1969-73 SAAB 99 INLINE 4 CYLINDER

GENERAL SPECIFICATIONS

Year	Displ.		Carburetor	HP at RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore		Stroke	
	cu. ins.	cc					in.	mm	in.	mm
1969-72										
1700	104.2	1709	1x1-Bbl.	80@5200	94@3000	9.0-1	3.288	83.5	3.071	78
1700E	104.2	1709	Fuel Inj.	87@5200	95@3000	9.0-1	3.288	83.5	3.071	78
1850	113.1	1854	1x1-Bbl.	86@5000	108@3000	9.0-1	3.425	87.0	3.071	78
1850E	113.1	1854	Fuel Inj.	95@5200	105@3200	9.0-1	3.425	87.0	3.071	78
1973										
1985	121	1985	1x1-Bbl.	95@5200	115@3500	8.7-1	3.543	90	3.071	78
1985E	121	1985	Fuel Inj.	110@5500	123@3700	8.7-1	3.543	90	3.071	78

ENGINE IDENTIFICATION

On 1969-72 engines, engine number is stamped on a pad on cylinder block, just above exhaust manifold and below spark plugs, on left side of engine. On 1973 engines, engine number is stamped on a pad on cylinder block, just below distributor on right-hand side of engine. Engine is identified as shown in the following example:

B 20 P01 000 000

1st Digit – Carburetor (B) or Fuel Injection (BE).
2nd & 3rd Digits – Two Liter Engine.
4th, 5th & 6th Digits – Man. Trans. (P01 or P03) or Auto. Trans. (P02).
Remaining Digits – Serial Number.

ENGINE REMOVAL

NOTE – It is not recommended to remove engine without transmission. Remove engine and transmission as an assembly.

1) Remove hood attaching bolts and lift off hood. Disconnect battery cables. Unclamp and remove battery. Drain coolant from radiator, engine block and heater core by opening all petcocks.

2) On carburetor engines, detach vacuum hose from power assist servo at intake manifold. Disconnect fuel line from intake side of fuel pump.

3) On fuel injection engines, disconnect vacuum hoses of power assist cylinder and pressure sensor from intake manifold. Disconnect fuel lines from injector tubes at intake manifold.

4) On all models, disconnect electrical wires from the following: Ignition coil, ballast resistor, temperature transmitter, oil pressure transmitter (carburetor engine), radiator fan, thermostat, headlights and headlight wipers, and automatic transmission (fuel injection engine).

5) On fuel injection engines, disconnect electrical leads from the following: Fuel injection distributor, injectors, air cleaner, throttle valve switch at temperature sensor, and temperature switch below intake manifold.

6) On carburetor engines, remove air cleaner and preheater complete with hose and ignition cable.

NOTE – Save spacer sleeves under outer preheater casing.

7) On carburetor engines, disconnect throttle linkage from throttle shaft and remove return spring. Remove choke cable from carburetor. Loosen hose clamps at thermostat housing, radiator and both hoses to heater.

8) On fuel injection engines, remove air cleaner, complete with hoses. Disconnect throttle control shaft from driver on throttle housing. Disconnect hoses at thermostat housing, radiator, and both hoses to heater.

9) Front panel assembly is made up of grille, radiator, cooling fan and headlights. To remove front panel assembly, remove four attaching screws from panel assembly. Remove two self-tapping screws attaching headlight frames. Remove four lower self-tapping screws attaching headlight to edge of body. Remove hood lock cable from dash panel and wheel housing.

10) On Man. Trans., remove clutch slave cylinder and hang it out of the way. Move free wheel lever forward to locked position. Release wire clamp at transmission and free cable from holder at right-hand differential bearing seat, if so equipped.

11) On Auto. Trans., remove heat shield on exhaust manifold at exhaust manifold and exhaust pipe.

12) On all models, remove exhaust pipe from manifold. Disconnect ground strap at transmission. Raise front of vehicle and place blocks under chassis.

13) On Man. Trans., place transmission in neutral. Knock out front taper pin from gear shift rod. Pull rubber bellows free of groove in gear selector rod, if so equipped. Separate gear selector rod and arm.

14) On Auto. Trans., remove screw for gear selector wire at transmission. Move gear selector lever to position No. 1 and pull outer cable housing back. Using a suitable tool (Saab Tool No. 879038) on wire, turn tool a small amount and pull out wire.

15) Disconnect speedometer cable from transmission. Remove nuts from engine mounts. Unclamp larger clamps around rubber bellows on inner universal joints. On 1968-69 models, "T" pieces of drive shafts must be rotated to a horizontal position. Attach suitable hoist to engine.

