PRODRIVE TECHNOLOGIES MOTION & MECHATRONICS

LINEAR MOTOR CATALOGUE

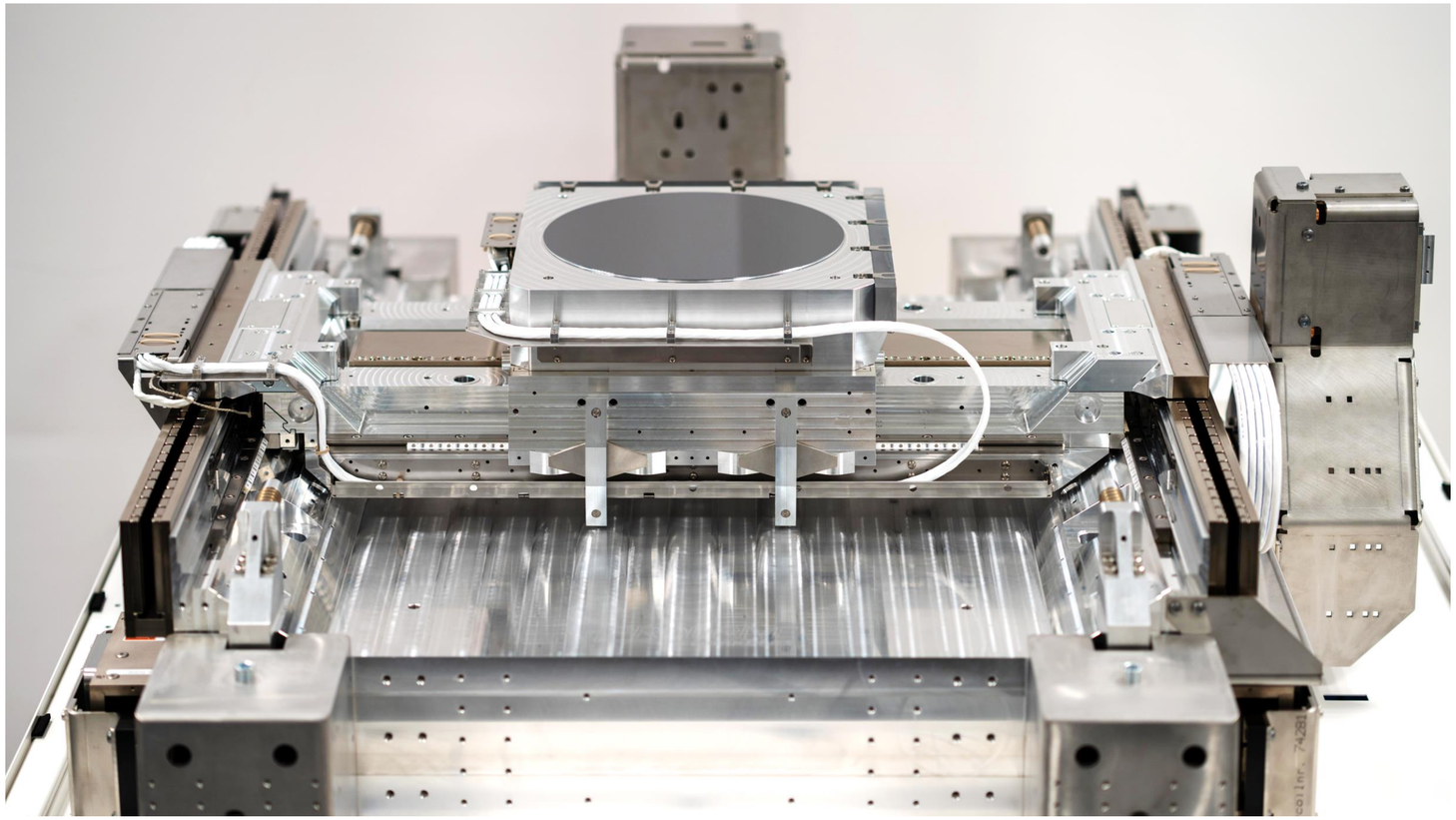
CHIRON

Iron Core Motors

January 2022

Linear motors
integrated in a custom mechatronic system

TABLE OF CONTENTS



Linear motors integrated in a motion stage

A PASSION FOR TECHNOLOGY

Knowledge

Engineering excellence is the driving force behind linear motor innovation in both design and manufacturing. Prodrive has a highly skilled group of (electro-)mechanical engineers capable of customizing linear motor technology towards your needs.

Quality

Quality is in the DNA of Prodrive Technologies. With a long history in electronics manufacturing, Prodrive continues in the area of linear motor manufacturing with the same philosophy and processes, setting a new standard within the linear motor market.

Automation

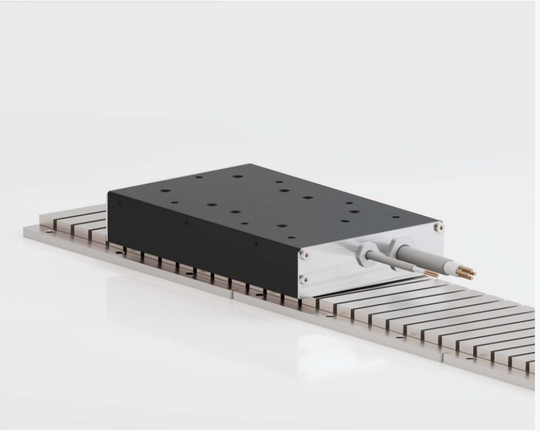
Design for manufacturing is key to reduce cost and guarantee quality. Winding, assembly, vacuum potting and magnet gluing are highly automated processes which guarantees a constant quality at minimum cost.

Time to market

Due to the agility of Prodrive Technologies' large development department, customization can be performed in a very short time, providing a short time to market for challenging mechatronic applications.

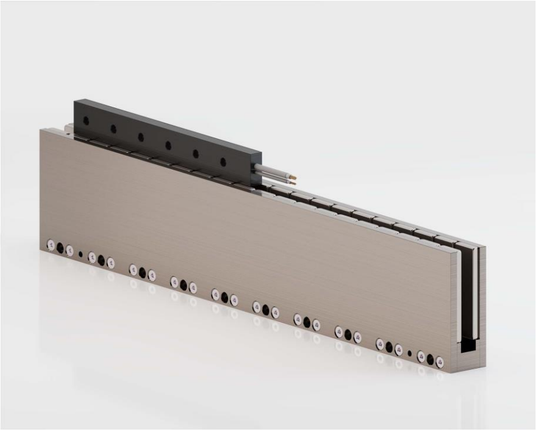
Prodrive Technologies HQ Campus, The Netherlands

OVERVIEW



Chiron

The Chiron line offers iron core linear motors which are optimized for high force and high efficiency. Find the optimal fit for your application due to the many different available form factors.

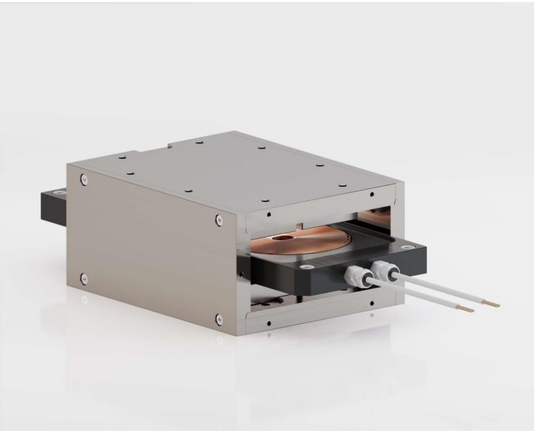


Phoenix

The Phoenix line offers ironless linear motors, for applications requiring an extremely low force ripple for excellent servo performance without attraction forces. Available in a large range of sizes.

Gryphon

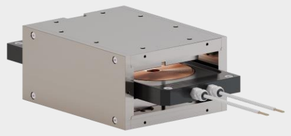
The Gryphon line offers a cost-effective solution for vacuum-compatible ironless linear motors. These motors also contain features providing magnetic shielding.



Iris

For short stroke applications requiring a relatively large displacement in three directions, the Iris line provides a high force density with zero attraction forces in a rectangular form factor.

