

1800 cc 4 CYLINDER

ENGINE CODING

ENGINE IDENTIFICATION

Engine serial number is stamped on a machined pad on right side of cylinder block. 5th digit of VIN (located at top left of instrument panel) also identifies engine.

ENGINE, CYLINDER HEAD & MANIFOLD

ENGINE

Removal — 1) Remove battery cables and hood. Drain cooling system and crankcase. Remove air cleaner by disconnecting PCV, ECS, AIR and CCS hoses.

2) Disconnect the CCS hot air hose, remove manifold cover and disconnect alternator wiring at connector. Remove exhaust pipe from manifold. Free clutch control cable by turning adjusting nut. Disconnect heater hose at engine and from heater and joint. Disconnect control cable and remove water cock assembly with heater hose. Remove left engine mounting nut and install engine hanger (J-26555) on exhaust manifold stud bolts.

3) Disconnect ground cable from engine, fuel hoses from carburetor and high tension cable from coil. Disconnect vacuum hose at rear of manifold, accelerator control cable from carburetor, and starter motor connections. Disconnect the thermo unit, oil pressure switch, and distributor wiring at connector.

4) Disconnect carburetor solenoid valve lead and automatic choke wiring at connector. Disconnect backup light switch at rear of engine. Disconnect ECS hose from oil pan. Remove right engine mounting nut and stopper plate.

5) Disconnect water hoses from engine and radiator. Remove fan shroud and radiator assembly. Remove gearshift lever assembly. Remove parking brake return spring and disconnect brake cable. Disconnect propeller shaft from transmission.

6) Remove clutch cable heat protector, clutch return spring, and clutch control cable. Remove exhaust pipe bracket from transmission. Remove front side exhaust pipe. Disconnect speedometer cable. Remove four rear engine mounting bolts after lifting engine slightly.

7) Check that all parts have been properly disconnected or removed, and remove engine toward front of vehicle.

Installation — Install all components in reverse order of removal. Check that crankcase and cooling system are refilled. Adjust clutch pedal free play. Check engine for leaks after running at idle. Adjust fan belt tension, distributor breaker point gap, valve clearances, ignition timing and engine idle.

EXHAUST MANIFOLD

Remove air cleaner and hot air hose. Remove manifold cover, EGR pipe and exhaust pipe from manifold, and exhaust manifold from engine. To install, reverse removal procedure, using new gaskets.

INTAKE MANIFOLD

Removal — 1) Drain cooling system completely. Remove air cleaner (See Engine Removal).

NOTE — Incomplete draining will permit coolant to enter cylinders when intake manifold is removed.

2) Remove the following parts from intake manifold: water top hose, fuel hose, vacuum hose, heater hose (also from connector under instrument panel). Disconnect accelerator control cable and vacuum hose from carburetor. Disconnect automatic choke and solenoid wiring at connectors, PCV hose from cylinder head cover, and EGR pipe from EGR valve. Disconnect AIR vacuum hose from manifold. Remove intake manifold from engine.

Installation — Reverse removal procedure. Use new gaskets and fill cooling system with equal amounts of water and anti-freeze.

CYLINDER HEAD

Removal — 1) Drain cooling system, remove air cleaner, and all parts attached to intake manifold. Remove manifold cover.

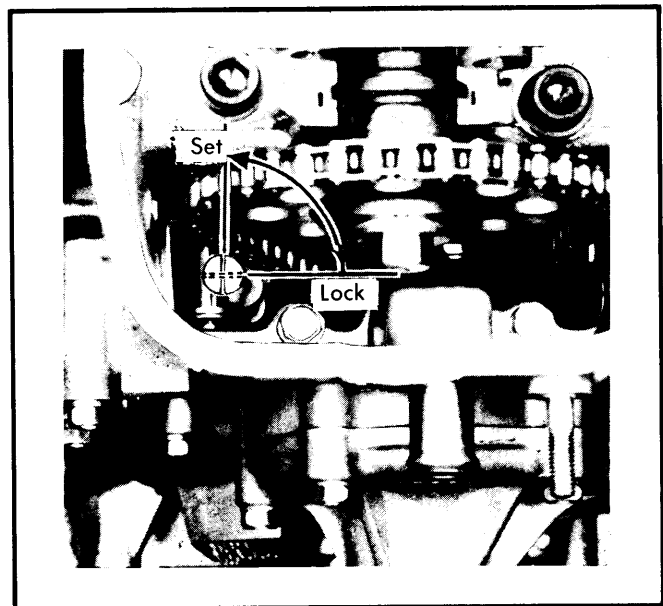


Fig. 1 Locking Timing Chain Adjuster

2) Remove EGR pipe clip from rear of cylinder block, and disconnect exhaust pipe from manifold. Remove cylinder head cover, lock timing chain in place (See Fig. 1), and separate sprocket from camshaft. Disconnect air hoses from check valve and AIR pump. Remove air bypass valve and bracket, and remove two bolts securing front cover and cylinder head. Loosen cylinder head bolts in sequence shown in Fig. 2. Remove cylinder head with exhaust and intake manifolds.

