

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	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	5
2.5 Safety precautions when working on the subframe	5
2.6 Safety precautions when working on the exhaust system	5
3 Repair instructions	7
3.1 Rules for cleanliness	7
3.2 General notes	7
3.3 General repair instructions	8
3.4 Bolts/nuts	9
3.5 Identification plates	9
3.6 Use of impact wrenches	9
3.7 Foreign material in engine	10
3.8 Contact corrosion	10
3.9 Routing and attachment of pipes, hoses and wiring	10
3.10 Installing radiators and condensers	11
10 - Removing and installing engine	12
1 Removing and installing engine	12
1.1 Removing engine	12
1.2 Securing engine to engine and gearbox support	44
1.3 Installing engine	44
2 Assembly mountings	55
2.1 Assembly overview - assembly mountings	55
2.2 Removing and installing engine mountings	57
2.3 Removing and installing torque reaction support and cross member	61
3 Engine cover panel	65
3.1 Removing and installing engine cover panel	65
13 - Crankshaft group	66
1 Cylinder block (pulley end)	66
1.1 Assembly overview - poly V-belt drive	66
1.2 Assembly overview - sealing flange (pulley end)	72
1.3 Removing and installing poly V-belt	73
1.4 Removing and installing poly V-belt tensioner	76
1.5 Removing and installing vibration damper	79
1.6 Removing and installing bracket for ancillaries	80
1.7 Renewing crankshaft oil seal (pulley end)	83
1.8 Removing and installing sealing flange (pulley end)	86
2 Cylinder block (gearbox end)	90
2.1 Assembly overview - cylinder block (gearbox end)	90
2.2 Removing and installing drive plate	91
2.3 Removing and installing sealing flange (gearbox end)	92
2.4 Renewing needle bearing in drive plate	103
3 Crankshaft	105
3.1 Assembly overview - crankshaft	105
3.2 Crankshaft dimensions	106



3.3	Measuring axial clearance of crankshaft	106
3.4	Measuring radial clearance of crankshaft	107
3.5	Pulling spur gear off crankshaft and shrink-fitting new spur gear	107
4	Pistons and conrods	111
4.1	Assembly overview - pistons and conrods	111
4.2	Measuring piston projection at TDC	117
4.3	Piston and cylinder dimensions	119
4.4	Checking radial clearance of conrod bearings	119
15	- Cylinder head, valve gear	121
1	Cylinder head	121
1.1	Assembly overview - cylinder head	121
1.2	Assembly overview - cylinder head cover	125
1.3	Removing and installing cylinder head	127
1.4	Removing and installing cylinder head cover	141
1.5	Removing and installing seals for injectors	145
1.6	Checking compression	146
2	Toothed belt drive	149
2.1	Assembly overview - toothed belt	149
2.2	Removing and installing toothed belt	151
3	Valve gear	165
3.1	Assembly overview - valve gear	165
3.2	Measuring axial clearance of camshaft	167
3.3	Measuring radial clearance of camshaft	168
3.4	Removing and installing camshaft oil seal	169
3.5	Removing and installing camshaft	172
3.6	Removing and installing valve stem oil seals	181
4	Inlet and exhaust valves	191
4.1	Reworking valve seats	191
4.2	Checking valve guides	191
4.3	Checking valves	192
4.4	Valve dimensions	192
17	- Lubrication	193
1	Sump/oil pump	193
1.1	Assembly overview - sump/oil pump	193
1.2	Engine oil	198
1.3	Checking oil level	198
1.4	Removing and installing sump	198
1.5	Removing and installing oil pump	202
1.6	Removing and installing oil level and oil temperature sender G266	203
2	Engine oil cooler	205
2.1	Removing and installing engine oil cooler	205
3	Oil filter/oil pressure switches	206
3.1	Exploded view - oil filter housing/oil pressure switch	206
3.2	Checking oil pressure	207
3.3	Checking oil pressure switch F1	208
3.4	Removing and installing oil pressure switch F1	209
3.5	Removing and installing oil filter housing	211
4	Balance shaft module	214
4.1	Removing and installing balance shaft module	214
19	- Cooling	222
1	Cooling system/coolant	222
1.1	Connection diagram - coolant hoses	222

