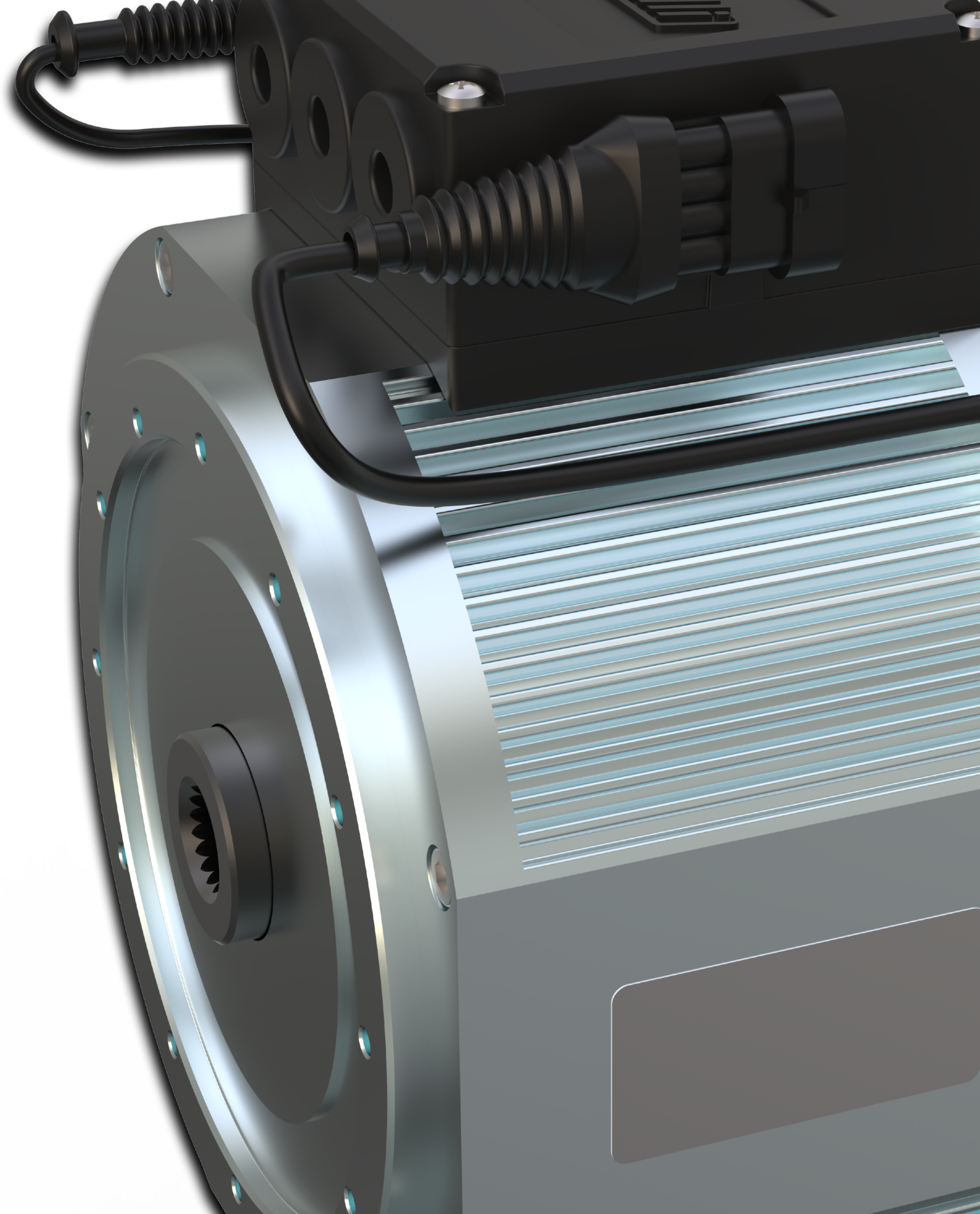
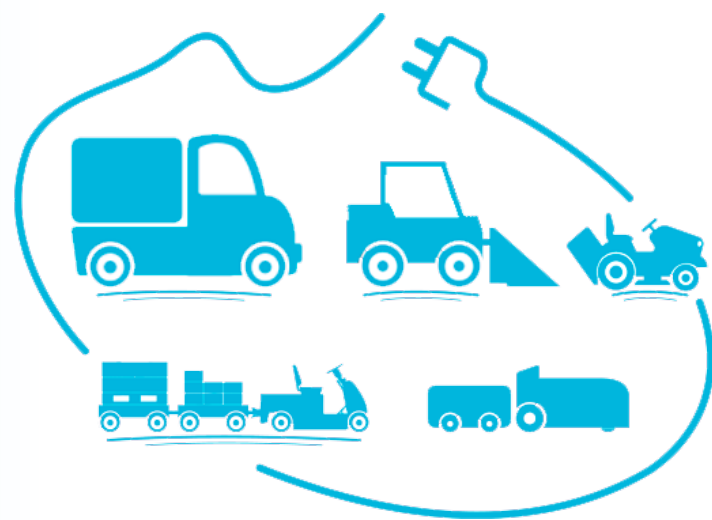
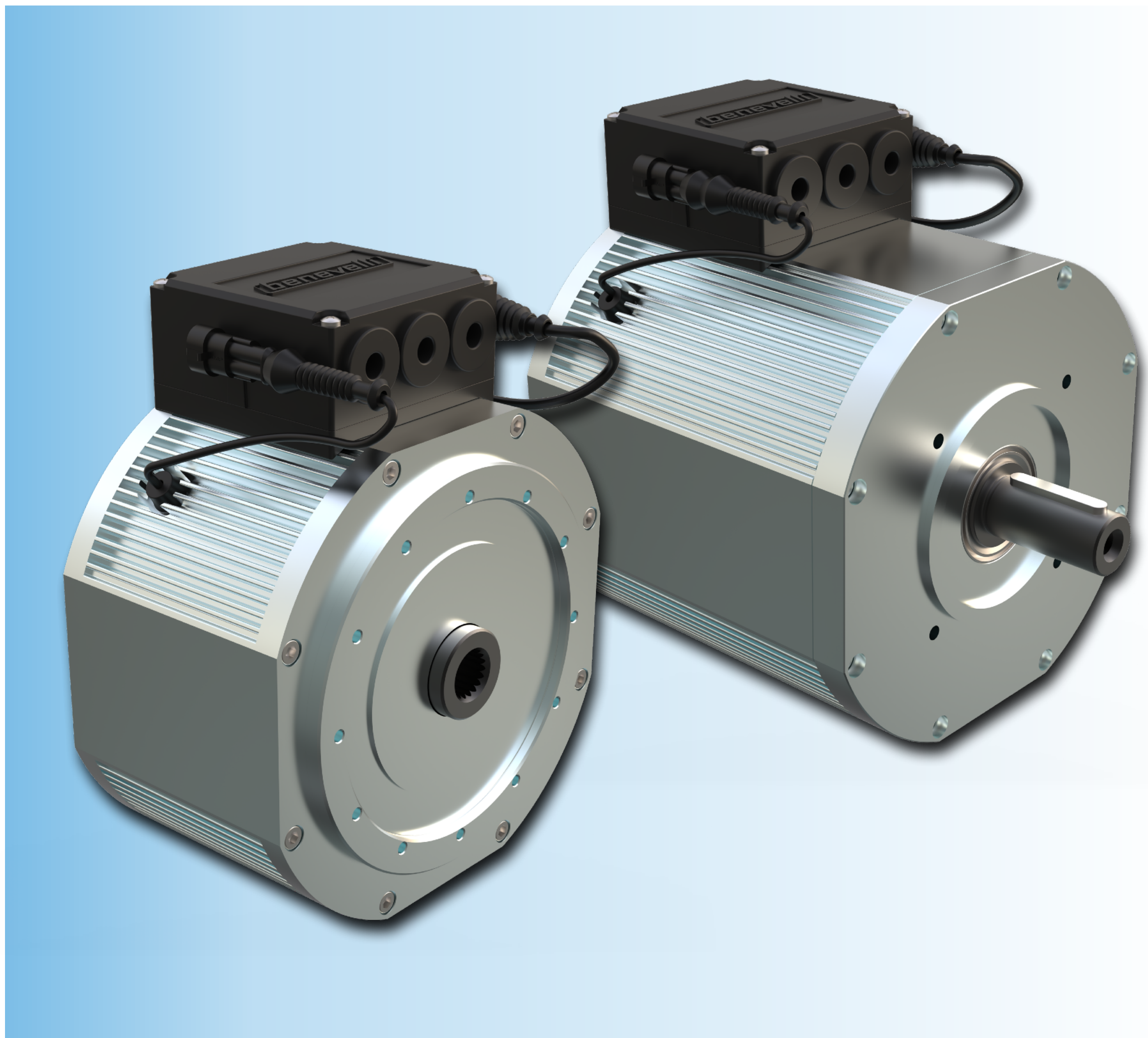




SMAC SERIE

PMAC ELECTRIC MOTORS





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WARNINGS

Failure or improper selection of the products described here can cause death, personal injury and property damage. This document provide products and options for further investigation by users having technical expertise. Users must analyze all aspects of application, follow applicable industry standards & certifications, and follow the information concerning the product in the current product catalog.



OVERVIEW

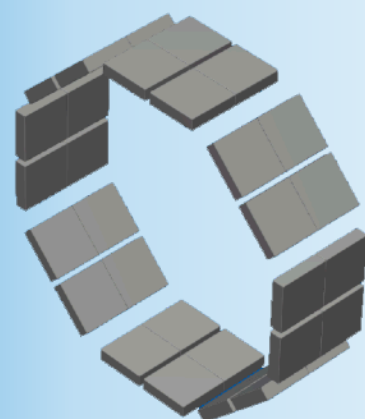
SMAC Serie offer Permanent Magnet Synchronous technology boasting up to 97% efficiency that enables the production of motors a third of the size and weight of typical induction ones.

Scalable design and high-speed performance thanks to field weakening equates to an unbeatable overall package, available for traction, hydraulics pumps and IEC/NEMA flanges.

TECHNICAL CHARACTERISTICS

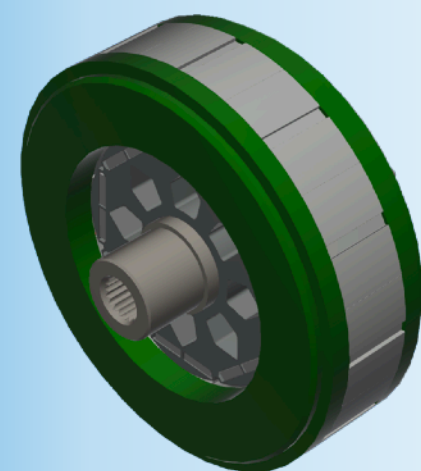
Motor Type	Permanent Magnet Synchronous Motor
Power Range	0,2 to 80kW (peak)
Voltage Range	24 to 600 Vdc
Torque Range	Up to 270Nm (peak)
Magnet Materiales	NeFeB rare earth magnets
Poles Numbers	4 to 10 poles
Motor Feedback	SinCos (resolver option)
Protection	Up to IP 6k9k
Thermal Class	F with potting
Thermal Protection	KTY 84-130
Connections	Terminal box (flying cables option)
Cooling	Self or liquid cooling
Mounting Orientation	Arbitrary
General Regulations	Complying IEC 60034
Marking	CE, UL®

TECHNICAL CHARACTERISTICS



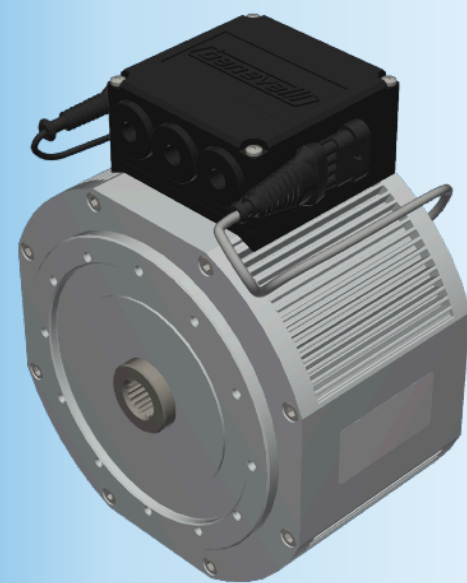
INTERIOR PERMANENT MAGNET

Rare-earth permanent magnet deeply positioned in the rotor generating a strong magnet torque.



ENCAPSULATED STATOR

Fully encapsulated for an excellent electrical insulation, thermal dissipation and shock proof.



HIGH POWER DENSITY

IPM technology allows production of motors a third of the size & weight of typical AC induction.

FEATURES

✓ HIGHEST EFFICIENCY

High Efficiency thanks to optimal electric design characteristics (dedicated to each single application) combined to the best component technology, allowing minimize of losses during power generation.

✓ SMALLER DIMENSIONS

Benevelli innovative motors are the key technology to space-saving in electrification. The combination of two rotating forces of the ever potent neodymium magnet torque and original reluctance torque, elevated power can be generated at lower motor volumes.

✓ BREAKTHROUGH PERFORMANCE

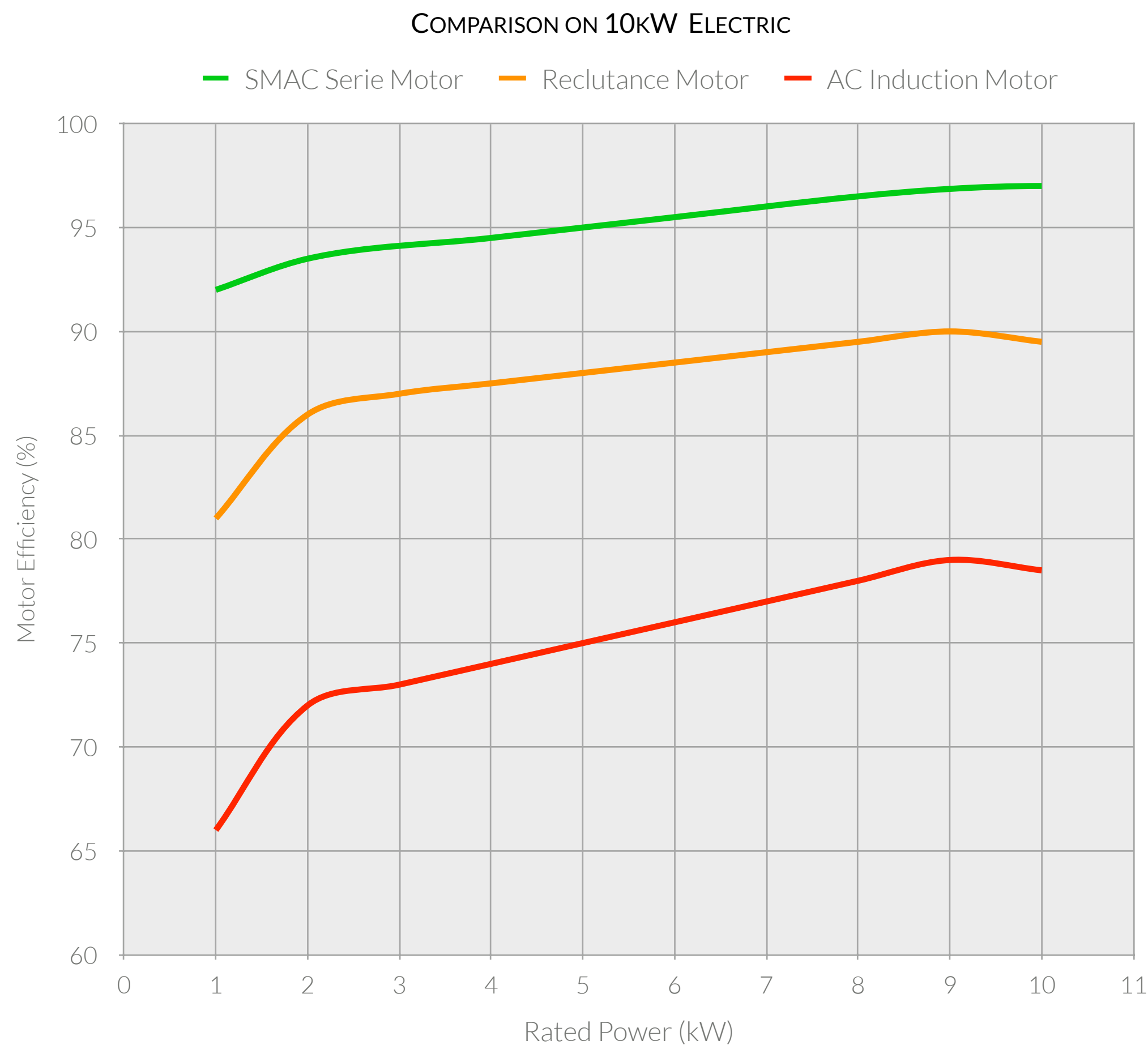
SMAC Serie utilizes highly engineered rotor design to achieve the highest efficiencies. Higher power density thanks to NeFeB rare earth magnet NiCuNi surface-coated to guarantee high performance and protect them against oxidation and corrosion.

✓ MODULAR

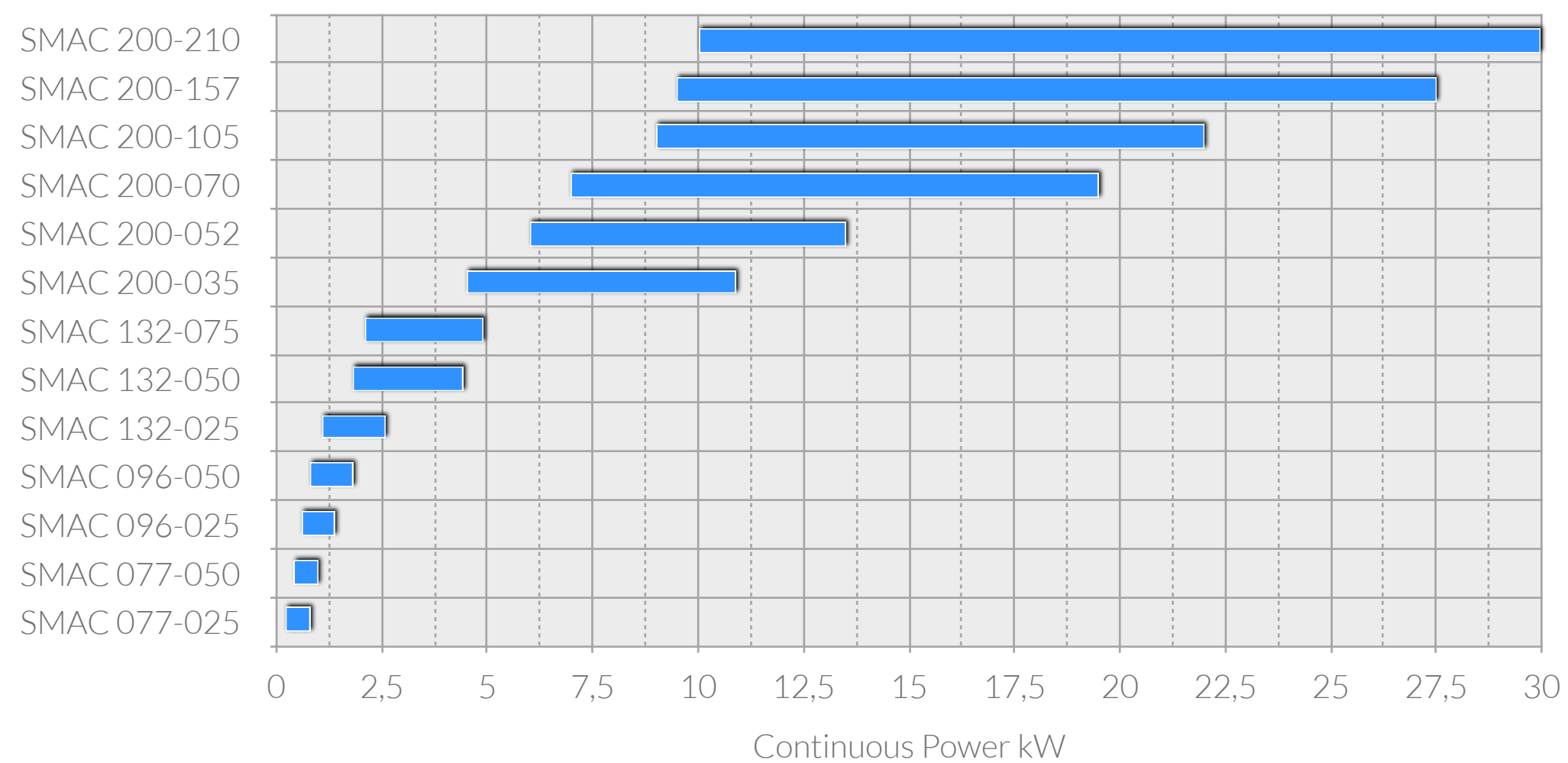
Thanks to high modularity of standard lamination stack length and great scalability in performances SMAC Serie motors fit within a wide-range of applications. Customization capability including specific mechanical design, we collaborate with every customer providing special solutions and interfaces

