2300 CC 4 CYL.

GENERAL SPECIFICATIONS						
Engine	Net HP At RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore	Stroke	Displ. Cu. Ins.
140" 1-Bbl.	70@4400	107@2400	8.0:1	3.500"	3.625"	140"
140" 2-Bbl.						
Federal	84@4400	113@3200	8.0:1	3.500"	3.625"	140"
California	79@4400	109@2800	8.0:1	3.500"	3.625"	140"

NOTE — Horsepower and Torque figures given above are NET. Net Horsepower and Torque represents power at the flywheel when the engine is installed in a vehicle, with wide open throttle and all systems operating such as; air cleaner, exhaust system, water pump, generator, oil pump and air conditioning.

ENGINE IDENTIFICATION

Engine Code is stamped opposite number three cylinder on right side of cylinder block.

Application	Code
Chevrolet Vega & Monza	
1-Bbl. Man. Trans.	CBW
1-Bbl. Auto. Trans.	CBU
2-Bbl. Man. Trans. (Federal)	CBS
2-Bbl. Man. Trans. (Calif.)	CBK
2-Bbl. Auto. Trans.	CBT
Oldsmobile Starfire	
Federal	CBS, CBZ, CAZ, CBT
Calif.	CBK, CBY, CAY, CBL
Pontiac Astre & Sunbird	
1-Bbl.	CBH, CBJ
2-Bbl. (Federal)	CBS, CBT
2-Bbl. (Calif.)	CBK, CBL

ENGINE REMOVAL

See Engine Removal at end of ENGINE Section.

INTAKE MANIFOLD

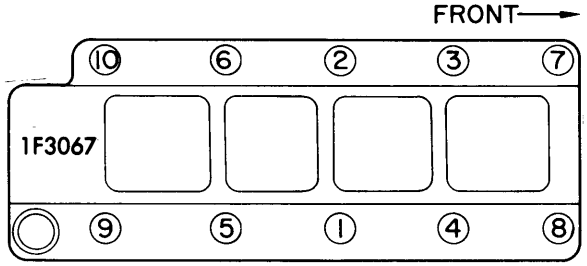
Removal — Remove exhaust gas recirculation tube. Disconnect battery, heater hose, vent tube at base of air cleaner and remove air cleaner. Remove air cleaner silencer. Disconnect choke rod, positive crankcase ventilation valve, fuel line, bowl vent line, throttle linkage, transmission throttle valve linkage and power steering pump. Disconnect Delcotron unit and remove intake manifold retaining bolts. Remove manifold.

Installation — To install, reverse removal procedure using new manifold gasket.

CYLINDER HEAD

Removal — Drain cooling system and disconnect heater hose from water outlet. Remove engine front cover, camshaft cover, timing belt and camshaft timing sprocket. Remove intake and exhaust manifolds. Remove head bolts and remove head.

Installation — Install head gasket with smooth side up. Coat head bolt threads with anti-seize compound. *NOTE — Head bolts are two different lengths; 6 3/8" on manifold side and 5 5/8" on spark plug side.* Tighten head bolts a little at a time, in sequence (see illustration), until proper torque is attained.



CYLINDER HEAD TIGHTENING SEQUENCE

VALVES							
Engine & Valve	Head Diam.	Face Angle	Seat Angle	Seat Width	Stem Diameter	Stem Clearance	Valve Lift
140"							
Int.	1.615-1.625"	45°	46°	.047-.063"	.3410-.3417"	.0010-.0027"	.4000"
Exh.	1.370-1.380"	45°	46°	.047-.078"	.3410-.3417"	.0010-.0027"	.4150"

2300 CC 4 CYL. (Cont.)

VALVE ARRANGEMENT

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

VALVE GUIDE SERVICING

Guides are integral with cylinder head. If valve stem clearance in guide is excessive, valves with oversize stems are available in .003", .015" and .030" oversize for replacement. Ream guide bores to accomodate oversize stems and afford specified clearance.

VALVE STEM OIL SEALS

Seal is an umbrella type oil seal, fitted to valve guide and valve stem before valve spring is installed. See *Valve Springs*. A new seal should be installed whenever valve spring is removed.

