

924 4-CYLINDER

ENGINE CODING

ENGINE IDENTIFICATION

Engine number is located on left side of crankcase next to the clutch housing. Engine number is coded as follows:

Engine Identification	
Application	Code
924	V/C
924 Turbo	M31/02

ENGINE & CYLINDER HEAD

ENGINE

NOTE — Manufacturer does not provide specific instructions for 924 Turbo.

Removal — 1) Disconnect battery cable and remove engine protection plate. Scribe hood at hinges and remove hood. Drain cooling system, remove hoses and expansion tank. Remove fan motors with shroud and alternator cooling hose.

NOTE — Remove A/C compressor without disconnecting hoses and lay aside.

2) Disconnect all wiring, hoses, lines, linkage and brackets from engine. On 924 Turbo, disconnect necessary parts of turbocharger and oiling system. On all models, disconnect exhaust pipe at manifold. Support drive line at front brace with wooden block. See Fig. 1.

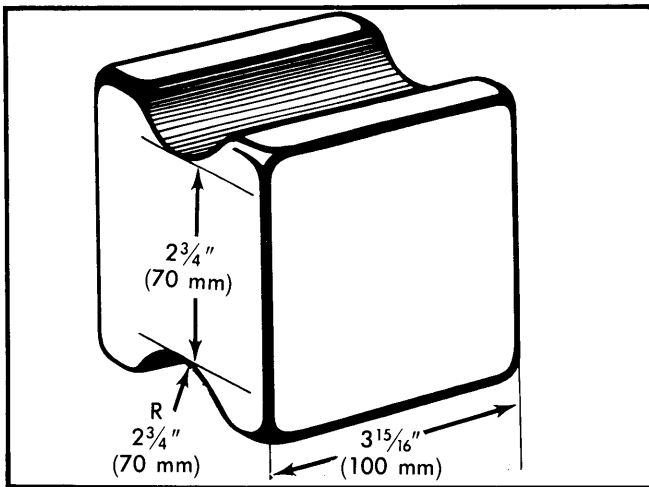


Fig. 1 Drive Line Support Block

3) Disconnect universal joint at steering rack. Disconnect stabilizer bar at frame on both sides and remove crossmember. Attach hoist and lift engine slightly. Remove bellhousing bolts and engine mounts. On vehicles equipped with automatic transmissions, remove bolts from metal/rubber damper. Lift engine carefully and turn at same time.

Installation — To install engine, reverse removal procedure.

CYLINDER HEAD

Removal & Installation — 1) Disconnect battery ground strap and drain cooling system. Remove hoses and wiring con-

nected to cylinder head. Remove exhaust pipe at manifold and remove camshaft timing belt and "V" belt.

2) Remove cylinder head cover and head bolts in sequence. To install, coat threads of cylinder head bolts with a light coat of oil and tighten in sequence as described below.

3) On 924, insert head bolts Nos. 8 and 10 first to center head. With engine cold, tighten bolts in numerical sequence shown in Fig. 2. Mark position of bolt head and then turn each bolt an additional 1/2 turn (180°) in sequence.

4) On 924 Turbo, install bolts Nos. 8 and 10 to center head. Tighten bolts in sequence in steps to specifications. After 60 minutes, loosen bolts approximately 30° in reverse sequence, then tighten once again. Run engine to operating temperature of 176°F (80°C), let engine cool and repeat loosening and tightening procedure.

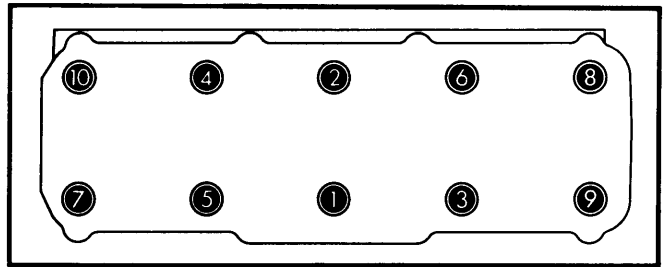


Fig. 2 Cylinder Head Tightening Sequence (Loosen in Reverse Order)

CAMSHAFT

FRONT MAIN BEARING OIL SEAL

Remove pulley bolt and using oil seal removing tool 10-221 (or equivalent), pry oil seal out of oil pump. Use installing tool 2033 to install new seal.

