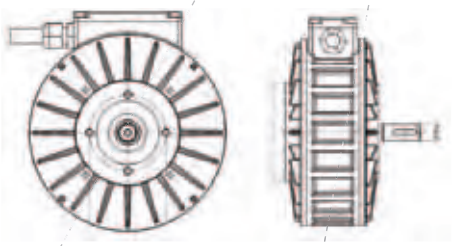
HEINZMANN®
Energy requires Control

PERM
TECHNOLOGY



PRODUCT CATALOGUE

Disc Motors

HEINZMANN®
Energy requires Control

Electric & Hybrid Drives

Your partner for

- Disc motors
- Wheel hub motors
- Motors for battery driven vehicles
- Hybrid drives for industrial applications
- Generators for windmills and block heating plants
- Electric vehicle drives

HEINZMANN - driving your innovation

PERM TECHNOLOGY

CONTENTS

PMS Brushless Disc Motors

SL Disc Motors with Brushes

HEINZMANN
Electric & Hybrid Drives

For decades, HEINZMANN has been developing and producing sturdy, powerful electric drives up to approx. 30 kW, which have proven their worth in numerous applications, particularly in harsh industrial environments.

Over one hundred years of experience in engine management for combustion engines has put HEINZMANN in an ideal position to develop innovative hybrid drives.

These have been used in industrial applications and mobile work machines since 2006. They are suitable for diesel, gas and petrol engines.

In 2008, our range of products was further expanded by the Group's acquisition of Perm Motor GmbH. Since January 2012, the portfolio of Perm Motor GmbH, manufacturer of electric motors with patented rotor technology, has been completely integrated into HEINZMANN's division of Electric Drives.

Today, our customers around the world benefit from the synergies of this flexible, innovative melting pot of ideas, and from the experience and reliability of a global yet traditional company with an international services and sales network. Make the most of our pooled expertise to gain outstanding drive solutions in consistently reliable quality.

Based in the heart of the Black Forest, HEINZMANN develops and produces progressive solutions for drive technology. From industrially batch-produced engines to application-based redesigns, substitute solutions and individual new developments: our patented drive technology constantly excels through above-average performance data and significant increases in efficiency.

HEINZMANN drive systems are used in a diverse range of industrial applications, in electric cars, wind turbines and mobility scooters.

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PMS Series

Brushless AC-Synchronous Disc Motors

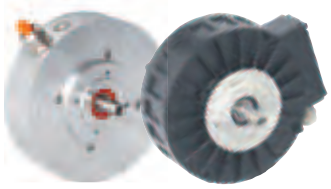
A disc motor has several advantages over a typical electric motor. Small size, flat shape of construction, reduced weight at equivalent power rating and a high efficiency factor are its plus. So as a servo motor for drive functions in an axially confined area, it is ideally suited. Its small overall size as well as its high capacity and quiet synchronous operation make it a very efficient drive, which is often used in the production of machines and apparatus as well as traction applications.

HEINZMANN offers its customers a complete range of these brushless drive motors. They have a motor output of up to 30 kW and torque of up to 60 Nm, depending on way of cooling. The DC link voltage is variable.

The brushless design means that the disc motor does not have any wearing parts, e.g. carbon brushes and collectors. These drive motors have a longer service life and are almost maintenance-free. This gives a considerable reduction in maintenance, service and replacement costs.

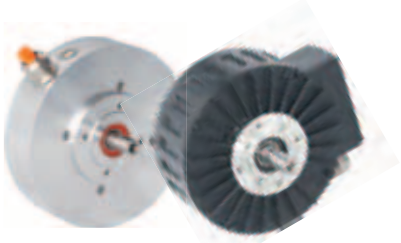
PMS 060F

(SL-EC 80-11B)



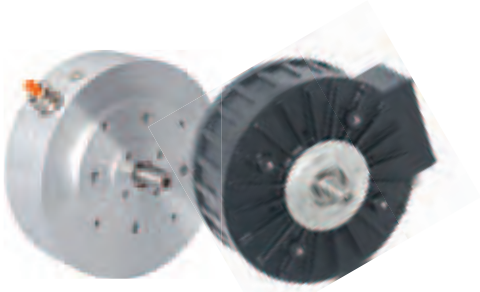
PMS 080F / PMS 080

(SL-EC 100-11B / SL-EC 100-22B)



PMS 100F / PMS 100

(SL-EC 120-11B / SL-EC 120-22B)



PMS 120F / PMS 120

(SL-EC 160-11B / SL-EC 160-22B)

PMS 150F / PMS 150

(SL-EC 180-11B / SL-EC 180-22B)

Advantages of PMS Motors

Powerful

The advantages of the large air gap area of disc motors, coupled with the winding housed in iron packets, allow high torque and a powerful motor with high efficiency. In the double-sided variant this effect is further enhanced by the use of two stators and doubled magnets.

This provides a powerful operating range housed in a compact device.

Maintenance-free and durable

Having replaced the mechanical commutator with electronic commutation, PMS motors are maintenance-free. Service life is limited only by the bearings. Depending on dimensioning of the bearings, the motors allow up to 20,000 operating hours.

Our durable motors are designed for operation in the most diverse environments.

Dynamic

With their self-supporting magnets, PMS motors with two stators have a low inertial torque and are well suited for dynamic applications. In addition, they have a minimal cogging torque.

This allows precise and easy control of dynamic servo drives.

Flat

PMS motors are built very flat, especially the variant with a one-side stator (Type F).

This saves mounting space in axial direction and reduces weight considerably.

- Patented rotor technology
- Powerful
- Maintenance-free
- Durable
- Dynamic
- Flat
- Flexible

Flexible

HEINZMANN PMS motors are available in many other versions besides the ones presented here.

They are built as servo drives or slow running motors with high torque in different variants. The series is produced with high protection grade, with air or liquid cooling. The various types are available with a solid or hollow shaft and as assembly kits for machine integration.

HEINZMANN PMS motors are the better solution.

Applications for PMS Motors

Brushless PMS motors are used in industrial, medical and traction applications. Their flat design makes them ideal for using where space is at a premium. Malfunctions caused, e.g. through brush arcing, or wear and dirt accumulation no longer apply, and therefore they are almost maintenance-free.

The motors are available in a sensorless version, and several other sensor system solutions.

Along with the controller, these motors are the ideal drive where speed control and high dynamic requirements are called for, or where fast changes in load or directions of rotation and speedy run ups are required.

PMS motors can also be used as highly-efficient alternators.

Examples:

- ***Industrial applications as printing, textile and machine tools, robotics***
- ***Traction drive for electric vehicles, boats, lawn mowers or turf applications***
- ***Compact pumps and fans for low-maintenance continuous service***
- ***Drive for auxiliary generators in vehicles***
- ***Medical equipment***

Examples for Application

Actuator

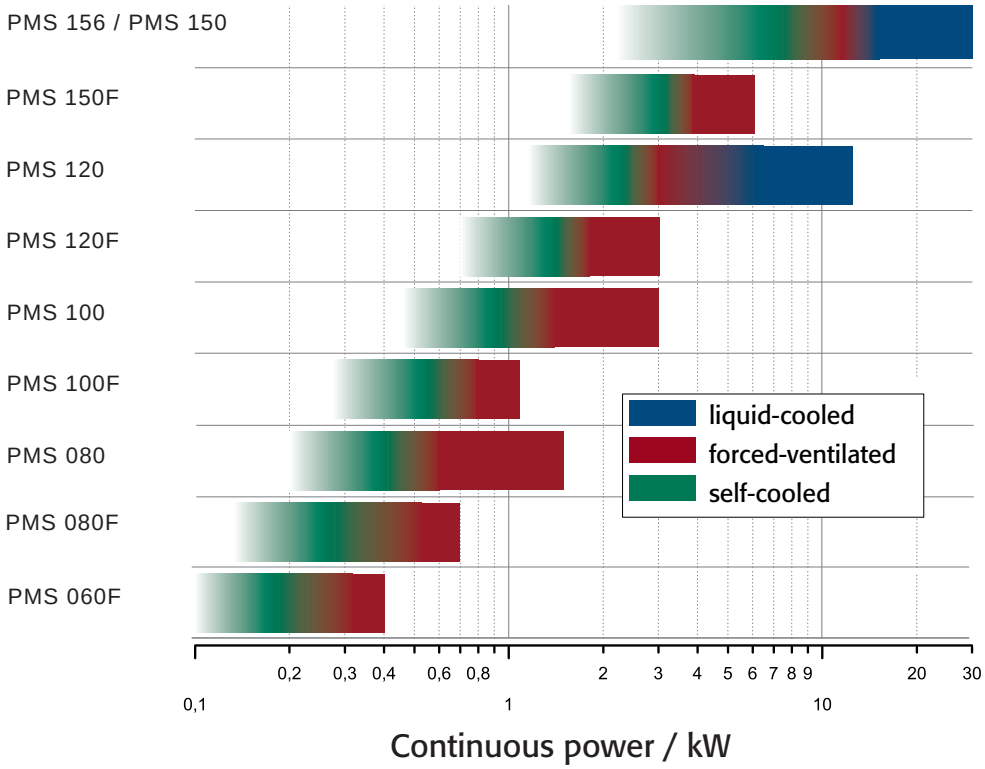
Fan drive

Production line

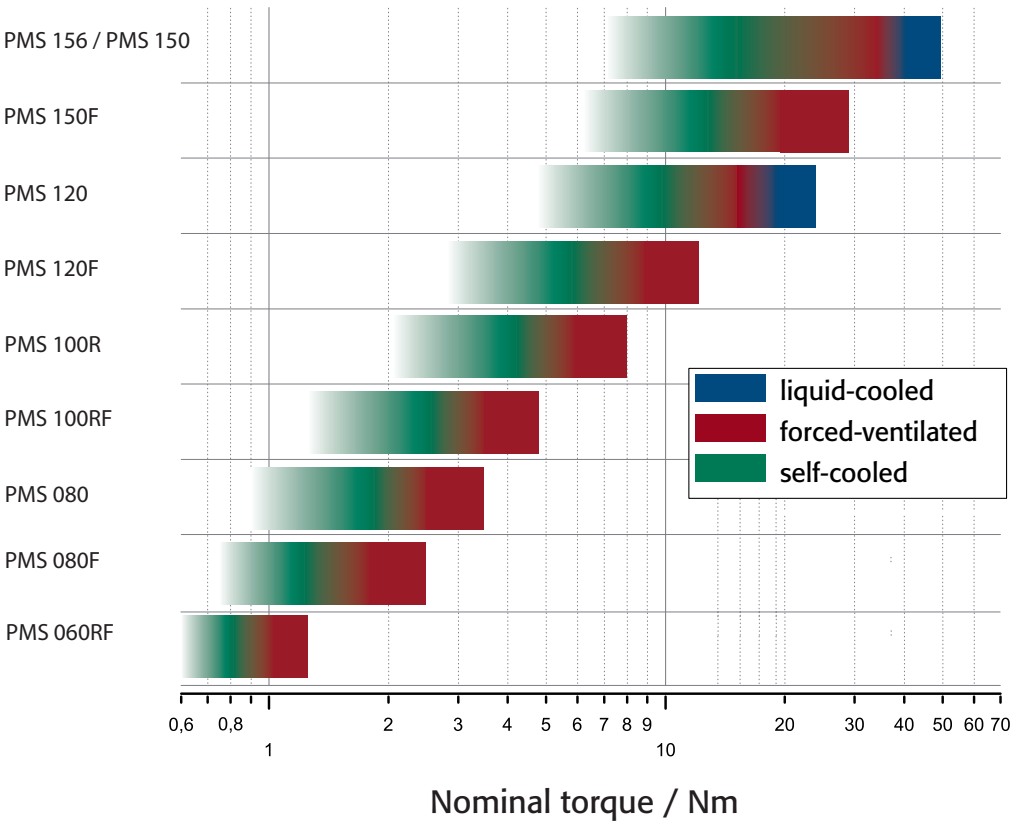
Electric vehicle

Auxilliary drive

Power range PMS Disc Motors



Torque range PMS Disc Motors



PMS 060F

(SL-EC 80, Type 11B)

Weight: approx. 1.5 kg
Inertia: 2.14 kg · cm³

		Output power	Speed	Torque	Current	Stall torque	Stall current	Max. stall torque	Max. stall current	Back-EMF constant	Torque constant
		P	n	M	I	M_o	I_o	M_{omax}	I_{omax}	K_e	K_t
		kW	min^{-1}	Nm	A	Nm	A	Nm	A	$V/1000min^{-1}$	Nm/A
24 VDC	*Self cooling*	0,10	1500	0,64	6,1	0,76	7,3	2,0	19	8,4	0,10
		0,23	3000	0,73	12,0	0,88	14,4	2,0	33	4,2	0,06
		0,37	4500	0,79	20,1	0,94	24,2	2,0	51	2,6	0,04
		0,37	6000	0,59	19,6	0,71	23,6	2,0	67	2,0	0,03
36 VDC		0,10	1500	0,64	4,1	0,76	4,9	2,0	13	12,7	0,16
		0,23	3000	0,73	8,0	0,88	9,5	2,0	22	6,3	0,09
		0,38	4500	0,81	12,8	0,97	15,4	2,0	32	4,2	0,06
		0,38	6000	0,60	12,3	0,73	14,8	2,0	41	3,2	0,05
48 VDC		0,09	1500	0,57	2,8	0,69	3,4	2,0	10	16,9	0,20
		0,23	3000	0,73	6,1	0,88	7,3	2,0	17	8,4	0,12
		0,40	4500	0,85	9,8	1,02	11,7	2,0	23	5,8	0,09
		0,35	6000	0,56	8,7	0,67	10,4	2,0	31	4,2	0,06
330 VDC		0,32	4500	0,68	1,2	0,81	1,4	2,0	3	38,9	0,58
		0,35	6000	0,56	1,3	0,67	1,5	2,0	5	29,0	0,43
560 VDC		0,35	6000	0,56	0,8	0,67	1,0	2,0	3	45,9	0,69

PMS 080F

(SL-EC 100, Type 11B)

