Ford V6 Engines

3.8 LITER V6

IDENTIFICATION CODING

ENGINE IDENTIFICATION

Engine is identified by a number code, eighth digit of Vehicle Identification Number (VIN). The VIN is stamped on a metal tab attached to left upper side of instrument panel, near windshield. The VIN is also located on the Safety Compliance Certification Label, located on left door lock pillar.

ENGINE IDENTIFICATION CODE

Engine	Code
3.8L (230") 2-Bbl.	3

ENGINE REMOVAL

See Engine Removal at end of ENGINE Section.

CYLINDER HEAD & MANIFOLD

INTAKE MANIFOLD

Removal

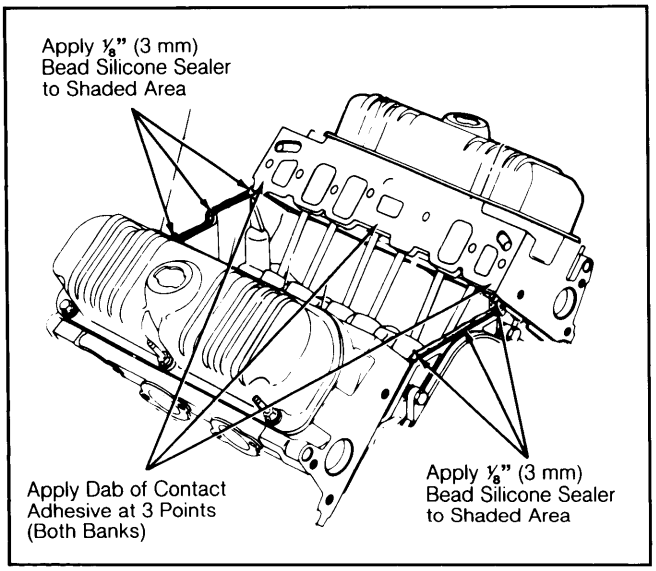
1) Drain cooling system. Remove air cleaner assembly and heat tube. Disconnect accelerator cable and transmission linkage at carburetor and position aside. Remove accelerator mounting bracket.

2) Disconnect cruise control unit (if equipped) and position aside. Disconnect carburetor bowl vent hose and fuel line at carburetor. Disconnect thermactor air supply hose at check valve, located at rear of intake manifold.

3) Disconnect all coolant hoses attached to intake manifold. Disconnect heater tube at manifold and remove tube support bracket. Label and disconnect vacuum lines and electrical connectors at carburetor and intake manifold. If A/C equipped, remove air compressor support bracket.

4) Remove carburetor and studs from manifold. Loosen EGR tube at EGR valve adapter. Remove EGR spacer adapter bolts and work spacer loose from manifold.

Fig. 1: Sealer Application Points



Assemble components within 15 minutes of silicone sealer application.

5) Disconnect EGR tube from adapter and remove EGR spacer, adapter and valve as an assembly. Remove intake manifold. If necessary to pry on manifold to break seal, use care not to damage machined surfaces.

Installation

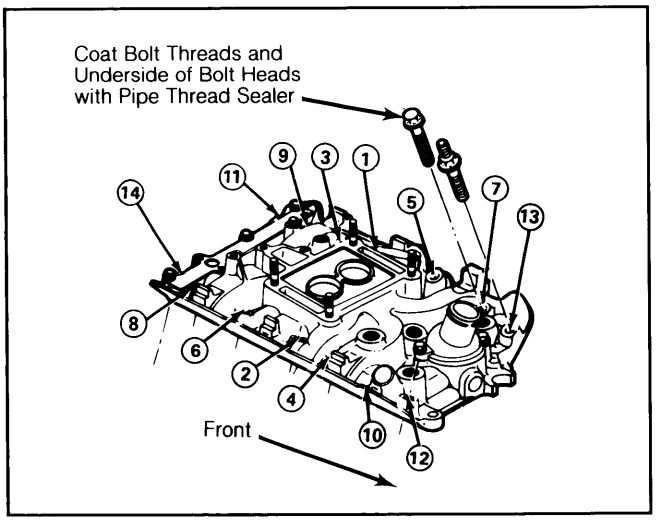
1) Clean all gasket surfaces. If intake manifold was disassembled, apply a coat of pipe thread sealer to temperature sending unit, all threaded vacuum fittings, spark knock sensor/adapter assembly and electric PVS (if equipped). Apply 1/16" (1.6 mm) bead silicone sealer to thermostat housing.

2) Apply small amount of contact adhesive to cylinder head-to-manifold mating surface. *See Fig. 1.* Assemble new intake manifold side gaskets into place, using locating pins to aid in assembly.

3) Apply 1/8" (3 mm) bead silicone sealer at 4 corners of cylinder head-to-block junction, and along front and rear manifold-to-block mating surfaces. Components must be assembled within 15 minutes of sealer application. *See Fig. 1.*

4) Carefully lower intake manifold into position using locating pins as a guide. Coat manifold bolt threads and bottom of bolt heads with pipe thread sealer. Install and tighten manifold bolts in 3 steps. *See Fig. 2.* Reverse removal procedures to complete installation.

Fig. 2: Intake Manifold Tightening Sequence



Tighten in 3 steps: First to 5 ft. lbs. (7 N.m); then to 10 ft. lbs. (14 N.m); and finally to 18 ft. lbs. (25 N.m).

CYLINDER HEAD

Removal

1) Drain cooling system. Disconnect battery cable at negative post. Loosen accessory drive belt idler and remove drive belt.

2) To remove left cylinder head, remove and position power steering pump aside. Remove oil fill cap. If A/C equipped, remove and position compressor aside.

3) To remove right cylinder head, remove diverter valve and hose assembly at by-pass valve and downstream air tube. Remove accessory drive idler. Remove thermactor pump pulley and pump.

4) Remove alternator and bracket. Remove intake manifold. Remove rocker arm cover attaching bolts. Carefully break silicone seal between cover and head, by

3.8 LITER V6 (Cont.)

inserting a putty knife under cover flange and working cover loose. Remove rocker arm covers.

5) Disconnect exhaust pipes at manifolds and remove exhaust manifolds. Loosen rocker arm bolts and position rockers to one side. Identify push rods for reinstallation in original locations, and remove. Remove cylinder heads and discard bolts.

