

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	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 Bolts/nuts	8
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	10
10 - Removing and installing engine	11
1 Removing and installing engine	11
1.1 Removing engine	11
1.2 Securing engine to engine and gearbox support	30
1.3 Installing engine	31
2 Assembly mountings	39
2.1 Assembly overview - assembly mountings	39
2.2 Removing and installing engine mountings	40
2.3 Removing and installing torque reaction support and cross member	42
3 Engine cover panel	46
3.1 Removing and installing engine cover panel	46
13 - Crankshaft group	47
1 Cylinder block (pulley end)	47
1.1 Assembly overview - poly V-belt drive	47
1.2 Assembly overview - sealing flange (pulley end)	50
1.3 Removing and installing poly V-belt	51
1.4 Removing and installing poly V-belt tensioner	53
1.5 Removing and installing vibration damper	55
1.6 Removing and installing bracket for ancillaries	56
1.7 Renewing crankshaft oil seal (pulley end)	59
1.8 Removing and installing sealing flange (pulley end)	62
2 Cylinder block (gearbox end)	66
2.1 Assembly overview - cylinder block (gearbox end)	66
2.2 Removing and installing drive plate	67
2.3 Removing and installing sealing flange (gearbox end)	68
2.4 Renewing needle bearing in drive plate	78
3 Crankshaft	81
3.1 Assembly overview - crankshaft	81
3.2 Crankshaft dimensions	81

3.3	Measuring radial clearance of crankshaft	82
3.4	Pulling spur gear off crankshaft and shrink-fitting new spur gear	82
4	Pistons and conrods	87
4.1	Assembly overview - pistons and conrods	87
4.2	Measuring piston projection at TDC	91
4.3	Piston and cylinder dimensions	92
4.4	Separating parts of new conrod	92
4.5	Bearing shells - installation position	93
4.6	Measuring radial clearance of conrods	93
15 - Cylinder head, valve gear	95	
1	Cylinder head	95
1.1	Assembly overview - cylinder head	95
1.2	Assembly overview - cylinder head cover	98
1.3	Removing and installing cylinder head	100
1.4	Removing and installing cylinder head cover	106
1.5	Checking compression	108
1.6	Identification of cylinder head gasket	110
2	Toothed belt drive	111
2.1	Assembly overview - toothed belt	111
2.2	Removing and installing toothed belt	113
3	Valve gear	127
3.1	Assembly overview - valve gear	127
3.2	Removing and installing camshaft oil seal	129
3.3	Removing and installing camshaft	132
3.4	Removing and installing valve stem oil seals	141
4	Inlet and exhaust valves	151
4.1	Reworking valve seats	151
4.2	Checking valve guides	151
4.3	Valve dimensions	152
17 - Lubrication	153	
1	Sump/oil pump	153
1.1	Assembly overview - sump/oil pump	153
1.2	Engine oil	159
1.3	Removing and installing sump	159
1.4	Removing and installing oil pump	164
2	Engine oil cooler	166
2.1	Removing and installing engine oil cooler	166
3	Oil filter housing/oil pressure switches and oil supply line	168
3.1	Exploded view - oil filter housing/oil pressure switch	168
3.2	Checking oil pressure and oil pressure switch	170
3.3	Removing and installing oil supply line	172
3.4	Removing and installing oil filter housing	174
3.5	Checking oil level	176
4	Balance shaft module	177
4.1	Removing and installing balance shaft module	177
19 - Cooling	184	
1	Cooling system/coolant	184
1.1	Connection diagram - coolant hoses	184
1.2	Checking cooling system for leaks	191
1.3	Draining and filling cooling system	193
2	Coolant pump/thermostat assembly	201

