225" 6 CYLINDER ENGINE

IDENTIFICATION CODING

ENGINE IDENTIFICATION

Engine Identification number is stamped on block below No. 6 spark plug. First letter indicates model year (A). Next 3 numbers designate engine cubic inch displacement.

Application	Numerals
225" (3.7L) 1 & 2-Bbl.	225

SPECIAL ENGINE MARKS

Information identifying undersize and oversize components will be found on various locations on engine. Coding and location is as follows:

- "M" or "R" followed by number indicates main or rod journals .001" undersize. Found on center counterweight.
- "M-10" or "R-10" indicates all main or rod journals are .010" undersize. Found on center counterweight.

"A" – Indicates all cylinder bores .020" oversize.
"♦" – Indicates .008 oversize tappets.
"O/S" – Indicates .005" oversize valve stems and is stamped on the thermostat boss at front of cylinder head.

ENGINE REMOVAL

See Engine Removal at end of ENGINE Section.

CYLINDER HEAD & MANIFOLDS

MANIFOLD ASSEMBLY

Removal – Disconnect all lines, hoses and linkage to air cleaner and carburetor. Remove air cleaner and disconnect exhaust pipe at manifold. Remove carburetor and manifolds as an assembly. Remove three screws securing intake manifold to exhaust manifold and separate.

Installation – **1)** Install new gasket between intake and exhaust manifold and install three screws securing manifolds together. DO NOT tighten screws at this time. Position manifold assembly on cylinder head using new gasket.

2) Install steel conical washer with cup side against nut. Washers spanning intake and exhaust flanges and brass washers must be flat against manifold. Tighten three intake to exhaust screws starting with inner screw.

3) Start at center of manifold assembly and work outward, tightening manifold nuts. Reinstall carburetor, linkage, hoses and air cleaner.

CYLINDER HEAD

Removal – **1)** Drain cooling system and remove air cleaner. Remove all wiring, hoses, lines and linkage from carburetor, distributor, manifolds and cylinder head.

2) Disconnect exhaust pipe at manifold and remove with carburetor as an assembly. Remove rocker arm cover, rocker arm and shaft assembly. Remove push rods and identify to insure installation in original location. Remove cylinder head bolts, cylinder head and gasket.

Installation – Clean all gasket surfaces and coat new gasket with suitable sealer. Install gasket and cylinder head on block. Install head bolts and tighten in two steps to specifications. See *Fig. 1*.

NOTE – *Do not retighten bolts after engine has been operated when steel head gaskets are used.*

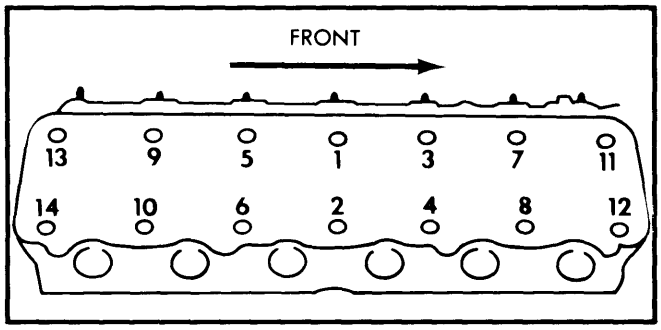

Fig. 1 Cylinder Head Tightening Sequence.

VALVES

VALVE ARRANGEMENT

E-I-E-I-E-I-I-E-I-E-I-E (front to rear).

VALVE GUIDE SERVICING

Wear Check – **1)** Remove valve spring and install suitable sleeve tool (C-3973) over valve stem and install valve in cylinder head. Attach dial indicator to cylinder head and position at right angle to valve stem being measured.

2) Total sideplay should not exceed .017". If dial reading is excessive or stems are scuffed or scored, ream guides for installation of valves with oversize stems.

Servicing – Ream guides to next oversize valve stem if necessary. Oversize valves are available in .005", .015" and .030" oversize.

NOTE – *Do not attempt to ream guides from standard to .030" oversize in one step. Use step procedure to obtain the .030" oversize.*

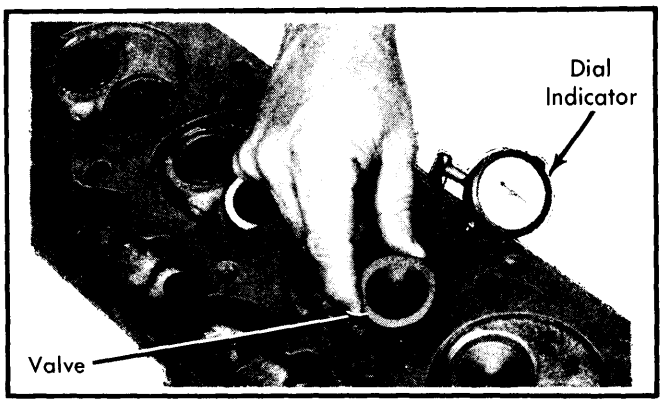

Fig. 2 Measuring Valve Stem-to-Guide Clearance.

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225" 6 CYLINDER ENGINE (Cont.)

VALVE STEM OIL SEALS

Cup type seal is used on all valves. Long seal is used on intake valve and short seal is used on exhaust valve. If seals are removed for any reason, new seals must be used upon assembly.

