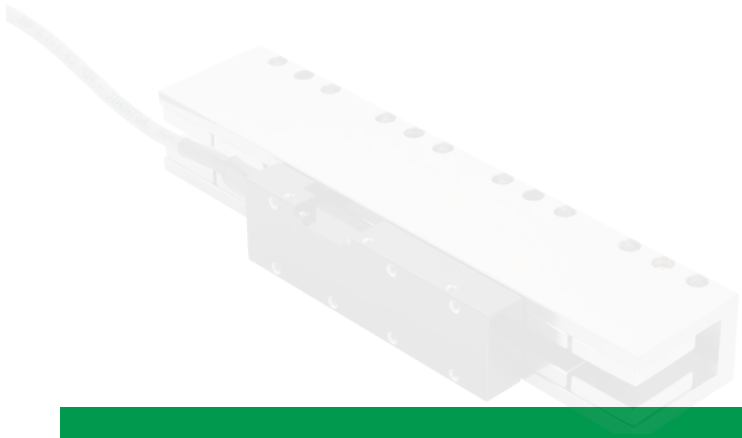




Linear Motor

Technical Information



HIWIN Support



About HIWIN



Linear Motor System

Automated Transport / AOI Application
/ Precision Positioning / Semiconductor Application

- Air Bearing Platform
- XY Stage
- Gantry Systems
- Single-Axis Linear Motor Stage



Linear Motor

Machine Tool / Semiconductor / Touch Panel / Laser Manufacturing Machine / Glass Cutting Machine

- Iron Core Linear Motor-LMSA, LMSA-Z, LMFA, LMFC, LMFP, LME Series
- Ironless Linear Motor-LMC Series
- Tubular Motor-LMT Series



Torque Motor / Direct Drive Motor

Machine Tools / Lithium-ion Battery / Gear Machining and Inspection

- Torque Motor-TM-5 / IM-2, TMRW Series

Display / Automation / Semiconductor / Lithium-ion Battery / Robot / Laser Cutting / AOI Inspection

- Direct Drive Motor-DMS, DMY, DMN, DMT, DMH Series



Controller / Drive / AC Servo Motor

Semiconductor / SMT / 3C Electronics / Automation Equipment / New Energy Equipment / Industrial Machinery

- Controller-HIMC3
- Drive-E Series
- AC Servo Motor-E Series



Linear Actuator

Medical / Automation / Electric Servo Press / Barrier-free Equipment Industry

- Linear Actuator-LAM, LAS, LAN, LAC Series



Position Measurement System

PCB / Automobile Automation / Automation / Solar Process Equipment / Laser Cutting

- High Resolution-PM, APM Series
- Signal Translator
- High Performance Counter



Semiconductor Subsystem

Semiconductor / LED / Panel

- EFEM (Equipment Front End Module)
- Wafer Robot
- Load Port
- Wafer Aligner



Multi-Axis Robot

Pick-and-Place / Assembly / Array and Packaging / Semiconductor / Electro-Optical Industry / Automotive Industry / Food Industry

- Articulated Robot
- SCARA Robot
- Electric Gripper
- Integrated Electric Gripper



Single-Axis Robot

Precision / Semiconductor / Medical / FPD

- KK, SK
- KS, KA
- KU, KE, KC



Torque Motor Rotary Table

Medical / Automotive Industry / Machine Tools / Machinery Industry

- RAB Series
- RAS Series
- RCV Series
- RCH Series

Wire-cut EDM / Die-sinker EDM / Small-hole Drilling EDM

- RAS-E Series
- RCV-E Series
- RCH-E Series



Ball Screw

Precision Ground / Rolled

- Super S Series
- Super T Series
- Mini Roller
- Ecological & Economical Lubrication Module E2
- Auxiliary Lubrication Module EL
- Rotating Nut (R1, R2)
- Energy-Saving & Thermal-Controlling (Cool Type)
- Heavy Load Series (RD)



Linear Guideway

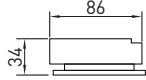
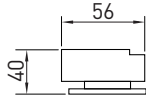
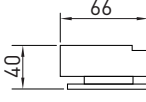
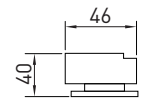
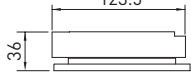
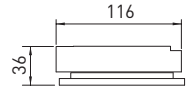
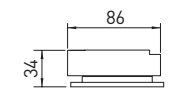
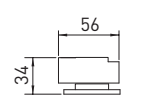
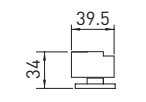
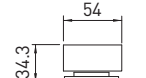
Automation / Semiconductor / Medical

- Ball Type-HG, EG, WE, MG, CG
- Quiet Type-QH, QE, QW, QR
- Other-RG, E2, PG, SE, RC

Linear Motor Power Range

Continuous Force(Fcn) Peak Force(Fpk)

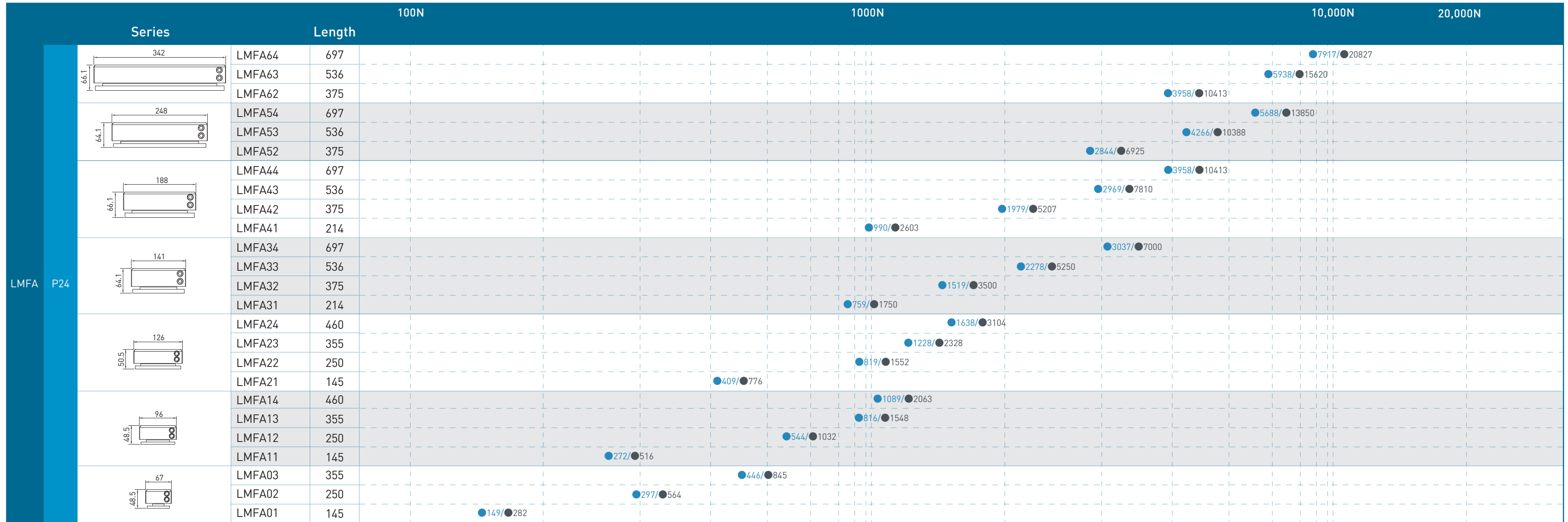
Unit:N

				100N		1000N		10,000N		20,000N	
Series		Length									
LME	P6		LME-B-23-L	328					826/2119		
			LME-B-23-0	328					819/2011		
			LME-B-22-0	223				548/1319			
			LME-B-13-0	328			394/931				
			LME-A-22-L	181			330/752				
			LME-A-22-0	181			342/741				
			LME-A-12-0	181		160/352					
LMSA	P11		LMSAC5	538					1579/4458		
			LMSA34	433					1166/3292		
			LMSA33	328					875/2469		
			LMSA32	223				583/1646			
			LMSA31	118			292/823				
			LMSA24	433					725/2048		
			LMSA23	328				544/1535			
			LMSA22	223			362/1023				
			LMSA21	118			181/512				
			LMSA13	328			308N/868N				
			LMSA12	223			205/579				
			LMSA11	118			103/289				
			LMSA02	223			104/224				
			LMSA01	118			52/112				
LMSS	P22		LMSS11	96			95/263				

Linear Motor Power Range

● Continuous Force(F_{cn}) ● Peak Force(F_{pk})

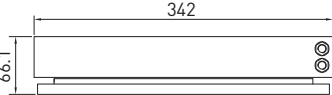
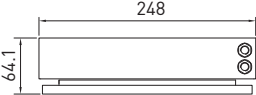
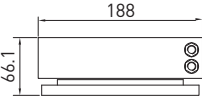
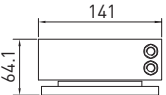
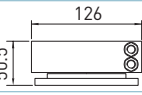
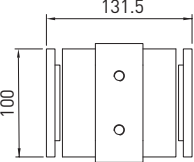
Unit:N



Linear Motor Power Range

Continuous Force(Fcn) Peak Force(Fpk)

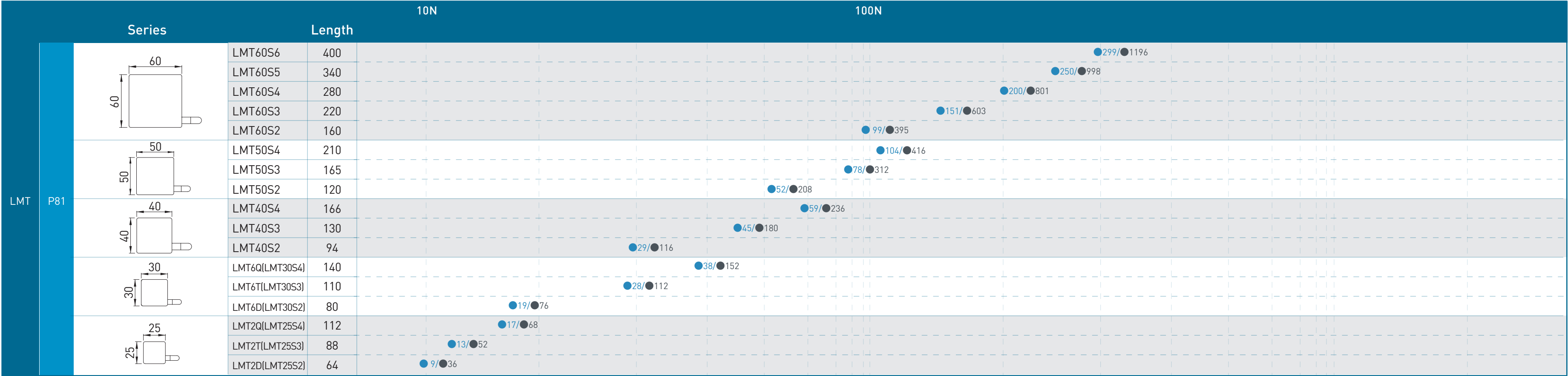
Unit:N

				100N	1000N	10,000N	20,000N
Series		Length					
LMFP	P37		LMFP64-Q80	704			7639/19147
			LMFP64-Q40				8115/20827
			LMFP63-Q60	543			6086/15620
			LMFP63-Q30				5732/14211
			LMFP62-Q40	382		3933/9805	
			LMFP62-Q20			4057/10414	
			LMFP54-Q80	704			5474/13866
			LMFP54-Q40				5525/13977
			LMFP53-Q60	543		4266/10500	
			LMFP53-Q30			4266/10500	
			LMFP52-Q40	382	2844/7000		
			LMFP52-Q20		2844/7000		
			LMFP44-Q80	704		3791/9975	
			LMFP44-Q40			3774/10049	
			LMFP43-Q60	543		2969/8460	
			LMFP43-Q30			2780/7367	
			LMFP42-Q40	382	1979/5460		
			LMFP42-Q20		1979/5460		
			LMFP41-Q20	221	990/2820		
			LMFP41-Q20		990/2820		
			LMFP34-Q80	704		2865/6757	
			LMFP34-Q40			3307/7187	
			LMFP33-Q60	543		2480/5390	
			LMFP33-Q30			2480/5390	
			LMFP32-Q40	382	1653/3593		
			LMFP32-Q20		1481/3341		
			LMFP31-Q20	221	827/1797		
			LMFP31-Q10		716/1671		
			LMFP24-F40	465		1692/3144	
			LMFP24-H40			1676/3046	
LMSC	P57		LMSC7	299		1819/2140	

Linear Motor Power Range

Continuous Force(Fcn) Peak Force(Fpk)

Unit:N



HIWIN® MIKROSYSTEM

Contents

Linear Motor

1.Basic Information 04

Introduction to proper nouns.

2.Linear Motor 06

HIWIN MIKROSYSTEM's linear motors can be Ironless or Iron-core type motors. Iron-core linear motors have large thrust capabilities, Ironless linear motors are more lightweight, with good dynamic characteristics. HIWIN's linear motors are brushless, direct drive, linear synchronous motors that offer better dynamic response and accuracy with no wear and maintenance due to the non-contact design.

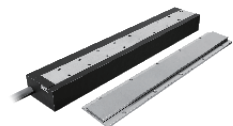
2.1	LME Series	06
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3.E Series Servo Drive 76

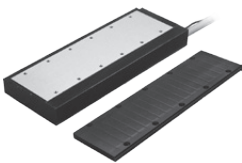
3.1	Drive	76
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LME Series:
Provides energy saving, carbon reduction and high cost performance, conforming to ESG sustainability principles.



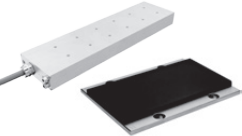
LMSA / LMSA-Z Series:
High thrust density, low cogging force, high dynamic response, low installation height and other characteristics, complies with UL and CE certification.



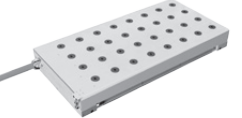
LMSS Series:
The shorter length forcer design reduces stroke and optimizes cogging force. Used in automatic inspection and semiconductor industry.



LMFA Series:
Built-in water cooling system, high thrust density, peak force of 20,000 N, complies with UL and CE certifications.



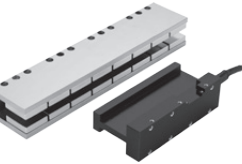
LMFP Series:
Built-in water cooling system, high thrust density and protection level of IP65, which provides better protection for harsh environments in machine tools.



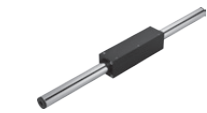
LMFC Series:
Additional precision cooling system for THE LMFA/LMFP, used to reduce or maintain a low motor surface temperature, eliminates the affect of the motor temperature on the application.



LMSC Series:
Built-in water cooling system, attraction force between forcer and stator is offset, reducing slide load.



LMC Series:
U-shaped stator and coreless linear motor, without attraction force between forcers and stators, no cogging, very low velocity ripple and excellent dynamic characteristics. Suitable for continuous, scanning motion and high precision positioning control applications, complies with the meets CE certification.



LMT Series:
Shaft motor, with no wear, zero backlash, high velocity, no cogging, and low velocity ripple. Satisfies high precision positioning control and smooth operation application requirements, and complies with CE certification requirements and IP66 rating.

1. Basic Information

1.1 Technical terms | Linear Motor

Continuous force F_c (N)

Defined as motor output thrust at ambient temperature 25°C, output thrust under continuous movement without resting, Continuous current I_c corresponding to supplied to motor.

Continuous current I_c (A_{rms})

Defined as current that can be continuously supplied to motor coil at ambient temperature at 25°C and is also constant current.

Peak force F_p (N)

Defined as the maximum thrust that motor can output for no more than one second, generally used for acceleration or deceleration purposes.

Peak current I_p (A_{rms})

Defined as motor reaches Peak force corresponding to instant large current, under normal operating range, Peak current can be allowed to supply for one second.

Ultimate force F_u (N)

Defined as the corresponding output thrust of motor at the Ultimate current I_u .

Ultimate current I_u (A_{rms})

Defined as five times of the motor Continuous current I_c ; at this current, motor outputs thrust in saturated nonlinear region, force constant will be reduced, input current motor has over-temperature risk, recommended operating time is 0.5 seconds or less.

Force constant K_f (N/ A_{rms})

Defined as the output thrust of motor at unit current (A_{rms}), and this parameter is multiplied by current to obtain thrust: $F = I \times K_f$.

Attraction force F_a (N)

Defined as the force between core motor and stator under rated air gap, which forces the preload of guideway to be supported by rail.

Maximum winding temperature T_{MAX} (°C)

Defined as the maximum permissible temperature of

motor coil. Actual equilibrium temperature of motor will depend on factors such as structure, cooling methods, and motion planning, etc. theoretical calculations may be biased, usually based on actual testing.

Electrical time constant K_e (ms)

Defined as the time required for current supplied to motor to reach 63% of target value, the smaller the value, the faster the response time.

Resistance (line to line · 25°C) R_{25} (Ω)

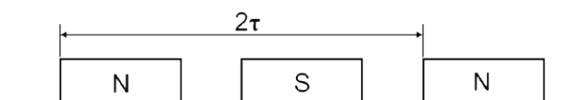
Defined as the resistance of motor measured coil temperature at 25°C; resistance value increases with increasing temperature.

Inductance (line to line) L (mH)

Defined as measured motor inductance values line to line.

Pole pair pitch 2τ (mm)

Defined as the distance between two same polar magnets of stator, that is, N→N or S→S identical magnetic poles.



Back emf constant K_v [$V_{rms}/(m/s)$]

Defined as when motor magnet temperature at 25°C unit velocity generated by induced electromotive force. Occurs when coil senses and generates electromotive force magnetic field when resistance current passes.

Motor constant K_m (N/ $\sqrt{W}$)

Defined as coil and the magnet temperature at 25°C when the motor output thrust to the ratio of square root of power consumption, the higher the motor constant represents the lower power loss when motor outputs a specific thrust, one of indicators to determine motor efficiency.

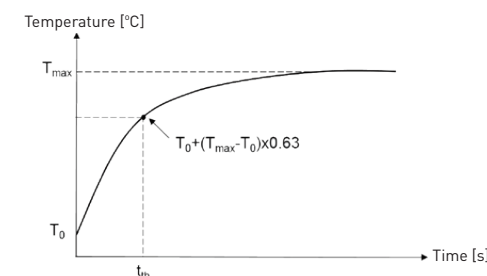
Thermal resistance R_{TH} (°C/W)

Defined as the resistance of heat from motor coil to heat dissipation environment; the smaller the blocking

stands for the same amount of heat input, coil and cooling environment, the smaller the temperature difference the better the cooling effect.

Thermal time constant t_{TH} (s)

Defined as the time required for motor to rise to 63% of the maximum temperature difference of coil under continuous current supply.



Minimum flow rate (L/min)

Defined as coolant under rated water cooling temperature, the minimum water-cooled flow required for motor to reach Continuous force F_c (WC).

Temperature of cooling water (°C)

Defined as under the minimum flow rate, motor coolant at this temperature to achieve water-cooled Continuous force F_c (WC).

Pressure drop ΔP (bar)

Defined as coolant under the Minimum flow rate, inlet and outlet pressure difference.

Maximum velocity at maximum force $V_{MAX,FP}$ (m/s)

Defined as the maximum velocity that motor can achieve under Peak force; this parameter is required at maximum operating voltage.

Maximum electric power input $P_{EL,MAX}$ (W)

Defined as input power required for motor operation at Maximum velocity at maximum force $V_{MAX,FP}$ with the Maximum dissipated heat output $Q_{P,H,MAX_{co}}$ conditions.

Maximum dissipated heat output $Q_{P,H,MAX}$ (W)

Defined as motor heat output at coil under the Maximum winding temperature T_{MAX} .

Stall current I_0 (A_{rms})

Defined as motor at ambient temperature 25°C and stall conditions, the upper limit current can be supplied, this value is related to heat dissipation conditions.

Stall force F_0 (N)

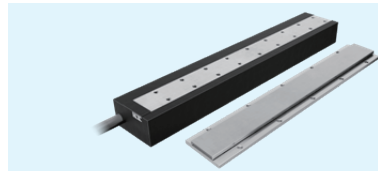
Defined as motor at ambient temperature 25°C and stall conditions, the upper limit of thrust that motor can supply, this value is related to heat dissipation conditions.

Maximum DC bus voltage (V_{DC})

Defined as the maximum operating voltage that motor can use in normal operating conditions.

2. Linear Motor

2.1 LME Series Linear Motor



- High motor and force constant
- Low installation height
- Continuous force range from 160N to 826N
- Peak force range from 352N to 2119N
- Installation height 40 mm

The linear motor LME series has the characteristics of energy saving, carbon reduction and high cost performance, and is a solution that complies with the ESG sustainable concept.

Force chart for LME series

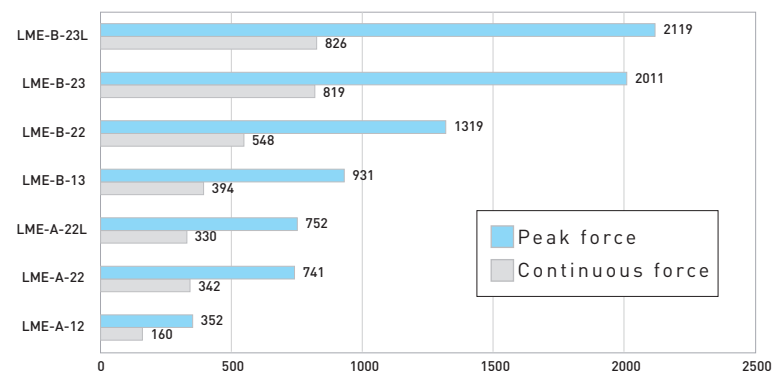


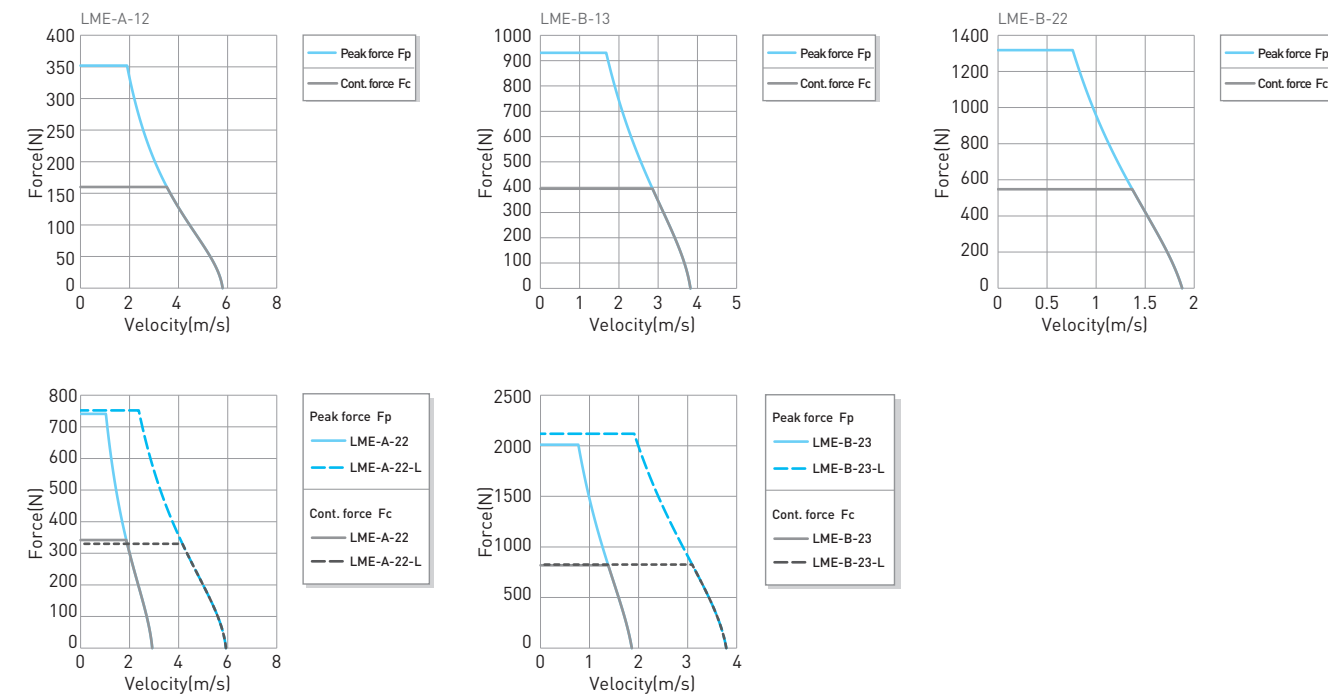
Table 2-1 LME Series specifications

	Symbol	Unit	LME-A-12	LME-A-22	LME-A-22-L	LME-B-13	LME-B-22	LME-B-23	LME-B-23-L
Continuous force	F_c	N	160	342	330	394	548	819	826
Continuous current	I_c	A _{rms}	3	3	6	4.5	3	4.4	8.8
Peak force (1s)	F_p	N	352	741	752	931	1319	2011	2119
Peak current (1s)	I_p	A _{rms}	12	12	24	18	12	18	36
Force constant	K_f	N/A _{rms}	53.3	114	55	87.5	182.8	186.1	93.9
Attraction force	F_a	N	584	1153	1153	1480	1970	2962	2962
Maximum winding temperature	T_{max}	°C	120						
Electrical time constant	K_e	ms	8.2	9.0	8	9.1	9.9	10.1	8.8
Resistance (line to line, 25°C)	R_{25}	Ω	7.5	11.3	2.9	5.2	12.8	8.3	2.1
Resistance (line to line, 120°C)	R_{120}	Ω	10.3	15.5	4	7.2	17.6	11.4	2.9
Inductance (line to line)	L	mH	61.5	102	23.2	47.4	126.6	83.9	18.8
Pole pair pitch	2τ	mm	24	24	24	30	30	30	30
Maximum bending radius of cable	R_{bend}	mm	68						
Back emf constant (line to line)	K_v	V _{rms} /m/s	35.7	70.8	34.9	54.1	110.2	111.1	54.6
Motor constant (25°C)	K_m	N/√W	16.4	27.8	26.8	31	40.4	51.4	51.4
Thermal resistance	R_{TH}	°C/W	0.72	0.46	0.46	0.43	0.40	0.28	0.28
Thermal time constant	t_{TH}	s	1020	1560	1560	1980	2100	2880	2880
Thermal switch	-	-	3 PTC 120 In Series						
Maximum DC bus voltage	-	V	600						
Mass offorcer	M_f	kg	1.3	2	2	3	3.4	5	5
Unit mass of stator	M_s	kg/m	1.5	2.5	2.5	2.3	4.1	4.1	4.1
Width of stator	W_s	mm	40.6	60.6	60.6	50.6	80.6	80.6	80.6
Length of stator/Dimension N	L_s	mm	120mm/N=2, 240mm/N=4, 360mm/N=6			120mm/N=2, 180mm/N=3, 300mm/N=5			
Stator mounting distance	W_{s1}	mm	32	52	52	42	72	72	72
Total installation height	H	mm	40	40	40	40	40	40	40

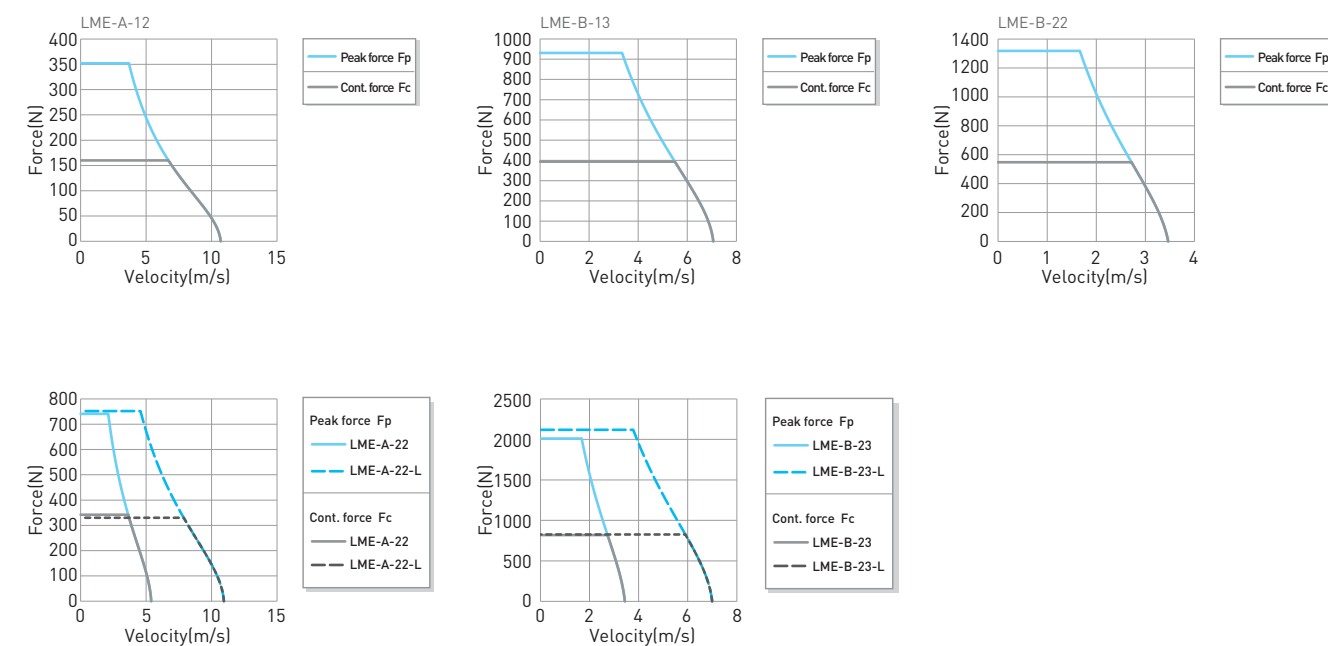
Note: 1. Except dimensions, the electrical specifications are in ±10% of tolerance.
2. We reserve the right to change, please follow customer recognition drawings.

2.1.1 LME Series F-V curves

■ Force and velocity curves (DC bus voltage = 325 V_{DC})

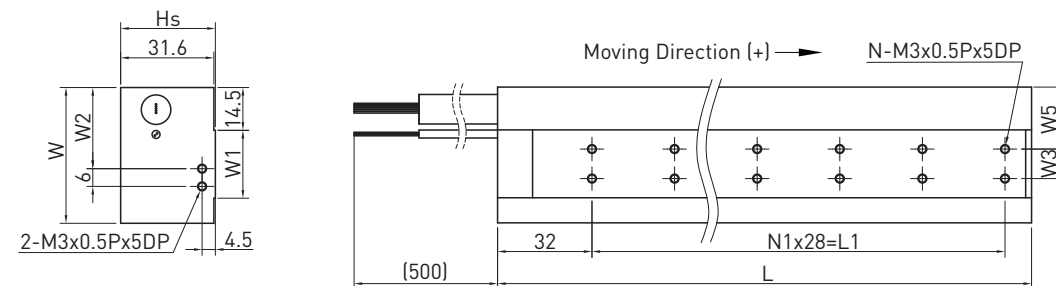


■ Force and velocity curve (DC bus voltage = 600 V_{DC})

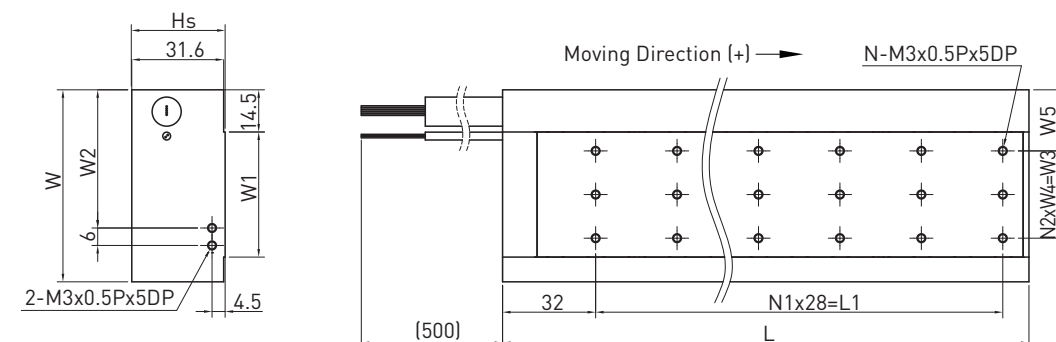


2.1.2 LME Series forcers and stators dimensions

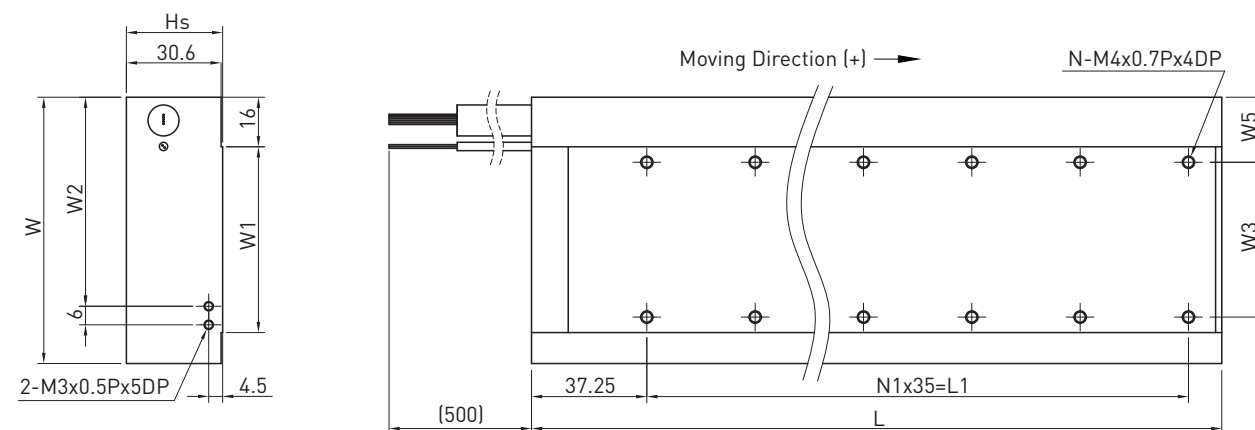
■ Dimension of LME-A-1 forcers



■ Dimension of LME-A-2 forcers

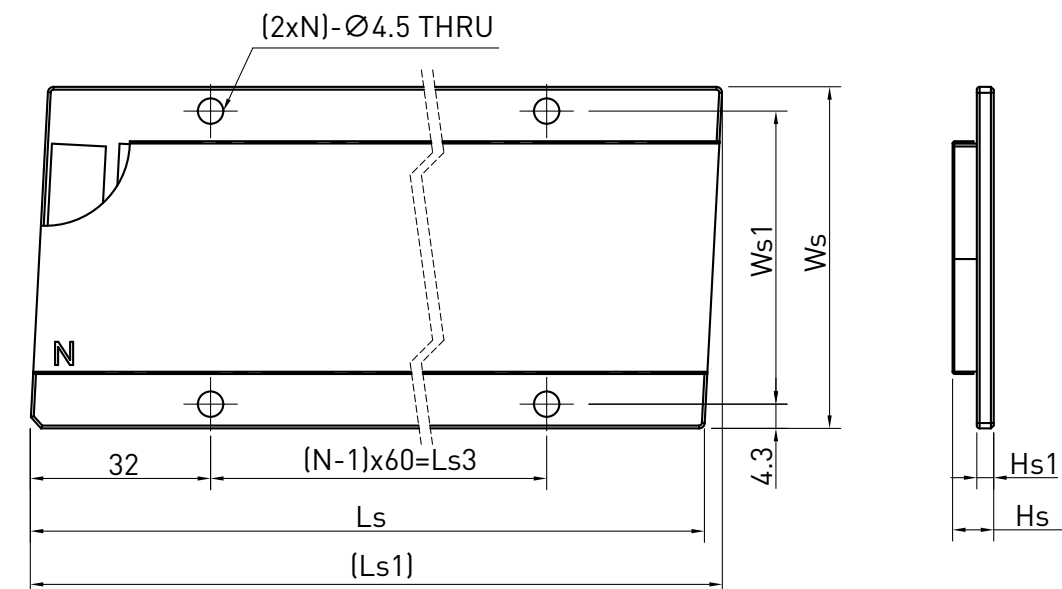


■ Dimension of LME-B forcers



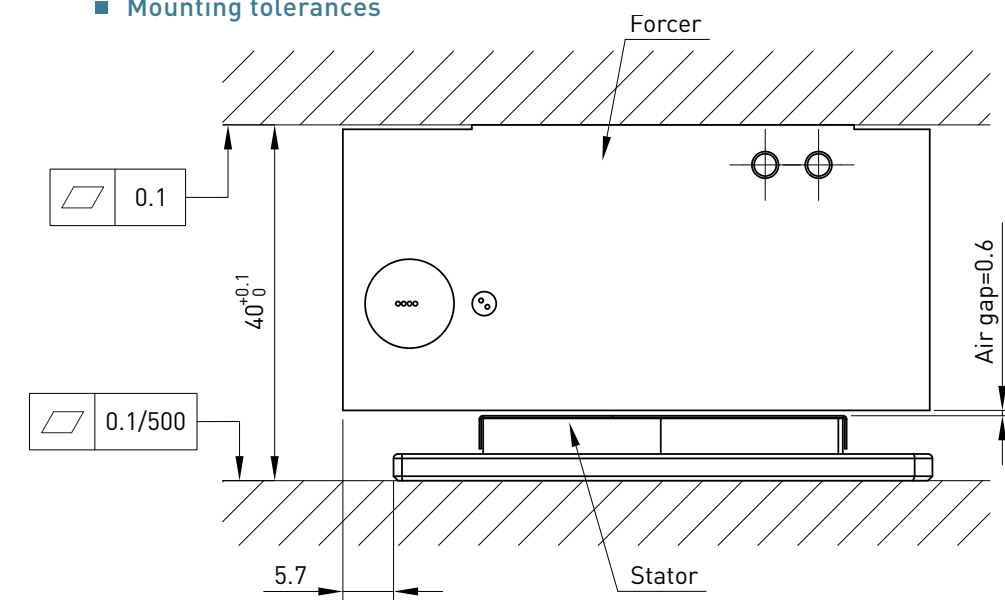
Type	L	L1	W	W1	W2	W3	W4	W5	N	N1	N2	Hs
LME-A-12	181	140	46	23	27.5	10	10	21	12	5	-	32.1
LME-A-22	181	140	66	43	47.5	30	15	21	18	5	2	32.1
LME-A-22-L	181	140	66	43	47.5	30	15	21	18	5	2	32.1
LME-B-13	328	280	56	30	37.5	20	-	21	18	8	-	31.1
LME-B-22	223	175	86	60	67.5	50	-	21	12	5	-	31.1
LME-B-23	328	280	86	60	67.5	50	-	21	18	8	-	31.1
LME-B-23-L	328	280	86	60	67.5	50	-	21	18	8	-	31.1

■ Dimension of stators



Type	Ls	Ls1	Ls3	Ws	Ws1	Hs	Hs1	N
LME-A-1S1	120	124.27	60	40.6	32	7.3	3	2
LME-A-1S2	240	244.27	180	40.6	32	7.3	3	4
LME-A-1S3	360	364.27	300	40.6	32	7.3	3	6
LME-A-2S1	120	123.18	60	60.6	52	7.3	3	2
LME-A-2S2	240	243.18	180	60.6	52	7.3	3	4
LME-A-2S3	360	363.18	300	60.6	52	7.3	3	6
LME-B-1S1	120	124.25	60	50.6	42	8.3	4	2
LME-B-1S2	180	184.25	120	50.6	42	8.3	4	3
LME-B-1S3	300	304.25	240	50.6	42	8.3	4	5
LME-B-2S1	120	122.53	60	80.6	72	8.3	4	2
LME-B-2S2	180	182.53	120	80.6	72	8.3	4	3
LME-B-2S3	300	302.53	240	80.6	72	8.3	4	5

■ Mounting tolerances



2.1.3 Order code of primary part (forcer)

Series	Type	Width of forcer	Length of forcer	Winding code	Thermal sensor	Cable type	Hall sensor	Cable length	Customized coding
LME	- A	- 2	2	- L	- 1	H	N	010	000
Linear motor	A: Pole pair pitch: 24	1: [A: 46 mm /	2: [A: 181 mm /	0: Standard	0: No thermal sensor	L: Low voltage version,	N: Without hall sensor	005: 0.5 M	000: Standard
	B: Pole pair pitch: 30	B: 56 mm)	B: 223 mm)	L: Low back EMF	1: PTC120	325 Vdc	A: Digital hall sensor	010: 1.0 M	001: Customized
		2: [A: 66 mm /	3: [B: 328 mm)		2: PT1000	H: High voltage version,		*0.1times and so on	serial number
		B: 86 mm)				600 Vdc (with UL)			

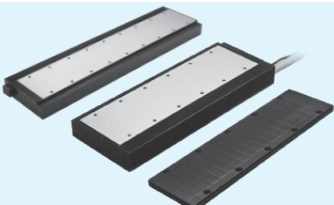
2.1.4 Order code of primary part (stator)

Series	Type	Width of forcer	Length of forcer	Magnet package	Customized coding
LME	A	1	S1	C	000
Linear motor	A: Pole pair pitch: 24	1: [A: 40.6 mm / B: 50.6 mm)	S1: [A&B: 120 mm)	N: No Epoxy or cover plate	000: Standard
	B: Pole pair pitch: 30	2: [A: 60.6 mm / B: 80.6 mm)	S2: [A: 240 mm / B: 180 mm)	packaging	001: Customized serial number
			S3: [A: 360 mm / B: 300 mm)	C: Cover plate	

2.2 **LMSA(-Z) Series**
Linear Motor

The LMSA is one of the best-selling linear drive products from HIWIN MIKROSYSTEM due to its high performance and cost effective price. With a low profile and compact design, LMSA provides the smallest volume and the largest force output. This optimizes the utilization rate of the design space of the mechanism.

The newly launched LMSA-Z series adopts the design of quick installation and anti-vibration connectors making the construction and maintenance of wiring more convenient. It's not only widely used in PCB, FPC, FPD, and LDI industries, but also for solar energy, digital printing and automation equipment.



