

ENGINE MECHANICAL

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EM

TROUBLESHOOTING (22R-E)

ENGINE OVERHEATING

Problem	Possible cause	Remedy	Page
Engine overheats	Cooling system faulty Incorrect ignition timing	Troubleshoot cooling system Reset timing	CO-2 IG-10

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 wires 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 Compression low	Troubleshoot EFI system Repair as necessary Perform spark test Inspect coil Inspect igniter Inspect distributor Inspect plugs Inspect wires Repair as necessary Repair as necessary Check compression	FI-9 IG-5,7 IG-6,8 IG-9 IG-4 IG-4 EM-11

ROUGH IDLING

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses	Spark plugs faulty	Inspect plugs	IG-4
	High tension wires faulty	Inspect wires	IG-4
	Ignition problems <ul style="list-style-type: none"> • Ignition coil • Igniter • Distributor 	Inspect coil Inspect igniter Inspect distributor	IG-5,7 IG-6,8 IG-9,10
	Incorrect ignition timing	Reset timing	IG-10
	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 idle speed	Adjust idle	MA-8
	EFI system problems	Repair as necessary	

ROUGH IDLING (CONT'D)

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses (cont'd)	Engine overheats Compression low Incorrect valve clearance	Check cooling system Check compression Adjust valve clearance	CO-2 EM-11 MA-7

ENGINE HESITATES/POOR ACCELERATION

Problem	Possible cause	Remedy	Page
Engine hesitates/ Poor acceleration	Spark plugs faulty High tension wires faulty Vacuum leaks <ul style="list-style-type: none"> • PCV hoses • EGR valve • Intake manifold • Air intake chamber • Throttle body 	Inspect plugs Inspect wires Repair as necessary	IG-4 IG-4
	Pulling in air between air flow meter and throttle body Incorrect ignition timing Fuel system clogged Air cleaner clogged EFI system problems Emission control system problem (cold engine) <ul style="list-style-type: none"> • EGR system always on 	Repair as necessary Reset timing Check fuel system Check air cleaner Repair as necessary	IG-10
	Engine overheats Compression low	Check EGR system Check cooling system Check compression	CO-2 EM-11

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-74
Muffler explosion (after fire) all the time	Air cleaner clogged EFI system problem Incorrect ignition timing Incorrect valve clearance	Check air cleaner Repair as necessary Reset timing Adjust valve clearance	IG-10 MA-7

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 Pulling in air between air flow meter and throttle body Insufficient fuel flow Incorrect ignition timing Incorrect valve clearance Carbon deposits in combustion chambers	Repair as necessary Check hoses and repair as necessary Repair as necessary Troubleshoot fuel system Reset timing Adjust valve clearance Inspect cylinder head	FI-9 IG-10 MA-7 EM-18

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	EM-57 EM-19

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 Spark plugs faulty EGR system always on Compression low Tires improperly inflated Clutch slips Brakes drag	Repair as necessary Check air cleaner Reset timing Repair as necessary Inspect plugs Check EGR system Check compression Inflate tires to proper pressure Troubleshoot clutch Troubleshoot brakes	MA-5 IG-10 IG-4 EM-11 FA-3 CL-2 BR-2
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 EFI system problems	Adjust idle Reset timing Repair as necessary Repair as necessary	MA-8 IG-10

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-10

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 Ignition wiring disconnected or broken Vacuum leaks <ul style="list-style-type: none"> • PCV line • EGR line • MC line • Intake manifold • CMH Compression low	Troubleshoot fuel system Repair as necessary Perform spark test Inspect coil Inspect igniter Inspect distributor Inspect plugs Inspect wiring Repair as necessary Check compression	FU-2 FU-4 IG-4 IG-5,7 IG-6,8 IG-9,10 IG-4 IG-4 EM-11

ROUGH IDLING

Problem	Possible cause	Remedy	Page
Rough idle or stalls	Spark plugs faulty Ignition wiring 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 wiring Repair as necessary Reset timing Perform spark test Inspect coil Inspect igniter Inspect distributor	IG-4 IG-4 IG-10 IG-4 IG-5,7 IG-6,8 IG-9,10

ROUGH IDLING (CONT'D)

Problem	Possible cause	Remedy	Page
Rough idle or stalls	Carburetor problems	Perform on-vehicle inspection of carburetor	FU-3
	• 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		
	HAI system faulty	Check compression	EC-53
	Engine overheats	Troubleshoot cooling system	CO-2
	EGR valve faulty	Check EGR valve	EC-30
	MC valve faulty	Check MC valve	EC-26
	Incorrect valve clearance	Adjust valve clearance	MA-7
	Compression low	Check compression	EM-11

ENGINE HESITATES/POOR ACCELERATION

Problem	Possible cause	Remedy	Page
Engine hesitates/ Poor acceleration	Spark plugs faulty	Inspect plugs	IG-4
	Ignition wiring faulty	Inspect wiring	IG-4
	Vacuum leaks	Repair as necessary	
	• PCV line		
	• EGR line		
	• HAC line		
	• Intake manifold		
	• CMH		
	• MC		
	Incorrect ignition timing	Reset timing	IG-10
	Air filter clogged	Check air filter	MA-5
	Fuel line clogged	Check fuel line	
	Carburetor problems	Repair as necessary	FU-4
	• 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		
	• HAI system always on (hot engine)	Check HAI system	EC-53
	• AAP system faulty	Check AAP system	EC-61
	• EGR system always on (cold engine)	Check EGR system	EC-30
	• HAC system faulty	Check HAC system	EC-48
	Engine overheats	Check cooling system	CO-2
	Compression low	Check compression	EM-11

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-10 EC-30

AFTER FIRE, BACKFIRE

Problem	Possible cause	Remedy	Page
Muffler explosion (after fire) on deceleration only	AS system faulty	Check AS system	EC-43
	MC system faulty	Check MC system	EC-26
	Deceleration fuel cut system always off	Check fuel cut system	EC-63
Muffler explosion (after fire) all the time	Air filter clogged	Check air filter	MA-5
	Choke system faulty	Check choke	EC-55
	Incorrect ignition timing	Reset timing	IG-10
	Incorrect valve clearance	Adjust valves clearance	MA-7
Engine backfires	Choke valve open (cold engine)	Check choke system	EC-55
	Carburetor vacuum leak	Check hoses and repair as necessary	
	Insufficient fuel flow	Troubleshoot fuel system	FU-2
	Incorrect ignition timing	Reset timing	IG-10
	Incorrect valve clearance	Adjust valve clearance	MA-7
	Carbon deposits in combustion chambers	Inspect cylinder head	EM-18

EXCESSIVE OIL CONSUMPTION

Problem	Possible cause	Remedy	Page
Excessive oil consumption	Oil leak	Repair as necessary	
	PCV line clogged	Check PCV system	EC-19
	Piston ring worn or damaged	Check rings	EM-57
	Valve stem and guide worn	Check valves and guides	EM-19
	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 Inspect plugs EGR system always on Compression low 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-10 FU-4 IG-4 EC-30 EM-11 FA-3 CL-2 BR-2

ENGINE TUNE-UP

1. INSPECT ENGINE OIL LEVEL
2. INSPECT AIR CLEANER (See page MA-5)
3. INSPECT SPARK PLUGS (See page IG-4)
4. INSPECT VALVE CLEARANCE (See page MA-7)
Valve clearance: Intake 0.20 mm (0.008 in.)
Exhaust 0.30 mm (0.012 in.)
5. INSPECT IGNITION TIMING (See step 3 on page IG-10)
Ignition timing:
22R 0° TDC @ Max. 950 rpm
(w/vacuum advancer OFF)
22R-E 5° BTDC (w/short terminal "T")
6. INSPECT CARBURETOR FLOAT LEVEL
(with Carburetor)
(See step 3 on page FU-3)
7. INSPECT FAST IDLE SPEED
(with Carburetor)
(See step 15 on page MA-9)
8. ADJUST IDLE SPEED (See page MA-8)
Idle speed: with EFI
750 rpm
with carburetor
700 rpm for M/T
750 rpm for A/T

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.

- (i) Carburetor fuel level about even with correct level in the sight glass
- (j) Tachometer and HC/CO meter calibrated and at hand

PRECHECK

INITIAL CONDITIONS

- (a) Normal engine operating temperature
- (b) Choke fully open (with carburetor)
- (c) Air cleaner installed
- (d) All pipe and hoses of air intake system connected (with EFI)
- (e) All accessories switched off
- (f) All vacuum lines properly connected
- (g) EFI system wiring connectors fully plugged.
- (h) Idle speed set correctly

MEASUREMENT

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

2. 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.

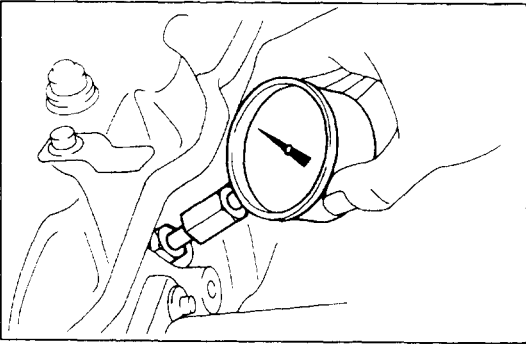
TROUBLESHOOTING

HC	CO	Problems	Causes
High	Normal	Rough idle	1. Faulty ignition: <ul style="list-style-type: none"> • Incorrect timing • Fouled, shorted or improperly gapped plugs • Open or crossed ignition wires • Cracked distributor cap 2. Incorrect valve clearance 3. Leaky EGR valve 4. Leaky exhaust valves 5. Leaky cylinder
High	Low	Rough idle Fluctuating HC reading	1. Vacuum leak: <ul style="list-style-type: none"> • Vacuum hose • Intake manifold • Air chamber (with EFI) • PCV line • Carburetor base (with carburetor) • Throttle body (with EFI) • CMH (with carburetor) 2. Leaky MC valve (with carburetor)
High	High	Rough idle Black smoke from exhaust	1. Restricted air filter 2. Plugged PCV valve 3. AS system problem (with carburetor) 4. Faulty carburetion: (with carburetor) <ul style="list-style-type: none"> • Faulty choke action • Incorrect float setting • Leaking needle or seat • Leaking power valve 5. Faulty EFI system: (with EFI) <ul style="list-style-type: none"> • Faulty pressure regulator • Clogged fuel return line • Faulty air flow meter • Defective water thermo sensor • Defective air thermo sensor • Faulty EFI computer • 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 FOUR SPARK PLUGS**
3. **DISCONNECT HIGH TENSION WIRE FROM IGNITION COIL**



4. **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: 12 kg/cm² (171 psi, 1,177 kPa)

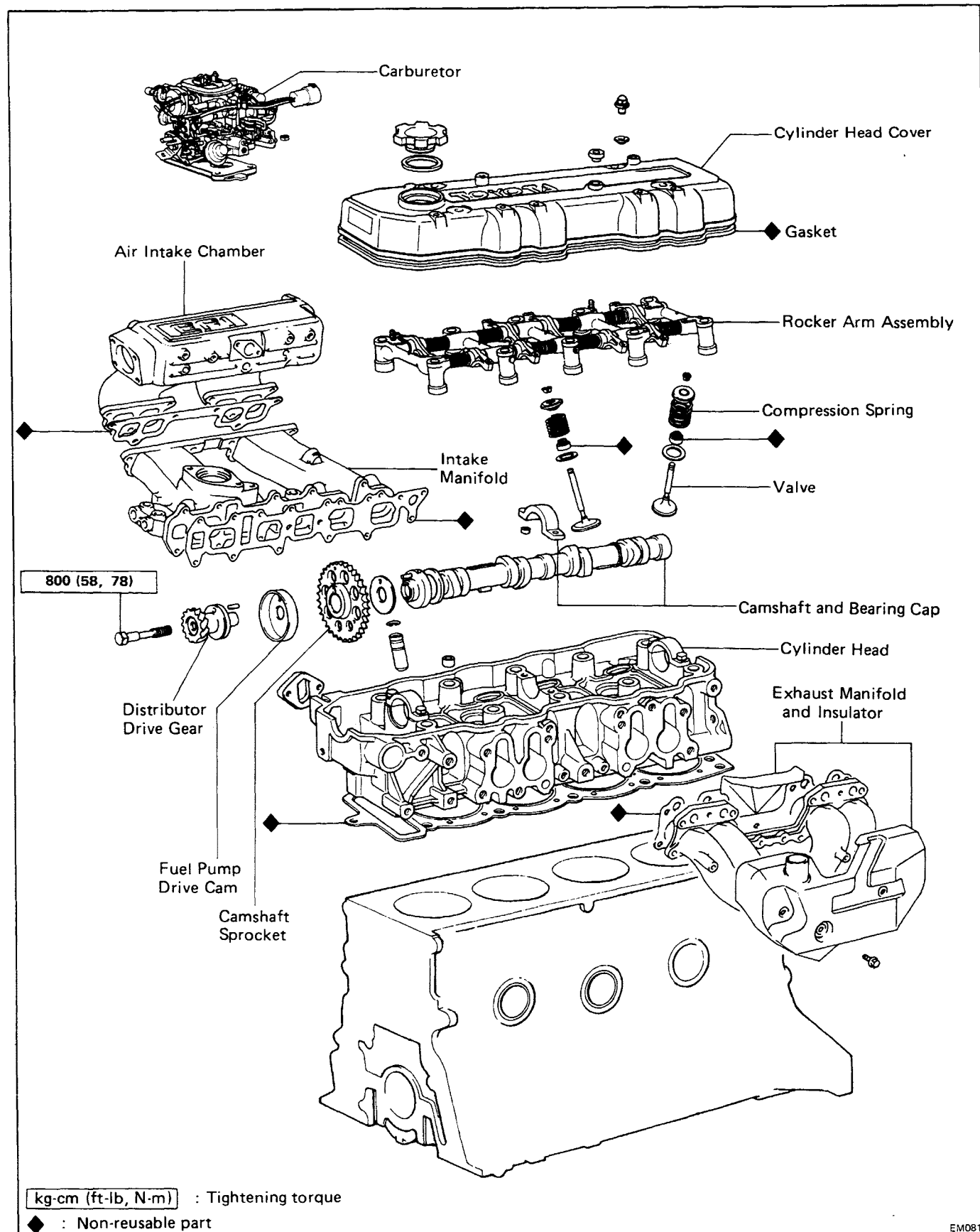
Minimum pressure: 10 kg/cm² (142 psi, 981 kPa)

Difference between each cylinder:

Less than 1.0 kg/cm² (14 psi, 98 kPa)

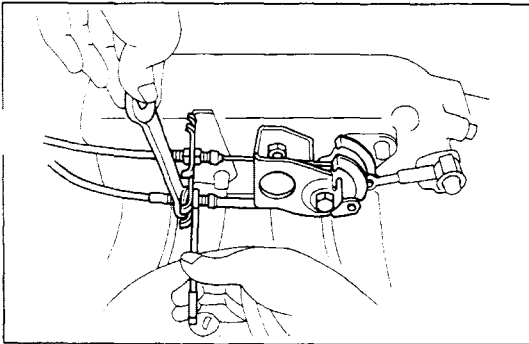
- (e) If cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for the low compression cylinder.
 - If adding oil helps the compression, chances are that the piston rings and/or cylinder bore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

CYLINDER HEAD COMPONENTS

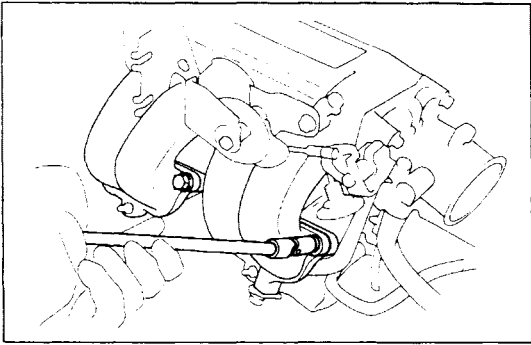


22R-E**PREPARATION FOR REMOVAL**

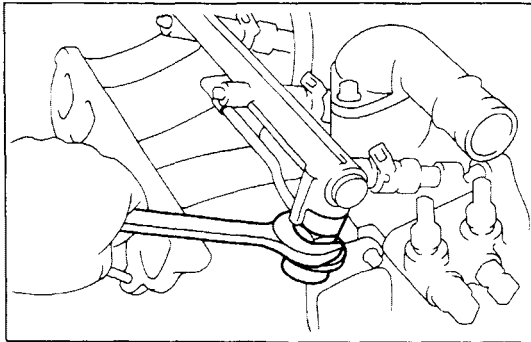
1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
2. **DRAIN COOLANT FROM RADIATOR AND CYLINDER BLOCK**
3. **DRAIN ENGINE OIL**
4. **REMOVE AIR CLEANER HOSE**
5. **DISCONNECT EXHAUST PIPE FROM EXHAUST MANIFOLD**
 - (a) Disconnect the Ox sensor wire.
 - (b) Remove three nuts holding exhaust manifold to the exhaust pipe.
6. **DISCONNECT RADIATOR UPPER HOSE FROM THERMOSTAT HOUSING**
7. **DISCONNECT TWO HEATER HOSES**
8. **DISCONNECT ACCELERATOR CABLE**



- Disconnect the accelerator cable and throttle cable for A/T from the bracket.
9. **DISCONNECT FOLLOWING PARTS:**
 - (a) PCV hoses No.1 and No.2
 - (b) Brake booster hose
 - (c) Air control valve hoses
 - (d) EVAP hose (from canister)
 - (e) Actuator hose (with cruise control)
 - (f) EGR vacuum modulator hose
 - (g) Air valve hose No.1 from the throttle body
 - (h) Air valve hose No.2 from the chamber
 - (i) Water by-pass hoses No.2 and No.3 from the throttle body
 - (j) Air control valve hose for actuator
 - (k) Pressure regulator hose from the chamber
 - (l) Cold start injection pipe
 - (m) BVSV hoses
 10. **DISCONNECT FOLLOWING WIRES:**
 - (a) Cold start injection wire
 - (b) Throttle position wire
 - (c) Air valve wire

**11. REMOVE CHAMBER WITH THROTTLE BODY**

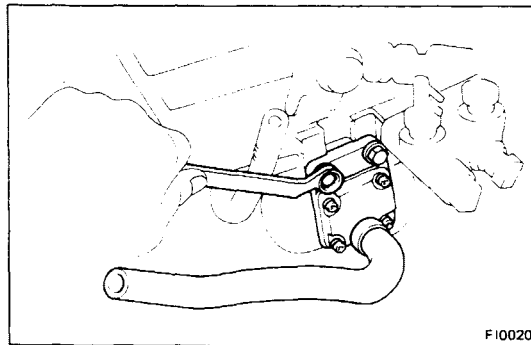
- (a) Remove the bolt holding the EGR valve to the chamber.
- (b) Disconnect the chamber and stay.
- (c) Remove the bolts and nuts holding the chamber to the intake manifold.
- (d) Remove the chamber with the throttle body.

**12. DISCONNECT FOLLOWING WIRES:**

- (a) Water temperature sender gauge wire
- (b) Temperature sensor wire
- (c) Start injection time switch wire
- (d) OD thermo switch wire (with A/T)
- (e) Injection wires

13. DISCONNECT FUEL HOSE FROM DELIVERY PIPE

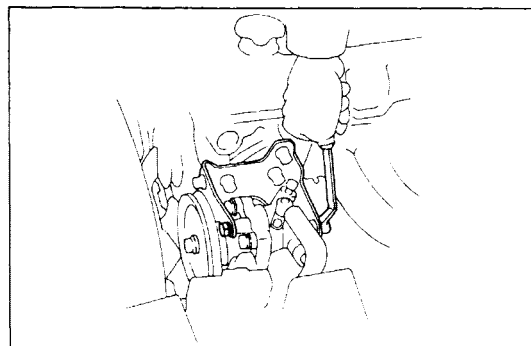
- (a) Remove the pulsation damper.
- (b) Remove the bolt holding the fuel hose to the delivery pipe.
- (c) Disconnect the fuel hose from the delivery pipe.

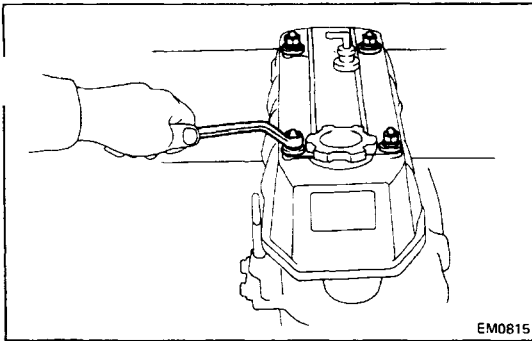
**14. REMOVE AIR VALVE FROM INTAKE MANIFOLD**

- (a) Disconnect the No.4 by-pass hose.
- (b) Remove the air valve from intake manifold.

15. DISCONNECT BY-PASS HOSE FROM INTAKE MANIFOLD**16. REMOVE DISTRIBUTOR AND SPARK PLUGS****17. DISCONNECT BOND CABLE FROM VANE PUMP BRACKET****18. IF VEHICLE HAS POWER STEERING, REMOVE VANE PUMP WITH BRACKET**

- (a) Disconnect the vacuum hose from the air control valve.
- (b) Loosen and remove the drive belt.
- (c) Remove the vane pump to one side without disconnecting the hoses.

