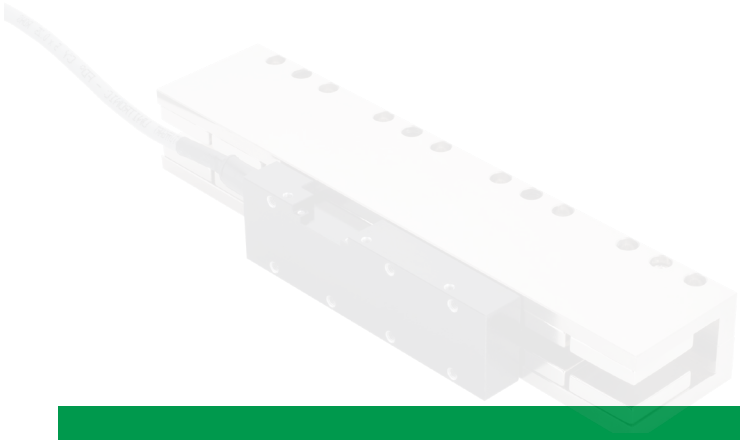
HIWIN® MIKROSYSTEM



# Linear Motor

Technical Information

HIWIN Support

About HIWIN

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-2 / IM-2, TMRW, TM-2 (J0) 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-HIMC Series
- Drive-E1, E2, D1, D2T/D2T-LM Series
- AC Servo Motor-E, FR Series

## Linear Actuator / Servo Actuator

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

- Servo Actuator-LAA Series
- 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

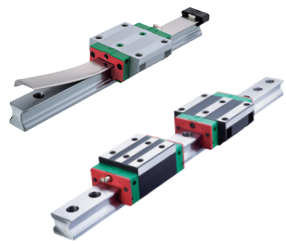
Medical / Automotive Industry / Machine Tools / Machinery Industry

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

## Ballscrew

Precision Ground / Rolled

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



## Linear Guideway

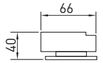
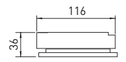
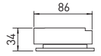
Automation / Semiconductor / Medical

- 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)

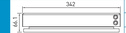
Unit:N

| | | Series | Length | | 100N | 1000N | 10,000N | 20,000N |
|---|---|---|---|---|---|---|---|---|
| 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 | |
| | | | LMSAC3 | 328 | | ●947/●2675 | | |
| | |  | 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(Fcn) ● Peak Force(Fpk)

Unit:N

| | | Series | | Length | 100N | 1000N | 10,000N | 20,000N |
|---|---|---|---|---|---|---|---|---|
| LMFA | P24 |  | LMFA64 | 697 | | | 7917/20827 | |
| | | | LMFA63 | 536 | | | 5938/15620 | |
| | | | LMFA62 | 375 | | | 3958/10413 | |
| | |  | LMFA54 | 697 | | | 5688/13850 | |
| | | | LMFA53 | 536 | | | 4264/10388 | |
| | | | LMFA52 | 375 | | | 2844/6925 | |
| | |  | LMFA44 | 697 | | | 3958/10413 | |
| | | | LMFA43 | 536 | | | 2969/7810 | |
| | | | LMFA42 | 375 | | | 1979/5207 | |
| | | | LMFA41 | 214 | | | 990/2603 | |
| | |  | LMFA34 | 697 | | | 3037/7000 | |
| | | | LMFA33 | 536 | | | 2278/5250 | |
| | | | LMFA32 | 375 | | | 1519/3500 | |
| | | | LMFA31 | 214 | | | 759/1750 | |
| | |  | LMFA24 | 460 | | | 1638/3104 | |
| | | | LMFA23 | 355 | | | 1228/2328 | |
| | | | LMFA22 | 250 | | | 819/1552 | |
| | | | LMFA21 | 145 | | | 409/776 | |
| | |  | LMFA14 | 460 | | | 1089/2063 | |
| | | | LMFA13 | 355 | | | 816/1548 | |
| | | | LMFA12 | 250 | | | 544/1032 | |
| | | | LMFA11 | 145 | | | 272/516 | |
| | |  | LMFA03 | 355 | | | 444/845 | |
| | | | LMFA02 | 250 | | | 297/564 | |
| | | | LMFA01 | 145 | | | 149/282 | |

HIWIN.MIKROSYSTEM
Linear Motor

# Linear Motor Power Range

● Continuous Force(Fcn) ● Peak Force(Fpk)

Unit:N

| | | Series | | Length | 100N | 1000N | 10,000N | 20,000N |
|---|---|---|---|---|---|---|---|---|
| LMFP | P37 |  | LMFP64-Q80 | 704 | | | 7639/19147 | |
| | | | LMFP64-Q40 | | | | 8115/20827 | |
| | | | LMFP63-60 | 543 | | | 6086/15620 | |
| | | | LMFP63-30 | | | | 5732/14211 | |
| | | | LMFP62-Q40 | 382 | | | 3933/9805 | |
| | | | LMFP62-Q20 | | | | 4057/10414 | |
| | |  | LMFP54-Q80 | 704 | | | 5474/13866 | |
| | | | LMFP54-Q40 | | | | 5525/13977 | |
| | | | LMFP53-Q60 | 543 | | | 4264/10500 | |
| | | | LMFP53-Q30 | | | | 4264/10500 | |
| | | | LMFP52-Q40 | 382 | | | 2844/7000 | |
| | | | LMFP52-Q20 | | | | 2844/7000 | |
| | |  | LMFP44-Q80 | 704 | | | 3791/9975 | |
| | | | LMFP44-Q40 | | | | 3774/10049 | |
| | | | LMFP43-Q60 | 543 | | | 2969/5460 | |
| | | | LMFP43-Q30 | | | | 2788/7367 | |
| | | | LMFP42-Q40 | 382 | | | 1979/5460 | |
| | | | LMFP42-Q20 | | | | 1979/5460 | |
| | | | LMFP41-Q20 | 221 | | | 990/2820 | |
| | | | LMFP41-Q20 | | | | 990/2820 | |
| | |  | LMFP34-Q80 | 704 | | | 2845/6757 | |
| | | | LMFP34-Q40 | | | | 3307/7187 | |
| | | | LMFP33-Q60 | 543 | | | 2480/5390 | |
| | | | LMFP33-Q30 | | | | 2480/5390 | |
| | | | LMFP32-Q40 | 382 | | | 1453/3593 | |
| | | | 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

| | | Series | Length | 10N | 100N | 1000N | 2000N | 3000N |
|---|---|---|---|---|---|---|---|---|
| LMC | P60 | LMCFC | 740 | | | 884/2736 | | |
| | | LMCFA | 620 | | | 571/2280 | | |
| | | LMCF8 | 500 | | | 456/1824 | | |
| | | LMCF6 | 380 | | | 342/1368 | | |
| | | LMCF4 | 260 | | | 228/912 | | |
| | | LMCEC | 740 | | | 552/2208 | | |
| | | LMCEA | 620 | | | 460/1840 | | |
| | | LMCE8 | 500 | | | 368/1472 | | |
| | | LMCE6 | 380 | | | 276/1104 | | |
| | | LMCE4 | 260 | | | 184/736 | | |
| | | LMCDA | 620 | | | 328/1312 | | |
| | | LMCD8 | 500 | | | 262/1048 | | |
| | | LMCD6 | 380 | | | 197/788 | | |
| | | LMCD4 | 260 | | | 131/524 | | |



# Linear Motor Power Range

● Continuous Force(Fcn) ● Peak Force(Fpk)

Unit:N

| | | Series | Length | 10N | 100N | 1000N |
|---|---|---|---|---|---|---|
| LMC | P60 | LMCCC | 400 | | | 293/1173 |
| | | LMCCA | 336 | | | 244/977 |
| | | LMCC8 | 272 | | | 195/780 |
| | | LMCC7 | 240 | | | 171/684 |
| | | LMCC6 | 208 | | | 147/586 |
| | | LMCC5 | 176 | | | 122/489 |
| | | LMCC4 | 144 | | | 98/391 |
| | | LMCC3 | 112 | | | 73/293 |
| | | LMCC2 | 80 | | | 49/195 |
| | | LMCC1 | 48 | | 24/98 | |
| | | LMCBC | 400 | | | 216/864 |
| | | LMCBA | 336 | | | 181/724 |
| | | LMCB8 | 272 | | | 145/580 |
| | | LMCB7 | 240 | | | 128/512 |
| | | LMCB6 | 208 | | | 109/436 |
| | | LMCB5 | 176 | | | 91/364 |
| | | LMCB4 | 144 | | | 73/292 |
| | | LMCB3 | 112 | | | 54/216 |
| | | LMCB2 | 80 | | 36/144 | |
| | | LMCB1 | 48 | | 18/72 | |
| | | LMCAC | 400 | | | 124/496 |
| | | LMCAA | 336 | | | 96/386 |
| | | LMCA8 | 272 | | | 83/331 |
| | | LMCA7 | 240 | | | 72/289 |
| | | LMCA6 | 208 | | | 62/248 |
| | | LMCA5 | 176 | | | 52/208 |
| | | LMCA4 | 144 | | | 45/180 |
| | | LMCA3 | 112 | | 34/136 | |
| | | LMCA2 | 80 | | 24/96 | |
| | | LMCA1 | 48 | 12/48 | | |
| | | LMC-HUB2 | 97 | | 40/140 | |
| | | LMC-HUB1 | 49 | | 20/80 | |

# Linear Motor Power Range

● Continuous Force(Fcn) ● Peak Force(Fpk)

Unit:N

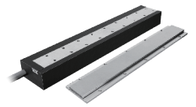
| | | Series | | Length | 10N 100N |
|---|---|---|---|---|---|
| LMT | P81 | 60 / 60 | LMTC6 | 400 | ●299/●1196 |
| | | | LMTC5 | 340 | ●250/●998 |
| | | | LMTC4 | 280 | ●200/●801 |
| | | | LMTC3 | 220 | ●151/●603 |
| | | | LMTC2 | 160 | ●99/●395 |
| | | 50 / 50 | LMTB4 | 210 | ●104/●416 |
| | | | LMTB3 | 165 | ●78/●312 |
| | | | LMTB2 | 120 | ●52/●208 |
| | | 40 / 40 | LMTA4 | 166 | ●59/●236 |
| | | | LMTA3 | 130 | ●45/●180 |
| | | | LMTA2 | 94 | ●29/●116 |
| | | 30 / 30 | LMT6Q | 140 | ●38/●152 |
| | | | LMT6T | 110 | ●28/●112 |
| | | | LMT6D | 80 | ●19/●76 |
| | | 25 / 25 | LMT2Q | 112 | ●17/●68 |
| | | | LMT2T | 88 | ●13/●52 |
| | | | LMT2D | 64 | ●9/●36 |

HIWIN® MIKROSYSTEM

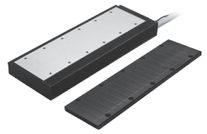
# Contents

Linear Motor



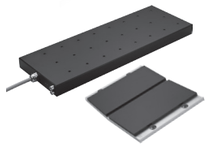


**LME Series:**
Provides energy saving, carbon reduction and high cost performance, conforming to ESG sustainability principles.



**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.

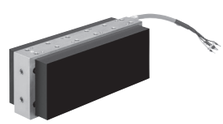
**LMSS Series:**
The shorter length forcer design reduces stroke and optimizes cogging force. Used in automatic inspection and semiconductor industry.



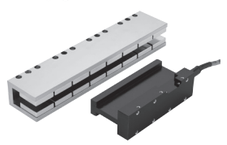
**LMFA Series:**
Built-in water cooling system, high thrust density, peak force of 20,000 N, complies with UL and CE certifications.

**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.

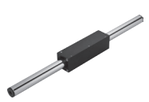
**LMFC Series:**
Additional precision cooling system for THE LMFA/LMFP, used to reduce or maintain a low motor surface temperature, eliminates the affect of the motor temperature on the application.



**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. Satisifies 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 x $K_f$.

**Attraction force Fa (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.

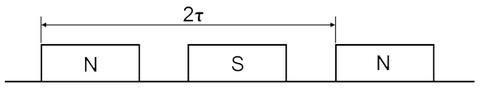
**Maximum winding temperature $T_{MAX}$ (°C)**
Defined as the maximum permissible temperature of motor coil. Actual equilibrium temperature of motor will depend on factors such as structure, cooling methods, and motion planning, etc. theoretical calculations may be biased, usually based on actual testing.

**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.

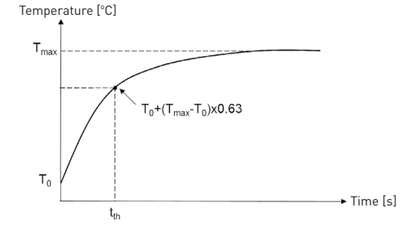



**Back emf constant $K_v$ [$V_{rms}$/(m/s)]**
Defined as when motor magnet temperature at 25°C unit velocity generated by induced electromotive force. Occurs when coil senses and generates electromotive force magnetic field when resistance current passes.

**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.

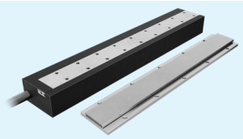
**Stall force $F_0$ (N)**
Defined as motor at ambient temperature 25°C and stall conditions, the upper limit of thrust that motor can supply, this value is related to heat dissipation conditions.

**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

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.



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

Force chart for LME series

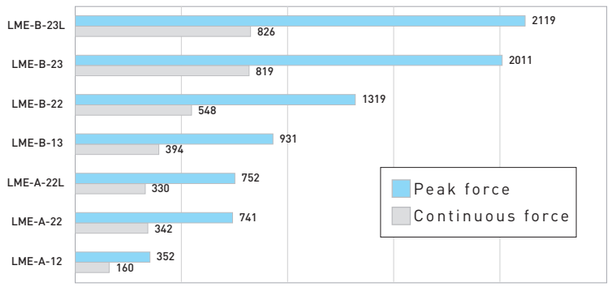



**Table 2-1 LME Series specifications**

| | 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) | $K_m$ | $N/\sqrt{W}$ | 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 SNM120 In Series | | | | | | |
| Maximum DC bus voltage | - | V | 600 | | | | | | |
| Mass of forcer | $M_f$ | 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 |

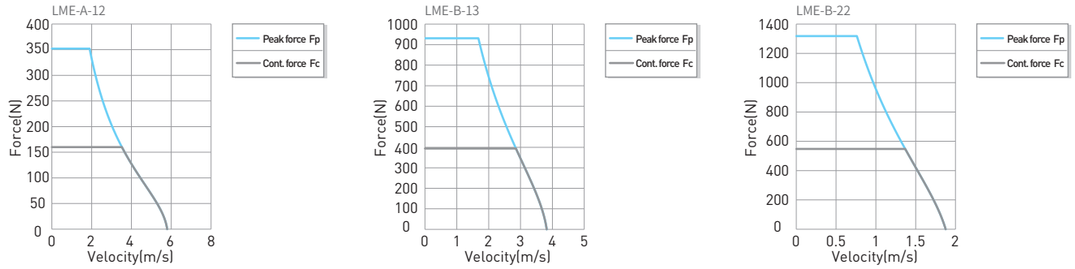
Note: 1.Except dimensions, the electrical specifications are in ±10% of tolerance.
2.We reserve the right to change, please follow customer recognition drawings.

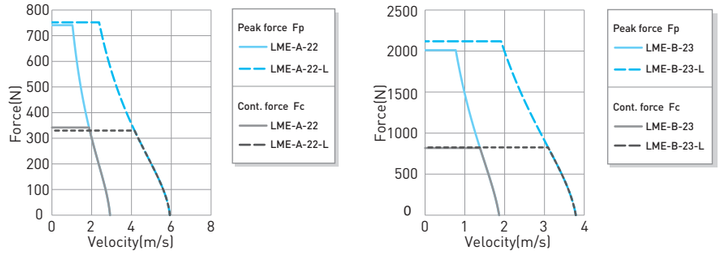




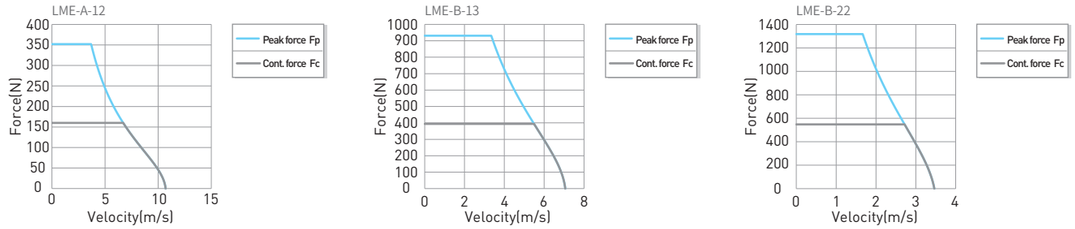
## 2.1.1 LME Series F-V curves

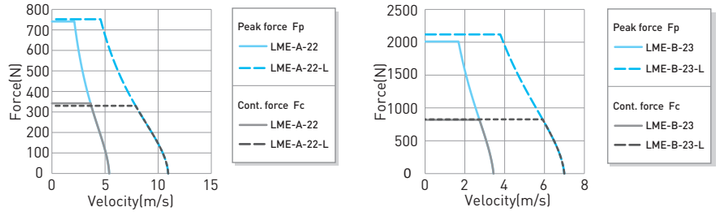
■ Force and velocity curves ( DC bus voltage = 325 $V_{DC}$)



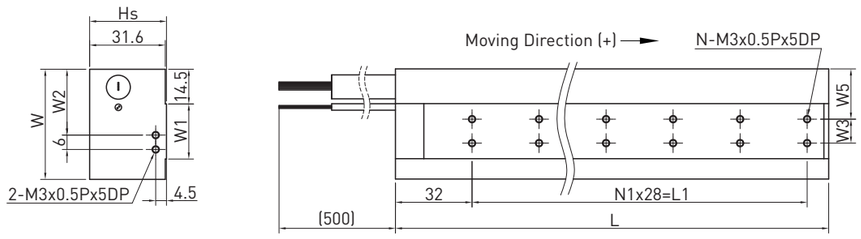

■ Force and velocity curvel ( DC bus voltage = 600 $V_{DC}$)



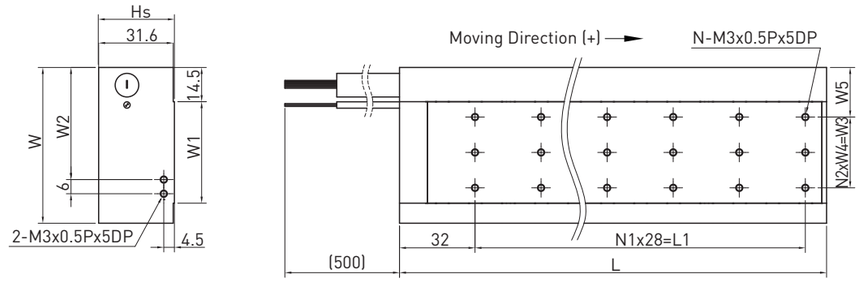



## 2.1.2 LME Series forcers and stators dimensions

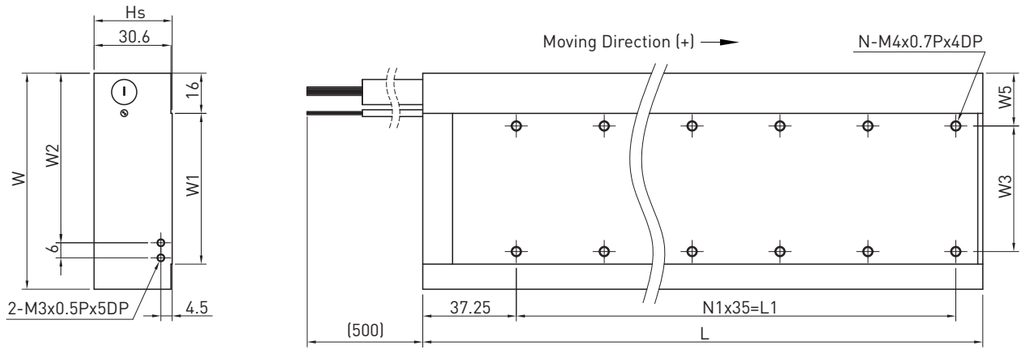
### ■ Dimension of LME-A-1□ forcers




### ■ Dimension of LME-A-2□ forcers

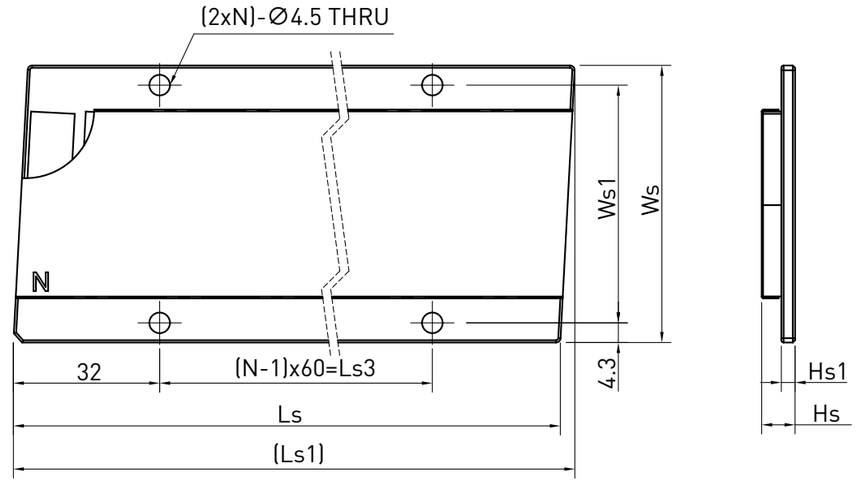



### ■ Dimension of LME-B forcers



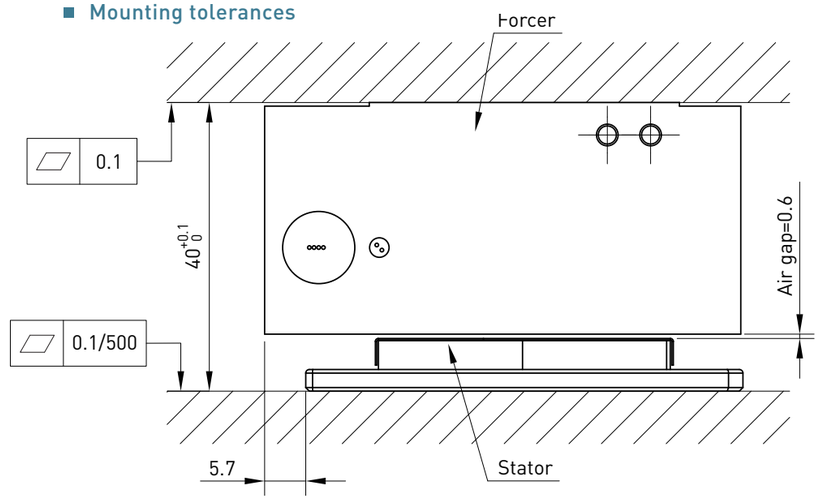

| Type | L | L1 | W | W1 | W2 | W3 | W4 | W5 | N | N1 | N2 | Hs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LME-A-12 | 181 | 140 | 46 | 23 | 27.5 | 10 | 10 | 21 | 12 | 5 | - | 32.1 |
| LME-A-22 | 181 | 140 | 66 | 43 | 47.5 | 30 | 15 | 21 | 18 | 5 | 2 | 32.1 |
| LME-A-22-L | 181 | 140 | 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<br>B: Pole pair pitch: 30 | 1: (A: 46 mm / B: 56 mm)<br>2: (A: 66 mm / B: 86 mm) | 2: (A: 181 mm / B: 223 mm)<br>3: (B: 328 mm) | 0: Standard<br>L: Low back EMF | 0: No thermal sensor<br>1: PTC120<br>2: PT1000 | L: Low voltage version, 325 Vdc<br>H: High voltage version, 600 Vdc (with UL) | N: Without hall sensor<br>A: Digital hall sensor | 005: 0.5 M<br>010: 1.0 M<br>*0.1times and so on | 000: Standard<br>001: Customized serial number |

### 2.1.4 Order code of primary part (forcer)

| 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<br>B: Pole pair pitch: 30 | 1: (A: 40.6 mm / B: 50.6 mm)<br>2: (A: 60.6 mm / B: 80.6 mm) | S1: (A&B: 120 mm)<br>S2: (A: 240 mm / B: 180 mm)<br>S3: (A: 360 mm / B: 300 mm) | N: No Epoxy or cover plate packaging<br>C: Cover plate | 000: Standard<br>001: Customized serial number |

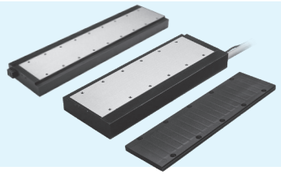




# 2.2 LMSA(-Z) Series

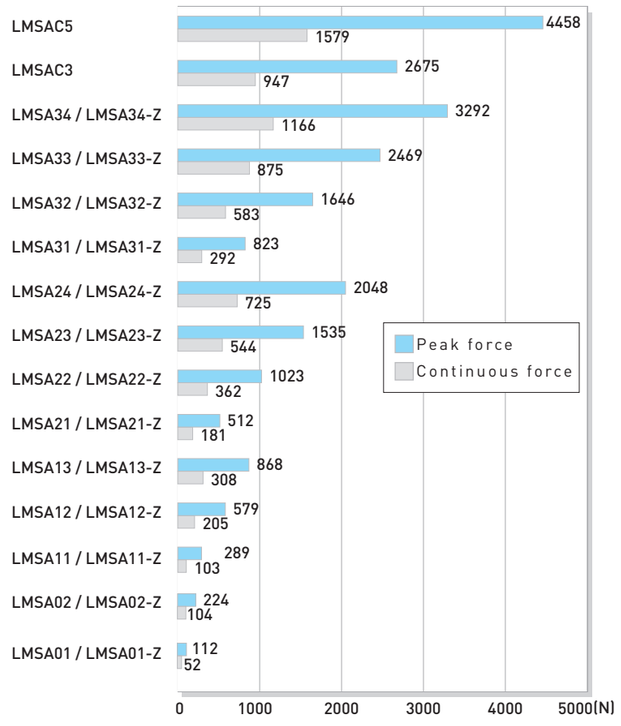
## Linear Motor

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 optomizes 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) | $K_m$ | $N/\sqrt{W}$ | 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 SNM120 In Series | | | | | | | | | |
| Maximum DC bus voltage | - | $V_{DC}$ | 750/(325V) | | | | | | | | | |
| Mass of forcer | $M_f$ | kg | 0.49 | 0.98 | 0.7 | 0.7 | 1.4 | 1.4 | 2.1 | 2.1 | 1.1 | 1.1 |
| Unit mass of stator | $M_s$ | kg/m | 1.9 | 1.9 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 4.8 | 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 | 120mm/N=2, 180mm/N=3, 300mm/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) | $K_m$ | $N/\sqrt{W}$ | 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 SNM120 In Series | | | | | | | | |
| Maximum DC bus voltage | - | $V_{DC}$ | 750/(325V) | | | | | | | | |
| Mass of forcer | $M_f$ | kg | 2.2 | 2.2 | 3.3 | 3.3 | 4.4 | 4.4 | 1.9 | 1.9 | 3.8 |
| Unit mass of stator | $M_s$ | kg/m | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 | 8.5 | 8.5 | 8.5 |
| 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 | 120mm/N=2, 180mm/N=3, 300mm/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.

