

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 system	2
2.2 Safety precautions when working on vehicles with start/stop system	3
2.3 Safety precautions when using testers and measuring instruments during a road test	3
2.4 Safety precautions when working on the subframe	4
2.5 Safety precautions when working on the cooling system	4
2.6 Safety precautions when working on the exhaust system	4
3 Repair instructions	6
3.1 Rules for cleanliness	6
3.2 General notes	6
3.3 General repair instructions	7
3.4 Nuts, bolts	7
3.5 Identification plates	8
3.6 Use of impact wrenches	8
3.7 Foreign material in engine	9
3.8 Contact corrosion	9
3.9 Routing and attachment of pipes, hoses and wiring	9
3.10 Installing radiators and condensers	9
10 - Removing and installing engine	10
1 Removing and installing engine	10
1.1 Removing engine	10
1.2 Securing engine to engine and gearbox support	34
1.3 Installing engine	35
2 Assembly mountings	43
2.1 Assembly overview - assembly mountings	43
2.2 Removing and installing engine mountings	43
2.3 Supporting engine in installation position	45
3 Engine cover panel	48
3.1 Removing and installing engine cover panel	48
13 - Crankshaft group	49
1 Cylinder block (pulley end)	49
1.1 Assembly overview - poly V-belt drive	49
1.2 Assembly overview - sealing flange (pulley end)	51
1.3 Removing and installing poly V-belt	53
1.4 Removing and installing poly V-belt tensioner	55
1.5 Removing and installing vibration damper	57
1.6 Removing and installing bracket for ancillaries	58
1.7 Renewing crankshaft oil seal (pulley end)	61
1.8 Removing and installing sealing flange (pulley end)	63
2 Cylinder block (gearbox end)	68
2.1 Assembly overview - cylinder block (gearbox end)	68
2.2 Removing and installing drive plate	69
2.3 Removing and installing sealing flange (gearbox end)	70
2.4 Renewing needle bearing in drive plate	81
3 Crankshaft	84
3.1 Assembly overview - crankshaft	84
3.2 Crankshaft dimensions	85

3.3	Measuring axial clearance of crankshaft	86
3.4	Measuring radial clearance of crankshaft	87
3.5	Pulling spur gear off crankshaft and shrink-fitting new spur gear	87
4	Pistons and conrods	91
4.1	Assembly overview - pistons and conrods	91
4.2	Measuring piston projection at TDC	97
4.3	Piston and cylinder dimensions	99
4.4	Checking radial clearance of conrod bearings	99
15	- Cylinder head, valve gear	100
1	Cylinder head	100
1.1	Assembly overview - cylinder head	100
1.2	Assembly overview - cylinder head cover	103
1.3	Removing and installing cylinder head	105
1.4	Removing and installing cylinder head cover	113
1.5	Checking compression	115
2	Toothed belt drive	118
2.1	Assembly overview - toothed belt	118
2.2	Removing and installing toothed belt	120
3	Valve gear	135
3.1	Assembly overview - valve gear	135
3.2	Measuring axial clearance of camshaft	137
3.3	Measuring radial clearance of camshaft	138
3.4	Removing and installing camshaft oil seal	139
3.5	Removing and installing camshaft	141
3.6	Removing and installing valve stem oil seals	149
4	Inlet and exhaust valves	160
4.1	Reworking valve seats	160
4.2	Checking valve guides	160
4.3	Checking valves	161
4.4	Valve dimensions	161
17	- Lubrication	162
1	Sump/oil pump	162
1.1	Assembly overview - sump/oil pump	162
1.2	Engine oil	168
1.3	Removing and installing sump	168
1.4	Removing and installing oil pump	173
1.5	Removing and installing oil level and oil temperature sender G266	174
2	Engine oil cooler	176
2.1	Removing and installing engine oil cooler	176
3	Oil filter/oil pressure switches	178
3.1	Exploded view - oil filter housing/oil pressure switch	178
3.2	Removing and installing oil pressure switch F1	180
3.3	Checking oil pressure and oil pressure switch	181
3.4	Removing and installing oil supply line	183
3.5	Removing and installing oil filter housing	185
3.6	Checking oil level	187
4	Balance shaft module	188
4.1	Removing and installing balance shaft module	188
19	- Cooling	195
1	Cooling system/coolant	195
1.1	Connection diagram - coolant hoses	195
1.2	Checking cooling system for leaks	197