CAUTION: Use new head bolts to preclude compression leaks or coolant loss at cylinder head mating surface. Torque retention can vary with used head bolts, causing leaks.

Installation

1) Clean all gasket surfaces. Using dowel pins as guides, place head gaskets on block. Apply a thin coat of pipe thread sealer to threads of short head bolts. Coat head bolt flat washers with oil and install bolts and washers.

2) Tighten cylinder head bolts in 4 steps. Back off head bolts 2 to 3 turns, then retighten head bolts using 4-step procedure. *See Fig. 3.* Coat all push rods with heavy engine oil and install in their original locations.

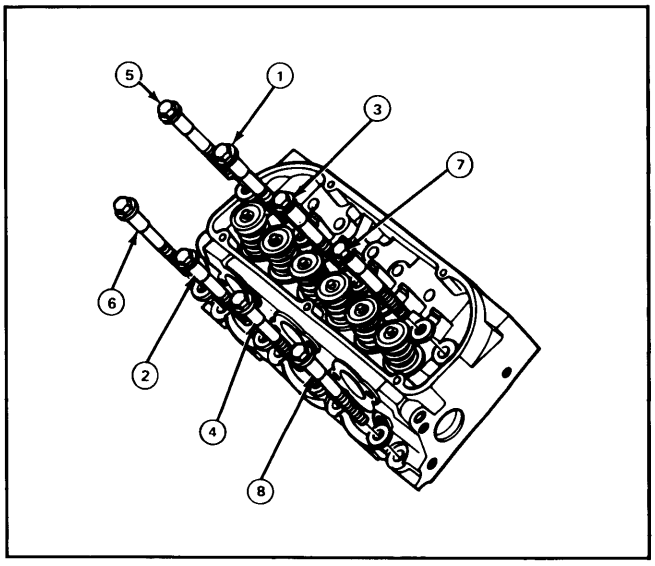
3) Install rocker arm assemblies 1 at a time. Make sure lifter is on low base circle of camshaft lobe prior to installing and tightening rocker arm assemblies. Install rocker arms and fulcrums. Install and tighten fulcrum attaching bolts.

CAUTION: Fulcrums must be fully seated in cylinder head and push rods seated in rocker arm sockets, prior to final tightening.

4) Install exhaust manifolds. Apply 1/8-3/16" (3-5 mm) bead of sealer to rocker arm cover flange. Make sure sealer fills the channel in cover flange. Install and tighten rocker arm covers within 15 minutes of sealer application. Reverse removal procedure to complete installation.

NOTE: After using 4-step method of tightening head bolts twice, it is not necessary to retighten head bolts after extended engine operation.

Fig. 3: Cylinder Head Tightening Sequence



Use 4-step method to tighten head bolts twice.

VALVES

VALVE ARRANGEMENT

E-I-E-I-E-I (Left bank, front to rear)
I-E-I-E-I-E (Right bank, front to rear)

VALVE GUIDE SERVICING

When reaming valve guides, always use reamers in proper sequence. Reface valves and seats after reaming operation. Use a scraper to break sharp corner at top (ID) of valve guide bore, after reaming. Replacement valves are available with standard, .015" (.38 mm) and .030" (.76 mm) oversize stems.

VALVE STEM OIL SEALS

Cup-type oil seals are used on all valves. Lubricate valve stem with heavy engine oil and install new valve stem seal with cup side down. Use a 5/8" deep-well socket and light mallet to seat oil seal on valve stem.

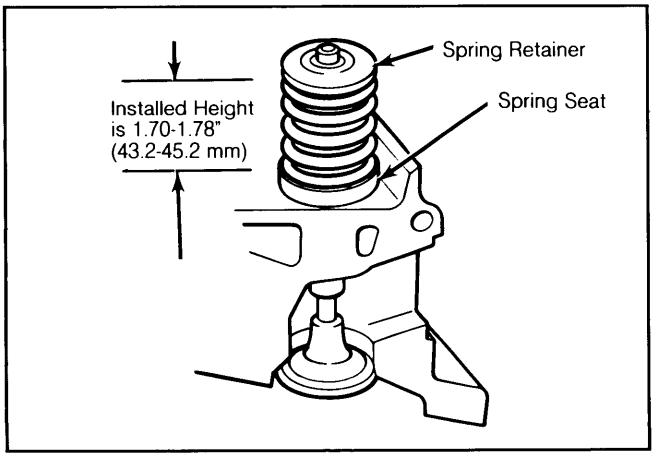
VALVE SPRINGS

Removal

1) Remove cylinder head. Identify all valve parts for reinstallation in original locations. Remove rocker arm assemblies, spark plugs and exhaust manifolds.

2) Using valve spring compressor, compress valve spring and remove retainer locks. Release spring compressor and remove spring retainer, spring and oil seal.

Fig. 4: Checking Installed Height of Valve Spring



Measure from top of spring seat to underside of spring retainer.

Inspection

1) Inspect valve stem for wear and out-of-round condition. Check valve for binding in valve guide. Using valve spring tester, check springs for proper pressure. Replace springs that fail specifications. *See Valve Springs table.*

2) Inspect each spring for squareness, using a steel square and flat surface. With closed-coil end of spring down, observe gap between top of spring coil and square, while slowly rotating spring. Replace spring if more than 5/64" (1.98 mm) out-of-square.

Installation

1) Lubricate valve stem with heavy engine oil and install valve stem oil seal. Install spring seat (if removed), spring and retainer.

Ford V6 Engines

3.8 LITER V6 (Cont.)

2) Compress spring and install retainer locks. Apply polyethelene grease (or equivalent) to valve stem tips and install remaining components.

VALVE SPRING INSTALLED HEIGHT

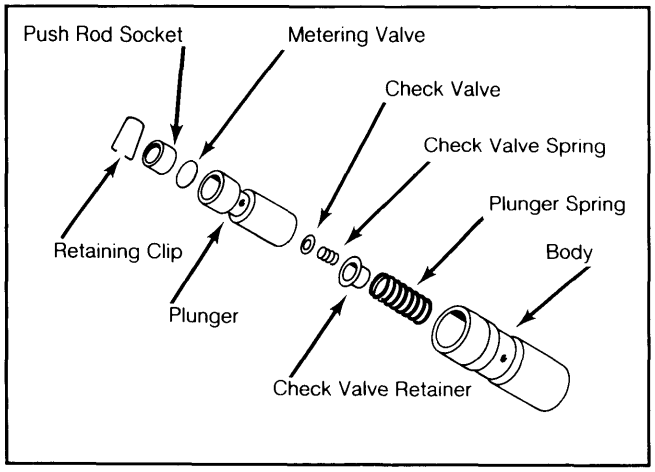
Measure spring height from top of spring seat to underside of spring retainer, using dividers and a ruler. *See Fig. 4.* If height is greater than 1.70-1.78" (43.2-45.2 mm), install .030" (.076 mm) spacer(s) between cylinder head spring pad and spring, to bring height within limits.

