

## 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 ignition system	4
<b>3 Repair instructions</b>	<b>5</b>
3.1 Rules for cleanliness	5
3.2 General notes	5
3.3 General repair instructions	6
3.4 Performing adaptations after renewing a component	7
3.5 Foreign material in engine	8
3.6 Cleaning engine	8
3.7 Contact corrosion	8
3.8 Routing and attachment of pipes, hoses and wiring	9
3.9 Installing radiators and condensers	9
3.10 Nuts, bolts	9
3.11 Identification plates	10
3.12 Use of impact wrenches	10
<b>10 - Removing and installing engine</b>	<b>12</b>
<b>1 Removing and installing engine</b>	<b>12</b>
1.1 Removing engine	12
1.2 Separating engine and gearbox	64
1.3 Securing engine to engine and gearbox support	67
1.4 Installing engine	69
<b>2 Assembly mountings</b>	<b>73</b>
2.1 Assembly overview - assembly mountings	73
2.2 Supporting engine in installation position	75
2.3 Removing and installing engine mountings	82
2.4 Removing and installing gearbox mounting	84
2.5 Removing and installing pendulum support	88
2.6 Checking adjustment of assembly mountings	89
2.7 Adjusting assembly mountings	89
<b>3 Engine cover panel</b>	<b>94</b>
3.1 Removing and installing engine cover panel	94
<b>13 - Crankshaft group</b>	<b>95</b>
<b>1 Cylinder block (pulley end)</b>	<b>95</b>
1.1 Assembly overview - cylinder block (pulley end)	95
1.2 Removing and installing poly V-belt	98
1.3 Removing and installing poly V-belt tensioner	101
1.4 Bringing poly V-belt tensioner into assembly position	102
1.5 Removing and installing vibration damper	103
1.6 Removing and installing bracket for ancillaries	115
1.7 Removing and installing engine support	117
<b>2 Cylinder block (gearbox end)</b>	<b>120</b>
2.1 Assembly overview - cylinder block (gearbox end)	120

2.2	Removing and installing flywheel	121
2.3	Removing and installing sealing flange (gearbox end)	123
<b>3</b>	<b>Crankshaft</b>	<b>126</b>
3.1	Assembly overview - crankshaft	126
3.2	Crankshaft dimensions	129
3.3	Allocation of main bearing shells	129
3.4	Renewing needle bearing in crankshaft	130
3.5	Measuring axial clearance of crankshaft	132
3.6	Measuring radial clearance of crankshaft	133
3.7	Removing and installing crankshaft	134
3.8	Removing and installing sender wheel	135
<b>4</b>	<b>Balance shaft</b>	<b>137</b>
4.1	Assembly overview - balance shaft	137
4.2	Removing and installing balance shaft	139
4.3	Renewing oil seal for balance shaft (inlet side)	142
<b>5</b>	<b>Pistons and conrods</b>	<b>145</b>
5.1	Assembly overview - pistons and conrods	145
5.2	Removing and installing pistons	149
5.3	Removing and installing oil spray jets	150
5.4	Checking pistons and cylinder bores	153
5.5	Separating parts of new conrod	154
5.6	Checking radial clearance of conrod bearings	154
<b>15</b>	<b>Cylinder head, valve gear</b>	<b>156</b>
<b>1</b>	<b>Timing chain cover</b>	<b>156</b>
1.1	Assembly overview - timing chain cover	156
1.2	Removing and installing timing chain cover	159
1.3	Renewing oil seal for vibration damper	162
<b>2</b>	<b>Chain drive</b>	<b>165</b>
2.1	Assembly overview - camshaft timing chains	165
2.2	Assembly overview - drive chain for balance shaft	167
2.3	Removing and installing bearing saddle	169
2.4	Removing and installing camshaft timing chain	174
2.5	Checking chain elongation	183
2.6	Removing and installing drive chain for balance shaft	184
<b>3</b>	<b>Cylinder head</b>	<b>188</b>
3.1	Assembly overview - cylinder head	188
3.2	Removing and installing cylinder head	192
3.3	Removing and installing vacuum pump	201
3.4	Checking compression	201
<b>4</b>	<b>Valve gear</b>	<b>204</b>
4.1	Assembly overview - valve gear	204
4.2	Removing and installing camshaft	208
4.3	Installing ball for slider	215
4.4	Removing and installing cam adjustment actuators	216
4.5	Removing and installing camshaft control valves N205 / N318	217
4.6	Removing and installing valve stem oil seals	218
<b>5</b>	<b>Inlet and exhaust valves</b>	<b>227</b>
5.1	Checking valve guides	227
5.2	Checking valves	228
5.3	Valve dimensions	228
<b>17</b>	<b>Lubrication</b>	<b>229</b>
<b>1</b>	<b>Sump/oil pump</b>	<b>229</b>
1.1	Assembly overview - sump/oil pump	229

