1968-73 350", 400", 428", 455" V8 ENGINES

GENERAL SPECIFICATIONS

Year	Displ. Cu. Ins.	Carburetor	HP at RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore	Stroke
1968	350"	2-Bbl.	265 @ 4600	355 @ 2800	9.2-1	3.88"	3.75"
		4-Bbl.	320 @ 5100	380 @ 3200	10.5-1	3.88"	3.75"
	400"	2-Bbl.	265 @ 4400	397 @ 2400	8.6-1	4.120"	3.75"
		2-Bbl.	265 @ 4600	397 @ 2400	8.6-1	4.120"	3.75"
		2-Bbl.	290 @ 4600	428 @ 2500	10.5-1	4.120"	3.75"
		4-Bbl.	340 @ 4800	445@ 2900	10.5-1	4.120"	3.75"
		4-Bbl.	350 @ 5000	445 @ 3000	10.5-1	4.120"	3.75"
		4-Bbl.	330 @ 4800	430 @ 3300	10.75-1	4.120"	3.75"
		4-Bbl.	335 @ 5000	430 @ 3400	10.75-1	4.120"	3.75"
		4-Bbl.	335 @ 5300	430 @ 3600	10.75-1	4.120"	3.75"
		4-Bbl.	350 @ 5000	445 @ 3000	10.75-1	4.120"	3.75"
		4-Bbl.	360 @ 5100	445@ 3600	10.75-1	4.120"	3.75"
		4-Bbl.	360 @ 5400	445 @ 3800	10.75-1	4.120"	3.75"
	428"	4-Bbl.	375 @ 4800	472 @ 3200	10.5-1	4.120"	4.00"
		4-Bbl.	390 @ 5200	465 @ 3400	10.75-1	4.120"	4.00"
1969	350"	2-Bbl.	265 @ 4600	355 @ 2800	9.2-1	3.88"	3.75"
		4-Bbl.	325 @ 5100	380 @ 3200	10.5-1	3.88"	3.75"
		4-Bbl.	330 @ 5100	380 @ 3200	10.5-1	3.88"	3.75"
	400"	2-Bbl.	265 @4600	397 @ 2400	8.6-1	4.120"	3.75"
		2-Bbl.	290 @ 4600	428 @ 2500	10.5-1	4.120"	3.75"
		4-Bbl.	350 @ 5000	445 @ 3000	10.75-1	4.120"	3.75"
		4-Bbl.	366 @ 5100	445@ 3600	10.75-1	4.120"	3.75"
		4-Bbl.	370 @ 5500	445 @ 3900	10.75-1	4.120"	3.75"
		4-Bbl.	330 @ 4800	430 @ 3300	10.75-1	4.120"	3.75"
		4-Bbl.	335 @ 5000	430 @ 3400	10.75-1	4.120"	3.75"
		4-Bbl.	345 @ 5400	430@ 3700	10.75-1	4.120"	3.75"
		4-Bbl.	340 @ 4800	445 @ 2900	10.5-1	4.120"	3.75"
		4-Bbl.	350 @ 5000	445 @ 3000	10.5-1	4.120"	3.75"
	428"	4-Bbl.	370 @ 4800	472 @ 3200	10.5-1	4.120"	4.00"
		4-Bbl.	360 @ 4600	472 @ 3200	10.5-1	4.120"	4.00"
		4-Bbl.	390 @ 5200	465 @ 3400	10.75-1	4.120"	4.00"
1970	350"	2-Bbl.	255 @ 4600	355 @ 2800	8.8-1	3.88"	3.75"
	400"	2-Bbl.	265 @ 4600	397 @ 2400	8.8-1	4.120"	3.75"
		2-Bbl.	390 @ 4600	428 @ 2500	10.0-1	4.120"	3.75"
		4-Bbl.	330 @ 4800	445 @ 2900	10.0-1	4.120"	3.75"
		4-Bbl.	350 @ 5000	445 @ 3000	10.25-1	4.120"	3.75"
		4-Bbl.	366 @ 5100	445 @ 3600	10.5-1	4.120"	3.75"
		4-Bbl.	370 @ 5500	445 @ 3900	10.5-1	4.120"	3.75"
	455"	4-Bbl.	360 @ 4300	500 @ 2700	10.0-1	4.150"	4.210"
		4-Bbl.	370 @ 4600	500 @ 3100	10.25-1	4.150"	4.210"
1971	350"	2-Bbl.	250 @ 4400	350 @ 2400	8.0-1	3.88"	3.75"
	400"	2-Bbl.	265 @ 4400	400 @ 2400	8.2-1	4.120"	3.75"
		4-Bbl.	300 @ 4800	400 @ 3600	8.2-1	4.120"	3.75"
	455"	2-Bbl.	280 @ 4400	455 @ 2000	8.2-1	4.150"	4.210"
		4-Bbl.	325 @ 4400	455 @ 3200	8.2-1	4.150"	4.210"
		4-Bbl.	335 @ 4800	480 @ 3600	8.4-1	4.150"	4.210"

(Continued)

1968-73 350", 400", 428", 455" V8 ENGINES (Cont.)

GENERAL SPECIFICATIONS (Cont.)

Year	Displ. Cu. Ins.	Carburetor	HP at RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore	Stroke
1972	350"	2-Bbl. ①	160@4400	270@2000	8.0-1	3.88"	3.75"
		2-Bbl. ②	175@4400	275@2000	8.0-1	3.88"	3.75"
	400"	2-Bbl. ①	175@4000	310@2400	8.2-1	4.12"	3.75"
		2-Bbl. ②	200@4000	325@2400	8.2-1	4.12"	3.75"
		4-Bbl. ①	200@4000	295@2800	8.2-1	4.12"	3.75"
		4-Bbl. ②	250@4400	325@3200	8.2-1	4.12"	3.75"
	455"	2-Bbl. ①	185@4000	350@2000	8.2-1	4.15"	4.21"
		2-Bbl. ②	200@4000	370@2000	8.2-1	4.15"	4.21"
		4-Bbl. ①	220@3600	350@2400	8.2-1	4.15"	4.21"
		4-Bbl. ②	250@3600	370@2400	8.2-1	4.15"	4.21"
		4-Bbl. HO	300@4000	415@3200	8.4-1	4.15"	4.21"
1973	350"	2-Bbl. ①	150@4000	270@2000	7.6-1	3.88"	3.75"
		2-Bbl. ②	175@4000	280@2400	7.6-1	3.88"	3.75"
	400"	2-Bbl. ①	170@3600	320@2000	8.0-1	4.12"	3.75"
		2-Bbl. ②	185@4000	320@2400	8.0-1	4.12"	3.75"
	400"	4-Bbl. ①	200@4000	310@2400	8.0-1	4.12"	3.75"
		4-Bbl. ②	230@4400	325@3200	8.0-1	4.12"	3.75"
	455"	4-Bbl. ①	215@3600	350@2400	8.0-1	4.15"	4.21"
		4-Bbl. ②	250@4000	370@2800	8.0-1	4.15"	4.21"
		4-BbL. S.D.	310@4000	390@3600	8.4-1	4.15"	4.21"

① – Single Exhaust.

② – Dual Exhaust.

► *NET HORSEPOWER & TORQUE NOTE – Horsepower and Torque figures given for 1972 and later are NET. NET Horsepower and Torque represent power at the flywheel when the engine is installed in the 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 on front of engine block below right cylinder head.

