

ENGINE SERVICE

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CYLINDER HEAD

DISASSEMBLY

Disassemble the parts in the numerical order shown in the figure.

Fig. 3-1

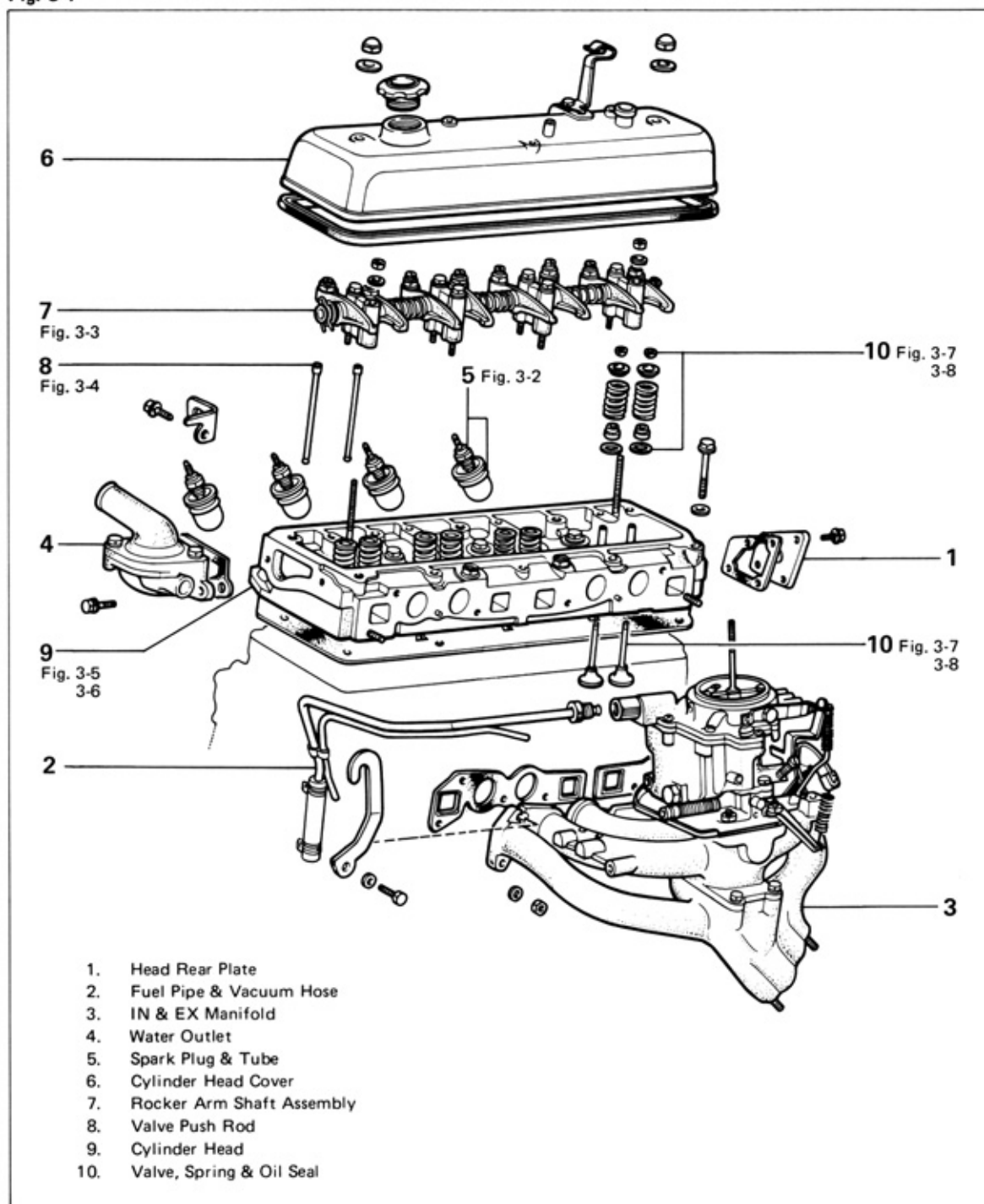
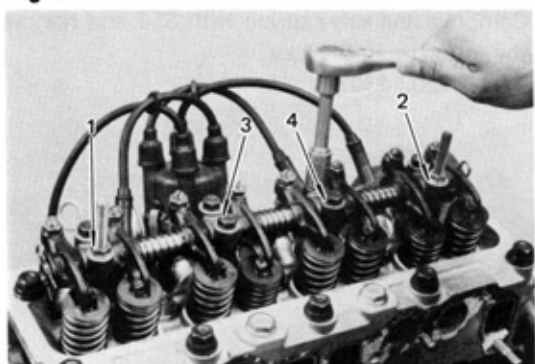


Fig. 3-2



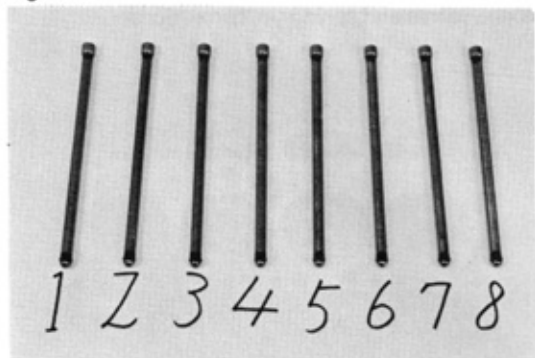
Remove the plug cords carefully by pulling on rubber boot.

Fig. 3-3



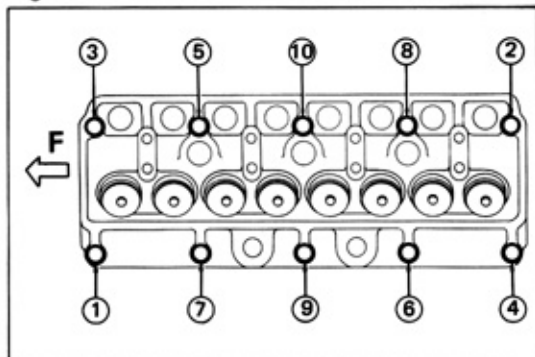
Loosen the valve rocker support bolts little by little, in three or four steps, in the specified numerical sequence.

Fig. 3-4



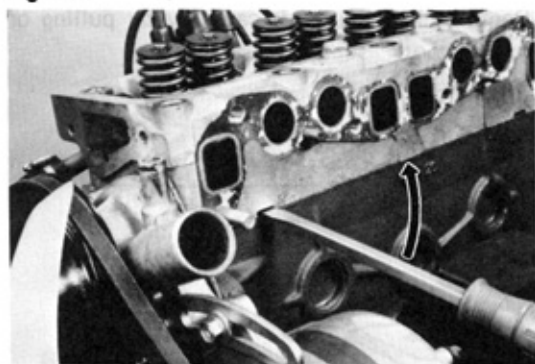
Keep the push rods in correct order.

Fig. 3-5



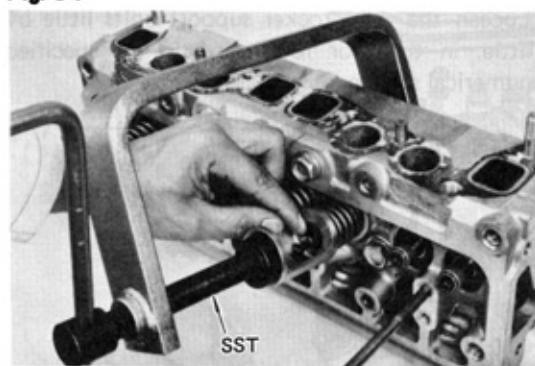
Loosen cylinder head bolts little by little, in two or three steps, in the specified numerical sequence.

Fig. 3-6



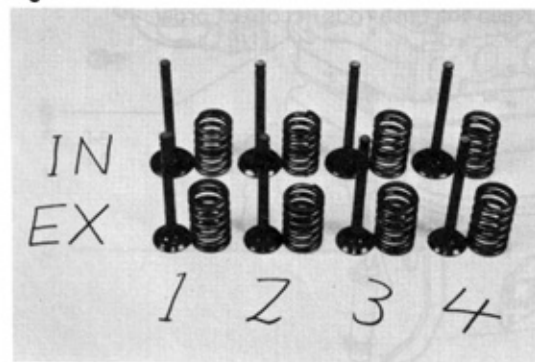
If it is difficult to lift up the cylinder head, insert a screwdriver between the head and block and pry off as shown in the figure.

Fig. 3-7



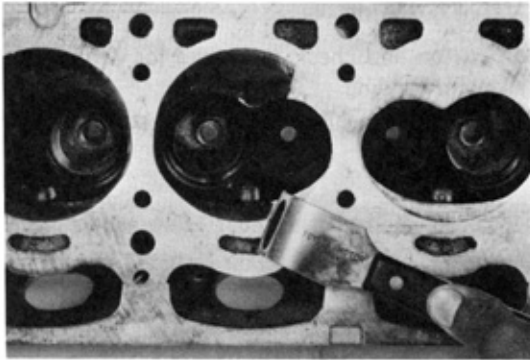
Compress the valve spring with SST and remove the spring retainer locks.
SST [09202-43012]

Fig. 3-8



Keep valves and springs in correct order.

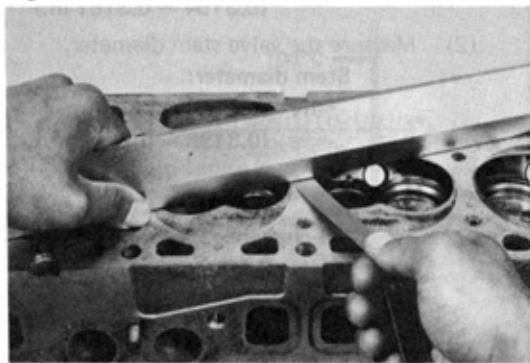
Fig. 3-9

**INSPECTION & REPAIR****Cylinder Head**

1. Clean and check the cylinder head for cracks or scoring.



Fig. 3-10

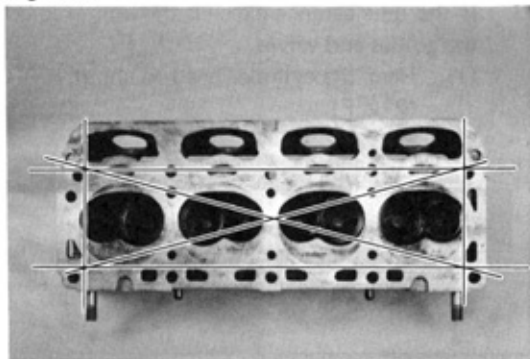


2. Using a precision straight edge and thickness gauge, check cylinder head underside surface for warpage.

Underside surface warpage limit:

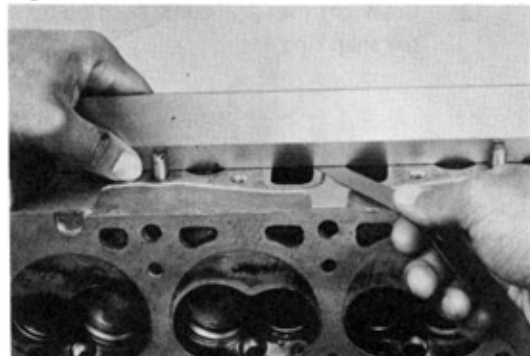
**0.05 mm
(0.0020 in.)**

Fig. 3-11



3. Check surfaces along the indicated lines for warpage.

Fig. 3-12



4. Inspect the manifold mounting surface for warpage.

**Manifold mounting surface
warpage limit: 0.1 mm
(0.004 in.)**

5. If the warpage exceeds the limit, either machine flatten or replace the cylinder head.

**Maximum reface limit: 0.3 mm
(0.012 in.)**

Fig. 3-13

**Valve & Guide**

1. Clean and check the valves for wear, scores and bending.

2. Measure the valve stem oil clearance.

- (1) Measure the inner diameter of the valve guide.

Inner diameter

(for both IN and EX):

8.01 – 8.03 mm

(0.3154 – 0.3161 in.)

- (2) Measure the valve stem diameter.

Stem diameter:

IN 7.965 – 7.980 mm

(0.3136 – 0.3142 in.)

EX 7.960 – 7.975 mm

(0.3134 – 0.3140 in.)

Oil clearance limit:

IN 0.08 mm

(0.0031 in.)

EX 0.10 mm

(0.0039 in.)

Fig. 3-14

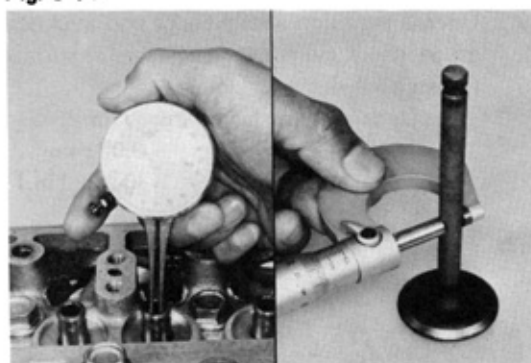
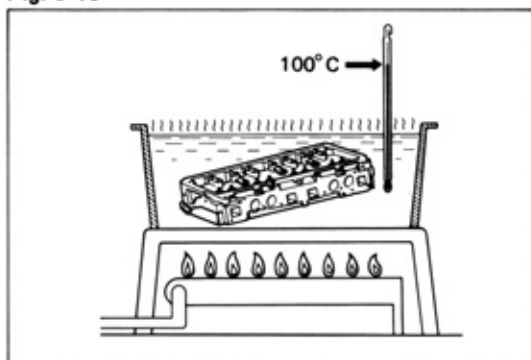


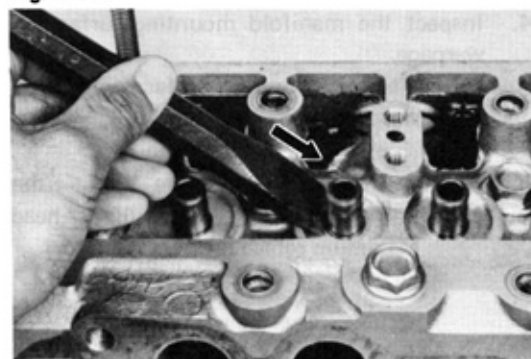
Fig. 3-15



3. If the oil clearance exceeds the limit, replace the guides and valves.

- (1) Heat the cylinder head to about 100°C (212°F).

Fig. 3-16



- (2) Break off the valve guide bushing tip at the snap ring.

Fig. 3-17

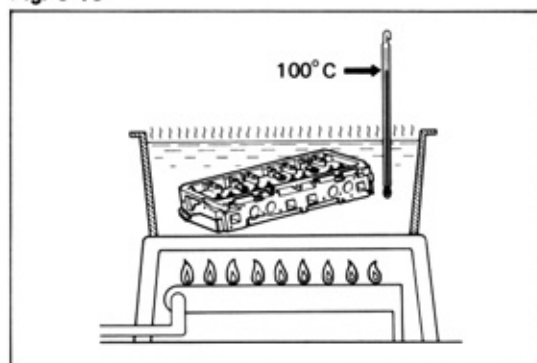


- (3) Using SST, drive out the valve guide from the top end toward the combustion chamber.
SST [09201-60011]

— Caution —

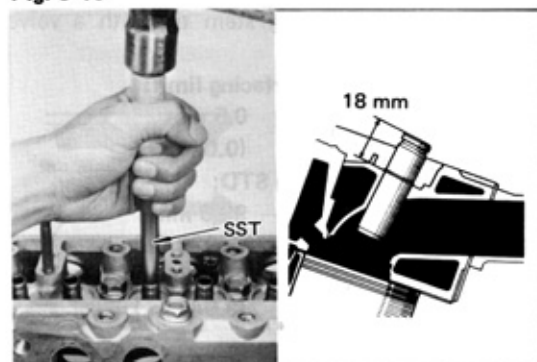
Before driving out the bushing, be sure the snap ring is removed.

Fig. 3-18



- (4) Reheat the cylinder head to about 100°C (212°F).

Fig. 3-19



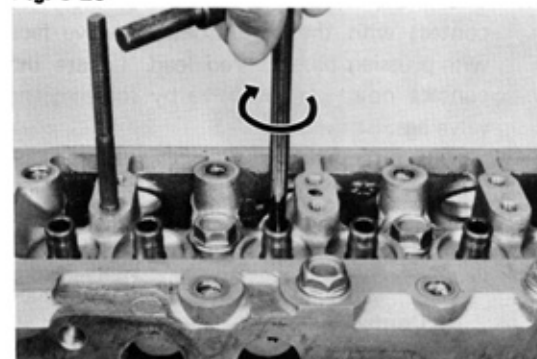
- (5) Drive in the new bushing with SST.
SST [09201-60011]

**Projected length: 18 mm
(0.71 in.)**

— Note —

An oversize valve guide bushing of 0.05 is available to obtain proper tightness between the cylinder head and valve guide bushing.

Fig. 3-20

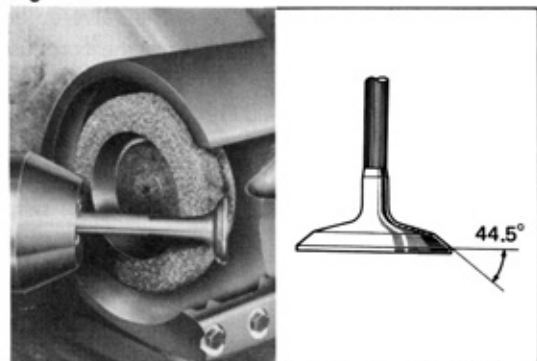


- (6) Ream the valve guide with a sharp reamer to obtain the specified clearance.

Oil clearance STD:

IN	0.030 – 0.065 mm (0.0012 – 0.0026 in.)
EX	0.035 – 0.070 mm (0.0014 – 0.0028 in.)

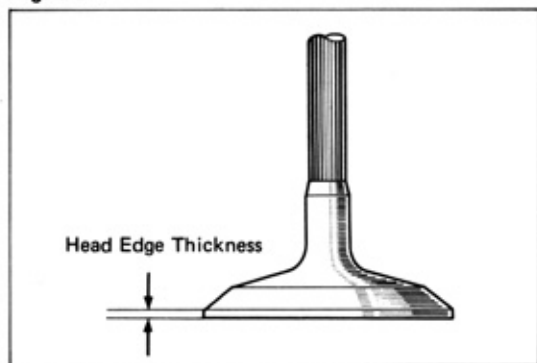
Fig. 3-21



4. Reface the valve seating face with a valve refacer.

Valve face angle: 44.5°

Fig. 3-22

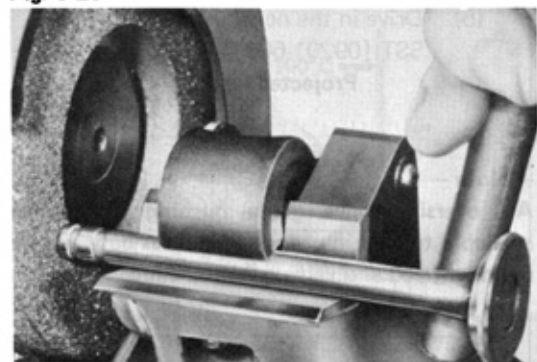


5. Check the valve head edge thickness.

Head edge thickness limit:

IN	0.8 mm (0.031 in.)
EX	0.9 mm (0.035 in.)

