Jaguar Engines

XJ6 6-CYLINDER

ENGINE CODING

ENGINE IDENTIFICATION

Engine can be identified by the number stamped on top of cylinder block at rear of engine and on identification plate in engine compartment.

ENGINE, MANIFOLDS & CYLINDER HEAD

ENGINE

Removal

NOTE: Engine and transmission are removed as an assembly.

1) Remove hood and disconnect battery. Discharge air conditioning system. Disconnect and cap refrigerant lines. Remove fuel lines from fuel cooler and plug fuel inlet line. Remove fuel cooler mounting screws and secure cooler, receiver-drier, refrigerant lines and fuel lines away from engine.

2) Remove fender brace rods. Remove air cleaner. Detach and remove radiator. Disconnect coolant hoses to expansion tank. Remove both engine mount-to-bracket nuts. Drain power steering fluid. Disconnect power steering lines. Slacken pump mounting bolts and push pump as close as possible to engine.

3) Remove connectors from alternator. Separate connector plug from engine harness. Disconnect brake vacuum pipe at manifold, and secure pipe out of way. Release pipe clip and pull heater-A/C operating vacuum pipe from non-return valves; secure away from engine. Remove exhaust manifolds.

4) Remove starter cable and solenoid wires. Disconnect heater hoses at firewall connectors. From fuel injection system, disconnect the following: Thermotime switch, cold start injector, throttle switch, oxygen sensor, auxiliary air valve, water temperature sensor and throttle linkage. Disconnect hoses from charcoal canister. Remove intake manifold.

5) Position lifting device and attach to rear lifting bracket on engine. Remove nut at center of rear transmission mounting. Remove nuts securing bracket on transmission. Remove heat shield. Position jack to support mounting plate of transmission and remove mounting bolts. Lower jack and remove mounting plate along with spring washers and rubber ring.

6) Remove nuts securing propeller shaft to output flange. From transmission unit selector lever, remove nut to release ball peg on inner selector cable. Remove setscrew and spring washer securing outer selector cable clamp. Disconnect speedometer cable from transmission.

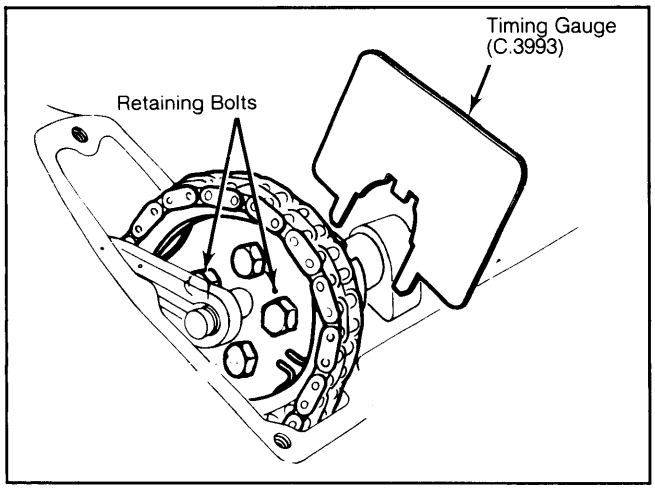
7) From front of vehicle, position jack to support transmission assembly below oil sump. Support engine on lifting assembly. Lift front of engine while lowering rear and withdraw engine/transmission assembly forward and upward.

NOTE: Use extreme care when withdrawing engine to prevent damage to air conditioning expansion valve.

Installation

Fit insulating material across transmission and reverse removal procedure to complete installation. Ensure that all fluid levels are to specifications. Evacuate and charge air conditioning system.

Fig. 1: Retaining Bolts Installed to Hold Camshaft During Cylinder Head Installation



Fit timing gauge into front flange slot of camshaft.

CYLINDER HEAD

Removal

1) Disconnect battery and drain cooling system. Remove both wiring valance stays (firewall-to-fender support rods), removing pressure line from support rod. Remove air cleaner. Detach throttle linkage and disconnect thermotime switch, cold start injector, throttle switch, oxygen sensor, auxiliary air valve and water temperature sensor wires.

2) Disconnect and plug fuel lines at fuel cooler (heat exchanger) and move cooler to side of engine compartment. Remove heat shield from exhaust manifold. Remove steering pump drive belt and swing pump away from engine. Remove top radiator hose and pull remote header and radiator bleed lines from header tank. Disconnect coolant hose from water pump.

3) Disconnect any remaining lines or wires from intake manifold, noting position for assembly. Detach exhaust manifolds from head. Remove distributor cap, plug wires and spark plugs. Disconnect 2 camshaft oil lines from rear of head and remove camshaft covers. Detach breather housing from front of head.

4) Remove camshaft sprocket retaining bolts from both camshafts and slide sprockets up support brackets. Mark aligning holes in adjuster plates. Working from center outward, remove cylinder head bolts. Carefully lift cylinder head assembly from engine.

NOTE: Crankshaft must not be rotated after camshaft sprockets are disconnected and head is still in place. When head is removed, it must not rest on a flat surface. Support head with wooden blocks at each end to protect open valves which protrude.

XJ6 6-CYLINDER (Cont.)

Installation

1) Install new head gasket (ensuring "TOP" mark is upward). Rotate crankshaft until No. 6 cylinder (front) is at TDC, with distributor rotor pointing approximately forward in-line with engine.

