ATESTEO

Excellence in drivetrain testing

Data sheet

DF *plus*

DF plus

Technical data

Type	-	DF1 plus	DF2 plus	DF3 plus	DF4 plus	DF5 plus
Accuracy class	%			≤±0.04		
Rated torque (Md_n)	Nm	100 200 500	500 1,000	1,000 2,000 3,000	4,000 5,000	5,000 10,000
Torque measuring system						
Technology	-			Rotating		
Rated torque (Md_n) #1	Nm	100 200 500	500 1,000	1,000 2,000 3,000	4,000 5,000	5,000 10,000
Rated torque short measurement range (optional, minimum) (Md_{ns}) #2	Nm			N/A		
Accuracy class extended (for Md_n)	%			N/A		
Outputs	-			Frequency (RS422), Voltage, CAN bus, Alert		
Test signal	-			see test report		
Mechanical dimensions #3						
Outer diameter of rotor #4	mm	107	128	158	187	230
Lengths (Rotor, without centering)	mm	45	48	49	50	60
Pitch circle diameter #5	mm	84.0	101.5	130.0	155.5	196.0
Speeds and speed measuring systems						
Speed detection (integrated)	-			without		
Speed detection (optional)	-			magn.		
Maximum Speed without speed detection system	rpm	21,000	20,000	16,000	15,000	12,000
Optional increased speed	rpm	25,000	23,000	18,000	17,000	14,000
Maximum speed with magnetic speed encoder	rpm	14,000	11,000	9,000	8,000	6,500
Maximum speed with optical speed encoder	rpm			N/A		
Maximum speed with inductive speed encoder	rpm			N/A		
Torque accuracy class per output type (related to Md_n)						
Frequency output	%			≤±0.04		
CAN output	%			≤±0.04		
Voltage output	%			≤±0.05		
Current output	%			N/A		
Frequency output (option higher accuracy)	%			N/A		
CAN (option higher accuracy)	%			N/A		

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Technical data

Type	-	DF1 plus	DF2 plus	DF3 plus	DF4 plus	DF5 plus
Accuracy class	%			≤±0.04		
Rated torque (Md_n)	Nm	100 200 500	500 1,000	1,000 2,000 3,000	4,000 5,000	5,000 10,000
Linearity deviation including hysteresis related to Md_n #6						
Frequency, 0%...30%	%			≤±0.010		
Frequency, 30%...60%	%			≤±0.020		
Frequency, 60%...100%	%			≤±0.030		
CAN, 0%...30%	%			≤±0.010		
CAN, 30%...60%	%			≤±0.020		
CAN, 60%...100%	%			≤±0.030		
Voltage output	%			≤±0.05		
Current output	%			N/A		
Rel. standard deviation of the reproducibility according to DIN 1319, by reference to variation of the output signal (rel. to Md_n)						
Frequency output	%			≤±0.03		
CAN output	%			≤±0.03		
Voltage output	%			≤±0.05		
Current output	%			N/A		
Temperature influence per 10K in the nominal temperature range on the output signal related to the actual value of signal span (rel. to Md_n)						
Frequency output	%			≤±0.04		
CAN output	%			≤±0.04		
Voltage output	%			≤±0.05		
Current output	%			N/A		
Temperature influence per 10K in the nominal temperature range on the zero signal (rel. to Md_n)						
Frequency output	%			≤±0.04		
CAN output	%			≤±0.04		
Voltage output	%			≤±0.05		
Current output	%			N/A		
Long-term drift over 48h at reference temperature						
Voltage output	mV			<1.5 / <3.0 / <0.8 / <1.5		
Current output	µA			N/A		

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Accuracy class	%			≤±0.04		
Rated torque (Md_n)	Nm	100 200 500	500 1,000	1,000 2,000 3,000	4,000 5,000	5,000 10,000

Nominal sensitivity (range between zero torque and rated torque)		
Frequency output	kHz	5 / 20 / 30 / 120
Voltage output	V	5.0 / 10.0 / 2.5 / 5.0
Current output	mA	N/A
Output signal at zero torque		
Frequency output	kHz	10 / 60 / 60 / 240
Voltage output	V	0.0 / 0.0 / 2.5 / 5.0
Current output	mA	N/A
Nominal output signal		
Frequency output at positive nominal value	kHz	15 / 80 / 90 / 360
Frequency output at negative nominal value	kHz	5 / 40 / 30 / 120
Voltage output at positive nominal value	V	5 / 10 / 5 / 10
Voltage output at negative nominal value	V	-5 / -10 / 0 / 0
Current output at positive nominal value	mA	N/A
Current output at negative nominal value	mA	N/A
Max. modulation range		
Frequency output	kHz	0...420
Voltage output	V	-12.0...12.0
Current output	mA	N/A
Group delay time (main TCU)		
Frequency output	µs	300
Voltage output	µs	300
CAN bus	µs	800

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Technical data

Type	-	DF1 plus	DF2 plus	DF3 plus	DF4 plus	DF5 plus
Accuracy class	%			≤±0.04		
Rated torque (Md_n)	Nm	100 200 500	500 1,000	1,000 2,000 3,000	4,000 5,000	5,000 10,000

Speed measuring system	Inductive (track at rotor)					
Pulse per rev (PPR)	ppr.			N/A		
Maximum speeds (related to PPR)	rpm			N/A		
Max. output frequency (RS422)	kHz			N/A		
Minimum speed for sufficient pulse stability	rpm			N/A		
Speed measuring system	**Magneto resistive (2 tracks approx. 90 degree phase shifted)**					
Pulses per rev (PPR)	ppr.	680	808	1,000	1,176	1,448
Maximum speeds (related to PPR)	rpm	14,000	11,000	9,000	8,000	6,500
Max. output frequency (RS422)	kHz	159	149	150	157	157
Minimum speed for sufficient pulse stability	rpm			>0.1		
Nominal clearance (sensor - pole ring)	mm			0.7		
Working airgap (sensor - pole ring)	mm			0.1...1.0		
Nominal axial displacement (rotor - stator) #7	mm			7.0		
Tolerance to nominal axial displacement (rotor - stator)	mm			±0.5		
Speed measuring system	**Optical**					
Pulses per rev (PPR)	ppr.			N/A		
Maximum speeds (related to PPR)	rpm			N/A		
Max. output frequency (RS422)	kHz			N/A		
Minimum speed for sufficient pulse stability	rpm			N/A		
Nominal radial displacement (rotor - stator)	mm			N/A		
Tolerated radial displacement (rotor - stator) #7	mm			N/A		
Nominal axial displacement (rotor - stator) #7	mm			N/A		
Tolerance to nominal axial displacement (rotor - stator)	mm			N/A		

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Technical data

Type	-	DF1 plus	DF2 plus	DF3 plus	DF4 plus	DF5 plus
Accuracy class	%	≤±0.04				
Rated torque (Md_n)	Nm	100 200 500	500 1,000	1,000 2,000 3,000	4,000 5,000	5,000 10,000

Angular measuring system						
Pulses per rev	ppr.	680	808	1,000	1,176	1,448
Resolution	°	0.132	0.111	0.090	0.077	0.062
Output signals	-	CAN bus, Voltage				
Measurement ranges	°	0.00...360.00 / -180.00...180.00 / -360.00...360.00 / -720.00...720.00 / -1,080.00...1,080.00 / -1,440.00...1,440.00 / -1,800.00...1,800.00				

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Technical data

Type	-	DF1 plus	DF2 plus	DF3 plus	DF4 plus	DF5 plus
Accuracy class	%			≤±0.04		
Rated torque (Md_n)	Nm	100 200 500	500 1,000	1,000 2,000 3,000	4,000 5,000	5,000 10,000
Temperature ranges						
Nominal temperature range *(Rotor)*	°C			0...80		
Operating temperature range *(Rotor)* #8	°C			-20...85		
Storage temperature range *(Rotor)*	°C			-30...85		
Nominal temperature range *(Stator)*	°C			0...80		
Operating temperature range *(Stator)* #9	°C			-20...85		
Storage temperature range *(Stator)*	°C			-30...85		
Nominal temperature range *(TCU)*	°C			0...70		
Operating temperature range *(TCU)*	°C			-20...70		
Storage temperature range *(TCU)*	°C			-30...85		
Mechanical shock (EN 60068-2-27)						
Quantity	-			1,000		
Duration	ms			3		
Acceleration	m/s²			650		
Vibration load (EN 60068-2-6)						
Frequency	Hz			10...2,000		
Duration	min.			150		
Acceleration	m/s²			200		
Load limits #10						
Limit torque, related to Md_n	%	500 275 175	300	300	300	300
Breaking torque approx., related to Md_n	%	1,000 550 350	600	600	600	600
Axial limit force	kN	2.90 5.40 7.40	19.00 26.00	35.00 46.00 57.00	83.00 89.00	82.00 104.00
Lateral limit force	N	1,000.00 1,890.00 2,880.00	4,000.00 7,000.00	7,000.00 11,000.00 15,000.00	20,000.00 23,000.00	20,000.00 32,000.00
Bending limit torque	Nm	22.50 42.00 65.00	152.00 245.00	221.00 348.00 487.00	841.00 986.00	1,057.00 1,689.00

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Technical data

Type	-	DF1 plus	DF2 plus	DF3 plus	DF4 plus	DF5 plus
Accuracy class	%			≤±0.04		
Rated torque (Md_n)	Nm	100 200 500	500 1,000	1,000 2,000 3,000	4,000 5,000	5,000 10,000
Mechanical values						
Torsional stiffness	kNm/rad	83 156 269	376 647	865 1,461 1,988	3,317 3,894	5,047 8,296
Angle of twist at Md_n	°	0.068 0.073 0.106	0.076 0.089	0.066 0.078 0.086	0.069 0.074	0.057 0.069
Axial stiffness	kN/mm	145 272 374	952 1,338	1,170 1,539 1,912	2,074 2,237	2,072 2,603
Radial stiffness	kN/mm	68 126 192	281 467	466 775 1,061	1,366 1,578	1,370 2,148
Bending stiffness	kNm/°	0.55 1.05 1.60	3.80 6.00	7.40 11.60 16.20	24.00 28.00	35.20 56.30
Deflection at axial limit force	mm	<0.03	<0.03	<0.03 <0.04 <0.04	<0.05	<0.05
Additional radial deviation at lateral limit force	mm			<0.02		
Parallel deviation at bending limit torque	mm	<0.08	<0.10	<0.10	<0.12	<0.14
Inherent frequency	Hz	1,400 1,400 1,800	N/A	N/A	N/A	N/A
Balance quality-level (DIN ISO 1949)	-			G2.5		
Inertia of rotor	kgm²	0.0010 0.0017 0.0017	0.0033 0.0034	0.0084 0.0085 0.0085	0.0188 0.0189	0.0486 0.0492
Max. limits for relative shaft vibration (peak to peak) #11	µm			$S_{(p-p)} = \frac{9000}{\sqrt{n}}$		

DF plus

Technical data

Type	-	DF1 plus	DF2 plus	DF3 plus	DF4 plus	DF5 plus
Accuracy class	%			≤±0.04		
Rated torque (Md_n)	Nm	100 200 500	500 1,000	1,000 2,000 3,000	4,000 5,000	5,000 10,000
Weight approx.						
Rotor #12	kg	0.7 1.2 1.2	1.6 1.7	2.8 2.9 2.9	4.4 4.5	7.5 7.8
Stator (without speed encoder) #12	kg			0.60		
Mounting distances (without optional speed detection system)						
Nominal radial displacement (rotor - stator)	mm			3		
Tolerance to nominal radial displacement (rotor - stator)	mm			+1/-2		
Nominal axial displacement (rotor - stator) #7	mm			7		
Tolerance to nominal axial displacement (rotor - stator)	mm			≤±1		
Flatness and concentricity tolerances rotor						
Circular run-out-axial tolerance #13	mm	0.01	0.01	0.01	0.03	0.04
Circular run-out-radial tolerance #13	mm	0.01	0.01	0.01	0.03	0.04
Power supply						
Nominal supply	V			(DC) 24		
Supply range #14	V			(DC) 23...25		
Max. current consumption in measuring mode	A			<1		
Max. current consumption in start-up mode	A			<2		
Nominal power consumption	W			<24		
Load resistance						
Frequency output	-			RS422		
Voltage output	kOhm			≥50		
Dynamic						
Frequency output	kHz			≤6		
Voltage output	kHz			≤6		
Current output	kHz			N/A		
CAN output conversation rate	1/s			≤2,000		

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Technical data

Type	-	DF1 plus	DF2 plus	DF3 plus	DF4 plus	DF5 plus
Accuracy class	%			≤±0.04		
Rated torque (Md_n)	Nm	100 200 500	500 1,000	1,000 2,000 3,000	4,000 5,000	5,000 10,000
Miscellaneous						
Protection class *(Rotor)*	-			IP54		
Protection class *(Stator)*	-			IP54		
Protection class (rotor, extended)	-			N/A		
Protection class (stator, extended)	-			N/A		
Pitch circle screw information	-	6 * M8 (10.9) 6 * M8 (12.9) 6 * M8 (12.9)	8 * M10 (12.9)	8 * M12 (12.9)	8 * M14 (12.9)	8 * M16 (12.9)
CAN bus type	-			2B		
Configuration interface	-			Ethernet		
Central hole	mm			N/A		
Material	-	Titanium Steel Steel	Steel	Steel	Steel	Steel
Measuring range (related to Md_n)	%			110		
Compatible evaluation units (TCU)	-			TCU5		
Stator type	-			DF plus		
Sales information						
Article number	-	10004450 10003751 10003751	10003753	10003755	10003757	10003759
U.S. FCC certificate	-	Yes	Yes	Yes	Yes	No

DF plus

Remarks and information

Link no.	Topic	Remark
#1	Nominal torque	Based on customer requests, the measurement systems can optionally be optimized for not listed nominal torque values (intermediate ranges possible).
#2	Second torque range	The written second nominal torque value (Md_{ns}) is the smallest possible. Greater second torque ranges can be chosen on demand. Mechanical values and load limits vary between single and dual range torque meters. A data sheet for dual range torque meters with specific values can be requested.
#3	Dimensions	Mechanical dimensions are without engagement. Use the drawings and step files as master for your constructions.
#4	Details in the drawings	Value can vary by optional components. Please find details to this attribute in the integrated drawings.
#5	Pitch circle diameter	The pitch circle diameter is identically at input and output side for most systems. More information is given in the drawings of a product.
#6	Linearity	Values of Linearity deviation incl. Hysteresis can only be reached if positive and negative sensitivity values are used.
#7	Reference planes	Please check the drawings for information about the reference planes of this attribute.
#8	Temperature range (rotor)	No condensation allowed.
#9	Temperature range (stator)	No condensation allowed. Temperature related to housing ground point.
#10	Load limits	The given values are only valid if no other load occurs at the same time. If the loads in sum are 100%, the max. error will be 0.3% of the nominal torque. Limit and break torque are lower if other loads are applied (such as lateral forces).