- High dynamic response
- Low installation height
- UL and CE certifications
- Continuous force range from 52 N to 1579 N
- Peak force range from 112 N to 4458 N
- Installation height 34 mm, 36 mm

Force chart for LMSA series

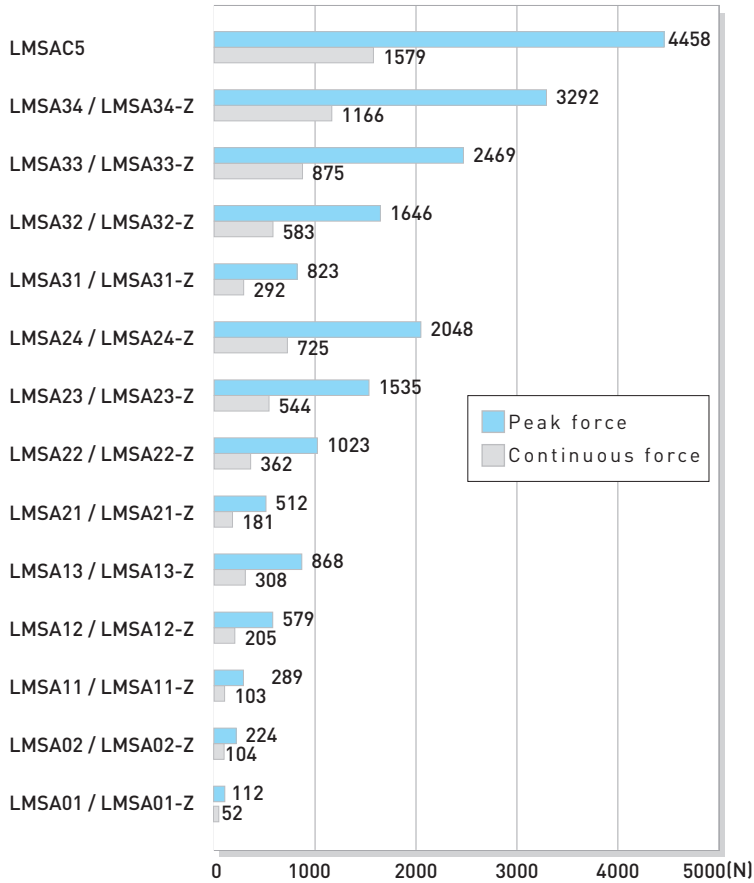


Table 2-2 LMSA/LMSA-Z Series specifications

	Symbol	Unit	LMSA01(-Z)	LMSA02(-Z)	LMSA11(-Z)	LMSA11L	LMSA12(-Z)	LMSA12L	LMSA13(-Z)	LMSA13L	LMSA21(-Z)	LMSA21L
Continuous force	F _c	N	52	104	103	103	205	205	308	308	181	181
Continuous current	I _c	A _{rms}	2.1	4.2	2.1	4.7	4.2	9.4	6.3	14.1	2.0	4.4
Peak force (1s)	F _p	N	112	224	289	289	579	579	868	868	512	512
Peak current (1s)	I _p	A _{rms}	6.3	12.6	6.3	14.1	12.7	28.3	19.0	42.4	5.9	13.1
Ultimate force (0.5s)	F _u	N	143	286	379	379	759	759	1138	1138	670	670
Ultimate current (0.5s)	I _u	A _{rms}	10.6	21.1	10.6	23.6	21.1	47.1	31.7	70.7	9.8	21.9
Force constant	K _f	N/A _{rms}	24.5	24.5	48.6	21.7	48.6	21.7	48.6	21.7	92.5	41.4
Attraction force	F _a	N	241	482	481	481	963	963	1444	1444	963	963
Maximum winding temperature	T _{max}	°C	120									
Electrical time constant	K _e	ms	3	3.74	4.4	4.3	4.5	4.1	4.4	4.0	4.6	4.6
Resistance (line to line, 25°C)	R ₂₅	Ω	6.2	3.1	8.4	1.7	4.1	0.9	2.8	0.6	13.8	2.8
Resistance (line to line, 120°C)	R ₁₂₀	Ω	8.5	4.3	11.6	2.3	5.7	1.2	3.9	0.8	19.0	3.9
Inductance (line to line)	L	mH	23	11.6	37.1	7.3	18.5	3.7	12.4	2.4	64.0	12.8
Pole pair pitch	2τ	mm	30									
Minimum bending radius of cable	R _{bend}	mm	69									
Back emf constant (line to line)	K _v	V _{rms} /[m/s]	14.2	14.2	28.1	12.6	28.1	12.6	28.1	12.6	53.4	23.9
Motor constant (25°C)	K _m	N/√W	8.1	11.5	13.7	13.6	19.6	18.7	23.7	22.9	20.3	20.2
Thermal resistance	R _{TH}	°C/W	1.69	0.83	1.23	1.23	0.63	0.63	0.41	0.41	0.87	0.87
Thermal time constant	t _{TH}	s	431	610	610	610	890	890	2290	2290	975	975
Thermal switch	-	-	3 PTC 120 In Series									
Maximum DC bus voltage	-	V _{DC}	750/(325V)									
Mass of forcer	M _f	kg	0.44	0.8	0.74	0.74	1.33	1.33	2.06	2.06	1.16	1.16
Unit mass of stator (cover/EA)	M _s	kg/m	1.54/1.74	1.54/1.74	2.59/2.7	2.59/2.7	2.59/2.7	2.59/2.7	2.59/2.7	2.59/2.7	4.53/4.8	4.53/4.8
Width of stator	W _s	mm	35.6	35.6	50.6	50.6	50.6	50.6	50.6	50.6	84.6	84.6
Length of stator/Dimension N	L _s	mm	120 mm/N=2, 180 mm/N=3, 300 mm/N=5									
Stator mounting distance	W _{s1}	mm	27	27	42	42	42	42	42	42	74	74
Total installation height	H	mm	34	34	34	34	34	34	34	34	34	34

Table 2-2 LMSA/LMSA-Z Series specifications

	Symbol	Unit	LMSA22 [-Z]	LMSA22L	LMSA23 [-Z]	LMSA23L	LMSA24 [-Z]	LMSA24L	LMSA31 [-Z]	LMSA31L	LMSA32 [-Z]
Continuous force	F _c	N	362	362	544	544	725	725	292	292	583
Continuous current	I _c	A _{rms}	3.9	8.8	5.9	13.1	7.8	17.5	2.0	4.5	4.0
Peak force (1s)	F _p	N	1023	1023	1535	1535	2048	2048	823	823	1646
Peak current (1s)	I _p	A _{rms}	11.8	26.3	17.6	39.4	23.5	52.5	6.0	13.4	12.0
Ultimate force (0.5s)	F _u	N	1341	1341	2011	2011	2682	2682	1079	1079	2157
Ultimate current (0.5s)	I _u	A _{rms}	19.6	43.8	29.4	65.7	39.2	87.6	10.0	22.3	20.0
Force constant	K _f	N/A _{rms}	92.5	41.4	92.5	41.4	92.5	41.4	145.8	65.2	145.8
Attraction force	F _a	N	1926	1926	2888	2888	3851	3851	1444	1444	2888
Maximum winding temperature	T _{max}	°C	120								
Electrical time constant	K _e	ms	4.9	4.6	4.9	4.8	4.6	4.7	4.9	4.9	4.9
Resistance (line to line, 25°C)	R ₂₅	Ω	6.8	1.4	4.6	0.9	3.5	0.7	19.2	4.0	9.6
Resistance (line to line, 120°C)	R ₁₂₀	Ω	9.4	1.9	6.3	1.2	4.8	0.9	26.5	5.5	13.2
Inductance (line to line)	L	mH	33.0	6.4	22.4	4.3	16.0	3.2	94.1	19.6	47.1
Pole pair pitch	2τ	mm	30								
Minimum bending radius of cable	R _{bend}	mm	69								
Back emf constant (line to line)	K _v	V _{rms} /(m/s)	53.4	23.9	53.4	23.9	53.4	23.9	84.2	37.7	84.2
Motor constant (25°C)	K _m	N/√W	28.9	28.6	35.2	35.6	40.6	40.8	27.2	26.6	38.4
Thermal resistance	R _{TH}	°C/W	0.44	0.44	0.29	0.29	0.22	0.22	0.60	0.60	0.30
Thermal time constant	t _{TH}	s	2540	2540	2670	2670	3270	3270	1440	1440	3060
Thermal switch	-	-	3 PTC 120 In Series								
Maximum DC bus voltage	-	V _{DC}	750/(325V)								
Mass of forcer	M _f	kg	2.23	2.23	3.35	3.35	4.3	4.3	1.79	1.79	3.21
Unit mass of stator (cover/EA)	M _s	kg/m	4.53/4.8	4.53/4.8	4.53/4.8	4.53/4.8	4.53/4.8	4.53/4.8	8.28/8.47	8.28/8.47	8.28/8.47
Width of stator	W _s	mm	84.6	84.6	84.6	84.6	84.6	84.6	114.6	114.6	114.6
Length of stator/Dimension N	L _s	mm	120 mm/N=2, 180 mm/N=3, 300 mm/N=5								
Stator mounting distance	W _{s1}	mm	74	74	74	74	74	74	104	104	104
Total installation height	H	mm	34	34	34	34	34	34	36	36	36

Note: 1. The data of this table are values without forced cooling.
2. Except dimensions, the electrical specifications are in ±10% of tolerance.
3. We reserve the right to change, please follow customer recognition drawings.

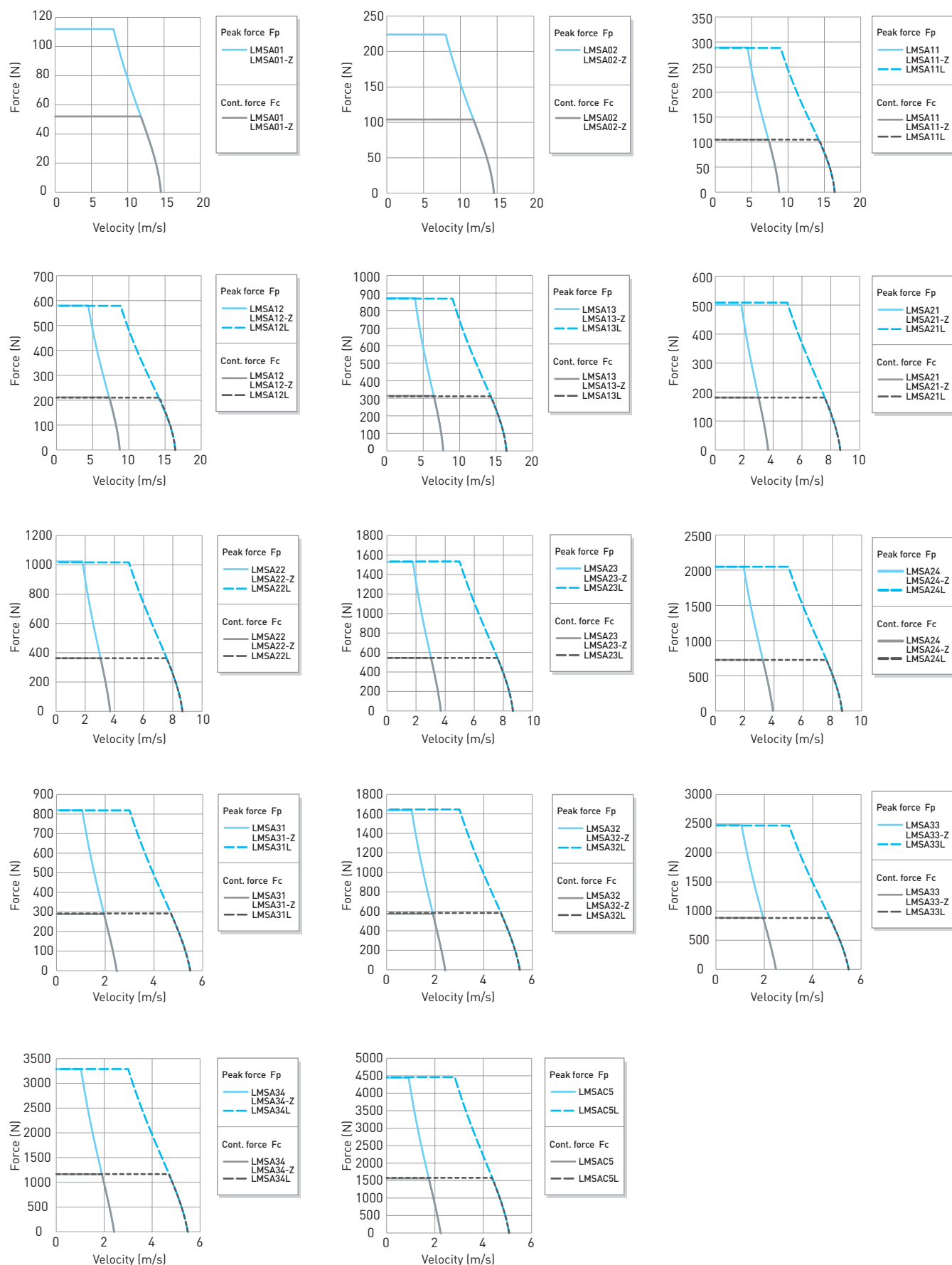
Table 2-2 LMSA/LMSA-Z Series specifications

	Symbol	Unit	LMSA32L	LMSA33(-Z)	LMSA33L	LMSA34(-Z)	LMSA34L	LMSAC5	LMSAC5L
Continuous force	F _c	N	583	875	875	1166	1166	1579	1579
Continuous current	I _c	A _{rms}	8.9	6.0	13.4	8.0	17.9	10.0	22.3
Peak force (1s)	F _p	N	1646	2469	2469	3292	3292	4458	4458
Peak current (1s)	I _p	A _{rms}	26.8	18.0	40.2	24.0	53.6	30.0	67.0
Ultimate force (0.5s)	F _u	N	2157	3236	3236	4314	4314	5842	5842
Ultimate current (0.5s)	I _u	A _{rms}	44.7	30.0	67.0	40.0	89.4	50.0	111.7
Force constant	K _f	N/A _{rms}	65.2	145.8	65.2	145.8	65.2	157.9	70.7
Attraction force	F _a	N	2888	4333	4333	5777	5777	7823	7823
Maximum winding temperature	T _{max}	°C	120						
Electrical time constant	K _e	ms	4.9	4.9	5.0	4.9	4.9	5.0	5.0
Resistance (line to line, 25°C)	R ₂₅	Ω	2.0	6.4	1.3	4.8	1.0	4.1	0.8
Resistance (line to line, 120°C)	R ₁₂₀	Ω	2.8	8.8	1.8	6.6	1.3	5.7	1.1
Inductance (line to line)	L	mH	9.8	31.3	6.5	23.5	4.9	20.3	4.1
Pole pair pitch	2τ	mm	30						
Minimum bending radius of cable	R _{bend}	mm	69						
Back emf constant (line to line)	K _v	V _{rms} /[m/s]	37.7	84.2	37.7	84.2	37.7	91.2	40.8
Motor constant (25°C)	K _m	N/√W	37.7	47.0	46.7	54.3	54.5	63.7	63.9
Thermal resistance	R _{TH}	°C/W	0.30	0.20	0.20	0.15	0.15	0.11	0.11
Thermal time constant	t _{TH}	s	3060	3480	3480	4800	4800	4530	4530
Thermal switch	-	-	3 PTC 120 In Series						
Maximum DC bus voltage	-	V _{DC}	750/(325V)						
Mass of forcer	M _f	kg	3.21	4.73	4.73	6.05	6.05	10.5	10.5
Unit mass of stator (cover/EA)	M _s	kg/m	8.28/8.47	8.28/8.47	8.28/8.47	8.28/8.47	8.28/8.47	9.02/9.7	9.02/9.7
Width of stator	W _s	mm	114.6	114.6	114.6	114.6	114.6	126	126
Length of stator/Dimension N	L _s	mm	120 mm/N=2, 180 mm/N=3, 300 mm/N=5						
Stator mounting distance	W _{s1}	mm	104	104	104	104	104	114	114
Total installation height	H	mm	36	36	36	36	36	36	36

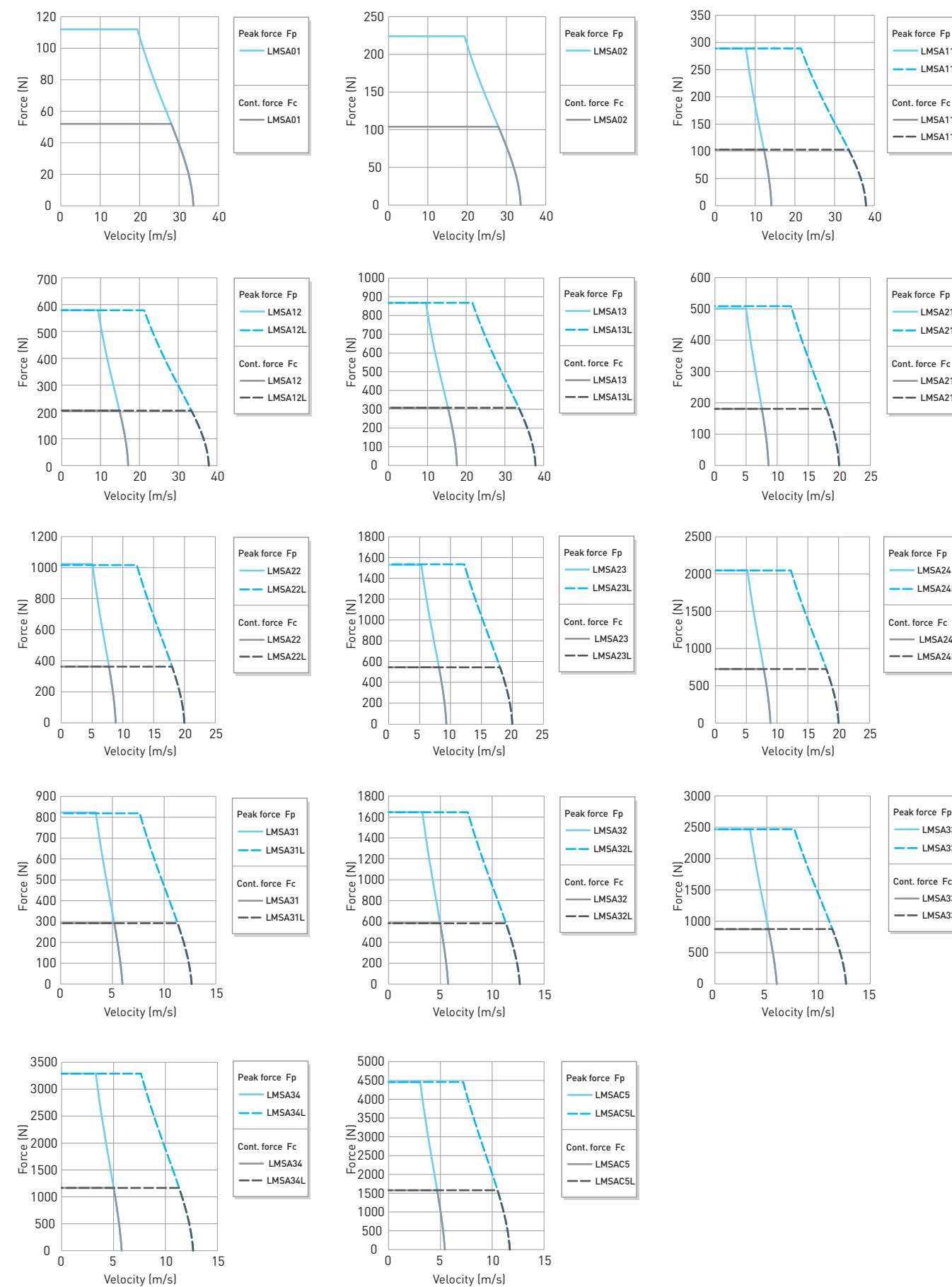
Note: 1. The data of this table are values without forced cooling.
2. Except dimensions, the electrical specifications are in ±10% of tolerance.
3. We reserve the right to change, please follow customer recognition drawings.

2.2.1 LMSA/LMSA-Z Series F-V curves

■ Force and velocity curves (DC bus voltage = 325 V_{DC})

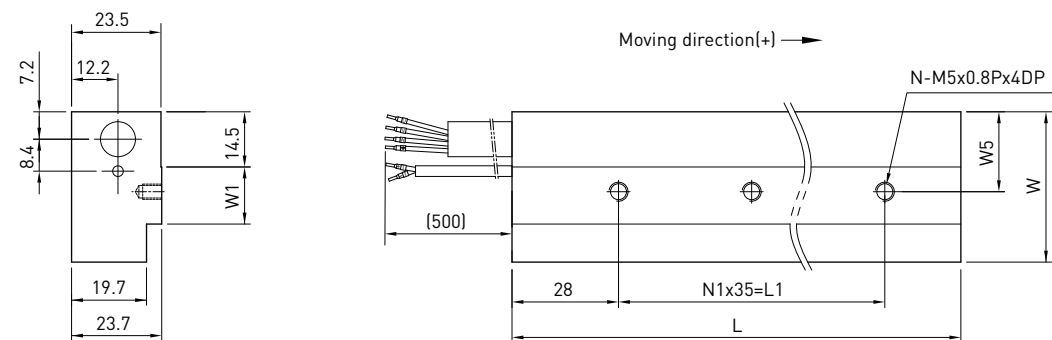


■ Force and velocity curves (DC bus voltage = 750 V_{DC})

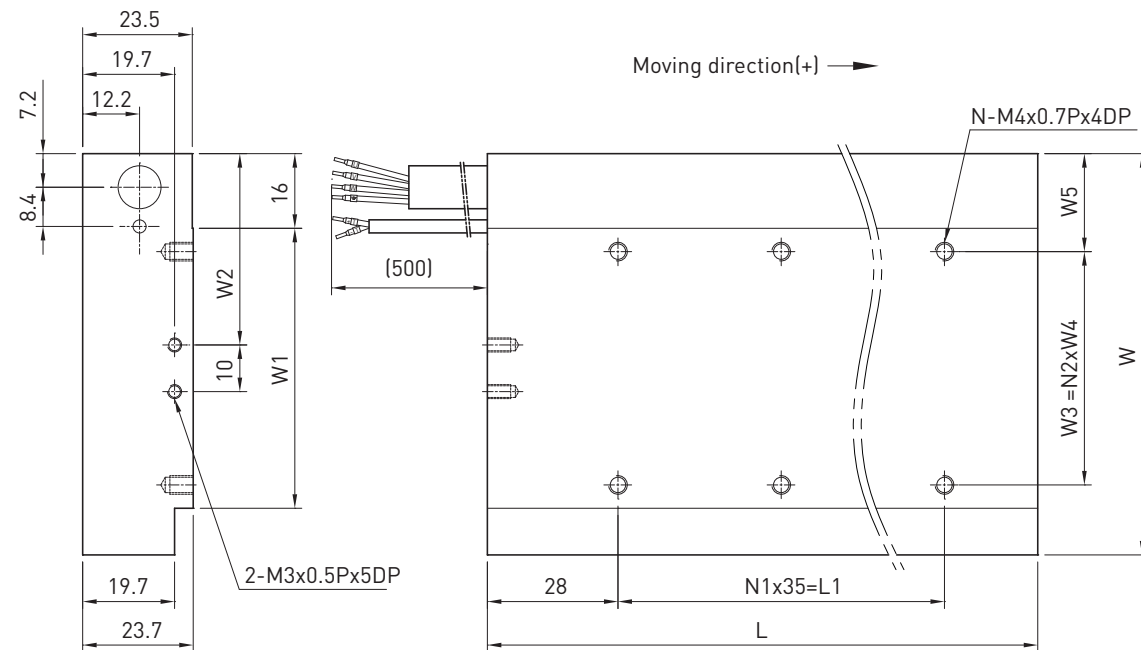


2.2.2 LMSA Series forcers and stators dimensions

■ Dimension of LMSA0 forcers

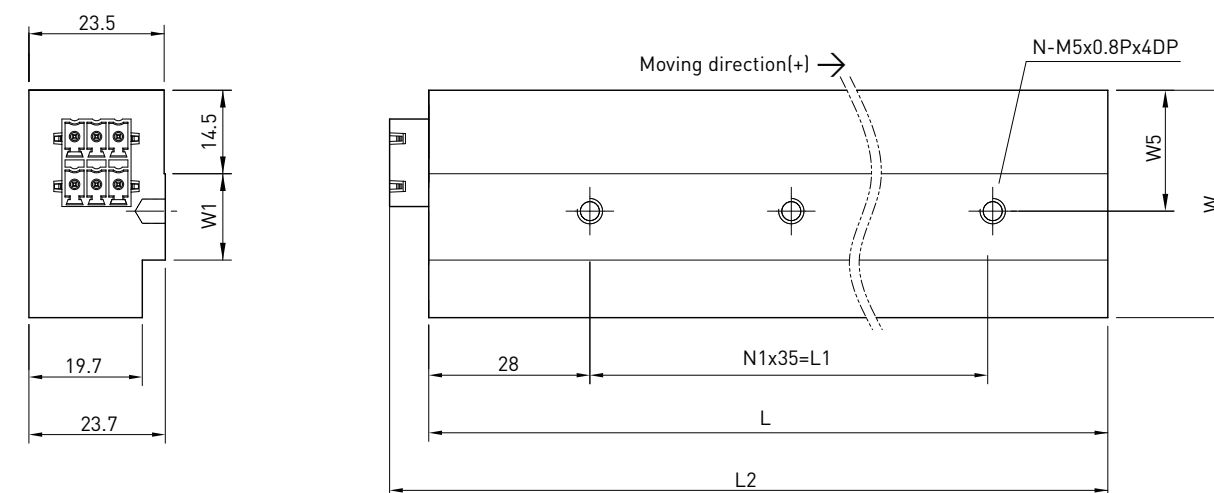


■ Dimension of LMSA1,2,3,C forcers

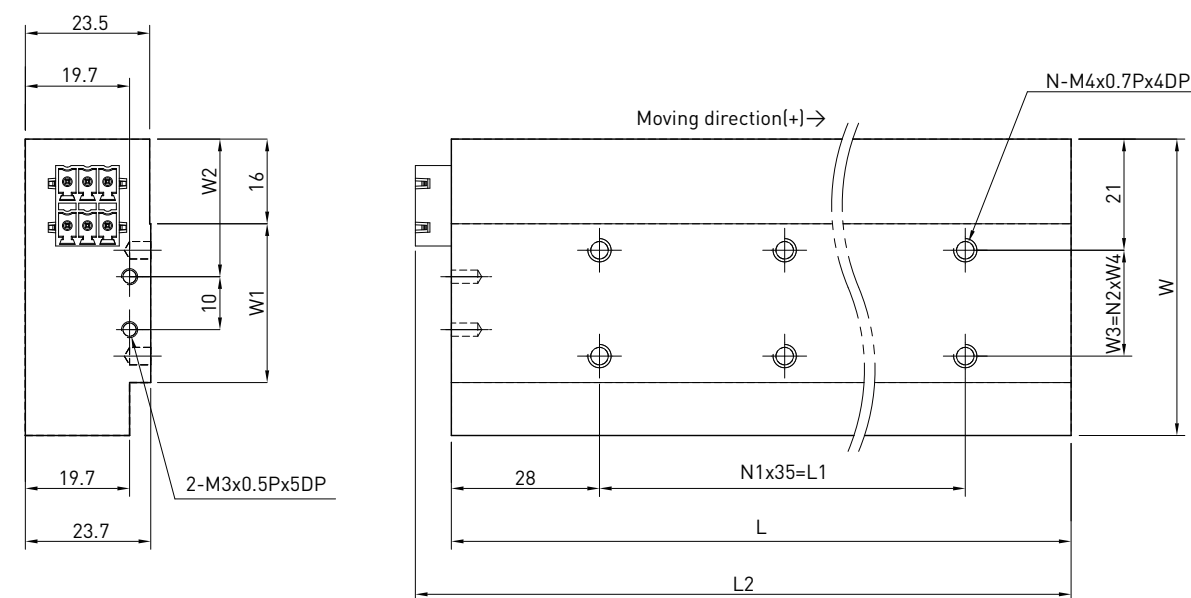


Type	L	L1	W	W1	W2	W3	W4	W5	N	N1	N2
LMSA01	118	70	39.5	15	-	-	-	22	3	2	-
LMSA02	223	175	39.5	15	-	-	-	22	6	5	-
LMSA11	118	70	56	30	26	20	20	21	6	2	1
LMSA12	223	175	56	30	26	20	20	21	12	5	1
LMSA13	328	280	56	30	26	20	20	21	18	8	1
LMSA21	118	70	86	60	41	50	50	21	6	2	1
LMSA22	223	175	86	60	41	50	50	21	12	5	1
LMSA23	328	280	86	60	41	50	50	21	18	8	1
LMSA24	433	385	86	60	41	50	50	21	24	11	1
LMSA31	118	70	116	90	56	80	40	21	9	2	2
LMSA32	223	175	116	90	56	80	40	21	18	5	2
LMSA33	328	280	116	90	56	80	40	21	27	8	2
LMSA34	433	385	116	90	56	80	40	21	36	11	2
LMSAC5	538	490	123.5	97.5	59.75	80	40	24.75	45	14	2

■ Dimension of LMSA0-Z

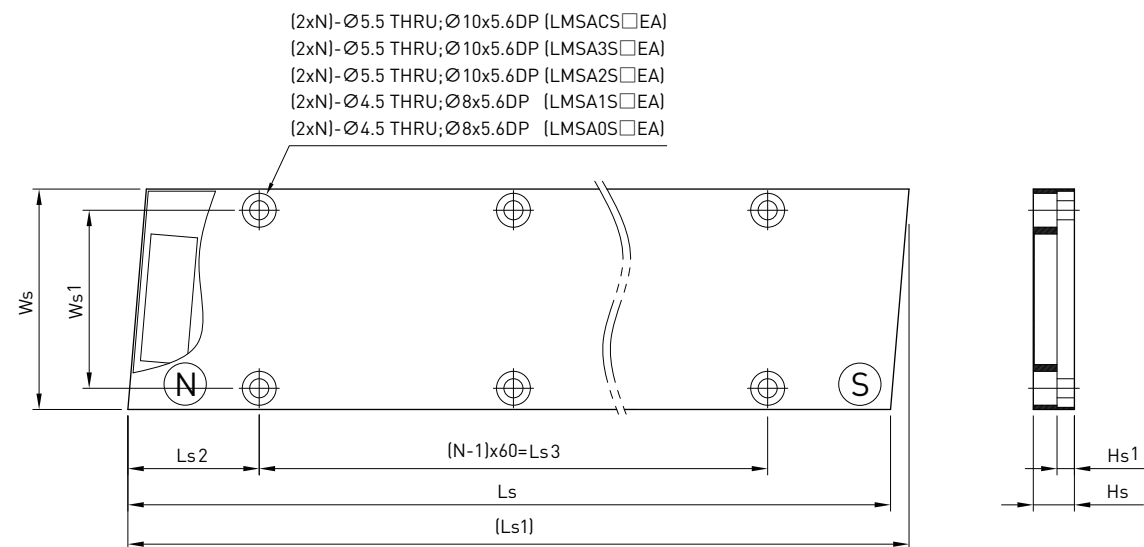
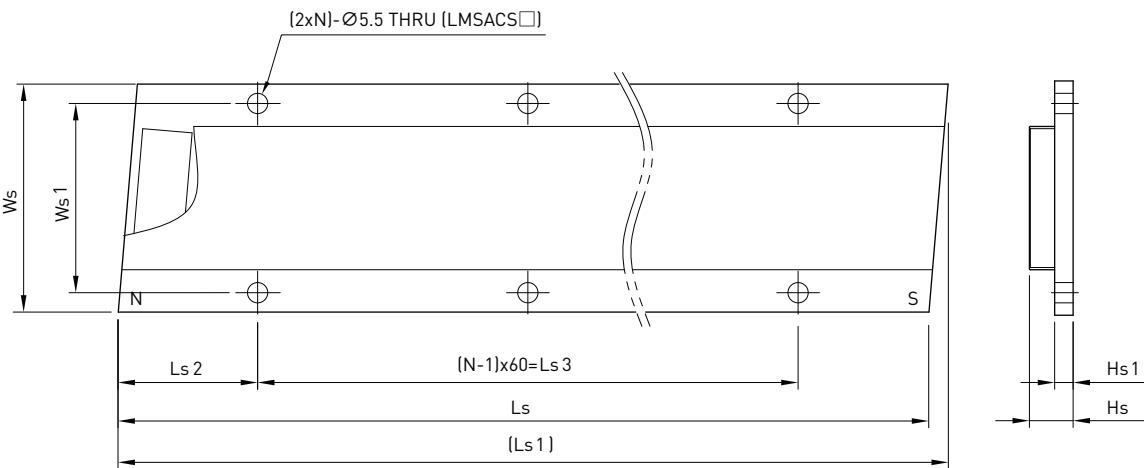
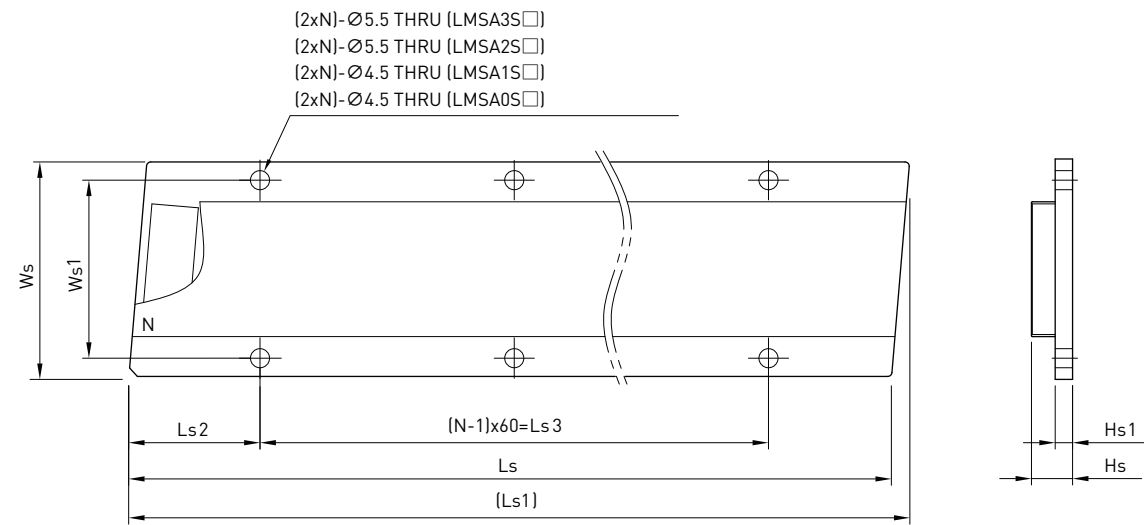


■ Dimension of LMSA1,2,3-Z



Type	L	L1	L2	W	W1	W2	W3	W4	N	N1	N2
LMSA01-Z	118	70	124.8	39.5	15	-	-	-	3	2	-
LMSA02-Z	223	175	229.8	39.5	15	-	-	-	6	5	-
LMSA11-Z	118	70	124.8	56	30	26	20	20	6	2	1
LMSA12-Z	223	175	229.8	56	30	26	20	20	12	5	1
LMSA13-Z	328	280	334.8	56	30	26	20	20	18	8	1
LMSA21-Z	118	70	124.8	86	60	41	50	50	6	2	1
LMSA22-Z	223	175	229.8	86	60	41	50	50	12	5	1
LMSA23-Z	328	280	334.8	86	60	41	50	50	18	8	1
LMSA24-Z	433	385	439.8	86	60	41	50	50	24	11	1
LMSA31-Z	118	70	124.8	116	90	56	80	40	9	2	2
LMSA32-Z	223	175	229.8	116	90	56	80	40	18	5	2
LMSA33-Z	328	280	334.8	116	90	56	80	40	27	8	2
LMSA34-Z	433	385	439.8	116	90	56	80	40	36	11	2

■ Dimension of stators

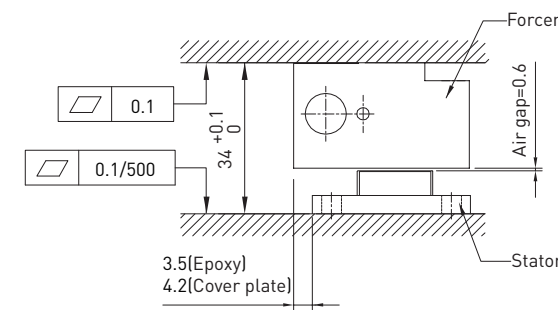


Type	Ls	Ls1	Ls2	Ls3	Ws	Ws1	Hs	Hs1	N
LMSA0S1(EA)	120	123.11	31	60	35.6(37)	27	9.7	4	2
LMSA0S2(EA)	180	183.11	31	120	35.6(37)	27	9.7	4	3
LMSA0S3(EA)	300	303.11	31	240	35.6(37)	27	9.7	4	5
LMSA1S1(EA)	120	124.36	31	60	50.6(52)	42	9.7	4	2
LMSA1S2(EA)	180	184.36	31	120	50.6(52)	42	9.7	4	3
LMSA1S3(EA)	300	304.36	31	240	50.6(52)	42	9.7	4	5
LMSA2S1(EA)	120	122.7	30.57	60	84.6(86)	74	9.7	4	2
LMSA2S2(EA)	180	182.7	30.57	120	84.6(86)	74	9.7	4	3
LMSA2S3(EA)	300	302.7	30.57	240	84.6(86)	74	9.7	4	5
LMSA3S1(EA)	120	123.04	30.37	60	114.6(116)	104	11.7	6	2
LMSA3S2(EA)	180	183.04	30.37	120	114.6(116)	104	11.7	6	3
LMSA3S3(EA)	300	303.04	30.37	240	114.6(116)	104	11.7	6	5
LMSACS1(EA)	120	123.3	30.37	60	126	114	11.7	6	2
LMSACS2(EA)	180	183.3	30.37	120	126	114	11.7	6	3
LMSACS3(EA)	300	303.3	30.37	240	126	114	11.7	6	5

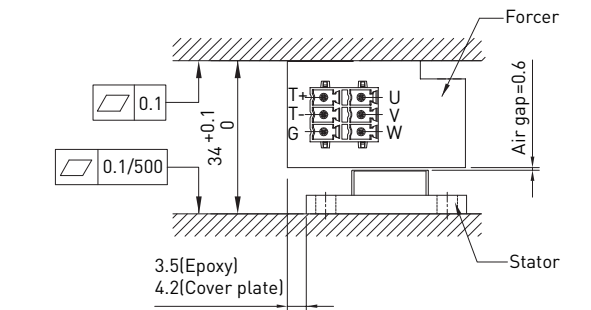
*Note: The dimension of the parentheses in Ws is for the EA version.

■ Mounting tolerances

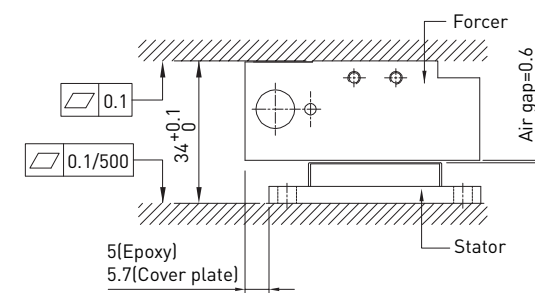
LMSA0 Series



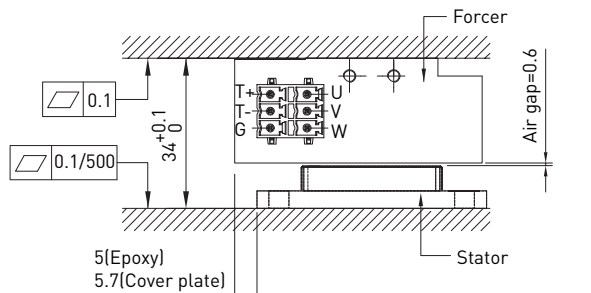
LMSA0-Z Series



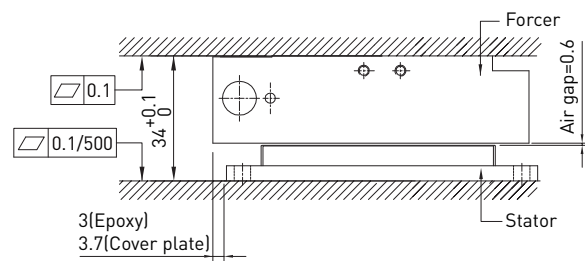
LMSA1 Series



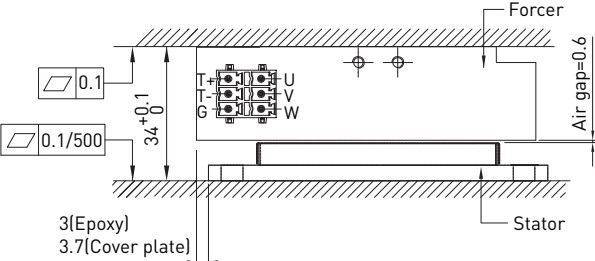
LMSA1-Z Series



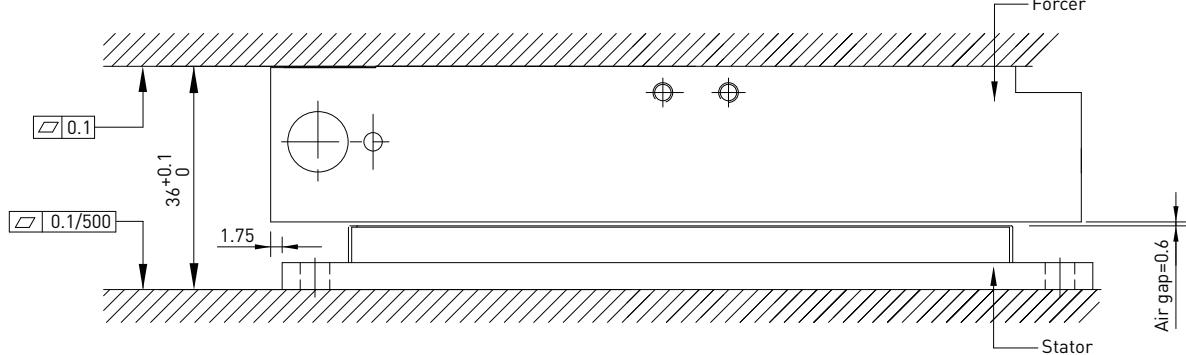
LMSA2 Series



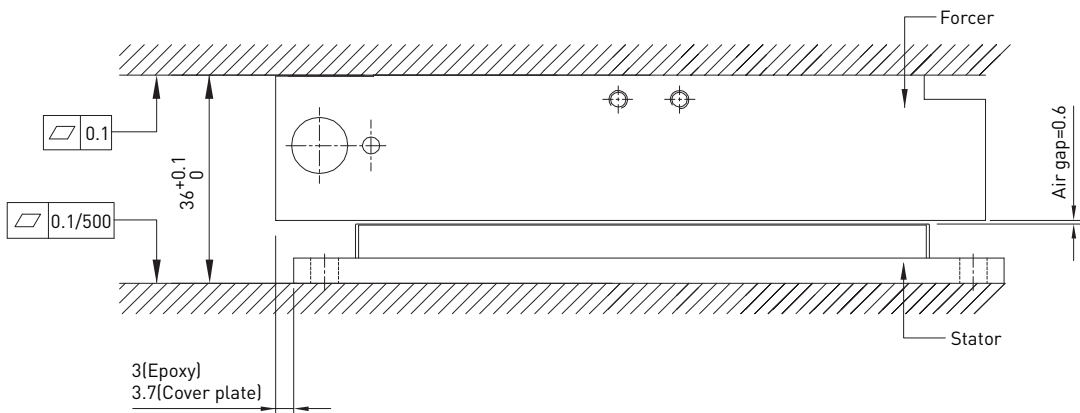
LMSA2-Z Series



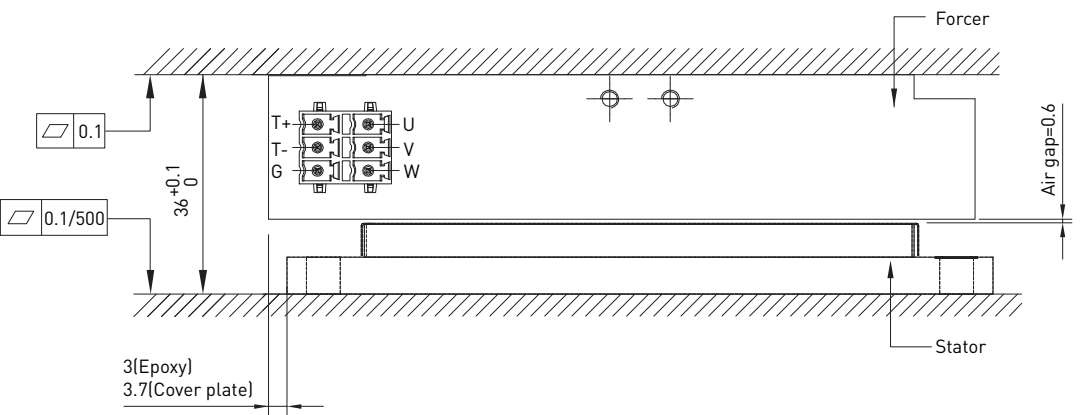
LMSAC Series



LMSA3 Series



LMSA3-Z Series



2.2.3 Order code of primary part (forcer)

Series	Type	Width of forcer	Length of forcer	Winding code
LM	SA	1	1	L
Linear motor	Linear motor type	0: 39.5 mm 1: 56 mm 2: 86 mm 3: 116 mm C: 123.5 mm	1: 118 mm 2: 223 mm 3: 328 mm 4: 433 mm 5: 538 mm	None: Standard L: Low back EMF

2.2.4 Order code of primary part (forcer)

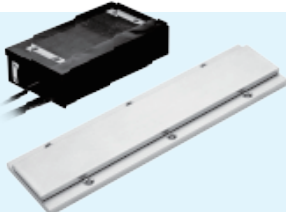
Series	Type	Width of forcer	Length of forcer	Winding code	No cable
LM	SA	1	1	-	Z
Linear motor	Linear motor type	0: 39.5 mm 1: 56 mm 2: 86 mm 3: 116 mm	1: 118 mm 2: 223 mm 3: 328 mm 4: 433 mm		

2.2.5 Order code of magnet track (stator)

Series	Type	Width of stator	Model	Length of forcer	Magnet package
LM	SA	1	S	1	EA
Linear motor	Linear motor type	0: 35.6/37 mm 1: 50.6/52 mm 2: 84.6/86 mm 3: 114.6/116 mm C: 126 mm	S: Standard C: Customize	1: 120 mm 2: 180 mm 3: 300 mm	EA: Epoxy None: Cover plate No cover: No Epoxy or cover plate packaging

2.3 **LMSS11**
Linear Motor

Application:
General automation, PCB, Inspection, Semiconductor

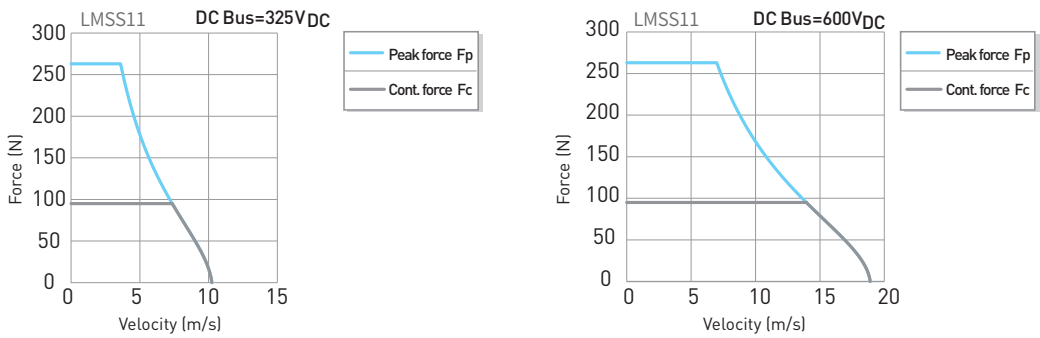


- Short length design to reduce stroke
- Optimized cogging force
- Insulation Class F
- UL and CE certification

Table 2-3 LMSS Series specifications			
	Symbol	Unit	LMSS11
Continuous force (@120°C)	Fc	N	95
Continuous current (@120°C)	Ic	A _{rms}	2.7
Peak force for 1 sec.	Fp	N	263
Peak current for 1 sec.	I _p	A _{rms}	10.8
Force constant	K _f	N/A(rms)	35
Attraction force	F _a	N	381.4
Max. winding temp.	T _{max}	°C	120
Electrical time constant	K _e	ms	3.8
Resistance (line to line at 25°C)	R ₂₅	Ω	6.2
Resistance (line to line at 120°C)	R ₁₂₀	Ω	8.1
Inductance (line to line)	L	mH	23.5
Pole pair pitch	2τ	mm	20
Minimum bending radius of cable	-	mm	39
Back emf constant (line to line)	K _v	Vrms/(m/s)	20.2
Motor constant (at 25°C)	K _m	N/√W	11.4
Thermal resistance	R _{th}	°C/W	1.1
Thermal time constant	T _{th}	s	375
Thermal switch	-	-	3 PTC 120 In Series
Max. DC bus voltage	-	V _{dc}	600
Mass of forcer	M _f	kg	0.6
Unit mass of stator	M _s	kg/m	1.7

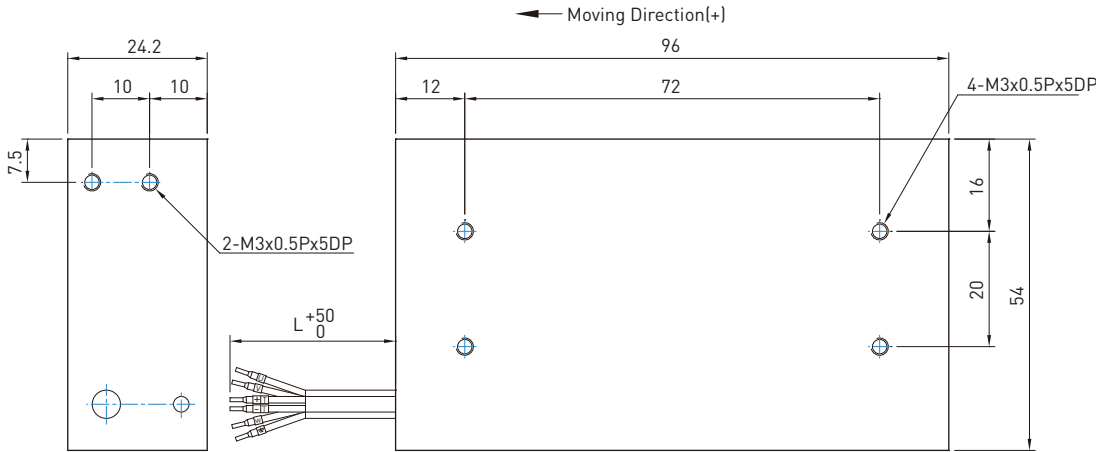
Note: All the electrical specifications in the table are in ±10% of tolerance.

