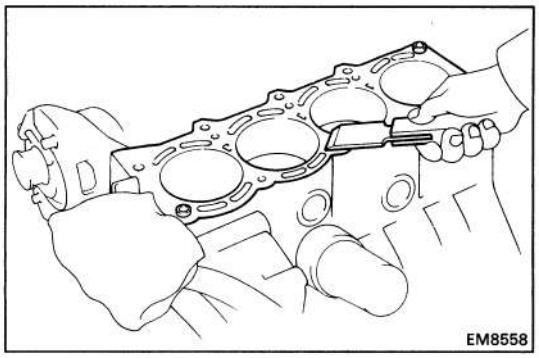
cardiagn.com



INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

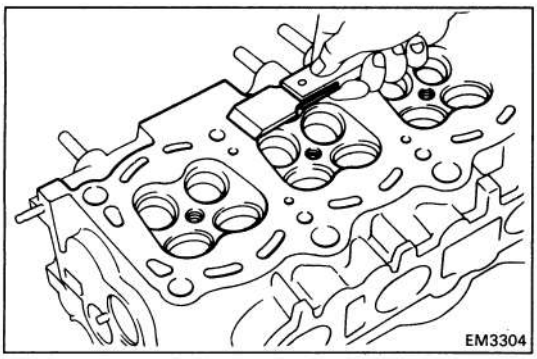
(a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.



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

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

CAUTION: Protect your eyes when using high-com

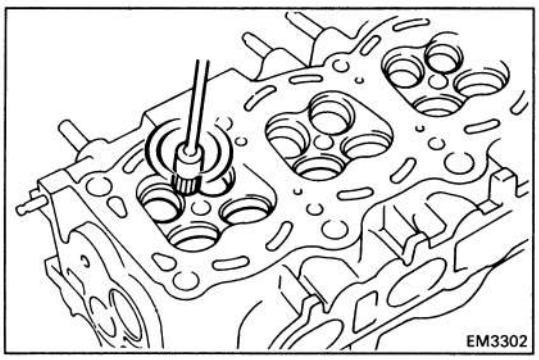


2. CLEAN CYLINDER HEAD

A. Remove gasket material

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

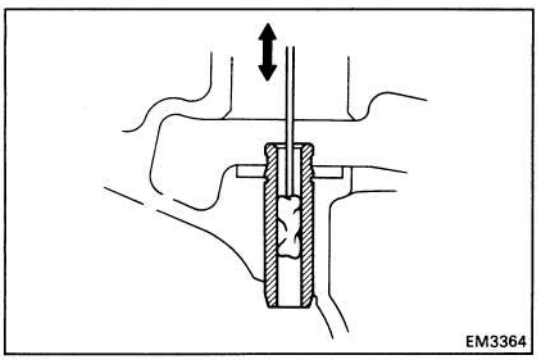
NOTICE: Be careful not to scratch the cylinder block contact surface.



B. Clean combustion chambers

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

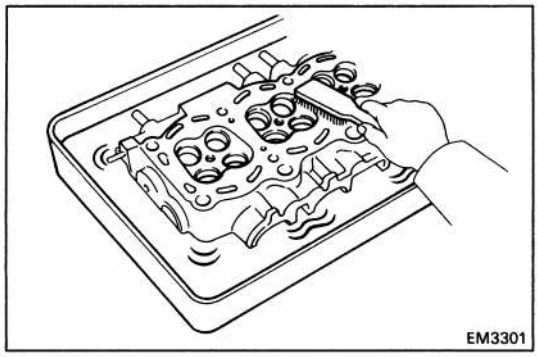
NOTICE: Be careful not to scratch the cylinder block contact surface.



C. Clean valve guide bushings

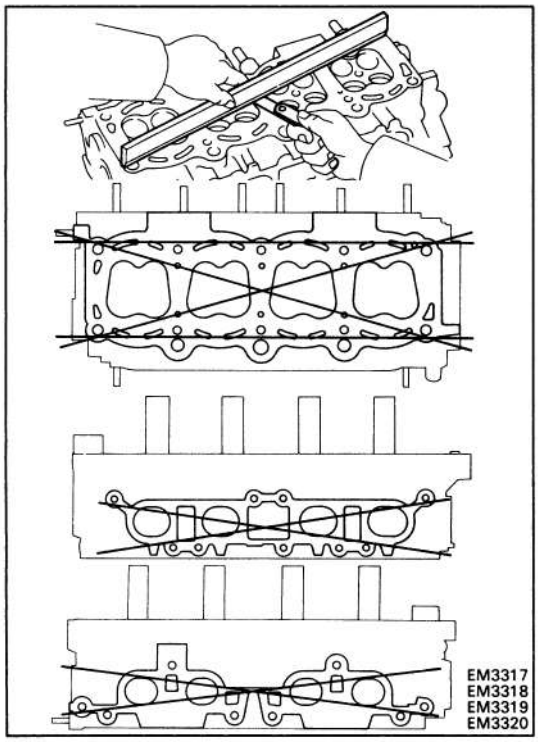
Using a valve guide bushing brush and solvent, clean all the guide bushings.

cardiagn.com



D. Clean cylinder head

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



3. INSPECT CYLINDER HEAD

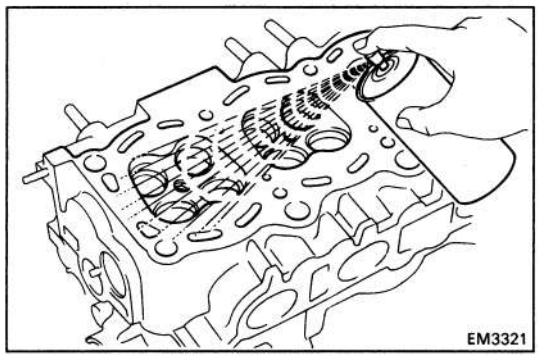
A. Inspect for flatness

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

Maximum warpage:

Cylinder block side	**0.05 mm (0.0020 in.)**
Manifold side	**0.08 mm (0.0031 in.)**

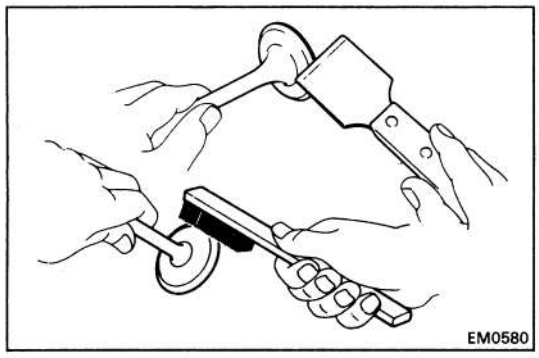
If warpage is greater than maximum, replace the cylinder head.



B. Inspect for cracks

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

If cracked, replace the cylinder head.

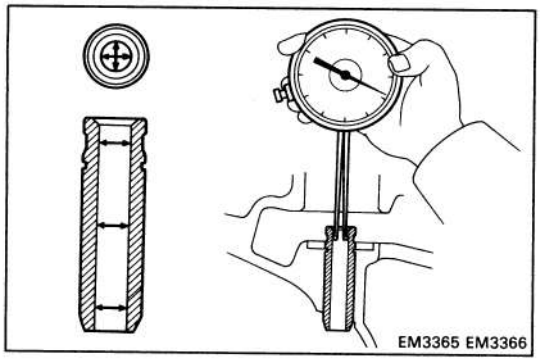


4. CLEAN VALVES

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

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

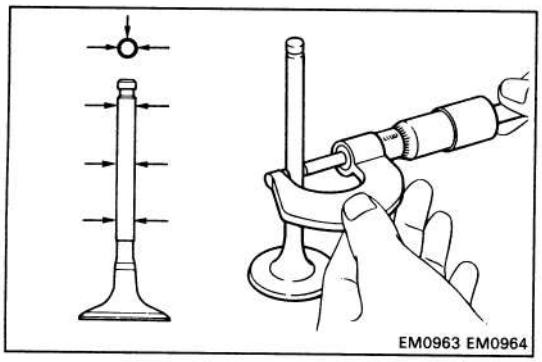
cardiagn.com



5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

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



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

Valve stem diameter:

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

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

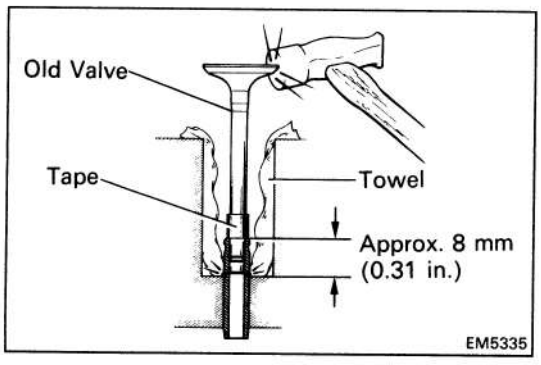
Standard oil clearance:

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

Maximum oil clearance:

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

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

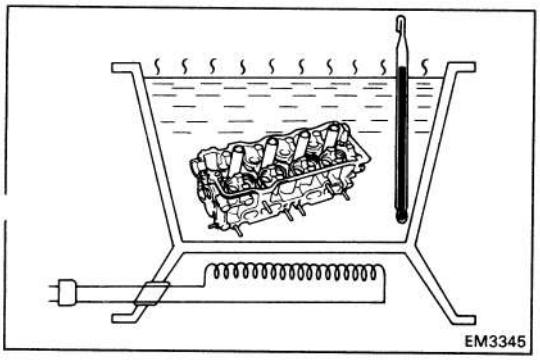


6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

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

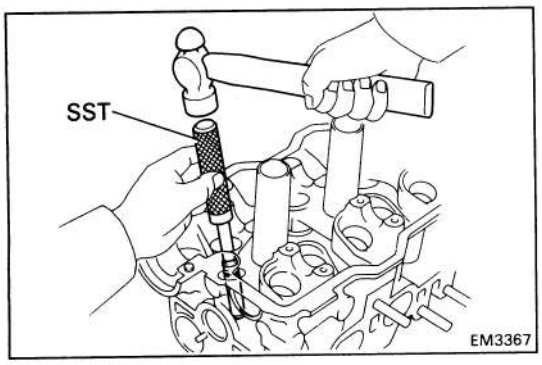
HINT: Wrap the tape approx. 8 mm (0.31 in.) from the valve stem end.

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



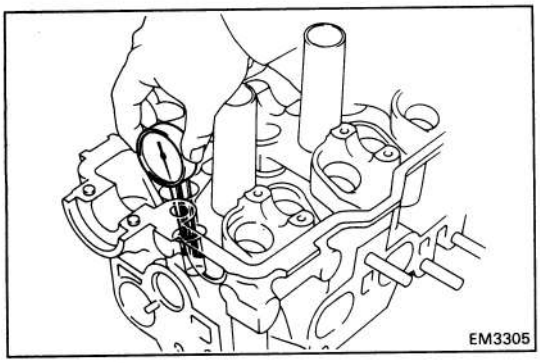
(b) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F).

cardiagn.com



(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

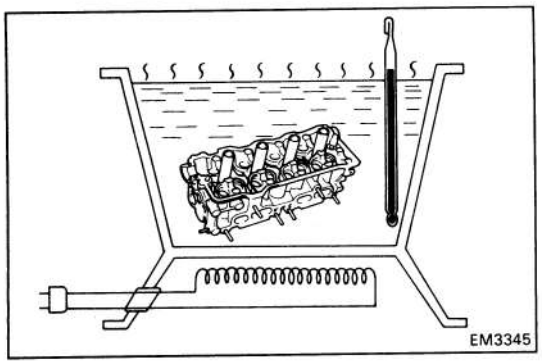
Bushing bore diameter mm (in.)	Bushing size
11.000 – 11.027 (0.4331 – 0.4342)	Use STD
11.050 – 11.077 (0.4350 – 0.4361)	Use O/S 0.05

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

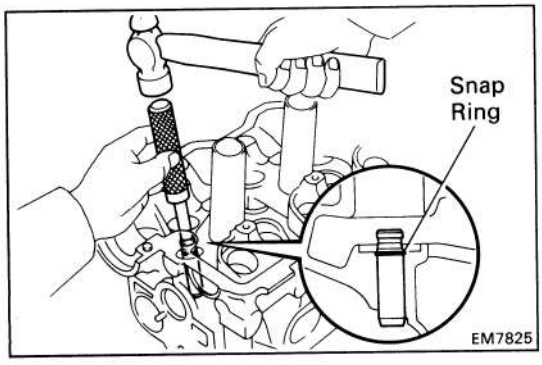
If the bushing bore diameter of the cylinder head is greater than 11.027 mm (0.4341 in.), machine the bushing bore to the following dimension:

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.



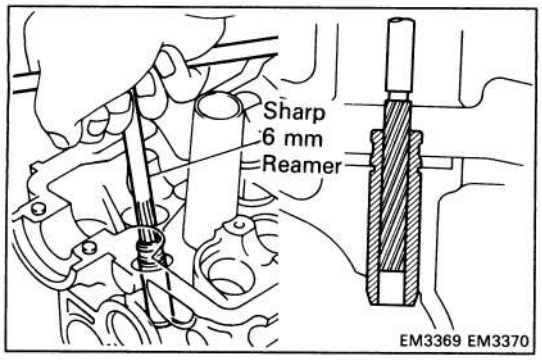
(f) Gradually heat the cylinder head to 80 – 100[C (176 – 212°F).



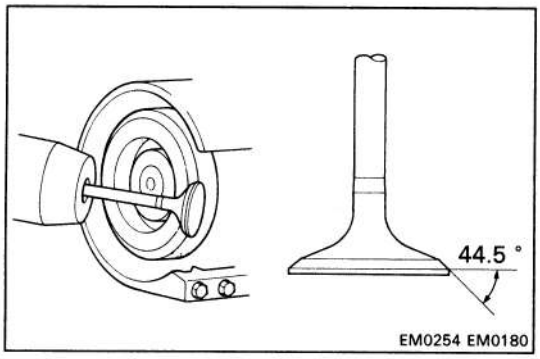
(g) Using SST and a hammer, tap in a new guide bushing until the snap ring makes contact with the cylinder head.

SST 09201-70010

cardiagn.com



(h) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page EM-111) between the guide bushing and valve stem.

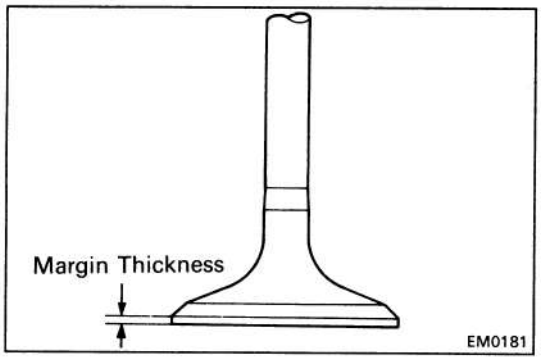


7. INSPECT AND GRIND VALVES

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

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

Valve face angle: 44.5°

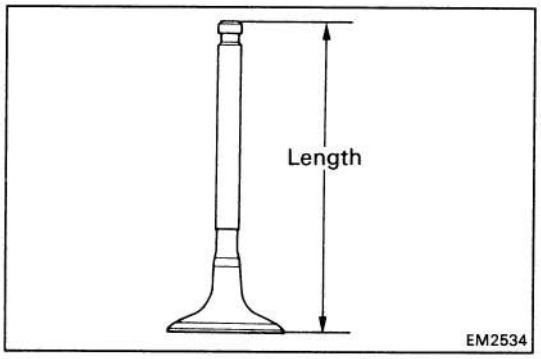


(c) Check the valve head margin thickness.

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

Minimum margin thickness: 0.5 mm (0.020 in.)

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



(d) Check the valve overall length.

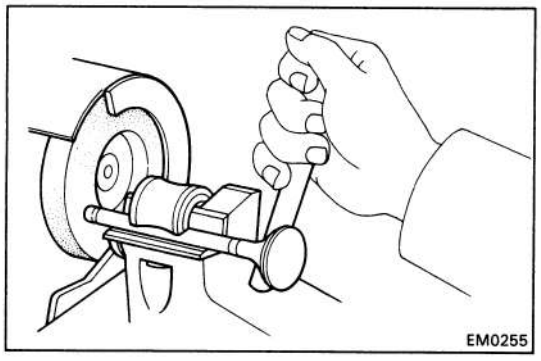
Standard overall length:

Intake	**100.60 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.

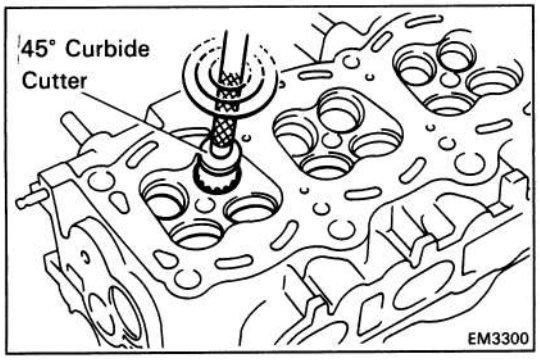


(e) Check the surface of the valve stem tip for wear.

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

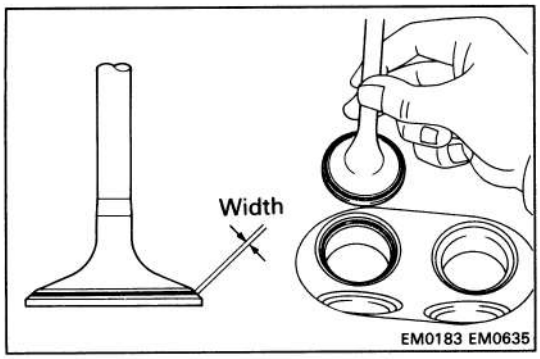
NOTICE: Do not grind off more than the minimum.

cardiagn.com



8. INSPECT AND CLEAN VALVE SEATS

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



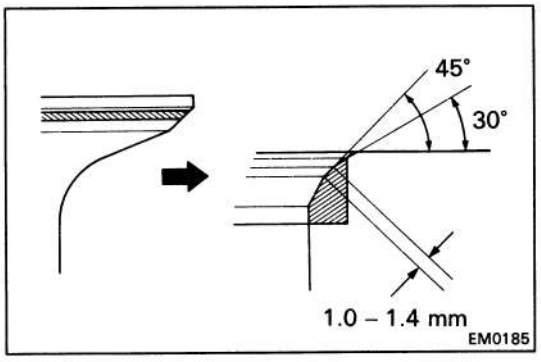
(b) Check the valve seating position.

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

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

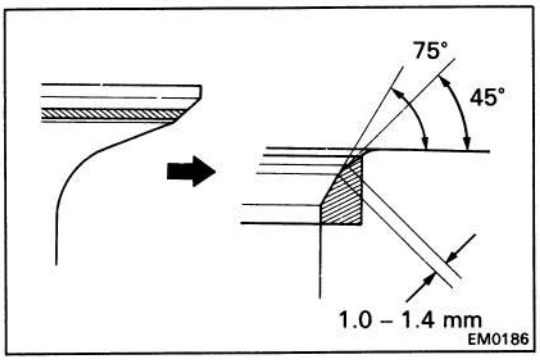
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with the following width:

1.0 – 1.4 mm (0.039 – 0.055 in.)



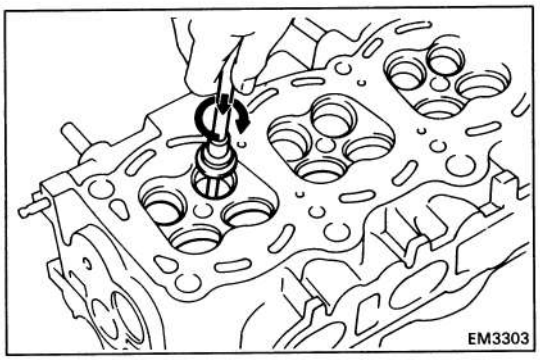
If not, correct the valve seats as follows:

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



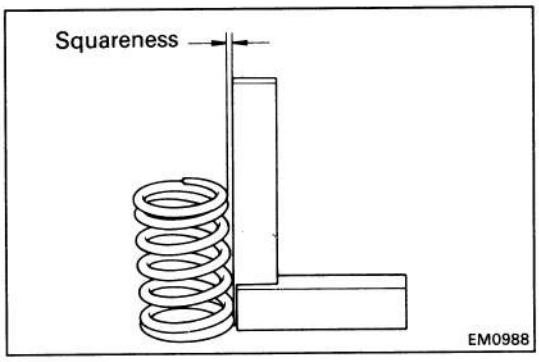
(2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.

Cardiagn.com



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

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

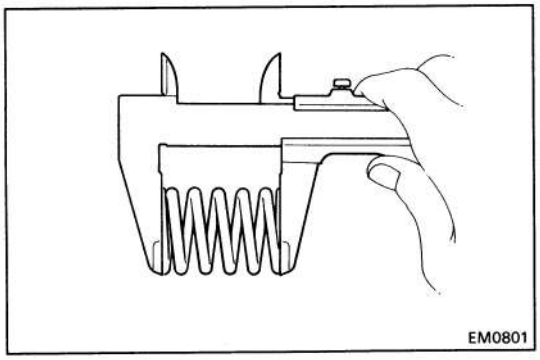


9. INSPECT VALVE SPRINGS

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

Maximum squareness: 2.0 mm (0.075 in.)

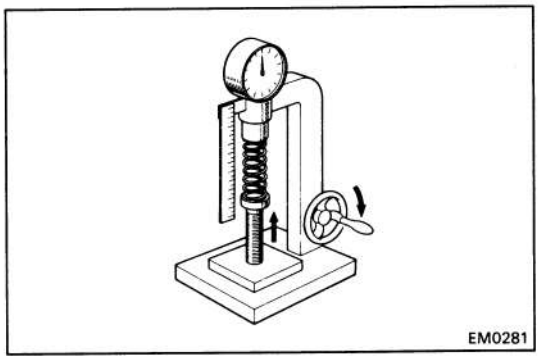
If squareness is greater than maximum, replace the valve spring.



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

Free length: 45.0 mm (1.772 in.)

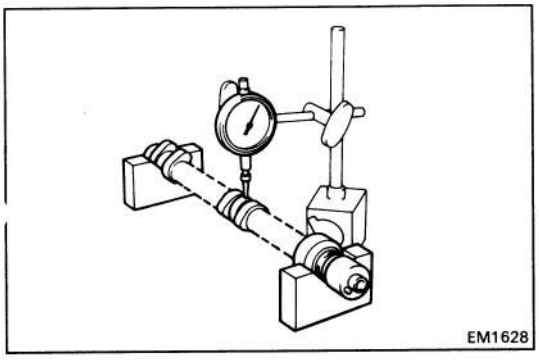
If the free length is not as specified, replace the valve spring.



(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.



10. INSPECT CAMSHAFTS AND BEARINGS

A. Inspect camshaft for runout

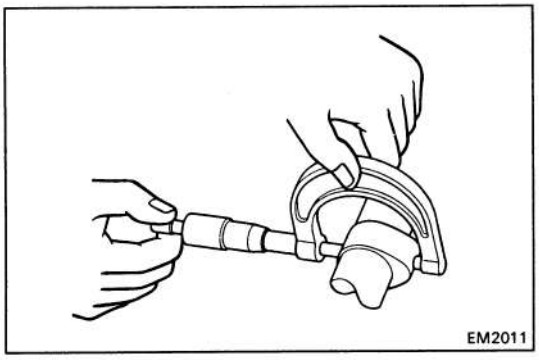
(a) Place the camshaft on V-blocks.

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

Maximum circle runout: 0.04 mm (0.0016 in.)

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

cardiagn.com



B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

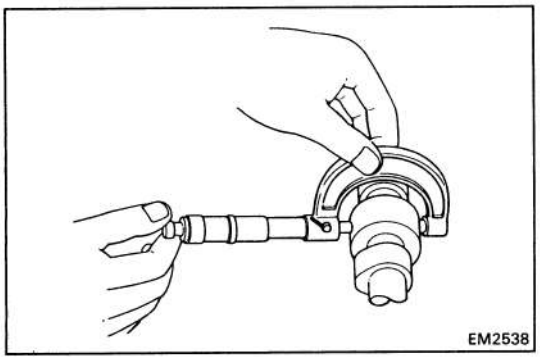
Standard cam lobe height:

Intake	**35.310 – 35.410 mm (1.3902 – 1.3941 in.)**
Exhaust	**35.560 – 35.660 mm (1.4000 – 1.4039 in.)**

Minimum cam lobe height:

Intake	**35.20 mm (1.3858 in.)**
Exhaust	**35.45 mm (1.3957 in.)**

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

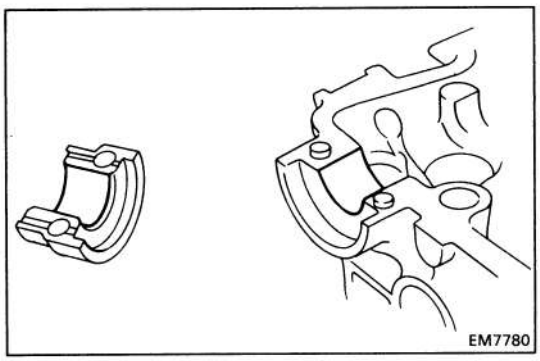


C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

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

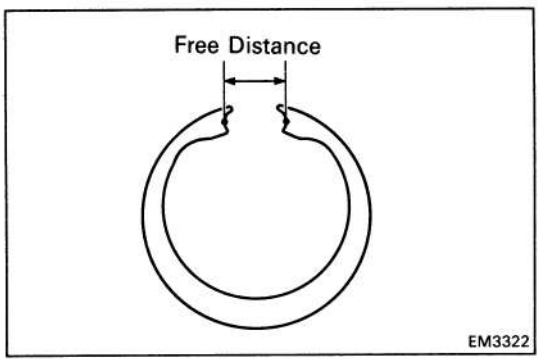
If the journal diameter is not as specified, check the oil clearance.



D. Inspect camshaft bearings

Check the bearings for flaking and scoring.

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

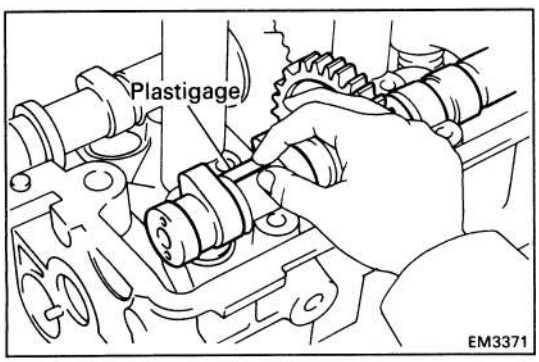


E. Inspect camshaft gear spring

Using vernier 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.



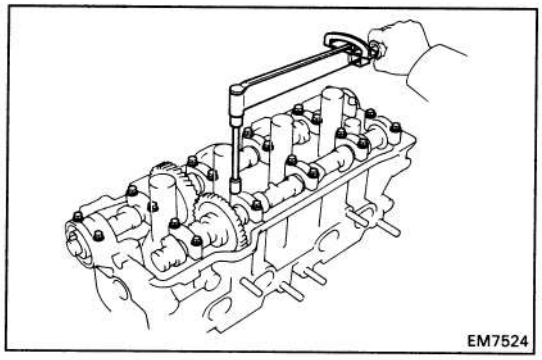
F. Inspect camshaft journal oil clearance

(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.

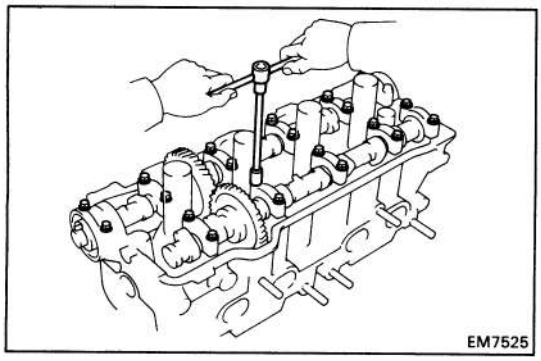
cardiagn.com



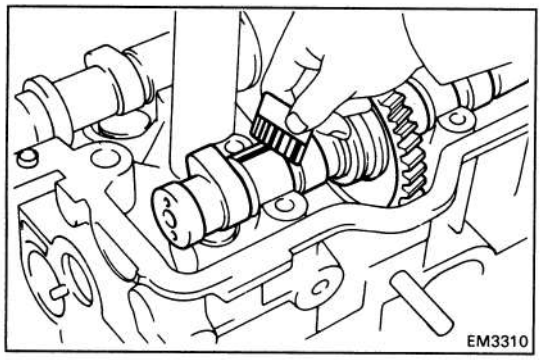
(d) Install the bearing caps.
(See step 4 on pages EM-123 to 125)

Torque: 190 kg-cm (14 ft-lb, 19 N·m)

NOTICE: Do not turn the camshaft.



(e) Remove the bearing caps.



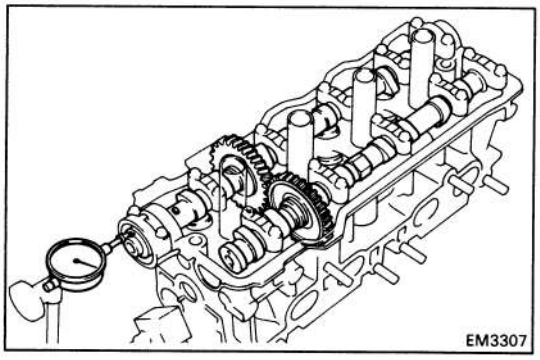
(f) Measure the Plastigage at its widest point.

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

Maximum oil clearance: 0.10 mm (0.0039 in.)

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

(g) Completely remove the Plastigage.



G. Inspect camshaft thrust clearance

(a) Install the camshafts.
(See step 4 on pages EM-123 to 125)

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

Standard thrust clearance:

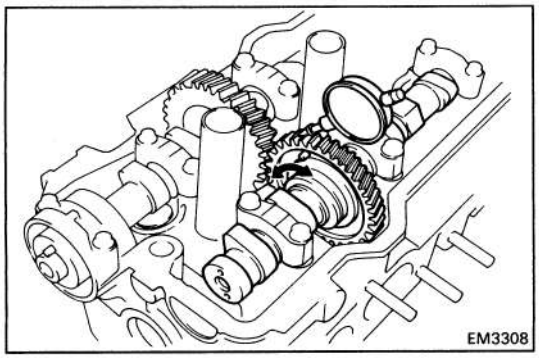
Intake	**0.045 – 0.100 mm (0.0018 – 0.0039 in.)**
Exhaust	**0.030 – 0.085 mm (0.0012 – 0.0033 in.)**

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.

cardiagn.com



H. Inspect camshaft gear backlash

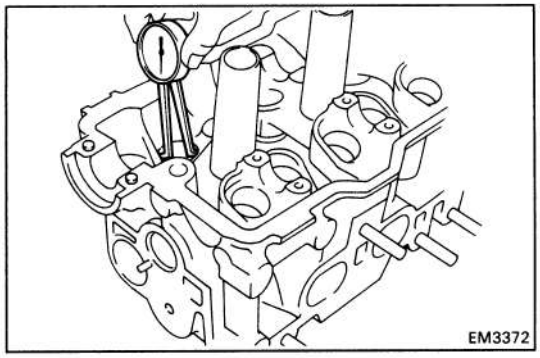
(a) Install the camshafts without installing the exhaust cam sub-gear.
(See step 4 on page EM-123 to 125)

(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.)

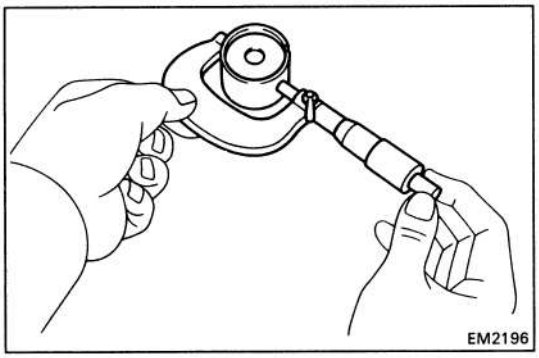
If the backlash is greater than maximum, replace the camshafts.



11. INSPECT VALVE LIFTERS AND LIFTER BORES

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

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



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

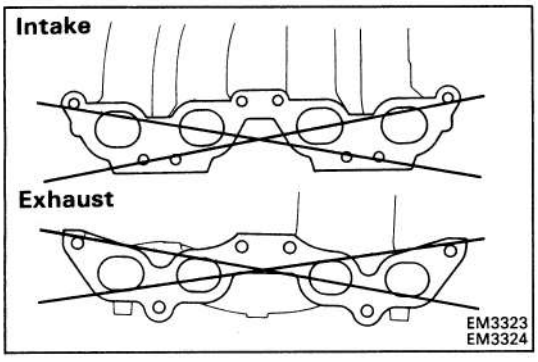
Lifter diameter: 27.975 – 27.985 mm (1.1014 – 1.1018 in.)

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

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

Maximum oil clearance: 0.07 mm (0.0028 in.)

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



12. INSPECT INTAKE AND EXHAUST MANIFOLDS

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

Maximum warpage: 0.30 mm (0.0118 in.)

If warpage is greater than maximum, replace the manifold.

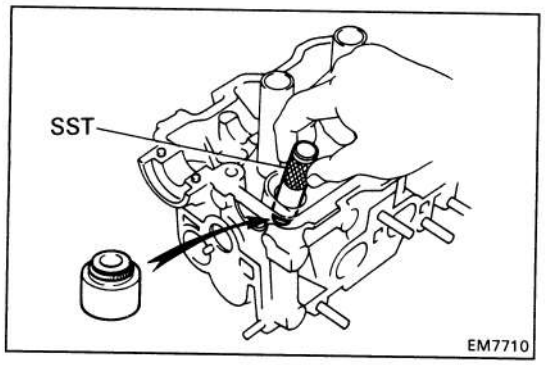
cardiagn.com

ASSEMBLY OF CYLINDER HEAD

(See page EM-97)

HINT:

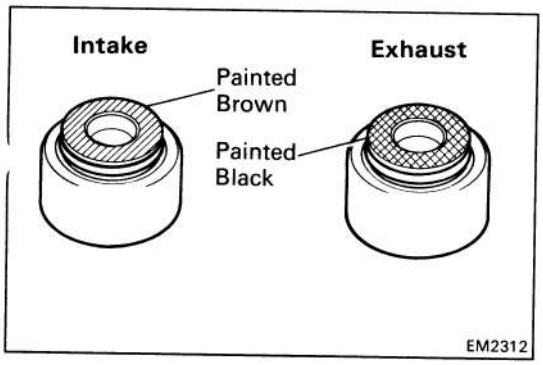
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.



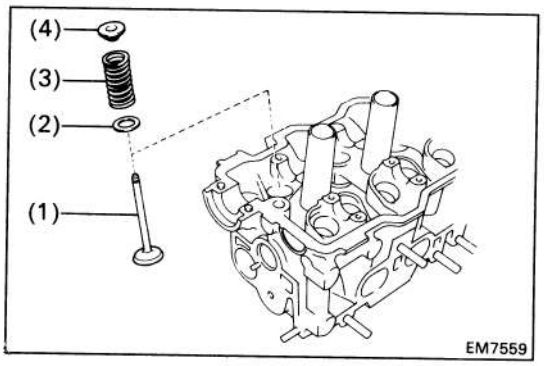
1. INSTALL VALVES

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

SST 09201-41020

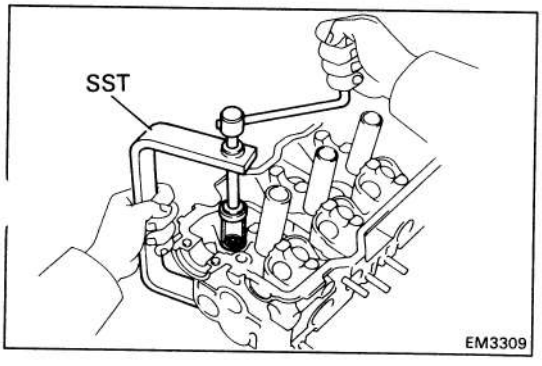


HINT: The intake valve oil seal is brown and the exhaust valve oil seal is black.



(b) Install the following parts:

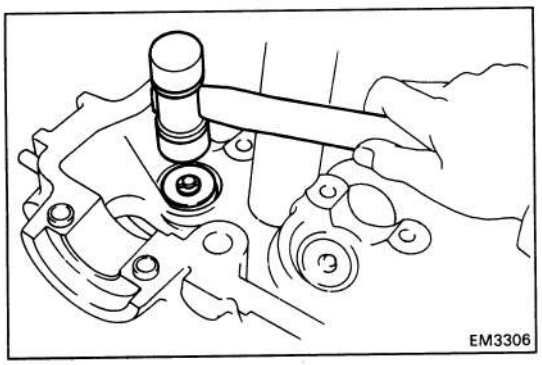
(1) Valve
(2) Spring seat
(3) Valve spring
(4) Spring retainer



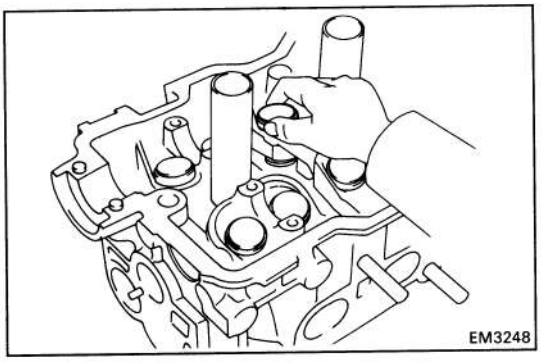
(c) Using SST, compress the valve spring and place the two keepers around the valve stem.

SST 09202-70010

cardiagn.com



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

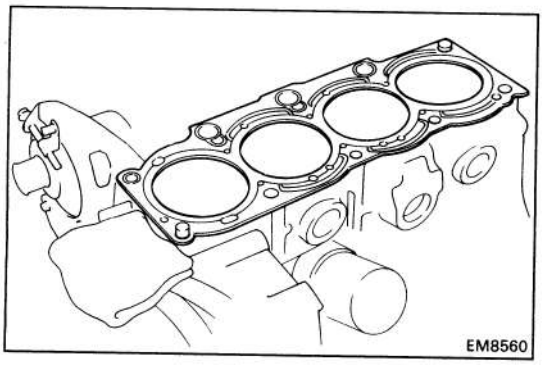


2. INSTALL VALVE LIFTERS AND SHIMS

(a) Install the valve lifter and shim.

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

cardiagn.com



INSTALLATION OF CYLINDER HEAD

(See page EM-97)

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.

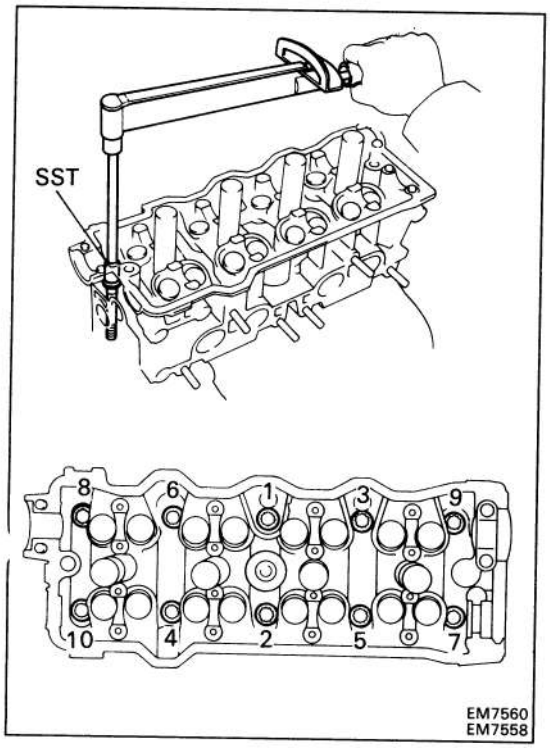
(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

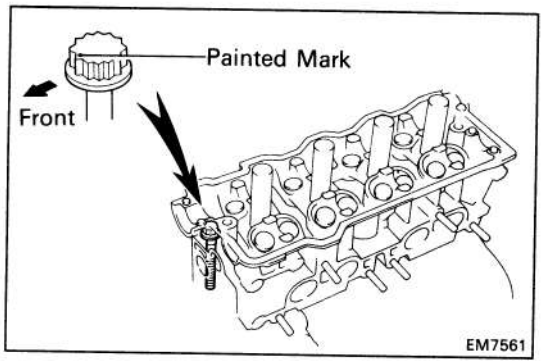
(b) Using SST, install and uniformly tighten the ten cylinder head bolts in several passes in the sequence shown.

SST 09011-38121

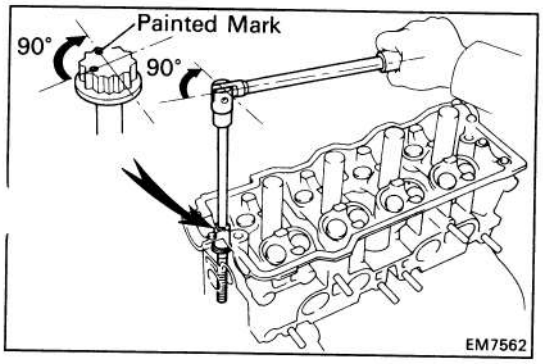
Torque: 500 kg-cm (36 ft-lb, 47 N·m)

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





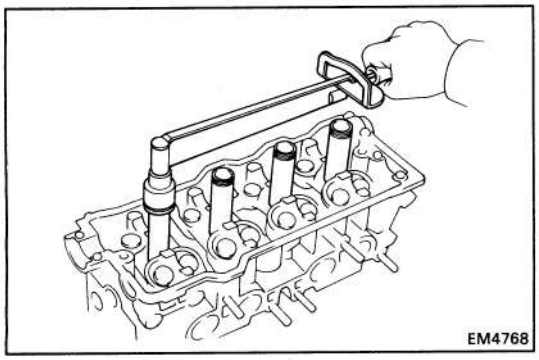
(c) Mark the front of the cylinder head bolt head with paint.



(d) 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.

cardiagn.com



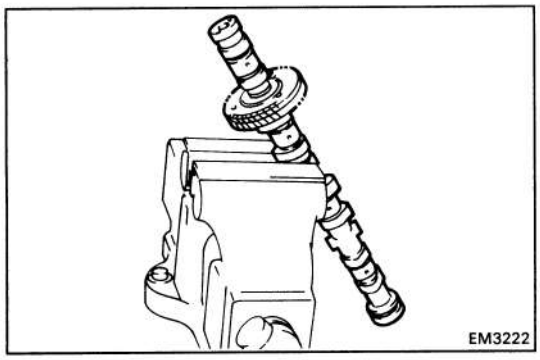
2. INSTALL SPARK PLUG TUBES

(a) Clean the cylinder head tube holes of any residual adhesive, oil or 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) Using the spark plug tube nut and a 30 mm socket wrench, tighten the spark plug tubes.

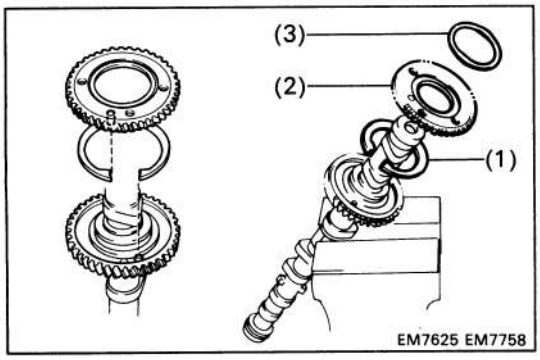
Torque: 400 kg-cm (29 ft-lb, 39 N·m)



3. ASSEMBLE EXHAUST CAMSHAFT

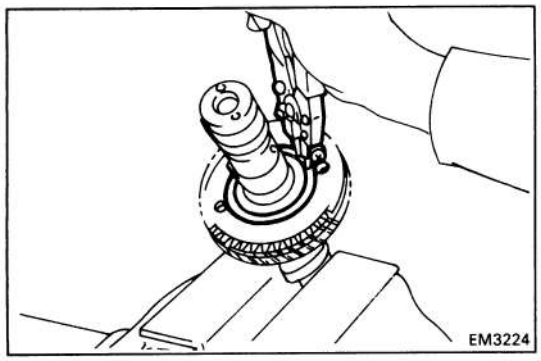
(a) Mount the hexagonal wrench head portion of the camshaft in a vise.

NOTICE: Be careful not to damage the camshaft.

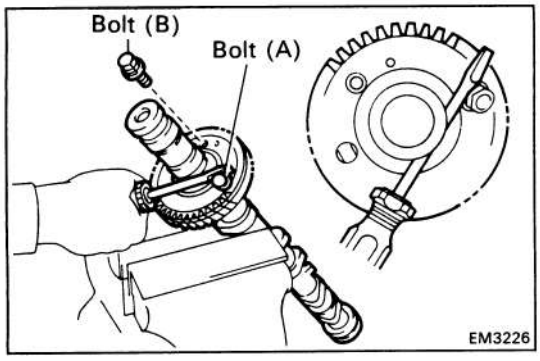


(b) Install the following parts:
(1) Camshaft gear spring
(2) Camshaft sub-gear
(3) Wave washer

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



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



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

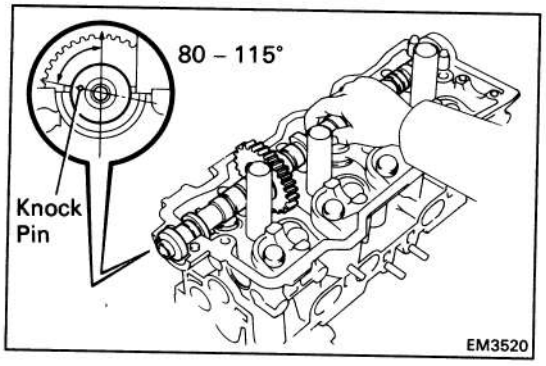
(e) Using a screwdriver, align the holes of the camshaft main gear and sub-gear by turning the camshaft sub-gear clockwise, and install a service bolt (B).

NOTICE: Be careful not to damage the camshaft.

cardiagn.com

4. INSTALL CAMSHAFTS

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

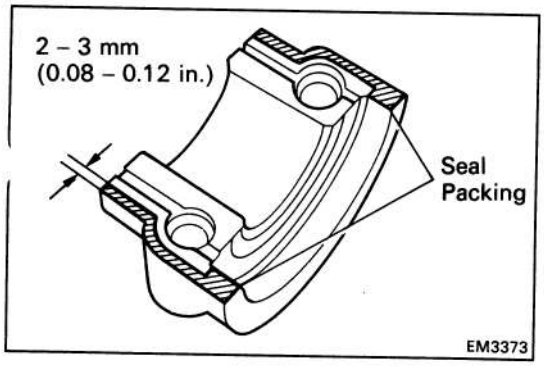


A. Install intake camshaft

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

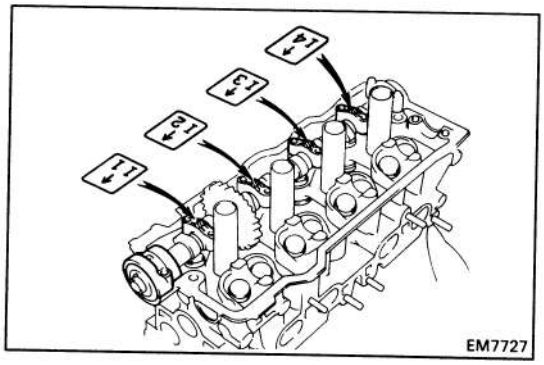
(b) Place the intake camshaft at 80 – 115° BTDC of camshaft angle on the cylinder head.

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

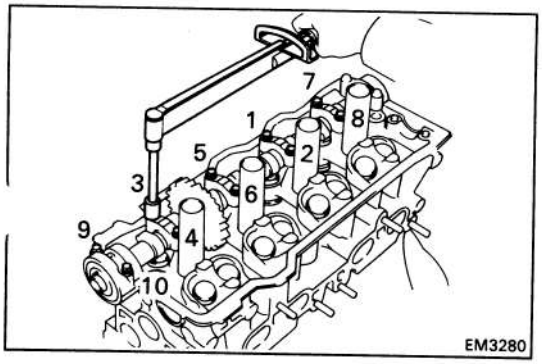


(c) Apply seal packing to the No.1 bearing cap as shown.

Seal packing: Part No. 08826-00080 or equivalent



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

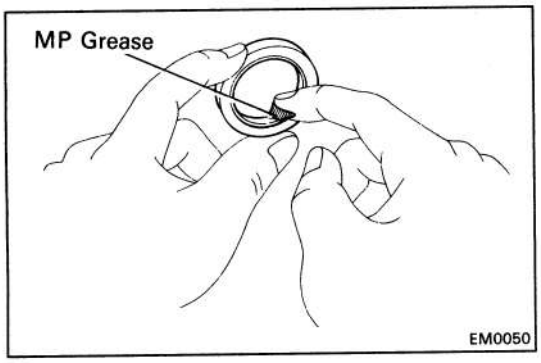


(e) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

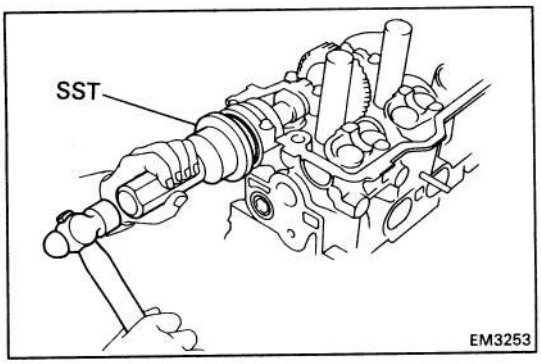
(f) Install and uniformly tighten the ten bearing cap bolts in several passes in the sequence shown.

Torque: 190 kg-cm (14 ft-lb, 19 N·m)

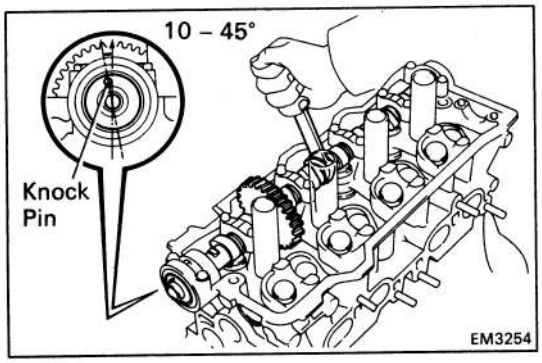
cardiagn.com



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



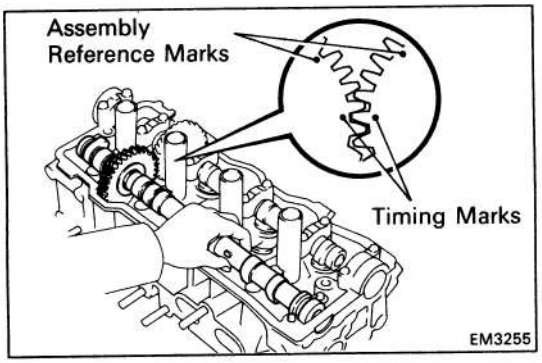
(h) Using SST, tap in the oil seal.
SST 09223-46011



B. Install exhaust camshaft

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

HINT: The above angle allows the No.2 and No.4 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.



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

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

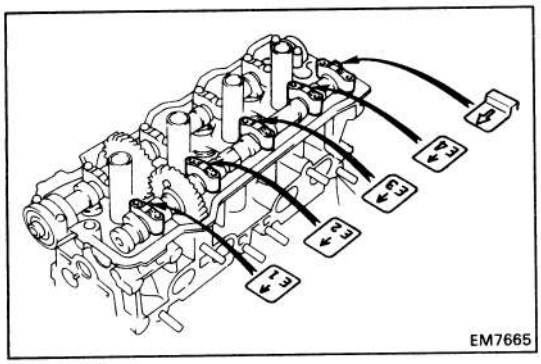
(d) Roll down the exhaust camshaft onto the bearing journals while engaging gears with each other.

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

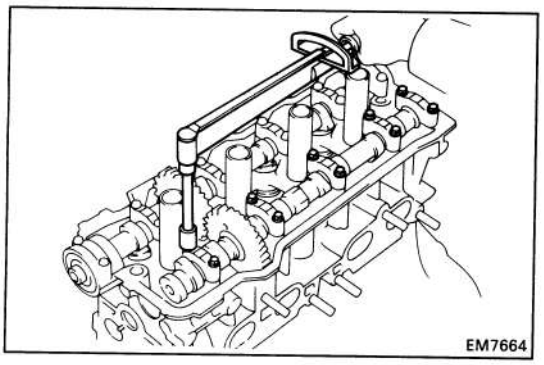
(e) Turn the intake camshaft clockwise or counterclockwise little by little until the exhaust camshaft sits in the bearing journals evenly without rocking the camshaft on the bearing journals.

