



## Contents

<b>00 - Technical data</b>	<b>1</b>
<b>1 Safety information</b>	<b>1</b>
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 the cooling system	2
1.5 Safety precautions when working on ignition system	2
1.6 Safety precautions when working on exhaust system	3
<b>2 Marking</b>	<b>4</b>
2.1 Engine number/engine data	4
<b>3 Repair instructions</b>	<b>12</b>
3.1 Rules for cleanliness	12
3.2 General information	12
3.3 General repair instructions	13
3.4 Foreign objects in engine	13
3.5 Contact corrosion	13
3.6 Routing and attachment of lines	14
3.7 Fitting radiator and condensers	14
3.8 Checking vacuum system	14
<b>10 - Removing and installing engine</b>	<b>15</b>
<b>1 Removing and installing motor</b>	<b>15</b>
1.1 Removing motor	15
1.2 Separating engine and gearbox	72
1.3 Securing engine on engine and gearbox support	78
1.4 Installing engine	80
<b>2 Assembly mountings</b>	<b>93</b>
2.1 Assembly overview - assembly mountings	93
2.2 Removing and installing engine mounting	103
2.3 Removing and installing gearbox mountings	107
2.4 Removing and installing pendulum support	112
2.5 Supporting engine in installation position	115
2.6 Adjusting assembly mountings	149
2.7 Checking adjustment of assembly mountings (engine and gearbox mountings)	152
<b>13 - Crankshaft group</b>	<b>154</b>
<b>1 Cylinder block (pulley end)</b>	<b>154</b>
1.1 Assembly overview - poly V-belt drive	154
1.2 Removing and installing poly-V belt	158
1.3 Removing and installing tensioner for poly V-belt	162
1.4 Removing and installing vibration damper	163
1.5 Removing and installing engine support	167
1.6 Renewing crankshaft oil seal - belt pulley end	171
<b>2 Cylinder block, gearbox end</b>	<b>174</b>
2.1 Assembly overview - cylinder block, gearbox end	174
2.2 Removing and installing flywheel	176
2.3 Removing and installing sealing flange on gearbox side	178
<b>3 Crankshaft</b>	<b>189</b>
3.1 Crankshaft dimensions	189
3.2 Renewing needle bearing in crankshaft	189
<b>4 Pistons and conrods</b>	<b>192</b>
4.1 Assembly overview - pistons and conrods	192



4.2	Removing and installing pistons	195
4.3	Checking pistons and cylinder bores	196
4.4	Separating new conrod	198
4.5	Checking radial clearance of conrods	199
4.6	Removing and installing oil spray jets	199
4.7	Setting piston to TDC position	201
<b>15</b>	<b>- Cylinder head, valve gear</b>	<b>205</b>
<b>1</b>	<b>Cylinder head</b>	<b>205</b>
1.1	Assembly overview - cylinder head	205
1.2	Assembly overview - camshaft housing	207
1.3	Removing and installing cylinder head	210
1.4	Removing and installing camshaft housing	213
1.5	Checking compression	218
<b>2</b>	<b>Toothed belt drive</b>	<b>221</b>
2.1	Assembly overview - toothed belt cover	221
2.2	Assembly overview - toothed belt	221
2.3	Removing and installing toothed belt	223
2.4	Preassembling and installing test tool VAS 611 007	230
2.5	Checking valve timing	238
2.6	Adjusting valve timing	241
2.7	Removing toothed belt from camshaft	252
<b>3</b>	<b>Valve gear</b>	<b>260</b>
3.1	Assembly overview - valve gear	260
3.2	Measuring axial play of camshaft	262
3.3	Removing and installing camshaft oil seal	263
3.4	Removing and installing camshaft adjuster	270
3.5	Removing and installing camshaft control valve 1 N205	282
3.6	Removing and installing exhaust camshaft control valve 1 N318	283
3.7	Removing and installing valve stem seals	284
<b>4</b>	<b>Inlet and exhaust valves</b>	<b>297</b>
4.1	Checking valve guides	297
4.2	Checking valves	298
4.3	Valve dimensions	298
<b>17</b>	<b>- Lubrication</b>	<b>299</b>
<b>1</b>	<b>Sump, oil pump</b>	<b>299</b>
1.1	Assembly overview - sump/oil pump	299
1.2	Engine oil:	303
1.3	Removing and installing sump	303
1.4	Removing and installing oil pump	308
1.5	Removing and installing oil level and oil temperature sender G266	310
<b>2</b>	<b>Engine oil cooler</b>	<b>312</b>
2.1	Assembly overview - engine oil cooler	312
2.2	Removing and installing engine oil cooler	313
<b>3</b>	<b>Crankcase ventilation</b>	<b>314</b>
3.1	Assembly overview - crankcase breather system	314
3.2	Removing and installing oil separator	315
<b>4</b>	<b>Oil filter, oil pressure switch</b>	<b>319</b>
4.1	Assembly overview - oil filter/oil pressure switch	319
4.2	Removing and installing oil pressure sender G10	320
4.3	Checking oil pressure and oil pressure switch	321
4.4	Removing and installing oil filter housing	321
4.5	Removing and installing oil pressure regulating valve N428	323