BREAKTHROUGH PERFORMANCE

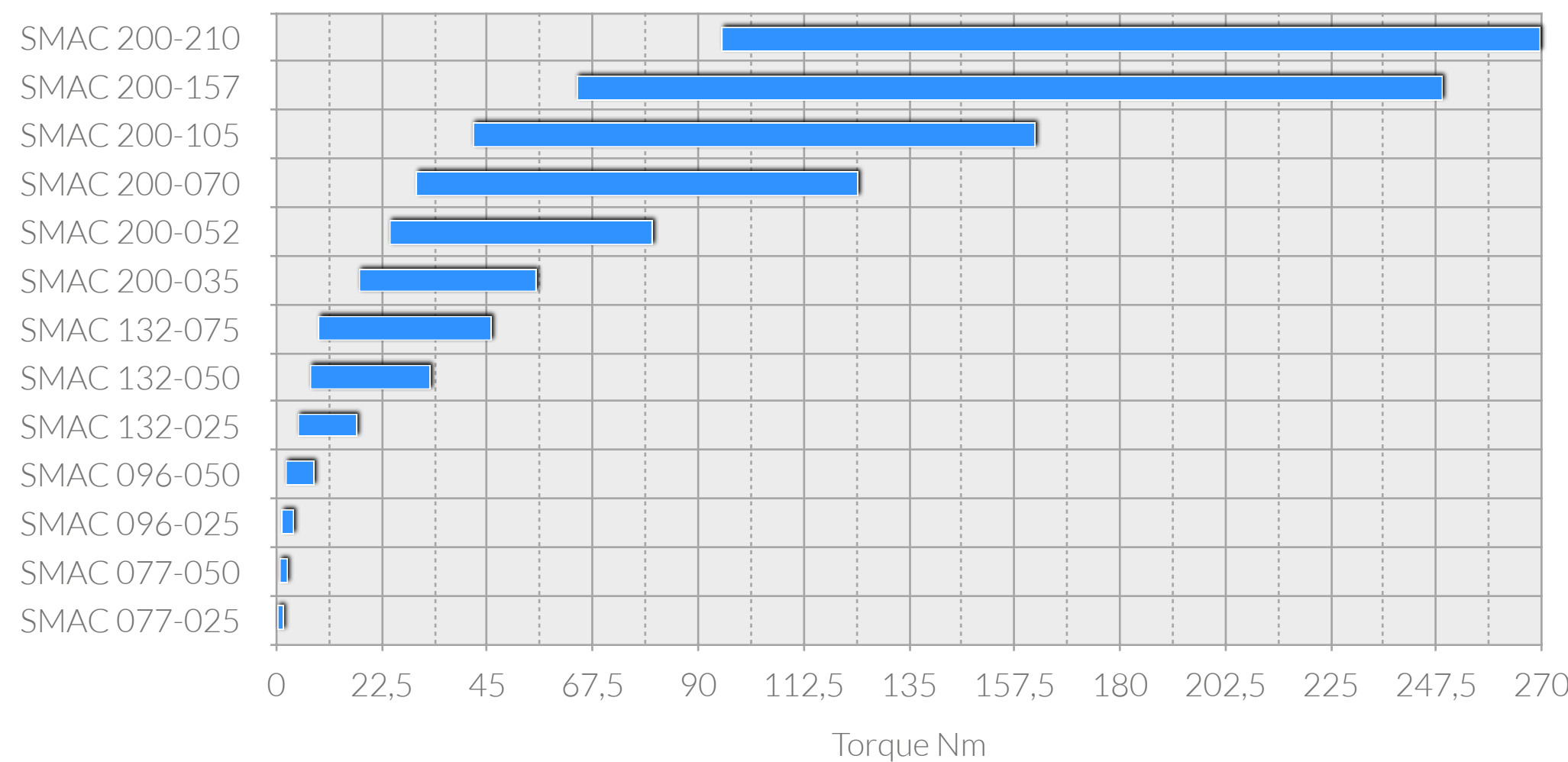
Thanks to interior permanent magnet technology, SMAC Serie efficiency is much higher than traditional AC Induction and Reluctance motors.



POWER RANGE



TORQUE RANGE



CHOOSING THE RIGHT MOTOR

Motor sizing is the key for the success of any electrification project

By selecting the appropriate voltage, rotor length and winding model, following parameters can be refined to match the vehicle's specific performance requirements:

1. INSTANT AREA

Extreme working conditions, where electric motor can operate for limited periods only.

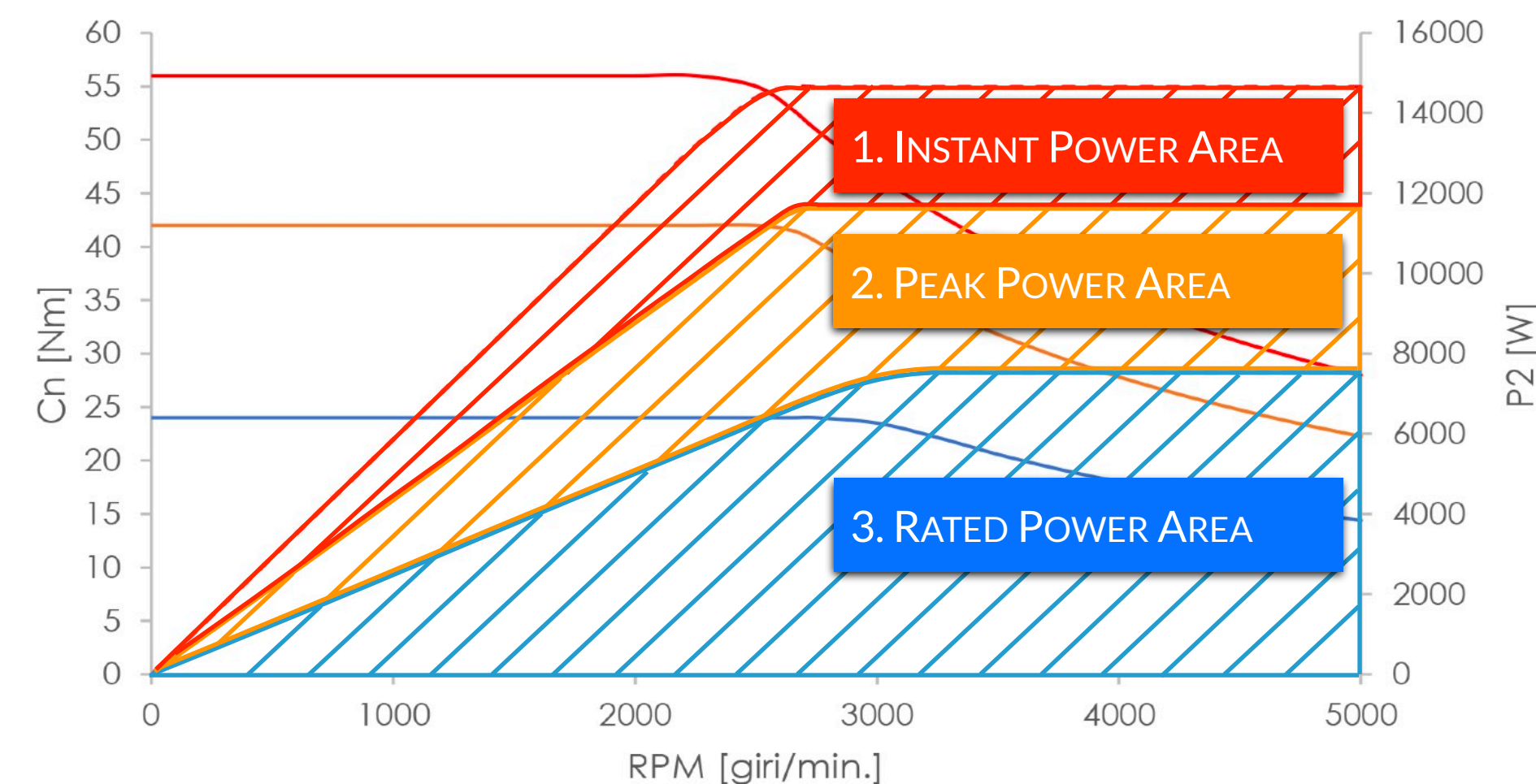
2. PEAK AREA

Peak working conditions, where electric motor can operate intermittently in safe conditions.

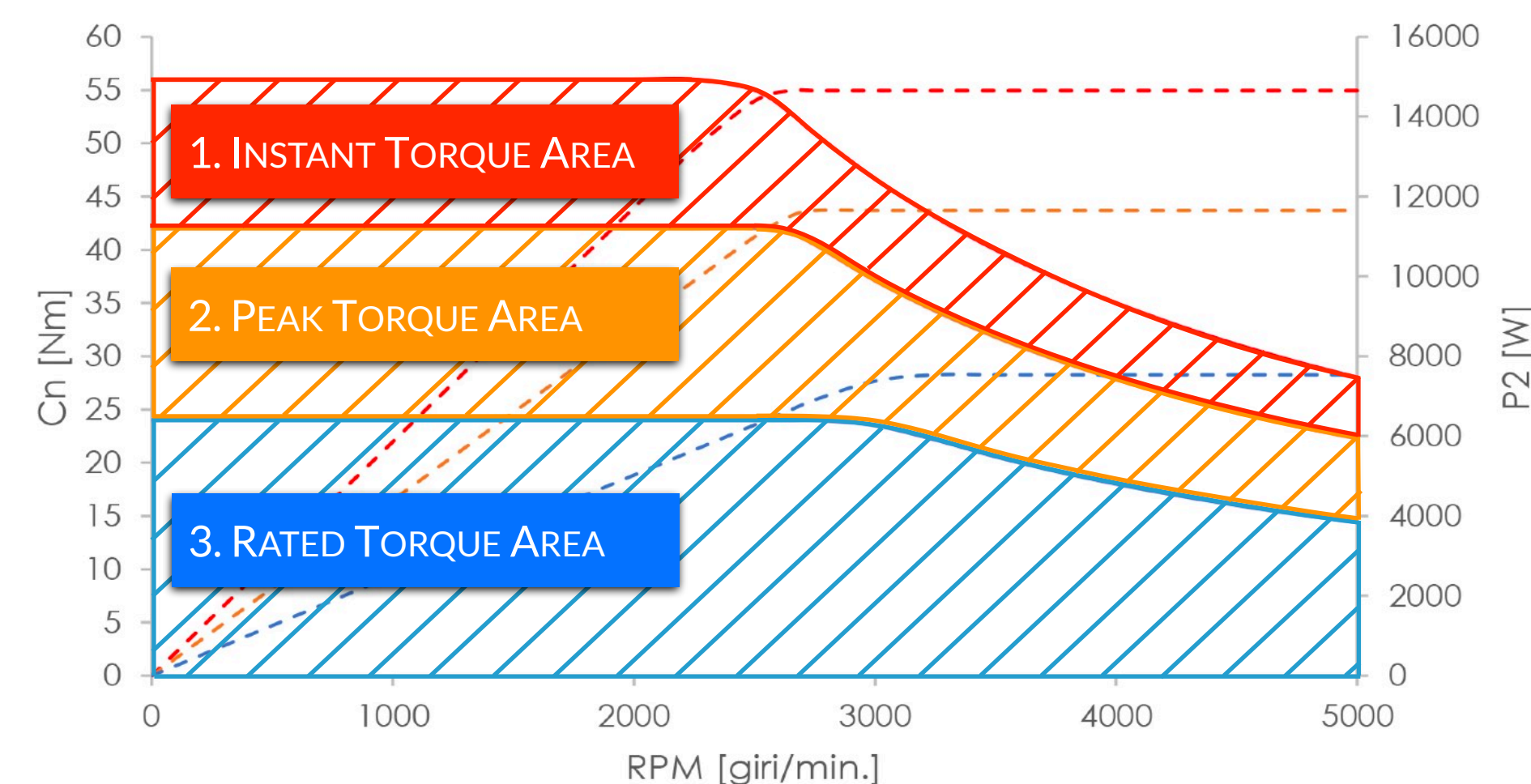
3. RATED AREA

Nominal working conditions where the electric motor can operate continuously.

POWER CURVES



TORQUE CURVES



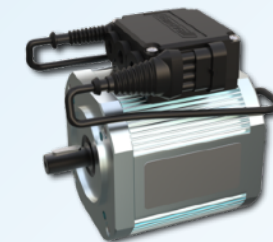
SMAC SERIE RANGE

High power density and speed capabilities of SMAC Serie motors (PMAC) combined with a matched inverter provide the speed and torque required to achieve unparalleled performances in a wide variety of electric vehicle and machines.

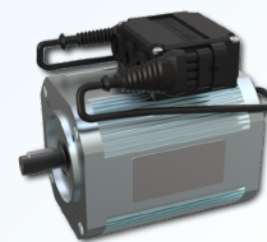
Benevelli motors have been designed in 4 families, each family provide different motor models thanks to modularity of lamination stack length.

- ✓ SMAC 077 SERIE
- ✓ SMAC 096 SERIE
- ✓ SMAC 132 SERIE
- ✓ SMAC 200 SERIE
- ✓ SMAC 270 SERIE (COMING SOON)