1968 Engine Code Letters

Engine		Man. Trans.	Auto. Trans.
350"	265 HP	WC, WD	YJ, YN
	320 HP	WK, WR	YM, YP
400"	265 HP	WC, WD	YJ, YN
	290 HP	WA, WB	YC
	330 HP		YW, YT
	335 HP	WQ, WI, WZ	XN
	340 HP		YE
	350 HP	XZ	YS, YZ, XH
	360 HP	WT, WS, XP	XS
428"	375 HP	WG	YH
	390 HP	WJ	YK

1969 Engine Code Letters

Engine		Man. Trans.	Auto. Trans.
350"	265 HP	WU, WM	XS, YU, XB, YE
	①	WP, YC	XL, YJ, XR, YN
	325 HP	WN	XC
	330 HP	WV	XU
400"	265 HP		XX, YB, YF
	①		XM, YA
	290 HP	WD, WE	YD
	①	WA, WB	YC
	330 HP	WZ	YT
	335 HP	WQ	YW
	340 HP		XZ
	345 HP	WH	XN
	350 HP	WT, WX	YH, YS
	366 HP	WS	YZ
	370 HP	WW	XP
428"	360 HP	XK, WG	XJ, YH
	①	XE	XL
	370 HP	WF	XF
	390 HP	WJ, WL	YK, XG

① – Early production models using a 30° intake valve seat (small valve).

1968-73 350", 400", 428", 455" V8 ENGINES (Cont.)

1970 Engine Code Letters

Engine	Man. Trans.	Auto. Trans.
350" 255 HP	WU, W7	YU, X7
400" 265 HP		XX, YB
290 HP	WE	YD
330 HP	WT	YS, XV, XZ
345 HP ①	WS	YZ
350 HP	WT, WX	YS, XH
366 HP ①	WS	YZ
370 HP ②	WW	XP
370 HP ③	WH	XN
455" 360 HP		YH
370 HP	WA, WG	YC, XF

① – Ram Air III. ② – Ram Air IV. ③ – Ram Air Super Duty.

1971 Engine Code Letters

Engine	Man. Trans.	Auto. Trans.
350" 250 HP	WR, WU	① YU, XR
400" 265 HP	WS	XX
300 HP	WI, WK	YS
455" 280 HP	WG	YG
325 HP	WJ	YC
335 HP (H.O.)	WL, WC	YE

① – "YU" is Powerglide "XR" is Turbo-Hydramatic

1972 Engine Code Letters

Engine	Man. Trans.	Auto. Trans.
350" 2 Bbl.	WR	YV, YR
400" 2 Bbl.		YX
2 Bbl. ①		ZX
4 Bbl.	WS, WK	YS
455" 2 Bbl.		YH
2 Bbl. ①		ZH
4 Bbl.		YA, YC
4 Bbl. (H.O.)	WM	YB

① – Available California only; equipped with A.I.R.

Engines Manufactured before March 15, 1973.

Application	Man. Trans.	Auto. Trans.
350" 2-Bbl.	XR,XV	Y2,YR,Y7,YV, ZR,ZV,YL
400" 2-Bbl.		YP,Y4,YX,Y1, ZX,ZK, YZ
400" 4-Bbl.	WK,WS,WP	YS,Y3,YN, ZS, YY,ZN,YT
455" 4-Bbl.	WW,WT	YC,YA,ZC,ZA, YK,YD
455" Super Duty	W8	Y8

Engines manufactured after March 15, 1973.

Application	Man. Trans.	Auto. Trans.
350" 2-Bbl.	ZB,ZD	WD,XC,X2,WF,WA, XF,WC,WL,WN,YW
400" 2-Bbl.		X4,X1,X3,XH,W5
400" 4-Bbl.	Y6,YF,YG	XN,XX,X5,XZ,XK
455" 4-Bbl.	ZZ,ZE	XE,XA,XJ,XL,XO, XT,X7,XY,XM
455" Super Duty	ZJ	XD

CYLINDER HEAD

Removal – 1) Remove intake manifold, push rod cover and rocker arm cover. Remove push rods and exhaust pipe to manifold attaching bolts (except left head of 455" S.D.). In order to remove head on 455" S.D., it will be necessary to remove exhaust manifold attaching nuts and drop manifold. On Firebird models only, remove compressor mounting bolts and slide unit to one side.

2) Remove battery ground strap, engine ground strap and oil level tube bracket on right head. Remove cylinder head bolts and remove head. *CAUTION – Care must be taken when removing head bolts not to strike rocker arm studs. Studs are hardened and may crack if hit by wrench.*

Installation – Three types of cylinder head bolts are used. When installed properly, all will project equally from bosses. Tighten bolts evenly to specification. On Firebird models with air conditioning, insert right rear bolt into head before installing head. *NOTE – Do not use sealer on bolt threads.*

ENGINE REMOVAL

See Engine Removal at end of ENGINE Section.

OIL PAN REMOVAL

See Oil Pan Removal at end of ENGINE Section.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs.
Cylinder Head	95
Intake Manifold	40
Exhaust Manifold	30
Oil Pan	12
Main Bearing Cap (Rear)	120
(Others)	100
Con. Rod Caps (except 455" S.D.)	43
455" S.D.	63
Flywheel	95
Vibration Damper	160
Camshaft Sprocket	40
Camshaft Thrust Plate	20
Engine Front Cover	12
Oil Pump-to-Block	30
Rocker Arm Stud	50
Rocker Arm Retaining Nut	20

1968-73 350", 400", 428", 455" V8 ENGINES (Cont.)

PISTONS, PINS, RINGS						
	PISTONS	PINS		RINGS		
Engine	①Clearance	Piston Fit	Rod Fit	Rings	End Gap	Side Clearance
350" & 400" 1968-69	.0025-.003"	.0005-.0007"	Press Fit	1 & 2 3	.020" .035"	.0015-.005" .0015-.005"
428" 1968-69	.0030-.0036"	.0005-.0007"	Press Fit	1 & 2 3	.020" .035"	.0015-.005" .0015-.005"
350" & 400" 1970-72	② .0025-.0033"	.0005-.0007"	Press Fit	1 & 2 3	.019" .035"	.0015-.005" .0015-.005"
1973	.0029-.0037"	.0005-.0007"	Press Fit	1 2 3	.019" .015" .035"	.0015-.005" .0015-.005" .0015-.005"
455" 1970-72	.0025-.0033"	.0005-.0007"	Press Fit	1 & 2 3	.021" .035"	.0015-.005" .0015-.005"
1973	.0025-.0033"	.0005-.0007"	Press Fit	1 2 3	.021" .015" .035"	.0015-.005" .0015-.005" .0015-.005"
455" S.D. 1973	.0060-.0068"	.0005-.0007"	Press Fit	1 2 3	.021" .015" .035"	.0015-.005" .0015-.005" .0015-.005"

① – Measured at top of skirt.

② – 1970 Ram Air IV, .0055-.0061".

PISTON & ROD INSTALLATION

Notch on piston head must point toward front of engine. Identification bosses on side of connecting rod (see illustration) must point toward front of engine (Right Bank), toward rear of engine (Left Bank). When properly installed, oil spurt holes in connecting rod will face camshaft.

