1967-73 MERCEDES-BENZ 220D/8 DIESEL 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
1967-73 220D/8	133.9	2197	Fuel Inj.	65@4200	96@2400	21-1	3.427	87.0	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.

Model	Code
220D/8	615.912

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 idle control cable and stop-start cable. Remove accelerator linkage.

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.

INTAKE & EXHAUST MANIFOLD REMOVAL

Intake Manifold – Remove air cleaner. Disconnect throttle linkage and bowden cable for idling control on throttle duct. Unscrew vacuum line. Remove attaching nuts and intake manifold from cylinder head.

Exhaust Manifold – Disconnect exhaust pipe from manifold. Remove attaching nuts and lift off exhaust manifold.

CYLINDER HEAD REMOVAL

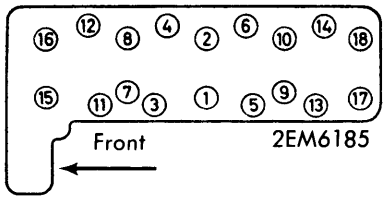
Removal – 1) Drain cooling system. Disconnect all water hoses attached to cylinder head. Remove vent line, air cleaner and rocker cover.

2) Disconnect vacuum line, injection lines and leakage oil line. Loosen fuel filter screws and move filter out of the way. Remove exhaust pipe from manifold.

3) Disconnect cable to glow plugs and heat sensor from water thermometer. Rotate engine until there is no load on rocker arms and remove rocker arm assembly.

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 screws in front of head. Connect ground lead for glow plugs to screw under main fuel filter. Insert Woodruff key in camshaft. Place 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. Run engine until it has reached 176°F and retighten head bolts, recheck tappet clearance. Drive vehicle 180-600 miles and retorque head bolts. Loosen each head bolt slightly, a bolt at a time, when retorquing head bolts.

1967-73 MERCEDES-BENZ 220D/8 DIESEL 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)
220D/8							
Int.	1.5263 (38.77)	30°	30°+	.051-.063 (1.29-1.60)	.3899 (9.90)	.004 (.10)	-----
Exh.	1.3031 (33.10)	30°	30°+	.098-.114 (2.49-2.89)	.3904 (9.92)	.002 (.05)	-----

VALVE ARRANGEMENT

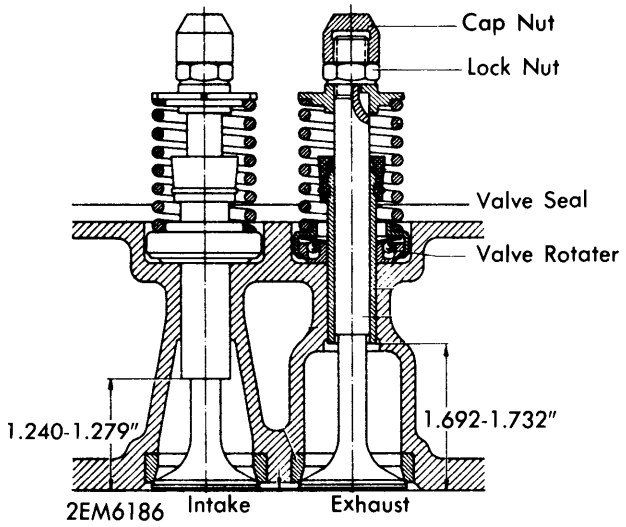
E-I-I-E-E-I-I-E (front to rear).

VALVE GUIDE SERVICING

1) Check valve guide bores to see that they are not less than .3937" or more than .3942". Remove all carbon before measuring guides.

2) Using a suitable drift, drive intake guide out toward top of head and exhaust guide toward combustion chamber.

3) Press in new guides from combustion side until specified distance is achieved (see illustration). Check guide bores and remove any tight spots.



VALVE ASSEMBLY

4) Valve guides are available in standard and one oversize (red). An interference fit of .0004-.0015" is used, if guide does not meet specifications, install oversize guide (red). Intake guides are 2.40" and exhaust guides are 1.95" long.

