260" OLDSMOBILE, 350" CADILLAC 350"(VIN Code R) & 403" BUICK, OLDSMOBILE & PONTIAC

IDENTIFICATION CODING

ENGINE IDENTIFICATION

On all models except Cadillac, engine can be identified by a Code Tape containing engine code letters. The Code Tape is located directly above engine unit number on oil fill tube. On Cadillac (except Seville), unit number is located on block behind left cylinder head. On Seville, unit number is located on front left side of cylinder block. Engines are coded as follows:

Application	Code
Buick	
350"	TK,TL,TN,Q2,Q3, QL,QK,QP,QQ,Q6,Q7
403"	UA,UB,U2,U3,VA,VB,VJ,VK
Cadillac	
350"	6
Oldsmobile	
260"	QC,QD,QS,QT,QE,QJ
350"	QK,QL,QN,QO,QP,QQ,Q2,Q3, Q6,Q7,TK,TL,TN,TO,TP,TQ
403"	UA,UB,UC,UD,UE,U2,U3, U6,VA,VB,VJ,VK,VE
Pontiac	
350"	TL,TK,TN,TO,TX,TY,Q2, Q3,QP,QQ,Q6,Q7,Q8,Q9
403"	UA,UB,U2,U3,VA,VB,VJ,VK

ENGINE REMOVAL

See Engine Removal at end of ENGINE Section.

CYLINDER HEAD & MANIFOLDS

INTAKE MANIFOLD (EXC. CADILLAC)

Removal – Drain radiator and remove air cleaner assembly. Disconnect all coolant hoses to manifold, throttle cable, fuel and vacuum lines. Remove coil and disconnect or remove alternator and A/C compressor brackets as necessary. Remove bolts and remove intake manifold assembly from engine with carburetor attached.

Installation – Clean all gasket surfaces. Coat both sides of new intake manifold gasket with sealer and install gasket on head. Install end seals, being sure that end of seals are positioned under edges of heads. Install manifold and bolts. Tighten bolts in two steps in sequence shown in *Fig. 1*.

INTAKE MANIFOLD (CADILLAC)

Removal – **1)** Disconnect negative battery cable, remove air cleaner and crankcase filter. Disconnect throttle cable and cruise control linkage at throttle body, remove cable from bracket and position out of way. Disconnect all electrical wiring, vacuum lines and fuel lines. **CAUTION** – *Fuel in injection system could be under pressure. Relieve pressure by removing cap from Schrader fitting on fuel rail near pressure regulator. Then loosely install suitable valve depressor (J-5420) on fitting and arrange a shop rag or container to collect fuel. Slowly tighten valve depressor tool until pressure is relieved.*

2) Remove PCV valve from cover and position out of way. Remove spark plug leads, drain radiator and disconnect upper radiator hose, thermostat by-pass hose and heater hose at rear of manifold. Position A/C compressor out of way and remove fuel return hose from pressure regulator. Remove bolts and lift intake manifold from engine. Do not lift manifold by fuel rails or brackets.

Installation – **1)** Clean all gasket surfaces. Coat both sides of new gasket with sealer (use sealer carefully near injectors) and install gasket on head. Install end seals, being sure that end of seals are positioned under edges of heads. Install manifold and bolts. Tighten bolts in two steps in sequence shown in *Fig. 1*.

2) Continue in reverse of removal procedure and note the following: Black/red injector leads go to cylinders 1, 2, 7 and 8. White/black injector leads go to cylinders 3, 4, 5, and 6. Dark blue/black leads go to fast idle valve. Brown/black leads to EGR solenoid, orange/black/red lead to air temperature sensor and green wire to coolant temperature switch. When reconnecting fuel line to fuel rail use a new gasket in the fitting. **NOTE** – *This gasket is NOT installed during production, however a new one should be installed each time the connection is broken in the field. Do NOT reuse old gasket.*

