ALVA

REV.1.4 @ALVAINDUSTRIES

Product Catalog

SlimTorq™ Motors

Precision Torque Motors

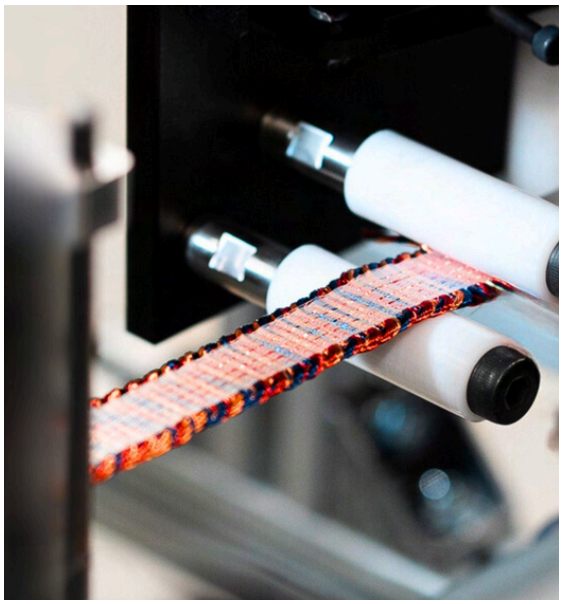
Contents

About Us

Purpose & mission

In Alva, we envision a world where everyone enjoys a high standard of living, made possible through universal access to energy and human-centered technology.

Our purpose is to create affordable, energy-efficient motors and generators that improve lives and protect the planet.



Safety & reliability by design

We direct our passion for electric solutions into every product & system that leaves our production facility. With complete control of the entire value chain, we monitor every component all the way from design to finished product, with full traceability along the way. We design our motors with safety & reliability as our leading design criteria. This way, you can focus on what really matters, & rest assured that your Alva system will perform in any & all conditions.

Our Origin

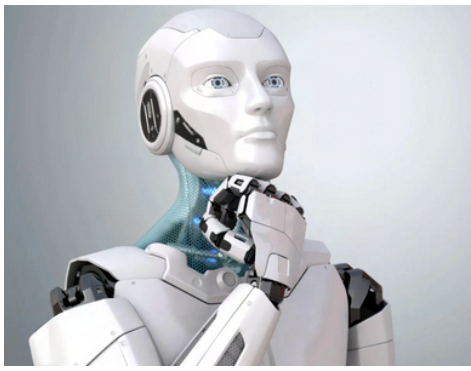
Alva was founded in 2017 in Trondheim, Norway, starting as a passion project in our CEO Jørgen Selnes' garage. What began as an idea to rethink electric motor technology has grown into a dedicated company focused on pushing the boundaries of what electric motors can achieve. With a strong foundation of innovation & collaboration, we continue to develop groundbreaking solutions that meet the evolving needs of various industries.

Industries & Applications

Powering the Future

At Alva, we're pioneering electrification with innovative motor technology, driving sustainable transformation in AUV, marine, & aerospace. With FiberPrinting™ technology, we engineer the reliability & efficiency to propel industries forward.





High Precision Gimbals

With Alva's FiberPrinted™ slotless motors the Size, Weight & Power of Gimbals can be drastically improved through high precision & high gravimetric torque density.

Medical Devices

The medical industry is advancing by utilizing robot solutions to rehabilitate & heal patients faster & in a less invasive manner. Alva's cogging free motors improve the precision of medical devices like surgical robotics & exoskeletons.

Marine Propulsion

FiberPrinted™ motors offer high efficiency, reliability, & a market-leading ID/OD ratio for marine propulsion systems, making them ideal for rim-drive thrusters in cleaning ROVs & long-range AUVs & UUVs, where minimal drag & low speed-dependent losses are critical.

Defense & SatCom

Alva motors designed for defense, satellite communication, reaction wheels, laser communication, & high-speed auxiliary power units, will offer precision, low cogging, lightweight designs, & low power usage for critical applications in dynamic environments.

Metrology

The physical world has become more digital than ever before. Almost all industries rely on measurement data, including manufacturing, construction, medical, & aerospace. To maximize efficiency & throughput within these industries, measurements are increasingly automated, & Alva's high-precision motors support this.

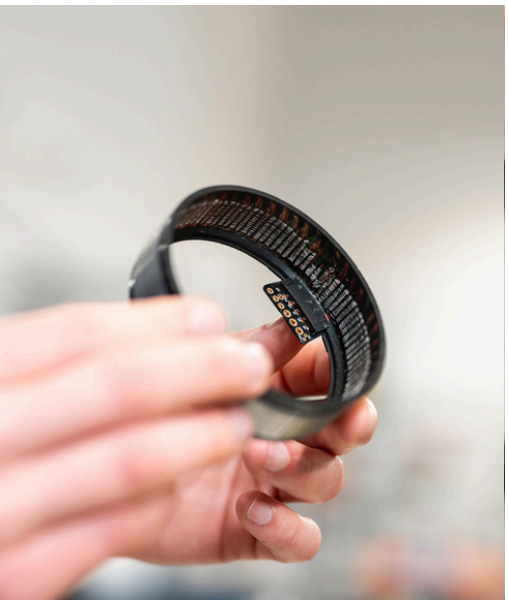
Semiconductor

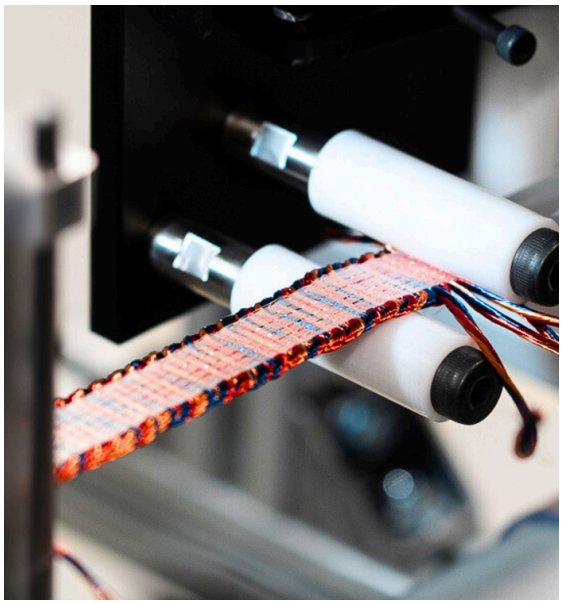
Alva Industries' FiberPrinted™ motors offer high torque density & virtually zero cogging, making them ideal for wafer handling robots in the semiconductor industry, where speed, precision, & compact design are essential.

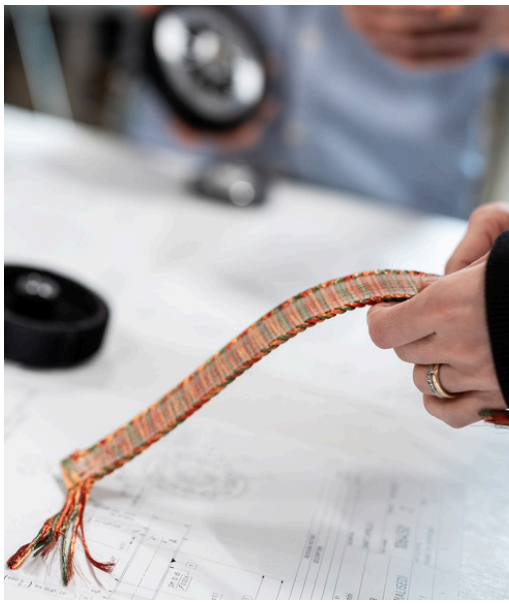
FiberPrinting™

A Patented Technology

Alva's next-gen electric motors are manufactured by our patented FiberPrinting™ technology. This groundbreaking & 6 times patented process enables us to rapidly design & manufacture ironless & slotless windings with high copper fill factor for any electric motor or generator, setting a new standard in precision, torque-density & adaptability.







The FiberPrinting™ Process

Alva's FiberPrinting™ revolutionizes stator windings for rotary, linear, and arc motors. With a 60% copper fill factor, it boosts efficiency, torque, and power. The process enables custom stators for precision & performance applications across industries like marine, medical, and aerospace.

- High Copper Fill: Maximizes power, reduces resistance.
- Custom Configurations: Rotary, linear, or arc.
- Non-Skewed Windings: Perfect magnetic alignment.

The Advantage

Alva's next-generation electric motors are powered by FiberPrinting™, our six-time patented technology. This never before seen method allows us to design & produce ironless, slotless windings with unmatched precision & torque density. With a high copper fill factor, custom shapes, & non-skewed windings, FiberPrinting™ pushes the limits of electric motor performance - delivering higher power, efficiency, & reliability for any application.

SlimTorq™ Motors

Configured To Your Needs

The SlimTorq™ motors can easily be configured to meet the distinct requirements of your application. Check out the Product Selector to simplify the configuration process.

Cable Options

The cables can be configured in terms of gauge & insulation type. Default type (A) is a UL certified cable with PTFE wire insulation.

Sensor Options

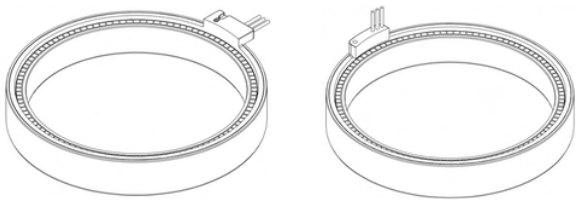
The motors can be equipped with both a temperature sensor & a hall-effect sensor. The default temp sensor (A) is a 10K NTC with a B25/100 value of 3492 ±1% K (TDK B57541G1103+000).

Winding Options

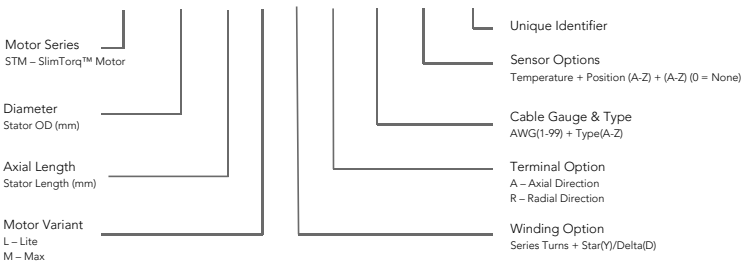
The stators can be configured to meet the speed requirements of your applications. Both the number of turns & star/delta connection type can be configured.

Terminal area options

The terminal area of the frameless motors and the wires exiting the terminal area can exit in two different directions.



STM-130-27-L-4Y-A-000-00-000



	Motor	Motor constant [Nm/√W]	Continuous torque [Nm]	Rated voltage [V]	Stator OD [mm]	Axial length [mm]	Rotor ID [mm]	Total mass [g]
SlimTorq™ Lite	75-20-L	0.134	0.679	72	75	20	61	122.2
	85-24-L	0.187	1.067	72	85	24	69	196.4
	105-17-L	0.213	1.216	72	105	17	89	173.6
	130-27-L	0.296	2.190	72	130	27	112	328.0
SlimTorq™ Max	39-10-M	0.0204	0.057	72	39	10	25	27.5
	51-12-M	0.0418	0.140	72	51	12	37	43.7
	75-20-M	0.183	0.940	72	75	20	53	204.9
	85-24-M	0.250	1.435	72	85	24	64	287.7
	105-17-M	0.259	1.480	72	105	17	84	248.3
	130-27-M	0.507	3.785	72	130	27	107	468.0

SlimTorq™ Motors

Precision & Performance Unified

SlimTorq™ is a slotless thin-section frameless motor series for high-precision applications. The SlimTorq™ motor series has zero cogging, high torque density, no saturation & large through-hole.

-50%
Lower Mass.

Zero
Cogging Torque.

+100%
Higher Torque Density.

Large through-hole
Easy integration in application & compact design.

FiberPrinted™ Stator
High copper fill factor ensures maximum performance.

Halbach Rotor
Maximises the magnetic field density

Performance

Alva's proprietary manufacturing technology allows for maximised copper fill factor & non-skewed stator windings, which result in a motor-constant & torque-density rivalling even the best slotted motors.

Light & Compact

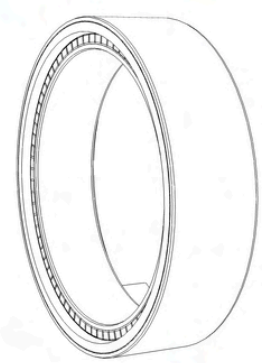
The removal of the iron-teeth in the SlimTorq™ motors result in a stator & rotor that's astonishingly thin & light. The motors feature a large through-hole that allows for design of incredible compact actuators.

Precision

SlimTorq™ torque motors are slotless & therefore has virtually zero cogging torque & minor torque ripple. Making them the perfect choice for high-precision applications that also require high-performance.