19. DISCONNECT BOND CABLE ON REAR SIDE

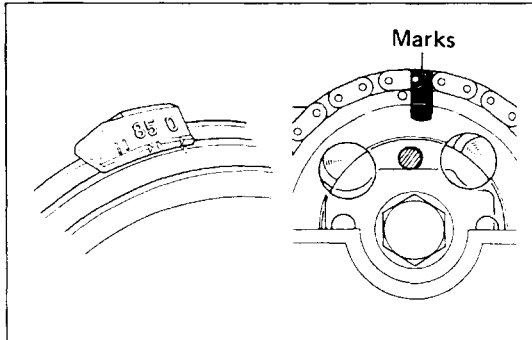


REMOVAL OF CYLINDER HEAD

1. REMOVE HEAD COVER

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

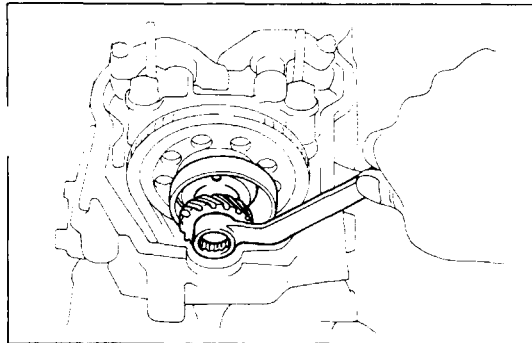
CAUTION: Cover the oil return hole in the head with a rag to prevent objects from falling in.



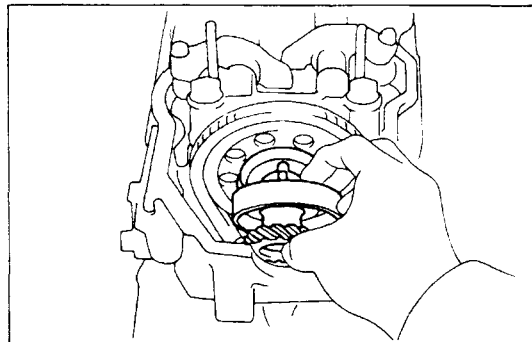
2. REMOVE CAM SPROCKET BOLT

- (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 semi-circular plug.

- (d) Remove the cam sprocket bolt.

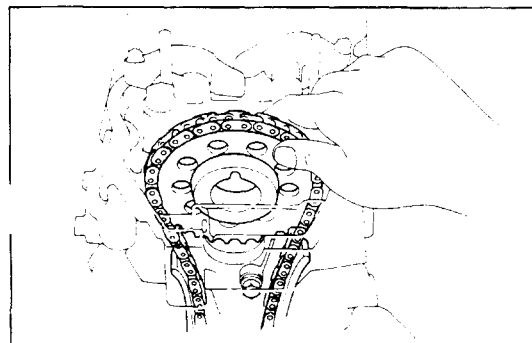


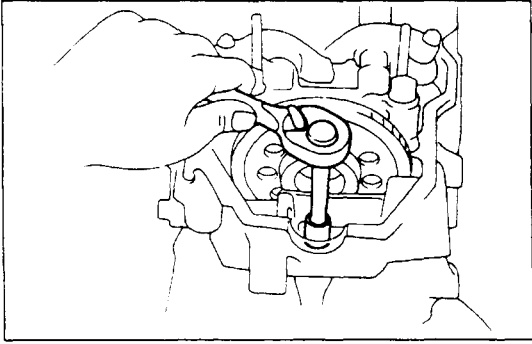
3. REMOVE DISTRIBUTOR DRIVE GEAR AND FUEL PUMP DRIVE CAM (22R) or CAMSHAFT THRUST PLATE (22R-E)



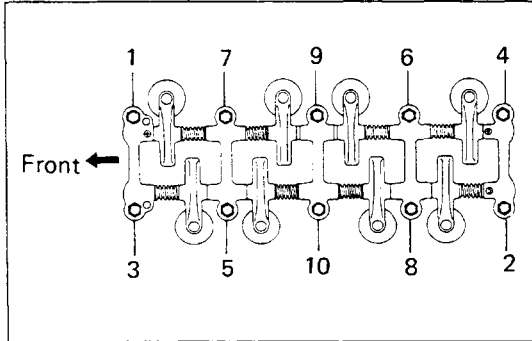
4. REMOVE CAM SPROCKET

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

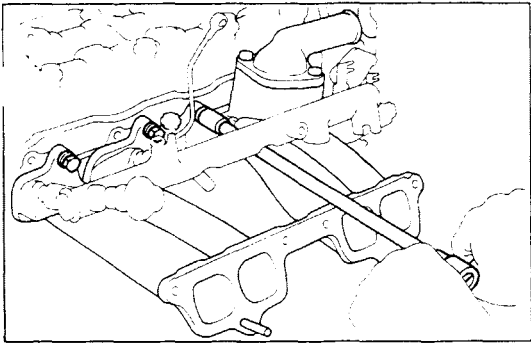
It may be necessary to use a pry bar on the front and rear of the rocker arm assembly to separate it from the head.

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.

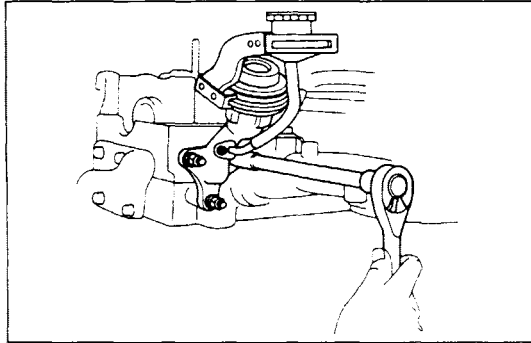


DISASSEMBLY OF CYLINDER HEAD

(See page EM-12)

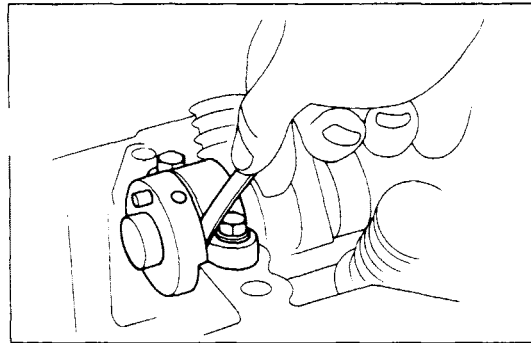
1. REMOVE INTAKE MANIFOLD WITH DELIVERY PIPE AND INJECTION NOZZLE

- (a) Remove the six bolts, one hexagon bolt and two nuts.
- (b) Remove the intake manifold together with the delivery pipe and the injection nozzles.



2. REMOVE EGR VALVE WITH VACUUM MODULATOR FROM CYLINDER HEAD

3. REMOVE EXHAUST MANIFOLD FROM CYLINDER HEAD



4. MEASURE CAMSHAFT THRUST CLEARANCE

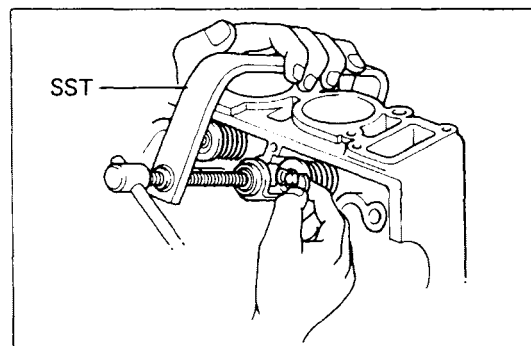
Using a feeler gauge, measure the camshaft thrust clearance between the thrust bearing and camshaft.

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

Maximum clearance: 0.25 mm (0.010 in.)

Standard clearance: 0.08 — 0.18 mm
(0.003 — 0.007 in.)

5. REMOVE CAM BEARING CAPS AND SHAFT

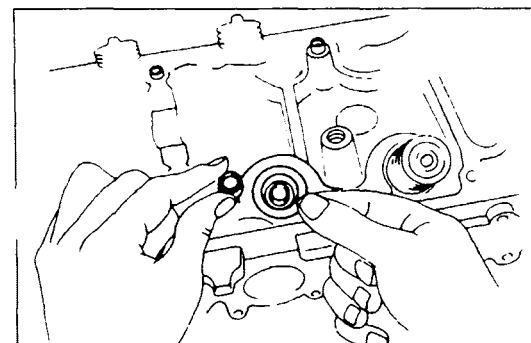


6. REMOVE VALVES

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

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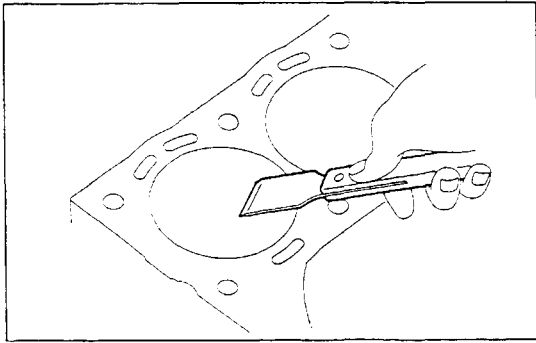
- (b) Remove the valve keepers, retainers, springs and valves.



- (c) Remove the valve seals.

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

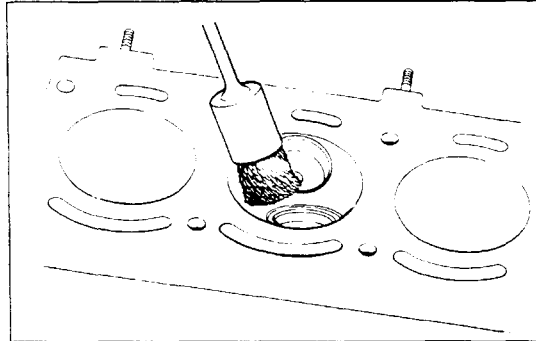
NOTE: Keep the valves arranged so they can be installed in the same order as removed.



INSPECTION AND CLEANING OF CYLINDER HEAD COMPONENTS

1. CLEAN TOP OF PISTONS AND TOP OF BLOCK

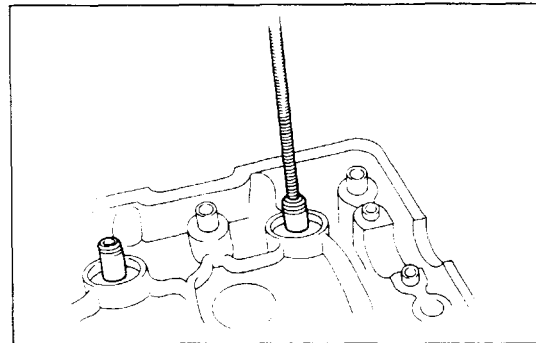
- Turn the crankshaft and bring each piston to top dead center. Scrape the carbon from the piston top.
- Remove all gasket material from the top of the block. Blow carbon and oil from the bolt holes.



2. CLEAN COMBUSTION CHAMBER

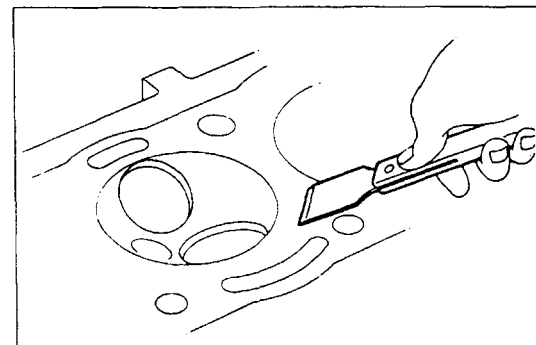
Using a wire brush, remove all the carbon from the combustion chambers.

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



3. CLEAN VALVE GUIDES

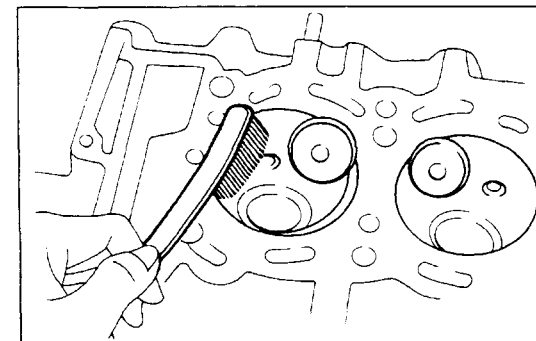
Using a valve guide brush and solvent, clean all valve guides.



4. REMOVE GASKET MATERIAL

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

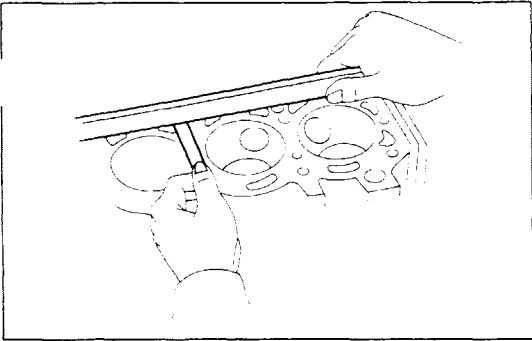
CAUTION: Do not scratch the surfaces.



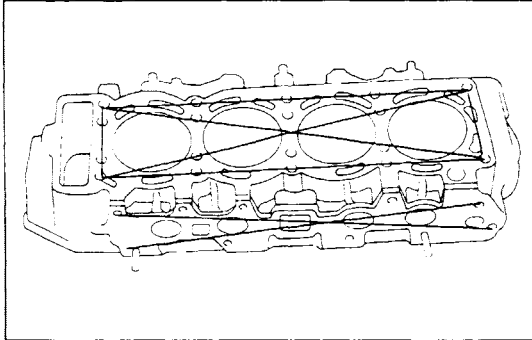
5. CLEAN CYLINDER HEAD

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.

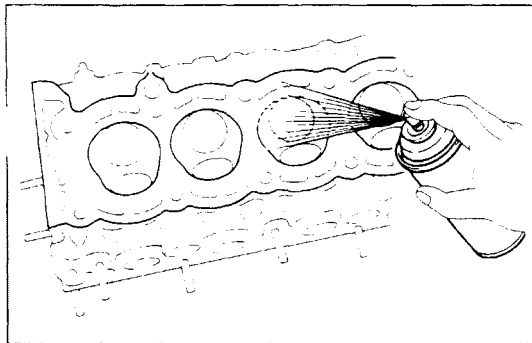


- (b) Measure warpage along the four edges and diagonally as illustrated.

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

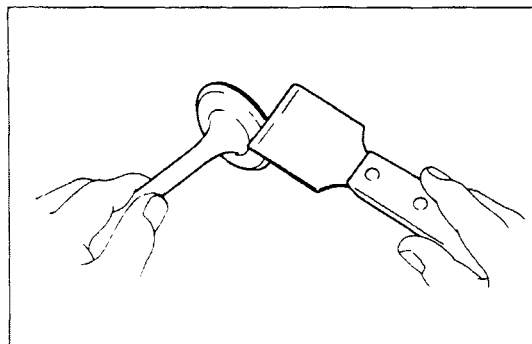
Maximum head surface warpage: 0.15 mm (0.0059 in.)

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

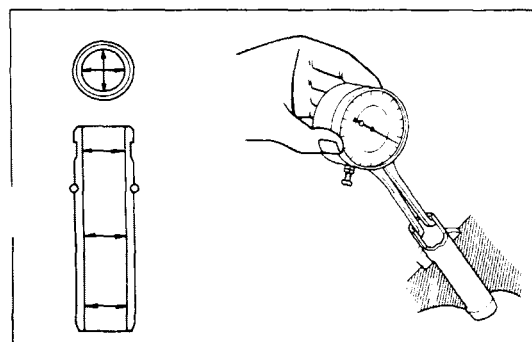
**7. INSPECT CYLINDER HEAD FOR CRACKS**

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

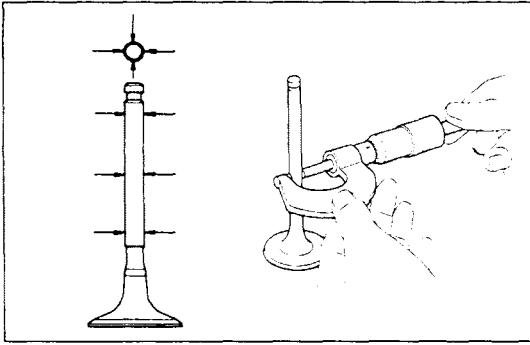
If a crack is found, replace the head.

**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.

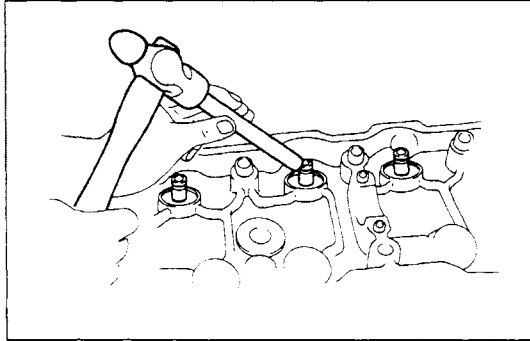


- (b) Using a micrometer, measure the diameter of the valve stem.
- (c) Subtract the valve stem measurement from the valve guide measurement.

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

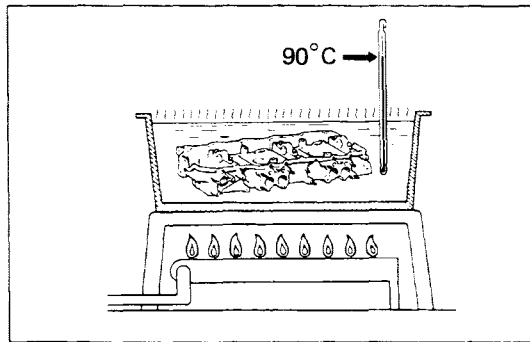
Maximum intake clearance: 0.08 mm (0.0031 in.)

Maximum exhaust clearance: 0.10 mm (0.0039 in.)

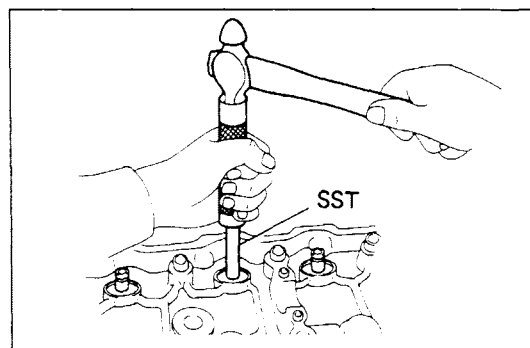


10. IF NECESSARY, REPLACE VALVE GUIDE

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



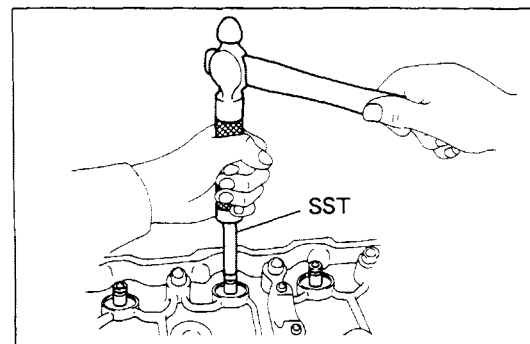
- (b) Heat the cylinder head to about 90°C (194°F).



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

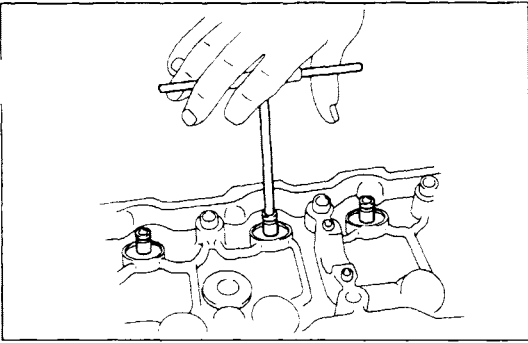
SST 09201-60011

- (d) Heat the cylinder head to about 90°C (194°F).



- (e) Using SST and hammer, drive in a new valve guide until the snap ring makes contact with the cylinder head.

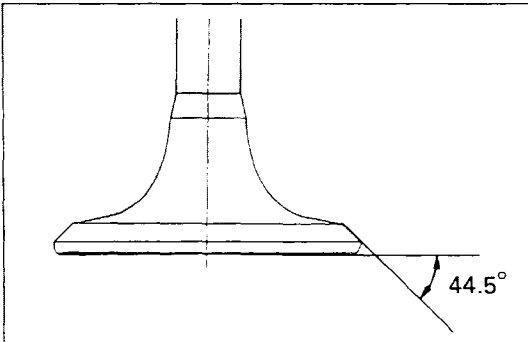
SST 09201-60011



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

Intake clearance: 0.02 — 0.06 mm (0.0008 — 0.0024 in.)

Exhaust clearance: 0.03 — 0.07 mm (0.0012 — 0.0028 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.

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

Minimum margin: 0.6 mm (0.024 in.)

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

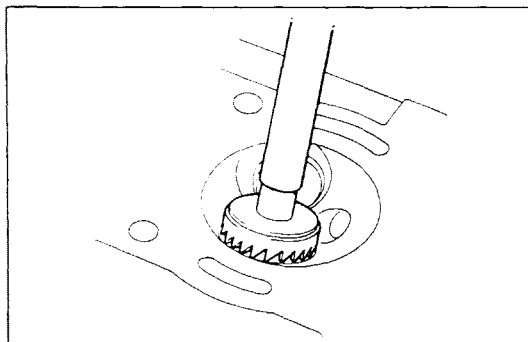
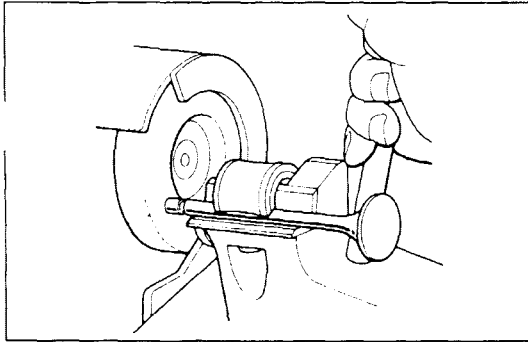
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

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

Standard overall length:

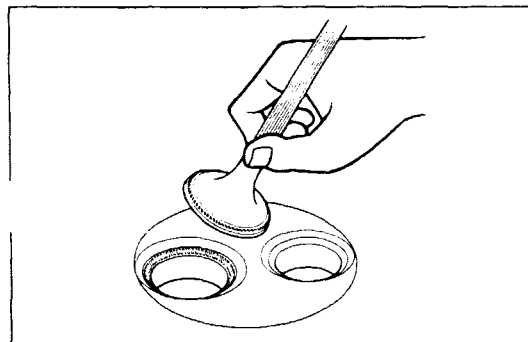
Intake 113.5 mm (4.468 in.)