TIMING BELT

Remove belt cover and loosen drive belt tensioner. Remove crankshaft pulley and drive belt pulley. Remove drive belt. To install, reverse removal procedure.

NOTE — Belt must be tightened until belt can be turned 90° with thumb and index finger at a point midway between crankshaft and camshaft.

CAMSHAFT

1) Remove cylinder head cover and timing belt cover. Rotate crankshaft so marks on crankshaft pulley and camshaft sprocket are in No. 1 TDC position. Remove camshaft sprocket, distributor and distributor drive housing.

2) Remove camshaft lubrication tube, then replace nuts (hand tight) on bearing caps 2 and 4. Remove bearing caps 5, 1 and 3. Loosen bearing caps 2 and 4 evenly in a crosswise pattern and lift out camshaft.

NOTE — Ensure that bearing caps are replaced in original position. Note the correct off-center position of bearing caps.

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3) To install camshaft, reverse removal procedure and note the following: Place camshaft into position and install caps 2 and 4, tighten nuts in a crosswise pattern. Install caps 1, 3 and 5 and tighten all nuts to specifications. Loosen nuts 2 and 4 to install lubrication tube. Press in new camshaft oil seal.

VALVE TIMING

Using either TDC mark on flywheel and casting in bell housing, or crankshaft pulley TDC mark, rotate crankshaft to TDC position. Mark on rear of camshaft sprocket and indicator on cylinder head cover must be in line. Ensure that Woodruff key is installed and camshaft sprocket bolt is tightened properly. Install timing belt and adjust tension.

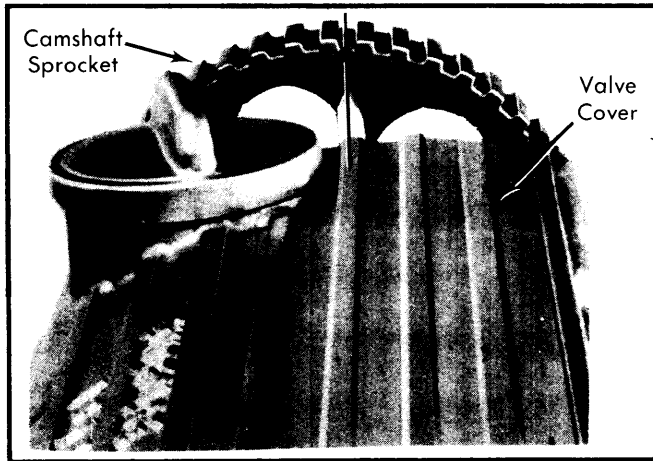


Fig. 3 Camshaft Sprocket Alignment

VALVES

VALVE ARRANGEMENT

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

VALVE GUIDE SERVICING

1) With dial indicator, measure amount of clearance between valve and guide with end of stem flush with guide. If wear exceeds limits of .032" (0.8 mm) for intake, or .039" (1.0 mm) for exhaust, replace valve guides.

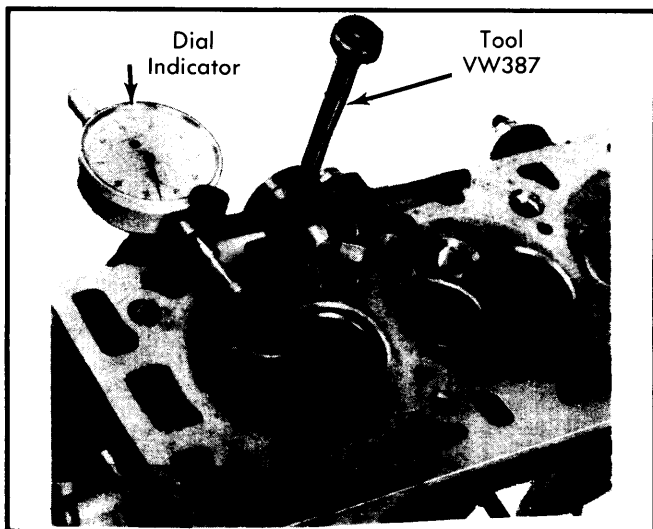


Fig. 4 Measuring Valve Guide Clearance

2) Press worn guide out from combustion chamber side. Place circlip into groove on replacement guide and press guide in from camshaft side. Replacement guides have a circlip in addition to 1 or 2 grooves.