NOTICE: It 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.



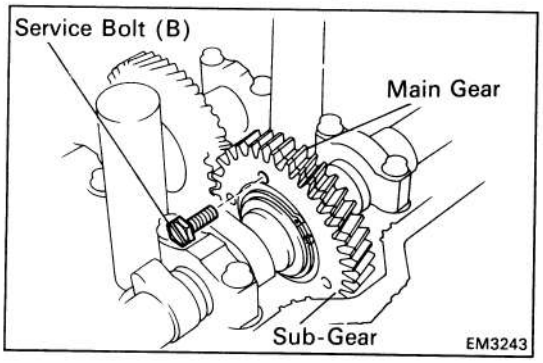
cardiagn.com



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

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

Torque: 190 kg-cm (14 ft-lb, 19 N·m)



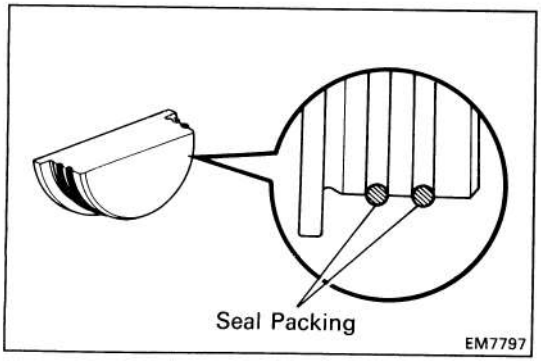
(i) Remove the service bolt (B).

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

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

Valve clearance (Cold):

Intake	**0.19 – 0.29 mm (0.007 – 0.011 in.)**
Exhaust	**0.28 – 0.38 mm (0.011 – 0.015 in.)**

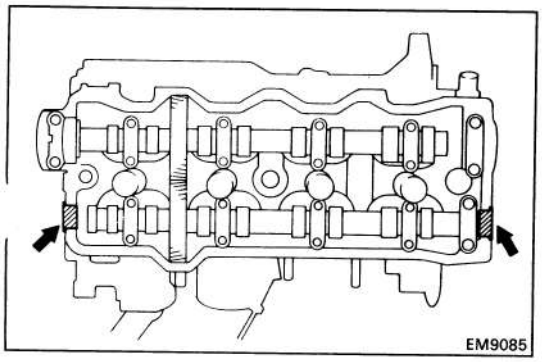


6. INSTALL SEMI-CIRCULAR PLUGS

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

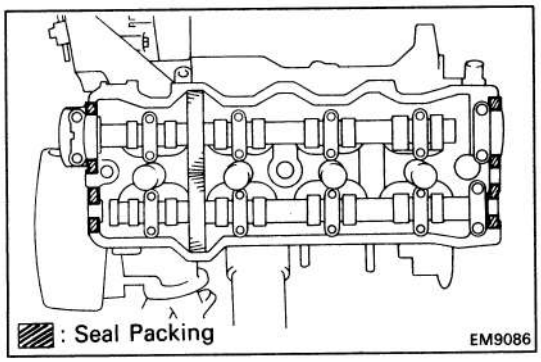
(b) Apply seal packing to the semi-circular plug grooves.

Seal packing: Part No. 08826-00080 or equivalent



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

cardiagn.com

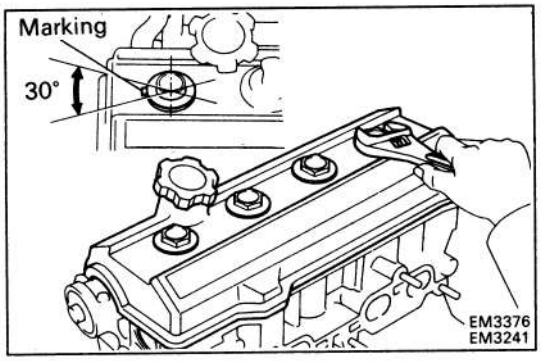


7. INSTALL CYLINDER HEAD COVER

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

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

Seal packing: Part No. 08826-00080 or equivalent

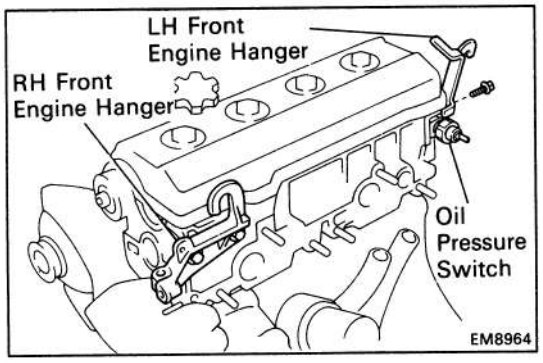


(c) Install the gasket to the head cover.

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

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

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



8. INSTALL OIL PRESSURE SWITCH

Apply adhesive to two or three threads.

Adhesive: Part No. 08833-00080, THREE BOND 1324 or equivalent

9. INSTALL RH FRONT ENGINE HANGER

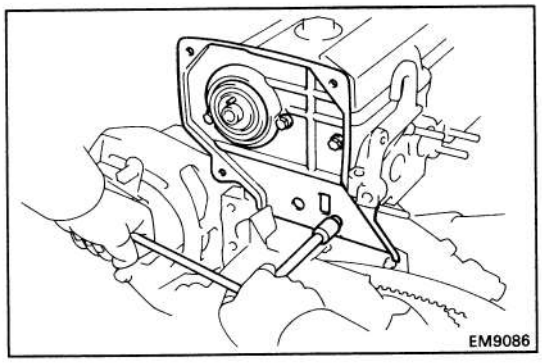
Install the engine hanger with the two bolts.

Torque: 250 kg-cm (18 ft-lb, 25 N·m)

10. INSTALL LH FRONT ENGINE HANGER

Install the engine hanger with the bolt.

Torque: 250 kg-cm (18 ft-lb, 25 N·m)



11. INSTALL NO.3 TIMING BELT COVER

Install the timing belt cover with the four bolts.

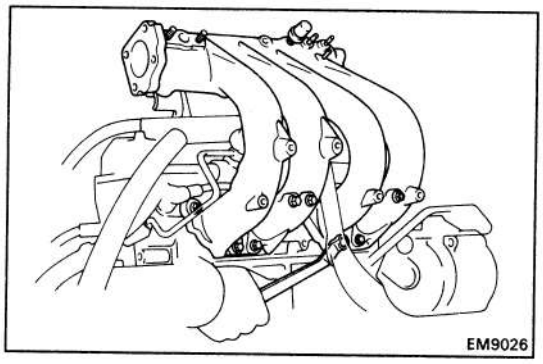
Torque: 80 kg-cm (69 in.-lb, 7.8 N·m)

12. INSTALL NO.1 IDLER PULLEY AND TENSION SPRING
(See step 4 on page EM-55)

13. INSTALL CAMSHAFT TIMING PULLEY
(See steps 9 to 17 on pages EM-56 to 59)

14. INSTALL INJECTOR AND DELIVERY PIPE
(See steps 1 and 3 to 6 on pages FI-125 to 127)

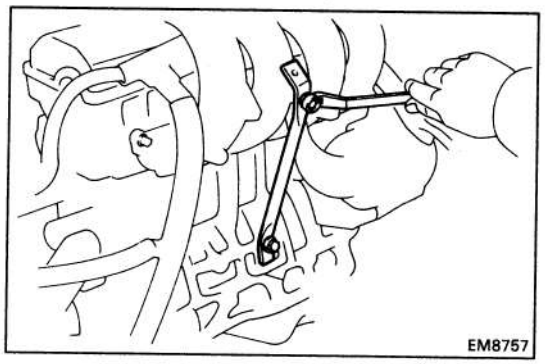
cardiagn.com



15. INSTALL INTAKE MANIFOLD

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

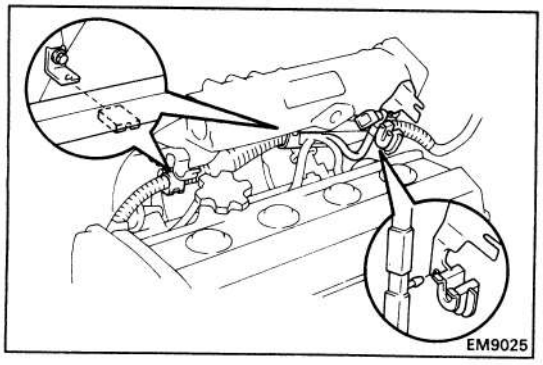
Torque: 195 kg-cm (14 ft-lb, 19 N·m)



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

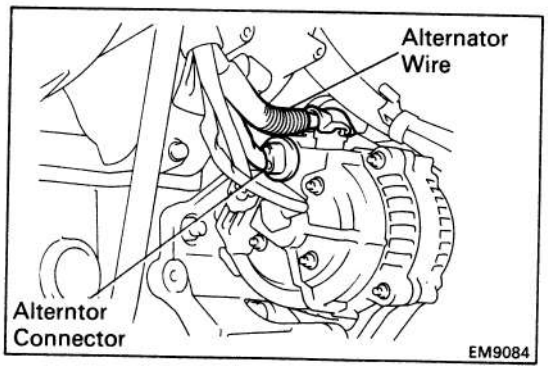
Torque:

12 mm head bolt	**195 kg-cm (14 ft-lb, 19 N·m)**
14 mm head bolt	**425 kg-cm (31 ft-lb, 42 N·m)**

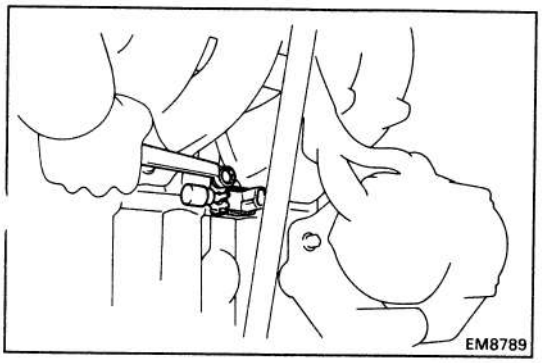


(c) Connect the two wire clamps to the wire bracket.

(d) Connect the wire clamp to the accelerator bracket.



(e) Connect the alternator connector and wire.

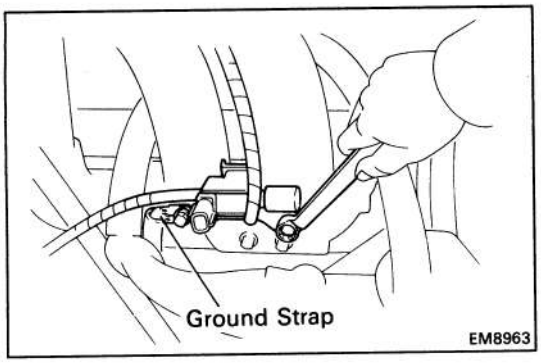


16. INSTALL EGR VSV

(a) Install the VSV with the bolt.

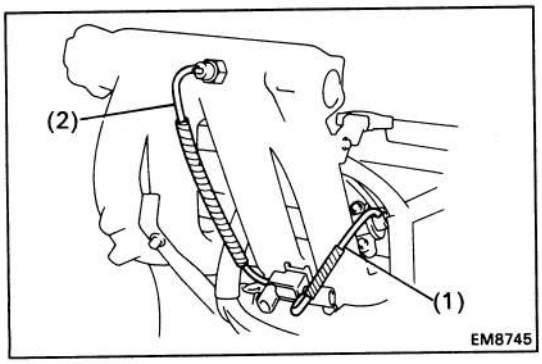
(b) Connect the VSV connector.

cardiagn.com



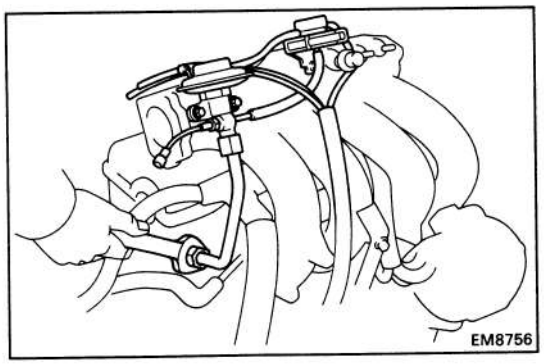
17. INSTALL FUEL PRESSURE VSV

(a) Install the VSV with the two bolts. Connect the ground strap.



(b) Connect the following hoses:
(1) Vacuum hose from fuel pressure regulator
(2) Vacuum hose from intake manifold

(c) Connect the VSV connector.



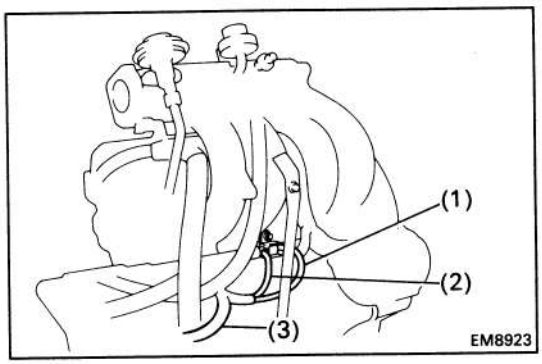
18. INSTALL EGR VALVE AND VACUUM MODULATOR

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

Torque:

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

(b) Install the EGR modulator to the clamp.



(c) Connect the following hoses:
(1) Vacuum hose (from Q port of EGR vacuum modulator) to G port of EGR VSV
(2) Vacuum hose (from EGR valve) to E port of EGR VSV
(3) Vacuum hose to charcoal canister

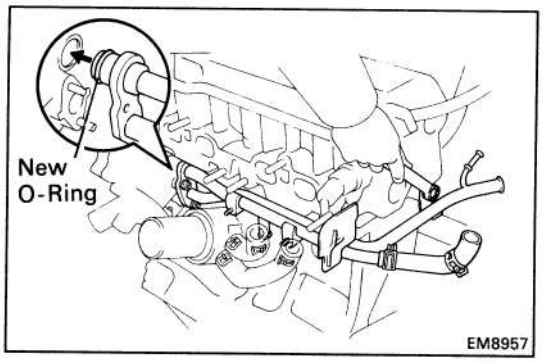
(d) (CALIF. only)
Connect the EGR gas temperature sensor connector.

19. INSTALL COLD START INJECTOR
(See steps 1 and 3 on page FI-104)

20. INSTALL COLD START INJECTOR PIPE
(See step 2 on page FI-104)

21. INSTALL THROTTLE BODY
(See steps 2 to 5 on pages FI-146 and 147)

cardiagn.com



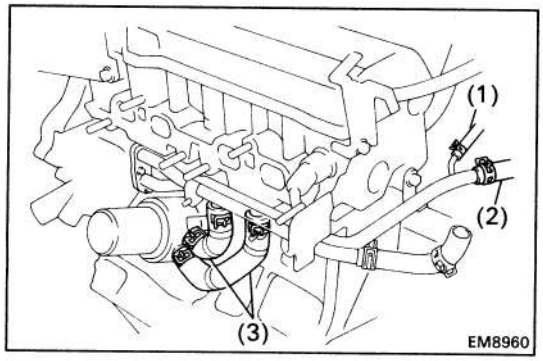
22. INSTALL WATER BY-PASS PIPE

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

(b) Apply soapy water on the O-ring.

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

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

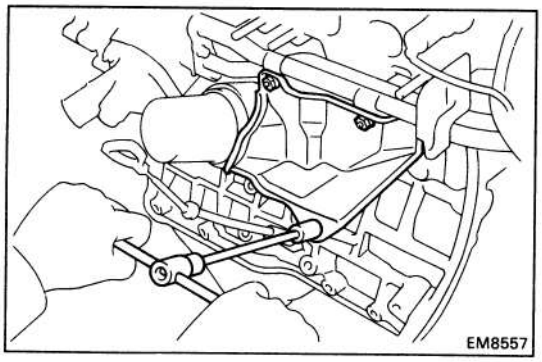


(d) Connect the following hoses:

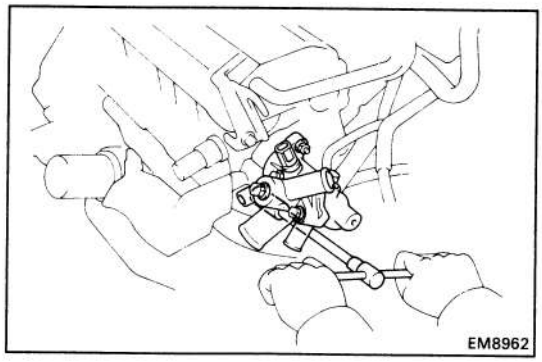
(1) ISC water by-pass hose

(2) Heater water hose

(3) Two oil cooler water by-pass hoses



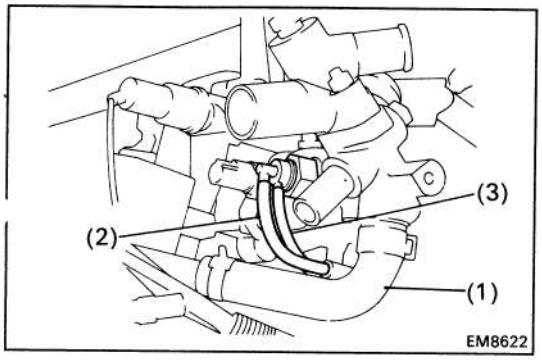
(e) Install the oil cooler heat protector with the bolt and two nuts.



23. INSTALL WATER OUTLET AND HOUSING

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

Torque: 150 kg-cm (11 ft-lb, 15 N·m)



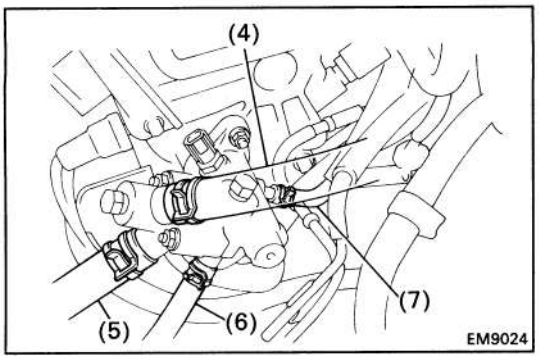
(b) Connect the following hoses:

(1) Water by-pass pipe hose

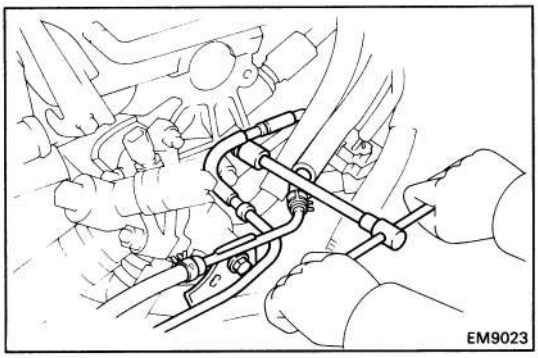
(2) EVAP BVSV vacuum hose (from P port of throttle body)

(3) EVAP BVSV vacuum hose (from charcoal canister)

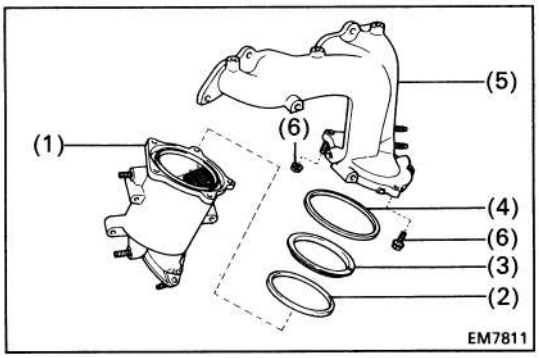
cardiagn.com



(4) Water filler hose
(5) Radiator hose
(6) Heater water hose
(7) ISC water by-pass hose



(c) Install the fuel inlet hose (with the return tube) from the water outlet and cylinder head.
(d) Connect the following connectors:
- Water temperature sender gauge connector
- Water temperature sensor connector
- Cold start injector time switch connector



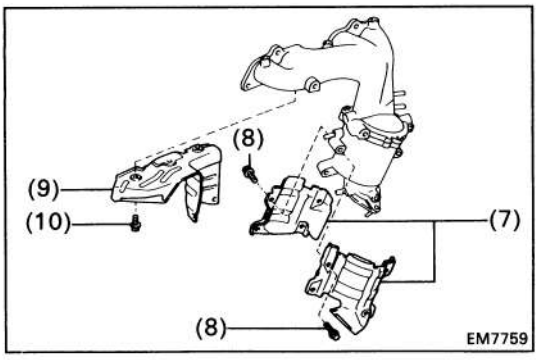
24. ASSEMBLE EXHAUST MANIFOLD AND CATALYTIC CONVERTER

Assemble the following parts:

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

Torque: 300 kg-cm (22 ft-lb, 29 N·m)

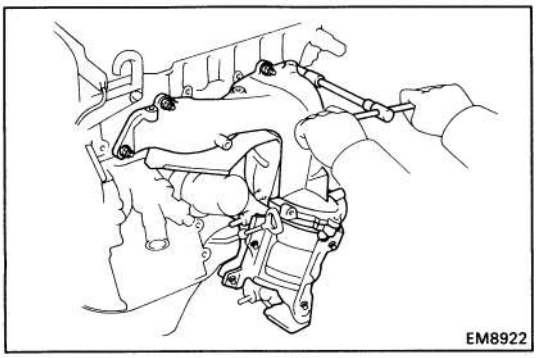
(7) Two converter heat insulators
(8) Eight bolts
(9) Manifold lower heat insulator
(10) Five bolts



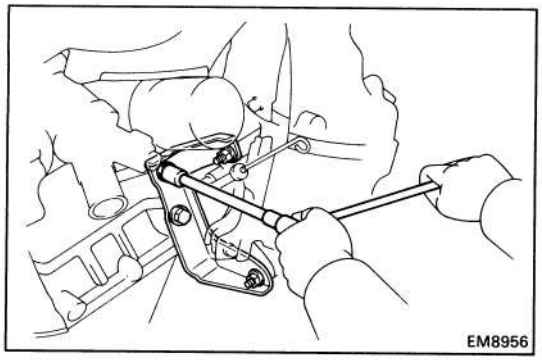
25. INSTALL EXHAUST MANIFOLD AND CATALYTIC CONVERTER ASSEMBLY

(a) Install a new gasket, the exhaust manifold and catalytic converter assembly with the new six nuts.

Torque: 500 kg-cm (36 ft-lb, 49 N·m)

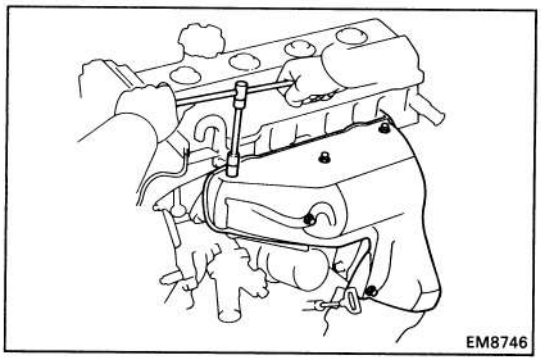


cardiagn.com



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

Torque: 425 kg-cm (31 ft-lb, 42 N·m)



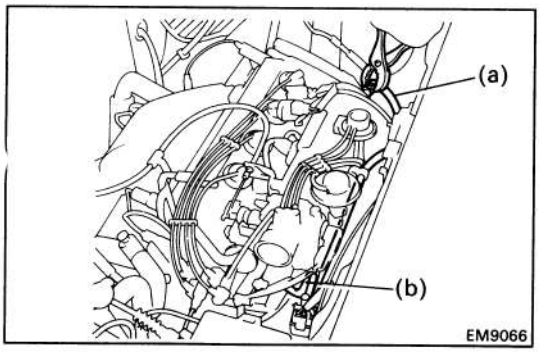
(c) Install the manifold upper heat insulator with the six bolts.

(d) Connect the oxygen sensor (main) connector.

(e) (CALIF. only)
Connect the sub-oxygen sensor connector.

26. INSTALL FRONT EXHAUST PIPE
(See step 15 on page EM-197)

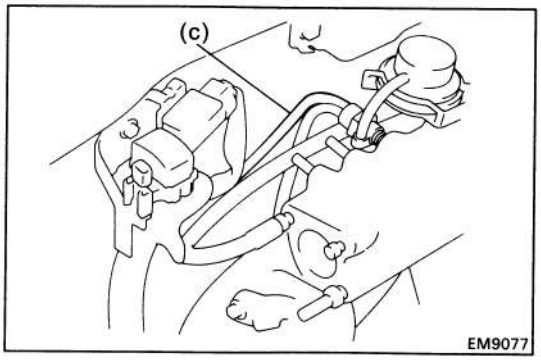
27. INSTALL DISTRIBUTOR
(See steps 1 to 4 on page IG-21 and 22)



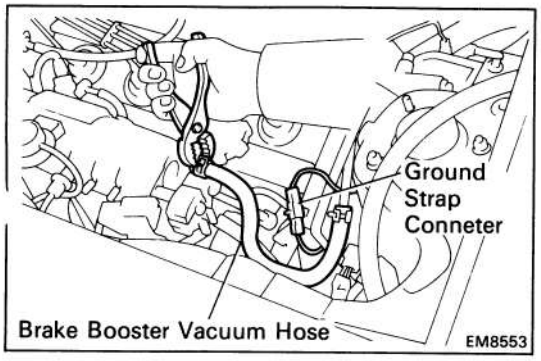
28. CONNECT VACUUM HOSES

(a) A/C VSV vacuum hose from intake manifold

(b) A/C VSV air hose from ISC valve



(c) Vacuum sensor hose from intake manifold



(d) Brake booster vacuum hose from intake manifold

29. CONNECT GROUND STRAP CONNECTOR

cardiagn.com

30. **INSTALL AIR CLEANER CAP**
(See page 35 on page EM-226)

31. **INSTALL CRUISE CONTROL ACTUATOR (w/ CRUISE CONTROL SYSTEM) AND ACCELERATOR LINKAGE**
(See step 33 on page EM-225)

32. **INSTALL ACCELERATOR CABLE, AND ADJUST IT**

33. **(A/T)**
CONNECT THROTTLE CABLE, AND ADJUST IT

34. **INSTALL SUSPENSION UPPER BRACE**
(See step 36 on page EM-226)

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

36. **FILL WITH ENGINE COOLANT (See page CO-7)**
Capacity (w/ Heater):
13.0 liters (13.7 US qts, 11.4 Imp. qts)

37. **START ENGINE AND CHECK FOR LEAKS**

38. **ADJUST IGNITION TIMING**
(See steps 9 to 13 on pages IG-21 and 22)
Ignition timing:
10°BTDC @ idle
(w/ Terminals TE1 and E1 connected)

39. **INSTALL ENGINE HOOD SIDE PANELS**

40. **INSTALL ENGINE UNDER COVER**

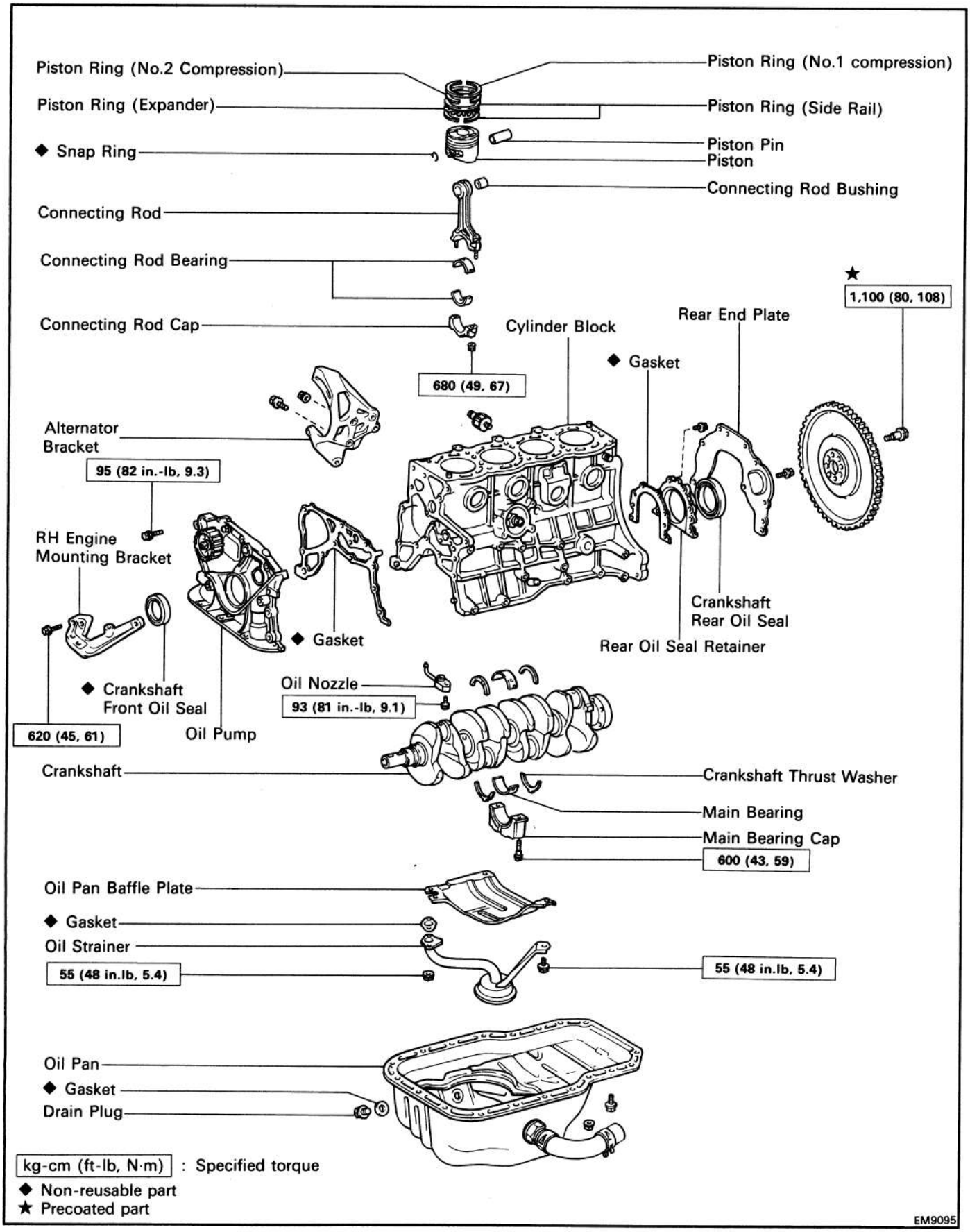
41. **PERFORM ROAD TEST**
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

42. **RECHECK ENGINE COOLANT LEVEL AND OIL LEVEL**

cardiagn.com

CYLINDER BLOCK (3S-GTE)

COMPONENTS



cardiagn.com

REMOVAL OF ENGINE

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**

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

2. **REMOVE ENGINE HOOD**

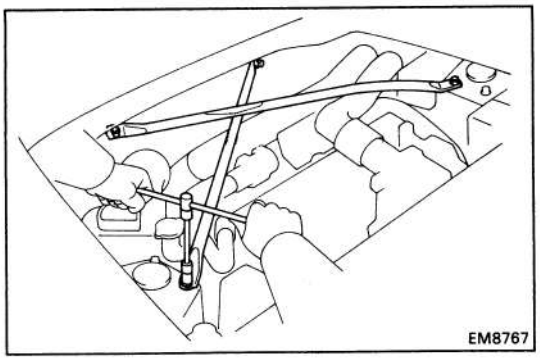
3. **REMOVE ENGINE HOOD SIDE PANELS**

4. **REMOVE ENGINE UNDER COVERS**

5. **DRAIN ENGINE COOLANT (See page CO-6)**

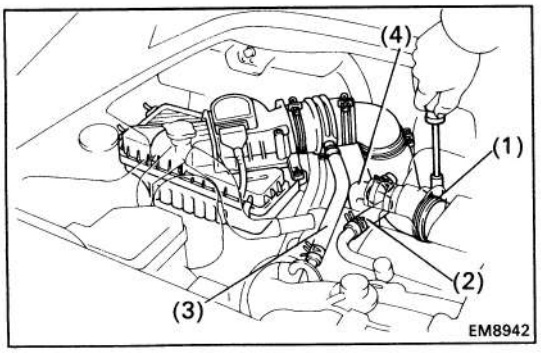
6. **DRAIN ENGINE OIL (See page LU-7)**

7. **DRAIN TRANSAXLE OIL**

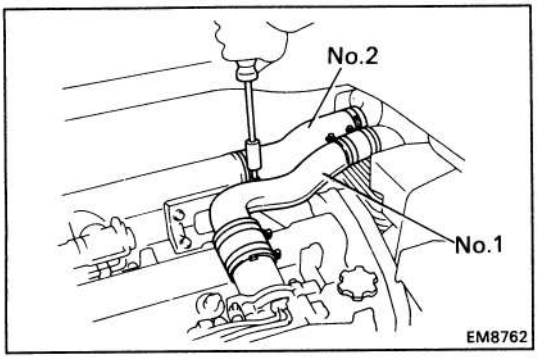


8. **REMOVE SUSPENSION UPPER BRACE**

   Remove the two bolts, two nuts and upper brace.



9. **REMOVE AIR CLEANER**
   (a) Disconnect the air flow meter connector.
   (b) Disconnect the four air cleaner cap clips.
   (c) Disconnect the following hoses:
      (1) Air cleaner hose from turbocharger
      (2) PCV hose from cylinder head cover
      (3) Air hose from No.2 air tube
      (4) Air hose from air by-pass valve
   (d) Remove the air cleaner cap, air flow meter assembly and element.
   (e) Remove the three bolts and air cleaner case.

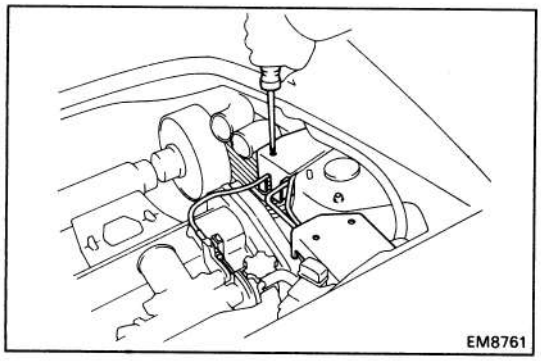


10. **REMOVE NO.1 AIR INTAKE CONNECTOR**

11. **REMOVE NO.2 AIR INTAKE CONNECTOR**

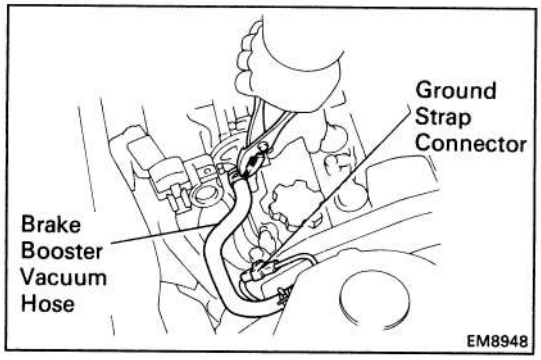
12. **DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY**

cardiagn.com



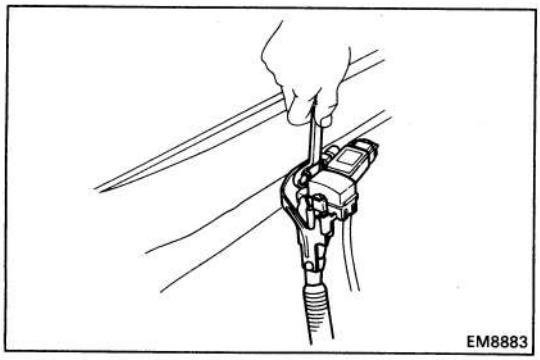
13. REMOVE CRUISE CONTROL ACTUATOR (w/ CRUISE CONTROL SYSTEM) AND LINKAGE

(a) Remove the two screws and actuator cover.
(b) Remove the screw and accelerator linkage cover.
(c) Remove the three bolts and actuator.
(d) Disconnect the actuator connector
(e) Remove the three bolts and accelerator linkage.
(f) Disconnect the cable from the accelerator linkage.

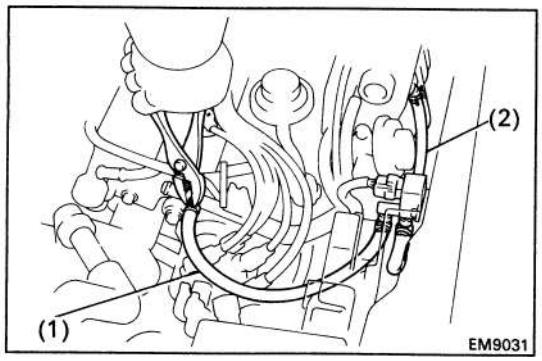


14. DISCONNECT BRAKE BOOSTER VACUUM HOSE

15. DISCONNECT GROUND STRAP CONNECTOR



16. REMOVE CHECK CONNECTOR AND TURBOCHARGING PRESSURE SENSOR

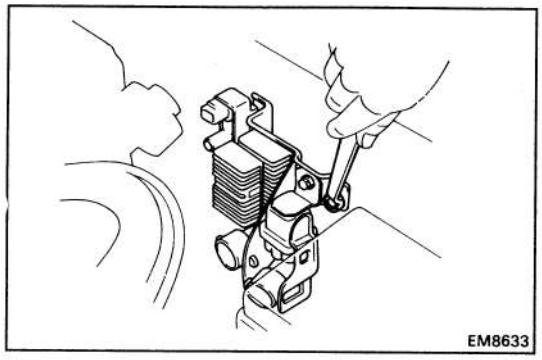


17. REMOVE INJECTOR SOLENOID RESISTOR, FUEL PUMP RELAY, FUEL PUMP RESISTOR AND A/C VSV

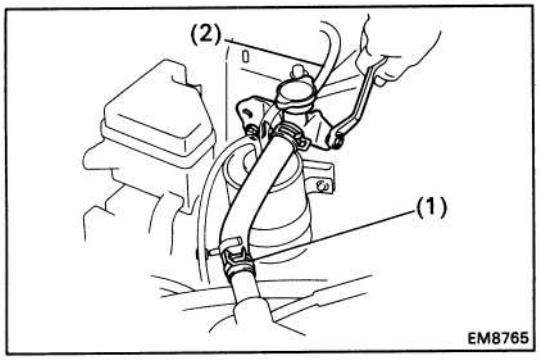
(a) Disconnect the following connectors:
- Solenoid resistor connector
- Fuel pump relay connector
- Fuel pump resistor connector
- A/C VSV connector

(b) Disconnect the following hoses:
(1) A/C VSV air hose from No.2 air tube
(2) A/C VSV vacuum hose from intake manifold

(c) Remove the two bolts, A/C VSV, the solenoid resistor and fuel pump relay, fuel pump resistor assembly.



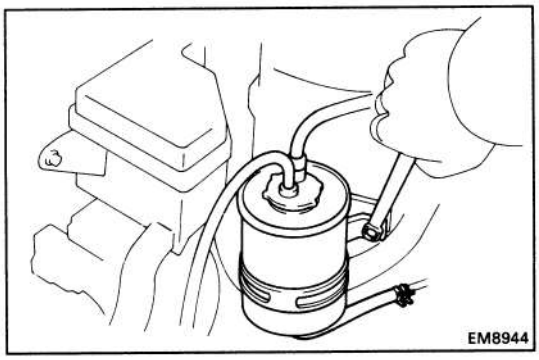
cardiagn.com



18. REMOVE WATER FILLER

(a) Disconnect the following hose:
  (1) Water filler hose
  (2) Coolant reservoir hose

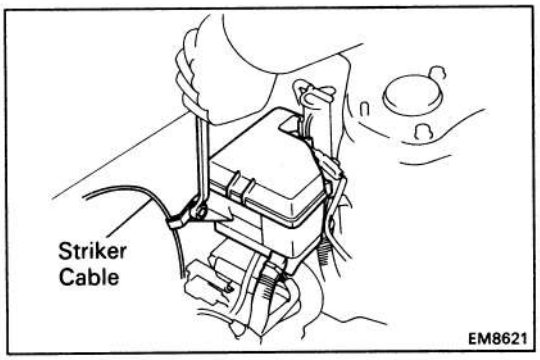
(b) Remove the two bolts and water filler.



19. REMOVE CHARCOAL CANISTER

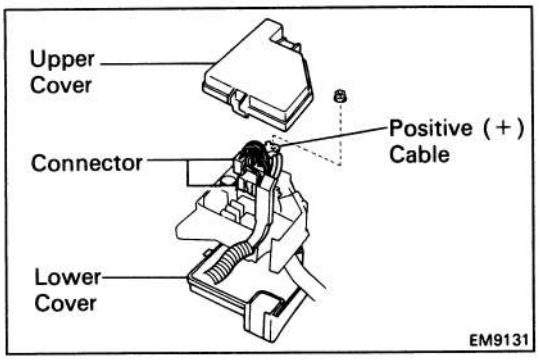
(a) Disconnect the three vacuum hoses.

(b) Remove the two bolts and charcoal canister.



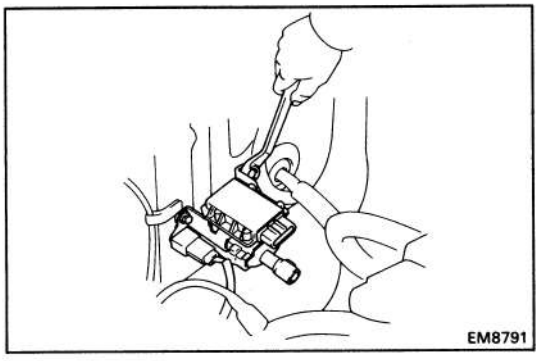
20. REMOVE ENGINE RELAY BOX, AND DISCONNECT ENGINE WIRE

(a) Remove the two bolts and relay box. Disconnect the luggage compartment striker cable



(b) Remove the upper and lower covers from the relay box.

(c) Disconnect the positive (+) cable and two connectors of the engine wire from the relay box.



21. REMOVE IGNITION COIL AND IGNITER

(a) Disconnect the ignition coil connector.

(b) Disconnect the igniter connector.

(c) Disconnect the high-tension cord.

(d) Remove the two bolts, the ignition coil and igniter assembly. Disconnect the noise filter.

cardiagn.com

22. DISCONNECT ENGINE WIRE FROM LUGGAGE COMPARTMENT

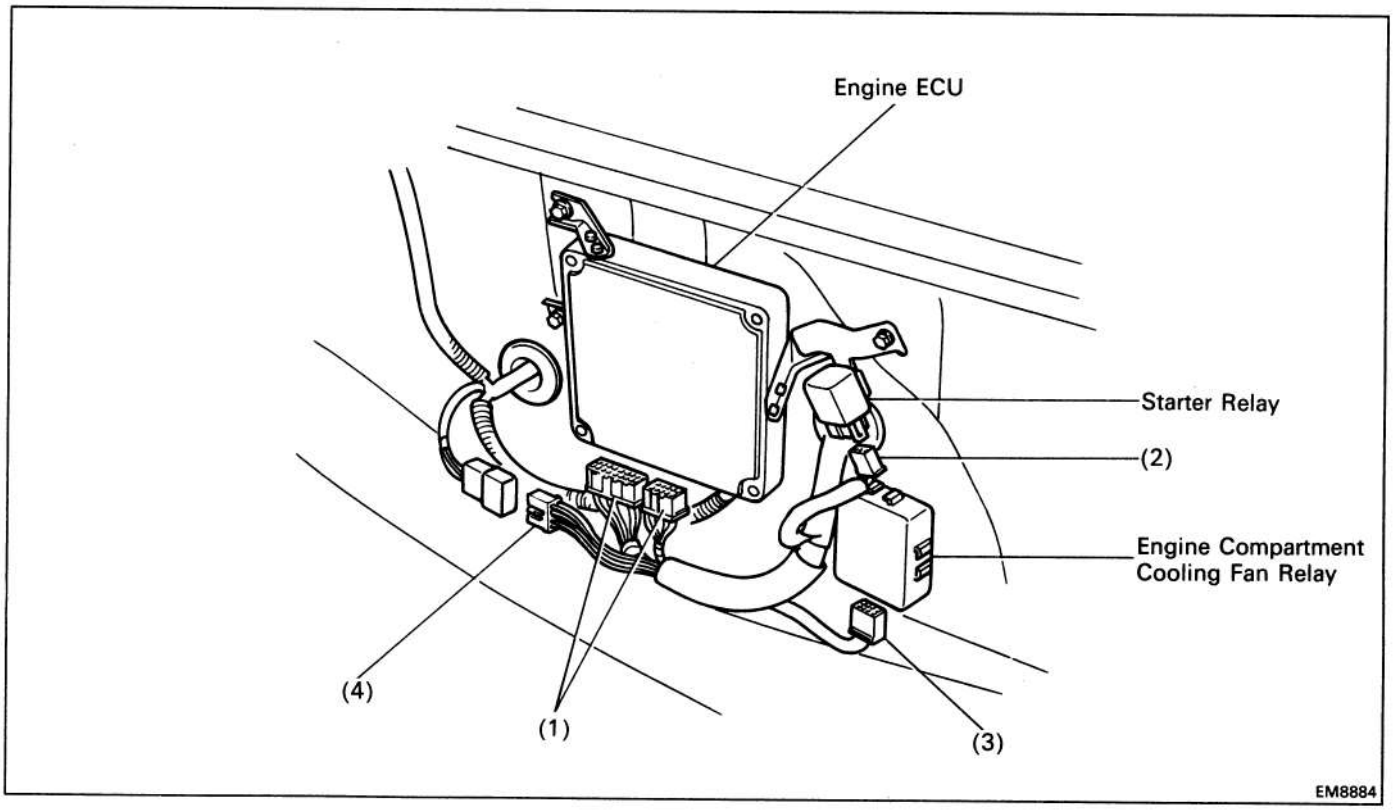
(a) Disconnect the following connectors:

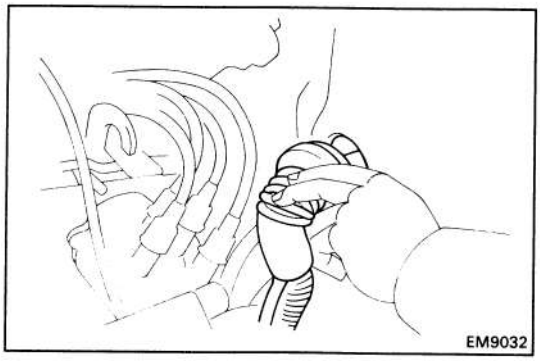
(1) Two engine ECU connectors

(2) Starter relay connector

(3) Engine compartment cooling fan relay connector

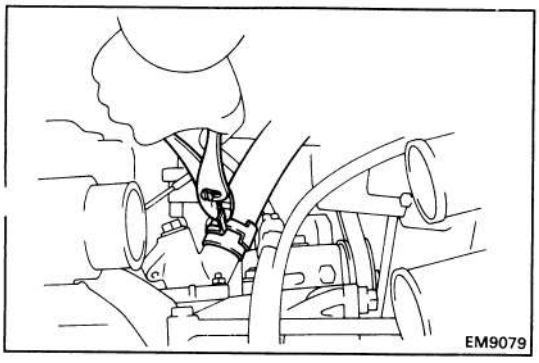
(4) Engine compartment wire connector





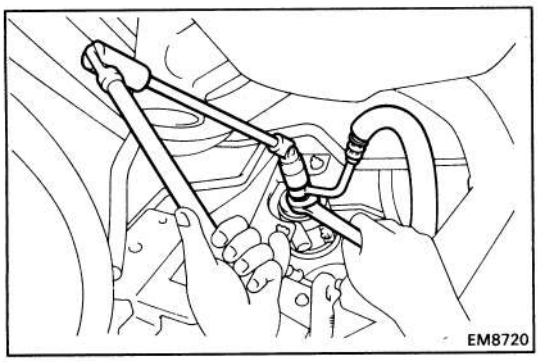
(b) Pull out the engine wire from the luggage compartment.

23. DISCONNECT STARTER CABLE



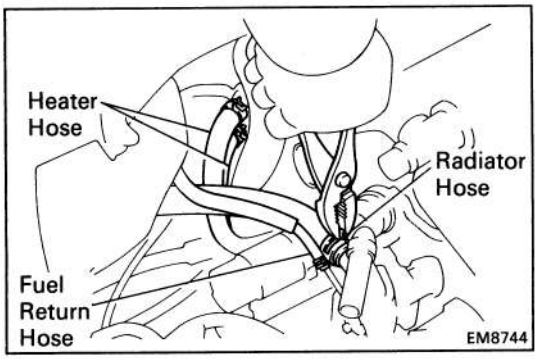
24. DISCONNECT RADIATOR HOSE FROM WATER INLET

cardiagn.com



25. DISCONNECT FUEL INLET HOSE

CAUTION: Catch leaking fuel in a container.

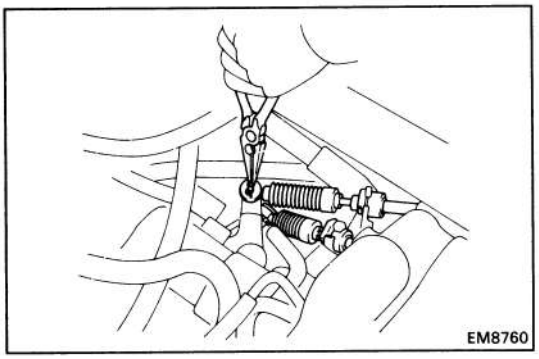


26. DISCONNECT FUEL RETURN HOSE

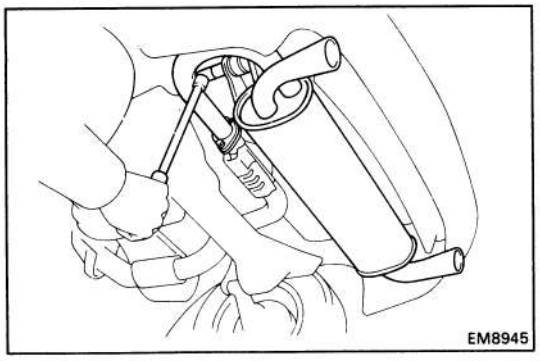
CAUTION: Catch leaking fuel in a container.

27. DISCONNECT RADIATOR HOSE FROM WATER OUTLET HOUSING

28. DISCONNECT HEATER HOSES



29. DISCONNECT TRANSAXLE CONTROL CABLES FROM TRANSAXLE

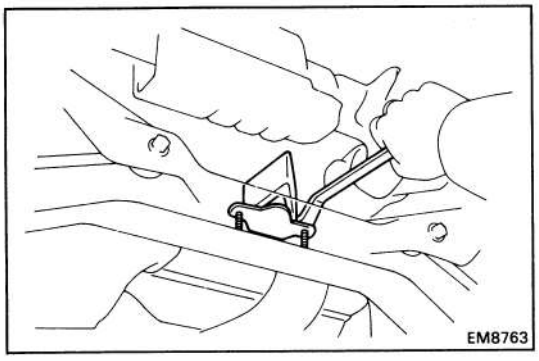


30. REMOVE TAILPIPE

(a) Remove the two bolts holding the front exhaust pipe to the tailpipe stopper bracket.

(b) Remove the two bolts holding the front exhaust pipe to the tailpipe. Remove the gasket.

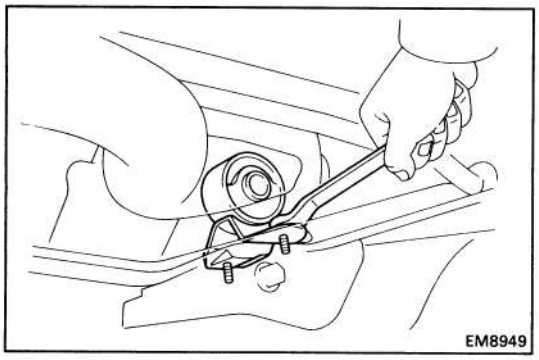
(c) Remove the two through bolts holding the tailpipe to the tailpipe bracket.



