260", 350" VIN CODE R & 403" V8 ENGINES

IDENTIFICATION CODING

ENGINE IDENTIFICATION

Engines may be identified by code tape located on left front valve cover on Oldsmobile and Pontiac. Code on Buick is located on front left side of cylinder block. Codes are as follows:

Application	Code
Buick	
350" 4-Bbl.	R
403" 4-Bbl.	K
Oldsmobile	
260" 2-Bbl.	F
350" 4-Bbl.	R
403" 4-Bbl.	K
Pontiac	
350" 4-Bbl.	R
403" 4-Bbl.	K

ENGINE REMOVAL

See Engine Removal at end of ENGINE Section.

CYLINDER HEAD & MANIFOLDS

INTAKE MANIFOLD

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*.

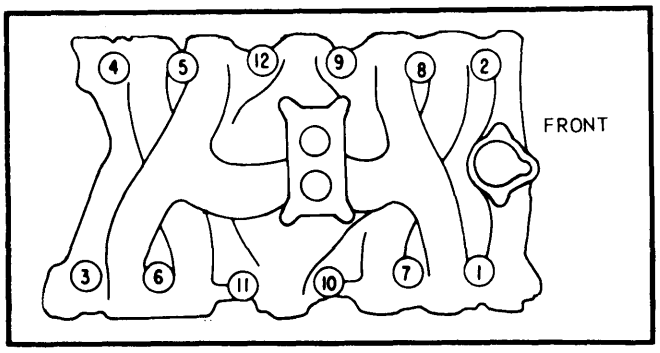

Fig. 1 Intake Manifold Tightening Sequence

CYLINDER HEAD

Removal – 1) Drain cooling system and remove intake manifold. Remove exhaust manifold. Remove valve cover, rocker arm bolts, pivots, rocker arms and push rods.

NOTE – *Keep components separate for reinstallation in original location.*

2) Loosen or remove any accessory brackets which interfere. Disconnect ground strap. Remove 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. Dip cylinder head bolts in engine oil. Install and tighten in sequence in two steps. *See Fig. 2.*

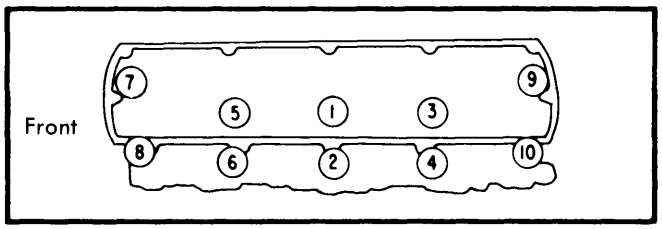

Fig. 2 Cylinder Head Tightening Sequence

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.

260", 350" VIN CODE R & 403" V8 ENGINES (Cont.)

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.

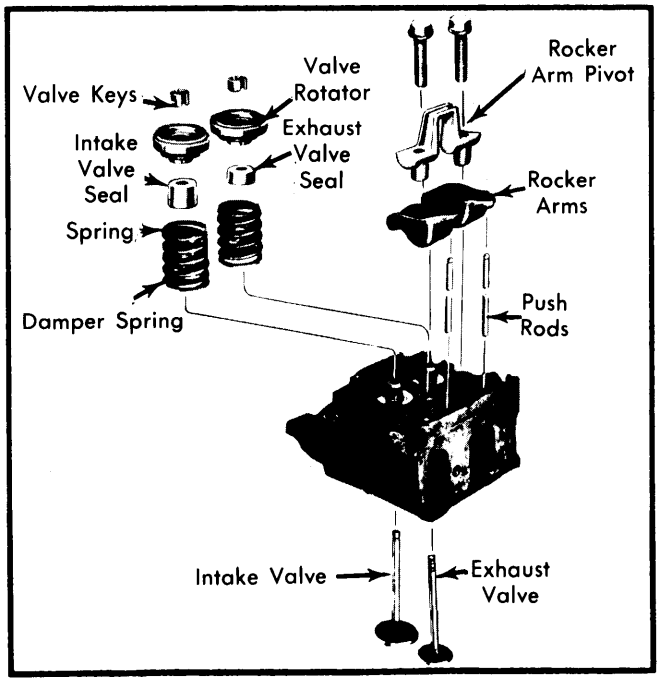

Fig. 3 Rocker Arm & Valve Assemblies

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 lead-down time is 6 seconds for used lifters and 9-60 seconds for new lifters.