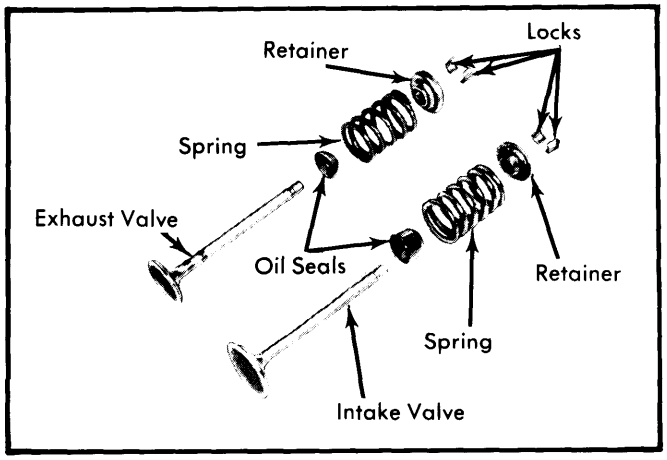

Fig. 3 Intake & Exhaust Valve Assemblies

VALVE SPRINGS

Removal – With cylinder head removed, compress valve springs using valve spring compressor C-3422A (or equivalent). Remove valve retaining locks, spring retainers, springs and cup seals.

NOTE – *Remove burrs from valve stem lock grooves to prevent damage to valve guides if valves are removed.*

Inspection – 1) Valve springs should be tested whenever they are removed from cylinder head. Using valve spring tester C-647 (or equivalent), check springs against specifications. See *Valve Spring Table*.

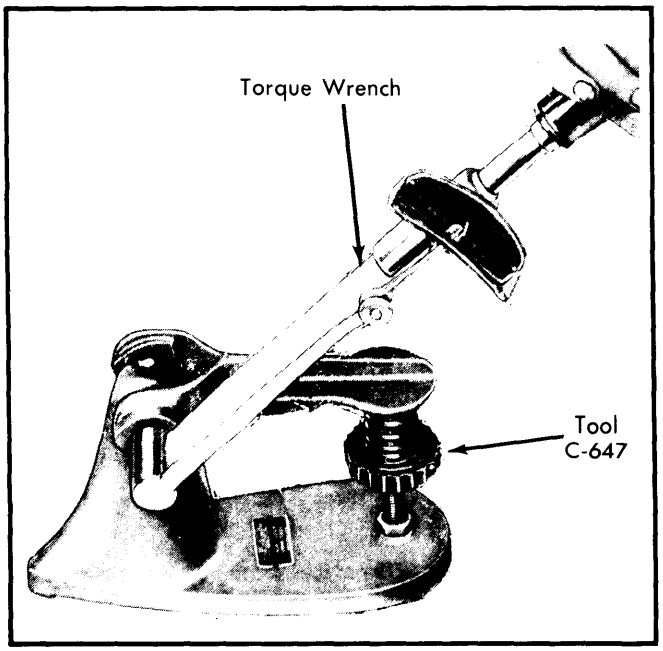

Fig. 4 Testing Valve Spring Tension

2) Replace springs if they do not meet specifications. Inspect each spring for squareness using a steel square and flat surface. Replace spring if more than 1/16" out-of-square.

Installation – 1) Coat valve stems with engine oil and insert in cylinder head. Install new cup seals, valve springs and retainers.

2) Install springs so closed coils are against cylinder head. Compress valve springs using compression tool and install retaining locks.

VALVE SPRING INSTALLED HEIGHT

1) If valves or seats are regrouped, measure installed height of springs. Measurement is taken from bottom surface of spring seat in cylinder head to bottom surface of spring retainer.

NOTE – *If spacers are installed, measure from top of spacer.*

2) Installed height should be 1 11/16"-1 5/8". If valve height is greater than 1 43/64", install 1/16" spacer at head counterbore to correct spring height.

ROCKER ARM ASSEMBLY

Stamped steel rocker arms are arranged on single rocker arm shaft. Hardened steel spacers are used between pairs of rocker arms. Shaft is supported and attached to seven mounts on cylinder head. See *Fig. 5* for assembly of parts, noting the following:

- The flat end of shaft and oil hole must be installed upward and toward front of engine.
- Install long retainer at center position and long shaft bolt at rear of engine.
- Shaft retainers must seat on rocker shaft and not on extended bushing of rocker arm.

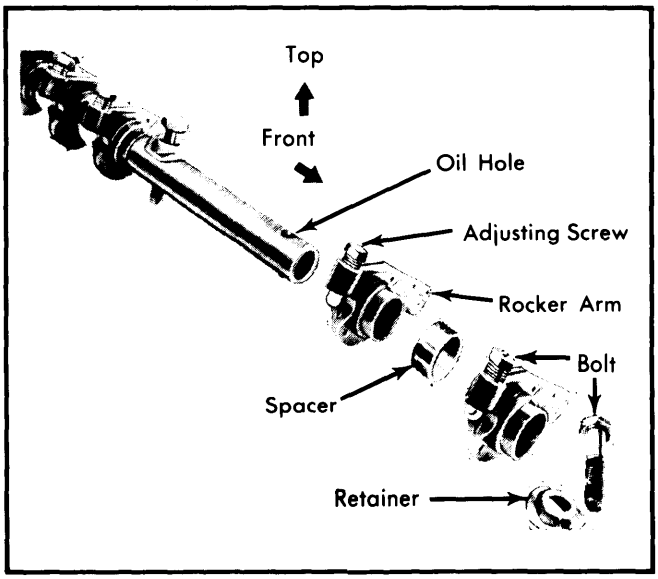

Fig. 5 Exploded View of Front Rocker Arm Shaft Assembly

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225" 6 CYLINDER ENGINE (Cont.)