OVERVIEW



Chiron-S-050
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06
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Chiron-S-080
03
06
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15
18
24
Chiron-S-100
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06
09
12
15
18
24
30
Chiron-S-130
03
06
09
12
15
18
24
30
Phoenix-S
03
06
09
12
Phoenix-M
03
06
09
12
15
Phoenix-L
03
06
09
12
15
18
Phoenix-X
03
06
09
12
15
18
Phoenix-U
03
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Gryphon-M
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Gryphon-L
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Iris-M
Iris-L
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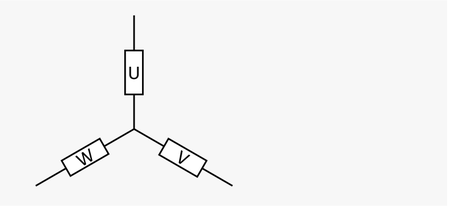
100
1000
10000
Motor constant [N2/W]

WINDING CONFIGURATIONS

The phases of all three-phase linear motors are star-connected.

The Chiron, Phoenix and Gryphon line can be selected with different winding configurations to create an optimal fit for your application.



Phase connection chart

Winding configuration A

The windings are configured such that independent of the number of coils, the force constant remains equal, and the maximum velocity remains unchanged. The maximum current increases with the number of coils.

Winding configuration B

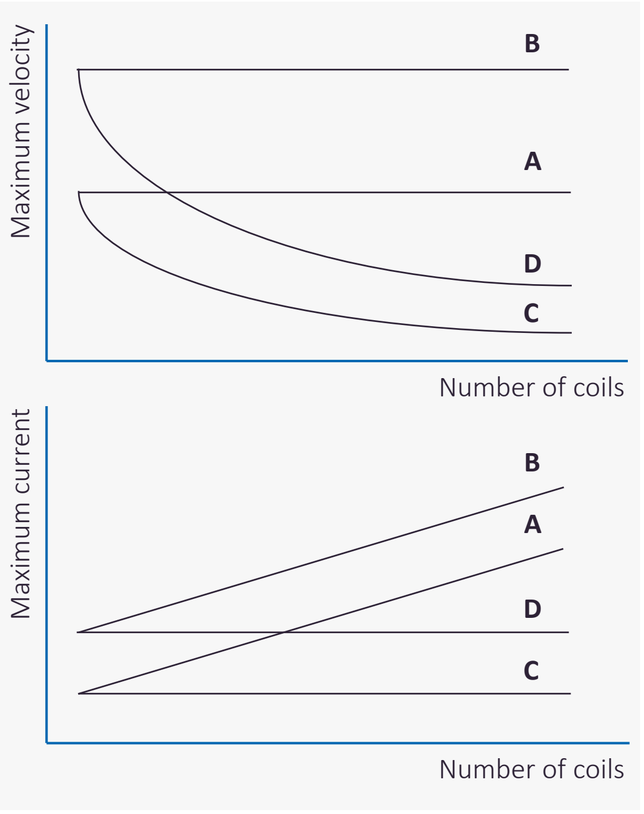
The windings are configured like winding configuration A, but this winding configuration can reach higher velocities at the expense of a lower force constant.

Winding configuration C

The windings are configured such that the current remains constant with increasing number of coils at the expense of reducing the maximum velocity. For the Chiron, Phoenix and Gryphon line, this configuration allows moving magnet applications with partial coil unit overlap.

Winding configuration D

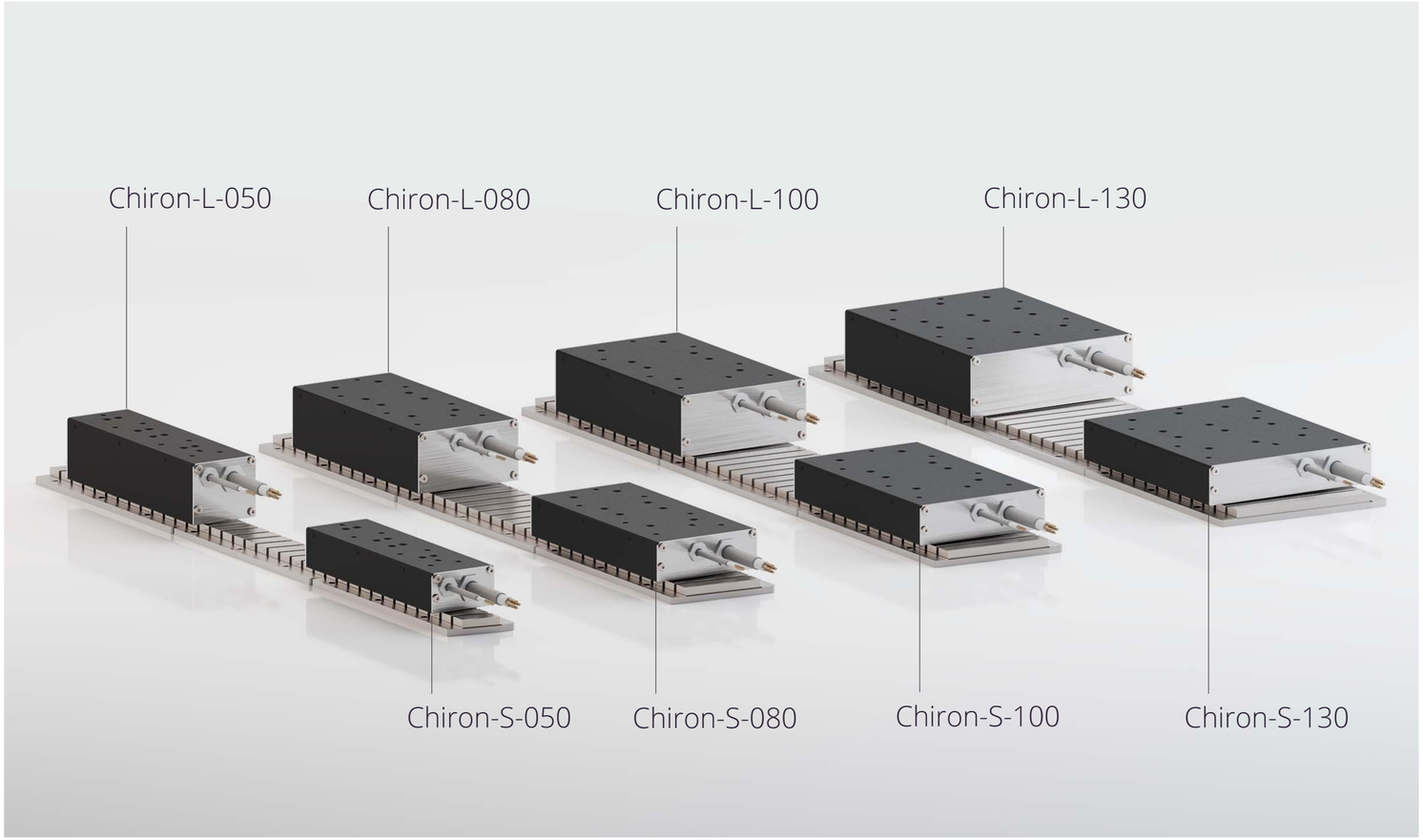
The windings are configured such that the current remains constant with increasing number of coils at the expense of reducing the maximum velocity. This configuration has a higher maximum velocity compared to winding configuration C. For the Phoenix line, this configuration allows moving magnet applications with partial coil unit overlap.



