

2F 6 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
1976	257.9	4230	1x2-Bbl.	.....	.....	7.8-1	3.70	94	4.00	101.6

ENGINE IDENTIFICATION

Engine number is stamped on right side of cylinder block above starter motor. First two digits indicate engine type.

Application **Engine Code**
 4230 cc..... 2F

ENGINE REMOVAL

1) Disconnect battery and drain cooling system. Remove hood, radiator grille and hood lock support rod. Disconnect hood lock from radiator support and remove radiator support. Disconnect heater and radiator hoses and remove radiator.

2) Disconnect all necessary wiring and fuel lines. Remove fuel filter assembly and air cleaner. Disconnect rod end of high and low shift rod from shift link lever. Disconnect throttle rod, choke rod, and accelerator rod from carburetor.

3) Remove vacuum hose connection on intake manifold and remove check valve of transfer front drive controller. Disconnect exhaust pipe from manifold and parking brake cable from intermediate lever. Disconnect front propeller shaft from transfer output front shaft flange.

4) Remove engine and transmission undercovers. Disconnect high and low shift rod from transfer high and low shift inner lever. Remove high and low shift link lever and high and low shift rod. Remove clutch release cylinder assembly from engine mount rear bracket.

5) Loosen clamp screws and disconnect vacuum hoses from transfer diaphragm cylinder. Remove front drive indicator switch and disconnect speedometer drive cable from transmission. Disconnect rear propeller shaft from transmission.

6) Disconnect gear shifting rod and gear selecting rod from gear shift outer lever and gear select outer lever. Remove nuts at front and rear engine mounts. Using suitable hoist, move engine up and forward to remove. To install, reverse removal procedure.

INTAKE & EXHAUST MANIFOLDS

Removal - 1) Disconnect battery and remove air cleaner. Disconnect throttle rod, choke rod, accelerator wire, vacuum line, and fuel line from carburetor.

2) Disconnect magnetic valve wire from ignition coil terminal and remove carburetor assembly. Disconnect exhaust pipe from exhaust manifold. Remove manifold nuts, manifolds and gaskets.

Installation - Thoroughly clean all gasket surfaces and install new gaskets. Install manifold assembly and gradually tighten bolts working from center out. Install remaining components in reverse of removal procedure.

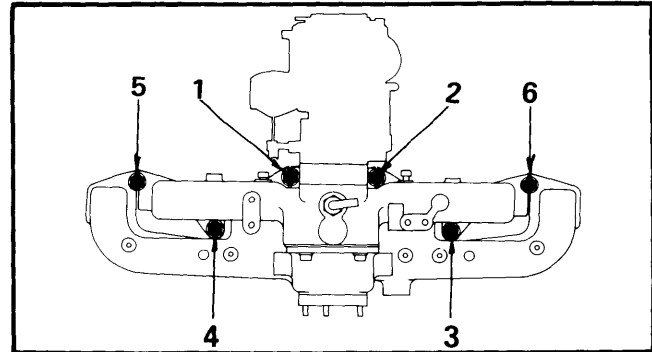


Fig. 1 Manifold Tightening Sequence

CYLINDER HEAD

Removal - 1) Disconnect battery, drain cooling system and remove air cleaner. Remove intake and exhaust manifolds. See *Intake & Exhaust Manifolds*. Remove bolts attaching oil filler tube to rocker arm cover and remove rocker arm cover.

2) Disconnect all necessary wiring, radiator and heater hoses. Remove ignition coil from cylinder head. Remove rocker arm assembly retaining nuts and bolts and remove rocker arm assembly.

3) Remove push rods and keep in order for proper installation. Loosen cylinder head bolts gradually in sequence shown and remove cylinder head.

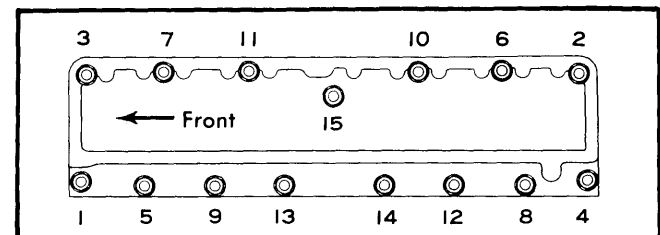


Fig. 2 Cylinder Head Loosening Sequence

Installation - Clean all gasket surfaces and install new gasket. Install cylinder head and tighten bolts gradually in sequence shown. Reverse removal procedure for remaining components.

