

Contents

00 - Technical data	1
1 Identification	1
1.1 Engine number/engine data	1
2 Safety information	2
2.1 Safety precautions when working on the fuel supply system	2
2.2 Safety precautions when working on vehicles with start/stop system	2
2.3 Safety precautions when using testers and measuring instruments during a road test	3
2.4 Safety precautions when working on the cooling system	3
2.5 Safety precautions when working on the exhaust system	3
2.6 Safety precautions when working on selective catalytic reduction system	4
2.7 Safety precautions when working on the glow plug system	5
3 Repair instructions	6
3.1 Rules for cleanliness	6
3.2 General notes	6
3.3 General repair instructions	8
3.4 Performing adaptations after renewing a component	9
3.5 Cleaning engine	9
3.6 Nuts, bolts	9
3.7 Identification plates	10
3.8 Use of impact wrenches	10
3.9 Foreign material in engine	11
3.10 Contact corrosion	11
3.11 Routing and attachment of pipes, hoses and wiring	12
3.12 Installing radiators and condensers	12
3.13 Checking vacuum system	12
10 - Removing and installing engine	13
1 Removing and installing engine	13
1.1 Removing engine	13
1.2 Removing engine from scissor-type assembly platform	13
1.3 Securing engine to engine and gearbox support	15
1.4 Installing engine	16
2 Assembly mountings	17
3 Engine cover panel	18
3.1 Removing and installing engine cover panel	18
13 - Crankshaft group	19
1 Cylinder block (pulley end)	19
1.1 Assembly overview - cylinder block (pulley end)	19
1.2 Assembly overview - sealing flange (pulley end)	22
1.3 Removing and installing poly V-belt	24
1.4 Removing and installing poly V-belt tensioner	25
1.5 Removing and installing vibration damper	25
1.6 Removing and installing bracket for ancillaries	27
1.7 Removing and installing engine support	28
1.8 Removing and installing sealing flange (pulley end)	28
1.9 Renewing cylinder block sealing cap (pulley end)	31
2 Cylinder block (gearbox end)	33
2.1 Assembly overview - cylinder block (gearbox end)	33
2.2 Removing and installing drive plate	36
2.3 Removing and installing sealing flange (gearbox end)	37
2.4 Renewing cylinder block sealing cap (gearbox end)	50



2.5	Renewing needle bearing in drive plate	51
3	Crankshaft	54
3.1	Crankshaft dimensions	54
3.2	Measuring axial clearance of crankshaft	54
4	Pistons and conrods	56
4.1	Assembly overview - pistons and conrods	56
4.2	Removing and installing pistons	60
4.3	Measuring piston projection at TDC	61
4.4	Checking pistons and cylinder bores	63
4.5	Separating parts of new conrod	65
4.6	Checking radial clearance of conrod bearings	66
15	- Cylinder head, valve gear	67
1	Toothed belt drive	67
1.1	Assembly overview - toothed belt guard	67
1.2	Assembly overview - toothed belt	68
1.3	Removing and installing toothed belt guard	70
1.4	Detaching toothed belt from camshaft	73
1.5	Removing and installing toothed belt	81
2	Cylinder head	94
2.1	Assembly overview - cylinder head cover	94
2.2	Assembly overview - cylinder head	96
2.3	Removing and installing cylinder head cover	99
2.4	Removing and installing seals for injectors	100
2.5	Removing and installing cylinder head	101
2.6	Removing and installing camshaft housing	124
2.7	Checking compression	129
3	Valve gear	132
3.1	Assembly overview - valve gear	132
3.2	Removing and installing camshaft oil seal	134
3.3	Removing and installing valve stem oil seals	136
4	Inlet and exhaust valves	147
4.1	Checking valve guides	147
4.2	Checking valves	148
4.3	Valve dimensions	148
17	- Lubrication	149
1	Sump/oil pump	149
1.1	Assembly overview - sump/oil pump	149
1.2	Engine oil	153
1.3	Removing and installing lower part of sump	153
1.4	Removing and installing upper part of sump	156
1.5	Removing and installing oil pump	164
1.6	Removing and installing oil level and oil temperature sender G266	165
2	Engine oil cooler	167
3	Oil filter/oil pressure switches	168
3.1	Assembly overview - oil filter	168
3.2	Assembly overview - oil pressure switches/oil pressure control	169
3.3	Removing and installing oil filter housing	170
3.4	Removing and installing oil pressure sender G10	172
3.5	Removing and installing valve for oil pressure control N428	173
3.6	Checking oil pressure	174
3.7	Removing and installing piston cooling jet control valve N522	175
19	- Cooling	176