DF plus

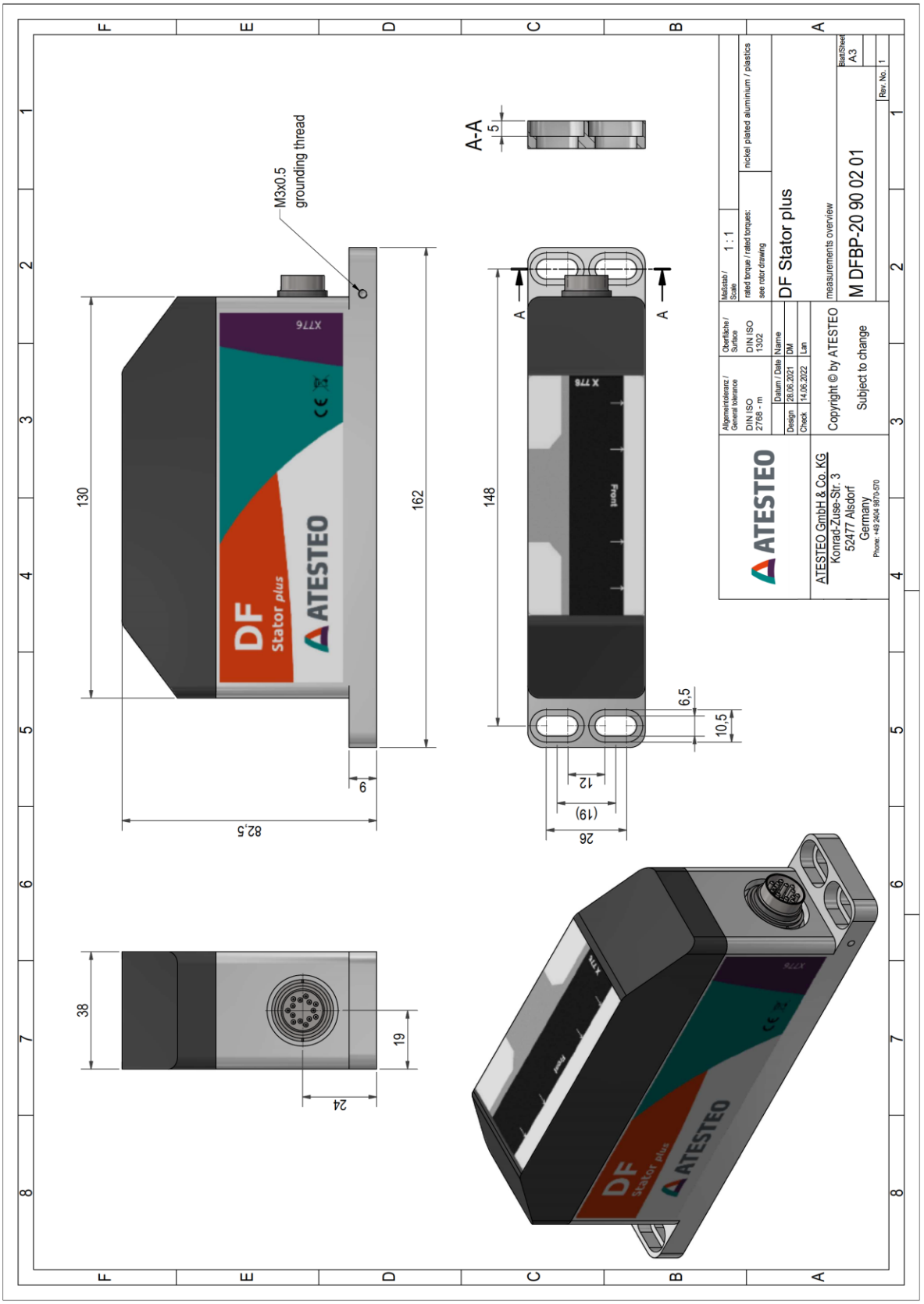
Remarks and information

Link no.	Topic	Remark
#11	Vibration limits	Vibration limits are not an influence to the machine. They reflect the allowed effect onto the rotor (ISO 7919-3). Parameter "n" is given in "r/min.".
#12	Weights	Weights are related to components without options like speed detection system. Please contact us for exact weight information of options.
#13	Flatness and concentricity tolerances	The parameters of "Flatness and concentricity tolerances rotor" are manufacturing tolerances.
#14	Supply voltage	The supply voltage range must be given at measurement system side. Long wires can reduce the voltage level from power supply to measurement system.

DF plus components

Drawing

Drawing



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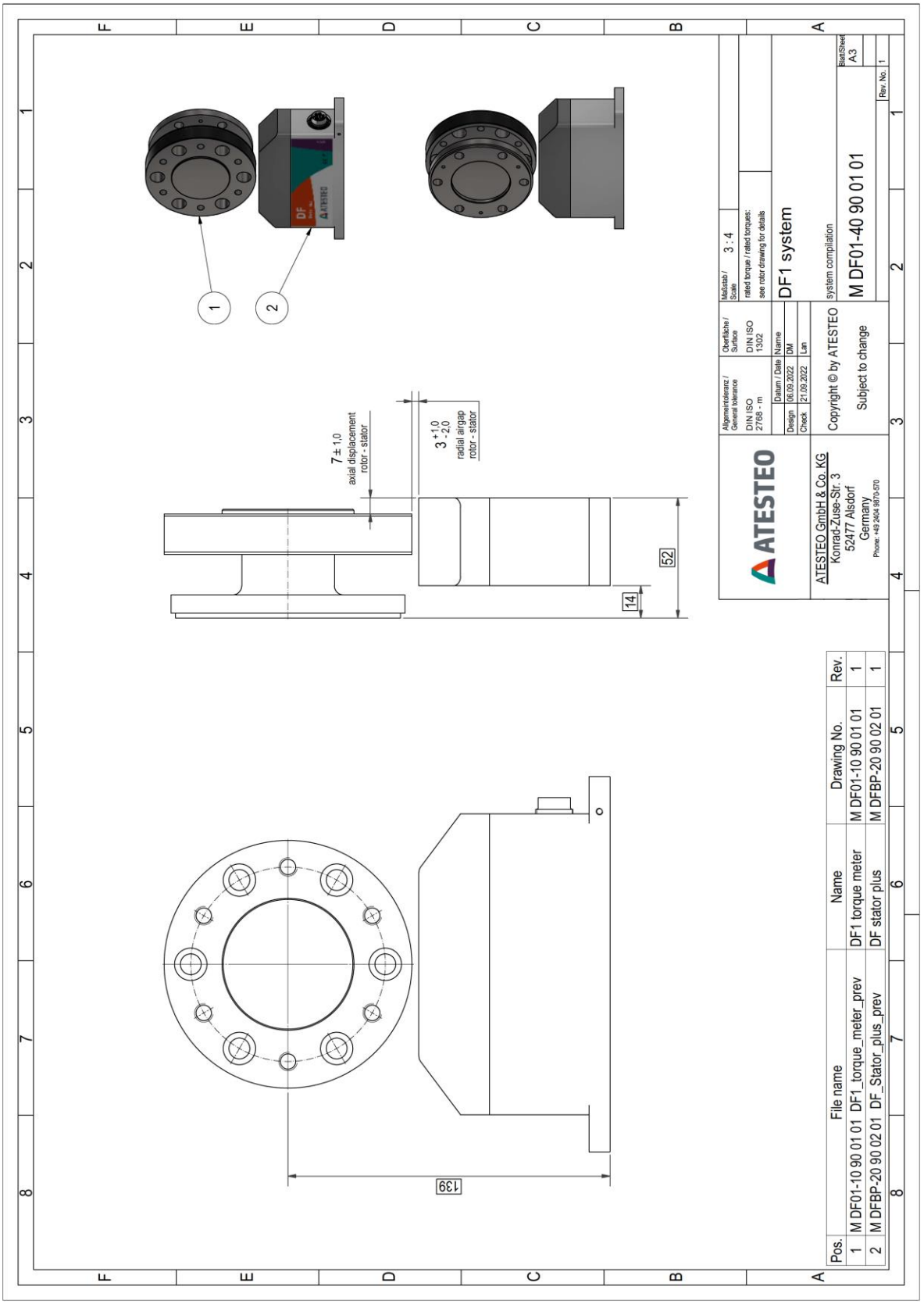

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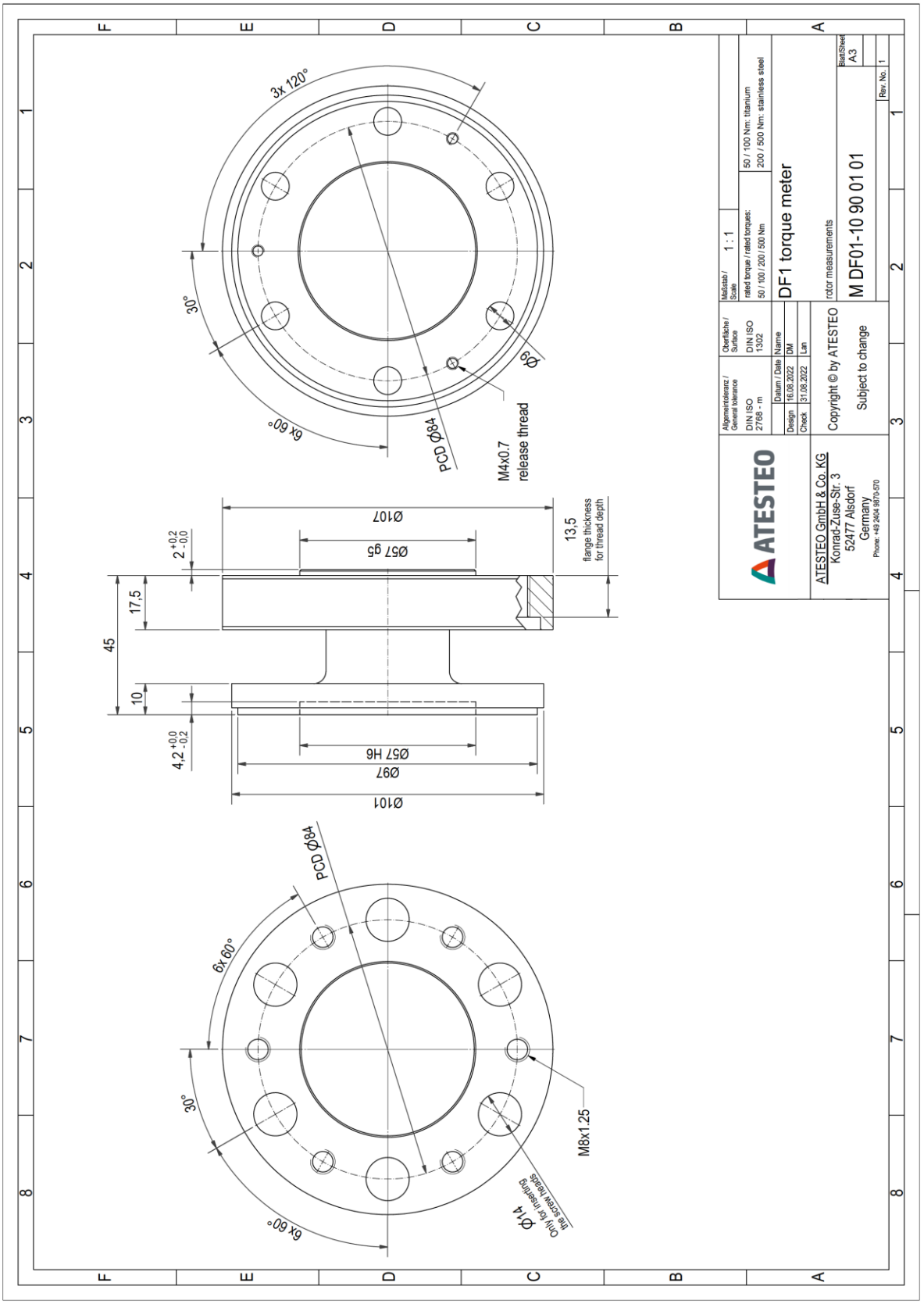
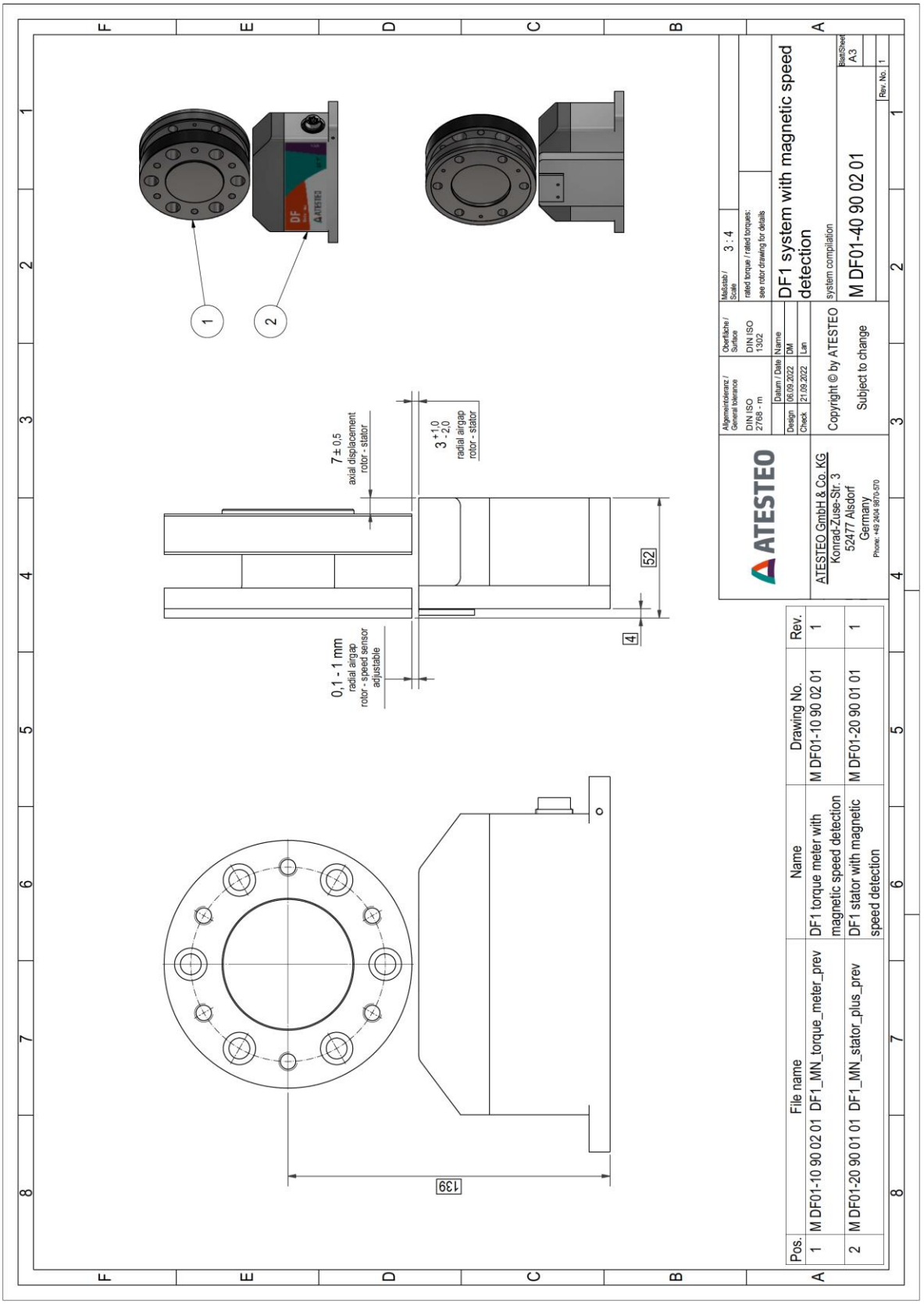


