

128 & X1/9 4 CYLINDER

GENERAL SPECIFICATIONS										
Year	Displ.		Carburetor	HP at RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore		Stroke	
	cu. ins.	cc					in.	mm	in.	mm
1975										
128	78.7	1290	1-Bbl.	62 @ 6000	67 @ 4000	8.5-1	3.39	86	2.19	55.5
X1/9	78.7	1290	1-Bbl.	61 @ 5800	76 @ 4000	8.5-1	3.39	86	2.19	55.5

ENGINE IDENTIFICATION

Engine identification and serial numbers are stamped in crankcase on flywheel side of engine next to union for radiator hoses. Engine code is stamped above serial number.

Application

Engine Code

Model 128.....	128A1.040.5
Model X1/9.....	128AS.31.5

ENGINE REMOVAL

NOTE — Engine and transmission are removed as one unit.

Model 128 — 1) Raise and support vehicle with safety stands. Raise hood and disconnect stay rod. Remove spare tire from engine compartment. Remove lower protective guard. Disconnect both battery cables.

1) Raise vehicle and support with safety stands. Raise hood and disconnect stay rod. Remove spare tire from engine compartment. Remove lower protective guard. Disconnect both battery cables.

2) Drain complete cooling system. Lower heater lever inside vehicle. Remove radiator cap and supply tank cap. Open drain on bottom of radiator and on inner side of crankcase.

3) Disconnect wires from coil to distributor. Disconnect wires at generator, starter, oil pressure switch and water temperature sending unit. Remove air cleaner housing and cartridge.

4) Disconnect accelerator linkage and choke cable at carburetor. Disconnect fuel inlet line at fuel pump. Disconnect exhaust pipe at exhaust manifold.

5) Remove radiator hoses from union at left side of engine. Remove heater hoses from engine. Remove speedometer cable from transmission. Remove adjustable rod from clutch release lever by removing nut and lock-nut.

6) From underneath vehicle, remove stabilizer bar from body and lower suspension control arms. Remove exhaust pipe support bracket from transmission. Disconnect rod from gear shift control lever.

7) Remove left wheel and tire. Remove left tie-rod nut and separate tie-rod from steering arm using a suitable puller (A.47044). Disconnect shock absorber at lower mount. Remove outer axle nuts from both sides.

8) Remove strut connecting engine to body. Attach a suitable lifting fixture (A.60559) to engine. Connect lifting fixture to a hoist and raise engine slightly. Remove bolt from clamp securing engine to body. Remove engine support crossmember from under engine.

9) Pull shafts of axle joints from bearing housings. Secure axle shafts to differential with wire to prevent working loose from seats. Remove engine and transmission assembly from bottom of vehicle. Separate transmission and differential assembly from engine.

Model X1/9 — 1) Disconnect battery cables and loosen fuel cap to vent fuel tank. Drain complete cooling system. Disconnect hoses from air injection valve and air cleaner, then disconnect fresh air duct from fan. Remove air cleaner assembly with fresh air duct.

2) Disconnect hoses from air pump, then separate heater return hose at coupling joint and heater hose at pump. Disconnect wires from alternators. Remove bolts holding louvered protection panel below carbon trap in rear firewall.

3) Disconnect choke linkage, hoses and wires from carburetor. Disconnect electrical leads from distributor, oil pressure switch, water temperature sending unit and starter.

4) Remove clamp holding fuel lines to firewall and disconnect fuel lines from firewall. Disconnect accelerator cable from support. Remove cooling system expansion tank and disconnect hoses from thermostat. Disconnect clutch master cylinder from transmission and swing out of way.

5) Raise and support vehicle with safety stands. Remove remaining bolt attaching louvered panel in rear firewall, then remove panel. Remove alternator heat shield, engine panels and wheel panels. Drain transmission and differential assembly. Disconnect back-up light and seat belt interlock connectors, then remove clamps to allow wires to come out with engine. Disconnect speedometer cable and gearshift linkage from transmission.

6) Disconnect ground strap at engine, then remove muffler and muffler upper bracket. Remove axle boot retaining bolts and slide boots away from differential.

7) Remove nuts securing hand brake cable brackets to control arms. Remove bolts attaching control arms to body and swing arms down out of brackets. **NOTE** — Record number of shims at control arm mounting points for installation purpose. Move control arms away from differential until axles are free of differential.

8) Remove lower crossmember attaching bolts and remove crossmember. From above engine, disconnect reaction arm from bracket on engine, then remove front engine mount through bolt. Remove engine and transmission assembly from bottom of vehicle. Separate transmission and differential from engine.

