TYPE 2 & 4 (1700 CC & 1800 CC) 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
1974										
EA	102.5	1700	①	80@4900	99@3500	8.2-1	3.543	90	2.600	66
AW	109.5	1800	2x1-Bbl.	65@4200	92@3000	7.3-1	3.660	93	2.600	66
EC	109.5	1800	①	72@4900	95@2700	.....	3.660	93	2.600	66
ED	109.5	1800	①	70@4800	70@2400	.....	3.660	93	2.600	66

① — W/Electronic Fuel Injection.

ENGINE IDENTIFICATION

Engine serial and code number is stamped on crankcase below breather and near ignition coil. First two digits indicate engine type.

Application	Code
Type 2	ED, AW
Type 4	EA, EC

ENGINE REMOVAL

Type 2 (Transporter/Bus) — 1) Disconnect battery and remove air cleaner. Disconnect wiring from distributor, alternator regulator, oil pressure switch, carburetors, transmission switch, trigger for ignition timing, and temperature sensor mounted in upper right hand side of engine compartment.

2) Disconnect wire for backup lights at in-line fuse holder, near ignition coil, and remove ignition coil. Disconnect hose from activated charcoal filter canister. Disconnect wires and two hoses from vacuum advance cutoff valve near warm air fan.

3) Remove duct hoses connecting warm air fan with heat exchangers. Remove hose and end piece from top of left carburetor. Remove rear and side engine cover plates, and gravel guard from under rear bumper.

4) On vehicles with automatic transmission, remove ATF dipstick, loosen clamp nuts holding filler pipe and remove ATF filler pipe by turning counterclockwise. Disconnect vacuum line from intake manifold balance tube.

5) Disconnect accelerator cable from throttle operating crossrod. On vehicles with automatic transmission, remove three bolts attaching torque converter to drive plate by turning engine to make bolts accessible through opening in converter housing.

6) Remove two upper engine-to-transmission bolts. Pull accelerator cable out of guide tube and disconnect fuel line from fuel pump. *CAUTION — Plug fuel line to prevent fuel spillage.*

7) Disconnect wires from starter solenoid and disconnect heater flap cables from heat exchangers. Pull off ducts connecting heat exchangers with vehicle interior. Install a suitable bar under transmission to support transmission (VW 785).

8) Remove two lower engine-to-transmission bolts. Place floor jack under engine and support engine. Remove bolts attaching engine bearer brackets to frame. Move engine to rear to clear transmission drive shaft and carefully lower to floor.

NOTE — On vehicles with automatic transmission install retaining strap across converter housing to prevent torque converter from falling off support tube.

9) To install engine, reverse removal procedure. Lubricate clutch release bearing, transmission drive shaft and starter drive bushing. Tighten engine-to-transmission bolts before tightening engine bearer bracket bolts. Engine bearer bracket must be vertical and parallel to engine fan housing.

Type 4/412 — 1) Disconnect ground cable from battery, located under driver's seat. Remove air cleaner with hoses. Withdraw dipstick and remove rubber boot from between body and dipstick tube.

2) Pull cooling air bellows from body. Disconnect all electrical connections from fuel injection and position wiring harness out of way.

3) Remove coil with bracket and disconnect electrical connections at alternator and oil pressure switch. Disconnect accelerator cable and choke cable from air intake distributor.

4) Remove three bolts securing transmission converter to drive plate. Bolts are accessible through hole in cylinder block (right side). Remove ATF dipstick and rubber boot.

5) Remove two upper engine mounting nuts. Raise vehicle and remove muffler shield and heat exchanger. Disconnect battery cable at starter solenoid.

6) Disconnect and plug fuel lines. Remove heater booster pipe. Pull accelerator cable, vacuum hose and heater air blower cable forward.

7) Remove two lower engine mounting nuts. Lift engine slightly, using a floor jack and a suitable adapter (VW 612/4). Remove four bolts from engine carrier.

8) Remove engine by lowering jack and pulling engine out from under vehicle. Install a retaining bar to retain converter in transaxle.

9) To install engine, reverse removal procedure. Bolt engine carrier in position with bolts in top of elongated holes.

INTAKE MANIFOLD

Type 2 Dual Carburetor — 1) Intake pipes connecting carburetors to cylinder heads can be removed with engine in vehicle. Disconnect fuel lines and electrical connections on carburetors. Remove vacuum line on left carburetor. Disconnect return springs and throttle linkage connecting rods.

2) Remove intake manifold cover plates. Remove nuts and washers securing intake pipes to cylinder heads and remove intake pipes with carburetors.

TYPE 2 & 4 (1700 CC & 1800 CC) 4 CYLINDER (Cont.)

3) To install, reverse removal procedure. Use new gaskets and tighten intake pipe securing nuts uniformly. Adjust throttle cable so that there is .04" clearance between throttle valve lever and stop on carburetor body when accelerator pedal is at full open position.

All Fuel Injection – 1) Fuel injection manifold can be removed with engine in vehicle. Remove air cleaner, hoses, and pressure switch.