Winding configurations chart

CHIRON LINE

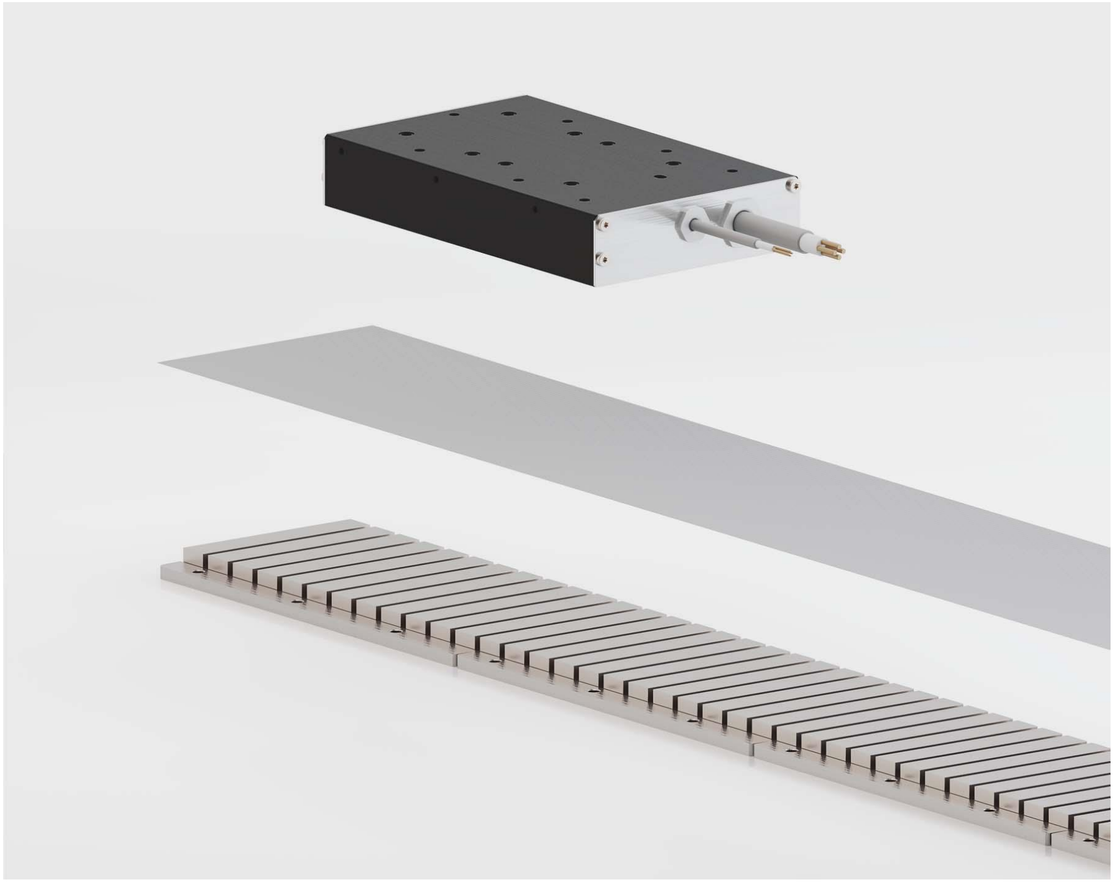
The Chiron line offers iron core linear motors which are optimized for high force and high efficiency. Find the optimal fit for your application due to the many different available form factors.



Chiron line linear motors in different sizes

* Performance and mechanical specifications of Chiron-L are available on request

CHIRON LINE - FEATURES



Chiron in exploded view

Chiron-CU-S-080-12-A-N

- Thermal interface (N = none / B = PTC+PT1000)
- Winding configuration (A / B / C / D)
- # of coils
- Depth (050 / 080 / 100 / 130)
- Height (S / L*)
- Coil unit

Chiron-MP-080-16

- # of poles
- Depth (050 / 080 / 100 / 130)
- Magnet plate

- Modularity in width, depth and height for optimal mechanical integration
- Multiple winding configurations for optimal current/velocity matching
- Coil units have an optional temperature protection (PTC) and sensor (PT1000)
- Magnet plates can be butted together
- Magnets are skewed to minimize force ripples and detent forces
- Optional stainless-steel cover plate for protection of the magnet plates

* Performance and mechanical specifications of Chiron-L are available on request

CHIRON-S-050 PERFORMANCE SPECIFICATIONS

	Parameter	Symbol	Unit	T_{coil} (°C)	CU-S-050-03	CU-S-050-06		CU-S-050-09		CU-S-050-12			CU-S-050-15	
	Winding configuration	-	-	-	C	B	C	B	C	A	B	C	B	C
Electromechanical	Peak force (a_T = 5°C/s increase)	F_p	N	20	100	205		305		410			510	
	Continuous force, interface at 20°C	F_c	N	100	65	130		190		255			320	
	Attraction force (I = 0)	F_{att}	N	-	350	600		850		1100			1350	
	Motor constant	S	N^2/W	20	85	170		255		340			420	
	Force constant ($I = I_c$)	$K_{f,c}$	N/A_{rms}	-	27	27	53	27	80	53	27	106	27	133
	Force constant ($I = I_p$)	$K_{f,p}$	N/A_{rms}	-	23	23	45	23	68	45	23	90	23	113
	Maximum velocity (F = 0)	v_m	m/s	-	31	31	16	31	10	16	31	7.8	31	6.2
	Maximum velocity ($F = F_p$)	v_i	m/s	20	18	18	8.8	18	5.7	8.8	18	4.1	18	3.2
Electrical	Maximum dc bus voltage	V_{dc}	V	-	690	690		690		690			690	
	Phase resistance	$R_{ph,20}$	Ohm	20	2.9	1.5	5.8	1.0	8.7	2.9	0.7	12	0.6	15
	Phase inductance	L_{ph}	mH	20	14	7.0	28	4.7	42	14	3.5	56	2.8	70
	Peak line emf constant	$K_{e,ll,p}$	Vs/m	-	22	22	44	22	66	44	22	89	22	111
	Maximum rms current	I_p	A_{rms}	20	4.5	9.1	4.5	14	4.5	9.1	18	4.5	23	4.5
	Continuous rms current, interface at 20°C	I_c	A_{rms}	100	2.4	4.8	2.4	7.3	2.4	4.8	9.7	2.4	12	2.4
Thermal	Continuous dissipation, interface at 20°C	$P_{d,c}$	W	100	67	133		200		267			333	
	Thermal resistance	R_{th}	K/W	-	1.2	0.60		0.40		0.30			0.24	
	Coil unit heat capacity	C_{th}	J/K	-	36	72		108		144			180	
	Thermal time constant, interface at 20°C	τ_{th}	s	-	43	43		43		43			43	

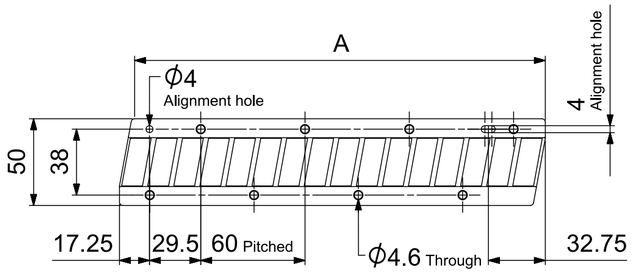
Notes

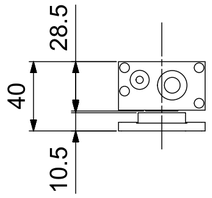
- Specifications are based upon a magnet temperature of 20°C
- Specifications consider complete overlap of the coil unit with a magnet plate
- Specifications consider sinusoidal q-axis commutation
- Velocity specifications are based on the maximum bus voltage
- Thermal resistance is defined from average coil temperature to the mounting interface
- Specifications are based upon an airgap of 1 mm

Product marking / approvals

CE

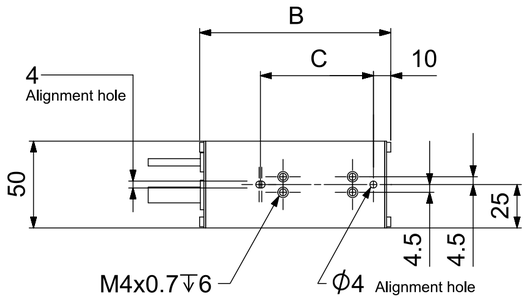
CHIRON-S-050 MECHANICAL SPECIFICATIONS





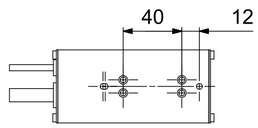
Magnet Plates

	Parameter	Symbol	Unit	MP-050-08	MP-050-16	MP-050-28
Magnet Plates	Number of poles	N_p	-	8	16	28
	Pole pitch (N-N)	$2\tau_p$	mm	30	30	30
	Width	A	mm	120	240	420
	Mass	M_{mp}	kg	0.3	0.7	1.2

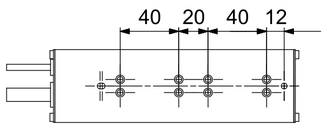


Coil Units

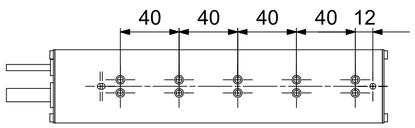
	Parameter	Symbol	Unit	CU-S-050-03	CU-S-050-06	CU-S-050-09	CU-S-050-12	CU-S-050-15
Coil Units	Number of coils	N_{coil}	-	3	6	9	12	15
	Coil pitch	τ_{coil}	mm	20	20	20	20	20
	Width	B	mm	110	170	230	290	350
	Center pin distance	C	mm	65	125	185	245	305
	Number of 60 mm pitches	D	mm	0	0	0	1	2
	Mass	M_{cu}	kg	0.5	0.8	1.2	1.5	1.8
	Standard cable length	L_{cable}	m	1	1	1	1	1