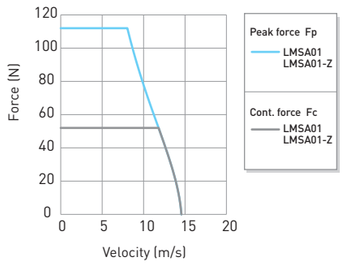
## Table 2-2 LMSA/LMSA-Z Series specifications

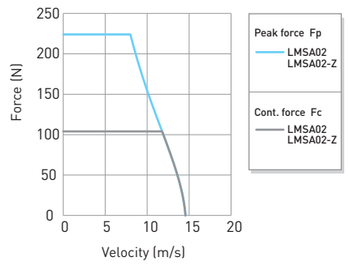
| | Symbol | Unit | LMSA32L | LMSA33 (-Z) | LMSA33L | LMSA34 (-Z) | LMSA34L | LMSAC3 | LMSAC3L | LMSAC5 | LMSAC5L |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Continuous force | $F_c$ | N | 583 | 875 | 875 | 1166 | 1166 | 947 | 947 | 1579 | 1579 |
| Continuous current | $I_c$ | $A_{rms}$ | 8.9 | 6.0 | 13.4 | 8.0 | 17.9 | 6.0 | 13.4 | 10.0 | 22.3 |
| Peak force (1s) | $F_p$ | N | 1646 | 2469 | 2469 | 3292 | 3292 | 2675 | 2675 | 4458 | 4458 |
| Peak current (1s) | $I_p$ | $A_{rms}$ | 26.8 | 18.0 | 40.2 | 24.0 | 53.6 | 18.0 | 40.2 | 30.0 | 67.0 |
| Ultimate force (0.5s) | $F_u$ | N | 2157 | 3236 | 3236 | 4314 | 4314 | 3505 | 3505 | 5842 | 5842 |
| Ultimate current (0.5s) | $I_u$ | $A_{rms}$ | 44.7 | 30.0 | 67.0 | 40.0 | 89.4 | 30.0 | 67.0 | 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 | 157.9 | 70.7 |
| Attraction force | $F_a$ | N | 2888 | 4333 | 4333 | 5777 | 5777 | 4694 | 4694 | 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 | 5.0 | 5.0 |
| Resistance (line to line, 25°C) | $R_{25}$ | Ω | 2.0 | 6.4 | 1.3 | 4.8 | 1.0 | 6.8 | 1.4 | 4.1 | 0.8 |
| Resistance (line to line, 120°C) | $R_{120}$ | Ω | 2.8 | 8.8 | 1.8 | 6.6 | 1.3 | 9.4 | 1.9 | 5.7 | 1.1 |
| Inductance (line to line) | L | mH | 9.8 | 31.3 | 6.5 | 23.5 | 4.7 | 33.8 | 6.8 | 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 | 91.2 | 40.8 |
| Motor constant (25°C) | $K_m$ | $N/\sqrt{W}$ | 37.7 | 47.0 | 46.7 | 54.3 | 54.5 | 49.3 | 49.5 | 63.7 | 63.9 |
| Thermal resistance | $R_{TH}$ | °C/W | 0.30 | 0.20 | 0.20 | 0.15 | 0.15 | 0.19 | 0.19 | 0.11 | 0.11 |
| Thermal time constant | $t_{TH}$ | s | 3060 | 3480 | 3480 | 4800 | 4800 | 3780 | 3780 | 4530 | 4530 |
| Thermal switch | - | - | 3 PTC SNM120 In Series | | | | | | | | |
| Maximum DC bus voltage | - | $V_{DC}$ | 750/(325V) | | | | | | | | |
| Mass of forcer | $M_f$ | kg | 3.8 | 5.7 | 5.7 | 7.6 | 7.6 | 6.3 | 6.3 | 10.5 | 10.5 |
| Unit mass of stator | $M_s$ | kg/m | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 9.7 | 9.7 | 9.7 | 9.7 |
| Width of stator | $W_s$ | mm | 114.6 | 114.6 | 114.6 | 114.6 | 114.6 | 126 | 126 | 126 | 126 |
| Length of stator/Dimension N | $L_s$ | mm | 120mm/N=2, 180mm/N=3, 300mm/N=5 | | | | | | | | |
| Stator mounting distance | $W_{s1}$ | mm | 104 | 104 | 104 | 104 | 104 | 114 | 114 | 114 | 114 |
| Total installation height | H | mm | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 |

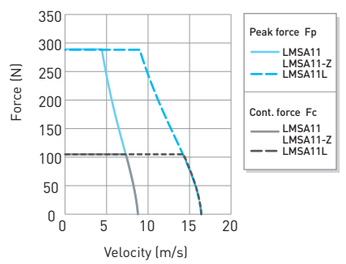
Note: 1.The data of this table are values without forced cooling.
2.Except dimensions, the electrical specifications are in ±10% of tolerance.
3.We reserve the right to change, please follow customer recognition drawings.

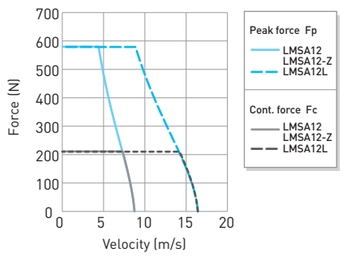
## 2.2.1 LMSA/LMSA-Z Series F-V curves

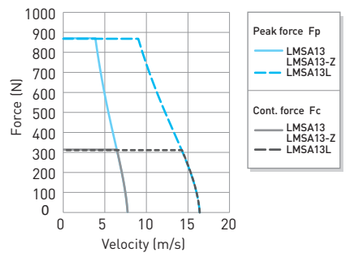
■ Force and velocity curves ( DC bus voltage = 325 $V_{DC}$)

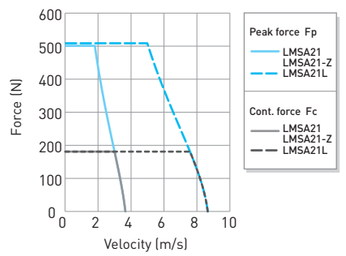


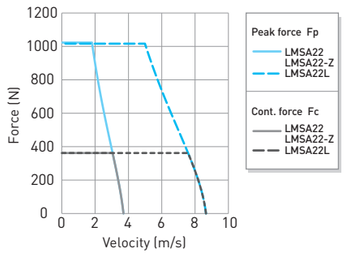



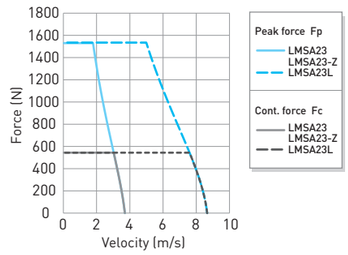



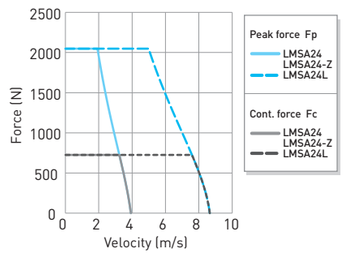



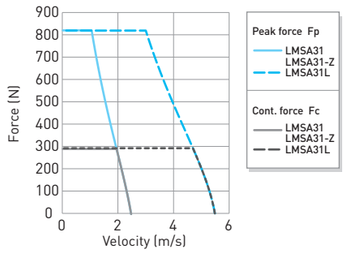



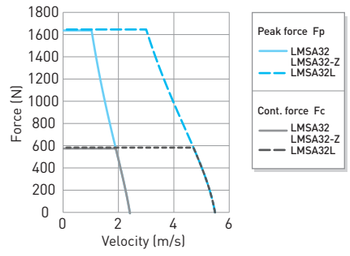



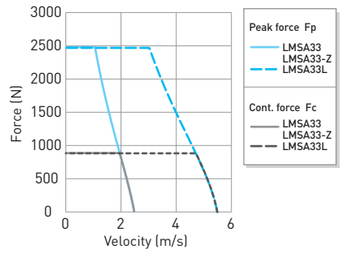



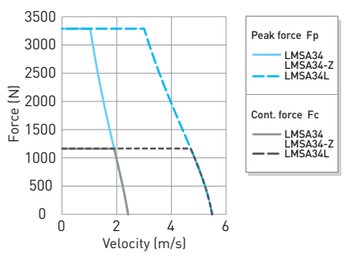



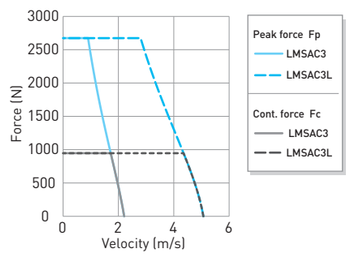



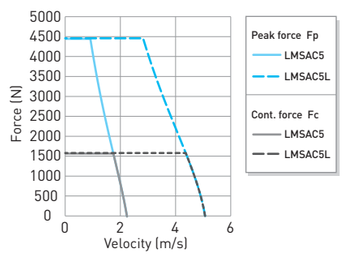



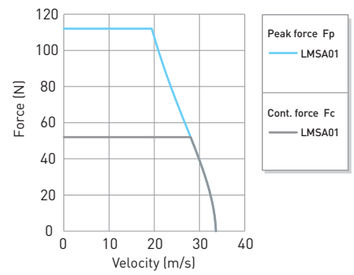



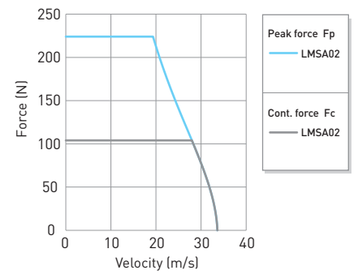



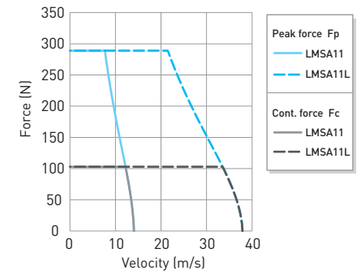



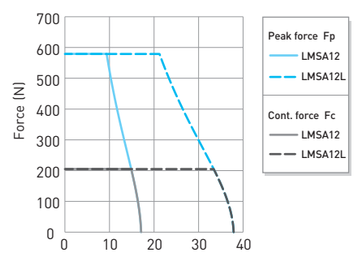



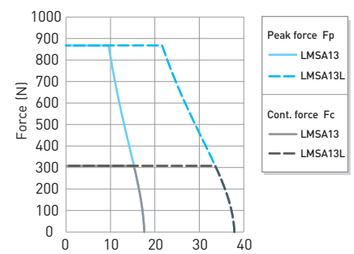

■ Force and velocity curves ( DC bus voltage = 750 $V_{DC}$)

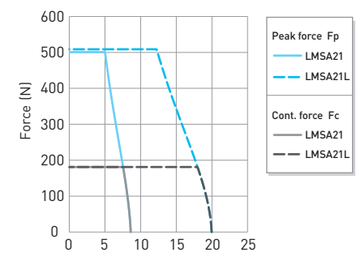


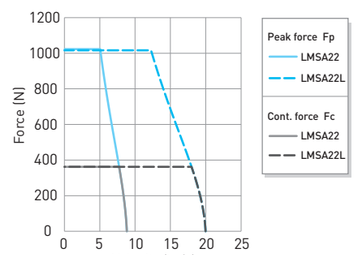



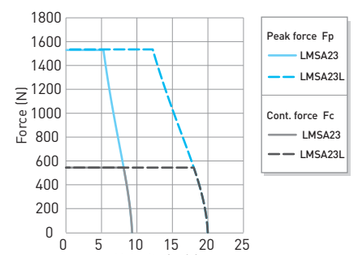



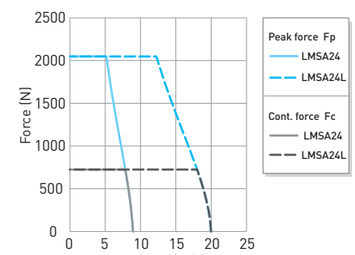



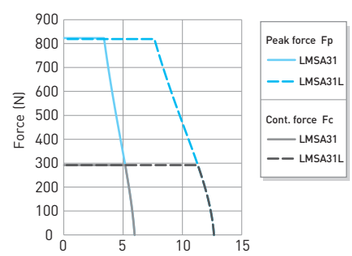



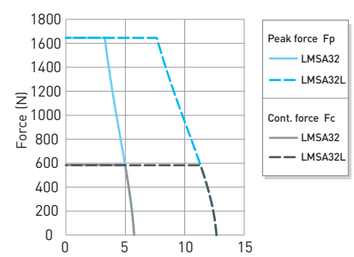



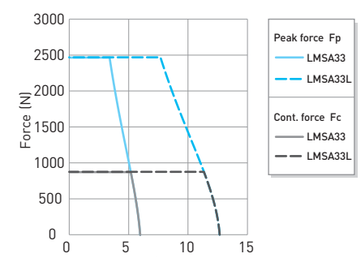



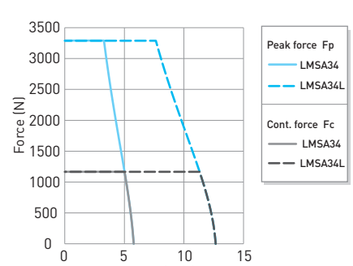



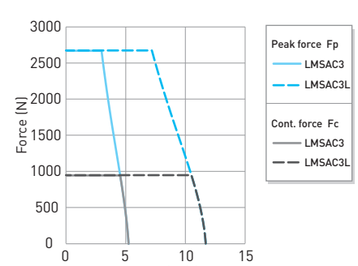



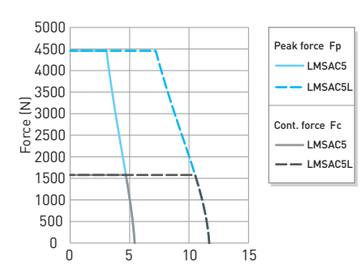



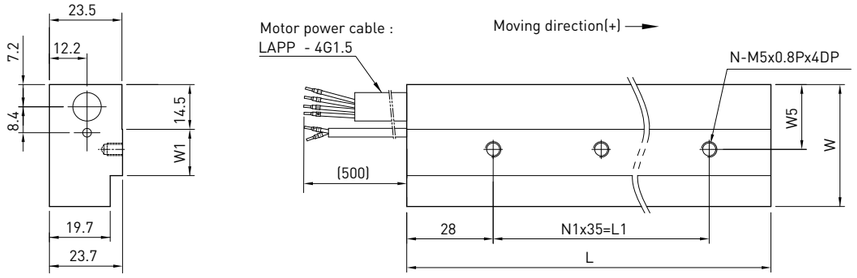



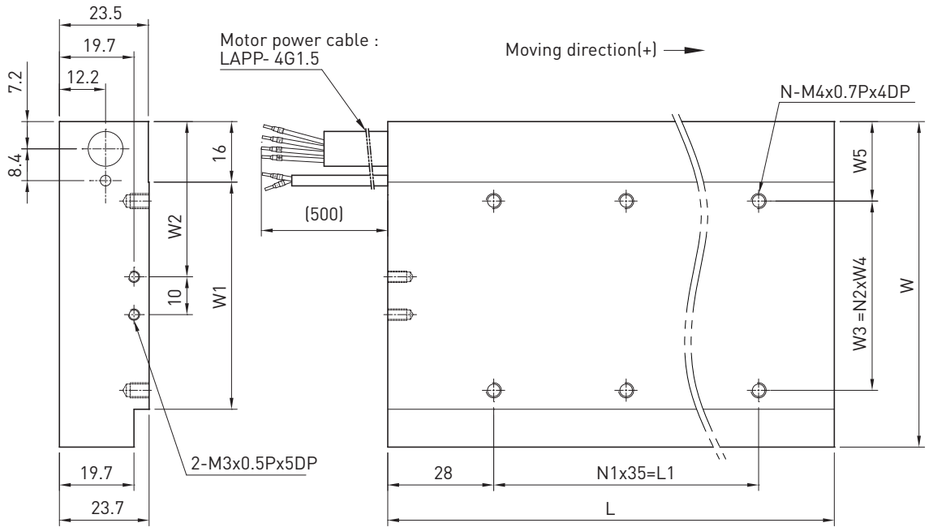



## 2.2.2 LMSA Series forcers and stators dimensions

### ■ Dimension of LMSA0 forcers

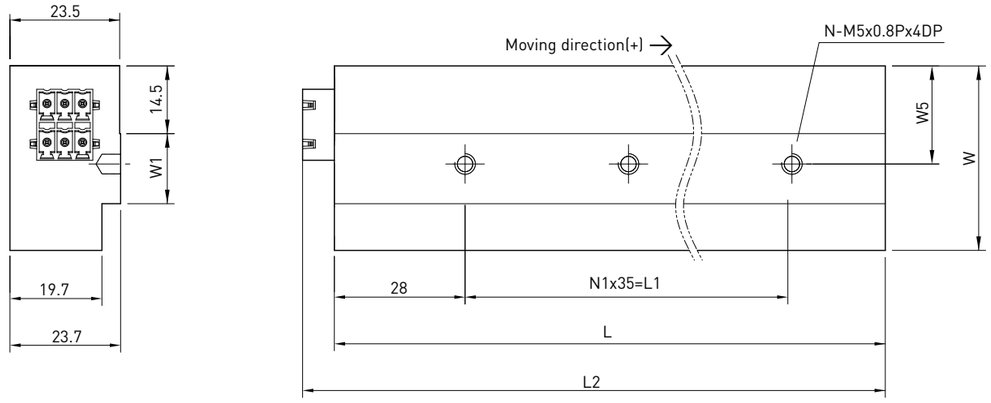



### ■ Dimension of LMSA1,2,3,C forcers

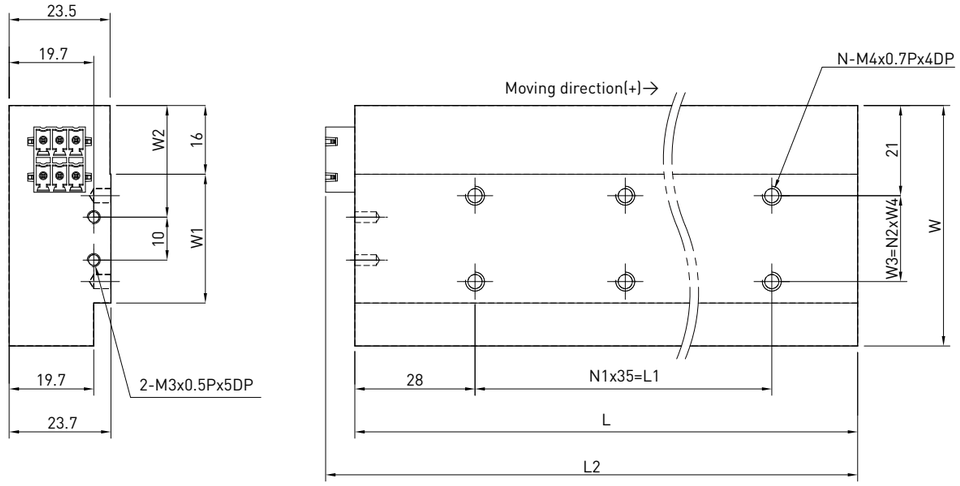



| Type | L | L1 | W | W1 | W2 | W3 | W4 | W5 | N | N1 | N2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LMSA01 | 118 | 70 | 39.5 | 15 | - | - | - | 22 | 3 | 2 | - |
| LMSA02 | 223 | 175 | 39.5 | 15 | - | - | - | 22 | 6 | 5 | - |
| LMSA11 | 118 | 70 | 56 | 30 | 26 | 20 | 20 | 21 | 6 | 2 | 1 |
| 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 |
| LMSAC3 | 328 | 280 | 123.5 | 97.5 | 59.75 | 80 | 40 | 24.75 | 27 | 8 | 2 |
| LMSAC5 | 538 | 490 | 123.5 | 97.5 | 59.75 | 80 | 40 | 24.75 | 45 | 14 | 2 |

### ■ Dimension of LMSA0-Z

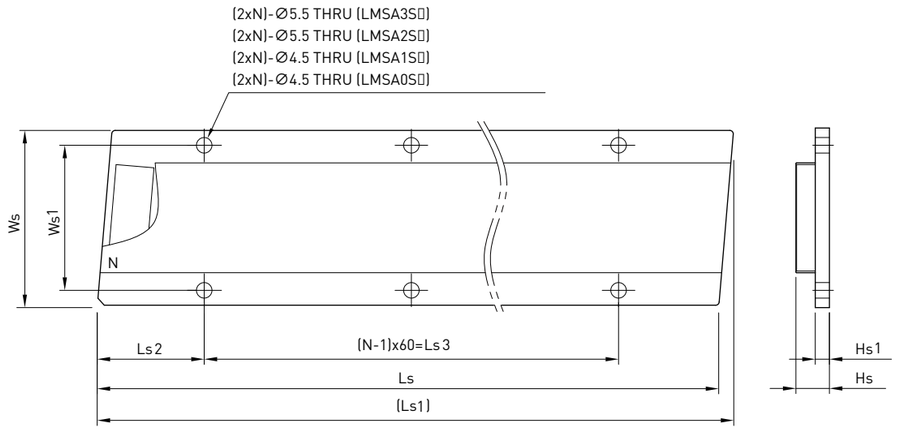


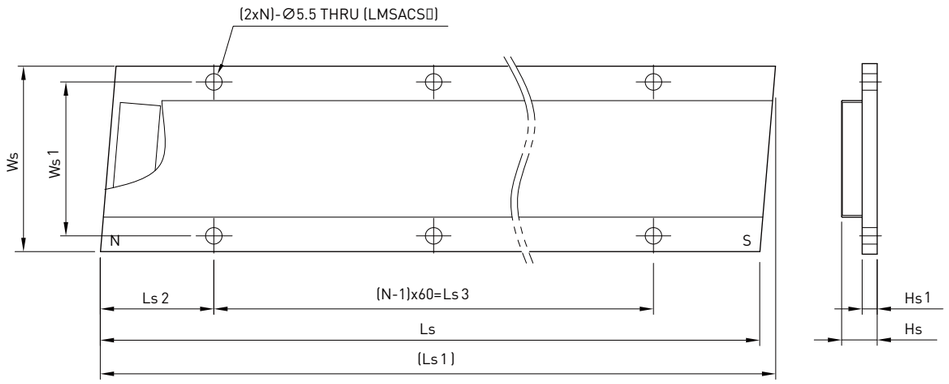

### ■ Dimension of LMSA1,2,3-Z

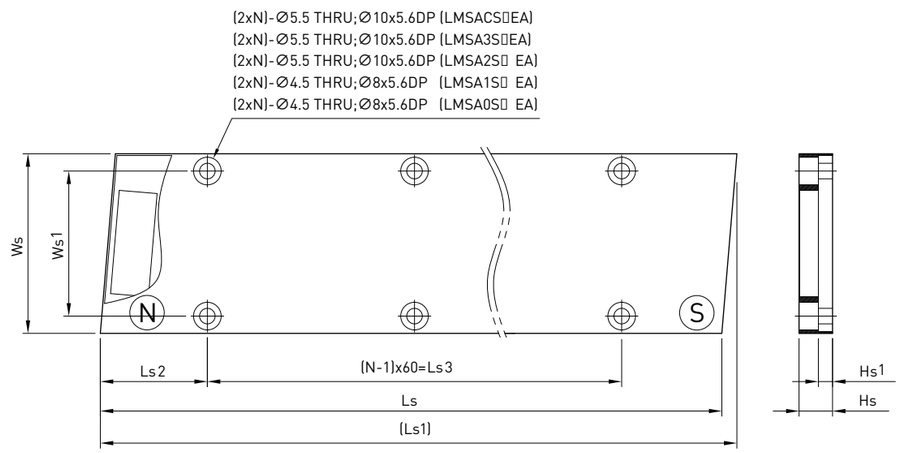



| Type | L | L1 | L2 | W | W1 | W2 | W3 | W4 | N | N1 | N2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LMSA01-Z | 118 | 70 | 124.8 | 39.5 | 15 | - | - | - | 3 | 2 | - |
| LMSA02-Z | 223 | 175 | 229.8 | 39.5 | 15 | - | - | - | 6 | 5 | - |
| LMSA11-Z | 118 | 70 | 124.8 | 56 | 30 | 26 | 20 | 20 | 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



