

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 ignition system	3
2.6 Safety precautions when working on the subframe	4
2.7 Safety precautions when working on the exhaust system	4
3 Repair instructions	5
3.1 Rules for cleanliness	5
3.2 Foreign material in engine	5
3.3 Contact corrosion	5
3.4 Routing and attachment of pipes, hoses and wiring	6
3.5 Installing radiators and condensers	6
3.6 Cleaning engine	6
3.7 Nuts, bolts	6
3.8 Identification plates	7
3.9 Use of impact wrenches	7
10 - Removing and installing engine	8
1 Removing and installing engine	8
1.1 Removing engine	8
1.2 Separating engine and gearbox	28
1.3 Securing engine to engine and gearbox support	36
1.4 Installing engine	40
2 Assembly mountings	46
2.1 Assembly overview - assembly mountings	46
2.2 Supporting engine in installation position	48
2.3 Removing and installing engine mountings	49
2.4 Removing and installing gearbox mounting	52
3 Engine cover panel	54
3.1 Removing and installing engine cover panel	54
13 - Crankshaft group	55
1 Cylinder block (pulley end)	55
1.1 Assembly overview - poly V-belt drive	55
1.2 Removing and installing poly V-belt	59
1.3 Removing and installing poly V-belt tensioner	64
1.4 Removing and installing vibration damper	66
1.5 Removing and installing sealing flange (pulley end)	67
2 Cylinder block (gearbox end)	72
2.1 Assembly overview - cylinder block (gearbox end)	72
2.2 Removing and installing drive plate	72
2.3 Renewing crankshaft oil seal (gearbox end)	74
3 Crankshaft	78
3.1 Assembly overview - crankshaft	78
3.2 Crankshaft dimensions	83
3.3 Measuring axial clearance of crankshaft	84
3.4 Measuring radial clearance of crankshaft	84



3.5	Removing and installing sender wheel	85
3.6	Checking sender wheel	86
4	Balance shaft	88
4.1	Assembly overview - balance shaft	88
4.2	Removing and installing balance shaft	88
5	Pistons and conrods	91
5.1	Assembly overview - pistons and conrods	91
5.2	Removing and installing pistons	94
5.3	Checking pistons and cylinder bores	95
5.4	Checking radial clearance of conrod bearings	97
15	Cylinder head, valve gear	99
1	Timing chain cover	99
1.1	Assembly overview - timing chain cover	99
1.2	Removing and installing timing chain cover	103
2	Chain drive	120
2.1	Assembly overview - camshaft timing chains	120
2.2	Assembly overview - drive chain for valve gear	123
2.3	Assembly overview - drive chain for oil pump	125
2.4	Removing camshaft timing chain from camshafts	126
2.5	Removing and installing camshaft timing chain	140
2.6	Removing and installing drive chain for valve gear	144
2.7	Removing and installing drive chain for oil pump	147
3	Cylinder head	149
3.1	Assembly overview - cylinder head	149
3.2	Removing and installing cylinder head	152
3.3	Removing and installing cylinder head cover	161
3.4	Checking compression	163
4	Valve gear	166
4.1	Assembly overview - valve gear	166
4.2	Measuring axial clearance of camshaft	170
4.3	Measuring radial clearance of camshaft	171
4.4	Removing and installing camshaft	172
4.5	Removing and installing camshaft control valves	182
4.6	Checking hydraulic compensation elements	183
4.7	Removing and installing valve stem oil seals	185
5	Inlet and exhaust valves	195
5.1	Checking valve guides	195
5.2	Checking valves	196
5.3	Valve dimensions	196
17	Lubrication	198
1	Sump/oil pump	198
1.1	Assembly overview - sump/oil pump	198
1.2	Engine oil	201
1.3	Removing and installing lower part of sump	202
1.4	Removing and installing upper part of sump	204
1.5	Removing and installing oil pump	208
1.6	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
3	Crankcase breather	214
3.1	Assembly overview - crankcase breather system	214

