

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	2
2.3 Safety precautions when using testers and measuring instruments during a road test	3
2.4 Safety precautions when working on the cooling system	3
2.5 Safety precautions when working on the exhaust system	3
2.6 Safety precautions when working on the ignition system	4
2.7 Safety precautions when working on the underbody	4
3 Repair instructions	5
3.1 Rules for cleanliness	5
3.2 General notes	5
3.3 General repair instructions	6
3.4 Identification plates	7
3.5 Use of impact wrenches	7
3.6 Foreign material in engine	8
3.7 Cleaning engine	8
3.8 Contact corrosion	8
3.9 Routing and attachment of pipes, hoses and wiring	8
3.10 Installing radiators and condensers	9
3.11 Checking fuel system for leaks	9
3.12 Nuts, bolts	9
10 - Removing and installing engine	10
1 Removing and installing engine	10
2 Assembly mountings	11
3 Engine cover panel	12
13 - Crankshaft group	13
1 Cylinder block (pulley end)	13
1.1 Assembly overview - cylinder block (pulley end)	13
1.2 Assembly overview - sealing flange (pulley end)	19
1.3 Removing and installing poly V-belt	21
1.4 Removing and installing poly V-belt tensioner	23
1.5 Removing and installing vibration damper	24
1.6 Removing and installing bracket for ancillaries	26
1.7 Removing and installing engine support	28
1.8 Renewing crankshaft oil seal (pulley end)	28
1.9 Removing and installing sealing flange (pulley end)	29
2 Cylinder block (gearbox end)	34
2.1 Assembly overview - cylinder block (gearbox end)	34
2.2 Removing and installing drive plate	35
2.3 Renewing crankshaft oil seal (gearbox end)	36
3 Crankshaft	39
3.1 Assembly overview - crankshaft	39
3.2 Crankshaft dimensions	43
3.3 Allocation of main bearing shells	43
3.4 Measuring axial clearance of crankshaft	43
3.5 Measuring radial clearance of crankshaft	44
3.6 Removing and installing sender wheel	45



3.7	Checking sender wheel	45
3.8	Removing and installing crankshaft	46
4	Transmission shaft	50
4.1	Assembly overview - transmission shaft	50
4.2	Removing and installing transmission shaft	50
5	Pistons and conrods	54
5.1	Assembly overview - pistons and conrods	54
5.2	Removing and installing pistons	58
5.3	Removing and installing oil spray jets	62
5.4	Checking pistons and cylinder bores	65
5.5	Checking radial clearance of conrod bearings	66
15	Cylinder head, valve gear	67
1	Timing chain cover	67
1.1	Assembly overview - timing chain cover	67
1.2	Removing and installing timing chain cover	70
2	Chain drive	79
2.1	Assembly overview - camshaft timing chains	79
2.2	Assembly overview - drive chain for oil pump	83
2.3	Removing camshaft timing chain from camshafts	84
2.4	Removing and installing camshaft timing chain	102
2.5	Removing and installing chain tensioner	103
3	Cylinder head	107
3.1	Assembly overview - cylinder head	107
3.2	Assembly overview - camshaft housing	110
3.3	Removing and installing cylinder head	115
3.4	Removing and installing camshaft housing	123
3.5	Checking compression	134
4	Valve gear	137
4.1	Assembly overview - valve gear	137
4.2	Measuring axial clearance of camshaft	139
4.3	Measuring radial clearance of camshaft	140
4.4	Removing and installing camshaft	141
4.5	Removing and installing cam actuators	143
4.6	Removing and installing camshaft control valve 1 N205	144
4.7	Removing and installing valve stem oil seals	145
4.8	Removing and installing valve springs	155
5	Inlet and exhaust valves	161
5.1	Checking valve guides	161
5.2	Checking valves	162
5.3	Valve dimensions	162
17	Lubrication	163
1	Sump/oil pump	163
1.1	Assembly overview - sump/oil pump	163
1.2	Engine oil	166
1.3	Removing and installing lower part of sump	166
1.4	Removing and installing upper part of sump	168
1.5	Removing and installing oil pump	171
1.6	Removing and installing oil level and oil temperature sender G266	173
2	Engine oil cooler	174
2.1	Assembly overview - engine oil cooler	174
2.2	Removing and installing engine oil cooler	175
3	Crankcase breather	176