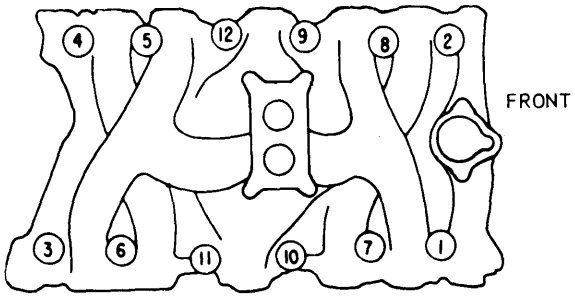


Fig. 1 Intake Manifold Tightening Sequence

CYLINDER HEAD

Removal – Drain cooling system and remove intake manifold. Remove exhaust manifold. Remove valve cover, rocker arm bolts, pivots, rocker arms and push rods. **NOTE** – *Identify pivots and rocker arms for installation to original locations.* Loosen or remove any accessory brackets which interfere. Disconnect ground strap from right cylinder head. Remove cylinder head bolts and cylinder head.

Installation – Clean all gasket surfaces and coat both sides of head gasket with sealer. Install gasket on block and install cylinder heads. **NOTE** – *On Cadillac, bottom rear bolts must be installed prior to positioning of cylinder heads.* Dip cylinder head bolts in engine oil, install and tighten in two steps in sequence shown in *Fig. 2*.

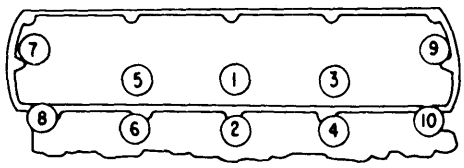


Fig. 2 Cylinder Head Tightening Sequence

260" OLDSMOBILE, 350" CADILLAC 350"(VIN Code R) & 403" BUICK, OLDSMOBILE & PONTIAC (Cont.)

VALVES

VALVE ARRANGEMENT

I-E-I-E-E-I-E-I (both banks, front to rear).

VALVE GUIDE SERVICING

Guides are integral with cylinder head. If stem-to-guide clearance is excessive, replace valve. Some valves with oversize stems are used in production, and can be identified by marks on inboard side of cylinder head on machined surface just above intake manifold. Valve guide reamers are available in .003", .005" and .013" oversize. When reconditioning, always use next oversize reamer and replacement valve. Service valves are available in standard, .003", .005", .010", and .013" oversizes.

VALVE STEM OIL SEALS

Cup type seals are used on all valves. Install with cupped side down, toward cylinder head. Position seals down as far as possible on valve stem. Seals will correctly position themselves when engine is started.

VALVE SPRINGS

Removal – Remove rocker arm cover, spark plug and rocker arm assemblies on cylinder(s) to be serviced. Install air line adapter (BT-72-1B) to spark plug port and apply air to hold valves in place. Using suitable tool (BT-6413), compress valve spring and remove valve keys, rotators and springs.

Installation – Reverse removal procedure and ensure that valve keys are securely locked in groove of valve stem.

VALVE STEM INSTALLED HEIGHT

To measure valve stem height, place suitable tool (BT-6428 or J-25289) over installed valve stem and measure clearance between gauge and stem. Clearance should be at least .015". Grind tip of valve stem if clearance is less than specified. With valve keys installed on valves, tap all valve stem ends with a hammer to seat valve retainers (or rotators) and keys. Remeasure clearance between valve retainer (or rotator) and gauge. If any valve stem end is less than .005" above rotator or .030" above retainer, valve is too short and must be replaced.

ROCKER ARM ASSEMBLY

Friction surfaces or rocker arms and pivots must be coated with a suitable lubricant upon reassembly and installed in original locations.

HYDRAULIC VALVE LIFTER ASSEMBLY

Valve lifter assemblies must be kept in sequence when removed, (for installation in their original location). Some engines have both standard and .010" oversize lifters. Oversize is etched "O" on side of lifter and cylinder block. Inspect all components for nicks, burrs or scoring of parts. If either body or plunger is defective, replace with new lifter assembly. Check lifter foot for wear with a straightedge across lifter foot. Replace any lifter showing a concave surface on lifter foot.

Leak-Down Testing – Lifter must be assembled while submerged in test fluid. Proceed as follows:

1) Install suitable adapter tool (BT-105-2) in reservoir of suitable leak-down tester (BT-60) and fill reservoir with test fluid to ½" below top of reservoir. Assemble ball check, spring and retainer into plunger with flange pressed tight against bottom of recess in plunger.