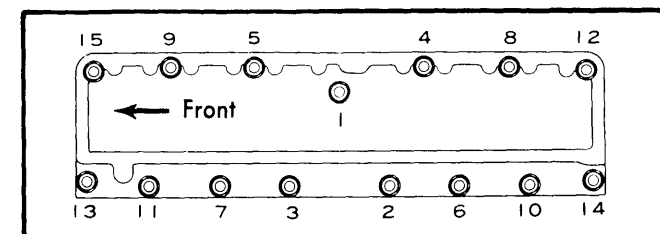


Fig. 3 Cylinder Head Tightening Sequence

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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)
2F Engine Intake	1.81 (46.0)	45°	45°	.055 (1.4)	.3138-.3144 (7.970-7.985)	.0012-.0024 (.03-.06)	.....
Exhaust	1.48 (37.5)	45°	45°	.067 (1.7)	.3134-.3140 (7.960-7.975)	.0016-.0028 (.04-.07)	.....

VALVE ARRANGEMENT

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

VALVE GUIDE SERVICING

1) Check clearance between valve stems and valve guides. If clearance exceeds .004" (.10 mm) for intake or .005" (.12 mm) for exhaust, replace valve and/or valve guide.

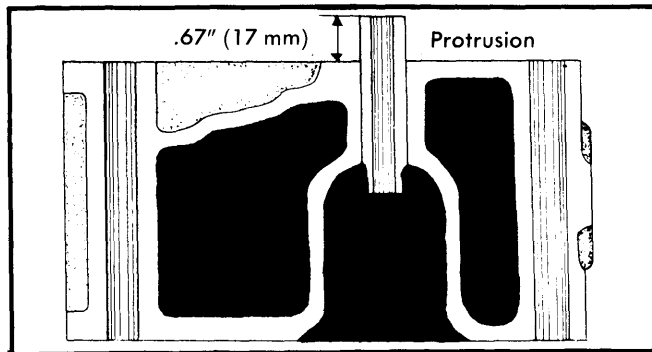


Fig. 4 Intake Valve Guide Installation

2) To replace valve guide, drive guide toward combustion chamber using suitable driver (09201-60011). Using same tool, install new guide from top of cylinder head. Valve guide should extend .67" (17 mm) from top of cylinder head (See Fig. 4 & 5). Intake valve guide length is 2.13" (54 mm) and exhaust guide is 2.32" (59 mm) long. After installing new guide, ream for proper clearance.

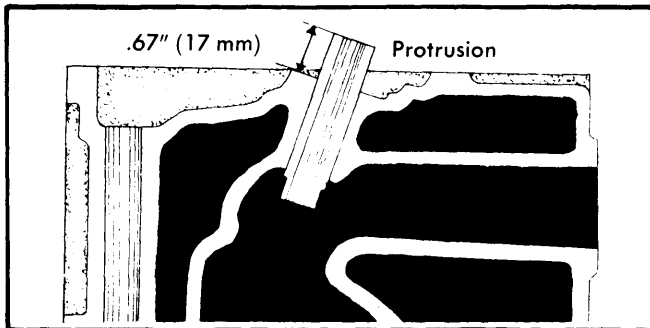


Fig. 5 Exhaust Valve Guide Installation

VALVE SPRINGS			
Engine	Free Length In. (mm)	PRESSURE (LBS.) Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
2F Engine	2.028 (51.5)	71.7@1.693 (32.5@43.0)	.....

VALVE SPRINGS

Removal — Using suitable valve spring compressor, compress valve spring and remove valve spring retainer locks. Release compressor and remove spring retainer, spring, valve stem oil seal and spring seat. Remove valve.