2) Disconnect wires on fuel injectors and remove two screws. Pull injectors off with plate and retainer. Make sure locating bushings are removed from manifold. Disconnect hoses on injectors and remove.

3) Remove intake manifold cover plate. Remove nuts and washers securing manifold to cylinder heads. Lift up on manifold and pull from tubes on air distributor.

4) To install, reverse removal procedure. Use new gaskets and tighten intake manifold securing nuts uniformly. Make sure gray protective cap on injector is to rear and black cap is to front.

CYLINDER HEAD

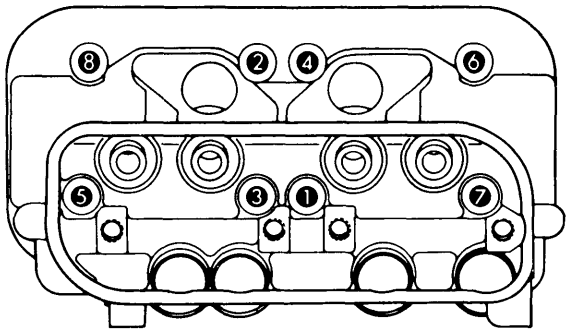
NOTE – Engine must be removed from vehicle and manifolds removed, before removing cylinder heads. If cylinders are not to be removed, use retaining device to keep cylinders from pulling free.

Removal – 1) Remove rocker arm cover and gasket. Remove rocker arm shaft retaining nuts, loosening gradually one at a time to relieve spring tension evenly. Remove rocker arm assemblies.

2) Remove push rods, keeping in order for reassembly. Loosen cylinder head nuts gradually working in sequence from outside toward center.

Installation – 1) Install new seals on pushrod tubes. Install cylinder head with new gaskets on cylinder head studs and position pushrod tubes with seams facing upward. Push head onto cylinders to hold pushrod tubes.

2) Install cylinder head washers and nuts to studs and tighten just enough to hold head and pushrod tubes in place. Uniformly tighten nuts to approximately 11 ft. lb. in sequence, then tighten in sequence again to 23 ft. lb. Reverse removal procedure for remaining components.



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CYLINDER HEAD TIGHTENING SEQUENCE

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)
1700 cc							
Int.	1.546 (39.27)	29.5°	30°	.071-.087 (1.80-2.21)	.3125-.3129 (7.94-7.95)	.018 (.046)	.....
Exh.	1.299 (33.00)	45°	45°	.079-.098 (2.01-2.49)	.3508-.3512 (8.91-8.92)	.018 (.046)	.....
1800 cc							
Int.	1.614 (41.00)	29.5	30°	.071-.087 (1.80-2.21)	.3125-.3129 (7.94-7.95)	.018 (.046)	.....
Exh.	1.338 (34.00)	45°	45°	.079-.098 (2.01-2.49)	.3508-.3512 (8.91-8.92)	.018 (.046)	.....

VALVE ARRANGEMENT

E-I-I-E

VALVE GUIDE SERVICING

1) Place valve in valve guide with stem flush with end of guide. With dial indicator, measure valve rock at valve head. If rock exceeds .035" replace valve guide or valve. Valve guide with inside machined shoulder is exhaust.

2) To replace valve guide, drill guide with shouldered drill to depth of 1½-2" using slow speed drill. Drive guides down through cylinder head with suitable tool. Drive oversize guide from top of cylinder head using press. Pressure required should be 2000-4000 lbs. Ream guides to proper fit.

VALVE SPRINGS

Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
All Int. & Exh.	.....	168-186@1.14 (76.20-84.37@28.96)	.....

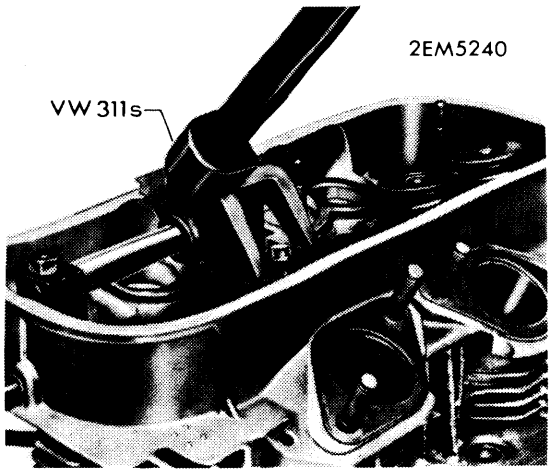
VALVE SPRINGS

NOTE – Valve spring may be removed with cylinder head installed. Apply constant air pressure (minimum 85 psi) to

TYPE 2 & 4 (1700 CC & 1800 CC) 4 CYLINDER (Cont.)

cylinder through spark plug hole to hold valve in place while compressing spring.

Removal – Remove cylinder head cover and rocker arm shaft. Install suitable valve spring compressor tool (VW311s with cylinder head removed, VW653/2 with cylinder head installed). Compress spring retainer and spring and remove valve keepers. Release compressor and remove spring retainer and spring.