1800 cc 4 CYLINDER (Cont.)

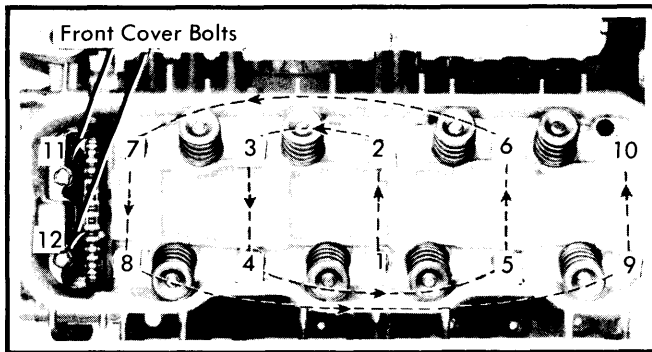


Fig. 2 Cylinder Head Bolt Loosening & Tightening Sequence

NOTE — Do not separate camshaft timing sprocket from chain. Keep sprocket in chain, and chain between guide and tensioner.

Installation — 1) Install components in reverse order of removal. Apply a thin coat of liquid gasket evenly on clean block face around sprocket hole. Install a new cylinder head gasket with "TOP" mark up, using dowels for proper alignment. See Fig. 3.

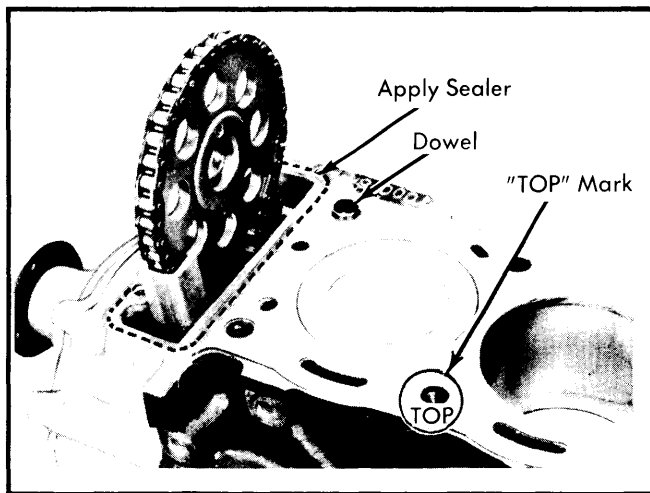


Fig. 3 Installing Liquid Gasket & Head Gasket

2) Align cylinder head over dowels, oil cylinder head bolt threads and install bolts. Install two bolts securing front cover to cylinder head. Tighten cylinder head bolts in sequence (See Fig. 2) in two stages. Tighten securely front cover-to-cylinder head bolts.

Cylinder Head Bolt Tightening Specifications

	Ft. Lbs. (mkg)
Step One	61 (8.4)
Step Two	72 (9.9)

VALVES

VALVE ARRANGEMENT

E-I-I-E-E-I-I-E

ROCKER ARM ASSEMBLY & CAMSHAFT

Removal — 1) Remove air cleaner and disconnect accelerator control cable from carburetor. Pull out three clips and high tension cables from head cover. Disconnect AIR vacuum hose and PCV hose. Remove head cover.

2) Align mark on camshaft with mark on No. 1 rocker arm shaft bracket by turning crankshaft, Fig. 4. Lock the automatic chain adjuster in free state, by pressing downward on pin while turning it 90 degrees clockwise (See Fig. 1).

3) Remove bolt and slip timing sprocket off camshaft. Keep chain on sprocket and support sprocket on chain guide and tensioner. Loosen nuts on rocker arm shaft brackets in stages, starting with the outer brackets. Remove rocker arm assembly and camshaft from cylinder head.

