

## 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 Identification plates	5
3.2 Use of impact wrenches	5
3.3 Safety precautions when working on the subframe	6
3.4 Rules for cleanliness	6
3.5 Performing adaptations after renewing a component	7
3.6 Foreign material in engine	8
3.7 Cleaning engine	8
3.8 Contact corrosion	8
3.9 Routing and attachment of pipes, hoses and wiring	9
3.10 Installing radiators and condensers	9
3.11 Checking vacuum system	9
3.12 Nuts, bolts	10
<b>10 - Removing and installing engine</b>	<b>11</b>
<b>1 Removing and installing engine</b>	<b>11</b>
1.1 Removing engine	11
1.2 Securing engine to engine and gearbox support	11
1.3 Installing engine	12
<b>2 Assembly mountings</b>	<b>13</b>
<b>3 Engine cover panel</b>	<b>14</b>
3.1 Removing and installing engine cover panel	14
<b>13 - Crankshaft group</b>	<b>15</b>
<b>1 Cylinder block (pulley end)</b>	<b>15</b>
1.1 Assembly overview - cylinder block (pulley end)	15
1.2 Removing and installing poly V-belt	22
1.3 Removing and installing poly V-belt tensioner	24
1.4 Removing and installing vibration damper	28
1.5 Removing and installing bracket for ancillaries	42
1.6 Removing and installing engine support	47
<b>2 Cylinder block (gearbox end)</b>	<b>48</b>
2.1 Assembly overview - cylinder block (gearbox end)	48
2.2 Removing and installing drive plate	50
2.3 Removing and installing sealing flange (gearbox end)	52
2.4 Renewing needle bearing in drive plate	56
<b>3 Crankshaft</b>	<b>58</b>
3.1 Assembly overview - crankshaft	58
3.2 Crankshaft dimensions	61
3.3 Allocation of main bearing shells	61
3.4 Measuring axial clearance of crankshaft	63
3.5 Measuring radial clearance of crankshaft	64



3.6	Removing and installing sender wheel	64
<b>4</b>	<b>Balance shaft</b>	<b>66</b>
4.1	Assembly overview - balance shaft	66
4.2	Removing and installing balance shaft	69
4.3	Renewing oil seal for balance shaft (inlet side)	74
<b>5</b>	<b>Pistons and conrods</b>	<b>76</b>
5.1	Assembly overview - pistons and conrods	76
5.2	Removing and installing pistons	80
5.3	Removing and installing oil spray jets	82
5.4	Checking pistons and cylinder bores	85
5.5	Separating parts of new conrod	86
5.6	Checking radial clearance of conrod bearings	87
<b>15</b>	<b>Cylinder head, valve gear</b>	<b>88</b>
<b>1</b>	<b>Timing chain cover</b>	<b>88</b>
1.1	Assembly overview - timing chain cover	88
1.2	Removing and installing timing chain cover	91
1.3	Renewing oil seal for vibration damper	97
<b>2</b>	<b>Chain drive</b>	<b>100</b>
2.1	Assembly overview - camshaft timing chains	100
2.2	Assembly overview - drive chain for balance shaft	103
2.3	Removing and installing bearing saddle	106
2.4	Removing and installing camshaft timing chain	111
2.5	Checking chain elongation	126
2.6	Removing and installing drive chain for balance shaft	127
2.7	Checking valve timing	131
<b>3</b>	<b>Cylinder head</b>	<b>135</b>
3.1	Assembly overview - cylinder head	135
3.2	Removing and installing cylinder head	140
3.3	Checking compression	149
<b>4</b>	<b>Valve gear</b>	<b>152</b>
4.1	Assembly overview - valve gear	152
4.2	Removing and installing camshaft	157
4.3	Installing ball for slider	168
4.4	Removing and installing cam adjustment actuators	169
4.5	Removing and installing camshaft control valve 1 N205	170
4.6	Removing and installing valve stem oil seals	171
<b>5</b>	<b>Inlet and exhaust valves</b>	<b>184</b>
5.1	Checking valve guides	184
5.2	Checking valves	185
5.3	Valve dimensions	185
<b>17</b>	<b>Lubrication</b>	<b>186</b>
<b>1</b>	<b>Sump/oil pump</b>	<b>186</b>
1.1	Assembly overview - sump/oil pump	186
1.2	Engine oil	190
1.3	Removing and installing lower part of sump	190
1.4	Removing and installing oil pump	191
1.5	Removing and installing upper part of sump	193
1.6	Removing and installing oil level and oil temperature sender G266	198
<b>2</b>	<b>Engine oil cooler</b>	<b>199</b>
2.1	Assembly overview - engine oil cooler	199
2.2	Removing and installing engine oil cooler	200
2.3	Removing and installing mechanical switching valve	200