MECHANICAL VALVE LIFTER ADJUSTMENT

1) Temporarily set intake valve clearance to .012" and exhaust valve clearance to .028". Operate engine until normal operating temperature is reached (approximately 195° F water temperature).

2) Allow engine to idle at 550 RPM at operating temperature for five minutes. Now adjust intake valve clearance to .010" and exhaust valve clearance to .020".

PISTONS, PINS & RINGS

OIL PAN

See Oil Pan Removal at end of Engine Section.

PISTON & ROD ASSEMBLY

Removal – 1) With cylinder head and oil pan removed, use ridge cutter C-3012 (or equivalvent), to remove any ridge or deposits on upper end of cylinder bore.

NOTE – *Piston must be at bottom of stroke and covered with cloth to collect cuttings.*

2) Inspect connecting rods and caps for cylinder identification and mark as necessary. Rotate crankshaft so each connecting rod is centered in cylinder bore for removal.

3) Remove rod cap and push piston and rod assembly out top of cylinder block, taking care not to nick crankshaft journal or cylinder wall. Install rod caps on mating rods.

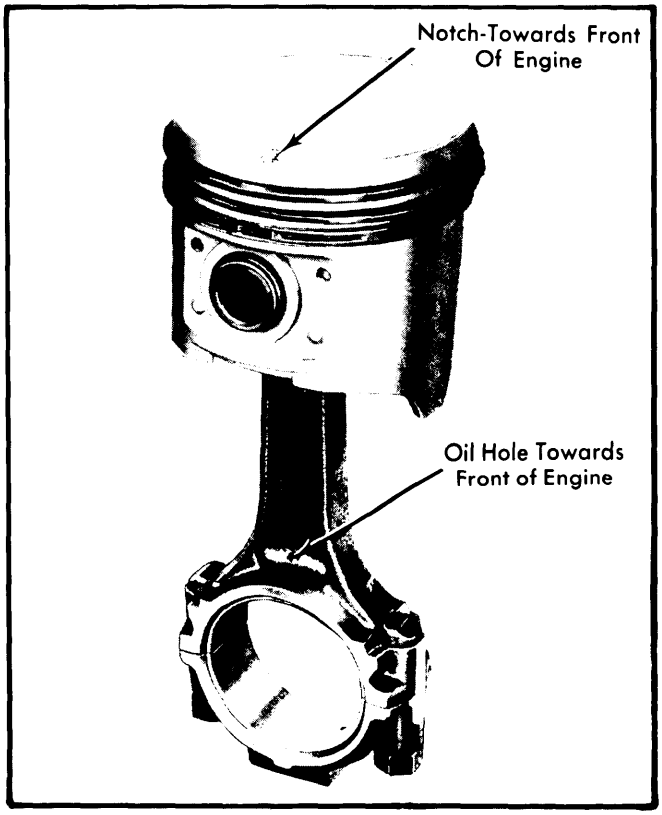

Fig. 6 View Showing Correct Assembly of Rod-to-Piston

Installation – 1) Compression ring gaps must be located on piston so they will be on left side of engine and staggered about 60° apart.

NOTE – *Neither gap should line up with oil ring gaps and identification "TOP" on each compression ring should face top of piston.*

2) Rotate oil ring expander so gaps are on right side of engine and rotate steel rails so gaps are opposite (positioned above piston pin holes).

3) Lightly coat cylinder bores, pistons and rings with engine oil, slide ring compressor over piston and tighten.

NOTE – *Do not allow position of rings to change during this operation.*

4) Install each piston and rod assembly, with notch on head of piston head facing front of engine and oil hole in connecting rod toward right side of engine, in its respective bore and guide connecting rod onto crankshaft journal.

5) Tap piston head lightly with hammer handle to seat connecting rod and bearing against crankshaft. Install rod cap with bearing, nut and tighten.

FITTING PISTONS

1) With piston and cylinder bores dry and clean, measure for piston-to-cylinder wall clearance. Measurements should be taken at room temperature (70° F).

2) Measure piston diameter at top of skirt, 90° to piston pin axis. Measure cylinder bore halfway down cylinder and 90° to crankshaft center line.

