

## 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
2.7 Safety precautions when working on the subframe	4
<b>3 Repair instructions</b>	<b>5</b>
3.1 Rules for cleanliness	5
3.2 Foreign material in engine	5
3.3 Contact corrosion	5
3.4 Routing and attachment of pipes, hoses and wiring	6
3.5 Installing radiators and condensers	6
3.6 Nuts, bolts	6
3.7 Identification plates	6
3.8 Use of impact wrenches	7
<b>10 - Removing and installing engine</b>	<b>8</b>
<b>1 Removing and installing engine</b>	<b>8</b>
1.1 Removing engine	8
1.2 Securing engine to engine and gearbox support	8
1.3 Installing engine	9
<b>2 Assembly mountings</b>	<b>10</b>
<b>3 Engine cover panel</b>	<b>11</b>
3.1 Removing and installing engine cover panel	11
<b>13 - Crankshaft group</b>	<b>13</b>
<b>1 Cylinder block (pulley end)</b>	<b>13</b>
1.1 Assembly overview - cylinder block (pulley end)	13
1.2 Removing and installing poly V-belt	20
1.3 Removing and installing poly V-belt tensioner	23
1.4 Removing and installing vibration damper	24
1.5 Removing and installing bracket for ancillaries	32
<b>2 Cylinder block (gearbox end)</b>	<b>34</b>
2.1 Assembly overview - cylinder block (gearbox end)	34
2.2 Removing and installing drive plate	36
2.3 Removing and installing sealing flange (gearbox end)	37
2.4 Renewing needle bearing in drive plate	45
<b>3 Crankshaft</b>	<b>48</b>
3.1 Assembly overview - crankshaft	48
3.2 Crankshaft dimensions	51
3.3 Allocation of main bearing shells	51
3.4 Measuring axial clearance of crankshaft	53
3.5 Measuring radial clearance of crankshaft	54
3.6 Removing and installing sender wheel	54
<b>4 Balance shaft</b>	<b>56</b>
4.1 Assembly overview - balance shaft	56
4.2 Removing and installing balance shaft	57



4.3	Renewing oil seal for balance shaft (inlet side)	64
<b>5</b>	<b>Pistons and conrods</b>	<b>67</b>
5.1	Assembly overview - pistons and conrods	67
5.2	Removing and installing pistons	71
5.3	Removing and installing oil spray jets	73
5.4	Checking pistons and cylinder bores	74
5.5	Separating parts of new conrod	77
5.6	Checking radial clearance of conrod bearings	78
<b>15</b>	<b>- Cylinder head, valve gear</b>	<b>79</b>
<b>1</b>	<b>Timing chain cover</b>	<b>79</b>
1.1	Assembly overview - timing chain cover	79
1.2	Removing and installing timing chain cover	82
1.3	Renewing oil seal for vibration damper	87
<b>2</b>	<b>Chain drive</b>	<b>90</b>
2.1	Assembly overview - camshaft timing chains	90
2.2	Assembly overview - drive chain for balance shaft	92
2.3	Removing and installing bearing saddle	95
2.4	Removing camshaft timing chain from camshafts	101
2.5	Removing and installing camshaft timing chain	113
2.6	Removing and installing drive chain for balance shaft	127
2.7	Checking timing chain	130
2.8	Checking valve timing	133
<b>3</b>	<b>Cylinder head</b>	<b>138</b>
3.1	Assembly overview - cylinder head	138
3.2	Removing and installing cylinder head	142
3.3	Removing and installing non-return valve	152
3.4	Checking compression	152
<b>4</b>	<b>Valve gear</b>	<b>155</b>
4.1	Assembly overview - valve gear	155
4.2	Removing and installing camshaft	160
4.3	Installing ball for slider	179
4.4	Removing and installing cam adjustment actuators	180
4.5	Removing and installing camshaft control valve 1 N205	181
4.6	Removing and installing valve stem oil seals	182
<b>5</b>	<b>Inlet and exhaust valves</b>	<b>194</b>
5.1	Checking valve guides	194
5.2	Checking valves	195
5.3	Valve dimensions	195
<b>17</b>	<b>- Lubrication</b>	<b>196</b>
<b>1</b>	<b>Sump/oil pump</b>	<b>196</b>
1.1	Assembly overview - sump/oil pump	196
1.2	Engine oil	199
1.3	Removing and installing lower part of sump	199
1.4	Removing and installing oil pump	202
1.5	Removing and installing upper part of sump	204
1.6	Removing and installing oil level and oil temperature sender G266	208
<b>2</b>	<b>Engine oil cooler</b>	<b>210</b>
2.1	Assembly overview - engine oil cooler	210
2.2	Removing and installing engine oil cooler	210
<b>3</b>	<b>Crankcase breather</b>	<b>212</b>
3.1	Assembly overview - crankcase breather system	212
3.2	Removing and installing oil separator	213