2.3.1 F-V curves

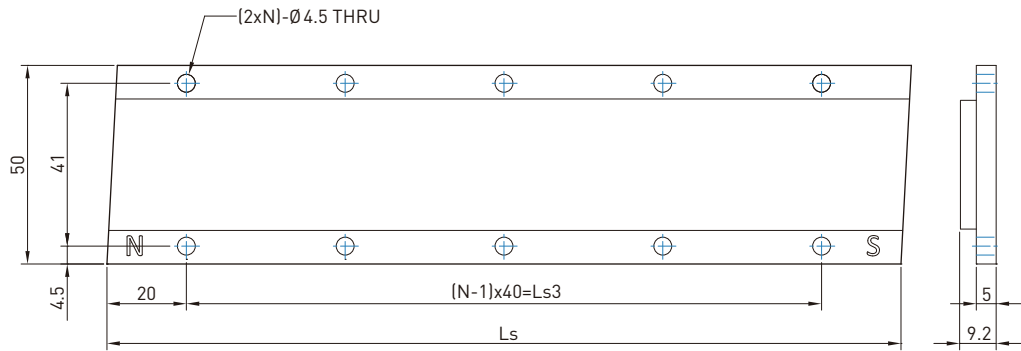


2.3.2 Product Dimension

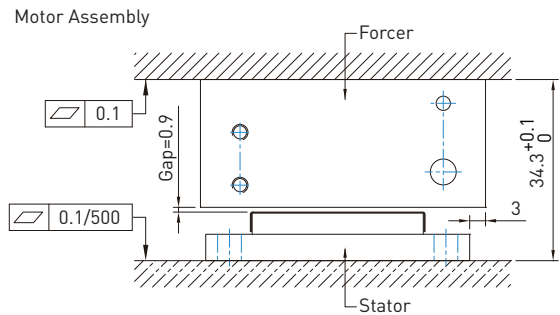
■ Dimensions of forcer



■ Dimensions of forcer



■ Dimensions of forcer



■ Dimensions of forcer

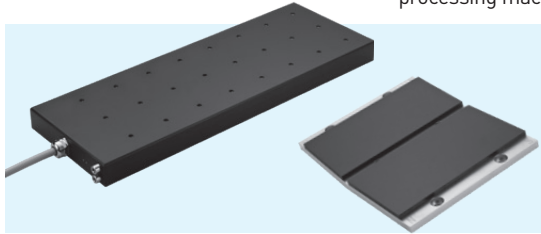
Type	Ls	Ls3	N
LMSS1S1	80	40	2
LMSS1S2	200	160	5

2.3.3 Model Description

	Series	Type	Width of forcer	Length of forcer
Forcer Primary part	LM	SS	1	1
	Linear motor	Linear motor type	1: 54 mm	1: 96 mm
	Series	Width of forcer	Type	Length of forcer
Stator Magnet track	LMSS	1	S	1
	Linear motor	1: 50 mm	Standard	1: 80 mm 2: 200 mm

2.4 LMFA Series Linear Motor

The HIWIN permanent magnet synchronous linear motor LMFA has a built-in water cooling system, with a special electromagnetic and thermal design. This motor has a high thrust density, and the maximum Peak force is up to 20,000 N. The three-phase motor is comprised of an iron core primary side (forcer) and a permanent magnet secondary side (stator). The forcer can use multiple units and can be infinitely extended, so motor moving stroke is not restricted. The LMFA series is widely used in the machine tool industry, laser processing machines, glass cutting machines and active vibration suppression platforms.



- Water-cooled design
- Ultrahigh thrust density
- UL and CE certification
- Water-cooled continuous force range from 149 N to 7,917 N
- Peak force range from 282 N to 20,827 N
- Installation height 48.5 mm, 50.5 mm, 64.1 mm, 66.1 mm

Force chart for LMFA series

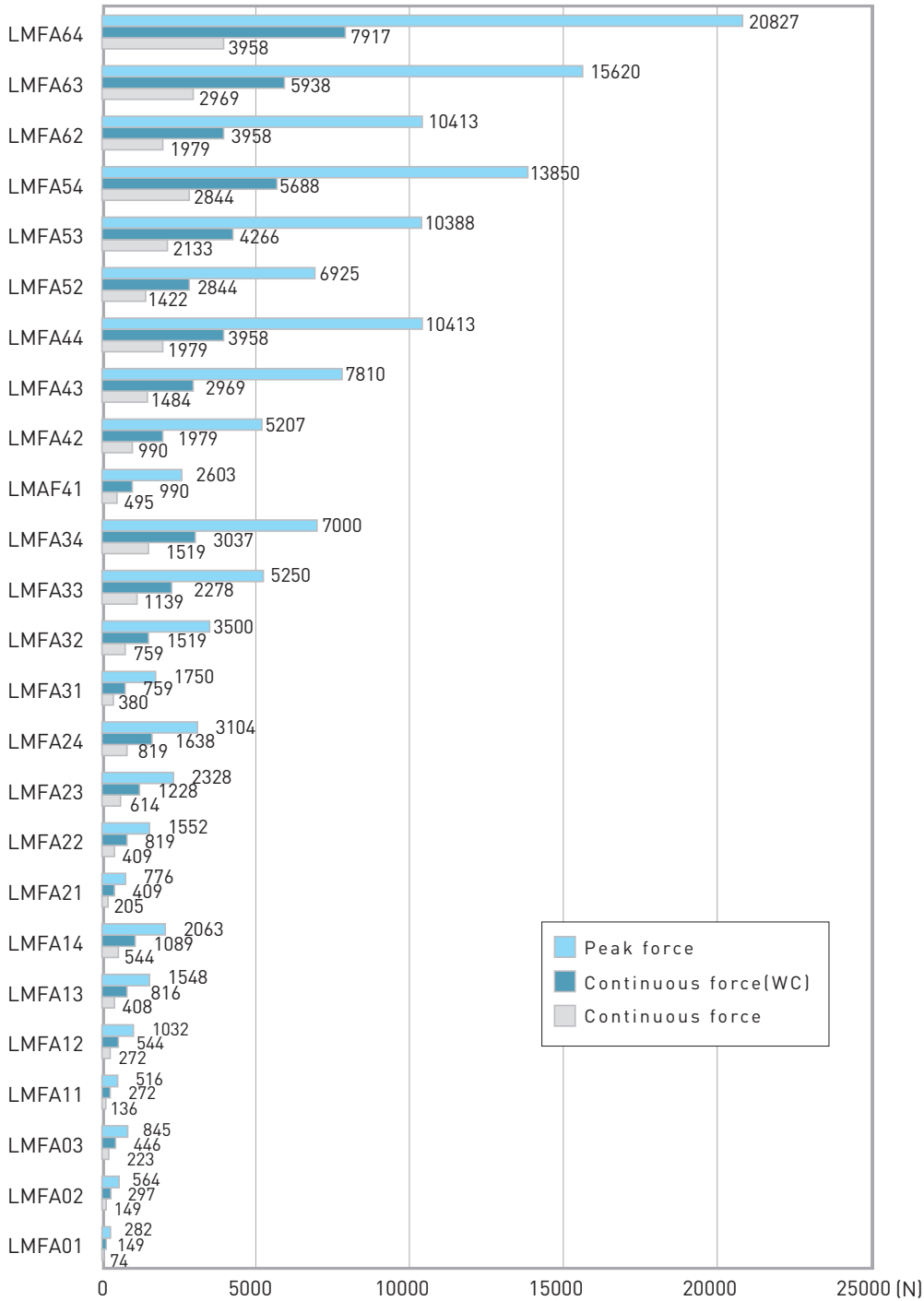


Table 2-4 LMFA Series specifications

	Symbol	Unit	LMFA01	LMFA01L	LMFA02	LMFA02L	LMFA03	LMFA03L	LMFA11	LMFA11L	LMFA12	LMFA12L	LMFA13	LMFA13L	LMFA14	LMFA14L
Continuous force	F_c	N	74	74	149	149	223	223	136	136	272	272	408	408	544	544
Continuous current	I_c	A _{rms}	1.4	1.8	2.7	3.6	4.1	5.5	1.4	1.8	2.7	3.6	4.0	5.5	5.4	7.3
Continuous force (WC)	$F_c(WC)$	N	149	149	297	297	446	446	272	272	544	544	816	816	1089	1089
Continuous current (WC)	$I_c(WC)$	A _{rms}	2.7	3.6	5.4	7.3	8.1	10.9	2.7	3.6	5.4	7.3	8.1	10.9	10.8	14.6
Peak force (1s)	F_p	N	282	282	564	564	845	845	516	516	1032	1032	1548	1548	2063	2063
Peak current (1s)	I_p	A _{rms}	8.4	11.3	16.7	22.6	25.1	33.9	8.4	11.3	16.7	22.6	25.1	33.9	33.5	45.2
Force constant	K_t	N/A _{rms}	55.1	40.8	55.1	40.8	55.1	40.8	100.8	74.6	100.8	74.6	100.8	74.6	100.8	74.6
Attraction force	F_a	N	457	457	914	914	1372	1372	837	837	1674	1674	2511	2511	3348	3348
Maximum winding temperature	T_{max}	°C	120													
Electrical time constant	K_s	ms	7.2	7.7	7.2	7.7	7.2	7.7	7.2	7.7	7.2	7.7	7.2	7.7	7.2	7.7
Resistance (line to line, 25°C)	R_{25}	Ω	11.7	6.0	5.9	3.0	3.9	2.0	16.9	8.7	8.4	4.3	5.6	2.9	4.2	2.2
Resistance (line to line, 120°C)	R_{120}	Ω	15.4	7.9	7.7	4.0	5.1	2.6	22.3	11.5	11.1	5.7	7.4	3.8	5.6	2.9
Inductance (line to line)	L	mH	84.2	46.2	42.1	23.1	28.1	15.4	121.9	66.8	60.9	33.4	40.6	22.3	30.5	16.7
Pole pair pitch	2τ	mm	30													
Minimum bending radius of cable	R_{bend}	mm	94													
Back emf constant (line to line)	K_v	V _{rms} /[m/s]	31.8	23.5	31.8	23.5	31.8	23.5	58.2	43.1	58.2	43.1	58.2	43.1	58.2	43.1
Motor constant	K_m	N/√W	13.1	13.6	18.6	19.2	22.8	23.5	20.0	20.7	28.3	29.2	34.7	35.8	40.1	41.4
Thermal resistance	R_{th}	°C/W	2.25	2.40	1.13	1.20	0.75	0.80	1.56	1.66	0.78	0.83	0.52	0.55	0.39	0.42
Thermal resistance (WC)	$R_{th(WC)}$	°C/W	0.56	0.60	0.28	0.30	0.19	0.20	0.39	0.42	0.20	0.21	0.13	0.14	0.10	0.10
Thermal time constant	t_{th}	s	150													
Minimum flow rate	-	L/min	3.3	3.3	3.3	3.3	3.3	3.3	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Temperature of cooling water	-	°C	20													
Pressure drop	ΔP	bar	0.54	0.54	0.82	0.82	1.1	1.1	0.75	0.75	1.21	1.21	1.67	1.67	2.13	2.13
Thermal switch	-	-	1 x Pt1000+1x(3 PTC 120 In Series)													
Maximum velocity at maximum force	$V_{MAX,FP}$	m/s	5.39	7.40	5.39	7.40	5.39	7.40	3.44	4.79	3.44	4.79	3.44	4.79	3.44	4.79
Maximum electric power input	$P_{EL,MAX}$	W	3140	3606	6280	7212	9421	10819	4115	4667	8231	9334	12346	13997	16461	18667
Maximum dissipated heat output	$Q_{PH,MAX}$	W	169	158	337	317	506	475	244	228	487	457	731	685	974	914
Stall force (WC)	F_0	N	104	104	208	208	312	312	191	191	381	381	571	571	762	762
Stall current (WC)	I_0	A _{rms}	1.9	2.6	3.8	5.1	5.7	7.7	1.9	2.6	3.8	5.1	5.7	7.7	7.6	10.2
Maximum DC bus voltage	-	V _{DC}	600													
Mass of forcer	M_f	kg	1.5	1.5	2.3	2.3	3.1	3.1	2.4	2.4	4	4	5.6	5.6	7.6	7.6
Unit mass of stator (cover/EA)	M_s	kg/m	3.8/3.7	3.8/3.7	3.8/3.7	3.8/3.7	3.8/3.7	3.8/3.7	6.1/5.7	6.1/5.7	6.1/5.7	6.1/5.7	6.1/5.7	6.1/5.7	6.1/5.7	6.1/5.7
Width of stator	W_s	mm	58	58	58	58	58	58	88	88	88	88	88	88	88	88
Length of stator/Dimension N	L_s	mm	120 mm/N=2, 180 mm/N=3, 300 mm/N=5													
Stator mounting distance	W_{s1}	mm	48	48	48	48	48	48	74	74	74	74	74	74	74	74
Total installation height	H	mm	48.5													

Note: 1. WC-water cooling
2. LMFA forcer is collocated with LMF stators.
3. Except dimensions,the electrical specifications are in ±10% of tolerance.
4. We reserve the right to change, please follow customer recognition drawings.

Table 2-4 LMFA Series specifications

	Symbol	Unit	LMFA21	LMFA21L	LMFA22	LMFA22L	LMFA23	LMFA23L	LMFA24	LMFA24L	LMFA31	LMFA31L	LMFA32	LMFA32L	LMFA33	LMFA33L
Continuous force	F _c	N	205	205	409	409	614	614	819	819	380	380	759	759	1139	1139
Continuous current	I _c	A _{rms}	1.4	1.8	2.7	3.6	4.1	5.5	5.4	7.3	3.1	4.6	6.2	9.1	9.3	13.7
Continuous force (WC)	F _c (WC)	N	409	409	819	819	1228	1228	1638	1638	759	759	1519	1519	2278	2278
Continuous current (WC)	I _c (WC)	A _{rms}	2.7	3.6	5.4	7.3	8.1	10.9	10.8	14.6	6.2	9.1	12.4	18.3	18.6	27.4
Peak force (1s)	F _p	N	776	776	1552	1552	2328	2328	3104	3104	1750	1750	3500	3500	5250	5250
Peak current (1s)	I _p	A _{rms}	8.4	11.3	16.7	22.6	25.1	33.9	33.5	45.2	19.2	28.3	38.4	56.6	57.5	84.9
Force constant	K _f	N/A _{rms}	151.6	112.2	151.6	112.2	151.6	112.2	151.6	112.2	122.7	83.1	122.7	83.1	122.7	83.1
Attraction force	F _a	N	1259	1259	2518	2518	3777	3777	5036	5036	3430	3430	6860	6860	10290	10290
Maximum winding temperature	T _{max}	°C	120													
Electrical time constant	K _e	ms	7.2	7.7	7.2	7.7	7.2	7.7	7.2	7.7	11.3	11.4	11.3	11.4	11.3	11.4
Resistance (line to line, 25°C)	R ₂₅	Ω	24.8	12.7	12.4	6.4	8.3	4.2	6.2	3.2	4.3	1.9	2.1	1.0	1.4	0.6
Resistance (line to line, 120°C)	R ₁₂₀	Ω	32.7	16.8	16.4	8.4	10.9	5.6	8.2	4.2	5.6	2.6	2.8	1.3	1.9	0.9
Inductance (line to line)	L	mH	178.6	97.8	89.3	48.9	59.5	32.6	44.6	24.5	48.3	22.2	24.2	11.1	16.1	7.4
Pole pair pitch	2τ	mm	30								46					
Minimum bending radius of cable	R _{bend}	mm	94								113					
Back emf constant (line to line)	K _v	V _{rms} /(m/s)	87.5	64.8	87.5	64.8	87.5	64.8	87.5	64.8	70.9	48.0	70.9	48.0	70.9	48.0
Motor constant	K _m	N/√W	24.9	25.7	35.2	36.3	43.1	44.5	49.7	51.3	48.4	48.7	68.5	68.9	83.9	84.4
Thermal resistance	R _{TH}	°C/W	1.06	1.13	0.53	0.57	0.35	0.38	0.27	0.28	1.17	1.19	0.59	0.59	0.39	0.40
Thermal resistance (WC)	R _{TH} (WC)	°C/W	0.27	0.28	0.13	0.14	0.09	0.09	0.07	0.07	0.29	0.30	0.15	0.15	0.10	0.10
Thermal time constant	t _{TH}	s	150													
Minimum flow rate	-	L/min	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	5.2	5.2	5.7	5.7
Temperature of cooling water	-	°C	20													
Pressure drop	△P	bar	1.15	1.15	1.83	1.83	2.5	2.5	3.18	3.18	0.57	0.57	0.74	0.74	0.98	0.98
Thermal switch	-	-	1 x Pt1000+1x{3 PTC 120 In Series}													
Maximum velocity at maximum force	V _{MAX,FP}	m/s	2.21	3.14	2.21	3.14	2.21	3.14	2.21	3.14	4.08	6.19	4.08	6.19	4.08	6.19
Maximum electric power input	P _{EL,MAX}	W	5152	5661	10304	11321	15455	16982	20607	22643	10255	13910	20509	27821	30764	41731
Maximum dissipated heat output	Q _{P,H,MAX}	W	358	336	715	671	1073	1007	1431	1342	324	320	648	641	972	961
Stall force (WC)	F ₀	N	287	287	573	573	860	860	1146	1146	531	531	1063	1063	1594	1594
Stall current (WC)	I ₀	A _{rms}	1.9	2.6	3.8	5.1	5.7	7.7	7.6	10.2	4.3	6.4	8.7	12.8	13.0	19.2
Maximum DC bus voltage	-	V _{DC}	600													
Mass of forcer	M _f	kg	3.2	3.2	5.5	5.5	8	8	10.4	10.4	6.4	6.4	11.7	11.7	17.3	17.3
Unit mass of stator (cover/EA)	M _s	kg/m	10.2/9.3	10.2/9.3	10.2/9.3	10.2/9.3	10.2/9.3	10.2/9.3	10.2/9.3	10.2/9.3	14.3/16.3	14.3/16.3	14.3/16.3	14.3/16.3	14.3/16.3	14.3/16.3
Width of stator	W _s	mm	118	118	118	118	118	118	118	118	134	134	134	134	134	134
Length of stator/Dimension N	L _s	mm	120 mm/N=2, 180 mm/N=3, 300 mm/N=5								184 mm/N=2, 276 mm/N=3, 460 mm/N=5					
Stator mounting distance	W _{s1}	mm	104	104	104	104	104	104	104	104	115	115	115	115	115	115
Total installation height	H	mm	50.5	50.5	50.5	50.5	50.5	50.5	50.5	50.5	64.1	64.1	64.1	64.1	64.1	64.1

Note: 1. WC-water cooling
2. LMFA forcer is collocated with LMF stators.
3. Except dimensions,the electrical specifications are in ±10% of tolerance.
4. We reserve the right to change, please follow customer recognition drawings.

Table 2-4 LMFA Series specifications

	Symbol	Unit	LMFA34	LMFA34L	LMFA41	LMFA41L	LMFA42	LMFA42L	LMFA43	LMFA43L	LMFA44	LMFA44L	LMFA52	LMFA52L	LMFA53	LMFA53L
Continuous force	F _c	N	1519	1519	495	495	990	990	1484	1484	1979	1979	1422	1422	2133	2133
Continuous current	I _c	A _{rms}	12.4	18.3	2.9	4.3	5.8	8.5	8.7	12.8	11.5	17.0	6.2	9.1	9.3	13.7
Continuous force (WC)	F _c (WC)	N	3037	3037	990	990	1979	1979	2969	2969	3958	3958	2844	2844	4266	4266
Continuous current (WC)	I _c (WC)	A _{rms}	24.7	36.5	5.8	8.5	11.5	17.0	17.3	25.6	23.1	34.1	12.4	18.3	18.6	27.4
Peak force (1s)	F _p	N	7000	7000	2603	2603	5207	5207	7810	7810	10413	10413	6925	6925	10388	10388
Peak current (1s)	I _p	A _{rms}	76.7	113.3	17.9	26.4	35.8	52.9	53.5	79.3	71.6	105.7	38.4	56.6	57.5	84.9
Force constant	K _f	N/A _{rms}	122.7	83.1	171.4	116.1	171.4	116.1	171.4	116.1	171.4	116.1	229.9	155.7	229.9	155.7
Attraction force	F _a	N	13720	13720	5145	5145	10290	10290	15435	15435	20580	20580	13700	13700	20550	20550
Maximum winding temperature	T _{max}	°C	120													
Electrical time constant	K _e	ms	11.3	11.4	12.0	12.1	12.0	12.1	12.0	12.1	12.0	12.1	12.2	12.4	12.2	12.4
Resistance (line to line, 25°C)	R ₂₅	Ω	1.1	0.5	6.0	2.7	3.0	1.4	2.0	0.9	1.5	0.7	3.9	1.8	2.6	1.2
Resistance (line to line, 120°C)	R ₁₂₀	Ω	1.4	0.6	7.9	3.6	4.0	1.8	2.6	1.2	2.0	0.9	5.1	2.3	3.4	1.6
Inductance (line to line)	L	mH	12.1	5.5	72.0	33.0	36.0	16.5	24.0	11.0	18.0	8.3	47.7	21.9	31.8	14.6
Pole pair pitch	2τ	mm	46													
Minimum bending radius of cable	R _{bend}	mm	113	128	94	94	94	94	113	113	128	94	94	113	113	113
Back emf constant (line to line)	K _v	V _{rms} /(m/s)	70.9	48.0	98.9	67.0	98.9	67.0	98.9	67.0	98.9	67.0	132.7	89.9	132.7	89.9
Motor constant	K _m	N/√W	96.9	97.4	57.1	57.5	80.8	81.3	98.9	99.5	114.2	114.9	95.0	95.6	116.4	117.1
Thermal resistance	R _{TH}	°C/W	0.29	0.30	0.96	0.97	0.48	0.49	0.32	0.32	0.24	0.24	0.32	0.33	0.21	0.22
Thermal resistance (WC)	R _{TH} (WC)	°C/W	0.07	0.07	0.24	0.24	0.12	0.12	0.08	0.08	0.06	0.06	0.08	0.08	0.05	0.05
Thermal time constant	t _{TH}	s	150													
Minimum flow rate	-	L/min	6.2	6.2	5.2	5.2	5.2	5.2	5.7	5.7	6.2	6.2	6.3	6.3	6.8	6.8
Temperature of cooling water	-	°C	20													
Pressure drop	△P	bar	1.28	1.28	0.89	0.89	1.17	1.17	1.45	1.45	1.8	1.8	1.25	1.25	1.77	1.77
Thermal switch	-	-	1 x Pt1000+1x{3 PTC 120 In Series}													
Maximum velocity at maximum force	V _{MAX,FP}	m/s	4.08	6.19	2.61	4.01	2.61	4.01	2.61	4.01	2.61	4.01	1.92	3.04	1.92	3.04
Maximum electric power input	P _{EL,MAX}	W	41019	55642	10598	14198	21197	28396	31691	42594	42393	56792	24645	32267	36967	48400
Maximum dissipated heat output	Q _{P,H,MAX}	W	1296	1281	396	391	792	782	1187	1173	1583	1565	1181	1167	1771	1751
Stall force (WC)	F ₀	N	2126	2126	693	693	1385	1385	2078	2078	2771	2771	1991	1991	2986	2986
Stall current (WC)	I ₀	A _{rms}	17.3	25.6	4.0	6.0	8.1	11.9	12.1	17.9	16.2	23.9	8.7	12.8	13.0	19.2
Maximum DC bus voltage	-	V _{DC}	600													
Mass of forcer	M _f	kg	22.5	22.5	9.5	9.5	16.2	16.2	23	23	29	29	23.8	23.8	32.3	32.3
Unit mass of stator (cover/EA)	M _s	kg/m	14.3/16.3	14.3/16.3	22.8/22.1	22.8/22.1	22.8/22.1	22.8/22.1	22.8/22.1	22.8/22.1	22.8/22.1	22.8/22.1	-/25.6	-/25.6	-/25.6	-/25.6
Width of stator	W _s	mm	134	134	180	180	180	180	180	180	180	180	240	240	240	240
Length of stator/Dimension N	L _s	mm	184 mm/N=2, 276 mm/N=3, 460 mm/N=5													
Stator mounting distance	W _{s1}	mm	115	115	161	161	161	161	161	161	161	161	222	222	222	222
Total installation height	H	mm	64.1	64.1	66.1	66.1	66.1	66.1	66.1	66.1	66.1	66.1	64.1	64.1	64.1	64.1

Note: 1. WC-water cooling
2. LMFA forcer is collocated with LMF stators.
3. Except dimensions,the electrical specifications are in ±10% of tolerance.
4. We reserve the right to change, please follow customer recognition drawings.

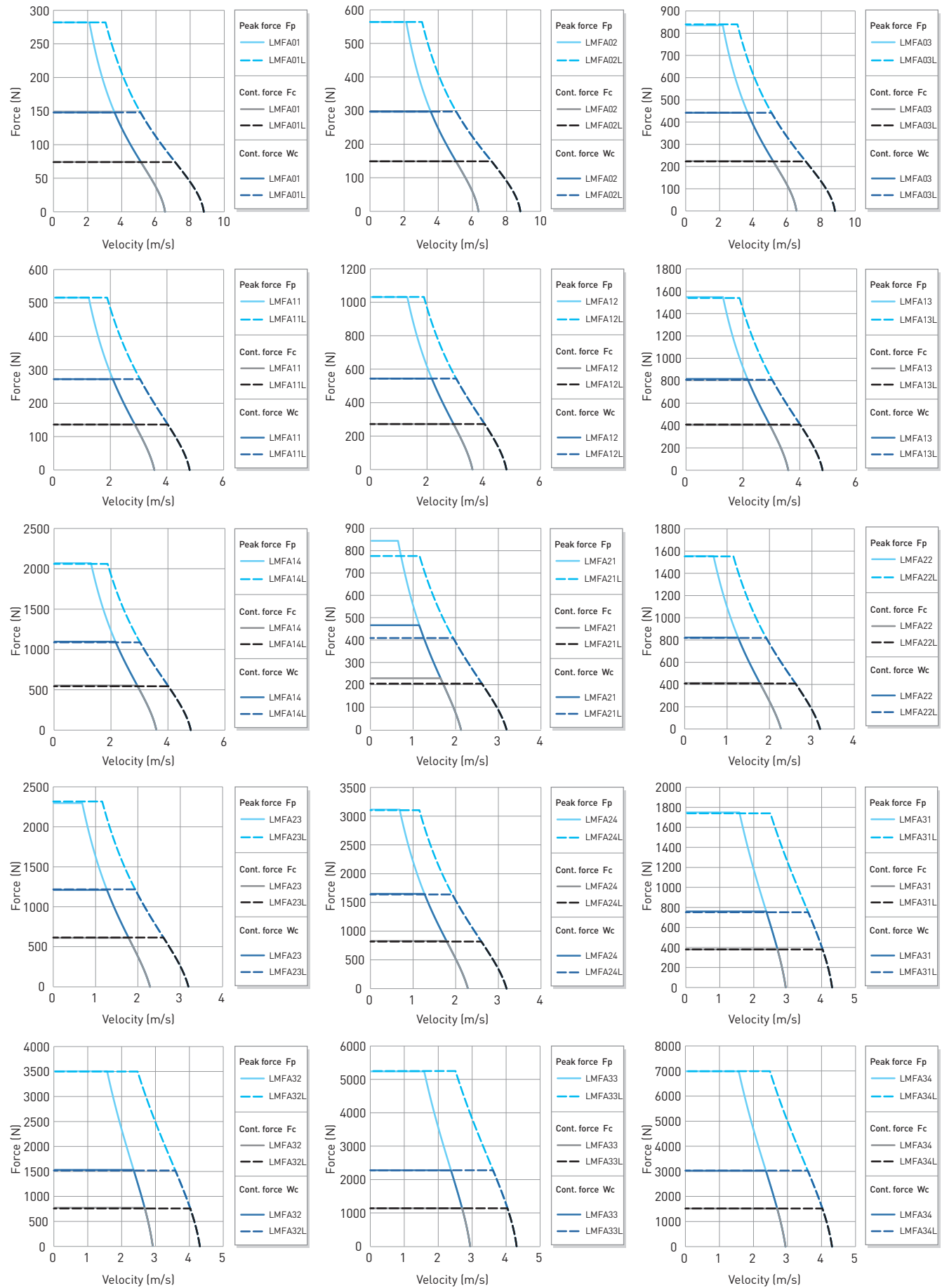
Table 2-4 LMFA Series specifications

	Symbol	Unit	LMFA54	LMFA54L	LMFA62	LMFA62L	LMFA63	LMFA63L	LMFA64	LMFA64L
Continuous force	F_c	N	2844	2844	1979	1979	2969	2969	3958	3958
Continuous current	I_c	A_{rms}	12.4	18.3	5.8	11.5	8.7	17.3	11.5	23.1
Continuous force (WC)	$F_c(WC)$	N	5688	5688	3958	3958	5938	5938	7917	7917
Continuous current (WC)	$I_c(WC)$	A_{rms}	24.7	36.5	11.5	23.1	17.3	34.6	23.1	46.2
Peak force (1s)	F_p	N	13850	13850	10413	10413	15620	15620	20827	20827
Peak current (1s)	I_p	A_{rms}	76.7	113.2	35.8	71.6	53.7	107.4	71.3	142.6
Force constant	K_f	N/A_{rms}	229.9	155.7	342.7	171.4	342.7	171.4	342.7	171.4
Attraction force	F_a	N	27400	27400	20580	20580	30870	30870	41160	41160
Maximum winding temperature	T_{max}	°C	120							
Electrical time constant	K_e	ms	12.2	12.4	12.0	12.0	12.0	12.0	12.0	12.0
Resistance (line to line, 25°C)	R_{25}	Ω	2.0	0.9	6.0	1.5	4.0	1.0	3.0	0.8
Resistance (line to line, 120°C)	R_{120}	Ω	2.6	1.2	7.9	2.0	5.3	1.3	4.0	1.0
Inductance (line to line)	L	mH	23.9	10.9	72.0	18.0	48.0	12.0	36.0	9.0
Pole pair pitch	2τ	mm	46							
Minimum bending radius of cable	R_{bend}	mm	113	128	113	113	113	128	113	150
Back emf constant (line to line)	K_v	$V_{rms}/(m/s)$	132.7	89.9	197.9	98.9	197.9	98.9	197.9	98.9
Motor constant	K_m	$N/\sqrt{W}$	134.4	135.2	114.2	114.2	139.9	139.9	161.6	161.6
Thermal resistance	R_{TH}	°C/W	0.16	0.16	0.24	0.24	0.16	0.16	0.12	0.12
Thermal resistance (WC)	$R_{TH}(WC)$	°C/W	0.04	0.04	0.06	0.06	0.04	0.04	0.03	0.03
Thermal time constant	t_{TH}	s	150							
Minimum flow rate	-	L/min	7.3	7.3	6.8	6.8	7.3	7.3	7.8	7.8
Temperature of cooling water	-	°C	20							
Pressure drop	ΔP	bar	2.3	2.3	1.64	1.64	2.25	2.25	3	3
Thermal switch	-	-	1 x Pt1000+1x[3 PTC 120 In Series]							
Maximum velocity at maximum force	$V_{MAX,FP}$	m/s	1.92	3.04	1.12	2.61	1.12	2.61	1.12	2.61
Maximum electric power input	$P_{EL,MAX}$	W	49290	64534	26878	42393	40316	63590	53478	84510
Maximum dissipated heat output	$Q_{PJH,MAX}$	W	2362	2334	1583	1583	2375	2375	3166	3166
Stall force (WC)	F_0	N	3982	3982	2771	2771	4156	4156	5542	5542
Stall current (WC)	I_0	A_{rms}	17.3	25.6	8.1	16.2	12.1	24.3	16.2	32.3
Maximum DC bus voltage	-	V_{DC}	600							
Mass of forcer	M_f	kg	40.8	40.8	32.2	32.2	44.2	44.2	56.2	56.2
Unit mass of stator (cover/EA)	M_s	kg/m	-/25.6	-/25.6	-/41.8	-/41.8	-/41.8	-/41.8	-/41.8	-/41.8
Width of stator	W_s	mm	240	240	334	334	334	334	334	334
Length of stator/Dimension N	L_s	mm	184 mm/N=2, 276 mm/N=3, 460 mm/N=5							
Stator mounting distance	W_{s1}	mm	222	222	316	316	316	316	316	316
Total installation height	H	mm	64.1	64.1	66.1	66.1	66.1	66.1	66.1	66.1

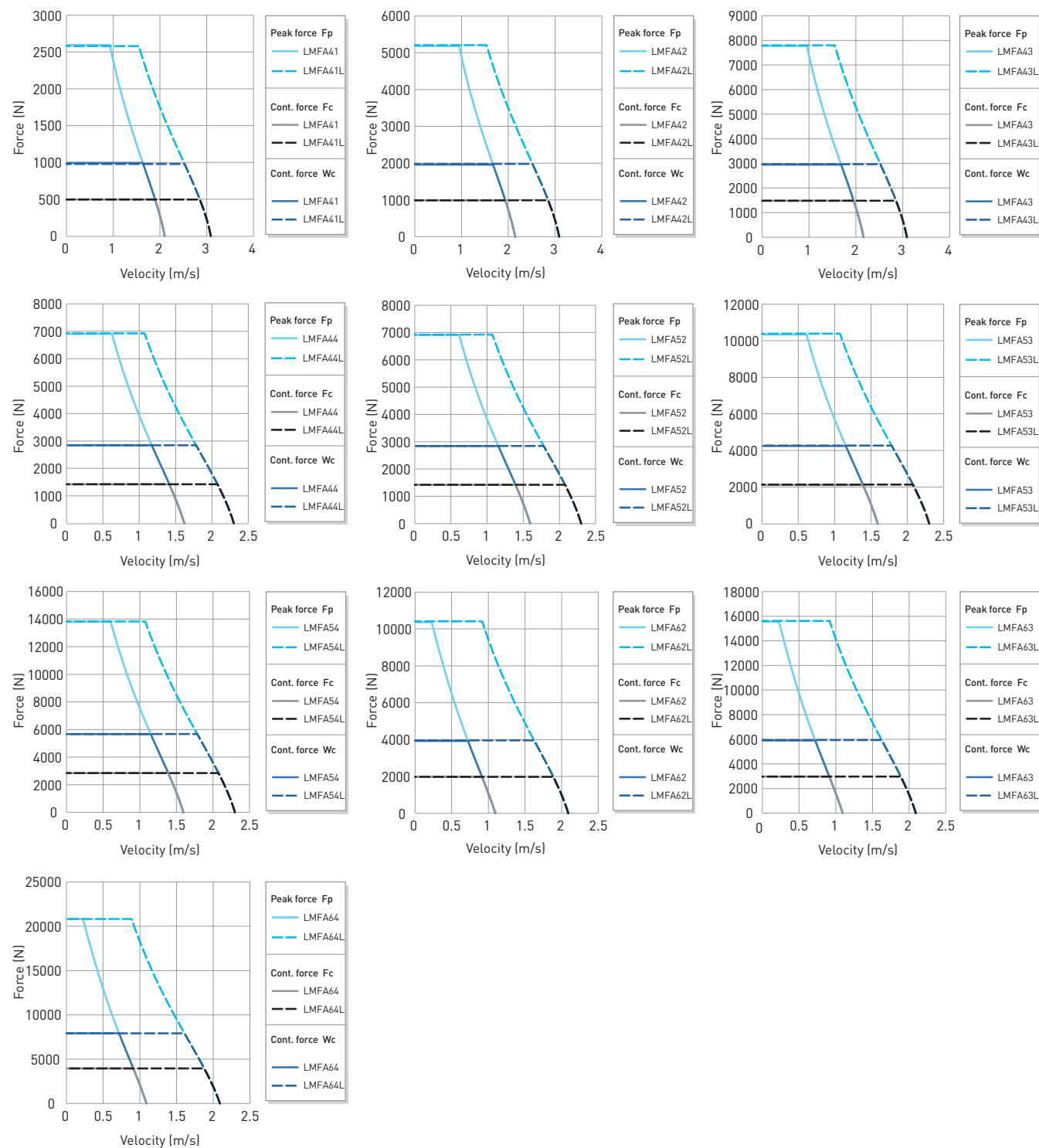
Note: 1. WC-water cooling
2. LMFA forcer is collocated with LMF stators.
3. Except dimensions,the electrical specifications are in $\pm 10\%$ of tolerance.
4. We reserve the right to change, please follow customer recognition drawings.

