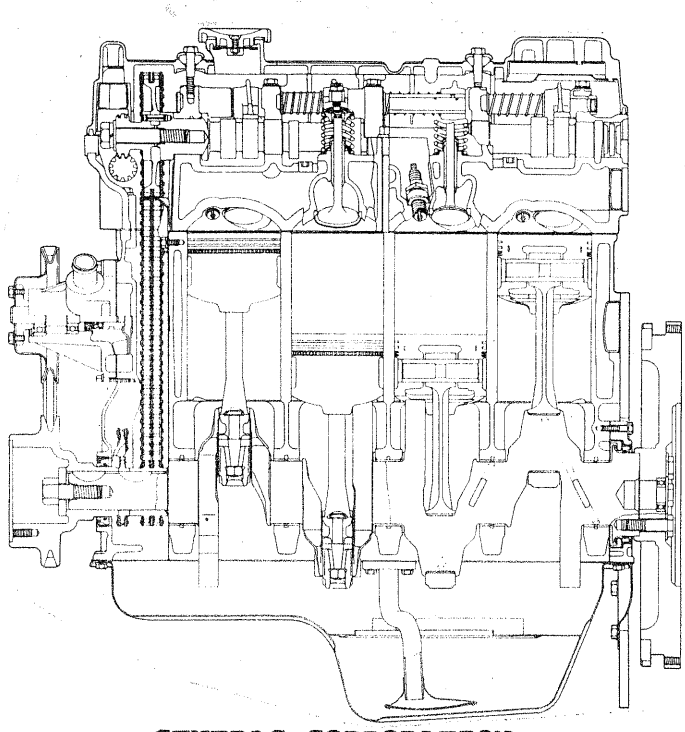
TECHNICAL INFORMATION

SERVICE MANUAL

2.6 LITER GAS/GASOLINE ENGINE



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Manual Part Number 63287

FOREWORD

This SERVICE MANUAL has been prepared especially for the purpose of familiarizing service mechanics with the repair of the 2.6 liter gas engine. Every efort has been made to ensure that the information contained herein is accurate and current. However, the manufacturer reserves the right to change, alter, or otherwise improve the product without prior notice.

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PART 1 - ENGINE PROPER

SECTION 1.1 - ADJUSTING VALVE CLEARANCE

1.1.1- TIGHTEN CYLINDER HEAD BOLTS (Figure 1.1-A)

Always tighten the cylinder head bolts prior to adjusting valve clearances. Tighten Cylinder Head Bolts in the sequence shown in Figure 1.1-A, to the following torque value:-

DESCRIPTION		SPECIFICATION
Cylinder Head Bolts Torque	COLD	65-72 Ft-Lbs (9-10 m-kg)
	WARM	72-80 Ft-Lbs (10-11 m-kg)

1.1.2- ADJUST VALVE CLEARANCES (Figure 1.1-B)

1. Warm up engine until coolant temperature reaches 176-194 degrees F. (80-90 degrees C.).
2. At top dead center on compression stroke of each cylinder (firing order 1-3-4-2), loosen the rocker arm nut and adjust valves to the specified clearance with adjusting screw and a feeler gauge. When proper clearance is obtained, prevent the adjusting screw from turning and tighten the rocker arm nut.

DESCRIPTION		SPECIFICATION
Valve Clearance (Warm)	INTAKE	0.006 inch (0.15 mm)
	EXHAUST	0.010 inch (0.25 mm)

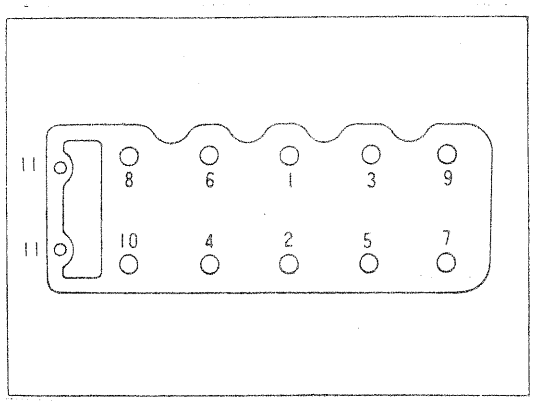


Figure 1.1-A. Cylinder Head Tightening Sequence

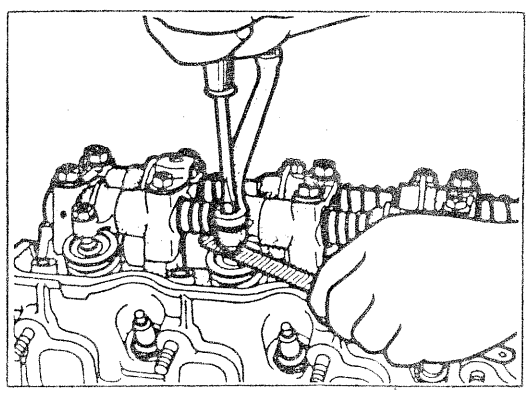


Figure 1.1-B. Adjusting Valve Clearance

SECTION 1.2 - CYLINDER HEAD

1.2.1- CYLINDER HEAD STRUCTURE (Figure 1.2-A)

The cylinder head is an aluminum alloy casting and is heat treated to increase its strength and durability. Valves are arranged in "V" shape. The camshaft is supported by five bearings.

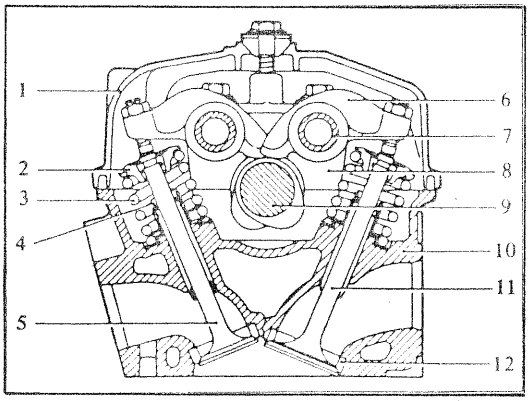
1.2.2- INTAKE MANIFOLD (Figure 1.2-B)

The aluminum alloy intake manifold permits the engine to utilize coolant to improve atomization and distribution of the air-fuel mixture, thus increasing combustion efficiency.

Coolant from the cylinder head water jacket enters the intake manifold and, after passing through the thermostat, flows to the radiator. The intake manifold mounts the THERMOSTAT, HIGH COOLANT TEMPERATURE SHUTDOWN SWITCH, LOW COOLANT LEVEL SENSOR, and a COOLANT TEMPERATURE SENDER UNIT.

1.2.3- CAMSHAFT (Figure 1.2-C)

An overhead camshaft is used. The cast iron camshaft has chill-hardened cams for wear resistance. A sprocket at the front of the shaft is driven by a "dual roller" timing chain. Chain tension is maintained by a tensioner, using hydraulic pressure and spring force. A loose-side and a tension-side guide guide prevent vibration and noise.



1. Rocker cover
2. Valve spring retainer
3. Valve spring
4. Valve stemp seal
5. Exhaust valve
6. Rocker arm
7. Rocker arm shaft
8. Rocker shaft bracket
9. Camshaft
10. Cylinder head
11. Inlet valve
12. Valve seat ring

Figure 1.2-A. Cylinder Head Sectional View

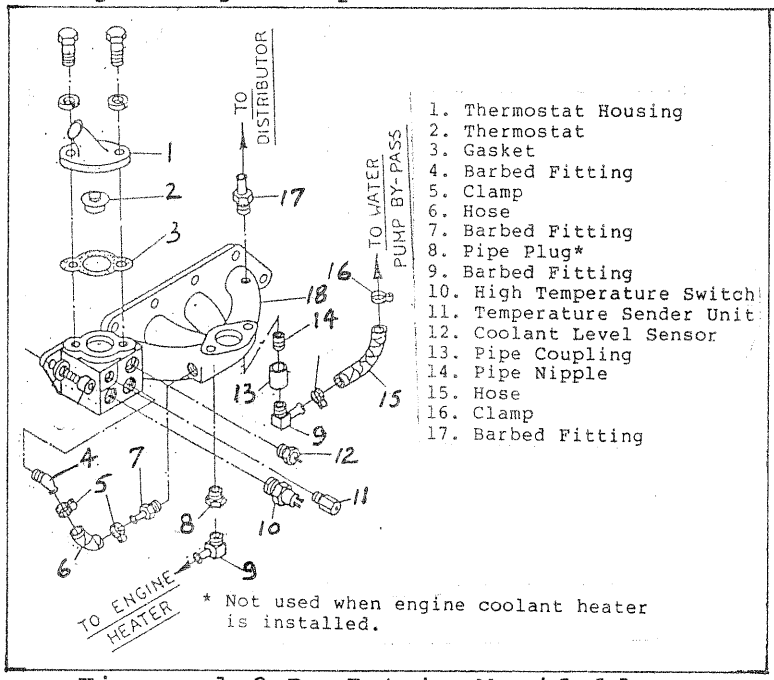
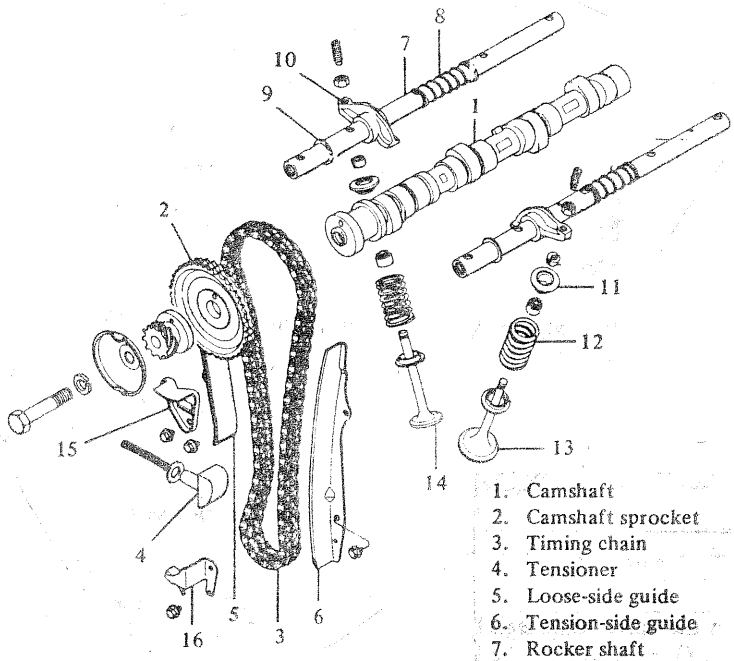


Figure 1.2-B. Intake Manifold



1. Camshaft
2. Camshaft sprocket
3. Timing chain
4. Tensioner
5. Loose-side guide
6. Tension-side guide
7. Rocker shaft
8. Rocker shaft spring
9. Waved washer
10. Rocker arm
11. Valve spring retainer
12. Valve spring
13. Intake valve
14. Exhaust valve
15. Sprocket holder
16. chain retainer

Figure 1.2-C. Valve Timing Parts

1.2.4- CYLINDER HEAD REMOVAL (Figure 1.2-D, 1.2-E)

1. Remove upper emission hose from air horn.
2. Remove Spark Plug wires.
3. Remove vacuum hoses from carburetor, intake manifold and distributor.
4. Remove distributor.
5. Remove the carburetor.
6. Remove intake manifold and gaskets.
7. Remove exhaust manifold and gaskets.
8. Remove rocker cover.
9. Crank engine to set No. 1 piston at top dead center of its compression stroke. Then, check to see that dowel pin at front end of camshaft and matchmark are positioned as shown in Figure 1.2-D. Use white paint to mark the timing chain at the point where it aligns with matchmark on sprocket.
10. Remove distributor drive gear mounting bolts.
11. Remove sprocket, with chain still installed, from the camshaft. **DO NOT TURN THE CRANKSHAFT AFTER THE SPROCKET HAS BEEN REMOVED.**
12. Remove camshaft cap bolts. Then, remove the rocker shaft assembly and the camshaft.
13. See Figure 1.2-E. Loosen cylinder head bolts in the numerical order shown, in two or three successive steps. Remove cylinder head assembly.
14. Remove cylinder head gasket. Be sure to remove all fragments of gasket. DO NOT PERMIT PIECES OF GASKET TO FALL INTO CYLINDERS OR CHAIN CASE.

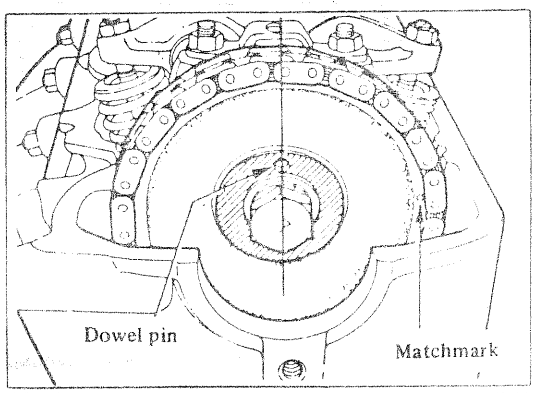


Figure 1.2-D. Matchmarks on Sprocket and Chain

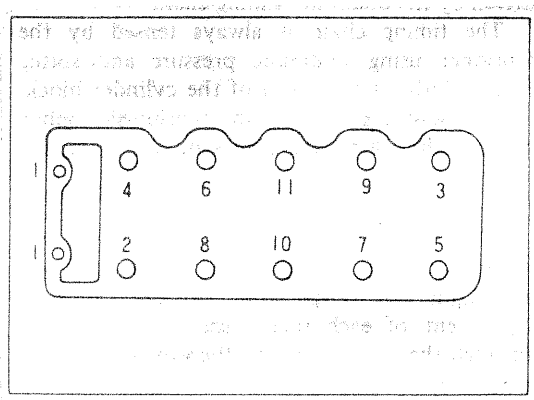


Figure 1.2-E. Loosening Sequence of Cylinder Head Bolts

1.2.5- CYLINDER HEAD DISASSEMBLY (Figures 1.2-F, 1.2-G)

1. See Figure 1.2-F. Use a valve spring compressor to remove retainer locks (Item 1).

IMPORTANT
Keep parts from each cylinder together as a set, and in order.

2. Remove spring retainer (Item 2), valve spring (Item 3), spring seat (Item 4), and valve (Item 5) IN THAT ORDER.
3. See Figure 1.2-G. Use a screwdriver to pry valve stem seals out.

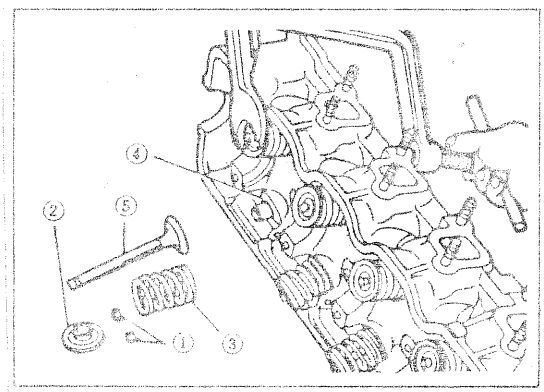


Figure 1.2-F. Valve Removal

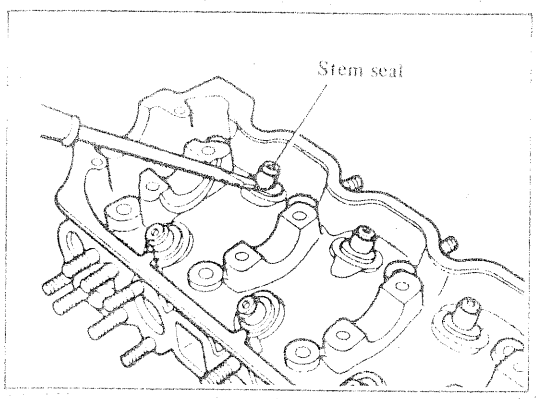


Figure 1.2-G. Stem Seal Removal

1.2.6- CYLINDER HEAD INSPECTION (Figures 1.2-H through 1.2-V)

Precautions:-
* Prior to inspection or repair, clean all parts thoroughly.
* Check the cylinder head for water leakage and damage before cleaning.
* Use compressed air to remove dirt from oil holes.
* Keep removed parts in order. Keep parts from the same assembly together as a matched set.

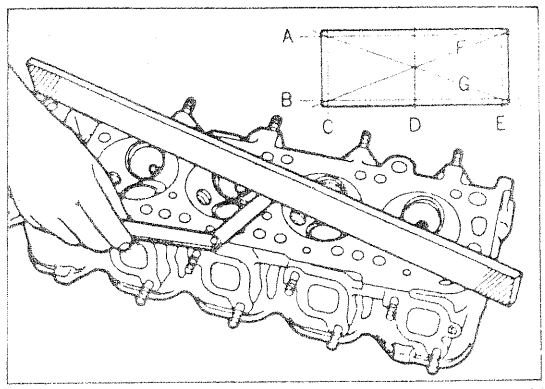


Figure 1.2-H. Checking Cylinder Head Distortion

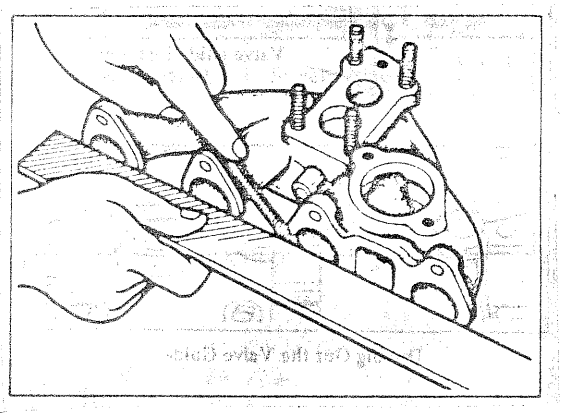


Figure 1.2-I. Checking Manifold Distortion

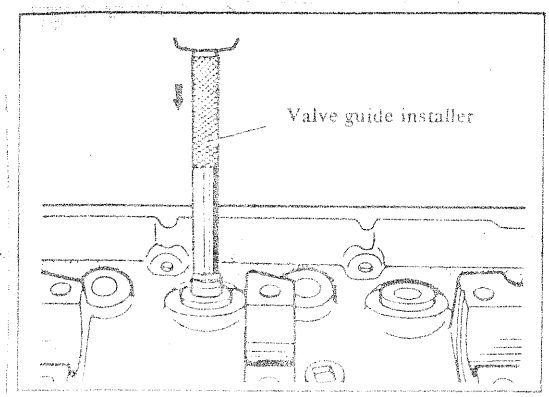


Figure 1.2-J. Driving out the Valve Guide

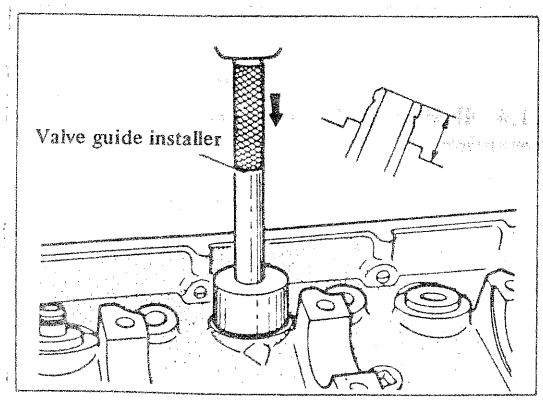


Figure 1.2-K. Driving in the Valve Guide

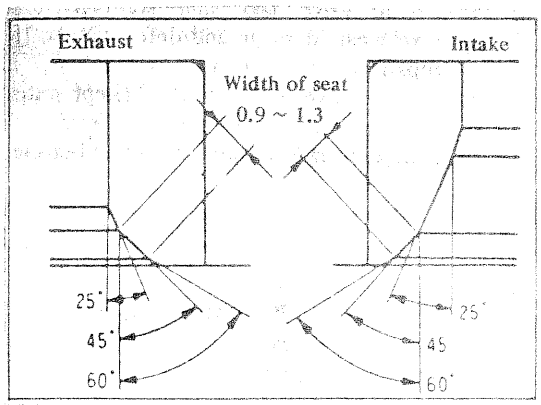


Figure 1.2-L. Seat Ring Repair

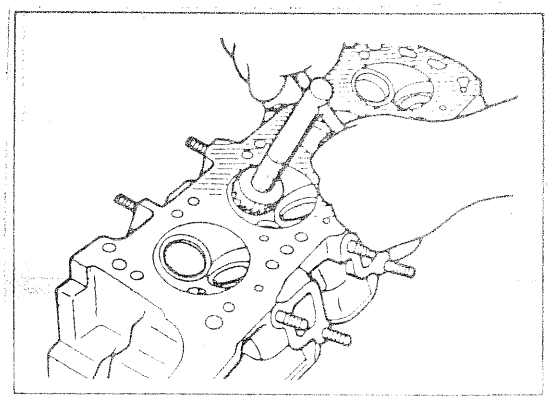


Figure 1.2-M. Seat Ring Repair

Cylinder Head Inspection (Figure 1.2-H):- Check cylinder head for cracks, damage, water leaks before cleaning it. Then, clean thoroughly. Check cylinder head lower surface for distortion using a straight edge and a feeler gauge (Figure 1.2-H). Replace cylinder head if any measurement exceeds the following specification:-

DESCRIPTION	SPECIFICATION
Distortion of Cylinder Head Lower Surface	Within 0.002 inch (0.05 mm)

Rocker Cover Inspection:- Check rocker cover for cracks and damage. Check breather hose nipple holes for clogging, clean holes thoroughly.
Manifolds (Figure 1.2-I):- Inspect manifolds for corrosion, damage, cracks. Repair or replace as necessary. Check for distortion of the manifold mounting surface - if service limit is exceeded, replace the manifold.

DESCRIPTION	SPECIFICATION	SERVICE LIMIT
Distortion of manifold Mounting Surface	Within 0.006 inch (0.15 mm)	0.012 inch (0.3 mm)

Valve Guide Inspection (Figures 1.2-J, 1.2-K):- Check clearance between each valve stem and its guide. If the service limit is exceeded, remove valve guide and install the next oversize one.

DESCRIPTION		SPECIFICATION	SERVICE LIMIT
Valve to Valve Guide Clearance	INTAKE	0.0010-0.002 in. (0.025-0.058 mm)	0.004 inch (0.10 mm)
	EXHAUST	0.002-0.003 in. (0.05-0.088 mm)	0.006 inch (0.15 mm)

Replacement valve guides are available in 0.002, 0.010 and 0.020 inch oversizes as follows:-

OVERSIZE	IDENTIFICATION MARK	SPECIFICATION
0.002 Inch (0.05 mm)	5	0.514-0.515 inch (13.05-13.07 mm)
0.010 Inch (0.25 mm)	25	0.522-0.523 inch (13.25-13.27 mm)
0.020 Inch (0.50 mm)	50	0.531-0.532 inch (13.50-13.52 mm)

Replace the Valve Guide as follows:-

1. Heat the cylinder head to about 485 degrees F. (250 degrees C.).
2. Use valve guide installer tool to drive guide out, towards the cylinder block side.
3. Let cylinder head cool to normal room temperature. Then, ream the valve guide hole in the head to the specified hole size.
4. Again, heat the cylinder head to about 485 degrees F. (250 degrees C.). Then, press fit the new guide using valve guide installer tool. Press fit depth of guide should be 0.579-0.602 inch (14.7-15.3 mm).
5. After press fitting is complete, check valve guide bore ID. Guide bore ID should be 0.315-0.316 inch (8-8.018 mm).

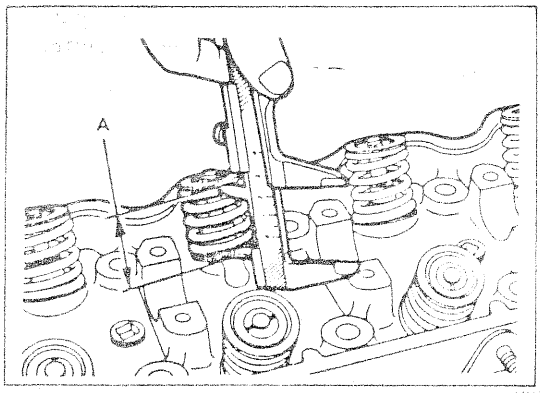


Figure 1.2-N. Checking Valve Spring Installed Length

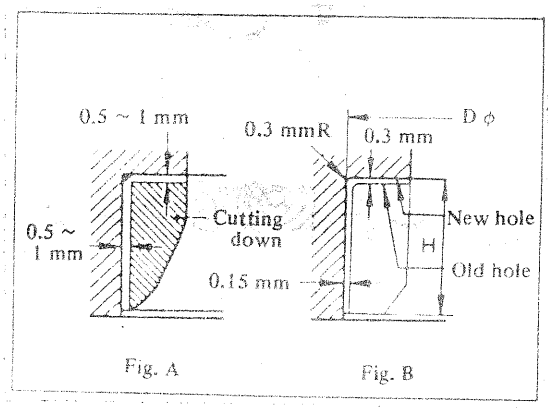


Figure 1.2-O. Replacing Valve Seat Ring

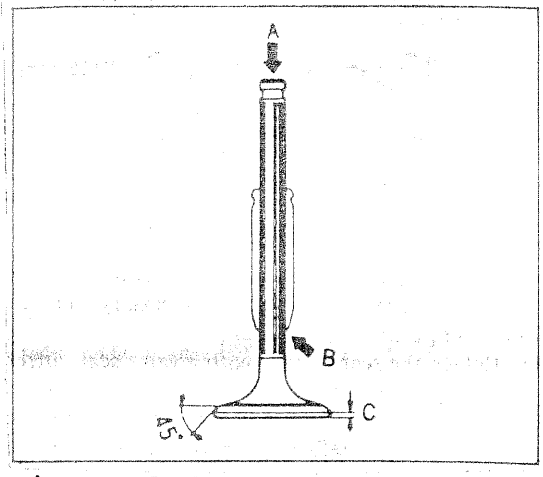


Figure 1.2-P. Inspecting the Valve

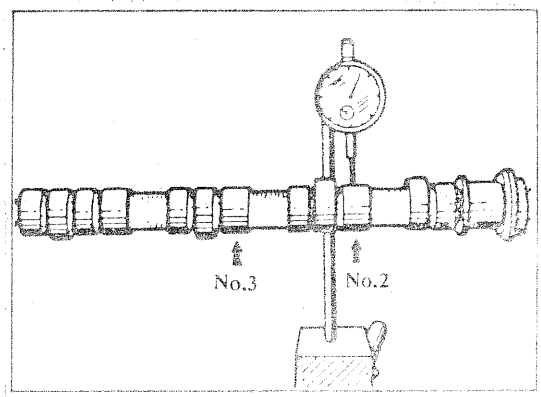


Figure 1.2-Q. Check for Camshaft Bending

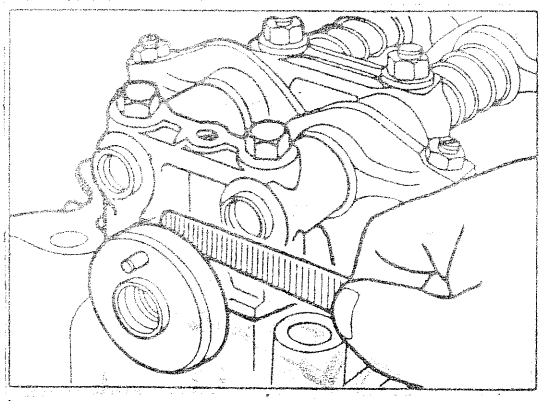


Figure 1.2-R. Checking Camshaft End Play

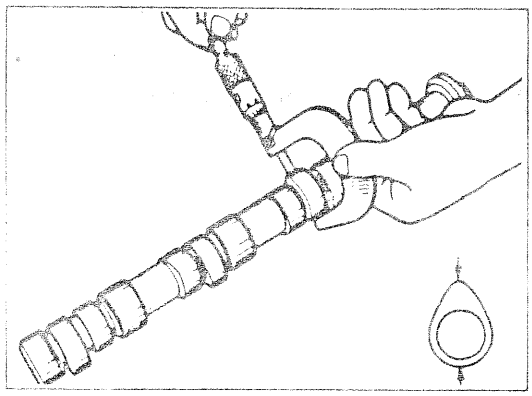


Figure 1.2-S. Checking Cam Lobe

Valve Seat (Figures 1.2-L, 1.2-M, 1.2-N, 1.2-O):- Check valve seats for burning, poor contact. If necessary, repair or replace the seat. Before replacing the seat ring, check valve guide for wear and replace if necessary. Reface seat surface with a valve seat cutter or seat grinder, so that the specified valve contact width can be obtained at the center of the valve head face. After refacing, lap the valve and valve seat using compound. Use a 45 degree cutter for cutting seat face. Use a 65 degree cutter for inside chamfering. Use a 30 degree cutter for outside chamfering. Width of valve seat contact should be 0.035-0.051 inch (0.9-1.3 mm) for both the intake and exhaust valves. Intake and exhaust valve seat angle should be 45 degrees.

Check for valve seat face sinkage by measuring the installed length of the valve spring, between the spring seat and retainer (Figure 1.2-N). If service limit is exceeded, replace the valve seat with the next oversize one.

DESCRIPTION	SPECIFICATION	SERVICE LIMIT
Spring Installed Length (Intake and Exhaust)	1.591 inch (40.4 mm)	+0.039 inch (+1.0 mm)

DESCRIPTION	OVERSIZE	CODE	SERVICE STANDARD
SEAT RING HOLE ID (Intake)	0.012 inch OS (0.3 mm OS)	30	1.862-1.863 inch (47.3-47.325 mm)
	0.024 inch OS (0.6 mm OS)	60	1.874-1.875 inch (47.6-47.625 mm)
SEAT RING HOLE ID (Exhaust)	0.012 inch OS (0.3 mm OS)	30	1.587-1.588 inch (40.3-40.325 mm)
	0.024 inch OS (0.6 mm OS)	60	1.598-1.599 inch (40.6-40.625 mm)
SEAT RING HEIGHT (Intake/Exhaust)	0.012 inch OS (0.3 mm OS)	30	0.311-0.319 inch (7.9-8.1 mm)
	0.024 inch OS (0.6 mm OS)	60	0.323-0.330 inch (8.2-8.4 mm)

To replace Valve Seats, proceed as follows:-

1. Remove worn valve seat by using a cutter to reduce its wall thickness (see Figure 1.2-O).
2. Machine the ring hole in the cylinder head to the specified size with a cutter or reamer (Figure 1.2-O).
3. Heat cylinder head to about 495 degrees F. (250 degrees C.), then press fit the correct oversize valve seat to the machined ring hole.
4. After press fitting the new seat, reface the valve seat as was described previously.

Valves (Figure 1.2-P):- Inspect valve faces and stems (B) for wear, damage, deformation. If any, repair or replace the valve. Check valve stem tip (A) for wear. Dents may be removed with an oil stone.

DESCRIPTION		SPECIFICATION	SERVICE LIMIT
Valve Length	INTAKE	4.333 Inch (110.06 mm)	-0.020 Inch (-0.5 mm)
	EXHAUST	4.250 Inch (107.96 mm)	-0.020 Inch (-0.5 mm)

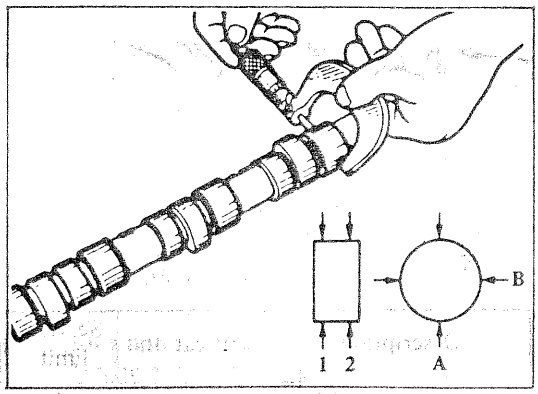


Figure 1.2-T. Checking Camshaft Journal OD

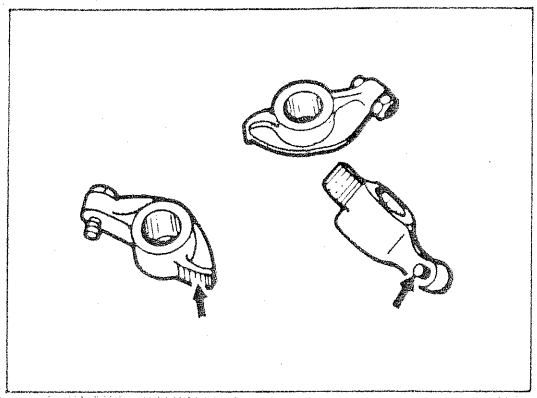


Figure 1.2-U. Checking Rocker Arm

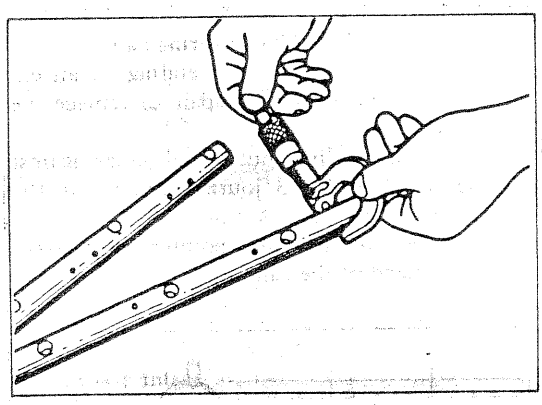


Figure 1.2-V. Checking Rocker Shaft OD

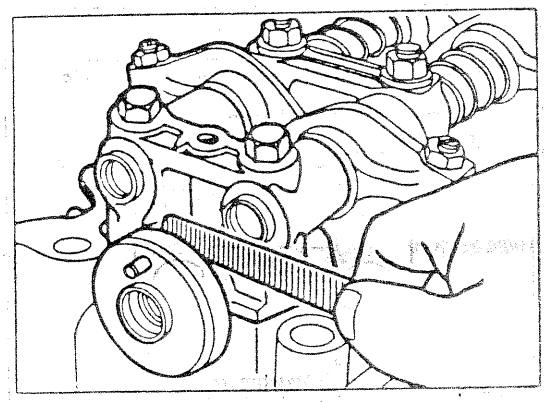


Figure 1.2-W. Checking Camshaft End Play

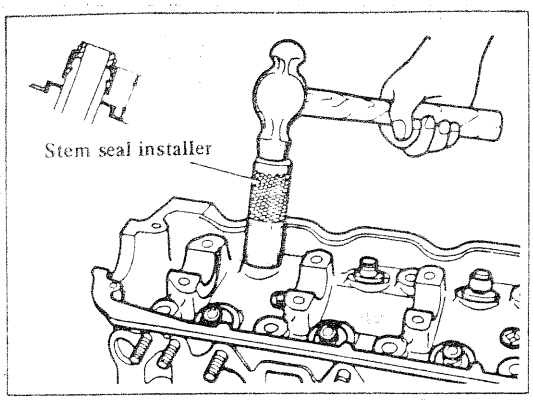


Figure 1.2-X. Driving in the Stem Seal

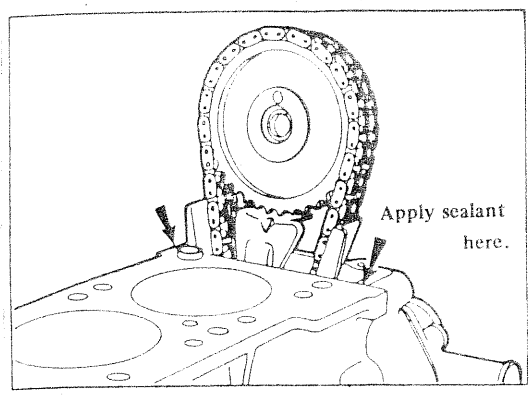


Figure 1.2-Y. Applying Sealant

DESCRIPTION		SPECIFICATION	SERVICE LIMIT
Valve Stem OD	INTAKE	0.315 Inch (8.0 mm)	-0.004 Inch (-0.1 mm)
	EXHAUST	0.315 Inch (8.0 mm)	-0.006 Inch (-0.15 mm)
Valve Head Thickness (C)	INTAKE	0.047 Inch (1.2 mm)	0.028 Inch (0.7 mm)
	EXHAUST	0.079 Inch (2.0 mm)	0.059 Inch (1.5 mm)

Valve Springs:- Check each valve spring for free length, tension and squareness. If any of these exceed the service limit, replace the spring.

