

11 00 Standard screw connection

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Screws and nuts	B48	M5		5 Nm $\pm 0,5$
2AZ Screws and nuts	B48	M6		8 Nm ± 1
3AZ Screws and nuts	B48	M7		13 Nm ± 2
4AZ Screws and nuts	B48	M8		19 Nm ± 3
5AZ Screws and nuts	B48	M10		38 Nm ± 5
6AZ Hose clamp, WAF 5	B48			1.0 to 1.5 Nm
7AZ Hose clamp, WAF 6	B48			2,5 up to 3,5 Nm

1100 Overview of Technical Data

Engine oil	
	Filling capacity, engine oil change with oil filter element
	5,25 l

Engine oil	
	Oil capacity in the oil sump (without oil filter exchange)
	4,95 l

Engine oil	
	Filling capacity, engine oil change with oil filter element
	5,25 l

Engine oil B48B20O1/B46B20O1	
	Filling capacity, engine oil change with oil filter element
	5,25 l

1100 Overview of tightening torques

Engine fixture to engine support arm		
Hexagon screws from special tool set	Tightening torque	105Nm
Engine support arm on the assembly stand		
M14 x 95	Tightening torque	130Nm
Special tool 2 455 010 to crankcase		
M10x30	Tightening torque	38Nm
Special tool to cylinder head		
M8	Tightening torque	21,5Nm
Special tool to cylinder head		
M8	Tightening torque	21,5Nm
Special tool to cylinder head		
M8	Tightening torque	21,5Nm
Standard screw connection		
M6		8Nm
Standard screw connection 4 Nm		
Oval-head screw	Tightening torque	4Nm
Standard screw connection M10		
M10		38Nm
Standard screw connection M5		
M5		5Nm
Standard screw connection M6		
M6		8Nm
Standard screw connection M7		
M7		13Nm
Standard screw connection M8		
M8	Tightening torque	19Nm

Standard screw connection hose clamp 5

Hose clamp L12 - L15

Tightening torque

1,25Nm

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11 27 Dual-mass balance
Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Gear to counterbalance shaft	B46M0/O0 / B48M0/O0	M10	1. Jointing torque	20 Nm
			2. Angle of rotation	180 °
2AZ Idler gear to crankcase	B46M0/O0 / B48M0/O0	M12	1. Jointing torque	10 Nm
			2. Angle of rotation	45 °

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11 11 Engine block

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Bearing cap to crankcase (collar bolt 11.9)	B46M0/O0 / B48M0/O0	M10x1.5	Renew screws and screw in hand-tight.	
			1. Jointing torque	25 Nm
			2. Angle of rotation	60 °
			3. Angle of rotation	60 °
2AZ Oil spray nozzle in crankcase	B46M0/O0 / B48M0/O0	M6		8 Nm
3AZ Bearing journal of tensioning and guide rail	B46M0/O0 / B48M0/O0	M8	Replace bolt.	20 Nm
4AZ Camshaft sprocket with ball bearing to crankcase	B46M0/O0 / B48M0/O0	M12x1.5		108 Nm
5AZ Special tool/holder to crankcase	B46M0/O0 / B48M0/O0	M10x35		40 Nm
6AZ Special tool 11 8 930 to special tool 00 2 300	B46M0/O0 / B48M0/O0	M14x35		160 Nm
7AZ Chain tensioner to crankcase	B46M0/O0 / B48M0/O0	M6x22		10 Nm
8AZ Spacing screw for acoustic cover on engine block (AF 17)	B46M0/O0 / B48M0/O0	M8x12		12 Nm

11 00 Standard screw connection

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Screws and nuts	B48	M5		5 Nm $\pm 0,5$
2AZ Screws and nuts	B48	M6		8 Nm ± 1
3AZ Screws and nuts	B48	M7		13 Nm ± 2
4AZ Screws and nuts	B48	M8		19 Nm ± 3
5AZ Screws and nuts	B48	M10		38 Nm ± 5
6AZ Hose clamp, WAF 5	B48			1.0 to 1.5 Nm
7AZ Hose clamp, WAF 6	B48			2,5 up to 3,5 Nm

1111 Overview of Technical Data

Cylinder bore	
	Diameter of cylinder bore
	82,007 mm ... 82,014 mm
	Permitted irregularity of the cylinder bore
	0,01 mm
	Permitted conicity of the cylinder bore
	0,01 mm
	Permissible total wear tolerance between piston and cylinder bore (engine operated)
	0,15 mm

Cylinder bore B38/B46/B48/B58	
	Diameter of cylinder bore
	82,000 mm ... 82,014 mm
	Permitted irregularity of the cylinder bore
	0,01 mm
	Permitted conicity of the cylinder bore
	0,01 mm
	Permissible total wear tolerance between piston and cylinder bore (engine operated)
	0,15 mm

1111 Overview of tightening torques

Bearing journal of tensioning and guide rail		
M8		20Nm
Camshaft sprocket with bearing to crankcase		
M12x1.5		108Nm
Chain tensioner to crankcase		
M6x22		10Nm
Main bearing cap to crankcase		
M10x1.5 Renew screws.	1. Jointing torque	25Nm
	2. Angle of rotation	60°
	3. Angle of rotation	60°
Special tool 11 8 930 to special tool 00 2 320		
M14x35	Tightening torque	160Nm
Special tool/holder to crankcase		
M10x35		40Nm

