

## 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>2</b>
2.1 Safety precautions when working on the fuel supply system .....	2
2.2 Safety precautions when working on vehicles with start/stop system .....	2
2.3 Safety precautions when using testers and measuring instruments during a road test .....	3
2.4 Safety precautions when working on the cooling system .....	3
2.5 Safety precautions when working on the exhaust system .....	3
2.6 Safety precautions when working on the SCR system .....	4
2.7 Safety precautions when working on the glow plug system .....	5
<b>3 Repair instructions</b> .....	<b>6</b>
3.1 Rules for cleanliness .....	6
3.2 General notes .....	7
3.3 General repair instructions .....	8
3.4 Performing adaptations after renewing a component .....	9
3.5 Cleaning engine .....	9
3.6 Nuts, bolts .....	10
3.7 Identification plates .....	10
3.8 Use of impact wrenches .....	10
3.9 Foreign material in engine .....	11
3.10 Contact corrosion .....	11
3.11 Routing and attachment of pipes, hoses and wiring .....	12
3.12 Installing radiators and condensers .....	12
3.13 Checking vacuum system .....	12
<b>10 - Removing and installing engine</b> .....	<b>14</b>
<b>1 Removing and installing engine</b> .....	<b>14</b>
1.1 Removing engine .....	14
1.2 Separating engine and gearbox .....	27
1.3 Securing engine to engine and gearbox support .....	32
1.4 Installing engine .....	34
<b>2 Assembly mountings</b> .....	<b>39</b>
2.1 Assembly overview - assembly mountings .....	39
2.2 Supporting engine in installation position .....	41
2.3 Removing and installing engine mountings .....	46
2.4 Removing and installing gearbox mounting .....	47
2.5 Removing and installing pendulum support .....	49
2.6 Checking adjustment of assembly mountings .....	49
2.7 Adjusting assembly mountings .....	50
<b>3 Engine cover panel</b> .....	<b>53</b>
3.1 Removing and installing engine cover panel .....	53
<b>13 - Crankshaft group</b> .....	<b>54</b>
<b>1 Cylinder block (pulley end)</b> .....	<b>54</b>
1.1 Assembly overview - cylinder block (pulley end) .....	54
1.2 Assembly overview - sealing flange (pulley end) .....	57
1.3 Removing and installing poly V-belt .....	59
1.4 Removing and installing poly V-belt tensioner .....	60
1.5 Removing and installing vibration damper .....	60
1.6 Removing and installing bracket for ancillaries .....	61
1.7 Removing and installing sealing flange (pulley end) .....	62



1.8	Renewing cylinder block sealing cap (pulley end)	64
1.9	Removing and installing engine support	65
<b>2</b>	<b>Cylinder block (gearbox end)</b>	<b>67</b>
2.1	Assembly overview - cylinder block (gearbox end)	67
2.2	Removing and installing flywheel	70
2.3	Renewing cylinder block sealing cap (gearbox end)	71
2.4	Removing and installing sealing flange (gearbox end)	72
<b>3</b>	<b>Crankshaft</b>	<b>82</b>
3.1	Assembly overview - crankshaft	82
3.2	Allocation of main bearing shells	84
3.3	Crankshaft dimensions	85
3.4	Measuring axial clearance of crankshaft	85
3.5	Renewing needle bearing in crankshaft	86
3.6	Removing and installing crankshaft	88
<b>4</b>	<b>Pistons and conrods</b>	<b>90</b>
4.1	Assembly overview - pistons and conrods	90
4.2	Removing and installing pistons	94
4.3	Measuring piston projection at TDC	95
4.4	Checking pistons and cylinder bores	96
4.5	Separating parts of new conrod	98
4.6	Checking radial clearance of conrod bearings	99
<b>15</b>	<b>Cylinder head, valve gear</b>	<b>100</b>
<b>1</b>	<b>Toothed belt drive</b>	<b>100</b>
1.1	Assembly overview - toothed belt guard	100
1.2	Assembly overview - toothed belt	101
1.3	Removing and installing toothed belt guard	103
1.4	Detaching toothed belt from camshaft	107
1.5	Removing and installing toothed belt	112
<b>2</b>	<b>Cylinder head</b>	<b>122</b>
2.1	Assembly overview - cylinder head	122
2.2	Assembly overview - cylinder head cover	125
2.3	Removing and installing cylinder head cover	127
2.4	Removing and installing seals for injectors	128
2.5	Removing and installing cylinder head	129
2.6	Removing and installing camshaft housing	138
2.7	Checking compression	142
<b>3</b>	<b>Valve gear</b>	<b>144</b>
3.1	Assembly overview - valve gear	144
3.2	Removing and installing camshaft oil seal	148
3.3	Removing and installing valve stem oil seals	149
<b>4</b>	<b>Inlet and exhaust valves</b>	<b>159</b>
4.1	Checking valve guides	159
4.2	Checking valves	160
4.3	Valve dimensions	160
<b>17</b>	<b>Lubrication</b>	<b>161</b>
<b>1</b>	<b>Sump/oil pump</b>	<b>161</b>
1.1	Assembly overview - sump/oil pump	161
1.2	Engine oil	164
1.3	Removing and installing lower part of sump	164
1.4	Removing and installing upper part of sump	169
1.5	Removing and installing oil pump	175
1.6	Removing and installing oil level and oil temperature sender G266	176
<b>2</b>	<b>Engine oil cooler</b>	<b>178</b>