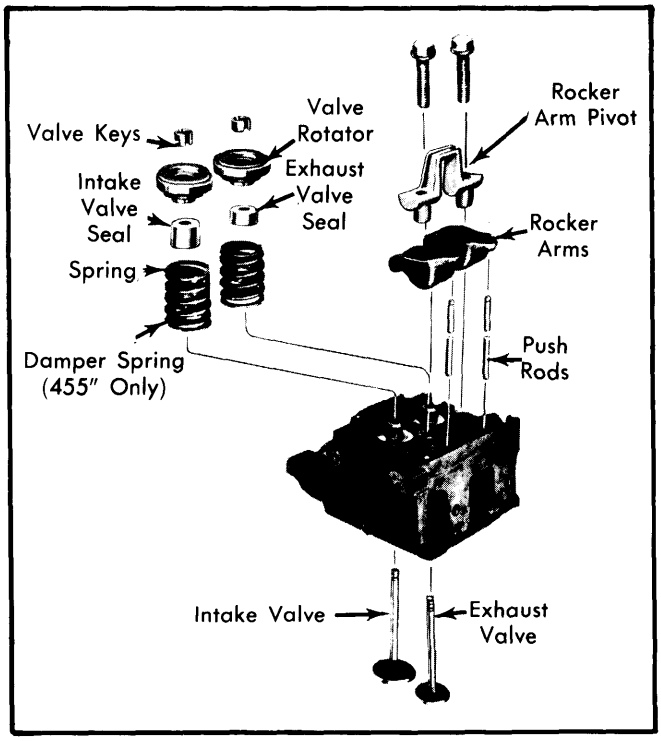


Fig. 3 Rocker Arm & Valve Assemblies

2) Install spring over ball check retainer. Hold plunger with spring up and insert into lifter body (to prevent cocking spring). Place assembly in tester cup and position push rod seat into plunger. Position ¼" steel test ball on push rod seat and lower tester ram until it contacts steel ball. Allow ram to move downward by its own weight until air bubbles disappear. Repeat several times until all air is expelled from lifter. **CAUTION** – *Do not attempt to expel air from lifter by pumping ram.*

3) After air removed, allow ram to bleed down lifter to expose ring groove and install retaining ring. Adjust ram screw so it contacts steel ball in push rod seat when pointer is at start line. Raise arm and start test by resting ram on steel ball.

4) Rotate reservoir one revolution every two seconds, and time indicator from start line to stop line. Allowable leak-down time is six seconds for used lifters, and 9-60 seconds for new lifters. **NOTE** – *If lifter within specifications, place in service without removing test fluid.*

260" OLDSMOBILE, 350" CADILLAC
350"(VIN Code R) & 403" BUICK, OLDSMOBILE & PONTIAC (Cont.)

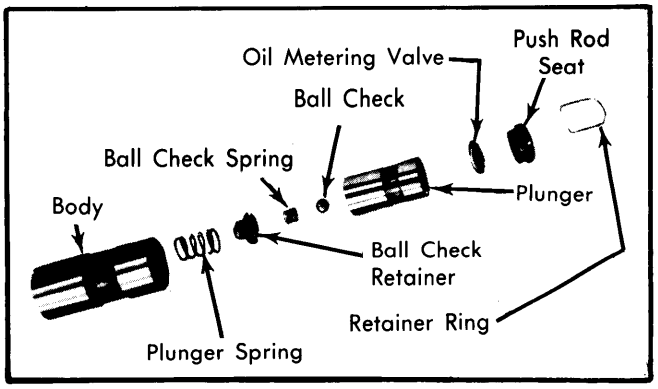


Fig. 4 Hydraulic Valve Lifter Assembly

PISTONS, PINS & RINGS

OIL PAN

See Oil Pan Removal at end of ENGINE Section.

PISTON & ROD ASSEMBLY

Removal – With oil pan, oil pump and cylinder head 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 a short piece of ⅜" hose over connecting rod studs. Push piston and rod assembly out top of cylinder block.

Installation – Lightly coat pistons, rings and cylinder walls with engine oil. Install ring compressor on piston and install piston and rod assembly in its respective cylinder bore with notch on piston head facing front of engine. Guide connecting rod onto crankshaft journal while tapping piston head with hammer handle to seat connecting rod against crankshaft. Install mating rod cap and tighten rod cap nuts.

