



## Contents

<b>00 - Technical data</b>	<b>1</b>
<b>1 Identification</b>	<b>1</b>
1.1 Engine number/engine data	1
<b>2 Safety information</b>	<b>3</b>
2.1 Safety precautions when working on fuel system	3
2.2 Safety precautions when using testers and measuring instruments during a road test	4
2.3 Safety measures when working on vehicles with a start/stop system	4
2.4 Safety precautions when working on the cooling system	4
2.5 Safety precautions when working on the SCR system	5
2.6 Safety precautions when working on exhaust system	5
<b>3 Repair notes</b>	<b>7</b>
3.1 Rules for cleanliness	7
3.2 Foreign objects in engine	7
3.3 Checking vacuum system	8
<b>10 - Removing and installing engine</b>	<b>9</b>
<b>1 Removing and installing engine</b>	<b>9</b>
1.1 Removing and installing engine	9
1.2 Securing engine on engine and gearbox support	22
1.3 Installing engine	23
<b>2 Assembly mountings</b>	<b>27</b>
2.1 Assembly overview - assembly mountings	27
2.2 Supporting engine in installation position	28
2.3 Adjusting assembly mountings	36
<b>3 Engine cover panel</b>	<b>41</b>
3.1 Removing and installing engine cover	41
<b>13 - Crankshaft group</b>	<b>42</b>
<b>1 Cylinder block (pulley end)</b>	<b>42</b>
1.1 Assembly overview - poly V-belt drive	42
1.2 Removing and installing poly-V belt	46
1.3 Removing and installing tensioner for poly V-belt	50
1.4 Removing and installing bracket for ancillaries	51
1.5 Removing and installing engine bracket	53
1.6 Assembly overview - cylinder block (pulley end)	63
1.7 Removing and installing sealing flange on pulley end	64
1.8 Renewing crankshaft oil seal - belt pulley end	66
<b>2 Cylinder block, gearbox end</b>	<b>69</b>
2.1 Assembly overview - cylinder block, gearbox end	69
2.2 Removing and installing sealing flange on gearbox side	70
<b>3 Crankshaft</b>	<b>79</b>
3.1 Assembly overview - crankshaft	79
3.2 Renewing needle bearing in crankshaft	79
3.3 Crankshaft dimensions	82
<b>4 Pistons and conrods</b>	<b>83</b>
4.1 Assembly overview - pistons and conrods	83
4.2 Measuring piston projection at TDC	86
4.3 Separating new conrod	87
<b>15 - Cylinder head, valve gear</b>	<b>89</b>
<b>1 Cylinder head</b>	<b>89</b>
1.1 Assembly overview - cylinder head	89



1.2	Removing and installing cylinder head	91
1.3	Assembly overview - cylinder head cover	100
1.4	Removing and installing cylinder head cover	101
1.5	Removing and installing vacuum pump	104
1.6	Checking compression	105
<b>2</b>	<b>Toothed belt drive</b>	<b>107</b>
2.1	Assembly overview - toothed belt	107
2.2	Removing and installing toothed belt	109
<b>3</b>	<b>Valve gear</b>	<b>116</b>
3.1	Assembly overview - valve gear	116
3.2	Removing and installing camshaft oil seal	117
3.3	Removing and installing camshaft	121
3.4	Removing and installing valve stem seals	128
<b>4</b>	<b>Inlet and exhaust valves</b>	<b>133</b>
4.1	Valve dimensions	133
4.2	Reworking valve seats	133
4.3	Checking valve guides	133
<b>17 - Lubrication</b>		<b>134</b>
<b>1</b>	<b>Sump, oil pump</b>	<b>134</b>
1.1	Assembly overview - sump/oil pump	134
1.2	Removing and installing oil sump	140
1.3	Removing and installing oil pump	143
1.4	Engine oil:	144
<b>2</b>	<b>Engine oil cooler</b>	<b>146</b>
2.1	Assembly overview - engine oil cooler	146
<b>3</b>	<b>Oil filter, oil pressure switch</b>	<b>148</b>
3.1	Assembly overview - oil filter/oil pressure switch	148
3.2	Removing and installing oil filter housing	149
3.3	Checking oil pressure and oil pressure switch	152
<b>4</b>	<b>Oil circuit</b>	<b>154</b>
4.1	Removing and installing oil supply line for turbocharger	154
<b>5</b>	<b>Balancer shaft module</b>	<b>156</b>
5.1	Assembly overview - balancer shaft module	156
5.2	Removing and installing balance shaft module	159
<b>19 - Cooling</b>		<b>170</b>
<b>1</b>	<b>Cooling system/coolant</b>	<b>170</b>
1.1	Coolant hose connection diagram	170
1.2	Checking cooling system for leaks	174
1.3	Draining and adding coolant	178
1.4	Assembly overview - engine preheater	182
<b>2</b>	<b>Coolant pump, regulation of cooling system</b>	<b>186</b>
2.1	Removing and installing coolant pump	186
2.2	Removing and installing thermostat	187
2.3	Removing and installing 4/2-way valve with thermostat	189
<b>3</b>	<b>Coolant pipes</b>	<b>191</b>
3.1	Assembly overview - coolant pipes	191
<b>4</b>	<b>Radiator, radiator fan</b>	<b>195</b>
4.1	Assembly overview - radiator/radiator fan	195
4.2	Removing and installing radiator	198
4.3	Removing and installing radiator cowl with radiator fan	199
<b>21 - Turbocharging/supercharging</b>		<b>200</b>



