



Contents

00 - Technical data	1
1 Identification	1
1.1 Engine number/engine data	1
2 Safety precautions	2
2.1 Safety precautions when working on the fuel system	2
2.2 Safety precautions when working on vehicles with start/stop system	4
2.3 Safety precautions when using testers and measuring instruments during a road test	4
2.4 Safety precautions when working on the cooling system	4
2.5 Safety precautions when working on the SCR system	5
2.6 Safety precautions when working on the exhaust system	6
3 Repair instructions	7
3.1 Rules for cleanliness	7
3.2 General notes	7
3.3 General repair instructions	8
3.4 Adapting learnt values for SCR system	9
3.5 Foreign particles in engine	9
3.6 Contact corrosion	9
3.7 Routing and attachment of pipes, hoses and wiring	10
3.8 Installing radiators and condensers	10
3.9 Checking vacuum system	10
10 - Removing and installing engine	12
1 Removing and installing engine	12
1.1 Removing engine	12
1.2 Separating engine and gearbox	32
1.3 Securing engine to engine and gearbox support	41
1.4 Installing engine	45
2 Assembly mountings	52
2.1 Exploded view - assembly mountings	52
2.2 Supporting engine in installation position	54
2.3 Removing and installing engine mountings	56
2.4 Removing and installing gearbox mounting	67
2.5 Removing and installing torque reaction support and cross member	68
3 Engine cover panel	70
3.1 Removing and installing engine cover panel	70
13 - Crankshaft group	71
1 Cylinder block (pulley end)	71
1.1 Exploded view - poly V-belt drive	71
1.2 Exploded view - sealing flange (pulley end)	77
1.3 Removing and installing poly V-belt	81
1.4 Removing and installing tensioner for poly V-belt	84
1.5 Removing and installing vibration damper	85
1.6 Renewing crankshaft oil seal (pulley end)	85
1.7 Removing and installing sealing flange (pulley end)	87
2 Cylinder block (gearbox end)	92
2.1 Exploded view - cylinder block (gearbox end)	92
2.2 Removing and installing drive plate	93
2.3 Removing and installing sender wheel	94
2.4 Checking sender wheel	95
2.5 Renewing crankshaft oil seal (gearbox end)	95
3 Crankshaft	98



3.1	Exploded view - crankshaft	98
3.2	Crankshaft dimensions	99
3.3	Allocation of main bearing shells	100
3.4	Measuring axial clearance of crankshaft	100
3.5	Measuring radial clearance of crankshaft	101
4	Balance shaft	102
4.1	Exploded view - balance shaft	102
4.2	Removing and installing balance shaft	102
4.3	Renewing roller bearing for balance shaft	104
5	Pistons and conrods	106
5.1	Exploded view - pistons and conrods	106
5.2	Removing and installing pistons	108
5.3	Measuring piston projection at TDC	109
5.4	Checking pistons and cylinder bores	112
5.5	Checking radial clearance of conrod bearings	113
15	Cylinder head, valve gear	114
1	Timing chain cover	114
1.1	Exploded view - timing chain cover	114
1.2	Removing and installing timing chain cover	119
2	Chain drive	127
2.1	Exploded view - camshaft timing chains	127
2.2	Exploded view - drive chain for oil pump and high-pressure pump	129
2.3	Removing camshaft timing chain from camshafts	130
2.4	Removing and installing camshaft timing chain	138
2.5	Removing and installing drive chain for oil pump and high-pressure pump	148
3	Cylinder head	150
3.1	Exploded view - cylinder head	150
3.2	Exploded view - cylinder head cover	152
3.3	Removing and installing cylinder head	154
3.4	Removing and installing cylinder head cover	160
3.5	Removing and installing seals for injectors	166
3.6	Checking compression	167
4	Valve gear	169
4.1	Exploded view - valve gear	169
4.2	Measuring axial clearance of camshaft	171
4.3	Measuring radial clearance of camshaft	172
4.4	Removing and installing camshaft	173
4.5	Removing and installing valve stem oil seals	196
5	Inlet and exhaust valves	203
5.1	Checking valve guides	203
5.2	Checking valves	204
5.3	Valve dimensions	205
17	Lubrication	206
1	Sump/oil pump	206
1.1	Exploded view - sump/oil pump	206
1.2	Engine oil	210
1.3	Removing and installing sump (bottom section)	210
1.4	Removing and installing sump (top section)	212
1.5	Removing and installing oil pump	217
1.6	Removing and installing oil level and oil temperature sender G266	219
2	Engine oil cooler	220
2.1	Exploded view - engine oil cooler	220
2.2	Removing and installing engine oil cooler	221

