

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	3
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	4
2.5 Safety precautions when working on the SCR system	4
2.6 Safety precautions when working on the exhaust system	5
3 Repair instructions	6
3.1 Rules for cleanliness	6
3.2 General notes	6
3.3 General repair instructions	7
3.4 Nuts, bolts	8
3.5 Identification plates	8
3.6 Use of impact wrenches	8
3.7 Performing adaptations after renewing a component	9
3.8 Adapting learnt values for SCR system	9
3.9 Foreign material in engine	10
3.10 Contact corrosion	10
3.11 Routing and attachment of pipes, hoses and wiring	10
3.12 Installing radiators and condensers	10
10 - Removing and installing engine	11
1 Removing and installing engine	11
1.1 Removing engine	11
1.2 Securing engine to engine and gearbox support	34
1.3 Installing engine	36
2 Assembly mountings	45
2.1 Assembly overview - assembly mountings	45
2.2 Supporting engine in installation position	46
2.3 Removing and installing engine mountings	47
2.4 Removing and installing torque reaction support and cross member	50
3 Engine cover panel	53
3.1 Removing and installing engine cover panel	53
13 - Crankshaft group	54
1 Cylinder block (pulley end)	54
1.1 Assembly overview - cylinder block (pulley end)	54
1.2 Assembly overview - sealing flange (pulley end)	57
1.3 Removing and installing poly V-belt	59
1.4 Removing and installing poly V-belt tensioner	60
1.5 Removing and installing vibration damper	61
1.6 Removing and installing bracket for ancillaries	63
1.7 Removing and installing sealing flange (pulley end)	64
2 Cylinder block (gearbox end)	68
2.1 Assembly overview - cylinder block (gearbox end)	68
2.2 Removing and installing drive plate	70
2.3 Renewing cylinder block sealing cap (gearbox end)	72
2.4 Removing and installing sealing flange (gearbox end)	74
2.5 Renewing needle bearing in drive plate	83



3	Crankshaft	86
3.1	Assembly overview - crankshaft	86
3.2	Crankshaft dimensions	87
3.3	Measuring axial clearance of crankshaft	87
4	Pistons and conrods	89
4.1	Assembly overview - pistons and conrods	89
4.2	Removing and installing pistons	93
4.3	Measuring piston projection at TDC	94
4.4	Checking pistons and cylinder bores	96
4.5	Checking radial clearance of conrod bearings	98
15	- Cylinder head, valve gear	99
1	Toothed belt drive	99
1.1	Assembly overview - toothed belt guard	99
1.2	Assembly overview - toothed belt	99
1.3	Removing and installing toothed belt guard	101
1.4	Detaching toothed belt from camshaft	104
1.5	Removing and installing toothed belt	117
2	Cylinder head	132
2.1	Assembly overview - cylinder head cover	132
2.2	Assembly overview - cylinder head	134
2.3	Removing and installing cylinder head	137
2.4	Removing and installing cylinder head cover	145
2.5	Removing and installing seals for injectors	147
2.6	Removing and installing camshaft housing	148
2.7	Checking compression	153
3	Valve gear	156
3.1	Assembly overview - valve gear	156
3.2	Removing and installing camshaft oil seal	160
3.3	Removing and installing camshaft control valve 1 N205	162
3.4	Removing and installing camshaft adjuster	164
3.5	Removing and installing control valve from camshaft control valve 1 N205	169
3.6	Removing and installing valve stem oil seals	173
4	Inlet and exhaust valves	183
4.1	Checking valve guides	183
4.2	Checking valves	184
4.3	Valve dimensions	184
17	- Lubrication	185
1	Sump/oil pump	185
1.1	Assembly overview - sump/oil pump	185
1.2	Engine oil	188
1.3	Removing and installing sump	188
1.4	Removing and installing oil pump	193
1.5	Removing and installing oil level and oil temperature sender G266	194
2	Engine oil cooler	195
3	Oil filter/oil pressure switches	196
3.1	Assembly overview - oil filter housing/oil pressure switch	196
3.2	Removing and installing oil pressure switch F22	198
3.3	Removing and installing oil pressure switch for reduced oil pressure F378	201
3.4	Removing and installing oil filter housing	202
3.5	Removing and installing valve for oil pressure control N428	205
3.6	Checking oil pressure	206
19	- Cooling	208

