

Contents

| | |
|---|-----------|
| 00 - Technical data | 1 |
| 1 Identification | 1 |
| 2 Safety information | 2 |
| 3 Repair instructions | 3 |
| 10 - Removing and installing engine | 4 |
| 1 Removing and installing engine | 4 |
| 1.1 Removing engine | 4 |
| 1.2 Separating engine and gearbox | 20 |
| 1.3 Securing engine to engine and gearbox support | 27 |
| 1.4 Installing engine | 30 |
| 2 Assembly mountings | 34 |
| 2.1 Assembly overview - assembly mountings | 34 |
| 2.2 Supporting engine in installation position | 36 |
| 2.3 Removing and installing engine mountings | 39 |
| 2.4 Removing and installing gearbox mounting | 42 |
| 3 Engine cover panel | 43 |
| 13 - Crankshaft group | 44 |
| 1 Cylinder block (pulley end) | 44 |
| 1.1 Assembly overview - cylinder block (pulley end) | 44 |
| 1.2 Assembly overview - sealing flange (pulley end) | 44 |
| 1.3 Removing and installing poly V-belt | 44 |
| 1.4 Removing and installing poly V-belt tensioner | 45 |
| 1.5 Removing and installing vibration damper | 45 |
| 1.6 Removing and installing bracket for ancillaries | 49 |
| 1.7 Removing and installing engine support | 51 |
| 1.8 Renewing crankshaft oil seal (pulley end) | 52 |
| 1.9 Removing and installing sealing flange (pulley end) | 52 |
| 2 Cylinder block (gearbox end) | 54 |
| 3 Crankshaft | 55 |
| 4 Balance shaft | 56 |
| 5 Pistons and conrods | 57 |
| 15 - Cylinder head, valve gear | 58 |
| 1 Timing chain cover | 58 |
| 1.1 Assembly overview - timing chain cover | 58 |
| 1.2 Removing and installing timing chain cover | 58 |
| 2 Chain drive | 60 |
| 3 Cylinder head | 61 |
| 3.1 Assembly overview - cylinder head | 61 |
| 3.2 Assembly overview - cylinder head cover | 61 |
| 3.3 Removing and installing cylinder head | 61 |
| 3.4 Removing and installing cylinder head cover | 61 |
| 3.5 Removing and installing seals for injectors | 64 |
| 3.6 Checking compression | 64 |
| 4 Valve gear | 65 |
| 5 Inlet and exhaust valves | 66 |
| 17 - Lubrication | 67 |
| 1 Sump/oil pump | 67 |