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INTAKE & EXHAUST MANIFOLD

- 1) Drain cooling system. Remove spare tire from engine compartment. Remove air cleaner and cartridge. Disconnect accelerator linkage and choke cable from carburetor. Remove carburetor pre-heating water hoses.
- 2) Remove carburetor with guard and gaskets. Remove shroud from intake and exhaust manifold. Remove intake and exhaust manifold from engine.
- 3) To install, use new gaskets and reverse removal procedure.

CYLINDER HEAD

NOTE — This procedure is with engine in vehicle.

- 1) Drain engine cooling system and remove spare tire from engine compartment. Remove air cleaner housing and cartridge. Disconnect spark plug wires at spark plugs.
- 2) Disconnect accelerator linkage and choke cable at carburetor. Disconnect fuel line at carburetor. Disconnect wire from temperature sending unit.
- 3) Disconnect heater hose at cylinder head. Disconnect all water hoses at union on left side of engine. Disconnect exhaust pipe from exhaust manifold.
- 4) Disconnect reaction rod from engine bracket and hose from exhaust shroud. Remove timing cover, then remove alternator

and water pump drive belt. Remove air pump drive belt, then loosen nut on tensioner pulley and remove timing belt. Remove cylinder head nuts and bolts, then remove head and manifolds as an assembly.

- 5) Thoroughly clean gasket surfaces on crankcase and cylinder head. Use new gasket and install with word "Alto" up. Reverse removal procedure to install remaining components. Tighten cylinder head nuts in sequence shown in Fig. 1. Make sure timing belt is properly installed.

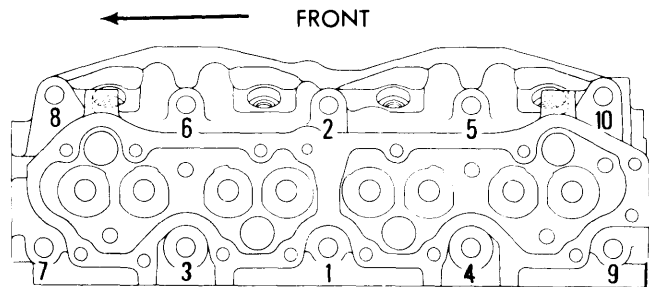


Fig. 1 Cylinder Head Tightening Sequence

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)
1290cc Intake	1.4173 (36)	45° 30'	45°	.0787 (2)	.3139-.3146 (7.974-7.992)	.0012-.0026 (.030-.066)	.3839 (9.75)
Exhaust	1.2205 (31)	45° 30'	45°	.0787 (2)	.3139-.3146 (7.974-7.992)	.0012-.0026 (.030-.066)	.3839 (9.75)

VALVE ARRANGEMENT

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

VALVE GUIDE SERVICING

- 1) With cylinder head removed and disassembled, check clearance between valve stem and valve guide. If clearance is more than .006", and valve stem is not worn, valve guide must be replaced.
- 2) Drive guide from cylinder head using a suitable driver (A.60153). Use same driver to install guides with a suitable spacer installed (6A intake and 6S exhaust).

VALVE STEM OIL SEALS

Use new seals when assembling cylinder head. Use a suitable guide (A.60313) to install seals on valve guides.

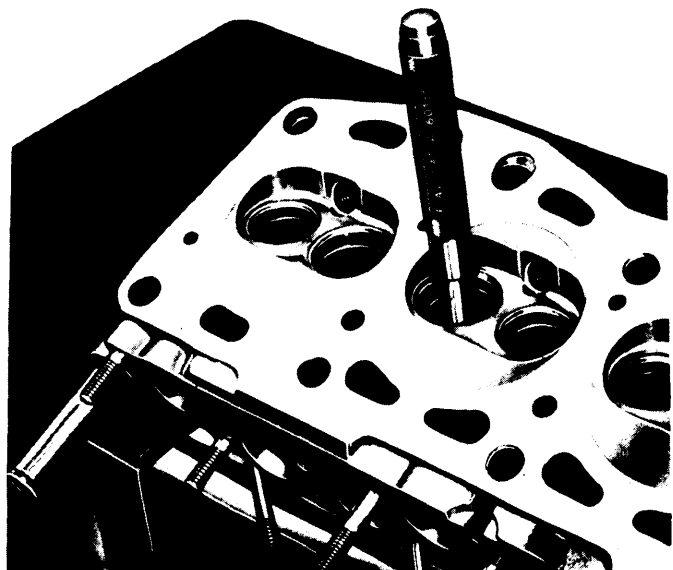


Fig. 2 Using Special Driver to Remove Valve Guide

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VALVE SPRINGS			
Engine	Free Length	PRESSURE (LBS.)	
		Valve Closed	Valve Open
1290 cc	1.646 (41.81)	33@1.220 (15@31.00)	62@.846 (28@21.49)
		Outer	2.122 (53.90)	86@1.417 (39@36.00)	131@1.043 (60@26.49)

