



## Contents

<b>00 - Technical data</b> .....	<b>1</b>
<b>1 Engine number</b> .....	<b>1</b>
<b>2 Engine data</b> .....	<b>2</b>
<b>3 Safety precautions</b> .....	<b>4</b>
3.1 Safety precautions when working on the fuel supply system .....	4
3.2 Safety precautions when working on the cooling system .....	4
3.3 Safety precautions when using testers and measuring instruments during a road test .....	4
3.4 Safety precautions when working on the exhaust system .....	5
<b>4 General repair instructions</b> .....	<b>6</b>
4.1 Different types of glow plugs .....	6
4.2 Handling ceramic glow plugs .....	7
4.3 Rules for cleanliness when working on fuel supply system, injection system and turbocharger .....	7
4.4 Checking for leaks in the fuel system .....	8
4.5 Foreign particles in engine .....	8
4.6 Contact corrosion .....	8
4.7 Routing and attachment of pipes, hoses and wiring .....	8
4.8 Installing radiators, condensers and charge air coolers .....	8
4.9 Checking vacuum system .....	9
<b>10 - Removing and installing engine</b> .....	<b>10</b>
<b>1 Removing engine</b> .....	<b>10</b>
<b>2 Securing engine to engine and gearbox support</b> .....	<b>32</b>
<b>3 Installing engine</b> .....	<b>33</b>
<b>13 - Crankshaft group</b> .....	<b>37</b>
<b>1 Poly V-belt drive - vehicles up to 05.2003</b> .....	<b>37</b>
1.1 Exploded view - poly V-belt drive for power steering pump, alternator and viscous fan ..	37
1.2 Exploded view - poly V-belt drive for air conditioner .....	39
1.3 Removing and installing poly V-belt .....	41
1.4 Removing and installing vibration damper .....	43
1.5 Removing and installing bracket for ancillaries .....	44
<b>2 Poly V-belt drive - vehicles from 06.2003 onwards</b> .....	<b>48</b>
2.1 Exploded view - poly V-belt drive for power steering pump, alternator and air conditioner compressor .....	48
2.2 Removing and installing poly V-belt .....	51
2.3 Removing and installing tensioner for poly V-belt .....	52
2.4 Removing and installing vibration damper .....	54
2.5 Removing and installing bracket for ancillaries .....	56
<b>3 Toothed belt drive with hydraulically damped tensioning roller - engine codes AVB, AVF, AWX</b> .....	<b>62</b>
3.1 Exploded view - toothed belt drive with hydraulically damped tensioning roller .....	62
3.2 Removing and installing toothed belt - vehicles with hydraulically damped tensioning roller .....	64
<b>4 Toothed belt drive with friction-damped tensioning roller - engine codes AVB, AVF, AWX</b> .....	<b>73</b>
4.1 Exploded view - toothed belt drive with friction-damped tensioning roller .....	73
4.2 Removing and installing toothed belt - vehicles with friction-damped tensioning roller .....	75
<b>5 Toothed belt drive - engine codes BKE, BPW, BRB, BRC</b> .....	<b>83</b>
5.1 Exploded view - toothed belt drive .....	83
5.2 Removing and installing toothed belt .....	85
<b>6 Sealing flanges and flywheel</b> .....	<b>93</b>