2.3	Removing and installing mounting plate for engine oil cooler/coolant shut-off valve	222
2.4	Removing and installing temperature regulator for engine oil cooler	222
3	Oil filter/oil pressure switches	224
3.1	Exploded view - oil filter housing/oil pressure switch	224
3.2	Removing and installing oil pressure switch F22 / F378	225
3.3	Removing and installing oil temperature sender 2 G664	225
3.4	Checking oil pressure	226
3.5	Removing and installing oil filter housing	227
3.6	Removing and installing valve for oil pressure control N428	228
19	Cooling	229
1	Cooling system/coolant	229
1.1	Connection diagram - coolant hoses	229
1.2	Checking cooling system for leaks	236
1.3	Draining and filling cooling system	237
2	Coolant pump/thermostat assembly	247
2.1	Exploded view - coolant pump	247
2.2	Exploded view - thermostat	248
2.3	Exploded view - coolant temperature senders	249
2.4	Removing and installing coolant pump	249
2.5	Removing and installing map-controlled engine cooling system thermostat F265	250
2.6	Removing and installing coolant temperature sender G62	251
2.7	Removing and installing radiator outlet coolant temperature sender G83	251
2.8	Removing and installing temperature sender for engine temperature regulation G694	252
2.9	Removing and installing coolant valves	254
2.10	Removing and installing non-return valve	256
3	Coolant pipes	259
3.1	Exploded view - coolant pipes	259
3.2	Removing and installing coolant pipes	263
3.3	Removing and installing coolant lines for injector for reducing agent	273
4	Radiator/radiator fans	275
4.1	Exploded view - radiator/radiator fans	275
4.2	Removing and installing radiator	277
4.3	Removing and installing radiator cowl	282
4.4	Removing and installing radiator fan	284
21	Turbocharging/supercharging	285
1	Turbocharger	285
1.1	Exploded view - turbocharger	285
1.2	Removing and installing turbocharger	291
1.3	Removing and installing turbocharger 1 control unit J724	295
2	Charge air system	307
2.1	Exploded view - charge air system	307
2.2	Exploded view - hose connections for charge air system	310
2.3	Removing and installing charge air cooler	310
2.4	Removing and installing charge pressure sender G31 / intake air temperature sender G42	315
2.5	Checking charge air system for leaks	316
23	Mixture preparation - injection	320
1	Injection system	320
1.1	Overview - fuel system	320
1.2	Overview of fitting locations - injection system	322
1.3	Filling and bleeding fuel system	330
1.4	Checking fuel system for leaks	331



2	Vacuum system	332
2.1	Connection diagram - vacuum system	332
2.2	Checking vacuum system	332
3	Air cleaner	334
3.1	Exploded view - air cleaner housing	334
3.2	Removing and installing air cleaner housing	335
4	Intake manifold	338
4.1	Exploded view - intake manifold	338
4.2	Removing and installing intake manifold	339
4.3	Removing and installing intake manifold flap motor V157	344
4.4	Removing and installing throttle valve module J338	346
5	Injectors/high-pressure reservoir (rail)	347
5.1	Exploded view - injectors	347
5.2	Checking injectors	349
5.3	Performing adaption of correction values for injectors	350
5.4	Checking for injectors sticking open	351
5.5	Checking return flow rate of injectors with engine running	352
5.6	Checking return flow rate of injectors at starter cranking speed	355
5.7	Checking restrictor in fuel return line	357
5.8	Removing and installing injectors	359
5.9	Removing and installing high-pressure pipes	363
5.10	Removing and installing high-pressure reservoir (rail)	365
6	Senders and sensors	369
6.1	Removing and installing fuel pressure regulating valve N276	369
6.2	Checking fuel pressure regulating valve N276	370
6.3	Removing and installing fuel pressure sender G247	373
6.4	Removing and installing air mass meter G70	375
6.5	Removing and installing pressure differential sender G505	376
7	High-pressure pump	378
7.1	Exploded view - high-pressure pump	378
7.2	Removing and installing high-pressure pump	379
8	Lambda probe	385
8.1	Exploded view - Lambda probe	385
8.2	Removing and installing Lambda probe	388
8.3	Removing and installing control unit for NOx sender J583 with NOx sender G295	389
8.4	Removing and installing control unit for NOx sender 2 J881 with NOx sender 2 G687 ..	391
9	Engine control unit	392
9.1	Removing and installing engine/motor control unit J623	392
26 - Exhaust system	394	
1	Exhaust pipes/silencers	394
1.1	Exploded view - silencer	394
1.2	Removing and installing front exhaust pipe	400
1.3	Separating exhaust pipes/silencers	402
1.4	Stress-free alignment of exhaust system	404
1.5	Checking exhaust system for leaks	405
2	Emission control system	406
2.1	Removing and installing particulate filter	406
2.2	Removing and installing SCR catalytic converter	409
3	SCR (selective catalytic reduction) system	412
3.1	Exploded view - reducing agent tank	412
3.2	Exploded view - reducing agent supply line	417
3.3	Exploded view - delivery unit for reducing agent	419
3.4	Exploded view - control unit for reducing agent metering system J880	422

3.5	Draining reducing agent tank	422
3.6	Removing and installing reducing agent tank	425
3.7	Removing and installing delivery unit for reducing agent	427
3.8	Removing and installing injector for reducing agent N474	431
3.9	Removing and installing active tank for reducing agent	433
3.10	Removing and installing passive tank for reducing agent	435
3.11	Removing and installing control unit for reducing agent metering system J880	436
3.12	Removing and installing transfer pump for reducing agent V436	437
4	Exhaust gas temperature control	439
4.1	Exploded view - exhaust gas temperature control	439
4.2	Removing and installing exhaust gas temperature senders	443
5	Exhaust gas recirculation	451
5.1	Exploded view - exhaust gas recirculation system	451
5.2	Removing and installing exhaust gas recirculation cooler	454
5.3	Removing and installing exhaust gas recirculation control motor V338	455
5.4	Removing and installing exhaust gas recirculation temperature sensor G98	456
6	Exhaust manifolds	457
6.1	Exploded view - exhaust manifold	457
6.2	Removing and installing exhaust manifolds	458
28	Glow plug system	462
1	Glow plug system	462
1.1	Exploded view - glow plug system	462
1.2	Removing and installing glow plug	463
1.3	Removing and installing Hall sender G40	464
1.4	Removing and installing engine speed sender G28	465