<b>1</b>	<b>Exhaust turbocharger</b> .....	<b>200</b>
1.1	Assembly overview - turbocharger .....	200
1.2	Removing and installing turbocharger .....	206
1.3	Renewing vacuum unit for turbocharger .....	210
<b>2</b>	<b>Charge air system</b> .....	<b>218</b>
2.1	Assembly overview - charge air system .....	218
2.2	Assembly overview - charge-air hose connections .....	220
2.3	Checking charge air system for leaks .....	221
<b>23</b>	<b>- Mixture preparation - injection</b> .....	<b>224</b>
<b>1</b>	<b>Injection system</b> .....	<b>224</b>
1.1	Schematic overview - fuel system .....	224
1.2	Assembly overview - fuel system .....	226
1.3	Filling/bleeding fuel system .....	229
1.4	Checking fuel system for leaks .....	230
<b>2</b>	<b>Injectors/high-pressure accumulator (rail)</b> .....	<b>231</b>
2.1	Check pressure retention valve in fuel return line .....	231
2.2	Removing and installing injectors .....	232
2.3	Removing and installing high-pressure lines .....	236
2.4	Removing and installing fuel rail .....	238
<b>3</b>	<b>Vacuum system</b> .....	<b>242</b>
3.1	Assembly overview - vacuum system .....	242
3.2	Checking vacuum system .....	243
<b>4</b>	<b>Air filter</b> .....	<b>247</b>
4.1	Assembly overview - air filter housing .....	247
4.2	Removing and installing air filter housing .....	249
4.3	Checking changeover flap for intake air preheating .....	250
4.4	Removing and installing changeover flap for intake air preheating .....	251
<b>5</b>	<b>Intake manifold</b> .....	<b>254</b>
5.1	Assembly overview - intake manifold .....	254
5.2	Removing and installing intake manifold .....	254
<b>6</b>	<b>Senders and sensors</b> .....	<b>258</b>
6.1	Checking fuel pressure regulating valve .....	258
6.2	Removing and installing fuel pressure regulating valve N276 .....	259
6.3	Removing and installing fuel pressure sender .....	261
6.4	Assembly overview - actuator for structure-borne sound and control unit for structure-borne sound .....	262
<b>7</b>	<b>High-pressure pump</b> .....	<b>265</b>
7.1	Removing and installing high-pressure pump .....	265
<b>8</b>	<b>Engine (motor) control unit</b> .....	<b>269</b>
8.1	Removing and installing engine control unit .....	269
<b>9</b>	<b>Lambda probe</b> .....	<b>287</b>
9.1	Removing and installing lambda probe .....	287
<b>26</b>	<b>- Exhaust system</b> .....	<b>291</b>
<b>1</b>	<b>Exhaust pipes and silencers</b> .....	<b>291</b>
1.1	Assembly overview - silencers .....	291
1.2	Separating exhaust pipes from silencers .....	299
1.3	Aligning exhaust system free of stress .....	301
1.4	Check exhaust system for leaks .....	303
1.5	Installation position of clamp .....	304
<b>2</b>	<b>Exhaust gas cleaning</b> .....	<b>306</b>
2.1	Assembly overview - emission control .....	306
2.2	Removing and installing particulate filter .....	316



2.3	Removing and installing particulate filter with NOx storage catalytic converter	324
2.4	Removing and installing NOx storage catalytic converter	332
<b>3</b>	<b>SCR system (selective catalytic reduction)</b>	<b>334</b>
3.1	Assembly overview - tank for reducing agent	334
3.2	Draining reducing agent tank	335
3.3	Removing and installing reducing agent tank	338
3.4	Assembly overview - delivery module for reducing agent	340
3.5	Assembly overview - reducing agent delivery line	342
3.6	Removing and installing reducing agent supply line	343
3.7	Removing and installing injector for reducing agent	345
3.8	Removing and installing heater element (heater cup)	346
<b>4</b>	<b>Exhaust gas recirculation</b>	<b>351</b>
4.1	Assembly overview - exhaust gas recirculation	351
4.2	Removing and installing exhaust gas recirculation filter	354
4.3	Removing and installing exhaust gas recirculation cooler	356
4.4	Checking exhaust gas recirculation cooler for leaks	360
4.5	Removing and installing temperature sensor for exhaust gas recirculation	363
4.6	Cleaning exhaust gas recirculation system	367
<b>28</b>	<b>Glow plug system</b>	<b>374</b>
<b>1</b>	<b>Glow plug system</b>	<b>374</b>
1.1	Removing and installing automatic glow period control unit J179	374
1.2	Removing and installing glow plug	375
1.3	Removing and installing Hall sender	382
1.4	Removing and installing engine speed sender	386