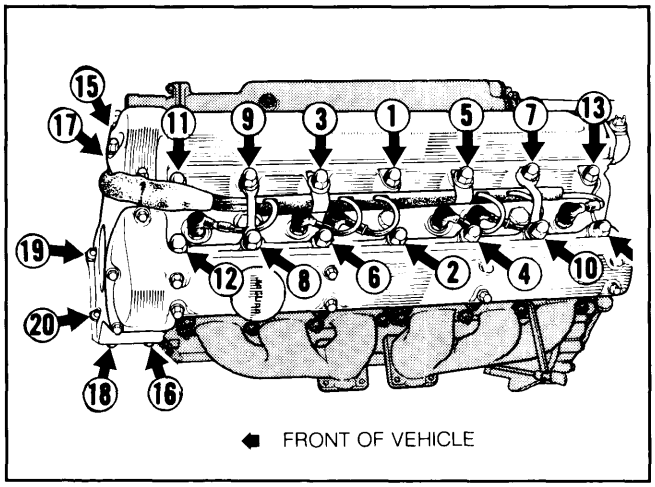
2) Rotate camshafts until timing gauge (C.3993) can be located in front flange slots. *See Fig. 1.* Lower cylinder head into position, attach spark plug wire brackets and lifting brackets to appropriate head studs, then place washers and 14 large damed nuts on studs. Affix nuts and washers at forward end of head, then tighten all nuts. *See Fig. 2.*

3) Locate sprockets on camshaft flanges and ensure both holes in each flange are positioned with aligning holes marked during removal. If necessary, remove circlip and reposition adjuster plate. Make sure engine is not rotated until camshaft sprockets are fully seated and chain installed.

4) Secure each adjuster plate to camshaft, then rotate engine until remaining attachment holes are accessible. Install bolts and bend up lock plate tabs. Set timing chain tension using an adjusting tool (JD2B). Tighten lock nut.

5) Ensure No. 6 (front) cylinder is at TDC and recheck position of camshafts using timing gauge (C.3993). Complete installation by reversing removal procedures. Recheck ignition timing and perform exhaust emission test.

Fig. 2: Jaguar XJ6 Cylinder Head Tightening Sequence



Tighten cylinder head bolts in 3 steps.

CAMSHAFTS

CAMSHAFTS

Removal

1) Remove camshaft covers and detach breather housing from front of head. Using tool (JD.2B), slacken timing chain by rotating tool clockwise. Remove camshaft sprocket retaining bolts from each sprocket, rotating crankshaft as necessary to gain access to remaining bolts.

2) Rotate crankshaft further until timing gauge (C.3993) can be installed. Draw sprockets off camshaft and slide up support brackets. Mark attachment holes in adjuster plate for assembly reference. Remove camshaft bearing caps and withdraw camshaft.

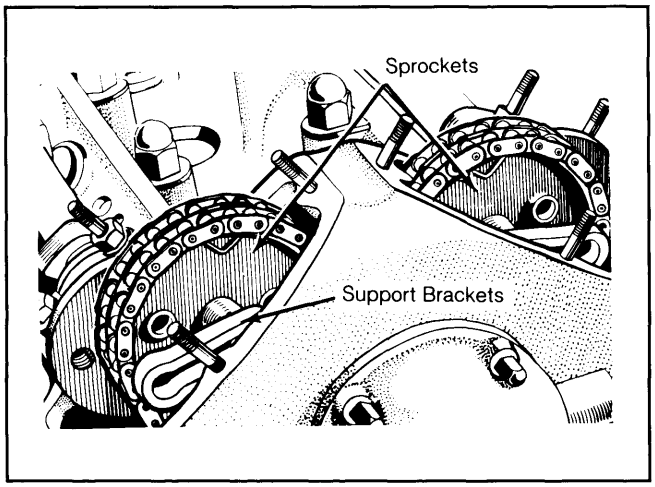
NOTE: Crankshaft must not be rotated after camshaft sprockets are removed.

Installation

To install, reverse removal procedure, ensuring that all components are replaced in original position.

NOTE: If preceding instructions have not been followed, it will be necessary to ensure that valve timing is still correct. See Valve Timing.

Fig. 3: Camshaft Sprockets in Disconnected Position



ENGINE FRONT COVER & OIL SEAL

Removal

1) Remove radiator and fan belt. Mark position of vibration damper for reassembly. Remove crankshaft pulley. Using a pair of levers, pry damper off of split cone. Remove split cone from crankshaft.

2) Remove oil pan and water pump. Remove screws attaching timing cover and slide timing cover and oil seal off of crankshaft.

Installation

1) Place new seal in groove in timing cover. Using a new gasket and sealing compound, install timing cover and seal. Reinstall oil pan with a new gasket. Install short screw in front right hand corner of oil pan.

2) Reinstall split cone on crankshaft. Position crankshaft damper to mark, install pulley and torque attaching bolts to specifications. Reinstall remaining components in reverse order of removal procedures.

VALVE TIMING

1) Rotate engine so that No. 6 (front) piston is at TDC on compression stroke and distributor rotor arm points to No. 6 segment. Check that timing chains are properly adjusted. See Timing Chain Replacement.

2) Remove lock wire from camshaft sprocket screws. Rotate crankshaft until inaccessible screws can be removed. Return engine to TDC of No. 6 piston and remove retaining screws. Tap camshaft sprockets off camshaft flanges.