NOTE – On models with top mounted alternator, remove alternator and attach rear lifting sling to alternator bracket.

16) On 1968-69 models, raise engine about two inches and separate inner universal joints (first left and then right), with engine displaced as far as possible towards opposite side. Make sure that needle bearings do not come apart.

17) On 1970-73 models, remove attaching hardward from lower end piece of control arm on right-hand side. Turn steering wheel to left and withdraw right universal joint. Raise engine slightly and withdraw left universal joint.

1969-73 SAAB 99 INLINE 4 CYLINDER (Cont.)

18) Raise engine to gain access to starter and alternator, disconnect cables. Lift engine clear of vehicle and place on an engine stand.

19) To install reverse removal procedures.

NOTE — To separate engine and transmission see Oil Pan Removal.

INTAKE MANIFOLD REMOVAL

1) Remove air cleaner and carburetor. On injection engines, remove throttle housing.

2) Remove attaching bolts and lift off manifold.

CYLINDER HEAD REMOVAL

Removal — 1) With engine in vehicle, disconnect battery cables. Drain coolant from engine block and radiator. Open heater core petcock.

2) Disconnect power assist vacuum hose from intake manifold and fuel line from fuel pump. On fuel injection engines, disconnect fuel hoses from inlet and outlet of injector valves.

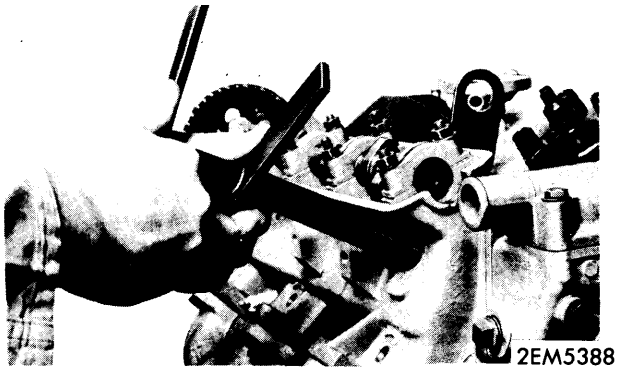
3) Disconnect lead from temperature transmitter. Remove air cleaner and preheater. Loosen hose clamps at thermostat housing, water pump and intake manifold. Disconnect choke cable on carburetor engines. Loosen exhaust pipe and remove exhaust manifold.

4) Remove distributor cap and ignition leads. On 1968-69 models, remove side and torsion stays. Remove camshaft cover and gaskets.

5) Remove camshaft sprocket by screwing a nut onto center stud against mounting bracket. Bend back locks and remove attaching screws from camshaft sprocket. Separate sprocket from camshaft plate until it hangs free with bracket.

CAUTION — Tighten nut securely, so sprocket and chain can not move. Otherwise chain tensioner will tighten chain, and tensioner can not be reset without lifting engine out of vehicle

6) Remove all cylinder head nuts and bolts.


2EM5388

CYLINDER HEAD STUD REMOVAL

7) Using suitable tools (Saab Tool Nos. 839051 & 839052 1969-72 or 839212 1973), remove two studs and screw these in two cylinder head bolt holes to act as locating dowels (see illustration).

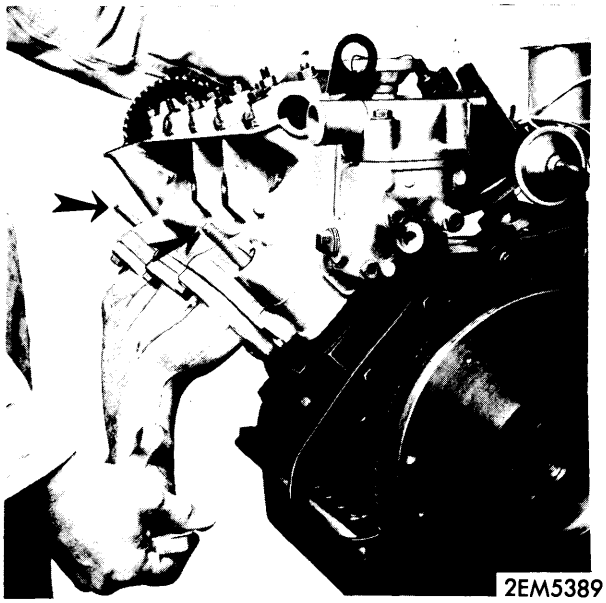
8) Remove timing cover screws and remaining studs and lift off head.

NOTE — Before installing cylinder head, align camshaft timing mark with mark on cylinder or damage to valves may occur.

Installation — 1) Clean cylinder head and block. Install head gasket over locating dowels.

NOTE — Do not use sealing compound on head gasket or engine. Gasket is fitted dry.