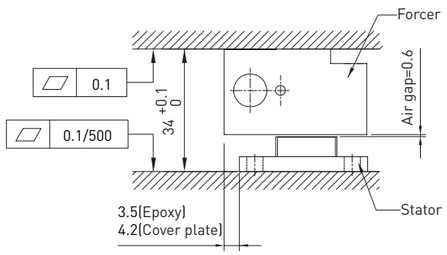



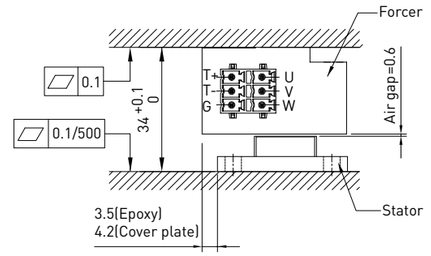

| Type | Ls | Ls1 | Ls2 | Ls3 | Ws | Ws1 | Hs | Hs1 | N |
|---|---|---|---|---|---|---|---|---|---|
| LMSA0S1(EA) | 120 | 123.11 | 31 | 60 | 35.6(37) | 27 | 9.7 | 4 | 2 |
| LMSA0S2(EA) | 180 | 183.11 | 31 | 120 | 35.6(37) | 27 | 9.7 | 4 | 3 |
| LMSA0S3(EA) | 300 | 303.11 | 31 | 240 | 35.6(37) | 27 | 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 |

## ■ Mounting tolerances

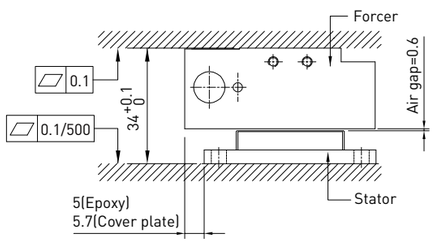
LMSA0 Series



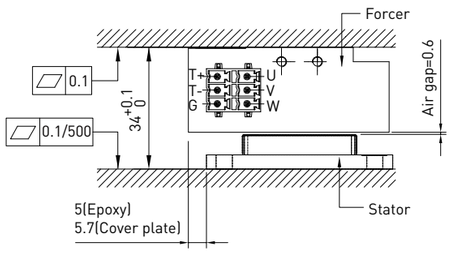

LMSA0-Z Series



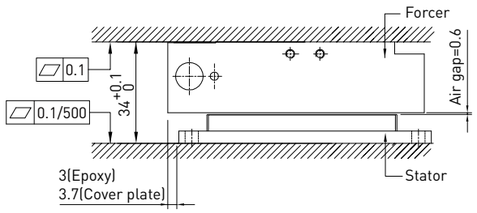

LMSA1 Series



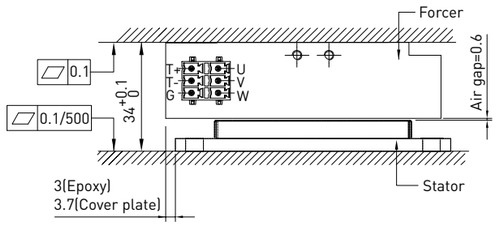

LMSA1-Z Series



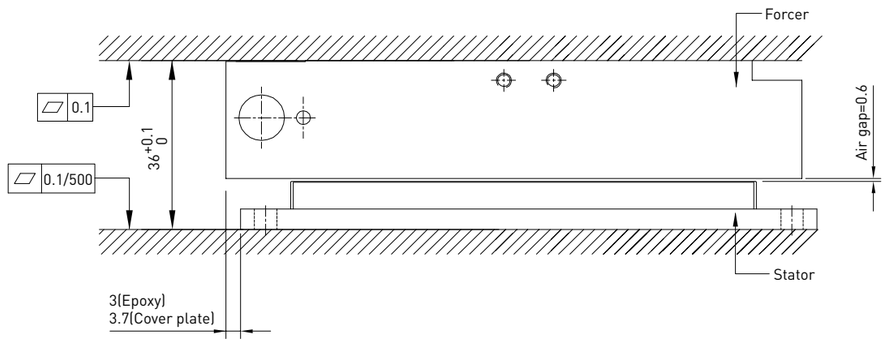
LMSA2 Series



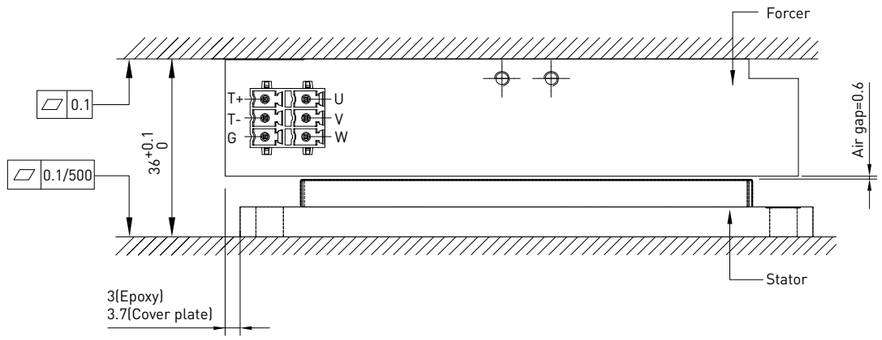

LMSA2-Z Series




LMSA3 Series

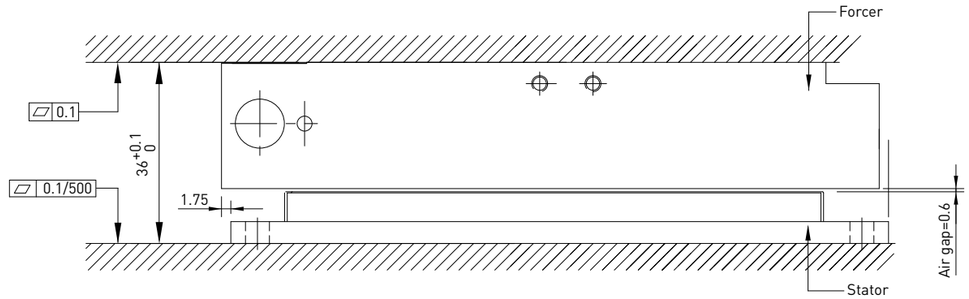



LMSA3-Z Series






LMSAC 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<br>1: 56 mm<br>2: 86 mm<br>3: 116 mm<br>C: 123.5 mm | 1: 118 mm<br>2: 223 mm<br>3: 328 mm<br>4: 433 mm<br>5: 538 mm | None: Standard<br>L: Low back EMF |

## 2.2.4 Order code of primary part (forcer)

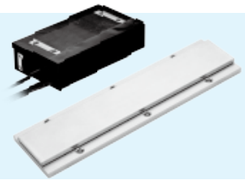
| Series | Type | Width of forcer | Length of forcer | Winding code | No cable |
|---|---|---|---|---|---|
| LM | SA | 1 | 1 | - | Z |
| Linear motor | Linear motor type | 0: 39.5 mm<br>1: 56 mm<br>2: 86 mm<br>3: 116 mm | 1: 118 mm<br>2: 223 mm<br>3: 328 mm<br>4: 433 mm | | |

## 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<br>1: 50.6/52 mm<br>2: 84.6/86 mm<br>3: 114.6/116 mm<br>C: 126 mm | S: Standard<br>C: Customize | 1: 120 mm<br>2: 180 mm<br>3: 300 mm | EA: Epoxy<br>None:Cover plate<br>No cover: No Epoxy or cover plate packaging |

# 2.3 LMSS11 Linear Motor

Application:
General automation, PCB, Inspection, Semiconductor



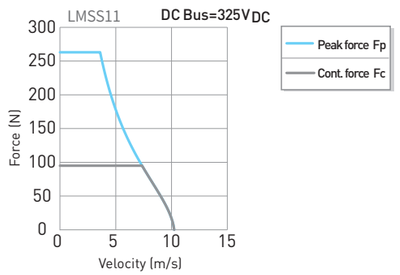
- Short length design to reduce stroke
- Optimized cogging force
- Insulation Class F
- UL and CE certification

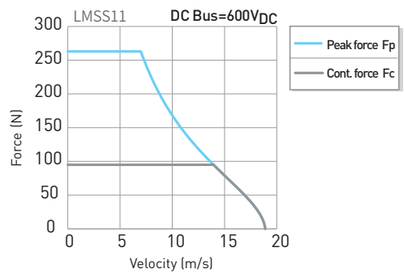
**Table 2-3 LMSS Series specifications**

| | 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. | Ip | $A_{rms}$ | 10.8 |
| Force constant | Kf | N/A(rms) | 35 |
| Attraction force | Fa | N | 311 |
| Max. winding temp. | Tmax | °C | 120 |
| Electrical time constant | Ke | 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 | 8.2 |
| Inductance (line to line) | L | mH | 23.5 |
| Pole pair pitch | 2τ | mm | 20 |
| Minimun bending radius of cable | - | mm | 39 |
| Back emf constant (line to line) | Kv | Vrms/(m/s) | 20.2 |
| Motor constant (at 25°C) | Km | N/√W | 11.5 |
| Thermal resistance | $R_{th}$ | °C/W | 1.05 |
| Thermal time constant | $T_{th}$ | s | 465 |
| Thermal switch | - | - | 3 PTC 120 In Series |
| Max. DC bus voltage | - | $V_{dc}$ | 600 |
| Mass of forcer | Mf | kg | 0.6 |
| Unit mass of stator | Ms | kg/m | 1.9 |

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

## 2.3.1 F-V curves

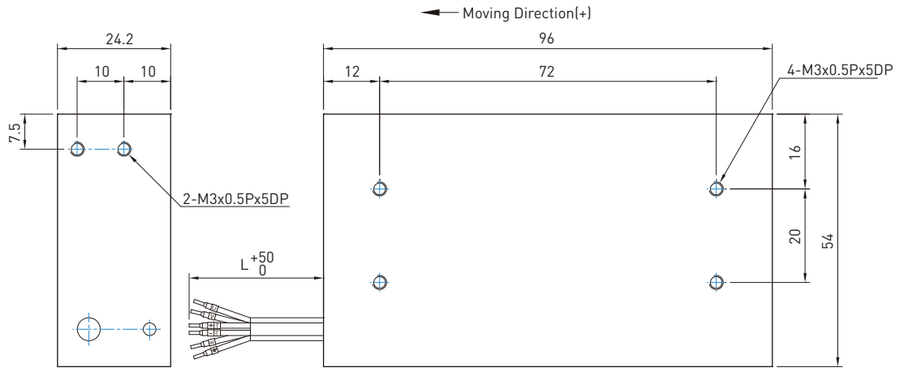


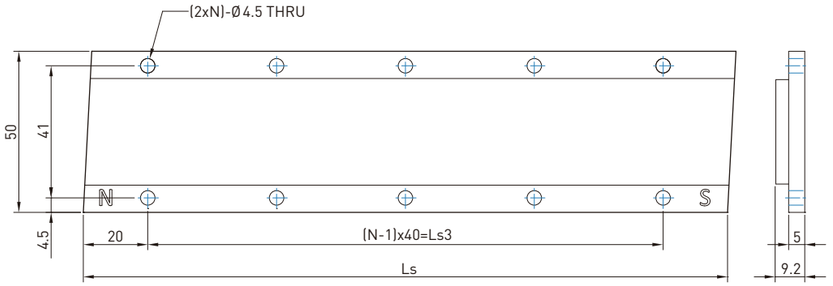



## 2.3.2 Product Dimension

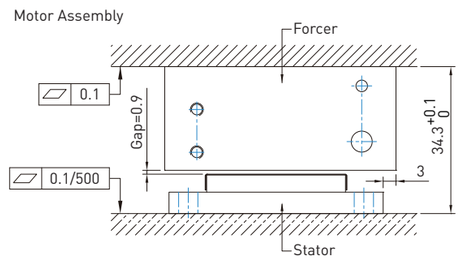
### Dimensions of forcer




### Dimensions of forcer




### Dimensions of forcer




### Dimensions of forcer

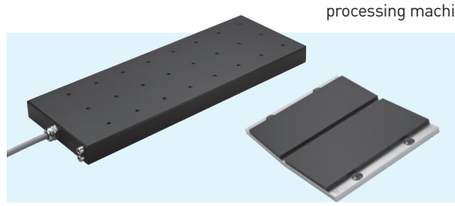
| Type | Ls | Ls3 | N |
|---|---|---|---|
| LMSS1S1 | 80 | 40 | 2 |
| LMSS1S2 | 200 | 160 | 5 |

## 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<br>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

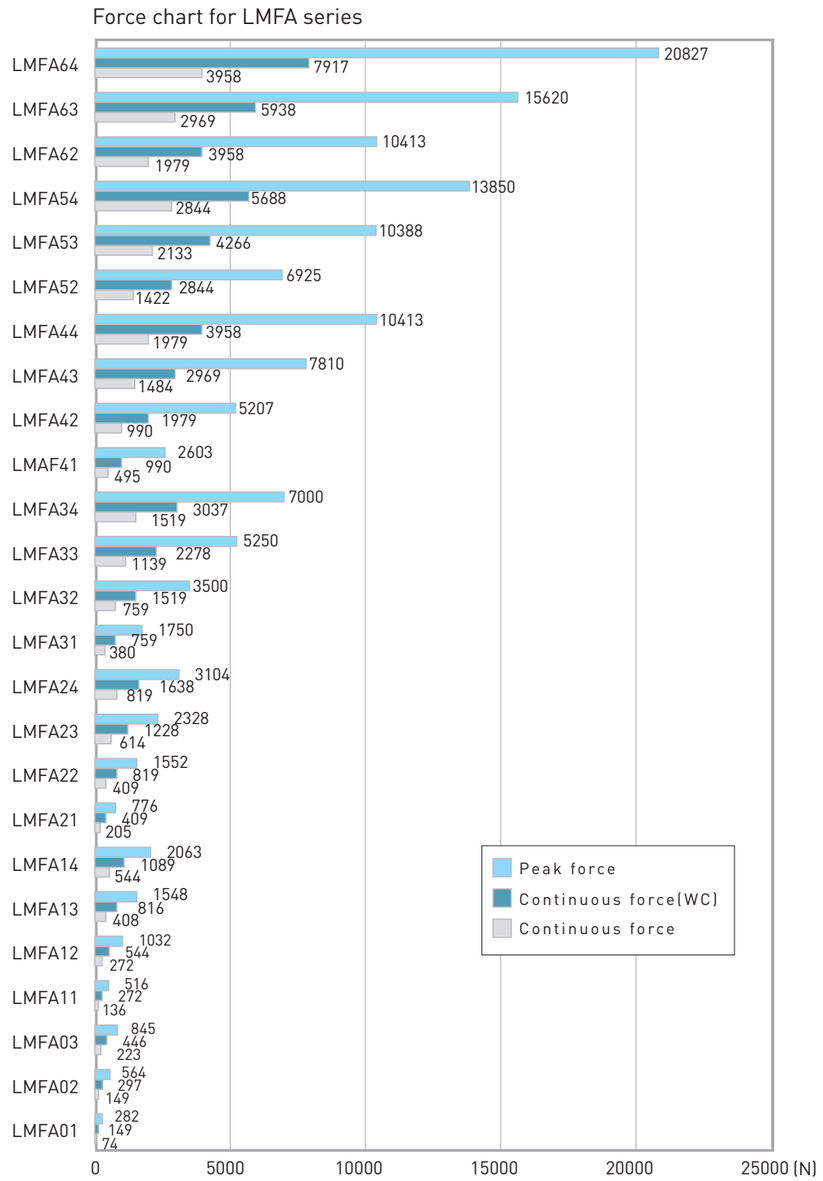



**Table 2-4 LMFA Series specifications**

| | 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 | $K_f$ | $N/A_{rms}$ | 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 | $K_e$ | 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 | $K_m$ | $N/\sqrt{W}$ | 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 | △P | 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 SNM120 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 | $Q_{P,H,MAX}$ | 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 | - | $V_{DC}$ | 750 | | | | | | | | | | | | | |
| 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 | $M_s$ | kg/m | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 |
| 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 | 120mm/N=2, 180mm/N=3, 300mm/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 | $K_m$ | $N/\sqrt{W}$ | 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 SNM120 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 | - | $V_{DC}$ | 750 | | | | | | | | | | | | | |
| 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 | $M_s$ | kg/m | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 16.2 | 16.2 | 16.2 | 16.2 | 16.2 | 16.2 |
| 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 | 120mm/N=2, 180mm/N=3, 300mm/N=5 | | | | | | | | 184mm/N=2, 276mm/N=3, 460mm/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 | 113 | 128 | 94 | 94 | 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 | $K_m$ | $N/\sqrt{W}$ | 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 SNM120 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 | - | $V_{DC}$ | 750 | | | | | | | | | | | | | |
| 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 | $M_s$ | kg/m | 16.2 | 16.2 | 22.3 | 22.3 | 22.3 | 22.3 | 22.3 | 22.3 | 22.3 | 22.3 | 25 | 25 | 25 | 25 |
| 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 | 184mm/N=2, 276mm/N=3, 460mm/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**

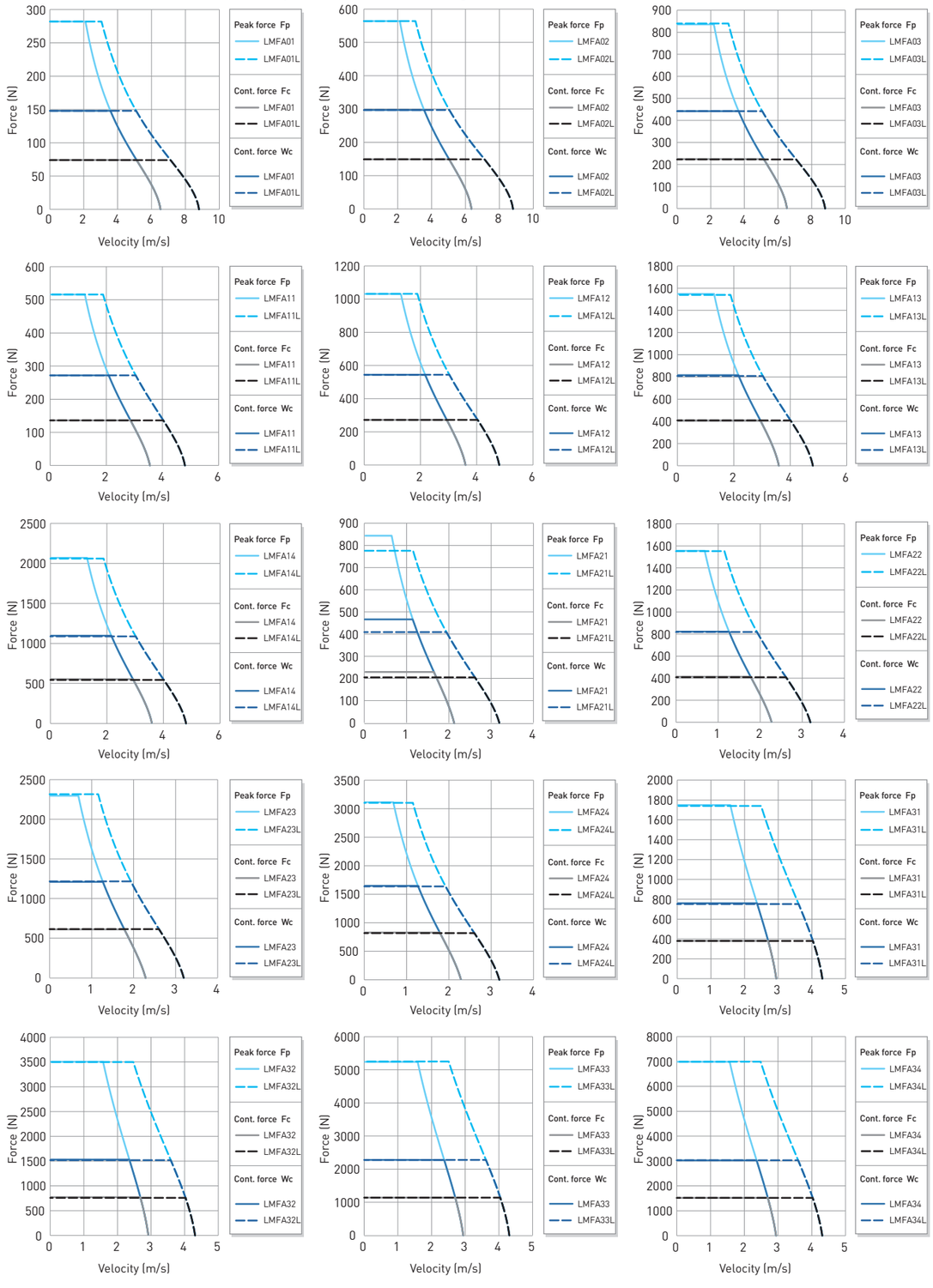
| | Symbol | Unit | LMFA54 | LMFA54L | LMFA62 | LMFA62L | LMFA63 | LMFA63L | LMFA64 | LMFA64L |
|---|---|---|---|---|---|---|---|---|---|---|
| Continuous force | $F_c$ | N | 2844 | 2844 | 1979 | 1979 | 2969 | 2969 | 3958 | 3958 |
| Continuous current | $I_c$ | $A_{rms}$ | 12.4 | 18.3 | 5.8 | 11.5 | 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 | △P | bar | 2.3 | 2.3 | 1.64 | 1.64 | 2.25 | 2.25 | 3 | 3 |
| Thermal switch | - | - | 1 x Pt1000+1x(3 PTC SNM120 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 | $Q_{P.H,MAX}$ | 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 | - | $V_{DC}$ | 750 | | | | | | | |
| 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 | $M_s$ | kg/m | 25 | 25 | 40.1 | 40.1 | 40.1 | 40.1 | 40.1 | 40.1 |
| Width of stator | $W_s$ | mm | 240 | 240 | 334 | 334 | 334 | 334 | 334 | 334 |
| Length of stator/Dimension N | $L_s$ | mm | 184mm/N=2, 276mm/N=3, 460mm/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 ±10% of tolerance.
4.We reserve the right to change, please follow customer recognition drawings.