DESCRIPTION	SPECIFICATION	SERVICE LIMIT
Valve Spring Free Length	1.890 Inch (48 mm)	-0.039 Inch (-1.0 mm)
Valve Spring Load	1.590 Inch at 39.7 lbs (40.4 mm at 18 kg) 1.197 Inch at 114.7 lbs (30.4 mm at 52 kg)	1.590 Inch at 35.2 lbs (40.4 mm at 16 kg) 1.197 Inch at 110.25 lbs (30.4 mm at 50 kg)
Squareness	1.5 degrees Max	3 degrees

Camshaft and Camshaft Bearing Cap (Figures 1.2-Q through 1.2-T):-
1. Check camshaft for bending - if bent excessively, replace camshaft. To check bending, place a dial indicator against the No. 2 or 3 camshaft journal and rotate camshaft one turn. One-half of the maximum deflection of the dial corresponds to the bend of the camshaft. See Figure 1.2-Q.

DESCRIPTION	SPECIFICATION
Bend of Camshaft	Within 0.0008 inch (0.02 mm)

2. Check camshaft end play. If service limit is exceeded, replace camshaft or cylinder head (with camshaft cap) whichever wear is greatest. To check end play, tighten camshaft front cap and measure clearance between cap side face and camshaft flange. See Figure 1.2-R.

DESCRIPTION	SPECIFICATION	SERVICE LIMIT
Camshaft End Play	0.004-0.008 inch (0.1-0.2 mm)	0.016 inch (0.4 mm)

3. Check height of cam lobes. Replace camshaft if cam surface is damaged or worn excessively. See Figure 1.2-S.

DESCRIPTION		SPECIFICATION	SERVICE LIMIT
Height of Cam Lobe	INTAKE	1.660 inch (42.18 mm)	-0.020 inch (-0.5 mm)
	EXHAUST	1.662 inch (42.24 mm)	-0.020 inch (-0.5 mm)

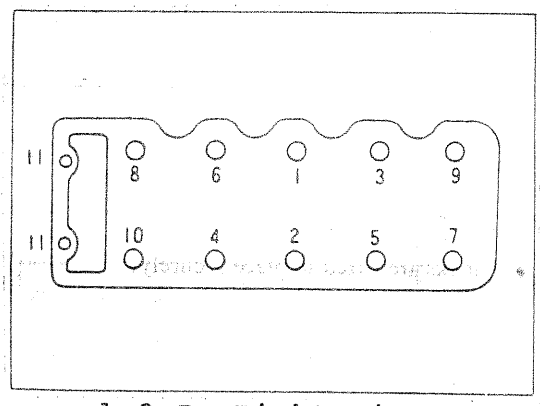


Figure 1.2-Z. Tightening Sequence of Cylinder Head Bolts

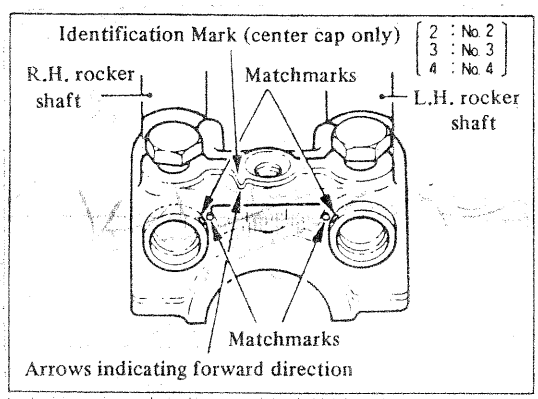
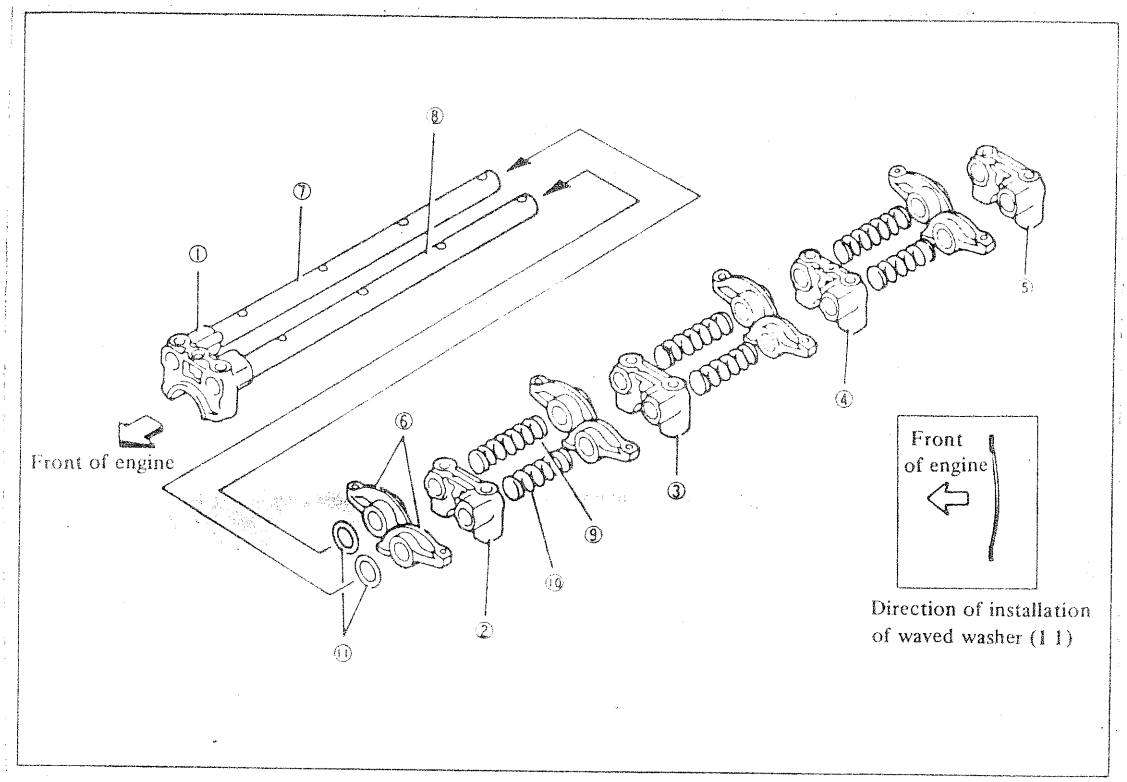


Figure 1.2-AA. Rocker Shafts Installation



1. Camshaft bearing cap, front
2. Camshaft bearing cap No. 2
3. Camshaft bearing cap No. 3
4. Camshaft bearing cap No. 4
5. Camshaft bearing cap, rear
6. Rocker arms
7. Rocker shaft, right (exhaust side)
8. Rocker shaft, left (intake side)
9. Rocker shaft spring, right
10. Rocker shaft spring, left
11. Waved washers

Figure 1.2-BB. Rocker Shafts Assembly Sequence

4. Inspect inside of camshaft bearings on cylinder head. Replace cylinder head if excessive damage is found. Install camshaft bearing cap onto cylinder head and tighten to 14-15 foot-pounds (1.9-2.1 m-kg). Then, measure the cap ID. Finally, measure the camshaft journal OD. If the clearance between the cap ID and the journal OD exceeds the service limit, replace camshaft or cylinder head assembly. Also check oil hole in front cap for clogging. See Figure 1.2-T.

DESCRIPTION	SPECIFICATION	SERVICE LIMIT
Camshaft to Cap Clearance	0.002-0.0035 inch (0.05-0.09 mm)	0.004 inch (0.15 mm)

5. Inspect the distributor gear for worn or damaged teeth.

Rocker Arm and Rocker Shaft:- Inspect rocker arms for wear or damage at the portions shown in Figure 1.2-U. If worn or damaged, replace rocker arm. Check clearance between rocker arm and rocker shaft - if service limit is exceeded, replace arm or shaft (Figure 1.2-V). Inspect rocker shaft for damage, bending. If any, replace shaft.

DESCRIPTION	SPECIFICATION	SERVICE LIMIT
Rocker Shaft to Rocker Arm Clearance	0.0004-0.0016 inch (0.01-0.04 mm)	0.004 inch (0.1 mm)
Bend of Rocker Shaft	Within 0.002 inch (Within 0.05 mm)	

1.2.7- CYLINDER HEAD REASSEMBLY (Figures 1.2-W, 1.2-X)

Precautions:-
* Clean all parts thoroughly.
* Coat sliding and rotating parts with clean, fresh engine oil prior to assembly.
* Before installing valves, check for camshaft end play.

Assembly Procedure:-
1. Coat camshaft journals and cams with engine oil. Then, fit camshaft to cylinder head. Finally, check camshaft end play as outlined in Paragraph 1.2-6.
2. Install spring seats onto the cylinder head and drive the stem seal into each valve guide (Figure 1.2-X).

CAUTION!
Stem seals must be driven securely into place. Oil leakage will result from improperly installed stem seals. Use NEW seals only - never attempt to re-use old stem seals.

DESCRIPTION	SPECIFICATION	
	Press-Fit Depth of Stem Seal	0.618-0.634 inch (15.7-16.1 mm)

3. Install valves, valve springs and retainers. Use a valve spring compressor to compress the valve spring, then fit retainer locks. When all valve assemblies are installed, check that retainer locks are securely installed.

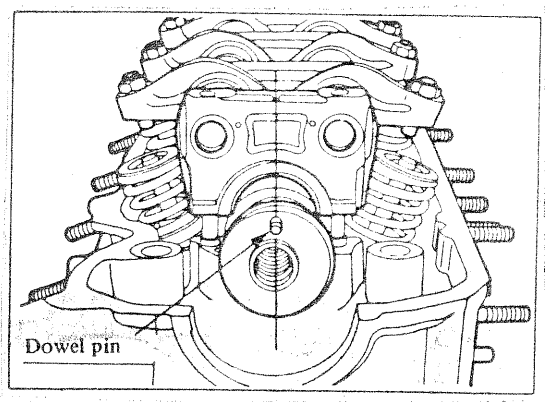


Figure 1.2-CC. Installation Position of Camshaft

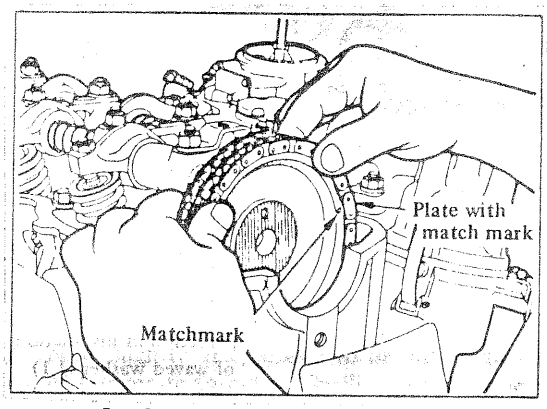


Figure 1.2-DD. Camshaft Sprocket Installation

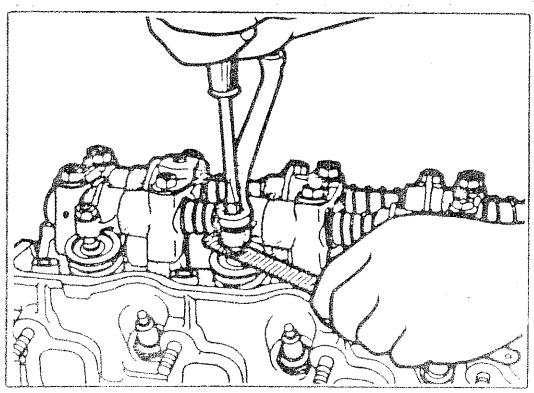


Figure 1.2-EE. Adjusting Valve Clearance

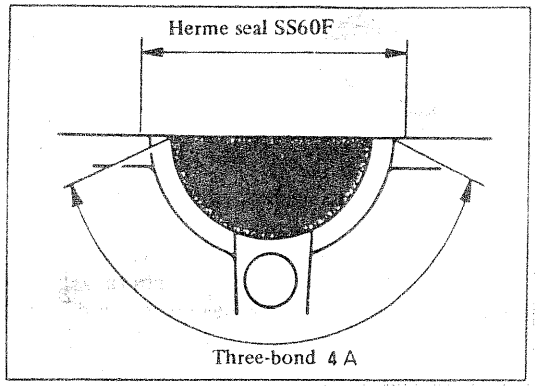


Figure 1.2-FF. Coating Packing with Sealant

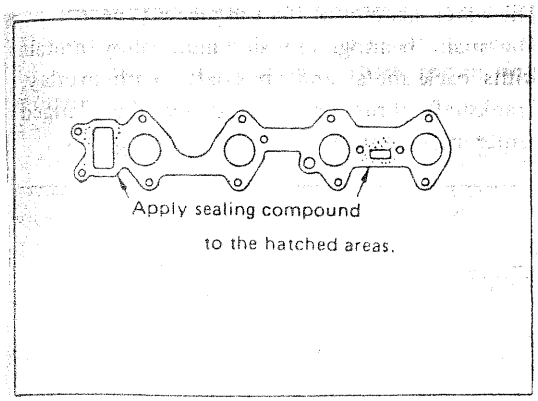


Figure 1.2-GG. Coating Intake Manifold Gasket with Sealant

CAUTION!
Do NOT compress the valve spring excessively or retainer bottoms may damage stem seals.

1.2.8- CYLINDER HEAD INSTALLATION (Figures 1.2-Y through 1.2-GG)

1. Coat the contact surfaces between cylinder block and chain case with SUPER 3-BOND or HERME SEAL SS60F sealant (Figure 1.2-Y).
2. Fit the cylinder head gasket to the cylinder block upper surface so that dowels on the cylinder block align with holes in the gasket.
3. Install cylinder head assembly onto cylinder block. Tighten cylinder head bolts in the sequence shown in Figure 1.2-Z. Tighten all bolts to 25 foot-pounds (3.5 m-kg); then, tighten all bolts to 50 foot-pounds (7 m-kg). Finally, tighten all bolts in proper sequence to 65-72 foot-pounds (9-10 m-kg) cold torque or 72-79 foot-pounds (10-11 m-kg) warm torque.
4. Coat camshaft journals and cams with clean, fresh engine oil. Then, install camshaft in cylinder head.
5. When assembling rocker shaft assembly, install rocker shafts, camshaft bearing caps, rocker arm springs and wave washers in the numerical order shown in Figure 1.2-BB. Be careful not to confuse parts identification or sequence of installation. **RIGHT HAND ROCKER SHAFT AND SPRINGS MAY BE DISCRIMINATED FROM LEFT-HAND ONES AS FOLLOWS:**

DESCRIPTION		RH SIDE (Exhaust Side)	LH SIDE (Intake Side)
Rocker Shaft		No. of oil holes: 8	No. of oil holes: 4
Springs	Free Length	3.244 in. (82.4 mm)	2.539 in. (64.5 mm)
	Color	Brown	Green

CAUTION!
Camshaft bearing caps No. 2 and 4 are stamped with marks "2" and "4", respectively, on their top face. The No. 3 cap has no marking. When fitting the rocker shaft to the camshaft bearing cap, align match marks on shaft end with matchmarks on cap as shown in Figure 1.2-AA. The camshaft bearing cap must be installed so that arrows on their upper surface face forward.

CAUTION!
Install wave washers with their projecting side facing the rocker arm side.

6. Install rocker shaft assembly into cylinder head. Make sure that push knocks are in place. Position camshaft with its dowel pin hole at front end of shaft facing upward (see Figure 1.2-CC). Install rockers shaft retainers and tighten nuts.
7. Tighten the No. 3, No. 2, No. 4, front and rear bearing caps IN THAT ORDER. These bolts should be tightened in 2 or 3 successive stages, so that bolts are tightened to the torque specified in the final tightening stage.

DESCRIPTION		SPECIFICATION
Bearing Cap Bolts	M8 x 70	14-15 Ft-Lbs (1.9-2.1 m-kg)
Tightening Torque	M8 x 25	15-19 Ft-Lbs (2.0-2.7 m-kg)

8. Check that the dowel pin at front of camshaft is at the top. Also make sure that the No. 1 cylinder piston is at top dead center (TDC) of its compression stroke. Then, install the camshaft sprocket onto the camshaft. Finally, tighten the distributor drive gear and sprocket mounting bolts temporarily. See Figure 1.2-DD.
9. Rotate the crankshaft about 90 degrees opposite its normal direction of rotation, then check that chain and sprocket are properly engaged.
10. Retighten the distributor drive gear mounting bolts to their specified torque.

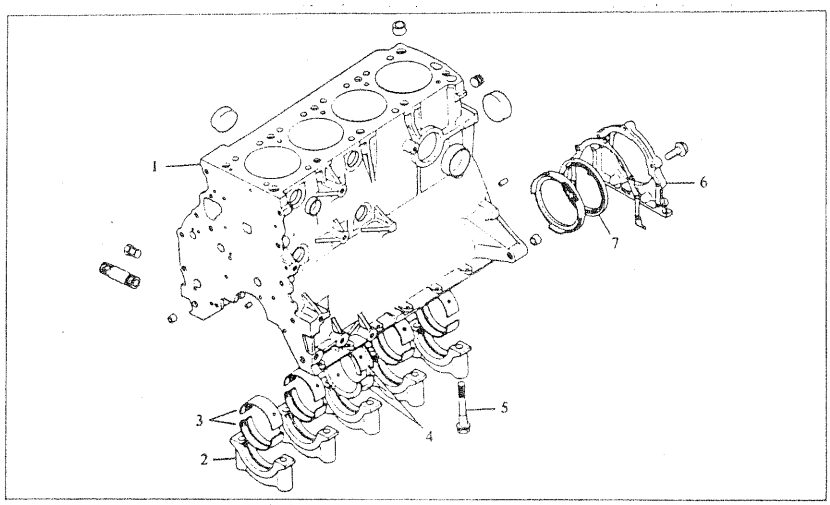
DESCRIPTION	SPECIFICATION
Tightening Torque of Distributor Drive Gear Bolts	36-43 Ft-Lbs (5-6 m-kg)

11. Complete a temporary COLD adjustment of valve clearances, as outlined in Section 1.1. Set INTAKE cold clearance to 0.003 inch (0.08 mm). Set EXHAUST cold clearance to 0.007 inch (0.18 mm).
12. Fit the semi-circular packings to front and rear of cylinder head. Apply sealant to the portions shown in Figure 1.2-FF.
13. Install rocker cover seal into rocker cover. Then, install rocker cover onto cylinder head and tighten rocker cover bolts to 3.6-5.0 foot-pounds (0.5-0.7 m-kg).
14. Install exhaust manifold and gaskets. Tighten exhaust manifold nuts to 11-14 foot-pounds (1.5-2 m-kg).
15. Install intake manifold with new gaskets. Apply 3-BOND 4A sealant to front and rear of gaskets as shown in Figure 1.2-GG. Tighten intake manifold to 11-14 foot-pounds (1.5-2 m-kg).
16. Install air governor, carburetor and air horn (as applicable for particular fuel system used).
17. Install fuel hoses.
18. Install Distributor and connect vacuum hoses.
19. Install spark plug wires.
20. Install breather hose.

SECTION 1.3- CYLINDER BLOCK

1.3.1- CYLINDER BLOCK STRUCTURE (Figures 1.3-A through 1.3-1.3-D)

A. **Cylinder Block** (Figures 1.3-A, 1.3-B):- The 5-bearing, deep skirt type cylinder block is made of special alloy cast iron. Main bearings are aluminum alloy and are coated with an overlay. Crankshaft thrust is received by the flanged center main bearing.



1. Cylinder block
2. Bearing cap
3. Main bearing
4. Main bearing, center
5. Bearing cap bolt
6. Oil seal case
7. Rear oil seal

Figure 1.3-A. Cylinder Block Components

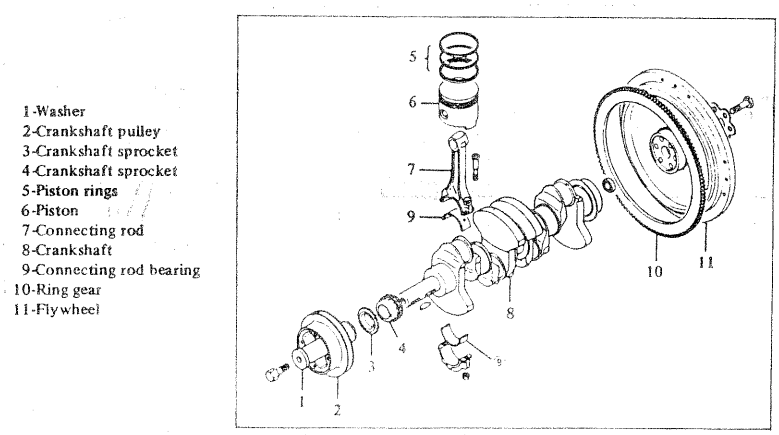


Figure 1.3-B. Crankshaft Parts

B. **Piston, Piston Pin and Piston Rings**:- The special alloy piston has three piston ring grooves. The hollow, special steel piston pin is carburized and hardened. The pin is press-fit into the connecting rod. Two compression rings and a single oil control ring are made of special cast iron and chrome-plated.

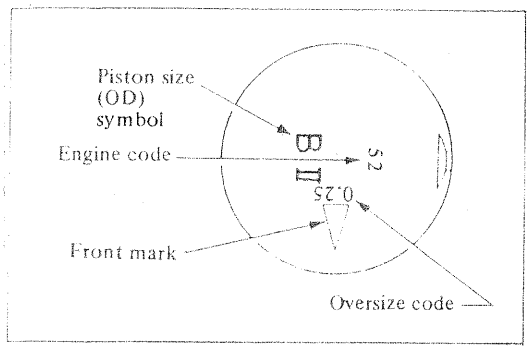


Figure 1.3-C. Piston Identification Marks

C. **Connecting Rod**:- The connecting rod is forged from carbon steel.

D. **Timing System** (Figure 1.3-D):- The aluminum die-cast timing chain case mounts the water pump, oil pump and distributor. A double roller chain drives the camshaft.

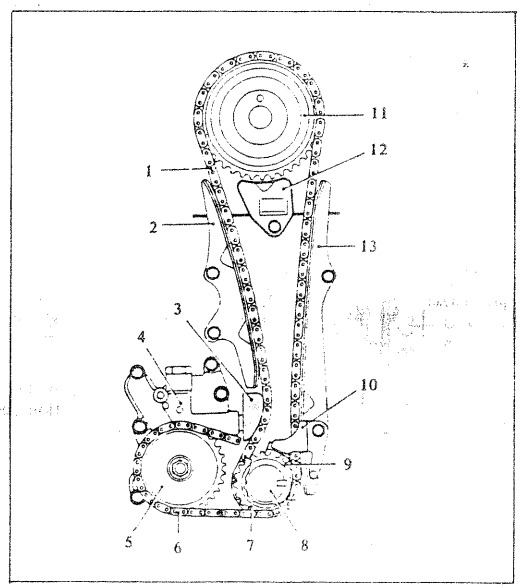


Figure 1.3-D. Timing System Parts

1.3.2- CYLINDER BLOCK DISASSEMBLY (Figures 1.3-E, 1.3-F)

1. Remove oil pan and gasket. Remove oil screen.
2. Remove crankshaft pulley mounting bolt, then remove pulley.
3. Remove timing chain case.
4. Remove oil pump sprocket mounting nut. Remove oil pump sprocket, crankshaft sprocket "0", and oil pump drive chain as a unit.
5. Remove oil pump assembly and tensioner.
6. Remove crankshaft sprocket, camshaft sprocket and timing chain.
7. Remove sprocket holder and chain guide.
8. Remove rear oil seal case.

9. Remove connecting rod cap nuts, then remove connecting rod caps. Pull piston and connecting rod assemblies upward through cylinder block to remove.

CAUTION!
Use care to avoid scratching or scoring the cylinder walls and connecting rod bearings.

10. To disassemble piston and connecting rod, first remove piston pin with special piston pin setting tool. See Figure 1.3-E and 1.3-F.

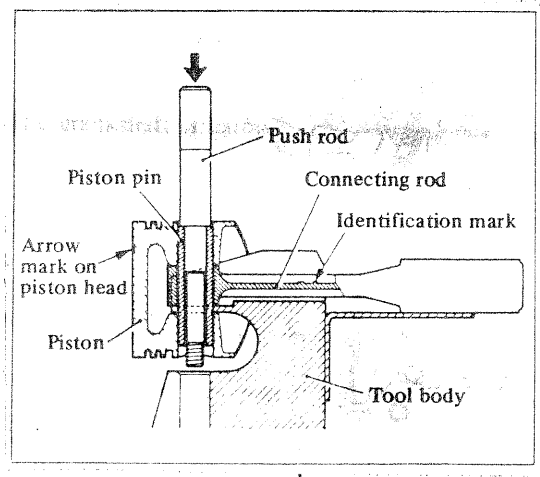


Figure 1.3-E. Piston Pin Removal

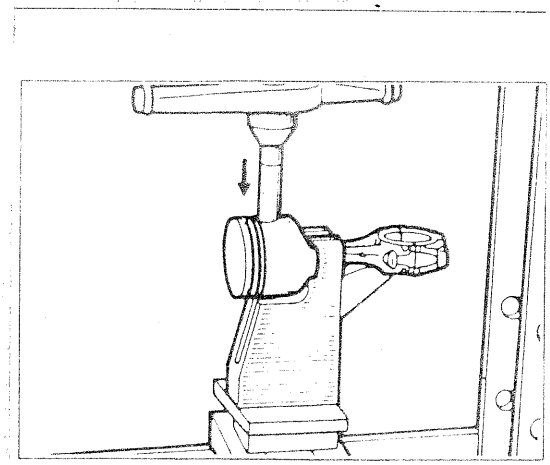


Figure 1.3-F. Piston Pin Removal

1.3.3- CYLINDER BLOCK INSPECTION (Figures 1.3-G through 1.3-S)

A. **Precautions**:-
* Clean all parts thoroughly prior to inspection.
* Check cylinder block for water leaks, damage before cleaning.
* Blow out oil holes with compressed air.
* Keep all parts together as matched sets.

B. **Cylinder Block Inspection** (Figures 1.3-G, 1.3-H. 1.3-I):-
1. Inspect cylinder block visually for scratches, cracks, rusting, corrossion. If necessary, use dye penetrant to locate faults. Repair or replace cylinder block if defective.
2. Use a straight edge and feeler gauge (Figure 1.3-G) to check cylinder block upper surface for distortion. If any measurement exceeds specification, regrind the surface.

DESCRIPTION	SPECIFICATION
Distortion of Cylinder Block Upper Surface	Within 0.002 inch (Within 0.05 mm)

3. Use a cylinder gauge to check cylinder bore (Figure 1.3-H). If scratching, evidence of seizing, or out-of-roundness is found, rebore all cylinders to the proper oversize - if one cylinder requires reboring, all cylinders must be rebored. If cylinders do NOT require reboring, but piston rings must be replaced, remove ridges from upper part of cylinder with a ridge reamer and hone the cylinder.

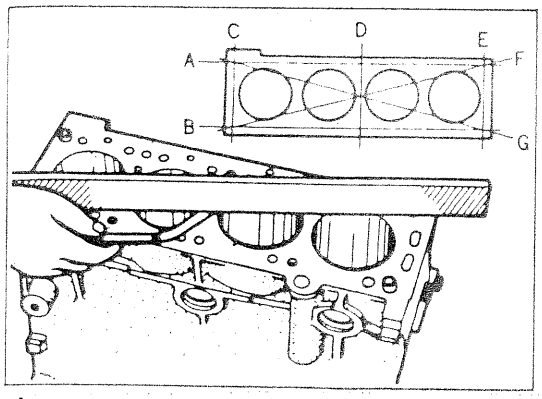


Figure 1.3-G. Checking Cylinder Block for Distortion

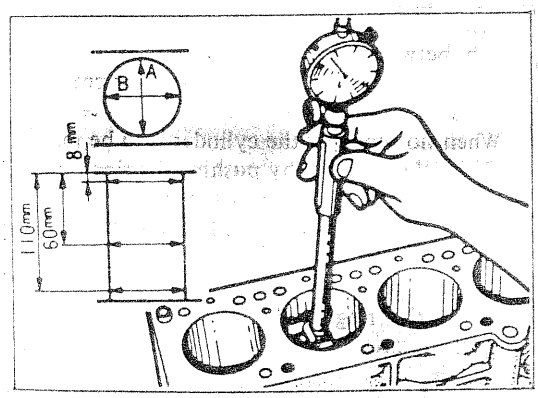


Figure 1.3-H. Measuring Cylinder Bore

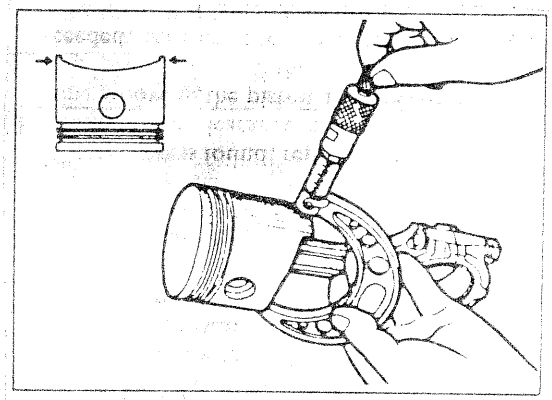


Figure 1.3-I. Measuring Piston OD

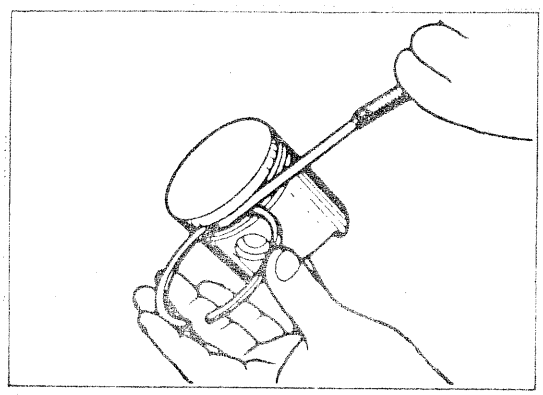


Figure 1.3-J. Checking Ring Groove to Ring Clearance

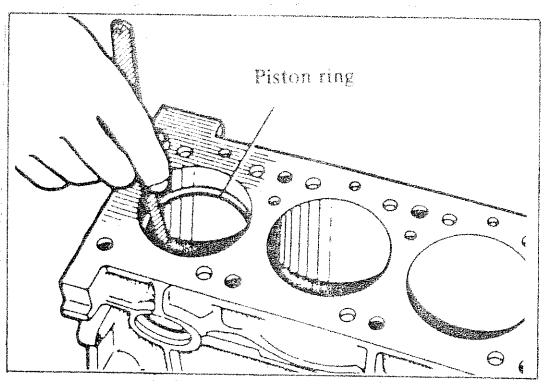


Figure 1.3-K. Checking Ring Gap

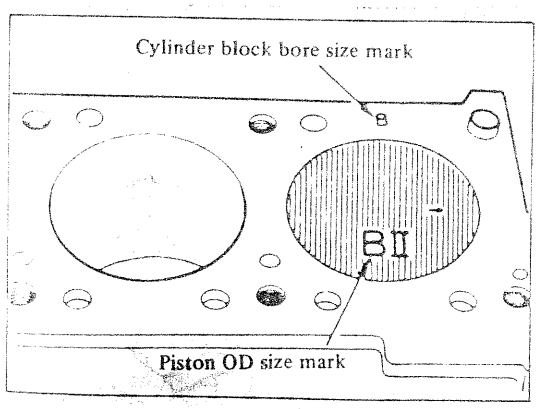


Figure 1.3-L. Cylinder and Piston Size Markings

DESCRIPTION	SPECIFICATION	SERVICE LIMIT
Cylinder Bore	3.587 inch (91.1 mm)	+0.047 inch (+1.2 mm)
Cylindricity	Within 0.0004 inch (Within 0.01 mm)	---
Difference in Cylindricity between Cylinders	Within 0.0007 inch (Within 0.02 mm)	---

Four oversize pistons are available as follows:-

SIZE	IDENTIFICATION CODE
Standard	STD
0.25 mm OS	0.25
0.50 mm OS	0.50
0.75 mm OS	0.75
1.00 mm OS	1.00

CAUTION!

Do NOT cut cylinder too deeply all at once. Allow about 0.002 inch (0.05 mm) for machining by a finishing cutter. Perform boring in the order of cylinders No. 2-4-1-3 to prevent cylinder distortion. Let cylinders cool after boring before measuring cylinder bores. Finish cylinder bores to final size by honing at an angle of 30-45 degrees. Restrict honing depth to that required for removing all traces of cutting tool.

4. Measure clearance between piston and cylinder. This clearance should be 0.0008-0.002 inch (0.02-0.06 mm). See Figure 1.3-I.

C. **Pistons, Piston Pins, Piston Rings** (Figures 1.3-J, 1.3-K, 1.3-L):-

1. Inspect pistons for evidence of seizing, scratches, excessive wear. Replace piston, if necessary.
2. Inspect piston rings for bending, damage, excessive wear. Replace rings, if necessary.

CAUTION!

If a piston is to be replaced, install new piston rings as well.

3. Check piston pin for proper fit in piston. The pin must slide smoothly in piston pin bore, with a slight resistance. If looseness is noted, replace the piston.
4. Check clearance between each piston ring groove and the appropriate piston ring (Figure 1.3-J). If service limit is exceeded, repeat measurement using a new ring. If clearance is still excessive, replace both the piston and piston ring.

DESCRIPTION		SPECIFICATION	SERVICE LIMIT
Clearance between Compression Ring Groove and Ring	No. 1	0.002-0.004 in. (0.06-0.10 mm)	0.006 in. (0.15 mm)
	No. 2	0.0008-0.002 in. (0.02-0.06 mm)	0.006 in. (0.15 mm)
Clearance Between Oil Control Ring Groove and Ring		0.0008-0.0025 in. (0.02-0.065 mm)	0.006 in. (0.15 mm)

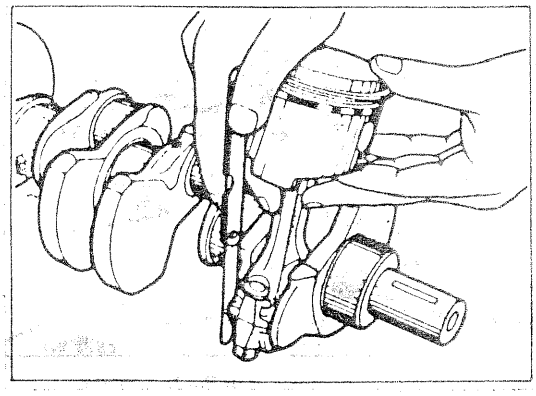


Figure 1.3-M. Measuring Thrust Clearance

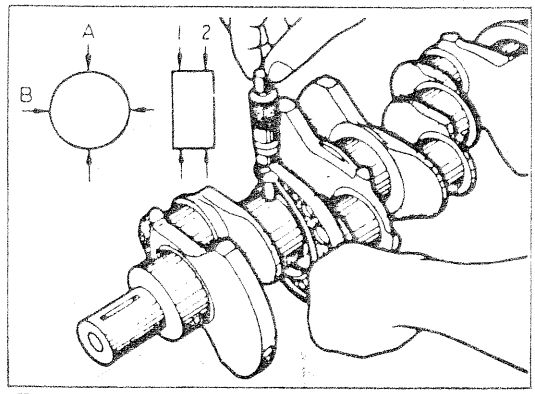


Figure 1.3-N. Measuring Crankshaft or Pin Diameter

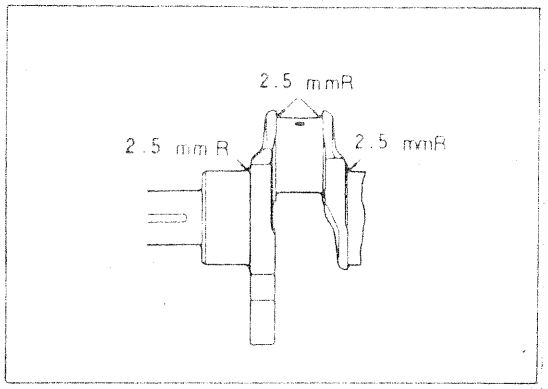


Figure 1.3-O. Radius of Fillets

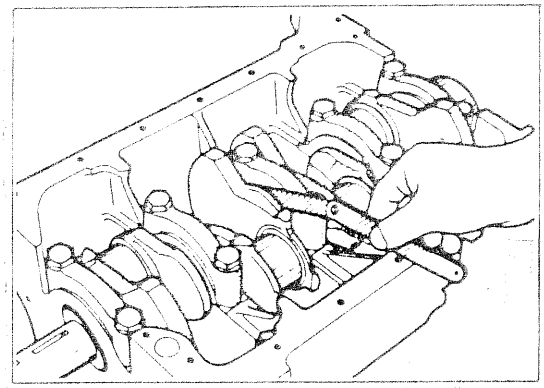


Figure 1.3-P. Crankshaft End Play

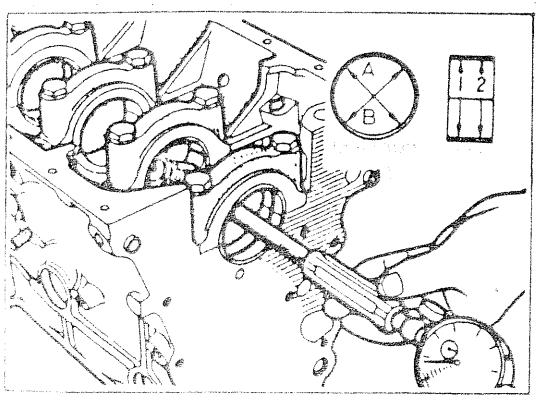


Figure 1.3-Q. Measuring Bearing ID

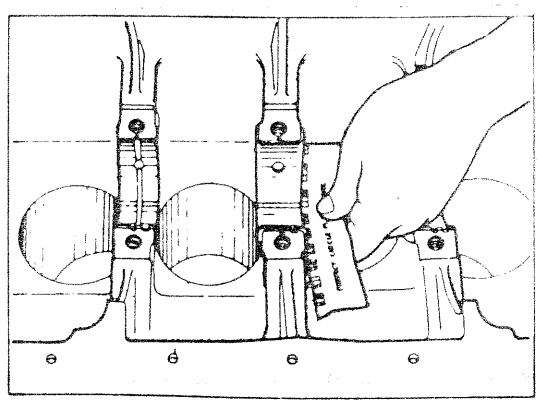


Figure 1.3-R. Measuring Oil Clearance

4. Check piston ring end gap by positioning ring down into cylinder bore with the piston. Measure ring end gap. If service limit is exceeded, replace the ring. (NOTE:- When replacing a ring, be sure to select a ring that matches the piston size.) See Figure 1.3-K.