<b>19 - Cooling</b>	<b>325</b>
<b>1 Cooling system/coolant</b>	<b>325</b>
1.1 Connection diagram - coolant hoses	325
1.2 Checking cooling system for leaks	326
1.3 Draining and adding coolant	331
<b>2 Coolant pump, regulation of cooling system</b>	<b>359</b>
2.1 Assembly overview - coolant pump, thermostat	359
2.2 Assembly overview - electric coolant pump	362
2.3 Assembly overview - coolant temperature sender	363
2.4 Removing and installing electric coolant pump	364
2.5 Removing and installing coolant pump	367
2.6 Removing and installing thermostat	371
2.7 Removing and installing toothed belt pulley for coolant pump	375
2.8 Removing and installing coolant temperature sender G62	377
2.9 Removing and installing radiator outlet coolant temperature sender G83	380
<b>3 Coolant pipes</b>	<b>385</b>
3.1 Assembly overview - coolant pipes	385
3.2 Removing and installing coolant pipes	385
<b>4 Radiator, radiator fan</b>	<b>388</b>
4.1 Assembly overview - radiator/radiator fan	388
4.2 Assembly overview - radiator cowl and radiator fan	398
4.3 Assembly overview - radiator blind	400
4.4 Removing and installing radiator	403
4.5 Removing and installing water radiator for charge air cooling circuit	428
4.6 Removing and installing radiator cowl	434
4.7 Removing and installing radiator fan V7	441
4.8 Removing and installing radiator blind	443
4.9 Removing and installing radiator blind control motor V544	445
<b>21 - Turbocharging/supercharging</b>	<b>451</b>
<b>1 Turbocharger</b>	<b>451</b>
1.1 Assembly overview - turbocharger	451
1.2 Removing and installing turbocharger	454
1.3 Removing and installing charge pressure positioner V465	461
1.4 Removing and installing connection for turbocharger	463
<b>2 Charge air system</b>	<b>468</b>
2.1 Assembly overview - charge air system	468
2.2 Removing and installing charge air cooler	470
2.3 Removing and installing charge pressure sender GX26	474
2.4 Checking charge air system for leaks	475
2.5 Removing and installing air pipe	477
<b>24 - Mixture preparation - injection</b>	<b>480</b>
<b>1 Injection system</b>	<b>480</b>
1.1 Overview of fitting locations - injection system	480
<b>2 Injectors</b>	<b>493</b>
2.1 Assembly overview - fuel rail with injectors	493
2.2 Removing and installing fuel rail	496
2.3 Removing and installing injectors	497
2.4 Cleaning injectors	512
<b>3 Air filter</b>	<b>514</b>
3.1 Assembly overview - air filter housing	514
3.2 Removing and installing air filter housing	522
3.3 Removing air duct on lock carrier	525



<b>4</b>	<b>Intake manifold</b> .....	<b>528</b>
4.1	Assembly overview - intake manifold .....	528
4.2	Removing and installing intake manifold .....	530
4.3	Removing and installing throttle valve module GX3 .....	537
4.4	Cleaning throttle valve module GX3 .....	539
<b>5</b>	<b>Senders and sensors</b> .....	<b>541</b>
5.1	Assembly overview - actuator for structure-borne sound R214 and control unit for structure-borne sound J869 .....	541
5.2	Removing and installing fuel pressure sender G247 .....	543
5.3	Checking fuel pressure sender G247 .....	545
5.4	Removing and installing intake manifold sender GX9 .....	548
5.5	Removing and installing exhaust gas pressure sensor 1 G450 .....	548
<b>6</b>	<b>Engine control unit</b> .....	<b>551</b>
6.1	Assembly overview - engine control unit .....	551
6.2	Removing and installing engine control unit J623 .....	554
<b>7</b>	<b>High-pressure pump</b> .....	<b>565</b>
7.1	Assembly overview - high-pressure pump .....	565
7.2	Removing and installing high-pressure pump .....	566
7.3	Removing and installing high-pressure pipe .....	568
<b>8</b>	<b>Lambda probe</b> .....	<b>570</b>
8.1	Assembly overview - Lambda probe .....	570
8.2	Removing and installing Lambda probe .....	571
<b>26</b>	<b>- Exhaust system</b> .....	<b>574</b>
<b>1</b>	<b>Exhaust pipes and silencers</b> .....	<b>574</b>
1.1	Assembly overview - silencers .....	574
1.2	Separating exhaust pipes from silencers .....	583
1.3	Removing and installing silencer .....	587
1.4	Aligning exhaust system free of stress .....	599
1.5	Checking exhaust system for leaks .....	600
1.6	Installation position of clamp .....	600
<b>2</b>	<b>Emission control</b> .....	<b>604</b>
2.1	Assembly overview - emission control .....	604
2.2	Removing and installing catalytic converter .....	612
2.3	Removing and installing particulate filter .....	616
<b>28</b>	<b>- Ignition system</b> .....	<b>617</b>
<b>1</b>	<b>Ignition system</b> .....	<b>617</b>
1.1	Assembly overview - ignition system .....	617
1.2	Removing and installing ignition coils with output stage .....	619
1.3	Removing and installing knock sensor 1 G61 .....	622
1.4	Removing and installing Hall sender .....	624
1.5	Removing and installing engine speed sender G28 .....	625