1967-73 MERCEDES-BENZ 220 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
1967-71	134.1	2197	2x1-Bbl.	116@5000	140@3000	9.1:1	3.427	87	3.64	92.4
1972	134.1	2197	1x1-Bbl.	105@4800	123@2800	8.7:1	3.427	87	3.64	92.4
1973	134.1	2197	1x1-Bbl.	105@4800	131@2800	8.7:1	3.427	87	3.64	92.4

ENGINE IDENTIFICATION

Engine code is determined by first six digits of engine identification number, stamped on left side of engine block.

Application	Code
220/8 & 220 Gasoline Engine	115.920

ENGINE REMOVAL

Removal – 1) Remove hood and disconnect battery ground cable. Drain cooling system, remove radiator guard, radiator and disconnect heating hoses. On Auto. Trans. models, disconnect and plug oil cooler lines from transmission.

2) Remove air intake silencer. Disconnect fuel hoses and vacuum hose to power brake. On models with power steering and level control, disconnect and plug oil lines.

3) Disconnect oil pressure gauge hose. Disconnect choke cable and accelerator linkage from carburetors.

4) Disconnect ground cable from engine to chassis and all other electrical leads. Disconnect gearshift linkage and exhaust pipe at manifold.

5) Loosen steering relay arm and move downward together with center tie rod and steering shock absorber. Disconnect hydraulic line from clutch slave cylinder.

6) On Auto. Trans. models, disconnect oil cooler lines between transmission and oil cooler.

7) Disconnect exhaust pipe support bracket at transmission, loosen clamp on exhaust pipe and push downward.

8) Attach suitable lifting sling to engine. Mark position of rear engine crossmember in relation to chassis base panel, disconnect rubber mount at transmission and remove crossmember.

9) Disconnect speedometer cable. Disconnect propeller shaft and shaft plate from transmission. Push propeller shaft to rear after loosening clamping nut.

10) Disconnect plug from automatic transmission.

11) Remove bolts at both front engine mounts. Remove front limit stop. Loosen one screw and move power steering reservoir to one side.

12) Lift out engine at a 45° angle. To install, reverse removal procedures.

CYLINDER HEAD REMOVAL

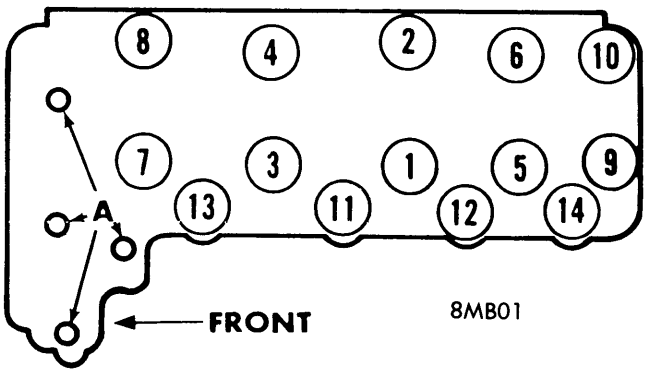
Removal – 1) Drain cooling system. Disconnect all water hoses attached to cylinder head. Remove vent line, air cleaner and rocker cover.

2) Disconnect vaccum line and fuel line to carburetors. Loosen fuel filter screws and move filter out of way. Disconnect exhaust pipe at manifold.

3) Disconnect spark plug wires from spark plugs and heat sensor from thermostat. Rotate engine until camshaft is in a position to have opened the least amount of valves as possible.

4) Remove top chain guide. Unscrew camshaft sprocket screw. Remove chain tensioner and camshaft sprocket.

5) Loosen and remove head bolts, working from outside toward inside of head. Remove four socket screws at front of head. Lift off head and gasket.



CYLINDER HEAD TIGHTENING SEQUENCE

Installation – 1) Rotate engine until No. 1 piston is at TDC of compression stroke. Install head gasket and cylinder head, torque head bolts to specifications (see illustration).

2) Install four socket head screws in front of cylinder head. Insert Woodruff key in camshaft. Position shim on camshaft so mark aligns with mark of first camshaft bearing support.