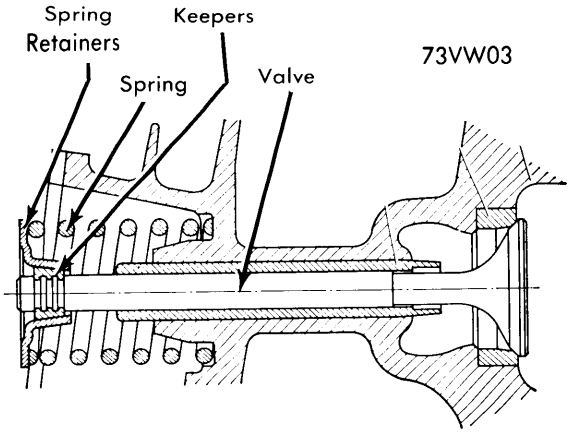


VALVE SPRING REMOVAL

Installation – Install valve, valve spring, and valve spring retainer. *NOTE – Install spring with closely spaced coils against cylinder head.* Compress spring with suitable compressor and install valve keepers.

ROCKER ARM ASSEMBLY

1) With rocker arm assembly, push rod tubes and valve tappets removed, check valve tappet face and sides for wear or scoring. If diameter of tappet is less than .9421", replace tappet.



VALVE ASSEMBLY

2) Check rocker arms and shafts for wear. If inside diameter is more than .7890", replace rocker arm. If diameter of shaft is less than .7846", replace rocker shaft.

3) To install components, lubricate tappet with oil and insert in crankcase. Install push rod tubes with new seals. Slide shaft support stands on rocker shafts so slots face down when installed on engine.

NOTE – A new type rocker shaft spring is available (ends not ground). When using new type spring, thrust washers must be removed.

4) Install rocker arm assemblies and tighten nuts to specifications. Install push rod tube securing clip. Clip is secured to head by sliding into slots in rocker arm shaft support stands. Adjust valve clearance. See *Valve Clearance Adjustment*.

VALVE CLEARANCE ADJUSTMENT

Valve clearance is checked or adjusted with engine cold. Rotate engine until piston of valve being adjusted is at TDC of compression stroke. Both valves can be adjusted at same time. Adjust both intake and exhaust valves to .006".

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)
All	.0016.0023 (.041-.058)	①	.0004-.0012 (.010-.030)	1	.014-.021 (.356-.533)	.0023-.0035 (.058-.089)
				2	.012-.014 (.305-.356)	.0016-.0028 (.041-.071)
				3	.010-.016 (.254-.406)	.0008-.0019 (.020-.048)

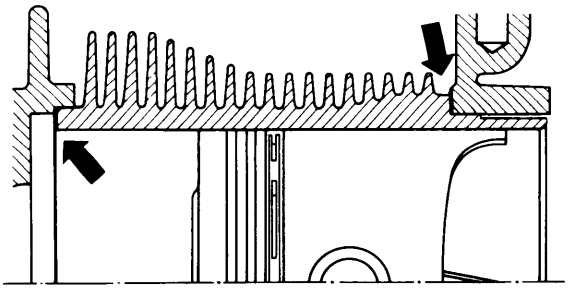
① – Push fit with light thumb pressure.

CYLINDERS

Removal – Remove engine and remove cylinder head. *NOTE – Mark cylinders to insure they are reinstalled in original position.* Remove deflector plates from bottom of cylinders and pull cylinders from pistons.

Installation – 1) Check seating surfaces of cylinders on both ends. Make sure seating areas are perfectly clean and true before installing cylinders. Stagger ring gaps 90° apart so that oil ring gap faces upward when cylinder is installed.

TYPE 2 & 4 (1700 CC & 1800 CC) 4 CYLINDER (Cont.)



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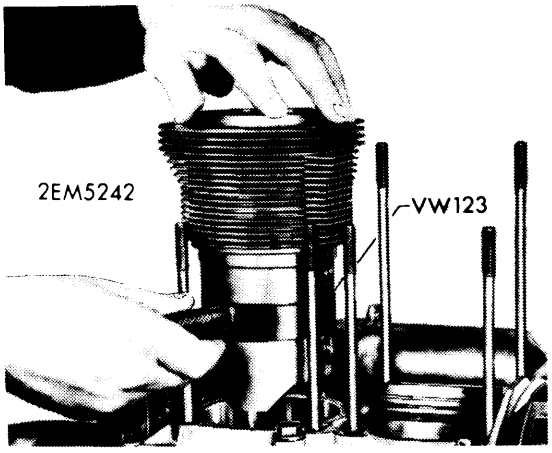
CYLINDER SEALS

2) Apply oil to cylinder, piston, rings and piston pin. Compress rings with suitable ring compressor (VW123). Install new sealing gasket on crankcase side and slide cylinder over piston.

