



## 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>7</b>
3.1 Rules for cleanliness	7
3.2 General information	7
3.3 General repair instructions	8
3.4 Foreign objects in engine	8
3.5 Contact corrosion	8
3.6 Routing and attachment of lines	8
3.7 Fitting radiator and condensers	8
3.8 Checking vacuum system	8
<b>10 - Removing and installing engine</b>	<b>10</b>
<b>1 Removing and installing engine</b>	<b>10</b>
1.1 Removing engine	10
1.2 Separating engine and gearbox	20
1.3 Securing engine on engine and gearbox support	23
1.4 Installing engine	24
<b>2 Assembly mountings</b>	<b>29</b>
2.1 Assembly overview – assembly mountings	29
2.2 Removing and installing engine mounting	41
2.3 Removing and installing gearbox mounting	42
2.4 Removing and installing pendulum support	44
2.5 Supporting engine in installation position	45
2.6 Adjusting assembly mountings	78
2.7 Checking adjustment of assembly mountings	80
<b>3 Engine cover panel</b>	<b>82</b>
3.1 Removing and installing engine cover	82
<b>13 - Crankshaft group</b>	<b>83</b>
<b>1 Cylinder block (pulley end)</b>	<b>83</b>
1.1 Assembly overview - poly V-belt drive	83
1.2 Removing and installing poly-V belt	89
1.3 Removing and installing tensioner for poly V-belt	94
1.4 Removing and installing vibration damper	96
1.5 Removing and installing engine support	99
1.6 Renewing crankshaft oil seal - belt pulley end	101
<b>2 Cylinder block, gearbox end</b>	<b>105</b>
2.1 Assembly overview - cylinder block, gearbox end	105
2.2 Removing and installing flywheel	108
2.3 Removing and installing sealing flange on gearbox side	110
<b>3 Crankshaft</b>	<b>123</b>
3.1 Renewing needle bearing in crankshaft	123
3.2 Crankshaft dimensions	125
3.3 Measuring axial clearance of crankshaft	125



<b>4</b>	<b>Pistons and conrods</b>	<b>127</b>
4.1	Assembly overview - pistons and conrods	127
4.2	Removing and installing pistons	129
4.3	Checking pistons and cylinder bores	131
4.4	Separating new conrod	133
4.5	Checking radial clearance of conrods	133
4.6	Removing and installing oil spray jets	134
4.7	Setting piston to TDC position	135
<b>15</b>	<b>Cylinder head, valve gear</b>	<b>138</b>
<b>1</b>	<b>Cylinder head</b>	<b>138</b>
1.1	Assembly overview - cylinder head	138
1.2	Assembly overview - camshaft housing	140
1.3	Removing and installing cylinder head	143
1.4	Removing and installing camshaft housing	147
1.5	Checking compression	153
<b>2</b>	<b>Toothed belt drive</b>	<b>156</b>
2.1	Assembly overview - toothed belt cover	156
2.2	Assembly overview - toothed belt	157
2.3	Assembly overview - valve timing tool	160
2.4	Removing and installing toothed belt guard	160
2.5	Removing and installing toothed belt	161
2.6	Preassembling and installing valve timing tool	168
2.7	Checking valve timing	178
2.8	Adjusting valve timing	181
2.9	Removing toothed belt from camshaft	192
<b>3</b>	<b>Valve gear</b>	<b>197</b>
3.1	Assembly overview - valve gear	197
3.2	Removing and installing camshaft oil seal	200
3.3	Removing and installing camshaft adjuster	212
3.4	Removing and installing cam actuators	224
3.5	Removing and installing inlet camshaft control valve 1 N727	226
3.6	Removing and installing exhaust camshaft control valve 1 N318	227
3.7	Removing and installing valve stem seals	228
3.8	Removing and installing holder for oil seal	243
<b>4</b>	<b>Inlet and exhaust valves</b>	<b>247</b>
4.1	Checking valve guides	247
4.2	Checking valves	248
4.3	Valve dimensions	248
<b>17</b>	<b>Lubrication</b>	<b>249</b>
<b>1</b>	<b>Sump, oil pump</b>	<b>249</b>
1.1	Assembly overview - sump/oil pump	249
1.2	Engine oil:	254
1.3	Removing and installing sump	254
1.4	Removing and installing oil pump	259
1.5	Removing and installing oil level and oil temperature sender G266	262
<b>2</b>	<b>Engine oil cooler</b>	<b>263</b>
2.1	Assembly overview - engine oil cooler	263
2.2	Removing and installing engine oil cooler	263
<b>3</b>	<b>Crankcase ventilation</b>	<b>265</b>
3.1	Assembly overview - crankcase breather system	265
3.2	Removing and installing oil separator	267
<b>4</b>	<b>Oil filter, oil pressure switch</b>	<b>271</b>
4.1	Assembly overview - oil pressure switches/oil pressure control	271