3) Postion camshafts accurately with valve timing gauge, and check that TDC marks are in exact alignment. *See Fig. 1.* Withdraw clips from camshaft sprockets and press adjusting plates forward until serrations disengage. *See Fig. 4.*

Jaguar Engines

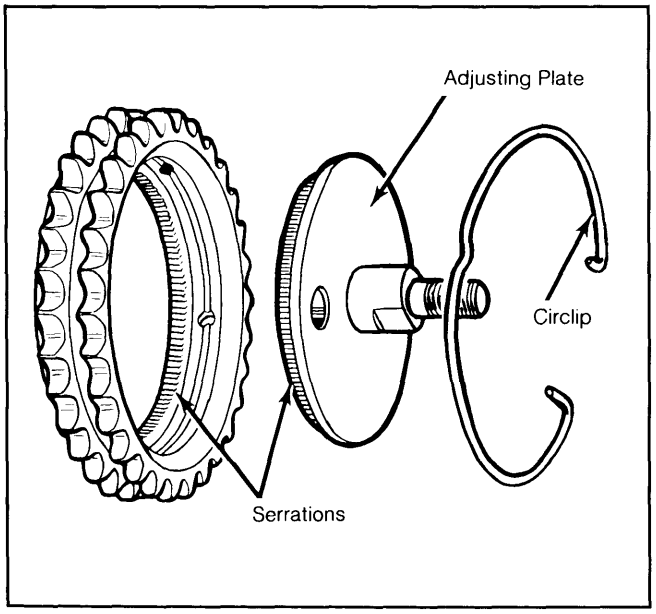
XJ6 6-CYLINDER (Cont.)

4) Replace sprockets on flanges of camshaft and align two holes in adjuster plate with holes in flanges. Engage serrations of adjuster plates with serrations in sprocket.

NOTE: Screw holes must be in exact alignment. If difficulty is experienced in aligning holes turn adjuster plates 180° and realign holes.

5) Replace circlips in camshaft sprockets. Replace camshaft sprocket screws and lock wire. Recheck valve timing.

Fig. 4: Exploded View of Camshaft Sprocket Assembly



VALVES

VALVE ARRANGEMENT

Right Side — Intake valves.
Left Side — Exhaust valves.

VALVE GUIDE SERVICING

Check valve guide for wear and proper guide-to-valve stem clearance. If guide is worn beyond specifications, replace guide by heating head in boiling water for approximately 30 minutes (or by other method), then drive guide(s) out of head from combustion chamber end. Coat new guide with graphite grease and refit circlip. Reheat head and drive new guide in from top until circlip is seated in groove.

REPLACEMENT VALVE GUIDES

Application	Size Mark	Dimension In. (mm)
Standard	No Mark	.501-.502 (12.73-12.75)
1st Oversize	1 Groove	.503-.504 (12.78-12.80)
wnd Oversize	2 Grooves	.506-.507 (12.85-12.87)
3rd Oversize	3 Grooves	.511-.512 (12.98-13.00)

NOTE: When installing oversize replacement guides, check O.D. of guide to be used. If necessary, ream cylinder head bore to obtain proper interference fit.

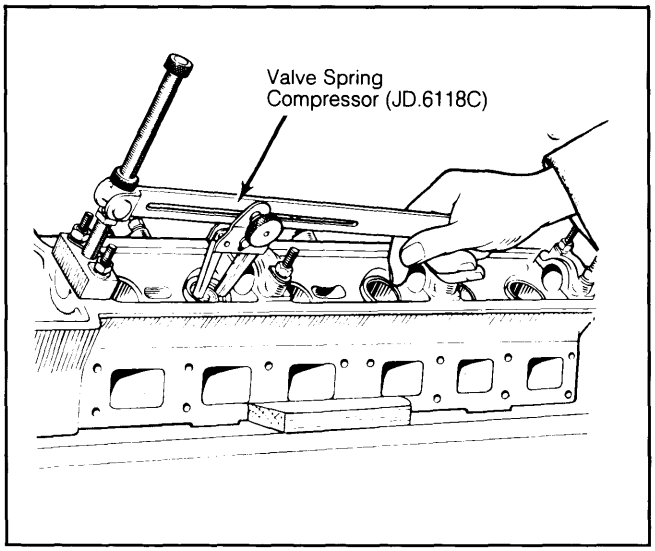
VALVE SPRING SERVICING

NOTE: Support ends of cylinder head with wooden blocks to prevent damage to valves. Opened valves protrude below face of cylinder head.

1) Remove camshaft bearing caps, note markings for reassembly. Remove camshaft, tappets and adjusting pads. Retain tappets and pads in proper order for reassembly.

2) Install spring compressor (Churchill No. JD.6118C). Compress springs and remove valve keepers. Compare old spring with new spring or with specification table. Replace springs as necessary. To install, reverse procedure.

Fig. 5: Valve Spring Compressor Tool Installation



VALVE TAPPET SERVICE

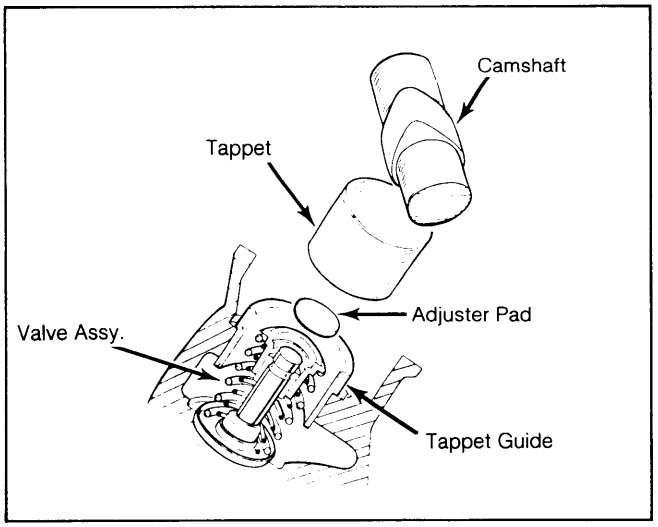
NOTE: Valves and operating mechanisms are numbered and must be kept in order when disassembled. No. 1 is at flywheel end of engine.