3.2	Removing and installing oil separator	216
3.3	Removing and installing pressure regulating valve	218
3.4	Removing and installing oil drain valve	220
3.5	Removing and installing hose for crankcase breather system	221
3.6	Removing and installing crankcase breather shut-off valve N548	222
4	Oil filter/oil pressure switches	224
4.1	Assembly overview - oil filter	224
4.2	Assembly overview - oil pressure switches/oil pressure control	224
4.3	Removing and installing oil pressure switch F22	225
4.4	Removing and installing oil pressure switch for reduced oil pressure F378	227
4.5	Checking oil pressure	228
4.6	Removing and installing valve for oil pressure control N428	229
19	Cooling	231
1	Cooling system/coolant	231
1.1	Connection diagram - coolant hoses	231
1.2	Checking cooling system for leaks	235
1.3	Draining and filling cooling system	237
2	Coolant pump/thermostat assembly	248
2.1	Assembly overview - coolant pump/thermostat	248
2.2	Assembly overview - electric coolant pump	250
2.3	Assembly overview - coolant temperature senders	251
2.4	Removing and installing electric coolant pump	252
2.5	Removing and installing coolant pump	256
2.6	Removing and installing thermostat	258
2.7	Removing and installing coolant temperature sender G62	258
2.8	Removing and installing temperature sender for engine temperature regulation G694	259
2.9	Removing and installing coolant valves	260
3	Coolant pipes	263
3.1	Assembly overview - coolant pipes	263
3.2	Removing and installing coolant pipes	266
4	Radiators/radiator fans	283
4.1	Exploded view - radiators/radiator fans	283
4.2	Assembly overview - auxiliary radiator	286
4.3	Removing and installing radiator	287
4.4	Removing and installing water radiator for charge air cooling circuit	294
4.5	Removing and installing radiator cowl	298
4.6	Removing and installing radiator fan V7	301
4.7	Removing and installing auxiliary radiator	301
21	Turbocharging/supercharging	304
1	Supercharger	304
1.1	Exploded view - supercharger	304
1.2	Assembly overview - magnetic clutch	307
1.3	Assembly overview - rotor assembly	308
1.4	Removing and installing supercharger	309
1.5	Checking supercharger for leaks	317
1.6	Removing and installing magnetic clutch	320
1.7	Removing and installing pulley for supercharger	328
1.8	Removing and installing drive unit	329
1.9	Removing and installing rotor assembly	333
1.10	Renewing input shaft oil seal	338
1.11	Securing supercharger to engine and gearbox support	340
1.12	Removing and installing sender 1 for turbocharger speed G688	344
2	Charge air system	345



2.1	Assembly overview - charge air system	345
2.2	Assembly overview - hose connections for charge air system	347
2.3	Removing and installing charge air cooler	347
2.4	Removing and installing charge pressure sender G31/G447	353
24	Mixture preparation - injection	354
1	Injection system	354
1.1	Overview of fitting locations - injection system	354
1.2	Checking fuel system for leaks	362
2	Vacuum system	363
2.1	Connection diagram - vacuum system	363
2.2	Checking vacuum system	364
3	Air filter	366
3.1	Assembly overview - air filter housing	366
3.2	Removing and installing air filter housing	366
4	Intake manifold	369
4.1	Assembly overview - lower part of intake manifold with fuel rail	369
4.2	Removing and installing lower part of intake manifold with fuel rail	372
4.3	Removing and installing throttle valve module J338	376
4.4	Removing and installing regulating flap control unit J808	378
4.5	Removing and installing fuel line	379
5	Injectors	381
5.1	Assembly overview - fuel rail with injectors	381
5.2	Removing and installing fuel rail	385
5.3	Removing and installing injectors	387
5.4	Cleaning FSI injectors - vehicles with FSI engine	395
6	Senders and sensors	398
6.1	Removing and installing intake air temperature sender G42/intake manifold pressure sender G71	398
6.2	Removing and installing fuel pressure sender G247	398
6.3	Removing and installing fuel pressure sender for low pressure G410	400
7	High-pressure pump	401
7.1	Assembly overview - high-pressure pump	401
7.2	Removing and installing high-pressure pump	403
7.3	Removing and installing high-pressure pipe	408
8	Lambda probe	411
8.1	Assembly overview - Lambda probe	411
8.2	Removing and installing Lambda probe	412
9	Engine control unit	417
9.1	Removing and installing engine/motor control unit J623	417
26	Exhaust system	419
1	Exhaust pipes/silencers	419
1.1	Exploded view - silencers	419
1.2	Separating exhaust pipes/silencers	422
1.3	Removing and installing front silencers	424
1.4	Removing and installing silencers	425
1.5	Stress-free alignment of exhaust system	426
1.6	Checking exhaust system for leaks	428
2	Emission control system	429
2.1	Assembly overview - emission control system	429
2.2	Removing and installing catalytic converter	430
3	Secondary air system	441
3.1	Assembly overview - secondary air system	441

3.2	Removing and installing secondary air pump motor V101	444
3.3	Checking combination valve	445
3.4	Removing and installing combination valve	447
4	Exhaust manifolds	454
4.1	Exploded view - exhaust manifold	454
4.2	Removing and installing exhaust manifold	456
28	Ignition system	466
1	Ignition system	466
1.1	Assembly overview - ignition system	466
1.2	Test data - spark plugs	468
1.3	Removing and installing ignition coils with output stages	468
1.4	Removing and installing knock sensor	471
1.5	Removing and installing Hall senders	473
1.6	Removing and installing engine speed sender G28	476