

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 cooling system	4
2.7 Safety precautions when working on the exhaust system	5
2.8 Safety precautions when working on the ignition system	5
3 Repair instructions	6
3.1 Identification plates	6
3.2 Use of impact wrenches	6
3.3 Safety precautions when working on the subframe	7
3.4 Rules for cleanliness	7
3.5 Performing adaptations after renewing a component	8
3.6 General notes	9
3.7 General repair instructions	9
3.8 Foreign material in engine	10
3.9 Cleaning engine	10
3.10 Contact corrosion	10
3.11 Routing and attachment of pipes, hoses and wiring	10
3.12 Nuts, bolts	11
3.13 Installing radiators and condensers	11
3.14 Checking vacuum system	11
10 - Removing and installing engine	13
1 Safety information	13
2 Removing and installing engine	14
2.1 Removing engine	14
2.2 Securing engine to engine and gearbox support	14
2.3 Installing engine	15
3 Assembly mountings	16
4 Engine cover panel	17
4.1 Removing and installing engine cover panel	17
13 - Crankshaft group	18
1 Safety information	18
2 Cylinder block (pulley end)	19
2.1 Assembly overview - cylinder block (pulley end)	19
2.2 Removing and installing poly V-belt	28
2.3 Removing and installing poly V-belt tensioner	30
2.4 Removing and installing vibration damper	34
2.5 Removing and installing bracket for ancillaries	51
2.6 Removing and installing engine support	58
3 Cylinder block (gearbox end)	59
3.1 Assembly overview - cylinder block (gearbox end)	59
3.2 Removing and installing drive plate	62
3.3 Removing and installing dual-mass flywheel	64
3.4 Removing and installing sealing flange (gearbox end)	66



3.5	Renewing needle bearing in drive plate	69
4	Crankshaft	72
4.1	Assembly overview - crankshaft	72
4.2	Crankshaft dimensions	75
4.3	Allocation of main bearing shells	75
4.4	Measuring axial clearance of crankshaft	77
4.5	Measuring radial clearance of crankshaft	78
4.6	Removing and installing sender wheel	79
5	Balance shaft	81
5.1	Assembly overview - balance shaft	81
5.2	Removing and installing balance shaft	84
5.3	Renewing oil seal for balance shaft (inlet side)	89
6	Pistons and conrods	91
6.1	Assembly overview - pistons and conrods	91
6.2	Removing and installing pistons	96
6.3	Removing and installing oil spray jets	98
6.4	Checking pistons and cylinder bores	100
6.5	Separating parts of new conrod	102
6.6	Checking radial clearance of conrod bearings	103
15	Cylinder head, valve gear	104
1	Safety information	104
2	Timing chain cover	105
2.1	Assembly overview - timing chain cover	105
2.2	Removing and installing timing chain cover	109
2.3	Renewing oil seal for vibration damper	115
3	Chain drive	118
3.1	Assembly overview - camshaft timing chains	118
3.2	Assembly overview - drive chain for balance shaft	121
3.3	Removing and installing bearing saddle	124
3.4	Removing and installing camshaft timing chain	130
3.5	Checking timing chain	148
3.6	Checking valve timing	150
4	Cylinder head	156
4.1	Assembly overview - cylinder head	156
4.2	Removing and installing cylinder head	160
4.3	Checking compression	167
5	Valve gear	172
5.1	Assembly overview - valve gear	172
5.2	Removing and installing camshaft	177
5.3	Installing ball for slider	199
5.4	Removing and installing cam adjustment actuators	200
5.5	Removing and installing camshaft control valve 1 N205	201
5.6	Removing and installing valve stem oil seals	202
6	Inlet and exhaust valves	215
6.1	Checking valve guides	215
6.2	Checking valves	216
6.3	Valve dimensions	216
17	Lubrication	217
1	Safety information	217
2	Sump/oil pump	218
2.1	Assembly overview - sump/oil pump	218
2.2	Engine oil	226