CAUTION: Install spacers only if necessary. Excess use of spacers will overstress the valve train and cause unnecessary damage.

HYDRAULIC VALVE LIFTER ASSEMBLY

1) Service lifters as complete assemblies only. Do not interchange parts. Disassemble and clean lifters. *See Fig. 5.* Reassemble lifters and test with hydraulic lifter test fluid and a lifter leak-down tester tool.

Fig. 5: Hydraulic Lifter Assembly



Parts are not interchangeable between lifters.

2) Leak-down rate on hydraulic lifters is 20-200 seconds at ⅛" (3.18 mm) plunger travel (under 50 lb., 23 kg load.)

VALVE CLEARANCE ADJUSTMENT

1) Turn crankshaft to place No. 1 piston at TDC at end of compression stroke. With crankshaft in this position, check clearances of valves listed in *VALVE CLEARANCE ADJUSTMENT* table, using the following procedure:

2) Using lifter bleed-down tool, slowly apply pressure to push rod end of rocker arm to bleed down lifter, until plunger is completely bottomed. Hold lifter in this position and check clearance between rocker arm and valve stem tip with a feeler gauge.

3) To check remaining valves, rotate crankshaft 360° to place No. 5 piston at TDC at end of compression stroke. With crankshaft in this position, check clearance of valves listed in table.

4) Desired collapsed lifter clearance is .088-.189" (2.24-4.80 mm). If clearance is less than specified, install a shorter push rod; if clearance is greater, install a longer push rod.

VALVE LIFTER ADJUSTMENT

Piston On TDC	Check Int. Nos.	Check Ex. Nos.
No. 1	1-3-6	1-3-4
No. 5	2-4-5	3-5-6

PISTONS, PINS & RINGS

OIL PAN

See Oil Pan Removal at end of ENGINE Section.

PISTON & ROD ASSEMBLY

Removal

1) Remove intake manifold, cylinder heads and oil pan. Turn crankshaft until piston to be removed is at bottom of stroke. Cover piston with cloth to collect metal cuttings. Using ridge reamer, remove ridge at top of cylinder bore.

CAUTION: Never cut more than 1/32" (.79 mm) into ring travel area when removing ridge.

2) Inspect connecting rods and caps for cylinder identification, and mark as necessary. Place piston to be removed at bottom of its stroke.

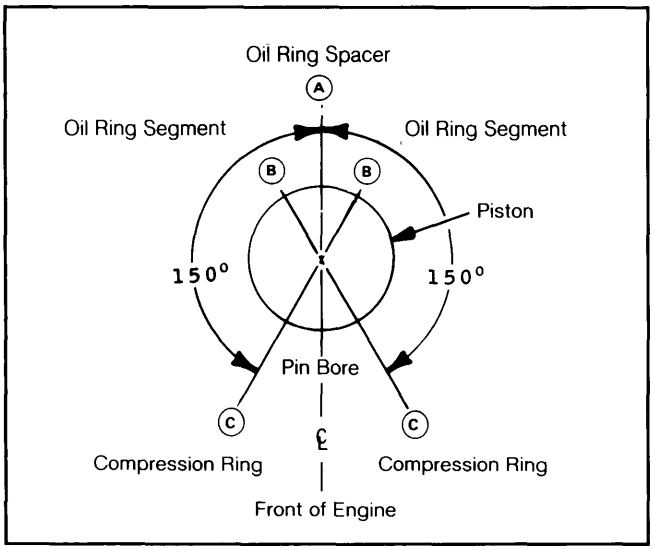
3) Remove rod cap and cover rod studs with rubber hose to avoid damage to crankshaft and cylinder walls. Push piston and rod assembly out top of cylinder block. Install rod cap on mating rod.

Installation

1) Oil piston, rings and cylinder wall with heavy engine oil. Ensure that ring gaps are properly spaced on piston. *See Fig. 6* Install ring compressor, ensuring position of rings does not change.

2) Ensure notch on piston head faces front of engine. Tap piston into cylinder bore using a wooden handle. Guide connecting rod onto crankshaft journal, and install and tighten rod cap. Check rod side clearance.

Fig. 6: Correctly Spaced Piston Ring Gaps



Ensure ring gaps do not change when installing ring compressor.

3.8 LITER V6 (Cont.)

FITTING PISTONS

NOTE: Take measurements at normal room temperature (70°F, 21°C).

1) Measure piston at centerline of piston pin, and at 90° to piston pin axis. Measure cylinder bore 90° to crankshaft centerline, at top, middle and bottom of bore. Use measurements to determine piston-to-cylinder bore clearance.

2) Measure cylinder bore 90° to crankshaft centerline at top of bore (below ring travel) and at bottom of bore (above ring travel). Taper is the difference between the 2 measurements, and must not exceed .010" (.254 mm).

3) Measure cylinder bore at center of piston travel, 90° to crankshaft centerline. Measure bore at center of piston travel, in line with crankshaft centerline. Out-of-round is the difference between the 2 measurements, and must not exceed .005" (.127 mm).

4) If taper or out-of-round are not within limits, or cylinder walls are deeply scored, hone or bore cylinders for installation of new pistons. Check Piston Size Code Chart.