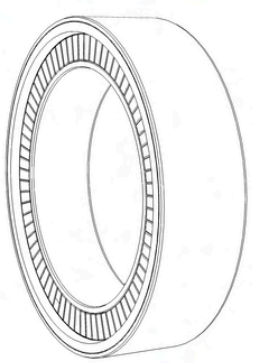
Lightweight

Large ID



High Motor Constant

High Conti. Torque



SlimTorq™ Lite

The Lite version is designed & optimised to be as light as possible while sustaining a high torque-density. It's a good choice for weight sensitive applications. It allows has the added value of a large through-hole to simply mechanical integration.

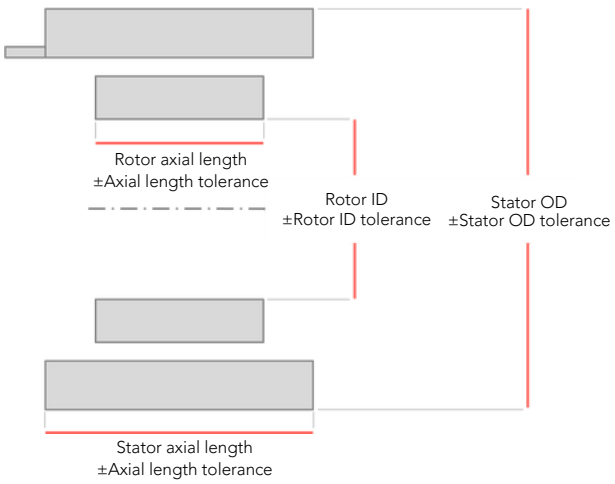
SlimTorq™ Max

The Max version is designed & optimised for maximum performance i.e. as high as possible torque and motor-constant that the space envelope allows. It's a good choice for applications that require the maximum performance in combination of compactness.

SlimTorq™ 39-10

PROPERTY	UNIT	STM-39-10-M			
Motor type	—	Max			
Winding type	—	2D	2Y	4D	4Y
PERFORMANCE					
Motor constant	Nm/√W	0.0204			
Max continuous torque [1]	Nm	0.0568			
Peak torque, 1 s [2]	Nm	0.371			
Peak torque, 3 s [2]	Nm	0.230			
Peak torque, 5 s [2]	Nm	0.195			
Cogging torque	Nm	0.000			
Max continuous current [1]	A	5.20	2.54	2.59	1.26
Peak current, 1 s [2]	A	55.5	32.0	27.7	16.0
Peak current, 3 s [2]	A	34.5	19.9	17.2	9.96
Peak current, 5 s [2]	A	29.4	16.9	14.7	8.47
Max speed at max voltage [5]	RPM	10000	10000	10000	10000
ELECTRICAL					
Torque constant [3]	Nm/Arms	0.007	0.012	0.014	0.025
Voltage constant [3]	V/kRPM	0.604	1.050	1.210	2.110
Line to line resistance [3]	Ohm	0.081	0.242	0.323	0.969
Line to line inductance [3]	µH	0.536	1.610	2.140	6.430
Electrical time constant	µs	6.64			
Spatial harmonic torque ripple	%	0.36			

PROPERTY	UNIT	STM-39-10-M
Rated voltage	V	72
Poles	—	26
Thermal resistance	C/W	19.3
Max stator temperature	°C	140
Max rotor temperature	°C	85
MECHANICAL		
Stator outer diameter (OD)	mm	39
Stator OD tolerance	mm	h9
Rotor inner diameter (ID)	mm	25
Rotor ID tolerance	mm	H9
Stator axial length	mm	10
Stator axial length tolerance	mm	+/- 0.2
Rotor axial length	mm	6.84
Rotor axial length tolerance	mm	+/- 0.2
Rotational inertia	gcm^2	33.9
Stator mass [4]	g	12.8
Rotor mass	g	14.7
Total mass [4]	g	27.5
Power cable length	mm	500
Power cable size	—	AWG26
ENVIRONMENTAL		
Minimum ambient temperature	°C	-30
Maximum ambient temperature	°C	80
Ambient conditions	°C	20



[1]Housing without fins, 5 m/s airflow, 25°C ambient temp. [2]Winding temperature increases from 30 °C to 140 °C. [3]Windings at 20 °C & w/o AC cables.

[4]W/o AC cables. [5]Lowest of max mechanical speed & max electrical speed @rated voltage

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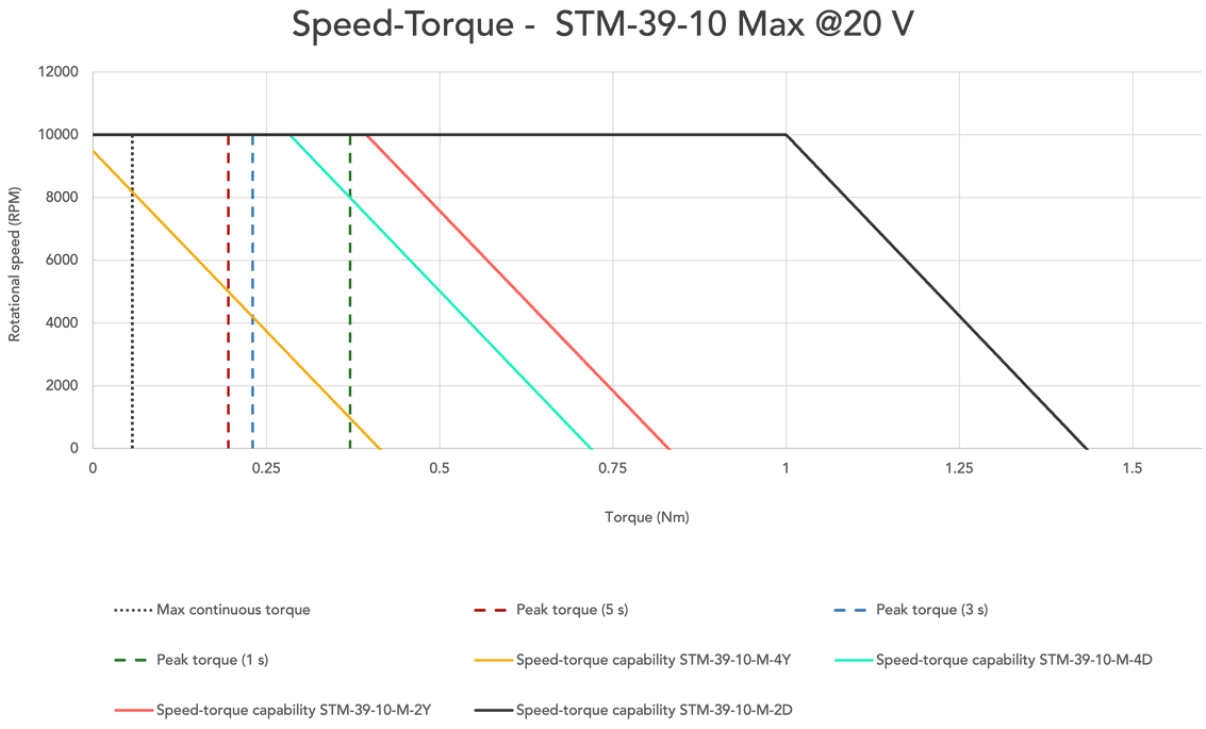
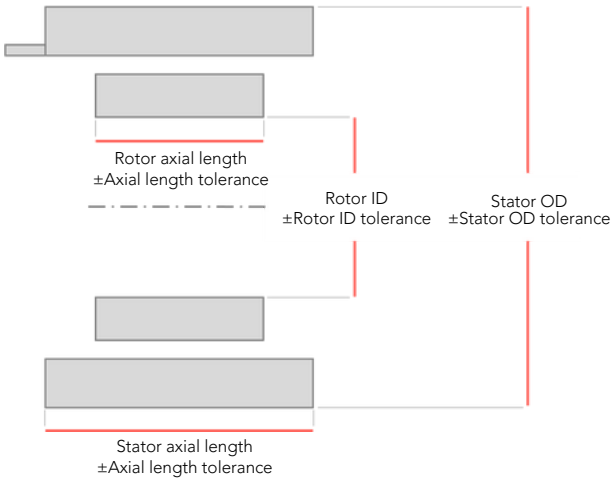

Speed-Torque - STM-39-10 Max @20 V
Rotational speed (RPM)
12000
10000
8000
6000
4000
2000
0
0
0.25
0.5
0.75
1
1.25
1.5
Torque (Nm)
Max continuous torque
Peak torque (5 s)
Peak torque (3 s)
Peak torque (1 s)
Speed-torque capability STM-39-10-M-4Y
Speed-torque capability STM-39-10-M-4D
Speed-torque capability STM-39-10-M-2Y
Speed-torque capability STM-39-10-M-2D

SlimTorq™ 51-12

PROPERTY	UNIT	STM-51-12-M					
Motor type	—	Max					
Winding type	—	2D	2Y	4D	4Y	8D	8Y
PERFORMANCE							
Motor constant	Nm/√W	0.0418					
Max continuous torque [1]	Nm	0.140					
Peak torque, 1 s [2]	Nm	1.040					
Peak torque, 3 s [2]	Nm	0.647					
Peak torque, 5 s [2]	Nm	0.550					
Cogging torque	Nm	0.000					
Max continuous current [1]	A	7.5	3.97	3.74	2.00	1.87	1.01
Peak current, 1 s [2]	A	82.6	47.7	41.3	23.8	20.6	11.9
Peak current, 3 s [2]	A	51.3	29.6	25.7	14.8	12.8	7.41
Peak current, 5 s [2]	A	43.7	25.2	21.8	12.6	10.9	6.3
Max speed at max voltage [5]	RPM	10000	10000	10000	10000	10000	9390
ELECTRICAL							
Torque constant [3]	Nm/Arms	0.013	0.022	0.026	0.045	0.052	0.089
Voltage constant [3]	V/kRPM	1.100	1.920	2.200	3.830	4.400	7.660
Line to line resistance [3]	Ohm	0.064	0.191	0.254	0.763	1.020	3.050
Line to line inductance [3]	µH	0.745	2.24	2.98	8.95	11.90	35.80
Electrical time constant	µs	11.7					
Spatial harmonic torque ripple	%	0.75					

PROPERTY	UNIT	STM-51-12-M
Rated voltage	V	72
Poles	—	36
Thermal resistance	C/W	12.5
Max stator temperature	°C	140
Max rotor temperature	°C	85
MECHANICAL		
Stator outer diameter (OD)	mm	51
Stator OD tolerance	mm	h9
Rotor inner diameter (ID)	mm	37
Rotor ID tolerance	mm	H9
Stator axial length	mm	12
Stator axial length tolerance	mm	+/- 0.2
Rotor axial length	mm	9.4
Rotor axial length tolerance	mm	+/- 0.2
Rotational inertia	gcm^2	105
Stator mass [4]	g	20.1
Rotor mass	g	23.6
Total mass [4]	g	43.7
Power cable length	mm	500
Power cable size	—	AWG24
ENVIRONMENTAL		
Minimum ambient temperature	°C	-30
Maximum ambient temperature	°C	80
Ambient conditions	°C	20



[1]Housing without fins, 5 m/s airflow, 25°C ambient temp. [2]Winding temperature increases from 30 °C to 140 °C. [3]Windings at 20 °C & w/o AC cables.