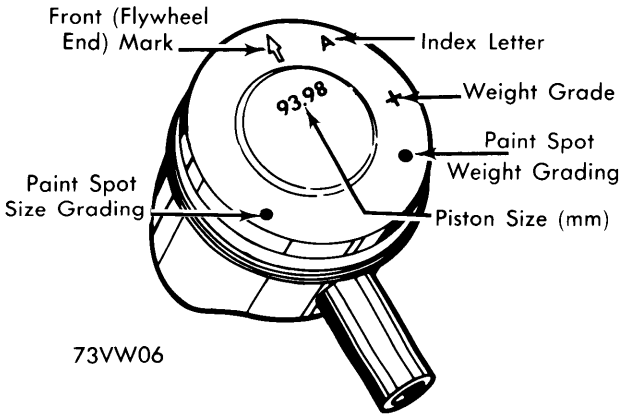


CYLINDER INSTALLATION

3) Make sure studs do not contact cooling fins when cylinder is completely seated against crankcase. Install cylinder deflector plates and remaining components in reverse of removal.

FITTING PISTONS

1) With piston and cylinder removed, measure clearance between piston and cylinder. Check piston size at bottom of skirt and 90° to piston pin. Check cylinder size at several points throughout cylinder, using largest reading to determine clearance.



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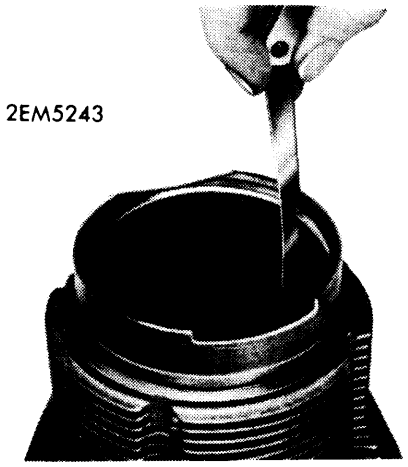
PISTON MARKINGS

2) If clearance exceeds .008" replace piston and cylinder as a set. New piston must be of same weight grade as original or within 10 g of original piston weight. Piston size, weight, and installation position are marked on top of piston.

Standard Size & Code	Cylinders	Pistons
3.54"		
Blue	3.5429-3.5433"	3.5413"
Pink	3.5433-3.5437"	3.5417"
Green	3.5437-3.5441"	3.5421"
3.56"		
Blue	3.5626-3.5630"	3.5610"
Pink	3.5630-3.5633"	3.5614"
Green	3.5634-3.5638"	3.5618"
3.58"		
Blue	3.5823-3.5826"	3.5807"
Pink	3.5827-3.5830"	3.5811"
Green	3.5831-3.5835"	3.5815"

NOTE — Piston alone may be replaced with one of matching size. Only pistons of same size and weight grade should be installed in same engine.

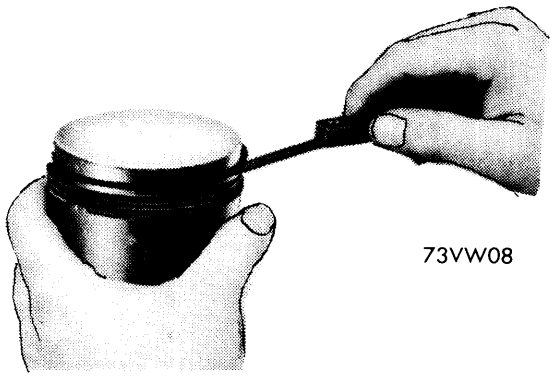
3) New piston rings are size graded to match piston-cylinder sets. Measure ring gap with ring installed approximately ¼" from bottom of cylinder.



MEASURING RING GAP

4) Install rings on piston and measure ring side clearance using feeler gauge. If clearance exceeds .005" on top ring or .004" on second or oil ring, piston must be replaced.

TYPE 2 & 4 (1700 CC & 1800 CC) 4 CYLINDER (Cont.)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MEASURING RING CLEARANCE

PISTON PINS

Removal – Remove cylinders and mark pistons before removing for proper installation. Using suitable pliers (VW122b), remove piston pin circlips and push piston pin out of piston.

Installation – 1) Check fit of pin in piston. Piston pin should be light push fit with piston at 68-167°F. If pin is too loose, both pin and piston must be replaced. Check clearance of pin in rod. If clearance exceeds .0016" replace piston pin and rod bushing. See *Piston Pin Bushing Replacement.*

2) Install one circlip in piston on side facing flywheel. Position piston on connecting rod and push piston pin through piston. Replace remaining circlip. *NOTE – Piston may be heated to ease pin installation.* Replace remaining components in reverse of removal.

PISTON PIN BUSHING REPLACEMENT

1) At normal temperature, piston pin should push fit in connecting rod. If side clearance is felt with a new pin installed, bushing must be replaced and reamed to correct fit with a new piston pin.

2) Press bushing out using a suitable mandrel and components (VW402, 409, 421 and 416B). Install new bushing using same procedure and tools as used for removal.

3) Drill through oil holes in connecting rod. Ream bushing to .9455-.9458" with a reamer. Bushing should be free of chatter marks when reaming is completed. Piston pin should push fit into bushing without oil.