Fig. 3-23



6. Resurface the valve stem tip with a valve grinder.

Stem tip resurfacing limit:

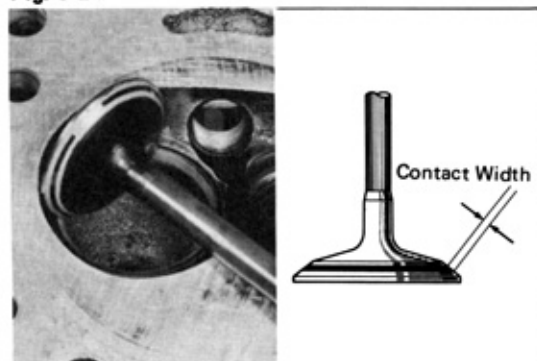
0.5 mm (0.020 in.)

Overall length STD:

IN	99.9 mm (3.933 in.)
EX	100.1 mm (3.941 in.)

Valve Seat

Fig. 3-24



1. Check the width and position of the valve contact with the seat. Coat the valve face with prussian blue or red lead. Locate the contact point on the valve by rotating the valve against the seat.

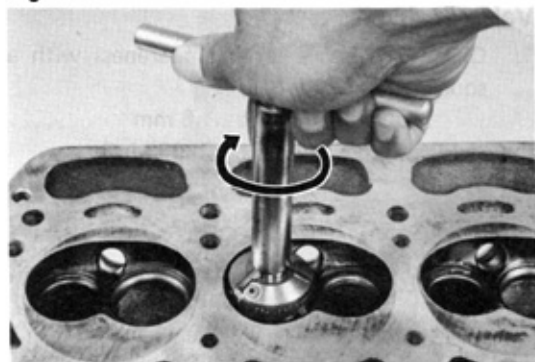
Contact width:

IN	1.1 – 1.8 mm (0.043 – 0.071 in.)
EX	1.2 – 1.8 mm (0.047 – 0.071 in.)

Contact position:

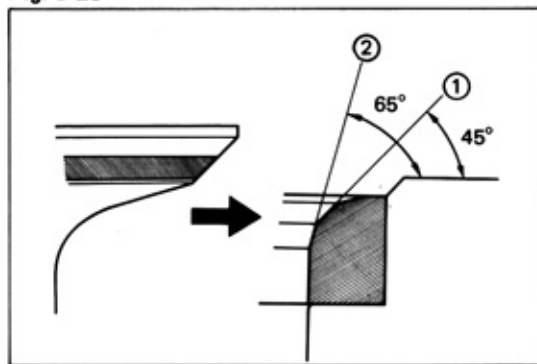
Middle of valve face

Fig. 3-25



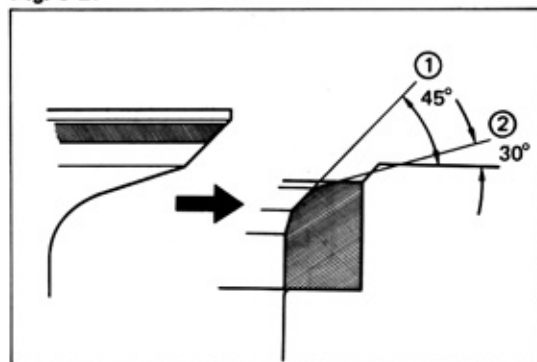
2. Resurface the valve seat with a 45° cutter to clean the seat.

Fig. 3-26



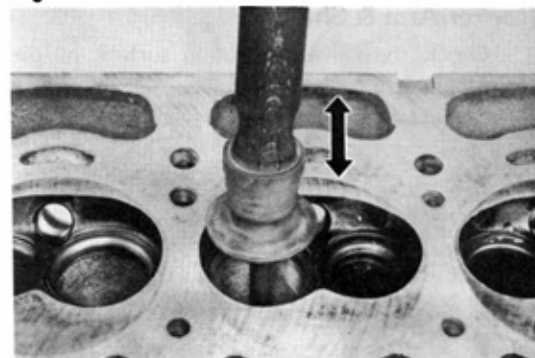
3. Correct seat position.
 - (1) If the seat position is too high, use 45° and 65° cutters in the order indicated.

Fig. 3-27



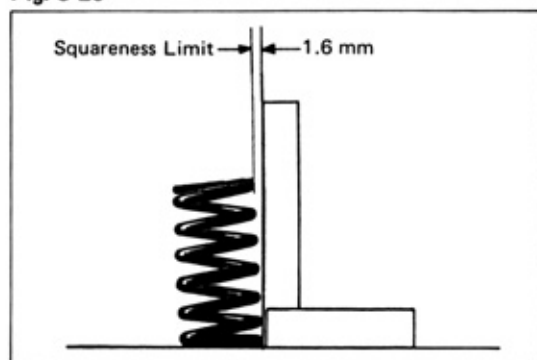
- (2) If the seat position is too low, use 45° and 30° cutters in the order indicated.

Fig. 3-28



4. After correction, the valve and valve seat should be lapped lightly with a lapping compound.

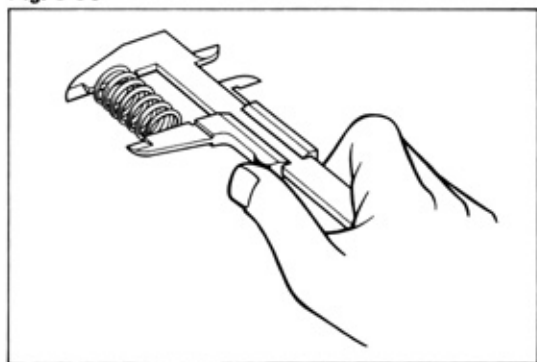
Fig. 3-29

**Valve Spring**

1. Check the valve spring squareness with a square.

Squareness limit: 1.6 mm
(0.063 in.)

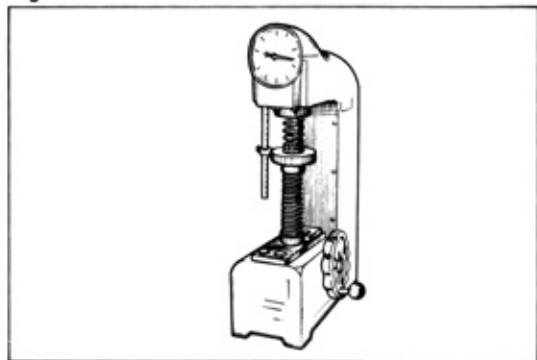
Fig. 3-30



2. Measure the free length of the valve springs.

Free length: 46.5 mm
(1.831 in.)

Fig. 3-31

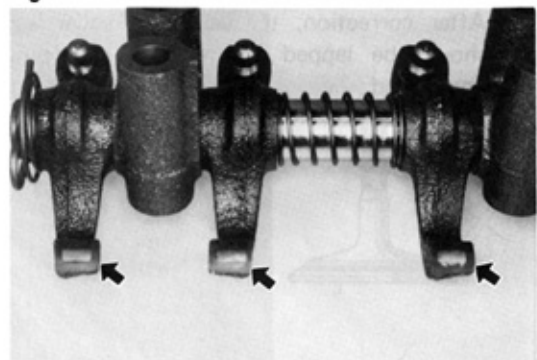


3. Using a spring tester, measure the spring tension at the specified installed length.

Installed length: 38.4 mm
(1.512 in.)

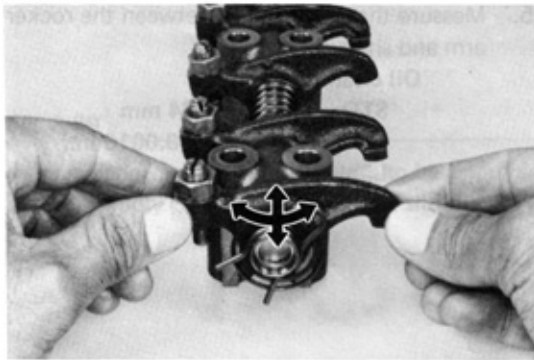
Installed load:
STD 31.8 kg
(70.1 lb)
Limit 25.0 kg
(55.1 lb)

Fig. 3-32

**Rocker Arm & Shaft**

1. Check the valve contacting surface of the rocker arm for wear.
Correct or replace if necessary.

Fig. 3-33



2. Check the rocker arm-to-shaft clearance by moving each rocker arm as shown in the figure. Little or no movement should be possible.
If movement is felt, disassemble and inspect.



3. Disassemble the valve rocker shaft assembly in the numerical order shown in the figure.

— Note —

Keep the rocker arms in correct order.

Fig. 3-34

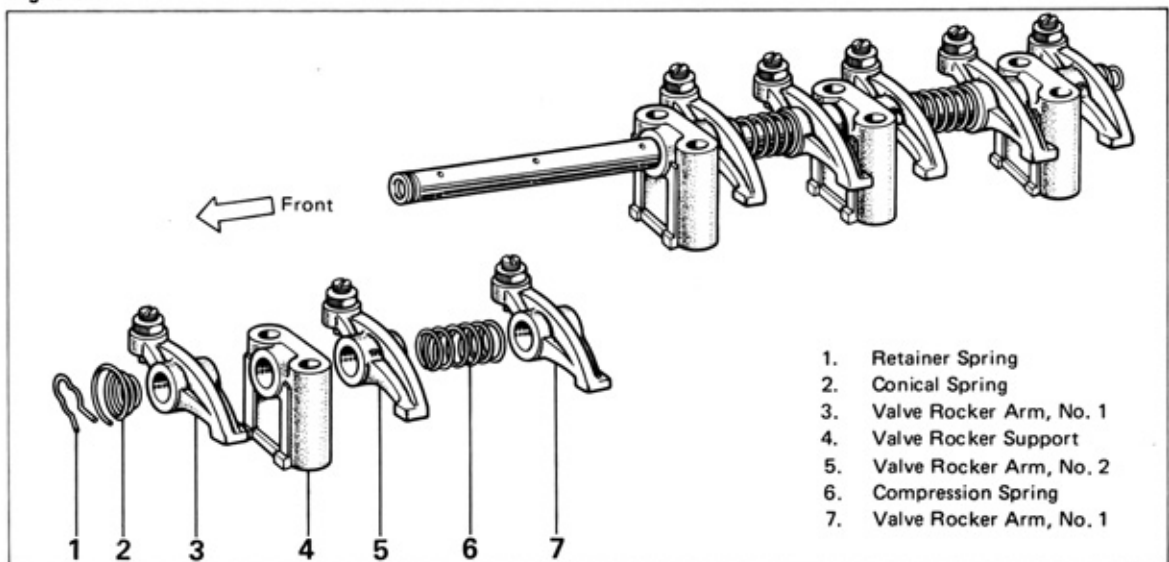
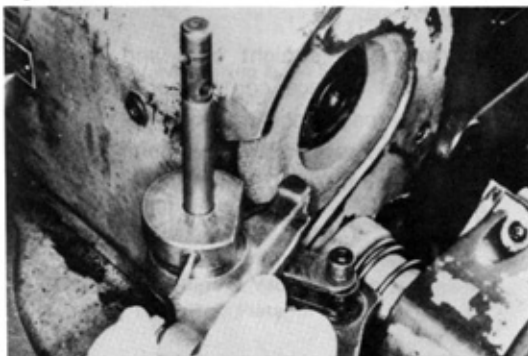
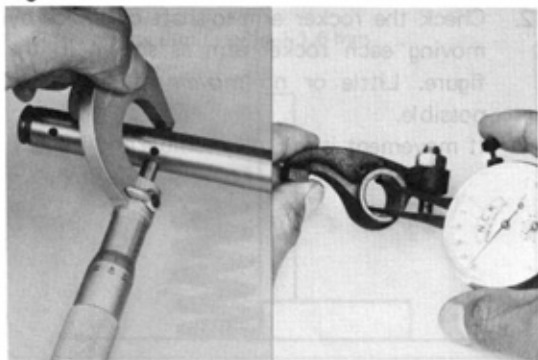


Fig. 3-35



4. If only a light ridged wear, correct the valve contacting surface of the rocker arm with a valve refacer and oil stone.

Fig. 3-36



5. Measure the oil clearance between the rocker arm and shaft.

Oil clearance:

STD	0.02 – 0.04 mm (0.0008 – 0.0016 in.)
Limit	0.06 mm (0.0024 in.)



6. Assemble the valve rocker shaft assembly in the numerical order shown in the figure.

Fig. 3-37

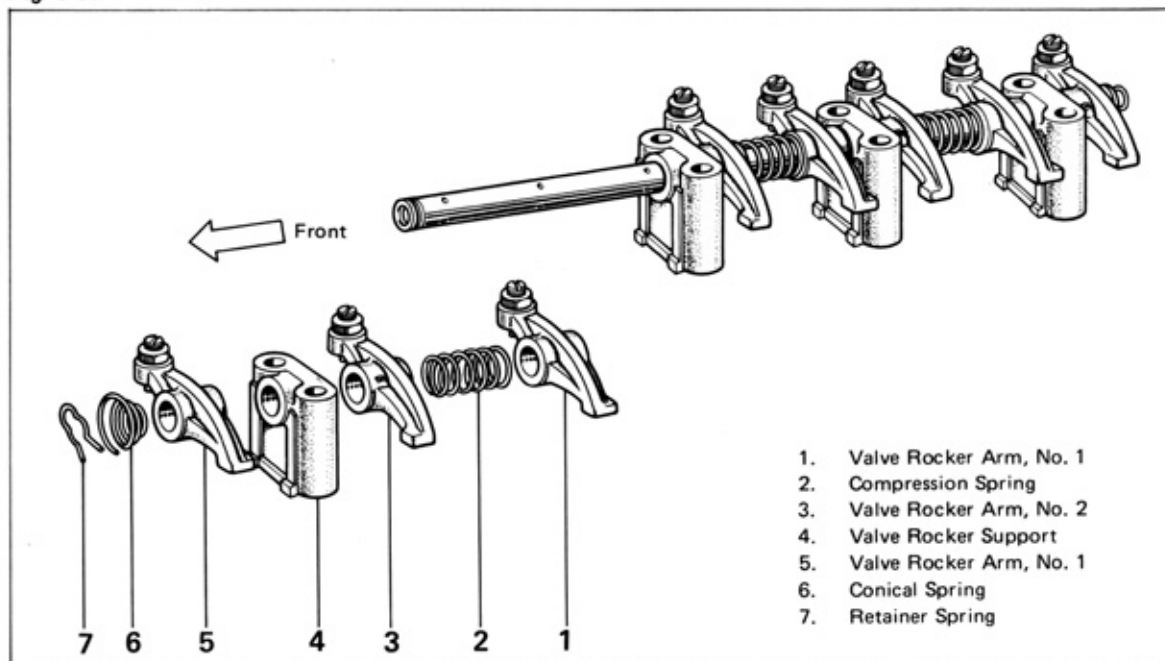
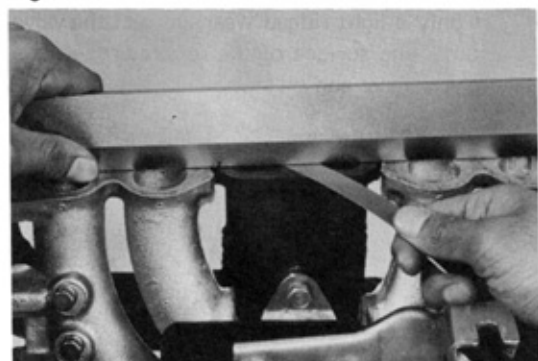


Fig. 3-38



Manifold

Using a precision straight edge and thickness gauge, inspect surface contacting the cylinder head for warpage, and correct or replace if warped over the specified limit.

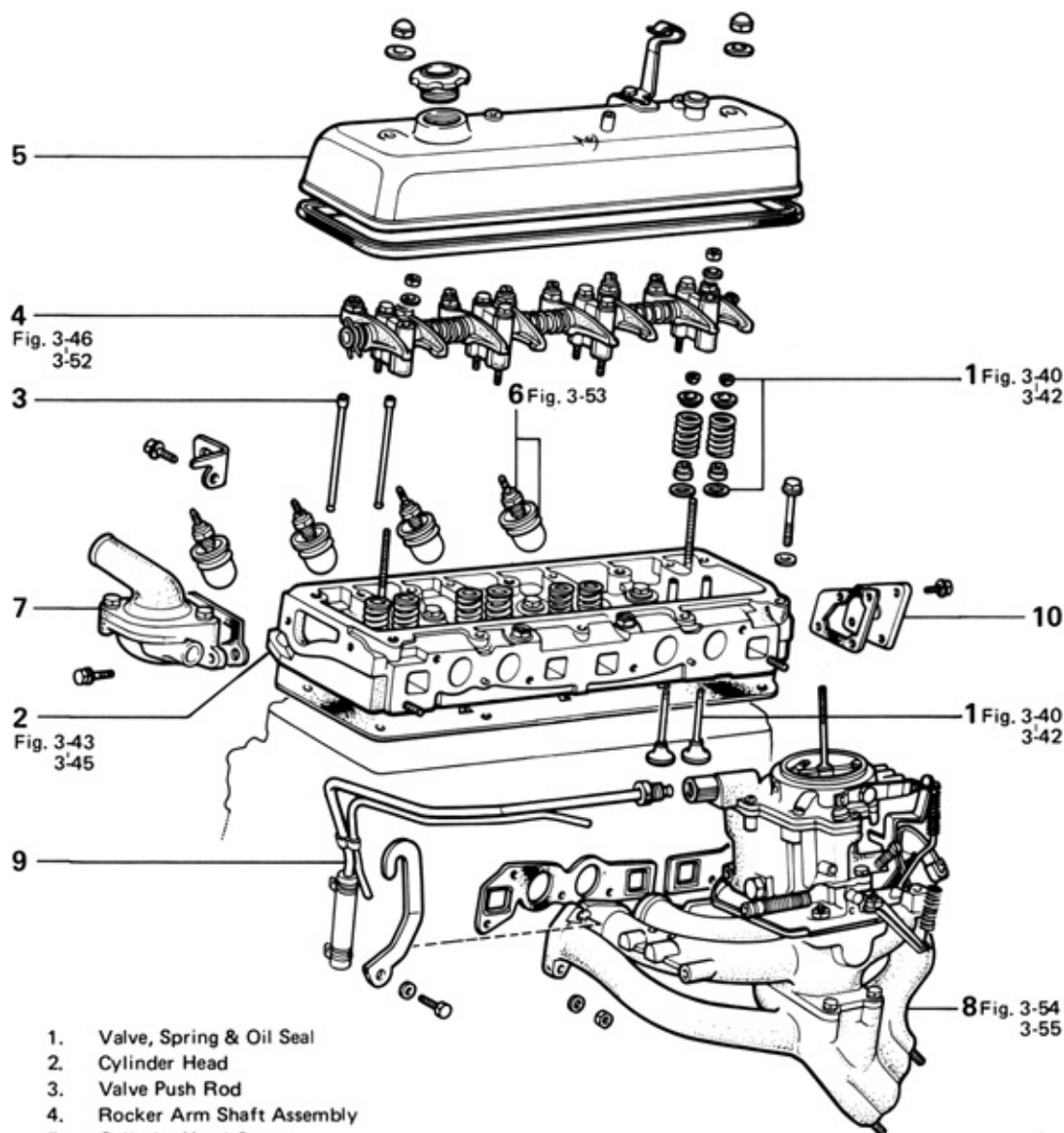
Warpage limit:	0.3 mm (0.012 in.)
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ASSEMBLY

Assemble the parts in the numerical order shown in the figure.