FITTING PISTONS

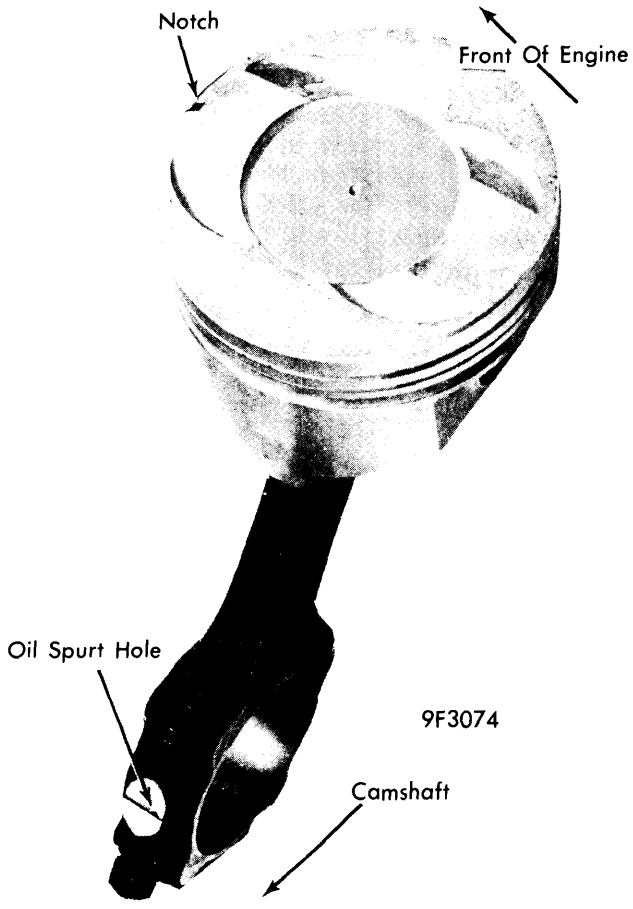
1) Inspect cylinder bores for out-of-round or excessive taper using suitable gauge. Make several measurements parallel and at right angles to crankshaft 1/2" and 4" from top of cylinder. If difference between measurements exceeds .0006", standard piston cannot be properly fitted.

2) Measure piston skirt perpendicular to piston pin boss, with pin removed, 1/8" from top of piston.

PISTON PIN INSTALLATION

See illustrations and note the following: Use suitable tool for removal and installation of piston pins. To install, place plunger and spring in tool support (use correct support and pilot plunger for piston type). Place plunger in piston pin bore. Position on press. Coat pin and rod lightly with graphite lubricant and insert pin. Press pin in until it bottoms against plunger. Piston must turn freely on pin. *Pin must not move under 1500 lb. load after assembly.*

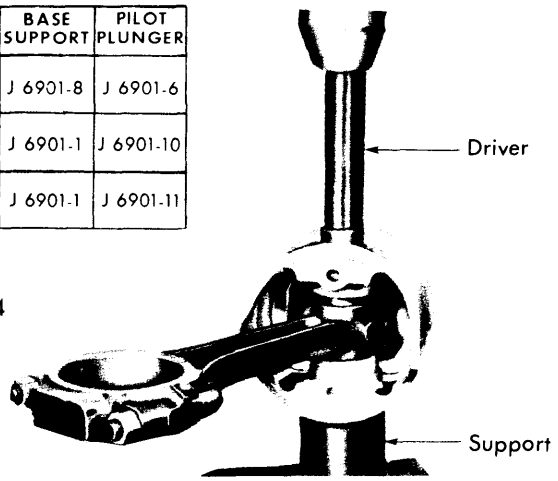
Oversize Pin Installation - .001" and .003" Oversize pins may be installed. Connecting rod may be honed to fit but **must be .0008-.0016" smaller than pin.**



PISTON & ROD ASSEMBLY

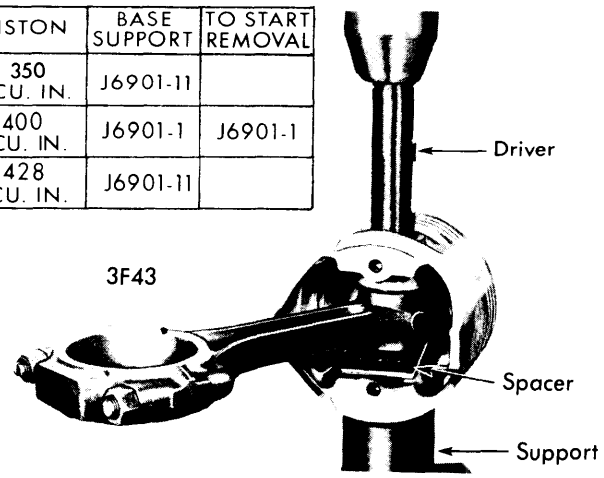
1968-73 350", 400", 428", 455" V8 ENGINES (Cont.)

PISTON	BASE SUPPORT	PILOT PLUNGER
350 CU. IN.	J 6901-8	J 6901-6
400 CU. IN.	J 6901-1	J 6901-10
428 CU. IN.	J 6901-1	J 6901-11



PISTON PIN INSTALLATION

PISTON	BASE SUPPORT	TO START REMOVAL
350 CU. IN.	J6901-11	
400 CU. IN.	J6901-1	J6901-1
428 CU. IN.	J6901-11	



PISTON PIN REMOVAL

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS							
	MAIN BEARINGS				CONNECTING ROD BEARINGS		
Engine	Journal Diam.	Clearance	Thrust Bearing	Crankshaft Endplay	Journal Diam.	Clearance	①Sideplay
350", 400" 1968-69	3.00"	.0002-.002"	No. 4	.003-.009"	2.25"	.0005-.0025"	.006-.011"
428" 1968-69	3.25"	.0002-.002"	No. 4	.003-.009"	2.25"	.0005-.0025"	.006-.011"
350", 400" 1970-73	3.00"	.0002-.0017"	No. 4	.003-.009"	2.25"	.0005-.0025"	.012-.017"
455" 1970-73	3.25"	.0005-.0021" ②	No. 4	.003-.009"	2.25"	.0005-.0025"	.012-.017"
Ram Air III 1970	3.00"	.0007-.0023"	No. 4	.003-.009"	2.25"	.0005-.0025"	.012-.017"
Ram Air IV 1970	3.00"	.0012-.0028"	No. 4	.003-.009"	2.25"	.0015-.0031"	.012-.017"

① — Total, two rods.

② — 1970-72 No. 1 main bearing, small valves .0003-.0019".

REAR MAIN BEARING OIL SEAL REPLACEMENT

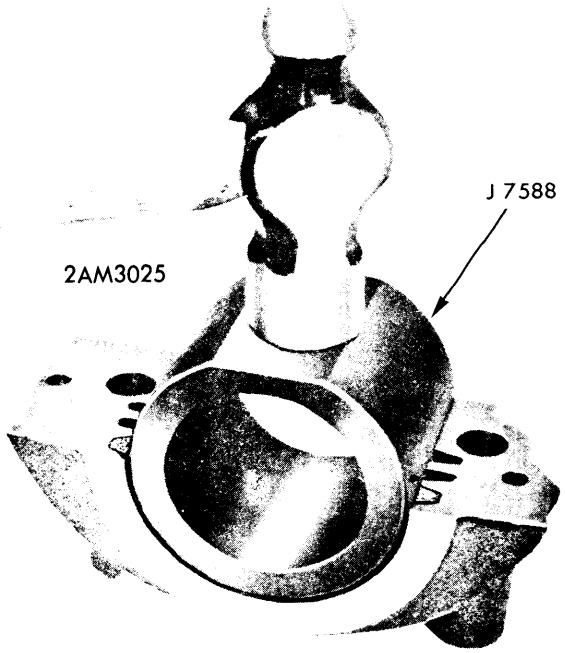
1) Remove oil pan as previously described. Remove oil pump and baffle, and rear main bearing cap. Using suitable tool, pack upper seal. Insert tool against one end of oil seal in block and gently seat seal. Remove tool and repeat at other end of seal in cylinder block.