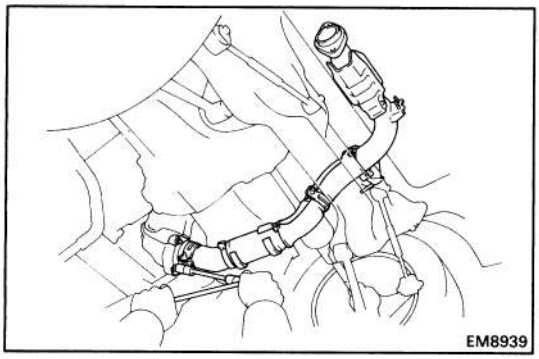
31. REMOVE FRONT EXHAUST PIPE

(a) Remove the two bolts and damper.

cardiagn.com

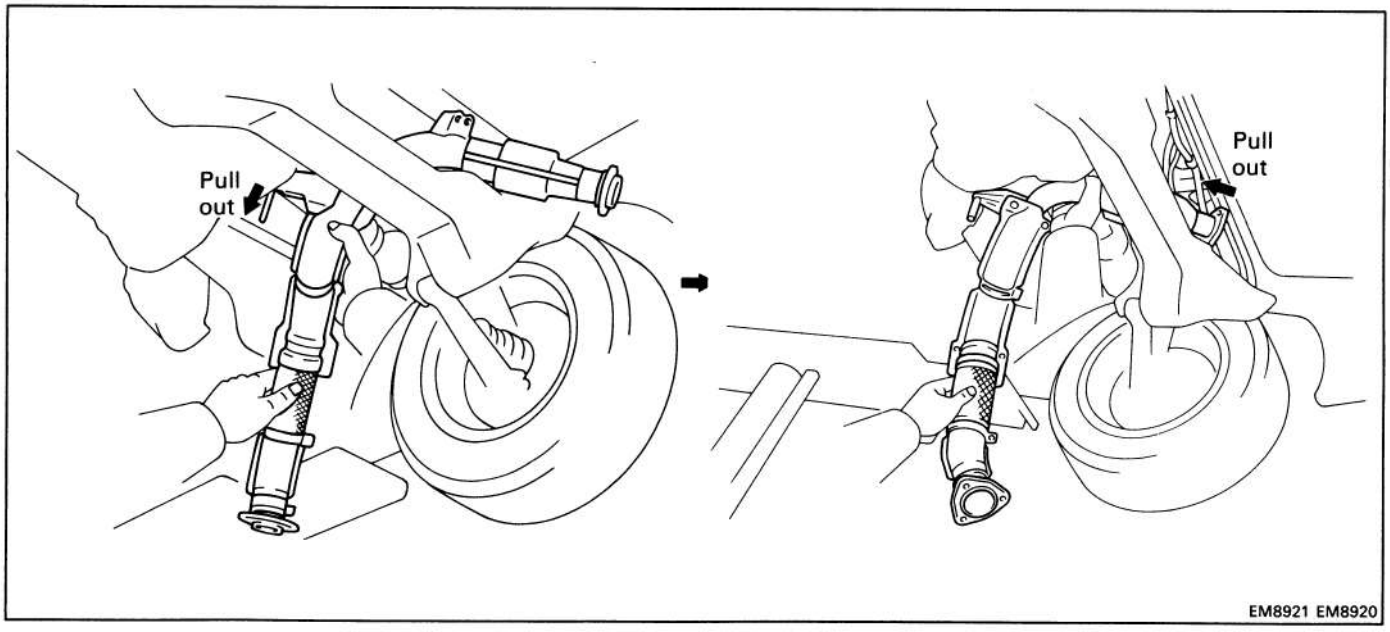


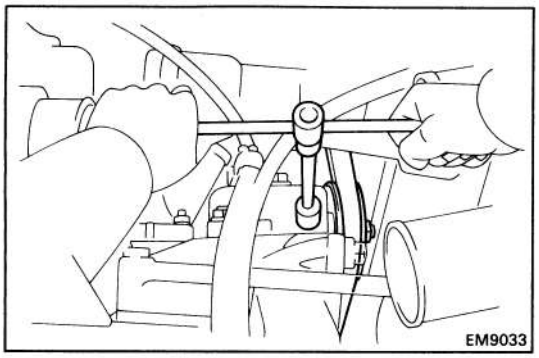
(b) Remove the two bolts and support bracket.



(c) Using a 14 mm deep socket wrench, remove the three nuts, exhaust pipe and gasket.

HINT: Passing the exhaust pipe rear side between the body and suspension crossmember is not easy, so follow the method shown in the illustration.



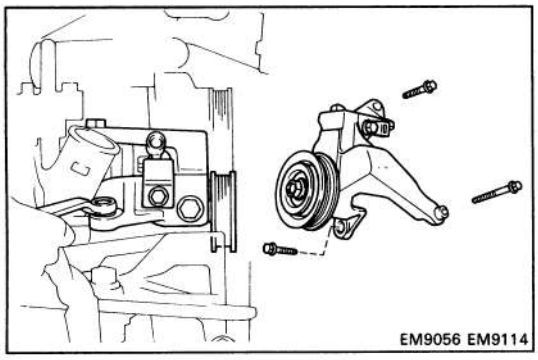


32. REMOVE ENGINE COMPARTMENT COOLING FAN (See steps 4 and 5 on page CO-34)

33. REMOVE IDLER PULLEY BRACKET AND A/C COMPRESSOR WITHOUT DISCONNECTING HOSES

(a) Disconnect the idler pulley bolt and adjusting bolt, and remove the drive belt.

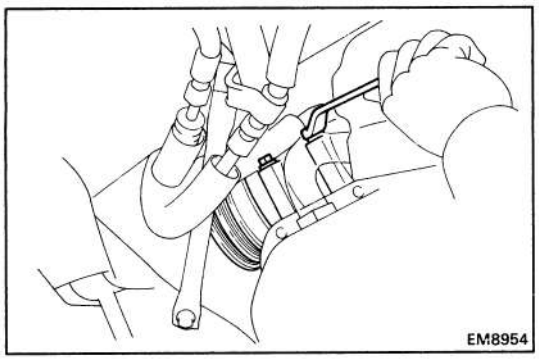
cardiagn.com



(b) Disconnect the A/C compressor connector.

(c) Remove the bolt and the wire clamp of the A/C compressor.

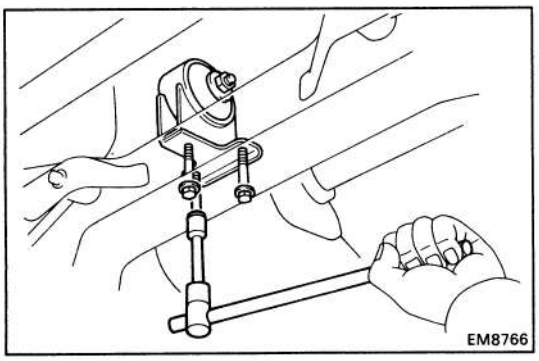
(d) Remove the three bolts and idler pulley bracket.



(e) Remove the two bolts, and disconnect the A/C compressor from the engine.

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

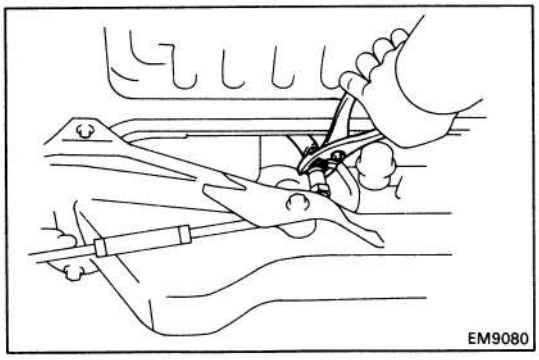
34. REMOVE INTERCOOLER
(See steps 8 to 12 (a) and 13 on pages TC-21 and 22)



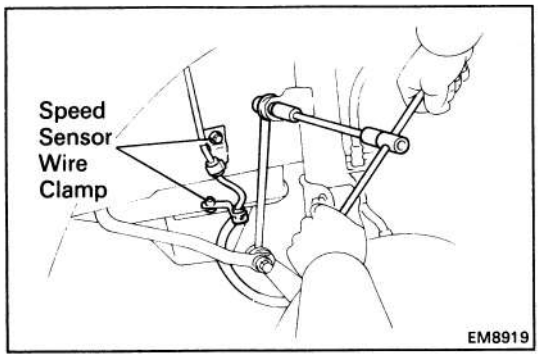
35. REMOVE REAR ENGINE MOUNTING INSULATOR

(a) Remove the through bolt holding the mounting insulator to the mounting bracket.

(b) Remove the three bolts and mounting insulator.



36. DISCONNECT SPEEDOMETER CABLE



37. REMOVE REAR SUSPENSION CROSSMEMBER

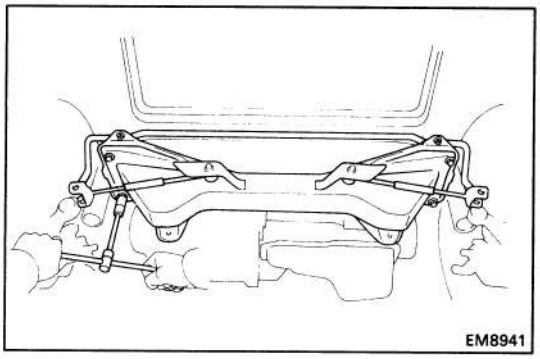
(a) Remove the nut, and disconnect the stabilizer link from the shock absorber.

(b) Remove the bolt, and disconnect the wire clamp of the ABS speed sensor from the body.

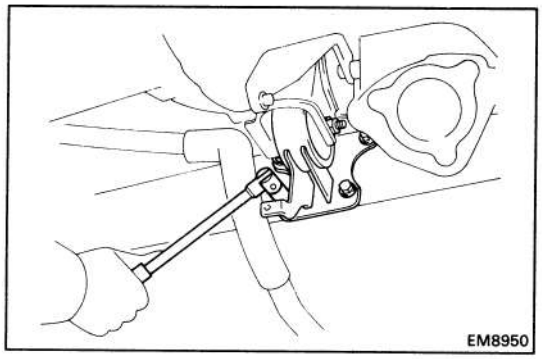
(c) Remove the lower suspension arms.
(See page SA-76)

(d) Remove the drive shafts.
(See page SA-53 and 54)

cardiagn.com



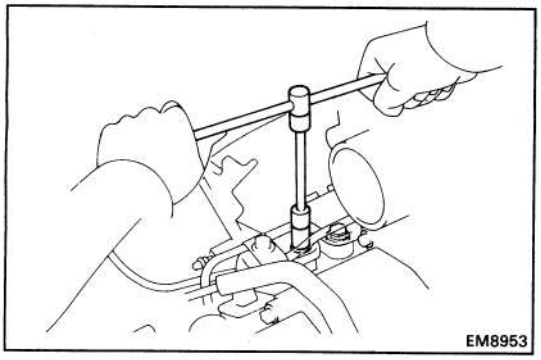
(e) Remove the four bolts and lower crossmember.



38. REMOVE FRONT ENGINE MOUNTING INSULATOR

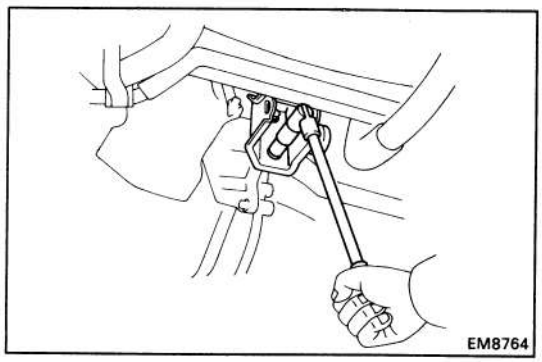
(a) Remove the through bolt and nut holding the mounting insulator to the mounting bracket.

(b) Remove the four bolts and mounting insulator.

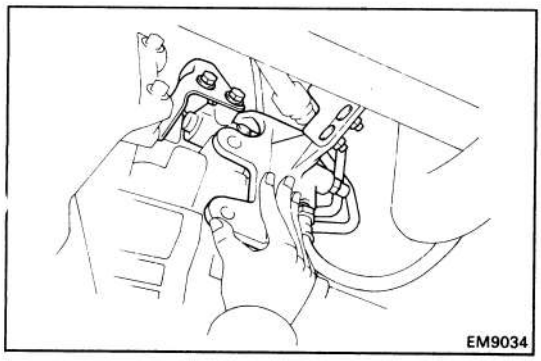


39. REMOVE FRONT ENGINE MOUNTING BRACKET AND CLUTCH RELEASE CYLINDER

(a) Remove the bolt and nut holding the clutch release cylinder to the transaxle.

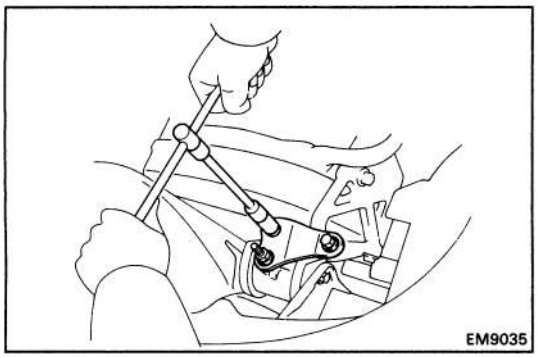


(b) Remove the two bolts and mounting bracket.



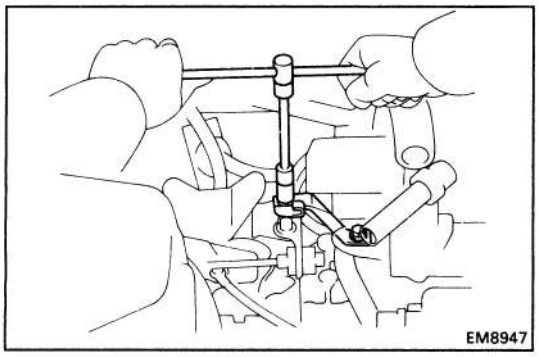
(c) Disconnect the clutch release cylinder without disconnecting the tubes.

cardiagn.com



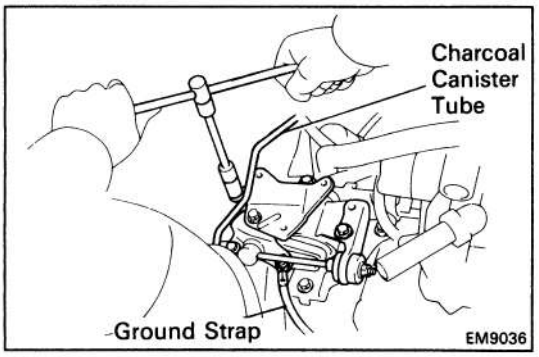
40. REMOVE RH ENGINE MOUNTING STAY

Remove the two bolts, nut and mounting stay.



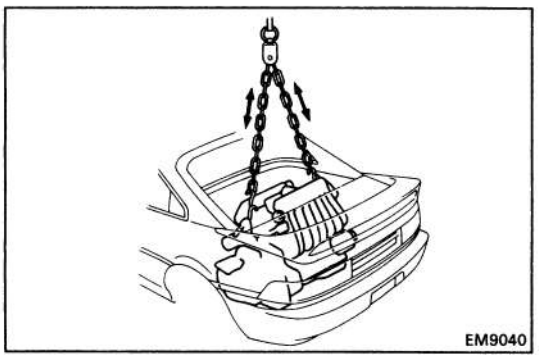
41. REMOVE LH ENGINE MOUNTING STAY

Remove the two bolts speedometer cable clamp and mounting stay.



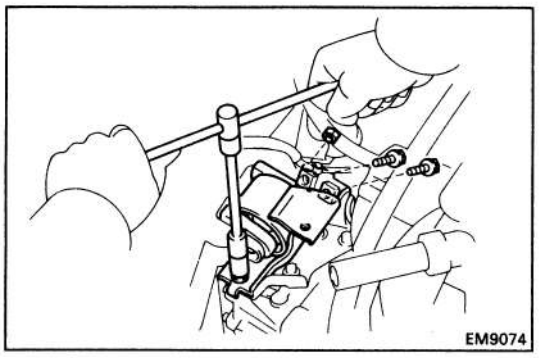
42. REMOVE LATERAL CONTROL ROD AND AIR CLEANER CASE BRACKET

Remove the five bolts, the control rod and case bracket. Disconnect the charcoal canister tube and ground strap (from the transaxle).



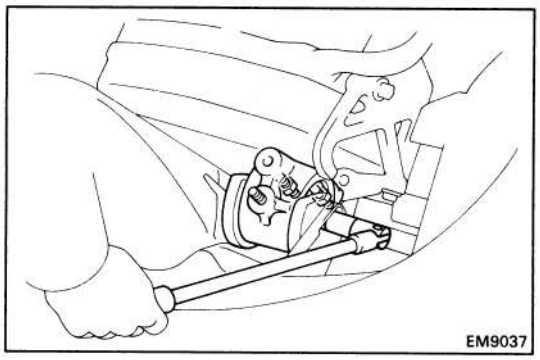
43. REMOVE ENGINE AND TRANSAXLE ASSEMBLY FROM VEHICLE

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

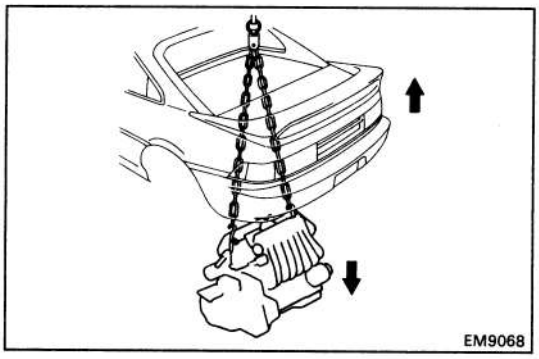


(b) Remove the through bolt, nut, three bolts and LH mounting insulator.

cardiagn.com



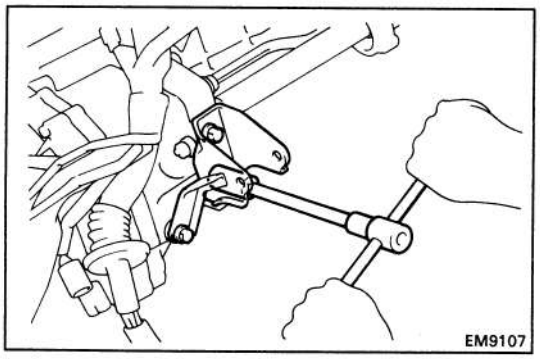
(c) Remove the through bolt, two nuts and RH mounting insulator.



(d) Lower the engine out of the vehicle slowly and carefully, and raise the engine.

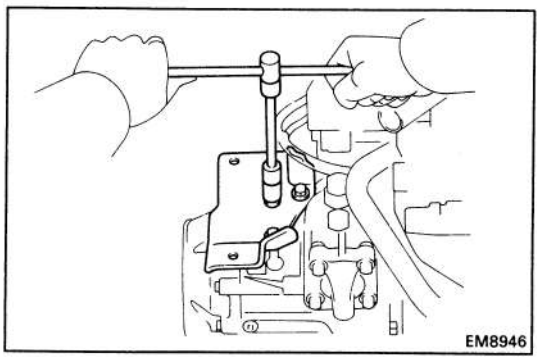
HINT: Make sure the engine is clear of all wiring, hoses and cables.

(e) Place the engine and transaxle assembly onto the stand.



44. REMOVE ENGINE REAR ENGINE MOUNTING BRACKET

Remove the six bolts and mounting bracket.



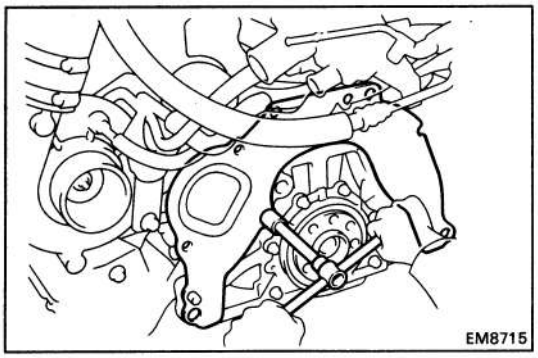
45. REMOVE LH ENGINE MOUNTING BRACKET

Remove the three bolts and mounting bracket.

46. REMOVE STARTER (See page ST-4)

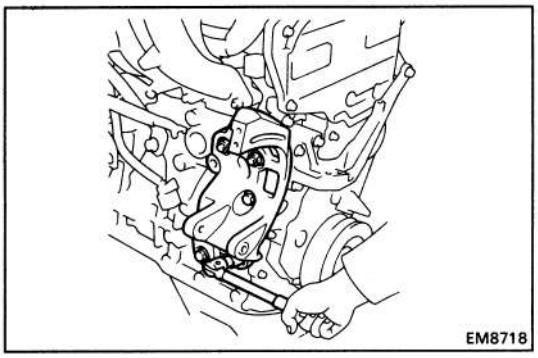
47. SEPARATE ENGINE AND TRANSAXLE (See pages MT-5 and 6)

cardiagn.com

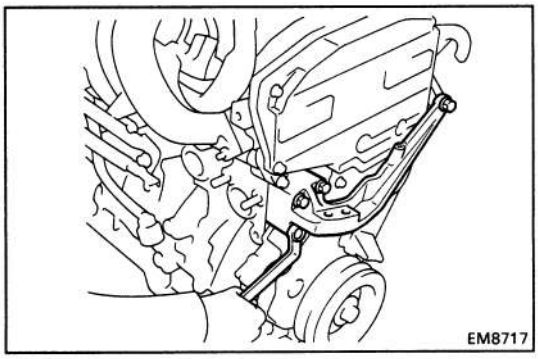


PREPARATION FOR DISASSEMBLY

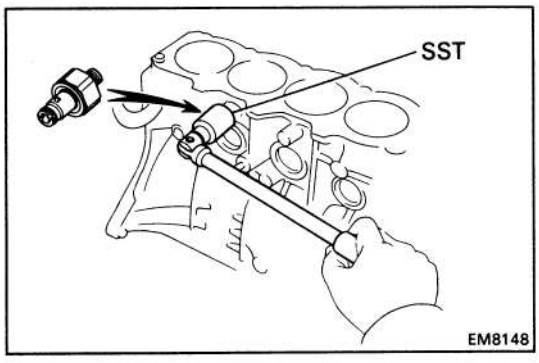
1. **REMOVE CLUTCH COVER AND DISC**
2. **REMOVE FLYWHEEL**
3. **REMOVE REAR END PLATE**
   Remove the bolt and end plate.
4. **INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY**



5. **REMOVE ALTERNATOR (See page CH-6)**
6. **REMOVE ALTERNATOR BRACKET**
   Remove the three bolts, two nuts and mounting bracket.

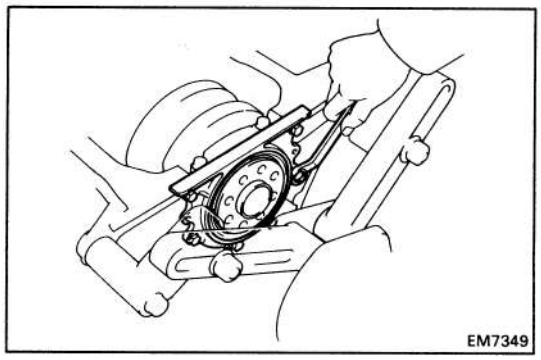


7. **REMOVE RH ENGINE MOUNTING BRACKET**
   Remove the four bolts and mounting bracket.
8. **REMOVE TIMING BELT AND PULLEYS (See pages EM-28 to 32)**
9. **REMOVE TURBOCHARGER (See pages TC-9 to 12)**
10. **REMOVE CYLINDER HEAD (See pages EM-63 to 71)**
11. **REMOVE WATER PUMP (See page CO-11)**
12. **REMOVE OIL PAN AND OIL PUMP (See pages LU-11 and 12)**
13. **REMOVE OIL FILTER (See page LU-7)**
14. **REMOVE OIL COOLER (See page LU-19)**



15. **REMOVE KNOCK SENSOR**
    Using SST, remove the knock sensor.
    SST 09816-30010

cardiagn.com

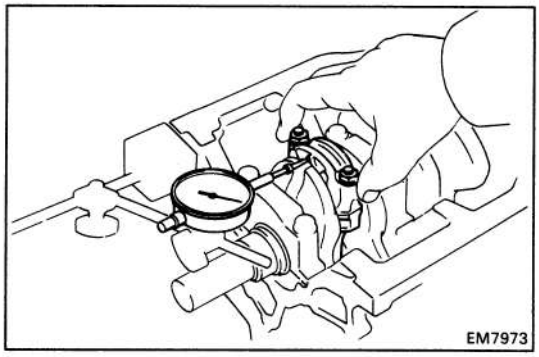


DISASSEMBLY OF CYLINDER BLOCK

(See page EM-133)

1. **REMOVE REAR OIL SEAL RETAINER**

Remove the six bolts, retainer and gasket.



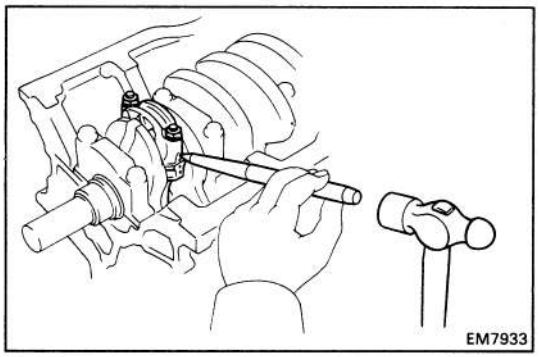
2. **CHECK CONNECTING ROD THRUST CLEARANCE**

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.)**

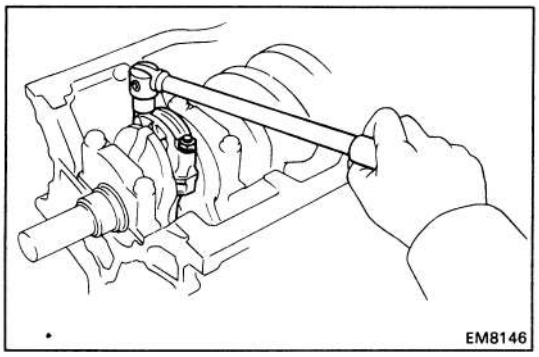
Maximum thrust clearance: **0.35 mm (0.0138 in.)**

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

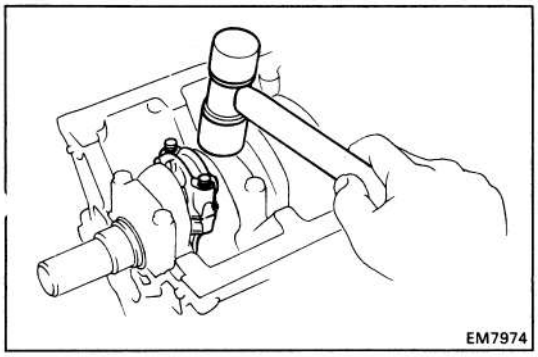


3. **REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE**

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



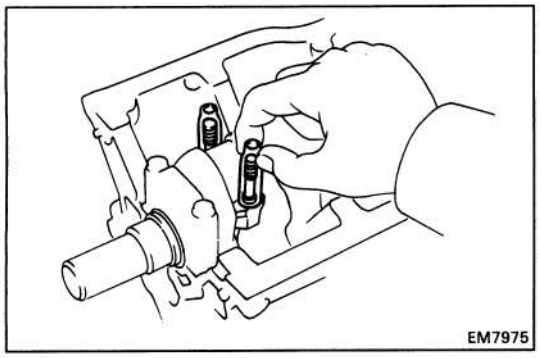
(b) Remove the connecting rod cap nuts.



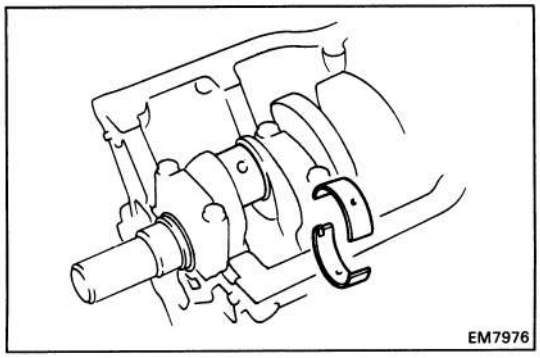
(c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

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

cardiagn.com



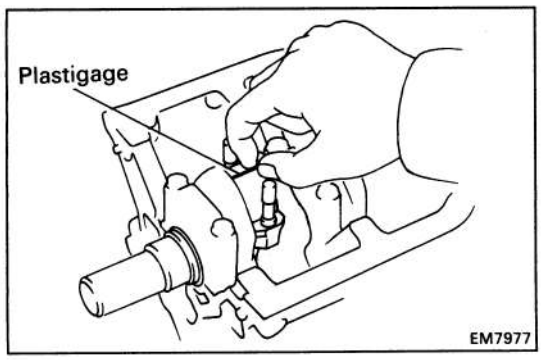
(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



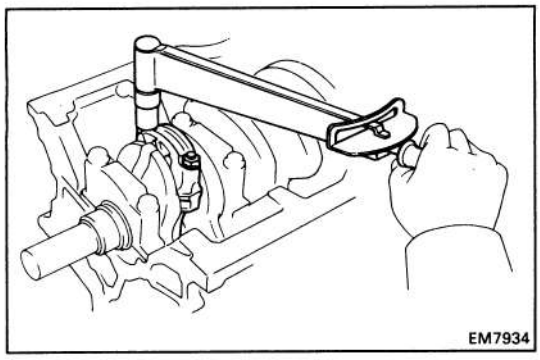
(e) Clean crank pin and bearing.

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

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



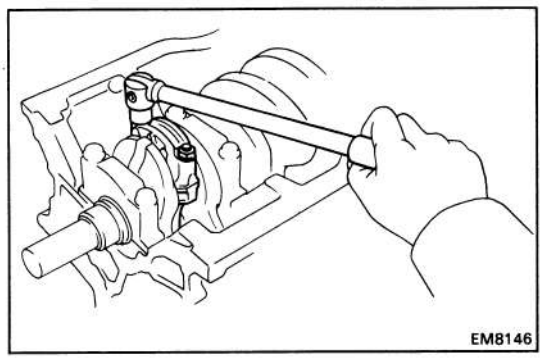
(g) Lay a strip of Plastigage across the crank pin.



(h) Install the connecting rod cap.
(See step 7 on page EM-166)

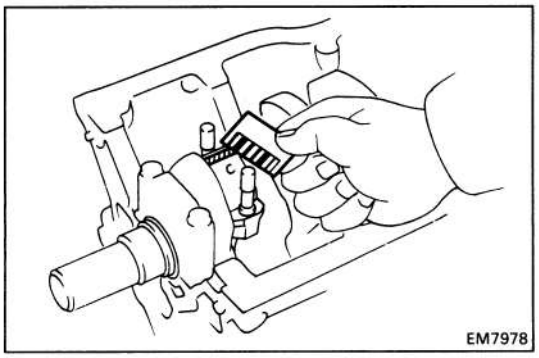
Torque: 680 kg-cm (49 ft-lb, 67 N·m)

NOTICE: Do not turn the crankshaft.



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

cardiagn.com


EM7978

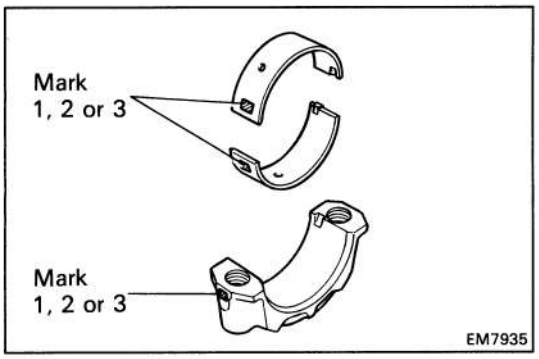
(j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD	**0.024 – 0.055 mm (0.0009 – 0.0022 in.)**
U/S 0.25	**0.023 – 0.069 mm (0.0009 – 0.0027 in.)**

Maximum oil clearance: 0.08 mm (0.0031 in.)

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



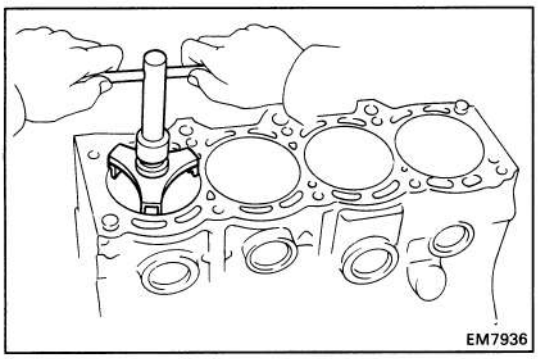
EM7935

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

Standard sized bearing center wall thickness:

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

(k) Completely remove the Plastigage.

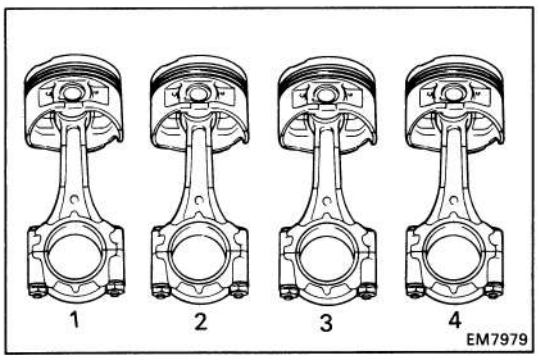

EM7936

4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

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

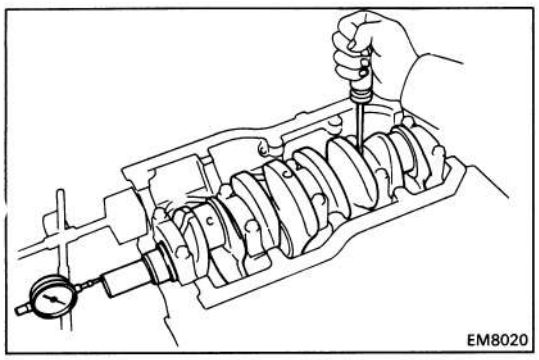
(b) Cover the connecting rod bolts.
(See page EM-146)

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



EM7979

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


EM8020

5. CHECK CRANKSHAFT THRUST CLEARANCE

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

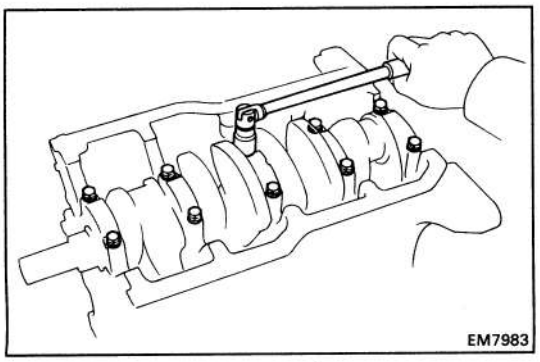
Standard thrust clearance: 0.020 – 0.220 mm (0.0008 – 0.0087 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.

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

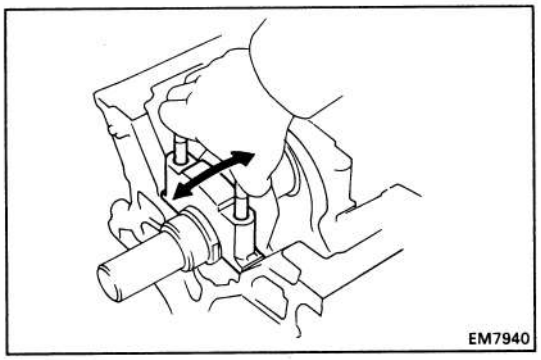
Thrust washer thickness: 2.440 – 2.490 mm (0.0961 – 0.0980 in.)

cardiagn.com



6. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

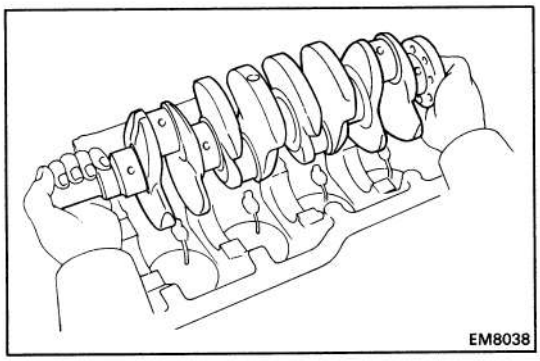
(a) Remove the main bearing cap bolts.



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

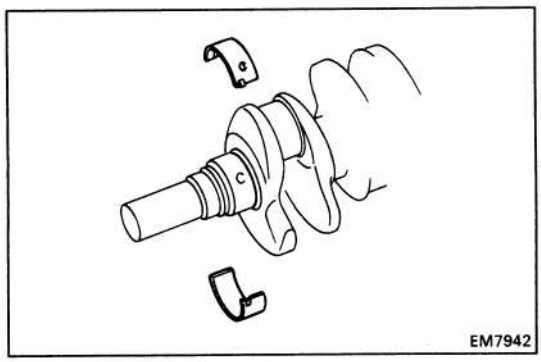
HINT:

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



(c) Lift out the crankshaft.

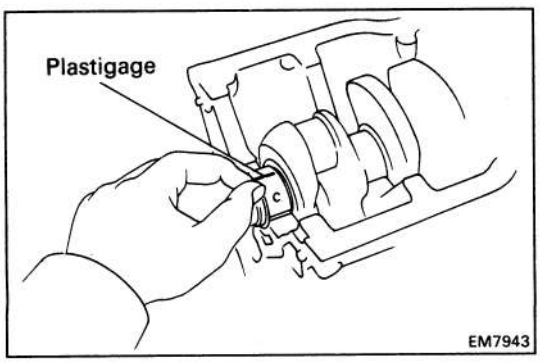
HINT: Keep the upper bearing and upper thrust washers together with the cylinder block.



(d) Clean each main journal and bearing.

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

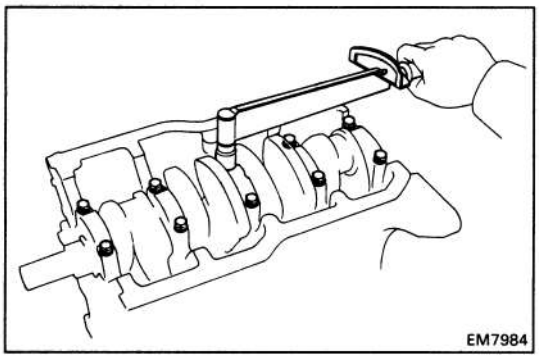
If the journal or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



(f) Place the crankshaft on the cylinder block.

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

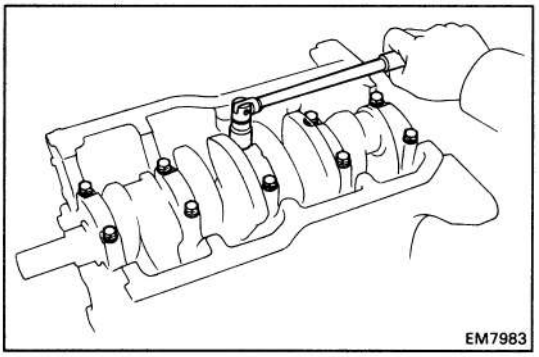
cardiagn.com



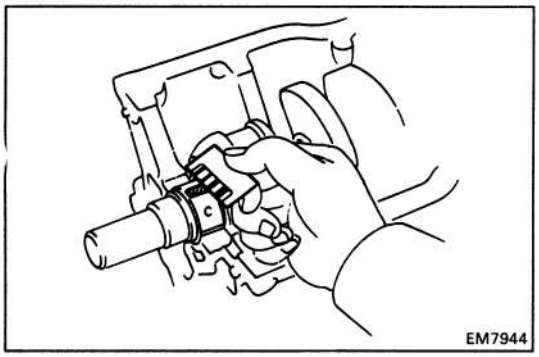
(h) Install the main bearing caps.
(See step 5 on page EM-165)

Torque: 600 kg-cm (43 ft-lb, 59 N·m)

NOTICE: Do not turn the crankshaft.



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



(j) Measure the Plastigage at its widest point.

Standard clearance:

No.3	**STD**	**0.025 – 0.044 mm (0.0010 – 0.0017 in.)**
	U/S 0.25	**0.021 – 0.061 mm (0.0008 – 0.0024 in.)**
Others	**STD**	**0.015 – 0.034 mm (0.0006 – 0.0013 in.)**
	U/S 0.25	**0.029 – 0.069 mm (0.0011 – 0.0027 in.)**

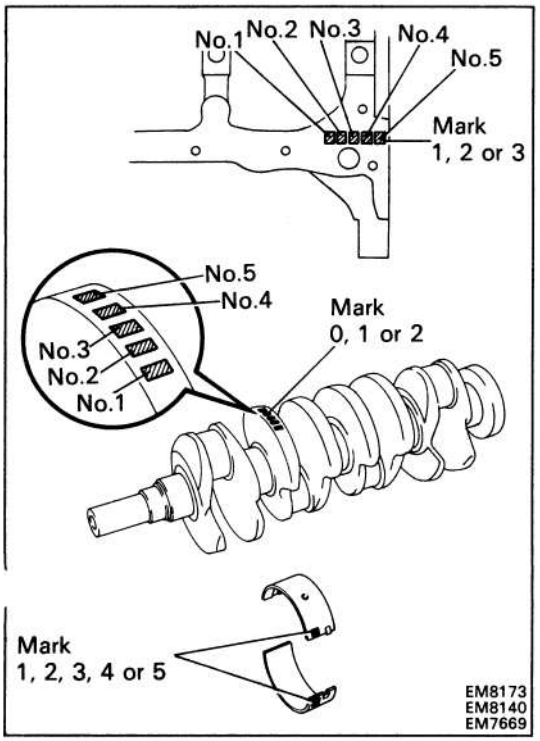
Maximum clearance: 0.08 mm (0.0031 in.)

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

No.3	**0.027 – 0.054 mm (0.0011 – 0.0021 in.)**
Others	**0.017 – 0.044 mm (0.0007 – 0.0017 in.)**

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

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



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

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

cardiagn.com

(Reference)

Cylinder block main journal bore diameter:

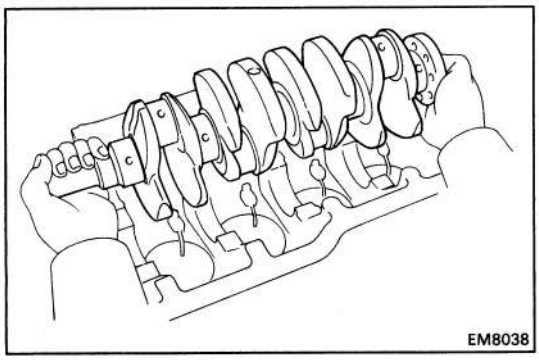
Mark "1"	59.020 – 59.026 mm (2.3236 – 2.3239 in.)
Mark "2"	59.026 – 59.032 mm (2.3239 – 2.3241 in.)
Mark "3"	59.032 – 59.038 mm (2.3241 – 2.3243 in.)

Crankshaft journal diameter:

Mark "0"	54.998 – 55.003 mm (2.1653 – 2.1655 in.)
Mark "1"	54.993 – 54.998 mm (2.1651 – 2.1653 in.)
Mark "2"	54.988 – 54.993 mm (2.1649 – 2.1651 in.)

Standard sized bearing center wall thickness:

No.3	Mark "1"	1.992 – 1.995 mm (0.0784 – 0.0785 in.)
	Mark "2"	1.995 – 1.998 mm (0.0785 – 0.0787 in.)
	Mark "3"	1.998 – 2.001 mm (0.0787 – 0.0788 in.)
	Mark "4"	2.001 – 2.004 mm (0.0788 – 0.0789 in.)
	Mark "5"	2.004 – 2.007 mm (0.0789 – 0.0790 in.)
Others	Mark "1"	1.997 – 2.000 mm (0.0786 – 0.0787 in.)
	Mark "2"	2.000 – 2.003 mm (0.0787 – 0.0789 in.)
	Mark "3"	2.003 – 2.006 mm (0.0789 – 0.0790 in.)
	Mark "4"	2.006 – 2.009 mm (0.0790 – 0.0791 in.)
	Mark "5"	2.009 – 2.012 mm (0.0791 – 0.0792 in.)

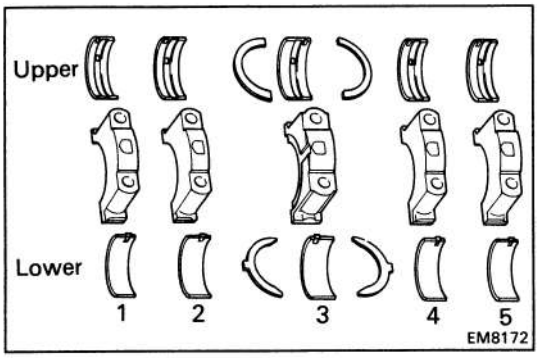


(k) Completely remove the Plastigage.

7. REMOVE CRANKSHAFT

(a) Lift out the crankshaft.

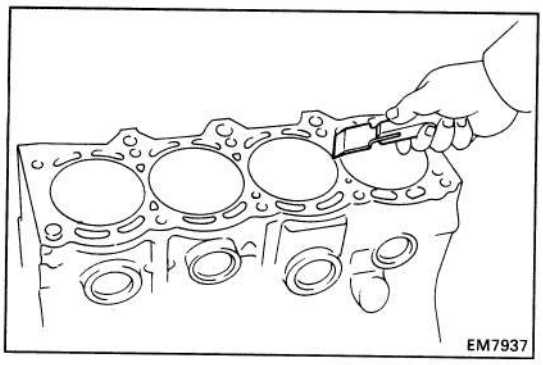
(b) Remove the upper bearings and upper thrust washers from the cylinder block.



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

8. REMOVE OIL NOZZLES (See page LU-26)

cardiagn.com



INSPECTION OF CYLINDER BLOCK

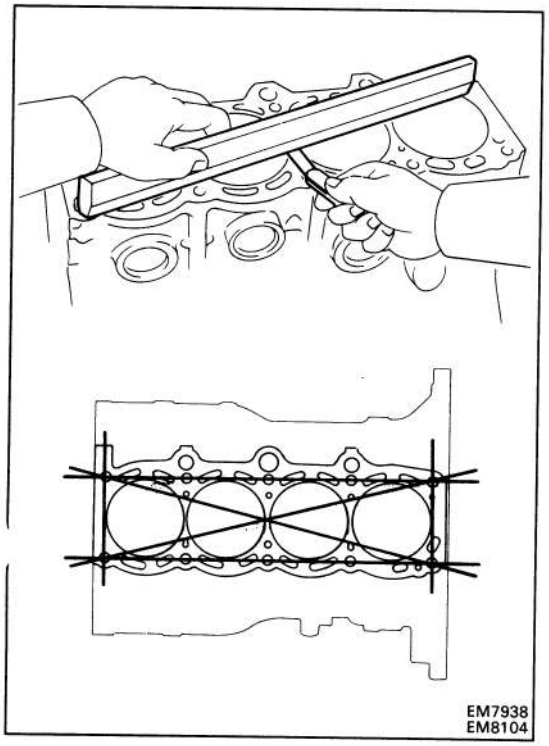
1. CLEAN CYLINDER BLOCK

A. Remove gasket material

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

B. Clean cylinder block

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

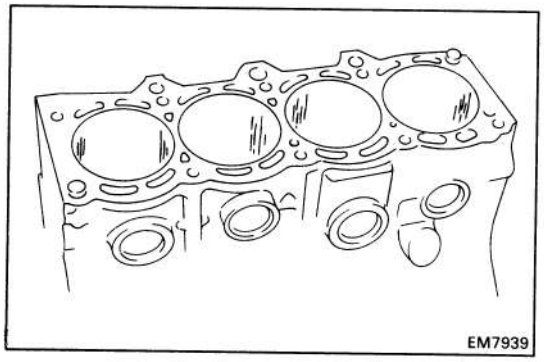


2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage: 0.05 mm (0.0020 in.)

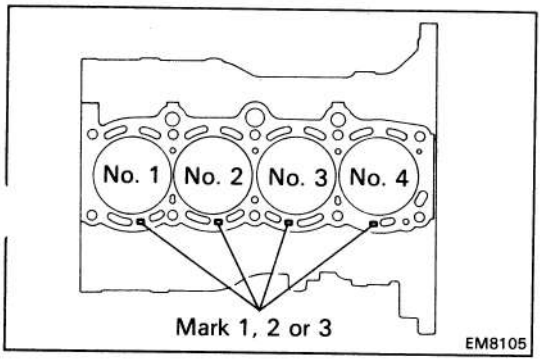
If warpage is greater than maximum, replace the cylinder block.



3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

Visually check the cylinder for vertical scratches.

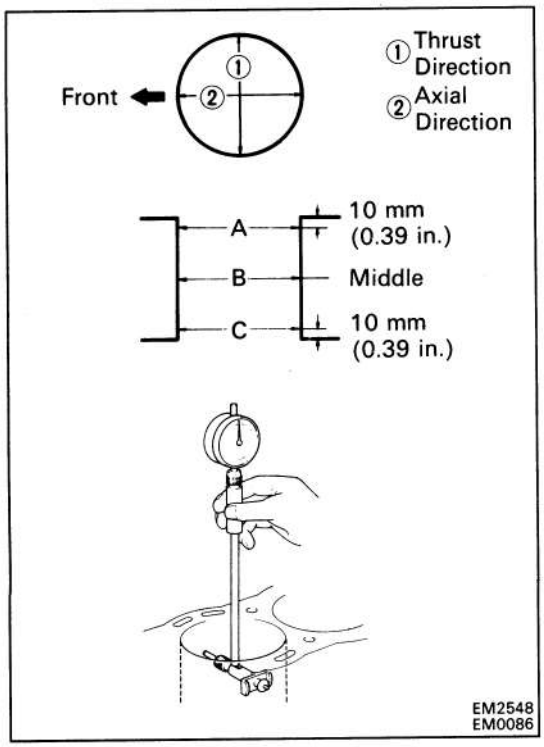
If deep scratches are present, replace the cylinder block.



4. INSPECT CYLINDER BORE DIAMETER

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

cardiagn.com



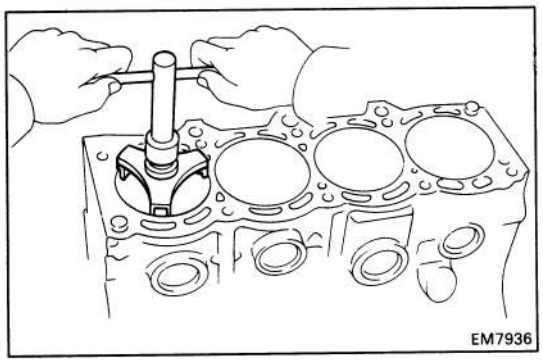
Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust axial directions.

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.)

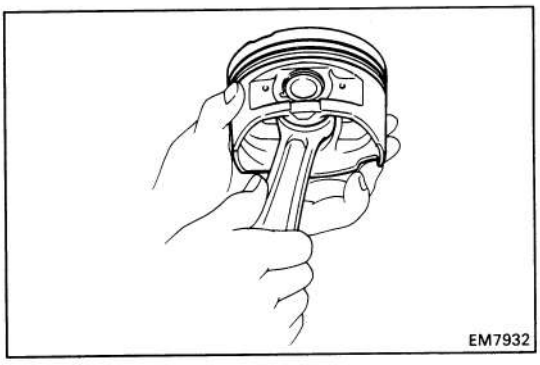
If the diameter is greater than maximum, replace the cylinder block.



5. REMOVE CYLINDER RIDGE

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

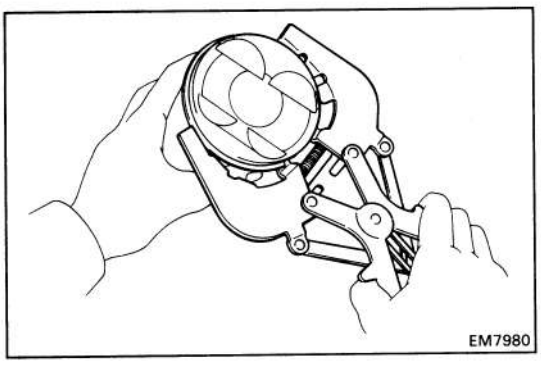
DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES



1. CHECK FIT BETWEEN PISTON AND PISTON PIN

Try to move the piston back and forth on the piston pin.

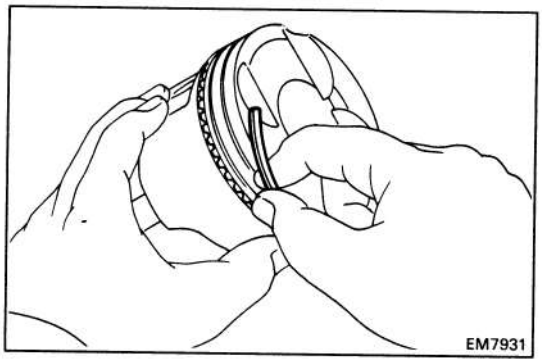
If any movement is felt, replace the piston and pin as a set.