3) Install camshaft sprocket and chain with tension on driving side of chain, using care not to move camshaft or crankshaft.

4) Check endplay of camshaft. See *Camshaft Bearing Replacement*. Install upper chain guide. Using a new seal, install chain tensioner filled with oil.

5) Install rocker arm assembly, rotating camshaft so there is no load on rocker arms while tightening. Adjust tappets with engine cold. See *Valve Clearance Adjustment*.

6) Reinstall remaining components in reverse of removal procedure. Operate engine until temperature of 176°F (80°C) is reached and retighten head bolts. Recheck valve tappet clearance. Drive vehicle 180-600 miles (290-966 km) and retorque head bolts. Loosen each head bolt slightly before tightening to final torque.

1967-73 MERCEDES-BENZ 220 4 CYLINDER (Cont.)

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)
1967-70							
Int.	1.736-1.744 (44.1-44.3)	45°	45°	.0512-.0629 (1.30-1.60)	.3522-.3531 (8.95-8.97)	.....	.....
Exh.	1.454-1.467 (36.9-37.2)	45°	45°	.1023-.1141 (2.60-2.90)	.4298-.4307 (10.92-10.94)	.....	.....
1971-73							
Int.	1.736-1.744 (44.1-44.3)	45°	45°	.0512-.0787 (1.30-1.99)	.3522-.3531 (8.95-8.97)	.....	.....
Exh.	1.454-1.467 (36.9-37.2)	45°	45°	.0591-.0787 (1.50-1.99)	.4298-.4307 (10.92-10.94)	.....	.....

VALVE ARRANGEMENT

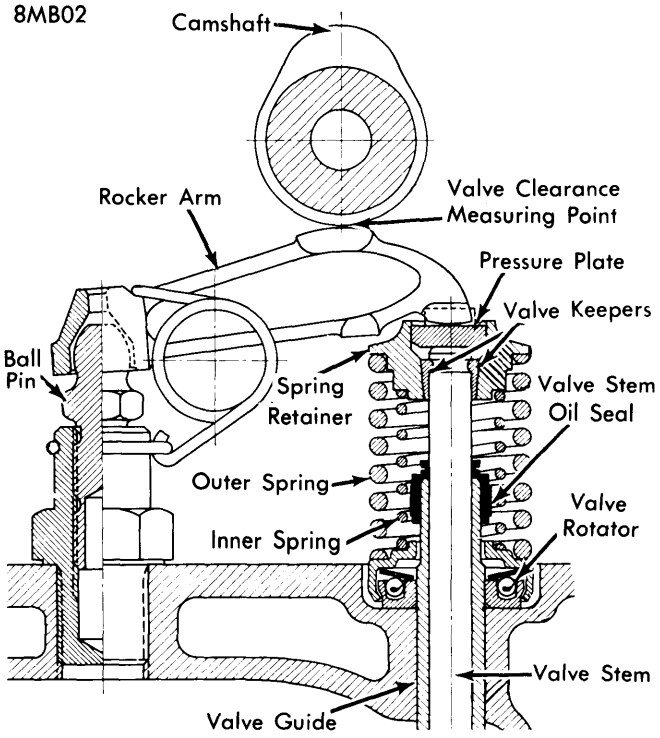
E-I-I-E-E-I-I-E (front to rear).

VALVE GUIDE SERVICING

1) Thoroughly clean carbon from guide bore and measure inside diameter. If measurement exceeds .3553" (9 mm) on intake guide or .4343" (11 mm) on exhaust guide, replacement of guide is necessary.

2) Drive guides out through top of head with a suitable driver. Drive new guides into cylinder head from top until snap ring contacts top of head. Guide bores might require reaming to obtain correct fit with valve stem.

3) Valve guides require a .0004-.0012" (.010-.030 mm) press fit in cylinder head. If fit is too loose, two oversize valve guide sizes are available with oversize designated by color code. See specification table for suitable application.