11 12 Cylinder head with cylinder head cover

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Cylinder head bolt Observe strength class!	B46M0/ B48M0	M11x1.5x188 11.9	Renew screws.	
			1. Jointing torque	30 Nm
			2. Angle of rotation	90 °
			3. Angle of rotation	180 °
	B46O0 / B48O0	M11x1.5x188 13.9	Renew screws.	
			1. Jointing torque	50 Nm
			2. Angle of rotation	180 °
3. Angle of rotation			180 °	
2AZ Cylinder head bolt to timing case cover	B46M0/O0 / B48M0/O0	M8x40		20 Nm
3AZ Cylinder head cover to cylinder head.	B46M0/O0 / B48M0/O0	M6		10 Nm
4AZ Securing eye to cylinder head.	B46M0/O0 / B48M0/O0	M8		22 Nm
5AZ Chain tensioner to cylinder head.	B46M0/O0 / B48M0/O0		1. Jointing torque	20 Nm
			2. Angle of rotation	30°

1112 Overview of Technical Data

Check for cylinder head watertightness	
	Temperature of the cylinder head
	60 °C

Check for cylinder head watertightness	
	Testing pressure
	max. 3,0 bar

Cross deviation from flatness	
	max. 0,05 mm

Longitudinal deviation from flatness	
	max. 0,10 mm

1112 Overview of tightening torques

Bearing journal to cylinder head		
Renew the bearing journal!		20Nm
Bearing journal to cylinder head		
Bearing journal Renew the bearing journal!	Tightening torque	20Nm
Chain tensioner to cylinder head		
	1. Jointing torque	20Nm
	2. Angle of rotation	30°
Clamping strip to cylinder head		
M7	1. Jointing torque	10Nm
	2. Jointing torque	16Nm
	3. tightening torque	18Nm
Cover on rear cylinder head		
M6	Tightening torque	8Nm
Cylinder head bolt to timing case cover		
M8x40		20Nm
Cylinder head bolt to timing case cover		
M8x40 Renew screws.	Tightening torque	19Nm
Cylinder head cover to cylinder head		
M6		10Nm
Cylinder head cover to cylinder head		
M6x30	Jointing torque	6Nm
	Tightening torque	11Nm

Cylinder head to crankcase

M11 Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque	30Nm
	2. Angle of rotation	90°
	3. Angle of rotation	180°

Cylinder head to crankcase

M11x1.5x188 11.9 Fit new cylinder head bolts.	1. Jointing torque	30Nm
	2. Angle of rotation	90°
	3. Angle of rotation	180°

M11x1.5x188 13.9 Fit new cylinder head bolts.	1. Jointing torque	30Nm
	2. Jointing torque	50Nm
	3. Angle of rotation	180°
	4. Angle of rotation	180°

Cylinder head to special tool 2 361 215

	35Nm
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Flange to assembly stand

M14X30	Tightening torque	135Nm
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Front lifting eye on the cylinder head

M8 x 22	19Nm
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Holder for electrical auxiliary coolant pump on cylinder head

M6	Tightening torque	7Nm
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Sliding rail to cylinder head

M6x16	8Nm
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Special tool 2 456 190 to cylinder head

M6X20	Tightening torque	8Nm
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Ventilation connection/special tool to cylinder head

M10	18Nm
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11 13 Oil sump

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Oil drain plug	B46M0/O0 / B48M0/O0	M12 x 1.5	Renew the sealing ring.	25 Nm
2AZ Oil sump to crankcase	B46M0/O0 / B48M0/O0	M8x30 M8x110		24 Nm
3AZ Oil level sensor to oil sump	B46M0/O0 / B48M0/O0	M6		8,5 Nm

1113 Overview of Technical Data

Height of the sealing bead	
	2,0 mm ... 2,5 mm

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1113 Overview of tightening torques

Oil deflector to crankcase			
M8 x 35		Renew screws.	15Nm
			45°
Oil drain plug			
M12x16 Renew the sealing ring.			25Nm
Oil drain plug			
M12x16 Replace sealing ring.		Tightening torque	25Nm
Oil drain plug			
M12x16 Renew the sealing ring.		Tightening torque	25Nm
Oil drain plug on oil sump			
M12 x 1.5 Replace sealing ring.			20Nm
Oil sump to crankcase			
M8x30		Tightening torque	24Nm
M8x110		Tightening torque	24Nm
Oil sump to crankcase			
M8 x 110		Tightening torque	24Nm
Oil sump to crankcase			
M8 x 30		Tightening torque	24Nm
Oil sump to crankcase			
M8x30		Tightening torque	24Nm
M8x110		Tightening torque	24Nm
Transmission to oil sump (manual gearbox and automatic transmission)			
M8 x 50		Tightening torque	19Nm

11 14 Case Covers
Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Timing case cover to crankcase	B46M0/O0 / B48M0/O0	M6	Replace screws	8 Nm 90 °
			Jointing torque Angle of rotation	

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1114 Overview of tightening torques

Acoustic cover (side) to cylinder head cover		
TS6 x 20		8Nm
Acoustic cover, rear bottom on cylinder head		
M6 x 16		8Nm
Rear timing case cover to crankcase		
M6 x 31 Renew screws.	Jointing torque	8Nm
	Angle of rotation	90°
Timing case cover to crankcase		
M6 Renew screws.	1. Join	8Nm
	2. Angle of rotation	90°