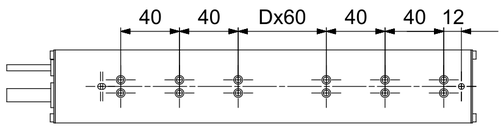
Chiron-CU-S-050-03



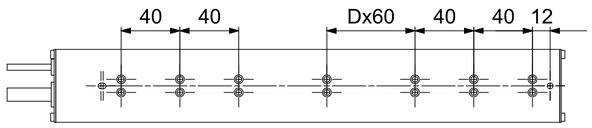
Chiron-CU-S-050-06



Chiron-CU-S-050-09



Chiron-CU-S-050-12



Chiron-CU-S-050-15

CHIRON-S-080 PERFORMANCE SPECIFICATIONS

	Parameter	Symbol	Unit	T_{coil} (°C)	CU-S-080-03	CU-S-080-06		CU-S-080-09		CU-S-080-12			CU-S-080-15		CU-S-080-18				CU-S-080-24			
	Winding configuration	-	-	-	C	B	C	B	C	A	B	C	B	C	A	B	C	D	A	B	C	D
Electromechanical	Peak force (a_T = 5°C/s increase)	F_p	N	20	260	520		770		1030			1290		1550				2060			
	Continuous force, interface at 20°C	F_c	N	100	155	310		460		615			770		925				1230			
	Attraction force (I = 0)	F_{att}	N	-	870	1490		2110		2730			3350		3970				5210			
	Motor constant	S	N^2/W	20	250	500		760		1010			1260		1510				2020			
	Force constant (I = I_c)	$K_{f,c}$	N/A_{rms}	-	62	62	124	62	186	124	62	248	62	310	124	62	371	186	124	62	495	248
	Force constant (I = I_p)	$K_{f,p}$	N/A_{rms}	-	56	56	112	56	168	112	56	224	56	281	112	56	337	168	112	56	449	224
	Maximum velocity (F = 0)	v_m	m/s	-	13	13	6.7	13	4.5	6.7	13	3.4	13	2.7	6.7	13	2.2	4.5	6.7	13	1.7	3.4
	Maximum velocity (F = F_p)	v_i	m/s	20	8.0	8.0	3.8	8.0	2.3	3.8	8.0	1.6	8.0	1.2	3.8	8.0	0.9	2.3	3.8	8.0	0.5	1.6
Electrical	Maximum dc bus voltage	V_{dc}	V	-	690	690		690		690			690		690				690			
	Phase resistance	$R_{ph,20}$	Ohm	20	5.2	2.6	10	1.7	16	5.2	1.3	21	1.0	26	3.5	0.9	31	7.8	2.6	0.7	42	10
	Phase inductance	L_{ph}	mH	20	29	15	58	9.7	87	29	7.3	116	5.8	145	19	4.8	174	44	15	3.6	232	58
	Peak line emf constant	$K_{e,ll,p}$	Vs/m	-	51	51	102	51	154	102	51	205	51	256	102	51	307	154	102	51	410	205
	Maximum rms current	I_p	A_{rms}	20	4.6	9.2	4.6	14	4.6	9.2	18	4.6	23	4.6	14	28	4.6	9.2	18	37	4.6	9.2
	Continuous rms current, interface at 20°C	I_c	A_{rms}	100	2.5	5.0	2.5	7.5	2.5	5.0	9.9	2.5	12	2.5	7.5	15	2.5	5.0	9.9	20	2.5	5.0
Thermal	Continuous dissipation, interface at 20°C	$P_{d,c}$	W	100	126	253		379		505			632		758				1011			
	Thermal resistance	R_{th}	K/W	-	0.63	0.32		0.21		0.16			0.13		0.11				0.079			
	Coil unit heat capacity	C_{th}	J/K	-	66	132		198		264			330		396				528			
	Thermal time constant, interface at 20°C	τ_{th}	s	-	42	42		42		42			42		42				42			

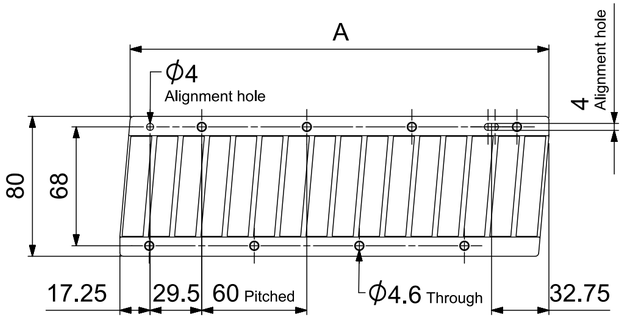
Notes

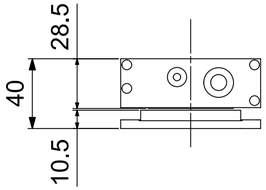
- Specifications are based upon a magnet temperature of 20°C
- Specifications consider complete overlap of the coil unit with a magnet plate
- Specifications consider sinusoidal q-axis commutation
- Velocity specifications are based on the maximum bus voltage
- Thermal resistance is defined from average coil temperature to the mounting interface
- Specifications are based upon an airgap of 1 mm

Product marking / approvals

CE

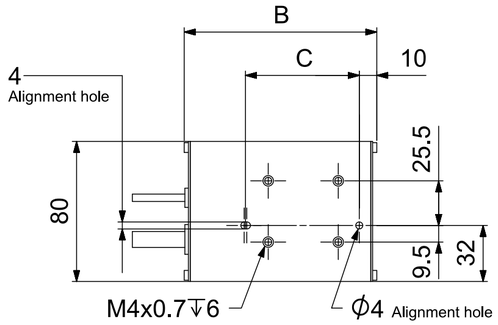
CHIRON-S-080 MECHANICAL SPECIFICATIONS





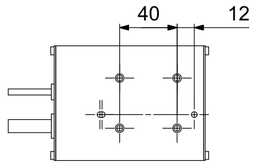
Magnet Plates

	Parameter	Symbol	Unit	MP-080-12	MP-080-16	MP-080-28	MP-080-36
Magnet Plates	Number of poles	N_p	-	12	16	28	36
	Pole pitch (N-N)	$2\tau_p$	mm	30	30	30	30
	Width	A	mm	180	240	420	540
	Mass	M_{mp}	kg	0.9	1.2	2.1	2.7

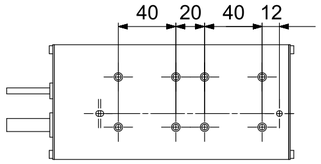


Coil Units

	Parameter	Symbol	Unit	CU-S-080-03	CU-S-080-06	CU-S-080-09	CU-S-080-12	CU-S-080-15	CU-S-080-18	CU-S-080-24
Coil Units	Number of coils	N_{coil}	-	3	6	9	12	15	18	24
	Coil pitch	τ_{coil}	mm	20	20	20	20	20	20	20
	Width	B	mm	110	170	230	290	350	410	530
	Center pin distance	C	mm	65	125	185	245	305	365	485
	Number of 60 mm pitches	D	mm	0	0	0	1	2	3	5
	Mass	M_{cu}	kg	1.0	1.6	2.3	3.0	3.7	4.3	5.7
	Standard cable length	L_{cable}	m	1	1	1	1	1	1	1



Chiron-CU-S-080-03



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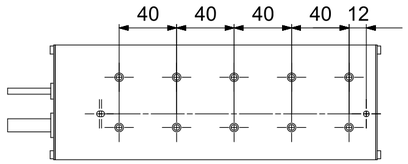

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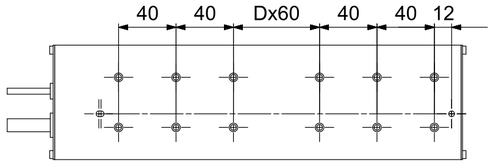

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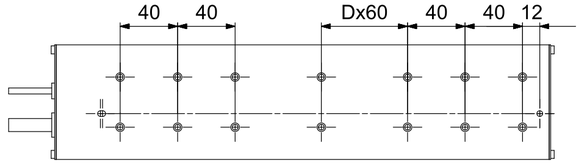