SMAC 077 SERIE

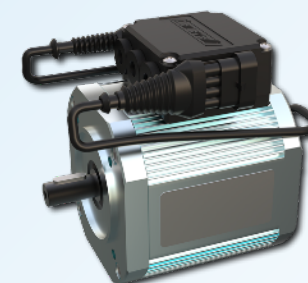


077-025

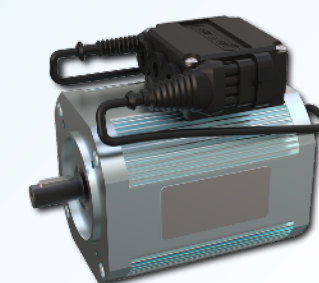


077-050

SMAC 096 SERIE



096-025

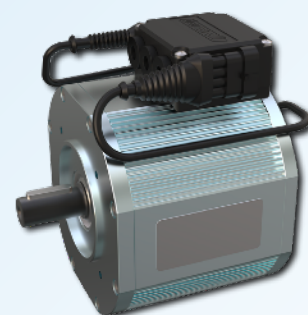


096-050

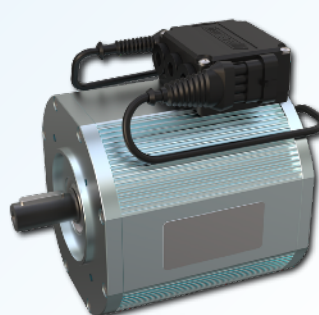
SMAC 132 SERIE



132-025

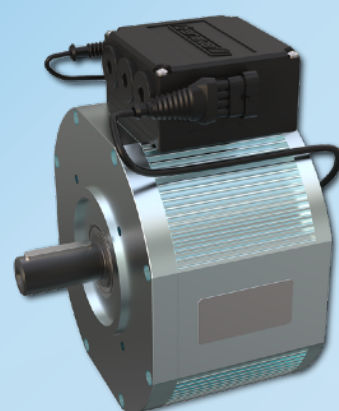


132-050

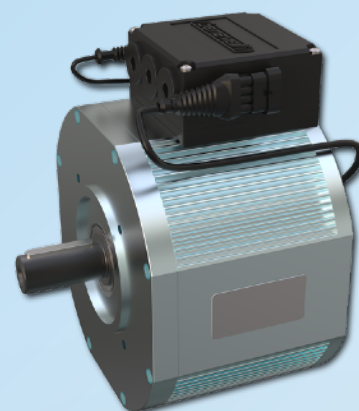


132-075

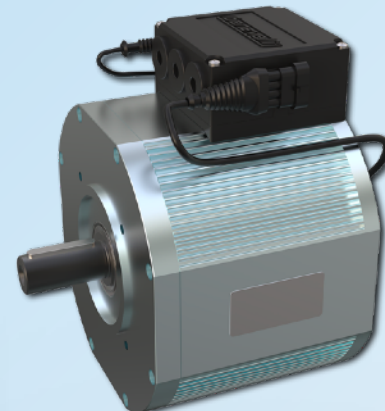
SMAC 200 SERIE



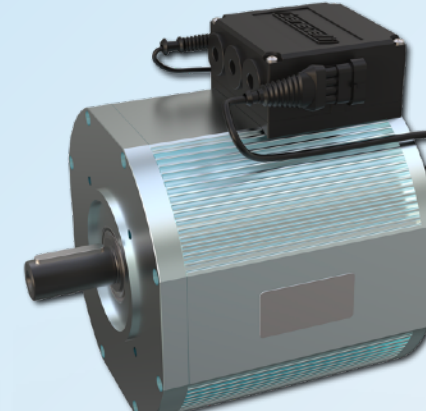
200-035



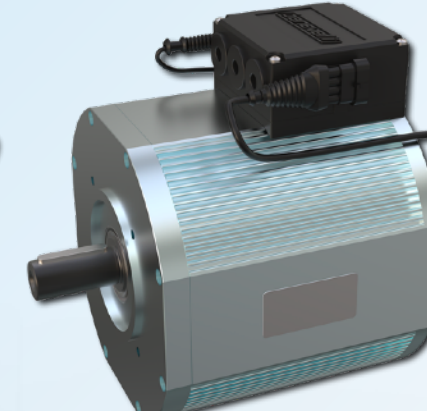
200-052



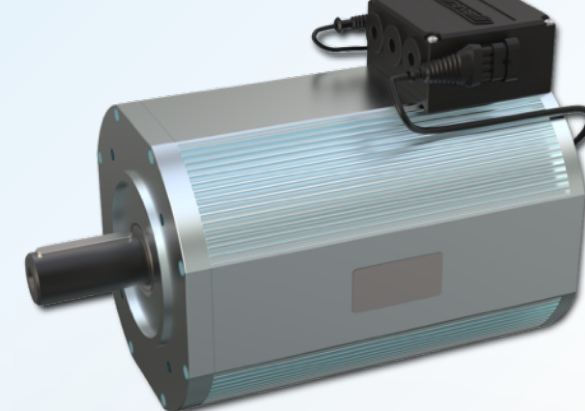
200-070



200-105

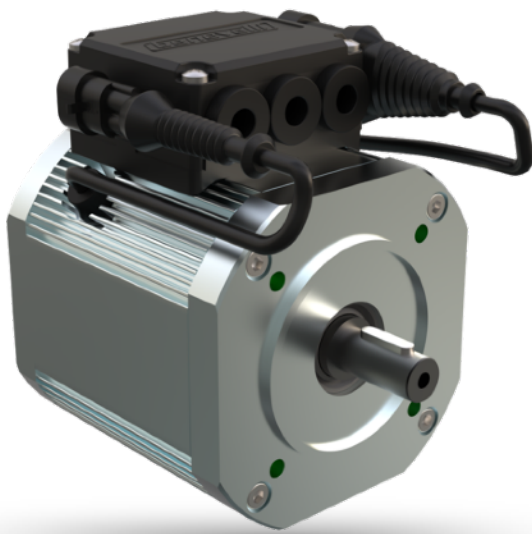


200-157



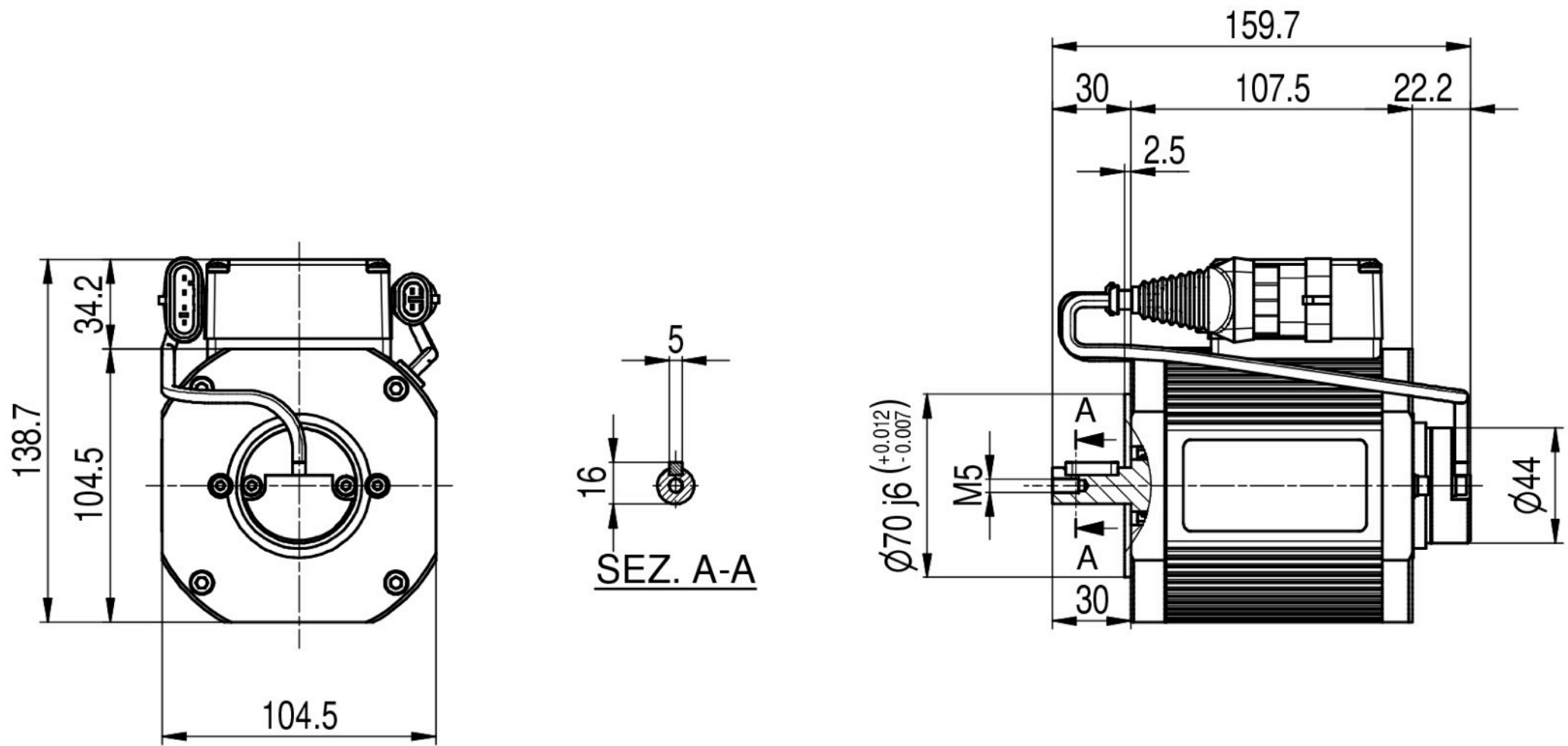
200-210

SMAC 077-025



3D VIEWER

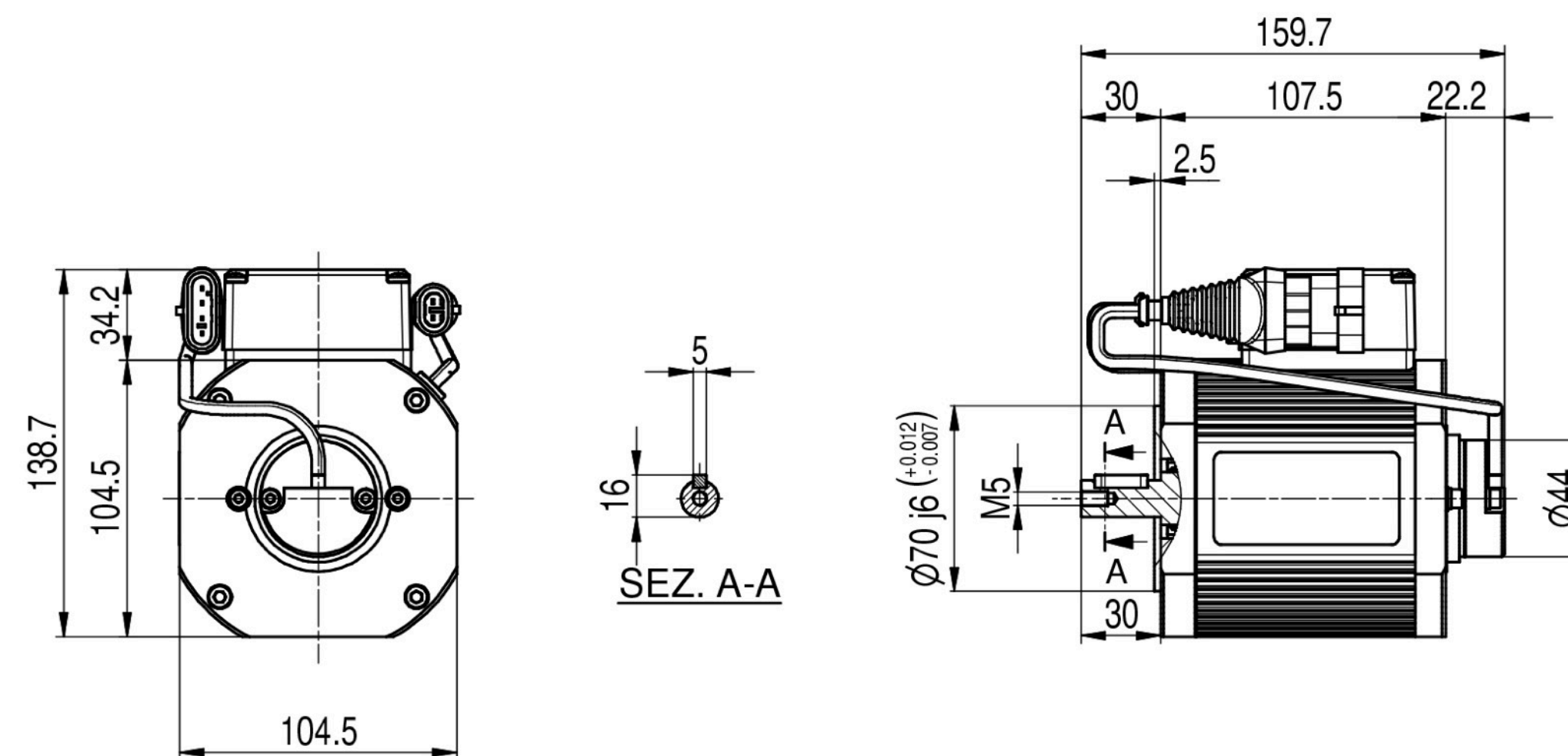
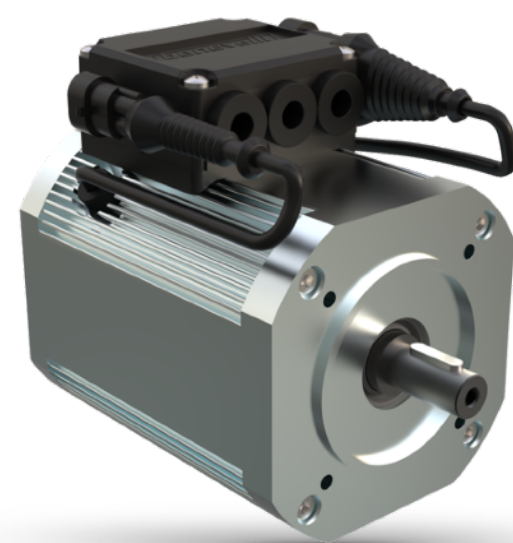
STANDARD LAYOUT



TECHNICAL DATA

Motor			Battery DC Voltage [V]	Rated Power [kW]	Instant Power [kW]	Rated Torque [Nm]	Instant Torque [Nm]	Rated Current [Arms]	Peak Current [Arms]	Rated Speed min ⁻¹	DOWNLOAD
1	SMAC 077-025-10		24	0,37	0,6	1	2,6	16	48	3.700	
2	SMAC 077-025-A4		48	0,25	0,8	0,5	1,9	17	23	5000	

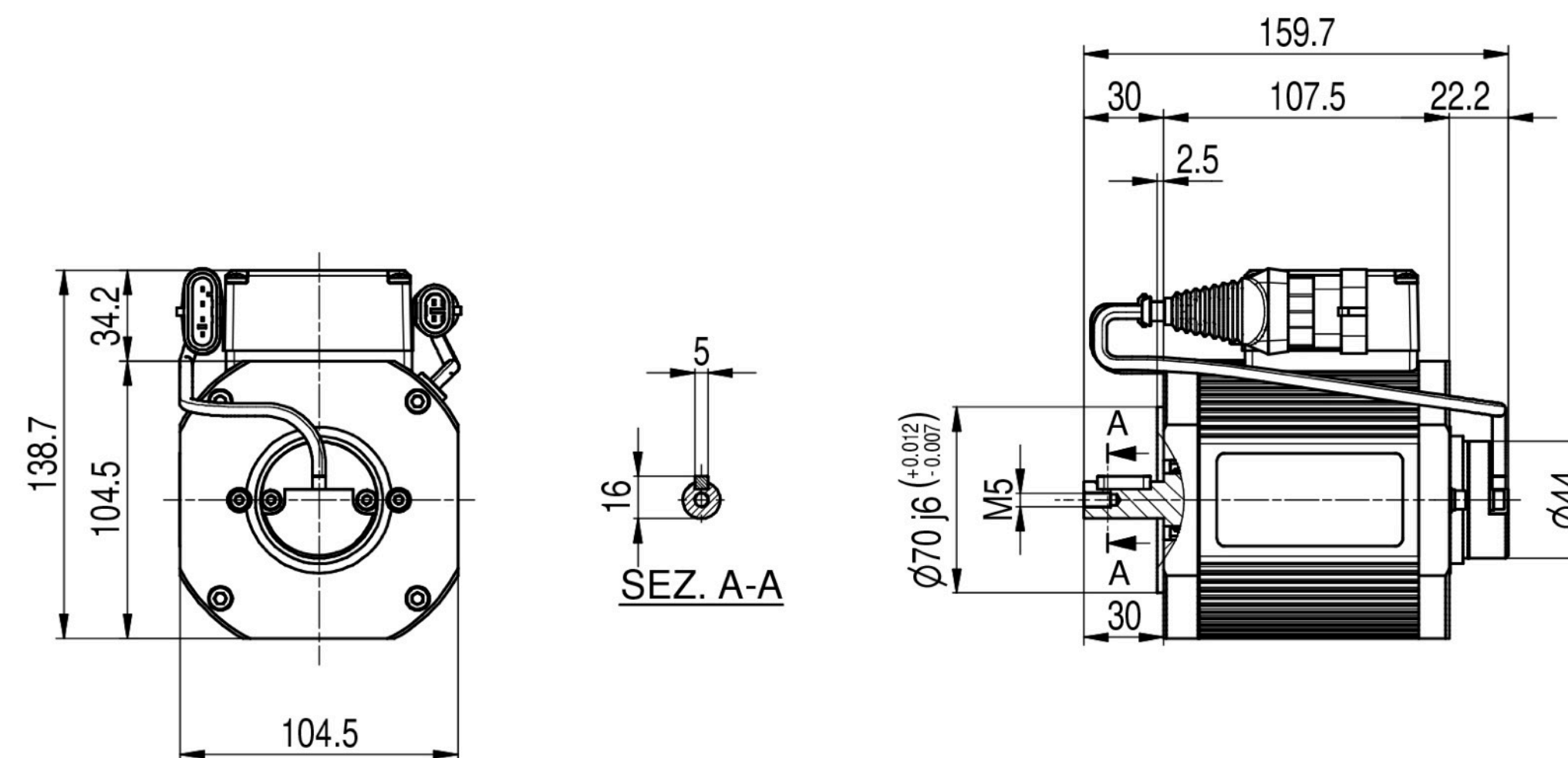
STANDARD LAYOUT



TECHNICAL DATA

[illegible]

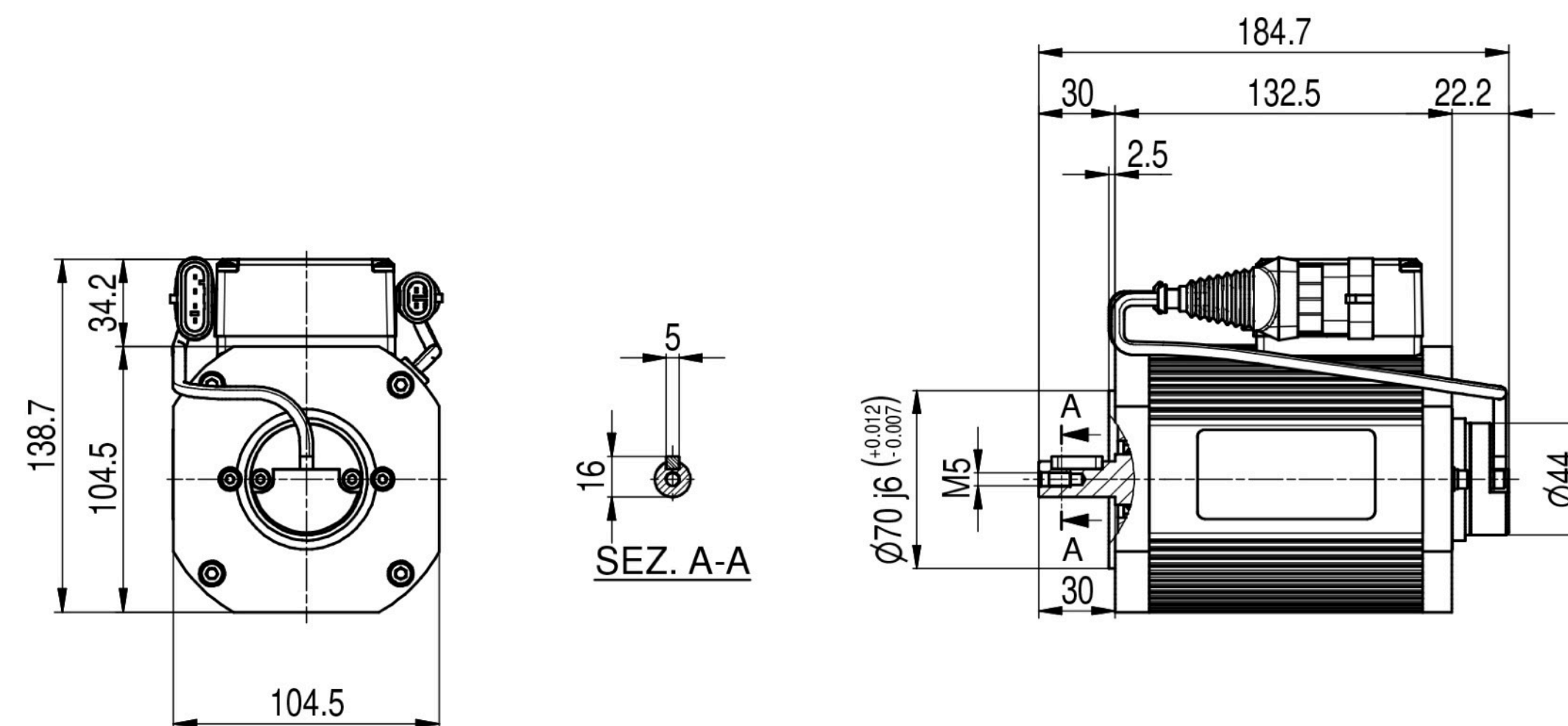
STANDARD LAYOUT



TECHNICAL DATA

[illegible]

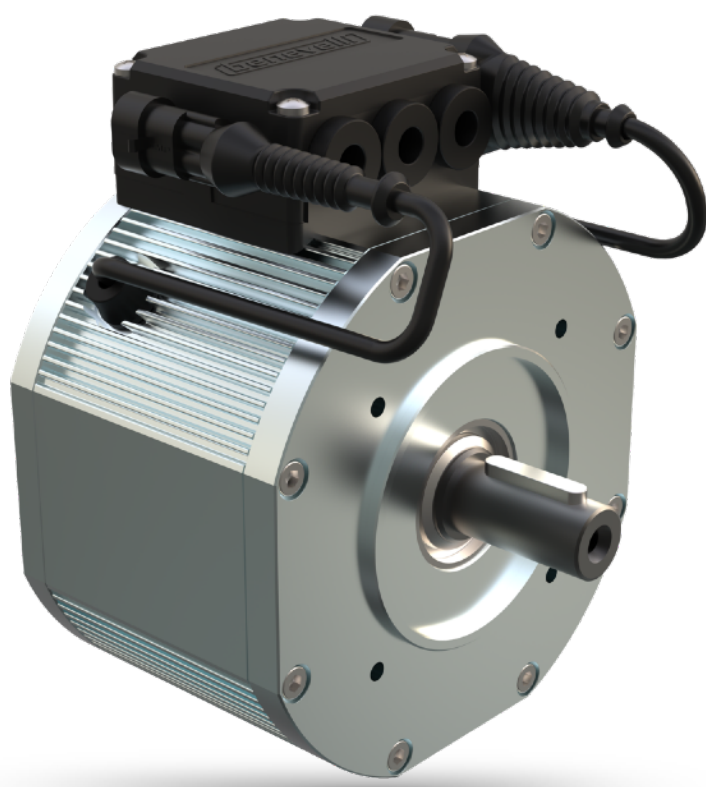
STANDARD LAYOUT



TECHNICAL DATA

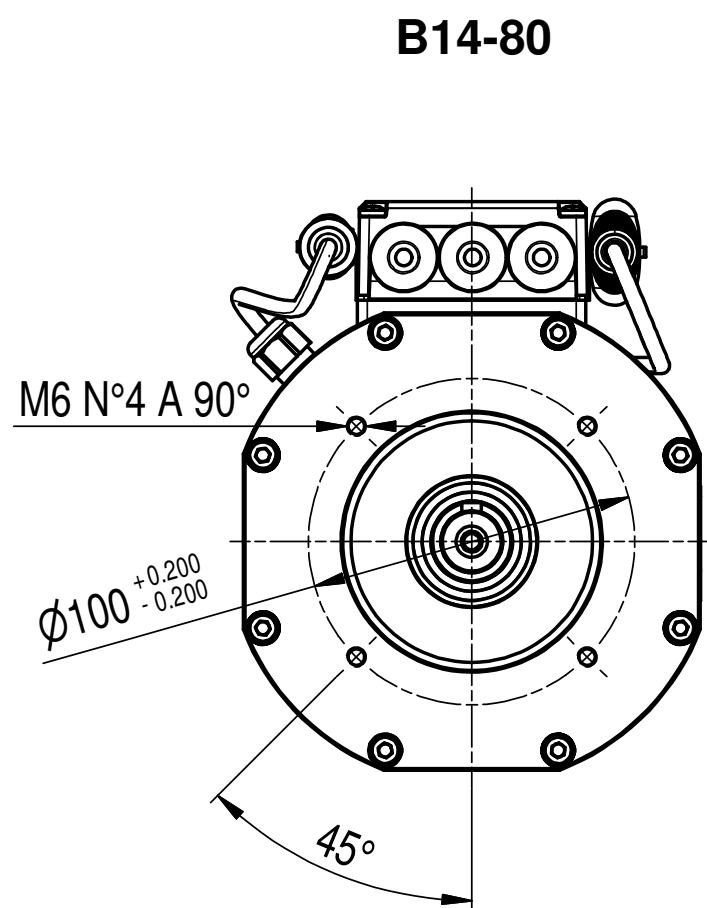
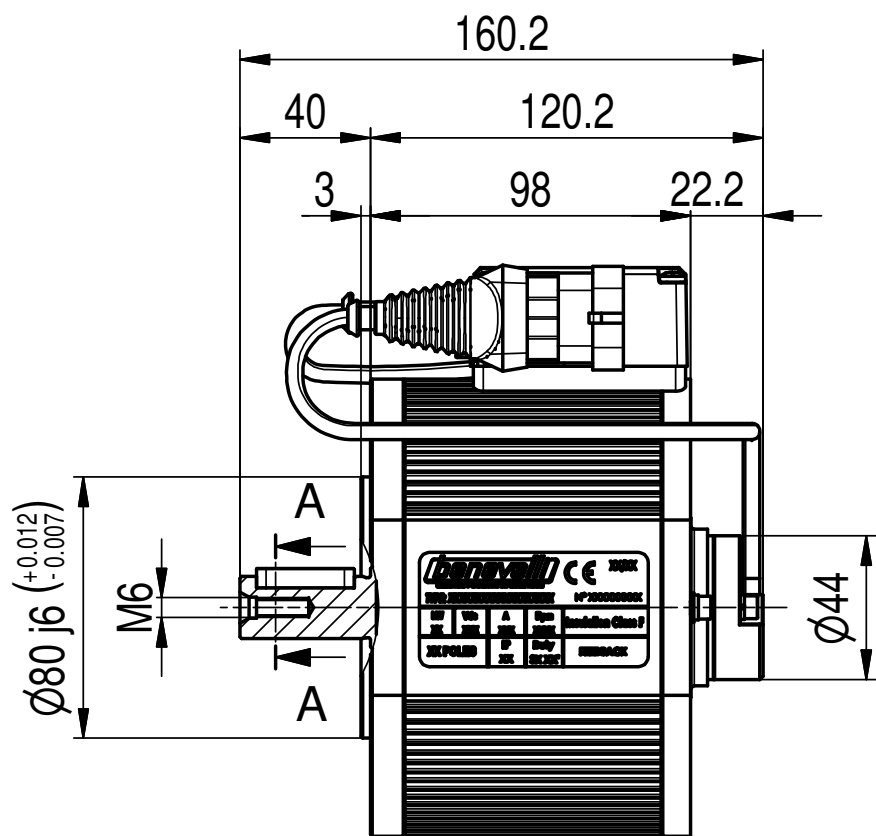
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SMAC 132-025