Exhaust 112.4 mm (4.425 in.)



12. INSPECT AND CLEAN VALVE SEATS

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

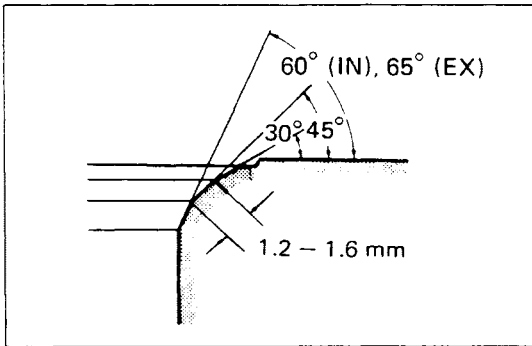


- (b) Check the valve seating position.

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.



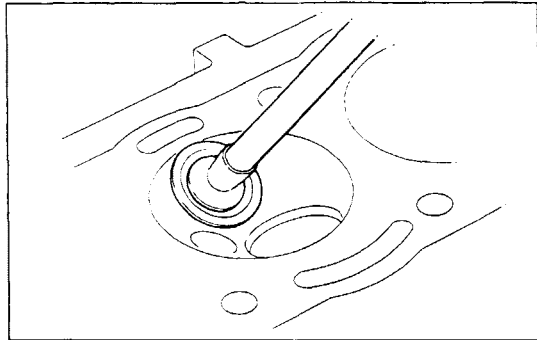
- Check that the seat contact is on the middle of the valve face with the following width:

1.2 – 1.6 mm (0.047 – 0.063 in.)

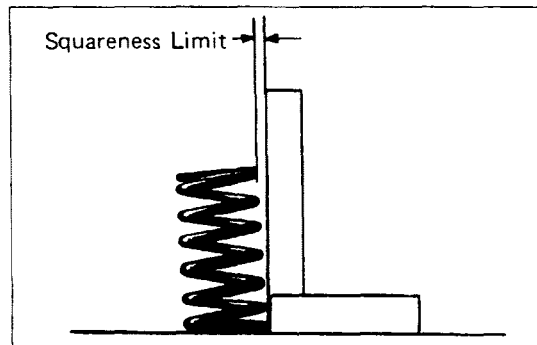
If not, correct the valve seat as follows:

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.



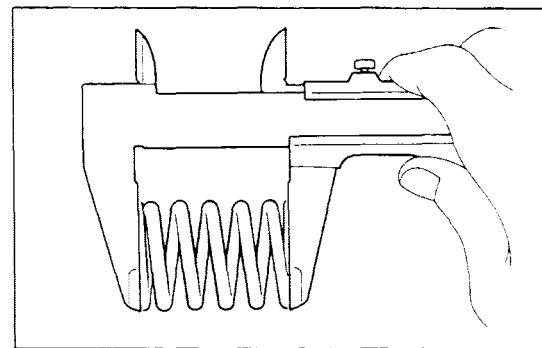
- Hand-lap the valve and valve seat together with abrasive compound.
- Clean the valve and valve seat after hand-lapping.



13. INSPECT VALVE SPRINGS

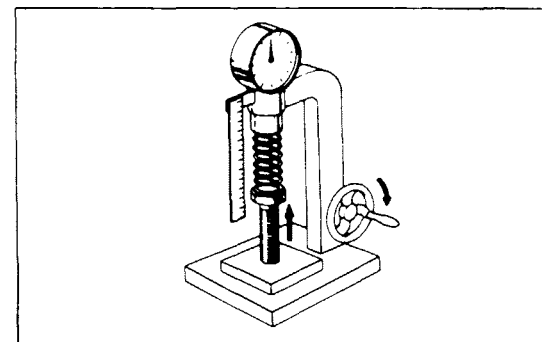
- Using a steel square, check the squareness of the valve springs. If a spring is out of square more than the maximum allowable, replace the spring.

Maximum allowable: 1.6 mm (0.063 in.)



- Measure the free height of all springs. Replace any spring that is not correct.

Free height: 48.5 mm (1.909 in.)

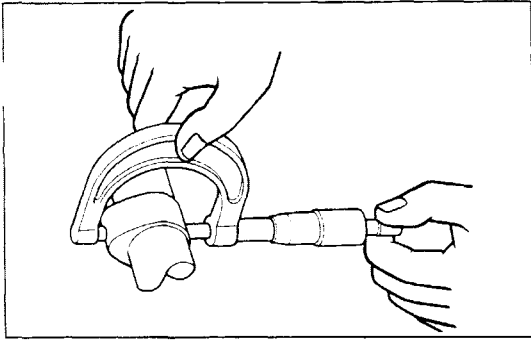


- Using a spring tester, check the tension of each spring at the specified installed height.

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

Installed height: 40.5 mm (1.594 in.)

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

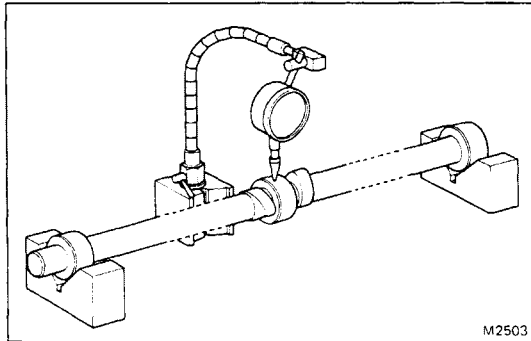
**14. INSPECT CAMSHAFT AND BEARING CAPS**

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

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

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

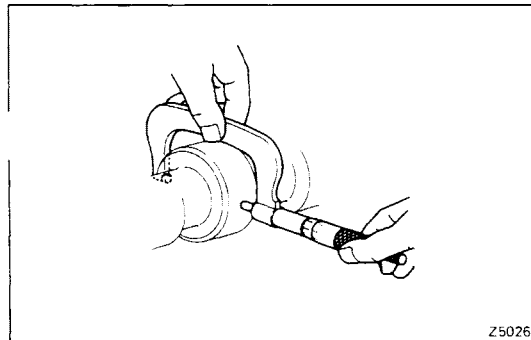
Minimum exhaust lobe height: 42.69 — 42.78 mm
(1.6807 — 1.6842 in.)



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

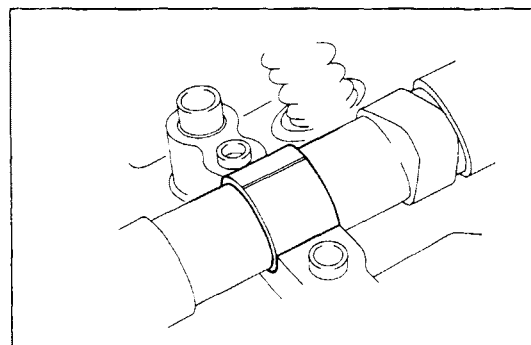
If the runout is greater than the maximum allowable, replace the camshaft.

Maximum circle runout: 0.2 mm (0.008 in.)



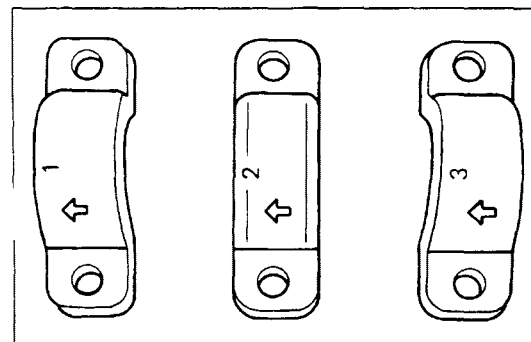
(c) Using a micrometer, measure the journal diameter.

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



(d) Measure the camshaft journal oil clearance.

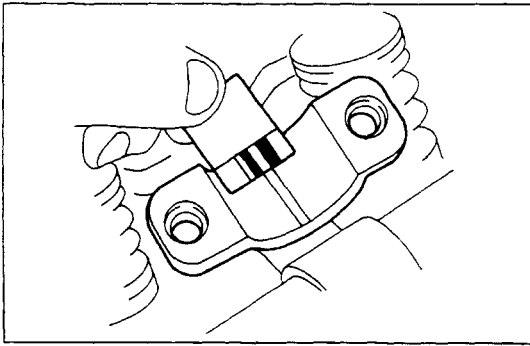
- Clean the bearing caps and camshaft journal.
- Lay a strip of Plastigage across each journal.



- 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.

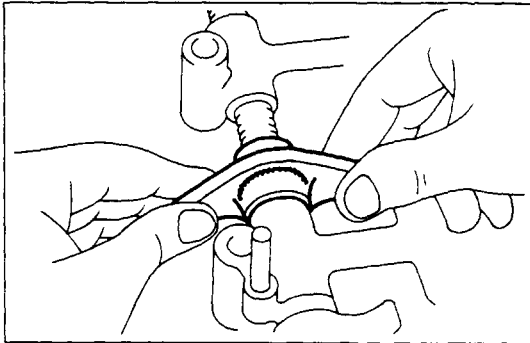


- Remove the caps. Measure the Plastigage at its widest point.

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

Maximum clearance: 0.1 mm (0.004 in.)
Standard clearance: 0.01 — 0.05 mm
 (0.0004 — 0.0020 in.)

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



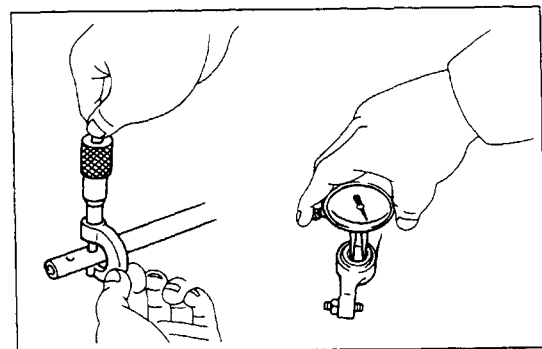
15. INSPECT ROCKER ARMS

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.



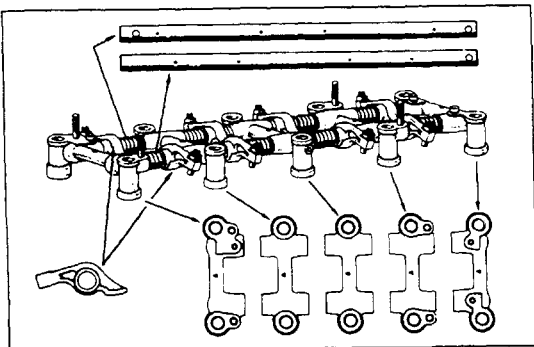
- (b) Using a dial indicator, measure the inside diameter of the rocker arm. Using a micrometer, measure the outside diameter of the shaft. Subtract the shaft diameter from the rocker arm diameter.

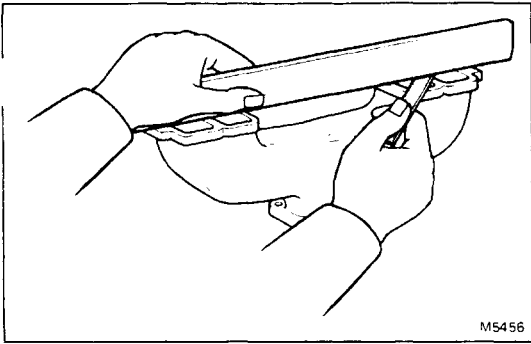
If the oil clearance is not within specification, replace the rocker arm and/or shaft.

Maximum oil clearance: 0.08 mm (0.0031 in.)

- (c) 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.





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16. INSPECT INTAKE 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: 0.20 mm (0.0079 in.)

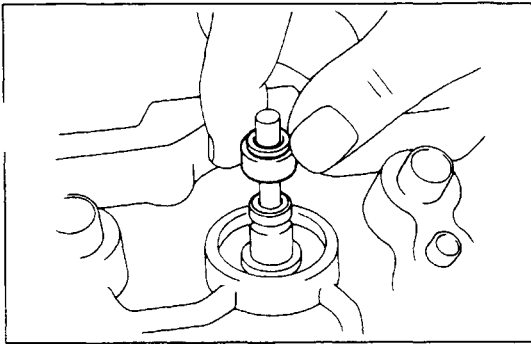
Maximum exhaust warpage: 0.70 mm (0.0276 in.)

ASSEMBLY OF CYLINDER HEAD

(See page EM-12)

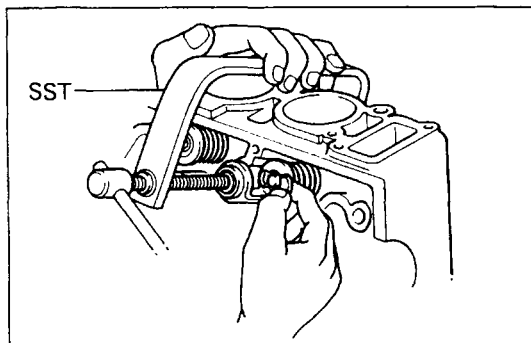
NOTE:

- 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.



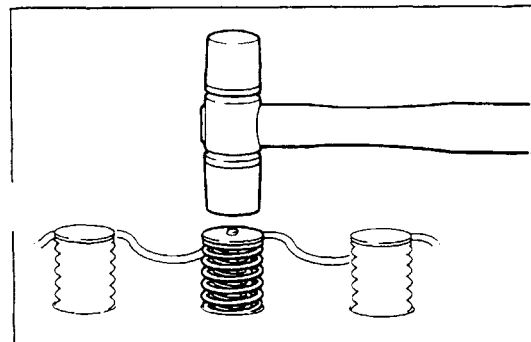
1. INSTALL VALVES

- 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 seals.

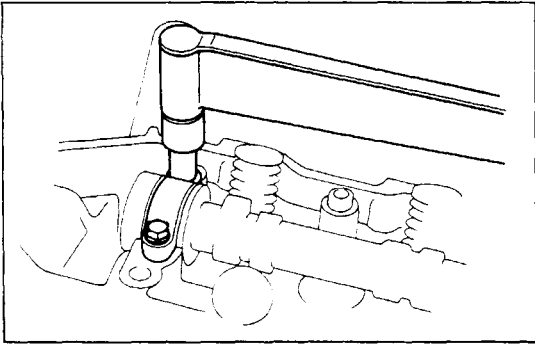


- Install springs and spring retainers on the valves.
- Using SST, compress valve retainers and place two keepers around the valve stem.

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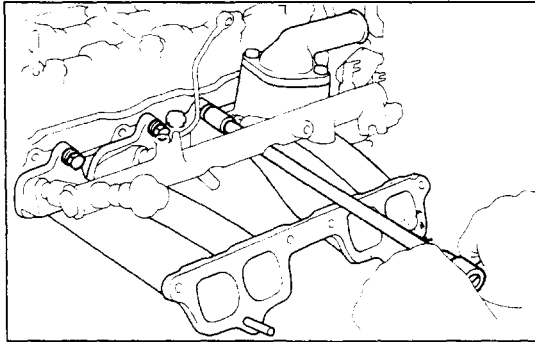


- Tap the stem lightly to assure proper fit.

**2. INSTALL CAMSHAFT**

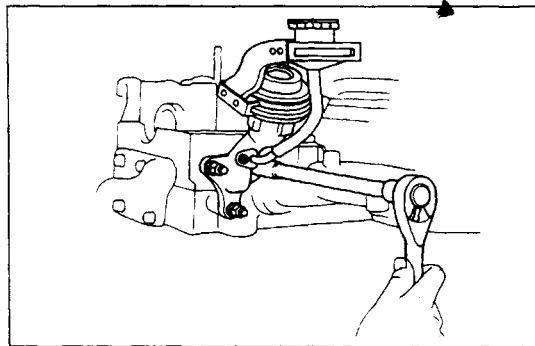
- (a) Place the camshaft in the cylinder head and install the bearing caps in numbered order from the front w arrows pointing toward the front.
- (b) Install and torque the cap bolts.

Torque: 200 kg-cm (14 ft-lb, 20 N·m)

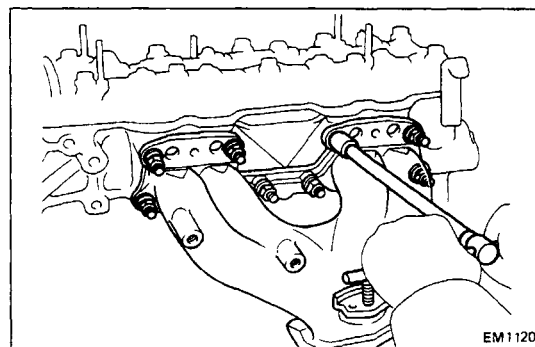
**3. INSTALL INTAKE MANIFOLD**

- (a) Position a new gasket on the cylinder head.
- (b) Install the intake manifold with the delivery pipe and injection nozzles.
- (c) Install the six bolts, one hexagon bolt and two nuts. Torque the bolts and nuts.

Torque: 195 kg-cm (14 ft-lb, 19 N·m)

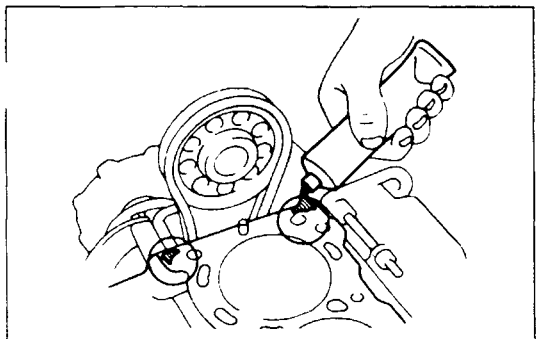
**4. INSTALL EGR VALVE WITH VACUUM MODULATOR**

- (a) Position a new gasket on the cylinder head.
- (b) Apply a sealer to the upper right bolt.
- (c) Place the EGR with vacuum modulator valve in the installed position and tighten the two bolts on the intake manifold side of EGR pipe.
- (d) Install the vacuum hose to the top of the EGR valve.

**5. 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)



INSTALLATION OF CYLINDER HEAD

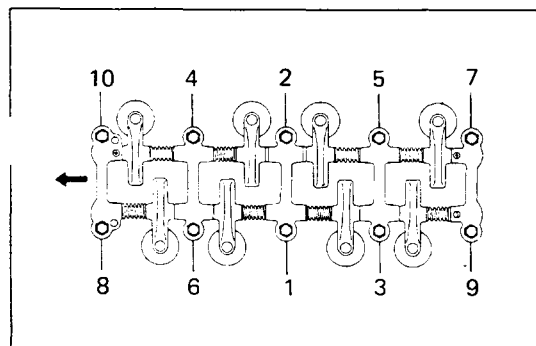
(See page EM-12)

1. APPLY SEALER TO CYLINDER BLOCK

- (a) Apply liquid sealer to two locations as shown.
- (b) Place a new head gasket over dowels on the cylinder block.

2. INSTALL CYLINDER HEAD

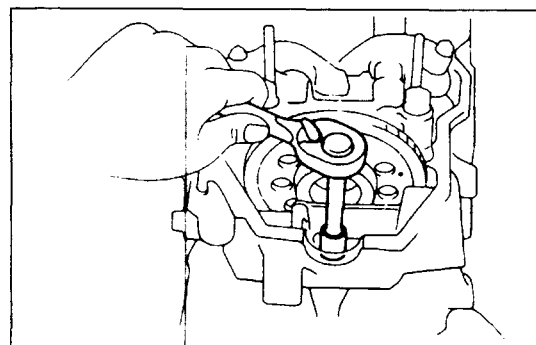
- (a) If the sprocket was removed, align the alignment marks placed on the sprocket and chain during removal.
- (b) Position the cylinder head over dowels on the block.



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.

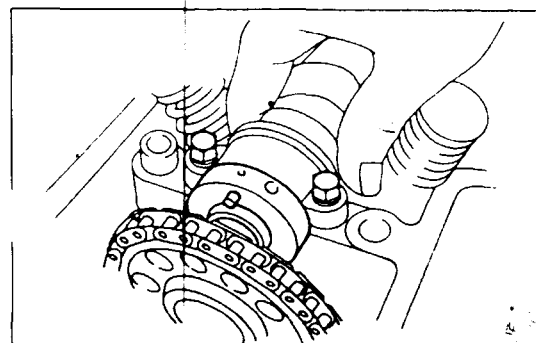
Torque: 800 kg-cm (58 ft-lb, 78 N·m)



4. INSTALL CHAIN COVER BOLT

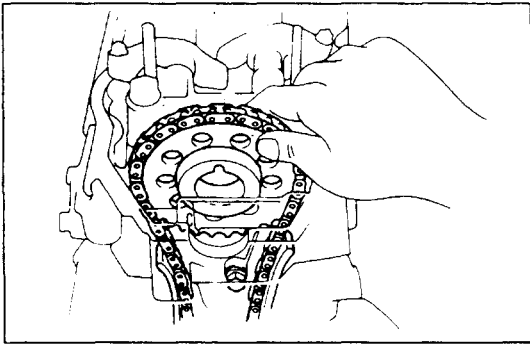
Torque the bolt.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)

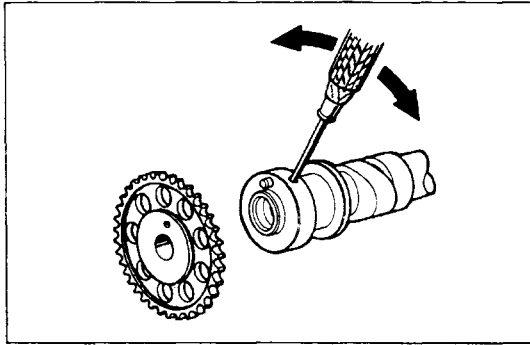


5. INSTALL CAM SPROCKET ON CAMSHAFT

- (a) Turn the camshaft to position the dowel at the top.