VALVE TRAIN COMPONENTS

Valve Guide Specifications

Application	Intake Guide	Exhaust Guide
Standard	.5523-.5531" (14.03-14.05 mm)	.5917-.5925" (15.03-15.05 mm)
Red Code Oversize	.5594-.5602" (14.21-14.23 mm)	.5673-.5681" (14.41-14.43 mm)
White Code Oversize	.5988-.5996" (15.21-15.23 mm)	.6066-.6075" (15.41-15.43 mm)

VALVE STEM OIL SEALS

Early models are equipped with valve stem oil seals only on intake valve. Later models utilize valve seals on both intake and exhaust. Seal is a teflon type, utilizing a lock ring mounted around seal to secure it to valve guide. Valve spring must be removed to replace seal.

VALVE SPRINGS

Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
1967-69			
Inner	1.771 (44.9)	33.5@1.22 (15.2@31)	55.6@.826 (25.2@21)
Outer	1.854 (47.1)	66.1@1.57 (29.9@40)	169.7@1.18 (76.9@30)
1970-73			
Inner	1.771 (44.9)	28.2-33.5@1.22 (12.8-15.2@31)	50.3-55.6@.827 (22.8-25.2@21)
Outer	1.969 (50)	79.4@1.54 (36.0@39)	149.3-168.2@1.18 (67.7-76.3@30)

VALVE SPRING REMOVAL

Compress valve spring with a suitable spring compressor. Remove valve keepers and release spring compressor. Remove upper spring seat, both valve springs and valve rotator. Check spring for wear or fatigue and replace as necessary. To install valve springs, reverse removal procedure.

ROCKER ARM ASSEMBLY

1) Remove valve cover. Remove spring clamp from notch in top of rocker arm and push outward over ball cup of rocker arm. Rotate camshaft until there is no load on rocker arm being removed.

1967-73 MERCEDES-BENZ 220 4 CYLINDER (Cont.)

CAUTION — Rotate engine in correct direction of rotation by cranking collar bolt on crankshaft. Do not rotate by turning bolt on camshaft. If these procedures are not followed, drive chain tensioning rail could be distorted or damaged.

2) Insert a suitable spring compressor (112 589 08 61 00) between camshaft and valve spring and push valve spring down to relieve pressure from rocker arm. Lift rocker arm off of ball pin and remove.

3) To install rocker arm, reverse removal procedure. Check and, if necessary, adjust valve clearance.

VALVE CLEARANCE ADJUSTMENT

1) Valve clearance is checked or adjusted with engine cold. Clearance is measured between sliding surface of rocker arm and heel of camshaft. Remove breather line from valve cover and remove valve cover.

2) Rotate engine until lobe on camshaft is pointing away from sliding surface on rocker arm. *NOTE — Take care in rotating engine, see previous CAUTION.*

3) Measure valve clearance. If clearance is too tight, screw in rocker arm ball pin, using a suitable adapter (111 589 00 01 00) and a torque wrench. If clearance is excessive, follow same procedure and screw ball pin out.

4) A required torque of 14.5-25.3 ft. lbs. (2.0-3.5 mkg) is needed when screwing ball pin out of or into cylinder head. If torque is less than specified; ball pin, base plate, or both must be replaced.

5) If clearance is too small and ball pin cannot be screwed into cylinder head any further, a thinner pressure plate must be installed in valve spring retainer. Standard thickness of pressure plate is .177" (4.50 mm). Undersize plates are available in thicknesses of .138" (3.50 mm) and .098" (2.49 mm).

Valve Clearance Specifications

Application	Clearance
Intake	.003" (.076 mm)
Exhaust	.008" (.20 mm)

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)
1967-72	.0004-.0008 (.010-.020)	.0000-.0001 (.000-.002)	.0004-.0009 (.010-.023)	No. 1	.012-.022 (.30-.56)	.0020-.0032 (.051-.081)
				No. 2	.012-.018 (.30-.46)	.0016-.0029 (.041-.074)
				No. 3	.010-.016 (.25-.41)	.0020-.0028 (.051-.071)
1973	.0007-.0011 (.018-.028)	.0000-.0001 (.000-.002)	.0004-.0009 (.010-.023)	No. 1	.012-.018 (.30-.46)	.0020-.0032 (.051-.081)
				No. 2	.012-.018 (.30-.46)	.0016-.0028 (.041-.071)
				No. 3	.010-.016 (.25-.41)	.0004-.0017 (.010-.043)

OIL PAN REMOVAL

Removal — 1) Drain engine oil. Remove dipstick and guide tube. Remove cover plate from clutch housing. Remove oil pan bolts.