[4]W/o AC cables. [5]Lowest of max mechanical speed & max electrical speed @rated voltage

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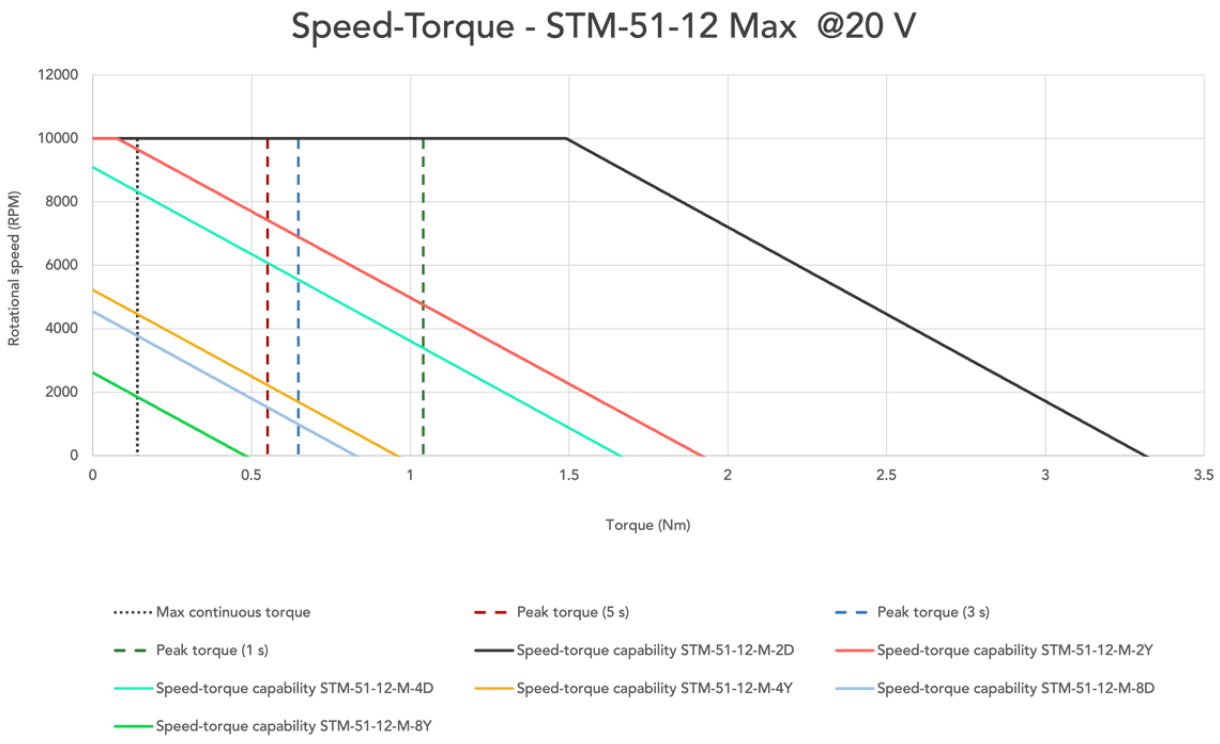
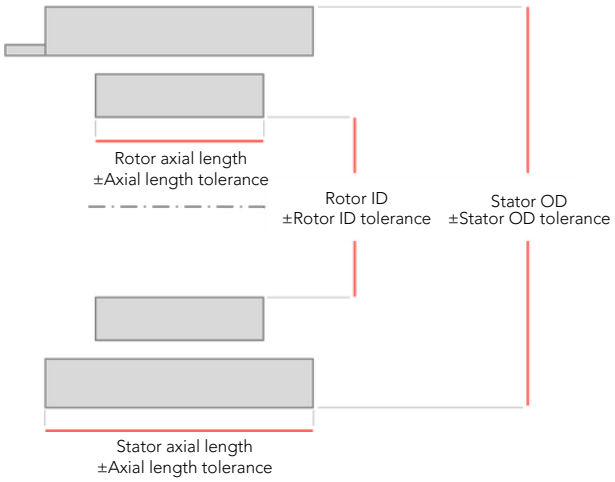

Speed-Torque - STM-51-12 Max @20 V
Rotational speed (RPM)
12000
10000
8000
6000
4000
2000
0
0
0.5
1
1.5
2
2.5
3
3.5
Torque (Nm)
Max continuous torque
Peak torque (5 s)
Peak torque (3 s)
Peak torque (1 s)
Speed-torque capability STM-51-12-M-2D
Speed-torque capability STM-51-12-M-2Y
Speed-torque capability STM-51-12-M-4D
Speed-torque capability STM-51-12-M-4Y
Speed-torque capability STM-51-12-M-8D
Speed-torque capability STM-51-12-M-8Y

SlimTorq™ 75-20

PROPERTY	UNIT	STM-75-20-L						STM-75-20-M					
Motor type	—	Lite						Max					
Winding type	—	2D	2Y	4D	4Y	8D	8Y	2D	2Y	4D	4Y	8D	8Y
PERFORMANCE													
Motor constant	Nm/√W	0.134						0.183					
Max continuous torque [1]	Nm	0.679						0.940					
Peak torque, 1 s [2]	Nm	6.41						8.79					
Peak torque, 3 s [2]	Nm	3.88						5.32					
Peak torque, 5 s [2]	Nm	3.21						4.39					
Cogging torque	Nm	0.000						0.000					
Max continuous current [1]	A	15.0	8.53	7.51	4.28	3.76	2.15	15.0	8.49	7.49	4.26	3.75	2.14
Peak current, 1 s [2]	A	198	115	99.2	57.3	49.6	23.4	198	115	99.2	57.3	49.6	23.2
Peak current, 3 s [2]	A	120	69.4	60.1	34.7	30.0	17.3	120	69.4	60.1	34.7	30	17.3
Peak current, 5 s [2]	A	99.2	57.3	49.6	28.6	24.8	14.3	99.2	57.3	49.6	28.6	24.8	14.3
Max speed at max voltage [5]	RPM	8400	8400	8400	7450	6530	3730	4800	4800	4800	4800	4760	2720
ELECTRICAL													
Torque constant [3]	Nm/Arms	0.032	0.056	0.065	0.112	0.130	0.225	0.044	0.077	0.089	0.154	0.178	0.308
Voltage constant [3]	V/kRPM	2.76	4.83	5.51	9.66	11.0	19.3	3.79	6.61	7.57	13.2	15.1	26.4
Line to line resistance [3]	Ohm	0.039	0.118	0.157	0.47	0.627	1.88	0.039	0.118	0.157	0.47	0.627	1.88
Line to line inductance [3]	µH	1.23	3.70	4.93	14.8	19.7	59.2	1.23	3.70	4.93	14.8	19.7	59.2
Electrical time constant	µs	31.5											
Spatial harmonic torque ripple	%	0.57						0.40					

PROPERTY	UNIT	STM-75-20-L	STM-75-20-M
Rated voltage	V	72	
Poles	—	36	
Thermal resistance	C/W	5.95	
Max stator temperature	°C	140	
Max rotor temperature	°C	85	
MECHANICAL			
Stator outer diameter (OD)	mm	75	75
Stator OD tolerance	mm	h9	h9
Rotor inner diameter (ID)	mm	61	53
Rotor ID tolerance	mm	H9	H9
Stator axial length	mm	20	20
Stator axial length tolerance	mm	+/- 0.2	+/- 0.2
Rotor axial length	mm	15.7	15.7
Rotor axial length tolerance	mm	+/- 0.2	+/- 0.2
Rotational inertia	gcm^2	622	1350
Stator mass [4]	g	63.9	63.9
Rotor mass	g	58.3	141
Total mass [4]	g	122.2	204.9
Power cable length	mm	500	500
Power cable size	—	AWG24	AWG24
ENVIRONMENTAL			
Minimum ambient temperature	°C	-30	
Maximum ambient temperature	°C	80	
Ambient conditions	°C	20	



[1]Housing without fins, 5 m/s airflow, 25°C ambient temp. [2]Winding temperature increases from 30 °C to 140 °C. [3]Windings at 20 °C & w/o AC cables.

[4]W/o AC cables. [5]Lowest of max mechanical speed & max electrical speed @rated voltage

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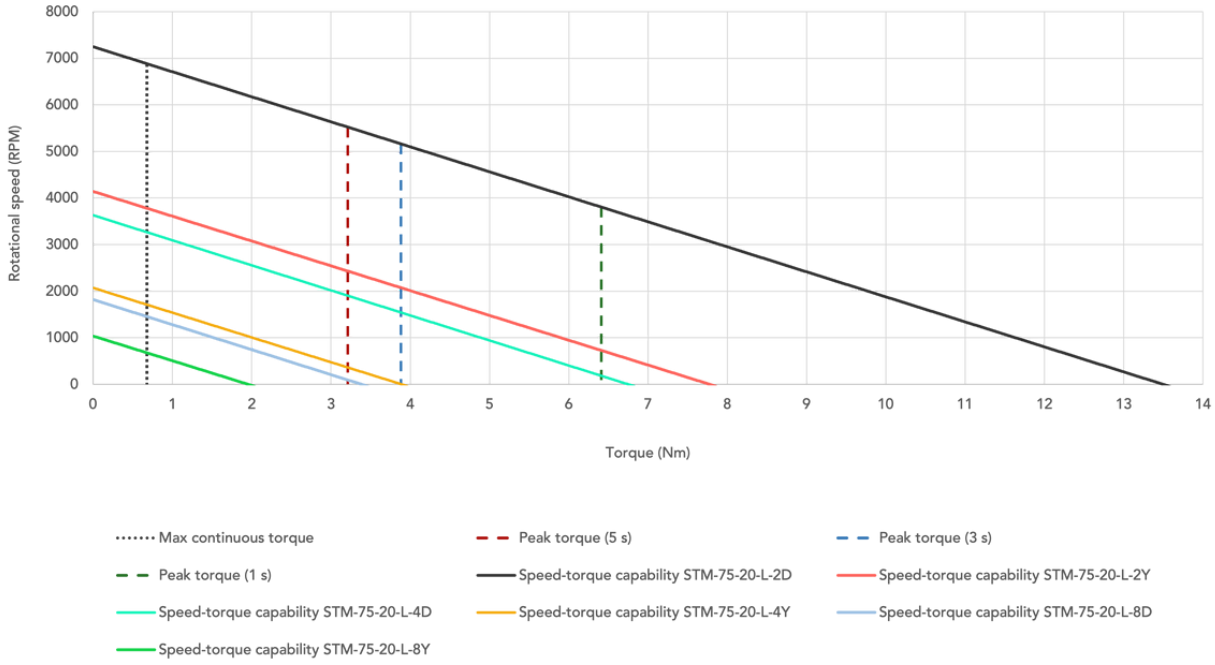
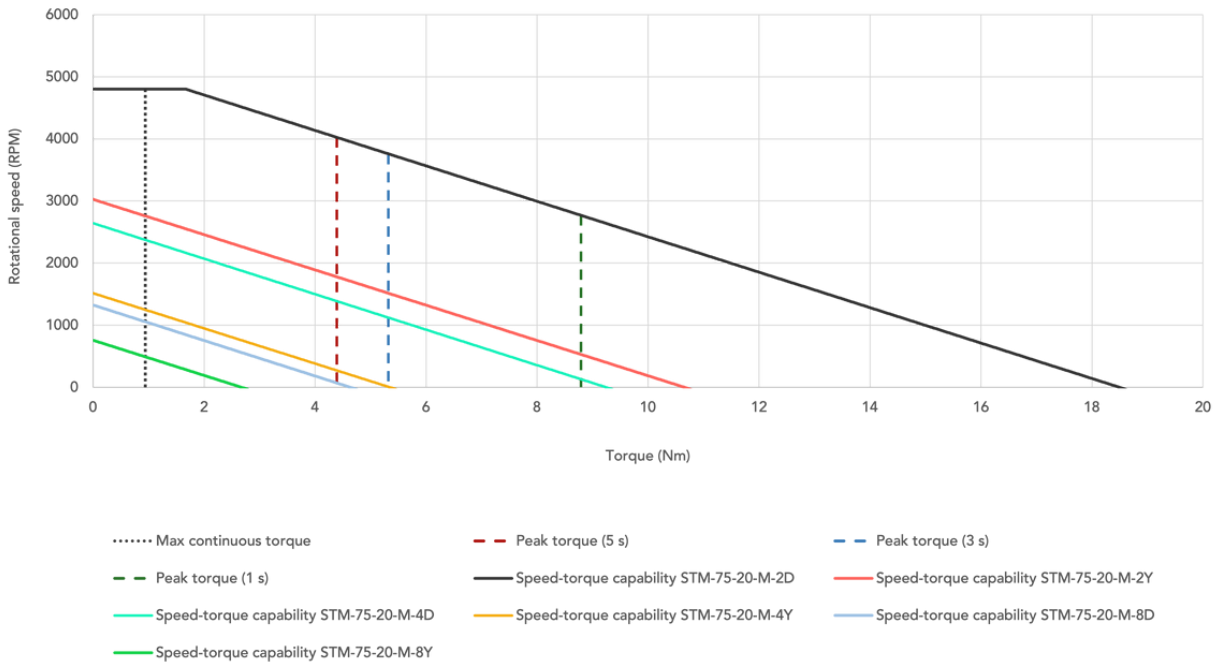
Speed-Torque - STM-75-20 Lite @20 V



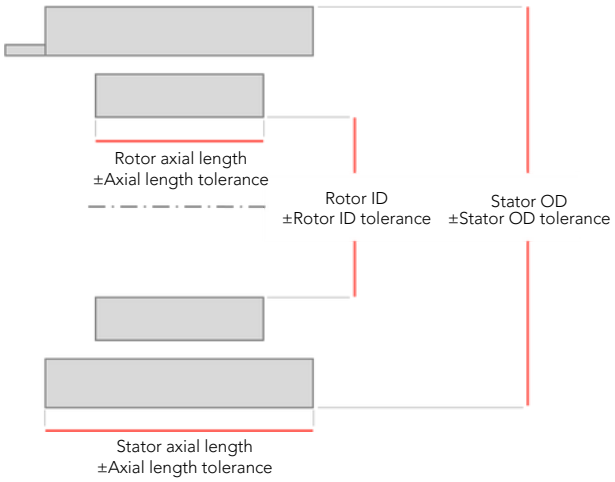
Speed-Torque curves - STM-75-20 Max @20 V



