



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 a 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 the cooling system	2
1.5 Safety precautions when working on SCR system	2
1.6 Safety precautions when working on ignition system	3
1.7 Safety precautions when working on exhaust system	3
2 Identification	4
2.1 Engine number/engine data	4
3 Repair instructions	6
3.1 Rules for cleanliness	6
3.2 General information	6
3.3 General repair instructions	7
3.4 Foreign objects in engine	7
3.5 Contact corrosion	7
3.6 Routing and attachment of lines	8
3.7 Fitting radiator and condensers	8
3.8 Checking vacuum system	8
10 - Removing and installing engine	9
1 Removing and installing engine	9
1.1 Removing engine	9
1.2 Separating engine and gearbox	15
1.3 Securing engine on engine and gearbox support	18
1.4 Installing engine	20
2 Assembly mountings	23
2.1 Assembly overview - assembly mountings	23
2.2 Removing and installing engine mounting	25
2.3 Removing and installing gearbox mounting	26
2.4 Removing and installing pendulum support	27
2.5 Supporting engine in installation position	27
2.6 Adjusting assembly mountings	30
2.7 Checking adjustment of assembly mountings (engine and gearbox mountings)	33
13 - Crankshaft group	34
1 Cylinder block (pulley end)	34
1.1 Assembly overview - cylinder block (pulley end)	34
1.2 Assembly overview - sealing flange, belt pulley end	36
1.3 Removing and installing poly-V belt	37
1.4 Removing and installing tensioner for poly V-belt	38
1.5 Removing and installing vibration damper	39
1.6 Removing and installing bracket for ancillaries	40
1.7 Removing and installing engine support	41
1.8 Removing and installing sealing flange on pulley end	42
2 Cylinder block, gearbox end	45
2.1 Assembly overview - cylinder block, gearbox end	45
2.2 Removing and installing flywheel	46
2.3 Removing and installing sealing flange on gearbox side	47
3 Crankshaft	55
3.1 Assembly overview - crankshaft	55



3.2	Crankshaft dimensions	56
3.3	Renewing needle bearing in crankshaft	56
3.4	Measuring axial clearance of crankshaft	58
3.5	Measuring radial clearance of crankshaft	58
4	Pistons and conrods	60
4.1	Assembly overview - pistons and conrods	60
4.2	Removing and installing pistons	62
4.3	Measuring piston projection at TDC	63
4.4	Checking pistons and cylinder bores	65
4.5	Separating new conrod	66
4.6	Checking radial clearance of conrods	66
4.7	Removing and installing oil spray jets	67
15	Cylinder head, valve gear	69
1	Cylinder head	69
1.1	Assembly overview - cylinder head	69
1.2	Assembly overview - camshaft housing	71
1.3	Assembly overview - cylinder head cover	71
1.4	Removing and installing cylinder head	73
1.5	Removing and installing cylinder head cover	78
1.6	Removing and installing injector seals	80
1.7	Removing and installing camshaft housing	81
1.8	Checking compression	86
2	Toothed belt drive	88
2.1	Assembly overview - toothed belt cover	88
2.2	Assembly overview - toothed belt	89
2.3	Removing and installing toothed belt guard	90
2.4	Removing and installing toothed belt	93
2.5	Removing toothed belt from camshaft	103
3	Valve gear	108
3.1	Assembly overview - valve gear	108
3.2	Measuring axial play of camshaft	111
3.3	Removing and installing camshaft oil seal	111
3.4	Removing and installing camshaft adjuster	113
3.5	Removing and installing camshaft control valve 1 N205	116
3.6	Checking hydraulic compensation elements	116
3.7	Removing and installing valve stem seals	117
4	Inlet and exhaust valves	124
4.1	Checking valve guides	124
4.2	Checking valves	125
4.3	Valve dimensions	125
17	Lubrication	126
1	Sump, oil pump	126
1.1	Assembly overview - sump/oil pump	126
1.2	Engine oil:	127
1.3	Removing and installing sump	128
1.4	Removing and installing oil pump	130
1.5	Removing and installing oil level and oil temperature sender G266	131
2	Engine oil cooler	133
3	Oil filter, oil pressure switch	134
3.1	Assembly overview - oil filter housing, oil pressure switch	134
3.2	Removing and installing oil pressure switch F1	135
3.3	Removing and installing oil pressure switch for reduced oil pressure F378	137
3.4	Checking oil pressure	138