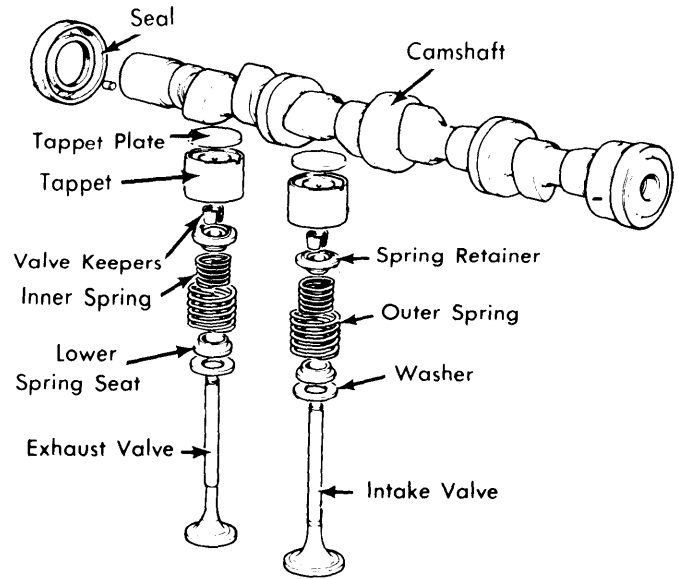


Fig. 4 Expanded View of Valve Train Components

VALVE SPRING REMOVAL

1) Remove cylinder head as previously outlined. Remove camshaft housing cover, carburetor, intake and exhaust manifolds. Remove camshaft housing with camshaft.

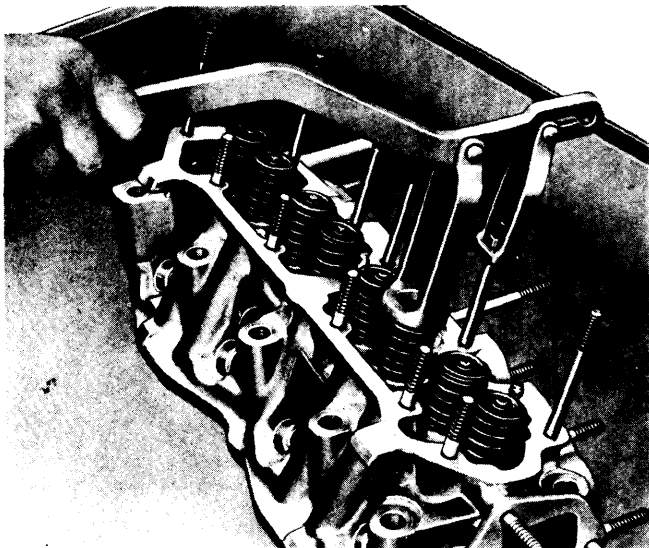


Fig. 3 Using Special Valve Spring Compressor to Remove Valve Springs

2) Using a suitable valve spring compressor (A.60311) compress valve spring. Remove valve keepers and release compressor. Remove spring retainer, inner spring, outer spring, lower spring seat and washer.

3) Inspect valve springs for wear or cracking. Using a suitable spring tester (AP.5049) check inner and outer springs against specifications with specified load applied.

4) To install valve spring, reverse removal procedure. Install cylinder head as previously outlined.

VALVE CLEARANCE ADJUSTMENT

NOTE - Valve clearance is checked and adjusted with engine cold.

Valve Clearance Specifications

Application	Intake Valve	Exhaust Valve
All012" (.3mm)	.016" (.4mm)

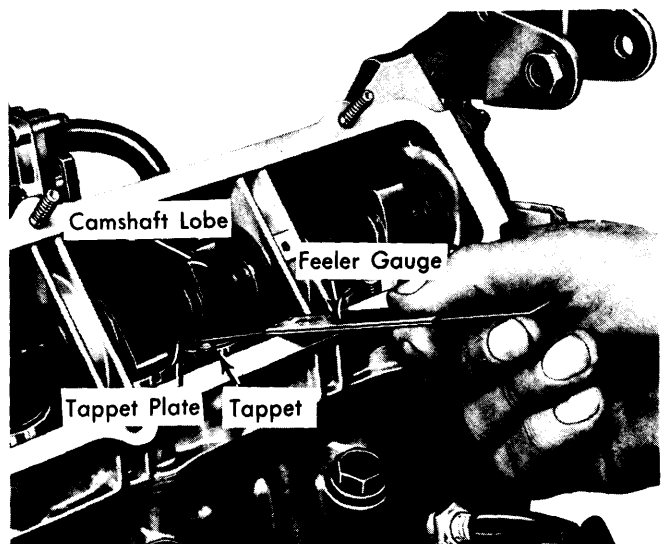


Fig. 5 Showing Where to Make Valve Clearance Check

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1) Remove camshaft cover. Rotate engine until lobe on camshaft of valve being checked is pointing straight up. Using a feeler gauge, check clearance between camshaft lobe and valve tappet plate.