2.1	Assembly overview - coolant pump/thermostat	201
2.2	Removing and installing pump for exhaust gas recirculation cooler V400	201
2.3	Removing and installing coolant pump	203
2.4	Removing and installing thermostat	205
2.5	Removing and installing 4/2-way valve with thermostat	207
2.6	Removing and installing coolant temperature sender G62	209
2.7	Removing and installing radiator outlet coolant temperature sender G83	210
3	Radiator/radiator fans	212
3.1	Exploded view - radiator/radiator fans	212
3.2	Removing and installing radiator	214
3.3	Removing and installing radiator fan control unit J293	222
3.4	Removing and installing radiator fans	223
21	- Turbocharging/supercharging	225
1	Turbocharger	225
1.1	Exploded view - turbocharger	225
1.2	Removing and installing turbocharger	227
2	Charge air system	233
2.1	Assembly overview - charge air system	233
2.2	Removing and installing charge air cooler	235
2.3	Removing and installing charge pressure sender G31	238
2.4	Checking charge air system for leaks	239
23	- Mixture preparation - injection	243
1	Injection system	243
1.1	Overview of fitting locations - injection system	243
1.2	Overview - fuel system	253
1.3	Exploded view - fuel system	255
1.4	Filling and bleeding fuel system	258
1.5	Checking fuel system for leaks	259
1.6	Checking fuel pressure (low pressure) system	259
2	Vacuum system	263
2.1	Checking vacuum system	263
3	Air filter	264
3.1	Assembly overview - air filter housing	264
3.2	Removing and installing air filter element	266
3.3	Removing and installing air filter housing	267
4	Intake manifold	271
4.1	Exploded view - intake manifold	271
4.2	Removing and installing intake manifold	271
5	Injectors/high-pressure reservoir (rail)	277
5.1	Checking injectors	277
5.2	Performing adaptation of correction values for injectors	277
5.3	Checking for injectors sticking open	278
5.4	Checking return flow rate of injectors with engine running	280
5.5	Checking return flow rate of injectors at starter cranking speed	283
5.6	Checking pressure retention valve in fuel return line	285
5.7	Removing and installing injectors	286
5.8	Removing and installing high-pressure pipes	293
5.9	Removing and installing high-pressure reservoir (rail)	296
6	High-pressure pump	300
6.1	Removing and installing high-pressure pump	300
6.2	Performing first fuel filling operation after installing high-pressure pump	303
7	Senders and sensors	304

7.1	Checking fuel pressure regulating valve N276	304
7.2	Removing and installing fuel pressure regulating valve N276	305
7.3	Removing and installing fuel pressure sender G247	307
7.4	Removing and installing air mass meter G70	310
7.5	Removing and installing exhaust gas pressure sensor 1 G450	311
8	Lambda probe	312
8.1	Assembly overview - Lambda probe	312
8.2	Removing and installing Lambda probe	313
9	Engine control unit	315
9.1	Wiring and component check with test box V.A.G 1598/42	315
9.2	Removing and installing engine control unit J623	317
26 - Exhaust system	322
1	Exhaust pipes/silencers	322
1.1	Exploded view - silencers	322
1.2	Removing and installing front exhaust pipe	326
1.3	Separating exhaust pipes/silencers	327
1.4	Renewing tailpipes	328
1.5	Stress-free alignment of exhaust system	329
1.6	Checking exhaust system for leaks	331
2	Emission control system	332
2.1	Removing and installing particulate filter	332
3	Exhaust gas temperature regulation	337
3.1	Assembly overview - exhaust gas temperature regulation	337
3.2	Removing and installing exhaust gas temperature sender	338
4	Exhaust gas recirculation	345
4.1	Assembly overview - exhaust gas recirculation system	345
4.2	Assembly overview - exhaust gas recirculation valve G212 with exhaust gas recirculation potentiometer N18	346
4.3	Removing and installing exhaust gas recirculation valve N18	347
4.4	Removing and installing exhaust gas recirculation cooler	349
4.5	Removing and installing vacuum unit for exhaust gas recirculation cooler	350
4.6	Cleaning exhaust gas recirculation system	353
5	Exhaust manifold	359
5.1	Exploded view - exhaust manifold	359
5.2	Removing and installing exhaust manifold	359
28 - Glow plug system	361
1	Glow plug system	361
1.1	Checking glow plug system	361
1.2	Removing and installing glow plug	361
1.3	Different types of glow plugs	364
1.4	Handling ceramic glow plugs	365
1.5	Removing and installing Hall sender G40	365
1.6	Removing and installing engine speed sender G28	367