Weight: approx. 3.2 kg
Inertia: 6.5 kg · cm²

		Output power	Speed	Torque	Current	Stall torque	Stall current	Max. stall torque	Max. stall current	Back-EMF constant	Torque constant
		P	n	M	I	M_o	I_o	M_{omax}	I_{omax}	K_e	K_t
		kW	min^{-1}	Nm	A	Nm	A	Nm	A	V/1000min^{-1}	Nm/A
24 VDC	*Self cooling*	0,22	1500	1,4	11,1	1,7	13,3	5	40	8,9	0,13
		0,39	3000	1,2	19,4	1,5	23,3	5	78	4,3	0,06
		0,42	4500	0,9	20,7	1,1	24,9	5	116	2,8	0,04
		0,39	6000	0,6	18,8	0,7	22,6	5	152	2,1	0,03
	External ventilation	0,29	1500	1,8	15,0	2,2	18,0	5	41	8,9	0,12
		0,66	3000	2,1	32,8	2,5	39,4	5	78	4,3	0,06
		0,75	4500	1,6	37,0	1,9	44,4	5	116	2,8	0,04
		0,82	6000	1,3	39,5	1,6	47,5	5	152	2,1	0,03
36 VDC	*Self cooling*	0,24	1500	1,5	8,2	1,8	9,8	5	27	13,1	0,19
		0,39	3000	1,2	13,1	1,5	15,7	5	53	6,4	0,10
		0,45	4500	1,0	14,7	1,1	17,6	5	77	4,3	0,07
		0,38	6000	0,6	12,6	0,7	15,1	5	104	3,2	0,05
	External ventilation	0,30	1500	1,9	10,4	2,3	12,5	5	27	13,1	0,18
		0,65	3000	2,1	22,0	2,5	26,4	5	53	6,4	0,09
		0,78	4500	1,7	25,5	2,0	30,6	5	77	4,3	0,07
		0,82	6000	1,3	26,6	1,6	32,0	5	102	3,3	0,05
48 VDC	*Self cooling*	0,23	1500	1,5	5,9	1,8	7,1	5	20	17,5	0,25
		0,38	3000	1,2	9,4	1,5	11,3	5	39	8,7	0,13
		0,45	4500	1,0	11,1	1,1	13,3	5	58	5,7	0,09
		0,38	6000	0,6	9,8	0,7	11,7	5	81	4,3	0,06
	External ventilation	0,30	1500	1,9	8,0	2,3	9,5	5	21	17,5	0,24
		0,65	3000	2,1	16,0	2,5	19,2	5	39	8,7	0,13
		0,78	4500	1,7	19,2	2,0	23,1	5	58	5,7	0,09
		0,82	6000	1,3	19,8	1,6	23,7	5	76	4,3	0,07
330 VDC	*Self cooling*	0,21	1500	1,3	0,8	1,6	1,0	5	3,1	117,4	1,64
		0,37	3000	1,2	1,4	1,4	1,6	5	5,7	58,7	0,87
		0,45	4500	1,0	1,6	1,1	1,9	5	8,3	39,7	0,60
		0,38	6000	0,6	1,4	0,7	1,7	5	11,4	29,9	0,44
	External ventilation	0,27	1500	1,7	1,1	2,1	1,3	5	3,2	117,4	1,58
		0,62	3000	2,0	2,3	2,4	2,7	5	5,7	58,7	0,87
		0,78	4500	1,7	2,7	2,0	3,3	5	8,3	39,9	0,60
		0,82	6000	1,3	3,0	1,6	3,5	5	11,3	29,2	0,44
560 VDC	*Self cooling*	0,21	1500	1,3	0,6	1,6	0,8	5	2,4	147,6	2,06
		0,35	3000	1,1	0,8	1,3	0,9	5	3,4	100,0	1,46
		0,45	4500	1,0	0,9	1,1	1,1	5	4,9	66,9	1,01
		0,36	6000	0,6	0,8	0,7	0,9	5	6,9	49,5	0,73
	External ventilation	0,27	1500	1,7	0,8	2,1	1,0	5	2,4	150,8	2,05
		0,61	3000	1,9	1,3	2,3	1,6	5	3,4	99,9	1,48
		0,76	4500	1,6	1,6	1,9	1,9	5	5,0	66,4	1,00
		0,80	6000	1,3	1,7	1,5	2,0	5	6,6	49,7	0,75

PMS 080

(SL-EC 100, Type 22B)

Weight: approx. 3.8 kg
Inertia: 3.8 kg · cm²

		Output power	Speed	Torque	Current	Stall torque	Stall current	Max. stall torque	Max. stall current	Back-EMF constant	Torque constant
		P	n	M	I	M_o	I_o	M_{omax}	I_{omax}	K_e	K_t
		kW	min^{-1}	Nm	A	Nm	A	Nm	A	V/1000min^{-1}	Nm/A
24 VDC	*Self cooling*	0,35	1500	2,2	17,5	2,7	21,1	10	79	9,0	0,13
		0,55	3000	1,8	30,2	2,1	36,2	10	172	4,1	0,06
		0,70	4500	1,5	35,4	1,8	42,4	10	238	2,8	0,04
		0,60	6000	1,0	29,8	1,1	35,8	10	313	2,3	0,03
	External ventilation	0,45	1500	2,9	23,1	3,4	27,7	10	81	9,0	0,12
		1,00	3000	3,2	54,9	3,8	65,9	10	172	4,1	0,06
		1,10	4500	2,3	55,6	2,8	66,7	10	238	2,8	0,04
		1,20	6000	1,9	57,9	2,3	69,4	10	303	2,3	0,03
36 VDC	*Self cooling*	0,38	1500	2,4	13,0	2,9	15,6	10	54	13,0	0,19
		0,55	3000	1,8	19,0	2,1	22,8	10	109	6,5	0,09
		0,70	4500	1,5	23,6	1,8	28,3	10	159	4,2	0,06
		0,60	6000	1,0	19,4	1,1	23,3	10	204	3,2	0,05
	External ventilation	0,48	1500	3,1	16,9	3,7	20,3	10	55	13,0	0,18
		1,00	3000	3,2	34,6	3,8	41,5	10	109	6,5	0,09
		1,20	4500	2,5	40,4	3,1	48,5	10	159	4,2	0,06
		1,30	6000	2,1	42,1	2,5	50,6	10	204	3,2	0,05
48 VDC	*Self cooling*	0,35	1500	2,2	9,8	2,7	11,8	10	44	16,9	0,23
		0,60	3000	1,9	13,9	2,3	16,7	10	73	9,2	0,14
		0,70	4500	1,5	17,3	1,8	20,7	10	116	5,7	0,09
		0,60	6000	1,0	14,1	1,1	17,0	10	148	4,4	0,07
	External ventilation	0,45	1500	2,9	13,0	3,4	15,6	10	45	16,9	0,22
		1,00	3000	3,2	23,1	3,8	27,8	10	73	9,2	0,14
		1,20	4500	2,5	29,6	3,1	35,5	10	116	5,7	0,09
		1,30	6000	2,1	30,7	2,5	36,8	10	148	4,4	0,07
330 VDC	*Self cooling*	0,31	1500	2,0	1,3	2,4	1,6	10	6,6	115,3	1,51
		0,60	3000	1,9	2,2	2,3	2,6	10	11,5	58,6	0,87
		0,70	4500	1,5	2,6	1,8	3,1	10	17,3	38,2	0,58
		0,60	6000	1,0	2,2	1,1	2,6	10	22,7	28,8	0,44
	External ventilation	0,38	1500	2,4	1,6	2,9	2,0	10	6,8	115,3	1,48
		0,90	3000	2,9	3,3	3,4	3,9	10	11,5	58,6	0,87
		1,20	4500	2,5	4,4	3,1	5,3	10	17,3	38,2	0,58
		1,30	6000	2,1	4,7	2,5	5,6	10	22,7	28,8	0,44
560 VDC	*Self cooling*	0,60	3000	1,9	1,3	2,3	1,5	10	6,6	101,2	1,51
		0,65	4500	1,4	1,4	1,7	1,7	10	10,2	65,0	0,98
		0,55	6000	0,9	1,1	1,1	1,3	10	12,7	51,0	0,79
	External ventilation	0,85	3000	2,7	1,8	3,2	2,2	10	6,7	101,2	1,48
		1,15	4500	2,4	2,5	2,9	3,0	10	10,2	65,0	0,98
		1,25	6000	2,0	2,5	2,4	3,0	10	12,7	51,0	0,79

PMS 100F

(SL-EC 120, Type 11B)

Weight: approx. 5.5 kg
Inertia: 17.3 kg · cm²

		Output power	Speed	Torque	Current	Stall torque	Stall current	Max. stall torque	Max. stall current	Back-EMF constant	Torque constant
		P	n	M	I	M_o	I_o	M_{omax}	I_{omax}	K_e	K_t
		kW	min^{-1}	Nm	A	Nm	A	Nm	A	$V/1000min^{-1}$	Nm/A
24 VDC	*Self cooling*	0,58	1500	3,7	33,2	4,4	39,8	13	120	7,7	0,11
		0,80	3000	2,6	39,8	3,1	47,8	13	200	4,5	0,06
		1,00	4500	2,1	52,8	2,5	63,3	13	320	2,8	0,04
	External ventilation	0,65	1500	4,1	37,9	5,0	45,5	13	120	7,7	0,11
		1,35	3000	4,3	66,3	5,2	79,6	13	200	4,5	0,06
		1,40	4500	3,0	72,0	3,6	86,4	12	290	2,9	0,04
36 VDC	*Self cooling*	0,58	1500	3,7	20,0	4,4	24,0	13	72	12,8	0,18
		0,80	3000	2,6	27,5	3,1	33,0	13	141	6,4	0,09
		1,00	4500	2,1	34,9	2,5	41,8	13	215	4,3	0,06
	External ventilation	0,65	1500	4,1	22,7	5,0	27,2	13	72	12,8	0,18
		1,40	3000	4,5	47,6	5,4	57,1	13	141	6,4	0,09
		1,50	4500	3,2	52,1	3,8	62,6	13	215	4,3	0,06
		1,60	6000	2,6	58,1	3,1	69,7	10	230	3,2	0,04
48 VDC	*Self cooling*	0,58	1500	3,7	14,2	4,4	17,1	13	52	18,0	0,26
		0,80	3000	2,6	19,7	3,1	23,6	13	100	9,0	0,13
		1,00	4500	2,1	26,3	2,5	31,5	13	160	5,7	0,08
	External ventilation	0,65	1500	4,1	16,2	5,0	19,5	13	52	18,0	0,25
		1,45	3000	4,6	35,2	5,5	42,3	13	100	9,0	0,13
		1,50	4500	3,2	36,5	3,8	43,8	13	150	6,1	0,09
		1,60	6000	2,6	43,5	3,1	52,2	10	175	4,2	0,06
330 VDC	*Self cooling*	0,58	1500	3,7	2,6	4,4	3,1	13	9	100,0	1,43
		0,80	3000	2,5	3,1	3,1	3,7	13	18	57,9	0,83
		1,00	4500	2,1	4,2	2,5	5,0	13	26	35,2	0,50
	External ventilation	0,65	1500	4,1	5,1	5,0	6,1	13	9	100,0	1,42
		1,40	3000	4,5	3,1	5,3	3,7	13	18	57,9	0,83
		1,45	4500	3,1	6,2	3,7	7,4	12	24	35,1	0,50
560 VDC	*Self cooling*	0,50	1500	3,5	1,2	4,2	1,5	13	4,6	200,1	2,82
		0,80	3000	2,6	1,8	3,1	2,1	13	9,0	100,0	1,43
		1,00	4500	2,1	2,2	2,5	2,7	13	14,0	67,9	0,96
	External ventilation	0,58	1500	3,7	1,3	4,4	1,6	13	4,6	200,1	2,82
		1,45	3000	4,6	3,2	5,5	3,8	13	9,0	100,4	1,45
		1,50	4500	3,2	3,4	3,8	4,1	13	14,0	66,1	0,94

PMS 100

(SL-EC 120, Type 22B)

PERM TECHNOLOGY

Weight: approx. 7.2 kg
Inertia: 9.6 kg · cm²

		Output power	Speed	Torque	Current	Stall torque	Stall current	Max. stall torque	Max. stall current	Back-EMF constant	Torque constant
		P	n	M	I	M_o	I_o	M_{omax}	I_{omax}	K_e	K_t
		kW	min^{-1}	Nm	A	Nm	A	Nm	A	$V/1000min^{-1}$	Nm/A
24 VDC	*Self cooling*	0,92	1500	5,9	45,8	7,0	55,0	18	140	8,9	0,13
		1,30	3000	3,9	69,1	4,7	82,9	14	250	3,9	0,06
		1,20	4500	2,6	59,6	3,1	71,5	13	300	2,9	0,04
	External ventilation	1,15	1500	7,3	58,4	8,4	67,2	22	175	8,9	0,13
		1,40	3000	6,0	105,5	7,2	126,6	18	315	3,9	0,06
		1,40	4500	3,0	73,2	3,6	87,8	14	350	2,8	0,04
		1,35	6000	2,2	72,3	2,6	86,8	13	420	2,2	0,03
36 VDC	*Self cooling*	0,92	1500	5,9	32,1	7,0	38,5	20	110	12,8	0,18
		1,20	3000	3,6	42,8	4,3	51,4	17	200	6,0	0,08
		1,20	4500	2,6	42,2	3,1	50,6	14	230	4,3	0,06
	External ventilation	1,15	1500	7,3	40,9	8,8	49,1	22	120	12,8	0,18
		2,20	3000	6,6	76,7	7,9	92,0	20	230	6,0	0,09
		2,40	4500	5,1	80,2	6,1	96,2	18	290	4,4	0,06
		2,00	6000	3,18	71,4	3,8	85,7	15	330	3,19	0,05
48 VDC	*Self cooling*	0,92	1500	5,9	22,5	7,0	27,0	21	80	17,7	0,26
		1,40	3000	4,5	35,1	5,4	42,1	18	140	8,8	0,13
		1,20	4500	2,6	30,6	3,1	36,7	15	180	5,9	0,08
	External ventilation	1,15	1500	7,3	28,6	8,8	34,3	21	80	17,7	0,26
		2,40	3000	7,6	59,0	9,1	70,8	20	155	9,0	0,13
		2,50	4500	5,3	64,2	6,4	77,0	19	230	5,7	0,08
		2,70	6000	4,3	66,8	5,2	80,2	16	250	4,5	0,06
330 VDC	*Self cooling*	0,90	1500	5,7	4,2	6,9	5,0	20	15	98,4	1,37
		1,40	3000	4,5	5,9	5,4	7,1	18	24	52,7	0,76
		1,20	4500	2,6	5,3	3,1	6,4	15	31	34,5	0,48
	External ventilation	1,10	1500	7,0	5,2	8,4	6,3	21	16	98,4	1,34
		2,00	3000	6,4	8,3	7,7	10,0	21	28	52,7	0,76
		2,50	4500	5,3	10,4	6,4	12,5	19	38	35,7	0,51
		2,70	6000	4,3	11,6	5,2	13,9	15	41	25,8	0,37
560 VDC	*Self cooling*	0,90	1500	5,7	2,1	6,9	2,5	21	8	192,3	2,72
		1,40	3000	4,5	3,1	5,4	3,7	17	12	100,0	1,45
		1,20	4500	2,6	2,7	3,1	3,2	15	16	67,4	0,96
	External ventilation	1,10	1500	7,0	2,6	8,4	3,2	20	8	192,3	2,66
		2,10	3000	6,7	4,6	8,0	5,5	20	14	100,1	1,45
		2,50	4500	5,3	5,5	6,4	6,6	19	20	67,9	0,97
		2,70	6000	4,3	6,0	5,2	7,2	15	21	49,6	0,71

PMS 120F

(SL-EC 160, Type 11B)