FITTING PISTONS

When measuring piston for size or taper, measurement must be made on skirt 90° from piston pin hole. To check cylinder-to-piston clearance, insert a .0015" x ½" x 12" ribbon feeler gauge between inverted piston (pin removed) and cylinder wall at right angle to piston pin position. Force required to withdraw feeler gauge should be 3-12 lbs.

PISTON PINS

Use tool (J-24086) or equivalent for installation or removal of piston pin *(see Fig. 5)*. Coat piston bore with engine oil before pressing new pin into place. Press in pin until it contacts stop tool.

CRANKSHAFT & ROD BEARINGS

MAIN & CONNECTING ROD BEARINGS

NOTE – *Following procedures are performed with oil pan and oil pump removed.*

Connecting Rod Bearings – After ensuring rod caps are marked for cylinder identification, remove rod caps. Use Plastigage method to check for proper bearing clearances. If not within specifications, new bearings must be installed.

NOTE – *Tang on bearing half must fit with notch on rod cap and connecting rod.* Coat bearing surfaces with oil, install rod cap and tighten nuts.

Main Bearings – 1) Support crankshaft at both front and rear and ensure that all bearing caps, other than one being checked, are tight. Starting with rear main bearing cap and working forward, remove one cap at a time and check bearing clearances using Plastigage method.

2) If clearances are not within specifications, new bearings are available in standard, .0005", .0010", and .0015" undersizes. To replace upper main bearing half, insert a flattened

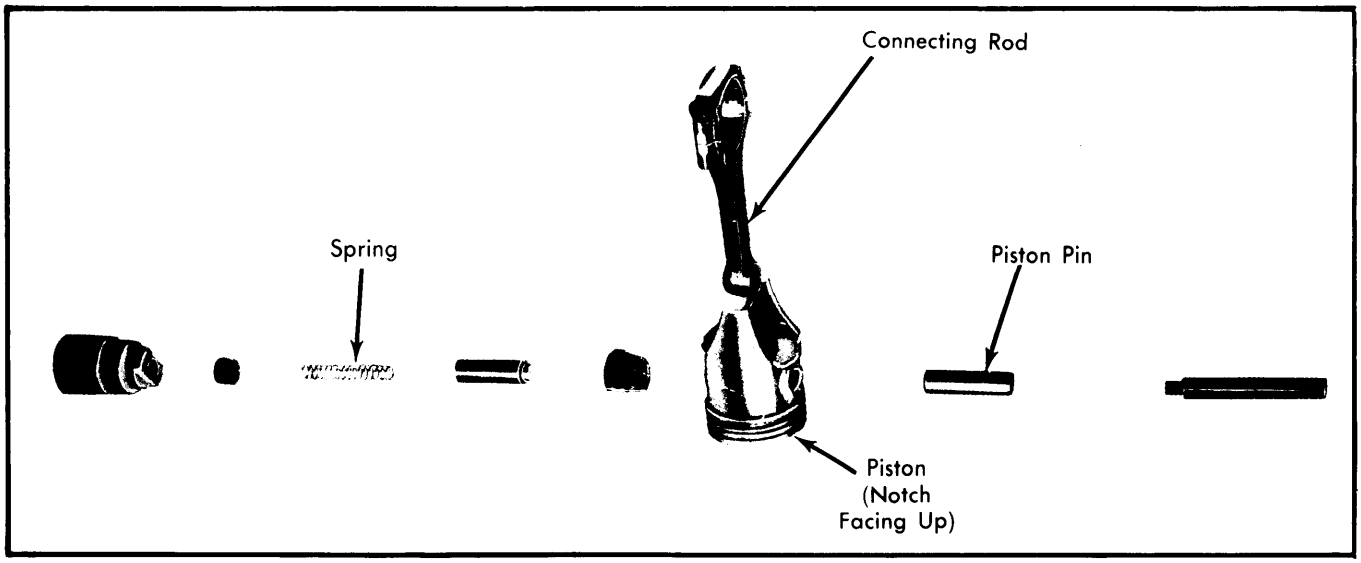
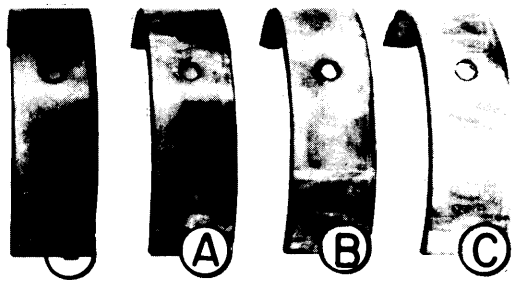


