



## Contents

<b>00 - Technical data</b>	<b>1</b>
<b>1 Safety information</b>	<b>1</b>
1.1 Safety regulations for working on fuel supply	1
1.2 Safety measures when working on vehicles with a start/stop system	1
1.3 Safety precautions when using testing and measuring instruments during a road test	1
1.4 Safety precautions when working on ignition system	2
1.5 Safety precautions when working on the cooling system	2
<b>2 Identification</b>	<b>3</b>
2.1 Engine number/engine data	3
2.2 Numbering of cylinders	3
<b>3 Repair instructions</b>	<b>5</b>
3.1 Rules for cleanliness	5
3.2 Foreign objects in engine	5
3.3 Contact corrosion	5
3.4 Routing and attachment of lines	5
3.5 Fitting radiator and condensers	5
<b>10 - Removing and installing engine</b>	<b>7</b>
<b>1 Removing and installing engine</b>	<b>7</b>
1.1 Removing engine	7
1.2 Securing engine on engine and gearbox support VAS 6095	19
1.3 Installing engine	22
1.4 Separating engine and gearbox	24
<b>2 Assembly mountings</b>	<b>30</b>
2.1 Assembly overview - assembly mountings	30
2.2 Removing engine mounting (left-side)	30
2.3 Remove engine mounting (right-side)	33
<b>13 - Crankshaft group</b>	<b>37</b>
<b>1 Cylinder block (pulley end)</b>	<b>37</b>
1.1 Assembly overview - supercharger poly V-belt drive	37
1.2 Removing and installing supercharger poly V-belt	38
1.3 Removing and installing tensioning element for supercharger poly V-belt	39
1.4 Assembly overview - poly-V-belt drive for ancillary units	40
1.5 Removing and installing poly-V belt	42
1.6 Removing and installing tensioning element for poly V-belt	43
1.7 Removing and installing vibration damper	45
1.8 Renewing sealing flange with oil seal for crankshaft	45
<b>2 Cylinder block, gearbox end</b>	<b>50</b>
2.1 Assembly overview - drive plate	50
2.2 Removing and installing drive plate	50
2.3 Removing and installing sender wheel	51
2.4 Checking sender wheel	52
2.5 Renewing oil seal for crankshaft at gearbox end	52
<b>3 Crankshaft</b>	<b>55</b>
3.1 Assembly overview - crankshaft	55
3.2 Crankshaft dimensions	58
3.3 Measuring axial clearance of crankshaft	58
3.4 Measuring radial clearance of crankshaft	59
<b>4 Pistons and conrods</b>	<b>60</b>
4.1 Assembly overview - pistons and conrods	60
4.2 Piston and cylinder dimensions	63



4.3	Measuring radial clearance of conrods	63
<b>15</b>	<b>Cylinder head, valve gear</b>	<b>64</b>
<b>1</b>	<b>Cylinder head</b>	<b>64</b>
1.1	Assembly overview - cylinder head	64
1.2	Removing and installing left cylinder head cover	67
1.3	Removing and installing cylinder head cover (right side)	67
1.4	Removing and installing cylinder heads	69
1.5	Checking compression	75
<b>2</b>	<b>Chain drive</b>	<b>77</b>
2.1	Assembly overview - timing chain covers	77
2.2	Removing and installing timing chain cover (left and right)	80
2.3	Removing and installing timing chain cover (bottom)	83
2.4	Assembly overview - camshaft timing chains	87
2.5	Checking valve timing	89
2.6	Removing and installing camshaft adjuster	90
2.7	Removing and installing camshaft timing chains	100
2.8	Assembly overview - drive chain for valve gear	102
2.9	Removing and installing drive chain for valve gear	104
2.10	Assembly overview - drive chain for auxiliary drives	105
2.11	Removing and installing drive chain for auxiliary drives	106
2.12	Assembly overview - balance shaft	110
2.13	Removing and installing balance shaft	110
<b>3</b>	<b>Valve gear</b>	<b>113</b>
3.1	Assembly overview - valve gear	113
3.2	Checking axial clearance of camshafts	116
3.3	Measuring radial clearance of camshafts	116
3.4	Removing and installing camshafts	117
3.5	Checking hydraulic compensation elements	123
3.6	Renewing valve stem seals with cylinder head installed	125
3.7	Renewing valve stem seals with cylinder head removed	128
3.8	Valve dimensions	132
3.9	Checking valve guides	132
3.10	Checking valves	133
<b>17</b>	<b>Lubrication</b>	<b>134</b>
<b>1</b>	<b>Engine oil:</b>	<b>134</b>
1.1	Check engine oil level with oil gauge tester T40178	134
<b>2</b>	<b>Lower part of sump, upper part of sump, oil pump, engine oil cooler</b>	<b>136</b>
2.1	Assembly overview - lower part of sump, upper part of sump, oil pump, engine oil cooler	136
2.2	Removing and installing engine oil cooler	139
2.3	Removing and installing oil level and oil temperature sender G266	140
2.4	Removing and installing lower part of sump	141
2.5	Removing and installing oil pump	143
2.6	Removing and installing upper part of sump	144
<b>3</b>	<b>Oil filter housing, oil pressure switch</b>	<b>147</b>
3.1	Assembly overview – oil filter housing	147
3.2	Assembly overview - oil pressure switch for reduced oil pressure F378	148
3.3	Removing and installing oil filter housing	148
3.4	Checking oil pressure switch F22 / oil pressure switch for reduced oil pressure F378	150
3.5	Removing and installing oil pressure switch F22	150
3.6	Removing and installing oil pressure switch for reduced oil pressure F378	151
3.7	Removing and installing oil pressure regulating valve N428	153
3.8	Checking oil pressure	153



