

Contents

00 - Technical data	1
1 Identification	1
1.1 Engine number/engine data	2
2 Safety precautions	3
2.1 Safety precautions when working on the fuel system	3
2.2 Safety precautions when using testers and measuring instruments during a road test	4
2.3 Safety precautions when working on the subframe	5
2.4 Safety precautions when working on the cooling system	5
2.5 Safety precautions when working on the ignition system	5
3 Repair instructions	7
3.1 Rules for cleanliness	7
3.2 Foreign particles in engine	7
3.3 Contact corrosion	7
3.4 Routing and attachment of pipes, hoses and wiring	8
3.5 Installing radiators and condensers	8
3.6 Checking vacuum system	8
3.7 General notes on self-diagnosis	9
3.8 General notes on ignition system	9
4 Technical data	10
4.1 Technical data of injection system	10
10 - Removing and installing engine	11
1 Removing and installing engine	11
1.1 Removing engine	11
1.2 Separating engine and gearbox	68
1.3 Securing engine to engine and gearbox support	82
1.4 Installing engine	86
2 Assembly mountings	109
2.1 Exploded view - assembly mountings	109
2.2 Removing and installing engine mounting (left-side)	109
2.3 Removing and installing engine mounting (right-side)	112
13 - Crankshaft group	116
1 Cylinder block (pulley end)	116
1.1 Exploded view - poly V-belt drive	116
1.2 Removing and installing poly V-belt	118
1.3 Removing and installing poly V-belt tensioner	119
1.4 Removing and installing vibration damper	120
1.5 Removing and installing sealing flange (pulley end)	120
2 Cylinder block (gearbox end)	124
2.1 Exploded view - drive plate	124
2.2 Removing and installing drive plate	124
2.3 Renewing needle bearing in drive plate	125
2.4 Renewing crankshaft oil seal (gearbox end)	127
3 Crankshaft	129
3.1 Exploded view - crankshaft	129
3.2 Crankshaft dimensions	132
3.3 Measuring axial clearance of crankshaft	132
3.4 Measuring radial clearance of crankshaft	133
4 Balance shaft	135
4.1 Exploded view - balance shaft	135
4.2 Removing and installing balance shaft	135

5	Pistons and conrods	138
5.1	Exploded view - pistons and conrods	138
5.2	Piston and cylinder dimensions	141
5.3	Checking radial clearance of conrod bearings	141
15 - Cylinder head, valve gear		142
1	Cylinder head	142
1.1	Exploded view - cylinder head	142
1.2	Removing and installing cylinder head	145
1.3	Removing and installing cylinder head cover (left-side)	165
1.4	Removing and installing cylinder head cover (right-side)	168
1.5	Checking compression	171
2	Timing chain cover	176
2.1	Exploded view - timing chain cover	176
2.2	Removing and installing timing chain covers (left and right)	178
2.3	Removing and installing timing chain cover (bottom)	182
3	Chain drive	188
3.1	Exploded view - camshaft timing chains	188
3.2	Exploded view - drive chain for valve gear	190
3.3	Exploded view - drive chain for balance shaft and oil pump	192
3.4	Removing and installing camshaft timing chain	192
3.5	Removing camshaft timing chain from camshafts	194
3.6	Removing and installing drive chain for valve gear	204
3.7	Removing and installing drive chain for auxiliary drive	205
4	Valve gear	209
4.1	Exploded view - valve gear	209
4.2	Measuring axial clearance of camshaft	212
4.3	Measuring radial clearance of camshaft	212
4.4	Removing and installing camshaft	213
4.5	Checking hydraulic compensation elements	218
4.6	Removing and installing valve stem oil seals	220
5	Inlet and exhaust valves	228
5.1	Checking valve guides	228
5.2	Checking valves	229
5.3	Valve dimensions	230
17 - Lubrication		231
1	Sump/oil pump	231
1.1	Exploded view - sump/oil pump	231
1.2	Engine oil	234
1.3	Checking engine oil level	234
1.4	Removing and installing sump (bottom section)	234
1.5	Removing and installing sump (top section)	237
1.6	Removing and installing oil pump	240
1.7	Removing and installing oil level and oil temperature sender G266	240
2	Engine oil cooler	241
2.1	Exploded view - engine oil cooler	241
2.2	Removing and installing engine oil cooler	243
3	Crankcase breather	245
3.1	Exploded view - crankcase breather system	245
3.2	Removing and installing crankcase breather hoses	246
3.3	Removing and installing oil separator	247
3.4	Removing and installing pressure control valve	248
3.5	Removing and installing oil drain valve	249
3.6	Removing and installing crankcase breather shut-off valve N548	250