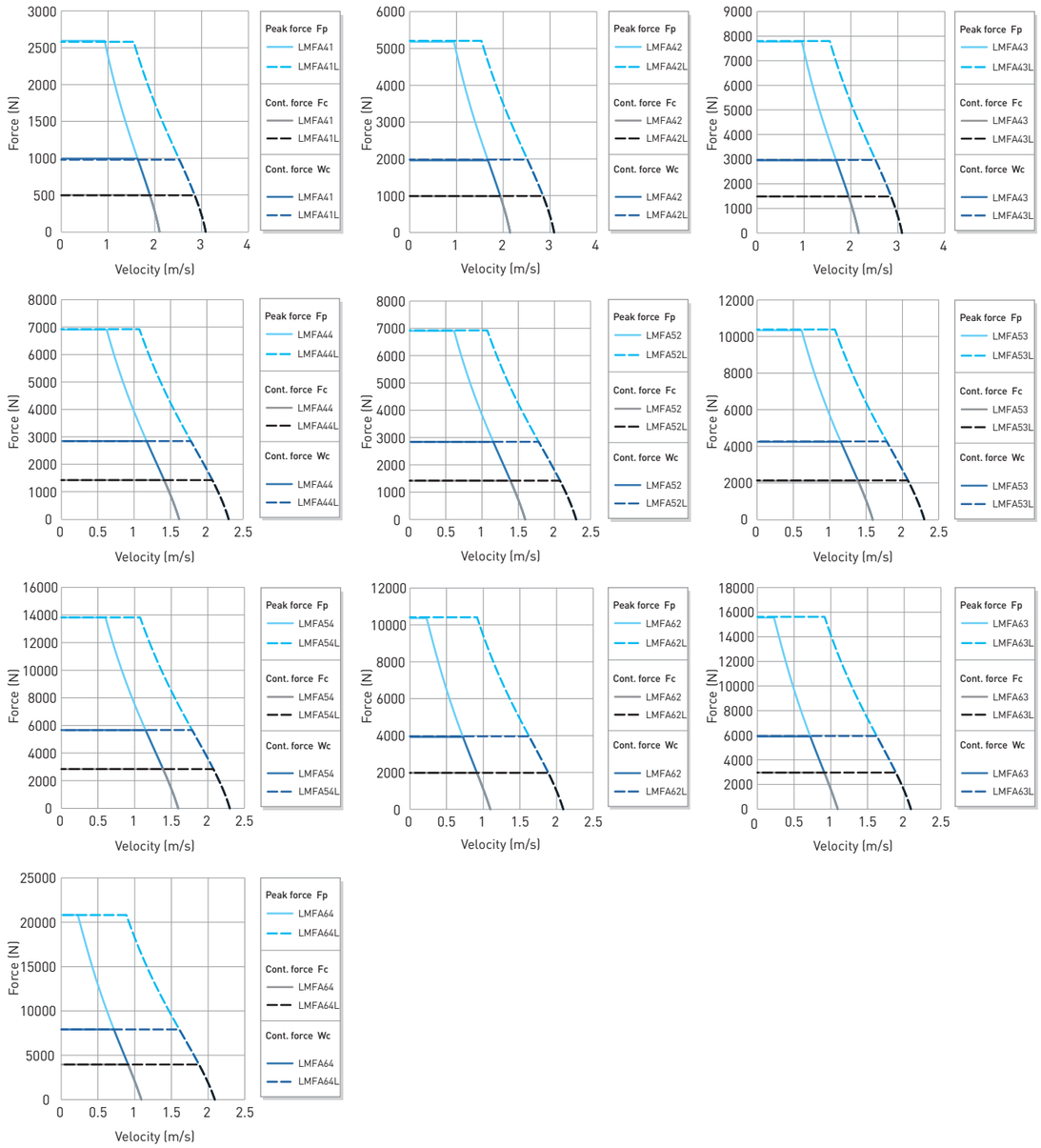


## 2.4.1 LMFA Series F-V curves

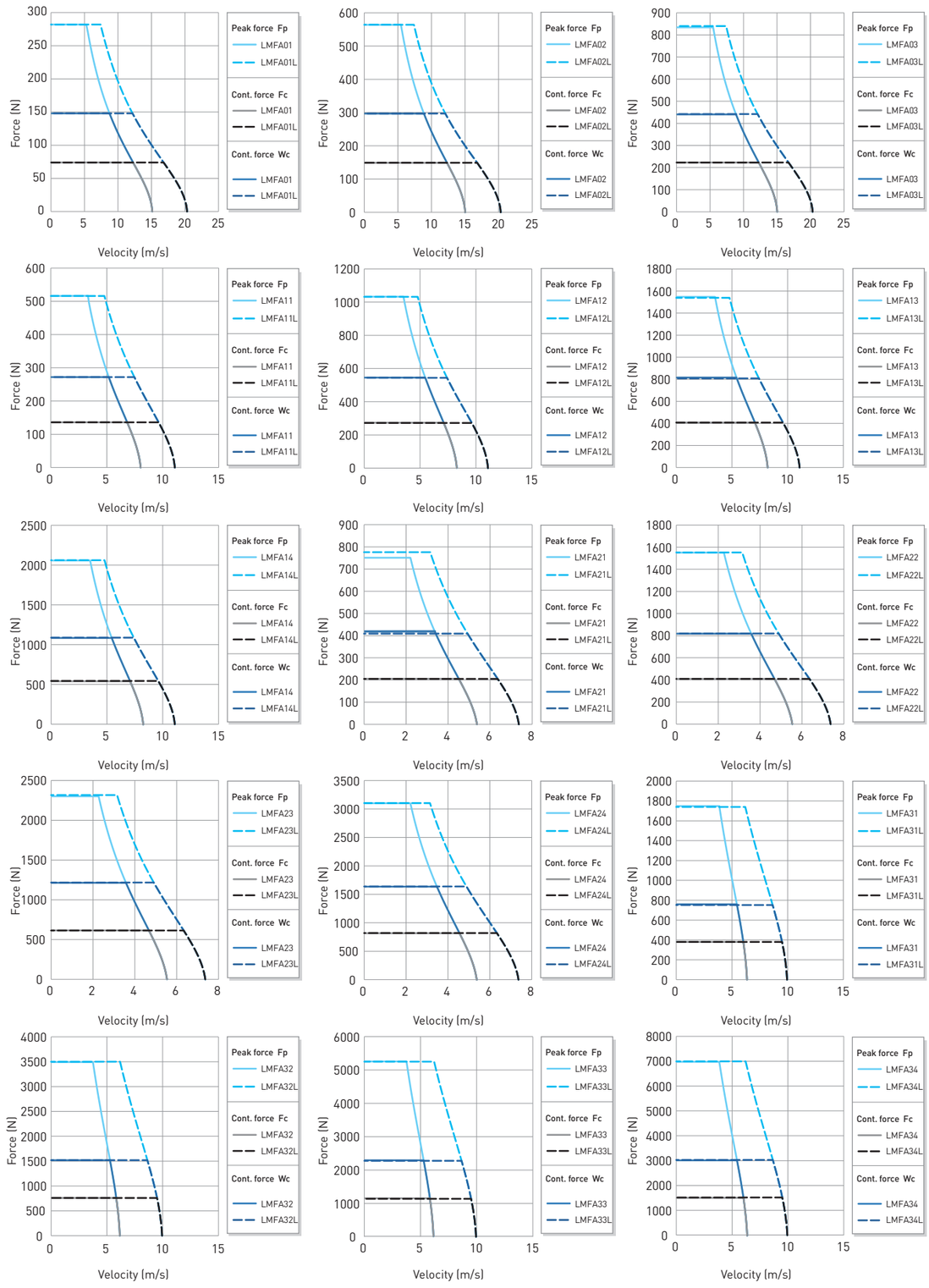
■ Force and velocity curves ( DC bus voltage = 325 $V_{DC}$)



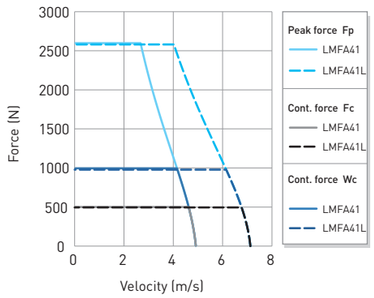
## ■ Force and velocity curves ( DC bus voltage = 325 $V_{DC}$)

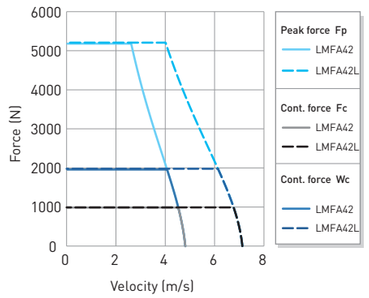


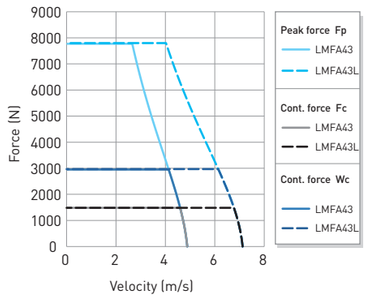

## ■ Force and velocity curves ( DC bus voltage = 750 $V_{DC}$)

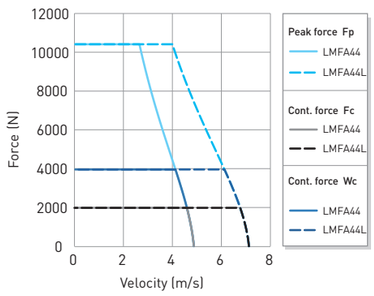


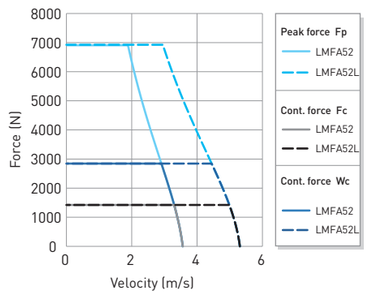
■ Force and velocity curves ( DC bus voltage = 750 $V_{DC}$)

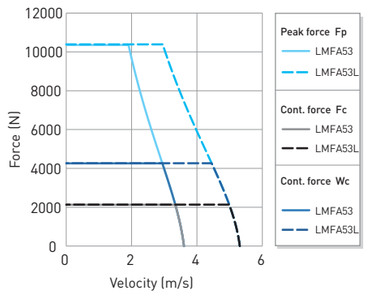


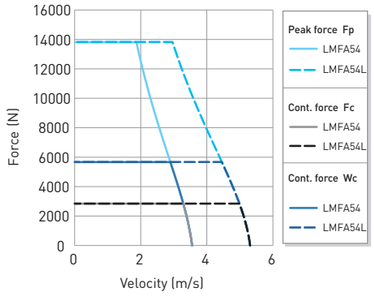



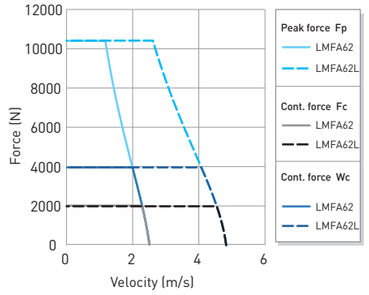



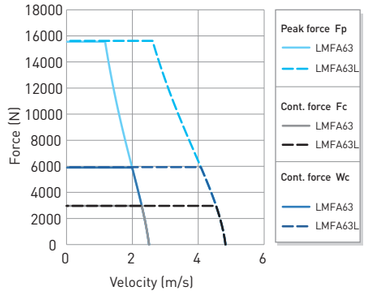



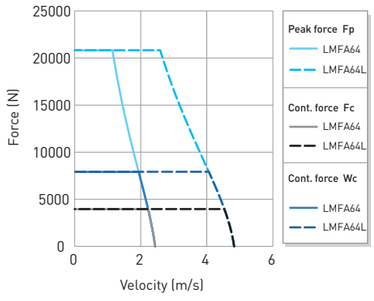



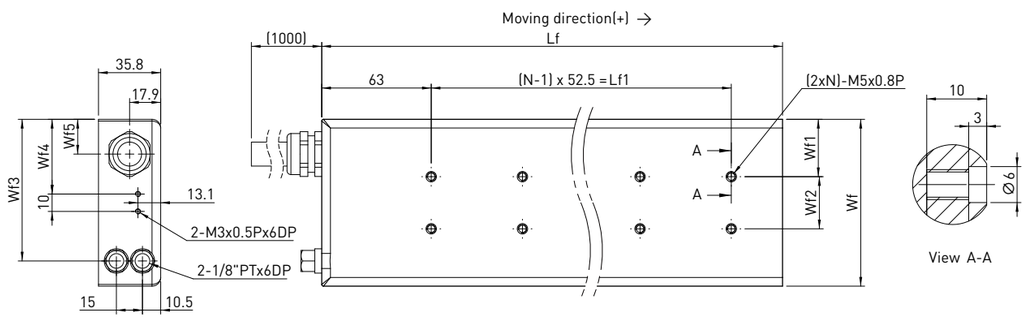



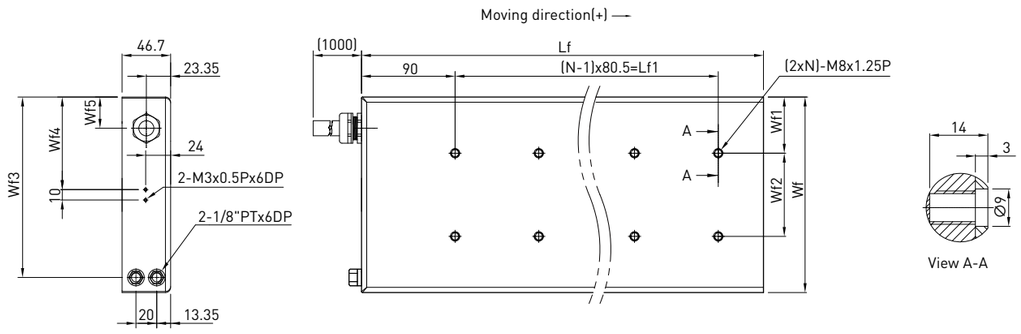

## 2.4.2 LMFA Series forcers and stators dimensions

■ Dimension of LMFA0,1,2 forcers



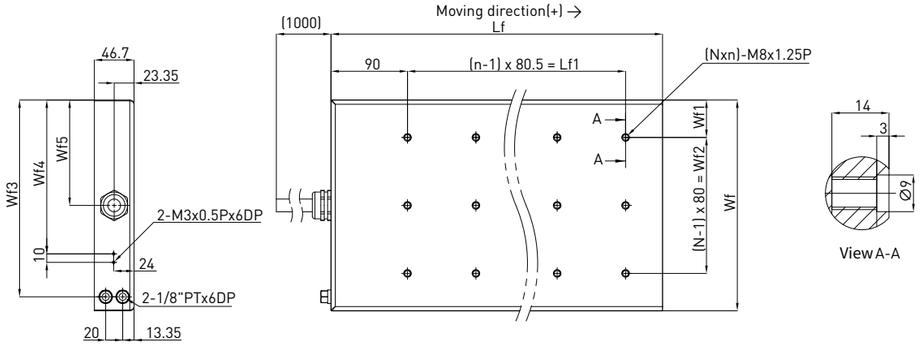

| Type | Lf | Lf1 | Wf | Wf1 | Wf2 | Wf3 | Wf4 | Wf5 | N |
|---|---|---|---|---|---|---|---|---|---|
| LMFA01 | 145 | 52.5 | 67 | 18.5 | 30 | 55 | 33.75 | 14.4 | 2 |
| LMFA02 | 250 | 157.5 | 67 | 18.5 | 30 | 55 | 33.75 | 14.4 | 4 |
| LMFA03 | 355 | 262.5 | 67 | 18.5 | 30 | 55 | 33.75 | 14.4 | 6 |
| LMFA11 | 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



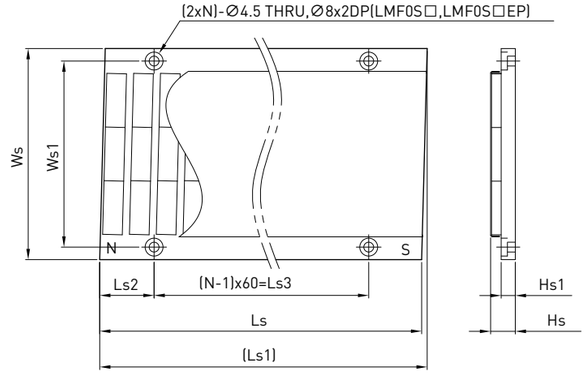

| Type | Lf | Lf1 | Wf | Wf1 | Wf2 | Wf3 | Wf4 | Wf5 | N |
|---|---|---|---|---|---|---|---|---|---|
| LMFA31 | 214 | 80.5 | 141 | 40.5 | 60 | 126.5 | 65.5 | 30 | 2 |
| LMFA32 | 375 | 241.5 | 141 | 40.5 | 60 | 126.5 | 65.5 | 30 | 4 |
| LMFA33 | 536 | 402.5 | 141 | 40.5 | 60 | 126.5 | 65.5 | 30 | 6 |
| 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 |

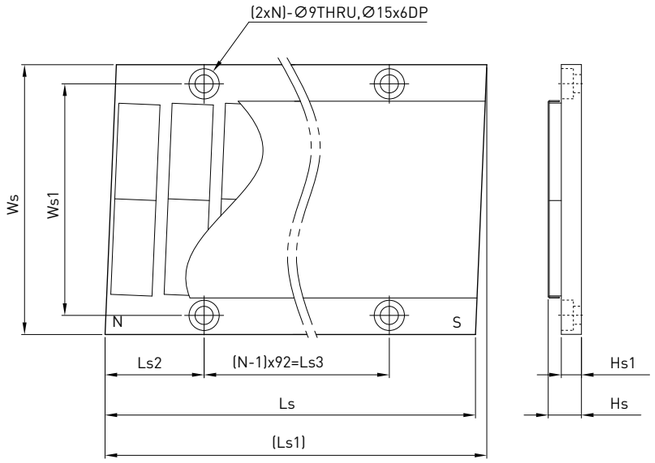
## Dimension of LMFA0,1,2 stators




| 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 |

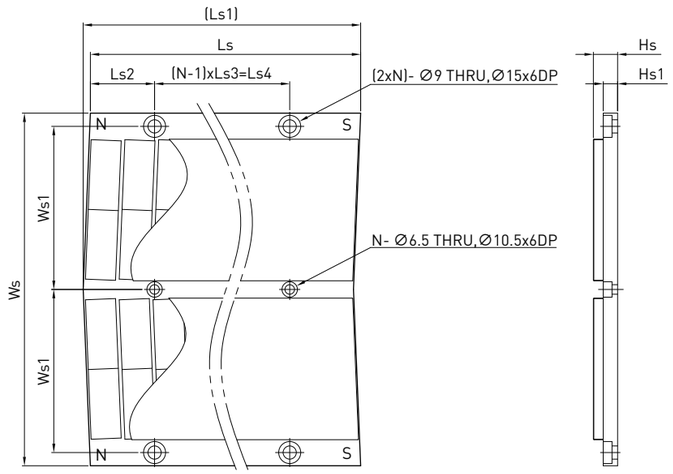


## Dimension of LMFA 3,4 stators



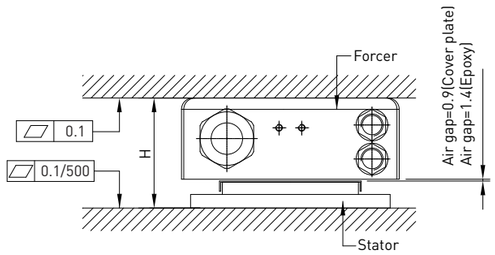

| Type | Ls | Ls1 | Ls2 | Ls3 | Hs | Hs1 | Ws | Ws1 | N |
|---|---|---|---|---|---|---|---|---|---|
| LMF3S1 | 184 | 189.62 | 49.2 | 92 | 16.5 | 10 | 134 | 115 | 2 |
| LMF3S1EP | 184 | 189.62 | 49.2 | 92 | 16 | 9.8 | 134 | 115 | 2 |
| LMF3S2 | 276 | 281.62 | 49.2 | 184 | 16.5 | 10 | 134 | 115 | 3 |
| 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 | Type | H |
|---|---|---|---|
| LMFA01 | 48.5 | LMFA31 | 64.1 |
| LMFA02 | 48.5 | LMFA32 | 64.1 |
| LMFA03 | 48.5 | LMFA33 | 64.1 |
| LMFA11 | 48.5 | LMFA34 | 64.1 |
| LMFA12 | 48.5 | LMFA41 | 66.1 |
| LMFA13 | 48.5 | LMFA42 | 66.1 |
| LMFA14 | 48.5 | LMFA43 | 66.1 |
| LMFA21 | 50.5 | LMFA44 | 66.1 |
| LMFA22 | 50.5 | LMFA52 | 64.1 |
| LMFA23 | 50.5 | LMFA53 | 64.1 |
| LMFA24 | 50.5 | 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 | Replace Character |
|---|---|---|---|---|---|
| LM | FA | 3 | 1 | L | B |
| Linear motor | Linear motor type | 0: 67 mm<br>1: 96 mm<br>2: 126 mm<br>3: 141 mm<br>4: 188 mm<br>5: 248 mm<br>6: 342 mm | LMFA 0-2 series<br>1: 145 mm<br>2: 250 mm<br>3: 355 mm<br>4: 460 mm<br>LMFA 3-6 series<br>1: 214 mm<br>2: 375 mm<br>3: 536 mm<br>4: 697 mm | None: Standard<br>L: Low back EMF | None: Anodized black<br>B: Non-anodized |

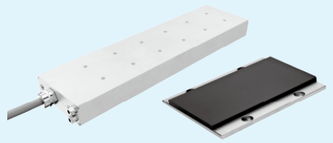
## 2.4.4 Order code of magnet track (stator)

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



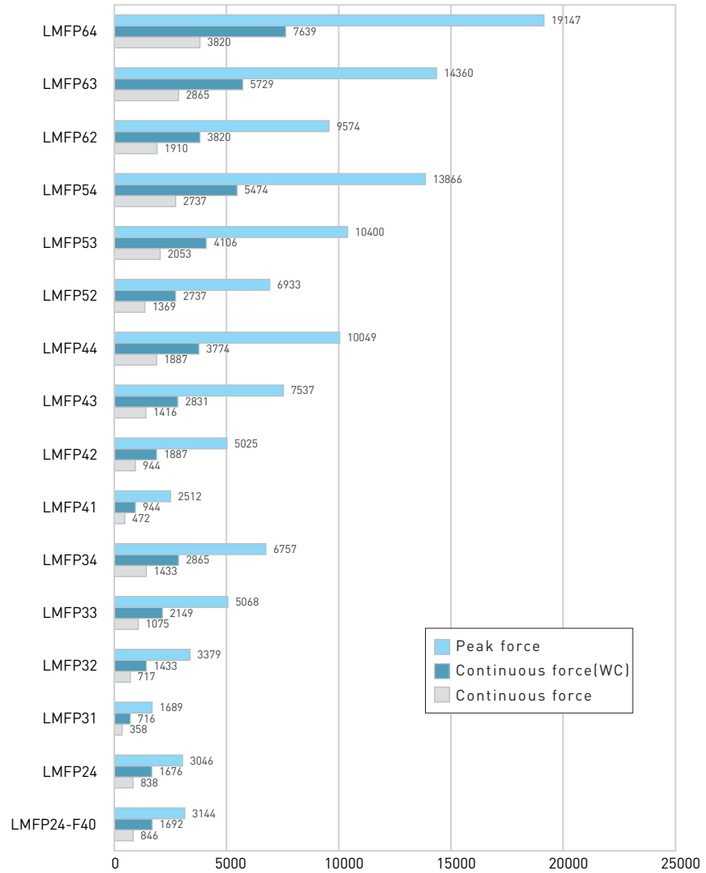
# 2.5 LMFP Series
## Linear Motor

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 20,000N. 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 | $K_m$ | $N/\sqrt{W}$ | 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 SNM 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 | $Q_{P,H,MAX}$ | 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 | - | $V_{DC}$ | 750 | | | | | |
| Mass of forcer | $M_f$ | kg | 11 | 11 | 6.9 | 6.9 | 12.1 | 12.1 |
| Unit mass of stator | $M_s$ | kg/m | 9.8 | 9.8 | 16.2 | 16.2 | 16.2 | 16.2 |
| 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 | 120mm/N=2, 180mm/N=3, 300mm/N=5 | | 184mm/N=2, 276mm/N=3, 460mm/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 | $K_m$ | $N/\sqrt{W}$ | 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 SNM 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 | $Q_{P,H,MAX}$ | 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 | - | $V_{DC}$ | 750 | | | | | |
| 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 | 16.2 | 16.2 | 16.2 | 16.2 | 22.3 | 22.3 |
| 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 | 184mm/N=2, 276mm/N=3, 460mm/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 | $K_m$ | $N/\sqrt{W}$ | 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 SNM 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 | - | $V_{DC}$ | 750 | | | | | |
| Mass of forcer | $M_f$ | kg | 16.7 | 16.7 | 25 | 25 | 29.8 | 29.8 |
| Unit mass of stator | $M_s$ | kg/m | 22.3 | 22.3 | 22.3 | 22.3 | 22.3 | 22.3 |
| 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 | 184mm/N=2, 276mm/N=3, 460mm/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 | $K_m$ | $N/\sqrt{W}$ | 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 SNM 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 | - | $V_{DC}$ | 750 | | | | | |
| 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 | 25 | 25 | 25 | 25 | 25 |
| 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 | 184mm/N=2, 276mm/N=3, 460mm/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**

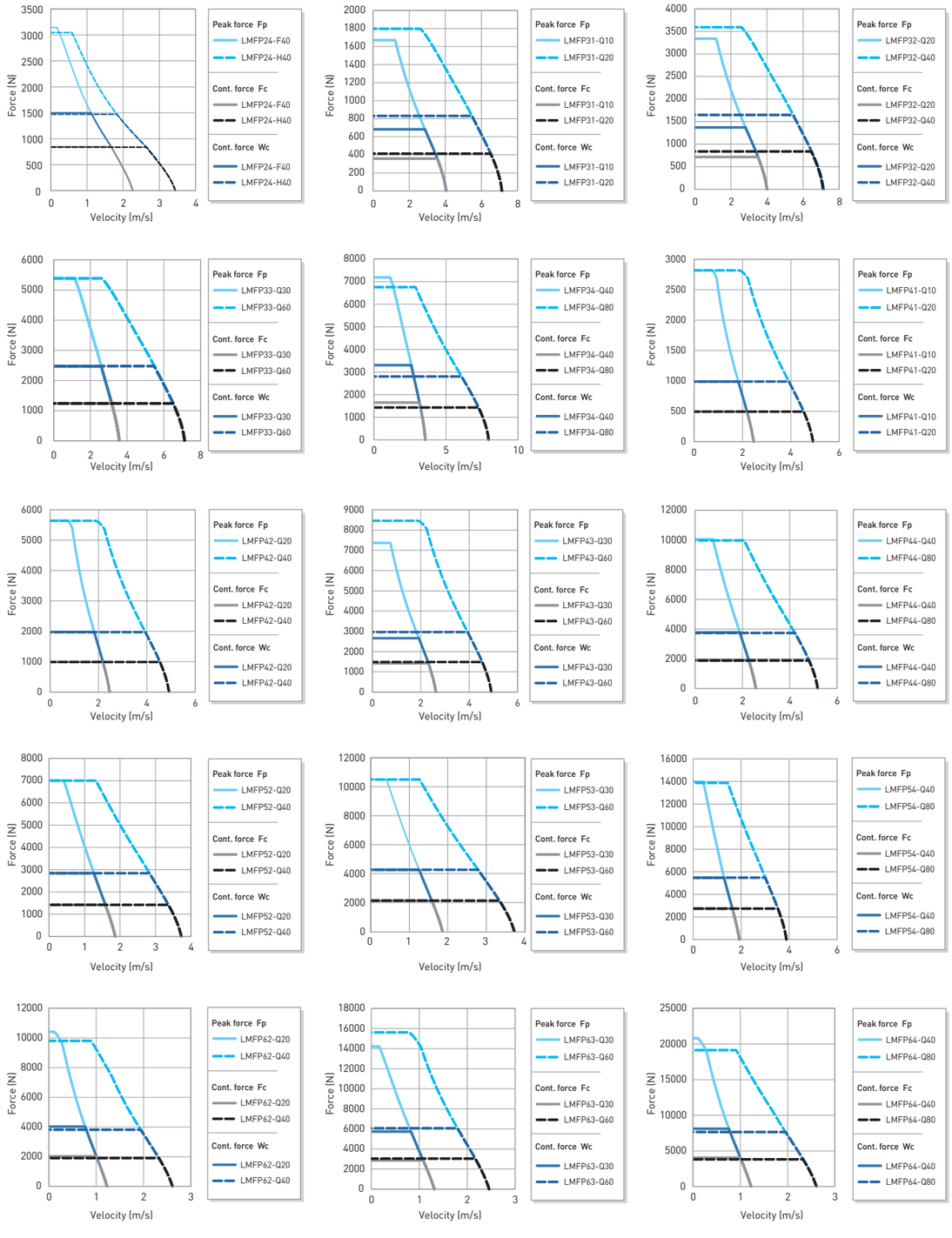
| | Symbol | Unit | LMFP62-Q20 | LMFP62-Q40 | LMFP63-Q30 | LMFP63-Q60 | LMFP64-Q40 | LMFP64-Q80 |
|---|---|---|---|---|---|---|---|---|
| Continuous force | $F_c$ | N | 2029 | 1910 | 2865 | 3043 | 4058 | 3820 |
| Continuous current | $I_c$ | $A_{rms}$ | 7 | 13.9 | 10.4 | 20.9 | 13.9 | 27.8 |
| Continuous 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 | △P | bar | 1.64 | 1.64 | 2.25 | 2.25 | 3 | 3 |
| Thermal switch | - | - | 1 x Pt1000 + 1 x (3 PTC SNM 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 | $Q_{P,H,MAX}$ | 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 | - | $V_{DC}$ | 750 | | | | | |
| 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 | 40.1 | 40.1 | 40.1 | 40.1 | 40.1 | 40.1 |
| 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 | 184mm/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 ±10% of tolerance.
4.We reserve the right to change, please follow customer recognition drawings.