NOTE – *If lifter is within specifications, place in service without removing test fluid.*

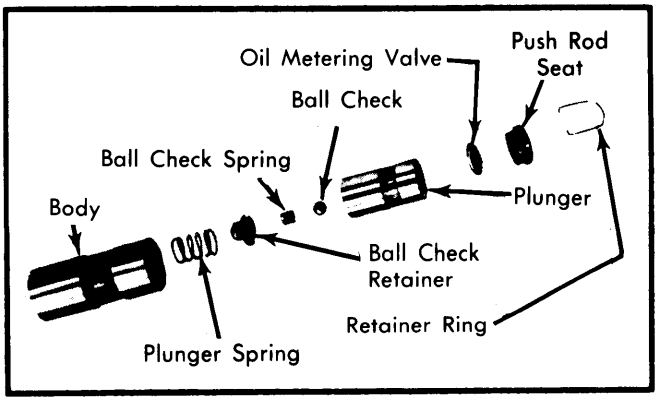

Fig. 4 Hydraulic Valve Lifter Assembly

PISTONS, PINS & RINGS

OIL PAN

See Oil Pan Removal at end of ENGINE Section.

PISTON & ROD ASSEMBLY

Removal – 1) 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.*

2) 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

260", 350" VIN CODE R & 403" V8 ENGINES (Cont.)

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 (with piston pin removed). The largest reading must be taken at bottom of skirt. Maximum allowable taper is .000" to .0001".

PISTON PINS

Using components from tool set J-24068 (See *Fig. 5*), remove and install piston pin. Coat piston pin bore with oil before pressing pin into place. Press pin until it contacts stop.

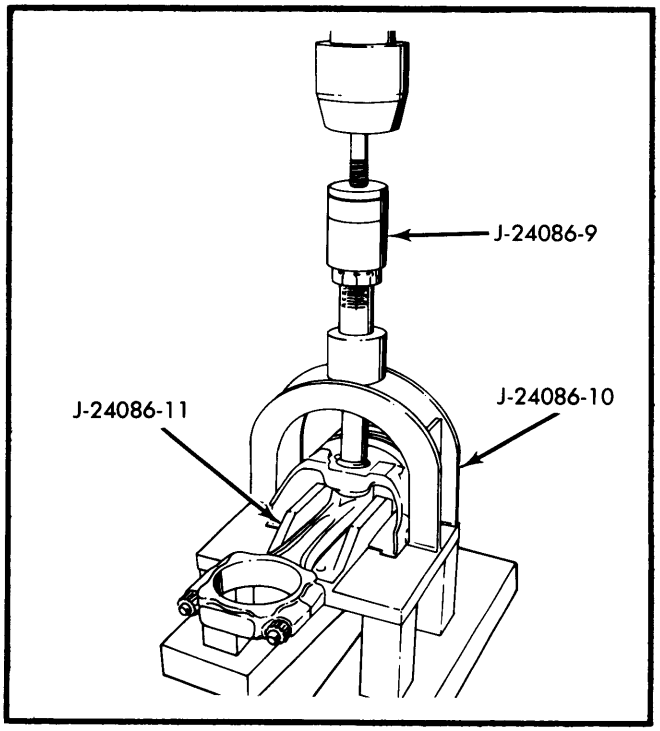

Fig. 5 Piston Pin Removal & Installation

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) To replace upper main bearing half, insert a flattened cotter pin or roll 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. 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 drag.

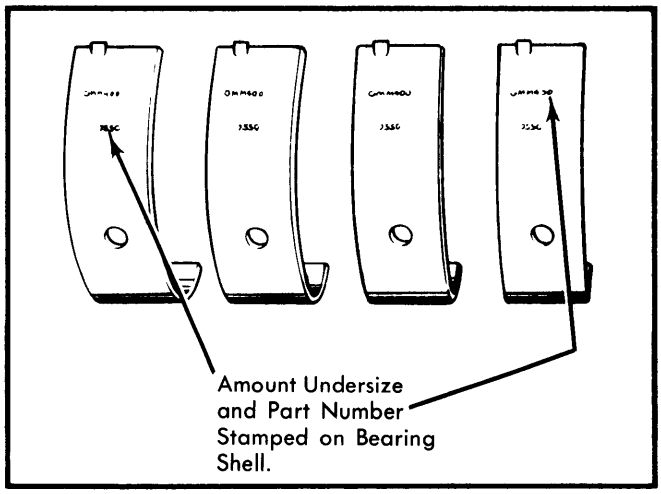

Fig. 6 Main Bearing Identification

REAR MAIN BEARING OIL SEAL

Repair & Installation – 1) Drain crankcase, remove oil pan and rear bearing cap. Using packing tool BT-6433 (or equivalent), gently drive old seal into groove until it is packed tight. This varies from 1/4" to 3/4" depending on amount of pack required. Repeat on other end of seal in block.