DESCRIPTION		SPECIFICATION	SERVICE LIMIT
Piston Ring Gap	No. 1	0.010-0.016 in. (0.25-0.40 mm)	0.039 in. (1.0 mm)
	No. 2	0.010-0.018 in. (0.25-0.45 mm)	0.039 in. (1.0 mm)

NOTE

Piston rings may be ordered in STANDARD (STD) size, 0.25 mm (25) oversize, 0.50 mm (50) oversize, 0.75 mm (75) oversize, and 1.00 mm (100) oversize.

CAUTION!

When installing a piston into a new cylinder block, select one that matches the cylinder bore. A cylinder bore size (A, none, or C) is stamped on the cylinder block upper surface. A piston OD size mark is stamped on the piston head (A, B or C). See Figure 1.3-L.

D. Connecting Rods (Figure 1.3-M):-

1. Inspect connecting rod large end for damage to thrust end faces. If damage is found, replace the connecting rod.

NOTE

When using a new connecting rod, stamp the cylinder number at the large end, in the same position as on the old connecting rod.

2. Check connecting rod for bend or twist, using an alignment fixture. If excessive bend or twist is noted, replace the connecting rod. Connecting rod bend or twist must be within 0.001 inch (0.03 mm).

3. Fit the connecting rod to the crankshaft pin and measure thrust clearance (Figure 1.3-M). If service limit is exceeded, replace the connecting rod.

DESCRIPTION	SPECIFICATION	SERVICE LIMIT
Thrust Clearance	0.004-0.010 in. (0.1-0.25 mm)	0.019 in. (0.5 mm)

4. Measure connecting rod small end ID. If not within specified range, replace the connecting rod.

DESCRIPTION	SPECIFICATION
Connecting Rod Small End ID	0.8650-0.8655 in. (21.974-21.985 mm)

E. Crankshaft (Figures 1.3-N, 1.3-O, 1.3-P):-

1. Inspect crankshaft journals and pins for damage, uneven wear, cracks, clogged oil passages.

2. Check crankshaft for bending. If bend is not within 0.001 inch (0.03 mm), replace crankshaft.

3. See Figure 1.3-N. Measure diameter of each journal and pin in

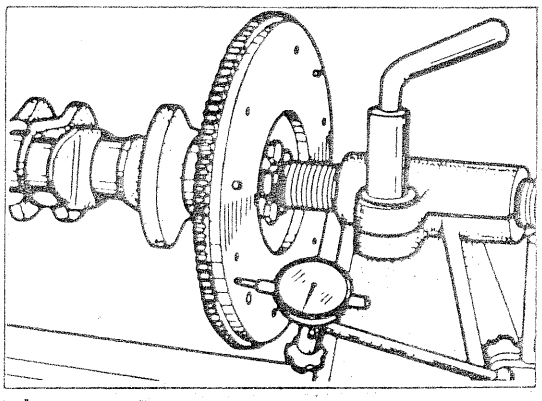


Figure 1.3-S. Checking Flywheel Runout

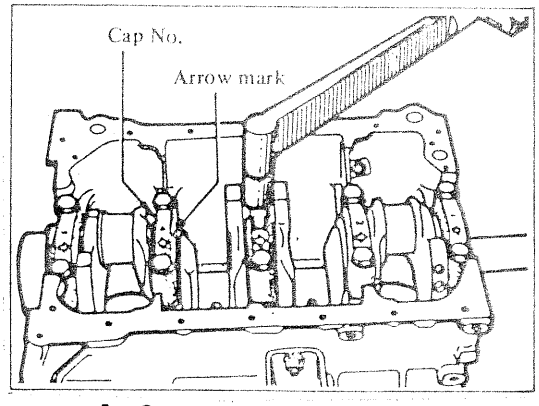


Figure 1.3-T. Installing Main Bearing Caps

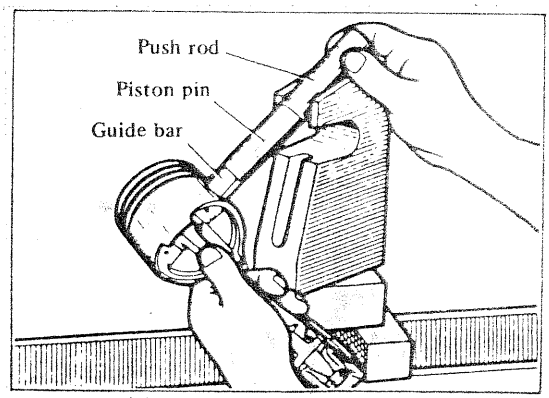


Figure 1.3-U. Press-Fitting the Piston Pin

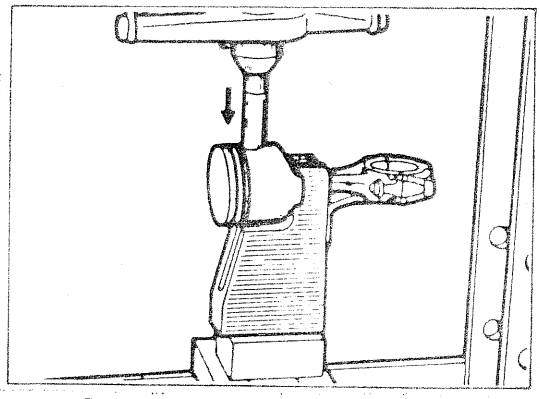


Figure 1.3-V. Press Fitting the Piston Pin

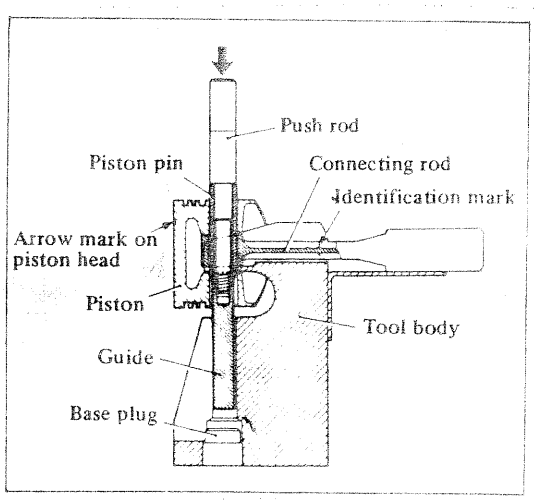


Figure 1.3-W. Press Fitting the Piston Pin

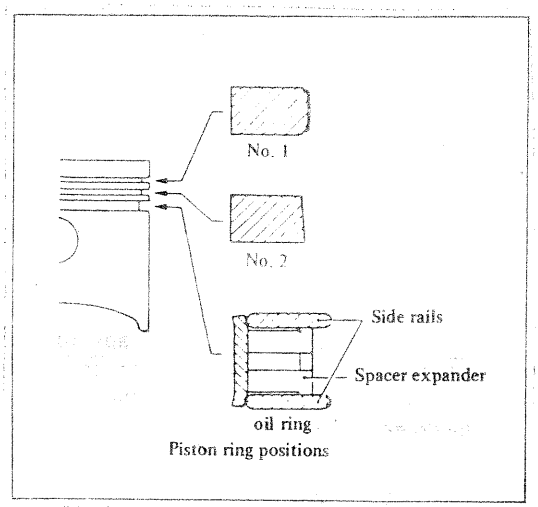


Figure 1.3-X. Installing Piston Rings

directions A and B and a front and rear ends of journal or pin. If excessive out-of-roundness or wear is found, grind the journal or pin to the next undersize. If service limit is exceeded, replace crankshaft. When grinding crankshaft journals and pins to an undersize, pay attention to radius of fillets (Figure 1.3-O). Maximum fillet radius is 2.5 millimeters.

4. Measure crankshaft end play (Figure 1.3-P), by checking thrust clearance at center bearing position. Replace center bearing if service limit is exceeded. (NOTE:- When measuring end play, tap front and rear ends of crankshaft with a mallet to obtain thrust movement in both directions.)

DESCRIPTION	SPECIFICATION	SERVICE LIMIT
Crankshaft End Play	0.002-0.007 in. (0.05-0.18 mm)	0.0098 inch (0.25 mm)
Main Bearing Cap Bolt Tightening Torque	55-61 ft-lbs (7.5-8.5 m-kg)	---

F. **Main Bearing and Connecting Rod Bearing** (Figure 1.3-Q, 1.3-R):-

1. Visually inspect bearings for breaking away, melting, seizing, improper contact. Replace bearings, if necessary.
2. Check journal and pin clearances, by subtracting journal or pin OD from the installed bearing ID.

CAUTION!

When installing a new crankshaft, use standard size bearings. If a clearance does not fall within the specified range even after replacing the bearing, grind the journal or pin to the next undersize and install a bearing of the same undersize.

DESCRIPTION	SPECIFICATION	REPAIR LIMIT
Journal Oil Clearance at Center Bearing	0.0008-0.003 in. (0.020-0.080 mm)	0.006 inch (0.15 mm)
Pin Oil Clearance	0.00055-0.002 in. (0.014-0.064 mm)	0.006 inch (0.15 mm)
Main Bearing Bolt Tightening Torque	55-61 ft-lbs (7.5-8.5 m-kg)	---
Connecting Rod Cap Bolt Tightening Torque	33-34 ft-lbs (4.5-4.8 m-kg)	---

NOTE

If desired, check oil clearance using Plastigage. Clean bearings and journals to be checked. Cut Plastigage strip to same length as bearing width. Place the strip into journal bearing cap (not over oil hole). Install crankshaft, bearings and caps. Tighten bolts to specified torque. DO NOT ROTATE CRANKSHAFT. Remove cap and measure width of Plastigage strip (use special scale supplied with Plastigage).

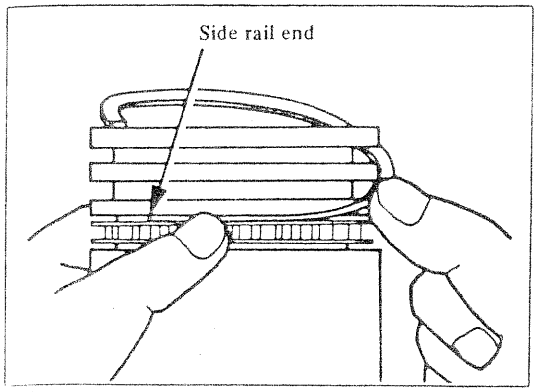


Figure 1.3-Y. Installing Side Rail

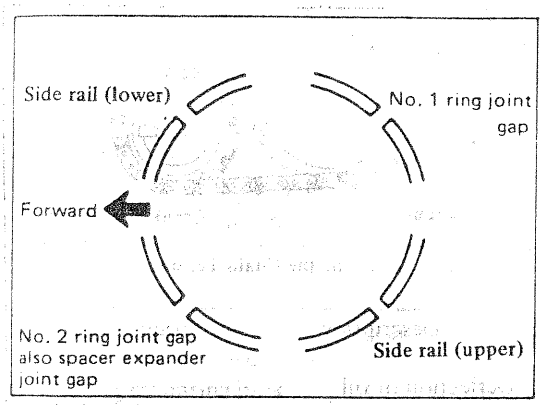


Figure 1.3-Z. Piston Ring Gap Gap Arrangement

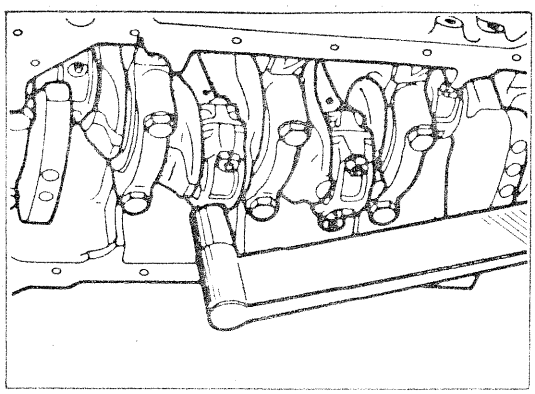


Figure 1.3-AA. Tightening the Connecting Rod Caps

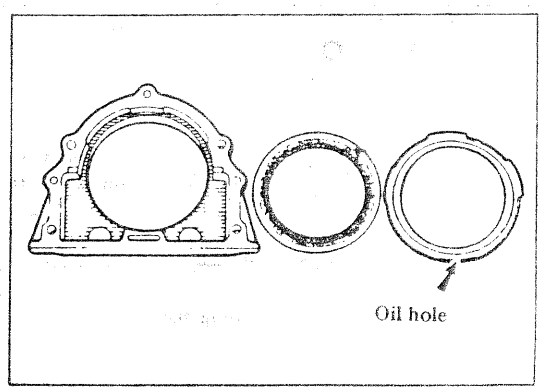


Figure 1.3-BB. Rear Oil Seal

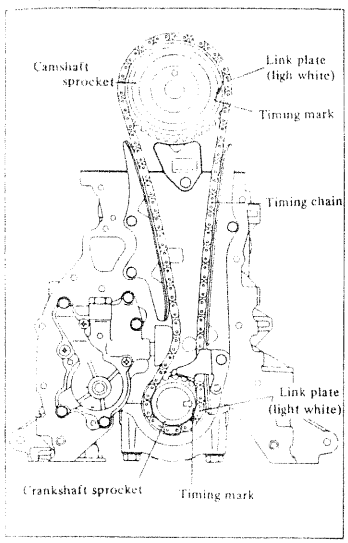


Figure 1.3-CC. Timing Chain Installation

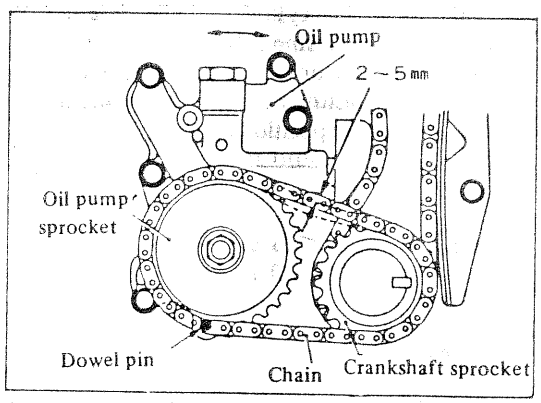


Figure 1.3-DD. Adjusting Chain Tension

G. **Crankshaft Sprocket**:- Inspect sprocket teeth for damage, wear. Replace sprocket, if necessary,

H. **Flywheel and Ring Gear** (Figure 1.3-S):- Inspect the clutch disc contact surface of flywheel for wear, damage. Replace flywheel, if necessary.

1. Check flywheel runout (Figure 1.3-S). Replace flywheel if service limit is exceeded.

DESCRIPTION	SPECIFICATION	SERVICE LIMIT
Flywheel Runout	Within 0.005 inch (Within 0.13 mm)	0.007 inch (0.2 mm)

2. Inspect ring gear for damage, cracks, wear. Replace ring gear, if necessary. If ring gear must be replaced, proceed as follows:-
   a. Tap around outer periphery of ring gear until it is free of flywheel.
   b. Heat new replacement ring gear to 500-538 degrees F. (260-280 degrees C.). Then, shrink fit ring gear to flywheel.

CAUTION!
Do NOT heat ring gear when removing it.

I. **Oil Seal**:- Inspect lips of front and rear oil seals for damage, wear. Replace seal(s) if necessary.

J. **Oil Pan and Oil Screen**:- Check oil pan for cracks, damage. Check oil screen and oil screen o-ring. Replace any damaged, defective components.

K. **Sprocket and Tensioner**:- Inspect camshaft sprocket, crankshaft sprocket, oil pump sprocket for excessive wear, cracks and damage. Replace any defective sprocket.

CAUTION!
Do NOT use gasoline, kerosene, or other detergent to clean sprockets or tensioner. If necessary, wipe off dirt with a clean cloth.

L. **Front Case**:- Inspect front case for cracks,damage.For oil pump checking procedures, refer to Part 2, LUBRICATION SYSTEM.

M. **Tensioner Sleeve**:- Check sleeve for wear, damaged rubber, Replace sleeve, if necessary. Also check that the sleeve functions smoothly when installed in the oil pump body. Check tensioner spring load, replace spring if service limit is exceeded.

DESCRIPTION	SPECIFICATION	SERVICE LIMIT
Tensioner Spring		
Free Length	2.866 inches	------
Length at 5.5 Pounds	1.452 inches	1.452 inches at 4.6 pounds

Check for clogging of oil relief holes in tensioner sleeve hole of the oil pump body.

N. **Chain Tensioner and Guide**:- Inspect tensioner rubber shoes for wear, tensioner spring for deterioration. Replace any faulty parts.

O. **Timing Chain**:- Inspect timing chain for cracks, damage, excessive wear, elongation. If any, replace chain.

P. **Timing Chain Case**:- Inspect case for damage, cracks. replace, if necessary.

1.3.4- CYLINDER BLOCK REASSEMBLY (Figures 1.3-T through 1.3-DD)

A. **Precautions**:-
* Thoroughly clean all parts.
* Apply engine oil to all sliding or rotating parts.
* Replace all gaskets and oil seals.
* Apply sealant to packings and gaskets.
* Observe tightening torques and tightening sequence, if specified.
* Proceed with each step of the reassembly only after confirming that specified oil and thrust clearances are satisfactory.

B. **Reassembly Procedure**:-

1. Apply engine oil to all crankshaft journals and pins. Then, install crankshaft.
2. Install crankshaft bearing caps. Tighten the No. 2, No. 4, front and rear bearing caps (in that order) to the specified torque. The arrow mark on the bearing caps lower surface must be positioned forward. Cap numbers are stamped next to the arrow mark - install each cap in the correct order (No. 1 through 5, starting at the front of the engine). After tightening bearing caps to the specified torque, check that the crankshaft can be rotated slightly and that crankshaft end play is correct.

DESCRIPTION	SPECIFICATION
Main Bearing Cap Bolt Tightening Torque	55-61 foot-pounds (7.5-8.5 m-kg)
Crankshaft End Play	0.002-0.007 inch (0.05-0.18 mm)

3. Assemble the piston, piston pin, connecting rod and rings as follows:-
   a. Place piston pin securely between the push rod and guide of special piston setting tool (Figure 1.3-U).

CAUTION!
Apply liberal quantity of engine oil to piston pin outer periphery and to the connecting rod small end hole.

   b. Place connecting rod and piston in the special tool with front marks face up. Then, install piston pin (Figure 1.3-V).
   c. Insert the guide into the tool body with cutout in guide aligned with that in the tool body. Then, turn the piston pin 90 degrees so that it is positioned vertically. Make sure small end of connecting rod rests properly on the tool body.
   d. Use a press-fitting force of 1654-3858 pounds (750-1750 kg) to press-fit the piston pin.

NOTE

The piston pin is properly positioned when tip of tool guide contacts the tool bottom.

CAUTION!

Do not apply a load to the piston when press-fitting the pin. Apply only the specified press-fit load.

e. Turn the push rod 90 degrees until the cutout in the guide aligns with that in the tool body. Then, remove the piston and connecting rod assembly from the tool body.
f. Check that the connecting rod can be moved on and turn on the piston pin.

4. Install piston rings. Install oil control ring, No. 2 compression ring, and No. 1 compression ring, IN THAT ORDER.
   a. Install each ring with the stamped manufacturer's or oversize mark facing the piston head.
   b. For the 3-piece oil control ring, install the spacer expander first. Check that both ends of the expander join with each other (Figure 1.3-X). Then, install the upper side rail as shown. Finally, install the lower side rail. (NOTE:- The upper and low side rail gaps should be positioned 45 degrees apart from the spacer gap in opposite directions.)
5. Arrange piston ring and side rail gaps as shown in Figure 1.3-Z. Ring gaps must NOT be positioned in either the piston boss direction or in the thrust direction. Use a RING COMPRESSOR to hold rings securely in place, then install piston and connecting rod assemblies into cylinders. Make sure that the piston ring gap arrangement shown in Figure 1.3-Z is maintained.
6. Install connecting rod caps and tighten them to 33-34 foot-pounds (4.5-4.8 m-kg). When caps are properly torqued, check connecting rod thrust clearance at its large end. Specification thrust clearance is 0.004-0.0098 inch (0.1-0.25 mm); service limit is 0.0196 inch (0.5 mm).
7. Install the crankshaft rear oil seal case. Prior to installation, apply SAE 40 engine oil to outer periphery of oil seal lip and crankshaft flange. When the case, oil seal and separator have been separated from each other, push oil seal into the case by hand and install the separator with its oil hole facing downward. See Figure 1.3-BB.
8. Install the loose side chain guide, tension side chain guide and sprocket holder.
9. Install oil pump gasket and oil pump assembly. Tighten oil pump mounting bolts to 6-7 foot-pounds (0.8-1.0 m-kg).
10. Install the tensioner spring and tensioner.
11. Rotate crankshaft to position No. 1 piston at top dead center.
12. See Figure 1.3-CC. Fit timing chain to sprockets by aligning timing marks (plated links) with the mark on the crankshaft and camshaft sprockets, respectively. Align crankshaft key with sprocket keyway and install crankshaft sprocket onto crankshaft.
13. Refer to Figure 1.3-DD. Install oil pump sprocket and oil pump driving chain. Tighten oil pump sprocket nut to 22-28 foot-pounds (3-4 m-kg).

14. Check oil pump drive chain tension. Chain deflection should be 0.079-0.196 inch (2-5 mm). If tension is incorrect, loosen five oil pump mounting bolts and rotate oil pump body on the lower dowel pin to adjust tension. After correct chain tension is obtained, tighten the mounting bolts to the specified torque.
15. Install timing chain case, with its gasket. Prior to installation, apply engine oil to outer periphery of crankshaft front oil seal lip and crankshaft front end. Trim the upper and lower ends of the chain case gasket, if they protrude from the upper and lower surfaces of the cylinder block.
16. Install the crankshaft pulley and tighten its mounting bolt to 80-94 foot-pounds (11-13 m-kg). Apply engine oil to the pulley boss circumference and use care to avoid damaging the oil seal during pulley installation.
17. Install the rear plate.
18. Install the flywheel and tighten its mounting bolts to 84-90 foot-pounds (11.5-12.5 m-kg).
19. Install oil pan with its gasket. Prior to installation, apply Super 3-Bond or Herme Seal SS60F sealant at the chain case to cylinder block contact portions and to the rear oil seal case to cylinder block contact portions. Tighten bolts diagonally, starting with a bolt at the uttermost end, to 5 foot-pounds (0.6-0.8 m-kg).

SECTION 1.4 - CYLINDER BLOCK VENTILATION

1.4.1- GENERAL

The cylinder block ventilation is of the closed type, which does not permit blowby gases to disperse into the atmosphere.

Under light load conditions, blowby gases are conducted from the rocker cover to the intake manifold via the breather (PCV) hose. At the same time, fresh air is drawn from the air cleaner to the oil pan through the air horn, breather hose, and oil separator.

Under heavy load conditions, air horn negative pressure draws in blowby gases which are then sent to the combustion chamber through the oil pan and oil separator.

1.4.2- INSPECTION

Inspect breather hose for damage, cracks, clogging. Inspect rocker cover side nipple hole for clogging, as well as the intake manifold nipple hole.

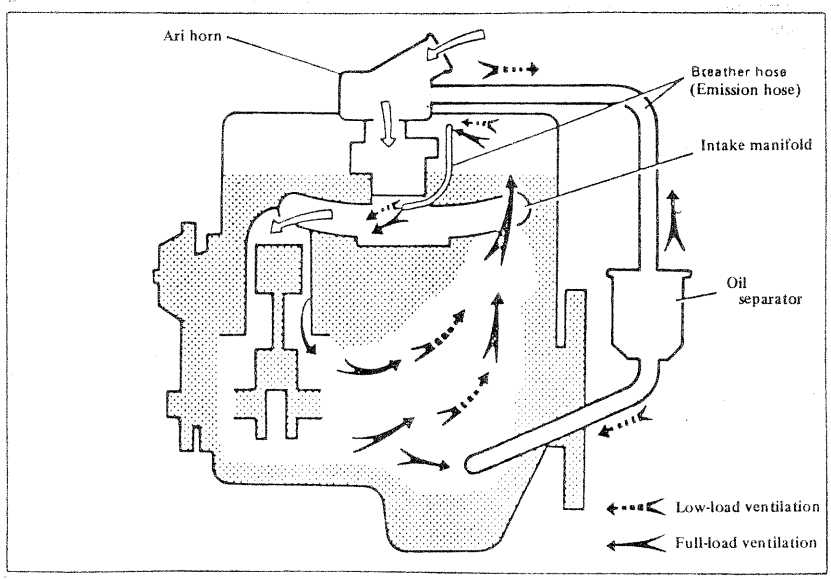


Figure 1.4-A. Cylinder Block Ventilation

PART 2

LUBRICATION SYSTEM

SECTION 2.1 - GENERAL

2.1.1- RECOMMENDED ENGINE OILS

Use oils having API Service Classification "For Service SC or above". Change oil every 200 hours of operation.

AMBIENT TEMPERATURE	RECOMMENDED OIL VISCOSITY
Below 32 degrees F.	SAE 10W
14-50 degrees F.	SAE 20W
32-104 degrees F.	SAE 30
86 degrees F. and above	SAE 40
All Seasons	SAE 10W-30

2.1.2- CHANGING ENGINE OIL

Drain oil whole engine is still warm from running. After draining oil completely, reinstall drain plug and tighten to 44-50 foot-pounds (6-8 m-kg). Refill oil pan with clean, fresh oil through the oil filler cap hole on rocker cover.

SECTION 2.2 - OIL FILTER

2.2.1- GENERAL

The cartridge type filter should be replaced every 100-200 hours of operation. The filter incorporates a bypass valve, which allows unfiltered oil to flow through the system if the filter becomes clogged.

2.2.2- REMOVAL AND INSTALLATION

Remove oil filter by hand, or use a filter wrench (available locally).

Before installing new filter, coat filter o-ring with clean engine oil. Then, install filter and tighten hand tight (correct torque is 8-10 foot-pounds). Start engine and check filter carefully for leakage.

SECTION 2.3 - OIL PUMP

2.3.1- GENERAL (Figure 2.3-A)

The trochoid type oil pump is mounted in the chain case. A sprocket is connected to its inner rotor and driven by the crankshaft through a chain. The pump picks up oil from the oil pan by means of the oil screen and delivers all oil to the filter. When pump delivery pressure reaches 50-64 psi (3.5-4.5 kg/sq. cm), a relief valve opens to relieve pressure.

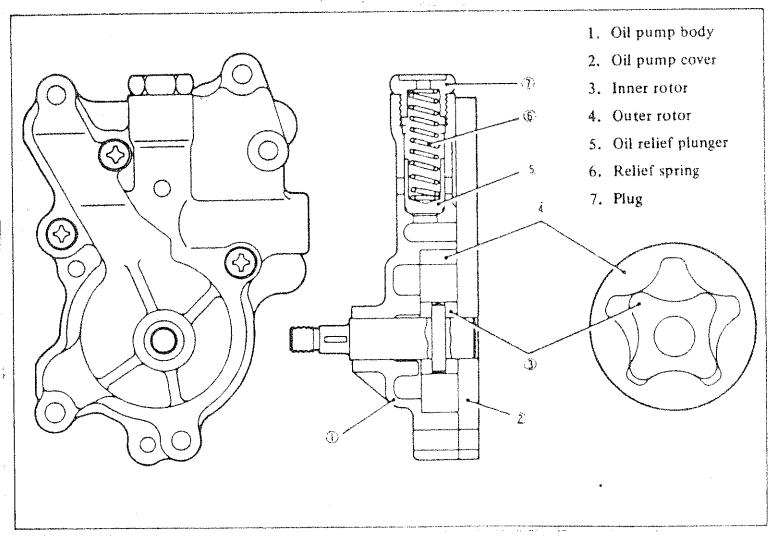


Figure 2.3-A. Oil Pump

2.3.2- REMOVAL AND INSTALLATION

Refer to Paragraph 1.3.2, CYLINDER BLOCK DISASSEMBLY. For oil pump installation see Paragraph 1.3.4, CYLINDER BLOCK REASSEMBLY.

2.3.4- OIL PUMP DISASSEMBLY (Figure 2.3-B)

Remove three screws that retain the oil pump cover, then remove the cover. Remove the inner and outer rotors. Mark the outer rotor to indicate the direction it must be reinstalled in. Remove the plug. Finally, remove the relief spring and plunger.

2.3.5- OIL PUMP INSPECTION (Figure 2.3-C)

Clean all parts prior to inspection. Replace any defective parts.

Oil Pump Body and Cover:- Inspect pump body for cracks, excessive wear. Check for "ridged" wear caused by contact with the rotors. Inspect cover for "ridged" wear caused by contact with the gear.

CAUTION!
The oil pump BODY and COVER must be replaced as an assembly.

Rotor Clearances (Figure 2.3-C):- Check BODY, SIDE and TIP clearances as shown in Figure 2.3-C. If excessive wear is noted, replace the applicable component.

DESCRIPTION	SPECIFICATION
Body Clearance (Outer Rotor OD to Body)	0.004-0.006 in. (0.1-0.17 mm)
Side Clearance	0.003-0.005 in. (0.08-0.14 mm)
Tip Clearance	0.001-0.005 in. (0.04-0.15 mm)

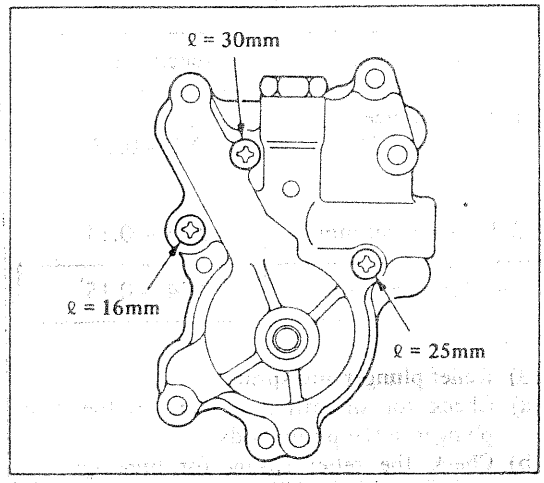


Figure 2.3-B. Oil Pump Cover Screws

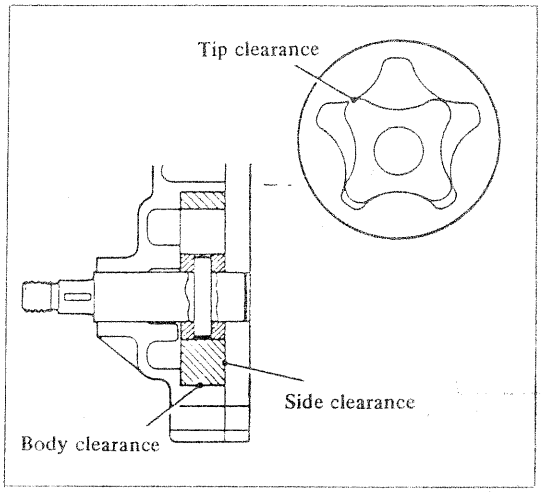


Figure 2.3-C. Oil Pump Clearances

Relief Plunger and Spring:- Check that the relief plunger moves smoothly in the pump body. Inspect spring for breakage, deterioration.

DESCRIPTION		SPECIFICATION
Relief Spring	FREE LENGTH	1.85 in. (47 mm)
	LOAD	1.575 in. at 9.48 lbs. (40 mm at 4.3 kg)

2.3.6- OIL PUMP REASSEMBLY

1. Coat the oil relief plunger with engine oil and install into pump body.
2. Install the oil relief spring, then the plug. Tighten plug to 22-32 foot-pounds (3-4.5 m-kg).
3. Apply a liberal quantity of engine oil to the inner and outer rotors. Then, install the rotors into the body.
4. Install oil pump cover after aligning its dowel pin hole with dowel pin on body. Tighten the 3 mounting screws securely (Figure 2.3-B).

SECTION 2.4 - OIL PRESSURE SWITCH

2.4.1- GENERAL (Figure 2.4-A)

A tee fitting in the engine block delivers engine oil pressure to both an oil pressure sender unit and to an oil pressure switch. The sender unit operates an oil pressure gauge, usually mounted on a meter and control panel. The oil pressure switch is normally-closed (NC), is held open by engine oil pressure during operation. If oil pressure should, for any reason, drop below approximately 15 psi the pressure switch will close to shut the engine down automatically.

NOTE
The oil pressure switch is required on stationary duty (standby) generator units, in compliance with applicable codes. The switch must never be disconnected or otherwise rendered inoperative on those generator units.

2.4.2- TESTING THE OIL PRESSURE SWITCH (Figure 2.4-B)

1. Remove the switch from its tee fitting.
2. Attach the switch to a pressure testing device, such as the one shown in Figure 2.4-B.
3. Connect the test leads of an ohmmeter to the pressure switch terminal and to the switch housing.
4. With no pressure applied to the switch, the ohmmeter should indicate continuity.
5. Slowly apply pressure to the switch. At approximately 12-18 psi, the switch contacts should open and the ohmmeter reading should drop to infinity.
6. Release the pressure applied to the switch - at some point between 12-18 psi (and below), the ohmmeter should again indicate continuity.

Replace switch if test results are not as described.

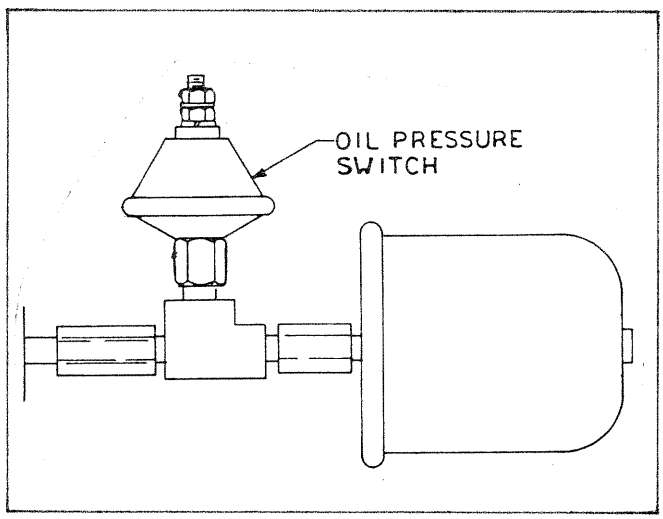


Figure 2.4-A. Oil Pressure Switch

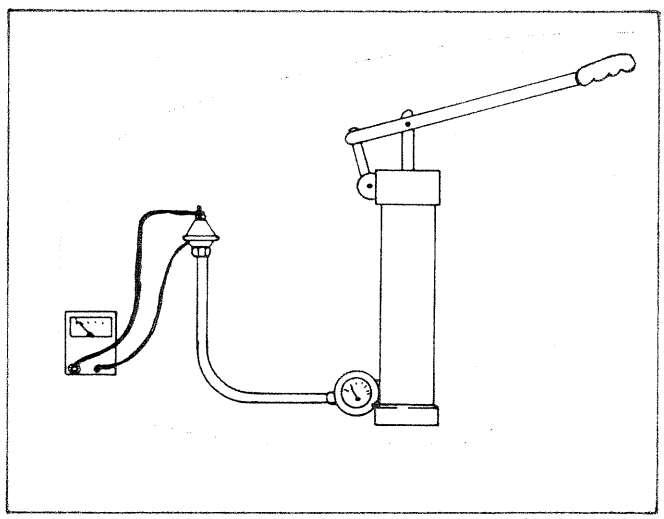


Figure 2.4-B. Testing the Oil Pressure Switch

2.4.3- OPERATIONAL TEST OF OIL PRESSURE SWITCH

If engine oil pressure, as measured with an accurate pressure gauge, is normal but an automatic low oil pressure shutdown occurs, perform an operational test of the switch and its circuit as follows:-

1. With the switch installed on the engine, disconnect the wire from the switch terminal.
2. Start the engine. Check that engine oil pressure is normal.