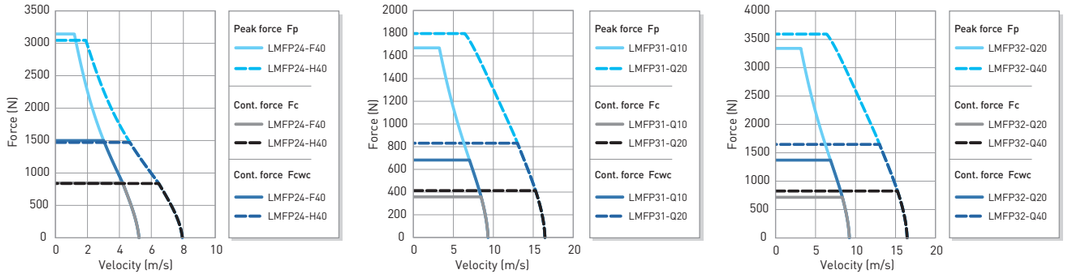


## 2.5.1 LMFP Series F-V curves

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



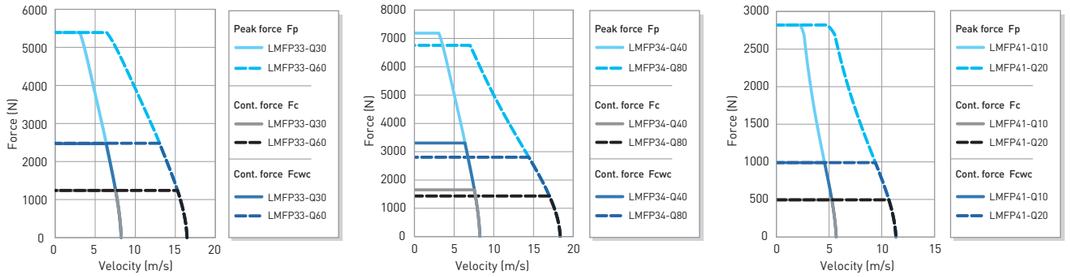
■ Force and velocity curves ( DC bus voltage = 750 $V_{DC}$ )







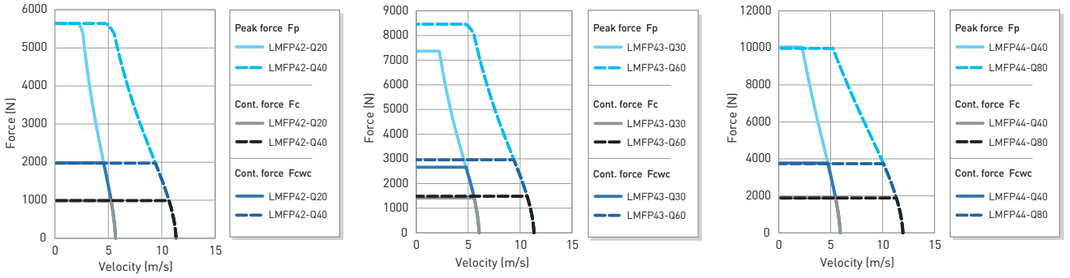






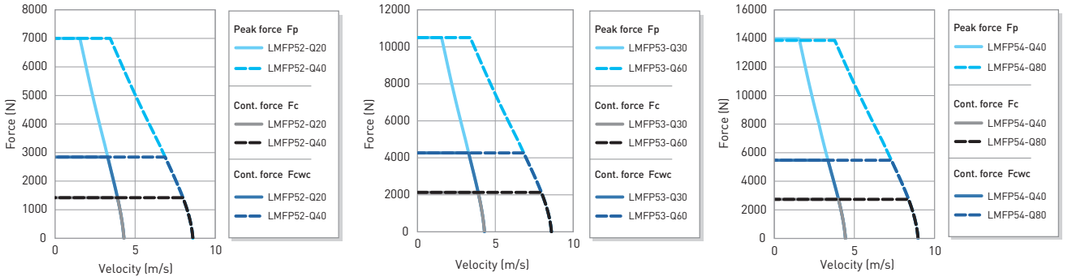






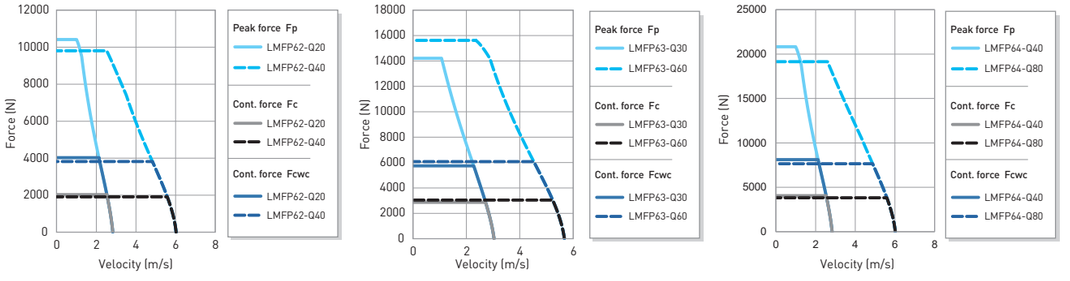










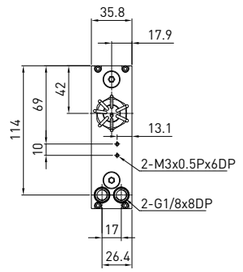


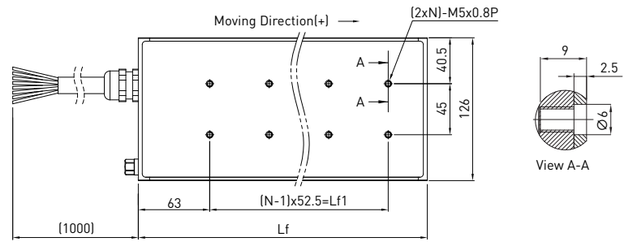





## 2.5.2 LMFP series forcers and stators dimensions

■ Dimension of LMFP 2 forcers



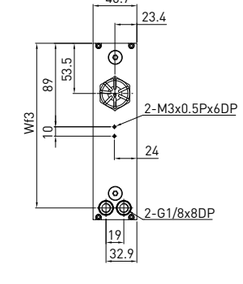



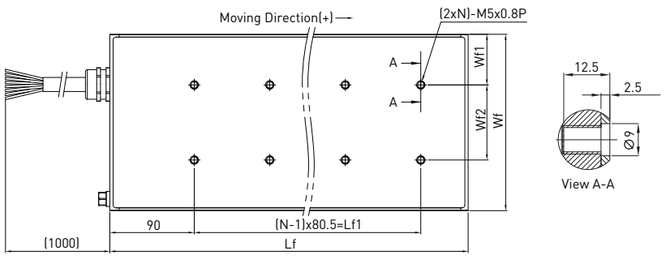




| Type | Lf | Lf1 | N |
|---|---|---|---|
| LMFP24-F40 | 465 | 367.5 | 8 |
| LMFP24-H40 | 465 | 367.5 | 8 |

■ Dimension of LMFP 3,4 forcers



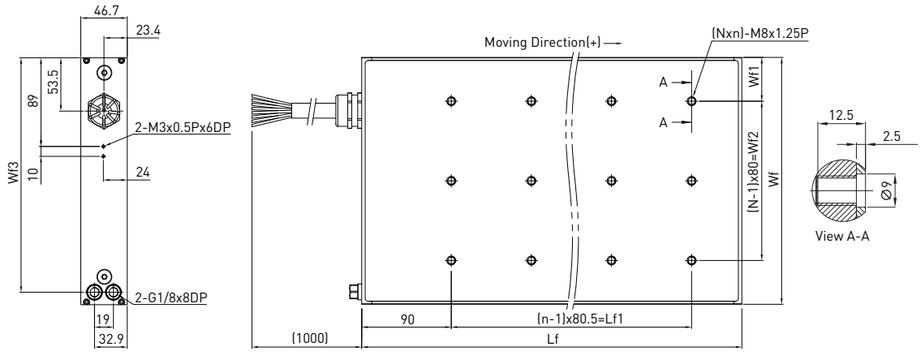







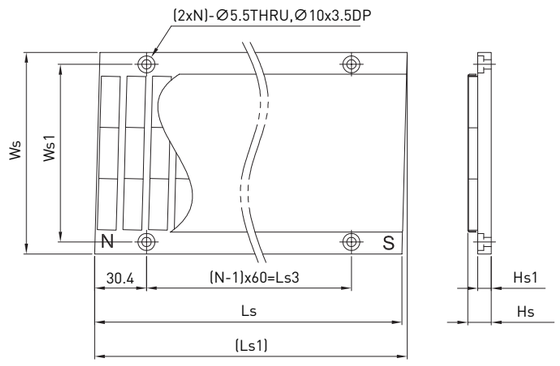
| Type | Lf | Lf1 | Wf | Wf1 | Wf2 | Wf3 | N |
|---|---|---|---|---|---|---|---|
| LMFP31-Q10 | 221 | 80.5 | 141 | 40.5 | 60 | 128.5 | 2 |
| LMFP31-Q20 | 221 | 80.5 | 141 | 40.5 | 60 | 128.5 | 2 |
| LMFP32-Q20 | 382 | 241.5 | 141 | 40.5 | 60 | 128.5 | 4 |
| LMFP32-Q40 | 382 | 241.5 | 141 | 40.5 | 60 | 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 |

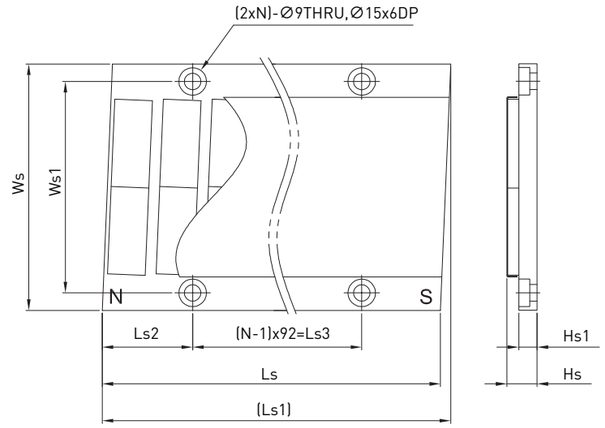
## Dimension of LMF 2 stators




| Type | Ls | Ls1 | Ls3 | Hs | Hs1 | Ws | Ws1 | N |
|---|---|---|---|---|---|---|---|---|
| LMF2S1 | 120 | 123.09 | 60 | 13.8 | 7.9 | 118 | 104 | 2 |
| LMF2S1EP | 120 | 123.09 | 60 | 13.3 | 7.7 | 118 | 104 | 2 |
| LMF2S2 | 180 | 183.09 | 120 | 13.8 | 7.9 | 118 | 104 | 3 |
| LMF2S2EP | 180 | 183.09 | 120 | 13.3 | 7.7 | 118 | 104 | 3 |
| LMF2S3 | 300 | 303.09 | 240 | 13.8 | 7.9 | 118 | 104 | 5 |
| LMF2S3EP | 300 | 303.09 | 240 | 13.3 | 7.7 | 118 | 104 | 5 |

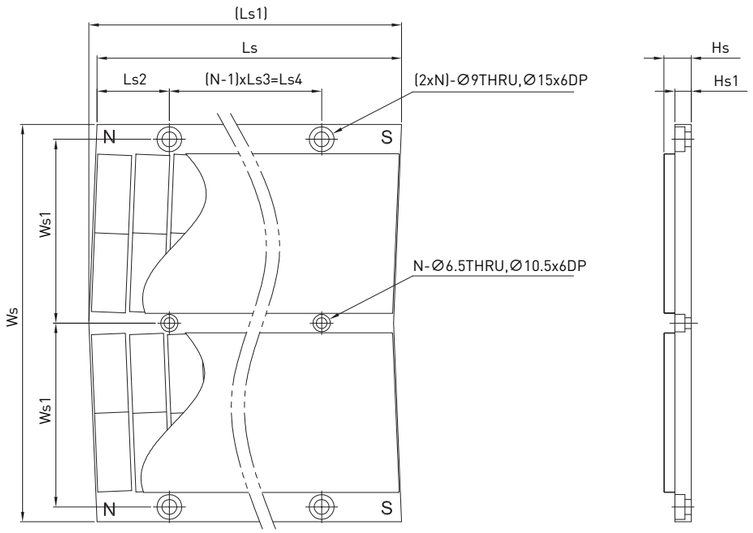


## Dimension of LMF 3,4 stators




| Type | Ls | Ls1 | Ls2 | Ls3 | Hs | Hs1 | Ws | Ws1 | N |
|---|---|---|---|---|---|---|---|---|---|
| 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 |

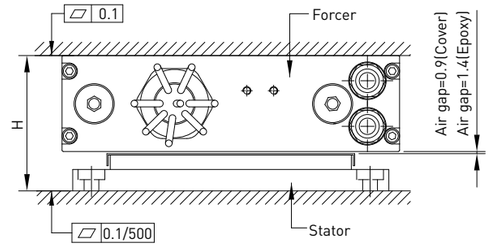
## ■ Dimension of LMF 5,6 stators




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



## ■ Mounting tolerances




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

## 2.5.3 LMFP Order code of primary part (forcer)

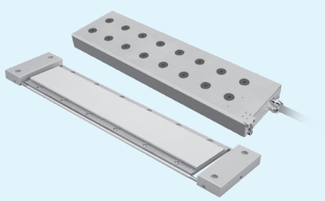
| Series | Type | Width of forcer | Length of forcer | | Wiring Code |
|---|---|---|---|---|---|
| LM | FP | 3 | 2 | - | □□□ |
| Linear motor | Linear motor type | 2: 126 mm<br>3: 141 mm<br>4: 188 mm<br>5: 248 mm<br>6: 342 mm | LMFP 2 series<br>4: 465 mm<br>LMFP 3-6 series<br>1: 221 mm<br>2: 382 mm<br>3: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

## 2.5.4 LMFP Order code of magnet track (stator)

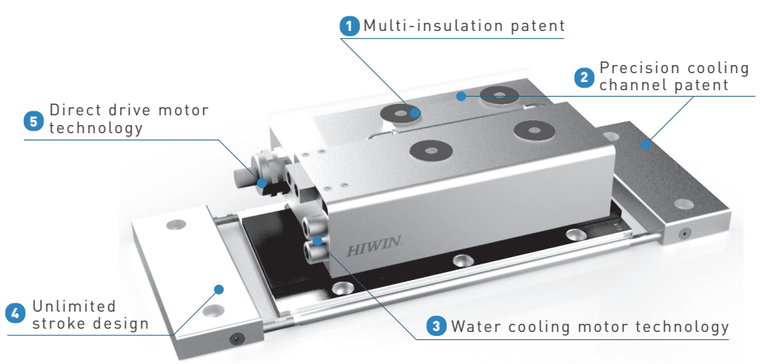
| Series | Width of Stator | Model | Length of Stator | Magnet Package |
|---|---|---|---|---|
| LMF | 3 | S | 1 | EP |
| | 2: 118 mm<br>3: 134 mm<br>4: 180 mm<br>5: 240 mm<br>6: 334 mm | S: Standard<br>C: Custom | LMF2 series<br>1: 120 mm<br>2: 180 mm<br>3: 300 mm<br>LMF3~5 series<br>1: 184 mm<br>2: 276 mm<br>3: 460 mm<br>LMF6 series<br>1: 184 mm | E: Epoxy<br>None: Cover plate |

# 2.6 LMFC series
## Precision water cooling

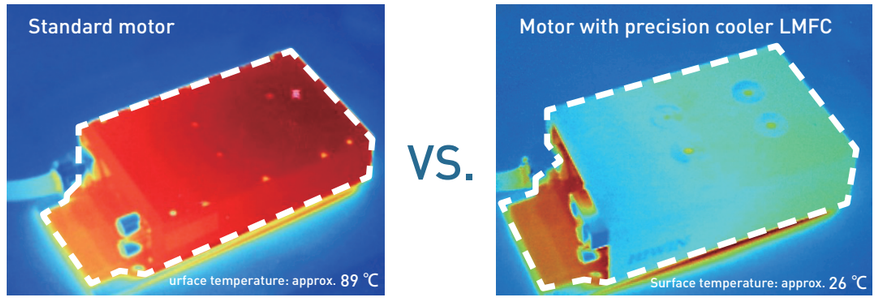
The LMFC precision cooling system supports the LMFP/LMFA series of linear motors. The LMFC provides precise insulation through a dual reflux water cooling system which keeps the temperature of the motor consistent within 2°C across the surface.
The precision cooling system can be directly installed with 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.

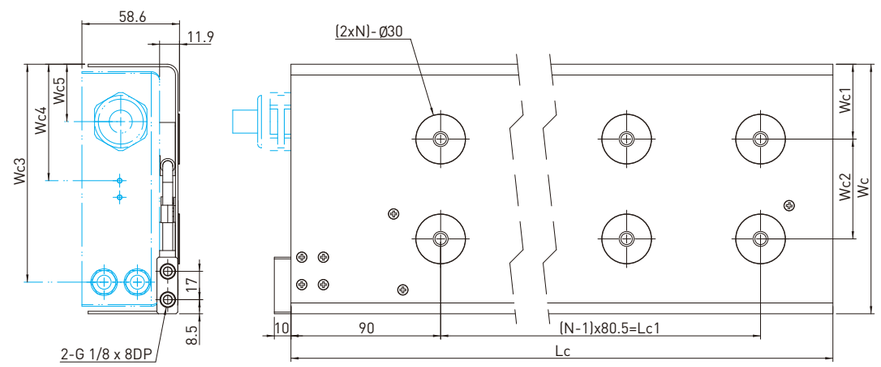






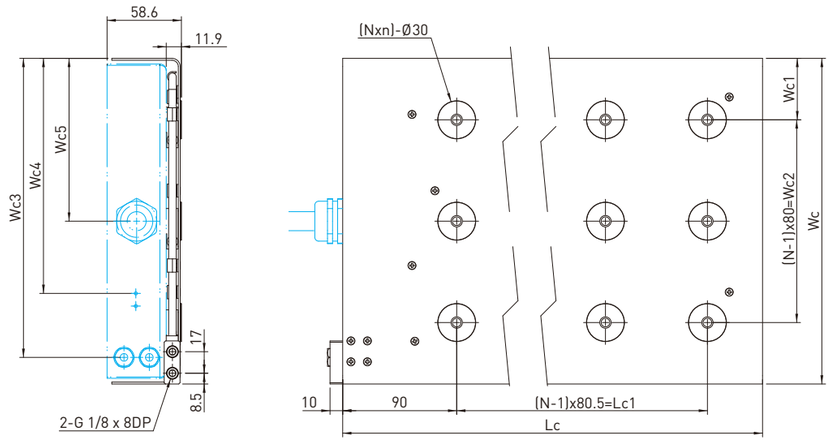
## 2.6.1 LMFC series forcers and stators dimensions

### ■ Dimension of LMFC 3,4 forcers




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

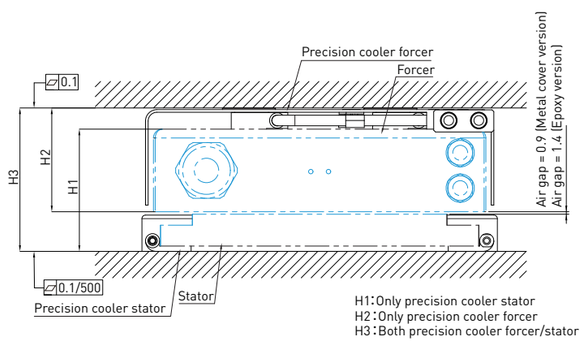
### ■ Dimension of LMFC 5,6 forcers




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

# 2.6.2 LMFC series forcers and stators dimensions

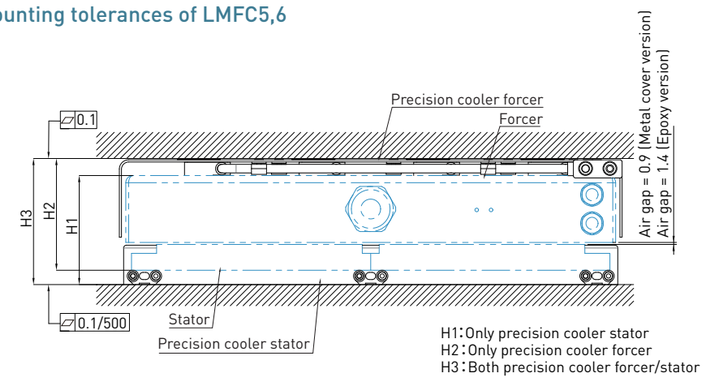
## ■ Mounting tolerances of LMFC3,4




| 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 |

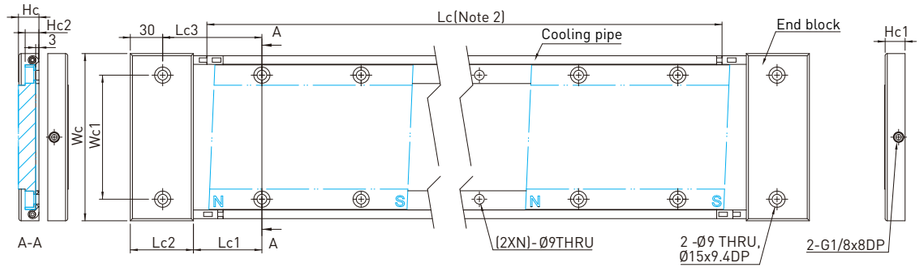


## ■ Mounting tolerances of LMFC5,6




| 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 |

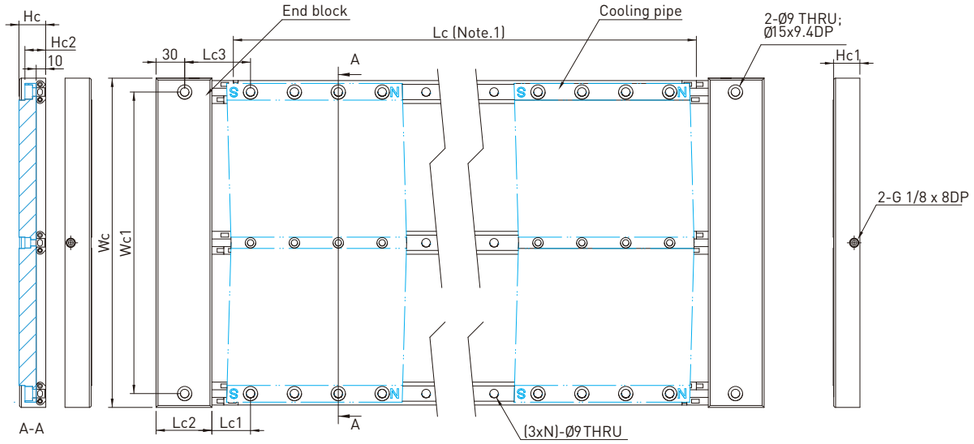
## ■ LMFC3,4-S Series Stator Precision Water Cooling Dimensions
## Straight Out Type Stator Precision Water Cooling




| 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

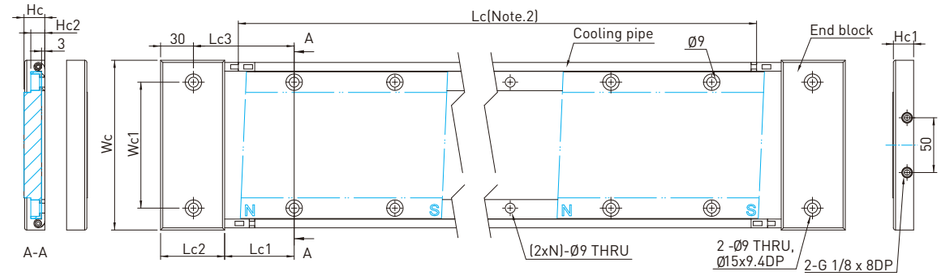
## ■ LMFC5,6 Series Stator Precision Water Cooling Dimensions
## Straight Out Type Stator Precision Water Cooling




| 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

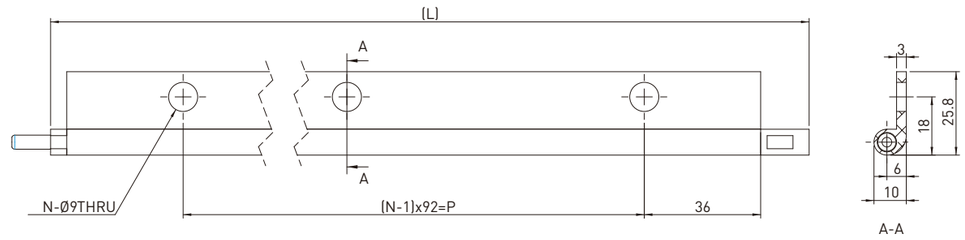



| Type | Lc | Lc1 | Lc2 | Lc3 | Wc | Wc1 | Hc | Hc1 | Hc2 |
|---|---|---|---|---|---|---|---|---|---|
| LMFC3 | - | 63.5 | 58.5 | 92 | 155 | 115 | 19 | 18.5 | 13 |
| LMFC4 | - | 63.5 | 58.5 | 92 | 201 | 161 | 21 | 20.5 | 15 |