1	Cooling system/coolant	208
1.1	Connection diagram - coolant hoses	208
1.2	Draining and filling cooling system	212
1.3	Checking filling quality of cooling system	221
1.4	Checking cooling system for leaks	223
2	Coolant pump/thermostat assembly	227
2.1	Assembly overview - coolant pump/thermostat	227
2.2	Assembly overview - electric coolant pump	229
2.3	Assembly overview - coolant temperature senders	229
2.4	Removing and installing electric coolant pump	230
2.5	Removing and installing coolant pump	234
2.6	Checking thermostat	235
2.7	Removing and installing coolant valve for cylinder head N489	235
2.8	Removing and installing coolant temperature sender G62	236
3	Coolant pipes	239
3.1	Assembly overview - coolant pipes	239
3.2	Removing and installing coolant pipes	241
4	Radiators/radiator fans	258
4.1	Assembly overview - radiators/radiator fans	258
4.2	Removing and installing radiator	261
4.3	Removing and installing water radiator for charge air cooling circuit	265
4.4	Removing and installing radiator cowl	268
4.5	Removing and installing radiator fans	272
4.6	Removing and installing radiator fan control unit	272
21	Turbocharging/supercharging	274
1	Turbocharger	274
1.1	Assembly overview - turbocharger	274
1.2	Removing and installing turbocharger	277
1.3	Renewing vacuum unit for turbocharger	282
2	Charge air system	291
2.1	Assembly overview - charge air system	291
2.2	Removing and installing charge pressure sender G31	294
2.3	Checking charge air system for leaks	294
23	Mixture preparation - injection	300
1	Injection system	300
1.1	Overview of fitting locations - injection system	300
1.2	Overview - fuel system	307
1.3	Filling and bleeding fuel system	308
1.4	Checking fuel system for leaks	309
2	Vacuum system	310
2.1	Connection diagram - vacuum system	310
2.2	Checking vacuum system	310
3	Air filter	312
3.1	Assembly overview - air filter housing	312
3.2	Removing and installing air filter housing	314
3.3	Removing and installing air filter element	316
4	Intake manifold	319
4.1	Assembly overview - intake manifold	319
4.2	Removing and installing throttle valve module J338	323
4.3	Removing and installing intake manifold	325
5	Injectors/high-pressure reservoir (rail)	330
5.1	Assembly overview - injectors	330



5.2	Assembly overview - high-pressure reservoir (rail)	332
5.3	Checking injectors	334
5.4	Performing adaption of correction values for injectors	334
5.5	Checking return flow rate of injectors with engine running	335
5.6	Checking return flow rate of injectors at starter cranking speed	339
5.7	Checking for injectors sticking open	340
5.8	Removing and installing injectors	342
5.9	Removing and installing high-pressure pipes	345
5.10	Removing and installing high-pressure reservoir (rail)	349
6	High-pressure pump	352
6.1	Assembly overview - high-pressure pump	352
6.2	Removing and installing high-pressure pump	354
7	Senders and sensors	360
7.1	Removing and installing charge air temperature sender G810/G811	360
7.2	Removing and installing fuel temperature sender G81	361
7.3	Removing and installing air mass meter G70	362
7.4	Checking fuel pressure regulating valve N276	363
7.5	Removing and installing fuel pressure regulating valve N276	364
7.6	Removing and installing fuel pressure sender G247	370
8	Lambda probe	372
8.1	Assembly overview - Lambda probe	372
8.2	Removing and installing Lambda probe	374
8.3	Removing and installing NOx sender	375
9	Engine control unit	378
9.1	Removing and installing engine control unit J623	378
26	Exhaust system	383
1	Exhaust pipes/silencers	383
1.1	Assembly overview - silencers	383
1.2	Removing and installing front exhaust pipe	387
1.3	Separating exhaust pipes/silencers	390
1.4	Removing and installing silencers	391
1.5	Stress-free alignment of exhaust system	392
1.6	Checking exhaust system for leaks	394
2	Emission control system	395
2.1	Assembly overview - emission control system	395
2.2	Removing and installing catalytic converter	398
2.3	Removing and installing emission control module	399
2.4	Removing and installing exhaust gas pressure sensor 1 G450	408
2.5	Removing and installing pressure differential sender G505	409
2.6	Removing and installing exhaust flap control unit J883	410
3	SCR (selective catalytic reduction) system	412
3.1	Assembly overview - reducing agent tank	412
3.2	Assembly overview - reducing agent supply line	412
3.3	Assembly overview - delivery unit for reducing agent	413
3.4	Assembly overview - control unit for reducing agent metering system J880	414
3.5	Draining reducing agent tank	415
3.6	Removing and installing delivery unit for reducing agent	417
3.7	Removing and installing reducing agent tank	419
3.8	Removing and installing injector for reducing agent N474	423
3.9	Removing and installing control unit for reducing agent metering system J880	425
4	Exhaust gas temperature regulation	427
4.1	Assembly overview - exhaust gas temperature regulation	427
4.2	Removing and installing exhaust gas temperature sender	429

5	Exhaust gas recirculation	436
5.1	Assembly overview - exhaust gas recirculation system	436
5.2	Removing and installing exhaust gas recirculation control motor V338	438
5.3	Removing and installing exhaust gas recirculation control motor 2 V339	439
5.4	Removing and installing exhaust gas recirculation cooler	441
5.5	Checking exhaust gas recirculation cooler for leaks	443
28	Glow plug system	448
1	Glow plug system	448
1.1	Assembly overview - glow plug system	448
1.2	Removing and installing glow plug	449
1.3	Removing and installing automatic glow period control unit J179	453
1.4	Removing and installing Hall sender G40	454
1.5	Removing and installing engine speed sender G28	454