SlimTorq™ 85-24

PROPERTY	UNIT	STM-85-24-L						STM-85-24-M					
Motor type	—	Lite						Max					
Winding type	—	2D	2Y	4D	4Y	8D	8Y	2D	2Y	4D	4Y	8D	8Y
PERFORMANCE													
Motor constant	Nm/√W	0.187						0.25					
Max continuous torque [1]	Nm	1.067						1.435					
Peak torque, 1 s [2]	Nm	10.8						14.5					
Peak torque, 3 s [2]	Nm	6.60						8.84					
Peak torque, 5 s [2]	Nm	5.49						7.36					
Cogging torque	Nm	0.000						0.000					
Max continuous current [1]	A	12.6	7.11	6.29	3.57	3.15	1.79	12.5	7.05	6.27	3.54	3.13	1.78
Peak current, 1 s [2]	A	177	102	88.7	51.2	38.3	12.5	177	102	88.7	51.2	37.9	12.3
Peak current, 3 s [2]	A	108	62.5	54.1	31.2	27	12.9	108	62.5	54.1	31.2	27	12.6
Peak current, 5 s [2]	A	90.1	52	45.1	26	22.5	13.0	90.1	52	45.1	26	22.5	12.6
Max speed at max voltage [5]	RPM	7900	7900	6920	3950	3460	1970	5100	5100	5100	2950	2580	1480
ELECTRICAL													
Torque constant [3]	Nm/Arms	0.061	0.106	0.122	0.212	0.245	0.424	0.082	0.142	0.164	0.284	0.328	0.568
Voltage constant [3]	V/kRPM	5.21	9.12	10.4	18.2	20.8	36.5	6.98	12.2	14	24.4	27.9	48.8
Line to line resistance [3]	Ohm	0.072	0.215	0.287	0.86	1.15	3.44	0.072	0.215	0.287	0.86	1.15	3.44
Line to line inductance [3]	µH	1.9	5.69	7.59	22.8	30.4	91.1	1.9	5.69	7.59	22.8	30.4	91.1
Electrical time constant	µs	26.5											
Spatial harmonic torque ripple	%	0.57						0.43					

PROPERTY	UNIT	STM-85-24-L	STM-85-24-M
Rated voltage	V	72	
Poles	—	42	
Thermal resistance	C/W	4.65	
Max stator temperature	°C	140	
Max rotor temperature	°C	85	
MECHANICAL			
Stator outer diameter (OD)	mm	85	85
Stator OD tolerance	mm	h9	h9
Rotor inner diameter (ID)	mm	69	64
Rotor ID tolerance	mm	H9	H9
Stator axial length	mm	24	24
Stator axial length tolerance	mm	+/- 0.2	+/- 0.2
Rotor axial length	mm	22.2	22.2
Rotor axial length tolerance	mm	+/- 0.2	+/- 0.2
Rotational inertia	gcm^2	1380	2480
Stator mass [4]	g	96.4	96.4
Rotor mass	g	100.0	190.0
Total mass [4]	g	196.4	287.7
Power cable length	mm	500	500
Power cable size	—	AWG24	AWG24
ENVIRONMENTAL			
Minimum ambient temperature	°C	-30	
Maximum ambient temperature	°C	80	
Ambient conditions	°C	20	



[1]Housing without fins, 5 m/s airflow, 25°C ambient temp. [2]Winding temperature increases from 30 °C to 140 °C. [3]Windings at 20 °C & w/o AC cables.

[4]W/o AC cables. [5]Lowest of max mechanical speed & max electrical speed @rated voltage

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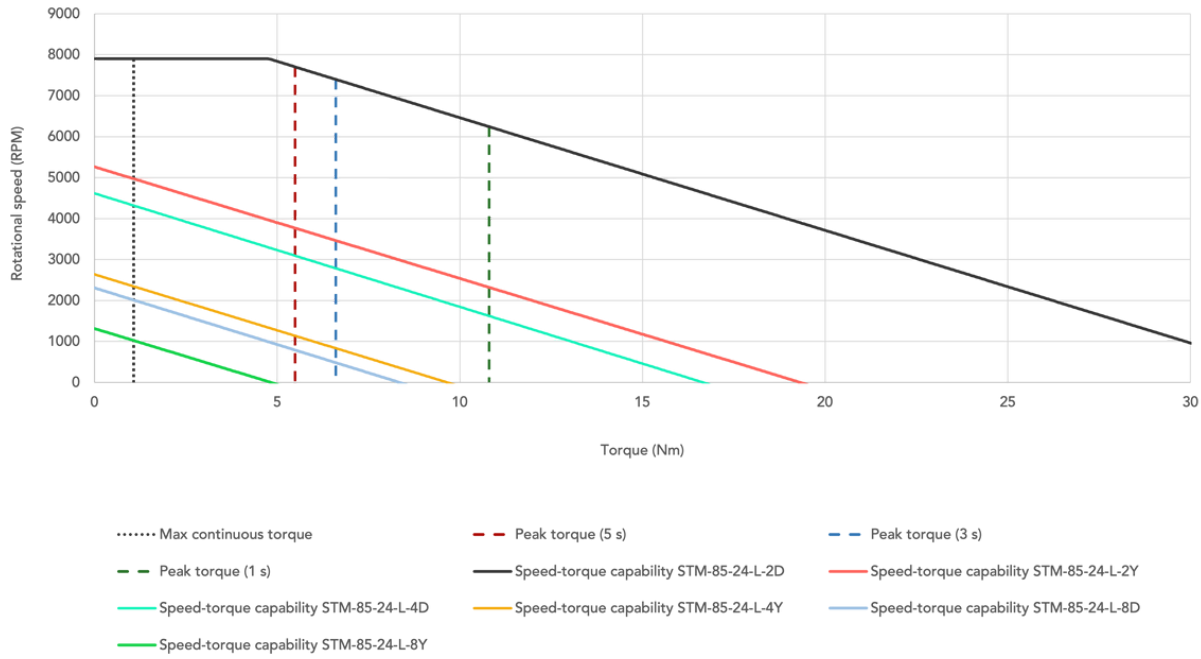
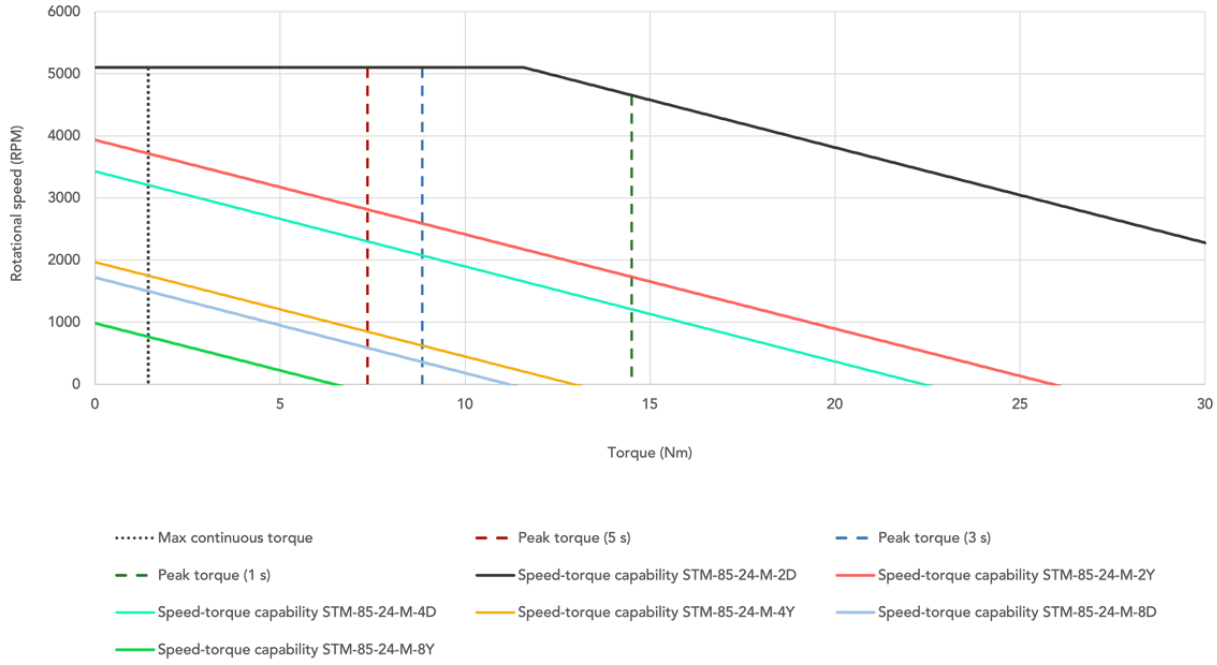
Speed-Torque curves - STM-85-24 Lite @48 V



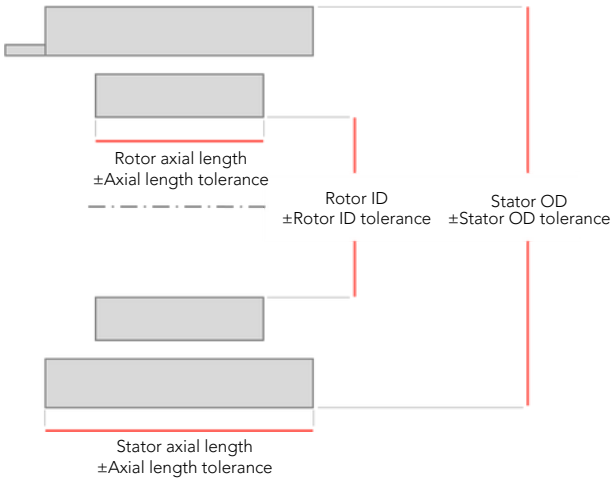
Speed-Torque curves - STM-85-24 Max @48 V



SlimTorq™ 105-17

PROPERTY	UNIT	STM-105-17-L						STM-105-17-M					
Motor type	—	Lite						Max					
Winding type	—	2D	2Y	4D	4Y	8D	8Y	2D	2Y	4D	4Y	8D	8Y
PERFORMANCE													
Motor constant	Nm/√W	0.213						0.259					
Max continuous torque [1]	Nm	1.216						1.480					
Peak torque, 1 s [2]	Nm	11.2						13.6					
Peak torque, 3 s [2]	Nm	6.79						8.24					
Peak torque, 5 s [2]	Nm	5.63						6.84					
Cogging torque	Nm	0.000						0.000					
Max continuous current [1]	A	11.5	6.44	5.78	3.24	2.9	1.63	11.5	6.4	5.77	3.22	2.89	1.63
Peak current, 1 s [2]	A	150	86.8	75.2	43.4	33.3	10.8	150	86.8	75.2	43.4	33	10.6
Peak current, 3 s [2]	A	91.5	52.8	45.7	26.4	22.9	11.1	91.5	52.8	45.7	26.4	22.9	11.0
Peak current, 5 s [2]	A	75.9	43.8	38	21.9	19.0	11.0	75.9	43.8	38	21.9	19.0	11.0
Max speed at max voltage [5]	RPM	6200	6200	5660	3240	2830	1620	4300	4300	4300	2670	2330	1330
ELECTRICAL													
Torque constant [3]	Nm/Arms	0.075	0.129	0.149	0.259	0.299	0.518	0.091	0.157	0.181	0.314	0.363	0.628
Voltage constant [3]	V/kRPM	6.36	11.1	12.7	22.2	25.4	44.5	7.72	13.5	15.4	27	30.9	54
Line to line resistance [3]	Ohm	0.082	0.245	0.327	0.982	1.31	3.93	0.082	0.245	0.327	0.982	1.31	3.93
Line to line inductance [3]	µH	1.73	5.19	6.92	20.8	27.7	83	1.73	5.19	6.92	20.8	27.7	83
Electrical time constant	µs	21.1											
Spatial harmonic torque ripple	%	0.50						0.41					

PROPERTY	UNIT	STM-105-17-L	STM-105-17-M
Rated voltage	V	72	
Poles	—	54	
Thermal resistance	C/W	4.69	
Max stator temperature	°C	140	
Max rotor temperature	°C	85	
MECHANICAL			
Stator outer diameter (OD)	mm	105	105
Stator OD tolerance	mm	h9	h9
Rotor inner diameter (ID)	mm	89	84
Rotor ID tolerance	mm	H9	H9
Stator axial length	mm	17	17
Stator axial length tolerance	mm	+/- 0.2	+/- 0.2
Rotor axial length	mm	13.6	13.6
Rotor axial length tolerance	mm	+/- 0.2	+/- 0.2
Rotational inertia	gcm^2	2090	3570
Stator mass [4]	g	80.2	80.2
Rotor mass	g	93.4	167
Total mass [4]	g	173.6	248.3
Power cable length	mm	500	500
Power cable size	—	AWG22	AWG22
ENVIRONMENTAL			
Minimum ambient temperature	°C	-30	
Maximum ambient temperature	°C	80	
Ambient conditions	°C	20	



[1]Housing without fins, 5 m/s airflow, 25°C ambient temp. [2]Winding temperature increases from 30 °C to 140 °C. [3]Windings at 20 °C & w/o AC cables.