2.3	Removing and installing lower part of sump	226
2.4	Removing and installing oil pump	229
2.5	Removing and installing upper part of sump	232
2.6	Removing and installing oil level and oil temperature sender G266	237
3	Engine oil cooler	239
3.1	Assembly overview - engine oil cooler	239
3.2	Removing and installing engine oil cooler	239
3.3	Removing and installing mechanical switching valve	240
4	Crankcase breather	242
4.1	Assembly overview - crankcase breather system	242
4.2	Removing and installing oil separator	243
4.3	Removing and installing tank breather pressure sensor 1 G950	245
5	Oil filter/oil pressure switches	246
5.1	Assembly overview - oil filter	246
5.2	Assembly overview - oil pressure switches/oil pressure control	247
5.3	Removing and installing oil pressure switch F22	251
5.4	Removing and installing oil pressure switch for reduced oil pressure F378	251
5.5	Removing and installing stage 3 oil pressure switch F447	252
5.6	Removing and installing valve for oil pressure control N428	256
5.7	Removing and installing piston cooling jet control valve N522	257
5.8	Checking oil pressure	258
5.9	Checking oil pressure and oil pressure switch	261
19	Cooling	262
1	Safety information	262
2	Cooling system/coolant	263
2.1	Connection diagram - coolant hoses	263
2.2	Checking cooling system for leaks	263
2.3	Draining and filling cooling system	268
3	Coolant pump/thermostat assembly	271
3.1	Assembly overview - coolant pump/thermostat	271
3.2	Assembly overview - electric coolant pump	273
3.3	Assembly overview - coolant temperature senders	273
3.4	Removing and installing electric coolant pump	275
3.5	Removing and installing coolant pump	275
3.6	Removing and installing toothed belt for coolant pump	277
3.7	Removing and installing actuator for engine temperature regulation N493	280
3.8	Removing and installing coolant temperature sender G62	283
3.9	Removing and installing radiator outlet coolant temperature sender G83	284
3.10	Removing and installing coolant valves	284
4	Coolant pipes	285
5	Radiator/radiator fans	286
21	Turbocharging/supercharging	287
1	Safety information	287
2	Turbocharger	288
2.1	Assembly overview - turbocharger	288
2.2	Removing and installing turbocharger	294
2.3	Removing and installing turbocharger air recirculation valve N249	304
2.4	Removing and installing charge pressure positioner V465	305
3	Charge air system	307
3.1	Assembly overview - charge air system	307
3.2	Assembly overview - hose connections for charge air system	307
3.3	Removing and installing charge air cooler	308



3.4	Removing and installing charge pressure sender G31	308
3.5	Checking charge air system for leaks	308
24	Mixture preparation - injection	310
1	Safety information	310
2	Injection system	311
2.1	Overview of fitting locations - injection system	311
2.2	Checking fuel system for leaks	311
3	Air filter	312
4	Intake manifold	313
4.1	Assembly overview - intake manifold	313
4.2	Removing and installing intake manifold	316
4.3	Removing and installing throttle valve module GX3	317
4.4	Cleaning throttle valve module GX3	318
4.5	Removing and installing intake manifold flap valve N316	319
4.6	Checking intake manifold change-over function	319
5	Injectors	322
5.1	Assembly overview - fuel rail with injectors	322
5.2	Removing and installing fuel rail	326
5.3	Removing and installing injectors	327
5.4	Cleaning injectors	343
6	Senders and sensors	345
6.1	Removing and installing intake air temperature sender G42/intake manifold pressure sender G71	345
6.2	Removing and installing fuel pressure sender G247	346
6.3	Checking fuel pressure sender G247	347
6.4	Removing and installing fuel pressure sender for low pressure G410	352
6.5	Removing and installing pressure differential sender for particulate filter G1037	353
7	High-pressure pump	356
7.1	Assembly overview - high-pressure pump	356
7.2	Removing and installing high-pressure pump	362
7.3	Removing and installing high-pressure pipe	367
8	Lambda probe	373
8.1	Assembly overview - Lambda probe	373
8.2	Removing and installing Lambda probe	376
9	Engine control unit	381
26	Exhaust system	382
1	Safety information	382
2	Exhaust pipes/silencers	383
2.1	Assembly overview - silencers	383
2.2	Separating exhaust pipes/silencers	383
2.3	Removing and installing front silencers	383
2.4	Removing and installing silencers	383
2.5	Stress-free alignment of exhaust system	383
2.6	Checking exhaust system for leaks	383
3	Emission control system	384
3.1	Assembly overview - emission control system	384
3.2	Removing and installing catalytic converter	388
3.3	Removing and installing particulate filter	388
4	Exhaust gas temperature regulation	389
5	Secondary air system	390
5.1	Assembly overview - secondary air system	390
5.2	Removing and installing secondary air pump motor V101	392

5.3	Removing and installing secondary air inlet valve N112	393
5.4	Removing and installing sender 1 for secondary air pressure G609	393
5.5	Removing and installing resonator for secondary air system	394
28	Ignition system	396
1	Safety information	396
2	Ignition system	397
2.1	Assembly overview - ignition system	397
2.2	Removing and installing ignition coils	399
2.3	Removing and installing knock sensor 1 G61	402
2.4	Removing and installing Hall senders	403
2.5	Removing and installing engine speed sender G28	405