NOTE

If an automatic engine shutdown occurs and the unit's engine monitor system (see appropriate instruction manual) indicates that the shutdown was caused by a low oil pressure condition, a problem exists in the unit's low oil pressure shutdown circuit and not in the switch (since the switch wire is disconnected). Refer to the appropriate schematic/wiring diagram for the specific unit involved.

3. With the engine running, connect the pressure switch wire to the switch terminal. If engine shuts down, the pressure switch has failed closed and should be replaced.
4. With engine running, hold the pressure switch wire terminal end firmly into contact with the engine frame (frame ground). An engine shutdown should occur. If a shutdown does NOT occur, a problem exists in the unit's automatic shutdown circuit.
5. With the engine shut down, check that oil pressure has dropped to zero. Then, use an ohmmeter to check the pressure switch for continuity. Replace switch, if defective.

PART 3

ENGINE COOLING SYSTEM

SECTION 3.1 - GENERAL

3.1.1- GENERAL DESCRIPTION

The engine cooling system is of the forced water circulation type, using a centrifugal impeller type coolant pump.

3.1.2- RECOMMENDED COOLANT

Fill the cooling system with a 50-50 mixture of ethylene glycol base anti-freeze and soft water. If the system is of the closed recovery type, fill the coolant recovery bottle about half full with the same mixture. Also add a high quality rust inhibitor to the coolant.

DANGER!
Ethylene glycol base anti-freeze is poisonous. Do NOT use mouth to siphon coolant from radiator, coolant recovery bottle, or any container. Wash hands after handling coolant.

3.1.3- CHECKING COOLANT LEVEL

Check coolant level periodically. If the system is of the closed recovery type, removal of the radiator pressure cap is not necessary when checking coolant level. Simply check the coolant level in the recovery bottle - maintain recovery bottle about half full with the recommended mixture.

DANGER!
Do NOT remove radiator pressure cap while engine coolant is hot. Serious burns from boiling liquid or steam may result.

3.1.4- FAN BELT (Figure 3.1-A)

Adjust fan belt tension so that an applied force of about 22 pounds (10 kg) applied midway between pulleys provides a belt deflection of 0.27-0.39 inch (7-10 mm).

Inspect fan belts periodically for wear, cracking, damage, etc. Replace any defective belt immediately.

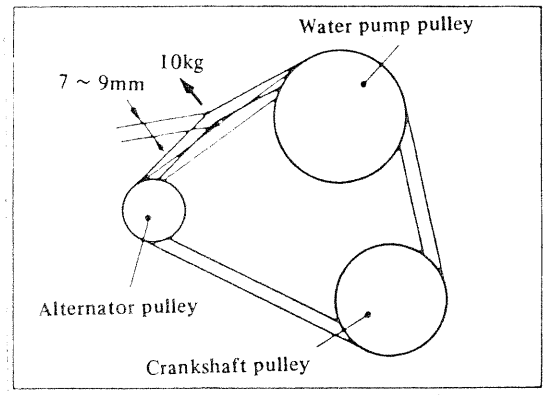
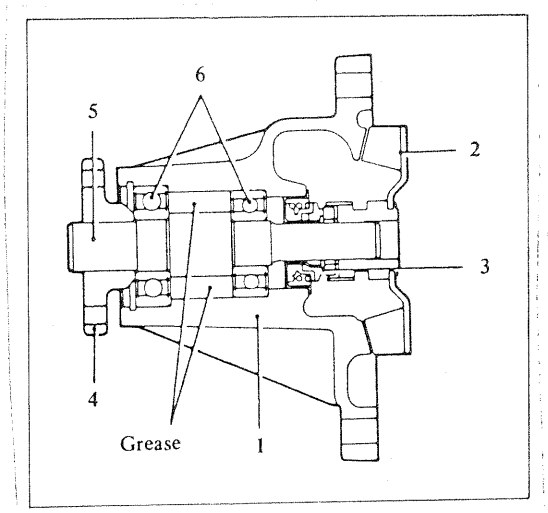


Figure 3.1-A. Adjusting Belt Tension

SECTION 3.2 - ENGINE COOLANT PUMP

3.2.1- DESCRIPTION (Figure 3.2-A)

The coolant pump is located on the front of the chain case. The pump shaft is supported on two ball bearings, is pre-lubricated and requires no additional lubrication for the life of bearings.



1. Water pump body
2. Impeller
3. Seal unit
4. Pulley bracket
5. Shaft assembly
6. Ball bearings

Figure 3.2-A. Sectional View of Coolant Pump

3.2.2- COOLANT PUMP REMOVAL

1. Remove the pump pulley and fan belt.
2. Remove five bolts that retain the pump.
3. Remove the pump.

3.2.3- PUMP INSPECTION

Inspect pump body for cracks, damage. Check that the pump shaft rotates smoothly with no abnormal sounds. Check that the seal unit does not leak.

3.2.4 - PUMP INSTALLATION

1. Install pump assembly with a new gasket.
2. Install pump pulley.
3. Install fan belt.
4. Adjust fan belt tension.

PART 4

ENGINE CRANKING AND CHARGING SYSTEM

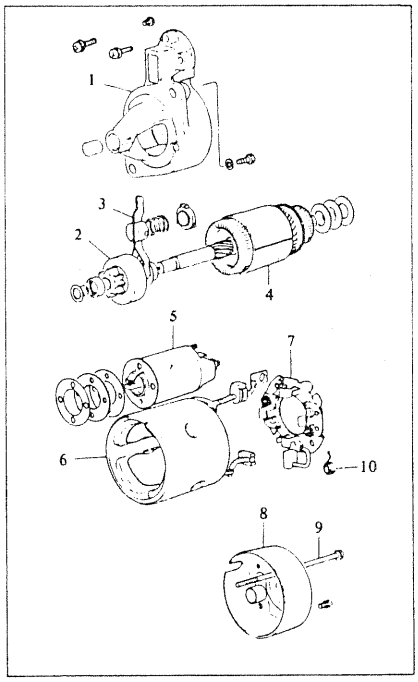
SECTION 4.1 - STARTER

Starter Type..... Solenoid Shift Type
Starter Output..... 1.1-12 KW-V
Direction of Rotation (Viewed from pinion end)..... Clockwise
No-Load Characteristics
  Terminal Voltage..... 11.5 Volts
  Current..... 60 Amperes Maximum
  Rotational Speed..... 6600 RPM Minimum
Solenoid Switch
  Terminal Voltage..... 5
  Current..... 500 Amperes Maximum
  Torque..... 1.15 m-kg Minimum
Solenoid Switch Working Voltage..... 8 Maximum

4.1.1- STARTER CONSTRUCTION (Figure 4.1-A)

The starter may be divided into the following major sections:-

1. **Motor Section**:- Generates the drive power.
2. **Overrunning Clutch Section**:- Transmits armature torque and prevents engine from overrunning after startup.
3. **Switch Section**:- Moves the overrunning clutch via a lever and supplies a load current to the motor.



1-Front bracket
2-Overrunning clutch
3-Lever assembly
4-Armature
5-Electro magnetic switch
6-Yoke assembly
7-Brush holder
8-Rear bracket
9-Through bolt
10-Brush spring

Figure 4.1-A. Starter Components

4.1.2- INSPECTION/MAINTENANCE BEFORE DISASSEMBLY

Engine cranking problems may not necessarily be caused by the starter. If problems are encountered, check the entire cranking circuit. If the cranking circuit checks good, remove the starter for testing.

Inspect the cranking circuit prior to starter removal as follows:-

1. Check battery electrolyte level.
2. Check battery STATE OF CHARGE and CONDITION.
3. Inspect battery terminals for cleanliness, corrosion, security.
4. Check starter terminals for cleanliness, corrosion, security.
5. Check wiring for shorted or open condition.
6. Check that the starter itself is properly grounded.

4.1.3- CHECKING BATTERY STATE OF CHARGE

DANGER!
Storage batteries give off EXPLOSIVE hydrogen gas. Do not permit smoking, open flame, sparks, etc., in the vicinity of a battery. Do not use a match or other flame to provide light for checking battery electrolyte level.

DANGER!
Battery electrolyte fluid is an extremely caustic sulfuric acid solution that can cause severe burns. Handle batteries with care. Avoid contact of electrolyte fluid with eyes, skin, clothing, painted surfaces, etc. If spillage occurs, flush the affected area with clear water immediately.

Use an automotive type battery hydrometer to test the specific gravity of electrolyte in all battery cells. Follow the hydrometer manufacturer's instructions carefully. As the specific gravity reading of each cell is obtained, write that reading down. To find battery STATE OF CHARGE, calculate the AVERAGE of all the specific gravity readings. If the hydrometer scale does not provide percentage of charge readings, compare the average of all readings obtained with the following:-

STATE OF CHARGE	SPECIFIC GRAVITY
100%	1.260
75%	1.230
50%	1.200
25%	1.170

EXAMPLE:- Specific gravity readings are 1.200; 1.200; 1.190; 1.200; 1.190; 1.190. The AVERAGE of all readings is 1.195. The battery is slightly less than 50 percent charged.

If necessary, use an automotive type battery charger to recharge any discharged battery.

4.1.4- CHECKING BATTERY CONDITION

Use an automotive type battery charger, as described in Paragraph 4.1.3, to check battery condition. If the difference in specific gravity between the highest and lowest cell is 0.050 (50 points) or more, the battery is nearing the end of its useful life and should be replaced. However, if the highest cell reads less than 1.200 the test for condition is questionable - recharge the battery and repeat the test.

EXAMPLE:- Readings taken are 1.230; 1.220; 1.230; 1.210; 1.225; 1.230. Battery condition is good. If readings are 1.250; 1.180; 1.240; 1.240; 1.230; 1.210 - battery is worn out.

4.1.5- STARTER NO-LOAD TEST (Figure 4.1-B)

Connect the starter to a battery as shown in Figure 4.1-B, with an ammeter and a voltmeter connected into the circuit as shown. Close the switch to rotate the starter motor. Read the voltmeter and ammeter and observe starter motor rotation. **CAUTION: Use adequately heavy wiring for the test circuit and tighten every terminal securely.** The probable cause of a problem may be estimated by comparing the test result to the following table:-

TEST RESULT	CAUSE
High current, Low Motor Speed. (Low Torque)	1. Bushing binding or dirty. 2. Armature core is rubbing. 3. Armature/Field Coil grounded. 4. Armature coil is shorted.
High Current, no motor rotation	1. Solenoid switch grounded. 2. Armature or field coil grounded. 3. Bushing is seized.
No current flow, no motor rotation	1. Armature or field coil disconnected 2. Brush disconnected from pigtail 3. Commutator dirty or poor contact between brush and commutator due to protrusion of mica.
Low Current, Low Motor Speed (Low Torque)	1. Field Coil junction is poor.
High Current, High Motor Speed	1. Field coil is shorted.

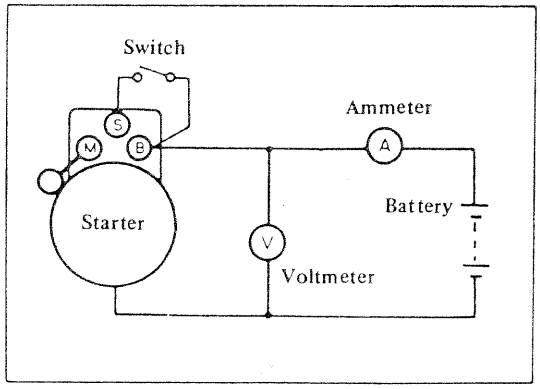


Figure 4.1-B. No-Load Test Wiring

SECTION 4.2 - STARTER REMOVAL, DISASSEMBLY, INSPECTION AND TESTING

4.2.1- REMOVAL

1. Remove the Generator unit's 30 ampere FUSE (if applicable).
2. Remove the battery cable from the battery post or terminal indicated by a NEGATIVE, NEG, or (-).
3. Remove the battery cable from the battery post or terminal indicated by a POSITIVE, POS, or (+).
4. Remove all wires from starter.
5. Remove two bolts that retain the starter, then remove the starter.

4.2.2- DISASSEMBLY (Figures 4.2-A through 4.2-G)

1. See Figure 4.2-A. Remove the Terminal "M" connector. Then, remove three screws that retain the solenoid switch and remove the switch.
2. Remove two through bolts and separate the armature from the yoke (Figure 4.2-B).
3. Carefully remove the armature and lever from the front bracket (Figure 4.2-C). **NOTE:- Remember the direction of installation of the lever and the sequence of installation of the spring and its retainer.**
4. See Figure 4.2-D. Remove the small washer from the tip of the armature shaft. (Grease will sometimes cause this washer to stick inside the front bracket.)
5. Remove two screws that retain the rear bracket (Figure 4.2-E), then remove the bracket.
6. See Figure 4.2-F. Remove the brush holder assembly.
7. Refer to Figure 4.2-G. Remove the overrunning clutch. Drive snap ring temporarily toward the clutch side and remove snap ring. Then, remove clutch and stop ring.

4.2.3- INSPECTION (Figures 4.2-H through 4.2-K)

1. **Armature Shaft to Bushing Clearance**:- Check clearances between the front bushing and armature shaft; also check clearance between the rear bushing and armature shaft. This can be done by measuring the respective bushing ID's and the shaft OD's. If service limit is exceeded, replace the worn part(s).

DESCRIPTION		SPECIFICATION	SERVICE LIMIT
Armature Shaft OD	Front	0.433 in. (11 mm)	-0.004 in. (0.1 mm)
	Rear	0.559 in. (14.2 mm)	-0.004 in. (0.1 mm)
Bushing ID	Front	0.433 in. (11 mm)	+0.004 in. (0.1 mm)
	Rear	0.559 in. (14.2 mm)	+0.004 in. (0.1 mm)

2. **Brush** (Figure 4.2-H):- Check brush for wear. If wear limit line has been reached, replace the brush (see Figure 4.2-H). Also check brush spring tension.

DESCRIPTION		SPECIFICATION	SERVICE LIMIT
Brush	Length	0.669 in. (17 mm)	0.452 in. (11.5 mm)
	Spring Tension	3-5.7 lbs (1.4-2.6 kg	1.79 lbs (0.9 kg)

See Figure 4.2-I. Check for conduction between the positive (+) side brush holder and holder base. Replace holder, if any.

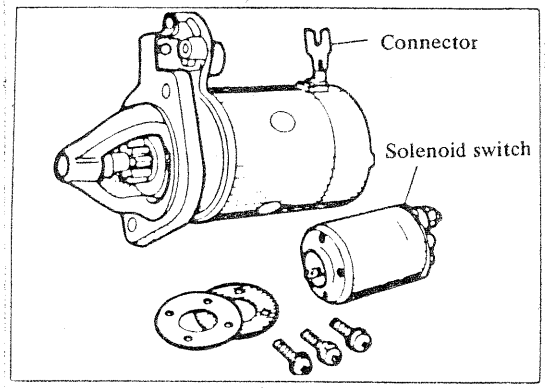


Figure 4.2-A. Solenoid Switch Removal

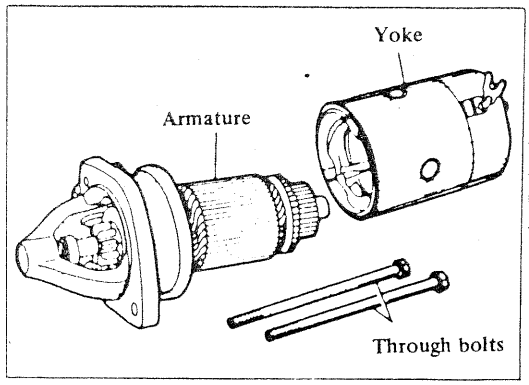


Figure 4.2-B. Through Bolts Removal

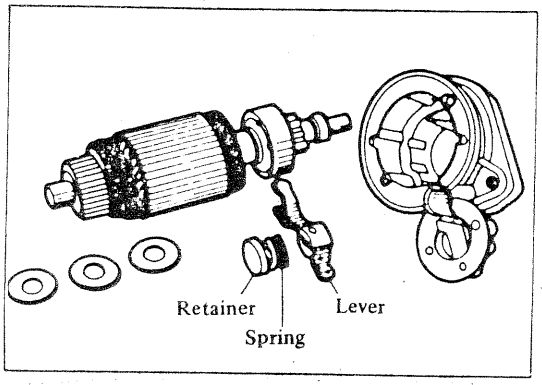


Figure 4.2-C. Armature and Lever Removal

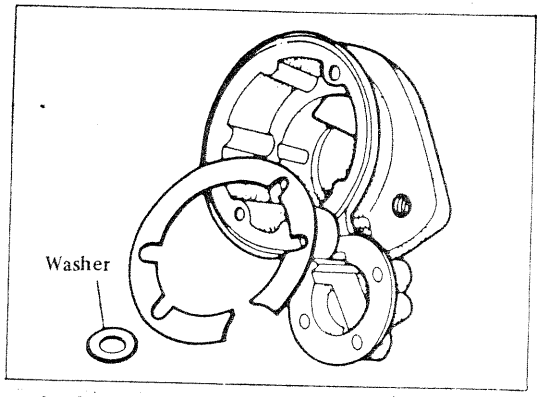


Figure 4.2-D. Armature Shaft End Washer Removal

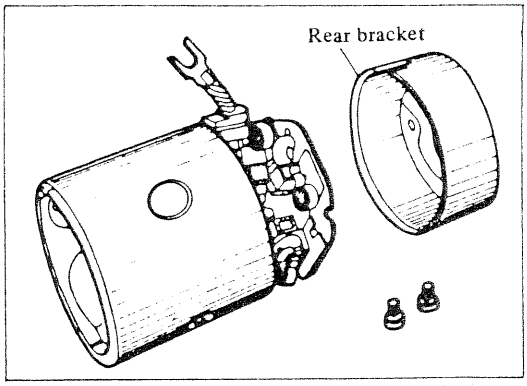


Figure 4.2-E. Rear Bracket Removal

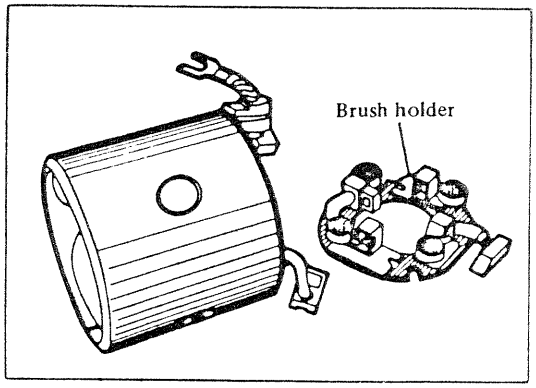


Figure 4.2-F. Brush Holder Removal

3. **Armature** (Figure 4.2-J):- Use a "Growler" tester to check the armature for short circuit condition. Replace the coil if shorted.

Use a dial indicator to check runout of armature shaft and commutator. Also measure the commutator OD and the depth of undercut. Repair or replace armature is service limit is exceeded.

DESCRIPTION		SPECIFICATION	SERVICE LIMIT
Bending of Armature Shaft		Within 0.001 in. (Within 0.03 mm)	0.0039 in. 0.1 mm)
Commutator	OD	Within 1.26 in. (32 mm)	1.22 in. (31 mm)
	RUNOUT	Within 0.001 in. (Within 0.03 mm)	0.002 in. (0.05 mm)
	UNDERCUT DEPTH	0.016-0.023 In. (0.4-0.6 mm)	0.0078 In. (0.2 mm)

Check for conduction between commutator and armature coil. If any, replace the armature. Also check bearing for freedom of rotation. If binding or noisy, replace the bearing.

4. **Field Coil**:- Check for conduction between terminal lead wire and positive (+) brush. If no conduction, replace the yoke assembly.

Make sure there is NO conduction between the field coil and the positive (+) brush. If conduction is found, coil is grounded and yoke assembly must be replaced. Also check poles and coil for looseness.

5. **Overrunning Clutch**:- Inspect pinion gear for wear, damage. If any, replace the pinion.

CAUTION!
Be sure to replace the snap ring. Try turning the pinion by hand and replace if defective. DO NOT LUBRICATE THE OVERRUNNING CLUTCH.

6. **Solenoid Switch**:- Perform a resistance check between terminals S and M, and between terminal S and body. If no resistance, replace the switch.

4.2.4- STARTER REASSEMBLY (Figures 4.2-L through 4.2-O)

Assemble the starter in the reverse order of disassembly. Apply grease to the following parts:-

1. Sleeve Bearing
2. Pinion
3. Lever sliding part
4. Plunger
5. Armature shaft splines
6. Overrunning Clutch ring

See Figure 4.2-L. Install armature and brush holder into the yoke. When installing the overrunning clutch, install snap ring firmly onto shaft then install the stop ring (Figure 4.2-M). Install the lever in its correct direction (Figure 4.2-N).

After assembly, check pinion protrusion. With the pinion fully out, measure the pinion gap to the stop ring. If not within the specified

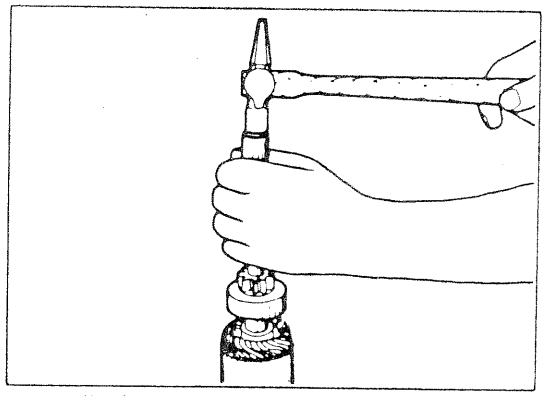


Figure 4.2-G. Overrunning Clutch Removal

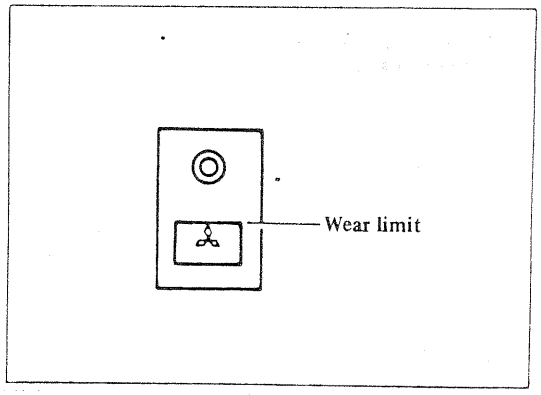


Figure 4.2-H. Checking Brush Wear

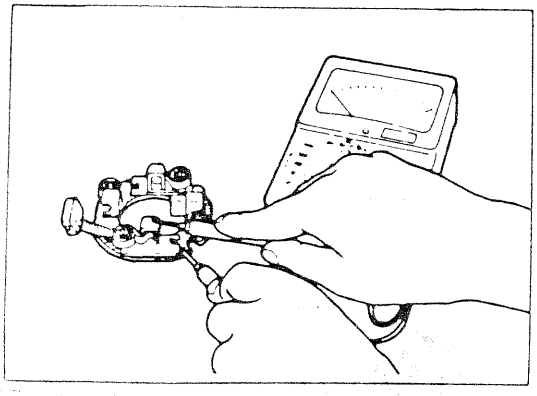


Figure 4.2-I. Checking Brush for Grounding

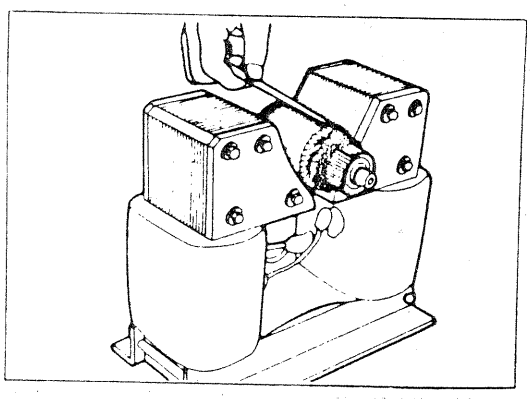


Figure 4.2-J. Armature Coil Short Circuit Test

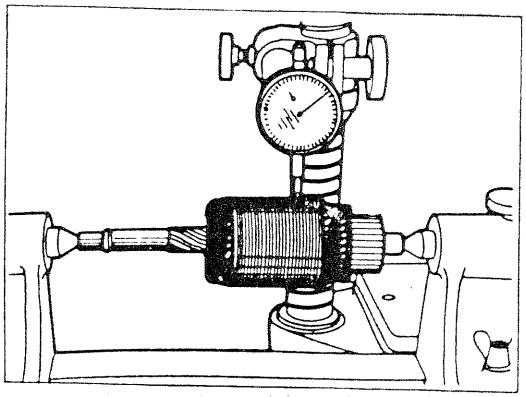


Figure 4.2-K. Checking for Armature Shaft Bending

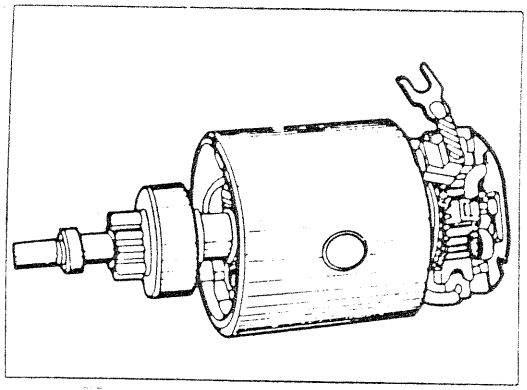


Figure 4.2-L. Assembling Armature, Yoke and Brush Holder

range, adjust the gap by adding or deleting packings at the solenoid switch mounting site. To decrease gap, add packings (and vice versa). See Figure 4.2-O.

DESCRIPTION	SPECIFICATION
Pinion Gap	0.020-0.079 in. (0.5-2 mm)

4.2.5- STARTER INSTALLATION

Install starter assembly in reverse order of removal. Be sure to remove paint, rust, oil, dirt, etc. from starter/engine contact surface. When installing battery cables, connect the positive (+) cable first.

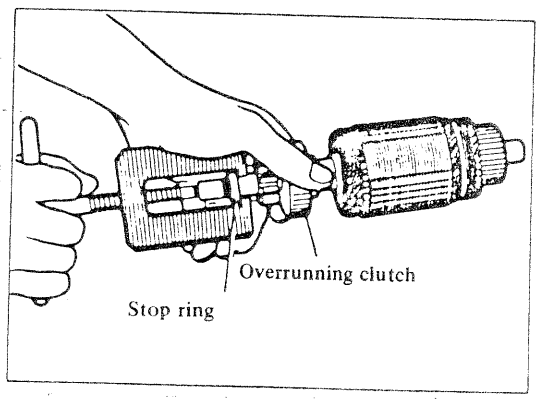


Figure 4.2-M. Overrunning Clutch Installation

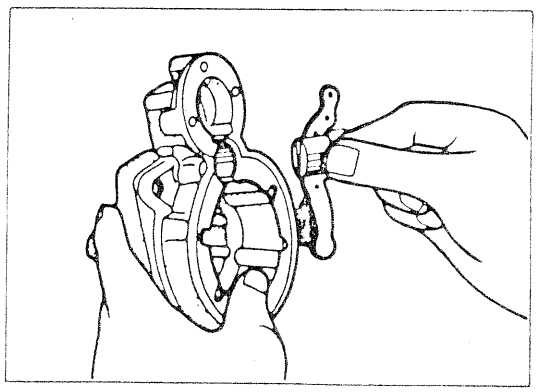


Figure 4.2-N. Lever Installation

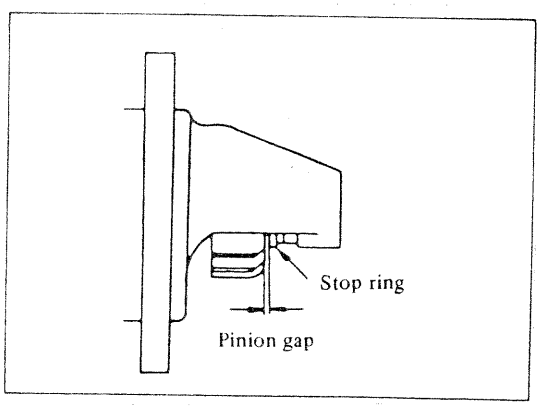


Figure 4.2-O. Checking Pinion Protrusion

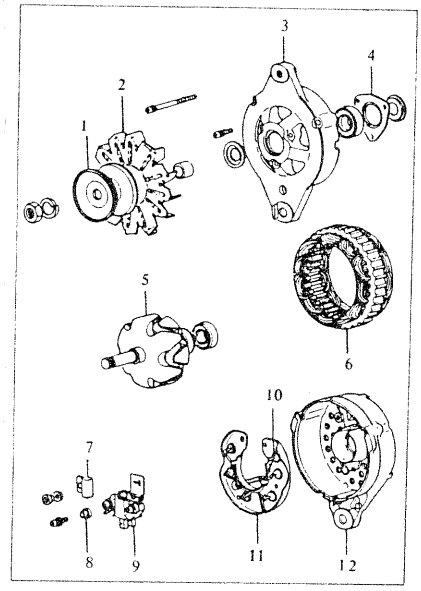
SECTION 4.3 - ENGINE DC ALTERNATOR

Alternator Output..... 12-50 VA
Polarity..... Negative Ground
Direction of Rotation (Viewed from Pulley End)..... Clockwise
Output Characteristics in V-A
Hot..... 14-15 at 1300 rpm or below
Cold..... 14-23 at 1300 rpm or below
Hot..... 14-42 at 2500 rpm or below
Cold..... 14-51 at 2500 rpm or below
Condensor Rating..... 0.5 Micro-Farad
Neutral Point Voltage (When alternator voltage is 14 Volts)..... 6.5-7.5 V

4.3.1- CONSTRUCTION (Figure 4.3-A)

The engine DC alternator is a 3-phase AC generator with a diode rectifier. The DC alternator may be divided into the rotor and stator sections.

The ROTOR SECTION consists of a rotor, ball bearings, and a pulley with fan. The STATOR SECTION consists of an armature, front and rear brackets, fin and brushes. Three diodes are attached to a heat sink.



1. Pulley
2. Fan
3. Front bracket assembly
4. Bearing retainer
5. Rotor
6. Stator
7. Condenser
8. Insulator
9. Brush holder assembly
10. Diode
11. Rectifier assembly
12. Rear bracket assembly

Figure 4.3-A. DC Alternator Components

4.3.2- REMOVAL

1. Disconnect the battery ground cable.
2. Disconnect wire from terminal "B" at back of alternator.
3. Remove alternator connector.
4. Loosen alternator brace bolt and support bolt. Push alternator toward the engine and remove the fan belt.
5. Remove the alternator.

4.3.3- CHECKING THE DIODES PRIOR TO DISASSEMBLY (Figure 4.3-B)

Check for conduction between alternator terminals "A" and "N". First, check for conduction with the tester positive lead connected to terminal "A" and the common (-) lead at terminal "N". Then, reverse the leads and note the reading.

Now, check for conduction between alternator terminals "E" and "N", using the same procedure as above.

Test Results:- It is considered normal is the circuit indicates a large resistance in one direction and a small resistance in the opposite direction. Insufficient resistance in both directions, or too much resistance in both directions indicates an open circuit. In both cases, replace the rectifier assembly.

NOTE

The preceding test method does not check individual diodes. The alternator must be disassembled to test individual diodes.

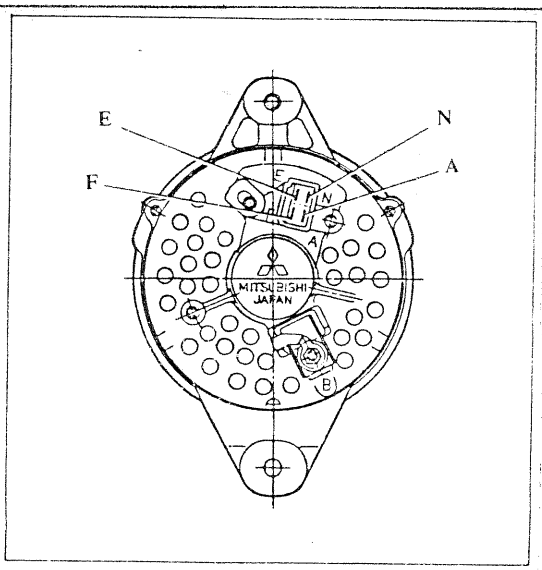


Figure 4.3-B. DC Alternator Terminals

4.3.4- DC ALTERNATOR DISASSEMBLY

1. Remove three through-bolts.
2. Separate the stator and rotor by inserting a screwdriver into the gap between the rear bracket and the stator core. **DO NOT INSERT SCREWDRIVER TOO DEEPLY OR DAMAGE TO THE STATOR COIL MAY RESULT.**
3. Place rotor in a vise. Remove the pulley retaining nut. Remove the pulley.
4. Use a hand press to remove the rotor.
5. Remove diode holder nuts and terminal insulator. Remove stator and brush holder.
6. Remove three stator coil wires and three stator coil neutral wires that are soldered to diodes. Then, separate the stator from the rear bracket.

CAUTION!
When melting solder to remove stator wires from diodes, do it quickly (within 3 seconds) to prevent damage to diodes. If internal diode temperature exceeds about 300 degrees F. (150 degrees C.), diode will fail.

4.3.5- ALTERNATOR INSPECTION AFTER DISASSEMBLY (Figures 4.3-C through 4.3-G)

1. **Diodes**:- Use a circuit tester to test for conduction between lead wire of diode and diode case. Diode should show a large resistance at one polarity and a low resistance at the opposite polarity. Inadequate resistance at both polarities indicates a shorted diode; excessive resistance at both polarities indicates an open diode. If even one diode is found defective, replace the rectifier assembly.
2. **Field Coil** (Figure 4.3-C):- Check for conduction between slip rings. If no conduction is noted, replace the field coil. Check for conduction between the slip ring and shaft (or core). If conduction is noted, replace the field coil.
3. **Stator Coil** (Figure 4.3-E):- Test for conduction between stator coil lead wires. If no conduction is evident, replace the stator coil. Also make sure there is no conduction between each lead wire and the stator core.
4. **Brush** (Figure 4.3-G):- Inspect brush for wear. If worn beyond wear limit line, replace the brush.

4.3.6- ALTERNATOR ASSEMBLY (Figure 4.3-H)

Assemble the alternator in the reverse order of removal. When assembling the rotor to the rear bracket, use a wire inserted through the brushes to keep the brushes pulled up.

4.3.7- DC ALTERNATOR PERFORMANCE TEST (Figure 4.3-I)

Complete connections as shown in Figure 4.3-I. When all connections are completed as shown, proceed as follows:-

1. Close Switch "K1" to supply field current from the battery. With K1 closed, increase alternator speed gradually until the ammeter indicates zero. At this point, open Switch K1 to let the alternator excite by itself. Then, further increase alternator speed until the voltmeter indicates 14 volts. Read the alternator sped at that point - reading must be 1000 rpm (rated speed).
2. Increase load resistance "R" to its maximum, so that practically no load current flows. In this state, close Switches "K1" and "K2". Then, increase load current gradually by increasing alternator speed. If the service standard is met, alternator performance is satisfactory.

4.3.8- INSTALLATION (Figure 4.3-J)

Install alternator in reverse order of removal. Insert shims in the clearance "A", between the alternator front leg and front case, until shims will remain in place without support. When installation is complete, adjust belt tension.