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)
All							
No. 1	2.3609-2.3617 (59.97-59.99)	.0016-.0039 (.041-.099)	No. 1	.0027-.0050 (.069-.127)	2.1644-2.1653 (54.98-55.00)	.0008-.0027 (.020-.069)	.004-.016 (.102-.406)
2	2.3609-2.3617 (59.97-59.99)	.0012-.0035 (.030-.089)					
3	2.3609-2.3617 (59.97-59.99)	.0016-.0039 (.041-.099)					
4	1.5739-1.5758 (39.98-40.00)	.0020-.0039 (.051-.099)					

CRANKCASE

Crankcase must be taken apart to replace connecting rods, connecting rod bearings and main bearings. It is also necessary to disassemble crankcase to remove crankshaft, camshaft, and camshaft bearings.

Disassembly – 1) Remove engine from vehicle and remove cylinder heads, cylinders, and pistons. Remove flywheel or drive plate, and crankshaft pulley. Remove distributor, distributor drive shaft and fuel pump.

2) Remove oil cooler, oil filter and bracket, and oil pump assembly. See *Oil Pump Removal.* Remove rear engine carrier crossmember, bonded rubber mountings, and fan hub. Remove oil pan and oil filler pipe mounting bracket bolt.

3) Remove six 10 mm nuts and five 8 mm bolts and nuts. Using spring clips, clamp tappets in right hand crankcase half and lift off right hand crankcase half. *CAUTION – Never use sharp tool to pry crankcase halves apart. Smallest scratches will cause oil leak. Use rubber hammer to loosen crankcase halves.*

Assembly – 1) Thoroughly clean and inspect both crankcase halves. Remove old sealing compound from mating surfaces and from all bolts, studs and washers. Blow out oil passages with compressed air. Check studs for tightness and check oil suction pipe for tightness.

2) Install crankshaft with connecting rods, in left side crankcase half, making sure dowel pins are properly seated in bearings. Install camshaft. See *Camshaft Installation.* Install camshaft plug using liquid sealer all around plug. Spread liquid sealer over mating surfaces of crankcase halves.

3) Using spring clips, clamp tappets in right hand half of crankcase and join crankcase halves. Coat main bearing bolt heads (10 mm) with sealer and install in crankcase. *NOTE – Install plastic dampers (part No. 021 101 107) on shank of main bearing bolts whether or not originally equipped.*

4) Coat the sealing nuts for main bearing bolts with sealer and install nuts with sealing rings outward. Tighten main bearing nuts and bolts and hand turn crankshaft to check for free movement. Coat bolt heads and nuts of 8 mm bolts with sealer, then install and tighten.

TYPE 2 & 4 (1700 CC & 1800 CC) 4 CYLINDER (Cont.)

5) Check crankshaft end play. *See Thrust Bearing Alignment.* Install new crankshaft oil seals. *See Front Crankshaft Oil Seal Replacement and Rear Crankshaft Oil Seal Replacement.* Install remaining components in reverse of removal procedure.

MAIN & CONNECTING ROD BEARING SERVICE

1) With crankshaft and connecting rod assembly removed, remove snap ring securing distributor drive gear and crankshaft gear to crankshaft. Remove distributor drive gear and crankshaft gear by pressing or using a suitable mandrel (VW457). Remove number three bearing. Remove connecting rods.

2) Thoroughly clean and inspect crankshaft. Blow out oil passages with compressed air. Check runout of crankshaft, if runout is more than .0008", regrind crankshaft to next undersize.

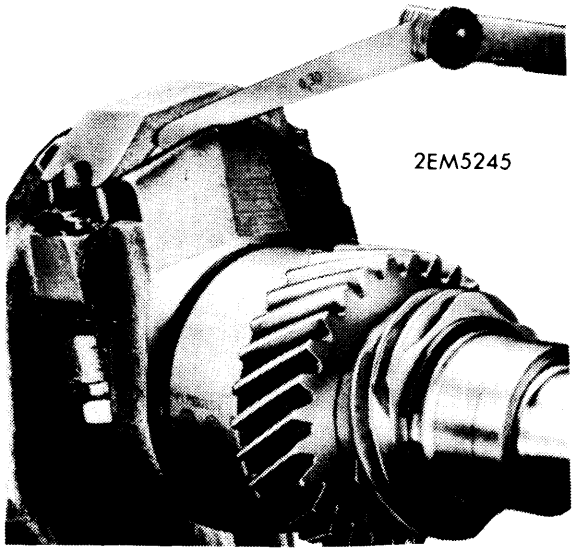
3) Check crankshaft journals for wear, if journals are worn more than .0012", regrind crankshaft to next undersize. Main and connecting rod bearings are available in .010", .020" and .030" undersize.

4) Lubricate and install number three bearing. Heat crankshaft to approximately 176°F in an oil bath and install crankshaft and distributor drive gears using suitable drivers (VW427, VW428 and VW415a). Install snap ring.

5) Throughly clean and inspect connecting rods for damage. Replace connecting rod if studs are damaged. Using plastigage method, check connecting rod bearing clearance. If clearance exceeds .006" replace bearings. Check piston pin fit in connecting rod, if fit is too loose, replace pin bushing. *See Piston Pin Installation.*

6) Install bearing halves in connecting rod and cap. Install on crankshaft with numbers on rod and cap on same side. Forged mark on connecting rod must face up when crankshaft is installed. Install and tighten rod cap nuts.