PISTON SIZE CODE CHART

Size Code	Size In. (mm)
Red	3.8095-3.8101 (96.761-96.777)
Blue	3.8107-3.8113 (96.792-96.807)
.004" Oversize	3.8119-3.8125 (96.822-96.838)

PISTON PINS

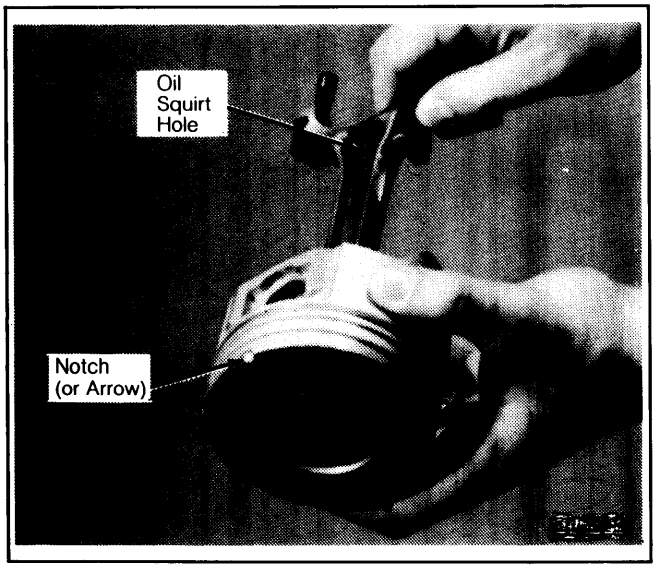
Removal

Using arbor press and piston pin removal tool, press pin from piston and connecting rod.

Installation

1) Apply light coat of engine oil to all parts to be assembled. Assemble piston to connecting rod as shown in *Fig. 7*.

Fig. 7: Positioning Connecting Rod to Piston

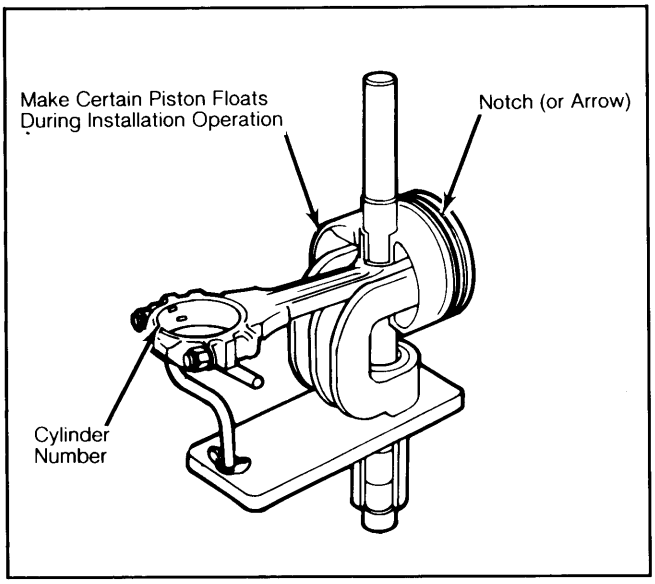


Note position of oil squirt hole to notch on piston head.

2) On replacement connecting rods, large chamfered side of bearing bore must be positioned on same side as notch on piston head (front) for right bank, and positioned opposite notch on piston head (rear) for left bank.

3) Light tap with mallet may be needed to start pin into piston and rod assembly. Using arbor press and pin installing tool, press pin into piston and rod assembly until pin is centered in piston. *See Fig. 8.*

Fig. 8: Installing Piston Pin



Lightly oil parts prior to assembly.

FITTING RINGS

1) Position ring in cylinder bore at a point where normal ring wear is not present. Exercise care not to damage ring or cylinder bore. Ring must be square in bore. Check ring end gap with a feeler gauge.

2) Check side clearance of compression rings, with feeler gauge inserted between ring and its lower land. Feeler gauge should slide freely around entire circumference of piston without binding. If lower lands have high steps, replace piston.

CRANKSHAFT & ROD BEARINGS

MAIN & CONNECTING ROD BEARINGS

NOTE: Use Plastigage method for checking bearing clearances. Following procedures are performed with oil pan and oil pump removed, and oil film removed from surfaces to be checked.

Connecting Rod Bearings

1) Ensure rod caps are marked for cylinder identification. Place crankshaft journal of cylinder to be checked at bottom of stroke and remove rod cap.

2) Place strip of Plastigage on bearing surface over full width of cap about ¼" (6 mm) off center, and away from oil holes. Install cap and tighten to specifications. Do not allow crankshaft to turn.

Ford V6 Engines

3.8 LITER V6 (Cont.)

3) Remove cap and measure width of Plastigage with scale furnished. A standard bearing may be used in combination with a .001" (.025 mm) or .002" (.051 mm) undersize bearing to obtain proper bearing clearance.

Main Bearings

1) Fit main bearings 1 at a time, while leaving other bearings securely fastened. Make sure main bearing caps are marked for identification. Remove main bearing cap. Support crankshaft weight by placing a jack under the counterweight adjacent to the bearing being checked.

2) Use Plastigage method (as explained in Connecting Rod Bearings) to measure main bearing clearance, tightening caps to specifications.

3) Standard size bearings may be used in combination with a .001" (.025 mm) or .002" (.051 mm) undersize bearing. If .002" (.051 mm) undersize main bearings are used on more than 1 journal, bearings must be installed in cylinder block side of crankshaft journal.

4) Main bearing sets are replaced 1 at a time, while leaving other bearings securely fastened. Remove bearing cap to which new bearings are to be installed.

5) Insert upper bearing remover/installer tool (6331 or equivalent) into crankshaft journal oil hole. Turn crankshaft in direction of engine rotation, forcing upper bearing out of block.

6) Lightly oil bearing and journal surfaces. Partially install plain end of upper bearing in place. Insert tool (6331 or equivalent) into journal oil hole. Turn crankshaft slowly in opposite direction of engine rotation until bearing is seated. Remove tool. Install and tighten main bearing cap.

7) To install rear main bearing cap, clean bearing cap-to-block mating surfaces. Apply 1/8" (3 mm) bead silicone sealer to bearing cap-to-cylinder block parting line. *See Fig. 10.* Install and tighten within 15 minutes of sealer application.

THRUST BEARING ALIGNMENT

Install thrust bearing cap after all other main bearing caps have been tightened. Install thrust bearing cap bolts finger tight. Pry crankshaft forward against thrust surface of upper half of bearing. Hold crankshaft forward, and pry thrust bearing cap to rear. Tighten cap bolts, while retaining forward pressure on crankshaft.

REAR MAIN BEARING OIL SEAL

Removal

1) Remove oil pan. Loosen main bearing cap attaching bolts to allow crankshaft to drop slightly, but not more than 1/32" (.79 mm). Remove main bearing cap and remove seal from cap.