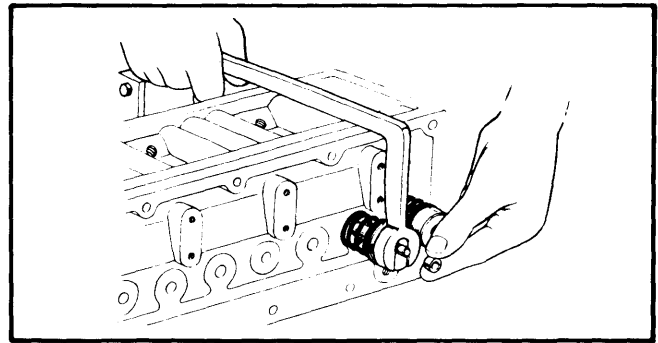


Fig. 6 Removing Valve Springs

Installation — Insert valve into valve stem guide, and install valve spring seat, valve spring, valve stem oil seal and valve spring retainer onto valve stem. Compress valve spring using suitable valve spring compressor and install valve spring retainer locks. Make sure retainer locks seat properly in valve stem groove.

VALVE SPRING INSTALLED HEIGHT

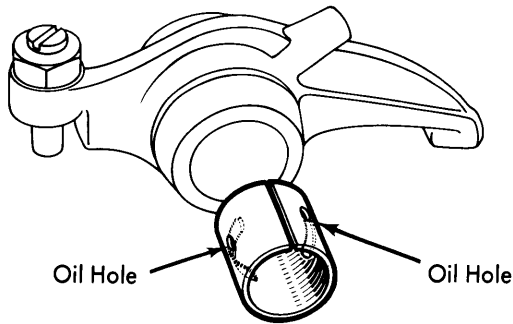
After assembling valve, check installed height of valve spring by measuring from spring seat to point where spring contacts oil shield or spacer. Installed height of both intake and exhaust valve springs should be 1.693 (43.0 mm). Check squareness of springs by placing spring on flat surface next to steel square. Squareness should be within .079" (2.0 mm).

ROCKER ARM ASSEMBLY

1) Check rocker arms and shaft for damage or wear. If clearance is excessive, replace bushing and ream to provide a clearance of .0004-.0016" (.01-.04 mm). When replacing bushing make sure oil hole in bushing lines up with oil hole in rocker arm.

2) Install rocker arms, springs and rocker shaft supports onto valve rocker shaft, then install valve rocker shaft lock springs.
NOTE — There are two types of rocker arms and two types of rocker supports. Rocker support with oil hole is installed in the fourth position. Boss of rocker supports should face forward.

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Oil Holes Must Match with Those in Rocker

Fig. 7 Rocker Shaft Bushing Alignment

VALVE CLEARANCE ADJUSTMENT

- 1) Set No. 1 piston at TDC of compression stroke and align timing mark with pointer. Adjust valves 1,2,3,5,7 and 9 (as numbered from front).
- 2) Rotate crankshaft one complete turn and again align timing mark with pointer. Adjust remaining valves 4,6,8,10,11 and 12.

Valve Clearance Specifications

Valve	Clearance (Hot) In. (mm)
Intake .....	.008 (.20)
Exhaust .....	.014 (.35)

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)
2F Engine	.0012-.0020 (.03-.05)	.0003-.0005 (.008-.012)	①	No. 1	.008-.015 (.20-.38)	.0012-.0024 (.03-.06)
				No. 2	.008-.015 (.20-.38)	.0008-.0024 (.02-.06)
				Oil	.....	.....

① - No clearance.

OIL PAN

Removal - Remove engine undercovers, and remove flywheel side and undercover. Remove front propeller shaft. Drain oil, remove oil pan attaching bolts and oil pan.

Installation - Thoroughly clean all gasket mating surfaces. Apply liquid sealer onto both oil pan gasket surfaces, install oil pan and tighten bolts. Reverse removal procedure for remaining components.

PISTON & ROD ASSEMBLY

Removal - With cylinder head and oil pan removed, remove connecting rod caps and remove bearings. Push piston and rod assembly up through cylinder block. Mark all components with cylinder numbers for correct reassembly.

