

ENGINE MECHANICAL

	Page
TROUBLESHOOTING (22R-E, 22R-TE)	EM-2
(22R)	EM-5
ENGINE TUNE-UP.....	EM-9
IDLE HC/CO CONCENTRATION CHECK METHOD	EM-10
COMPRESSION CHECK.....	EM-12
CYLINDER HEAD.....	EM-13
TIMING CHAIN	EM-45
CYLINDER BLOCK	EM-52

EM

TROUBLESHOOTING (22R-E, 22R-TE)**ENGINE OVERHEATING**

Problem	Possible cause	Remedy	Page
Engine overheats	Cooling system faulty Incorrect ignition timing	Troubleshoot cooling system Reset timing	CO-2 IG-15

HARD STARTING

Problem	Possible cause	Remedy	Page
Engine will not crank or cranks slowly	Starting system faulty	Troubleshoot starting system	ST-2
Engine will not start/ Hard to start (cranks OK)	No fuel supply to injector <ul style="list-style-type: none"> • No fuel in tank • Fuel pump not working • Fuel filter clogged • Fuel line clogged or leaking EFI system problems Ignition problems <ul style="list-style-type: none"> • Ignition coil • Igniter • Distributor Spark plugs faulty High-tension cords disconnected or broken Vacuum leaks <ul style="list-style-type: none"> • PCV hoses • EGR valve • Intake manifold • Air intake chamber • Throttle body Pulling in air between air flow meter and throttle body Low compression	Troubleshoot EFI system Repair as necessary Perform spark test Inspect coil Inspect distributor Inspect plugs Inspect cords Repair as necessary Repair as necessary Check compression	FI-10 IG-5 IG-7 IG-9 IG-6 IG-6 EM-12

ROUGH IDLING

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses	Spark plugs faulty High-tension cords faulty Ignition problems <ul style="list-style-type: none"> • Ignition coil • Igniter • Distributor Incorrect ignition timing Vacuum leaks <ul style="list-style-type: none"> • PCV hoses • EGR valve • Intake manifold • Air intake chamber • Throttle body Pulling in air between air flow meter and throttle body Incorrect idle speed EFI system problems	Inspect plugs Inspect cords Inspect coil Inspect distributor Reset timing Repair as necessary Repair as necessary Adjust idle Repair as necessary	IG-6 IG-6 IG-7 IG-9 IG-15 MA-8

ROUGH IDLING (CONT'D)

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses (cont'd)	Engine overheats Low compression Incorrect valve clearance	Check cooling system Check compression Adjust valve clearance	CO-2 EM-12 MA-8

ENGINE HESITATES/POOR ACCELERATION

Problem	Possible cause	Remedy	Page
Engine hesitates/ Poor acceleration	Spark plugs faulty	Inspect plugs	IG-6
	High-tension cords faulty	Inspect cords	IG-6
	Vacuum leaks <ul style="list-style-type: none"> • PCV hoses • EGR valve • Intake manifold • Air intake chamber • Throttle body 	Repair as necessary	
	Pulling in air between air flow meter and throttle body	Repair as necessary	
	Incorrect ignition timing	Reset timing	IG-15
	Fuel system clogged	Check fuel system	
	Air cleaner clogged	Check air cleaner	MA-5
	EFI system problems	Repair as necessary	
	Emission control system problem (cold engine) <ul style="list-style-type: none"> • EGR system always on 	Check EGR system	EC-12,15
	Engine overheats	Check cooling system	CO-2
	Low compression	Check compression	EM-12

ENGINE DIESELING

Problem	Possible cause	Remedy	Page
Engine dieseling (run after ignition switch is turned off)	EFI system problems	Repair as necessary	

AFTER FIRE, BACKFIRE

Problem	Possible cause	Remedy	Page
Muffler explosion (after fire) on deceleration only	Deceleration fuel cut system always off	Check EFI (fuel cut) system	FI-86
	As system faulty	Check AS system	EC-19
Muffler explosion (after fire) all the time	Air cleaner clogged	Check air cleaner	MA-5
	EFI system problem	Repair as necessary	
	Incorrect ignition timing	Reset timing	IG-15
	Incorrect valve clearance	Adjust valve clearance	MA-8

AFTER FIRE, BACKFIRE (CONT'D)

Problem	Possible cause	Remedy	Page
Engine backfires	EFI system problem Vacuum leak <ul style="list-style-type: none"> • PCV hoses • EGR valve • Intake manifold • Air intake chamber • Throttle body 	Repair as necessary Check hoses and repair as necessary	FI-10 IG-15 MA-8 EM-21
	Pulling in air between air flow meter and throttle body Insufficient fuel flow Incorrect ignition timing Incorrect valve clearance Carbon deposits in combustion chambers	Repair as necessary Troubleshoot fuel system Reset timing Adjust valve clearance Inspect cylinder head	

EXCESSIVE OIL CONSUMPTION

Problem	Possible cause	Remedy	Page
Excessive oil consumption	Oil leak PCV line clogged Piston ring worn or damaged Valve stem and guide worn Valve stem seal worn	Repair as necessary Check PCV system Check rings Check valves Check seals	EC-5 EM-65 EM-22

POOR GASOLINE MILEAGE

Problem	Possible cause	Remedy	Page
Poor gasoline mileage	Fuel leak Air cleaner clogged Incorrect ignition timing EFI system problems <ul style="list-style-type: none"> • Injector faulty • Deceleration fuel cut system faulty 	Repair as necessary Check air cleaner Reset timing Repair as necessary	MA-5 IG-15 IG-6 EC-12 EM-12 FA-3 CL-2 BR-2
	Spark plugs faulty EGR system always on Low compression Tires improperly inflated Clutch slips Brakes drag	Inspect plugs Check EGR system Check compression Inflate tires to proper pressure Troubleshoot clutch Troubleshoot brakes	
Unpleasant odor	Incorrect idle speed Incorrect ignition timing Vacuum leaks <ul style="list-style-type: none"> • PCV hoses • EGR valve • Intake manifold • Air intake chamber • Throttle body 	Adjust idle Reset timing Repair as necessary Repair as necessary	MA-8 IG-15

TROUBLESHOOTING (22R)**ENGINE OVERHEATING**

Problem	Possible cause	Remedy	Page
Engine overheats	Cooling system faulty Incorrect ignition timing	Troubleshoot cooling system Reset timing	CO-2 IG-15

HARD STARTING

Problem	Possible cause	Remedy	Page
Engine will not crank or cranks slowly	Starting system faulty	Troubleshoot starting system	ST-2
Engine will not start/ Hard to start (cranks OK)	No fuel supply to carburetor Carburetor problems <ul style="list-style-type: none"> • Choke operating • Flooding • Needle valve sticking or clogged • Vacuum hose disconnected or damaged • Fuel cut solenoid valve not open • Secondary throttle valve not close Ignition problems <ul style="list-style-type: none"> • Ignition coil • Igniter • Distributor Spark plugs faulty High-tension cords disconnected or broken Vacuum leaks <ul style="list-style-type: none"> • PCV line • EGR line • MC line • Intake manifold • CMH Low compression	Troubleshoot fuel system Repair as necessary Perform spark test Inspect coil Inspect distributor Inspect plugs Inspect cords Repair as necessary Check compression	FU-2 FU-4 IG-5 IG-7 IG-9 IG-6 IG-6 EM-12

ROUGH IDLING

Problem	Possible cause	Remedy	Page
Rough idle or stalls	Spark plugs faulty High-tension cords faulty Vacuum leaks <ul style="list-style-type: none"> • PCV line • MC line • EGR line • Intake manifold • HAC line • CMH Incorrect ignition timing Ignition problems <ul style="list-style-type: none"> • Ignition coil • Igniter • Distributor 	Inspect plugs Inspect cords Repair as necessary Reset timing Perform spark test Inspect coil Inspect distributor	IG-6 IG-6 IG-15 IG-5 IG-7 IG-9

ROUGH IDLING (CONT'D)

Problem	Possible cause	Remedy	Page
Rough idle or stalls	Carburetor problems <ul style="list-style-type: none"> • Idle speed incorrect • Slow jet clogged • Idle mixture incorrect • Fuel cut solenoid valve not open • Fast idle speed setting incorrect (cold engine) • Choke system faulty 	Perform on-vehicle inspection of carburetor	FU-3
	HAI system faulty Engine overheats EGR valve faulty MC valve faulty Incorrect valve clearance Low compression	Check HAI system Troubleshoot cooling system Check EGR valve Check MC valve Adjust valve clearance Check compression	EC-59 CO-2 EC-36 EC-34 MA-8 EM-12

ENGINE HESITATES/POOR ACCELERATION

Problem	Possible cause	Remedy	Page
Engine hesitates/ Poor acceleration	Spark plugs faulty High-tension cords faulty Vacuum leaks <ul style="list-style-type: none"> • PCV line • EGR line • HAC line • Intake manifold • CMH • MC line 	Inspect plugs Inspect cords Repair as necessary	IG-6 IG-6
	Incorrect ignition timing Air filter clogged Fuel line clogged Carburetor problems <ul style="list-style-type: none"> • Float level too low • Accelerator pump faulty • Power valve faulty • Choke valve closed (hot engine) • Choke system • Secondary throttle stopper operation faulty (cold engine) CMH system faulty (cold engine) Emission control system problem <ul style="list-style-type: none"> • HAI system always on (hot engine) • AAP system faulty • EGR system always on (cold engine) • HAC system faulty Engine overheats Low compression	Reset timing Check air filter Check fuel line Repair as necessary Check HAI system Check AAP system Check EGR system Check HAC system Check cooling system Check compression	IG-15 MA-5 FU-4 EC-59 EC-66 EC-36 EC-54 CO-2 EM-12

ENGINE DIESELING

Problem	Possible cause	Remedy	Page
Engine dieseling (runs after ignition switch is turned off)	Carburetor problems <ul style="list-style-type: none"> • Linkage sticking • Idle speed or fast idle speed out of adjustment • Fuel cut solenoid faulty 	Repair as necessary	FU-4
	Incorrect ignition timing EGR system faulty	Reset timing Check EGR system	IG-15 EC-36

AFTER FIRE, BACKFIRE

Problem	Possible cause	Remedy	Page
Muffler explosion (after fire) on deceleration only	AI system faulty	Check AI system	EC-46
	AS system faulty	Check AS system	EC-39
	MC system faulty	Check MC system	EC-34
	Deceleration fuel cut system always off	Check fuel cut system	EC-68
Muffler explosion (after fire) all the time	Air filter clogged	Check air filter	MA-5
	Choke system faulty	Check choke	EC-61
	Incorrect ignition timing	Reset timing	IG-15
	Incorrect valve clearance	Adjust valves clearance	MA-8
Engine backfires	Choke valve open (cold engine)	Check choke system	EC-61
	Carburetor vacuum leak	Check hoses and repair as necessary	
	Insufficient fuel flow	Troubleshoot fuel system	FU-2
	Incorrect ignition timing	Reset timing	IG-15
	Incorrect valve clearance	Adjust valve clearance	MA-8
	Carbon deposits in combustion chambers	Inspect cylinder head	EM-21

EXCESSIVE OIL CONSUMPTION

Problem	Possible cause	Remedy	Page
Excessive oil consumption	Oil leak	Repair as necessary	
	PCV line clogged	Check PCV system	EC-27
	Piston ring worn or damaged	Check rings	EM-65
	Valve stem and guide worn	Check valves and guides	EM-22
	Valve stem oil seal worn or damaged	Check oil seal	

POOR FUEL MILEAGE

Problem	Possible cause	Remedy	Page
Poor fuel mileage	Fuel leak Air filter clogged Incorrect ignition timing Carburetor problems <ul style="list-style-type: none"> • Choke system faulty • Idle speed too high • Deceleration fuel cut system faulty • Power valve always open Spark plugs faulty EGR system always on Low compression Tires improperly inflated Clutch slips Brakes drag	Repair as necessary Check air filter Reset timing Perform on-vehicle inspection of carburetor Inspect plugs Check EGR system Check compression Inflate tires to proper pressure Troubleshoot clutch Troubleshoot brakes	MA-5 IG-15 FU-4 IG-5 EC-36 EM-12 FA-3 CL-2 BR-2

ENGINE TUNE-UP

1. **INSPECT ENGINE COOLANT**
(See page CO-3)
2. **INSPECT ENGINE OIL**
(See page LU-3)
3. **INSPECT AIR CLEANER**
(See page MA-5)
4. **INSPECT BATTERY**
(See page CH-3)
5. **INSPECT HIGH-TENSION CODE**
(See page IG-6)
6. **INSPECT SPARK PLUGS**
(See page IG-6)
7. **INSPECT DRIVE BELTS**
(See page MA-4)
8. **INSPECT VALVE CLEARANCE**
(See page MA-8)
Valve clearance: Intake 0.20 mm (0.008 in.)
Exhaust 0.30 mm (0.012 in.)
9. **INSPECT IGNITION TIMING**
(See step 3 on page IG-15)
Ignition timing:
22R 0° TDC @ Max. 950 rpm
(w/ Vacuum advancer OFF)
22R-E, 22R-TE 5° BTDC @ Idle
(T and E₁ short circuit)
10. (22R)
INSPECT CARBURETOR FLOAT LEVEL
(See step 3 on page FU-3)
11. (22R)
INSPECT FAST IDLE SPEED
(See step 14 on page MA-10)
12. **ADJUST IDLE SPEED**
(See page MA-8)
Idle speed: 22R 700 rpm
22R-E 750 rpm
22R-TE 800 rpm

NOTE: Adjust idle mixture as necessary.

IDLE HC/CO CONCENTRATION CHECK METHOD

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

PRECHECK

INITIAL CONDITIONS

- (a) Normal engine operating temperature
- (b) Choke fully open (22R)
- (c) Air cleaner installed
- (d) All pipe and hoses of air intake system connected (22R-E, 22R-TE)
- (e) All accessories switched off
- (f) All vacuum lines properly connected
- (g) EFI system wiring connectors fully plugged
- (h) Idle speed set correctly
- (i) Carburetor fuel level about even with the correct level in the sight glass (22R)
- (j) Tachometer and HC/CO meter calibrated and at hand

MEASUREMENT

1. CHECK V_F VOLTAGE (22R-E, 22R-TE)

- (a) Short terminals T and E_1 of the check connector.
- (b) Connect the voltmeter to the check connector.

Check connector location: Near the No. 2 relay block

Connect the positive (+) testing probe to the Ox terminal and negative (−) testing probe to terminal E.

- (c) Race the engine at 2,500 rpm for approx. 90 seconds.
- (d) Maintain engine speed at 2,500 rpm.
- (e) Check that the needle of the voltmeter fluctuates 8 times or more in 10 seconds within 0 – 7 volts.

2. (22R)

RACE ENGINE AT 2,500 RPM FOR APPROX. 90 SECONDS

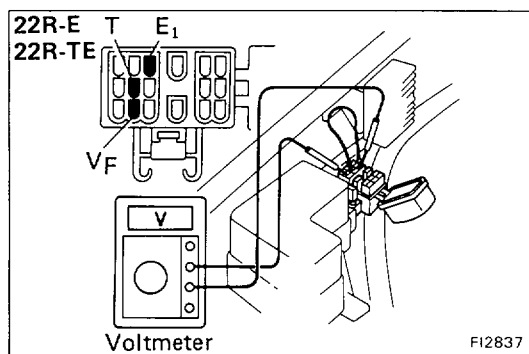
3. INSERT TESTING PROBE OF HC/CO METER INTO TAILPIPE AT LEAST 40 cm (1.3 ft)

4. MEASURE HC/CO CONCENTRATION AT IDLE

Wait at least one minute before measuring to allow the concentration to stabilize.

Complete the measuring within three minutes.

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



TROUBLESHOOTING

HC	CO	Problems	Causes
High	Normal	Rough idle	<ol style="list-style-type: none"> Faulty ignition: <ul style="list-style-type: none"> Incorrect timing Fouled, shorted or improperly gapped plugs Open or crossed ignition wires Cracked distributor cap Incorrect valve clearance Leaky EGR valve Leaky exhaust valves Leaky cylinder
High	Low	Rough idle Fluctuating HC reading	<ol style="list-style-type: none"> Vacuum leak: <ul style="list-style-type: none"> Vacuum hose Intake manifold Intake chamber (22R-E, 22R-TE) PCV line Carburetor base (22R) Throttle body (22R-E, 22R-TE) CMH (22R) Leaky MC valve (22R)
High	High	Rough idle Black smoke from exhaust	<ol style="list-style-type: none"> Restricted air filter Plugged PCV valve AS system problem (22R) Faulty carburetion: (22R) <ul style="list-style-type: none"> Faulty choke action Incorrect float setting Leaking needle or seat Leaking power valve Faulty EFI system: (22R-E, 22R-TE) <ul style="list-style-type: none"> Faulty pressure regulator Clogged fuel return line Faulty air flow meter Defective water temp. sensor Defective air temp. sensor Faulty ECU Faulty injector Faulty cold start injector

COMPRESSION CHECK

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

1. WARM UP ENGINE
2. REMOVE SPARK PLUGS
3. DISCONNECT DISTRIBUTOR CONNECTOR
4. (22R-E, 22R-TE)
DISCONNECT COLD START INJECTOR CONNECTOR
5. (22R-E, 22R-TE)
DISCONNECT SOLENOID RESISTOR CONNECTOR

6. MEASURE CYLINDER COMPRESSION PRESSURE

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

CAUTION: This test must be done for as short a time as possible to avoid overheating of the catalytic converter.

NOTE: A fully charged battery must be used to obtain at least 250 rpm.

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

Compression pressure:

22R, 22R-E	12 kg/cm ² (171 psi, 1,177 kPa)
22R-TE	10.5 kg/cm ² (149 psi, 1,030 kPa)

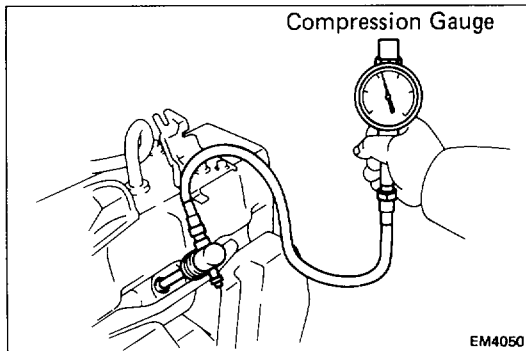
Minimum pressure:

22R, 22R-E	10 kg/cm ² (142 psi, 981 kPa)
22R-TE	8.5 kg/cm ² (121 psi, 834 kPa)

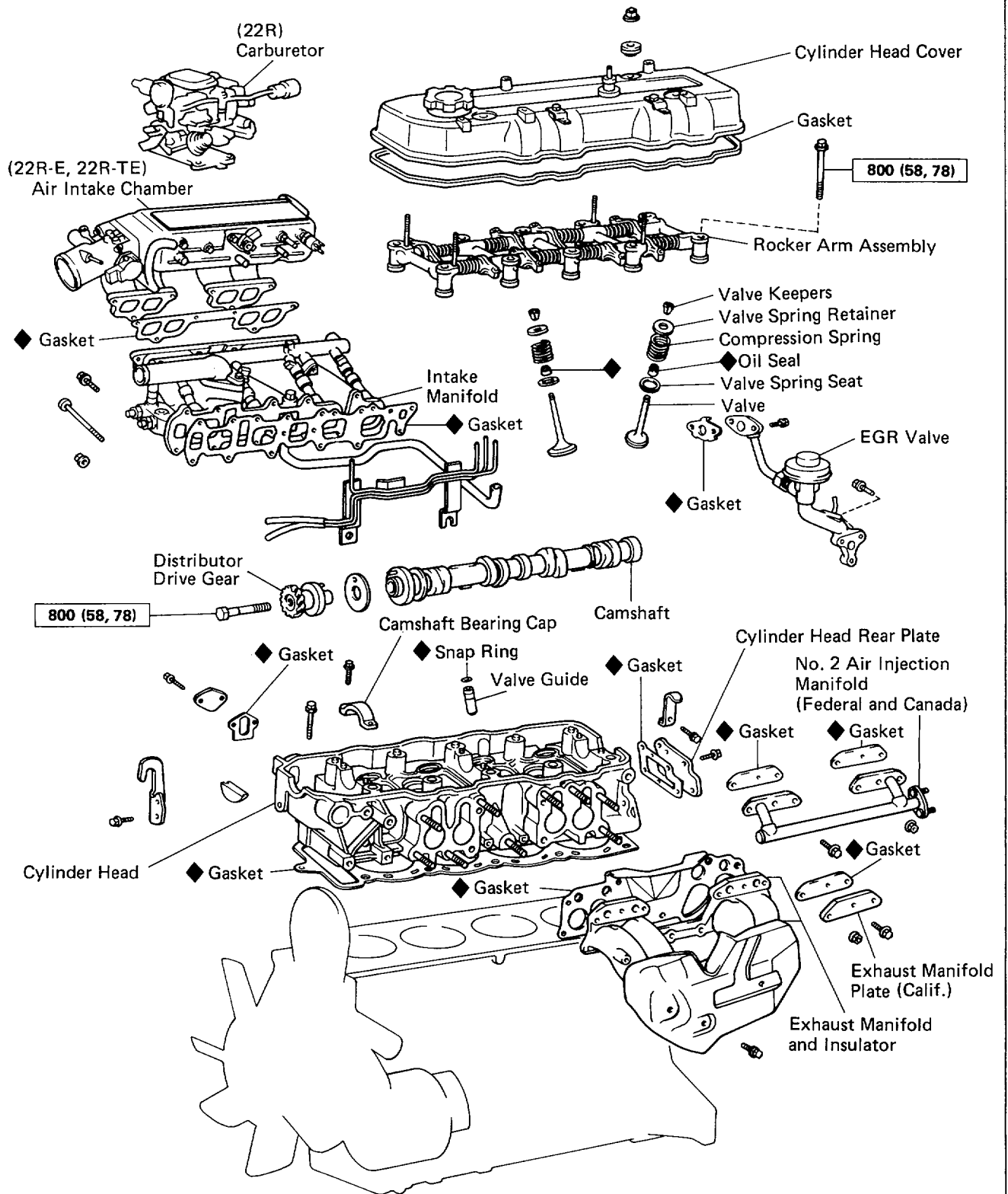
Difference between each cylinder:

Less than 1.0 kg/cm² (14 psi, 98 kPa)

- (e) If cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for the low compression cylinder.
 - If adding oil helps the compression, chances are that the piston rings and/or cylinder bore are worn or damaged.
 - If pressure stays low, a valve may be sticking or seating improperly, or there may be leakage past the gasket.
7. (22R-E, 22R-TE)
CONNECT SOLENOID RESISTOR CONNECTOR
8. (22R-E, 22R-TE)
CONNECT COLD START INJECTOR CONNECTOR
9. CONNECT DISTRIBUTOR CONNECTOR
10. INSTALL SPARK PLUGS



CYLINDER HEAD COMPONENTS

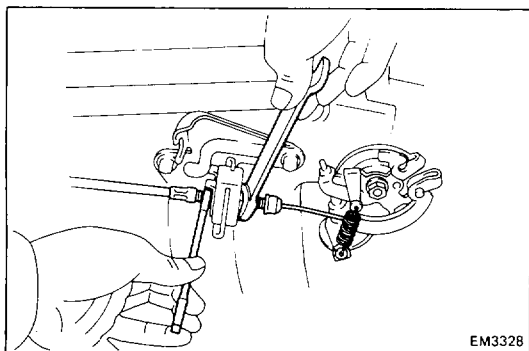


kg-cm (ft-lb, N-m) : Specified torque

◆ Non-reusable part

22R-E, 22R-TE PREPARATION FOR REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY
2. DRAIN COOLANT FROM RADIATOR AND CYLINDER BLOCK
3. (22R-TE)
REMOVE TURBOCHARGER
(See steps 3 to 13 on pages TC-8, 9)
4. (22R-E)
REMOVE AIR CLEANER HOSE
5. DISCONNECT EXHAUST PIPE FROM EXHAUST MANIFOLD
 - (a) Remove the exhaust pipe clamp.
 - (b) Remove the three nuts, and disconnect the exhaust pipe
6. REMOVE OIL DIPSTICK
7. REMOVE DISTRIBUTOR AND SPARK PLUGS
8. REMOVE RADIATOR INLET HOSE
9. DISCONNECT HEATER WATER INLET HOSE FROM HEATER WATER INLET PIPE
10. DISCONNECT ACCELERATOR WIRE
11. (A/T)
DISCONNECT THROTTLE CABLE
Disconnect the throttle cable from the bracket and clamp.
12. DISCONNECT GROUND STRAP FROM ENGINE REAR SIDE
13. DISCONNECT FOLLOWING PARTS:
 - (a) (22R-E)
No.1 and No.2 PCV hoses
(22R-TE)
No.2 PCV hose
 - (b) Brake booster hose
 - (c) (w/ PS)
Air control valve hoses
 - (d) (with A/C)
VSV hoses.
 - (e) EVAP hose
 - (f) EGR vacuum modulator hose
 - (g) (22R-E)
Fuel pressure up VSV and hose
Reed valve hose
(22R-TE)
Pressure regulator hose
 - (h) (22R-TE)
VCV
 - (i) No.1 air valve hose from throttle body
 - (j) No.2 air valve hose from throttle body
 - (k) No.2 and No.3 water by-pass hoses from the throttle body

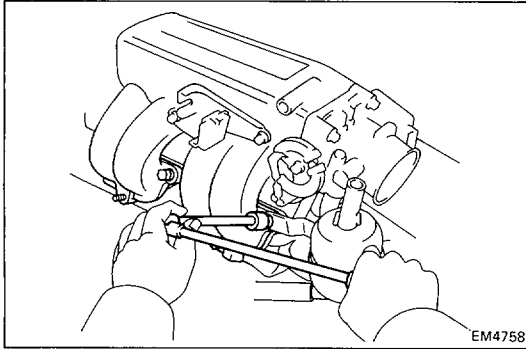


14. REMOVE EGR VACUUM MODULATOR**15. DISCONNECT FOLLOWING WIRES:**

- (a) Cold start injector wire
- (b) Throttle position wire
- (c) (Calif. and C&C)
EGR gas temp. sensor wire

16. REMOVE CHAMBER WITH THROTTLE BODY

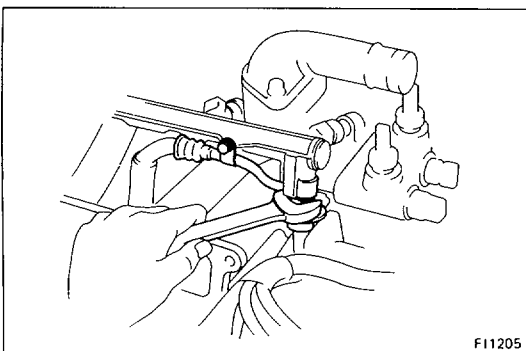
- (a) Remove the union bolt holding the cold start injector pipe to the chamber.
- (b) Remove the bolts holding the No.1 EGR pipe to the chamber.
- (c) Remove the bolts holding the manifold stay to the chamber.
- (d) Remove the four bolts, two nuts, bond strap and fuel hose clamp.
- (e) Remove the chamber with the throttle body, resonator and gasket.

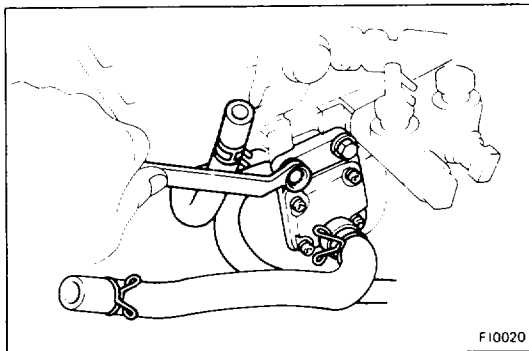
**17. DISCONNECT FUEL RETURN HOSE****18. DISCONNECT FOLLOWING WIRES:**

- (a) Auxiliary air valve wire
- (b) Knock sensor wire
- (c) Oil pressure sender gauge or switch
- (d) Starter wire (terminal 50)
- (e) Transmission wires
- (f) (with A/C)
Compressor wires
- (g) Injector wires
- (h) Water temp. sender gauge wire
- (i) (A/T)
OD temp. switch wire
- (j) Oxygen sensor wire
- (k) Igniter wire
- (l) (with A/C)
VSV wire
- (m) Cold start injector time switch wire
- (n) Water temp. sensor wire

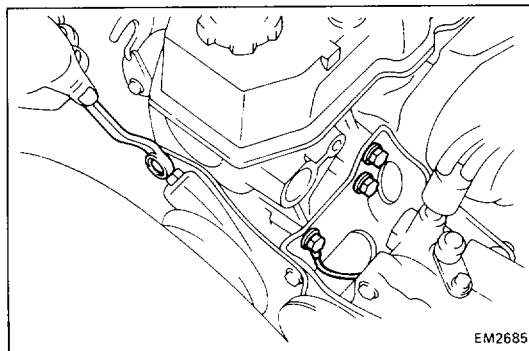
19. DISCONNECT FUEL HOSE FROM DELIVERY PIPE

Remove the bolt, pulsation damper and two gaskets.

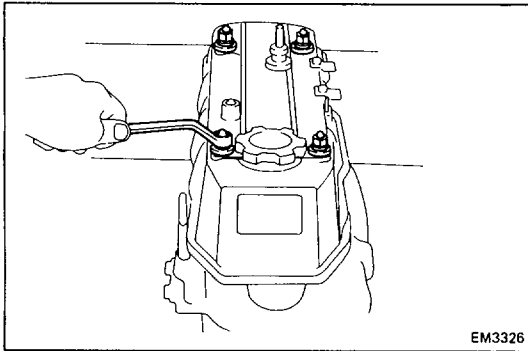


**20. REMOVE AUXILIARY AIR VALVE**

- (a) Disconnect the water by-pass hose.
- (b) Remove the two bolts and auxiliary air valve.

**21. (22R-E)
DISCONNECT BY-PASS HOSE FROM INTAKE MANIFOLD
(22R-TE)
DISCONNECT OIL COOLER HOSE FROM INTAKE
MANIFOLD****22. (w/ PS)
REMOVE PS BELT****23. (w/ PS)
DISCONNECT PS BRACKET FROM CYLINDER HEAD**

Remove the four bolts, and disconnect the ground strap and bracket.

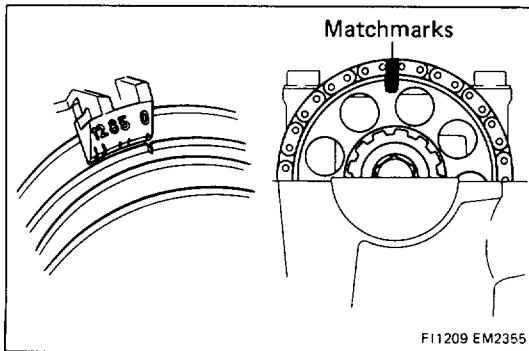


REMOVAL OF CYLINDER HEAD

1. REMOVE HEAD COVER

- (a) Remove the ground strap from the body.
- (b) Remove the four nuts and seals.
- (c) Remove the head cover.

