



Contents

00 - Technical data	1
1 Identification	1
1.1 Engine number/engine data	1
2 Safety information	3
2.1 Safety measures when working on fuel supply	3
2.2 Safety precautions when using testers and measuring instruments during a road test	4
2.3 Safety measures when working on vehicles with a start/stop system	4
2.4 Safety precautions when working on the cooling system	4
2.5 Safety precautions when working on exhaust system	5
3 Repair notes	6
3.1 Rules for cleanliness	6
3.2 Checking vacuum system	7
10 - Removing and installing engine	8
1 Removing and installing engine	8
1.1 Removing engine	8
1.2 Separating engine and gearbox	48
1.3 Securing engine on engine and gearbox support	50
1.4 Installing engine	51
2 Assembly mountings	60
2.1 Assembly overview - assembly mountings	60
2.2 Supporting engine in installation position	66
2.3 Adjusting assembly mountings	72
3 Engine cover panel	76
3.1 Removing and installing engine cover	76
13 - Crankshaft group	77
1 Cylinder block (pulley end)	77
1.1 Assembly overview - poly V-belt drive	77
1.2 Removing and installing poly-V belt	80
1.3 Removing and installing tensioner for poly V-belt	84
1.4 Removing and installing vibration damper	88
1.5 Removing and installing bracket for ancillaries	89
1.6 Renewing crankshaft oil seal - belt pulley end	91
1.7 Removing and installing sealing flange on pulley end	92
1.8 Removing and installing engine bracket	95
2 Cylinder block, gearbox end	110
2.1 Assembly overview - cylinder block, gearbox end	110
2.2 Removing and installing flywheel	111
2.3 Removing and installing sealing flange on gearbox side	112
3 Crankshaft	122
3.1 Assembly overview - crankshaft	122
3.2 Renewing needle bearing in crankshaft	123
3.3 Crankshaft dimensions	125
3.4 Measuring axial clearance of crankshaft	125
3.5 Measuring radial clearance of crankshaft	125
4 Pistons and conrods	127
4.1 Assembly overview - pistons and conrods	127
4.2 Removing and installing pistons	130
4.3 Measuring piston projection at "TDC"	131
4.4 Separating new conrod	133
4.5 Checking radial clearance of conrods	134



15 - Cylinder head, valve gear	135
1 Cylinder head	135
1.1 Assembly overview - cylinder head	135
1.2 Removing and installing cylinder head	138
1.3 Assembly overview - cylinder head cover	167
1.4 Removing and installing cylinder head cover	168
1.5 Removing and installing vacuum pump	176
1.6 Checking compression	177
2 Toothed belt drive	179
2.1 Assembly overview - toothed belt	179
2.2 Removing and installing toothed belt	184
3 Valve gear	199
3.1 Assembly overview - valve gear	199
3.2 Measuring axial play of camshaft	200
3.3 Measuring radial play of camshaft	201
3.4 Removing and installing camshaft oil seal	202
3.5 Removing and installing camshaft	204
3.6 Checking hydraulic compensation elements	211
3.7 Removing and installing valve stem seal	212
4 Inlet and exhaust valves	219
4.1 Valve dimensions	219
4.2 Reworking valve seats	219
4.3 Checking valve guides	219
4.4 Checking valves	219
17 - Lubrication	220
1 Sump, oil pump	220
1.1 Assembly overview - sump/oil pump	220
1.2 Removing and installing sump	222
1.3 Removing and installing oil level and oil temperature sender G 266	227
1.4 Removing and installing oil pump	228
1.5 Engine oil:	229
2 Engine oil cooler	231
2.1 Assembly overview - engine oil cooler	231
2.2 Removing and installing engine oil cooler	232
2.3 Checking engine oil cooler for leaks	234
3 Oil filter, oil pressure switch	237
3.1 Assembly overview - oil filter housing	237
3.2 Removing and installing oil filter housing	238
3.3 Checking oil pressure and oil pressure switch	241
3.4 Removing and installing oil pressure switch F1	244
4 Oil circuit	246
4.1 Assembly overview - oil circuit	246
4.2 Removing and installing oil supply line	248
4.3 Oil spray jets/nozzles	254
19 - Cooling	255
1 Cooling system/coolant	255
1.1 Coolant hose connection diagram	255
1.2 Checking cooling system for leaks	259
1.3 Draining and adding coolant	261
2 Coolant pump, regulation of cooling system	266
2.1 Assembly overview - coolant pump, thermostat	266
2.2 Removing and installing coolant pump	269