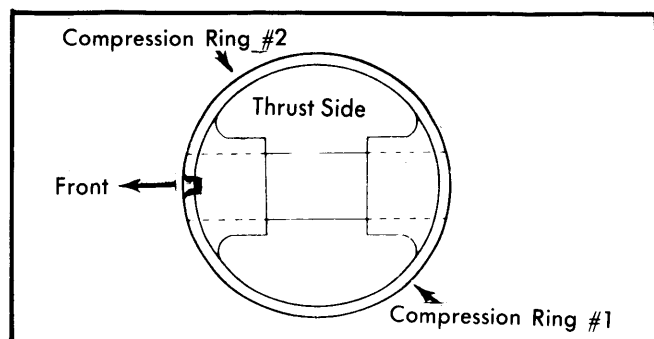


Fig. 8 Piston Ring Gap Spacing

Installation - 1) Apply oil to piston and rings. Position ring gaps as shown in Fig. 8. Use a ring compressor and install piston assemblies through top of cylinder. Notch on piston MUST face FORWARD and index mark (symbol) on connecting rod MUST face REAR.

2) Replace connecting rod bearings and connecting rod caps. Tighten connecting rod bearing cap nuts. Rotate crankshaft to make sure bearings are not too tight.

FITTING PISTONS

1) Measure cylinder bores and pistons to be fitted. Measure piston with micrometer at bottom of skirt at right angles to piston pin. If clearance exceeds specifications, replace piston.

2) If cylinder bore is worn or tapered beyond specifications, cylinder must be bored and oversize pistons installed. Oversize pistons are available in .020" .040" and .060" (.50, 1.00 and 1.50 mm).

Cylinder Bore Specifications

Application	Wear Limits
Bore Wear Limit008" (.2 mm)
Taper0008" (.02 mm)
Difference Between Cylinders002" (.05 mm)

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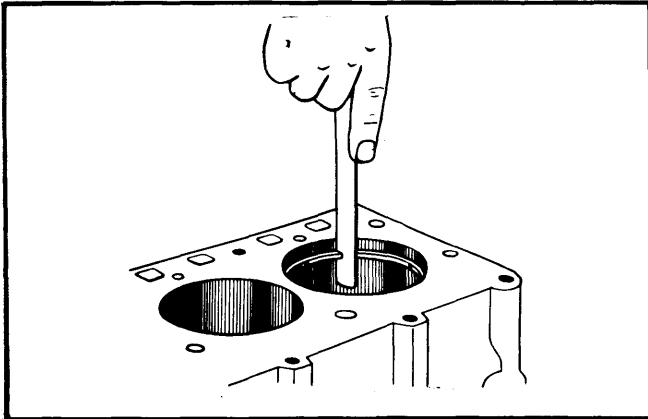


Fig. 9 Measuring Piston Ring Gap

3) Use .001-.002" (.03-.05 mm) feeler gauge with pull scale to check clearance of oversize pistons. Force of 2.2-5.5 lbs. (1.0-2.5 kg) must not be exceeded when pulling feeler gauge from cylinder.

4) Measure piston ring gaps in cylinder. If cylinder has not been bored, check gap with ring in lowest part of cylinder. Check clearance of piston ring in ring groove. Always install rings with marks facing upward.

PISTON PINS

Removal — Remove piston pin bolt and push out piston pin from piston and connecting rod. Mark all parts for correct reassembly.

Installation — Position piston and connecting rod so that when notch on top of piston faces forward, oil hole in connecting rod faces camshaft side. Push pin into assembly and center pin in piston. Center connecting rod between piston pin bosses and tighten piston pin bolt.