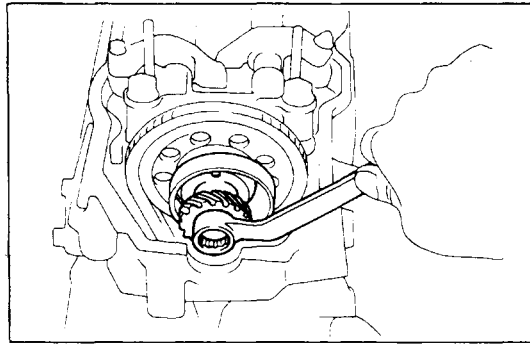


- (b) While holding up on the sprocket and chain, turn the crankshaft until the No.1 and No.4 cylinders are at top dead center.



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

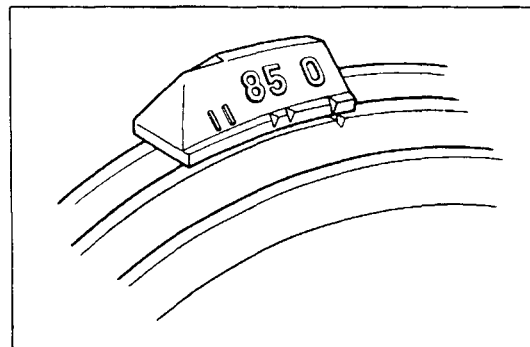
NOTE: If the chain does not seem long enough, turn the camshaft back and forth while pulling up on the chain and sprocket.



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

Place the distributor drive gear and fuel pump drive cam over the chain sprocket. Torque the bolt.

Torque: 800 kg-cm (58 ft-lb, 78 N·m)



7. 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 0 mark position timing mark.
- Check that the rocker arms on the No.1 cylinder are loose and the rockers on No.4 are tight.

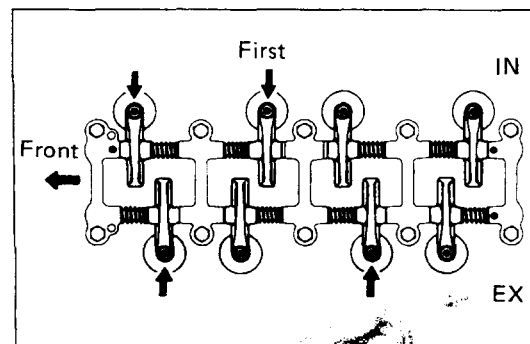
If not, turn the crankshaft one complete revolution and align the marks as above.

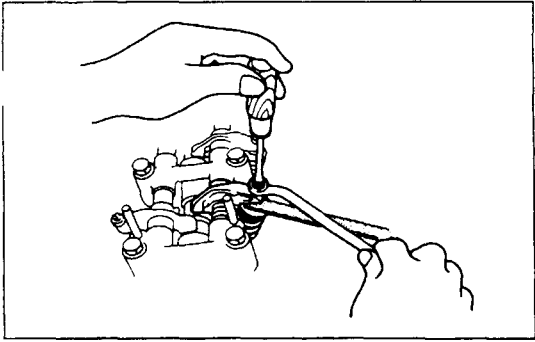
- (b) Adjust the clearance of half of the valves.

- Adjust only those valves indicated by arrows as shown.

Intake clearance: 0.20 mm (0.008 in.)

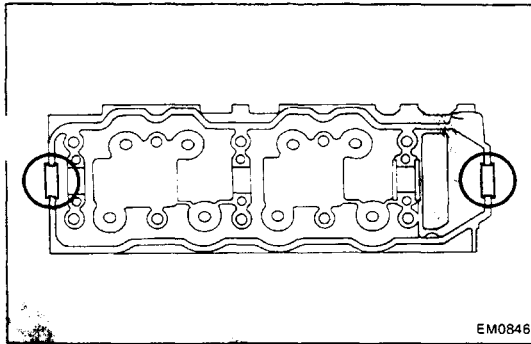
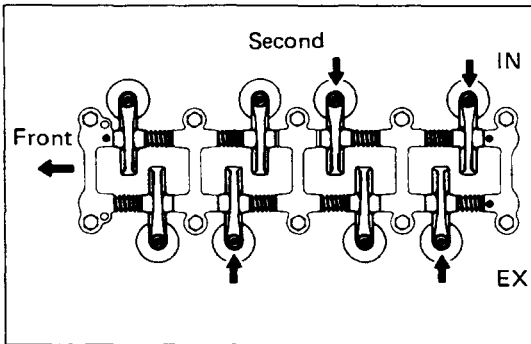
Exhaust clearance: 0.30 mm (0.012 in.)





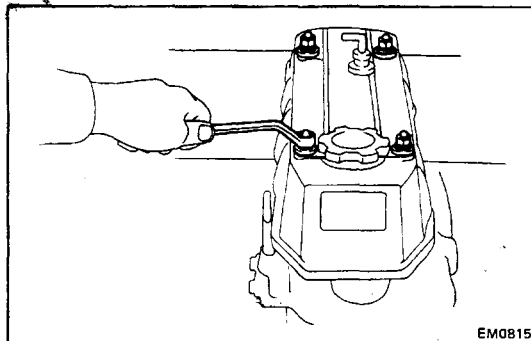
- Use a feeler gauge to measure between the valve stem and rocker arm. Loosen the lock nut and turn the adjusting screw to set the proper clearance. Hold the adjusting screw in position and tighten the lock nut.
- Recheck the clearance. The feeler gauge should move with a very slight drag.

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



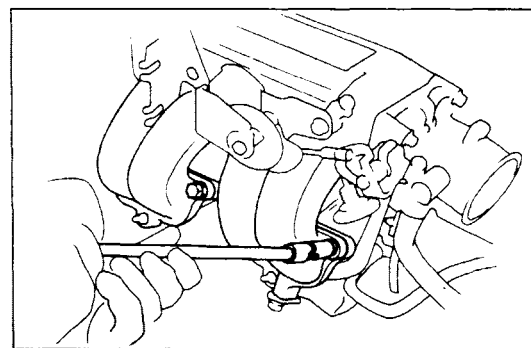
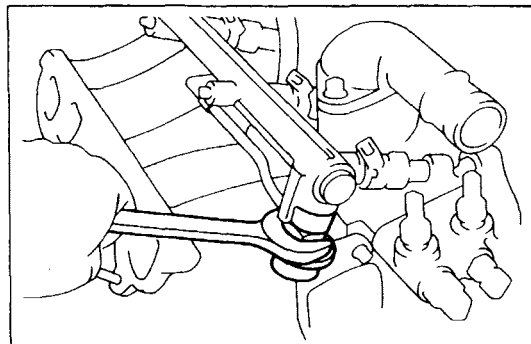
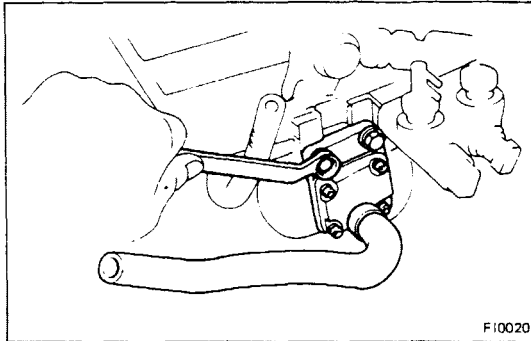
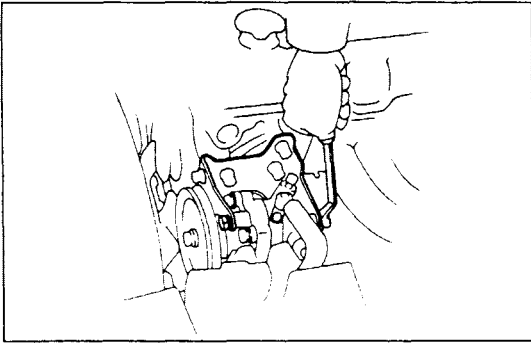
8. INSTALL SEMI-CIRCULAR PLUG

Apply liquid sealer to the cylinder head installation surface of the plug.



9. INSTALL HEAD COVER

- Install the gasket to the cylinder head.
- Place the head cover on the cylinder head and install the four seals and nuts.



POST INSTALLATION

1. INSTALL VANE PUMP WITH BRACKET

(With power steering)

- (a) Position the vane pump with the bracket.
- (b) Install the five bolts and one bolt with the bond cable. Torque the bolts.

Torque: 450 kg-cm (33 ft-lb, 44 N·m)

2. INSTALL DRIVE BELT AND ADJUST BELT TENSION

(See step 1 on page MA-17)

3. CONNECT BY-PASS HOSE TO INTAKE MANIFOLD

4. INSTALL AIR VALVE TO INTAKE MANIFOLD

- (a) Install the air valve to the intake manifold.
- (b) Connect by-pass hose No.4.

5. CONNECT FUEL HOSE TO DELIVERY PIPE

- (a) Install the fuel hose with a bolt.
- (b) Install the pulsation damper and new gaskets and torque the damper.

Torque: 450 kg-cm (33 ft-lb, 44 N·m)

6. CONNECT FOLLOWING WIRES:

- (a) Injection wires
- (b) OD thermo switch wire (with A/T)
- (c) Start injection time switch wire
- (d) Temperature sensor wire
- (e) Water temperature sender gauge wire

7. INSTALL CHAMBER WITH THROTTLE BODY

- (a) Position a new gasket on the intake manifold.
- (b) Install the chamber and throttle body with four bolts and two nuts.
- (c) Connect the chamber and stay with a bolt.
- (d) Install the EGR valve to the chamber.

8. CONNECT FOLLOWING WIRES:

- (a) Air valve wire
- (b) Throttle position wire
- (c) Cold start injection wire

9. CONNECT FOLLOWING PARTS:

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

10. CONNECT BOND CABLE OF REAR SIDE**11. CONNECT ACCELERATOR CABLE**

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

12. CONNECT TWO HEATER HOSES**13. CONNECT RADIATOR UPPER HOSE FOR THERMOSTAT HOUSING****14. CONNECT EXHAUST PIPE TO EXHAUST MANIFOLD**

- (a) Connect the exhaust pipe and exhaust manifold with the three bolts.
- (b) Connect the Ox sensor wire.

15. INSTALL AIR CLEANER HOSE**16. INSTALL DISTRIBUTOR AND SPARK PLUGS, AND SET TIMING (See page IG-10)****17. FILL WITH ENGINE OIL**

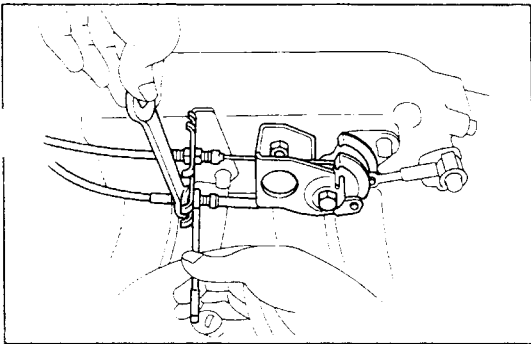
Fill the engine with new oil, API grade SF or SF/CC multi-grade, fuel efficient, and recommended viscosity oil.

Oil capacity:

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

Drain and refill

w/o Oil filter change	4.0 liters
	(4.2 US qts, 3.5 Imp. qts)
w/ Oil filter change	4.6 liters
	(4.9 US qts, 4.0 Imp. qts)



18. 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)

19. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**20. START ENGINE**

Warm up the engine and inspect for leaks.

21. PERFORM ENGINE ADJUSTMENT

- (a) Retighten the cylinder head bolts.
(See step 3 on page EM-27)
- (b) Readjust the valve clearance.
(See page MA-13)
- (c) Recheck ignition timing. (See step 1 on page IG-10)
- (d) Adjust idle speed. (See step 14 on page MA-14)

22. RECHECK COOLANT AND ENGINE OIL LEVEL**23. ROAD TEST**

Perform a road test.

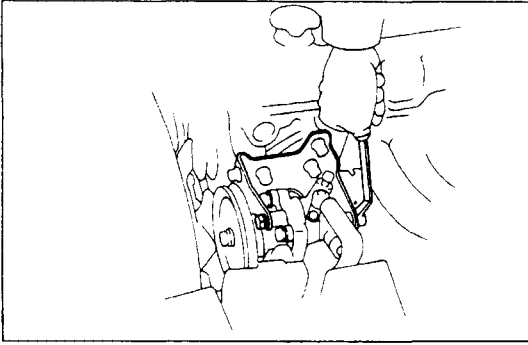
22R**PREPARATION FOR REMOVAL**

(See page EM-12)

- 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 UPPER HOSE FROM THERMOSTAT HOUSING**
- 7. DISCONNECT TWO HEATER HOSES**
- 8. DISCONNECT ACCELERATOR CABLE FROM CARBURETOR**

Disconnect the cable from the carburetor and bracket.
- 9. DISCONNECT FOLLOWING WIRES:**
 - (a) VSV wire for A/C
 - (b) Vacuum switch wire
 - (c) VSV wire for EVAP
 - (d) Water temperature sender gauge wire
 - (e) Cold mixture heater wire
 - (f) Thermo switch wire
 - (g) Fuel cut solenoid valve wire
 - (h) EACV wire (for Calif.)
- 10. 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) HAC from the bracket (Ex. Calif.)
 - (f) Vacuum switch, EBCV (For Calif.) and VSV with the bracket



11. REMOVE BOND CABLE OF REAR SIDE

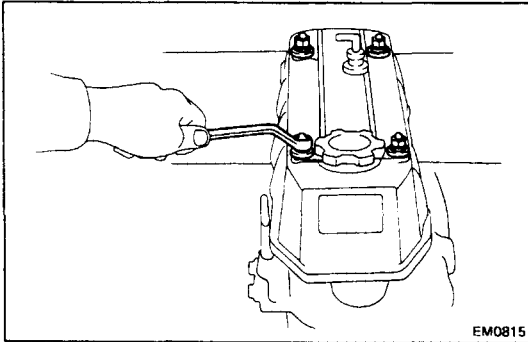
12. REMOVE DISTRIBUTOR AND SPARK PLUGS

13. IF VEHICLE HAS POWER STEERING, REMOVE VANE PUMP WITH BRACKET

(a) Remove the drive belt.

(b) Remove the vane pump with the bracket.

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

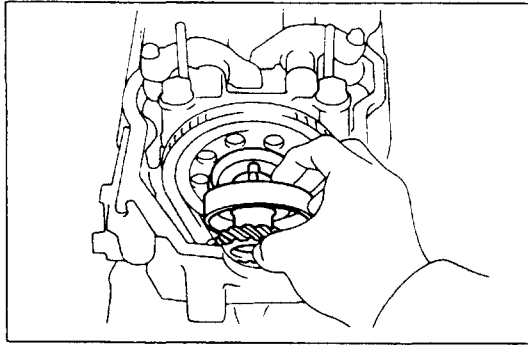


REMOVAL OF CYLINDER HEAD

(See page EM-12)

1. REMOVE HEAD COVER (See step 1 on page EM-15)

2. REMOVE CAM SPROCKET BOLT
(See step 2 on page EM-15)



3. REMOVE DISTRIBUTOR DRIVE GEAR AND FUEL PUMP DRIVE CAM (See step 3 on page EM-15)

4. REMOVE CAM SPROCKET
(See step 4 on page EM-16)

5. REMOVE CHAIN COVER BOLT
(See step 5 on page EM-16)

6. REMOVE CYLINDER HEAD BOLTS
(See step 6 on page EM-16)

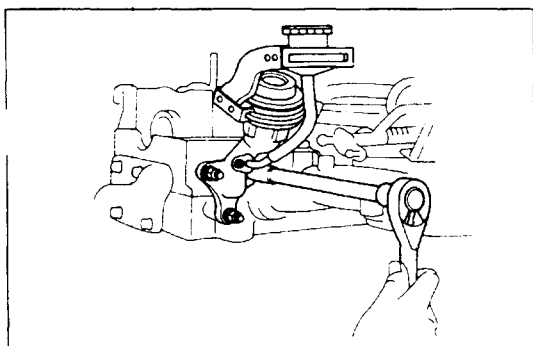
7. REMOVE ROCKER ARM ASSEMBLY
(See step 7 on page EM-16)

8. REMOVE CYLINDER HEAD
(See step 8 on page EM-16)

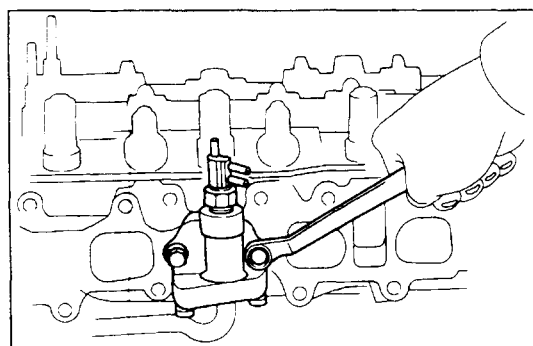
DISASSEMBLY OF CYLINDER HEAD

(See page EM-12)

1. **REMOVE HEAT INSULATER FROM EXHAUST MANIFOLD**
2. **REMOVE CHECK VALVE WITH AIR PIPE**
 - (a) Disconnect the air pipe from the exhaust manifold.
 - (b) Disconnect air hose No.3 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 (Ex. Calif.)**
 - (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 bond cable from the cylinder head.
 - (b) Remove the six bolts and two nuts.
 - (c) Remove the intake manifold with the carburetor.



8. **REMOVE THERMOSTATIC VALVE**
9. **REMOVE EXHAUST MANIFOLD FROM CYLINDER HEAD**
10. **MEASURE CAMSHAFT THRUST CLEARANCE**
(See step 4 on page EM-17)
11. **REMOVE CAM BEARING CAPS AND SHAFT**
(See step 5 on page EM-17)
12. **REMOVE VALVES**
(See step 6 on page EM-17)

INSPECTION OF CYLINDER HEAD

(See page EM-18)

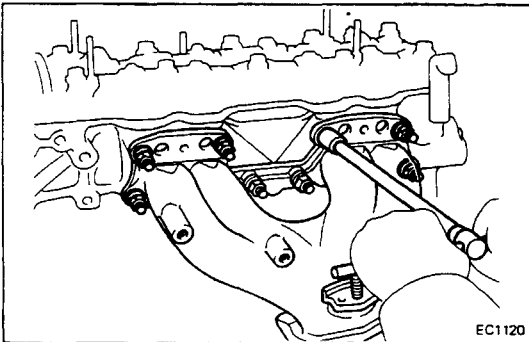
ASSEMBLY OF CYLINDER HEAD

(See page EM-12)

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.

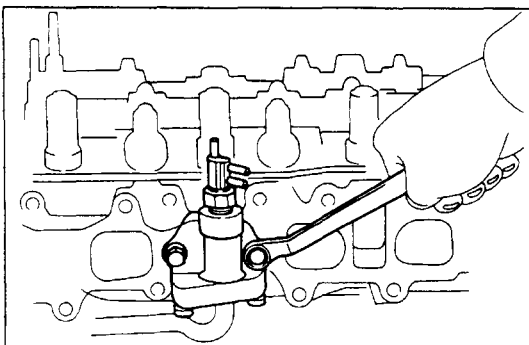
1. **INSTALL VALVE** (See step 1 on page EM-25)
2. **INSTALL CAMSHAFT** (See step 2 on page EM-26)



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)



4. **INSTALL THERMOSTATIC VALVE**

- (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 bond cable with the bolt.

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

7. **INSTALL EGR PIPE AND EGR VALVE WITH VACUUM MODULATOR (Ex. Calif.)**

- (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

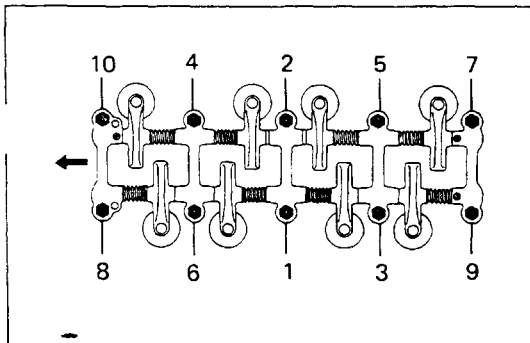
- (a) Install the check valve with the air pipe.
- (b) Connect air hose No.3 to the EACV.
- (c) Connect the air pipe to the exhaust manifold.