Weight: approx. 10 kg
Inertia: 26.3 kg · cm²

		Output power	Speed	Torque	Current	Stall torque	Stall current	Max. stall torque	Max. stall current	Back-EMF constant	Torque constant
		P	n	M	I	M_o	I_o	M_{omax}	I_{omax}	K_e	K_t
		kW	min^{-1}	Nm	A	Nm	A	Nm	A	V/1000min^{-1}	Nm/A
48 VDC	*Self cooling*	1,5	1500	9,5	36,5	11,5	43,8	20	76	17,7	0,26
		2,5	3000	8,0	60,3	9,5	72,3	20	152	8,7	0,13
		2,2	4500	4,7	52,0	5,6	62,5	20	223	5,9	0,09
	External ventilation	1,8	1500	11,5	44,5	13,8	53,4	20	78	17,7	0,26
		3,7	3000	11,8	88,0	14,1	105,6	20	149	8,9	0,13
		3,7	4500	7,9	87,5	9,4	105,0	20	223	5,9	0,09
		3,5	6000	5,6	85,8	6,7	103,0	20	308	4,3	0,06
80 VDC	*Self cooling*	1,5	1500	9,5	22,7	11,5	27,2	20	47	28,8	0,42
		2,4	3000	7,6	33,4	9,2	40,1	20	87	15,1	0,23
		2,5	4500	5,3	36,5	6,4	43,8	20	137	9,5	0,15
	External ventilation	1,8	1500	11,5	27,5	13,8	33,0	20	48	28,8	0,42
		3,7	3000	11,8	54,0	14,1	64,8	20	92	14,5	0,22
		3,9	4500	8,3	55,5	9,9	66,7	20	134	9,8	0,15
		3,9	6000	6,2	55,0	7,4	66,0	20	177	7,4	0,11
96 VDC	*Self cooling*	1,5	1500	9,5	17,9	11,5	21,5	20	38	36,1	0,53
		2,4	3000	7,6	27,8	9,2	33,4	20	73	18,1	0,27
		2,2	4500	4,7	26,6	5,6	31,9	20	114	11,6	0,18
	External ventilation	1,9	1500	12,1	22,5	14,5	27,0	20	37	36,1	0,54
		3,7	3000	11,8	43,3	14,1	51,9	20	74	18,0	0,27
		3,9	4500	8,3	45,0	9,9	54,0	20	109	12,1	0,18
		3,8	6000	6,0	45,9	7,3	55,1	20	152	8,6	0,13
330 VDC	*Self cooling*	1,5	1500	9,5	5,3	11,5	6,4	20	11	122,5	1,79
		2,3	3000	7,3	8,0	8,8	9,7	20	22	60,3	0,91
		2,2	4500	4,7	7,5	5,6	9,0	20	32	40,8	0,62
	External ventilation	1,8	1500	11,5	6,5	13,8	7,8	20	11	122.47	1,77
		3,5	3000	11,1	12,0	13,4	14,4	20	22	61,4	0,93
		3,8	4500	8,1	13,6	9,7	16,3	20	34	39,1	0,59
		3,8	6000	6,0	13,4	7,3	16,1	20	44	29,6	0,45
560 VDC	*Self cooling*	1,5	1500	9,5	3,2	11,5	3,8	20	7	205,3	3,00
		2,4	3000	7,6	4,9	9,2	5,9	20	13	102,5	1,55
		2,4	4500	5,1	4,9	6,1	5,9	20	19	68,1	1,03
	External ventilation	1,7	1500	10,8	3,6	13,0	4,4	20	7	205,4	2,97
		3,5	3000	11,1	7,3	13,4	8,8	20	13	101,1	1,53
		3,9	4500	8,3	8,2	9,9	9,9	20	20	66,3	1,01
		3,9	6000	6,2	8,2	7,4	9,9	20	27	49,3	0,75

PMS 120

(SL-EC 160, Type 22B)

PERM TECHNOLOGY

Weight: approx. 12.3 kg
Inertia: 26.3 kg · cm²

		Output power	Speed	Torque	Current	Stall torque	Stall current	Max. stall torque	Max. stall current	Back-EMF constant	Torque constant
		P	n	M	I	M_o	I_o	M_{omax}	I_{omax}	K_e	K_t
		kW	min^{-1}	Nm	A	Nm	A	Nm	A	V/1000min^{-1}	Nm/A
48 VDC	*Self cooling*	2,4	1500	15,3	58,8	18,3	70,6	40	155	17,7	0,26
		3,5	3000	11,1	83,7	13,3	100,4	40	300	8,8	0,13
		4,2	4500	8,9	96,9	10,7	116,3	40	440	6,0	0,09
	External ventilation	3,0	1500	19,1	74,9	22,9	89,9	41	160	17,7	0,26
		5,3	3000	16,9	126,9	20,3	152,3	41	310	8,8	0,13
		6,3	4500	13,3	146,2	16,0	175,4	40	440	6,0	0,09
		6,3	6000	10,0	146,5	12,0	175,8	40	580	4,3	0,07
80 VDC	*Self cooling*	2,5	1500	15,9	35,9	19,1	43,1	40	90	29,7	0,44
		4,4	3000	14,0	62,6	16,8	75,1	40	180	14,9	0,22
		4,3	4500	9,1	59,0	11,0	70,8	40	260	10,2	0,15
	External ventilation	3,0	1500	19,1	44,4	22,9	53,3	45	105	29,7	0,43
		5,8	3000	18,5	82,4	22,2	98,9	45	200	14,8	0,22
		7,0	4500	14,9	98,5	17,8	118,2	45	300	10,2	0,15
		7,5	6000	11,9	108,9	14,3	130,7	40	370	7,5	0,11
	Liquid cooling	3,7	1500	23,5	54,7	28,2	65,6	45	105	29,7	0,43
		7,5	3000	23,9	107,1	28,7	128,5	45	200	14,8	0,22
		9,5	4500	20,2	131,0	24,2	157,2	45	290	10,2	0,15
		10,0	6000	15,9	144,5	19,1	173,4	40	360	7,5	0,11
96 VDC	*Self cooling*	2,4	1500	15,3	30,2	18,4	36,2	40	80	34,8	0,51
		3,8	3000	12,1	43,9	14,5	52,7	40	150	18,1	0,28
		4,0	4500	8,5	49,1	10,2	58,9	40	230	11,6	0,17
	External ventilation	3,0	1500	19,1	38,7	22,9	46,4	45	92	34,8	0,49
		5,3	3000	16,9	61,4	20,3	73,7	45	165	18,1	0,27
		7,0	4500	14,9	87,2	17,8	104,6	45	270	11,6	0,17
		7,5	6000	11,9	95,3	14,3	114,4	40	320	8,5	0,13
	Liquid cooling	3,7	1500	23,6	47,7	28,3	57,2	45	91	34,3	0,49
		7,5	3000	23,9	96,4	28,7	115,7	45	180	16,7	0,25
		10,5	4500	22,3	127,4	26,7	152,9	45	260	11,6	0,17
		11,0	6000	17,5	137,3	21,0	164,8	40	310	8,6	0,13
330 VDC	*Self cooling*	2,2	1500	14,0	10,3	16,8	12,4	41	30	89,9	1,35
		4,2	3000	13,3	18,5	16,0	22,2	40	55	48,1	0,72
		4,0	4500	8,5	16,7	10,2	20,0	40	80	33,8	0,51
	External ventilation	2,8	1500	17,8	13,4	21,4	16,1	45	33	89,9	1,33
		5,8	3000	18,5	25,6	22,2	30,7	45	61	48,2	0,72
		7,0	4500	14,8	29,4	17,8	35,3	45	87	33,7	0,51
		7,0	6000	11,1	30,6	13,3	36,7	40	110	24,9	0,36
	Liquid cooling	3,8	1500	24,2	15,5	29,0	18,6	45	30	105,9	1,56
		7,5	3000	23,9	33,0	28,7	39,6	45	62	48,2	0,72
		10,5	4500	22,3	41,9	26,7	50,3	45	85	35,3	0,53
		11,0	6000	17,5	47,7	21,0	57,2	40	110	24,9	0,37
560 VDC	*Self cooling*	2,2	1500	14,0	4,4	16,8	5,3	41	13	205,6	3,17
		4,2	3000	13,3	8,4	16,0	10,1	40	25	103,5	1,59
		4,0	4500	8,5	8,7	10,2	10,4	40	42	64,3	0,97
	External ventilation	2,8	1500	17,8	5,7	21,4	6,8	44	14	205,6	3,12
		5,8	3000	18,5	11,3	22,1	13,6	44	27	103,5	1,63
		7,0	4500	14,8	15,4	17,8	18,5	44	46	64,3	0,96
		7,3	6000	11,6	16,2	13,9	19,4	41	57	48,7	0,72
	Liquid cooling	3,8	1500	24,2	7,8	29,0	9,4	45	15	205,6	3,12
		7,5	3000	23,9	15,5	28,7	18,6	45	29	103,5	1,54
		11,0	4500	23,3	24,1	28,0	28,9	45	47	64,3	0,97
		11,5	6000	18,3	25,3	22,0	30,4	40	62	48,8	0,72

PMS 150F

(SL-EC 180, Type 11B)

Weight: approx. 16 kg
Inertia: 58.6 kg · cm²

		Output power	Speed	Torque	Current	Stall torque	Stall current	Max. stall torque	Max. stall current	Back-EMF constant	Torque constant
		P	n	M	I	M_o	I_o	M_{omax}	I_{omax}	K_e	K_t
		kW	min^{-1}	Nm	A	Nm	A	Nm	A	V/1000min^{-1}	Nm/A
48 VDC	*Self cooling*	2,7	1500	17,2	62,7	20,6	75,3	40	146	17,7	0,27
		5,0	3000	15,9	112,1	19,1	134,5	40	282	8,8	0,14
		4,5	4500	9,5	102,7	11,5	123,2	40	430	5,8	0,09
	External ventilation	3,2	1500	20,4	75,2	24,4	90,2	40	148	17,7	0,27
		6,7	3000	21,3	151,3	25,6	181,5	40	284	8,8	0,14
		7,5	4500	15,9	178,8	19,1	214,6	40	449	5,8	0,09
		7,9	6000	12,6	184,9	15,1	221,9	40	588	4,2	0,07
80 VDC	*Self cooling*	2,7	1500	17,2	37,8	20,6	45,3	40	88	29,3	0,46
		5,1	3000	16,2	68,2	19,5	81,9	40	168	14,7	0,24
		4,9	4500	10,4	67,5	12,5	81,0	40	260	9,5	0,15
	External ventilation	3,2	1500	20,4	45,3	24,4	54,3	40	89	29,3	0,45
		6,8	3000	21,6	92,1	26,0	110,5	40	170	14,7	0,24
		8,1	4500	17,2	111,6	20,6	133,9	40	260	9,5	0,15
		8,0	6000	12,7	107,0	15,3	128,4	40	336	7,3	0,12
96 VDC	*Self cooling*	2,7	1500	17,2	29,9	20,6	35,9	40	70	36,7	0,58
		5,1	3000	16,2	54,7	19,5	65,6	40	135	18,3	0,30
		4,8	4500	10,2	52,5	12,2	63,0	40	206	12,0	0,19
	External ventilation	3,3	1500	21,0	37,4	25,2	44,9	40	71	36,7	0,56
		6,8	3000	21,6	73,6	26,0	88,3	40	136	18,3	0,29
		8,0	4500	17,0	87,5	20,4	105,0	40	206	12,0	0,19
		7,9	6000	12,6	85,0	15,1	101,9	40	270	9,1	0,15
330 VDC	*Self cooling*	2,7	1500	17,2	9,0	20,6	10,8	40	21	122,3	1,92
		5,0	3000	15,9	16,1	19,1	19,3	40	40	61,2	0,99
		5,0	4500	10,6	16,4	12,7	19,7	40	62	39,9	0,65
	External ventilation	3,2	1500	20,4	10,9	24,4	13,0	40	21	122,3	1,88
		6,7	3000	21,3	21,8	25,6	26,1	40	41	61,2	0,98
		8,2	4500	17,4	26,9	20,9	32,3	40	62	39,9	0,65
		7,8	6000	12,4	24,7	14,9	29,6	40	80	31,1	0,50
560 VDC	*Self cooling*	2,6	1500	16,6	5,3	19,9	6,4	40	13	200,5	3,11
		5,0	3000	15,9	9,8	19,1	11,8	40	25	100,2	1,62
		5,0	4500	10,6	9,6	12,7	11,6	40	36	67,9	1,10
	External ventilation	3,2	1500	20,4	6,6	24,4	8,0	40	13	200,5	3,07
		6,7	3000	21,3	13,3	25,6	15,9	40	25	100,2	1,61
		8,2	4500	17,4	15,8	20,9	19,0	40	36	67,9	1,10
		7,8	6000	12,4	15,0	14,9	18,0	40	48	51,2	0,83

PMS 150

(SL-EC 180, Type 22B)

PERM TECHNOLOGY

Weight: approx. 22.3 kg
Inertia: 58.6 kg · cm²

		Output power	Speed	Torque	Current	Stall torque	Stall current	Max. stall torque	Max. stall current	Back-EMF constant	Torque constant
		P	n	M	I	M_o	I_o	M_{omax}	I_{omax}	K_e	K_t
		kW	min^{-1}	Nm	A	Nm	A	Nm	A	$V/1000min^{-1}$	Nm/A
48 VDC	*Self cooling*	4,8	1500	30,5	111,1	36,6	133,3	80	315	17,9	0,28
		7,6	3000	24,2	169,0	29,0	202,8	80	550	8,9	0,14
		7,4	4500	15,7	166,8	18,8	200,2	56	600	6,1	0,09
	External ventilation	5,7	1500	36,3	133,7	43,5	160,4	80	315	17,9	0,28
		8,6	3000	27,4	191,3	32,9	229,6	80	550	8,9	0,14
		8,6	4500	18,3	192,6	21,9	231,1	61	650	6,1	0,09
		8,0	6000	12,7	188,7	15,3	226,4	51	750	4,4	0,07
80 VDC	*Self cooling*	4,8	1500	30,6	72,2	36,7	86,6	80	190	28,4	0,42
		6,8	3000	21,6	99,4	25,9	119,3	80	370	14,2	0,22
		7,6	4500	21,6	109,3	25,9	131,2	80	550	9,7	0,15
	External ventilation	5,5	1500	35,0	83,4	42,0	100,1	80	192	28,4	0,42
		9,0	3000	28,6	131,0	34,3	157,2	80	370	14,2	0,22
		12,5	4500	26,5	180,5	31,8	216,6	80	550	9,7	0,15
		13,0	6000	20,7	190,6	24,8	228,7	71	650	7,3	0,11
	Liquid cooling	6,0	1500	38,2	92,0	45,8	110,4	80	193	28,4	0,42
		11,0	3000	35,0	160,4	42,0	192,5	80	370	14,2	0,22
		13,0	4500	27,6	187,6	33,1	225,1	80	550	9,7	0,15
		13,0	6000	20,7	192,2	24,8	230,6	71	650	7,3	0,11
96 VDC	*Self cooling*	4,8	1500	30,6	55,3	36,7	66,4	80	145	35,8	0,55
		6,8	3000	21,7	78,9	26,0	94,7	80	290	17,9	0,27
		7,6	4500	16,1	93,1	19,4	111,7	80	455	11,6	0,17
	External ventilation	5,5	1500	35,0	64,6	42,0	77,5	80	150	74,4	0,54
		9,2	3000	29,3	107,1	35,2	128,5	80	295	17,9	0,27
		12,5	4500	26,5	150,8	31,8	181,0	80	455	11,6	0,18
		13,0	6000	20,7	160,0	24,8	192,0	71	550	8,7	0,13
	Liquid cooling	6,3	1500	40,1	74,2	48,1	89,0	80	150	35,8	0,54
		11,0	3000	35,0	129,8	42,0	155,8	80	300	17,9	0,27
		16,0	4500	34,0	190,9	40,8	229,1	80	450	11,6	0,18
		16,0	6000	25,5	192,3	30,6	230,8	79	600	8,7	0,13
330 VDC	*Self cooling*	4,0	1500	25,5	17,1	30,6	20,5	80	54	98,4	1,49
		6,8	3000	21,6	28,5	25,9	34,2	80	105	49,2	0,76
		7,4	4500	15,7	31,3	18,8	37,6	80	160	33,6	0,50
	External ventilation	4,6	1500	29,3	19,8	35,2	23,8	80	54	98,4	1,48
		9,0	3000	28,6	37,7	34,3	45,2	80	105	49,2	0,67
		12,0	4500	25,5	50,0	30,6	60,0	80	160	33,5	0,51
		13,5	6000	21,4	56,0	25,7	67,2	72	190	25,8	0,38
	Liquid cooling	6,0	1500	38,0	26,4	45,6	31,7	80	55	98,4	1,45
		12,0	3000	38,2	50,6	45,8	60,7	80	105	49,2	0,75
		16,0	4500	33,9	66,5	40,7	79,8	80	160	33,6	0,51
		20,0	6000	31,8	82,5	38,2	99,0	72	190	25,8	0,39
560 VDC	*Self cooling*	4,2	1500	26,7	8,9	32,0	10,7	80	27	196,8	2,99
		6,8	3000	21,6	14,9	25,9	17,9	80	55	98,4	1,50
		7,0	4500	14,9	14,9	17,8	17,9	80	80	67,1	0,99
	External ventilation	4,7	1500	29,3	10,1	35,2	12,1	80	27	196,8	2,97
		9,3	3000	29,6	19,8	35,5	23,8	80	54	98,4	1,50
		12,0	4500	25,5	25,1	30,6	30,1	80	79	67,1	1,01
		14,0	6000	22,3	30,5	26,8	36,6	72	99	48,8	0,73
	Liquid cooling	6,0	1500	38,2	13,1	45,8	15,7	80	28	196,8	2,90
		12,0	3000	38,2	25,7	45,8	30,8	80	54	98,4	1,49
		16,0	4500	33,9	33,4	40,7	40,1	80	81	67,1	1,02
		21,0	6000	33,4	45,7	40,1	54,8	72	98	48,8	0,73