<b>3</b>	<b>Crankcase breather</b> .....	<b>202</b>
3.1	Assembly overview - crankcase breather system .....	202
3.2	Removing and installing oil separator .....	203
<b>4</b>	<b>Oil filter/oil pressure switches</b> .....	<b>205</b>
4.1	Assembly overview - oil filter .....	205
4.2	Assembly overview - oil pressure switches/oil pressure control .....	206
4.3	Removing and installing oil pressure switch F22 .....	210
4.4	Removing and installing oil pressure switch for reduced oil pressure F378 .....	211
4.5	Removing and installing stage 3 oil pressure switch F447 .....	211
4.6	Removing and installing valve for oil pressure control N428 .....	215
4.7	Removing and installing piston cooling jet control valve N522 .....	216
4.8	Checking oil pressure .....	218
<b>19</b>	<b>- Cooling</b> .....	<b>221</b>
<b>1</b>	<b>Cooling system/coolant</b> .....	<b>221</b>
1.1	Connection diagram - coolant hoses .....	221
1.2	Checking cooling system for leaks .....	221
1.3	Draining and filling cooling system .....	226
<b>2</b>	<b>Coolant pump/thermostat assembly</b> .....	<b>229</b>
2.1	Assembly overview - coolant pump/thermostat .....	229
2.2	Assembly overview - electric coolant pump .....	231
2.3	Assembly overview - coolant temperature senders .....	231
2.4	Removing and installing electric coolant pump .....	232
2.5	Removing and installing coolant pump .....	232
2.6	Removing and installing toothed belt for coolant pump .....	235
2.7	Removing and installing actuator for engine temperature regulation N493 .....	237
2.8	Removing and installing coolant temperature sender G62 .....	239
2.9	Removing and installing radiator outlet coolant temperature sender G83 .....	240
<b>3</b>	<b>Coolant pipes</b> .....	<b>242</b>
<b>4</b>	<b>Radiator/radiator fans</b> .....	<b>243</b>
<b>21</b>	<b>- Turbocharging/supercharging</b> .....	<b>244</b>
<b>1</b>	<b>Turbocharger</b> .....	<b>244</b>
1.1	Assembly overview - turbocharger .....	244
1.2	Removing and installing turbocharger .....	250
1.3	Removing and installing charge pressure positioner V465 .....	259
<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 .....	262
2.4	Removing and installing charge pressure sender G31 .....	262
2.5	Checking charge air system for leaks .....	262
<b>24</b>	<b>- Mixture preparation - injection</b> .....	<b>264</b>
<b>1</b>	<b>Injection system</b> .....	<b>264</b>
<b>2</b>	<b>Air filter</b> .....	<b>265</b>
<b>3</b>	<b>Intake manifold</b> .....	<b>266</b>
3.1	Assembly overview - intake manifold .....	266
3.2	Removing and installing intake manifold .....	269
3.3	Removing and installing throttle valve module GX3 .....	286
3.4	Cleaning throttle valve module GX3 .....	287
3.5	Removing and installing intake manifold flap valve N316 .....	288
3.6	Checking intake manifold change-over function .....	289
<b>4</b>	<b>Injectors</b> .....	<b>291</b>



4.1	Assembly overview - fuel rail with injectors	291
4.2	Removing and installing fuel rail	295
4.3	Removing and installing injectors	298
4.4	Cleaning injectors	313
<b>5</b>	<b>Gas injection valves</b>	<b>315</b>
<b>6</b>	<b>Gas pressure regulator</b>	<b>316</b>
<b>7</b>	<b>Senders and sensors</b>	<b>317</b>
7.1	Removing and installing intake air temperature sender G42/intake manifold pressure sender G71	317
7.2	Removing and installing air mass meter G70	317
7.3	Removing and installing fuel pressure sender G247	318
7.4	Checking fuel pressure sender G247	320
7.5	Removing and installing fuel pressure sender for low pressure G410	326
7.6	Removing and installing pressure differential sender for particulate filter G1037	327
<b>8</b>	<b>High-pressure pump</b>	<b>330</b>
8.1	Assembly overview - high-pressure pump	330
8.2	Removing and installing high-pressure pump	337
8.3	Removing and installing high-pressure pipe	341
<b>9</b>	<b>Lambda probe</b>	<b>344</b>
9.1	Assembly overview - Lambda probe	344
9.2	Removing and installing Lambda probe	347
<b>10</b>	<b>Engine control unit</b>	<b>351</b>
<b>26 - Exhaust system</b>		<b>352</b>
<b>1</b>	<b>Exhaust pipes/silencers</b>	<b>352</b>
1.1	Assembly overview - silencers	352
1.2	Separating exhaust pipes/silencers	352
1.3	Removing and installing front silencers	352
1.4	Stress-free alignment of exhaust system	352
1.5	Checking exhaust system for leaks	352
<b>2</b>	<b>Emission control system</b>	<b>353</b>
2.1	Assembly overview - emission control system	353
2.2	Removing and installing catalytic converter	357
2.3	Removing and installing particulate filter	361
<b>3</b>	<b>Exhaust gas temperature regulation</b>	<b>365</b>
3.1	Assembly overview - exhaust gas temperature regulation	365
3.2	Removing and installing parts of exhaust gas temperature regulation	366
<b>28 - Ignition system</b>		<b>371</b>
<b>1</b>	<b>Ignition system</b>	<b>371</b>
1.1	Assembly overview - ignition system	371
1.2	Removing and installing ignition coils	373
1.3	Removing and installing knock sensor 1 G61	376
1.4	Removing and installing Hall senders	377
1.5	Removing and installing engine speed sender G28	379