1115 Overview of Technical Data

Differential pressure between ambient pressure and engine internal pressure	
	Nominal value
	0 (-15 - +30) mbar

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11 24 Connecting rod with connecting rod bearing
Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Connecting rod bolts	B46M0/O0 / B48M0/O0	M9x1.25	Loosen screws. Clean crack surfaces.	
			1. Jointing torque	5 Nm
			2. Jointing torque	20 Nm
			3. Angle of rotation	70 °
			4. Angle of rotation	70 °

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11 21 Crankshaft and Bearings
Tightening Torques

	Type	Thread	Tightening specification	Torque
1AZ Increment wheel on crankshaft	S54	M5 10.9	Replace screws	
			Jointing torque Torque angle	5.0 Nm 45 °
Increment wheel on crankshaft		M5 10.9	Replace screws	13 Nm
Increment wheel on crankshaft		M5 8.8	Replace screws	5.5 Nm

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11 27 Dual-mass balance
Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Gear to counterbalance shaft	B46M0/O0 / B48M0/O0	M10	1. Jointing torque	20 Nm
			2. Angle of rotation	180 °
2AZ Idler gear to crankcase	B46M0/O0 / B48M0/O0	M12	1. Jointing torque	10 Nm
			2. Angle of rotation	45 °

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11 11 Engine block

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Bearing cap to crankcase (collar bolt 11.9)	B46M0/O0 / B48M0/O0	M10x1.5	Renew screws and screw in hand-tight.	
			1. Jointing torque	25 Nm
			2. Angle of rotation	60 °
			3. Angle of rotation	60 °
2AZ Oil spray nozzle in crankcase	B46M0/O0 / B48M0/O0	M6		8 Nm
3AZ Bearing journal of tensioning and guide rail	B46M0/O0 / B48M0/O0	M8	Replace bolt.	20 Nm
4AZ Camshaft sprocket with ball bearing to crankcase	B46M0/O0 / B48M0/O0	M12x1.5		108 Nm
5AZ Special tool/holder to crankcase	B46M0/O0 / B48M0/O0	M10x35		40 Nm
6AZ Special tool 11 8 930 to special tool 00 2 300	B46M0/O0 / B48M0/O0	M14x35		160 Nm
7AZ Chain tensioner to crankcase	B46M0/O0 / B48M0/O0	M6x22		10 Nm
8AZ Spacing screw for acoustic cover on engine block (AF 17)	B46M0/O0 / B48M0/O0	M8x12		12 Nm

11 00 Standard screw connection

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Screws and nuts	B48	M5		5 Nm $\pm 0,5$
2AZ Screws and nuts	B48	M6		8 Nm ± 1
3AZ Screws and nuts	B48	M7		13 Nm ± 2
4AZ Screws and nuts	B48	M8		19 Nm ± 3
5AZ Screws and nuts	B48	M10		38 Nm ± 5
6AZ Hose clamp, WAF 5	B48			1.0 to 1.5 Nm
7AZ Hose clamp, WAF 6	B48			2,5 up to 3,5 Nm

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1121 Overview of Technical Data

Axial play of crankshaft	
	min. 0,060 mm
	max. 0,250 mm

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Maximum permitted torque of the crankshaft	
	max. 2 Nm

11 22 Flywheel
Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Flywheel to crankshaft	B46M0/O0 / B48M0/O0	M12x1.5	Renew screws.	120 Nm

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1122 Overview of tightening torques

Flywheel to crankshaft		
M12x1.5 Renew screws.	Jointing torque	45Nm
	Angle of rotation	40°
Flywheel to crankshaft (automatic)		
M12x1.5x25.5 Renew screws.	Tightening torque	120Nm

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11 23 Vibration damper
Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Vibration damper with belt pulley to crankshaft	B46M0/O0 / B48M0/O0	M10	Renew screw.	
			1. Jointing torque	28 Nm
			2. Angle of rotation	180 °

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1123 Overview of tightening torques

Vibration damper with belt pulley to crankshaft		
M10 Renew screws.	1. Jointing torque	40Nm
	2. Angle of rotation	120°
Vibration damper with belt pulley to crankshaft		
M10x65 Renew screws. Tighten screws crosswise.	1. Jointing torque	40Nm
	2. Angle of rotation	60°
	3. Angle of rotation	60°

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11 24 Connecting rod with connecting rod bearing
Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Connecting rod bolts	B46M0/O0 / B48M0/O0	M9x1.25	Loosen screws. Clean crack surfaces.	
			1. Jointing torque	5 Nm
			2. Jointing torque	20 Nm
			3. Angle of rotation	70 °
			4. Angle of rotation	70 °

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11 27 Dual-mass balance
Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Gear to counterbalance shaft	B46M0/O0 / B48M0/O0	M10	1. Jointing torque	20 Nm
			2. Angle of rotation	180 °
2AZ Idler gear to crankcase	B46M0/O0 / B48M0/O0	M12	1. Jointing torque	10 Nm
			2. Angle of rotation	45 °

