

## 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 high-voltage system	2
2.2 Safety precautions when working in the vicinity of high-voltage components	3
2.3 Safety precautions when working on the fuel supply system	3
2.4 Safety precautions when working on vehicles with start/stop system	4
2.5 Safety precautions when using testers and measuring instruments during a road test	4
2.6 Safety precautions when working on the cooling system	4
2.7 Safety precautions when working on the exhaust system	5
2.8 Safety precautions when working on the ignition system	6
<b>3 Repair instructions</b>	<b>7</b>
3.1 Rules for cleanliness	7
3.2 General notes	7
3.3 General repair instructions	8
3.4 Foreign material in engine	8
3.5 Cleaning engine	8
3.6 Contact corrosion	8
3.7 Routing and attachment of pipes, hoses and wiring	9
3.8 Installing radiators and condensers	9
3.9 Nuts, bolts	9
3.10 Identification plates	10
3.11 Use of impact wrenches	10
3.12 Checking vacuum system	10
3.13 Work on high-voltage components or potential equalisation lines	11
3.14 Painting work on vehicles with high-voltage system	11
<b>4 Assessing high-voltage system risk level</b>	<b>12</b>
4.1 Necessary qualifications	12
4.2 Work that requires high-voltage system to be de-energised	12
<b>10 - Removing and installing engine</b>	<b>15</b>
<b>1 Safety information</b>	<b>15</b>
<b>2 Removing and installing engine</b>	<b>16</b>
2.1 Removing engine	16
2.2 Separating engine and gearbox	76
2.3 Securing engine to engine and gearbox support	89
2.4 Installing engine	92
<b>3 Assembly mountings</b>	<b>100</b>
3.1 Assembly overview - assembly mountings	100
3.2 Supporting engine in installation position	107
3.3 Removing and installing engine mountings	114
3.4 Removing and installing gearbox mounting	119
3.5 Removing and installing pendulum support	124
3.6 Checking adjustment of assembly mountings	125
3.7 Adjusting assembly mountings	127
<b>4 Engine cover panel</b>	<b>132</b>
4.1 Removing and installing engine cover panel	132
<b>13 - Crankshaft group</b>	<b>134</b>
<b>1 Safety information</b>	<b>134</b>
<b>2 Cylinder block (pulley end)</b>	<b>135</b>



2.1	Assembly overview - poly V-belt drive	135
2.2	Assembly overview - sealing flange (pulley end)	138
2.3	Plug for "TDC" drilling in cylinder block - tightening torque	139
2.4	Removing and installing poly V-belt	139
2.5	Removing and installing poly V-belt tensioner	143
2.6	Removing and installing engine support	144
2.7	Removing and installing vibration damper	147
2.8	Renewing crankshaft oil seal (pulley end)	152
2.9	Removing and installing sealing flange (pulley end)	154
<b>3</b>	<b>Cylinder block (gearbox end)</b>	<b>157</b>
3.1	Assembly overview - cylinder block (gearbox end)	157
3.2	Assembly overview - drive plate	159
3.3	Removing and installing flywheel	160
3.4	Removing and installing drive plate	163
3.5	Removing and installing sealing flange (gearbox end)	165
<b>4</b>	<b>Crankshaft</b>	<b>176</b>
4.1	Crankshaft dimensions	176
4.2	Renewing needle bearing in crankshaft	176
<b>5</b>	<b>Pistons and conrods</b>	<b>179</b>
5.1	Assembly overview - pistons and conrods	179
5.2	Removing and installing pistons	183
5.3	Removing and installing oil spray jets	184
5.4	Checking pistons and cylinder bores	186
5.5	Separating parts of new conrod	189
5.6	Checking radial clearance of conrod bearings	189
5.7	Setting pistons to TDC position	190
<b>15</b>	<b>Cylinder head, valve gear</b>	<b>196</b>
<b>1</b>	<b>Safety information</b>	<b>196</b>
<b>2</b>	<b>Toothed belt drive</b>	<b>197</b>
2.1	Assembly overview - toothed belt guard	197
2.2	Assembly overview - toothed belt	198
2.3	Detaching toothed belt from camshaft	200
2.4	Removing and installing toothed belt	242
2.5	Removing and installing toothed belt guard	295
<b>3</b>	<b>Cylinder head</b>	<b>297</b>
3.1	Assembly overview - cylinder head	297
3.2	Assembly overview - camshaft housing	299