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

(See step 1 on page EM-26)

2. INSTALL CYLINDER HEAD

(See step 2 on page EM-27)

**3. INSTALL ROCKER ARM ASSEMBLY**

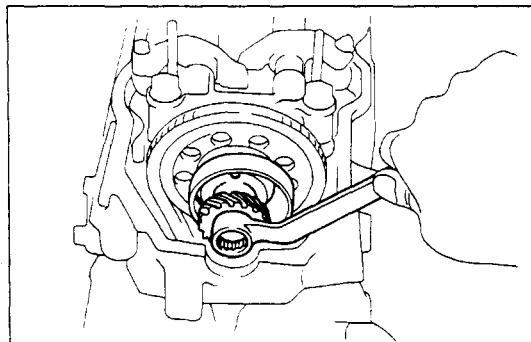
(See step 3 on page EM-27)

4. INSTALL CHAIN COVER BOLT

(See step 4 on page EM-27)

5. INSTALL CAM SPROCKET ON CAMSHAFT

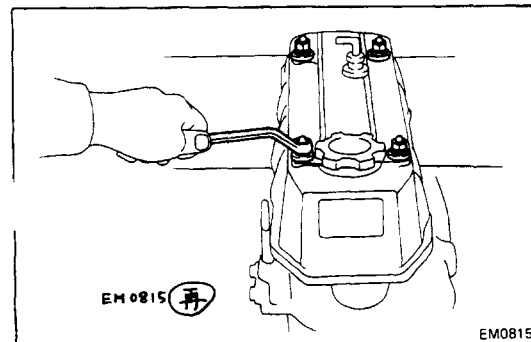
(See step 5 on page EM-27)

**6. INSTALL DISTRIBUTOR DRIVE GEAR**

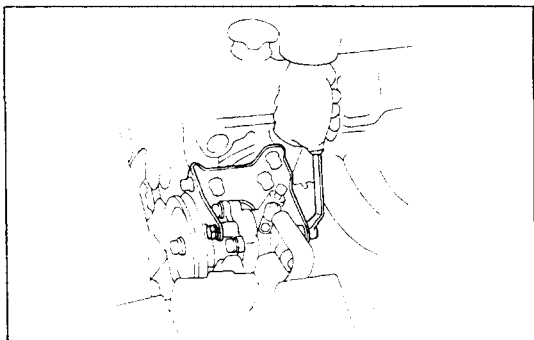
(See step 6 on page EM-28)

7. ADJUST VALVES CLEARANCE

(See step 7 on page EM-28)

**8. INSTALL HEAD COVER**

(See step 8 on page EM-29)



POST INSTALLATION

1. INSTALL VANE PUMP WITH BRACKET (WITH POWER STEERING)

Install the vane pump with the six bolts. Torque the bolts.

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

2. INSTALL DRIVE BELT AND ADJUST BELT TENSION (See page MA-17)

3. INSTALL DISTRIBUTOR AND SPARK PLUGS

4. INSTALL BOND CABLE OF REAR SIDE

5. CONNECT FOLLOWING PARTS:

- (a) Vacuum switch, EBCV (Ex. Calif.) and VSV with the bracket
- (b) HAC to bracket (Ex. Calif.)
- (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

6. CONNECT FOLLOWING WIRES:

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

7. CONNECT ACCELERATOR CABLE TO CARBURETOR

Connect the cable to the carburetor and bracket.

8. CONNECT TWO HEATER HOSES

9. CONNECT RADIATOR UPPER HOSE TO THERMOSTAT HOUSING

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	4.0 liters (4.2 US qts, 3.5 Imp. qts)
w/ Oil filter change	4.6 liters (4.9 US qts, 4.0 Imp. qts)

13. 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)

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

Warm up the engine and inspect for leaks.

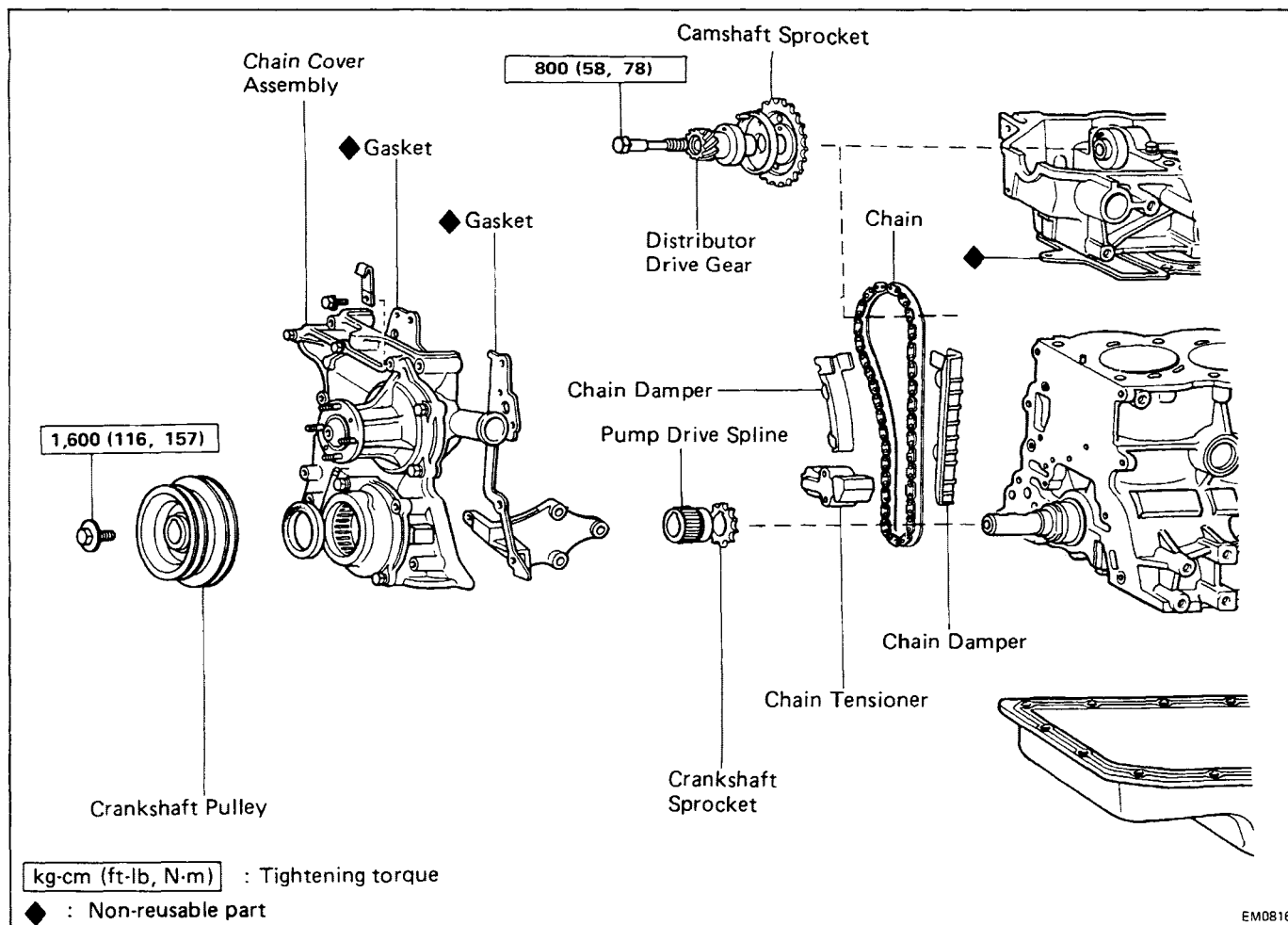
16. PERFORM ENGINE ADJUSTMENT

- (a) Retighten the cylinder head bolts.
(See step 3 on page EM-27)
- (b) Readjust the valve clearance.
(See page MA-13)
- (c) Recheck ignition timing. (See step 1 on page IG-10)
- (d) Adjust idle speed. (See step 14 on page MA-14)

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

Perform a road test.

TIMING CHAIN COMPONENTS



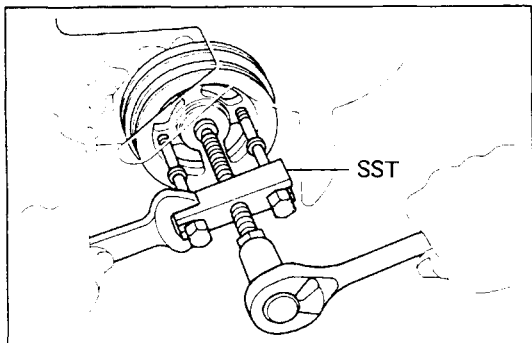
PREPARATION OF REMOVAL

1. **REMOVE CYLINDER HEAD**
(22R-E See page EM-13)
(22R See page EM-33)
2. **REMOVE RADIATOR**
(See page CO-6)
3. **REMOVE OIL PAN (ON VEHICLE)**
 - (a) Remove the engine undercover.
 - (b) Remove the engine mounting bolts.
 - (c) Place a jack under the transmission and raise the engine about 25 mm (0.98 in.).
 - (d) Remove the fifteen bolts, three nuts, oil pan.

REMOVAL OF TIMING CHAIN

1. REMOVE DRIVE BELTS

- (a) Loosen the belt adjusting bolt and pivot bolt of the alternator.
- (b) Remove the two belts.



2. REMOVE CRANKSHAFT PULLEY

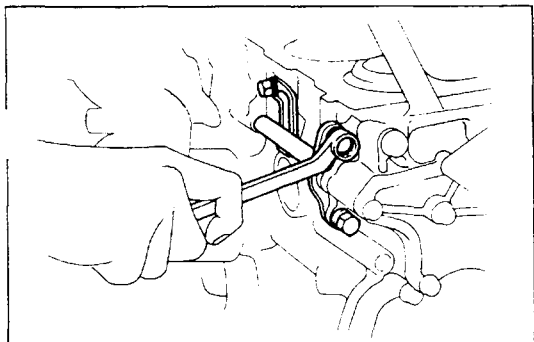
- (a) Remove the pulley center bolt.
- (b) Using SST, remove the pulley.

SST 09213-31021

NOTE: If the front seal is to be replaced, see page LU-5.

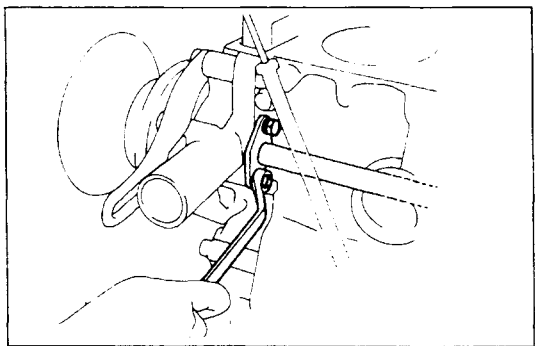
3. REMOVE WATER BY-PASS TUBE

Remove the three bolts.



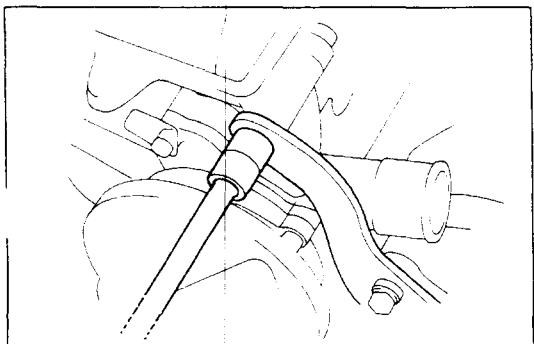
4. REMOVE HEATER TUBE

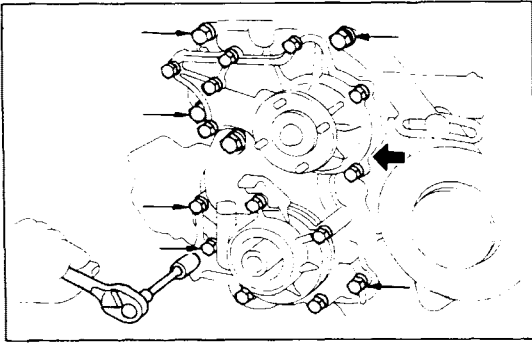
Remove the two bolts.



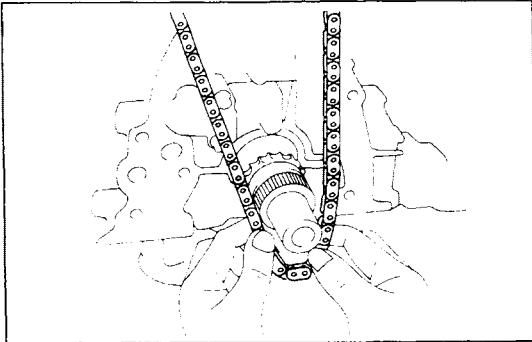
5. REMOVE BOLT HOLDING ALTERNATOR ADJUSTER BRACKET

Remove the bolt holding the alternator adjuster bracket to the chain cover. Move the bracket toward the alternator.

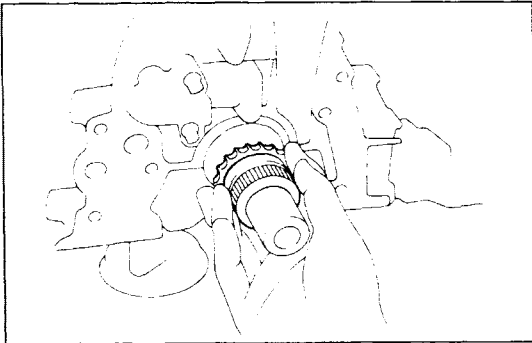


**6. REMOVE CHAIN COVER ASSEMBLY**

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

**7. REMOVE CHAIN AND CAMSHAFT SPROCKET**

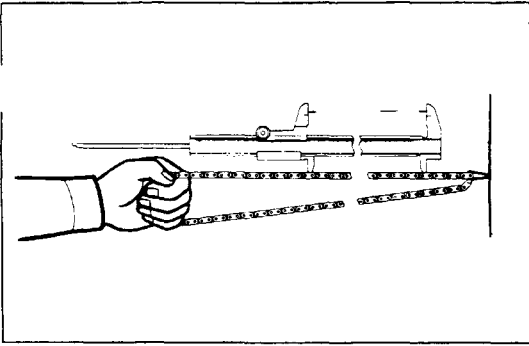
- (a) Remove the chain from the damper.
- (b) Remove the cam sprocket and chain together.

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

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

SST 09213-36020

9. REMOVE GASKET MATERIAL ON CYLINDER BLOCK



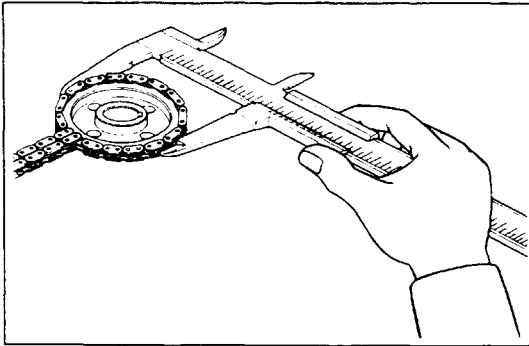
INSPECTION OF COMPONENTS

1. MEASURE CHAIN AND SPROCKET WEAR

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

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

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

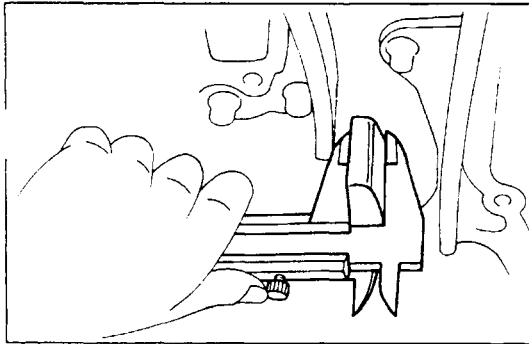


- (c) Wrap the chain around the sprocket.
- (d) Using a vernier caliper, measure the outer sides of the chain rollers as shown. Measure both sprockets.

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

Crankshaft sprocket minimum: 59.4 mm (2.339 in.)

Camshaft sprocket minimum: 113.8 mm (4.480 in.)

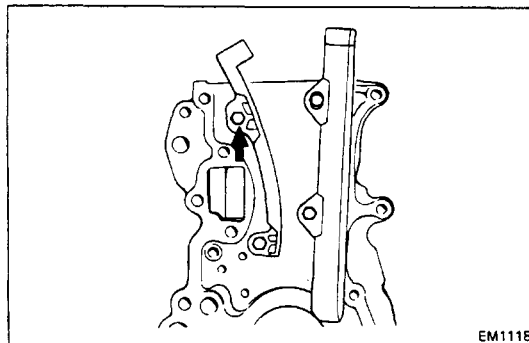


2. MEASURE CHAIN TENSIONER

Using a vernier caliper, measure the tensioner as shown.

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

Tensioner minimum: 11.0 mm (0.433 in.)



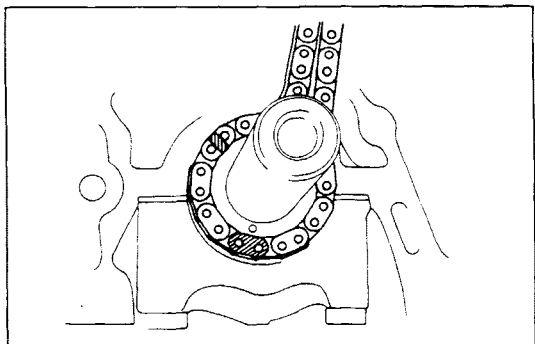
3. MEASURE CHAIN DAMPERS

- (a) Using a micrometer, measure each damper.

Damper wear limit: 0.5 mm (0.020 in.)

If either damper is worn or less than the minimum, replace the damper as follows:

- (b) Tighten down the new damper bolts as shown.

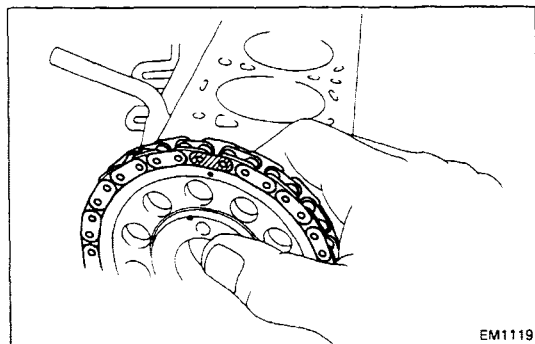


INSTALLATION OF TIMING CHAIN

(See page EM-40)

1. INSTALL CRANKSHAFT SPROCKET AND CHAIN

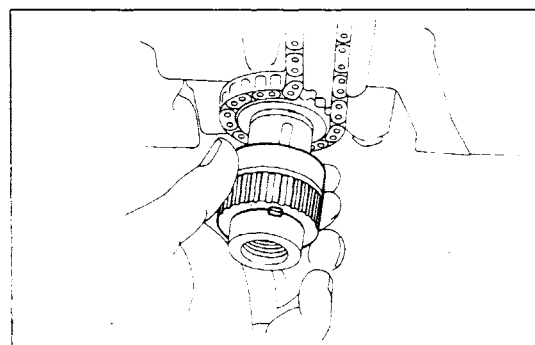
- Turn the crankshaft until the shaft key is on top.
- Slide the sprocket over the key on the crankshaft.
- Place the timing chain on the sprocket with the single bright link aligned with the timing mark on the sprocket.



EM1119

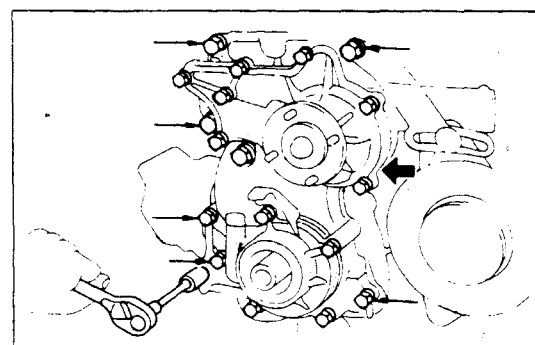
2. PLACE CHAIN ON CAMSHAFT SPROCKET

- Place the timing chain on the sprocket so that the timing mark is bright chain links.
- Make sure the chain is positioned between the two 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.



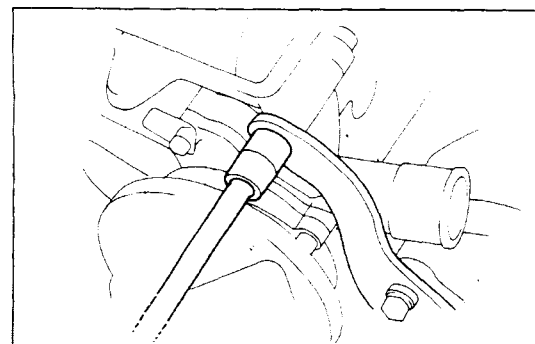
4. INSTALL TIMING CHAIN COVER ASSEMBLY

- 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)

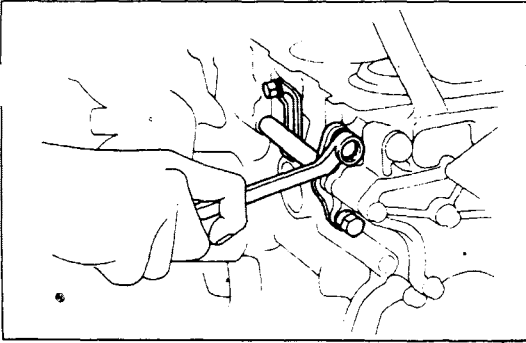


5. INSTALL BOLT HOLDING ALTERNATOR ADJUSTER BRACKET

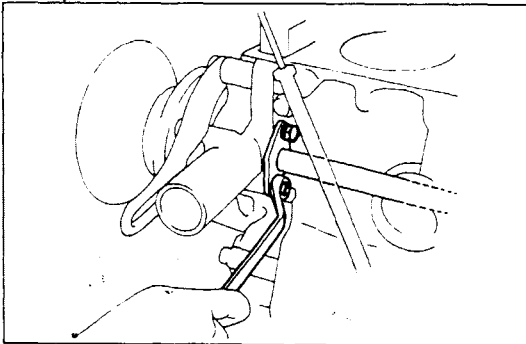
Install the bolt holding the alternator adjuster bracket to the chain cover.

Torque the bolt.

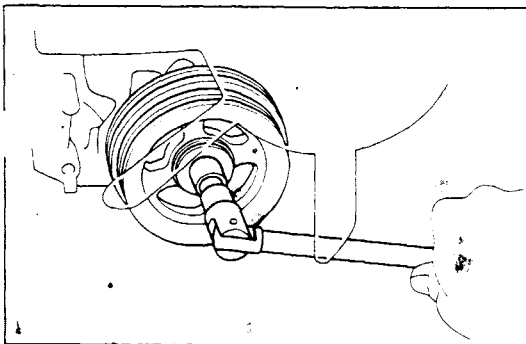
Torque: 130 kg-cm (9 ft-lb, 13 N·m)

**6. INSTALL WATER BY-PASS TUBE TO CHAIN COVER**

Install the three bolts.