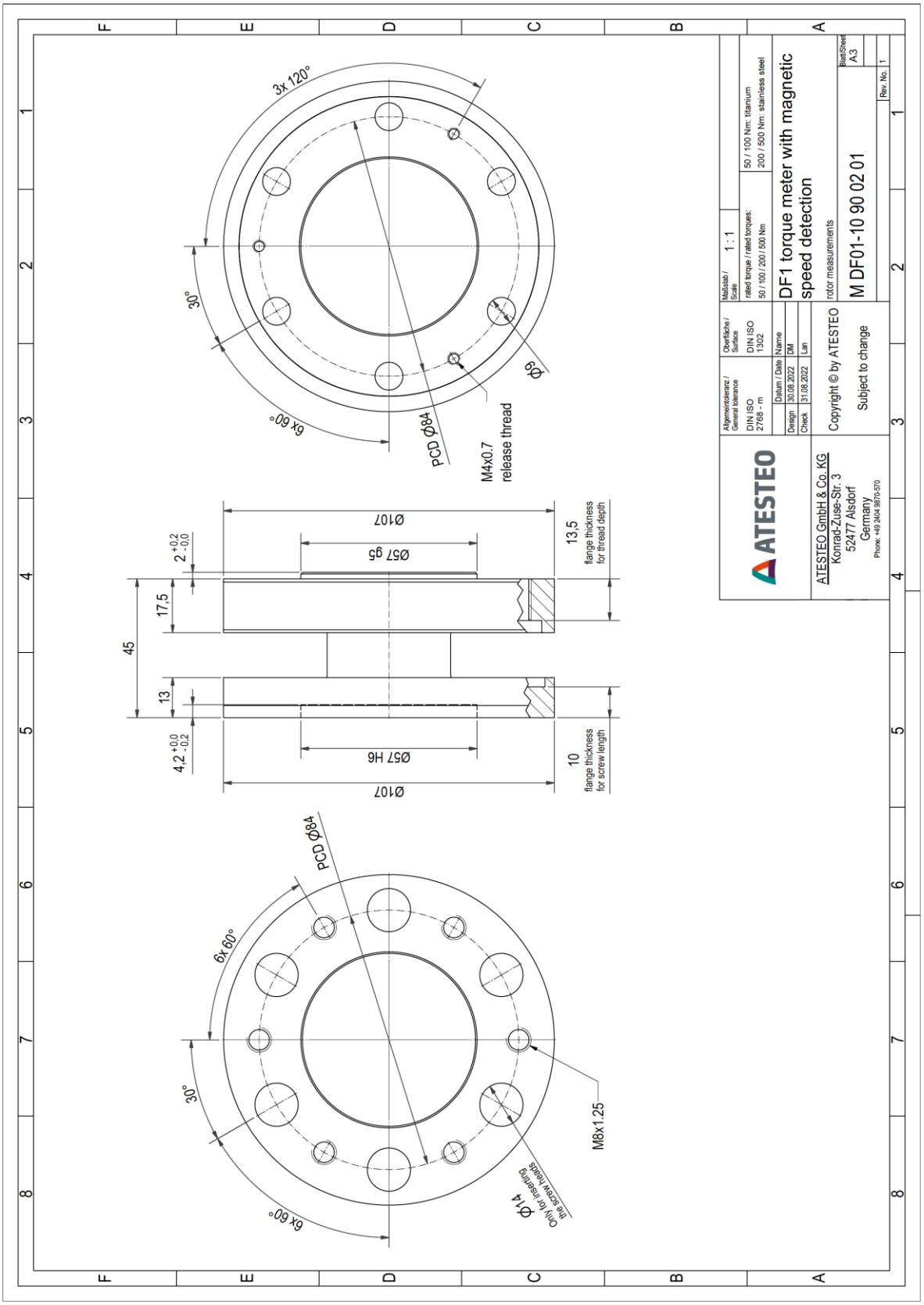
DF1 plus SPD_MGN System

Drawing



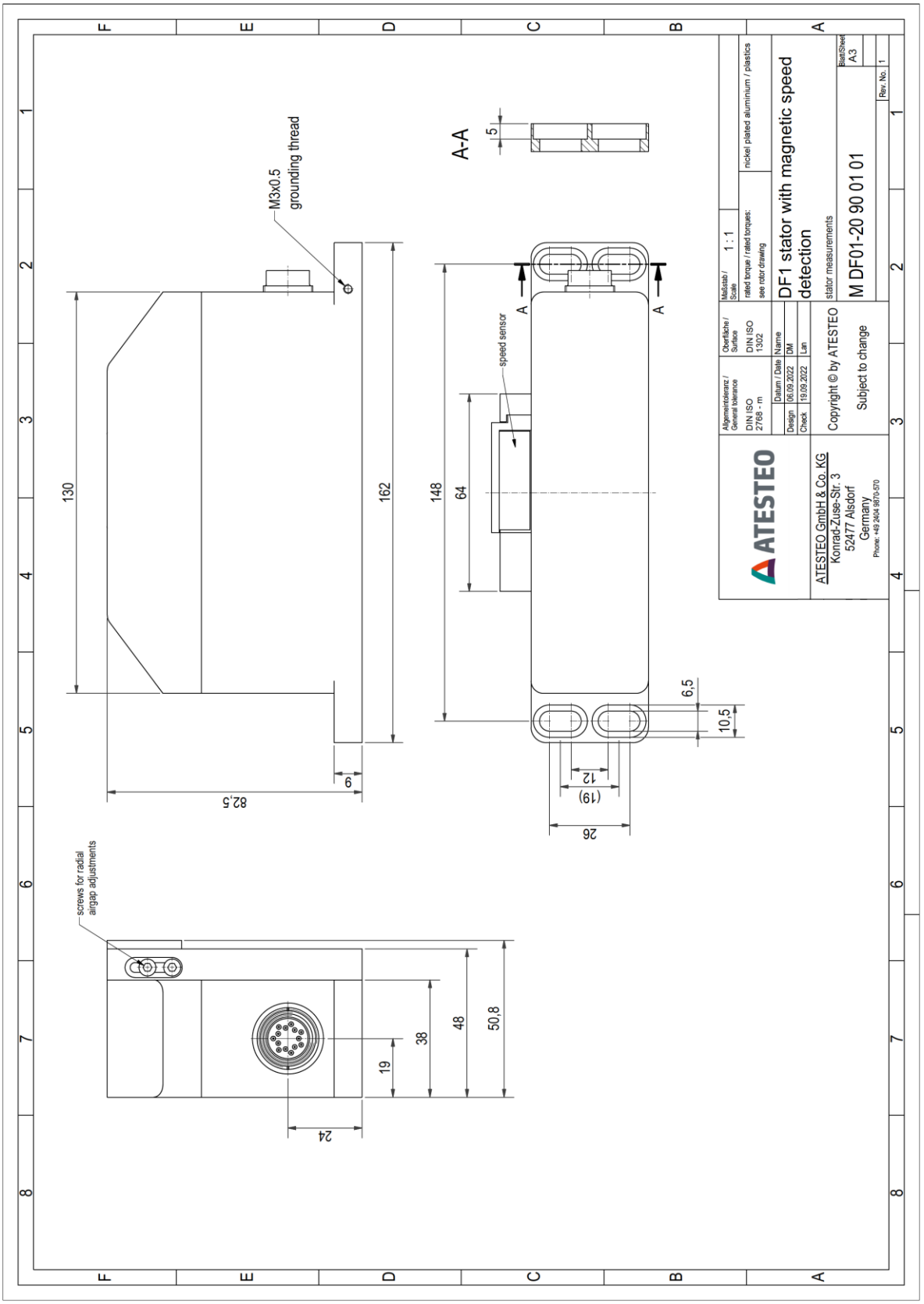
DF1 plus SPD_MGN
Rotor

Drawing



DF1 plus SPD_MGN
Stator

Drawing



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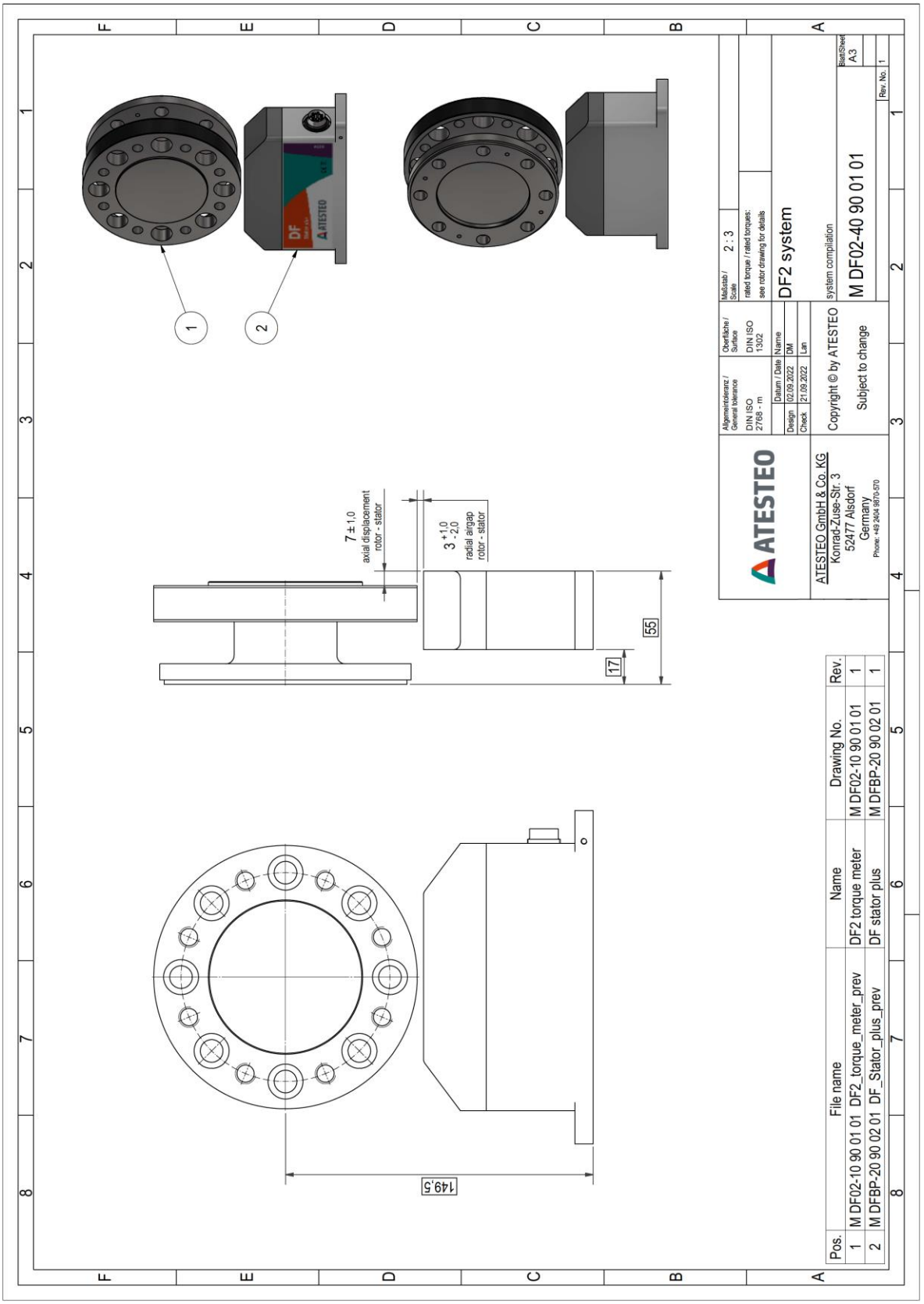