3.3	Removing and installing cylinder head	302
3.4	Removing and installing camshaft housing	307
3.5	Checking compression	317
<b>4</b>	<b>Valve gear</b>	<b>320</b>
4.1	Assembly overview - valve gear	320
4.2	Measuring axial clearance of camshaft	322
4.3	Removing and installing camshaft oil seal	323
4.4	Removing and installing camshaft adjuster	332
4.5	Removing and installing cam actuators	342
4.6	Removing and installing camshaft control valve 1 N205	344
4.7	Removing and installing valve stem oil seals	345
<b>5</b>	<b>Inlet and exhaust valves</b>	<b>354</b>
5.1	Checking valve guides	354
5.2	Checking valves	355
5.3	Valve dimensions	355
<b>17</b>	<b>Lubrication</b>	<b>356</b>

<b>1</b>	<b>Safety information</b>	<b>356</b>
<b>2</b>	<b>Sump/oil pump</b>	<b>357</b>
2.1	Assembly overview - sump/oil pump	357
2.2	Engine oil	360
2.3	Removing and installing lower part of sump	360
2.4	Removing and installing upper part of sump	365
2.5	Removing and installing oil pump	368
2.6	Removing and installing oil level and oil temperature sender G266	369
<b>3</b>	<b>Engine oil cooler</b>	<b>371</b>
3.1	Assembly overview - engine oil cooler	371
3.2	Removing and installing engine oil cooler	371
<b>4</b>	<b>Crankcase breather</b>	<b>373</b>
4.1	Assembly overview - crankcase breather system	373
4.2	Removing and installing oil separator	374
<b>5</b>	<b>Oil filter/oil pressure switches</b>	<b>378</b>
5.1	Assembly overview - oil filter/oil pressure switch	378
5.2	Removing and installing oil pressure switch F22	380
5.3	Removing and installing oil pressure switch for reduced oil pressure F378	381
5.4	Checking oil pressure	383
5.5	Removing and installing valve for oil pressure control N428	384
<b>19 - Cooling</b>		<b>386</b>
<b>1</b>	<b>Safety information</b>	<b>386</b>
<b>2</b>	<b>Cooling system/coolant</b>	<b>387</b>
2.1	Connection diagram - coolant hoses	387
2.2	Assembly overview - coolant expansion tank	391
2.3	Checking cooling system for leaks	393
2.4	Draining and filling cooling system	397
2.5	Removing and installing coolant expansion tank	418
<b>3</b>	<b>Coolant pump/thermostat assembly</b>	<b>423</b>
3.1	Assembly overview - coolant pump/thermostat	423
3.2	Assembly overview - electric coolant pump	426
3.3	Assembly overview - coolant temperature senders	429
3.4	Assembly overview - coolant valves	430
3.5	Removing and installing electric coolant pump	432
3.6	Removing and installing coolant pump	441
3.7	Removing and installing thermostat	450
3.8	Removing and installing toothed belt pulley for coolant pump	459
3.9	Removing and installing coolant temperature sender G62	464
3.10	Removing and installing radiator outlet coolant temperature sender G83	469
3.11	Removing and installing coolant temperature sender for heater G241	471
3.12	Removing and installing engine temperature sender 2 G652	472
3.13	Removing and installing coolant valves	473
<b>4</b>	<b>Coolant pipes</b>	<b>480</b>
4.1	Assembly overview - coolant pipes	480
4.2	Removing and installing coolant pipes	483
<b>5</b>	<b>Radiator/radiator fan</b>	<b>494</b>
5.1	Assembly overview - radiator/radiator fan	494
5.2	Assembly overview - radiator cowl and radiator fan	497
5.3	Removing and installing radiator	498
5.4	Removing and installing radiator cowl	507
5.5	Removing and installing radiator fan V7	509
5.6	Removing and installing radiator for high-voltage cooling circuit	509



<b>21 - Turbocharging/supercharging</b>	<b>514</b>
1 Safety information	514
2 Turbocharger	515
2.1 Assembly overview - turbocharger	515
2.2 Removing and installing turbocharger	523
2.3 Removing and installing charge pressure positioner V465	535
2.4 Renewing vacuum unit for turbocharger	536
2.5 Removing and installing connection for turbocharger	536
3 Charge air system	546
3.1 Assembly overview - charge air system	546
3.2 Assembly overview - hose connections for charge air system	548
3.3 Removing and installing charge air cooler	548