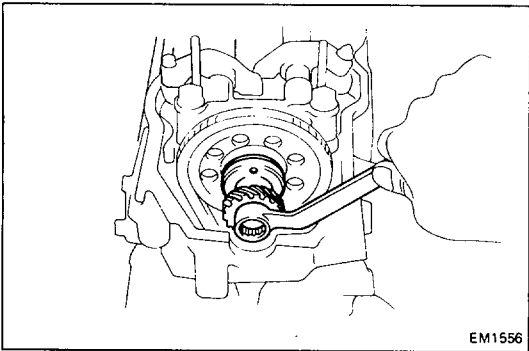
CAUTION: Cover the oil return hole in the head with a rag to prevent objects from falling in.



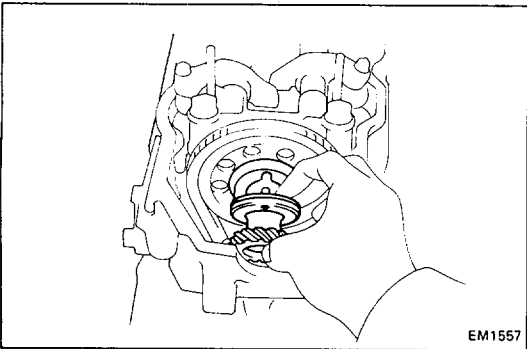
2. REMOVE CAM SPROCKET BOLT

- (a) Turn the crankshaft until the No.1 cylinder position is set at T.D.C. compression.
- (b) Place matchmarks on the sprocket and chain.
- (c) Remove the half-circular plug.

- (d) Remove the cam sprocket bolt.

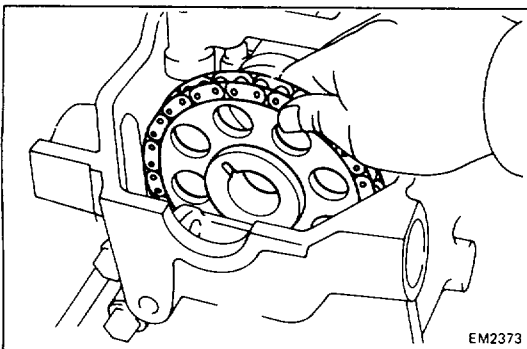


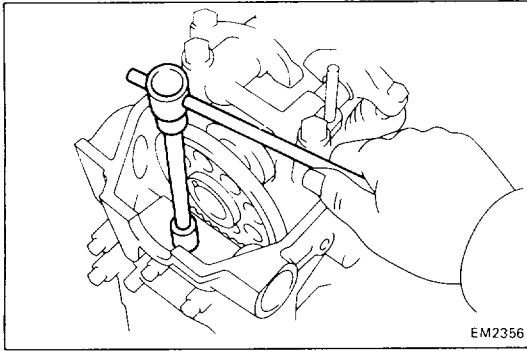
3. REMOVE DISTRIBUTOR DRIVE GEAR AND FUEL PUMP DRIVE CAM (22R) OR CAMSHAFT THRUST PLATE (22R-E, 22R-TE)



4. REMOVE CAM SPROCKET

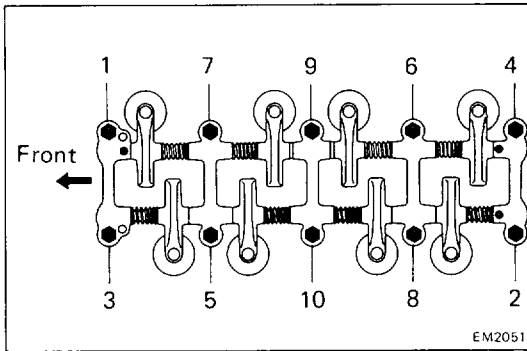
Remove the cam sprocket and chain from the camshaft and leave on the vibration damper.





5. REMOVE CHAIN COVER BOLT

Remove the bolt in front of the head before the other head bolts are removed.



6. REMOVE CYLINDER HEAD BOLTS

Remove the head bolts gradually in two or three passes and in the numerical order shown.

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

7. REMOVE ROCKER ARM ASSEMBLY

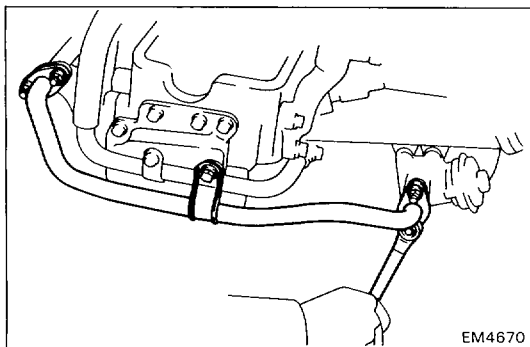
It may be necessary to use a pry bar on the front and rear of the rocker arm assembly to separate it from the head.

8. REMOVE CYLINDER HEAD

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

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

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

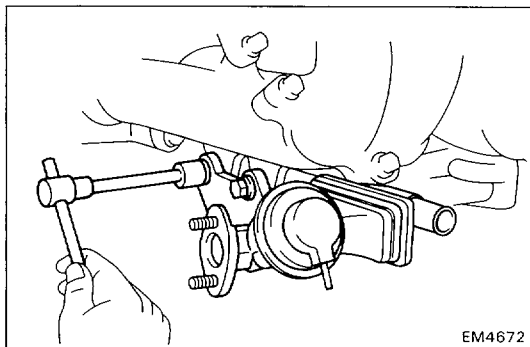


DISASSEMBLY OF CYLINDER HEAD

(See page EM-13)

1. (22R-E) REMOVE NO.1 AIR INJECTION MANIFOLD

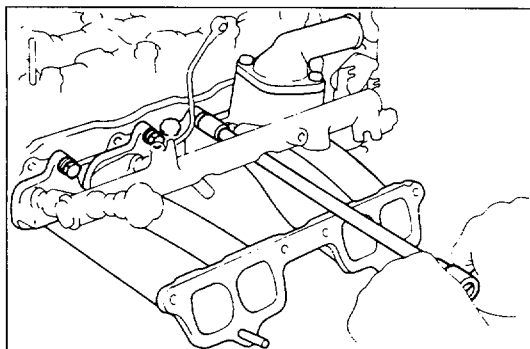
Remove the bolt, four nuts, No.1 air injection manifold and two gaskets.



2. REMOVE INTAKE MANIFOLD WITH DELIVERY PIPE AND INJECTION NOZZLE

(a) (22R-E)

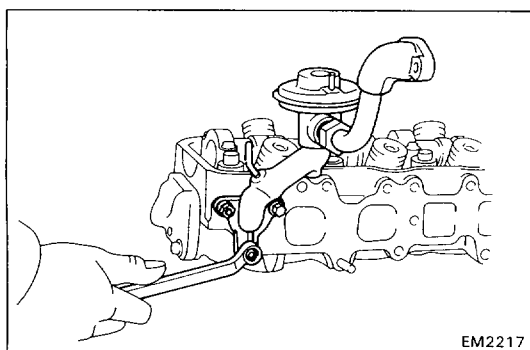
Remove the two nuts and read valve.



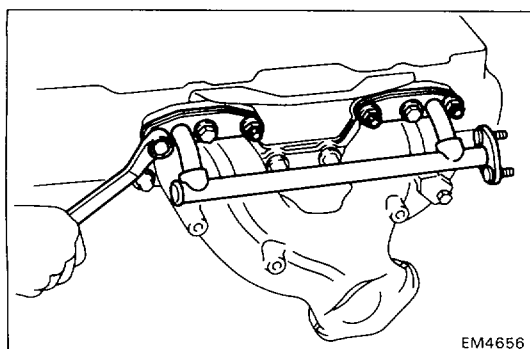
(b) Remove the bolt the heater inlet pipe from the cylinder head.

(c) Remove the seven bolts, one hexagon bolt, two nuts and No. 1 air pipe.

(d) Remove the intake manifold together with the delivery pipe, injection nozzles and heater water inlet pipe.



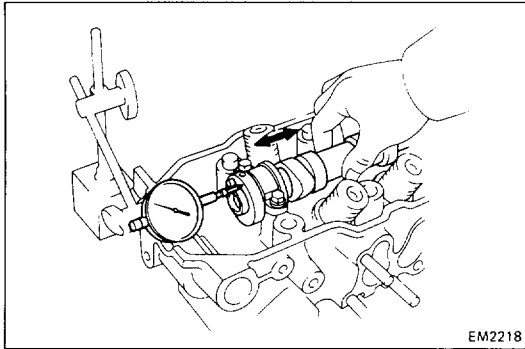
3. REMOVE EGR VALVE



4. (22R-E) REMOVE EXHAUST MANIFOLD WITH NO.2 AIR INJECTION MANIFOLD

5. REMOVE TWO ENGINE HANGERS AND GROUND STRAP

6. REMOVE CYLINDER HEAD REAR COVER



7. MEASURE CAMSHAFT THRUST CLEARANCE

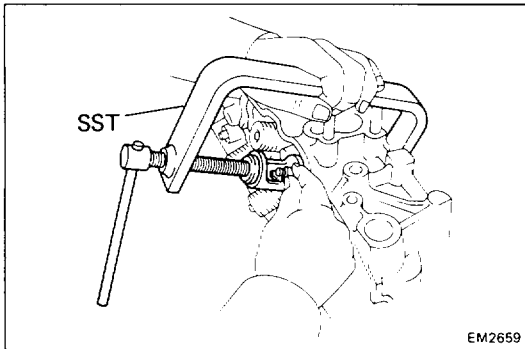
Using a dial gauge, measure the camshaft thrust clearance.

Standard clearance: 0.08 — 0.18 mm
(0.0031 — 0.0071 in.)

Maximum clearance: 0.25 mm (0.0098 in.)

If clearance is greater than maximum, replace the head.

8. REMOVE CAM BEARING CAPS AND SHAFT



9. REMOVE VALVES

(a) Using SST, compress the valve retainer until the two keepers can be removed.

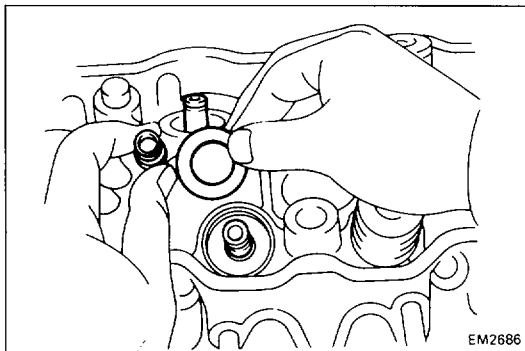
SST 09202-43013

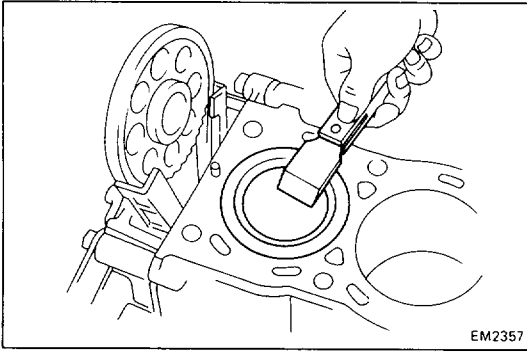
(b) Remove the valve keepers, retainers, springs and valves.

(c) Remove the valve seals.

(d) Using a small screwdriver or magnet, remove the valve spring seats.

NOTE: Keep the valves arranged so they can be installed in the same order as removed.

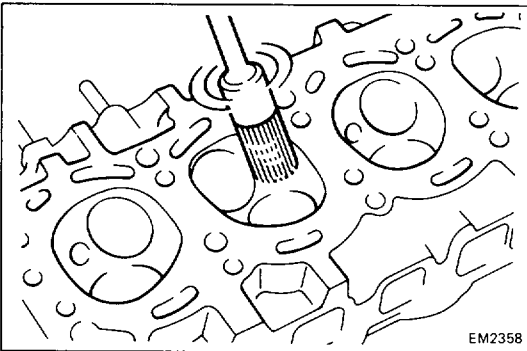




INSPECTION AND CLEANING OF CYLINDER HEAD COMPONENTS

1. CLEAN TOP OF PISTONS AND TOP OF BLOCK

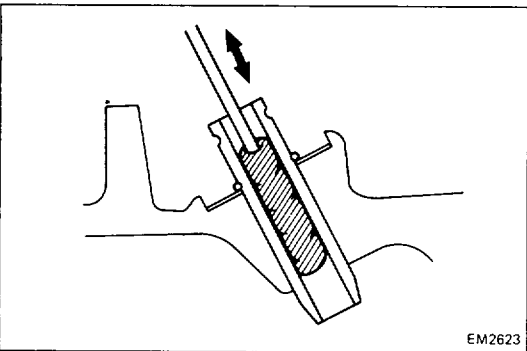
- (a) Turn the crankshaft and bring each piston to top dead center. Scrape the carbon from the piston top.
- (b) Remove all gasket material from the top of the block. Blow carbon and oil from the bolt holes.



2. CLEAN COMBUSTION CHAMBER

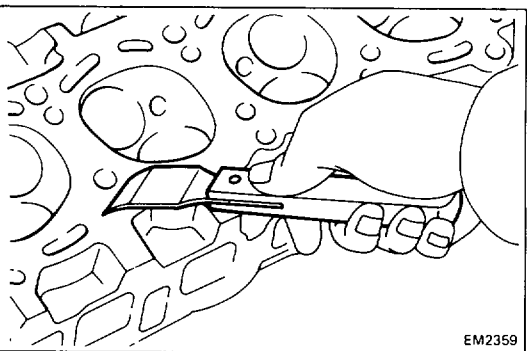
Using a wire brush, remove all the carbon from the combustion chambers.

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



3. CLEAN VALVE GUIDES

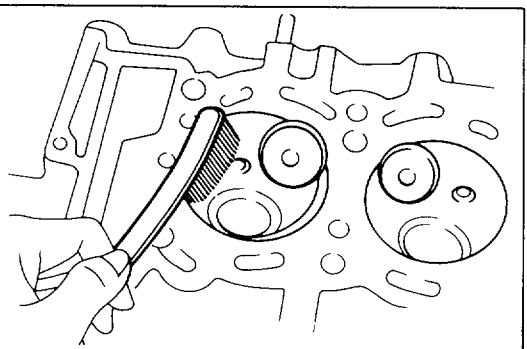
Using a valve guide brush and solvent, clean all valve guides.



4. REMOVE GASKET MATERIAL

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

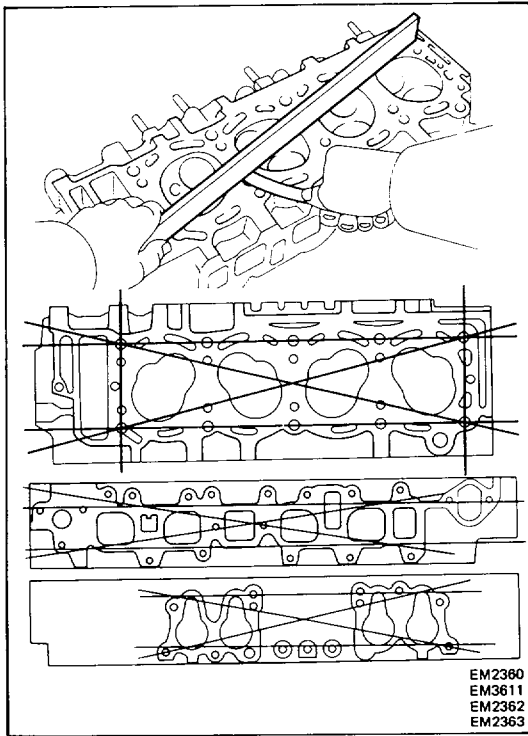
CAUTION: Do not scratch the surfaces.



5. CLEAN CYLINDER HEAD

Using a soft brush and solvent, clean the head.

CAUTION: Do not clean the head in a hot tank as this will seriously damage it.



6. INSPECT HEAD FOR FLATNESS

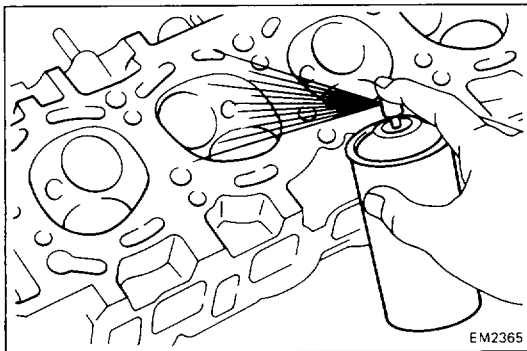
- (a) Using a precision straightedge and feeler gauge, check that the head and manifold surfaces are not warped.

- (b) Measure warpage along the four edges and diagonally as illustrated.

Maximum head surface warpage: 0.15 mm (0.0059 in.)

Maximum manifold surface warpage: 0.20 mm (0.0079 in.)

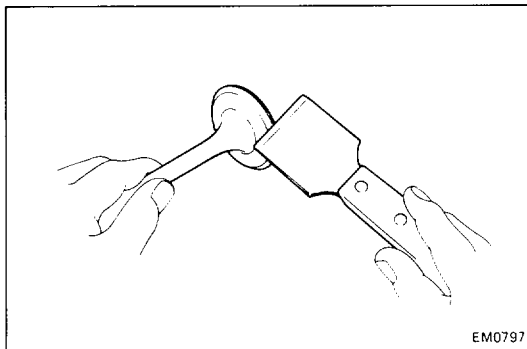
If warpage is greater than specified value, replace the head.



7. INSPECT CYLINDER HEAD FOR CRACKS

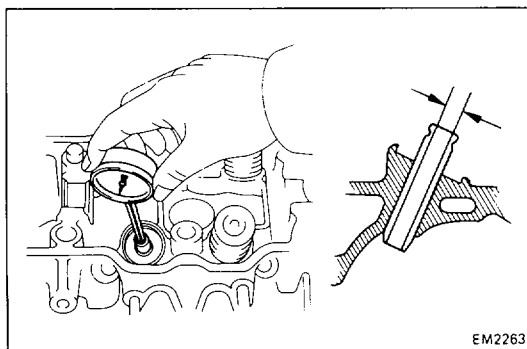
Using a dye penetrant, check the combustion chamber, intake and exhaust ports, head surface and the top of the head for cracks.

If a crack is found, replace the head.



8. CLEAN VALVES

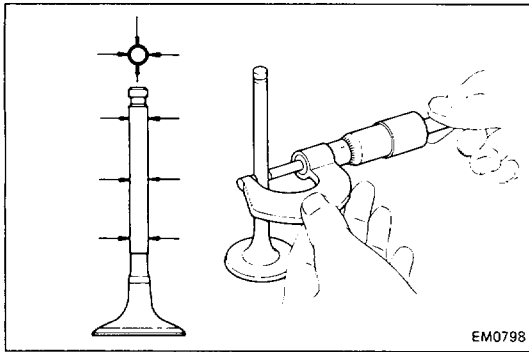
Use an old valve to chip any carbon from the valve head. Using a gasket scraper, clean the valve thoroughly.



9. INSPECT VALVE STEM GUIDE WEAR

- (a) Using a dial indicator or telescoping gauge, measure the inside diameter of the valve guide.

Standard inside diameter: 8.01 — 8.03 mm
(0.3154 — 0.3161 in.)



EM0798

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

Standard valve stem diameter:

Intake	7.970 — 7.985 mm (0.3138 — 0.3144 in.)
Exhaust	7.965 — 7.980 mm (0.3136 — 0.3142 in.)

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

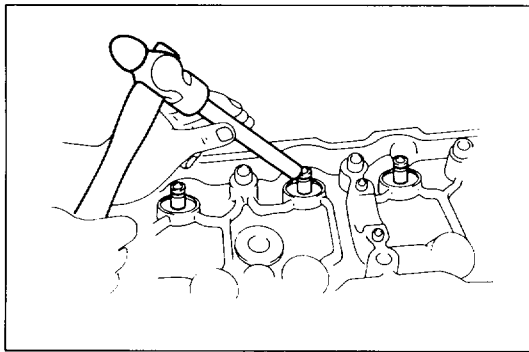
Standard oil clearance:

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:

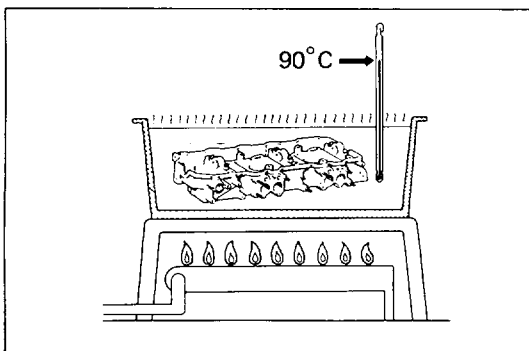
Intake	0.08 mm (0.0031 in.)
Exhaust	0.10 mm (0.0039 in.)

If the clearance is greater than following values, replace the valve and guide:

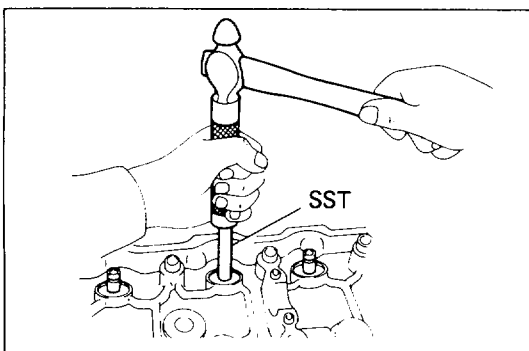


10. IF NECESSARY, REPLACE VALVE GUIDE

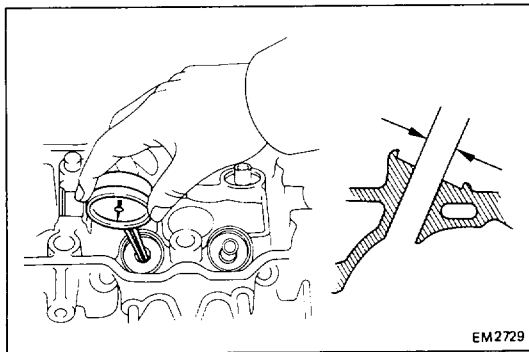
- (a) Using a brass bar and hammer, break the valve guide.



- (b) Heat the cylinder head to approx. 90°C (194°F).



- (c) Using SST and hammer, drive out the valve guide.
SST 09201-60011



- (d) Using a caliper gauge, measure the valve guide bore of the cylinder head.

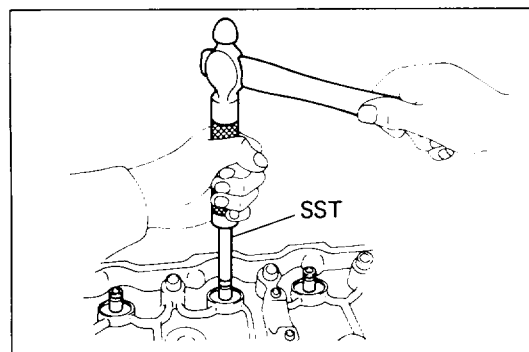
Both intake and exhaust

Guide bore mm (in.)	Guide size
13.000 – 13.018 (0.5118 – 0.5125)	Use STD
Over 13.018 (0.5125)	Use O/S 0.05

- (e) Select a new valve guide.

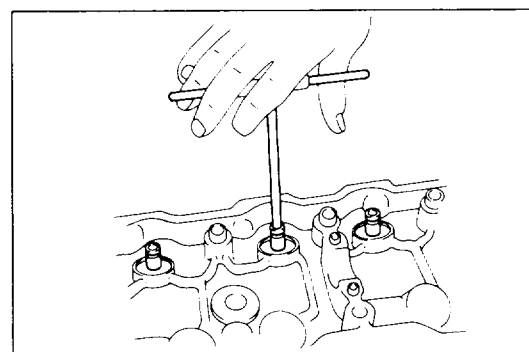
If the valve guide bore of the cylinder head is more than 13.018 mm (0.5125 in.), machine the bore to the following dimension.

Rebored valve guide bushing bore dimension (cold):
13.050 – 13.068 mm (0.5138 – 0.5145 in.)



- (f) Heat the cylinder head to approx. 90°C (194°F)
(g) Using SST and hammer, drive in a new valve guide until the snap ring makes contact with the cylinder head.

SST 09201-60011



- (h) Using a sharp 8 mm reamer, ream the valve guide to obtain the specified clearance between the guide and new valve.

Intake clearance: 0.025 – 0.06 mm
(0.0010 – 0.0024 in.)

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

11. INSPECT AND GRIND VALVES

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

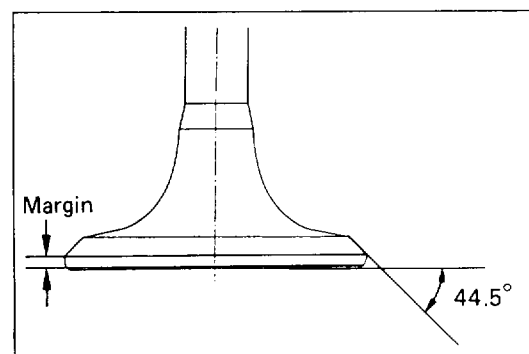
Make sure the valves are ground at the correct valve face angle.

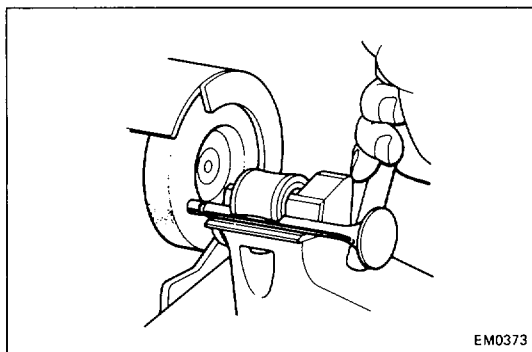
Valve face angle: 44.5°

- (b) Check the valve head margin.

Minimum margin: 22R, 22R-E 0.6 mm (0.024 in.)
22R-TE IN 0.9 mm (0.035 in.)
EX 1.1 mm (0.043 in.)

If the valve head margin is less than specified, replace the valve.





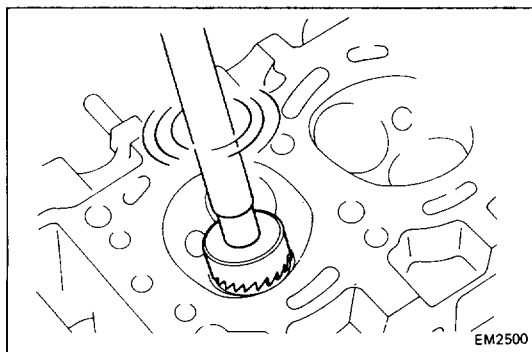
- (c) Check the surface of the valve stem tip for wear. If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

CAUTION: Do not grind more than 0.5 mm (0.020 in.)

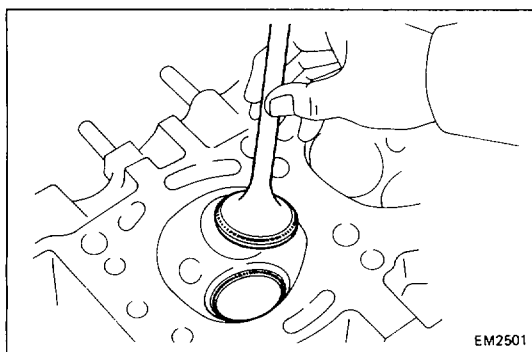
Standard overall length:

Intake	22R, 22R-E	113.5 mm (4.468 in.)
	22R-TE	113.8 mm (4.480 in.)
Exhaust	22R, 22R-E	112.4 mm (4.425 in.)
	22R-TE	112.9 mm (4.445 in.)

12. INSPECT AND CLEAN VALVE SEATS



- (a) Using a 45° cutter, resurface the valve seats. Remove 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. Install the valve. While applying light pressure to the valve, rotate the valve against the seat.

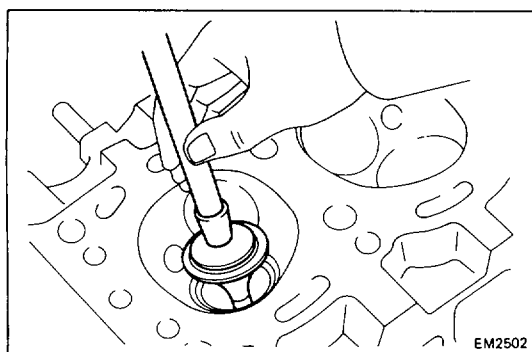
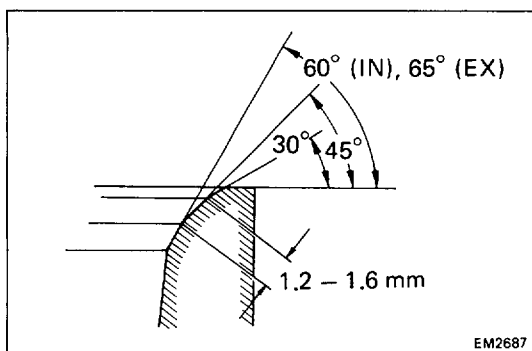
- (c) Check the valve face and seat for the following:

- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and seat are concentric. If not, resurface the seat.
- Check that the seat contact is on the middle of the valve face with the following width:
1.2 — 1.6 mm (0.047 — 0.063 in.)

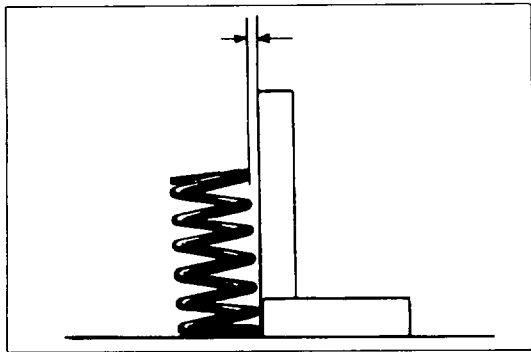
If not, correct the valve seat as follows:

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

If seating is too low on the valve face, use 60° (IN) or 65° (EX) and 45° cutters to correct the seat.



- (d) Hand-lap the valve and valve seat together with abrasive compound.
- (e) Clean the valve and valve seat after hand-lapping.

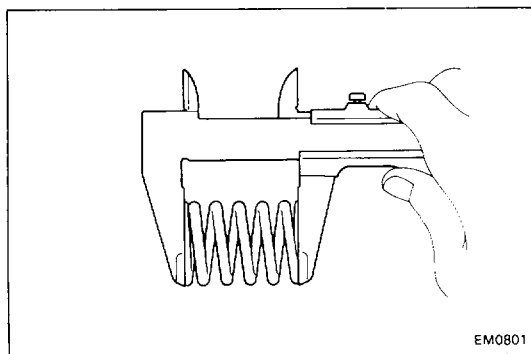


13. INSPECT VALVE SPRINGS

- (a) Using a steel square, check the squareness of the valve springs.

Maximum allowable: 1.6 mm (0.063 in.)