4	Oil filter/oil pressure switches	252
4.1	Exploded view - oil filter/oil pressure switch	252
4.2	Removing and installing oil pressure switch F22	253
4.3	Removing and installing oil pressure switch for reduced oil pressure F378	254
4.4	Checking oil pressure and oil pressure switch	256
4.5	Checking oil pressure	256
4.6	Removing and installing oil filter housing	256
4.7	Removing and installing valve for oil pressure control N428	258
19 - Cooling		261
1	Cooling system/coolant	261
1.1	Connection diagram - coolant hoses	261
1.2	Checking cooling system for leaks	264
1.3	Draining and filling cooling system	265
2	Coolant pump/thermostat assembly	272
2.1	Exploded view - coolant pump/thermostat	272
2.2	Exploded view - electric coolant pump	273
2.3	Removing and installing electric coolant pump	273
2.4	Removing and installing coolant pump	275
2.5	Removing and installing thermostat	276
2.6	Checking thermostat	276
2.7	Removing and installing coolant temperature sender G62	277
3	Coolant pipes	278
3.1	Exploded view - coolant pipes	278
3.2	Removing and installing coolant pipes (front)	279
3.3	Removing and installing coolant pipes (left-side)	282
3.4	Removing and installing coolant pipes (top)	284
4	Radiator/radiator fans	287
4.1	Exploded view - radiator/radiator fans	287
4.2	Removing and installing radiator	289
4.3	Removing and installing radiator cowl	300
4.4	Removing and installing radiator fan control unit J293	304
4.5	Removing and installing radiator fans	305
24 - Mixture preparation - injection		307
1	Injection system	307
1.1	Overview of fitting locations - injection system	307
1.2	Reducing pressure in high-pressure section of injection system	317
1.3	Procedure before opening high-pressure section of injection system	318
1.4	Checking fuel system for leaks	322
2	Injectors	324
2.1	Removing and installing injectors	324
3	Air cleaner	328
3.1	Exploded view - air cleaner housing	328
3.2	Removing and installing air filter element	329
3.3	Removing air cleaner (bottom section)	331
4	Intake manifold	334
4.1	Exploded view - intake manifold (bottom section) with fuel rail	334
4.2	Exploded view - intake manifold (top section)	336
4.3	Removing and installing intake manifold (bottom section) with fuel rail	337
4.4	Removing and installing intake manifold (top section)	339
5	Senders and sensors	342
5.1	Removing and installing fuel pressure sender G247	342
6	Engine control unit	343

6.1	Wiring and component check with test box V.A.G 1598/42	343
6.2	Removing and installing engine control unit J623	345
7	High-pressure pump	349
7.1	Exploded view - high-pressure pump	349
7.2	Removing and installing high-pressure pump	351
7.3	Removing and installing high-pressure pipe	354
7.4	Checking fuel system pressurisation pump G6	355
8	Lambda probe	360
8.1	Exploded view - Lambda probe	360
8.2	Removing and installing Lambda probe	361
26 - Exhaust system		369
1	Exhaust pipes/silencers	369
1.1	Exploded view - silencers	369
1.2	Separating exhaust pipes/silencers	373
1.3	Removing and installing front silencers	374
1.4	Renewing tailpipes	375
1.5	Stress-free alignment of exhaust system	376
1.6	Aligning tailpipes	377
1.7	Checking exhaust system for leaks	377
2	Emission control system	378
2.1	Removing and installing catalytic converter (left-side)	378
2.2	Removing and installing catalytic converter (right-side)	381
3	Secondary air system	384
3.1	Exploded view - secondary air system	384
3.2	Removing and installing secondary air pump motor V101	387
3.3	Removing and installing combination valve	391
3.4	Checking combination valves	397
3.5	Removing and installing sender 1 for secondary air pressure G609	400
4	Exhaust manifolds	402
4.1	Exploded view - exhaust manifolds	402
4.2	Removing and installing exhaust manifold (left-side)	403
4.3	Removing and installing exhaust manifold (right-side)	405
28 - Ignition system		407
1	Ignition system	407
1.1	Exploded view - ignition system	407
1.2	Test data - spark plugs	408
1.3	Removing and installing ignition coils	408
1.4	Removing and installing knock sensor	410
1.5	Removing and installing Hall senders	411
1.6	Removing and installing engine speed sender G28	412