7) Check connecting rod side play with feeler gauge. If side play exceeds .026", replace connecting rod. Install crankshaft and connecting rod assembly as previously outlined. Check crankshaft end play. *See Thrust Bearing Alignment.*



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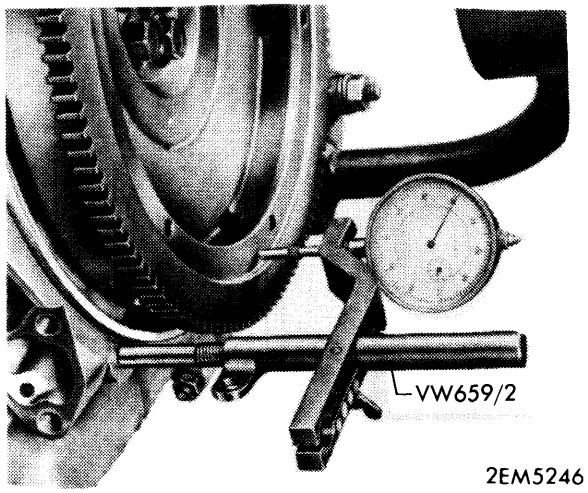
CONNECTING ROD SIDE CLEARANCE

THRUST BEARING ALIGNMENT

NOTE — Crankshaft end play is checked with engine assembled.

1) Install flywheel with two shims, but do not install crankshaft oil seal. Attach dial indicator to crankcase and measure back and forth movement of crankshaft.

2) Calculate necessary thickness of third shim. Install third shim and recheck end play. Thickness of shim is etched on face of shim, always use three shims to obtain correct end play.



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CRANKSHAFT END PLAY

Thrust Bearing Shims

MM Markings On Shim	Inch Equivalent
.24 mm	.0094"
.30 mm	.0118"
.32 mm	.0126"
.34 mm	.0134"
.36 mm	.0142"
.38 mm	.0150"

3) With correct shim thickness determined, install crankshaft oil seal. *See Front Crankshaft Oil Seal.* Install flywheel, tighten bolts as required, and recheck crankshaft end play.

FRONT CRANKSHAFT OIL SEAL

1) Remove flywheel and pry out crankshaft oil seal. Make sure seal seat in crankcase is clean. If necessary, chamfer edges of seal seat.

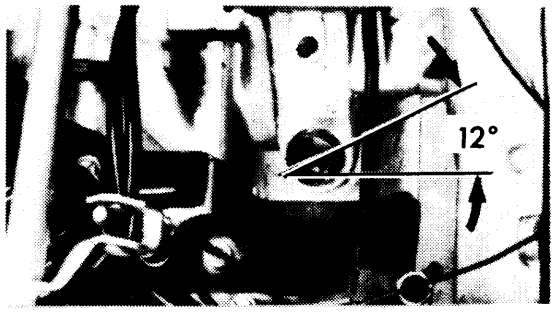
2) Press seal into crankcase, using a suitable seal installer (VW191). Make sure seal is seated in bottom of crankcase. Lubricate sealing edge of seal, install flywheel, and tighten bolts.

TYPE 2 & 4 (1700 CC & 1800 CC) 4 CYLINDER (Cont.)

REAR CRANKSHAFT OIL SEAL

1) Remove cooling blower impeller from rear of engine. Remove impeller hub, using a suitable puller (VW185).

2) Pry out old seal and thoroughly clean seal seat in crankcase. Chamfer edges of seal seat, if necessary. Press new seal into crankcase, using a suitable seal installer (VW190). Make sure seal is seated in bottom of crankcase. Lubricate sealing edge of seal and install cooling blower impeller.



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DISTRIBUTOR DRIVE INSTALLATION

DISTRIBUTOR DRIVE INSTALLATION

When crankcase has been assembled, and remaining components installed, distributor drive must be installed in correct position. Rotate crankshaft until number one piston is at TDC of compression stroke. Install distributor drive with slot at a 12° angle to center line of engine with small segment of slot toward outside of vehicle (see illustration).

CAMSHAFT			
Engine	**Journal Diam. In. (mm)**	**Clearance In. (mm)**	**Lobe Lift In. (mm)**
All	.9839-.9843 (24.99-25.00)	.0008-.0020 (.020-.051)	.....

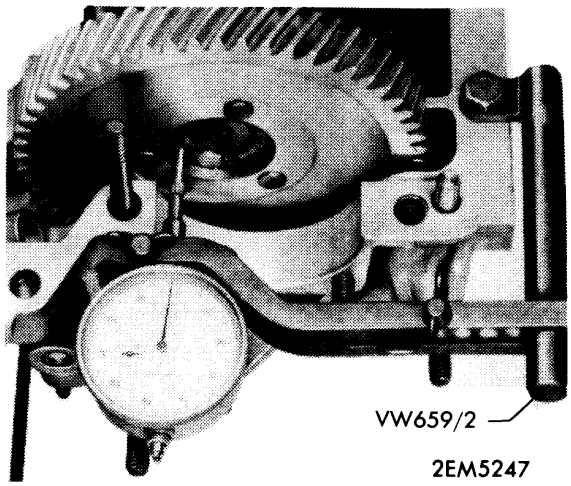
CAMSHAFT INSTALLATION

1) With camshaft removed, check riveting of camshaft gear to camshaft. Check camshaft for runout, if runout exceeds .0016", replace camshaft.