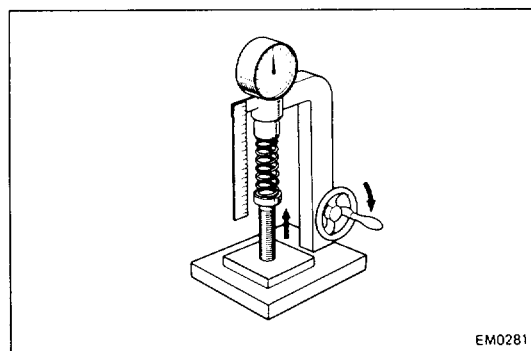
If a spring is out of square more than maximum allowable, replace the spring.



- (b) Measure the free height of all springs.

Free height: 48.5 mm (1.909 in.)

Replace any spring that is not correct.



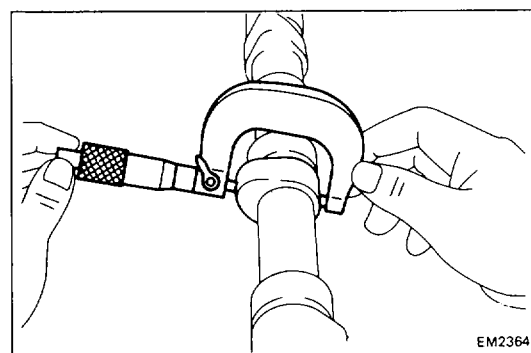
- (c) Using a spring tester, check the tension of each spring at the specified installed height.

Installed height: 40.5 mm (1.594 in.)

Standard installed tension: 30.0 kg (66.1 lb, 294 N)

Minimum installed tension: 28.5 kg (62.8 lb, 279 N)

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



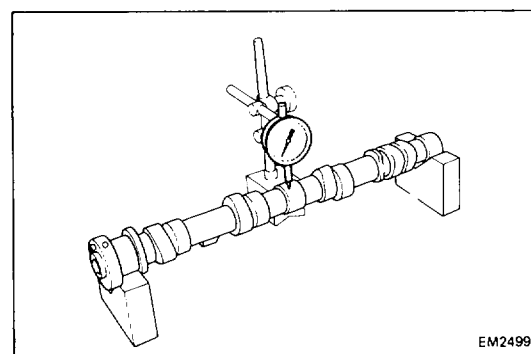
14. INSPECT CAMSHAFT AND BEARING CAPS

- (a) Using a micrometer, measure the cam lobes.

**Standard intake lobe height: 42.63 — 42.72 mm
(1.6783 — 1.6819 in.)**

**Standard exhaust lobe height: 42.69 — 42.78 mm
(1.6807 — 1.6842 in.)**

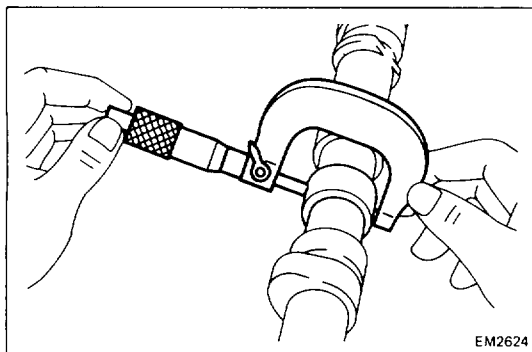
If the lobe height is less than standard allowable, the camshaft is worn and must be replaced.



- (b) Place the camshaft on V-blocks and measure the runout at the center journal.

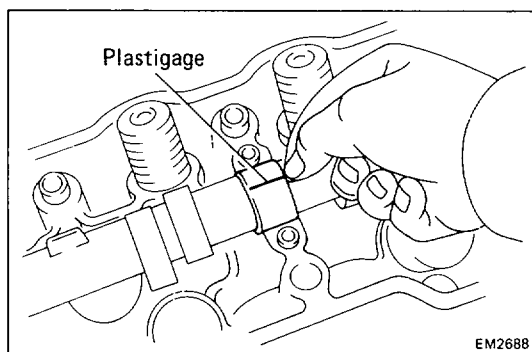
Maximum circle runout: 0.2 mm (0.008 in.)

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



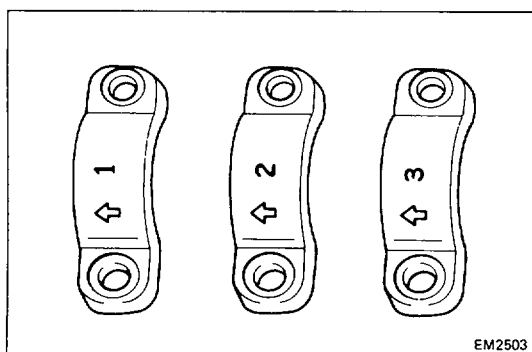
(c) Using a micrometer, measure the journal diameter.

Standard diameter: 32.98 — 33.00 mm
(1.2984 — 1.2992 in.)



(d) Measure the camshaft journal oil clearance.

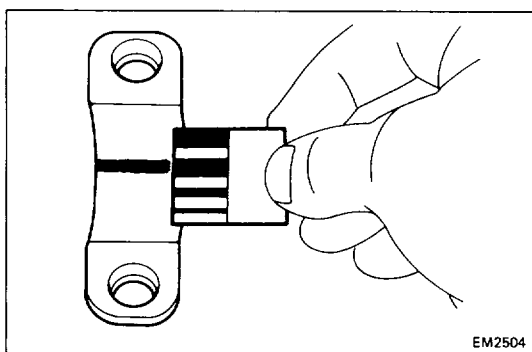
- Clean the bearing caps and camshaft journal.
- Lay a strip of Plastigage across each journal.



- Install the correct numbered bearing cap on each journal with the arrows pointing toward the front. Torque each bolt.

Torque: 200 kg-cm (14 ft-lb, 20 N·m)

NOTE: Do not turn the camshaft while the Plastigage is in place.



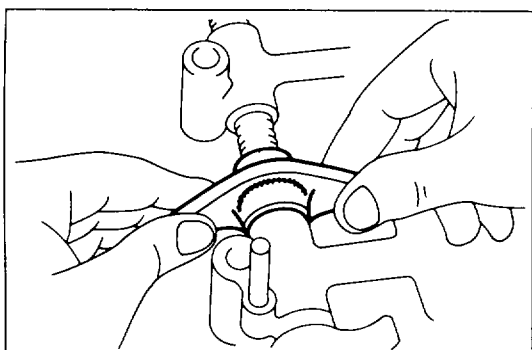
- Remove the caps. Measure the Plastigage at its widest point.

Standard clearance: 0.01 — 0.05 mm
(0.0004 — 0.0020 in.)

Maximum clearance: 0.1 mm (0.004 in.)

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

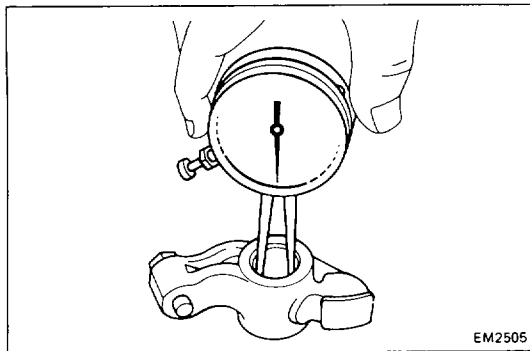
- Clean out the pieces of Plastigage from the bearings and journals.



15. INSPECT ROCKER ARMS

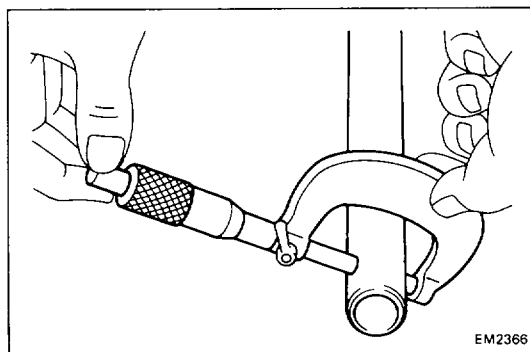
Check the clearance between the rocker arms and shaft by moving the rocker arms as shown. Little or no movement should be felt.

If movement is felt, disassemble the rocker arm assembly and measure the oil clearance as follows:



- (a) Disassemble rocker arm assembly.
- Remove the three screws.
 - Slide the rocker stands, springs and rocker arms off the shafts.
- (b) Using a dial indicator, measure the inside diameter of the rocker arm.

Standard inside diameter: 16.000 — 16.018 mm
(0.6299 — 0.6306 in.)



- (c) Using a micrometer, measure the outside diameter of the shaft.

Standard diameter: 15.97 — 15.99 mm
(0.6287 — 0.6295 in.)

- (d) Subtract the shaft diameter from the rocker arm diameter.

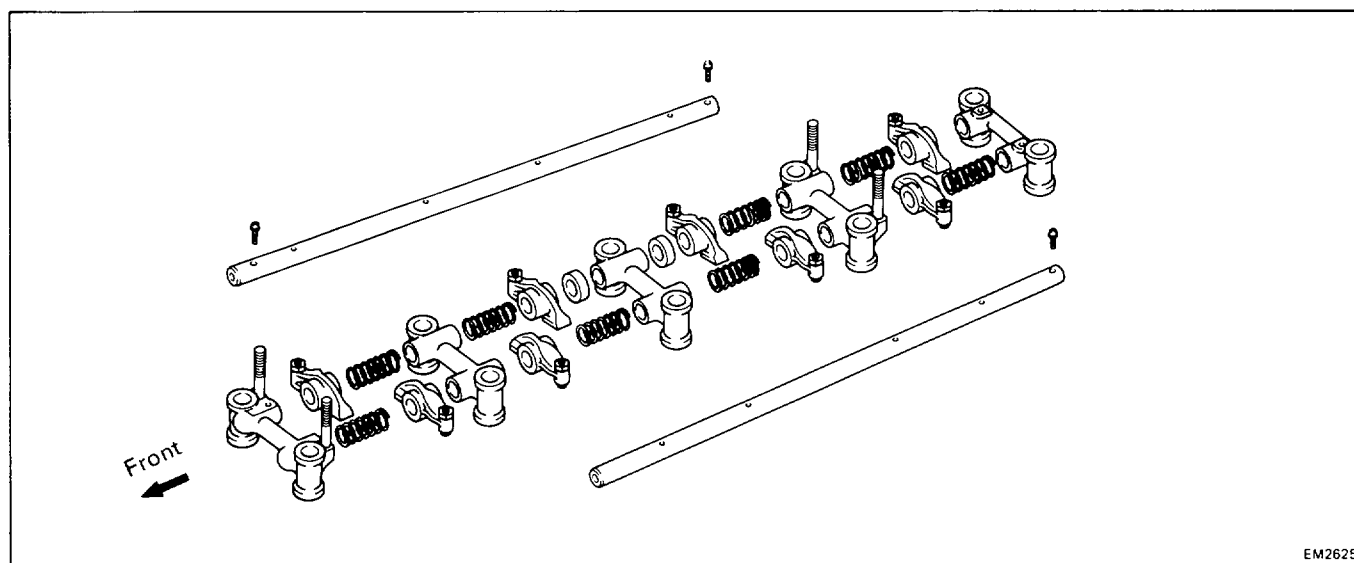
Standard oil clearance: 0.01 — 0.05 mm
(0.0004 — 0.0020 in.)

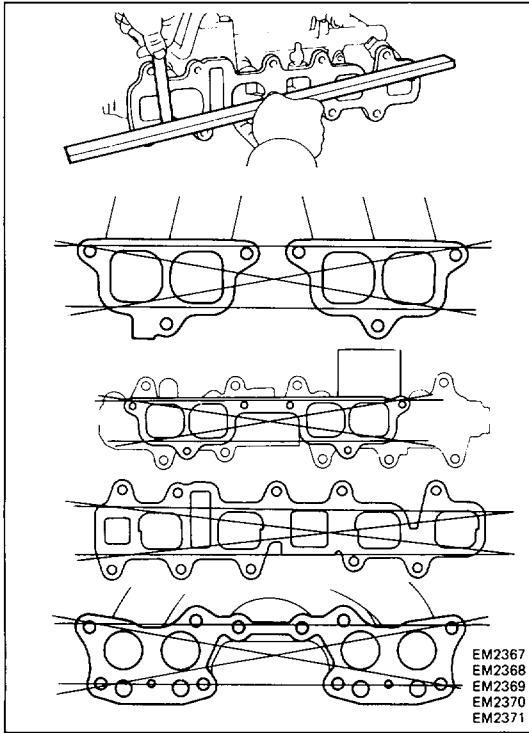
Maximum oil clearance: 0.08 mm (0.0031)

If the oil clearance is not within specification, replace the rocker arm and/or shaft.

- (e) Assemble the rocker arm assembly as shown, and install the three screws.

NOTE: All rocker arms are the same but all rocker stands are different and must be assembled in the correct order.





16. INSPECT INTAKE AIR INTAKE CHAMBER, AND EXHAUST MANIFOLDS

Using a precision straightedge and feeler gauge, check the surfaces contacting the cylinder head for warpage. If warpage is greater than maximum, replace the manifold.

Maximum intake warpage: 0.2 mm (0.008 in.)

Maximum exhaust warpage: 0.7 mm (0.028 in.)

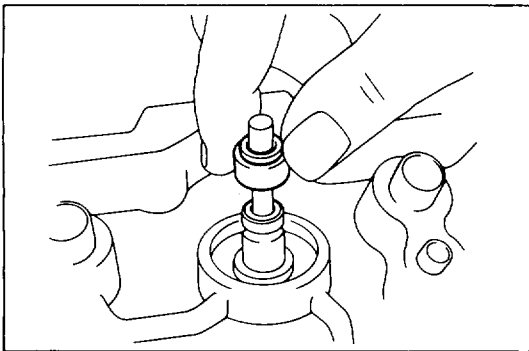
Maximum air intake chamber warpage:
0.2 mm (0.008 in.)

ASSEMBLY OF CYLINDER HEAD

(See page EM-13)

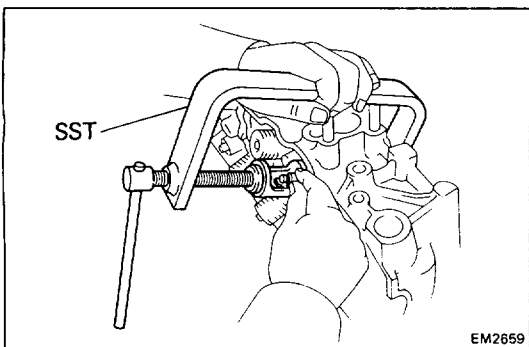
NOTE:

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



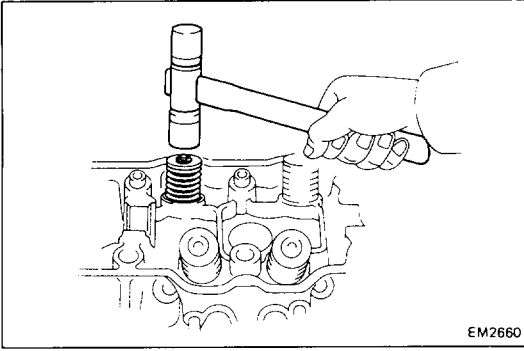
1. INSTALL VALVES

- Lubricate and insert valves in the cylinder head valve guides. Make sure the valves are installed in the correct order.
- Install the valve spring seats and new seals.

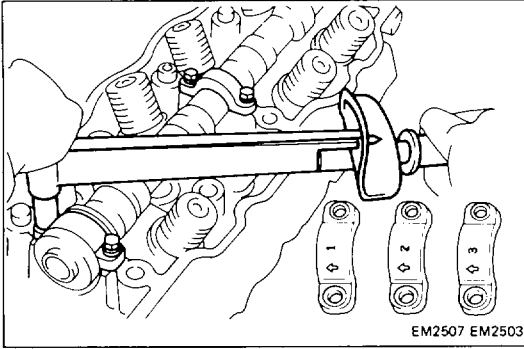


- Install springs and spring retainers on the valves.
- Using SST, compress valve retainers and place two keepers around the valve stem.

SST 09202-43013



(e) Tap the stem lightly to assure proper fit.



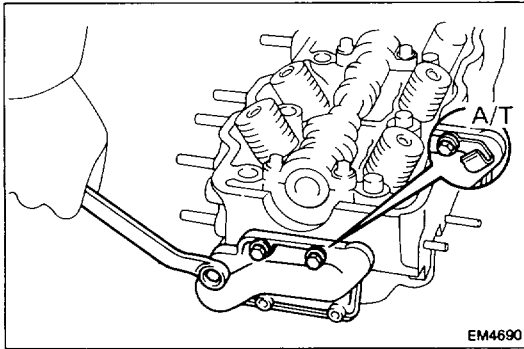
2. INSTALL CAMSHAFT

(a) Place the camshaft in the cylinder head and install the bearing caps in numbered order from the front with arrows pointing toward the front.

(b) Install and torque the cap bolts.

Torque: 200 kg-cm (14 ft-lb, 20 N·m)

(c) Turn the camshaft to position the dowel at the top.

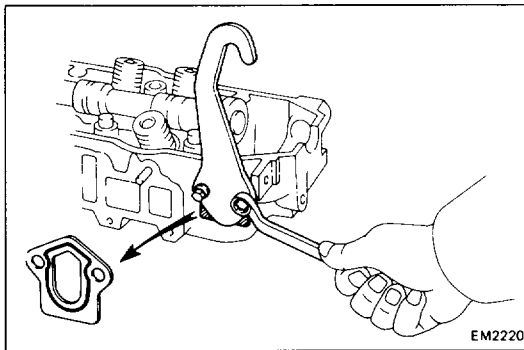


3. INSTALL CYLINDER HEAD REAR COVER

Install a new gasket, cylinder head rear cover and throttle cable clamp (for A/T) with the four bolts.

4. INSTALL LH ENGINE HANGER AND GROUND STRAP

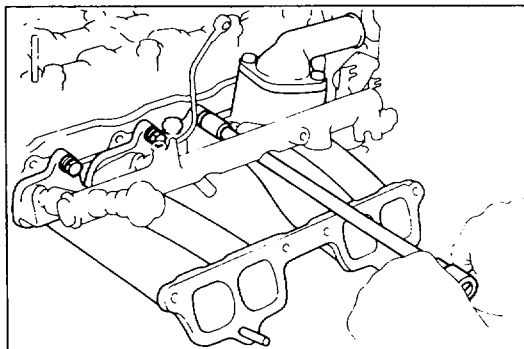
5. (22R-E) INSTALL RH ENGINE HANGER



6. INSTALL PLUG PLATE (22R-E), OR RH ENGINE HANGER (22R-TE)

Install the new gaskets and plug plate (22R-E) or RH engine hanger (22R-TE) with the two bolts.

NOTE: Attach the flat side of the gasket to the cylinder head.



7. INSTALL INTAKE MANIFOLD

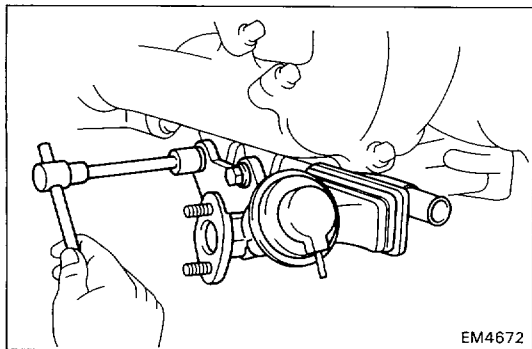
(a) Position a new gasket on the cylinder head.

(b) Install the intake manifold with the delivery pipe and injection nozzles and No.1 air pipe.

(c) Install the seven bolts, one hexagon bolt and two nuts. Torque the bolts and nuts.

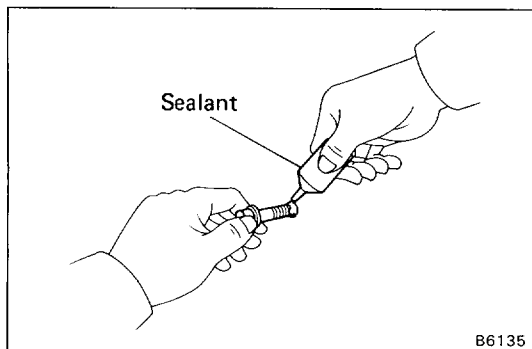
Torque: 195 kg-cm (14 ft-lb, 19 N·m)

(d) Install the bolt the heater inlet pipe to the cylinder head.



(e) (22R-E)

Install the reed valve with the two nuts.

**8. INSTALL EGR VALVE**

- (a) Clean the set bolt (closest to the front) threads and cylinder head bolt holes of any sealer, oil or foreign particles.

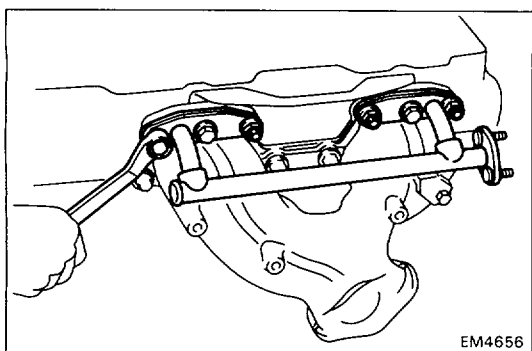
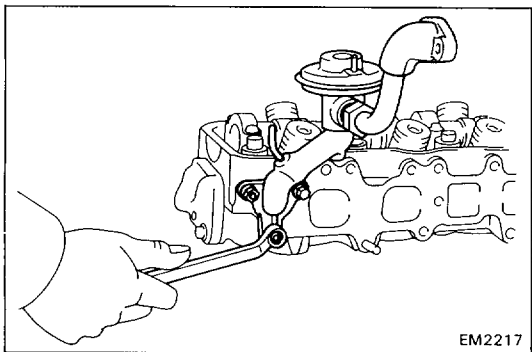
Remove any oil with kerosene or gasoline.

- (b) Apply sealant to 2 or 3 threads of the bolt end.

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

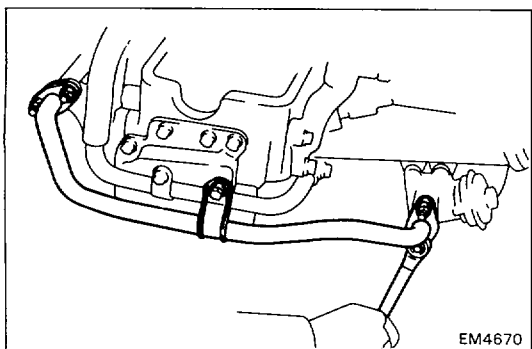
- This adhesive will not harden while exposed to air. It will act as a sealer or binding agent only when applied to threads, etc. and air is cut off.

- (c) Install the EGR valve with the two bolts and nut.

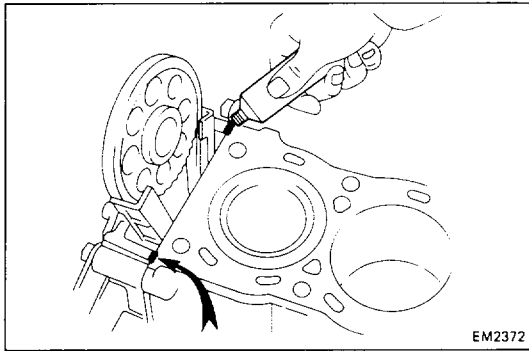
**9. (22R-E)****INSTALL EXHAUST MANIFOLD**

- (a) Position a new gasket on the cylinder head.
- (b) Install the exhaust manifold with eight nuts. Torque the nuts.

Torque: 450 kg-cm (33 ft-lb, 44 N-m)

**10. (22R-E)****INSTALL NO.1 AIR INJECTION MANIFOLD**

- (a) Position new gaskets on the reed valve and No.2 air injection pipe.
- (b) Install the No.1 air injection pipe with four nuts and bolt.



INSTALLATION OF CYLINDER HEAD

(See page EM-13)

1. APPLY SEAL PACKING TO CYLINDER BLOCK

- (a) Apply seal packing to two locations as shown.

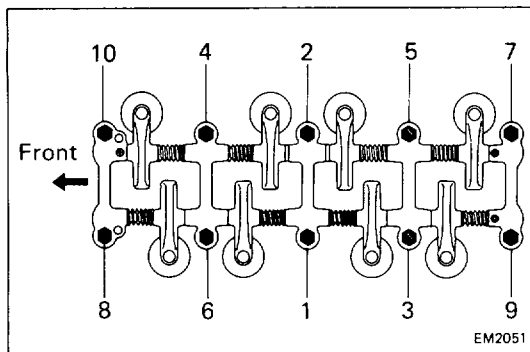
Seal packing: Part No. 08826-00080 or equivalent

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

2. INSTALL CYLINDER HEAD

- (a) If the sprocket was removed, align the alignment marks placed on the sprocket and chain during removal.

- (b) Position the cylinder head over dowels on the block.

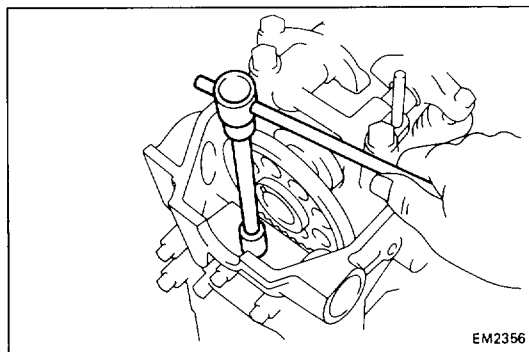


3. INSTALL ROCKER ARM ASSEMBLY

- (a) Place the rocker arm assembly over the dowels on the cylinder head.

- (b) Install and tighten the head bolts gradually in three passes and in the sequence shown. Torque the bolts on the final pass.

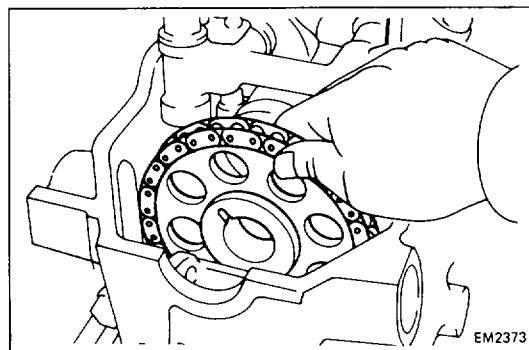
Torque: 800 kg-cm (58 ft-lb, 78 N·m)



4. INSTALL CHAIN COVER BOLT

Torque the bolt.

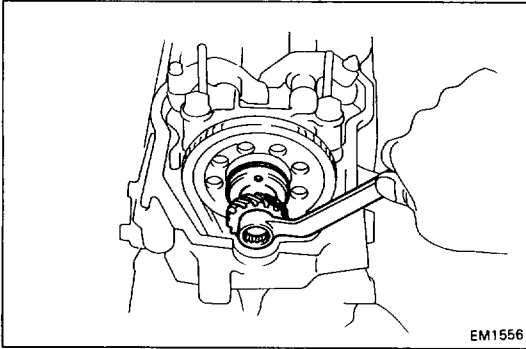
Torque: 130 kg-cm (9 ft-lb, 13 N·m)



- (a) While holding up on the sprocket and chain, turn the crankshaft until the No. 1 and No. 4 cylinders are at top dead center.

- (b) Place the chain sprocket over the camshaft dowel.

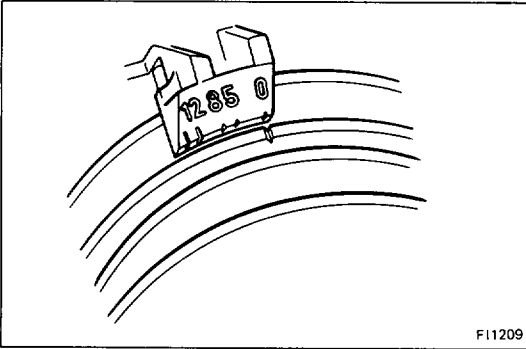
NOTE: If the chain does not seem long enough, turn the crankshaft back and forth while pulling up on the chain and sprocket.



5. INSTALL DISTRIBUTOR DRIVE GEAR AND FUEL PUMP DRIVE CAM (22R) OR CAMSHAFT THRUST PLATE (22R-E, 22R-TE)

Place the distributor drive gear and fuel pump drive cam (22R) or camshaft thrust plate (22R-E, 22R-TE) over the chain sprocket. Torque the bolt.

Torque: 800 kg-cm (58 ft-lb, 78 N·m)



6. ADJUST VALVES CLEARANCE

(a) Set the No.1 cylinder to TDC/compression.

- Turn the crankshaft with a wrench to align the timing marks at TDC. Set the groove on the pulley at the O mark position timing mark.
- Check that the rocker arms on the No.1 cylinder are loose and the rockers on No.4 are tight.

If not, turn the crankshaft one complete revolution and align the marks as above.

(b) Adjust the clearance of half of the valves.

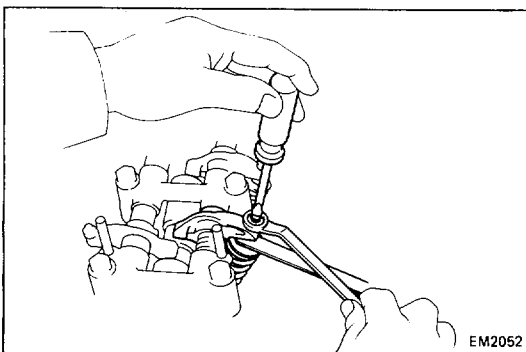
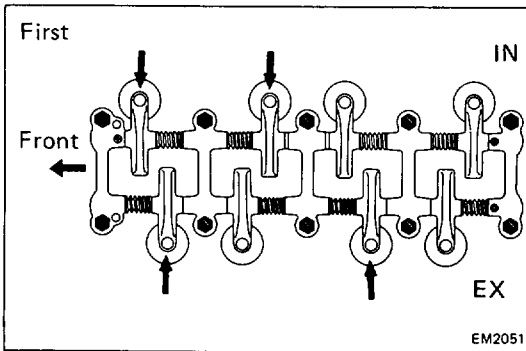
- Adjust only those valves indicated by arrows as shown.

Valve clearance (Cold):

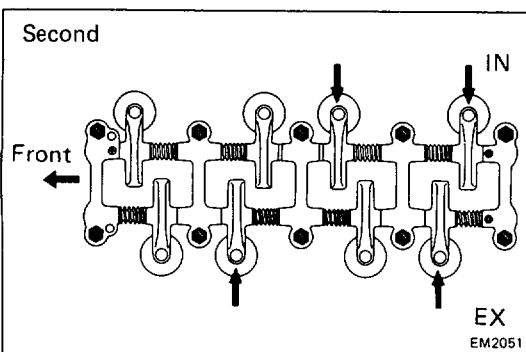
Intake 0.20 mm (0.008 in.)

Exhaust 0.30 mm (0.012 in.)

NOTE: After installing the cylinder head, warm up the engine and adjust the valve clearance.

