

Contents

00 - Technical data	1
1 Identification	1
1.1 Engine number/engine data	1
2 Safety precautions	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 subframe	3
2.5 Safety precautions when working on the cooling system	3
2.6 Safety precautions when working on the ignition system	4
2.7 Safety precautions when working on the exhaust system	4
3 Repair instructions	5
3.1 Rules for cleanliness	5
3.2 General notes	5
3.3 Foreign particles in engine	6
3.4 Contact corrosion	6
3.5 Routing and attachment of pipes, hoses and wiring	6
3.6 Installing radiators and condensers	6
3.7 Checking vacuum system	6
10 - Removing and installing engine	8
1 Removing and installing engine	8
1.1 Removing engine	8
1.2 Separating engine and gearbox	30
1.3 Securing engine to engine and gearbox support	38
1.4 Installing engine	43
2 Assembly mountings	52
2.1 Exploded view - assembly mountings	52
2.2 Supporting engine in installation position	54
2.3 Removing and installing engine mountings	57
2.4 Removing and installing gearbox mounting	61
3 Engine cover panel	63
3.1 Removing and installing engine cover panel	63
13 - Crankshaft group	64
1 Cylinder block (pulley end)	64
1.1 Exploded view - poly V-belt drive	64
1.2 Removing and installing poly V-belt	69
1.3 Removing and installing poly V-belt tensioner	71
1.4 Removing and installing vibration damper	72
1.5 Removing and installing sealing flange (pulley end)	72
2 Cylinder block (gearbox end)	77
2.1 Exploded view - cylinder block (gearbox end)	77
2.2 Removing and installing drive plate	77
2.3 Removing and installing sender wheel	79
2.4 Checking sender wheel	79
2.5 Renewing crankshaft oil seal (gearbox end)	80
3 Crankshaft	83
3.1 Exploded view - crankshaft	83
3.2 Crankshaft dimensions	87
3.3 Allocation of main bearing shells	87
3.4 Measuring axial clearance of crankshaft	89

3.5	Measuring radial clearance of crankshaft	90
4	Balance shaft	91
4.1	Exploded view - balance shaft	91
4.2	Removing and installing balance shaft	91
5	Pistons and conrods	94
5.1	Exploded view - pistons and conrods	94
5.2	Removing and installing pistons	97
5.3	Checking pistons and cylinder bores	98
5.4	Checking radial clearance of conrod bearings	100
15 - Cylinder head, valve gear	102	
1	Timing chain cover	102
1.1	Exploded view - timing chain cover	102
1.2	Removing and installing timing chain cover	106
2	Chain drive	120
2.1	Exploded view - camshaft timing chains	120
2.2	Exploded view - drive chain for valve gear	122
2.3	Exploded view - drive chain for balance shaft and oil pump	124
2.4	Removing camshaft timing chain from camshafts	125
2.5	Removing and installing camshaft timing chain	141
2.6	Removing and installing drive chain for valve gear	143
2.7	Removing and installing drive chain for balance shaft and oil pump	145
3	Cylinder head	151
3.1	Exploded view - cylinder head	151
3.2	Removing and installing cylinder head	157
3.3	Removing and installing cylinder head cover	189
3.4	Checking compression	190
4	Valve gear	193
4.1	Exploded view - valve gear	193
4.2	Measuring axial clearance of camshaft	197
4.3	Measuring radial clearance of camshaft	199
4.4	Removing and installing camshaft	199
4.5	Removing and installing cam actuators	208
4.6	Removing and installing camshaft control valves	209
4.7	Checking hydraulic compensation elements	210
4.8	Removing and installing valve stem oil seals	212
5	Inlet and exhaust valves	223
5.1	Checking valve guides	223
5.2	Checking valves	224
5.3	Valve dimensions	224
17 - Lubrication	226	
1	Sump/oil pump	226
1.1	Exploded view - sump/oil pump	226
1.2	Engine oil	229
1.3	Removing and installing sump (bottom section)	229
1.4	Removing and installing sump (top section)	235
1.5	Removing and installing oil pump	238
1.6	Removing and installing oil level and oil temperature sender G266	239
2	Engine oil cooler	240
2.1	Removing and installing engine oil cooler	240
3	Crankcase breather	244
3.1	Exploded view - crankcase breather system	244
3.2	Removing and installing crankcase breather hoses	246