2) Make sure that markings on camshaft and bearing cap are aligned. Check that flywheel mark is aligned with mark on engine block and ignition is set on No. 1 cylinder.

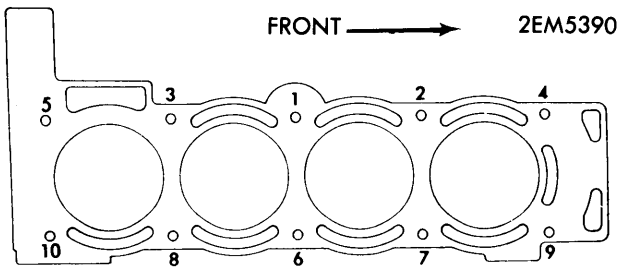

2EM5389

CYLINDER HEAD LOCATING DOWELS

3) Mount cylinder head on dowels. Screw in studs. Install nuts and bolts and tighten to specifications. Remember to reinstall locating studs in their original locations.

4) Cylinder head nuts and bolts are tightened in two stages as follows:

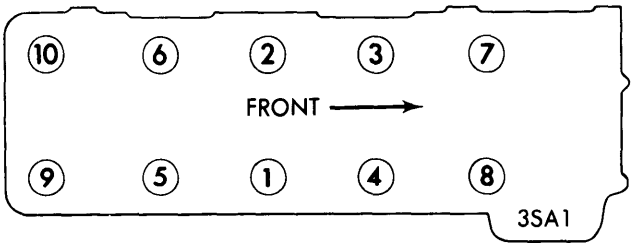
Application	Ft. Lbs. (mkg)
1969-72	
Stage 1 Nuts (top row)	22 (3.0)
Stage 1 Bolts	3.5 (.4)
Stage 2 Nuts	54 (7.4)
Stage 2 Bolts	54 (7.4)
1973	
Stage 1	43 (5.9)
Stage 2	69 (9.5)



2EM5390

CYLINDER HEAD TIGHTENING SEQUENCE (1969-72)

1969-73 SAAB 99 INLINE 4 CYLINDER (Cont.)



CYLINDER HEAD TIGHTENING SEQUENCE (1973)

5) Warm up engine, then let it cool for 30 minutes. Loosen each nut and bolt in turn and retighten to 54 ft. lbs. (7.4 mkg) on 1969-72 and 69 ft. lbs. (9.5 mkg) on 1973. Cylinder head nuts and bolts should be retightened again after 1,200 and 6,000 miles.

6) Reverse removal procedures for remaining components.

VALVES

Engine & 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)
1969-72							
1700 & 1850							
Int.	1.4397 (36.56)	45°	45°	.0866-.0984 (2.19-2.49)	.3106-.3310 (7.88-7.89)	.00145 (.03)	.....
Exh.	1.2799 (32.50)	45°	45°	.0866-.0984 (2.19-2.49)	.3098-.3102 (7.86-7.87)	.00224 (.05)	.....
1973							
1985							
Int.	1.653 (41.98)	44.5°	45°	.063-.106 (1.60-2.69)	.313-.314 (7.95-7.97)	① ①	.....
Exh.	1.397 (35.48)	44.5°	45°	.063-.106 (1.60-2.69)	.312-.313 (7.92-7.95)	① ①	.....

① — Side play of .019" (.48 mm) measured at valve head pulled .118" (2.99 mm) from seat.

VALVE ARRANGEMENT

E-I-I-E-E-I-I-E (front to rear).

VALVE GUIDE SERVICING

1) Check valve guide and valve stem for wear or damage. Using a suitable tool (839043), withdraw valve guide from camshaft side of head.

2) Install guide from cylinder side of head, using same tool as for removal. Ream guide to standard size, using (Saab Reamer No. 839038). Check valve seat for true, reface if necessary.

VALVE SPRINGS

Engine	Free Length In. (mm)	PRESSURE (LBS.) Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
1969-72 1700 & 1850	1.0794 (27.41)	.....	110±10 lbs. (49.5±4.5 kg)
1973 1985	1.744 (44.29)	.....	178-198@1.161 (80.7-89.8 @29.48)

VALVE SPRING REMOVAL

1) With cylinder head removed, remove camshaft bearing caps and camshaft.

2) Using a magnet, lift out cam followers along with adjusting pallets and retain in proper order for reassembly.

3) With spring compressor, depress spring and remove valve keepers. Release spring and valve collar.

4) Replace spring and reverse removal procedure.