Fig. 5 Piston Pin Removal & Installation

260" OLDSMOBILE, 350" CADILLAC 350"(VIN Code R) & 403" BUICK, OLDSMOBILE & PONTIAC (Cont.)

cotter pin or roll out pin in oil passage hole in crankshaft and rotate crankshaft in direction opposite to cranking rotation. Place new upper bearing half on crankshaft journal with locating tang in correct position and rotate shaft to turn bearing into place using tool as in removal. Tighten all main bearing cap bolts and rotate crankshaft to ensure there is no excessive drag.



No Letter – Std. Letter "B" – .0010"
Letter "A" – .0005" Letter "C" – .0015"

Fig. 6 Main Bearing Identification

REAR MAIN BEARING OIL SEAL

NOTE – *Replacement of upper oil seal requires removal of crankshaft.*

Repair & Installation – 1) Drain crankcase, remove oil pan and rear bearing cap. Using packing tool (BT-6433 or J-25286-2), drive end of upper oil seal into bearing groove in cylinder block until groove is packed tight. Measure amount seal was driven up into block add 1/16", then cut this length from old seal in bearing cap (remove bearing cap seal with razor blade). Repeat this procedure on other side of block.

2) Place a drop of sealer on end of seal piece and work two pieces of seal (cut from old cap seal) into cylinder block grooves using two small screwdrivers. Drive into place using packing tool (BT-6433 or J-25286). Trim seal flush with block, using seal trimming tool (BT-6436).

3) Install a new lower oil seal in bearing cap using seal installer tool BT-6408-1 or J-25285). Rotate tool slightly and cut off each end of seal flush with cap. Install sealer on cap and install cap to engine. Tighten rear main bearing cap bolts.

CAMSHAFT

ENGINE FRONT COVER

Removal – Drain cooling system and disconnect all coolant hoses. Remove radiator upper support and radiator. Remove all belts, fan and fan pulley, crankshaft pulley and harmonic balancer. Remove oil pan. Remove cover, timing pointer and water pump assembly.

Installation – Install new cover gasket with suitable sealer around water holes and position to block. Install front cover, timing indicator and water pump assembly. Apply engine oil to front cover bolts, install and tighten.

FRONT COVER OIL SEAL

Removal – With crankshaft pulley and pulley hub removed, remove seal with puller tool.

Installation – Apply sealer to outside diameter of new seal. Using seal installer tool (BT-6405 or J-25264), install oil seal to front cover. Tighten until .005" feeler gauge will just fit between front cover and tool.

TIMING CHAIN

Removal – Remove front cover, fuel pump eccentric and oil slinger. Remove camshaft sprocket and timing chain. Remove crankshaft sprocket key and then crankshaft sprocket.

Installation – Install camshaft sprocket, crankshaft sprocket and timing chain together and align timing marks *(see Fig. 7)*. Install fuel pump eccentric with flat side rearward. Drive crankshaft sprocket key in with a brass hammer until it bottoms.

NOTE – *When two marks are in alignment, number six piston is at TDC. To obtain TDC for number one cylinder, rotate crankshaft one revolution. This will bring camshaft sprocket mark to the top and number one piston will be in firing position.*

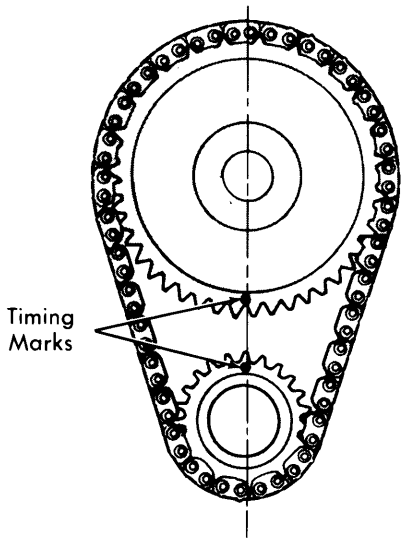


Fig. 7 Timing Chain Sprocket Alignment

CAMSHAFT

Removal – 1) Disconnect battery and drain radiator. Remove upper radiator baffle and hose support clamp. Disconnect transmission oil cooler lines at radiator. Remove radiator fan shroud and radiator. Disconnect fuel line at fuel pump.