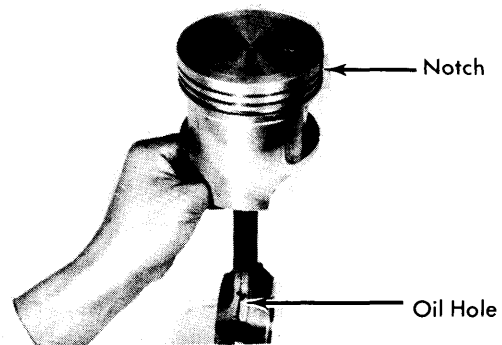


Fig. 10 Piston and Rod Assembly

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)
2F Engine							
No. 1	2.6367-2.6376 (66.972-66.996)	.0008-.0017 (.020-.044)	No. 3	.002-.006 (.06-.16)	2.1252-2.1260 (53.98-54.00)	.0008-.0024 (.020-.060)	.004-.009 (.11-.23)
No. 2	2.6957-2.6967 (68.472-68.496)						
No. 3	2.7548-2.7557 (69.972-69.996)						
No. 4	2.8139-2.8148 (71.472-71.496)						

MAIN & CONNECTING ROD BEARINGS

1) Thoroughly clean crankshaft and blow out oil passages with compressed air. Check crankshaft for runout with a dial indicator on second or third main bearing journal. If runout exceeds .004" (.10 mm), straighten or replace crankshaft.

2) Check main and connecting rod bearing journals for taper or out-of-round. If taper or out-of-round exceeds .0004" (.01 mm), crankshaft must be ground to next undersize.

3) Main and connecting rod bearing clearance is checked by the Plastigage method. If clearance exceeds specifications, replace bearings. If crankshaft wear is excessive and clearance cannot be brought to specifications by use of new standard size bearings, crankshaft must be reground to next undersize. Bearings are available in .002", .010", and .020" (.05, .25, and .50 mm) undersize.

NOTE — All main bearing configurations are different.

4) Make sure oil hole in No. 1 and No. 4 main bearing is installed toward block. Arrow on connecting rod cap **MUST** face FRONT.

THRUST BEARING

Check crankshaft end play at No. 3 main bearing. If clearance exceeds .012" (.3 mm), replace crankshaft bearings.

CRANKSHAFT REAR OIL SEAL

To install oil seal without disassembling crankshaft, pry out oil seal with a screwdriver. Use crankshaft rear oil seal replacer tool (Tool 09223-60010) to drive new oil seal into place.

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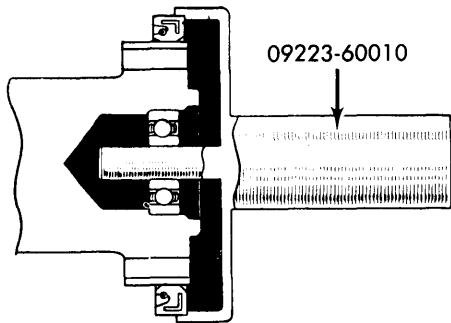


Fig. 11 Rear Oil Seal Installation

ENGINE FRONT COVER REMOVAL

1) Drain cooling system and remove upper and lower radiator hoses. Remove bolts holding radiator to radiator support. Remove radiator upward using care not to damage radiator.

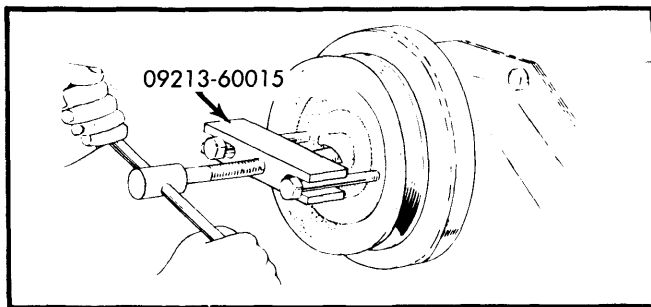


Fig. 12 Crankshaft Pulley Removal

2) Remove fan belt. Remove crankshaft pulley using suitable puller (09213-60015). Remove bolts and remove timing gear cover and gasket. To install, reverse removal procedure.

FRONT COVER OIL SEAL REPLACEMENT

Pry old oil seal out using screwdriver. Install new oil seal so that open end of seal is towards inside of timing gear cover. Drive seal in place with suitable tool (09515-35010).