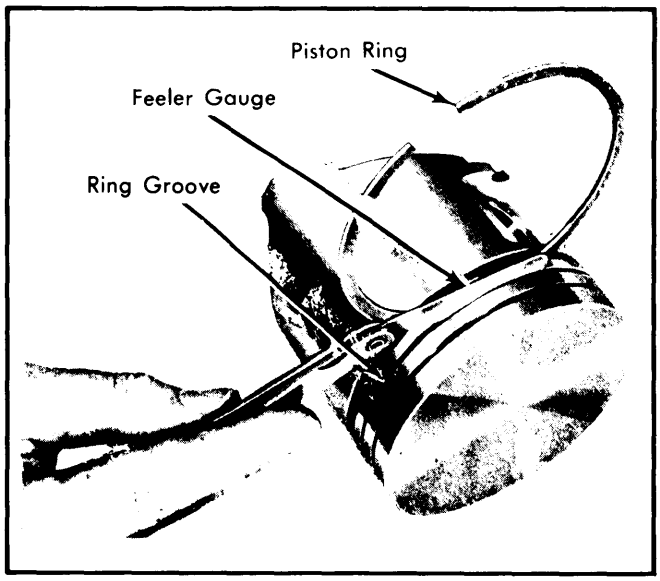

Fig. 7 Measuring Ring Side Clearance

3) Check cylinder bore for taper or out-of-round condition using a micrometer or cylinder gauge. Cylinder bore must not show more than .005" out-of-round or taper more than .010". If taper and out-of-round are not within specifications, or cylinder walls are scuffed or scored, cylinders should be honed before installing new rings.

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225" 6 CYLINDER ENGINE (Cont.)

4) If cylinders are honed, they must be thoroughly washed with soapy water before installing pistons. For cylinders which have been honed or rebored, piston assemblies are available in standard and .020" oversize.

5) Check clearance between piston and cylinder walls, clearance must be .0005-.0015". Check ring end gap in cylinder bore with a feeler gauge. Ring must be square in bore and about 2" from bottom of cylinder bore.

6) Check ring side clearance in ring groove of piston with a feeler gauge. Steel rail service oil ring should be free in groove and all ring grooves in piston must be clean.

PISTON PINS

Removal – Arrange piston pin removal tool C-3724 (or equivalent), as shown in *Fig. 8*. Spring must be removed from anvil. Install nut loosely on main screw. When pin falls from connecting rod, stop press to prevent damage to bottom of anvil.

Installation – 1) Measure piston pin fit in the piston. If pin is not a sliding fit in piston at 70° F, piston and piston pin must be replaced as an assembly. Lubricate piston pin holes and connecting rods. Arrange pin removal tool C-3724 parts for installation of piston pin as shown in *Fig. 9*.

2) Install spring inside pilot and install spring and pilot in the anvil. Position piston with notch up and oil hole in connecting rod so hole faces front of engine. Press pin into position until pin bottoms against pilot on tool.

Checking Pin Fit – Arrange piston pin tool parts as for removal of pin. Place assembly in vise, attach torque wrench to nut and test torque up to 15 ft. lbs. If connecting rod moves downward on piston pin, replacement is necessary.

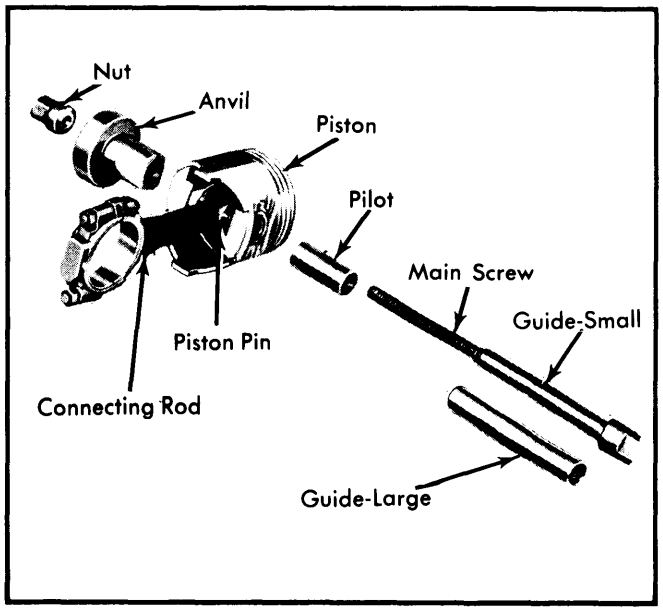

Fig. 8 Removing Piston Pin

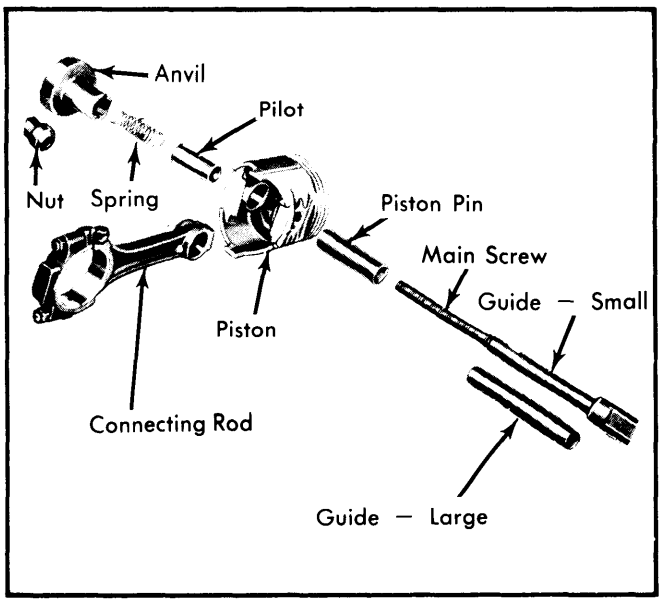

Fig. 9 Installing Piston Pin

CRANKSHAFT & ROD BEARINGS

MAIN & CONNECTING ROD BEARINGS

NOTE – *Use Plastigage method for checking bearing clearances. The following procedures are with oil pan and pump removed.*

Connecting Rod Bearings – 1) After ensuring rod caps are marked for cylinder identification, remove rod caps. Rotate crankshaft until connecting rod to be checked starts moving toward top of engine. Place strip of Plastigage across full width of lower insert at center of cap. Install bearing cap and tighten to 45 ft. lbs. Remove cap and measure width of Plastigage with INCH scale furnished.