2) Loosen steering shock absorber and drag link and turn to one side. Unscrew drag link on intermediate steering and turn aside. Remove oil pan.

NOTE — In August 1970 a new larger oil pan became available, which had a .5 qt. larger capacity. Late model vehicles starting with chassis end number 120 830 come equipped with new oil pan, early vehicles may be modified to accept new oil pan.

PISTON & ROD ASSEMBLY

Removal — 1) Remove cylinder head and oil pan. Unscrew connecting rod nuts. Tap rod bolts with a plastic mallet to loosen rod on crankshaft. Push piston and connecting rod assembly out top of cylinder block.

2) Remove piston pin circlips. Heat piston to 104-140°F (40-60°C) and press out wrist pins using suitable tool.

Installation — 1) Heat piston and reinstall wrist pin and circlips. Piston and wrist pin must be matched.

2) Install connecting rod and cap so cylinder numbers face left side of engine and arrow on piston crown faces forward.

NOTE — Piston must be installed facing proper direction or damage to the engine will occur.

3) Connecting rod bolts must be replaced if shank expansion has reached a minimum diameter of .2834" (7.198 mm) after several tightenings. Normal diameter of connecting rod bolts is .3937" (9.999 mm). Drive out old bolts and replace with new bolts, fitting new bolts to same spline traces. *NOTE — First tightening after new bolts are installed is 50.6 ft. lbs. (7 mkg). Subsequent tightenings are to 36 ft. lbs. (5.0 mkg).*

4) Rotate crankshaft until piston is at TDC. Measure distance between top of cylinder block and piston crown. Piston must not protrude more than .024-.043" (.58-1.10 mm) above block surface.

1967-73 MERCEDES-BENZ 220 4 CYLINDER (Cont.)

PISTON PINS

Removal & Replacement – Remove pin circlips. heat piston to 104-140°F (40-60°C) and press out piston pin using suitable tool. Check pin for undue wear or fatigue, replace if necessary. Diameter of piston pin should be 1.0234-1.0236" (25.99-26.00 mm). Heat piston to same temperature as for removal and install pin and circlips.

FITTING PISTONS

Measure piston and cylinder diameters to determine running clearance. Piston diameter is measured at 90° to piston pin bore near bottom of piston skirt. Install rings with marking "TOP", "F" or "GOE" up.

Piston Specifications

Application	Piston Diameter
Standard	3.4228-3.4236" (86.93-86.96 mm)
1st Oversize	3.4441-3.4449" (87.48-87.50 mm)
2nd Oversize	3.4638-3.4646" (87.98-88.00 mm)
3rd Oversize	3.4835-3.4842" (88.48-88.50 mm)

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

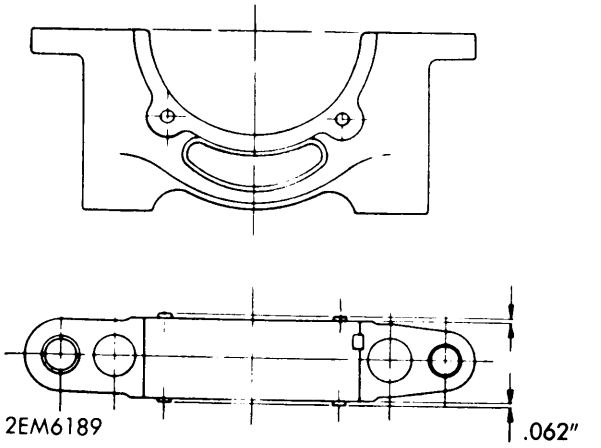
Engine	MAIN BEARINGS				CONNECTING ROD BEARINGS		
	Journal Diam. In. (mm)	Clearance In. (mm)	Thrust Bearing	Crankshaft End Play In. (mm)	Journal Diam. In. (mm)	Clearance In. (mm)	Side Play In. (mm)
1967-73	2.7541-2.7545 (69.95-.69-96)	.0018-.0026 (.045-.066)	Center	.004-.009 (.01-.02)	2.045-2.046 (51.94-51.96)	.0014-.0022 (.035-.056)	.0043-.0091 (.109-.231)