[4]W/o AC cables. [5]Lowest of max mechanical speed & max electrical speed @rated voltage

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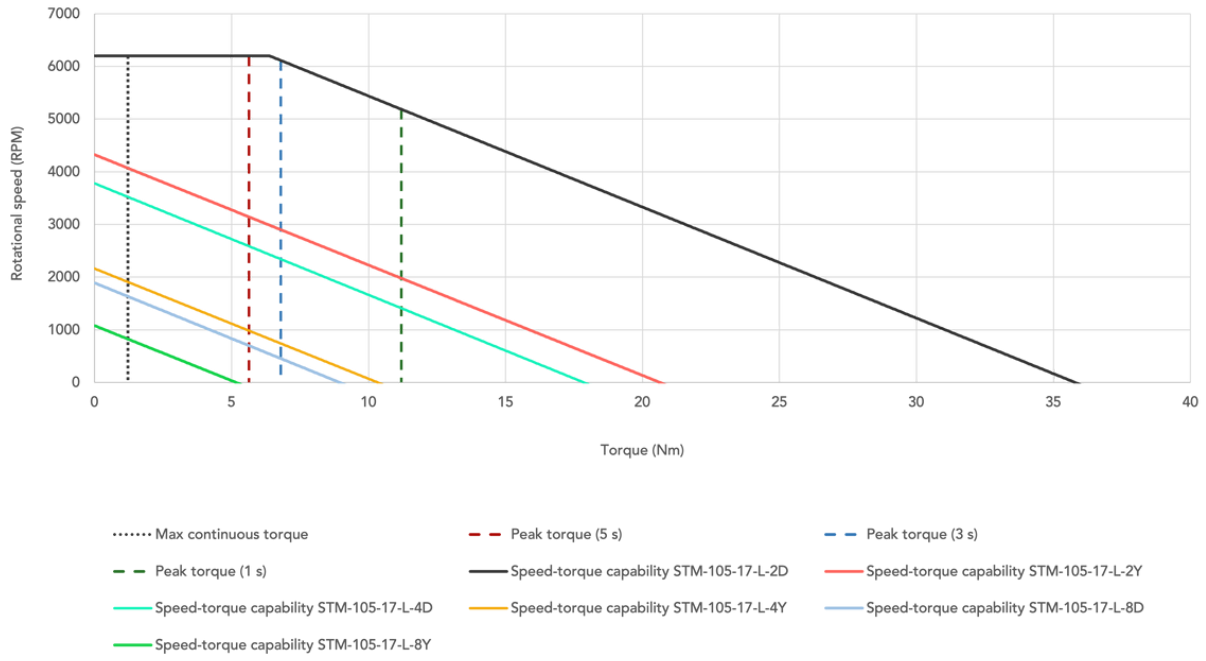
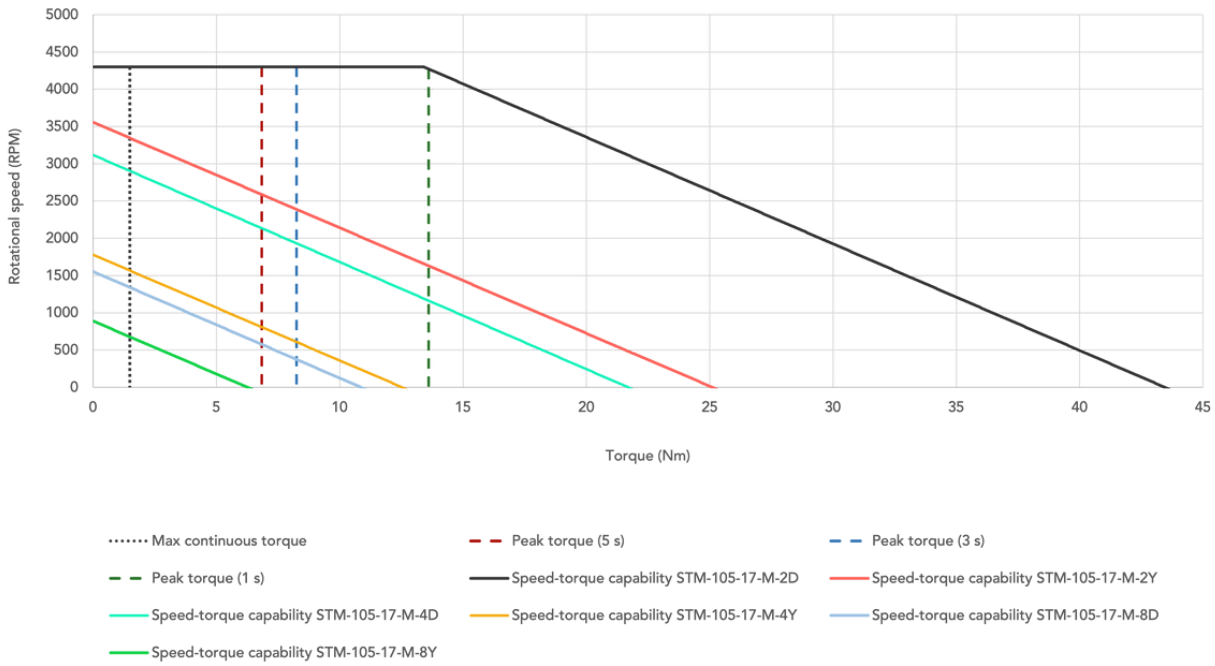
Speed-Torque - STM-105-17 Lite @48 V



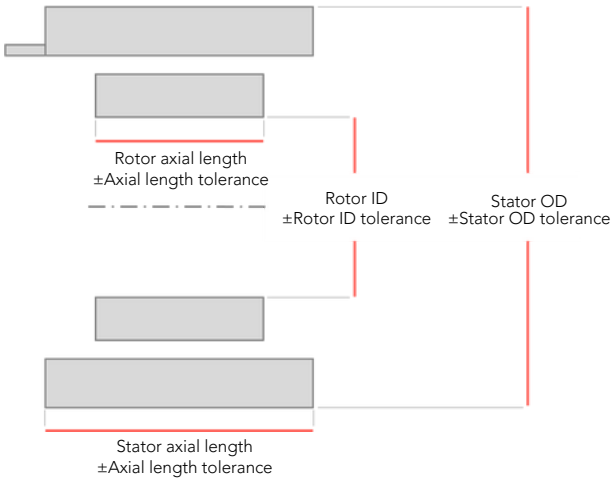
Speed-Torque - STM-105-17 Max @48 V



SlimTorq™ 130-27

PROPERTY	UNIT	STM-130-27-L						STM-130-27-M					
Motor type	—	Lite						Max					
Winding type	—	2D	2Y	4D	4Y	8D	8Y	2D	2Y	4D	4Y	8D	8Y
PERFORMANCE													
Motor constant	Nm/√W	0.296						0.507					
Max continuous torque [1]	Nm	2.190						3.785					
Peak torque, 1 s [2]	Nm	25.3						43.4					
Peak torque, 3 s [2]	Nm	15.40						26.4					
Peak torque, 5 s [2]	Nm	12.80						21.90					
Cogging torque	Nm	0.000						0.000					
Max continuous current [1]	A	24.2	13.9	12.1	6.95	6.04	3.48	24.2	13.9	12.1	6.96	6.06	3.49
Peak current, 1 s [2]	A	387	224	194	112	83.9	27.3	387	224	194	112	82	26.2
Peak current, 3 s [2]	A	236	136	118	68.1	59	28.2	236	136	118	68.1	59	27
Peak current, 5 s [2]	A	196	113	97.9	56.6	49	28.3	196	113	97.9	56.6	49	27
Max speed at max voltage [5]	RPM	6300	6300	6300	3690	3250	1840	4200	4200	3780	2160	1890	1080
ELECTRICAL													
Torque constant [3]	Nm/Arms	0.065	0.113	0.131	0.226	0.261	0.453	0.112	0.194	0.224	0.388	0.448	0.776
Voltage constant [3]	V/kRPM	5.54	9.77	11.1	19.5	22.1	39.1	9.52	16.7	19	33.4	38.1	66.8
Line to line resistance [3]	Ohm	0.033	0.0978	0.13	0.391	0.522	1.57	0.033	0.0978	0.13	0.391	0.522	1.57
Line to line inductance [3]	µH	2	5.99	7.99	24	32	95.9	2	5.99	7.99	24	32	95.9
Electrical time constant	µs	61.2											
Spatial harmonic torque ripple	%	0.92						0.62					

PROPERTY	UNIT	STM-130-27-L	STM-130-27-M
Rated voltage	V	72	
Poles	—	46	
Thermal resistance	C/W	2.79	
Max stator temperature	°C	140	
Max rotor temperature	°C	85	
MECHANICAL			
Stator outer diameter (OD)	mm	130	130
Stator OD tolerance	mm	h9	h9
Rotor inner diameter (ID)	mm	112	107
Rotor ID tolerance	mm	H9	H9
Stator axial length	mm	27	27
Stator axial length tolerance	mm	+/- 0.2	+/- 0.2
Rotor axial length	mm	15.5	18.3
Rotor axial length tolerance	mm	+/- 0.2	+/- 0.2
Rotational inertia	gcm^2	3950	8400
Stator mass [4]	g	213	215
Rotor mass	g	115	253
Total mass [4]	g	328	468
Power cable length	mm	500	500
Power cable size	—	AWG18	AWG18
ENVIRONMENTAL			
Minimum ambient temperature	°C	-30	
Maximum ambient temperature	°C	80	
Ambient conditions	°C	20	



[1]Housing without fins, 5 m/s airflow, 25°C ambient temp. [2]Winding temperature increases from 30 °C to 140 °C. [3]Windings at 20 °C & w/o AC cables.

[4]W/o AC cables. [5]Lowest of max mechanical speed & max electrical speed @rated voltage

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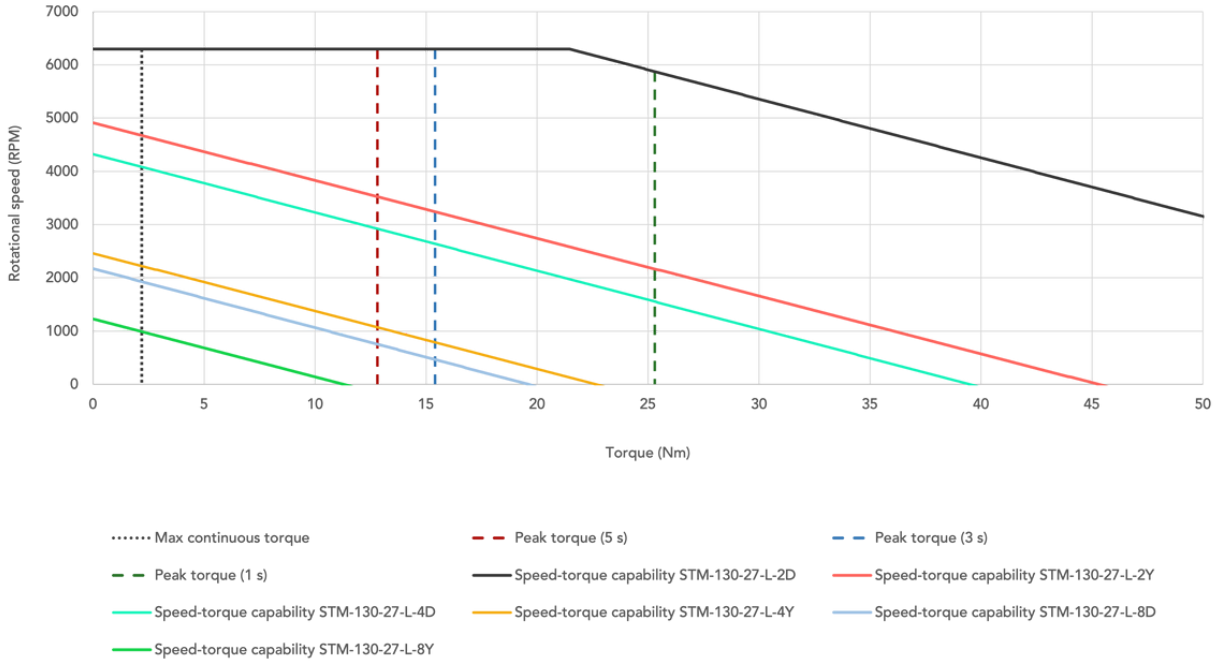
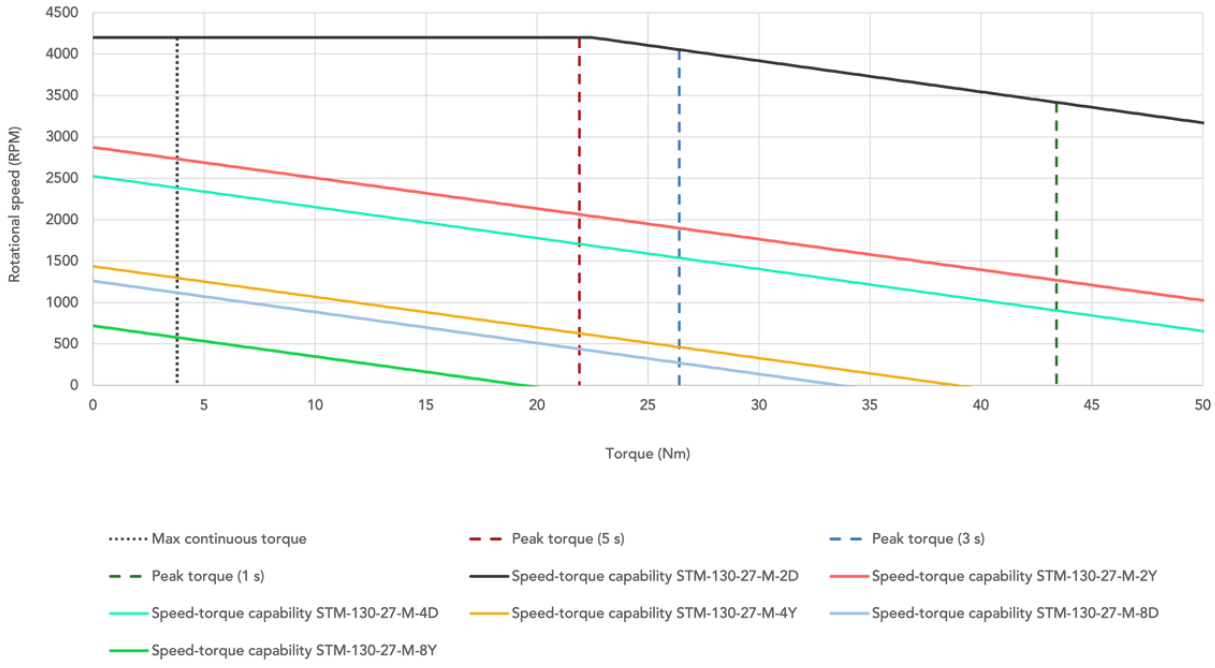
Speed-Torque - STM-130-27 Lite @48 V