Chiron-CU-S-080-15/18/24

CHIRON-S-100 PERFORMANCE SPECIFICATIONS

	Parameter	Symbol	Unit	T_{coil} (°C)	CU-S-100-03	CU-S-100-06		CU-S-100-09		CU-S-100-12			CU-S-100-15		CU-S-100-18				CU-S-100-24				CU-S-100-30			
	Winding configuration	-	-	-	C	B	C	B	C	A	B	C	B	C	A	B	C	D	A	B	C	D	A	B	C	D
Electromechanical	Peak force (α_T = 5°C/s increase)	F_p	N	20	360	720		1090		1450			1810		2170				2900				3620		3280	3620
	Continuous force, interface at 20°C	F_c	N	100	220	440		650		870			1090		1310				1740				2180			
	Attraction force (I = 0)	F_{att}	N	-	1220	2090		2960		3830			4700		5570				7310				9050			
	Motor constant	S	N^2/W	20	370	740		1110		1490			1860		2230				2970				3710			
	Force constant (I = I_c)	$K_{f,c}$	N/A_{rms}	-	85	85	171	85	256	171	85	342	85	427	171	85	512	256	171	85	683	342	171	85	854	427
	Force constant (I = I_p)	$K_{f,p}$	N/A_{rms}	-	78	78	156	78	234	156	78	312	78	390	156	78	467	234	156	78	623	312	156	78	779	390
	Maximum velocity (F = 0)	v_m	m/s	-	10	10	5	10	3	5	10	2.4	10	2.0	4.9	10	1.6	3.3	4.9	10	1.2	2.4	4.9	10	1.0	2.0
	Maximum velocity (F = F_p)	v_i	m/s	20	5.7	5.7	2.6	5.7	1.6	2.6	5.7	1.0	5.7	0.7	2.6	5.7	0.5	1.6	2.6	5.7	0.1	1.0	2.6	5.7	0.0	0.7
Electrical	Maximum dc bus voltage	V_{dc}	V	-	690	690		690		690			690		690				690				690			
	Phase resistance	$R_{ph,20}$	Ohm	20	6.7	3.4	13	2.2	20	6.7	1.7	27	1.3	34	4.5	1.1	40	10	3.4	0.8	54	13	2.7	0.7	67	17
	Phase inductance	L_{ph}	mH	20	39	20	78	13	117	39	9.8	156	7.8	195	26	6.5	234	59	20	4.9	312	78	16	3.9	390	98
	Peak line emf constant	$K_{e,ll,p}$	Vs/m	-	71	71	141	71	212	141	71	282	71	353	141	71	423	212	141	71	564	282	141	71	705	353
	Maximum rms current	I_p	A_{rms}	20	4.7	9.3	4.7	14	4.7	9.3	19	4.7	23	4.7	14	28	4.7	9.3	19	37	4.7	9.3	23	47	4.2	9.3
	Continuous rms current, interface at 20°C	I_c	A_{rms}	100	2.5	5.1	2.5	7.6	2.5	5.1	10	2.5	13	2.5	7.6	15	2.5	5.1	10	20	2.5	5.1	13	25	2.5	5.1
Thermal	Continuous dissipation, interface at 20°C	$P_{d,c}$	W	100	171	343		514		686			857		1029				1371				1714			
	Thermal resistance	R_{th}	K/W	-	0.47	0.23		0.16		0.12			0.093		0.078				0.058				0.047			
	Coil unit heat capacity	C_{th}	J/K	-	87	174		261		348			435		522				696				870			
	Thermal time constant, interface at 20°C	τ_{th}	s	-	41	41		41		41			41		41				41				41			

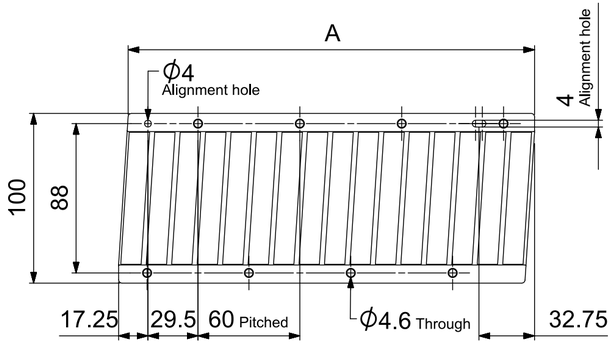
Notes

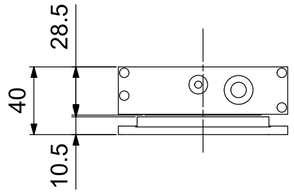
- Specifications are based upon a magnet temperature of 20°C
- Specifications consider complete overlap of the coil unit with a magnet plate
- Specifications consider sinusoidal q-axis commutation
- Velocity specifications are based on the maximum bus voltage
- Thermal resistance is defined from average coil temperature to the mounting interface
- Specifications are based upon an airgap of 1 mm

Product marking / approvals

CE

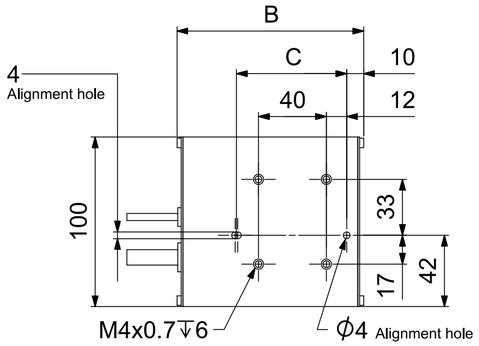
CHIRON-S-100 MECHANICAL SPECIFICATIONS





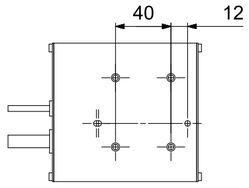
Magnet Plates

	Parameter	Symbol	Unit	MP-100-12	MP-100-16	MP-100-28	MP-100-36
Magnet Plates	Number of poles	N_p	-	12	16	28	36
	Pole pitch (N-N)	$2\tau_p$	mm	30	30	30	30
	Width	A	mm	180	240	420	540
	Mass	M_{mp}	kg	1.1	1.5	2.6	3.4

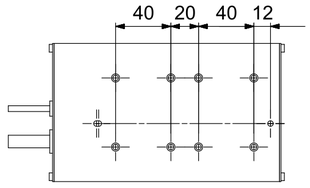


Coil Units

	Parameter	Symbol	Unit	CU-S-100-03	CU-S-100-06	CU-S-100-09	CU-S-100-12	CU-S-100-15	CU-S-100-18	CU-S-100-24	CU-S-100-30
Coil Units	Number of coils	N_{coil}	-	3	6	9	12	15	18	24	30
	Coil pitch	τ_{coil}	mm	20	20	20	20	20	20	20	20
	Width	B	mm	110	170	230	290	350	410	530	650
	Center pin distance	C	mm	65	125	185	245	305	365	485	605
	Number of 60 mm pitches	D	mm	0	0	0	1	2	3	5	7
	Mass	M_{cu}	kg	1.2	2.2	3.1	4.0	4.9	5.8	7.6	9.4
	Standard cable length	L_{cable}	m	1	1	1	1	1	1	1	1



Chiron-CU-S-100-03



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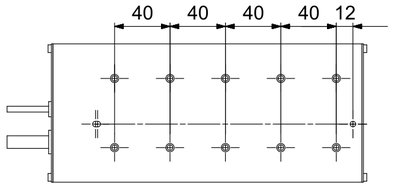

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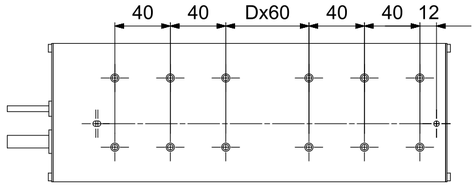

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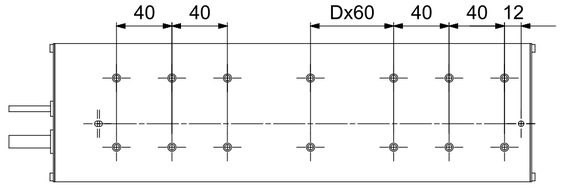