2) Remove block half of seal. Use seal remover tool, or install a small sheet metal screw in one end of seal and pull on screw to remove seal. Use care to avoid damage to bearing and sealing surfaces when installing screw.

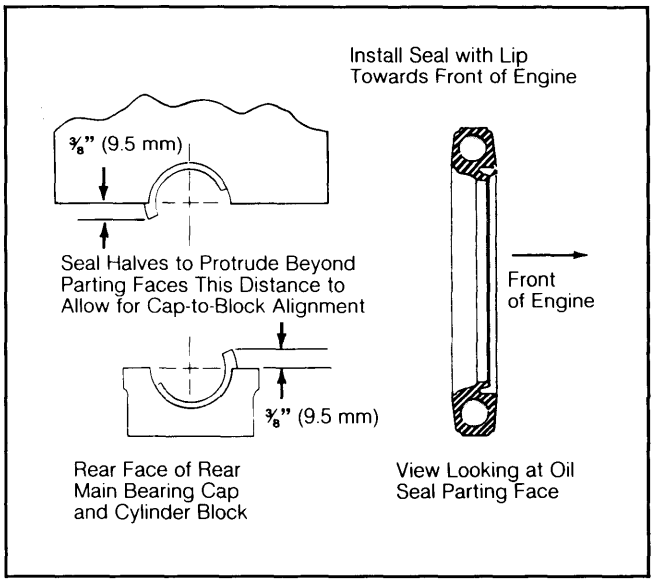
CAUTION: Avoid shaving any rubber from outside diameter of seal when installing in groove.

Installation

1) Seals are installed with lip (undercut side) toward front of engine, and locating tabs facing rear of engine. After installing seals, be sure to remove tabs.

2) Carefully clean oil seal grooves in bearing cap and block. Dip split-lip seal halves in engine oil. Rotate upper seal on crankshaft journal until approximately 3/8" (9.5 mm) of seal protrudes below parting surface. *See Fig. 9.*

Fig. 9: Installing Rear Main Bearing Oil Seal



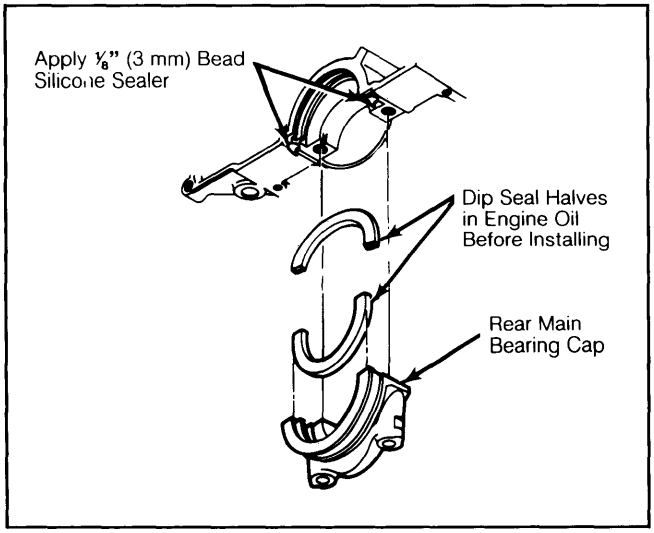
Install seals with locating tabs facing rear of engine, then remove tabs.

3) Tighten all other bearing cap bolts. Install lower seal in main bearing cap. *See Fig. 9.* Allow seal to protrude approximately 3/8" (9.5 mm) above parting surface, to mate with upper seal when cap is installed.

4) Apply 1/16" (1.5 mm) bead of silicone sealer to both sides of cylinder block-to-cap mating surface, and to both sides of bearing cap. *See Fig. 10.*

5) Install and tighten rear main bearing cap before sealer sets up (approximately 15 minutes). Install oil pan.

Fig. 10: Silicone Sealer Application Points



Do not allow sealer to contact lip of seal.

3.8 LITER V6 (Cont.)

CAMSHAFT

ENGINE FRONT COVER

Removal

1) Drain cooling system and disconnect negative battery cable. Remove air cleaner assembly and intake duct. Remove fan shroud and fan clutch assembly attaching bolts and remove components.

2) Loosen accessory drive belt idler and remove drive belt and water pump pulley. If equipped, remove power steering pump and position to one side (leaving hoses connected).

3) If A/C equipped, remove air compressor front support bracket. Disconnect by-pass and heater hoses at water pump. Disconnect upper radiator hose at thermostat housing.

4) Disconnect coil wire from distributor cap and remove cap with secondary wires attached. Remove distributor. If equipped with tripminder, remove fuel flow meter support bracket.

5) Raise vehicle. Remove crankshaft pulley and vibration damper. Remove fuel pump crash shield. Disconnect fuel line at fuel pump, and remove pump. Remove oil filter. Disconnect lower radiator hose at water pump. Remove oil pan. Lower vehicle.

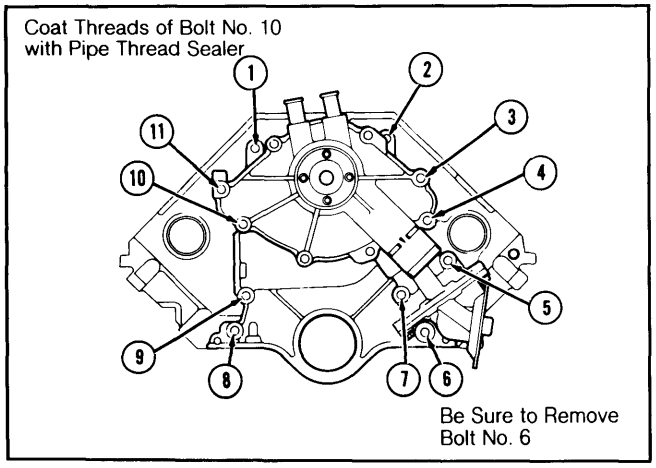
6) Remove front cover attaching bolts, including bolt behind oil filter adapter. Remove front cover and water pump as an assembly.

Installation

1) Clean all gasket surfaces. Replace front cover oil seal and lubricate with engine oil. Apply gasket sealer to front cover gasket and position on cylinder block.

2) Install and tighten front cover and water pump assembly. Coat threads of bolt No. 10 with pipe thread sealer. *See Fig. 11.* Lightly oil all other bolt and stud threads. Install and tighten attaching bolts and studs. Reverse removal procedure to install remaining components.