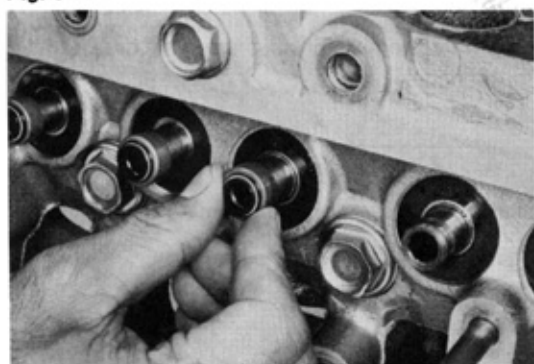
Fig. 3-39

- Thoroughly clean all parts to be assembled.
- Apply clean engine oil to all sliding and rotating surfaces of the parts before assembly.



1. Valve, Spring & Oil Seal
2. Cylinder Head
3. Valve Push Rod
4. Rocker Arm Shaft Assembly
5. Cylinder Head Cover
6. Spark Plug & Tube
7. Water Outlet
8. IN & EX Manifold
9. Fuel Pipe & Vacuum Hose
10. Head Rear Plate

Fig. 3-40

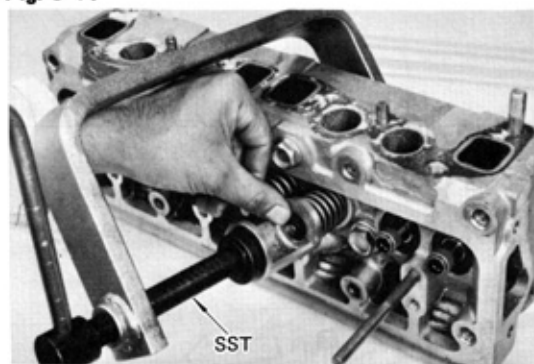


Install the spring seat and oil seal before assembling the valve spring.

— Note —

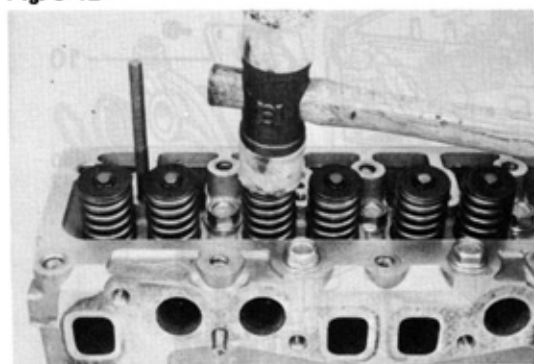
A new oil seal should be used whenever the valve is disassembled.

Fig. 3-41



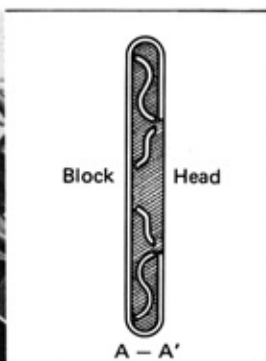
Compress the valve spring with SST and install the spring retainer locks.
SST [09202-43012]

Fig. 3-42



After installing the springs, lightly tap the stem ends to snug down the springs.

Fig. 3-43

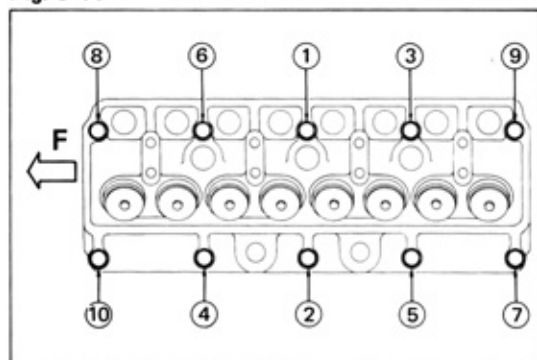


Put the cylinder head gasket on the cylinder block, aligning the bolt, water and oil holes as shown in the figure.

— Note —

Clean the cylinder block upper surface with a scraper before installing the head gasket.

Fig. 3-44

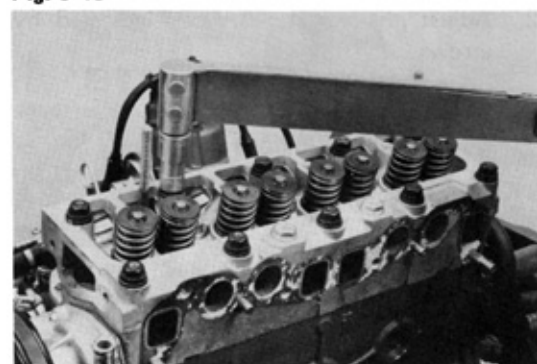


Tighten the cylinder head bolts little by little, in two or three steps, in the specified numerical sequence.

— Note —

Apply a light coating of engine oil on the bolt threads and under the bolt head before installing.

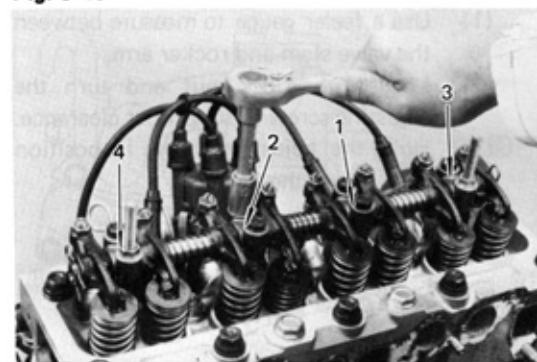
Fig. 3-45



Tighten the cylinder head bolts to specified torque.

Tightening torque: 5.4 – 6.6 kg-m
(40 – 47 ft-lb)

Fig. 3-46

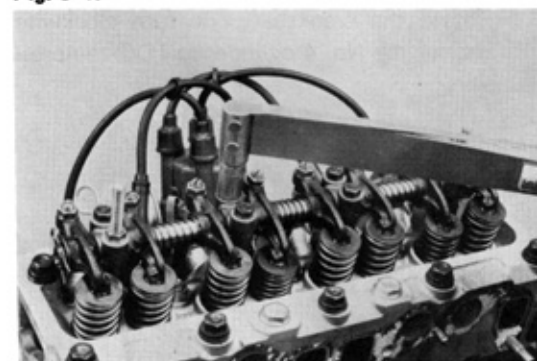


Tighten the valve rocker support bolts little by little, in three or four steps, in the specified numerical sequence.

— Note —

Do not keep the valve push rods apart from the adjusting screws while tightening the bolts.

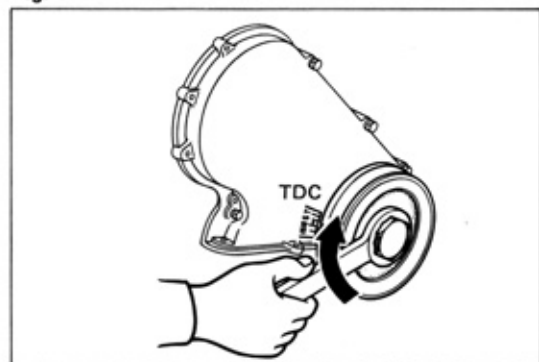
Fig. 3-47



Tighten the valve rocker support bolts to specified torque.

Tightening torque: 1.8 – 2.4 kg-m
(14 – 17 ft-lb)

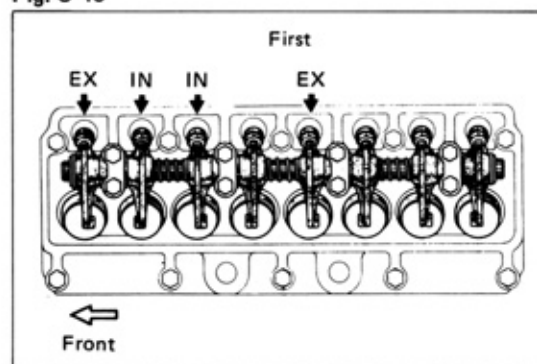
Fig. 3-48



Adjust the valve clearance.

1. Set No. 1 cylinder to TDC/compression.

Fig. 3-49

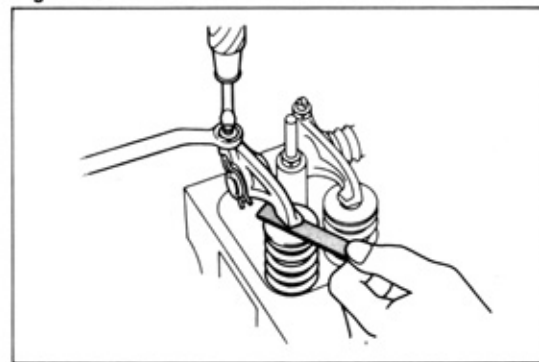


2. Adjust the valve clearances indicated by arrows.

Valve clearance, cold:

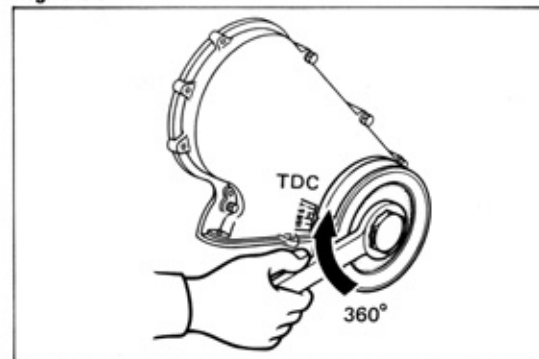
IN	0.13 mm (0.0051 in.)
EX	0.23 mm (0.0091 in.)

Fig. 3-50



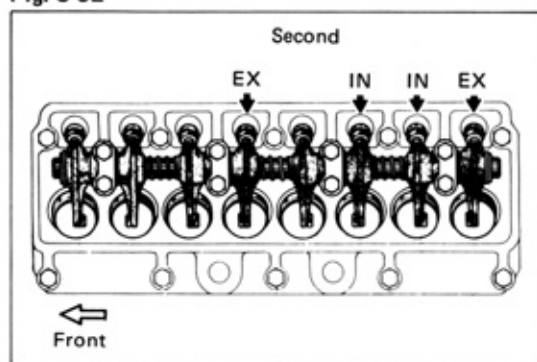
- (1) Use a feeler gauge to measure between the valve stem and rocker arm.
- (2) Loosen the lock nut and turn the adjusting screw to set proper clearance.
- (3) Hold the adjusting screw in position and tighten the lock nut.

Fig. 3-51



3. Rotate the crankshaft one turn clockwise and set the No. 4 cylinder to TDC/compression.

Fig. 3-52

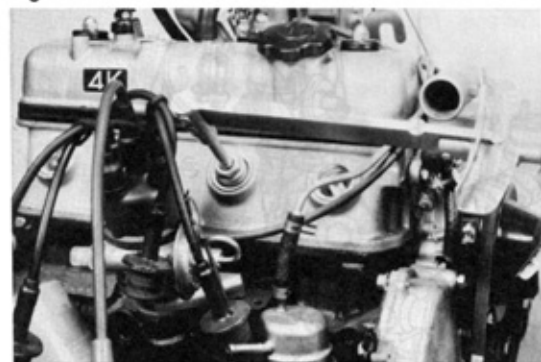


4. Adjust the remaining valves indicated by arrows.

Valve clearance, cold:

IN	0.13 mm (0.0051 in.)
EX	0.23 mm (0.0091 in.)

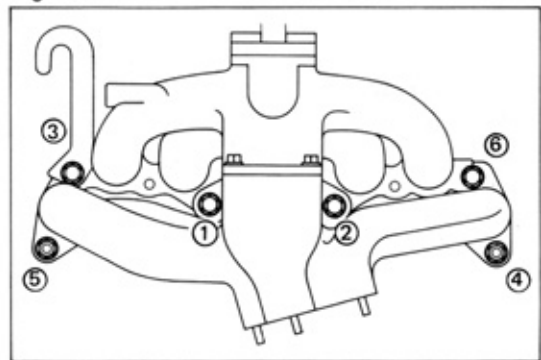
Fig. 3-53



Install the spark plug.

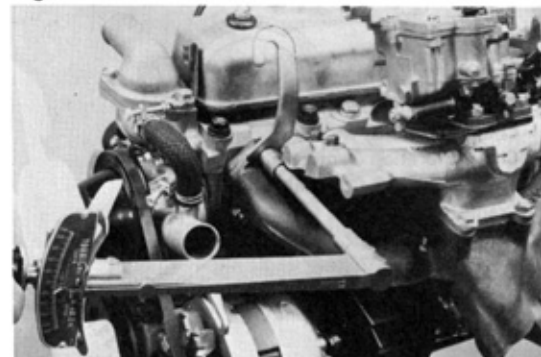
Tightening torque: 1.5 – 2.1 kg-m
(11 – 15 ft-lb)

Fig. 3-54



Tighten the mounting bolts and nuts in the specified numerical sequence.

Fig. 3-55



Tightening torque: 2.0 – 3.0 kg-m
(15 – 21 ft-lb)

TIMING CHAIN & CAMSHAFT

DISASSEMBLY

Disassemble the parts in the numerical order shown in the figure.

Fig. 3-56

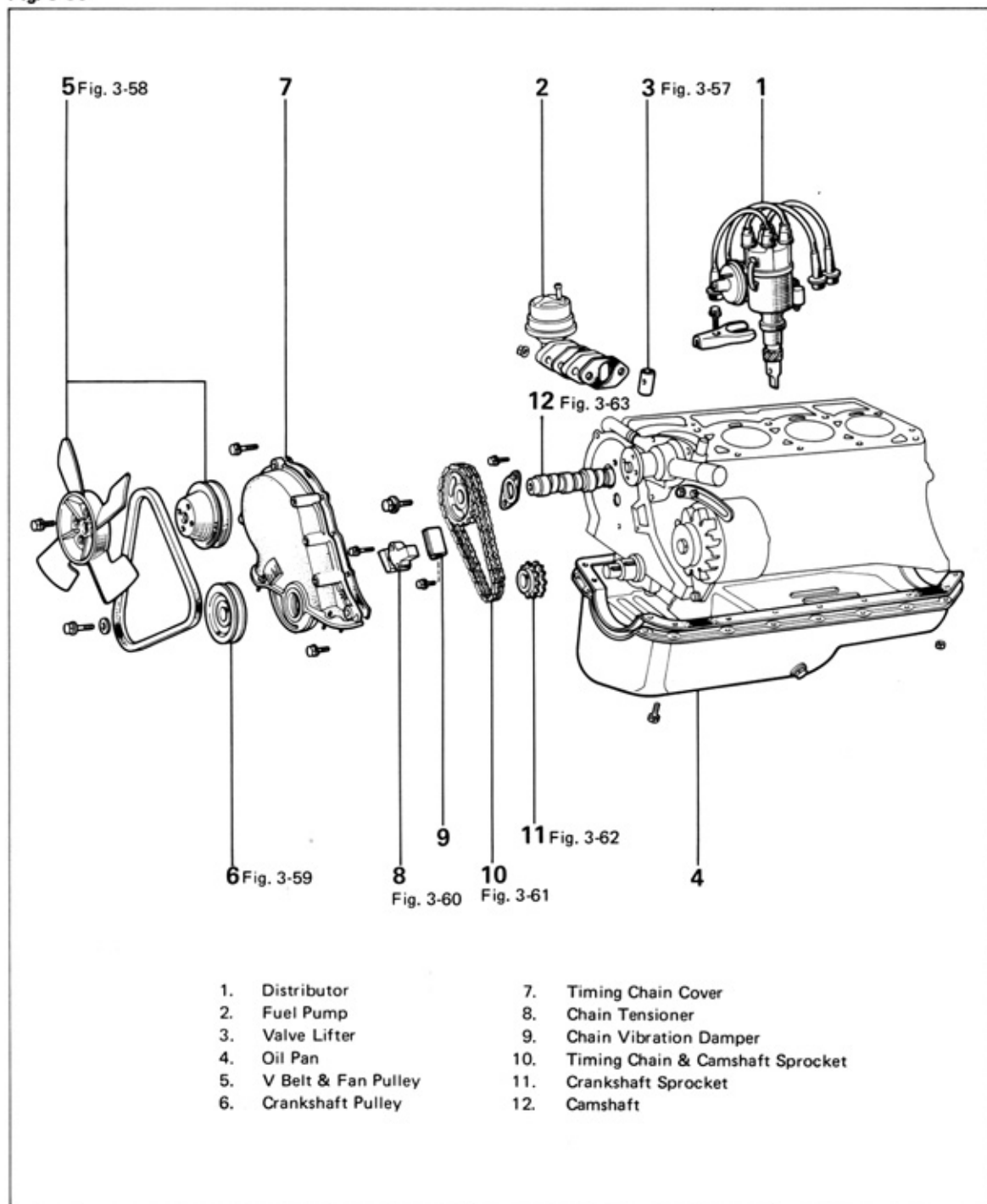
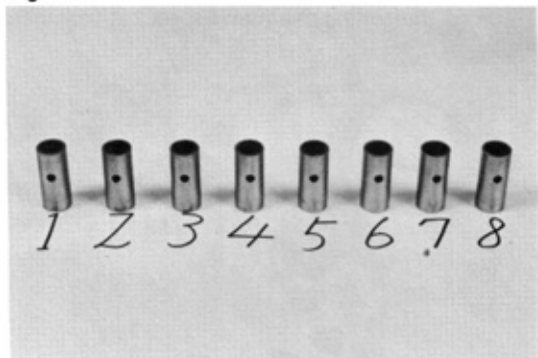
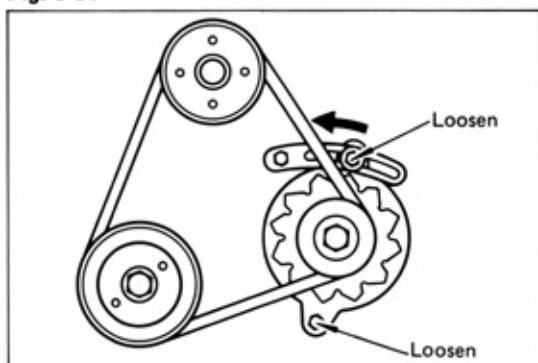


Fig. 3-57



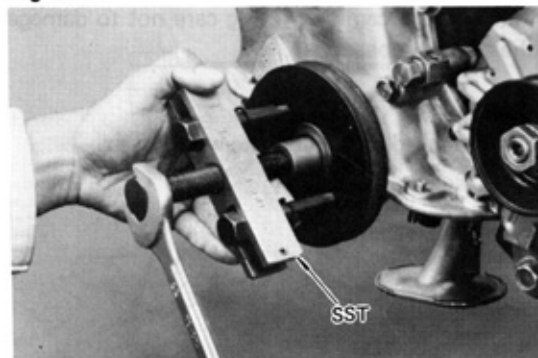
Keep the valve lifters in correct order.