2) Remove air cleaner and disconnect throttle cable. Remove alternator drive belt. Remove alternator mounting bracket bolts and place alternator aside. Remove power steering mounting bolts and move pump clear of engine.

260" OLDSMOBILE, 350" CADILLAC 350"(VIN Code R) & 403" BUICK, OLDSMOBILE & PONTIAC (Cont.)

3) Remove air conditioning compressor mounting bolts and water pump by-pass hose, electrical and vacuum connections. Remove distributor complete with cap and wiring. Raise vehicle and drain engine oil.

4) Remove balancer pulley, balancer and timing cover. Lower vehicle and remove valve covers. Remove intake manifold, gasket, rocker arms, push rods and lifters. NOTE – *Keep parts in order for reassembly.*

5) Discharge air conditioning system and remove condenser (if equipped). Remove fuel pump eccentric and attaching bolt, camshaft gear, oil slinger and timing chain. Carefully slide camshaft out of front of engine.

Installation – To install camshaft, reverse removal procedure. NOTE – *Before installation, coat camshaft and bearings liberally with suitable lubricant.*

CAMSHAFT BEARINGS

Removal – Bearings must be replaced as a complete set. Using suitable tool (BT-6409) remove bearings in order (No. 1 first, No. 2 second, etc.).

Installation – To install camshaft bearings, reverse removal procedure while noting the following: To aid in aligning bearings with oil passages, place bearing in front bore with tapered edge toward block and align oil hole in bearing with center of oil slot in bore. Mark top of bearing. When installing bearing, mark will act as a guide.

VALVE TIMING

1) Remove distributor cap, right valve cover, No. 4 cylinder intake and exhaust rocker arms and pivot. Remove wire from "BAT" terminal of distributor. Turn ignition switch on and crank engine until rotor is in line with No. 4 spark plug wire position (No. 4 piston at top of cylinder).

2) Measure from pivot boss on head surface to top of No. 4 intake push rod and record measurement. Crank engine until rotor approaches No. 1 spark plug wire position. Continue to turn engine until timing mark on crankshaft pulley is at TDC. Measure from pivot boss surface to top of No. 4 intake push rod. Measurement should increase over first recorded measurement by 1/8" ± 1/32".

ENGINE OILING

Crankcase Capacity – 4 quarts (Exc. Toronado); 5 quarts Toronado. Add 1 quart with filter change.

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

Normal Oil Pressure – 30-45 psi at 1500 RPM.

Pressure Regulator Valve – Located in oil pump cover. Not adjustable.

ENGINE OILING SYSTEM

Oil pump is mounted on rear main bearing cap in crankcase with full flow filter on right side of crankcase. Oil from filter flows through passages at rear of block to rear end of right main oil gallery and through "V" passage at front of engine to left main oil gallery *(see Fig. 9)*. Oil distribution is as follows:

Crankshaft & Camshaft Bearings – Rear crankshaft and camshaft bearings are lubricated by a vertical passage intersecting horizontal cross passage from oil filter. Other crankshaft and camshaft bearings are lubricated by a "V" shaped oil passage in each crankcase web.

Valve Lifters – Each lifter supplied with oil through short passage leading upward from main gallery at point directly below lifter.

Rocker Arms, Push Rods & Valves – Hollow push rods are supplied with oil through hole in valve lifter push rod seat.

Distributor Drive Gear – Lubricated from drilled hole in plug at rear end of left main oil gallery.

Timing Chain & Sprockets – Lubricated from drilled hole in hexagonal headed plug which closes front end of right main oil gallery.

OIL PUMP

Located on rear main bearing cap. Do not remove drive shaft extension washers (serviced as a unit). Pressure relief valve clearance in bore should be .0025-.005". End clearance of gears should be .0025-.0065".