VALVE CLEARANCE ADJUSTMENT

1) With valve cover removed, rotate engine until valve to be checked has heel of cam opposite cam follower. Measure clearance with feeler gauge. If clearance is not within specifications, intake .006-.012" (.15-.30 mm) and exhaust .014-.020" (.35-.50 mm) clearance, direct measurement will be required.

2) Install suitable tool (839145) and a dial indicator. Measure clearance of all valves and note reading. Proceed to adjust any valve which does not come within the following limits; .008-.010" (.20-.25 mm) intake and .016-.018" (.40-.45 mm) exhaust.

3) Remove camshaft, cam followers and adjusting pallets of any valve needing adjustment.

4) Measure pallet thickness and add noted valve clearance to arrive at total clearance. Subtract proper valve clearance from total clearance to determine needed pallet thickness.

5) Install new adjusting pallets and recheck valve clearance.

1969-73 SAAB 99 INLINE 4 CYLINDER (Cont.)

PISTONS, PINS, RINGS

Engine	PISTONS	PINS		RINGS		
	Clearance In. (mm)	Piston Fit	Rod Fit	Rings	End Gap In. (mm)	Side Clearance In. (mm)
1969-72 1700 & 1850	.0005-.0014 (.01-.03)	Push Fit	Push Fit	No. 1	.0118-.0177 (.29-.44)	.0025 (.06)
				No. 2	.0118-.0177 (.29-.44)	.0025 (.06)
				Oil	.0157-.0551 (.39-1.39)	.....
1973 1985	.0005-.0015 (.01-.04)	Push Fit	Push Fit	No. 1	.014-.021 (.35-.53)	.002-.003 (.05-.07)
				No. 2	.012-.018 (.30-.45)	.0015-.003 (.03-.07)
				Oil	.015-.016 (.38-.40)	.....

OIL PAN REMOVAL

The oil pan is an assembly made up of oil pan, transmission and various drives. It requires engine removal for disassembly.

Manual Transmission – 1) Drain engine oil and remove clutch cover. Remove starter, alternator and alternator drive belt. Withdraw clutch shaft.

2) Remove three screws of release bearing guide sleeve.

3) Back off adjusting screw and disconnect clutch lever.

4) Remove all screws in mating flange of engine and transmission and two screws from under transmission.

NOTE – Do not mix screws. Screws threaded into alloy transmission case have UNC threads and screws threaded into cast iron engine block have UNF threads.

5) Lift engine carefully off transmission. At same time remove release bearing guide sleeve.

6) Reassembly in reverse order.

Automatic Transmission – 1) Drain engine oil.

2) On 1970 models only, remove screw located inside crankcase, using a 1/2" socket and extension. This screw can be reached at an upward angle through oil drain plug hole.

3) Remove cover over flywheel ring gear, starter, alternator and alternator drive belt.

4) Disconnect throttle wire from throttle housing. Remove crankcase ventilation device and all screws (14 in number) on 1969-72 and (17 in number) on 1973 in mating flange of engine and transmission.

5) Remove four screws attaching flywheel gear to torque converter. These screws can be reached through a recess in starter mount. Lift engine carefully off transmission and support torque converter. Reassemble in reverse order.

NOTE – If engine and transmission fail to separate, check that all screws are removed, especially one in crankcase of 1970 models.

PISTON & ROD ASSEMBLY

Connecting rods and rod caps are numbered. Note positioning and location before disassembly.

Removal – With oil pan and cylinder head removed, unscrew rod nuts and withdraw bearing caps. Place plastic sleeves over rod bolts and push out rod and piston.

Installation – Using a ring compressor, place piston in cylinder bore with marking "FRONT" or arrow facing timing chain end of engine. Install rod caps in their proper position and torque nuts to specifications.

PISTON PIN REPLACEMENT

Piston pins are retained by circlips. Remove circlips and press out piston pins. Check pins and bearings for wear or damage, replace if necessary.

FITTING PISTONS

1) To fit pistons to cylinder bores, use a feeler gauge 1/2" (12.7 mm) wide and .0005-.0014" (.01-.03 mm) thick. Oil cylinder lightly and insert piston without rings.

Piston Specifications

Application & Mark	Diameter In. (mm)
1700	
F (Std.)	3.2859-3.2864 (83.46-83.47)
G (Std.)	3.2864-3.2868 (83.47-83.48)
H (Std.)	3.2869-3.2875 (83.48-83.50)
1850	
F (Std)	3.4236-3.4242 (86.95-86.97)
G (Std.)	3.4242-3.4248 (86.97-86.98)
H (Std.)	3.4254-3.4260 (87.00-87.02)
1985	
AB (Std.)	3.5425-3.5427 (89.97-89.98)
C (Std.)	3.5432-3.5436 (89.99-90.00)
1st O.S.	3.5618-3.5624 (90.46-90.48)
2nd O.S.	3.5815-3.5821 (90.97-90.98)

1969-73 SAAB 99 INLINE 4 CYLINDER (Cont.)