MAIN & CONNECTING ROD BEARINGS

Measure main bearing and connecting rod journals for out-of-round and taper. Out-of-round must not exceed .0002-.0004" (.005-.010 mm) and taper must not exceed .0004-.0006" (.010-.015 mm). If repair is necessary; select proper undersize and grind crankshaft to following diameters:

Crankshaft Journal Diameters

Application	Main	Connecting Rod
Standard	2.7541-2.7545" (69.95-69.96 mm)	2.0454-2.0458" (51.95-51.96 mm)
1st Undersize	2.7442-2.7446" (69.70-69.71 mm)	2.0356-2.0360" (51.70-51.71 mm)
2nd Undersize	2.7344-2.7348" (69.45-69.46 mm)	2.0257-2.0261" (51.45-51.46 mm)
3rd Undersize	2.7246-2.7249" (69.20-69.21 mm)	2.0159-2.0163" (51.20-51.21 mm)
4th Undersize	2.7147-2.7151" (68.95-68.96 mm)	2.0060-2.0064" (50.95-50.96 mm)



CENTER MAIN BEARING CAP

THRUST BEARING ALIGNMENT

Center main bearing cap has pin-located thrust washers to adjust crankshaft end play. Measure end play and install thrust washer giving proper end play. Measure pin protrusion from main bearing cap to see that protrusion does not exceed .062" (1.57 mm), see illustration. Standard and oversize thrust washers are available in following sizes:

Thrust Washers

Application	Thickness In. (mm)
Standard	.078 (1.98)
1st Oversize	.080 (2.03)
2nd Oversize	.082 (2.08)
3rd Oversize	.084 (2.13)
4th Oversize	.086 (2.18)
5th Oversize	.088 (2.24)
6th Oversize	.090 (2.29)
7th Oversize	.092 (2.34)

REAR MAIN BEARING OIL SEAL SERVICE

1) With oil pan and crankshaft removed, insert fabric oil seal in groove in crankcase behind rear main bearing. Cut seal at parting face so that it protrudes slightly above parting face.

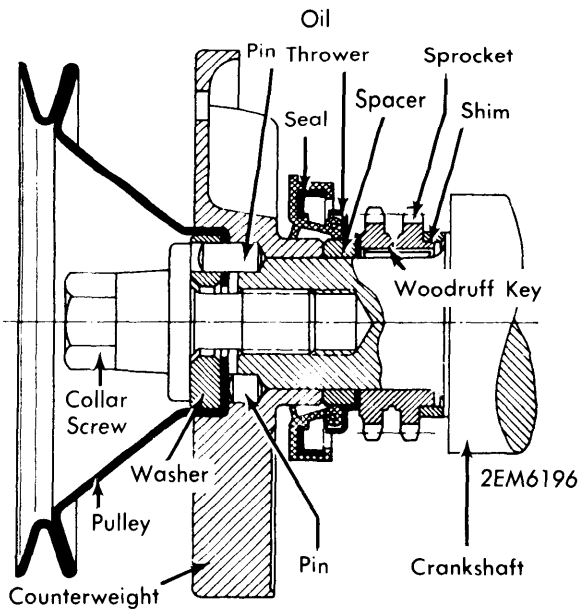
2) Install other half in oil pan groove, using tallow on seal halves. Reinstall crankshaft and oil pan. Rotate crankshaft to check tightness of seal. If seal is too tight, remove oil pan and crankshaft and roll down high spots with a hammer handle.

FRONT OIL SEAL

Removal – 1) Remove attaching bolt and crankshaft pulley. Attach a suitable puller and remove counterweight. Remove oil pan.

2) Press out seal ring and remove spacer from crankshaft.

1967-73 MERCEDES-BENZ 220 4 CYLINDER (Cont.)



CRANKSHAFT FRONT OIL SEAL

Installation – 1) Fill new seal between sealing lips with hot bearing grease and coat outer diameter with sealing compound.