2.3	Removing and installing thermostat	270
2.4	Checking thermostat	273
2.5	Removing and installing 4/2-way valve with thermostat	273
2.6	Electric coolant pump	279
2.7	Removing and installing coolant temperature sender	283
3	Coolant pipes	288
3.1	Assembly overview - coolant pipes	288
3.2	Removing and installing coolant pipes	290
4	Radiator, radiator fan	306
4.1	Assembly overview - radiator/radiator fan	306
4.2	Removing and installing radiator	309
4.3	Removing and installing radiator cowl with radiator fan	314
21	Turbocharging/supercharging	318
1	Turbocharger	318
1.1	Assembly overview - turbocharger	318
1.2	Removing and installing turbocharger	324
1.3	Renewing vacuum unit for turbocharger	347
2	Charge air system	355
2.1	Assembly overview - charge air system	355
2.2	Removing and installing charge air cooler	359
2.3	Assembly overview - charge-air hose connections	363
2.4	Checking charge air system for leaks	366
23	Mixture preparation - injection	369
1	Injection system	369
1.1	Schematic overview - fuel system	369
1.2	Assembly overview - fuel system	374
1.3	Filling/bleeding fuel system	386
1.4	Checking fuel system for leaks	386
2	Vacuum system	388
2.1	Connection diagram - vacuum system	388
3	Injectors/high-pressure accumulator (rail)	392
3.1	Assembly overview - injectors	392
3.2	Adapting correction values for injectors	393
3.3	Testing jammed-open injectors	393
3.4	Check pressure retention valve in fuel return line	395
3.5	Removing and installing injectors	397
3.6	Removing and installing fuel rail	402
3.7	Removing and installing high-pressure lines	406
4	High-pressure pump	413
4.1	Assembly overview - high-pressure pump	413
4.2	Removing and installing high-pressure pump	414
5	Senders and sensors	420
5.1	Removing and installing fuel pressure regulating valve N 276	420
5.2	Checking fuel pressure regulating valve N276	422
5.3	Removing and installing fuel pressure sender G 247	423
5.4	Checking fuel pressure sender G 247	425
5.5	Checking fuel metering valve N 290	425
5.6	Removing and installing pressure differential sender G505	426
6	Lambda probe	432
6.1	Assembly overview - Lambda probe	432
6.2	Removing and installing Lambda probe	436
7	Air filter	439



7.1	Assembly overview - air filter housing	439
7.2	Removing and installing air filter housing	441
8	Intake manifold	445
8.1	Assembly overview - intake manifold	445
8.2	Removing and installing intake manifold	447
8.3	Removing and installing throttle valve module J338	451
9	Engine control unit	453
9.1	Removing and installing engine control unit	453
26	- Exhaust system	468
1	Exhaust pipes and silencers	468
1.1	Assembly overview - silencers	468
1.2	Aligning exhaust system free of stress	473
1.3	Installation position of clamp	475
2	Emission control	476
2.1	Assembly overview - emission control	476
2.2	Removing and installing particulate filter	484
2.3	Removing and installing catalytic converter	505
3	Exhaust gas temperature regulation	510
3.1	Assembly overview - exhaust gas temperature regulation	510
3.2	Removing and installing parts of exhaust gas temperature regulation	513
4	Exhaust gas recirculation	524
4.1	Assembly overview - exhaust gas recirculation	524
4.2	Checking changeover for exhaust gas recirculation cooler	525
4.3	Removing and installing exhaust gas recirculation cooler	526
4.4	Checking exhaust gas recirculation cooler for leaks	531
4.5	Cleaning exhaust gas recirculation system	534
28	- Glow plug system	541
1	Glow plug system	541
1.1	Removing and installing glow plug	541
1.2	Checking glow plugs	543
1.3	Removing and installing Hall sender G40	543
1.4	Removing and installing engine speed sender G 28	545