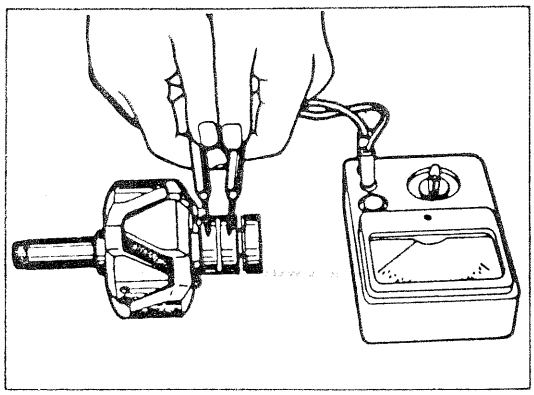


Figure 4.3-C. Field Coil Test

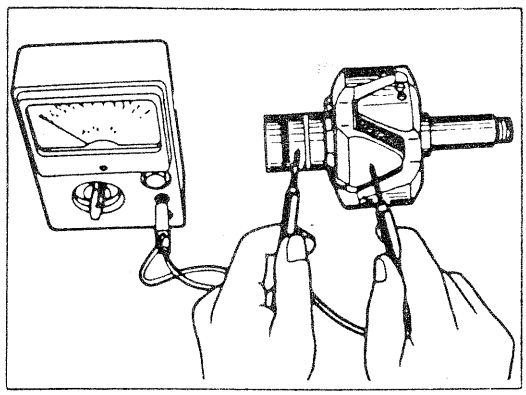


Figure 4.3-D. Field Coil Ground Test

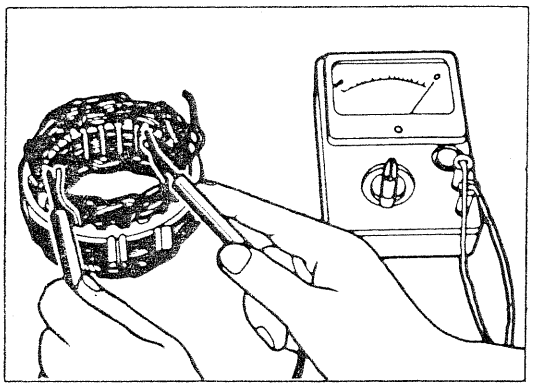


Figure 4.3-E. Stator Coil Conduction Test

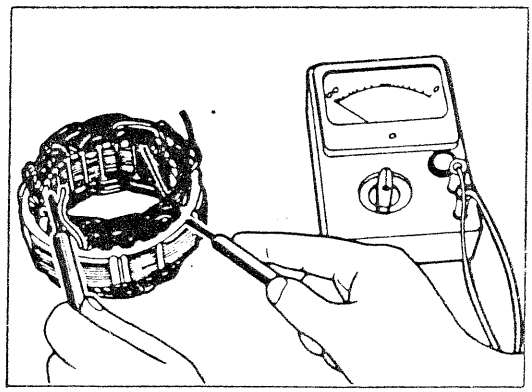


Figure 4.3-F. Stator Coil Ground Test

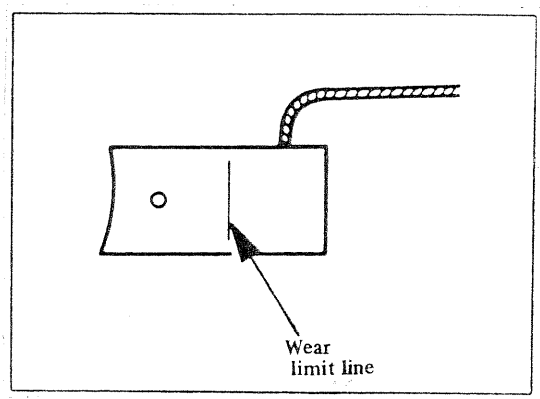


Figure 4.3-G. Checking Brush

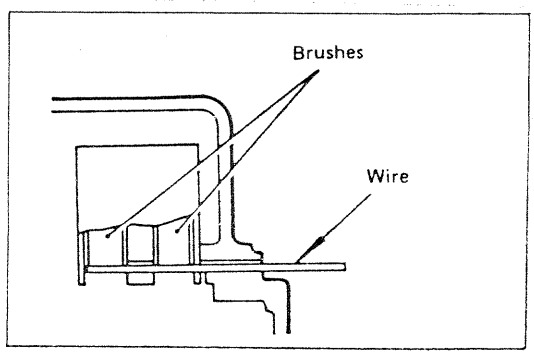


Figure 4.3-H. Holding Brushes Up

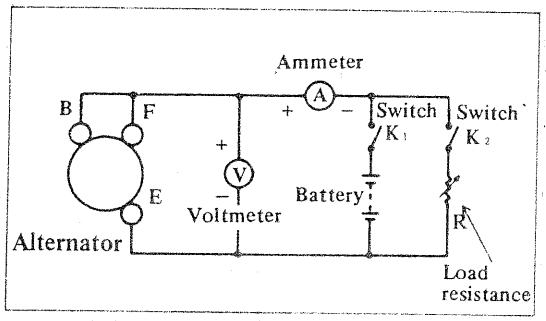


Figure 4.3-I. Connections for Alternator Performance Test

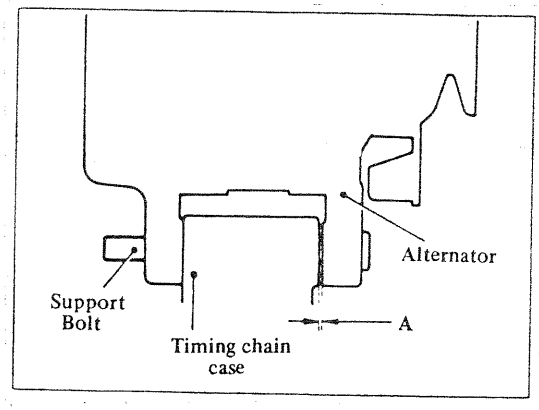


Figure 4.3-J. Installing the Alternator

PART 5

ENGINE FUEL SYSTEMS

SECTION 5.1 - INTRODUCTION TO FUEL SYSTEMS

5.1.1- FUEL SYSTEM INSTALLATION STANDARDS

All fuel system installations must be in strict compliance with applicable local and state regulations, in the interests of safety. If such regulations do not exist, published standards may be obtained from the National Fire Protection Association (NFPA). These booklet form standards are available at nominal cost from the National Fire Protection Association, 60 Battery March Street, Boston, Massachusetts, 02110. NFPA Standards Booklet No. 37, STATIONARY COMBUSTION ENGINES AND GAS TURBINES, contains information pertaining to the installation and operation of gasoline and gaseous fuel systems. Other booklets are referred to in NFPA No. 37, which should be used when applicable to a particular installation.

5.1.2- TYPES OF FUEL SYSTEMS

Any one of several different types of fuel systems may be used on the engine. Fuel systems that are available include (a) gasoline, (b) natural gas, and (c) liquefied petroleum (LP) gas.

NOTE

For additional information pertaining to the installation of fuel systems for stationary duty generators, refer to INSTALLATION MANUAL FOR GENERAC STANDBY ELECTRIC POWER SYSTEMS, Manual Part Number 46622.

5.1.3- NATURAL GAS FUEL SYSTEMS (Figure 5.1-A)

Natural gas is supplied in vapor state. The primary regulator may or may not be furnished by the gas supplier. The supplier, however, must ensure that sufficient gas pressure is available for primary regulator operation. Installation, repair and alterations to gas piping should be accomplished only by the gas supplier or by personnel authorized by him. Gas piping should never be used as an electrical ground. Piping must be rigidly mounted, but protected against damage from vibration. Only APPROVED flexible connections should be used, where such flexible connections are required.

Normally, the FUEL SHUTOFF SOLENOID, SECONDARY REGULATOR, and GAS CARBURETOR are supplied with the engine.

5.1.4- LP GAS FUEL SYSTEMS (Figures 5.1-B, 5.1-C)

A. Characteristics of LP Gas (Figure 5.1-B):- Liquefied petroleum (LP) gas is supplied as a liquid in pressure tanks. Since this gas does not deteriorate when stored for a long period (as gasoline does), a large supply can be kept on hand indefinitely. LP gas is made up of PROPANE, BUTANE, or a mixture of the two gases. Figure 5.1-B shows the approximate vapor pressure of the two gases at various temperatures.

DANGER!

LP gases are heavier than air and will settle in low areas where sparks, flame or heat can cause an explosion. Proper ventilation must be provided.

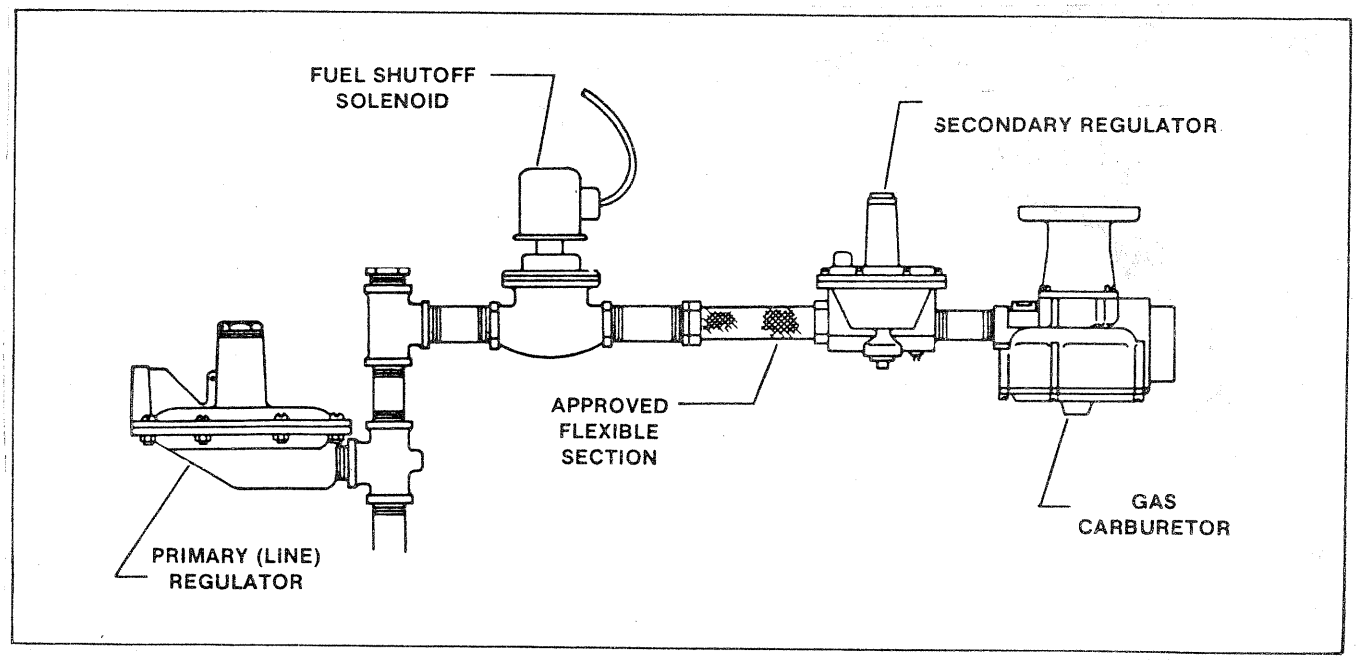


Figure 5.1-A. A Typical Natural Gas Fuel System

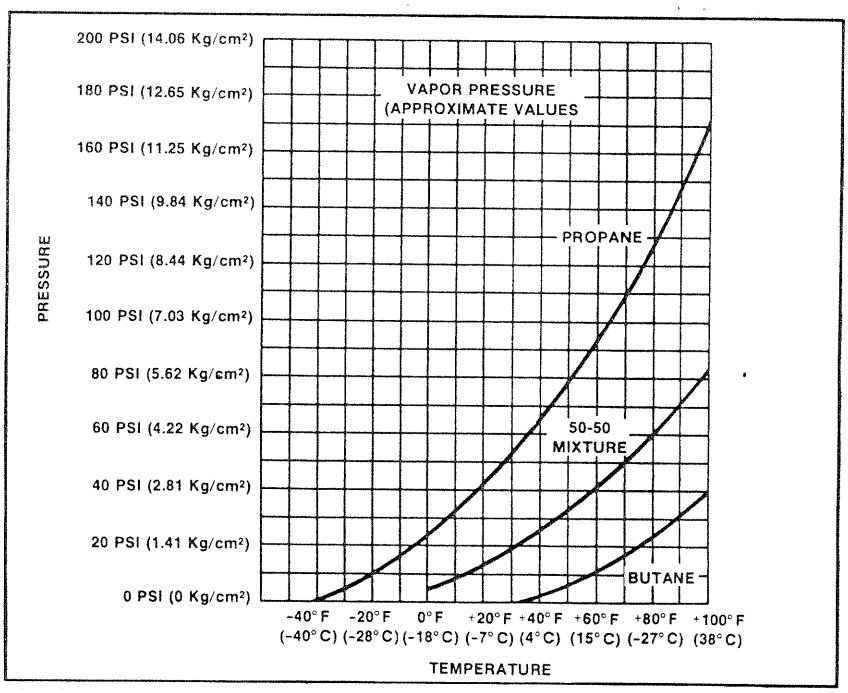


Figure 5.1-B. LP Gas Vapor-Pressure Curve

Butane gas requires higher temperatures for vaporization than propane gas (Figure 5.1-B). Thus, a fuel supplier may fill the tank with a fuel mixture composed mainly of butane in warm weather, or of propane in cold weather. LP gas must be converted to vapor state before it reaches the carburetor. For that reason, heated engine coolant is generally used to aid in vaporization.

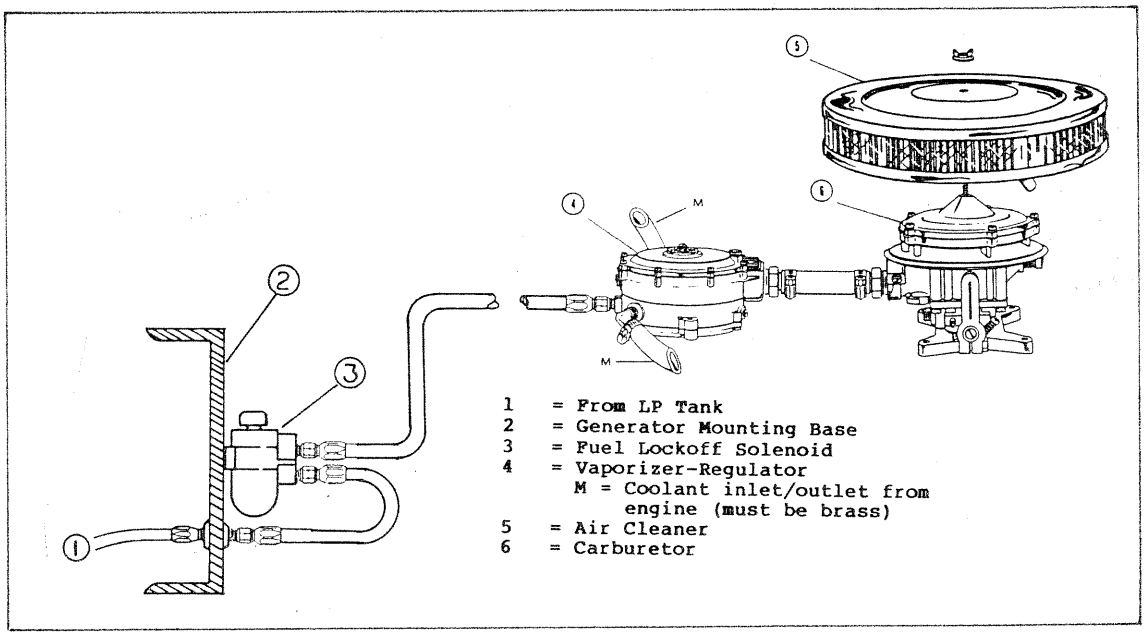


Figure 5.1-C. A Typical LP Gas Fuel System

NOTE

One gallon (3.78 Liters) of BUTANE liquid is equal to approximately 31.26 cubic feet of gas. One gallon (3.78 Liters) of PROPANE liquid is equal to about 36.39 cubic feet of gas.

5.1.5- GASOLINE FUEL SYSTEM

Where the main fuel tank can be installed within the engine fuel pump's lift capability, fuel can be delivered directly from the main tank to the engine. Where the engine fuel pump's lift capacity is exceeded, however, an auxiliary fuel pump may be required. Such an auxiliary pump should be mounted as close as possible to the fuel supply tank to help avoid cavitation and vapor lock.

A gravity feed priming tank may be installed to aid starting. To prevent the head pressure of fuel in the priming tank from unseating the carburetor needle valve when not operating, the priming tank should be installed no higher than the carburetor float bowl. When a priming tank is used, fuel is pumped to the priming tank from the main supply tank. From the priming tank, fuel is gravity fed to the engine fuel system. A return line back to the main fuel tank is required, to deliver excess fuel back to the main tank from the priming tank.

SECTION 5.2 - NATURAL GAS FUEL SYSTEM

5.2.1- NATURAL GAS FUEL SYSTEM COMPONENTS (Figure 5.2-A, 5.2-B)

A typical natural gas fuel system consists of the following major components:-

1. A primary (line service) regulator
2. A fuel shutoff solenoid
3. Pressure Reducing Valve
4. Carburetor
5. Interconnecting lines, hoses and fittings

5.2.2- PRIMARY (LINE SERVICE) REGULATOR (Figure 5.2-A, 5.2-B)

The Line Service Regulator may or may not be supplied by the gas supplier. Natural gas from the supply line enters the regulator at about 5-30 psi. The regulator reduces this supply pressure to approximately 10-20 inches of water column (0.36-0.72 psi, or 5.76-11.52 ounces per square inch), for delivery to the Fuel Shutoff Solenoid.

5.2.3- FUEL SHUTOFF SOLENOID (Figure 5.2-A, 5.2-B)

The Fuel Shutoff Solenoid is generally supplied with the engine fuel system. The Garretson No. 424-G solenoid is shown in Figure 5.2-A. That solenoid is 12 volts DC actuated, at 0.9 DC amperes of current. It is rated at up to a maximum pressure of 5 psi, and has 3/4 inch NPT inlet and outlet fittings.

During engine startup and operation, the solenoid is energized open by the unit's DC control circuit. On shutdown, the solenoid is de-energized closed to terminate gas flow to the Pressure Reducing Valve.

5.2.4- PRESSURE REDUCING VALVE (Figure 5.2-A, 5.2-B)

Natural gas pressure at the carburetor inlet should not exceed 3 ounces (5 inches water column). The Pressure Reducing Valve decreases the pressure of carburetor inlet gas to this value for 1000 BTU gas. Full load gas pressure at the carburetor gas inlet may drop as low as 2 inches water column. Exact pressure at full load is not important, as long as the carburetor's power mixture adjustment is still effective.

The IMPCO (IMP-52) Pressure Reduction Valve uses a metal-to-metal valve and seat. It does NOT seal off when the engine is stopped. The Valve uses a 3/4 inch NPT inlet and outlet.

NOTE

The IMP-52 Pressure Reduction Valve can be installed as a negative regulator by removing the Regulator spring and mounting the valve upside down. This would make the valve suitable for LP gas vapor withdrawal application. See Figure 5.2-B.

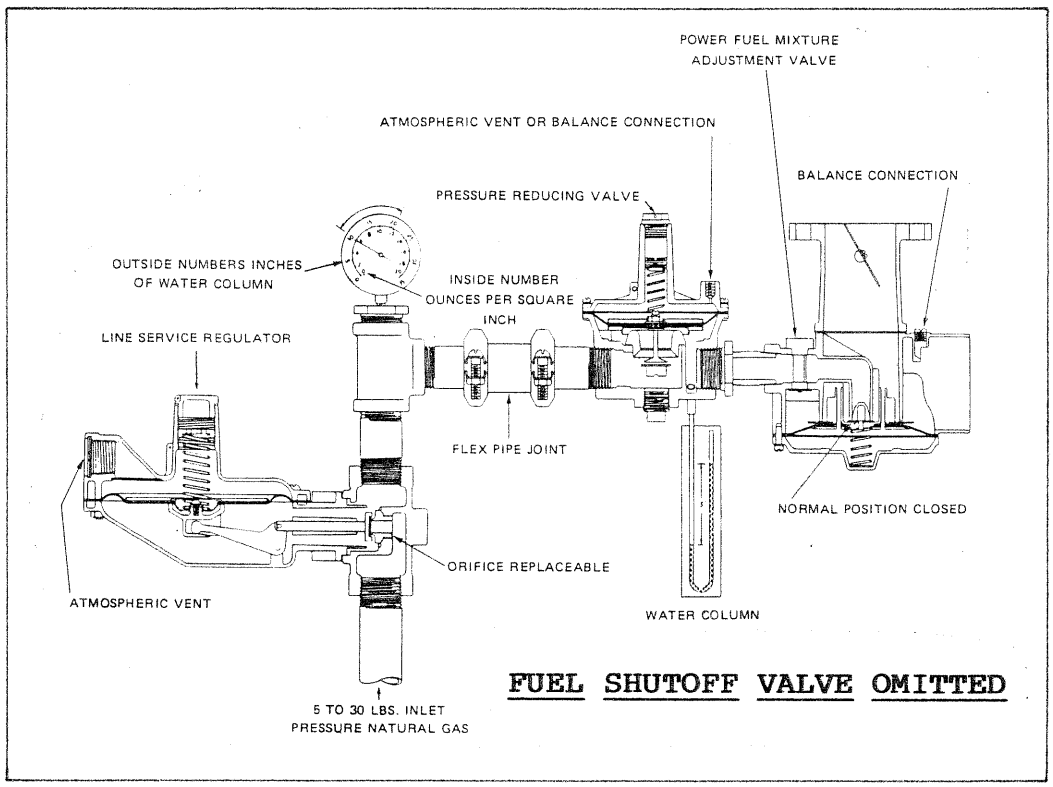


Figure 5.2-A. Schematic Diagram of Natural Gas Fuel System

5.2.5- CARBURETOR (Figure 5.2-A, 5.2-B, 5.2-C)

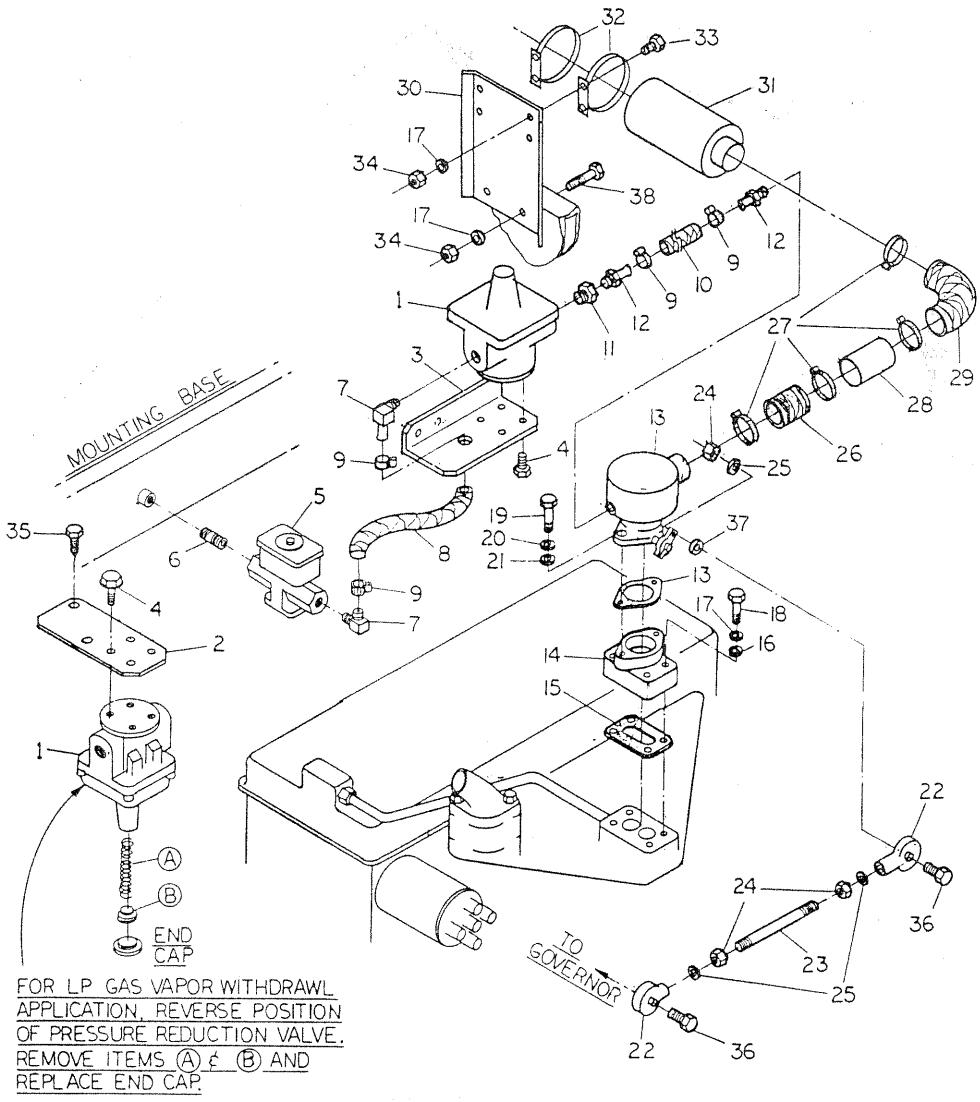
A. **General**:-The IMPCO CA100 carburetor has a builtin shutoff valve to stop gas flow when the engine is stopped. When using 1000 BTU gas, the carburetor normally operates with approximately 3 ounces of gas pressure at idle. Full load gas pressure may drop 1 to 1-1/2 ounces at the carburetor inlet. However, exact gas pressure at full load is immaterial as long as power mixture adjustment is effective.

NOTE
Natural gas with higher or lower BTU values can be accommodated by raising or lowering the output pressure of the regulator.

B. **Carburetor Operation** (Figure 5.2-C):-

1. Cranking the engine lowers pressure in shaded area as the piston descends. Reduced pressure is communicated to the upper side of the diaphragm "D", through passages "P" in the air valve. As a result, atmospheric pressure pushes upward on the diaphragm to lift it against the downward pressure of the metering spring "S".
2. Approximately 0.2 psi is required to lift the air valve off its seat. Approximately 0.4 psi lifts the valve to its full open position.
3. Lowered pressure communicated to the top of the diaphragm varies with engine speed and position of throttle valve opening "T". The air valve assembly measures the air flow into the engine by moving

Figure 5.2-B. Exploded View of Natural Gas Fuel System



1. Regulator
2. Regulator Support
3. Regulator Support
4. Screw
5. Solenoid
6. Nipple
7. Barbed Fitting
8. Hose
9. Clamp
10. Hose
11. Bushing
12. Barbed Fitting
13. Carburetor
14. Carburetor Adapter
15. Gasket
16. Washer
17. Washer
18. Capscrew
19. Capscrew
20. Washer
21. Washer
22. Ball Joint
23. Stud
24. Hex Nut
25. Washer
26. Hose
27. Clamp
28. Connector
29. Elbow
30. Air Cleaner Support
31. Air Cleaner
32. Air Cleaner Band
33. Capscrew
34. Hex Nut
35. Screw
36. Capscrew
37. Washer
38. Capscrew

precisely in response to engine demand and throttle valve position.
4. The controlled pressure drop of 0.2-0.4 psi established by the metering spring provides the force required to draw fuel into the air stream of the carburetor. The gas metering valve "V" is attached to the air valve assembly and is shaped to admit the correct amount of fuel from the gas jet to mix with incoming air at any opening of the air valve.
5. Mixtures between full load and no-load are controlled by gas metering valve shape. The valve is shaped to produce lean mixtures at light loads and increasingly richer mixtures at heavier loads and higher engine speeds.

C. **Carburetor Adjustments**:- The Carburetor provides two limited range mixture adjustments:-

1. IDLE AIR BYPASS ADJUSTMENT - The total volume of air and fuel passing the closed throttle at idle is constant. The idle adjustment bypasses a portion of incoming air around the air valve opening. As the idle adjustment is opened, the air valve partially closes thus closing the air valve and leaning the idle air-fuel mixture.
2. POWER MIXTURE ADJUSTMENT - Controls mixtures when the gas metering valve is withdrawn from the jet. This adjustment is effective only when the engine approaches full load condition, can be set only when the engine is loaded.

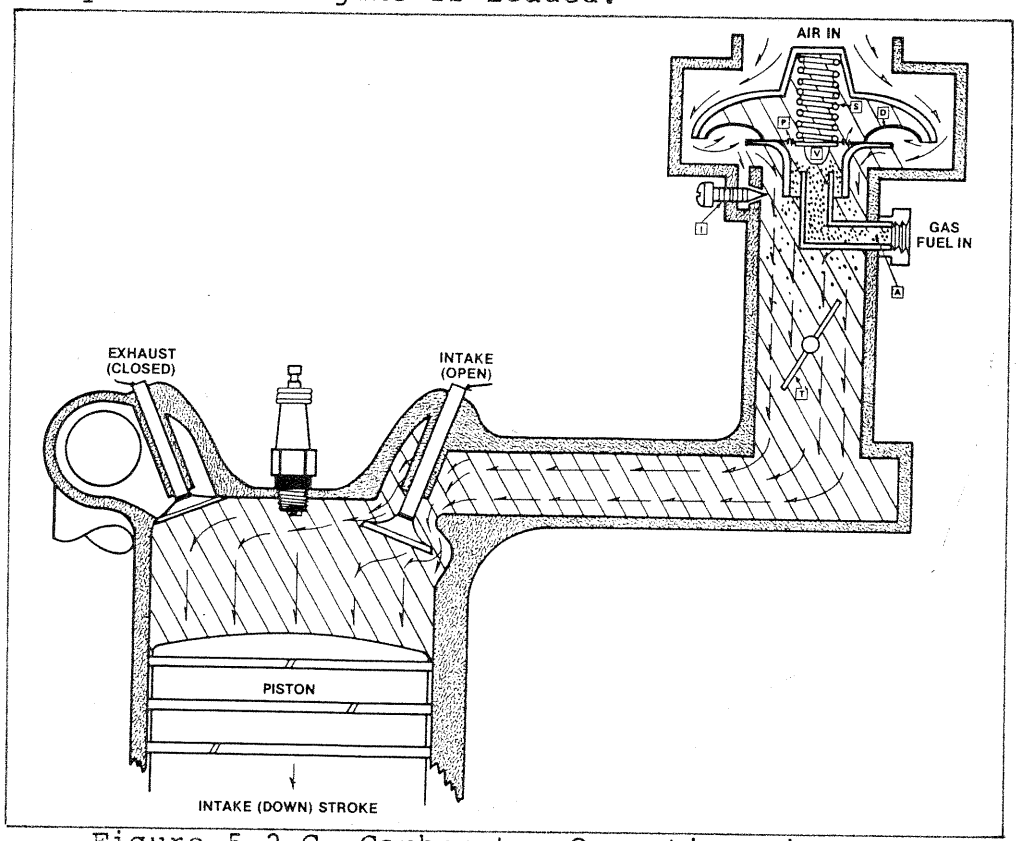


Figure 5.2-C. Carburetor Operating Diagram

5.2.6- TURBOCHARGED NATURAL GAS SYSTEM (Figure 5.2-D)

Turbocharged natural gas fuel systems are similar to the conventional system. Generally, a balance line is added from the carburetor air horn to the regulator vent hole. This will cause gas pressure to increase as the engine accelerates. The difference between gas and air pressure will remain the same as in naturally-aspirated carburetion systems.

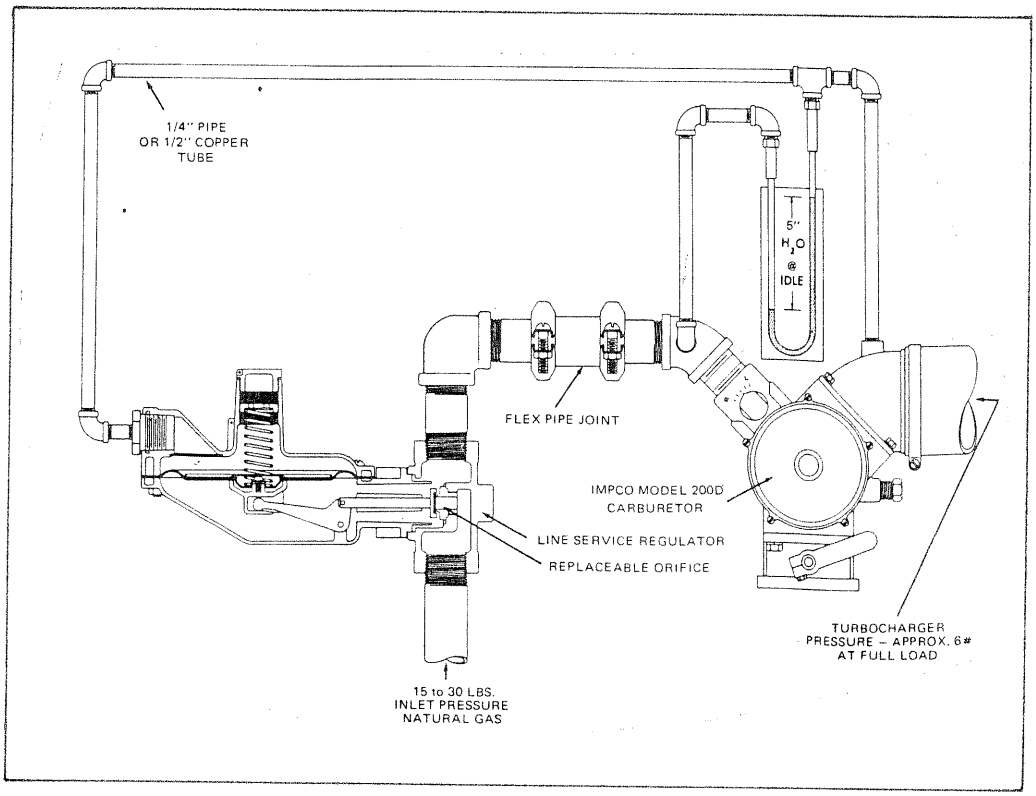


Figure 5.2-D. Turbocharged Natural Gas Fuel System

SECTION 5.3 - LP GAS FUEL SYSTEM

5.3.1- COMPONENTS (Figure 5.3-A)

The LP gas fuel system consists of the following major components:-

1. Fuel Lockoff Solenoid
2. Vaporizer-Regulator
3. Carburetor

5.3.2- FUEL LOCKOFF SOLENOID (Figure 5.3-A)

The "Fuellock*" solenoid is rated at 60 psi at 100 psi. It is energized open by a 12 volts DC power supply from the engine's DC control circuit during startup and operation, is de-energized closed on engine shutdown.

5.3.3- VAPORIZER-REGULATOR (Figure 5.3-A)

The IMPCO Model JB Vaporizer-Regulator (Part No. 51358) acts to (a) vaporize the LP gas and (b) provide a -1.5 (negative) inch water column at no-load state. The unit is a water-heated, 2-stage type. Heat for vaporization is provided by the engine cooling system. As a general rule, all liquid withdrawal LP gas fuel systems require that the engine be provided with an engine coolant heater. This will help ensure that heat is available for vaporization even when the engine is not running. **Use only BRASS fittings in water inlet/outlet passages.**

5.3.4- CARBURETOR (Figure 5.3-A)

An IMPCO Model CA100 carburetor is used, identical to the one used in the natural gas system.