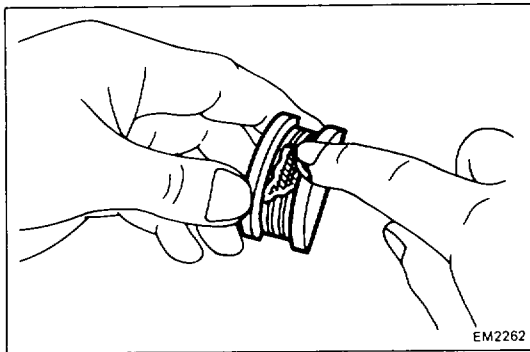


- Use a thickness gauge to measure between the valve stem and rocker arm. Loosen the lock nut and turn the adjusting screw to set the proper clearance. Hold the adjusting screw in position and tighten the lock nut.
- Recheck the clearance. The thickness gauge should move with a very slight drag.



(c) Turn the crankshaft one revolution and adjust the other valves.

(d) Set the No.1 cylinder to TDC/compression.

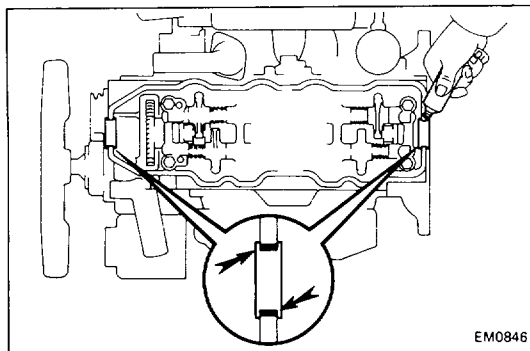


7. INSTALL HALF-CIRCULAR PLUG

- (a) Apply seal packing to the cylinder head installation surface of the plug.

Seal packing: Part No. 08826-00080 or equivalent

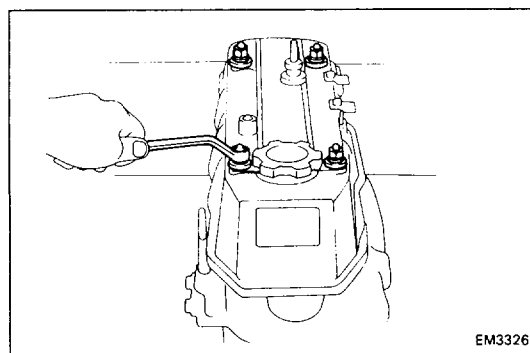
- (b) Install the half-circular plug to the cylinder head.



8. INSTALL HEAD COVER

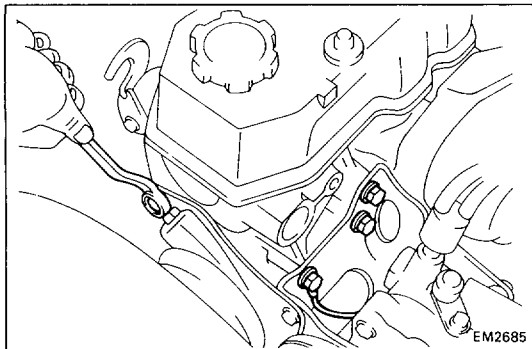
- (a) Apply seal packing to four the location shown.

Seal packing: Part No. 08826-00080 or equivalent



- (b) Install the gasket to the cylinder head.

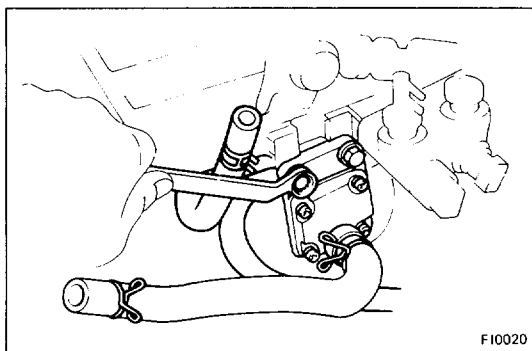
- (c) Place the head cover on the cylinder head and install the four seals and nuts.



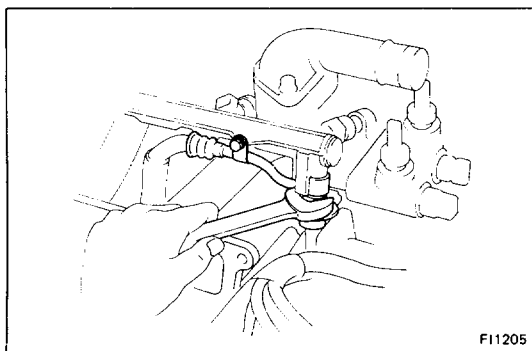
POST INSTALLATION

1. (w/ PS)
CONNECT PS BRACKET TO CYLINDER HEAD
Install the four bolts and bond strap. Torque the bolts.
Torque: 450 kg-cm (33 ft-lb, 44 N·m)
2. (w/ PS)
INSTALL DRIVE BELT AND ADJUST BELT TENSION
(See page MA-4)
3. (22R-E)
CONNECT BY-PASS HOSE TO INTAKE MANIFOLD

(22R-TE)
CONNECT OIL COOLER HOSE FROM INTAKE MANIFOLD



4. **INSTALL AUXILIARY AIR VALVE**
 - (a) Install the auxiliary air valve to the intake manifold.
 - (b) Connect the water by-pass hose.



5. **CONNECT FUEL HOSE TO DELIVERY PIPE**
 - (a) Install the fuel hose with a bolt.
 - (b) Install the pulsation damper and new gaskets. Torque the damper.

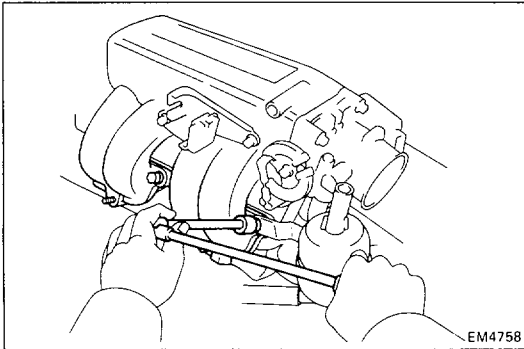
Torque: 450 kg-cm (33 ft-lb, 44 N·m)
6. **CONNECT FOLLOWING WIRES:**
 - (a) Water temp. sensor wire
 - (b) Cold start injector time switch wire
 - (c) (with A/C)
VSV wire
 - (d) Igniter wire
 - (e) Oxygen sensor wire
 - (f) (A/T)
OD temp. switch wire
 - (g) Water temp. sender gauge wire
 - (h) Injector wires
 - (i) (with A/C)
Compressor wires
 - (j) Transmission wires

- (k) Starter wire (terminal 50)
- (l) Oil pressure sender gauge or switch
- (m) Knock sensor wire
- (n) Auxiliary air valve wire

7. CONNECT FUEL RETURN HOSE

8. INSTALL CHAMBER WITH THROTTLE BODY

- (a) Position new gaskets on the intake manifold and No. 1 EGR pipe.
- (b) Install the chamber, throttle body, fuel hose clamp, resonator and bond strap with the four bolts and two nuts.
- (c) Connect the chamber and stay with a bolt.
- (d) Install the bolts holding the EGR valve to the chamber.
- (e) Install the new gaskets and cold start injector pipe.



9. CONNECT FOLLOWING WIRES:

- (a) (Calif. and C&C)
EGR gas temp. sensor wire
- (b) Throttle position wire
- (c) Cold start injector wire

10. INSTALL EGR VACUUM MODULATOR

11. CONNECT FOLLOWING PARTS:

- (a) No.2 and No.3 water by-pass hoses to the throttle body
- (b) No.2 air valve hose to throttle body
- (c) No.1 air valve hose to throttle body
- (d) (22R-TE)
VCV
- (e) (22R-E)
Fuel pressure up VSV and hose
Reed valve hose
(22R-TE)
Pressure regulator hose
- (f) EGR vacuum modulator hose
- (g) EVAP hose
- (h) (with A/C)
VSV hoses
- (i) (w/ PS)
Air control valve hoses
- (j) Brake booster hose
- (k) (22R-E)
No.1 and No.2 PCV hoses
(22R-TE)
No.2 PCV hoses

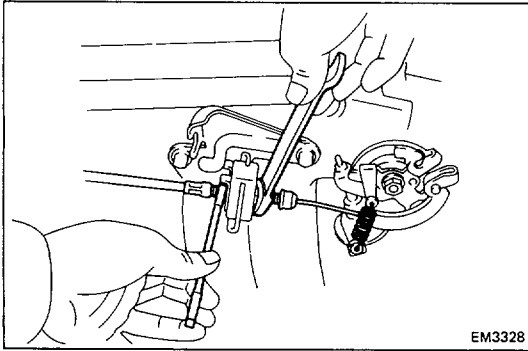
12. CONNECT GROUND STRAP TO ENGINE REAR SIDE

13. (A/T)

CONNECT THROTTLE CABLE

Connect the throttle cable to the clamp and bracket

14. CONNECT ACCELERATOR CABLE



15. **CONNECT HEATER WATER INLET HOSE TO HEATER WATER INLET PIPE**
16. **INSTALL RADIATOR INLET HOSE**
17. **INSTALL SPARK PLUGS AND DISTRIBUTOR**
(See page IG-15)
18. **INSTALL OIL LEVEL GAUGE**
19. **CONNECT EXHAUST PIPE TO EXHAUST MANIFOLD**
 - (a) Install the new gaskets, and connect the exhaust pipe to the exhaust manifold with the three nuts.
 - (b) Install the exhaust pipe clamp.
20. **(22R-E)**
INSTALL AIR CLEANER HOSE
21. **(22R-TE)**
INSTALL TURBOCHARGER
(See steps 6 to 15 on pages TC-12 to 15)
22. **FILL WITH ENGINE OIL**

Fill the engine with new oil, API grade SF or SF/CC multi-grade, fuel efficient, and recommended viscosity oil.

Oil capacity:

Dry fill	4.8 liters (5.1 US qts, 4.2 Imp. qts)
Drain and refill	
w/o Oil filter change	3.8 liters (4.0 US qts, 3.3 Imp. qts)
w/ Oil filter change	4.6 liters (4.9 US qts, 4.0 Imp. qts)
23. **FILL WITH COOLANT**
(See step 3 on page CO-3)
24. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**
25. **START ENGINE**

Warm up the engine and inspect for leaks.
26. **PERFORM ENGINE ADJUSTMENT**
 - (a) Readjust the valve clearance.
(See page MA-8)
 - (b) Recheck ignition timing. (See step 1 on page IG-15)
 - (c) Adjust idle speed. (See step 13 on page MA-8)
27. **RECHECK COOLANT AND ENGINE OIL LEVEL**
28. **ROAD TEST**

Road test the vehicle.

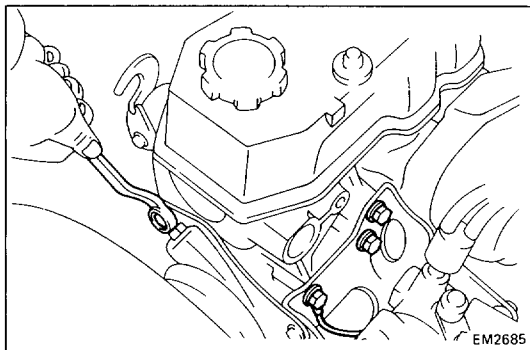
22R**PREPARATION FOR REMOVAL**

(See page EM-13)

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
2. **DRAIN COOLANT FROM RADIATOR AND CYLINDER BLOCK**
3. **DRAIN ENGINE OIL**
4. **REMOVE AIR CLEANER**
 - (a) Disconnect air hoses and air duct from the air cleaner.
 - (b) Remove the two nuts and wing nut.
 - (c) Remove the air cleaner.
5. **DISCONNECT EXHAUST PIPE FROM EXHAUST MANIFOLD**

Remove three nuts holding the exhaust manifold to the exhaust pipe.
6. **DISCONNECT RADIATOR INLET HOSE FROM WATER OUTLET**
7. **(w/ Air Pump)**
DISCONNECT NO.3 AIR HOSE FROM CHECK VALVE
8. **DISCONNECT TWO HEATER HOSES**
9. **DISCONNECT ACCELERATOR CABLE FROM CARBURETOR**

Disconnect the cable from the carburetor and bracket.
10. **DISCONNECT FOLLOWING WIRES:**
 - (a) (with A/C)
VSV wire
 - (b) Vacuum switch wire
 - (c) VSV wire for EVAP
 - (d) Water temp. sender gauge wire
 - (e) Cold mixture heater wire
 - (f) Temp. switch wire
 - (g) Fuel cut solenoid valve wire
 - (h) (Calif.)
EACV wire
11. **DISCONNECT FOLLOWING PARTS:**
 - (a) Charcoal canister hose
 - (b) Brake booster hose
 - (c) Fuel main hose from the fuel inlet pipe
 - (d) Fuel return hose from the fuel return pipe
 - (e) (Ex. Calif.)
HAC from the bracket
 - (f) Vacuum switch, EBCV (Calif.) and VSV with the bracket



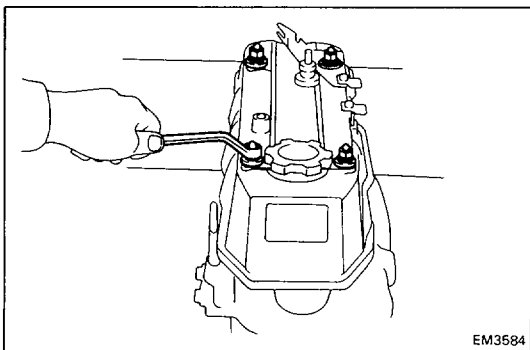
12. REMOVE GROUND STRAP OF REAR SIDE

13. REMOVE DISTRIBUTOR AND SPARK PLUGS

14. (w/ PS)

DISCONNECT PS BRACKET FROM CYLINDER HEAD

- (a) Remove the drive belt.
- (b) Remove the four bolts, and disconnect the ground strap and bracket.
- (c) (w/ Air pump and A/C)
Remove the bolt and compressor stay.

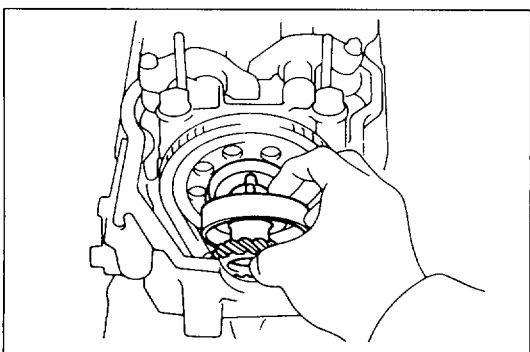


REMOVAL OF CYLINDER HEAD

(See page EM-13)

1. REMOVE HEAD COVER (See step 1 on page EM-17)

2. REMOVE CAM SPROCKET BOLT
(See step 2 on page EM-17)



3. REMOVE DISTRIBUTOR DRIVE GEAR AND FUEL PUMP DRIVE CAM (See step 3 on page EM-17)

4. REMOVE CAM SPROCKET
(See step 4 on page EM-17)

5. REMOVE CHAIN COVER BOLT
(See step 5 on page EM-18)

6. REMOVE CYLINDER HEAD BOLTS
(See step 6 on page EM-18)

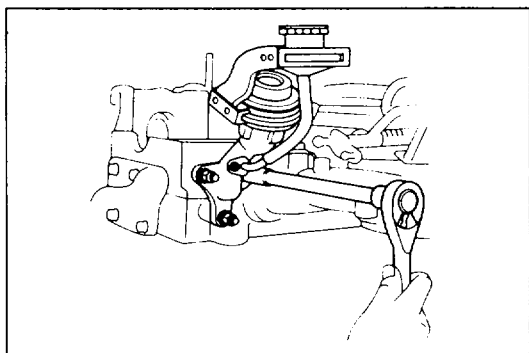
7. REMOVE ROCKER ARM ASSEMBLY
(See step 7 on page EM-18)

8. REMOVE CYLINDER HEAD
(See step 8 on page EM-18)

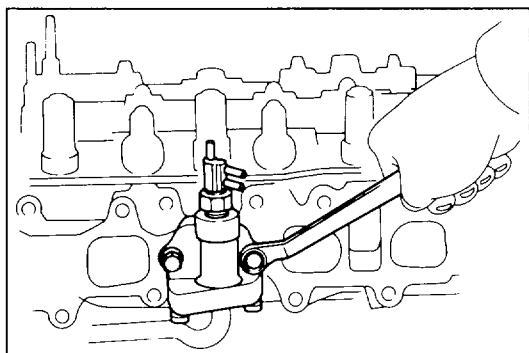
DISASSEMBLY OF CYLINDER HEAD

(See page EM-13)

1. REMOVE HEAT INSULATOR FROM EXHAUST MANIFOLD
2. REMOVE CHECK VALVE WITH AIR PIPE
 - (a) Disconnect the air pipe from the exhaust manifold.
 - (b) Disconnect No.3 air hose from the EACV.
 - (c) Remove the check valve with the air pipe.
3. REMOVE FUEL PUMP FROM CYLINDER HEAD
 - (a) Remove the three fuel hoses from the fuel pump.
 - (b) Remove the fuel pump from the cylinder head.
4. REMOVE FUEL PIPE FROM INTAKE MANIFOLD
5. REMOVE ENGINE HANGER AND AIR PIPE FROM CYLINDER HEAD

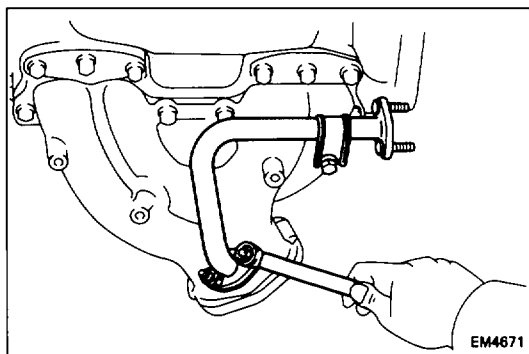


6. REMOVE EGR PIPE AND EGR VALVE WITH VACUUM MODULATOR
 - (a) Remove the vacuum hose from the air pipe.
 - (b) Disconnect the EGR pipe from the intake manifold.
 - (c) Remove the EGR valve with the EGR pipe.



7. REMOVE INTAKE MANIFOLD WITH CARBURETOR
 - (a) Remove the ground strap from the cylinder head.
 - (b) Remove the six bolts and two nuts.
 - (c) Remove the intake manifold with the carburetor.

8. REMOVE CYLINDER HEAD SIDE COVER



9. REMOVE EXHAUST MANIFOLD FROM CYLINDER HEAD
 - (a) (w/ Air Pump)
Remove the two nuts, bolt, No.2 air tube gasket.
 - (b) Remove the eight nuts, exhaust manifold and gasket.
10. MEASURE CAMSHAFT THRUST CLEARANCE
(See step 7 on page EM-20)
11. REMOVE CAM BEARING CAPS AND SHAFT
12. REMOVE VALVES
(See step 9 on page EM-20)

INSPECTION OF CYLINDER HEAD

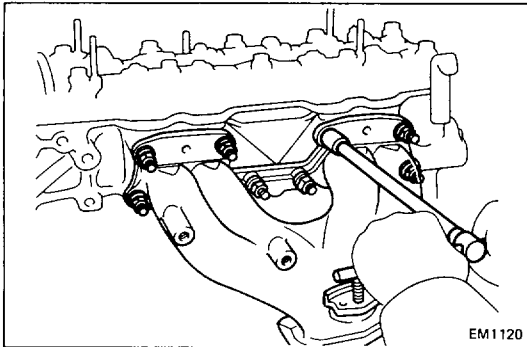
(See page EM-21)

ASSEMBLY OF CYLINDER HEAD

(See page EM-29)

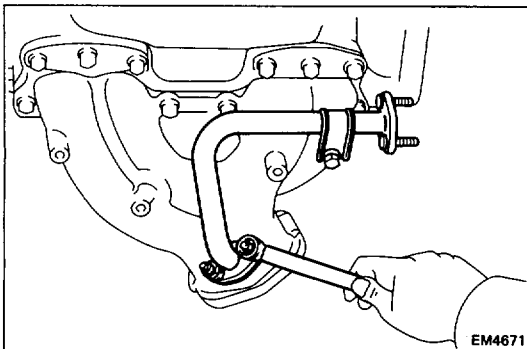
NOTE:

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

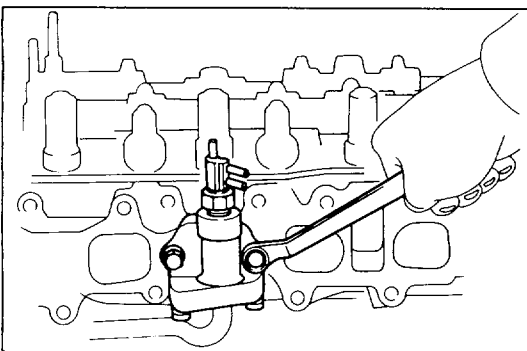


1. **INSTALL VALVE** (See step 1 on page EM-29)
2. **INSTALL CAMSHAFT** (See step 2 on page EM-30)
3. **INSTALL EXHAUST MANIFOLD TO CYLINDER HEAD**

- (a) Position a new gasket on the cylinder head.
- (b) Install the exhaust manifold with eight nuts. Torque the nuts.

Torque: 450 kg-cm (33 ft-lb, 44 N·m)

- (c) (w/ Air Pump)
Position a new gasket on the exhaust manifold.
- (d) (w/ Air Pump)
Install the No. 2 air tube with the bolt and two nuts.



4. **INSTALL CYLINDER HEAD SIDE COVER**

- (a) Position a new gasket on the cylinder head.
- (b) Install the thermostatic valve with two bolts. Torque the bolts.

Torque: 220 kg-cm (16 ft-lb, 22 N·m)

5. **INSTALL INTAKE MANIFOLD WITH CARBURETOR**

- (a) Install the intake manifold with the carburetor.
- (b) Install the six bolts and two nuts. Torque the bolts and nuts.

Torque: 195 kg-cm (14 ft-lb, 19 N·m)

- (c) Install the ground strap with the bolt.

6. **INSTALL FUEL PIPE TO INTAKE MANIFOLD**

7. **INSTALL EGR PIPE AND EGR VALVE WITH VACUUM MODULATOR**

- (a) Install the EGR valve with EGR pipe to the intake manifold.
- (b) Connect the vacuum hose to the air pipe.

8. INSTALL FUEL PUMP TO CYLINDER HEAD

- (a) Install the fuel pump with the two bolts.
Torque the bolts.

Torque: 220 kg-cm (16 ft-lb, 22 N·m)

- (b) Connect the three fuel pipes.

9. INSTALL CHECK VALVE WITH AIR PIPE

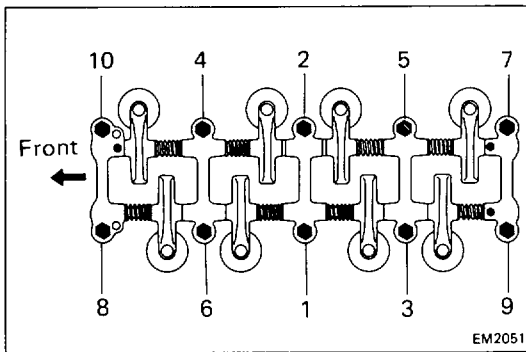
- (a) Install the check valve with the air pipe.
- (b) Connect No.3 air hose to the EACV.
- (c) Connect the air pipe to the exhaust manifold.

10. INSTALL HEAT INSULATOR TO EXHAUST MANIFOLD**INSTALLATION OF CYLINDER HEAD****1. APPLY SEAL PACKING TO CYLINDER BLOCK**

(See step 1 on page EM-32)

2. INSTALL CYLINDER HEAD

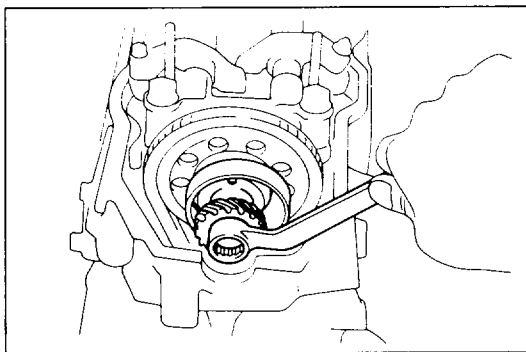
(See step 2 on page EM-32)

**3. INSTALL ROCKER ARM ASSEMBLY**

(See step 3 on page EM-32)

4. INSTALL CHAIN COVER BOLT

(See step 4 on page EM-32)

**5. INSTALL DISTRIBUTOR DRIVE GEAR AND FUEL PUMP DRIVE CAM**

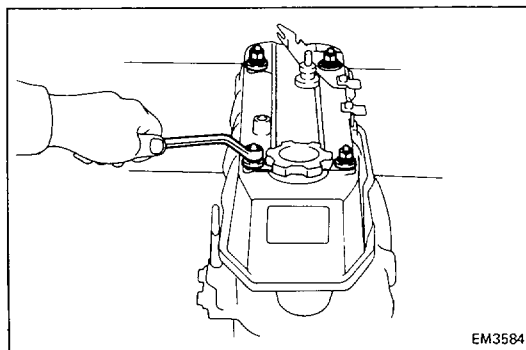
(See step 5 on page EM-33)

6. ADJUST VALVES CLEARANCE

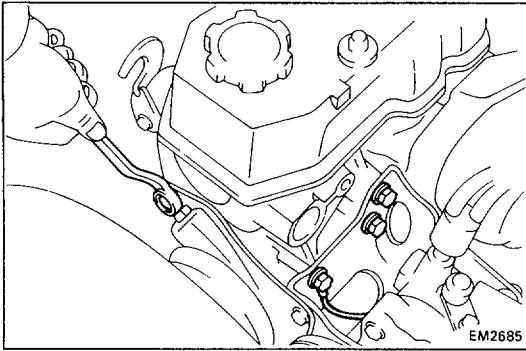
(See step 6 on page EM-33)

7. INSTALL HALF-CIRCULAR PLUG

(See step 7 on page EM-34)

**8. INSTALL HEAD COVER**

(See step 8 on page EM-34)



POST INSTALLATION

1. (w/ PS)

CONNECT PS BRACKET TO CYLINDER HEAD

- (a) (w/ Air Pump and A/C)
Install the compressor stay.
- (b) Connect the PS bracket and ground strap with the four bolts.

Torque: 450 kg-cm (33 ft-lb, 44 N·m)

- (c) Install drive belt and adjust belt tension.
(See page MA-4)

2. INSTALL DISTRIBUTOR AND SPARK PLUGS

3. INSTALL GROUND STRAP OF REAR SIDE

4. CONNECT FOLLOWING PARTS:

- (a) Vacuum switch, EBCV (Ex. Calif.) and VSV with the bracket
- (b) (Ex. Calif.)
HAC to bracket
- (c) Fuel return hose to the fuel return pipe
- (d) Fuel main hose to the fuel inlet pipe
- (e) Brake booster hose
- (f) Charcoal canister hose

5. CONNECT FOLLOWING WIRES:

- (a) (Calif.)
EACV wire
- (b) Fuel cut solenoid valve wire
- (c) Temp. switch wire
- (d) Cold mixture heater wire
- (e) Water temp. sender gauge wire
- (f) VSV wire for EVAP
- (g) Vacuum switch wire
- (h) (with A/C)
VSV wire

6. CONNECT ACCELERATOR CABLE TO CARBURETOR

Connect the cable to the carburetor and bracket.

7. (w/ Air Pump)

CONNECT NO.3 AIR HOSE TO CHECK VALVE

8. CONNECT TWO HEATER HOSES

9. CONNECT RADIATOR INLET HOSE TO WATER OUTLET

10. CONNECT EXHAUST PIPE TO EXHAUST MANIFOLD

Connect the exhaust pipe with the three nuts to the exhaust manifold.

11. INSTALL AIR CLEANER

- (a) Install the air cleaner on the carburetor.
- (b) Connect the air hoses and air duct.

12. FILL WITH ENGINE OIL

Fill the engine with new oil, API grade SF or SF/CC multi-grade, fuel efficient and recommended viscosity oil.

Capacity:

Dry fill	4.8 liters (5.1 US qts, 4.2 Imp. qts)
Drain and refill	
w/o Oil filter change	3.8 liters (4.0 US qts, 3.3 Imp. qts)
w/ Oil filter change	4.3 liters (4.5 US qts, 3.8 Imp. qts)

13. FILL WITH COOLANT

(See step 3 on page CO-3)

14. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**15. START ENGINE**

Warm up the engine and inspect for leaks.

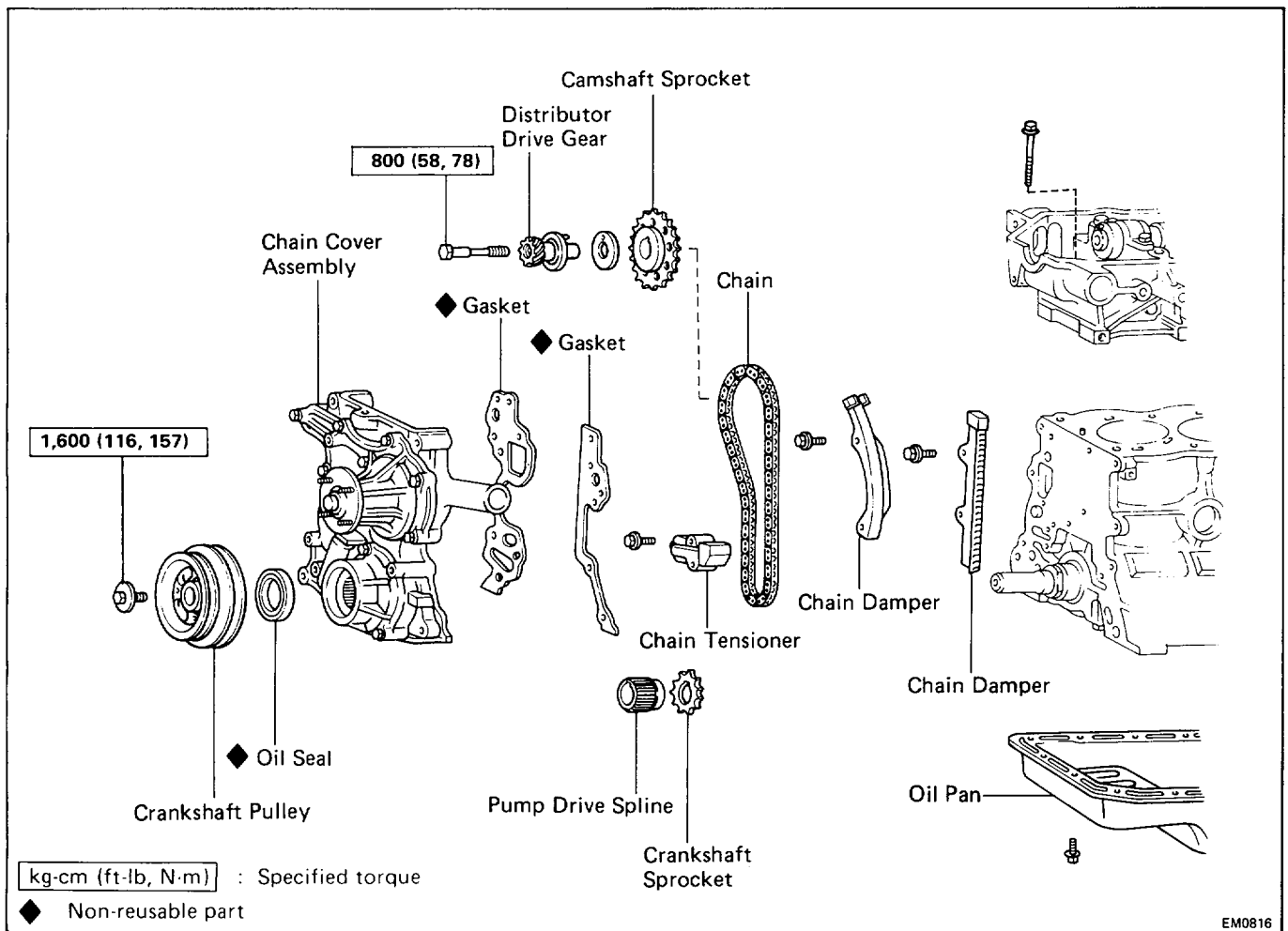
16. PERFORM ENGINE ADJUSTMENT

- (a) Readjust the valve clearance.
(See page MA-8)
- (b) Recheck ignition timing. (See step 1 on page IG-15)
- (c) Adjust idle speed. (See step 13 on page MA-8)

17. RECHECK COOLANT AND ENGINE OIL LEVEL**18. ROAD TEST**

Road test the vehicle.