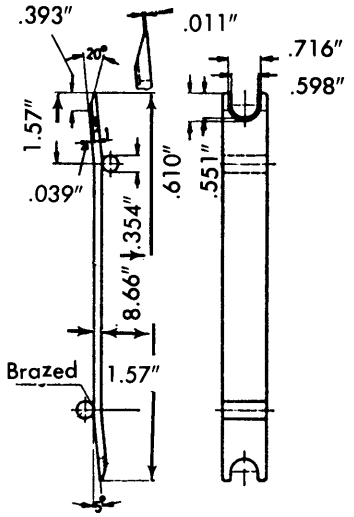
Valve Guide Specifications

Application	Valve Guide O.D. in. (mm)	Cylinder Head I.D. in. (mm)
Std.	.5522-.5527 (14.02-14.04)	.5511-.5518 (14.00-14.01)
Red	.5601-.5605 (14.23-14.24)	.5590-.5597 (14.20-14.21)

VALVE STEM OIL SEALS

1) Using a spring compressor, unscrew cap nut and lock nut from valve stem. Remove valve collar and spring.

2) Prepare a tool for removing oil seal (see illustration). Using oil seal tool, lever oil seal off of guide and stem.



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VALVE STEM OIL SEAL TOOL

3) Place plastic sleeve over threaded end of valve stem. Slide new oil seal in place using oil seal tool. Install spring and spring collar. Screw lock nut and cap nut on end of valve stem.

VALVE SPRINGS

Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
220D/8	1.9881 (50.50)	58.20 @ 1.5118 (26.39 @ 38.40)	116.84 @ 1.1771 (53.00 @ 29.90)

VALVE SPRING REMOVAL

Remove rocker arms. Using a spring compressor, unscrew cap nut and lock nut. Remove valve spring collar and lift out spring. Check spring for wear or fatigue, replace as necessary. To install, reverse removal procedure with close wound coils next to cylinder head.

ROCKER ARM ASSEMBLY

1) Remove air cleaner and tappet cover. Loosen rocker arm bracket bolts, rotate camshaft so there is no load on rocker arms being removed.

2) Slide rocker arm brackets, rocker arms tightening clamp and spacer off of shaft. Inspect all parts for wear. Replace shaft, rocker bushing or rocker bracket if necessary. To install, reverse removal procedures.

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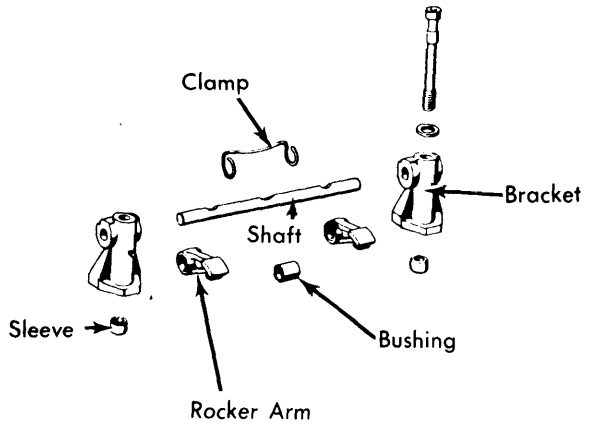
VALVE CLEARANCE ADJUSTMENT

Adjust in firing order sequence. Rotate crankshaft to TDC of compression stroke. On early engines, measure clearance between cap nut and rocker arm. On late engines, measure between heel of cam and rocker arm.

Tappet Clearance

Early Engines	Clearance (Hot) in. (mm)	Clearance (Cold) in. (mm)
Intake	.008 (.20)	① .004 (.10)
Exhaust	.018 (.46)	.016 (.41)
Late Engines		
Intake	① .006 ② (.15)	① .004 ① (.10)
Exhaust	.014 (.35)	.012 (.30)

① – Winter clearance is .006" (.15 mm).
② – Winter clearance is .008" (.20 mm).



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ROCKER ARM ASSEMBLY

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)
220D/8	.00078 ① (.02)	-.0003 to +.00007 (-.01 to +.001)	.0004-.0009 (.01-.02)	No. 1	.021-.027 (.53-.68)	.003-.004 (.08-.10)
				No. 2	.017-.023 (.43-.58)	.0015-.003 (.04-.08)
				No. 3	.011-.017 (.28-.43)	.0015-.003 (.04-.08)
				Oil	.011-.017 (.28-.43)	.0015-.003 (.04-.08)

① – Clearance for three ring piston is .00078-.00118" (.02-.03 mm).