2) If clearance is not as specified, insert a suitable spring compressor (A.60421) under camshaft to release spring tension against camshaft lobe. Remove tappet plate with a suitable removing tool (A.87001). With plate removed, measure thickness to determine size of plate to be installed.

3) Valve tappet plates are available in various thicknesses: .1280-.1850" (3.251-4.699 mm) in increments of .0019" (.048 mm). Plate size is shown on face, install this side toward tappet. Use same procedure on both intake and exhaust valves. Recheck clearance and install camshaft cover.

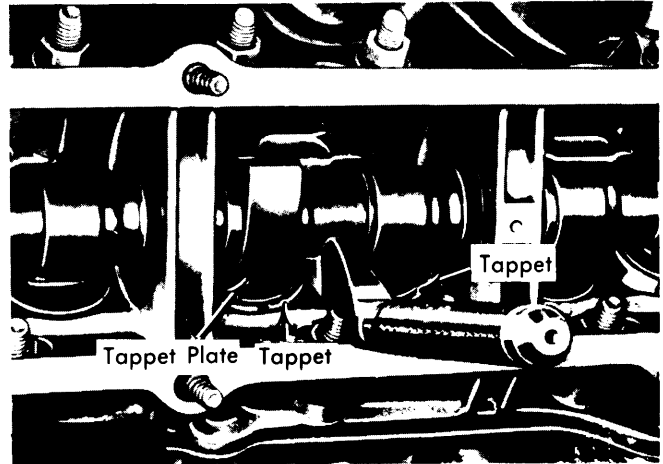


Fig. 6 Using Special Tool to Remove Valve Tappet Plate

PISTONS, PINS, RINGS						
Engine	PISTONS	PINS		RINGS		
	Clearance In. (mm)	Piston Fit In. (mm)	Rod Fit In. (mm)	Rings	End Gap In. (mm)	Side Clearance In. (mm)
1290cc	.0020-.0028 [ⓐ] (.05-.07)	.0001-.0003 (.002-.008)	.0004-.0006 (.010-.016)	No. 1	.0118-.0177 (.30-.45)	.0018-.0030 (.045-.077)
				No. 2	.0118-.0177 (.30-.45)	.0016-.0028 (.040-.072)
				No. 3	.0098-.0157 (.25-.40)	.0012-.0024 (.030-.062)

ⓐ - 128 models .0028-.0035" (.07-.09 mm).

OIL PAN REMOVAL

NOTE -- This procedure is with engine in vehicle.

- 1) Attach a suitable engine support (A.70526) to top of engine. Remove protective shields and engine crossmember.
- 2) Drain oil and remove oil pan retaining screws and oil pan. To install, clean all gasket surfaces, use new gasket and reverse removal procedure.

PISTON & ROD ASSEMBLY

- 1) Remove oil pan and cylinder head as previously outlined. Remove oil pump. See *Oil Pump*. Remove nuts from connecting rods and remove rod caps. Push piston and rod assembly up and out through top.
- 2) To install, compress piston rings with a suitable ring compressor. Pistons must be installed with number stamped on connecting rod and rod cap facing away from auxiliary shaft.