2) Thoroughly clean block and bearing cap. Form a new seal in cap using a hammer and suitable tool (J-7588). Remove newly formed seal from cap and cut four pieces approximately 3/8" long from seal.

3) Work two 3/8" pieces into each of the gaps which have been made at the end of seal in block. Without cutting ends, work seal pieces in until flush with parting line, ensure fibers are protruding over metal next to groove.

4) Form another seal in cap using same tools. Assemble cap to block and tighten to specifications. Remove cap and inspect parting line to ensure seal has not been compressed between block and cap. Apply 1/16" bead of sealer from center of seal across to external cork groove. Reassemble cap and tighten to specification.

1968-73 350", 400", 428", 455" V8 ENGINES (Cont.)



FORMING NEW SEAL

HARMONIC BALANCER

Removal - Remove drive belts, Position fan so wide angles will be at top and bottom (allows access to balancer) Remove balancer retaining bolt and washer and slide balancer off. *NOTE - Do not pry on outer diameter of balancer. Harmonic balancer is a rubber mounted inertia member and balance could be affected.*

Installation - Reverse removal procedure. *NOTE - Before tightening balancer bolt, remove flywheel cover and lock flywheel.*

ENGINE FRONT COVER

Removal - Drain radiator and cylinder block, loosen alternator adjusting bolts, remove fan and pulley, disconnect radiator hoses, remove fuel pump, remove harmonic balancer. Remove bolts attaching oil pan to cover. Remove cover.

Installation - Thoroughly clean gasket surfaces on block and cover, inspect oil pan gasket and replace if damaged. Use new "O" ring seal in water passage in intake manifold. Install and tighten cover-to-block and intake manifold bolts first, then install oil pan screws. Tighten to correct torque specifications.

FRONT COVER OIL SEAL

To replace seal, remove fan and accessory drive belts. Remove harmonic balancer. Remove seal by prying from bore. Using suitable tool, install seal with lip of seal facing rear of engine.

VALVES

Engine & Valve		Head Diam.	Face Angle	Seat Angle	Seat Width	Stem Diameter	Stem Clearance	Valve Lift
350",400" Std.								
1968-69	Int.	1.91"	29°	30°	.045-.071"	.34"	.0016-.0033"	.....
	Exh.	1.61"	44°	45°	.048-.070"	.34"	.0021-.0038"	.....
428",GTO,GP, HO,RA								
1968-69	Int.	2.06"	29°	30°	.045-.071"	.34"	.0016-.0033"	.....
	Exh.	1.72"	44°	45°	.048-.070"	.34"	.0021-.0038"	.....
350",400",455"Std.								
1970	Int.	1.96"	29°	30°	.045-.071"	.34"	.0016-.0033"	.....
	Exh.	1.66"	44°	45°	.048-.070"	.34"	.0021-.0038"	.....
455",GTO,GP								
1970	Int.	2.11"	29°	30°	.045-.071"	.34"	.0016-.0033"	.....
	Exh.	1.77"	44°	45°	.048-.070"	.34"	.0021-.0038"	.....
350",400", 455" 2-Bbl.								
1971	Int.	1.96"	29°	30°	.045-.071"	.34"	.0016-.0033"	.....
	Exh.	1.66"	44°	45°	.048-.070"	.34"	.0021-.0038"	.....

1968-73 350", 400", 428", 455" V8 ENGINES (Cont.)

VALVES (Cont.)							
Engine & Valve	Head Diam.	Face Angle	Seat Angle	Seat Width	Stem Diameter	Stem Clearance	Valve Lift
400" & 455" 4-Bbl.							
1971 Int.	2.11"	29°	30°	.045-.071"	.34"	.0016-.0033"	.....
Exh.	1.77"	44°	45°	.048-.070"	.34"	.0021-.0038"	.....
350" & 400" 455" 2-Bbl.							
1972 Int.	1.96"	29°	30°	.045-.071"	.34"	.0016-.0033"	.....
Exh.	1.77"	44°	45°	.048-.070"	.34"	.0021-.0038"	.....
400" & 455" 4-Bbl.							
1972 Int.	2.11"	29°	30°	.045-.071"	.34"	.0016-.0033"	.....
Exh.	1.77"	44°	45°	.048-.070"	.34"	.0021-.0038"	.....
350" & 400"							
1973 Int.	1.96"	44°	45°	.047-.063"	.34"	.0016-.0033"	.377"
Exh.	1.66"	44°	45°	.063"	.34"	.0021-.0038"	.413"
400" 4-Bbl.							
1973 Int.	2.11"	29°	30°	.047-.063"	.34"	.0016-.0033"	.410"
Exh.	1.66"	44°	45°	.063"	.34"	.0021-.0038"	.415"
455"							
1973 Int.	2.11"	29°	30°	.047-.063"	.34"	.0016-.0033"	410"
Exh.	1.66"	44°	45°	.063"	.34"	.0021-.0038"	.414"
455" S.D.							
1973 Int.	2.11"	29°	30°	.047-.063"	.34"	.0016-.0033"	.470"
Exh.	1.77"	44°	45°	.063"	.34"	.0021-.0038"	.470"

① — See "Valve Lift Table".
② — Intake small valve face angle — 44°.
③ — Intake small seat angle — 45°.

VALVE ARRANGEMENT

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

VALVE STEM OIL SEALS

"O" ring type used on all valves. 350" H.O. (High Output), 400" H.O. (High Output), 428" & GTO 4-Bbl. use umbrella type and "O" ring type seals together. Install "O" ring seals in second groove from end of valve stem; install umbrella type seals with cup end down. Suction cup type seal tester and installer J-22330 is available.

1968 VALVE SPRINGS					
		PRESSURE (POUNDS) AT LENGTH (INCHES)			
		INTAKE		EXHAUST	
Engine	Spring	Valve Closed	Valve Open	Valve Closed	Valve Open
350" 2-Bbl.	Outer	60-66 at 1 37/64"	123-133 at 1 13/64"	60-66 at 1 37/64"	129-139 at 1 11/64"
	Inner	32-38 at 1 35/64"	89-99 at 1 11/64"	32-38 at 1 35/64"	94-104 at 1 1/8"
4-Bbl. Synchro-mesh	Outer	60-66 at 1 37/64"	128-138 at 1 11/64"	60-66 at 1 37/64"	129-139 at 1 11/64"
	Inner	32-38 at 1 35/64"	94-104 at 1 1/8"	32-38 at 1 35/64"	95-105 at 1 1/8"
4-Bbl. Auto. Trans.	Outer	60-66 at 1 37/64"	128-138 at 1 11/64"	60-66 at 1 37/64"	129-139 at 1 11/64"
	Inner	32-38 at 1 35/64"	94-104 at 1 1/8"	32-38 at 1 35/64"	95-105 at 1 1/8"
400" 2-Bbl. Synchro-mesh	Outer	60-66 at 1 37/64"	128-138 at 1 11/64"	60-66 at 1 37/64"	129-139 at 1 11/64"
	Inner	32-38 at 1 35/64"	94-104 at 1 1/8"	32-38 at 1 35/64"	95-105 at 1 1/8"
2-Bbl. Auto. Trans.	Outer	60-66 at 1 37/64"	123-133 at 1 13/64"	60-66 at 1 37/64"	129-139 at 1 11/64"
	Inner	32-38 at 1 35/64"	89-99 at 1 11/64"	32-38 at 1 35/64"	94.104 at 1 1/8"

1968-73 350", 400", 428", 455" V8 ENGINES (Cont.)