**7. INSTALL HEATER TUBE TO CHAIN COVER**

Install the two bolts.

**8. INSTALL CRANKSHAFT PULLEY**

(a) Install the pulley over the crankshaft key.

CAUTION: Do not turn the crankshaft.

(b) Torque the pulley center bolt.

Torque: 1,600 kg-cm (116 ft-lb, 157 N-m)

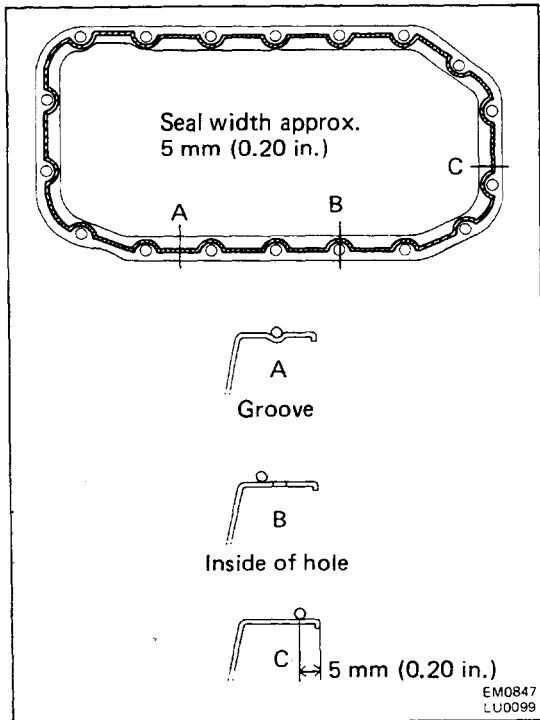
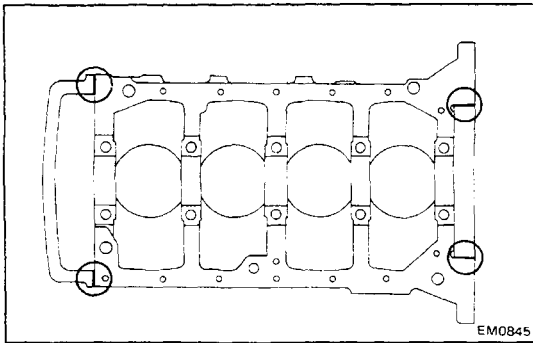
9. INSTALL DRIVE BELTS

Using a belt tension gauge, check the drive belt tension.

Belt tension gauge:

Nippondenso BTG-20 (95506-00020) or
Borroughs No. BT-33-73F

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



10. INSTALL OIL PAN

- (a) Remove any old packing material and be careful not to drop any oil on the contacting surfaces of the 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 liquid sealer to the joint part of the cylinder block and chain cover, cylinder block and rear oil seal retainer.
- (c) Apply No. 102 seal packing (Part No. 08826-00080 or equivalent to the oil pan as shown in the figure.
 - 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

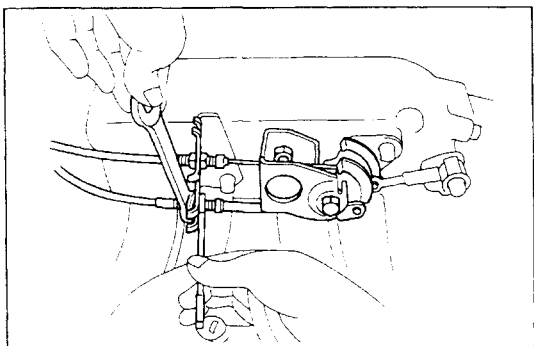
11. INSTALL RADIATOR (See page CO-12)

12. INSTALL CYLINDER HEAD (22R-E See page EM-25) (22R See page EM-36)

22R-E CYLINDER BLOCK

PREPARATION FOR REMOVAL

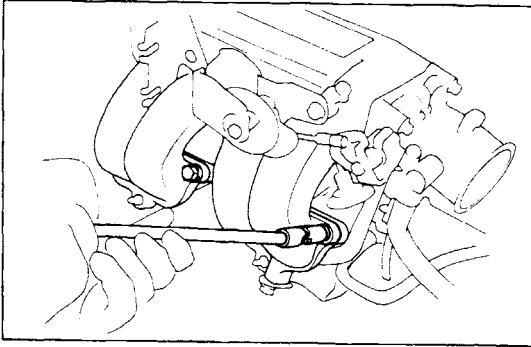
1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
2. **REMOVE ENGINE UNDER COVER**
3. **REMOVE ENGINE HOOD**
Disconnect the washer hose from the hood.
4. **DRAIN COOLANT FROM RADIATOR AND CYLINDER BLOCK**
5. **DRAIN AUTOMATIC TRANSMISSION FLUID (with A/T)**
6. **REMOVE AIR CLEANER HOSE AND AIR CLEANER**
7. **REMOVE COUPLING FAN WITH FAN**
8. **REMOVE TWO HEATER HOSES**
9. **REMOVE RADIATOR WITH SHROUD**
 - (a) Disconnect the two cooler hoses. (with A/T)
 - (b) Disconnect the radiator upper and lower hoses from the engine.
 - (c) Disconnect the reservoir hose.
 - (d) Remove the radiator with the shroud.



10. **DISCONNECT CABLES FROM BRACKET**
Disconnect the accelerator cable and throttle cable for A/T from the bracket.
11. **DISCONNECT FOLLOWING PARTS:**
 - (a) PCV hose No.1 and No.2
 - (b) Brake booster hose
 - (c) Air control valve hoses
 - (d) EVAP hose (from canister)
 - (e) Actuator hose (with cruise control)
 - (f) EGR vacuum modulator hose
 - (g) Air valve hose No.1 from the throttle body
 - (h) Air valve hose No.2 from the chamber
 - (i) Water by-pass hose No.2 and No.3 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

12. DISCONNECT FOLLOWING WIRES:

- (a) Cold start injection wire
- (b) Throttle position sensor wire
- (c) Air valve wire

**13. REMOVE CHAMBER WITH THROTTLE BODY**

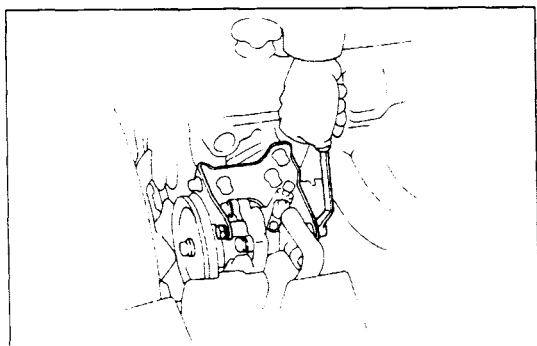
- (a) Remove the two bolts holding the EGR valve to the chamber.
- (b) Disconnect the chamber from the stay.
- (c) Remove the bolts and nuts holding the chamber to the intake manifold.
- (d) Remove the chamber with the throttle body.

14. DISCONNECT FOLLOWING WIRES:

- (a) Cold start injector time switch wire
- (b) Water thermo sensor wire
- (c) OD thermo switch wire (with A/T)
- (d) Injector wires
- (e) Thermo sensor wire
- (f) Vacuum switch wire
- (g) Oil pressure switch wire
- (h) 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
- (d) Ox sensor wire

**2. IF VEHICLE HAS POWER STEERING, REMOVE VANE PUMP FROM BRACKET**

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

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

3. DISCONNECT BOND CABLE FROM VANE PUMP BRACKET**4. REMOVE COMPRESSOR FROM BRACKET (with A/C)**

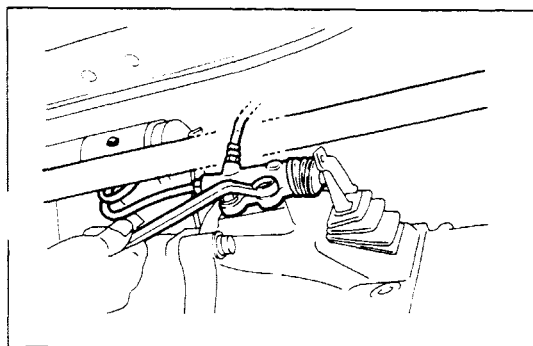
- (a) Loosen the drive belt adjusting bolt and remove the drive belt.
- (b) Remove the compressor on the front side without disconnecting the hoses.

5. DISCONNECT BOND CABLES FROM ENGINE REAR SIDE AND RH SIDE**6. REMOVE SHIFT LEVER FROM INSIDE OF VEHICLE (with M/T)****7. RAISE VEHICLE**

CAUTION: Be sure the vehicle is securely supported.

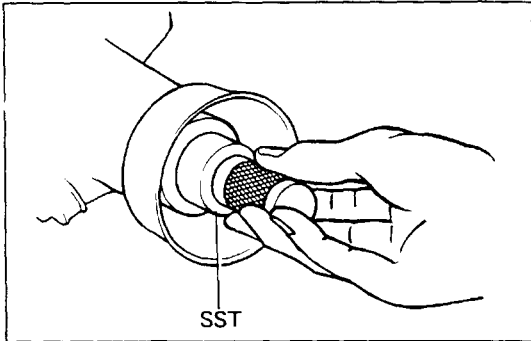
8. REMOVE EXHAUST PIPE

- (a) Disconnect the exhaust pipe from the exhaust manifold.
- (b) Remove the exhaust pipe clamp from the clutch housing.
- (c) Remove the exhaust pipe from the catalytic converter.

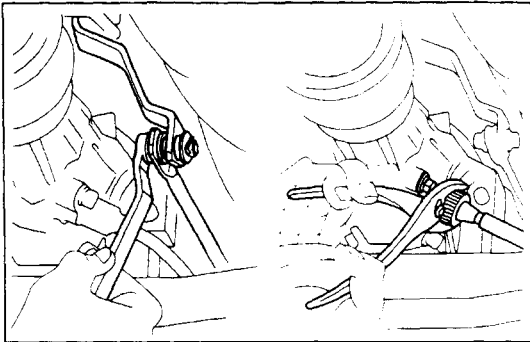
9. REMOVE CLUTCH RELEASE CYLINDER WITH BRACKET FROM TRANSMISSION (with M/T)**10. REMOVE ENGINE MOUNTING BOLTS ON EACH SIDE OF ENGINE**

11. DISCONNECT FOLLOWING PARTS:

- (a) Oil pressure sender gauge wire
- (b) Neutral start switch wire (with A/T)
- (c) Back-up light switch wire
- (d) Fuel hose

**12. REMOVE INTERMEDIATE SHAFT**

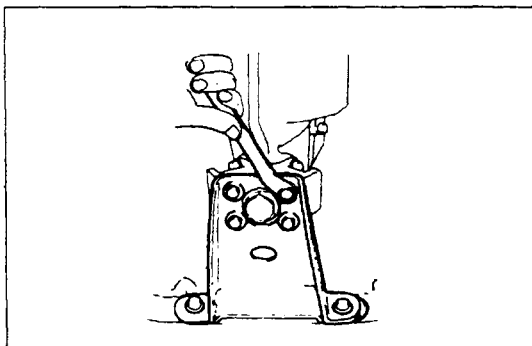
- (a) Put alignment marks on the flanges.
 - (b) Remove the four bolts and nuts.
 - (c) Remove the two bolts holding the center support bearing to the body.
 - (d) Pull the sleeve yoke from the transmission.
 - (e) Insert SST in the transmission to prevent oil leakage.
- SST 09325-20010

**13. DISCONNECT SHIFT LINKAGE FROM SHIFT LEVER (with A/T)****14. DISCONNECT SPEEDOMETER CABLE**

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

15. PLACE JACK UNDER TRANSMISSION

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

**16. REMOVE ENGINE REAR MOUNTING BRACKET**

- (a) Remove the four bolts holding the bracket to the member.
- (b) Remove the four bolts holding the bracket to the transmission and remove the bracket.

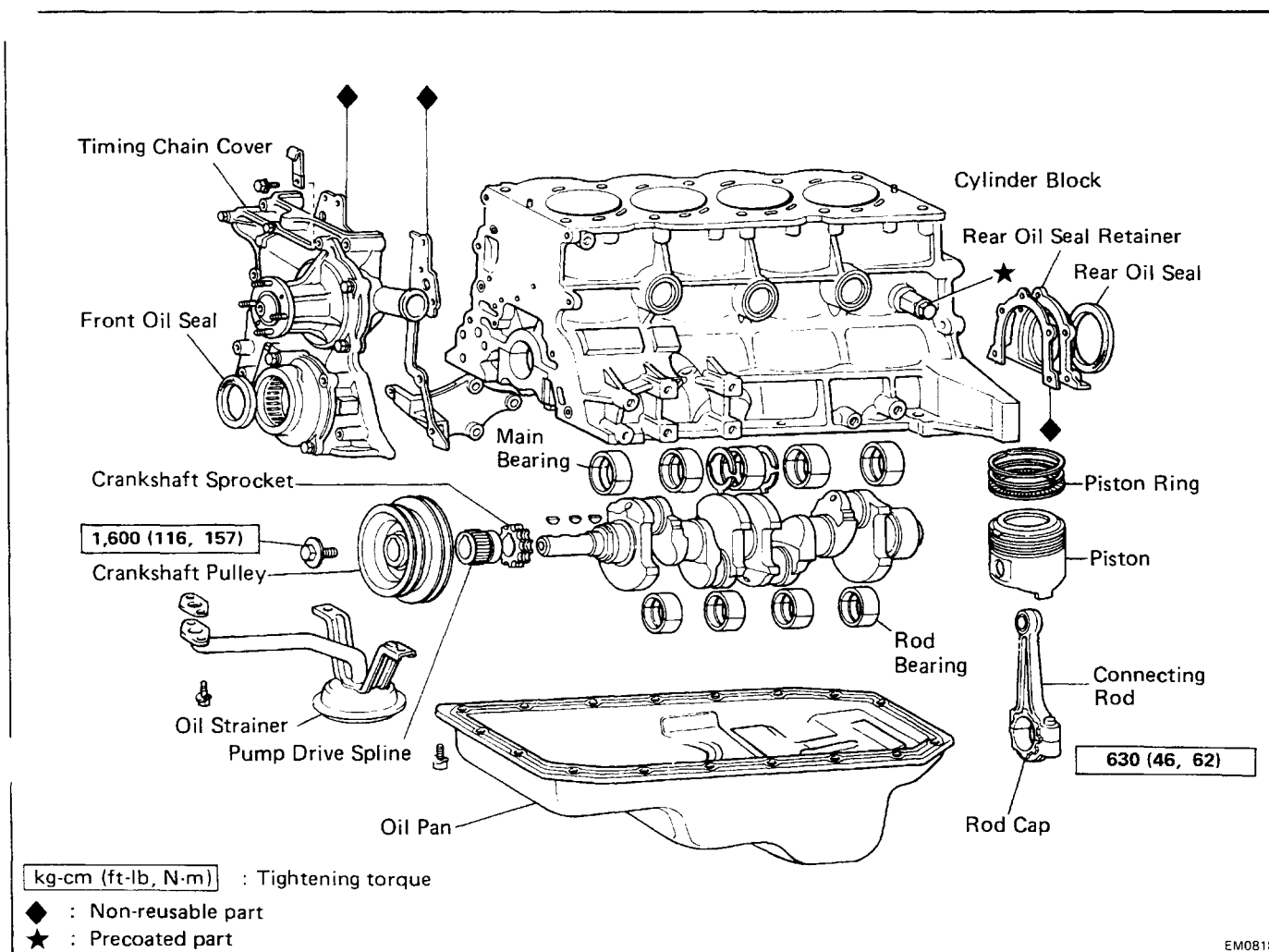
17. REMOVE ENGINE WITH TRANSMISSION FROM VEHICLE

- (a) Attach the engine hoist chain to the lift brackets of the engine.
 - (b) Lift the engine out of the vehicle slowly and carefully.
- NOTE:** Make sure the engine is clear of all wiring and hoses.

18. 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

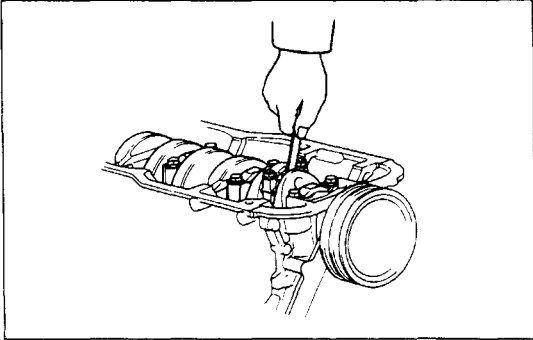
1. REMOVE CLUTCH COVER AND DISC FOR M/T
(See page CL-7)
2. REMOVE FLYWHEEL OR DRIVE PLATE AND REAR END PLATE
3. INSTALL ENGINE STAND FOR DISASSEMBLY
4. REMOVE CYLINDER HEAD
(See page EM-15)
5. REMOVE OIL PAN
Remove the sixteen bolts and two nuts, and then remove the oil pan and gasket.
6. REMOVE TIMING CHAIN (See page EM-41)
7. REMOVE ALTERNATOR (See page CH-6)

DISASSEMBLY OF CYLINDER BLOCK**1. REMOVE OIL STRAINER**

Remove the four bolts holding the oil strainer.

2. REMOVE REAR OIL SEAL RETAINER

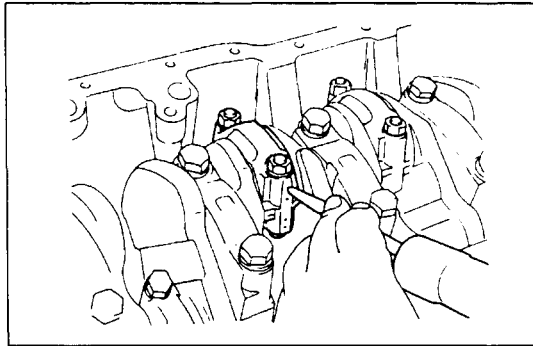
Remove the five bolts, rear oil seal retainer and gasket.

**3. MEASURE CONNECTING ROD THRUST CLEARANCE**

Using a feeler gauge, measure the rod thrust clearance.

If clearance is greater than the maximum, replace the connecting rod.

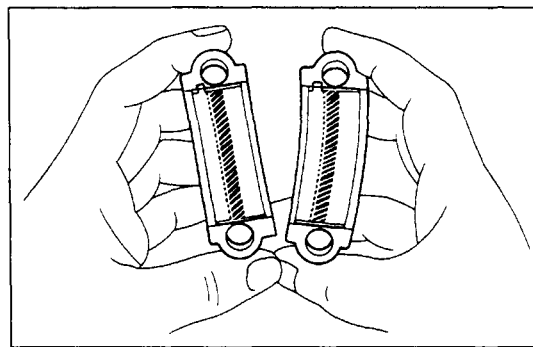
Rod thrust maximum clearance: 0.30 mm (0.0118 in.)

**4. REMOVE CONNECTING ROD CAPS AND MEASURE OIL CLEARANCE**

(a) Using a punch or numbering stamp, mark the connecting rods and caps to ensure correct reassembly.

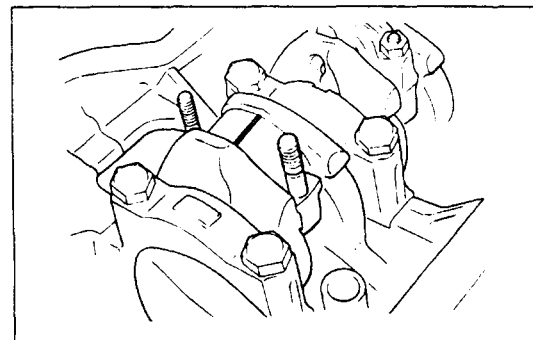
(b) Remove the rod caps.

Remove the rod cap nuts. Using a plastic hammer, tap the rod bolts lightly and lift off the rod caps. Keep the bearing inserted with the cap.

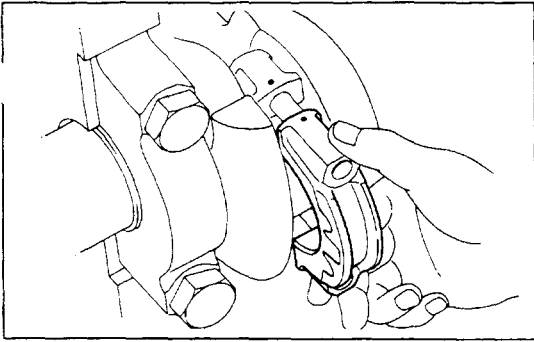


(c) Clean the bearings and crankshaft pins.

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



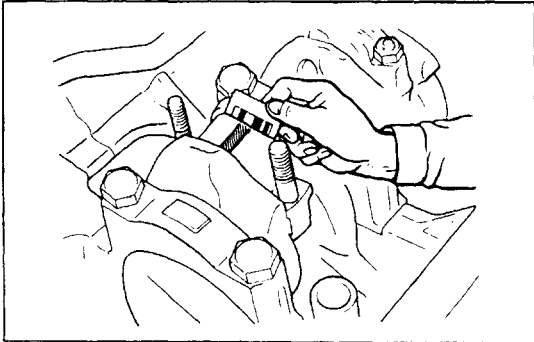
(e) Lay a strip of Plastigage across the crankshaft pin.



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

Torque: 630 kg-cm (46 ft-lb, 62 N·m)

NOTE: Do not turn the crankshaft.



- (g) Remove the rod cap.