| | | |
|-----------|---|------------|
| 1.1 | Assembly overview - sump/oil pump | 67 |
| 1.2 | Engine oil | 67 |
| 1.3 | Removing and installing lower part of sump | 67 |
| 1.4 | Removing and installing upper part of sump | 67 |
| 1.5 | Removing and installing oil pump | 68 |
| 1.6 | Removing and installing oil level and oil temperature sender G266 | 68 |
| 2 | Engine oil cooler | 69 |
| 3 | Crankcase breather | 70 |
| 4 | Oil filter/oil pressure switches | 71 |
| 4.1 | Assembly overview - oil filter | 71 |
| 4.2 | Removing and installing oil filter housing | 71 |
| 4.3 | Removing and installing oil pressure sender G10 | 72 |
| 4.4 | Checking oil pressure | 73 |
| 4.5 | Removing and installing valve for oil pressure control N428 | 73 |
| 4.6 | Removing and installing oil temperature sender 2 G664 | 73 |
| 19 | Cooling | 75 |
| 1 | Cooling system/coolant | 75 |
| 1.1 | Connection diagram - coolant hoses | 75 |
| 1.2 | Assembly overview - coolant expansion tank | 79 |
| 1.3 | Checking cooling system for leaks | 80 |
| 1.4 | Draining and filling cooling system | 80 |
| 2 | Coolant pump/thermostat assembly | 86 |
| 2.1 | Assembly overview - coolant pump | 86 |
| 2.2 | Assembly overview - electric coolant pump | 86 |
| 2.3 | Assembly overview - thermostat | 88 |
| 2.4 | Assembly overview - coolant temperature senders | 88 |
| 2.5 | Removing and installing electric coolant pump | 89 |
| 2.6 | Removing and installing coolant pump | 91 |
| 2.7 | Removing and installing thermostat | 92 |
| 2.8 | Removing and installing coolant temperature sender G62 | 92 |
| 2.9 | Removing and installing temperature sender for engine temperature regulation G694 | 92 |
| 2.10 | Removing and installing coolant valves | 93 |
| 3 | Coolant pipes | 94 |
| 3.1 | Assembly overview - coolant pipes | 94 |
| 3.2 | Removing and installing coolant pipes | 100 |
| 4 | Radiator/radiator fans | 117 |
| 4.1 | Assembly overview - radiator/radiator fans | 117 |
| 4.2 | Assembly overview - radiator cowl and radiator fans | 119 |
| 4.3 | Assembly overview - auxiliary radiator | 120 |
| 4.4 | Removing and installing radiator | 121 |
| 4.5 | Removing and installing radiator cowl | 125 |
| 4.6 | Removing and installing radiator fans V7 / V177 | 127 |
| 4.7 | Removing and installing auxiliary radiator | 127 |
| 21 | Turbocharging/supercharging | 130 |
| 1 | Turbocharger | 130 |
| 1.1 | Assembly overview - turbocharger | 130 |
| 1.2 | Assembly overview - electric compressor with control unit for electric compressor J1123 | 130 |
| 1.3 | Removing and installing turbocharger | 132 |
| 1.4 | Removing and installing electric compressor with control unit for electric compressor J1123 | 133 |
| 1.5 | Removing and installing sender 1 for turbocharger speed G688 | 135 |
| 2 | Charge air system | 138 |
| 2.1 | Assembly overview - charge air system | 138 |

| | | |
|-----------|---|------------|
| 2.2 | Assembly overview - hose connections for charge air system | 140 |
| 2.3 | Removing and installing charge air cooler | 140 |
| 2.4 | Removing and installing charge pressure sender G31 | 142 |
| 2.5 | Removing and installing charge air temperature sender before charge air cooler G810 | 142 |
| 2.6 | Removing and installing charge air temperature sender after charge air cooler G811 | 143 |
| 2.7 | Checking charge air system for leaks | 144 |
| 23 | Mixture preparation - injection | 145 |
| 1 | Injection system | 145 |
| 1.1 | Overview - fuel system | 145 |
| 1.2 | Overview of fitting locations - injection system | 146 |
| 1.3 | Filling and bleeding fuel system | 154 |
| 1.4 | Checking fuel system for leaks | 154 |
| 2 | Vacuum system | 155 |
| 3 | Air filter | 156 |
| 3.1 | Assembly overview - air filter housing | 156 |
| 3.2 | Removing and installing air filter housing | 158 |
| 4 | Intake manifold | 160 |
| 4.1 | Assembly overview - intake manifold | 160 |
| 4.2 | Removing and installing upper part of intake manifold | 160 |
| 4.3 | Removing and installing lower part of intake manifold | 164 |
| 4.4 | Removing and installing intake manifold flap control unit GX14 | 164 |
| 4.5 | Removing and installing throttle valve module GX3 | 167 |
| 5 | Injectors/high-pressure reservoir (rail) | 169 |
| 5.1 | Assembly overview - injectors | 169 |
| 5.2 | Checking injectors | 169 |
| 5.3 | Performing adaptation of correction values for injectors | 169 |
| 5.4 | Checking for injectors sticking open | 169 |
| 5.5 | Checking return flow rate of injectors with engine running | 170 |
| 5.6 | Checking return flow rate of injectors at starter cranking speed | 170 |
| 5.7 | Checking pressure retention valve in fuel return line | 171 |
| 5.8 | Removing and installing injectors | 171 |
| 5.9 | Removing and installing high-pressure pipes | 173 |
| 5.10 | Removing and installing high-pressure reservoir (rail) | 173 |
| 6 | Senders and sensors | 175 |
| 6.1 | Assembly overview - actuator for structure-borne sound and control unit for structure-borne sound | 175 |
| 6.2 | Removing and installing actuator for structure-borne sound R214 | 176 |
| 6.3 | Removing and installing control unit for structure-borne sound J869 | 177 |
| 6.4 | Removing and installing air mass meter G70 | 177 |
| 6.5 | Removing and installing fuel temperature sender G81 | 178 |
| 6.6 | Removing and installing fuel pressure sender G247 | 178 |
| 6.7 | Removing and installing fuel pressure sender for low pressure G410 | 178 |
| 6.8 | Checking fuel pressure regulating valve N276 | 179 |
| 6.9 | Removing and installing fuel pressure regulating valve N276 | 181 |
| 6.10 | Removing and installing pressure differential sender G505 / pressure differential sender 2 G524 | 181 |
| 7 | High-pressure pump | 184 |
| 8 | Lambda probe | 185 |
| 8.1 | Assembly overview - Lambda probe | 185 |
| 8.2 | Removing and installing Lambda probe | 185 |
| 8.3 | Removing and installing NOx senders | 185 |
| 8.4 | Removing and installing particulate sensor G784 | 188 |
| 9 | Engine control unit | 190 |
| 9.1 | Assembly overview - engine control unit | 190 |



