



Contents

00 - Technical data	1
1 Safety information	1
1.1 Safety regulations for working on fuel supply	1
1.2 Safety measures when working on vehicles with start/stop system	1
1.3 Safety precautions when using testers and measuring instruments during a road test	2
1.4 Safety precautions when working on ignition system	2
1.5 Safety precautions when working on the cooling system	2
2 Identification	3
2.1 Engine number/engine data	3
2.2 Numbering of cylinders	4
3 Repair instructions	5
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	6
10 - Removing and installing engine	7
1 Removing and installing engine	7
1.1 Removing engine	7
1.2 Installing engine	20
1.3 Separating engine and gearbox	23
1.4 Securing engine on engine and gearbox support VAS 6095	29
1.5 Supporting engine in installation position	31
2 Assembly mountings	35
2.1 Assembly overview - assembly mountings	35
2.2 Removing engine mounting (left-side)	36
2.3 Remove engine mounting (right-side)	39
13 - Crankshaft group	43
1 Cylinder block - belt pulley end	43
1.1 Assembly overview - poly V-belt drive	43
1.2 Removing and installing poly-V belt	45
1.3 Removing and installing tensioning element for poly V-belt	45
1.4 Removing and installing bracket for alternator	46
1.5 Removing and installing vibration damper	46
1.6 Renewing crankshaft oil seal - belt pulley end	47
2 Cylinder block, gearbox end	49
2.1 Assembly overview - drive plate	49
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
3 Crankshaft	55
3.1 Assembly overview - crankshaft	55
3.2 Allocation of main bearing shells for new crankshaft	59
3.3 Allocation of main bearing shells for worn and re-machined crankshaft	60
3.4 Crankshaft dimensions	60
3.5 Measuring axial clearance of crankshaft	60
3.6 Measuring radial clearance of crankshaft	61
4 Pistons and conrods	63
4.1 Assembly overview - pistons and conrods	63



4.2	Piston and cylinder dimensions	66
4.3	Measuring radial clearance of conrods	66
15	Cylinder head, valve gear	67
1	Chain drive	67
1.1	Assembly overview - timing chain covers	67
1.2	Removing and installing timing chain cover (left)	69
1.3	Removing and installing timing chain cover (right)	71
1.4	Removing and installing timing chain cover (bottom)	74
1.5	Assembly overview - camshaft timing chains	78
1.6	Removing camshaft timing chains from camshafts	82
1.7	Removing and installing camshaft timing chains	89
1.8	Assembly overview - drive chain for valve gear	91
1.9	Removing and installing drive chain for valve gear	93
1.10	Assembly overview - drive chain for auxiliary drives	94
1.11	Removing and installing drive chain for auxiliary drives	95
1.12	Assembly overview - auxiliary drives	95
1.13	Renewing oil seal for vane pump drive	97
1.14	Renewing oil seal for air conditioning compressor drive	98
1.15	Removing and installing spur gear drive	100
2	Cylinder head	104
2.1	Assembly overview - cylinder head	104
2.2	Removing and installing cylinder head cover	107
2.3	Removing left cylinder head	109
2.4	Removing right cylinder head	110
2.5	Installing cylinder head	112
2.6	Checking compression	115
3	Valve gear	119
3.1	Assembly overview - valve gear	119
3.2	Measuring axial clearance of camshaft	122
3.3	Measuring radial clearance of camshafts	123
3.4	Removing and installing camshafts	123
3.5	Checking hydraulic compensation elements	132
3.6	Renewing valve stem seals with cylinder head installed	134
3.7	Renewing valve stem seals with cylinder head removed	137
3.8	Valve dimensions	141
3.9	Checking valve guides	141
3.10	Checking valves	142
17	Lubrication	143
1	Engine oil:	143
1.1	Check engine oil level with oil gauge tester T40178	143
2	Oil pump and lower part of sump	145
2.1	Assembly overview - oil pump and lower part of sump	145
2.2	Removing and installing oil level and oil temperature sender G266	148
2.3	Removing and installing lower part of sump	148
2.4	Removing and installing oil pump	151
3	Upper part of sump	153
3.1	Assembly overview - upper part of sump	153
3.2	Removing and installing oil pressure regulating valve N428	154
3.3	Removing and installing upper part of sump	154
4	Spray nozzle valve, oil pressure switch, oil filter housing, engine oil cooler	159
4.1	Assembly overview - spray nozzle valve and oil pressure switch F22	159
4.2	Removing and installing oil pressure switch F22	160
4.3	Removing and installing spray nozzle valve	161