PMS 156

(SL-EC 180/50, Type 22B)

Weight: 29.8 kg
Inertia: 58.6 kg · cm²

		Output power	Speed	Torque	Current	Stall torque	Stall current	Max. stall torque	Max. stall current	Back-EMF constant	Torque constant
		P	n	M	I	M_o	I_o	M_{omax}	I_{omax}	K_e	K_t
		kW	min^{-1}	Nm	A	Nm	A	Nm	A	V/1000min^{-1}	Nm/A
48 VDC	*Self cooling*	6,0	1500	38,2	146,9	45,8	176,3	80	308	17,4	0,26
		10,0	3000	31,8	246,8	38,2	296,1	80	620	8,4	0,13
	External ventilation	7,2	1500	45,8	176,3	55,0	211,6	80	308	17,4	0,26
		10,5	3000	33,4	259,1	40,1	310,9	80	620	8,4	0,13
80 VDC	*Self cooling*	6,0	1500	38,2	85,7	45,8	102,9	80	180	29,0	0,45
		10,0	3000	31,8	142,3	38,2	170,8	80	358	14,5	0,22
		11,0	4500	23,3	153,2	28,0	183,8	80	525	9,4	0,15
	External ventilation	7,0	1500	44,6	100,9	53,5	121,1	80	181	29,0	0,44
		14,0	3000	44,6	199,2	53,5	239,1	80	358	14,5	0,22
		16,0	4500	34,0	222,2	40,7	266,6	80	524	9,4	0,15
		16,0	6000	25,5	243,4	30,6	292,1	72	688	6,8	0,10
	Liquid cooling	9,0	1500	57,3	131,4	68,8	157,7	80	184	29,0	0,44
		18,0	3000	57,3	257,5	68,8	309,0	80	360	14,5	0,22
		18,5	4500	39,3	256,1	47,1	307,3	80	522	9,4	0,15
		17,0	6000	27,1	257,2	32,5	308,6	72	684	6,8	0,11
96 VDC	*Self cooling*	6,0	1500	38,2	72,6	45,8	87,1	80	152	34,5	0,53
		11,0	3000	35,0	128,3	42,0	153,9	80	293	17,7	0,27
		11,0	4500	23,3	124,2	28,0	149,0	80	426	11,6	0,19
	External ventilation	7,3	1500	46,5	88,4	55,8	106,0	80	152	34,5	0,53
		15,0	3000	47,7	174,9	57,3	209,9	80	293	17,7	0,27
		16,0	4500	34,0	182,2	40,7	218,6	80	429	11,5	0,19
		17,0	6000	27,1	197,5	32,5	237,0	72	526	8,9	0,14
	Liquid cooling	9,2	1500	58,6	112,7	70,3	135,3	80	154	34,5	0,52
		18,5	3000	58,9	215,7	70,7	258,8	80	293	17,7	0,27
		22,5	4500	47,7	256,7	57,3	308,0	80	430	11,5	0,19
		22,0	6000	35,0	255,6	42,0	306,7	72	526	8,9	0,14
330 VDC	*Self cooling*	5,6	1500	35,7	21,6	42,8	25,9	80	49	113,6	1,65
		10,0	3000	31,8	48,7	38,2	58,5	80	123	42,6	0,65
		10,0	4500	21,2	37,4	25,5	44,8	80	141	37,8	0,57
	External ventilation	6,6	1500	42,0	25,5	50,4	30,6	80	49	113,6	1,65
		13,0	3000	41,4	63,4	49,7	76,0	80	123	42,6	0,65
		15,0	4500	31,8	56,0	38,2	67,2	80	141	37,8	0,57
		17,0	6000	27,1	63,2	32,5	75,8	72	168	30,0	0,43
	Liquid cooling	8,2	1500	52,2	32,4	62,6	38,8	80	50	113,6	1,61
		16,0	3000	50,9	78,4	61,1	94,0	80	123	42,6	0,65
		26,0	4500	55,2	97,1	66,2	116,6	80	141	37,8	0,57
		30,0	6000	47,7	122,7	57,3	147,3	72	185	27,3	0,39
560 VDC	*Self cooling*	5,6	1500	35,7	12,3	42,8	14,7	80	28	200,2	2,91
		10,0	3000	31,8	25,6	38,2	30,8	80	64	81,0	1,24
		10,0	4500	21,2	21,4	25,5	25,6	80	81	66,6	0,99
	External ventilation	6,5	1500	41,4	14,2	49,7	17,1	80	28	200,2	2,91
		13,0	3000	41,4	33,6	49,7	40,3	80	65	80,4	1,23
		15,0	4500	31,8	31,7	38,2	38,1	80	80	67,1	1,00
		17,0	6000	27,1	32,6	32,5	39,1	72	87	50,8	0,83
	Liquid cooling	8,1	1500	51,6	18,1	61,9	21,8	80	28	200,2	2,84
		17,2	3000	54,7	44,6	65,7	53,5	80	65	80,4	1,23
		26,0	4500	55,2	54,8	66,2	65,7	80	79	67,1	1,01
		30,0	6000	47,7	57,8	57,3	69,4	72	87	50,5	0,83

PMS 156 Liquid-cooled

PERM TECHNOLOGY

Power range up to 30 kW

One fundamental premise of an electric motors capacity is its cooling! To achieve maximum performance at full load heat must be carried off. This can be done best by liquid cooling.

At the motor variante PMS 156W power could be increased by 250 % from 12 kW up to 30 kW for excample.

Liquid-cooled modification of PMS motors on request.

PMS 156W
Liquid-cooled

PMS 150
Self cooling

Technical Data and Information

Motor type	Brushless synchronous disc motor, excited by permanent magnets
Miscellaneous provisions	Relevant standards DIN EN 60034
Operational mode	S1 (continuous duty)
Cooling	Self cooling: without fan, mounting on satisfactory cooling surface Forced ventilation: air velocity > 5 m/s required, generated independently from motor Liquid cooled: coolant water Permissible coolant temperature max. 60 °C Permissible coolant pressure max. 3.0 bar W = coolant water with 6 l/min, max. 60 °C water temperature, max. operating pressure 3 bar, customer specific design on request
Pairs of poles	4
Magnetic material	Neodymium iron boron (NdFeB)
Electrical connection	Terminal box with cable approx. 1 m, wire cross-section depending on motor current
Plug	Obtainable on request
Electric strength	According to standard DIN EN 60034
Thermal class	155 (F)
System protection	IP54, alternatives obtainable on request
Permissible ambient temperature	-10 °C ... +40 °C
Motor feedback/variants of pick-up	Resolver two-pin, digital Hall probe, analogue Hall probe with sin/cos-output further types of motor feedback optional
Temperature sensor	KTY84-130, optional PTC
Painting	On request Standard finish: cast aluminium
Shaft	Shaft with key groove, quill shaft optional
Types	PMS Type F: one stator, one rotor with closed magnetic circuit PMS double-sided: two stators, one rotor self-contained with doubled magnets

Permissible Forces

PERM TECHNOLOGY

for 20,000 hours lifespan

Radial force F_R [N] at n rpm					
Speed	**0**	**1500**	**3000**	**4500**	**6000**
Type					
PMS 060	710	625	540	460	375
PMS 080	925	815	700	600	490
PMS 100	1975	1745	1510	1280	1050
PMS 120	1975	1745	1510	1280	1050
PMS 150	3025	2670	2315	1965	1610

Axial force F_R [N] at n rpm					
Speed	**0**	**1500**	**3000**	**4500**	**6000**
Type					
PMS 060	140	125	105	90	75
PMS 080	185	160	140	120	95
PMS 100	395	345	300	255	210
PMS 120	395	345	300	255	210
PMS 150	605	530	460	390	320

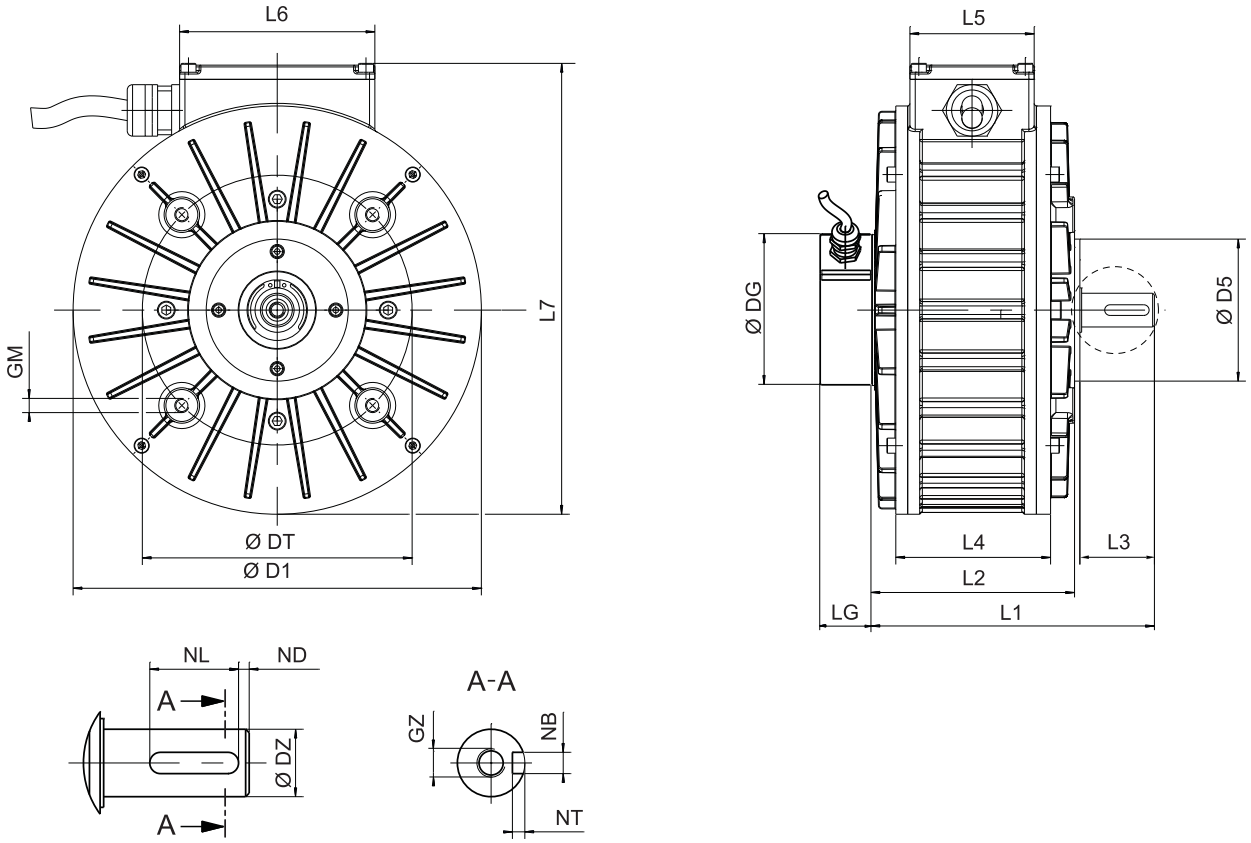
All given characteristics of the motors are calculated data which may differ slightly, subject to alterations.

Alternative voltage, speed, torque or power for customised applications obtainable on request.

Additional mounting of gearbox or brake obtainable on request.

Furthermore it is possible to integrate components of the PMS motor series into an engine as kit.

Double-sided Model



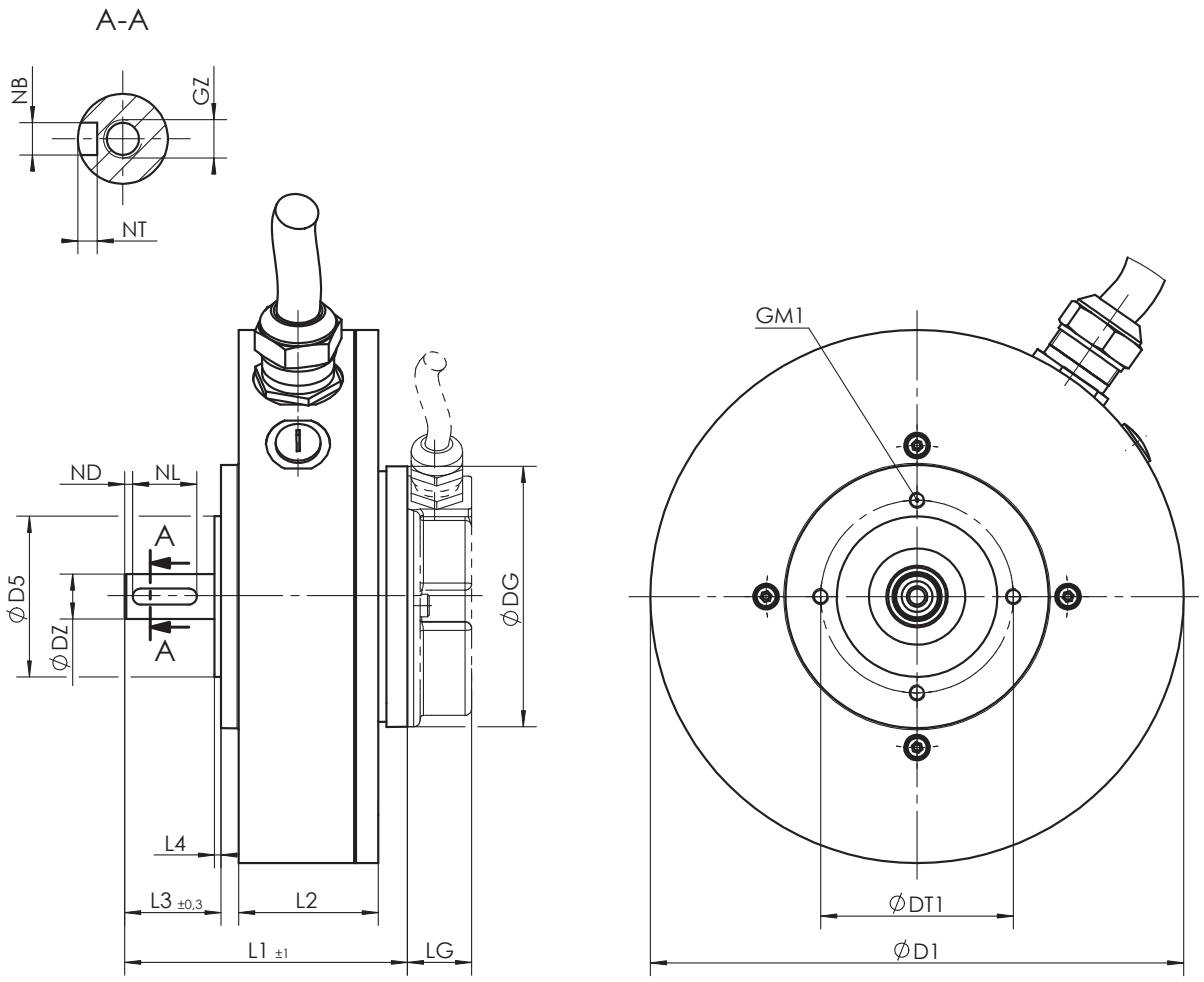
Motor type	Ø D1	Ø DT	Ø D5	L1	L2	L3	L4	L5	L6	L7	GM
PMS 080	155	60	50	112	78	31	54	40	85	173,5	M6×12
PMS 100	188	73	52	146,5	102	41,5	77	62	112	211	M8×12
PMS 120	230	152	80	160	113	42	87	70	110	254	M8×12
PMS 150	274	155	65	186	142	42	106	78	126	301	M8×16

