



## 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
<b>2 Identification</b>	<b>3</b>
2.1 Engine number/engine data	3
<b>3 Repair instructions</b>	<b>6</b>
3.1 Rules for cleanliness	6
3.2 Foreign objects in engine	6
3.3 Contact corrosion	6
3.4 Routing and attachment of lines	6
3.5 Fitting radiator and condensers	7
<b>10 - Removing and installing engine</b>	<b>8</b>
<b>1 Removing and installing motor</b>	<b>8</b>
1.1 Removing motor	8
1.2 Separating engine and gearbox	22
1.3 Securing engine on engine and gearbox support	23
1.4 Installing engine	25
<b>2 Assembly mountings</b>	<b>30</b>
2.1 Assembly overview - assembly mountings	30
2.2 Removing and installing engine mounting	34
2.3 Removing and installing gearbox mounting	35
2.4 Removing and installing pendulum support	38
2.5 Supporting engine in installation position	39
2.6 Adjusting assembly mountings	54
2.7 Checking adjustment of assembly mountings (engine and gearbox mountings)	57
<b>13 - Crankshaft group</b>	<b>59</b>
<b>1 Cylinder block (pulley end)</b>	<b>59</b>
1.1 Assembly overview - poly V-belt drive	59
1.2 Assembly overview - sealing flange, belt pulley end	63
1.3 Removing and installing poly-V belt	65
1.4 Removing and installing tensioner for poly V-belt	69
1.5 Removing and installing vibration damper	70
1.6 Removing and installing engine support	72
1.7 Renewing crankshaft oil seal - belt pulley end	76
1.8 Removing and installing sealing flange on pulley end	79
<b>2 Cylinder block, gearbox end</b>	<b>83</b>
2.1 Assembly overview - cylinder block, gearbox end	83
2.2 Removing and installing flywheel	84
2.3 Removing and installing sealing flange on gearbox side	85
<b>3 Crankshaft</b>	<b>97</b>
3.1 Renewing needle bearing in crankshaft	97
3.2 Crankshaft dimensions	99
3.3 Measuring axial clearance of crankshaft	100
<b>4 Pistons and conrods</b>	<b>102</b>
4.1 Assembly overview - pistons and conrods	102
4.2 Removing and installing pistons	105



4.3	Removing and installing oil spray jets	106
4.4	Checking pistons and cylinder bores	108
4.5	Checking radial clearance of conrods	110
4.6	Setting piston to TDC position	110
<b>15</b>	<b>Cylinder head, valve gear</b>	<b>116</b>
<b>1</b>	<b>Cylinder head</b>	<b>116</b>
1.1	Assembly overview - cylinder head	116
1.2	Assembly overview - camshaft housing	119
1.3	Removing and installing cylinder head	127
1.4	Removing and installing camshaft housing	133
1.5	Checking compression	139
<b>2</b>	<b>Toothed belt drive</b>	<b>141</b>
2.1	Assembly overview - toothed belt cover	141
2.2	Assembly overview - toothed belt	142
2.3	Removing and installing toothed belt guard	146
2.4	Preassembling and installing valve timing tool	147
2.5	Removing and installing toothed belt	158
2.6	Checking valve timing	168
2.7	Adjusting valve timing	170
2.8	Removing toothed belt from camshaft	193
<b>3</b>	<b>Valve gear</b>	<b>203</b>
3.1	Assembly overview - valve gear	203
3.2	Measuring axial play of camshaft	206
3.3	Removing and installing camshaft oil seal	207
3.4	Removing and installing camshaft adjuster	218
3.5	Removing and installing camshaft control valve 1 N205	234
3.6	Removing and installing exhaust camshaft control valve 1 N318	235
3.7	Removing and installing valve stem seals	236
3.8	Removing and installing toothed belt pulley	249
3.9	Removing and installing cam actuators	252
<b>4</b>	<b>Inlet and exhaust valves</b>	<b>255</b>
4.1	Checking valve guides	255
4.2	Checking valves	256
4.3	Valve dimensions	256
<b>17</b>	<b>Lubrication</b>	<b>257</b>
<b>1</b>	<b>Sump, oil pump</b>	<b>257</b>
1.1	Assembly overview - sump/oil pump	257
1.2	Engine oil:	261
1.3	Removing and installing lower part of sump	261
1.4	Removing and installing upper part of sump	268
1.5	Removing and installing oil pump	274
1.6	Removing and installing oil level and oil temperature sender G266	275
<b>2</b>	<b>Engine oil cooler</b>	<b>277</b>
2.1	Assembly overview - engine oil cooler	277
2.2	Removing and installing engine oil cooler	277
<b>3</b>	<b>Crankcase ventilation</b>	<b>279</b>
3.1	Assembly overview - crankcase breather system	279
3.2	Removing and installing oil separator	280
<b>4</b>	<b>Oil filter, oil pressure switch</b>	<b>283</b>
4.1	Assembly overview - oil filter/oil pressure switch	283
4.2	Removing and installing oil pressure switch F1	285
4.3	Removing and installing oil pressure switch for reduced oil pressure F378	287
4.4	Removing and installing oil pressure regulating valve N428	289