2) Slide oil thrower ring and seal onto crankshaft. Press seal in until it touches face of crankcase. Slide spacer ring onto crankshaft.

3) Replace oil pan. Install remaining components in reverse of removal procedures.

CAMSHAFT			
Engine	**Journal Diam. In. (mm)**	**Clearance In. (mm)**	**Lobe Lift In. (mm)**
1967-72			
Journal			
No. 1	1.3736-1.3770 (34.89-34.97)	.001-.0022 (.025-.056)	.....
No. 2 & 3	1.9175-1.9281 (48.96-48.97)	.001-.0022 (.025-.056)	.....

VALVE TIMING				
	INTAKE		**EXHAUST**	
Engine	**Open (BTDC)**	**Close (ABDC)**	**Open (BBDC)**	**Close (ATDC)**
1967-69	11°	47°	48°	15°
1970-73	①14°	20°	23°	11°
	②24.5°	26.5°	8.5°	11°

① – Camshaft with identification Nos. 16 & 17.
② – Camshaft with identification No. 61.

TIMING CHAIN REPLACEMENT

1) Remove rocker cover and disconnect spark plug wires at spark plugs. Remove all four spark plugs to allow engine to turn over freely.

NOTE – Removal of rocker arm brackets is not imperative, but is recommended in order to avoid damage to valves or pistons, if, while turning engine, chain jumps over camshaft sprocket.

2) Grind off pins on a link of old chain and remove link. Using a master link, connect new chain to old chain on driving side of old chain.

NOTE – Install master link facing camshaft side of chain with spring lock closed end facing direction of rotation (see illustration).

3) Slowly turn engine in direction of rotation, feeding new chain in and old chain out uniformly. After chain threading is complete join ends of new chain with master link and make sure spring lock closed end is facing direction of rotation. Check that valve timing is correct. See *Valve Timing*. Reverse removal procedures for remaining components.

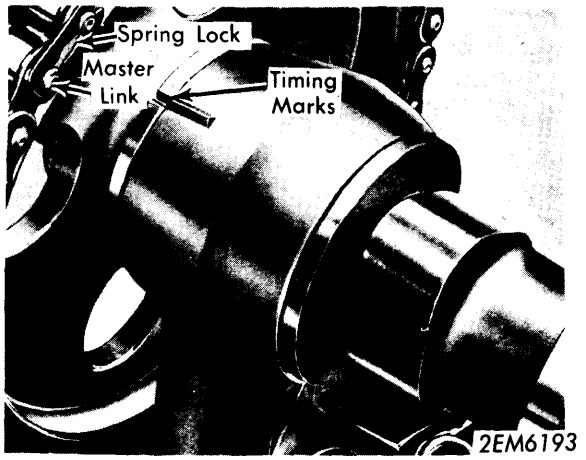
VALVE TIMING

1) Rotate No. 1 piston to TDC of compression stroke. Align camshaft timing mark with mark on No. 1 camshaft bearing support bracket (see illustration). Install camshaft sprocket.

2) If correct valve timing is not achieved when camshaft sprocket is installed, offset Woodruff keys are available to make timing corrections, see following table:

Offset Woodruff Keys

Offset	Crankshaft Correction
.0275" (.7 mm)	4°
.0354" (.9 mm)	6 1/2°
.0433" (1.1 mm)	8°
.0511" (1.3 mm)	10°



CAMSHAFT TIMING MARKS & TIMING CHAIN MASTER LINK

1967-73 MERCEDES-BENZ 220 4 CYLINDER (Cont.)

ENGINE OILING

ENGINE OILING SYSTEM

Engine lubrication is provided by a gear type oil pump, which force feeds oil through an oil filter to oil gallery. From oil gallery, oil flows to main and connecting rod bearings. Pistons, wrist pins and connecting rod bushings are splash lubricated. A vertical oil passage from oil gallery has a transverse passage which supplies oil to intermediate sprocket shaft and bearings. Another oil passage supplies oil to oil pump drive shaft and helical gear. Vertical passage also supplies oil to No. 1 camshaft bearing. An external oil tube attached to No. 1 camshaft bearing support lubricates other camshaft bearings and rocker arms.

