

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 high-voltage system	2
2.2 Safety precautions when working in the vicinity of high-voltage components	3
2.3 Safety precautions when working on the fuel supply system	3
2.4 Safety precautions when working on vehicles with start/stop system	4
2.5 Safety precautions when using testers and measuring instruments during a road test	4
2.6 Safety precautions when working on the ignition system	4
2.7 Safety precautions when working on the cooling system	5
2.8 Safety precautions when working on the exhaust system	5
3 Repair instructions	6
3.1 Identification plates	6
3.2 Use of impact wrenches	6
3.3 Rules for cleanliness	7
3.4 General notes	7
3.5 General repair instructions	7
3.6 Foreign material in engine	8
3.7 Contact corrosion	9
3.8 Cleaning engine	9
3.9 Routing and attachment of pipes, hoses and wiring	9
3.10 Installing radiators and condensers	9
3.11 Nuts, bolts	10
3.12 Checking fuel system for leaks	10
10 - Removing and installing engine	11
1 Safety information	11
2 Removing and installing engine	12
3 Assembly mountings	13
4 Engine cover panel	14
4.1 Removing and installing engine cover panel	14
13 - Crankshaft group	16
1 Safety information	16
2 Cylinder block (pulley end)	17
2.1 Assembly overview - cylinder block (pulley end)	17
2.2 Assembly overview - sealing flange (pulley end)	30
2.3 Removing and installing poly V-belts	32
2.4 Removing and installing poly V-belt tensioner	41
2.5 Removing and installing vibration damper	44
2.6 Removing and installing bracket for ancillaries	52
2.7 Removing and installing engine support	57
2.8 Renewing crankshaft oil seal (pulley end)	57
2.9 Removing and installing sealing flange (pulley end)	58
3 Cylinder block (gearbox end)	64
3.1 Assembly overview - cylinder block (gearbox end)	64
3.2 Removing and installing drive plate	64
3.3 Renewing crankshaft oil seal (gearbox end)	66
4 Crankshaft	69
4.1 Assembly overview - crankshaft	69
4.2 Crankshaft dimensions	73



4.3	Allocation of main bearing shells	73
4.4	Measuring axial clearance of crankshaft	75
4.5	Measuring radial clearance of crankshaft	76
4.6	Removing and installing sender wheel	76
4.7	Checking sender wheel	77
4.8	Removing and installing crankshaft	78
5	Balance shaft	83
5.1	Assembly overview - balance shaft	83
5.2	Removing and installing balance shaft	83
5.3	Renewing roller bearing	88
6	Pistons and conrods	92
6.1	Assembly overview - pistons and conrods	92
6.2	Removing and installing pistons	97
6.3	Removing and installing oil spray jets	101
6.4	Checking pistons and cylinder bores	102
6.5	Checking radial clearance of conrod bearings	105
15	Cylinder head, valve gear	107
1	Safety information	107
2	Timing chain cover	108
2.1	Assembly overview - timing chain cover	108
2.2	Removing and installing timing chain cover	112
3	Chain drive	123
3.1	Assembly overview - camshaft timing chains	123
3.2	Assembly overview - drive chain for oil pump	127
3.3	Removing camshaft timing chain from camshafts	128
3.4	Removing and installing camshaft timing chain	154
3.5	Removing and installing chain tensioner	155
4	Cylinder head	159
4.1	Assembly overview - cylinder head	159
4.2	Assembly overview - camshaft housing	164
4.3	Removing and installing cylinder head	168
4.4	Removing and installing camshaft housing	186
4.5	Checking compression	199
5	Valve gear	204
5.1	Assembly overview - valve gear	204
5.2	Measuring axial clearance of camshaft	207
5.3	Measuring radial clearance of camshaft	208
5.4	Removing and installing camshaft	209
5.5	Removing and installing cam actuators	211
5.6	Removing and installing camshaft control valves	213
5.7	Removing and installing valve stem oil seals	214
6	Inlet and exhaust valves	228
6.1	Checking valve guides	228
6.2	Checking valves	229
6.3	Valve dimensions	229
17	Lubrication	230
1	Safety information	230
2	Sump/oil pump	231
2.1	Assembly overview - sump/oil pump	231
2.2	Engine oil	236
2.3	Removing and installing lower part of sump	236
2.4	Removing and installing upper part of sump	239