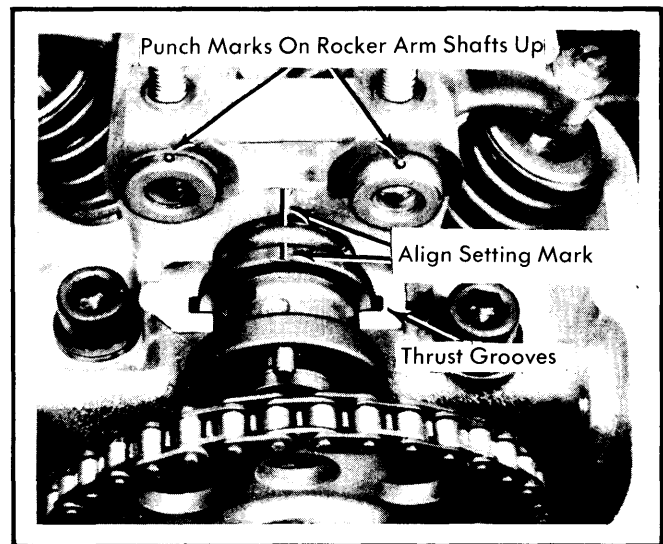


Fig. 4 Installing Camshaft & Rocker Arm Assembly

Installation — 1) Lubricate camshaft and rocker arm assemblies well prior to installation. Install camshaft, aligning thrust grooves, Fig. 4. Be sure punch marks on rocker arm shafts are in upward position.

2) Install rocker arm shaft bracket assembly and align camshaft mark with mark on No. 1 rocker arm shaft bracket. See Fig. 4. Tighten rocker arm shaft bracket nuts to 16 ft. lbs. (2.2 mkg) torque, while holding rocker arm springs with an adjustable wrench.

3) Align crankshaft pulley groove with TDC mark ("O" mark) on front cover. Be sure No. 4 cylinder (rear) is at TDC. Align sprocket hole with camshaft pin. Install sprocket and tighten bolt to 58 ft. lbs. (8.02 mkg). Set automatic chain adjuster by turning pin 90 degrees counterclockwise (See Fig. 1). Be sure chain is tensioned.

1800 cc 4 CYLINDER (Cont.)

VALVE GUIDE SERVICING

1) Using valve spring compressor (J-26513), remove valve collets, upper seats, and outer and inner springs. Remove seals and lower seat springs. Check stems and guides for wear and clearance. Do not remove guides unless they are to be replaced.

2) To remove guides, use driver (J-26512) to drive guide upward. Drive new guide in until it extends 0.6378" (16.2 mm) above cylinder head, (See Fig. 5). Be sure valve moves freely in guide. Install seals over guides and reassemble.

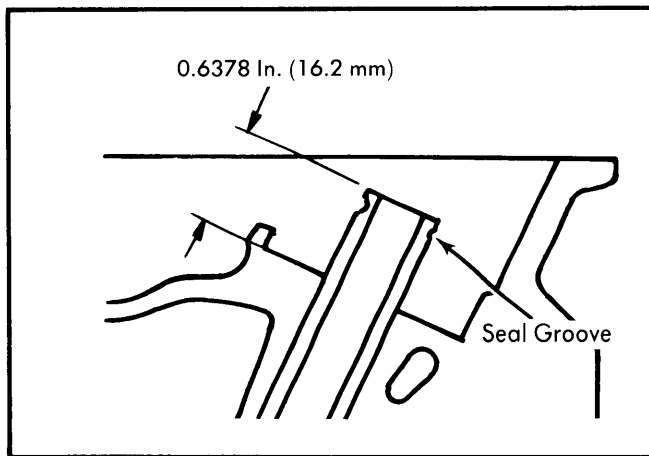


Fig. 5 Installing Valve Guide to Proper Depth

VALVE FACE AND SEAT

1) To replace valve seat insert, weld end of welding rods to several portions of inner face of insert. Allow cylinder head to cool. Apply shock load to welding rods and pull out inserts. Clean insert face area of cylinder head and heat with steam. Chill new insert on dry ice and install in cylinder head.

2) Cut valve seat face with 15°, 45°, and 75° cutters to achieve specified valve seat contact width. Grind valves to an angle of 45° and lap valve and seat to specified width.

VALVE CLEARANCE ADJUSTMENT

1) Check rocker arm shaft bracket nuts for 16 ft. lbs. (2.2 mkg) torque. Bring No. 1 piston (front) to TDC on compression stroke (notched line on crankshaft pulley aligns with "0" mark on front cover). Check clearances of No. 1 and 2 intake valves and No. 1 and 3 exhaust valves.

2) Turn crankshaft one full turn until No. 4 piston (rear) is at TDC on compression stroke, and check clearances of No. 3 and 4 intake valves and No. 2 and 4 exhaust valves.

3) Adjust intake valves to .006" (.15 mm) and exhaust valves to .010" (.25 mm).

PISTONS, PINS & RINGS

OIL PAN

Removal — Remove oil pressure switch from block and remove 14 bolts and 6 nuts holding pan to block. Remove dust cover.

Installation — Apply liquid gasket to points shown in Fig. 6. Place oil pan gasket on cylinder block, aligning bolt holes. Install and tighten bolts and nuts to 3.6 ft. lbs. (.5 mkg). Check gasket position and install dust cover on the rear plate.