2) Measure amount seal was driven up on one side, add 1/16", then cut this length from old seal removed from bearing cap. Place a drop of sealer on each end of seal and work these two pieces into cylinder block with two small screwdrivers. Pack these short pieces into block using packing tool. Trim excess packing flush with block. Form a new rope seal in bearing cap. Install cap bolts and torque to specifications.

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.

260", 350" VIN CODE R & 403" V8 ENGINES (Cont.)

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 equivalent), install oil seal in front cover. Install pulley hub and crankshaft pulley. Install and adjust belts.

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.*

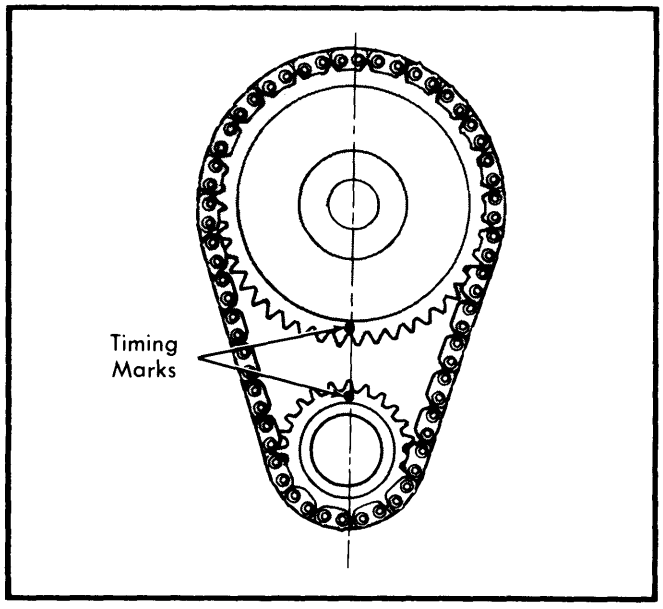

Fig. 7 Timing Chain Sprocket Alignment

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.

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 arm, 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 the 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 at 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 .125"-.134".

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.

260", 350" VIN CODE R & 403" V8 ENGINES (Cont.)

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 .0015-.0086".