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

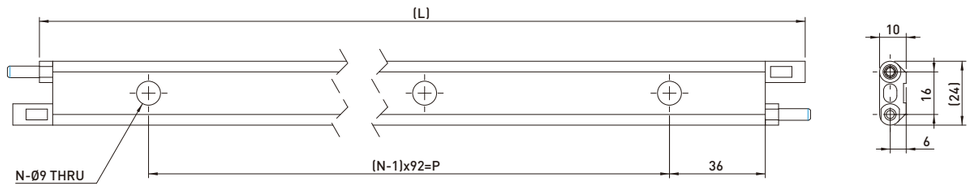


## ■ LMFC 3,4 Series cooling pipe



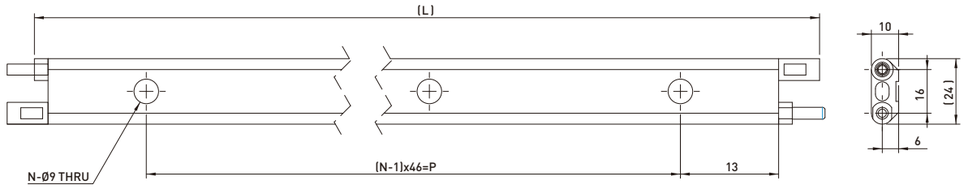

| Specifications | L(mm) | N | P(mm) | Weight(g/pc) | For stator |
|---|---|---|---|---|---|
| **LMFC3-P-0092** | 92 | 1 | 0 | 17 | LMF3S□(EP)<br>LMF4S□(EP)<br>Note:<br>1.LMFC3&4 Series includes end blocks and dual cooling pipes.<br>2.[LC] is defined by total jointing length of stators. If the length is longer than 1288mm, mult cooling pipes will be connected to cover the total length.<br>3.Take Lc=3312mm for example,<br>3312mm =1288mm*2+736mm*1.<br>Therefore, LMFC3-P-1288*2 and<br>LMFC3-P-0736*1 will be ultilized.<br>4.All connectors of precision cooler stator are connected with special adhensive, 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<br>Note:<br>1.LMFC5 Series includes end blocks and triple cooling pipes.<br>2.[LC] is defined by total jointing length of stators. If the length is longer than 1288mm, multiple cooling pipes will be connected to cover the total length.<br>3.Take Lc=3312mm for example,<br>3312mm =1288mm*2+736mm*1.<br>Therefore, LMFC3-P-1288*2 and<br>LMFC3-P-0736*1 will be ultilized.<br>4.All connectors of precision cooler stator are connected with special adhensive, 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<br>Note:<br>1.LMFC6 Series includes end blocks and triple cooling pipes.<br>2.[LC] is defined by total jointing length of stators. If the length is longer than 1288mm, multiple cooling pipes will be connected to cover the total length.<br>3.Take Lc=3312mm for example,<br>3312mm =1288mm*2+736mm*1.<br>Therefore, LMFC3-P-1288*2 and LMFC3-P-0736*1 will be ultilized.<br>4.All connectors of precision cooler stator are connected with special adhensive, 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☐<br>4:LMFA4☐/LMFP4☐<br>5:LMFA5☐/LMFP5☐<br>6:LMFA6☐/LMFP6☐ | 1:LMFA☐1/LMFP☐1<br>2:LMFA☐2/LMFP☐2<br>3:LMFA☐3/LMFP☐3<br>4:LMFA☐4/LMFP☐4 |

### Precision cooler stator series

End block

| Series | Type | Width of precision cooler stator | End block type |
|---|---|---|---|
| **LM** | **FC** | **3** | **S** |
| | | 3:LMF3S☐(EP)<br>4:LMF4S☐(EP)<br>5:LMF5S☐EP<br>6:LMF6S1EP | S: Standard type<br>R: Reverse type |

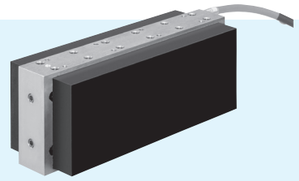
Cooling pipe

| 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)<br>5:LMF5S☐EP<br>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

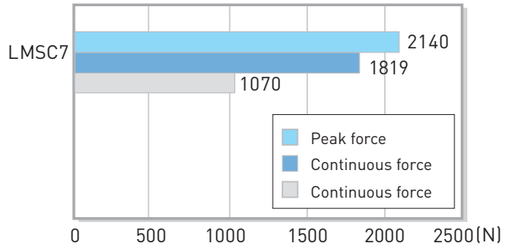


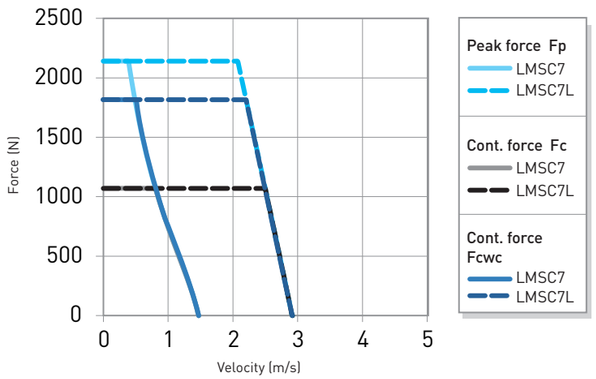

**Table 2-7 LMSC Series specifications**

| | Symbol | Unit | LMSC7 | LMSC7L |
|---|---|---|---|---|
| Continuous force | $F_c$ | N | 1070 | 1070 |
| Continuous current | $I_c$ | $A_{rms}$ | 3.9 | 7.9 |
| Continuous force (WC) | Fc(WC) | N | 1819 | 1819 |
| Continuous current (WC) | Ic(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) | $K_m$ | $N/\sqrt{W}$ | 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 | 128mm/N=1, 192mm/N=2, 320mm/N=4 | |
| Stator mounting distance | $W_{s1}$ | mm | 85 | |
| Total installation height | H | mm | 131.5 | |

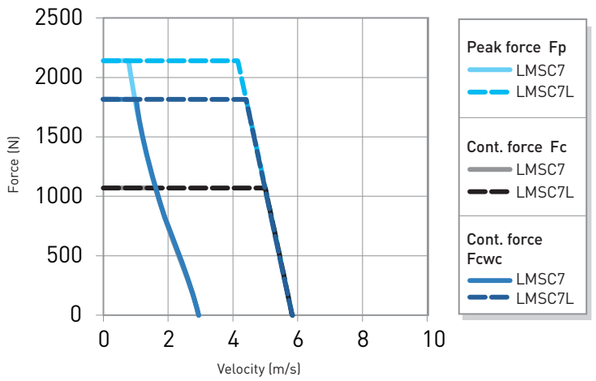
Note: 1.WC-water cooling
2.Except for WC, the data in this table are the values without forced cooling.
3.Except dimensions,the electrical specifications are in ±10% of tolerance.
4.We reserve the right to change, please follow customer recognition drawings.

## 2.7.1 LMSC Series F-V curves

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



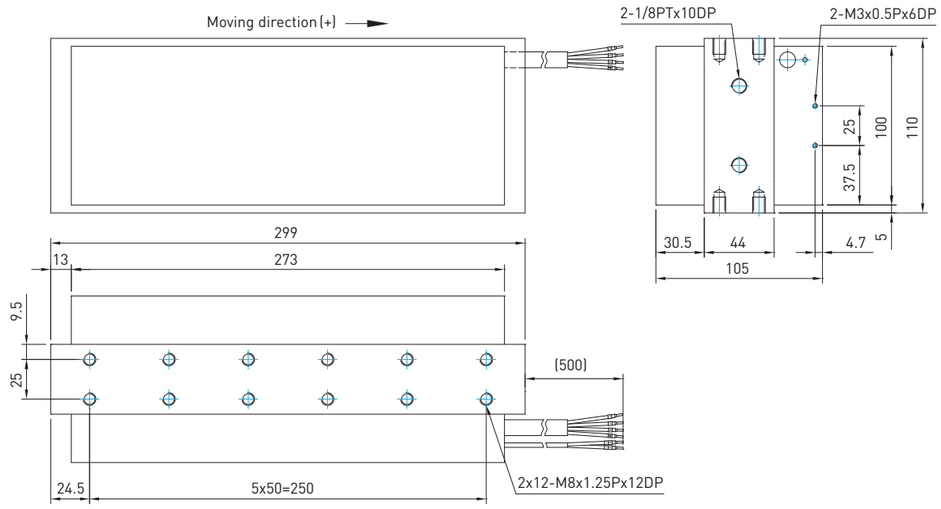

■ Force and velocity curve (DC bus voltage = 600 $V_{DC}$)



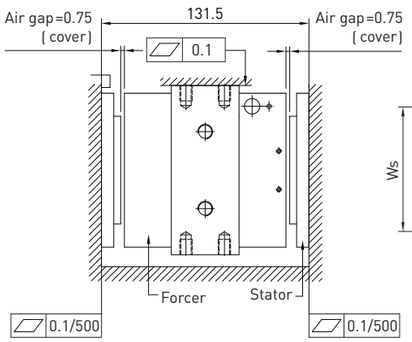



## 2.7.2 LMSC series forcers and stators dimensions

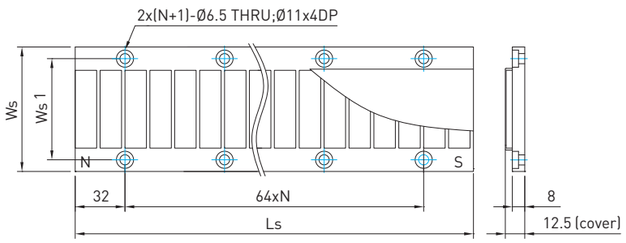
■ Dimensions of LMSC 7 forcer




■ Mounting tolerances

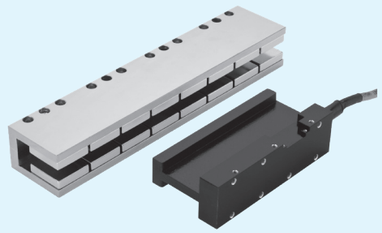



■ Dimensions of LMSC 7 stator



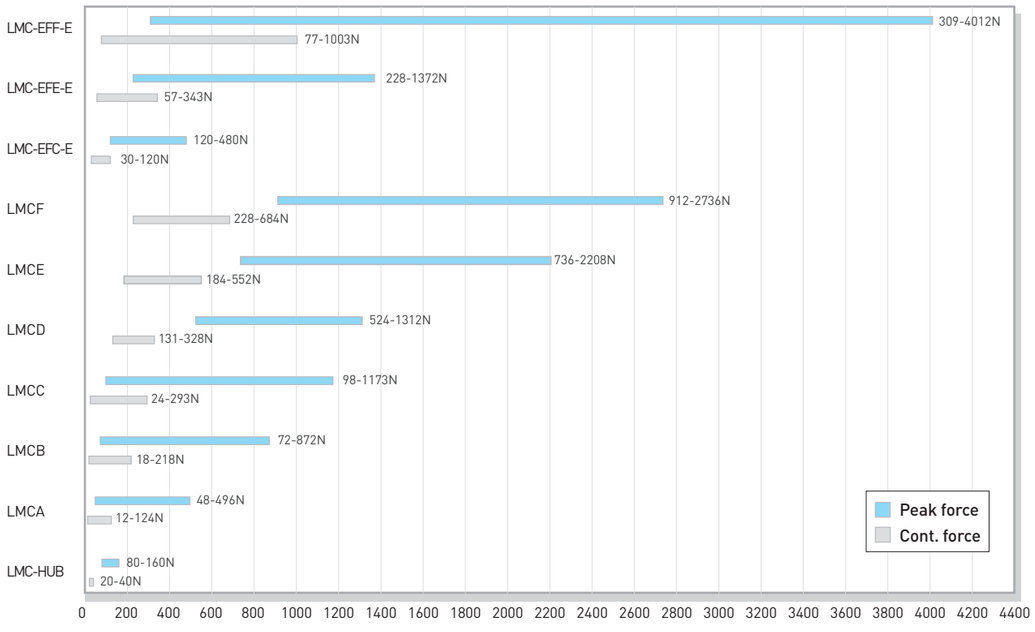
# 2.8 LMC series
## Linear Motor

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-phrase
- 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





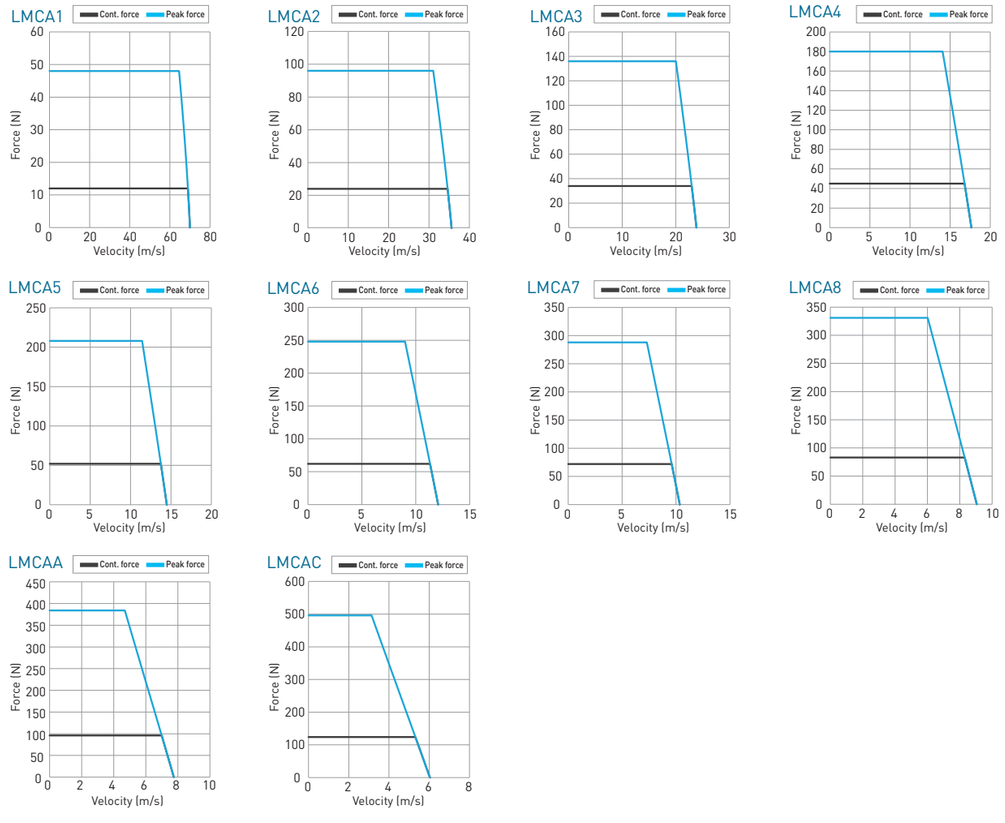

## 2.8.1 LMCA series

**Table 2-8 LMCA Series specifications**

| | Symbol | Unit | LMCA1 | LMCA2 | LMCA3 | LMCA4 | LMCA5 | LMCA6 | LMCA7 | LMCA8 | LMCAA | LMCAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Continuous force | $F_c$ | N | 12 | 24 | 34 | 45 | 52 | 62 | 72 | 83 | 96 | 124 |
| Continuous current | $I_c$ | $A_{rms}$ | 2.2 | 2.3 | 2.1 | 2.1 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |
| Peak force for 1 sec. | $F_p$ | N | 48 | 96 | 136 | 180 | 208 | 248 | 289 | 331 | 386 | 496 |
| Peak current for 1 sec. | $I_p$ | $A_{rms}$ | 8.8 | 9.2 | 8.4 | 8.4 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 |
| Force constant | $K_f$ | $N/A_{rms}$ | 5.3 | 10.6 | 15.8 | 21.2 | 28.2 | 33.8 | 39.4 | 45 | 53 | 68 |
| Max. winding temp. | $T_{max}$ | °C | 100 | | | | | | | | | |
| Electrical time constant | $K_e$ | ms | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Resistance (line to line at 25°C) | $R_{25}$ | Ω | 1.4 | 2.7 | 4.1 | 5.4 | 6.7 | 8.2 | 9.6 | 11 | 13 | 16 |
| Inductance (line to line) | L | mH | 0.5 | 1.0 | 1.4 | 1.9 | 2.3 | 2.8 | 3.3 | 3.7 | 4.7 | 5.6 |
| Pole pair pitch | 2τ | mm | 32 | | | | | | | | | |
| Minimum bending radius of cable | $R_{bend}$ | mm | 37.5 | | | | | | | | | |
| Back emf constant (line to line) | $K_v$ | $V_{rms}/(m/s)$ | 3.0 | 5.9 | 8.8 | 11.9 | 14.5 | 17.4 | 20.3 | 23.2 | 27.1 | 34.8 |
| Motor constant (at 25°C) | $K_m$ | $N/\sqrt{W}$ | 3.8 | 5.2 | 6.5 | 7.5 | 9.1 | 9.8 | 10.6 | 11.3 | 12.2 | 13.9 |
| Thermal resistance | $R_{TH}$ | °C/W | 6.11 | 2.80 | 2.21 | 1.68 | 1.84 | 1.50 | 1.29 | 1.13 | 0.97 | 0.75 |
| Thermal switch | - | - | 3 PTC SNM100 In Series | | | | | | | | | |
| Maximum DC bus voltage | - | $V_{DC}$ | 330 | | | | | | | | | |
| Mass of forcer | $M_f$ | kg | 0.08 | 0.15 | 0.23 | 0.31 | 0.38 | 0.45 | 0.56 | 0.64 | 0.74 | 0.76 |
| Unit mass of stator | $M_s$ | kg/m | 7 | | | | | | | | | |
| Length of forcer/Dimension n | $L_f$ | mm | 34 | 66/2 | 98/3 | 130/4 | 162/5 | 194/6 | 226/7 | 258/8 | 322/10 | 386/12 |
| Length of stator/Dimension N | $L_s$ | mm | 128mm/N=2, 192mm/N=3, 320mm/N=5 | | | | | | | | | |

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 = 330 $V_{DC}$)

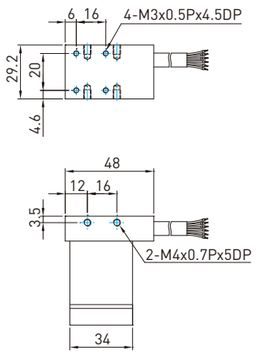


# LMCA Series forcers and stators dimensions

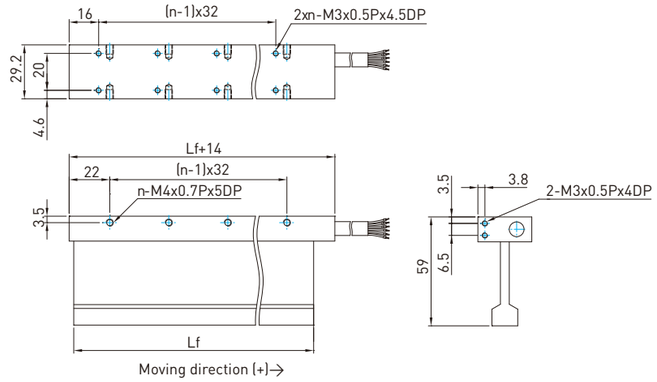
## ■ Dimension of LMCA forcers

(Value for Lf and n: see Table 2-6)

LMCA1:

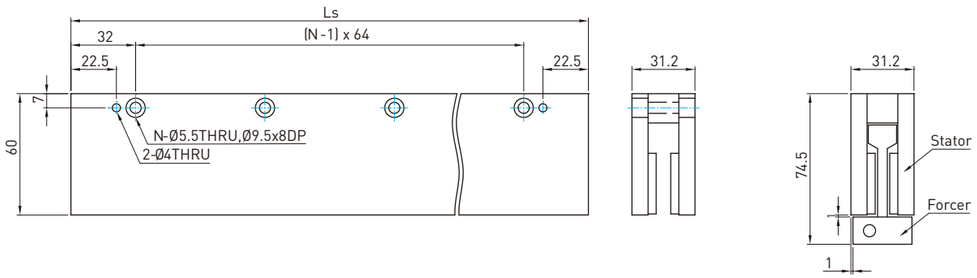



LMCA2~LMCAC




## ■ Dimensions of LMCA stators

(Value for Ls and N: see Table 2-6)




## ■ Mounting tolerances

# Order code of magnet track (stator)

| Series | Height of stator | Model | Length of stator |
|---|---|---|---|
| LMC | A | S | 3 |
| | A: 60 mm | S: Standard | 0: 128 mm<br>1: 192 mm<br>3: 320 mm |



## 2.8.2 LMCB series

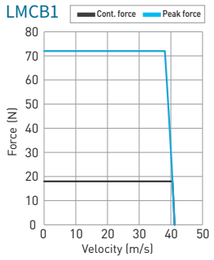
**Table 2-8 LMCB Series specifications**

| | Symbol | Unit | LMCB1 | LMCB2 | LMCB3 | LMCB4 | LMCB5 | LMCB6 | LMCB7 | LMCB8 | LMCBA | LMCBC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Continuous force | $F_c$ | N | 18 | 36 | 54 | 73 | 91 | 109 | 128 | 145 | 181 | 216 |
| Continuous current | $I_c$ | $A_{rms}$ | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 1.8 |
| Peak force for 1 sec. | $F_p$ | N | 72 | 144 | 216 | 292 | 364 | 436 | 512 | 580 | 724 | 864 |
| Peak current for 1 sec. | $I_p$ | $A_{rms}$ | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 7.2 |
| Force constant | $K_f$ | $N/A_{rms}$ | 9.1 | 18.1 | 27.2 | 36.3 | 45.4 | 54.5 | 63.5 | 72.5 | 90.6 | 109.0 |
| Max. winding temp. | $T_{max}$ | °C | 100 | | | | | | | | | |
| Electrical time constant | $K_e$ | ms | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 | 0.4 |
| Resistance (line to line at 25°C) | $R_{25}$ | Ω | 1.8 | 3.6 | 5.4 | 7.1 | 9.0 | 10.7 | 12.6 | 14.6 | 17.9 | 21.0 |
| Inductance (line to line) | L | mH | 0.7 | 1.4 | 1.9 | 2.6 | 3.2 | 3.8 | 4.4 | 5.0 | 6.2 | 8.0 |
| Pole pair pitch | 2τ | mm | 32 | | | | | | | | | |
| Minimum bending radius of cable | $R_{bend}$ | mm | 37.5 | | | | | | | | | |
| Back emf constant (line to line) | $K_v$ | $V_{rms}$/(m/s) | 5.1 | 10.1 | 15.2 | 20.0 | 24.8 | 29.3 | 34.7 | 40.0 | 50.0 | 59.0 |
| Motor constant (at 25°C) | $K_m$ | $N/\sqrt{W}$ | 5.5 | 7.7 | 9.5 | 11.2 | 12.4 | 13.6 | 14.7 | 15.5 | 17.5 | 21.4 |
| Thermal resistance | $R_{TH}$ | °C/W | 5.55 | 2.77 | 1.85 | 1.41 | 1.11 | 0.93 | 0.79 | 0.68 | 0.56 | 0.58 |
| Thermal switch | - | - | 3 PTC SNM100 In Series | | | | | | | | | |
| Maximum DC bus voltage | - | $V_{DC}$ | 330 | | | | | | | | | |
| Mass of forcer | $M_f$ | kg | 0.10 | 0.20 | 0.29 | 0.38 | 0.48 | 0.58 | 0.68 | 0.72 | 0.88 | 1.16 |
| Unit mass of stator | $M_s$ | kg/m | 12 | | | | | | | | | |
| Length of forcer/Dimension n | $L_f$ | mm | 34 | 66/2 | 98/3 | 130/4 | 162/5 | 194/6 | 226/7 | 258/8 | 322/10 | 386/12 |
| Length of stator/Dimension N | $L_s$ | mm | 128mm/N=2, 192mm/N=3, 320mm/N=5 | | | | | | | | | |

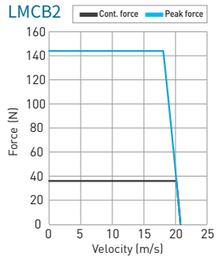
Note: 1.Values in this table are motor at 25°C ambient temperature and no forced cooling.
2.Except dimensions, the electrical specifications are in ±10% of tolerance.
3.We reserve the right of changes, please follow customer recognition drawings.