1968 VALVE SPRINGS (Cont.)

Engine	Spring	PRESSURE (POUNDS) AT LENGTH (INCHES)			
		INTAKE		EXHAUST	
		Valve Closed	Valve Open	Valve Closed	Valve Open
4-Bbl. ① Man. Trans.	Outer	63-69 at 1 9/16"	132-142 at 1 5/32"	63-69 at 1 9/16"	133-143 at 1 9/64"
	Inner	55-60 at 1 33/64"	118-128 at 1 7/64"	55-60 at 1 33/64"	118-128 at 1 7/64"
4-Bbl. ③ Auto. Trans.	Outer	63-69 at 1 9/16"	132-142 at 1 5/32"	63-69 at 1 9/16"	133-143 at 1 9/64"
	Inner	35-41 at 1 33/64"	97-107 at 1 7/64"	35-41 at 1 33/64"	98-108 at 1 7/64"
4-Bbl. High Output ① Man. Trans.	Outer	63-69 at 1 9/16"	133-143 at 1 9/64"	63-69 at 1 9/16"	133-143 at 1 9/64"
	Inner	55-60 at 1 33/64"	119-129 at 1 7/64"	55-60 at 1 33/64"	118-128 at 1 7/64"
4-Bbl. ② Man. Trans.	Outer	63-69 at 1 9/16"	132-142 at 1 5/32"	63-69 at 1 9/16"	133-143 at 1 9/64"
	Inner	35-41 at 1 33/64"	97-107 at 1 7/64"	35-41 at 1 33/64"	98-108 at 1 7/64"
4-Bbl. ② Auto. Trans. exc. G.P. ⑤	Outer	60-66 at 1 37/64"	128-138 at 1 11/64"	60-66 at 1 37/64"	129-139 at 1 11/64"
	Inner	32-38 at 1 35/64"	94-104 at 1 1/8"	32-38 at 1 35/64"	95-105 at 1 1/8"
4-Bbl. ② G.P. Auto. Trans. ⑤	Outer	63-69 at 1 9/16"	132-142 at 1 5/32"	63-69 at 1 9/16"	133-143 at 1 9/64"
	Inner	35-41 at 1 33/64"	97-107 at 1 7/64"	35-41 at 1 33/64"	98-108 at 1 7/64"
4-Bbl. Ram Air All Trans.	Outer	71-81 at 1 23/32"	182-198 at 1 19/64" ④	71-81 at 1 23/32"	182-198 at 1 19/64"
	Inner	40-46 at 1 41/64"	88-98 at 1 15/64"	40-46 at 1 41/64"	88-98 at 1 15/64"
428" Std. Man. Trans.	Outer	63-69 at 1 9/16"	133-143 at 1 9/64"	63-69 at 1 9/16"	133-143 at 1 9/64"
	Inner	55-60 at 1 33/64"	119-129 at 1 7/64"	55-60 at 1 33/64"	118-128 at 1 7/64"
Std. Auto. Trans.	Outer	63-69 at 1 9/16"	132-142 at 1 5/32"	63-69 at 1 9/16"	133-143 at 1 9/64"
	Inner	35-41 at 1 33/64"	97-107 at 1 7/64"	35-41 at 1 33/64"	98-108 at 1 7/64"
High Output All Trans.	Outer	63-69 at 1 9/16"	132-142 at 1 5/32"	63-69 at 1 9/16"	133-143 at 1 9/64"
	Inner	35-41 at 1 33/64"	97-107 at 1 7/64"	35-41 at 1 33/64"	98-108 at 1 7/64"

① - Firebird & Tempest. ② - Pontiac. ③ - Standard & H.O. Engines. ④ - Auto. Trans. 182-193. ⑤ - Grand Prix.

1969 VALVE SPRINGS

Application	Spring	PRESSURE (LBS.) AT LENGTH (INCHES)			
		INTAKE		EXHAUST	
		Valve Open	Valve Closed	Valve Open	Valve Closed
Standard	Outer	135-145 @ 1.134"	59-65 @ 1.586"	135-145 @ 1.134"	59-65 @ 1.586"
	Inner	99-105 @ 1.114"	28-34 @ 1.566"	99-105 @ 1.114"	28-34 @ 1.566"
GTO With Standard Transmission	Outer	135-145 @ 1.134"	59-65 @ 1.586"	135-145 @ 1.134"	59-65 @ 1.586"
	Inner	118-128 @ 1.114"	48-53 @ 1.566"	118-128 @ 1.114"	48-53 @ 1.566"
GTO and Firebird With Ram Air	Outer	180-190 @ 1.299"	93-99 @ 1.712"	180-190 @ 1.299"	93-99 @ 1.712"
	Inner	.....	.....	.....	.....
428 H. O. With Std. Transmission	Outer	135-145 @ 1.134"	59-65 @ 1.586"	135-145 @ 1.134"	59-65 @ 1.586"
	Inner	118-128 @ 1.114"	48-53 @ 1.566"	118-128 @ 1.114"	48-53 @ 1.566"

1968-73 350", 400", 428", 455" V8 ENGINES (Cont.)

1970 VALVE SPRINGS

Engine	Spring	PRESSURE (POUNDS) AT LENGTH (INCHES)			
		INTAKE		EXHAUST	
		Valve Closed	Valve Open	Valve Closed	Valve Open
1970					
350", 400" 2-Bbl.	Outer	63 @ 1.582"	128 @ 1.206"	63 @ 1.582"	134 @ 1.170"
Reg. Fuel & Auto. Trans.	Inner	35 @ 1.542"	94 @ 1.166"	35 @ 1.542"	99 @ 1.130"
400" 4-Bbl.	Outer	66 @ 1.561"	137 @ 1.151"	66 @ 1.561"	138 @ 1.148"
Reg. Fuel & Auto. Trans.	Inner	38 @ 1.521"	100 @ 1.111"	38 @ 1.521"	102 @ 1.108"
400" 2-Bbl.	Outer	63 @ 1.582"	133 @ 1.172"	63 @ 1.582"	134 @ 1.168"
Prem. Fuel & Auto. Trans.	Inner	35 @ 1.542"	99 @ 1.132"	35 @ 1.542"	100 @ 1.128"
400" 4-Bbl.	Outer	59 @ 1.582"	132 @ 1.181"	61 @ 1.591"	132 @ 1.181"
Man. Trans.	Inner	57 @ 1.521"	123 @ 1.111"	57 @ 1.521"	124 @ 1.108"
400" Ram Air	Outer	61 @ 1.591"	132 @ 1.177"	61 @ 1.591"	223 @ 1.291"
	Inner	40 @ 1.748"	111 @ 1.221"	40 @ 1.748"	111 @ 1.221"
400" Ram Air IV	Outer	75 @ 1.818"	223 @ 1.291"	75 @ 1.818"	223 @ 1.291"
	Inner	40 @ 1.748"	223 @ 1.291"	40 @ 1.748"	223 @ 1.291"
455"	Outer	66 @ 1.561"	137 @ 1.147"	66 @ 1.561"	137 @ 1.147"
	Inner	38 @ 1.521"	102 @ 1.108"	38 @ 1.521"	102 @ 1.108"