VALVE SPRINGS

Engine	Free Length	PRESSURE (LBS.)	
		Valve Closed	Valve Open
140"	1.77"	58-66@1.56"	179-191@1.45"

VALVE SPRINGS

Removal – Remove valve tappet and adjusting screw. Remove spark plug on cylinder to be serviced and install air line adapter to plug hole. Rotate crankshaft 90° from TDC position before applying air pressure to eliminate possibility of interference between valve and piston with valve compressed. Use suitable spring compressor (J-23592) and compress valve spring to remove valve locks. Remove tool, valve cap, valve spring and damper assembly and valve stem oil seal.

Installation – Before reinstalling old springs, check with a suitable spring tester. Springs should be replaced if not within 10 lbs. of specified load (without dampers). Install new oil seal over valve guide, valve spring and damper assembly over valve stem, then install valve cap. Compress valve spring and install valve locks.

VALVE SPRING INSTALLED HEIGHT

Specified height is 1 9/16" (± 1/32") measured from spring seat to top of spring. If measured height exceeds specifications, install spring seat shim approximately 1/16" thick. Do not shim to give an installed height under specifications.

HYDRAULIC VALVE LIFTERS

Valve lifters require no service or adjustment. If lifters are noisy they should be replaced. *NOTE – When installing new lifters, coat foot of lifter with Molykote or equivalent. Also, after installation of new lifters, up to 30 minutes of operation may be required to completely purge air from lifters for quiet operation.*

PISTONS, PINS, RINGS

Engine	PISTONS	PINS		RINGS		
	Clearance	Piston Fit	Rod Fit	Rings	End Gap	Side Clearance
140"	.0018-.0028"	.0003-.0004"	① .0008-.0021"	1 2 3	.015-.025" .009-.019" .010-.030"	.0012-.0027" .0012-.0027" .0000-.0050"

① – Interference Fit.

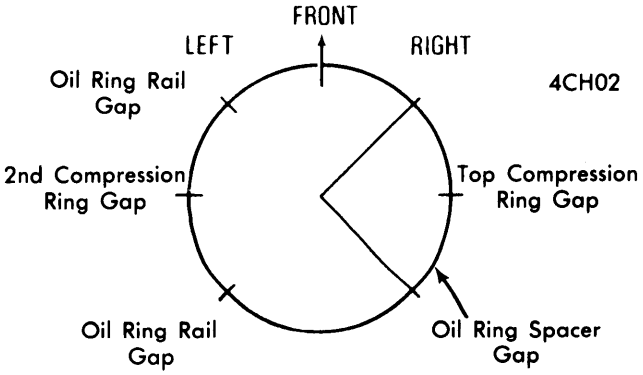
OIL PAN

See Oil Pan Removal at end of ENGINE Section.

PISTON & ROD ASSEMBLY

NOTE – New pistons must be installed in same cylinders for which they were fitted and used pistons in same cylinder from which they were removed.

Removal – With cylinder head, oil pan and baffle removed, use a suitable ridge reamer 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.* Inspect connecting rods and caps for cylinder identification and mark as necessary. Remove rod cap and install suitable tool (J-23627) on connecting rod studs. Push piston and rod assembly out top of cylinder block.



RING GAP LOCATION

Installation – Lightly coat cylinder bores, pistons and rings with engine oil. Ensure that ring gaps are properly spaced (see illustration) and marked side of compression ring is toward top

2300 CC 4 CYL. (Cont.)

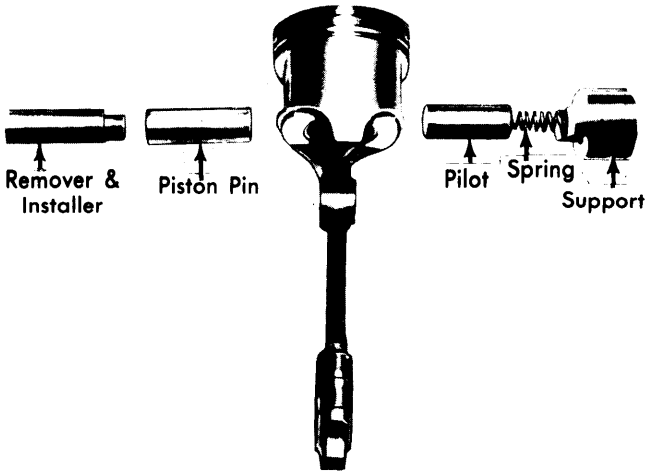
of piston. Install ring compressor on piston. Install suitable tool (J-23627) on connecting rod studs. Install each piston and rod assembly (with "F" on piston facing front of engine) in its respective bore and guide connecting rod onto crankshaft journal while tapping piston head with hammer handle to seat connecting rod against crankshaft. Remove tool from studs and install rod caps. Tighten nuts.