<b>4</b>	<b>Renewing oil non-return valve, oil separator</b>	<b>155</b>
4.1	Assembly overview - oil non-return valve, oil separator	155
4.2	Removing and installing pipes for crankcase breather system	156
4.3	Removing and installing cover with oil separator	156
<b>19</b>	<b>Cooling</b>	<b>158</b>
<b>1</b>	<b>Cooling system</b>	<b>158</b>
1.1	Coolant hose connection diagram	158
1.2	Cooling system - fitting locations	160
1.3	Assembly overviews - cooling system	161
<b>2</b>	<b>Coolant for high-temperature cooling circuit</b>	<b>164</b>
2.1	Drain coolant (high-temperature cooling circuit)	164
2.2	Drain cooling system (high-temperature cooling circuit)	165
2.3	Filling with coolant	166
2.4	Checking coolant for air bubbles (high-temperature cooling circuit)	170
2.5	Checking cooling system for leaks	171
<b>3</b>	<b>Coolant for low-temperature cooling circuit</b>	<b>174</b>
3.1	Draining and adding coolant	174
3.2	Checking cooling system for leaks	179
<b>4</b>	<b>Coolant pump, thermostat</b>	<b>182</b>
4.1	Assembly overview - coolant pump, thermostat, connections	182
4.2	Removing and installing coolant pump	183
4.3	Removing and installing thermostat	183
4.4	Checking thermostat	184
<b>5</b>	<b>Coolant pipes, coolant temperature sender G62 and electric coolant pump</b>	<b>185</b>
5.1	Assembly overview - coolant pipes	185
5.2	Removing and installing coolant temperature sender G62	188
5.3	Removing and installing front coolant pipe	189
5.4	Removing and installing front left coolant pipes	191
5.5	Removing and installing pipes for engine cooling system	193
5.6	Removing and installing rear left coolant pipe on gearbox	195
5.7	Removing and installing upper coolant pipe	196
5.8	Removing and installing coolant pipe on supercharger	197
5.9	Removing and installing electric coolant pump	199
<b>6</b>	<b>Radiator and radiator fans</b>	<b>200</b>
6.1	Assembly overview - radiator and radiator fan	200
6.2	Removing and installing radiator module	201
6.3	Removing and installing cooler for charge air cooling circuit	205
6.4	Removing and installing radiator cowl	207
6.5	Dismantling cooler module	208
<b>20</b>	<b>Fuel supply system</b>	<b>210</b>
<b>1</b>	<b>Parts of fuel supply system</b>	<b>210</b>
1.1	Rules for cleanliness	211
1.2	Assembly overview - fuel tank with attachments	211
1.3	Assembly overview - fuel delivery unit, fuel gauge sender and suction jet pumps	213
1.4	Removing, installing and renewing fuel filter	215
1.5	Emptying fuel tank	217
1.6	Removing and installing fuel gauge sender 2 G169 and suction-jet pump	219
1.7	Removing and installing fuel delivery unit and fuel gauge sender G	223
1.8	Removing and installing fuel tank with attached components	226
<b>2</b>	<b>Checking fuel pump</b>	<b>231</b>
2.1	Checking fuel pressure	231
2.2	Checking holding pressure	234
2.3	Checking fuel delivery rate	235