2. REMOVE PISTON RINGS

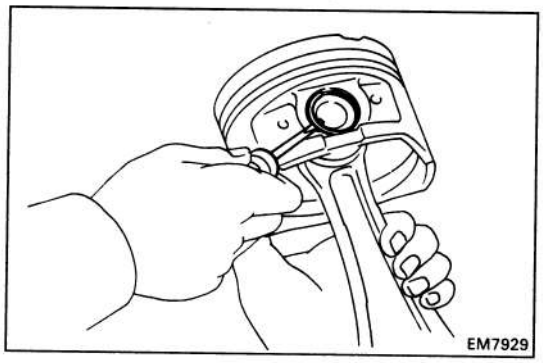
(a) Using a piston ring expander, remove the two compression rings.

cardiagn.com



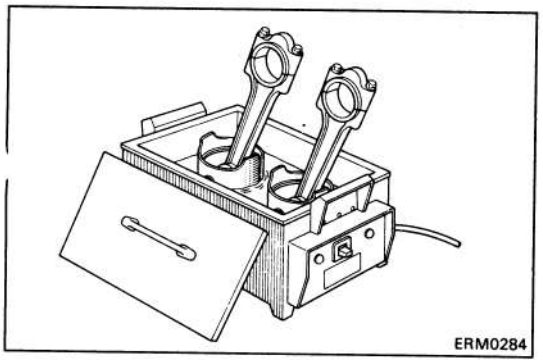
(b) Remove the two side rails and oil ring expander by hand.

HINT: Arrange the rings in correct order only.

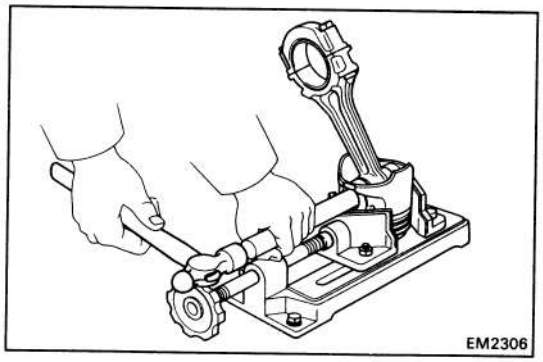


3. DISCONNECT CONNECTING ROD FROM PISTON

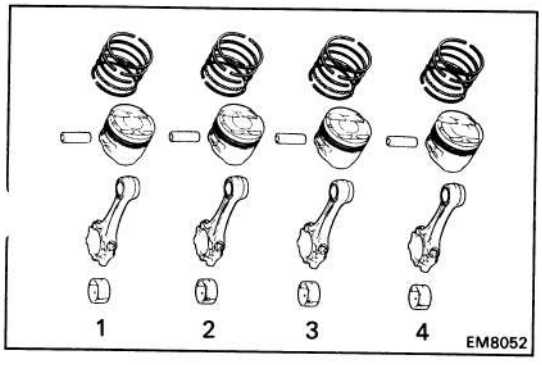
(a) Using a small screwdriver, pry out the two snap rings.



(b) Gradually heat the piston to 80 – 90°C (176 – 194°F).



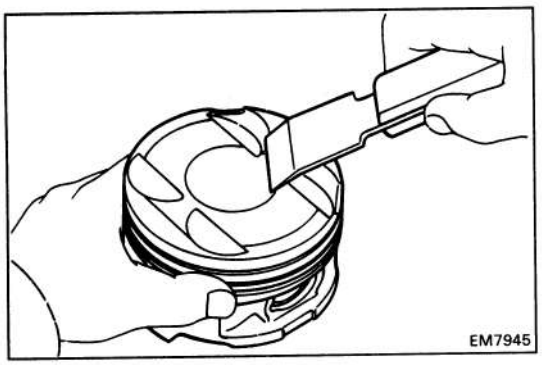
(c) Using plastic-faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.



HINT:

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

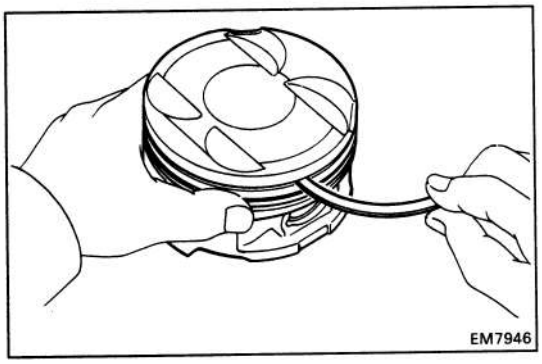
cardiagn.com



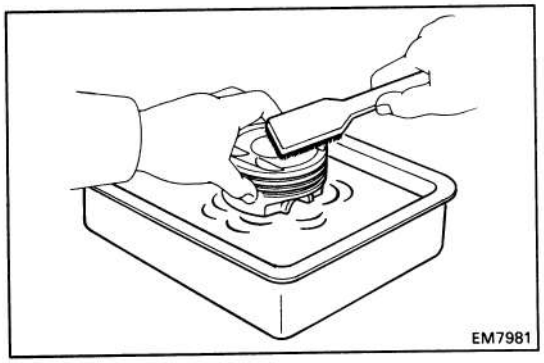
INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLIES

1. CLEAN PISTON

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

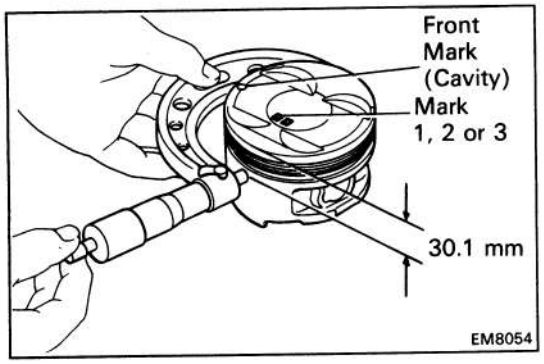


(b) Using a groove cleaner or broken ring, clean the piston ring grooves.



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

NOTICE: Do not use a wire brush.



2. INSPECT PISTON

A. Inspect piston oil clearance

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

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 30.1 mm (1.185 in.) from the piston head.

Piston diameter:

Mark "1"	**85.920 – 85.930 mm (3.3827 – 3.3831 in.)**
Mark "2"	**85.930 – 85.940 mm (3.3831 – 3.3835 in.)**
Mark "3"	**85.940 – 85.950 mm (3.3835 – 3.3839 in.)**

cardiagn.com

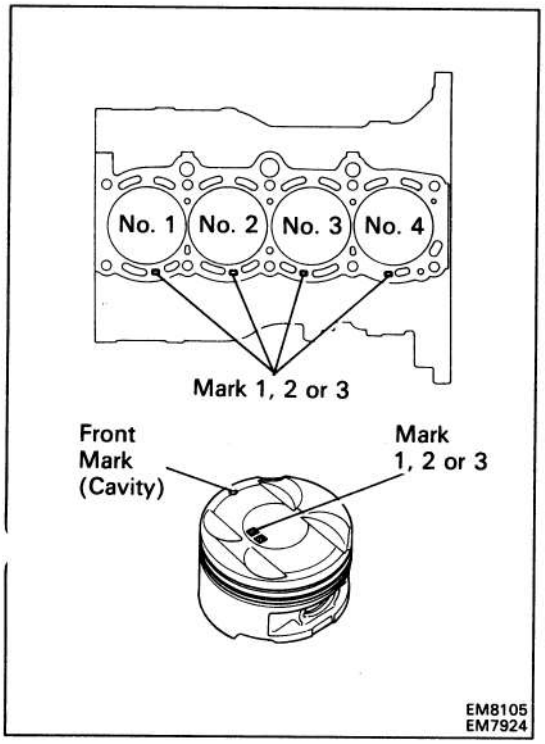
(b) Measure the cylinder bore diameter in the thrust directions. (See step 4 on page EM-152)

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

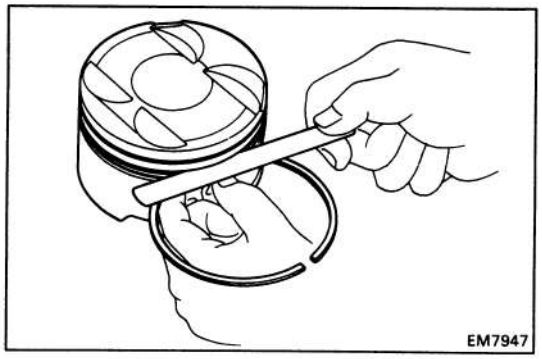
Standard oil clearance: **0.070 – 0.090 mm (0.0028 – 0.0035 in.)**

Maximum oil clearance: **0.110 mm (0.0043 in.)**

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



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



B. Inspect piston ring groove clearance

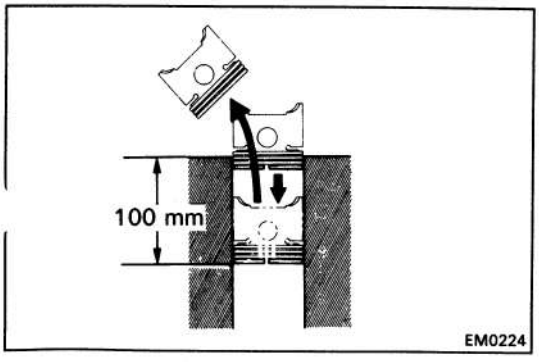
Using a feeler gauge, measure the clearance between new piston ring and the wall of the piston ring groove.

Ring groove clearance:

No.1 0.040 – 0.080 mm (0.0016 – 0.0031 in.)

No.2 0.030 – 0.070 mm (0.0012 – 0.0028 in.)

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

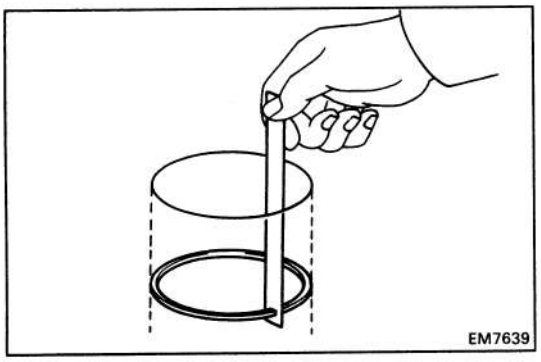


C. Inspect piston ring end gap

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

(b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 115 mm (4.53 in.) from the top of the cylinder block.

cardiagn.com



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

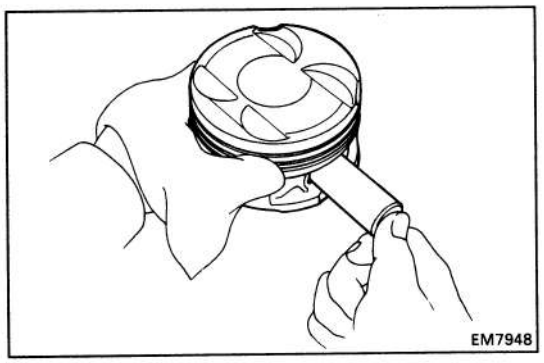
Standard end gap:

No.1	**0.330 – 0.550 mm (0.0130 – 0.0217 in.)**
No.2	**0.450 – 0.670 mm (0.0177 – 0.0264 in.)**
Oil (Side rail)	**0.200 – 0.600 mm (0.0079 – 0.0236 in.)**

Maximum end gap:

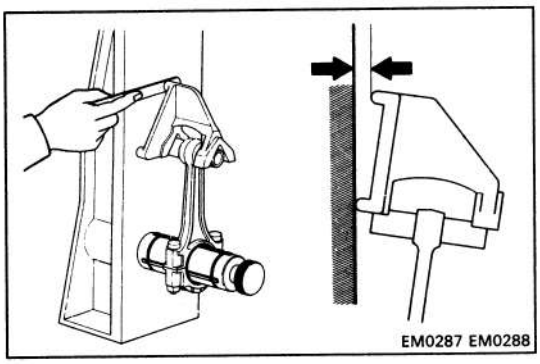
No.1	**0.85 mm (0.0335 in.)**
No.2	**0.97 mm (0.0382 in.)**
Oil (Side rail)	**0.90 mm (0.0354 in.)**

If the end gap is greater than maximum, replace the piston ring. If the end gap is greater than maximum, even with a new piston ring, replace the cylinder block.



D. Inspect piston pin fit

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



3. INSPECT CONNECTING ROD

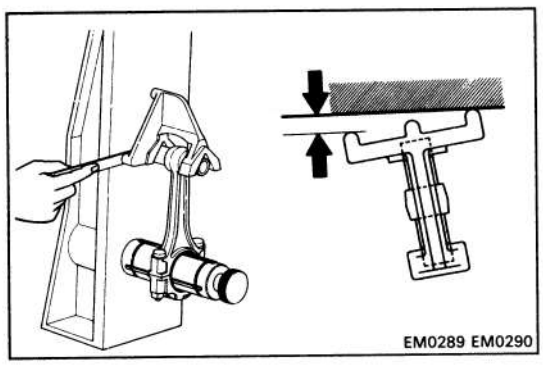
A. Inspect connecting rod alignment

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

- Check for bending.

Maximum bending:
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

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

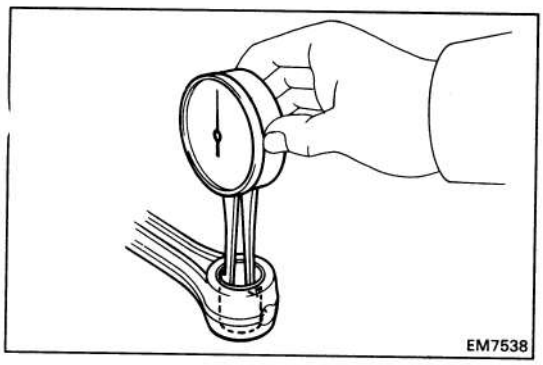


- Check for twist.

Maximum twist:
0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

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

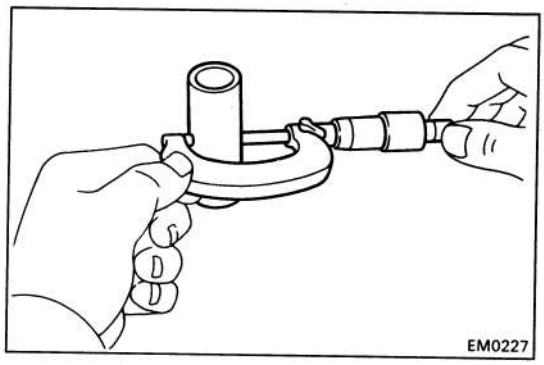
cardiagn.com



B. Inspect piston pin oil clearance

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

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



(b) Using a micrometer, measure the piston pin diameter.

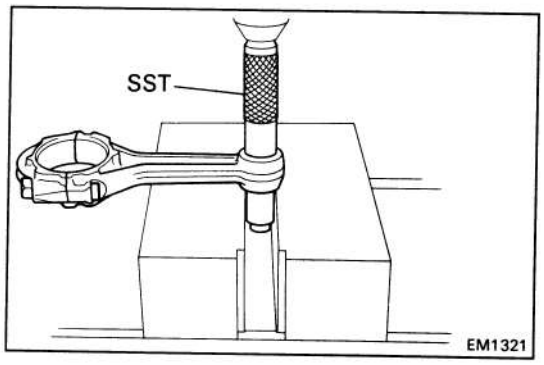
Piston pin diameter: 21.997 – 22.009 mm (0.8660 – 0.8665 in.)

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

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

Maximum oil clearance: 0.05 mm (0.0020 in.)

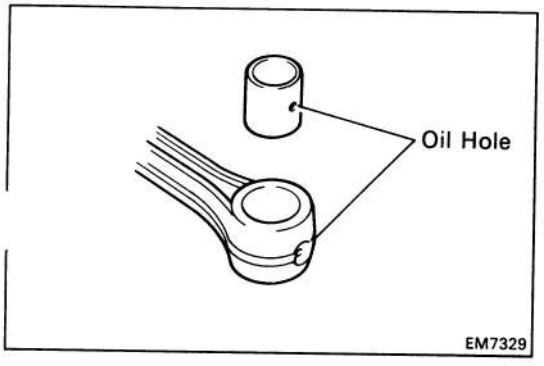
If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the piston and piston pin as a set.



C. If necessary, replace connecting rod bushing

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

SST 09222-30010

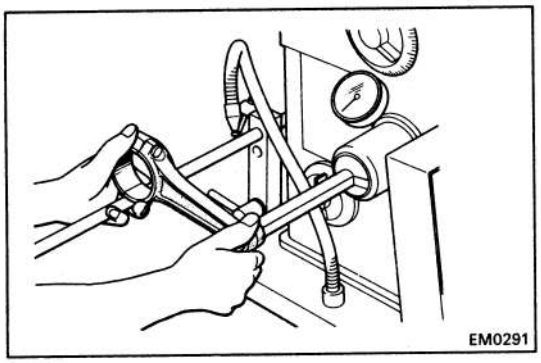


(b) Align the oil holes of a new bushing and the connecting rod.

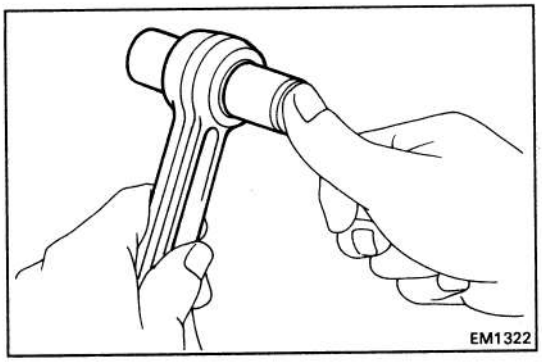
(c) Using SST and a press, press in the bushing.

SST 09222-30010

cardiagn.com



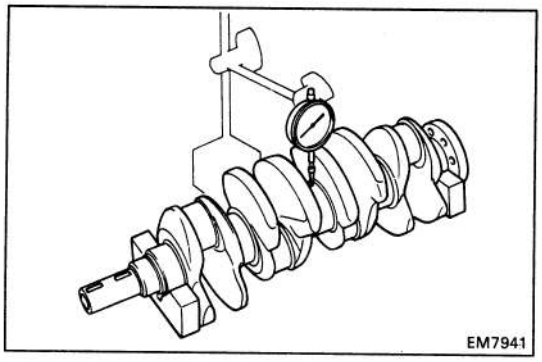
(d) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance (see step B above) between the bushing and piston pin.

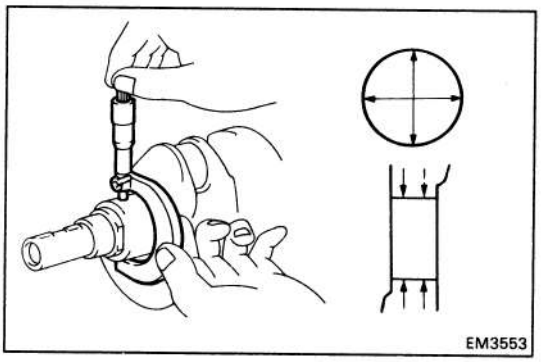


(e) Check the piston pin fit at normal room temperature.

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

cardiagn.com


EM7941


EM3553

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 (2.1653 – 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-145 to 149). If necessary, grind or replace the crankshaft.

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

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

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

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

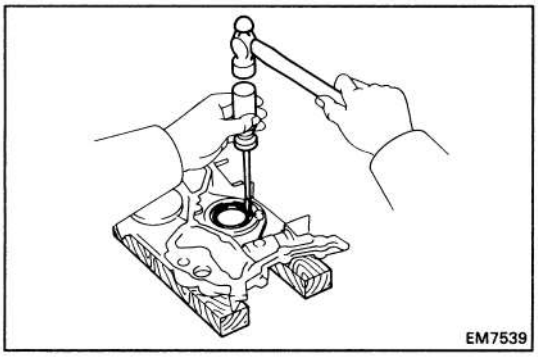
Grind and hone the main journals and/or crank pins to the finished undersized diameter (See procedure step 2).

Install new main journal and/or crank pin undersized bearings.

cardiagn.com

REPLACEMENT OF CRANKSHAFT OIL SEALS

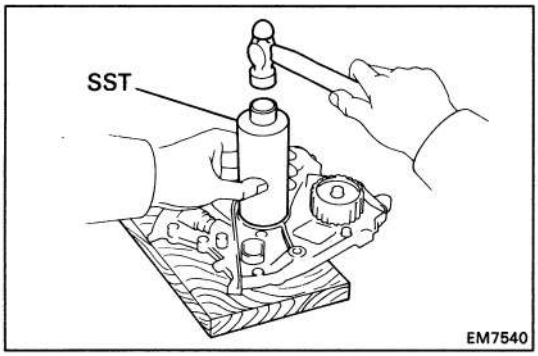
HINT: There are two methods (A and B) to replace the oil seal which are as follows:



1. REPLACE CRANKSHAFT FRONT OIL SEAL

A. If oil pump is removed from cylinder block:

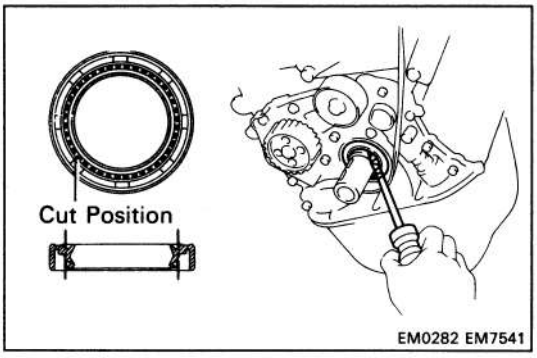
(a) Using a screwdriver and hammer, tap out the oil seal.



(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump case edge.

SST 09226-10010

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

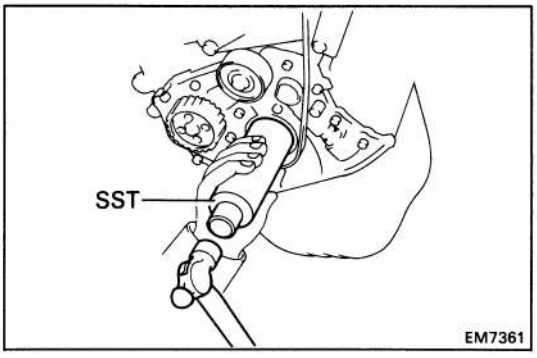


B. If oil pump is installed to the cylinder block:

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

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

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

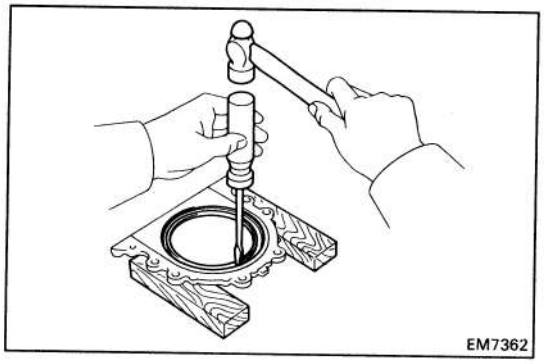


(c) Apply MP grease to a new oil seal lip.

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

SST 09226-10010

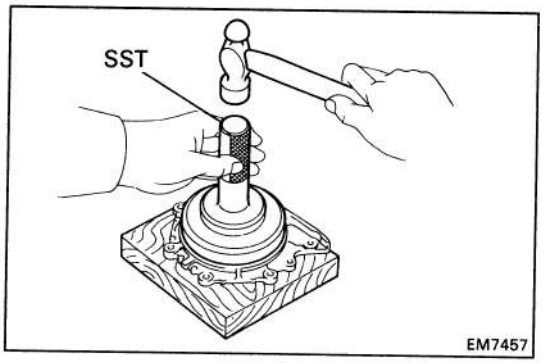
cardiagn.com



2. REPLACE CRANKSHAFT REAR OIL SEAL

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

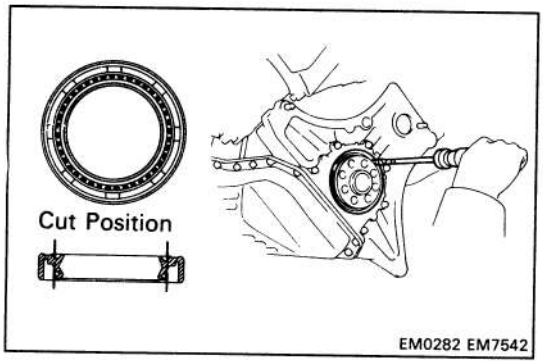
(a) Using screwdriver and hammer, tap out the oil seal.



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

SST 09223-63010

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

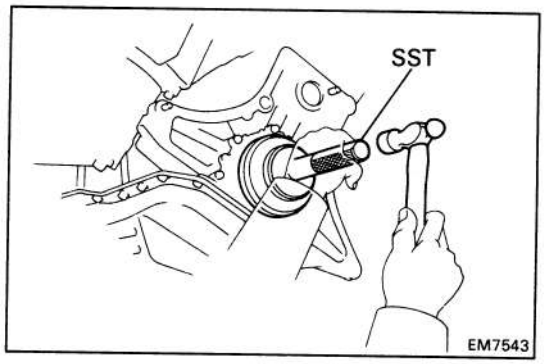


B. If rear oil seal retainer is installed to cylinder block:

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

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

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

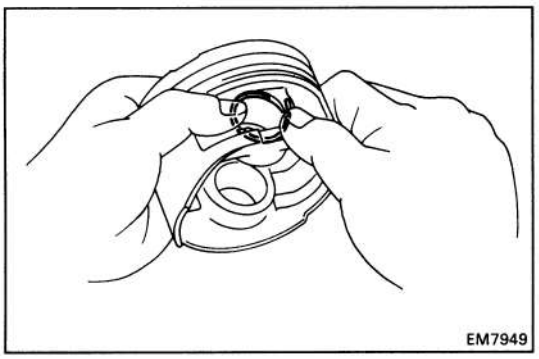


(c) Apply MP grease to a new oil seal lip.

(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

cardiagn.com

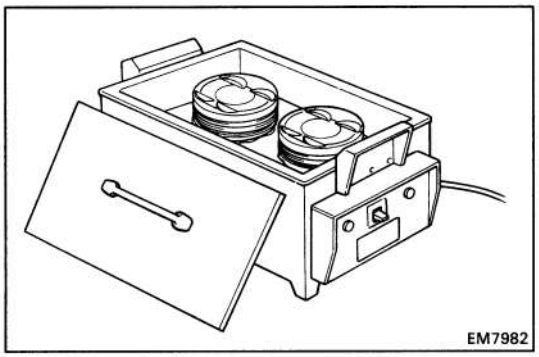

EM7949

ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

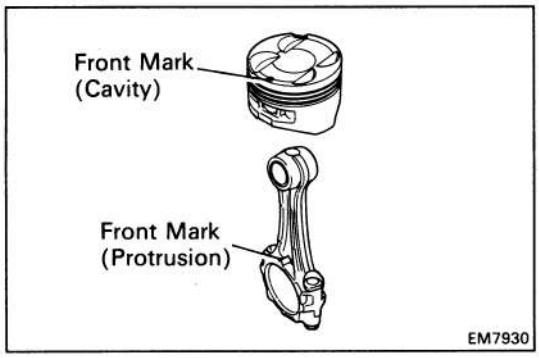
1. ASSEMBLE PISTON AND CONNECTING ROD

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

HINT: Be sure the end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.


EM7982

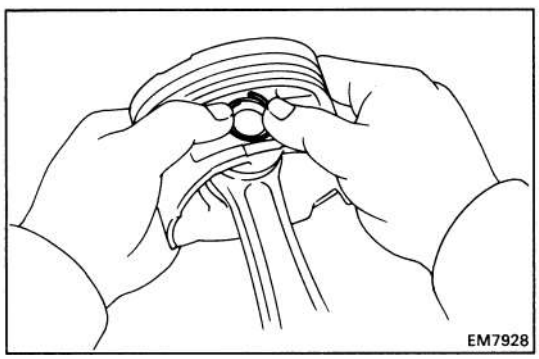
(b) Gradually heat the piston to 80 – 90°C (176 – 194°F).



EM7930

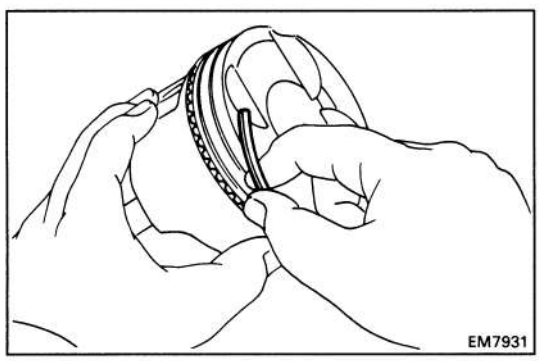
(c) Coat the piston pin with engine oil.

(d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.


EM7928

(e) Install a new snap ring on the other side of the piston pin hole.

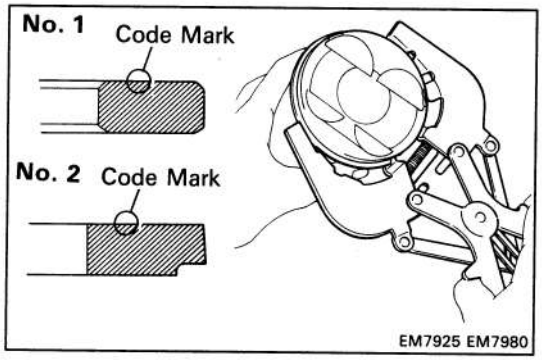
HINT: Be sure the end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.


EM7931

2. INSTALL PISTON RINGS

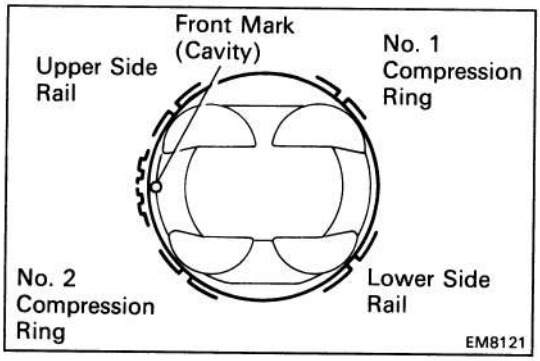
(a) Install the oil ring expander and two side rails by hand.

cardiagn.com



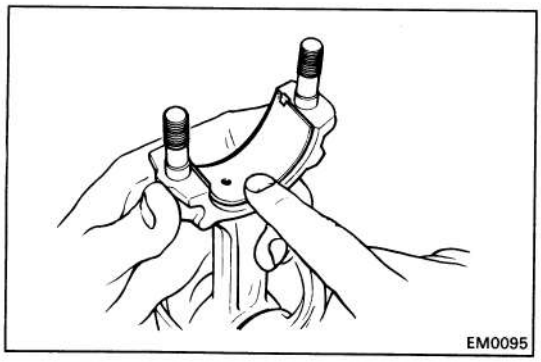
(b) Using a piston ring expander, install the two compression rings with the code mark facing upward.

Code mark: R



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

NOTICE: Do not align the ring ends.



3. INSTALL BEARINGS

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

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

cardiagn.com

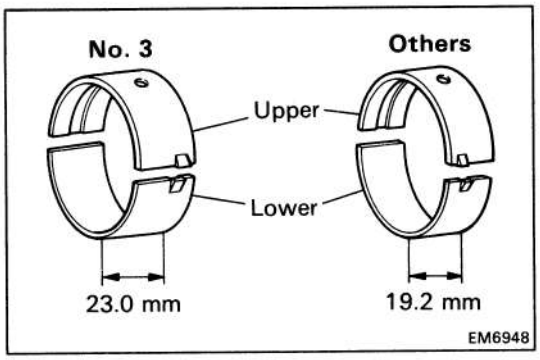
ASSEMBLY OF CYLINDER BLOCK

(See page EM-133)

HINT:

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

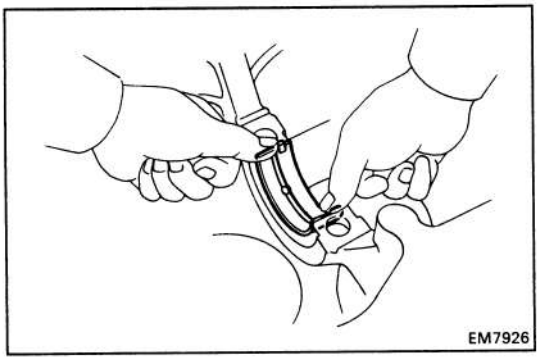
1. INSTALL OIL NOZZLES (See page LU-14)



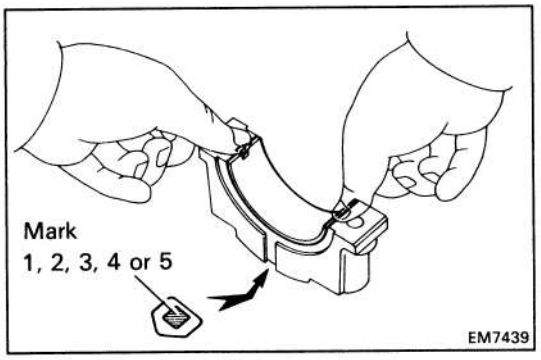
2. INSTALL MAIN BEARINGS

HINT:

- Main bearings come in widths of 19.2 mm (0.756 in.) and 23.0 mm (0.906 in.). Install the 23.0 mm (0.906 in.) bearings in the No.3 cylinder block journal position with the main bearing cap. Install the 19.2 mm (0.756 in.) bearings in the other positions.
- Upper bearings have an oil groove and oil holes; lower bearings do not.



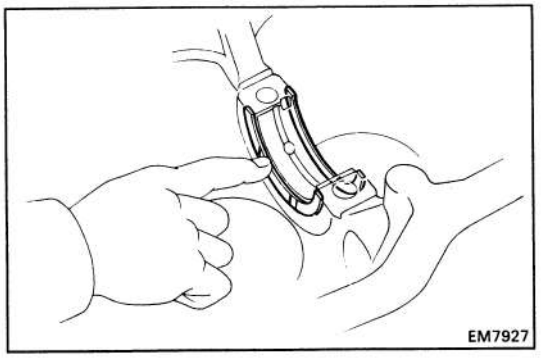
(a) Align the bearing claw with the claw groove of the cylinder block, and push in the five upper bearings.



(b) Align the bearing claw with the claw groove of the main bearing cap, and push in the five lower bearings.

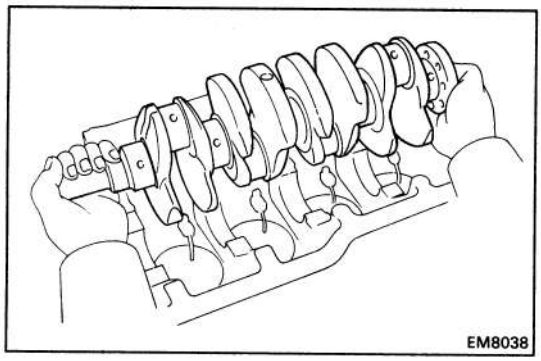
HINT: A number is marked on each main bearing cap to indicate the installation position.

3. INSTALL UPPER THRUST WASHERS

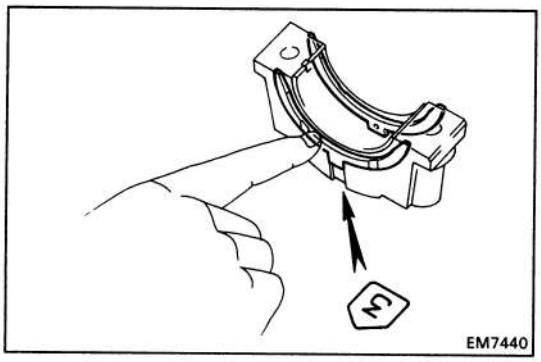


Install the two thrust washers under the No.3 journal position of the cylinder block with the oil grooves facing outward.

cardiagn.com

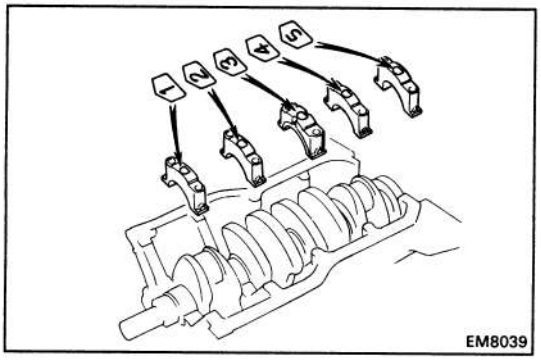


4. PLACE CRANKSHAFT ON CYLINDER BLOCK



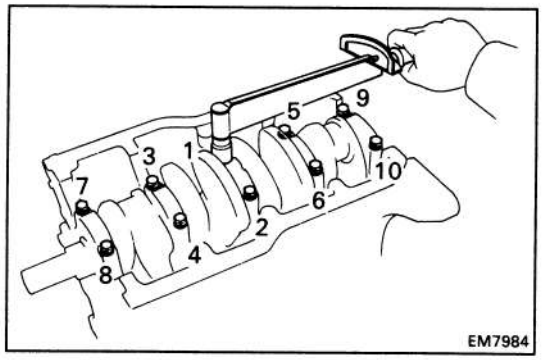
5. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

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



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

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



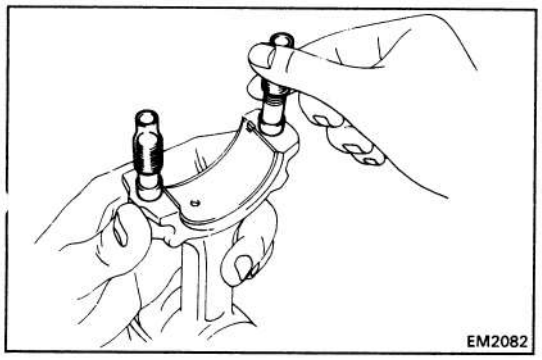
(c) Apply a light coat of engine oil on the threads and under the heads of the main bearing caps.

(d) Install and uniformly tighten the ten bolts of the main bearing caps in several passes in the sequence shown.

Torque: 600 kg-cm (43 ft-lb, 59 N·m)

(e) Check that the crankshaft turns smoothly.

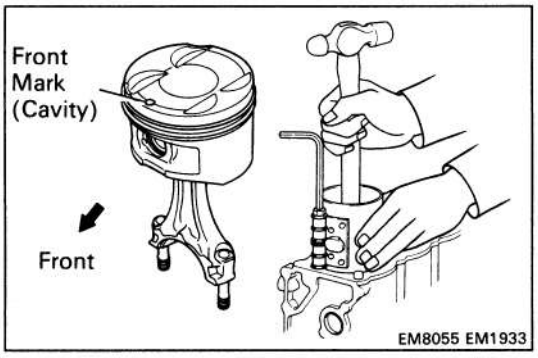
(f) Check the crankshaft thrust clearance.
(See step 5 on page EM-147)



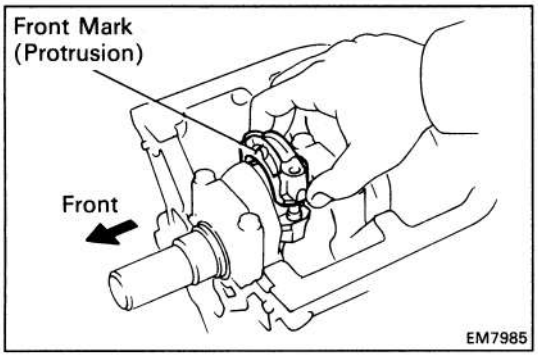
6. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

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

cardiagn.com



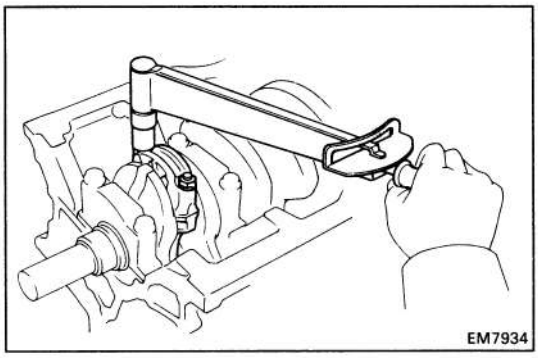
(b) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.



7. INSTALL CONNECTING ROD CAPS

(a) Match the numbered connecting rod cap with the connecting rod.

(b) Install the connecting rod cap with the front mark facing forward.



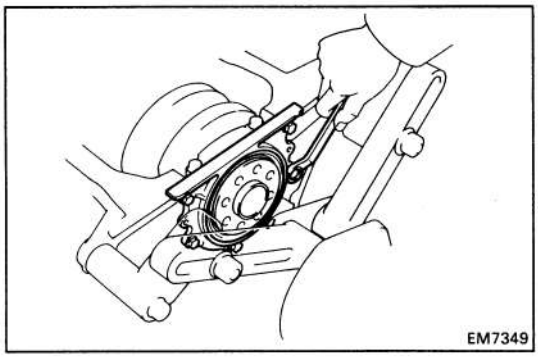
(c) Apply a light coat of engine oil on the threads and under the cap nuts.

(d) Using SST, install and alternately tighten the cap nuts in several passes.

Torque: 680 kg-cm (49 ft-lb, 67 N·m)

(e) Check that the crankshaft turns smoothly.

(f) Check the connecting rod thrust clearance. (See step 2 on page EM-145)

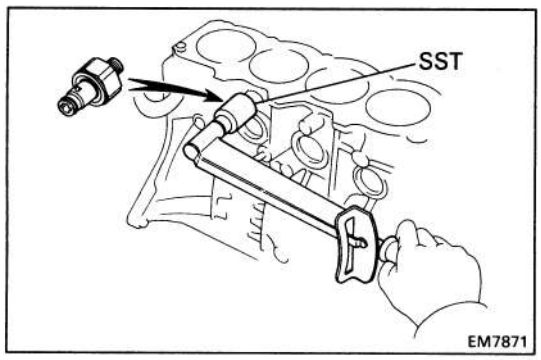


8. INSTALL REAR OIL SEAL RETAINER

Install a new gasket and the retainer with the six bolts.

Torque: 95 kg-cm (82 in.-lb, 9.3 N·m)

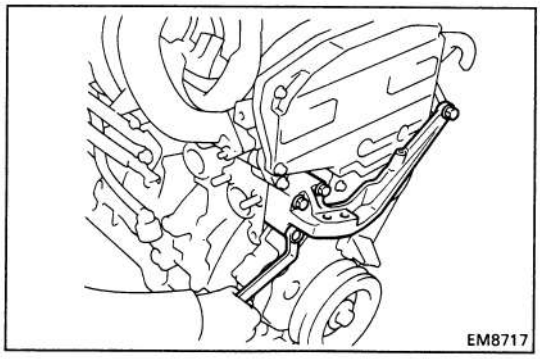
cardiagn.com



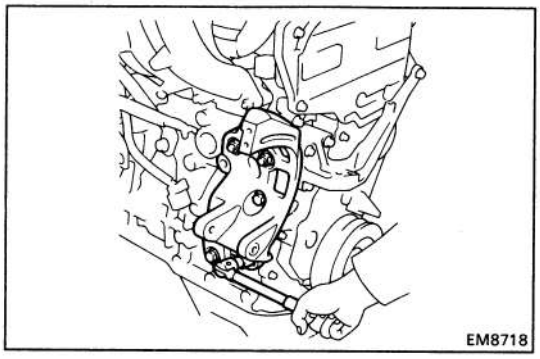
POST ASSEMBLY

1. **INSTALL KNOCK SENSOR**
   Using SST, install the knock sensor.
   SST 09816-30010
   Torque: 450 kg-cm (33 ft-lb, 44 N·m)

2. **INSTALL OIL COOLER (See pages LU-21 and 22)**
3. **INSTALL OIL FILTER (See page LU-7)**
4. **INSTALL OIL PUMP AND OIL PAN (See pages LU-15 and 16)**
5. **INSTALL WATER PUMP (See pages CO-12 and 13)**
6. **INSTALL CYLINDER HEAD (See pages EM-86 to 95)**
7. **INSTALL TURBOCHARGER (See pages TC-16 to 19)**
8. **INSTALL PULLEYS AND TIMING BELT (See pages EM-35 to 41)**

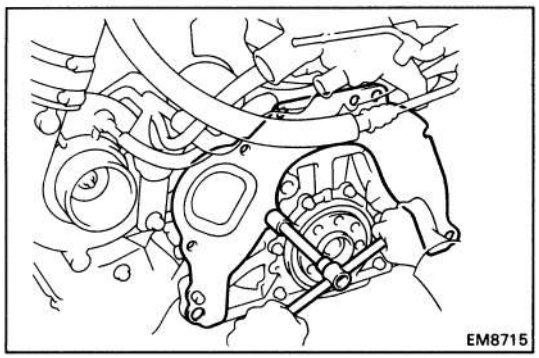


9. **INSTALL RH ENGINE MOUNTING BRACKET**
   Install the mounting bracket with the four bolts.
   Torque: 620 kg-cm (45 ft-lb, 61 N·m)



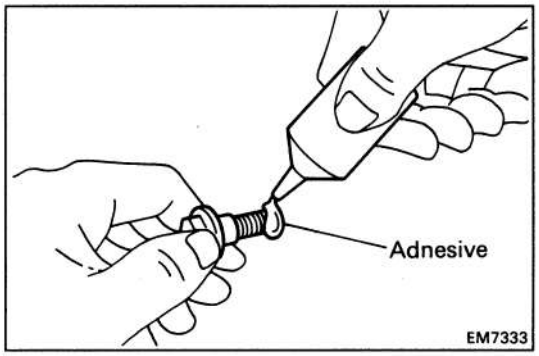
10. **INSTALL ALTERNATOR BRACKET**
    Install the alternator bracket with the three bolts and two nuts.
    Torque: 440 kg-cm (32 ft-lb, 43 N·m)
11. **INSTALL ALTERNATOR (See page CH-17)**
12. **REMOVE ENGINE STAND**

cardiagn.com



13. INSTALL REAR END PLATE

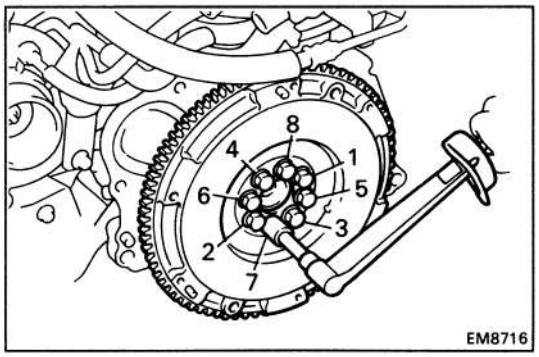
Torque: 95 kg-cm (82 ft-lb, 9.3 N·m)



14. 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: 1,100 kg-cm (80 ft-lb, 108 N·m)

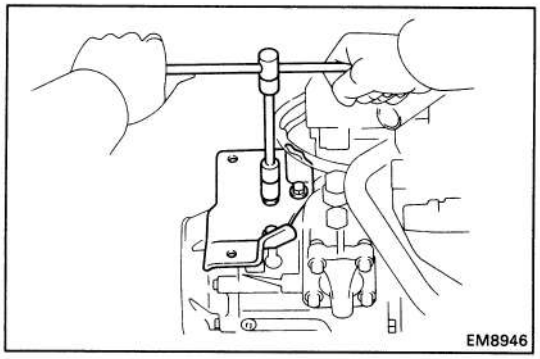
15. INSTALL CLUTCH DISC AND COVER

cardiagn.com

INSTALLATION OF ENGINE

1. **ASSEMBLE ENGINE AND TRANSAXLE (See pages MT-5 and 6)**

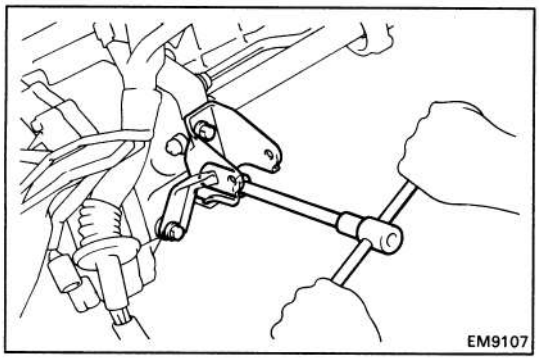
2. **INSTALL STARTER (See page ST-17)**



3. **INSTALL LH ENGINE MOUNTING BRACKET**

Install the LH mounting bracket to the transaxle case with the three bolts.

Torque: 530 kg-cm (38 ft-lb, 52 N·m)

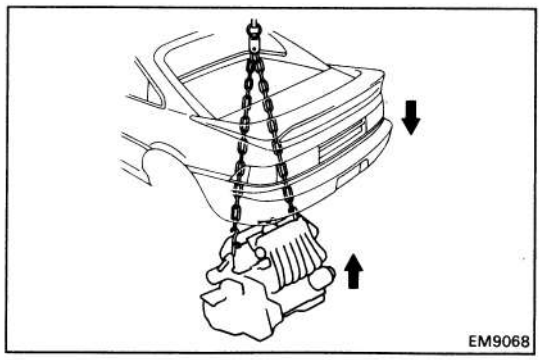


4. **INSTALL REAR ENGINE MOUNTING BRACKET**

Install the mounting bracket with the six bolts.

Torque:

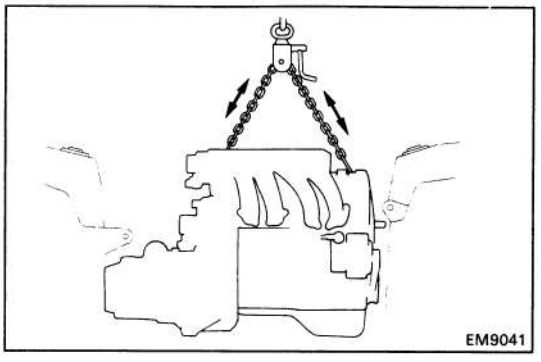
14 mm head bolt 530 kg-cm (38 ft-lb, 52 N·m)
17 mm head bolt 790 kg-cm (57 ft-lb, 77 N·m)



5. **INSTALL ENGINE AND TRANSAXLE ASSEMBLY IN VEHICLE**

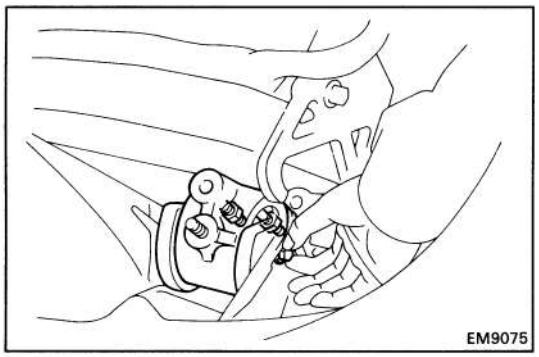
(a) Attach the engine chain hoist to the engine hangers.

(b) Slowly lower the vehicle, and raise the engine.



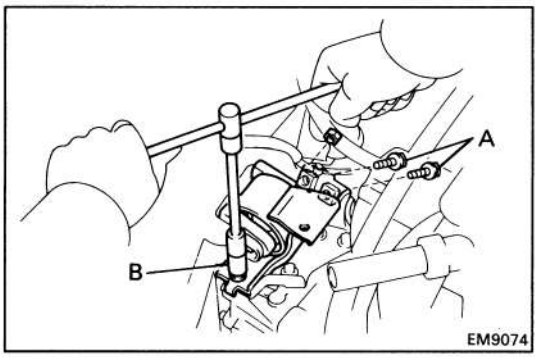
(c) Keep the engine level, and align RH and LH mountings with the body mountings.

cardiagn.com



(d) Attach the RH mounting insulator to the body, and temporarily install the through bolt.

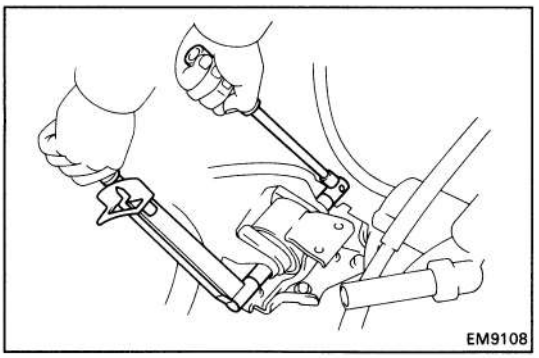
(e) Attach the RH mounting insulator to the mounting bracket, and temporarily install the two nuts.



(f) Attach the LH mounting insulator to the body, and temporarily install the through bolt.