Speed-Torque - STM-130-27 Max @48 V



Ordering Alva Motors

Pricing & Lead-Time

Alva's pricing strategy focuses on delivering customer value while ensuring sustainable profitability. Instead of cost-plus pricing, we collaborate with customers to establish pricing that fosters win-win outcomes. Our goal is to maintain stable pricing, allowing customers to rely on consistent quality. Final pricing will depend on factors like part configuration, motor size, annual volumes, & testing requirements.

Standard products are delivered in 8-10 weeks for small quantities, with plans to reduce this to 4-6 weeks. Custom solutions may extend lead times to 12-16 weeks, while full customization can take up to 20 weeks from specifications to prototype. We work closely with customers to meet timelines, & volume lead times are determined upon request based on customer needs.

Delivery Terms

Alva's standard delivery terms are EXW; however, Alva remains flexible & open to discussing customized delivery arrangements to meet customers' specific needs.

Terms & Conditions

Alva's term & conditions can be found under www.alvaindustries,com/terms-conditions & as an annex of this product guide.

How to place an order

Use the Product Selector to configure & order your motor or get in touch with Alva's sales team at sales@alvaindustries.com to receive an official quotation according to which an order can be placed, or a sales contract can be signed.

Scope of delivery

Stator

Fiberprinted™ stator with a aluminium sleeve with tight tolerances for easy mechanical integration. The aluminium sleeve is engraved with the PN & SN of the stator.

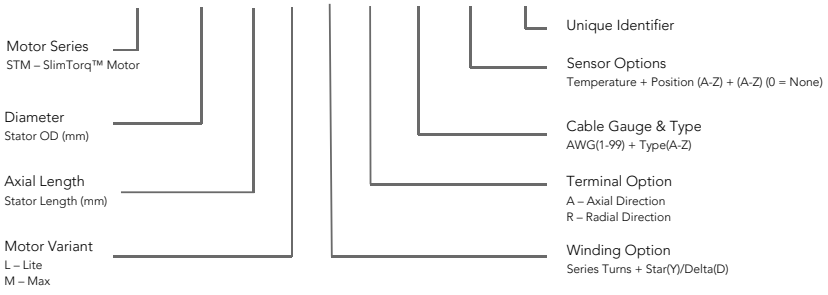
The stator comes with pre-installed cables with a length of 500mm with flying leads. The standard cable is UL rated with PTFE insulation material.

Rotor

The rotor consists of a magnetic Halbach, for maximum performance with a glass fiber sleeve, for maximum reliability, and a inner aluminium ring with tight tolerances for easy mechanical integration.

The inner aluminium ring is engraved with the PN & SN of the rotor.

STM-130-27-L-4Y-A-000-00-000



Evaluation Kits

High-end Bearings

Aluminium Housing

RLS AksIM-2™

Kick-start your testing

All the SlimTorq™ motors can be ordered as evaluation kits, which includes a SlimTorq™ frameless motor, bearings, & a RLS AksIM-2™ (BiSS C) encoder; all integrated into an aluminium housing for easy setup and use.

Motor	Encoder
STM-39-10	RLS: MRA029GP013DMN00
	RLS: MB029DCC18BFNT00
STM-51-12	RLS: MRA049BC025DSE00
	RLS: MB049DCC17BDNT00
STM-75-20	RLS: MRA064BC040DSE00
	RLS: MB064DCC20BDNT00
STM-85-24	RLS: MRA064BC040DSE00
	RLS: MB064DCC17BDNT00
STM-105-17	RLS: MRA064BC040DSE00
	RLS: MB064DCC17BDNT00
STM-130-27	RLS: MRA080DF068DMH00
	RLS: MB080DCC20BDNT00

Easy mounting

The framed motors comes with a mechanical interface adapter to simplify the installation into your test-bench.

CAD-files of the framed motors are available on request, please contact sales@alvaindustries.com

Mechanical Integration

Safety precautions

The frameless motor rotors contain high-energy rare-earth magnets that produce strong magnetic fields. Therefore, anyone with active implants, such as pacemakers, should keep a safe distance from the rotors of these motors.

The rotor's magnetic field creates strong attractive forces to ferromagnetic materials when in close proximity. If the rotor & surrounding ferromagnetic items are not properly restrained, this can result in collisions, potentially damaging the rotor or causing personnel injuries (e.g., pinched fingers). When handling the rotor, precautions should be taken to remove all other magnetic items from an area greater than approximately 3 times the diameter of the rotor. This includes other rotors.

Strong magnetic fields produced by the rotor magnets may affect or damage electronic devices & measuring equipment. Rotors should not be placed near computer disks, computers, monitors, credit cards, etc.

Handling & Storage

Correct handling & storage of motor components is very important. It is recommended that stators & rotors be stored in their original packaging until installation is required. Special care must be taken when handling stator assemblies, as damage to the coil insulation and lead wires can result in electrical shorts and possible electrical shocks. Precautions should also be taken when handling the rotor assembly, as strong magnetic forces are present. The magnets on the rotor are brittle & prone to cracking, chipping, or even shattering on impact.

Mechanical Integration

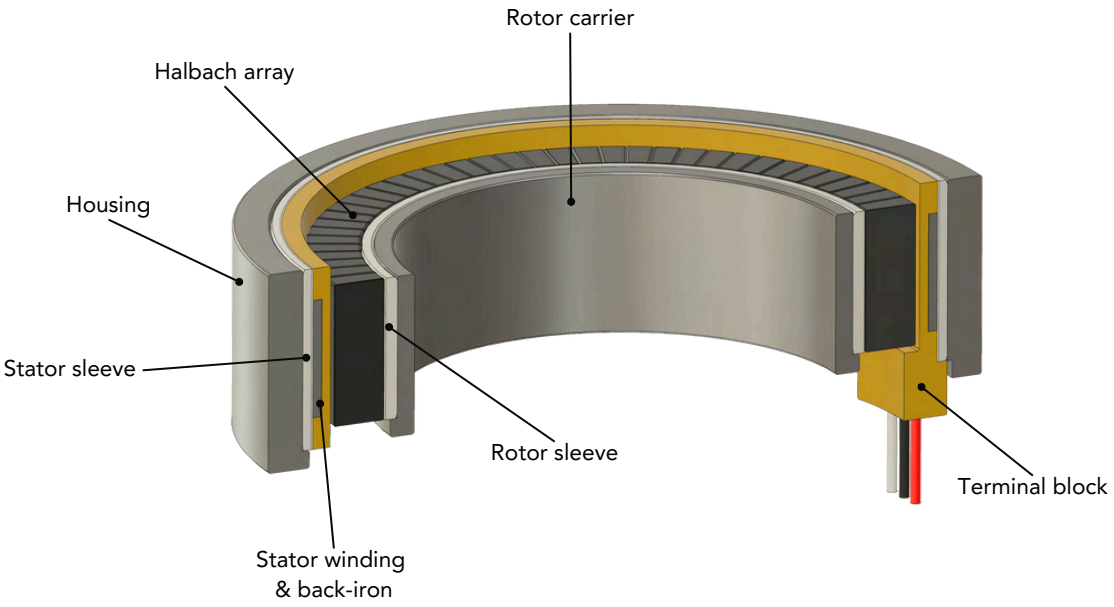
General considerations

Alva frameless motors are supplied as rotor & stator pairs. From this point forward, the part that the rotor attaches to will be referred to as the rotor carrier, & the part that the stator attaches to will be referred to as the housing. Both the stator & rotor have an aluminium backing ring(sleeve) on the mounting side. Only the exposed surfaces of these rings should be subjected to force during assembly or disassembly. Depending on the motor configuration, it may only be possible to insert the rotor from one side of the stator.

Alva's motors are electromagnetically self-sufficient, i.e., proper operation does not depend on the electromagnetic properties of surrounding parts. For structural purposes, it is recommended that the housing & rotor carrier be made of aluminum. This is particularly beneficial for applications operating within a large temperature range, as the coefficient of thermal expansion (CTE) is matched with the stator/rotor sleeve.

It is good practice to design any electrically conducting surfaces to have a minimum of 0.5mm of clearance to the stator windings in all directions for electrical insulation purposes. The windings should not be in direct contact with any electrically conducting surfaces. If grounding is required, a ground stud can be placed on the housing or stator sleeve. While this may not be at the same voltage potential as the stator stack, it represents a typical grounding scheme used in most motors with two- or three-part housings. A ground stud is typically only necessary when the motor operates without isolation between the mains & the motor drive.

The housing & surrounding parts must be designed with sufficient clearance around the terminal block & phase cables to ensure no stress is applied to the terminal block. Please refer to the STEP files for specific motor measurements & tolerances for the terminal block.



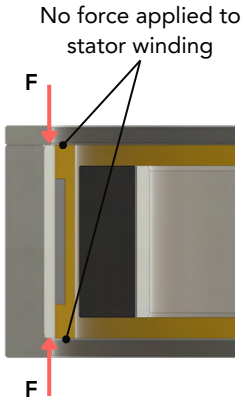
Mechanical Integration

Retention

A well designed integration method is required to assure a strong retention of the rotor & stator to allow for robust torque transfer. The outlined options will all achieve a strong retention if they are applied correctly.

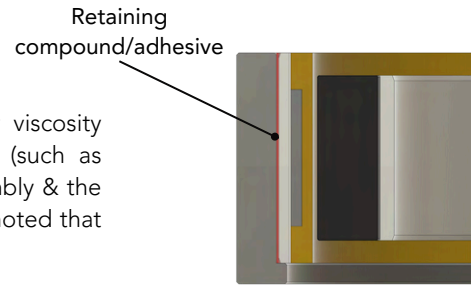
Axial clamping

The simplest method of retention is axial clamping. This allows for easy assembly & disassembly of the stator & rotor. It's recommended to use a or several clamping components to evenly distribute the clamping force on the aluminium sleeves. Clamping force should only be applied to the stator/rotor aluminium sleeve. Absolutely no force should be applied on the stator winding or the rotor magnets. The amount of clamping force as well as the housing shoulder & clamping parts should be designed so that the stresses in the stator/rotor sleeve are appropriate. It's recommended to add a thermal paste on the mounting surfaces to maximise the thermal performance of the motor.



