

Crankcase, Engine Mounts

Tolerances and Wear Limits

Engine M 44.43/44

		When fitting (new)	Wear limit
Cooling			
Coolant thermostat	opening temperature	81 to 85°C	
Cooling system cap Pressure relief valve	opens at excess pressure of	1.3 to 1.5 bar	
Vacuum relief valve	opens at partial vacuum of	0.1 bar	
Oil circuit			
Oil consumption	l / 1,000 km		approx. 1.5
Oil pressure at 80 deg. C oil temperature: at 5,000 rpm	excess pressure	approx. 4 bar	
Oil volume		6.5 l	
Quantity difference at oil gauge		approx. 1.5 l	
Oil thermostat	opening temperature	95° ± 4 °C	
Valve gear			
Camshaft bore	inside dia.	28 + 0.021 mm - 0	
Camshaft	dia.	28 - 0.04 mm - 0.055	
Camshaft	axial end play	0.08 to 0.18 mm	
Flat-base tappet bore	inside dia.	35 + 0.015 mm + 0.005	
Flat-base tappet	dia.	35 - 0.025 mm - 0.041	
Camshaft	runout	0.02 mm	

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Motor M 44.43/44

		When fitting (new)	Wear limit
Cylinder head with valves			
Sealing surface	distortion		max. 0.05 mm
Valve seat width	inlet	1.5 mm	
	exhaust	1.8 mm	
Seat angle		45°	
Outer correction angle		30°	
Inner correction angle		60°	
Valve guides	inside dia.	7 + 0.015 mm	
Valve stem:			
Inlet	dia.	6.98 - 0.012	
Exhaust	dia. (stem end)	6.974 ± 0.006 tapered stem	
Valve guide/valve stem	rocking clearance		
Inlet			0.8
Exhaust			0.8
Compression		8 bar and above	6.5 bar
Pistons with connecting rods			
Cylinder/piston	clearance	0.008 to 0.032	approx. 0.080
Piston rings	vertical clearance	Groove 1	0.040 to 0.075
		Groove 2	0.030 to 0.065
		Groove 3	0.020 to 0.055
Piston rings	gap width	Groove 1	0.20 to 0.50
		Groove 2	0.20 to 0.55
		Groove 3	0.30 to 0.90

Tolerances and Wear limits**Engine M 44.43/44**

		When fitting (new)	Wear limit
Small end bush	dia.	24 + 0.018 + 0.028	
Piston pin	dia.	24 – 0.004	
Small end bush/piston pin	radial clearance	0.018 to 0.032	
Crankshaft and cylinder block			
Crankshaft measure at bearing 2, 3 or 4 Bearings 1 and 5 on prisms	runout	0.04	max. 0.06
Crankpin	dia.	51.971 to 51.990	
Con-rod bearing/crankshaft	radial clearance	0.027 to 0.069	
	axial clearance	0.080 to 0.240	
Main bearing web	dia.	69.971 to 69.990	
Crankshaft main bearings/ crankshaft	radial clearance	0.028 to 0.070	0.16
Crankshaft main bearings/ crankshaft	axial bearings	0.060 to 0.192	0.40
Cylinder bore	ovality	0.010	0.020
Balance shaft bearing bore in crankcase or balance shaft cover	dia.	34.000 to 34.019	
Bore for bushing in bearing housing	dia.	34.000 to 34.019	
Balance shaft	dia.	30.975 to 30.991	

Engine tightening torques

Location	Thread	Tightening torque Nm (ftlb)	
Crankshaft/ crankcase			
Crankcase bolt joints top and bottom section (studs)	M 12 x 1.5	30 (22) 60° torque angle	1st stage 2nd stage
	M 10	20 (15) 50 (37)	1st stage 2nd stage
	M 8	20 (15)	
	M 6	10 (7)	
Rotation body on balance shaft	M 6	10 (7), secured with Loctite 270	
Cover for balance shaft housing to upper crankcase section	M 6	10 (7)	
Hexagon head bolt	M 8	20 (15)	
Hexagon head bolt (bearing saddle)	M 8 x 58	15 (11) 33 (24)	1st stage 2nd stage
Left-hand and right-hand bearing housing to upper crankcase section	M 8	20 (15)	
Sprocket on balance shaft	M 10	45 (33)	
Tensioning pulley to bearing housing	M 10	45 (33)	
Water pump to crankcase	M 6	10 (7), secured with Loctite 270	
Idler pulley to water-pump housing	M 10	45 (33)	
Tensioning pulley to oil pump housing	M 10	45 (33)	
Oil pump to crankcase	M 6 M 10	10 (7) 45 (33)	
Toothed belt tensioner to crankcase	M 8	20 (15)	
Tensioning pulley to tensioning lever	M 10	45 (33)	
Connecting-rod bolts (forged con-rods) Verbus-Ripp nut	M 10 x 1.25	25 (18) + 90° torque angle	