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11 11 Engine block

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Bearing cap to crankcase (collar bolt 11.9)	B46M0/O0 / B48M0/O0	M10x1.5	Renew screws and screw in hand-tight.	
			1. Jointing torque	25 Nm
			2. Angle of rotation	60 °
			3. Angle of rotation	60 °
2AZ Oil spray nozzle in crankcase	B46M0/O0 / B48M0/O0	M6		8 Nm
3AZ Bearing journal of tensioning and guide rail	B46M0/O0 / B48M0/O0	M8	Replace bolt.	20 Nm
4AZ Camshaft sprocket with ball bearing to crankcase	B46M0/O0 / B48M0/O0	M12x1.5		108 Nm
5AZ Special tool/holder to crankcase	B46M0/O0 / B48M0/O0	M10x35		40 Nm
6AZ Special tool 11 8 930 to special tool 00 2 300	B46M0/O0 / B48M0/O0	M14x35		160 Nm
7AZ Chain tensioner to crankcase	B46M0/O0 / B48M0/O0	M6x22		10 Nm
8AZ Spacing screw for acoustic cover on engine block (AF 17)	B46M0/O0 / B48M0/O0	M8x12		12 Nm

11 00 Standard screw connection

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Screws and nuts	B48	M5		5 Nm $\pm 0,5$
2AZ Screws and nuts	B48	M6		8 Nm ± 1
3AZ Screws and nuts	B48	M7		13 Nm ± 2
4AZ Screws and nuts	B48	M8		19 Nm ± 3
5AZ Screws and nuts	B48	M10		38 Nm ± 5
6AZ Hose clamp, WAF 5	B48			1.0 to 1.5 Nm
7AZ Hose clamp, WAF 6	B48			2,5 up to 3,5 Nm

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1124 Overview of tightening torques

Connecting rod bearing cap to connecting rod	
Renew screws.	
	Tighten screws crosswise.
	Jointing torque 20Nm
	1. Angle of rotation 70°
	2. Angle of rotation 70°

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1125 Overview of Technical Data

End clearance of centre piston ring	
Before measuring the end clearance, make sure the cylinder is within the permissible tolerance.	0,30 mm ... 0,45 mm

End clearance of upper piston ring	
Before measuring the end clearance, make sure the cylinder is within the permissible tolerance.	0,15 mm ... 0,25 mm

Piston diameter	
Measure the piston diameter at distance (A) from the lower end of the piston skirt.	Distance (A) to the lower end of the piston skirt
	10 mm
	Nominal dimension of piston diameter
	81,978 mm ... 82,016 mm

Piston diameter	
Measure the piston diameter at distance (A) from the lower end of the piston skirt.	Distance (A) to the lower end of the piston skirt
	10 mm
	Nominal dimension of piston diameter
	81,958 mm ... 81,996 mm

Side clearance of centre piston ring

Clean all components before measuring the side clearance.

0,07 mm ... 0,11 mm

Side clearance of upper piston ring

Clean all components before measuring the side clearance.

0,07 mm ... 0,11 mm

11 27 Dual-mass balance
Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Gear to counterbalance shaft	B46M0/O0 / B48M0/O0	M10	1. Jointing torque	20 Nm
			2. Angle of rotation	180 °
2AZ Idler gear to crankcase	B46M0/O0 / B48M0/O0	M12	1. Jointing torque	10 Nm
			2. Angle of rotation	45 °

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1127 Overview of tightening torques

Gear to counterbalance shaft		
	1. Jointing torque	40Nm
	2. Angle of rotation	70°
Gear to crankcase		
		70Nm
Special tool 2 288 054 to crankshaft		
	Tightening torque	20Nm

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11 28 Drive belt with belt tensioner and deflecting element

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Belt tensioner with deflection pulley to crankcase	B46M0/O0 / B48M0/O0	M10		30 Nm
2AZ Belt tensioner to alternator	B46M0/O0 / B48M0/O0	M8		22 Nm
3AZ Deflecting element to belt tensioner	B46M0/O0 / B48M0/O0	M8		20 Nm

1128 Overview of tightening torques

Belt tensioner to alternator		
M8 x 30	Tightening torque	28Nm

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1130 Overview of tightening torques

SWZ2249117		
Screw M6	Tightening torque	10Nm

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11 31 Camshaft

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Intake camshaft and exhaust camshaft to cylinder head	B46M0/O0 / B48M0/O0	M6	Tightening torque Mount bearing cap flush Tightening torque	10 Nm 10 Nm
2AZ Top tensioning rail	B46M0/O0 / B48M0/O0	M6		10 Nm
3AZ Guide rail/slide rail to cylinder head	B46M0/O0 / B48M0/O0	M16	Replace bearing journal.	20 Nm
4AZ Guide rail/slide rail to crankcase	B46M0/O0 / B48M0/O0	M8	Replace bearing journal.	20 Nm
5AZ Chain tensioner to cylinder head	B46M0/O0 / B48M0/O0		Renew the sealing ring.	70 Nm
6AZ Chain tensioner to crankcase	B46M0/O0 / B48M0/O0	M6		10 Nm
7AZ Camshaft sensor wheel to intake camshaft	B46M0/O0 / B48M0/O0	M6		10 Nm

11 31 Chain tensioner
Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Chain tensioner to cylinder head			Replace sealing ring	70 Nm