3.4 Removing and installing charge pressure sender GX26	551
3.5 Checking charge air system for leaks	552
<b>24 - Mixture preparation - injection</b>	<b>555</b>
1 Safety information	555
2 Injection system	556
2.1 Overview of fitting locations - injection system	556
3 Air filter	573
3.1 Assembly overview - air filter housing	573
3.2 Removing and installing air filter housing	575
4 Intake manifold	576
4.1 Assembly overview - intake manifold	576
4.2 Removing and installing intake manifold	579
4.3 Removing and installing throttle valve module GX3	588
4.4 Cleaning throttle valve module GX3	590
4.5 Removing and installing activated charcoal filter solenoid valve 1 N80	591
5 Injectors	593
5.1 Assembly overview - fuel rail with injectors	593
5.2 Removing and installing fuel rail	597
5.3 Removing and installing injectors	598
5.4 Cleaning injectors	611
6 Senders and sensors	613
6.1 Removing and installing fuel pressure sender G247	613
6.2 Checking fuel pressure sender G247	614
6.3 Removing and installing intake manifold sender GX9	616
6.4 Removing and installing pressure differential sender for particulate filter G1037	617
7 High-pressure pump	620
7.1 Assembly overview - high-pressure pump	620
7.2 Removing and installing high-pressure pump	628
7.3 Removing and installing high-pressure pipe	631
8 Lambda probe	633
8.1 Assembly overview - Lambda probe	633
8.2 Removing and installing Lambda probe	636
9 Engine control unit	639
9.1 Assembly overview - engine control unit	639
9.2 Removing and installing engine control unit J623	640
<b>26 - Exhaust system</b>	<b>649</b>
1 Safety information	649
2 Exhaust pipes/silencers	650
2.1 Assembly overview - silencers	650

2.2	Separating exhaust pipes/silencers	660
2.3	Removing and installing silencers	666
2.4	Stress-free alignment of exhaust system	674
2.5	Checking exhaust system for leaks	675
2.6	Installation position of clamp	675
<b>3</b>	<b>Emission control system</b>	<b>678</b>
3.1	Assembly overview - emission control system	678
3.2	Assembly overview - bracket and pipes for pressure differential sender for particulate filter G1037	687
3.3	Removing and installing catalytic converter	689
3.4	Removing and installing particulate filter	695
<b>4</b>	<b>Exhaust gas temperature regulation</b>	<b>701</b>
4.1	Assembly overview - exhaust gas temperature regulation	701
4.2	Removing and installing parts of exhaust gas temperature regulation	704
<b>28</b>	<b>Ignition system</b>	<b>711</b>
1	<b>Safety information</b>	<b>711</b>
2	<b>Ignition system</b>	<b>712</b>
2.1	Assembly overview - ignition system	712
2.2	Removing and installing ignition coils	714
2.3	Removing and installing knock sensor 1 G61	717
2.4	Removing and installing Hall senders	719
2.5	Removing and installing engine speed sender G28	722
<b>93</b>	<b>Electric drive systems</b>	<b>725</b>
1	<b>Safety information</b>	<b>725</b>
2	<b>High-voltage components</b>	<b>726</b>
2.1	Overview of fitting locations - high-voltage components	726
2.2	Checking high-voltage components and high-voltage wiring	728
3	<b>Warning stickers</b>	<b>729</b>
3.1	Checking warning stickers	729
4	<b>High-voltage battery unit</b>	<b>735</b>
4.1	Assembly overview - high-voltage battery	735
4.2	Inspecting and classifying hybrid battery unit AX1	736
4.3	Removing and installing hybrid battery unit AX1	739
4.4	Performing leak test for high-voltage battery	746
4.5	Checking high-voltage battery for leaks	749
4.6	Raising high-voltage battery	749
4.7	Storing and transporting high-voltage batteries	751
4.8	Removing and installing battery regulation control unit J840	751
4.9	Removing and installing heat shield for hybrid battery unit	751
5	<b>High-voltage battery components</b>	<b>754</b>
5.1	Overview of fitting locations - high-voltage battery	754
5.2	Overview of fitting locations - battery modules	755
5.3	Overview of fitting locations - battery connectors	756
5.4	Assembly overview - battery housing	758