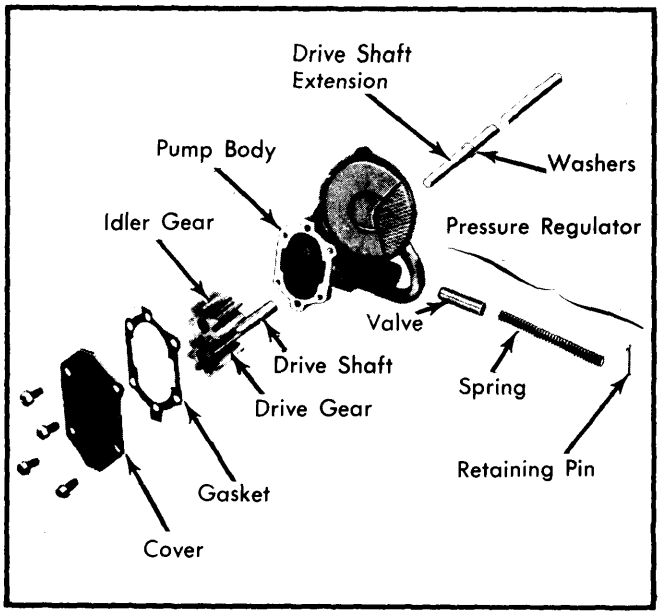

Fig. 8 Oil Pump Assembly

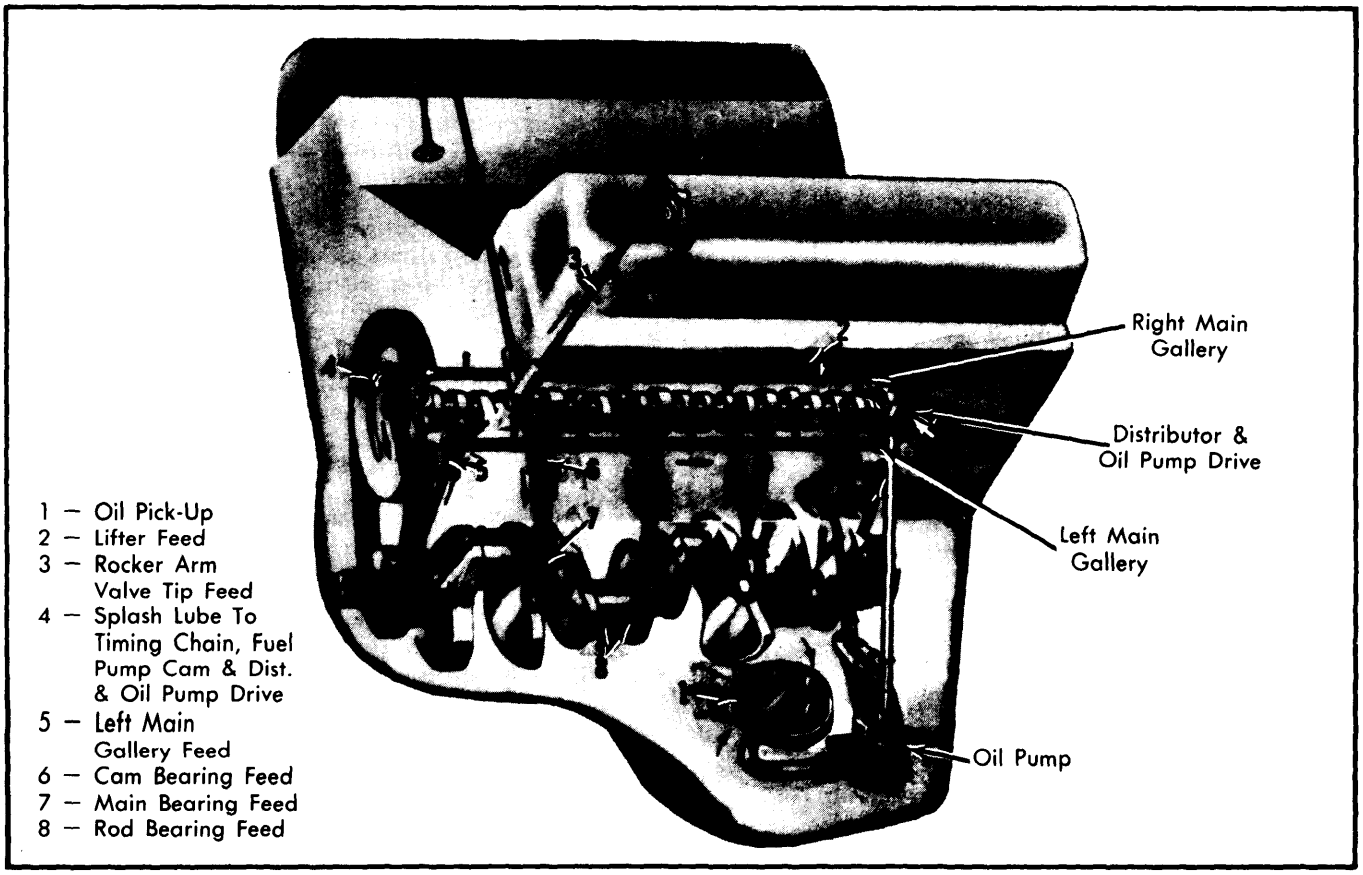

Fig. 9 Engine Oiling System

260", 350" VIN CODE R & 403" V8 ENGINES (Cont.)

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS						
Engine	Net HP At RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore	Stroke	Displ. Cu. Ins.
260"	110@3400	205@1800	8.0-1	3.500"	3.385"	260
350"	170@3800	275@2000	8.5-1	4.057"	3.385"	350
403"	185@3600	320@2200	8.5-1	4.351"	3.385"	403

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"	.....

PISTONS, PINS, RINGS						
Engine	PISTONS	PINS		RINGS		
	Clearance	Piston Fit	①Rod Fit	Rings	End Gap	Side Clearance
260", 350" &403"	.001-.002"	.0003-.0005"	.0008-.0018"	No.1 No.2 No.3	.010-.023" .010-.023" .015-.055"	.0020-.0024" .0020-.0040" .....

① – Press Fit.

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS							
Engine	MAIN BEARINGS				CONNECTING ROD BEARINGS		
	Journal Diam.	Clearance	Thrust Bearing	Crankshaft End Play	Journal Diam.	Clearance	①Side Play
260", 350" & 403"	②2.4990"	③.0005-.0021"	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"

260", 350" VIN CODE R & 403" V8 ENGINES (Cont.)

ENGINE SPECIFICATIONS (Cont.)

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	②2.0357-2.0365"	.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.