FITTING PISTONS

Production pistons are available in four sizes, increasing in diameter by .0005" for each part number. Measure cylinder bore 2½" from top of bore. Measure piston diameter at skirt across centerline of piston pin. If clearance exceeds .005", a new piston may be required, or cylinder may need to be bored and oversize pistons installed. Pistons and rings are available .010" and .020" oversize.

PISTON PINS

Pins are press fit in piston. Piston and pin are a matched set and are not serviced separately. Measure pin and piston pin bore. If clearance is in excess of .001" wear limit, replace piston and pin assembly. Remove pin using arbor press and suitable adaptors (see illustration).



PISTON PIN INSTALLATION

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS							
	MAIN BEARINGS				CONNECTING ROD BEARINGS		
Engine	Journal Diam.	Clearance	Thrust Bearing	Crankshaft End Play	Journal Diam.	Clearance	Side Play
140"	2.2983-2.2993"	①.0003-.0027"	No. 4	.002-.007"	1.999-2.000"	.0007-.0038"	.0085-.0135"

① – Clearance for bearing number 1 is .0003-.0020".

MAIN & CONNECTING ROD BEARINGS

NOTE – Following procedures are with oil pan and baffle removed.

Connecting Rod Bearings – After ensuring rod caps are marked for cylinder identification, remove rod caps. Use Plasitgage method to check for proper bearing clearances. If not within specifications, new bearings must be installed. New bearings are available in .001", .002", .010" and .020" undersize. Selective fitting is required on each connecting rod. A standard bearing half may be used in combination with a .001" undersize or a .001" undersize in combination with a .002" undersize. Coat bearing surfaces with oil, install rod cap and tighten nuts.

Main Bearings – Starting with rear main bearing cap and working forward, remove one main bearing cap at a time and check bearing clearances using Plastigage method. If clearances are not within specifications, bearing halves must be replaced or crankshaft must be ground and undersize bearings installed. A standard bearing half may be used in combination with a .001" undersize bearing half or a .001" undersize bearing half may be used in combination with a .002" undersize bearing half to obtain correct clearance. If crankshaft must be ground, bearings are available .010" and .020" undersize. Using a suitable tool installed in oil hole in crankshaft, rotate crankshaft clockwise to remove upper bearing half. Oil new upper bearing half and insert plain (unnotched) end between crankshaft and indented (notched) side of block. Rotate bearing into place. Install main bearing cap (with "F" pointed toward front of engine) with bearing on engine and tighten bolts. After all bearings have been checked, rotate crankshaft to see that there is no excessive drag.

THRUST BEARING ALIGNMENT

With crankshaft forced toward front of engine, check end play at front of number four bearing cap with a feeler gauge. If end play exceeds specifications, thrust bearings must be replaced.

REAR MAIN BEARING OIL SEAL

Removal – With oil pan and baffle removed, remove rear main bearing cap and discard lower seal. Loosen remaining bearing caps to allow crankshaft to be lowered slightly. Use suitable punch to push upper seal out of bearing sufficiently to permit it to be fully removed with pliers. Rotating crankshaft while pulling on seal will aid in removal.

Installation – Install new seal in bearing cap using suitable forming tool and cut ends of seal off flush with surface of bearing cap. Install new upper seal by inserting a piece of soft wire in end of seal and wrapping wire a few turns around end of seal (use "Chinese Finger" type installer if available). Use wire to pull seal into place in block (rotate crankshaft if necessary).

2300 CC 4 CYL. (Cont.)

Tighten all other bearing caps. Install rear main bearing cap and side sealant (comes with new gaskets along with instructions). Tighten bolts on rear main bearing cap.