2.4.1 LMFA Series F-V curves

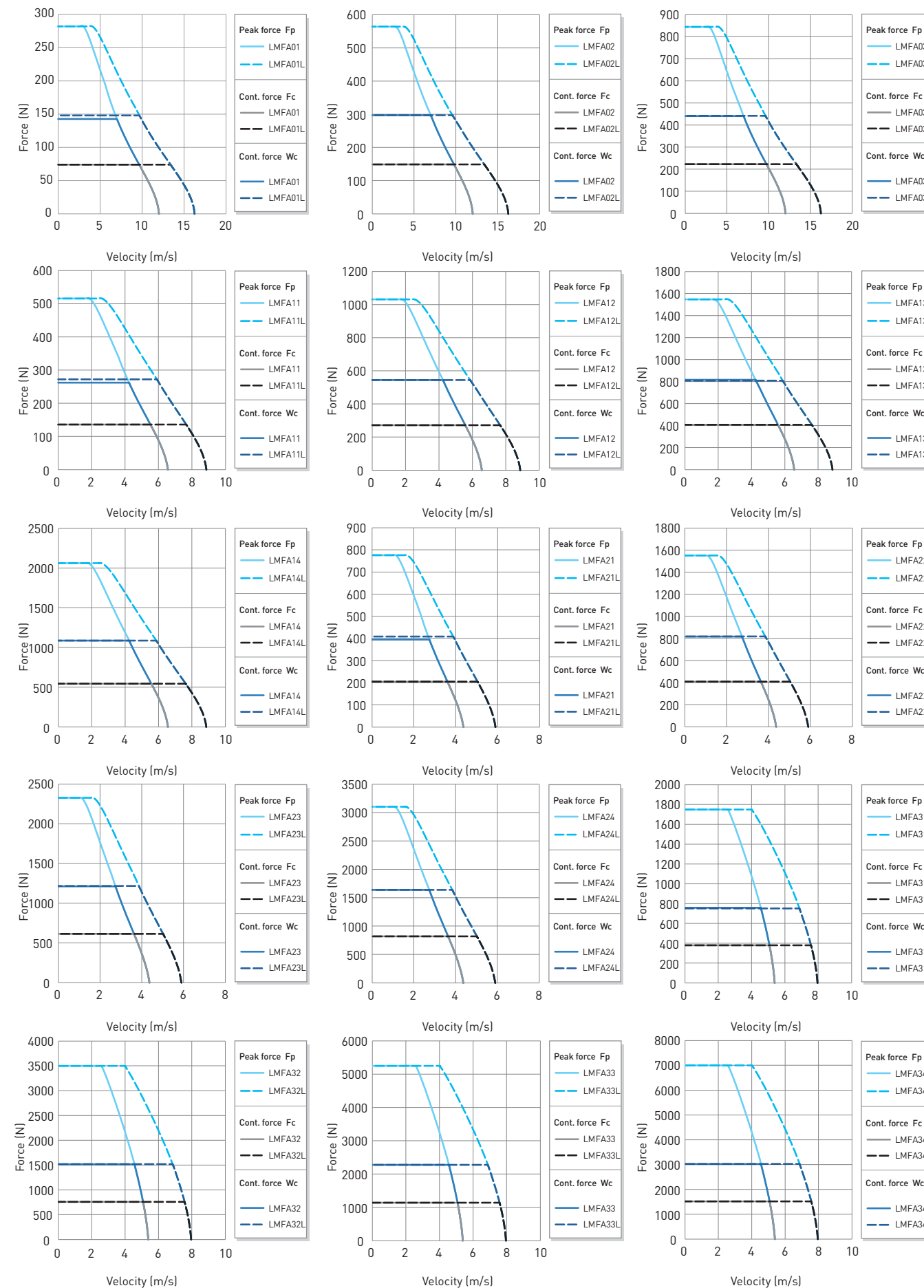
■ Force and velocity curves (DC bus voltage = 325 V_{DC})



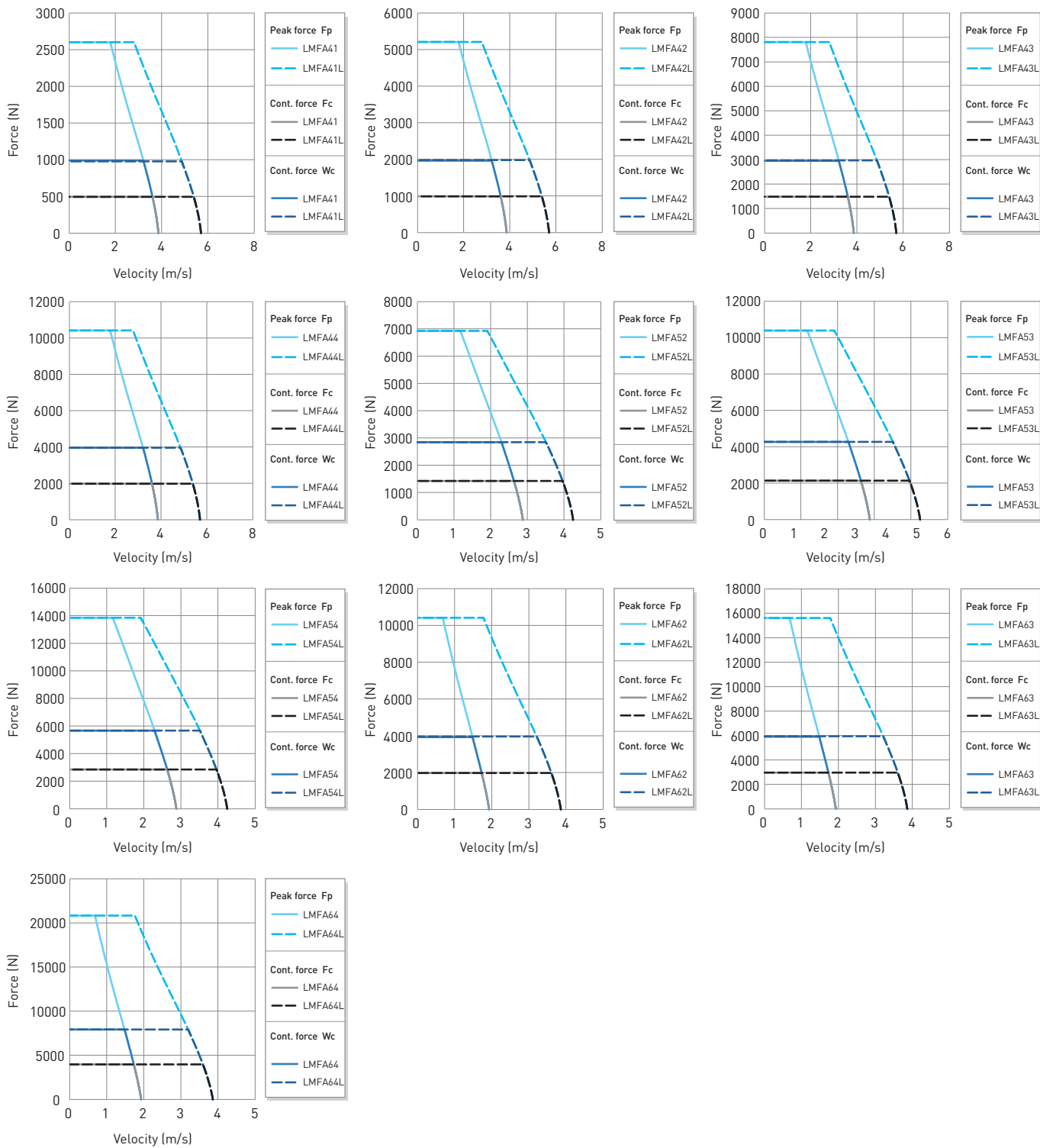
■ Force and velocity curves (DC bus voltage = 325 V_{DC})



■ Force and velocity curves (DC bus voltage = 600 V_{DC})

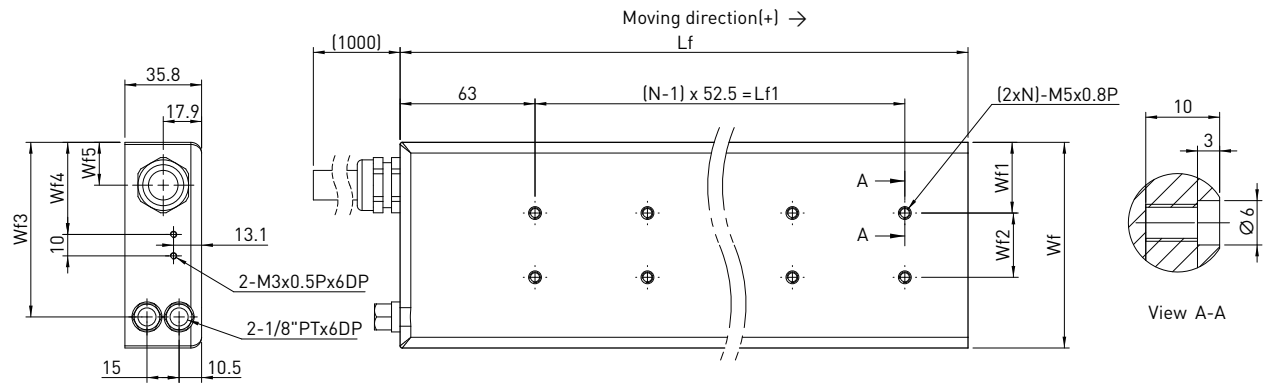


■ Force and velocity curves (DC bus voltage = 600 V_{DC})



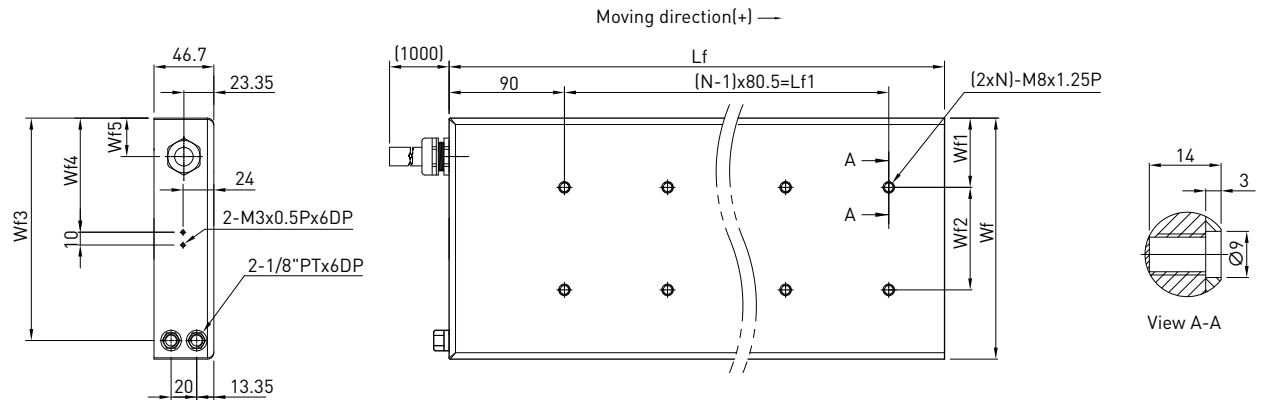
2.4.2 LMFA Series forcers and stators dimensions

■ Dimension of LMFA0,1,2 forcers



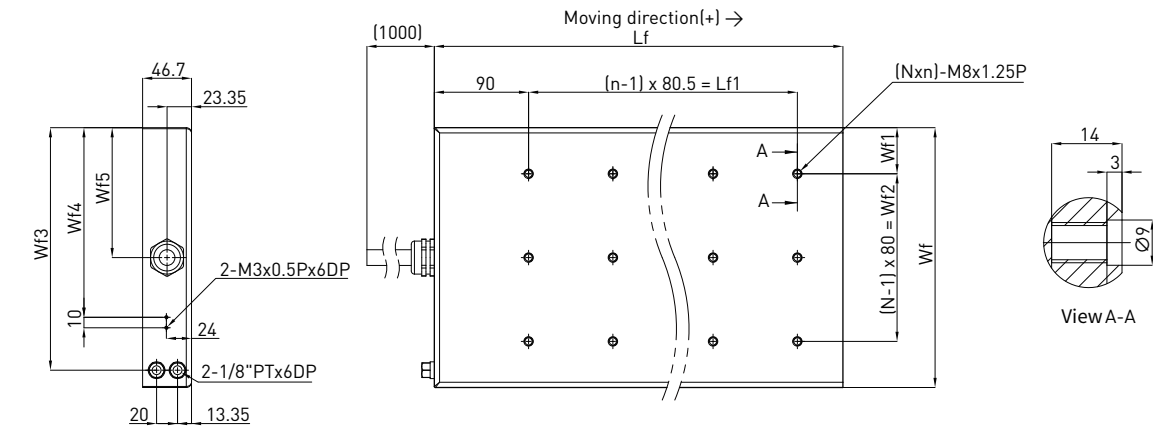
Type	Lf	Lf1	Wf	Wf1	Wf2	Wf3	Wf4	Wf5	N
LMFA01	145	52.5	67	18.5	30	55	33.75	14.4	2
LMFA02	250	157.5	67	18.5	30	55	33.75	14.4	4
LMFA03	355	262.5	67	18.5	30	55	33.75	14.4	6
LMFA11	145	52.5	96	33	30	81.5	43	20	2
LMFA12	250	157.5	96	33	30	81.5	43	20	4
LMFA13	355	262.5	96	33	30	81.5	43	20	6
LMFA14	460	367.5	96	33	30	81.5	43	20	8
LMFA21	145	52.5	126	40.5	45	111.5	58	20	2
LMFA22	250	157.5	126	40.5	45	111.5	58	20	4
LMFA23	355	262.5	126	40.5	45	111.5	58	20	6
LMFA24	460	367.5	126	40.5	45	111.5	58	20	8

■ Dimension of LMFA3,4 forcers



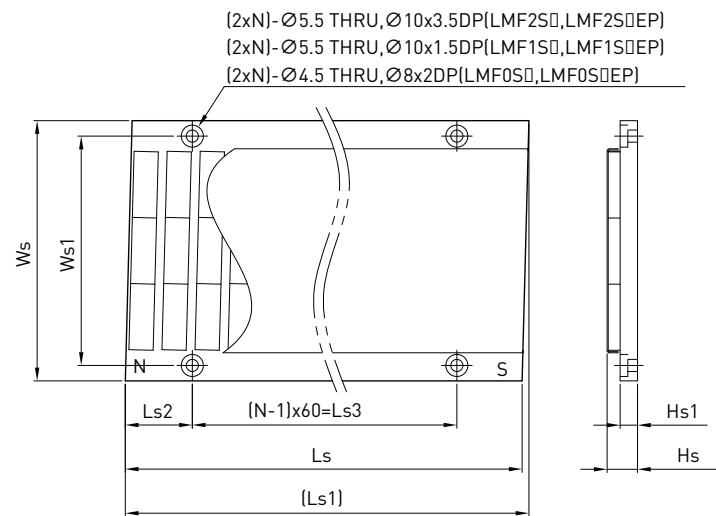
Type	Lf	Lf1	Wf	Wf1	Wf2	Wf3	Wf4	Wf5	N
LMFA31	214	80.5	141	40.5	60	126.5	65.5	30	2
LMFA32	375	241.5	141	40.5	60	126.5	65.5	30	4
LMFA33	536	402.5	141	40.5	60	126.5	65.5	30	6
LMFA34	697	563.5	141	40.5	60	126.5	65.5	30	8
LMFA41	214	80.5	188	54	80	173.5	89	30	2
LMFA42	375	241.5	188	54	80	173.5	89	30	4
LMFA43	536	402.5	188	54	80	173.5	89	30	6
LMFA44	697	563.5	188	54	80	173.5	89	30	8

■ Dimension of LMFA5,6 forcers



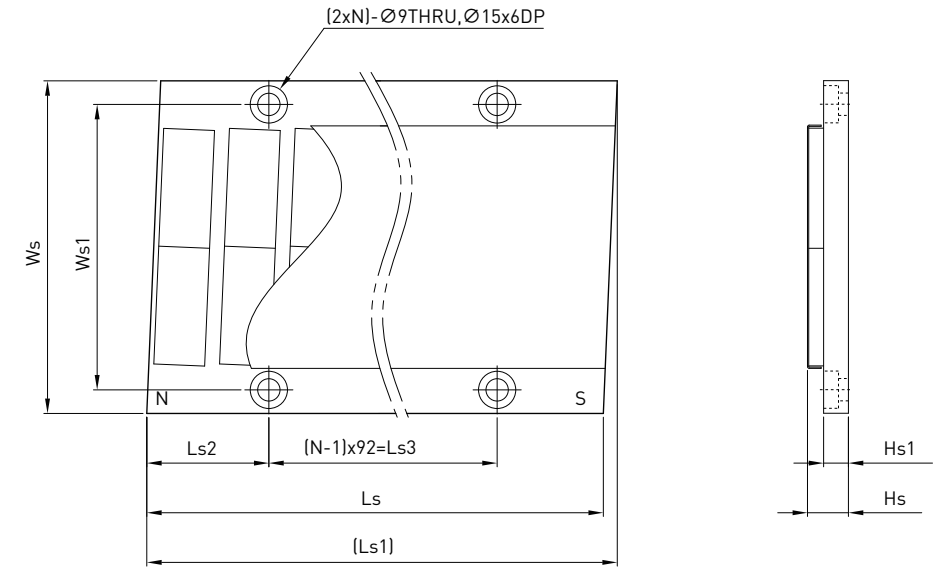
Type	Lf	Lf1	Wf	Wf1	Wf2	Wf3	Wf4	Wf5	N	n
LMFA52	375	241.5	248	44	160	231.5	181	124	3	4
LMFA53	536	402.5	248	44	160	231.5	181	124	3	6
LMFA54	697	563.5	248	44	160	231.5	181	124	3	8
LMFA62	375	241.5	342	51	240	325.5	245	171	4	4
LMFA63	536	402.5	342	51	240	325.5	245	171	4	6
LMFA64	697	563.5	342	51	240	325.5	245	171	4	8

■ Dimension of LMFA0,1,2 stators



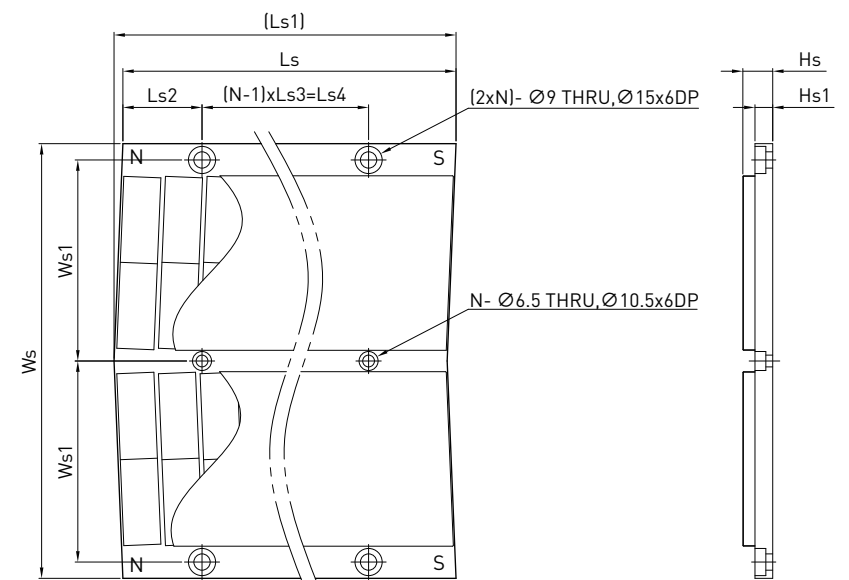
Type	Ls	Ls1	Ls2	Ls3	Hs	Hs1	Ws	Ws1	N
LMF0S1	120	124.87	31.25	60	11.8	5.9	58	48	2
LMF0S1EP	120	124.87	31.25	60	11.3	5.7	58	48	2
LMF0S2	180	184.87	31.25	120	11.8	5.9	58	48	3
LMF0S2EP	180	184.87	31.25	120	11.3	5.7	58	48	3
LMF0S3	300	304.87	31.25	240	11.8	5.9	58	48	5
LMF0S3EP	300	304.87	31.25	240	11.3	5.7	58	48	5
LMF1S1	120	122.77	30.6	60	11.8	5.9	88	74	2
LMF1S1EP	120	122.77	30.6	60	11.3	5.7	88	74	2
LMF1S2	180	182.77	30.6	120	11.8	5.9	88	74	3
LMF1S2EP	180	182.77	30.6	120	11.3	5.7	88	74	3
LMF1S3	300	302.77	30.6	240	11.8	5.9	88	74	5
LMF1S3EP	300	302.77	30.6	240	11.3	5.7	88	74	5
LMF2S1	120	123.09	30.4	60	13.8	7.9	118	104	2
LMF2S1EP	120	123.09	30.4	60	13.3	7.7	118	104	2
LMF2S2	180	183.09	30.4	120	13.8	7.9	118	104	3
LMF2S2EP	180	183.09	30.4	120	13.3	7.7	118	104	3
LMF2S3	300	303.09	30.4	240	13.8	7.9	118	104	5
LMF2S3EP	300	303.09	30.4	240	13.3	7.7	118	104	5

■ Dimension of LMFA 3,4 stators



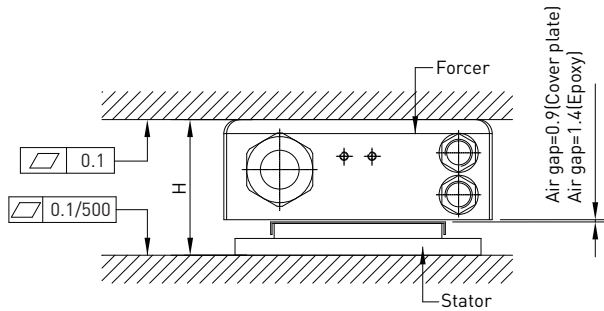
Type	Ls	Ls1	Ls2	Ls3	Hs	Hs1	Ws	Ws1	N
LMF3S1	184	189.62	49.2	92	16.5	10	134	115	2
LMF3S1EP	184	189.62	49.2	92	16	9.8	134	115	2
LMF3S2	276	281.62	49.2	184	16.5	10	134	115	3
LMF3S2EP	276	281.62	49.2	184	16	9.8	134	115	3
LMF3S3	460	465.62	49.2	368	16.5	10	134	115	5
LMF3S3EP	460	465.62	49.2	368	16	9.8	134	115	5
LMF4S1	184	189.03	48.9	92	18.5	12	180	161	2
LMF4S1EP	184	189.03	48.9	92	18	11.8	180	161	2
LMF4S2	276	281.03	48.9	184	18.5	12	180	161	3
LMF4S2EP	276	281.03	48.9	184	18	11.8	180	161	3
LMF4S3	460	465.03	48.9	368	18.5	12	180	161	5
LMF4S3EP	460	465.03	48.9	368	18	11.8	180	161	5

■ Dimension of LMFA 5,6 stators



Type	Ls	Ls1	Ls2	Ls3	Ls4	Hs	Hs1	Ws	Ws1	N
LMF5S1EP	184	188.89	43.7	92	92	16	9.8	240	111	2
LMF5S2EP	276	280.89	43.7	92	184	16	9.8	240	111	3
LMF5S3EP	460	464.89	43.7	92	368	16	9.8	240	111	5
LMF6S1EP	184	188.66	20.97	46	138	18	11.8	334	158	4

■ Mounting tolerances



Type	H
LMFA01	48.5
LMFA02	48.5
LMFA03	48.5
LMFA11	48.5
LMFA12	48.5
LMFA13	48.5
LMFA14	48.5
LMFA21	50.5
LMFA22	50.5
LMFA23	50.5
LMFA24	50.5
LMFA31	64.1
LMFA32	64.1
LMFA33	64.1
LMFA34	64.1
LMFA41	66.1
LMFA42	66.1
LMFA43	66.1
LMFA44	66.1
LMFA52	64.1
LMFA53	64.1
LMFA54	64.1
LMFA62	66.1
LMFA63	66.1
LMFA64	66.1

2.4.3 Order code of primary part (forcer)

Series	Type	Width of forcer	Length of forcer	Winding code
LM	FA	3	1	L
Linear motor	Linear motor type	0: 67 mm 1: 96 mm 2: 126 mm 3: 141 mm 4: 188 mm 5: 248 mm 6: 342 mm	LMFA 0-2 series 1: 145 mm 2: 250 mm 3: 355 mm 4: 460 mm LMFA 3-6 series 1: 214 mm 2: 375 mm 3: 536 mm 4: 697 mm	None: Standard L: Low back EMF

2.4.4 Order code of magnet track (stator)

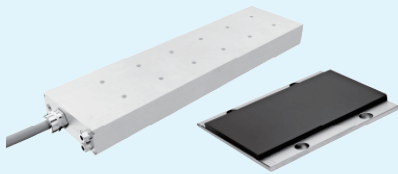
Series	Width of stator	Model	Length of stator	Magnet package
LMF	0	S	1	EP
	0: 58 mm 1: 88 mm 2: 118 mm 3: 134 mm 4: 180 mm 5: 240 mm 6: 334 mm	S: Standard C: Customize	LMF0-2 series 1: 120 mm 2: 180 mm 3: 300 mm LMF3-5 series 1: 184 mm 2: 276 mm 3: 460 mm LMF6 series 1: 184 mm	EP: Epoxy None: Cover plate

2.5 LMFP Series
Linear Motor

HIWIN provides the best solution for thermal countermeasures for high-precision positioning platforms.

LMFP is the new generation of permanent magnet synchronous linear motors. With water cooling, the special electromagnetic and heat dissipation design give a better force density performance, and is the only linear motor with a peak force of 20,000 N. Introduced to the European machine tool industry.

In addition, the integrated packaging shell technology can be better than IP65 protection, in the highly polluted environment of the machine tools industry, such as: cutting fluid, machining and cutting, or other high-dust environments.



- Water-cooled design
- IP65 ingress of protection
- UL and CE certification
- Water-cooled continuous force range from 149 N to 7,917 N
- Peak force range from 282 N to 20,827 N
- Installation height 48.5 mm, 50.5 mm, 64.1 mm, 66.1 mm

Force chart for LMFP series

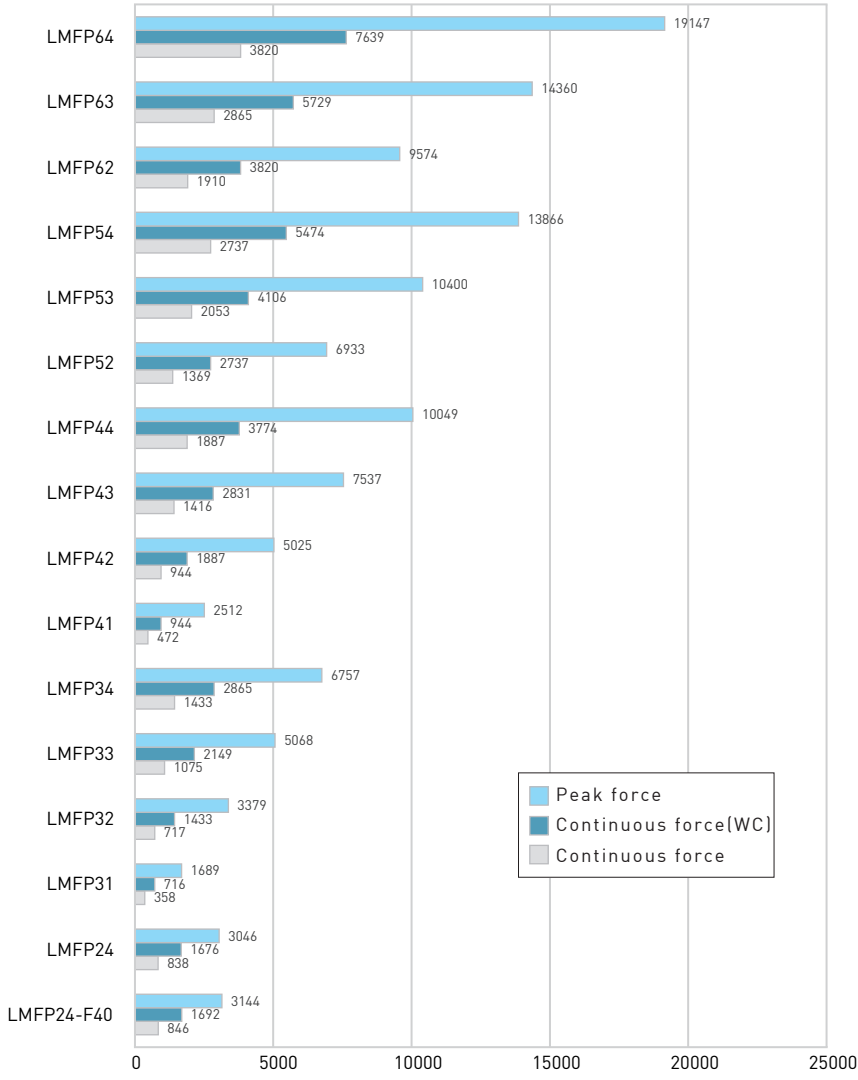


Table 2-5 LMFP Series specifications								
	Symbol	Unit	LMFP24-F40	LMFP24-H40	LMFP31-Q10	LMFP31-Q20	LMFP32-Q20	LMFP32-Q40
Continuous force	F _c	N	846	838	358	413	717	827
Continuous current	I _c	A _{rms}	5.7	8.6	4.1	8.2	8.2	16.5
Continuous force (WC)	F _c (WC)	N	1692	1676	757	827	1481	1653
Continuous current (WC)	I _c (WC)	A _{rms}	11.4	17.2	8.2	16.5	16.5	32.9
Peak force (1s)	F _p	N	3144	3046	1671	1797	3341	3593
Peak current (1s)	I _p	A _{rms}	32.8	49.5	25.6	51.2	51.2	102.4
Ultimate force (0.5s)	F _u	N	3380	3264	1833	1833	3667	3667
Ultimate current (0.5s)	I _u	A _{rms}	39	58.8	30.4	60.8	60.8	121.7
Force constant	K _f	N/A _{rms}	148.4	97.4	92.4	50.2	89.8	50.2
Attraction force	F _a	N	4583	4583	3121	3121	6243	6243
Maximum winding temperature	T _{max}	°C	120					
Electrical time constant	K _e	ms	8.3	8	12.3	12	12.7	10.8
Resistance (line to line, 25°C)	R ₂₅	Ω	6.5	3	3.4	0.9	1.7	0.5
Resistance (line to line, 120°C)	R ₁₂₀	Ω	8.9	4.1	4.7	1.2	2.3	0.7
Inductance (line to line)	L	mH	53.8	24.1	41.9	10.8	21.6	5.4
Pole pair pitch	2τ	mm	30	30	46	46	46	46
Minimum bending radius of cable	R _{bend}	mm	94	94	94	94	90	128
Back emf constant (line to line)	K _v	V _{rms} /(m/s)	91.3	60.1	51.1	29	51.7	29
Motor constant	K _m	N/√W	45.5	45.9	38.7	43.3	54.8	57.9
Thermal resistance	R _{TH}	°C/W	0.22	0.21	0.8	0.78	0.41	0.33
Thermal resistance (WC)	R _{TH} (WC)	°C/W	0.05	0.05	0.2	0.19	0.1	0.08
Thermal time constant (WC)	t _{TH}	s	150					
Minimum flow rate	-	L/min	4	4	4	4	5.2	5.2
Temperature of cooling water	-	°C	20					
Pressure drop	△P	bar	3.18	3.18	0.57	0.57	0.74	0.74
Thermal switch	-	-	1 x Pt1000 + 1 x {3 PTC 120 In Series}					
Maximum velocity at maximum force	V _{MAX,FP}	m/s	0.77	1.37	2.5	5.1	2.5	5.1
Maximum electric power input	P _{EL,MAX}	W	16783	19242	8798	13883	17396	29334
Maximum dissipated heat output	Q _{PH,MAX}	W	1735	1819	474	490	939	1137
Stall force (WC)	F ₀ (WC)	N	1187	1169	498	584	1014	1153
Stall current (WC)	I ₀ (WC)	A _{rms}	8	12	5.7	11.6	11.6	23
Maximum DC bus voltage	-	V _{DC}	600					
Mass of forcer	M _f	kg	11	11	6.9	6.9	12.1	12.1
Unit mass of stator	M _s	kg/m	9.3	9.3	16.3	16.3	16.3	16.3
Length of forcer	L _f	mm	465	465	221	221	382	382
Width of stator	W _s	mm	118	118	134	134	134	134
Length of stator/Dimension N	L _s	mm	120 mm/N=2, 180 mm/N=3, 300 mm/N=5		184 mm/N=2, 276 mm/N=3, 460 mm/N=5			
Stator mounting distance	W _{s1}	mm	104	104	115	115	115	115
Total installation height	H	mm	50.5	50.5	64.1	64.1	64.1	64.1
Note: 1. WC-water cooling 2. LMFP forcer is collocated with LMF stators. 3. Except dimensions,the electrical specifications are in ±10% of tolerance. 4. We reserve the right to change, please follow customer recognition drawings.								

Table 2-5 LMFP Series specifications								
	Symbol	Unit	LMFP33-Q30	LMFP33-Q60	LMFP34-Q40	LMFP34-Q80	LMFP41-Q10	LMFP41-Q20
Continuous force	F _c	N	1240	1240	1653	1433	495	495
Continuous current	I _c	A _{rms}	12.4	24.7	16.5	32.9	3.4	6.8
Continuous force (WC)	F _c (WC)	N	2480	2480	3307	2865	990	990
Continuous current (WC)	I _c (WC)	A _{rms}	24.7	49.4	33	65.9	6.8	13.6
Peak force (1s)	F _p	N	5390	5390	7187	6757	2820	2820
Peak current (1s)	I _p	A _{rms}	76.8	153.6	102.4	204.8	22.7	45.4
Ultimate force (0.5s)	F _u	N	5500	5500	7333	7333	2739	2739
Ultimate current (0.5s)	I _u	A _{rms}	91.2	182.5	121.7	243.3	27	53.9
Force constant	K _f	N/A _{rms}	100.3	50.2	100.3	39.7	145.7	72.9
Attraction force	F _a	N	9364	9364	12485	12485	4682	4682
Maximum winding temperature	T _{max}	°C	120					
Electrical time constant	K _e	ms	12	12	12	12.5	12.6	12.4
Resistance (line to line, 25°C)	R ₂₅	Ω	1.2	0.3	0.9	0.2	5.1	1.3
Resistance (line to line, 120°C)	R ₁₂₀	Ω	1.6	0.4	1.2	0.3	7	1.8
Inductance (line to line)	L	mH	14.4	3.6	10.8	2.5	64.5	16.1
Pole pair pitch	2τ	mm	46	46	46	46	46	46
Minimum bending radius of cable	R _{bend}	mm	113	150	128	176	94	94
Back emf constant (line to line)	K _v	V _{rms} /(m/s)	57.9	29	57.9	26	84.1	42.1
Motor constant	K _m	N/√W	74.5	74.8	86.2	79.5	52.6	52.1
Thermal resistance	R _{TH}	°C/W	0.26	0.26	0.19	0.2	0.78	0.76
Thermal resistance (WC)	R _{TH} (WC)	°C/W	0.06	0.06	0.05	0.05	0.2	0.19
Thermal time constant	t _{TH}	s	150	150	150	150	150	150
Minimum flow rate	-	L/min	5.7	5.7	6.2	6.2	5.2	5.2
Temperature of cooling water	-	°C	20	20	20	20	20	20
Pressure drop	△P	bar	0.98	0.98	1.28	1.28	0.89	0.89
Thermal switch	-	-	1 x Pt1000 + 1 x {3 PTC 120 In Series}					
Maximum velocity at maximum force	V _{MAX,FP}	m/s	2.4	5.1	2.4	5.2	1.7	3.7
Maximum electric power input	P _{EL,MAX}	W	27092	41645	36123	54011	10205	15999
Maximum dissipated heat output	Q _{PH,MAX}	W	1464	1464	1960	1954	486	499
Stall force (WC)	F ₀ (WC)	N	1730	1737	2314	2008	699	692
Stall current (WC)	I ₀ (WC)	A _{rms}	17.3	34.6	23.1	46.1	4.8	9.5
Maximum DC bus voltage	-	V _{DC}	600					
Mass of forcer	M _f	kg	17.8	17.8	23.1	23.1	9.9	9.9
Unit mass of stator	M _s	kg/m	16.3	16.3	16.3	16.3	22.1	22.1
Length of forcer	L _f	mm	543	543	704	704	221	221
Width of stator	W _s	mm	134	134	134	134	180	180
Length of stator/Dimension N	L _s	mm	184 mm/N=2, 276 mm/N=3, 460 mm/N=5					
Stator mounting distance	W _{s1}	mm	115	115	115	115	161	161
Total installation height	H	mm	64.1	64.1	64.1	64.1	66.1	66.1
Note: 1. WC-water cooling 2. LMFP forcer is collocated with LMF stators. 3. Except dimensions,the electrical specifications are in ±10% of tolerance. 4. We reserve the right to change, please follow customer recognition drawings.								

Table 2-5 LMFP Series specifications								
	Symbol	Unit	LMFP42-Q20	LMFP42-Q40	LMFP43-Q30	LMFP43-Q60	LMFP44-Q40	LMFP44-Q80
Continuous force	F _c	N	990	990	1416	1485	1887	1887
Continuous current	I _c	A _{rms}	6.8	13.6	10.2	20.4	13.6	27.1
Continuous force (WC)	F _c (WC)	N	1979	1979	2780	2969	3774	3791
Continuous current (WC)	I _c (WC)	A _{rms}	13.6	27.1	20.4	40.7	27.2	54.3
Peak force (1s)	F _p	N	5640	5640	7367	8460	10049	9975
Peak current (1s)	I _p	A _{rms}	45.5	90.9	69	136.4	90.9	181.8
Ultimate force (0.5s)	F _u	N	5479	5479	8218	8218	10958	10958
Ultimate current (0.5s)	I _u	A _{rms}	54.1	108	81	162	108	216
Force constant	K _f	N/A _{rms}	145.7	72.9	136.3	72.9	138.8	69.5
Attraction force	F _a	N	9363	9363	14045	14045	18727	18727
Maximum winding temperature	T _{max}	°C	120					
Electrical time constant	K _e	ms	12.4	13.5	12.6	13.5	12.2	12
Resistance (line to line, 25°C)	R ₂₅	Ω	2.6	0.6	1.7	0.4	1.3	0.3
Resistance (line to line, 120°C)	R ₁₂₀	Ω	3.6	0.8	2.3	0.5	1.8	0.4
Inductance (line to line)	L	mH	32.3	8.1	21.5	5.4	15.9	3.6
Pole pair pitch	2τ	mm	46	46	46	46	46	46
Minimum bending radius of cable	R _{bend}	mm	94	113	113	128	113	176
Back emf constant (line to line)	K _v	V _{rms} /(m/s)	84.1	42.1	78.8	42.1	80.6	39.9
Motor constant	K _m	N/√W	73.7	76.7	86.9	94	99.4	103.8
Thermal resistance	R _{TH}	°C/W	0.38	0.43	0.26	0.3	0.19	0.22
Thermal resistance (WC)	R _{TH} (WC)	°C/W	0.1	0.11	0.07	0.08	0.05	0.05
Thermal time constant	t _{TH}	s	150	150	150	150	150	150
Minimum flow rate	-	L/min	5.2	5.2	5.7	5.7	6.2	6.2
Temperature of cooling water	-	°C	20	20	20	20	20	20
Pressure drop	△P	bar	1.17	1.17	1.45	1.45	1.8	1.8
Thermal switch	-	-	1 x Pt1000 + 1 x [3 PTC 120 In Series]					
Maximum velocity at maximum force	V _{MAX,FP}	m/s	1.7	3.7	1.7	3.7	1.7	4
Maximum electric power input	P _{EL,MAX}	W	20767	30783	28949	45256	39393	59731
Maximum dissipated heat output	Q _{P,H,MAX}	W	999	881	1436	1242	1998	1769
Stall force (WC)	F ₀	N	1383	1383	1981	2075	2636	2646
Stall current (WC)	I ₀	A _{rms}	9.5	19	14.3	28.5	19	38
Maximum DC bus voltage	-	V _{DC}	600					
Mass of forcer	M _f	kg	16.7	16.7	25	25	29.8	29.8
Unit mass of stator	M _s	kg/m	22.1	22.1	22.1	22.1	22.1	22.1
Length of forcer	L _f	mm	382	382	543	543	704	704
Width of stator	W _s	mm	180	180	180	180	180	180
Length of stator/Dimension N	L _s	mm	184 mm/N=2, 276 mm/N=3, 460 mm/N=5					
Stator mounting distance	W _{s1}	mm	161	161	161	161	161	161
Total installation height	H	mm	66.1	66.1	66.1	66.1	66.1	66.1
Note: 1. WC-water cooling 2. LMFP forcer is collocated with LMF stators. 3. Except dimensions,the electrical specifications are in ±10% of tolerance. 4. We reserve the right to change, please follow customer recognition drawings.								

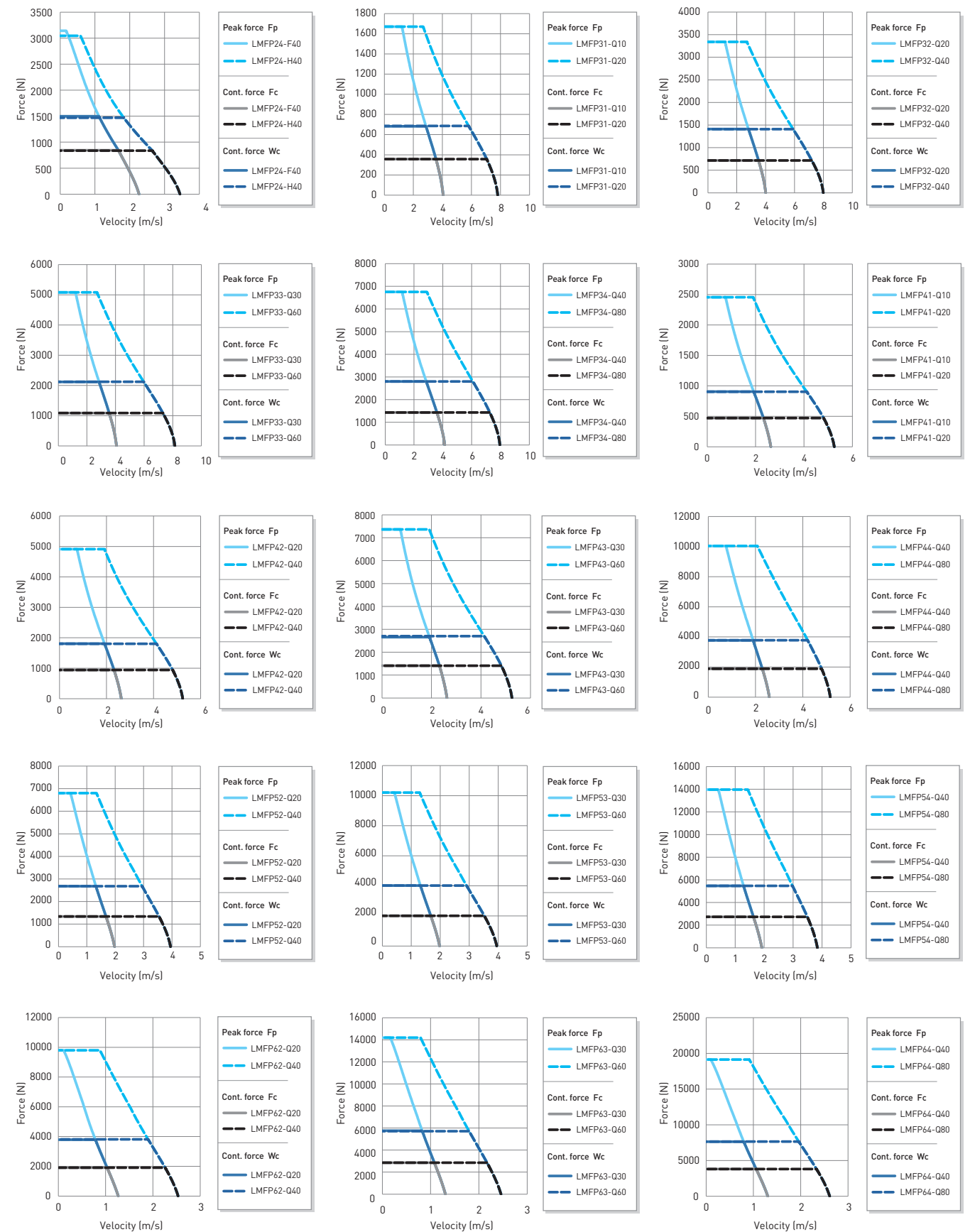
Table 2-5 LMFP Series specifications								
	Symbol	Unit	LMFP52-Q20	LMFP52-Q40	LMFP53-Q30	LMFP53-Q60	LMFP54-Q40	LMFP54-Q80
Continuous force	F _c	N	1422	1422	2133	2133	2737	2737
Continuous current	I _c	A _{rms}	7.4	14.8	11.1	22.2	14.8	29.6
Continuous force (WC)	F _c (WC)	N	2844	2844	4266	4266	5525	5474
Continuous current (WC)	I _c (WC)	A _{rms}	14.8	29.6	22.2	44.4	29.6	59.2
Peak force (1s)	F _p	N	7000	7000	10500	10500	13977	13866
Peak current (1s)	I _p	A _{rms}	46.3	92.7	69.5	139	92.7	185.3
Ultimate force (0.5s)	F _u	N	7558	7558	11337	11337	15116	15116
Ultimate current (0.5s)	I _u	A _{rms}	55	110.1	82.6	165.1	110.1	220
Force constant	K _f	N/A _{rms}	192.3	96.1	192.3	96.1	186.6	92.5
Attraction force	F _a	N	12467	12467	18700	18700	24933	24933
Maximum winding temperature	T _{max}	°C	120					
Electrical time constant	K _e	ms	12.6	13.4	12.4	12	12.8	12
Resistance (line to line, 25°C)	R ₂₅	Ω	3.4	0.8	2.3	0.6	1.7	0.4
Resistance (line to line, 120°C)	R ₁₂₀	Ω	4.7	1.1	3.2	0.8	2.3	0.5
Inductance (line to line)	L	mH	42.9	10.7	28.6	7.2	21.7	4.8
Pole pair pitch	2τ	mm	46	46	46	46	46	46
Minimum bending radius of cable	R _{bend}	mm	94	113	113	150	113	176
Back emf constant (line to line)	K _v	V _{rms} /(m/s)	111	55.5	111	55.5	107.5	53.2
Motor constant	K _m	N/√W	85.1	87.7	103.5	101.3	115.8	119.4
Thermal resistance	R _{TH}	°C/W	0.25	0.26	0.16	0.16	0.13	0.14
Thermal resistance (WC)	R _{TH} (WC)	°C/W	0.06	0.07	0.04	0.04	0.03	0.04
Thermal time constant	t _{TH}	s	150	150	150	150	150	150
Minimum flow rate	-	L/min	6.3	6.3	6.8	6.8	7.3	7.3
Temperature of cooling water	-	°C	20	20	20	20	20	20
Pressure drop	△P	bar	1.25	1.25	1.77	1.77	2.3	2.3
Thermal switch	-	-	1 x Pt1000 + 1 x [3 PTC 120 In Series]					
Maximum velocity at maximum force	V _{MAX,FP}	m/s	1.2	2.7	1.2	2.7	1.2	2.7
Maximum electric power input	P _{EL,MAX}	W	23513	33079	35785	51535	46419	63190
Maximum dissipated heat output	Q _{P,H,MAX}	W	1544	1446	2366	2366	3023	2628
Stall force (WC)	F ₀	N	1998	1989	2979	2988	3928	3828
Stall current (WC)	I ₀	A _{rms}	10.4	20.7	15.5	31.1	20.7	41.4
Maximum DC bus voltage	-	V _{DC}	600					
Mass of forcer	M _f	kg	24.8	24.8	33.5	33.5	42.3	42.3
Unit mass of stator	M _s	kg/m	25.6	25.6	25.6	25.6	25.6	25.6
Length of forcer	L _f	mm	382	382	543	543	704	704
Width of stator	W _s	mm	240	240	240	240	240	240
Length of stator/Dimension N	L _s	mm	184 mm/N=2, 276 mm/N=3, 460 mm/N=5					
Stator mounting distance	W _{s1}	mm	222	222	222	222	222	222
Total installation height	H	mm	64.1	64.1	64.1	64.1	64.1	64.1
Note: 1. WC-water cooling 2. LMFP forcer is collocated with LMF stators. 3. Except dimensions,the electrical specifications are in ±10% of tolerance. 4. We reserve the right to change, please follow customer recognition drawings.								