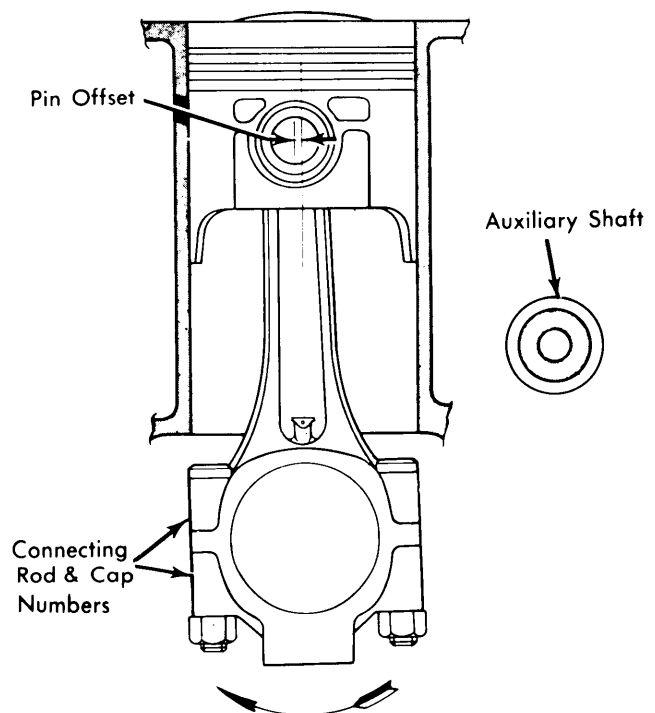


Fig. 7 Piston and Connecting Rod Assembly with Detail of Index Locations

- 3) Tighten rod nuts to specifications. Install remaining components as previously outlined.

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FITTING PISTONS

1) With piston and rod assembly removed and disassembled as previously outlined, thoroughly clean piston. Check ring side clearance, side clearance should be no more than .006" (.15mm). Check ring end gap in cylinder against specifications.

2) Check fit of piston in cylinders with rings removed. There should be no more than .006" (.15mm) clearance. Pistons are available in .0079" (.2mm), .0157" (.4mm) and .0236" (.6mm) oversizes. There are three classes of standard size pistons. If piston is replaced, one of the same class must be installed. Class of piston is stamped on bottom of piston.



Fig. 8 Using a Feeler Gauge to Check Piston-to-Cylinder Wall Clearance

Piston Class Specification

Application	ⓐ Size
X1/9	
Class A	3.3835-3.3839" (85.94-85.95mm)
Class C	3.3842-3.3846" (85.96-85.70mm)
Class E	3.3850-3.3854" (85.98-85.99mm)

ⓐ — Measured at 1.35" (34.3 mm) from piston skirt edge.

Piston Class Specification

Application	ⓐ Size
128	
Class A	3.3827-3.3831" (85.92-85.94 mm)
Class C	3.3835-3.3839" (85.94-85.95 mm)
Class E	3.3842-3.3846" (85.96-85.70 mm)
ⓐ — Measured at 1.35" (34.3 mm) from piston skirt edge.	

3) When installing rings, make sure gaps are spaced approximately 120° apart. Assemble piston and connecting rod and install in vehicle as previously outlined.

PISTON PIN REPLACEMENT

1) Remove piston and rod assembly as previously outlined. Remove circlips and drive out piston pin using a suitable driver (A.60251).

2) Check fit of pin in piston. Pin should be push fit in piston and should not fall through under its own weight. There are two classes of piston pin and piston bore sizes. If piston pin is replaced it must be replaced with a pin of the same class. Class of piston is stamped on bottom and class of pin is stamped on face of pin.

Piston Pin & Bore Class Specifications

Application	Size
Piston Pin	
Class 1 .....	.8658-.8659" (21.991-21.994mm)
Class 2 .....	.8659-.8660" (21.994-21.996mm)
Piston Pin Bore	
Class 1 .....	.8660-.8661" (21.996-21.999mm)
Class 2 .....	.8661-.8662" (21.999-21.002mm)

3) Check piston pin clearance in connecting rod. If clearance is more than specified, drive bushing from connecting rod using a suitable driver (A.60054). Install a new bushing with same driver and ream to size with a new piston pin.

4) Piston pin bore in piston is offset .08". Install connecting rod with numbered side on same side as offset. Lubricate piston pin and secure connecting rod big end in a vise. Place piston in proper position with connecting rod and push in piston pin using a suitable driver (A.60251). Install circlips.

5) Install piston and connecting rod assembly as previously outlined.

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)
1290cc	1.9994-2.0002 (50.785-50.805)	.0016-.0033 (.040-.085)	ⓐ	.0022-.0104 (.055-.265)	1.7913-1.7920 (45.498-45.518)	.0014-.0034 (.036-.086)	.....

ⓐ — Thrust ring is installed at flywheel end main bearing cap.

MAIN & CONNECTING ROD BEARING SERVICE

1) Remove engine as previously outlined. Remove cylinder head, oil pan, clutch and flywheel as previously outlined.

Remove oil pump. See *Oil Pump*. Remove all sprockets and timing belt. See *Timing Belt Replacement*.

2) Remove cover plates and seals from both ends of engine. Remove all piston and connecting rod assemblies. Remove main bearing caps with lower bearing halves.

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3) Remove crankshaft and upper bearing halves. Remove thrust bearings from flywheel end main bearing saddle. Thoroughly clean and inspect crankshaft and crankcase.

4) Check crankshaft journals for out-of-round, if more than .0002", crankshaft must be ground to next undersize. Bearings for undersize crankshafts are available in .010", .020", .030" and .040" undersize.