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11 36 VANOS

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Intake and exhaust VANOS central bolt to camshaft	B48 A (till 10/2015) / B46 A (till 10/2015)	M12x1		
			1. Join	30 Nm
			2. Join	50 Nm
			3. Angle of rotation	65 °
1AZ Intake and exhaust VANOS central bolt to camshaft	B48 B / B46 B / B46A/ B48 A (as from 11/2015- 01/2017)	M22x1		
			1. Join	30 Nm
			2. Join	50 Nm
			3. Angle of rotation	28 °
1AZ Intake and exhaust VANOS central bolt to camshaft (SWZ 2 450 487)	B48 B / B46 B / B48 A B46 A (as from 01/2017)	M21x1		
			1. Join	10 Nm
			2. Join	30 Nm
			3. Join	50 Nm
			4. Angle of rotation	28 °

1131 Overview of tightening torques

Basic carrier to cylinder head		
M6	Tightening torque	8Nm
Bearing journal to crankcase		
Bearing journal Replace bearing journal.	Tightening torque	20Nm
Camshaft sensor wheel to intake camshaft		
M6		10Nm
Camshaft sensor wheel to intake camshaft		
M6x16	Tightening torque	8Nm
Chain tensioner to cylinder head		
Chain tensioner piston M22x1.5	Jointing torque	20Nm
	Angle of rotation	30°
Chain tensioner to cylinder head		
Chain tensioner	Tightening torque	20Nm
	Angle of rotation	40°
Exhaust camshaft to cylinder head		
M6	Observe tightening sequence. Mount bearing cap flush.	
	Jointing torque	10Nm
	Tighten the screws.	
	Tightening torque	10Nm
Intake camshaft to cylinder head		
M6	Observe tightening sequence, mount bearing cap flush.	
	Jointing torque	10Nm
Tighten the screws.		Tightening torque 10Nm
Preload timing chain		
	Tightening torque	0,6Nm

Setting gauge to basic carrier

M6	Tightening torque	8Nm
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Test gauge to basic carrier

M6	Tightening torque	8Nm
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1136 Overview of tightening torques

VANOS central valve to camshaft

M20 x 1.5	1. Jointing torque	10Nm
	2. Jointing torque	30Nm
	3. Jointing torque	50Nm
	4. Angle of rotation	35°

VANOS central valve to camshaft

M12 x 1	1. Jointing torque	30Nm
	2. Jointing torque	50Nm
	3. Angle of rotation	65°

M21 x 1	1. Jointing torque	10Nm
	2. Jointing torque	30Nm
	3. Jointing torque	50Nm
	4. Angle of rotation	28°

M22 x 1	1. Jointing torque	30Nm
	2. Jointing torque	50Nm
	3. Angle of rotation	28°

VANOS central valve to camshaft

M20 x 1.5	1. Jointing torque	10Nm
	2. Jointing torque	30Nm
	3. Jointing torque	50Nm
	4. Angle of rotation	35°

Variable camshaft timing control central bolt to camshaft

M22x1	1. Join	30Nm
	2. Join	50Nm
	3. Angle of rotation	28°

11 27 Dual-mass balance
Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Gear to counterbalance shaft	B46M0/O0 / B48M0/O0	M10	1. Jointing torque	20 Nm
			2. Angle of rotation	180 °
2AZ Idler gear to crankcase	B46M0/O0 / B48M0/O0	M12	1. Jointing torque	10 Nm
			2. Angle of rotation	45 °

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11 37 Variable valve gear

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Crank on the camshaft bearing cap.	B46M0/O0 / B48M0/O0	M8		20 Nm
2AZ Electrical servomotor to cylinder head	B46M0/O0 / B48M0/O0	M6		10 Nm
3AZ Eccentric shaft to cylinder head (bearing bracket).	B46M0/O0 / B48M0/O0	M6		10 Nm

1137 Overview of tightening torques

Eccentric shaft to bearing support/cylinder head		
M6		10Nm
Electrical servomotor to cylinder head		
M6		10Nm
Electrical servomotor to cylinder head		
M6	Tightening torque	8Nm
Gate to bearing bracket		
M8		20Nm

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11 41 Oil pump with strainer and motor

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Intake pipe to oil pump	B46M0/O0 / B48M0/O0	M6 x25		8 Nm
2AZ Oil/vacuum tandem pump to crankcase	B46M0/O0 / B48M0/O0	M8		19 Nm
3AZ Centre oil deflector screw connection	B46M0/O0 / B48M0/O0	M8x35	Renew screws.	
			1. Jointing torque	15 Nm
			2. Angle of rotation	45 °
4AZ Oil deflector screw connection, outer	B46M0/O0 / B48M0/O0	M8x35	Renew screws.	
			1. Jointing torque	15 Nm
			2. Angle of rotation	45 °
5AZ Sprocket to oil pump	B46M0/O0 / B48M0/O0	M10	Important - left-hand thread Renew screw.	
			1. Jointing torque	5 Nm
			2. Angle of rotation	90 °
6AZ Hydraulic valve to engine block	B46M0/O0 / B48M0/O0	M6x18		8 Nm

1141 Overview of tightening torques

Camshaft sprocket to oil vacuum pump

M8
Important - left-hand thread
Renew screw.

1. Jointing torque	5Nm
2. Angle of rotation	90°

Hydraulic valve to crankcase

M6 x 18

Tightening torque	8Nm
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Intake pipe to oil pump

M6x25

10Nm

Oil vacuum pump to crankcase

M8
Renew screw.