2) Attach feeler gauge to a spring scale. Insert feeler gauge between piston and cylinder wall at right angles to piston pin. When feeler gauge can be pulled out of cylinder with a force of 1.8-2.6 lbs. (.81-1.17 kg), piston clearance has been determined.

3) Repeat test at several different depths in cylinder bore. Graded standard and non-graded oversize pistons are available.

4) Check piston rings for end gap and side clearance, using an inverted piston to position ring in bore. On worn bores, measure at lower end of bore.

5) Install rings on piston, making sure gaps of compression rings are 180° apart with lower compression ring mark "TOP" facing up. On three piece oil ring make sure ends are staggered.

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

	MAIN BEARINGS				CONNECTING ROD BEARINGS		
Engine	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)
1969-72 1700 & 1850	2.1254-2.1259 (53.98-53.99)	.0009-.0025 (.02-.06)	Center	.0031-.0098 (.07-.24)	1.7499-1.7505 (44.44-44.46)	.0007-.0022 (.01-.05)	.....
1973 1985	2.2829-2.2834 (57.98-57.99)	.001-.003 (.02-.07)	Center	.003-.011 (.07-.27)	2.0467-2.0472 (51.98-51.99)	.001-.003 (.02-.07)	.....

MAIN BEARING SERVICE

1) Remove connecting rods and main bearing caps. Measure journals with a micrometer. Out-of-round should not exceed .002". If crankshaft is near or over stated limit of wear, regrind journals and fit oversize bearings.

2) Using "V" blocks and a dial indicator check crankshaft for bend. If it exceeds .002" of bend, place in a press and straighten.

THRUST BEARING ALIGNMENT

Center main bearing is thrust bearing. Check crankshaft endplay. If it exceeds specifications, replace thrust washers with oil grooves facing outwards.

FRONT MAIN BEARING OIL SEAL SERVICE

NOTE — Seal may be replaced with engine in vehicle if clutch and flywheel are first removed.

Remove attaching screws from cap seal and drive out old seal. Using suitable tools (839034 & 839044) on 1969-72 or (839196 & 839192) on 1973, install new seal with spring ring facing flywheel. Slip suitable guide sleeve (839041) on 1969-72 or (839197) on 1973 over end of crankshaft. Oil guide sleeve. Slide seal cap into position and install attaching screws. Remove guide sleeve tool.

ENGINE TIMING COVER & OIL SEAL

NOTE — Engine must be removed from vehicle to replace timing cover oil seal.

Remove belt pulley screw and pulley, using suitable puller (839114). Pry out old seal. Install new seal, using suitable tools (839188 & 839044). Grease seal with silicone grease and make sure keyway of tool is aligned with keyway of crankshaft.

CAMSHAFT

Engine	Journal Diam. In. (mm)	Clearance In. (mm) ①	Lobe Lift In. (mm)
1969-73	1.2499 (31.74)	.....	.....

① — End play is .004-.007" (.10-.17 mm).

CAMSHAFT REMOVAL

Removal — 1) Remove camshaft cover and gaskets.

2) Remove camshaft sprocket by screwing a nut onto center stud of camshaft sprocket and clamp center stud against mounting bracket.

CAUTION — Tighten nut securely, so sprocket and chain can not move. Otherwise chain tensioner will tighten chain, and tensioner can not be reset without lifting engine out of vehicle.

3) Bend back locks and remove attaching screws from camshaft sprocket. Separate sprocket from camshaft plate until it hangs free with bracket.

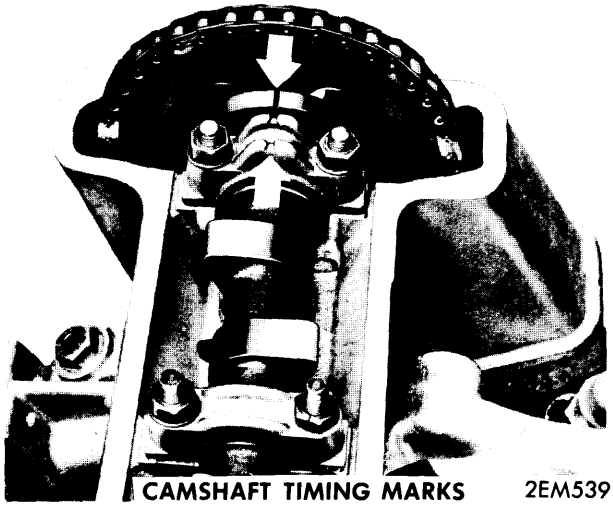
4) Remove camshaft bearing caps. Lift off camshaft, inspect camshaft and bearings for wear or damage.