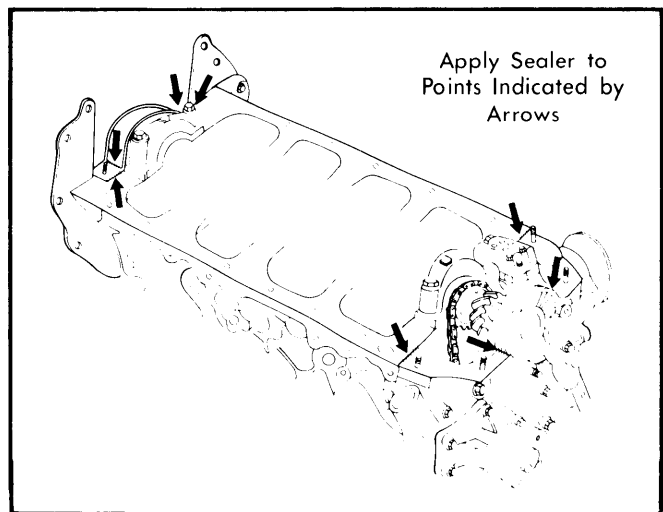


Fig. 6 Installing Oil Pan & Gasket

PISTON & ROD ASSEMBLY

Removal — Remove cylinder head and oil pan. Remove carbon ridge from cylinder bore. Remove bearing and cap from connecting rod. Remove piston and rod assembly by pushing upward with wooden handle of hammer.

NOTE — Remove one piston at a time and mark piston, rod, and bearings with their cylinder numbers.

Installation — 1) Turn crankshaft so that the crankpin of No. 1 cylinder (front) is in uppermost position. Install bearings with tangs inserted in notches in rod and cap. Oil bearing surfaces and outer contact areas of piston and rings.

2) Arrange ring gaps as shown in Fig. 7. Mark on head of piston should point toward front of engine. Using ring compressor, push piston head in until connecting rod contacts crankpin. Head of piston should be approximately .016" (.4 mm) below face of block when at TDC.

3) Face of connecting rod with cylinder number mark should be toward starter side of engine. Align number marks on connecting rod cap and rod and torque nuts to 33 ft. lbs. (4.6 mkg).

1800 cc 4 CYLINDER (Cont.)

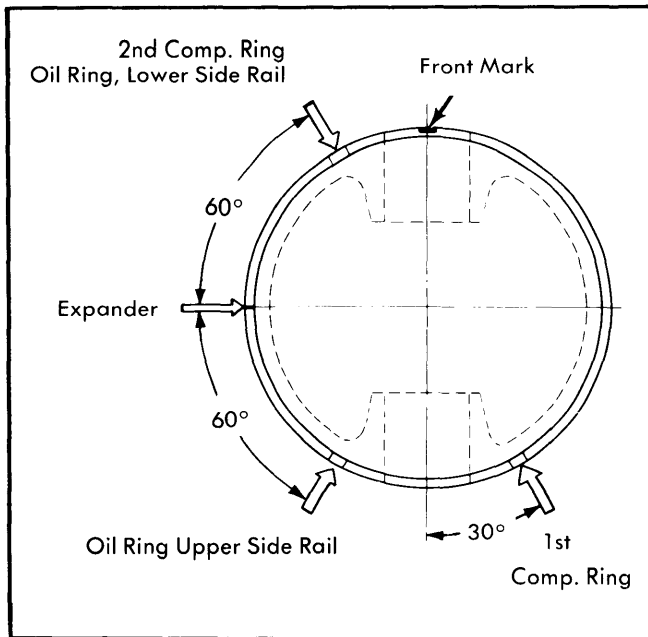


Fig. 7 Piston Ring Position & Piston Marking

4) After piston and rod assembly is installed in No. 1 cylinder, proceed with No. 4, No. 2, and No. 3 cylinders in sequence. After bearing nuts are tightened, check that crankshaft turns smoothly.

PISTON PINS

Do not remove piston from connecting rod unless replacing parts. Always use new piston pin. Check piston pin hole in piston and connecting rod for damage. If pin is to be removed, remove rings and use pin remover (J-25270-45) to press pin from rod. Position piston so that marks on head and notches in connecting rod point upward. Use same position and tool for removal and installation.

FITTING PISTONS

1) Measure cylinder bores .32" (8.1 mm) and 2.76" (70.1 mm) below cylinder block face. Measure both in line and at right angles to crankshaft. If diameter varies more than .0079" (.2 mm), reboring is indicated. Variance of bore diameter after reboring and honing should be less than .0008" (.02 mm).