Fig. 3-58



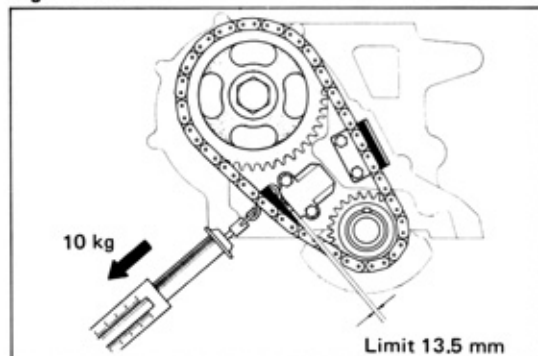
Loosen the locking bolts just enough so that the alternator can be moved, and remove the V belt.

Fig. 3-59



Remove the crankshaft pulley with SST.
SST [09213-31021]

Fig. 3-60



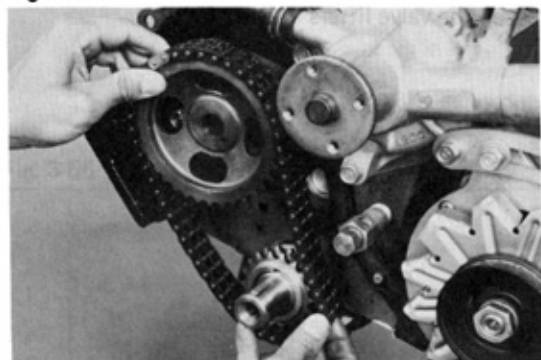
Measure the timing chain slack and, if over the limit, replace the timing chain and sprocket.

Slack limit at 10 kg (22 lb) tension:

13.5 mm

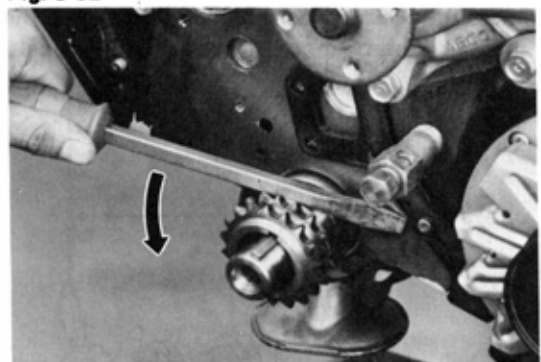
(0.531 in.)

Fig. 3-61



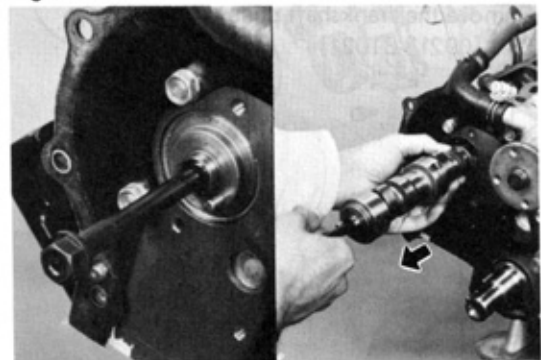
Remove the timing chain and sprocket together.

Fig. 3-62



Remove the crankshaft sprocket.

Fig. 3-63

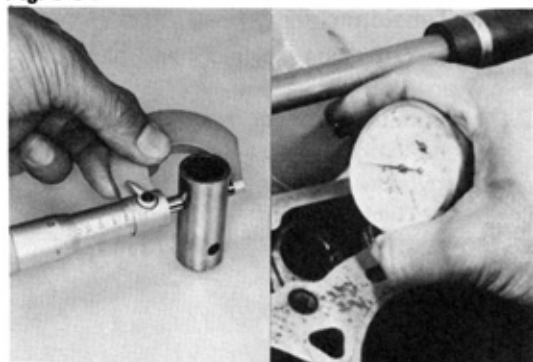


Pull out the camshaft using care not to damage the camshaft bearings.

— Note —

Use of a head bolt will make work easier.

Fig. 3-64



INSPECTION & REPAIR

Valve Lifter

Inspect the valve lifters and lifter bores for wear or damage.

Oil clearance:

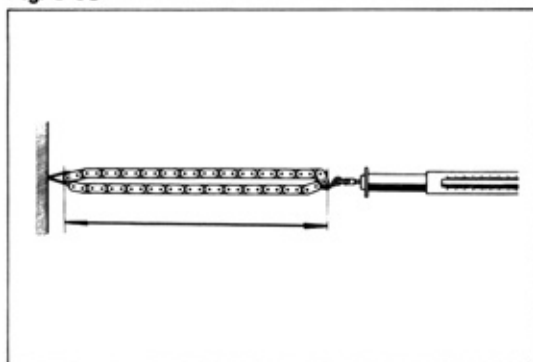
STD 0.015 – 0.029 mm
(0.0006 – 0.0011 in.)

Limit 0.1 mm
(0.004 in.)

— Note —

If the oil clearance exceeds the limit, it should be replaced with a lifter of O/S 0.05 to obtain proper clearance.

Fig. 3-65



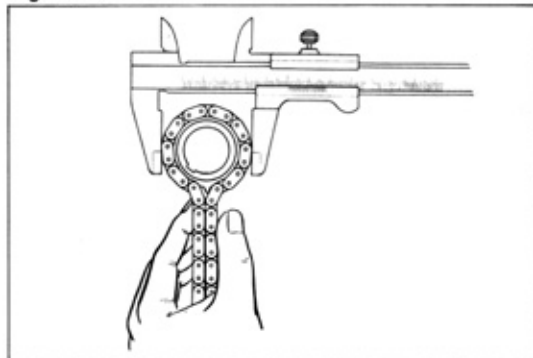
Timing Chain & Sprocket

1. Inspect the chain and sprocket for cracks, wear, or chipped teeth.
2. Measure the length of the timing chain.

Elongation limit at 5 kg (11 lb) tension:

272.7 mm
(10.736 in.)

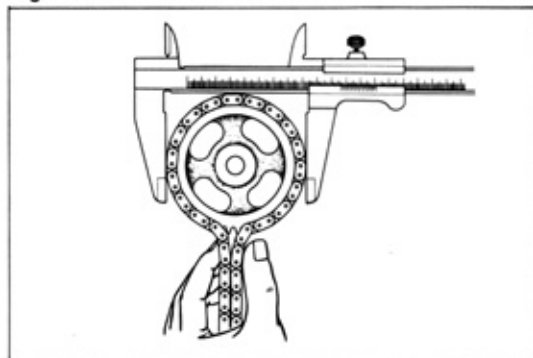
Fig. 3-66



3. Measure the crankshaft sprocket for wear as shown in the figure.

Wear limit: 59.4 mm
(2.339 in.)

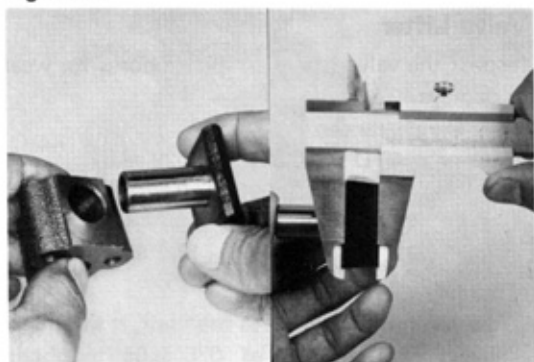
Fig. 3-67



4. Measure the camshaft sprocket for wear as shown in the figure.

Wear limit: 113.8 mm
(4.480 in.)

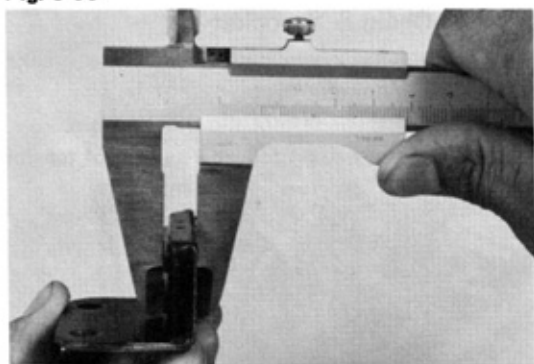
Fig. 3-68

**Chain Tensioner**

1. Inspect the body cylinder and plunger for wear.
2. Measure the tensioner head thickness. If the thickness is less than the limit, replace the cylinder and plunger as a set.

Thickness limit: 12.0 mm
(0.472 in.)

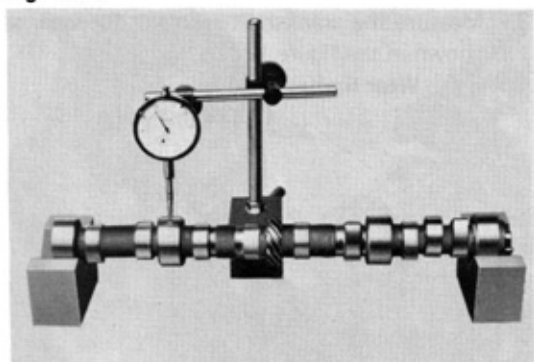
Fig. 3-69

**Chain Damper**

Measure the chain damper thickness.

Thickness limit: 7.0 mm
(0.276 in.)

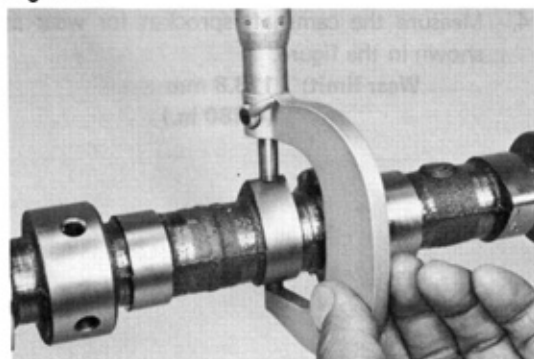
Fig. 3-70

**Camshaft**

1. Inspect the camshaft straightness, and for damage or wear.
2. Measure the runout as shown in the figure.

Circle runout limit: 0.03 mm
(0.0012 in.)

Fig. 3-71

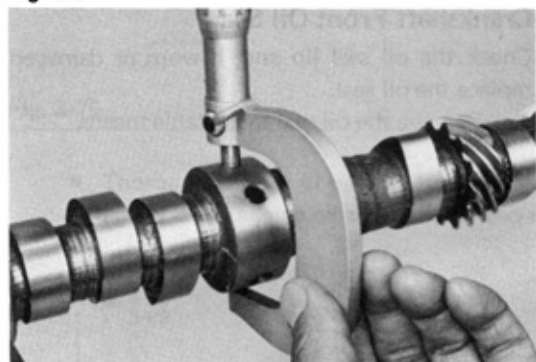


3. Measure the cam lobe height.

Cam height:

IN	STD	36.469 – 36.569 mm	
		(1.4358 – 1.4397 in.)	
	Limit	36.17 mm	
		(1.4240 in.)	
EX	STD	36.369 – 36.469 mm	
		(1.4318 – 1.4358 in.)	
	Limit	36.07 mm	
		(1.4201 in.)	

Fig. 3-72



4. Measure the journal oil clearance.

- (1) Measure the camshaft journal diameter.

Journal diameter:**STD**

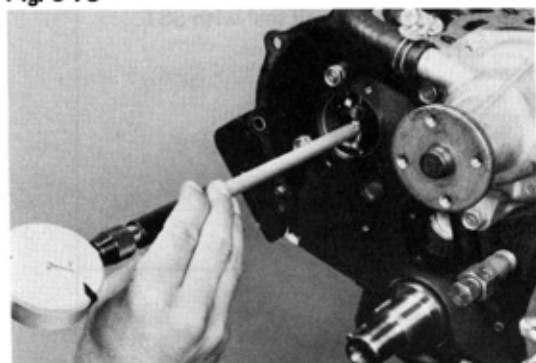
No. 1 43.209 – 43.225 mm
(1.7011 – 1.7018 in.)

No. 2 42.954 – 42.970 mm
(1.6911 – 1.6917 in.)

No. 3 42.704 – 42.720 mm
(1.6813 – 1.6819 in.)

No. 4 42.459 – 42.475 mm
(1.6716 – 1.6722 in.)

Fig. 3-73



- (2) Measure the camshaft bearing inner diameter.

To replace the bearing, refer to the CYLINDER BLOCK section.

Oil clearance:**STD No. 1 & No. 4**

0.025 – 0.066 mm
(0.0010 – 0.0026 in.)

No. 2 & No. 3

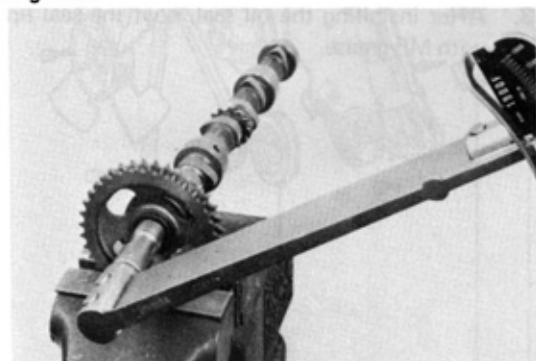
0.030 – 0.071 mm
(0.0012 – 0.0028 in.)

Limit 0.1 mm

(0.004 in.)

U/S bearing type: 0.125, 0.250

Fig. 3-74



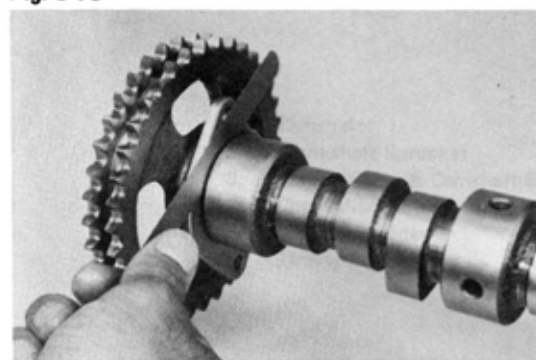
5. Measure the camshaft thrust clearance and, if it exceeds the limit, replace the thrust plate.

- (1) Install the camshaft thrust plate and sprocket onto the camshaft and tighten to specified torque.

Tightening torque:

5.4 – 6.6 kg-m
(40 – 47 ft-lb)

Fig. 3-75



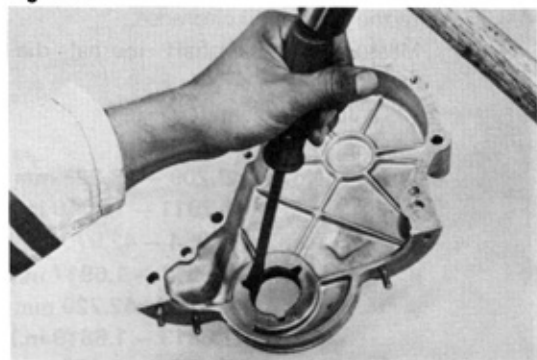
- (2) Measure the thrust clearance.

Thrust clearance:

STD 0.070 – 0.138 mm
(0.0028 – 0.0054 in.)

Limit 0.3 mm
(0.012 in.)

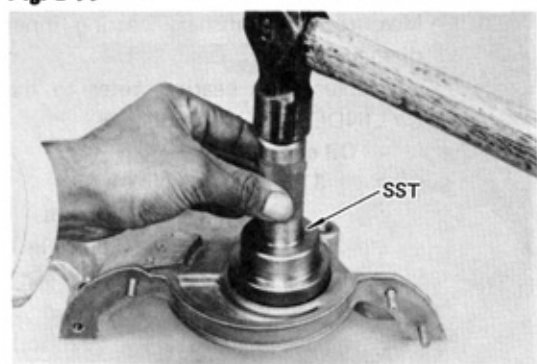
Fig. 3-76

**Crankshaft Front Oil Seal**

Check the oil seal lip and, if worn or damaged, replace the oil seal.

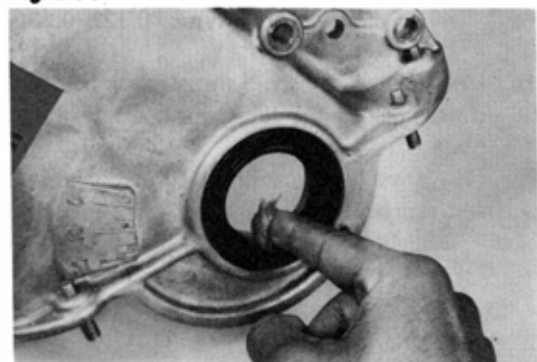
1. Remove the oil seal by suitable means.