1.3	Draining and filling cooling system	199
2	Coolant pump/thermostat assembly	206
2.1	Assembly overview - coolant pump/thermostat	206
2.2	Removing and installing pump for exhaust gas recirculation cooler V400	206
2.3	Removing and installing coolant pump	208
2.4	Removing and installing thermostat	210
2.5	Removing and installing 4/2-way valve with thermostat	212
2.6	Removing and installing coolant temperature sender G62	214
2.7	Removing and installing radiator outlet coolant temperature sender G83	215
3	Radiator/radiator fans	217
3.1	Exploded view - radiator/radiator fans	217
3.2	Removing and installing radiator cowl with radiator fans	219
3.3	Removing and installing radiator cowl	226
3.4	Removing and installing radiator fan control unit J293	232
3.5	Removing and installing radiator fans	234
21	Turbocharging/supercharging	235
1	Turbocharger	235
1.1	Exploded view - turbocharger	235
1.2	Removing and installing turbocharger	237
2	Charge air system	243
2.1	Assembly overview - charge air system	243
2.2	Removing and installing charge air cooler	245
2.3	Removing and installing charge pressure sender G31	249
2.4	Checking charge air system for leaks	249
23	Mixture preparation - injection	253
1	Injection system	253
1.1	Overview - fuel system	253
1.2	Overview of fitting locations - injection system	255
1.3	Exploded view - fuel system	265
1.4	Filling and bleeding fuel system	268
1.5	Checking fuel system for leaks	269
1.6	Checking fuel pressure (low pressure) system	269
2	Vacuum system	270
2.1	Checking vacuum system	270
3	Injectors/high-pressure reservoir (rail)	271
3.1	Checking injectors	271
3.2	Performing adaptation of correction values for injectors	271
3.3	Checking for injectors sticking open	272
3.4	Measuring return flow rate of injectors with engine running	275
3.5	Checking return flow rate of injectors at starter cranking speed	278
3.6	Checking pressure retention valve in fuel return line	280
3.7	Removing and installing injectors	281
3.8	Removing and installing high-pressure pipes	287
3.9	Removing and installing high-pressure reservoir (rail)	290
4	Air filter	294
4.1	Assembly overview - air filter housing	294
4.2	Removing and installing air filter housing	296
5	Intake manifold	301
5.1	Exploded view - intake manifold	301
5.2	Removing and installing intake manifold	301
6	Senders and sensors	306
6.1	Removing and installing fuel pressure regulating valve N276	306



6.2	Checking fuel pressure regulating valve N276	308
6.3	Removing and installing fuel pressure sender G247	310
6.4	Removing and installing air mass meter G70	312
6.5	Removing and installing exhaust gas pressure sensor 1 G450	313
7	Engine control unit	315
7.1	Wiring and component check with test box V.A.G 1598/42	315
7.2	Removing and installing engine/motor control unit J623	317
8	High-pressure pump	322
8.1	Removing and installing high-pressure pump	322
8.2	Performing first fuel filling after installing high-pressure pump	324
9	Lambda probe	326
9.1	Assembly overview - Lambda probe	326
9.2	Removing and installing Lambda probe	327
26	Exhaust system	329
1	Exhaust pipes/silencers	329
1.1	Exploded view - silencers	329
1.2	Removing and installing front exhaust pipe	333
1.3	Separating exhaust pipes/silencers	334
1.4	Renewing tailpipes	335
1.5	Stress-free alignment of exhaust system	336
1.6	Checking exhaust system for leaks	338
2	Emission control system	339
2.1	Removing and installing particulate filter	339
3	Exhaust gas temperature regulation	344
3.1	Assembly overview - exhaust gas temperature regulation	344
3.2	Removing and installing exhaust gas temperature sender	345
4	Exhaust gas recirculation	350
4.1	Assembly overview - exhaust gas recirculation system	350
4.2	Removing and installing exhaust gas recirculation valve N18	351
4.3	Removing and installing exhaust gas recirculation cooler	352
4.4	Removing and installing vacuum unit for exhaust gas recirculation cooler	353
4.5	Cleaning exhaust gas recirculation system	356
5	Exhaust manifold	362
5.1	Exploded view - exhaust manifold	362
5.2	Removing and installing exhaust manifold	362
28	Glow plug system	364
1	Glow plug system	364
1.1	Removing and installing glow plug	364
1.2	Checking glow plug	366
1.3	Removing and installing Hall sender G40	367
1.4	Removing and installing engine speed sender G28	368