1. Tightening torque	15Nm
2. Angle of rotation	45°

11- 42 Oil filter with line

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Oil filter cover to oil filter housing	B46M0/O0 / B48M0/O0	S88.5x3	O-ring lightly oiled	
			1. Initial tightening	25 Nm
			2. Undo oil filter cover by 180°.	
			3. Final torque	25 Nm
2AZ Oil drain plug to oil filter cover	B46M0/O0 / B48M0/O0		Renew screw.	5 Nm
3AZ Oil filter module to crankcase	B46M0/O0 / B48M0/O0	M6	Observe tightening sequence.	
			1. Jointing torque	8 Nm
			2. Tighten to	8 Nm.
4AZ Oil feed line to crankcase	B46M0/O0 / B48M0/O0	M6x12	Replace O-ring.	10 Nm
5AZ Oil return line to crankcase	B46M0/O0 / B48M0/O0	M6x16	Replace O-ring.	10 Nm
6AZ Oil return line to turbocharger	B46M0/O0 / B48M0/O0	M6x16	Replace beaded metal gasket.	10 Nm
7AZ Oil feed line to exhaust manifold (with heat protection)	B46M0/O0 / B48M0/O0	M6x12		10 Nm
8AZ Oil drain plug in oil filter housing	B46M0/O0 / B48M0/O0		Renew screw.	5 Nm
9AZ Oil-to-water heat exchanger to full-flow oil filter	B46M0/O0 / B48M0/O0			10 Nm
10AZ Oil spray nozzle	B46M0/O0 / B48M0/O0			8 Nm

1142 Overview of tightening torques

Full-flow oil filter to crankcase		
M6 Observe tightening sequence.	Jointing torque	4Nm
	Tightening torque	10Nm
Oil drain plug to oil filter cover		
		5Nm
Oil feed line on cylinder head		
M6 x 12 Replace O-ring.		8Nm
Oil feed line to exhaust turbocharger		
M6 x 12	Replace O-ring.	8Nm
Oil feed line to exhaust turbocharger/crankcase		
M6x12	Tightening torque	8Nm
Oil filter cover to oil filter module		
Apply light coating of oil to O-ring.	Initial tightening torque	25Nm
	Release	180°
	Tightening torque	25Nm
Oil filter cover to oil filter module		
O-ring lightly oiled.	Tightening torque	25Nm
Oil filter cover to oil sump upper part		
S88, 5x3 Apply light coating of oil to O-ring.	Initial tightening torque	25Nm
	Releasing the oil filter cover	180°
	Tightening torque	25Nm
Oil filter module to crankcase		
M6		8Nm
Oil return line of the exhaust turbocharger to crankcase		
M6x16	Replace O-ring.	10Nm

Oil return line to exhaust turbocharger/crankcase

M6x14

Tightening torque

8Nm

Oil return line to turbocharger

M6x16

Replace beaded metal gasket.

10Nm

Oil-to-water heat exchanger to full-flow oil filter

10Nm

Special tool to measure the pressure on the oil filter module

O-ring lightly oiled.

Tightening torque

25Nm

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11 51 Coolant pump

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Coolant pump to component carrier	B46M0/O0 / B48M0/O0	M6	If the coolant pump is reused apply liquid seal 2.2.	10 Nm
2AZ Thermostat cover to component carrier	B46M0/O0 / B48M0/O0	M6		10 Nm
3AZ Coolant pump housing / component carrier to crankcase	B46M0/O0 / B48M0/O0	M8x35		19 Nm
4AZ Auxiliary coolant pump to engine block	B46M0/O0 / B48M0/O0	M8x22		19 Nm
5AZ Electric coolant pump to holder	B46M0/O0 / B48M0/O0	M6 hexagon nut		8 Nm
6AZ Auxiliary coolant pump holder to cylinder head	B46M0/O0 / B48M0/O0	M6x16		8 Nm
7AZ Belt pulley to coolant pump	B46M0/O0 / B48M0/O0	M6x16		8 Nm

11 53 Thermostat and coolant lines

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Coolant line to exhaust turbocharger	B46M0/O0 / B48M0/O0	M6	Replace O-ring.	10 Nm
2AZ Coolant line to crankcase	B46M0/O0 / B48M0/O0	M6	Replace O-ring.	10 Nm
3AZ Heat exchange module to crankcase	B46M0/O0 / B48M0/O0	M6		8 Nm
4AZ Coolant return line to exhaust turbocharger	B46M0/O0 / B48M0/O0	M6x12		8 Nm
5AZ Connecting branch to engine block	B46M0/O0 / B48M0/O0	M6x25		8 Nm

1151 Overview of tightening torques

Auxiliary coolant pump holder to cylinder head		
M6	Tightening torque	8Nm
Belt pulley to coolant pump		
M6	Tightening torque	8Nm
Bracket for coolant hose to component carrier		
BM6x16		10Nm
Bracket for electric changeover valve to component carrier		
BM6x16		10Nm
Component carrier to crankcase		
M8 x 35	Tightening torque	19Nm
Coolant pump to component carrier		
M6		10Nm
Coolant pump to component carrier		
M6x20	Tightening torque	8 ± 1Nm
Coolant pump to holder		
M6		8Nm
Electric coolant pump to holder		
M6	Tightening torque	8Nm
Transmission oil line holders to component carrier		
M6X16	Tightening torque	12Nm