5) Use the Plastigage method to check main bearing clearances. Install upper bearing halves in crankcase and install crankshaft. Place a piece of Plastigage on journal and install main bearing cap with bearing. Tighten bolts to specifications and then remove main bearing cap.

6) With cap removed, check flattened Plastigage against scale on back of package to determine if clearance is as specified. Check connecting rod bearing clearance using same procedure. If clearance is incorrect, crankshaft must be ground to next undersize and bearings of corresponding undersize installed.

7) With correct clearance obtained, install upper bearing halves in crankcase. Lubricate bearings and install crankshaft. Install main bearing caps with bearings and tighten bolts to specifications. Rotate crankshaft to check for freedom of movement.

8) Check crankshaft endplay. See *Thrust Bearing Alignment*. Install remaining components in reverse of removal order or as previously outlined. Install engine as previously outlined.

THRUST BEARING ALIGNMENT

1) With crankshaft installed and main bearing caps tightened to specifications. Attach a dial indicator to crankcase with arm against flywheel end of crankshaft. Pry crankshaft back and forth to measure endplay.

2) If endplay is more than .0137", remove flywheel end main bearing cap and install oversize thrust rings. Thrust rings are available in .005" oversize. Install a suitable size thrust ring to obtain correct endplay.

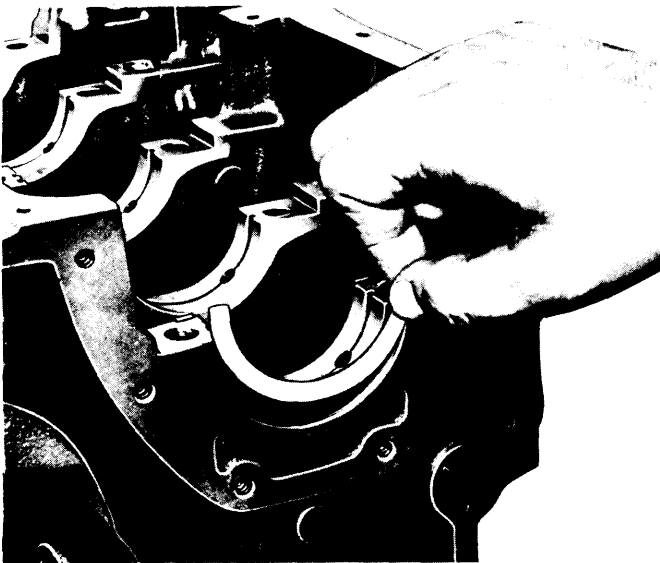


Fig. 9 Fitting Crankshaft Thrust Washer to Block

FRONT & REAR MAIN BEARING OIL SEAL SERVICE

1) Front and rear main bearing oil seals are secured in end plates mounted to both ends of crankcase. Both seals should be replaced when crankshaft has been removed.

2) Drive seals from end plates and install new ones. Lubricate sealing lip of seal and use new gaskets when installing end plates.

CAMSHAFT			
Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
1290cc No. 1	1.1789-1.1795	.0011-.0028	....
	(29.944-29.960)	(.029-.070)	....
No. 2	1.8872-1.8878	.0012-.0028	....
	(47.935-47.950)	(.030-.070)	....
No. 3	1.8951-1.8957	.0012-.0028	....
	(48.135-48.150)	(.030-.070)	....
No. 4	1.9030-1.9035	.0012-.0028	....
	(48.335-48.350)	(.030-.070)	....
No. 5	1.9108-1.9114	.0012-.0028	....
	(48.535-48.550)	(.030-.070)	....

TIMING BELT REPLACEMENT

NOTE — This procedure is with engine in vehicle. If a timing belt is loosened or removed to perform repair work, it should always be replaced.