Fig. 3-77



2. Install the new oil seal with SST.
SST [09223-22010]

Fig. 3-78



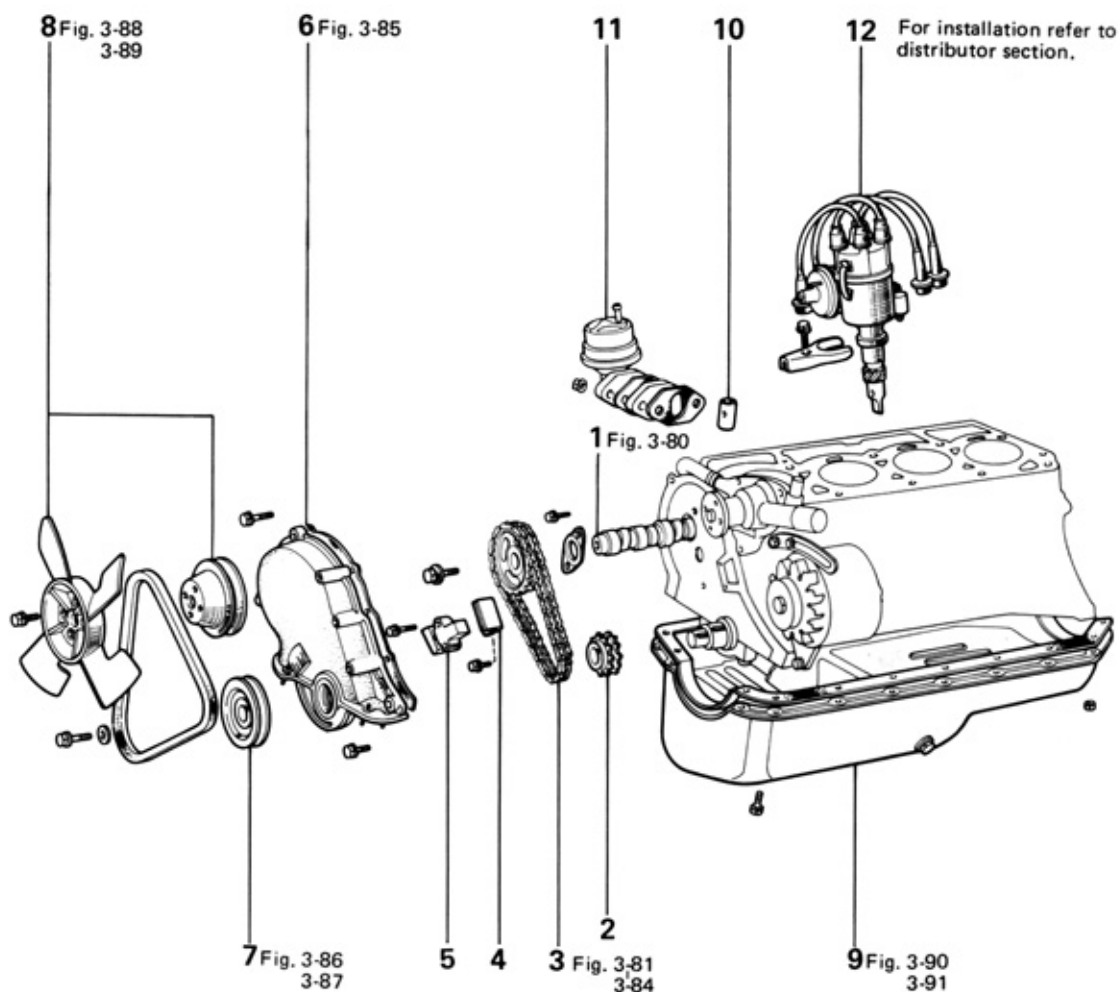
3. After installing the oil seal, coat the seal lip with MP grease.

ASSEMBLY

Assemble the parts in the numerical order shown in the figure.

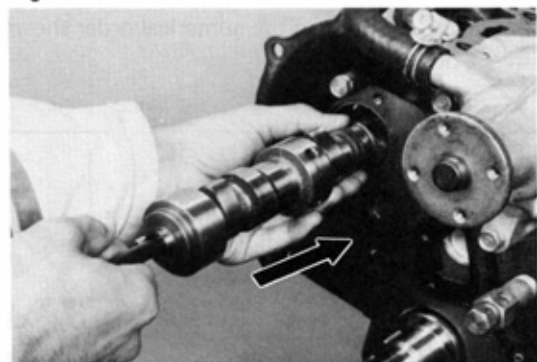
Fig. 3-79

- Thoroughly clean all parts to be assembled.
- Apply clean engine oil to all sliding and rotating surfaces of the parts before assembly.



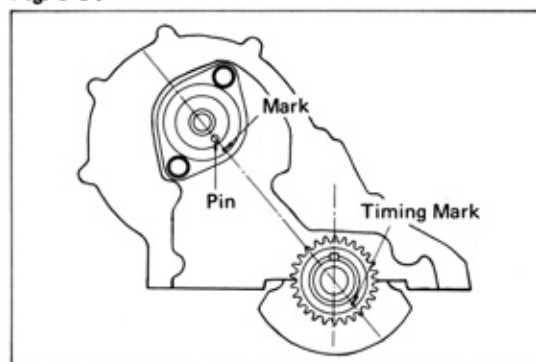
- | | |
|-------------------------------------|------------------------|
| 1. Camshaft | 7. Crankshaft Pulley |
| 2. Crankshaft Sprocket | 8. V Belt & Fan Pulley |
| 3. Timing Chain & Camshaft Sprocket | 9. Oil Pan |
| 4. Chain Vibration Damper | 10. Valve Lifter |
| 5. Chain Tensioner | 11. Fuel Pump |
| 6. Timing Chain Cover | 12. Distributor |

Fig. 3-80



Install the camshaft, using care not to damage the camshaft bearings.

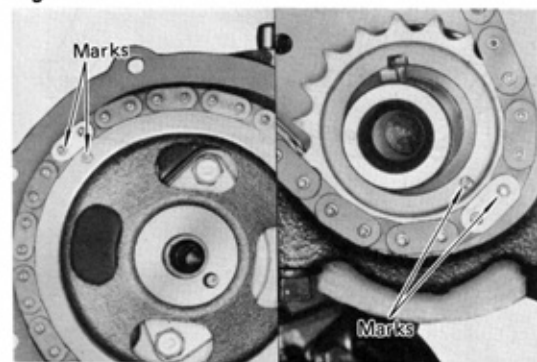
Fig. 3-81



Install the timing chain and sprocket.

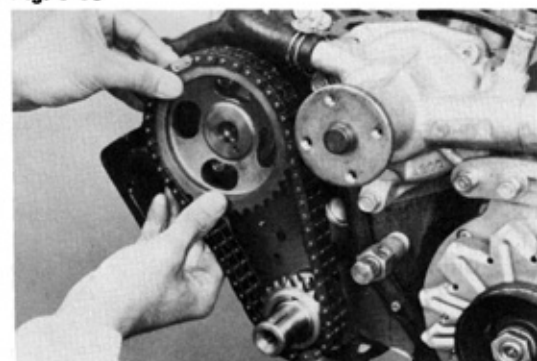
1. Set No. 1 piston to TDC.
2. Align the camshaft dowel pin with the mark on the thrust plate.

Fig. 3-82



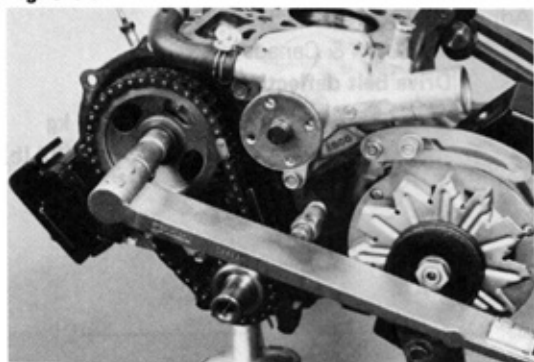
3. Align the chain timing marks with those on the sprockets.

Fig. 3-83



4. Install the timing chain and sprocket together.

Fig. 3-84



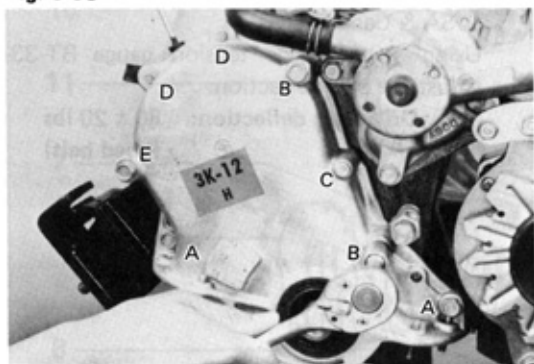
5. Tighten the set bolt.

Tightening torque: 5.4 – 6.6 kg-m
(40 – 47 ft-lb)

— Note —

Apply a light coating of engine oil on the bolt threads and under the bolt head before installing.

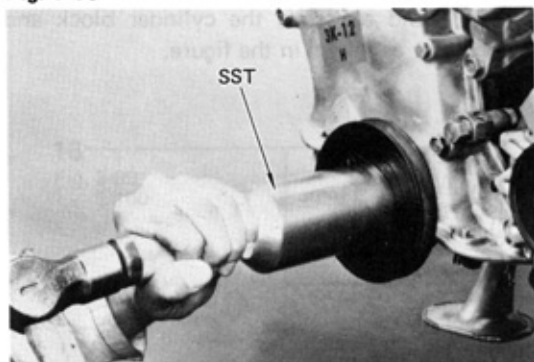
Fig. 3-85



Use the indicated bolts in the respective places.

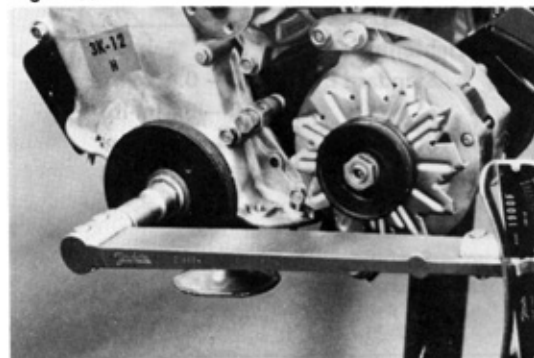
Location	Part No.
A	91611-40828
B	91651-40855
C	91651-60655
D	91651-40820
E	91651-40855

Fig. 3-86



Install the crankshaft pulley with SST.
SST [09214-60010]

Fig. 3-87



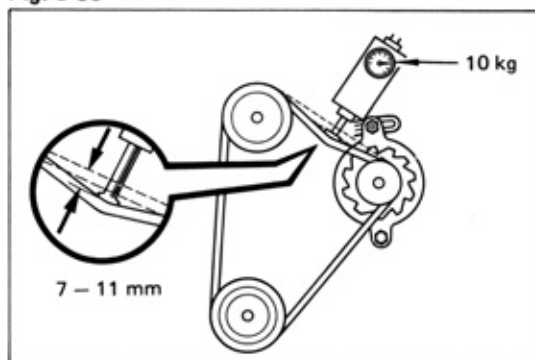
Tighten the retaining bolt.

Tightening torque: 7.5 – 10.5 kg-m
(55 – 75 ft-lb)

— Note —

Apply a light coat of engine oil on the bolt threads and under the bolt head before installing.

Fig. 3-88

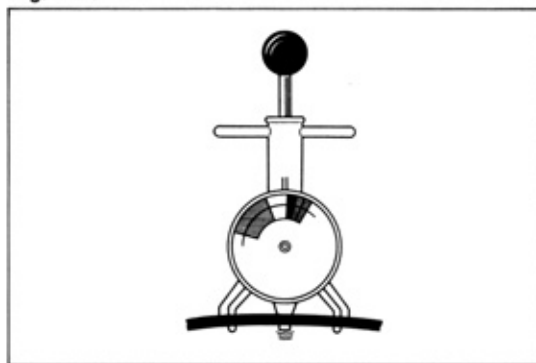


Adjust the V belt deflection.
(Except USA & Canada)

Drive belt deflection:

7 – 11 mm at 10 kg
(0.28 – 0.43 in.) (22 lb)

Fig. 3-89



(USA & Canada)

Using a borroughs tension gauge BT-33-7,
adjust the belt deflection.

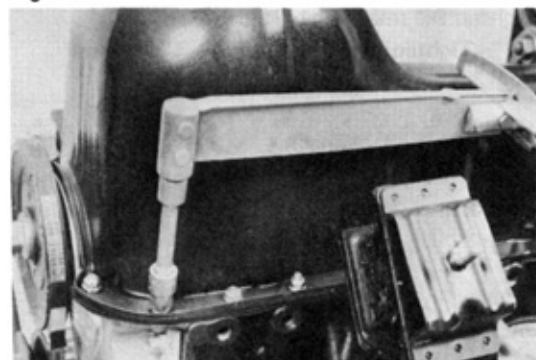
Drive belt deflection: 80 ± 20 lbs
(Used belt)

Fig. 3-90



Apply liquid sealer to the cylinder block and
chain cover as shown in the figure.

Fig. 3-91



Install the oil pan.

Tightening torque:

Standard bolt 0.2 – 0.4 kg-m
(18 – 34 in.-lb)
Step bolt 0.3 – 0.7 kg-m
(27 – 60 in.-lb)

CYLINDER BLOCK

DISASSEMBLY

Disassemble the parts in the numerical order shown in the figure.

Fig. 3-92

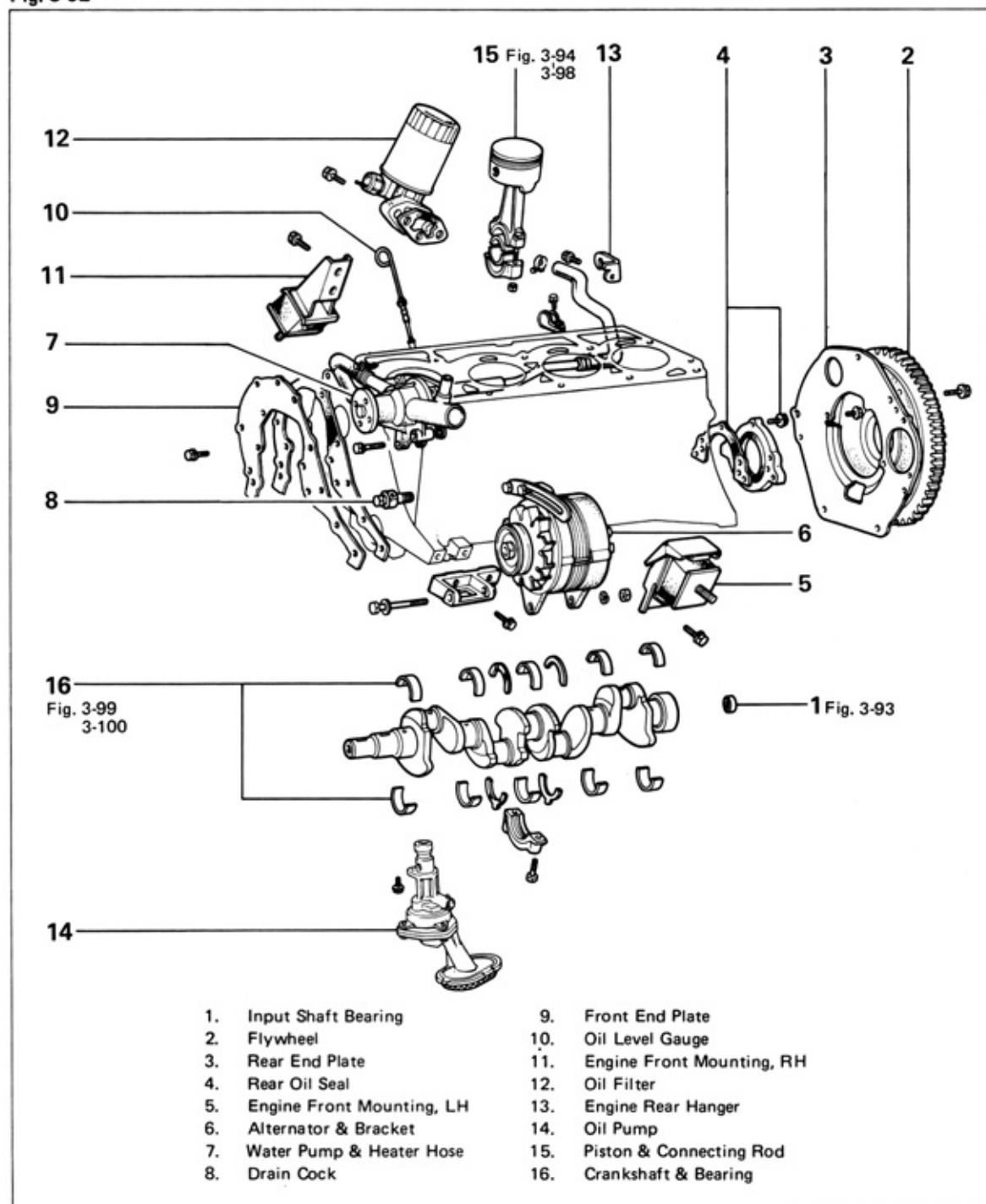
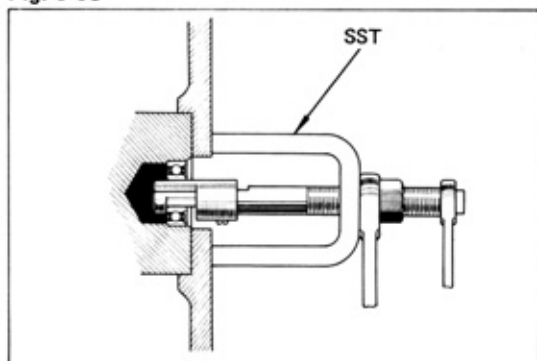


Fig. 3-93

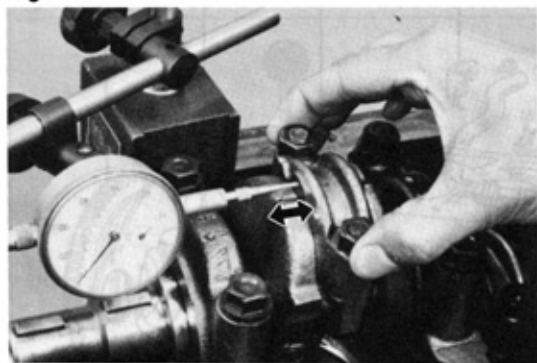


Remove the input shaft front bearing with SST. SST [09303-35011]

— Note —

In case the bearing is not normal, also check the transmission input shaft and rear bearing.

Fig. 3-94



Measure the connecting rod thrust clearance. If it exceeds the limit, replace the connecting rod.

Thrust clearance:

STD 0.200 – 0.304 mm
(0.0079 – 0.0120 in.)

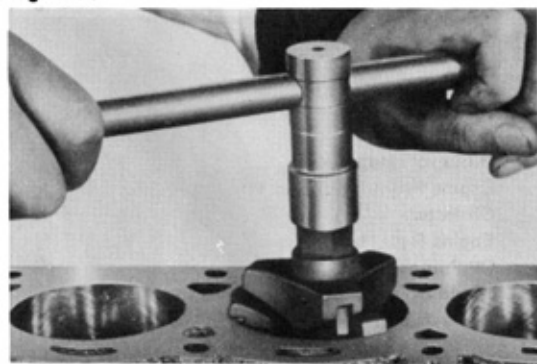
Limit 0.35 mm
(0.0138 in.)

