

## Contents

<b>00 - Technical data</b>	<b>1</b>
<b>1 Identification</b>	<b>1</b>
1.1 Engine number/engine data	1
<b>2 Safety information</b>	<b>2</b>
2.1 Safety precautions when working on the fuel 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 exhaust system	3
2.6 Safety precautions when working on the SCR system	4
<b>3 Repair instructions</b>	<b>6</b>
3.1 Identification plates	6
3.2 Use of impact wrenches	6
3.3 Rules for cleanliness	7
3.4 General notes	7
3.5 General repair instructions	9
3.6 Foreign material in engine	11
3.7 Cleaning engine	11
3.8 Contact corrosion	11
3.9 Routing and attachment of pipes, hoses and wiring	12
3.10 Installing radiators and condensers	12
3.11 Performing adaptations after renewing a component	12
<b>10 - Removing and installing engine</b>	<b>14</b>
<b>1 Removing and installing engine</b>	<b>14</b>
1.1 Removing engine	14
1.2 Separating engine and gearbox	97
1.3 Securing engine to engine and gearbox support	120
1.4 Installing engine	123
<b>2 Assembly mountings</b>	<b>127</b>
2.1 Assembly overview - assembly mountings	127
2.2 Supporting engine in installation position	134
2.3 Removing and installing engine mounting	150
2.4 Removing and installing power unit mounting senders	160
2.5 Removing and installing gearbox mountings	161
2.6 Removing and installing power unit mounting control unit J931	164
2.7 Calibrating electrohydraulic engine mounting	164
<b>3 Engine cover panel</b>	<b>165</b>
3.1 Removing and installing engine cover panel	165
<b>13 - Crankshaft group</b>	<b>168</b>
<b>1 Cylinder block (pulley end)</b>	<b>168</b>
1.1 Assembly overview - cylinder block (pulley end)	168
1.2 Assembly overview - sealing flange (pulley end)	171
1.3 Removing and installing poly V-belts	173
1.4 Removing and installing poly V-belt tensioner	176
1.5 Removing and installing vibration damper	181
1.6 Removing and installing bracket for ancillaries	204
1.7 Removing and installing engine support	208
1.8 Renewing crankshaft oil seal (pulley end)	210
1.9 Removing and installing sealing flange (pulley end)	211
<b>2 Cylinder block (gearbox end)</b>	<b>216</b>



2.1	Assembly overview - cylinder block (gearbox end)	216
2.2	Removing and installing drive plate	217
2.3	Renewing crankshaft oil seal (gearbox end)	218
<b>3</b>	<b>Crankshaft</b>	<b>221</b>
3.1	Assembly overview - crankshaft	221
3.2	Crankshaft dimensions	223
3.3	Allocation of main bearing shells	224
3.4	Measuring axial clearance of crankshaft	227
3.5	Measuring radial clearance of crankshaft	227
3.6	Checking sender wheel	228
<b>4</b>	<b>Balance shaft</b>	<b>230</b>
4.1	Assembly overview - balance shaft	230
4.2	Removing and installing balance shaft	231
4.3	Renewing roller bearing	237
<b>5</b>	<b>Pistons and conrods</b>	<b>240</b>
5.1	Assembly overview - pistons and conrods	240
5.2	Removing and installing pistons	243
5.3	Measuring piston projection at TDC	244
5.4	Checking pistons and cylinder bores	246
5.5	Checking radial clearance of conrod bearings	247
<b>15</b>	<b>Cylinder head, valve gear</b>	<b>249</b>
<b>1</b>	<b>Timing chain cover</b>	<b>249</b>
1.1	Assembly overview - timing chain cover	249
1.2	Removing and installing timing chain cover	253
<b>2</b>	<b>Chain drive</b>	<b>262</b>
2.1	Assembly overview - camshaft timing chains	262
2.2	Assembly overview - drive chain	264
2.3	Removing camshaft timing chain from camshafts	266
2.4	Removing and installing camshaft timing chain	275
2.5	Removing and installing drive chain for high-pressure pump	284
2.6	Installing intermediate drive	285
<b>3</b>	<b>Cylinder head</b>	<b>292</b>
3.1	Assembly overview - cylinder head	292
3.2	Assembly overview - cylinder head cover	295
3.3	Removing and installing cylinder head	298
3.4	Removing and installing cylinder head cover	305
3.5	Removing and installing seals for injectors	310
3.6	Checking compression	311
<b>4</b>	<b>Valve gear</b>	<b>313</b>
4.1	Assembly overview - valve gear	313
4.2	Measuring axial clearance of camshaft	320
4.3	Measuring radial clearance of camshaft	322
4.4	Removing and installing camshaft	322
4.5	Removing and installing valve stem oil seals	335
<b>5</b>	<b>Inlet and exhaust valves</b>	<b>343</b>
5.1	Reworking valve seats	343
5.2	Checking valve guides	343
5.3	Checking valves	344
5.4	Valve dimensions	344
<b>17</b>	<b>Lubrication</b>	<b>345</b>
<b>1</b>	<b>Sump/oil pump</b>	<b>345</b>
1.1	Assembly overview - sump/oil pump	345
1.2	Engine oil	349