3D VIEWER

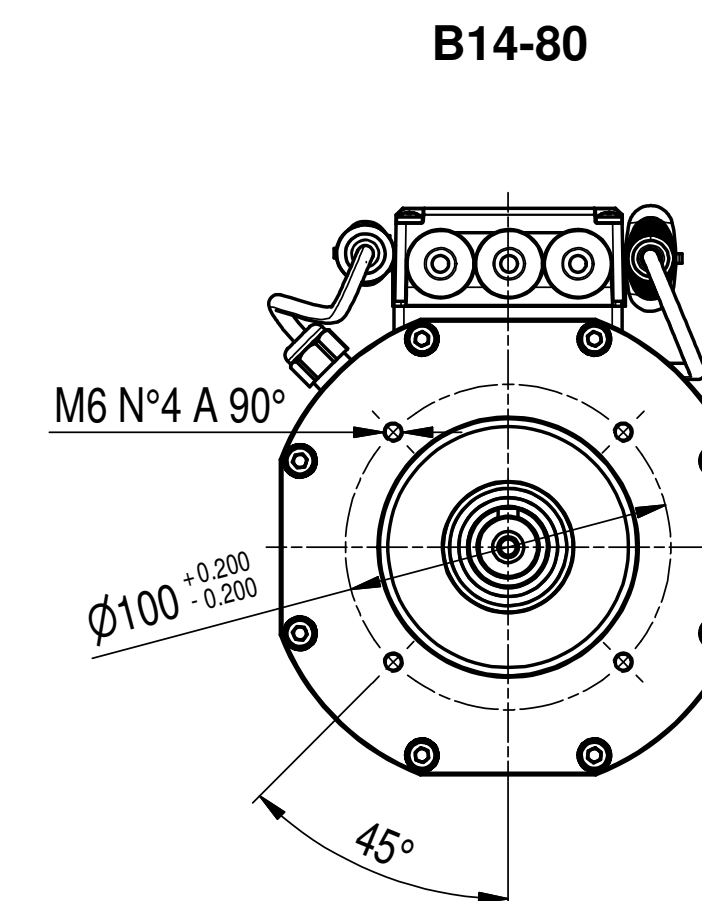
STANDARD LAYOUT



TECHNICAL DATA

Motor			Battery DC Voltage [V]	Rated Power [kW]	Instant Power [kW]	Rated Torque [Nm]	Instant Torque [Nm]	Rated Current [Arms]	Peak Current [Arms]	Rated Speed min ⁻¹	DOWNLOAD
1	SMAC 132-025-10		24	1,5	3,5	4,3	13,0	73	250	3.000	
2	SMAC 132-025-20		36	1,1	1,5	4,7	12,7	35	105	2.300	
3	SMAC 132-025-20		48	1,5	3,1	4,3	13,0	34	115	3.000	
4	SMAC 132-025-40		80	1,5	2,8	4,3	13,0	19	65	3.000	
5	SMAC 132-025-68		96	1,5	3,6	4,7	12,7	17	51	3.000	

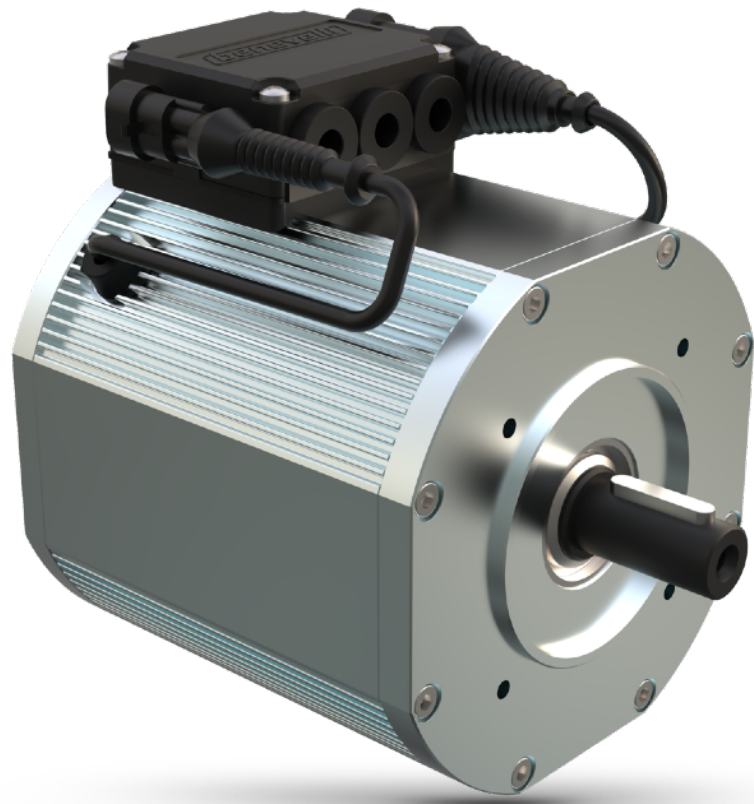
STANDARD LAYOUT



TECHNICAL DATA

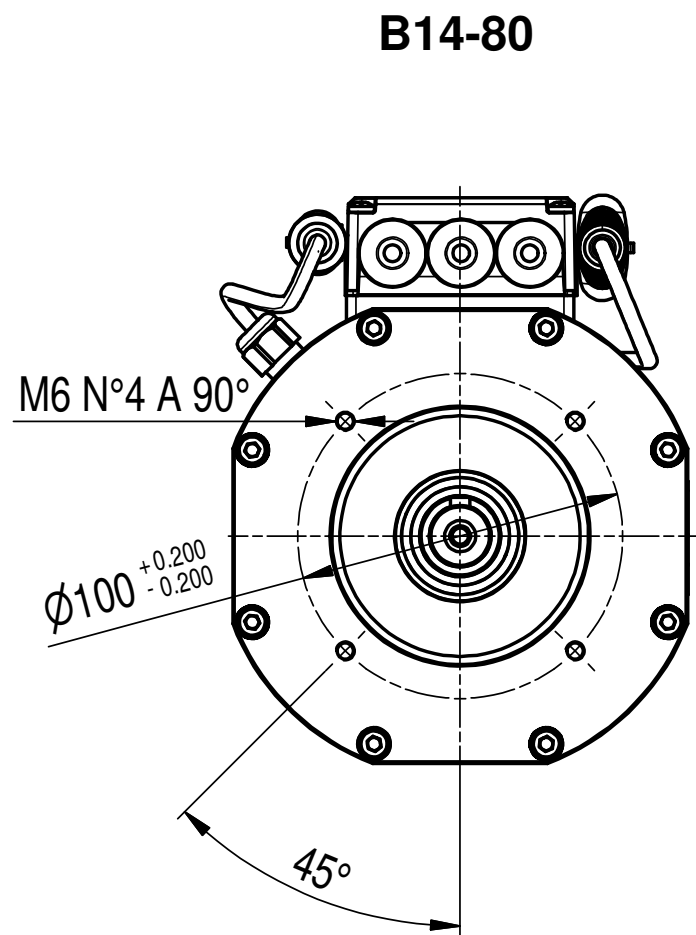
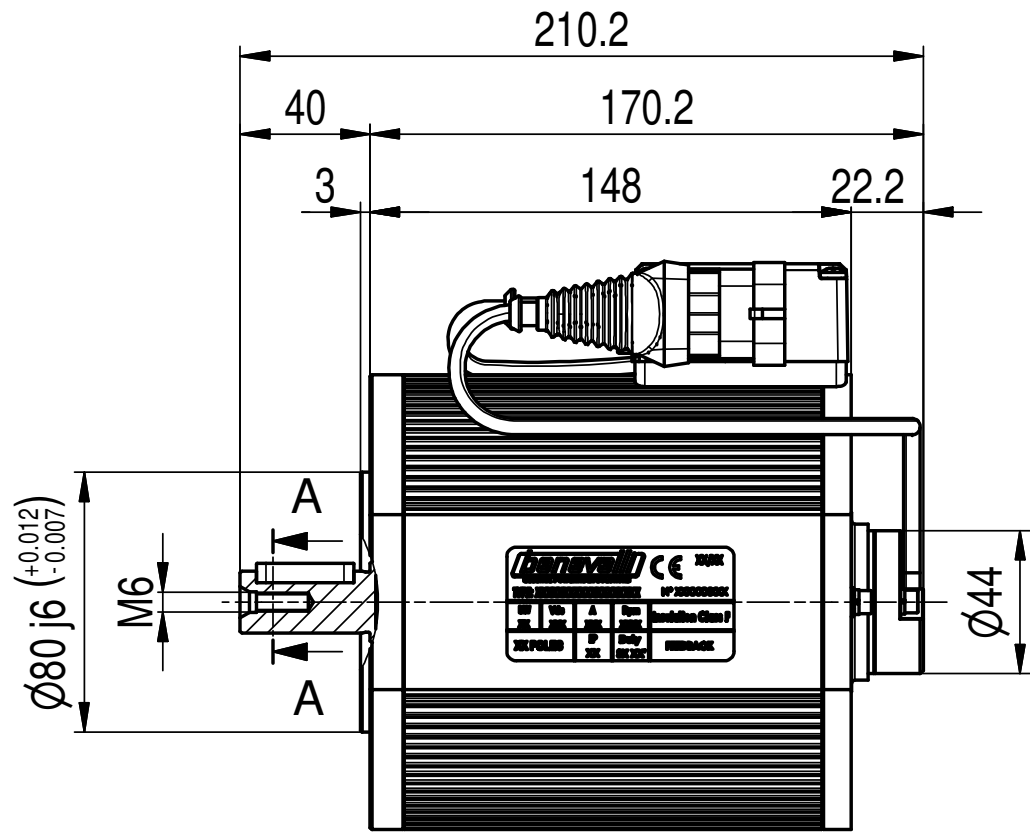
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SMAC 132-075



3D VIEWER

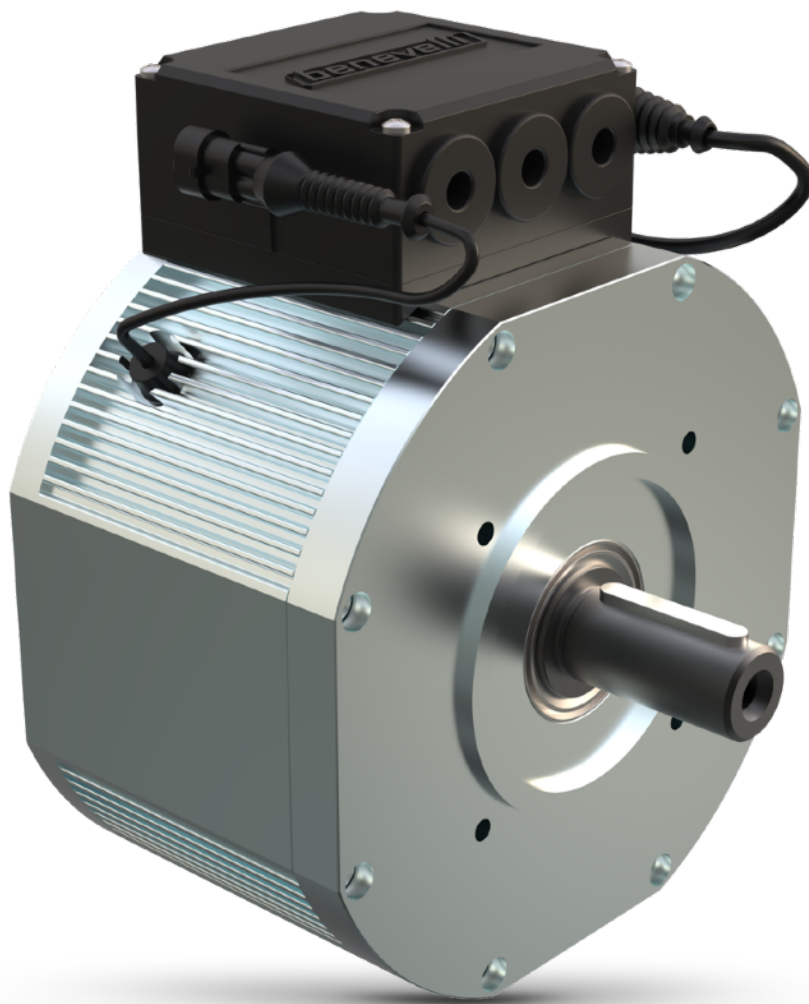
STANDARD LAYOUT



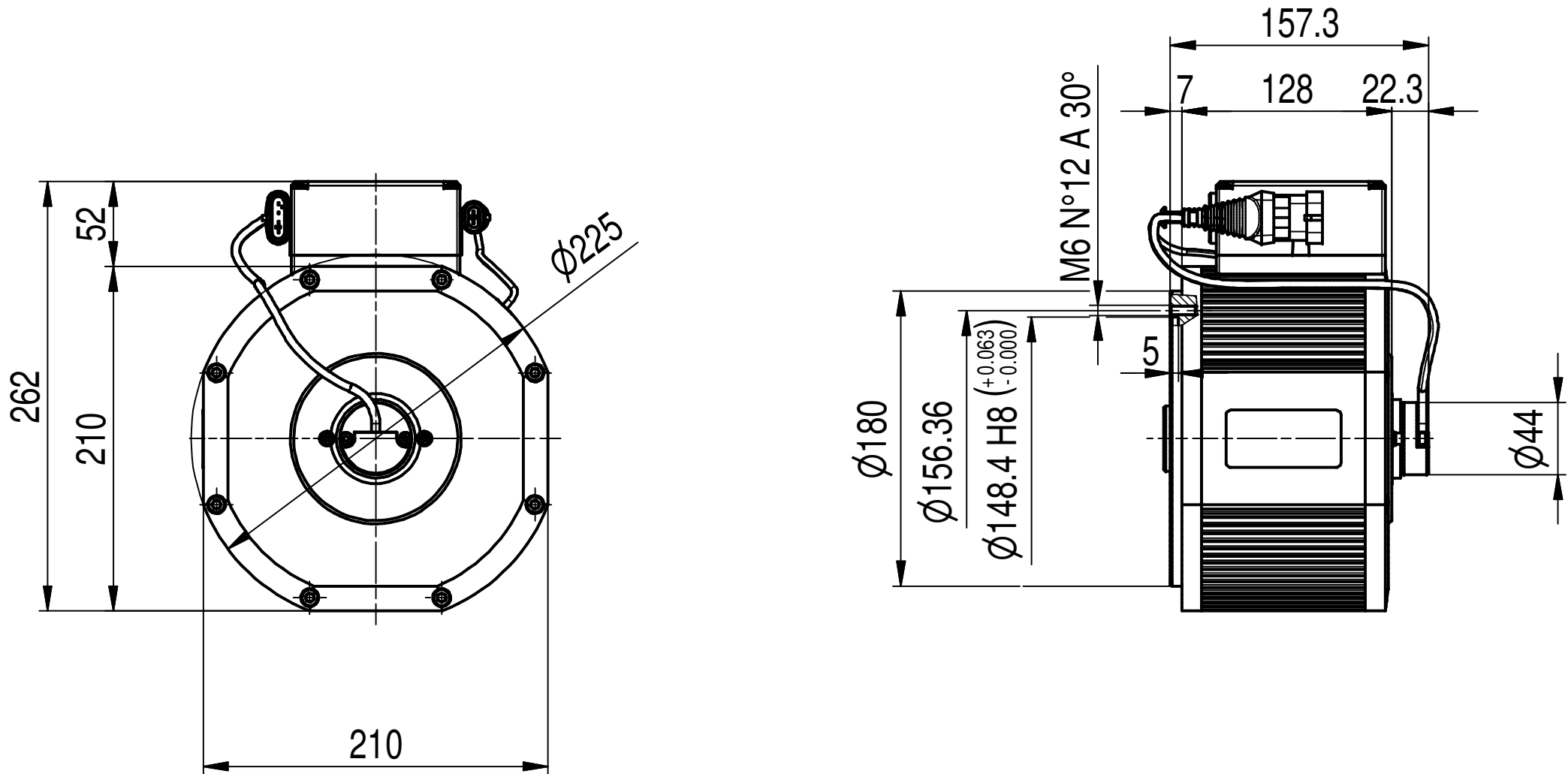
TECHNICAL DATA

Motor			Battery DC Voltage [V]	Rated Power [kW]	Instant Power [kW]	Rated Torque [Nm]	Instant Torque [Nm]	Rated Current [Arms]	Peak Current [Arms]	Rated Speed min ⁻¹	DOWNLOAD
1	SMAC 132-075-06		24	3,0	10,0	9,5	41,0	130	660	3.000	
2	SMAC 132-075-06		36	2,1	5,9	9,0	37,0	68	312	2.250	
3	SMAC 132-075-06		48	3,0	10,0	9,5	41,0	65	330	3.000	
4	SMAC 132-075-06		80	3,0	10,0	9,5	40,0	38	200	3.000	
5	SMAC 132-075-70		560	2,8	14,0	9,0	37,0	21	37	3.000	

SMAC 200-035



STANDARD LAYOUT



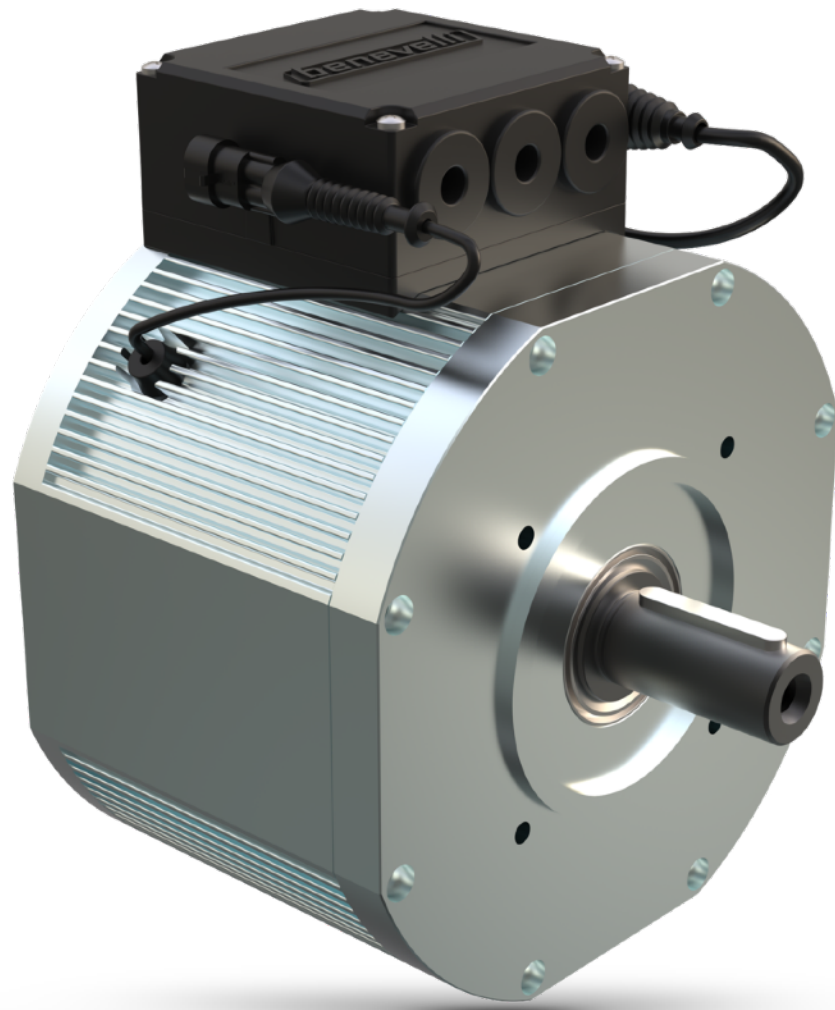
TECHNICAL DATA

Motor					Battery DC Voltage [V]	Rated Power [kW]	Instant Power [kW]	Rated Torque [Nm]	Instant Torque [Nm]	Rated Current [Arms]	Peak Current [Arms]	Rated Speed min ⁻¹	DOWNLOAD
1	SMAC 200-035-19	T	P		24	5,5	9,5	17,5	38,0	250	700	3.000	
2	SMAC 200-035-48		P		48	4,5	9,8	17,5	48,0	85	300	2.500	
3	SMAC 200-035-28	T			48	5,5	14,8	17,5	38,0	170	460	3.000	
4	SMAC 200-035-28	T	P		72	6,4	15,0	17,5	48,00	85	300	3.500	
5	SMAC 200-035-28	T	P		80	6,4	12,0	17,5	38,0	85	255	3.500	
6	SMAC 200-035-28	T	P		96	6,4	14,2	17,5	38,0	85	255	3.500	
7	SMAC 200-035-96	T	P	LC	400	6,0	10,0	23,0	50,0	18,2	49	2.500	