| | | |
|-----------|---|------------|
| 9.2 | Removing and installing engine control unit J623 | 190 |
| 26 | - Exhaust system | 192 |
| 1 | Exhaust pipes/silencers | 192 |
| 1.1 | Assembly overview - silencer | 192 |
| 1.2 | Removing and installing front exhaust pipe | 194 |
| 1.3 | Removing and installing silencer | 196 |
| 1.4 | Stress-free alignment of exhaust system | 197 |
| 1.5 | Checking exhaust system for leaks | 198 |
| 2 | Emission control system | 199 |
| 2.1 | Assembly overview - emission control system | 199 |
| 2.2 | Removing and installing emission control module | 199 |
| 2.3 | Removing and installing ammonia trap | 201 |
| 2.4 | Removing and installing exhaust flap control unit J883 | 201 |
| 2.5 | Removing and installing exhaust flap control unit 2 J945 | 201 |
| 3 | SCR (selective catalytic reduction) system | 203 |
| 3.1 | Assembly overview - reducing agent tank | 203 |
| 3.2 | Assembly overview - control unit for SCR system | 204 |
| 3.3 | Assembly overview - delivery unit | 205 |
| 3.4 | Assembly overview - reducing agent supply line | 207 |
| 3.5 | Releasing pressure in SCR system | 207 |
| 3.6 | Draining reducing agent tank | 207 |
| 3.7 | Removing and installing reducing agent tank | 209 |
| 3.8 | Removing and installing injector for reducing agent N474 | 212 |
| 3.9 | Removing and installing control unit for reducing agent metering system J880 | 212 |
| 3.10 | Removing and installing pump for reducing agent V437 | 213 |
| 3.11 | Removing and installing pressure sender for reducing agent metering system G686 | 216 |
| 3.12 | Removing and installing connection for SCR supply line | 218 |
| 4 | Exhaust gas temperature regulation | 221 |
| 5 | Exhaust gas recirculation | 222 |
| 5.1 | Assembly overview - exhaust gas recirculation system | 222 |
| 5.2 | Removing and installing exhaust gas recirculation cooler | 224 |
| 5.3 | Removing and installing exhaust gas recirculation valve 2 GX6 | 226 |
| 5.4 | Removing and installing exhaust gas recirculation temperature sensor G98 | 227 |
| 6 | Exhaust manifold | 228 |
| 6.1 | Assembly overview - exhaust manifold | 228 |
| 6.2 | Removing and installing exhaust manifold | 228 |
| 28 | - Glow plug system | 232 |
| 1 | Glow plug system | 232 |