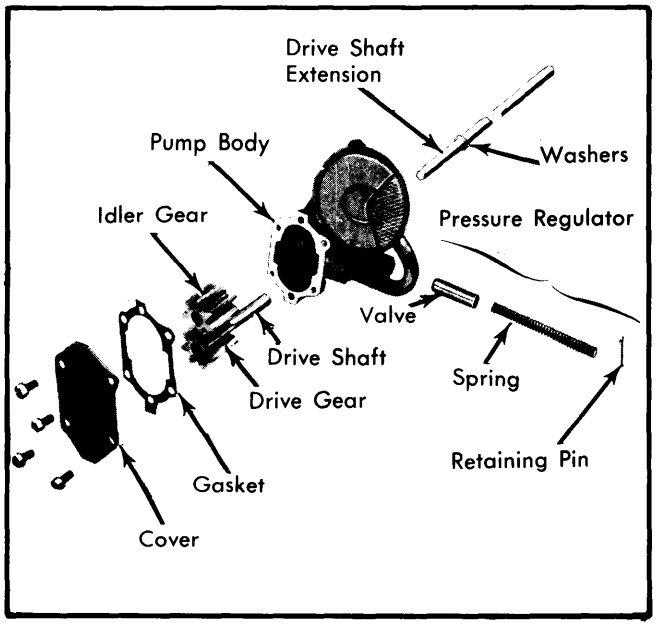
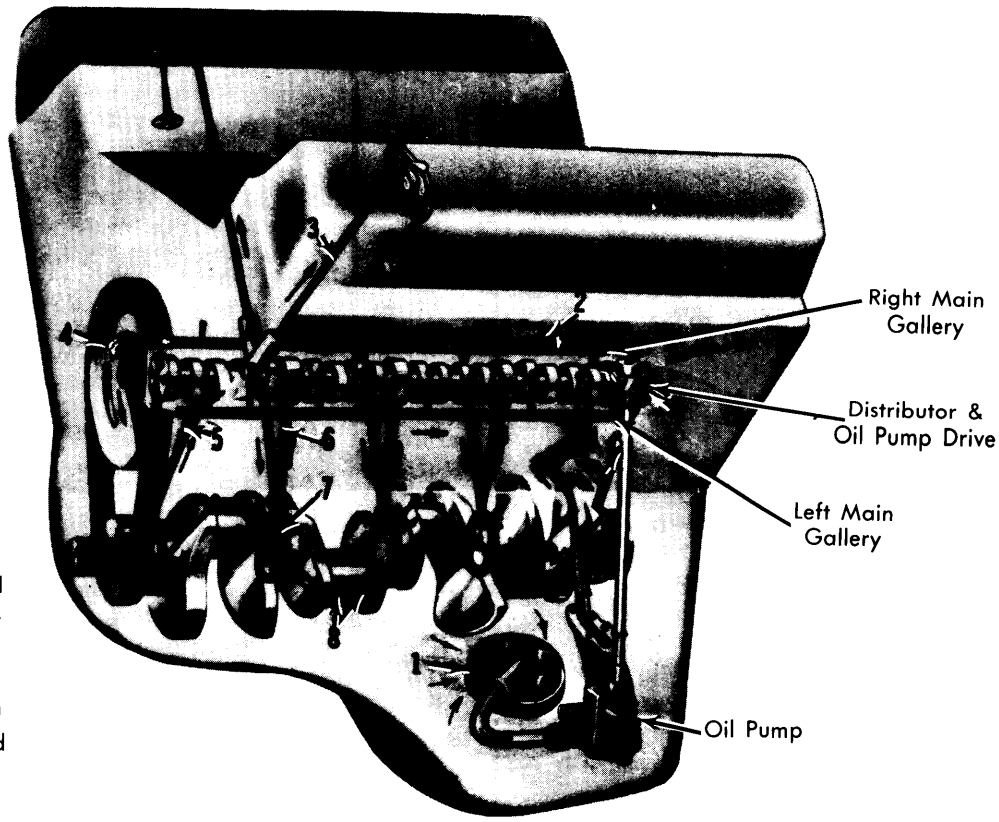


Fig. 8 Oil Pump Assembly

260" OLDSMOBILE, 350" CADILLAC
350"(VIN Code R) & 403" BUICK, OLDSMOBILE & PONTIAC (Cont.)



