



Contents

00 - Technical data	1
1 Safety information	1
1.1 Safety measures when 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 ignition system	2
1.6 Safety precautions when working on exhaust system	3
2 Identification	4
2.1 Engine number/engine data	4
3 Repair instructions	5
3.1 Rules for cleanliness	5
3.2 General information	5
3.3 General repair instructions	6
3.4 Foreign objects in engine	6
3.5 Contact corrosion	6
3.6 Nuts and bolts	7
3.7 Routing and attachment of lines	7
3.8 Fitting radiator and condensers	7
3.9 Checking vacuum system	7
10 - Removing and installing engine	9
1 Removing and installing engine	9
1.1 Removing engine	9
1.2 Securing engine on engine and gearbox support	16
1.3 Installing engine	18
2 Assembly mountings	22
2.1 Assembly overview - assembly mountings	22
2.2 Removing and installing engine mounting	23
2.3 Removing and installing gearbox mounting	27
2.4 Supporting engine in installation position	29
3 Engine cover panel	32
3.1 Removing and installing engine cover	32
13 - Crankshaft group	33
1 Cylinder block (pulley end)	33
1.1 Assembly overview - cylinder block (pulley end)	33
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	42
1.8 Renewing crankshaft oil seal - belt pulley end	43
1.9 Removing and installing sealing flange on pulley end	44
2 Cylinder block, gearbox end	48
2.1 Assembly overview - drive plate	48
2.2 Assembly overview - flywheel	49
2.3 Removing and installing drive plate	49
2.4 Removing and installing flywheel	51
2.5 Renewing crankshaft oil seal (gearbox end)	53
3 Crankshaft	55



3.1	Assembly overview - crankshaft	55
3.2	Crankshaft dimensions	56
3.3	Allocation of main bearing shells	57
3.4	Measuring axial clearance of crankshaft	57
3.5	Measuring radial clearance of crankshaft	58
3.6	Removing and installing sender wheel	59
3.7	Checking sender wheel	59
4	Balancer shaft	61
4.1	Assembly overview - balance shaft	61
4.2	Removing and installing balance shaft	61
5	Pistons and conrods	67
5.1	Assembly overview - pistons and conrods	67
5.2	Removing and installing pistons	69
5.3	Measuring piston projection at TDC	70
5.4	Checking pistons and cylinder bores	72
5.5	Checking radial clearance of conrods	73
15	Cylinder head, valve gear	74
1	Cylinder head	74
1.1	Assembly overview - cylinder head	74
1.2	Assembly overview - cylinder head cover	76
1.3	Removing and installing cylinder head	78
1.4	Removing and installing cylinder head cover	86
1.5	Removing and installing injector seals	90
1.6	Checking compression	91
2	Cover for timing chain	93
2.1	Assembly overview - cover for timing chain	93
2.2	Removing and installing timing chain cover	96
3	Chain drive	104
3.1	Assembly overview - camshaft timing chains	104
3.2	Assembly overview - drive chain for high pressure pump	106
3.3	Assembly overview - drive chain for oil pump	107
3.4	Assembly overview - intermediate drive	108
3.5	Removing camshaft timing chain from camshafts	108
3.6	Removing and installing camshaft timing chain	116
3.7	Removing and installing drive chain for high-pressure pump	124
3.8	Installing intermediate drive	126
4	Valve gear	132
4.1	Assembly overview - valve gear	132
4.2	Measuring axial play of camshaft	136
4.3	Measuring radial play of camshaft	138
4.4	Removing and installing camshaft	138
4.5	Renewing camshaft	143
4.6	Checking hydraulic compensation elements	145
4.7	Removing and installing valve stem seals	146
5	Inlet and exhaust valves	154
5.1	Reworking valve seats	154
5.2	Checking valve guides	154
5.3	Checking valves	155
5.4	Valve dimensions	155
17	Lubrication	156
1	Sump, oil pump	156
1.1	Assembly overview - sump/oil pump	156
1.2	Engine oil:	159



1.3	Removing and installing oil level and oil temperature sender G266	159
1.4	Removing and installing lower part of sump	160
1.5	Removing and installing upper part of sump	163
1.6	Removing and installing oil pump	166
1.7	Removing and installing dipstick tube	168
2	Engine oil cooler	169
2.1	Assembly overview - engine oil cooler	169
2.2	Assembly overview - engine oil cooler temperature regulator	170
2.3	Removing and installing engine oil cooler	170
2.4	Removing and installing temperature regulator for engine oil cooler	171
3	Oil filter, oil pressure switch	173
3.1	Assembly overview - oil filter housing, oil pressure switch	173
3.2	Removing and installing oil pressure sender G10	174
3.3	Checking oil pressure	175
3.4	Removing and installing oil filter housing	175
3.5	Removing and installing oil pressure regulating valve N428	176
3.6	Removing and installing oil temperature sender 2 G664	177
19	Cooling	179
1	Cooling system/coolant	179
1.1	Connection diagram - coolant hoses	179
1.2	Checking cooling system for leaks	189
1.3	Draining and adding coolant	191
2	Coolant pump, regulation of cooling system	199
2.1	Assembly overview - coolant pump	199
2.2	Assembly overview - thermostat	201
2.3	Assembly overview - coolant temperature sender	202
2.4	Assembly overview - coolant valve	203
2.5	Removing and installing coolant pump	203
2.6	Removing and installing map-controlled engine cooling thermostat F265	205
2.7	Removing and installing thermostat housing for map-controlled engine cooling thermostat F265	206
2.8	Removing and installing coolant temperature sender G62	206
2.9	Removing and installing coolant temperature sender 2 G802	207
2.10	Removing and installing coolant temperature sender 3 G812	208
2.11	Removing and installing coolant valve	210
3	Coolant pipes	212
3.1	Assembly overview - coolant pipes	212
3.2	Removing and installing coolant pipes	213
4	Radiator, radiator fan	223
4.1	Assembly overview - radiator / radiator fan	223
4.2	Assembly overview - radiator cowl and radiator fan	224
4.3	Removing and installing radiator	225
4.4	Removing and installing radiator cowl with radiator fan	227
4.5	Removing and installing radiator fan V7	228
21	Turbocharging/supercharging	230
1	Turbocharger	230
1.1	Assembly overview - turbocharger	230
1.2	Removing and installing turbocharger	232
2	Charge air system	238
2.1	Assembly overview - charge air system	238
2.2	Removing and installing charge air cooler	239
2.3	Removing and installing charge pressure sender G31	240
2.4	Removing and installing intake air temperature sender G42	241