4.5	Checking oil pressure .....	290
<b>19</b>	<b>- Cooling .....</b>	<b>293</b>
<b>1</b>	<b>Cooling system/coolant .....</b>	<b>293</b>
1.1	Connection diagram - coolant hoses .....	293
1.2	Checking cooling system for leaks .....	295
1.3	Draining and adding coolant .....	300
<b>2</b>	<b>Coolant pump, regulation of cooling system .....</b>	<b>309</b>
2.1	Assembly overview - coolant pump, thermostat .....	309
2.2	Assembly overview - electric coolant pump .....	312
2.3	Assembly overview - engine preheater .....	313
2.4	Assembly overview - coolant temperature sender .....	314
2.5	Removing and installing electric coolant pump .....	315
2.6	Removing and installing coolant pump .....	317
2.7	Removing and installing thermostat .....	323
2.8	Removing and installing toothed belt pulley for coolant pump .....	327
2.9	Removing and installing coolant temperature sender G62 .....	332
2.10	Removing and installing radiator outlet coolant temperature sender G83 .....	334
2.11	Removing and installing engine preheating element Z97 .....	335
<b>3</b>	<b>Coolant pipes .....</b>	<b>338</b>
3.1	Assembly overview - coolant pipes .....	338
3.2	Removing and installing coolant pipes .....	338
<b>4</b>	<b>Radiator, radiator fan .....</b>	<b>343</b>
4.1	Assembly overview - radiator/radiator fan .....	343
4.2	Assembly overview - radiator cowl and radiator fan .....	347
4.3	Removing and installing radiator .....	349
4.4	Removing and installing water radiator for charge air cooling circuit .....	359
4.5	Removing and installing radiator cowl with radiator fan .....	365
4.6	Removing and installing radiator fan .....	367
<b>21</b>	<b>- Turbocharging/supercharging .....</b>	<b>370</b>
<b>1</b>	<b>Turbocharger .....</b>	<b>370</b>
1.1	Assembly overview - turbocharger .....	370
1.2	Removing and installing turbocharger .....	374
1.3	Removing and installing charge pressure positioner V465 .....	380
1.4	Removing and installing connection for turbocharger .....	383
<b>2</b>	<b>Charge air system .....</b>	<b>386</b>
2.1	Assembly overview - charge air system .....	386
2.2	Removing and installing charge pressure sender GX26 .....	388
2.3	Removing and installing charge air cooler .....	389
2.4	Checking charge air system for leaks .....	392
2.5	Removing and installing air pipe .....	394
<b>24</b>	<b>- Mixture preparation - injection .....</b>	<b>397</b>
<b>1</b>	<b>Injection system .....</b>	<b>397</b>
1.1	Overview of fitting locations - injection system .....	397
<b>2</b>	<b>Injectors .....</b>	<b>402</b>
2.1	Assembly overview - fuel rail with injectors .....	402
2.2	Removing and installing fuel rail .....	404
2.3	Removing and installing injectors .....	405
2.4	Cleaning injectors .....	411
<b>3</b>	<b>Air filter .....</b>	<b>413</b>
3.1	Assembly overview - air filter housing .....	413
3.2	Removing and installing air filter housing .....	414
3.3	Removing and installing resonator for intake air .....	415



<b>4</b>	<b>Intake manifold</b>	<b>417</b>
4.1	Assembly overview - intake manifold	417
4.2	Removing and installing intake manifold	420
4.3	Removing and installing throttle valve module GX3	423
4.4	Cleaning throttle valve module GX3	424
<b>5</b>	<b>Senders and sensors</b>	<b>426</b>
5.1	Removing and installing intake manifold sender GX9	426
5.2	Removing and installing fuel pressure sender G247	426
5.3	Checking fuel pressure sender G247	428
5.4	Removing and installing exhaust gas pressure sensor 1 G450	432
<b>6</b>	<b>Engine control unit</b>	<b>434</b>
6.1	Removing and installing engine control unit J623	434
<b>7</b>	<b>High-pressure pump</b>	<b>442</b>
7.1	Assembly overview - high-pressure pump	442
7.2	Removing and installing high-pressure pump	448
7.3	Removing and installing high-pressure pipe	450
<b>8</b>	<b>Lambda probe</b>	<b>452</b>
8.1	Assembly overview - Lambda probe	452
8.2	Removing and installing Lambda probe	453
<b>26 - Exhaust system</b>		<b>455</b>
<b>1</b>	<b>Exhaust pipes and silencers</b>	<b>455</b>
1.1	Assembly overview - silencers	455
1.2	Removing and installing silencer	466
1.3	Separating exhaust pipes from silencers	477
1.4	Aligning exhaust system free of stress	485
1.5	Checking exhaust system for leaks	487
1.6	Installation position of clamp	487
<b>2</b>	<b>Emission control</b>	<b>490</b>
2.1	Assembly overview - emission control	490
2.2	Removing and installing catalytic converter	499
2.3	Removing and installing particulate filter	507
2.4	Removing and installing exhaust flap control unit J883	507
<b>28 - Ignition system</b>		<b>509</b>
<b>1</b>	<b>Ignition system</b>	<b>509</b>
1.1	Assembly overview - ignition system	509
1.2	Removing and installing ignition coils with output stage	511
1.3	Removing and installing knock sensor 1 G61	514
1.4	Removing and installing Hall sender	514
1.5	Removing and installing engine speed sender G28	515