1) Remove tappets and adjusting pads and inspect guides, tappets and timing gauge (C.3993) before removing final camshaft retaining bolt. If required, disconnect sprockets from camshafts. See Valve Timing.

2) Remove camshaft bearing caps and lift off camshaft. Remove each tappet that requires adjustment and note its location for assembly in original position. Remove adjusting pad and measure thickness.

XJ6 6-CYLINDER (Cont.)

Fig. 6: Valve Tappet and Guide Assembly



3) Use measured pad thickness and difference between measured valve clearance and specified clearance to calculate required thickness of new adjusting pad. Adjusting pads are available in increments of .001" (.03 mm) from .085" (2.16 mm) to .110" (2.79 mm) and are marked with letters from "A" to "Z" respectively.

4) Insert correct adjusting pads and install tappets. Attach camshafts (using timing gauge). Tighten camshaft bearing cap nuts. Connect camshaft sprockets, and install camshaft covers.

PISTONS, PINS & RINGS

OIL PAN

NOTE: Oil pan removal is best accomplished with engine out of vehicle. Following procedures may be used with engine installed.

Removal

Remove front suspension components to gain access and clearance. Drain engine oil. Remove oil return pipe nuts and transmission oil cooler line clips. Remove screws and nuts holding pan to engine and remove pan.

Installation

To install, ensure that all mating surfaces are clean. Lightly grease seals and gaskets and install pan. Reverse removal procedure to complete installation.

NOTE: Do not trim seal ends. Press into groove until flush. Oil return pipe must have new "O" ring and fit in sump properly. Ensure that short screw is replaced in right front corner of pan.

PISTON & ROD ASSEMBLY

NOTE: Piston/connecting rod assemblies are numbered to their corresponding position in engine. No. 1 cylinder is at rear of engine.

Removal

With cylinder head and oil pan (sump) removed, remove nuts from connecting rods and remove bearing caps. Remove bolts from connecting rods and push piston/rod assembly out top of cylinder.

Installation

1) Use ring compressor and insert piston/rod assembly so that "FRONT" stamp on piston is toward front of engine.

2) If installing new parts, stamp-mark with numbers "1" through "6" corresponding to the bore in which they are installed. Coat bearing shells and journals with oil and complete installation in reverse order of removal.

PISTON RINGS

1) After checking ring end gap and side play, install compression rings in top two grooves and oil ring in bottom groove.

2) Both compression rings have tapered peripheries and are marked with "TOP" to ensure correct installation.

3) The top ring is also chrome-plated and cargraph (red) coated; the red coating must NOT be removed. When fitting oil ring, ensure expander ends do not overlap.

PISTON PINS

1) When removing and replacing pistons, immerse assembly in hot oil bath (or use other method) to bring piston end of assembly to approximately 230°F (110°C).

2) When installing pins, always use new pin circlips. Note that pins are color coded for grading purposes. Always select proper color pin for replacement.

FITTING PISTONS

1) Check piston and cylinder bore to determine if proper clearance exists. If it is necessary to rebore cylinder for installation of oversize piston, note that reboring is not to exceed .030" (.76 mm).

2) Oversize pistons are available in .010", .020", and .030" (.25 mm, .51 mm, and .76 mm) oversizes.

3) If replacing pistons with standard sizes (no reboring), note the following list of piston grades and select replacement piston of same grade. Piston grade is stamped in piston crown and on top face of block adjacent to cylinder.

STANDARD PISTON GRADING

Stamp Mark	Cylinder Diameter In. (mm)
F	3.6250-3.6253 (92.075-92.083)
G	3.6254-3.6257 (92.085-92.093)
H	3.6258-3.6261 (92.095-92.103)
J	3.36262-3.6265 (92.106-92.113)
K	3.6266-3.6269 (92.116-92.123)

CYLINDER LINERS

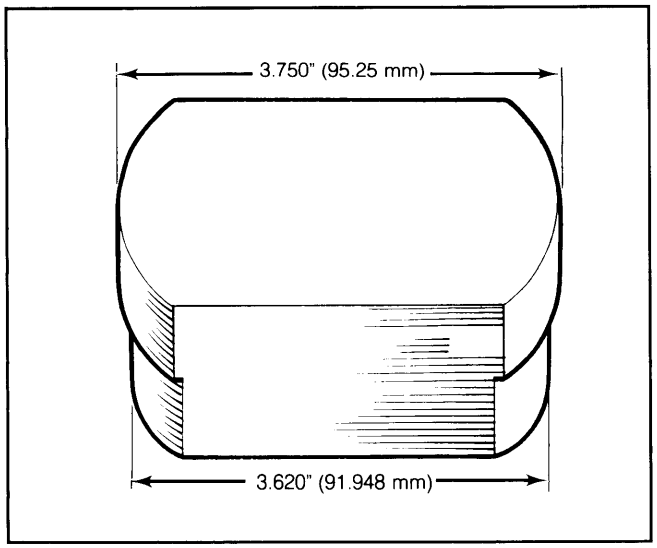
1) Should piston-to-cylinder clearance be excessive and reboring require more than .030" (.76 mm), new cylinder liners must be installed.

2) Press out the worn liners from below. Lightly coat outer top half of new liner with a jointing compound, then press in new liner until flush with top of block. Apply more jointing compound around area of liner-to-block mating surface.

Jaguar Engines

XJ6 6-CYLINDER (Cont.)