Chiron-CU-S-100-15/18/24/30

CHIRON-S-130 PERFORMANCE SPECIFICATIONS

	Parameter	Symbol	Unit	T_{coil} (°C)	CU-S-130-03	CU-S-130-06		CU-S-130-09		CU-S-130-12			CU-S-130-15		CU-S-130-18				CU-S-130-24				CU-S-130-30			
	Winding configuration	-	-	-	C	B	C	B	C	A	B	C	B	C	A	B	C	D	A	B	C	D	A	B	C	D
Electromechanical	Peak force (α_T = 5°C/s increase)	F_p	N	20	500	1000		1500		2050			2550		3050				4050		3450	4050	5100		3450	5100
Electromechanical	Continuous force, interface at 20°C	F_c	N	100	310	620		930		1250			1560		1870				2490				3110		2850	3110
Electromechanical	Attraction force (I = 0)	F_{att}	N	-	1750	3000		4250		5500			6750		8000				10500				13000			
Electromechanical	Motor constant	S	N^2/W	20	550	1100		1650		2150			2700		3250				4350				5400			
Electromechanical	Force constant (I = I_c)	$K_{f,c}$	N/A_{rms}	-	120	120	239	120	359	239	120	478	120	598	239	120	718	359	239	120	957	478	239	120	1196	598
Electromechanical	Force constant (I = I_p)	$K_{f,p}$	N/A_{rms}	-	111	111	221	111	332	221	111	442	111	553	221	111	664	332	221	111	885	442	221	111	1106	553
Electromechanical	Maximum velocity (F = 0)	v_m	m/s	-	7.0	7.0	3.5	7.0	2.3	3.5	7.0	1.7	7.0	1.4	3.5	7.0	1.2	2.3	3.5	7.0	0.9	1.7	3.5	7.0	0.7	1.4
Electromechanical	Maximum velocity (F = F_p)	v_i	m/s	20	4.0	4.0	1.8	4.0	1.0	1.8	4.0	0.6	4.0	0.3	1.8	4.0	0.1	1.0	1.8	4.0	0.0	0.6	1.8	4.0	0.0	0.3
Electrical	Maximum dc bus voltage	V_{dc}	V	-	690	690		690		690			690		690				690				690			
Electrical	Phase resistance	$R_{ph,20}$	Ohm	20	9.0	4.5	18	3.0	27	9.0	2.3	36	1.8	45	6.0	1.5	54	14	4.5	1.1	72	18	3.6	0.9	90	23
Electrical	Phase inductance	L_{ph}	mH	20	55	28	110	18.3	165	55	13.8	220	11	275	37	9.2	330	83	28	6.9	440	110	22	5.5	550	138
Electrical	Peak line emf constant	$K_{e,ll,p}$	Vs/m	-	99	99	198	99	296	198	99	395	99	494	198	99	593	296	198	99	790	395	198	99	988	494
Electrical	Maximum rms current	I_p	A_{rms}	20	4.6	9.2	4.6	14	4.6	9.2	18	4.6	23	4.6	14	28	4.6	9.2	18	37	3.9	9.2	23	46	3.1	9.2
Electrical	Continuous rms current, interface at 20°C	I_c	A_{rms}	100	2.6	5.2	2.6	7.8	2.6	5.2	10	2.6	13	2.6	7.8	16	2.6	5.2	10	21	2.6	5.2	13	26	2.4	5.2
Thermal	Continuous dissipation, interface at 20°C	$P_{d,c}$	W	100	240	480		720		960			1200		1440				1920				2400			
Thermal	Thermal resistance	R_{th}	K/W	-	0.33	0.17		0.11		0.08			0.067		0.056				0.042				0.033			
Thermal	Coil unit heat capacity	C_{th}	J/K	-	114	228		342		456			570		684				912				1140			
Thermal	Thermal time constant, interface at 20°C	τ_{th}	s	-	38	38		38		38			38		38				38				38			

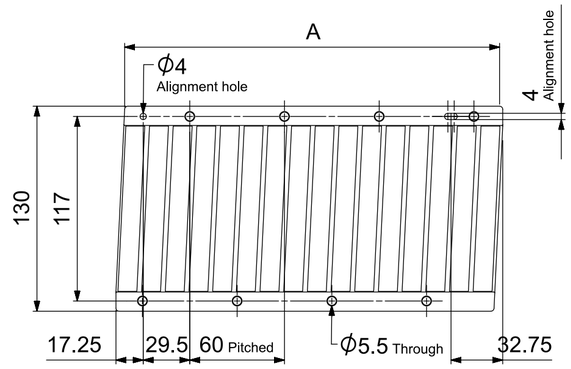
Notes

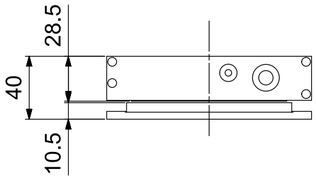
- Specifications are based upon a magnet temperature of 20°C
- Specifications consider complete overlap of the coil unit with a magnet plate
- Specifications consider sinusoidal q-axis commutation
- Velocity specifications are based on the maximum bus voltage
- Thermal resistance is defined from average coil temperature to the mounting interface
- Specifications are based upon an airgap of 1 mm

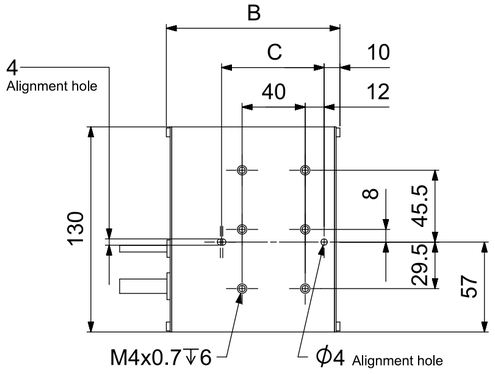
Product marking / approvals

CE

CHIRON-S-130 MECHANICAL SPECIFICATIONS





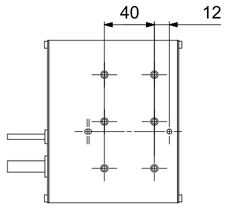


Magnet Plates

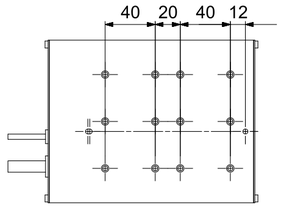
	Parameter	Symbol	Unit	MP-130-12	MP-130-16	MP-130-28	MP-130-36
Magnet Plates	Number of poles	N_p	-	12	16	28	36
	Pole pitch (N-N)	$2\tau_p$	mm	30	30	30	30
	Width	A	mm	180	240	420	540
	Mass	M_{mp}	kg	1.5	2.0	3.4	4.4

Coil Units

	Parameter	Symbol	Unit	CU-S-130-03	CU-S-130-06	CU-S-130-09	CU-S-130-12	CU-S-130-15	CU-S-130-18	CU-S-130-24	CU-S-130-30
Coil Units	Number of coils	N_{coil}	-	3	6	9	12	15	18	24	30
	Coil pitch	τ_{coil}	mm	20	20	20	20	20	20	20	20
	Width	B	mm	110	170	230	290	350	410	530	650
	Center pin distance	C	mm	65	125	185	245	305	365	485	605
	Number of 60 mm pitches	D	mm	0	0	0	1	2	3	5	7
	Mass	M_{cu}	kg	1.7	2.9	4.2	5.5	6.7	8.0	10.5	13.0
	Standard cable length	L_{cable}	m	1	1	1	1	1	1	1	1



Chiron-CU-S-130-03



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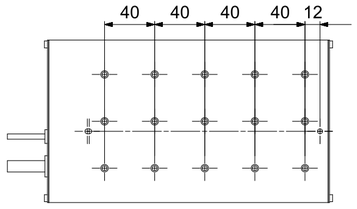

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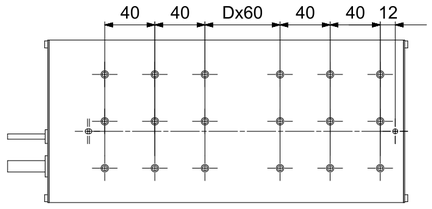