<b>3</b>	<b>Oil filter/oil pressure switches</b>	<b>179</b>
3.1	Assembly overview - oil filter	179
3.2	Assembly overview - oil pressure switches/oil pressure control	181
3.3	Removing and installing oil filter housing	182
3.4	Removing and installing oil pressure sender G10	187
3.5	Removing and installing valve for oil pressure control N428	189
3.6	Checking oil pressure	189
3.7	Removing and installing piston cooling jet control valve N522	190
<b>19</b>	<b>Cooling</b>	<b>191</b>
<b>1</b>	<b>Cooling system/coolant</b>	<b>191</b>
1.1	Connection diagram - coolant hoses	191
1.2	Checking cooling system for leaks	195
1.3	Draining and filling cooling system	198
1.4	Checking filling quality of cooling system	213
1.5	Flushing cooling system	215
1.6	Renewing sealing cap	235
<b>2</b>	<b>Coolant pump/thermostat assembly</b>	<b>236</b>
2.1	Assembly overview - coolant pump/thermostat	236
2.2	Assembly overview - electric coolant pump	238
2.3	Assembly overview - coolant temperature senders	238
2.4	Removing and installing electric coolant pump	240
2.5	Removing and installing coolant pump	244
2.6	Removing and installing coolant valve for cylinder head N489	246
2.7	Removing and installing coolant distribution module	247
2.8	Removing and installing coolant temperature sender G62	248
2.9	Removing and installing temperature sender for engine temperature regulation G694	249
2.10	Removing and installing coolant temperature sender 2 G802	251
<b>3</b>	<b>Coolant pipes</b>	<b>253</b>
3.1	Assembly overview - coolant pipes	253
3.2	Removing and installing coolant pipes	254
<b>4</b>	<b>Radiator/radiator fan</b>	<b>259</b>
4.1	Assembly overview - radiator/radiator fan	259
4.2	Assembly overview - radiator cowl and radiator fans	261
4.3	Assembly overview - radiator blind	263
4.4	Removing and installing radiator	266
4.5	Removing and installing water radiator for charge air cooling circuit	269
4.6	Removing and installing radiator cowl	271
4.7	Removing and installing radiator fan V7	272
4.8	Removing and installing radiator fan 2 V177	272
4.9	Removing and installing radiator blind	273
4.10	Removing and installing radiator blind control motor (top)	274
4.11	Removing and installing radiator blind control motor (bottom)	275
<b>21</b>	<b>Turbocharging/supercharging</b>	<b>277</b>
<b>1</b>	<b>Turbocharger</b>	<b>277</b>
1.1	Assembly overview - turbocharger	277
1.2	Removing and installing turbocharger	279
<b>2</b>	<b>Charge air system</b>	<b>283</b>
2.1	Assembly overview - charge air system	283
2.2	Assembly overview - hose connections for charge air system	285
2.3	Removing and installing charge pressure sender G31	286
2.4	Removing and installing charge air temperature sender	287
2.5	Removing and installing air intake pipe	287
2.6	Checking charge air system for leaks	289