Fig. 7: Cylinder Liner Removing and Installing Block



3) Bore out liner to correspond with grade of piston to be installed. Following reboring process, the plugs in the main oil gallery should be removed and cylinder block oilways thoroughly cleaned. When dry, coat interior of crankcase with an oil and heat resistant paint.

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

MAIN & CONNECTING ROD BEARINGS

1) Remove connecting rod and main bearing caps, retaining all parts in exact order for reassembly. Note that all caps are numbered for reassembly reference.

2) When wear or out-of-roundness exceeds .003" (.08 mm), regrind crankshaft and install undersize bearings. Bearings are available in .010", .020", .030", and .040" (.25 mm, .51 mm, .76 mm, and 1.02 mm) undersizes. If regrinding must exceed .040" (1.02 mm), replace crankshaft.

3) Using Plastigauge method, measure bearing clearances. Do not rotate crankshaft while Plastigauge is installed. Install main and connecting rod caps and tighten.

REAR MAIN BEARING OIL SEAL

NOTE: The following procedure must be performed before crankshaft is installed.

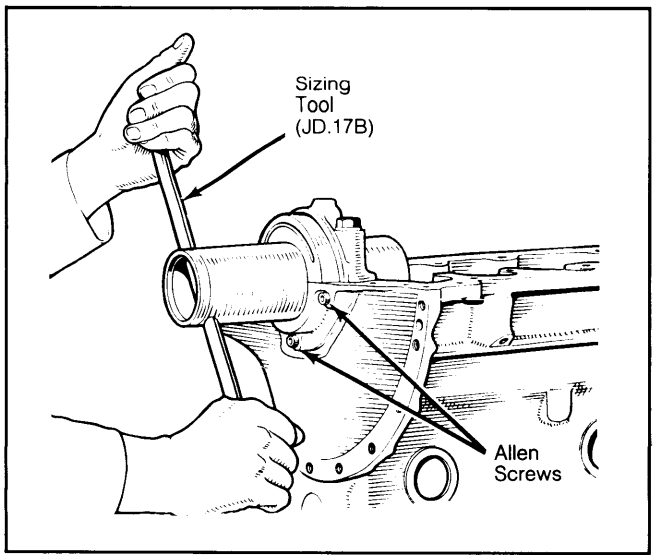
1) Carefully tap new rear oil seal halves into position, then roll seal into housing (with a hammer handle) until ends do not protrude.

NOTE: DO not cut seal ends. When both halves are properly in place, secure them with Allen screws.

2) Attach rear main bearing cap without bearings and torque to 72 ft. lbs. (10 mkg). Assemble rear oil seal housing to cylinder block, using three Allen screws.

3) Lightly coat inside surface of oil seal with graphite grease and insert a sizing tool (JD.17B) as shown in *Fig. 8.* Press tool inward and turn until it is fully seated; this should properly size the oil seal.

Fig. 8: Sizing Rear Oil Seal



Do not cut seal ends.

4) Remove sizing tool by pulling and twisting in opposite direction. Remove oil seal housing and install crankshaft.

THRUST BEARING ALIGNMENT

Thrust bearing washers are used on center main bearing caps to adjust end play. If beyond specifications, bearings .004" (.10 mm) oversize as well as standard are available. Install with white metal side (with groove) outward.

TIMING CHAIN

TIMING CHAIN REPLACEMENT

Removal

1) Remove cylinder head, oil pan, water pump, crankcase breather, vibration damper (including cone and Woodruff key), and timing gear cover. Withdraw timing pointer, spacer, and front oil seal.

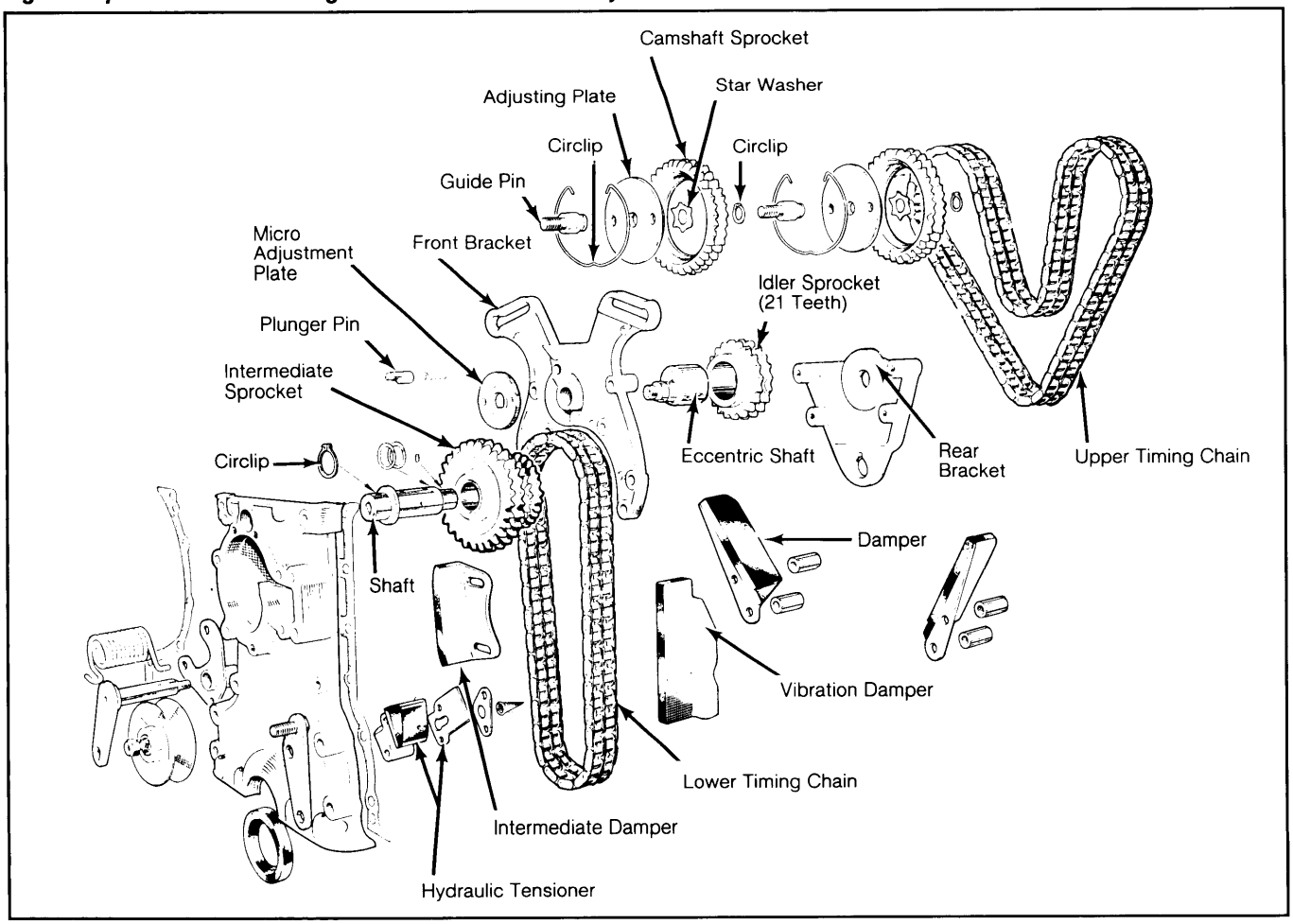
2) Remove oil slinger from crankshaft. remove 2 bottom timing chain tensioner and chain guide retaining screws. Withdraw conical filter behind tensioner. Slacken four setscrews securing top timing chain assembly (DO NOT remove setscrews at this point).