11 52 Fan
Tightening Torques

	Type	Thread	Tightening specification	Torque
1AZ Fan clutch on water pump Coupling nut (left-hand threads)	All			40 Nm
	M54			45 Nm
2AZ Fan to fan clutch	All			10 Nm

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1153 Overview of tightening torques

Connecting branch to engine block		
M6x25	Tightening torque	8Nm
Coolant feed line to crankcase		
M6 x 12	Tightening torque	8Nm
Coolant feed line/coolant return line to exhaust turbocharger		
M6 x 12	Tightening torque	8Nm
Coolant line to coolant pump/cylinder head		
M6x20	Tightening torque	8Nm
Coolant line to exhaust turbocharger		
M6		10Nm
Coolant return line holder to exhaust turbocharger		
M6 x 12		8Nm
Coolant return line holder to exhaust turbocharger		
M6	Tightening torque	8Nm
Heat exchange module to crankcase		
M6		8Nm
Heat exchange module to crankcase		
M6	Tightening torque	9Nm

11 65 Exhaust turbocharger with control

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Heat shield to cylinder head	B46M0/O0 / B48M0/O0	M8x12		19 Nm
2AZ Heat shield to clamping strip	B46M0/O0 / B48M0/O0	M6x12		8 Nm
3AZ Electrical actuator drive for wastegate valve to exhaust turbocharger	B46M0/O0 / B48M0/O0	M4	Screw with washer	2,5±0,5 Nm
		M4	Screw without washer	1,9±0,2 Nm
4AZ Linkage to electrical controller drive for wastegate valve	B46M0/O0 / B48M0/O0		Tighten nut using only a second open-end spanner (to hold up).	6±0,3 Nm

11 61 Intake manifold

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Intake manifold to cylinder head	alle	M8		22 Nm
	alle	M7		15 Nm
	alle	M6		10 Nm
2AZ Sound absorption cover to holder	M60/1 / M60/2 / M62	M6		8 Nm
3AZ Throttle valve to intake manifold	N73	M6x60/ M6x80		8 Nm

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11 61 Intake plenum

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Intake plenum to cylinder head	B46M0/O0 / B48M0/O0	M6		10 Nm
2AZ Holder for intake plenum to cylinder head / crankcase	B46M0/O0 / B48M0/O0	M6		10 Nm
3AZ Rear intake plenum holder	B46M0/O0 / B48M0/O0	M6		10 Nm
4AZ Intake plenum to rear/front holder	B46M0/O0 / B48M0/O0			8 Nm
5AZ Holder for wiring harness to intake plenum	B46M0/O0 / B48M0/O0			5 Nm
6AZ Tank ventilation line to intake plenum	B46M0/O0 / B48M0/O0			5 Nm

1161 Overview of tightening torques

Manifold support to intake plenum		
M6x25	Tightening torque	8Nm
Holder for intake plenum to cylinder head / crankcase		
M6		10Nm
Holder for intake system to cylinder head/crankcase		
M6		10Nm
Holder for wiring harness to intake plenum		
		5Nm
Holder for wiring harness to intake system		
Screw	Tightening torque	5Nm
Intake plenum holder on engine		
BM6x16		10Nm
Intake plenum to cylinder head		
M6		10Nm
Intake plenum to cylinder head Observe tightening sequence.		
M6	Tightening torque	10Nm
Intake plenum to cylinder head		
M6	Tightening torque	10Nm
Intake plenum to rear/front holder		
		8Nm
Intake plenum to support		
M6X25	Tightening torque	8Nm
Intake system to holder front/rear		
		8Nm
Manifold support for intake air to cylinder head		
M6X16	Tightening torque	8Nm

Manifold support to crankcase	
M6x16	Tightening torque 8Nm
Tank ventilation line to intake plenum	
	5Nm
Tank ventilation line to intake system	
	5Nm

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1162 Overview of tightening torques

Exhaust manifold to cylinder head		
Flange nutM7 Replace nuts.	1. Jointing torque	10Nm
	2. Jointing torque	10Nm
	3. Jointing torque	16Nm
	4. tightening torque	16Nm

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11 65 Exhaust turbocharger with control

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Heat shield to cylinder head	B46M0/O0 / B48M0/O0	M8x12		19 Nm
2AZ Heat shield to clamping strip	B46M0/O0 / B48M0/O0	M6x12		8 Nm
3AZ Electrical actuator drive for wastegate valve to exhaust turbocharger	B46M0/O0 / B48M0/O0	M4	Screw with washer	2,5±0,5 Nm
		M4	Screw without washer	1,9±0,2 Nm
4AZ Linkage to electrical controller drive for wastegate valve	B46M0/O0 / B48M0/O0		Tighten nut using only a second open-end spanner (to hold up).	6±0,3 Nm

1165 Overview of tightening torques

Control rod of electrical wastegate valve controller

M6 Always use a second open-end spanner (for counter support) to tighten the lock nut!	Tightening torque	$6 \pm 0,3\text{Nm}$
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Electrical controller drive to exhaust turbocharger

Screw	Tightening torque	$2,5 \pm 0,5\text{Nm}$
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Electrical controller drive to exhaust turbocharger