3) Ream replacement guide by hand with dry reamer for proper clearance. Change valve spring retainer resting on head to replacement type with groove.

Valve Guide Identification		
Valve	Marking	Outside Diameter In. (mm)
Intake	No Groove .....	.5542 (14.079)
Exhaust	No Groove .....	.5538 (14.068)
Intake	1 Groove .....	.5622 (14.279)
Exhaust	1 Groove .....	.5617 (14.268)
Intake	2 Grooves .....	.5700 (14.479)
Exhaust	2 Grooves .....	.5695 (14.467)

NOTE — During repairs, installed guides must have the same codes as those replaced.

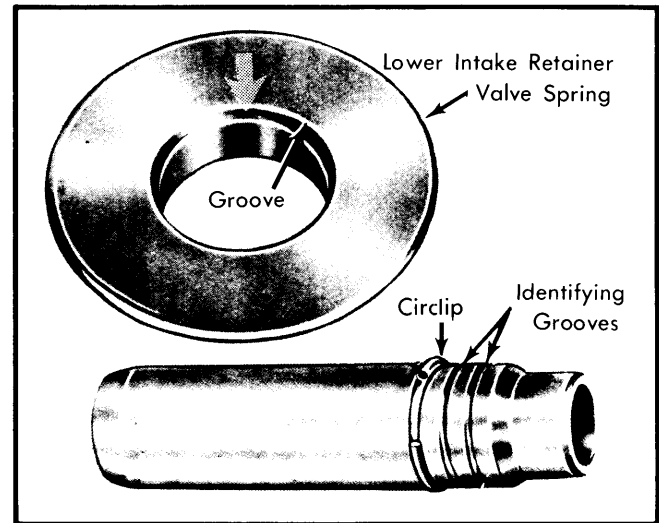


Fig. 5 Replacement Valve Guide and Intake Spring Retainer

VALVE STEM OIL SEALS

NOTE — Valve stem oil seal may be replaced with cylinder head installed.

Remove spark plug on cylinder being serviced, install air hose and adapter to maintain constant pressure in cylinder. Remove camshaft, tappets, valve stem keepers and valve spring. Remove oil seal and discard. To install, reverse removal procedures while noting the following; Be sure plastic sleeve is installed prior to seal installation. Place sleeve on valve stem, lubricate seal and install onto valve stem.

MECHANICAL VALVE LIFTERS

With camshaft removed, lift out tappet and inspect for wear or damage. Oil tappets lightly and replace in original position.

VALVE CLEARANCE ADJUSTMENT

1) Remove cylinder head cover and turn crankshaft until cam lobes of cylinder to be adjusted are pointing upward. Check valve clearance with feeler gauge between tappet and lobe.

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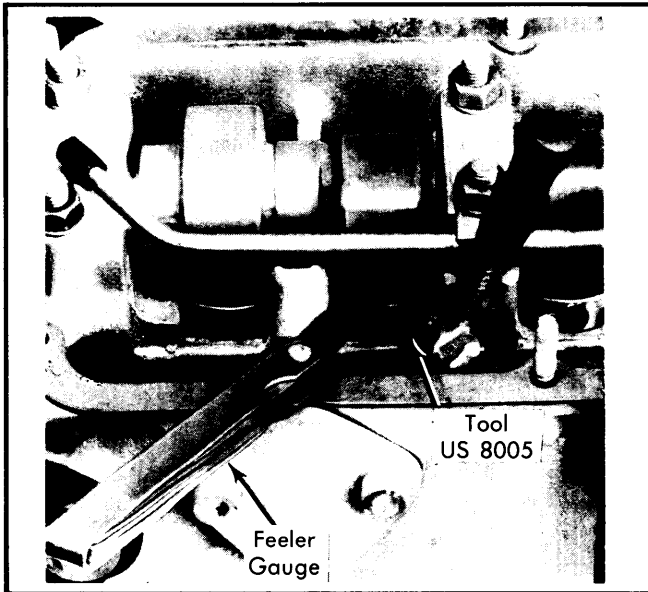


Fig. 6 Checking and Adjusting Valve Clearance
(Note Cam Lobes Pointing Upward)

2) Basic valve clearance with engine cold (when reconditioning engine) is .004" (.10 mm) for intake valve and .016" (.40 mm) for exhaust valve. Valve clearance should be checked with engine warmed to 176°F (80°C) oil temperature. Intake valve clearance is .008" (.20 mm) and exhaust clearance is .018" (.45 mm).