2) Cylinder bores for various pistons available include:

Cylinder Bore Sizes

Piston Size	Bore Diameter Inches (mm)
Standard	3.3071-3.3087 (84.00-84.04)
.020" Oversize	3.3268-3.3276 (84.50-84.52)
.040" Oversize	3.3465-3.3472 (85.00-85.02)

3) Cylinder blocks are stamped on the upper face to show cylinder bore grade or size:

Cylinder Bore Grades

Bore Size	Bore Grade	Bore Diameter Inches (mm)
Standard	A ..	3.3071-3.3075 (84.00-84.01)
	B ..	3.3075-3.3079 (84.01-84.02)
	C ..	3.3079-3.3083 (84.02-84.03)
	D ..	3.3083-3.3087 (84.03-84.04)

4) Pistons are also stamped with a grade on their heads to show their diameter at a point 1.575" (40 mm) below piston head and at right angles to piston pin.

Piston Grades and Diameters

Piston Size	Piston Grade	Diameter Inches (mm)
Standard	A	3.3049-3.3053 (83.94-83.95)
	B	3.3053-3.3057 (83.95-83.96)
	C	3.3057-3.3061 (83.96-83.97)
	D	3.3061-3.3065 (83.97-83.98)
.020" Oversize	A.B	3.3246-3.3254 (84.44-84.47)
.040" Oversize	A.B	3.3443-3.3451 (84.95-84.97)

5) Check cylinder-to-piston clearance by measuring piston diameter 1.575" (40 mm) below piston head and at right angles with piston pin. Subtract this measurement from cylinder bore diameter, measured 4.724" (120 mm) below face of cylinder block. If clearance is excessive, install oversize pistons.

6) Check end gap and groove clearance. Install rings on pistons using a ring expander. Compression rings should be installed with "NPR" or "TOP" mark turned up. When installing oil control ring, install expander ring, followed by lower side rail and upper side rail. Oil rings are not marked.

7) When all rings are installed, apply engine oil and see that rings move freely in grooves. Weigh piston and rod assemblies. Variation in weight should be less than .42 oz. (12 gms). Adjust gaps as shown in Fig. 7 and install pistons in block.

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

MAIN & CONNECTING ROD BEARINGS

Removal - 1) Remove oil pan and pipe from oil pump. Remove crankshaft pulley and front cover assembly. Remove cylinder head, sprockets and timing chain. Remove flywheel assembly, rear plate and oil seal retainer. Remove connecting rod and piston assemblies.

2) Loosen main bearing cap bolts in sequence, beginning with outer bolts. Remove bolts, bearing caps and bearings.

1800 cc 4 CYLINDER (Cont.)

NOTE — Check each connecting rod and main bearing cap for identification, so that it can be reinstalled in its original location and position.

3) Lift out crankshaft. Remove thrust bearings and crankshaft bearings from cylinder block.

Inspection — 1) Using an outside micrometer, measure crankshaft and crankpin journals at front and rear of each journal, (1 and 2). See Fig. 8. Take both vertical and horizontal measurements (A and B). If wear exceeds .002" (.05 mm), grind crankshaft and install undersize bearings.

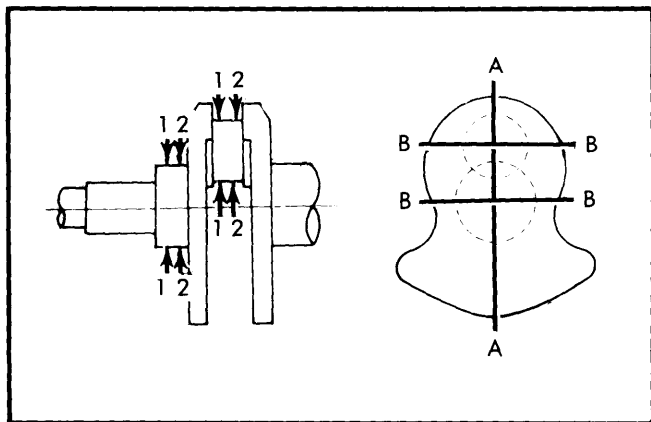


Fig. 8 Measuring Crankshaft & Crankpin Journals

2) Install crankshaft bearings in block and install bearing caps and bolt. Torque to 72 ft. lbs (10 mkg) and measure inside diameter of bearings. Measure inside diameter of connecting rod bearings in same manner, torquing to 33 ft. lbs. (4.6 mkg). Compare outside diameters of journals with inside diameter of bearings to determine oil clearance. Plastigage method may also be used to determine clearance.

3) When installing undersize bearings, grind crankshaft and crankpin journals to match bearing size:

Crankshaft & Crankpin Journal Diameters

Bearing Size	Crankshaft Journal Inches (mm)	Crankpin Journal Inches (mm)
Standard	2.2016-2.2022 (55.92-55.94)	1.9262-1.9268 (48.92-48.94)
.010" Undersize	2.1917-2.1923 (55.67-55.68)	1.9163-1.9169 (48.67-48.69)
.020" Undersize	2.1819-2.1825 (55.42-55.44)	1.9065-1.9071 (48.42-48.44)

4) Check crankshaft end play, and install new thrust bearings on each side of No. 3 journal if excessive.