Renew screws.	Tighten screws crosswise. Tightening torque	$3 \pm 0,5\text{Nm}$
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Exhaust turbocharger to cylinder head

M7 Observe tightening sequence.	Replace nuts.	
	1. Jointing torque	10Nm
	2. tightening torque	10Nm
	3. Jointing torque	16Nm
	4. tightening torque	16Nm
	5. Tightening torque	16Nm

Heat shield to clamping strip

M6 x 12	Tightening torque	8Nm
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Heat shield to cylinder head

M8 x 12	Tightening torque	19Nm
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Wastegate valve controller control rod

Only tighten the lock nut using a second open-end spanner (for counter support)!		$6 \pm 0,3\text{Nm}$
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11 66 Vacuum pump

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Intake pipe to oil pump	B46M0/O0 / B48M0/O0	M6 x25		10 Nm
2AZ Oil/vacuum tandem pump to crankcase	B46M0/O0 / B48M0/O0	M8	Renew screws.	
			1. Jointing torque	15 Nm
			2. Angle of rotation	45 °
3AZ Sprocket to oil pump	B46M0/O0 / B48M0/O0	M10	Important - left-hand thread Renew screw.	
			1. Jointing torque	5 Nm
			2. Angle of rotation	90 °

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11 78 Emissions control, control sensor / monitoring sensor

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Control sensor / monitoring sensor	B46M0/O0 / B48M0/O0	M18 x 1.5		50 Nm

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11 78 Emissions-control, Lambda oxygen sensor

Tightening Torques

	Type	Thread	Tightening specification	Torque
1AZ Oxygen control sensor; oxygen monitor sensor	All	M18 x 1.5		50 Nm

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1178 Overview of tightening torques

Control sensor			
M18x1.5		Tightening torque	50Nm
Monitoring sensor			
M18x1.5			50Nm

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11 14 Case Covers
Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Timing case cover to crankcase	B46M0/O0 / B48M0/O0	M6	Replace screws	8 Nm 90 °
			Jointing torque Angle of rotation	

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11 27 Dual-mass balance
Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Gear to counterbalance shaft	B46M0/O0 / B48M0/O0	M10	1. Jointing torque	20 Nm
			2. Angle of rotation	180 °
2AZ Idler gear to crankcase	B46M0/O0 / B48M0/O0	M12	1. Jointing torque	10 Nm
			2. Angle of rotation	45 °

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11 11 Engine block

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Bearing cap to crankcase (collar bolt 11.9)	B46M0/O0 / B48M0/O0	M10x1.5	Renew screws and screw in hand-tight.	
			1. Jointing torque	25 Nm
			2. Angle of rotation	60 °
			3. Angle of rotation	60 °
2AZ Oil spray nozzle in crankcase	B46M0/O0 / B48M0/O0	M6		8 Nm
3AZ Bearing journal of tensioning and guide rail	B46M0/O0 / B48M0/O0	M8	Replace bolt.	20 Nm
4AZ Camshaft sprocket with ball bearing to crankcase	B46M0/O0 / B48M0/O0	M12x1.5		108 Nm
5AZ Special tool/holder to crankcase	B46M0/O0 / B48M0/O0	M10x35		40 Nm
6AZ Special tool 11 8 930 to special tool 00 2 300	B46M0/O0 / B48M0/O0	M14x35		160 Nm
7AZ Chain tensioner to crankcase	B46M0/O0 / B48M0/O0	M6x22		10 Nm
8AZ Spacing screw for acoustic cover on engine block (AF 17)	B46M0/O0 / B48M0/O0	M8x12		12 Nm

11 00 Standard screw connection

Tightening Torques

	Type	Thread	Tightening specifications	Torque
1AZ Screws and nuts	B48	M5		5 Nm $\pm 0,5$
2AZ Screws and nuts	B48	M6		8 Nm ± 1
3AZ Screws and nuts	B48	M7		13 Nm ± 2
4AZ Screws and nuts	B48	M8		19 Nm ± 3
5AZ Screws and nuts	B48	M10		38 Nm ± 5
6AZ Hose clamp, WAF 5	B48			1.0 to 1.5 Nm
7AZ Hose clamp, WAF 6	B48			2,5 up to 3,5 Nm

11 operating fluid overview

Testing equipment

Connecting hose
Ä = 8 x 13 mm, length = 70 mm

Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517
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[Overview of consumables \(Electronic Parts Catalogue\)](#)

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215

Expendable materials

lubricating grease Longtime PD -1	400 g, Cartridge	83192160340
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[Overview of consumables \(Electronic Parts Catalogue\)](#)

Expendable materials

Copper paste	100 g, Tube	81229400794
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[Overview of consumables \(Electronic Parts Catalogue\)](#)

Expendable materials

Lubricating grease SYNTHESO GLEP 1	100 g, Tube	83299407778
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[Overview of consumables \(Electronic Parts Catalogue\)](#)

Engine oil

Technically suitable engine oils for BMW Group engines

[3.0 Technically appropriate engine oils for BMW Group engines](#)

Engine oil

Technically suitable engine oils for BMW Group engines

[3.0 Specified engine oils for Toyota J29](#)

Sealing compound

Sealant Drei Bond 1209	30 ml, Tube	07 58 9 062 376
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