Fig. 3-95



Mark the connecting rods and caps to prevent changing their original combinations.

Fig. 3-96

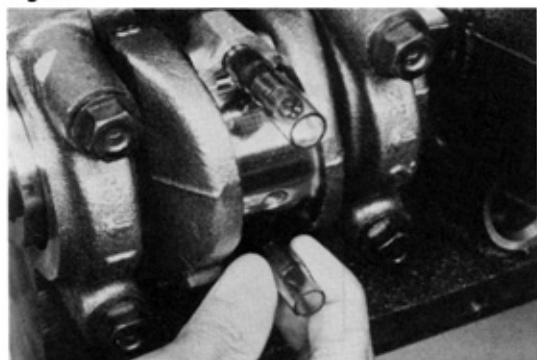


Ream the piston ring ridge at the top of the cylinder.

— Note —

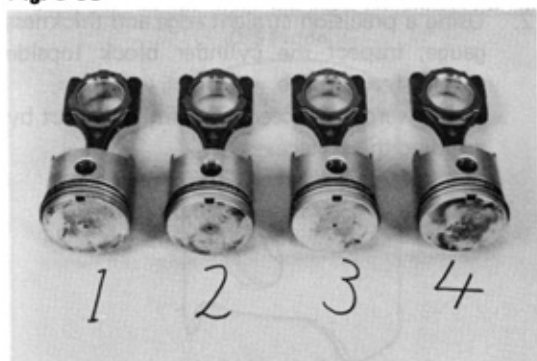
If this step is not performed prior to removing the pistons, the piston ring lands will be damaged.

Fig. 3-97



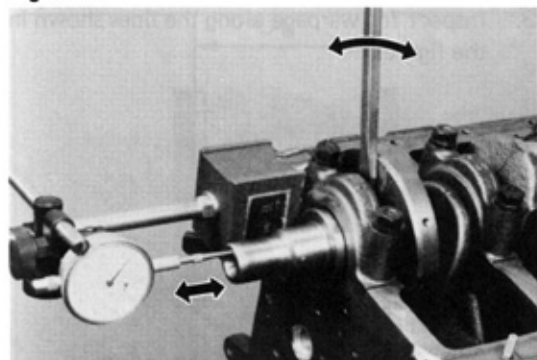
Cover the rod bolts with hoses to protect the crankshaft pins from damage.

Fig. 3-98



Keep the connecting rods and bearings in correct order.

Fig. 3-99



Measure the crankshaft thrust clearance. If it exceeds the limit, replace the thrust washers as a set.

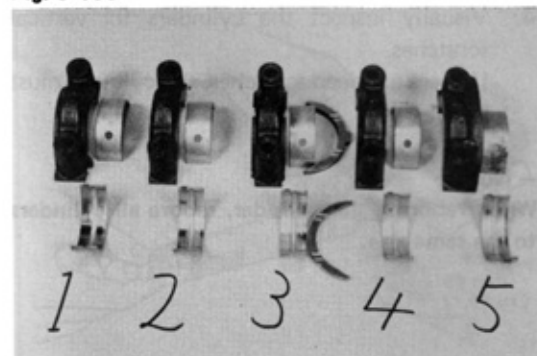
Thrust clearance:

STD 0.040 – 0.242 mm
(0.0016 – 0.0095 in.)

Limit 0.3 mm
(0.012 in.)

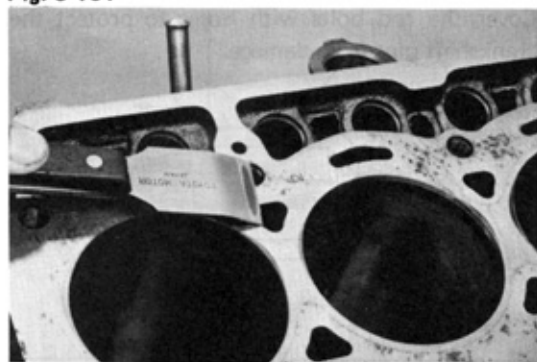
O/S thrust washer type: 0.125, 0.250

Fig. 3-100



Keep the crankshaft bearings and caps in correct order.

Fig. 3-101



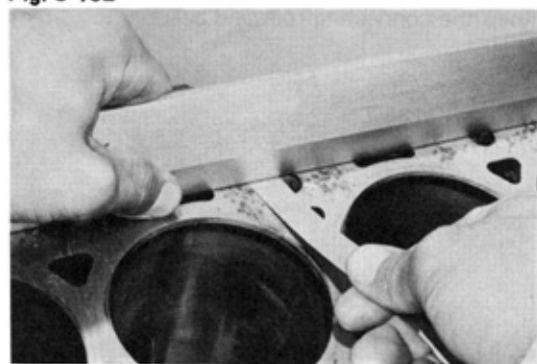
INSPECTION & REPAIR

Cylinder Block

1. Clean and check the cylinder block for cracks or scores.



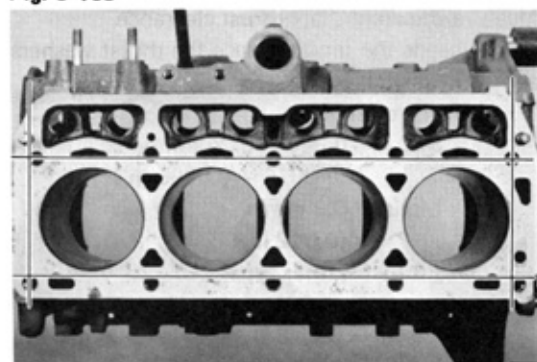
Fig. 3-102



2. Using a precision straight edge and thickness gauge, inspect the cylinder block topside surface for warpage. If the warpage exceeds the limit, correct by grinding the surface.

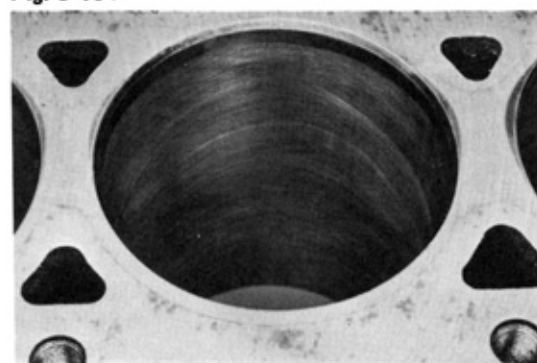
Warpage limit: 0.05 mm
(0.0020 in.)

Fig. 3-103



3. Inspect for warpage along the lines shown in the figure.

Fig. 3-104

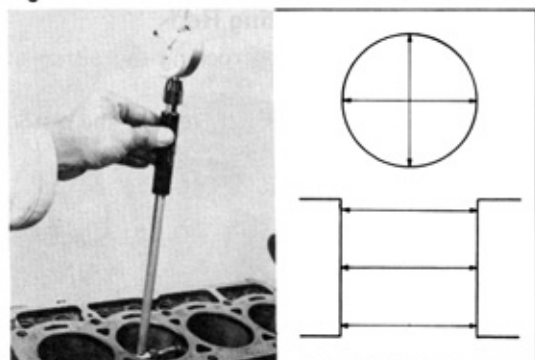


4. Visually inspect the cylinders for vertical scratches. If there are deep scratches, the cylinder must be rebored.

— Note —

When reboring the cylinder, rebore all cylinders to the same size.

Fig. 3-105



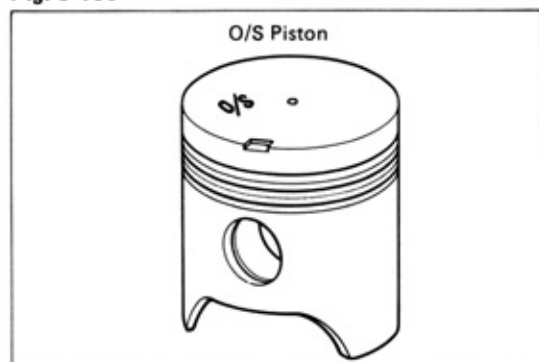
5. Measure the cylinder bores in axial and thrust directions at the top, middle and bottom as shown in the figure. If the bore exceeds the limit, it must be rebored.

Standard bore:

2K	72.00 – 72.05 mm (2.8346 – 2.8366 in.)
3K,4K series	75.00 – 75.05 mm (2.9528 – 2.9547 in.)

Wear limit: 0.2 mm
(0.008 in.)

Fig. 3-106

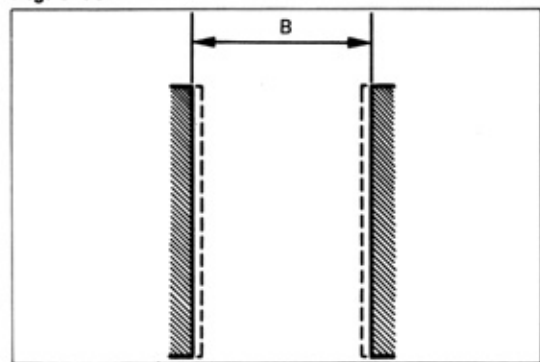


6. Use an O/S piston when the cylinders are rebored.

O/S piston diameter mm (in.)

O/S	2K	3K, 4K series
O/S 0.50	72.46 – 72.51 (2.8528 – 2.8547)	75.46 – 75.51 (2.9709 – 2.9728)
O/S 0.75	72.71 – 72.76 (2.8626 – 2.8646)	75.71 – 75.76 (2.9807 – 2.9827)
O/S 1.00	72.96 – 73.01 (2.8724 – 2.8744)	75.96 – 76.01 (2.9905 – 2.9925)

Fig. 3-107



7. Use the following equation to determine the reboring finished diameter.

$$B = P + C - H$$

Where B: Reboring finished diameter

P: O/S piston diameter

C: Piston clearance

0.03 – 0.05 mm
(0.0012 – 0.0020 in.)

H: Honing allowance

Less than 0.02 mm
(0.0008 in.)

Fig. 3-108

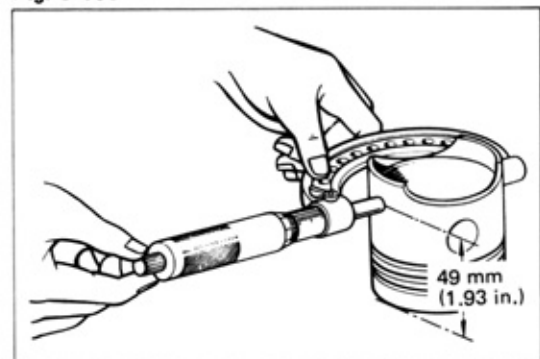


Fig. 3-109

**Piston Pin & Connecting Rod**

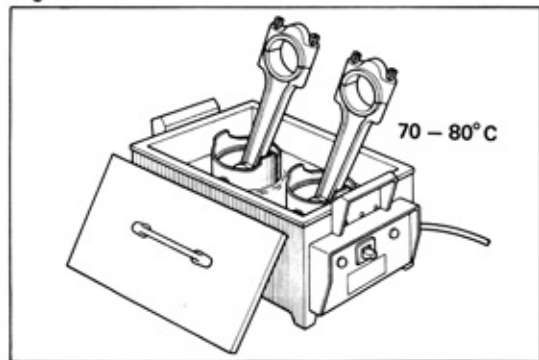
1. Check the pin fit by rocking the piston at right angle to pin.
If any movement is felt, replace the piston and pin.

Fig. 3-110



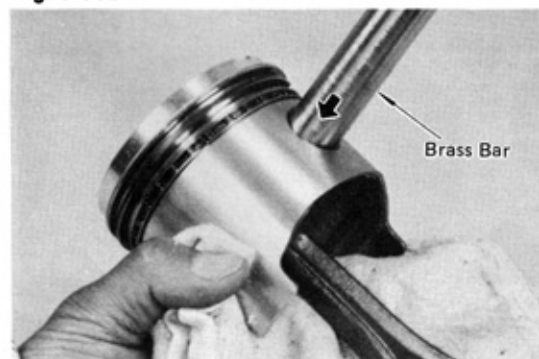
2. Remove the snap rings.

Fig. 3-111



3. Heat the piston to around 70 – 80°C (158 – 176°F) in a piston heater.

Fig. 3-112



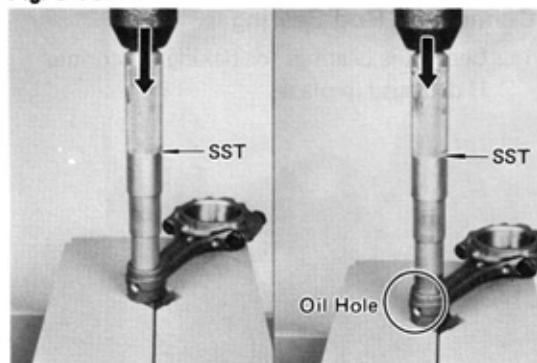
4. Remove the piston pin from the piston.

Fig. 3-113



5. Check the fit of the piston pin. Heat the piston to around 70 – 80°C (158 – 176°F), and coat the pin with engine oil. It should then be possible to push the pin into the piston hole with thumb pressure.

Fig. 3-114



6. If the bushing is worn or damaged, replace it with SST.
SST [09222-30010]



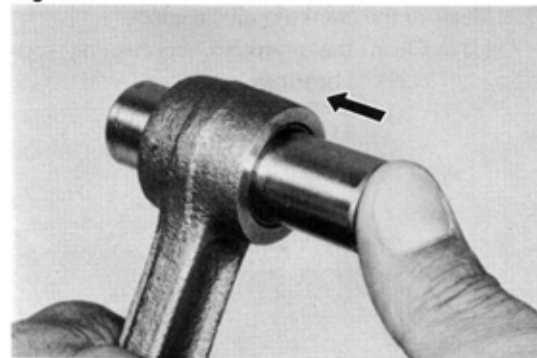
— Note —
Align the bushing oil hole with the connecting rod oil hole.

Fig. 3-115



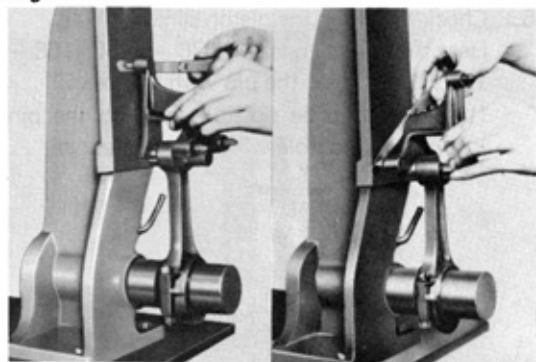
7. After installing the bushing, re-finish the bushing bore with a pin hole grinder.

Fig. 3-116



8. The fitting between the bushing and pin should be such that the pin, when coated with engine oil, can be pushed in with the thumb at normal temperature.

Fig. 3-117



9. Inspect for bending and twisting using a connecting rod aligner.

If over the limit, correct or replace the rod.

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

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

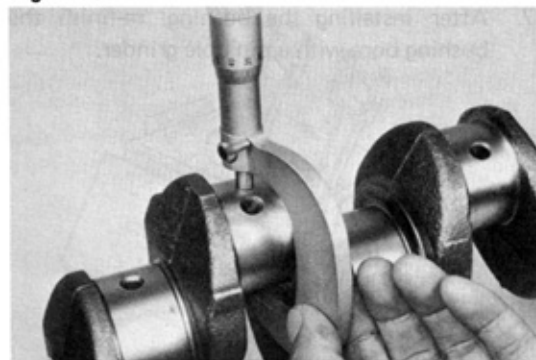
Fig. 3-118



Connecting Rod Bearing

1. Check the bearings for flaking or scoring.
If damaged, replace.

Fig. 3-119

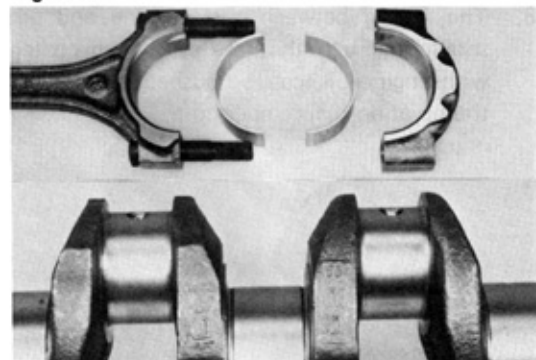


2. Measure the crankpin diameter.
If the wear is excessive, the crankshaft must be reground or replaced.

Crankpin journal diameter STD:
41.976 – 42.000 mm
(1.6526 – 1.6535 in.)

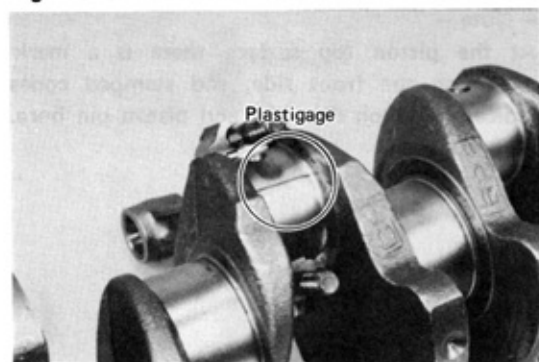
Taper & out-of-round limit:
0.01 mm
(0.0004 in.)

Fig. 3-120



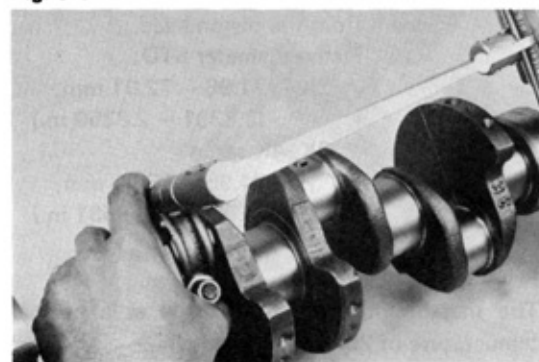
3. Measure the crankpin oil clearance.
(1) Clean the crankpin, connecting rod, cap and bearings.

Fig. 3-121



- (2) Lay the strip of plastigage across the crankpin, but not over the oil hole.

Fig. 3-122



- (3) Tighten the bearing cap nuts to specified torque.