5) Replace camshaft, bearings and caps, and tighten cap nuts to specifications. Align camshaft timing mark with mark on cylinder head (see illustration).

6) Install camshaft sprocket on camshaft. Unscrew nut from center stud on camshaft sprocket and lock both attaching screws. Replace camshaft cover and gaskets.

CAUTION — Nut on camshaft sprocket center stud must not on any account be unscrewed before sprocket is tightly screwed to camshaft.

1969-73 SAAB 99 INLINE 4 CYLINDER (Cont.)



CAMSHAFT TIMING MARKS 2EM5391

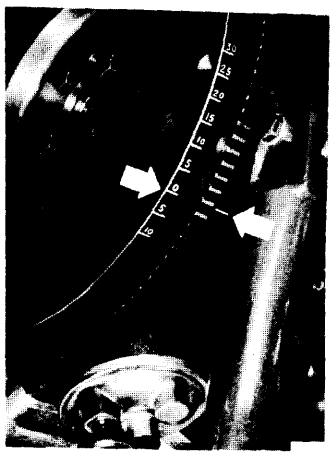
VALVE TIMING				
	INTAKE		EXHAUST	
Engine	Open (BTDC)	Close (ABDC)	Open (BBDC)	Close (ATDC)
1969-72				
1700,1700E & 1850①	12°	52°	52°	12°
1850E①	16°	56°	56°	16°
1973				
1985②	16°	70°	70°	26°

① – Set intake clearance to .0125" (.31 mm) and exhaust clearance to .0179" (.45 mm), when checking valve timing.
② – Set intake clearance to .010" (.25 mm) and exhaust clearance to .018" (.45 mm), when checking valve timing.

VALVE TIMING & CHAIN REPLACEMENT

Removal – 1) Remove timing cover and camshaft cover. Separate camshaft from camshaft sprocket. *See Camshaft Removal.*

2) Remove chain tensioner, chain guide screws and mounting plate complete with camshaft sprocket and chain.



2EM5392

CRANKSHAFT TIMING MARKS

3) Remove chain guides, oil thrower ring and pull sprocket off crankshaft, using a suitable puller.

4) Remove idler shaft keeper plate and withdraw idler shaft.

Installation – 1) Reinstall idler shaft. Install keeper plate and attaching bolts. Position idler sprocket so marked line is horizontal.

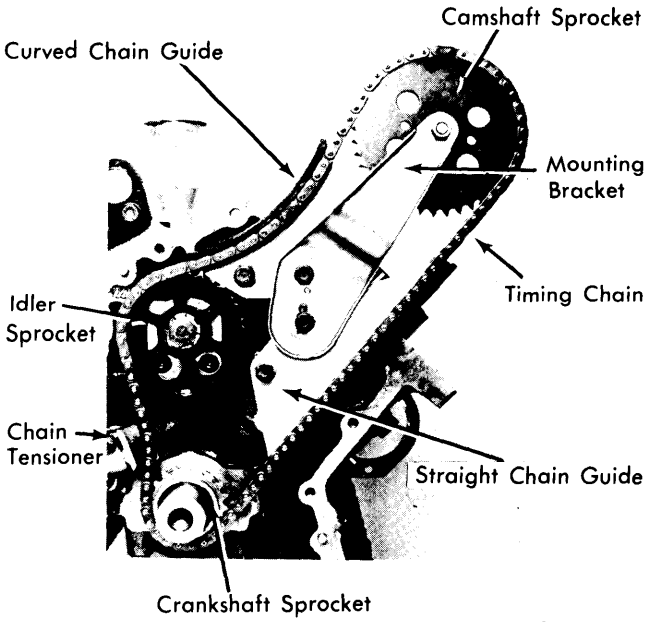
2) Mount pinion sprocket on crankshaft. Align "O" degree mark on flywheel with mark on cylinder block (see illustration).

3) Align camshaft mark with mark on cylinder head. Install straight chain guide with long screw in bottom hole.

4) Loosely mount curved chain guide with short screw in hole nearest idler shaft.

5) Place camshaft chain over camshaft sprocket and mounting bracket. Lower chain and sprocket past camshaft flange until center stud of sprocket is lined up with camshaft.

6) Rotate camshaft sprocket until screw holes match threaded holes in camshaft flange.



2EM5393

TIMING CHAIN INSTALLATION

7) Place timing chain over crankshaft and idler sprockets so chain will be in a straight line between camshaft and crankshaft (see illustration). Do not change any of the sprocket settings while installing chain.