3.5	Removing and installing oil filter housing	138
3.6	Removing and installing oil pressure regulating valve N428	141
4	Oil circuit	143
4.1	Removing and installing oil supply line	143
4.2	Removing and installing oil return line for turbocharger	144
19	Cooling	146
1	Cooling system/coolant	146
1.1	Connection diagram - coolant hoses	146
1.2	Draining and adding coolant	150
1.3	Checking cooling system for leaks	155
2	Coolant pump, regulation of cooling system	157
2.1	Assembly overview - coolant pump, thermostat	157
2.2	Assembly overview - coolant temperature sender	161
2.3	Assembly overview - electric coolant pump	162
2.4	Removing and installing coolant pump	162
2.5	Removing and installing charge air cooling pump V188	163
2.6	Removing and installing auxiliary pump for heating V488	165
2.7	Removing and installing thermostat	167
2.8	Checking thermostat	170
2.9	Removing and installing coolant temperature sender G62	170
2.10	Removing and installing coolant valve for cylinder head N489	172
3	Coolant pipes	173
3.1	Assembly overview - coolant pipes	173
3.2	Removing and installing coolant pipes	174
4	Radiator, radiator fan	185
4.1	Assembly overview - radiator/radiator fan	185
4.2	Assembly overview - radiator cowl and radiator fan	187
4.3	Removing and installing radiator	188
4.4	Removing and installing radiator cowl with radiator fan	189
4.5	Removing and installing radiator fan V7	190
4.6	Removing and installing radiator fan 2 V177	191
4.7	Removing and installing auxiliary radiator	192
21	Turbocharging/supercharging	195
1	Turbocharger	195
1.1	Assembly overview - turbocharger	195
1.2	Removing and installing turbocharger	197
1.3	Renewing vacuum unit for turbocharger	199
2	Charge air system	203
2.1	Assembly overview - charge air system	203
2.2	Removing and installing charge air cooler	203
2.3	Removing and installing charge pressure sender G31	203
2.4	Removing and installing charge air temperature sender ahead of charge air cooler G810	204
2.5	Removing and installing charge air temperature sender after charge air cooler G811	205
2.6	Checking charge air system for leaks	205
2.7	Removing and installing charge air pipe	207
23	Mixture preparation - injection	208
1	Injection system	208
1.1	Schematic overview - fuel system	208
1.2	Filling/bleeding fuel system	209
1.3	Checking fuel system for leaks	209
2	Vacuum system	211



2.1	Connection diagram - vacuum system	211
3	Injectors/high-pressure accumulator (rail)	212
3.1	Assembly overview - injectors	212
3.2	Assembly overview - fuel rail	214
3.3	Adapting correction values for injectors	215
3.4	Checking return flow rate of injectors with engine running	215
3.5	Checking return flow rate of injectors at starter speed	218
3.6	Testing jammed-open injectors	219
3.7	Removing and installing injectors	221
3.8	Removing and installing high-pressure lines	225
3.9	Removing and installing fuel rail	230
4	Air filter	232
4.1	Assembly overview - air filter housing	232
4.2	Removing and installing air filter housing	233
4.3	Removing and installing air duct	234
5	Intake manifold	236
5.1	Assembly overview - intake manifold	236
5.2	Removing and installing intake manifold	238
5.3	Removing and installing throttle valve module GX3	241
6	Senders and sensors	244
6.1	Removing and installing fuel temperature sender G81	244
6.2	Removing and installing air mass meter G70	244
6.3	Removing and installing fuel pressure regulating valve N276	246
6.4	Checking fuel pressure regulating valve N276	248
6.5	Removing and installing fuel pressure sender G247	249
6.6	Removing and installing pressure differential sender G505	251
6.7	Removing and installing exhaust gas pressure sensor 1 G450	252
6.8	Removing and installing control unit for NOx sender J583 / NOx sender G295	254
6.9	Removing and installing control unit for NOx sender 2 J881 / NOx sender 2 G687	255
7	Engine control unit	257
7.1	Removing and installing engine (motor) control unit J623 with protective housing	257
8	High-pressure pump	260
8.1	Assembly overview - high-pressure pump	260
8.2	Removing and installing high-pressure pump	260
8.3	Checking high-pressure pump	263
9	Lambda probe	266
9.1	Assembly overview - Lambda probe	266
9.2	Removing and installing Lambda probe 1 before catalytic converter GX10	266
26	Exhaust system	268
1	Exhaust pipes and silencers	268
1.1	Assembly overview - silencers	268
1.2	Assembly overview - front exhaust pipe	269
1.3	Removing and installing front exhaust pipe	270
1.4	Separating exhaust pipes from silencers	272
1.5	Removing and installing rear silencer	274
1.6	Aligning exhaust system free of stress	275
1.7	Checking exhaust system for leaks	276
1.8	Installation position of clamp	276
2	Emission control	277
2.1	Assembly overview - emission control	277
2.2	Removing and installing particulate filter	281
2.3	Removing and installing emission control module	283
2.4	Removing and installing exhaust flap control unit J883	288



3	SCR system (selective catalytic reduction)	290
3.1	Assembly overview - tank for reducing agent	290
3.2	Assembly overview - delivery module for reducing agent	291
3.3	Assembly overview - injector for reducing agent	292
3.4	Draining reducing agent tank VX85	292
3.5	Removing and installing reducing agent tank VX85	295
3.6	Removing and installing delivery line	297
3.7	Removing and installing delivery unit for reducing agent metering system GX19	300
3.8	Removing and installing injector for reduction agent N474	302
3.9	Removing and installing control unit for reducing-agent heater J891	306
4	Exhaust gas temperature regulation	307
4.1	Assembly overview - exhaust gas temperature regulation	307
4.2	Removing and installing exhaust gas temperature sender 1 G235	308
4.3	Removing and installing exhaust gas temperature sender 2 G448	309
4.4	Removing and installing exhaust gas temperature sender 3 G495	310
4.5	Removing and installing exhaust gas temperature sender 4 G648	311
5	Exhaust gas recirculation	313
5.1	Assembly overview - exhaust gas recirculation	313
5.2	Assembly overview - exhaust gas recirculation valve	315
5.3	Removing and installing exhaust gas recirculation cooler	315
5.4	Checking exhaust gas recirculation cooler for leaks	318
5.5	Removing and installing exhaust gas recirculation valve 1 GX5	318
5.6	Removing and installing exhaust gas recirculation valve 2 GX6	319
28	Glow plug system	321
1	Glow plug system	321
1.1	Assembly overview - glow plug system	321
1.2	Removing and installing glow plug	323
1.3	Removing and installing automatic glow period control unit J179	324
1.4	Removing and installing Hall sender G40	324
1.5	Removing and installing engine speed sender G28	325