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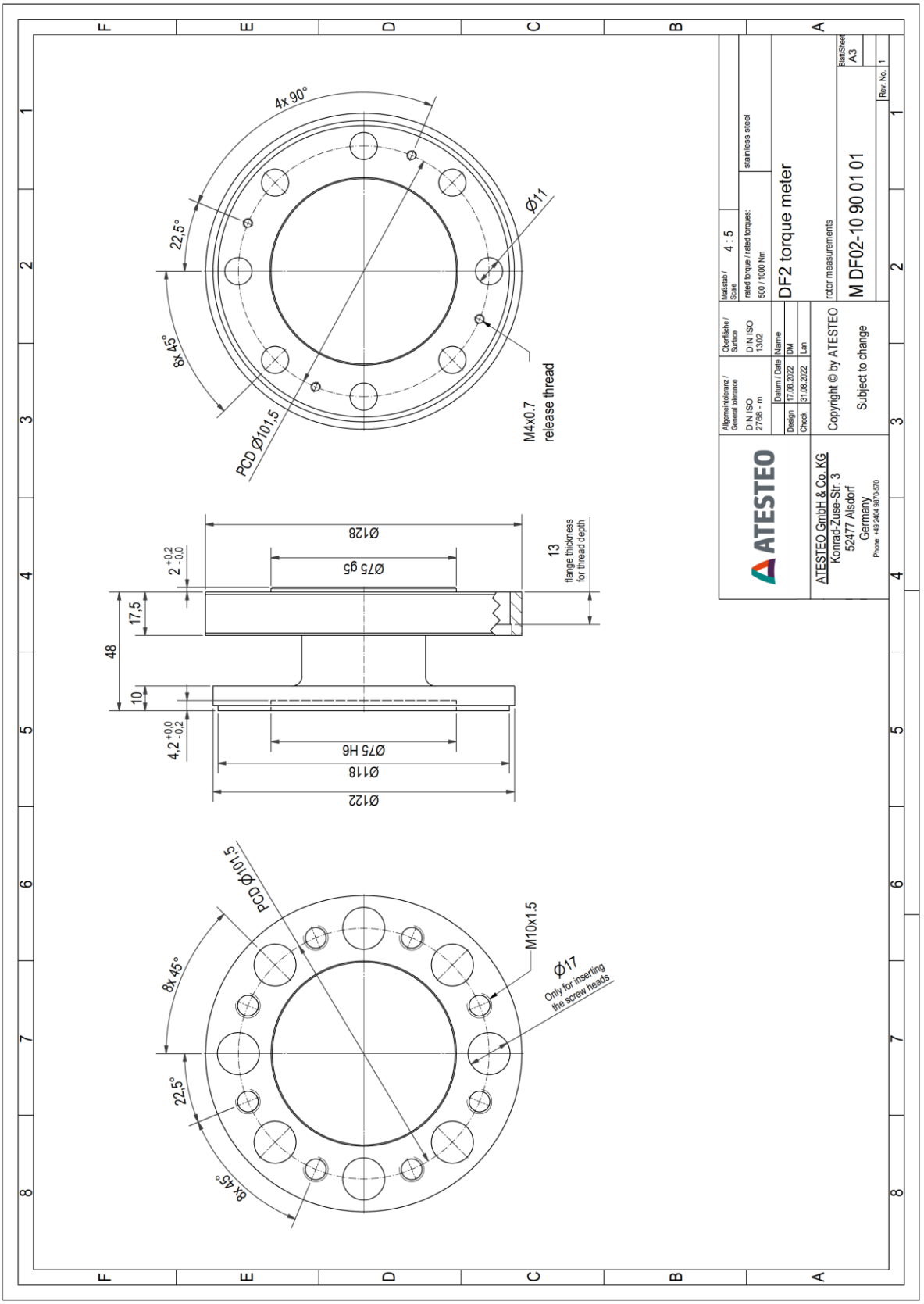
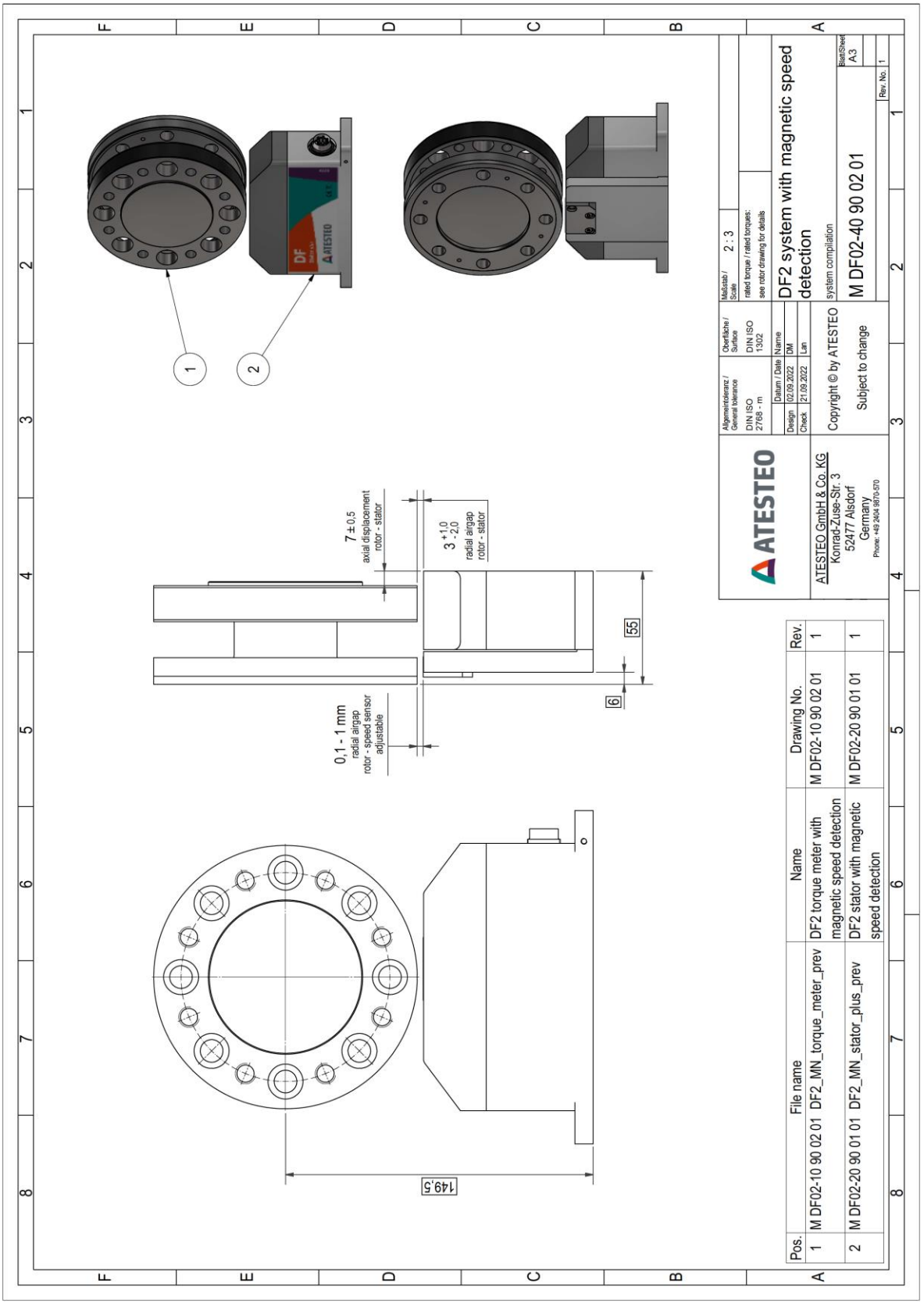


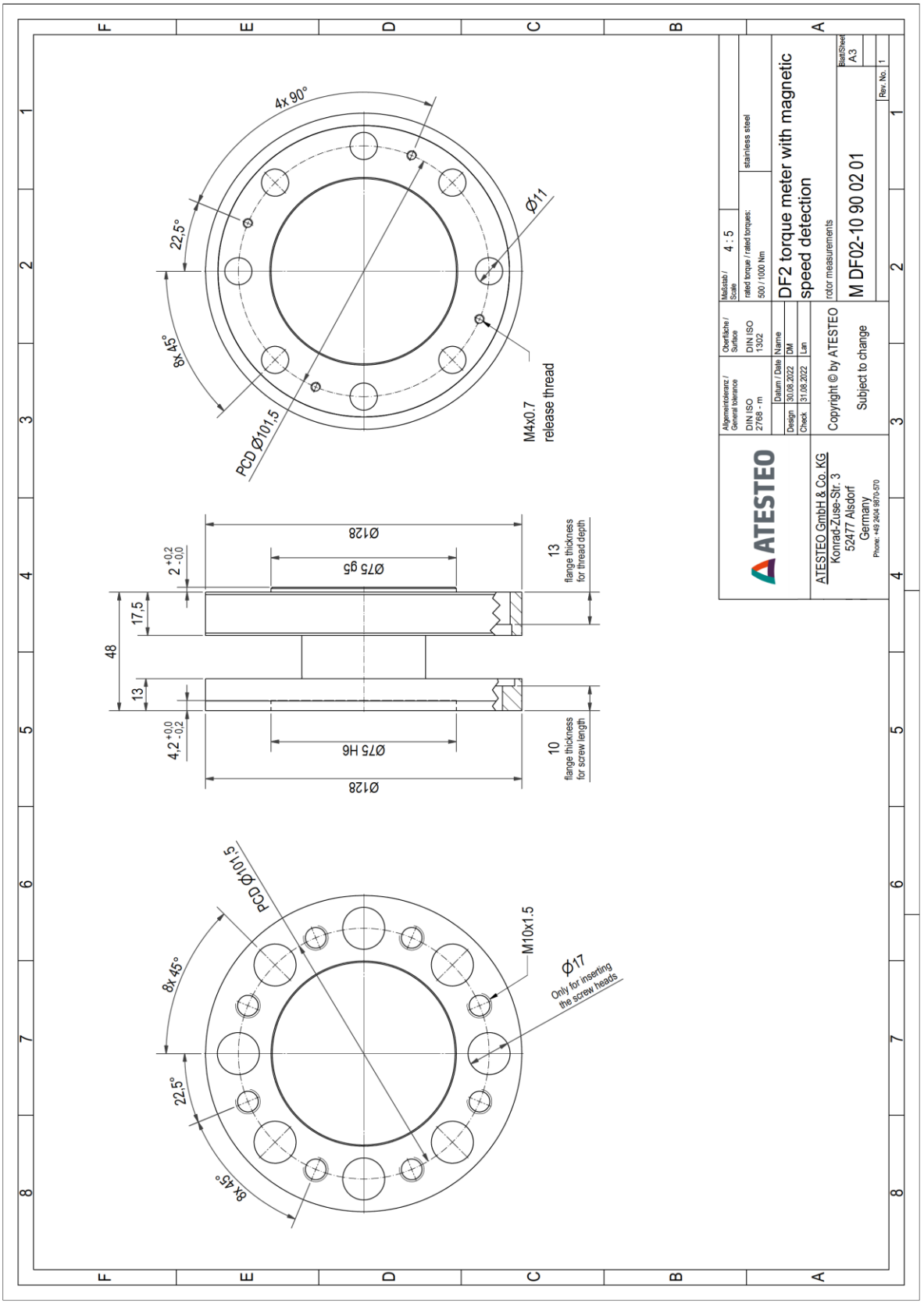
DF2 plus SPD_MGN System

Drawing



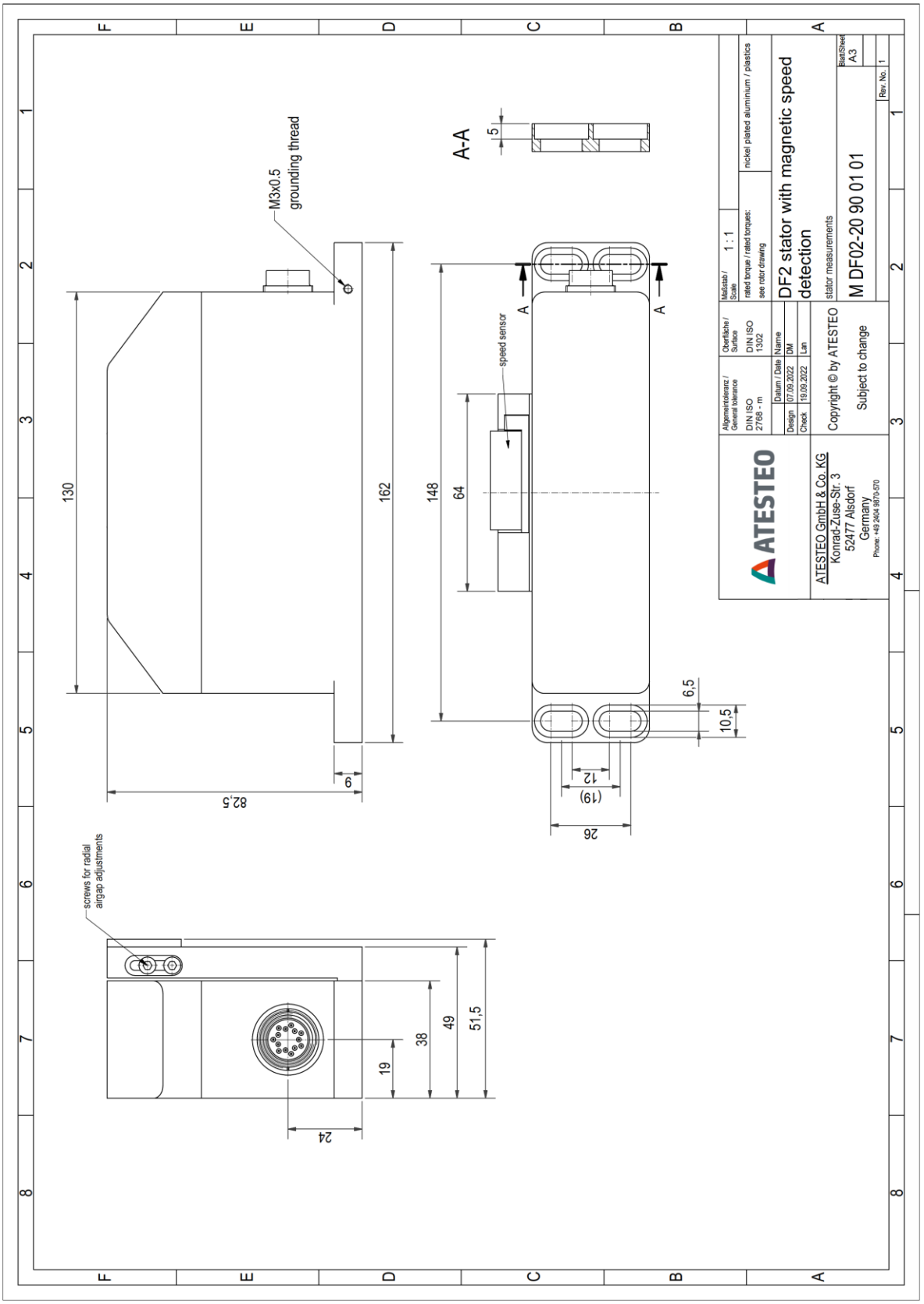
DF2 plus SPD_MGN
Rotor

Drawing



DF2 plus SPD_MGN
Stator

Drawing



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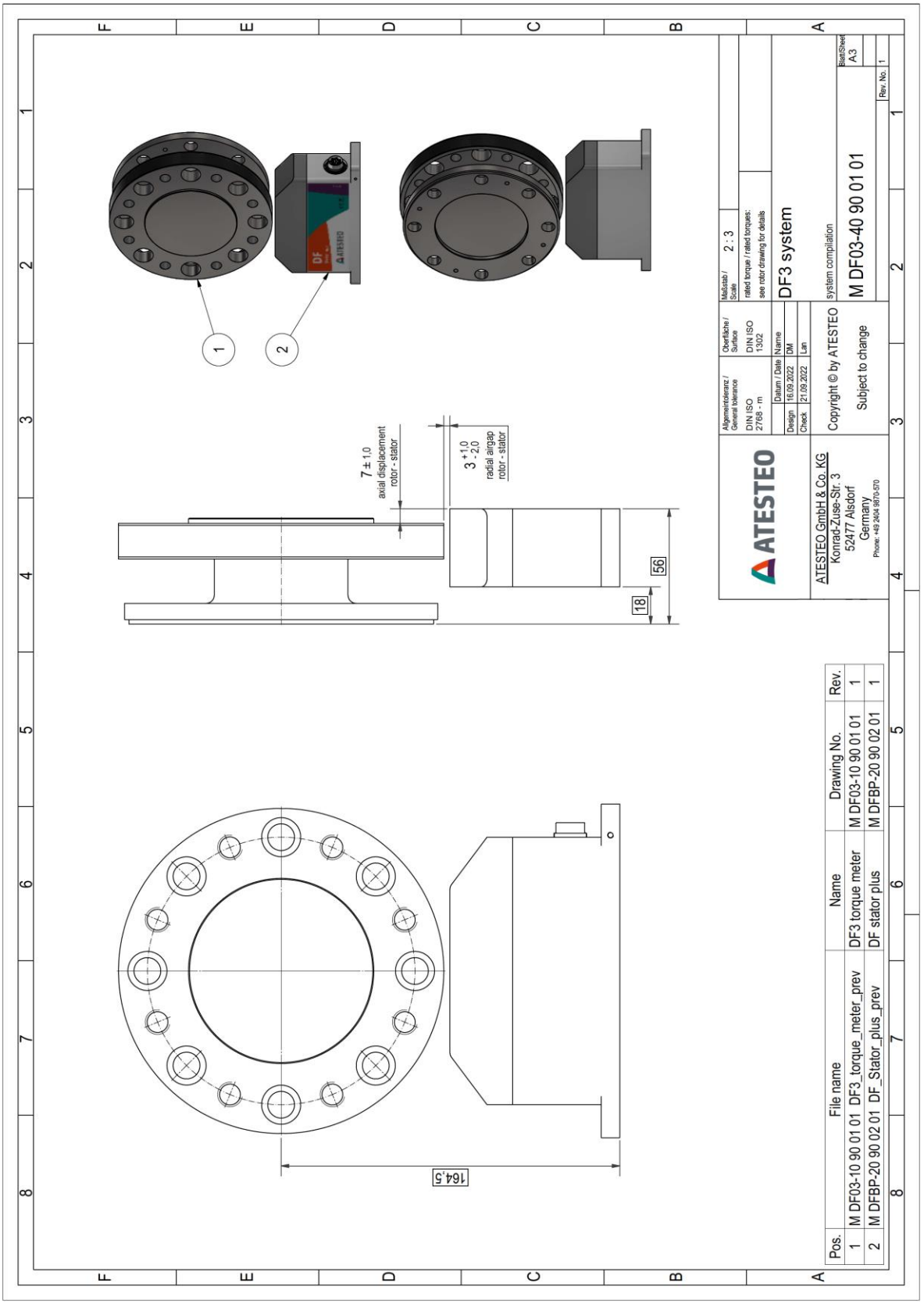