4.4	Removing and installing hose for crankcase breather system	162
4.5	Assembly overview - oil filter housing and oil pressure switch for reduced oil pressure F378	163
4.6	Removing and installing oil filter housing	164
4.7	Removing and installing engine oil cooler	165
4.8	Checking oil pressure switch F22 / oil pressure switch for reduced oil pressure F378	166
4.9	Removing and installing oil pressure switch for reduced oil pressure F378	166
4.10	Checking oil pressure	168
19	- Cooling	170
1	Cooling system	170
1.1	Connection diagrams for coolant hoses	170
1.2	Draining coolant	171
1.3	Draining cooling system (vehicles with one heat exchanger)	173
1.4	Draining cooling system (vehicles with two heat exchangers)	175
1.5	Filling with coolant	176
1.6	Checking filling quality	180
1.7	Checking cooling system for leaks	181
2	Coolant pump and thermostat	184
2.1	Assembly overview - coolant pump and thermostat	184
2.2	Removing and installing coolant pump	185
2.3	Removing and installing map-controlled engine cooling thermostat F265	186
2.4	Thermostat opening data	187
3	Coolant pipes	188
3.1	Assembly overview - coolant pipes	188
3.2	Removing and installing coolant temperature sender G62	189
3.3	Removing and installing temperature sender for engine temperature regulation G694	191
3.4	Removing and installing front coolant pipe	191
3.5	Removing and installing right coolant pipe	192
3.6	Removing and installing left coolant pipe	193
3.7	Removing and installing coolant shut-off valve	196
3.8	Removing and installing coolant union	196
3.9	Removing and installing rear coolant pipe	197
4	Radiator and radiator fans	200
4.1	Assembly overview - radiator and radiator fan	200
4.2	Removing and installing radiator module	201
4.3	Removing and installing radiator cowl	205
4.4	Dismantling cooler module	206
20	- Fuel supply system	208
1	Safety precautions	208
1.1	Safety regulations for working on fuel supply	208
2	Parts of fuel supply system	209
2.1	Rules for cleanliness	210
2.2	Assembly overview - fuel tank with attachments	210
2.3	Assembly overview - fuel delivery unit, fuel gauge sender and suction jet pumps	212
2.4	Removing, installing and renewing fuel filter	214
2.5	Emptying fuel tank	216
2.6	Removing and installing fuel gauge sender 2 G169 and suction-jet pump	219
2.7	Removing and installing fuel delivery unit and fuel gauge sender G	223
2.8	Removing and installing fuel tank with attached components	226
3	Checking fuel pump	231
3.1	Checking fuel pressure	231
3.2	Checking holding pressure	235
3.3	Checking fuel delivery rate	236



4	Electronic power control (EPC)	241
4.1	Assembly overview - accelerator	241
5	Activated charcoal filter system	242
5.1	Assembly overview - activated charcoal filter system	242
5.2	Checking fuel system for leaks	242
24	Mixture preparation - injection	245
1	Injection system	245
1.1	Rules for cleanliness	245
1.2	Technical data	245
1.3	Assembly overview - connectors and senders at front of engine	246
2	Vacuum system	247
2.1	Assembly overview - vacuum hoses at front of engine	247
2.2	Assembly overview - vacuum hoses at rear of engine	248
2.3	Checking vacuum system	248
3	Injectors	250
3.1	Removing and installing injectors	250
4	Intake manifold	256
4.1	Assembly overview - intake manifold	256
4.2	Removing and installing intake manifold	257
4.3	Assembly overview - lower part of intake manifold with fuel rail	260
4.4	Removing and installing lower part of intake manifold with fuel rail	263
4.5	Removing and installing throttle valve module J338	266
5	Air filter	268
5.1	Assembly overview - air filter	268
5.2	Removing and installing air filter element	268
5.3	Removing and installing lower part of air filter	270
6	Senders and sensors	272
6.1	Removing and installing intake manifold pressure sender G71 with intake air temperature sender G42	272
6.2	Removing and installing fuel pressure sender G247	273
7	Engine control unit	275
7.1	Removing and installing engine (motor) control unit J623	275
8	High-pressure pump	277
8.1	Assembly overview - high-pressure pump	277
8.2	Removing and installing high-pressure pump	278
9	Lambda probes	281
9.1	Overview - Lambda probes	281
9.2	Removing and installing Lambda probe G39	282
9.3	Removing and installing Lambda probe 2 G108	283
9.4	Removing and installing Lambda probe after catalytic converter G130	285
9.5	Removing and installing Lambda probe 2 after catalytic converter G131	285
26	Exhaust system	287
1	Exhaust manifold	287
1.1	Assembly overview - exhaust manifold	287
1.2	Removing and installing left exhaust manifold	288
1.3	Removing and installing right exhaust manifold	289
2	Silencers and catalytic converters	291
2.1	Assembly overview - catalytic converters and front silencers	291
2.2	Assembly overview - catalytic converter mountings	292
2.3	Assembly overview - centre and rear silencers	293
2.4	Removing and installing left catalytic converter (bank 2)	294
2.5	Removing and installing right catalytic converter (bank 1)	296



2.6	Separating centre and rear silencers	298
2.7	Aligning exhaust system free of stress	299
2.8	Renewing and aligning exhaust pipes	300
2.9	Checking exhaust system for leaks	300
3	Secondary air system	301
3.1	Assembly overview - secondary air system	301
3.2	Checking combination valves for secondary air system for proper operation and leakage	303
3.3	Removing and installing combination valve for secondary air system	304
3.4	Removing and installing secondary air pump	304
3.5	Removing and installing sender 1 for secondary air pressure G609	305
28	- Ignition system	306
1	Ignition system	306
1.1	Safety precautions	306
1.2	Assembly overview - ignition system	306
1.3	Removing and installing ignition coils with output stage	308
1.4	Removing and installing knock sensors G61 , G66 , G198 , G199	310
1.5	Removing and installing Hall sender	311
1.6	Removing and installing engine speed sender G28	312
1.7	Test data, spark plugs	312