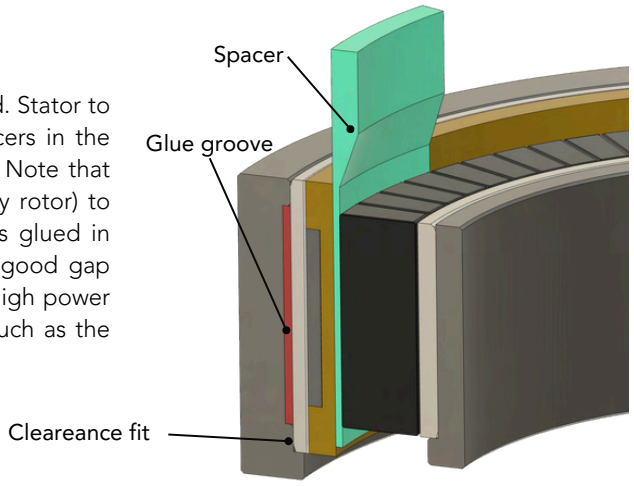
Bonding: Small gap

The most space efficient option is to bond the parts using a low viscosity adhesive or retaining compound with sufficient temperature range (such as Loctite 638). The mating surfaces should be clean & dry prior to assembly & the parts needs to be held in position during the initial cure. It should be noted that disassembly is not possible with this retention method.



Bonding: Large gap

A large gap bonding method can also be used if desired. Stator to rotor alignment can either be achieved by use of spacers in the airgap OR combine a clearance fit with a glue groove. Note that spacer method require the rotor (alternatively a dummy rotor) to be pre-mounted on the rotor carrier while the stator is glued in place & vice versa. A general structural adhesive with good gap filling capabilities should be used. In applications with high power demands a thermally conductive adhesive is required(such as the MG chemicals 8329 TFS).



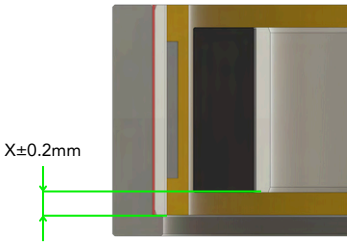
Interference fit

The use of an interference fit to circumvent the need for clamping & adhesives is possible but require careful consideration not to overstress & damage the stator or rotor. Therefore it is not recommended over the use of axial clamping or bonding. Alva should be consulted before a interference fit is implemented.

Mechanical Integration

Alignment

A good alignment between the rotor & stator is important to ensure safe operation & high performance of the motor.

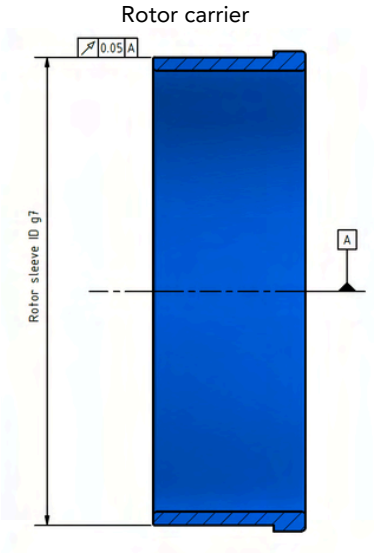


Axial alignment

Axial placement of the stator & rotor should be ensured by the use of a hard-stop shoulder on the rotor carrier & the stator housing. The shoulders should control the axial alignment to center the rotor within the stator with a ±0.2mm tolerance. Any further misalignment will reduce performance.

Rotor radial alignment

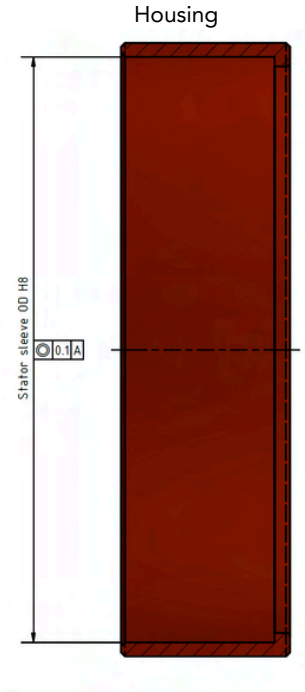
It's recommend to retain the rotor with axial clamping, small bond line, clearance fit with a glue groove or full interference fit. For all the methods except for the full interference fit, it's recommended to dimension the diameter of the rotor carrier(where the rotor ID sits) equal to the rotor sleeve ID with a g7 tolerance, or tighter. It's important that the rotor carrier has maximum runout of 0.05mm relative to the rotation axis if one these methods are used. Please contact Alva if you are considering a full interference fit.



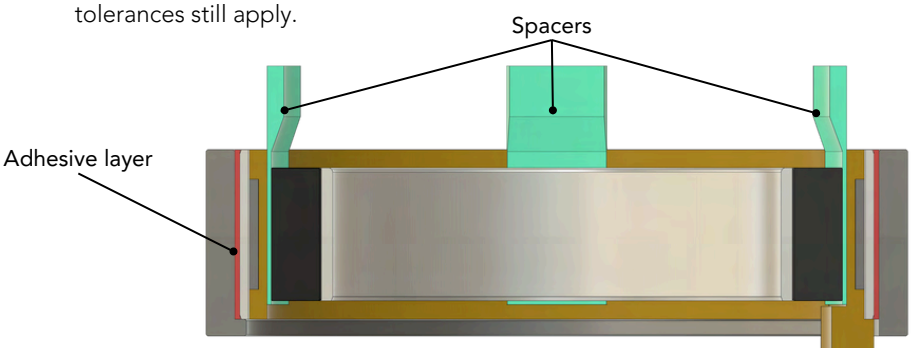
Stator radial alignment

Stator alignment options:
1. Alignment with the stator housing
2. In-situ alignment with spacers

Alignment through the housing is achieved by a clearance fit between the stator sleeve and the housing. In this case the housing mating surface ID should be dimensioned equal to the Stator sleeve OD with a H8 tolerance or tighter. The housing mating surface should be concentric to the rotor carrier rotation axis to within 0.1mm in the final assembly.



In situ alignment is achieved by first assembling the rotor, then bonding the stator into the housing while using spacers between the stator & rotor to ensure the correct airgap. In this case there should be a minimal stator sleeve to housing gap of 0.1mm (minimal, not nominal). This method of assembly, tough more process demanding, reduces the need for high precision on the housing ID & general assembly tolerances. Note that the requirement for rotor carrier tolerances still apply.



Choosing a Motor Drive

Commutation Type

SlimTorq™ motors have an almost perfect sinusoidal back-EMF & it is therefore recommended to use sinusoidal, or even better, FOC commutation. Trapezoidal commutation can be utilised, however, with a penalty in terms of precision & performance.

Switching Frequency

Slotless motors have a relatively low inductance, & therefore a low electrical time constant. It's therefore important to use a high enough switching frequency to maximise the precision & performance of the motors in your application. The general recommendation is to use a switching frequency of at least 20kHz. The required switching frequency can be reduced by adding output filter on the motor drive to increase the system inductance. Please contact us at sales@alvaindustries.com if you are uncertain if your application require a output filter.

Current Rating

Most motor drives has a two current ratings: continuous- & peak-current. It's important to understand both ratings & assure to pick the motor drive with correct current ratings for your application.

Continuous current

The required continuous current rating can be calculated with the equation below. It's important to consider that the continuous current rating of motor drives is dependant on ambient temperature, cooling conditions & switching frequency. So ensure to review these aspects of the motor drive & if your are uncertain you should contact your motor drive supplier for support.

$$ContinuousCurrent\,(A_{rms}) = ContinuousTorque\,(Nm) \div K_T\,(Nm \div A_{rms})$$

Electrical Frequency

It's important to select a motor drive that has high enough electrical frequency for your application. It's easy to calculate the required electrical frequency for your application, see the equation below:

$$ElectricalFrequency\,(Hz) = \frac{MaxSpeed\,(RPM) \times No.\,Poles}{2 \times 60\,(s \div min)}$$

Sensored vs Sensorless control

The SlimTorq™ motors can be controlled both by a sensored & sensorless motor drive. If you have a precision applications where you need to control the motors either in position- or torque-mode it's highly recommended to use sensored a motor drive with an high-end encoder. In performance applications, where low-speed performance & precision isn't of importance, sensorless control is a good option.

Voltage Level

Your power source & motor drive should have a high enough voltage rating to reach the required no-load max speed of your application. Use the equation below to calculate the required voltage level for your application.

$$VDC\,(V) = K_E\,(V \div kRPM) \times 1000 \times Speed\,(RPM)$$

Peak Current

The required peak current rating can be calculated with the equation below. Keep in mind that the equation is only valid for a ideal motor drive which means you should add a buffer of 15% to account for current ripple caused by switching.

$$PeakCurrent\,(A_{rms}) = PeakTorque\,(Nm) \div K_T\,(Nm \div A_{rms})$$

Definitions & Glossary

Motor constant, Km

The motor constant for the three-phase SlimTorq™ motors is given by the torque constant, & line to line resistance, see the equation below:

$$Km\left(Nm \div \sqrt{W}\right) = \frac{K_T\,(Nm \div A_{rms})}{\sqrt{Line2LineResistance\,(Ohm) \times \frac{3}{2}}}$$

Note that the line to line resistance is converted to the three-phase equivalent of the resistance by multiplying it with the factor of 3/2.

Voltage constant, Ke

The voltage constant is based on peak value of the line-to-line voltage & the rotational speed.

$$K_E\,(V \div kRPM) = \frac{Line2LineVoltage\,(V)}{1000 \times RotationalSpeed\,(RPM)}$$

Torque constant, Kt

The torque constant is based on the torque output & RMS Iq current.

$$K_T\,(Nm \div A_{rms}) = \frac{Torque\,(Nm)}{I_q\,(A_{rms})}$$

Max continuous torque

The highest torque the motor can output continuously without overheating. The stated values assumes that the motor is unmounted without any forced cooling with an ambient temperature of 20°C.

Keep in mind that this is a highly conservative cooling assumption & higher continuous torque can be expected if the motor is mounted in thermally conducting housing.

Peak torque

The peak torque assumes the motor starts from a rest with a motor temperature equivalent to the ambient temperature of 20°C.

Line to line resistance

The resistance measured at the motor terminals. Also called terminal resistance. The phase resistance can be calculated with the equations below.

Delta connections:
Phase resistance = Line-to-line resistance x 1.5

Star connections:
Phase resistance = Line-to-line resistance x 0.5

Electrical Time Constant

The electrical time constant (denoted as τ) of an electric motor or circuit is a measure of how quickly the current in the motor or circuit responds to changes in voltage. It indicates how fast the current can rise to its steady-state value after a voltage is applied.

In a motor, it's calculated as the ratio of the motor's inductance (L) to its resistance (R):

$$\tau = \frac{L}{R}$$

The time constant impacts how quickly a motor can accelerate or decelerate and how it will behave under dynamic load conditions.

Continuous power loss

The continuous power loss is the loss that is generated as heat at the rated continuous torque. The value is based on the assumption that the speed is equal to 0 RPM, i.e. speed dependant losses are not considered.

FAQs

Contact us today

For any additional inquiries not addressed on this page, please feel free to contact us at sales@alvaindustries.com. Our team will respond quickly to assist you.

How do I mechanically integrate the motor?

There are three general concepts for mechanical integration of the frameless motors.

1. Clamping
2. Adhesion
3. Interference fit

All three has their inherent advantages & considerations, please read more under Mechanical Integration.

What's required to drive the motors?

The SlimTorq™ motors are of the three-phase BLDC type & can be driven with most off-the-shelf controllers. The motors can be driven in trapezoidal, FOC, sinusoidal mode & with or without sensor feedback. Special considerations need to be taken regarding the switching frequency due to low inductance of the motors. Please read more under Choosing a Motor Drive.

I can't find the motor size I need, do you offer custom motors?

Due the inherent simplicity & flexibility our manufacturing technology FiberPrinting™ we can offer fully custom solutions for your application. Please contact us at sales@alvaindustries.com to learn more.

Does the motors come with a temperature sensor?

Most of the SlimTorq™ motors can be ordered with a temperature sensor as an optional feature. Please the see Ordering Alva Motors section to see how you configure your product with a temperature sensor. The default temp sensor (A) is a 10K NTC with a B25/100 value of 3492 ±1% K (TDK B57541G1103+000).

How do I select the correct motor for my application?

The easiest way to select correct motor for your application is to use our Product Selector. Insert you requirements in the Product Selector and it will find precisely the right motor for you. It will also allow you to fully configure the motor and order it. We are happy to help if you desire personal assistance to select the right motor, just contact us on sales@alvaindustries.com.

What's the typical delivery time for a standard motor?

Depending on the version of the motor, the lead time may vary. As a general rule of thumb, for units that are standard configurations, the lead time for small volumes (1-5 units) is around 6-8 weeks. For bigger volumes or small customizations the lead time may change, please reach out to us at sales@alvaindustries.com or call us.

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Can I change the specifications of the motors?

Almost all the motor come in two main configurations: Lite and Max. Lite is the lightweight option & Max has been maximised in terms of motor constant and torque output.

Each motor has multiple winding configurations to align with your required max-speed. The motors can be configured in Star(Y) and Delta(D), and in different number of series-turns. The cables exit orientation also come in two variants: axial and radial.