5.3.5- SYSTEM OPERATION (Figure 5.3-B)

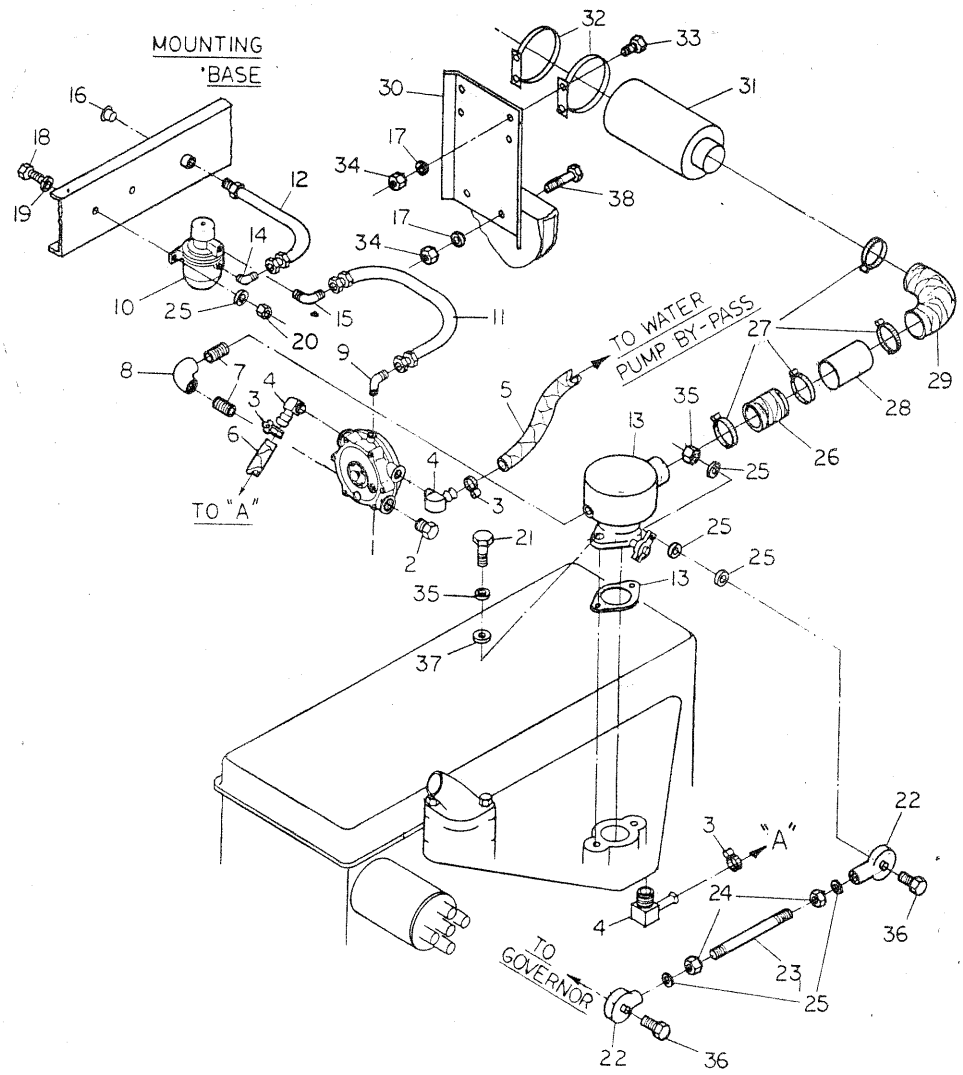
Fuel enters the Vaporizer-Regulator as a liquid and is reduced to approximately 1-1/2 pounds in the vaporizing chamber. The liquid fuel is also changed to vapor state, with heat for vaporization provided by the engine cooling system. The gaseous fuel then passes through the secondary valve, which is controlled by the secondary diaphragm, and into the secondary chamber. Fuel is drawn from the secondary chamber through the gas outlet to the carburetor. Gas flow through the carburetor is controlled by an air-gas valve. The gas metering valve is connected directly to the air valve, to provide accurate fuel-air ratios at all engine demands. The air-gas valve provides an automatic choke for faster starts and seals off the fuel at rest.

5.3.6- TURBOCHARGED LP GAS SYSTEM (Figure 5.3-C)

The turbocharged system is similar to the naturally aspirated type, except that a balance line is added between the carburetor air horn and the regulator vent hole. Gas pressure will then rise with air pressure as the engine accelerates. Difference between gas and air pressure will remain the same as in naturally-aspirated systems.

* Trademark of Marvel-Schebler

Figure 5.3-A. Exploded View of LP Gas Fuel System



1. Regulator
2. Pipe Plug
3. Hose Clamp
4. Barbed Fitting
5. Hose
6. Hose
7. Nipple
8. Pipe Elbow
9. Brass Elbow
10. Fuel Lockoff Solenoid
11. Fuel Line
12. Fuel Line
13. Carburetor
14. Connector
15. Brass Elbow
16. Plug
17. Washer
18. Capscrew
19. Washer
20. Hex Nut
21. Capscrew
22. Ball Joint
23. Stud
24. Hex Nut
25. Washer
26. Hose
27. Clamp
28. Connector
29. Elbow
30. Air Cleaner Support
31. Air Cleaner
32. Air Cleaner Band
33. Capscrew
34. Hex Nut
35. Hex Nut
36. Capscrew
37. Washer
38. Capscrew

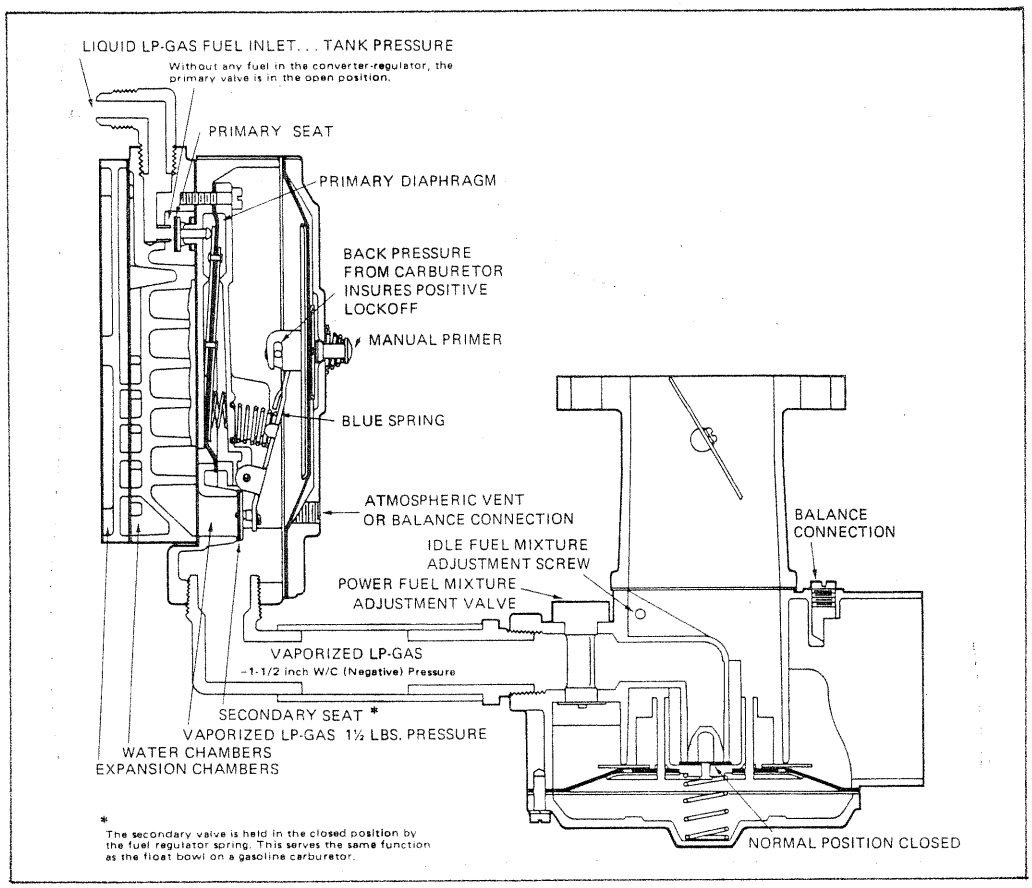


Figure 5.3-B. Operating Diagram of LP Gas Fuel System

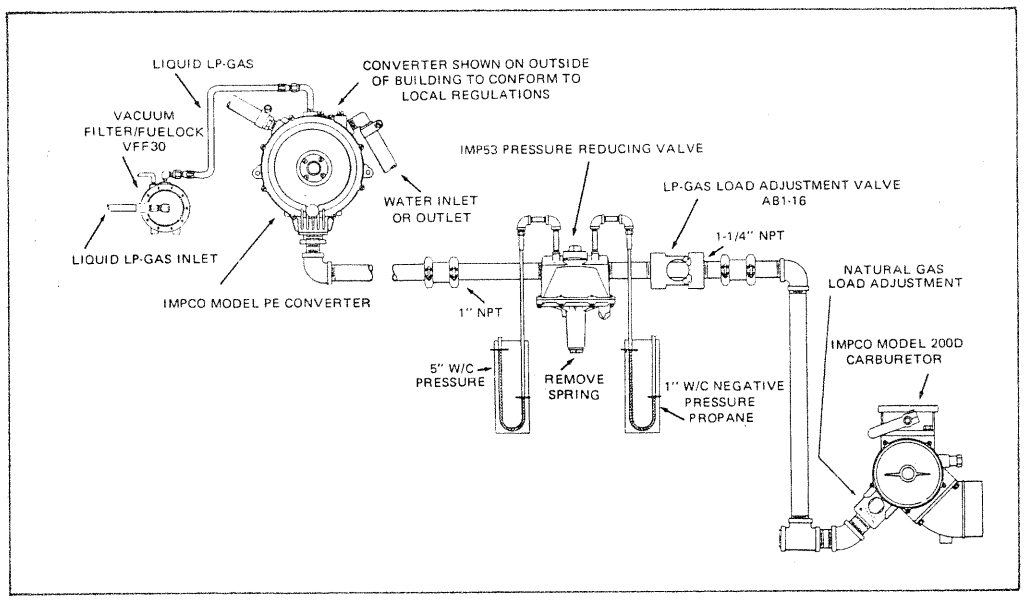


Figure 5.3-C. Diagram of a Turbocharged LP Gas System

SECTION 5.4 - GASOLINE FUEL SYSTEM

Information pertaining to gasoline fuel system was not available at the time of printing.

PART 6 - IGNITION SYSTEMS

SECTION 6.1 - BREAKER POINT TYPE IGNITION SYSTEM

Firing Order..... 1-3-4-2
Distributor Direction of Rotation (from Cap Side)..... Clockwise
Centrifugal Advance
  Beginning..... 0 degrees at 500 rpm
  End..... 10 degrees at 2500 rpm
Vacuum Advance
  Beginning..... 0 degrees at 8.6 inches Hg
  End..... 8.5 degrees at 17.7 inches Hg
Dwell Angle..... 49-55 degrees
Condensor Capacity..... 0.27 Micro-Farad
Breaker Point Gap..... 0.018-0.021 inch (0.45-0.55 mm)

6.1.1- ON-VEHICLE INSPECTION OF IGNITION SYSTEM

A. **Spark Test** (Figures 6.1-A, 6.1-B):- Remove spark plug wire from a spark plug. Hold the wire tip about 0.23-0.31 inch (6-8 mm) from a clean frame ground, such as the engine block. Crank engine and observe emission of sparks across the gap.

Remove the secondary wire from the distributor cap center electrode. Hold tip of the secondary wire about 0.23-0.32 inch (6-8 mm) away from a clean frame ground such as the engine block and crank engine. Note if sparks are emitted across the gap.

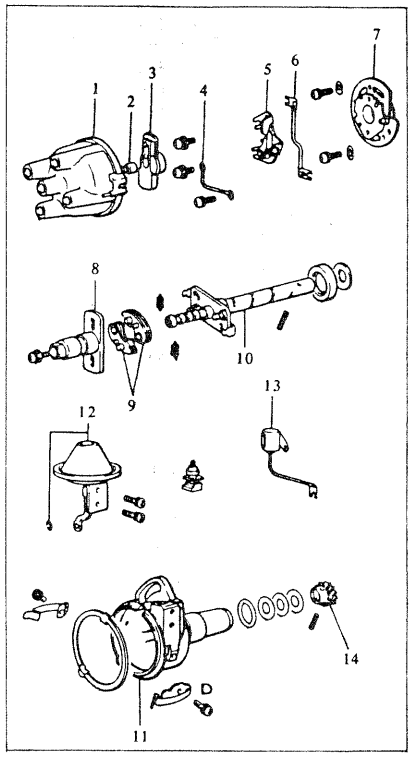
B. **Insulation Test of Distributor cap and Rotor** (Figures 6.1-C, 6.1-D):-

1. See Figure 6.1-C. Remove distributor cap. With the secondary (high tension) wire still attached, crank engine. If any part of cap is poorly insulated, sparks will run along the cap surface.
2. See Figure 6.1-D. With distributor cap removed, bring the secondary (high tension) wire close to the rotor. If any part of rotor is poorly insulated, sparks will rise from that area.

C. **Spark Testing of Spark Plugs** (Figure 6.1-D):- Remove the spark plug to be tested from the engine. Connect spark plug wire to plug and ground the plug's external electrode (body) against the cylinder block. Crank engine. Sparks should jump across the spark plug electrode gap. If no spark or weak spark, replace the spark plug.

D. **Inspecting the Distributor** (Figure 6.1-E):-

1. Inspect rotor and cap for corrosion, rust, damage, cracks.
2. Inspect rotor and cap terminals for cleanliness.
3. Use a feeler gauge to check breaker point gap. Gap should be set at 0.018-0.021 inch (0.45-0.55 mm).
4. Use a dwell angle tester to check for correct dwell angle. Dwell angle should be 49-55 degrees. Decrease engine speed from 1500 rpm down to about 650 rpm. If dwell angle tester needle deflects excessively, check for loosening of the distributor shaft or breaker plate.
5. Inspect breaker point contact surface for pitting, roughness. If any, replace the points.
6. Measure the spring tension at which the breaker points just start to open. If this measurement is less than 17.6-22.9 ounces (500-650 grams), replace the spring.



1-Cap
2-Carbon
3-Rotor
4-Ground wire
5-Arm support
6-Wire lead
7-Breaker base
8-Cam
9-Governor weight
10-Shaft
11-Housing
12-Vacuum control
13-Condenser
14-Gear

Figure 6.1-A. Distributor Components

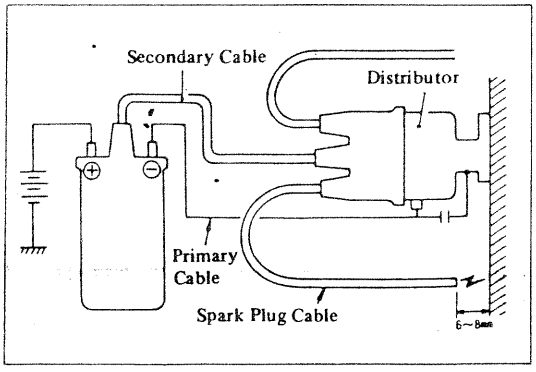


Figure 6.1-B. Spark Test

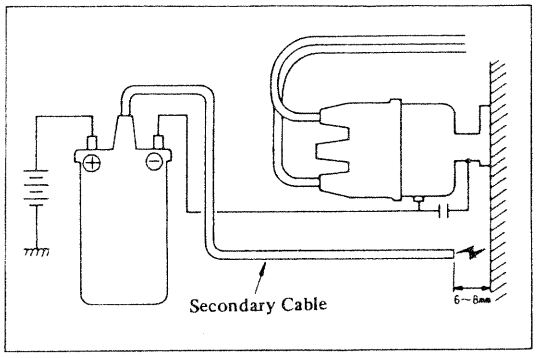


Figure 6.1-C. Spark Test

7. Rotate the rotor to the right, then release. Rotor should return to its original position smoothly.

E. **Check Ignition Timing**:- Use a timing light to check timing. If necessary, adjust to 4-6 degrees BTDC at 650 rpm. (NOTE:- Engine speed governor must be disconnected to perform this test and adjust timing.)

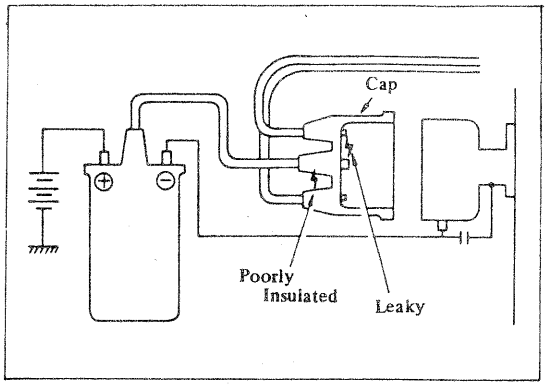


Figure 6.1-D. Distributor Cap Insulation Test

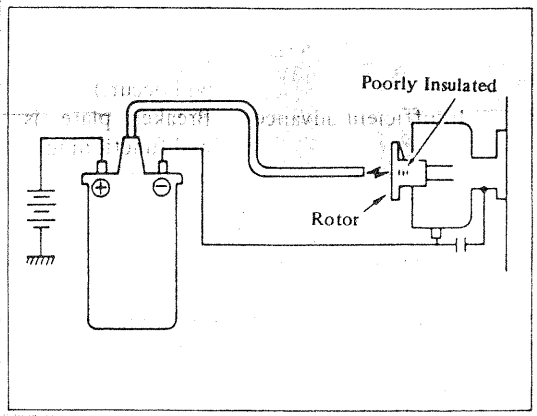


Figure 6.1-E. Rotor Insulation Test

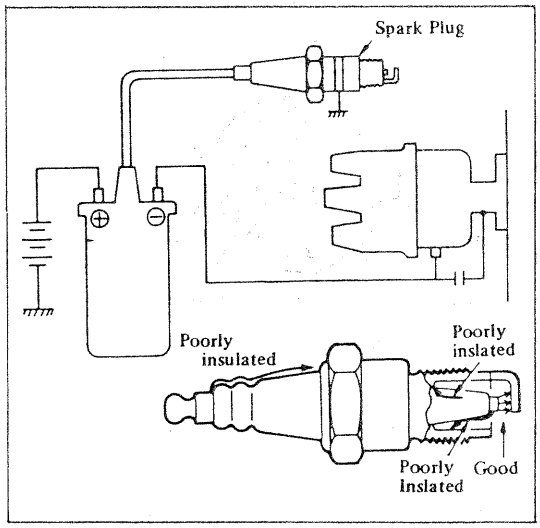


Figure 6.1-F. Spark Plug Test

Figure 6.1-G. Governor Test

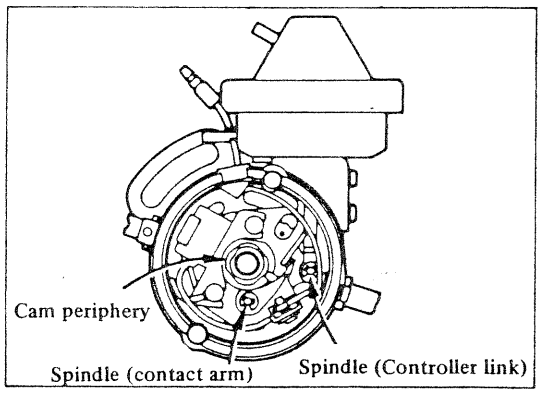


Figure 6.1-H. Distributor Lubrication Points

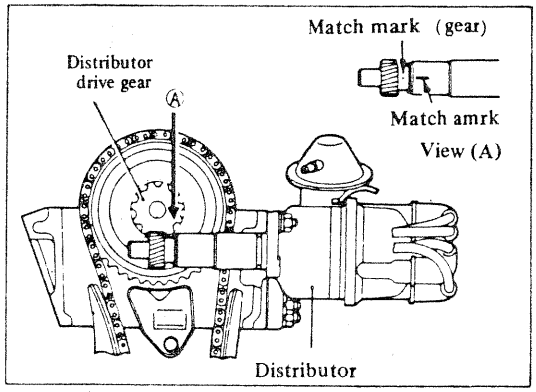


Figure 6.1-I. Distributor Installation

6.1.2- DISTRIBUTOR LUBRICATION (Figure 6.1-H)

Apply a thin coat of grease to distributor can outer periphery, breaker arm spindle and vacuum control rod pin.

6.1.3- DISTRIBUTOR REMOVAL

1. Position the No. 1 piston to top dead center (TDC) of its compression stroke.
2. Disconnect spark plug wires from distributor.
3. Disconnect primary and secondary wires from distributor.
4. Remove vacuum hose from distributor.
5. Remove distributor retaining nuts.
6. Remove the distributor.

6.1.4- DISTRIBUTOR INSTALLATION (Figure 6.1-I)

1. Rotate crankshaft to position No. 1 piston at top dead center (TDC) of its compression stroke.
2. Align match mark of distributor housing with that of pinion.
3. With match marks aligned, install the distributor and engage its pinion with the distributor drive gear.
4. Tighten distributor mounting nuts.
5. Install distributor cap. Install all wires and vacuum hose.

6.1.5- IGNITION COIL

DESCRIPTION	SPECIFICATION	REMARKS
Primary coil resistance	1.4 Ohms	Between Terminals (+) and (-)
Secondary Coil Resistance	10.2 Ohms	Between center and (-) terminals
Resistor Resistance	1.35 Ohms	

1. Check resistance of the primary coil, secondary coil, and resistor. Replace ignition coil if defective.
2. Check insulation resistance between the primary terminal and case with a 500 volts megger. A reading of 10 meg-ohms or above is considered normal.

SECTION 6.2 - SOLID STATE IGNITION SYSTEM

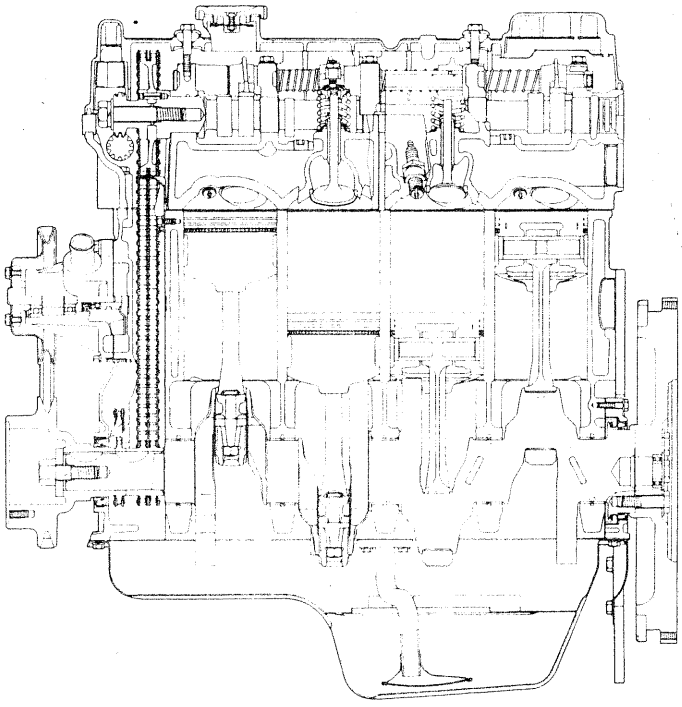
This information will be supplied when it becomes available.

PART 7

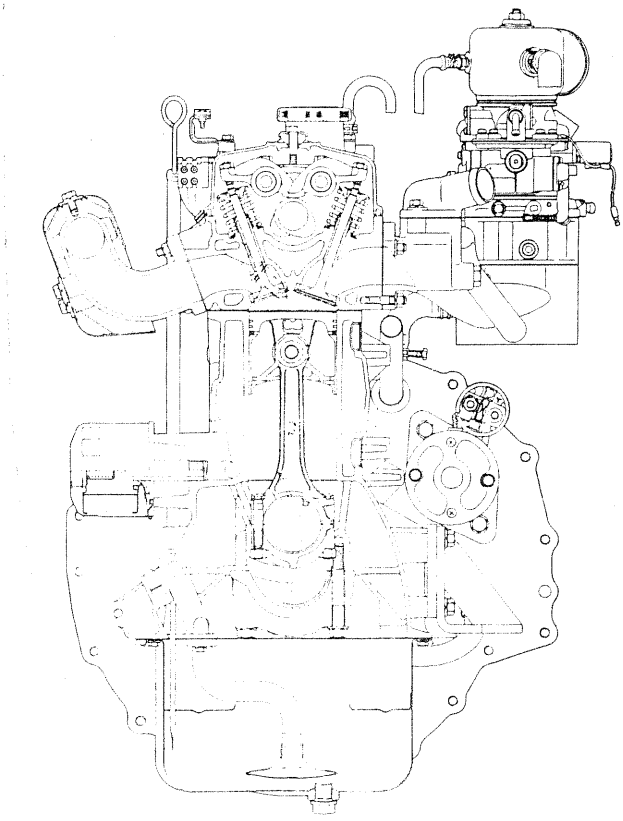
SPECIFICATIONS AND CHARTS

7.1- ENGINE SECTIONAL VIEWS

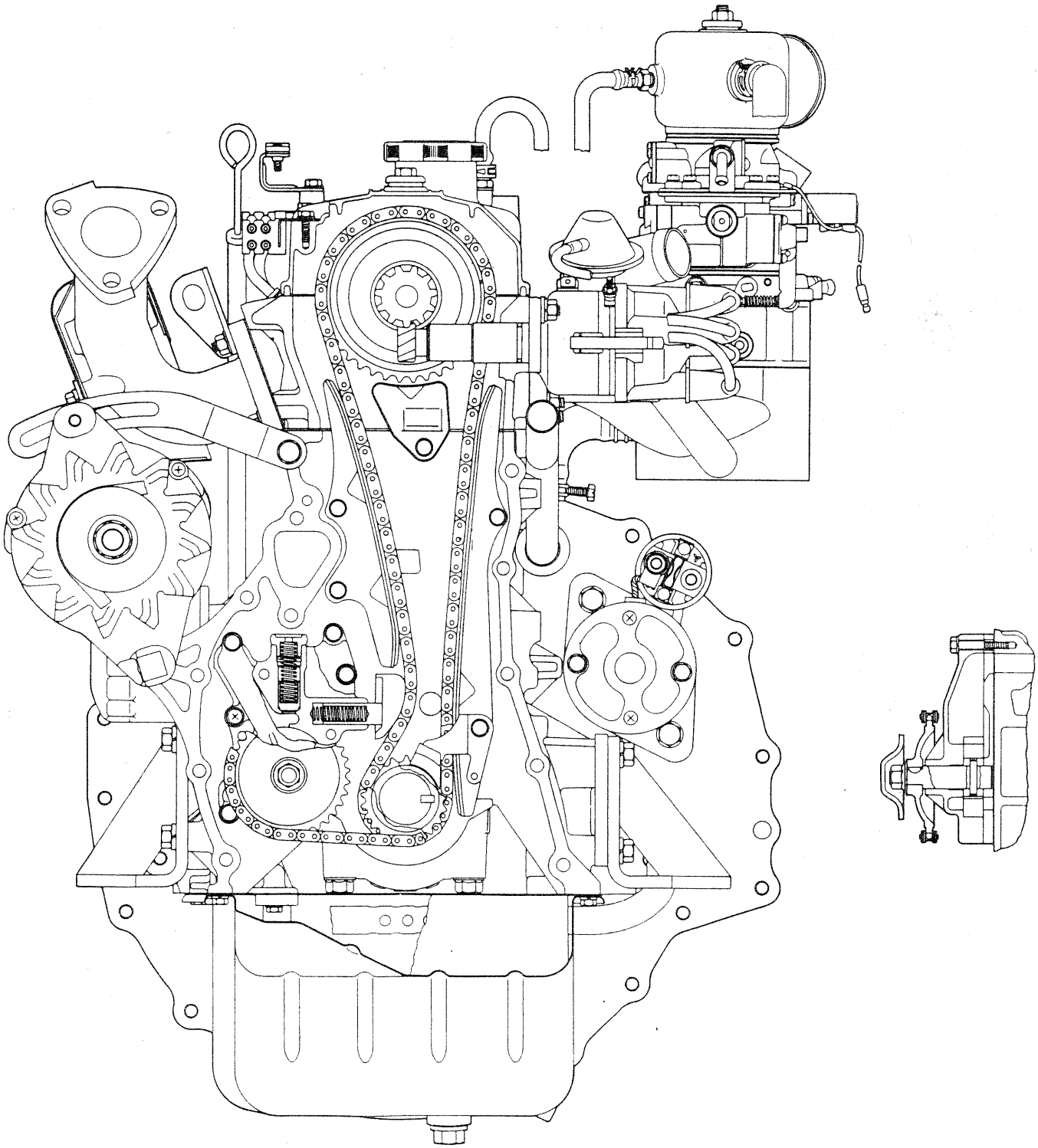
Longitudinal Sectional View



Cross Sectional View



7.2- TIMING CHAIN



7.3- MAINTENANCE STANDARDS CHART

GENERAL

Compression Pressure at 250 rpm..... 149 psi (10.5 kg/sq. cm)
Difference in Compression Pressure between Cylinders..... Within 10 %
Ignition Timing..... 5 degrees BTDC at 600-650 rpm
Engine Oil Capacity..... 4.76 quarts (4.5 Liters)

CYLINDER HEAD

Flatness of Lower Surface..... Within 0.002 inch (0.05 mm)
Flatness of Manifold Mounting Surface.. Within 0.012 inch (0.30 mm)
Valve Seat Hole Oversize Machining Size
- Intake - 0.012 inch OS..... 1.862 +0.0010 inch (47.3 +0.025 mm) (0.3 mm OS)
  0.024 inch OS..... 1.874 +0.0010 inch (47.6 +0.025 mm) (0.6 mm OS)
- Exhaust - 0.012 inch OS..... 1.587 +0.0010 inch (40.3 +0.025 mm) (0.3 mm OS)
  0.024 inch OS..... 1.598 +0.0010 inch (40.6 +0.025 mm) (0.6 mm OS)

Camshaft Bearing to Camshaft Clearance
- Standard..... 0.002-0.0035 inch (0.05-0.09 mm)
- Service Limit..... 0.006 inch (0.15 mm)

Valve Guide Hole Oversize Machining Size (Intake and Exhaust)
- 0.002 inch OS (0.05 mm)..... 0.513-0.514 inch (13.05-13.068 mm)
- 0.010 inch OS (0.25 mm)..... 0.521-0.522 inch (13.25-13.268 mm)
- 0.020 inch OS (0.50 mm)..... 0.531-0.532 inch (13.50-13.518 mm)

Valve Seat Contact Width..... 0.035-0.051 inch (0.9-1.3 mm)
Valve Seat Contact Angle..... 45 degrees

CYLINDER BLOCK

Flatness of Upper Surface..... Within 0.002 inch (0.05 mm)
Cylinder Bore
- Standard..... 3.587 inch (91.1 mm)
- Service Limit..... +0.047 inch (+1.2 mm)
- Cylindricity..... Within 0.0004 inch (0.01 mm)

Cylinder to Piston Clearance..... 0.0008-0.0015 inch (0.02-0.04 mm)

PISTON

Piston OD (measure on skirt in thrust direction.3.587 in. (91.1 mm)
Piston Pin Hole Diameter..... 0.866 inch (22 mm)
Piston Oversizes in mm..... 0.25, 0.50, 0.75, 1.00 OS
Piston Ring to Groove Clearance
- Compression Ring No. 1
  - Standard..... 0.002-0.004 inch (0.06-0.10 mm)
  - Service Limit..... 0.006 inch (0.15 mm)
- Compression Ring No. 2
  - Standard..... 0.0008-0.002 inch (0.02-0.06 mm)
  - Service Limit..... 0.006 inch (0.15 mm)

PISTON RING

Piston Ring Gap
- Standard..... 0.010-0.016 inch (0.25-0.40 mm)
- Service Limit..... 0.039 inch (1.0 mm)

Oil Control Ring Gap..... 0.008-0.035 inch (0.2-0.9 mm)
Piston Ring Oversizes in mm ..... 0.25, 0.50, 0.75, 1.00 OS

PISTON PIN

Piston Pin OD..... 0.866 inch (22 mm)
Piston to Piston Pin Clearance
- Standard..... 0.0002-0.00035 inch (0.005-0.009 mm)
- Service Limit..... 0.002 inch (0.05 mm)

Interference to Connecting Rod
- Standard..... Press-fit Load 1654-3858 lbs (750-1750 kg)
- Service Limit..... Other than range of press-fit load above

CONNECTING ROD

Bend or Twist of Rod..... Within 0.001 inch (0.03 mm)
End Play of Rod Large End
- Standard..... 0.004-0.010 inch (0.1-0.25 mm)
- Service Limit..... 0.020 inch (0.5 mm)

Rod Bearing Oil Clearance
- Standard..... 0.00055-0.0025 inch (0.014-0.064 mm)
- Service Limit..... 0.004 inch (0.1 mm)

Rod Bearing Undersizes in mm..... 0.25, 0.50, 0.75, 1.00 US

CRANKSHAFT

Crankshaft Journal Oil Clearance
- Other than Center
  - Standard..... 0.0008-0.003 inch (0.020-0.080 mm)
  - Service Limit..... 0.006 inch (0.15 mm)
- Center Only
  - Standard..... 0.001-0.003 inch (0.026-0.076 mm)
  - Service Limit..... 0.006 inch (0.15 mm)

Crankshaft Pin Oil Clearance
- Standard..... 0.00055-0.0025 inch (0.014-0.064 mm)
- Service Limit..... 0.004 inch (0.10 mm)

Crankshaft Bearing Undersizes in mm..... 0.25, 0.50, 0.75 US
Crankshaft Journal Standard OD..... 2.363 inches (60 mm)
Crankshaft Journal Undersize Machining Size.... 0.25, 0.50, 0.75 mm
Crankshaft Pin Standard OD..... 2.087 inch (53 mm)
Crankshaft Pin Undersize Machining Size..... 0.25, 0.50, 0.75 mm US
Crankshaft Bend..... Within 0.001 inch (0.03 mm)
Journal and Pin Cylindricity..... Within 0.0002 inch (0.005 mm)
Crankshaft End Play
- Standard..... 0.002-0.007 inch (0.05-0.18 mm)
- Service Limit..... 0.010 inch (0.25 mm)

FLYWHEEL

Flywheel Runout
- Standard..... Within 0.005 inch (0.13 mm)
- Service Limit..... 0.008 inch (0.2 mm)

CAMSHAFT

- Camshaft Journal OD
  - Standard..... 1.338 inch (34 mm)
  - Service Limit..... -0.006 inch (-0.15 mm)
- Camshaft Journal Cylindricity
  - Standard..... 0.0004 inch (0.01 mm)
  - Service Limit..... 0.002 inch (0.05 mm)
- Camshaft Bend..... Within 0.0008 inch (0.02 mm)
  - Intake
    - Standard..... 1.654, 0.709 inch (42, 18 mm)
    - Service Limit..... -0.020 inch (-0.5 mm)
  - Exhaust
    - Standard..... 1.654, 0.945 inch (42, 24 mm)
    - Service Limit..... -0.020 inch (-0.5 mm)
- Fuel Pump Drive Cam Diameter
  - Standard..... 1.457 inch (37 mm)
  - Service Limit..... -0.020 inch (-0.5 mm)
- Camshaft End Play
  - Standard..... 0.004-0.008 inch (0.1-0.2 mm)
  - Service Limit..... 0.016 inch (0.4 mm)

VALVE TRAIN

- Valve OD
  - Intake Standard..... 0.315 inch (8 mm)
  - Intake Service Limit..... -0.004 inch (-0.1 mm)
  - Exhaust Standard..... 0.315 inch (8 mm)
  - Exhaust Service Limit..... -0.020 inch (-0.15 mm)
- Valve Overall Length
  - Intake..... 4.335 inch (110.1 mm)
  - Exhaust..... 4.252 inch (108 mm)
- Thickness of Valve Head
  - Intake Standard..... 0.047 inch (1.2 mm)
  - Intake Service Limit..... 0.028 inch (0.7 mm)
  - Exhaust Standard..... 0.079 inch (2.0 mm)
  - Exhaust Service Limit..... 0.039 inch (1.0 mm)
- Valve Clearance to Guide
  - Intake Standard..... 0.0010-0.002 inch (0.025-0.058 mm)
  - Intake Service Limit..... 0.004 inch (0.1 mm)
  - Exhaust Standard..... 0.002-0.003 inch (0.05-0.088 mm)
  - Exhaust Service Limit..... 0.006 inch (0.15 mm)
- Valve Guide OD (Intake and Exhaust)..... 0.512 inch (13 mm)
- Valve Guide ID (Intake and Exhaust).. 0.315-0.316 inch (8-8.018 mm)
  - Intake Guide ID Service Limit..... -0.004 inch (-0.10 mm)
  - Exhaust Guide ID Service Limit..... -0.006 inch (-0.15 mm)
- Valve Guide Installed Length..... 0.618-0.634 inch (15.7-16.1 mm)
- Valve Guide Oversizes in mm..... 0.05, 0.25, 0.50 mm OS
- Valve Seat Ring Oversizes
  - Intake 0.3 mm OS..... 1.862 inch (47.3 mm)
  - Intake 0.6 mm OS..... 1.874 inch (47.6 mm)
  - Exhaust 0.3 mm OS..... 1.587 inch (40.3 mm)
  - Exhaust 0.6 mm OS..... 1.598 inch (40.6 mm)
- Height of Valve Seat Ring (Intake and Exhaust)
  - 0.3 mm OS..... 0.311-0.319 inch (7.9-8.1 mm)
  - 0.6 mm OS..... 0.323-0.331 inch (8.2-8.4 mm)

Valve Spring
- Free Length..... 2.539 inch (48 mm)
- Compressed Length at 39.69 Lbs (18 kg)..... 1.591 inch (40.4 mm)
- Compressed Length Service Limit..... 1.591 inch (40.4 mm) at 35.28 Lbs (16 kg)
- Spring Squareness Standard..... 1.5 degrees
- Spring Squareness Service Limit..... 3 degrees

Rocker Arm Shaft OD..... 0.744 inch (18.9 mm)
Bend of Rocker Arm Shaft..... Within 0.002 inch (0.05 mm)
Rocker Arm ID..... 0.744 inch (18.9 mm)
Rocker Arm to Rocker Shaft Clearance
- Standard..... 0.0005-0.0017 inch (0.012-0.043 mm)
- Service Limit..... 0.008 inch (0.2 mm)

Rocker Shaft Spring
- Free Length..... 2.539 inch (64.5 mm)
- Length at 7.72 Lbs (3.5 kg)..... 1.673 inch (42.5 mm)

LUBRICATION SYSTEM

Recommended Oils
- Use oil classified "For Service SC, SD, SE, or SF"
- Below 32 degrees F. (0 degrees C.)..... SAE 10W Oil
- 14-50 degrees F. (-10 to +10 degrees C.)..... SAE 20W Oil
- 32-104 degrees F. (0-40 degrees C.)..... SAE 30 Oil
- 86 degrees F. (30 degrees C.) and above..... SAE 40 Oil
- All Seasons..... SAE 10W-30 Oil

Oil Pan Capacity
- Without Oil Filter Change..... 4.2 quarts (4.0 Liters)
- With Oil Filter Change..... 4.75 quarts (4.5 Liters)

Oil Pump
- Relief Valve Opening Pressure..... 50-64 psi (3.5-4.5 kg/sq. cm)
- Outer Rotor to Inner Rotor Clearance
  - Standard..... 0.0016-0.006 inch (0.04-0.15 mm)
  - Service Limit..... 0.010 inch (0.25 mm)
- Pump Body to Outer Rotor Clearance
  - Standard..... 0.004-0.007 inch (0.1-0.17 mm)
  - Service Limit..... 0.012 inch (0.3 mm)
- Rotor End Play..... 0.003-0.0055 inch (0.08-0.14 mm)
- Rotor End Play Service Limit..... 0.008 inch (0.2 mm)
- Oil Pump Relief Spring
  - Free Length..... 1.85 inch (47 mm)
  - Length at 9.48 Lbs (4.3 kg)..... 1.575 inch (40 mm)

Low Oil Pressure Switch Actuating Pressure..... 12-18 psi

7.4- TORQUE CHART

ENGINE PROPER

Cylinder Head Bolts	
Cold Torque	65-72 Foot-Pounds (9-10 m-kg)
Warm Torque	72-79 Foot-Pounds (10-11 m-kg)
M8 x 50 Cylinder Head Bolts	11-16 Foot-Pounds (1.5-2.2 m-kg)
Rocker Cover Mounting Bolts	4-5 Foot-Pounds (0.5-0.7 m-kg)
Intake/Exhaust Manifold Nuts	11-15 Foot-Pounds (1.5-2 m-kg)
Camshaft Bearing Cap Mounting Bolts	
M8 x 70	14-15 Foot-Pounds (1.9-2.1 m-kg)
M8 x 25	15-19 Foot-Pounds (2-2.7 m-kg)
Camshaft Sprocket Mounting Bolt	36-43 Foot-Pounds (5-6 m-kg)
Crankshaft Main Bearing Cap Bolts	54-61 Foot-Pounds (7.5-8.5 m-kg)
Connecting Rod Cap Bolts	33-35 Foot-Pounds (4.5-4.8 m-kg)
Crankshaft Pulley Bolt	80-94 Foot-Pounds (11-13 m-kg)
Flywheel Bolts	94-101 Foot-Pounds (13-14 m-kg)
Engine Support Mounting Bolts	33-39 Foot-Pounds (4.5-5.5 m-kg)

LUBRICATION SYSTEM

Oil Pan Mounting Bolts	5-6 Foot-Pounds (0.6-0.8 m-kg)
Oil Pan Drain Plug	44-57 Foot-Pounds (6-8 m-kg)
Oil Filter Mounting Studs	37-43 Foot-Pounds (5-6 m-kg)
Oil Filter	8-9 Foot-Pounds (1.1-1.3 m-kg)
Oil Pump Sprocket Mounting Bolt	22-28 Foot-Pounds (3-4 m-kg)

ELECTRICAL SYSTEM

Spark Plugs	18-21 Foot-Pounds (2.5-3 m-kg)
Alternator Support Bolt	15-18 Foot-Pounds (2-2.5 m-kg)
Alternator Brace Bolt	9-10 Foot-Pounds (1.2-1.5 m-kg)
Starter Mounting Bolts	16-23 Foot-Pounds (2.2-3.2 m-kg)

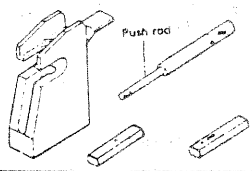
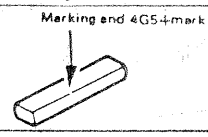
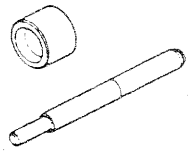
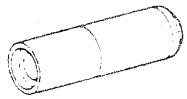
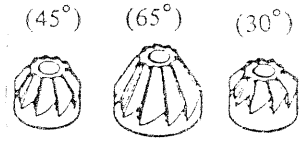
7.5- SEALANT CHART

Use SUPER THREE-BOND or HERMESEAL SS60F sealant as outlined in this Manual at the following places:- Oil Pan Gasket, Breather Semicircular packing.