2.5	Removing and installing oil baffle plate	249
2.6	Removing and installing oil pump	251
2.7	Removing and installing oil level and oil temperature sender G266	252
3	Engine oil cooler	253
3.1	Assembly overview - engine oil cooler	253
3.2	Removing and installing engine oil cooler	254
3.3	Removing and installing spray nozzle valve	256
4	Crankcase breather	258
4.1	Assembly overview - crankcase breather system	258
4.2	Removing and installing crankcase breather module	259
5	Oil filter/oil pressure switches	261
5.1	Assembly overview - oil filter	261
5.2	Assembly overview - oil pressure switches/oil pressure control	263
5.3	Removing and installing oil filter housing	265
5.4	Removing and installing oil pressure switch F22	267
5.5	Removing and installing oil temperature sender G8	269
5.6	Removing and installing oil pressure sender G10	271
5.7	Checking oil pressure	273
5.8	Removing and installing valve for oil pressure control N428	274
19	Cooling	277
1	Safety information	277
2	Cooling system/coolant	278
2.1	Connection diagram - coolant hoses	278
2.2	Checking cooling system for leaks	278
2.3	Draining and filling cooling system	283
3	Coolant pump/thermostat assembly	286
3.1	Assembly overview - coolant pump/thermostat	286
3.2	Assembly overview - electric coolant pump	288
3.3	Assembly overview - coolant valves	288
3.4	Assembly overview - coolant temperature senders	288
3.5	Removing and installing electric coolant pump	290
3.6	Removing and installing coolant pump	290
3.7	Removing and installing map-controlled engine cooling system thermostat F265	290
3.8	Removing and installing coolant temperature sender G62	293
3.9	Removing and installing engine outlet coolant temperature sender G82	296
3.10	Removing and installing radiator outlet coolant temperature sender G83	299
3.11	Removing and installing temperature sender for engine temperature regulation G694	299
3.12	Removing and installing coolant valves	302
4	Coolant pipes	304
5	Radiators/radiator fans	305
21	Turbocharging/supercharging	306
1	Safety information	306
2	Turbochargers	307
2.1	Assembly overview - turbocharger	307
2.2	Removing and installing turbocharger	316
2.3	Renewing vacuum unit for turbocharger	327
2.4	Removing and installing temperature sender for engine cover panel G765	342
3	Charge air system	344
3.1	Assembly overview - charge air system	344
3.2	Assembly overview - hose connections for charge air system	359
3.3	Removing and installing air pipe	360
3.4	Removing and installing intake manifold	362



3.5	Removing and installing charge air cooler	370
3.6	Removing and installing charge pressure sender G31	370
3.7	Removing and installing charge air temperature sender	370
3.8	Removing and installing overrun air recirculation valve	371
3.9	Checking charge air system for leaks	374
24	Mixture preparation - injection	376
1	Safety information	376
2	Injection system	377
3	Vacuum system	378
3.1	Connection diagram - vacuum system	378
3.2	Checking vacuum system	380
4	Air filter	382
5	Intake manifold	383
5.1	Assembly overview - intake manifold	383
5.2	Removing and installing intake manifold	384
5.3	Removing and installing throttle valve module GX3	387
5.4	Cleaning throttle valve module GX3	387
6	Injectors	389
6.1	Assembly overview - fuel rail with injectors	389
6.2	Removing and installing fuel rail	394
6.3	Removing and installing injectors	397
6.4	Cleaning injectors	410
7	Senders and sensors	413
7.1	Assembly overview - actuator for structure-borne sound and control unit for structure-borne sound	413
7.2	Assembly overview - pressure differential sender	413
7.3	Removing and installing actuator for structure-borne sound R214	415
7.4	Removing and installing control unit for structure-borne sound J869	415
7.5	Removing and installing intake air temperature sender G42/intake manifold pressure sender G71	415
7.6	Removing and installing fuel pressure sender G247	416
7.7	Removing and installing fuel pressure sender for low pressure G410	416
7.8	Removing and installing pressure differential sender for particulate filter G1037	417
8	High-pressure pump	423
8.1	Assembly overview - high-pressure pump	423
8.2	Removing and installing high-pressure pump	427
8.3	Removing and installing high-pressure pipe	430
9	Lambda probe	438
9.1	Assembly overview - Lambda probe	438
9.2	Removing and installing Lambda probe	442
10	Engine control unit	450
26	Exhaust system	451
1	Safety information	451
2	Exhaust pipes/silencers	452
2.1	Assembly overview - silencers	452
2.2	Separating exhaust pipes/silencers	452
2.3	Removing and installing front silencers	452
2.4	Stress-free alignment of exhaust system	452
2.5	Checking exhaust system for leaks	452
3	Emission control system	453
4	Exhaust gas temperature regulation	454
4.1	Assembly overview - exhaust gas temperature regulation	454

4.2	Removing and installing parts of exhaust gas temperature regulation	455
28	- Ignition system	462
1	Safety information	462
2	Ignition system	463
2.1	Assembly overview - ignition system	463
2.2	Removing and installing ignition coils	465
2.3	Removing and installing knock sensor 1 G61/knock sensor 2 G66	468
2.4	Removing and installing Hall senders	468
2.5	Removing and installing engine speed sender G28	471