TIMING CHAIN COMPONENTS

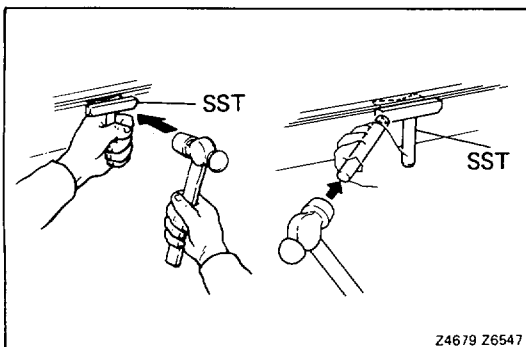


PREPARATION OF REMOVAL

1. REMOVE CYLINDER HEAD
(22R-E, 22R-TE See page EM-14)
(22R See page EM-38)
2. REMOVE RADIATOR
(See page CO-8)
3. REMOVE OIL PAN
 - (a) Remove the engine undercover.
 - (b) Remove the engine mounting bolts.
 - (c) Place a jack under the transmission and raise the engine approx. 25 mm (0.98 in.).
 - (d) Remove the sixteen bolts and two nuts.
 - (e) Using SST and brass bar, separate the oil pan from the cylinder block.

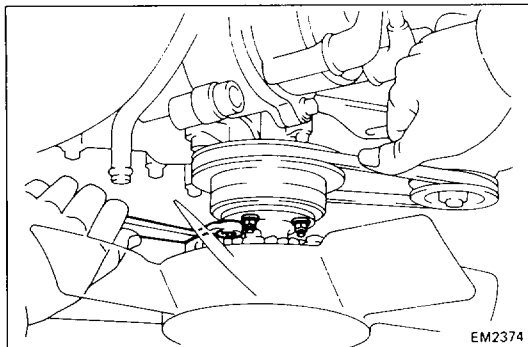
SST 09032-00100

NOTE: When removing the oil pan, be careful not to damage the oil pan flange.



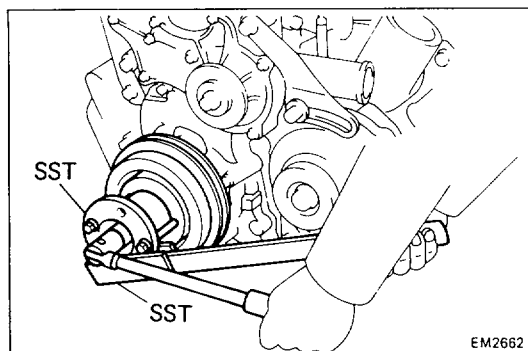
REMOVAL OF TIMING CHAIN

1. (w/ PS)
REMOVE PS BELT
2. (with A/C)
REMOVE A/C BELT, COMPRESSOR AND BRACKET



3. REMOVE FLUID COUPLING WITH FAN AND WATER PUMP PULLEY

- (a) Loosen the water pump pulley set bolts.
- (b) Loosen the belt adjusting bolt and pivot bolt of the alternator, and remove the drive belt.
- (c) Remove the set nuts, fluid coupling with fan and water pump pulley.



4. REMOVE CRANKSHAFT PULLEY

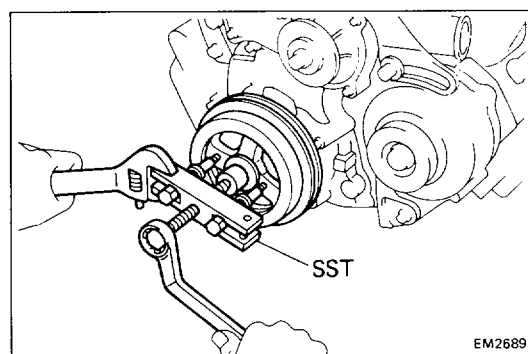
- (a) (with A/C (w/o Air pump) or w/ PS (w/ Air pump))
Remove the No.2 crankshaft pulley.
- (b) Using SST to hold the crankshaft pulley, loosen the pulley bolt.

SST 09213-70010 and 09330-00021

- (c) Using SST, remove the crankshaft pulley.

SST 09213-31021

NOTE: If the front seal is to be replaced, see page LU-6.



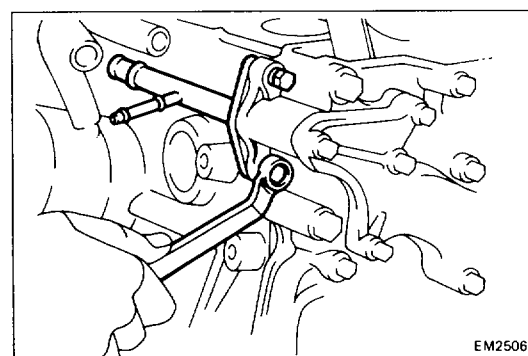
5. REMOVE NO.1 WATER BY-PASS PIPE

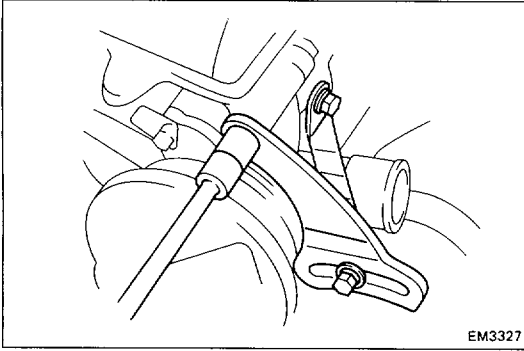
(22R, 22R-E)

Remove the two bolts and pipe.

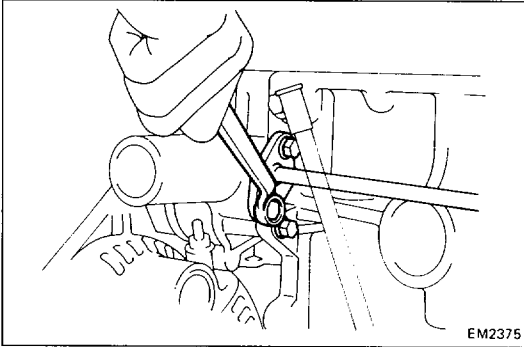
(22R-TE)

Remove the two bolts, and disconnect the pipe from the timing chain cover.



**6. REMOVE FAN BELT ADJUSTING BAR**

- (a) (w/ PS)
Remove the bolt and PS lower bracket.
- (b) Remove the three bolts and bar.

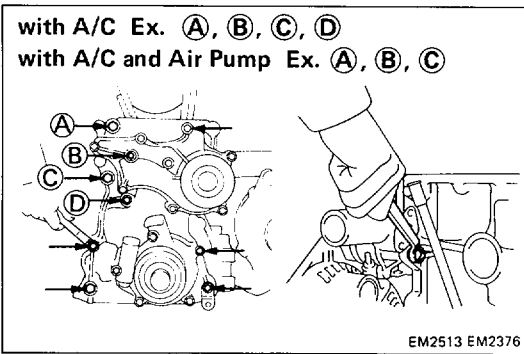
**7. (22R, 22R-E) DISCONNECT HEATER WATER OUTLET PIPE**

Remove the two bolts, and disconnect heater water outlet pipe.

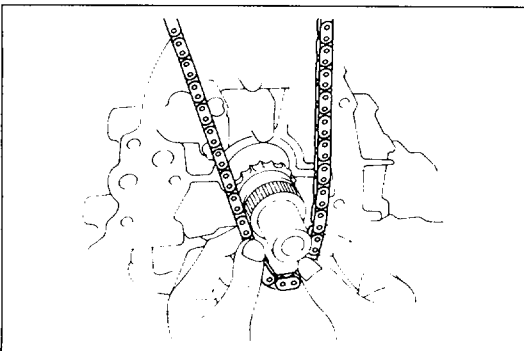
(22R-TE)

REMOVE NO.3 TURBO WATER PIPE

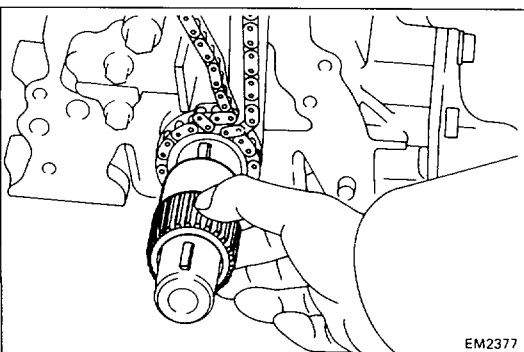
Remove the two bolts and No.3 turbo water pipe.

**8. REMOVE CHAIN COVER ASSEMBLY**

- (a) Remove timing chain cover bolts shown by the arrows.
- (b) Using a plastic faced hammer, loosen the chain cover and remove it.

**9. REMOVE CHAIN AND CAMSHAFT SPROCKET**

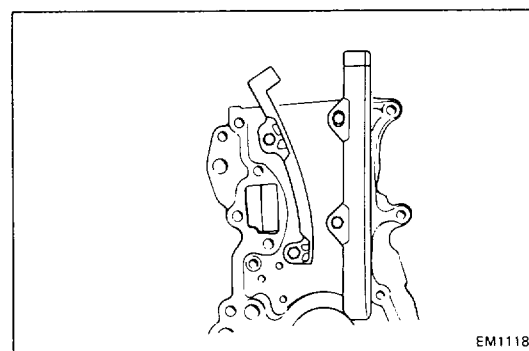
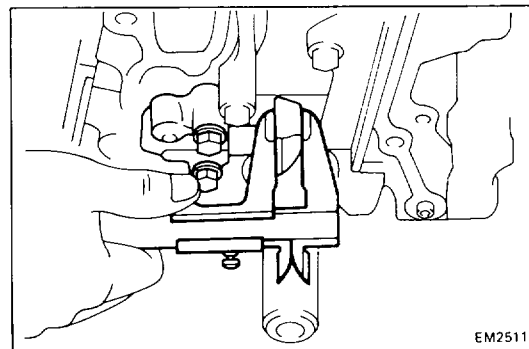
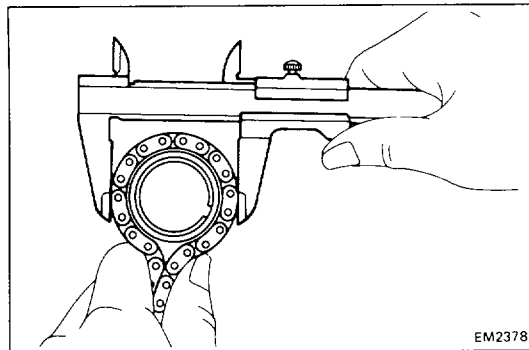
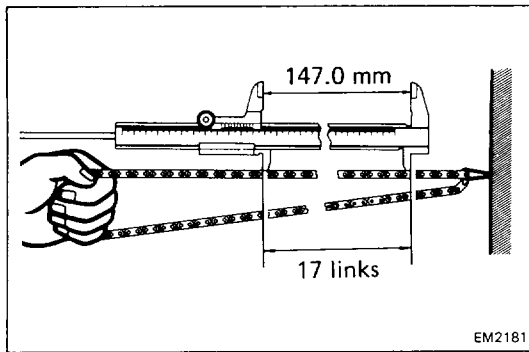
- (a) Remove the chain from the damper.
- (b) Remove the cam sprocket and chain together.

**10. REMOVE PUMP DRIVE SPLINE AND CRANKSHAFT SPROCKET**

If the oil pump drive spline and sprocket cannot be removed by hand, use SST to remove them together.

SST 09213-36020

11. REMOVE GASKET MATERIAL ON CYLINDER BLOCK



INSPECTION OF COMPONENTS

1. MEASURE CHAIN AND SPROCKET WEAR

- Measure the length of 17 links with the chain fully stretched.
- Make the same measurements at least three other places selected at random.

Chain elongation limit at 17 links: 147.0 mm (5.787 in.)

If over the limit at any one place, replace the chain.

- Wrap the chain around the sprocket.
- Using a vernier caliper, measure the outer sides of the chain rollers as shown. Measure both sprockets.

Crankshaft sprocket minimum: 59.4 mm (2.339 in.)

Camshaft sprocket minimum: 113.8 mm (4.480 in.)

If the measurement is less than minimum, replace the chain and two sprockets.

2. MEASURE CHAIN TENSIONER

Using a vernier caliper, measure the tensioner as shown.

Tensioner minimum: 11.0 mm (0.433 in.)

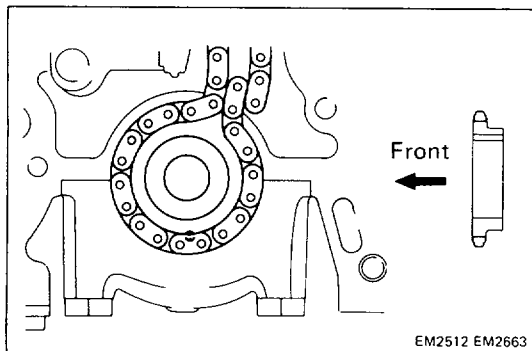
If the tensioner is worn or less than minimum, replace the chain tensioner.

3. MEASURE CHAIN DAMPERS

Using a micrometer, measure each damper.

Damper wear limit: 0.5 mm (0.020 in.)

If either damper is worn or less than minimum, replace the damper.

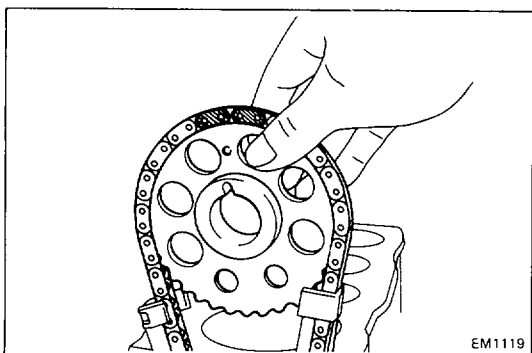


INSTALLATION OF TIMING CHAIN

(See page EM-45)

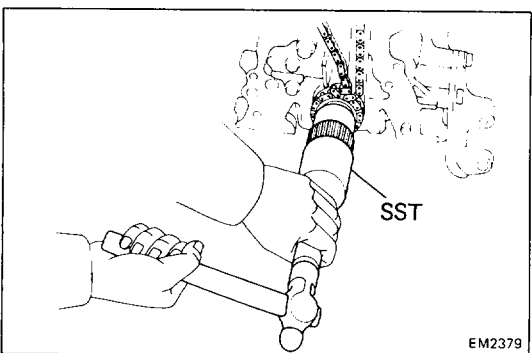
1. INSTALL CRANKSHAFT SPROCKET AND CHAIN

- Turn the crankshaft until the shaft key is on top.
- Slide the sprocket over the key on the crankshaft.
- Place the timing chain on the sprocket with the single bright link aligned with the timing mark on the sprocket.



2. PLACE CHAIN ON CAMSHAFT SPROCKET

- Place the timing chain on the sprocket so that the space between the bright chain links is aligned with the timing mark.
- Make sure the chain is positioned dampers.
- Turn the camshaft sprocket counterclockwise to take the slack out of the chain.

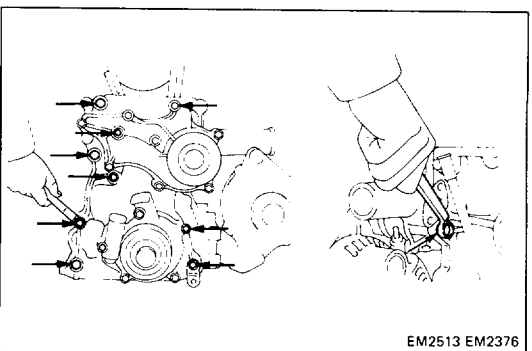


3. INSTALL OIL PUMP DRIVE SPLINE

Slide the oil pump drive spline over the crankshaft key.

NOTE: If the oil pump drive spline is difficult to install by hand, install using SST.

SST 09608-35014 (09608-06040)



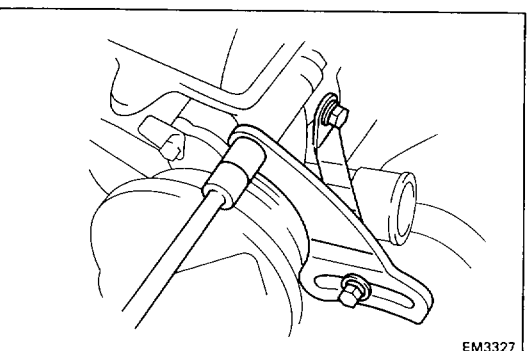
4. INSTALL TIMING CHAIN COVER ASSEMBLY

- Remove the old cover gaskets. Clean the gasket surface. Install new gaskets over the dowels.
- Slide the cover assembly over the dowels and pump spline.
- Insert the bolts as shown and torque them.

Torque:

8 mm bolt 130 kg-cm (9 ft-lb, 13 N·m)

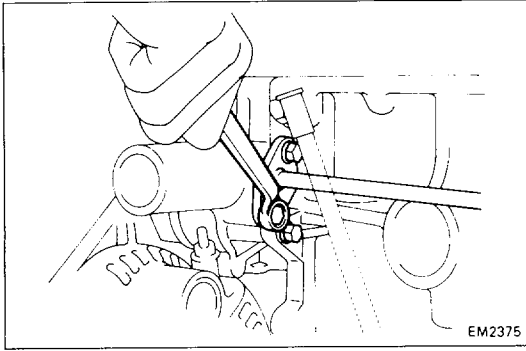
10 mm bolt 400 kg-cm (29 ft-lb, 39 N·m)



5. INSTALL FAN BELT ADJUSTING BAR

- Temporarily install the adjusting bar to the alternator.
- Install the adjusting bar to the chain cover and cylinder head.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)

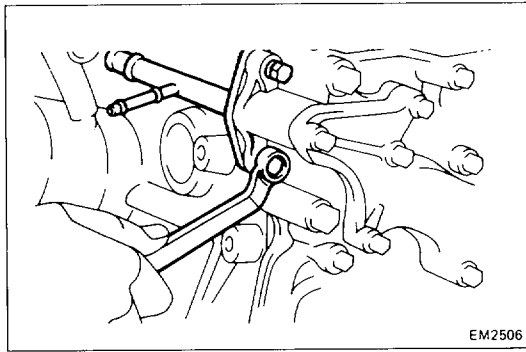


**6. (22R, 22R-E)
INSTALL HEATER WATER OUTLET PIPE**

Connect the heater water outlet pipe to the timing chain cover with two bolts.

**(22R-TE)
INSTALL NO.3 TURBO WATER PIPE**

Install the No.3 turbo water pipe with the two bolts.



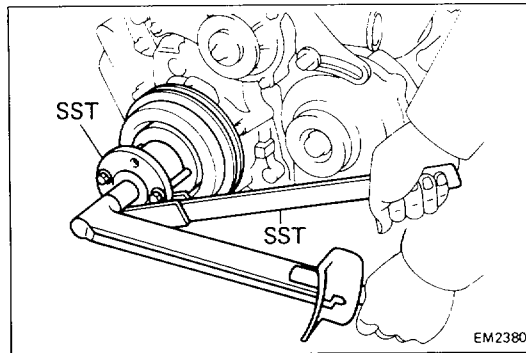
7. INSTALL NO.1 WATER BY-PASS PIPE

(22R, 22R-E)

Install the pipe with the two bolts.

(22R-TE)

Connect the pipe to the timing chain cover with the two bolts.



8. INSTALL CRANKSHAFT PULLEY

(a) Install the crankshaft pulley and bolt.

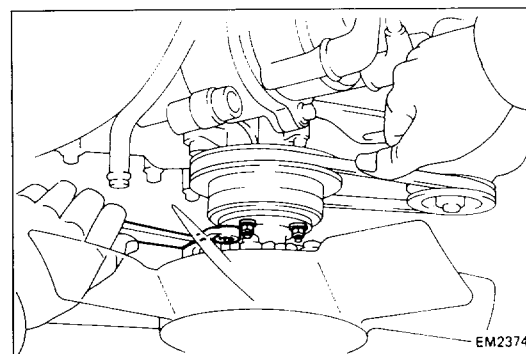
(b) Using SST to hold the crankshaft pulley, torque the bolt.

SST 09213-70010 and 09330-00021

Torque: 1600 kg-cm (116 ft-lb, 157 N·m)

(c) (with A/C)

Install the No.2 crankshaft pulley.



9. INSTALL WATER PUMP PULLEY AND FLUID COUPLING WITH FAN

(a) Temporarily install the water pump pulley and fluid coupling with fan with four nuts.

(b) Place the drive belt on to each pulley.

(c) Stretch the belt tight and tighten the four nuts.

10. ADJUST DRIVE BELT TENSION
(See page MA-4)

**11. (with A/C)
INSTALL A/C COMPRESSOR BRACKET, COMPRESSOR AND BELT**
(See page MA-4)

**12. (w/ PS)
INSTALL PS BELT**
(See page MA-4)

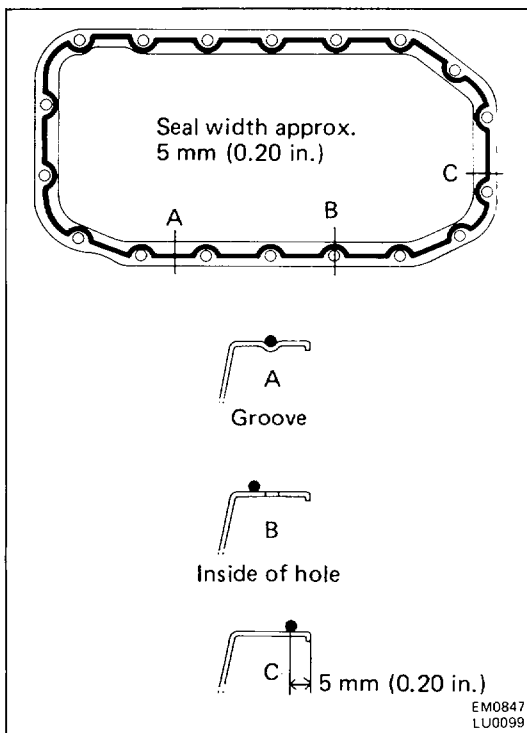
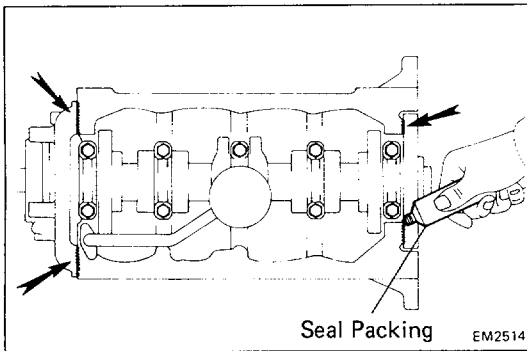
13. INSTALL OIL PAN

- (a) Remove any old packing material and be careful not to drop any oil on the contacting surfaces of the oil pan and cylinder block.
 - Using a razor blade and gasket scraper, remove all the packing (FIPG) material from the gasket surfaces.
 - Thoroughly clean all components to remove all the loose material.
 - Clean both sealing surfaces with a non-residue solvent.

CAUTION: Do not use a solvent which will affect the painted surfaces.

- (b) Apply seal packing to the joint part of the cylinder block and chain cover, cylinder block and rear oil seal retainer.

Seal packing: Part No. 08826-00080 or equivalent



- (c) Apply seal packing to the oil pan as shown in the figure.

Seal packing: Part No. 08826-00080 or equivalent

- Install a nozzle that has been cut to a 5-mm (0.20 in.) opening.

NOTE: Avoid applying an excess amount to the surface. Be especially careful near oil passages.

- Parts must be assembled within 5 minutes of application. Otherwise, the material must be removed and re-applied.
 - Immediately remove nozzle from tube and reinstall cap.
- (d) Install the oil pan over the studs on the block with sixteen bolts and two nuts. Torque the bolts and nuts.
- Torque: 130 kg-cm (9 ft-lb, 13 N-m)**
- (e) Lower the engine and install the engine mounting bolts.
 - (f) Install the engine under cover.

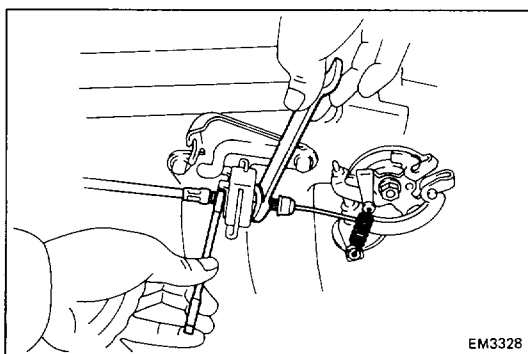
POST INSTALLATION

1. INSTALL RADIATOR
2. INSTALL CYLINDER HEAD
(22R-E, 22R-TE See page EM-32)
(22R See page EM-42)

22R-E, 22R-TE CYLINDER BLOCK

PREPARATION FOR REMOVAL

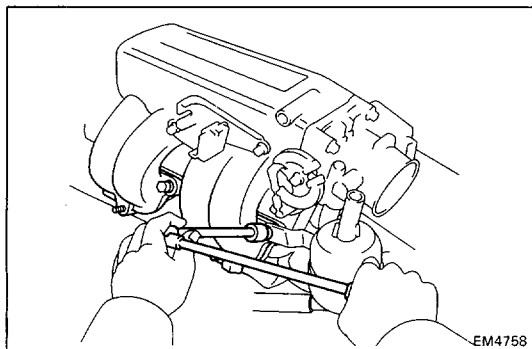
1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
2. **REMOVE ENGINE UNDER COVER**
3. **REMOVE ENGINE HOOD**
Disconnect the washer hose from the hood.
4. **DRAIN ENGINE OIL**
5. **DRAIN COOLANT FROM RADIATOR AND CYLINDER BLOCK**
6. **(A/T)
DRAIN AUTOMATIC TRANSMISSION FLUID**
7. **REMOVE AIR CLEANER HOSE AND AIR CLEANER**
8. **REMOVE RADIATOR WITH SHROUD**
 - (a) **(A/T)**
Disconnect the two cooler hoses.
 - (b) Disconnect the radiator upper and lower hoses from the engine.
 - (c) **(22R-TE)**
Disconnect the No.1 turbo water hose.
 - (d) Disconnect the reservoir hose.
 - (e) **(with A/C)**
Remove the No.2 fan shroud.
 - (f) Remove the radiator with the shroud.
9. **REMOVE COUPLING FAN WITH FAN**
10. **DISCONNECT TWO HEATER HOSES**
11. **DISCONNECT CABLES FROM BRACKET**
Disconnect the accelerator cable and throttle cable for A/T from the bracket.
12. **DISCONNECT FOLLOWING PARTS:**
 - (a) No.1 and No.2 PCV hose
 - (b) Brake booster hose
 - (c) Air control valve hoses
 - (d) EVAP hose (from canister)
 - (e) **(w/ cruise control)**
Actuator hose
 - (f) EGR vacuum modulator hose
 - (g) No.1 air valve hose from the throttle body
 - (h) No.2 air valve hose from the chamber
 - (i) No.2 and No.3 water by-pass hose from the throttle body



- (j) Air control valve hose for the actuator
- (k) Pressure regulator hose from the chamber
- (l) Cold start injection pipe
- (m) BVSV hoses

13. DISCONNECT FOLLOWING WIRES:

- (a) Cold start injection wire
- (b) Throttle position sensor wire
- (c) (Calif. and C&C)
EGR gas temp. sensor wire

**14. REMOVE CHAMBER WITH THROTTLE BODY**

- (a) Remove the two bolts holding the EGR valve to the chamber.
- (b) Disconnect the chamber from the stay.
- (c) Remove the bolts and nuts holding the chamber to the intake manifold.
- (d) Remove the chamber with the throttle body, resonator and ground strap, return hose clamp.

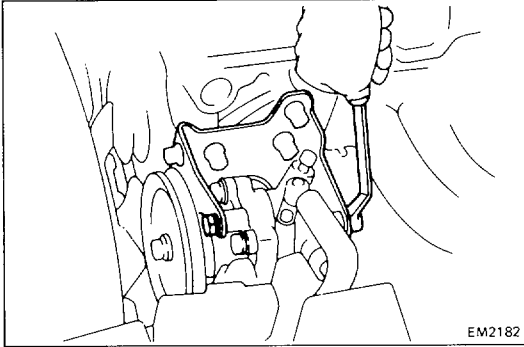
15. DISCONNECT FOLLOWING WIRES:

- (a) Cold start injector time switch wire
- (b) Water temp. sensor wire
- (c) (with A/C)
VSV wire
- (d) (22R-TE)
Oxygen sensor wire
- (e) (A/T)
OD temp. switch wire
- (f) Injector wires
- (g) (with A/C)
A/C compressor wire
- (h) Knock sensor connector
- (i) Air valve wire
- (j) Oil pressure switch wire
- (k) Starter wire

REMOVAL OF CYLINDER BLOCK

1. DISCONNECT FOLLOWING PARTS:

- (a) Alternator wires
- (b) High-tension cord for ignition coil
- (c) Distributor wire from igniter



2. (w/ PS) REMOVE VANE PUMP FROM BRACKET

- (a) Remove the drive belt.
- (b) Remove the four bolts.
- (c) Remove the PS pump.