Table 2-5 LMFP Series specifications

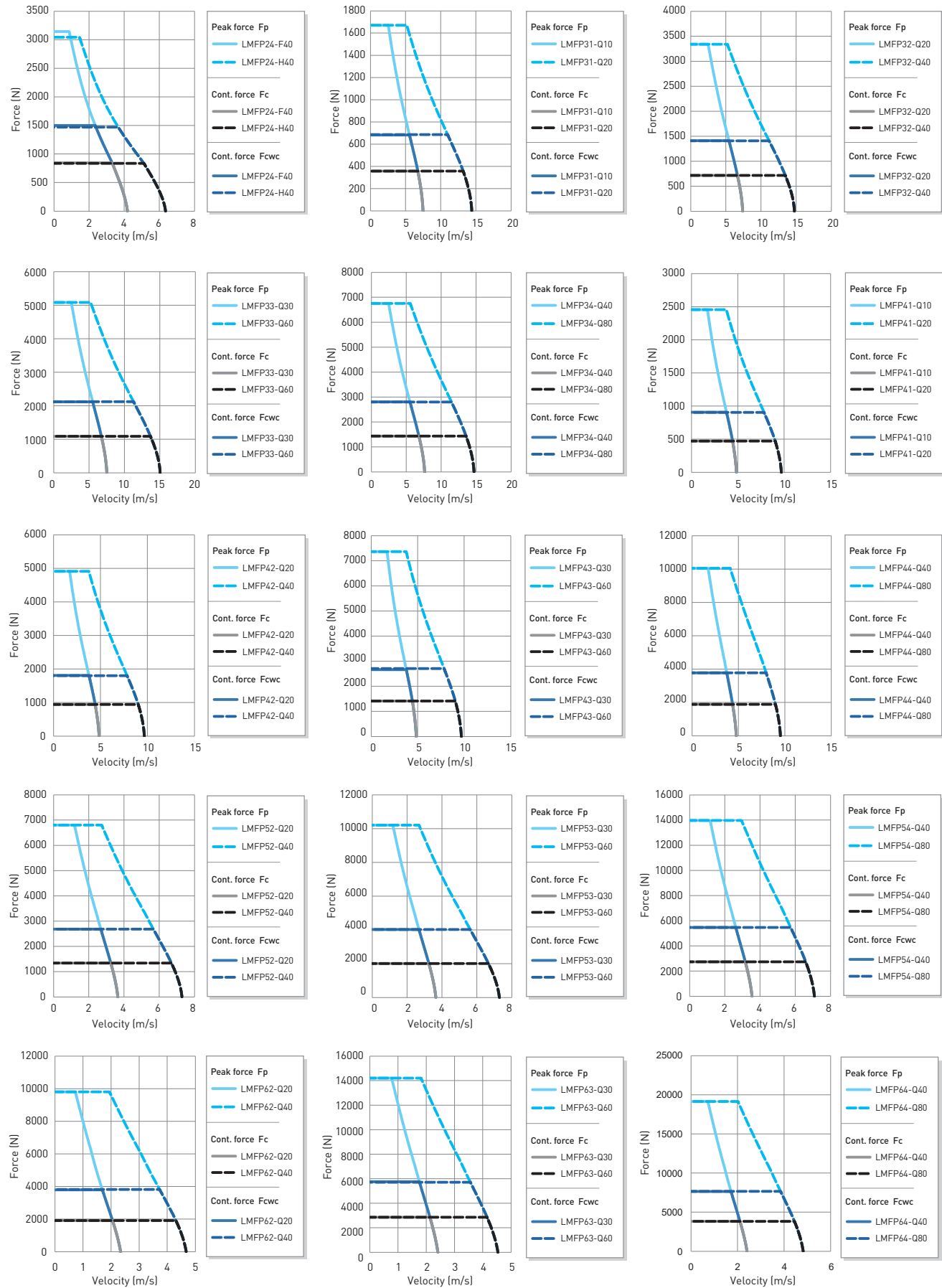
	Symbol	Unit	LMFP62-Q20	LMFP62-Q40	LMFP63-Q30	LMFP63-Q60	LMFP64-Q40	LMFP64-Q80
Continuous force	F_c	N	2029	1910	2865	3043	4058	3820
Continuous current	I_c	A_{rms}	7	13.9	10.4	20.9	13.9	27.8
Continuous force (WC)	$F_c(WC)$	N	4057	3933	5732	6086	8115	7639
Continuous current (WC)	$I_c(WC)$	A_{rms}	13.9	27.8	20.9	41.7	27.8	55.7
Peak force (1s)	F_p	N	10414	9805	14211	15620	20827	19147
Peak current (1s)	I_p	A_{rms}	41.9	83.8	62.9	125.7	83.8	167.6
Ultimate force (0.5s)	F_u	N	10481	10481	15722	15722	20962	20962
Ultimate current (0.5s)	I_u	A_{rms}	49.8	99.6	74.7	149.3	99.6	199.1
Force constant	K_f	N/A_{rms}	291.7	141.5	274.2	145.8	291.7	137.1
Attraction force	F_a	N	18727	18727	28091	28091	37454	37454
Maximum winding temperature	T_{max}	°C	120					
Electrical time constant	K_e	ms	12.6	12.7	13.1	11.9	12.4	12.2
Resistance (line to line, 25°C)	R_{25}	Ω	5.1	1.2	3.2	0.9	2.6	0.6
Resistance (line to line, 120°C)	R_{120}	Ω	7	1.6	4.4	1.2	3.6	0.8
Inductance (line to line)	L	mH	64.3	15.2	41.8	10.7	32.2	7.3
Pole pair pitch	2τ	mm	46	46	46	46	46	46
Minimum bending radius of cable	R_{bend}	mm	94	113	113	150	113	176
Back emf constant (line to line)	K_v	$V_{rms}/(m/s)$	168.4	79.2	157.3	84.2	168.4	79.3
Motor constant	K_m	$N/\sqrt{W}$	104.8	102.4	125.7	125.3	147.8	144.8
Thermal resistance	R_{TH}	°C/W	0.18	0.2	0.13	0.12	0.09	0.1
Thermal resistance (WC)	$R_{TH(WC)}$	°C/W	0.05	0.05	0.03	0.03	0.02	0.03
Thermal time constant	t_{TH}	s	150	150	150	150	150	150
Minimum flow rate	-	L/min	6.8	6.8	7.3	7.3	7.8	7.8
Temperature of cooling water	-	°C	20	20	20	20	20	20
Pressure drop	ΔP	bar	1.64	1.64	2.25	2.25	3	3
Thermal switch	-	-	1 x Pt1000 + 1 x {3 PTC 120 In Series}					
Maximum velocity at maximum force	$V_{MAX,FP}$	m/s	0.7	1.9	0.7	1.8	0.7	1.9
Maximum electric power input	$P_{EL,MAX}$	W	25724	35483	36060	56557	52500	70087
Maximum dissipated heat output	$Q_{PH,MAX}$	W	2029	1855	2883	3130	4173	3723
Stall force (WC)	F_0	N	2812	2679	4022	4251	5693	5359
Stall current (WC)	I_0	A_{rms}	9.7	19.5	14.6	29.2	19.5	39
Maximum DC bus voltage	-	V_{DC}	600					
Mass of forcer	M_f	kg	33.4	33.4	46.7	46.7	57.6	57.6
Unit mass of stator	M_s	kg/m	41.8	41.8	41.8	41.8	41.8	41.8
Length of forcer	L_f	mm	382	382	543	543	704	704
Width of stator	W_s	mm	334	334	334	334	334	334
Length of stator/Dimension N	L_s	mm	184 mm/N=4					
Stator mounting distance	W_{s1}	mm	158	158	158	158	158	158
Total installation height	H	mm	66.1	66.1	66.1	66.1	66.1	66.1

Note: 1. WC-water cooling
2. LMFP forcer is collocated with LMF stators.
3. Except dimensions, the electrical specifications are in $\pm 10\%$ of tolerance.
4. We reserve the right to change, please follow customer recognition drawings.

2.5.1 LMFP Series F-V curves

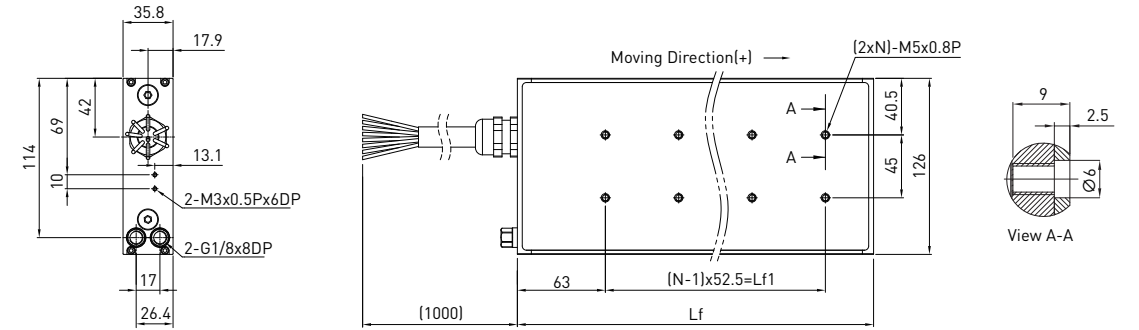
■ Force and velocity curves (DC bus voltage = 325 V_{DC})

■ Force and velocity curves (DC bus voltage = 600 V_{DC})



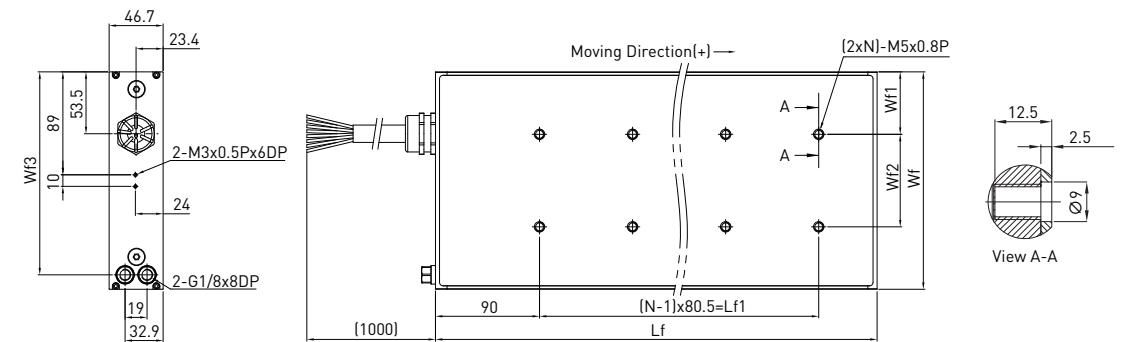
2.5.2 LMFP Series forcers and stators dimensions

■ Dimension of LMFP 2 forcers



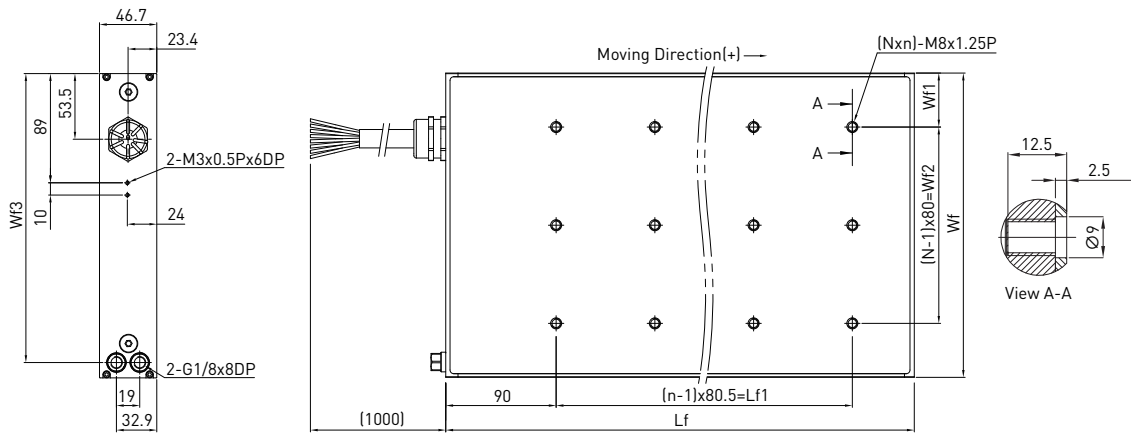
Type	Lf	Lf1	N
LMFP24-F40	465	367.5	8
LMFP24-H40	465	367.5	8

■ Dimension of LMFP 3,4 forcers



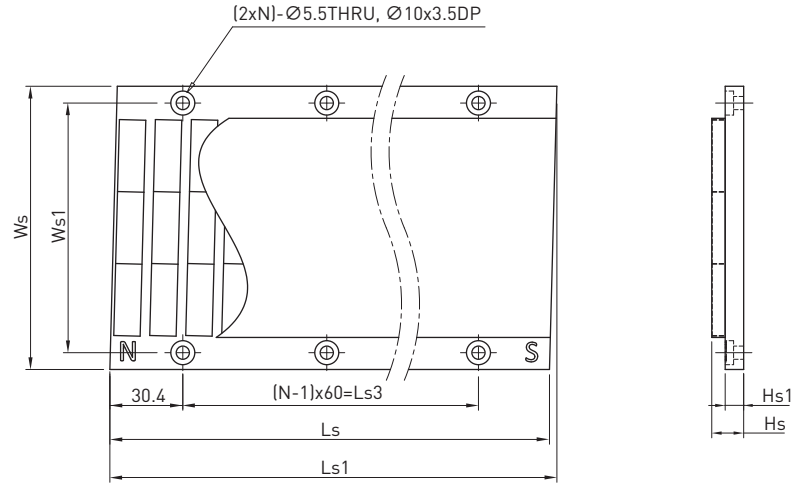
Type	Lf	Lf1	Wf	Wf1	Wf2	Wf3	N
LMFP31-Q10	221	80.5	141	40.5	60	128.5	2
LMFP31-Q20	221	80.5	141	40.5	60	128.5	2
LMFP32-Q20	382	241.5	141	40.5	60	128.5	4
LMFP32-Q40	382	241.5	141	40.5	60	128.5	4
LMFP33-Q30	543	402.5	141	40.5	60	128.5	6
LMFP33-Q60	543	402.5	141	40.5	60	128.5	6
LMFP34-Q40	704	563.5	141	40.5	60	128.5	8
LMFP34-Q80	704	563.5	141	40.5	60	128.5	8
LMFP41-Q10	221	80.5	188	54	80	175.5	2
LMFP41-Q20	221	80.5	188	54	80	175.5	2
LMFP42-Q20	382	241.5	188	54	80	175.5	4
LMFP42-Q40	382	241.5	188	54	80	175.5	4
LMFP43-Q30	543	402.5	188	54	80	175.5	6
LMFP43-Q60	543	402.5	188	54	80	175.5	6
LMFP44-Q40	704	563.5	188	54	80	175.5	8
LMFP44-Q80	704	563.5	188	54	80	175.5	8

■ Dimension of LMFP 5,6 forcers



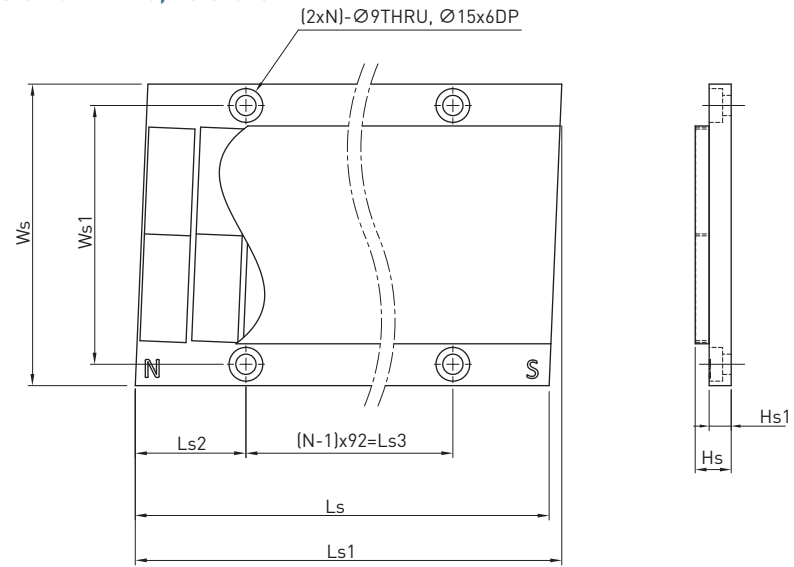
Type	Lf	Lf1	Wf	Wf1	Wf2	Wf3	N	n
LMFP52-Q20	382	241.5	248	44	160	235.5	3	4
LMFP52-Q40	382	241.5	248	44	160	235.5	3	4
LMFP53-Q30	543	402.5	248	44	160	235.5	3	6
LMFP53-Q60	543	402.5	248	44	160	235.5	3	6
LMFP54-Q40	704	563.5	248	44	160	235.5	3	8
LMFP54-Q80	704	563.5	248	44	160	235.5	3	8
LMFP62-Q20	382	241.5	342	51	240	329.5	4	4
LMFP62-Q40	382	241.5	342	51	240	329.5	4	4
LMFP63-Q30	543	402.5	342	51	240	329.5	4	6
LMFP63-Q60	543	402.5	342	51	240	329.5	4	6
LMFP64-Q40	704	563.5	342	51	240	329.5	4	8
LMFP64-Q80	704	563.5	342	51	240	329.5	4	8

■ Dimension of LMF 2 stators



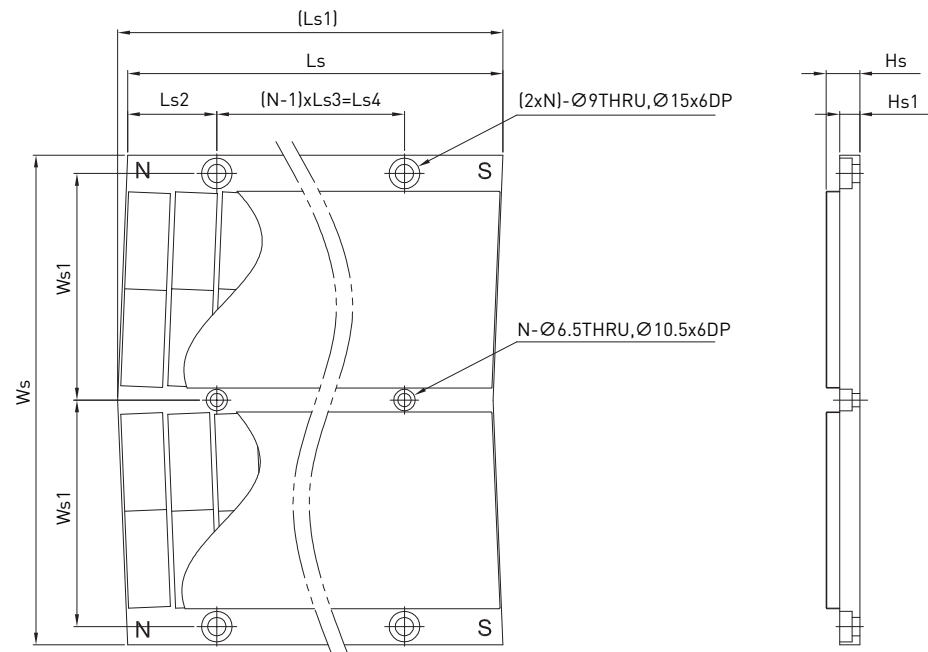
Type	Ls	Ls1	Ls3	Hs	Hs1	Ws	Ws1	N
LMF2S1EP	120	123.09	60	13.3	7.7	118	104	2
LMF2S2EP	180	183.09	120	13.3	7.7	118	104	3
LMF2S3EP	300	303.09	240	13.3	7.7	118	104	5

■ Dimension of LMF 3,4 stators



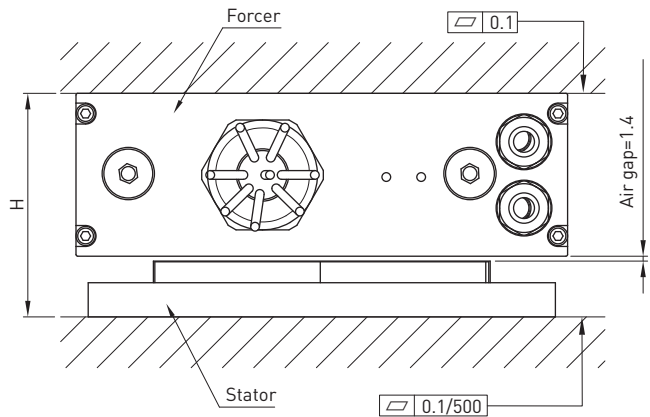
Type	Ls	Ls1	Ls2	Ls3	Hs	Hs1	Ws	Ws1	N
LMF3S1EP	184	189.62	49.2	92	16	9.8	134	115	2
LMF3S2EP	276	281.62	49.2	184	16	9.8	134	115	3
LMF3S3EP	460	465.62	49.2	368	16	9.8	134	115	5
LMF4S1EP	184	189.03	48.9	92	18	11.8	180	161	2
LMF4S2EP	276	281.03	48.9	184	18	11.8	180	161	3
LMF4S3EP	460	465.03	48.9	368	18	11.8	180	161	5

■ Dimension of LMF 5,6 stators



Type	Ls	Ls1	Ls2	Ls3	Ls4	Hs	Hs1	Ws	Ws1	N
LMF5S1EP	184	188.89	43.7	92	92	16	9.8	240	111	2
LMF5S2EP	276	280.89	43.7	92	184	16	9.8	240	111	3
LMF5S3EP	460	464.89	43.7	92	368	16	9.8	240	111	5
LMF6S1EP	184	188.66	20.97	46	138	18	11.8	334	158	4

■ Mounting tolerances



Type	H
LMFP24	50.5
LMFP31	64.1
LMFP32	64.1
LMFP33	64.1
LMFP34	64.1
LMFP41	66.1
LMFP42	66.1
LMFP43	66.1
LMFP44	66.1
LMFP52	64.1
LMFP53	64.1
LMFP54	64.1
LMFP62	66.1
LMFP63	66.1
LMFP64	66.1

2.5.3 LMFP Order code of primary part (forcer)

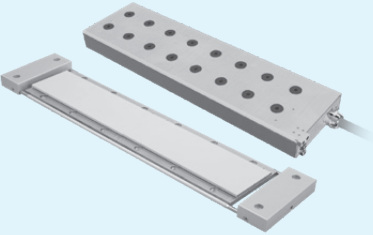
Series	Type	Width of forcer	Length of forcer	Wiring Code
LM	FP	3	2	-
Linear motor	Linear motor type	2: 126 mm 3: 141 mm 4: 188 mm 5: 248 mm 6: 342 mm	LMFP 2 series 4: 465 mm LMFP 3-6 series 1: 221 mm 2: 382 mm 3: 543 mm 4: 704 mm	□□□

2.5.4 LMFP Order code of magnet track (stator)

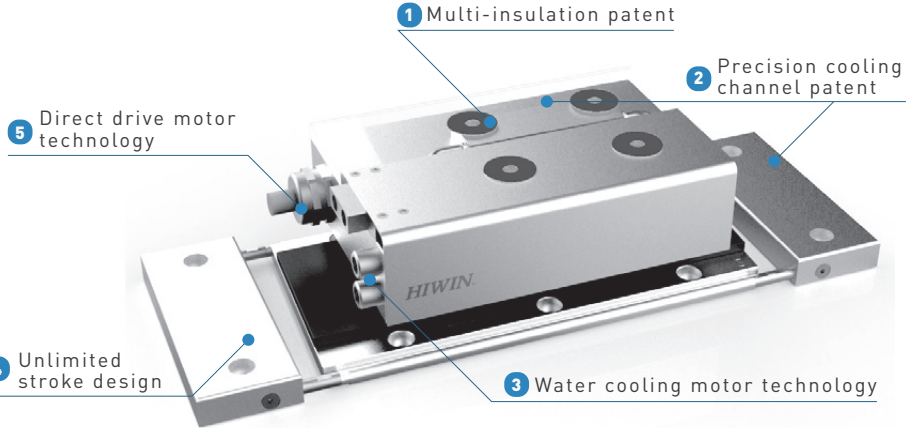
Series	Width of Stator	Model	Length of Stator	Magnet Package
LMF	3	S	1	EP
	2: 118 mm 3: 134 mm 4: 180 mm 5: 240 mm 6: 334 mm	S: Standard C: Custom	LMF2 series 1: 120 mm 2: 180 mm 3: 300 mm LMF3-5 series 1: 184 mm 2: 276 mm 3: 460 mm LMF6 series 1: 184 mm	EP: Epoxy

2.6 **LMFC Series**
Precision water cooling

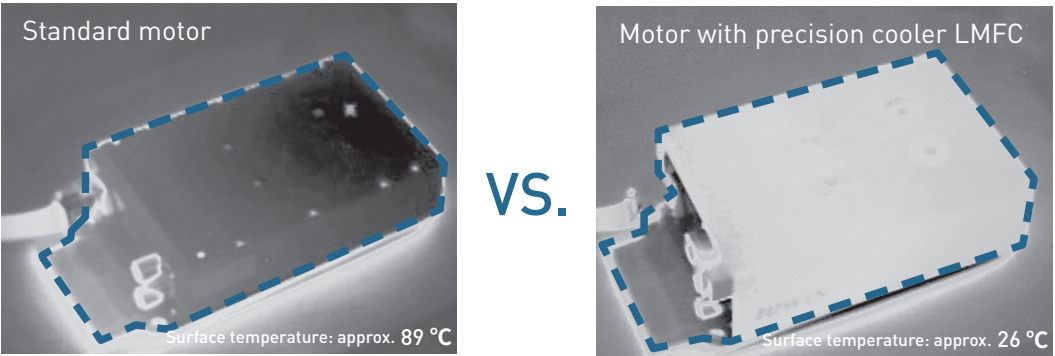
The LMFC precision cooling system supports the LMFP/LMFA series of linear motors. The LMFC provides precise insulation through a dual reflux water cooling system which keeps the temperature of the motor consistent within 2°C across the surface.
The precision cooling system can be directly installed with the LMFP/LMFA forcer, and the precision cooling stator can be jointed without limit.



- Precision water cooling design
- Used with LMFA and LMFP series linear motors
- Efficient water temperature management with less than 4°C inlet/outlet temperature difference.
- Effective at maintaining cooler temperatures from heat generated during linear motor cycling.
- Easy installation, unlimited splicing for the stator precision water cooling

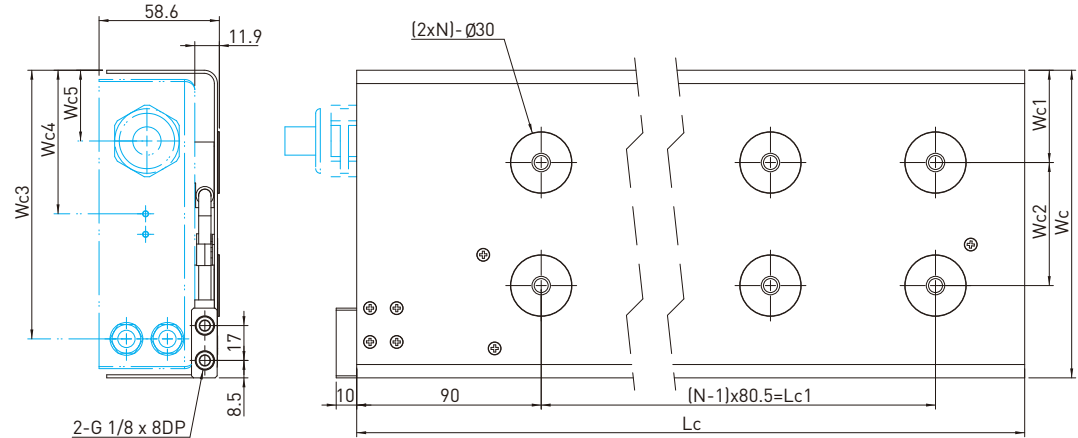


The thermal imager shows that the temperature of motor surface is significantly reduced.



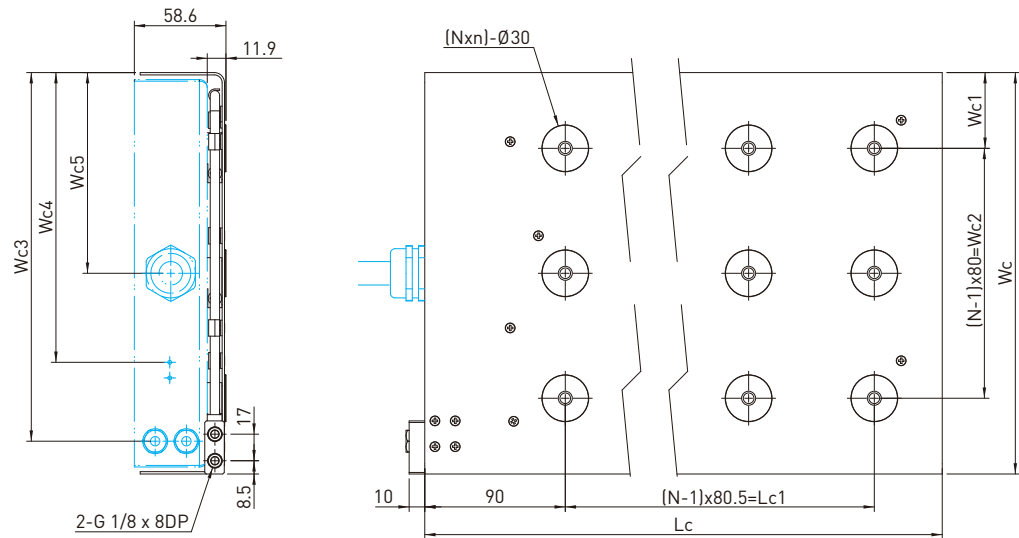
2.6.1 LMFC Series forcers and stators dimensions

■ Dimension of LMFC 3,4 forcers



Type	Motor	Lc	Lc1	Wc	Wc1	Wc2	Wc3	Wc4	Wc5	N
LMFC31	LMFA31/LMFP31	214	80.5	150	45	60	131	70	34.5	2
LMFC32	LMFA32/LMFP32	375	241.5	150	45	60	131	70	34.5	4
LMFC33	LMFA33/LMFP33	536	402.5	150	45	60	131	70	34.5	6
LMFC34	LMFA34/LMFP34	697	563.5	150	45	60	131	70	34.5	8
LMFC41	LMFA41/LMFP41	214	80.5	197	58.5	80	178	93.5	34.5	2
LMFC42	LMFA42/LMFP42	375	241.5	197	58.5	80	178	93.5	34.5	4
LMFC43	LMFA43/LMFP43	563	402.5	197	58.5	80	178	93.5	34.5	6
LMFC44	LMFA44/LMFP44	697	563.5	197	58.5	80	178	93.5	34.5	8

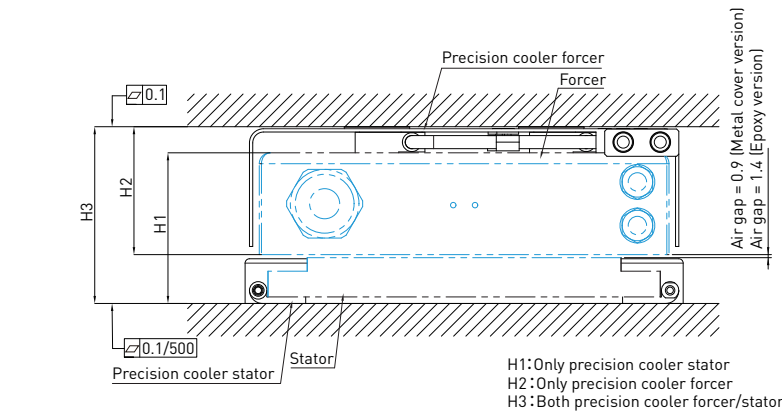
■ Dimension of LMFC 5,6 forcers



Type	Motor	Lc	Lc1	Wc	Wc1	Wc2	Wc3	Wc4	Wc5	N	n
LMFC52	LMFA52/LMFP52	375	241.5	257	48.5	160	236	185.5	128.5	3	4
LMFC53	LMFA53/LMFP53	536	402.5	257	48.5	160	236	185.5	128.5	3	6
LMFC54	LMFA54/LMFP54	697	563.5	257	48.5	160	236	185.5	128.5	3	8
LMFC62	LMFA62/LMFP62	375	241.5	351	55.5	240	330	249.5	175.5	4	4
LMFC63	LMFA63/LMFP63	536	402.5	351	55.5	240	330	249.5	175.5	4	6
LMFC64	LMFA64/LMFP64	697	563.5	351	55.5	240	330	249.5	175.5	4	8

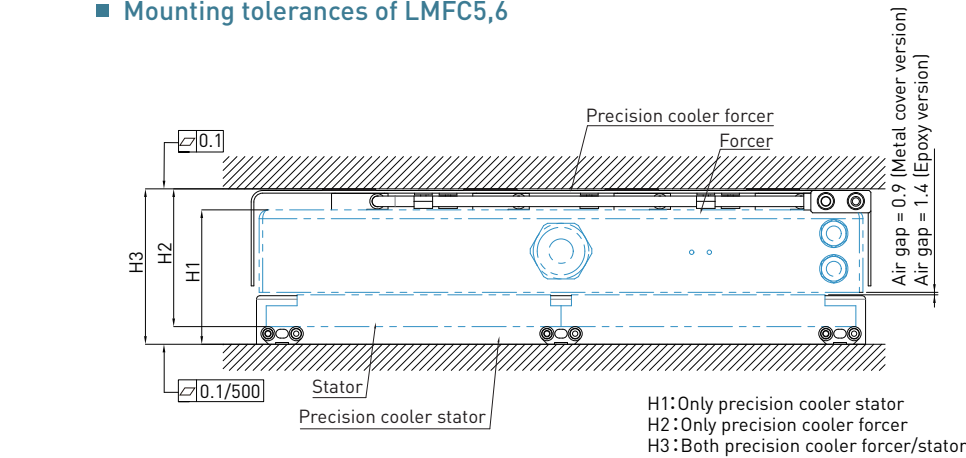
2.6.2 LMFC Series forcers and stators dimensions

■ Mounting tolerances of LMFC3,4



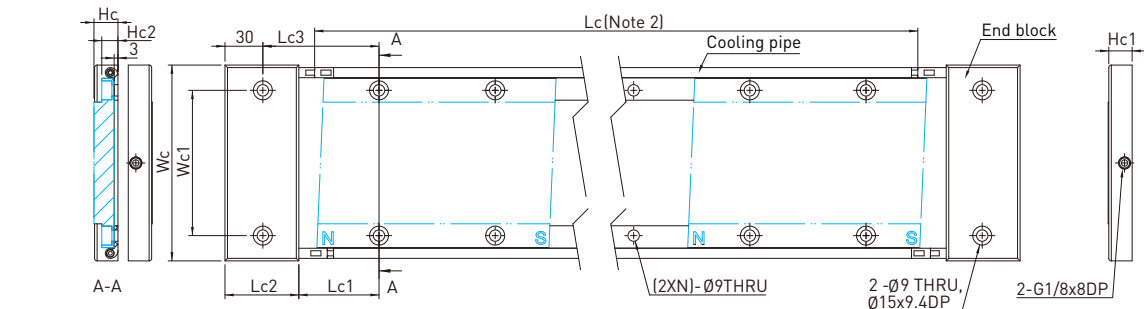
Type	H1	H2	H3
LMFA31/LMFP31	67.1	76	79
LMFA32/LMFP32	67.1	76	79
LMFA33/LMFP33	67.1	76	79
LMFA34/LMFP34	67.1	76	79
LMFA41/LMFP41	69.1	78	81
LMFA42/LMFP42	69.1	78	81
LMFA43/LMFP43	69.1	78	81
LMFA44/LMFP44	69.1	78	81

■ Mounting tolerances of LMFC5,6



Type	H1	H2	H3
LMFA52/LMFP52	74.1	76	86
LMFA53/LMFP53	74.1	76	86
LMFA54/LMFP54	74.1	76	86
LMFA62/LMFP62	76.1	78	88
LMFA63/LMFP63	76.1	78	88
LMFA64/LMFP64	76.1	78	88

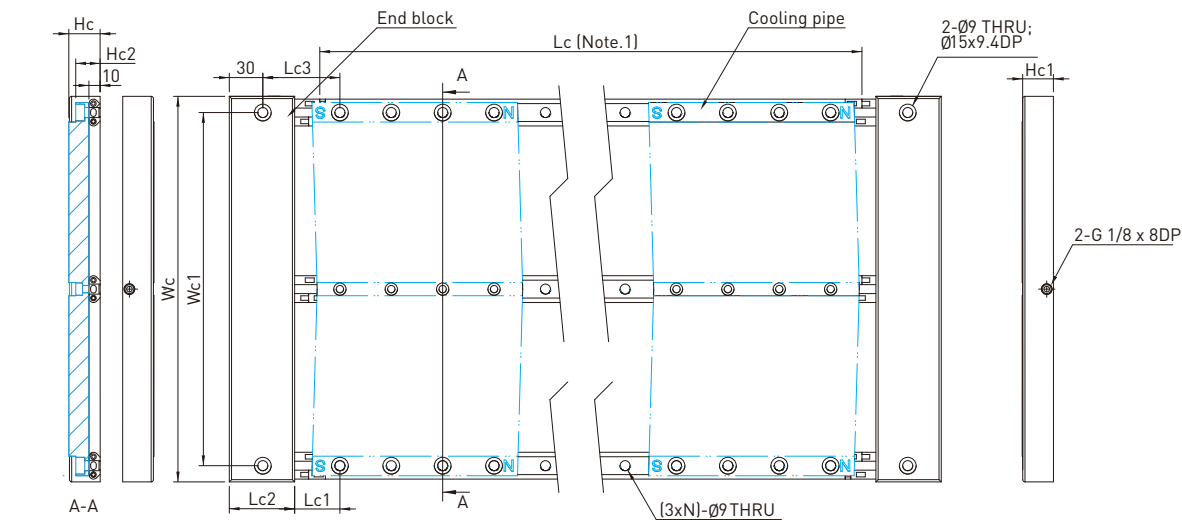
■ LMFC3,4-S Series Stator Precision Water Cooling Dimensions
Straight Out Type Stator Precision Water Cooling



Type	Lc	Lc1	Lc2	Lc3	Wc	Wc1	Hc	Hc1	Hc2
LMFC3	-	63.5	58.5	92	155	115	19	18.5	13
LMFC4	-	63.5	58.5	92	201	161	21	20.5	15

1. Dimension of LMFC3&4(S) is the same as LMFC3&4 (R). The only difference is the in/outlet position.
2. Lc: Total jointing length of stator

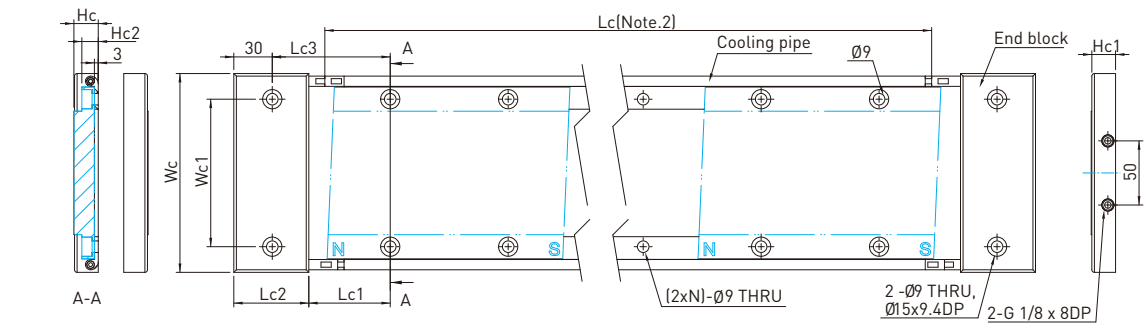
■ LMFC5,6 Series Stator Precision Water Cooling Dimensions
Straight Out Type Stator Precision Water Cooling



Type	Lc	Lc1	Lc2	Lc3	Wc	Wc1	Hc	Hc1	Hc2
LMFC5	-	40.5	58.5	69	251	222	26	25.5	19.8
LMFC6	-	40.5	58.5	69	345	316	28	27.5	21.8

1. Lc: Total jointing length of stator

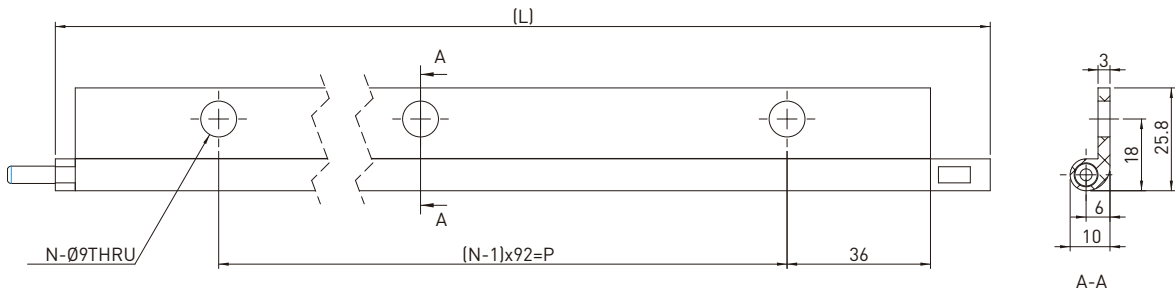
■ LMFC3,4-R series stator precision water cooling dimensions
Return flow type stator precision water cooling



Type	Lc	Lc1	Lc2	Lc3	Wc	Wc1	Hc	Hc1	Hc2
LMFC3	-	63.5	58.5	92	155	115	19	18.5	13
LMFC4	-	63.5	58.5	92	201	161	21	20.5	15

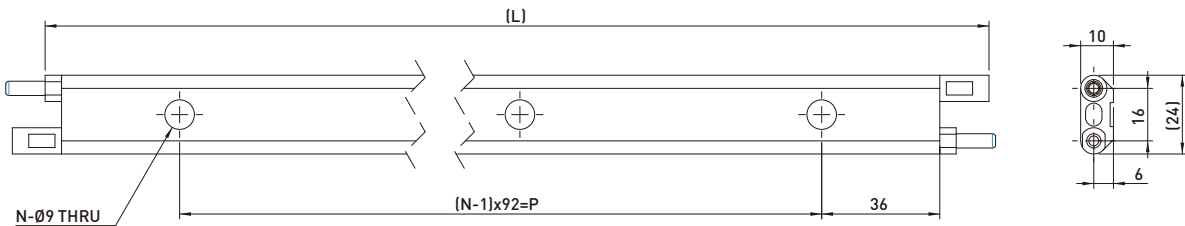
1. Dimension of LMFC3&4(S) is the same as LMFC3&4 (R). The only difference is the in/outlet position.
2. Lc: Total jointing length of stator

■ LMFC 3,4 Series cooling pipe



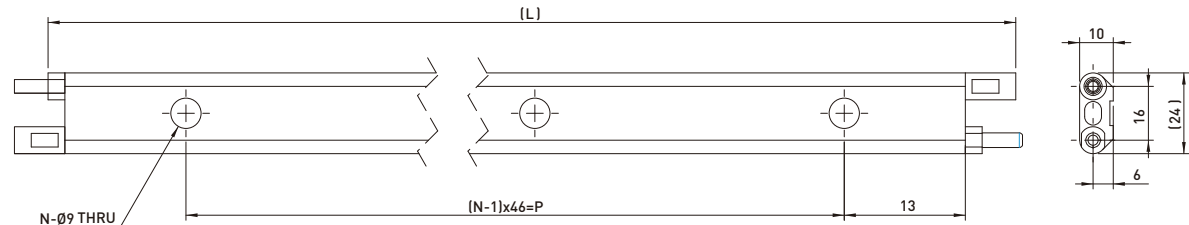
Specifications	L(mm)	N	P(mm)	Weight(g/pc)	For stator
LMFC3-P-0092	92	1	0	17	LMF3S□ (EP) LMF4S□ (EP) Note: 1. LMFC3&4 Series includes end blocks and dual cooling pipes. 2. [LC] is defined by total jointing length of stators. If the length is longer than 1288 mm, mult cooling pipes will be connected to cover the total length. 3. Take Lc=3312 mm for example, 3312 mm =1288 mm*2+736 mm*1. Therefore, LMFC3-P-1288*2 and LMFC3-P-0736*1 will be utilized. 4. All connectors of precision cooler stator are connected with special adhesive, turning it will cause manual damage and responsibility will be taken by the user.
LMFC3-P-0184	184	2	92	32	
LMFC3-P-0276	276	3	184	47	
LMFC3-P-0368	368	4	276	61	
LMFC3-P-0460	460	5	368	76	
LMFC3-P-0552	552	6	460	91	
LMFC3-P-0644	644	7	552	105	
LMFC3-P-0736	736	8	644	120	
LMFC3-P-0828	828	9	736	135	
LMFC3-P-0920	920	10	828	149	
LMFC3-P-1012	1012	11	920	164	
LMFC3-P-1104	1104	12	1012	179	
LMFC3-P-1196	1196	13	1104	193	
LMFC3-P-1288	1288	14	1196	208	
End block weight of LMFC3&4 [S&R]					
LMFC3 (g/set)				960	
LMFC4 (g/set)				1040	

■ LMFC 5 Series cooling pipe



Specifications	L(mm)	N	P(mm)	Weight(g/pc)	For stator
LMFC5-P-0092	92	1	0	35	LMF5S□EP Note: 1.LMFC5 Series includes end blocks and triple cooling pipes. 2.[LC] is defined by total jointing length of stators. If the length is longer than 1288 mm, multiple cooling pipes will be connected to cover the total length. 3.Take Lc=3312 mm for example, 3312 mm =1288 mm*2+736 mm*1. Therefore, LMFC3-P-1288*2 and LMFC3-P-0736*1 will be utilized. 4.All connectors of precision cooler stator are connected with special adhesive, turning it will cause manual damage and responsibility will be taken by the user.
LMFC5-P-0184	184	2	92	65	
LMFC5-P-0276	276	3	184	96	
LMFC5-P-0368	368	4	276	132	
LMFC5-P-0460	460	5	368	167	
LMFC5-P-0552	552	6	460	200	
LMFC5-P-0644	644	7	552	227	
LMFC5-P-0736	736	8	644	260	
LMFC5-P-0828	828	9	736	291	
LMFC5-P-0920	920	10	828	317	
LMFC5-P-1012	1012	11	920	350	
LMFC5-P-1104	1104	12	1012	384	
LMFC5-P-1196	1196	13	1104	415	
LMFC5-P-1288	1288	14	1196	451	
End block weight ofLMFC5 [S]					
LMFC5 (g/set)				2030	

■ LMFC 6 Series cooling pipe



Specifications	L(mm)	N	P(mm)	Weight(g/pc)	For stator
LMFC6-P-0184	184	4	138	62	LMF6S1EP Note: 1. LMFC6 Series includes end blocks and triple cooling pipes. 2. [LC] is defined by total jointing length of stators. If the length is longer than 1288 mm, multiple cooling pipes will be connected to cover the total length. 3. Take Lc=3312 mm for example, 3312 mm =1288 mm*2+736 mm*1. Therefore, LMFC3-P-1288*2 and LMFC3-P-0736*1 will be utilized. 4. All connectors of precision cooler stator are connected with special adhesive, turning it will cause manual damage and responsibility will be taken by the user.
LMFC6-P-0368	368	8	322	125	
LMFC6-P-0552	552	12	506	190	
LMFC6-P-0736	736	16	690	247	
LMFC6-P-0920	920	20	874	301	
LMFC6-P-1104	1104	24	1058	365	
LMFC6-P-1288	1288	28	1242	428	
End block weight of LMFC6 [S]					
LMFC6 (set)				2908	

Specification code

Precision cooler forcer series

Series	Type	Width of precision cooler forcer	Length of precision cooler forcer
LM	FC	3	1
		3: LMFA3□/LMFP3□ 4: LMFA4□/LMFP4□ 5: LMFA5□/LMFP5□ 6: LMFA6□/LMFP6□	1: LMFA□1/LMFP□1 2: LMFA□2/LMFP□2 3: LMFA□3/LMFP□3 4: LMFA□4/LMFP□4

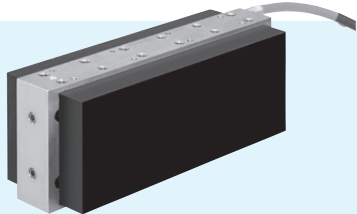
Precision cooler stator series

Series	Type	Width of precision cooler stator	End block type
LM	FC	3	S
		3: LMF3S□ (EP) 4: LMF4S□ (EP) 5: LMF5S□EP 6: LMF6S1EP	S: Standard type R: Reverse type

Series	Type	Precision cooler stator series	Length of cooling pipe (Pls. refer to length table of each series)
LM	FC	3 - P	- □□□□
		3: LMF3S□ (EP)&LMF4S□ (EP) 5: LMF5S□EP 6: LMF6S1EP	

2.7 LMSC Series
Linear Motor

The HIWIN LMSC synchronous linear motors are core-type, with the same characteristic as the LMS series but have about 2 times the thrust. Because forcers are arranged in a special way between two stators, attraction of forcers and stators will be offset. Load on slide rail is greatly reduced, and relatively high thrust density can be achieved in a very small volume.