6.1	Exploded view - sealing flanges and flywheel	93
6.2	Renewing crankshaft oil seal (pulley end)	95
6.3	Removing and installing sealing flange (front) - vehicles up to 05.2003	98
6.4	Removing and installing sealing flange (front) - vehicles from 06.2003	103
6.5	Removing and installing dual-mass flywheel - vehicles with manual gearbox	107
6.6	Removing and installing flywheel - vehicles with multitronic gearbox	108
6.7	Removing and installing sealing flange (rear)	109
<b>7</b>	<b>Crankshaft</b>	<b>112</b>
7.1	Exploded view - crankshaft	112
7.2	Removing and installing sender wheel for engine speed sender G28	113
7.3	Extracting and driving in needle bearing for crankshaft - needle bearing (open version)	114
7.4	Extracting and driving in needle bearing for crankshaft - needle bearing (closed version)	116
7.5	Crankshaft dimensions	117
7.6	Measuring axial clearance of crankshaft	117
7.7	Measuring radial clearance of crankshaft	118
7.8	Removing and installing drive chain sprocket for oil pump - engine codes AVB, AVF, AWX, BKE and BRB	118
7.9	Converting balance shaft assembly to spur gear drive	119
7.10	Pulling spur gear off crankshaft and shrink-fitting new spur gear	122
<b>8</b>	<b>Pistons and conrods</b>	<b>126</b>
8.1	Different versions of conrods and conrod bolts	126
8.2	Exploded view - piston with industrially cracked conrod	126
8.3	Exploded view - piston with sawn conrod	128
8.4	Measuring piston projection at TDC	131
8.5	Piston and cylinder dimensions	132
8.6	Measuring radial clearance of conrods	133
<b>15</b>	<b>Cylinder head, valve gear</b>	<b>134</b>
<b>1</b>	<b>Handling different types of glow plugs</b>	<b>134</b>
1.1	Different types of glow plugs	134
1.2	Handling ceramic glow plugs	135
<b>2</b>	<b>Cylinder head</b>	<b>136</b>
2.1	Exploded view - cylinder head	136
2.2	Removing and installing cylinder head cover	139
2.3	Removing and installing cylinder head	140
2.4	Checking compression - engine codes AVB, AVF and AWX	152
2.5	Checking compression - engine codes BKE, BPW, BRB and BRC	154
<b>3</b>	<b>Valve gear</b>	<b>156</b>
3.1	Exploded view - valve gear	156
3.2	Checking axial clearance of camshaft	158
3.3	Renewing camshaft oil seal	159
3.4	Removing and installing camshaft	163
3.5	Renewing valve stem oil seals with cylinder head installed	168
3.6	Renewing valve stem oil seals with cylinder head removed	173
3.7	Checking hydraulic bucket tappets	178
3.8	Valve dimensions	179
3.9	Machining valve seats	180
3.10	Checking valve guides	182
3.11	Checking valves	182
<b>17</b>	<b>Lubrication</b>	<b>183</b>
<b>1</b>	<b>Removing and installing parts of lubrication system</b>	<b>183</b>
<b>2</b>	<b>Sump, oil pump - engine codes AVB, AVF, AWX, BKE, BRB</b>	<b>184</b>
2.1	Exploded view - sump, oil pump	184



2.2	Removing and installing oil level and oil temperature sender G266	186
2.3	Removing and installing sump	186
2.4	Removing and installing oil pump	197
<b>3</b>	<b>Sump, oil pump, balance shaft assembly with chain drive - engine codes BPW, BRC</b>	<b>198</b>
3.1	Exploded view - sump, oil pump, balance shaft assembly with chain drive	198
3.2	Removing and installing oil level and oil temperature sender G266	199
3.3	Removing and installing sump	200
3.4	Removing and installing balance shaft assembly	209
3.5	Removing and installing oil pump	216
3.6	Removing and installing chain tensioner for balance shaft assembly	217
<b>4</b>	<b>Sump, oil pump, balance shaft assembly with spur gear drive - engine codes BPW, BRC</b>	<b>220</b>
4.1	Exploded view - sump, oil pump, balance shaft assembly with spur gear drive	220
4.2	Removing and installing oil level and oil temperature sender G266	222
4.3	Removing and installing sump	222
4.4	Removing and installing oil pump	232
4.5	Removing balance shaft assembly	232
4.6	Installing a new balance shaft assembly	234
4.7	Re-installing the "old" balance shaft assembly	238
<b>5</b>	<b>Oil filter bracket with engine oil cooler</b>	<b>240</b>
5.1	Exploded view - oil filter bracket with engine oil cooler	240
5.2	Removing and installing oil filter bracket with engine oil cooler	241
5.3	Checking oil pressure and oil pressure switch	243
5.4	Engine oil	245
5.5	Checking oil level	245
<b>19</b>	<b>Cooling</b>	<b>246</b>
<b>1</b>	<b>Cooling system</b>	<b>246</b>
1.1	Connection diagram - coolant hoses	246
1.2	Draining and filling cooling system	249
1.3	Removing and installing coolant pump	255
1.4	Removing, installing and checking thermostat	257
1.5	Removing and installing coolant pipe (top)	258
1.6	Removing and installing coolant pipe (bottom)	259
1.7	Removing and installing viscous fan - vehicles up to 05.2003	261
1.8	Removing and installing bearing for viscous fan in bracket - vehicles up to 05.2003	263
1.9	Removing and installing radiator	266
1.10	Removing and installing radiator cowl - vehicles up to 10.2004	272
1.11	Removing and installing radiator fan - vehicles up to 10.2004	274
1.12	Removing and installing radiator cowl - vehicles from 11.2004 onwards	275
1.13	Removing and installing radiator fan - vehicles from 11.2004 onwards	276
1.14	Renewing radiator fan motor	276
1.15	Checking cooling system for leaks	277
<b>21</b>	<b>Turbocharging/supercharging</b>	<b>279</b>
<b>1</b>	<b>Charge air system with turbocharger</b>	<b>279</b>
1.1	Exploded view - turbocharger	279
1.2	Removing and installing turbocharger- engine codes AVB, AVF, AWX and BKE	281
1.3	Removing and installing turbocharger - engine codes BPW, BRB, BRC	287
1.4	Exploded view - charge air cooler	291
1.5	Removing and installing charge air cooler	292
<b>26</b>	<b>Exhaust system</b>	<b>295</b>
<b>1</b>	<b>Exhaust system without particulate filter</b>	<b>295</b>
1.1	Exploded view - exhaust system on vehicles with front-wheel drive	295
1.2	Disconnecting centre silencer and rear silencer - vehicles with front-wheel drive	296