1971-72 VALVE SPRINGS

Engine	Spring	PRESSURE (LBS.) AT LENGTH (INCHES)			
		INTAKE		EXHAUST	
		Valve Closed	Valve Open	Valve Closed	Valve Open
1971					
350", 400", 455"	Outer	61 @ 1.563"	132 @ 1.156"	61 @ 1.563"	132 @ 1.156"
2-Bbl.	Inner	33 @ 1.563"	98 @ 1.156"	33 @ 1.563"	98 @ 1.156"
400", 455"	Outer	65 @ 1.531"	135 @ 1.125"	65 @ 1.531"	135 @ 1.125"
4-Bbl.	Inner	37 @ 1.531"	101 @ 1.125"	37 @ 1.531"	101 @ 1.125"
1972					
350" 2-Bbl.	Outer	61 @ 1.590"	126 @ 1.213"	61 @ 1.590"	133 @ 1.177"
Man. Trans.	Inner	33 @ 1.550"	94 @ 1.173"	33 @ 1.550"	98 @ 1.137"
350" 2-Bbl.	Outer	61 @ 1.590"	132 @ 1.179"	61 @ 1.590"	132 @ 1.175"
Auto. Trans.	Inner	33 @ 1.550"	98 @ 1.139"	33 @ 1.545"	99 @ 1.135"
400" 2-Bbl.	Outer	61 @ 1.590"	126 @ 1.213"	61 @ 1.590"	133 @ 1.177"
Auto. Trans.	Inner	33 @ 1.550"	93 @ 1.173"	33 @ 1.550"	98 @ 1.137"
400" 4-Bbl.	Outer	60 @ 1.598"	131 @ 1.188"	60 @ 1.598"	131 @ 1.184"
Man. Trans.	Inner	56 @ 1.528"	122 @ 1.118"	56 @ 1.528"	122 @ 1.114"
400" 4-Bbl.	Outer	65 @ 1.568"	135 @ 1.158	65 @ 1.568"	136 @ 1.154"
Auto. Trans.	Inner	37 @ 1.528"	101 @ 1.118"	37 @ 1.528"	102 @ 1.114"
455" 4-Bbl.	Outer	65 @ 1.569"	136 @ 1.159"	65 @ 1.569"	136 @ 1.155"
	Inner	37 @ 1.529"	101 @ 1.119"	37 @ 1.529"	102 @ 1.115"
455" H.O.	Outer	66 @ 1.561"	138 @ 1.146"	66 @ 1.561"	138 @ 1.147"
	Inner	38 @ 1.521"	103 @ 1.106"	38 @ 1.521"	103 @ 1.107"

1968-73 350", 400", 428", 455" V8 ENGINES (Cont.)

1973 VALVE SPRINGS

Engine	Spring	PRESSURE (POUNDS) AT LENGTH (INCHES)			
		INTAKE		EXHAUST	
		Valve Closed	Valve Open	Valve Closed	Valve Open
350", 400" 2-Bbl.	Outer	60@1.586"	132@1.179"	60@1.590"	132@1.175"
	Inner	33@1.550"	98@1.139"	33@1.550"	99@1.135"
400" 4-Bbl. Man. Trans.	Outer	60@1.598"	131@1.188"	56@1.528"	122@1.118"
	Inner	60@1.598"	131@1.184"	56@1.528"	122@1.114"
400" 4-Bbl. Auto. Trans.	Outer	65@1.568"	135@1.158"	65@1.568"	136@1.154"
	Inner	37@1.528"	101@1.118"	37@1.528"	102@1.114"
455" 4-Bbl.	Outer	65@1.569"	136@1.159"	66@1.569"	101@1.119"
	Inner	37@1.529"	136@1.154"	37@1.529"	102@1.115"
455" S.D.	Outer	70@1.82"	190@1.35"	40@1.75"	90@1.28"
	Inner	70@1.82"	190@1.35"	40@1.75"	90@1.28"

VALVE SPRING INSTALLED HEIGHT

Measure from spring seat on head to underside of spring retainer. See valve spring specification table.

ROCKER ARM STUD REPLACEMENT

Two types of studs are used; "Press In" and "Screw In". Oversize press in studs are available in .005" only. When installing oversize stud, stud hole must first be reamed with pilot attachment on reamer, then finish reamed without pilot.

Removal, Press-In Type – File two notches 3/32-1/8" deep so that top of notch is 1/4-3/8" below thread travel of stud. Attach suitable stud puller, tighten two side (holding) screws. Place spacer over threads of puller and tighten nut against spacer until stud is removed. Carefully ream stud hole, using suitable tool (J-22126 and pilot shaft). *NOTE – If stud hole did not clean-up, replace cylinder head.*

Installation – Coat new stud with white lead and oil. Using suitable tool, carefully drive stud into head. Stud is seated when tool bottoms out. *NOTE – If tool J-23342 is not availabe, measure dimension from stud machined boss to bottom of stud threads. Install new oversize stud to this exact dimension.*

Removal, Screw-In Type – Use deep-well socket and turn rocker stud out of cylinder head.

Installation – Install new stud in cylinder head threads and torque to 50 ft. lbs.