<b>4</b>	<b>Oil filter/oil pressure switches</b> .....	<b>216</b>
4.1	Assembly overview - oil filter .....	216
4.2	Assembly overview - oil pressure switches/oil pressure control .....	216
4.3	Removing and installing oil pressure switch F22 .....	217
4.4	Removing and installing oil pressure switch for reduced oil pressure F378 .....	219
4.5	Removing and installing valve for oil pressure control N428 .....	220
4.6	Checking oil pressure .....	221
<b>19</b>	<b>Cooling</b> .....	<b>223</b>
<b>1</b>	<b>Cooling system/coolant</b> .....	<b>223</b>
1.1	Connection diagram - coolant hoses .....	223
1.2	Checking cooling system for leaks .....	223
1.3	Draining and filling cooling system .....	228
<b>2</b>	<b>Coolant pump/thermostat assembly</b> .....	<b>231</b>
2.1	Assembly overview - coolant pump/thermostat .....	231
2.2	Assembly overview - electric coolant pump .....	234
2.3	Removing and installing electric coolant pump .....	234
2.4	Removing and installing coolant pump .....	234
2.5	Detaching and attaching coolant pump at thermostat housing .....	236
2.6	Removing and installing toothed belt for coolant pump .....	239
2.7	Removing and installing thermostat .....	240
2.8	Checking thermostat .....	241
2.9	Removing and installing coolant temperature sender G62 .....	241
2.10	Removing and installing coolant valves .....	242
<b>3</b>	<b>Coolant pipes</b> .....	<b>243</b>
<b>4</b>	<b>Radiator/radiator fans</b> .....	<b>244</b>
<b>21</b>	<b>Turbocharging/supercharging</b> .....	<b>245</b>
<b>1</b>	<b>Turbocharger</b> .....	<b>245</b>
1.1	Assembly overview - turbocharger .....	245
1.2	Removing and installing turbocharger .....	250
1.3	Checking vacuum unit for turbocharger .....	253
1.4	Renewing vacuum unit for turbocharger .....	255
1.5	Adjusting vacuum unit for turbocharger .....	256
<b>2</b>	<b>Charge air system</b> .....	<b>261</b>
2.1	Assembly overview - charge air system .....	261
2.2	Assembly overview - hose connections for charge air system .....	261
2.3	Removing and installing charge air cooler .....	263
2.4	Removing and installing charge pressure sender G31 .....	263
2.5	Checking charge air system for leaks .....	263
<b>24</b>	<b>Mixture preparation - injection</b> .....	<b>267</b>
<b>1</b>	<b>Injection system</b> .....	<b>267</b>
1.1	Overview of fitting locations - injection system .....	267
1.2	Checking fuel system for leaks .....	267
<b>2</b>	<b>Vacuum system</b> .....	<b>268</b>
2.1	Checking vacuum system .....	268
2.2	Checking dual non-return valve .....	268
<b>3</b>	<b>Air filter</b> .....	<b>271</b>
<b>4</b>	<b>Intake manifold</b> .....	<b>272</b>
4.1	Assembly overview - intake manifold .....	272
4.2	Removing and installing intake manifold .....	276
4.3	Removing and installing throttle valve module J338 .....	277
4.4	Cleaning throttle valve module .....	277



4.5	Checking intake manifold change-over function	278
<b>5</b>	<b>Injectors</b>	<b>281</b>
5.1	Assembly overview - fuel rail with injectors	281
5.2	Removing and installing fuel rail	285
5.3	Removing and installing injectors	286
5.4	Cleaning injectors	292
5.5	Removing and installing cold-start valve N17	293
<b>6</b>	<b>Senders and sensors</b>	<b>295</b>
6.1	Removing and installing intake air temperature sender G42	295
6.2	Removing and installing air mass meter G70	295
6.3	Removing and installing fuel pressure sender G247	296
6.4	Checking fuel pressure sender G247	299
<b>7</b>	<b>High-pressure pump</b>	<b>302</b>
7.1	Assembly overview - high-pressure pump	302
7.2	Removing and installing high-pressure pump	304
<b>8</b>	<b>Lambda probe</b>	<b>308</b>
8.1	Assembly overview - Lambda probe	308
8.2	Removing and installing Lambda probe	310
<b>9</b>	<b>Engine control unit</b>	<b>311</b>
9.1	Removing and installing engine control unit J623	311
9.2	Wiring and component check	311
<b>26</b>	<b>- Exhaust system</b>	<b>315</b>
<b>1</b>	<b>Exhaust pipes/silencers</b>	<b>315</b>
1.1	Assembly overview - silencers	315
1.2	Separating exhaust pipes/silencers	315
1.3	Removing and installing front silencers	315
1.4	Removing and installing silencers	315
1.5	Stress-free alignment of exhaust system	315
1.6	Checking exhaust system for leaks	315
<b>2</b>	<b>Emission control system</b>	<b>316</b>
2.1	Assembly overview - emission control system	316
2.2	Removing and installing catalytic converter	318
<b>3</b>	<b>Secondary air system</b>	<b>319</b>
<b>28</b>	<b>- Ignition system</b>	<b>320</b>
<b>1</b>	<b>Ignition system</b>	<b>320</b>
1.1	Assembly overview - ignition system	320
1.2	Removing and installing ignition coils with output stages	321
1.3	Removing and installing knock sensor 1 G61	324
1.4	Removing and installing Hall senders	324
1.5	Removing and installing engine speed sender G28	325