Motor type	Ø DZ	NL	NB	NT	ND	GZ
PMS 080	14	20	5	3	2,5	M6×20, DIN332-D
PMS 100	19	25	6	3,5	2,5	M8×20, DIN332-D
PMS 120	19	25	6	3,5	3	M8×20, DIN332-D
PMS 150	24	30	8	4	5	M8×25, DIN332-D

For any type	Ø DG	LG
Pick-up with cable glands (RLS)	81	20
Pick-up with connector and/or resolver	93	33
Types with Hall probe	0	0

Dimensions in mm

Model F



Motortyp	Ø D1	Ø DT1	Ø D5	L1	L2	L3	GM1
PMS 060F	120	60	50	75,1±1	38	25,6	M5×8
PMS 080F	166	60	50	88 ±1	43.5	30	M5×8
PMS 100F	200	73	52	119,5 ±1	55	44,5	M8×10
PMS 120F	250	152	80	137,5 ±1	74.5	45	M8×10
PMS 150F	290	152	65	153 ±1	85	45	M8×16

Motortyp	Ø DZ	NL	NB	NT	ND	GZ
PMS 060F	12	12	4	2,5	2	-
PMS 080F	14	20	5	3	2,5	M6×20
PMS 100F	19	25	6	3,5	2,5	M6×20
PMS 120F	19	25	6	3,5	3	M8×20
PMS 150F	24	30	8	4	5	M8×20

For any type	Ø DG	LG
Pick-up with cable glands (RLS)	81	20
Pick-up with connector and/or resolver	93	33
Types with Hall probe	0	0

Dimensions in mm

Electrical Connections

Motor connection

Where possible the motors are equipped as standard with highly flexible, two-norm servo cables (UL/CSA and VDE-REG. no.) suitable for drag chains. These cables combine supply cores and pilot cores for thermal protection KTY 84-130.
The cables are equipped with an additional overall screen for increased interference immunity (EMC).
Motors with bigger wire cross-section are equipped with single strands.

Technical data/design

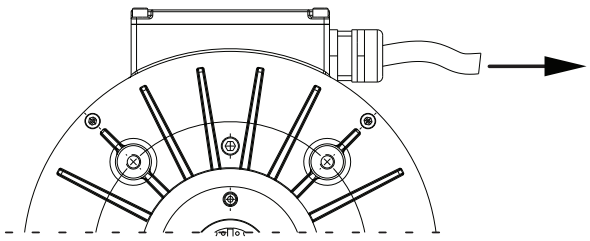
Special PUR drag chain cable in accordance with UL AWM Style. Overall screen from galvanised copper braid with approx. 85 % cover

Pilot cores	Imprint BR1, BR2 Thermal protection
Outer sheath	PUR, extremely abrasion-resistant, low-adhesion, halogen-free, resistant to UV, oil, hydrolysis and microbes Sheath colour: orange (RAL 2003) in accordance with DESINA (grey available on request, but without UL approval)
Lowest permissible bend radius	at least 7.5 × cable diameter
Temperature range	Flexing: -30 °C to +80 °C Fixed installation: -40 °C to +80 °C
Rated voltage in accordance with VDE	Power cores: Uo/U 600/1000 V Pilot cores: Uo/U 300/500 V

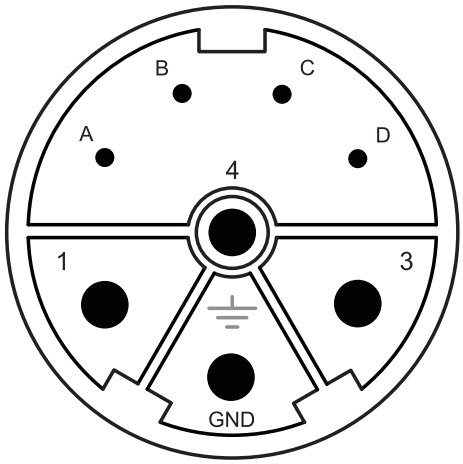
Core measurement motor connection & KTY cable

Number of cores × cross section mm²	Rated current A	Outer diameter mm
4×1,5 / (2×1)	up to 18	11.5
4×2,5 / (2×1)	up to 26	13.6
4×4 / (2×1)	up to 34	15
4×6 / (2×1)	up to 44	16.1
4×10 / (2×1)	up to 61	20.2
4×16 / (2×1)	up to 82	23.8

Electrical Connections



Open end		
Core colour	**No.**	**Function**
black	1	Phase U
black or blue	2	Phase V
black or red	3	Phase W
green-yellow	-	PE
brown	-	Temperature sensor (optional)
blue	-	

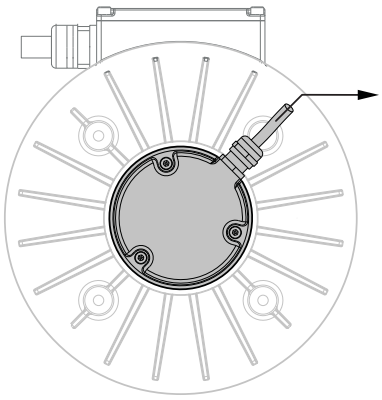


View of pin insert from the connector side

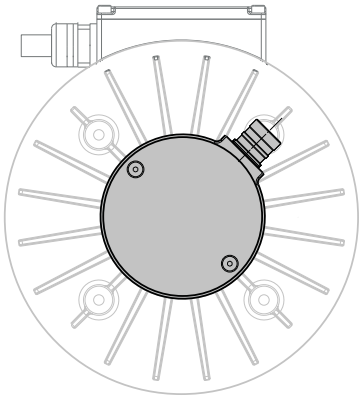
Power connector M23 Pin insert, motor	
Pin	**Function**
1	Phase U
4	Phase V
3	Phase W
GND / 2	PE
A	n.c.
B	n.c.
C	Temperature sensor PTC / KTY 84 (optional)
D	

Electrical Connections

Transmitter connection



Transmitter with cable gland



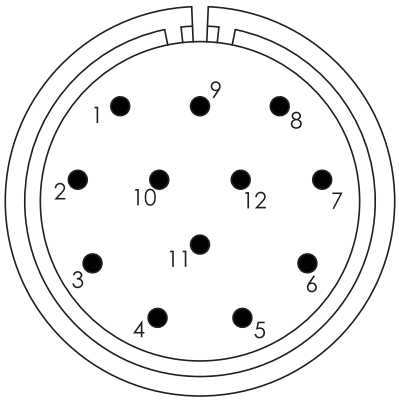
Transmitter with connector

Technical Data/Structure

Overall screen from galvanised copper braid

Cores	braided in pairs Core colour in accordance with DIN 47100
Outer sheath	PVC
Lowest permissible bend radius	at least 6 × Cable diameter
Temperature range	Flexing: -5 °C to +70 °C Fixed installation: -40 °C to +80 °C
Rated voltage in accordance with VDE	500 V
Effective capacitance	core/core: approx. 120 nF/km core/sheath: approx. 160 nF/km

Electrical Connections



Coninvers-M23 pin, RC Series, 12-pole, view on pin insert from connector side

Resolver-Connector: Coninvers - M 23 - Series RC - 12 pol., Type: Pin insert, motor, reverse rotation, coding centre			
	KEB F5-Multi	LENZE	LTI Servo One
Pin	Function	Function	Function
1	SIN -	REF +	COS + (S1)
2	COS -	REF –	COS – (S3)
3	n.c.	n.c.	SIN + (S2)
4	n.c.	COS +	SIN – (S4)
5	REF -	COS –	n.c.
6	n.c.	SIN +	REF + (R1)
7	REF +	SIN –	REF – (R2)
8	n.c.	n.c.	n.c.
9	n.c.	n.c.	n.c.
10	SIN +	n.c.	n.c.
11	COS +	KTY +	KTY + / PTC
12	n.c.	KTY –	KTY – / PTC

Resolver: open cable ends			
Function	Core colour		
	LTI	KEB	Lenze
SIN +	yellow	green	green
SIN -	green	yellow	yellow
COS +	red	red	red
COS -	blue	blue	blue
REF +	pink	pink	pink
REF -	grey	grey	grey
KTY +	brown	–	brown
KTY -	white	–	white

Hall-Sensors: open cable ends		
	F version (single-sided)	Double-sided
Function	Core colour	Core colour
Hall 1	yellow	yellow
Hall 2	green	green
Hall 3	grey	grey
Vcc	brown	brown
GND	white	white
KTY-	blue	
KTY+	pink	pink

RLS sensors: open cable ends	
Function	Core colour
SIN	pink
COS	brown
Vcc	green
GND / KTY-	yellow
KTY+	white

SL Series

Disc Motors with Brushes

They are flat, dynamic and very adaptable: disc motors from HEINZMANN. As they differ from other electric motors in their flat shape, they are an optimal solution when a drive motor of up to 1.1 kW is needed, which is easy to control accurately, for installation in a narrow space.

By now, disc motors have conquered large sectors of machine and apparatus production, such as medical equipment. They are used to carry out the most varied drive functions reliably and with quiet synchronous operation.

Through continuous further development of the materials used, the maintenance intervals of wearing parts, such as carbon brushes and collectors, are considerably lengthened. For this reason, the life expectancy of HEINZMANN brushed motors is increased appreciably.

That is why disc motors are a drive solution that, apart from the significant advantages mentioned, also has a very convincing price-performance ratio.

SL 80-F

SL 100-F / SL 100-1NFB / SL 100-2NFB

SL 120-F / SL 120-1NFB / SL 120-2NFB

SL 140-2NFB

SL 160-2NFB

SL 180-2NFB

Advantages of SL Motors

- Flat
- Dynamic
- Versatile
- Robust

Flat

HEINZMANN disc motors are built flat. It is this extremely flat (pancake) design that offers excellent mounting options for which other motors are not suited. The permanent magnets being arranged in a circle around the shaft generate an axial field through the disc rotor and at the same time a large air gap area which in turn is proportional to the available torque.

This yields a powerful motor for extremely narrow mounting spaces.

Dynamic

Due to the non-ferrous thin disc armature the HEINZMANN disc motor has a very low inertial torque. Since the windings are manufactured as air coils they have a very small electrical time constant due to their small inductance and their low internal resistance. Besides, the non-ferrous disc motors are entirely free of cogging torques.

Thus, dynamic drives are created that are well suited for easy and simple control.

Versatile

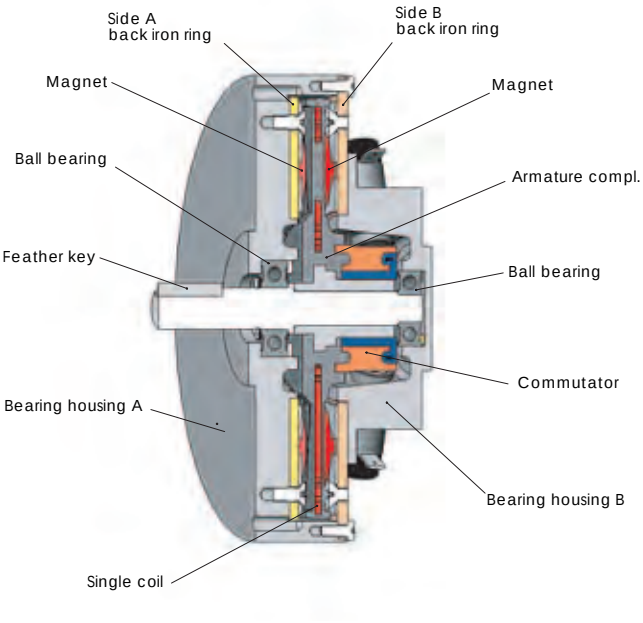
HEINZMANN disc motors are available in many other versions besides the ones presented here. These versions represent a selection of possibilities to facilitate your first choice. Customer specific solutions are our strong points.

Strong teams specialised on sales, design and motor development will take care of your requirements and interests. We are convinced that by cooperation we will find the optimum solution for your drive.

Robust

Originally, HEINZMANN had developed and optimised its disc motors for application in its own products. The aforesaid properties have been optimally implemented in proprietary mechatronical systems.

In long-time tests we develop robust motors which work under most demanding environmental conditions.



Cross section of a disc motor SL 120-2NFB

Applications for SL Motors

Disc armature motors with brushes have been used for several decades now in rough environments in HEINZMANN positioning devices for medium and large combustion engines.

In other industrial applications, too they are deployed wherever reliable operation at the supply voltage itself is required, without any need for a controller. With an optional controller however, torque and speed can then also be regulated.

Examples:

- ***Industrial and individual transport systems with greater range like electric vehicles, guided warehouse vehicles or disabled person assistance systems***
- ***Positioning and delivery systems or handling units***
- ***Machine tools, winding devices***
- ***Pumps***
- ***Replacement for hydraulic systems in agricultural vehicles and machinery***
- ***Medical engineering, e.g. centrifuges, hose and metering pumps***