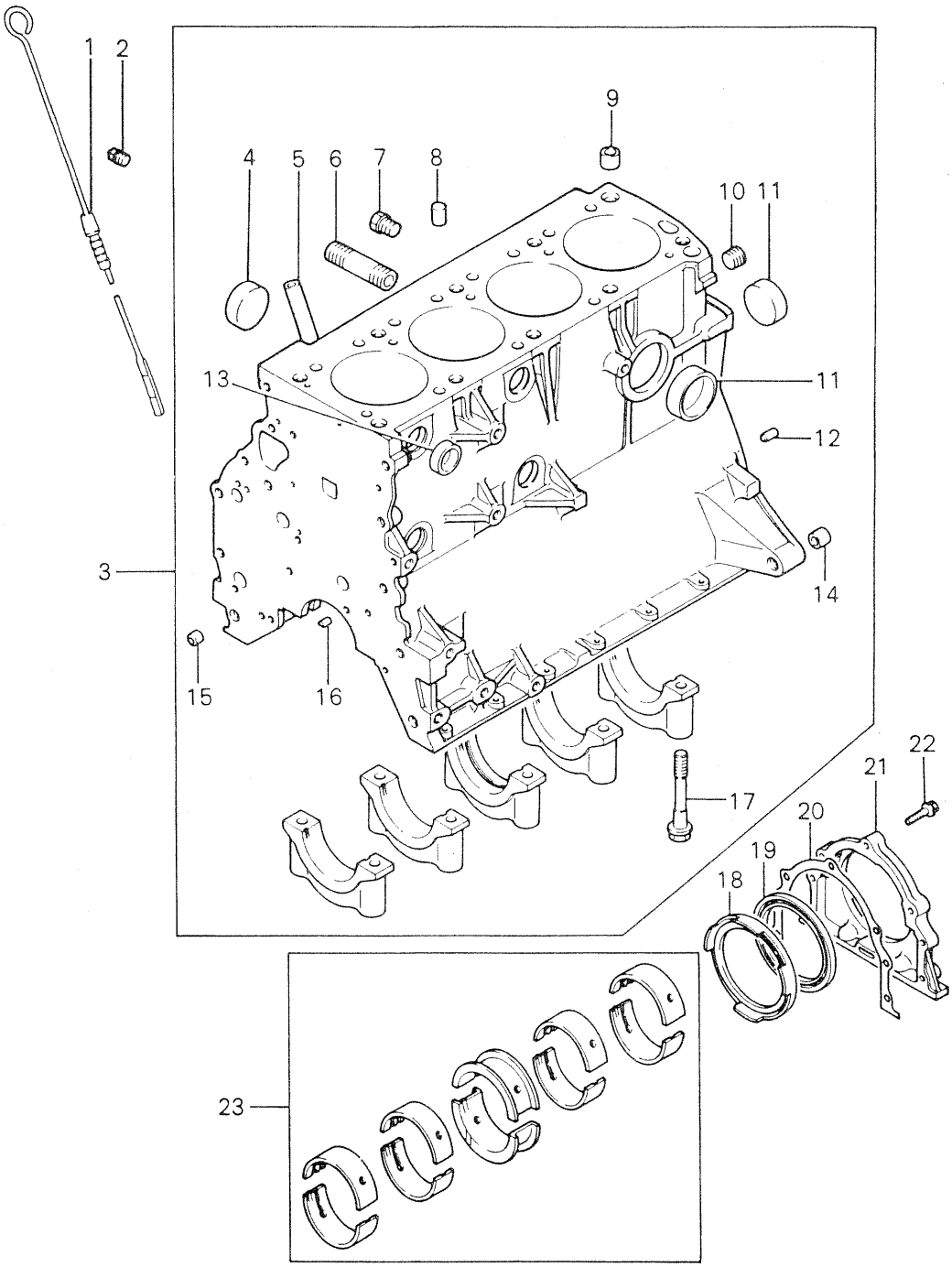
Use THREE-BOND 4-A Sealant as outlined in this Manual at the following places:- Breather Semicircular packing, Intake Manifold Gasket, Cylinder Block Expansion Plug, Cylinder Head Expansion Plug, Cylinder Head Upper Surface Taper Plug, Water Bypass Nipple.

Use HERMESEAL H-7 Sealant as outlined in this Manual at the following places:- Taper Plug at rear end of cylinder block main gallery, cylinder head oil hole plug (rear, exhaust side), Manifold mounting studs.

7.6- SPECIAL TOOL CHART

TOOL NAME	USE	ILLUSTRATION
Piston Pin Setting Tool	Removal/installation of Piston Pin	
Guide	For use with Piston Pin Setting Tool	
Valve Guide Installer	Press fitting/removal of Valve Guide	
Valve Stem Oil Seal Installer	Driving in Valve Stem Oil Seal	
Valve Seat Cutter	Use 45 degree Cutter to cut valve seat surfaces. Use 65 degree cutter to chamfer valve seat inner surfaces. Use 30 degree cutter to chamfer valve seat outer surface. There are two 30 degree cutters and two 45 degree cutters, one for the intake and one for the ex-hause valve seat.	

CYLINDER BLOCK COMPONENTS- 2.6 LITER ENGINE
Drawing Number 63482- Sheet 1 of 16
Revised- 09/07/84
File #10-84.11

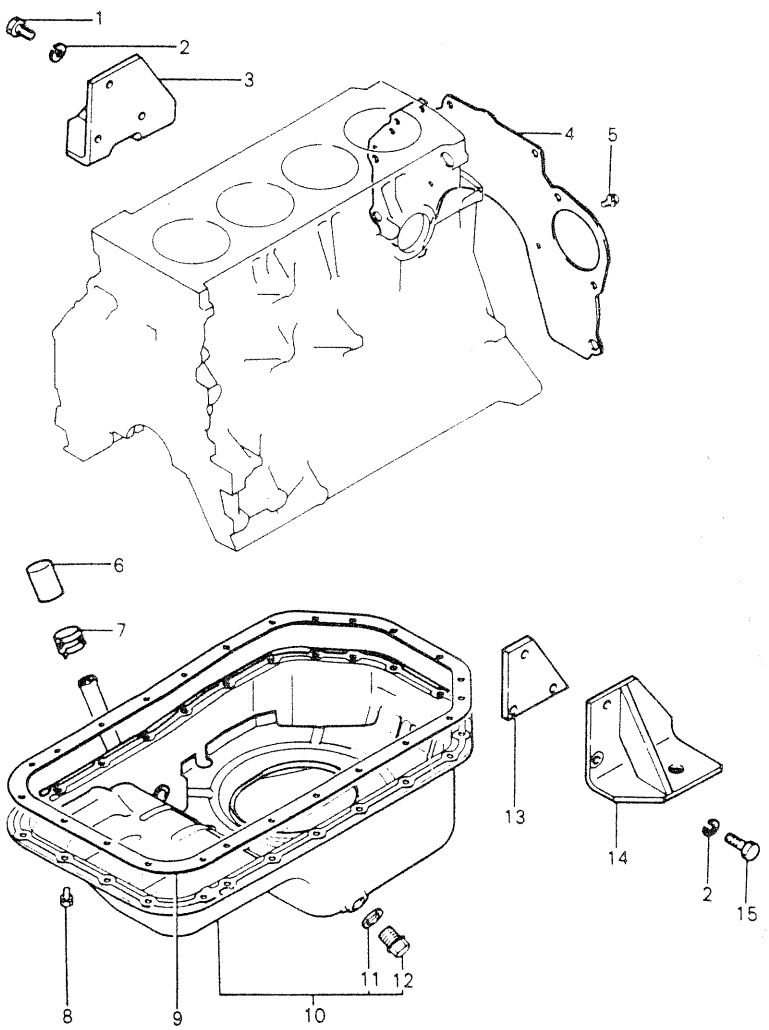


CYLINDER BLOCK COMPONENTS- 2.6 LITER ENGINE
Drawing Number 63482- Sheet 1 of 16
Revised- 09/07/84
File #10-84.11

ITEM	PART NUMBER	REQ'D	DESCRIPTION
1	413-62245A	1	DIPSTICK, Oil Level
2	105-62245A	1	PLUG, Taper
3	101-62245A	1	BLOCK ASSEMBLY, Cylinder (Consists of Items 4 thru 17)
4	109-62245A	2	CAP, Sealing
5	406-62245A	1	GUIDE, Oil Level Dipstick
6	103-62245A	1	STUD, Oil Filter
7	108-62245A	1	PLUG, Taper
8	105-62245A	1	PLUG, Taper
9	110-62245A	2	BUSHING
10	115-62245A	1	PLUG, Taper
11	117-62245A	3	CAP, Sealing
12	118-62245A	2	PIN, Dowel
13	119-62245A	4	CAP, Sealing
14	120-62245A	2	BUSHING, Knock
15	127-62245A	2	BUSHING, Knock
16	126-62245A	1	NOZZLE
17	125-62245A	10	BOLT, Bearing Cap
18	111-62245A	1	SEPARATOR, Oil
19	112-62245A	1	SEAL, Rear Oil
20	113-62245A	1	GASKET, Oil Seal Case
21	114-62245A	1	CASE, Oil Seal
22	412-62245A	5	BOLT, Flange- M6 x 20 mm
23	121-62245A	1	SET, Crankshaft Bearing- STANDARD
	122-62245A	1	SET, Crankshaft Bearing- 0.25 MM UNDERSIZE
	123-62245A	1	SET, Crankshaft Bearing- 0.50 MM UNDERSIZE
	124-62245A	1	SET, Crankshaft Bearing- 0.75 MM UNDERSIZE

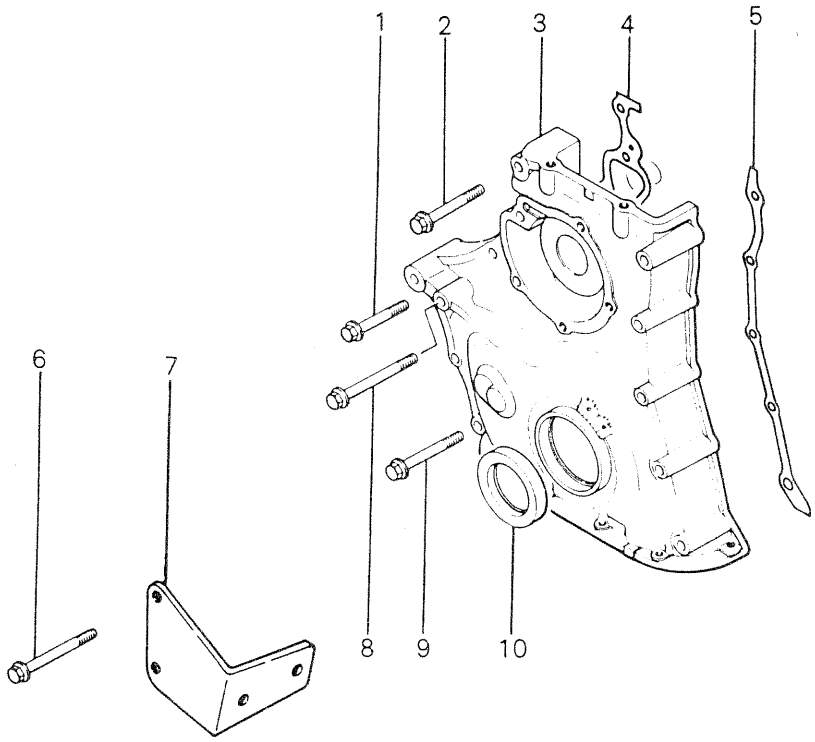
OIL PAN AND REAR PLATE- 2.6 LITER ENGINE
Drawing Number 63482- Sheet 2 of 16
Revised- 09/07/84
File #10-84.11

ITEM	PART NUMBER	REQ'D	DESCRIPTION
1	140-62245A	3	BOLT- M10 x 20 mm
2	141-62245A	6	WASHER, Lock- M10
3	142-62245A	1	SUPPORT, Engine- Right Hand
4	132-62245A	1	PLATE, Rear
5	134-62245A	2	BOLT (Includes Washer)- M6 x 12 mm
6	363-62245A	1	CAP, Rubber
7	364-62245A	1	CLIP, Hose
8	140-62245A	24	BOLT (Includes Washer)
9	131-62245A	1	GASKET, Oil Pan
10	128-62245A	1	PAN ASSEMBLY, Oil (Consists of Items 11,12)
11	130-62245A	1	GASKET, Oil Drain Plug
12	129-62245A	1	PLUG, Oil Drain
13	143-62245A	1	SPACER, Engine Support- Left hand
14	144-62245A	1	SUPPORT, Engine- Left Hand
15	145-62245A	3	BOLT- M10 x 30 mm

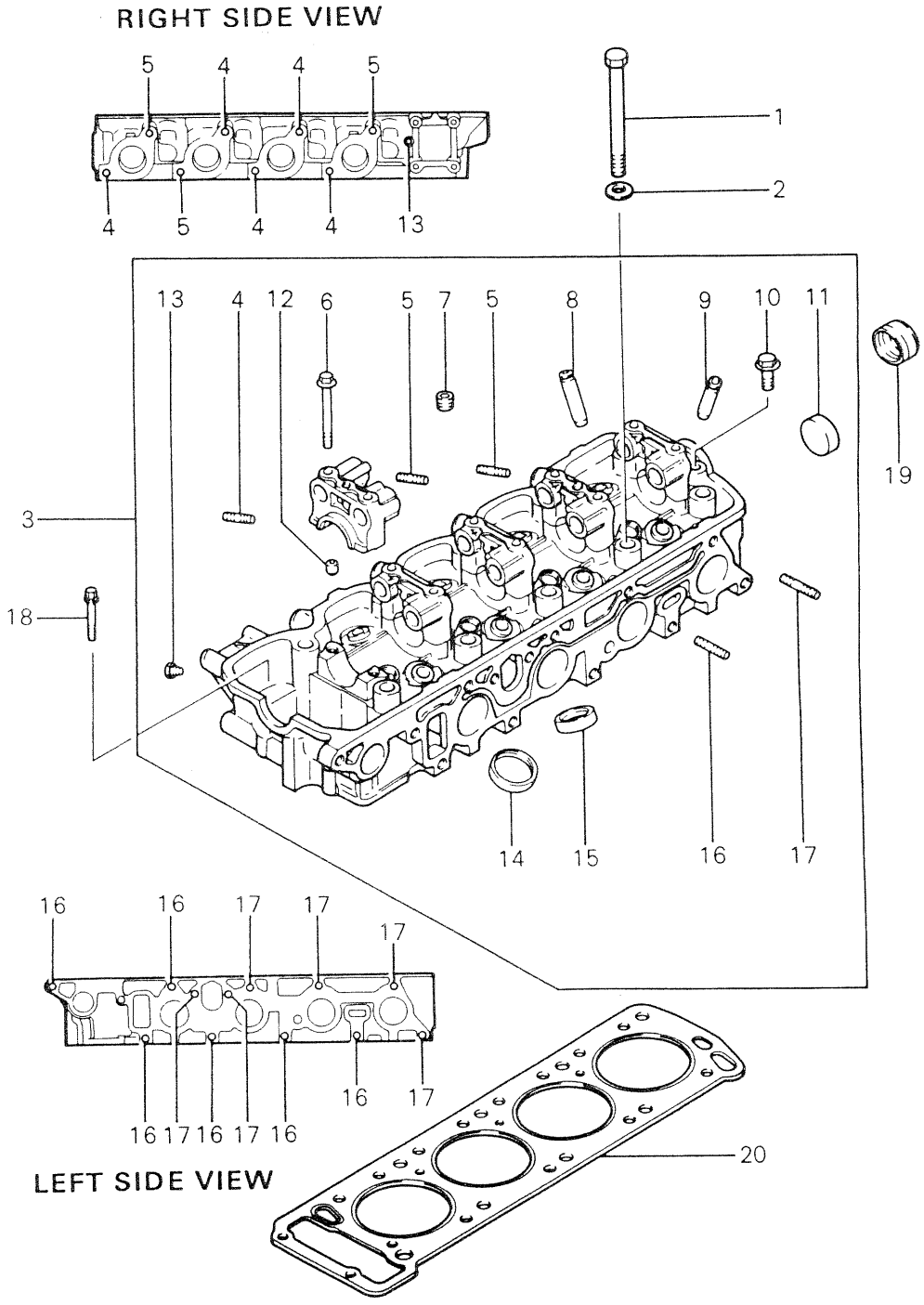


TIMING CHAIN CASE COMPONENTS- 2.6 LITER ENGINE
Drawing Number 63482- Sheet 3 of 16
Revised- 09/07/84
File #10-84.11

ITEM	PART NUMBER	REQ'D	DESCRIPTION
1	155-62245A	1	BOLT, Flanged- M8 x 58 mm
2	153-62245A	1	BOLT, Flanged- M8 x 63 mm
3	154-62245A	1	CASE, Timing Chain
4	152-62245A	1	GASKET, Timing Chain Case- Right Hand
5	161-62245A	1	GASKET, Timing Chain Case- Left Hand
6	416-62245A	2	BOLT, Flanged- M8 x 73 mm
7	417-62245A	1	SUPPORT, Ignition Coil
8	156-62245A	1	BOLT, Flanged- M8 x 83 mm
9	157-62245A	5	BOLT, Flanged- M8 x 68 mm
10	158-62245A	1	SEAL, Front Oil



CYLINDER HEAD COMPONENTS- 2.6 LITER EN `N
Drawing Number 63482- Sheet 4 of 16
Revised- 09/07/84
File #10-84.11

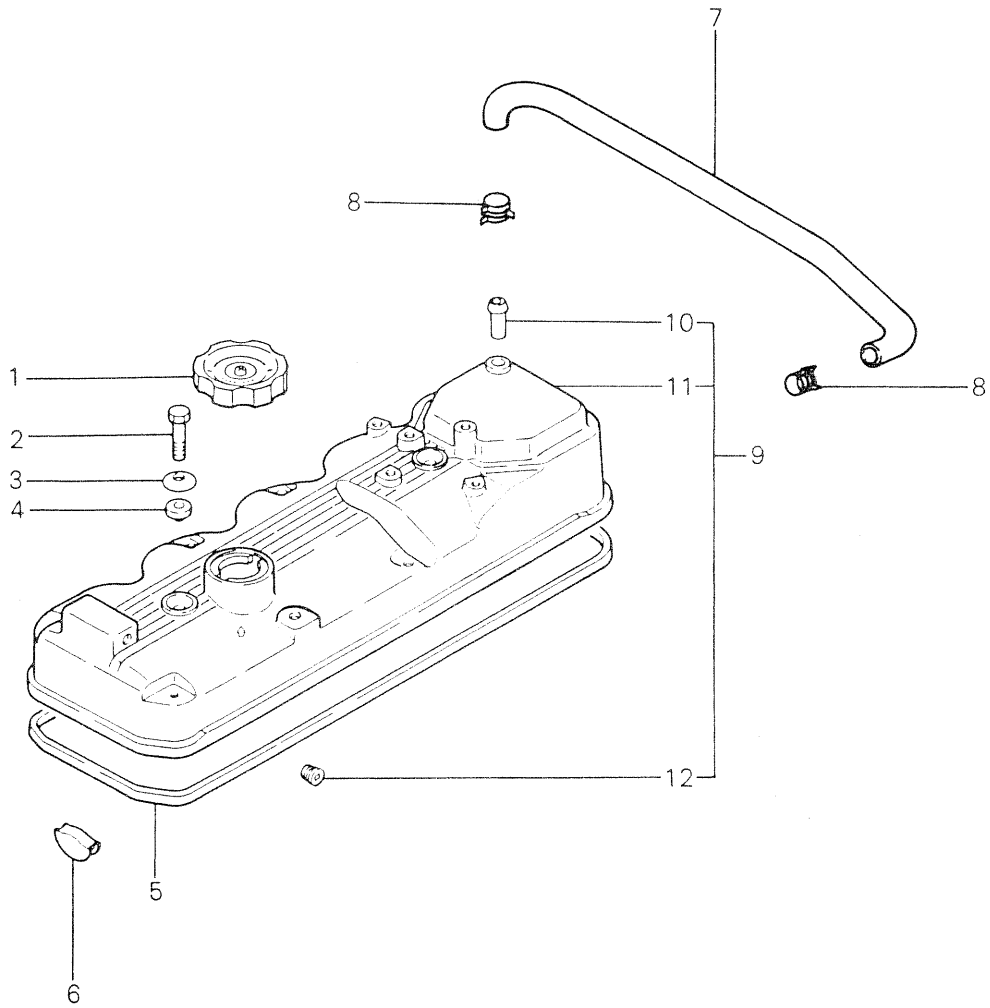


CYLINDER HEAD COMPONENTS- 2.6 LITER ENGINE
Drawing Number 63482- Sheet 4 of 16
Revised- 09/07/84
File #10-84.11

ITEM	PART NUMBER	REQ'D	DESCRIPTION
1	173-62245A	10	BOLT, Cylinder Head
2	174-62245A	10	WASHER, Cylinder Head Bolt
3	162-62245A	1	HEAD ASSEMBLY, Cylinder
4	168-62245A	5	STUD
5	169-62245A	3	STUD
6	163-62245A	10	BOLT, Flanged
7	165-62245A	1	PLUG, Taper
8	170-62245A	4	GUIDE, Exhaust Valve- 0.05 mm OS
	171-62245A	4	GUIDE, Exhaust Valve- 0.25 mm OS
	172-62245A	4	GUIDE, Exhaust Valve- 0.50 mm OS
9	177-62245A	4	GUIDE, Intake Valve- 0.05 mm OS
	178-62245A	4	GUIDE, Intake Valve- 0.25 mm OS
	179-62245A	4	GUIDE, Intake Valve- 0.50 mm OS
10	164-62245A	2	BOLT, Flanged
11	176-62245A	1	PLUG, Expansion
12	166-62245A	10	BUSHING, Knock
13	165-62245A	1	PLUG, Taper
14	184-62245A	4	SEAT, Intake Valve- 0.30 mm OS
	185-62245A	4	SEAT, Intake Valve- 0.60 mm OS
15	182-62245A	4	SEAT, Exhaust Valve- 0.30 mm OS
	183-62245A	4	SEAT, Exhaust Valve- 0.60 mm OS
16	181-62245A	6	STUD- M8 x 25 mm
17	180-62245A	6	STUD- M8 x 28 mm
18	187-62245A	2	BOLT (Includes Washer)- M8 x 50 mm
19	175-62245A	1	PACKING
20	186-62245A	1	GASKET, Cylinder Head

ROCKER COVER COMPONENTS
Drawing Number 63482- Sheet 5 of 16
Revised- 09/07/84
File #10-84.11

ITEM	PART NUMBER	REQ'D	DESCRIPTION
1	193-62245A	1	CAP, Oil Filler
2	191-62245A	2	BOLT- M8 x 40 mm
3	190-62245A	2	WASHER
4	189-62245A	2	SEAL, Oil
5	198-62245A	1	GASKET, Rocker Cover
6	203-62245A	1	PACKING, Semi-Circular
7	365-62245A	1	HOSE, Breather
8	366-62245A	2	CLIP, Hose
9	367-62245A	1	COVER ASSEMBLY, Rocker (Consists of Items 10 thru 12)
10	368-62245A	1	PIPE
11		1	COVER, Rocker
12	370-62245A	1	PLUG, Taper



PISTON AND CONNECTING ROD
Drawing Number 63482- Sheet 6 of 16
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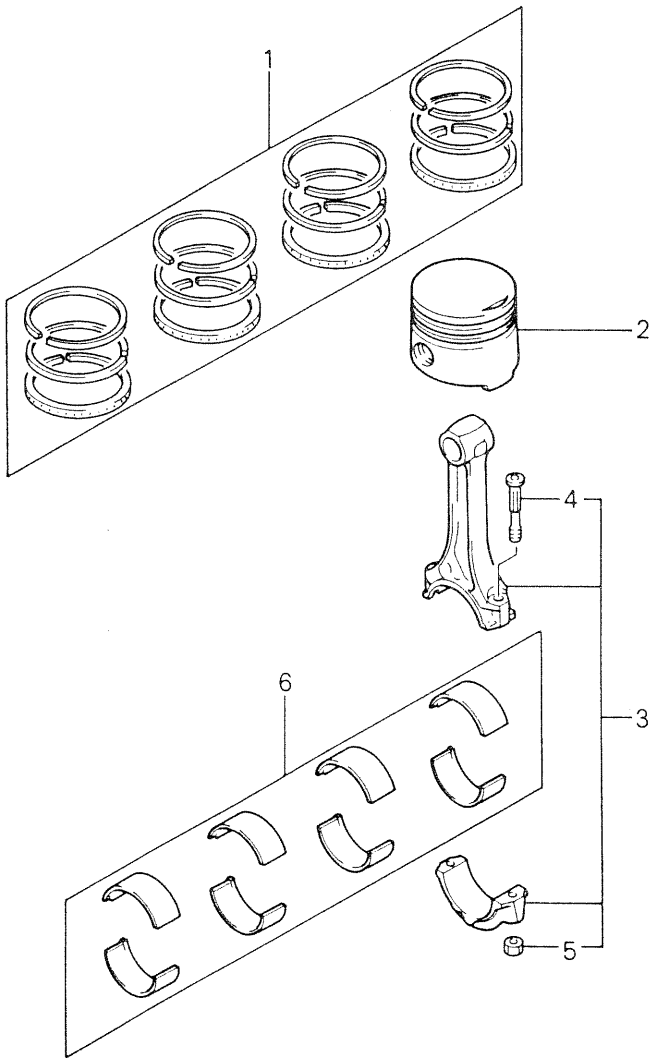
ITEM	PART NUMBER	REQ'D	DESCRIPTION
1	204-62245A	1	SET, Piston Ring- STANDARD
	205-62245A	1	SET, Piston Ring- 0.25 mm OS
	206-62245A	1	SET, Piston Ring- 0.50 mm OS
	207-62245A	1	SET, Piston Ring- 0.75 mm OS
	208-62245A	1	SET, Piston Ring- 1.00 mm OS
2	209-62245A	4	PISTON (with Pin)- STANDARD
	210-62245A	4	PISTON (with Pin)- 0.25 mm OS
	211-62245A	4	PISTON (with Pin)- 0.50 mm OS
	212-62245A	4	PISTON (with Pin)- 0.75 mm OS
	213-62245A	4	PISTON (with Pin)- 1.00 mm OS
3	214-62245A	4	ROD, Connecting
4	215-62245A	8	BOLT, Connecting Rod
5	216-62245A	8	NUT, Connecting Rod
6	217-62245A	1	SET, Connecting Rod Bearing- STANDARD
	218-62245A	1	SET, Connecting Rod Bearing- 0.25 mm OS
	219-62245A	1	SET, Connecting Rod Bearing- 0.50 mm OS
	220-62245A	1	SET, Connecting Rod Bearing- 0.75 mm OS



CRANKSHAFT AND FLYWHEEL
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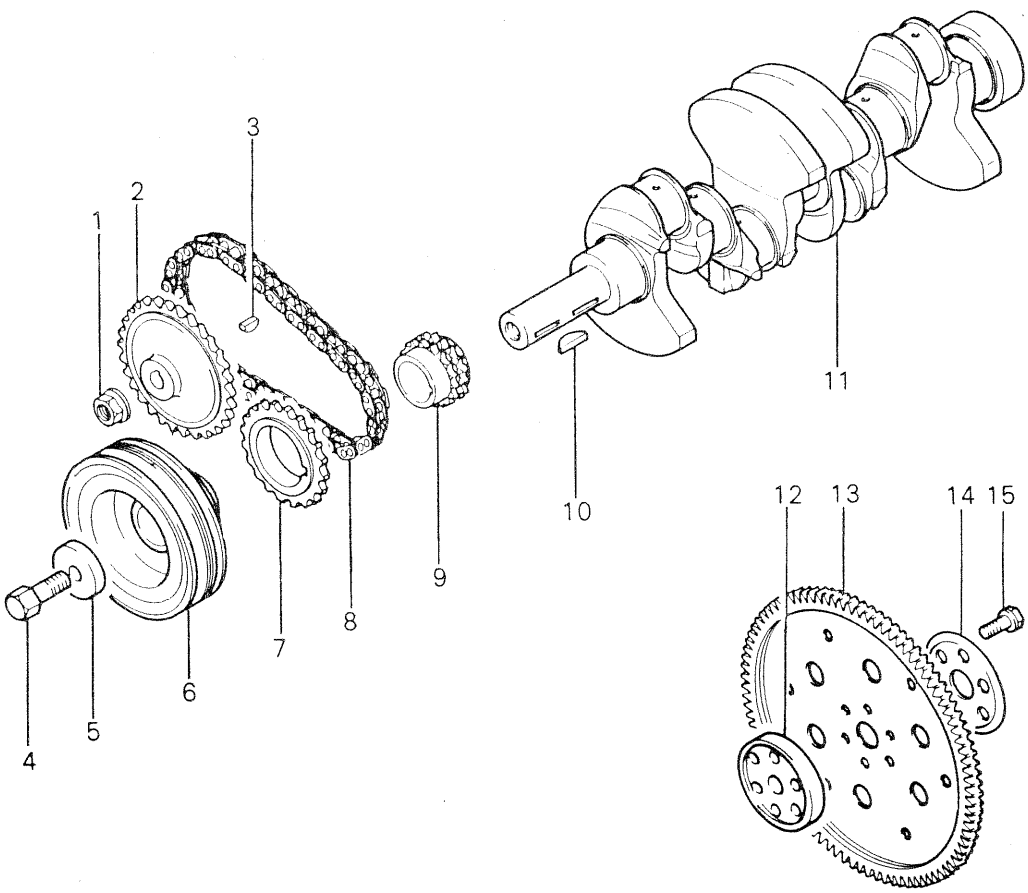
ITEM	PART NUMBER	REQ'D	DESCRIPTION
1	224-62245A	1	NUT
2	223-62245A	1	SPROCKET, Oil Pump
3	222-62245A	1	KEY, Woodruff
4	225-62245A	1	BOLT, Crankshaft Pulley
5	226-62245A	1	WASHER- Special
6	227-62245A	1	PULLEY, Crankshaft
7	228-62245A	1	SPROCKET, Crankshaft
8	221-62245A	1	CHAIN, Oil Pump
9	229-62245A	1	SPROCKET, Crankshaft
10	230-62245A	2	KEY
11	231-62245A	1	CRANKSHAFT
12	371-62245A	1	ADAPTER, Crankshaft
13	372-62245A	1	PLATE ASSEMBLY, Drive
14	373-62245A	1	PLATE, Adapter
15	374-62245A	6	BOLT, Drive Plate