3.3	Removing and installing oil separator	246
3.4	Removing and installing pressure control valve	248
3.5	Removing and installing oil drain valve	250
3.6	Removing and installing crankcase breather shut-off valve N548	251
4	Oil filter/oil pressure switches	253
4.1	Exploded view - oil filter housing/oil pressure switches	253
4.2	Removing and installing oil pressure switch F22	256
4.3	Removing and installing oil pressure switch for reduced oil pressure F378	257
4.4	Checking oil pressure	258
4.5	Removing and installing oil filter housing	258
4.6	Removing and installing valve for oil pressure control N428	261
19 - Cooling	266	
1	Cooling system/coolant	266
1.1	Connection diagram - coolant hoses	266
1.2	Checking cooling system for leaks	270
1.3	Draining and filling cooling system	272
2	Coolant pump/thermostat assembly	282
2.1	Exploded view - coolant pump/thermostat	282
2.2	Removing and installing coolant pump	282
2.3	Removing and installing thermostat	284
2.4	Removing and installing coolant temperature sender G62	285
2.5	Removing and installing temperature sender for engine temperature regulation G694	286
2.6	Removing and installing coolant valves	287
3	Coolant pipes	290
3.1	Exploded view - coolant pipes	290
3.2	Removing and installing coolant pipes	293
4	Radiator/radiator fans	305
4.1	Exploded view - radiator/radiator fans	305
4.2	Removing and installing radiator	308
4.3	Removing and installing radiator cowl	316
4.4	Removing and installing radiator fans	318
24 - Mixture preparation - injection	319	
1	Injection system	319
1.1	Overview of fitting locations - injection system	319
1.2	Checking fuel system for leaks	327
2	Air cleaner	328
2.1	Exploded view - air cleaner housing	328
2.2	Removing and installing air cleaner housing	329
3	Intake manifold	332
3.1	Exploded view - intake manifold	332
3.2	Removing and installing intake manifold	334
3.3	Removing and installing throttle valve module J338	336
4	Injectors	338
4.1	Exploded view - fuel rail with injectors	338
4.2	Removing and installing fuel rail	340
4.3	Removing and installing injectors	341
4.4	Cleaning injectors	346
5	Senders and sensors	349
5.1	Removing and installing fuel pressure sender G247	349
6	High-pressure pump	350
6.1	Exploded view - high-pressure pump	350
6.2	Removing and installing high-pressure pump	353



6.3	Removing and installing high-pressure pipe	358
7	Lambda probe	360
7.1	Exploded view - Lambda probe	360
7.2	Removing and installing Lambda probe	361
8	Engine control unit	365
8.1	Wiring and component check	365
8.2	Removing and installing engine/motor control unit J623	367
26 - Exhaust system	369
1	Exhaust pipes/silencers	369
1.1	Exploded view - silencers	369
1.2	Separating exhaust pipes/silencers	374
1.3	Removing and installing front silencers	376
1.4	Stress-free alignment of exhaust system	377
1.5	Checking exhaust system for leaks	379
2	Emission control system	380
2.1	Removing and installing catalytic converter	380
2.2	Removing and installing exhaust flap 1 valve N321	385
3	Secondary air system	387
3.1	Exploded view - secondary air system	387
3.2	Removing and installing secondary air pump motor V101	389
3.3	Checking combination valve	390
3.4	Removing and installing combination valve	393
4	Exhaust manifolds	398
4.1	Exploded view - exhaust manifold	398
4.2	Removing and installing exhaust manifolds	400
28 - Ignition system	406
1	Ignition system	406
1.1	Exploded view - ignition system	406
1.2	Test data - spark plugs	408
1.3	Removing and installing ignition coils with output stages	408
1.4	Removing and installing knock sensor	411
1.5	Removing and installing Hall senders	412
1.6	Removing and installing engine speed sender G28	414