3) Adjust clearance by turning screw mounted in tappet with adjusting tool US 8005. Adjustment must be in complete turns only. One turn of screw changes clearance by .002" (.05 mm). After adjusting valve, be sure edge of tappet is in line with green area of tool.

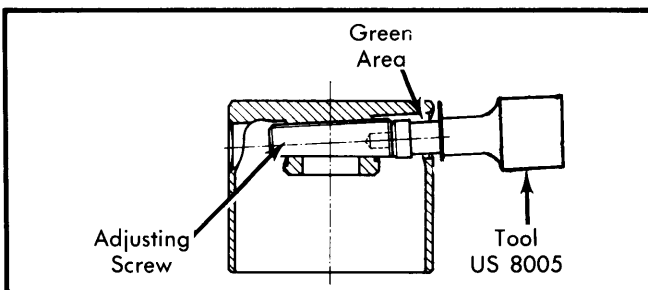


Fig. 7 Valve Lifter (Tappet) with Adjusting Screw and Tool

PISTONS, PINS & RINGS

OIL PAN

Drain engine oil and loosen left engine mount slightly. Disconnect steering at crossmember and remove crossmember. Remove oil pan bolts and lower oil pan. To install, reverse removal procedure and tighten pan bolts.

PISTONS & ROD ASSEMBLY

1) Before removing connecting rods, mark rod and cap for installation in original position. Remove rod caps and carefully push piston and rod assembly out top of block.

2) On reassembly of piston and rod assembly, cast bosses on rod and cap must face pulley end of engine. Code numbers must be on same side. Using a suitable ring compressor, install piston and rod assembly with arrow on crown of piston facing front of engine.

FITTING PISTONS

1) Measure cylinder bore .39" (9.9 mm) down from top and up same distance from bottom, also in the center. Take two measurements, one in line with crankshaft and again 90° to crankshaft.

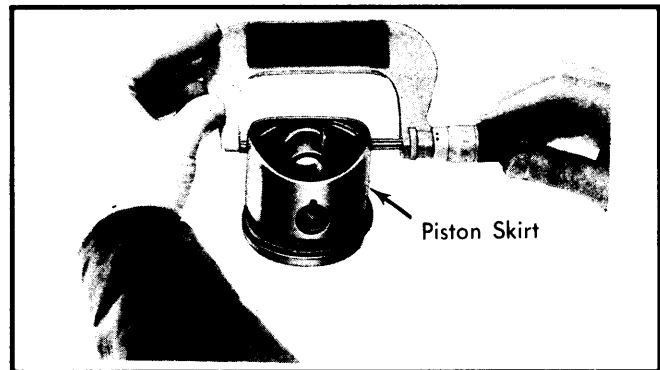


Fig. 8 Measuring Piston Diameter at Skirt

2) Measure piston .63" (16 mm) from bottom of skirt, 90° to pin bore. Combine measurements with those taken from cylinder bore. If piston-to-cylinder measurement exceeds .0016" (.04 mm), oversized pistons must be installed.

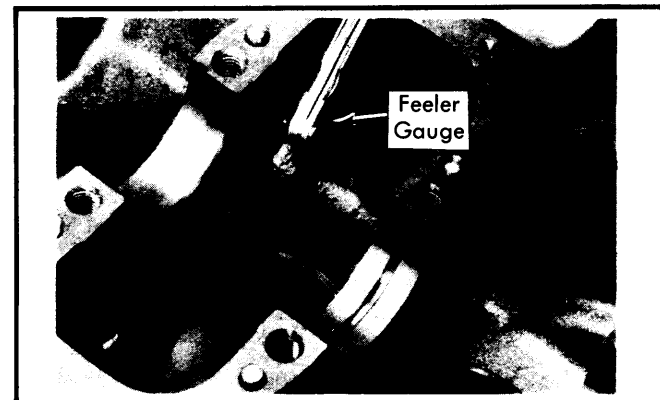


Fig. 9 Measuring Ring Gap in Cylinder Bore

3) Place piston rings squarely in bottom of cylinder bore approximately .59" (15 mm) from surface and measure ring gap. Wear limit is .039" (1.0 mm). Measure ring side clearance in piston. Wear limit is .004" (0.1 mm). Install rings with "TOP" mark facing piston crown and gaps offset 120° from each other.