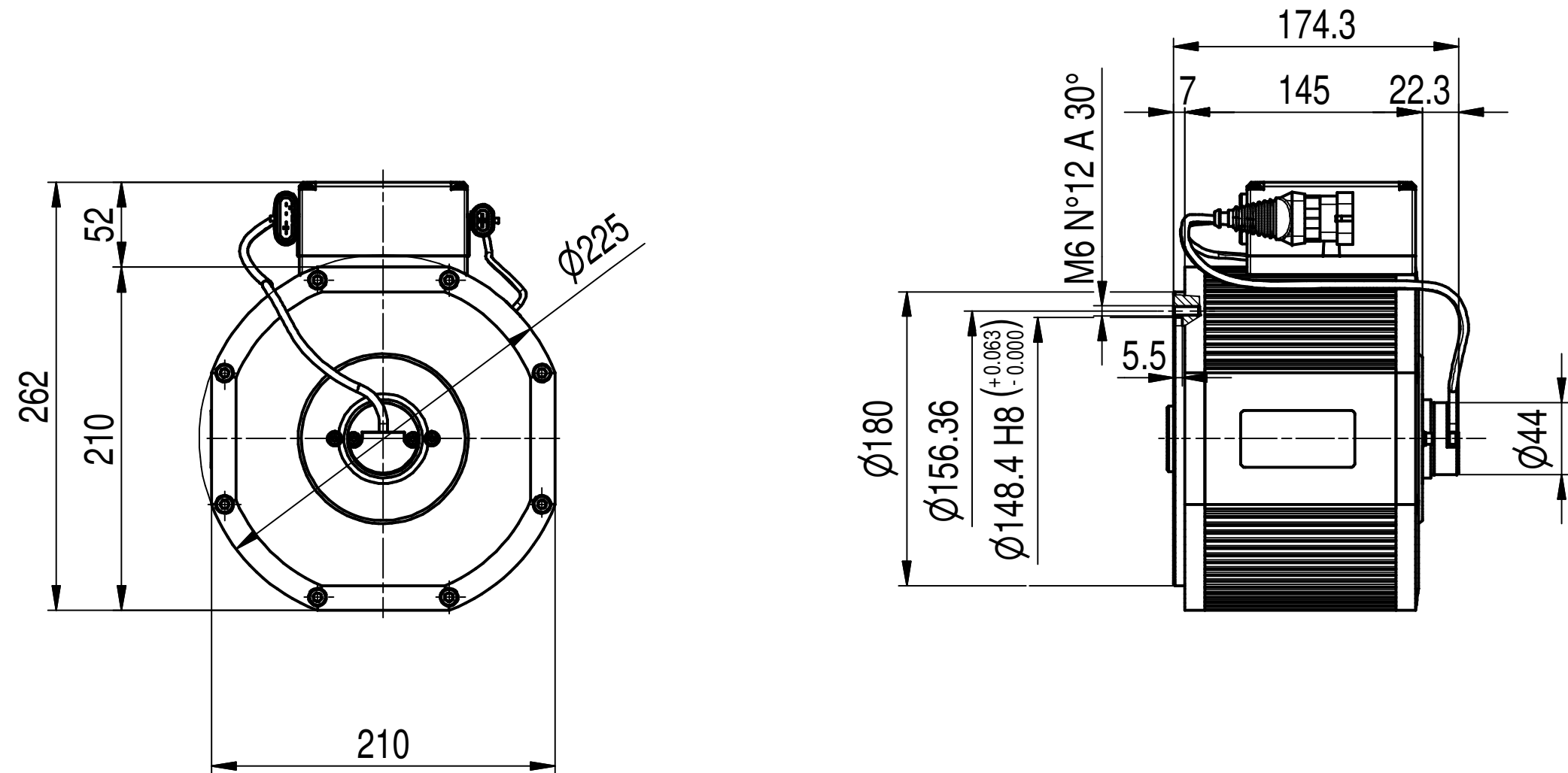
LC - LIQUID COOLED T - IDEAL FOR TRACTION P - IDEAL FOR PUMP

SMAC 077 SERIE
SMAC 096 SERIE
SMAC 132 SERIE
SMAC 200 SERIE

SMAC 200-052



STANDARD LAYOUT

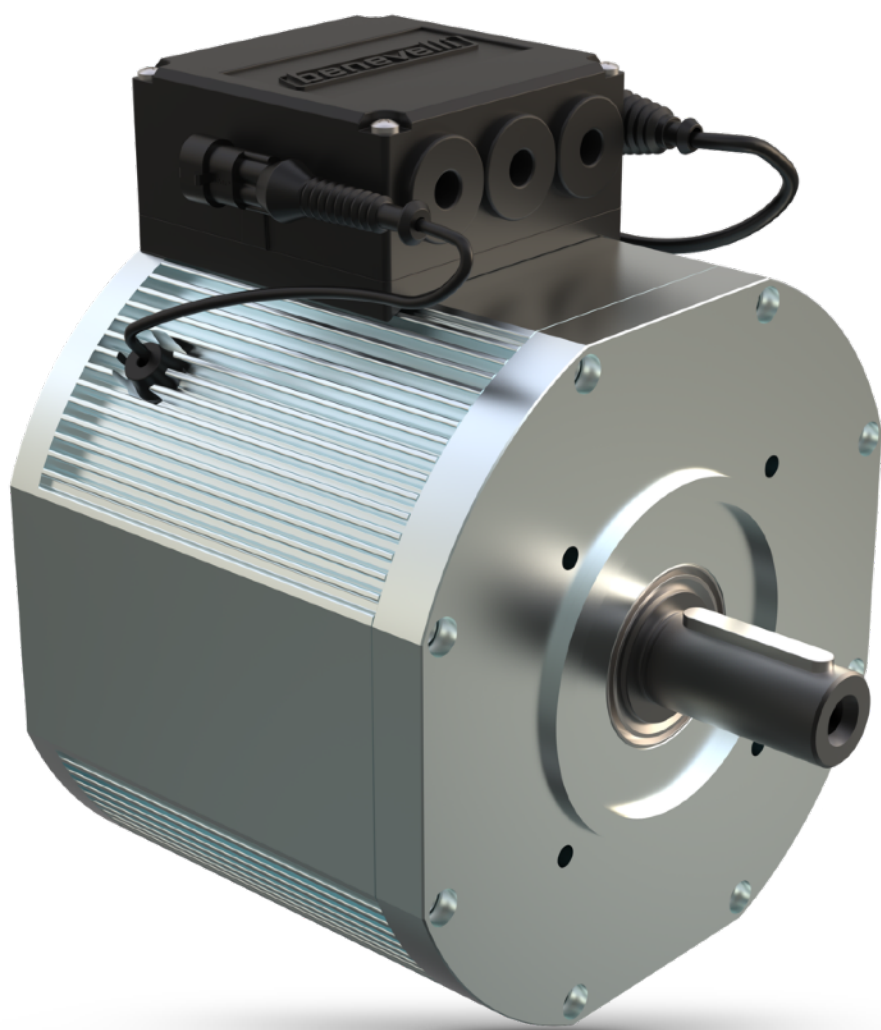


TECHNICAL DATA

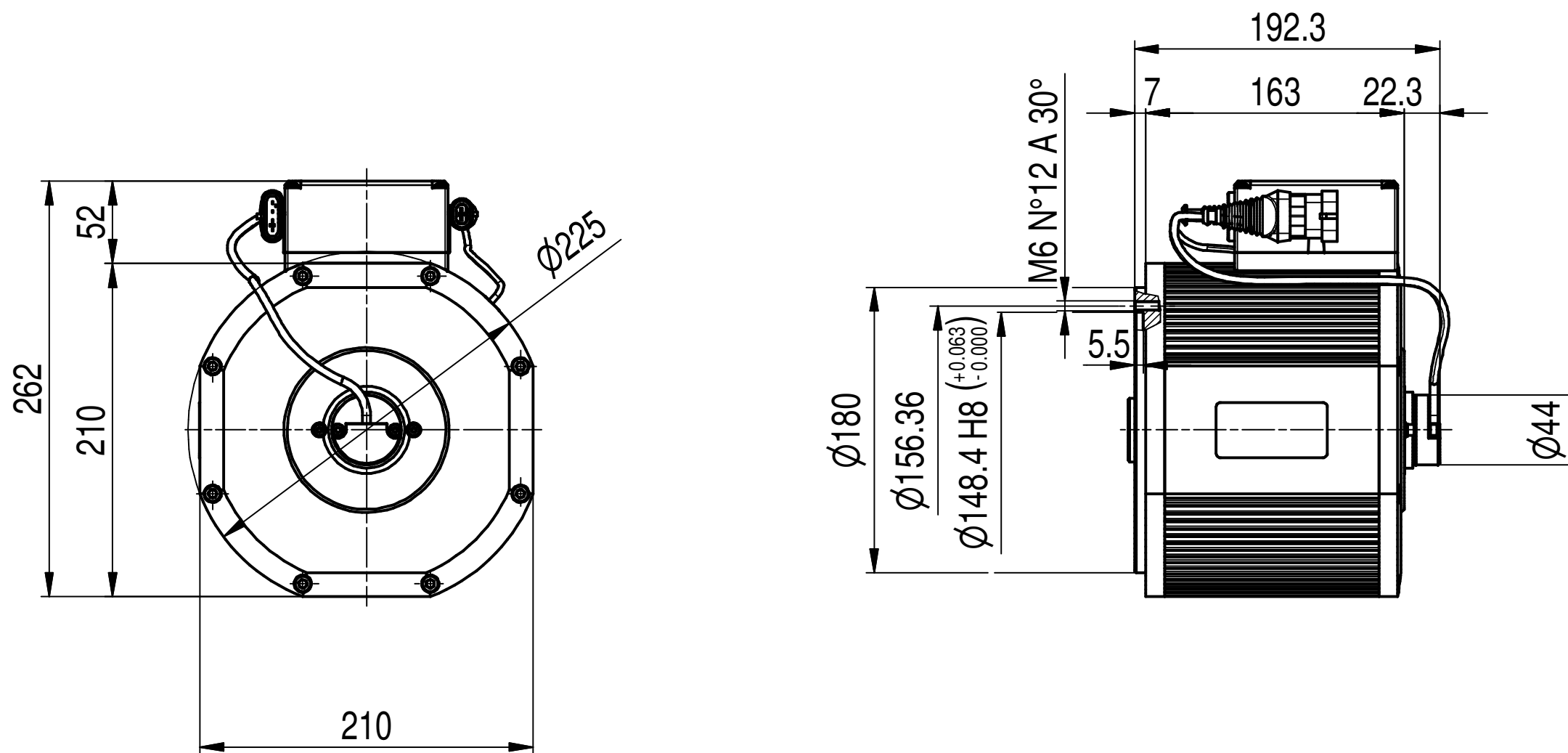
Motor					Battery DC Voltage [V]	Rated Power [kW]	Instant Power [kW]	Rated Torque [Nm]	Instant Torque [Nm]	Rated Current [Arms]	Peak Current [Arms]	Rated Speed min ⁻¹	DOWNLOAD
1	SMAC 200-052-19	T	P		24	5,0	9,8	24,0	56,0	230	690	2.000	
2	SMAC 200-052-19		P		48	5,0	10,0	24,0	67,0	110	380	2.000	
3	SMAC 200-052-28	T			48	7,5	14,8	24,0	56,0	160	490	3.000	
4	SMAC 200-052-28	T	P	LC	48	8,0	15,5	30,0	70,0	190	525	2.500	
5	SMAC 200-052-28	T	P		80	6,3	11,8	24,0	56,0	80	240	2.500	
7	SMAC 200-052-28	T	P		96	7,5	14,0	24,0	56,0	80	240	3.500	
8	SMAC 200-052-68	T	P	LC	400	8,0	14,0	30,0	70,0	23	62	2.500	

LC - LIQUID COOLED T - IDEAL FOR TRACTION P - IDEAL FOR PUMP

SMAC 200-070



STANDARD LAYOUT

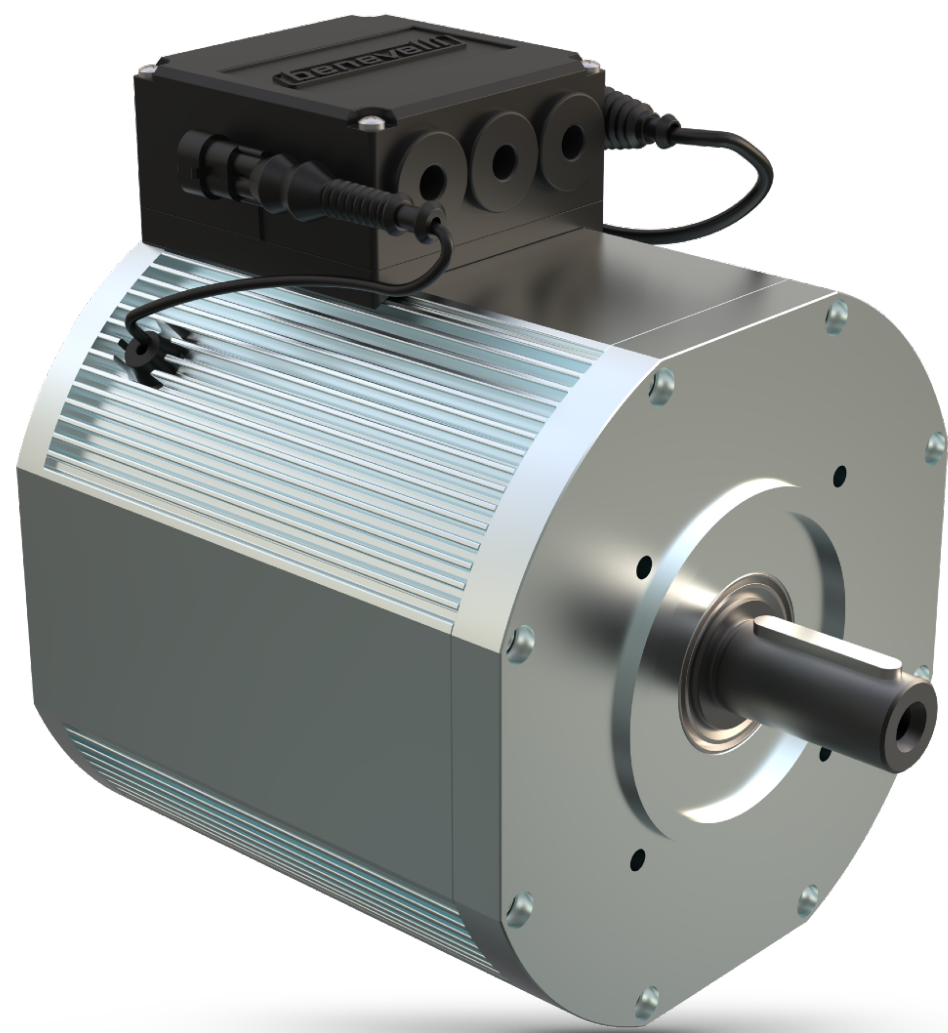


TECHNICAL DATA

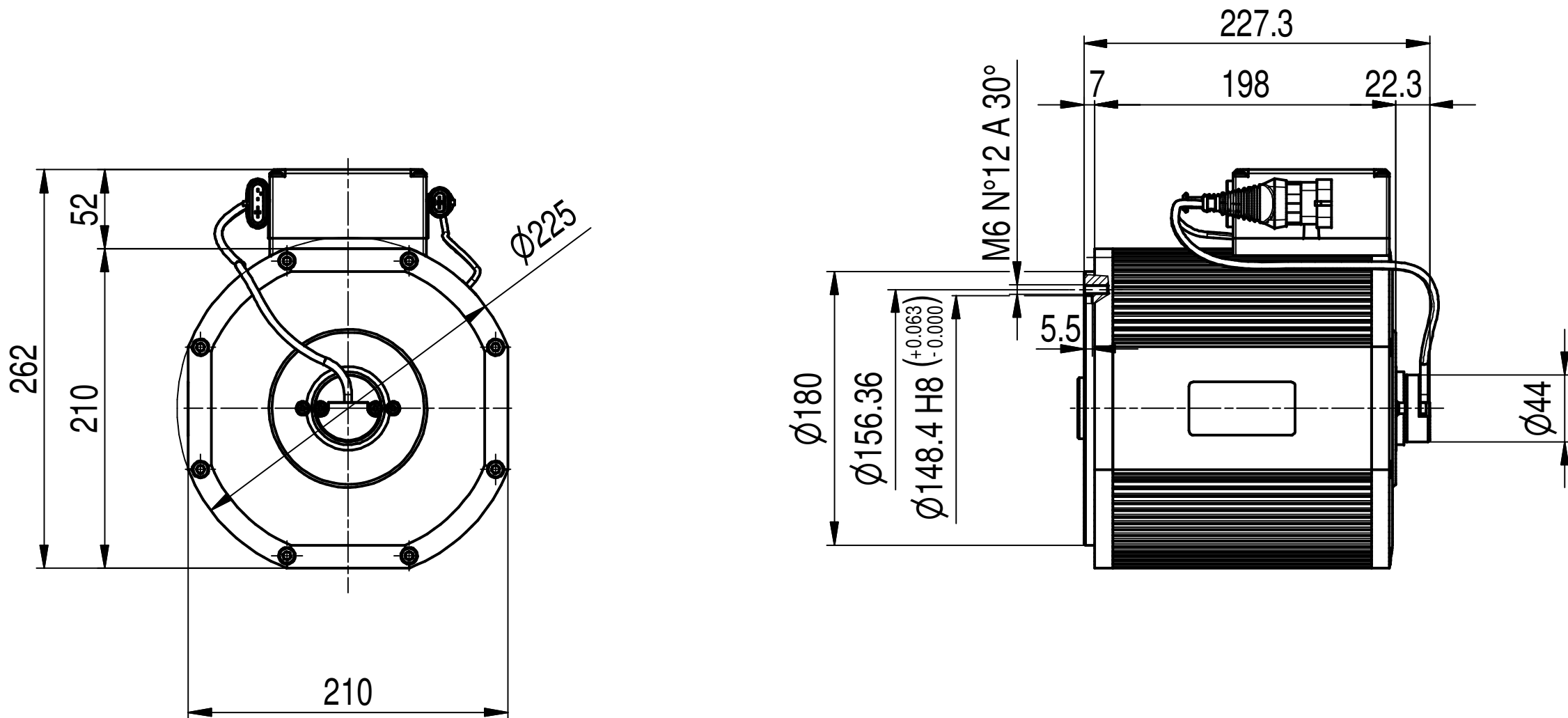
Motor					Battery DC Voltage [V]	Rated Power [kW]	Instant Power [kW]	Rated Torque [Nm]	Instant Torque [Nm]	Rated Current [Arms]	Peak Current [Arms]	Rated Speed min ⁻¹	DOWNLOAD
1	SMAC 200-070-19	T	P		48	5,0	15,0	32,0	92,0	115	400	1.500	
2	SMAC 200-070-28	T	P		48	8,0	20,8	32,0	94,0	155	540	2.500	
3	SMAC 200-070-28			LC	48	8,0	18,0	40,0	80,0	180	540	2.000	
4	SMAC 200-070-28	T	P		72	10,0	29,0	30,0	83,0	148	448	3.000	
5	SMAC 200-070-28	T	P		80	10,0	20,5	30,0	72,0	148	448	3.000	
6	SMAC 200-070-19		P		96	10,0	22,5	30,0	86,0	100	350	3.000	
7	SMAC 200-070-28	T			96	12,5	26,0	30,0	72,0	148	448	4.000	
8	SMAC 200-070-36	T	P		400	10,0	15,0	30,0	72,0	24	72	3.000	
9	SMAC 200-070-48	T	P	LC	400	10,0	21,0	38,0	90,0	30	84	2.500	
10	SMAC 200-070-30	T	P		600	10,0	15,0	30,0	72,0	30	51	3.000	