VALVE LIFT

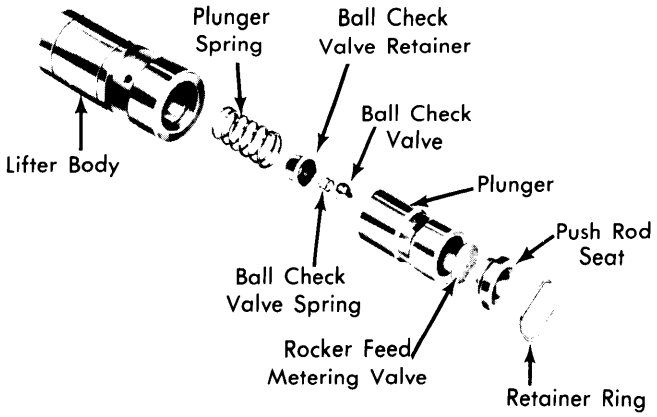
Year & Engine Code	Cam No.	Intake LIFT	Exh. LIFT
1968			
WC,YJ,WR,WP,YN, WD,XM,YA	9777254	.375"	.410"
WK,YM,WA,WB,XH,YE①	9779066	.407"	.412"
YC,YZ,YS,YT,YW,WZ, XP,WT,YH,YK,WJ	9779067	.407"	.411"
XN,WQ,XS,WS,WG	9779068	.414"	.413"
WI	9785744	.413"	.413"
1969			
XS,XR,YN,YU,WP,WU,WC, WM,YJ,XL,XB,YE,YA,YF, YB,XM,XX,YC,YD,YW,YZ	9777254	.375"	.410"
WZ,YT,XU,XC,WX,WF,YS, XE,XJ,WG,XK,YK,XG	9779067	.407"	.411"
WB,WA,WB,WE,XH,XF, YL,YH	9779066	.407"	.412"
WN,WV,YZ,WQ,WT, WJ,WL,WS	9779068	.414"	.413"
XP,WW,YH,XN	9779041	.516"	.516"
1970			
W7,X7,XX,YB,YD,YU,WU	9777254	.376"	.412"
WE,XH,XZ,XV	9779066	.410"	.414"
WX,XF,YH,WT,YS,YC	9779067	.410"	.413"
WG,WS,YZ,WA	9779068	.414"	.413"
WW,XP	9794041	.527"	.527"
1971			
WR,WU,YU,XX,WS	483555	.376"	.412"
XR,YG,WG	9779066	.410"	.414"
WT,WK,YS,YC,WJ	9779067	.410"	.413"
WL,WC,YE	9779068	.414"	.413"
1972			
YV,YR,WR,YX	483555	.374"	.407"
ZX,YH	9779066	.404"	.408"
WS,WK,YS,YC,YA,ZH	9779067	.403"	.406"
WM,YB	9779068	.408"	.406"
1973			
XR,Y2, YR, Y7, YV, XV,ZV,YL,ZR	483555		
YP,Y4,YX,YI, ZX,ZK,YZ	491255		
WK,WS,WP,WW,YC,YA, WT,ZC,ZA,YK,YD,YH	9779067		
YS,Y3,YN,ZS, YY,ZN,YT	9779066		
Y8,W8,X8, Z8,ZJ,XD	493323		

① – All YE engines beginning with serial No. 321194 in 1968 use camshaft No. 537441 (specifications not available).

1968-73 350", 400", 428", 455" V8 ENGINES (Cont.)

HYDRAULIC VALVE LIFTER TESTING

Fill tester cup of Tool J-5790 to about 1" from top with special testing fluid. Swing weight arm out of way, raise ram, and position lifter into boss of cup. Place 7/32" steel ball in pushrod seat of lifter and lower ram onto ball. Adjust ram (with weight arm clear of ram) so pointer is positioned on set line (marked "S"). Tighten jam nut to maintain setting. Operate lifter through full plunger travel to displace air in lifter with tester fluid. Continue pumping weight arm for several strokes after resistance is felt. Raise weight arm to allow plunger spring to expand fully. Lower arm into Ram and commence turning crank slowly (1 revolution every 2 seconds). Time indicator travel from lower line (first line above "S") to line marked .125" or 1/8" while still rotating cup. Lifter is satisfactory if rate is between 20 and 90 seconds. Check a questionable lifter three or four times before discarding.



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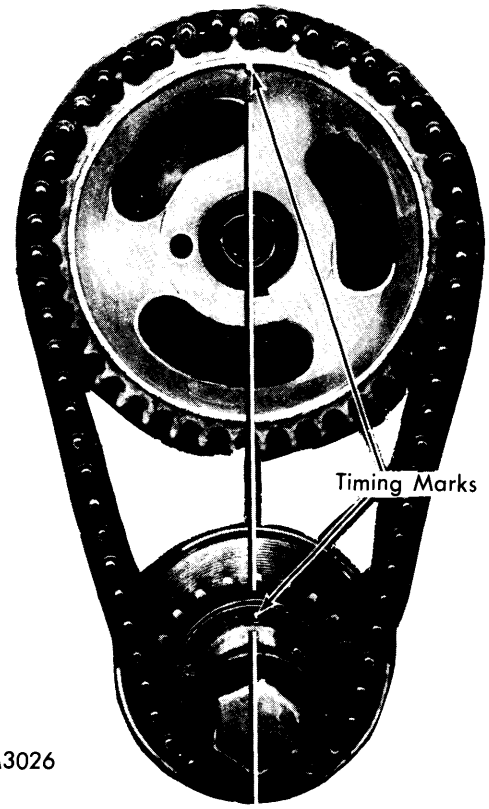
HYDRAULIC VALVE LIFTER ASSEMBLY



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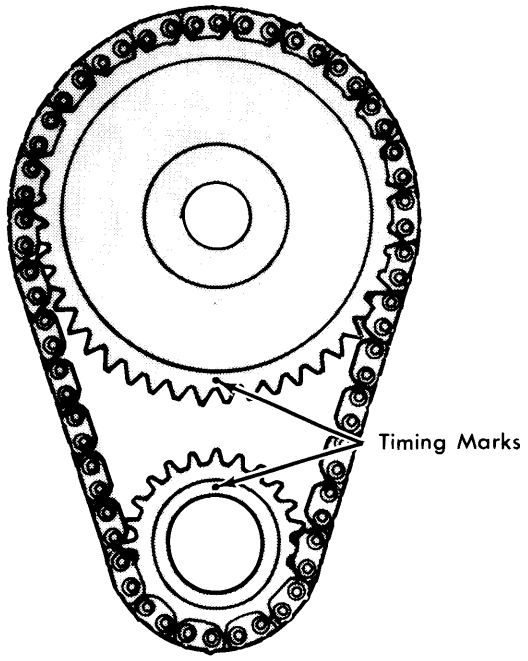
VALVE TIMING MARKS 1969-73



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VALVE TIMING MARKS 1968

VALVE TIMING

Engine	INTAKE Open (BTDC)	INTAKE Close (ABDC)	EXHAUST Open (BBDC)	EXHAUST Close (ATDC)
1968-72				
9777254	22°	67°	72°	25°
9779067	23°	70°	78°	31°
9779066	30°	63°	77°	25°
9779068	31°	77°	90°	32°
9785744	38°	83°	95°	38°
9794041	42°	86°	95°	45°
483555	26°	63°	72°	25°
480737	42°	86°	95°	45°
491255	26°	63°	68°	29°

1968-73 350", 400", 428", 455" V8 ENGINES (Cont.)

CAMSHAFT

Removal – Camshaft may be removed without removing engine from vehicle using the following procedure:

1) Remove air cleaner and disconnect all water and vacuum hoses, spark plug wires, carburetor linkage, fuel lines and wires to thermogauge unit.

2) Remove hood latch brace, radiator, generator mounting bracket, generator, crankcase ventilator hose and rocker arm covers. Remove distributor, intake manifold, push rod cover, push rods and valve lifters.

3) Remove harmonic balancer, engine front cover, fuel pump eccentric, camshaft thrust plate and carefully remove camshaft.

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

CAMSHAFT BEARING REPLACEMENT

Use Tool J-6173 and note the following:

1) To replace rear bearing without removing and disassembling engine, propeller shaft, transmission, and clutch housing must be removed to get at camshaft rear plug.

2) If front bearing is being replaced, insert remover adapter in center bearing to support shaft.

3) Outside of new bearing should be coated with oil before installation. Notch in edge of bearing is used to properly position bearing with respect to oil holes when installing. Index notch in edge of bearing with pin on replacer adapter. When bearings are installed in production, notches all face front except on rear bearing. In the field all bearings should be installed with notches facing rear.

4) Rear bearing should be pulled in until front edge is flush with block to leave room for camshaft rear plug. Other bearings should be flush with both sides of transverse member.