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

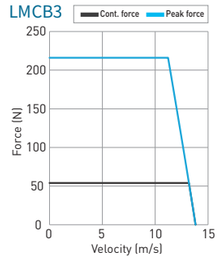
LMCB1



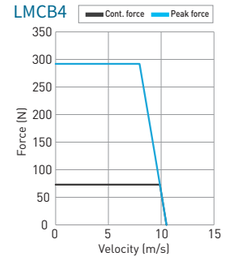

LMCB2



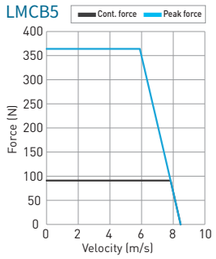

LMCB3



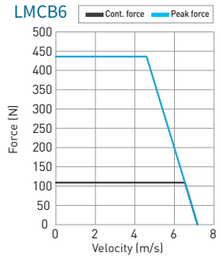

LMCB4



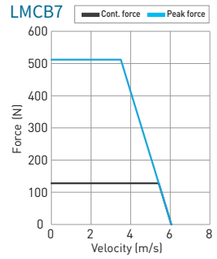

LMCB5



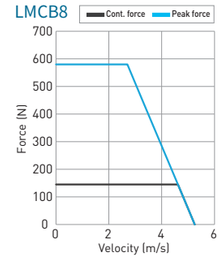

LMCB6



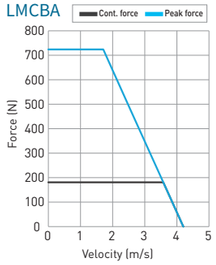

LMCB7



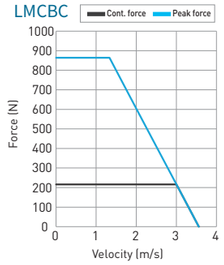

LMCB8




LMCBA




LMCBC

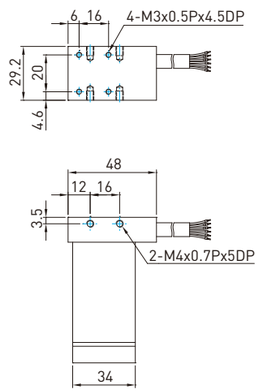


# LMCB series forcers and stators dimensions

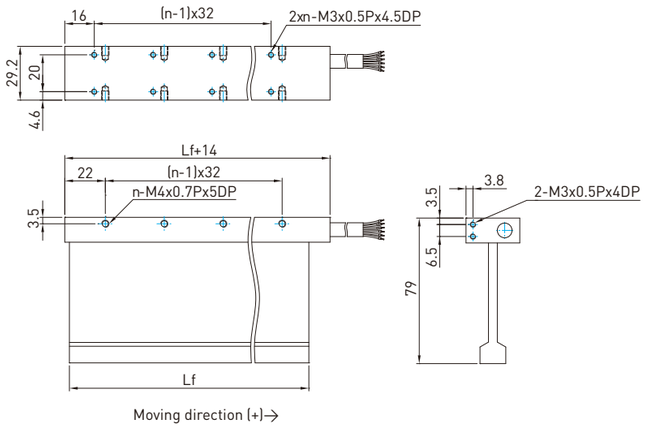
## Dimension of LMCB forcers

(Value for Lf and n: see Table 2-7)

LMCB1:



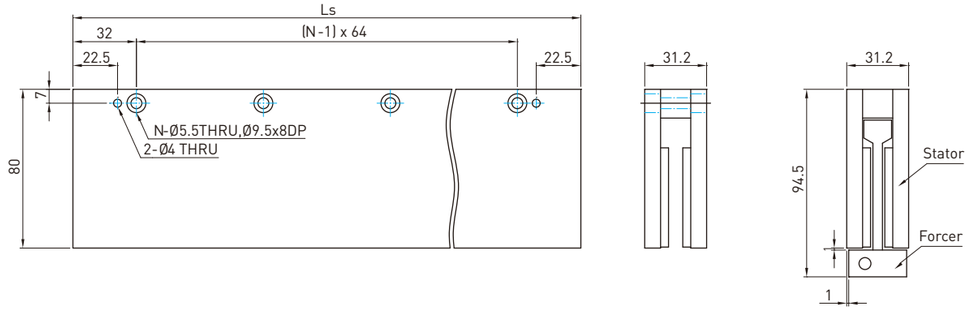

LMCB2~LMCBC:




Moving direction (+)→

## Dimensions of LMCB stators

(Value for Ls and N: see Table 2-7)




## Mounting tolerances

## Order code of magnet track (stator)

| Series | Height of stator | Model | Length of stator |
|---|---|---|---|
| LMC | B | S | 3 |
| | B: 80 mm | S: Standard | 0: 128 mm<br>1: 192 mm<br>3: 320 mm |



## 2.8.3 LMCC series

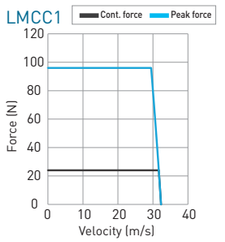
**Table 2-8 LMCC Series specifications**

| | Symbol | Unit | LMCC1 | LMCC2 | LMCC3 | LMCC4 | LMCC5 | LMCC6 | LMCC7 | LMCC8 | LMCCA | LMCCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Continuous force | $F_c$ | N | 24 | 49 | 73 | 98 | 122 | 147 | 171 | 195 | 244 | 293 |
| Continuous current | $I_c$ | $A_{rms}$ | 2.0 | | | | | | | | | |
| Peak force for 1 sec. | $F_p$ | N | 98 | 195 | 293 | 391 | 489 | 586 | 684 | 780 | 977 | 1173 |
| Peak current for 1 sec. | $I_p$ | $A_{rms}$ | 8.0 | | | | | | | | | |
| Force constant | $K_f$ | $N/A_{rms}$ | 12.2 | 24.4 | 36.6 | 48.8 | 61.0 | 73.2 | 85.4 | 97.5 | 122.0 | 146.4 |
| Max. winding temp. | $T_{max}$ | °C | 100 | | | | | | | | | |
| Electrical time constant | $K_e$ | ms | 0.3 | | | | | | | | | |
| Resistance (line to line at 25°C) | $R_{25}$ | Ω | 2.3 | 4.5 | 6.8 | 9.0 | 11.3 | 13.5 | 15.8 | 18.2 | 22.6 | 27.1 |
| Inductance (line to line) | L | mH | 0.8 | 1.6 | 2.4 | 3.1 | 3.9 | 4.7 | 5.5 | 6.3 | 7.9 | 9.4 |
| Pole pair pitch | 2τ | mm | 32 | | | | | | | | | |
| Minimum bending radius of cable | $R_{bend}$ | mm | 37.5 | | | | | | | | | |
| Back emf constant (line to line) | $K_v$ | $V_{rms}/(m/s)$ | 6.5 | 13.0 | 19.5 | 25.9 | 32.4 | 38.9 | 45.4 | 51.9 | 64.9 | 77.8 |
| Motor constant (at 25°C) | $K_m$ | $N/\sqrt{W}$ | 6.6 | 9.4 | 11.5 | 13.3 | 14.8 | 16.3 | 17.6 | 18.7 | 21.0 | 23.0 |
| Thermal resistance | $R_{TH}$ | °C/W | 4.42 | 2.21 | 1.47 | 1.11 | 0.88 | 0.74 | 0.63 | 0.55 | 0.44 | 0.37 |
| Thermal switch | - | - | 3 PTC SNM100 In Series | | | | | | | | | |
| Maximum DC bus voltage | - | $V_{DC}$ | 330 | | | | | | | | | |
| Mass of forcer | $M_f$ | kg | 0.11 | 0.21 | 0.32 | 0.42 | 0.53 | 0.63 | 0.74 | 0.76 | 1.06 | 1.27 |
| Unit mass of stator | $M_s$ | kg/m | 21 | | | | | | | | | |
| Length of forcer/Dimension n | $L_f$ | mm | 34 | 66/2 | 98/3 | 130/4 | 162/5 | 194/6 | 226/7 | 258/8 | 322/10 | 386/12 |
| Length of stator/Dimension N | $L_s$ | mm | 128mm/N=2, 192mm/N=3, 320mm/N=5 | | | | | | | | | |

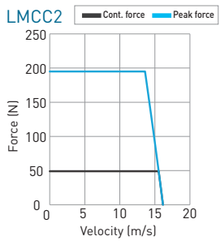
Note: 1.Values in this table are motor at 25°C ambient temperature and no forced cooling.
2.Except dimensions, the electrical specifications are in ±10% of tolerance.
3.We reserve the right of changes, please follow customer recognition drawings.

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

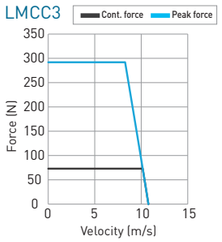
LMCC1



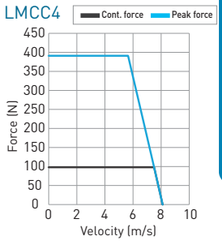

LMCC2



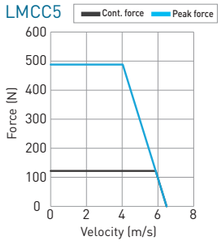

LMCC3



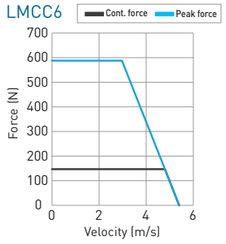

LMCC4



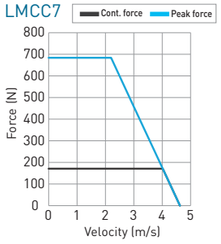

LMCC5



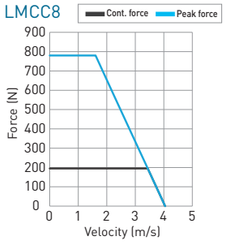

LMCC6



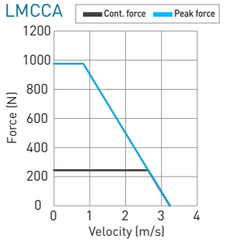

LMCC7



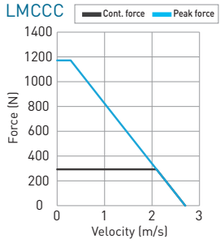

LMCC8




LMCCA




LMCCC

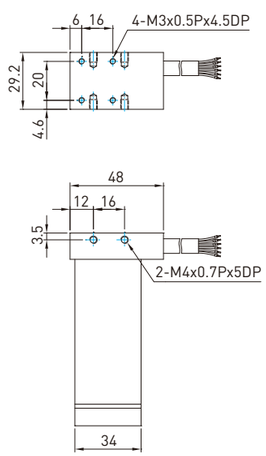


# LMCC Series forcers and stators dimensions

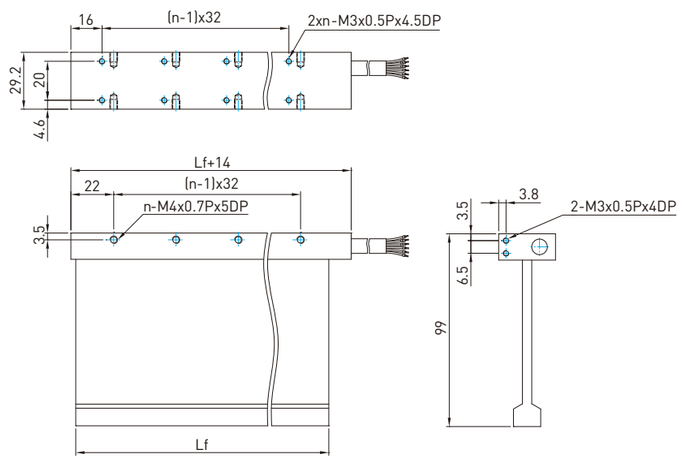
## ■ Dimension of LMCC forcers

(Value for Lf and n: see Table 2-8)

LMCC1:




LMCC2~LMCCC:



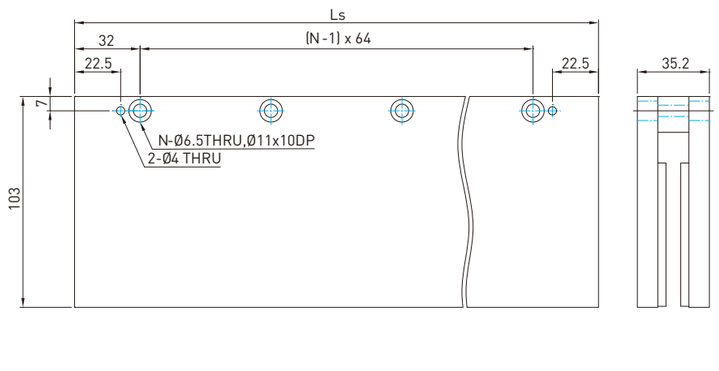




Moving direction (+)→

## ■ Dimensions of LMCC stators

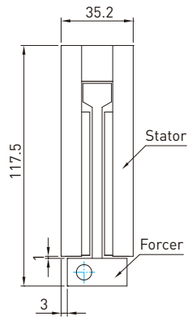
(Value for Ls and N: see Table 2-8)







## ■ Mounting tolerances




# Order code of magnet track (stator)

| Series | Height of stator | Model | Length of stator |
|---|---|---|---|
| LMC | C | S | 3 |
| | C: 103 mm | S: Standard | 0: 128 mm<br>1: 192 mm<br>3: 320 mm |



# 2.8.4 LMCD series

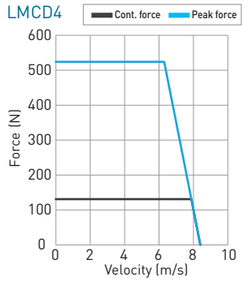
**Table 2-8 LMCD Series specifications**

| | Symbol | Unit | LMCD4 | LMCD6 | LMCD8 | LMCDA |
|---|---|---|---|---|---|---|
| Continuous force | $F_c$ | N | 131 | 197 | 262 | 328 |
| Continuous current | $I_c$ | $A_{rms}$ | 3.25 | 3.25 | 3.25 | 3.25 |
| Peak force for 1 sec. | $F_p$ | N | 524 | 788 | 1048 | 1312 |
| Peak current for 1 sec. | $I_p$ | $A_{rms}$ | 13 | | | |
| Force constant | $K_f$ | $N/A_{rms}$ | 40.3 | 60.6 | 80.6 | 100.9 |
| Max. winding temp. | $T_{max}$ | °C | 100 | | | |
| Electrical time constant | $K_e$ | ms | 0.5 | 0.5 | 0.5 | 0.5 |
| Resistance (line to line at 25°C) | $R_{25}$ | Ω | 4.6 | 7.1 | 9 | 11.6 |
| Inductance (line to line) | L | mH | 2.3 | 3.5 | 4.7 | 5.8 |
| 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) | 25 | 38 | 50 | 63 |
| Motor constant (at 25°C) | $K_m$ | $N/\sqrt{W}$ | 14.6 | 17.8 | 20 | 22.2 |
| Thermal resistance | $R_{TH}$ | °C/W | 0.82 | 0.53 | 0.42 | 0.33 |
| Thermal switch | - | - | 3 PTC SNM100 In Series | | | |
| Maximum DC bus voltage | - | $V_{DC}$ | 330 | | | |
| Mass of forcer | $M_f$ | kg | 0.88 | 1.32 | 1.76 | 2.20 |
| Unit mass of stator | $M_s$ | kg/m | 16 | | | |
| Length of forcer/Dimension n | $L_f$ | mm | 260/7 | 380/10 | 500/13 | 620/16 |
| Length of stator/Dimension N | $L_s$ | mm | 120mm/N=2, 180mm/N=3, 300mm/N=5 | | | |

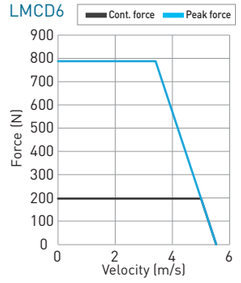
Note: 1.Values in this table are motor at 25°C ambient temperature and no forced cooling.
2.Except dimensions, the electrical specifications are in ±10% of tolerance.
3.We reserve the right of changes, please follow customer recognition drawings.

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

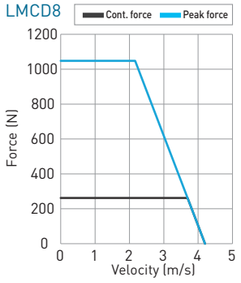
LMCD4



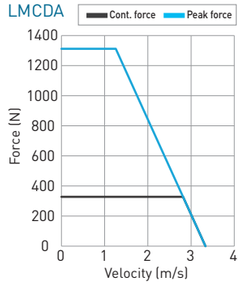

LMCD6




LMCD8



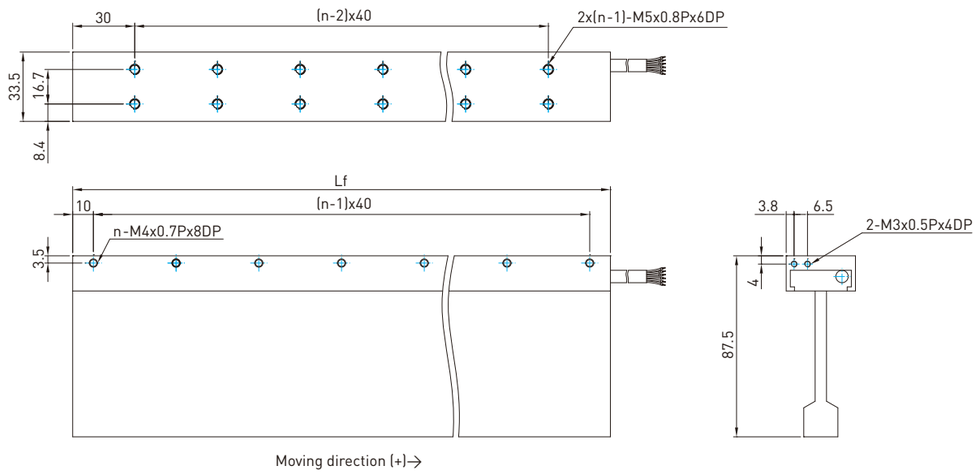

LMCDA



# LMCD series forcers and stators dimensions

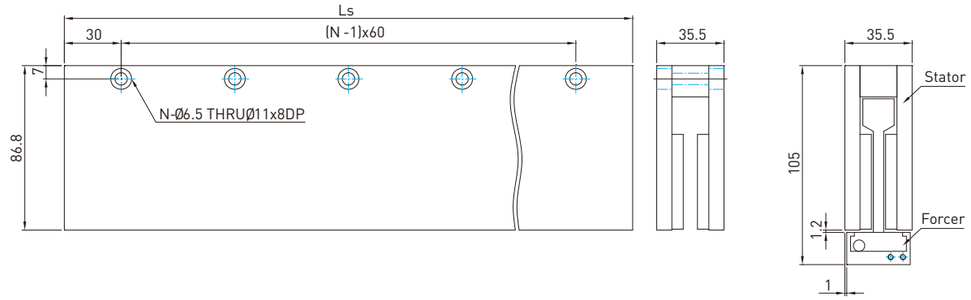
## ■ Dimension of LMCD forcers

(Value for Lf and n: see Table 2-9)




## ■ Dimensions of LMCD stators

(Value for Ls and N: see Table 2-9)




## ■ Mounting tolerances

# Order code of magnet track (stator)

| Series | Height of stator | Model | Length of stator |
|---|---|---|---|
| LMC | D | S | 1 |
| | D: 86.8 mm | S: Standard | 1: 120 mm<br>B: 180 mm<br>2: 300 mm |



# 2.8.5 LMCE series

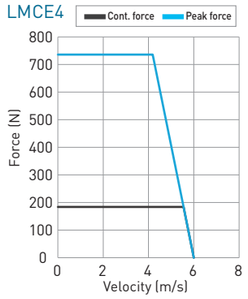
**Table 2-8 LMCE Series specifications**

| | Symbol | Unit | LMCE4 | LMCE6 | LMCE8 | LMCEA | LMCEC |
|---|---|---|---|---|---|---|---|
| Continuous force | $F_c$ | N | 184 | 276 | 368 | 460 | 552 |
| Continuous current | $I_c$ | $A_{rms}$ | 3.25 | | | | |
| Peak force for 1 sec. | $F_p$ | N | 736 | 1104 | 1472 | 1840 | 2208 |
| Peak current for 1 sec. | $I_p$ | $A_{rms}$ | 13 | 13 | 13 | 13 | 13 |
| Force constant | $K_f$ | $N/A_{rms}$ | 56.6 | 84.9 | 113.2 | 141.5 | 169.8 |
| Max. winding temp. | $T_{max}$ | °C | 100 | | | | |
| Electrical time constant | $K_e$ | ms | 0.5 | | | | |
| Resistance (line to line at 25°C) | $R_{25}$ | Ω | 5.6 | 8.4 | 11.0 | 13.8 | 16.7 |
| Inductance (line to line) | L | mH | 2.9 | 4.4 | 5.9 | 7.3 | 8.8 |
| 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) | 35 | 53 | 70 | 88 | 106 |
| Motor constant (at 25°C) | $K_m$ | $N/\sqrt{W}$ | 19.1 | 23.4 | 27.0 | 30.2 | 33.2 |
| Thermal resistance | $R_{TH}$ | °C/W | 0.68 | 0.45 | 0.34 | 0.27 | 0.23 |
| Thermal switch | - | - | 3 PTC SNM100 In Series | | | | |
| Maximum DC bus voltage | - | $V_{DC}$ | 330 | | | | |
| Mass of forcer | $M_f$ | kg | 1.23 | 1.84 | 2.46 | 3.08 | 3.70 |
| Unit mass of stator | $M_s$ | kg/m | 20 | | | | |
| Length of forcer/Dimension n | $L_f$ | mm | 260/7 | 380/10 | 500/13 | 620/16 | 740/19 |
| Length of stator/Dimension N | $L_s$ | mm | 120mm/N=2, 180mm/N=3, 300mm/N=5 | | | | |

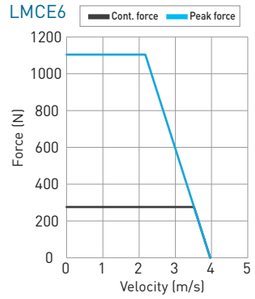
Note: 1.Values in this table are motor at 25°C ambient temperature and no forced cooling.
2.Except dimensions, the electrical specifications are in ±10% of tolerance.
3.We reserve the right of changes, please follow customer recognition drawings.