Fig. 11: Front Cover Attaching Bolt Locations



Tighten front cover bolts to 15-22 ft. lbs. (20-30 N.m)

FRONT COVER OIL SEAL

Removal

Remove fan shroud and fan clutch assembly. Loosen accessory drive belt idler. Raise vehicle. Disengage accessory drive belt and remove crankshaft pulley. Remove vibration damper. Using screwdriver, pry oil seal from front cover. Use care not to damage front cover or crankshaft.

Installation

Lubricate new oil seal with engine oil. Use seal installing tool (T82L-6316-A or equivalent) and adapter (T70P-6B070-A or equivalent) to install front cover oil seal. Reverse removal procedure to complete installation.

TIMING CHAIN

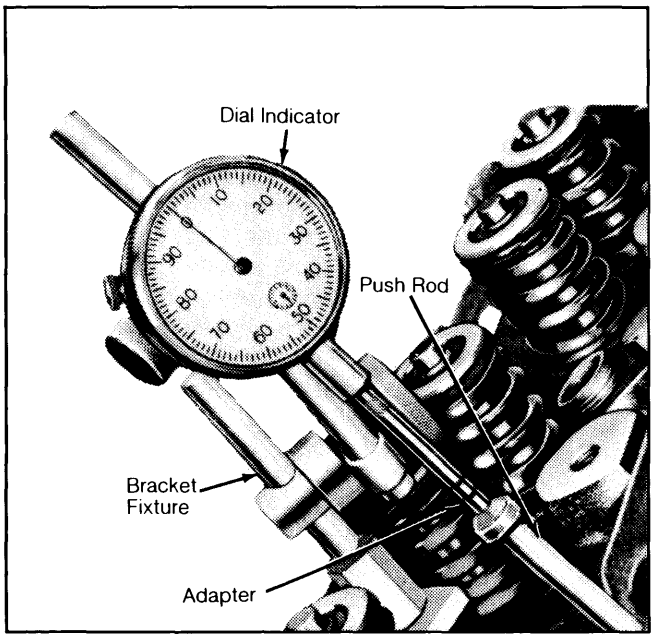
NOTE: The following procedures are performed with engine front cover removed.

Checking Timing Chain Deflection

1) Turn crankshaft to place No. 1 piston on TDC at end of compression stroke, to take up slack on right side of timing chain. Remove right rocker arm cover. Loosen No. 3 exhaust rocker arm and rotate to one side.

2) Install dial indicator, with indicator point on end of push rod, and in same plane as push rod movement. *See Fig. 12.* Zero the dial indicator. Slowly turn crankshaft counterclockwise, until slightest movement is seen on dial indicator needle, then stop.

Fig. 12: Dial Indicator Installation For Checking Timing Chain Deflection & Cam Lobe Lift



Ensure push rod end is in center of valve lifter socket.

3) Observe vibration damper timing mark, for number of degrees of travel from TDC. If reading exceeds 6°, replace timing chain and sprockets.

Removal

Place No. 1 piston on TDC at end of compression stroke. Remove camshaft thrust button and spring from end of camshaft. Remove camshaft sprocket attaching bolts. Remove camshaft and crankshaft sprockets and timing chain.

Installation

1) Lubricate timing chain with engine oil and position chain on sprockets. Align timing marks and slide both sprockets and timing chain onto engine. *See Fig. 13.* Install and tighten camshaft sprocket attaching bolts.

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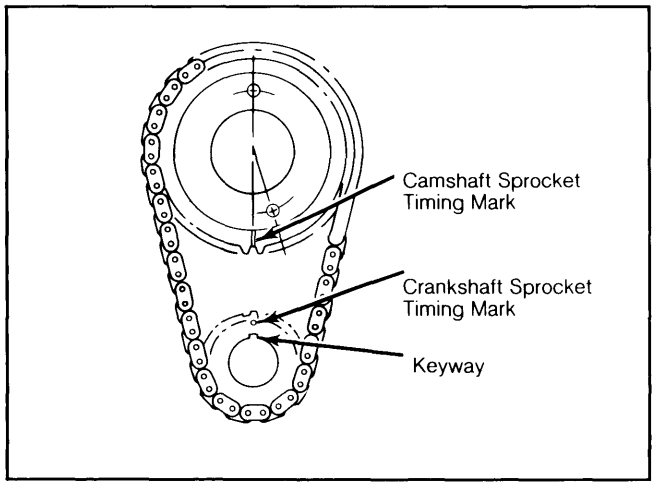
Fig. 13: Aligning Sprocket Timing Marks



Tighten camshaft sprocket attaching bolts to 15-22 ft. lbs (20-30 N.m).

2) Lubricate thrust button with polyethelene grease (or equivalent) and install button and spring into camshaft. The thrust button and spring must be bottomed out in camshaft recess, and not allowed to fall out during front cover installation.

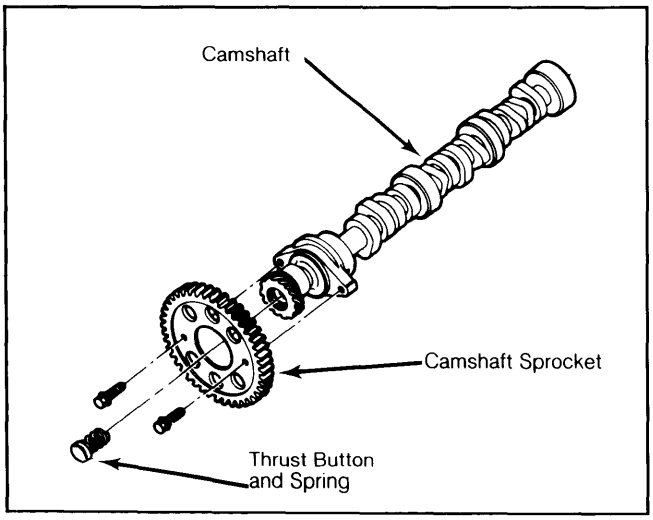
CAMSHAFT

Removal

1) Drain cooling system and crankcase. Remove radiator. If A/C equipped, remove condenser. Remove grille. Remove intake manifold. Identify rocker arm assemblies, push rods and valve lifters for reinstallation in original locations, and remove these components.