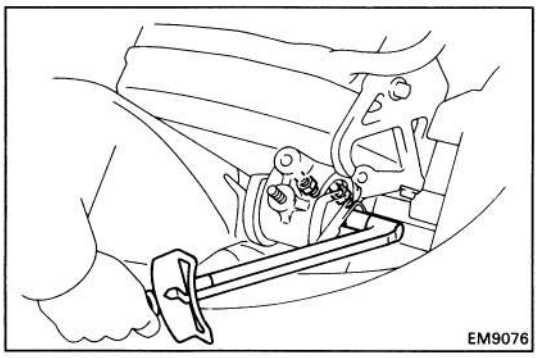
(g) Attach the LH mounting insulator to the mounting bracket, and install the three bolts.

Torque:
A 650 kg-cm (47 ft-lb, 63 N·m)
B 740 kg-cm (54 ft-lb, 73 N·m)



(h) Tighten the through bolt holding the LH mounting insulator to the body.

Torque: 800 kg-cm (58 ft-lb, 78 N·m)



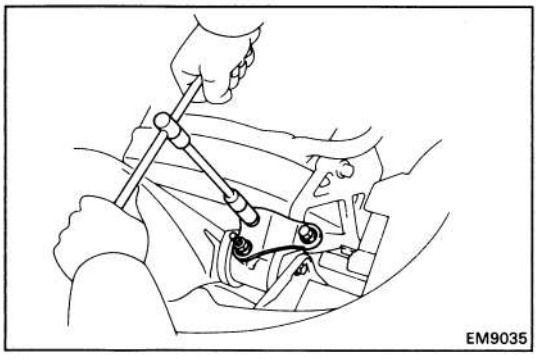
(i) Tighten the two nuts holding the RH mounting insulator to the mounting bracket.

Torque: 530 kg-cm (38 ft-lb, 52 N·m)

(j) Tighten the through bolt holding the RH mounting insulator to the body.

Torque: 800 kg-cm (58 ft-lb, 78 N·m)

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

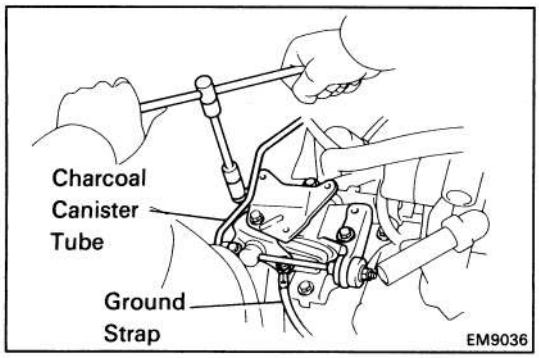


6. INSTALL RH ENGINE MOUNTING STAY

Install the mounting stay with the two bolts and nut.

Torque: 740 kg-cm (54 ft-lb, 73 N·m)

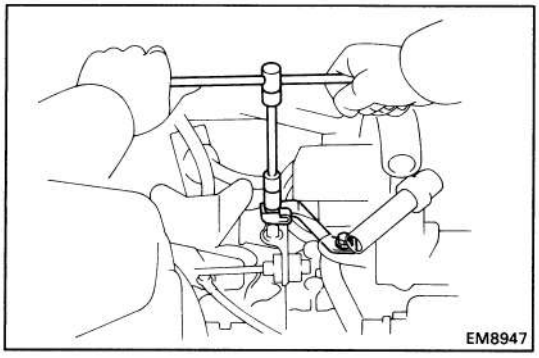
cardiagn.com



7. INSTALL LATERAL CONTROL ROD AND AIR CLEANER CASE BRACKET

Install the control rod, case bracket and charcoal canister tube with the five bolts, and connect the ground strap (from transaxle). Do not the tighten the bolt (A).

Torque: 360 kg-cm (26 ft-lb, 35 N·m)



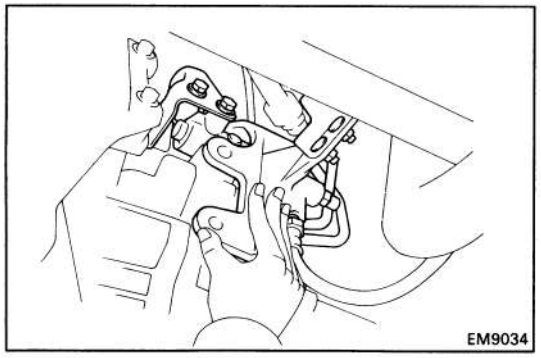
8. INSTALL LH ENGINE MOUNTING STAY

(a) Install the mounting stay and speedometer cable clamp with the two bolts.

Torque:
Transaxle side 250 kg-cm (18 ft-lb, 25 N·m)
Mounting insulator side 740 kg-cm (54 ft-lb, 73 N·m)

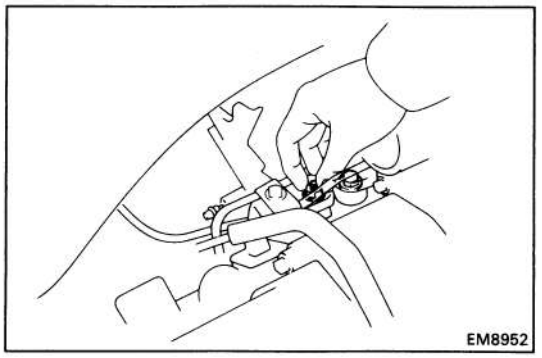
(b) Tighten the bolt (A) of step 6.

Torque: 380 kg-cm (27 ft-lb, 37 N·m)

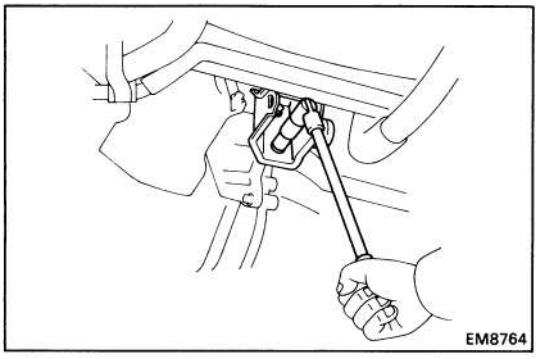


9. INSTALL CLUTCH RELEASE CYLINDER AND FRONT ENGINE MOUNTING BRACKET

(a) Place the release cylinder on the transaxle.



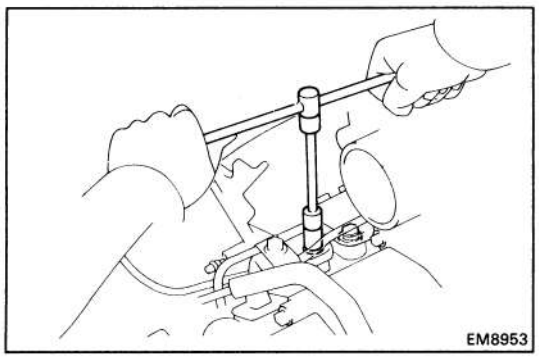
(b) Temporarily install the bolt and nut holding the release cylinder to the transaxle.



(c) Install the mounting bracket with the two bolts.

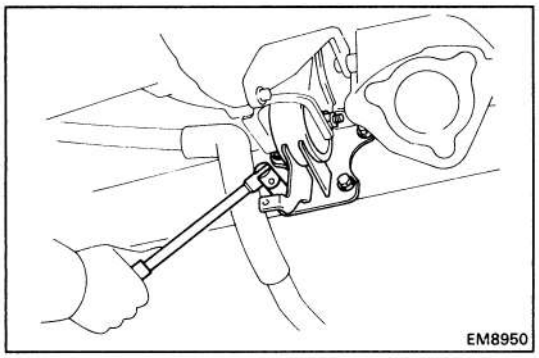
Torque: 790 kg-cm (57 ft-lb, 77 N·m)

cardiagn.com



(d) Tighten the bolt and nut holding the clutch release cylinder to the tranaxle.

Torque: 120 kg-cm (9 ft-lb, 12 N·m)

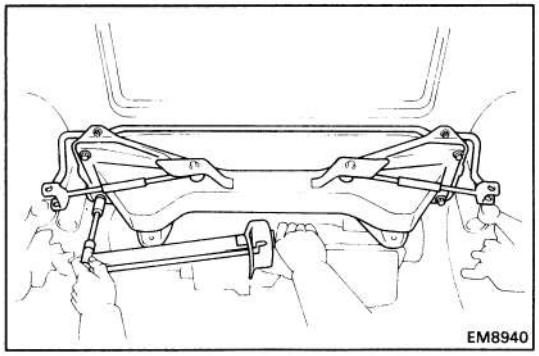


10. INSTALL FRONT ENGINE MOUNTING INSULATOR

(a) Install the mounting insulator to the body with the four bolts.

Torque: 740 kg-cm (54 ft-lb, 73 N·m)

(b) Temporarily install the through bolt and nut holding the mounting insulator to the mpunting bracket.



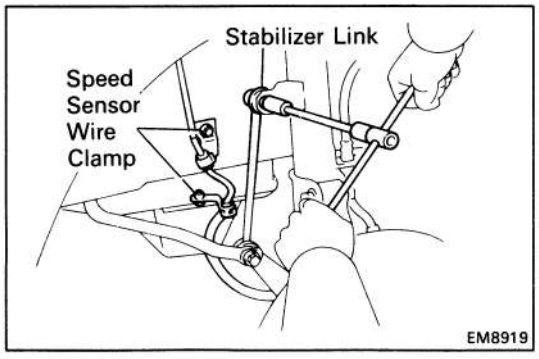
11. INSTALL REAR SUSPENSION LOWER CROSSMEMBER

(a) Install the lower crossmember with the four bolts.

Torque: 1,150 kg-cm (83 ft-lb, 113 N·m)

(b) Install the drive shafts. (See pages SA-66 to 68)

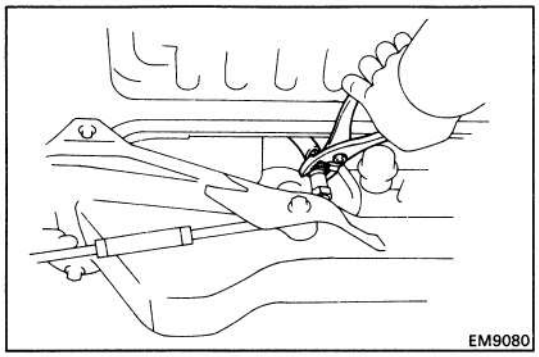
(c) Install the lower suspension arm. (See page SA-77)



(d) Install the stabilizer link to the shock absorber with the nut. Connect the two stabilizer links

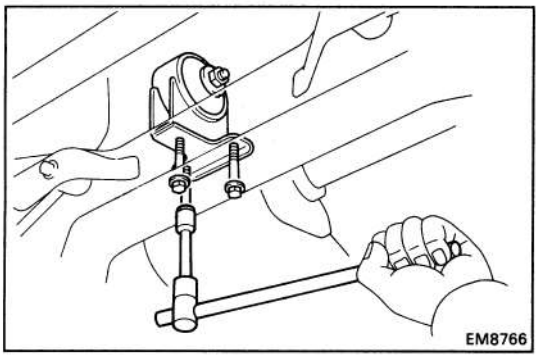
Torque: 500 kg-cm (36 ft-lb, 49 N·m)

(e) Install the wire clamp of the speed sensor with the bolt. Install the two wire clamp.



12. CONNECT SPEEDOMETER CABLE

cardiagn.com



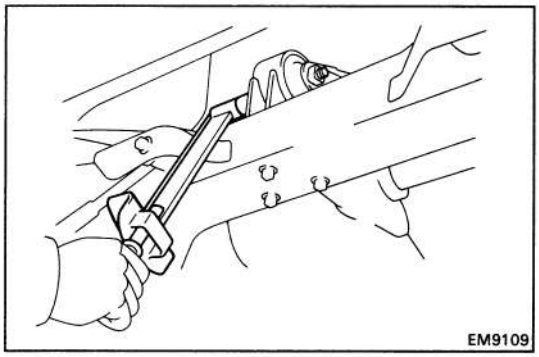
13. INSTALL REAR ENGINE MOUNTING INSULATOR

(a) Temporarily install the mounting bracket to the body with the three bolts.

(b) Temporarily install the through bolt holding the mounting insulator to the mounting bracket.

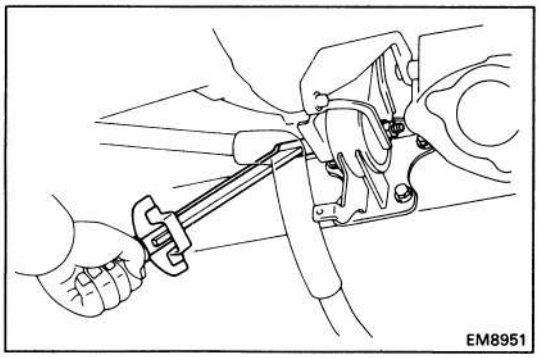
(c) Install the mounting bracket to the body with the three bolts.

Torque: 650 kg-cm (47 ft-lb, 64 N·m)



(d) Tighten the through bolt holding the mounting insulator to the mounting bracket.

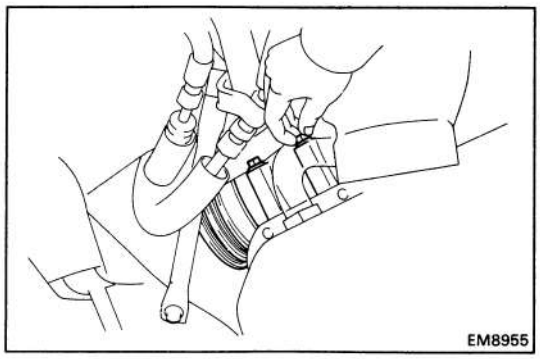
Torque: 800 kg-cm (58 ft-lb, 79 N·m)



14. TIGHTEN FRONT ENGINE MOUNTING THROUGH BOLT

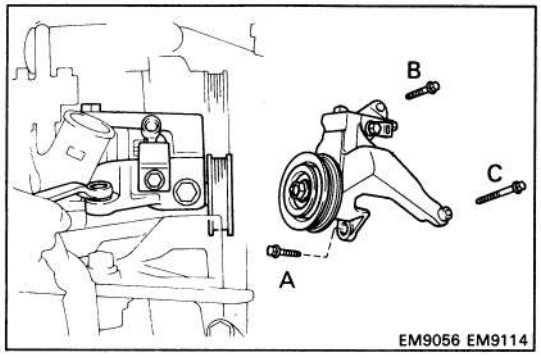
Torque: 980 kg-cm (71 ft-lb, 96 N·m)

15. INSTALL INTERCOOLER
(See steps 2, 3 (g) and 4 to 7 on page TC-23 and 24)



16. INSTALL A/C COMPRESSOR AND IDLER PULLEY BRACKET

(a) Temporarily install the compressor with the two bolts.

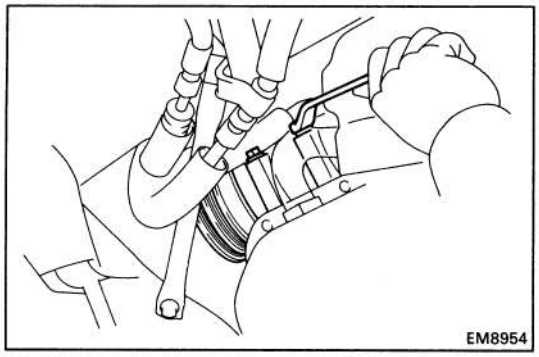


(b) Install the idler pulley bracket with the three bolts.

Torque:
A 275 kg-cm (20 ft-lb, 27 N·m)
B 375 kg-cm (27 ft-lb, 37 N·m)
C 250 kg-cm (18 ft-lb, 25 N·m)

(c) Install the wire clamp of the A/C compressor with the bolt.

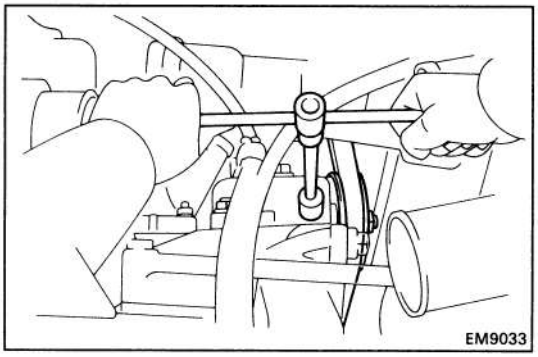
cardiagn.com



(d) Tighten the two bolts of the lower side holding the A/C compressor to the cylinder block.

Torque: 280 kg-cm (20 ft-lb, 27 N·m)

(e) Connect the A/C compressor connector.

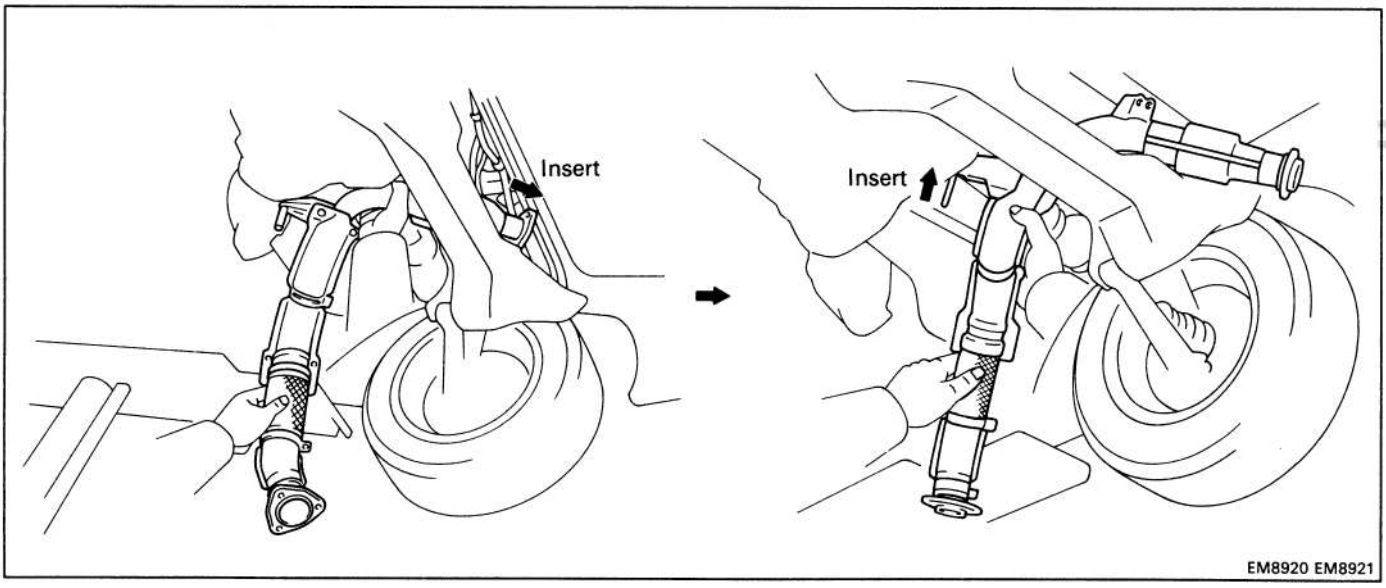


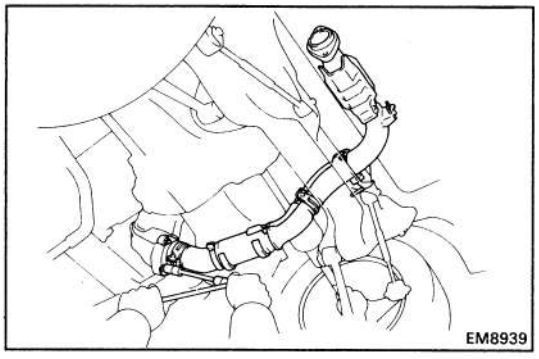
(f) Install and adjust the drive belt with the idler pulley bolt and adjusting bolt.

17. INSTALL ENGINE COMPARTMENT COOLING FAN
(See steps 1 and 2 on page CO-36)

18. INSTALL FRONT EXHAUST PIPE

HINT: Passing the exhaust pipe rear side between the body and suspension crossmember is not easy, so follow the method shown in the illustration.



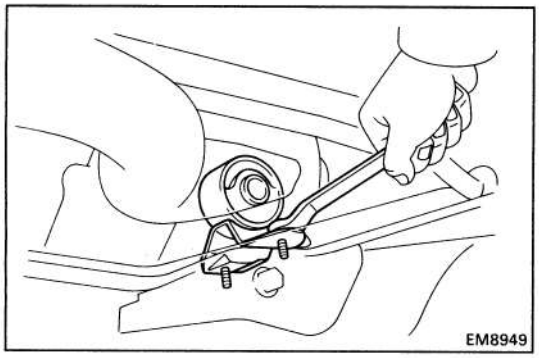


(a) Place a new gasket on the front of the front exhaust pipe.

(b) Using a 14 mm deep socket wrench, install the three new nuts holding the exhaust pipe to the catalytic converter.

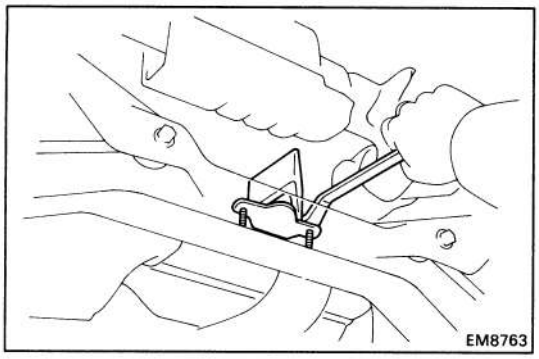
Torque: 630 kg-cm (46 ft-lb, 62 N·m)

cardiagn.com



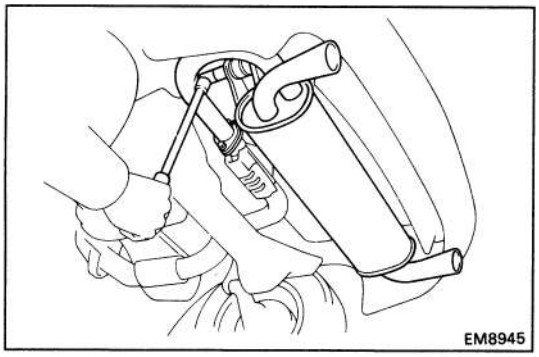
(c) Install the support bracket with the two bolts.

Torque: 210 kg-cm (15 ft-lb, 21 N·m)



(d) Install the damper with the two bolts.

Torque: 210 kg-cm (15 ft-lb, 21 N·m)



19. INSTALL TAILPIPE

(a) Install the tailpipe with the two through bolts.

Torque: 670 kg-cm (48 ft-lb, 66 N·m)

(b) Place a new gasket between the front exhaust pipe and tailpipe.

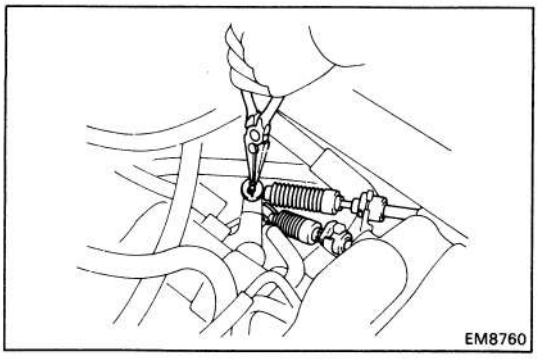
(c) Temporarily install the two bolts holding the front exhaust pipe to the tailpipe.

(d) Install the two bolts holding the stopper bracket of the front exhaust pipe to the tailpipe stopper bracket.

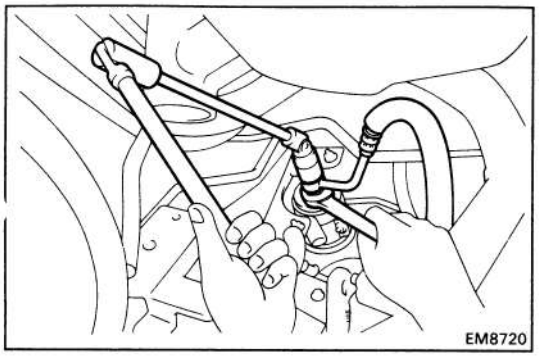
Torque: 190 kg-cm (14 ft-lb, 19 N·m)

(e) Tighten the two bolts holding the front exhaust pipe to the tailpipe.

Torque: 440 kg-cm (32 ft-lb, 43 N·m)



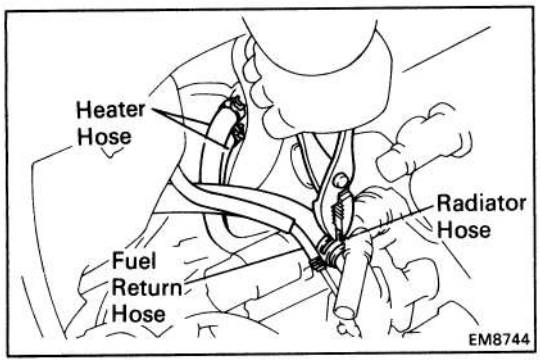
20. CONNECT TRANSAXLE CONTROL CABLES TO TRANSAXLE



21. CONNECT FUEL INLET HOSE TO FUEL FILTER

Torque: 300 kg-cm (22 ft-lb, 29 N·m)

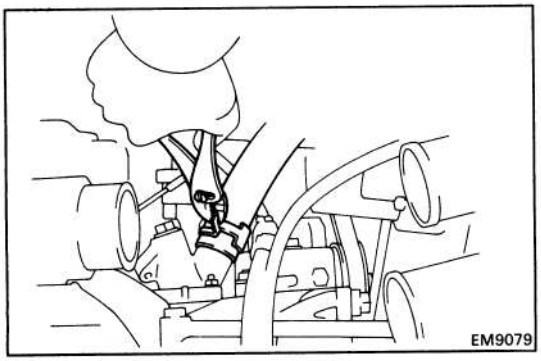
cardiagn.com



22. CONNECT FUEL RETURN HOSE

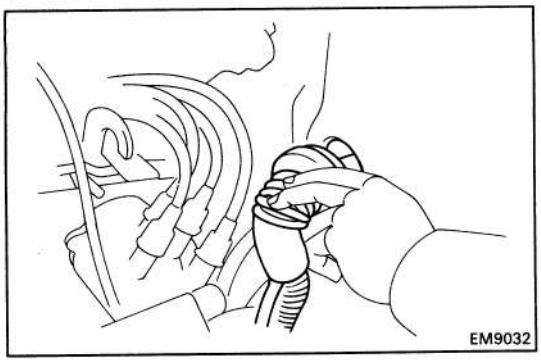
23. CONNECT RADIATOR HOSE TO WATER OUTLET

24. CONNECT HEATER HOSES



25. CONNECT RADIATOR HOSE TO WATER INLET

26. CONNECT STARTER CABLE



27. CONNECT ENGINE WIRE TO LUGGAGE COMPARTMENT

(a) Push in the engine wire through the luggage compartment.

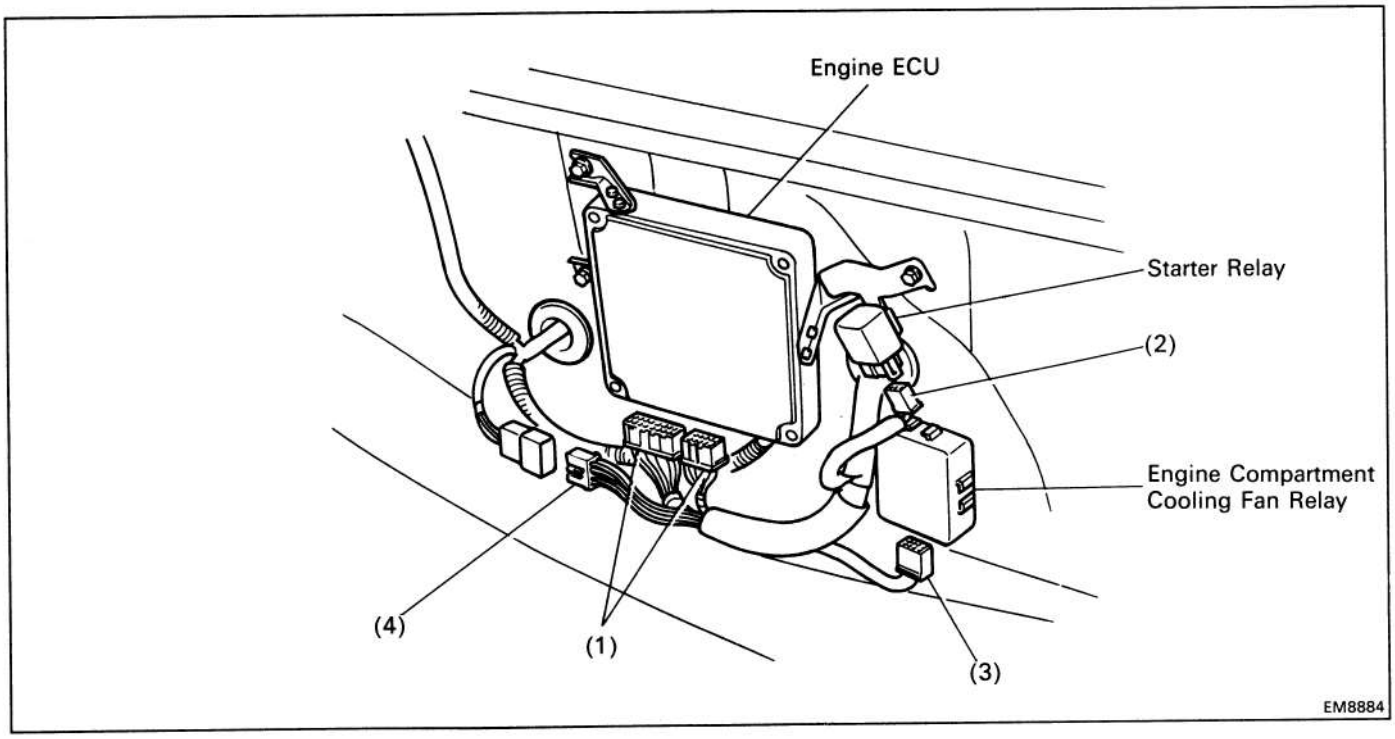
(b) Connect the following connectors:

(1) Two engine ECU connectors

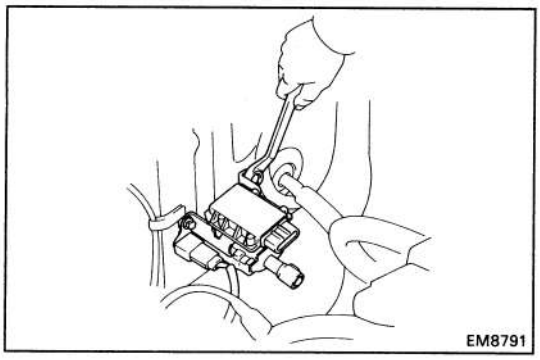
(2) Starter relay connector

(3) Engine comparment cooling fan relay connector

(4) Engine compartment wire connector



cardiagn.com



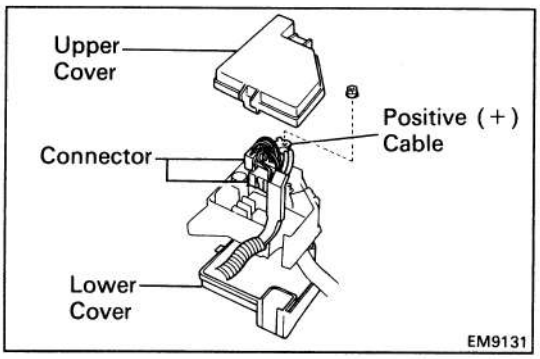
28. INSTALL IGNITION COIL AND IGNITER

(a) Install the ignition coil and igniter assembly with the two bolts. Connect the noise filter.

(b) Connect the high-tension cord.

(c) Connect the ignition coil connector.

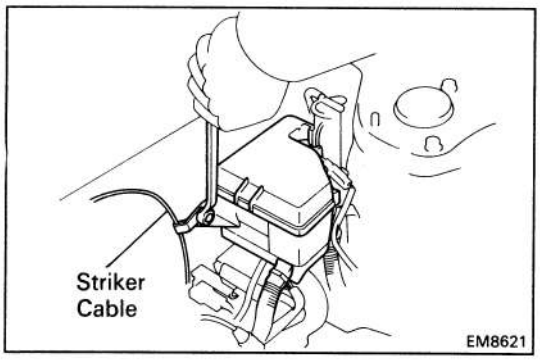
(d) Connect the igniter connector.



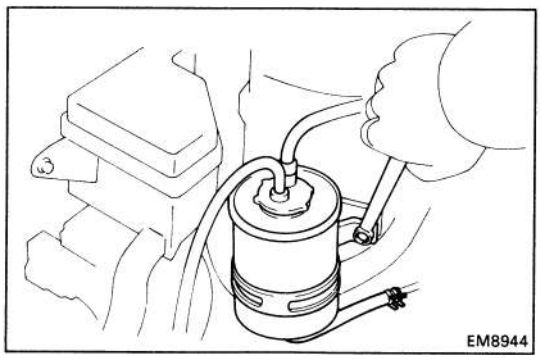
29. CONNECT ENGINE WIRE, AND INSTALL ENGINE RELAY BOX

(a) Connect the two connectors and positive (+) cable of the engine wire to the relay box.

(b) Install the upper and lower covers to the relay box.



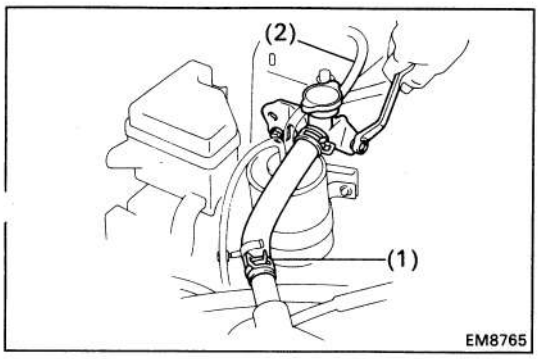
(c) Install the relay box with the two bolts. Install the luggage compartment striker cable.



30. INSTALL CHARCOAL CANISTER

(a) Install the charcoal canister with the two bolts.

(b) Connect the three hoses.



31. INSTALL WATER FILLER

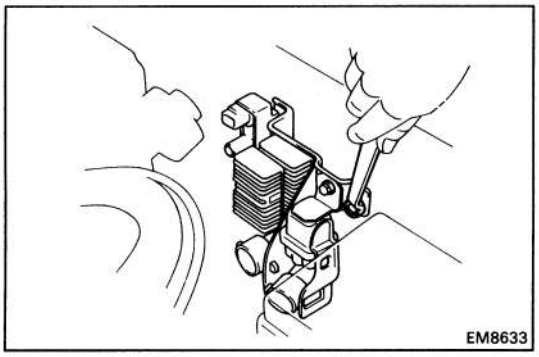
(a) Install the water filler with the two bolts.

(b) Connect the following hoses:

(1) Water filler hose

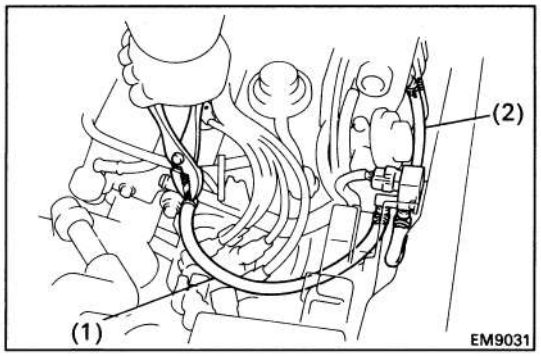
(2) Coolant reservoir hose

cardiagn.com



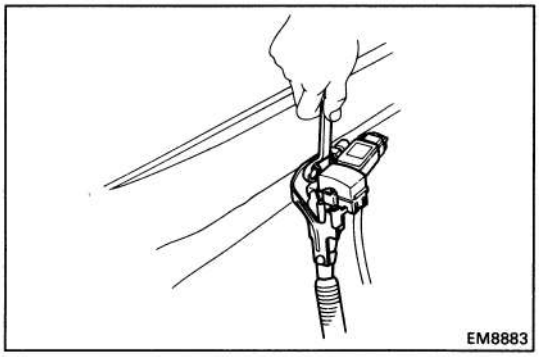
32. INSTALL INJECTOR SOLENOID RESISTOR, FUEL PUMP RELAY, FUEL PUMP RESISTOR AND A/C VSV

(a) Install the solenoid resistor, fuel pump relay, fuel pump resistor assembly and A/C VSV with the two bolts.



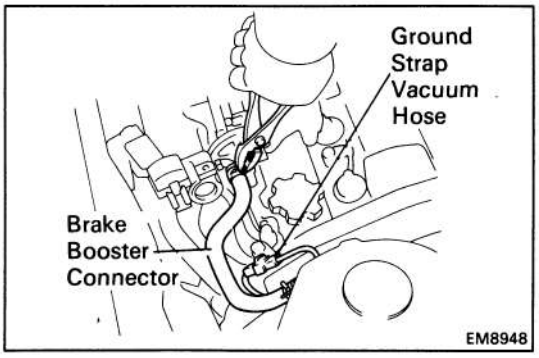
(b) Connect the following hoses:
  (1) A/C VSV air hose from No.2 air tube
  (2) A/C VSV vacuum hose from intake manifold

(c) Connect the following connectors:
- Solenoid resistor connector
- Fuel pump relay connector
- Fuel pump resistor connector
- A/C VSV connector



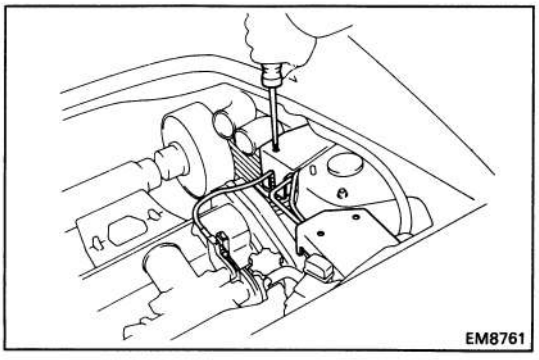
33. INSTALL CHECK CONNECTOR AND TURBOCHARGING PRESSURE SENSOR

Install the check connector and turbocharging pressure sensor with the bolt.



34. CONNECT BRAKE BOOSTER VACUUM HOSE

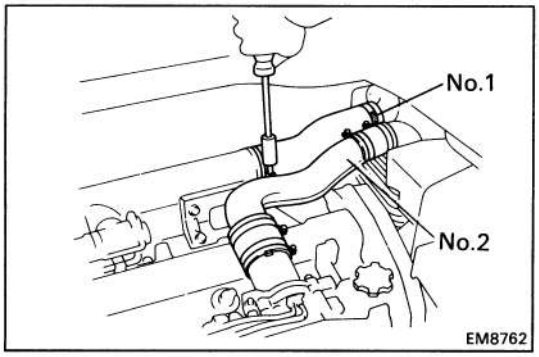
35. CONNECT GROUND STRAP CONNECTOR



36. INSTALL CRUISE CONTROL ACTUATOR (w/ CRUISE CONTROL SYSTEM) AND ACCELERATOR LINKAGE

(a) Connect the cable to the accelerator linkage.
(b) Install the accelerator linkage with the three bolts.
(c) Connect the actuator connector.
(d) Install the actuator with the three bolts.
(e) Install the accelerator linkage cover with the screw.
(f) Install the actuator cover with the two screws.

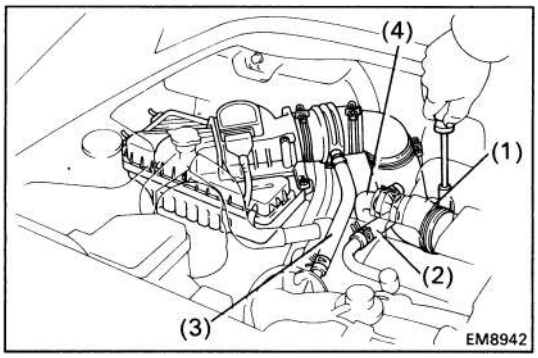
cardiagn.com



37. INSTALL ACCELERATOR CABLE, AND ADJUST IT

38. INSTALL NO.1 AIR INTAKE CONNECTOR

39. INSTALL NO.2 AIR INTAKE CONNECTOR



40. INSTALL AIR CLEANER

(a) Install the air cleaner case with the three bolts.

(b) Install the air cleaner element.

(c) Connect the following hose:

(1) Air cleaner hose from turbocharger

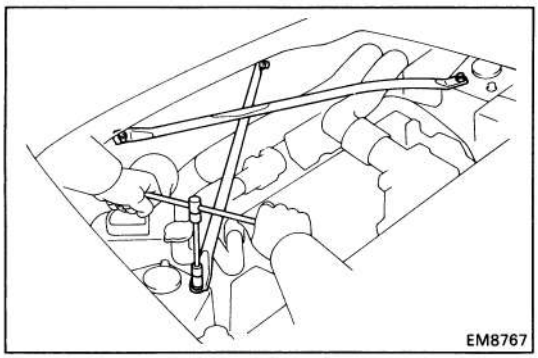
(2) PCV hose from cylinder head cover

(3) Air hose from No.2 air tube

(4) Air hose from air by-pass valve

(d) Install the air cleaner cap and air flow meter.

(e) Connect the air flow meter connector.



41. INSTALL SUSPENSION UPPER BRACE

Install the suspension upper brace with the two bolts and two nuts.

Torque: Bolt 740 kg-cm (54 ft-lb, 73 N·m)
Nut 650 kg-cm (47 ft-lb, 64 N·m)

42. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

43. FILL WITH ENGINE COOLANT (See page CO-7)

Capacity (w/ Heater):
13.6 liters (14.4 US qts, 12.0 Imp. qts)

44. FILL WITH ENGINE OIL (See page LU-8)

Capacity:
Drain and refill
w/ Oil filter change
3.9 liters (4.1 US qts, 3.4 Imp. qts)
w/o Oil filter change
3.6 liters (3.8 US qts, 3.2 Imp. qts)
Dry fill 4.3 liters (4.5 US qts, 3.8 Imp. qts)

45. START ENGINE AND CHECK FOR LEAKS

cardiagn.com

46. PERFORM ENGINE ADJUSTMENT

(a) Adjust the alternator drive belt.
(See page CH-3)

Drive belt tension: New belt 120 ± 20 lb
Used belt 104 ± 20 lb

(b) Adjust the A/C drive belt.

Drive belt tension: New belt 160 ± 20 lb
Used belt 100 ± 20 lb

(c) Adjust the ignition timing.
(See steps 9 to 13 on pages IG-17 and 18)

Ignition timing:
10° BTDC @ idle
(w/ Terminals TE1 and E1 connected)

47. INSTALL ENGINE UNDER COVERS

48. INSTALL ENGINE HOOD

49. INSTALL ENGINE COMPARTMENT SIDE PANELS

50. PERFORM ROAD TEST

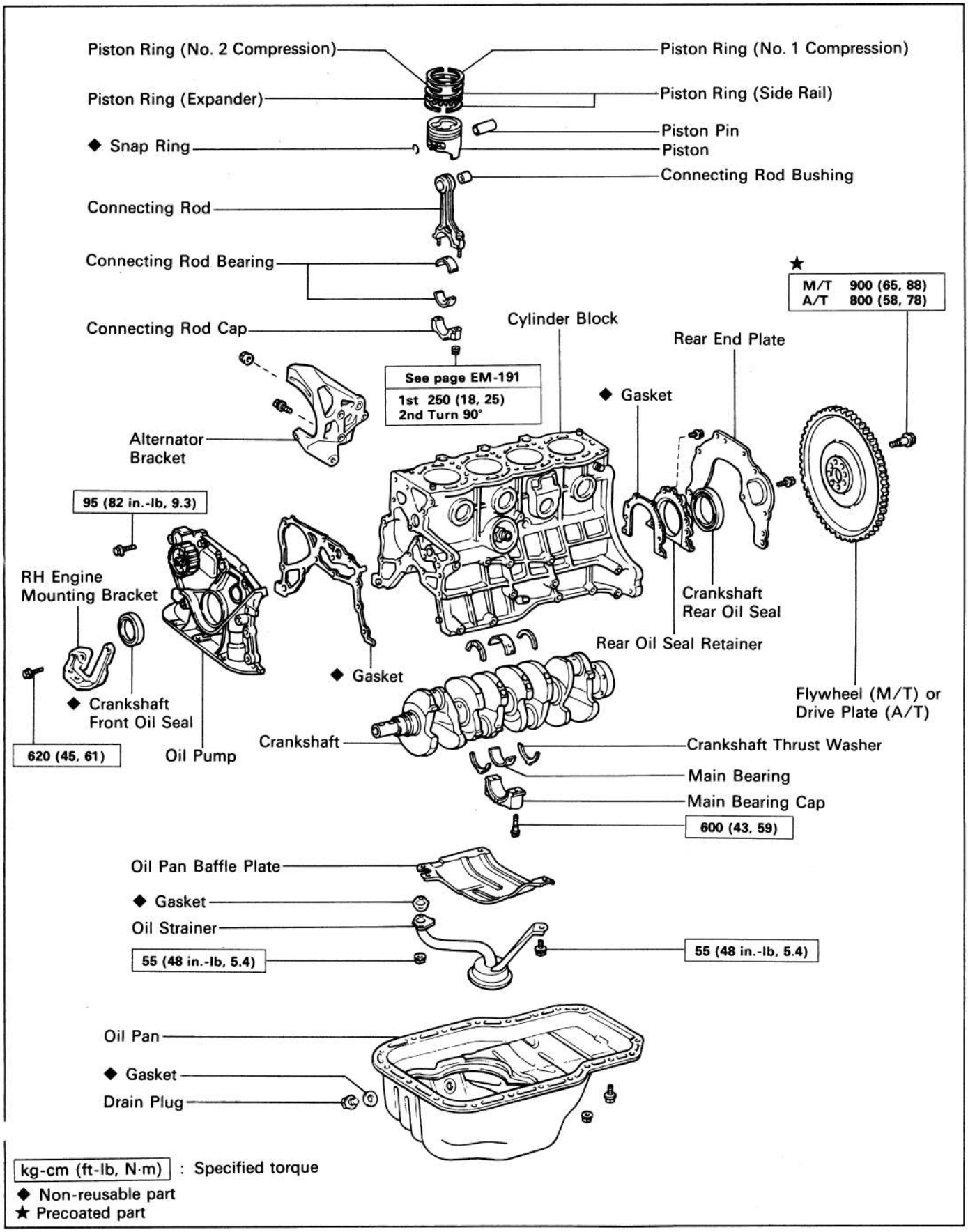
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

51. RECHECK ENGINE COOLANT AND OIL LEVELS

cardiagn.com

CYLINDER BLOCK (5S-FE)

COMPONENTS



kg-cm (ft-lb, N·m) : Specified torque

◆ Non-reusable part

★ Precoated part

cardiagn.com

REMOVAL OF ENGINE

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**

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

2. **REMOVE ENGINE HOOD**

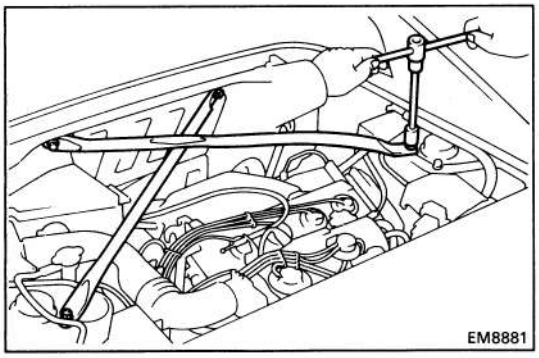
3. **REMOVE ENGINE HOOD SIDE PANELS**

4. **REMOVE ENGINE UNDER COVERS**

5. **DRAIN ENGINE COOLANT (See page CO-6)**

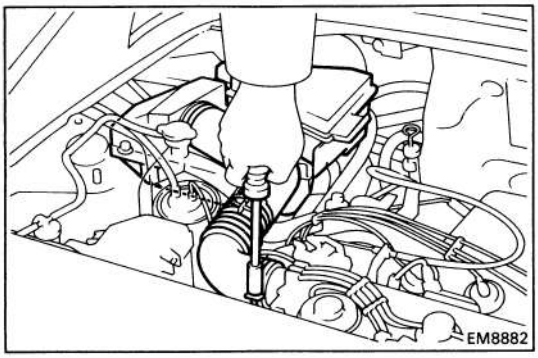
6. **DRAIN ENGINE OIL (See page LU-7)**

7. **DRAIN TRANSAXLE OIL**



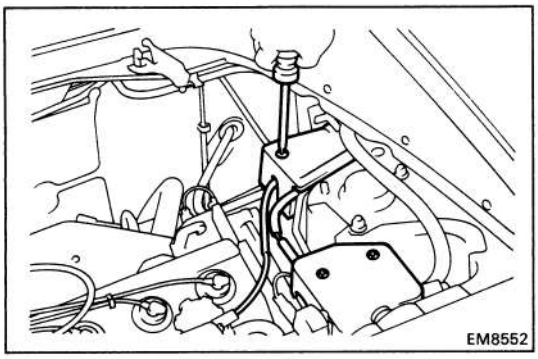
8. **REMOVE SUSPENSION UPPER BRACE**

   Remove the two bolts, two nuts and upper brace.



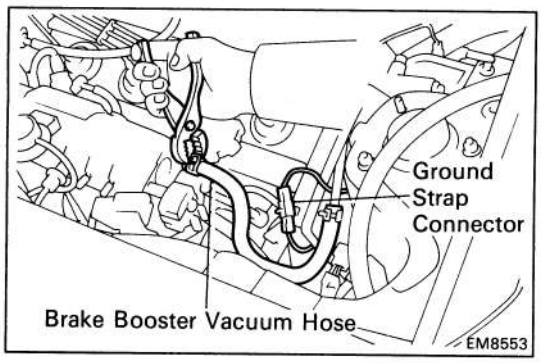
9. **REMOVE AIR CLEANER ASSEMBLY**
   (a) Disconnect the intake air temperature sensor connector.
   (b) Disconnect the four air cleaner cap clips.
   (c) Disconnect the air cleaner hose from the throttle body, and remove the air cleaner cap and element.
   (d) Remove the three bolts and air cleaner case.

10. **DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY**



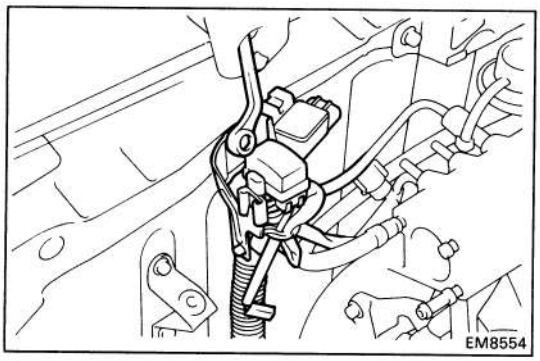
11. **REMOVE CRUISE CONTROL ACTUATOR (w/ CRUISE CONTROL SYSTEM) AND LINKAGE**
    (a) Remove the two screws and actuator cover.
    (b) Remove the screw and accelerator linkage cover.
    (c) Remove the three bolts and actuator.
    (d) Disconnect the actuator connector
    (e) Remove the three bolts and accelerator linkage.
    (f) Disconnect the cable from the accelerator linkage.

cardiagn.com

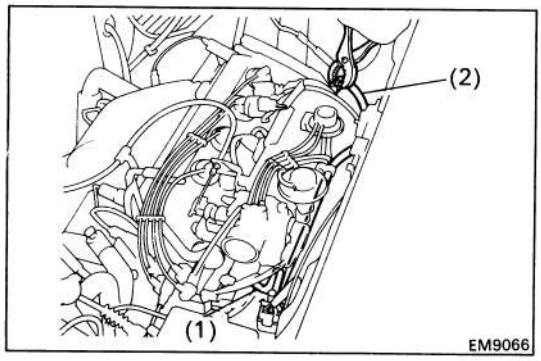


12. DISCONNECT BRAKE BOOSTER VACUUM HOSE

13. DISCONNECT GROUND STRAP CONNECTOR



14. REMOVE CHECK CONNECTOR AND VACUUM SENSOR



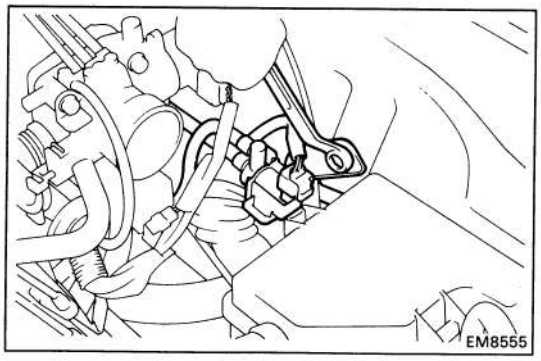
15. REMOVE A/C VSV

(a) Disconnect the A/C VSV connector.