1.3	Removing and installing lower part of sump	349
1.4	Removing and installing upper part of sump	353
1.5	Removing and installing oil pump	356
1.6	Removing and installing oil level and oil temperature sender G266	358
<b>2</b>	<b>Engine oil cooler</b>	<b>359</b>
2.1	Assembly overview - engine oil cooler	359
2.2	Removing and installing engine oil cooler	360
2.3	Removing and installing temperature regulator for engine oil cooler	361
<b>3</b>	<b>Oil filter/oil pressure switch</b>	<b>363</b>
3.1	Assembly overview - oil filter	363
3.2	Removing and installing oil filter housing	365
3.3	Removing and installing oil pressure sender G10	367
3.4	Checking oil pressure	369
3.5	Removing and installing valve for oil pressure control N428	369
3.6	Removing and installing oil temperature sender 2 G664	370
<b>19</b>	<b>Cooling</b>	<b>373</b>
<b>1</b>	<b>Cooling system/coolant</b>	<b>373</b>
1.1	Connection diagram - coolant hoses	373
1.2	Assembly overview - coolant expansion tank	389
1.3	Checking cooling system for leaks	394
1.4	Draining and filling cooling system	398
<b>2</b>	<b>Coolant pump/thermostat assembly</b>	<b>415</b>
2.1	Assembly overview - coolant pump	415
2.2	Assembly overview - electric coolant pump	417
2.3	Assembly overview - thermostat	423
2.4	Assembly overview - coolant valves	425
2.5	Assembly overview - coolant temperature senders	428
2.6	Removing and installing electric coolant pump	430
2.7	Removing and installing coolant pump	437
2.8	Removing and installing map-controlled engine cooling system thermostat F265	440
2.9	Removing and installing housing for map-controlled engine cooling system thermostat F265	441
2.10	Removing and installing coolant temperature sender G62	441
2.11	Removing and installing temperature sender for engine temperature regulation G694	443
2.12	Removing and installing coolant temperature sender 2 G802	444
2.13	Removing and installing coolant temperature sender for charge air cooler G1130	446
2.14	Removing and installing coolant valves	448
<b>3</b>	<b>Coolant pipes</b>	<b>458</b>
3.1	Assembly overview - coolant pipes	458
3.2	Removing and installing coolant pipes	465
3.3	Removing and installing coolant line	505
<b>4</b>	<b>Radiators/radiator fans</b>	<b>507</b>
4.1	Assembly overview - radiators/radiator fans	507
4.2	Assembly overview - radiator cowl and radiator fans	512
4.3	Assembly overview - radiator blind	513
4.4	Assembly overview - auxiliary radiator	515
4.5	Removing and installing radiator	516
4.6	Removing and installing radiator blind	537
4.7	Removing and installing radiator blind control motor V544	539
4.8	Removing and installing water radiator for charge air cooling circuit	542
4.9	Removing and installing radiator cowl	552
4.10	Removing and installing radiator fans	564
4.11	Removing and installing auxiliary radiator	564



<b>21 - Turbocharging/supercharging</b>	<b>567</b>
<b>1 Turbocharger</b>	<b>567</b>
1.1 Assembly overview - turbocharger	567
1.2 Removing and installing turbocharger	571
<b>2 Charge air system</b>	<b>575</b>
2.1 Assembly overview - charge air system	575
2.2 Assembly overview - hose connections for charge air system	577
2.3 Removing and installing charge air cooler	578
2.4 Removing and installing charge pressure sender G31	580
2.5 Removing and installing charge air temperature sender	581
2.6 Checking charge air system for leaks	582
<b>23 - Mixture preparation - injection</b>	<b>588</b>
<b>1 Injection system</b>	<b>588</b>
1.1 Overview - fuel system	588
1.2 Overview of fitting locations - injection system	590
1.3 Filling and bleeding fuel system	601
1.4 Checking fuel system for leaks	602
<b>2 Vacuum system</b>	<b>603</b>
2.1 Connection diagram - vacuum system	603
2.2 Checking vacuum system	603
<b>3 Air filter</b>	<b>605</b>
3.1 Assembly overview - air filter housing	605
3.2 Removing and installing air filter housing	613
<b>4 Intake manifold</b>	<b>620</b>
4.1 Assembly overview - intake manifold	620
4.2 Removing and installing upper part of intake manifold	623
4.3 Removing and installing lower part of intake manifold	626
4.4 Removing and installing intake manifold flap control unit GX14	627
4.5 Removing and installing throttle valve module GX3	628
<b>5 Injectors/high-pressure reservoir (rail)</b>	<b>630</b>
5.1 Assembly overview - injectors	630
5.2 Checking injectors	634
5.3 Performing adaptation of correction values for injectors	635
5.4 Checking return flow rate of injectors with engine running	635
5.5 Checking return flow rate of injectors at starter cranking speed	639
5.6 Removing and installing injectors	643
5.7 Removing and installing high-pressure pipes	662
5.8 Removing and installing high-pressure reservoir (rail)	664
<b>6 Senders and sensors</b>	<b>670</b>
6.1 Removing and installing air mass meter G70	670
6.2 Removing and installing fuel temperature sender G81	673
6.3 Removing and installing fuel pressure sender G247	674
6.4 Removing and installing fuel pressure sender for low pressure G410	676
6.5 Checking fuel pressure regulating valve N276	677
6.6 Removing and installing fuel pressure regulating valve N276	680
6.7 Removing and installing pressure differential senders	682
6.8 Removing and installing NOx senders	688
6.9 Removing and installing particulate sensor G784	694
<b>7 High-pressure pump</b>	<b>698</b>
7.1 Assembly overview - high-pressure pump	698
7.2 Removing and installing high-pressure pump	700
<b>8 Lambda probe</b>	<b>706</b>