PISTON PINS

Remove circlip and using piston pin remover VW 207c, remove pins. To install, reverse removal procedure.

NOTE — If pin is hard to install, heat piston to approximately 140°F (60°C).

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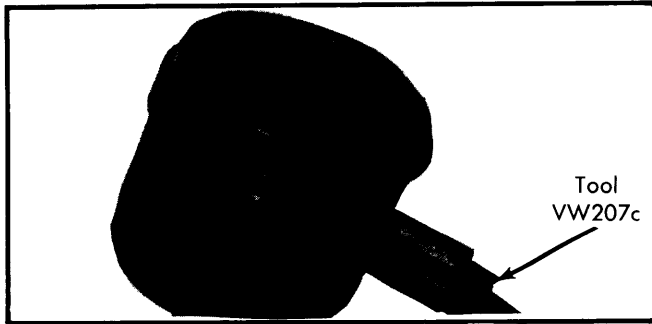


Fig. 10 Piston Pin Removal and Installation

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

MAIN & CONNECTING ROD BEARINGS

1) Push crankshaft toward one end and measure end play at No. 3 thrust bearing. Be sure main bearing caps are marked for reinstallation. Measure connecting rod side play. Remove rod and main bearing caps and check bearing clearance using Plastigage method.

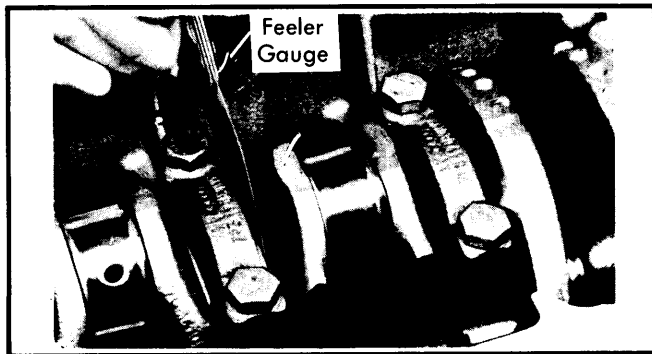


Fig. 11 Measure Crankshaft End Play as Shown (Check Connecting Rod Side Clearance Using Same Method)

2) Install plain bearing shell into bearing cap. Place grooved shell in block. Do not mix shells. Lubricate bearings and install caps.

NOTE — On No. 5. bearing, coat mating surface of bearing with sealing compound.

ENGINE OILING

Crankcase Capacity (Includes Filter) — 5.3 quarts for 924, 5.8 quarts for 924 Turbo.

Oil Filter — Spin-on type. Change at first oil change and every other one thereafter.

Oil Pressure — 73-101 psi (5.1-7.1 kg/cm²) at 5000 RPM.

ENGINE OILING SYSTEM

The engine oiling system is full pressure with rotary (sickle) type pump. Oil is picked up by pump through strainer and suction tube. Oil passes through pump and pressure control valve to oil filter and main oil channels. It is then distributed to main bearings, connecting rods and crankshaft. Camshaft lubrication is provided by spray tube at No. 1 cam bearing. Oil pressure switch is located at end of camshaft lubrication passage. A temperature sensor is located in oil pan. Lubrication system for 924 Turbo includes the following additional components: an oil cooler in front of engine, oil filter flange with thermostat for the oil cooler, and delivery and return lines for the turbocharger.