2) Remove front cover and water pump as an assembly. Remove camshaft thrust button, spring and timing chain and sprocket. Remove oil pan. Remove camshaft through front of engine, using care not to damage camshaft bearings. *See Fig. 14.*

Fig. 14: Camshaft Assembly



Camshaft bearings are not interchangeable between bores.

Installation

Lubricate cam lobes and bearing surfaces with heavy engine oil. Install camshaft, being careful not to damage bearing surfaces while sliding camshaft into position. Reverse removal procedure to complete installation.

CAMSHAFT BEARINGS

Removal

Remove engine from vehicle. Remove flywheel and rear cover plate. Remove camshaft and rear bearing bore plug. Remove crankshaft and push pistons to top of cylinder bores. Using camshaft bearing remover/installer tool, remove camshaft bearings.

Installation

1) Camshaft bearings are available in standard and .015 (.38 mm) undersize. The bearings are not interchangeable between bores. Using camshaft bearing remover/installer tool, press bearings into place.

2) Ensure that oil holes in bearings are aligned with oil holes in cylinder block. Install front bearing .136-.146" (3.455-3.705 mm) below front face of cylinder block. Reverse removal procedure to complete installation.

CAMSHAFT END THRUST

The 3.8L V6 engine has no thrust plate, thereby eliminating camshaft end play. Camshaft is restrained by a spring loaded thrust button.

CAM LOBE LIFT

1) Remove rocker arm cover, fulcrum bolt, fulcrum seat, rocker arm and fulcrum guide. Make sure push rod end is in valve lifter socket. Install a remote starter switch to rotate crankshaft.

2) Use a dial indicator to check lobe lift in consecutive order. Position dial indicator point (or cup-shaped adapter) on end of push rod (in same plane as push rod movement). *See Fig. 12.*

3) Rotate crankshaft until lifter and push rod are at lowest position. Zero dial indicator. Rotate crankshaft slowly until push rod is in fully raised position. Record dial indicator reading and compare with specifications.

4) Maximum allowable lift loss is .005" (.13 mm). If lift on any lobe is below specifications, replace camshaft and valve lifter operating on worn lobe(s).

ENGINE OILING

Crankcase Capacity

Capacity is 5 quarts (4.75L). Add 1 quart (.95L) with filter change.

Oil Filter

Full-flow filter has an integral by-pass valve. Replace filter at first oil change, then every second oil change thereafter.

Normal Oil Pressure

54-59 psi (3.8-4.1 kg/cm²) at 2500 RPM.

Pressure Regulator Valve

Valve located in pump body, not adjustable.

ENGINE OILING SYSTEM

Engine lubrication system is a force-feed type. A rotary gear type pump supplies oil under full pressure to crankshaft, connecting rods, valve lifters and camshaft.

From lifters, a controlled flow of oil is supplied to rocker arms through hollow push rods. All other moving

3.8 LITER V6 (Cont.)

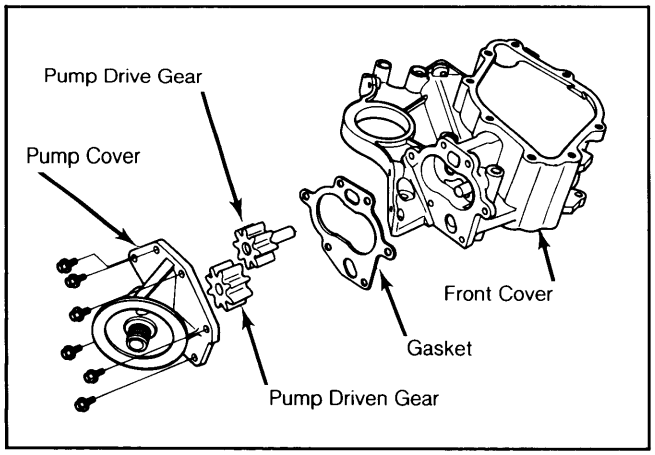
parts are lubricated by gravity flow or splash method. Oil pump shaft is driven by distributor shaft, through an intermediate shaft.

OIL PUMP

Removal & Disassembly

1) Remove engine front cover. With oil filter removed, remove pump cover. Lift pump gears out of front cover pocket. *See Fig. 15.*

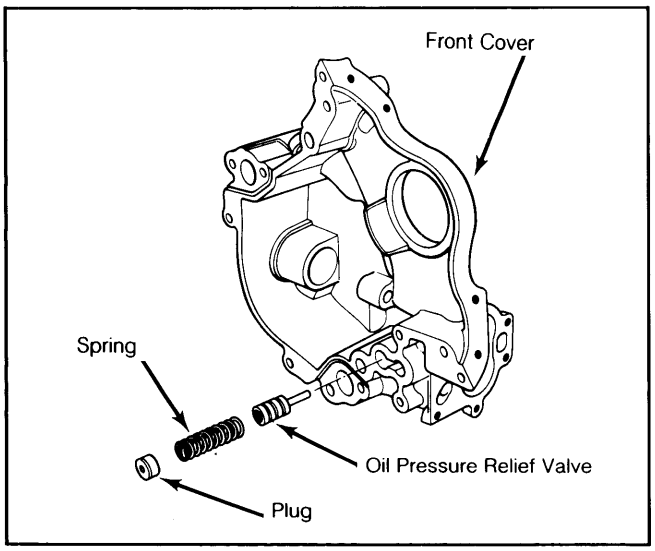
Fig. 15: Oil Pump Assembly



Prior to installing pump cover, pack pump gears and gear pocket with petroleum jelly.

2) Drill small hole in relief valve plug. Insert self-threading screw into plug, to aid in prying plug from chamber. Remove spring and valve from valve body.

Fig. 16: Relief Valve Location



Install new relief valve plug flush with machined surface of front cover.

Inspection

1) Clean gasket material from pump cover and front cover mating surface. Remove burrs or nicks from front cover mating surface.

2) To check pump gear end clearance, install gears in front cover. Place straightedge across gears and gasket surface of front cover. Insert feeler gauge between straightedge and front cover gasket surface to determine clearance.

3) If end clearance is below specifications, measure gear thickness with micrometer. If gear thickness is below limits, replace gear and recheck end clearance. If gear thickness is within limits, measure gear pocket depth in front cover. If depth is more than specification, replace front cover.

4) Measure oil pump gear side clearance by inserting feeler gauge between a gear tooth and side wall of gear pocket. If not within limits, measure gear diameter.