8) Guide center stud of camshaft sprocket into camshaft. Install locking plate and one screw. Install screws for chain guides and camshaft sprocket mounting bracket.

1969-73 SAAB 99 INLINE 4 CYLINDER (Cont.)

9) Rotate crankshaft one revolution. Install and tighten camshaft sprocket screws. Lock screws with locking plate. Check timing marks to see they are properly aligned.

10) Engines up to and including number 2954, fit chain tensioner as follows: Using an Allen wrench, back off adjusting screw until mounting position is reached. Slacken chain by loosening screws of curved chain guide. Mount chain tensioner on block. Press curved chain guide to stretch chain over tensioner shoe. Tighten chain guide screws. Apply spring pressure to chain tensioner by turning clamping sleeve clockwise with Allen wrench. A distinct click will be heard as spring pressure is applied. Install and lock screw on back of chain tensioner. Rotate crankshaft one revolution and check that chain tensioner has at least .020" (.50 mm) and not more than .060" (1.52 mm) clearance from its butted position.

11) Engines with number 2955 and higher (1969-72) and (1973), fit chain tensioner as follows: Relieve spring pressure on tensioner by turning clamping sleeve clockwise to mounting position. Fit a .118" (2.99 mm) shim on neck of tensioner and push neck into body of tensioner. Mount chain tensioner and guide plate on block. Remove shim. Press curved chain guide against chain to stretch it and push tensioner neck into housing. Then adjust to leave a clearance of .020" (.50 mm) between housing and tensioner neck. Tighten chain guide. Rotate crankshaft one full turn and check that tensioner has not less than .020" (.50 mm) and not more than .060" (1.52 mm) clearance. Remove nut from camshaft sprocket center stud. Reinstall remaining components in reverse order of disassembly.

ENGINE OILING

Crankcase Capacity – 4 qts. (1969-72), 4.5 qts. (1973) including filter.

Oil Filter – Full-flow, replace every 6000 miles.

Normal Oil Pressure – 54-60 psi (1969-72), 43 psi at 2000 RPM (1973).

Pressure Regulator Valve – Nonadjustable, opens at 57-71 psi (1973).

ENGINE OILING SYSTEM

Oil pressure is generated by one of two types of oil pumps; rotary vane type used on 1700 cc and 1850 cc engines up to chassis No. 99.050.000 or dual rotor type used on 1700 cc and 1850 cc from chassis No. 99.050.001 and all 1985 cc engines. Pump is driven from idler shaft and is located on outside of engine. Oil is forced through a full-flow filter and oil channels to various lubrication points. Each connecting rod bearing has a separate oil channel from main bearings.

OIL PUMP

Removal (Rotor Vane Type) – Remove four screws that pass through corners of pump. Withdraw pump complete with drive shaft. Remove "O" ring between pump and block.

Disassembly – Hold pump in hand with guide sleeve of housing downward. Remove retaining spring from pump cover and twist cover to one side. A guide sleeve in one of screw holes in housing locates cover. Check that this sleeve is still in place when cover is taken off. Remove rotor vanes and spacer rings. Remove pressure relief valve in cover by removing lock ring. Remove seat, spring and valve.

Reassembly – Oil all parts as they are assembled. Insert one spacer ring and rotor. Insert vanes with rounded edges facing outward toward pump housing wall. Install remaining spacer ring. Turn rotor until all vanes drop into their proper positions. Install pressure relief valve in cover. Locate cover on housing and install retaining spring. Insert drive shaft into block and install four attaching screws.

Removal (Dual Rotor Type) – Remove four screws attaching pump to engine. Withdraw pump and "O" ring from engine. Remove two screws attaching pump cover to housing. Remove rotors and "O" ring from housing. Pull cotter pin from pump cover and remove plug, "O" ring, spring and pressure relief valve piston. Using a straightedge and a feeler gauge, measure clearance between rotors and housing face. If clearance is excessive, lap face of pump until proper clearance is achieved.

Installation – Clean and oil all parts. Install outer rotor with chamfered edge inward facing toward drive shaft. Install valve piston, spring, plug, "O" ring and cotter pin in pump cover. Place "O" ring in pump housing groove. Install cover and tighten screws. Rotate pump until drive shaft engages in engine. Slide pump up against engine and install four attaching screws.