5.5	Assembly overview - switching unit for high-voltage battery SX6	760
5.6	Assembly overview - battery module assembly	761
5.7	Assembly overview - battery modules	763
5.8	Assembly overview - high-voltage system connection	764
5.9	Assembly overview - wiring harnesses	764
5.10	Diagnosis of hybrid battery unit AX1	766
5.11	Performing leak test on cooling system for hybrid battery unit AX1	766
5.12	Determining mean cell voltage	768
5.13	Charging and discharging battery modules	770



5.14	Removing and installing upper part of battery housing	771
5.15	Voltage and insulation measurement	774
5.16	Removing and installing switching unit for high-voltage battery SX6	776
5.17	Removing and installing wiring harness for hybrid battery unit AX1	779
5.18	Removing and installing coolant pipe	781
5.19	Removing and installing battery module assembly	784
5.20	Removing and installing wiring harness for battery module assembly	789
5.21	Removing and installing high-voltage system connection	790
5.22	Removing and installing battery module 1 J991/battery module 2 J992	793
5.23	Removing and installing battery module 3 J993/battery module 4 J994	798
5.24	Removing and installing battery module 5 J995/battery module 6 J996	803
5.25	Removing and installing battery module 7 J997/battery module 8 J998	809
<b>6</b>	<b>Power and control electronics for electric drive</b>	<b>815</b>
6.1	Assembly overview - power and control electronics for electric drive	815
6.2	Assembly overview - bracket for power and control electronics for electric drive	817
6.3	Removing and installing power and control electronics for electric drive	819
6.4	Removing and installing bracket for power and control electronics for electric drive JX1	826
6.5	Removing and installing high-voltage system fuse 3 S353	827
<b>7</b>	<b>Charging unit for high-voltage battery</b>	<b>831</b>
7.1	Assembly overview - charging unit for high-voltage battery	831
7.2	Removing and installing charging unit 1 for high-voltage battery AX4	835
7.3	Removing and installing bracket for charging unit 1 for high-voltage battery AX4	840
<b>8</b>	<b>Electric drive motor</b>	<b>842</b>
8.1	Removing and installing three-phase current drive VX54	842
8.2	Removing and installing drive motor temperature sender G712	842
8.3	Removing and installing drive motor rotor position sender 1 G713	842
<b>9</b>	<b>High-voltage wiring</b>	<b>843</b>
9.1	Overview of fitting locations - high-voltage wiring	843
9.2	Removing and installing high-voltage wiring harness for high-voltage battery	846
9.3	Removing and installing high-voltage wiring harness for drive motor	852
9.4	Removing and installing high-voltage wire for power and control electronics for electric drive	857
9.5	Removing and installing high-voltage wire for high-voltage heater (PTC)	858
9.6	Removing and installing high-voltage wiring for electrical air conditioner compressor	861
<b>10</b>	<b>Charging socket</b>	<b>864</b>
10.1	Assembly overview - charging socket	864
10.2	Charging system	865
10.3	Diagnosis of charging system	866
10.4	Removing and installing high-voltage battery charging socket 1 UX4	869
10.5	Removing and installing actuator for high-voltage charging socket lock 1 F498	876
<b>11</b>	<b>De-energising high-voltage system</b>	<b>878</b>
<b>12</b>	<b>Re-energising high-voltage system</b>	<b>880</b>
<b>13</b>	<b>Potential equalisation lines</b>	<b>882</b>
13.1	General notes - potential equalisation lines	882
13.2	Overview of fitting locations - potential equalisation lines	882
13.3	Potential equalisation measurement	884
13.4	Removing and installing potential equalisation line for hybrid battery unit AX1	885
<b>14</b>	<b>Vehicle noise/engine sound</b>	<b>887</b>
14.1	Overview of fitting locations - vehicle noise/engine sound	887
14.2	Removing and installing engine sound generator control unit J943	889
14.3	Removing and installing actuator 1 for engine sound generator R257	891