5) If gear diameter measures less than specifications, replace gear and recheck side clearance. If diameter is within limits, measure gear pocket width. If less than specifications, replace front cover.

6) Check pump cover flatness, using a feeler gauge and straightedge. If clearance exceeds specifications, replace cover.

7) Thoroughly clean relief valve bore and valve. Inspect relief valve and bore for scoring or wear. Replace valve and/or cover if parts are unserviceable.

8) Check relief valve-to-bore clearance. No side play or binding should be apparent. Check spring for fatigued or collapsed condition. Relief valve spring tension should test to 15.2-17.1 lbs. (6.9-7.8 kg) at 1.20" (30.5 mm).

OIL PUMP SPECIFICATIONS

Application	Specification In. (mm)
Gear End Clearance	.002-.005 (.05-.13)
Gear Thickness	.872-.873 (22.15-22.17)
Gear Pocket Depth	.868-.870 (22.05-22.10)
Gear Side Clearance	.002-.005 (.05-.13)
Gear Diameter	1.664-1.666 (42.27-42.32)
Gear Pocket Width	1.671-1.674 (42.44-42.52)
Pump Cover Flatness	.004 (.10) Max.
Relief Valve-to-Bore Clearance	.0017-.0029 (.043-.074)

CAUTION: Failure to properly pack oil pump gears with petroleum jelly may result in pump failure.

Reassembly & Installation

1) Lubricate relief valve with engine oil and install in bore. Position spring in bore and install new plug. Pack gear pocket in front cover with petroleum jelly. Do not use chassis lubricant.

2) Install gears in cover pocket, making sure petroleum jelly fills all air pockets between gears and gear pocket. Position cover gasket and install and tighten pump cover. Install remaining components.

ENGINE COOLING

WATER PUMP

Removal

1) Drain cooling system. Remove air cleaner and intake duct. Remove fan shroud and fan clutch assembly. Loosen accessory drive belt idler, and remove drive belt and water pump pulley.

2) If equipped with power steering, remove pump mounting bracket bolts and position pump aside. If

Ford V6 Engines

3.8 LITER V6 (Cont.)

equipped with A/C, remove compressor front support bracket and leave compressor in place.

3) If equippped with tripminder, remove fuel flow meter support bracket. Disconnect by-pass hose and heater hose at water pump. Remove water pump and discard gasket.

Installation

Clean all gasket surfaces. Apply gasket sealer to new gasket, and position gasket on water pump. Position water pump on front cover and install attaching bolts. Coat threads of No. 10 bolt with pipe thread sealer. *See Fig. 11.* Reverse removal procedures to complete installation.

NOTE: For further information on cooling system capacities and other cooling system components, see appropriate article in "Engine Cooling Systems" at end of ENGINE Section.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Camshaft Sprocket Bolts	15-22 (20-30)
Connecting Rod Cap Nuts	31-36 (42-49)
Cylinder Head Bolts	
Step 1	47 (64)
Step 2	55 (75)
Step 3	63 (86)
Step 4	74 (101)
Step 5	Back off 2-3 turns
Step 6	Repeat steps 1-4
Engine Front Cover Bolts	15-22 (20-30)
Exhaust Manifold Bolts	15-22 (20-30)
Flywheel-to-Crankshaft Bolts	54-64 (73-87)
Intake Manifold Bolts	
Step 1	5 (7)
Step 2	10 (14)
Step 3	18 (24)
Main Bearing Cap Bolts	65-81 (88-110)
Oil Pump Cover Bolts	18-22 (24-30)
Rocker Arm Fulcrum Bolts	
Step 1	5-11 (7-15)
Step 2	18-26 (24-35)
Vibration Damper Bolts	93-121 (126-165)
Water Pump Bolts	15-22 (20-30)

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Year	Displ.		Carburetor	HP at RPM	Torque Ft. Lbs.@RPM	Compr. Ratio	Bore		Stoke	
	cu. ins.	liters					in.	mm	in.	mm
1982	232	3.8	2-Bbl.	.....	.....	.....	3.81	96.8	3.39	86.1

VALVES

Engine & Valve	Head Diam. In. (mm)	Face Angle	Seat Angle	Seat Width In. (mm)	[1]Stem Diameter In. (mm)	Stem Clearance In. (mm)	Valve Lift In. (mm)
3.8L							
Int.	1.79 (45.5)	44°	45°	.06-.08 (1.5-2.0)	.3416-.3423 (8.677-8.694)	.0010-.0027 (.025-.069)	.415 (10.54)
Exh.	1.47 (37.3)	44°	45°	.06-.08 (1.5-2.0)	.3411-.3418 (8.664-8.682)	.0015-.0032 (.038-.081)	.417 (10.59)

PISTONS, PINS, RINGS

Engine	PISTONS	PINS		RINGS		
	Clearance In. (mm)	Piston Fit In. (mm)	Rod Fit In. (mm)	Rings	End Gap In. (mm)	Side Clearance In. (mm)
3.8L	.0014-.0022 (.035-.055)	.0002-.0005 (.005-.012)	Press Fit	1 & 2	.010-.020 (.25-.50)	.0016-.0037 (.040-.094)
				3	.015-.058 (.38-1.48)	.....

3.8 LITER V6 (Cont.)

ENGINE SPECIFICATIONS (Cont.)

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

Engine	MAIN BEARINGS				CONNECTING ROD BEARINGS		
	Journal Diam. In. (mm)	Clearance In. (mm)	Thrust Bearing	Crankshaft End Play In. (mm)	Journal Diam. In. (mm)	Clearance In. (mm)	Side Play In. (mm)
3.8L	2.5190-2.5198 (63.983-64.003)	.0010-.0014 (.025-.036)	No. 3	.004-.008 (.10-.20)	2.3103-2.3111 (58.682-58.702)	.0010-.0014 (.025-.036)	.0047-.0114 (.119-.290)

CAMSHAFT

Engine	Journal In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
3.8L	2.0505-2.0515 (52.082-52.108)	.001-.003 (.03-.08)	[1] .240 (6.10) [2] .241 (6.12)

[1] — Intake.
[2] — Exhaust.

VALVE SPRINGS

Engine	Free. Length In. (mm)	PRESSURE Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
3.8L	.....	75@1.70 (34@35.5)	215@1.40 (98@35.5)