- Magnetic force is offset
- Rails are not pre-stressed by magnetic attraction
- Can be water-cooled
- Continuous force range from 1070N to 1819 N
- Peak force 2140 N
- Installation height 131.5 mm

Force chart for LMSC series

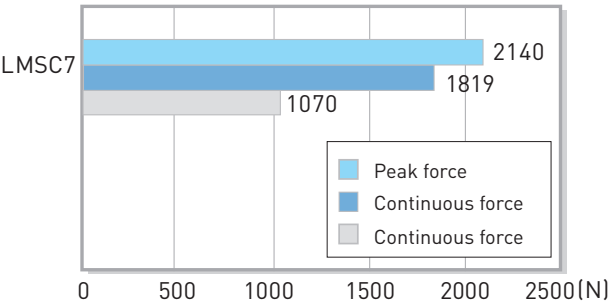


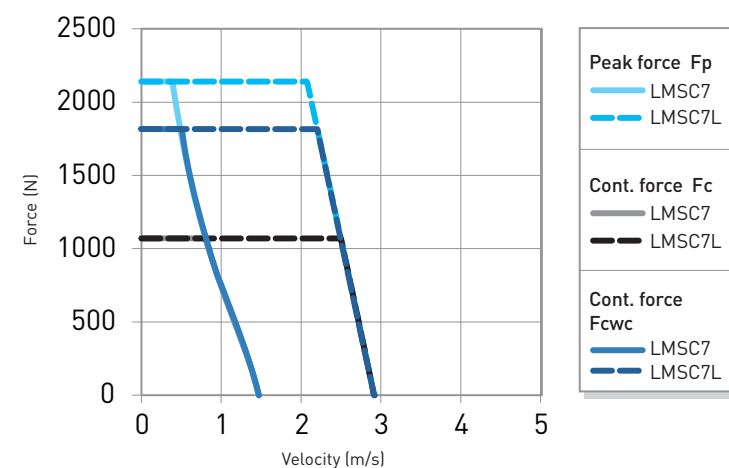
Table 2-7 LMSC Series specifications

	Symbol	Unit	LMSC7	LMSC7L
Continuous force	F _c	N	1070	1070
Continuous current	I _c	A _{rms}	3.9	7.9
Continuous force (WC)	F _c (WC)	N	1819	1819
Continuous current (WC)	I _c (WC)	A _{rms}	6.7	13.4
Peak force for 1 sec.	F _p	N		2140
Peak current for 1 sec.	I _p	A _{rms}	11.8	23.7
Force constant	K _f	N/A _{rms}	271	136
Attraction force	F _a	N		0
Max. winding temp.	T _{max}	°C		120
Electrical time constant	K _e	ms	10.5	10.0
Resistance (line to line at 25°C)	R ₂₅	Ω	17.8	4.2
Resistance (line to line at 120°C)	R ₁₂₀	Ω	23.5	5.5
Inductance (line to line)	L	mH	206.8	46.2
Pole pair pitch	2τ	mm		32
Minimum bending radius of cable	R _{bend}	mm		45(500V)/69(600V)
Back emf constant (line to line)	K _v	V _{rms} /(m/s)	141	71
Motor constant (at 25°C)	K _m	N/√W	52.4	54.2
Thermal resistance	R _{TH}	°C/W	0.17	0.18
Thermal resistance (WC)	R _{TH} (WC)	°C/W	0.06	0.06
Thermal switch	-	-	3 PTC SNM120 In Series	
Maximum DC bus voltage	-	V _{DC}		600
Mass of forcer	M _f	kg		14
Unit mass of stator	M _s	kg/m		16.4
Width of stator	W _s	mm		100
Length of stator/Dimension N	L _s	mm	128 mm/N=1, 192 mm/N=2, 320 mm/N=4	
Stator mounting distance	W _{s1}	mm		85
Total installation height	H	mm		131.5

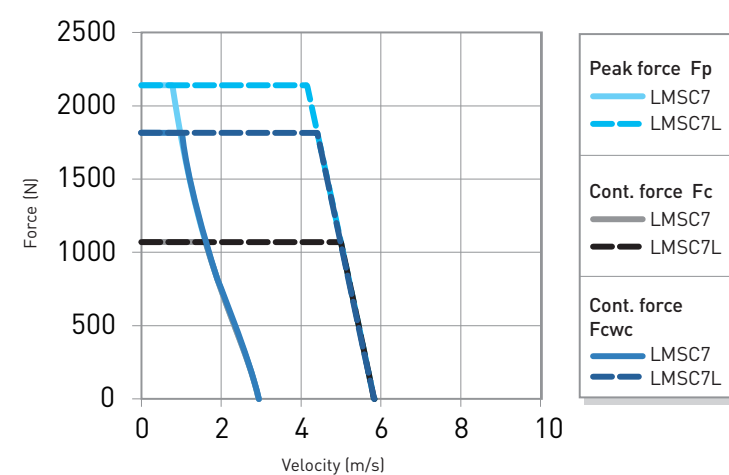
Note: 1. WC-water cooling
2. Except for WC, the data in this table are the values without forced cooling.
3. Except dimensions,the electrical specifications are in ±10% of tolerance.
4. We reserve the right to change, please follow customer recognition drawings.

2.7.1 LMSC Series F-V curves

- Force and velocity curves (DC bus voltage = 325 V_{DC})

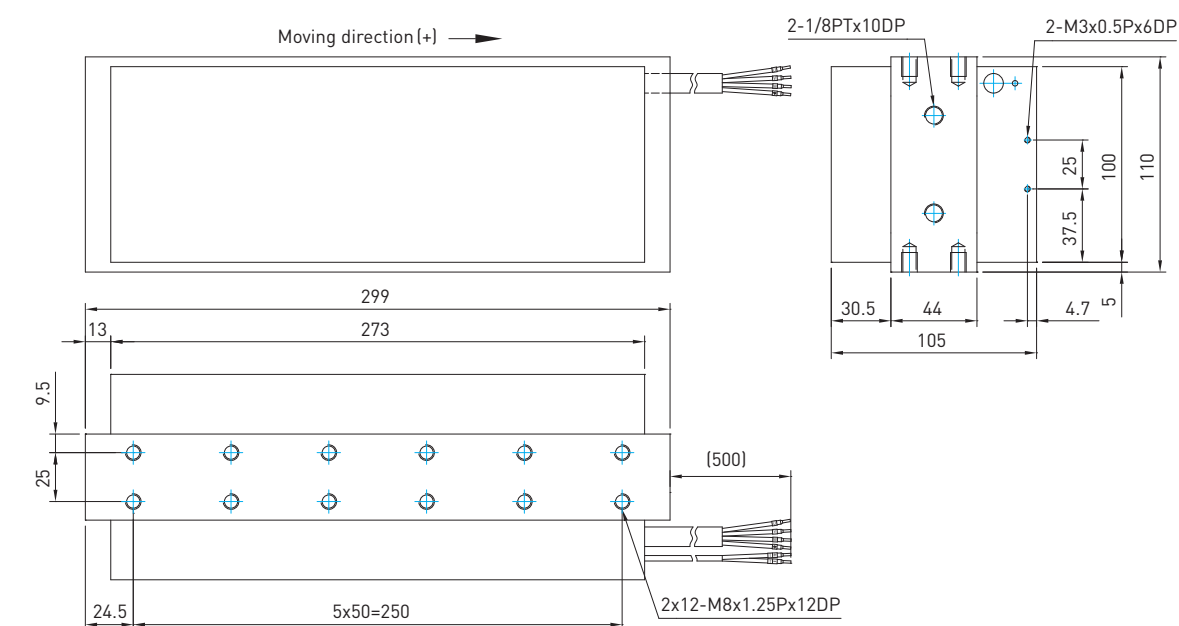


- Force and velocity curve (DC bus voltage = 600 V_{DC})



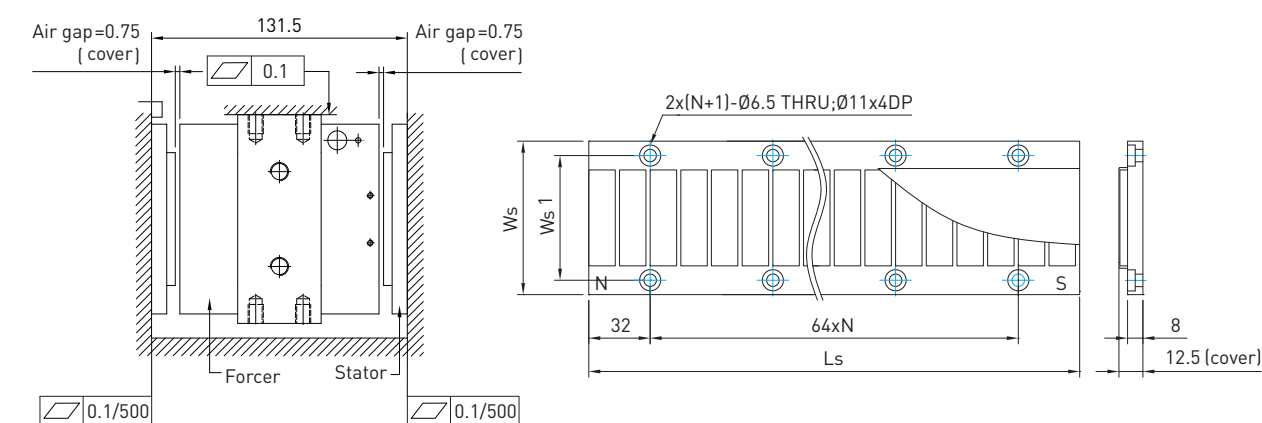
2.7.2 LMSC Series forcers and stators dimensions

- Dimensions of LMSC 7 forcer



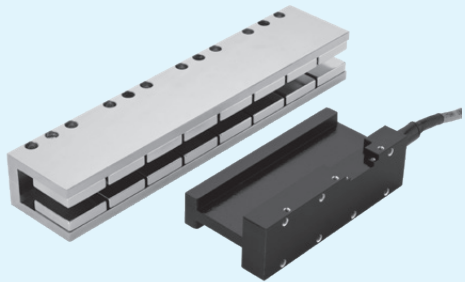
- Mounting tolerances

- Dimensions of LMSC 7 stator



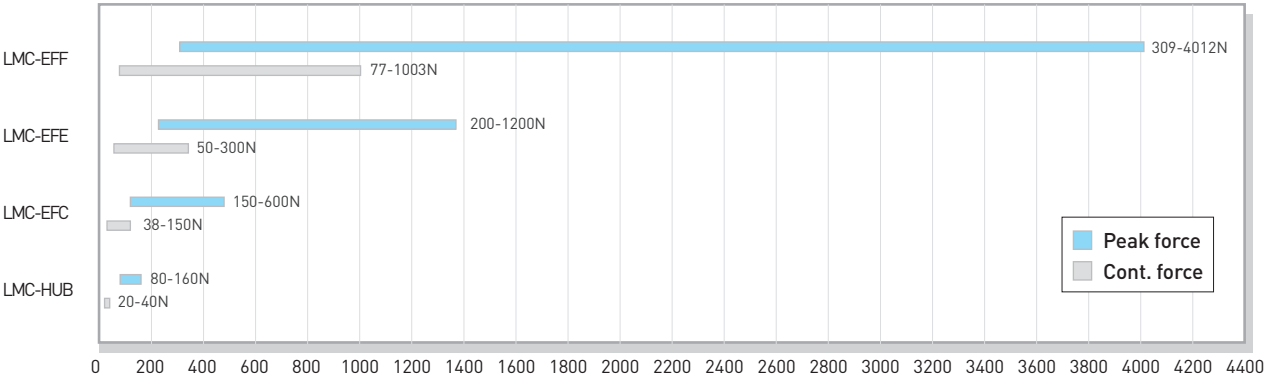
2.8 LMC Series
Linear Motor

The HIWIN LMC coreless U-shaped linear motor has no cogging, an excellent low velocity ripple and excellent dynamic characteristics. With no attraction between forcers and stators and a very low-profile structure, the motor can be applied to the installation platform without deformation and has a light load demand for continuous movement curve. Example applications include: high-speed, light-load automation equipment, dust-free environment automation equipment, flat panel equipment, optical detection equipment, scanning electron microscope equipment, semiconductor equipment.



- Three-phase
- Excellent dynamic characteristics
- Excellent synchronization and high speed coordination
- Small inertia, high acceleration
- Low installation height
- No cogging
- No attraction between force
- Same movement axis can use with multiple forcers
- CE certification

Force chart for LMC series



2.8.1 LMC-EFC series

Table 2-8 LMC-EFC series specifications						
	Symbol	Unit	LMC-EFC1	LMC-EFC2	LMC-EFC3	LMC-EFC4
Continuous force	F_c	N	38	75	113	150
Continuous current	I_c	A_{rms}	3.4			
Peak force (1s)	F_p	N	150	300	450	600
Peak current (1s)	I_p	A_{rms}	13.6	13.6	13.6	13.6
Force constant	K_f	N/A_{rms}	11.2	22.3	33.5	44.6
Maximum winding temperature	T_{max}	$^{\circ}C$	120			
Electrical time constant	K_e	ms	0.7			
Resistance (line to line, 25 $^{\circ}C$)	R_{25}	Ω	1.8	3.3	4.8	6.3
Inductance (line to line)	L	mH	1.2	2.3	3.4	4.5
Pole pair pitch	2τ	mm	60			
Minimum bending radius of cable	R_{bend}	mm	46.5			
Back emf constant (line to line)	K_v	$V_{rms}/(m/s)$	6.4	12.9	19.4	25.8
Motor constant (25 $^{\circ}C$)	K_m	$N/\sqrt{W}$	6.8	9.9	12.3	14.4
Thermal resistance	R_{TH}	$^{\circ}C/W$	2.31	1.26	0.87	0.66
Thermal switch	-	-	PTC			
Maximum DC bus voltage	-	V_{DC}	330			
Mass of forcer	M_f	kg	0.24	0.48	0.72	0.96
Unit mass of stator	M_s	kg/m	9.1			
Length of forcer/dimension n	L_f	mm	61	121/3	181/5	241/7
Height of forcer/dimension m	h	mm	59	59/3	59/4	59/6
Length of stator/dimension N	L_s	mm	120 mm/N=2, 180 mm/N=3, 300 mm/N=5			
Heat sink dimension	-	mm	210x210x10			

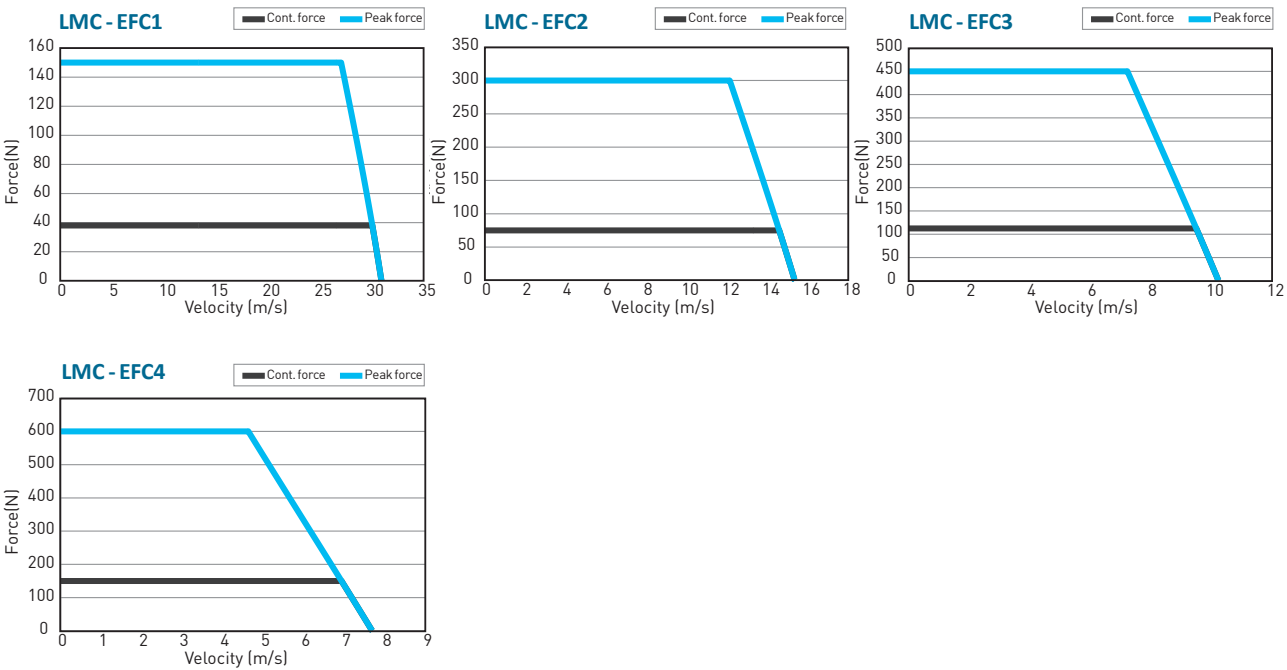
Note: 1. Values in this table are motor at 25 $^{\circ}C$ ambient temperature and no forced cooling.

2. Thermal resistance data are the values measured of forcer on heat sink.

3. Except dimensions, the electrical specifications are in $\pm 10\%$ of tolerance.

4. We reserve the right of changes, please follow customer recognition drawings.

Force and velocity curve(DC bus voltage = 330 V_{DC})

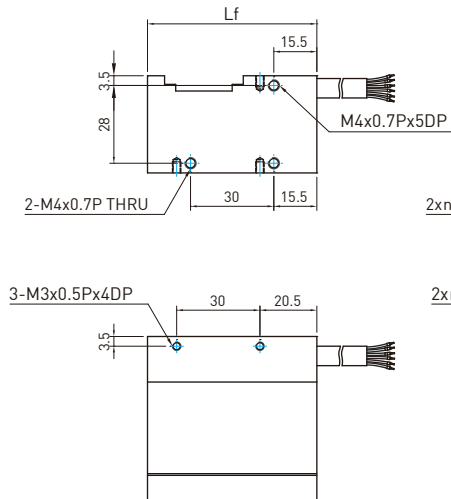


LMC-EFC series forcers and stators dimensions

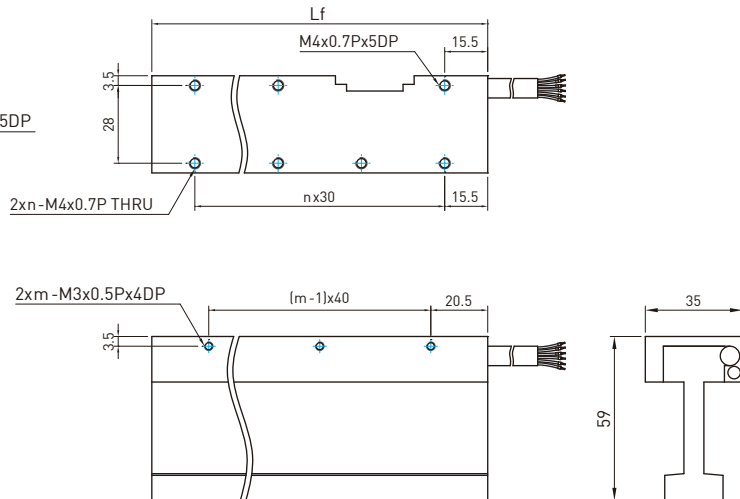
■ Dimensions of LMC-EFC forcers

(Value for L_f and n : see Table 2-10)

LMC-EFC 1:

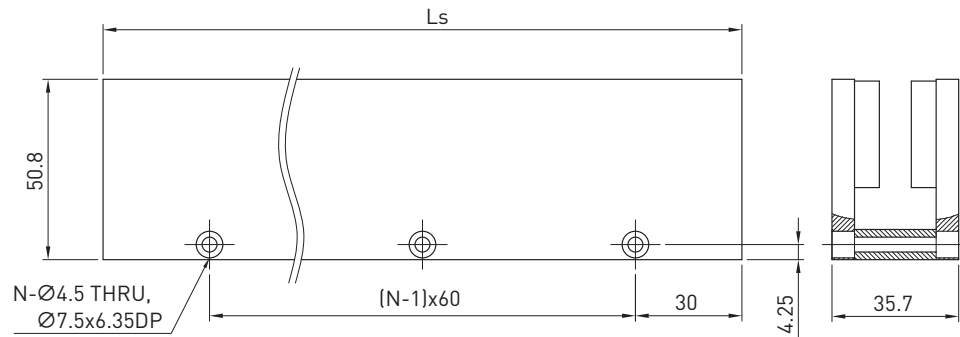


LMC-EFC2 / LMC-EFC3 / LMC-EFC4 :

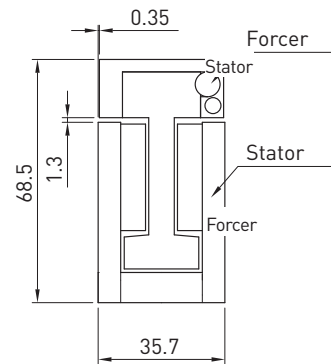


■ Dimensions of LMC-EFC stators

(Value for L_s and N : see Table 2-10)



■ Mounting tolerances



Order code of magnet track (stator)

Series	Height of stator	Model	Length of stator
LMC	EFC	S	1
EFC: 50.8 mm S: Standard			
1: 120 mm			
B: 180 mm			
2: 300 mm			

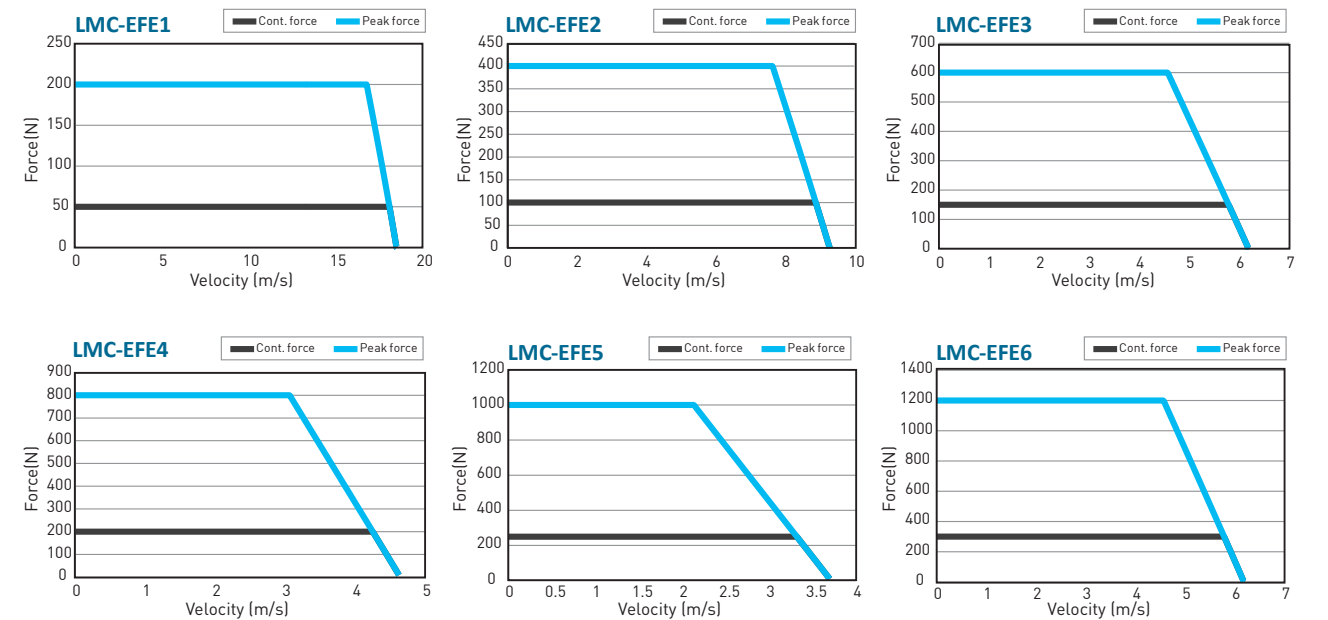
2.8.2 LMC-EFE series

Table 2-8 LMC-EFE series specifications

	Symbol	Unit	LMC-EFE1	LMC-EFE2	LMC-EFE3	LMC-EFE4	LMC-EFE5	LMC-EFE6
Continuous force	F_c	N	50	100	150	200	250	300
Continuous current	I_c	A_{rms}	2.7	2.7	2.7	2.7	2.7	5.4
Peak force (1s)	F_p	N	200	400	600	800	1000	1200
Peak current (1s)	I_p	A_{rms}	10.8	10.8	10.8	10.8	10.8	21.7
Force constant	K_f	N/A_{rms}	18.5	37.0	55.4	73.9	92.4	55.4
Maximum winding temperature	T_{max}	°C	120					
Electrical time constant	K_e	ms	0.85					
Resistance (line to line, 25°C)	R_{25}	Ω	1.8	3.6	5.4	7.1	8.9	2.7
Inductance (line to line)	L	mH	1.5	3.1	4.6	6.1	7.6	2.3
Pole pair pitch	2τ	mm	60					
Minimum bending radius of cable	R_{bend}	mm	37.5					
Back emf constant (line to line)	K_v	$V_{rms}/(m/s)$	10.7	21.3	32.0	42.7	53.3	32.0
Motor constant [25°C]	K_m	$N/\sqrt{W}$	11.3	16.0	19.5	22.6	25.2	27.6
Thermal resistance	R_{th}	°C/W	3.67	1.83	1.22	0.92	0.73	0.61
Thermal switch	-	-	PTC					
Maximum DC bus voltage	-	V	330					
Mass of forcer	M_f	kg	0.30	0.60	0.90	1.20	1.50	1.80
Unit mass of stator	M_s	kg/m	15.9					
Length of forcer/dimension n	L_f	mm	61	121/3	181/5	241/7	301/9	361/11
Height of forcer/dimension m	h	mm	79	79/3	79/4	79/6	79/7	79/9
Height of stator	H_s	mm	75.3					
Width of stator	W_s	mm	38.7					
Length of stator/dimension N	L_s	mm	120 mm/N=2, 180 mm/N=3, 300 mm/N=5					
Total installation height	H	mm	93					
Heat sink dimension	-	mm	210x210x10					

Note: 1. Values in this table are motor at 25°C ambient temperature and no forced cooling.
2. Thermal resistance data are the values measured of forcer on heat sink.
3. Except dimensions, the electrical specifications are in $\pm 10\%$ of tolerance.
4. We reserve the right of changes, please follow customer recognition drawings.

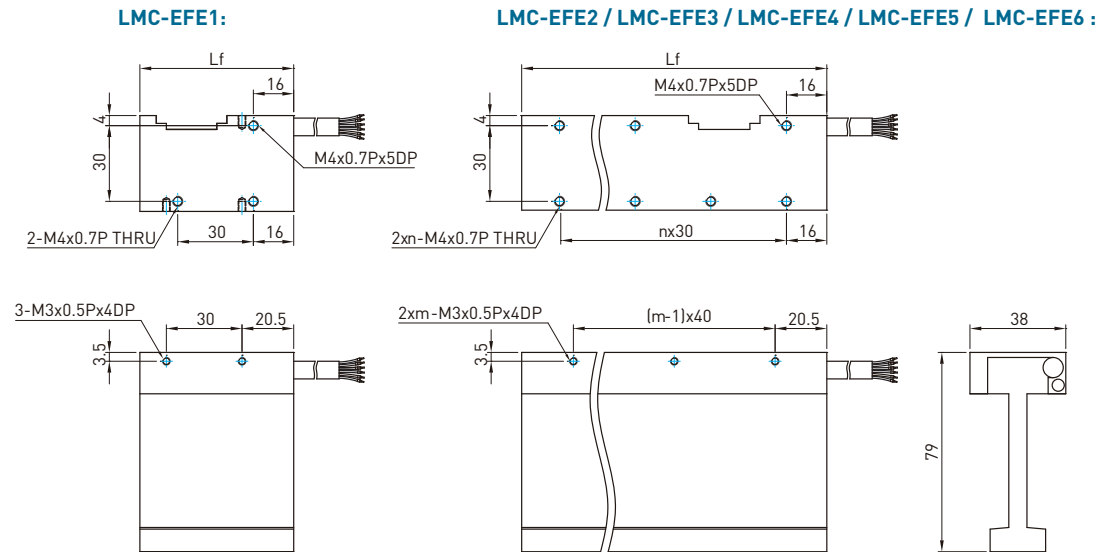
■ Force and velocity curve (DC bus voltage = 330 V_{DC})



LMC-EFE series forcers and stators dimensions

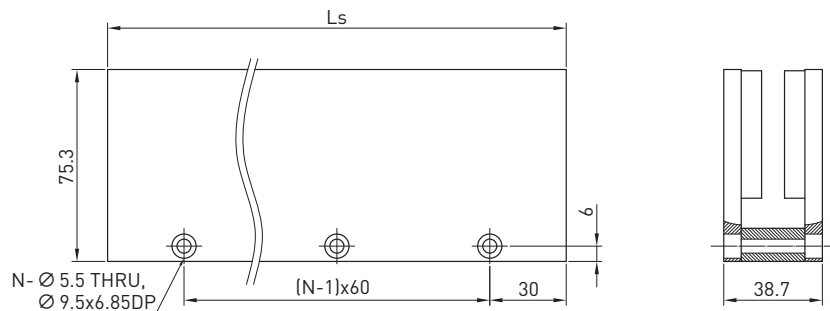
■ Dimensions of LMC-EFE forcers

(Value for L_f and n : see Table 2-11)

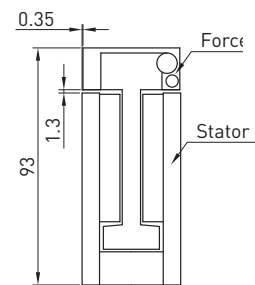


■ Dimensions of LMC-EFE stators

(Value for L_s and N : see Table 2-11)



■ Mounting tolerances



Order code of magnet track (stator)

Series	Height of stator	Model	Length of stator
LMC	EFE	S	1
EFE: 75.3 mm S: Standard			
1: 120 mm			
B: 180 mm			
2: 300 mm			

2.8.3 LMC-EFF series

Table 2-8 LMC-EFF series specifications

	Symbol	Unit	LMC-EFF1	LMC-EFF2	LMC-EFF3	LMC-EFF4	LMC-EFF5	LMC-EFF6	LMC-EFF7	LMC-EFF8	LMC-EFF9	LMC-EFFA	LMC-EFFB	LMC-EFFC	LMC-EFFD
Continuous force	F_c	N	77	154	231	309	386	463	540	617	694	771	849	926	1003
Continuous current	I_c	A_{rms}	5.7												
Peak force (1s)	F_p	N	309	617	926	1234	1543	1852	2160	2469	2777	3086	3394	3703	4012
Peak current (1s)	I_p	A_{rms}	22.6												
Force constant	K_f	N/A_{rms}	13.7	27.3	41.0	54.6	68.3	81.9	95.6	109.2	122.9	136.5	150.2	163.9	177.5
Maximum winding temperature	T_{max}	$^{\circ}C$	120												
Electrical time constant	K_e	ms	1.5												
Resistance (line to line, 25 $^{\circ}C$)	R_{25}	Ω	0.6	1.2	1.7	2.3	2.9	3.5	4.1	4.6	5.2	5.8	6.4	7	7.5
Inductance (line to line)	L	mH	0.9	1.7	2.6	3.5	4.3	5.2	6.1	6.9	7.8	8.7	9.6	10.4	11.3
Pole pair pitch	2τ	mm	60												
Minimum bending radius of cable	R_{bend}	mm	37.5												
Back emf constant (line to line)	K_v	$V_{rms}/(m/s)$	7.9	15.8	23.7	31.5	39.4	47.3	55.2	63.1	71.0	78.8	86.7	94.6	102.5
Motor constant (25 $^{\circ}C$)	K_m	$N/\sqrt{W}$	14.6	20.7	25.4	29.3	32.7	35.9	38.7	41.4	43.9	46.3	48.6	50.7	52.8
Thermal resistance	R_{TH}	$^{\circ}C/W$	2.59	1.30	0.86	0.65	0.52	0.43	0.37	0.32	0.29	0.26	0.24	0.22	0.20
Thermal switch	-	-	PTC												
Maximum DC bus voltage	-	V_{DC}	330												
Mass of forcer	M_f	kg	0.7	1.3	2.0	2.7	3.3	4.0	4.7	5.3	6.0	6.7	7.3	8.0	8.7
Unit mass of stator	M_s	kg/m	24.4												
Length of forcer/dimension n	L_f	mm	61	121/3	181/5	241/7	301/9	361/11	421/13	481/15	541/17	601/19	661/21	721/23	718/25
Length of stator/dimension N	L_s	mm	120 mm/ $N=2$, 180 mm/ $N=3$, 300 mm/ $N=5$												
Heat sink dimension	-	mm	210x210x10												

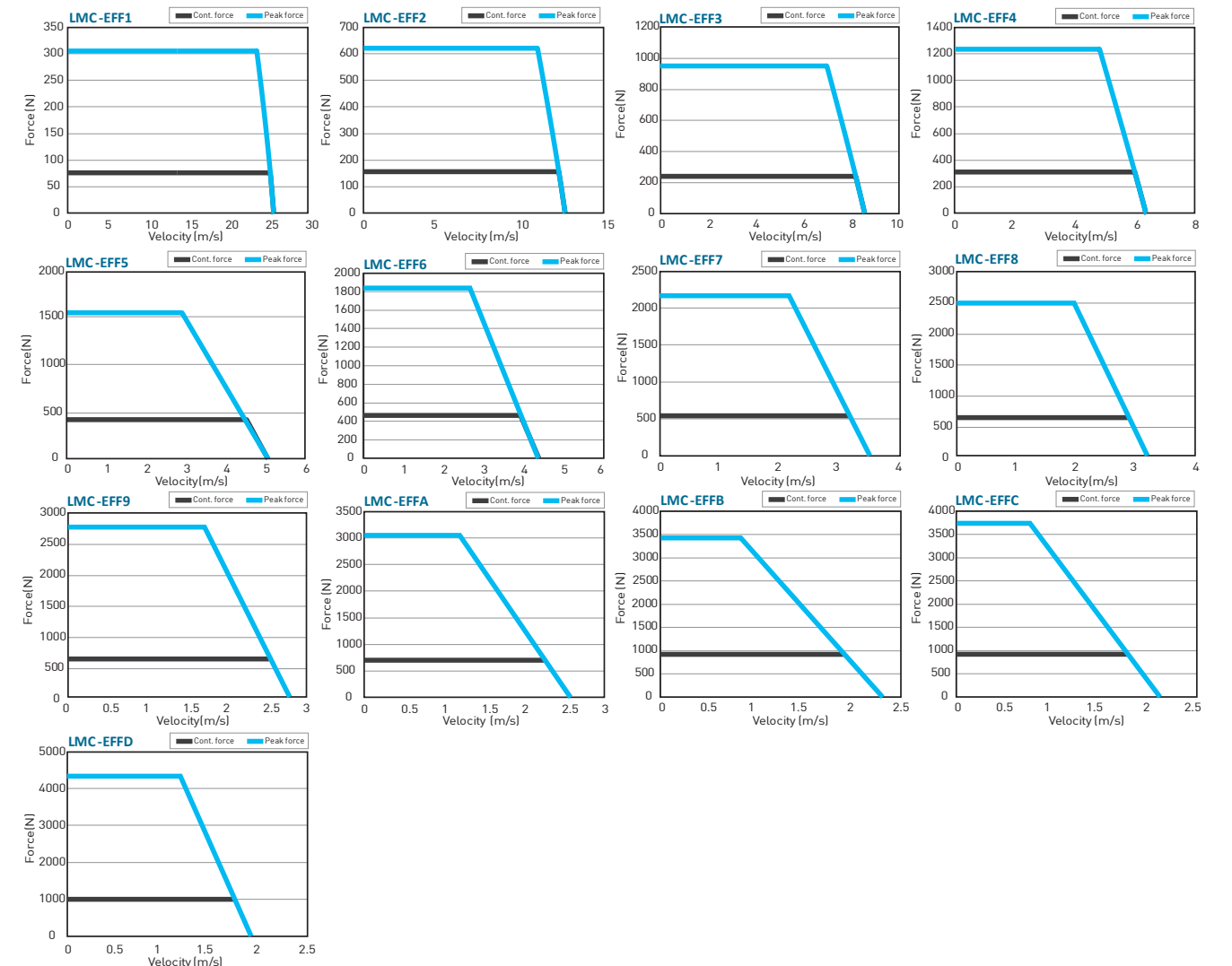
Note: 1. Values in this table are motor at 25 $^{\circ}C$ ambient temperature and no forced cooling.

2. Thermal resistance data are the values measured of forcer on heat sink.

3. Except dimensions, the electrical specifications are in $\pm 10\%$ of tolerance.

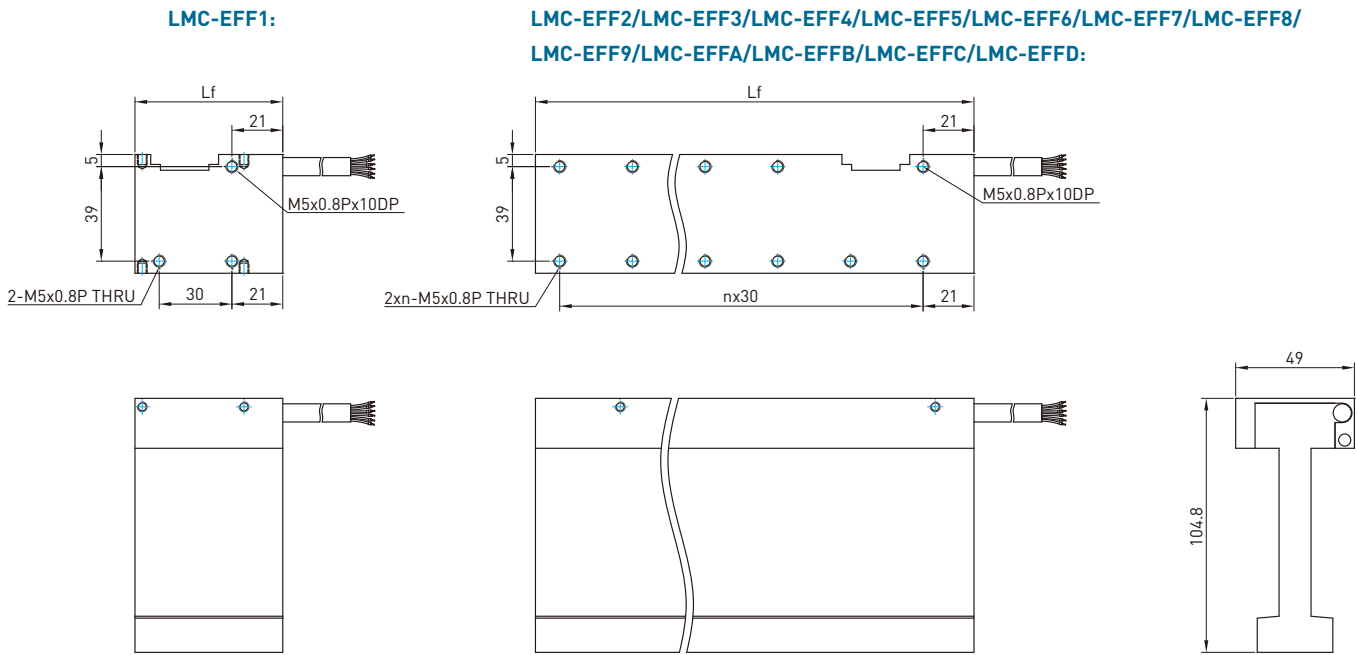
4. We reserve the right of changes, please follow customer recognition drawings.

■ Force and velocity curve (DC bus voltage = 330 V_{DC})



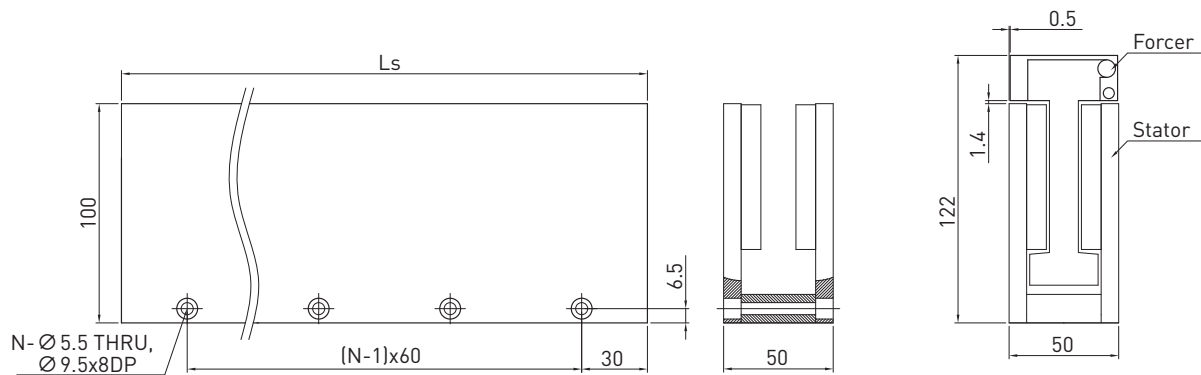
LMC-EFF series forcers and stators dimensions

■ Dimensions of LMC-EFF forcers
(Value for L_f and n : see Table 2-12)



■ Dimensions of LMC-EFF stators
(Value for L_s and N : see Table 2-12)

■ Mounting tolerances



Order code of magnet track (stator)

Series	Height of stator	Model	Length of stator
LMC	EFF	S	1
EFF: 100 mm S: Standard			
1: 120 mm			
B: 180 mm			
2: 300 mm			

2.8.4 LMC-HUB series

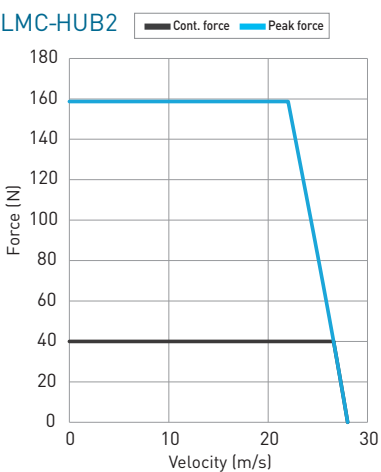
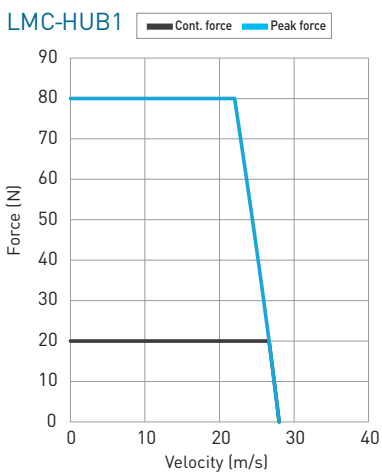
Table 2-8 LMC-HUB Series specifications

	Symbol	Unit	LMC-HUB1	LMC-HUB2
Continuous force	F_c	N	20	40
Continuous current	I_c	A_{rms}	1.5	3.1
Peak force for 1 sec.	F_p	N	80	160
Peak current for 1 sec.	I_p	A_{rms}	6.2	12.3
Force constant	K_f	N/A_{rms}	13.0	13.0
Max. winding temp.	T_{max}	$^{\circ}C$	120	120
Electrical time constant	K_e	ms	0.19	0.19
Resistance (line to line at 25 $^{\circ}C$)	R_{25}	Ω	7.5	3.8
Inductance (line to line)	L	mH	1.4	0.7
Pole pair pitch	2τ	mm	24	24
Minimum bending radius of cable	R_{bend}	mm	27.5	27.5
Back emf constant (line to line)	K_v	$V_{rms}/(m/s)$	7.5	7.5
Motor constant (at 25 $^{\circ}C$)	K_m	$N/\sqrt{W}$	3.9	5.5
Thermal resistance	R_{th}	$^{\circ}C/W$	2.68	1.34
Thermal switch	-	-	3 PTC SNM120 In Series	
Maximum DC bus voltage	-	V_{DC}	330	
Mass of forcer	M_f	kg	0.05	0.10
Unit mass of stator	M_s	kg/m	3.3	3.3
Length of forcer/Dimension n	L_f	mm	49	97
Length of stator/Dimension N	L_s	mm	72 mm, 120 mm	
Heat sink dimension	-	mm	100x60x14	

Note: 1. Values in this table are motor at 25 $^{\circ}C$ ambient temperature and no forced cooling.
2. Thermal resistance data are the values measured of forcer on heat sink.
3. Except dimensions, the electrical specifications are in $\pm 10\%$ of tolerance.
4. We reserve the right of changes, please follow customer recognition drawings.