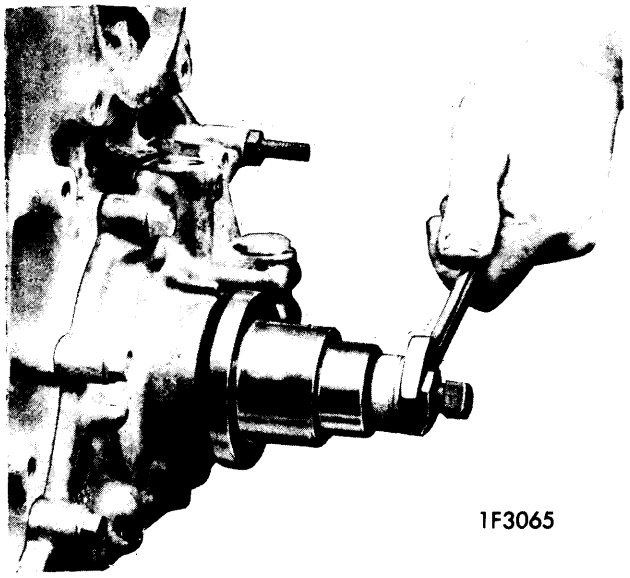
ENGINE FRONT COVER

Disconnect negative battery cable and remove fan and spacer. Loosen lower cover screws (cover is slotted) and remove upper screw and nut. Remove front cover.

OIL PUMP (FRONT CRANKCASE) SEAL REPLACEMENT

Removal – Remove engine front cover, accessory drive pulley, timing belt, lower cover, and crankshaft timing sprocket. Pry old seal from front cover.

Installation – Coat new seal lips with oil and apply sealing compound to outside diameter. Position seal, closed end outward, onto crankshaft and install in bore of cover with suitable tool (J-23624).



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INSTALLING CRANKSHAFT FRONT SEAL

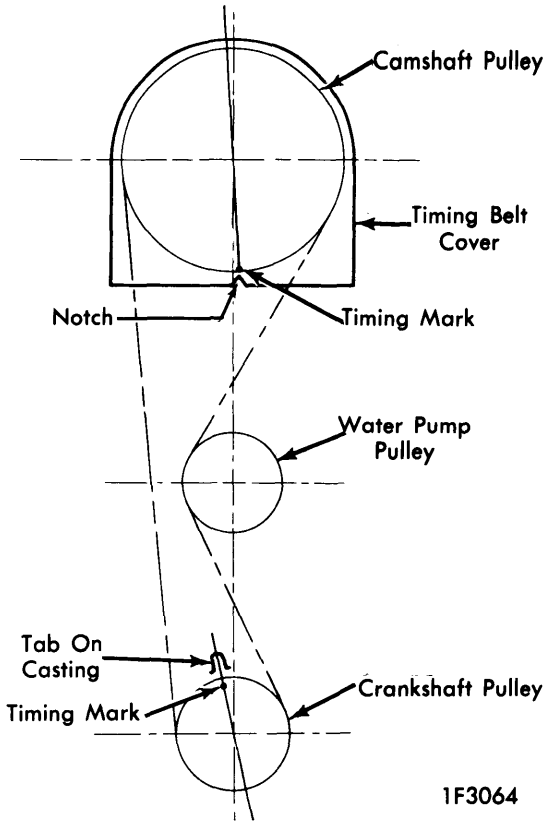
CAMSHAFT			
Engine	Journal Diam.	Clearance①	Lobe Lift
140″	2.2812-2.2822″	.....	Int. .4000″ Exh. .4150″

① – End play is .004-.012″.