Installation — 1) Install bearings in cylinder block and oil generously. Install crankshaft over bearings. Install thrust bearings with oil grooves outward. Clean surfaces and install bearings in caps.

2) Install main bearing caps so cast arrows point toward engine front and numbers on caps and journals align. Tighten bolts in sequence: Cap No. 3, No. 4, No. 2, No. 5, and No. 1. Torque to 72 ft. lbs. (10 mkg). Be sure crankshaft turns easily.

3) Install piston and connecting rod assemblies and other components previously removed.

REAR MAIN BEARING OIL SEAL

Removal — Remove clutch pressure plate assembly. Flatten flywheel bolt lock plates and remove flywheel assembly. Pry off oil seal from retainer.

Installation — Apply grease between lips of oil seal and engine oil to crankshaft. Install oil seal in retainer using setting tool (J-22928-2). Be sure flanged part of oil seal is properly seated on retainer. Reverse removal procedure to complete installation. Use new flywheel bolt lock plates and torque to 69 ft. lbs. (9.5 mkg).

CAMSHAFT

FRONT COVER

Removal — Remove crankshaft pulley, oil filter and distributor from cover. Remove front cover with water pump and oil pump.

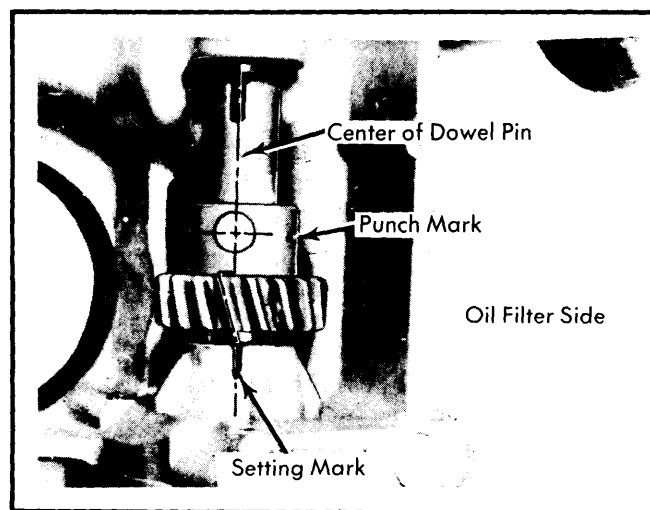


Fig. 9 Aligning Oil Pump in Front Cover

Installation — 1) Install gasket on block. Be sure oil pump, water pump and oil seal are installed properly. Punch mark on oil pump drive gear face should be turned to oil filter side. Align center of dowel pin with setting mark on oil pump case. See Fig. 9.

2) Set No. 1 and No. 4 pistons at TDC. Install cover assembly, engaging pinion gear with oil pump drive gear. Punch mark on oil pump gear should be pointing toward cylinder block. Slot in end of oil pump shaft should be parallel with front of block and offset forward.

1800 cc 4 CYLINDER (Cont.)

FRONT COVER OIL SEAL

Removal & Installation – Remove fan assembly, A/C compressor drive belt, fan belts, crankshaft pulley and pulley boss. Pry out oil seal. To install, fill space between oil seal lips with bearing grease and use setting tool (J-26587). Install crankshaft pulley and torque bolt to 87 ft. lbs. (12 mkg).

TIMING CHAIN

1) To install, turn crankshaft so key points to cylinder head (piston for No. 1 and 4 cylinders at TDC). Place timing chain on crankshaft sprocket, so that mark plate on chain faces forward and aligns with sprocket timing mark.

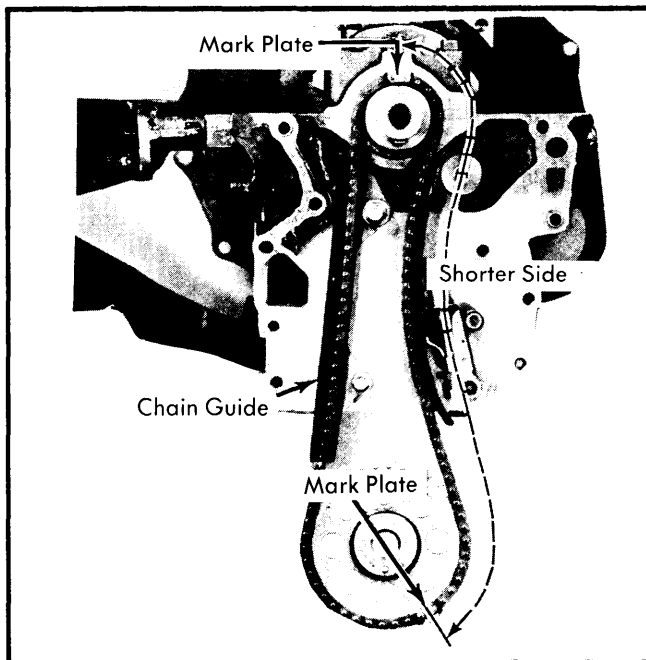


Fig. 10 Installing Timing Chain on Sprockets

NOTE – Chain has two mark plates. Be sure side of chain with most links between mark plates is toward chain guide side.