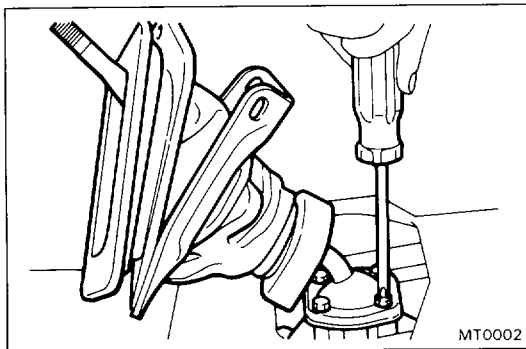
NOTE: Lay the PS pump to one side without disconnecting the hoses.

3. DISCONNECT GROUND STRAP FROM VANE PUMP BRACKET

4. (with A/C) REMOVE COMPRESSOR FROM BRACKET

- (a) Loosen the drive belt adjusting bolt and remove the drive belt.
- (b) Remove the compressor on the front side without disconnecting the hoses.

5. DISCONNECT GROUND STRAPS FROM ENGINE REAR SIDE AND RH SIDE



6. (M/T) REMOVE SHIFT LEVER FROM INSIDE OF VEHICLE

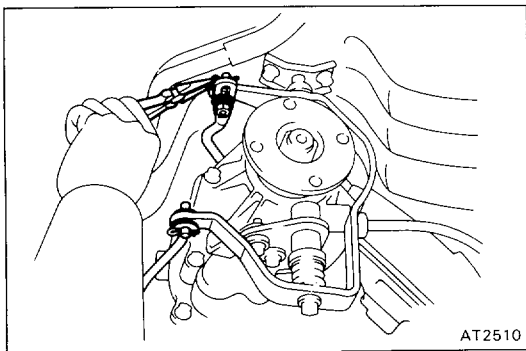
7. (R150) REMOVE SHIFT LEVER RETAINER

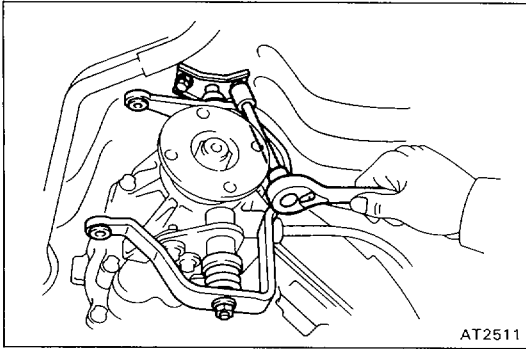
8. REMOVE REAR PROPELLER SHAFT (See page 2WD PR-3) (See page 4WD PR-5)

9. (A/T) DISCONNECT MANUAL SHIFT LINKAGE FROM NEUTRAL START SWITCH

10. (4WD A/T) DISCONNECT TRANSFER SHIFT LINKAGE

- (a) Disconnect the No.1 and No.2 transfer shift linkages from the cross shaft.





(b) Remove the cross shaft from the body.

11. DISCONNECT SPEEDOMETER CABLE

CAUTION: Do not lose the felt dust protector and washers.

12. (4WD)

REMOVE TRANSFER UNDER COVER

13. (4WD)

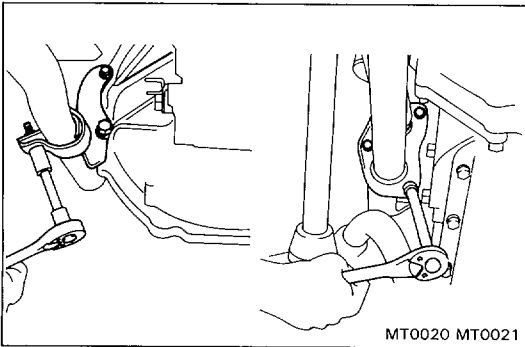
REMOVE STABILIZER BAR

14. (4WD)

REMOVE FRONT PROPELLER SHAFT

(See page PR-4)

15. REMOVE NO.1 FRAME CROSSMEMBER



16. REMOVE FRONT EXHAUST PIPE

(a) (22R-E)

Remove the LH front door scuff plate.

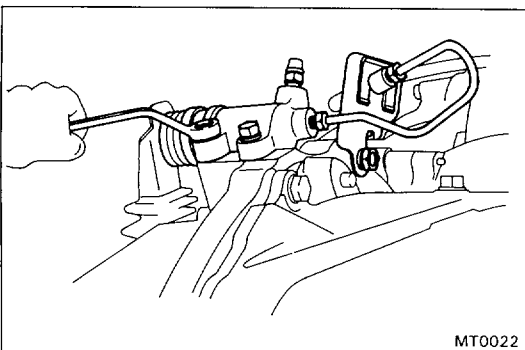
(b) (22R-E)

Disconnect the oxygen sensor connector.

(c) Disconnect the exhaust pipe from the exhaust manifold.

(d) Remove the exhaust pipe clamp from the clutch housing.

(e) Remove the exhaust pipe from the catalytic converter.

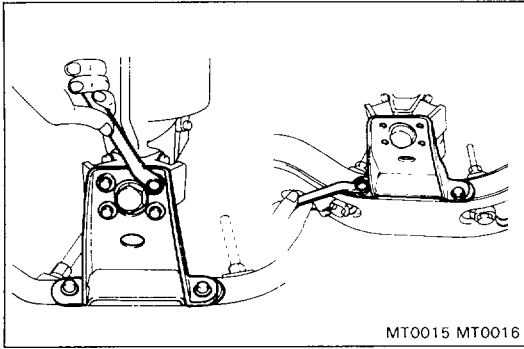


17. (M/T)

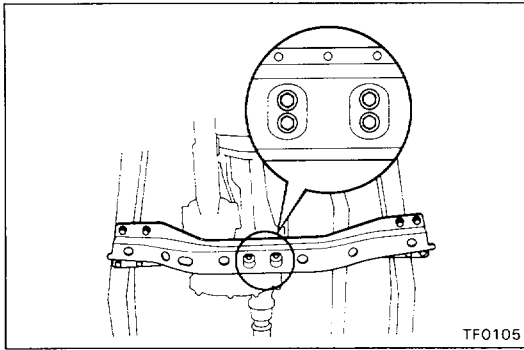
REMOVE CLUTCH RELEASE CYLINDER WITH BRACKET FROM TRANSMISSION

18. (4WD)

REMOVE NO.1 FRONT FLOOR HEAT INSULATOR AND BRAKE TUBE HEAT INSULATOR

**19. (2WD)****REMOVE ENGINE REAR MOUNTING AND BRACKET**

- (a) Remove the four bolts from the engine rear mounting.
- (b) Raise the transmission slightly by raising the engine with a jack.
- (c) Remove the four bolts from the support member.

**(4WD)****REMOVE FRAME CROSSMEMBER NO.2 FROM SIDE FRAME**

- (a) Remove the four bolts from the engine rear mounting.
- (b) Raise the transmission slightly with a jack.
- (c) Remove the four bolts from the side frame and remove the No.2 frame crossmember.

20. REMOVE ENGINE WITH TRANSMISSION FOR VEHICLE

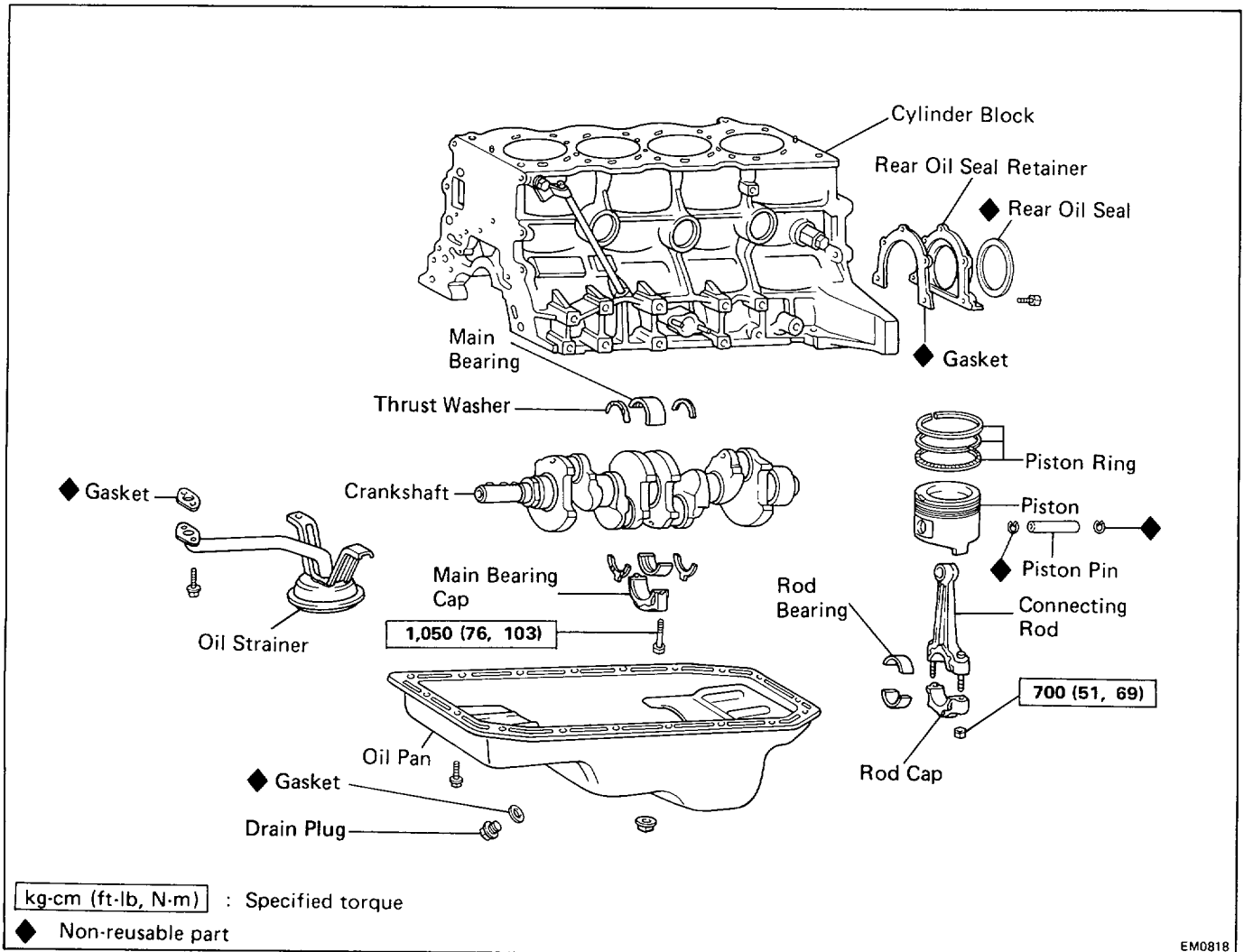
- (a) Attach the engine hoist chain to the lift brackets of the engine.
- (b) Remove the mounting nuts and bolts.
- (c) Lift the engine out of the vehicle slowly and carefully.

NOTE: Make sure the engine is clear of all wiring and hoses.

21. REMOVE TRANSMISSION FROM ENGINE

- (a) Remove the starter.
- (b) Remove the two stiffener plates and exhaust pipe bracket from engine.
- (c) Remove the transmission from the engine.

COMPONENTS



PREPARATION FOR DISASSEMBLY

1. (M/T)
REMOVE CLUTCH COVER AND DISC
(See page CL-10)
2. REMOVE FLYWHEEL (M/T) OR DRIVE PLATE (A/T) AND
REAR END PLATE
3. INSTALL ENGINE STAND FOR DISASSEMBLY
4. REMOVE CYLINDER HEAD
(See page EM-14)
5. REMOVE TIMING CHAIN (See page EM-45)
6. REMOVE ALTERNATOR (See page CH-5)

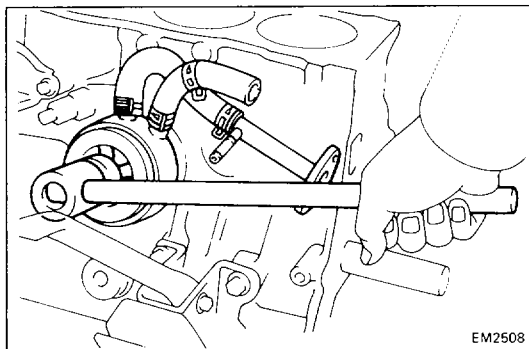
DISASSEMBLY OF CYLINDER BLOCK

1. REMOVE LH ENGINE MOUNTING BRACKET AND ALTERNATOR BRACKET

2. REMOVE CHAIN DAMPERS

3. REMOVE CHAIN TENSIONER

4. REMOVE OIL FILTER
(See step 2 on page LU-3)



5. (22R-TE)
REMOVE OIL COOLER
Remove the oil cooler relief valve, gasket and oil cooler.

6. REMOVE RH ENGINE MOUNTING BRACKET, CHAMBAR STAY AND GROUND STRAP

7. (A/T)
REMOVE FLEXIBLE HOSE CLAMP

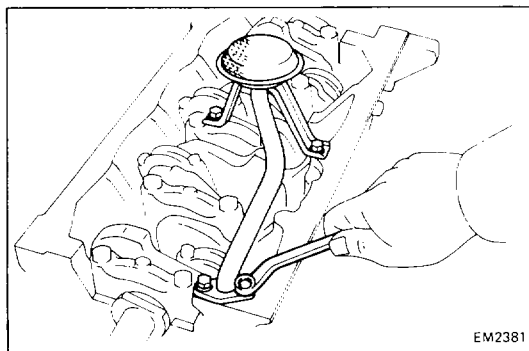
8. REMOVE OIL PRESSURE SENDER GAUGE OR SWITCH

9. REMOVE KNOCK CONTROL SENSOR

10. REMOVE FUEL FILTER AND BRACKET

11. REMOVE OIL STRAINER
Remove the four bolts, strainer and gasket.

12. REMOVE REAR OIL SEAL RETAINER
Remove the five bolts, rear oil seal retainer and gasket.



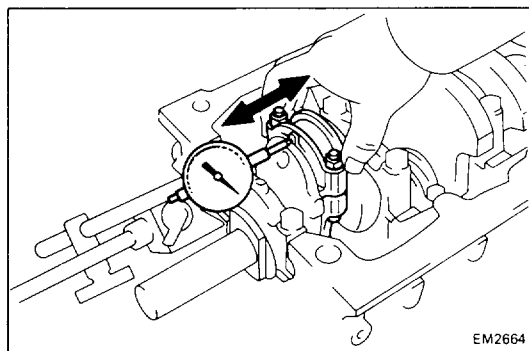
13. MEASURE CONNECTING ROD THRUST CLEARANCE

Using a dial gauge, measure the thrust clearance.

Standard clearance: 0.16 — 0.26 mm
(0.0063 — 0.0102 in.)

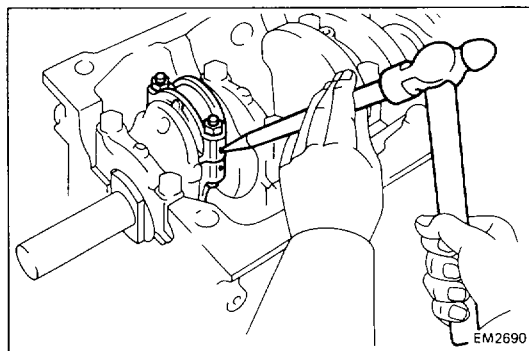
Maximum clearance: 0.3 mm (0.012 in.)

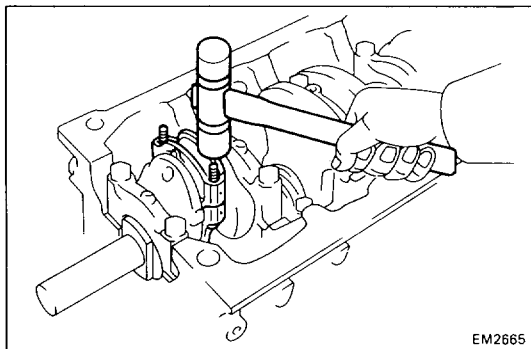
If clearance is greater than maximum, replace the connecting rod and/or crankshaft.



14. MEASURE OIL CLEARANCE

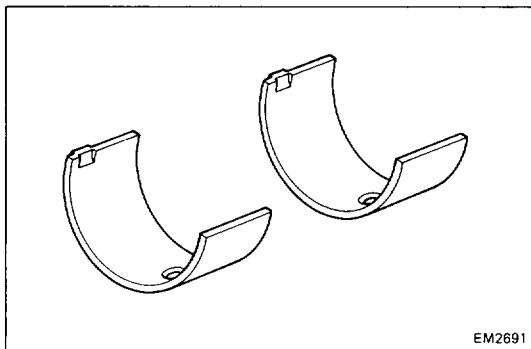
- (a) Using a punch or numbering stamp, mark connecting rods and caps to ensure correct reassembly.
- (b) Remove the rod cap nuts.





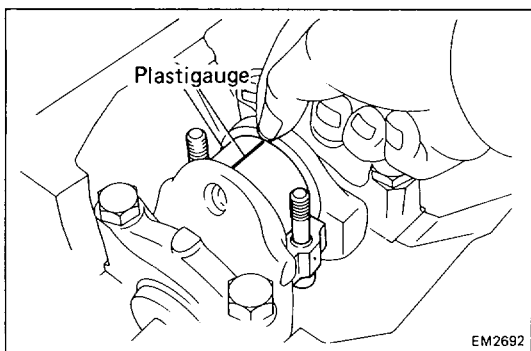
- (c) Using a plastic-faced hammer, tap the rod bolts lightly and lift off the rod cap.

NOTE: Keep the bearing inserted with the cap.

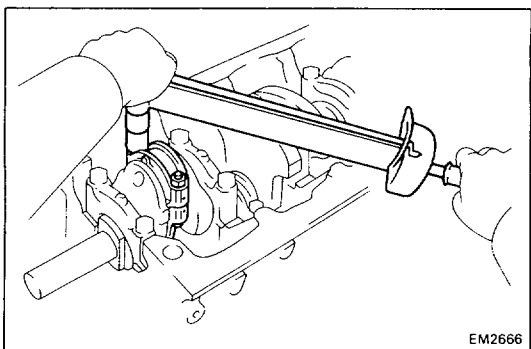


- (d) Clean the bearings and crankshaft pins.

- (e) Inspect each bearing for pitting and radial scratches. If bearings are damaged, replace.



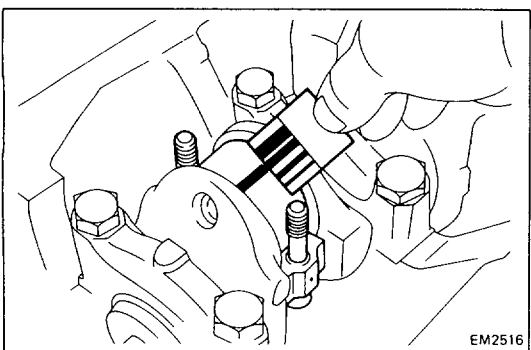
- (f) Lay a strip of Plastigage across the crankshaft pin.



- (g) Align the rod and cap marks and fit on the cap. Torque the rod cap nuts.

Torque: 700 kg-cm (51 ft-lb, 69 N·m)

NOTE: Do not turn the crankshaft.



- (h) Remove the rod cap.

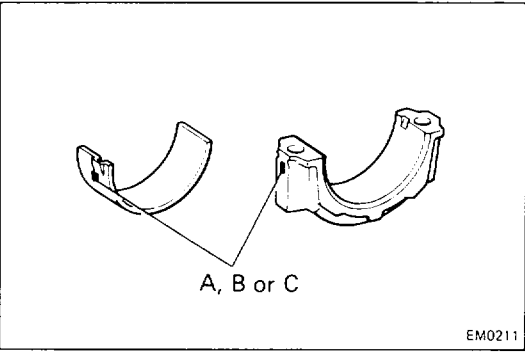
- (i) Measure the Plastigage at its widest point.

**Standard clearance: 0.025 — 0.055 mm
(0.0010 — 0.0022 in.)**

Maximum clearance: 0.10 mm (0.0039 in.)

If the clearance is greater than maximum, replace the bearings and/or grind the crank pins.

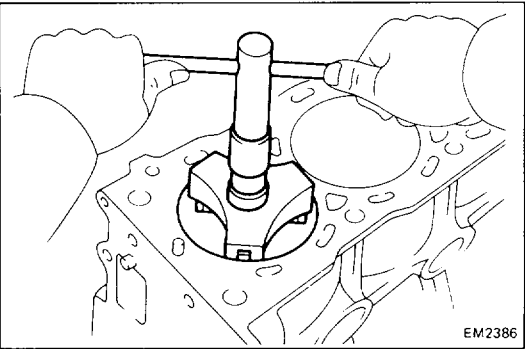
Undersized bearing: U/S 0.25



NOTE: If using standard bearing, replace with one having the same number as marked on the bearing cap. There are three sizes of standard bearings, marked A, B, C accordingly. mm (in.)

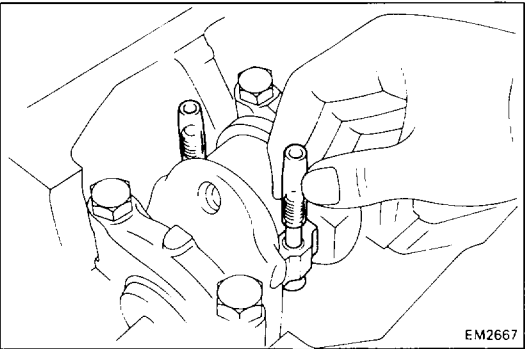
Size	Big End Inner Diameter	Crank Pin Diameter	Bearing Center Wall Thickness
A	56.000 – 56.006 (2.2047 – 2.2050)	52.988 – 53.000 (2.0861 – 2.0866)	1.484 – 1.488 (0.0584 – 0.0586)
B	56.006 – 56.012 (2.2050 – 2.2052)		1.488 – 1.492 (0.0586 – 0.0587)
C	56.012 – 56.018 (2.2052 – 2.2054)		1.492 – 1.496 (0.0587 – 0.0589)
U/S 0.25	56.000 – 56.018 (2.2047 – 2.2054)	52.701 – 52.711 (2.0748 – 2.0752)	1.626 – 1.636 (0.0640 – 0.0644)

- (j) Clean out the pieces of Plastigage from the bearings and journals.

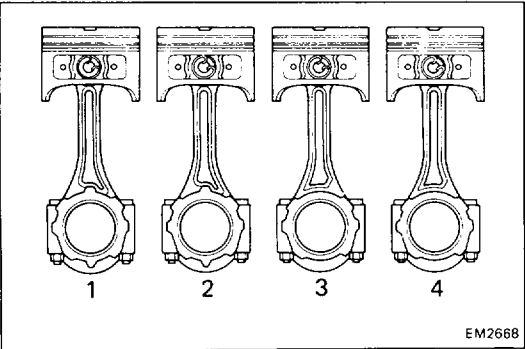


15. PUSH OUT PISTON AND CONNECTING ROD ASSEMBLY

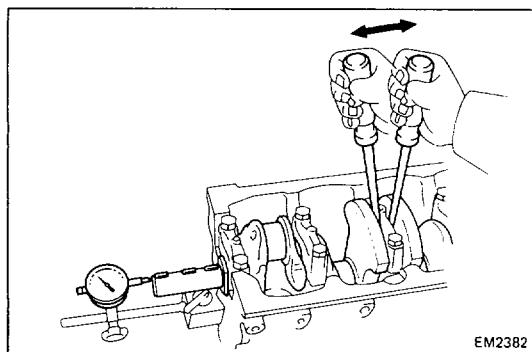
- (a) Remove all the carbon from top of the bore to the top of the cylinder.



- (b) Cover the rod bolts with a short piece of hose to protect the crank pin from damage.
- (c) Push the piston and connecting rod assembly out through the top of the cylinder block.



- (d) Arrange the piston and connecting rod caps in order.



16. MEASURE CRANKSHAFT THRUST CLEARANCE

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

Standard clearance: 0.02 — 0.22 mm
(0.0008 — 0.0087 in.)

Maximum clearance: 0.3 mm (0.012 in.)

If the clearance is greater than maximum, replace the thrust washer.

Thrust washer thickness:

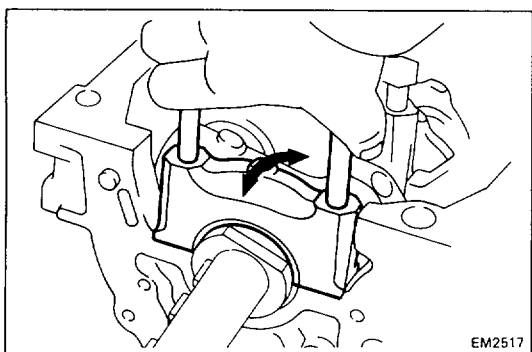
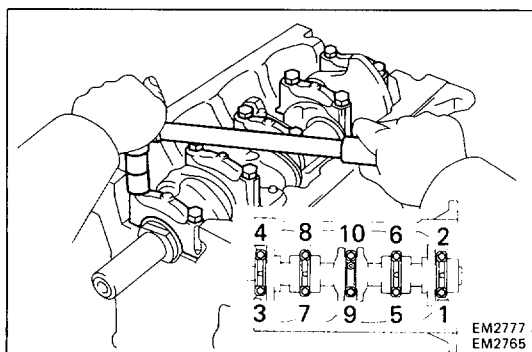
Standard 2.690 — 2.740 mm (0.1059 — 0.1079 in.)

O/S 1.25 2.753 — 2.803 mm (0.1084 — 0.1104 in.)

O/S 2.50 2.815 — 2.865 mm (0.1108 — 0.1128 in.)

17. MEASURE OIL CLEARANCE

- (a) Gradually loosen and remove the bearing cap bolts in three passes and in the numerical order shown.



- (b) Using the removed bearing cap bolts, pry the bearing cap fore and aft, and remove it with the lower bearing and thrust washers (No. 3 journal only).

NOTE:

- Keep the lower bearing inserted with the cap.
- Arrange the caps and lower thrust washers in correct order.

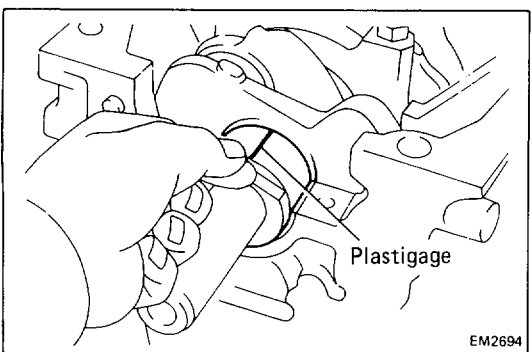
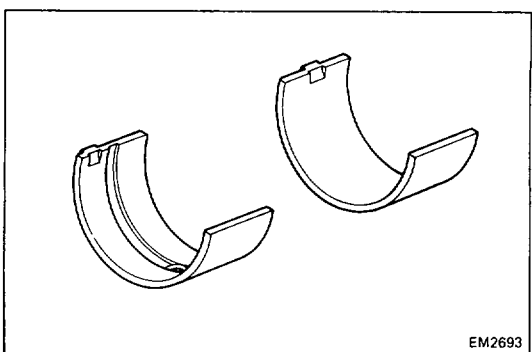
- (c) Lift off the crankshaft.

NOTE: Keep the upper bearings and upper thrust washers (for the No. 3 journal only) inserted in the cylinder block.

- (d) Clean the journals and bearings.

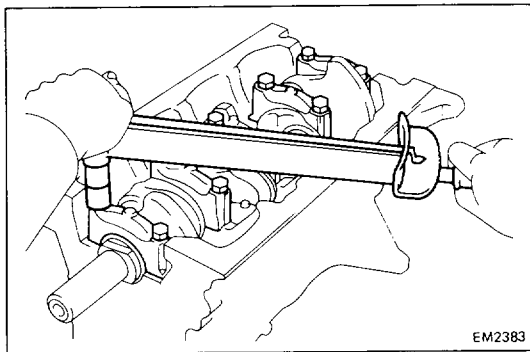
- (e) Check the journals and bearings for pitting and scratches.

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



- (f) Install the upper main bearings on the cylinder block and crankshaft.

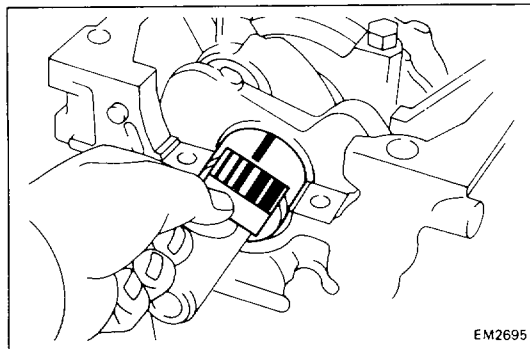
- (g) Lay a strip of Plastigage across the main journals.



(h) Install the main bearing caps. Torque the cap bolts.

Torque: 1,050 kg-cm (76 ft-lb, 103 N·m)

NOTE: Do not turn the crankshaft.



(i) Remove the main bearing caps.

(j) Measure the Plastigage at its widest point.

**Standard clearance: 0.025 – 0.055 mm
(0.0010 – 0.0022 in.)**

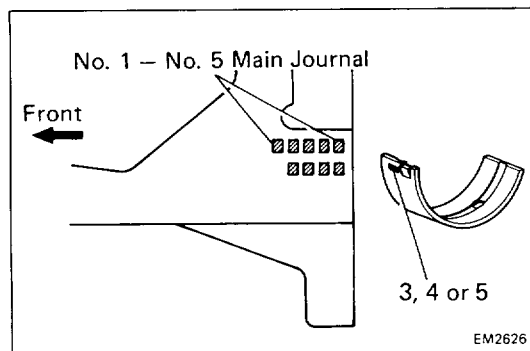
Maximum clearance: 0.08 mm (0.0031 in.)

If the clearance is greater than maximum, replace the bearings and/or grind the main journals.

Undersized bearing: U/S 0.25

(k) Clean out the pieces of Plastigage from the bearings and journals.

NOTE: If using a standard bearing, replace with one having the same number as marked on the cylinder block. There are three sizes of standard bearings, marked 3, 4, 5 accordingly.

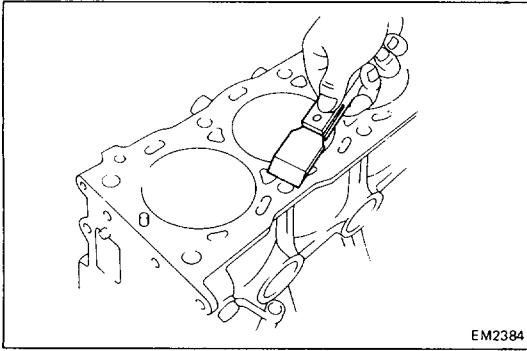


mm (in.)

Size	Cylinder Block Main Journal Bore	Main Journal Diameter	Bearing Center Wall Thickness
3	64.004 – 64.010 (2.5198 – 2.5201)	59.984 – 60.000 (2.3616 – 2.3622)	1.988 – 1.992 (0.0783 – 0.0784)
4	64.010 – 64.016 (2.5201 – 2.5203)		1.992 – 1.996 (0.0784 – 0.0786)
5	64.016 – 64.022 (2.5203 – 2.5205)		1.996 – 2.000 (0.0786 – 0.0787)
U/S 0.25	64.004 – 64.022 (2.5198 – 2.5205)	59.701 – 59.711 (2.3504 – 2.3508)	2.126 – 2.136 (0.0837 – 0.0841)

18. REMOVE CRANKSHAFT

- Lift out the crankshaft.
- Remove the upper main bearings from the cylinder block.
- Arrange the caps and bearings in order.