3.1	Assembly overview - crankcase breather system	176
3.2	Removing and installing oil separator	180
3.3	Renewing crankcase breather hose	181
4	Oil filter/oil pressure switches	184
4.1	Assembly overview - oil filter	184
4.2	Assembly overview - oil pressure switches/oil pressure control	186
4.3	Removing and installing oil filter housing	188
4.4	Removing and installing oil pressure switch F22	188
4.5	Removing and installing oil temperature sender G8	190
4.6	Removing and installing oil pressure sender G10	191
4.7	Checking oil pressure	191
4.8	Removing and installing valve for oil pressure control N428	193
4.9	Removing and installing piston cooling jet control valve N522	194
19	Cooling	195
1	Cooling system/coolant	195
1.1	Connection diagram - coolant hoses	195
1.2	Checking cooling system for leaks	195
1.3	Draining and filling cooling system	199
2	Coolant pump/thermostat assembly	200
2.1	Assembly overview - coolant pump/thermostat	200
2.2	Assembly overview - electric coolant pump	202
2.3	Assembly overview - coolant temperature senders	202
2.4	Removing and installing electric coolant pump	203
2.5	Removing and installing coolant pump	204
2.6	Removing and installing housing for map-controlled engine cooling system thermostat F265	205
2.7	Removing and installing map-controlled engine cooling system thermostat F265	207
2.8	Removing and installing radiator outlet coolant temperature sender G83	208
2.9	Removing and installing engine temperature sender G407	208
2.10	Removing and installing coolant valves	209
3	Coolant pipes	210
4	Radiator/radiator fans	211
21	Turbocharging/supercharging	212
1	Turbocharger	212
1.1	Assembly overview - turbocharger	212
1.2	Removing and installing turbocharger	216
1.3	Renewing vacuum unit for turbocharger	225
1.4	Removing and installing oil lines at turbocharger	234
1.5	Removing and installing coolant lines at turbocharger	235
1.6	Removing and installing temperature sender for engine cover panel G765	236
1.7	Removing and installing overrun air recirculation valve	237
2	Charge air system	238
2.1	Assembly overview - charge air system	238
2.2	Assembly overview - hose connections for charge air system	250
2.3	Removing and installing air intake pipe	251
2.4	Removing and installing charge air cooler	251
2.5	Removing and installing charge pressure sender G31	251
2.6	Removing and installing charge pressure sender 2 G447	251
2.7	Checking charge air system for leaks	251
24	Mixture preparation - injection	254
1	Injection system	254
2	Vacuum system	255



2.1	Assembly overview - vacuum system	255
2.2	Checking vacuum system	255
2.3	Removing and installing switch valve for mechanical coolant pump	255
2.4	Removing and installing charge pressure control solenoid valve	256
2.5	Removing and installing vacuum line	256
3	Air filter	257
4	Intake manifold	258
4.1	Assembly overview - intake manifold	258
4.2	Removing and installing intake manifold	261
4.3	Removing and installing throttle valve module	262
4.4	Cleaning throttle valve module	263
5	Injectors	265
5.1	Assembly overview - fuel rail with injectors	265
5.2	Removing and installing fuel rail	268
5.3	Removing and installing injectors	271
5.4	Cleaning injectors	276
6	Senders and sensors	278
6.1	Assembly overview - pressure differential sender	278
6.2	Removing and installing intake manifold pressure sender	279
6.3	Removing and installing fuel pressure sender G247	279
6.4	Removing and installing fuel pressure sender for low pressure G410	280
6.5	Removing and installing pressure differential senders	280
7	High-pressure pump	282
7.1	Assembly overview - high-pressure pump	282
7.2	Removing and installing high-pressure pump	286
7.3	Removing and installing high-pressure pipe	289
8	Lambda probe	296
8.1	Assembly overview - Lambda probe	296
8.2	Removing and installing Lambda probe	297
9	Motor control unit	298
26 - Exhaust system		299
1	Exhaust pipes/silencers	299
1.1	Assembly overview - silencers	299
1.2	Separating exhaust pipes/silencers	299
1.3	Removing and installing front silencers	299
1.4	Stress-free alignment of exhaust system	299
1.5	Checking exhaust system for leaks	299
2	Emission control system	300
2.1	Assembly overview - emission control system	300
2.2	Removing and installing catalytic converter	303
2.3	Removing and installing particulate filter	303
2.4	Removing and installing exhaust flap control unit J883	303
3	Exhaust gas temperature regulation	304
3.1	Assembly overview - exhaust gas temperature regulation	304
3.2	Removing and installing parts of exhaust gas temperature regulation	305
4	Exhaust manifold	306
4.1	Assembly overview - exhaust manifold	306
4.2	Removing and installing exhaust manifold	307
28 - Ignition system		308
1	Ignition system	308
1.1	Assembly overview - ignition system	308
1.2	Removing and installing ignition coils	310

1.3	Removing and installing knock sensor 1 G61	312
1.4	Removing and installing Hall senders	313
1.5	Removing and installing engine speed sender G28	313