1	Cooling system/coolant	176
1.1	Connection diagram - coolant hoses	176
1.2	Checking cooling system for leaks	176
1.3	Draining and filling cooling system	181
1.4	Checking filling quality	181
1.5	Removing and installing coolant expansion tank	183
1.6	Renewing sealing cap	183
2	Coolant pump/thermostat assembly	185
2.1	Assembly overview - coolant pump/thermostat	185
2.2	Assembly overview - electric coolant pump	186
2.3	Assembly overview - coolant valves	187
2.4	Assembly overview - coolant temperature senders	187
2.5	Removing and installing electric coolant pump	189
2.6	Removing and installing coolant pump	189
2.7	Removing and installing coolant valve for cylinder head N489	190
2.8	Removing and installing mixing valve for charge air cooler	192
2.9	Removing and installing coolant distribution module	192
2.10	Removing and installing coolant temperature sender G62	193
2.11	Removing and installing temperature sender for engine temperature regulation G694	195
2.12	Removing and installing coolant temperature sender 2 G802	195
3	Coolant pipes	197
4	Radiators/radiator fans	198
21 -	Turbocharging/supercharging	199
1	Turbocharger	199
1.1	Assembly overview - turbocharger	199
1.2	Removing and installing turbocharger	203
2	Charge air system	213
2.1	Assembly overview - charge air system	213
2.2	Assembly overview - hose connections for charge air system	214
2.3	Removing and installing charge pressure sender G31	215
2.4	Removing and installing air intake pipe	216
2.5	Removing and installing charge air temperature sender	218
2.6	Checking charge air system for leaks	219
23 -	Mixture preparation - injection	226
1	Injection system	226
1.1	Overview - fuel system	226
1.2	Overview of fitting locations - injection system	226
1.3	Filling and bleeding fuel system	226
1.4	Checking fuel system for leaks	227
2	Air filter	228
3	Intake manifold	229
3.1	Assembly overview - intake manifold	229
3.2	Removing and installing throttle valve module J338	231
3.3	Removing and installing intake manifold	232
4	Injectors/high-pressure reservoir (rail)	239
4.1	Assembly overview - injectors	239
4.2	Assembly overview - high-pressure reservoir (rail)	241
4.3	Checking injectors	243
4.4	Performing adaptation of correction values for injectors	244
4.5	Checking for injectors sticking open	245
4.6	Checking return flow rate of injectors with engine running	247
4.7	Checking return flow rate of injectors at starter cranking speed	251



4.8	Removing and installing injectors	253
4.9	Removing and installing high-pressure pipes	257
4.10	Removing and installing high-pressure reservoir (rail)	260
5	High-pressure pump	263
5.1	Assembly overview - high-pressure pump	263
5.2	Removing and installing high-pressure pump	264
5.3	Checking fuel pressure regulating valve N276 for dirt/swarf if high-pressure pump is defective	269
6	Senders and sensors	271
6.1	Removing and installing air mass meter G70	271
6.2	Removing and installing fuel pressure sender G247	271
6.3	Removing and installing temperature and pressure sender for low-pressure fuel system GX20	273
6.4	Removing and installing pressure differential sender G505	274
6.5	Checking fuel pressure regulating valve N276	275
6.6	Removing and installing fuel pressure regulating valve N276	276
7	Lambda probe	280
7.1	Assembly overview - Lambda probe	280
7.2	Removing and installing Lambda probe	285
7.3	Removing and installing NOx senders	286
7.4	Removing and installing particulate sensor G784	291
8	Engine control unit	295
26	- Exhaust system	296
1	Exhaust pipes/silencers	296
1.1	Assembly overview - silencers	296
1.2	Removing and installing front exhaust pipe	296
1.3	Removing and installing silencers	298
1.4	Stress-free alignment of exhaust system	298
1.5	Checking exhaust system for leaks	298
2	Emission control system	299
2.1	Assembly overview - emission control system	299
2.2	Removing and installing catalytic converter	304
2.3	Removing and installing particulate filter	308
2.4	Removing and installing ammonia trap	314
2.5	Removing and installing exhaust flap control unit J883	316
3	SCR (selective catalytic reduction) system	318
3.1	Assembly overview - reducing agent tank	318
3.2	Assembly overview - reducing agent supply line	318
3.3	Assembly overview - injector for reducing agent	318
3.4	Assembly overview - injector 2 for reducing agent	319
3.5	Assembly overview - delivery unit for reducing agent	320
3.6	Releasing pressure in SCR system	320
3.7	Disconnecting reducing agent supply line	321
3.8	Draining reducing agent tank	324
3.9	Removing and installing reducing agent tank	324
3.10	Removing and installing injector for reducing agent N474	324
3.11	Removing and installing injector 2 for reducing agent N758	326
3.12	Removing and installing control unit for reducing agent metering system J880	327
3.13	Removing and installing pump for reducing agent V437	328
3.14	Removing and installing pressure sender for reducing agent metering system G686	328
3.15	Removing and installing connection for SCR supply line	328
4	Exhaust gas temperature regulation	329
4.1	Assembly overview - exhaust gas temperature regulation	329
4.2	Removing and installing parts of exhaust gas temperature regulation	329

5	Exhaust gas recirculation	333
5.1	Assembly overview - exhaust gas recirculation system	333
5.2	Removing and installing exhaust gas recirculation valve 1 GX5	336
5.3	Removing and installing exhaust gas recirculation valve 2 GX6	337
5.4	Removing and installing exhaust gas recirculation temperature sensor	339
5.5	Removing and installing exhaust gas recirculation cooler	340
5.6	Checking exhaust gas recirculation cooler for leaks	343
28	Glow plug system	348
1	Glow plug system	348
1.1	Assembly overview - glow plug system	348
1.2	Removing and installing glow plug	350
1.3	Removing and installing automatic glow period control unit J179	354
1.4	Removing and installing Hall sender G40	354
1.5	Removing and installing engine speed sender G28	356