

## Contents

<b>00</b>	<b>Technical data</b> .....	<b>1</b>
1	<b>Engine number</b> .....	1
2	<b>Safety precautions</b> .....	2
2.1	Safety precautions when working on the fuel supply system .....	2
2.2	Safety precautions when working on the cooling system .....	2
2.3	Safety precautions when working on vehicles with start/stop system .....	3
2.4	Safety precautions when using testers and measuring instruments during a road test .....	3
2.5	Working on the exhaust system .....	3
2.6	Safety precautions when working on the ignition system .....	3
3	<b>General repair instructions</b> .....	5
3.1	Rules for cleanliness when working on fuel supply system, injection system and turbocharger .....	5
3.2	Checking fuel system for leaks .....	5
3.3	Foreign particles in engine .....	5
3.4	Contact corrosion .....	6
3.5	Routing and attachment of pipes, hoses and wiring .....	6
3.6	Checking vacuum system .....	6
3.7	Installing radiators, condensers and charge air coolers .....	7
<b>10</b>	<b>Removing and installing engine</b> .....	<b>8</b>
1	<b>Removing engine</b> .....	8
2	<b>Separating engine and dual clutch gearbox</b> .....	26
3	<b>Securing engine to engine and gearbox support</b> .....	29
4	<b>Installing engine</b> .....	31
5	<b>Assembly mountings</b> .....	35
5.1	Exploded view - assembly mountings .....	35
5.2	Supporting engine in installation position .....	36
5.3	Checking adjustment of assembly mountings (engine/gearbox mountings) .....	39
5.4	Adjusting assembly mountings .....	40
5.5	Removing and installing engine mountings .....	43
<b>13</b>	<b>Crankshaft group</b> .....	<b>47</b>
1	<b>Cylinder block (pulley end)</b> .....	47
1.1	Exploded view - poly V-belt drive, bracket for ancillaries .....	47
1.2	Removing and installing poly V-belt for air conditioner compressor .....	50
1.3	Removing and installing poly V-belt for alternator and coolant pump .....	51
1.4	Removing and installing poly V-belt tensioner for air conditioner compressor .....	52
1.5	Removing and installing poly V-belt tensioner for alternator and coolant pump .....	52
1.6	Removing and installing bracket for ancillaries .....	54
1.7	Removing and installing vibration damper .....	54
1.8	Exploded view - sealing flange (pulley end) .....	56
1.9	Renewing sealing flange (pulley end) .....	57
2	<b>Cylinder block (gearbox end)</b> .....	61
2.1	Exploded view - dual-mass flywheel .....	61
2.2	Removing and installing dual-mass flywheel .....	62
2.3	Checking sender wheel .....	63
2.4	Renewing crankshaft oil seal (gearbox end) .....	64
3	<b>Crankshaft</b> .....	67
3.1	Exploded view - crankshaft .....	67
3.2	Crankshaft dimensions .....	69
3.3	Renewing needle bearing in crankshaft .....	69
3.4	Measuring axial clearance of crankshaft .....	71

3.5	Measuring radial clearance of crankshaft .....	72
<b>4</b>	<b>Pistons and conrods .....</b>	<b>73</b>
4.1	Exploded view - pistons and conrods .....	73
4.2	Removing and installing pistons .....	74
4.3	Checking pistons and cylinder bores .....	76
4.4	Separating parts of new conrod .....	77
4.5	Checking radial clearance of conrod bearings .....	78
<b>15</b>	<b>- Cylinder head, valve gear .....</b>	<b>79</b>
<b>1</b>	<b>Chain drive .....</b>	<b>79</b>
1.1	Exploded view - timing chain covers .....	79
1.2	Removing and installing timing chain cover (top) .....	81
1.3	Renewing oil seal in timing chain cover (top) .....	84
1.4	Removing and installing timing chain cover (bottom) .....	85
1.5	Exploded view - camshaft timing chain .....	89
1.6	Removing and installing camshaft timing chain .....	90
1.7	Exploded view - drive chain for valve gear .....	97
1.8	Removing and installing drive chain for valve gear .....	98
<b>2</b>	<b>Cylinder head .....</b>	<b>101</b>
2.1	Exploded view - cylinder head cover and cylinder head .....	101
2.2	Removing and installing camshaft control valves N205 / N318 .....	104
2.3	Removing and installing cylinder head cover .....	104
2.4	Removing and installing cylinder head .....	106
2.5	Checking compression .....	114
<b>3</b>	<b>Valve gear .....</b>	<b>116</b>
3.1	Exploded view - valve gear .....	116
3.2	Measuring axial clearance of camshafts .....	119
3.3	Measuring radial clearance of camshafts .....	120
3.4	Removing and installing camshafts .....	120
3.5	Renewing valve stem oil seals with cylinder head installed .....	124
3.6	Renewing valve stem oil seals with cylinder head removed .....	128
3.7	Checking hydraulic compensation elements .....	131
3.8	Valve dimensions .....	133
3.9	Checking valve guides .....	133
3.10	Checking valves .....	134
<b>17</b>	<b>- Lubrication .....</b>	<b>135</b>
<b>1</b>	<b>Sump and oil pump .....</b>	<b>135</b>
1.1	Exploded view - sump (bottom section), sump (top section), oil pump .....	135
1.2	Removing and installing oil level and oil temperature sender G266 .....	139
1.3	Removing and installing sump (bottom section) .....	139
1.4	Removing and installing sump (top section) .....	141
1.5	Removing and installing oil pump .....	147
<b>2</b>	<b>Oil filter bracket and engine oil cooler .....</b>	<b>153</b>
2.1	Exploded view - oil filter bracket and engine oil cooler .....	153
2.2	Removing and installing engine oil cooler .....	155
2.3	Removing and installing oil filter bracket with engine oil cooler .....	155
2.4	Removing and installing oil pressure switch F22 .....	157
2.5	Removing and installing oil pressure switch for reduced oil pressure F378 .....	159
2.6	Checking oil pressure .....	159
2.7	Removing and installing valve for oil pressure control N428 .....	160
2.8	Engine oil .....	162
2.9	Checking oil level .....	162
<b>19</b>	<b>- Cooling .....</b>	<b>163</b>