2) New bearings are available in standard, .001", .002", .003", .010" and .012" undersize. Taper or out-of-round on any crankshaft journal should not exceed .001". Always install new bearings in pairs.

NOTE – *Never use a new bearing with an old bearing on same journal.*

3) Install bearings so small formed tang fits into machined groove in connecting rod. Install rod caps and tighten nuts.

Main Bearings – 1) Use Plastigage method to check main bearing clearances one at a time. This can be accomplished by placing a shim (minimum .010" thick) between bearing shell and bearing cap of bearings adjacent to one being checked. Tighten adjacent bearing caps to 10-15 ft. lbs. Place strip of Plastigage across full width of lower insert, ¼" off center and away from oil holes. Install bearing cap and tighten to 85 ft. lbs. Remove cap and measure width of Plastigage with INCH scale furnished. New bearings are available in standard, .001", .002", .003", .010" and .012" undersize.

NOTE – *Never use a new bearing with an old bearing on the same journal.*

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225" 6 CYLINDER ENGINE (Cont.)

2) Upper main bearings are grooved and lower main bearings are plain and are not interchangeable. Lower main bearings one, two and four are interchangeable. Upper main bearings one, two and four are interchangeable. The number 3 upper and lower main bearings are flanged to carry thrust loads and are not interchangeable with any other bearing.

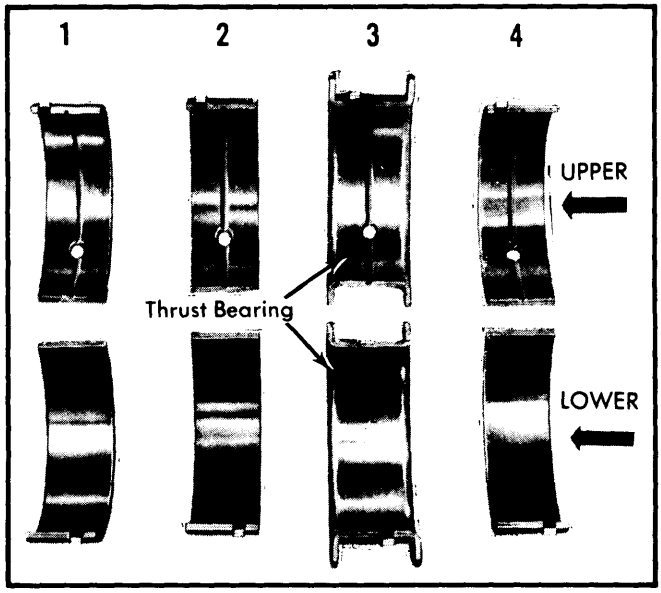

Fig. 10 Main Bearing Identification Showing Location of Thrust Bearing

3) If bearing clearances are not within limits, remove bearing cap and insert pin tool C-3059 in the oil hole of crankshaft. Rotate crankshaft clockwise to remove upper bearing. To install new bearing, slightly chamfer sharp edges from plain side and start bearing in place. Insert tool and slowly rotate crankshaft counterclockwise, sliding bearing in place. Install main bearing cap with new bearing installed and tighten.

4) Check crankshaft end play and if not within specifications, change number three main bearing. This bearing carries thrust load.

REAR MAIN BEARING OIL SEAL

New split type rubber seals may be replaced without removing the crankshaft. New type seals must be installed as a pair and cannot be used or combined with old type rope seals.

Removal – Remove upper rope seal by turning seal removal tool C-4148 (or equivalent) into end of seal and pulling out, being careful not to mar crankshaft. Remove lower seal by carefully prying from the side with a small screwdriver.

Installation – 1) Oil upper seal lightly with engine oil. Hold seal (with paint stripe to rear) tightly against crankshaft with thumb and rotate crankshaft while sliding seal into groove.

CAUTION – *Sharp edge of groove in block may shave or nick the back of seal. Care must be exercised not to damage seal lip.*

2) Install lower half of seal into lower seal retainer with paint stripe to rear. Install main bearing cap and tighten.

NOTE – *Do not use sealer or cement on seal ends or lip.*

CAMSHAFT

ENGINE FRONT COVER

Removal – 1) Drain cooling system and remove radiator from vehicle. Remove drive belts, fan and pulley from water pump hub. Using vibration damper removal tool C-3732A (or equivalent), remove damper.

2) Loosen oil pan bolts to provide clearance between pan and lower flange of cover. Remove front cover attaching bolts and cover.

Installation – 1) Check that mating surfaces of front cover and cylinder block are clean and free of burrs. Install cover with new gasket and tighten bolts. Tighten oil pan bolts with gaskets in place. Lubricate front cover seal lip with lubriplate, position vibration damper hub slot on key in crankshaft and slide hub onto crankshaft.

2) Position installing tool C-3732A and press vibration damper assembly on crankshaft. Install drive belt pulley, fan and drive belts. Install radiator and adjust belt tension and fill cooling system.