1.2	Checking cooling system for leaks	226
1.3	Draining and filling cooling system	228
2	Coolant pump/thermostat assembly	238
2.1	Assembly overview - coolant pump/thermostat	238
2.2	Assembly overview - pump for exhaust gas recirculation cooler V400	239
2.3	Assembly overview - coolant circulation pump V50	240
2.4	Assembly overview - coolant valve for gearbox	241
2.5	Removing and installing coolant pump	242
2.6	Checking thermostat	243
2.7	Removing and installing 4/2-way valve with thermostat	243
2.8	Removing and installing coolant temperature sender G62	247
2.9	Removing and installing radiator outlet coolant temperature sender G83	248
2.10	Removing and installing pump for exhaust gas recirculation cooler V400	249
2.11	Removing and installing coolant circulation pump V50	252
2.12	Removing and installing coolant valve for gearbox N488	253
3	Coolant pipes	255
3.1	Assembly overview - coolant pipes	255
3.2	Removing and installing coolant pipe (top left)	257
3.3	Removing and installing coolant pipe (bottom left)	258
3.4	Removing and installing coolant pipe (rear right)	260
3.5	Removing and installing coolant pipe (rear)	264
4	Radiator/radiator fans	268
4.1	Exploded view - radiator/radiator fans	268
4.2	Removing and installing radiator	270
4.3	Removing and installing radiator cowl with radiator fans	274
4.4	Removing and installing radiator fan control unit J293	280
4.5	Removing and installing radiator fans	281
21	Turbocharging/supercharging	283
1	Turbocharger	283
1.1	Exploded view - turbocharger	283
1.2	Removing and installing turbocharger	285
2	Charge air system	292
2.1	Overview - charge air system	292
2.2	Assembly overview - charge air system	293
2.3	Removing and installing charge air cooler	296
2.4	Removing and installing charge pressure sender G31 / intake air temperature sender G42	299
2.5	Checking charge air system for leaks	300
23	Mixture preparation - injection	304
1	Injection system	304
1.1	Overview of fitting locations - injection system	304
1.2	Overview - fuel system	314
1.3	Filling and bleeding fuel system	315
1.4	Checking fuel system for leaks	316
2	Vacuum system	317
2.1	Checking vacuum system	317
3	Air filter	318
3.1	Assembly overview - air filter housing	318
3.2	Removing and installing air filter housing	320
4	Intake manifold	325
4.1	Exploded view - intake manifold	325
4.2	Removing and installing intake manifold	327
4.3	Removing and installing throttle valve module J338	331
4.4	Cleaning throttle valve module J338	332



5	Injectors/high-pressure reservoir (rail)	334
5.1	Assembly overview - injectors	334
5.2	Checking injectors	337
5.3	Performing adaptation of correction values for injectors	337
5.4	Checking for injectors sticking open	338
5.5	Checking return flow rate of injectors with engine running	340
5.6	Checking return flow rate of injectors at starter cranking speed	343
5.7	Removing and installing injectors	345
5.8	Removing and installing high-pressure pipes	350
5.9	Removing and installing high-pressure reservoir (rail)	351
6	High-pressure pump	355
6.1	Assembly overview - high-pressure pump	355
6.2	Removing and installing high-pressure pump	357
6.3	Performing first fuel filling operation after installing high-pressure pump	359
7	Senders and sensors	361
7.1	Checking fuel pressure (low pressure)	361
7.2	Checking fuel pressure regulating valve N276	363
7.3	Removing and installing fuel pressure regulating valve N276	364
7.4	Removing and installing fuel pressure sender G247	366
7.5	Removing and installing air mass meter G70	369
8	Lambda probe	371
8.1	Assembly overview - Lambda probe	371
8.2	Removing and installing Lambda probe	371
9	Engine control unit	374
9.1	Wiring and component check with test box V.A.G 1598/42	374
9.2	Removing and installing engine/motor control unit J623	376
26 - Exhaust system	381	
1	Exhaust pipes/silencers	381
1.1	Exploded view - silencers	381
1.2	Removing and installing front exhaust pipe	385
1.3	Separating exhaust pipes/silencers	386
1.4	Renewing tailpipes	388
1.5	Stress-free alignment of exhaust system	389
1.6	Checking exhaust system for leaks	390
2	Emission control system	392
2.1	Removing and installing particulate filter	392
2.2	Removing and installing pressure differential sender G505	394
3	Exhaust gas temperature regulation	396
3.1	Assembly overview - exhaust gas temperature regulation	396
3.2	Removing and installing exhaust gas temperature sender 1 G235	398
3.3	Removing and installing exhaust gas temperature sender 3 G495	401
3.4	Removing and installing exhaust gas temperature sender 4 G648	403
4	Exhaust gas recirculation	407
4.1	Assembly overview - exhaust gas recirculation system	407
4.2	Removing and installing exhaust gas recirculation cooler	409
4.3	Checking exhaust gas recirculation cooler change-over	412
4.4	Cleaning exhaust gas recirculation system	414
5	Exhaust manifold	423
5.1	Exploded view - exhaust manifold	423
5.2	Removing and installing exhaust manifold	424
28 - Glow plug system	427	
1	Glow plug system	427

1.1	Assembly overview - glow plug system	427
1.2	Removing and installing glow plug	427
1.3	Checking glow plug	429
1.4	Removing and installing Hall sender G40	430
1.5	Removing and installing engine speed sender G28	431