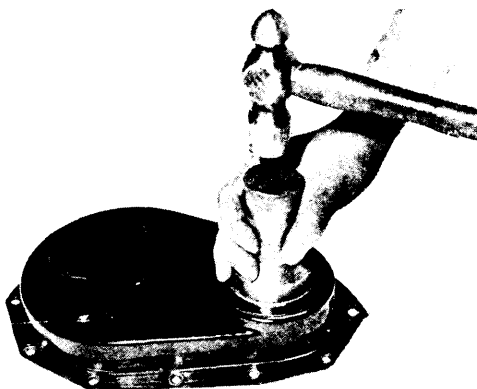


Fig. 13 Front Oil Seal Installation

CAMSHAFT

Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
2F Engine			
No. 1	1.8880-1.8888 (47.955-47.975)	.001-.003 (.025-.075)	.....
No. 2	1.8289-1.8297 (46.455-46.475)		
No. 3	1.7699-1.7707 (44.955-44.975)		
No. 4	1.7108-1.7116 (43.455-43.475)		

CAMSHAFT REMOVAL

Remove timing gear cover and gasket. Slide out oil slinger from crankshaft. Remove two bolts retaining camshaft thrust plate onto cylinder block by working through holes in camshaft timing gear. Remove camshaft by pulling out through front of block. Use care not to damage camshaft bearings or journals. To install, reverse removal procedure and set valve timing.

NOTE— Ensure timing gear oil nozzle is positioned to direct oil onto timing gears. Stake into place with a punch.

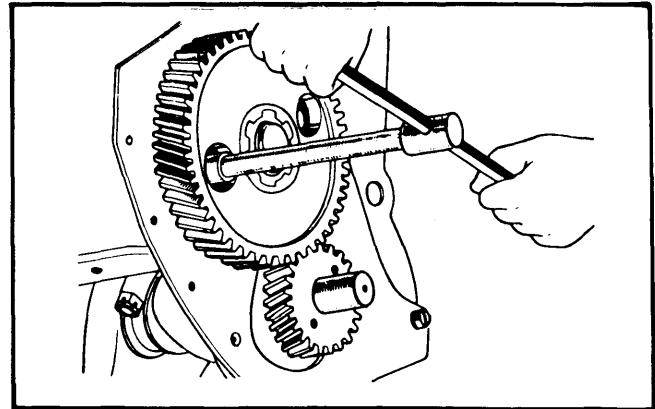


Fig. 14 Removing Camshaft Thrust Plate Bolts

CAM LOBE HEIGHT

Measure height of cam lobe. If wear exceeds specification limit, replace camshaft. Intake lobe limit, 1.496" (38 mm); Exhaust lobe limit, 1.492" (37.9 mm).

CAMSHAFT BEARING REPLACEMENT

1) Inspect camshaft for runout. If runout exceeds .0059" (.15 mm), replace camshaft. Inspect camshaft journals and bearings for wear or damage. If clearance exceeds specifications, replace camshaft bearings and/or regrind camshaft. Bearings are available in standard .010" and .020" (.25 and .50 mm) oversizes.

2) Drive out camshaft rear expansion plug from cylinder block. Remove front and No. 2 bearing using Camshaft Bearing Remover (Tool 09215-60010). Place front and second bearing adapters against rear of respective bearing, and place replacer against front part of cylinder block.

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3) Insert replacer shaft into the three parts, and screw in retainer nut onto replacer shaft. Hold slotted part of shaft with wrench to prevent shaft from turning. By screwing in retainer nut with another wrench, the front and No. 1 bearing will be pulled out to the front.

4) Remove No. 3 and rear bearing towards rear of block using tool in same manner as for front and No. 3 bearing. When installing new bearings, make sure that oil holes of bearing match up with oil holes in cylinder block.

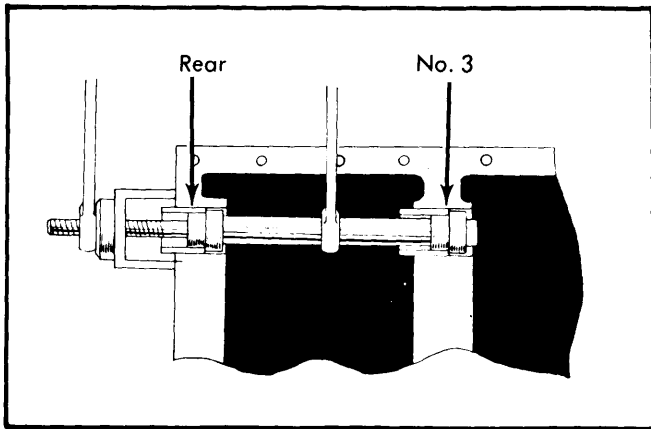


Fig. 15 Measuring Camshaft End Thrust

5) When new bearings have been installed, measure to obtain proper clearance. Only a very light cut is required to ream bearings to proper size. Coat rear expansion plug with sealer and reinstall plug in block.