Well pump

Examples for Application

Agricultural machinery

HEINZMANN actuators

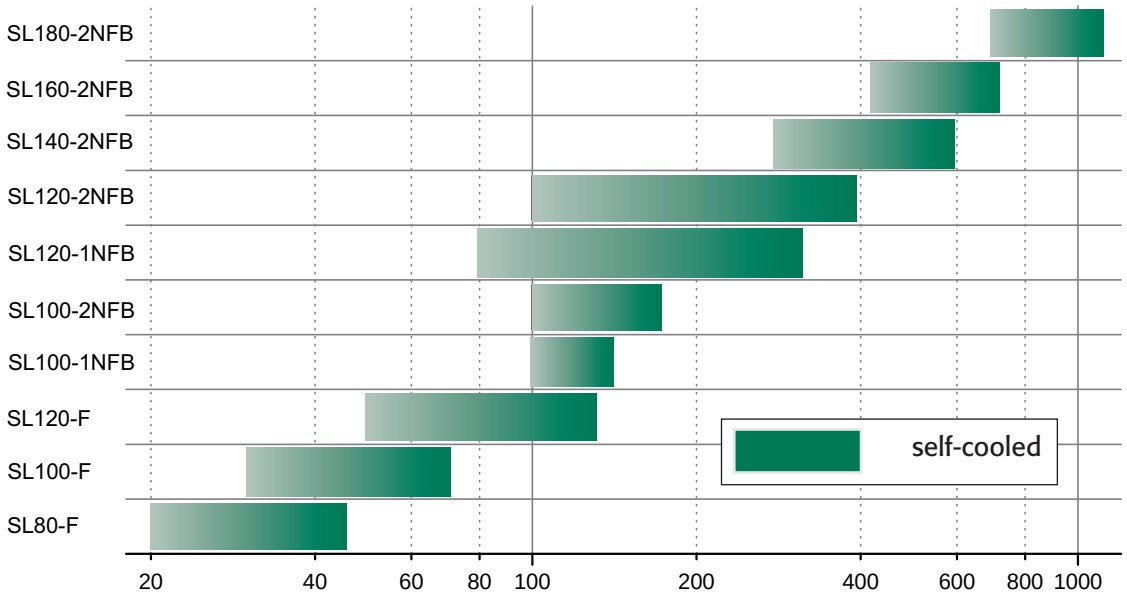
Sewer vehicles

Stair climbers

Electric bicycles

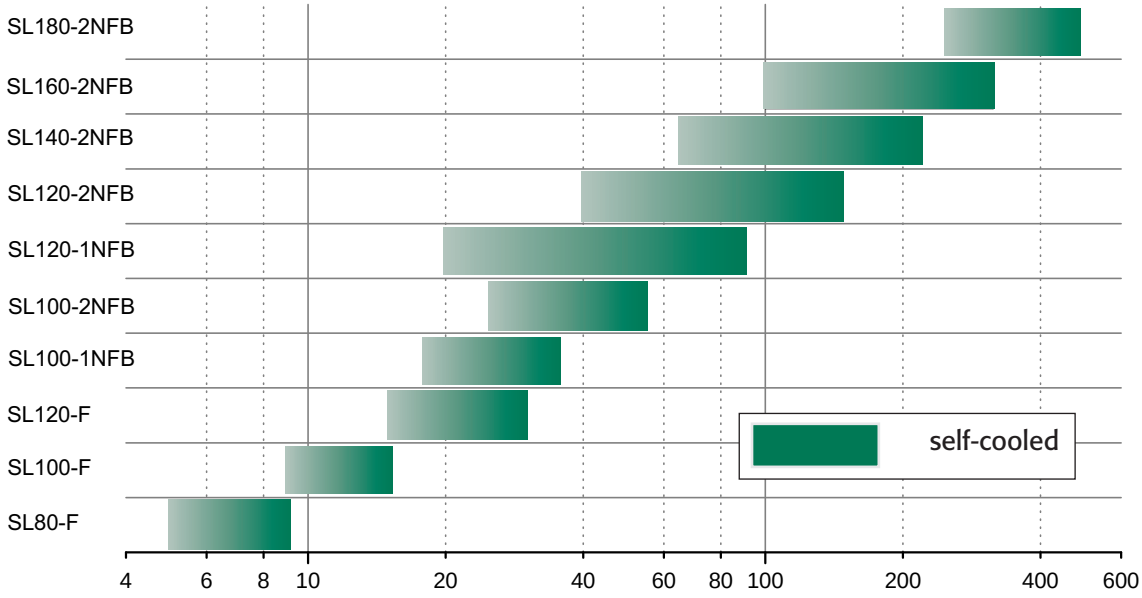
Overviews

Power range SL Motors



Continuous power / W

Torque range SL Motors

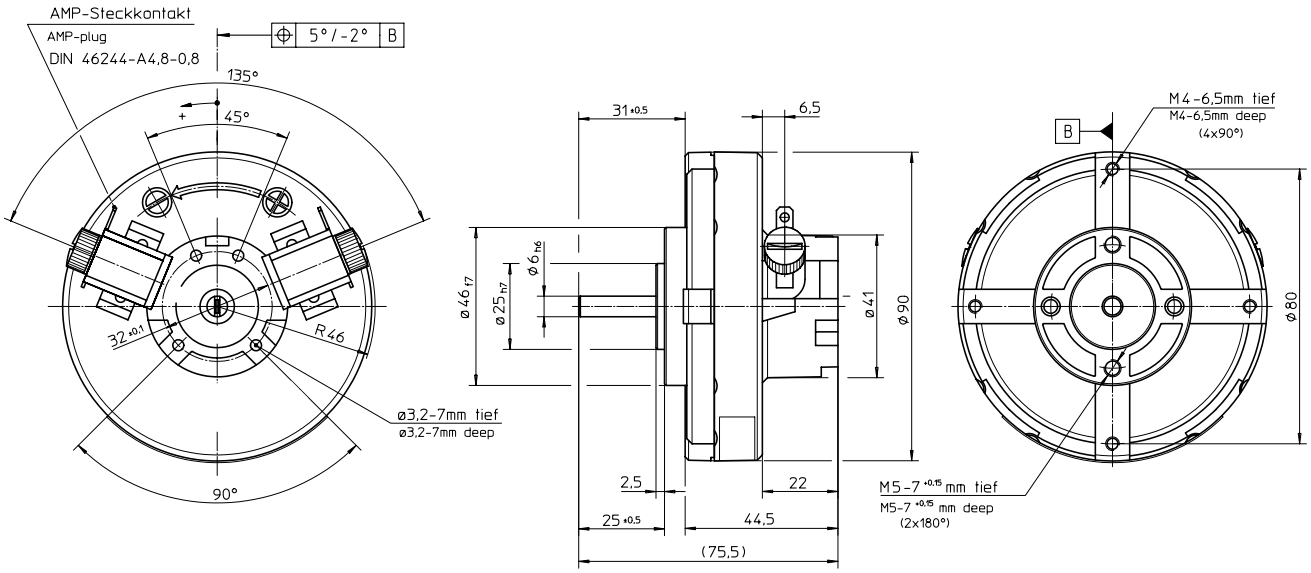


Nominal torque / Ncm

SL 80F Series

Weight: 0.9 kg
Inertia: 0.9 kg · cm²

	Voltage	Output power	Speed	Torque	Current	Back-EMF constant (25 °C)	Torque-constant (25 °C)
Coil	U [V]	P [W]	n [min⁻¹]	M [Ncm]	I [A]	K_E [V/1000min⁻¹]	K_T [Ncm/A]
11/53	12	22	3500	6	2.9	2.9	2.7
	18	38	6000	6	3.0		
	20	43	6800	6	3.1		
17/40	18	26	2900	8.5	2.6	4.4	4.2
	20	29	3500	8	2.5		
	24	37	4700	7.5	2.3		
22/31.5	24	22	3000	7	1.7	5.7	5.5
	30	31	4200	7	1.7		
	33	33	4900	6.5	1.6		

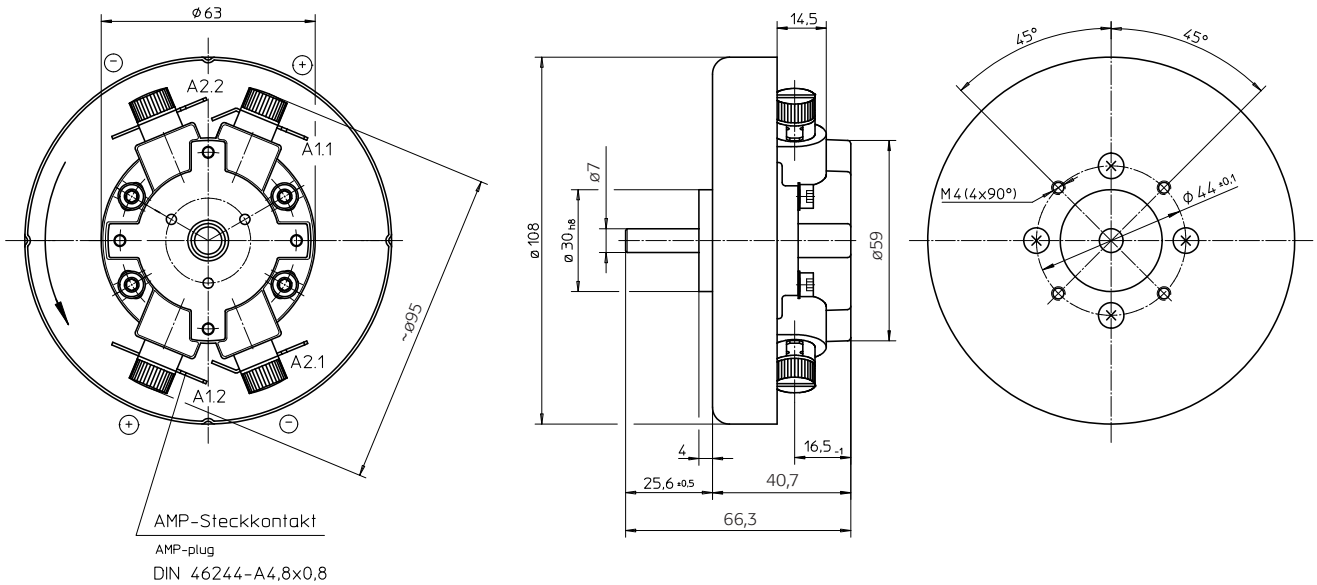


Rating

SL 100F Series

Weight: 0.9 kg
Inertia: 1.2 kg · cm²

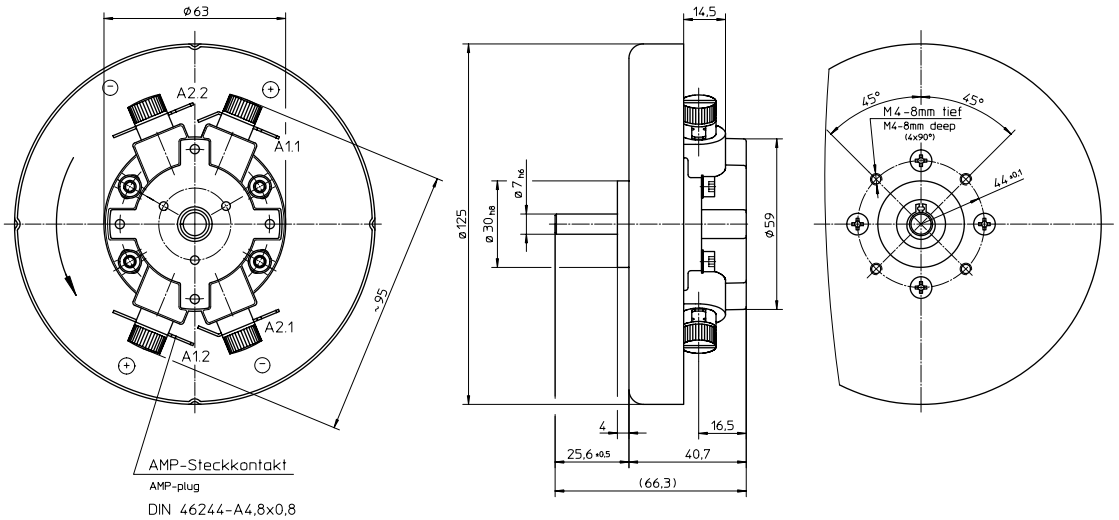
Coil	Voltage	Output power	Speed	Torque	Current	Back-EMF constant (25 °C)	Torque-constant (25 °C)
	U [V]	P [W]	n [min⁻¹]	M [Ncm]	I [A]	K_E [V/1000min⁻¹]	K_T [Ncm/A]
6/63	12	59	4700	12	7.8	2.1	2.0
	15	68	6500	10	6.8		
10/50	18	50	4000	12	4.6	3.5	3.4
	24	70	6100	11	4.4		
14/45	24	57	3900	14	3.8	5.0	4.7
	27	64	4700	13	3.6		
18/40	24	37	2500	14	2.9	6.4	6.1
	30	52	3800	13	2.8		
	36	67	4900	13	2.8		
21/37.5	24	30	1900	15	2.7	7.4	7.1
	36	57	3900	14	2.6		
	42	68	5000	13	2.4		
26/31.5	36	44	2800	15	2.2	9.2	8.8
	42	54	3700	14	2.0		
	48	65	4400	14	2.1		



SL 120-F Series

Weight: 1.2 kg
Inertia: 2.5 kg · cm²

	Voltage	Output power	Speed	Torque	Current	Back-EMF constant (25 °C)	Torque-constant (25 °C)
Coil	U [V]	P [W]	n [min⁻¹]	M [Ncm]	I [A]	K_E [V/1000min⁻¹]	K_T [Ncm/A]
8/63	12	44	1600	26	7.8	4.4	4.2
	15	63	2500	24	7.3		
	24	110	5000	20	6.5		
10/56	18	63	2400	25	6.1	5.5	5.3
	24	89	3700	23	5.8		
	36	110	6600	16	4.4		
12/53	24	79	2900	26	5.3	6.6	6.3
	36	110	5200	21	4.5		
	42	120	6400	18	4.1		
14/50	24	70	2300	29	5.0	7.7	7.4
	36	110	4300	25	4.6		
	48	125	6300	19	3.6		
16/45	24	53	1800	28	4.2	8.8	8.4
	36	95	3500	26	4.0		
	48	120	5200	22	3.5		
	60	120	7100	16	2.8		
22/40	36	64	2100	29	3.2	12.0	11.5
	48	96	3400	27	3.0		
	60	120	4700	24	2.8		
	72	130	5900	21	2.5		

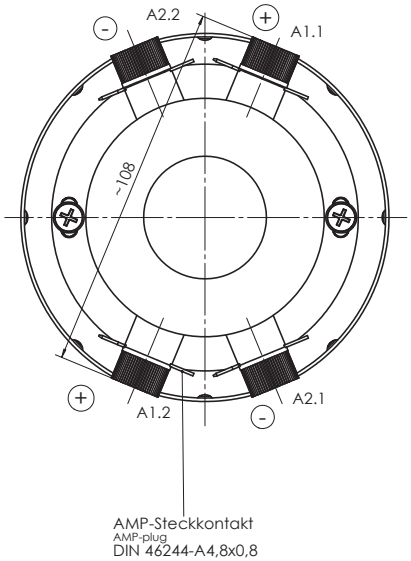


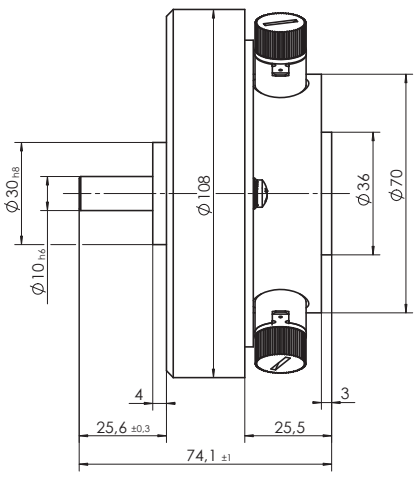
Rating

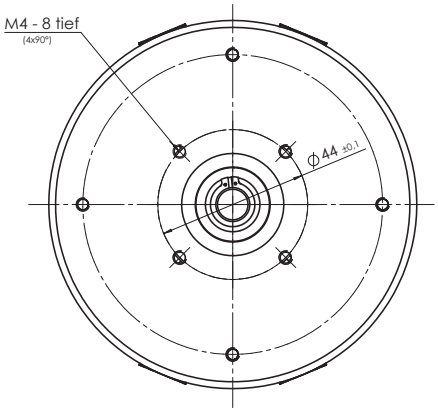
SL 100-1NFB Series

Weight: 0.9 kg
Inertia: 1.6 kg · cm²

	Voltage	Output power	Speed	Torque	Current	Back-EMF constant (25 °C)	Torque-constant (25 °C)
Coil	U [V]	P [W]	n [min⁻¹]	M [Ncm]	I [A]	K_E [V/1000min⁻¹]	K_T [Ncm/A]
4/90	12	100	4000	24	13	2.6	2.5
	15	100	5400	18	10		
5/85	12	100	3000	32	13	3.2	3.1
	18	120	5200	22	10		
7/71	18	110	3200	33	9.6	4.5	4.3
	24	120	4900	24	7.6		
	27	110	5700	18	6.2		
10/60	24	120	3100	36	7.2	6.4	6.1
	30	140	4200	31	6.5		
	36	130	5300	24	5.3		