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 circlips. Heat piston to 104-140°F and press out wrist pins.

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 after several tightenings expansion has reached a minimum diameter of .2834". Normal diameter of connecting rod bolts is .3937". Drive out old bolts and drive in new bolts, fitting them to same spline trace.

NOTE – First tightening after new bolts are installed is 50.6 ft. lbs. Subsequent tightenings are 36 ft. lbs.

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

PISTON PIN REPLACEMENT

Remove circlips, heat piston to 104-140°F and press out wrist pin. Check wrist pin for wear. Diameter of wrist pin is .9840-.9842", replace if necessary.

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. There are three compression

1967-73 MERCEDES-BENZ 220D/8 DIESEL 4 CYLINDER (Cont.)

rings and one oil ring. Install compression rings with marking "top" or "F" and oil ring with marking "GOE" or "F" facing upward. Install rings on piston in the following manner:

Piston Ring Location

Double Taper Ring (Molybdenum)	Top Groove
Rectangular Ring (Inside Chamfer Upward)	2nd Groove
Rectangular Ring (Stepped Downward)	3rd Groove
Chamfered Oil Ring with Hose Expander	4th Groove

Piston Diameters

Application	In. (mm)
Std.	3.4228-3.4236 (86.94-86.96)
Intermediate	3.4326-3.4334 (87.19-87.21)
1st OS	3.4425-3.4433 (87.44-87.46)
2nd OS	3.4621-3.4629 (87.94-87.96)
3rd OS	3.4818-3.4826 (88.44-88.46)

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

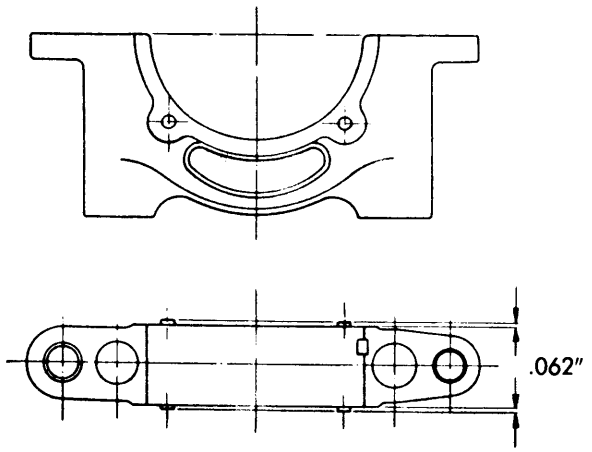
Engine	MAIN BEARINGS				CONNECTING ROD BEARINGS		
	Journal Diam. In. (mm)	Clearance In. (mm)	Thrust Bearing	Crankshaft End Play In. (mm)	Journal Diam. In. (mm)	Clearance In. (mm)	Side Play In. (mm)
220D/8	2.7541-2.7545 (69.95-69.96)	.0017-.0025 (.04-.06)	Center	.0039-.0068 (.10-.17)	2.0454-2.0458 (51.95-51.96)	.0014-.0021 (.03-.05)	.0043-.0102 (.11-.26)

MAIN BEARING SERVICE

Measure main bearing and connecting rod journals for out-of-round and taper. Out-of-round must not exceed .0002-.0004" and taper .0004-.0006". Select proper undersize and grind crankshaft to following diameters.

Crankshaft Journal Diameters

Application	Main in. (mm)	Connecting Rod in. (mm)
Std.	2.7541-2.7545 (69.95-69.96)	2.0454-2.0458 (51.95-51.96)
1st US	2.7442-2.7446 (69.70-69.71)	2.0356-2.0360 (51.70-51.71)
2nd US	2.7344-2.7348 (69.45-69.46)	2.0257-2.0261 (51.44-51.46)
3rd US	2.7246-2.7249 (69.20-69.21)	2.0159-2.0163 (51.20-51.21)
4th US	2.7147-2.7151 (68.95-68.96)	2.0060-2.0064 (50.95-50.96)