ENGINE OILING

Oil Pressure Chart

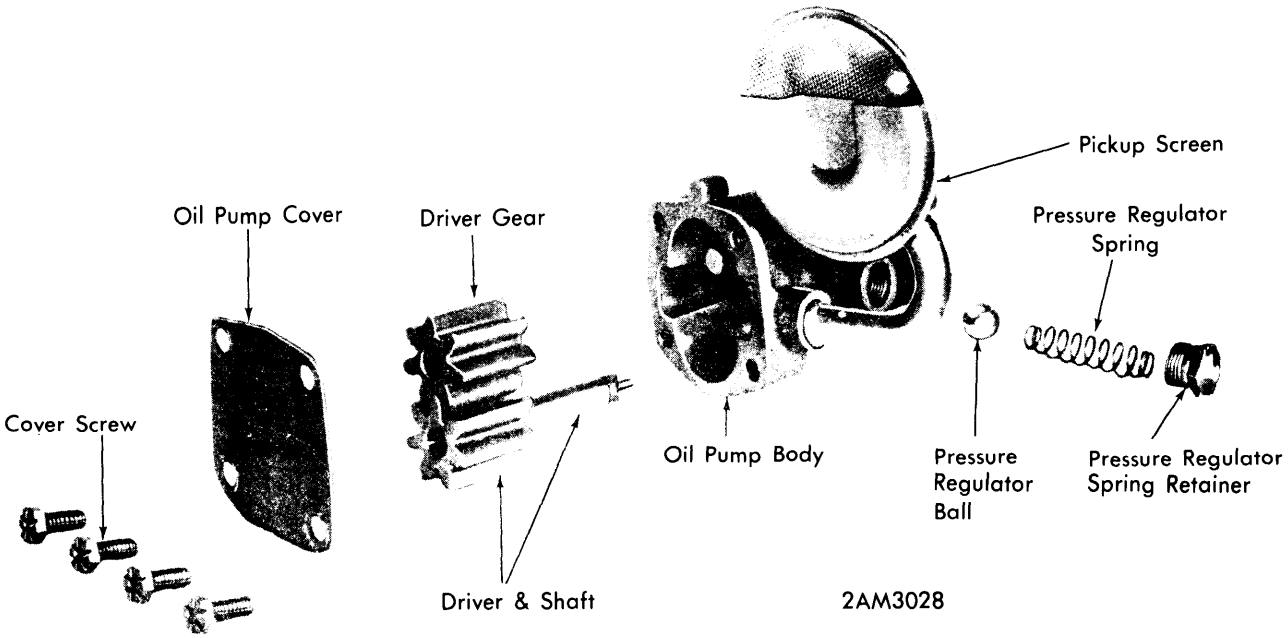
Application	Pressure (psi)
1968-69	
All Exc. GTO & 428"	30-40 psi at 2600 RPM
GTO & 428"	45-50 psi at 2600 RPM
1970	
GTO, 400 4-Bbl. Grand Prix & Large Valve 455"	55-60 psi at 2600 RPM
All Others	30-40 psi at 2600 RPM
1971-72	
All Exc. 4-Bbl. Engines	30-40 psi at 2600 RPM
4-Bbl. Engines	55-60 psi at 2600 RPM
1973	
All Exc. 455" S.D.	55-60 psi at 2600 RPM
455" S.D.	75-80 psi at 2600 RPM

Crankcase Capacity – All models 5 quarts and 6 quarts with filter change.

Oil Filter Replacement – Replace every 6000 miles or 6 months, whichever comes first. To install, screw filter on center stud by hand until gasket contacts filter base, then tighten an additional 2/3 turn. *Do not overtighten.*

OIL PUMP ASSEMBLY

Removal – Remove oil pan splash baffle. Hold oil pump in hand while removing attaching bolts. Lower oil pump with one hand while removing pump drive shaft with the other. *NOTE – Removal and installation of pump does not affect ignition timing.* If pump is disassembled for cleaning and inspection, do not loosen or remove oil pump screen from pump body. Do not attempt to change oil pressure by varying length of pressure regulator spring.



OIL PUMP

1968-73 350", 400", 428", 455" V8 ENGINES (Cont.)

ENGINE OILING (Cont.)

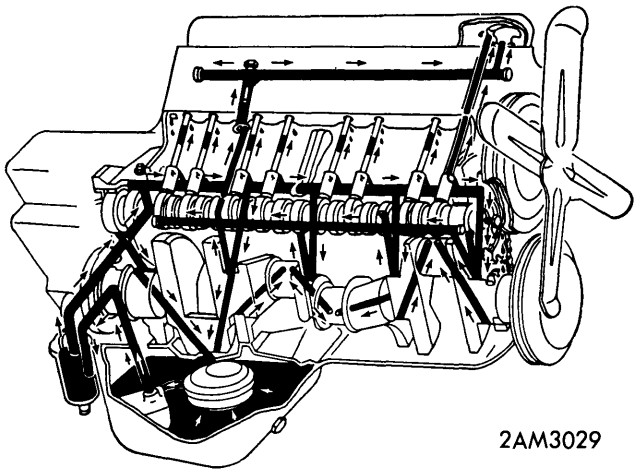
Installation – Position drive shaft in distributor and oil pump drive gears. Use new gasket between pump and block. Index drive shaft with pump drive gear shaft and install attaching bolts.

Push Rods and Rocker Arms – Oil from each lifter is directed up through hollow push rods to rocker arms. Oil then passes through a hole in the push rod contact area of the rocker arm and fills it. This supply lubricates the rocker arm ball, and the overflow lubricates the top of the valve stem and other valve train surfaces.

ENGINE OILING SYSTEM

Force feed type with oil supplied under full pressure to all crankshaft, connecting rod, and camshaft bearings and to the valve train parts (see illustration). Spray from main and connecting rod bearings lubricates cylinder walls, piston pins and bushings. Timing chain and sprockets receive metered jet lubrication as do the fuel pump eccentric and rocker arm. A hole in block from pushrod gallery through distributor boss lubricates distributor shaft and bushings.

Lifters – Hydraulic lifters are fed individually by holes drilled in each lifter boss to the main oil galleries in each bank.



ENGINE OILING SYSTEM

ENGINE NOTES

►*PONTIAC RAM AIR IV VALVE NOTE*– Since it is not possible to tighten the rocker arm adjusting nut until it seats on the shoulder of the rocker arm stud to obtain proper valve clearance, the following procedure must be used:

1) With engine at normal operating temperature and running, loosen lock nut on any valve that is clattering. Tighten adjusting nut until noise just barely stops. *(NOTE – Oil deflector clips to eliminate oil splash from rocker arm oil holes while adjusting valves may be purchased from most local parts or supply houses).*

2) Starting with front cylinder of each bank, individually loosen rocker arm adjusting nut until the valve assembly becomes noisy. Retighten adjusting nut until noise disappears.

3) Install lock nut. Being sure that adjusting nut position does not change, torque lock nut to 30-40 ft. lbs.

►*PONTIAC V8 ENGINE NOTE* – If a "knocking" noise is encountered at engine idling speed, check pulley to vibration damper screws for looseness.

►*1965-70 PONTIAC OIL PAN SEEPAGE V8 ENGINES:* Even after normal procedures have been followed, oil seepage may occur at the joint where the oil pan side rail gasket overlaps rear pan gasket. Oil pan reinforcement package (Part No. 484083) fits all 1965-70 V8 engines and will correct oil seepage.