TIMING BELT REPLACEMENT

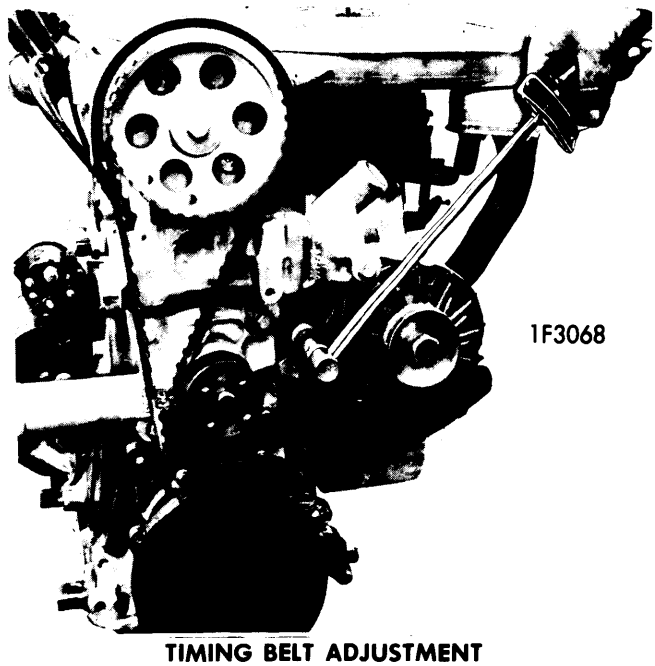
Removal – Remove engine front cover and accessory drive pulley. Drain cooling system and loosen water pump bolts. Remove lower belt cover and remove belt. Remove water pump, install new gasket and loosely install water pump.

Installation – Align timing mark on cam sprocket with notch on timing belt upper cover. Align crankshaft sprocket timing mark with cast rib on oil pump cover. Install timing belt on crankshaft sprocket (back of belt in water pump track), then install belt to camshaft sprocket making sure both sprockets maintain their indexed positions. Install lower belt cover and adjust belt tension.



SPROCKET TIMING MARKS

Belt Tension Adjustment – Position suitable tool (J-23564) in gauge hole adjacent to left side of water pump. Apply 15 ft. lbs. torque to water pump (see illustration) and while maintaining this torque, tighten water pump bolts.



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TIMING BELT ADJUSTMENT

2300 CC 4 CYL. (Cont.)

Belt Tension Check With Strand Tension Gauge – Position strand tension gauge onto belt so bail wire is between cogs and foot of gauge is on grooved side of belt. Depress handle of gauge until it bottoms and observe gauge reading. Correct tension for timing belt is 100-140 lbs.

CAMSHAFT

Removal – 1) Remove hood and disconnect battery ground cable. Remove alternator drive belt and upper timing belt cover bolts and pull cover forward. Remove camshaft sprocket and timing belt. Remove three screws retaining camshaft seal and retainer assembly and remove cover. Remove air cleaner bolt, disconnect ventilation tube and remove air cleaner.

2) Remove PCV valve and remove camshaft cover. Disconnect fuel line at carburetor and remove idle solenoid. Remove carburetor choke coil, cover and rod, and distributor. Raise vehicle on a hoist and disconnect front engine mounts. Raise front of engine and position wood block 1½" thick between engine mounts and body.

3) Install a suitable camshaft removal tool (J-23591) on cylinder head so that tool attaching holes align with lower camshaft cover attaching holes. Position tappet depressing levers on tool so that they contact squarely both intake and exhaust tappets. With tool correctly aligned, back off screws on tool so that they do not contact bosses underneath tool.

4) Use hardened screws to attach tool to cylinder head. Turn screws in bottom of tool until they just contact corresponding bosses in cylinder head. Apply a heavy lubricant to ball end of lever depressing screws. Tighten screws to depress tappets.

NOTE – If more than 10 ft. lbs. is required to turn screws, check tool for proper alignment.

5) With all tappets fully depressed, camshaft can be slid out toward front to remove. Care must be taken when removing camshaft to avoid damage to camshaft bearings or camshaft lobes. Thoroughly clean camshaft and check for wear or scoring. Measure camshaft journals with a micrometer. If journals are worn more than .001", camshaft must be replaced. Check camshaft runout with a dial indicator positioned on center journal. If runout exceeds .0015", camshaft must be replaced.

Installation – Lubricate camshaft and carefully install in cylinder head. Loosen all tappet depressing lever screws and remove tool. Reverse removal procedure to complete camshaft installation.

CAMSHAFT BEARINGS

Removal – Install remover-installer plate of suitable tool (J-23638) into front bearing and tap bearing from bore. To remove remaining bearings, install guide plate into front bore of head and tap bearing from bore. *NOTE – Tap rear bearing slowly into distributor shaft housing being careful not to unseat end plug. Crush bearing to remove from housing.*

Installation – Install new bearings beginning with rear bearing and working forward while noting the following: Oil holes in three rear bearings must be aligned with oil holes in case. Oil holes in first two bearings should be placed in 11 o'clock position and oil groove in number one bearing toward front of engine.