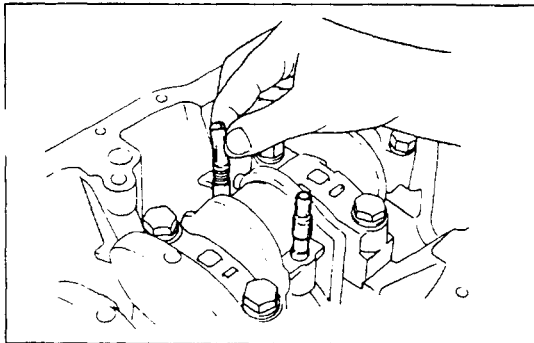
- (h) Measure the plastigage at its widest point.

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

Maximum clearance: 0.10 mm (0.0039 in.)

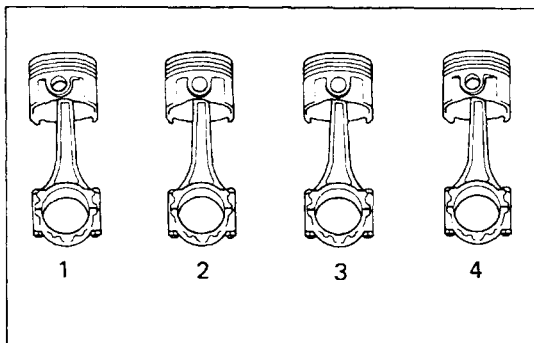
**Standard clearance: 0.025 — 0.055 mm
(0.0010 — 0.0022 in.)**

- (i) Clean out the pieces of plastigage from the bearings and journals.

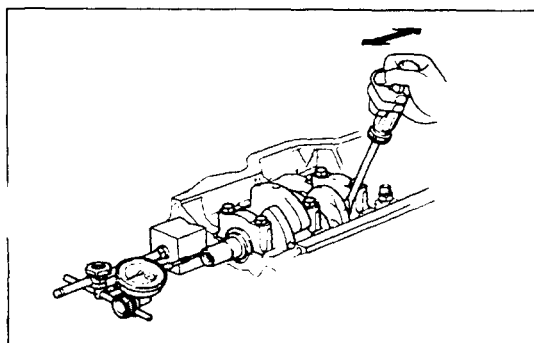


5. PUSH OUT PISTON AND CONNECTING ROD ASSEMBLY

- (a) Remove all carbon from the top of the cylinders.
(b) Cover the rod bolts with a short piece of hose to protect the crankshaft 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.

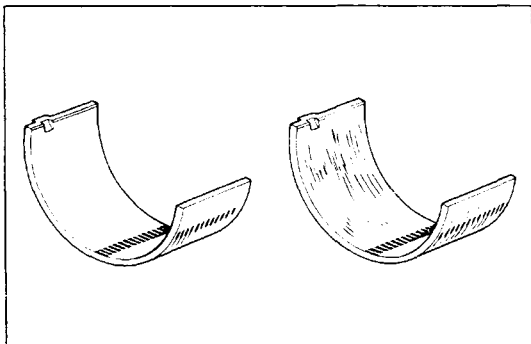


6. MEASURE CRANKSHAFT THRUST CLEARANCE

Using a dial indicator, measure the clearance at the center bearing. If it exceeds the maximum clearance, replace the thrust washer as a set.

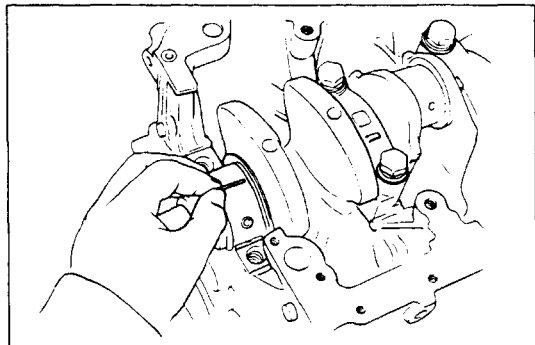
Maximum clearance: 0.30 mm (0.0118 in.)

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

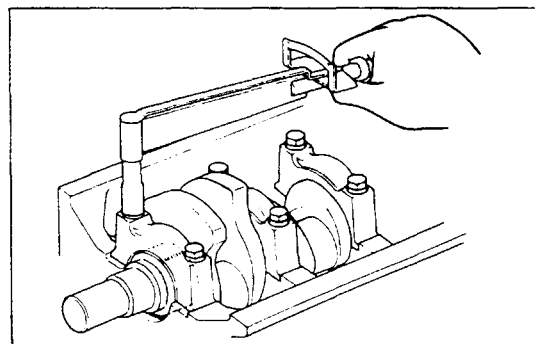


7. REMOVE MAIN BEARING CAPS AND MEASURE OIL CLEARANCE

- (a) Remove the main bearing caps by removing two bc
- (b) Lift out the crankshaft and remove the upper main bearings from the cylinder block.
- (c) Clean the bearing and main journals.
Inspect each bearing for pitting and radial scratches.
If bearings are damaged, replace them.



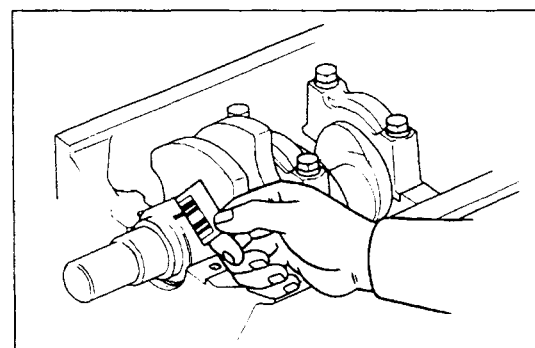
- (d) Install the upper main bearings on the cylinder block and crankshaft.
- (e) Lay a strip of plastigage across the main journals.



- (f) 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.



- (g) Remove the main bearing caps.
- (h) Measure the plastigage at its widest point.
If the clearance is greater than the maximum, replace the bearings and/or grind the main journals.
Maximum clearance: 0.08 mm (0.0031 in.)
Standard clearance: 0.025 — 0.055 mm (0.0010 — 0.0022 in.)
- (i) Clean out the pieces of plastigage from the bearings and journals.

8. REMOVE CRANKSHAFT

- (a) Lift out the crankshaft.
- (b) Remove the upper main bearings from the cylinder block.
- (c) 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. 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.

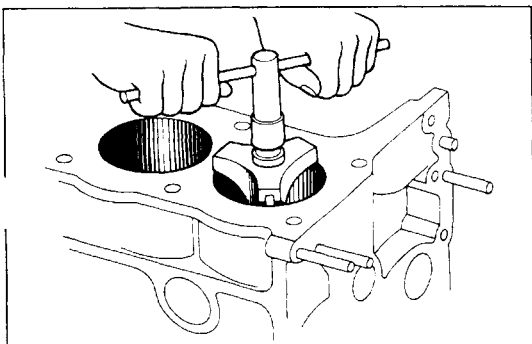
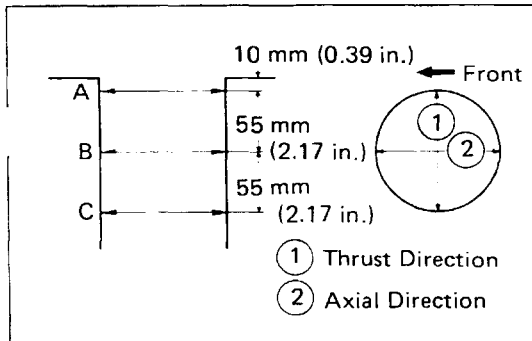
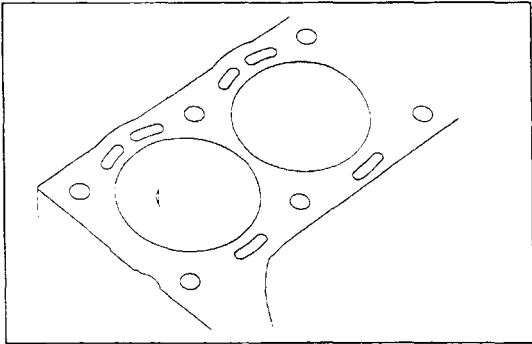
Taper limit: 0.01 mm (0.0004 in.)

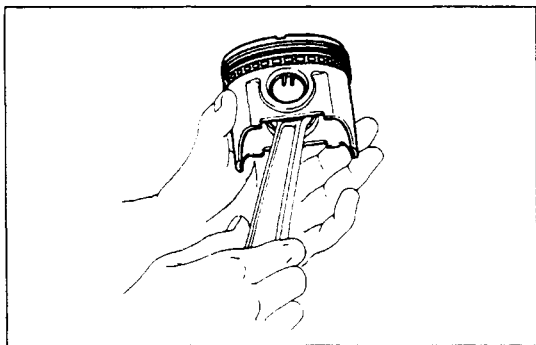
(c) Difference between the thrust and axial measurements is greater than the out-of-round limit.

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

5. REMOVE CYLINDER RIDGE

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

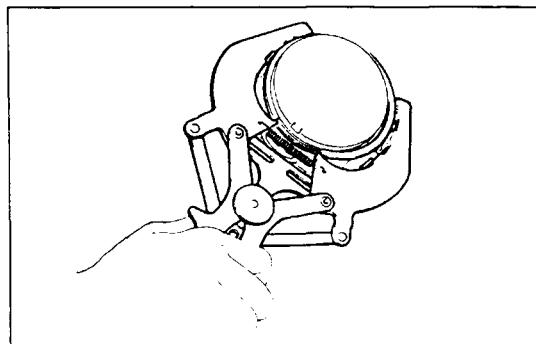




DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLY

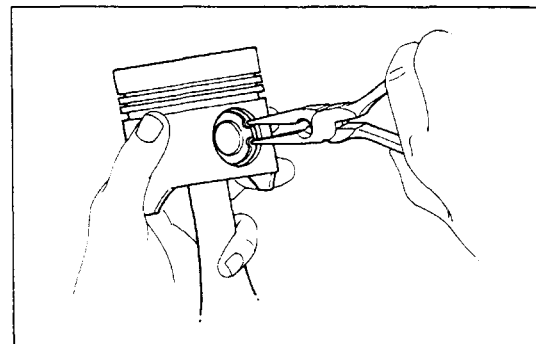
1. CHECK FIT BETWEEN PISTON AND PIN

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



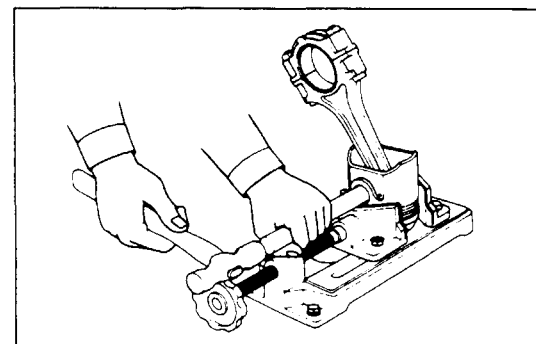
2. REMOVE PISTON RINGS

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



3. DISCONNECT CONNECTING ROD FROM PISTON

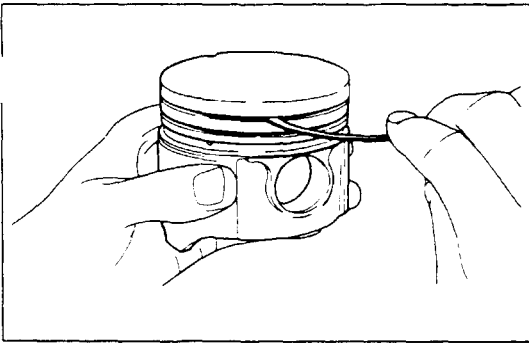
- (a) Using needle-nose pliers, remove the snap rings from the piston.
- (b) Heat the piston in hot water to about 80°C (176°F).



- (c) Using a hammer and driver, tap the pin lightly to remove the pin from the piston.

NOTE:

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

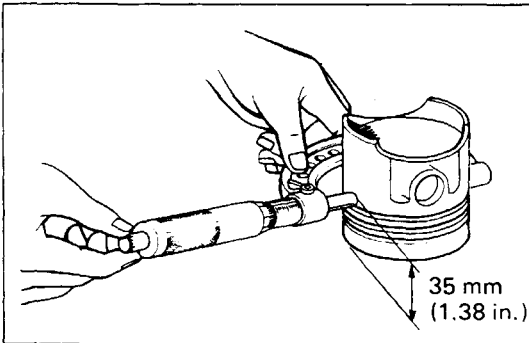


INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLY

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 as shown.

Standard diameter: 91.960 — 91.990 mm
(3.6205 — 3.6216 in.)

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

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

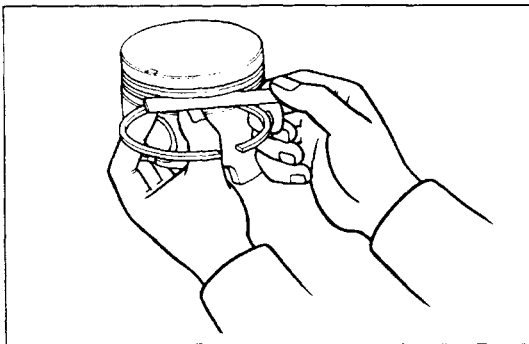
Piston clearance: 0.02 — 0.04 mm
(0.0008 — 0.0016 in.)

3. MEASURE CLEARANCE BETWEEN PISTON GROOVE AND PISTON RING

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

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

Maximum clearance between compression ring No. 1 or 2 and ring land: 0.2 mm (0.008 in.)



4. MEASURE RING END GAP

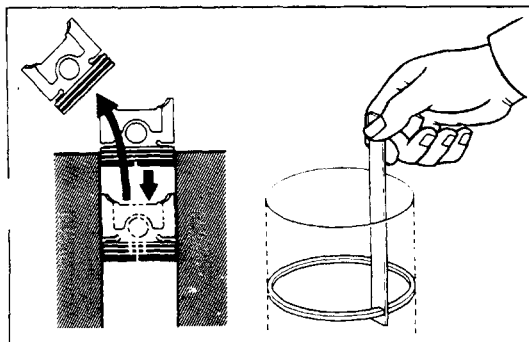
Measure the ring end gap.

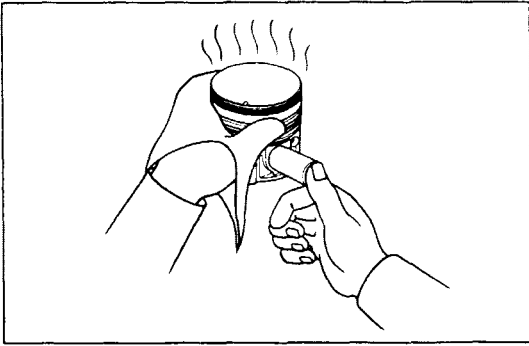
- Insert the piston ring into the cylinder.
- Using a piston, push the ring to the bottom of the ring travel.
- Using a feeler gauge, measure the end gap.

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

Ring end gap:

Standard	No.1	0.24—0.39 mm (0.009—0.015 in.)
	No.2	0.18—0.42 mm (0.007—0.017 in.)
	Oil	0.20—0.82 mm (0.008—0.032 in.)
Maximum	No.1	0.99 mm (0.039 in.)
	No.2	1.02 mm (0.040 in.)
	Oil	1.42 mm (0.056 in.)

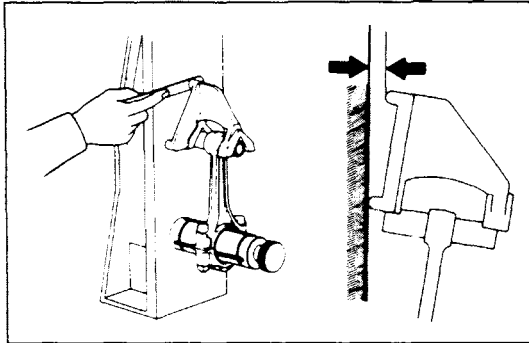




5. INSPECT PISTON PIN FIT

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.



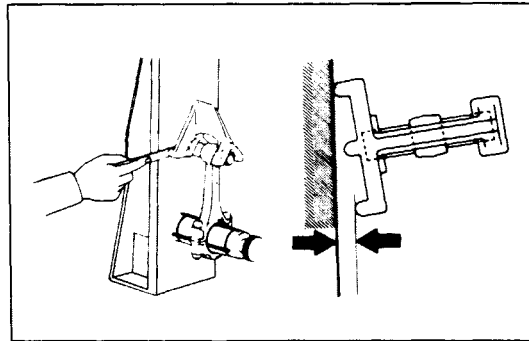
6. INSPECT CONNECTING RODS

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

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

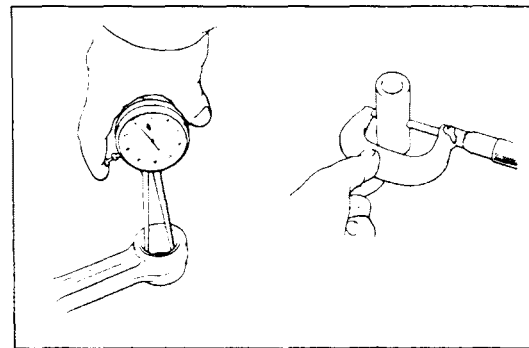
- Check that the rod is not bent.

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.)



(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.

If the clearance is greater than the limit, replace the rod bushing.

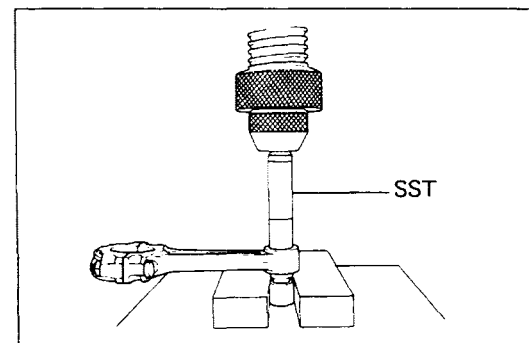
Oil clearance limit: 0.015 mm (0.0006 in.)

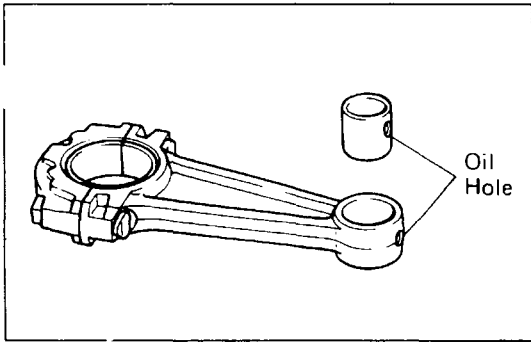
REPLACEMENT OF ROD BUSHING

1. REMOVE ROD BUSHING

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

SST 09222-30010

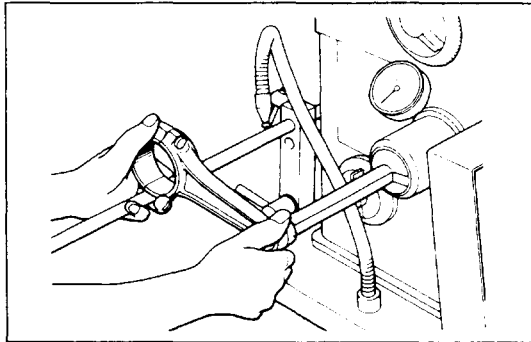




2. INSTALL NEW ROD BUSHING

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.

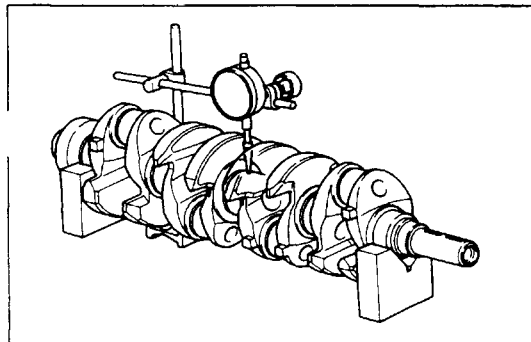


3. HONE NEW BUSHING AND CHECK PIN FIT IN CONNECTING ROD

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

Oil clearance standard: 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 runout gauge, measure the runout at the center journal.

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

Circle runout maximum: 0.1 mm (0.004 in.)

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

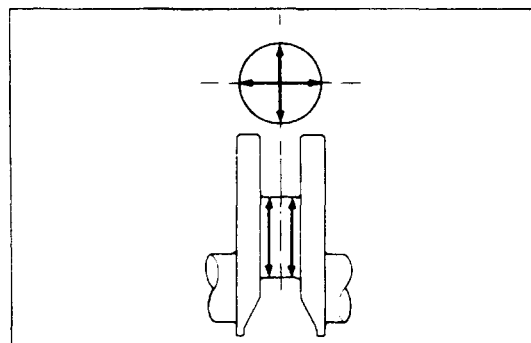
Measure the journals for out-of-round and taper as shown.

If journals are worn, regrind or replace the crankshaft.

Main journal diameter: 59.984 — 60.000 mm
(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.)



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

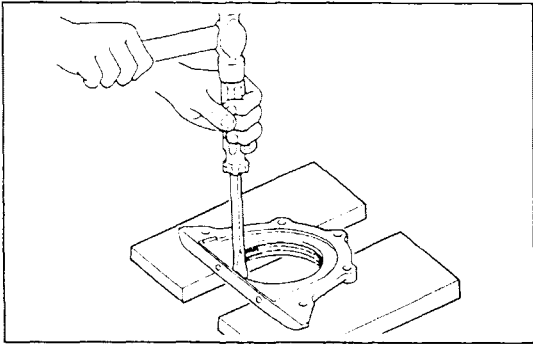
Grind the crank pins and/or main journals to the under-sized finished diameter. Install a new pin and/or main under-size bearings.

Bearing size (U/S 0.25)

Main journal finished diameter: 59.70 — 59.71 mm
(2.3504 — 2.3508 in.)