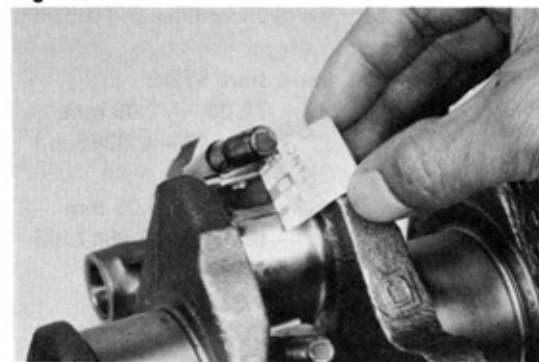
Tightening torque:

4.0 – 5.2 kg-m
(29 – 37 ft-lb)

— Caution —

Do not turn the connecting rod or crankshaft.

Fig. 3-123



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

If the clearance is not within specification, replace the bearings.

Oil clearance:

STD 0.016 – 0.040 mm
(0.0006 – 0.0016 in.)

Limit 0.10 mm
(0.0039 in.)

U/S bearing type:
0.05, 0.25, 0.50, 0.75

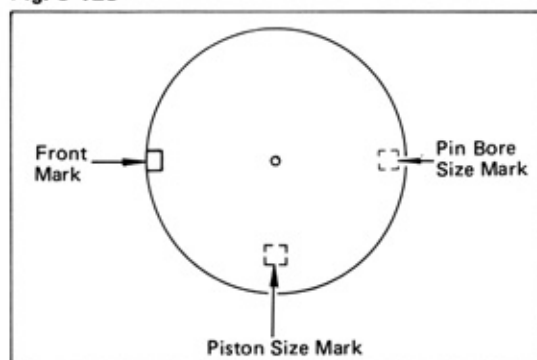
Fig. 3-124



Piston

1. Check the piston for wear or damage, especially in the piston ring grooves and ring lands.

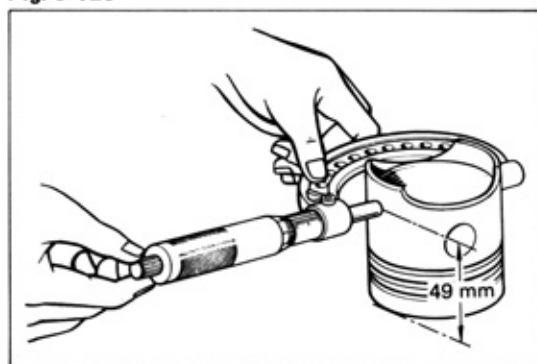
Fig. 3-125



— Note —

At the piston top surface there is a mark indicating the front side, and stamped codes indicating piston diameter and piston pin bore.

Fig. 3-126



2. Check the piston clearance.

- (1) Measure the piston diameter in the thrust direction about 49 mm (1.93 in.) down from the piston head.

Piston diameter STD:

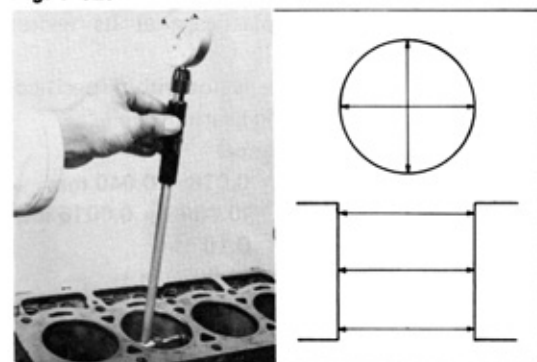
2K 71.96 – 72.01 mm
(2.8331 – 2.8350 in.)

3K, 4K series
74.96 – 75.01 mm
(2.9512 – 2.9531 in.)

— Note —

The measurement must be made at a normal temperature of 20°C (68°F).

Fig. 3-127



- (2) Measure the cylinder bore and subtract the piston size.

Cylinder bore STD:

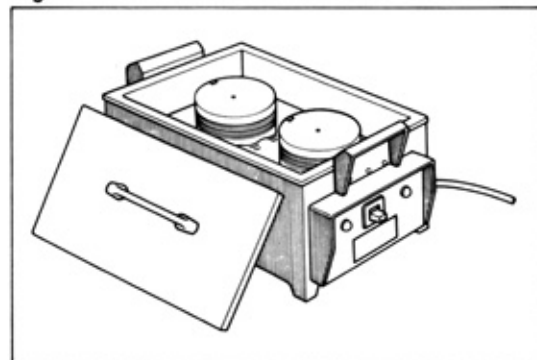
2K 72.00 – 72.05 mm
(2.8346 – 2.8366 in.)

3K, 4K series
75.00 – 75.05 mm
(2.9528 – 2.9547 in.)

Piston clearance:

0.03 – 0.05 mm
(0.0012 – 0.0020 in.)

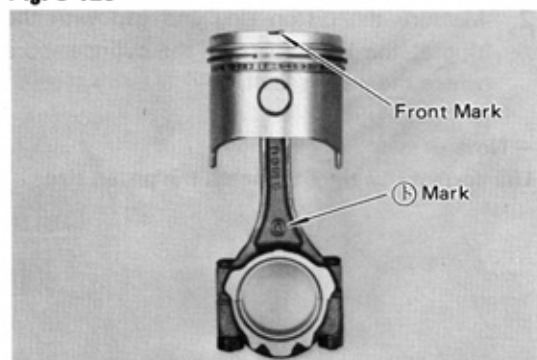
Fig. 3-128



3. Assemble the piston and connecting rod as follows.

- (1) Heat the piston to around 70 – 80°C (158 – 176°F) before installing the piston pin.

Fig. 3-129




- (2) Align the front mark of the piston head and  mark of the connecting rod as shown in the figure.

Fig. 3-130



- (3) Install the piston pin.

Fig. 3-131

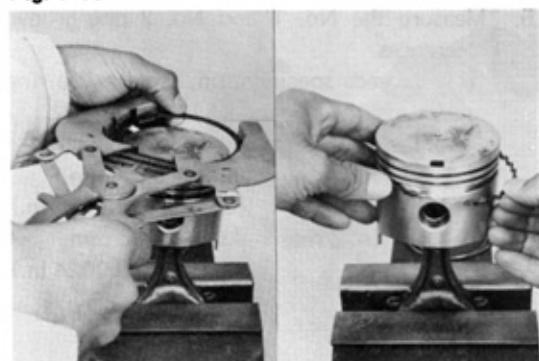


- (4) Install the snap rings on both side.

— Caution —

Make sure the snap ring completely in place.

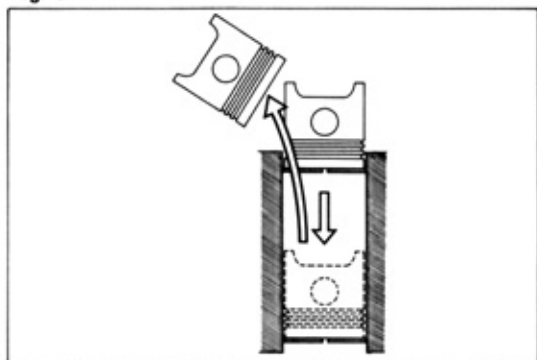
Fig. 3-132



Piston Ring

1. Remove the piston rings with a piston ring expander.

Fig. 3-133



2. Measure the piston ring end gap with the ring at the lower part of the cylinder bore where the wear is least.

— Note —

Use correct size rings to match the piston size.

Fig. 3-134



3. Measure the end gap.

End gap STD:

No. 1 ring	0.10 – 0.28 mm (0.0039 – 0.0110 in.)
No. 2 ring	0.15 – 0.30 mm (0.0059 – 0.0118 in.)
Oil ring	0.2 – 0.9 mm (0.008 – 0.035 in.)

Fig. 3-135



4. Clean the ring grooves with a groove cleaning tool or broken ring.

Fig. 3-136



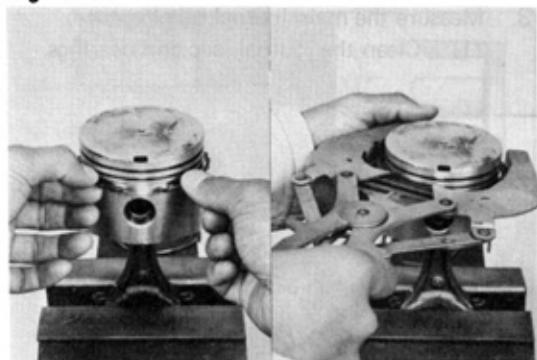
5. Measure the No. 1 and No. 2 ring groove clearances.

If it exceeds specification, replace the ring and/or piston.

Ring to groove clearance:

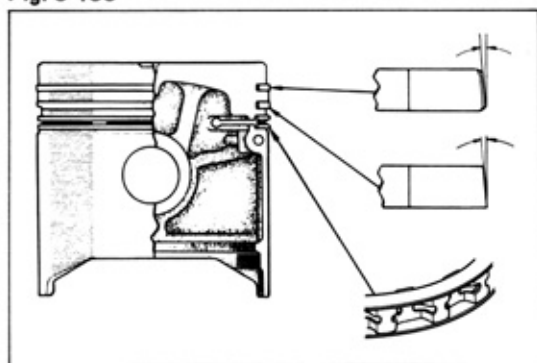
No. 1 ring	0.03 – 0.07 mm (0.0012 – 0.0028 in.)
No. 2 ring	0.02 – 0.06 mm (0.0008 – 0.0024 in.)

Fig. 3-137



6. Install the piston rings with the piston ring expander.

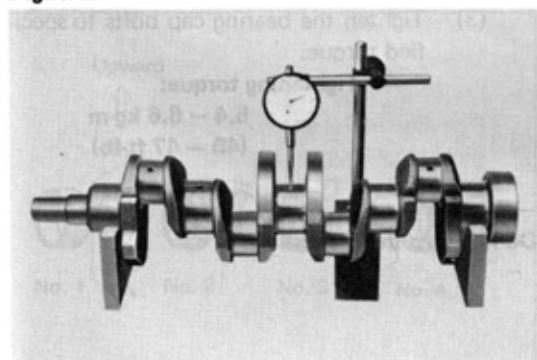
Fig. 3-138



— Note —

Always install the rings with the size marks and manufacturer marks facing up.

Fig. 3-139

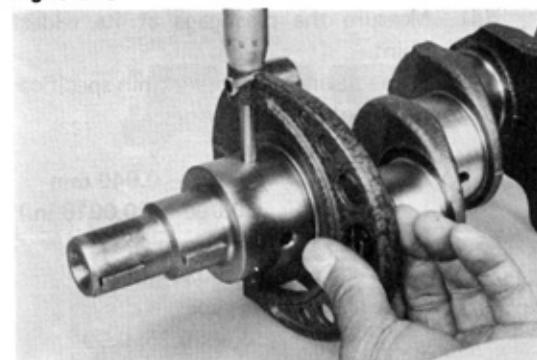


Crankshaft & Bearing

1. Check the crankshaft for runout and, if it exceeds the limit, replace.

Circle runout limit: 0.04 mm
(0.0016 in.)

Fig. 3-140

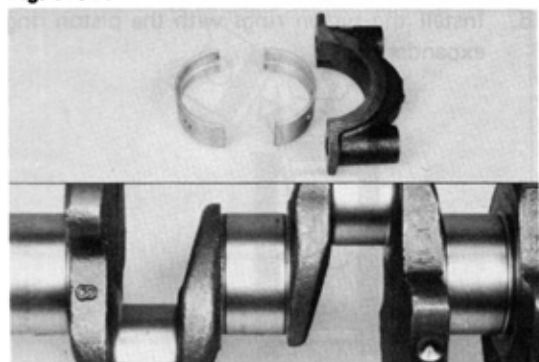


2. Measure the crankshaft main journal. If the wear is excessive, the crankshaft must be reground or replaced.

Main journal diameter STD:
49.976 – 50.000 mm
(1.9676 – 1.9685 in.)

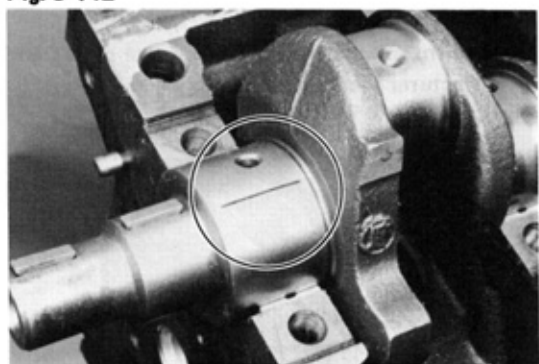
Taper & out-of-round limit:
0.01 mm
(0.0004 in.)

Fig. 3-141



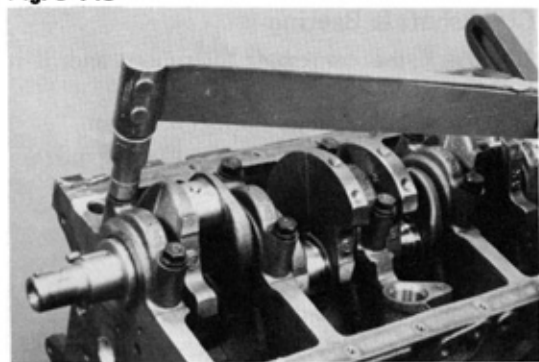
3. Measure the main journal oil clearance.
 - (1) Clean the journal, cap and bearings.

Fig. 3-142



- (2) Lay a strip of plastigage across the journal, but not over the oil hole.

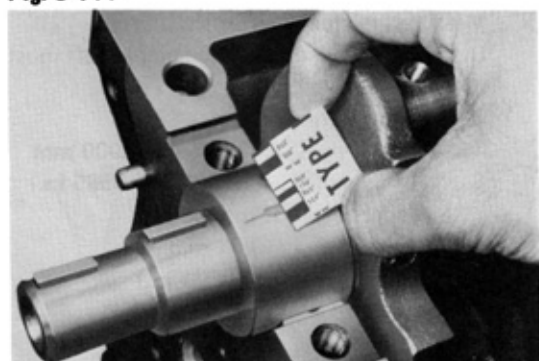
Fig. 3-143



- (3) Tighten the bearing cap bolts to specified torque.

Tightening torque:**5.4 – 6.6 kg-m****(40 – 47 ft-lb)****— Caution —****Do not turn the crankshaft.**

Fig. 3-144



- (4) Measure the plastigage at its widest point.
If the clearance is not within specification, replace the bearings.

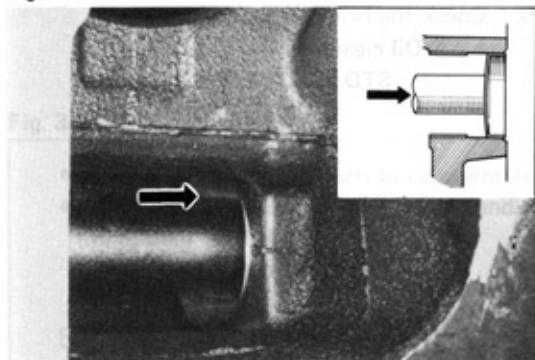
Oil clearance:

STD 0.016 – 0.040 mm
(0.0006 – 0.0016 in.)

Limit 0.10 mm
(0.0039 in.)

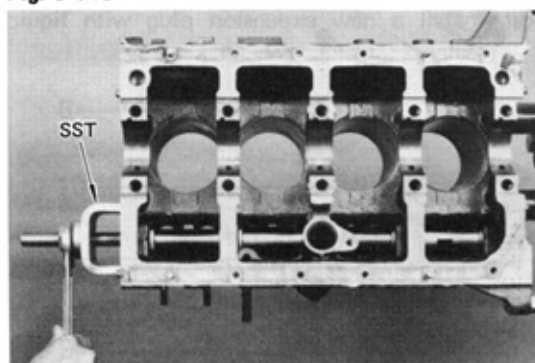
U/S bearing type:
0.05, 0.25, 0.50

Fig. 3-145

**Camshaft Bearing**

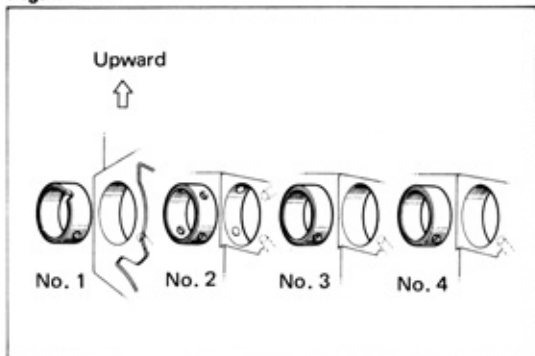
1. Remove the camshaft rear expansion plug.

Fig. 3-146



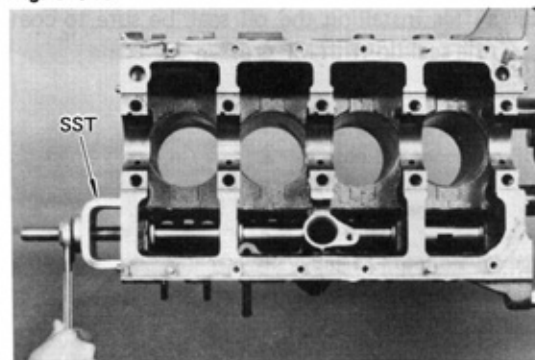
2. Remove the camshaft bearings with SST.
SST [09215-00100]

Fig. 3-147



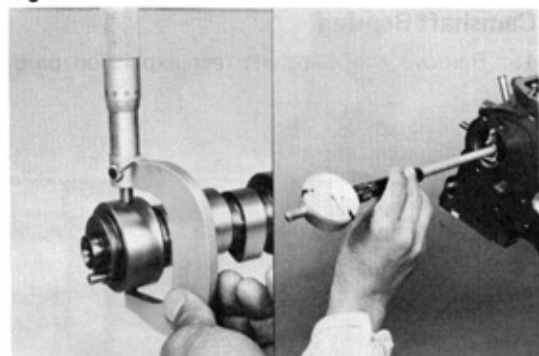
3. Align the bearing oil holes with the cylinder block oil holes when installing the bearings.

Fig. 3-148



4. Install the new bearings with SST.
SST [09215-00100]

Fig. 3-149



5. Check the bearing oil clearance.

Oil clearance:

STD No. 1 & No. 4

0.025 – 0.066 mm
(0.0010 – 0.0026 in.)

No. 2 & No. 3

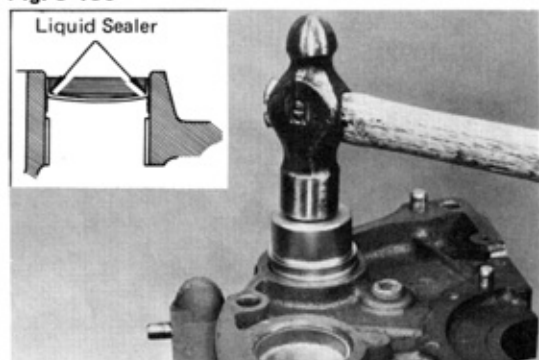
0.030 – 0.071 mm
(0.0012 – 0.0028 in.)