Location	Thread	Tightening torque Nm (ftlb)	
Oil pan to crankcase	M 6	hand-tight 4 (3) 10 (7)	1st stage 2nd stage 3rd stage
Oil pan insert to oil pan	M 5	6 (4), secured with Loctite 270	
Oil drain plug	M 20 x 1.5	50 (37)	
LH + RH engine support to crankcase	M 10	48 (35)	
Flywheel to crankshaft	M 10 x 1.25	40 (29) 90 (66)	1st stage 2nd stage
Sensor brackets to crankcase	M 8	20 (15)	
Sensor to bracket	M 6	10 (7)	
Sprocket to crankshaft	M 16 x 1.5	210 (155)	
Flywheel to sprocket	M 6 x 25 Grade 10.9	13 (10)	
Mounting of belt cover	M 6	8 (6)	
Bracket for alternator to crankcase	M 10	45 (33)	
Water temperature gauge	M 10 x 1	35 (26)	
Temperature sender (coolant or oil)	M 12 x 1.5	15 (11)	
Knock sensor	M 8	20 (15) Genuine bolt without washer	
Oil pressure sender	M 18 x 1.5	35 (26)	
Housing insert in oil pump housing	M 6	10 (7), mating flange sealed with Loctite 574	
Radiator fan/thermostat housing to crankcase	M 8	20 (15)	
Plug at oil/coolant radiator housing	M 18 x 1.5	35 (26)	
Coolant vent plug	M 8 x 1	12 + 3 (9 + 2)	
Oil filter pressure relief valve	M 20 x 1.5	45 (33) 20 (15)	

Location	Thread	Tightening torque Nm (ftlb)	
Cylinder head			
Cylinder head to crankcase upper section			
Engine type M 44.43/44	M 12	20 (15)	1st stage
		60° torque angle	2nd stage
		90° torque angle	3rd stage
Camshaft support to cylinder head	M 8	20 (15)	
Camshaft adjuster - VarioCam to cylinder head	M 6	10 (7)	
Socket head bolts for chain tensioner / oil pipe	M 6	10 (7)	
Banjo bolt / oil pipe	M 8 x 1	10 (7)	
Cylinder head cover	M 6	10 (7)	
Intake pipe to cylinder head	M 8	20 (15)	
Inlet flange for heater to cylinder head	M 8	20 (15)	
Flange for coolant pipe	M 8	20 (15)	
Toothed belt cover to cylinder head	M 6	10 (7)	
Hall sender / mounting	M 6	10 (7)	
Camshaft gearwheel to camshaft multi-tooth bolt	M 10	65 - 70 (48 - 52)	
Distributor rotor to camshaft gearwheel	M 4	4 (3)	
Transport bracket to cylinder head	M 6	10 (7)	
Spark plugs	M 14 x 1.25	25 - 30 (18 - 22); grease thread lightly with Molykote paste HTP (white)	

Location	Thread	Tightening torque Nm (ftlb)
Fuel system		
Mounting of pressure regulator to fuel collection pipe	M 6 x 12	10
Cap nut to fuel collection pipe	M 12 x 1.5	12 (9)
Exhaust system		
Plug nut to catalytic converter	M 14 x 1.5	30 (22)
All other nuts and bolts:	M 6	8 + 2 (6 + 1)
	M 8	20 + 2 (15 + 1)
	M 10	40 + 5 (29 + 4)
Coat all nut and bolt unions with Optimoly HT		

LAUNCH

Removing and installing engine (manual transmission)

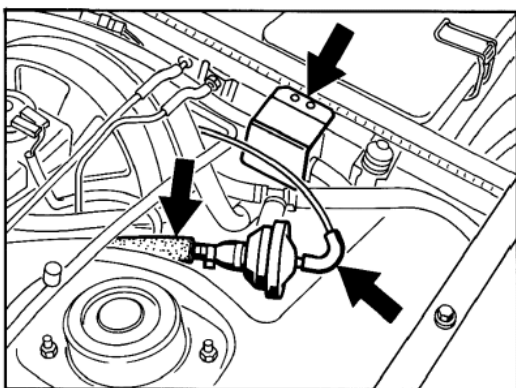
Engine Type M 44.43

Note

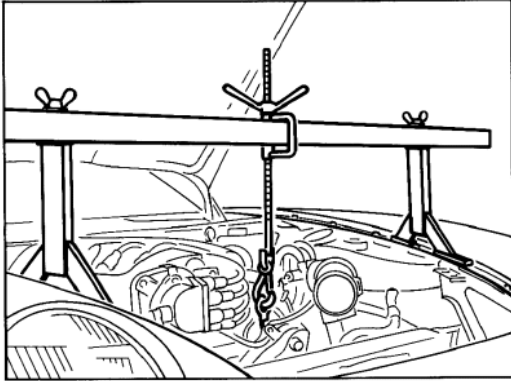
The engine is removed from above. The clutch housing remains fitted to the engine.