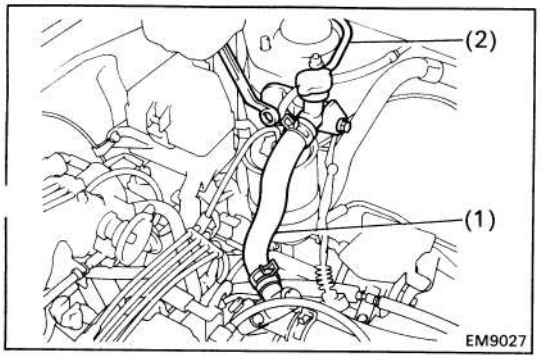
(b) Disconnect the following hoses:

(1) Air hose from ISC valve

(2) Vacuum hose from intake manifold



(c) Remove the two bolts and A/C VSV.



16. REMOVE WATER FILLER

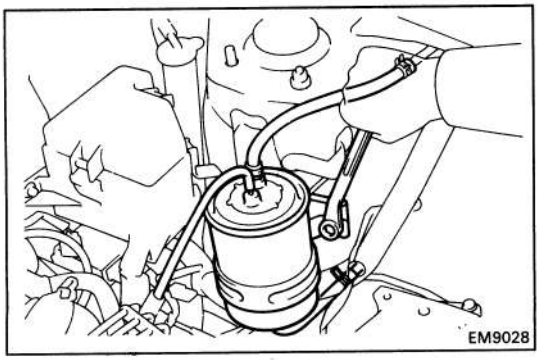
(a) Disconnect the following hose:

(1) Water filler hose

(2) Coolant reservoir hose

(b) Remove the two bolts and water filler.

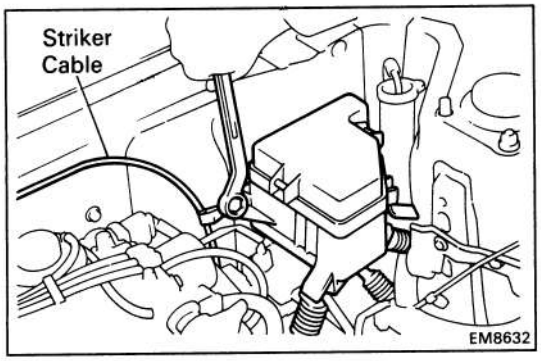
cardiagn.com



17. REMOVE CHARCOAL CANISTER

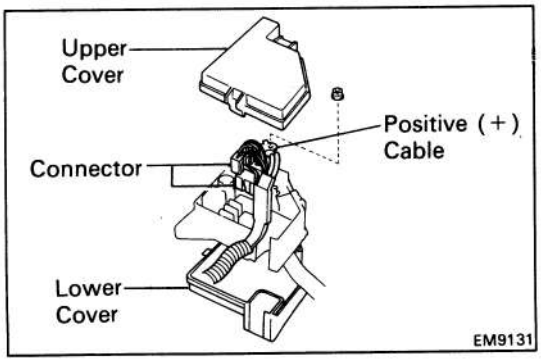
(a) Disconnect the three vacuum hoses.

(b) Remove the two bolts and charcoal canister.



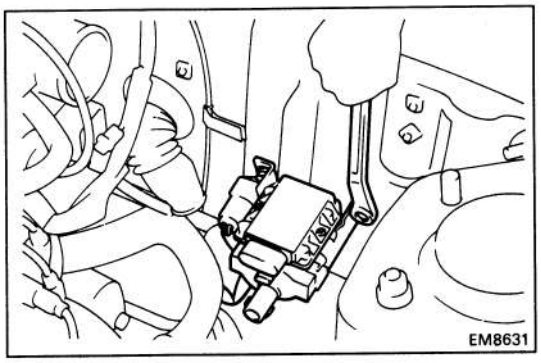
18. REMOVE ENGINE RELAY BOX, AND DISCONNECT ENGINE WIRE

(a) Remove the two bolts and relay box. Disconnect the luggage compartment striker cable.



(b) Remove the upper and lower covers from the relay box.

(c) Disconnect the positive (+) cable and two connectors of the engine wire from the relay box.



19. REMOVE IGNITION COIL AND IGNITER

(a) Disconnect the ignition coil connector.

(b) Disconnect the igniter connector.

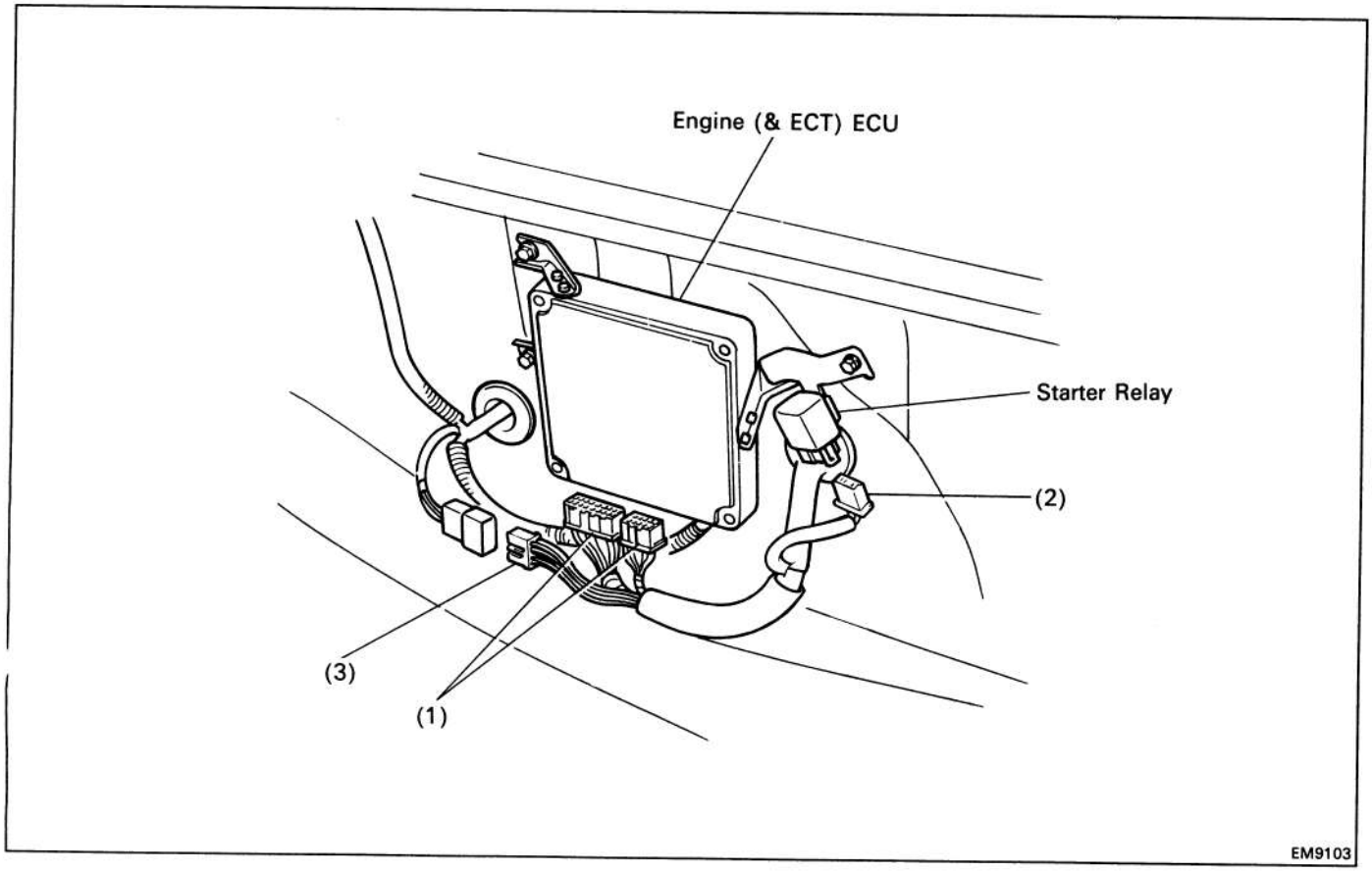
(c) Disconnect the high-tension cord.

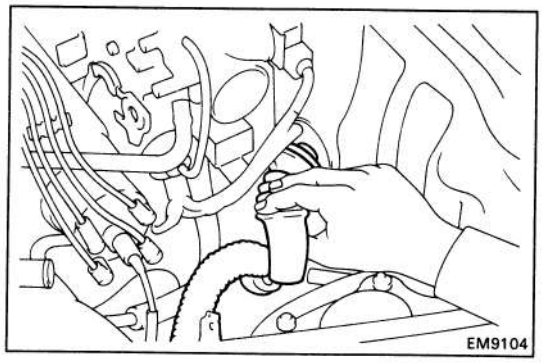
(d) Remove the two bolts, the ignition coil and igniter assembly. Disconnect the noise filter.

cardiagn.com

20. DISCONNECT ENGINE WIRE FROM LUGGAGE COMPARTMENT

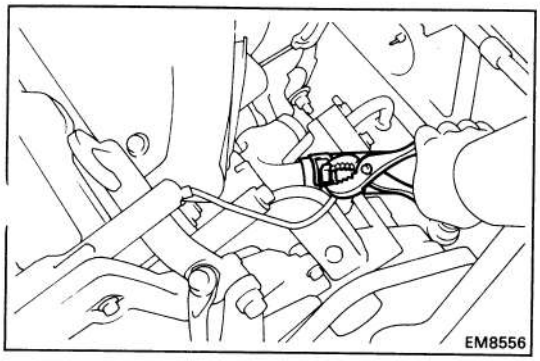
(a) Disconnect the following connectors:
  (1) Two engine ECU connectors
  (2) Starter relay connector
  (3) Engine compartment wire connector





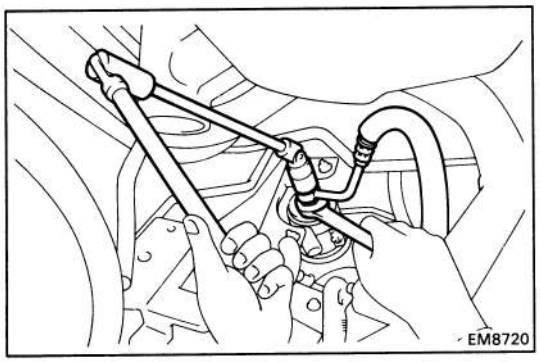
(b) Pull out the engine wire from the luggage compartment.

21. DISCONNECT STARTER CABLE



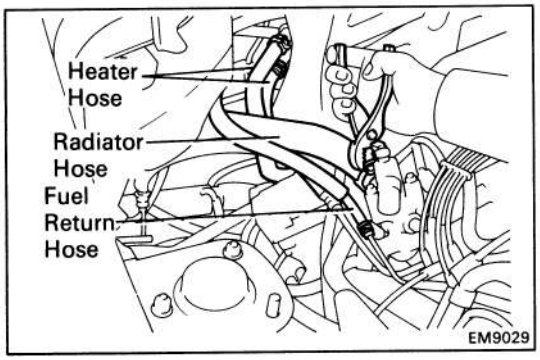
22. DISCONNECT RADIATOR HOSE FROM WATER INLET

cardiagn.com



23. **DISCONNECT FUEL INLET HOSE**

CAUTION: Catch leaking fuel in a container.

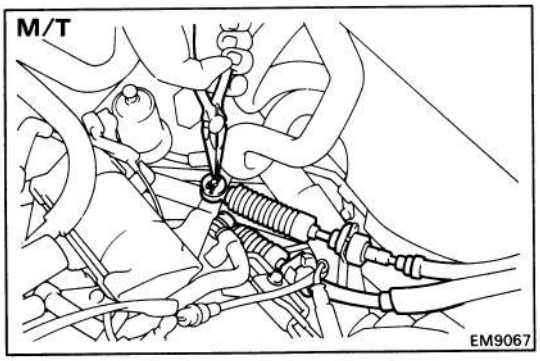


24. **DISCONNECT FUEL RETURN HOSE**

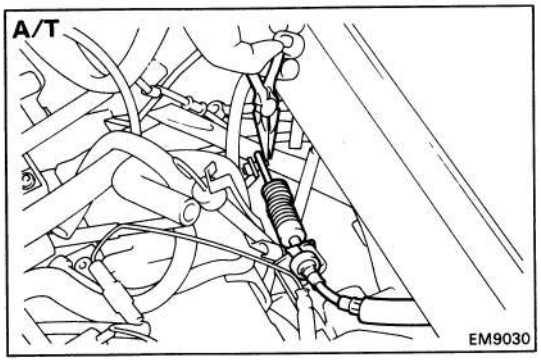
CAUTION: Catch leaking fuel in a container.

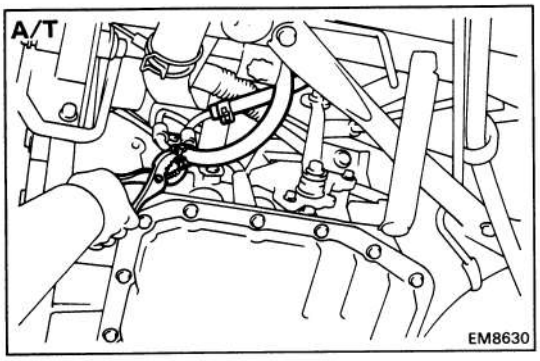
25. **DISCONNECT RADIATOR HOSE FROM WATER OUTLET HOUSING**

26. **DISCONNECT HEATER HOSES**



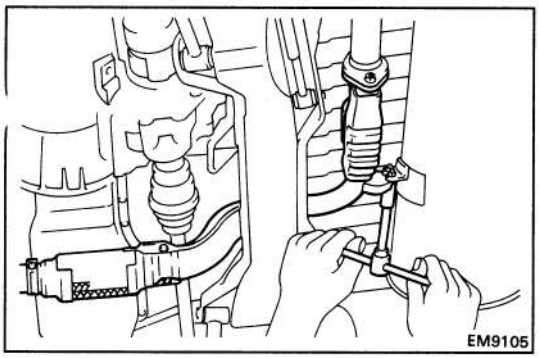
27. **DISCONNECT TRANSAXLE CONTROL CABLE(S) FROM TRANSAXLE**





28. **(A/T)**
DISCONNECT TRANSAXLE OIL COOLER HOSES

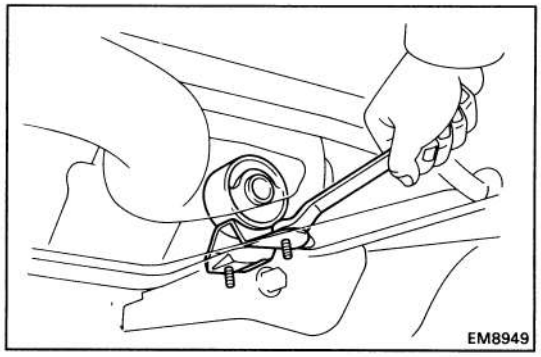
cardiagn.com



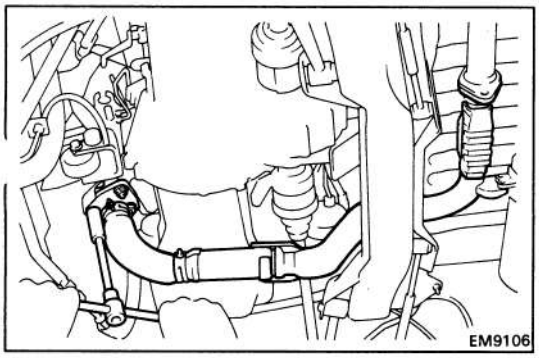
29. REMOVE FRONT EXHAUST PIPE

(a) Remove the two bolts holding the front exhaust pipe to the tailpipe stopper bracket.

(b) Remove the two bolts holding the front exhaust pipe to the tailpipe. Remove the gasket.

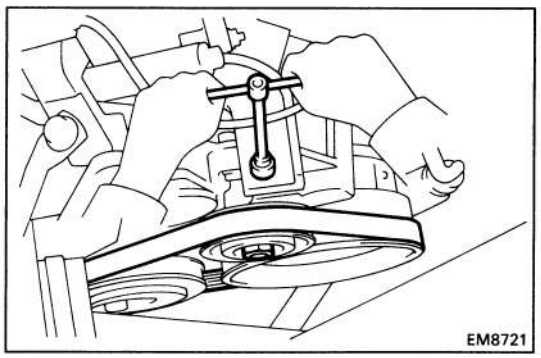


(c) Remove the two bolts and support bracket.



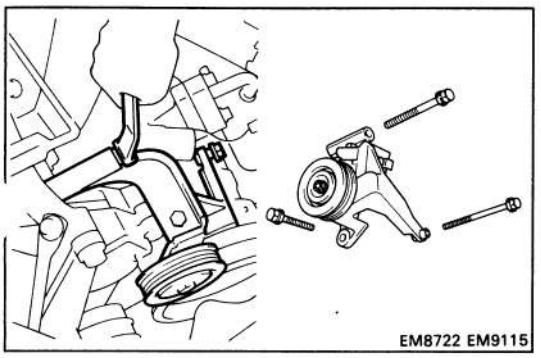
(d) Using a 14 mm deep socket wrench, remove the three nuts, exhaust pipe and gasket.

30. REMOVE DRIVE SHAFT (See pages SA-39 to 41)



31. REMOVE IDLER PULLEY BRACKET AND A/C COMPRESSOR WITHOUT DISCONNECTING HOSES

(a) Disconnect the idler pulley bolt and adjusting bolt, and remove the drive belt.

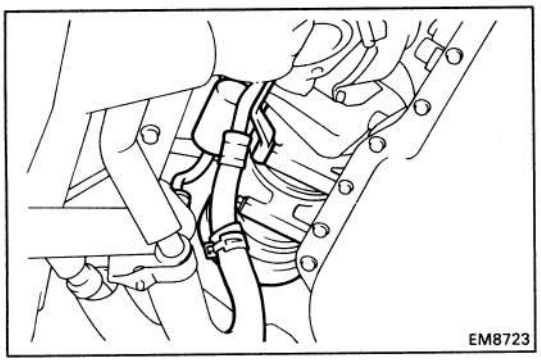


(b) Disconnect the A/C compressor connector.

(c) Remove the bolt and the wire clamp of the A/C compressor.

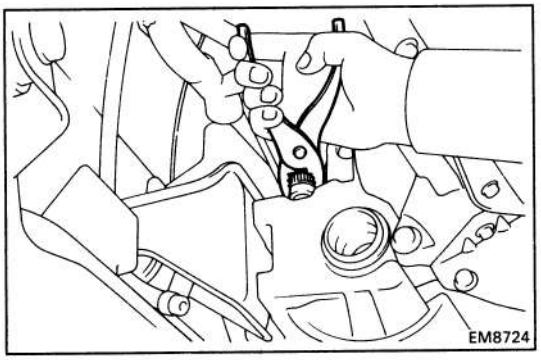
(d) Remove the three bolts and idler pulley bracket.

cardiagn.com

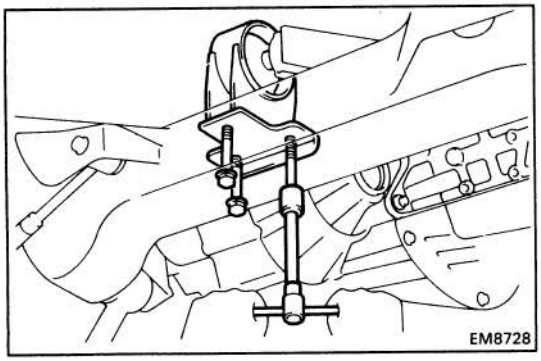


(e) Remove the two bolts, and disconnect the A/C compressor from the engine.

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



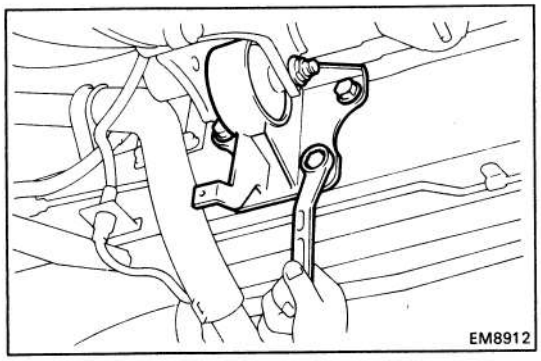
32. DISCONNECT SPEEDOMETER CABLE



33. REMOVE REAR ENGINE MOUNTING INSULATOR

(a) Remove the through bolt holding the mounting insulator to the mounting bracket.

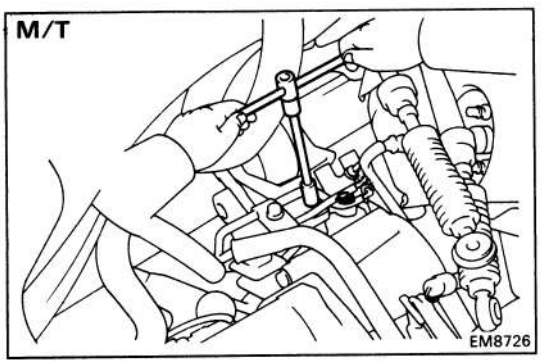
(b) Remove the three bolts and mounting insulator.



34. REMOVE FRONT ENGINE MOUNTING INSULATOR

(a) Remove the through bolt and nut holding the mounting insulator to the mounting bracket.

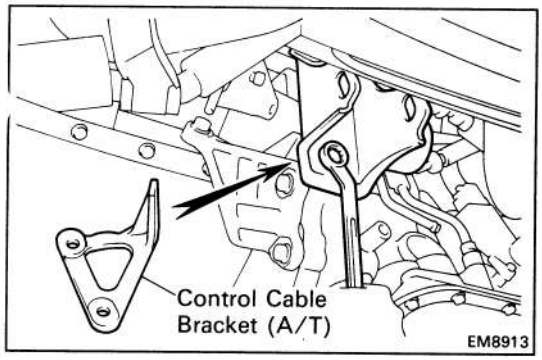
(b) Remove the four bolts and mounting insulator.



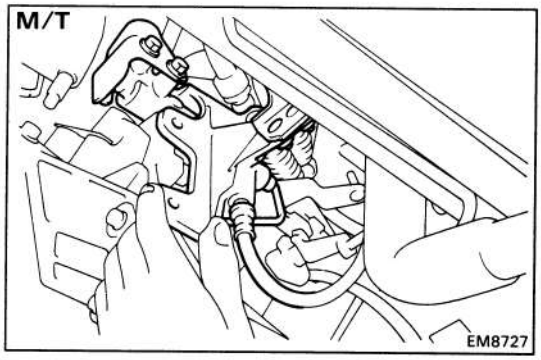
35. REMOVE FRONT ENGINE MOUNTING BRACKET, CLUTCH RELEASE CYLINDER (M/T) AND TRANSAXLE CONTROL CABLE (A/T)

(a) (M/T)
Remove the bolt and nut holding the clutch release cylinder to the transaxle.

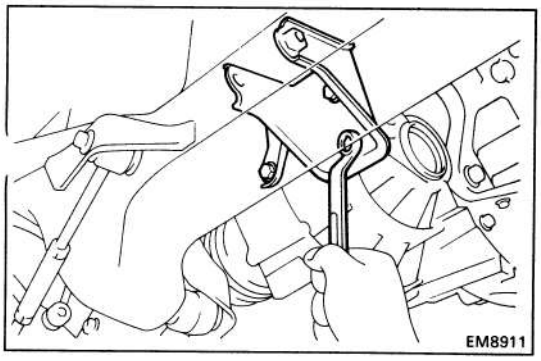
cardiagn.com



(b) Remove the two bolts and mounting bracket and control cable bracket (A/T).

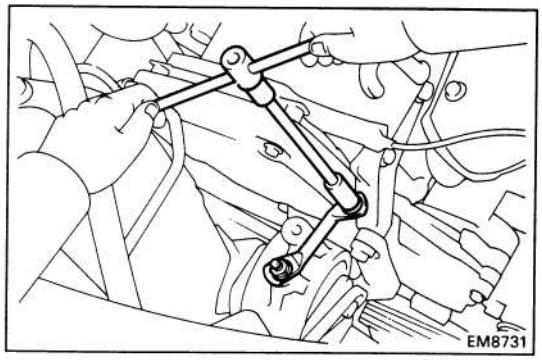


(c) (M/T)
Disconnect the clutch release cylinder without disconnecting the tube.



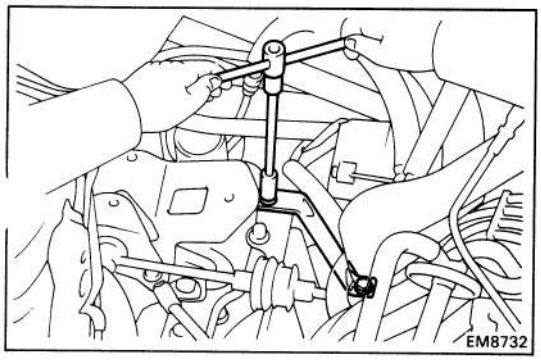
36. REMOVE REAR ENGINE MOUNTING BRACKET

Remove the three bolts and mounting bracket.



37. REMOVE RH ENGINE MOUNTING STAY

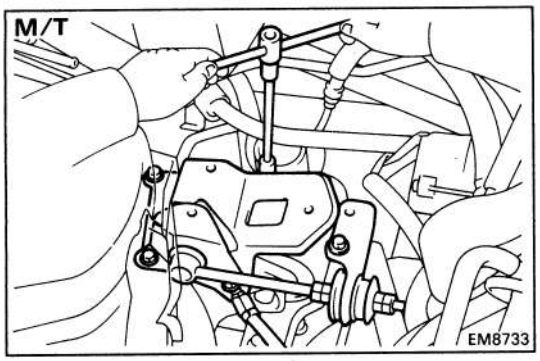
Remove the bolt, nut and mounting stay.



38. (M/T)
REMOVE LH ENGINE MOUNTING STAY

Remove the two bolts, speedometer cable clamp and mounting stay.

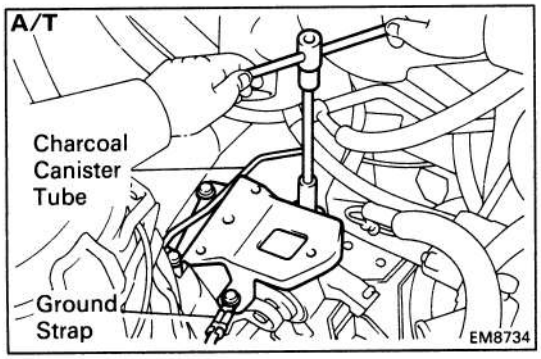
cardiagn.com



39. REMOVE LATERAL CONTROL ROD (M/T) AND AIR CLEANER CASE BRACKET

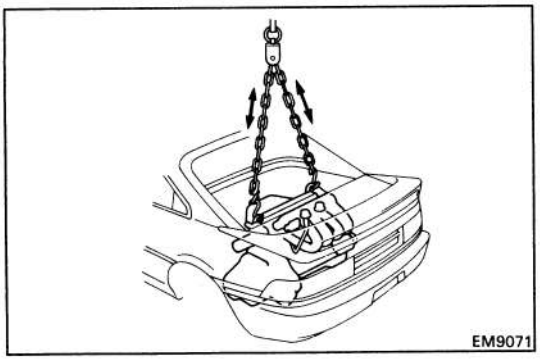
(M/T)

Remove the five bolts, the control rod and case bracket. Disconnect the charcoal canister tube and ground strap (from the transaxle).



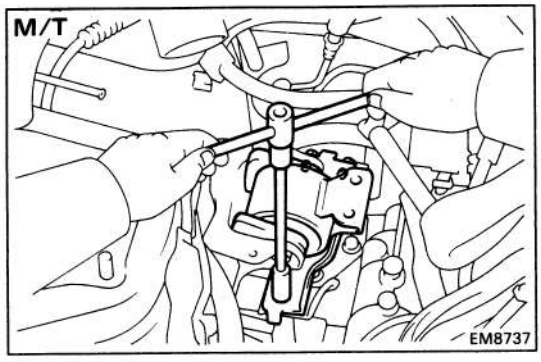
(A/T)

Remove the four bolts and case bracket. Disconnect the charcoal canister tube and ground strap (from the transaxle).



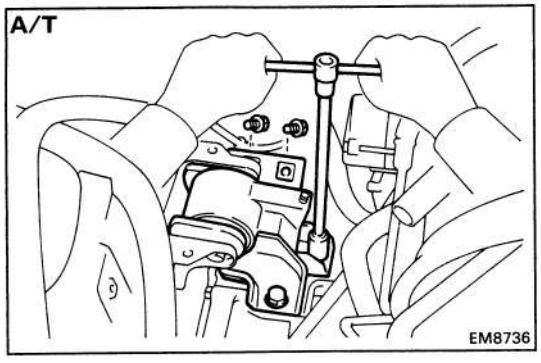
40. REMOVE ENGINE AND TRANSAXLE ASSEMBLY FROM VEHICLE

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

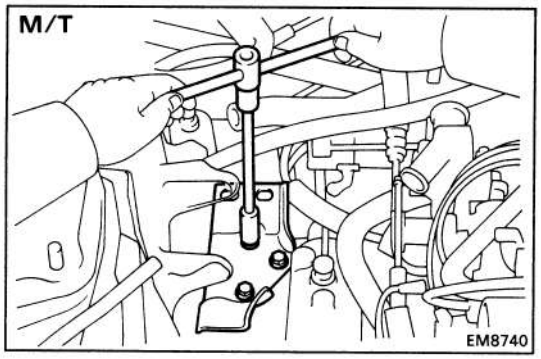


(b) Remove the three (M/T) or four (A/T) bolts holding the LH mounting insulator to the transaxle.

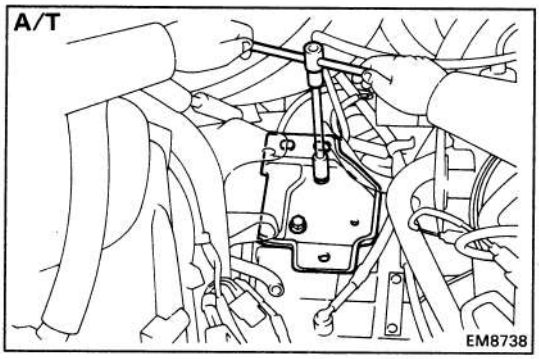
(c) Remove the through bolt, nut and LH mounting insulator.

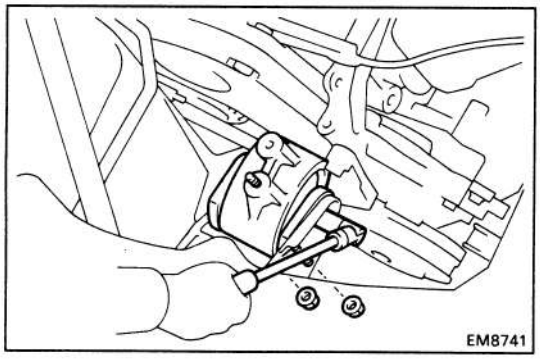


cardiagn.com



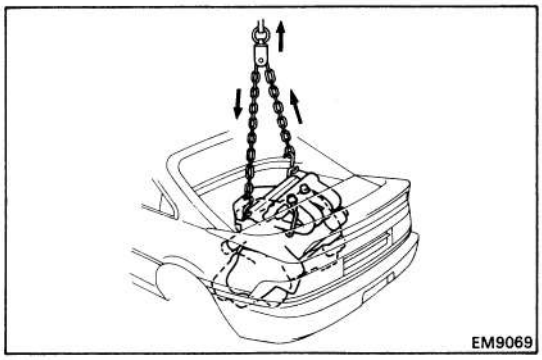
(d) Remove the three (M/T), two (A/T) bolts and LH mounting bracket.





(e) Remove the two nuts holding the RH mounting insulator to the mounting bracket.

(f) Remove the through bolt and RH mounting insulator.



(g) Lift the engine out of the vehicle slowly and carefully.

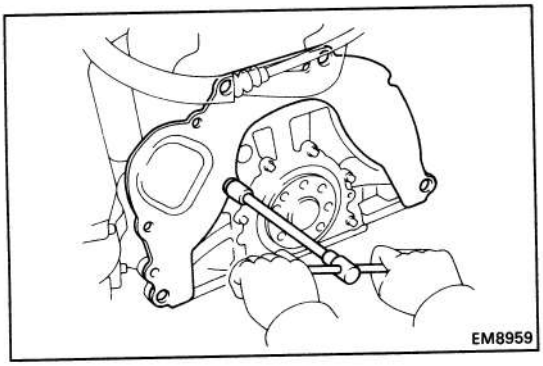
HINT: Make sure the engine is clear of all wiring, hoses and cables.

(h) Place the engine and transaxle assembly onto the stand.

41. REMOVE STARTER (See page ST-4)

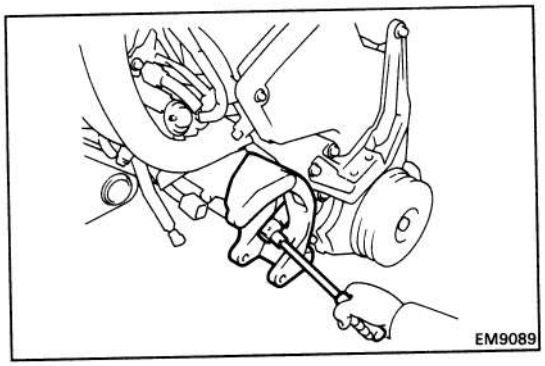
42. SEPARATE ENGINE AND TRANSAXLE
M/T (See pages MT-5 and 6)
A/T (See page AT-41)

cardiagn.com

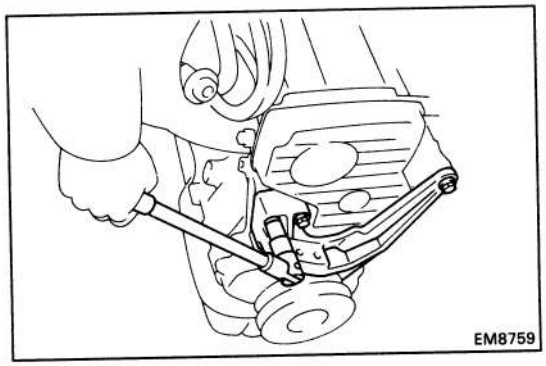


PREPARATION FOR DISASSEMBLY

1. **REMOVE CLUTCH COVER AND DISC**
2. **REMOVE FLYWHEEL**
3. **REMOVE REAR END PLATE**
   Remove the bolt and end plate.
4. **INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY**

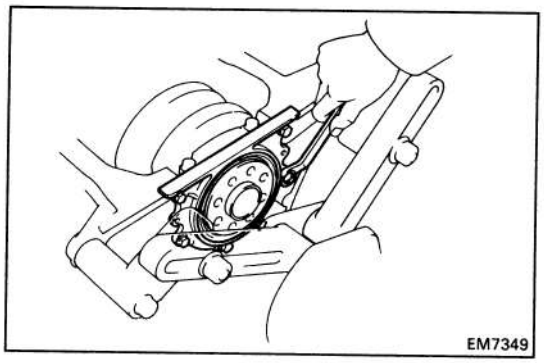


5. **REMOVE ALTERNATOR (See page CH-6)**
6. **REMOVE ALTERNATOR BRACKET**
   Remove the four bolts and mounting bracket.



7. **REMOVE RH ENGINE MOUNTING BRACKET**
   Remove the four bolts and mounting bracket.
8. **REMOVE TIMING BELT AND PULLEYS (See pages EM-49 to 53)**
9. **REMOVE CYLINDER HEAD (See pages EM-98 to 107)**
10. **REMOVE WATER PUMP (See page CO-11)**
11. **REMOVE OIL PAN AND OIL PUMP (See pages LU-11 and 12)**
12. **REMOVE OIL FILTER (See page LU-7)**
13. **REMOVE OIL COOLER (See page LU-24)**

cardiagn.com

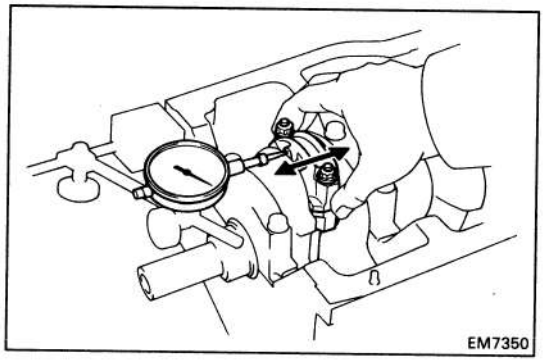


DISASSEMBLY OF CYLINDER BLOCK

(See page EM-181)

1. **REMOVE REAR OIL SEAL RETAINER**

Remove the six bolts, retainer and gasket.



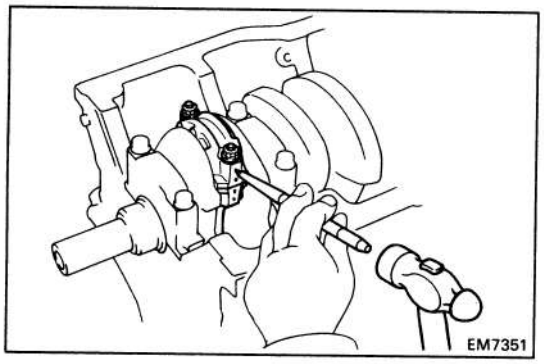
2. **CHECK CONNECTING ROD THRUST CLEARANCE**

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.)**

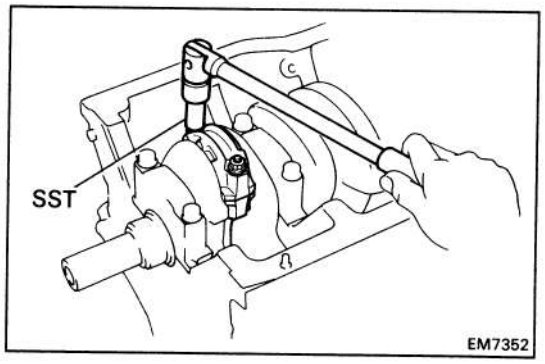
Maximum thrust clearance: **0.35 mm (0.0138 in.)**

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



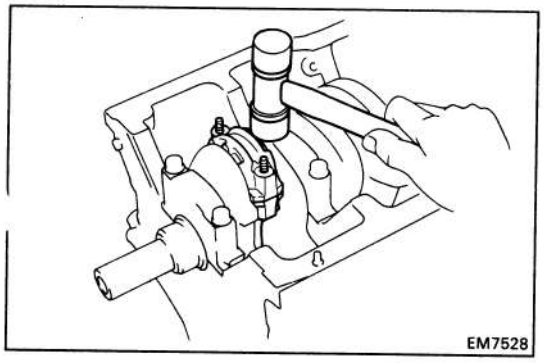
3. **REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE**

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



(b) Using SST, remove the connecting rod cap nuts.

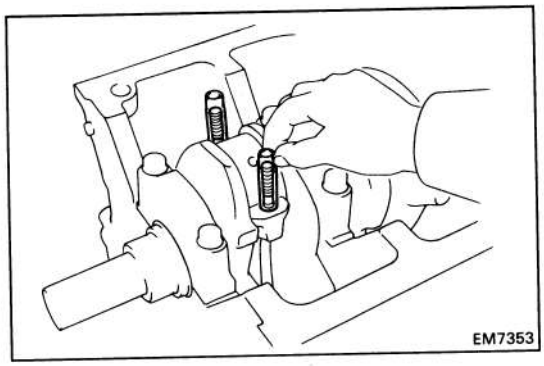
SST 09011-38121



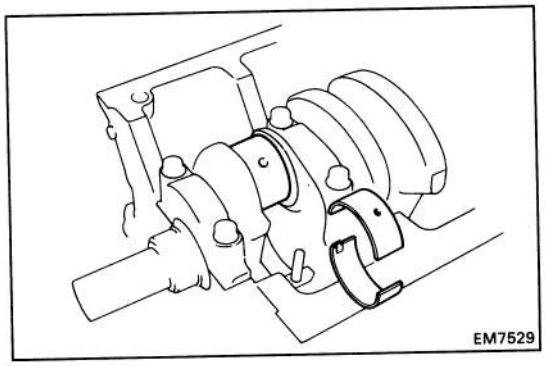
(c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

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

cardiagn.com



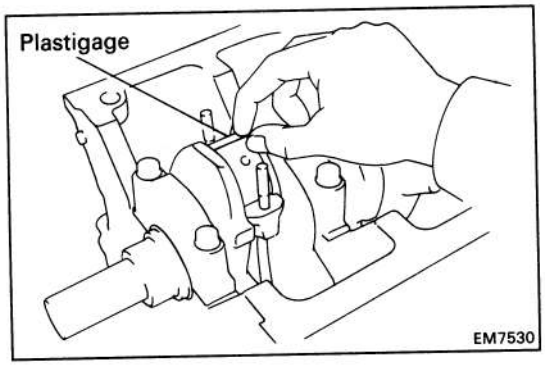
(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



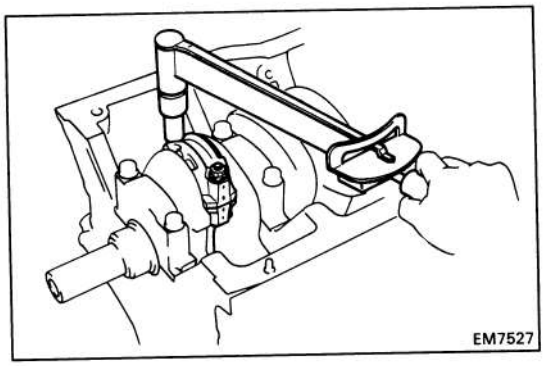
(e) Clean crank pin and bearing.

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

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



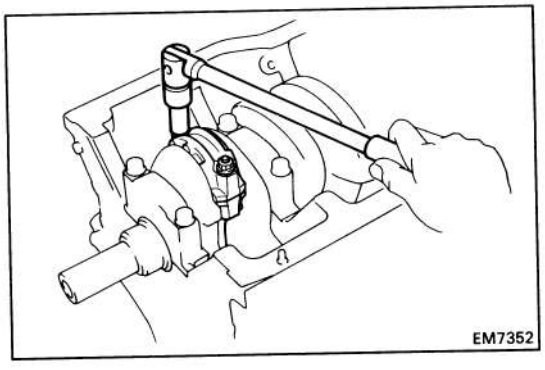
(g) Lay a strip of Plastigage across the crank pin.



(h) Install the connecting rod cap.
(See step 6 on pages EM-213 and 214)

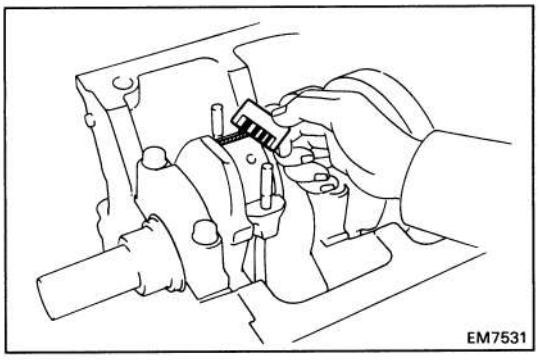
Torque: 1st 250 kg-cm (18 ft-lb, 25 N·m)
2nd Turn 90°

NOTICE: Do not turn the crankshaft.



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

cardiagn.com



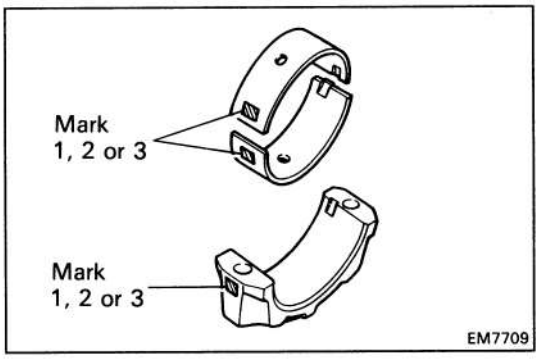
(j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD	**0.024 – 0.055 mm (0.0009 – 0.0022 in.)**
U/S 0.25	**0.023 – 0.069 mm (0.0009 – 0.0027 in.)**

Maximum oil clearance: 0.08 mm (0.0031 in.)

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

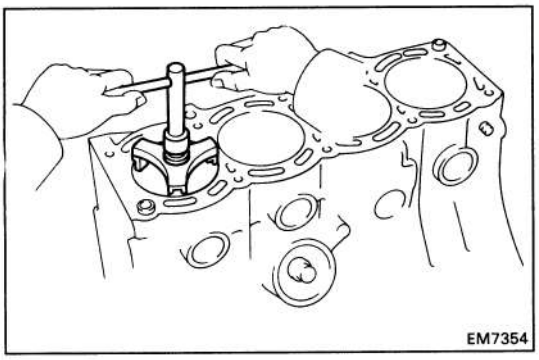


HINT: If using a standard bearing, replace it with one having the same number marked on the connecting rod cap. There are three sizes of standard bearings, marked "1", "2" and "3" accordingly.

Standard sized bearing center wall thickness:

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

(k) Completely remove the Plastigage.

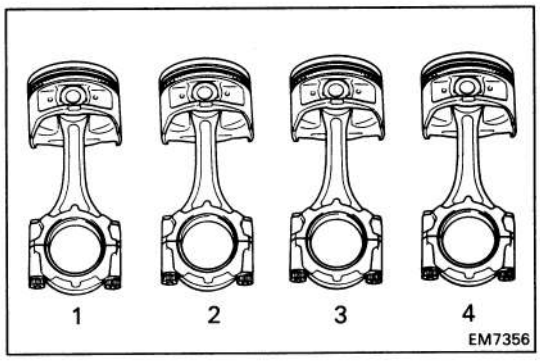


4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

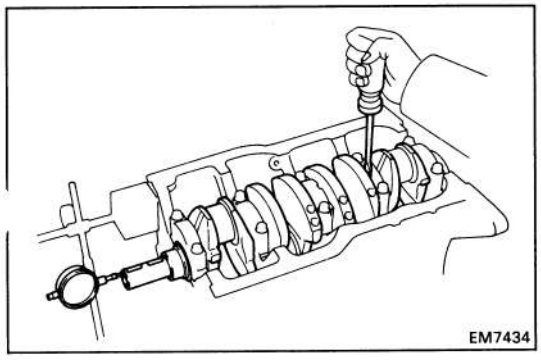
(a) Using a ridge reamer, remove all the carbon from the top of the cylinder.

(b) Cover the connecting rod bolts.
(See page EM-194)

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



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



5. CHECK CRANKSHAFT THRUST CLEARANCE

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

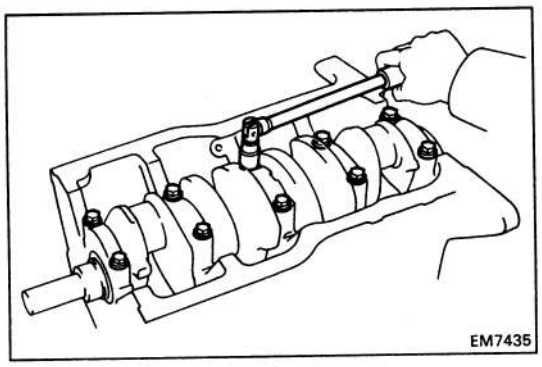
Standard thrust clearance: 0.020 – 0.220 mm (0.0008 – 0.0087 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

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

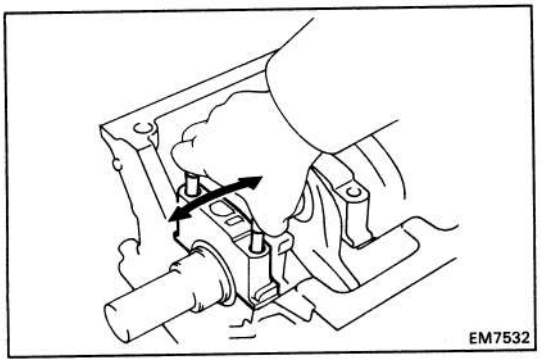
Thrust washer thickness: 2.440 – 2.490 mm (0.0961 – 0.0980 in.)

cardiagn.com



6. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

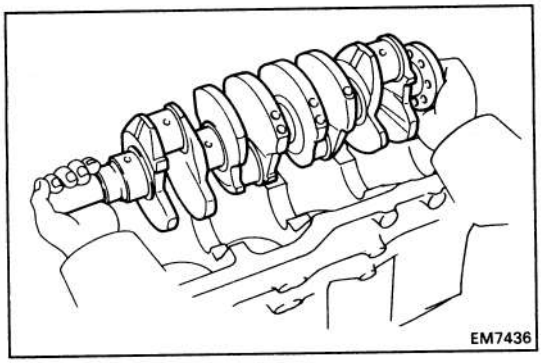
(a) Remove the main bearing cap bolts.



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

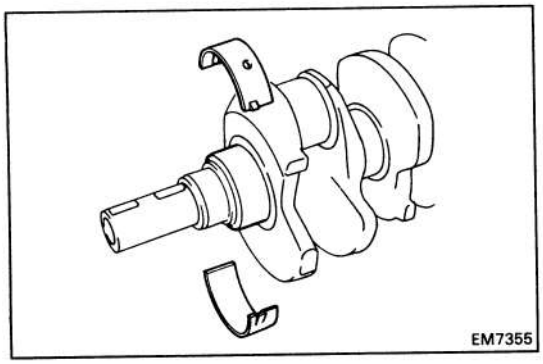
HINT:

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



(c) Lift out the crankshaft.

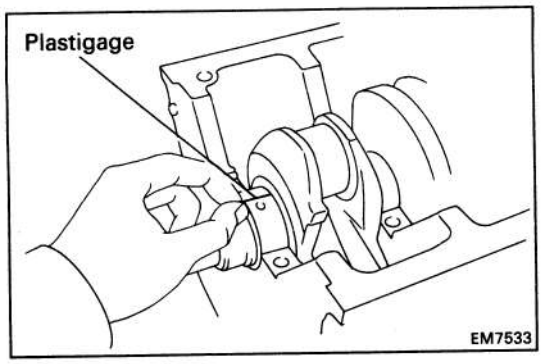
HINT: Keep the upper bearing and upper thrust washers together with the cylinder block.



(d) Clean each main journal and bearing.

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

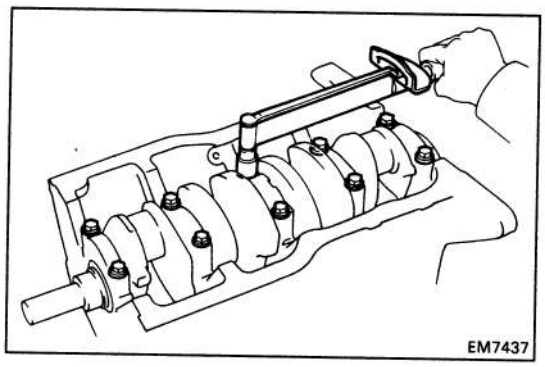
If the journal or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



(f) Place the crankshaft on the cylinder block.

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

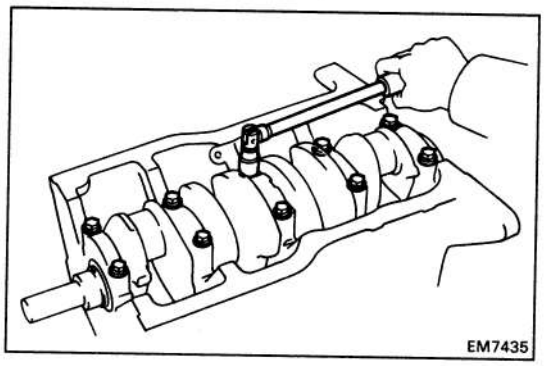
cardiagn.com



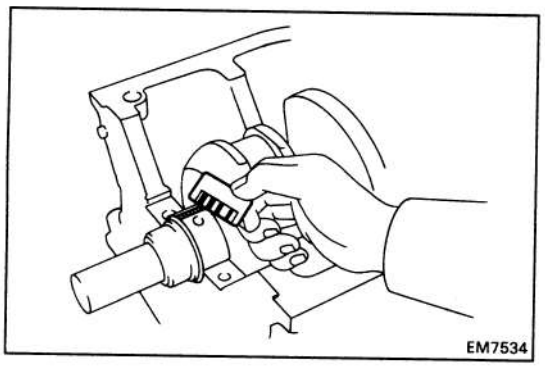
(h) Install the main bearing caps.
(See step 4 on page EM-212)

Torque: 600 kg-cm (43 ft-lb, 59 N·m)

NOTICE: Do not turn the crankshaft.