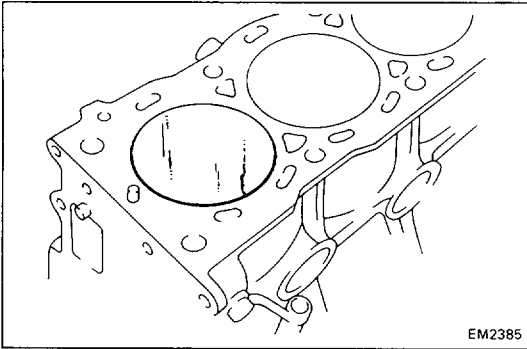
INSPECTION OF CYLINDER BLOCK

1. REMOVE GASKET MATERIAL

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

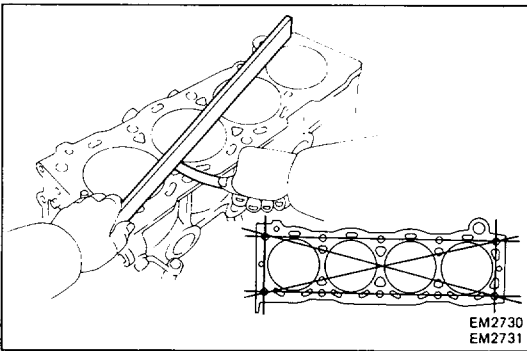
2. CLEAN CYLINDER BLOCK

Using a soft brush and solvent, clean the block.



3. INSPECT CYLINDERS

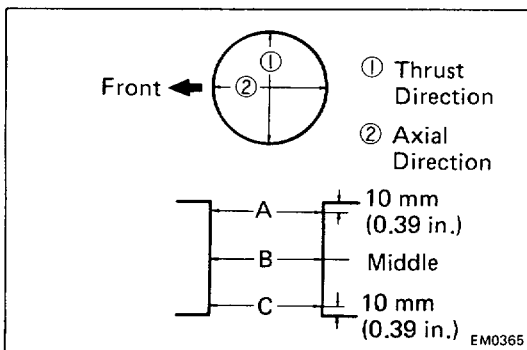
Visually inspect cylinders for vertical scratches. If deep scratches are present, rebore all four cylinders.



4. INSPECT CYLINDER BLOCK WARPAGE

Warpage limit: 0.05 mm (0.0020 in.)

If warpage is greater than specified value, replace the cylinder block.



5. MEASURE CYLINDER BORE

Using a cylinder micrometer, measure the cylinder bore at positions A, B and C in the thrust and axial directions. If any of the following measurements is not within specifications rebore all four cylinders.

(a) Cylinder diameter greater than maximum.

Standard size piston

Maximum diameter: 92.03 mm (3.6232 in.)

Oversized piston (O/S 0.50)

Maximum diameter: 92.53 mm (3.6429 in.)

Oversized piston (O/S 1.00)

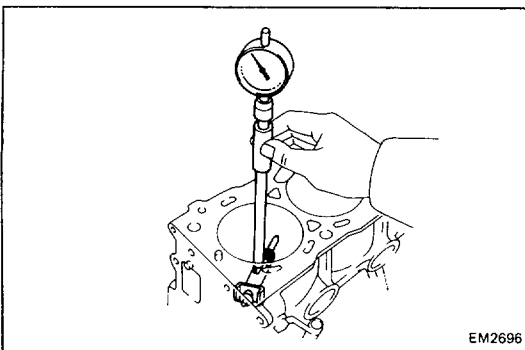
Maximum diameter: 93.03 mm (3.6626 in.)

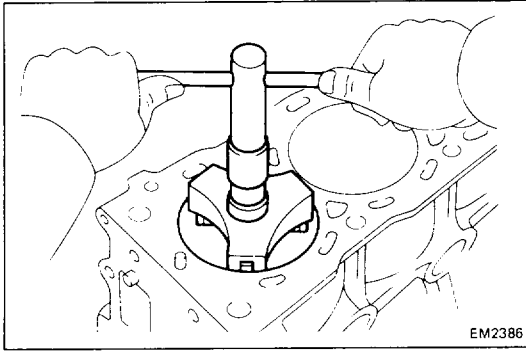
(b) Difference between measurements A, B and C is greater than the taper limit.

Taper limit: 0.01 mm (0.0004 in.)

(c) Difference between the thrust and axial measurements is greater than the out-of-round limit.

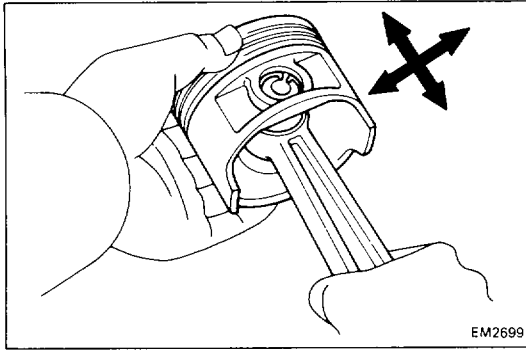
Out-of-round limit: 0.02 mm (0.0008 in.)





6. REMOVE CYLINDER RIDGE

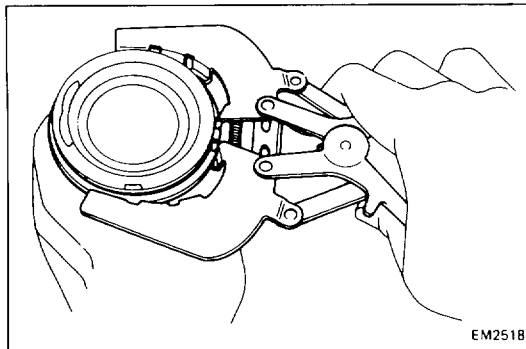
If wear is less than 0.2 mm (0.008 in.), use a ridge reamer to machine the top of the cylinder.



DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLY

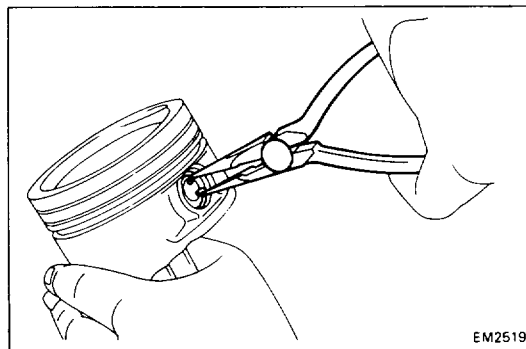
1. CHECK FIT BETWEEN PISTON AND PIN

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



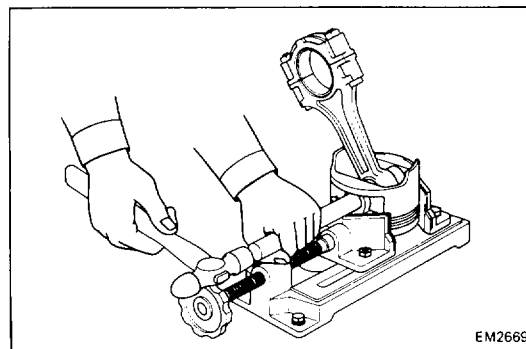
2. REMOVE PISTON RINGS

Using a piston ring expander, remove the piston rings. Keep the rings for each cylinder separated.



3. DISCONNECT CONNECTING ROD FROM PISTON

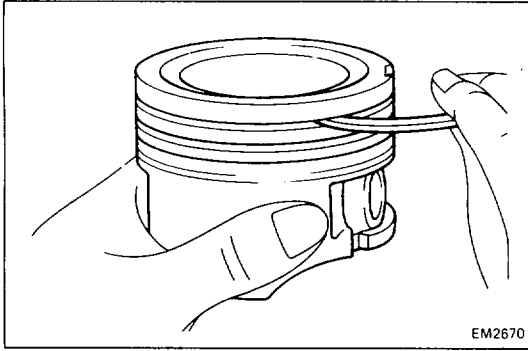
- (a) Using needle-nose pliers, remove the snap rings from the piston.
- (b) Heat the piston in hot water approx. 60°C (140°F).



- (c) Using a plastic-faced hammer and brass bar, tap the pin lightly to remove the pin from the piston.

NOTE:

- The piston and pin are a matched set.
- Keep the piston, pin, rings and connecting rod together for each cylinder.



INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLY

1. CLEAN PISTON

- Scrape off carbon from the piston top.
- Using a groove cleaning tool or broken ring, clean the ring grooves.
- Using solvent and a brush, clean the piston thoroughly.

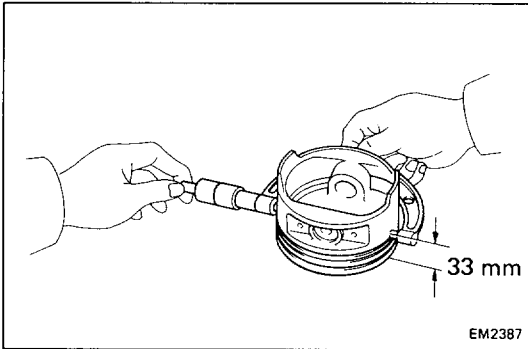
CAUTION: Do not use a wire brush.

2. MEASURE PISTON DIAMETER

- Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 33 mm (1.30 in.) from the piston head.

Standard diameter:

22R, 22R-E	91.970 — 92.000 mm (3.6209 — 3.6220 in.)
22R-TE	91.935 — 91.965 mm (3.6195 — 3.6207 in.)

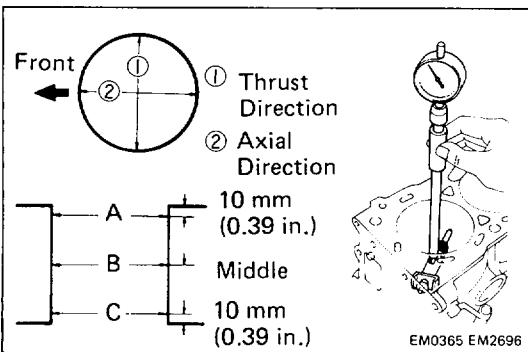


- Check that the difference between the cylinder diameter and the piston diameter is within specification.

Piston clearance:

22R, 22R-E	0.02 — 0.04 mm (0.0008 — 0.0016 in.)
22R-TE	0.055 — 0.075 mm (0.0022 — 0.0030 in.)

If not within specification, replace the piston and/or rebore the cylinder and install new piston.



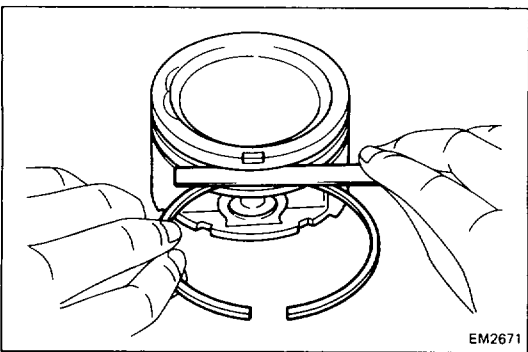
3. MEASURE CLEARANCE BETWEEN PISTON GROOVE AND PISTON RING

Using a thickness gauge, measure the clearance between the piston ring and the ring land.

Standard ring groove clearance: 0.03 — 0.07 mm
(0.0012 — 0.0028 in.)

Maximum ring groove clearance: 0.2 mm (0.008 in.)

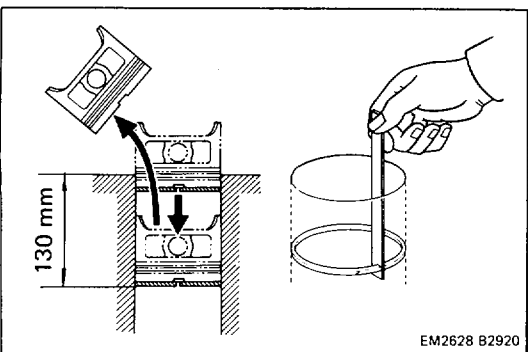
If the clearance is greater than maximum, replace the piston.



4. MEASURE RING END GAP

Measure the ring end gap.

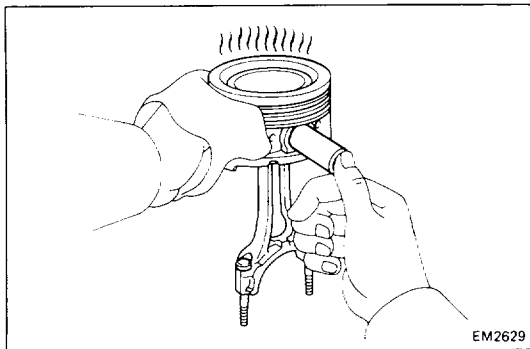
- Insert the piston ring into the cylinder.
- Using a piston, push the ring a little beyond the bottom of the ring travel.
(130 mm (5.12 in.) from top surface of cylinder block)
- Using a thickness gauge, measure the end gap.



Ring end gap:

Standard	No.1	0.25 — 0.47 mm (0.0098 — 0.0185 in.)
	No.2	0.60 — 0.82 mm (0.0236 — 0.0323 in.)
	Oil	0.20 — 0.57 mm (0.0079 — 0.0224 in.)
Maximum	No.1	1.07 mm (0.0421 in.)
	No.2	1.42 mm (0.0559 in.)
	Oil	1.17 mm (0.0461 in.)

If not within specification, replace the ring. Do not file the ring end.

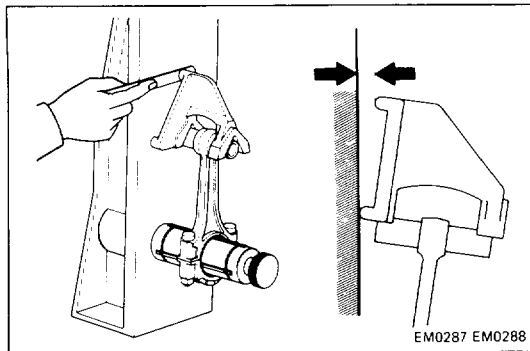


EM2629

5. INSPECT PISTON PIN FIT

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

If the pin can be installed at a lower temperature, replace it and the piston.



EM0287 EM0288

6. INSPECT CONNECTING RODS

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

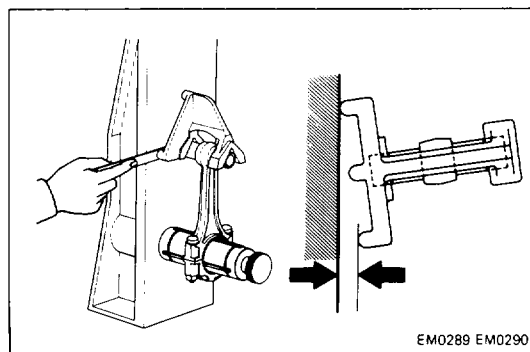
If the rod is bent or twisted, replace the connecting rod.

- Check that the rod is not bent.

Bend limit: 0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

- Check that the rod is not twisted.

Twist limit: 0.15 mm (0.0059 in.) per 100 mm (3.94 in.)



EM0289 EM0290

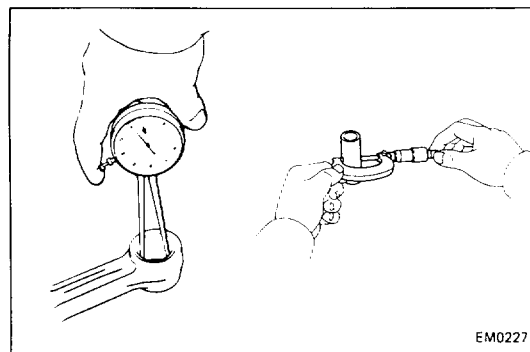
(b) Measure the oil clearance between the rod bushing and piston pin.

- Using an inside dial indicator, measure the inside diameter of the rod bushing.
- Using a micrometer, measure the diameter of the piston pin.
- Check that the difference between the measurements is less than the oil clearance limit.

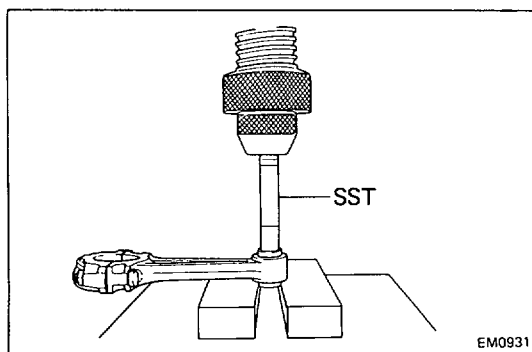
Standard oil clearance: 0.005 — 0.011 mm
(0.0002 — 0.0004 in.)

Maximum oil clearance: 0.015 mm (0.0006 in.)

If the clearance is greater than maximum replace the rod bushing.



EM0227

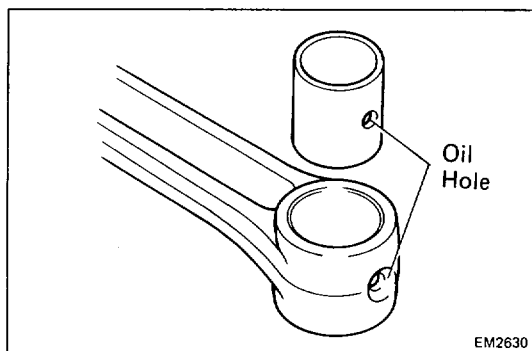


REPLACEMENT OF ROD BUSHING

1. REMOVE ROD BUSHING

Using SST, remove the rod bushing from the connecting rod.

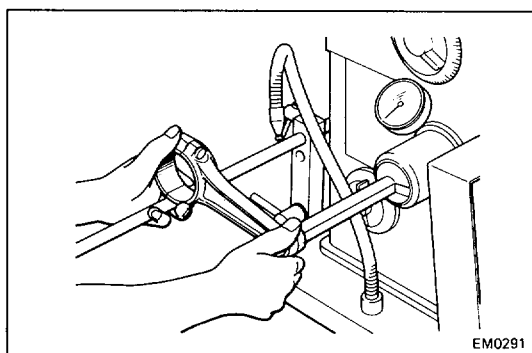
SST 09222-30010



2. INSTALL NEW ROD BUSHING

Using SST, install the rod bushing to the connecting rod.
SST 09222-30010

NOTE: Align the bushing oil hole with the connecting rod oil hole.

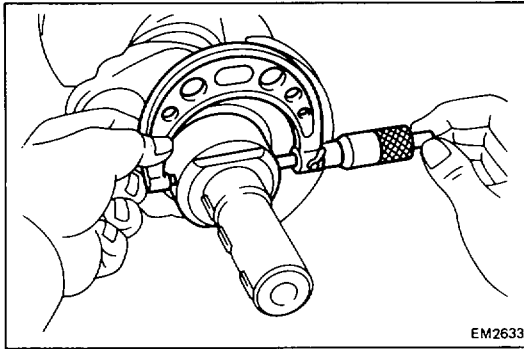
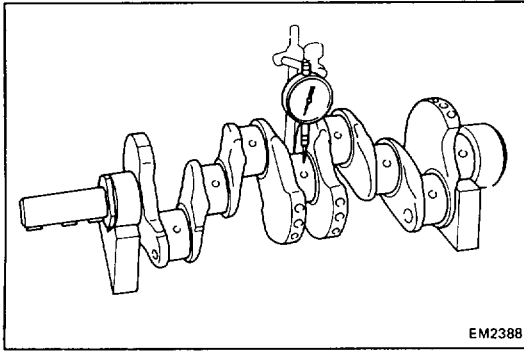


3. HONE NEW BUSHING AND CHECK PIN FIT IN CONNECTING ROD

- (a) Hone the new bushing and check that the oil clearance is within standard specification.

Standard oil clearance: 0.005 — 0.011 mm
(0.0002 — 0.0004 in.)

- (b) Check the pin fit at the normal room temperature.
Coat the pin with engine oil and push the pin into the rod with thumb pressure.



INSPECTION AND REPAIR OF CRANKSHAFT

1. MEASURE CRANKSHAFT

- (a) Place the crankshaft on V-blocks.
- (b) Using a dial gauge, measure the runout at the center journal.

Maximum circle runout: 0.1 mm (0.004 in.)

If the runout is greater than maximum, replace the crankshaft.

- (c) Using a micrometer, check the diameter of the main and crank pin journal.

Measure the journals for out-of-round and taper as shown.

**Main journal diameter: 59.984 – 60.000mm
(2.3616 – 2.3622 in.)**

**Crank pin diameter: 52.988 – 53.000 mm
(2.0861 – 2.0866 in.)**

Taper and out-of-round limit: 0.01 mm (0.0004 in.)

If journals are worn, regrind or replace the crankshaft.

2. GRIND CRANK PIN AND/OR MAIN JOURNAL, IF NECESSARY

Grind the crank pins and/or main journals to the undersized finished diameter. Install a new pin and/or main undersize bearings.

Bearing size (U/S 0.25)

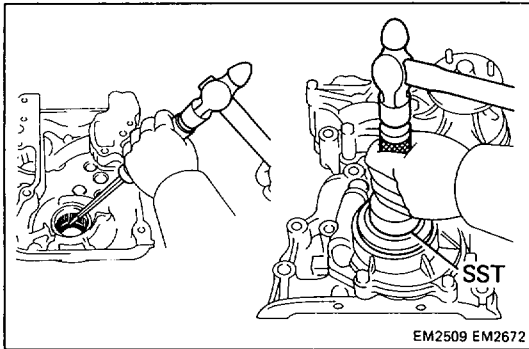
**Main journal finished diameter: 59.701 – 59.711 mm
(2.3504 – 2.3508 in.)**

**Crank pin finished diameter: 52.701 – 52.711 mm
(2.0748 – 2.0752 in.)**

Taper and out-of-round limit: 0.01 mm (0.0004 in.)

REPLACEMENT OF OIL SEALS

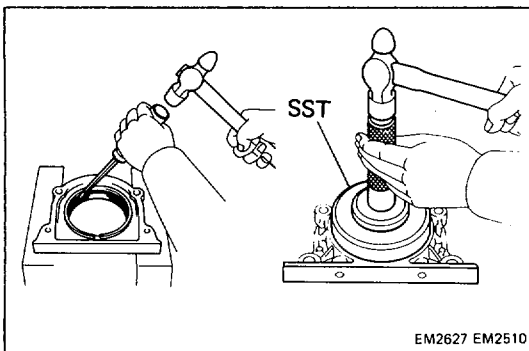
NOTE: There are two ways of oil seal replacement in accordance with the timing belt case or rear oil seal retainer condition.



1. IF TIMING CHAIN COVER IS REMOVED FROM CYLINDER BLOCK (Replacement of front oil seal)

- (a) Using a screwdriver, remove the oil seal.
- (b) Apply MP grease to the oil seal lip.
- (c) Using SST, install a new oil seal.

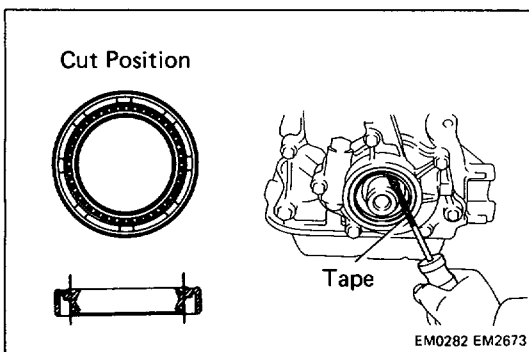
SST 09223-50010



2. IF REAR OIL SEAL RETAINER IS REMOVED FROM CYLINDER BLOCK (Replacement of rear oil seal)

- (a) Using a screwdriver, remove the oil seal.
- (b) Apply MP grease to a new oil seal lip.
- (c) Using SST, install the oil seal.

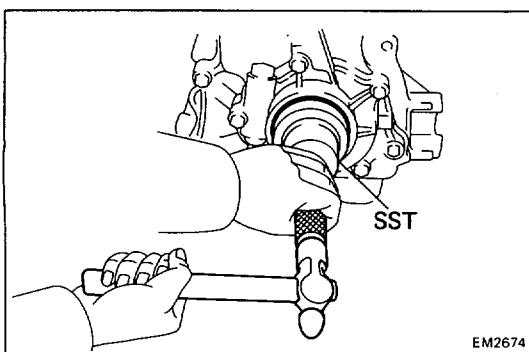
SST 09223-41020



3. IF TIMING CHAIN COVER IS INSTALLED ON CYLINDER BLOCK (Replacement of front oil seal)

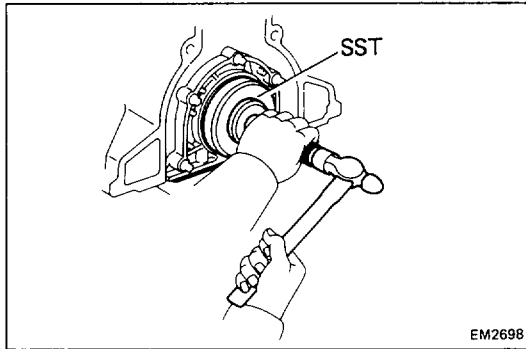
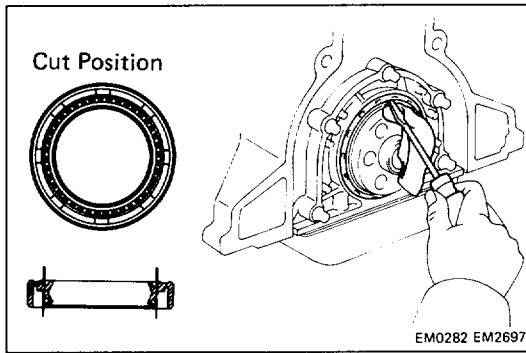
- (a) Using a knife, cut off the oil seal lip.
- (b) Using a screwdriver, pry out the oil seal.

NOTE: Be careful not to damage the crankshaft. Tape the screwdriver.

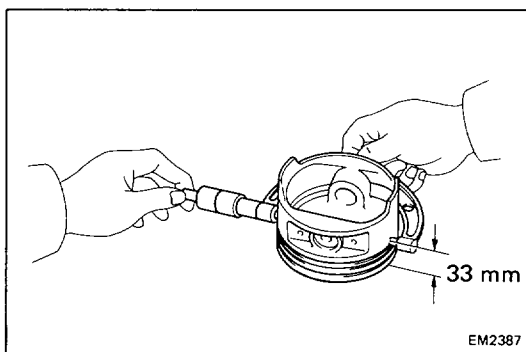


- (c) Apply MP grease to a new oil seal lip.
- (d) Using SST, install the oil seal.

SST 09223-50010



Size		Outside Diameter mm (in.)
O/S 0.50	22R-E	92.470 – 92.500 (3.6405 – 3.6417)
	22R-TE	92.435 – 92.465 (3.6392 – 3.6403)
O/S 1.00	22R-E	92.970 – 93.000 (3.6602 – 3.6614)
	22R-TE	92.935 – 92.965 (3.6589 – 3.6600)



4. IF REAR OIL SEAL RETAINER IS INSTALLED ON CYLINDER BLOCK (Replacement of rear oil seal)

- Using the knife, cut off lip of oil seal.
- Using a screwdriver, pry out the oil seal.

NOTE: Be careful not to damage crankshaft. Tape the screwdriver.

- Check crankshaft of oil seal lip contact surface for cracks or damage.
- Apply MP grease to a new oil seal.
- Using SST, install the oil seal.

SST 09223-41020

BORING OF CYLINDERS

1. SELECT OVERSIZED PISTON

O/S pistons with pins are available in the sizes listed.

Replace pistons in matched sets. Take the largest bore measured and select the oversized piston for that bore. Bore all cylinders for the oversized piston selected.

2. CALCULATE DIMENSION TO BORE CYLINDERS

- Using a micrometer, measure the piston diameter as shown.
- Calculate the size each cylinder is to be rebored as follows:

$$\text{Size to be rebored} = P + C - H$$

P = piston diameter

C = piston clearance

22R, 22R-E 0.02 – 0.04 mm
(0.0008 – 0.0016 in.)

22R-TE 0.0055 – 0.075 mm
(0.0022 – 0.0030 in.)

H = allowance for honing

Less than 0.02 mm (0.0008 in.)

3. BORE AND HONE CYLINDERS TO CALCULATED DIMENSIONS

Honing amount: 0.02 mm (0.0008 in.) maximum

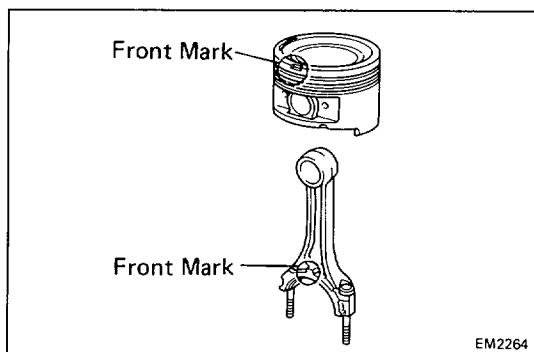
CAUTION: Excess honing will destroy the finished roundness.

GENERAL ASSEMBLY NOTE:

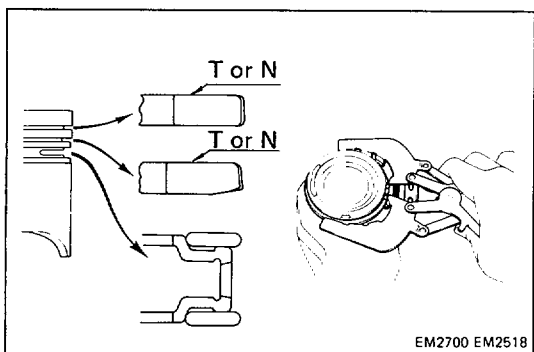
Thoroughly clean all parts to be assembled. Before installing parts, apply new engine oil to all sliding and rotating surfaces.

ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLY**1. ASSEMBLY PISTON AND CONNECTING ROD**

- (a) Install a new snap ring on one side of the piston pin hole.
- (b) Heat the piston in hot water to approx. 80°C (176°F).
- (c) Align the notch on the piston with the mark on the rod and push the piston pin in with your thumb.
- (d) Install a new snap ring on the other side of the pin.

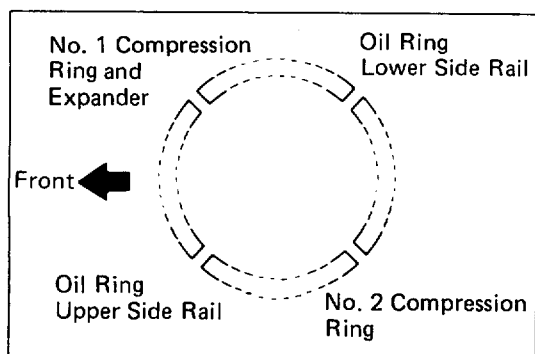
**2. PLACE RINGS ON PISTON**

- (a) Using a ring expander, install the top two compression rings with the code marks facing upward.