Oil Pump Specifications

End Clearance Rotor-to-Housing	
Rotor Vane Type	.001-.005" (.02-.12 mm)
Dual Rotor Type	.002-.003" (.05-.07 mm)
Radial Clearance Rotor	
Blades-to-Housing	max. .026" (.66 mm)
Rotor Shaft Diameter	.498-.499" (12.64-12.67 mm)
Rotor Shaft Bore	.500-.501" (12.70-12.72 mm)
Pressure Relief Spring	
Free Length	2.06" (52.32 mm)
Compressed Length	1.32" (33.52 mm)
Spring Pressure (Compressed)	15-16 lbs. (6.80-7.25 kg)

ENGINE COOLING

Cooling System Capacity – With Heater; 9 qts. (1969-72), 10 qts. (1973).

Thermostat – (1969-72) ..... 178-188°F (81-80°C)
(1973) ..... 185°F (84°C)

Radiator Cap – (1969-70) .... 7.5-8.5 psi (.52-.59 kg/cm²)
(1971-72) .. 7.5-10.3 psi (.51-.72 kg/cm²)
(1973) ..... 8.5 psi (.59 kg/cm²)

WATER PUMP

Removal – 1) Drain coolant and remove battery cable. Disconnect power assist vacuum hose from intake manifold. Disconnect fuel line at carburetor and hose from camshaft cover-to-crankcase.

2) Remove preheater hose and air cleaner. Disconnect throttle linkage. Loosen hose clamps to pump, intake manifold and distributor vacuum hoses.

1969-73 SAAB 99 INLINE 4 CYLINDER (Cont.)

ENGINE COOLING (Cont.)

3) Remove six manifold screws. Lift off intake manifold and carburetor as an assembly. If necessary remove choke cable. On 1968-69 models, remove distributor cap and torsion stay.

4) On 1973 models, remove alternator and engine mount bolts. Raise engine slightly and remove screw attaching bracket to timing cover. Loosen lower screw and swing bracket out of the way.

5) Remove three water pump cover screws and tap lower hose gently with a plastic mallet to loosen cover. Unscrew center screw from impeller while holding impeller with suitable pliers.

NOTE — Center screw of impeller is a left-hand thread.

CAUTION — Impeller must not turn when removing center nut or damage to gear teeth on pump and idler shaft may result.

6) Attach slide hammer and suitable adapter (839057) to water pump shaft and take out as unit. If bearing housing remains in block, use slide hammer for removal.

Disassembly — 1) Mount pump in suitable tool and press out impeller.

2) Press pump shaft, seals and bearing from bearing housing. Place worm drive uppermost.

3) Remove pump seal, "O" ring, thrower and seal ring. Loosen ball bearing lock ring.

4) Place pump shaft and bearing with drive end downward and press shaft from bearing.

Assembly — 1) Fit oil thrower ring and press ball bearing onto pump shaft. Install bearing lock ring.

2) Press shaft and bearing into bearing housing. Install seal ring.

3) Install thrower, "O" ring and water pump seal in this order.

4) Mount pump in engine block, checking that pump gear engages with idler gear. Seat bearing housing using suitable sleeve and drift. Make sure flange of bearing housing butts against engine block.

5) Install impeller screw and washer. Tighten screw counterclockwise (left-hand thread).

6) On 1969-72 models, there should be a clearance of .010-.020" (.25-.50 mm) between impeller center screw and cover. Adjust clearance if necessary. Install one or two gaskets as necessary to achieve proper clearance. Gaskets come in three different thicknesses .010" (.25 mm), .020" (.50 mm) and .030" (.76 mm).

7) Tighten cover screws and reinstall remaining components in reverse order of removal.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Main Bearings	
(1969-72)	58 (8.0)
(1973)	79 (10.9)
Rod Bearings	40 (5.5)
Camshaft Bearing Caps	
(1969-72)	17 (2.3)
(1973)	13 (1.7)
Camshaft Cover	1.5 (.2)
Crankshaft Pulley	
(1969-72)	62 (8.5)
(1973)	137 (18.9)
Rear Crankshaft Seal	
(1969-72)	7 (.9)
(1973)	14 (1.9)
Cylinder Head	
(1969-72)	54 (7.4)
(1973)	69 (9.5)
Flywheel	44 (6.0)
Water Pump Impeller	18 (2.4)
Carburetor	15 (2.0)
Oil Pump	
(1969-72)	18 (2.4)
(1973)	13 (1.7)
Idler Shaft Keeper Plate	
(1969-72)	18 (2.4)
(1973)	14 (1.9)
Idler Sprocket	18 (2.4)
Camshaft Sprocket	
(1969-72)	10 (1.3)
(1973)	14 (1.9)
Timing Cover	18 (2.4)
Intake Manifold	
(1969-72)	18 (2.4)
(1973)	13 (1.7)
Exhaust Manifold	
(1969-72)	27 (3.7)
(1973)	18 (2.4)
Thermostat Housing	
(1969-72)	18 (2.4)
(1973)	13 (1.7)