Crank pin finished diameter: 52.70 — 52.71 mm
(2.0748 — 2.0752 in.)

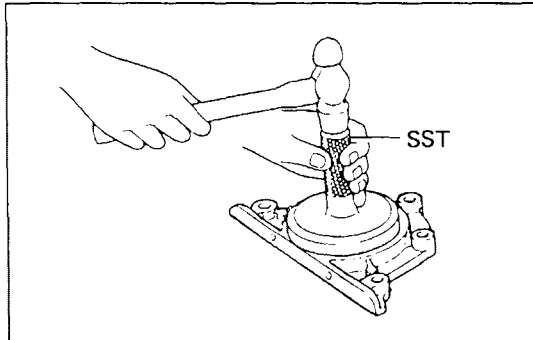
Taper and out-of-round limit: 0.01 mm (0.0004 in.)



REPLACEMENT OF REAR OIL SEAL

1. REMOVE OIL SEAL FROM OIL SEAL RETAINER

Using a screwdriver, remove the oil seal.



2. INSTALL NEW OIL SEAL ON OIL SEAL RETAINER

(a) Using SST, install a new oil seal.

SST 09223-41020

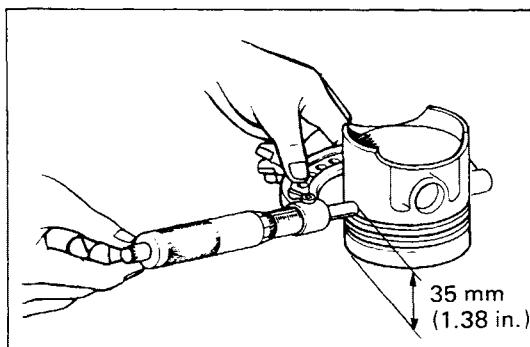
(b) Coat the seal lightly with multipurpose grease.

Size	Outside Diameter mm (in.)
O/S 0.50	92.460 – 92.490 (3.6402 – 3.6413)
O/S 1.00	92.960 – 92.990 (3.6598 – 3.6610)

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 bo. measured and select the oversized piston for that bore. Bore all cylinders for the oversized piston selected.



2. CALCULATE DIMENSION TO BORE CYLINDERS

(a) Using a micrometer, measure the piston diameter as shown.

(b) 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

$$0.02 - 0.04 \text{ mm (0.0008 - 0.0016 in.)}$$

H = allowance for honing

$$\text{Less than } 0.02 \text{ mm (0.0008 in.)}$$

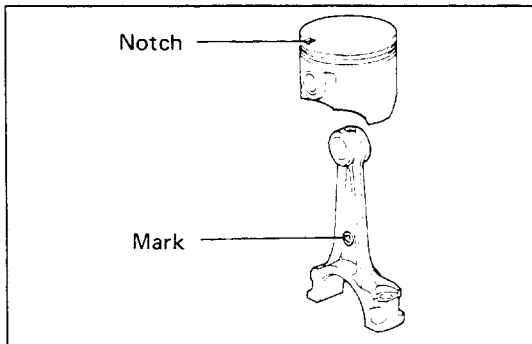
3. BORE AND HONE CYLINDERS TO CALCULATED DIMENSIONS

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.

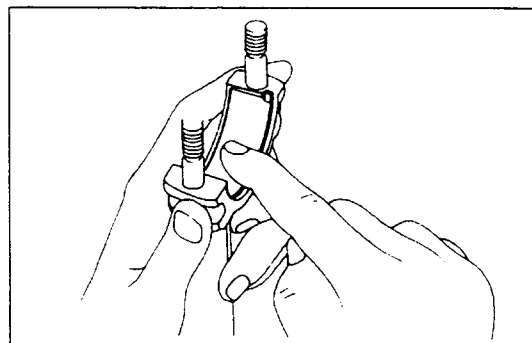
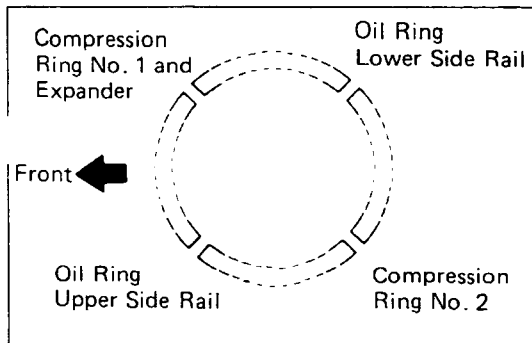
**ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLY****1. ASSEMBLY PISTON AND CONNECTING ROD**

- (a) Install a new snap ring on one side of the piston pin hole.
- (b) Heat the piston in hot water to about 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.

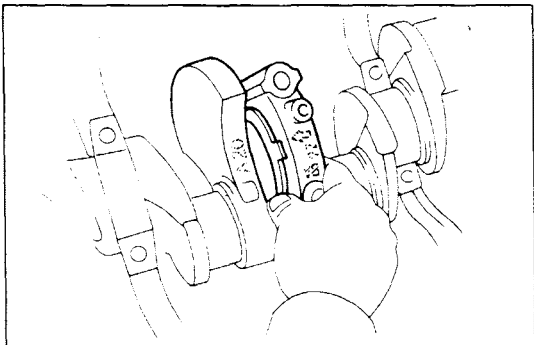
CAUTION: Do not align the end gaps.

**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

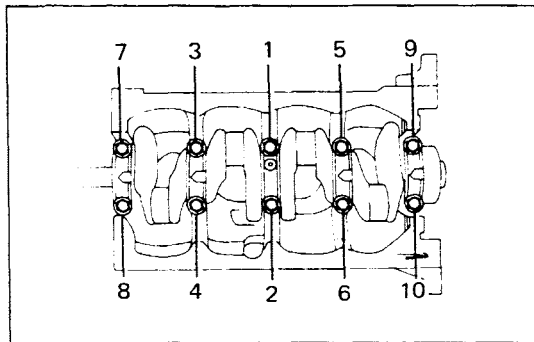
- 1. INSTALL UPPER MAIN BEARING IN CYLINDER BLOCK..
 - (a) Place the upper main bearing in the block.
 - (b) Install the upper thrust washers on the center main bearing with the oil grooves facing outward.
 - (c) Lubricate the faces of the bearings with engine oil.



2. PLACE CRANKSHAFT IN CYLINDER BLOCK

3. INSTALL MAIN BEARING CAPS

- NOTE: Each bearing cap is numbered.
- (a) Install thrust washers on bearing cap No.3 with the oil grooves facing out ward.



- (b) Install the bearing caps in numbered order with the arrows facing forward. Tighten the bolts to the specified torque in the sequence shown in two or three passes.

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

- (c) Measure the crankshaft thrust. (See step 6 on page EM-53)

Using a feeler gauge, measure the clearance at the center bearing.

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

Maximum clearance: 0.30 mm (0.0118 in.)

Select a thrust washer to obtain the standard clearance.

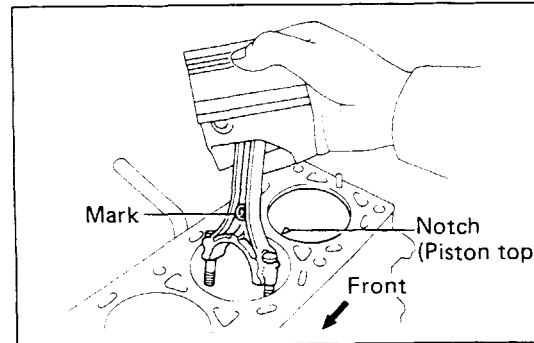
Standard clearance: 0.02 — 0.22 mm
(0.0008 — 0.0087 in.)

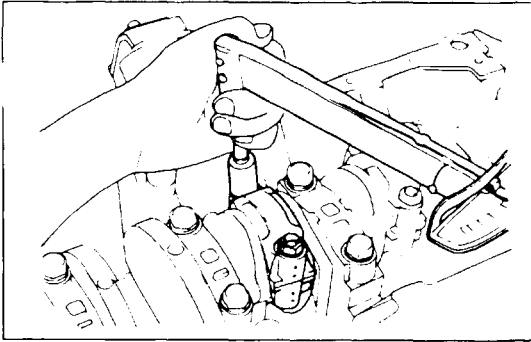
- (d) Check that the crankshaft turns.

4. INSTALL PISTON AND CONNECTING ROD ASSEMBLY

- (a) Lubricate the cylinder bore and rod journal with clean engine oil.
- (b) Using a ring compressor, push the correctly numbered piston and rod assembly into each cylinder. Make sure the notch and mark are facing forward.

Size	Thickness mm (in.)
STD	2.00 (0.0787)
O/S 0.125	2.06 (0.0811)
O/S 0.250	2.13 (0.0839)



**5. INSTALL ROD BEARING CAPS**

- (a) Match the numbered cap with the numbered rod.
- (b) Align the marks punched on the rod and cap and tighten the cap nuts to specified torque alternately in two or three passes.

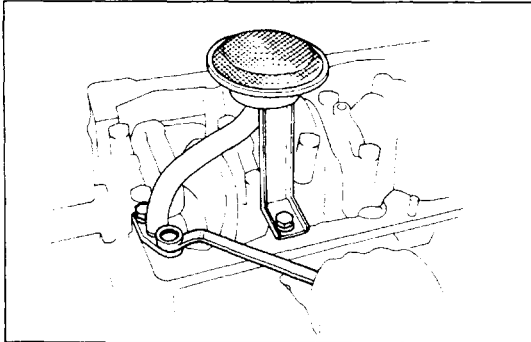
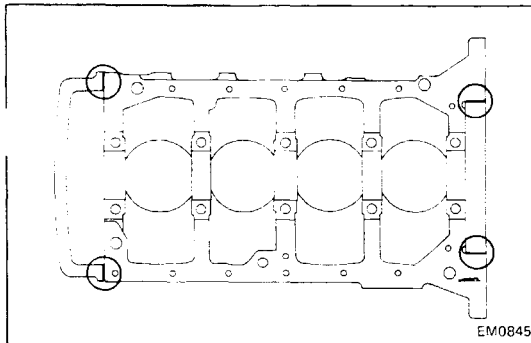
Torque: 630 kg-cm (46 ft-lb, 62 N-m)

NOTE: After tightening the caps, check that the crankshaft rotates smoothly.

6. MEASURE ROD THRUST CLEARANCE
(See step 3 on page EM-52)**7. INSTALL OIL STRAINER**

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

Torque: 130 kg-cm (9 ft-lb, 13 N-m)

**8. INSTALL REAR OIL SEAL RETAINER****9. INSTALL TIMING CHAIN** (See page EM-44)**10. INSTALL OIL PAN** (See step 11 on page EM-46)**11. INSTALL CYLINDER HEAD** (See page EM-27)**12. REMOVE ENGINE STANDS****13. INSTALL REAR END PLATE****14. 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)

15. INSTALL CLUTCH DISC AND COVER TO FLYWHEEL (for M/T) (See page CL-9)

INSTALLATION OF ENGINE

1. CONNECT TRANSMISSION TO ENGINE

2. PLACE ENGINE WITH TRANSMISSION IN VEHICLE

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

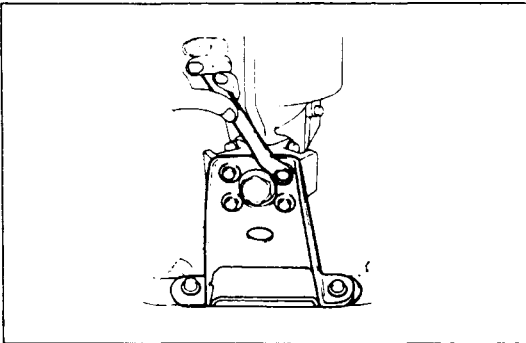
3. PLACE JACK UNDER TRANSMISSION

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

- Align the engine mounting and frame bracket.
- Install the engine mounting bolts on each side of the engine.
- Remove the hoist chain.



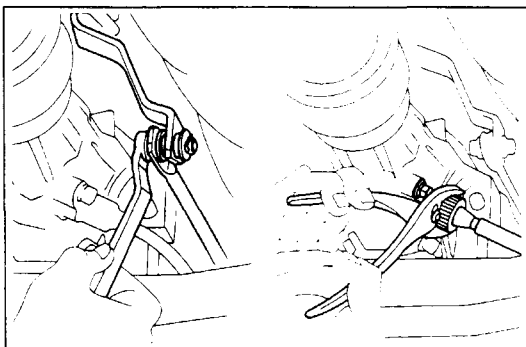
6. INSTALL ENGINE REAR MOUNTING BRACKET

- Place the bracket between the transmission and member.
- Install the eight bolts.
- Torque the four transmission mount bolts.

Torque: 260 kg-cm (19 ft-lb, 25 N·m)

- Torque the four bracket bolts.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)



7. CONNECT SPEEDOMETER CABLE

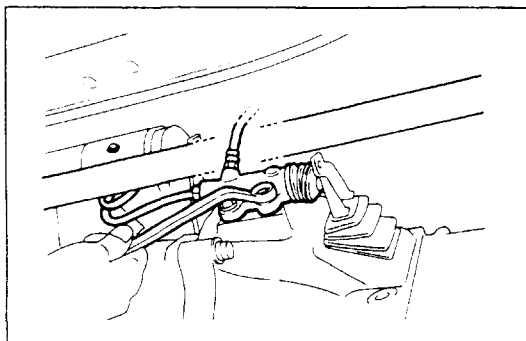
8. CONNECT SHIFT LINKAGE TO SHIFT LEVER (with A/T)

9. INSTALL CLUTCH RELEASE CYLINDER WITH BRACKET (with M/T)

10. INSTALL INTERMEDIATE SHAFT (See page PR-11)

11. INSTALL EXHAUST PIPE

- Connect the exhaust pipe to the catalytic converter.
- Connect the exhaust pipe to the exhaust manifold.
- Install the exhaust pipe clamp.

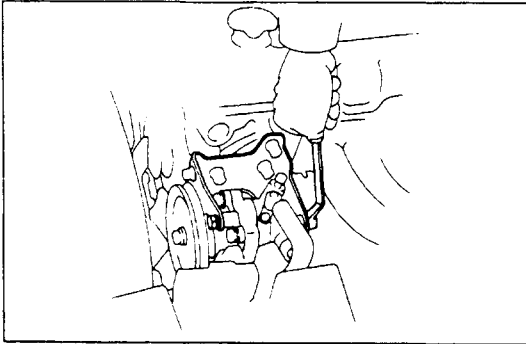


12. CONNECT FOLLOWING PARTS:

- Neutral start switch wire (with A/T)
- Back-up light switch wire
- Fuel hose
- Oil pressure sender gauge wire

13. LOWER VEHICLE

14. **INSTALL SHIFT LEVER FOR INSIDE OF VEHICLE (with M/T)**
15. **CONNECT BOND CABLES TO ENGINE REAR SIDE AND RH SIDE**
16. **INSTALL COMPRESSOR TO BRACKET (with A/C)**
 - (a) Install the compressor with four bolts.
 - (b) Install the drive belt and adjust the belt tension.



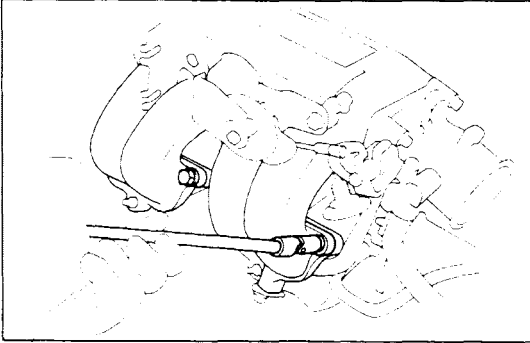
17. **CONNECT BOND CABLE FOR VANE PUMP BRACKET**
18. **INSTALL VANE PUMP WITH VANE PUMP BRACKET (with power steering)**

Install the vane pump with four bolts.
19. **CONNECT FOLLOWING PARTS:**
 - (a) Distributor wire
 - (b) High-tension cord
 - (c) Alternator wires
 - (d) Ox sensor wire

POST INSTALLATION

1. CONNECT FOLLOWING WIRES:

- (a) Starter wire
- (b) Oil pressure switch wire
- (c) Vacuum switch wire
- (d) Thermo sensor wire
- (e) Injector wires
- (f) OD thermo switch wire (with A/T)
- (g) Water thermo sensor wire
- (h) Cold start injector time switch wire



2. INSTALL CHAMBER WITH THROTTLE BODY

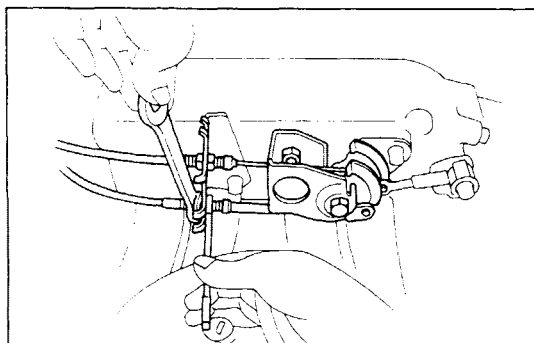
- (a) Position a new gasket on the intake manifold.
- (b) Install the chamber with throttle body.
- (c) Install the four bolts.
- (d) Install the two nuts with a bond cable.
- (e) Connect the chamber and stay with a bolt.
- (f) Install the EGR valve to the chamber with two bolts.

3. CONNECT FOLLOWING WIRES:

- (a) Air valve wire
- (b) Throttle position sensor wire
- (c) Cold start injection wire
- (d) Ox sensor 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) Water by-pass hose No.2 and No.3 to the throttle body.
- (f) Air valve hose No.2 to the chamber
- (g) Air valve hose No.1 to the throttle body
- (h) EGR vacuum modulator hose
- (i) Actuator hose (with cruise control)
- (j) EVAP hose (for canister)
- (k) Air control valve hoses
- (l) Brake booster hose
- (m) PCV hose No.1 and No.2



5. CONNECT CABLES TO BRACKET

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

6. 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.
- (d) Connect the two cooler hoses (with A/T)

7. INSTALL COUPLING FAN WITH FAN**8. INSTALL AIR CLEANER HOSE AND AIR CLEANER****9. 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

4.0 liters (4.2 US qts, 3.5 Imp. qts)

w/ Oil filter change

4.6 liters (4.9 US qts, 4.0 Imp. qts)

10. 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)

11. INSTALL ENGINE UNDER COVER**12. INSTALL AND ADJUST HOOD (See page BO-2)****13. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY****14. START ENGINE**

Warm up the engine and inspect for leaks.

15. PERFORM ENGINE ADJUSTMENT**16. ROAD TEST**

Perform a road test

17. 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. DRAIN AUTOMATIC TRANSMISSION FLUID (with A/T)**
- 6. REMOVE AIR CLEANER**
 - (a) Disconnect air hoses No.1 and No.4 from the air cleaner.
 - (b) Remove the air cleaner.
- 7. REMOVE COUPLING FAN WITH FAN**
- 8. DISCONNECT TWO HEATER HOSES**
- 9. REMOVE RADIATOR WITH SHROUD**
 - (a) Disconnect the two cooler hoses. (with A/T)
 - (b) Disconnect the radiator upper and lower hoses from the engine.
 - (c) Disconnect the reservoir hose.
 - (d) Remove the radiator with the shroud.
- 10. DISCONNECT ACCELERATOR CABLE FROM CARBURETOR**

Disconnect the cable from carburetor and bracket.
- 11. DISCONNECT FOLLOWING WIRES:**
 - (a) VSV wire for EVAP
 - (b) VSV wire for A/C
 - (c) Vacuum switch wire
 - (d) HAC wire (Ex. Calif.)
 - (e) Cold mixture heater wire
 - (f) OD thermo switch wire (for A/T)
 - (g) Fuel cut solenoid wire
 - (h) Water temperature sender gauge wire
 - (i) EACV wire (for Calif.)
 - (j) Starter wire
 - (k) Oil pressure switch wire

12. 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

13. REMOVE DRIVE BELT**REMOVAL OF CYLINDER BLOCK**

(See page EM-49)

PREPARATION FOR DISASSEMBLY

(See page EM-51)

DISASSEMBLY OF CYLINDER BLOCK

(See page EM-52)

INSPECTION OF CYLINDER BLOCK

(See page EM-55)

DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLY

(See page EM-56)

INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLY

(See page EM-57)

REPLACEMENT OF ROD BUSHING

(See page EM-58)

INSPECTION AND REPAIR OF CRANKSHAFT

(See page EM-59)

REPLACEMENT OF REAR OIL SEAL

(See page EM-60)

BORING OF CYLINDERS

(See page EM-60)

ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLY

(See page EM-61)

INSTALLATION OF CRANKSHAFT, PISTON AND CONNECTING ROD ASSEMBLY

(See page EM-62)

INSTALLATION OF ENGINE

(See page EM-64)

POSTINSTALLATION OF CYLINDER BLOCK**1. CONNECT FOLLOWING WIRES:**

- (a) Starter wire
- (b) Oil pressure switch wire
- (c) VCS wire (Ex. Calif.)
- (d) EACV wire (for Calif.)
- (e) Water temperature sender gauge wire
- (f) Fuel cut solenoid wire
- (g) OD thermo switch wire (for A/T)
- (h) Cold mixture heater wire
- (i) HAC wire (Ex. Calif.)
- (j) Vacuum switch wire
- (k) VSV wire for A/C
- (l) 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.
- (d) Connect the two cooler hoses (with A/T)

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

- (a) Connect air hoses No.1 and No.4 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	4.0 liters (4.2 US qts, 3.5 Imp. qts)
w/ Oil filter change	4.6 liters (4.9 US qts, 4.0 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**

Perform a road test.

16. RECHECK COOLANT AND ENGINE OIL LEVEL