LC - LIQUID COOLED T - IDEAL FOR TRACTION P - IDEAL FOR PUMP

SMAC 200-105



STANDARD LAYOUT



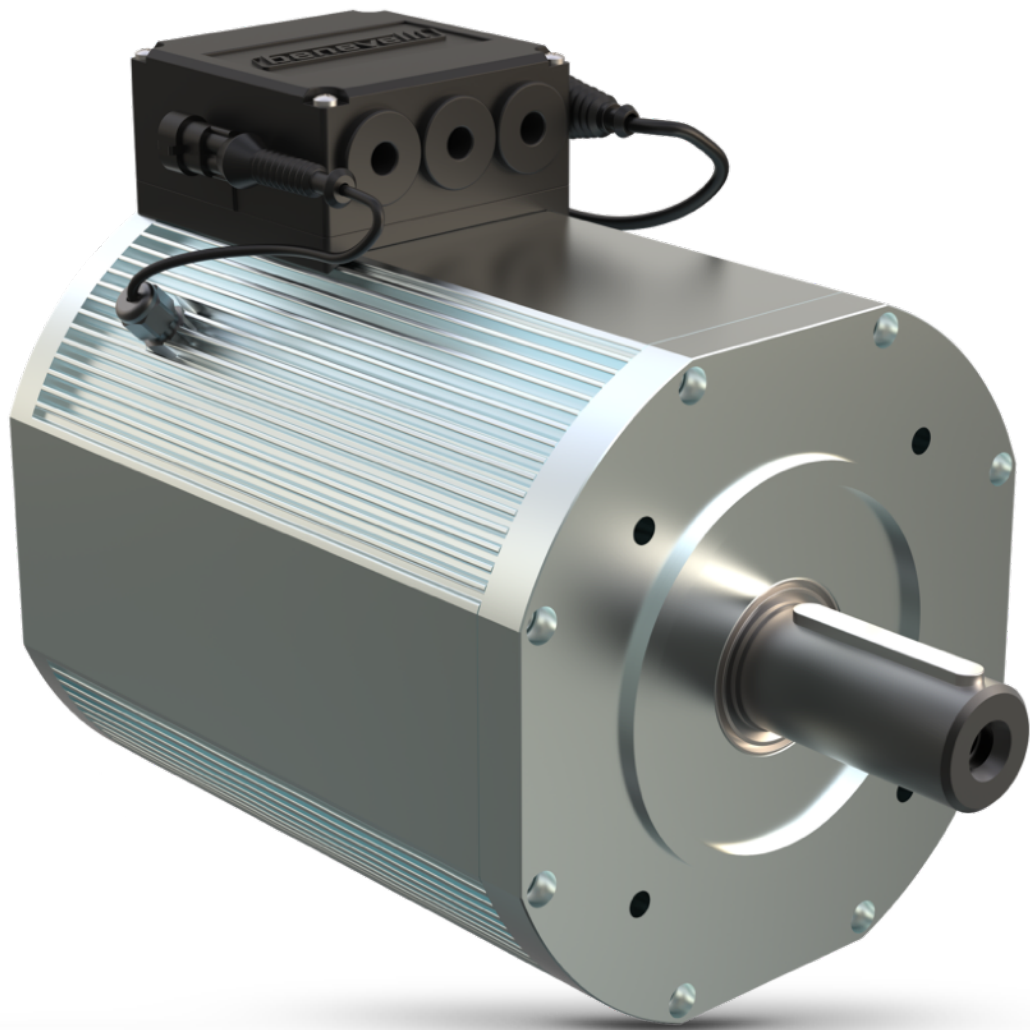
TECHNICAL DATA

Motor					Battery DC Voltage [V]	Rated Power [kW]	Instant Power [kW]	Rated Torque [Nm]	Instant Torque [Nm]	Rated Current [Arms]	Peak Current [Arms]	Rated Speed min ⁻¹	DOWNLOAD
1	SMAC 200-105-19	T	P		48	9,0	29,0	44,0	120,0	210	650	2.000	
2	SMAC 200-105-19	T	P	LC	48	12,0	25,5	56,0	116,0	250	730	2.000	
3	SMAC 200-105-19	T	P		80	13,0	35,0	42,0	109,0	210	650	3.000	
4	SMAC 200-105-28	T	P		96	13,0	29,0	42,0	109,0	140	420	3.000	
5	SMAC 200-105-68	T	P	LC	400	15,0	31,0	56,0	130,0	41	110	2.500	

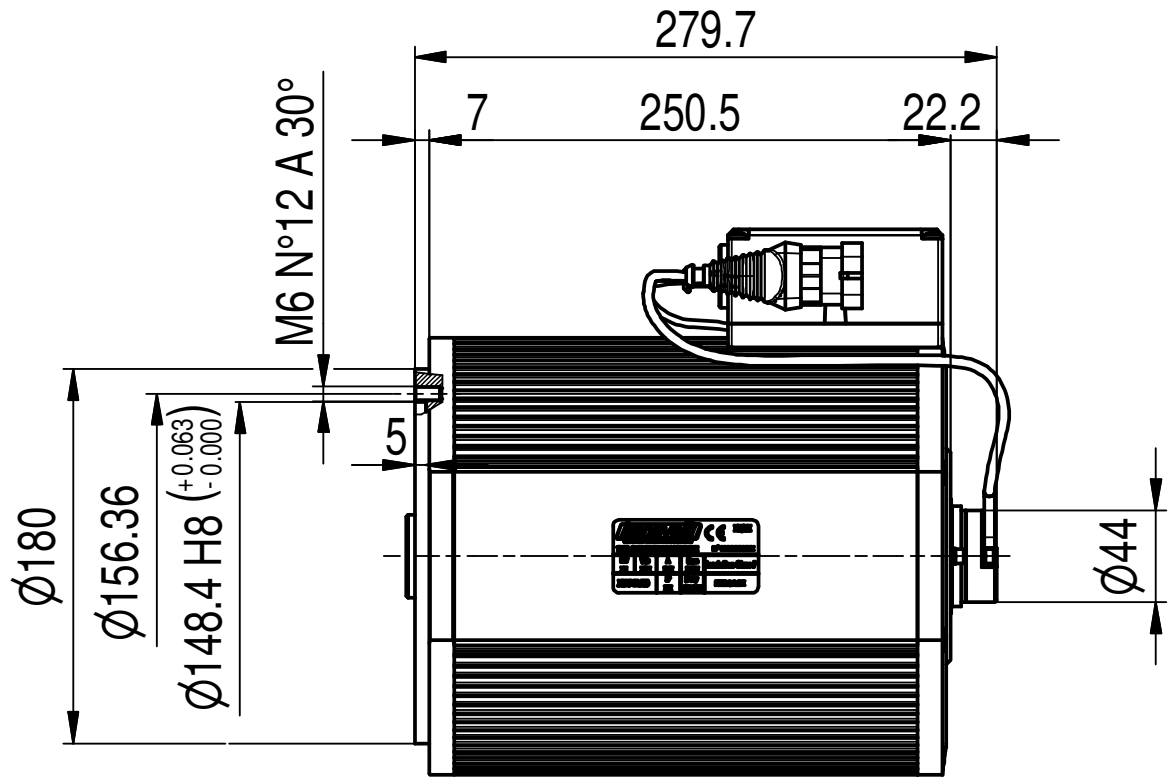
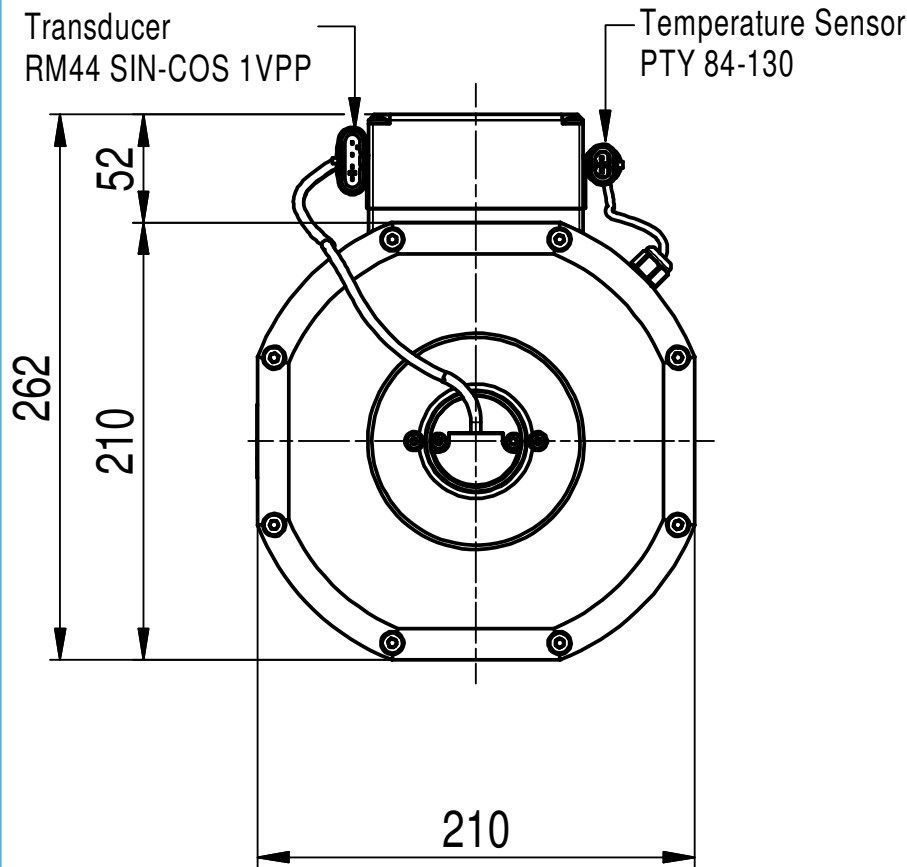
LC - LIQUID COOLED T - IDEAL FOR TRACTION P - IDEAL FOR PUMP

SMAC 077 SERIE
SMAC 096 SERIE
SMAC 132 SERIE
SMAC 200 SERIE

SMAC 200-157



STANDARD LAYOUT

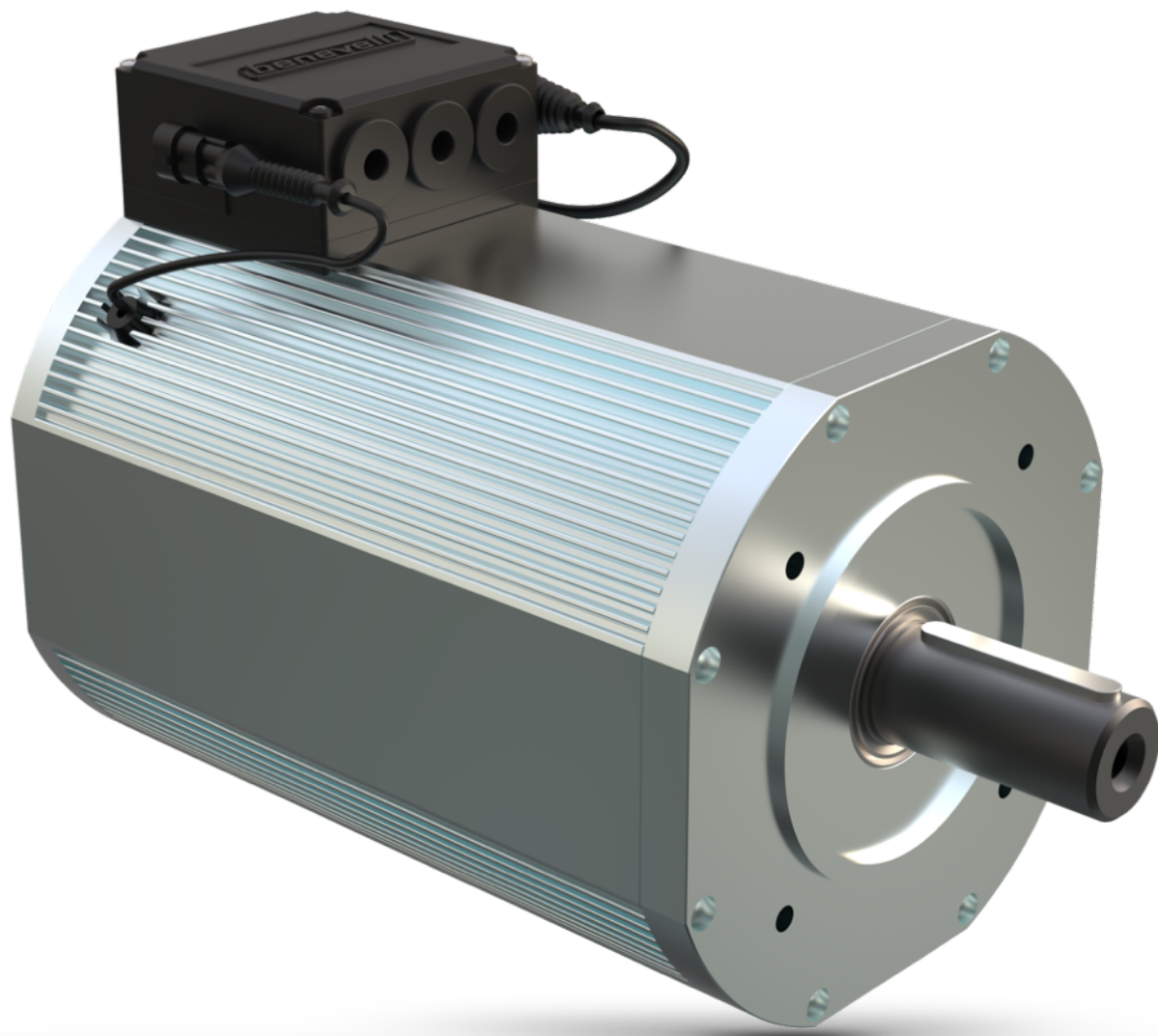


TECHNICAL DATA

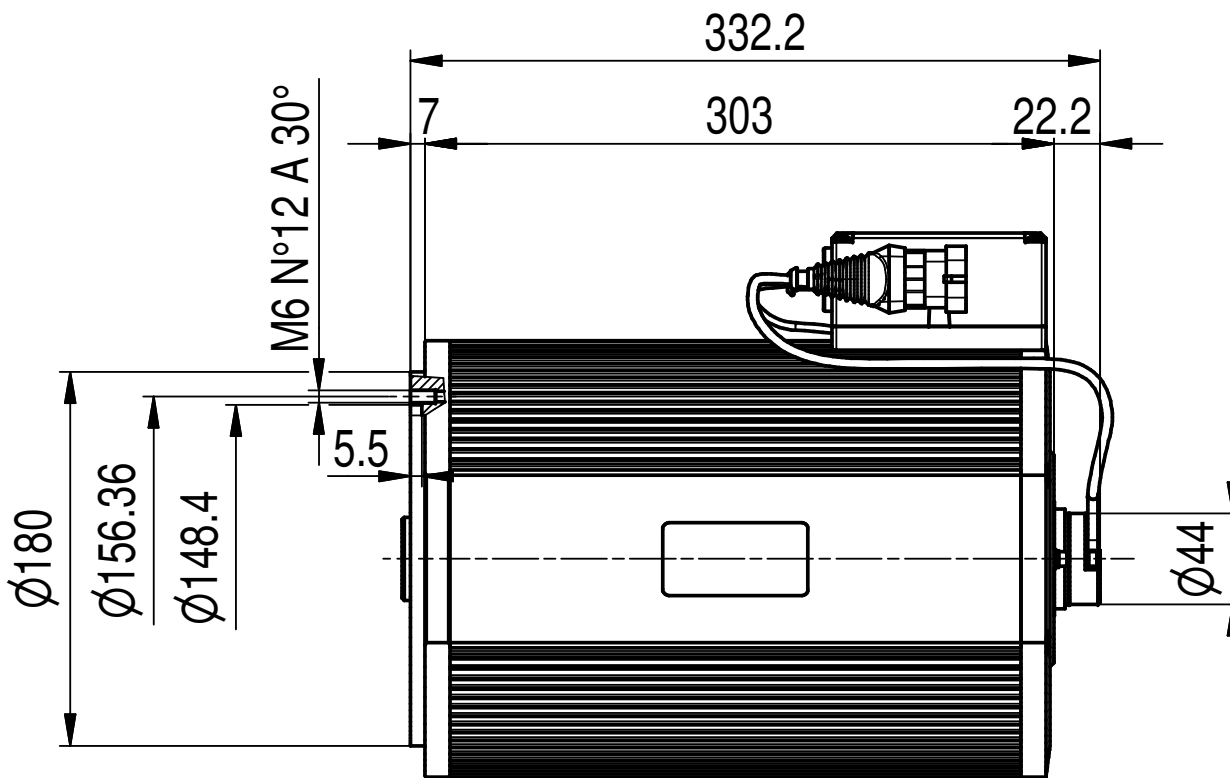
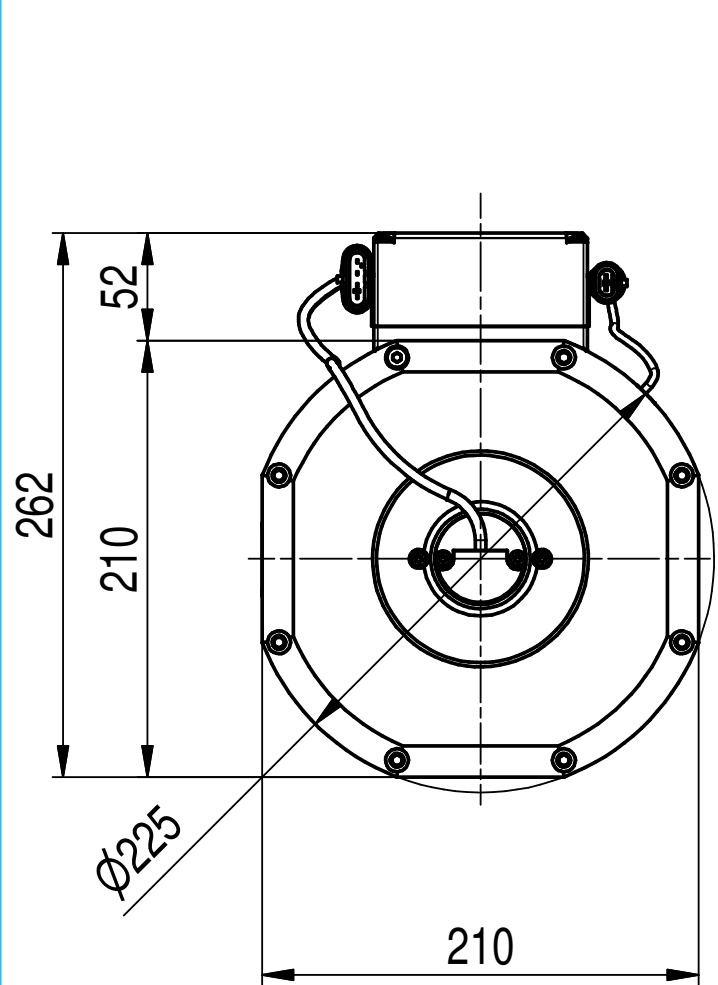
Motor					Battery DC Voltage [V]	Rated Power [kW]	Instant Power [kW]	Rated Torque [Nm]	Instant Torque [Nm]	Rated Current [Arms]	Peak Current [Arms]	Rated Speed min ⁻¹	DOWNLOAD
1	SMAC 200-157-19	T	P		48	8,5	22,5	64,0	185,0	190	660	1.250	
2	SMAC 200-157-19	T	P		96	16,5	45,0	64,0	185,0	190	660	2.500	
3	SMAC 200-157-47	T	P	LC	400	20,0	45,0	80,0	190,0	57	155	2.500	

LC - LIQUID COOLED T - IDEAL FOR TRACTION P - IDEAL FOR PUMP

SMAC 200-210



STANDARD LAYOUT

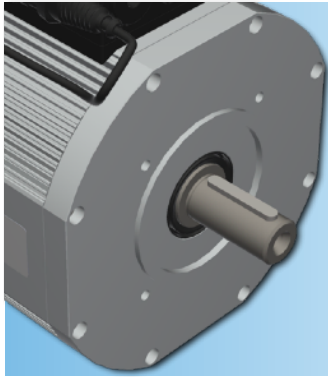


TECHNICAL DATA

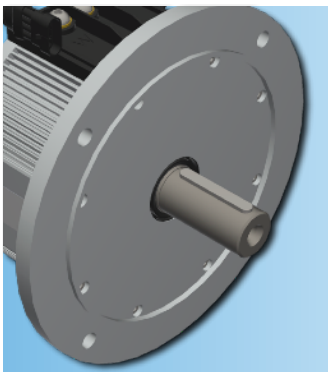
Motor					Battery DC Voltage [V]	Rated Power [kW]	Instant Power [kW]	Rated Torque [Nm]	Instant Torque [Nm]	Rated Current [Arms]	Peak Current [Arms]	Rated Speed min ⁻¹	DOWNLOAD
1	SMAC 200-210-19	T	P		48	10,0	27,0	95,0	245,0	230	660	1.000	
2	SMAC 200-210-19	T	P	LC	48	15,0	27,0	143,0	245,0	350	660	1.000	
3	SMAC 200-210-19	T	P		80	20,0	47,0	95,0	245,0	230	660	2.000	
4	SMAC 200-210-19	T	P		96	20,0	40,0	95,0	225,0	230	660	2.000	
5	SMAC 200-210-19	T	P	LC	96	25,0	49,0	130,0	265,0	290	730	2.000	
6	SMAC 200-210-19	T	P		120	20,0	60,0	95,0	265,0	210	730	2.000	
7	SMAC 200-210-28	T	P		400	30,0	90,0	95,0	270,0	95	260	3.500	
8	SMAC 200-210-68	T	P	LC	650	30,0	70,0	100,0	285,0	65	230	3.000	