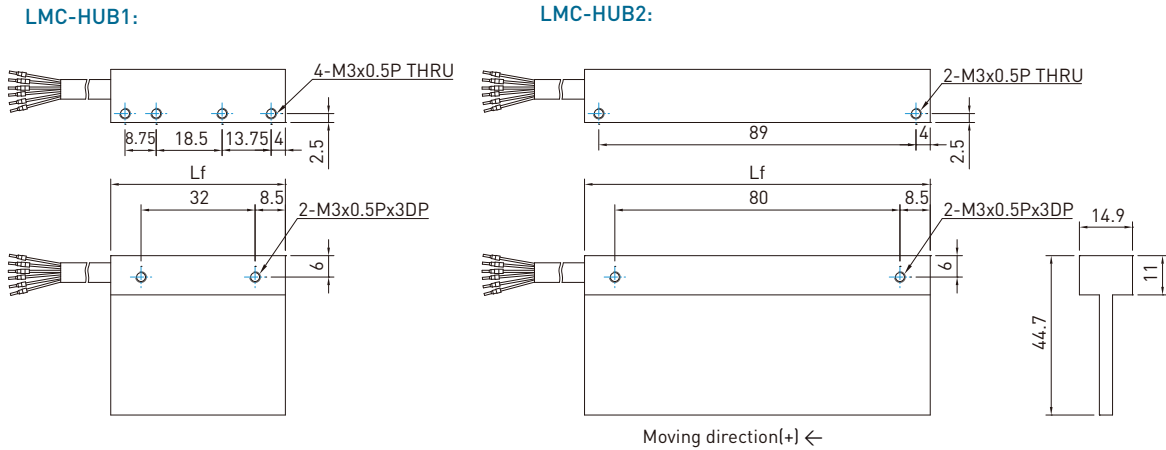
LMC-HUB Series F-V curves

■ Force and velocity curves (DC bus voltage = 330 V_{DC})

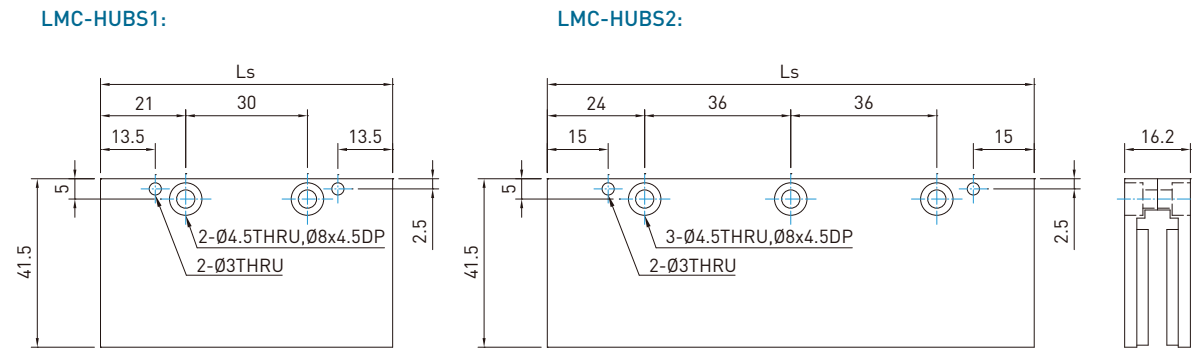


LMC-HUB Series forcers and stators dimensions

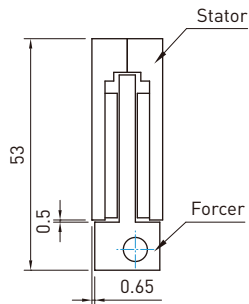
■ Dimension of LMC-HUB forcers
(Value for Lf : see Table 2-15)



■ Dimensions of LMC-HUB stators
(Value for Ls : see Table 2-15)



■ Mounting tolerances

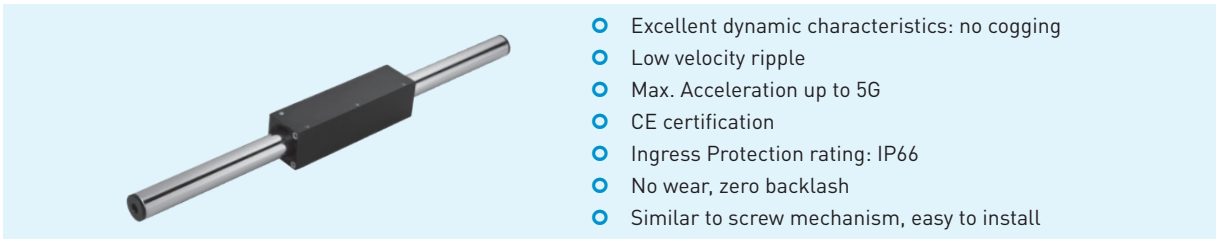


Order code of magnet track (stator)

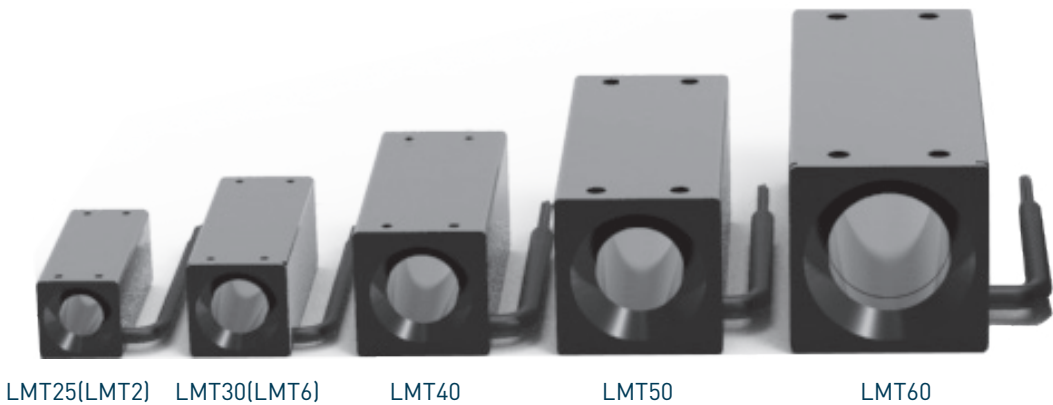
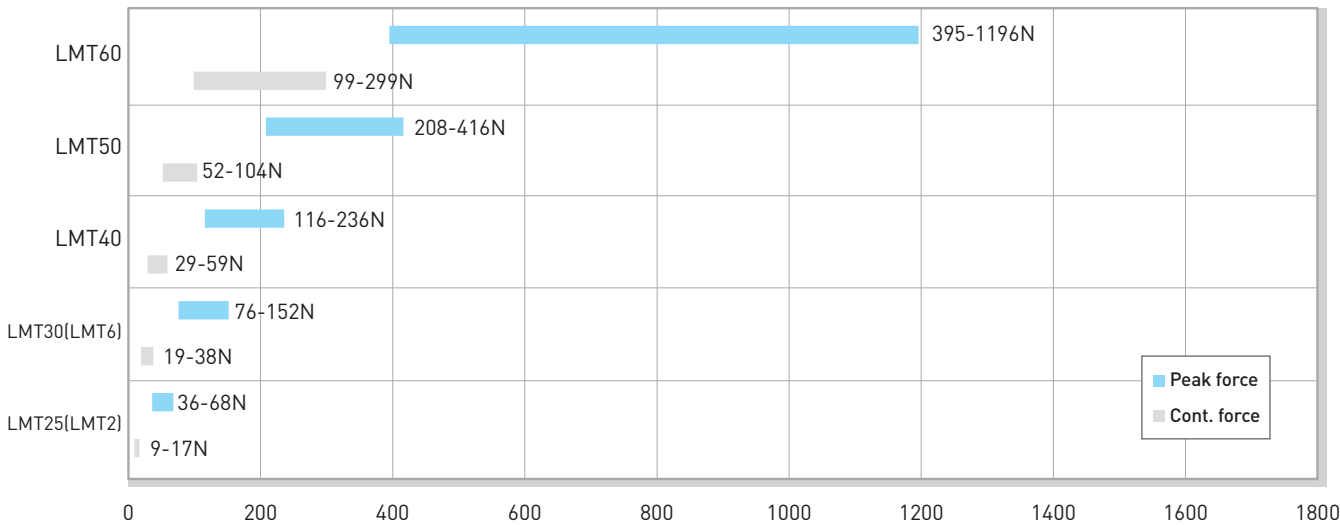
Series	Height of stator	Model	Length of stator
LMC	HUB	S	1
	HUB: 41.5 mm	S: Standard	1: 72 mm 2: 120 mm

2.9 LMT Series
Linear Motor

The HIWIN rod-shaped linear motor has a variety of sizes, with complete specifications, and easy installation. The maximum peak force for this motor is up to 1196 N. It complies with international safety CE certification, has dustproof and a waterproof IP66 rating. Using direct drive technology, no other mechanical drive components are needed to achieve linear transmission, with high-speed, no cogging and low velocity ripple along with other characteristics including; excellent dynamic performance, no wear, zero backlash, and easy maintenance. Compared to traditional mechanical linear solutions, the motor enhances machine equipment production capacity and reduces maintenance costs to meet the needs of high-precision positioning control and smooth operation applications such as high-speed light-load automation equipment, dust-free environment, automation equipment, panel equipment, optical inspection equipment, tool line cutting equipment, scanning electron microscope equipment, medical automation and other industries.



Force chart for LMT series

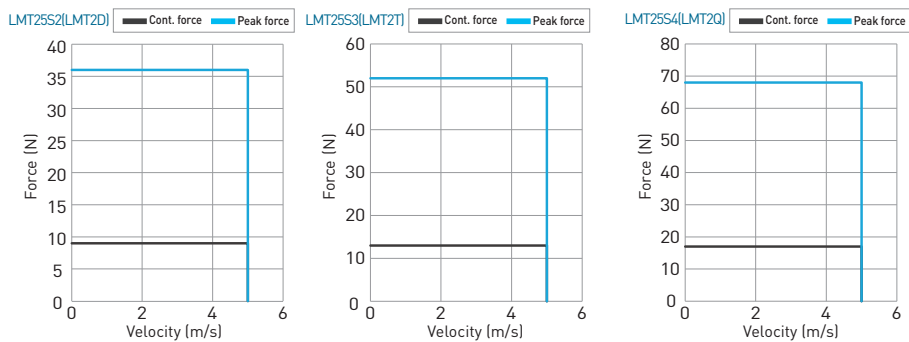


2.9.1 LMT25(LMT2) Series

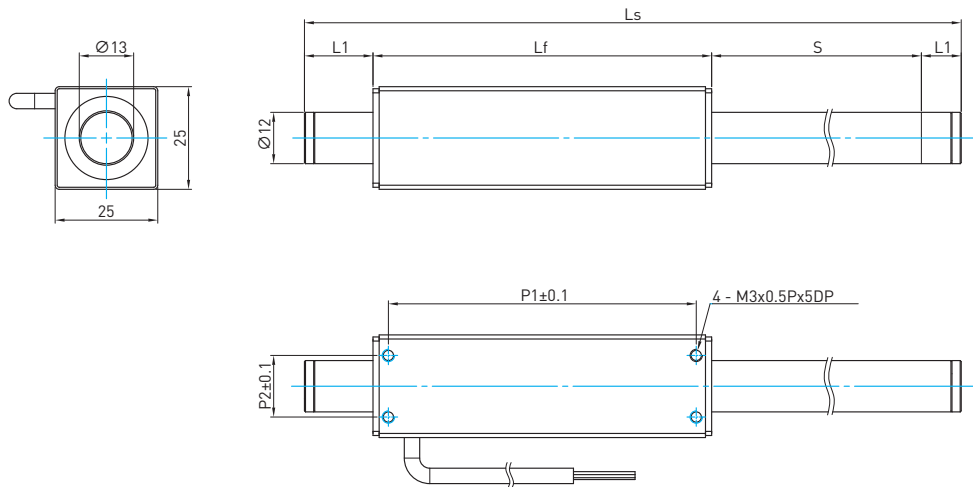
Table 2-9 LMT25(LMT2) Series specifications					
	Symbol	Unit	LMT25S2 (LMT2D)	LMT25S3 (LMT2T)	LMT25S4 (LMT2Q)
Continuous force	F_c	N	9	13	17
Continuous current	I_c	A_{rms}	1.5	1.5	1.5
Peak force for 1 sec.	F_p	N	36	52	68
Peak current for 1 sec.	I_p	A_{rms}	6	6	6
Force constant	K_f	N/A_{rms}	5.7	8.6	11.4
Electrical time constant	K_e	ms	0.3	0.3	0.3
Resistance (line to line at 25°C)	R_{25}	Ω	4.2	6.3	8.4
Inductance (line to line)	L	mH	1.1	1.7	2.2
Pole pair pitch	2τ	mm	48	48	48
Minimum bending radius of cable	R_{bend}	mm	40	40	40
Back emf constant (line to line)	K_v	$V_{rms}/(m/s)$	2.8	4.2	5.6
Motor constant (at 25°C)	K_m	$N/\sqrt{W}$	2.4	2.8	3.2
Thermal resistance	R_{TH}	$^{\circ}C/W$	5.4	3.6	2.7
Thermal switch	-	-	PTC 90		
Maximum DC bus voltage	-	V_{DC}	325		
Mass of forcer	M_f	kg	0.12	0.15	0.19
Unit mass of stator	M_s	kg/m	0.9	0.9	0.9
Length of forcer	L_f	mm	64	88	112
Mounting pitch	$P_1 \times P_2$	mm	56x12	80x12	104x12
Stroke	S	mm	50~1050 (Take 50 mm as increase unit)		
Clamping length	L_1	mm	25 (Stroke=50 mm~350 mm) 40 (Stroke=400 mm~800 mm) 60 (Stroke=850 mm~1050 mm)		
Total stator length	L_s	mm	$L_s(\text{Total stator length})=S(\text{Stroke})+L_f(\text{Length of forcer})+2 \times L_1(\text{Clamping length})$		

Note: 1. Values in this table are motor at 25°C ambient temperature and no forced cooling.
2. Except dimensions, the electrical specifications are in $\pm 10\%$ of tolerance.
3. We reserve the right of changes, please follow customer recognition drawings.

■ Force and velocity curves (DC bus voltage = 325 V_{DC})
(Considering load and stator stroke limitation, the maximum speed is set at 5 m/s.)



■ Dimensions of LMT25(LMT2) / LMT12S forcers and stators

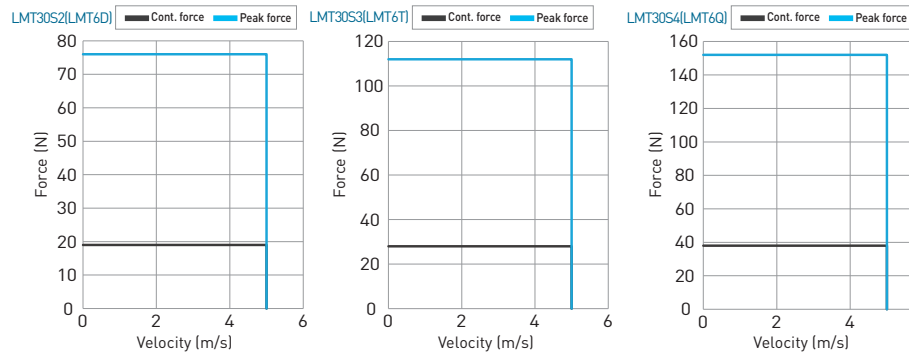


2.9.2 LMT30(LMT6) Series

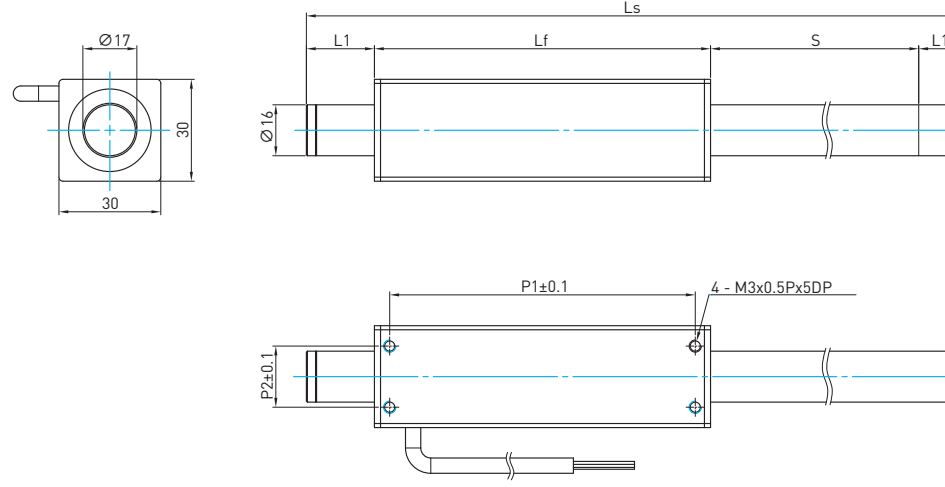
Table 2-9 LMT30(LMT6) Series specifications					
	Symbol	Unit	LMT30S2(LMT6D)	LMT30S3(LMT6T)	LMT30S4(LMT6Q)
Continuous force	F_c	N	19	28	38
Continuous current	I_c	A_{rms}	1.4	1.4	1.4
Peak force for 1 sec.	F_p	N	76	112	152
Peak current for 1 sec.	I_p	A_{rms}	5.6	5.6	5.6
Force constant	K_f	N/A_{rms}	13.4	20.1	26.8
Electrical time constant	K_e	ms	0.4	0.4	0.4
Resistance (line to line at 25°C)	R_{25}	Ω	7.3	10.9	14.5
Inductance (line to line)	L	mH	2.8	4.3	5.7
Pole pair pitch	2τ	mm	60	60	60
Minimum bending radius of cable	R_{bend}	mm	40	40	40
Back emf constant (line to line)	K_v	$V_{rms}/(m/s)$	6.6	9.8	13.2
Motor constant (at 25°C)	K_m	$N/\sqrt{W}$	4.1	4.9	5.8
Thermal resistance	R_{TH}	$^{\circ}C/W$	3.6	2.4	1.8
Thermal switch	-	-	PTC 90		
Maximum DC bus voltage	-	V_{DC}	325		
Mass of forcer	M_f	kg	0.20	0.26	0.34
Unit mass of stator	M_s	kg/m	1.4	1.4	1.4
Length of forcer	L_f	mm	80	110	140
Mounting pitch	$P_1 \times P_2$	mm	70x16	100x16	130x16
Stroke	S	mm	100~1050 (Take 50 mm as increase unit)		
Clamping length	L_1	mm	25 (Stroke=100 mm~350 mm) 40 (Stroke=400 mm~800 mm) 60 (Stroke=850 mm~1050 mm)		
Total stator length	L_s	mm	$L_s(\text{Total stator length})=S(\text{Stroke})+L_f(\text{Length of forcer})+2 \times L_1(\text{Clamping length})$		

Note: 1. Values in this table are motor at 25°C ambient temperature and no forced cooling.
2. Except dimensions, the electrical specifications are in $\pm 10\%$ of tolerance.
3. We reserve the right of changes, please follow customer recognition drawings.

■ Force and velocity curves (DC bus voltage = 325 V_{DC})
(Considering load and stator stroke limitation, the maximum speed is set at 5 m/s.)



■ Dimensions of LMT30 (LMT6) / LMT16S forcers and stators

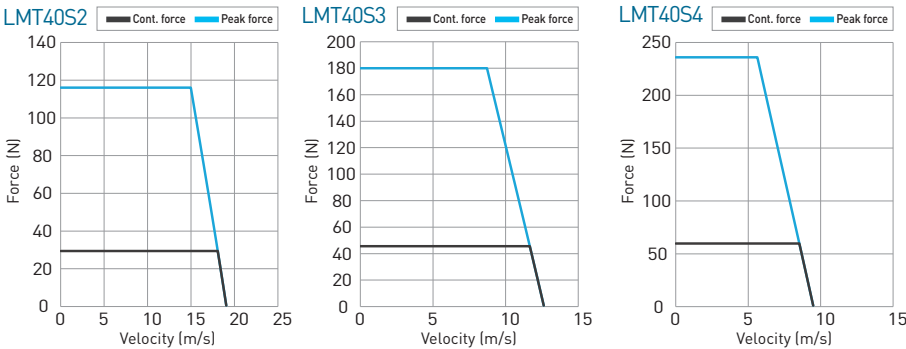


2.9.3 LMT40 Series

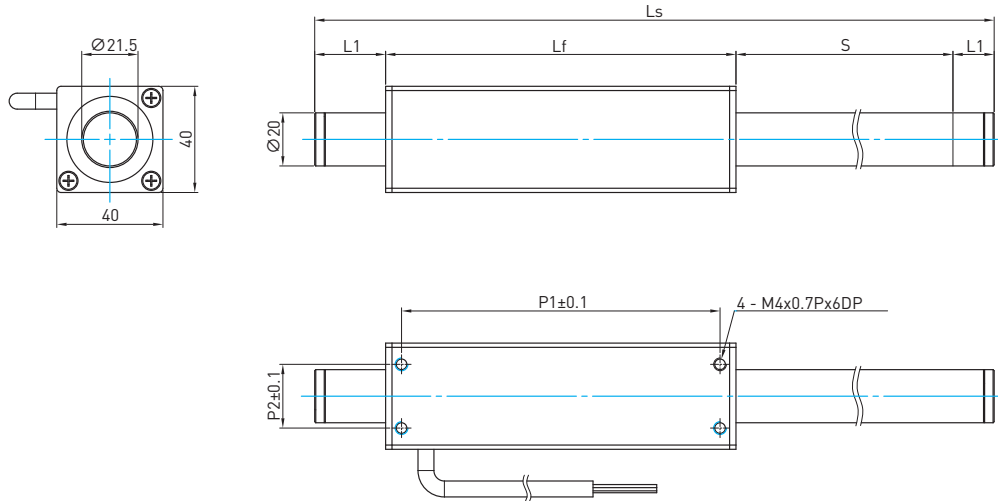
Table 2-9 LMT40 Series specifications					
	Symbol	Unit	LMT40S2	LMT40S3	LMT40S4
Continuous force	F_c	N	29	45	59
Continuous current	I_c	A_{rms}	1.6	1.6	1.6
Peak force for 1 sec.	F_p	N	116	180	236
Peak current for 1 sec.	I_p	A_{rms}	6.4	6.4	6.4
Force constant	K_f	N/A_{rms}	18.7	28.2	37.6
Electrical time constant	K_e	ms	0.6	0.6	0.6
Resistance (line to line at 25°C)	R_{25}	Ω	7.5	11.2	14.9
Inductance (line to line)	L	mH	4.6	6.7	9.1
Pole pair pitch	2τ	mm	72	72	72
Minimum bending radius of cable	R_{bend}	mm	37.5	37.5	37.5
Back emf constant (line to line)	K_v	$V_{rms}/(m/s)$	10.8	16.3	21.7
Motor constant (at 25°C)	K_m	$N/\sqrt{W}$	5.4	6.9	7.8
Thermal resistance	R_{TH}	$^{\circ}C/W$	2.60	1.74	1.31
Thermal switch	-	-	PTC 90		
Maximum DC bus voltage	-	V_{DC}	325		
Mass of forcer	M_f	kg	0.45	0.63	0.8
Unit mass of stator	M_s	kg/m	2	2	2
Length of forcer	L_f	mm	94	130	166
Mounting pitch	$P_1 \times P_2$	mm	84x20	120x20	156x20
Stroke	S	mm	100~1550 (Take 50 mm as increase unit)		
Clamping length	L_1	mm	25 (Stroke=100 mm~300 mm) 40 (Stroke=350 mm~700 mm) 60 (Stroke=750 mm~1550 mm)		
Total stator length	L_s	mm	L_s (Total stator length)= S (Stroke)+ L_f (Length of forcer)+2* L_1 (Clamping length)		

Note: 1. Values in this table are motor at 25°C ambient temperature and no forced cooling.
2. Except dimensions, the electrical specifications are in $\pm 10\%$ of tolerance.
3. We reserve the right of changes, please follow customer recognition drawings.

- Force and velocity curves (DC bus voltage = 325 V_{DC})
(Considering load and stator stroke limitation, the maximum speed is set at 5 m/s.)



- Dimensions of LMT40 / LMT20S forcers and stators

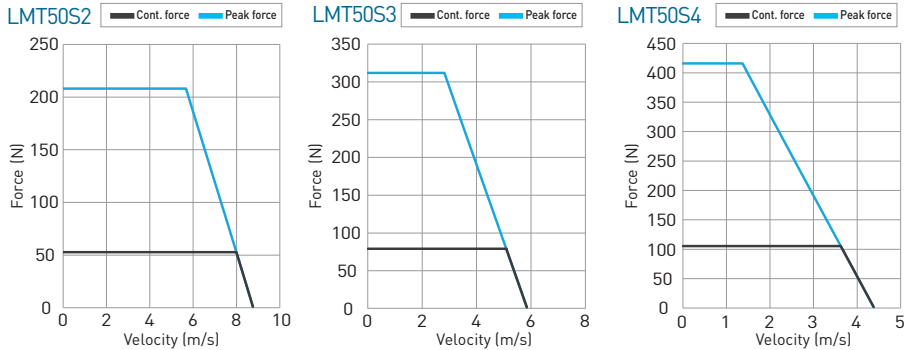


2.9.4 LMT50 Series

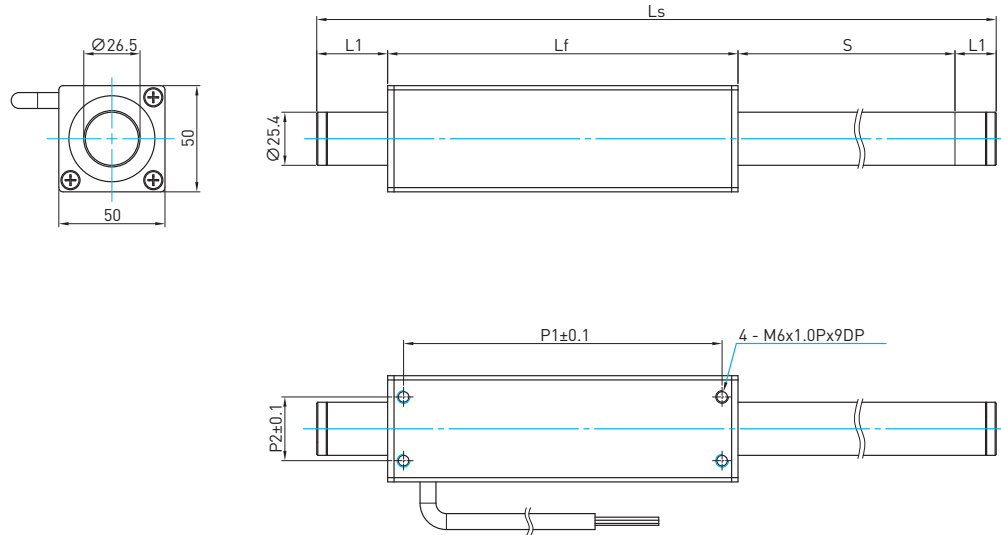
Table 2-9 LMT50 Series specifications					
	Symbol	Unit	LMT50S2	LMT50S3	LMT50S4
Continuous force	F_c	N	52	78	104
Continuous current	I_c	A_{rms}	1.3	1.3	1.3
Peak force for 1 sec.	F_p	N	208	312	416
Peak current for 1 sec.	I_p	A_{rms}	5.2	5.2	5.2
Force constant	K_f	N/A_{rms}	40.7	61.0	81.4
Electrical time constant	K_e	ms	1.0	1.0	1.0
Resistance (line to line at 25°C)	R_{25}	Ω	15.8	23.6	31.5
Inductance (line to line)	L	mH	15.3	23	30.6
Pole pair pitch	2τ	mm	90	90	90
Minimum bending radius of cable	R_{bend}	mm	37.5	37.5	37.5
Back emf constant (line to line)	K_v	$V_{rms}/(m/s)$	23.5	35.2	47
Motor constant (at 25°C)	K_m	$N/\sqrt{W}$	8.2	10.1	11.6
Thermal resistance	R_{TH}	$^{\circ}C/W$	1.87	1.25	0.94
Thermal switch	-	-	PTC 90		
Maximum DC bus voltage	-	V_{DC}	325		
Mass of forcer	M_f	kg	0.86	1.22	1.61
Unit mass of stator	M_s	kg/m	3.2	3.2	3.2
Length of forcer	L_f	mm	120	165	210
Mounting pitch	$P_1 \times P_2$	mm	105x25	150x25	195x25
Stroke	S	mm	100~1550 (Take 50 mm as increase unit)		
Clamping length	L_1	mm	50 (Stroke=100 mm~700 mm) 70 (Stroke=750 mm~1300 mm) 100 (Stroke=1350 mm~1550 mm)		
Total stator length	L_s	mm	L_s (Total stator length)= S (Stroke)+ L_f (Length of forcer)+2* L_1 (Clamping length)		

Note: 1. Values in this table are motor at 25°C ambient temperature and no forced cooling.
2. Except dimensions, the electrical specifications are in $\pm 10\%$ of tolerance.
3. We reserve the right of changes, please follow customer recognition drawings.

- Force and velocity curves (DC bus voltage = 325 V_{DC})



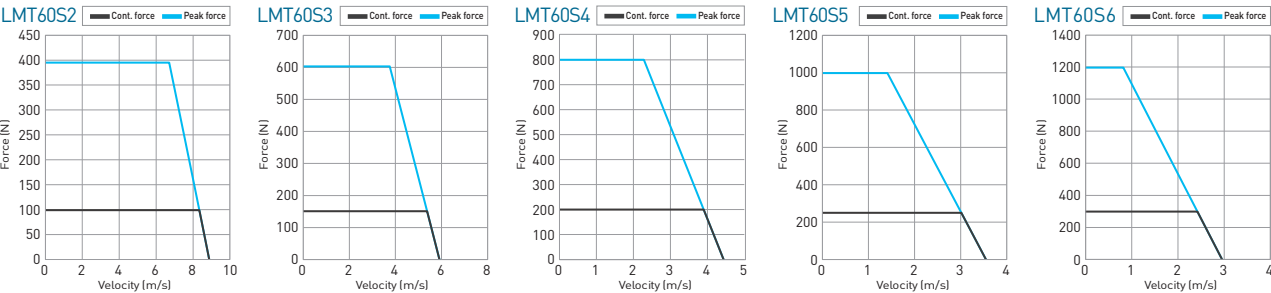
- Dimensions of LMT50 / LMT2AS forcers and stators



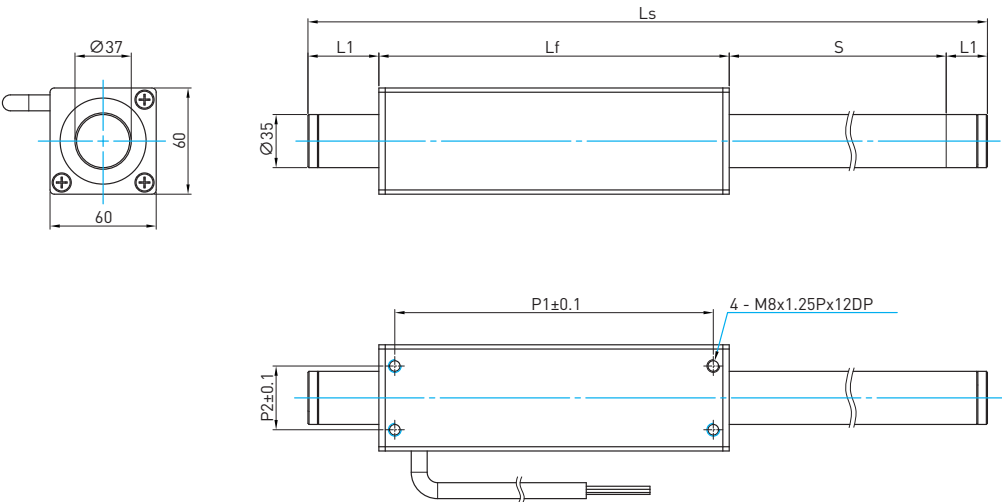
2.9.5 LMT60 Series

Table 2-9 LMT60 Series specifications							
	Symbol	Unit	LMT60S2	LMT60S3	LMT60S4	LMT60S5	LMT60S6
Continuous force	F _c	N	99	151	200	250	299
Continuous current	I _c	A _{rms}	2.6	2.6	2.6	2.6	2.6
Peak force for 1 sec.	F _p	N	395	603	801	998	1196
Peak current for 1 sec.	I _p	A _{rms}	10.4	10.4	10.4	10.4	10.4
Force constant	K _f	N/A _{rms}	40.4	60.6	80.7	101	121.2
Electrical time constant	K _e	ms	1.2	1.2	1.2	1.2	1.2
Resistance (line to line at 25°C)	R ₂₅	Ω	5.5	8.3	11.1	13.8	16.6
Inductance (line to line)	L	mH	6.5	9.7	12.9	16.2	19.4
Pole pair pitch	2τ	mm	120	120	120	120	120
Minimum bending radius of cable	R _{bend}	mm	37.5	37.5	37.5	37.5	37.5
Back emf constant (line to line)	K _v	V _{rms} /(m/s)	23.3	35	46.6	58.3	70
Motor constant (at 25°C)	K _m	N/√W	13.3	16.5	18.9	21.1	23
Thermal resistance	R _{TH}	°C/W	1.34	0.89	0.67	0.54	0.45
Thermal switch	-	-	PTC 90				
Maximum DC bus voltage	-	V _{DC}	325				
Mass of forcer	M _f	kg	1.5	2.1	2.8	3.4	4
Unit mass of stator	M _s	kg/m	6.4	6.4	6.4	6.4	6.4
Length of forcer	L _f	mm	160	220	280	340	400
Mounting pitch	P ₁ xP ₂	mm	140x30	200x30	260x30	320x30	380x30
Stroke	S	mm	100~2000 (Take 50 mm as increase unit)				
Clamping length	L ₁	mm	50 (Stroke=100 mm~750 mm) 70 (Stroke=800 mm~1500 mm) 100 (Stroke=1550 mm~2000 mm)				
Total stator length	L _s	mm	Ls (Total stator length)=S (Stroke)+Lf (Length of forcer)+2*L1 (Clamping length)				
Note: 1. Values in this table are motor at 25°C ambient temperature and no forced cooling. 2. Except dimensions, the electrical specifications are in ±10% of tolerance. 3. We reserve the right of changes, please follow customer recognition drawings.							

■ Force and velocity curves (DC bus voltage = 325 V_{DC})



■ Dimensions of LMT60 / LMT35S forcers and stators



Order code of magnet track (stator)

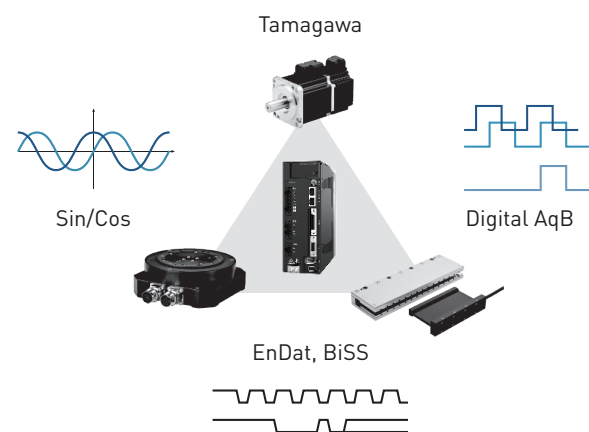
Series	Diameter of stator	Model	Width of stator
LMT	A	S	□ □ □ □
	12: Ø12 mm 16: Ø16 mm 20: Ø20 mm 2A: Ø25.4 mm 35: Ø35 mm	S: Standard C: Customized	

3. E Series Servo Drive

3.1 Drive

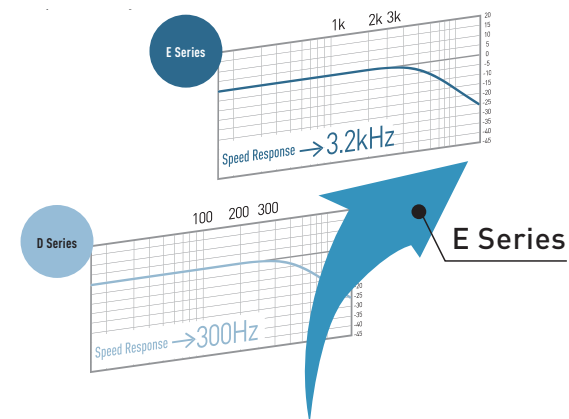
1 Supports Various Encoder / Motor Types

Supports AC Servo Motors, Direct Drive Motors, Linear Motors, and various encoder formats.



2 3.2 kHz Speed Response

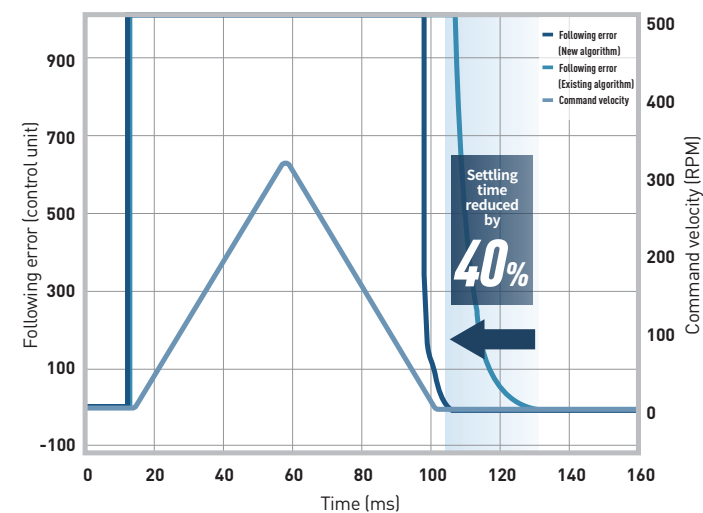
Higher speed response, faster settling time, and higher productivity.



3 Fast In-Position Performance

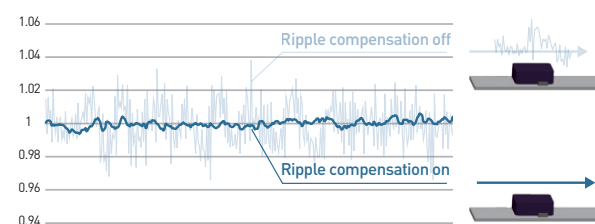
Fast and accurate precision positioning achieves fast response and increases equipment productivity.

With our next-generation algorithm, the vibration of mechanism can be suppressed and the shaking in positioning can be solved, improving the performance of servo motor to quickly enter the designated target position.



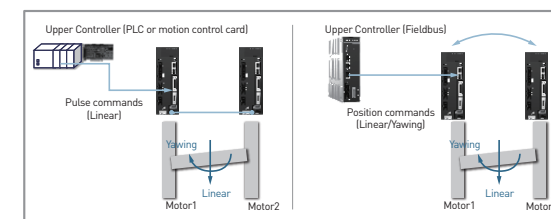
4 Ripple Compensation

Suppresses the speed ripple caused by motor cogging, and allows the ironcore motor to achieve smooth motion in detection and scanning applications.



5 Unique Gantry Control Function

Connect two fast-response drives with drive-level control circuit and linear & yaw movement to achieve high performance of a controller on a wide-span gantry.



6 Network with Industrial Communication

Support EtherCAT®, MECHATROLINK-III, PROFINET and EtherNet/IP. E series servo drive can also be connected to HIWIN EtherCAT (CoE) controllers.



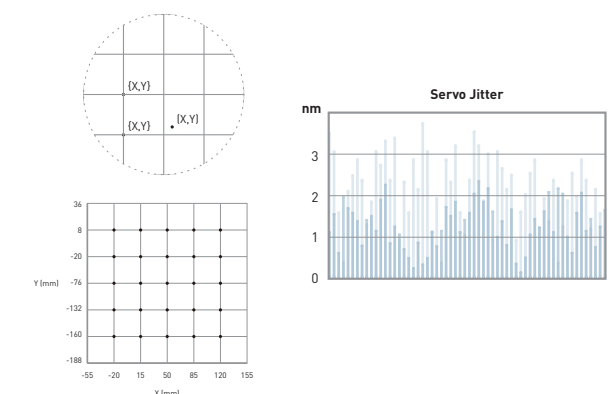
7 Built-in Multi-Motion Function

Tabulated pull-down menu of motion commands to simplify programming of typical motions.



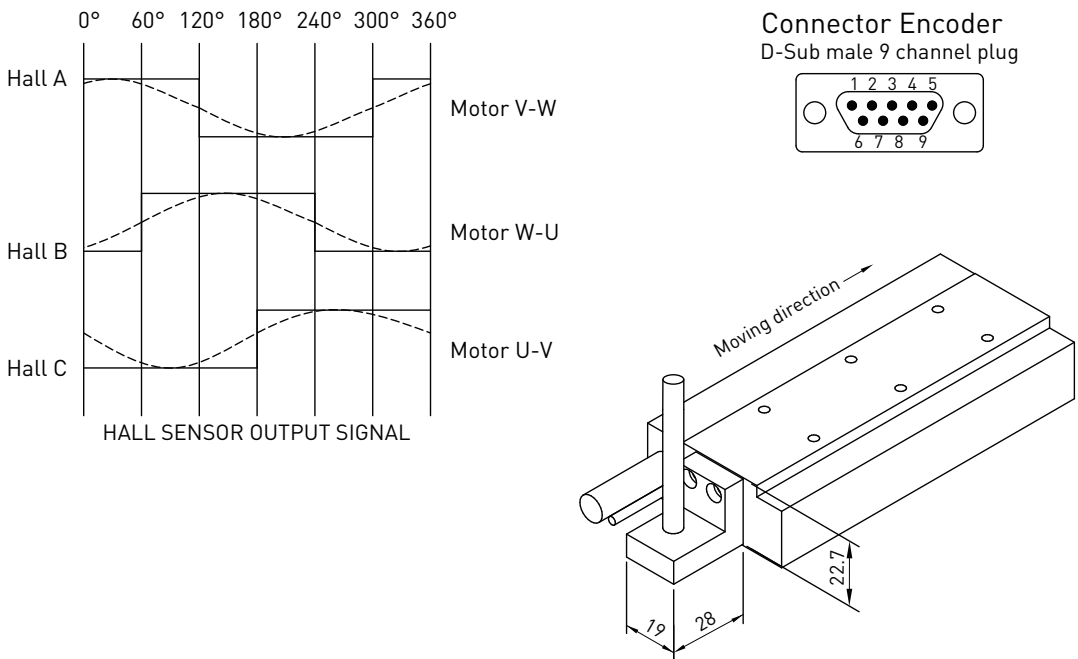
8 High Accuracy in Nano-Positioning

GT model supports nano-positioning for semiconductor equipment with high accuracy and supports 2D error map by using two sets of servo drives to achieve high accuracy and straightness on XY plane.