3) Withdraw crankshaft timing sprocket and chain assembly. Be sure to remove spacers, top timing chain damper, and top timing chain retainer. Disengage camshaft sprockets from top chain. Remove nut and serrated washer from idler shaft and withdraw serrated plate, plunger, and spring.

4) Remove nuts retaining front mounting bracket to rear mounting bracket. Remove timing chains from intermediate and idler sprockets. Draw idler shaft, idler sprocket, and bushing from rear mounting bracket. Remove circlip and press intermediate shaft from rear mounting bracket. Note location of bushing and shim under intermediate sprocket.

XJ6 6-CYLINDER (Cont.)

Fig. 9: Exploded View of Timing Gear and Chain Assembly



Installation

1) Position eccentric idler shaft to hole in front mounting bracket. Position spring and plunger in bracket and locate serrated plate on shaft. Loosely secure plate using washer and nut.

2) Attach idler sprocket (21 teeth) to idler shaft. Replace intermediate sprocket (large gear forward) onto intermediate shaft, placing shim in position. Install shaft assembly in rear mounting bracket, ensuring roll pin engages in slot. Install circlip.

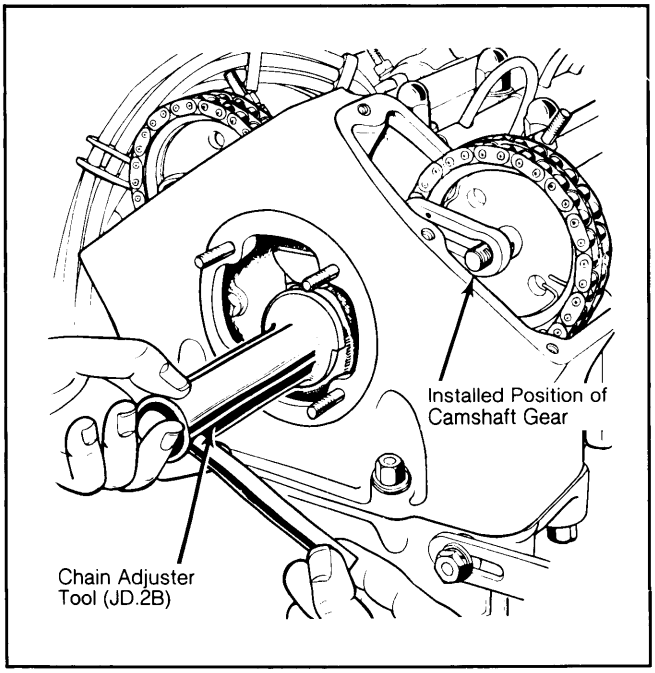
3) Locate top timing chain (longer chain) on small intermediate sprocket, and lower timing chain on large sprocket. Loop top chain beneath idler sprocket and secure top mounting bracket to rear bracket.

4) Install four long setscrews and spring washers to front mounting bracket and attach dampers, chain support plate, and spacers to setscrews. Equalize loops of top timing chain and locate camshaft sprockets in loops. Rotate eccentric idler shaft to lift idler sprocket to its highest position between camshaft sprockets.

5) Ensure Woodruff key is positioned in crankshaft. Locate crankshaft sprocket, but do not fully seat at this time. Loop bottom timing chain beneath crankshaft sprocket, then tap sprocket until it is fully seated. Position and secure crankshaft sprocket assembly.

6) Install, but do not tighten, bottom timing chain guides. Insert conical filter into its hole in cylinder

Fig. 10: Adjusting Upper Timing Chain



Do not use excessive force to tighten chain.

Jaguar Engines

XJ6 6-CYLINDER (Cont.)