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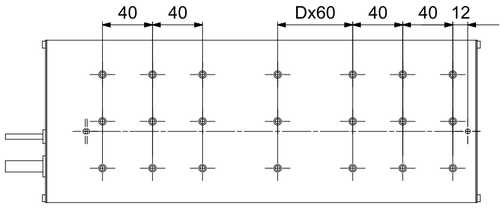
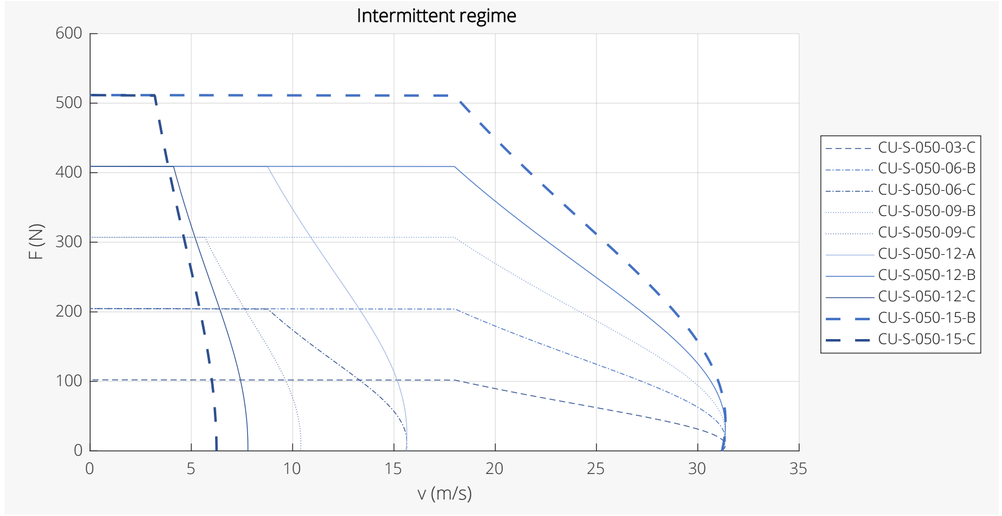
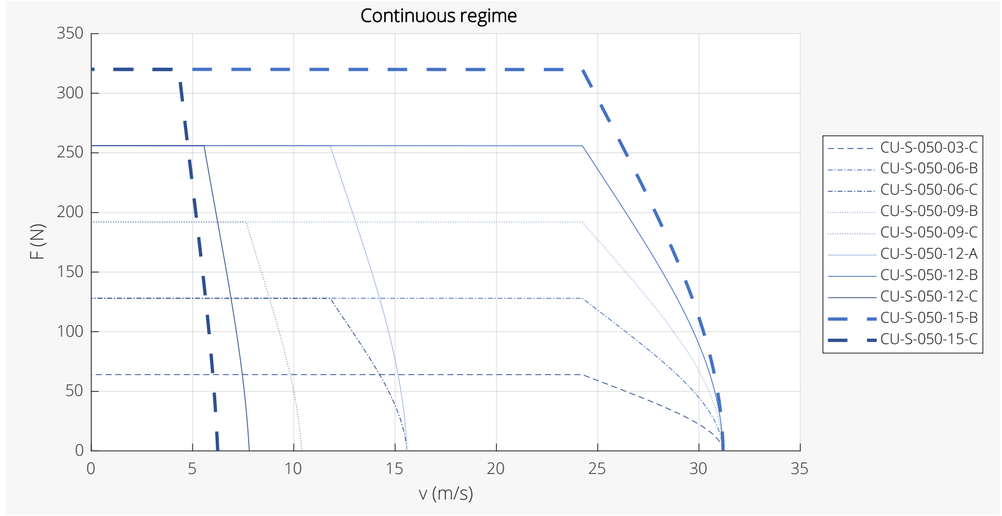


Chiron-CU-S-130-15/18/24/30

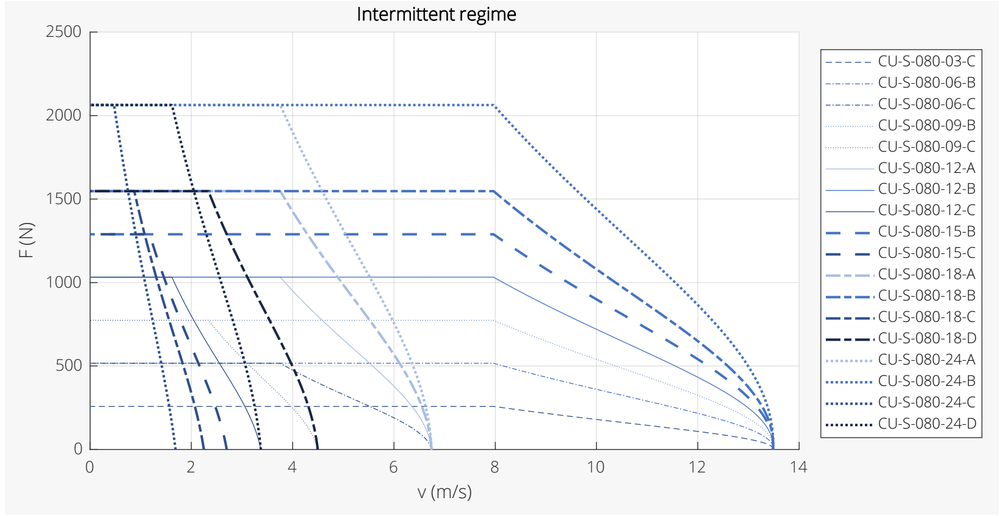
CHIRON-S-050/080 FORCE-VELOCITY DIAGRAMS



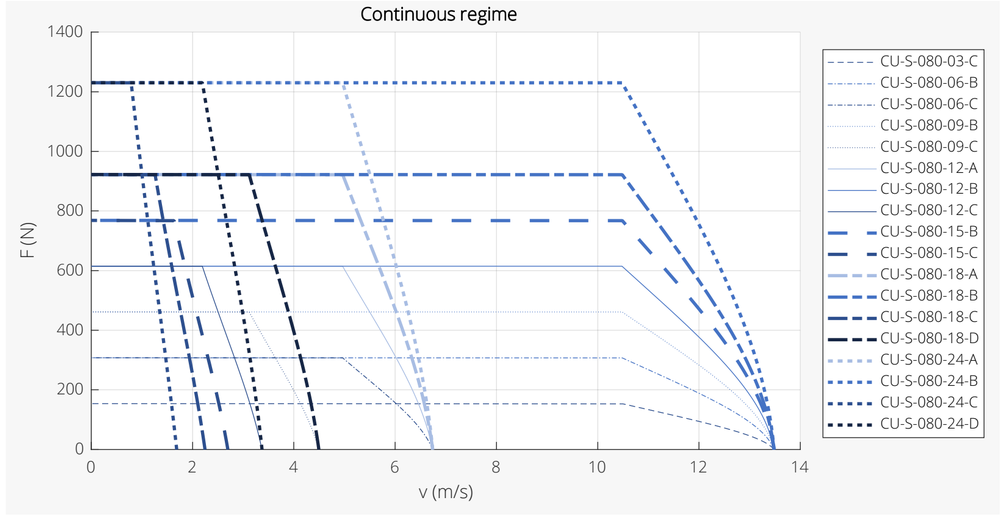
Force-Velocity Diagrams Size S-050 Intermittent Regime