Crankcase Capacity – 5.25 qts. (4.97 ltr) with filter.

Oil Filter – Full-flow type. Clean main element and replace by-pass element every 3000 miles (4828 km).

Normal Oil Pressure – 64-78 psi (4.50-5.48 kg/cm²).

Pressure Regulator Valve – Non-adjustable.

OIL PUMP

Removal – Remove oil pan. Remove two attaching screws and lift out pump.

Disassembly – 1) Remove oil strainer. Unscrew lower pump body, and remove pump gears and shafts. Measure clearances between gear-to-body and gear-to-cover (see specifications).

2) If cast-in bushings in housing are worn, replace complete housing. Worn gears are replaced as an assembly. Assemble upper and lower housing without a gasket. Install strainer with a new gasket. Check that pump turns freely.

Installation – 1) Align drive shaft follower with helical gear and follower faces with respect to one another.

2) Insert oil pump with bracket and tighten mounting screws. Install oil pan.

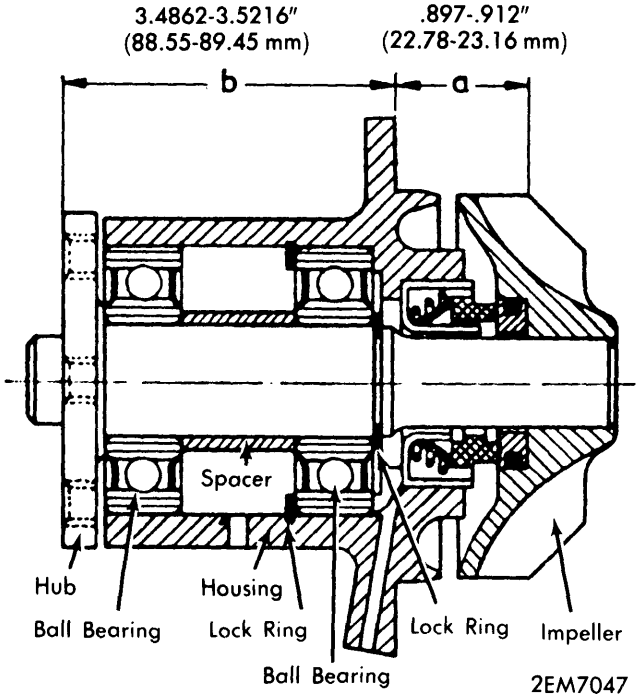
Oil Pump Specifications

Application	Clearance
Gear-to-Body	.0009-.0022" (.023-.056 mm)
Gear-to-Cover	.0018-.0029" (.046-.074 mm)
Back Lash	.0019-.0059" (.048-.150 mm)

ENGINE COOLING

WATER PUMP

Removal – 1) Drain cooling system below level of pump. Loosen hose clamps on top radiator hose. Remove radiator mounting bolts and push radiator forward.



WATER PUMP

2) Remove fan from drive pulley. Loosen nuts and adjusters on generator enough so fan belt may be removed. Unscrew and remove venting line between pump and cylinder head.

3) Water pump is a maintenance free type. When installing pump, check hub-to-flange and impeller-to-flange distance, (see illustration).

Thermostat – Wax Pellet-Type, opens at 195-201°F (90-94°C).

Cooling System Capacity – 11.3 qts. (10.7 ltr) with heater.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Cylinder Head	
M10 Bolts	①41 (5.7)
M12 Bolts	①74 (10.2)
Rocker Arm Mounting Bolts	58 (8.0)
Rocker Arm Bracket Bolts	27 (3.7)
Connecting Rod Bolts	29-36 (4.0-5.0)
Main Bearing Cap Bolts	58 (8.0)
Front Crankshaft Bolt	152 (21.0)
Pulley & Vibration Damper Bolts	25 (3.4)
Oil Pan Bolts (Sheet Metal)	8 (1.1)
Oil Filter Bolt	29 (4.0)

① – With engine cold, first tighten M10 bolts to 22 ft. lbs. (3.0 mkg), M12 bolts to 52 ft. lbs. (7.2 mkg). Then, tighten to torque specified in table. With engine at normal operating temperature, loosen each bolt and retighten to specification.