LC - LIQUID COOLED T - IDEAL FOR TRACTION P - IDEAL FOR PUMP

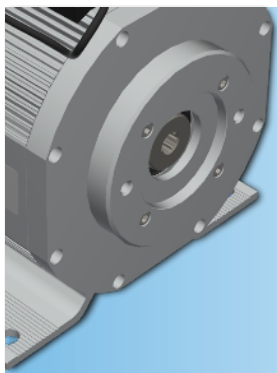
CONFIGURATIONS



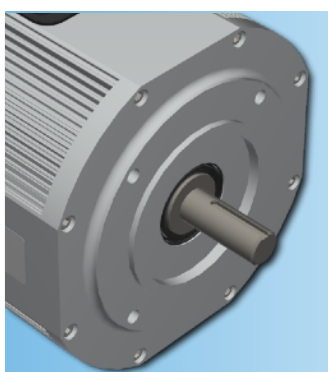
IEC B14 FLANGES



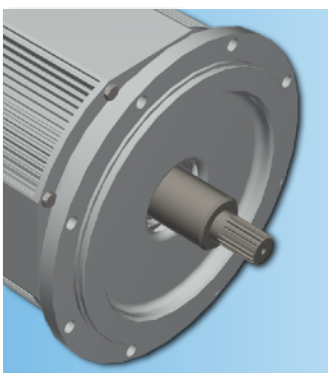
IEC B5 FLANGES



SAE A-B FLANGES



NEMA FLANGES



CUSTOM FLANGES

PERMISSIBLE FORCES

Radial force F_r [N]

Size	Model	1.000 rpm	2.000 rpm	3.000 rpm	4.000 rpm	5.000 rpm
SMAC 077	025	n/a	n/a	n/a	n/a	n/a
	050	n/a	n/a	n/a	n/a	n/a

Size	Model	1.000 rpm	2.000 rpm	3.000 rpm	4.000 rpm	5.000 rpm
SMAC 096	025	n/a	n/a	n/a	n/a	n/a
	050	n/a	n/a	n/a	n/a	n/a

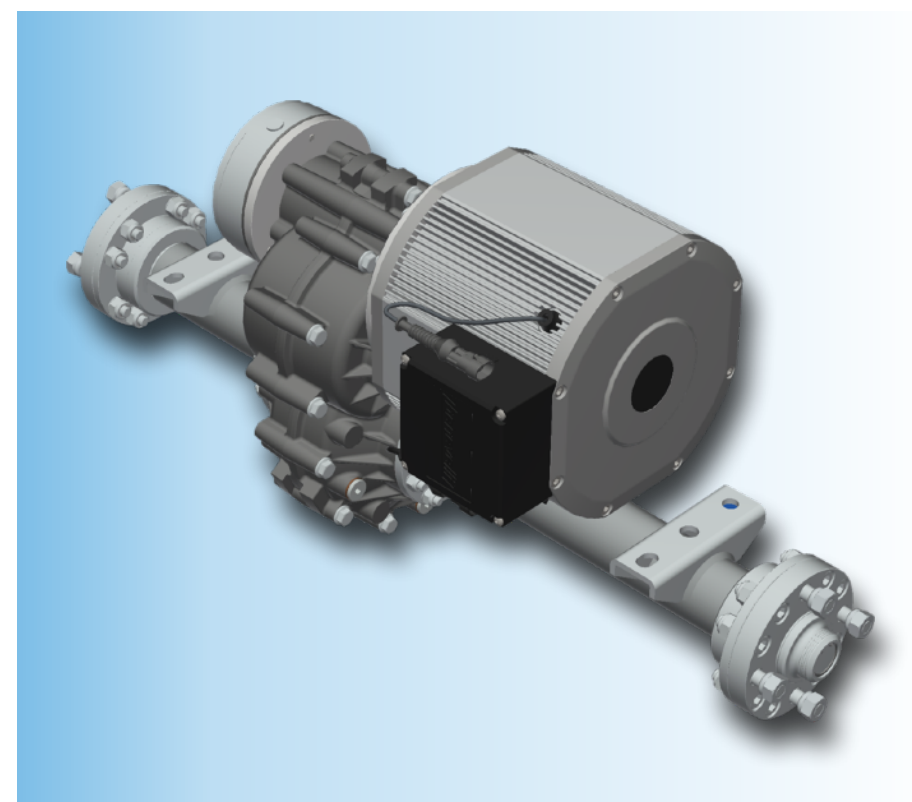
Size	Model	1.000 rpm	2.000 rpm	3.000 rpm	4.000 rpm	5.000 rpm
SMAC 125	025	1.070	850	740	670	620
	050	1.120	890	780	710	650
	075	1.160	920	800	730	680

Size	Model	1.000 rpm	2.000 rpm	3.000 rpm	4.000 rpm	5.000 rpm
SMAC 200	035	2.300	1.830	1.590	1.450	1.340
	052	2.360	1.870	1.630	1.480	1.380
	070	2.400	1.900	1.660	1.510	1.400
	105	2.460	1.950	1.710	1.550	1.440
	210	2.560	2.030	1.770	1.610	1.490

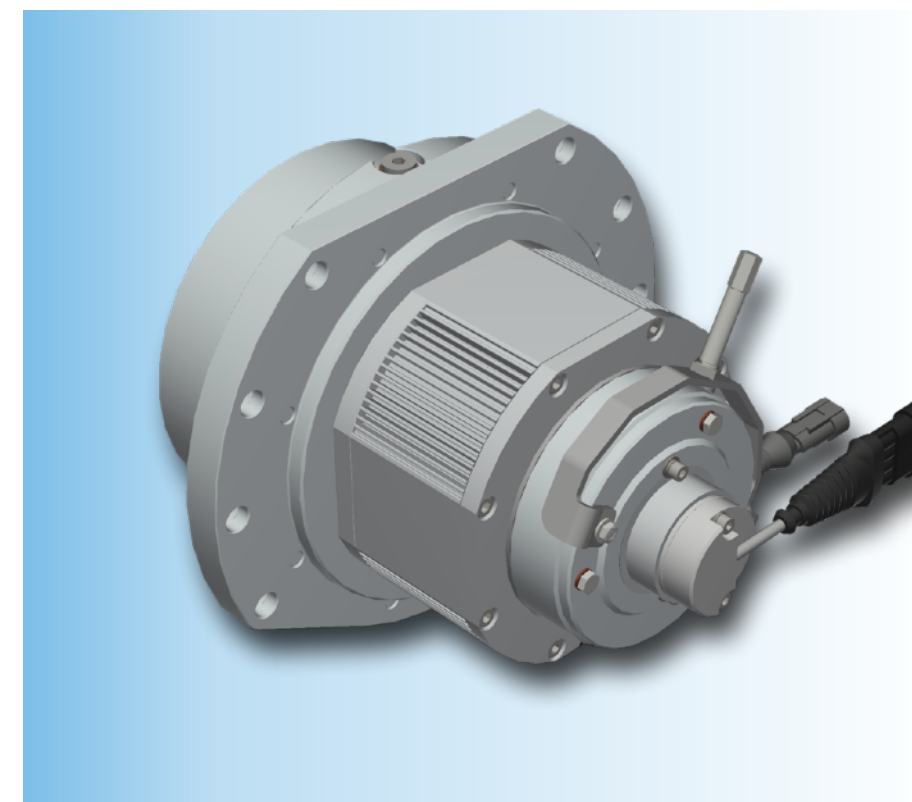
APPLICATIONS

Benevelli can provide complete system for electric vehicles as:

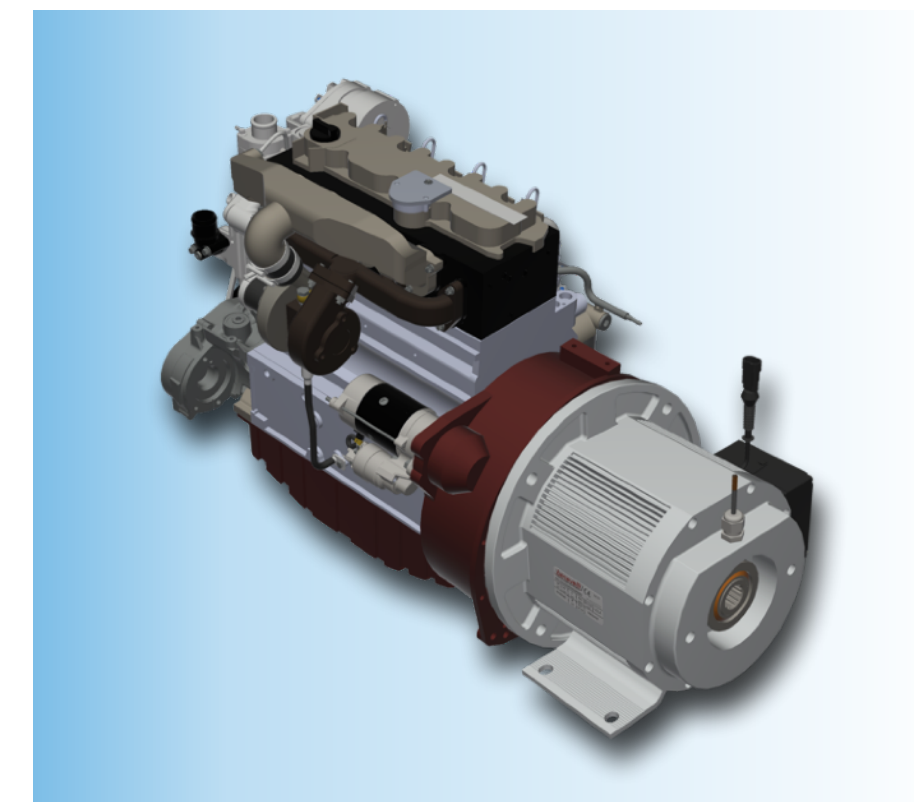
- ✓ ELECTRIC TRANSAXLES
- ✓ WHEEL DRIVES
- ✓ HYBRID SOLUTIONS
- ✓ HYDRAULIC PUMPS
- ✓ WATER PUMPS
- ✓ STEERING SYSTEMS



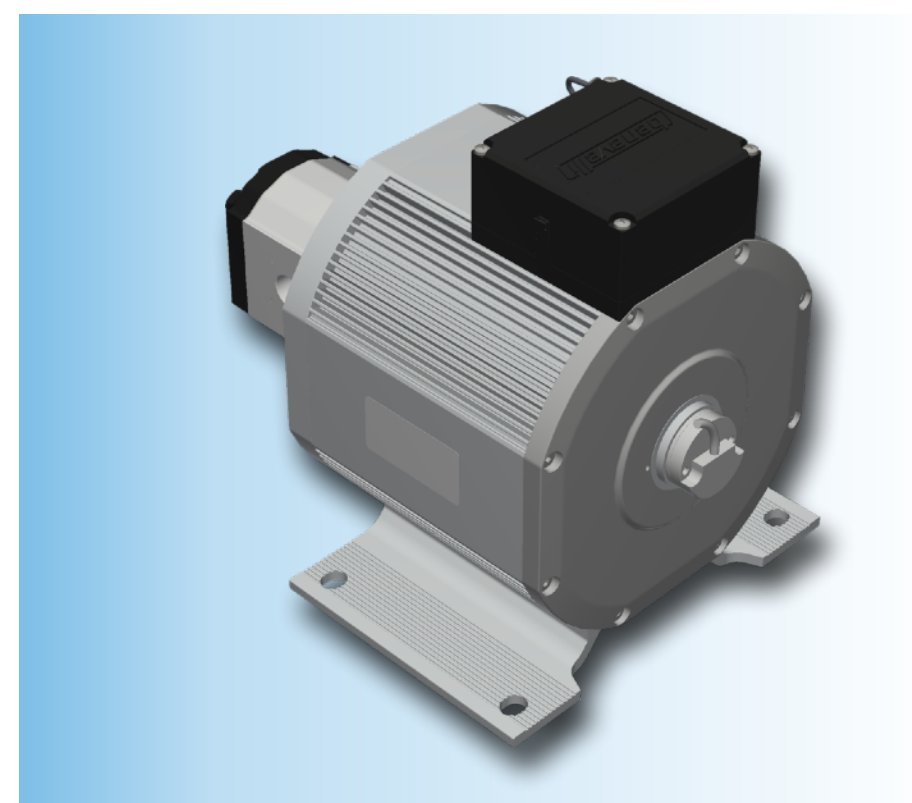
ELECTRIC TRANSAXLES



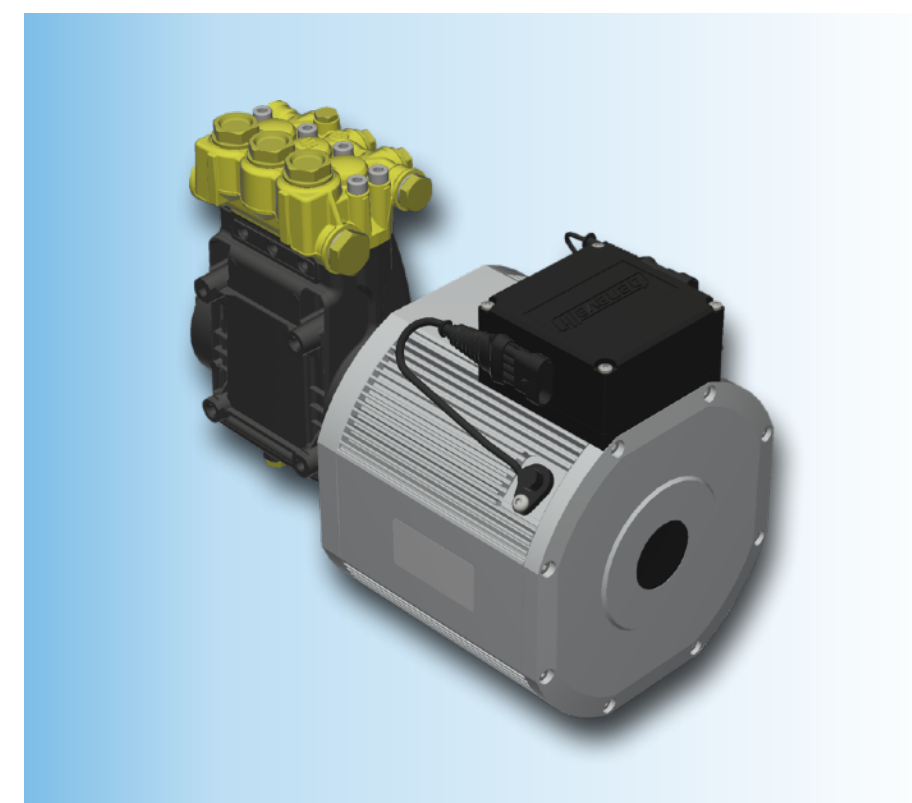
WHEEL DRIVES



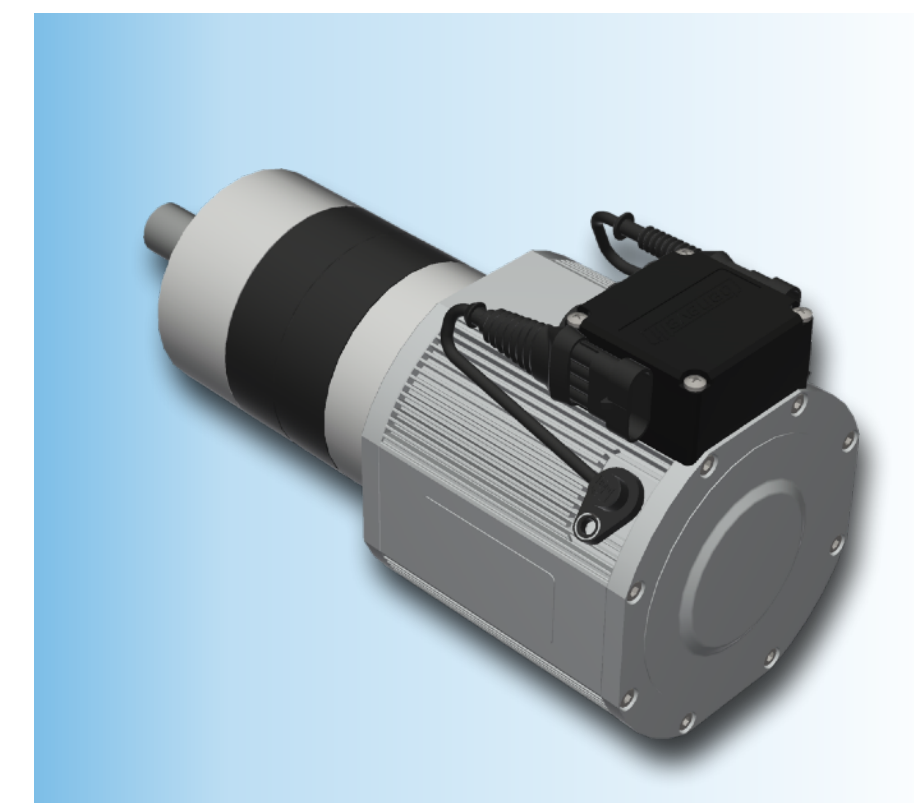
HYBRID SOLUTIONS



HYDRAULIC PUMPS



WATER PUMPS



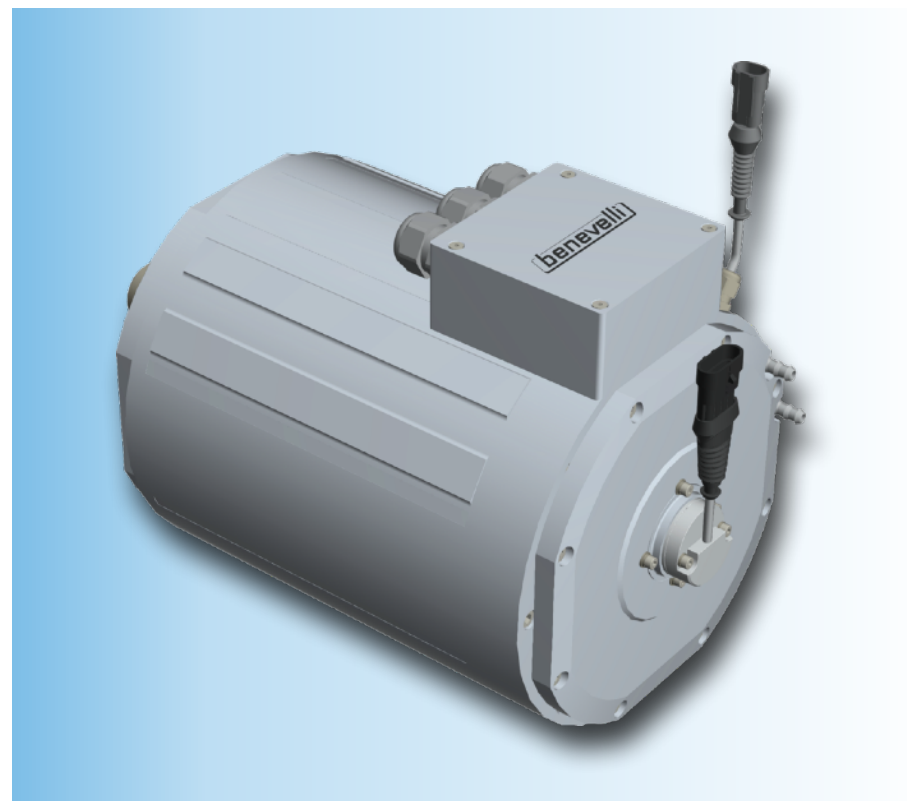
STEERING SYSTEMS

OPTIONS

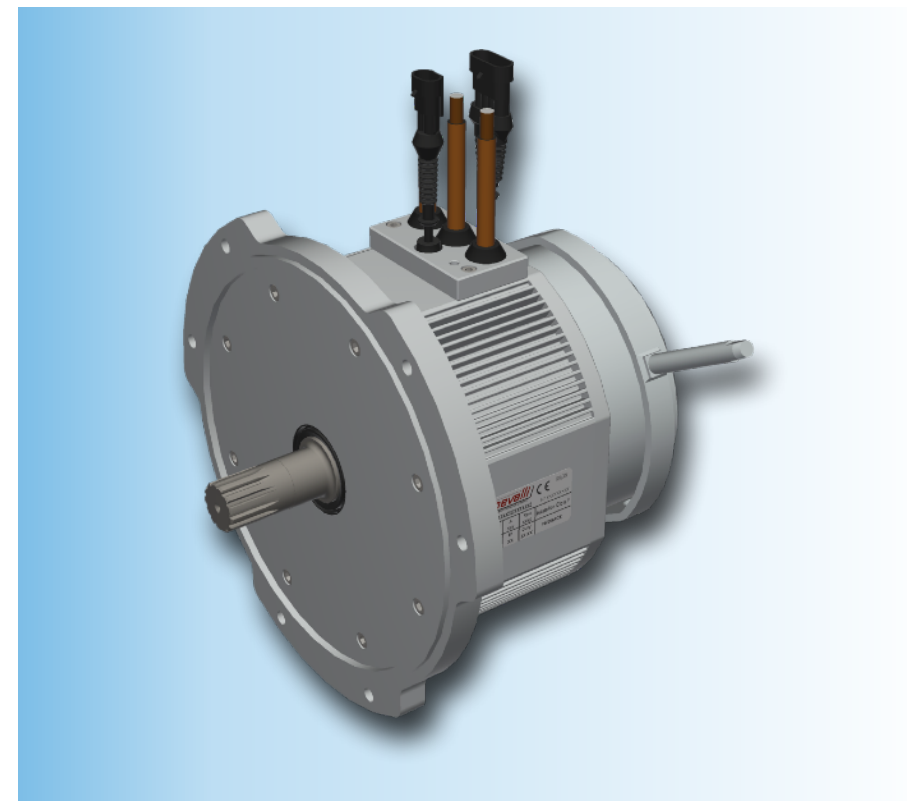
SMAC Serie is the most complete range of electric motors on the market.