2) Place camshaft timing sprocket in chain so that mark plate on chain aligns with triangular mark on camshaft sprocket. Install camshaft sprocket on camshaft as instructed under *Rocker Arm Assembly & Camshaft*.

VALVE TIMING

Valve timing will be correct if chain is properly installed and if camshaft is installed as instructed under *Rocker Arm Assembly & Camshaft*.

ENGINE OILING

Crankcase Capacity – 5 quarts.

Relief Valve – A relief valve built into oil pump cover bypasses oil to oil pan at 57-71 psi.

Oil Filter – Full-flow type, disposable cartridge. Filter has built-in bypass valve to permit engine oiling in event filter becomes restricted.

ENGINE OILING SYSTEM

A trochoid type pump feeds oil under pressure through the full-flow filter into the oil gallery, which supplies oil to crankshaft journals through drilled passages and ports. Oil is fed to crankpins, piston rings and pins as well as cylinder bore. Pressurized oil is also delivered through the No. 3 crankshaft oil port into the cylinder head to rocker arms, rocker arm shafts and camshaft. Timing chain and sprockets are lubricated by oil fed through No. 1 crankshaft journal to the oil jet on chain guide. Oil splashed by crankshaft lubricates cylinder walls.

OIL PUMP

Removal – 1) Remove engine from vehicle. Remove cylinder head cover, distributor assembly, engine stiffeners and oil pan. Remove oil pipe from pump and remove pump assembly. Remove rubber hose and relief valve assembly.

2) Inspect parts for wear and for clearance between drive rotor and driven rotor and between driven rotor and pump body. Check pump cover gear end clearance and clearance between drive shaft and pump cover hole.

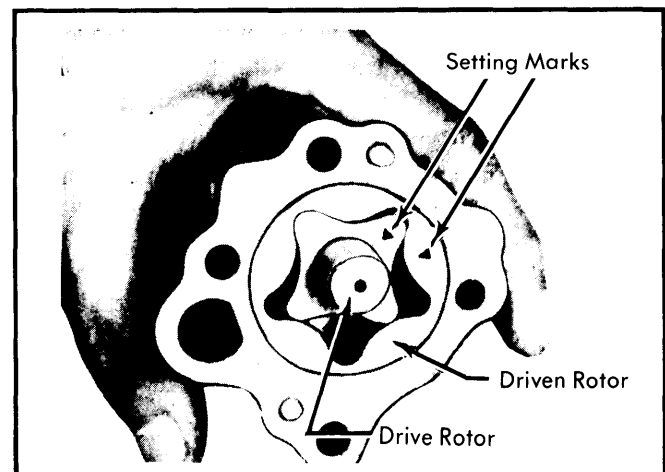


Fig. 11 Aligning Rotor Timing Marks

Installation – 1) Align timing marks on camshaft and rocker arm shaft support. Align notched line on crankshaft pulley with "0" mark on front cover (piston in No. 4 cylinder at TDC on compression stroke).

Opel Engines

1800 cc 4 CYLINDER (Cont.)

2) Install driven rotor so timing marks align with drive rotor, Fig 11. Install oil pump, engaging drive gear with crankshaft pinion gear. Setting mark on drive gear should be rearward and approximately 20 degrees clockwise from crankshaft centerline. (See Fig. 12).

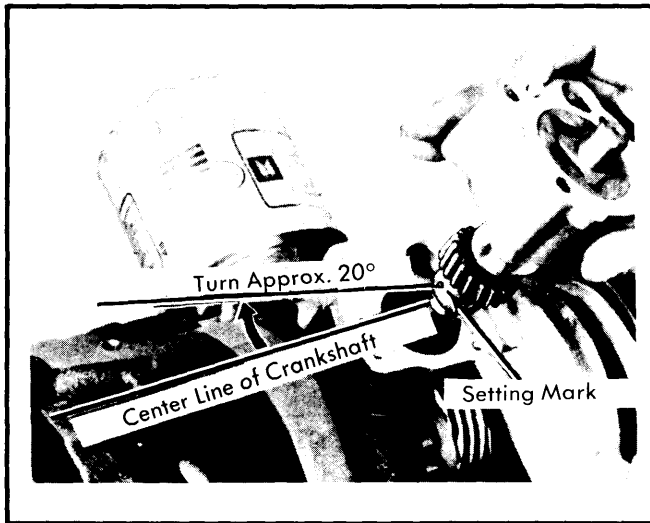


Fig. 12 Installing Oil Pump

3) After installation, check that setting mark is rearward (in clearance between front cover and block). Check that slot in end of pump drive shaft is parallel with front cylinder block face and offset forward, when viewed through distributor hole.