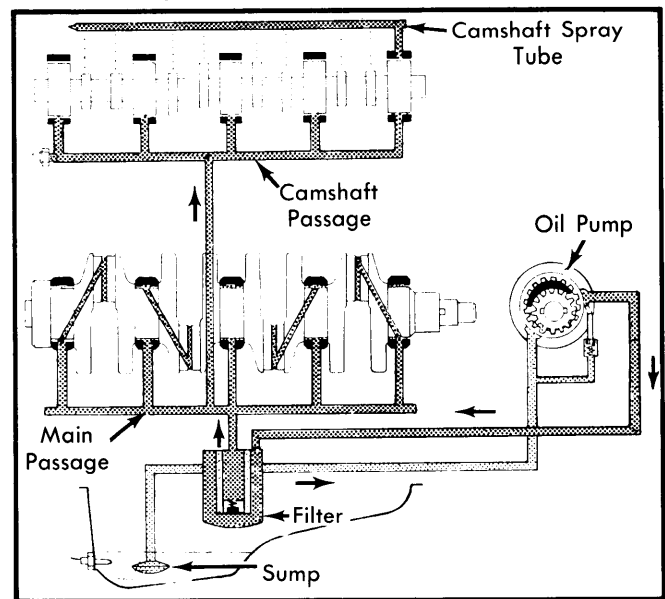


Fig. 12 Engine Oiling System (924 Shown, 924 Turbo Similar)

OIL PUMP

Oil pump is gear driven sickle type. Pump is mounted at front of engine and driven directly by crankshaft. Gear replacement is in pairs only.

ENGINE COOLING

Cooling System Capacity — 8.4 quarts with heater.

Thermostat — Opens at approximately 180°F.

Radiator Cap — 12-8-16-4 psi (.90-1.15 kg/cm²).

Cooling Fan — Comes on at 198°F, goes off at 189°F.

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS										
Year	Displ.		Carburetor	HP at RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore		Stroke	
	cu. ins.	cc					in.	mm	in.	mm
1981										
924	121	1984	Fuel Inj.	115 @ 5700	114 @ 3500	8.5:1	3.41	86.5	3.32	84.4
924 Turbo	121	1984	Fuel Inj.	156 @ 5700	154 @ 3500	8.0:1	3.41	86.5	3.32	84.4

Porsche Engines

924 4-CYLINDER (Cont.) ENGINE SPECIFICATIONS (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)
1984 cc Int.	1.575 (40)	45°	45°	.087-.118 (2.2-3.0)	.3532 (8.97)	.0157 (0.4)	..... .....
Exh.	1.299 ^② (33)	45°	45°	.087-.118 (2.2-3.0)	.3524 (8.95)	.020 (0.5)	

① — Maximum seat width .138" (3.5 mm).

② — 924 Turbo 1.417" (36 mm) diameter.

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)
1984 cc	.0012 (.03)	.....	.0004-.0008 (.01-.02)	.....	.012-.020 (.3-.5)	.0016-.0028 (.04-.07)

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)
1984 cc	2.518-2.519 (63.95-63.97)	.0008-.0031 (.02-.08)	3	.004-.007 (.10-.18)	1.888-1.889 (47.95-47.97)	.0008-.0027 (.02-.07)	.002-.003 (.05-.08)

VALVE TIMING				
Engine	INTAKE		EXHAUST	
	Open (BTDC)	Close (ABDC)	Open (BBDC)	Close (ATDC)
1984 cc ^①	6°	42°	47°	2°

① — With .039" (1 mm) valve clearance.

CAMSHAFT			
Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
1984 cc	1.0213-1.0220 (25.94-25.96)	.0015-.0032 (.040-.081)	.....

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (N•m)
Cylinder Head Bolts	
924	47 (64)
924 Turbo	
Step 1	29 (40)
Step 2	58 (79)
Step 3	① 80 (110)
Main Bearing Caps	58 (79)
No. 5 Allen Head Bolt	47 (64)
Connecting Rod Nuts	43 (58)
Flywheel	② 65 (88)
Crankshaft Pulley	180 (245)
Exhaust Manifold	18 (24)
Intake Manifold	17 (23)
Camshaft Bearing Cap Bolts	7 (10)
Camshaft Bearing Cap Nuts	12-15 (16-20)
Camshaft Sprocket Bolt	58 (79)

① — Retighten after 1 hour and after warming engine. See Text.

② — On Turbo, flywheel is a press fit and must be heated to install.