There are different options you can choose to customize your electric motor, discover them all:

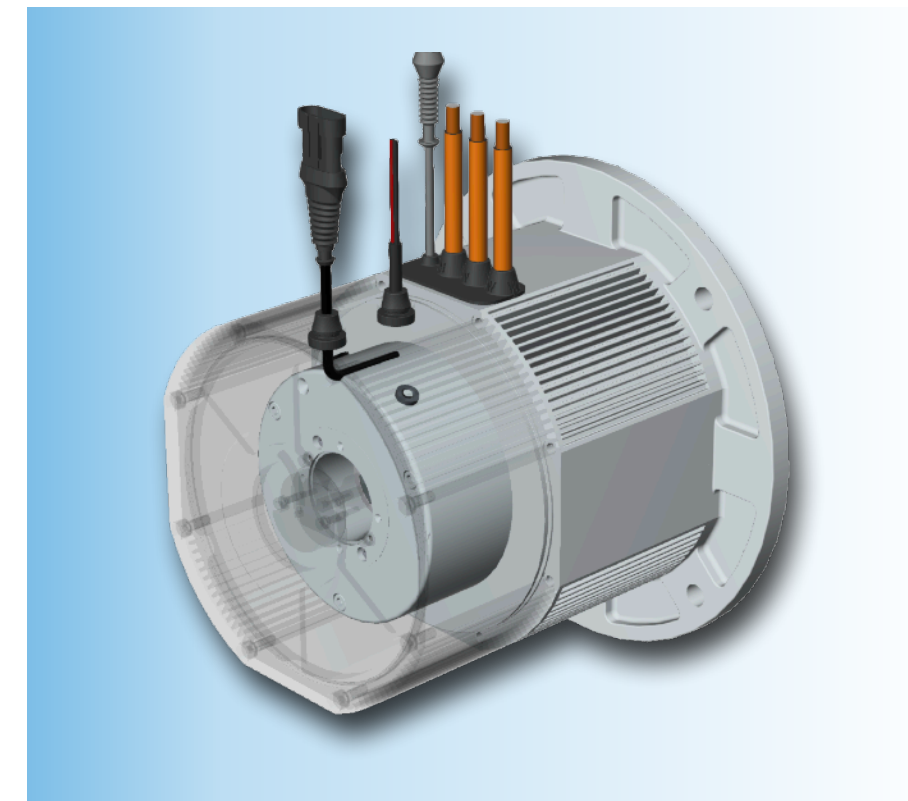
- ✓ LIQUID COOLED
- ✓ CUSTOM VERSIONS
- ✓ INTEGRATED EM BRAKES
- ✓ FLYING CABLES
- ✓ GORE VALVES
- ✓ MOTOR FEEDBACK



LIQUID COOLED



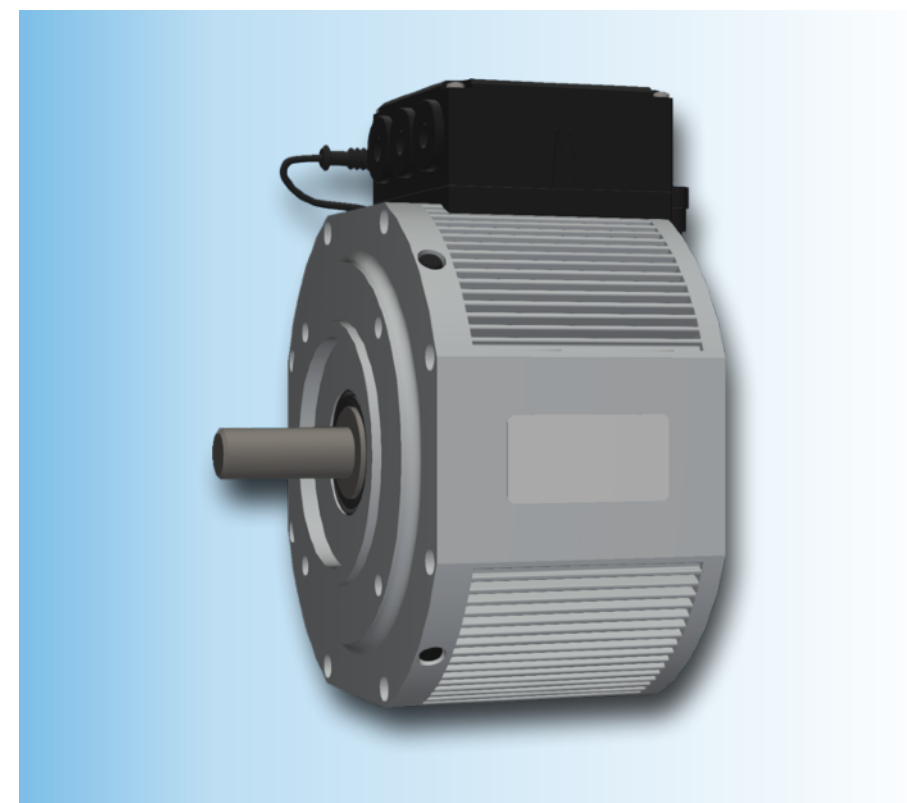
CUSTOM VERSION



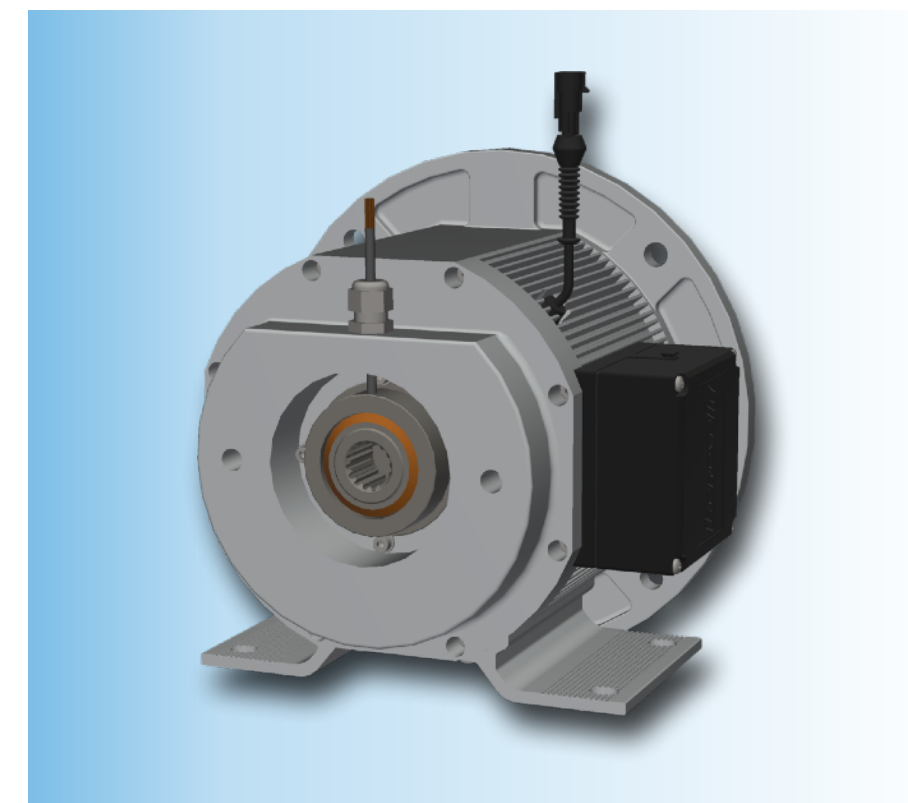
INTEGRATED EM BRAKES



FLYING CABLES



GORE VALVES

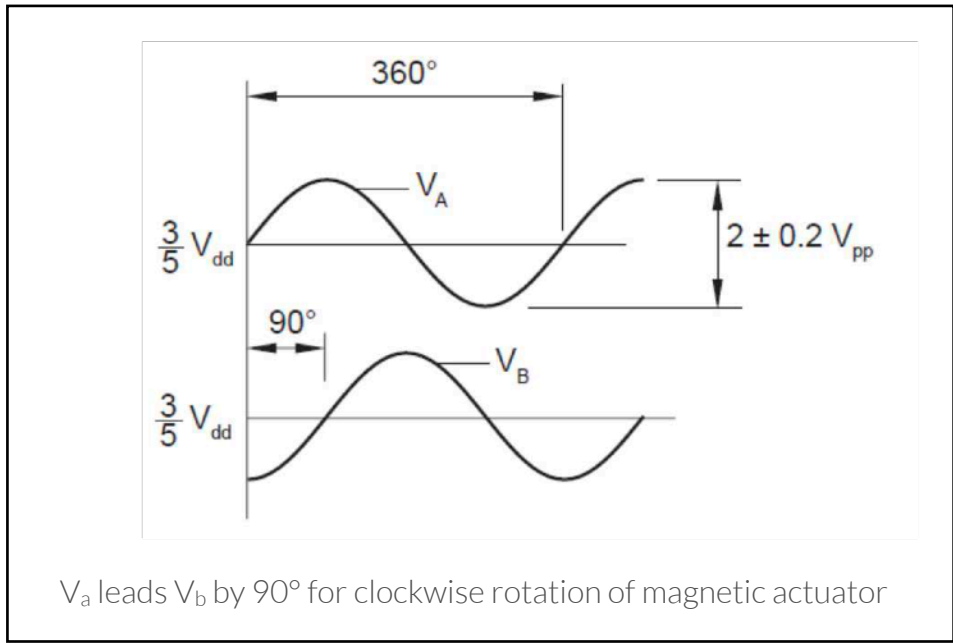


MOTOR FEEDBACK

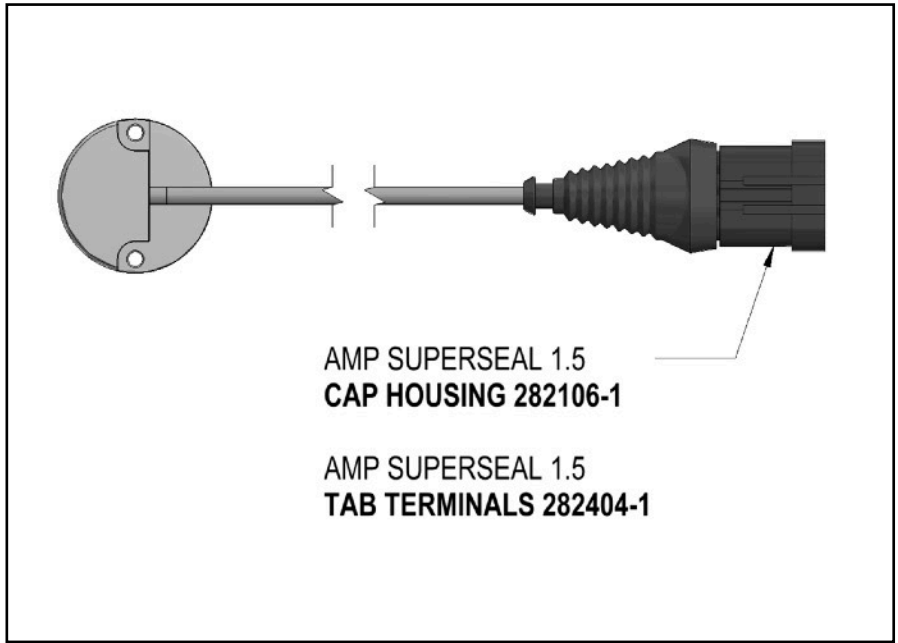
MOTOR FEEDBACK TECHNICAL DATA

Output Specifications		
5V 2 channels VA VB sinusoids (90° phase shifted, single ended)		
Power Supply	Vdd = 5V ± 5%	
Power Consumption	13mA	
Outputs	Signal amplitude 2 ± 0.2 Vpp	Signal offset 3/5 Vdd ± 5 mV
Maximum output frequency	1kHz	
Maximum cable length	3m	
Operating temperature	40 °C to +125 °C IP64	40 °C to + 85 °C IP68
Maximum speed	60.000rpm	
Internal serial impedance	720 Ω	

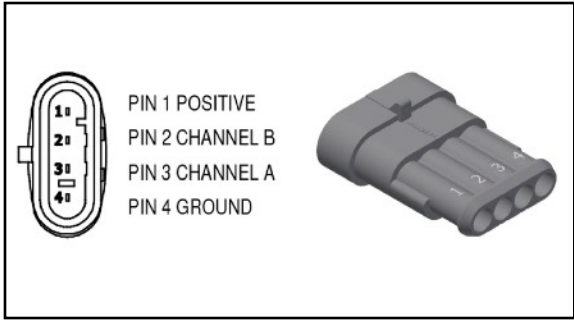
TIMING DIAGRAM



CONNECTORS



CONNECTIONS

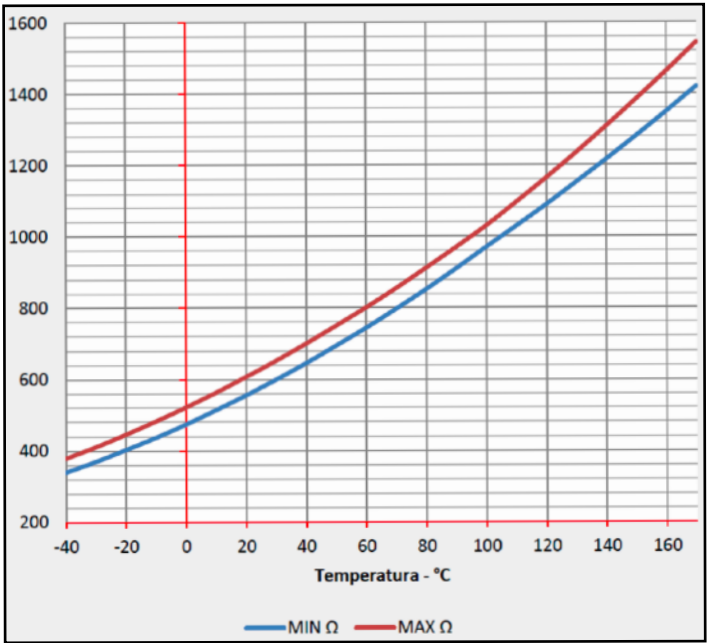


PIN	Function
1	Positive VDC
2	Channel B
3	Channel A
4	Ground

TEMPERATURE SENSOR TECHNICAL DATA

Output Signal										
Test current 2mA										
°C	Ω min	Ω max		°C	Ω min	Ω max		°C	Ω min	Ω max
-40	340	379		30	599	652		110	1.029	1.096
-30	370	411		40	645	700		120	1.089	1-164
-20	403	446		50	694	750		130	1.152	1.235
-10	437	483		60	744	801		140	1.216	1.309
0	474	522		70	797	855		150	1.282	1.285
10	514	563		80	852	912		160	1.250	1.463
20	555	607		90	910	970		170	1.420	1.544
25	577	269		100	970	1.030				

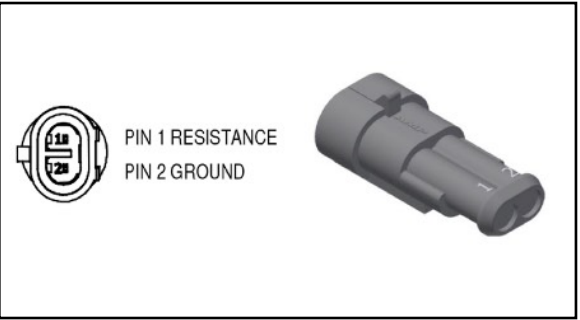
RESISTANCE DIAGRAM



CONNECTORS



CONNECTIONS



PIN	Function
1	Resistance
2	Ground

ORDER CODE

1	2	3	4	5	6	7	8	9	10	11	12
51	X	000	000	00	X	0	0	0	X	0	00

1	Product Category	
51	Electric Motors	

2	Motor Type	
A	PMDC	
C	SMDC SM	
E	AMAC	
G	SMAC SM IR	
H	SMAC SM ER	
J	SMAC IM IR	
K	SMAC IM ER	

3	Stator Diameter	
077	77 mm	
096	96 mm	
125	125 mm	
132	132 mm	
200	200 mm	

4	Stator Length	
025	25 mm	
035	35 mm	
050	50 mm	
052	52 mm	
075	75 mm	
090	90 mm	
105	105 mm	
125	125 mm	
157	157 mm	
165	165 mm	
200	200 mm	
210	210 mm	

5	Winding Turns	
	Turns Number	

6	Voltage	
C	24	
D	36	
E	48	
F	72	
G	80	
H	96	
I	60	
L	110	
M	120	
N	144	
O	360	
P	400	
S	560	
T	600	
U	650	
V	780	

7	IP Protection	
0	IP 00	
2	IP 20	
4	IP 44	
5	IP 54	
6	IP 55	
7	IP 65	
8	IP 66	
9	IP 67	
10		
11		

8	Interface	
1	TX1/DD1 Serie (Key)	
2	TX1/DD1 Serie (DIN5482)	
3	TX2 Serie	
4	IEC B14	
5	IEC B5	
6	IEC B14 + B3	
7	IEC B5 + B3	
8	SAE A	
9	SAE A + B3	
A	G1	
B	G2	
C	G3	
D	G4	
E	G1 + B3	
F	G2 + B3	
G	G3 + B3	
H	G4 + B3	
I		
J	DIN 5482	
K		
L	SAE AA	
M	SAE AA + B3	
N		
O	NEMA C	
P	NEMA D	
Q	NEMA TC	
R	NEMA TD	
S	SPECIAL	
T	SAE B	
U	SAE B + B3	
W	WD 220	

9	Feedback	
0	Sensorless	
1	Hall effect	
2		
3		
5	SinCos	
6	Sick EKS36	
7	Resolver	

10	EM Brake	
0	Without EM Brake	
1	Prepared for 01/037	
2	Prepared for /047	
3	Prepared for 03/056	
4	Prepared for 04/065	
5	Prepared for 05/075	
6	Prepared for 06/083	
7		
8	Prepared for 08/102	
9	Prepared for 09/114	
A	Prepared for 10/127	
B	Prepared for 12/148	
C	Prepared for 14/165	
D	Prepared for 16/190	
E	Prepared for 18/220	
F	Prepared for 20/257	
G		
H		
I		
J	EM Brake 01/037	
K	EM Brake 02/047	

	L	EM Brake 03/056
	M	EM Brake 04/065
	N	EM Brake 05/075
	O	EM Brake 06/083
	P	
	Q	EM Brake 08/102
	R	EM Brake 09/114
	S	EM Brake 10/127
	T	EM Brake 12/148
	U	EM Brake 14/165
	V	EM Brake 16/190
	W	EM Brake 18/220
	X	EM Brake 20/257

11	Cooling	
	0	Self Cooling
	1	Internal Fan (front)
	2	Internal Fan (rear)
	3	Forced Cooling (lateral)
	4	Forced Cooling (rear)
	5	Liquid cooling

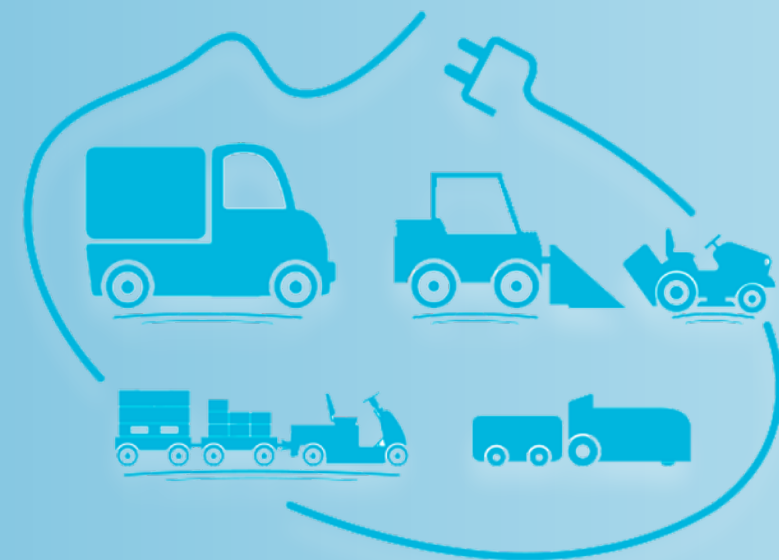
12	Version	
	00	Version 00
	01	Version 01
	...	Version ...

Ratings, features, and characteristics depending upon the model and type of service, application approvals must be obtained from Benevelli. We reserve the right to change or modify our product specs, configurations or dimensions at any time without notice.

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