CAMSHAFT END THRUST

Attach a dial indicator to cylinder head so indicator plunger can follow cam movement. Move camshaft back and forth and record movement. If end thrust is not within specifications, replace camshaft retainer. Retainers are available in increments of .004" beginning with .226" and ranging up to .238".

CAM LOBE LIFT

Attach dial indicator to cylinder head so intake and exhaust valve of same cylinder can be measured. Rotate crankshaft until dial indicator is on heel of cam lobe. Set dial at zero and bump engine over until indicator shows a fully raised position. If lift is not within specifications, replace camshaft. *NOTE – Distributor primary lead must be disconnected from negative post on coil.*

ENGINE OILING

Crankcase Capacity – 3.5 quarts. Add .5 qts. with filter change.

Oil Filter – Change filter at first oil change and every second oil change after that.

Normal Oil Pressure – 27-41 psi @ 1000 RPM.

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

ENGINE OILING SYSTEM

All oil from the oil pump passes through a full-flow oil filter and into a main gallery on left side of block. Main and rod bearings are oiled directly from main gallery. Overhead oiling for camshaft and valve train is from front main bearing, which acts as metering device, through vertical passages in block and head to the camshaft bearings. Oil from cam bearings lubricates valve train, tappets and adjusters. One of four drainback passages has a tubular extension to assure positive drain-back directly to oil pan.

OIL PUMP (CRANKCASE FRONT COVER)

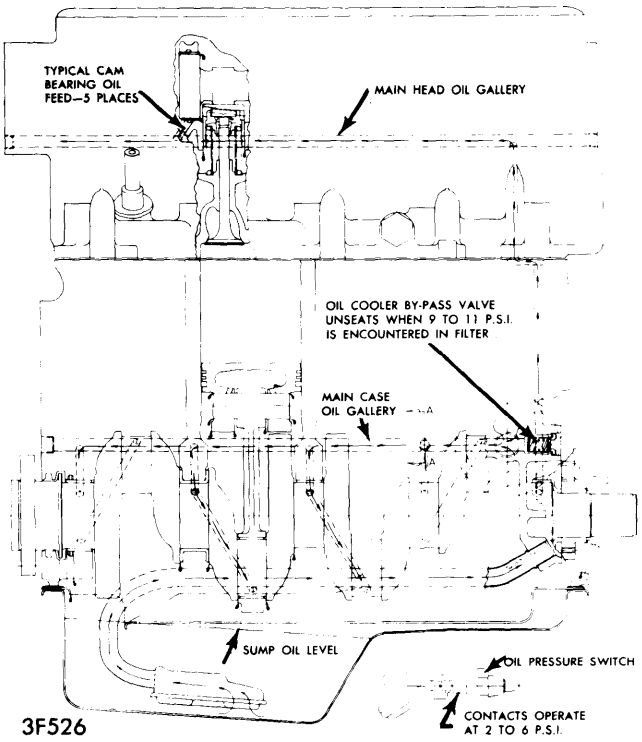
Inspection – Disassemble pump and thoroughly clean all parts. Check clearances given in following table.

Measurement	Clearance
Outside dia. of driven gear & pump	.0038-.0068"
Outside dia. of drive gear & crescent	.0023-.0093"
Inside dia. of driven gear & crescent	.0068-.0148"
Gear end clearance	.0009-.0023"

Pump gears and body are not serviced separately. If pump gears or body are worn, replace entire pump assembly.

2300 CC 4 CYL. (Cont.)

ENGINE OILING (Cont.)



ENGINE OILING

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs.
Cylinder Head	60
Clutch Pressure Plate	35
Camshaft Retainer	15
Connecting Rod Cap	35
Clutch Housing	25
Crankshaft Damper-to-Sprocket	15
Crankshaft Damper-to-Crankshaft	80
Camshaft Sprocket	80
Engine Front Cover	50 INCH lbs.
Fan Blades	20
Flywheel	60
Manifolds	30
Main Bearing Cap	65
Oil Pan	15
Oil Pump	15
Water Pump	15
Water Outlet	30