CAMSHAFT END THRUST

Measure end thrust with feeler gauge. Thrust should be .0035-.0059" (.09-.15 mm). If thrust exceeds .008" (.2 mm), replace camshaft thrust plate.



Fig. 16 View Showing Typical Camshaft Bearing Removal (No. 3 & Rear Shown)

CRANKSHAFT TIMING GEAR REMOVAL

Remove pulley key from crankshaft. Using suitable puller (09213-60015), pull off crankshaft gear. To reinstall, drive on gear using suitable driver (09214-60010). Make sure timing mark on gear faces outward.

VALVE TIMING

1) With crankshaft timing gear installed on crankshaft, oil camshaft journals and bearings and insert camshaft. Align mating mark on camshaft timing gear with mark on crankshaft timing gear and push camshaft into position. No. 6 cylinder should be at TDC, compression stroke. If oil nozzle was removed, refit with oil hole facing down (toward gears).

2) Tighten camshaft thrust plate retaining bolts to specifications. Check that timing gear backlash does not exceed .008" (.2 mm). Standard backlash is .0020-.0051" (.05-.13 mm). If backlash exceeds specifications, replace both camshaft and crankshaft gears.

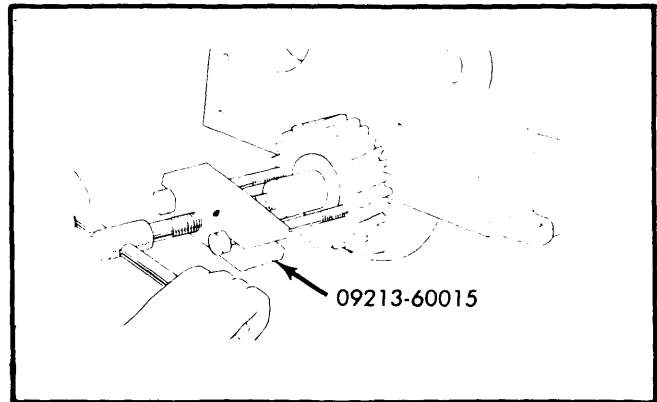


Fig. 17 Crankshaft Timing Gear Removal

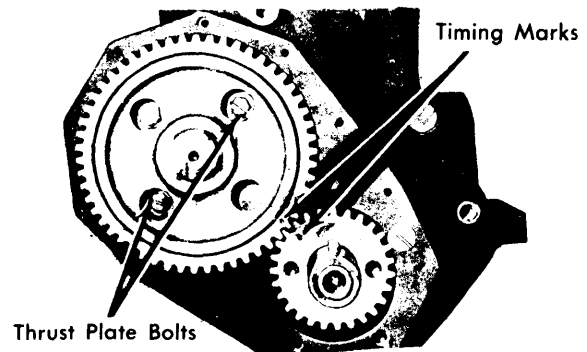


Fig. 18 Timing Mark Alignment

2F 6 CYLINDER (Cont.) ENGINE OILING

Crankcase Capacity – 7.4 qts. Add 1.0 qts. with filter.

Oil Filter – Full flow cartridge type with integral relief valve.

Normal Oil Pressure – Pressure maintained at 50-64 psi (3.5-4.5 kg/cm²) by safety valve in oil pressure regulator.

Pressure Regulator – Located in oil pump, non-adjustable.