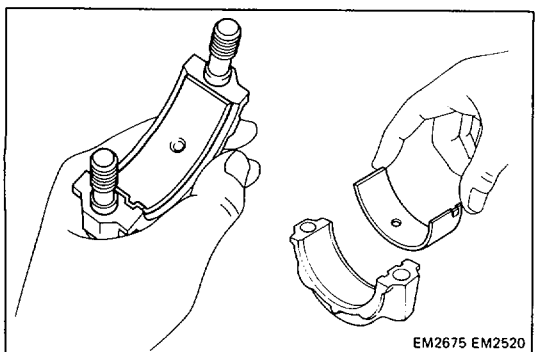


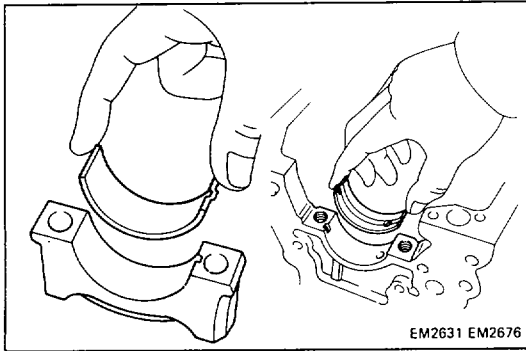
- (b) Position the piston rings so that the ring end gaps are in the shaded area as shown.

CAUTION: Do not align the end gaps.

**3. INSTALL BEARING INSERTS**

- (a) Install the bearing inserts in the connecting rods and rod caps.
- (b) Lubricate the face of the bearings with engine oil.





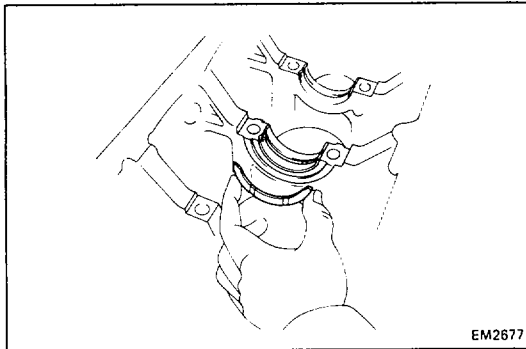
INSTALLATION OF CRANKSHAFT, PISTON AND CONNECTING ROD ASSEMBLY

(See page EM-57)

1. INSTALL MAIN BEARINGS

Install the bearing in the cylinder block and bearing caps.

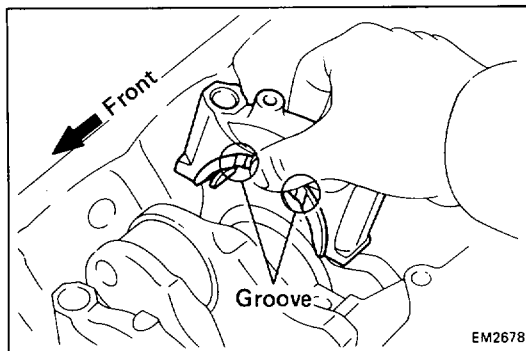
CAUTION: Install the upper bearing with the oil hole in the block.



2. INSTALL UPPER THRUST WASHERS

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

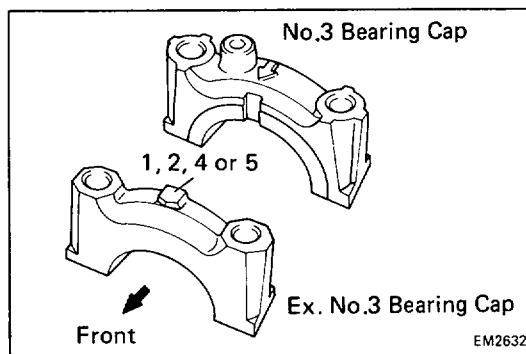
3. PLACE CRANKSHAFT ON CYLINDER BLOCK



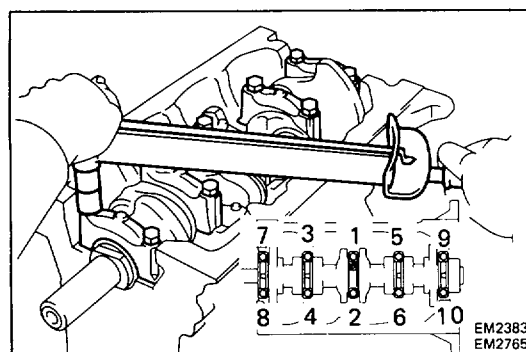
4. INSTALL MAIN BEARINGS CAPS WITH LOWER THRUST WASHERS

NOTE: Each bearing cap is numbered.

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



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



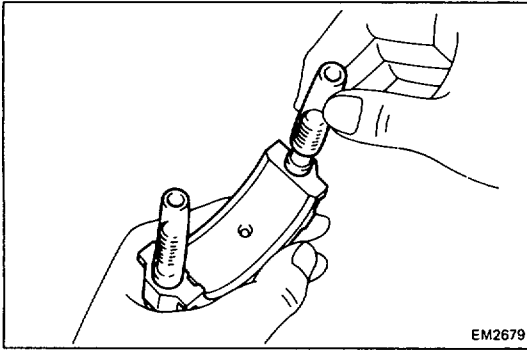
(c) Apply a light coating of engine oil on the threads and under the cap bolt heads.

(d) Install and tighten the cap bolts in two or three passes and in the sequence shown.

Torque: 1,050 kg-cm (76 ft-lb, 103 N·m)

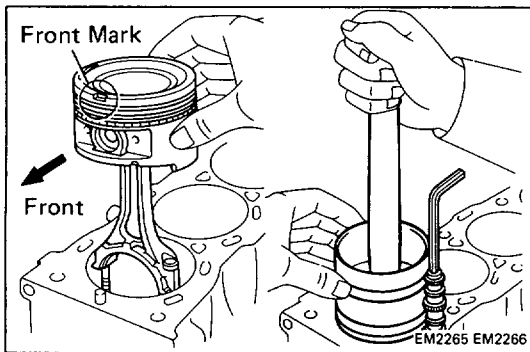
(e) Check that the crankshaft turns.

(f) Check the crankshaft thrust clearance.
(See page EM-61)



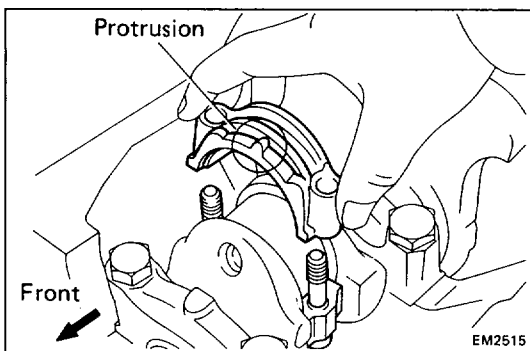
5. INSTALL PISTON AND CONNECTING ROD ASSEMBLY

- (a) Cover the rod bolts with a short piece of hose to protect the crankshaft from damage.
- (b) Lubricate the cylinder bore and rod journal with clean engine oil.



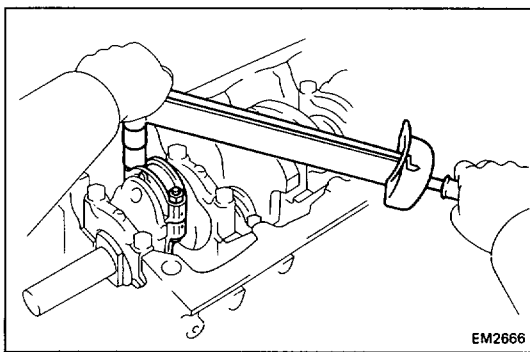
- (c) Tighten the compressor snugly but NOT tightly against the piston and gently tap the correctly numbered piston and rod assembly into its cylinders with a wooden hammer handle or like object. Make sure the notch and mark are facing forward.

NOTE: If the ring compressor is wound too tightly around the piston, the bottom edge of the ring compressor will catch against the beveled surface at the top of the cylinder when tapping the piston in.



6. INSTALL CONNECTING ROD CAPS

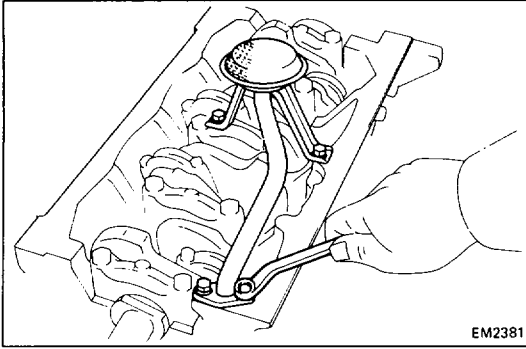
- (a) Match the numbered cap with the numbered rod.
- (b) Install the rod caps with the protrusion facing forward.



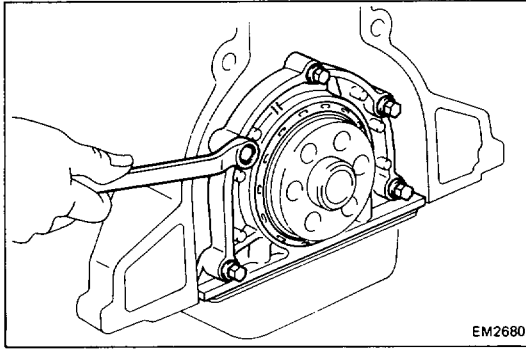
- (c) Apply a light coat of the engine oil on the threads and under of the rod nuts.
- (d) Install and tighten the rod nuts alternately and in two or three passes.

Torque: 700 kg-cm (51 ft-lb, 69 N·m)

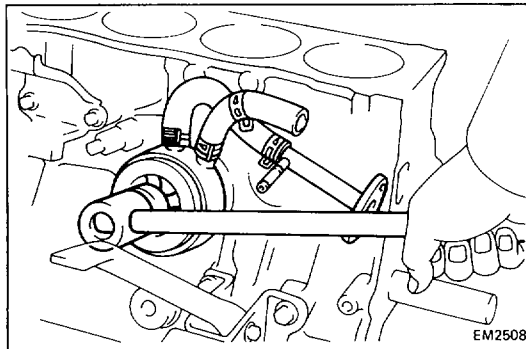
- (e) Check that the crankshaft turns smoothly.
- (f) Check the rod thrust clearance.
(See page EM-58)



EM2381



EM2680



EM2508

ASSEMBLY OF CYLINDER BLOCK

(See page EM-57)

1. INSTALL OIL STRAINER

- (a) Clean the oil strainer.
- (b) Place the gasket in place and install the oil strainer assembly with four bolts. Torque the bolts.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)

2. INSTALL REAR OIL SEAL RETAINER

Install a new gasket and the retainer with the four bolts. Torque the bolts.

Torque: 180 kg-cm (9 ft-lb, 13 N·m)

3. INSTALL FUEL FILTER BRACKET AND FILTER

4. INSTALL KNOCK CONTROL SENSOR

5. INSTALL OIL PRESSURE SENDER GAUGE OR SWITCH

6. (A/T) INSTALL FLEXIBLE HOSE CLAMP

7. INSTALL RH ENGINE MOUNTING BRACKET, CHAMBER STAY AND GROUND STRAP

8. (22R-TE) INSTALL OIL COOLER

- (a) Replace the O-ring.
- (b) Install a new gasket on the oil cooler relief valve.
- (c) Install the oil cooler with the oil cooler relief valve.

Torque: 450kg-cm (33 ft-lb, 44 N·m)

9. INSTALL OIL FILTER (See page LU-3)

10. INSTALL CHAIN TENSIONER

11. INSTALL CHAIN DAMPERS

12. INSTALL ALTERNATOR BRACKET AND LH ENGINE MOUNTING BRACKET

13. INSTALL TIMING CHAIN (See page EM-49)

14. INSTALL ALTERNATOR

15. INSTALL CYLINDER HEAD (See page EM-32)

16. REMOVE ENGINE STANDS

17. INSTALL REAR END PLATE

18. INSTALL FLYWHEEL OR DRIVE PLATE ON CRANKSHAFT

Install the flywheel or drive plate on the crankshaft with the six bolts. Torque the bolts.

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

19. (M/T) INSTALL CLUTCH DISC AND COVER TO FLYWHEEL (See page CL-13)

INSTALLATION OF ENGINE**1. CONNECT TRANSMISSION TO ENGINE****2. PLACE ENGINE WITH TRANSMISSION IN VEHICLE**

- (a) Attach the engine hoist chain to the lifting brackets on the engine.
- (b) Lower the engine with transmission into the engine compartment.

3. (4WD)**PLACE JACK UNDER TRANSMISSION**

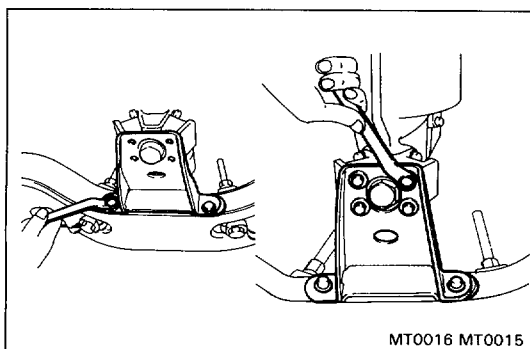
Be sure to put a wooden block between the jack and the transmission pan.

4. JACK UP AND PUT TRANSMISSION ONTO MEMBER**5. INSTALL ENGINE MOUNTING TO FRAME BRACKET**

- (a) Align the engine mounting and frame bracket.
- (b) Install the engine mounting bolts on each side of the engine.
- (c) Remove the hoist chain.

6. (2WD)**INSTALL ENGINE REAR MOUNTING AND BRACKET**

- (a) Raise the transmission slightly by raising the engine with a jack and a wooden block under the transmission.



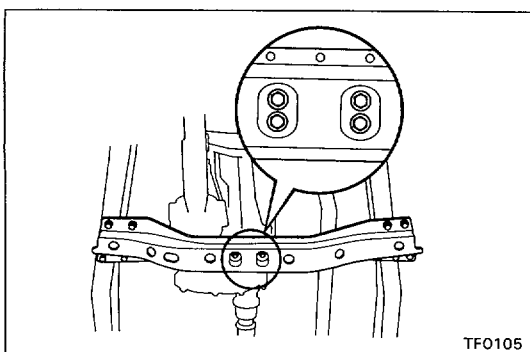
- (b) Install the engine rear mounting bracket to the support member. Torque the bolts.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)

- (c) Lower the transmission and rest it on the extension housing.

- (d) Install the bracket to the mounting. Torque the bolts.

Torque: 260 kg-cm (19 ft-lb, 25 N·m)

**(4WD)****INSTALL FRAME NO.2 CROSSMEMBER**

- (a) Raise the transmission slightly with a jack.
- (b) Install the frame No. 2 crossmember to the side frame with the bolts.
Torque the bolts.

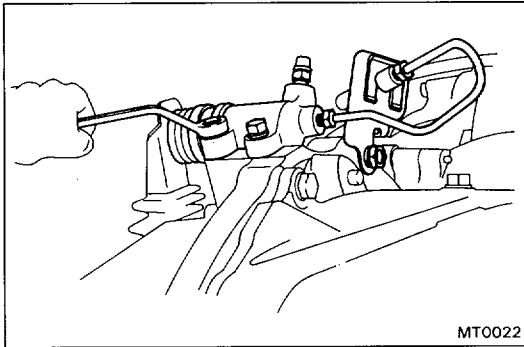
Torque: 970 kg-cm (70 ft-lb, 95 N·m)

- (c) Lower the transmission and transfer.

- (d) Install the four mounting bolts to the engine rear mounting. Torque the bolts.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)

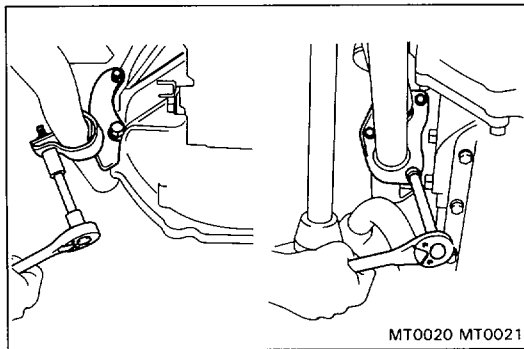
7. (4WD)
**INSTALL BRAKE TUBE HEAT INSULATOR AND NO.1
 FRONT FLOOR HEAT INSULATOR**



8. (M/T)
**INSTALL CLUTCH RELEASE CYLINDER WITH BRACKET
 TO TRANSMISSION**

Torque:

Bracket	400 kg-cm (29 ft-lb, 39 N·m)
Release cylinder	120 kg-cm (9 ft-lb, 12 N·m)



9. **INSTALL EXHAUST PIPE**

- Connect the exhaust pipe to the catalytic converter.
- Connect the exhaust pipe to the exhaust manifold.
- Install the exhaust pipe clamp.
- (22R-E)
 Connect the oxygen sensor connector.
- (22R-E)
 Install the LH front door scuff plate.

10. **INSTALL NO.1 FRAME CROSSMEMBER**

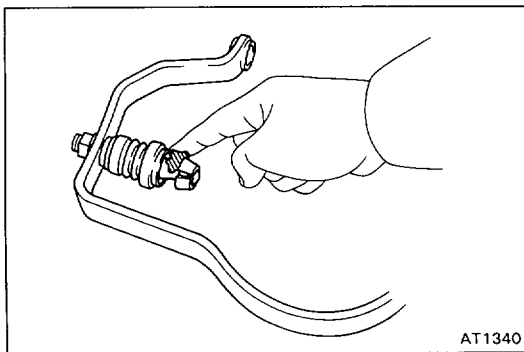
11. (4WD)
INSTALL FRONT PROPELLER SHAFT
 (See page PR-13)

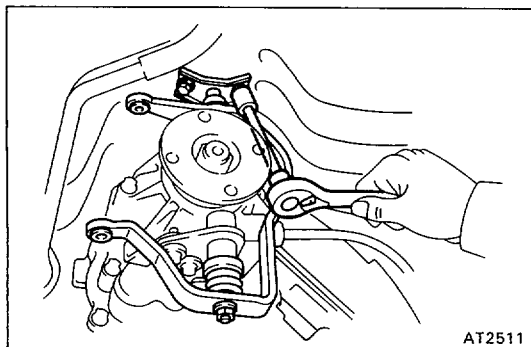
12. (4WD)
INSTALL STABILIZER BAR
 (See page FA-97)

13. (4WD)
INSTALL TRANSFER UNDER COVER

14. **CONNECT SPEEDOMETER CABLE**

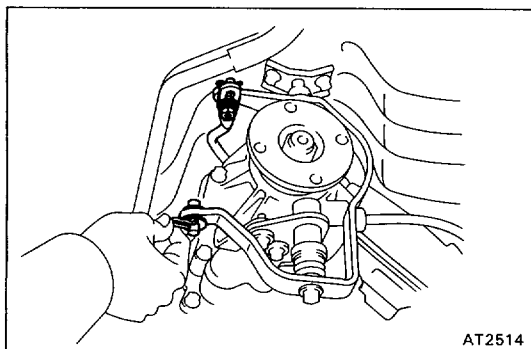
15. (4WD A/T)
CONNECT TRANSFER SHIFT LINKAGE
 (a) Apply MP grease to the cross shaft joint.





AT2511

(b) Install the cross shaft to the body.



AT2514

(c) Connect the No.1 and No.2 transfer shift linkage to the cross shaft.

**16. (A/T)
CONNECT MANUAL SHIFT LINKAGE TO NEUTRAL START SWITCH**

17. INSTALL PROPELLER SHAFT

(See page 2WD PR-12)

(See page 4WD PR-13)

**18. (R150)
INSTALL SHIFT LEVER RETAINER**

**19. (M/T)
INSTALL SHIFT LEVER**

(a) Apply MP grease to the shift lever.

(b) Install the shift lever to the transmission.

20. CONNECT GROUND STRAPS TO ENGINE REAR SIDE AND RH SIDE

**21. (with A/C)
INSTALL COMPRESSOR TO BRACKET**

(a) Install the compressor with four bolts.

(b) Install the drive belt and adjust the belt tension.

22. CONNECT GROUND STRAP FOR VANE PUMP BRACKET

**23. (w/ PS)
INSTALL PS PUMP WITH VANE PUMP BRACKET**

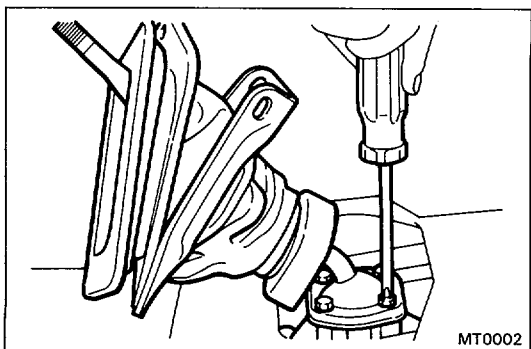
Install the PS pump with four bolts.

24. CONNECT FOLLOWING PARTS:

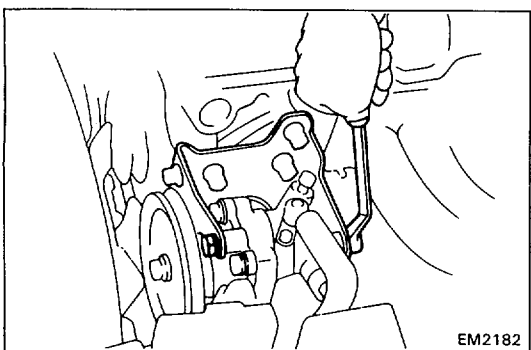
(a) Distributor wire

(b) High-tension cords

(c) Alternator wires



MT0002

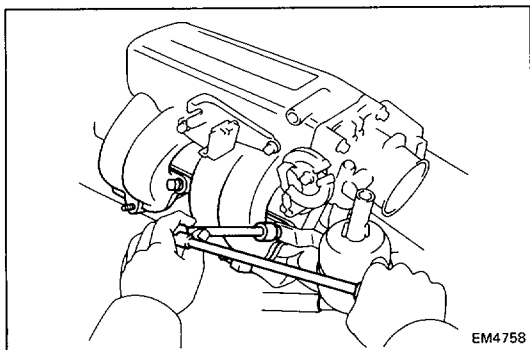


EM2182

POST INSTALLATION

1. CONNECT FOLLOWING WIRES:

- (a) Transmission wires
- (b) Starter wire
- (c) Oil pressure switch wire
- (d) Air valve wire
- (e) Knock sensor wire
- (f) (with A/C)
A/C compressor wire
- (g) Injector wires
- (h) (A/T)
OD temp. switch wire
- (i) (22R-TE)
Oxygen sensor wire
- (j) (with A/C)
VSV wire
- (k) Water temp. sensor wire
- (l) Cold start injector time switch wire



2. INSTALL CHAMBER WITH THROTTLE BODY

- (a) Position a new gasket on the intake manifold.
- (b) Install the resonator and chamber with throttle body.
- (c) Install the four bolts.
- (d) Install the return hose clamp, ground strap and two nuts.
- (e) Connect the chamber and stay with a bolt.
- (f) Install the EGR valve to the chamber with two bolts.

3. CONNECT FOLLOWING WIRES:

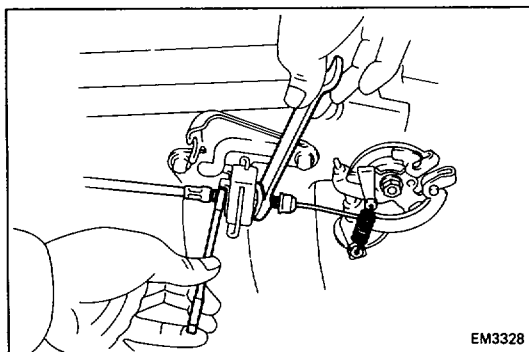
- (a) (Calif. and C&C)
EGR gas temp. sensor wire
- (b) Throttle position sensor wire
- (c) Cold start injection wire

4. CONNECT FOLLOWING PARTS:

- (a) BVSV hoses
- (b) Cold start injection pipe
- (c) Pressure regulator hose to the chamber
- (d) Air control valve hose to actuator
- (e) No.2 and No.3 water by-pass hose to the throttle body.
- (f) No.2 air valve hose to the chamber
- (g) Air valve hose No.1 to the throttle body
- (h) EGR vacuum modulator hose
- (i) (w/ cruise control)
Actuator hose
- (j) EVAP hose (for canister)
- (k) Air control valve hoses
- (l) Brake booster hose
- (m) No.1 and No.2 PCV hose

5. CONNECT CABLES TO BRACKET

Connect the accelerator cable and throttle cable for A/T to the bracket.



6. **CONNECT TWO HEATER HOSES**
7. **INSTALL COUPLING FAN WITH FAN**
8. **INSTALL RADIATOR WITH SHROUD**
 - (a) Install the radiator with the shroud.
 - (b) (with A/C)
Remove the No.2 fan shroud.
 - (c) Connect the reservoir hose.
 - (d) (22R-TE)
Disconnect the No.1 turbo water hose.
 - (e) Connect the radiator upper and lower hoses to the engine.
9. **INSTALL AIR CLEANER HOSE AND AIR CLEANER**
10. **FILL WITH ENGINE OIL**

Fill the engine with new oil, API grade SF or SF/CC multi-grade, fuel efficient and recommended viscosity oil.

Capacity:

Dry fill	4.8 liters (5.1 US qts. 4.2 Imp. qts)
Drain and refill	
w/o Oil filter change	3.8 liters (4.0 US qts, 3.3 Imp. qts)
w/ Oil filter change	4.3 liters (4.5 US qts, 3.8 Imp. qts)
11. **FILL WITH COOLANT**

(See step 3 on page CO-3)
12. **INSTALL ENGINE UNDER COVER**
13. **INSTALL AND ADJUST HOOD** (See page BO-3)
14. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**
15. **START ENGINE**

Warm up the engine and inspect for leaks.
16. **PERFORM ENGINE ADJUSTMENT**
17. **ROAD TEST**

Road test the vehicle.
18. **RECHECK COOLANT AND ENGINE OIL LEVEL**

22R**CYLINDER BLOCK****PREPARATION OF REMOVAL**

- 1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
- 2. REMOVE ENGINE UNDER COVER**
- 3. REMOVE ENGINE HOOD**
Disconnect the washer hose from the hood.
- 4. DRAIN COOLANT FROM RADIATOR AND CYLINDER BLOCK**
- 5. REMOVE AIR CLEANER**
 - (a) Disconnect air hoses No.1 and No.4 from the air cleaner.
 - (b) Remove the air cleaner.
- 6. REMOVE COUPLING FAN WITH FAN**
- 7. DISCONNECT TWO HEATER HOSES**
- 8. REMOVE RADIATOR WITH SHROUD**
 - (a) Disconnect the radiator upper and lower hoses from the engine.
 - (b) Disconnect the reservoir hose.
 - (c) Remove the radiator with the shroud.
- 9. DISCONNECT ACCELERATOR CABLE FROM CARBURETOR**
Disconnect the cable from carburetor and bracket.
- 10. DISCONNECT FOLLOWING WIRES:**
 - (a) VSV wire for EVAP
 - (b) VSV wire for A/C
 - (c) Vacuum switch wire
 - (d) (Ex. Calif.)
HAC wire
 - (e) Cold mixture heater wire
 - (f) Fuel cut solenoid wire
 - (g) Water temperature sender gauge wire
 - (h) (Calif.)
EACV wire
 - (i) Starter wire
 - (j) Oil pressure switch wire
- 11. DISCONNECT FOLLOWING PARTS:**
 - (a) Brake booster hose
 - (b) Fuel main hose from fuel inlet pipe
 - (c) Fuel return hose from fuel return pipe
 - (d) Charcoal canister hose
- 12. REMOVE DRIVE BELT**

REMOVAL OF CYLINDER BLOCK

(See page EM-54)

PREPARATION FOR DISASSEMBLY

(See page EM-57)

DISASSEMBLY OF CYLINDER BLOCK

(See page EM-58)

INSPECTION OF CYLINDER BLOCK

(See page EM-63)

DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLY

(See page EM-64)

INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLY

(See page EM-65)

REPLACEMENT OF ROD BUSHING

(See page EM-67)

INSPECTION AND REPAIR OF CRANKSHAFT

(See page EM-68)

REPLACEMENT OF REAR OIL SEAL

(See page EM-69)

BORING OF CYLINDERS

(See page EM-70)

ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLY

(See page EM-71)

INSTALLATION OF CRANKSHAFT, PISTON AND CONNECTING ROD ASSEMBLY

(See page EM-72)

ASSEMBLY OF CYLINDER BLOCK

(See page EM-74)

INSTALLATION OF ENGINE

(See page EM-75)

POST INSTALLATION OF CYLINDER BLOCK**1. CONNECT FOLLOWING WIRES:**

- (a) Starter wire
- (b) Oil pressure switch wire
- (c) (Ex. Calif.)
VCS wire
- (d) (Calif.)
EACV wire
- (e) Water temp. sender gauge wire
- (f) Fuel cut solenoid wire
- (g) Cold mixture heater wire
- (h) (Ex. Calif.)
HAC wire
- (i) Vacuum switch wire
- (j) (with A/C)
VSV wire
- (k) VSV wire for EVAP

2. CONNECT FOLLOWING PARTS:

- (a) Charcoal canister hose from the VSV
- (b) Fuel return hose from the fuel return pipe
- (c) Fuel main hose from the fuel inlet pipe
- (d) Brake booster hose

3. CONNECT ACCELERATOR CABLE TO CARBURETOR

- (a) Connect the cable to the carburetor and bracket.
- (b) Install the tension spring.

4. INSTALL RADIATOR WITH SHROUD

- (a) Install the radiator with the shroud.
- (b) Connect the reservoir hose.
- (c) Connect the radiator upper and lower hoses to the engine.

5. INSTALL COUPLING FAN WITH FAN**6. CONNECT TWO HEATER HOSES****7. INSTALL AIR CLEANER**

- (a) Connect No.1 and No.4 air hoses to the cleaner.
- (b) Install the air cleaner.

8. FILL WITH ENGINE OIL

Fill the engine with new oil, API grade SF or SF/CC multi-grade, fuel efficient and recommended viscosity oil.

Capacity:**Dry fill**

4.8 liters (5.1 US qts, 4.2 Imp. qts)

Drain and refill**w/o Oil filter change**

3.8 liters (4.0 US qts, 3.3 Imp. qts)

w/ Oil filter change

4.3 liters (4.5 US qts, 3.8 Imp. qts)

9. FILL WITH COOLANT

Close the radiator and engine drain cocks and fill with coolant.

Total capacity (w/ Heater):

8.4 liters (8.9 US qts, 7.4 Imp. qts)

10. INSTALL ENGINE UNDER COVER**11. INSTALL AND ADJUST HOOD (See page BO-2)****12. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY****13. START ENGINE**

Warm up the engine and inspect for leaks.

14. PERFORM ENGINE ADJUSTMENT**15. ROAD TEST**

Road test the vehicle.

16. RECHECK COOLANT AND ENGINE OIL LEVEL