Removal

1. Place protective covers on fenders and remove hood. Disconnect battery ground strap. Open tie-wraps at bulkhead. Disconnect cable from cruise control actuator motor and remove hood.
2. Undo fuel lines between engine and body, using a second wrench to lock. Catch remaining fuel in a suitable container. Do not kink fuel lines.
3. Disconnect cable for throttle operation. Pull off oxygen sensor connector and undo bracket from manifold. Pull vacuum hose off pressure regulator.
4. Undo ground cable and wire clamp from clutch housing. Pull off vacuum hose from brake booster.
5. Disconnect twin- and multi-plug connectors. Disconnect vacuum hose from tank vent valve and manifold.
6. Remove and take out air filter assembly. Pull off ignition cable from distributor to ignition coil.
7. Unscrew cover panel in passenger footwell and lift out. Unscrew support panel for DME control unit and pull off control unit plug. Disconnect electrical plug.
8. Remove engine undertray panel and front undertray cover.
9. Open coolant drain plug and drain coolant. Remove alternator vent hose.
10. Loosen radiator hose at bottom right-hand side of radiator and at engine and pull off hose. Catch remaining coolant in a suitable container.
11. Pull off electrical connectors from fan motors. Undo bracket for fan motors from radiator and take out from below.
12. Unbolt radiator bracket. Loosen radiator hose and vent hose on upper left-hand side of radiator and pull off. Pull off electrical connector from temperature switch of radiator.
13. Unclip radiator cover and lift radiator carefully out from above. Separate radiator hose from reservoir and pull off.



14. Suspend engine at front transport bracket using support 10 - 222A and keep suspended in installation position. Check for correct position of support.

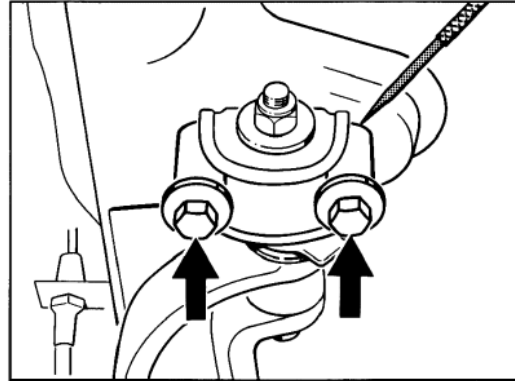


15. Remove Poly-Rib belt tensioner from A/C compressor and take off drive belt. Remove compressor from console and suspend out of the way. (Do not undo refrigerant hoses).

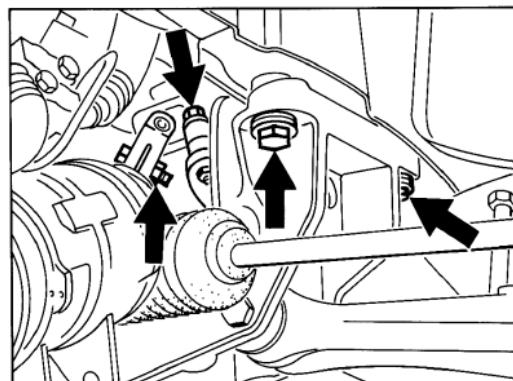
16. Unbolt stabilizer bar from body. Undo hose clamps between steering ATF radiator and power steering pump top-up reservoir and pull off hoses.

17. Slacken power pump belt and lift power steering pump off the console, taking the spacer bushing out from the front. Leave power steering pump suspended at steering. Remove oil pipes from oil cooler at engine console.

18. Mark installation position of left-hand and right-hand control arm mounts on body. Undo and remove control arm mounts.



19. Unbolt universal joint from steering rack, hydraulic engine mounts from engine supports and front-axle cross member from bodywork. The front-axle cross member remains suspended on the vehicle along with the steering rack and the power pump.

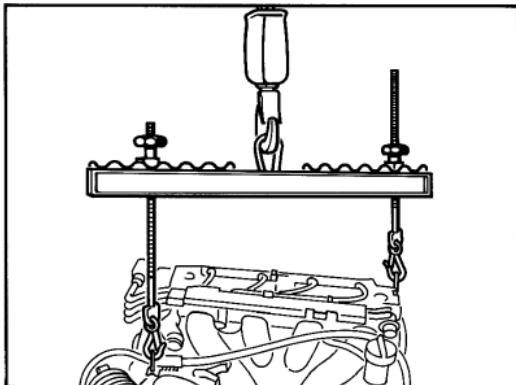


20. Disconnect electrical connections from starter and remove starter. Remove wire clamp from clutch housing.

21. Remove clutch slave cylinder from clutch housing (pipe remains connected). Undo and remove bracket for piping from upper clutch housing section.
22. Unbolt exhaust system from exhaust manifold flange and mount and remove exhaust system complete with oxygen sensor assembly.
23. Remove cover for clutch housing. Screw hex socket head bolts out of clamping sleeve and push clamping sleeve along with central shaft to the rear.
24. Screw out upper central tube / clutch housing fastening bolts.
25. Undo coolant hose for heater above exhaust manifold and at cylinder head.
26. Engage engine support (VW Special Tool 3033) into engine transport brackets as follows:

Pulley side:	Position 3
Flywheel side:	Position 11

 In position 3, the threaded rod is "below" the support. In position 11, the threaded rod is "above" the support



27. Slightly preload engine with shop crane, e.g. Bilstein K 750 H, and remove support bracket 10 - 222 A. The threaded rod for support bracket 10 - 222 A remains in the front mounting eye.
28. Screw out bottom central tube / clutch housing fastening bolts.
29. Pull engine forward, push rubber bellows out of bulkhead towards engine compartment and pull wiring harness carefully out of passenger's footwell. Lift out engine in upward direction.

Installation

When installing the engine, observe the following:

1. Insert wiring harness for DME control unit carefully into passenger side footwell.
2. Start by screwing in the central tube / clutch housing fastening bolts but do not tighten them yet.

Note

Tighten down fastening bolts to specified torque only after the hydraulic engine mounts have been fitted to the front-axle crossmember.

3. Install control arm.
The control arm mount must be fitted in exactly the same position marked before removal.
4. Check wheel alignment. Adjust if required.
5. Replace all gaskets, seals and O-rings before refitting. Check for correct location of the radiator in the rubber mounts.

6. Tighten nuts and bolts to specified torque.

Tightening torques:

Clamping sleeve to central shaft	M 10	80 Nm (59 ftlb)
Central tube to clutch housing	M 10	42 Nm (31 ftlb)
Control arm to body	M 10	46 Nm (34 ftlb)
Steering universal joint	M 8	30 + 5 Nm (22 + 4 ftlb)
Cross member to body	M 12	85 Nm (63 ftlb)

7. Add coolant and bleed cooling system.

8. Top up reservoir with ATF fluid and bleed steering system.

9. Warm up engine to operating temperature, check engine oil and coolant levels again, top up if required.

LAUNCH

Removing and installing engine (Tiptronic Transmission)

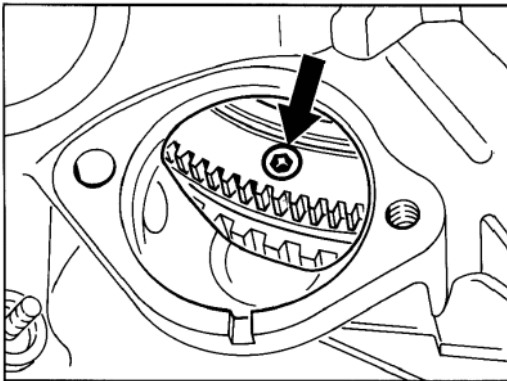
Engine Type M 44.44

Note

When removing and installing the engine on vehicles with Tiptronic transmission, certain deviations from the instructions for manual transmission versions must be observed.

Removal

1. The flywheel must be separated from the damper across the starter aperture (9 bolts). The clutch housing is unbolted from the engine and remains fixed to the central tube.



2. Remove ATF lines from cross member, cylinder head and radiator. Plug oil apertures to avoid dirt ingress. Remove protective shield from clutch housing.

3. When fitting engine and clutch housing, make sure that both marks are lined up with each other. Tighten fastening bolts evenly.

4. Before installing the engine, coat the clutch housing/engine bolts with Optimoly TA.

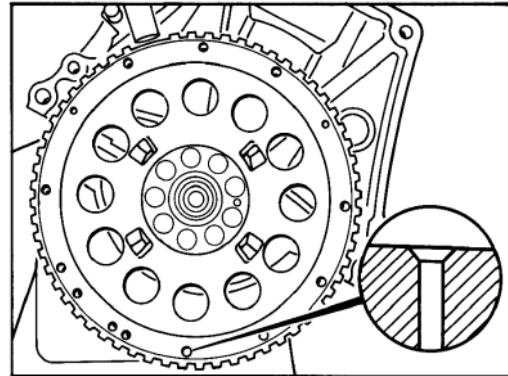
Tightening torques:

Clutch housing to engine	M 12	75 Nm (55 ftlb)
Damper to flywheel	M 8	21 Nm (15 ftlb)
ATF lines to radiator		24 Nm (18 ftlb)

Installation

Flywheel / damper installation note

1. Rotate flywheel until assembly mark (roll pin hole with large chamfer) points down.



2. Also rotate damper until positioning groove points down.