1.2	Engine oil	231
1.3	Removing and installing lower part of sump	232
1.4	Removing and installing oil pump	233
1.5	Removing and installing upper part of sump	234
1.6	Removing and installing oil level and oil temperature sender G266	238
<b>2</b>	<b>Engine oil cooler</b>	<b>239</b>
2.1	Assembly overview - engine oil cooler	239
2.2	Removing and installing engine oil cooler	239
2.3	Removing and installing mechanical switching valve	240
<b>3</b>	<b>Crankcase breather</b>	<b>241</b>
3.1	Assembly overview - crankcase breather system	241
3.2	Removing and installing oil separator	242
3.3	Removing and installing tank breather pressure sensor 1 G950	243
<b>4</b>	<b>Oil filter/oil pressure switches</b>	<b>244</b>
4.1	Assembly overview - oil filter	244
4.2	Assembly overview - oil pressure switches/oil pressure control	245
4.3	Removing and installing oil pressure switch F22	247
4.4	Removing and installing oil pressure switch for reduced oil pressure F378	247
4.5	Removing and installing stage 2 oil pressure switch F446	247
4.6	Removing and installing valve for oil pressure control N428	248
4.7	Removing and installing piston cooling jet control valve N522	249
4.8	Checking oil pressure	249
<b>19</b>	<b>Cooling</b>	<b>253</b>
<b>1</b>	<b>Cooling system/coolant</b>	<b>253</b>
1.1	Connection diagram - coolant hoses	253
1.2	Checking cooling system for leaks	254
1.3	Draining and filling cooling system	257
<b>2</b>	<b>Coolant pump/thermostat assembly</b>	<b>266</b>
2.1	Assembly overview - coolant pump/thermostat	266
2.2	Assembly overview - electric coolant pump	268
2.3	Assembly overview - coolant valves	269
2.4	Assembly overview - coolant temperature senders	270
2.5	Removing and installing electric coolant pump	271
2.6	Removing and installing coolant pump	274
2.7	Removing and installing toothed belt for coolant pump	275
2.8	Removing and installing actuator for engine temperature regulation N493	277
2.9	Removing and installing coolant temperature sender G62	279
2.10	Removing and installing radiator outlet coolant temperature sender G83	281
2.11	Removing and installing coolant valves	282
<b>3</b>	<b>Coolant pipes</b>	<b>284</b>
3.1	Assembly overview - coolant pipes	284
3.2	Removing and installing coolant pipes	285
<b>4</b>	<b>Radiator/radiator fan</b>	<b>289</b>
4.1	Assembly overview - radiator/radiator fan	289
4.2	Assembly overview - radiator cowl and radiator fan	292
4.3	Assembly overview - radiator blind	292
4.4	Removing and installing radiator	294
4.5	Removing and installing radiator cowl	297
4.6	Removing and installing radiator fan	301
4.7	Removing and installing radiator blind	302
4.8	Removing and installing radiator blind control motor (top)	303
4.9	Removing and installing radiator blind control motor (bottom)	303
<b>21</b>	<b>Turbocharging/supercharging</b>	<b>305</b>