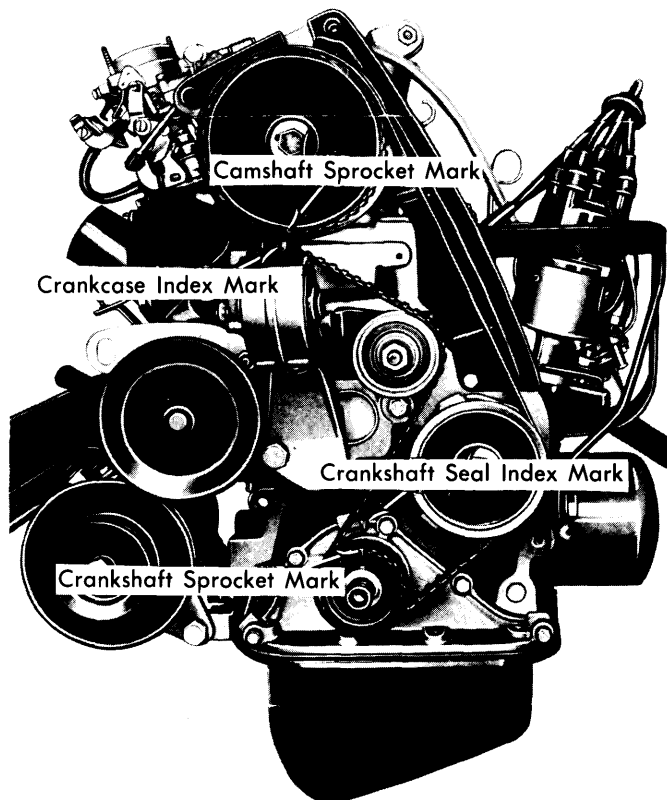


Fig. 10 Front View of Engine Showing Timing Belt Installed

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- 1) Remove timing belt protective cover. Align timing marks. See *Valve Timing*. Apply parking brake and place transmission in low gear to prevent crankshaft from turning.
- 2) Remove crankshaft and water pump drive belt. Loosen timing belt tensioner pulley and release spring action to remove timing belt.
- 3) Install timing belt making sure teeth are properly engaged in sprockets. Make sure sprockets and belt are still properly timed. See *Valve Timing*. Tighten belt tensioner pulley to specification. Install remaining components in reverse of removal order.

CAMSHAFT

- 1) Remove timing belt protective cover and loosen belt tensioner. Remove timing belt from camshaft sprocket and remove sprocket from camshaft. Remove camshaft cover, camshaft and housing. Remove camshaft from housing and thoroughly clean and inspect both.
- 2) If camshaft housing camshaft bores show signs of wear or scoring and are out-of-round, replace housing. Check camshaft for signs of seizure or scoring. If scoring or seizure marks cannot be removed with a fine abrasive stone, replace camshaft.
- 3) Check camshaft for out-of-round conditions. Center camshaft journal should not vary more than .008" out-of-round. Check lobe lift.
- 4) Install camshaft in housing using new drive end seal. Install sprocket and place housing and camshaft on cylinder head. Tighten nuts to specifications. Install timing belt correctly. See *Valve Timing*. Check valve clearance. See *Valve Clearance Adjustment*. Install camshaft cover.

AUXILIARY SHAFT

- 1) Auxiliary shaft drives; distributor, oil pump and fuel pump. Shaft is driven by timing belt. Remove oil pump. See *Oil Pump Removal*. Remove fuel pump and distributor. Inspect drive gears of distributor and oil pump, if gears are chipped or worn, auxiliary shaft must be replaced.
- 2) Remove timing belt as previously outlined. With fuel pump, oil pump and distributor removed, remove auxiliary shaft sprocket. Remove lock plate and auxiliary shaft. Thoroughly clean and inspect shaft.

- 3) Check inner and outer journals of shaft. If journal size is less than specified, replace shaft. Check inside diameter of inner and outer bushings, if more than specified, replace bushings.
- 4) To replace bushings, drive out of crankcase using a suitable driver (A.60372/1/2 outer journal and A.660372/1 inner journal). Install new bushings using same drivers as used for removal. Make sure oil holes in bushings align with oil holes in crankcase. Ream bushings to specified clearance with shaft using a suitable reamer (A.90365).
- 5) Install auxiliary shaft and lock plate. Install sprocket and secure with lock plate and screw. Install remaining components as previously outlined or in reverse of removal order.

Auxiliary Shaft Specifications

Application	Size
Auxiliary Shaft	
Outer Journal.....	1.4013-1.4023" (35.59-35.62mm)
Inner Journal.....	1.2575-1.2583" (31.94-31.96mm)
Bushings (Reamed)	
Outer Journal.....	1.4041-1.4049" (35.66-35.68mm)
Inner Journal.....	1.2598-1.2606" (32.00-32.02mm)
Clearance	
Outer Journal.....	.0018-.0036" (.046-.091mm)
Inner Journal.....	.0016-.0031" (.04-.08mm)

VALVE TIMING

Engine	INTAKE		EXHAUST	
	Open (BTDC)	Close (ABDC)	Open (BBDC)	Close (ATDC)
All ①	10°	54°	54°	10°

① - Valve timing checked with all valves adjusted to .020".

VALVE TIMING

- 1) With timing belt removed, rotate camshaft sprocket until mark on sprocket aligns with index mark on engine.
- 2) Rotate crankshaft sprocket until mark on sprocket aligns with index mark on end plate. Install timing belt as previously outlined, making sure camshaft or crankshaft are not rotated.