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



(j) Measure the Plastigage at its widest point.

Standard clearance:

No.3	**STD**	**0.025 – 0.044 mm (0.0010 – 0.0017 in.)**
	U/S 0.25	**0.027 – 0.067 mm (0.0011 – 0.0026 in.)**
Others	**STD**	**0.015 – 0.034 mm (0.0006 – 0.0013 in.)**
	U/S 0.25	**0.019 – 0.059 mm (0.0007 – 0.0023 in.)**

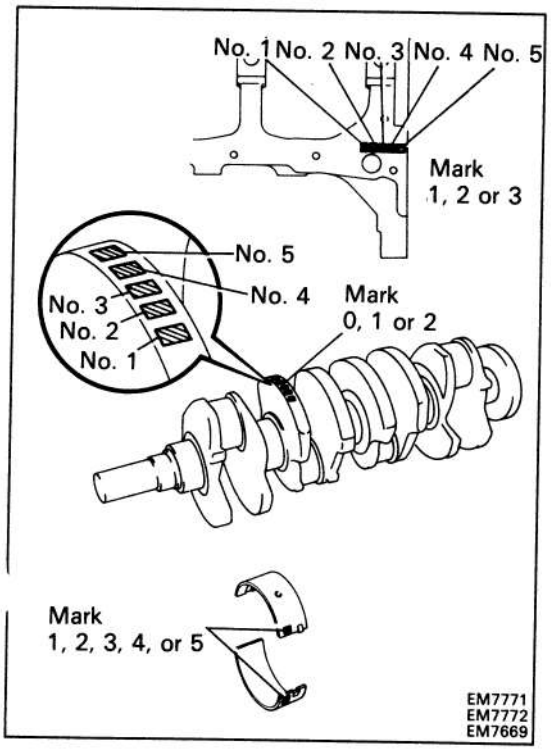
Maximum clearance: 0.08 mm (0.0031 in.)

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

No.3	**0.027 – 0.054 mm (0.0011 – 0.0021 in.)**
Others	**0.017 – 0.044 mm (0.0007 – 0.0017 in.)**

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

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



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

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

cardiagn.com

(Reference)

Cylinder block main journal bore diameter:

Mark "1"	59.020 – 59.026 mm (2.3236 – 2.3239 in.)
Mark "2"	59.026 – 59.032 mm (2.3239 – 2.3241 in.)
Mark "3"	59.032 – 59.038 mm (2.3241 – 2.3243 in.)

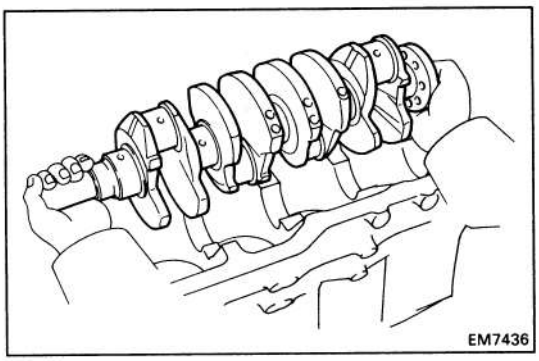
Crankshaft journal diameter:

Mark "0"	54.998 – 55.003 mm (2.1653 – 2.1655 in.)
Mark "1"	54.993 – 54.998 mm (2.1651 – 2.1653 in.)
Mark "2"	54.988 – 54.993 mm (2.1649 – 2.1651 in.)

Standard sized bearing center wall thickness:

No.3	Mark "1"	1.992 – 1.995 mm (0.0784 – 0.0785 in.)
	Mark "2"	1.995 – 1.998 mm (0.0785 – 0.0787 in.)
	Mark "3"	1.998 – 2.001 mm (0.0787 – 0.0788 in.)
	Mark "4"	2.001 – 2.004 mm (0.0788 – 0.0789 in.)
	Mark "5"	2.004 – 2.007 mm (0.0789 – 0.0790 in.)
Others	Mark "1"	1.997 – 2.000 mm (0.0786 – 0.0787 in.)
	Mark "2"	2.000 – 2.003 mm (0.0787 – 0.0789 in.)
	Mark "3"	2.003 – 2.006 mm (0.0789 – 0.0790 in.)
	Mark "4"	2.006 – 2.009 mm (0.0790 – 0.0791 in.)
	Mark "5"	2.009 – 2.012 mm (0.0791 – 0.0792 in.)

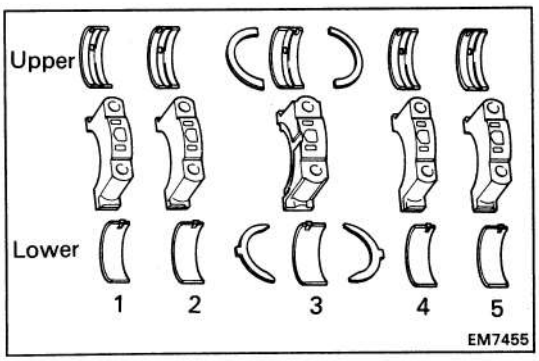
(k) Completely remove the Plastigage.



7. REMOVE CRANKSHAFT

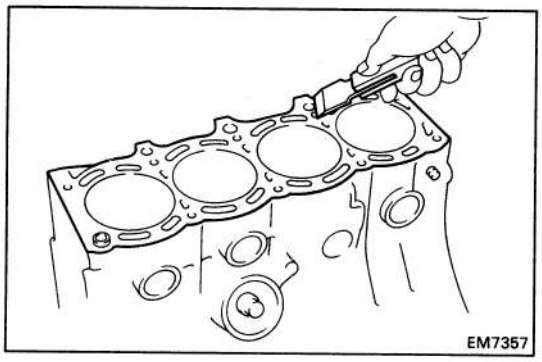
(a) Lift out the crankshaft.

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



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

cardiagn.com



INSPECTION OF CYLINDER BLOCK

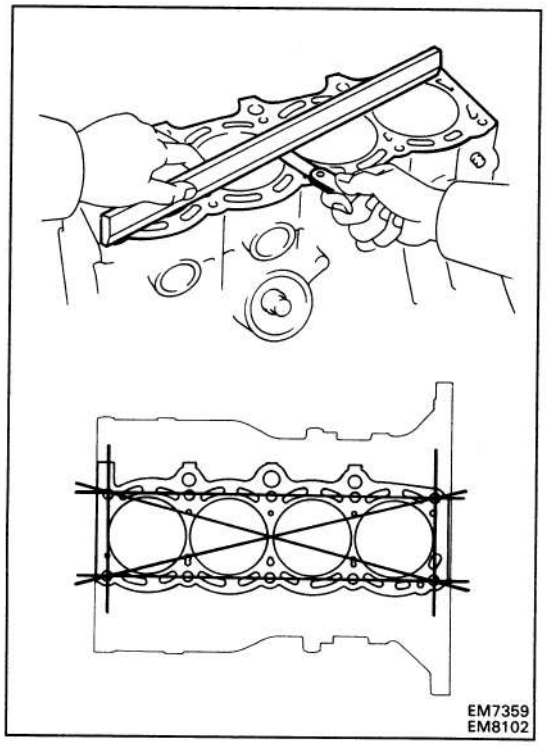
1. CLEAN CYLINDER BLOCK

A. Remove gasket material

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

B. Clean cylinder block

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

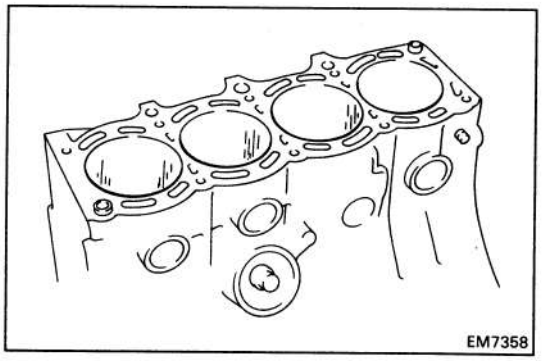


2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage: 0.05 mm (0.0020 in.)

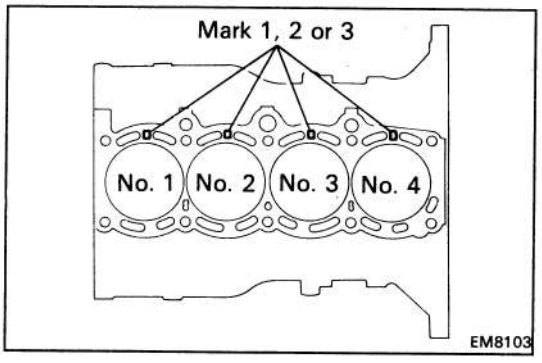
If warpage is greater than maximum, replace the cylinder block.



3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

Visually check the cylinder for vertical scratches.

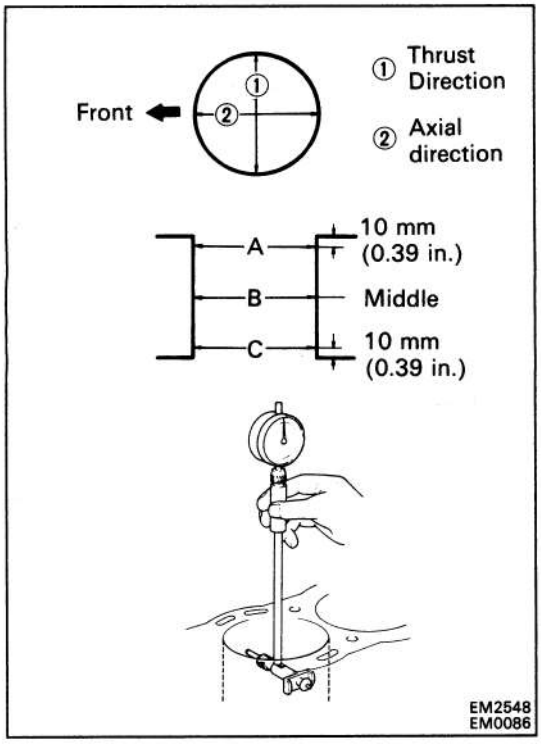
If deep scratches are present, rebore all the four cylinders. If necessary, replace the cylinder block.



4. INSPECT CYLINDER BORE DIAMETER

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

cardiagn.com



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

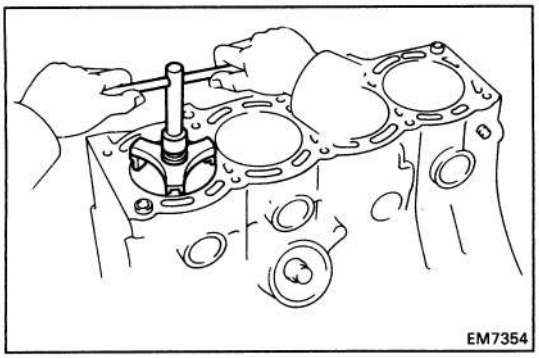
Standard diameter:

STD	**Mark "1"**	**87.000 – 87.010 mm (3.4252 – 3.4256 in.)**
	Mark "2"	**87.010 – 87.020 mm (3.4256 – 3.4260 in.)**
	Mark "3"	**87.020 – 87.030 mm (3.4260 – 3.4264 in.)**

Maximum diameter:

STD	**87.23 mm (3.4342 in.)**
O/S 0.50	**87.73 mm (3.4350 in.)**

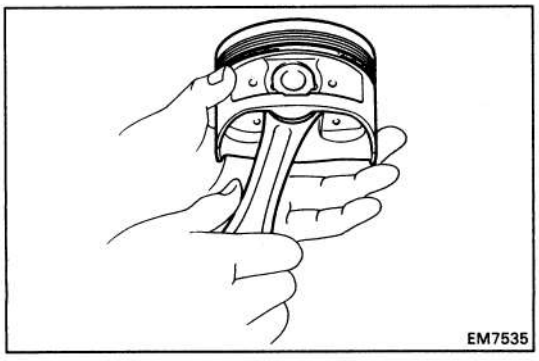
If the diameter is greater than maximum, rebore all the four cylinders. If necessary, replace the cylinder block.



5. REMOVE CYLINDER RIDGE

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

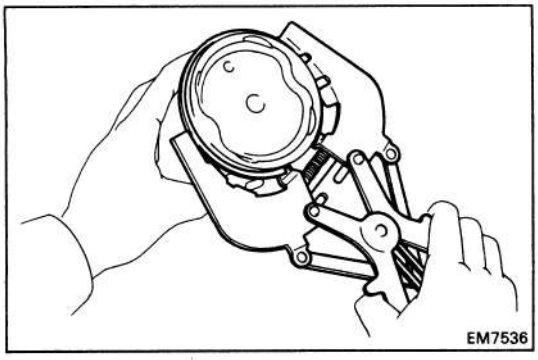
DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES



1. CHECK FIT BETWEEN PISTON AND PISTON PIN

Try to move the piston back and forth on the piston pin.

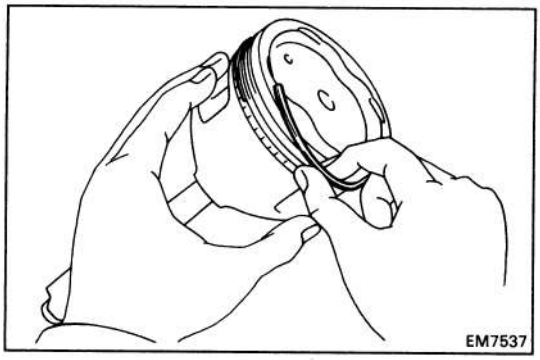
If any movement is felt, replace the piston and pin as a set.



2. REMOVE PISTON RINGS

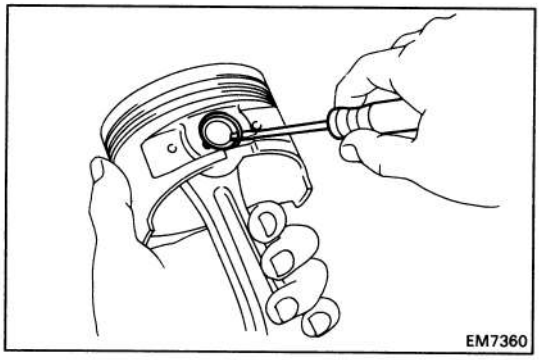
(a) Using a piston ring expander, remove the two compression rings.

cardiagn.com



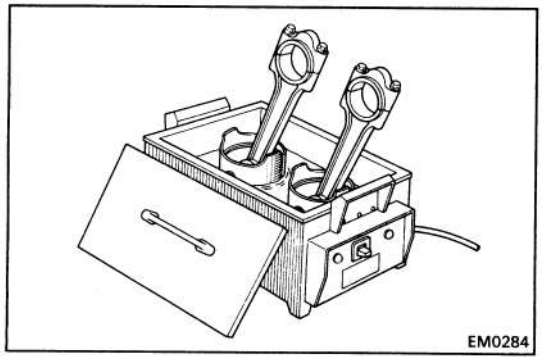
(b) Remove the two side rails and oil ring expander by hand.

HINT: Arrange the rings in correct order only.

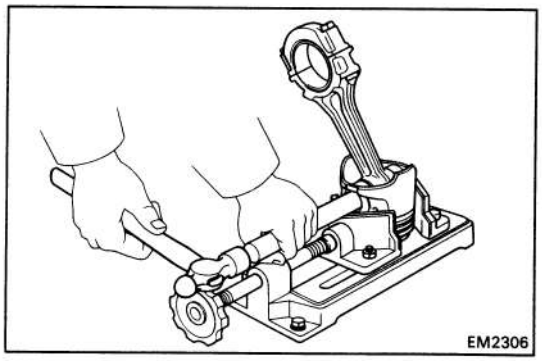


3. DISCONNECT CONNECTING ROD FROM PISTON

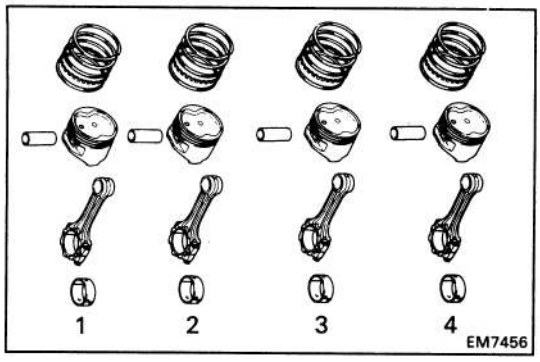
(a) Using a small screwdriver, pry out the two snap rings.



(b) Gradually heat the piston to 80 – 90°C (176 – 194°F).



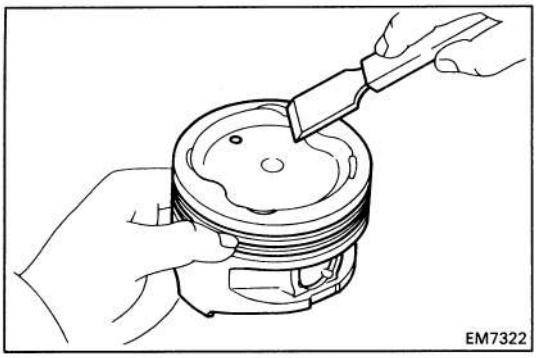
(c) Using plastic-faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.



HINT:

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

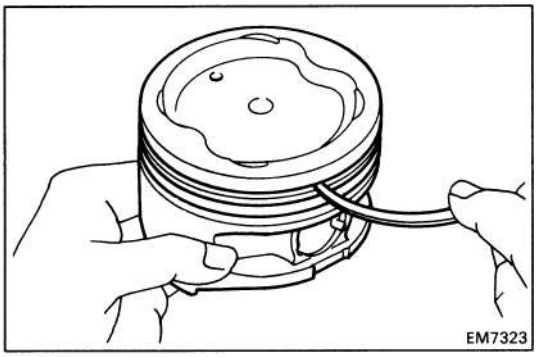
cardiagn.com



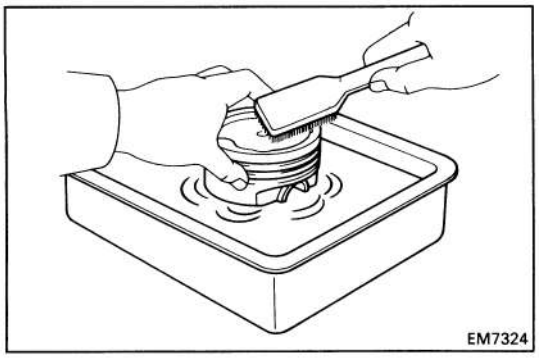
INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLIES

1. CLEAN PISTON

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

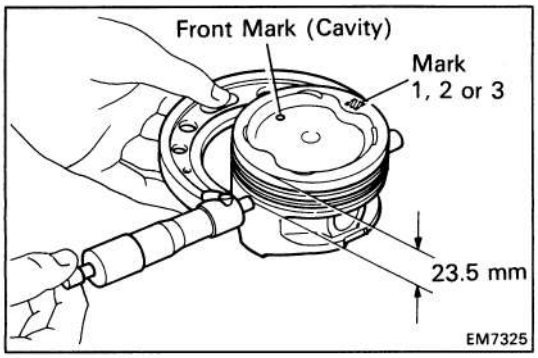


(b) Using a groove cleaner or broken ring, clean the piston ring grooves.



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

NOTICE: Do not use a wire brush.



2. INSPECT PISTON

A. Inspect piston oil clearance

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

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 23.5 mm (0.925 in.) from the piston head.

Piston diameter:

STD	**Mark "1"**	**86.911 – 86.921 mm (3.4217 – 3.4221 in.)**
	Mark "2"	**86.921 – 86.931 mm (3.4221 – 3.4225 in.)**
	Mark "3"	**86.931 – 86.941 mm (3.4225 – 3.4229 in.)**
O/S 0.50		**87.411 – 87.441 mm (3.4414 – 3.4426 in.)**

cardiagn.com

(b) Measure the cylinder bore diameter in the thrust directions. (See step 4 on page EM-200)

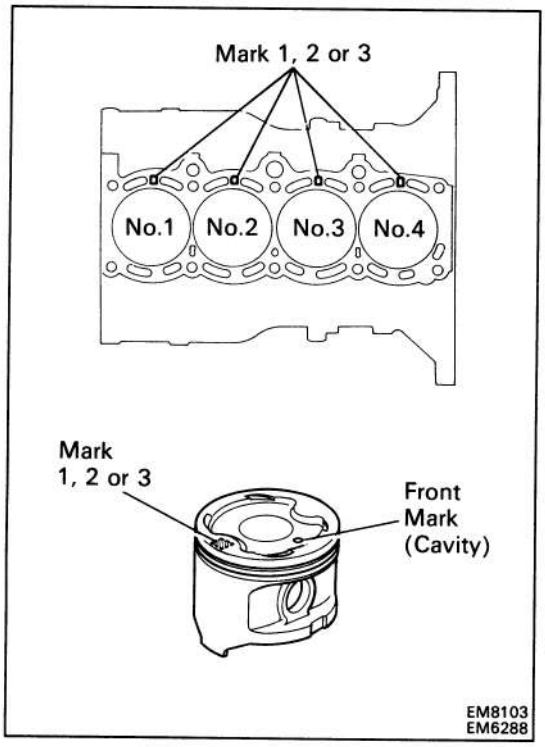
(c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

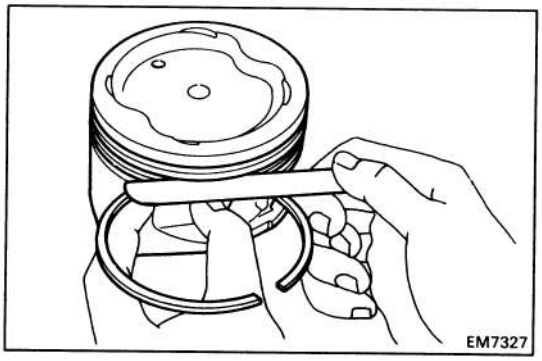
Standard oil clearance: 0.079 – 0.099 mm (0.0031 – 0.0039 in.)

Maximum oil clearance: 0.119 mm (0.0047 in.)

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

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



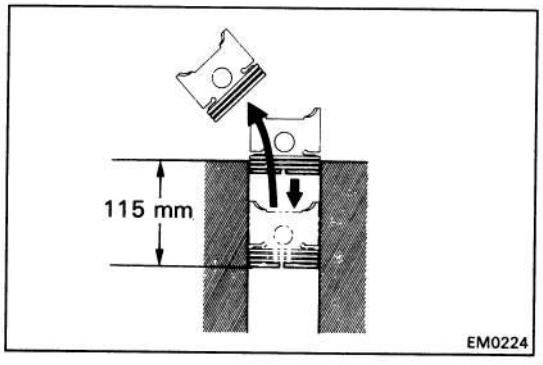


B. Inspect piston ring groove clearance

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

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

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

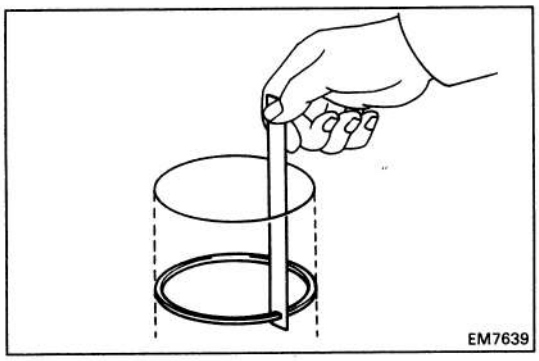


C. Inspect piston ring end gap

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

(b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 115 mm (4.53 in.) from the top of the cylinder block.

cardiagn.com



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

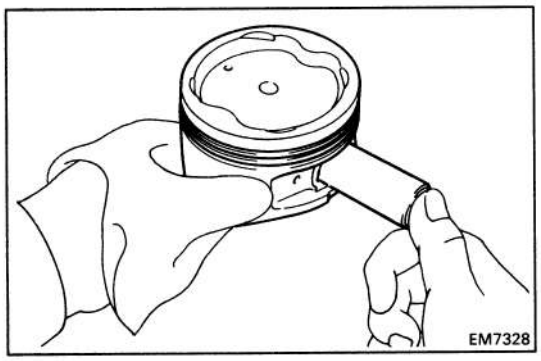
Standard end gap:

No.1	**0.270 – 0.500 mm (0.0106 – 0.0197 in.)**
No.2	**0.350 – 0.600 mm (0.0138 – 0.0234 in.)**
Oil (Side rail)	**0.200 – 0.550 mm (0.0079 – 0.0217 in.)**

Maximum end gap:

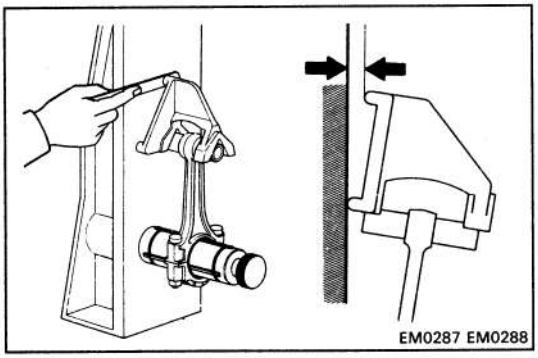
No.1	**1.10 mm (0.0433 in.)**
No.2	**1.20 mm (0.0472 in.)**
Oil (Side rail)	**1.15 mm (0.0453 in.)**

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



D. Inspect piston pin fit

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



3. INSPECT CONNECTING ROD

A. Inspect connecting rod alignment

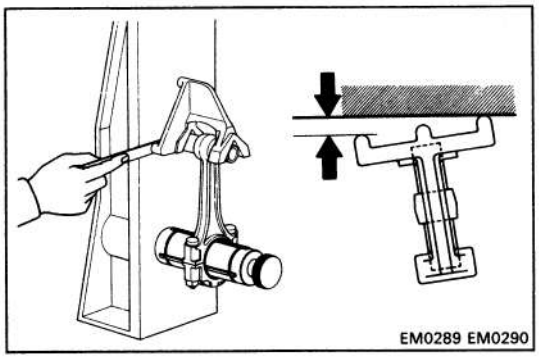
Using rod aligner and feeler gauge, check the connecting rod alignment.

- Check for bending.

Maximum bending:

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

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



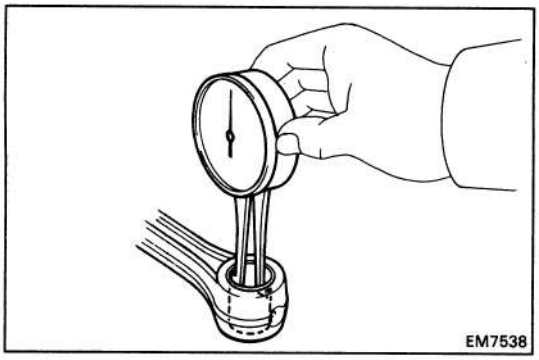
- Check for twist.

Maximum twist:

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

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

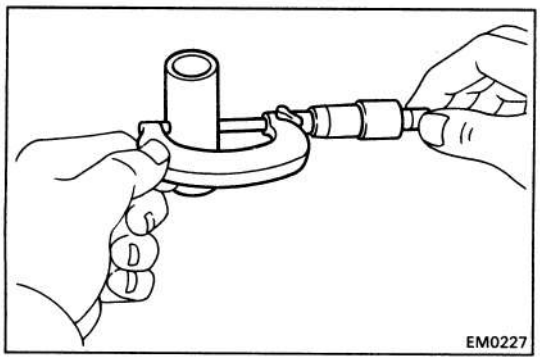
cardiagn.com



B. Inspect piston pin oil clearance

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

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



(b) Using a micrometer, measure the piston pin diameter.

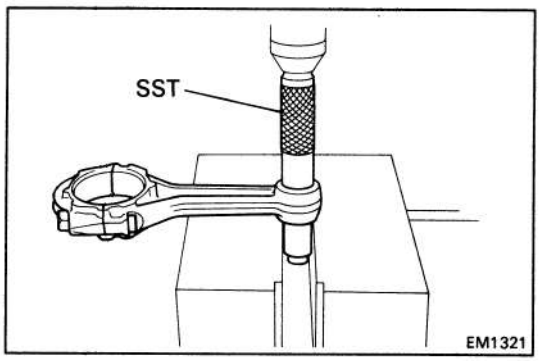
Piston pin diameter: 21.997 – 22.009 mm (0.8660 – 0.8665 in.)

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

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

Maximum oil clearance: 0.05 mm (0.0020 in.)

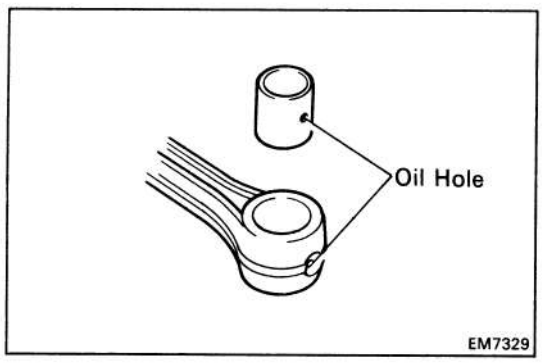
If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the piston and piston pin as a set.



C. If necessary, replace connecting rod bushing

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

SST 09222-30010

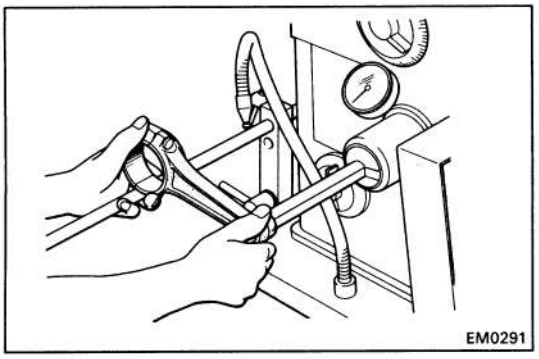


(b) Align the oil holes of a new bushing and the connecting rod.

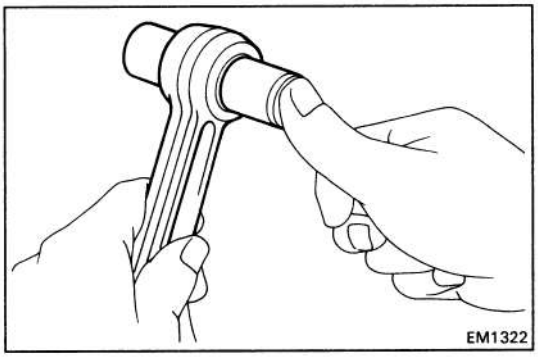
(c) Using SST and a press, press in the bushing.

SST 09222-30010

cardiagn.com

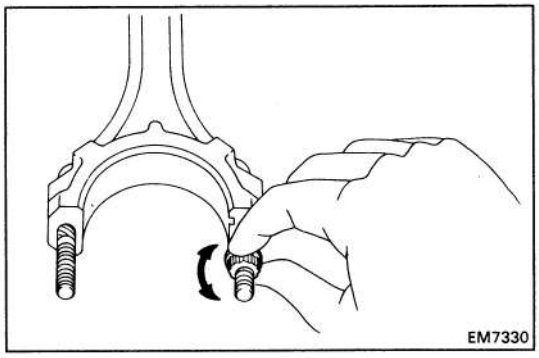


(d) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance (see step B above) between the bushing and piston pin.



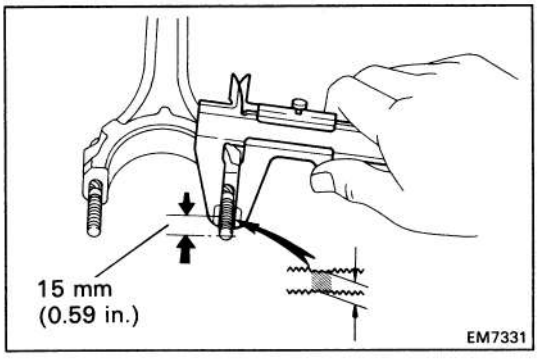
(e) Check the piston pin fit at normal room temperature.

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



D. Inspect connecting rod bolts

(a) Install the cap nut to the connecting rod bolt. Check that the cap nut can be turned easily by hand to the end of the thread.



(b) If the cap nut cannot be turned easily, measure the outside diameter of the connecting rod bolt.

Standard diameter: 7.860 – 8.000 mm (0.3094 – 0.3150 in.)

Minimum diameter: 7.60 mm (0.2992 in.)

HINT: If the location of this area cannot be judged by visual inspection, measure the outer diameter at the location shown in the illustration.

If the ouside diameter is less than minimum, replace the connecting rod bolt and cap nut as a set.

cardiagn.com

BORING OF CYLINDERS

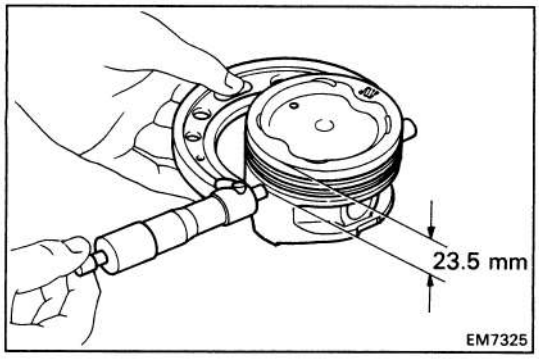
HINT:

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

1. KEEP OVERSIZED PISTONS

Oversized piston diameter:

O/S 0.50 87.411 – 87.441 mm
(3.4414 – 3.4426 in.)



2. CALCULATE AMOUNT TO BORE CYLINDERS

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 23.5 mm (0.925 in.) from the piston head.

(b) Calculate the amount each cylinder is to be rebored as follows:

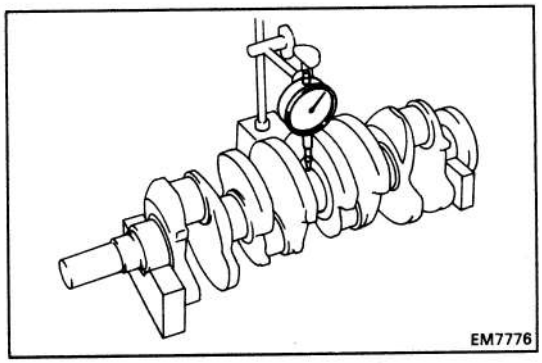
Size to be rebored = P + C – H
P = Piston diameter
C = Piston clearance
0.079 – 0.099 mm (0.0031 – 0.0039 in.)
H = Allowance for honing
0.02 mm (0.0008 in.) or less

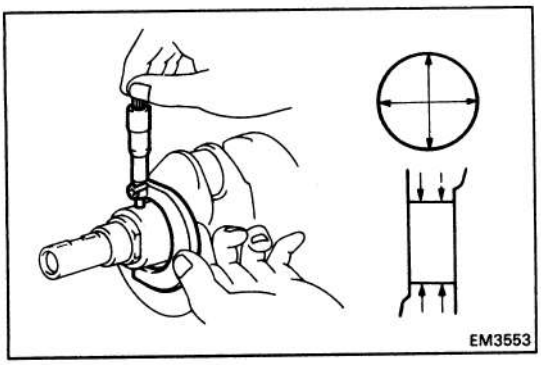
3. BORE AND HONE CYLINDERS TO CALCULATED DIMENSIONS

Maximum honing: 0.02 mm (0.0008 in.)

NOTICE: Excess honing will destroy the finished roundness.

cardiagn.com





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 (2.1653 – 2.1655 in.)**
U/S 0.25	**54.745 – 54.755 mm (2.1553 – 2.1557 in.)**

Crank pin diameter:

STD size	**51.985 – 52.000 mm (2.0466 – 2.0472 in.)**
U/S 0.25	**51.745 – 51.755 mm (2.0372 – 2.0376 in.)**

If the diameter is not as specified, check the oil clearance (See pages EM-193 to 197). If necessary, grind or replace the crankshaft.

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

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

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

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

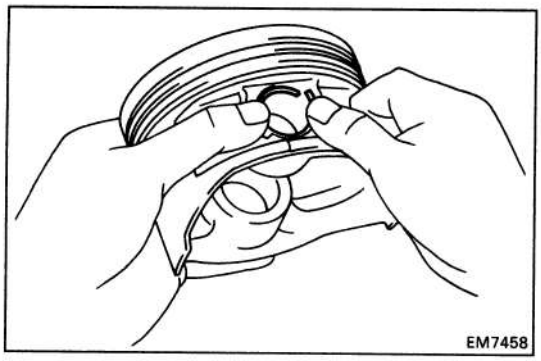
Grind and hone the main journals and/or crank pins to the finished undersized diameter (See procedure step 2).

Install new main journal and/or crank pin undersized bearings.

REPLACEMENT OF CRANKSHAFT OIL SEALS

(See pages EM-160 and 161)

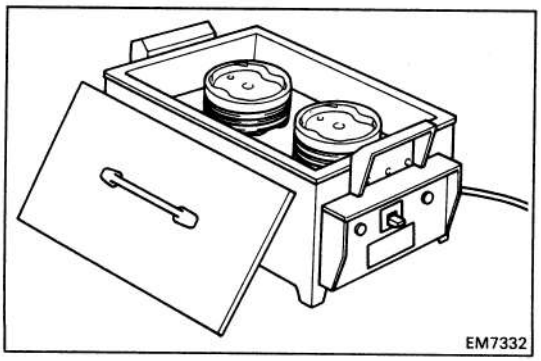
Cardiagn.com



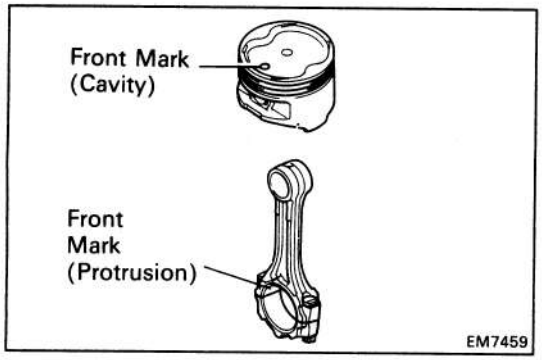
ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

1. ASSEMBLE PISTON AND CONNECTING ROD

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

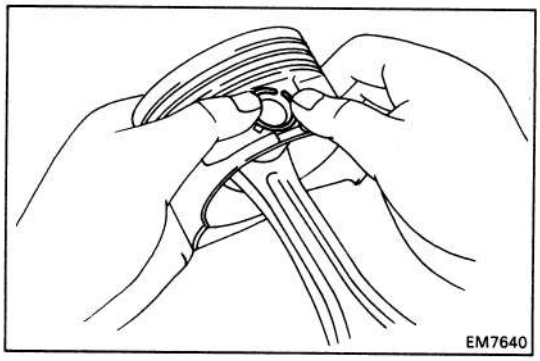


(b) Gradually heat the piston to 80 – 90°C (176 – 194°F).

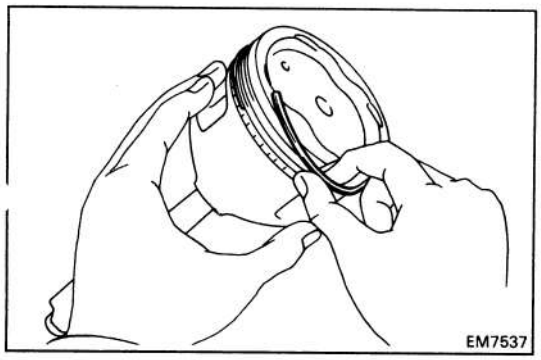


(c) Coat the piston pin with engine oil.

(d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.



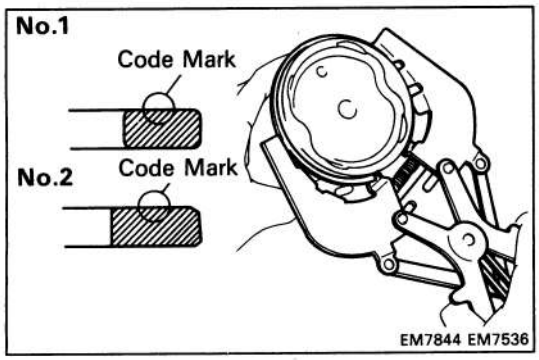
(e) Install a new snap ring on the other side of the piston pin hole.



2. INSTALL PISTON RINGS

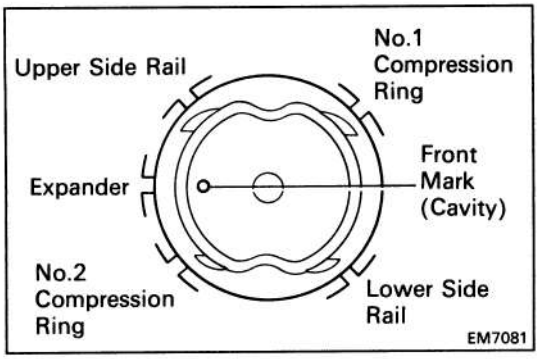
(a) Install the oil ring expander and two side rails by hand.

cardiagn.com



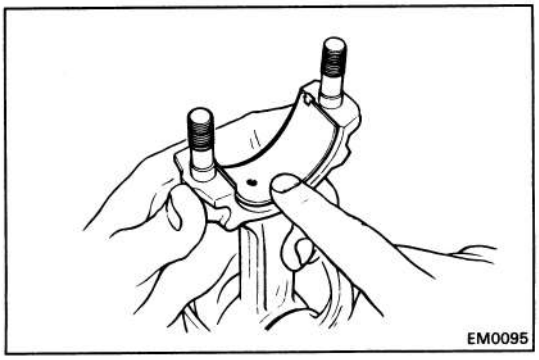
(b) Using a piston ring expander, install the two compression rings with the code mark facing upward.

Code mark: No.1 1N or T
No.2 2N or 2T



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

NOTICE: Do not align the ring ends.



3. INSTALL BEARINGS

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

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

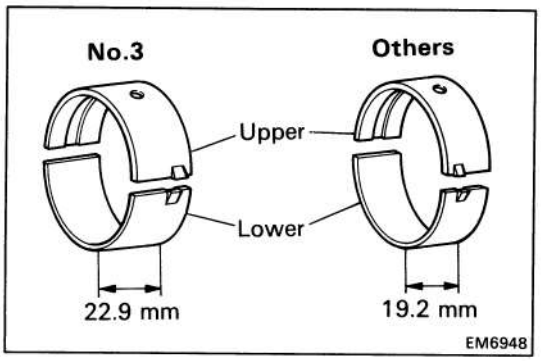
cardiagn.com

ASSEMBLY OF CYLINDER BLOCK

(See page EM-181)

HINT:

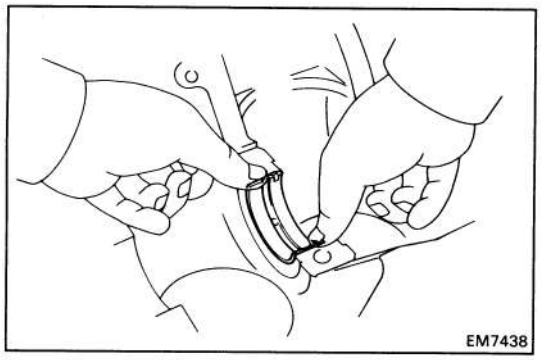
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.



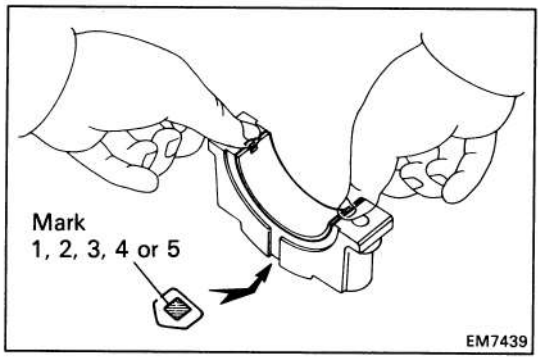
1. INSTALL MAIN BEARINGS

HINT:

- Main bearings come in widths of 19.2 mm (0.756 in.) and 22.9 mm (0.902 in.). Install the 22.9 mm (0.902 in.) bearings in the No.3 cylinder block journal position with the main bearing cap. Install the 19.2 mm (0.756 in.) bearings in the other positions.
- Upper bearings have an oil groove and oil holes; lower bearings do not.

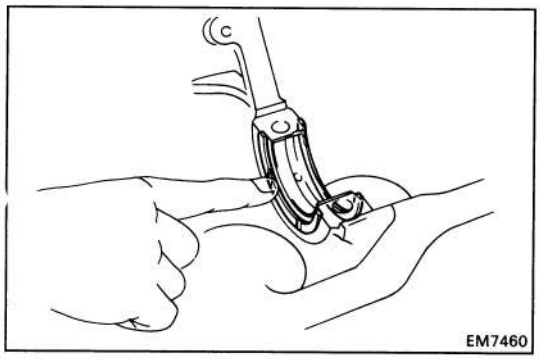


(a) Align the bearing claw with the claw groove of the cylinder block, and push in the five upper bearings.



(b) Align the bearing claw with the claw groove of the main bearing cap, and push in the five lower bearings.

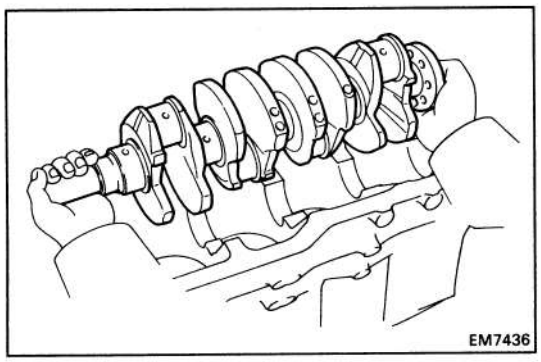
HINT: A number is marked on each main bearing cap to indicate the installation position.



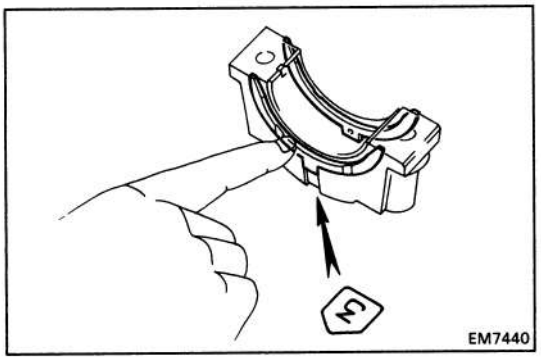
2. INSTALL UPPER THRUST WASHERS

Install the two thrust washers under the No.3 journal position of the cylinder block with the oil grooves facing outward.

cardiagn.com

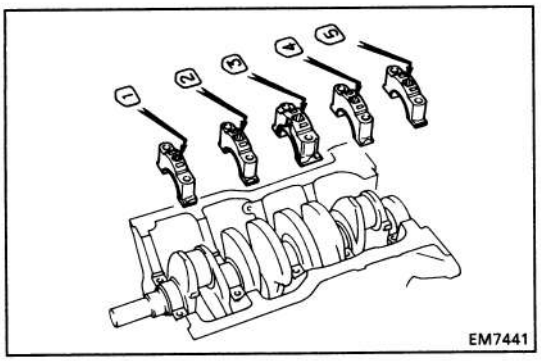


3. PLACE CRANKSHAFT ON CYLINDER BLOCK



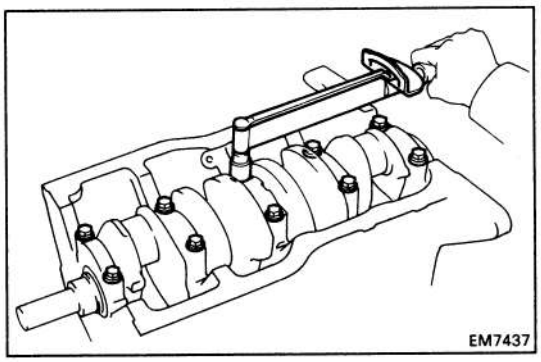
4. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

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



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

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



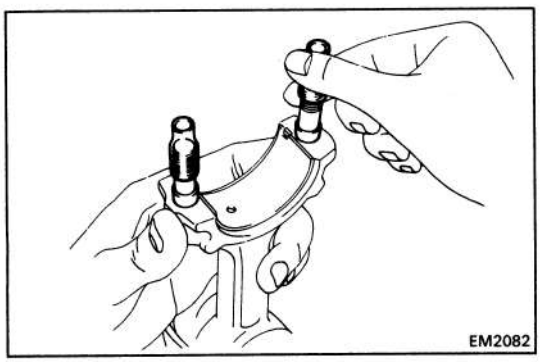
(c) Apply a light coat of engine oil on the threads and under the heads of the main bearing caps.

(d) Install and uniformly tighten the ten bolts of the main bearing caps in several passes in the sequence shown.

Torque: 600 kg-cm (43 ft-lb, 59 N·m)

(e) Check that the crankshaft turns smoothly.

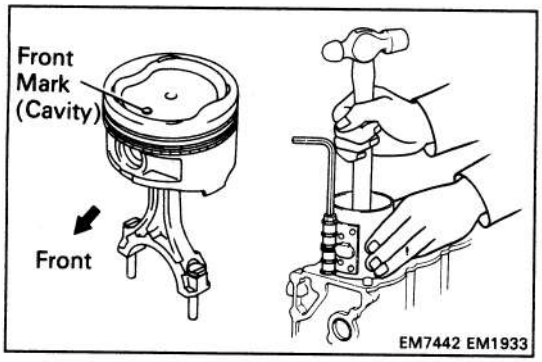
(f) Check the crankshaft thrust clearance. (See step 5 on page EM-195)



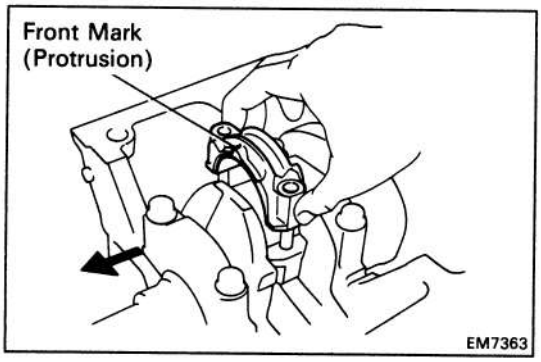
5. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

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

cardiagn.com



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



6. INSTALL CONNECTING ROD CAPS

A. Place connecting rod cap on connecting rod

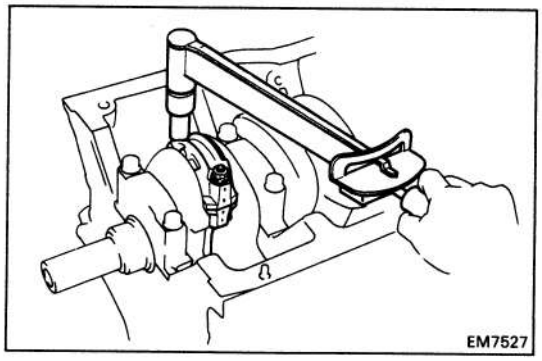
(a) Match the numbered connecting rod cap with the connecting rod.

(b) Install the connecting rod cap with the front mark facing forward.

B. Install connecting rod cap nuts

HINT:

- The cap nuts are tightened in two progressive steps (steps (b) and (d)).
- If any the connecting rod bolt is broken or deformed, replace it.



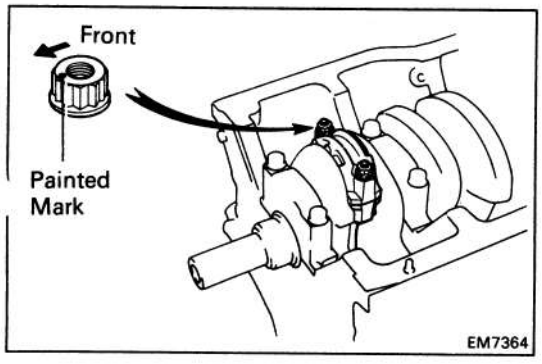
(a) Apply a light coat of engine oil on the threads and under the cap nuts.

(b) Using SST, install and alternately tighten the cap nuts in several passes.

SST 09011-38121

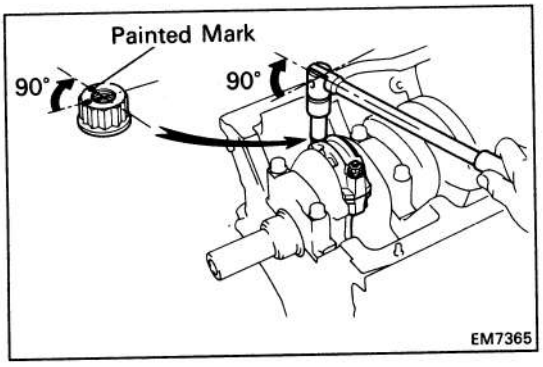
Torque: 250 kg-cm (18 ft-lb, 25 N·m)

If any one of the cap nuts does not meet the torque specification, replace the connecting rod bolt and cap nut as a set.