1.3	Exploded view - exhaust system on vehicles with four-wheel drive	297
1.4	Disconnecting centre silencer and rear silencers - vehicles with four-wheel drive	300
1.5	Removing and installing front exhaust pipe with catalytic converter	301
1.6	Stress-free alignment of exhaust system	302
1.7	Checking exhaust system for leaks	305
<b>2</b>	<b>Exhaust system with particulate filter</b>	<b>306</b>
2.1	Exploded view - exhaust system on vehicles with front-wheel drive	306
2.2	Disconnecting centre silencer and rear silencer - vehicles with front-wheel drive	308
2.3	Exploded view - exhaust system on vehicles with four-wheel drive	309
2.4	Separating Y-pipe and rear silencer - vehicles with four-wheel drive	312
2.5	Exploded view - front exhaust pipe with mountings on vehicles with manual gearbox	313
2.6	Removing and installing front exhaust pipe - vehicles with manual gearbox	314
2.7	Exploded view - front exhaust pipe with mountings on vehicles with multitronic gearbox	316
2.8	Removing and installing front exhaust pipe - vehicles with multitronic gearbox	317
2.9	Removing and installing particulate filter - vehicles with manual gearbox	320
2.10	Removing and installing particulate filter - vehicles with multitronic gearbox	324
2.11	Stress-free alignment of exhaust system	327
2.12	Checking exhaust system for leaks	330
<b>3</b>	<b>Exhaust manifold</b>	<b>331</b>
3.1	Exploded view - exhaust manifold	331
3.2	Removing and installing exhaust manifold	331
<b>4</b>	<b>Exhaust gas temperature control</b>	<b>333</b>
4.1	Removing and installing exhaust gas temperature sender 1 G235	333
4.2	Removing and installing temperature sender before particulate filter G506	334
4.3	Removing and installing temperature sender after particulate filter G527 - vehicles with manual gearbox	336
4.4	Removing and installing temperature sender after particulate filter G527 - vehicles with multitronic gearbox	339
<b>5</b>	<b>Exhaust gas recirculation system - vehicles without exhaust gas recirculation cooler</b>	<b>340</b>
5.1	Exploded view - exhaust gas recirculation system	340
5.2	Hose connection diagram for exhaust gas recirculation	341
5.3	Checking mechanical exhaust gas recirculation valve	342
<b>6</b>	<b>Exhaust gas recirculation system - vehicles with exhaust gas recirculation cooler</b>	<b>344</b>
6.1	Exploded view - exhaust gas recirculation system	344
6.2	Removing and installing exhaust gas recirculation cooler	346