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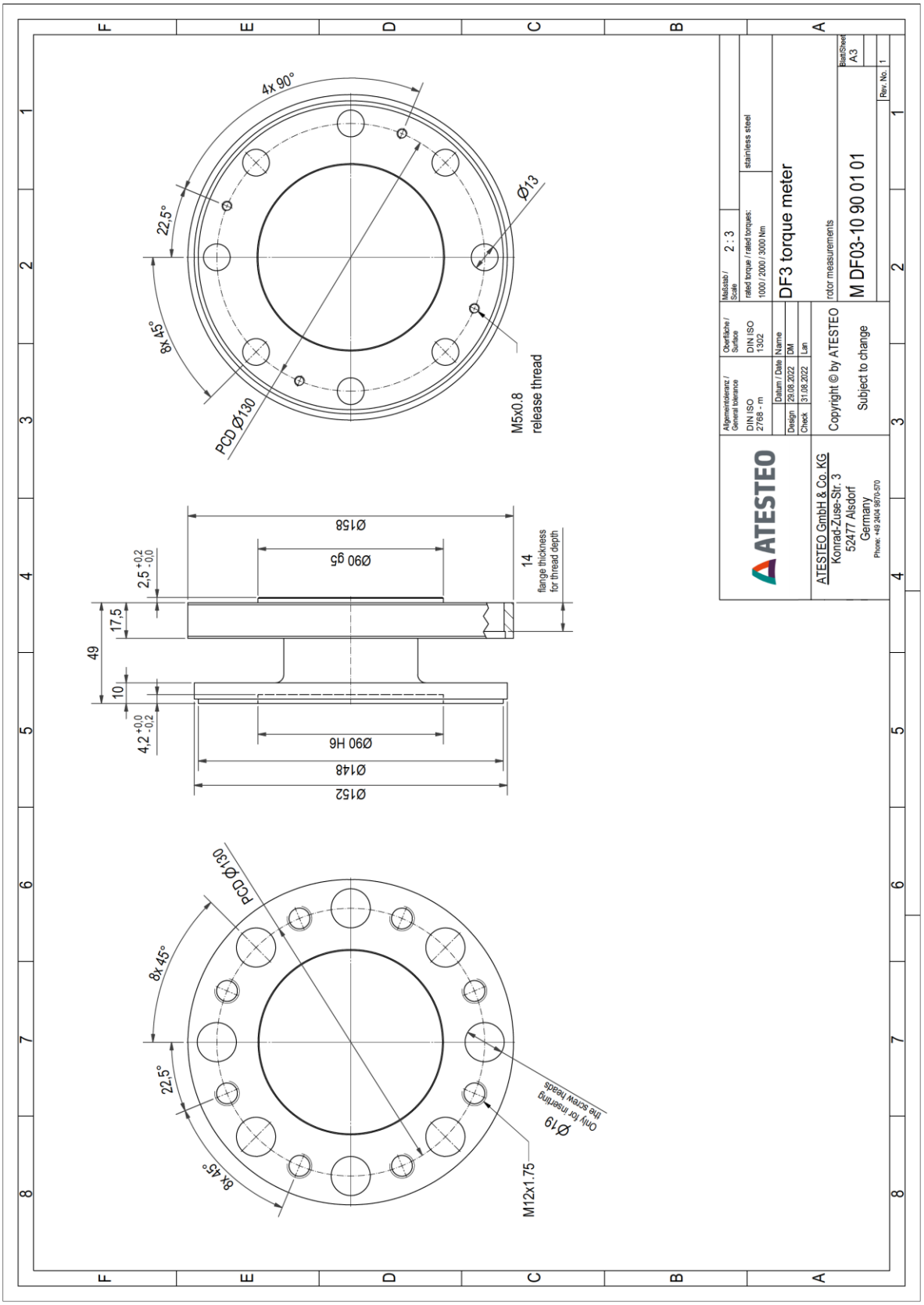
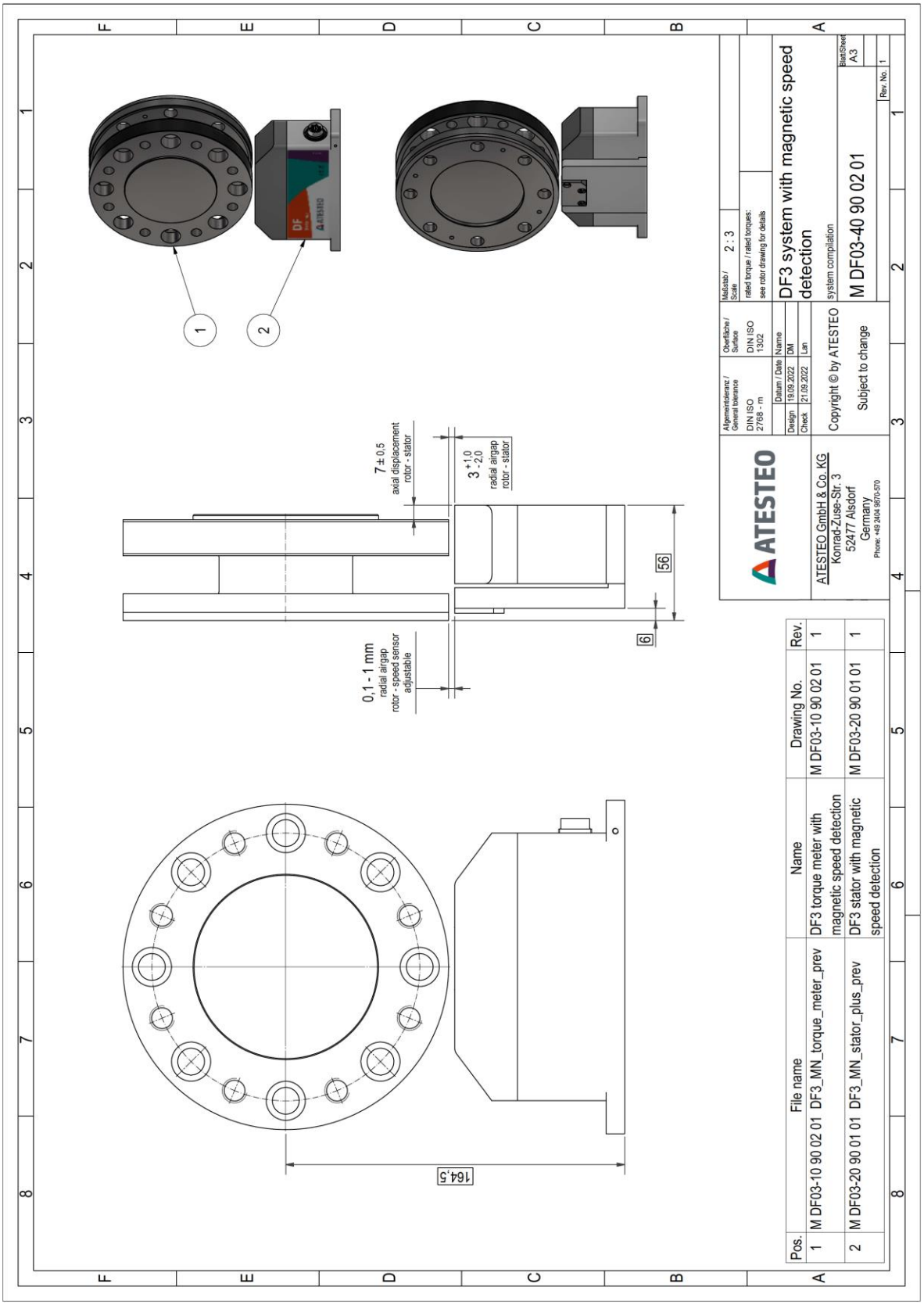