<b>1</b>	<b>Turbocharger</b> .....	<b>305</b>
1.1	Assembly overview - turbocharger .....	305
1.2	Removing and installing turbocharger .....	309
1.3	Removing and installing turbocharger air recirculation valve N249 .....	321
1.4	Removing and installing charge pressure control module GX34 .....	321
<b>2</b>	<b>Charge air system</b> .....	<b>324</b>
2.1	Assembly overview - charge air system .....	324
2.2	Assembly overview - hose connections for charge air system .....	328
2.3	Removing and installing charge air cooler .....	329
2.4	Removing and installing charge pressure sender G31 .....	331
2.5	Removing and installing air intake pipe .....	332
2.6	Checking charge air system for leaks .....	335
<b>24</b>	<b>Mixture preparation - injection</b> .....	<b>338</b>
<b>1</b>	<b>Injection system</b> .....	<b>338</b>
1.1	Overview of fitting locations - injection system .....	338
<b>2</b>	<b>Vacuum system</b> .....	<b>346</b>
2.1	Connection diagram - vacuum system .....	346
2.2	Checking vacuum system .....	346
<b>3</b>	<b>Air filter</b> .....	<b>348</b>
3.1	Assembly overview - air filter housing .....	348
3.2	Removing and installing air filter housing .....	351
3.3	Removing and installing air duct at lock carrier .....	352
<b>4</b>	<b>Intake manifold</b> .....	<b>354</b>
4.1	Assembly overview - intake manifold .....	354
4.2	Removing and installing intake manifold .....	356
4.3	Removing and installing throttle valve module GX3 .....	359
4.4	Cleaning throttle valve module GX3 .....	360
4.5	Removing and installing intake manifold flap valve N316 .....	361
4.6	Checking intake manifold change-over function .....	361
<b>5</b>	<b>Injectors</b> .....	<b>364</b>
5.1	Assembly overview - fuel rail with injectors .....	364
5.2	Removing and installing fuel rail .....	365
5.3	Removing and installing injectors .....	366
5.4	Cleaning injectors .....	371
<b>6</b>	<b>Senders and sensors</b> .....	<b>373</b>
6.1	Assembly overview - actuator for structure-borne sound and control unit for structure-borne sound .....	373
6.2	Removing and installing control unit for structure-borne sound J869 and actuator for structure-borne sound R214 .....	374
6.3	Removing and installing intake manifold pressure sender G71 .....	374
6.4	Removing and installing fuel pressure sender G247 .....	375
6.5	Checking fuel pressure sender G247 .....	376
6.6	Removing and installing pressure differential sender for particulate filter G1037 .....	378
<b>7</b>	<b>High-pressure pump</b> .....	<b>380</b>
7.1	Assembly overview - high-pressure pump .....	380
7.2	Removing and installing high-pressure pump .....	382
7.3	Removing and installing high-pressure pipe .....	385
<b>8</b>	<b>Lambda probe</b> .....	<b>387</b>
8.1	Assembly overview - Lambda probe .....	387
8.2	Removing and installing Lambda probe .....	389
<b>9</b>	<b>Engine control unit</b> .....	<b>391</b>
9.1	Assembly overview - engine control unit .....	391
9.2	Removing and installing engine control unit J623 .....	392

<b>26 - Exhaust system</b>	<b>396</b>
<b>1 Exhaust pipes/silencers</b>	<b>396</b>
1.1 Assembly overview - silencer	396
1.2 Separating exhaust pipes/silencers	405
1.3 Removing and installing silencers	408
1.4 Stress-free alignment of exhaust system	411
1.5 Checking exhaust system for leaks	411
<b>2 Emission control system</b>	<b>412</b>
2.1 Assembly overview - emission control system	412
2.2 Removing and installing catalytic converter	414
2.3 Removing and installing particulate filter	423
<b>3 Exhaust gas temperature regulation</b>	<b>424</b>
3.1 Assembly overview - exhaust gas temperature regulation	424
3.2 Removing and installing parts of exhaust gas temperature regulation	426
<b>4 Secondary air system</b>	<b>429</b>
4.1 Assembly overview - secondary air system	429
4.2 Removing and installing secondary air pump motor V101	431
4.3 Removing and installing secondary air inlet valve N112	431
4.4 Removing and installing sender 1 for secondary air pressure G609	432
<b>28 - Ignition system</b>	<b>433</b>
<b>1 Ignition system</b>	<b>433</b>
1.1 Assembly overview - ignition system	433
1.2 Removing and installing ignition coils	435
1.3 Removing and installing knock sensor 1 G61	437
1.4 Removing and installing Hall senders	438
1.5 Removing and installing engine speed sender G28	439