2) Check gear backlash with camshaft and crankshaft installed in crankcase half. Correct backlash is .002". Gears have correct fit when crankshaft is rotated backwards and camshaft does not try to rise out of bearings.

3) If camshaft rises out of bearings, teeth on camshaft gear have the wrong pitch radius for crankshaft gear. Camshafts with gears that have various pitch radiuses are available. Pitch radius is stamped on back of gear facing number three bearing journal of camshaft.

4) Install camshaft with "O" stamped in tooth on outside of camshaft gear between two teeth with punch marks on crankshaft gear. Assemble crankcase halves as previously outlined.



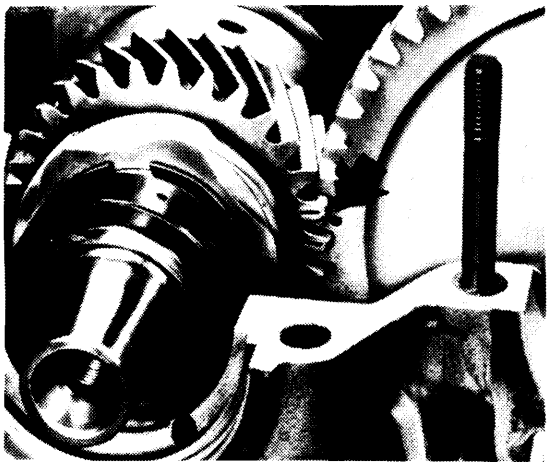
CAMSHAFT END PLAY

CAMSHAFT END PLAY

Camshaft end play is checked with camshaft installed in crankcase half. Measure back and forth movement of camshaft with a dial indicator. If endplay exceeds .0063", replace camshaft or camshaft bearings.

VALVE TIMING

Install camshaft with "O" stamped in tooth on outside of camshaft gear between two teeth with punch marks on crankshaft gear.



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CAMSHAFT TIMING GEAR POSITIONING

TYPE 2 & 4 (1700 CC & 1800 CC) 4 CYLINDER (Cont.)

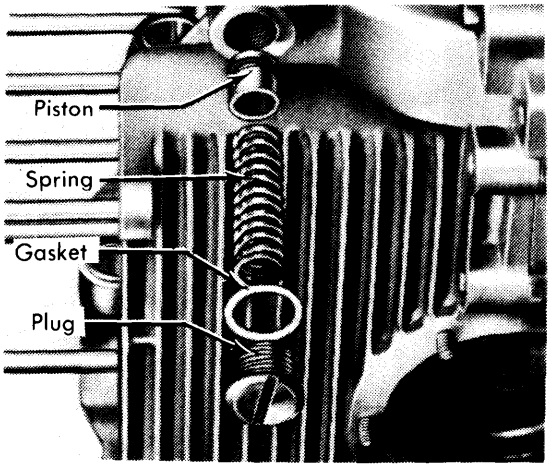
ENGINE OILING

Oil Capacity – 3.15 qts. Add .5 qt. with filter change.

Oil Pressure – 42 psi at 2500 RPM with engine at 158°F.

Oil Filter – Full flow oil filter.

Pressure Regulator Valves – Oil pressure relief valve, used to protect oil cooler from excessive pressure, is located in crankcase under oil filter. Oil pressure control valve, used to control oil pressure to bearings, is located in crankcase below oil breather. Oil pressure relief spring should have length of 1.563" at 15-19.5 lbs. load. Oil pressure control spring should have length of 1.062" at 3.8-4.4 lbs. load.

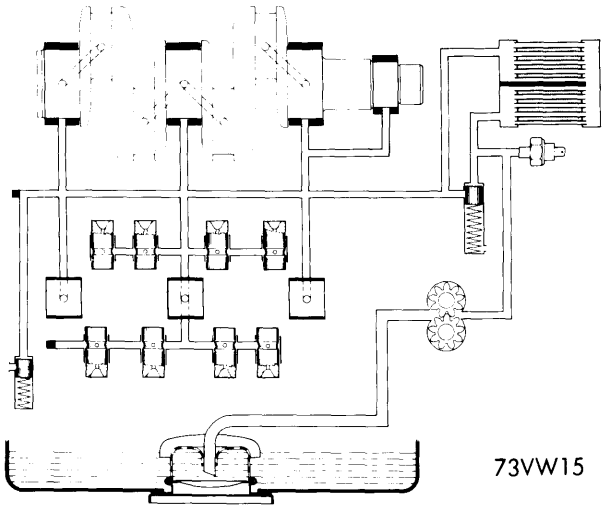


73VW14

RELIEF VALVE COMPONENTS

ENGINE OILING SYSTEM

Full pressure lubrication system utlizing a gear type oil pump installed in rear of engine and driven by the camshaft. Oil is pumped through oil filter, oil cooler and into main oil passages in crankcase. Crankshaft main and connecting rod journals are oiled through crossdrilled oil passages in crankcase. Oil is pumped to camshaft through oil passages that also lubricate valve tappets. Oil flows through push rods to lubricate rocker arms and shafts. Valve stems are lubricated by splash oil from rocker arms. Excess oil flows back into crankcase through push rod tubes. Cylinder walls and piston pins are lubricated by splash oil.