The motors can be equipped with temperature sensors and different wire gauges.

To understand how to configure your product please see Configured To Your Needs section & to simplify the process check out our Product Selector.

Please contact us at sales@alvaindustries.com if there isn't a configuration that meets your needs. Our FiberPrinting™ technology allows us to quickly develop custom motors according to your requirements.

What are the tolerances for the mounting?

You can find the mechanical tolerances of the motor components in the mechanical section of each product page. For more information how to mechanically integrate the motors into your application please see Mechanical Integration section. The STEP files of the motors are available on the SlimTorq™ product page.

Are these motors more expensive than other slotless motors?

No. Alva's manufacturing methods, lead by the FiberPrinting™ technology, are comparable in cost & price with motors with similar characteristics (thin, light, cogging free slotless frameless motors).

Are slotless motors more expensive than slotted motors?

Alva's FiberPrinting™ manufacturing technology for slottless stators & proprietary manufacturing method of Halbach array rotors, allow for production cost that can be quite competitive to even manufacturing methods of slotted motors, enabling also competitive pricing. On the other hand, slotless motors from other manufacturers tend to be more expensive than slotted motors due to the larger magnets & legacy manufacturing methods.

What is the airgap between rotor and stator?

The airgap dimension is dependant on the motor size, you can find the mechanical dimensions of the motor components in the mechanical section of each product page.

FAQs

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For any additional inquiries not addressed on this page, please feel free to contact us at sales@alvaindustries.com. Our team will respond quickly to assist you.

Do I need to have active cooling on the motors to achieve the specifications of Torque/speed?

The continuous torque and speed values in the product guide are based on the assumption that motors are not mounted in a housing and without active cooling. This is a conservative assumption, so to understand how the motor will perform in your application please insert your requirements and select the correct cooling conditions in our Product Selector.

Are these motors available for high voltage?

All the SlimTorq™ motors are rated with a maximum voltage level of 72V. Higher voltage ratings will be available in the future. Please contact sales@alvaindustries.com if your application require a higher voltage rating.

Are there possibilities for Custom Mounting solutions?

Our expertise not only lies on the design and manufacture of motors but also in their integration into diverse types of housings and mechatronics designs. Given that the possibilities to mount a frameless motor may vary, we give standard recommendations on how customers can do that on their own: Mechanical Integration. However, we are also capable of modifying the mounting possibilities of the motors, according to the applications needs. Reach out to: sales@alvaindustries.com or call us.

Can I use these motors combined with gearboxes? Any gearbox?

With a large inner-diameter and low-speed dependant losses, the SlimTorq™ motors are highly suitable to be combined with gearboxes for torque demanding applications. They can be combined with all the typical type of gearboxes for precision applications such as planetary-, worm-, strain wave-, bevel- and cycloidal-gearbox.

What is the life time of frameless motors?

The SlimTorq™ motors are brushless motors, they are therefore inherently not exposed to any mechanical wear assuming a well designed mechanical assembly. The Litz Wire of the stator windings are isolated with of a P180 enamel according to IEC 60172, with a rated lifetime of 20,000 hrs at a continuous temperature of 180 °C.
As long as the motors doesn't exceed their maximum rated temperature of 140°C, the motors will have next to unlimited life-time.

@ALVAINDUSTRIES

Contact

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www.alvaindustries.com

Terms & Conditions

1. Parties
1.1 Alva Industries AS ("Alva") is a manufacturing company with its headquarters in Fossegrenda 1E, 7038 Trondheim (org. no. 918 714 006). Alva develops, produces & sells stator & rotor components (the "Components") for electrical motor systems.
1.2 The Customer wish to employ the expertise of Alva by purchasing from Alva the Components for use & installation in Customer's electrical motors or motor systems in accordance with the terms set forth in these General Terms & Conditions (the "Agreement"). The "Customer" shall mean the company entering into this Agreement.
1.3 Alva & the Customer may hereinafter be referred to as a "Party", or collectively as the "Parties".
1.4 By purchasing the Components from Alva, the Customer accepts the terms & conditions set out herein & agrees to be bound by the Agreement. The Agreement shall, together with the Order Confirmation for the Customer's order, constitute the entire agreement entered into between the Parties, in addition to any written separate sales agreements or similar entered into by the Parties.
1.5 This Agreement shall apply to all quotations & offers made by & orders accepted by Alva for Components.
1.6 In the event of any conflict between the provisions of this Agreement & the order confirmation or a separate sales agreement or similar signed by Alva & the Customer, the order confirmation &/or such separate sales agreement or similar shall prevail. Any changes in this Agreement must specifically be agreed to in writing signed by an officer of Alva before becoming binding on either Party.

2. Scope
2.1 The scope of this agreement is defined in the Quotation.
2.2 Customer acknowledges & accepts that Components may solely be used for Customer's internal assembly, development, modifications & subsequent distribution & sale with respect to the Customer's electrical motors or motor systems.
2.3 The Components will be produced based on one or a set of specifications as agreed between the parties or as per Quotation.

3. Delivery
3.1 The estimated delivery schedule for the ordered Components(s) are set out in the order confirmation.
3.2 Delivery shall be considered as completed on such time as the Components are made available for collection by the Customer.

4. Inspection
4.1 The Customer shall return any Components to Alva upon Alva's request for purposes of inspection for wear & tear, as well as testing of the components of the respective Components.
4.2 Alva will cover all reasonable costs of return & redelivery of Components for the purposes set out above.
4.3 Alva shall ensure that the return & redelivery of Components pursuant to this section 4 shall not be unreasonably inconvenient to the Customer.

5. Data
5.1 The Customer shall provide Alva with operational data & test data for the Components(s) in the format & frequency as specified by Alva for the purposes of improving future revisions of the Components & further development of such.
5.2 The Customer shall provide Alva with insight accrued during the Customer's testing & use of the Components, as well as information on any changes made, as well as requests for improvements & similar information that may impact the performance of the Components. Such information shall be provided in a format & frequency as specified by Alva.

6. Documents
6.1 If available for the Components ordered by the Customer, Alva will provide the Customer with technical specifications, drawings, installation & service instructions & spare parts lists that concern the Components.
6.2 When making the Components available to other third parties, the Customer shall be responsible for ensuring that the transaction & contractual relationship with the relevant third party is subject to end user terms that are no less restrictive than this Agreement for the interests & liabilities of Alva, & to ensure for safe & sound utilization of the Components, or components incorporating them, by Customer's customer or partners..

7. Payment
7.1 All payments shall be made within such time as stated in the invoice or order confirmation.
7.2 Alva may require payment to be secured by an irrevocable letter of credit or a bank guarantee acceptable to Alva. Where payment is made by letter of credit, all costs of collection shall be for Customer's account.
7.3 If the Customer fails to make payment by the agreed time, Alva shall be entitled to claim interest on any overdue amount pursuant to the Late Payment Interest Act of 1976.
7.4 Unless otherwise is agreed in writing, Alva will issue an order confirmation within reasonable time after reception of a purchase order. The total purchase price, amounts & estimated delivery time(s) are set out in the relevant order confirmation.
7.5 Alva retains a security interest in the Components until the Customer's final payment to Alva for the Product. Risk of loss & title shall pass to the Customer as soon as the Components has been delivered as determined by the delivery terms, see section 3.

8. Defects
8.1 The Customer shall notify Alva of any visible defects, quantity shortages or incorrect Components shipments within three (3) days of delivery. Failure to notify Alva in writing of any visible defects in the products or of quantity shortages or incorrect shipments within such period shall be deemed an unqualified waiver of any rights to return products on the basis of visible defects, shortages or incorrect shipments.

9. No Warranty
9.1 All use of the Components, including use of Components in components or products not delivered by Alva, is undertaken at the sole risk & expense of the Customer. The Components(s), & all parts thereof & related documentation, are provided on an "AS IS" basis, without any explicit or implicit warranty for any non-infringement, specifications, features, merchantability or performance, hereunder for compliance with laws & regulations applicable at the location where the Customer operates or uses the Components(s).

Terms & Conditions

10. Liability
10.1 Alva shall under no circumstance have any liability (& there is no basis for any present or future action, suit, proceeding, hearing investigation, charge, complaint, claim or dem& against Alva giving rise to any liability) arising out of the Customer's ownership, possession, use, incorporation, & commercial utilization (including sales to & use by Customer's customers) of any product manufactured, sold, leased or delivered by Alva.
10.2 As Alva has no control over Customer's or end-customer's use, setup, final assembly, modification or misuse of technology, products, or services which incorporate or otherwise utilize the Components, no liability shall be assumed nor accepted by Alva for any resulting damage or injury. The Customer shall be solely responsible for its ownership & use of the Components, & shall indemnify & hold Alva harmless against any & all liabilities, including judgments, costs & reasonable attorney fees, for anything done or omitted by the Customer &/or Its end customers with respect to ownership & use of the Components, including, without limitation, personal injury or infringement of third party rights.
10.3 The Customer shall not incur any liabilities for or on behalf of Alva, nor make any representations nor give any warranty with direct or indirect effect for Alva, & shall indemnify & hold Alva harmless from any liability incurred by Alva because of a breach by Customer of this clause 10.3.
10.4 The Customer shall be responsible for ensuring that ownership, use & distribution of the Components, including any components or products incorporating or utilizing Components complies with any applicable regulatory requirements with respect to the lawfulness of the ownership, use, marketing & sales of the Components & any components or products incorporating or utilizing them. If – & to the extent – that certification or similar of the Components is required to market & sell the components or products incorporating or utilizing Components, the Customer is solely responsible for obtaining such certificates or approvals at its own cost, & to otherwise ensure compliance with applicable law & regulations. The Customer shall indemnify & hold Alva harmless from any liability incurred by Alva because of a breach of this clause 10.4.
10.5 Alva shall not be liable for any direct, indirect, incidental or consequential damages, whether based in contract, tort, strict liability or otherwise, arising out of or in any way connected with installation or use of the Components.
10.6 Alva shall not be liable for any damage or penalty for delay in delivery when such delay is due to force majeure events.
10.7 The Customer shall indemnify, defend & hold harmless Alva from & against any claim or related liabilities, costs, expenses, damages, deficiencies, losses or obligations of any kind or nature (including legal costs), brought by a third party to the extent arising out of, or otherwise relating to the Customer's use of the Components(s).

11. Cancellation
11.1 Alva shall have the right to cancel any unfilled order without notice to the Customer in the event that Customer becomes insolvent, adjudicated bankrupt, petitions for or consents to any relief under any bankruptcy reorganization statute, or becomes unable to meet its financial obligations in the normal course of business.

12. Rights
12.1 Alva retains all intellectual & industrial property rights in & to the deliverables to the Customer, including but not limited to trademarks, design, copyrights, visual representation, software, methods of manufacture, know- how, trade secrets & similar, & irrevocably grants the Customer all rights to use the deliverables for their intended purposes. Unless otherwise is explicitly agreed with the Customer, Alva also retains all rights to intellectual & industrial property rights in changes, improvements, developments & modifications to the deliverables made by Alva.
12.2 The Customer agrees not to copy, alter, modify, reverse engineer, or attempt to derive the composition or underlying information, structure or ideas associated with the Product(s). The Customer undertakes not to remove, overprint, deface or change any notice of confidentiality, copyright, trademark, logo, legend or other notices of ownership from the Product(s).

13. Confidentiality
13.1 The Parties are obliged to treat as confidential all information, know-how or other confidential material & any other material which is of such a nature that it should be considered confidential, & which is disclosed to the other party through business activities regulated by this Agreement. The Customer shall specifically treat as confidential all information relating to the Components.
13.2 Without prejudice to Alva's responsibilities with respect to confidential treatment, the Customer accepts that the existence of the Agreement & the identity of the Customer can be used by Alva as a reference in marketing materials & other promotion, unless otherwise is agreed in writing. Alva will notify the Customer of any such use.

14. Assignments
14.1 Alva shall be entitled to, at all times, to assign its rights under the Agreement (in whole or in part) or to subcontract any part of the work or services to be provided under the Agreement as it deems necessary or desirable.
14.2 The Customer shall not be entitled to assign its rights under the Agreement (in whole or in part) to any third party without the prior written consent of Alva.

15. Changes
15.1 No agreements amending, altering or supplementing the terms of this Agreement & the order confirmation may be made except by means of a written document signed by a duly authorized representative of each Party.

15. Governing Law & Jurisdiction
16.1 This Agreement is governed by the laws of Norway.
16.2 Any & all disputes, controversy or claim related to the Agreement, & which cannot be settled amicably, shall be settled by arbitration in accordance with the Arbitration Rules of the Norwegian Central Chamber of Commerce, unless otherwise is separately agreed. The arbitration proceeding & all related documents & decisions of the arbitral panel shall be confidential.
16.3 The place of arbitration shall be Trondheim, Norway.