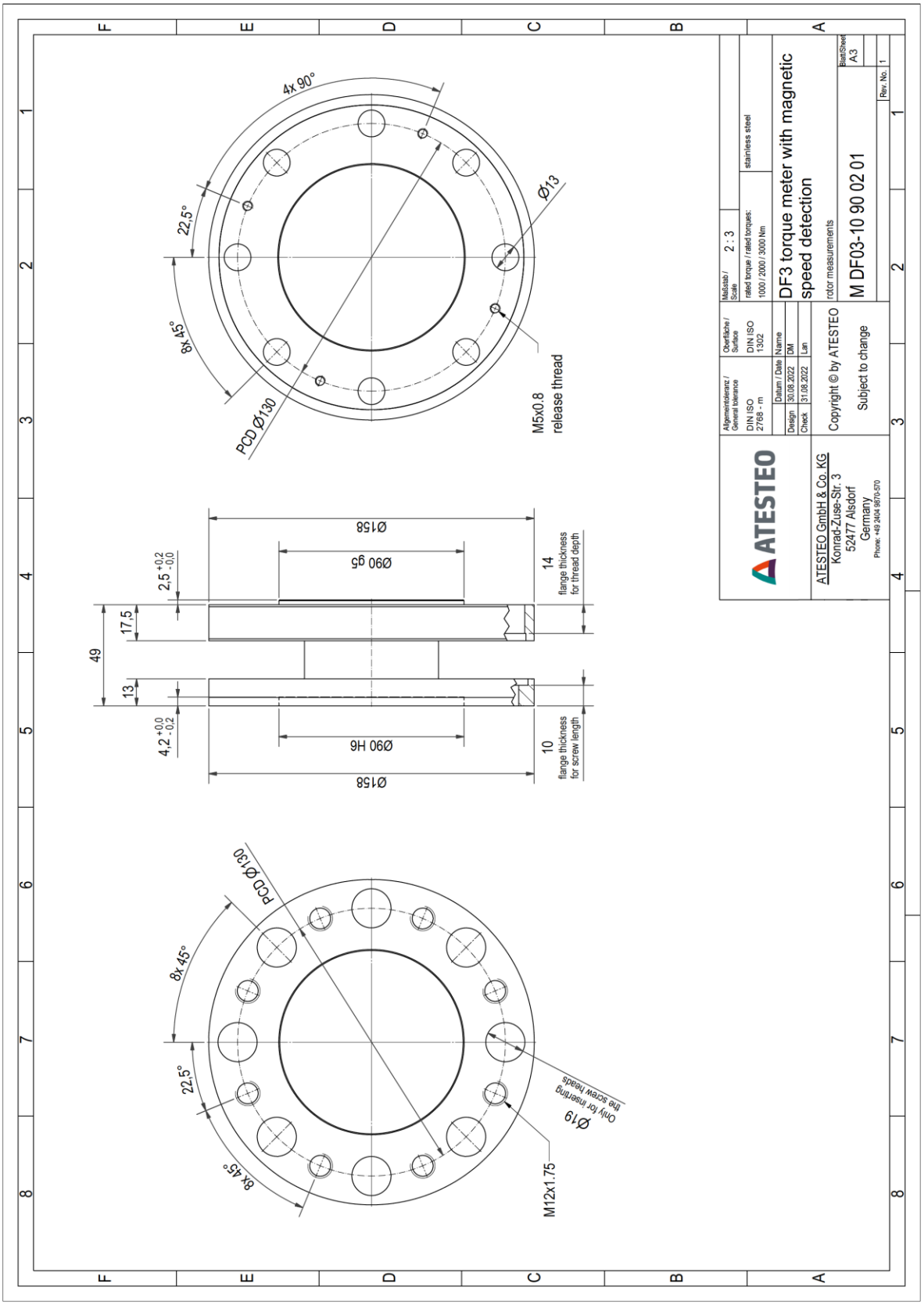
DF3 plus SPD_MGN System

Drawing



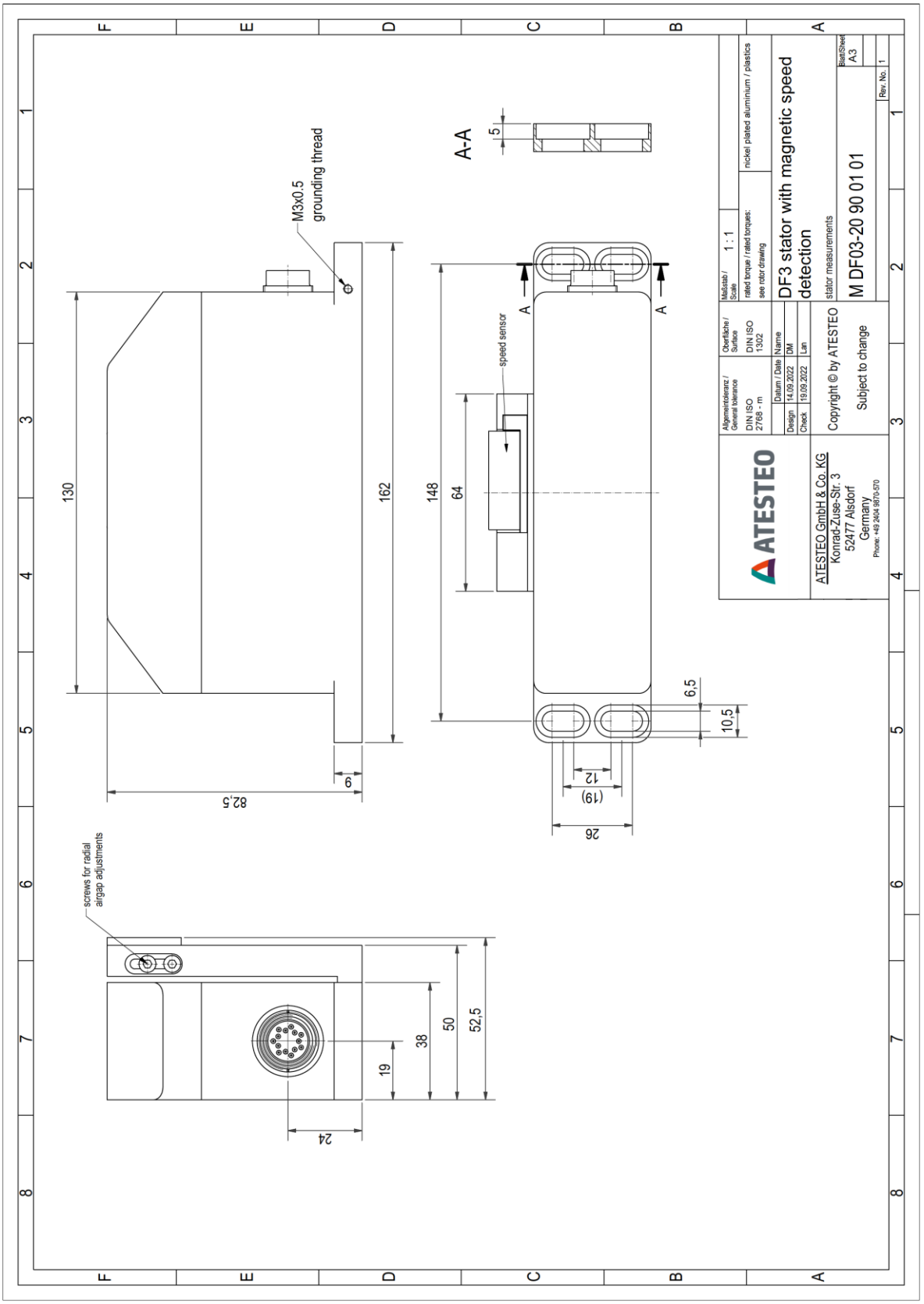
DF3 plus SPD_MGN
Rotor

Drawing



DF3 plus SPD_MGN
Stator

Drawing



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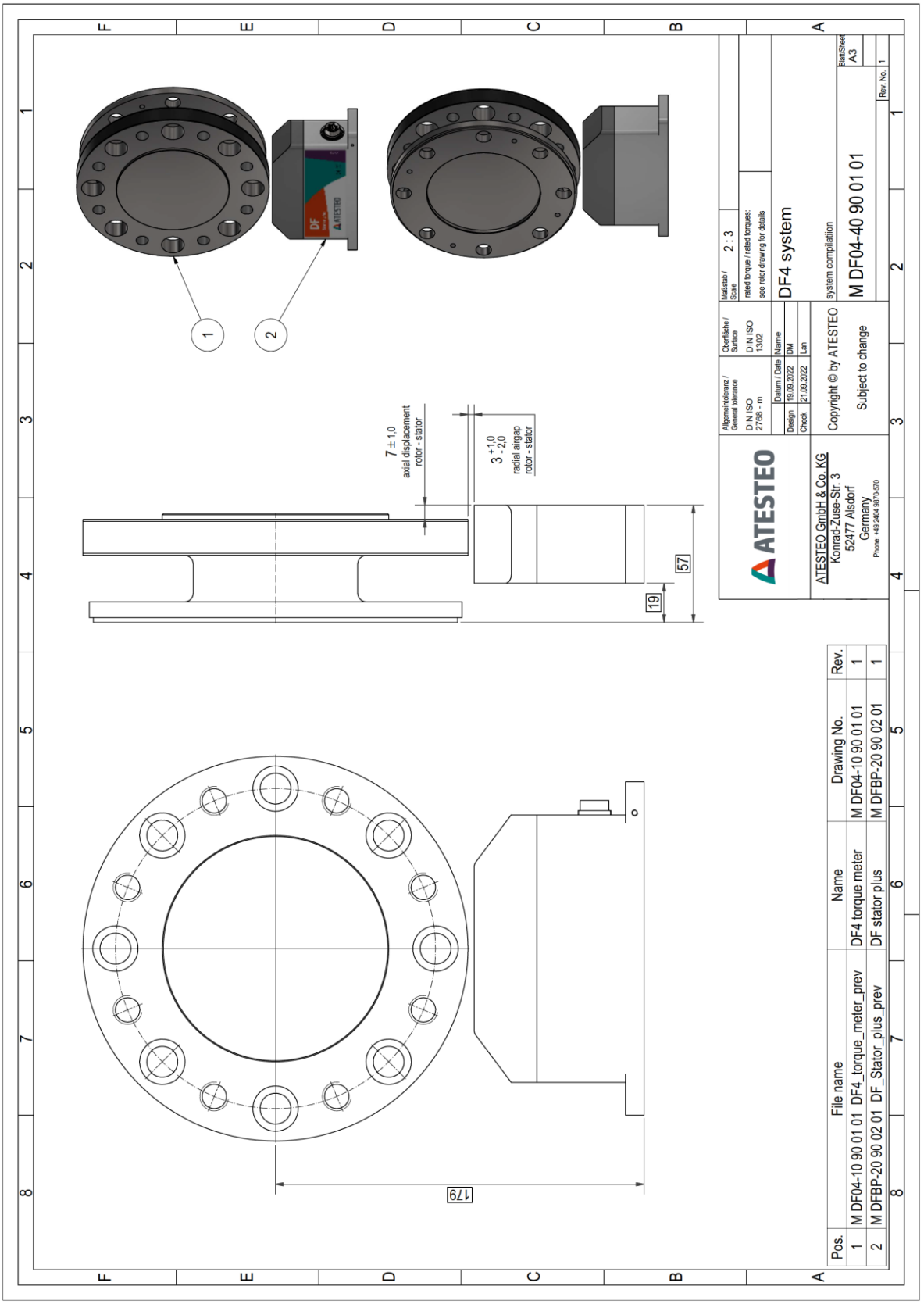

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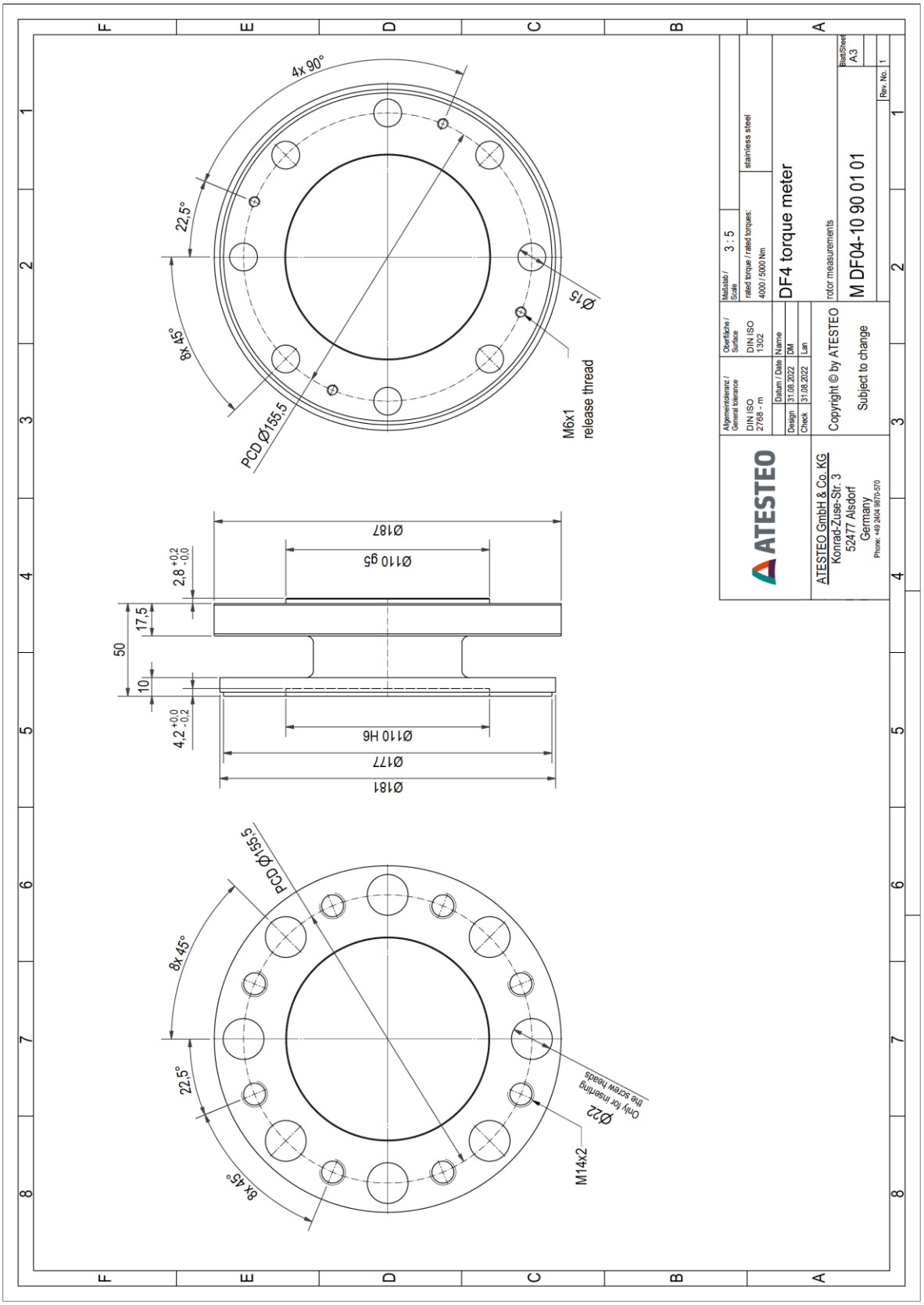
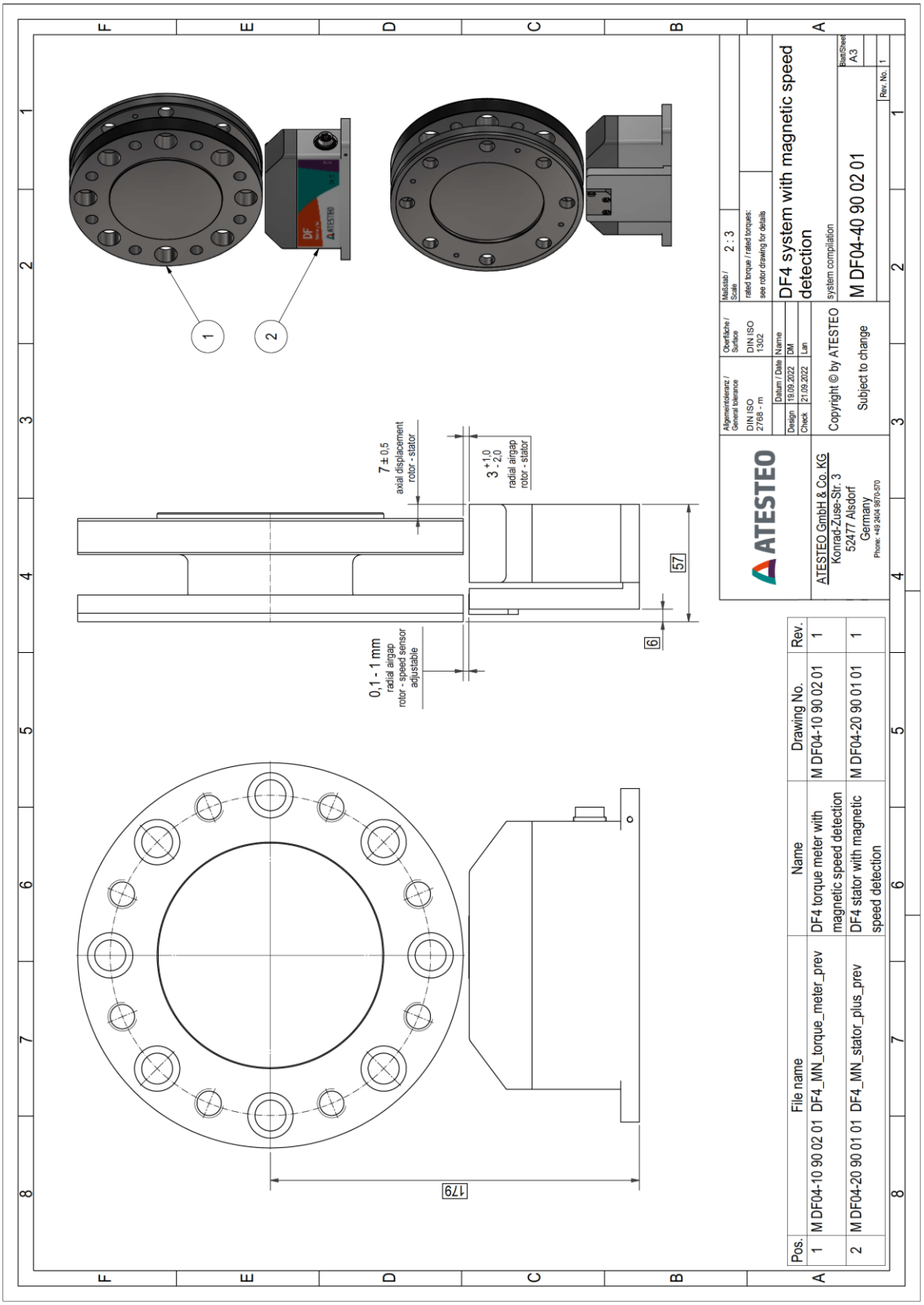