2.7	Checking charge air cooler for leaks	291
<b>23</b>	<b>Mixture preparation - injection</b>	<b>296</b>
<b>1</b>	<b>Injection system</b>	<b>296</b>
1.1	Overview - fuel system	296
1.2	Overview of fitting locations - injection system	297
1.3	Filling and bleeding fuel system	304
1.4	Checking fuel system for leaks	305
<b>2</b>	<b>Air filter</b>	<b>306</b>
2.1	Assembly overview - air filter housing	306
2.2	Removing and installing air filter housing	308
2.3	Removing and installing air duct at lock carrier	309
<b>3</b>	<b>Intake manifold</b>	<b>310</b>
3.1	Assembly overview - intake manifold	310
3.2	Removing and installing throttle valve module GX3	312
3.3	Removing and installing intake manifold	314
<b>4</b>	<b>Injectors/high-pressure reservoir (rail)</b>	<b>320</b>
4.1	Assembly overview - injectors	320
4.2	Assembly overview - high-pressure reservoir (rail)	322
4.3	Checking injectors	324
4.4	Performing adaptation of correction values for injectors	324
4.5	Checking return flow rate of injectors with engine running	325
4.6	Checking return flow rate of injectors at starter cranking speed	328
4.7	Checking for injectors sticking open	329
4.8	Removing and installing injectors	331
4.9	Removing and installing high-pressure pipes	335
4.10	Removing and installing high-pressure reservoir (rail)	338
<b>5</b>	<b>High-pressure pump</b>	<b>341</b>
5.1	Assembly overview - high-pressure pump	341
5.2	Removing and installing high-pressure pump	342
<b>6</b>	<b>Senders and sensors</b>	<b>347</b>
6.1	Removing and installing air mass meter G70	347
6.2	Removing and installing fuel pressure sender G247	348
6.3	Removing and installing pressure differential sender G505	350
6.4	Removing and installing temperature and pressure sender for low-pressure fuel system GX20	351
6.5	Checking fuel pressure regulating valve N276	352
6.6	Removing and installing fuel pressure regulating valve N276	354
<b>7</b>	<b>Lambda probe</b>	<b>357</b>
7.1	Assembly overview - Lambda probe	357
7.2	Removing and installing Lambda probe	359
7.3	Removing and installing NOx senders	361
7.4	Removing and installing particulate sensor G784	365
<b>8</b>	<b>Engine control unit</b>	<b>368</b>
8.1	Assembly overview - engine control unit	368
8.2	Removing and installing engine control unit J623	369
<b>26</b>	<b>Exhaust system</b>	<b>375</b>
<b>1</b>	<b>Exhaust pipes/silencers</b>	<b>375</b>
1.1	Assembly overview - silencer	375
1.2	Removing and installing silencer	380
1.3	Separating exhaust pipes/silencer	386
1.4	Stress-free alignment of exhaust system	387
1.5	Checking exhaust system for leaks	387
<b>2</b>	<b>Emission control system</b>	<b>388</b>

2.1	Assembly overview - emission control system	388
2.2	Removing and installing emission control module	392
2.3	Removing and installing exhaust flap control unit J883	398
2.4	Removing and installing ammonia traps	399
<b>3</b>	<b>SCR (selective catalytic reduction) system</b>	<b>405</b>
3.1	Assembly overview - reducing agent tank	405
3.2	Assembly overview - delivery unit for reducing agent	412
3.3	Assembly overview - injector for reducing agent	414
3.4	Assembly overview - reducing agent supply line	417
3.5	Disconnecting reducing agent supply line	419
3.6	Releasing pressure in SCR system	422
3.7	Draining reducing agent tank	423
3.8	Removing and installing filler pipe for reducing agent tank	427
3.9	Removing and installing reducing agent tank	435
3.10	Removing and installing delivery unit for reducing agent	443
3.11	Removing and installing injector for reducing agent N474	444
3.12	Removing and installing injector 2 for reducing agent N758	446
3.13	Removing and installing control unit for reducing agent heater J891	448
<b>4</b>	<b>Exhaust gas temperature regulation</b>	<b>450</b>
4.1	Assembly overview - exhaust gas temperature regulation	450
4.2	Removing and installing parts of exhaust gas temperature regulation	452
<b>5</b>	<b>Exhaust gas recirculation</b>	<b>457</b>
5.1	Assembly overview - exhaust gas recirculation system	457
5.2	Removing and installing exhaust gas recirculation valve 1 GX5	460
5.3	Removing and installing exhaust gas recirculation valve 2 GX6	461
5.4	Removing and installing exhaust gas recirculation temperature sensor 2 G690	462
5.5	Removing and installing exhaust gas recirculation cooler	463
5.6	Checking exhaust gas recirculation cooler for leaks	466
<b>28</b>	<b>Glow plug system</b>	<b>470</b>
<b>1</b>	<b>Glow plug system</b>	<b>470</b>
1.1	Assembly overview - glow plug system	470
1.2	Removing and installing glow plug	472
1.3	Removing and installing automatic glow period control unit J179	476
1.4	Removing and installing Hall sender G40	476
1.5	Removing and installing engine speed sender G28	477