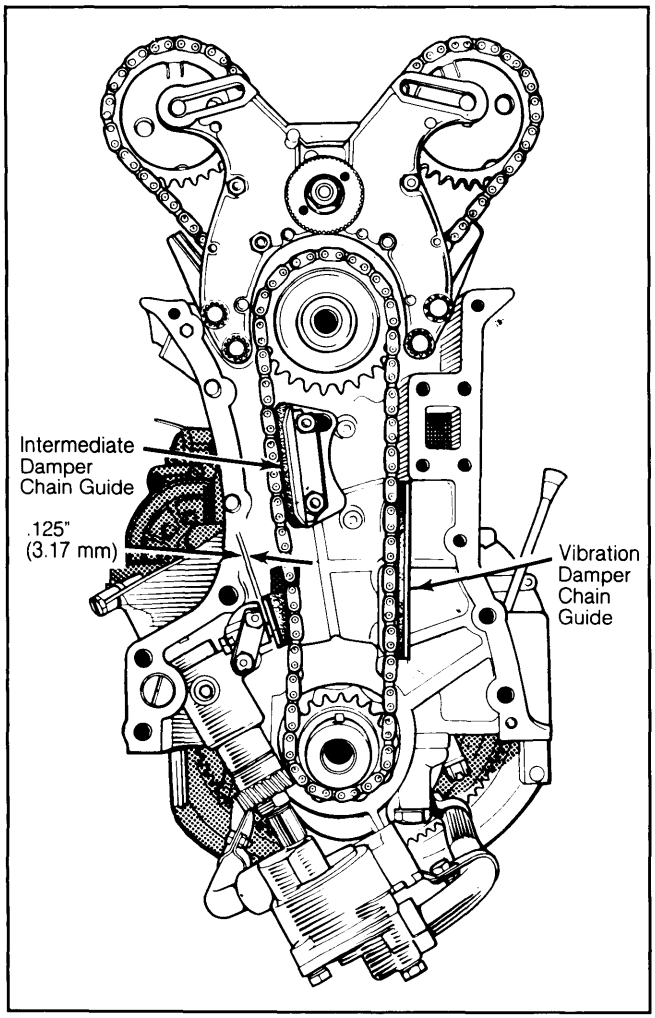
block. Screw slipper into tensioner until .125" (3.17 mm) exists between slipper and body. Locate tensioner on shims as necessary to ensure slipper runs central on chain, and secure using two setscrews and lock plate.

7) Place slip gauge or spacer card supplied with new tensioner between slipper and body of tensioner to maintain dimension set earlier, then adjust intermediate damper to touch chain.

8) Tighten setscrews and bend up tabs of lock plate. Remove slip gauge and top chain or tensioner slipper to release ratchet. Position oil slinger on crankshaft. Replace timing cover.

9) Adjust upper timing chain by loosening lock nut on eccentric shaft, then use tool (JD.2B) to rotate eccentric counterclockwise until chain has proper tension. Do not use excessive force to tighten chain. Tighten lock nut and install remaining components.

Fig. 11: Lower Timing Chain Adjustment Measuring Point



ENGINE OILING

ENGINE OILING SYSTEM

Lubrication is provided by a gear driven eccentric rotor type pump. Oil from pump goes through a full-flow oil filter to all moving engine components.

CRANKCASE CAPACITY

8.7 qts. (8.2L).

OIL FILTER

Replace every 3,000 miles.

NORMAL OIL PRESSURE (HOT)

40 psi @ 3,000 RPM.

OIL PUMP

Removal

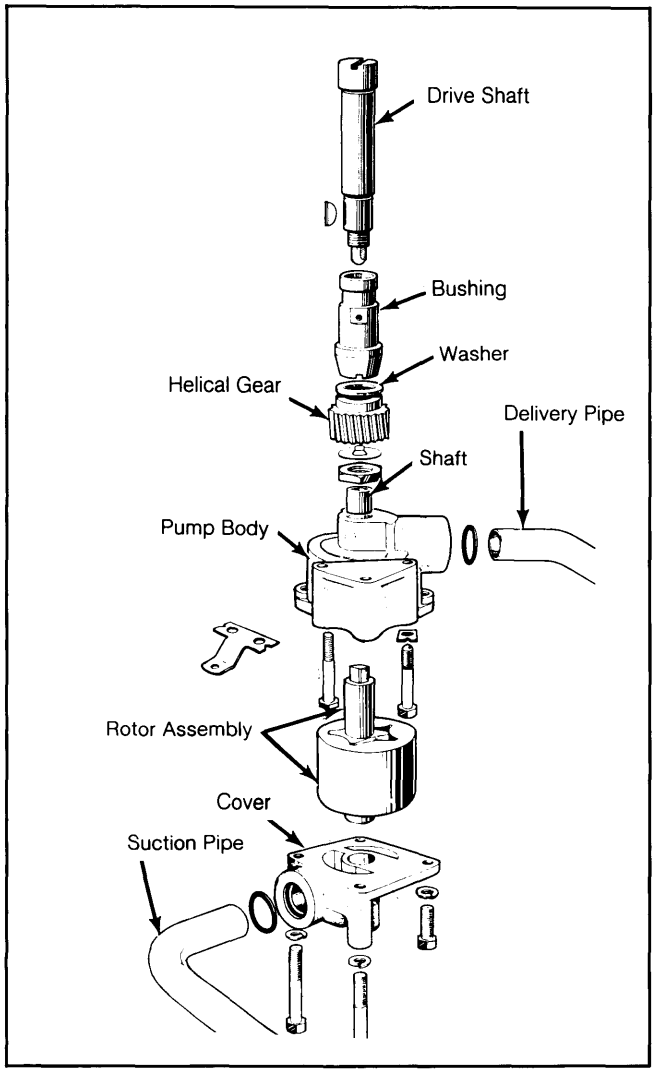
Remove oil pan, suction and delivery pipes. Remove bolts attaching oil pump to front main bearing cap. Withdraw pump and coupling sleeve at top of drive shaft.