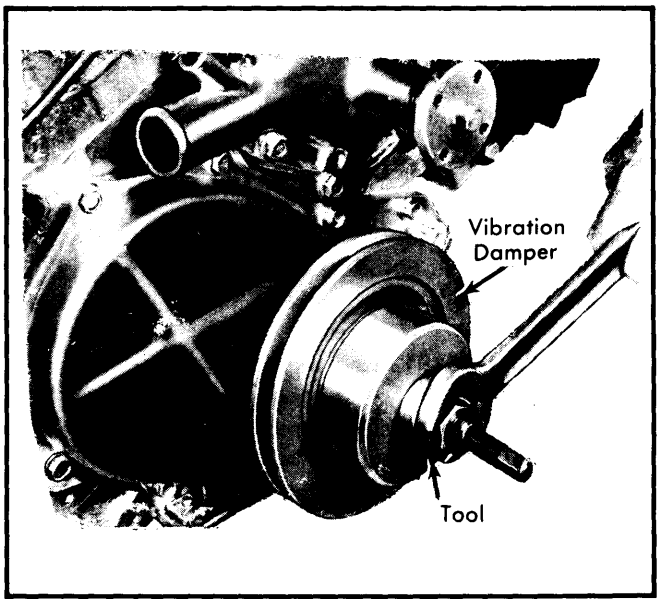

Fig. 11 Removing and Installing Vibration Damper

FRONT COVER OIL SEAL

Removal – 1) With front cover removed, use a drift and hammer to lightly tap at several positions around seal case to deform seal inward.

CAUTION – *Support front cover at seal area to prevent deforming front cover.*

2) Using vise grips, twist and pull seal at several positions to remove seal from cover.

Installation – Use seal installing tool C-4251 to press seal into front cover. Seal is properly installed when seal case is tight against face of cover.

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225" 6 CYLINDER ENGINE (Cont.)

TIMING CHAIN

Checking For Stretch – 1) Position scale next to timing chain, to measure any movement of the chain. Place torque wrench with socket over camshaft sprocket lock bolt and apply torque in direction of crankshaft rotation to remove slack. See *Fig. 12*.

NOTE – *Do not permit the crankshaft to move.*

2) Torque should be 30 ft. lbs. with cylinder head installed and 15 ft. lbs. with head removed. Apply same torque in reverse direction and measure amount of chain movement. If movement exceeds 1/8", replace timing chain. See *Fig. 12*.

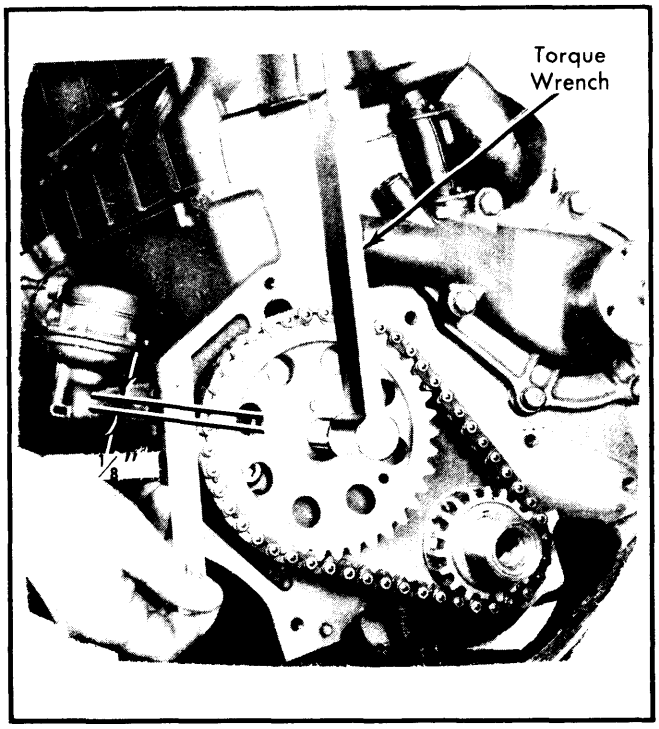

Fig. 12 Measuring Timing Chain Stretch

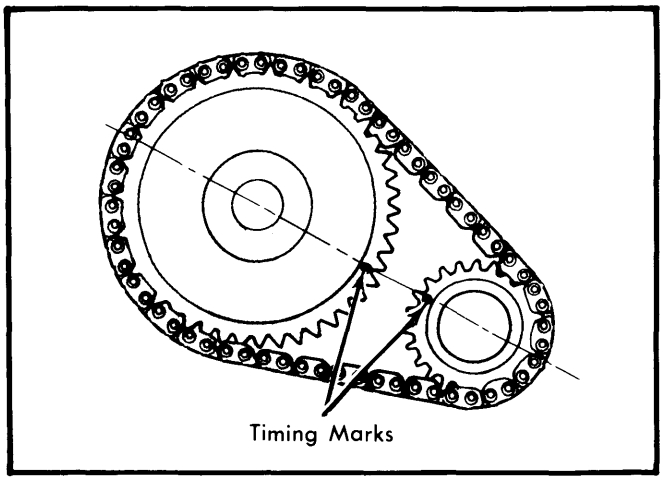

Fig. 13 Timing Chain Sprocket Alignment

Removal & Installation – Remove camshaft sprocket attaching bolt and remove timing chain with camshaft sprocket. Turn crankshaft to line up centerline of camshaft and crankshaft with the timing mark on crankshaft sprocket See *Fig. 13*. Install camshaft sprocket and timing chain with timing marks aligned. Tighten camshaft sprocket bolt.