(c) Mark the front of the cap nut with the paint.

cardiagn.com

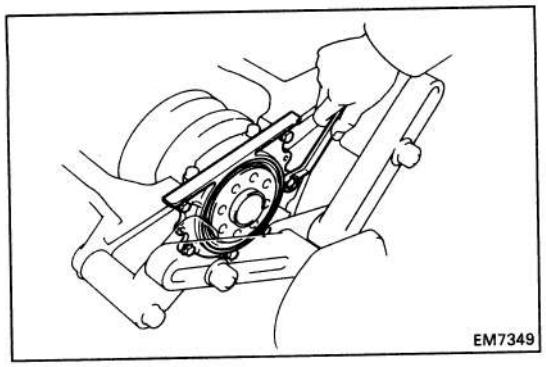


(d) Retighten the cap nuts 90° in the numerical order shown.

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

(f) Check that the crankshaft turns smoothly.

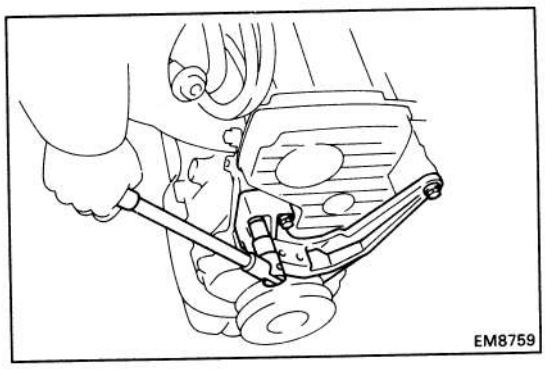
(g) Check the connecting rod thrust clearance. (See step 2 on page EM-193)



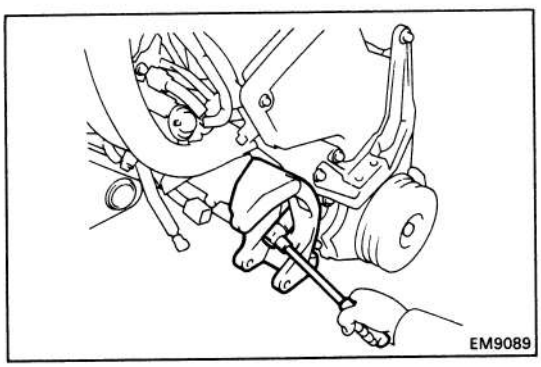
7. **INSTALL REAR OIL SEAL RETAINER**
Install a new gasket and the retainer with the six bolts.
Torque: 95 kg-cm (82 in.-lb, 9.3 N·m)

POST ASSEMBLY

1. **INSTALL OIL COOLER (See page LU-25)**
2. **INSTALL OIL FILTER (See page LU-7)**
3. **INSTALL OIL PUMP AND OIL PAN (See pages LU-15 and 16)**
4. **INSTALL WATER PUMP (See pages CO-12 and 13)**
5. **INSTALL CYLINDER HEAD (See pages EM-121 to 131)**
6. **INSTALL PULLEYS AND TIMING BELT (See pages EM-55 to 59)**

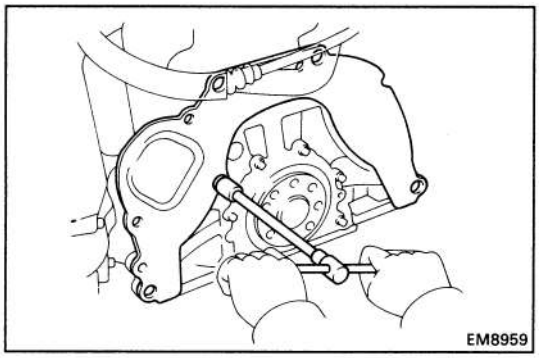


7. **INSTALL RH ENGINE MOUNTING BRACKET**
Install the mounting bracket with the four bolts.
Torque: 620 kg-cm (45 ft-lb, 61 N·m)



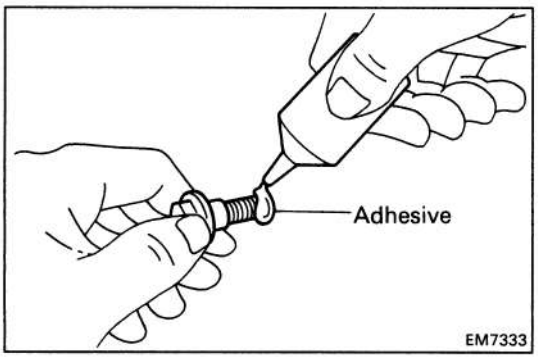
8. **INSTALL ALTERNATOR BRACKET**
Install the alternator bracket with the five bolts.
Torque: 440 kg-cm (32 ft-lb, 43 N·m)
9. **INSTALL ALTERNATOR (See page CH-17)**
10. **REMOVE ENGINE STAND**

cardiagn.com



11. **INSTALL REAR END PLATE**

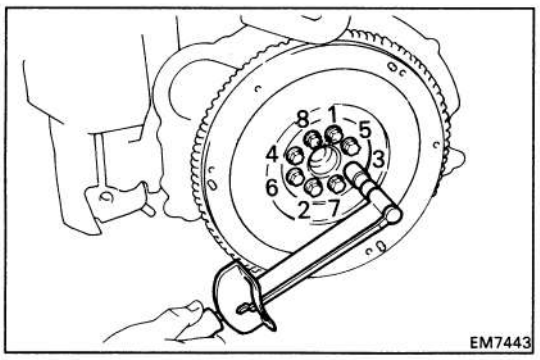
Torque: 95 kg-cm (82 ft-lb, 9.3 N·m)



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 mount bolts in several passes in the sequence shown.

Torque: 900 kg-cm (65 ft-lb, 88 N·m)

13. **(A/T)**
INSTALL DRIVE PLATE (See procedure step 12)

Torque: 850 kg-cm (61 ft-lb, 83 N·m)

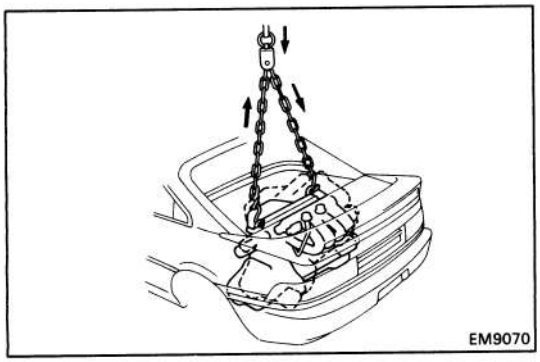
14. **(M/T)**
INSTALL CLUTCH DISC AND COVER (See page CL-10)

cardiagn.com

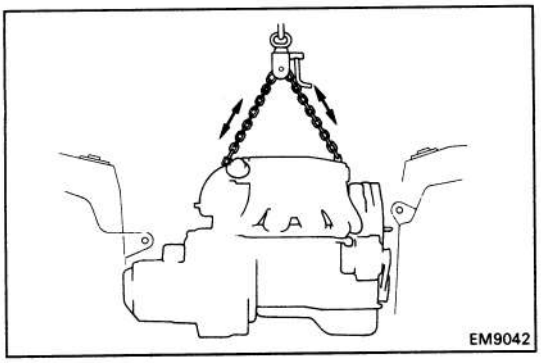
INSTALLATION OF ENGINE

1. **ASSEMBLE ENGINE AND TRANSAXLE**
   M/T (See pages MT-5 and 6)
   A/T (See page AT-41)

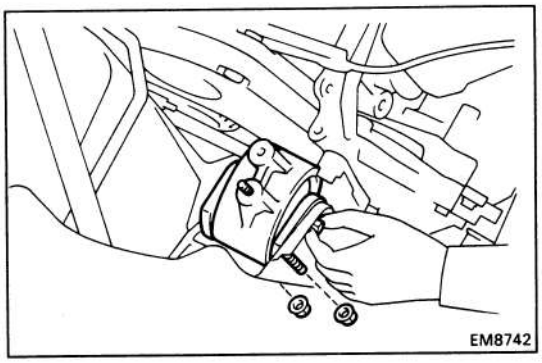
2. **INSTALL STARTER (See page ST-17)**



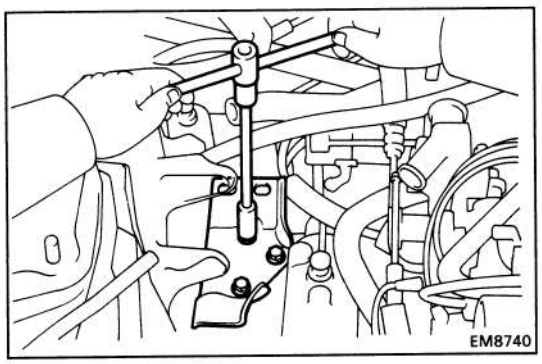
3. **INSTALL ENGINE AND TRANSAXLE ASSEMBLY IN VEHICLE**
   (a) Attach the engine chain hoist to the engine hangers.
   (b) Slowly lower the engine into the engine compartment.
   Tilt the transaxle downward, lower the engine and clear the LH body mounting.



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



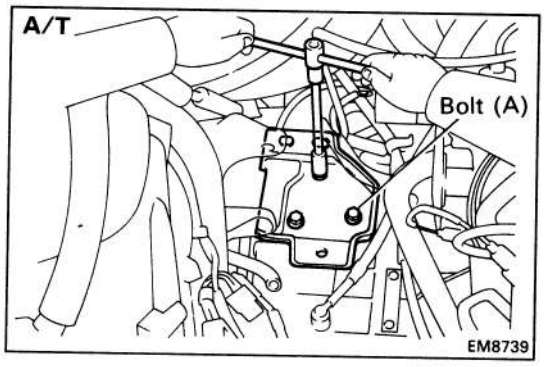
(d) Attach the RH mounting insulator to the body, and temporarily install the through bolt.
(e) Attach the RH mounting insulator to the mounting bracket, and temporarily install the two nuts.



(f) (M/T)
Install the LH mounting bracket to the transaxle case with the three bolts.

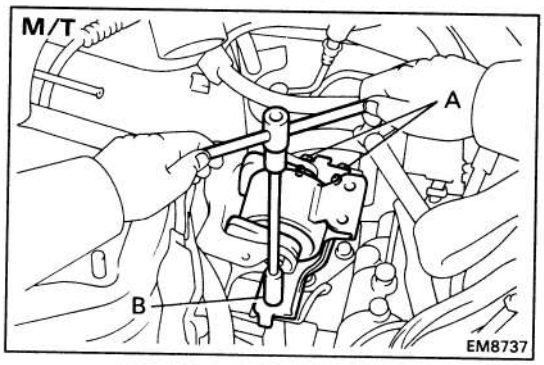
Torque: 530 kg-cm (38 ft-lb, 52 N·m)

cardiagn.com



(g) (A/T)
Install the LH mounting bracket to the transaxle case with the three bolts. Do not tighten the bolt (A).

Torque: 530 kg-cm (38 ft-lb, 52 N·m)

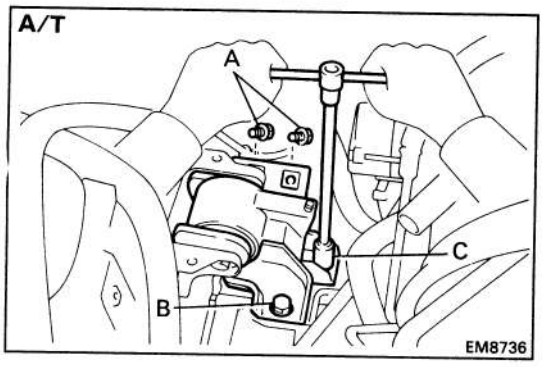


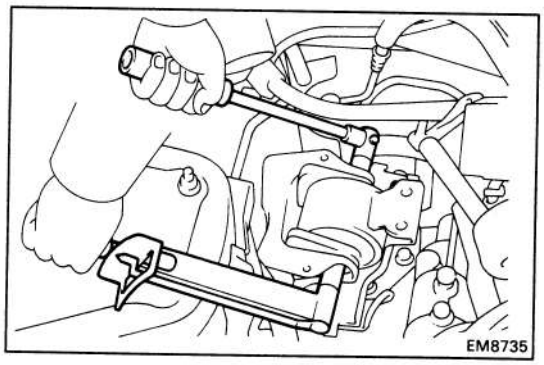
(h) Attach the LH mounting insulator to the body, and temporarily install the through bolt.

(i) Attach the LH mounting insulator to the mounting bracket, and install the three (M/T) or four (A/T) bolts.

Torque:

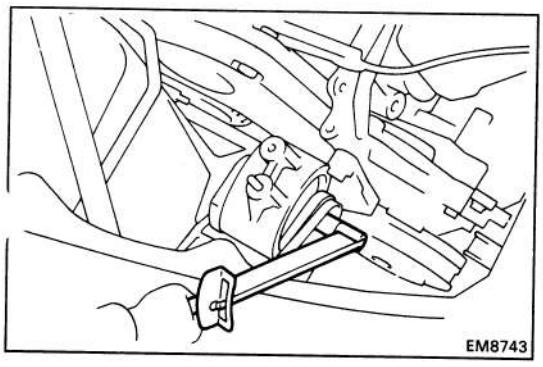
A 650 kg-cm (47 ft-lb, 63 N·m)
B 740 kg-cm (54 ft-lb, 73 N·m)
C 530 kg-cm (38 ft-lb, 52 N·m) A/T only





(j) Tighten the through bolt holding the LH mounting insulator to the body.

Torque: 800 kg-cm (58 ft-lb, 78 N·m)



(k) Tighten the two nuts holding the RH mounting insulator to the mounting bracket.

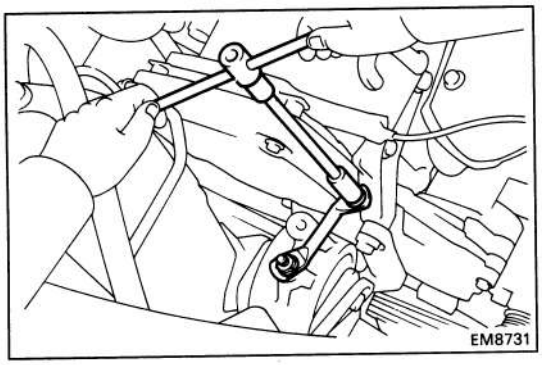
Torque: 530 kg-cm (38 ft-lb, 52 N·m)

(l) Tighten the through bolt holding the RH mounting insulator to the body.

Torque: 800 kg-cm (58 ft-lb, 78 N·m)

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

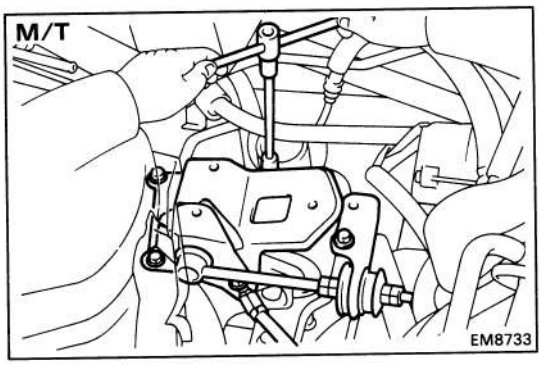
cardiagn.com



4. INSTALL RH ENGINE MOUNTING STAY

Install the mounting stay with the two bolts and nut.

Torque: 740 kg-cm (54 ft-lb, 73 N·m)

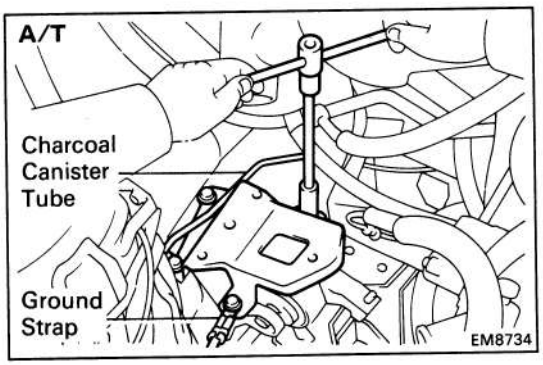


5. INSTALL LATERAL CONTROL ROD (M/T) AND AIR CLEANER CASE BRACKET

(M/T)

Install the control rod, case bracket and charcoal canister tube with the five bolts, and connect the ground strap (from transaxle). Do not the tighten the bolt (A).

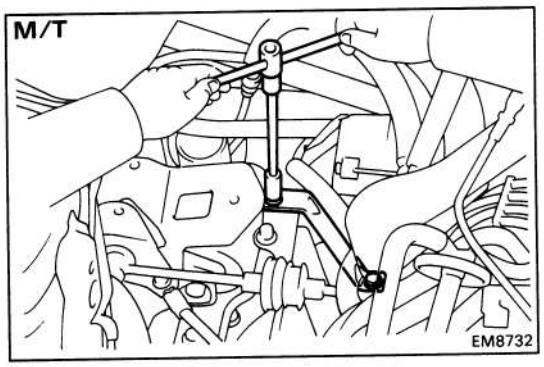
Torque: 360 kg-cm (26 ft-lb, 35 N·m)



(A/T)

Install the case bracket and charcoal canister tube with the four bolts, and connect the ground strap (from transaxle). Do not the tighten the bolt (A).

Torque: 360 kg-cm (26 ft-lb, 35 N·m)



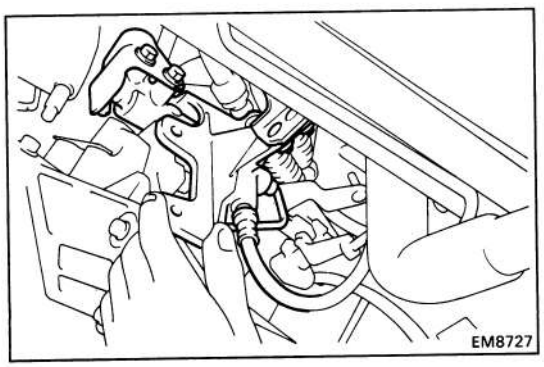
6. (M/T) INSTALL LH ENGINE MOUNTING STAY

(a) Install the mounting stay and speedometer cable clamp with the two bolts.

Torque:
Transaxle side 250 kg-cm (18 ft-lb, 25 N·m)
Mounting insulator side 740 kg-cm (54 ft-lb, 73 N·m)

(b) Tighten the bolt (A) of step 6.

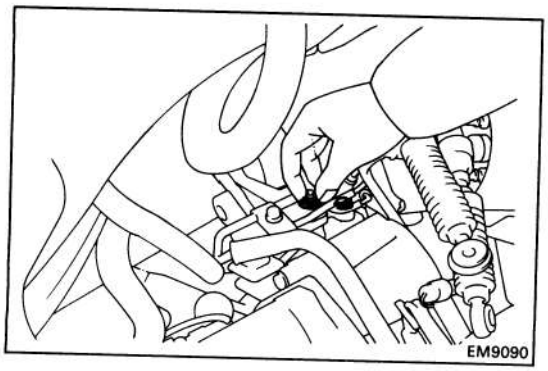
Torque: 380 kg-cm (27 ft-lb, 37 N·m)



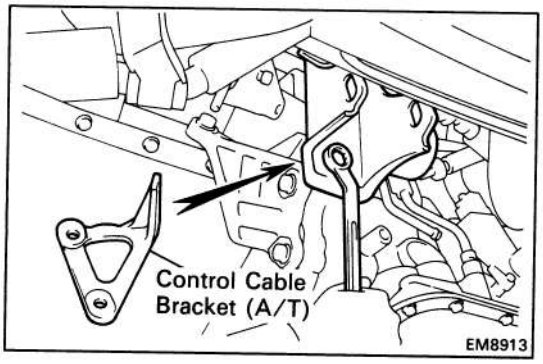
7. INSTALL CLUTCH RELEASE CYLINDER (M/T), TRANSAXLE CONTROL BRACKET (A/T) AND FRONT ENGINE MOUNTING BRACKET

(a) (M/T)
Place the release cylinder on the transaxle.

cardiagn.com

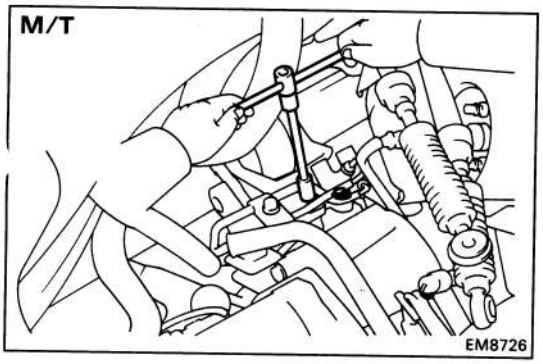


(b) (M/T)
Temporarily install the bolt and nut holding the release cylinder to the transaxle.



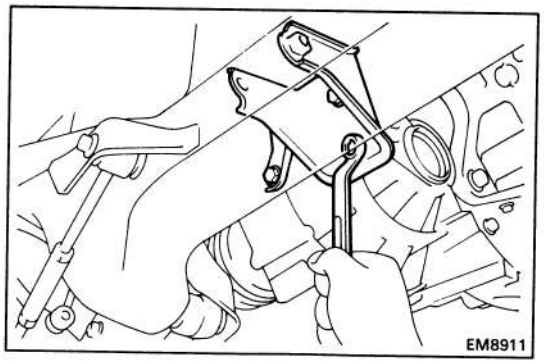
(c) Install the control cable bracket (A/T) and mounting bracket with the two bolts.

Torque: 790 kg-cm (57 ft-lb, 77 N·m)



(d) (M/T)
Tighten the bolt and nut holding the clutch release cylinder to the tranaxle.

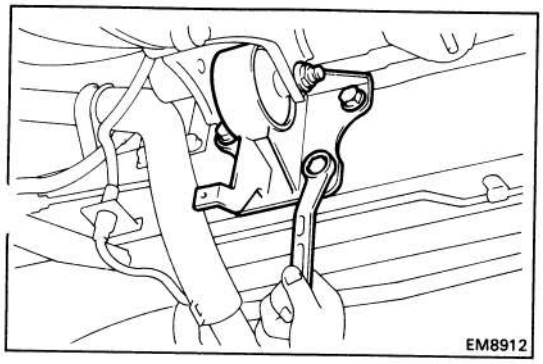
Torque: 120 kg-cm (9 ft-lb, 12 N·m)



8. INSTALL REAR ENGINE MOUNTING BRACKET

Install the mounting bracket with the three bolts.

Torque: 790 kg-cm (57 ft-lb, 77 N·m)



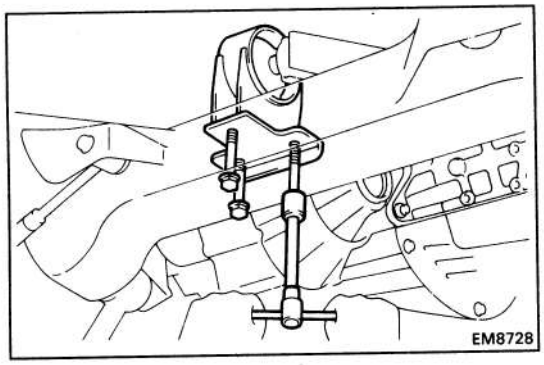
9. INSTALL FRONT ENGINE MOUNTING INSULATOR

(a) Install the mounting insulator to the body with the four bolts.

Torque: 740 kg-cm (54 ft-lb, 73 N·m)

(b) Temporarily install the through bolt and nut holding the mounting insulator to the mounting bracket.

cardiagn.com



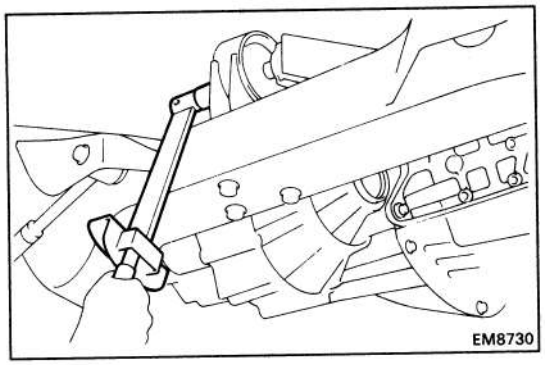
10. INSTALL REAR ENGINE MOUNTING INSULATOR

(a) Temporarily install the mounting bracket to the body with the three bolts.

(b) Temporarily install the through bolt holding the mounting insulator to the mounting bracket.

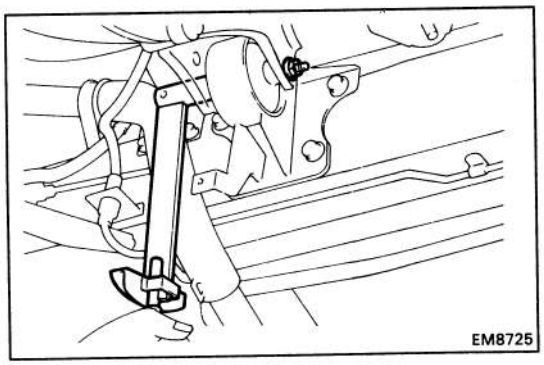
(c) Tighten the three bolts holding the mounting bracket to the body.

Torque: 650 kg-cm (47 ft-lb, 64 N·m)



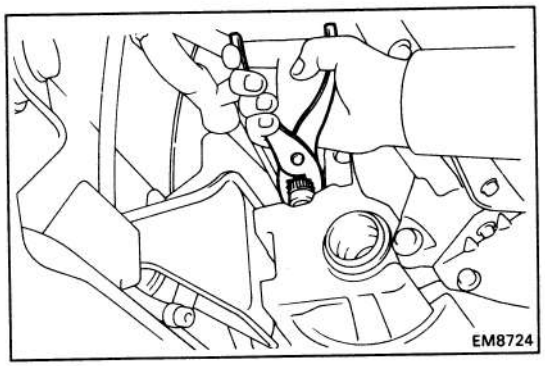
(d) Tighten the through bolt holding the mounting insulator to the mounting bracket.

Torque: 800 kg-cm (58 ft-lb, 79 N·m)

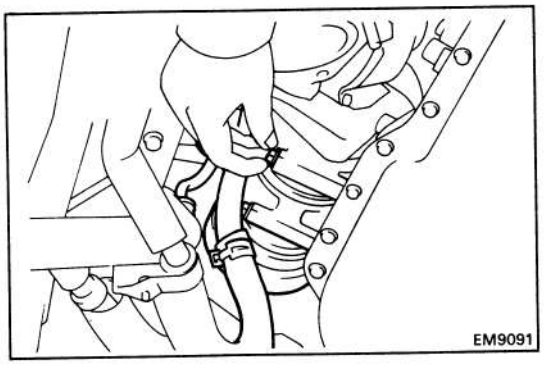


11. TIGHTEN FRONT ENGINE MOUNTING THROUGH BOLT

Torque: 800 kg-cm (58 ft-lb, 79 N·m)



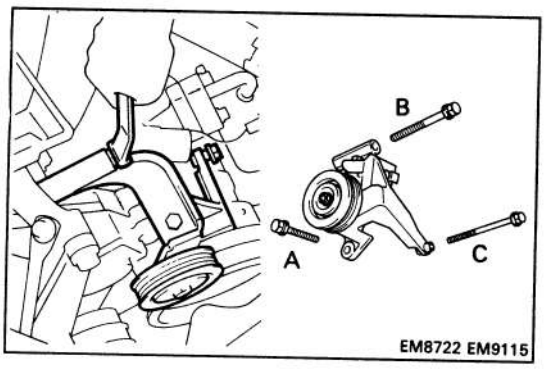
12. CONNECT SPEEDOMETER CABLE



13. INSTALL A/C COMPRESSOR AND IDLER PULLEY BRACKET

(a) Temporarily install the compressor with the two bolts.

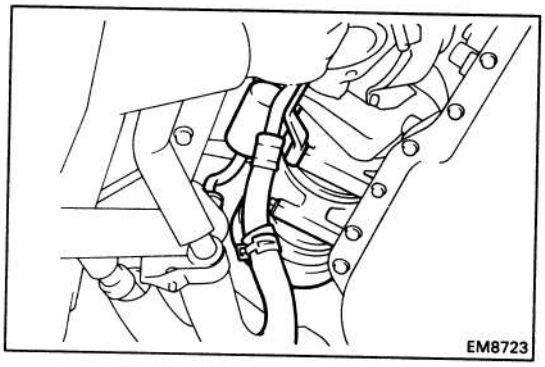
cardiagn.com



(b) Install the idler pulley and bracket with the three bolts.

Torque:
A 275 kg-cm (20 ft-lb, 27 N·m)
B 375 kg-cm (27 ft-lb, 37 N·m)
C 250 kg-cm (18 ft-lb, 25 N·m)

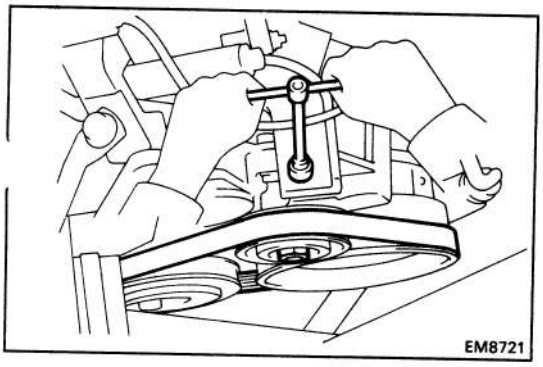
(c) Install the wire clamp of the A/C compressor with the bolt.



(d) Tighten the two bolts of the lower side holding the A/C compressor to the cylinder block.

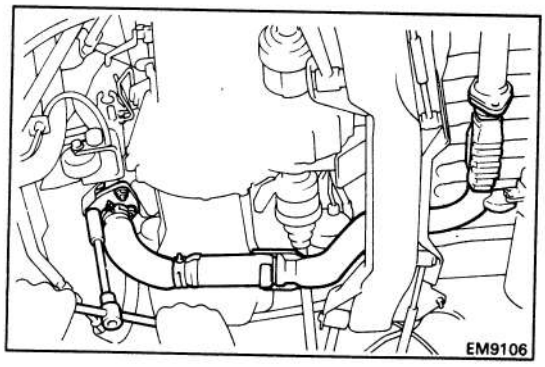
Torque: 280 kg-cm (20 ft-lb, 27 N·m)

(e) Connect the A/C compressor connector.



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

14. INSTALL DRIVE SHAFTS (See pages SA-49 to 51)

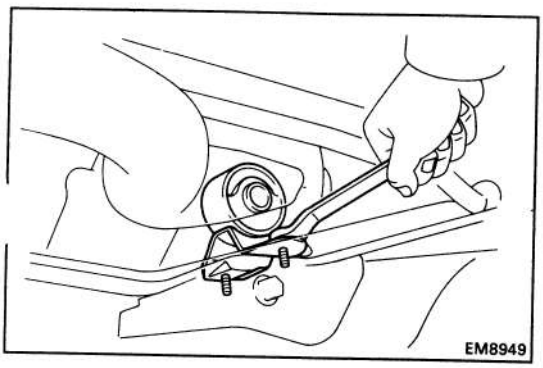


15. INSTALL FRONT EXHAUST PIPE

(a) Place a new gasket on the front of the front exhaust pipe.

(b) Using a 14 mm deep socket wrench, install the three new nuts holding the exhaust pipe to the catalytic converter.

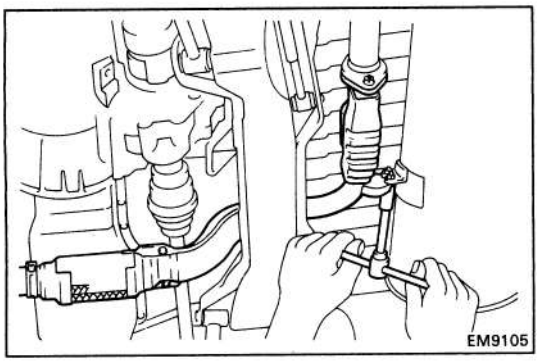
Torque: 630 kg-cm (46 ft-lb, 62 N·m)



(c) Install the support bracket with the two bolts.

Torque: 210 kg-cm (15 ft-lb, 21 N·m)

cardiagn.com



(d) Place a new gasket on the rear of the front exhaust pipe.

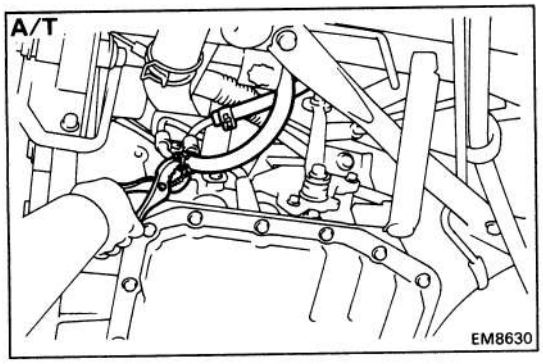
(e) Temporarily install the two bolts holding the front exhaust pipe to the tailpipe.

(f) Install the two bolts holding the stopper bracket of the front exhaust pipe to the tailpipe stopper bracket.

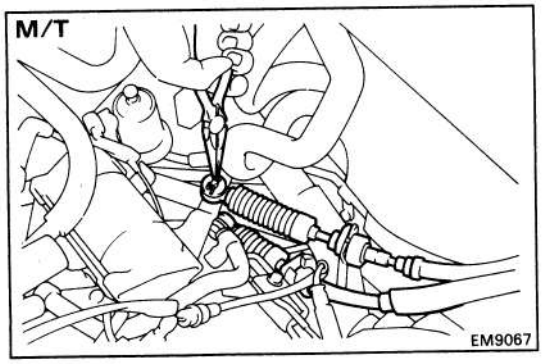
Torque: 190 kg-cm (190 ft-lb, 19 N·m)

(g) Tighten the two bolts holding the front exhaust pipe to the tailpipe.

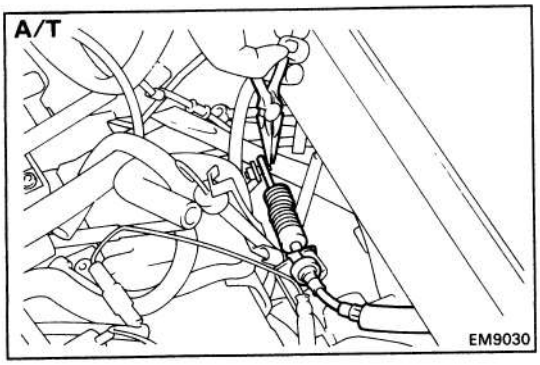
Torque: 440 kg-cm (32 ft-lb, 43 N·m)

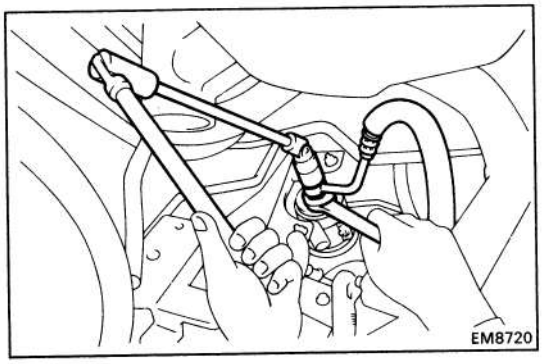


16. (A/T)
CONNECT TRANSAXLE OIL COOLER HOSES



17. CONNECT TRANSAXLE CONTROL CABLE(S)

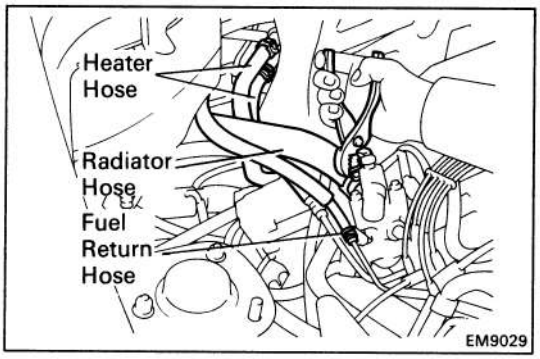




18. CONNECT FUEL INLET HOSE TO FUEL FILTER

Torque: 300 kg-cm (22 ft-lb, 29 N·m)

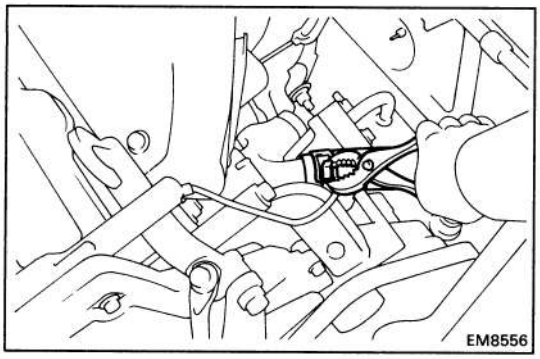
cardiagn.com



19. CONNECT FUEL RETURN HOSE

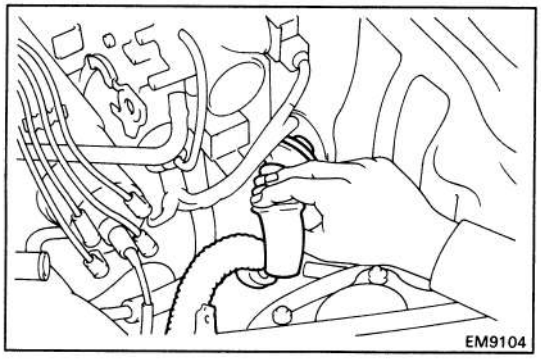
20. CONNECT RADIATOR HOSE TO WATER OUTLET

21. CONNECT HEATER HOSES



22. CONNECT RADIATOR HOSE TO WATER INLET

23. CONNECT STARTER CABLE



24. CONNECT ENGINE WIRE TO LUGGAGE COMPARTMENT

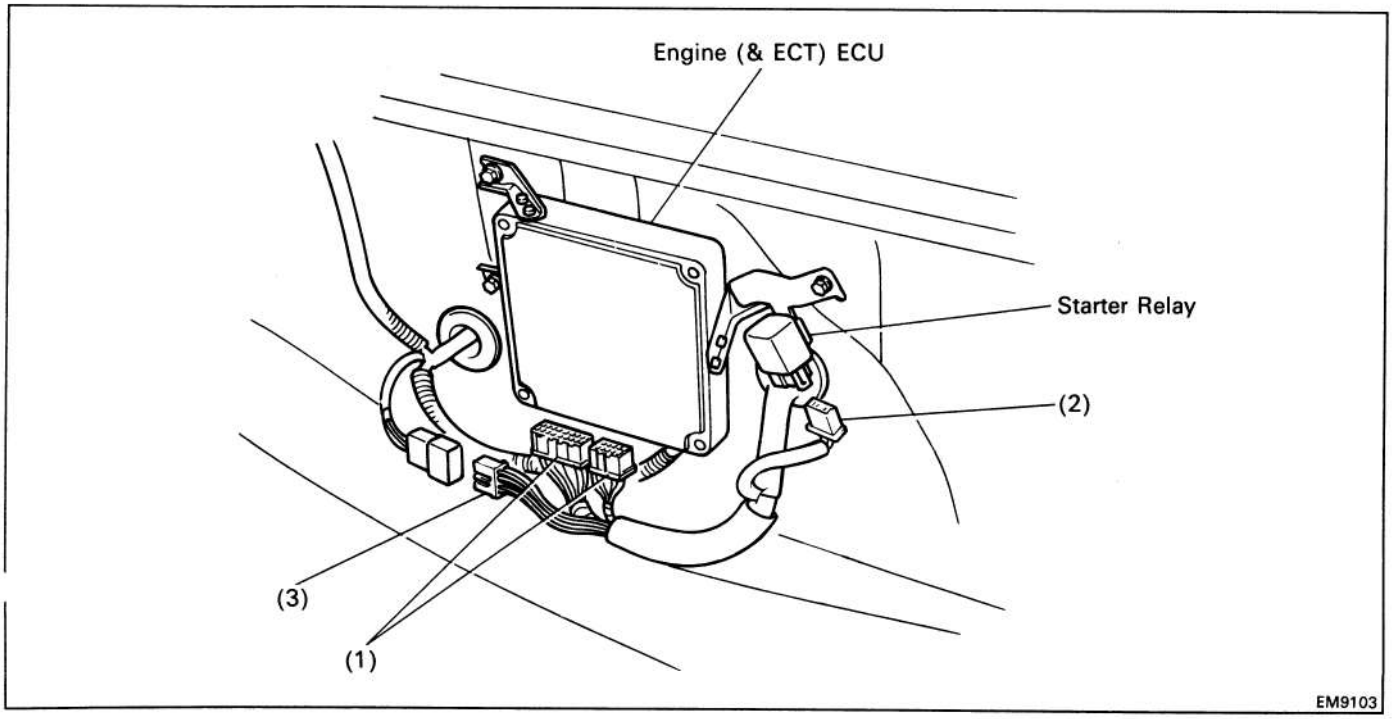
(a) Push in the engine wire through the luggage compartment.

(b) Connect the following connectors.

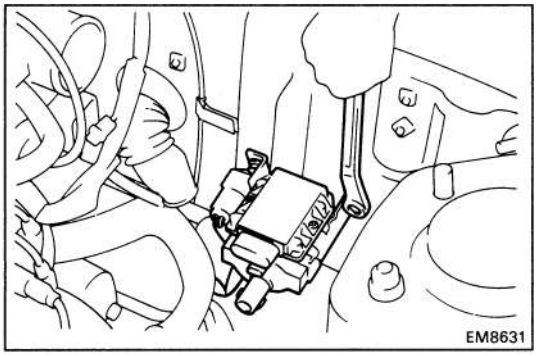
(1) Two engine ECU connectors

(2) Starter relay connector

(3) Engine compartment wire connector



cardiagn.com

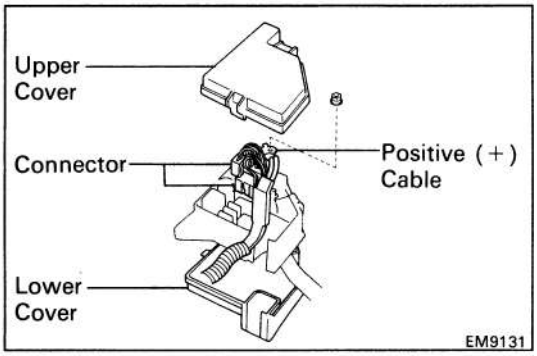


25. INSTALL IGNITION COIL AND IGNITER

(a) Install the ignition coil and igniter with the two bolts. Connect the noise filter.

(b) Connect the high-tension cord.

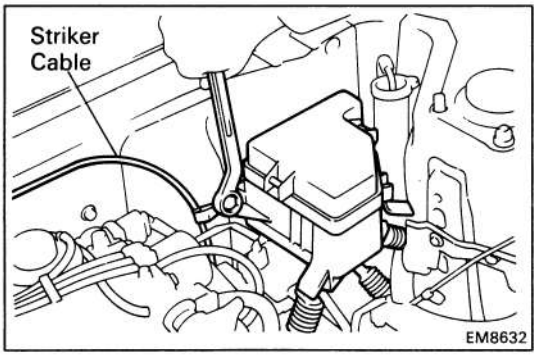
(c) Connect the igniter connector.



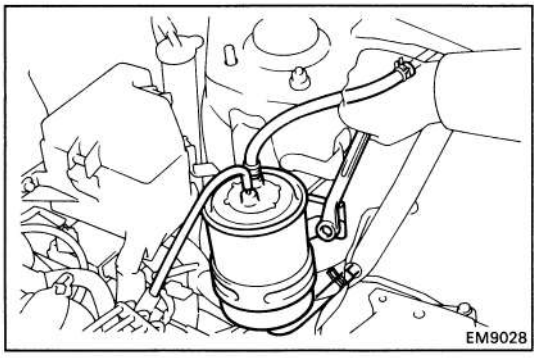
26. CONNECT ENGINE WIRE, AND INSTALL ENGINE RELAY BOX

(a) Connect the two connectors and positive (+) cable of the engine wire to the relay box.

(b) Install the upper and lower covers to the relay box.



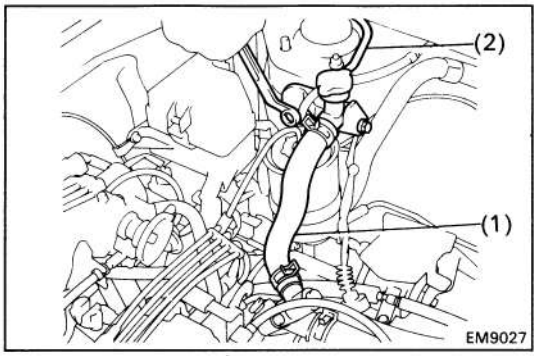
(c) Install the relay box with the two bolts. Install the luggage compartment striker cable.



27. INSTALL CHARCOAL CANISTER

(a) Install the charcoal canister with the two bolts.

(b) Connect the three hoses.



28. INSTALL WATER FILLER

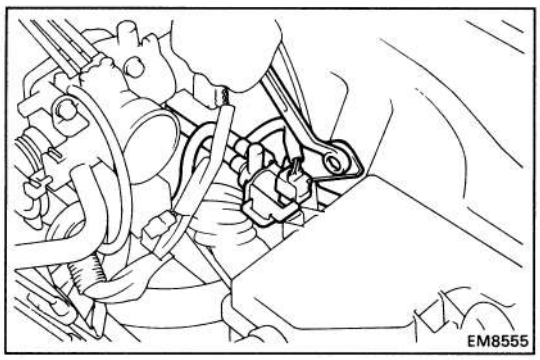
(a) Install the water filler with the two bolts.

(b) Connect the following hoses:

(1) Water filler hose

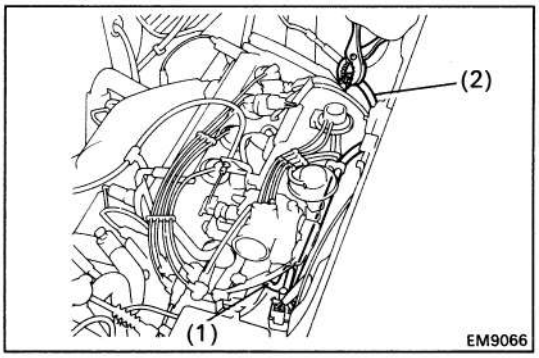
(2) Coolant reservoir hose

cardiagn.com



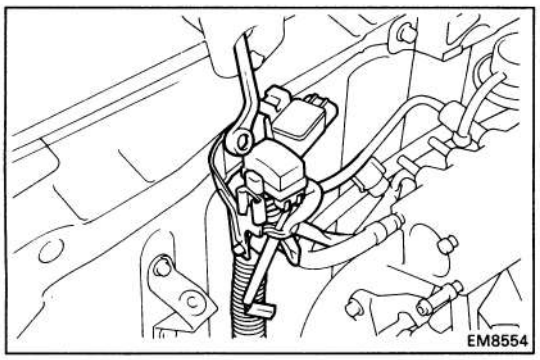
29. INSTALL A/C VSV

(a) Install the A/C VSV with the bolt.



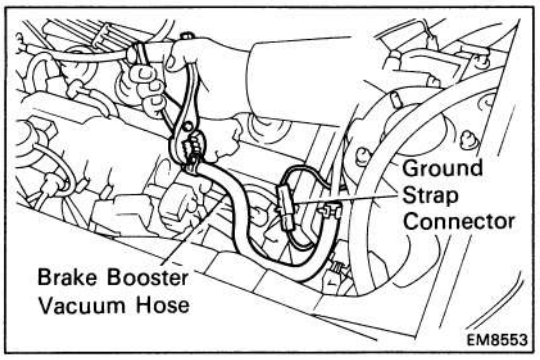
(b) Connect the following hoses:
  (1) Air hose from ISC valve
  (2) Vacuum hose from intake manifold

(c) Connect the VSV connector.



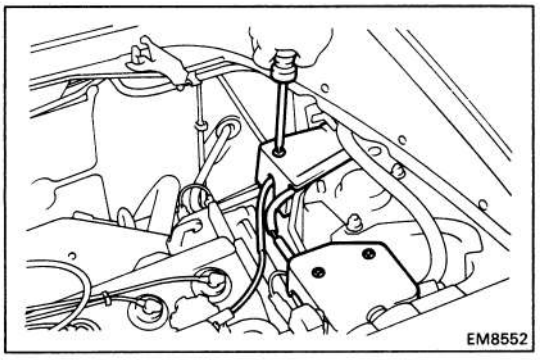
30. INSTALL CHECK CONNECTOR AND VACUUM SENSOR

Install the check connector and vacuum sensor with the bolt.



31. CONNECT BRAKE BOOSTER VACUUM HOSE

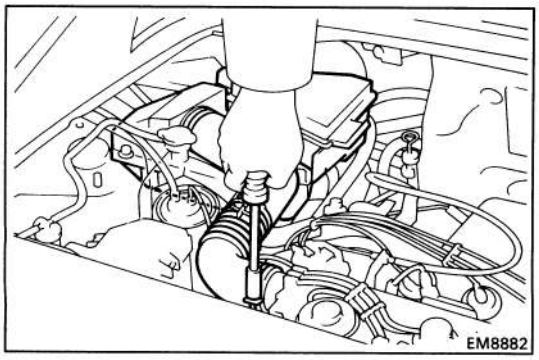
32. CONNECT GROUND STRAP CONNECTOR



33. INSTALL CRUISE CONTROL ACTUATOR (w/ CRUISE CONTROL SYSTEM) AND ACCELERATOR LINKAGE

(a) Connect the cable to the accelerator linkage.
(b) Install the accelerator linkage with the three bolts.
(c) Connect the actuator connector.
(d) Install the actuator with the three bolts.
(e) Install the accelerator linkage cover with the screw.
(f) Install the actuator cover with the two screws.

cardiagn.com



34. INSTALL ACCELERATOR CABLE, AND ADJUST IT

35. INSTALL AIR CLEANER ASSEMBLY

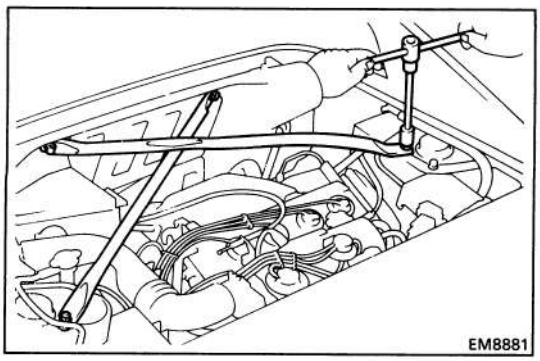
(a) Install the air cleaner case with the three bolts.

(b) Install the air cleaner element.

(c) Connect the air cleaner hose to the throttle body.

(d) Install the air cleaner cap.

(e) Connect the intake air temperature sensor connector.



36. INSTALL SUSPENSION UPPER BRACE

Install the suspension upper brace with the two bolts and two nuts.

Torque: Bolt 740 kg-cm (54 ft-lb, 73 N·m)
Nut 650 kg-cm (47 ft-lb, 64 N·m)

37. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

38. FILL WITH ENGINE COOLANT (See page CO-7)

Capacity (w/ Heater):
13.0 liters (13.7 US qts, 11.4 Imp. qts)

39. FILL WITH ENGINE OIL (See page LU-8)

Capacity:
Drain and refill
w/ Oil filter change
4.2 liters (4.4 US qts, 3.7 Imp. qts)
w/o Oil filter change
3.8 liters (4.0 US qts, 3.3 Imp. qts)
Dry fill 4.6 liters (4.9 US qts, 4.0 Imp. qts)

40. START ENGINE AND CHECK FOR LEAKS

41. PERFORM ENGINE ADJUSTMENT

(a) Adjust the alternator drive belt.
(See page CH-3)

Drive belt tension: New belt 120 ± 20 lb
Used belt 104 ± 20 lb

(b) Adjust the A/C drive belt.

Drive belt tension: New belt 160 ± 20 lb
Used belt 100 ± 20 lb

(c) Adjust the ignition timing.
(See steps 9 to 13 on pages IG-21 and 22)

Ignition timing:
10° BTDC @ idle
(w/ Terminals TE1 and E1 connected)

cardiagn.com

42. INSTALL ENGINE UNDER COVERS

43. INSTALL ENGINE HOOD

44. INSTALL ENGINE COMPARTMENT SIDE PANELS

45. PERFORM ROAD TEST

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

46. RECHECK ENGINE COOLANT AND OIL LEVELS

cardiagn.com