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CENTER MAIN BEARING CAP

THRUST BEARING ALIGNMENT

Center main bearing cap has pin located thrust washers to adjust crankshaft endplay. Measure endplay and install thrust washers giving proper endplay. Measure pin protrusion from main bearing cap to see that it does not exceed .062" (see illustration). Standard and oversize thrust washers are available in the following sizes:

Thrust Washers

Application	Thickness In.(mm)
Std	.078 (1.98)
1st OS	.080 (2.03)
2nd OS	.082 (2.08)
3rd OS	.084 (2.13)
4th OS	.086 (2.18)
5th OS	.088 (2.23)
6th OS	.090 (2.29)
7th OS	.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.

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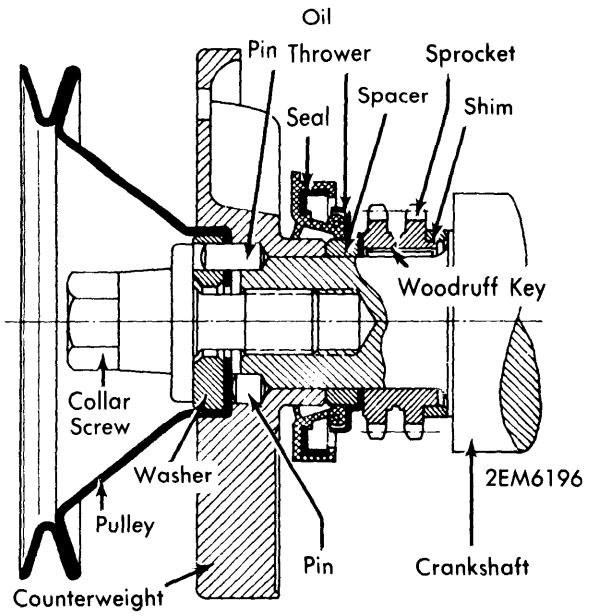


CRANKSHAFT FRONT OIL SEAL

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)**
220D/8			
No. 1	1.3763-1.3769 (34.96-35.04)	.0009-.0025 (.02-.06)	-----
No. 2 & 3	1.8290-1.8297 (46.46-46.47)	.0009-.0025 (.02-.06)	-----

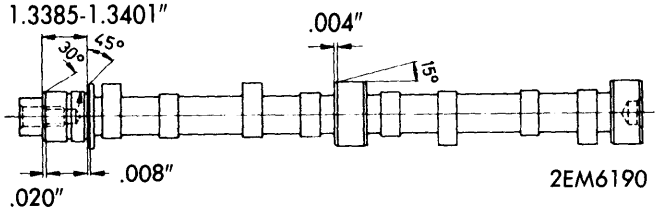
CAMSHAFT REMOVAL

1) Remove camshaft sprocket and rocker arm assembly. Disconnect external camshaft oiling tube.

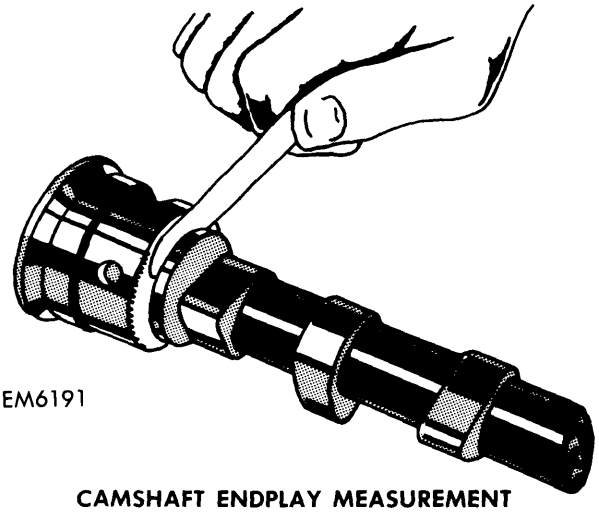
2) Remove camshaft bearing supports. Slide camshaft bearing supports off of camshaft. To install, reverse removal procedures.

CAMSHAFT BEARING REPLACEMENT

1) Inspect camshaft bearing journals for wear. If worn, grind bearing journals and fit undersize bearings.