1 – Oil Pick-Up
2 – Lifter Feed
3 – Rocker Arm Valve Tip Feed
4 – Splash Lube To Timing Chain, Fuel Pump Cam & Dist. & Oil Pump Drive
5 – Left Main Gallery Feed
6 – Cam Bearing Feed
7 – Main Bearing Feed
8 – Rod Bearing Feed

Fig. 9 Engine Oiling System

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Engine	Net HP At RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore	Stroke	Displ. Cu. Ins.
260" V8	.....	.....	8.0:1	3.500"	3.385"	260"
350" V8	.....	.....	①8.5:1	4.057"	3.385"	350"
403" V8	.....	.....	8.5:1	4.351"	3.385"	403"

① – 8.25:1 compression ratio is used on Seville.

VALVES

Engine & Valve	Head Diam.	Face Angle	Seat Angle	Seat Width	Stem Diameter	Stem Clearance	Valve Lift
260"							
Int.	1.522"	44°	45°	.037-.075"	.3425-.3432"	.0010-.0027"	.....
Exh.	1.300"	30°	31°	.050-.090"	.3420-.3427"	.0015-.0032"	.....
350"							
Int.	1.875"	44°	45°	.037-.075"	.3425-.3432"	.0010-.0027"	.....
Exh.	1.502"	30°	31°	.050-.090"	.3420-.3427"	.0015-.0032"	.....
403"							
Int.	1.995"	44°	45°	.037-.075"	.3425-.3432"	.0010-.0027"	.....
Exh.	1.502"	30°	31°	.050-.090"	.3420-.3427"	.0015-.0032"	.....

260" OLDSMOBILE, 350" CADILLAC
350"(VIN Code R) & 403" BUICK, OLDSMOBILE & PONTIAC (Cont.)

ENGINE SPECIFICATIONS (Cont.)

PISTONS, PINS, RINGS

Engine	PISTONS	PINS		RINGS		
	Clearance	Piston Fit	Rod Fit ①	Ring	End Gap	Side Clearance
All	.001-.002"	.0003-.0005"	.0008-.0018"	Top No. 2 Oil	.010-.023" .010-.023" .015-.055"	.0020-.0040" .0020-.0040" .....

① Interference fit.

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

Engine	MAIN BEARINGS				CONNECTING ROD BEARINGS		
	Journal Diam.	Clearance	Thrust Bearing	Crankshaft Endplay	Journal Diam.	Clearance	①Sideplay
260", 350" & 403"	2.4990" ②	.0005-.0021" ③	No. 3	.004-.008"	2.1243"	.0004-.0033"	.006-.020"

① Total 2 rods.
② No. 1 is 2.4993"
③ No. 5 is .0015-.0031"

VALVE SPRINGS

Engine	Free Length	PRESSURE (LBS.)	
		Valve Closed	Valve Open
260", 350" & 403"	1.96"	76-84 @ 1.670"	180-194 @ 1.270"

CAMSHAFT

Engine	Journal Diam.	Clearance ①	Lobe Lift
All	2.0357-2.0365" ②	.0020-.0058"	.....

① End play - .011-.077"
② Each succeeding journal .020" smaller than preceding journal.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs.
Cylinder Head	①130
Intake Manifold	②40
Exhaust Manifold	25
Main Bearings	
All except rear	80
Rear only	120
Con. Rod Caps	42
Balancer-to-Crankshaft Bolt	200-310
Oil Pump-to-Bearing Cap	35
Oil Pump Cover	8
Oil Pan	10
Engine Front Cover	
3/8" Bolts	35
Toronado	50
Water Pump-to-Front Cover	13
Rocker Arm Studs-to-Head	25
Rocker Arm Cover	7
Fuel Pump-to-Block	25
Fuel Pump Eccentric-to-Camshaft	65
Engine Mounts-to-Engine	75

①— Torque to 85 Ft. Lbs. on 260" CID.
②— Torque to 15 Ft. Lbs. and then 40 Ft. Lbs.