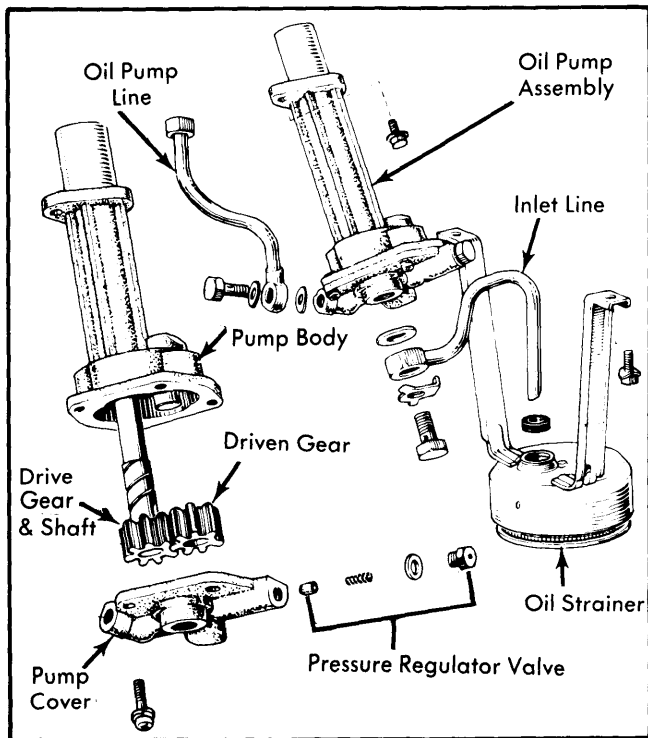


Fig. 19 Exploded View of Oil Pump Assembly

ENGINE OILING SYSTEM

Forced feed system insures positive lubrication through oil holes and galleries in engine block.

OIL PUMP REPLACEMENT

1) Remove engine front undercover, engine floor pan. Remove flywheel side cover and flywheel housing undercover. Remove front propeller shaft. Drain engine oil.

2) Remove oil pan. Remove oil strainer and loosen union nuts on oil pump pipe. Remove lock wire and oil pump retaining bolt and remove oil pump and pipe.

3) Straighten union bolt lock washer and remove union bolt, lock washer, gasket, and oil pump inlet pipe from oil pump cover. Remove cover and slide out oil pump driven gear and oil pump drive gear together with oil pump shaft.

4) Inspect gears and housing and check clearance between gear tip and pump body. Measure gear backlash. Place straightedge across pump housing and measure clearance between gear side and straightedge. Place straight edge across pump cover and measure wear. If any parts show wear exceeding specifications or other damage, replace parts as necessary.

Oil Pump Specifications

Application	Standard In. (mm)	Wear Limit In. (mm)
Gear-to-Housing Clearance.....	.0012-.0043 (.03-.11)	.008 (.2)
Gear Backlash.....	.0020-.0028 (.05-.07)	.0374 (.95)
Gear Side Clearance....	.0012-.0035 (.03-.09)	.0059 (.15)
Cover Wear.....		.0059 (.15)

ENGINE COOLING

Thermostat – Wax pellet type. Begins to open at 180°F (82°C) and is fully opened at 203°F (95°C).

Coolant Capacity – All models, 4.5 gallons.

WATER PUMP REMOVAL

1) Drain cooling system and remove alternator adjusting bar. Remove fan, fan pulley and fan belt. Loosen hose clamps, disconnect radiator lower hose and by-pass hose from water pump.

2) Remove water pump retaining bolts, and remove water pump and gasket. To install, reverse removal procedure using new water pump gasket. Adjust fan/alternator belt tension to provide .5-.6" (13-15 mm) deflection and fan/air pump belt to provide .3-.4" (7-10 mm) deflection.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Cylinder Head	83-98 (11.5-13.5)
Piston Pin Bolt	39-51 (5.4-7.0)
Connecting Rod Bearing Caps	35-55 (4.8-7.6)
Crankshaft Main Bearing Caps	
Front, No. 2 & No. 3	90-108 (12.5-15)
Rear	76-94 (10.5-13)
Camshaft Thrust Plate Bolts	7-12 (1.0-1.6)
Manifold Nuts	28-37 (3.5-5.1)
Flywheel Bolts	41-53 (5.7-7.3)
Crankshaft Pulley	116-145 (16-20)