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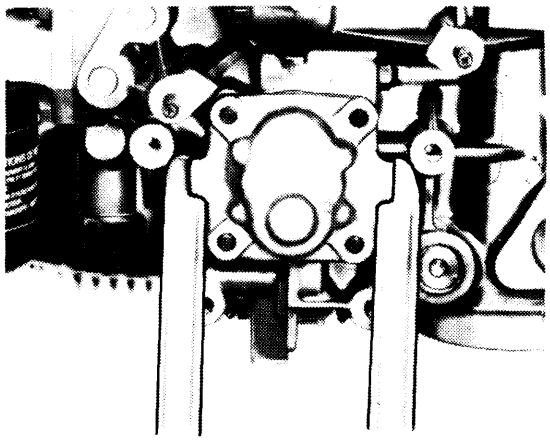
ENGINE LUBRICATION SYSTEM

OIL COOLER

To remove oil cooler, remove cooling air fan housing, three 6 mm nuts with washers attaching oil cooler to rear of crankcase, and bolts attaching oil cooler support strap. Remove support strap and oil cooler as unit. Always use new rubber seals when installing oil cooler.

OIL PUMP

1) Cooling shrouds, blower impeller and related components must be removed from rear of engine to remove oil pump. See *Engine Cooling*. Remove nuts securing oil pump to crankcase and pry pump out of crankcase, prying equally on both sides.



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OIL PUMP REMOVAL

2) With pump removed, remove four nuts from pump cover and remove cover with a suitable puller (VW803). Pull out drive gear and driven gear. Thoroughly clean and inspect all components for signs of wear or damage and replace as necessary.

3) To assemble, lubricate drive gear and driven gear and insert in oil pump housing. Install oil pump cover with new sealing ring lubricated and installed in housing. Tighten nuts and check rotation of gears.

4) To install oil pump, insert a new seal in crankcase. Position drive gear shaft so drive portion of shaft is aligned with slot in camshaft and install oil pump in crankcase. Rotate crankshaft two revolutions to center oil pump and tighten nuts.

TYPE 2 & 4 (1700 CC & 1800 CC) 4 CYLINDER (Cont.)

ENGINE COOLING

Thermostat – Opens at 149-158°F.

Cooling Volume – 1699 CFM @ 4600 RPM.

COOLING SYSTEM

Engine is cooled by a radial blower mounted to rear end of crankshaft. Blower draws air through opening in blower shroud at rear of engine. Blower shroud is two-piece unit, mounted around blower and attached to crankcase. As air is drawn in, it is directed over finned cylinders and cylinder heads by deflector plates. A thermostat is mounted under No. 1 and No. 2 cylinders and actuates flaps mounted in shroud to control volume of air directed in deflector plates. As engine warms up, thermostat opens flaps completely to allow total flow of air.

BLOWER SHROUD REMOVAL

1) Remove engine as previously outlined. Remove air injection pump, belt, and adjusting bracket. Remove extension shaft with pulley, ignition timing scale, fan with crankshaft pulley and alternator belt.

2) Disconnect cooling air control cable from control flap shaft. Pull rubber elbow for alternator out of front half of blower shroud. Remove four nuts attaching blower shroud to crankcase and pull assembly to rear and off engine. To install, reverse removal procedure. Adjust air flap control cable by pushing flaps into closed position and tighten cable.

3) Disconnect flap actuating cable from control shaft. Remove nuts securing shroud to crankcase and remove both halves of blower shroud.

4) To install, reverse removal procedure. Adjust air flap control by pushing flaps into closed position and tighten cable control. Attach elbow for cooling alternator to fan shroud front half.

5) Install drive belt and tighten alternator into proper belt tensioning position (maximum 0.6" deflection). Install cover plates and engine as previously outlined.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Connecting Rod Nut	24 (3.32)
Crankcase Half Nuts (8 mm)	14 (1.94)
Crankcase Half Sealing Nuts (10 mm)	25 (3.46)
Cylinder Head Nuts	23 (3.18)
Rocker Shaft-to-Cylinder Head Nuts	10 (1.38)
Heat Exchanger-to-Cylinder Head	16 (2.21)
Oil Pan-to-Crankcase Nuts	9 (1.24)
Drive Plate-to-Crankshaft	65 (8.99)
Hub-to-Crankshaft Bolt	23 (3.18)
Fan-to-Hub	14 (1.94)
Extension Shaft & Pulley-to-Fan	14 (1.94)
Engine-to-Transmission	22 (3.04)
Oil Pump-to-Crankcase	14 (1.94)
Oil Cooler-to-Crankcase	14 (1.94)
Flywheel-to-Crankshaft	80 (11.06)
Clutch-to-Flywheel	18 (2.49)
Torque Converter-to-Driveplate	14 (1.94)