Force-Velocity Diagrams Size S-050 Continuous Regime

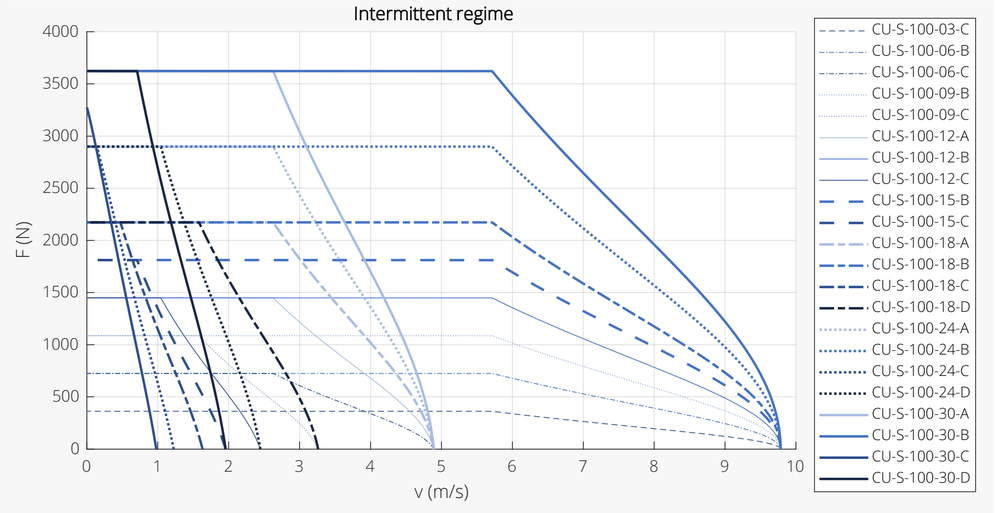


Force-Velocity Diagrams Size S-080 Intermittent Regime

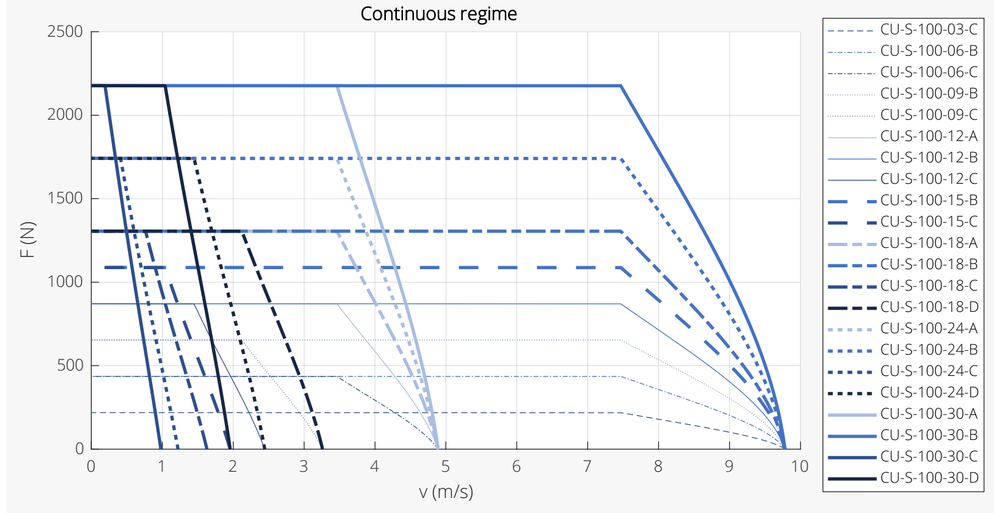


Force-Velocity Diagrams Size S-080 Continuous Regime

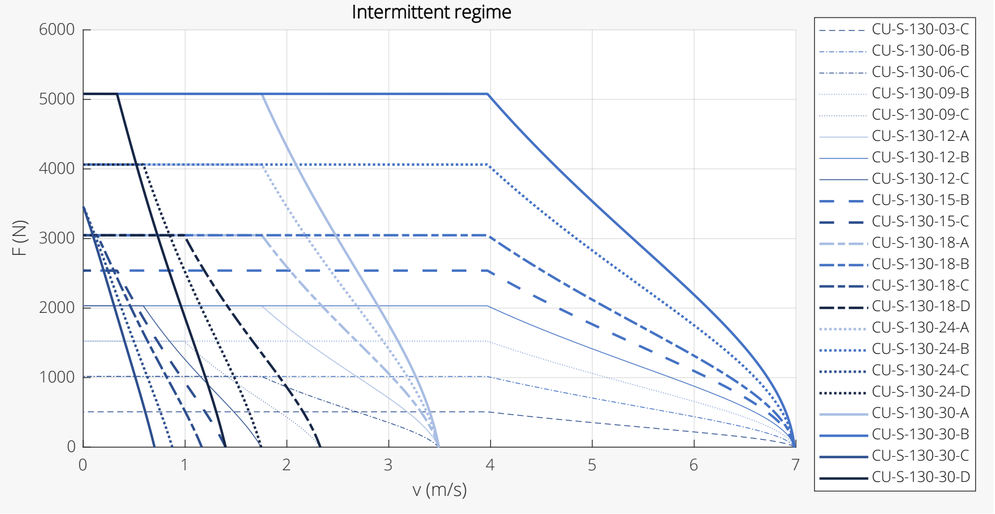
CHIRON-S-100/130 FORCE-VELOCITY DIAGRAMS



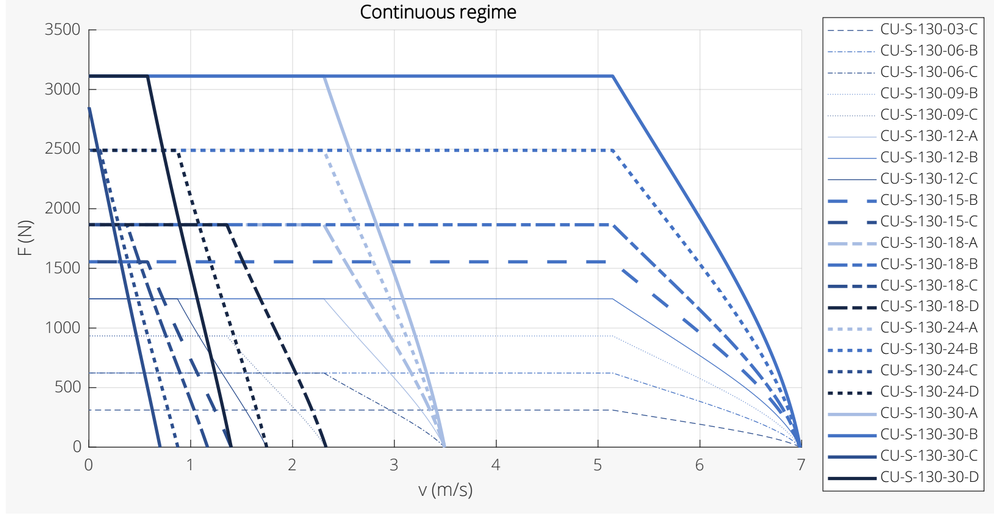
Force-Velocity Diagrams Size S-100 Intermittent Regime



Force-Velocity Diagrams Size S-100 Continuous Regime



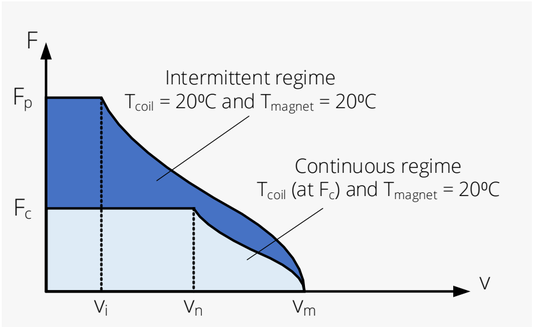
Force-Velocity Diagrams Size S-130 Intermittent Regime



Force-Velocity Diagrams Size S-130 Continuous Regime

DEFINITIONS

Description	Equation	Unit	Remarks
Phase resistance at T_{coil}	$R_{ph} = R_{ph,20}\left(1+0.0039(T_{coil}-20)\right)$	Ohm	
Force constant at no load	$K_{f,0} = \sqrt{3/2}\, K_{e,ll,p}$	N/A_{rms}	For Phoenix and Gryphon: $K_{f,0} = K_f$.
Continuous dissipation	$P_{d,c} = (T_{coil}-T_i)/R_{th}$	W	Only copper losses are considered. This catalogue considers T_i = 20ºC.
Peak dissipation	$P_{d,p} = C_{th}\alpha_T$	W	α_T is mentioned at the peak force specification.
Continuous rms current	$I_c = \min\left(\sqrt{\frac{P_{d,c}}{3R_{ph}}}, \frac{V_{dc}}{\sqrt{6}R_{ph}}\right)$	A_{rms}	Limited either by continuous dissipation or dc voltage and resistance or connector ratings (if applicable).
Peak rms current	$I_p = \min\left(\sqrt{\frac{P_{d,p}}{3R_{ph,20}}}, \frac{V_{dc}}{\sqrt{6}R_{ph,20}}\right)$	A_{rms}	Limited either by peak dissipation or dc voltage and resistance or connector ratings (if applicable).
Thermal time constant	$\tau_{th} = C_{th}R_{th}$	s	
Continuous force	$F_c = K_{f,c}I_c$	N	For Phoenix and Gryphon: $K_{f,c} = K_f$.
Peak force	$F_p = K_{f,p}I_p$	N	For Phoenix and Gryphon: $K_{f,p} = K_f$.
Steepness	$S = \frac{K_{f,0}^2}{3R_{ph,20}}$	N^2/W	For Phoenix and Gryphon: $K_{f,0} = K_f$.
Maximum velocity (F = 0)	$v_m = \frac{V_{dc}}{K_{e,ll,p}}$	m/s	Iron losses are not considered.
Maximum velocity ($F = F_p$)	$v_i = \left(\tau_p\sqrt{6\tau_p^2K_{f,p}^2V_{dc}^2+54\pi^2\left(L_{ph}^2I_p^2V_{dc}^2-6L_{ph}^2R_{ph,20}^2I_p^4\right)}-6\tau_p^2K_{f,p}R_{ph,20}I_p\right)\left(2\tau_p^2K_{f,p}^2+18\pi^2L_{ph}^2I_p^2\right)^{-1}$	m/s	For Phoenix and Gryphon: $K_{f,p} = K_f$. Iron losses are not considered.
Maximum velocity ($F = F_c$)	$v_n = \left(\tau_p\sqrt{6\tau_p^2K_{f,c}^2V_{dc}^2+54\pi^2\left(L_{ph}^2I_c^2V_{dc}^2-6L_{ph}^2R_{ph,100}^2I_p^4\right)}-6\tau_p^2K_{f,c}R_{ph,100}I_c\right)\left(2\tau_p^2K_{f,c}^2+18\pi^2L_{ph}^2I_c^2\right)^{-1}$	m/s	For Phoenix and Gryphon: $K_{f,c} = K_f$. Iron losses are not considered.



Force-velocity curves

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