



Contents

00 - Technical data	1
1 Safety information	1
1.1 Safety regulations for working on fuel supply	1
1.2 Safety measures when working on vehicles with a start/stop system	1
1.3 Safety precautions when using testers and measuring instruments during a road test	2
1.4 Safety precautions when working on ignition system	2
1.5 Safety precautions when working on the cooling system	2
2 Identification	3
2.1 Engine number/engine data	3
3 Repair instructions	5
3.1 Rules for cleanliness	5
3.2 Foreign objects in engine	5
3.3 Contact corrosion	5
3.4 Routing and attachment of lines	5
3.5 Fitting radiator and condensers	6
3.6 Checking vacuum system	6
10 - Removing and installing engine	7
1 Removing and installing motor	7
1.1 Removing motor	7
1.2 Securing engine on engine and gearbox support	24
1.3 Installing engine	26
2 Assembly mountings	30
2.1 Assembly overview - assembly mountings	30
2.2 Supporting engine in installation position	32
2.3 Removing and installing engine mounting	34
2.4 Removing and installing support bearing	37
2.5 Removing and installing gearbox mountings	38
13 - Crankshaft group	40
1 Cylinder block (pulley end)	40
1.1 Assembly overview - cylinder block (pulley end)	40
1.2 Removing and installing poly-V belt	43
1.3 Removing and installing tensioner for poly V-belt	44
1.4 Removing and installing vibration damper	44
1.5 Removing and installing bracket for ancillaries	52
1.6 Removing and installing engine support	55
2 Cylinder block, gearbox end	58
2.1 Assembly overview - cylinder block, gearbox end	58
2.2 Removing and installing drive plate	59
2.3 Removing and installing sealing flange on gearbox side	60
3 Crankshaft	65
3.1 Assembly overview - crankshaft	65
3.2 Crankshaft dimensions	68
3.3 Allocation of main bearing shells	68
3.4 Measuring axial clearance of crankshaft	70
3.5 Measuring radial clearance of crankshaft	71
3.6 Removing and installing sender wheel	72
4 Balancer shaft	74
4.1 Assembly overview - balance shaft	74
4.2 Removing and installing balance shaft	76
4.3 Renewing oil seal for balance shaft (inlet side)	81



5	Pistons and conrods	84
5.1	Assembly overview - pistons and conrods	84
5.2	Removing and installing pistons	88
5.3	Checking pistons and cylinder bores	90
5.4	Separating new conrod	92
5.5	Checking radial clearance of conrods	93
5.6	Removing and installing oil spray jets	93
15	- Cylinder head, valve gear	96
1	Cylinder head	96
1.1	Assembly overview - cylinder head	96
1.2	Removing and installing cylinder head	99
1.3	Removing and installing vacuum pump	105
1.4	Checking compression	107
2	Cover for timing chain	110
2.1	Assembly overview - cover for timing chain	110
2.2	Removing and installing timing chain cover	113
2.3	Renewing seal for vibration damper	118
3	Chain drive	121
3.1	Assembly overview - camshaft timing chains	121
3.2	Assembly overview - drive chain for balance shaft	123
3.3	Removing and installing bearing saddle	126
3.4	Removing and installing camshaft timing chain	131
3.5	Checking timing chain	147
3.6	Checking valve timing	148
4	Valve gear	152
4.1	Assembly overview - valve gear	152
4.2	Removing and installing camshaft	157
4.3	Installing ball for sliding piece	179
4.4	Removing and installing actuators for camshaft adjustment	180
4.5	Removing and installing camshaft control valve 1 N205	181
4.6	Removing and installing valve stem seals	182
5	Inlet and exhaust valves	194
5.1	Checking valve guides	194
5.2	Checking valves	195
5.3	Valve dimensions	195
17	- Lubrication	196
1	Sump, oil pump	196
1.1	Assembly overview - sump/oil pump	196
1.2	Engine oil:	199
1.3	Check engine oil level with oil gauge tester T40178	199
1.4	Removing and installing lower part of sump	201
1.5	Removing and installing oil pump	203
1.6	Removing and installing upper part of sump	205
1.7	Removing and installing oil level and oil temperature sender G266	210
2	Engine oil cooler	211
2.1	Assembly overview - engine oil cooler	211
2.2	Removing and installing engine oil cooler	211
2.3	Removing and installing mechanical switching valve	212
3	Crankcase ventilation	214
3.1	Assembly overview - crankcase breather system	214
3.2	Removing and installing oil separator	215
4	Oil filter, oil pressure switch	216