TIMING SYSTEM
Drawing Number 63482- Sheet 8 of 16
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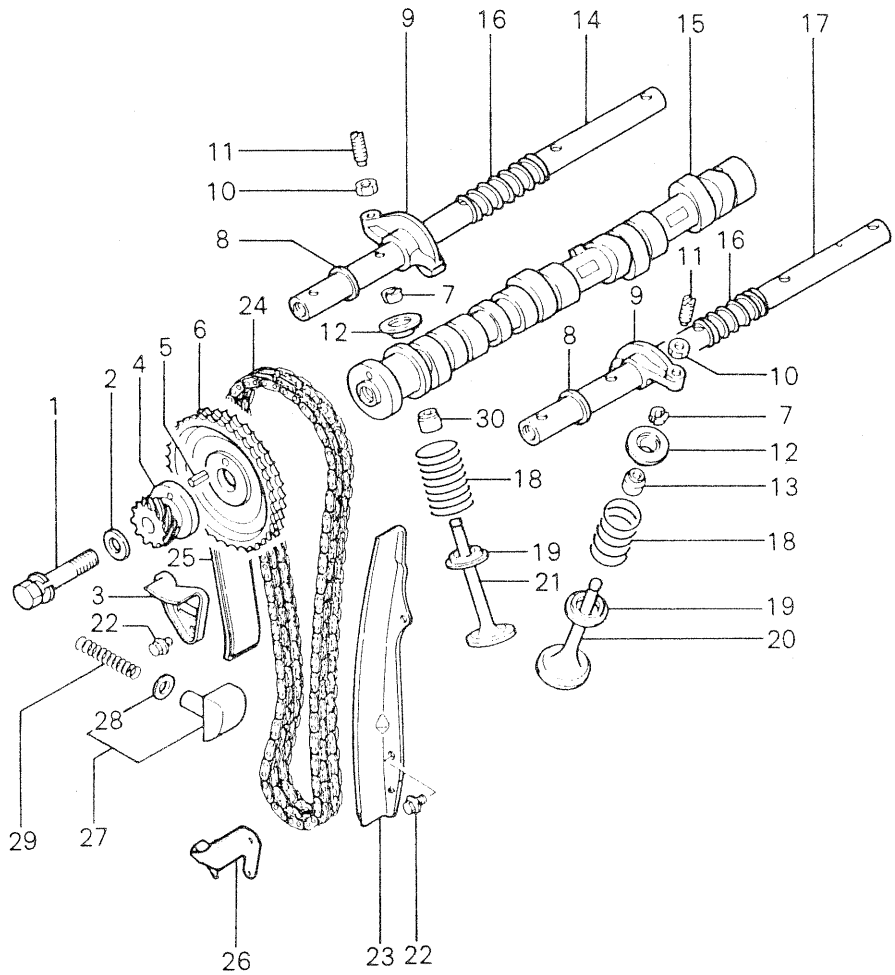

TIMING SYSTEM
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ITEM	PART NUMBER	REQ'D	DESCRIPTION
1	251-62245A	1	BOLT (Includes Washer)- M14 x 70 mm
2	252-62245A	1	WASHER, Flat- M14
3	265-62245A	1	HOLDER, Camshaft Sprocket
4	253-62245A	1	GEAR, Distributor
5	254-62245A	1	PIN, Spring
6	255-62245A	1	SPROCKET, Camshaft
7	239-62245A	16	LOCK, Valve Spring Retainer
8	245-62245A	2	WASHER, Wave
9	242-62245A	8	ARM, Rocker
10	241-62245A	8	NUT
11	240-62245A	8	SCREW, Rocker Arm Adjusting
12	238-62245A	8	RETAINER, Valve Spring
13	237-62245A	4	SEAL, Valve Stem
14	244-62245A	1	SHAFT ASSEMBLY, Rocker- Right Hand
15	256-62245A	1	CAMSHAFT
16	243-62245A	6	SPRING, Rocker Shaft- Left and Right Hand
17	246-62245A	1	SHAFT ASSEMBLY, Rocker- Left Hand
18	247-62245A	8	SPRING, Valve
19	248-62245A	8	SEAT, Valve Spring
20	249-62245A	4	VALVE, Intake
21	250-62245A	4	VALVE, Exhaust
22	257-62245A	5	BOLT, Flanged- M6 x 10 mm
23	258-62245A	1	GUIDE, Chain Tension Side
24	259-62245A	1	CHAIN, Timing
25	260-62245A	1	GUIDE, Chain Loose Side
26	261-62245A	1	RETAINER, Chain
27	262-62245A	1	SLEEVE (Complete)
28	263-62245A	1	SEAT, Rubber
29	264-62245A	1	SPRING, Tensioner
30	237-62245A	4	SEAL, Valve Stem

OIL PUMP AND OIL FILTER
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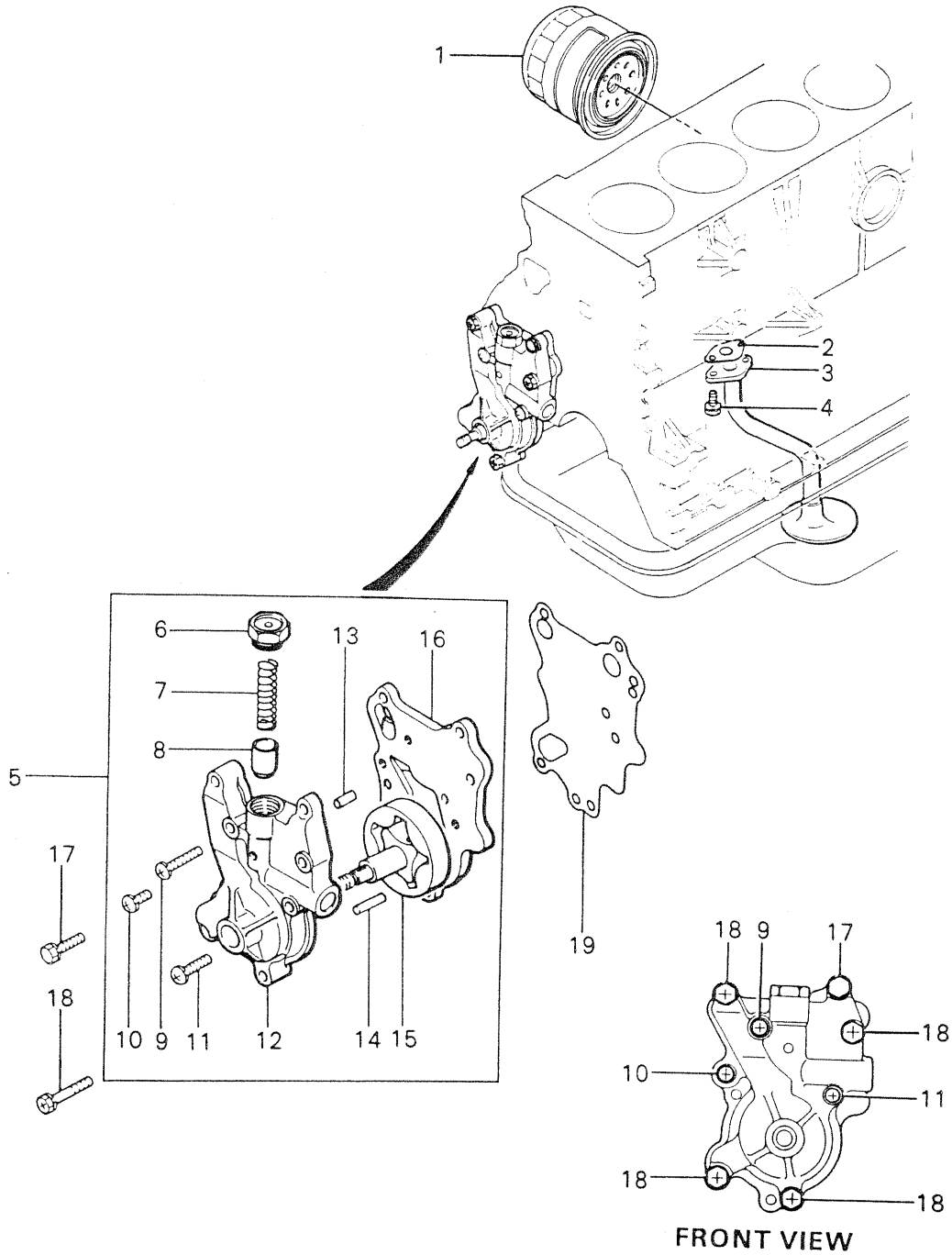

OIL PUMP AND OIL FILTER
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ITEM	PART NUMBER	REQ'D	DESCRIPTION
1	52241	1	FILTER ASSEMBLY, Oil
2	266-62245A	1	GASKET, Oil Screen
3	268-62245A	1	SCREEN ASSEMBLY, Oil
4	267-62245A	2	BOLT (Includes Washer)- M8 x 20 mm
5	269-62245A	1	PUMP ASSEMBLY, Oil (Consists of Items 6 thru 16)
6	270-62245A	1	PLUG
7	271-62245A	1	SPRING, Relief
8	272-62245A	1	PLUNGER, Relief
9	273-62245A	1	SCREW (Includes Washer)- M6 x 30 mm
10	274-62245A	1	SCREW (Includes Washer)- M6 x 16 mm
11	276-62245A	1	SCREW (Includes Washer)- M6 x 25 mm
12	278-62245A	1	BODY, Oil Pump
13	279-62245A	1	PIN
14	280-62245A	1	PIN, Dowel
15	281-62245A	1	ROTOR ASSEMBLY, Oil Pump
16	282-62245A	1	COVER, Oil Pump
17	275-62245A	1	BOLT (Includes Washer)- M6 x 25 mm
18	277-62245A	4	BOLT (Includes Washer)- M6 x 35 mm
19	283-62245A	1	GASKET, Oil Pump

FUEL PUMP
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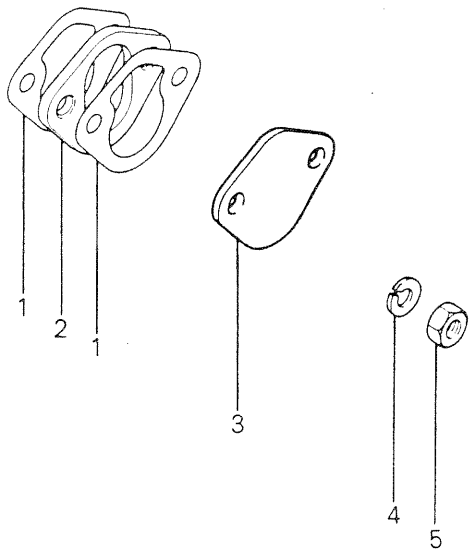
ITEM	PART NUMBER	REQ'D	DESCRIPTION
1	375-62245A	2	GASKET, Fuel Pump
2	376-62245A	1	INSULATOR, Fuel Pump
3	377-62245A	1	COVER, Fuel Pump
4	378-62245A	2	WASHER, Lock- M8
5	379-62245A	2	NUT- M8



WATER PUMP
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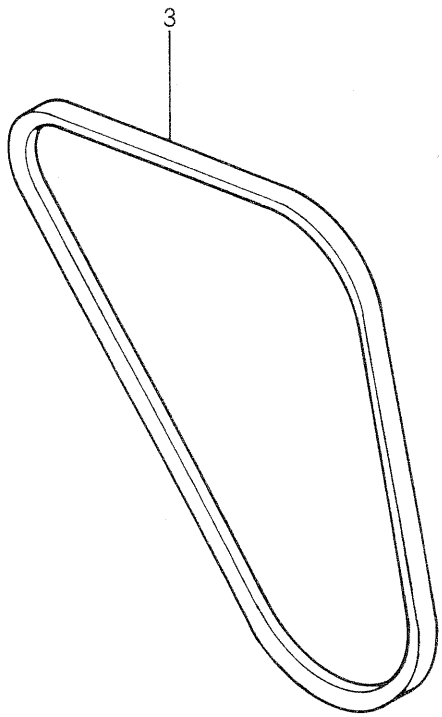
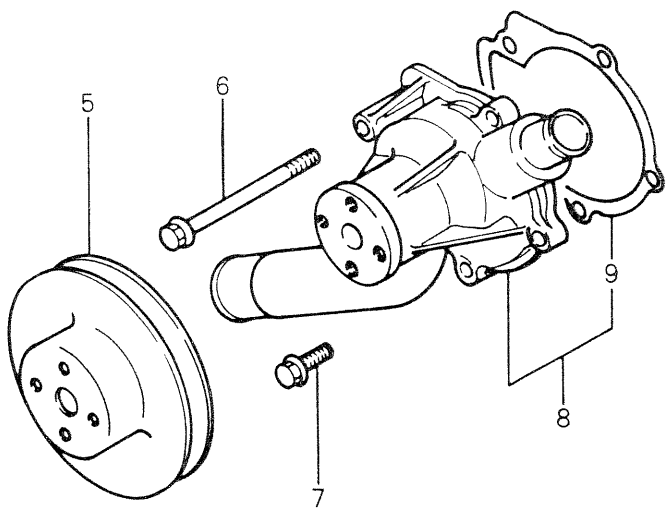
ITEM	PART NUMBER	REQ'D	DESCRIPTION
1	284-62245A	4	BOLT, Flanged- M6 x 55 mm
3	285-62245A	1	V-BELT
5	286-62245A	1	PULLEY (with Pump)
6	287-62245A	2	BOLT, Flanged- M8 x 98 mm
7	288-62245A	3	BOLT, Flanged- M8 x 23 mm
8	289-62245A	1	KIT, Water Pump and Gasket
9	290-62245A	1	GASKET, Water Pump





STARTER ASSEMBLY
Drawing Number 63482- Sheet 12 of 16
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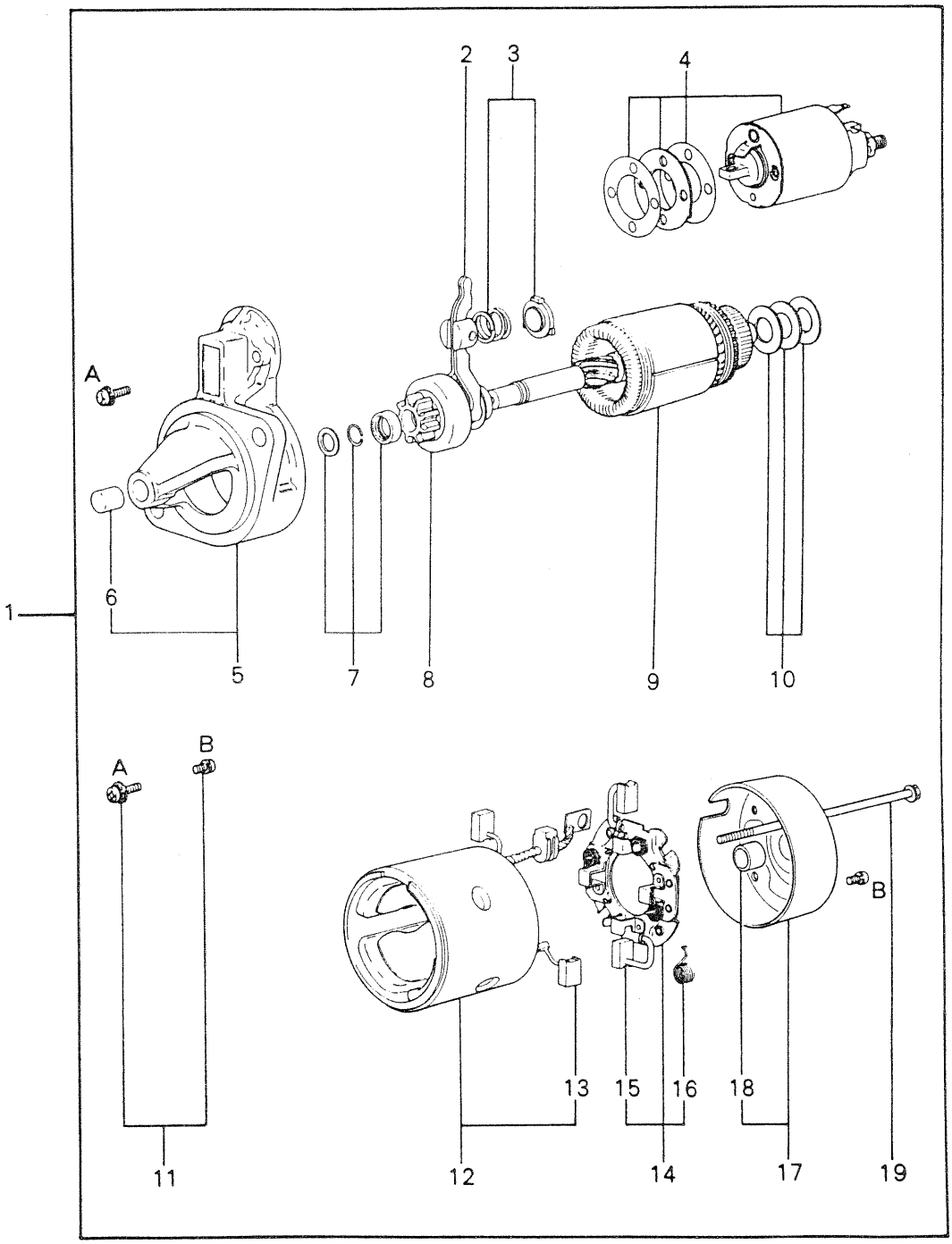

STARTER ASSEMBLY
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ITEM	PART NUMBER	REQ'D	DESCRIPTION
1	62574	1	STARTER ASSEMBLY
2	293-62245A	1	LEVER
3	294-62245A	1	SET, Spring
4	295-62245A	1	SWITCH
5	296-62245A	1	BRACKET, Front
6	297-62245A	1	BEARING, Sleeve
7	298-62245A	1	STOPPER SET
8	299-62245A	1	CLUTCH, Overrunning
9	300-62245A	1	ARMATURE
10	301-62245A	1	SET, Washer
11	302-62245A	1	SET, Screw
12	303-62245A	1	YOKE
13	304-62245A	2	BRUSH
14	305-62245A	1	HOLDER, Brush
15	306-62245A	1	BRUSH
16	307-62245A	3	SPRING, Brush
17	308-62245A	1	BRACKET, Rear
18	309-62245A	1	BEARING, Sleeve
19	310-62245A	1	SET, Bolt

DC ALTERNATOR
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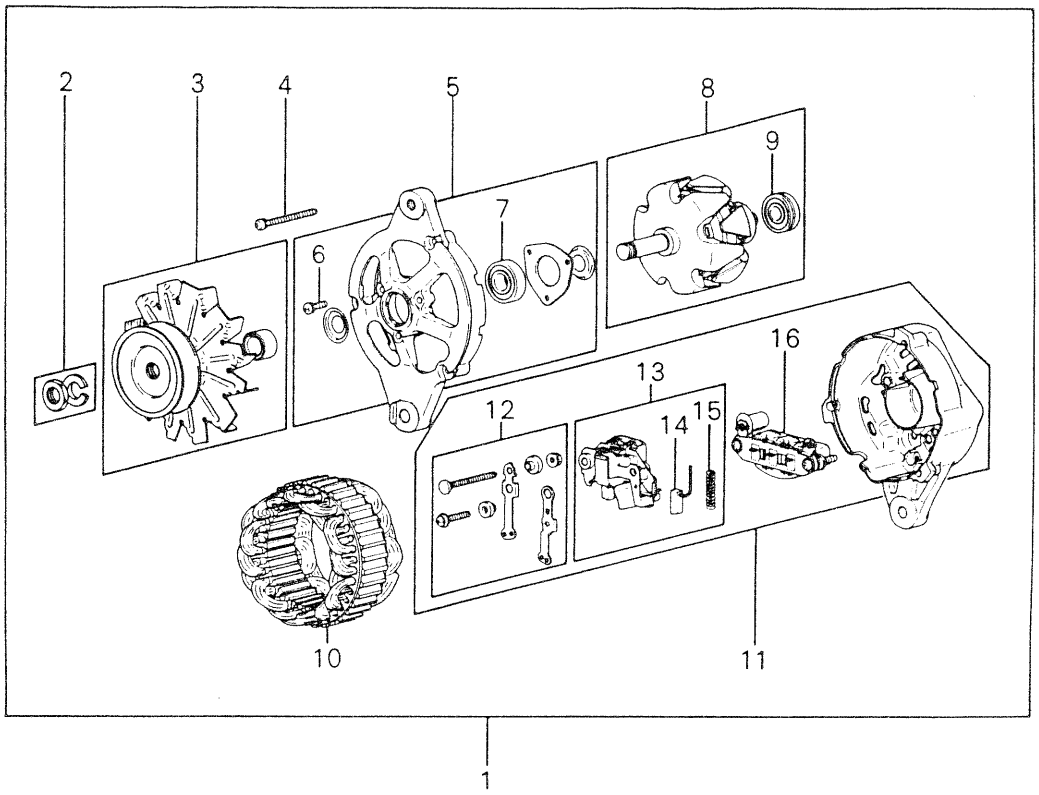

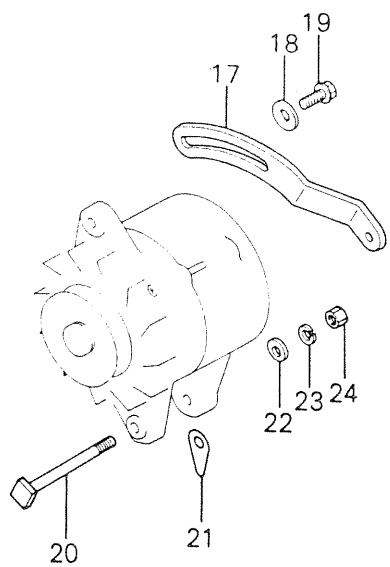

DC ALTERNATOR
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ITEM	PART NUMBER	REQ'D	DESCRIPTION
1	319-62245A	1	ASSEMBLY, DC Alternator
2	320-62245A	1	NUT SET
3	321-62245A	1	PULLEY
4	322-62245A	1	SCREW SET
5	323-62245A	1	BRACKET, Front
6	324-62245A	1	SCREW SET
7	325-62245A	1	BEARING, Front
8	326-62245A	1	ROTOR ASSEMBLY
9	327-62245A	1	BEARING, Rear
10	328-62245A	1	STATOR ASSEMBLY
11	329-62245A	1	BRACKET, Rear
12	380-62245A	1	SET, Terminal
13	381-62245A	1	SET, IC Regulator
14	337-62245A	2	BRUSH
15	338-62245A	2	SPRING, Brush
16	339-62245A	1	RECTIFIER
17	311-62245A	1	BRACE, DC Alternator
18	312-62245A	1	WASHER
19	313-62245A	1	BOLT, Flanged- M8 x 20 mm
20	314-62245A	1	BOLT- M8 x 92 mm
21	315-62245A	*	SHIM
22	316-62245A	1	WASHER, Flat- M8
23	317-62245A	1	WASHER, Lock- M8
24	382-62245A	1	NUT- M8

* As Required

DISTRIBUTOR ASSEMBLY
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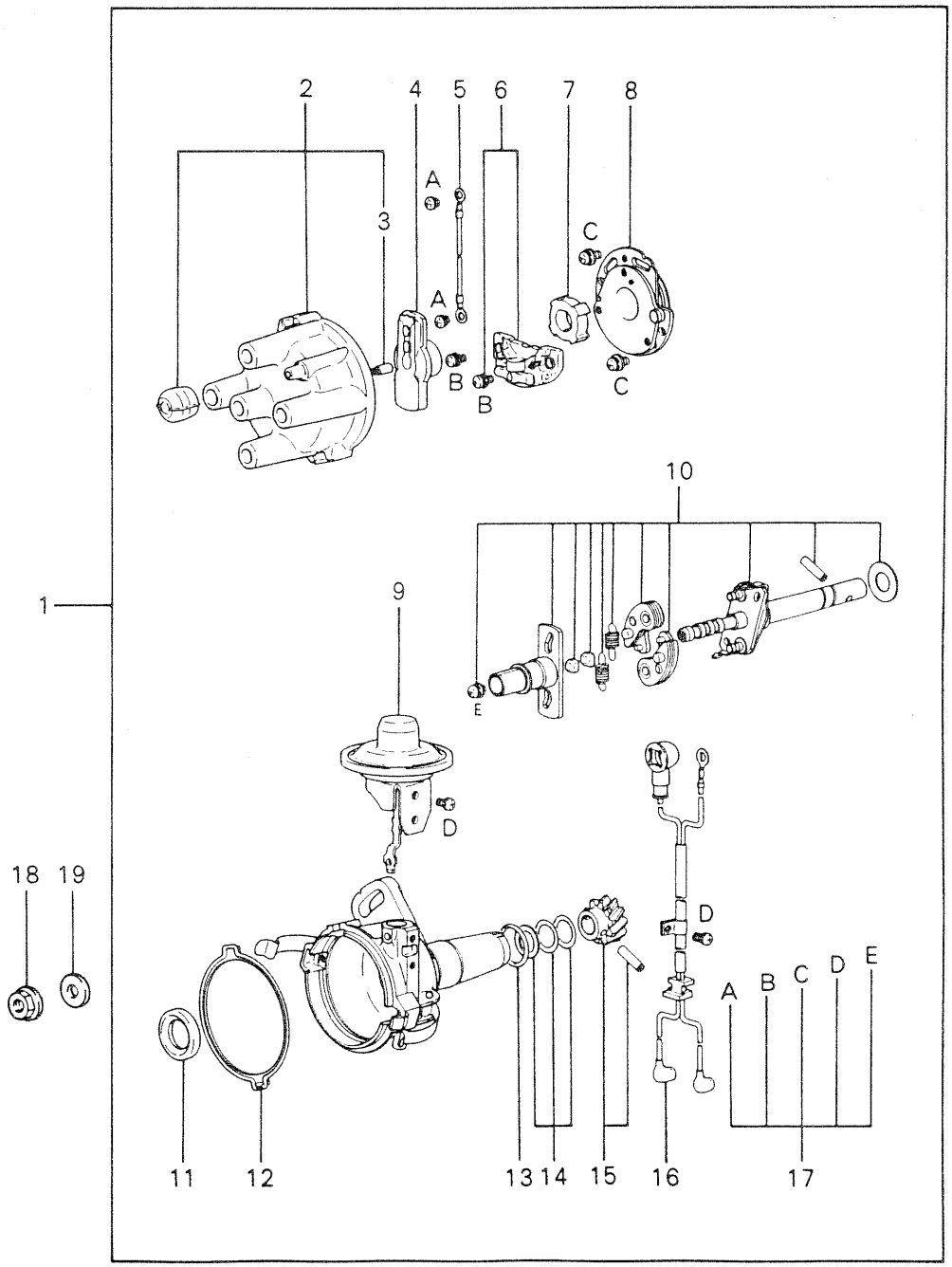

DISTRIBUTOR ASSEMBLY
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ITEM	PART NUMBER	REQ'D	DESCRIPTION
1	408-62245A	1	DISTRIBUTOR ASSEMBLY
2	407-62245A	1	CAP
3	409-62245A	1	CARBON ASSEMBLY, Contact
4	343-62245A	1	ROTOR
5	344-62245A	1	WIRE, Grounding
6	345-62245A	1	SET, Igniter
7	346-62245A	1	ROTOR ASSEMBLY, Signal
8	347-62245A	1	BREAKER ASSEMBLY
9	348-62245A	1	VACUUM ASSEMBLY
10	349-62245A	1	GOVERNOR
11	350-62245A	1	SEAL, Oil
12	351-62245A	1	PACKING
13	352-62245A	1	O-RING
14	353-62245A	1	WASHER SET
15	354-62245A	1	COUPLING SET
16	355-62245A	1	WIRE ASSEMBLY
17	356-62245A	1	SCREW SET, Distributor
18	410-62245A	1	NUT, Flanged- M8
19	411-62245A	1	WASHER

SPARK PLUGS AND IGNITION COIL
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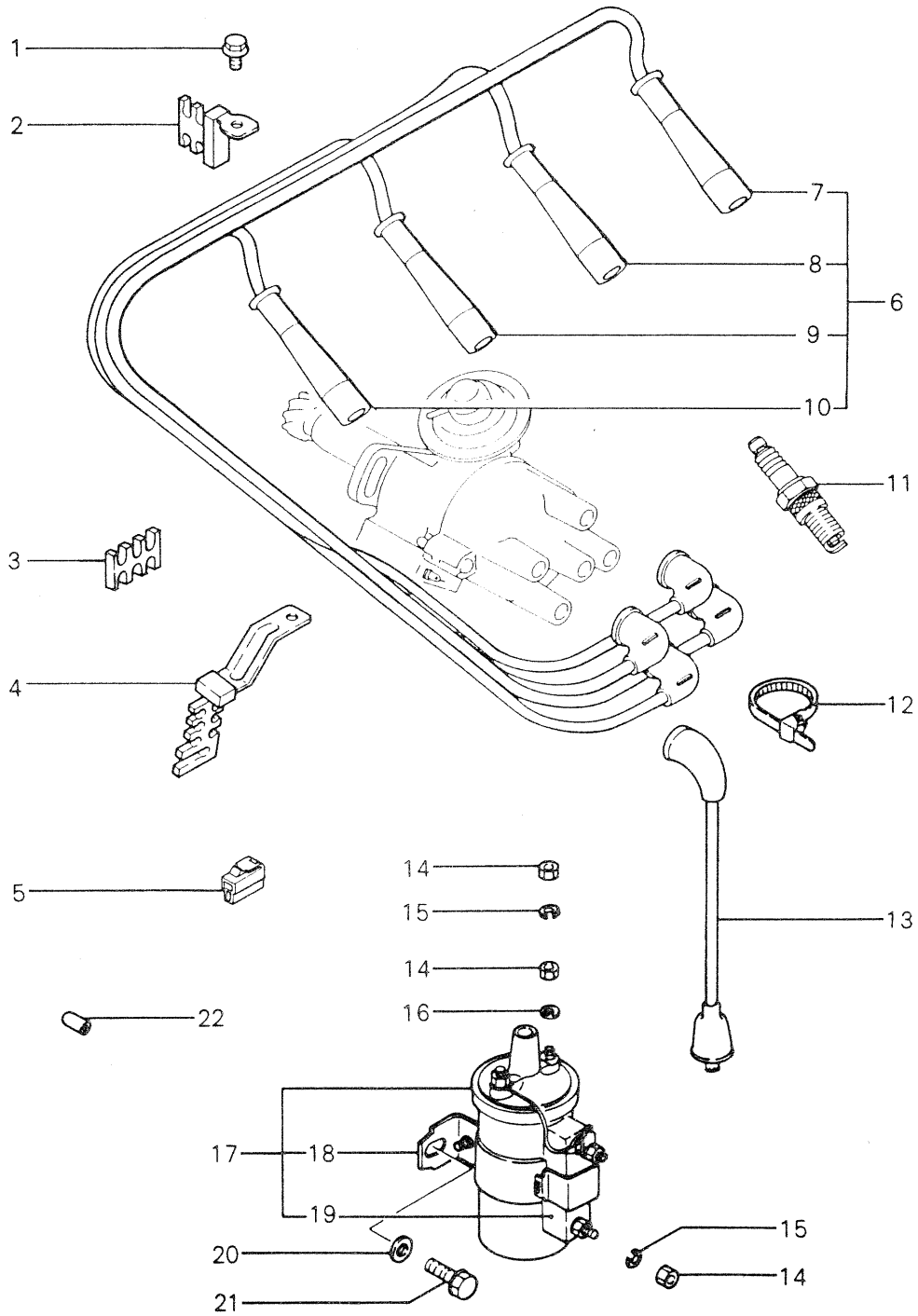

SPARK PLUGS AND IGNITION COIL
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ITEM	PART NUMBER	REQ'D	DESCRIPTION
1	414-62245A	4	BOLT, Flange- M6 x 10 mm
2	383-62245A	3	SUPPORT, High Tension Cable
3	384-62245A	1	CLAMP
4	385-62245A	1	SUPPORT
5	386-62245A	1	CONNECTOR ASSEMBLY- 2-Pole female
6	387-62245A	1	CABLE SET, Spark Plug
7	388-62245A	1	CABLE- No. 1 Spark Plug
8	389-62245A	1	CABLE- No. 2 Spark Plug
9	390-62245A	1	CABLE- No. 3 Spark Plug
10	391-62245A	1	CABLE- No. 4 Spark Plug
11	392-62245A	4	SPARK PLUG
12	393-62245A	3	CLAMP, Hose
13	394-62245A	1	CABLE, High Tension
14	395-62245A	3	NUT- M5
15	415-62245A	2	WASHER, Lock- M5
16	397-62245A	1	WASHER, Flat- M5
17	398-62245A	1	COIL, Ignition
18	399-62245A	1	BAND, Ignition Coil
19	400-62245A	1	RESISTOR
20	401-62245A	2	WASHER, Flat- M8
21	402-62245A	2	BOLT, Flanged- M8 x 14 mm
22	403-62245A	1	CAP, Rubber

ENGINE OVERHAUL GASKET SET
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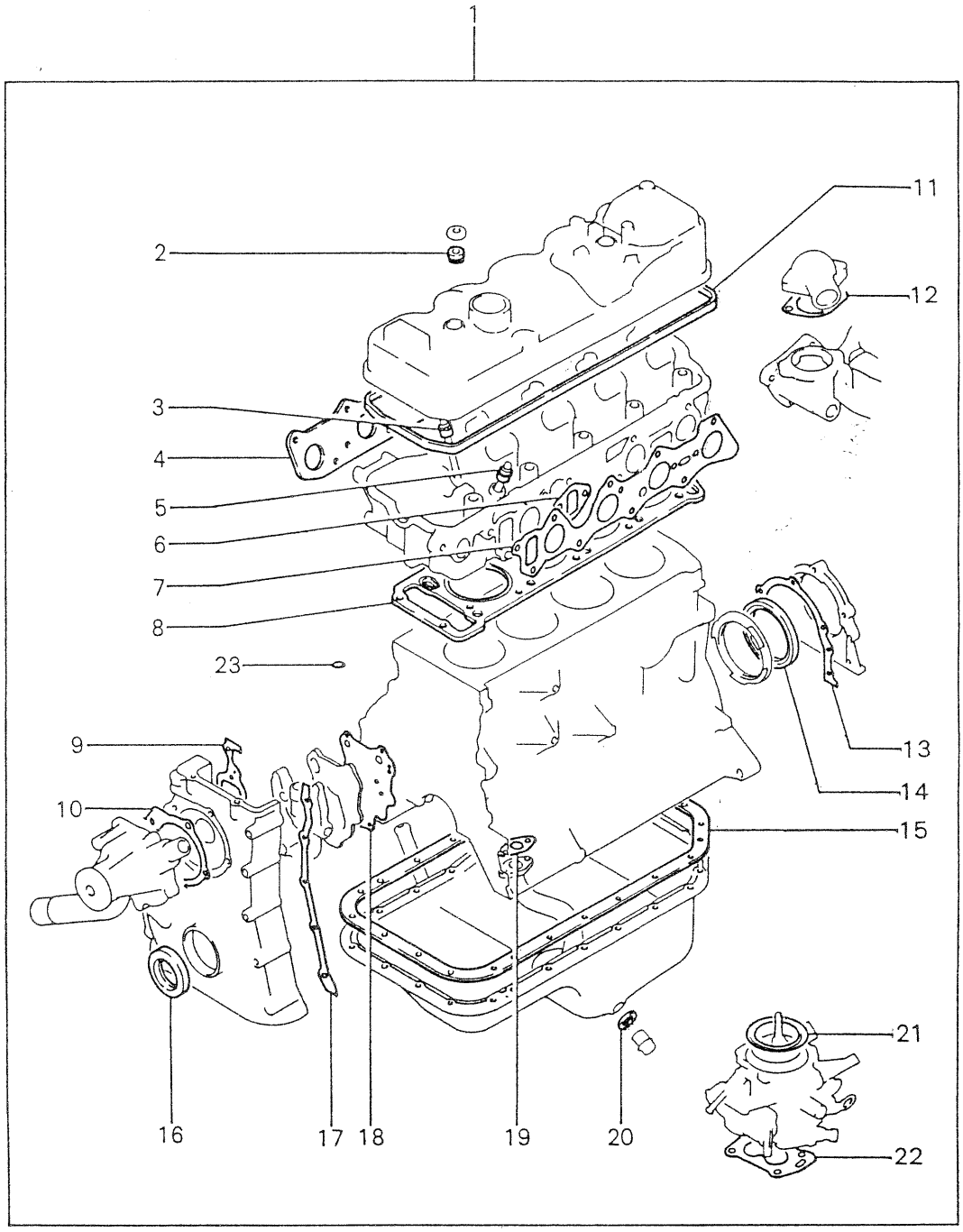

ENGINE OVERHAUL GASKET SET
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ITEM	PART NUMBER	REQ'D	DESCRIPTION
1	404-62245A	1	GASKET SET, Engine Overhaul
2	189-62245A	3	SEAL, Oil
3	237-62245A	4	SEAL, Exhaust Valve Stem
4	405-62245A	1	GASKET, Exhaust Manifold
5	237-62245A	4	SEAL, Intake Valve Stem
6	375-62245A	2	GASKET, Fuel Pump
7	341-62245A	1	GASKET, Intake Manifold
8	186-62245A	1	GASKET, Cylinder Head
9	152-62245A	1	GASKET, Chain Case- Right Hand
10	290-62245A	1	GASKET, Water Pump
11	198-62245A	1	GASKET, Rocker Cover
12	62575	1	GASKET
13	113-62245A	1	GASKET, Oil Seal Case
14	112-62245A	1	SEAL, Rear Oil
15	131-62245A	1	GASKET, Oil Pan
16	158-62245A	1	SEAL, Front Oil
17	161-62245A	1	GASKET, Chain Case- Left Hand
18	283-62245A	1	GASKET, Oil Pump
19	266-62245A	1	GASKET, Oil Screen
20	130-62245A	1	GASKET, Oil Drain Plug
21			Not Applicable
22			Not Applicable
23			Not Aplicable