4) Install oil pump cover on dowels, install bolts, relief valve assembly, rubber hose and oil pipe assembly. Install parts previously removed.

Oil Pump Specifications

Measurement Point	Inches (mm)
Drive Rotor-to-Driven Rotor	.0005-.0059 (.012-.150)
Driven Rotor-to-Pump Body	.0063-.0087 (.160-.220)
Rotors-to-Pump Body	.0012-.0035 (.030-.088)
Drive Shaft-to-Pump Cover Hole	.0028-.0043 (.071-.109)

ENGINE COOLING

Thermostat – Wax pellet-type. Begins to open at 177-182° F (81-83° C); fully open at 203° F (95° C).

Cooling System Capacity – 6.8 quarts.

WATER PUMP

Removal – Disconnect battery ground cable, remove radiator shroud and drain coolant from radiator. Remove drive belts. Remove cooling fan and pulley. Remove water pump from front cover.

Installation – If pump body is cracked, water is leaking from seal unit, bearing is noisy or has play, or impellers or front cover assembly are cracked or corroded, replace entire pump. Install new pump by reversing removal procedure.

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS										
Year	Displ.		Carburetor	HP at RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore		Stroke	
	cu. ins.	cc					in.	mm	in.	mm
1978	110.8	1800	2-Bbl	.....	95@3000	8.5-1	3.31	84.1	3.23	82.0

VALVES							
Engine & Valve	Head Diam. In. (mm)	Face Angle	Seat Angle	Seat Width In. (mm)	Stem Diameter In. (mm)	Stem Clearance In. (mm)	Valve Lift In. (mm)
1800 cc Intake	45°	⓪45°	.0472-.0630 (1.20-1.60)	.315 (8.0)	.0009-.0022 (.022-.056)	.....
Exhaust	45°	⓪45°	.0472-.0630 (1.20-1.60)	.315 (8.0)	.0015-.0031 (.038-.079)	.....

⓪ – Grind seat to obtain proper width.

1800 cc 4 CYLINDER (Cont.)

ENGINE SPECIFICATIONS (Cont.)

PISTONS, PINS, RINGS						
Engine	PISTONS		PINS		RINGS	
	Clearance In. (mm) ①	Piston Fit In. (mm)	Rod Fit In. (mm)	Rings	End Gap In. (mm) ②	Side Clearance In. (mm)
1800 cc	.0018-.0026 (.046-.066)	Push Fit	Press Fit	No. 1 & 2 Oil	.008-.016 (.203-.406) .008-.035 (.203-.890)	.0010-.0024 (.025-.061) .0008 (.020)

① — Piston diameter measured 1.575" (40 mm) below piston head and at right angles to piston pin.

② — End gap is measured with ring in cylinder.

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS							
Engine	MAIN BEARINGS				CONNECTING ROD BEARINGS		
	Journal Diam. In. (mm)	Clearance In. (mm)	Thrust Bearing	Crankshaft End Play In. (mm)	Journal Diam. In. (mm)	Clearance In. (mm)	Side Play In. (mm)
1800 cc	2.2016-2.2022 (55.92-55.94)	.0008-.0025 (.020-.063)	No. 3	.0024-.0094 (.061-.239)	1.9262-1.9268 (48.93-48.94)	.0007-.0030 (.018-.076)	.0079-.0130 (.201-.330)

VALVE SPRINGS			
Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
1800 cc Outer	1.8465 (46.9)	.....	32.2-37@1.614 (14.6-16.8@41.0)
Inner	1.7835 (45.3)	.....	18.7-21.5@1.516 (8.5-9.8@38.5)

CAMSHAFT			
Engine	Journal Diam. In. (mm)	Clearance ① In. (mm)	Lobe Lift In. (mm)
1800 cc	1.3362-1.3370 (33.94-33.96)	.0016-.0035 (.041-.089)	.....

① — End play is .0020-.0059" (.051-.150 mm).

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Cylinder Head Cover Bolts	3.6 (.50)
Cylinder Head Bolts	72 (9.95)
Oil Pan Bolts	3.6 (.50)
Crankshaft Bearing Cap Bolts	72 (9.95)
Connecting Rod Bearing Cap Bolts	33 (4.56)
Rocker Arm Shaft Bracket Nuts	16 (2.21)
Timing Sprocket Bolt	58 (8.02)
Crankshaft Pulley Bolt	87 (12.03)
Flywheel Bolts	69 (9.45)