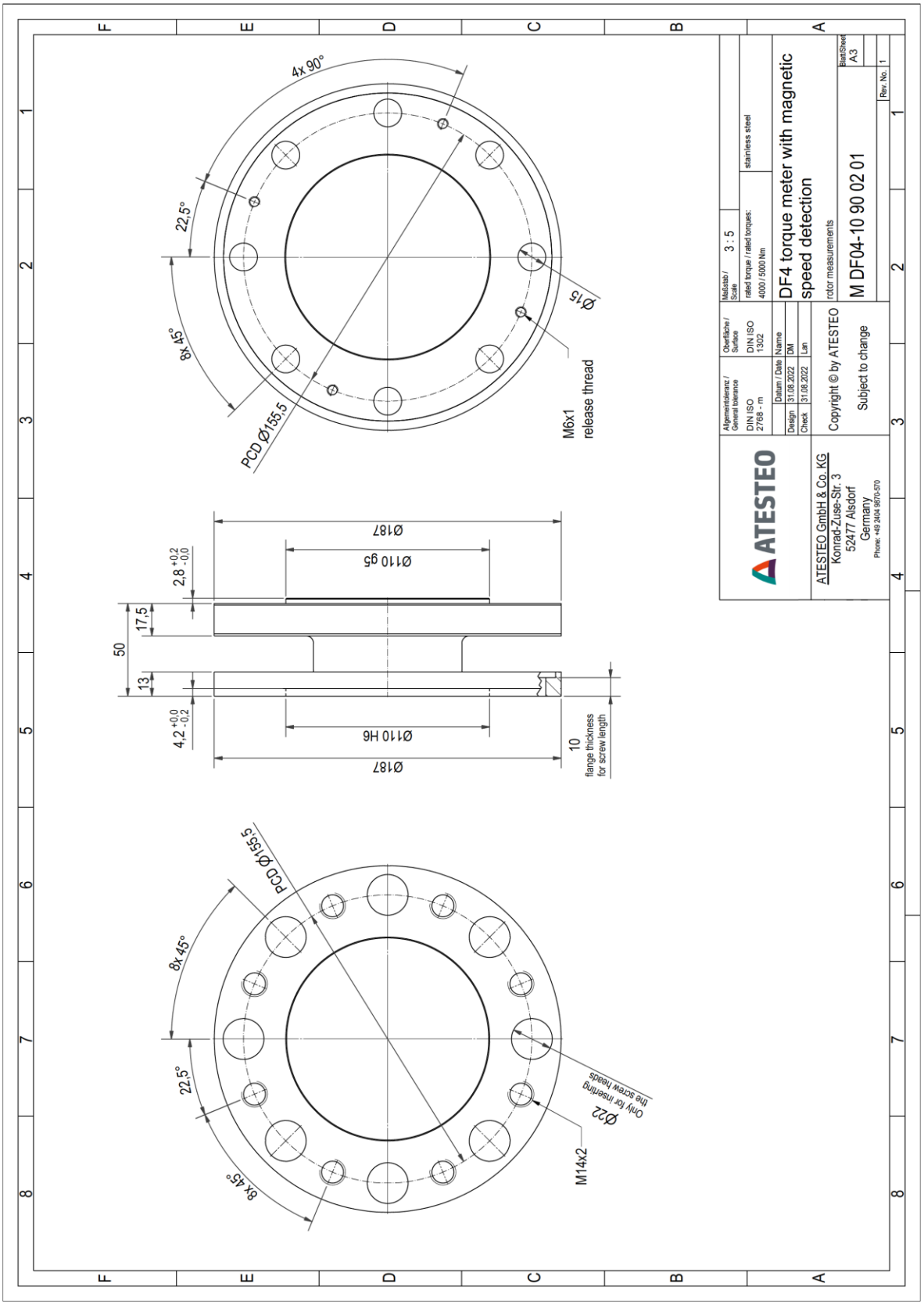
DF4 plus SPD_MGN System

Drawing



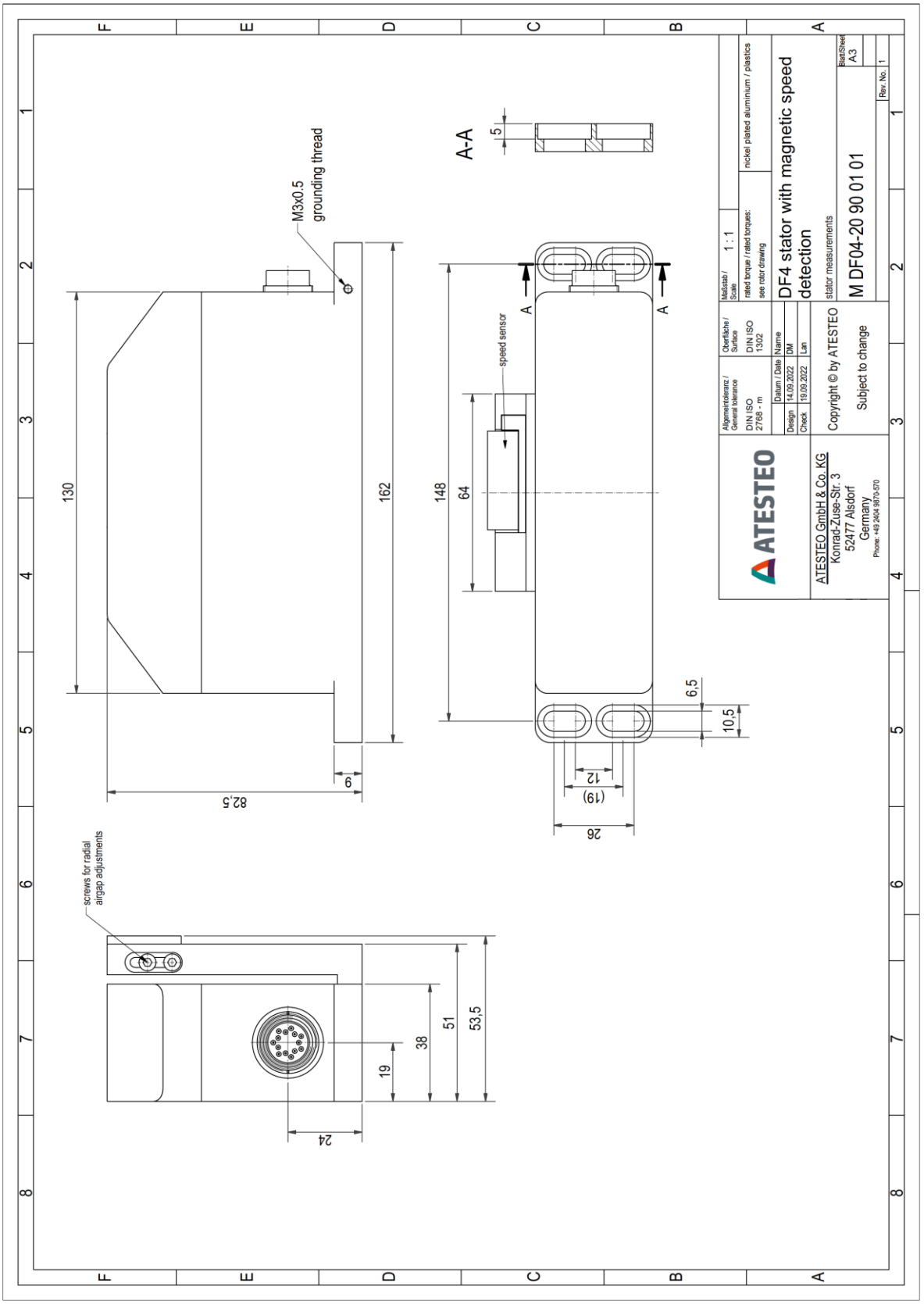
DF4 plus SPD_MGN
Rotor

Drawing



DF4 plus SPD_MGN
Stator

Drawing



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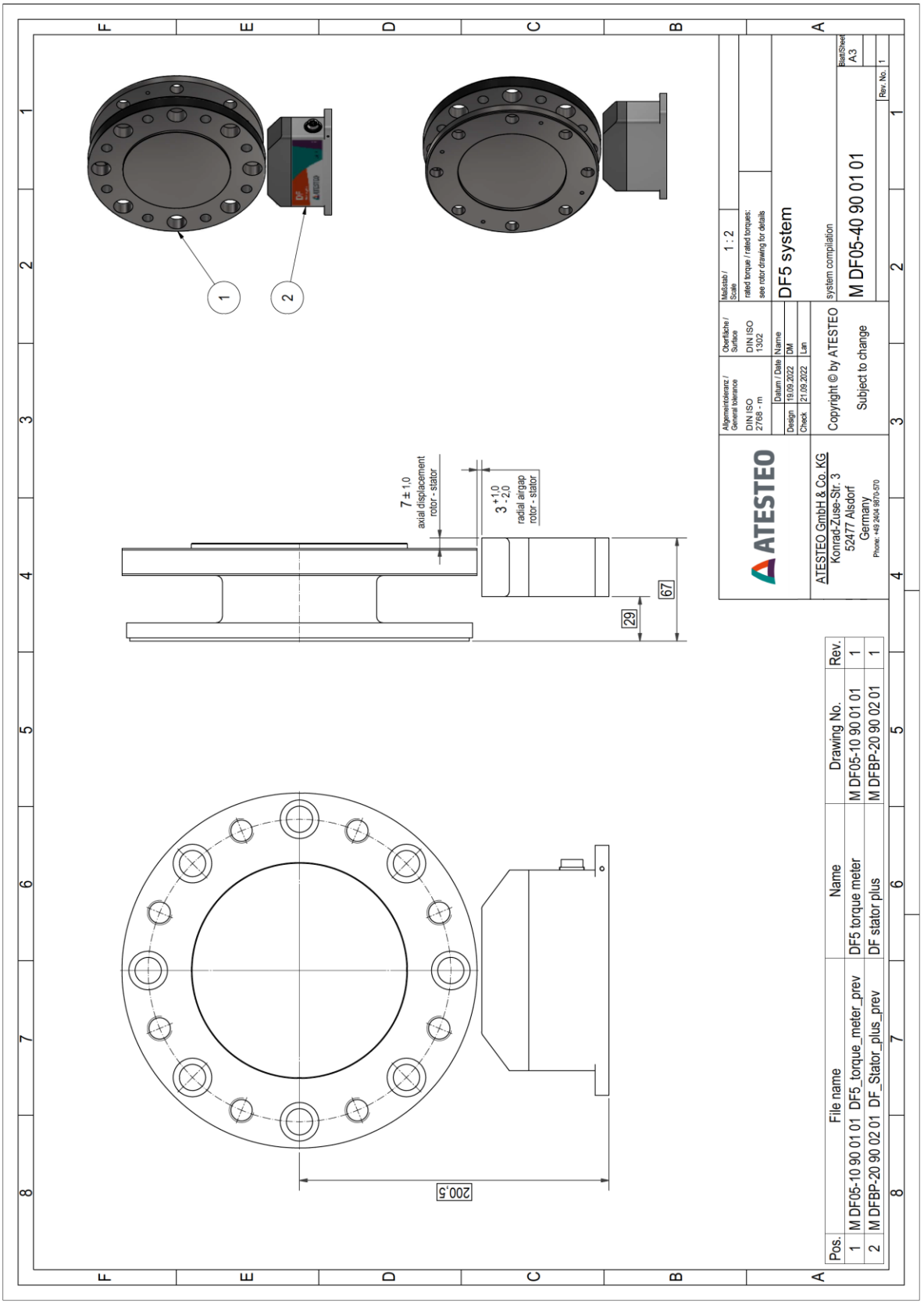
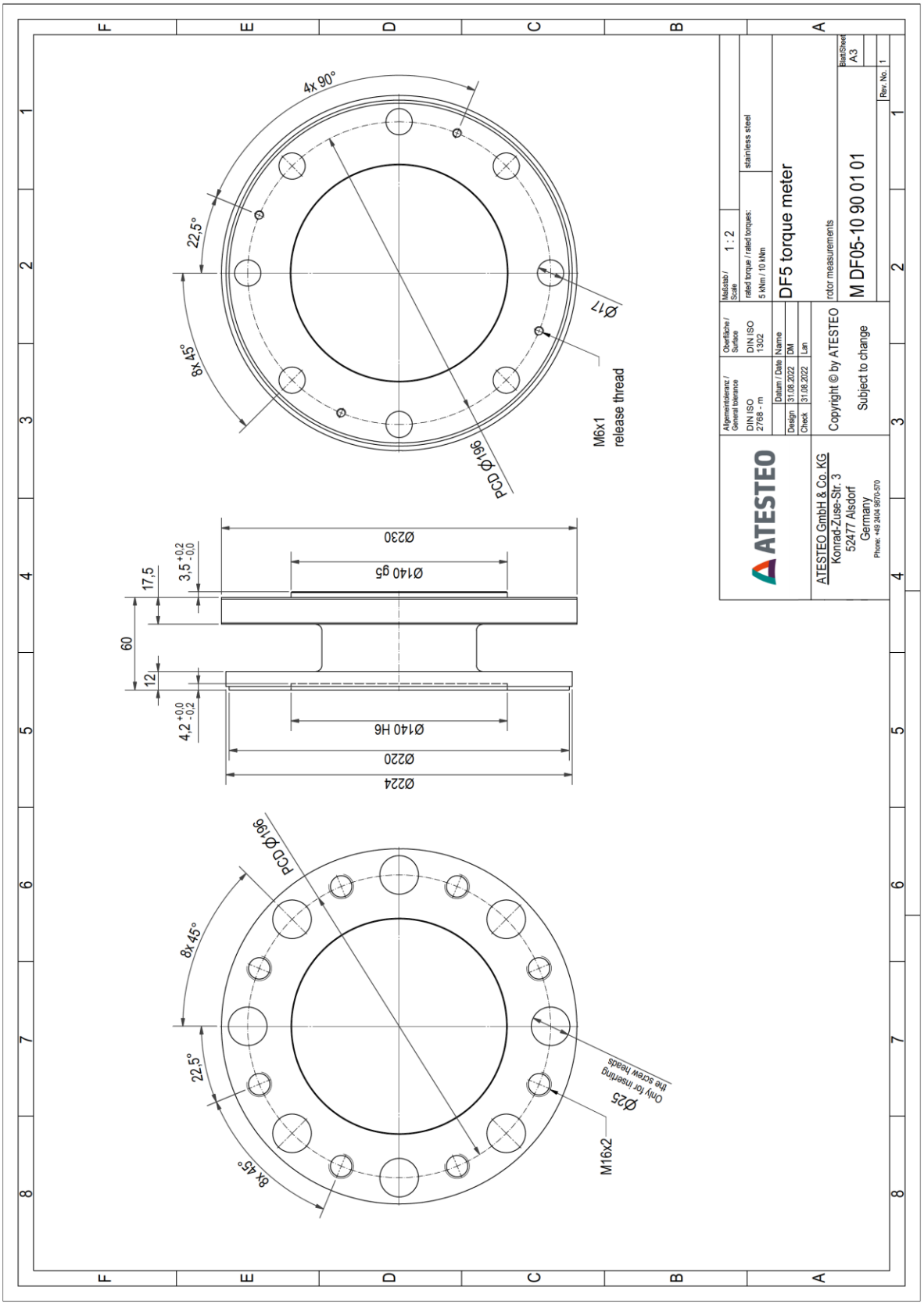
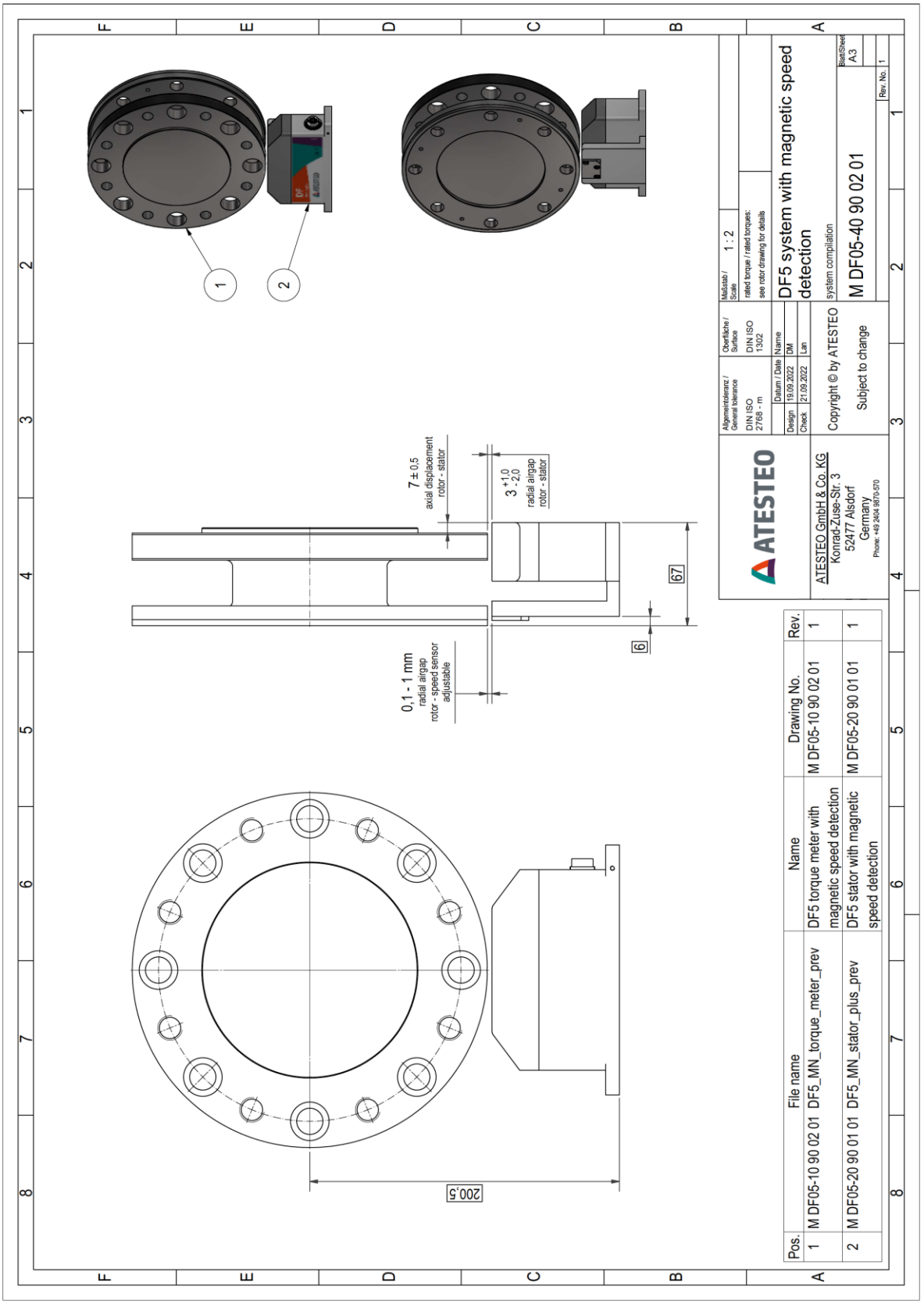


