



Contents

00 - Technical data	1
1 Technical data	1
1.1 Engine number	1
1.2 Engine data	1
10 - Removing and installing engine	2
1 Removing and installing engine	2
1.1 Removing engine	2
1.2 Notes on installing	14
1.3 Specified torques	14
13 - Crankshaft group	15
1 Dismantling and assembling engine	15
1.1 Assembly overview - components in the V space	15
1.2 Assembly overview - gear train assembly	17
1.3 Removing and installing gear train assembly	18
1.4 Removing and installing drive plate	21
2 Balancer shaft	22
2.1 Assembly overview - balancer shaft	22
3 Crankshaft	23
3.1 Assembly overview - crankshaft	23
3.2 Removing and installing bearing saddle for crankshaft	24
3.3 Crankshaft dimensions	26
4 Sealing flanges, seals and vibration dampers	27
4.1 Assembly overview - front sealing flange and vibration damper	27
4.2 Renewing crankshaft oil seal, vibration damper end	28
4.3 Crankshaft oil seal - engine timing end	29
4.4 Alternator shaft oil seal	31
5 Valve timing housing	34
5.1 Assembly overview - valve timing housing	34
6 Pistons and conrods	36
6.1 Assembly overview - pistons and conrods	36
6.2 Checking piston projection at TDC	37
6.3 Piston and cylinder dimensions	37
6.4 Piston rings, cylinder bore and piston installation position	38
15 - Cylinder head, valve gear	40
1 Cylinder head	40
1.1 Assembly overview - cylinder head	40
1.2 Removing and installing camshaft compensating gear and drive gear wheel	42
1.3 Checking valve timing	47
1.4 Adjusting valve timing	47
1.5 Removing and installing cylinder heads	50
1.6 Checking compression	52
2 Valve gear	55
2.1 Assembly overview - valve gear	55
2.2 Reworking valve seats	58
2.3 Checking valve guides	59
2.4 Renewing valve stem seals	59
2.5 Removing and installing camshaft	61
17 - Lubrication	63



1	Engine oil	63
1.1	Oil capacities	63
1.2	Checking engine oil level	63
2	Oil sump	64
2.1	Assembly overview - lower part of sump	64
2.2	Assembly overview - upper part of sump	65
2.3	Applying sealant	66
3	Assembly overview - oil filter housing	67
4	Assembly overview - oil pump	68
5	Checking oil pressure	69
5.1	Assembly overview - oil pressure switch	69
5.2	Check oil pressure in V space and oil pressure switch	70
5.3	Checking oil pressure at front of engine	71
6	Assembly overview - oil supply lines	72
6.1	Oil supply line for turbocharger of cylinder bank 1	72
6.2	Oil supply line for turbocharger of cylinder bank 2	73
19 - Cooling		75
1	Parts of cooling system	75
1.1	Assembly overview - radiator	75
1.2	Removing and installing fan support	76
1.3	Assembly overview - fans	77
1.4	Parts of cooling system, body side	78
1.5	Checking cooling system for leaks	79
1.6	Removing and installing coolant connection	80
1.7	Assembly overview - thermostat housing	80
1.8	Parts of cooling system - engine side and at top	82
1.9	Coolant hose schematic diagram	83
1.10	Draining and filling coolant	84
1.11	Removing and installing radiator	86
1.12	Assembly overview - coolant pump	87
21 - Turbocharging/supercharging		91
1	Charge air system with turbocharger	91
1.1	Removing and installing turbocharger with attachments	91
1.2	Removing and installing parts of charge air cooling	93
1.3	Rules for cleanliness	93
23 - Mixture preparation - injection		95
1	Repairing diesel direct injection system	95
1.1	Safety precautions	95
1.2	Rules for cleanliness	96
1.3	Removing and installing intake manifold	96
1.4	Assembly overview - intake connecting pipe	97
1.5	Assembly overview - unit injector	98
1.6	Removing and installing unit injector	99
1.7	Checking and adjusting position of pump plungers in unit injectors	101
1.8	Removing and installing O-rings for unit injector	103
1.9	Assembly overview - air filter	104
2	Engine control units	106
2.1	Reading and deleting engine control unit fault memory	106
2.2	Adapting functions and components	107
2.3	Removing and installing engine control units	107
26 - Exhaust system		109



1	Removing and installing parts of exhaust system	109
1.1	Removing and installing exhaust manifold	109
1.2	Front exhaust pipe and catalytic converter with attachments	111
1.3	Silencer with mountings	112
2	Exhaust gas recirculation system	114
2.1	Assembly overview - parts of exhaust gas recirculation	114
2.2	Checking exhaust gas recirculation valve (mechanical)	115
2.3	Vacuum hose schematic diagram	116
28	Glow plug system	118
1	Removing, installing and checking glow plugs	118