CAMSHAFT

Removal – With engine removed from vehicle, remove cylinder head and tappets. Remove fuel pump, distributor and oil pump. Remove front cover and timing chain. Install long bolt into front of camshaft and carefully remove camshaft.

CAUTION – *Take care not to damage bearings with cam lobes.*

Installation – 1) Lubricate camshaft lobes and bearing journals and insert camshaft into cylinder block. Check all tappets with a straight edge for crown. If any negative crown (dishing) is observed, tappet must be replaced. Install timing chain and sprockets, front cover, fuel pump and oil pump. Install tappets and cylinder head.

2) Install distributor, timing the engine as follows: Rotate crankshaft until mark on inner edge of crankshaft pulley is in line with the TDC mark on front cover. No. 1 piston should be at top dead center of compression stroke (both valves closed). With distributor "O" rings in position, hold distributor over mounting pad and turn rotor to point forward. Install distributor so that when fully seated on engine, the gear has spiraled to bring rotor to 5 o'clock position. Turn distributor so rotor is positioned directly under No.1 tower of distributor cap. Install and tighten distributor hold-down bolt.

CAMSHAFT BEARINGS

Removal – With camshaft removed, drive out rear cam bearing welch plug. Install proper size adapters and horseshoe washers of tool C-3132A, at back of each bearing.

Installation – 1) Use camshaft bearing installation tool to slide bearing over proper adapter and install bearing into place.

NOTE – *Camshaft bearing oil hole must be in exact alignment with drilled oil passage of main oil bearing.*

2) Insert remaining bearings in similar manner. No. 1 bearing must be installed 3/32" inward from front face of block. Apply sealing compound to new welch plug at rear of camshaft. Be sure plug does not leak.

ENGINE OILING

Crankcase Capacity – On all models, capacity is 5 quarts. Add one quart when changing filter.

Oil Filter – Replace at first oil change and every other change thereafter.

Normal Oil Pressure – 30-70 psi at 2000 RPM.

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225" 6 CYLINDER ENGINE (Cont.)

Pressure Regulator Valve – In oil pump body. Not adjustable.

ENGINE OILING SYSTEM

1) Rotor type oil pump mounted externally on right side of crankcase. Oil pump assembly consists of oil pump, oil filter and oil pressure regulator. Pump draws oil from pan through fixed strainer and intake pipe screwed into crankcase wall at pump mounting pad.

2) Pump delivers oil directly into main oil gallery extending along right side of crankcase.

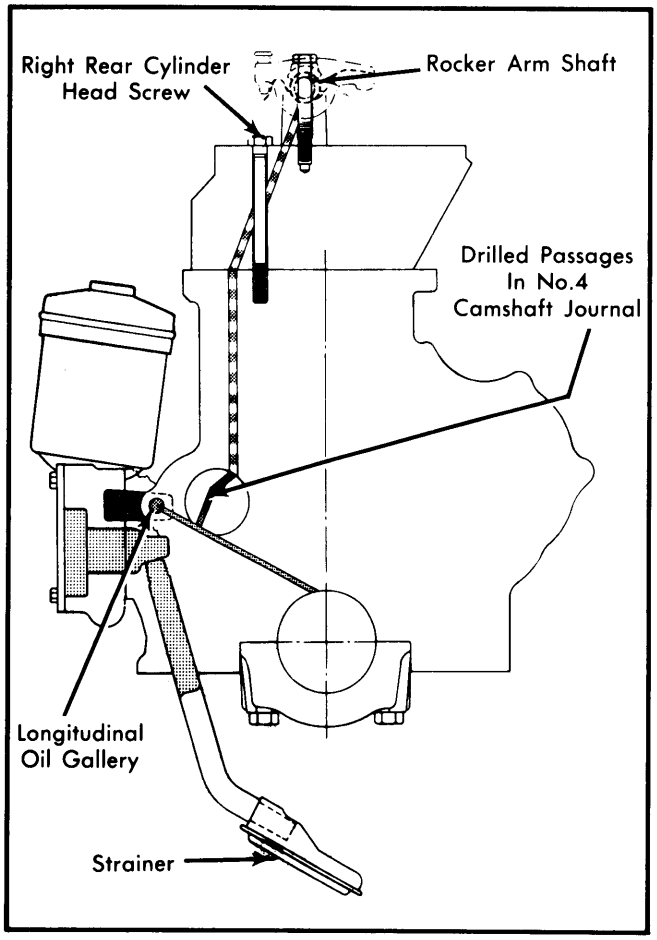

Fig. 14 Engine Oiling System

Rocker Arms & Valves – Transverse channel in rear camshaft journal feeds oil from rear camshaft bearing up through channel in block and cylinder head to rear rocker arm shaft bracket (oil flows around rear bracket bolt into rocker shaft). Trough on upper surface of rocker arm lubricates push rod seats and valve stems.