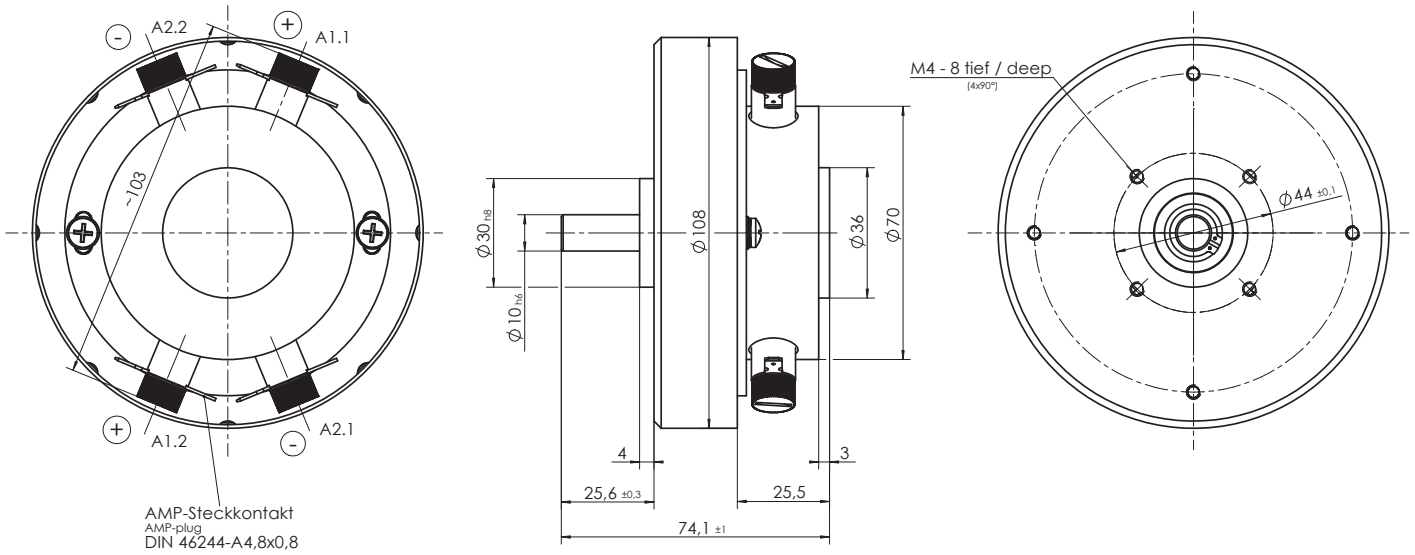




SL 100-2NFB Series

Weight: 1.0 kg
Inertia: 1.6 kg · cm²

	Voltage	Output power	Speed	Torque	Current	Back-EMF constant (25 °C)	Torque-constant (25 °C)
Coil	U [V]	P [W]	n [min⁻¹]	M [Ncm]	I [A]	K_E [V/1000min⁻¹]	K_T [Ncm/A]
4/90	12	110	2800	36	13	3.6	3.5
	15	140	3700	35	13		
5/85	18	160	3600	42	12	4.5	4.3
	24	130	5200	24	8.0		
7/71	18	120	2300	51	10	6.3	6.1
	24	160	3400	44	8.9		
	27	160	3900	40	8.3		
10/60	24	120	2100	56	7.6	9.0	8.6
	36	170	3600	46	6.5		
	48	140	5300	26	4.2		

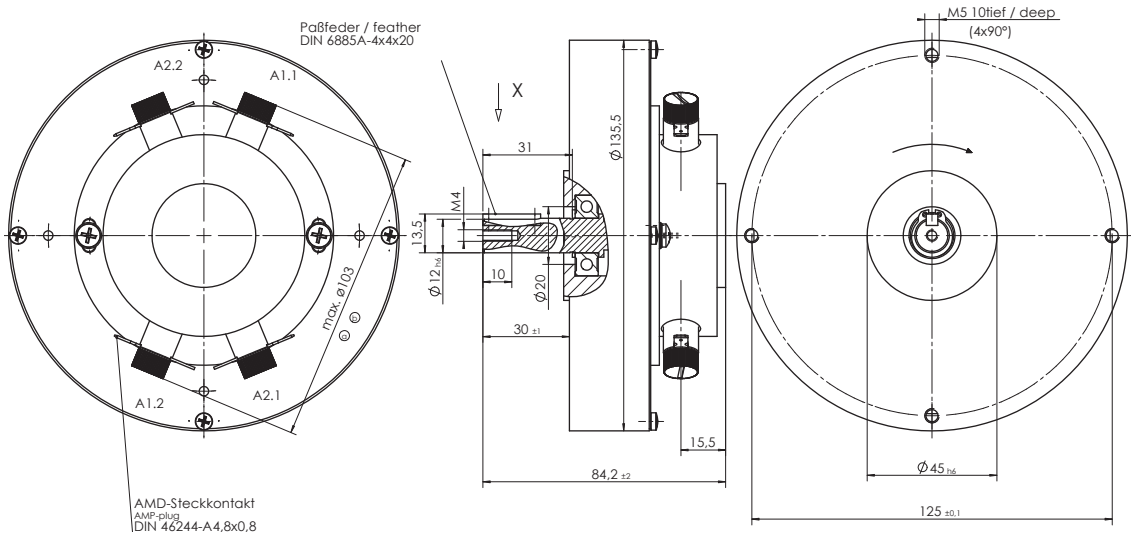


Rating

SL 120-1NFB Series

Weight: 1.8 kg
Inertia: 3.5 kg · cm²

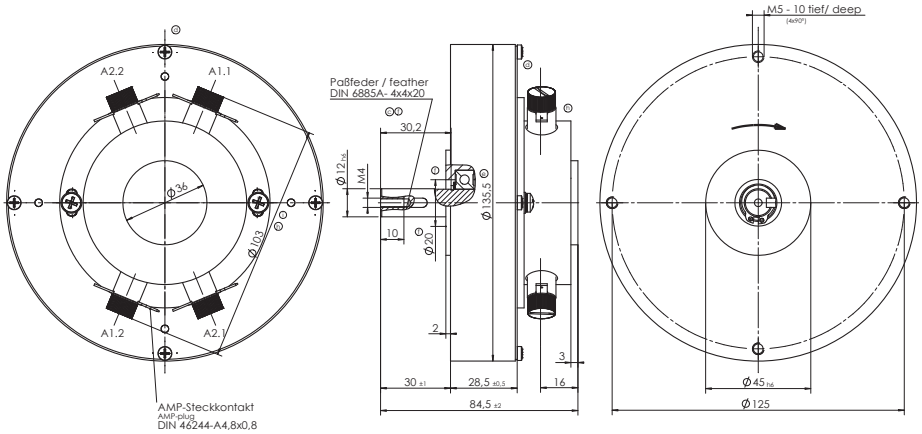
	Voltage	Output power	Speed	Torque	Current	Back-EMF constant (25 °C)	Torque-constant (25 °C)
Coil	U [V]	P [W]	n [min⁻¹]	M [Ncm]	I [A]	K_E [V/1000min⁻¹]	K_T [Ncm/A]
3/106	12	77	3700	20	9.9	3.0	2.9
	15	96	4800	19	10		
5/100	18	140	3400	38	10	5.0	4.7
	24	180	4700	37	10		
	27	200	5400	36	10		
7/90	24	200	3100	60	11	6.9	6.6
	36	270	5100	50	9.4		
10/75	24	160	1900	82	9.7	9.9	9.5
	36	260	3300	74	9.2		
	48	300	4700	60	7.7		
15/63	36	180	1900	90	7.2	15	14
	48	250	2800	84	6.8		
	72	310	4700	63	5.4		
17/56	36	140	1600	85	6.0	17	16
	48	200	2400	80	5.7		
	60	250	3200	75	5.4		
	72	280	4000	67	4.9		
22/47.5	48	140	1600	84	4.6	22	21
	60	190	2300	80	4.4		
	72	230	2900	76	4.2		
	80	250	3300	73	4.1		



SL 120-2NFB Series

Weight: 1.9 kg
Inertia: 3.5 kg · cm²

	Voltage	Output power	Speed	Torque	Current	Back-EMF constant (25 °C)	Torque-constant (25 °C)
Coil	U [V]	P [W]	n [min⁻¹]	M [Ncm]	I [A]	K_E [V/1000min⁻¹]	K_T [Ncm/A]
3/106	12	100	2300	41	11	4.8	4.6
	18	150	3600	40	12		
5/100	24	210	2900	70	11	8.1	7.7
	30	270	3700	70	11		
	36	240	4500	50	8.7		
7/90	24	180	1900	90	9.7	11	10
	36	280	3100	85	9.7		
	48	290	4300	65	7.7		
10/75	36	270	2000	130	9.6	16	15
	48	340	2800	115	8.7		
	60	350	3700	90	7.1		
	72	290	4600	60	5.1		
15/63	48	260	1700	145	7.1	24	23
	60	320	2300	135	6.7		
	72	360	2900	120	6.0		
	80	380	3200	114	5.8		
17/56	48	200	1400	138	5.9	27	26
	60	270	2000	130	5.6		
	72	310	2400	122	5.4		
	80	340	2800	116	5.2		
22/47.5	48	150	1000	140	4.6	35	34
	60	200	1400	135	4.5		
	72	250	1800	133	4.5		
	80	260	2000	126	4.3		

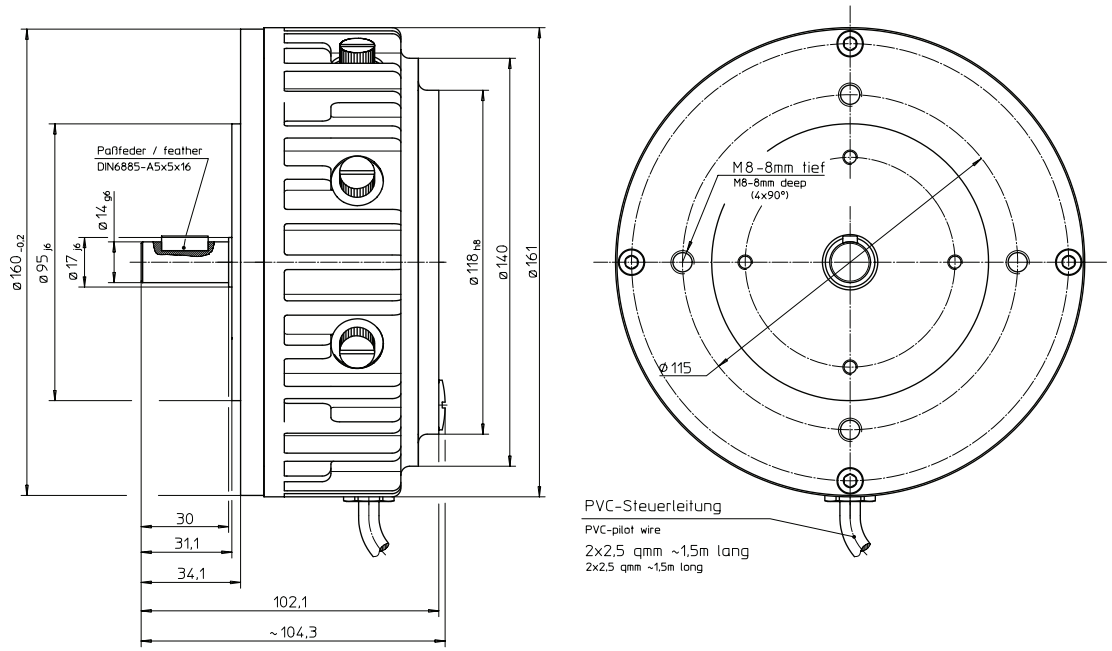


Rating

SL 140-2NFB Series

Weight: 4.9 kg
Inertia: 4.9 kg · cm²

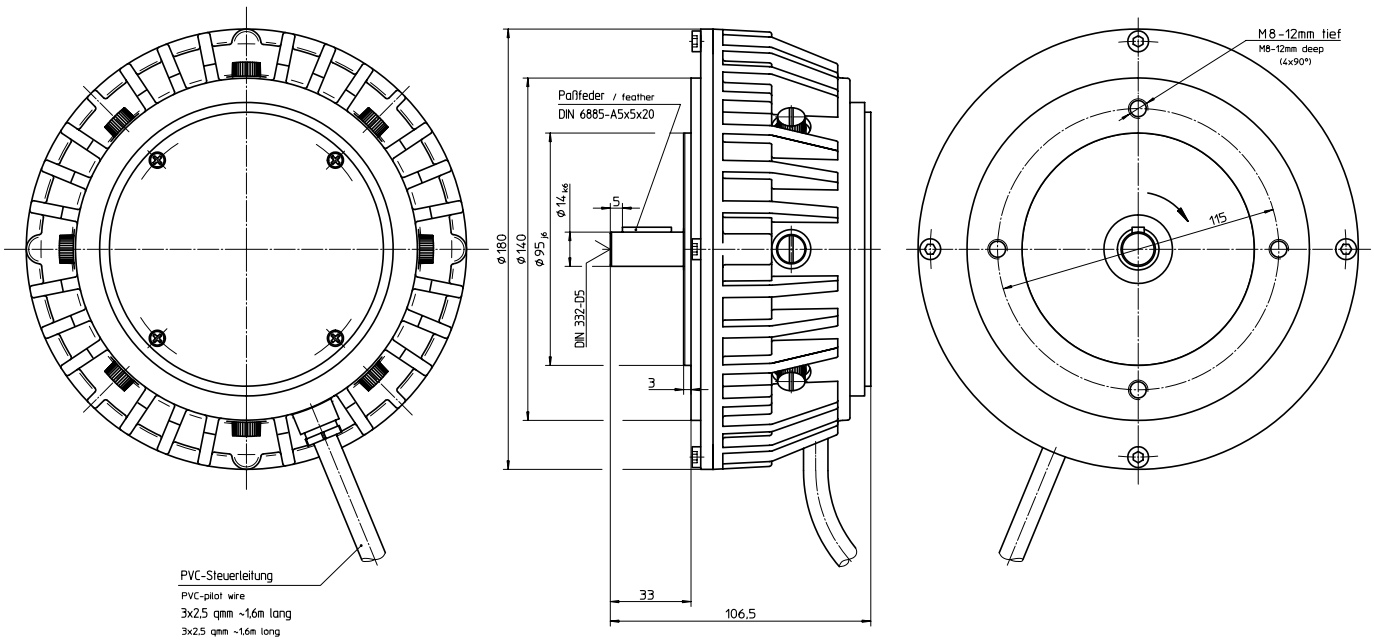
	Voltage	Output power	Speed	Torque	Current	Back-EMF constant (25 °C)	Torque-constant (25 °C)
Coil	U [V]	P [W]	n [min⁻¹]	M [Ncm]	I [A]	K_E [V/1000min⁻¹]	K_T [Ncm/A]
3/90	24	280	2000	135	16	11	10
	36	410	3300	120	14		
	48	310	4600	64	8.6		
6/71	48	410	2100	185	11	21	20
	60	480	2700	170	9.8		
	80	530	3800	132	7.9		
9/60	60	360	1700	200	7.6	32	31
	80	490	2400	196	7.4		
	96	570	3000	180	6.9		
	110	590	3500	160	6.2		
12/50	80	330	1700	185	5.3	42	40
	96	410	2100	185	5.3		
	110	480	2500	185	5.3		
15/47.5	96	370	1600	220	4.9	53	50
	110	430	1900	215	4.8		
	120	460	2100	210	4.8		



SL 160-2NFB Series

Weight: 5.5 kg
Inertia: 11.3 kg · cm²

	Voltage	Output power	Speed	Torque	Current	Back-EMF constant (25 °C)	Torque-constant (25 °C)
Coil	U [V]	P [W]	n [min⁻¹]	M [Ncm]	I [A]	K_E [V/1000min⁻¹]	K_T [Ncm/A]
3/90	36	440	2800	150	16	12	11
	48	420	4000	100	12		
6/80	48	510	1800	270	13	24	23
	60	600	2300	250	12		
	72	680	2900	225	11		
9/63	72	460	1800	245	8.1	36	35
	96	640	2500	245	8.2		
	120	710	3300	205	7.0		
12/60	96	570	1800	300	7.3	48	46
	110	630	2100	285	7.1		
	120	690	2400	275	6.8		
15/53	110	500	1600	300	5.8	61	58
	120	570	1800	300	5.9		
17/50	110	460	1400	315	5.4	69	66
	120	520	1600	310	5.3		