CAMSHAFT

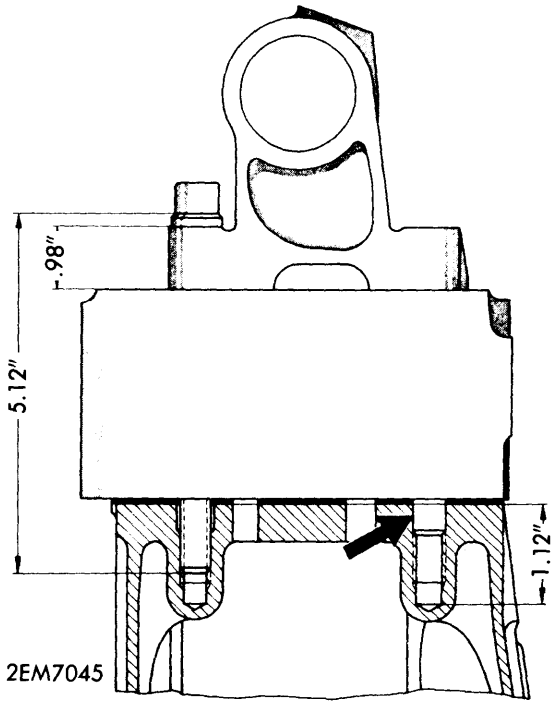


CAMSHAFT ENDPLAY MEASUREMENT

2) Bearing on No. 1 journal controls camshaft endplay, width of journal is 1.3385-1.3401". Place bearing on camshaft and install retaining ring. Using a feeler gauge, measure clearance between camshaft flange and bearing (see illustration). Lap bearing to proper fit. The following table lists camshaft bearing journal diameters for standard and undersize bearings:

Camshaft Journal Diameters

Application	Journal No. 1 in. (mm)	Journal No. 2 & 3 in. (mm)
Std	1.3763-1.3769 (34.96-34.97)	1.8290-1.8297 (46.46-46.47)
Intermediate (Grey)	1.3723-1.3730 (34.86-34.87)	1.8251-1.8257 (46.36-46.37)
1st US (Red)	1.3664-1.3671 (34.70-34.72)	1.8192-1.8198 (46.21-46.22)



OLD CAMSHAFT BEARING SUPPORT & NEW CRANKCASE

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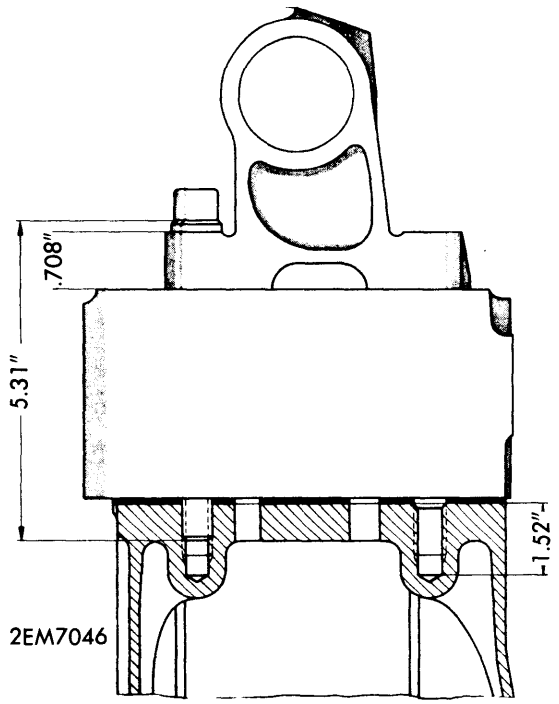


NEW CAMSHAFT BEARING SUPPORT & OLD CRANKCASE

NOTE — Starting in December 1971 there are two types of camshaft bearing supports. If old camshaft bearing supports and new crankcase are used, all new head bolts must be installed. They are six 12x145 mm, four 12x105 mm and eight 12x120 mm. If new camshaft bearing supports and old crankcase are used, six 12x120 mm camshaft bearing support bolts are needed.