4.2	Removing and installing oil pressure sender G10 .....	271
4.3	Checking oil pressure and oil pressure switch .....	273
4.4	Removing and installing oil filter housing .....	273
4.5	Removing and installing oil pressure regulating valve N428 .....	274
<b>19</b>	<b>- Cooling .....</b>	<b>276</b>
<b>1</b>	<b>Cooling system/coolant .....</b>	<b>276</b>
1.1	Connection diagram - coolant hoses .....	276
1.2	Checking cooling system for leaks .....	278
1.3	Draining and adding coolant .....	282
1.4	Flushing cooling system .....	290
<b>2</b>	<b>Coolant pump, regulation of cooling system .....</b>	<b>305</b>
2.1	Assembly overview - coolant pump, thermostat .....	305
2.2	Assembly overview - electric coolant pump .....	307
2.3	Assembly overview - coolant temperature sender .....	307
2.4	Removing and installing electric coolant pump .....	308
2.5	Removing and installing coolant pump .....	311
2.6	Removing and installing toothed belt pulley for coolant pump .....	316
2.7	Removing and installing coolant temperature sender G62 .....	320
2.8	Removing and installing radiator outlet coolant temperature sender G83 .....	322
2.9	Removing and installing engine outlet coolant temperature sender G82 .....	324
2.10	Removing and installing engine temperature regulation module GX33 .....	326
2.11	Checking coolant pump .....	330
<b>3</b>	<b>Coolant pipes .....</b>	<b>336</b>
3.1	Assembly overview - coolant pipes .....	336
3.2	Removing and installing coolant pipes .....	338
<b>4</b>	<b>Radiator, radiator fan .....</b>	<b>347</b>
4.1	Assembly overview - radiator/radiator fan .....	347
4.2	Assembly overview - radiator cowl and radiator fan .....	349
4.3	Assembly overview - radiator blind .....	351
4.4	Removing and installing radiator .....	354
4.5	Removing and installing water radiator for charge air cooling circuit .....	357
4.6	Removing and installing radiator cowl .....	362
4.7	Removing and installing radiator fan .....	363
4.8	Removing and installing radiator blind .....	365
4.9	Removing and installing radiator blind control motor V544 .....	367
<b>21</b>	<b>- Turbocharging/supercharging .....</b>	<b>373</b>
<b>1</b>	<b>Turbocharger .....</b>	<b>373</b>
1.1	Assembly overview - turbocharger .....	373
1.2	Removing and installing turbocharger .....	379
1.3	Removing and installing connection for turbocharger .....	384
1.4	Removing and installing charge pressure control module GX34 .....	386
<b>2</b>	<b>Charge air system .....</b>	<b>391</b>
2.1	Assembly overview - charge air system .....	391
2.2	Removing and installing charge air cooler .....	394
2.3	Removing and installing charge pressure sender GX26 .....	397
2.4	Checking charge air system for leaks .....	398
2.5	Removing and installing air pipe .....	402
2.6	Checking charge air cooler for leaks .....	409
<b>24</b>	<b>- Mixture preparation - injection .....</b>	<b>415</b>
<b>1</b>	<b>Injection system .....</b>	<b>415</b>
1.1	Overview of fitting locations - injection system .....	415
<b>2</b>	<b>Air filter .....</b>	<b>425</b>



2.1	Assembly overview - air filter housing	425
2.2	Removing and installing air filter housing	427
2.3	Removing and installing air guide on lock carrier	429
<b>3</b>	<b>Intake manifold</b>	<b>433</b>
3.1	Assembly overview – intake manifold	433
3.2	Removing and installing intake manifold	436
3.3	Removing and installing throttle valve module GX3	442
3.4	Cleaning throttle valve module GX3	444
<b>4</b>	<b>Injectors</b>	<b>446</b>
4.1	Assembly overview - fuel rail with injectors	446
4.2	Removing and installing fuel rail	448
4.3	Removing and installing injectors	449
4.4	Cleaning injectors	457
<b>5</b>	<b>Senders and sensors</b>	<b>459</b>
5.1	Removing and installing intake manifold sender GX9	459
5.2	Removing and installing fuel pressure sender G247	460
5.3	Checking fuel pressure sender G247	462
5.4	Removing and installing exhaust gas pressure sensor 1 G450	466
5.5	Removing and installing air mass measurement module GX35	467
<b>6</b>	<b>High-pressure pump</b>	<b>469</b>
6.1	Assembly overview - high-pressure pump	469
6.2	Removing and installing high-pressure pump	470
6.3	Removing and installing high-pressure pipe	472
<b>7</b>	<b>Lambda probe</b>	<b>474</b>
7.1	Assembly overview - Lambda probe	474
7.2	Removing and installing Lambda probe	475
<b>8</b>	<b>Engine control unit</b>	<b>477</b>
8.1	Removing and installing engine control unit J623	477
<b>26</b>	<b>- Exhaust system</b>	<b>485</b>
<b>1</b>	<b>Exhaust pipes and silencers</b>	<b>485</b>
1.1	Assembly overview – silencers	485
1.2	Removing and installing silencer	501
1.3	Separating exhaust pipes from silencers	516
1.4	Aligning exhaust system free of stress	518
1.5	Checking exhaust system for leaks	518
1.6	Installation position of clamp	519
1.7	Assembly overview - front exhaust pipe	520
1.8	Removing and installing bracket for front exhaust pipe	521
<b>2</b>	<b>Emission control</b>	<b>523</b>
2.1	Assembly overview – emission control	523
2.2	Removing and installing catalytic converter	526
2.3	Removing and installing particulate filter	531
2.4	Removing and installing exhaust flap control unit J883	532
<b>28</b>	<b>- Ignition system</b>	<b>533</b>
<b>1</b>	<b>Ignition system</b>	<b>533</b>
1.1	Assembly overview - ignition system	533
1.2	Removing and installing ignition coils with output stage	535
1.3	Removing and installing knock sensor 1 G61	539
1.4	Removing and installing engine speed sender G28	540
1.5	Removing and installing inlet camshaft position sender G1002	542
1.6	Removing and installing exhaust camshaft position sender G1003	543