<b>1</b>	<b>Cooling system</b>	<b>163</b>
1.1	Connection diagram - coolant hoses	163
1.2	Draining and filling cooling system	165
1.3	Checking cooling system for leaks	170
<b>2</b>	<b>Coolant pump and thermostat</b>	<b>172</b>
2.1	Exploded view - coolant pump and thermostat with housing	172
2.2	Removing and installing continued coolant circulation pump V51	173
2.3	Removing and installing solenoid valve for coolant circuit N492	175
2.4	Removing and installing coolant pump	176
2.5	Removing and installing thermostat with housing	178
2.6	Removing and installing coolant distributor housing	180
<b>3</b>	<b>Coolant pipes</b>	<b>182</b>
3.1	Exploded view - coolant pipes	182
3.2	Removing and installing coolant temperature sender G62	183
3.3	Removing and installing coolant pipe (left-side)	184
3.4	Removing and installing coolant pipes (right-side)	185
3.5	Removing and installing coolant pipes (front)	187
3.6	Removing and installing coolant pipe on gearbox	188
<b>4</b>	<b>Radiators and radiator fans</b>	<b>190</b>
4.1	Exploded view - radiator and radiator fans	190
4.2	Removing and installing radiator	192
4.3	Removing and installing auxiliary radiator	193
4.4	Removing and installing radiator cowl	195
4.5	Removing and installing radiator fans V7 / V177	197
<b>21</b>	<b>Turbocharging/supercharging</b>	<b>198</b>
<b>1</b>	<b>Turbocharger</b>	<b>198</b>
1.1	Exploded view - turbocharger	198
1.2	Removing and installing charge pressure sender G31 / intake air temperature sender 2 G299	202
1.3	Removing and installing turbocharger air recirculation valve N249	202
1.4	Removing and installing turbocharger	203
<b>2</b>	<b>Charge air cooler</b>	<b>208</b>
2.1	Exploded view - charge air cooler	208
2.2	Removing and installing charge air cooler	210
2.3	Checking charge air system for leaks	211
<b>24</b>	<b>Mixture preparation - injection</b>	<b>214</b>
<b>1</b>	<b>Injection system</b>	<b>214</b>
1.1	Overview of fitting locations	214
<b>2</b>	<b>Air cleaner</b>	<b>220</b>
2.1	Exploded view - air cleaner	220
2.2	Removing and installing air filter element	221
2.3	Removing and installing air cleaner housing	223
<b>3</b>	<b>Intake manifold, fuel rail and injectors</b>	<b>224</b>
3.1	Exploded view - intake manifold	224
3.2	Removing and installing intake air temperature sender G42 / intake manifold pressure sender G71	228
3.3	Removing and installing throttle valve module J338	228
3.4	Removing and installing intake manifold (top section)	230
3.5	Removing and installing intake manifold (bottom section) with fuel rail	232
3.6	Exploded view - fuel rail with injectors	234
3.7	Removing and installing injectors	236
3.8	Removing and installing fuel pressure sender G247	241
3.9	Removing and installing fuel pressure sender for low pressure G410	243



3.10	Checking fuel pressure and residual pressure (up to high-pressure pump)	243
<b>4</b>	<b>High-pressure pump</b>	<b>248</b>
4.1	Exploded view - high-pressure pump	248
4.2	Removing and installing high-pressure pump	249
4.3	Removing and installing high-pressure pipe	250
<b>5</b>	<b>Lambda probes</b>	<b>254</b>
5.1	Overview - Lambda probes	254
5.2	Removing and installing Lambda probe G39 with Lambda probe heater Z19	255
5.3	Removing and installing Lambda probe after catalytic converter G130 with Lambda probe 1 heater after catalytic converter Z29	256
<b>6</b>	<b>Engine control unit</b>	<b>259</b>
6.1	Wiring and component check with isolator boxes VAS 6606	259
6.2	Removing and installing engine/motor control unit J623	260
<b>26</b>	<b>- Exhaust system</b>	<b>264</b>
<b>1</b>	<b>Silencers</b>	<b>264</b>
1.1	Exploded view - silencers	264
1.2	Removing and installing starter catalytic converter	266
1.3	Removing and installing catalytic converters	267
1.4	Stress-free alignment of exhaust system	267
1.5	Checking exhaust system for leaks	268
<b>2</b>	<b>Exhaust manifold</b>	<b>269</b>
<b>3</b>	<b>Exhaust flap</b>	<b>270</b>
3.1	Checking vacuum unit for exhaust flap	270
<b>28</b>	<b>- Ignition system</b>	<b>271</b>
<b>1</b>	<b>Ignition system</b>	<b>271</b>
1.1	Exploded view - ignition system	271
1.2	Test data	272
1.3	Removing and installing ignition coils	272
1.4	Removing and installing knock sensors G61 / G66	274
1.5	Removing and installing Hall senders G40 / G300	275
1.6	Removing and installing engine speed sender G28	276