2.5	Checking charge air system for leaks	241
23	Mixture preparation - injection	244
1	Injection system	244
1.1	Filling/bleeding fuel system	244
1.2	Checking fuel system for leaks	244
2	Vacuum system	246
2.1	Connection diagram - vacuum system	246
2.2	Checking vacuum system	246
3	Injectors/high-pressure accumulator (rail)	248
3.1	Assembly overview - injectors	248
3.2	Assembly overview - fuel rail	249
3.3	Adapting correction values for injectors	251
3.4	Testing injectors	252
3.5	Testing jammed-open injectors	252
3.6	Checking return flow rate of injectors with engine running	255
3.7	Checking return flow rate of injectors at starter speed	258
3.8	Check pressure retention valve in fuel return line	260
3.9	Removing and installing injectors	262
3.10	Removing and installing high-pressure lines	267
3.11	Removing and installing fuel rail	280
4	Air filter	283
4.1	Assembly overview - air filter housing	283
4.2	Removing and installing air filter housing	284
5	Intake manifold	286
5.1	Assembly overview - intake manifold	286
5.2	Removing and installing intake manifold flap control unit GX14	288
5.3	Removing and installing intake manifold upper part	290
5.4	Removing and installing lower part of intake manifold	291
5.5	Removing and installing throttle valve module GX3	292
6	Senders and sensors	293
6.1	Removing and installing air mass meter G70	293
6.2	Removing and installing fuel pressure sender G247	294
6.3	Removing and installing fuel pressure regulating valve N276	296
6.4	Removing and installing pressure differential sender G505	298
6.5	Removing and installing fuel temperature sender G81	299
6.6	Removing and installing fuel pressure sender for low-pressure G410	300
6.7	Removing and installing intake manifold sender GX9	301
7	Engine control unit	302
7.1	Removing and installing engine (motor) control unit J623	302
8	High-pressure pump	303
8.1	Assembly overview - high-pressure pump	303
8.2	Removing and installing high-pressure pump	304
9	Lambda probe	309
9.1	Removing and installing Lambda probe 1 before catalytic converter GX10	309
9.2	Removing and installing control unit for NOx sender J583 / NOx sender G295	310
9.3	Removing and installing control unit for NOx sender 2 J881 / NOx sender 2 G687	312
9.4	Removing and installing control unit for sensor electronics J849 / particulate sensor G784	313
26	Exhaust system	315
1	Exhaust pipes and silencers	315
1.1	Assembly overview - silencers	315
1.2	Removing and installing exhaust pipe	315
1.3	Removing and installing rear silencer	316



1.4	Aligning exhaust system free of stress	317
1.5	Checking exhaust system for leaks	317
1.6	Installation position of clamp	318
2	Emission control	319
2.1	Assembly overview - emission control	319
2.2	Removing and installing catalytic converter	320
2.3	Removing and installing particulate filter	322
3	SCR system (selective catalytic reduction)	325
3.1	Assembly overview - tank for reducing agent	325
3.2	Assembly overview - delivery module for reducing agent	326
3.3	Removing and installing reducing agent tank VX85	327
3.4	Removing and installing delivery unit for reducing agent metering system GX19	329
3.5	Removing and installing injector for reduction agent N474	331
3.6	Removing and installing control unit for reducing-agent heater J891	333
3.7	Draining reducing agent tank VX85	334
3.8	Removing and installing filler pipe for reducing agent tank VX85	336
4	Exhaust gas temperature regulation	339
4.1	Assembly overview - exhaust gas temperature regulation	339
4.2	Removing and installing exhaust gas temperature sender 1 G235	340
4.3	Removing and installing exhaust gas temperature sender 2 G448	341
4.4	Removing and installing exhaust gas temperature sender 3 G495	342
4.5	Removing and installing exhaust gas temperature sender 4 G648	344
5	Exhaust gas recirculation	346
5.1	Assembly overview - exhaust gas recirculation	346
5.2	Removing and installing exhaust gas recirculation cooler	347
5.3	Removing and installing exhaust gas recirculation pipe	349
5.4	Removing and installing exhaust gas recirculation temperature sensor G98	349
6	Exhaust manifold	351
6.1	Assembly overview - exhaust manifold	351
6.2	Removing and installing exhaust manifold	352
28	Glow plug system	355
1	Glow plug system	355
1.1	Assembly overview - glow plug system	355
1.2	Removing and installing glow plug	356
1.3	Checking glow plug	357
1.4	Removing and installing automatic glow period control unit J179	357
1.5	Removing and installing Hall sender G40	358
1.6	Removing and installing engine speed sender G28	359