8.1	Assembly overview - Lambda probe	706
8.2	Removing and installing Lambda probe	711
<b>9</b>	<b>Engine control unit</b>	<b>716</b>
9.1	Assembly overview - engine control unit	716
9.2	Removing and installing engine/motor control unit J623	720
<b>26</b>	<b>- Exhaust system</b>	<b>723</b>
<b>1</b>	<b>Exhaust pipes/silencers</b>	<b>723</b>
1.1	Assembly overview - silencers	723
1.2	Removing and installing front exhaust pipe	733
1.3	Separating exhaust pipes/silencers	738
1.4	Removing and installing silencers	739
1.5	Stress-free alignment of exhaust system	745
1.6	Checking exhaust system for leaks	746
<b>2</b>	<b>Emission control system</b>	<b>747</b>
2.1	Assembly overview - emission control system	747
2.2	Removing and installing emission control module	750
2.3	Removing and installing ammonia trap	757
2.4	Removing and installing exhaust flap control unit J883	759
<b>3</b>	<b>SCR (selective catalytic reduction) system</b>	<b>761</b>
3.1	Assembly overview - reducing agent tank	761
3.2	Assembly overview - delivery unit for reducing agent metering system	771
3.3	Assembly overview - injector for reducing agent	773
3.4	Assembly overview - reducing agent supply line	775
3.5	Releasing pressure in SCR system	780
3.6	Disconnecting reducing agent supply line	781
3.7	Draining reducing agent tank	783
3.8	Removing and installing reducing agent tank	786
3.9	Removing and installing front reducing agent supply line	795
3.10	Removing and installing injector for reducing agent N474	797
3.11	Removing and installing injector 2 for reducing agent N758	799
3.12	Removing and installing control unit for reducing agent metering system J880	801
3.13	Removing and installing reducing agent quality sensor G849	803
3.14	Removing and installing pump for reducing agent V437	804
3.15	Removing and installing pressure sender for reducing agent metering system G686	806
3.16	Removing and installing connection for SCR supply line	808
<b>4</b>	<b>Exhaust gas temperature regulation</b>	<b>810</b>
4.1	Assembly overview - exhaust gas temperature regulation	810
4.2	Removing and installing exhaust gas temperature sender 1 G235	811
4.3	Removing and installing exhaust gas temperature sender 2 G448	812
4.4	Removing and installing exhaust gas temperature sender 3 G495	813
4.5	Removing and installing exhaust gas temperature sender 4 G648	815
<b>5</b>	<b>Exhaust gas recirculation</b>	<b>817</b>
5.1	Assembly overview - exhaust gas recirculation system	817
5.2	Removing and installing exhaust gas recirculation cooler	827
5.3	Removing and installing exhaust gas recirculation valve 2 GX6	840
5.4	Removing and installing exhaust gas recirculation temperature sensor G98	841
<b>6</b>	<b>Exhaust manifold</b>	<b>843</b>
6.1	Assembly overview - exhaust manifold	843
6.2	Removing and installing exhaust manifolds	844
<b>28</b>	<b>- Glow plug system</b>	<b>848</b>
<b>1</b>	<b>Glow plug system</b>	<b>848</b>
1.1	Assembly overview - glow plug system	848
1.2	Removing and installing glow plug	850



1.3	Removing and installing automatic glow period control unit J179 .....	854
1.4	Removing and installing Hall sender G40 .....	855
1.5	Removing and installing engine speed sender G28 .....	856