

Contents

00 - Technical data	1
1 Engine number	1
2 Engine data	2
3 Safety precautions	3
3.1 Observe the following to prevent injuries to persons and damage to the injection and ignition system:	3
3.2 Using testers and measuring instruments during a road test	4
3.3 Working on the cooling system	4
3.4 Procedure before opening high-pressure section of injection system	4
4 General repair instructions	8
4.1 Rules for cleanliness when working on fuel supply system, injection system and turbocharger	8
4.2 Checking fuel system for leaks	8
4.3 Foreign particles in engine	8
4.4 Contact corrosion!	9
4.5 Routing and attachment of pipes, hoses and wiring	9
4.6 Checking vacuum system	9
4.7 Installing radiators, condensers and charge air coolers	10
10 - Removing and installing engine	11
1 Removing and installing engine	11
1.1 Removing engine	12
1.2 Separating engine from manual gearbox	29
1.3 Separating engine from direct shift gearbox	31
1.4 Securing engine to engine and gearbox support	33
1.5 Installing engine	34
2 Assembly mountings	40
2.1 Assembly mountings - exploded view	40
2.2 Checking adjustment of assembly mountings (engine/gearbox mountings)	41
2.3 Adjusting assembly mountings	41
13 - Crankshaft group	45
1 Cylinder block (pulley end)	45
1.1 Poly V-belt drive - exploded view	45
1.2 Removing and installing poly V-belt	46
1.3 Removing and installing tensioner for poly V-belt	48
1.4 Removing and installing bracket for ancillaries	49
1.5 Removing and installing vibration damper	53
1.6 Renewing crankshaft oil seal (pulley end) - vehicles up to 11.2004	54
1.7 Removing and installing sealing flange, pulley end	57
2 Cylinder block (gearbox end)	62
2.1 Dual-mass flywheel - exploded view of components	62
2.2 Removing and installing dual-mass flywheel	63
2.3 Renewing crankshaft oil seal	63
3 Crankshaft	66
3.1 Exploded view - crankshaft	66
3.2 Extracting and driving in needle bearing for crankshaft	68
3.3 Crankshaft dimensions	70
3.4 Measuring axial clearance of crankshaft	70
3.5 Measuring radial clearance of crankshaft	71
3.6 Allocation of main bearing shells	71
4 Dismantling and assembling pistons and conrods	76

4.1	Pistons and conrods - exploded view	76
4.2	Piston and cylinder dimensions	79
15 - Cylinder head, valve gear	80
1	Removing and installing cylinder head	80
1.1	Cylinder head - exploded view	80
1.2	Removing and installing cylinder head cover	82
1.3	Removing cylinder head	90
1.4	Installing cylinder head	93
1.5	Checking compression	96
2	Chain drive	99
2.1	Timing chain covers - exploded view	99
2.2	Renewing the oil seals in the upper cover for timing chains	100
2.3	Timing chain - exploded view of components	101
2.4	Detaching and re-fitting timing chain on camshafts	104
2.5	Removing and installing drive chain for valve gear and camshaft timing chain	114
3	Valve gear	124
3.1	Valve gear - exploded view	124
3.2	Checking axial clearance of camshafts	129
3.3	Measuring radial clearance of camshafts	129
3.4	Removing and installing camshafts	129
3.5	Renewing valve stem oil seals with cylinder head installed	134
3.6	Renewing valve stem oil seals with cylinder head removed	138
3.7	Valve dimensions	143
3.8	Checking valve guides	143
3.9	Machining valve seats	144
17 - Lubrication	147
1	Oil pump and sump	147
1.1	Oil pump and sump - exploded view	147
1.2	Removing and installing sump	150
1.3	Oil pump - exploded view	153
2	Oil cooler and oil filter housing	155
2.1	Oil cooler, oil filter housing - exploded view	155
2.2	Removing and installing oil filter housing	156
2.3	Removing and installing oil pressure switch F1	158
2.4	Checking oil pressure and oil pressure switch F1	159
2.5	Engine oil	160
2.6	Checking oil level	160
19 - Cooling	162
1	Removing and installing parts of cooling system	162
1.1	Diagram of coolant hose connections	162
1.2	Draining and filling cooling system	164
1.3	Removing and installing coolant pump	168
1.4	Thermostat housing - exploded view of components	173
1.5	Removing and installing thermostat housing	173
1.6	Removing and installing thermostat	178
1.7	Checking thermostat	179
1.8	Removing and installing coolant pipe	179
1.9	Removing and installing continued coolant circulation pump V51	183
1.10	Radiator and radiator fans - exploded view of components	185
1.11	Removing and installing radiator	186
1.12	Checking cooling system for leaks	190
1.13	Removing and installing radiator fan V7 and radiator fan 2 V177	192

26 - Exhaust system	194
1 Removing and installing parts of exhaust system	194
1.1 Exhaust system - exploded view	194
1.2 Removing and installing front exhaust pipe with catalytic converter and front silencer	196
1.3 Exhaust manifold - exploded view	199
1.4 Removing and installing exhaust manifold	200
1.5 Stress-free alignment of exhaust system	202
1.6 Checking exhaust system for leaks	203
2 Servicing exhaust flap	204
2.1 Checking vacuum unit for exhaust flap	204
2.2 Removing and installing vacuum unit for exhaust flap	205
3 Servicing secondary air system	206
3.1 Principle and function	206
3.2 Secondary air system - exploded view	206
3.3 Checking combination valve for secondary air system for proper operation and leakage - engine code BDB, BMJ	211
3.4 Checking combination valve for secondary air system for proper operation and leakage - engine code BUB	212
3.5 Removing and installing combination valve for secondary air system - engine code BDB, BMJ, BUB	213
3.6 Checking combination valves for secondary air system for proper operation and leakage - engine code CBRA	213
3.7 Removing and installing combination valve for secondary air system (left-side) - engine code CBRA	217
3.8 Removing and installing combination valve for secondary air system (right-side) - engine code CBRA	217
3.9 Removing and installing sender 1 for secondary air pressure G609 - engine code CBRA	219
3.10 Removing and installing secondary air pump	219
3.11 Removing and installing secondary air pump relay J299	220