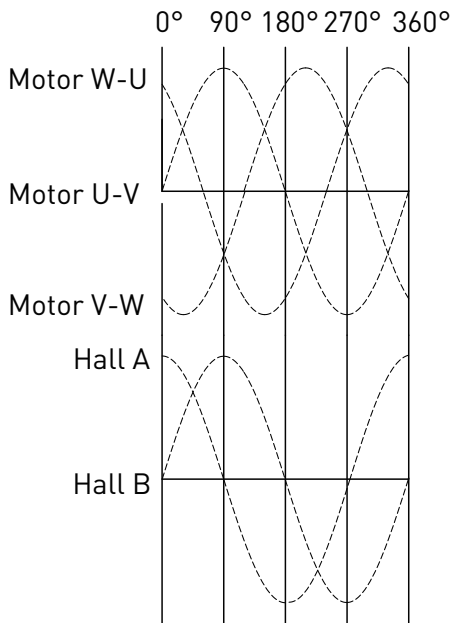
3.2 LM Hall Sensor

LMSA1~C / LMSA1-Z~3-Z hall sensor-LMAHSA

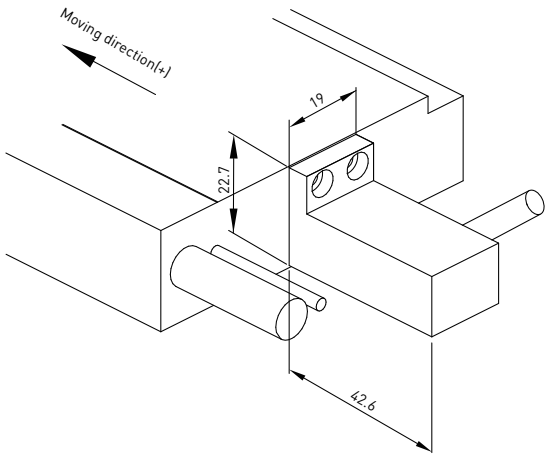


Digital connector - LMAHSA		Digital wire - LMAHSA-W	
Signal	connector	Signal	Color
Vcc	1	Vcc	Brown
Hall A(out)	2	Hall A(out)	White
Hall B(out)	3	Hall B(out)	Gray
Hall C(out)	4	Hall C(out)	Yellow
GND	5	GND	Green
⏏	Case	⏏	Shield

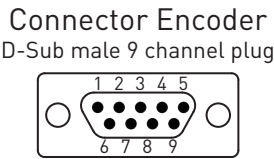
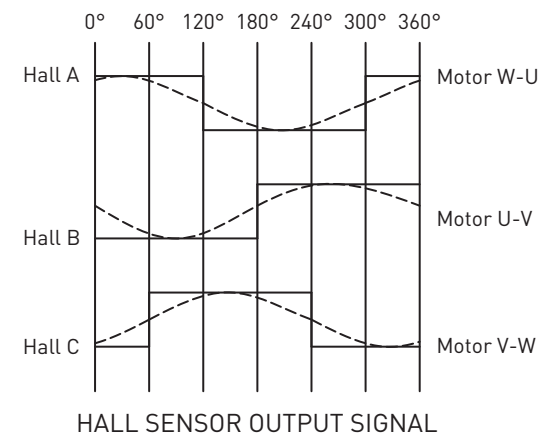
LMSA1~C / LMSA1-Z~3-Z hall sensor-LMAHSAA-D



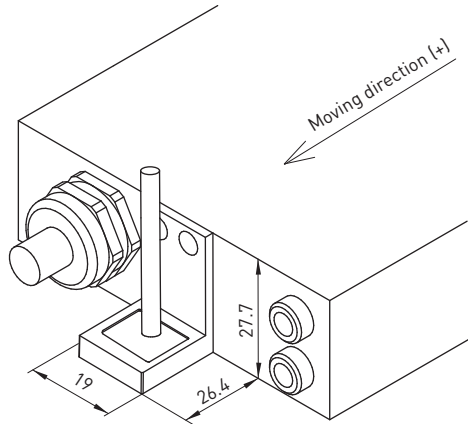
Analogy - LMAHSAA-D	
Signal	Color
+5V	Brown
A+	Red
A-	Blue
B+	Yellow
B-	Green
GND	White
⏏	Shield



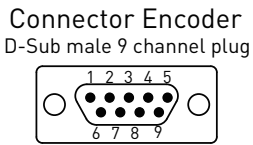
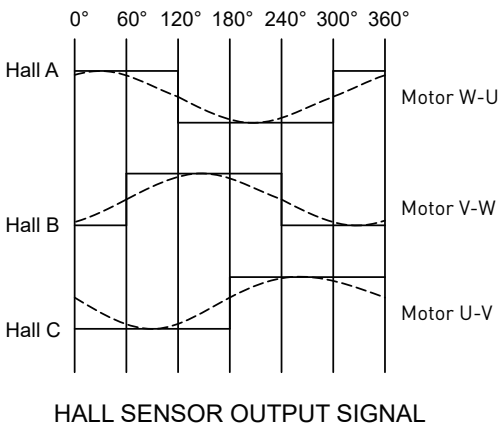
LMFA0-2 hall sensor-LMAHF1



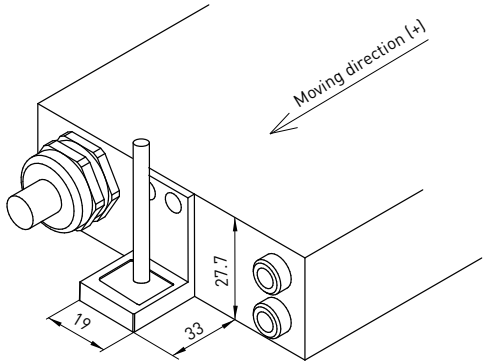
Digital connector - LMAHF1		Digital wire - LMAHF1-W	
Signal	connector	Signal	Color
Vcc	1	Vcc	Brown
Hall A(out)	2	Hall A(out)	White
Hall B(out)	3	Hall B(out)	Gray
Hall C(out)	4	Hall C(out)	Yellow
GND	5	GND	Green
⏏	Case	⏏	Shield



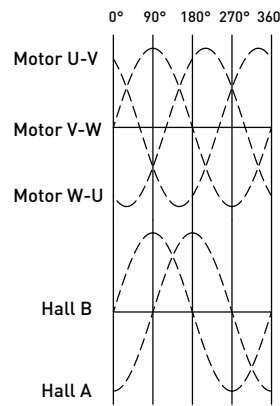
LMFA/LMFP3-6 hall sensor-LMAHF2



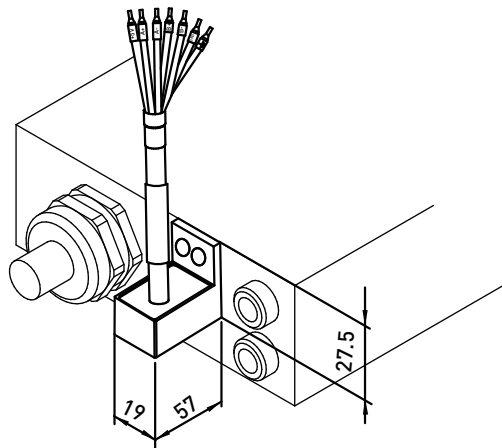
Digital connector - LMAHF2		Digital wire - LMAHF2-W	
Signal	connector	Signal	Color
Vcc	1	Vcc	Brown
Hall B(out)	2	Hall B(out)	White
Hall C(out)	3	Hall C(out)	Gray
Hall A(out)	4	Hall A(out)	Yellow
GND	5	GND	Green
⏏	Case	⏏	Shield



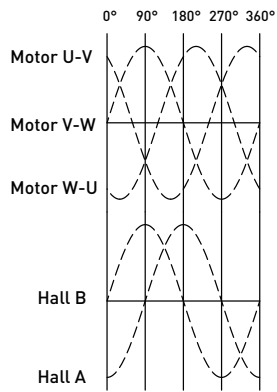
LMFA0-2 hall sensor-LMAHF1-D



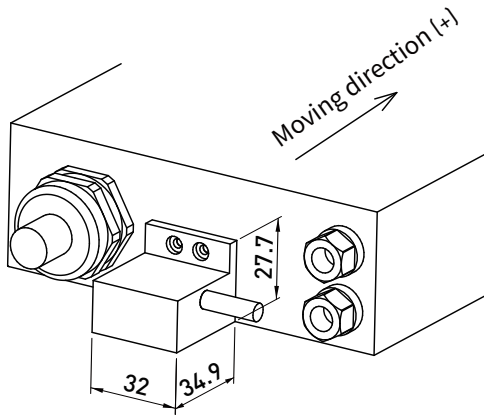
Analogy - LMAHFA1-D	
Signal	Color
+5V	Brown
A+	Red
A-	Blue
B+	Yellow
B-	Green
GND	White
⏏	Shield



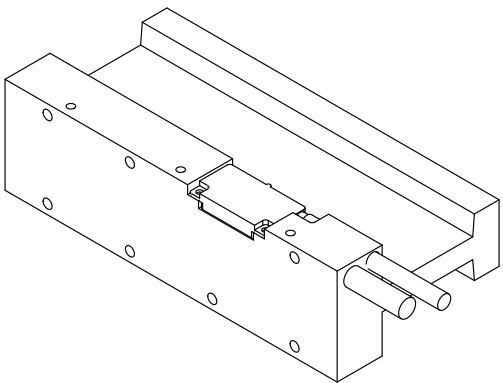
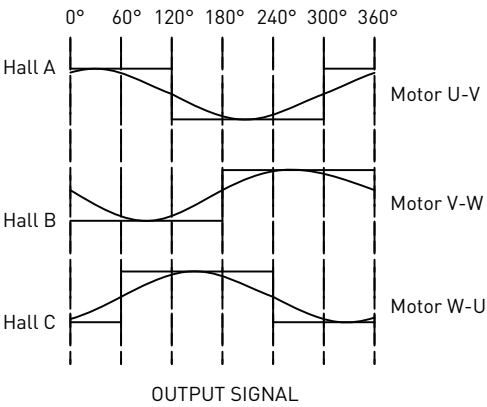
LMFA/LMFP3-6 hall sensor-LMAHF2-D



Analogy- LMAHFA2-D	
Signal	Color
+5V	Brown
A+	Red
A-	Blue
B+	Yellow
B-	Green
GND	White
⏏	Shield

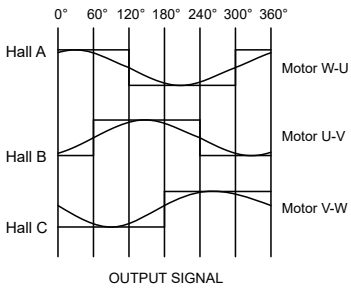


LMC-EFC/E/F hall sensor - LMAHEF3-W

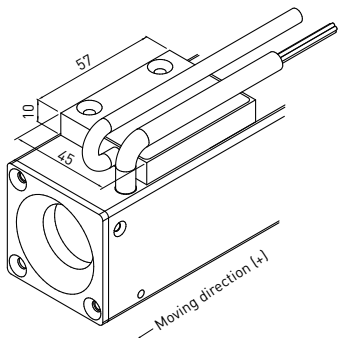
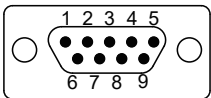


Digital wire - LMAHEF3-W	
Signal	Color
Vcc	Brown
Hall A (out)	White
Hall B (out)	Gray
Hall C (out)	Yellow
GND	Green
⏏	Shield

LMT50 hall sensor-LMDHTB

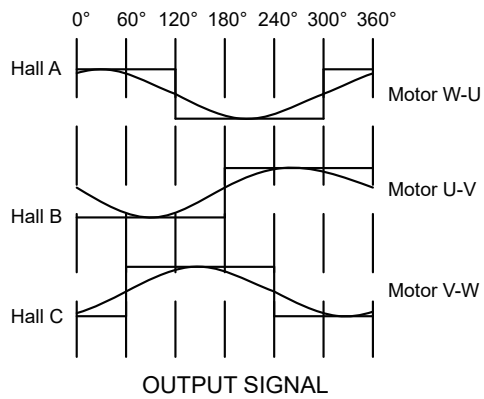


Connector Encoder
D-Sub male 9 channel plug

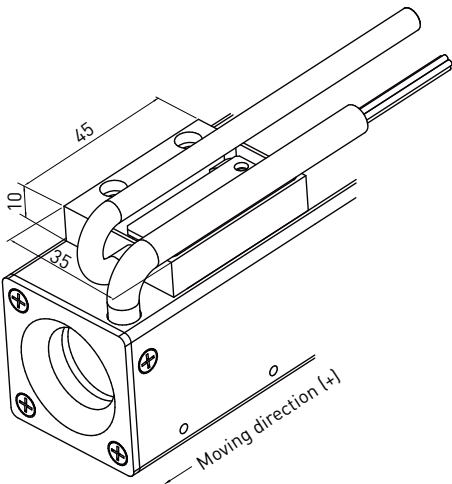
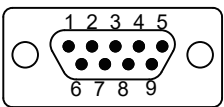


Digital connector - LMDHTB		Digital wire - LMDHTB-W	
Signal	connector	Signal	Color
Vcc	1	Vcc	Brown
Hall A (out)	2	Hall A (out)	White
Hall B (out)	3	Hall B (out)	Gray
Hall C (out)	4	Hall C (out)	Yellow
GND	5	GND	Green
⏏	Case	⏏	Shield

LMT40 hall sensor-LMDHTA

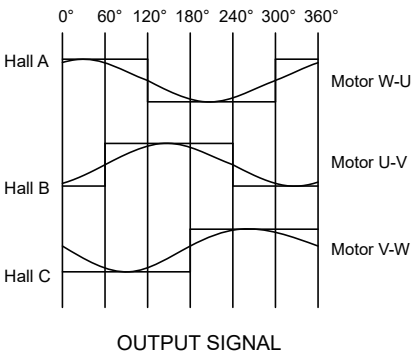


Connector Encoder
D-Sub male 9 channel plug

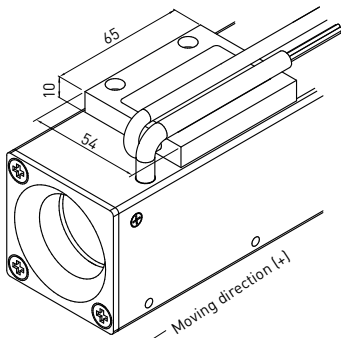
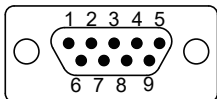


Digital connector - LMDHTA		Digital wire - LMDHTA-W	
Signal	connector	Signal	Color
Vcc	1	Vcc	Brown
Hall A (out)	2	Hall A (out)	White
Hall B (out)	3	Hall B (out)	Gray
Hall C (out)	4	Hall C (out)	Yellow
GND	5	GND	Green
⏏	Case	⏏	Shield

LMT60 hall sensor-LMDHTC

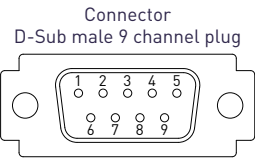
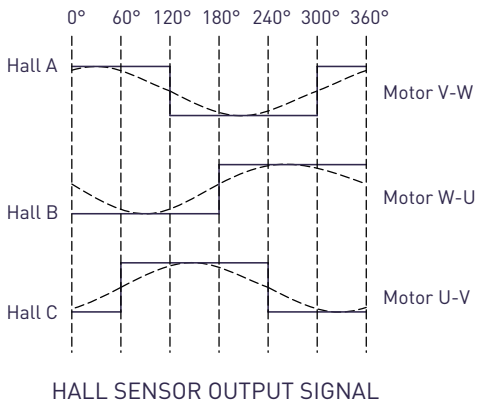


Connector Encoder
D-Sub male 9 channel plug



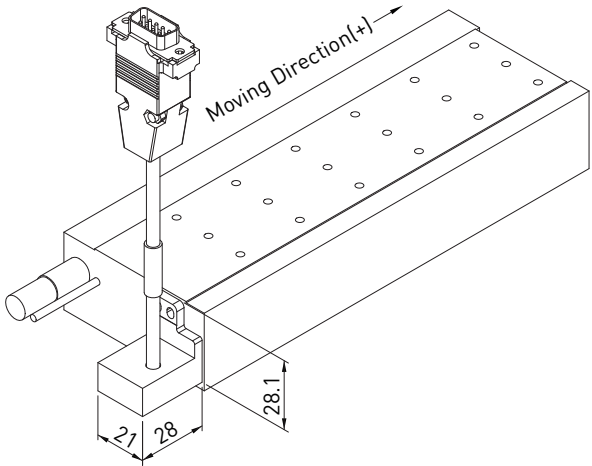
Digital connector - LMDHTC		Digital wire - LMDHTC-W	
Signal	connector	Signal	Color
Vcc	1	Vcc	Brown
Hall A(out)	2	Hall A(out)	White
Hall B(out)	3	Hall B(out)	Gray
Hall C(out)	4	Hall C(out)	Yellow
GND	5	GND	Green
⏏	Case	⏏	Shield

LME Hall sensor - LME-A - LMAH-EA-D-□□□-7-0

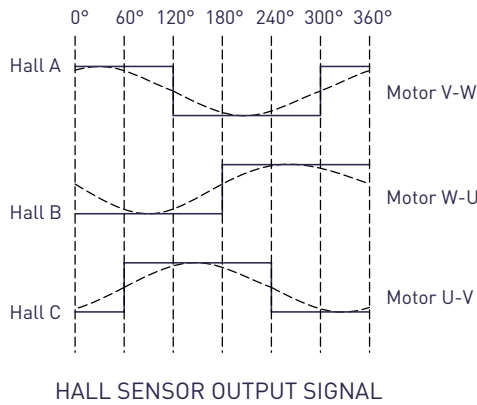


HALL SENSOR OUTPUT SIGNAL

Signal cable	
Signal	Connector
Vcc	1
Hall A(out)	2
Hall B(out)	3
Hall C(out)	4
GND	5
⏏	Casing

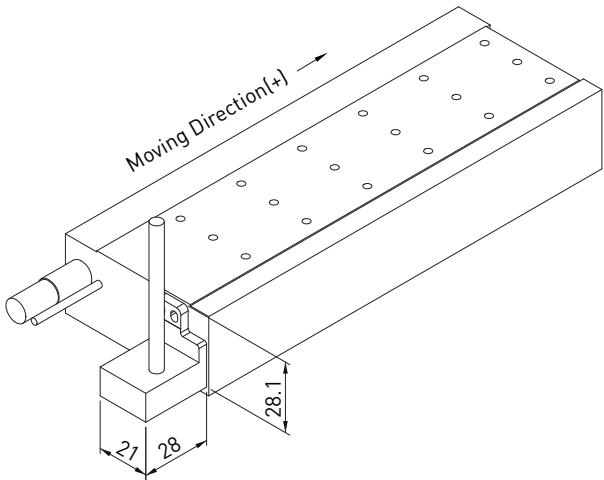


LME Hall sensor - LME-A - LMAH-EA-D-□□□-0-0

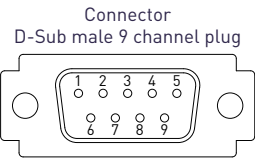
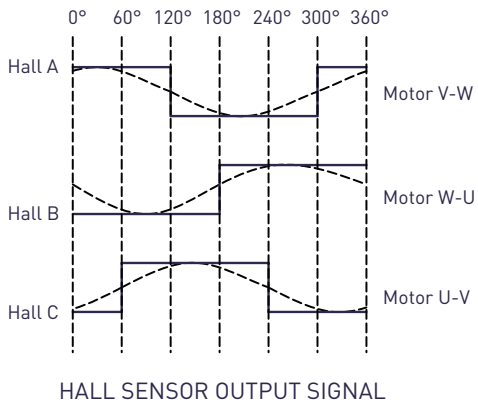


HALL SENSOR OUTPUT SIGNAL

Signal cable	
Signal	Color
Vcc	Brown
Hall A(out)	Red
Hall B(out)	Gray
Hall C(out)	Yellow
GND	White
⏏	Isolation net

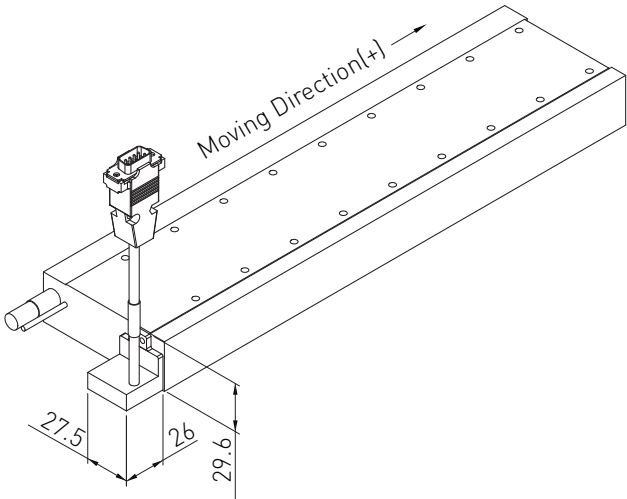


LME Hall sensor - LME-B - LMAH-EB-D-□□□-7-0

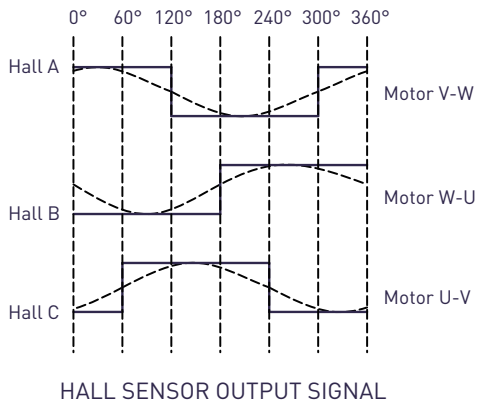


HALL SENSOR OUTPUT SIGNAL

Signal cable	
Signal	Connector
Vcc	1
Hall A(out)	2
Hall B(out)	3
Hall C(out)	4
GND	5
⏏	Casing

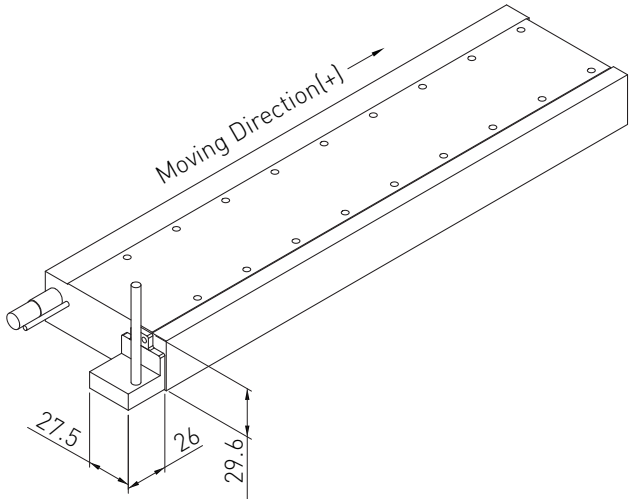


LME Hall sensor - LME-B - LMAH-EB-D-□□□-0-0



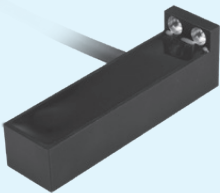
HALL SENSOR OUTPUT SIGNAL

Signal cable	
Signal	Color
Vcc	Brown
Hall A(out)	Red
Hall B(out)	Gray
Hall C(out)	Yellow
GND	White
⏏	Isolation net



3.3 LM Hall encoder-LMAESA

Analog hall encoder is used on the linear motor positioning platform. Apart from the incremental linear scale and magnetic scale available in the market, it provides customers with an additional encoder option. It only requires the installation of a hall sensor read head such that encoder position scale can be omitted, and it is able to achieve excellent positioning capability when operating with the existing stator parts of the linear motor.



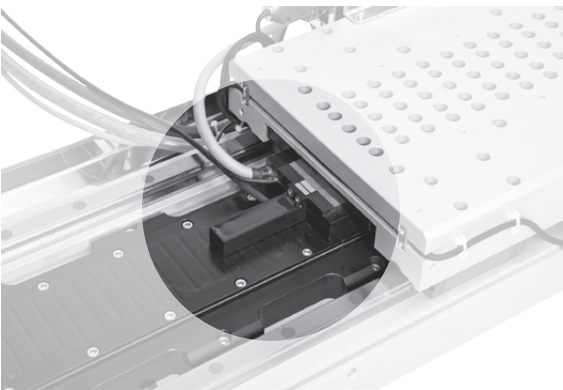
- Use in conjunction with iron core linear motor.
- Replace linear scale, magnetic scale encoders.
- Easy for assembly.
- Suitable to applications with general precision requirements for point-to-point long stroke.
- Excellent dust-resistant, oil-resistant and water-resistant.

	LMAESA	LMAEF1	LMAEF2
Power supply	5V±5 %	5V±5 %	5V±5 %
Pole pair pitch	30 mm	30 mm	46 mm
Resolution ⁽¹⁾	7.5 μm	7.5 μm	11.5 μm
Repeatability ⁽¹⁾	±15 μm	±15 μm	±23 μm
Accuracy ⁽¹⁾⁽²⁾	±45 μm	±45 μm	±69 μm
Signal Output signal	SIN/COS 1 Vp-p	SIN/COS 1 Vp-p	SIN/COS 1 Vp-p
Operating temperature (shall not freeze)	0°C~50 °C	0°C~50°C	0°C~50°C
Storage temperature (shall not freeze)	-5°C~60°C	-5°C~60°C	-5°C~60°C

*Note: 1. Operate with HIWIN driver, subdivision quantity of 4000.
2. Accuracy refers to the error after compensation (operate with HIWIN driver)
3. LMAESA can be shipped together with the SSA single-axis positioning platform, and the repeatability can reach ±5 μm.

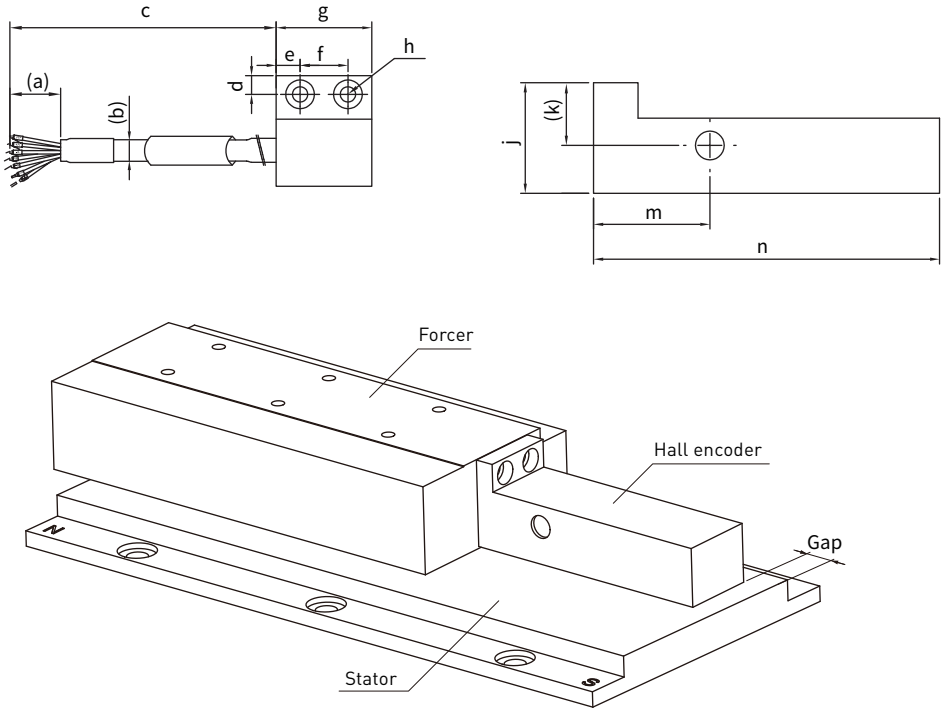
Model Description

Series	Specification	Signal	Cable length
LMAE	SA	A	05
	SA: operate with LMSA1~C/ LMSA1-Z~3-Z linear motor F1: operate with LMFA0~2/ LMFP24 linear motor F2: operate with LMFA3~6/ LMFP3~6 linear motor	A: incremental analog signal	05: 0.5 m 10: 1 m 30: 3 m 50: 5 m



Signal pin illustration

Function	Signal	Color
Power	+5V	Brown
	GND	White
Output signal	SIN+	Green
	SIN-	Yellow
	COS+	Blue
	COS-	Red



Dimension	LMAESA	LMAEF1	LMAEF2
a (mm)	50	50	50
b (mm)	5, Bending radius R=25	5, Bending radius =25	5, Bending radius R=25
c (mm)	500~5000	500~5000	500~5000
d (mm)	3.9	4.4	4.4
e (mm)	5	5	5
f (mm)	10	10	10
g (mm)	20	20	20
h (mm)	2-Ø3.5 THRU, Ø6x3DP	2-Ø3.5 THRU, Ø6x3DP	2-Ø3.5 THRU, Ø6x3DP
j (mm)	23.1	26.6	26.6
k (mm)	13.1	16.6	15.6
m (mm)	24.3	24.3	24.3
n (mm)	72.3	72.3	98.5
gap (mm)	1.1	1.4 (Cover type)/1.9 (Epoxy type)	1.4 (Cover type)/1.9 (Epoxy type)

Appendix A: Motor Sizing

Start Motor Sizing

The following contents describe how to choose proper motor according to velocity, stroke, and loading. The basic process for sizing a motor is:

- Decide motion profile and required parameters
- Calculate peak and continuous force
- Select motor

Symbols

X : stroke (mm)
T : cycle time (sec)
a : acceleration (mm/s²)
V : velocity (mm/s)
M_L : loading (kg)
g : gravitation acceleration (mm/s²)
F_p : peak force (N)
F_c : continuous force (N)
F_a : attraction force between stator and forcer (N)
F_i : inertia force (N)
K_f : force constant (N/A_{rms})
I_p : peak current (A_{rms})
I_e : effective current (A_{rms})
I_c : continuous current (A_{rms})
V₀ : starting velocity (mm/s)

STEP 1 Decide motion velocity profile and required parameters

In order to determine the correct motor for a particular application it is necessary to be familiar with the motion equation.

Motion equation

Basic kinematics equations are described as follows:

$$V = V_0 + aT$$

$$X = V_0T + \frac{1}{2}aT^2$$

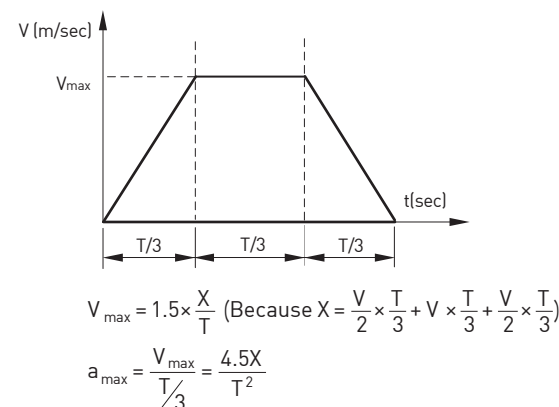
Where V is velocity, a is acceleration, T is cycle time and X is stroke.

You can choose two of the four parameters (V, a, T and X) as your designed parameters, then the last two parameters can be calculated by above equations.

Motion velocity profile

1.1/3-1/3-1/3 trapezoid profile

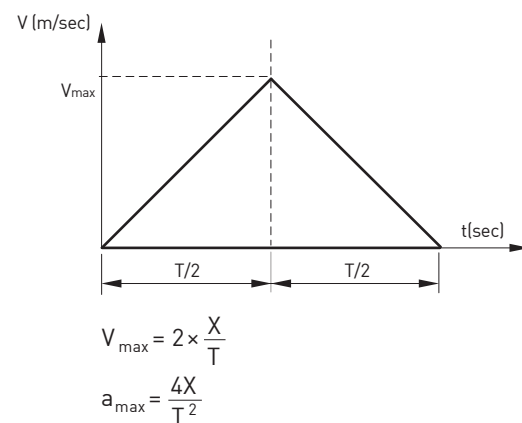
If X and T have been given, the most common and efficient velocity profile for point-to-point motion is the "1/3-1/3-1/3" trapezoid curve because it provides the optimal move by minimizing the power required to complete the move. It breaks the time of the acceleration, constant, and deceleration into three segments as shown below.



Herein the parameters are described as motion equation.

2.1/2-1/2 (Triangle profile)

If X and T are given, another common motion profile is the 1/2-1/2 triangle profile. The motion is divided into two parts, namely acceleration and deceleration. The second motion velocity profile is shown as follows.



The acceleration required in the first motion velocity profile is bigger than that in the second motion velocity profile; therefore, the required motor size is bigger. When choosing second motion velocity profile, the chosen motor size is smaller, however, we need to verify the DC bus of drive is bigger enough, due to the higher velocity (V_{max}).

3. Some useful equations

	1/3 -1/3-1/3 Trapezoid profile	Triangle profile
V	$1.5 \times \frac{X}{T}$	$2 \times \frac{X}{T}$, or $\sqrt{a \times X}$
a	$\frac{4.5X}{T^2}$	$\frac{4X}{T^2}$
t	$\frac{X}{V_{max}} + \frac{V_{max}}{a}$ (if $\frac{X}{V_{max}} \geq \frac{V_{max}}{a}$)	

STEP 2 Determine peak force and effective force

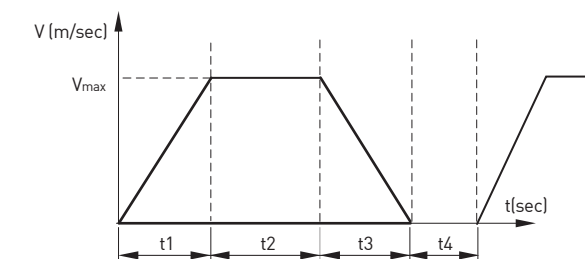
The peak force can be calculated by the follow equation

$$F_p = M_L \times a_{max} + (M_L \times g + F_a) \times \mu = F_i + F_f$$

Where F_i is inertia force while F_f is friction force, and μ is friction factor.

In most cases, motions are cyclic point-to-point movements. Assuming a cyclic motion shown in the following profile with a pause time of t₄ second, the effective force can be calculated as following formula:

$$F_e = \sqrt{\frac{(F_i + F_f)^2 t_1 + F_f^2 t_2 + (F_i - F_f)^2 t_3}{t_1 + t_2 + t_3 + t_4}}$$



The peak current I_p and effective current I_e can be calculated by using motor force constant K_f.

$$I_p = \frac{F_p}{K_f}$$

$$I_e = \frac{F_e}{K_f}$$

STEP 3 Select motor by peak force and verify the current supply of moto

From the catalog of HIWIN, you can check the specifications of motor and choose an applicable motor by peak force, and then you can verify the current supply if it is fitted the specification as follows.

$$I_p = \frac{F_p}{K_f} < I_p \text{ (motor specification)}$$

$$I_e = \frac{F_e}{K_f} < I_c \text{ (motor specification)}$$

Regarding effective and continuous current, the ratio of I_e/I_c had better be less than 0.7 to attain some margin.

Linear Motor Sizing Example

For example, if load is 5 kg (moving mass of mechanism is 1 kg and payload is 4 kg), friction factor μ is 0.01 ,stroke is 500 mm, moving time is 400 ms and dwell time is 350 ms.

At first, we can calculate the $V_{\max}$, $a_{\max}$, F_p and F_e by the formulas described above (choose the first motion velocity profile and LMC series)

$$V_{\max} = 1.5 \times \frac{X}{T} = 1.5 \times \frac{0.5}{0.4} = 1.875 \text{ (m/sec)}$$

$$a_{\max} = \frac{4.5 \times X}{T^2} = \frac{4.5 \times 0.5}{(0.4)^2} = 14.06 \text{ (m/sec}^2\text{)}$$

$$F_p = M_L \times a_{\max} + (M_L \times g + F_a) \times \mu$$

$$= 5 \times 14.06 + 5 \times 9.81 \times 0.01 = 70.3 + 0.49 = 70.79 \text{ (N)}$$

$$F_e = \sqrt{\frac{[(70.3 + 0.49)^2 + 0.49^2 + (70.3 - 0.49)^2] \times 0.1333}{0.4 + 0.35}}$$

$$= 41.92 \text{ (N)}$$

In this case, we can choose motor of type LMCA6 (p.32) which can provide up to 248(N)of peak force and continuous force 62(N), and the force constant is 33.8 N/A(rms). Then the current supply of motor can be determined as follows

$$I_p = \frac{F_p}{K_f} = \frac{70.79}{33.8} = 2.09 \text{ (Arms)} < 5.4 \text{ (Arms)}$$

$$I_p = \frac{F_e}{K_f} = \frac{41.92}{33.8} = 1.24 \text{ (Arms)} < 1.8 \text{ (Arms)}$$

$$\frac{I_e}{I_c} = \frac{1.24}{1.8} \times 100\% = 68.89\% < 70\%$$

Appendix B: Sizing a Regen Resistor

1. Gather required information

To calculate the power and resistance of the regen resistor requires information about the amplifier and the motor.

For all applications, gather the following information:

- Detail of motion profile, including acceleration and velocity
- Amplifier model number
- Applied line voltage to amplifier
- Toque/force constant of the motor
- Resistance (line-to-line) of the motor windings

For rotary motor applications, gather additional information

- Load inertia seen by the motor
- Inertia of the moto

For linear motor applications, gather additional information

- Moving mass

2. Observe the properties of each deceleration during a complete cycle of operation

For each deceleration during the motion cycle, determine:

- Speed at the start of the deceleration
- Speed at the end of the deceleration
- Time over which the deceleration takes place

3. Calculate energy returned for each deceleration

The energy returned during each deceleration can be calculated by the following formulas.

Rotary motor:

$$E_{\text{dec}} = \frac{1}{2} J_t (\omega_1^2 - \omega_2^2)$$

E_{dec} (joules): Energy returned by the deceleration
 J_t (kg m²): Load inertia on the motor shaft plus the motor inertia

ω_1 (radians /sec): Shaft speed at the start of deceleration

ω_2 (radians /sec): Shaft speed at the end of deceleration

I_e : effective current (Arms)

Linear motor:

$$E_{\text{dec}} = \frac{1}{2} M_t (V_1^2 - V_2^2)$$

E_{dec} (joules): Energy returned by the deceleration

M_t (kg): Moving mass

V_1 (meters /sec): Velocity at the start of deceleration

V_2 (meters /sec): Velocity at the end of deceleration

4. Determine the amount of energy dissipated by the motor Calculate the amount of energy dissipated by the motor due to current flow through the motor winding resistance using the following formula.

$$P_{\text{motor}} = \frac{3}{4} R_{\text{winding}} \left(\frac{F}{K_t} \cdot \sqrt{2} \right)^2$$

P_{motor} (watts): Power dissipated in the motor

R_{winding} (ohm): Line to Line resistance of the motor coil

F : Force need to decelerate the motor

(Nm) for rotary applications

(N) for linear applications

K_t : Torque constant for the motor

(Nm/Amp) for rotary applications

(N/Amp) for linear applications

$$E_{\text{motor}} = P_{\text{motor}} T_{\text{decel}}$$

E_{motor} (joules): Energy dissipated in the motor

T_{decel} (seconds): Time of deceleration

5. Determine the amount of energy returned to the amplifier

Calculate the amount of energy that will be returned to the amplifier for each deceleration using the following formula

$$E_{\text{returned}} = E_{\text{dec}} - E_{\text{motor}}$$

E_{returned} (joules): Energy returned to the amplifier

E_{dec} (joules): Energy returned by the deceleration

E_{motor} (joules): Energy dissipated by the motor

6. Determine if energy returned exceeds amplifier capacity Compare the amount of energy returned to the amplifier in each deceleration with the amplifier's absorption capacity. The following formula is used to determine the energy that can be absorbed by the amplifier.

$$W_{\text{capacity}} = \frac{1}{2} C (V_{\text{regen}}^2 - (1.414 V_{\text{mains}})^2)$$

W_{capacity} (joules): The energy that can be absorbed by the bus capacitor

C (farads): Bus capacitance

V_{regen} (volts): Voltage at which the regen circuit turns on

V_{mains} (volts): Mains voltage (AC) applied to the amplifier

7. Calculated energy to be dissipated for each deceleration For each deceleration where the energy exceeds the amplifier's capacity, using the following formula to calculate the energy that must be dissipated by the regen resistor.

$$E_{\text{regen}} = E_{\text{returned}} - E_{\text{amp}}$$

E_{regen} (joules): Energy that must be dissipated in the regen resistor

E_{returned} (joules): Energy delivered back to the amplifier from the motor

E_{amp} (joules): Energy that the amplifier will absorb

8. Calculate pulse power of each deceleration that exceeds amplifier capacity.
For each deceleration where energy must be dissipated by the regen resistor, use the following formula to calculate the pulse power that will be dissipated by the regen resistor.

$P_{\text{pulse}} = E_{\text{regen}} / T_{\text{decel}}$

P_{pulse} (watts): Pulse power

E_{regen} (joules): Energy that must be dissipated in the regen resistor

T_{decel} (seconds): Time of deceleration

9. Calculate resistance needed to dissipate the pulse power Using the maximum pulse power from the previous calculation, calculate the resistance value of the regen resistor required to dissipate the maximum pulse power.

$R = V_{\text{regen}}^2 / P_{\text{pulse max}}$

R(ohms): Resistance

P_{pulse max}: The maximum pulse power

V_{regen} : The voltage at which the regen circuit turns on

Choose a standard value of resistance less than the calculated value. The value must also be greater than the minimum regen resistor value specified by the amplifier supplier.

10. Regen resistor sizing example
Gather required information.

LM ROBOTS Type: LMXL1L-S37L-1200-G200

Amplifier: mega-fabs D1

DC bus capacitance: 1880 μF

Regen circuit turn on voltage: 390 V

Minimum resistance: 15 ohms

Moving mass: 86 Kg (include payload74 Kg)

(V_{max}): 2 m/s

Acceleration, deceleration: 5 m/s²

Power supply (AC) of drive: 220 VAC

Motor type: LMS37 L

Force constant(K_f): 68N/A(rms)

(R_{winding}): 2 ohms (line-to-line)

Calculate regen resistor as following step:

$F = ma = 86 \times 5 = 430 \text{ (N)}$

$E_{\text{dec}} = \frac{1}{2} m_t V^2 = \frac{1}{2} \times 86 \times 2^2 = 172 \text{ (joule)}$

$P_{\text{motor}} = \frac{3}{4} \times R_{\text{winding}} \times \left(\frac{F}{K_f} \times \sqrt{2}\right)^2 = \frac{3}{4} \times 2 \times \left(\frac{430}{68} \times \sqrt{2}\right)^2 = 120 \text{ (Watt)}$

$E_{\text{motor}} = P_{\text{motor}} \times T_{\text{decel}} = 120 \times \left(\frac{2}{5}\right) = 48 \text{ (joule)}$

$E_{\text{returned}} = E_{\text{dec}} - E_{\text{motor}} = 172 - 48 = 124 \text{ (joule)}$

$W_{\text{capacity}} = \frac{1}{2} \times C \times (V_{\text{regen}}^2 - (1.414V_{\text{mains}})^2) = \frac{1}{2} \times 1880 \times 10^{-6} \times (390^2 - (1.414 \times 220)^2) = 51.98 \text{ (joule)}$

$\therefore E_{\text{returned}} > W_{\text{capacity}}$

$E_{\text{regen}} = E_{\text{returned}} - E_{\text{amp}} = 124 - 51.98 = 72.02 \text{ (joule)}$

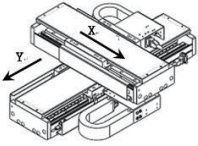
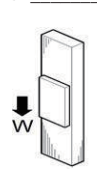
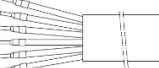
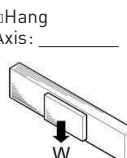
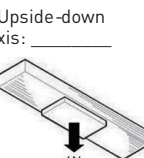
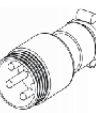
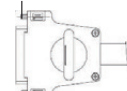
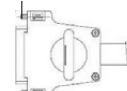
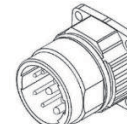
$P_{\text{pulse}} = E_{\text{regen}} / T_{\text{decel}} = 72.02 / 0.4 = 180.05 \text{ (Watt)}$

$R = \frac{V_{\text{regen}}^2}{P_{\text{pulse}}} = \frac{390^2}{180.05} = 844.77 \text{ (ohms)}$

Because the total value of selected resistance must be less than 844.77 ohms, and the power capacity must be more than 180.05 watts, we choose two resistors and connect them in series. In each resistor, the resistance is 68 ohms, and power capacity is 100 W. The total resistance value is 136 ohms, and power capacity is 200 W. The resistance order number is 050100700001.

Appendix C: Inquiry form

Fields marked with asterisk[*] are required. Date: _____

Customer name: _____		Contact HIWIN: _____	
Email : _____		Job description: _____	
Tel: _____ Fax: _____		Business owners: _____	
*Industry/Application	_____	Multi-forcers	☐ Yes, quantity: _____ pcs ☐ No
*Operational environment	☐ Indoor, general 25°C ☐ Cleaning room, class: _____ ☐ Vacuum, class: _____ ☐ Others: _____	*Movement	☐ Point to point movement ☐ Scanning
*Stage type	☐ Single ☐ XY axis ☐ Dual axis Bridge ☐ Gantry(single-driven) ☐ Gantry(dual-driven) ☐ Others: _____	Safety requirements	☐ CE ☐ UL ☐ Other: _____
*Pay load	☐ Mass: _____ kg	Travel time	_____ sec
External force (N)	X-axis _____ Y-axis _____ Z-axis _____	Dwelling time	_____ sec
*Max. speed (m/s)	X-axis _____ Y-axis _____ Z-axis _____	Drive	Voltage ☐ 110V ☐ 220V ☐ Other: _____ V
*Max. acceleration (m/s ²)	X-axis _____ Y-axis _____ Z-axis _____	Hall sensor	☐ Yes ☐ Digital signal ☐ Analog signal ☐ No
*Stroke (m)	X-axis _____ Y-axis _____ Z-axis _____	The type of forcer power cable, the standard is cable [as shown in the figure below]	
*Stage installation	☐Horizon Axis: _____  ☐Vertical Axis: _____ 	☐ Cable Applies to all types. 	☐ 90° connector Applies types: LMFx, LMTE 
	☐Hang Axis: _____  ☐Upside-down Axis: _____ 	☐ Cable + round connector Applies types: LMFx 	LMC, LMT 
		☐ Cable + D-sub Applies types: LMSA, LMC-EFE, LMC-EFF, LMCF 	External thread 
		☐ Cable + Metal connector Applies types: LMFA, LMFP 	
Motion profile: 		Others: _____	

The information below is to be filled out by HIWIN or authorized agents.
Recommended specification:

MEMO

[illegible]

MEMO

[illegible]

Linear Motor Technical Information

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