Disassembly

1) Remove bolts and take off bottom cover. Remove inner and outer rotors. Inner rotor is pinned to drive shaft and cannot be disassembled.

2) Check clearances of inner and outer rotor lobes, outer rotor-to-body and rotor-to-cover plate. Place drive shaft in a soft-jawed vise and check that rotor is tight on pin.

Fig. 12: Exploded View of Oil Pump



XJ6 6-CYLINDER (Cont.)

Reassembly

Reassemble in reverse order of disassembly. Install outer rotor to pump body with chamfered end forward. Use new "O" rings on suction and delivery pipes.

Installation

To install, reverse removal procedures.

OIL PUMP SPECIFICATIONS

Application	Clearance In. (mm)
Inner-to-Outer Rotor	.006 (.15)
Outer Rotor-to-Body	.010 (.25)
Rotor-to-Cover (End Play)	.0025 (.06)

ENGINE COOLING

WATER PUMP

Disassembly

1) Remove water pump and gasket from timing cover. Pull fan hub from shaft with a puller. Loosen lock nut and remove Allen locating screw.

2) Using an arbor press and a tube measuring 1.094" (27.79 mm) O.D. and .969" (24.60 mm) I.D., press shaft and impeller assembly out of pump body.

3) Press shaft from impeller and remove seal and rubber thrower. Spindle and bearing assembly cannot be further disassembled.

4) Clean and inspect all parts for wear or damage. Bearing is sealed and lubricated, therefore do not wash in solvents.

Reassembly

1) Install shaft and bearing assembly into pump body from rear. Align and install locating screw and lock nut. Place rubber thrower in its groove on shaft in front of seal.

2) Coat outside of brass seal housing with water resistant sealer and install into recess in pump housing. Push seal into its housing with carbon face towards rear of pump.

3) Press impeller onto shaft until rear face of impeller is flush with end of shaft. Press fan hub onto shaft until it is flush with end of shaft.

COOLING SYSTEM CAPACITY

19.5 qts. (18.5L).

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Camshaft Cap	9 (12)
Connecting Rod Caps	41 (56)
Cylinder Head Nuts	54 (73)
Flywheel	67 (91)
Front Engine Bracket-to-Beam	18 (24)
Main Bearing Caps	72 (98)
Rear Engine Mount-to-Body	
5/16" Bolt	18 (24)
3/8" Bolt	32 (44)
Torque Converter	35 (48)

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Year	Displacement Cu. In.	Displacement cc	Fuel System	HP@RPM	Torque Ft. Lbs.@RPM	Compr. Ratio	Bore In.	Bore mm	Stroke In.	Stroke mm
1982	258.4	4235	Fuel Inj.	.....	.....	8.1:1	3.625	92.07	4.173	106

VALVES

Engine Size & Valve	Head Diam. In. (mm)	Face Angle	Seat Angle	Seat Width In. (mm)	Stem Diameter In. (mm)	Stem Clearance In. (mm)	Valve Lift In. (mm)
4235 cc							
Intake	1.75 (44.45)	45°	45°	.....	.310-.3125 (7.87-7.94)	.001-.004 (.025-.10)	.375 (9.525)
Exhaust	1.625 (41.28)	45°	45°	.....	.310-.3125 (7.87-7.94)	.001-.004 (.025-.10)	.375 (9.525)

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

Engine	MAIN BEARINGS Journal Diam. In. (mm)	Clearance In. (mm)	Thrust Bearing	Crankshaft End Play In. (mm)	CONNECTING ROD BEARINGS Journal Diam. In. (mm)	Clearance In. (mm)	Side Play In. (mm)
4235 cc	2.749-2.750 (69.85-69.86)	.0008-.0025 (.020-.063)	Center	.004-.006 (.10-.15)	2.086-2.0866 (52.98-53.00)	.001-.0027 (.025-.069)	.0058-.0087 (.147-.221)

Jaguar Engines

XJ6 6-CYLINDER (Cont.)

ENGINE SPECIFICATIONS (Cont.)

PISTONS, PINS, RINGS

Engine	PISTONS	PINS		RINGS		
	Clearance In. (mm)	Piston Fit In. (mm)	Rod Fit In. (mm)	Ring No.	End Gap In. (mm)	Side Clearance In. (mm)
4235 cc	.0007-.0013 (.018-.033)	[1] Press Fit	[2] Push Fit	No. 1 No. 2 Oil	.015-.020 (.38-.51) .009-.014 (.23-.35) .015-.045 (.38-1.14	.0015-.0035 (.038-.089) .0015-.0035 (.038-.089) [3]

[1] — When heated to 230°F (110°C). [2] — At room temperature, without piston. [3] — Self-expanding.

VALVE SPRINGS

Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (Kg @ mm)	
		Valve Closed	Valve Open
4235 cc Inner	1.734 (44.04)	.....	.....
Outer	2.103 (53.42)	.....	.....

CAMSHAFT

Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
4235 cc	.9990-.9995 (25.375-25.387)	.0005-.002 (.013-.05)	.....

VALVE TIMING

Engine	INTAKE		EXHAUST	
	Open (BTDC)	Close (ABDC)	Open (BBDC)	Close (ATDC)
4235 cc	15°	57°	57°	15°