4.1	Assembly overview - oil filter	216
4.2	Assembly overview - oil pressure switches/oil pressure control	216
4.3	Removing and installing oil pressure switch F22	218
4.4	Removing and installing oil pressure switch for reduced oil pressure F378	218
4.5	Removing and installing stage 3 oil pressure switch F447	219
4.6	Removing and installing oil pressure regulating valve N428	220
4.7	Removing and installing piston cooling jet control valve N522	221
4.8	Checking oil pressure	221
19	- Cooling	225
1	Cooling system/coolant	225
1.1	Connection diagram - coolant hoses	225
1.2	Overview of fitting locations – cooling system	227
1.3	Checking cooling system for leaks	229
1.4	Draining and adding coolant	234
2	Coolant pump, regulation of cooling system	243
2.1	Assembly overview - coolant pump, thermostat	243
2.2	Assembly overview - electric coolant pump	245
2.3	Assembly overview - coolant temperature sender	246
2.4	Assembly overview - coolant valves	247
2.5	Removing and installing electric coolant pump	249
2.6	Removing and installing coolant pump	253
2.7	Removing and installing toothed belt for coolant pump	255
2.8	Removing and installing engine temperature regulation module GX33	258
2.9	Removing and installing coolant temperature sender G62	261
2.10	Removing and installing radiator outlet coolant temperature sender G83	262
2.11	Removing and installing coolant valves	263
3	Coolant pipes	268
3.1	Assembly overview - coolant pipes	268
3.2	Removing and installing coolant pipes	269
4	Radiator, radiator fan	276
4.1	Assembly overview - radiator/radiator fan	276
4.2	Removing and installing radiator module	279
4.3	Dismantling radiator module	282
4.4	Removing and installing radiator cowl	283
4.5	Removing and installing radiator fan	285
21	- Turbocharging/supercharging	286
1	Turbocharger	286
1.1	Assembly overview - turbocharger	286
1.2	Removing and installing turbocharger	290
1.3	Removing and installing turbocharger air recirculation valve N249	296
1.4	Removing and installing charge pressure positioner V465	297
2	Charge air system	299
2.1	Assembly overview - charge air system	299
2.2	Assembly overview - charge-air hose connections	300
2.3	Removing and installing charge air cooler	301
2.4	Removing and installing charge pressure sender G31	303
2.5	Checking charge air system for leaks	304
24	- Mixture preparation - injection	307
1	Injection system	307
1.1	Overview of fitting locations - injection system	307
1.2	Checking fuel system for leaks	314
2	Injectors	315



2.1	Assembly overview - fuel rail with injectors	315
2.2	Removing and installing fuel rail	317
2.3	Removing and installing injectors	318
2.4	Renewing seals on injectors	324
2.5	Cleaning injectors	327
3	Air filter	330
3.1	Assembly overview - air filter housing	330
3.2	Removing and installing air filter housing	332
4	Intake manifold	335
4.1	Assembly overview - intake manifold	335
4.2	Removing and installing intake manifold	337
4.3	Removing and installing throttle valve module GX3	341
4.4	Cleaning throttle valve module GX3	342
4.5	Checking intake manifold change-over	343
5	Senders and sensors	346
5.1	Removing and installing intake manifold sender GX9	346
5.2	Removing and installing fuel pressure sender G247	346
5.3	Checking fuel pressure sender G247	348
5.4	Removing and installing fuel pressure sender for low-pressure G410	350
6	Engine control unit	352
6.1	Assembly overview - engine control unit	352
6.2	Removing and installing engine control unit J623	352
7	High-pressure pump	354
7.1	Assembly overview - high-pressure pump	354
7.2	Removing and installing high-pressure pump	356
7.3	Removing and installing high-pressure pipe	359
8	Lambda probe	364
8.1	Assembly overview - Lambda probe	364
8.2	Removing and installing Lambda probe	365
26	- Exhaust system	370
1	Exhaust pipes and silencers	370
1.1	Assembly overview - silencers	370
1.2	Separating exhaust pipes from silencers	375
1.3	Removing and installing front silencer	376
1.4	Removing and installing silencer	378
1.5	Aligning exhaust system free of stress	381
1.6	Checking exhaust system for leaks	382
2	Emission control	383
2.1	Assembly overview - emission control	383
2.2	Assembly overview – brackets and pipes for pressure differential sender G505	385
2.3	Removing and installing catalytic converter	386
2.4	Removing and installing particulate filter	389
2.5	Removing and installing exhaust flap control unit J883	390
3	Exhaust gas temperature regulation	391
3.1	Removing and installing exhaust gas temperature sender 3 G495	391
3.2	Removing and installing exhaust gas temperature sender 4 G648	392
4	Secondary air system	394
4.1	Assembly overview - secondary air system	394
4.2	Removing and installing secondary air pump motor V101	396
4.3	Removing and installing secondary air inlet valve N112	397
4.4	Removing and installing sender 1 for secondary air pressure G609	398
28	- Ignition system	400



1	Ignition system	400
1.1	Assembly overview - ignition system	400
1.2	Removing and installing ignition coils with output stage	402
1.3	Removing and installing knock sensor 1 G61	405
1.4	Removing and installing Hall sender	406
1.5	Removing and installing engine speed sender G28	407