Drawing



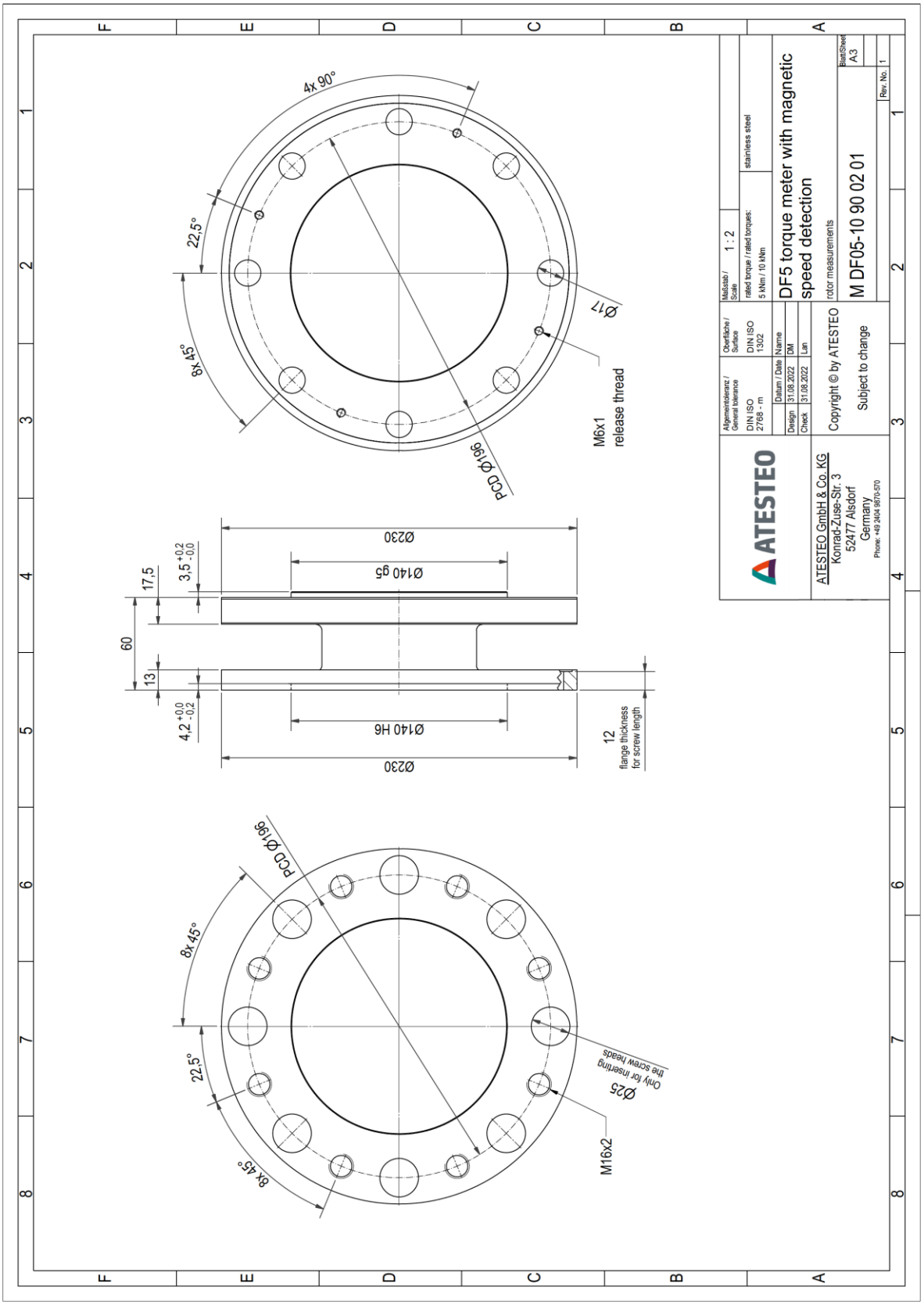
DF5 plus SPD_MGN System

Drawing



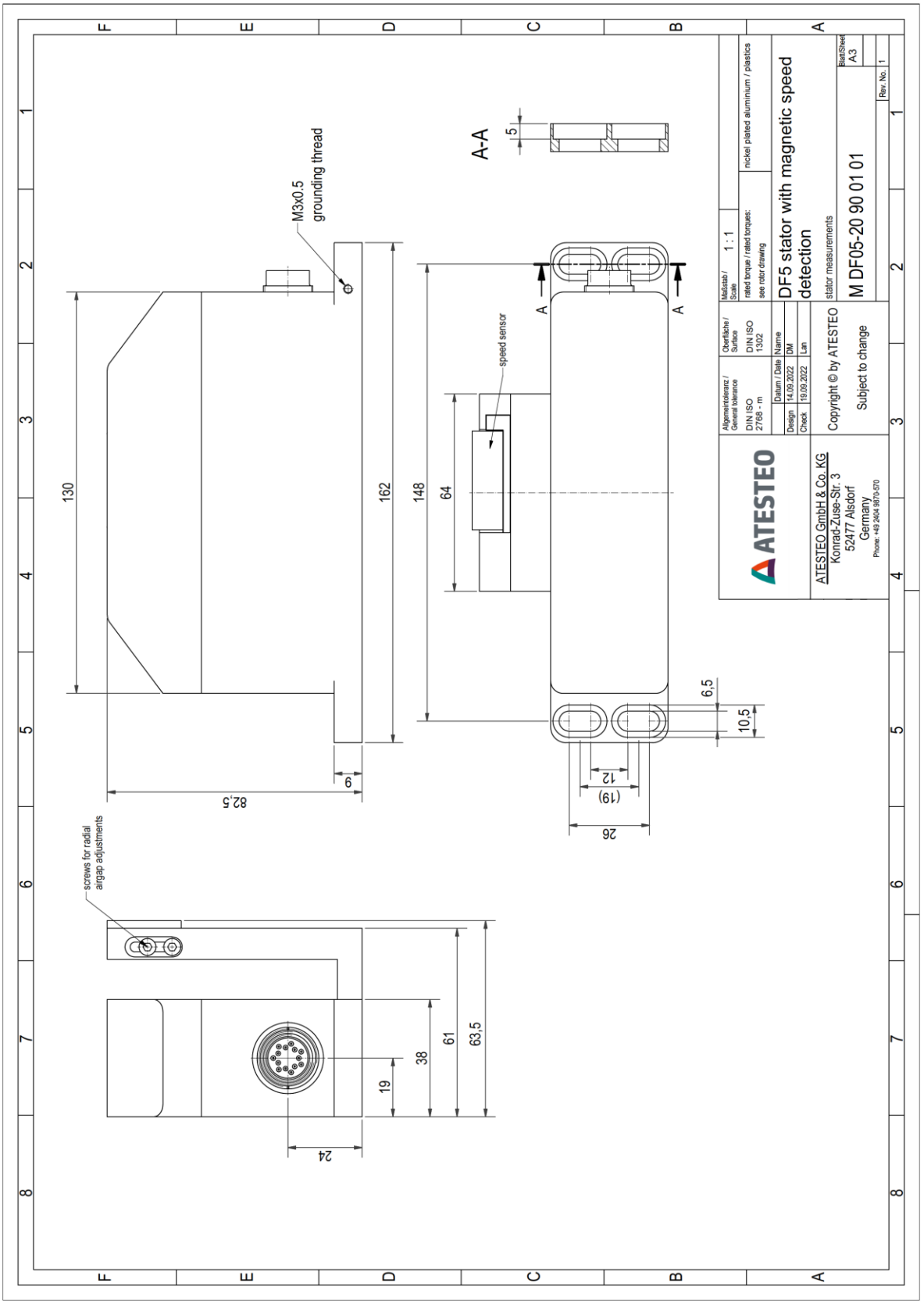
DF5 plus SPD_MGN
Rotor

Drawing

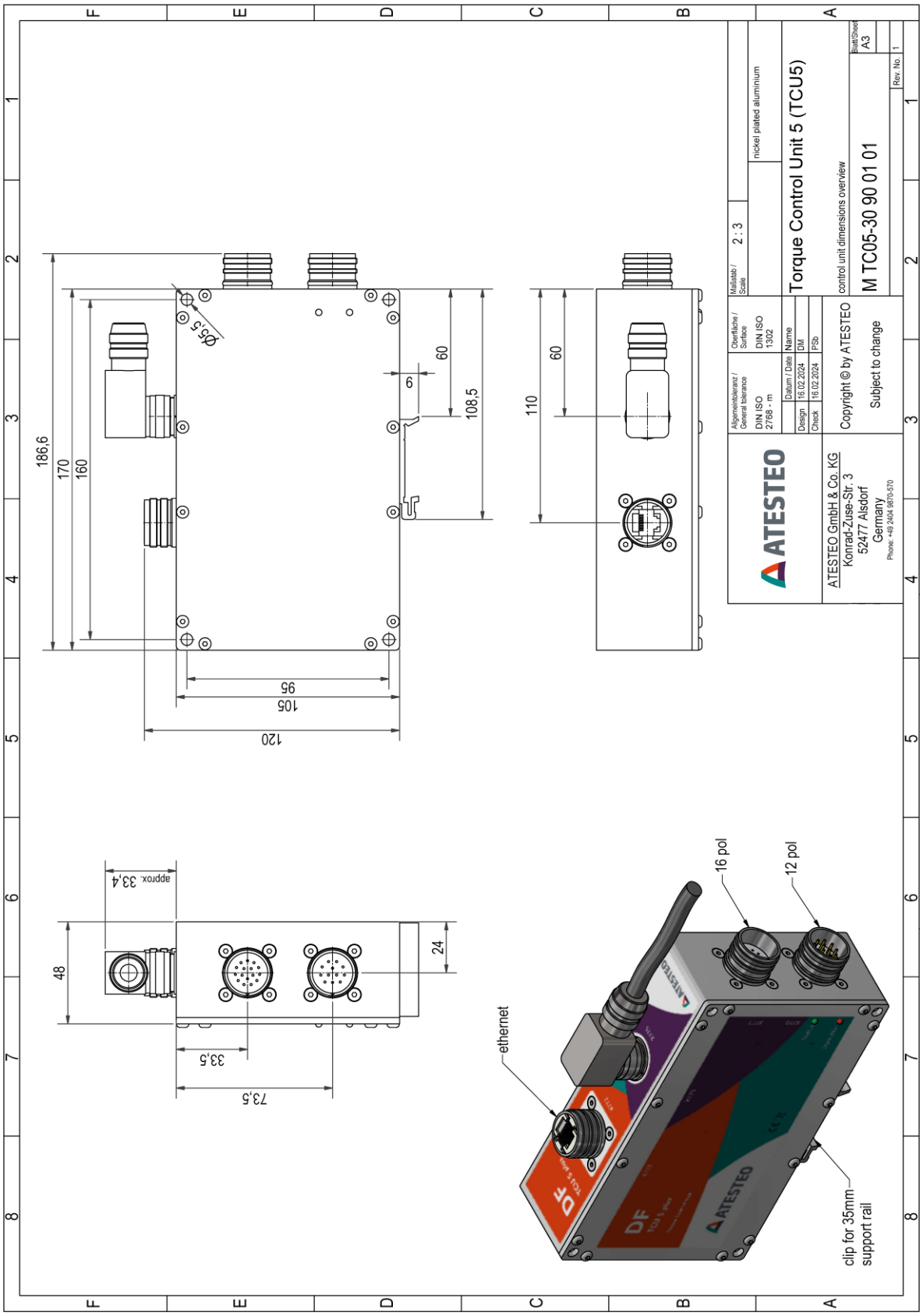


DF5 plus SPD_MGN
Stator

Drawing



Drawing



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