Limit 0.1 mm

(0.004 in.)

U/S bearing type: 0.125, 0.250

Fig. 3-150



6. Install a new expansion plug with liquid sealer.

Fig. 3-151



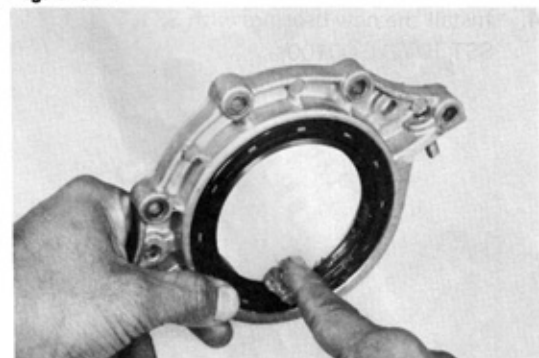
Crankshaft Rear Oil Seal

Check the oil seal lip and, if worn or damaged, replace the oil seal.



1. Remove the oil seal by a suitable means.
2. Install the new oil seal with SST.
SST [09250-10011]

Fig. 3-152



3. After installing the oil seal, be sure to coat the seal lip with MP grease.

ASSEMBLY

Assemble the parts in the numerical order shown in the figure.

Fig. 3-153

- Thoroughly clean all parts to be assembled.
- Apply clean engine oil to all sliding and rotating surfaces of the parts before assembly.

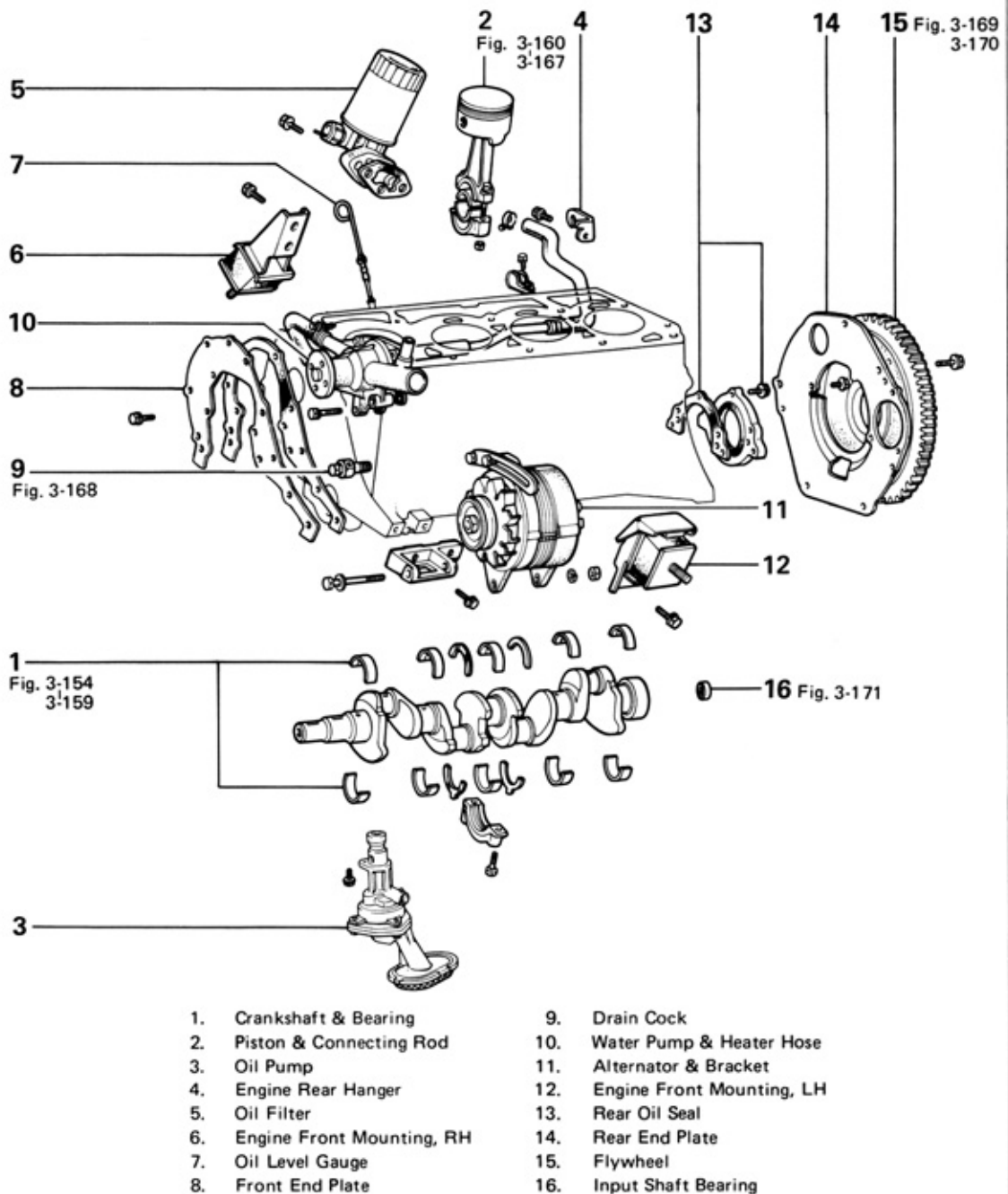
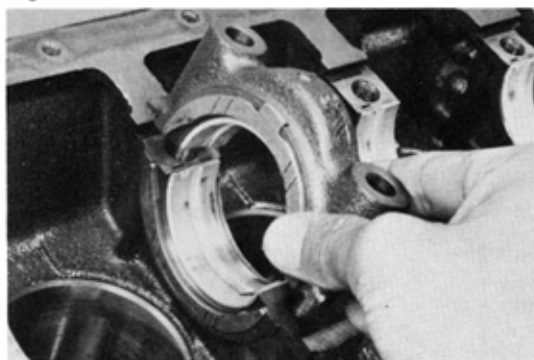
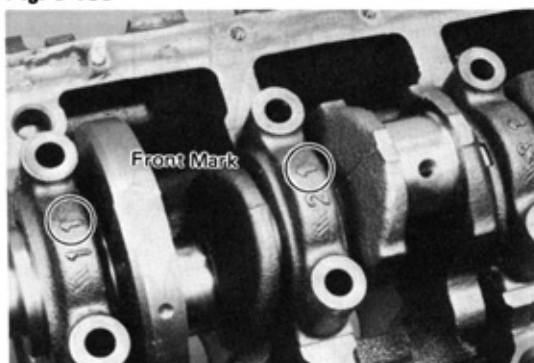


Fig. 3-154



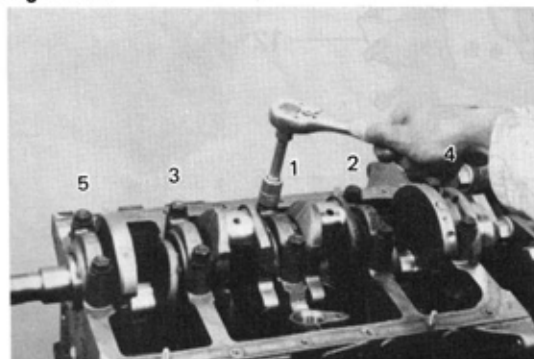
Install the thrust washers with their oil groove faces positioned toward the outside.

Fig. 3-155



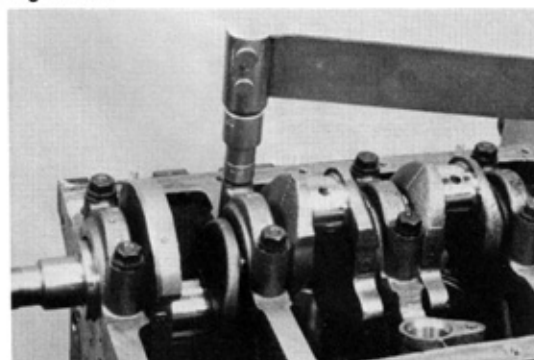
Face the arrow mark toward the front.

Fig. 3-156



Tighten the bearing cap bolts in the specified numerical sequence.

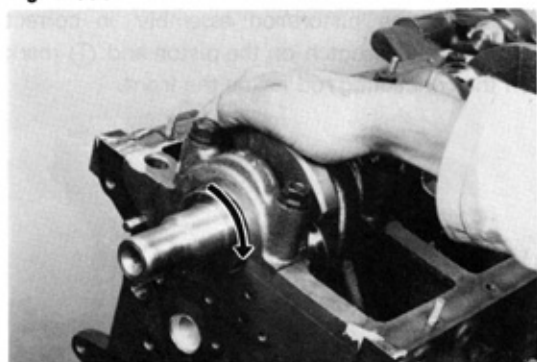
Fig. 3-157



Tighten the bearing caps to specified torque.

Tightening torque: 5.4 – 6.6 kg-m
(40 – 47 ft-lb)

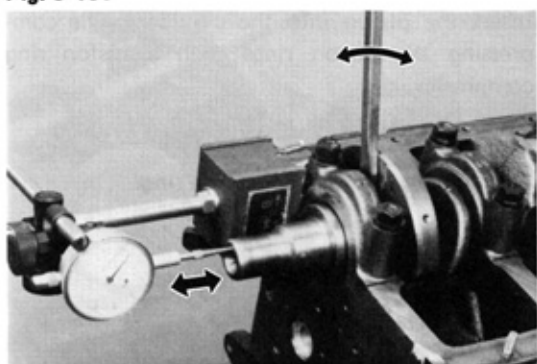
Fig. 3-158



— Note —

Check for tightness of the crankshaft rotation after tightening each bearing cap.

Fig. 3-159



Measure the crankshaft thrust clearance.

If it exceeds the limit, replace the thrust washers as a set.

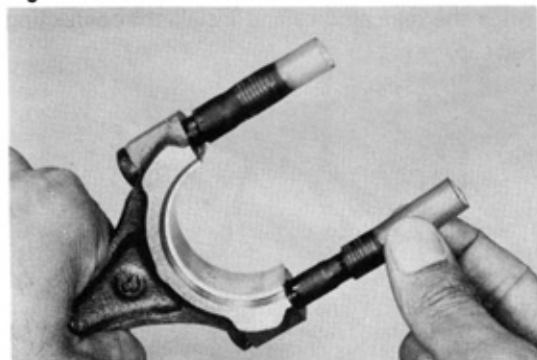
Thrust clearance:

STD 0.040 – 0.242 mm
(0.0016 – 0.0095 in.)

Limit 0.3 mm
(0.012 in.)

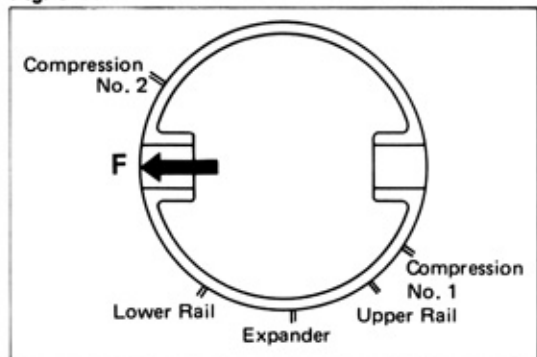
O/S thrust washer type: 0.125, 0.250

Fig. 3-160



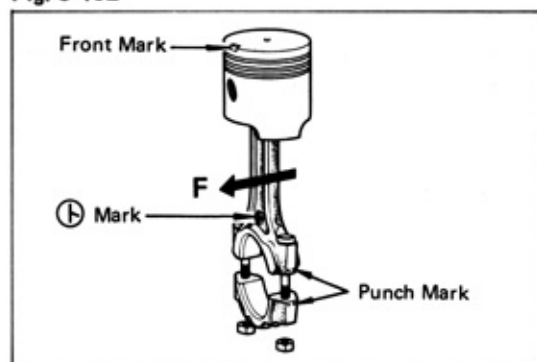
Cover the connecting rod bolts with hoses to protect crankpins from damage.

Fig. 3-161



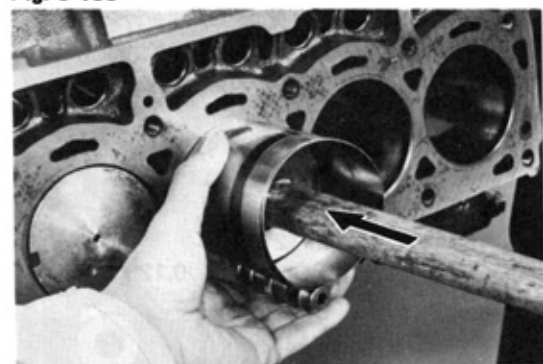
Position the piston ring end gaps in the direction shown in the figure.

Fig. 3-162



Assemble the piston/rod assembly in correct order with the notch on the piston and Ⓡ mark on the connecting rod facing the front.

Fig. 3-163



Insert the piston into the cylinder while compressing the piston rings with a piston ring compressor.

— Caution —

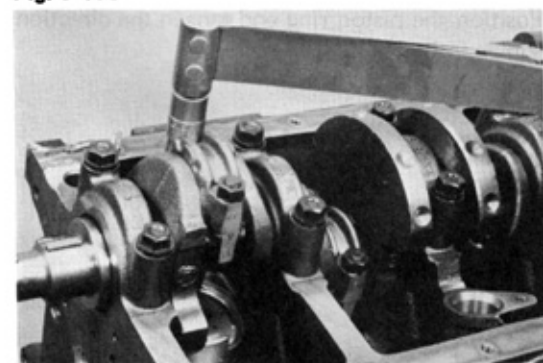
Use care not to break the piston ring.

Fig. 3-164



Align the matchmarks and install the connecting rod cap.

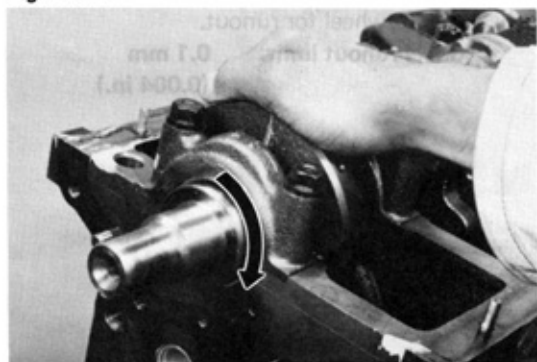
Fig. 3-165



Tighten the connecting rod cap to specified torque.

Tightening torque: 4.0 – 5.2 kg-m
(29 – 37 ft-lb)

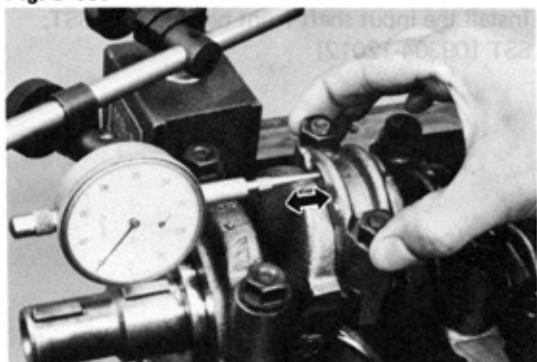
Fig. 3-166



— Note —

Check the crankshaft rotation after tightening each bearing cap.

Fig. 3-167

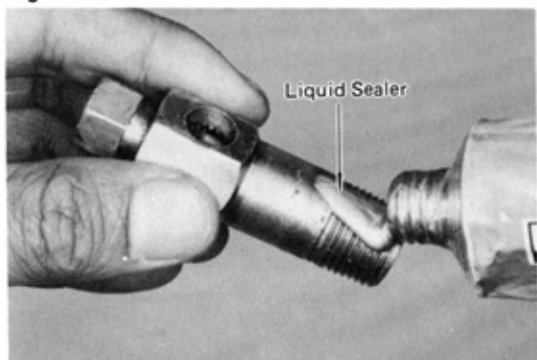


Check the connecting rod thrust clearance.

Thrust clearance:

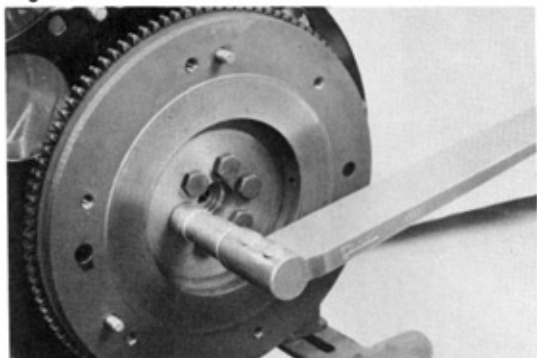
STD	0.200 – 0.304 mm (0.0079 – 0.0120 in.)
Limit	0.35 mm (0.0138 in.)

Fig. 3-168



Apply liquid sealer on the threads of the drain cock.

Fig. 3-169



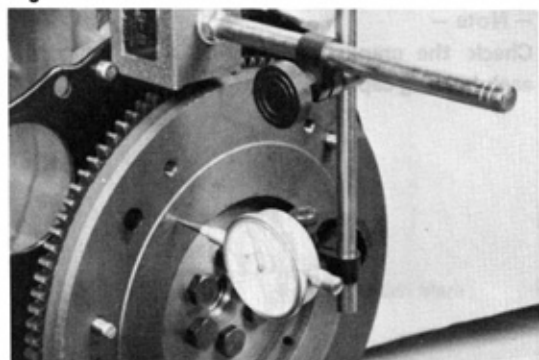
Tighten the bolts to specified torque.

Tightening torque:	5.4 – 6.6 kg-m (40 – 47 ft-lb)
---------------------------	-----------------------------------

— Note —

Apply a light coating of engine oil on the bolt threads and under the head before installing.

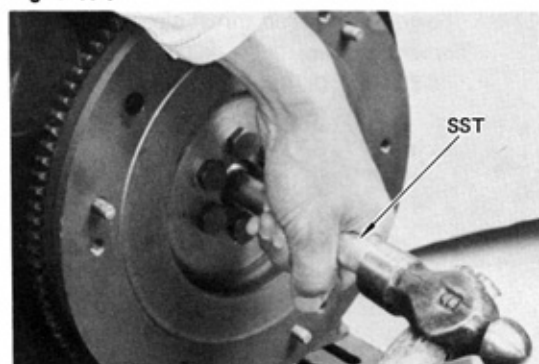
Fig. 3-170



Check the flywheel for runout.

Circle runout limit: 0.1 mm
(0.004 in.)

Fig. 3-171



Install the input shaft front bearing with SST.
SST [09304-12012]