VALVE TIMING				
	INTAKE		EXHAUST	
Engine	Open (BTDC)	Close (ABDC)	Open (BBDC)	Close (ATDC)
220D/8 ①	12.5°	41.5°	45°	9°

① — Valve clearance of .016" (.41 mm).

TIMING CHAIN REPLACEMENT

1) Remove rocker cover and glow plugs so that engine turns easily. Remove chain tensioner and rocker arm brackets.

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.

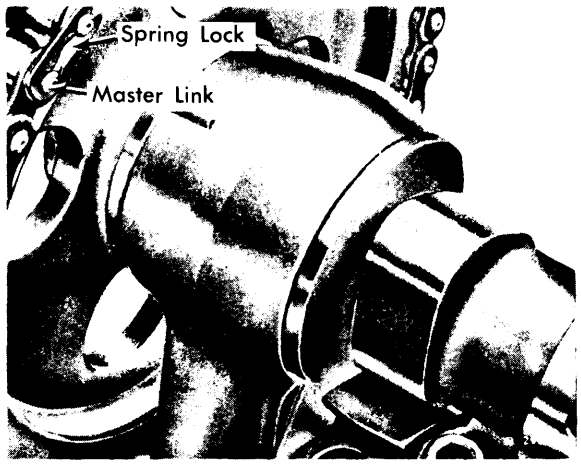
VALVE TIMING

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°



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CAMSHAFT TIMING MARKS & TIMING CHAIN MASTER LINK

1967-73 MERCEDES-BENZ 220D/8 DIESEL 4 CYLINDER (Cont.)

ENGINE OILING

Crankcase Capacity – 5.25 qts. with filter.

Oil Filter – Full-flow, clean main element 3,000 miles. Replace by-pass element 3,000 miles.

Normal Oil Pressure – 64-78 psi (4.5-5.5 kg/cm²).

Pressure Regulator Valve – Non-adjustable.

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.

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.

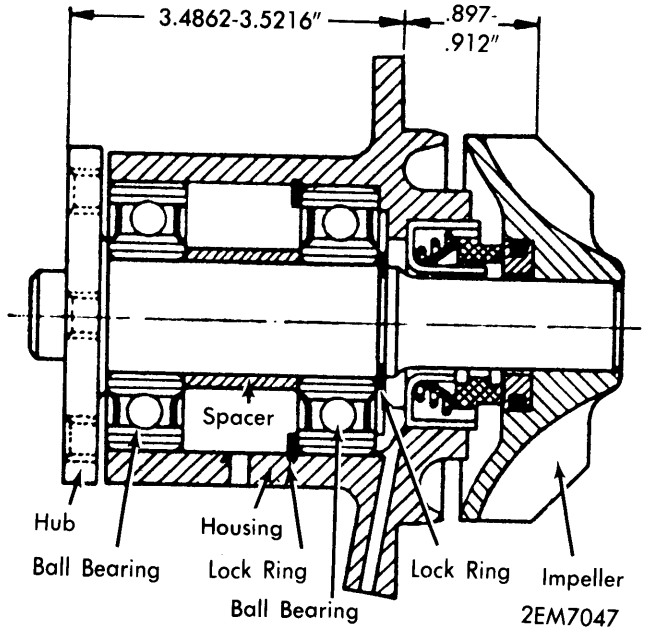
Oil Pump Specifications

Application	In. (mm)
Gear-to-Body	.0009-.0022 (.02-.05)
Gear-to-Cover	.0018-.0029 (.04-.07)
Backlash	.0019-.0059 (.05-.15)

ENGINE COOLING

Thermostat – Wax pellet type, opens at 195-201°F (90.5-93.8°C).

Cooling System Capacity – 11.3 qts. with heater.



WATER PUMP

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.

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).

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Cylinder Head	① 65 (9.0)
Rocker Arm Brackets	27 (3.7)
Glow Plugs	36 (5.0)
Connecting Rods	27 (3.7)
Main Bearings	65 (9.0)
Crankshaft Nut (Front)	130 (18.0)
Oil Pan (Sheet Metal)	6 (.8)
Oil Filter	25 (3.4)

① – Tighten in four stages; 29 (4.0), 43 (6.0), 65 (9.0) and retighten after running to 65 ft. lbs. (9.0 mkg).