<b>3</b>	<b>Electronic power control (EPC)</b> .....	<b>240</b>
3.1	Assembly overview - accelerator .....	240
<b>4</b>	<b>Activated charcoal filter system</b> .....	<b>241</b>
4.1	Assembly overview - activated charcoal filter system .....	241
4.2	Checking fuel system for leaks .....	241
<b>21</b>	<b>Turbocharging/supercharging</b> .....	<b>244</b>
<b>1</b>	<b>Compressor</b> .....	<b>244</b>
1.1	Assembly overview - supercharger .....	244
1.2	Removing and installing charge pressure sender G31 and G447 .....	246
1.3	Removing and installing supercharger .....	248
1.4	Assembly overview - charge air cooler .....	252
1.5	For assembly work, secure supercharger on engine and gearbox support .....	253
1.6	For leak test, secure supercharger on engine and gearbox support .....	255
1.7	Removing and installing charge air cooler .....	256
1.8	Assembly overview - drive unit .....	260
1.9	Removing and installing ancillary drive unit and decoupling spring .....	260
1.10	Checking supercharger for leaks .....	262
<b>24</b>	<b>Mixture preparation - injection</b> .....	<b>265</b>
<b>1</b>	<b>Injection system</b> .....	<b>265</b>
1.1	Rules for cleanliness .....	265
1.2	Technical data .....	265
<b>2</b>	<b>Vacuum system</b> .....	<b>266</b>
2.1	Assembly overview – vacuum pump .....	266
2.2	Removing and installing vacuum pump .....	266
2.3	Checking vacuum system .....	267
2.4	Assembly overview - vacuum system .....	268
<b>3</b>	<b>Injectors</b> .....	<b>270</b>
3.1	Removing and installing injectors .....	270
<b>4</b>	<b>Air filter</b> .....	<b>274</b>
4.1	Assembly overview - air filter .....	274
4.2	Removing and installing air filter element .....	274
4.3	Removing and installing air filter housing .....	277
<b>5</b>	<b>Intake manifold</b> .....	<b>278</b>
5.1	Assembly overview - intake manifold lower part, fuel rail .....	278
5.2	Removing and installing lower part of intake manifold with fuel rail .....	280
5.3	Removing and installing vacuum servo element for actuating intake manifold flaps .....	283
5.4	Removing and installing throttle valve module J338 .....	284
5.5	Removing and installing regulating flap control unit J808 .....	286
<b>6</b>	<b>Senders and sensors</b> .....	<b>288</b>
6.1	Removing and installing intake air temperature sender G42 / intake manifold pressure sender G71 .....	288
<b>7</b>	<b>Engine control unit</b> .....	<b>289</b>
7.1	Removing and installing engine (motor) control unit J623 .....	289
<b>8</b>	<b>High-pressure pump</b> .....	<b>291</b>
8.1	Assembly overview - high-pressure pump .....	291
8.2	Removing and installing high-pressure pipe .....	292
8.3	Removing and installing high-pressure pump .....	295
<b>9</b>	<b>Lambda probes</b> .....	<b>298</b>
9.1	Assembly overview – lambda probes .....	298
9.2	Removing and installing Lambda probe G39 .....	299
9.3	Removing and installing Lambda probe after catalytic converter G130 .....	300
9.4	Removing and installing Lambda probe 2 G108 .....	302



9.5	Removing and installing Lambda probe 2 after catalytic converter G131	303
<b>26</b>	<b>- Exhaust system</b>	<b>306</b>
<b>1</b>	<b>Exhaust manifold</b>	<b>306</b>
1.1	Assembly overview - exhaust manifold	306
1.2	Removing and installing left exhaust manifold (bank 2)	307
1.3	Removing and installing right exhaust manifold (bank 1)	309
<b>2</b>	<b>Silencers and catalytic converters</b>	<b>311</b>
2.1	Assembly overview - catalytic converters and front silencers	311
2.2	Assembly overview - catalytic converter mountings	312
2.3	Assembly overview - centre and rear silencers	313
2.4	Removing and installing left catalytic converter (bank 2)	314
2.5	Removing and installing right catalytic converter (bank 1)	315
2.6	Separating centre and rear silencers	316
2.7	Aligning exhaust system free of stress	317
2.8	Renew and align exhaust pipes	318
2.9	Checking exhaust system for leaks	319
<b>3</b>	<b>Secondary air system</b>	<b>320</b>
3.1	Assembly overview - secondary air system	320
3.2	Removing and installing secondary air pump motor V101	322
3.3	Checking combination valves for secondary air system for proper operation and leakage	322
3.4	Removing and installing left combination valve for secondary air system	324
3.5	Removing and installing right combination valve for secondary air system	325
<b>28</b>	<b>- Ignition system</b>	<b>326</b>
<b>1</b>	<b>General notes and safety precautions</b>	<b>326</b>
1.1	General notes on ignition system	326
1.2	Safety precautions	326
<b>2</b>	<b>Repairing ignition system</b>	<b>327</b>
2.1	Assembly overview - ignition system	327
2.2	Removing and installing ignition coils with output stage	328
2.3	Removing and installing knock sensors G61 and G66	331
2.4	Removing and installing Hall senders G40 and G163	331
2.5	Removing and installing engine speed sender G28	332
2.6	Test data, spark plugs	333