Crankshaft Bearings – All main bearings are lubricated as shown in illustration. Connecting rod bearings are lubricated by holes drilled in the crankshaft between main and connecting rod journals.

OIL PUMP

Disassembly – Remove pump cover and seal ring. Press off drive gear while supporting gear to eliminate load on aluminum body of pump. Remove outer rotor and inner rotor with shaft. Remove oil pressure relief valve plug, spring and valve.

Inspection – Clean all parts thoroughly. Mating face of oil pump cover should be smooth and must be replaced if scratched or grooved. Measure all clearances indicated in Oil Pump Specifications table and replace parts as follows:

1) Replace front cover if pump cover wear is excessive. Replace outer rotor if thickness and diameter are not within specifications. Replace inner rotor if thickness is not within specifications. Replace oil pump body if outer rotor-to-pump body is not within specifications.

2) Replace pump body if clearance over rotors is not within specifications. Replace both inner and outer rotors if tip clearance between rotors is not within specifications.

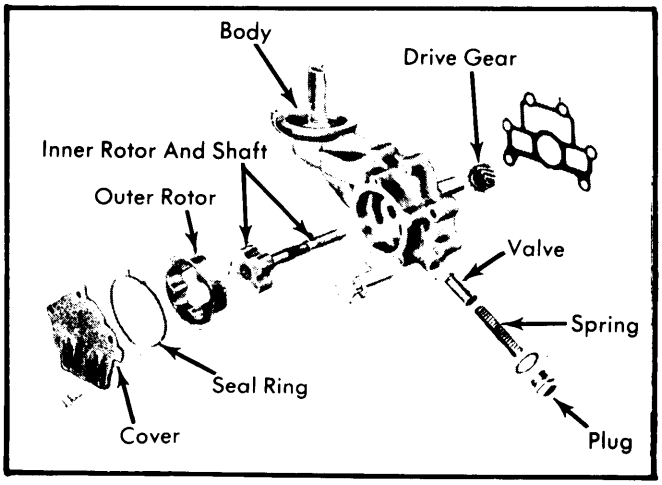

Fig. 15 Exploded View of Oil Pump Assembly

3) Relief valve spring should have free length of 2¼". Spring should test to 22.3-23.3 lbs. when compressed to 1 19/32". Replace spring which does not meet specifications.

Oil Pump Specifications

Pump Cover Wear	.0015" Max.
Inner & Outer Rotor Thickness	.649" Min.
Outer Rotor Diameter	2.469" Min.
Clearance Over Rotors	.004" Max.
Outer Rotor-to-Pump Body	.014" Max.
Tip Clearance Between Rotors	.010" Max.

Reassembly – Assemble pump in reverse order of disassembly using new parts as required. Prime oil pump before installation by filling rotor cavity with engine oil.

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225" 6 CYLINDER ENGINE (Cont.)

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Year	Displ. Cu. Ins.	Carburetor	HP at RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore	Stroke
1980	225"	1 & 2-Bbl.	.....	.....	8.4:1	3.40"	4.125"

VALVES

Engine & Valve	Head Diam.	Face Angle	Seat Angle	Seat Width	Stem Diameter	Stem Clearance	Valve Lift
225"							
Int.	1.615-1.625"	45°	45°	.070-.090"	.372-.373"	.001-.003"	.406"
Exh.	1.355-1.365"	43°	45°	.040-.060"	.371-.372"	.002-.004"	.414"

PISTONS, PINS, RINGS

Engine	PISTONS	PINS		RINGS		
	Clearance	Piston Fit	Rod Fit	Rings	End Gap	Side Clearance
225"	.0005-.0015"	.00035-.00085"	.0007-.0017"	1 & 2 3	.010-.020" .015-.055"	.0015-.003" .0002-.005"

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

Engine	MAIN BEARINGS				CONNECTING ROD BEARINGS		
	Journal Diam.	Clearance	Thrust Bearing	Crankshaft End Play	Journal Diam.	Clearance	Side Play
225"	2.7495-2.7505"	.0002-.0022"	No.3	.002-.009"	2.1865-2.1875"	.0002-.0022"	.006-.025"

VALVE SPRINGS

Engine	Free Length	PRESSURE (LBS.)	
		Valve Closed	Valve Open
225"	1.92"	49-57@1 11/16"	137-150@1 5/16"

CAMSHAFT

Engine	Journal Diam.	Clearance	Lobe Lift
225"		.001-.003"	Int. .271"
No.1	1.998-1.999"		Exh. .276"
No.2	1.982-1.983"		
No.3	1.967-1.968"		
No.4	1.951-1.952"		

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs.
Camshaft Lock Bolt	50
Connecting Rod Cap Nuts	45
Cylinder Head Bolts①	70
Exhaust Manifold Nuts	10
Front Cover Bolts	17
Fuel Pump Bolts	30
Intake-to-Exh. Manifold Bolts	17
Main Bearing Cap Bolts	85
Manifold-to-Cylinder Head Bolts	20
Oil Pump Attaching Bolts	17
Oil Pump Cover Bolts	8
Rear Main Bearing Seal Retainer	30
Rocker Arm Shaft Bolts	25
Water Pump Bolts	30
Rocker Arm Cover Bolts	4
Oil Pan Bolts	17

① — Tighten in 2 steps; First to 35 ft. lbs., then to 70 ft. lbs. See *Fig. 1*.

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