ENGINE OILING

Crankcase Capacity - 4.5 qts. Add 3/4 qt. for filter.

Oil Filter - Full flow, mounted on front side of engine.

Normal Oil Pressure - 64-85 psi. with engine @212°F.

Pressure Relief Valve - Mounted in oil pump. See *Oil Pump*.

ENGINE OILING SYSTEM

Oil is circulated through engine by pressure provided by a gear type oil pump. Pump is mounted on bottom of crankcase and driven by the auxiliary shaft. Oil is drawn from oil pan by oil pump and circulated through a full flow oil filter. Oil is then pumped into main oil gallery of crankcase where it is distributed to crankshaft and camshaft. Oil flows through crankshaft to lubricate main and connecting rod bearings. Cylinders, pistons and piston pins are lubricated by oil squirted from hole in connecting rod. Oil flows through camshaft to journals. Oil is squirted from number two and four journal to lubricate valve tappets and valves. Auxiliary shaft is lubricated by oil from main oil gallery. Excess oil flows back into oil pan.

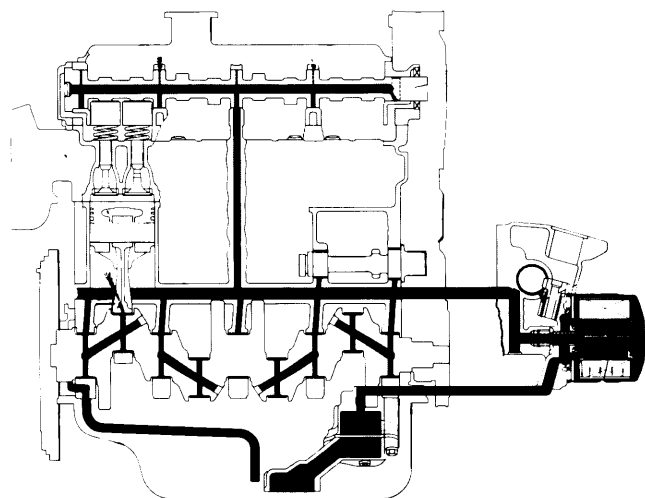


Fig. 11 Diagram Showing Engine Lubrication Flow

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ENGINE OILING (Cont.)

OIL PUMP

- 1) Remove oil pan as previously outlined. Remove retaining screws and slide out oil pump with suction tube.
- 2) Clamp pump housing in a vise and remove suction pipe with filter screen and relief valve. Remove pump cover and gears. Thoroughly clean all components.
- 3) Check both gears for excess wear and replace if necessary. Check clearance between gears, if more than .010", replace both gears. Check gear-to-pump housing clearance, if more than .010", replace gears or housing as necessary.
- 4) Check gear endplay by placing a straight edge on mating surface of pump and inserting a feeler gauge between straight edge and gears. If clearance is more than .006", replace gears or housing as necessary. Check clearance between drive gear

shaft and housing, if more than .004", replace gear or housing as necessary.

5) Inspect pressure relief spring for cracking or wear. Inspect valve for wear or scoring. Check spring against specifications. Spring should not collapse below given length under given load. Replace spring if length is less than specified.

6) Assemble oil pump in reverse of disassembly order. To install, reverse removal procedure.

Oil Pump Specifications

Application	Clearance
Gear-to-Gear .....	.006" (.15mm)
Gear-to-Housing .....	.004-.007" (.11-.18mm)
Gear Endplay .....	.0008-.0041" (.02-.11mm)

ENGINE COOLING

Thermostat – Fully open @ 176-183°F.

Cooling System Capacity – 7.25 qts for 128 models and 7 qts. for X1/9 models.

WATER PUMP

- 1) Remove protective panels from bottom of engine and drain cooling system. Remove alternator and drive belt. Disconnect hoses from water pump, then remove nuts attaching water pipe to pump and disconnect pipe. Remove bolts holding water pump to engine and remove pump.
- 2) Clean all gasket surfaces and install new gasket. To install, reverse removal procedure and refill cooling system. Run engine and check for leaks.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Cylinder Head Bolts	69 (9.5)
Cylinder Head Nuts	69 (9.5)
Main Bearing Cap Bolts	58 (8.0)
Connecting Rod Cap Bolts	36 (5.0)
Intake and Exhaust Manifold Nuts	22 (3.0)
Camshaft Sprocket Bolt	61 (8.5)
Timing Belt Tensioner Pulley Nut	33 (4.5)
Crankshaft Pulley and Sprocket Nut	101 (14.0)
Flywheel-to-Crankshaft Bolts	61 (8.5)