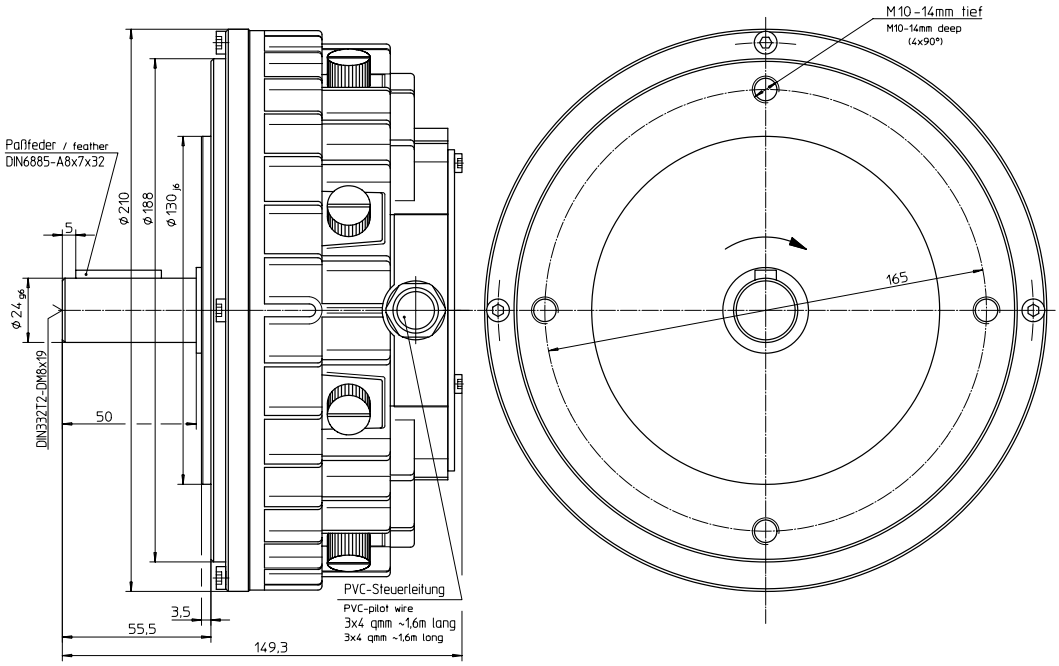


Rating

SL 180-2NFB Series

Weight: 10.2 kg
Inertia: 23.5 kg · cm²

	Voltage	Output power	Speed	Torque	Current	Back-EMF constant (25 °C)	Torque-constant (25 °C)
Coil	U [V]	P [W]	n [min⁻¹]	M [Ncm]	I [A]	K_E [V/1000min⁻¹]	K_T [Ncm/A]
3/90	60	770	2100	350	16	27	26
	80	910	2900	300	14		
6/63	125	830	2200	360	8.1	54	52
	150	930	2700	330	7.6		
	190	940	3600	250	5.9		
9/56	150	780	1700	440	6.5	81	77
	190	960	2300	400	5.9		
	220	1100	2700	375	5.7		
12/45	190	700	1600	415	4.6	110	100
	220	800	1900	400	4.5		
15/45	220	750	1500	480	4.2	130	120



Technical Data and Information

Motor type	Permanent magnet DC motor in disc armature technology
General regulations	Complying with IEC 60034
Operational mode	S1 (continuous)
Cooling	without cooling fan, without cooling circuit, mounting at adequate cooling surface is recommended
Permissible ambient temperature	-10 °C … +40 °C
Pairs of poles	4
Magnetic material	Ferrite (F) Neodymium iron boron (1NFB, 2NFB); 1,2 indicates size of magnets
Electrical connection	According to motor size and customer's request: flat connectors, terminal box, free cable
Electric strength	According to IEC 60034
Thermal class	155 (F)
System protection	IP44, alternatives obtainable on request
Fastening	On customer's request
Shaft	On customer's request, hollow shaft optional
Optional extensions	Gearbox, tachometer generator, encoder, holding break
Temperature sensor	On request
Kind of surface	Steel: zinc coating Aluminium: uncoated
Rating	All given characteristics of the motors are calculated data which may differ slightly, subject to alterations Without exception for the operating temperature status, based on: armature temperature ~ 125 °C solenoid temperature ~ 105 °C housing temperature ~ 85 °C Tolerances Back-EMF constant and torque constant: ±6 % of nominal value Speed: ±8 % of nominal value Efficiency: 1.15 % of nominal value - 15 % Alternative voltage, speed, torque or power for customised applications obtainable on request.

Permissible Forces

for 20,000 hours lifespan

Radial force F_R [N] at n rpm							
Speed	**C_o**	**0**	**1500**	**3000**	**4500**	**6000**	**7000**
Type							
SL80-F	0.95	238	210	182	154	127	108
SL100-F	1.37	343	303	263	223	183	156
SL120-F	1.37	343	303	263	223	183	156
SL100-1NFB	1.37	343	303	263	223	183	156
SL100-2NFB	1.96	490	433	376	319	261	223
SL120-1NFB	2.36	590	521	452	384	315	269
SL120-2NFB	2.36	590	521	452	384	315	269
SL140-2NFB	3.25	813	718	623	528	433	370
SL160-2NFB	3.25	813	718	623	528	433	370
SL180-2NFB	7.8	1950	1723	1495	1268	1040	888

Axial force F_R [N] at n rpm							
Speed		**0**	**1500**	**3000**	**4500**	**6000**	**7000**
Type							
SL80-F		48	42	36	31	25	22
SL100-F		69	61	53	45	37	31
SL120-F		69	61	53	45	37	31
SL100-1NFB		69	61	53	45	37	31
SL100-2NFB		98	87	75	64	52	45
SL120-1NFB		118	104	90	77	63	54
SL120-2NFB		118	104	90	77	63	54
SL140-2NFB		163	144	125	106	87	74
SL160-2NFB		163	144	125	106	87	74
SL180-2NFB		390	345	299	254	208	178

Selection Diagrams

Instructions for Use

The operational characteristics of the HEINZMANN disc armature motors are best illustrated through motor diagrams. They enable the ideal motor variant to be selected to suit a particular application case. The procedure for this is described below.

HEINZMANN offers a wide range of disc armature motor variants. Selection diagrams are therefore available in full scope on our product CD *Electric Drives* or on our homepage ***www.heinzmann.com***.

How to use the selection diagrams

Each selection diagram consists of 2 sub diagrams.

The upper diagram in each case shows the characteristics:

- Speed - Torque (blue wide)
- Current - Torque (red narrow)

The lower diagram in each case shows the characteristics:

- Output - Torque (green wide)
- Efficiency - Torque (orange narrow)

The characteristics are shown for several voltages.

For overview purposes the characteristics for the current and efficiency only show the lowest and the highest practical voltage (in this example 36 V and 72 V). Characteristic values for voltages in between (in this instance 48 V and 60 V) must be estimated.

The area highlighted in white on the diagram represents the safe operating range for the S1 operation of an uncooled motor mounted to a sufficiently-sized cooling area. The wide red line represents the limit for a power loss that is just on the borderline (in this example 75 W).

The section highlighted in light grey in the diagram represents the range for which additional cooling measures are required to operate motors. Without them this operating range must be avoided.

The diagrams are valid without exception for the operating temperature status, based on:

- armature temperature ~ 125 °C
- solenoid temperature ~ 105 °C
- ambient temperature 25 °C

Application example:

Given:	Voltage	U = 48 V
	Torque	M = 115 Ncm
Required:	Speed n	
	Current I	
	Output P	
	Efficiency η	

Readings in upper diagram:

- Starting from M = 115 Ncm vertical (1) go to the speed characteristic for U = 48 V. Intersecting point A is on the borderline, i.e. still in the permitted area.
- Go from A horizontally (2) to the left to the speed scale and then read off the relevant speed (here: ~2800 rpm).
- Continue from A vertically into the range between the two current characteristics (between 36 V and 72 V) and estimate point B.
- Go from B horizontally (3) to the right to the current scale and then read off the relevant amperage (here: ~8.7 A).

Readings in lower diagram:

- Starting from M = 115 Ncm vertical (4) go to the output characteristic for U = 48 V. Intersecting point C is also on the borderline, i.e. still in the permitted area.
- Go from C horizontally (5) to the left to the output scale and then read off the relevant output (here: approx. 340 W).
- Continue from C vertically into the range between the two efficiency characteristics and estimate point D.
- Go from D horizontally (6) to the right to the efficiency scale and then read off the relevant efficiency (here approx. 81%).

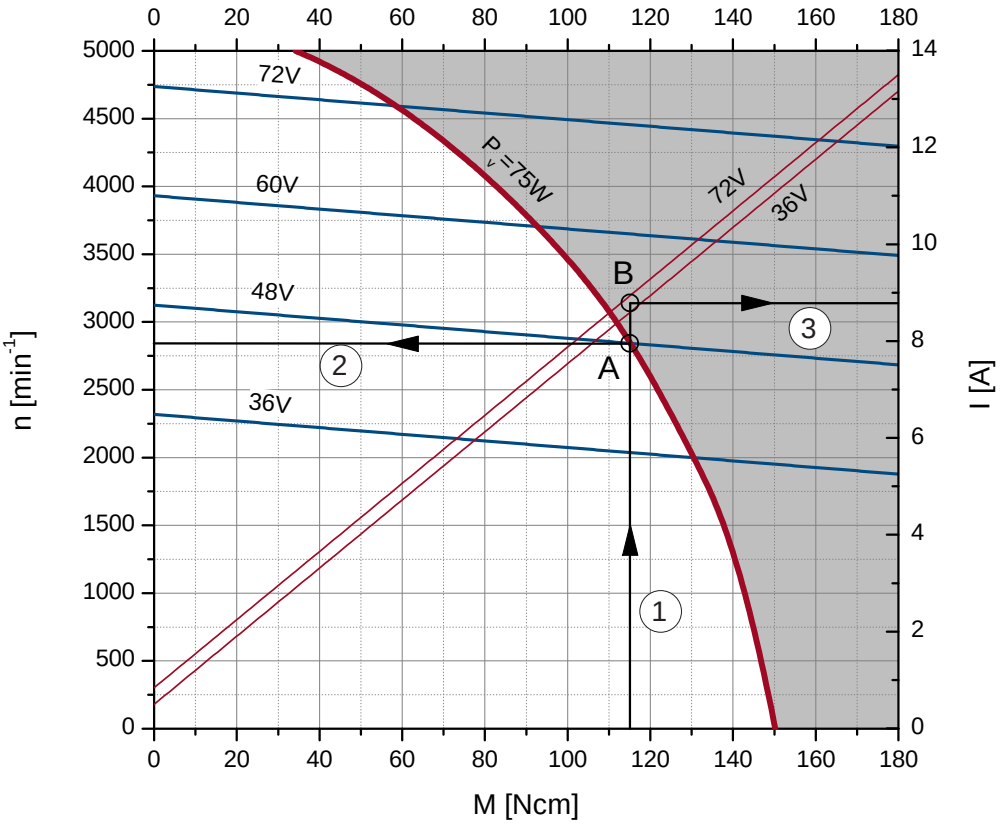
Unknown values can be determined for other given variables in the same manner.

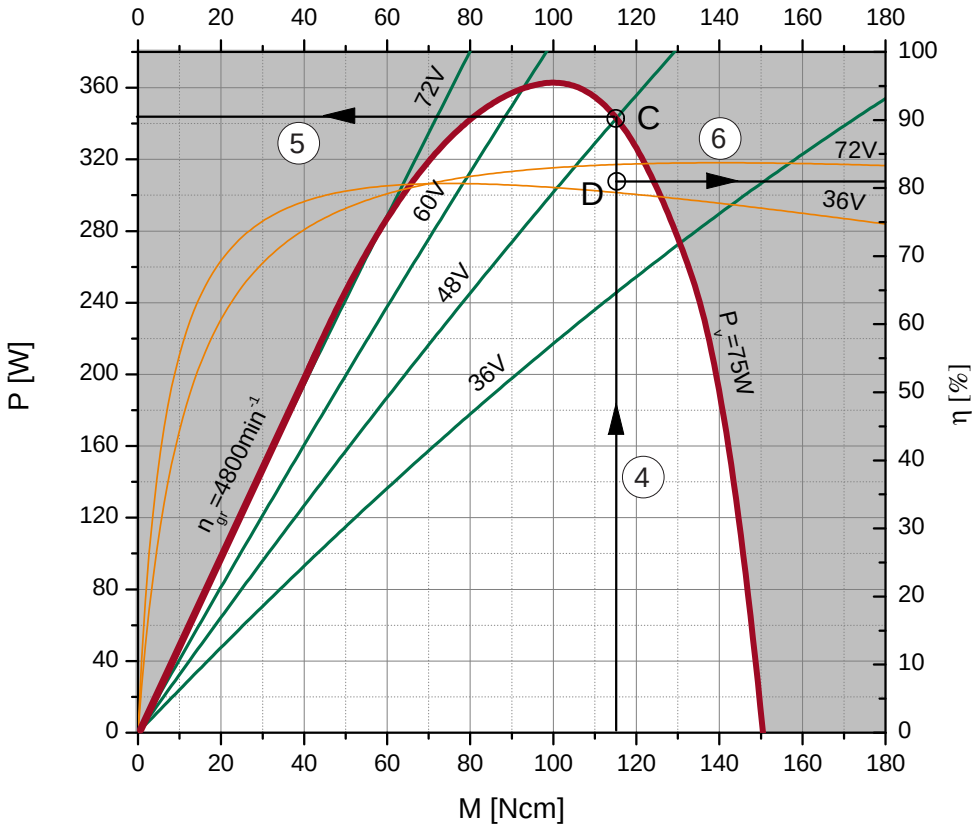
Additional example:

Required:	Speed n = 2000 rpm
	Torque M = 120 Ncm = 1.2 Nm
	(i.e. P = 0.104•M•n = 250 W)
Required:	The relevant required operating voltage
Result:	U ≈ 36 V

Selection Diagrams

Instructions for Use





HEINZMANN®
Energy requires Control

Notes

Notes

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PERM MOTOR
Member of the HEINZMANN Group

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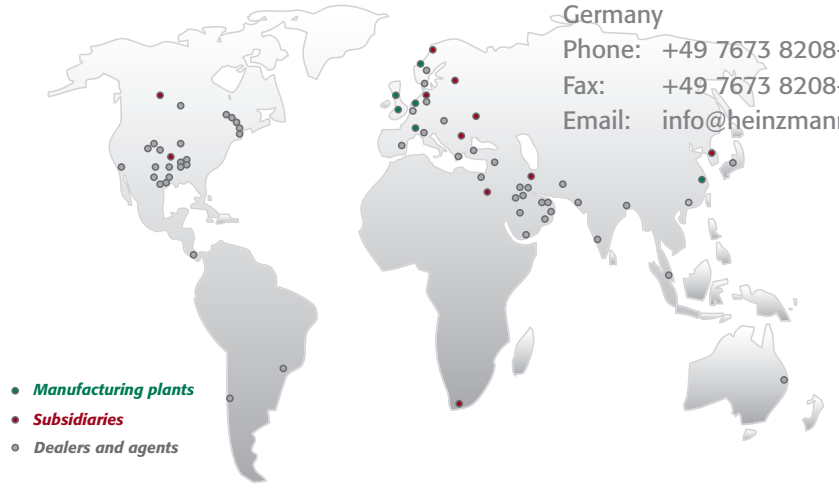

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