301" & 400" V8 ENGINES

IDENTIFICATION CODING

ENGINE IDENTIFICATION

Engine code number is stamped on machined pad on right front side of engine. Engine codes are as follows:

Application	Code
Buick	
301" 2-Bbl.	Y
400" 4-Bbl.	Z
Pontiac	
301" 2-Bbl.	Y
301" 4-Bbl.	W
400" 4-Bbl.	Z

ENGINE REMOVAL

See Engine Removal at end of ENGINE Section.

CYLINDER HEAD & MANIFOLDS

INTAKE MANIFOLD

Removal – Drain cooling system. Remove air cleaner and disconnect closed ventilation pipe at air cleaner. Disconnect air cleaner vacuum source at manifold and hot air duct. Remove water outlet bolts and set outlet aside with radiator hose attached. Disconnect wiring, vacuum hoses, fuel lines, and carburetor linkage. Remove carburetor and intake manifold as a unit.

Installation – Install new gaskets on cylinder heads and intake manifold assembly. Install "O" ring seal between manifold and timing chain cover. Install intake manifold assembly on engine and tighten bolts loosely. Tighten intake manifold to timing cover chain bolt. Tighten other bolts to specification.

CYLINDER HEAD

Removal – Remove intake manifold, push rod cover and rocker arm cover. Remove push rods, battery ground cable and engine ground strap. Remove exhaust pipe to manifold bolts. Remove cylinder head bolts and remove head with exhaust manifold attached.

CAUTION – *Do not strike rocker arm studs. Studs are hardened and may crack if struck.*

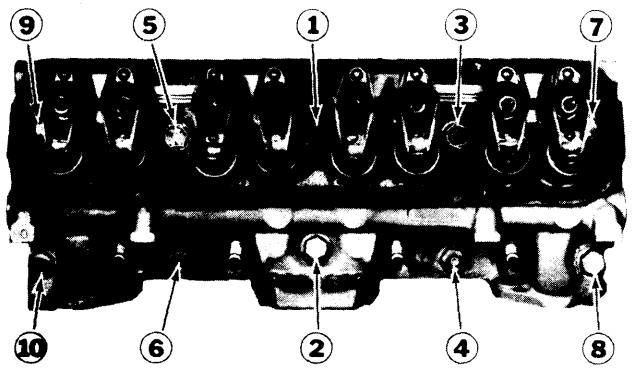

Fig. 1 Cylinder Head Tightening Sequence

Installation – 1) Clean all gasket surfaces.

NOTE – *On 301" engine, coat cylinder head bolt threads with thread sealer.*

2) Install cylinder head and bolts, tighten in sequence. See *Fig. 1*.

VALVES

VALVE ARRANGEMENT

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

VALVE GUIDE SERVICING

Valve guides are integral with head. If valve stem to guide clearance is excessive, ream guide to proper size to accomodate oversize valve stems. Valves are available in .003" oversize. Valve seat must be refaced after reaming valve guide.

VALVE STEM OIL SEALS

Valve stem seals are installed in the 2nd groove (from end of stem). Special valve seal installer and tester tools are available. Where necessary, install new umbrella type seal, using plastic protector over end of valve stem.

VALVE SPRINGS

Removal – Remove rocker arm cover, spark plug, and distributor cap. Crank engine until distributor rotor is in position to fire on cylinder being serviced. Install suitable air fitting (J-22278) in spark plug hole and attach air line. Remove rocker arm. Thread valve spring compressor stud (J-8929) on rocker arm stud and compress valve spring, using compressor and nut. Remove valve spring retainer cup locks, compressor, valve spring and seal.

Installation – Install new parts and compress valve spring. Install seal and retainer cup locks. Remove compressor. Install rocker arm and tighten rocker arm ball retaining nut.

ROCKER ARM STUDS

Removal & Installation – 1) Drain radiator (301" only). Remove rocker arm cover. Remove rocker arm and nut. Using a deep well socket, remove rocker stud.

NOTE – *On 301" engine only, coat lower stud threads with thread sealer.*

2) Install new stud and tighten to specifications.

HYDRAULIC VALVE LIFTER ASSEMBLIES

NOTE – *Lifters are serviced as complete assemblies only. Parts are not interchangeable between lifters. If any component of lifter is worn or damaged, complete lifter must be replaced.*

If lifters are disassembled for cleaning and inspeciton, after reassembly they should be tested using a suitable leak-down tester. Leak-down rate for 301" engine is 12-65 seconds. Leakdown rate for 400" engine is 12-90 seconds. Lifters must be replaced if they do not fall within limits.