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

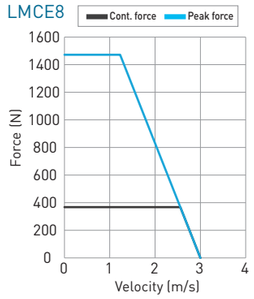
LMCE4



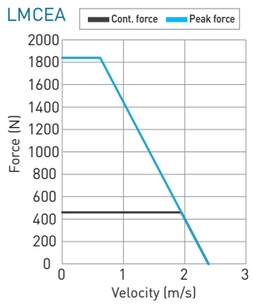

LMCE6



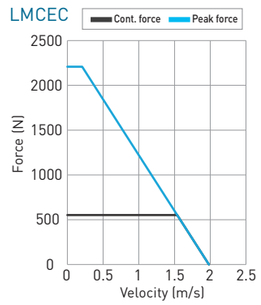

LMCE8




LMCEA



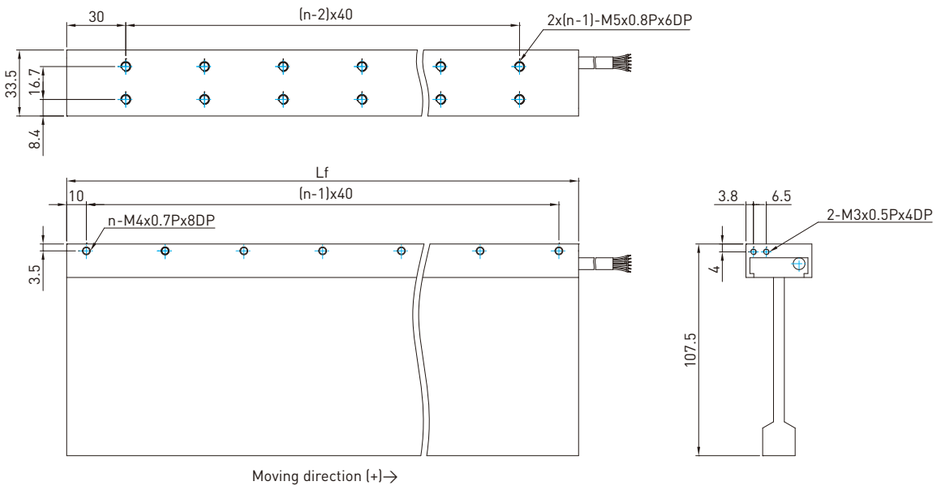

LMCEC



# LMCE series forcers and stators dimensions

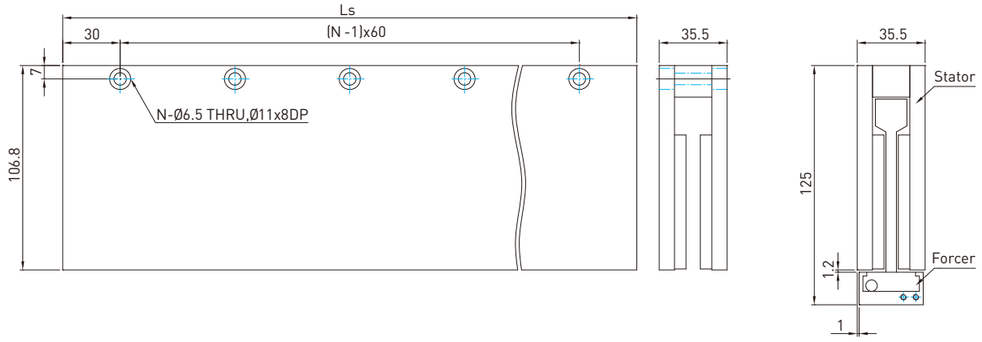
## Dimension of LMCE forcers

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




## Dimensions of LMCE stators

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




## Mounting tolerances

# Order code of magnet track (stator)

| Series | Height of stator | Model | Length of stator |
|---|---|---|---|
| LMC | E | S | 1 |
| | E: 106.8 mm | S: Standard | 1: 120 mm<br>B: 180 mm<br>2: 300 mm |



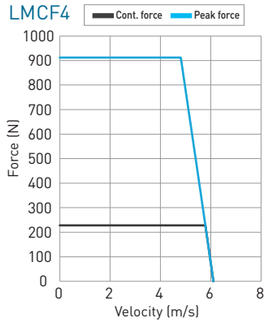
# 2.8.6 LMCF series

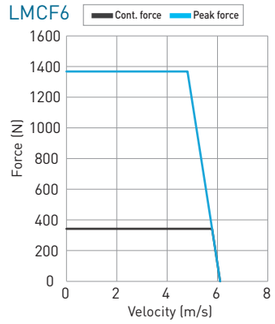
**Table 2-8 LMCF Series specifications**

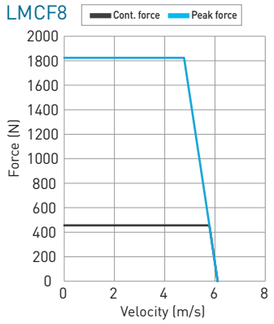
| | Symbol | Unit | LMCF4 | LMCF6 | LMCF8 | LMCFA | LMCFC |
|---|---|---|---|---|---|---|---|
| Continuous force | $F_c$ | N | 228 | 342 | 456 | 570 | 684 |
| Continuous current | $I_c$ | $A_{rms}$ | 3.8 | 5.7 | 7.6 | 9.5 | 11.4 |
| Peak force for 1 sec. | $F_p$ | N | 912 | 1368 | 1824 | 2280 | 2736 |
| Peak current for 1 sec. | $I_p$ | $A_{rms}$ | 15.2 | 22.8 | 30.4 | 38.0 | 45.6 |
| Force constant | $K_f$ | $N/A_{rms}$ | 60 | | | | |
| Max. winding temp. | $T_{max}$ | °C | 100 | | | | |
| Electrical time constant | $K_e$ | ms | 1 | | | | |
| Resistance (line to line at 25°C) | $R_{25}$ | Ω | 3.3 | 2.2 | 1.7 | 1.3 | 1.1 |
| Inductance (line to line) | L | mH | 3.3 | 2.2 | 1.7 | 1.3 | 1.1 |
| Pole pair pitch | 2τ | mm | 60 | | | | |
| Minimum bending radius of cable | $R_{bend}$ | mm | 57.5 | | | | |
| Back emf constant (line to line) | $K_v$ | $V_{rms}/(m/s)$ | 34.4 | | | | |
| Motor constant (at 25°C) | $K_m$ | $N/\sqrt{W}$ | 27.0 | 33.0 | 37.7 | 43.0 | 46.2 |
| Thermal resistance | $R_{TH}$ | °C/W | 0.84 | 0.56 | 0.41 | 0.34 | 0.27 |
| Thermal switch | - | - | 3 PTC SNM100 In Series | | | | |
| Maximum DC bus voltage | - | $V_{DC}$ | 330 | | | | |
| Mass of forcer | $M_f$ | kg | 2.50 | 3.75 | 5.00 | 6.25 | 7.50 |
| Unit mass of stator | $M_s$ | kg/m | 25.6 | | | | |
| Length of forcer/Dimension n | $L_f$ | mm | 260/7 | 380/10 | 500/13 | 620/16 | 740/19 |
| Length of stator/Dimension N | $L_s$ | mm | 120mm/N=2, 180mm/N=3, 300mm/N=5 | | | | |

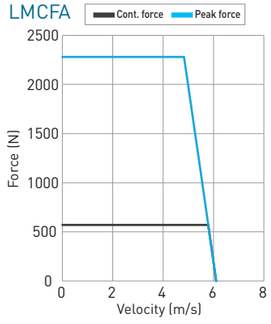
Note: 1.Values in this table are motor at 25°C ambient temperature and no forced cooling.
2.Except dimensions, the electrical specifications are in ±10% of tolerance.
3.We reserve the right of changes, please follow customer recognition drawings.

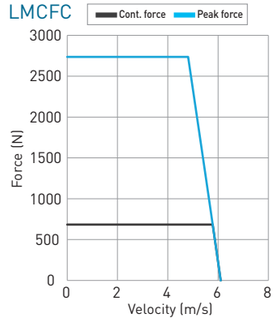
## Force and velocity curves (DC bus voltage = 330 $V_{DC}$)



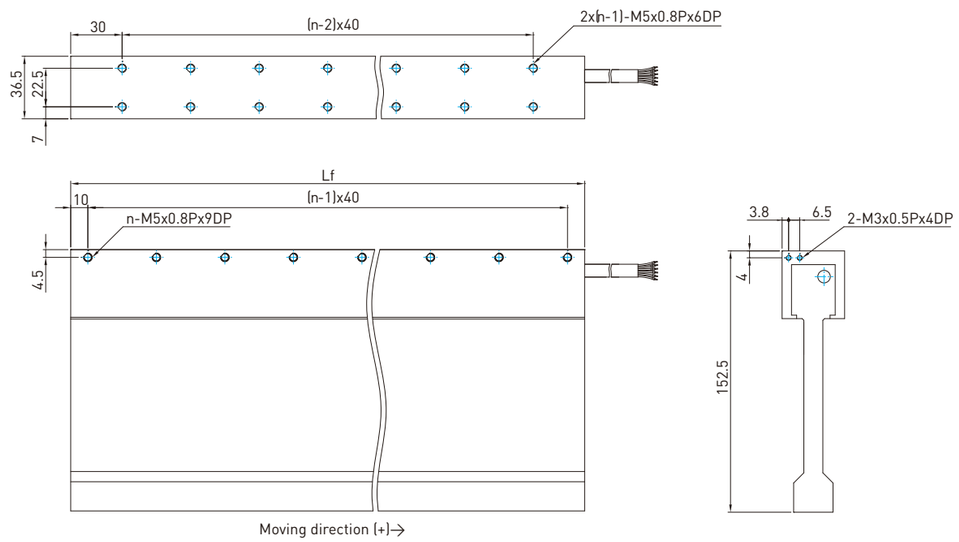



# LMCF Series forcers and stators dimensions

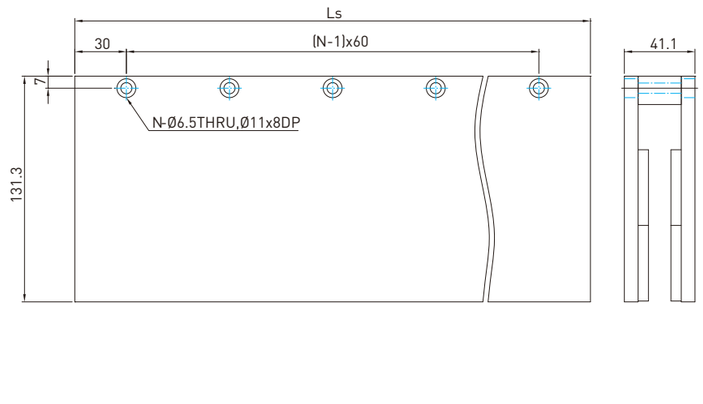
## Dimension of LMCF forcers

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

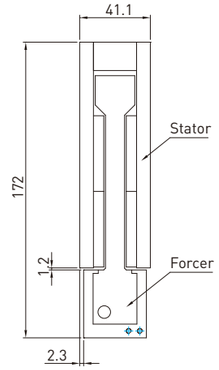



## Dimensions of LMCF stators

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




## Mounting tolerances




## Order code of magnet track (stator)

| Series | Height of stator | Model | Length of stator |
|---|---|---|---|
| LMC | E | S | 1 |
| | F: 131.3 mm | S: Standard | 1: 120 mm<br>B: 180 mm<br>2: 300 mm |



# 2.8.7 LMC-HUB series

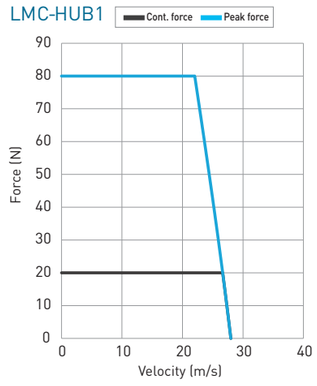
**Table 2-8 LMC-HUB Series specifications**

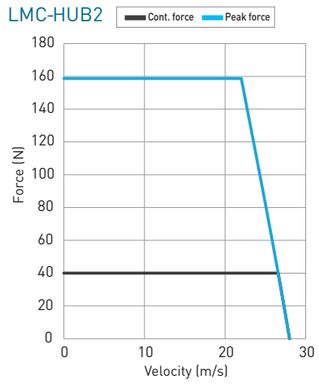
| | Symbol | Unit | LMC-HUB1 | LMC-HUB2 |
|---|---|---|---|---|
| Continuous force | $F_c$ | N | 20 | 40 |
| Continuous current | $I_c$ | $A_{rms}$ | 1.5 | 3.1 |
| Peak force for 1 sec. | $F_p$ | N | 80 | 160 |
| Peak current for 1 sec. | $I_p$ | $A_{rms}$ | 6.2 | 12.3 |
| Force constant | $K_f$ | $N/A_{rms}$ | 13.0 | 13.0 |
| Max. winding temp. | $T_{max}$ | °C | 120 | 120 |
| Electrical time constant | $K_e$ | ms | 0.19 | 0.19 |
| Resistance (line to line at 25°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°C) | $K_m$ | $N/\sqrt{W}$ | 3.9 | 5.5 |
| Thermal resistance | $R_{th}$ | °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 | 3.4 | 3.4 |
| Length of forcer/Dimension n | $L_f$ | mm | 49 | 97 |
| Length of stator/Dimension N | $L_s$ | mm | 72mm, 120mm | |
| Heat sink dimension | - | mm | 100x60x14 | |

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 ±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 $V_{DC}$)



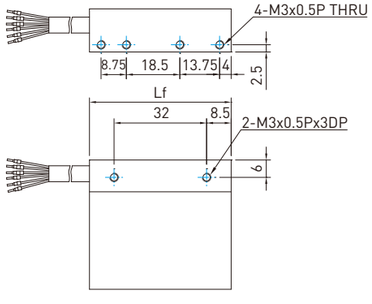



# LMC-HUB Series forcers and stators dimensions

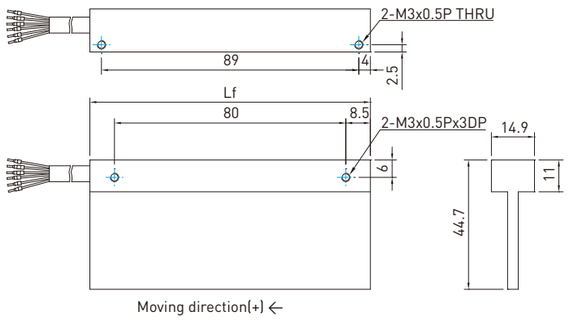
## Dimension of LMC-HUB forcers

(Value for Lf : see Table 2-15)

LMC-HUB1:



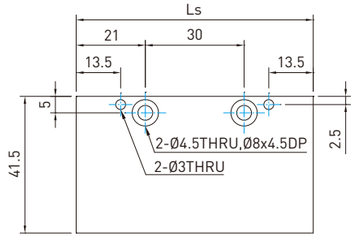

LMC-HUB2:



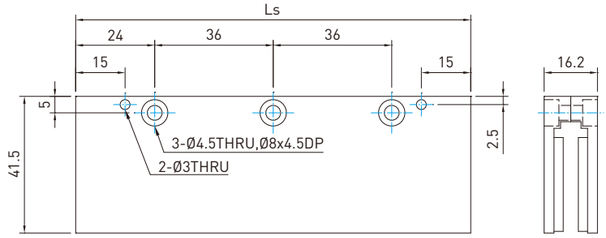

## Dimensions of LMC-HUB stators

(Value for Ls : see Table 2-15)

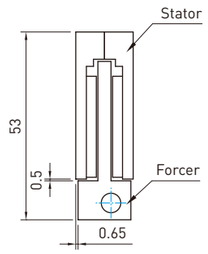
LMC-HUBS1:




LMC-HUBS2:




## Mounting tolerances



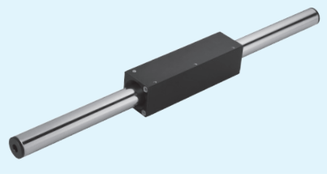

## Order code of magnet track (stator)

| Series | Height of stator | Model | Length of stator |
|---|---|---|---|
| LMC | HUB | S | 1 |
| | HUB: 41.5 mm | S: Standard | 1: 72 mm<br>2: 120 mm |



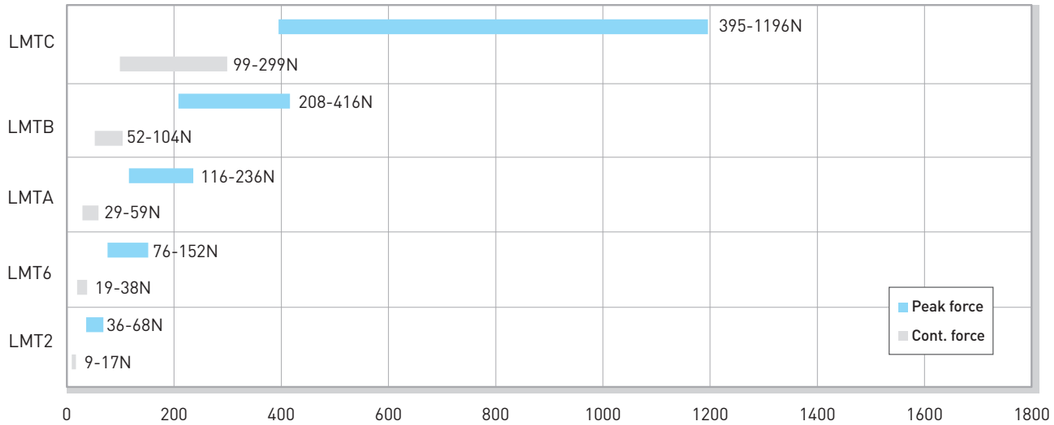
# 2.9 LMT Series
## Linear Motor

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.



- Excellent dynamic characteristics: no cogging
- Low velocity ripple
- Max. Acceleration up to 5G
- CE certification
- Ingress Protection rating: IP66
- No wear, zero backlash
- Similar to screw mechanism, easy to install

Force chart for LMT series




LMT2 LMT6 LMTA LMTB LMTC

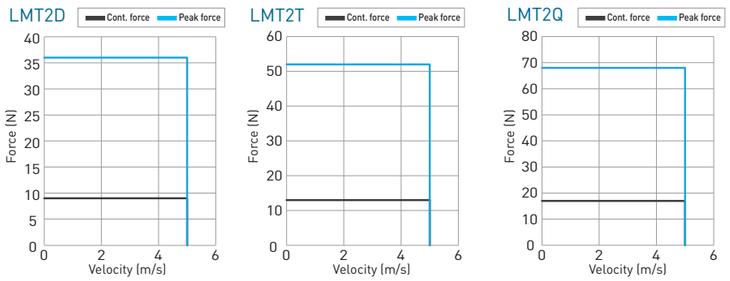
## 2.9.1 LMT2 Series

**Table 2-9 LMT2 Series specifications**

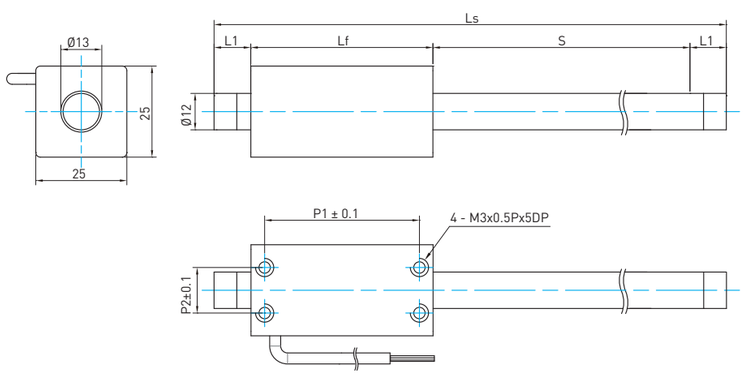
| | Symbol | Unit | LMT2D | LMT2T | LMT2Q |
|---|---|---|---|---|---|
| Continuous force | $F_c$ | N | 9 | 13 | 17 |
| Continuous current | $I_c$ | $A_{rms}$ | 1.5 | 1.5 | 1.5 |
| Peak force for 1 sec. | $F_p$ | N | 36 | 52 | 68 |
| Peak current for 1 sec. | $I_p$ | $A_{rms}$ | 6 | 6 | 6 |
| Force constant | $K_f$ | $N/A_{rms}$ | 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 | $R_{TH}$ | °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 | $P_1xP_2$ | 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)<br>40 (Stroke=400 mm~800 mm)<br>60 (Stroke=850 mm~1050 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 $V_{DC}$)
(Considering load and stator stroke limitation, the maximum speed is set at 5m/s.)




■ Dimensions of LMT2 forcers and stators





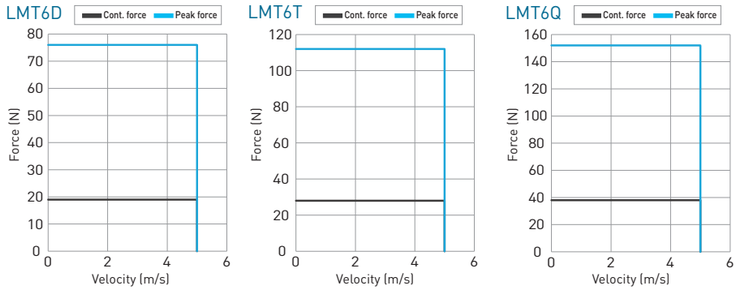

## 2.9.2 LMT6 Series

**Table 2-9 LMT6 Series specifications**

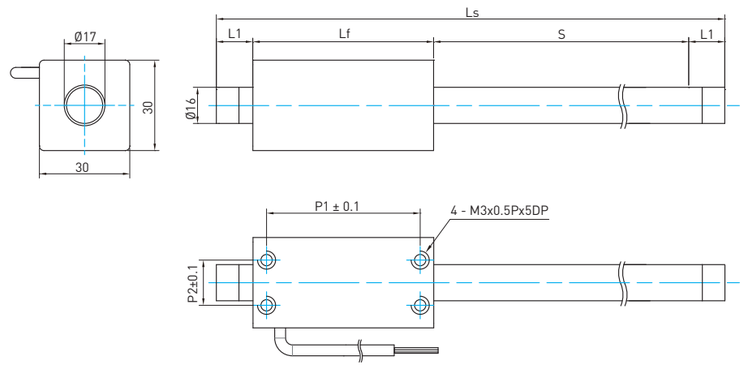
| | Symbol | Unit | LMT6D | LMT6T | LMT6Q |
|---|---|---|---|---|---|
| Continuous force | $F_c$ | N | 19 | 28 | 38 |
| Continuous current | $I_c$ | $A_{rms}$ | 1.4 | 1.4 | 1.4 |
| Peak force for 1 sec. | $F_p$ | N | 76 | 112 | 152 |
| Peak current for 1 sec. | $I_p$ | $A_{rms}$ | 5.6 | 5.6 | 5.6 |
| 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 | $R_{TH}$ | °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 | $P_1xP_2$ | 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)<br>40 (Stroke=400 mm~800 mm)<br>60 (Stroke=850 mm~1050 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 $V_{DC}$)
(Considering load and stator stroke limitation, the maximum speed is set at 5m/s.)




■ Dimensions of LMT6 forcers and stators



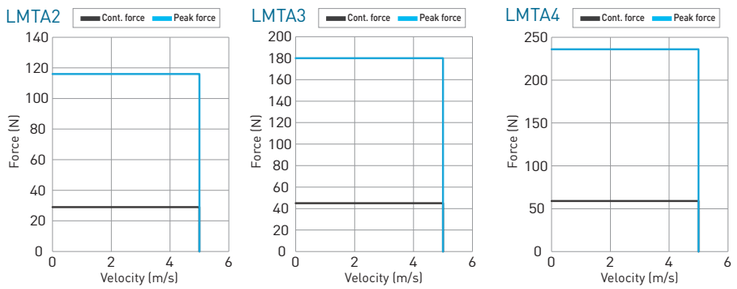
## 2.9.3 LMTA Series

**Table 2-9 LMTA Series specifications**

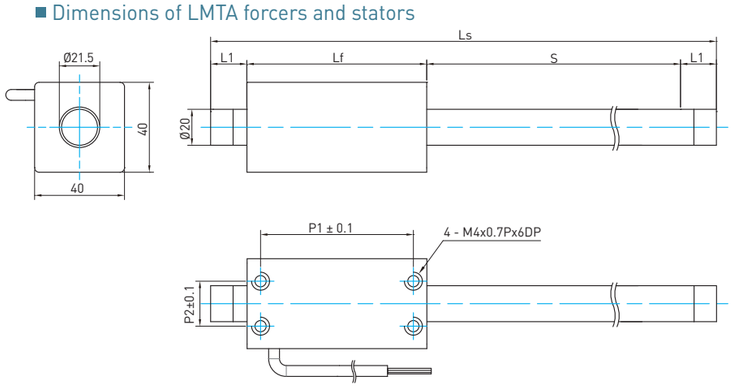
| | Symbol | Unit | LMTA2 | LMTA3 | LMTA4 |
|---|---|---|---|---|---|
| Continuous force | $F_c$ | N | 29 | 45 | 59 |
| Continuous current | $I_c$ | $A_{rms}$ | 1.6 | 1.6 | 1.6 |
| Peak force for 1 sec. | $F_p$ | N | 116 | 180 | 236 |
| Peak current for 1 sec. | $I_p$ | $A_{rms}$ | 6.4 | 6.4 | 6.4 |
| Force constant | $K_f$ | $N/A_{rms}$ | 18 | 28 | 37 |
| Electrical time constant | $K_e$ | ms | 0.7 | 0.7 | 0.7 |
| Resistance (line to line at 25°C) | $R_{25}$ | Ω | 7.4 | 11.1 | 14.8 |
| Inductance (line to line) | L | mH | 5.0 | 7.5 | 10.0 |
| 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) | $K_v$ | $V_{rms}/(m/s)$ | 11.7 | 17.5 | 23.3 |
| Motor constant (at 25°C) | $K_m$ | $N/\sqrt{W}$ | 5.4 | 6.9 | 7.9 |
| Thermal resistance | $R_{TH}$ | °C/W | 2.4 | 1.6 | 1.2 |
| Thermal switch | - | - | PTC 90 | | |
| Maximum DC bus voltage | - | $V_{DC}$ | 325 | | |
| Mass of forcer | $M_f$ | kg | 0.45 | 0.63 | 0.80 |
| Unit mass of stator | $M_s$ | kg/m | 2 | 2 | 2 |
| Length of forcer | $L_f$ | mm | 94 | 130 | 166 |
| Mounting pitch | $P_1xP_2$ | 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)<br>40 (Stroke=350 mm~700 mm)<br>60 (Stroke=750 mm~1550 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 $V_{DC}$)
### (Considering load and stator stroke limitation, the maximum speed is set at 5m/s.)




### ■ Dimensions of LMTA forcers and stators





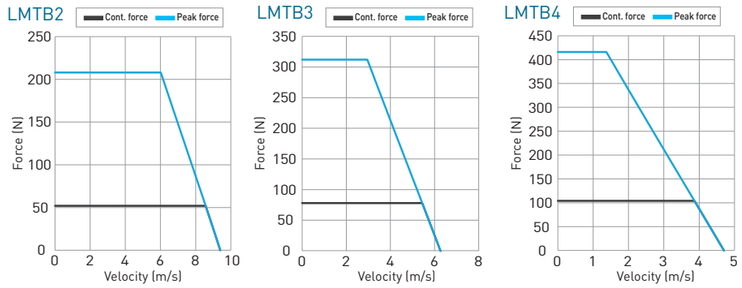

## 2.9.4 LMTB Series

**Table 2-9 LMTB Series specifications**

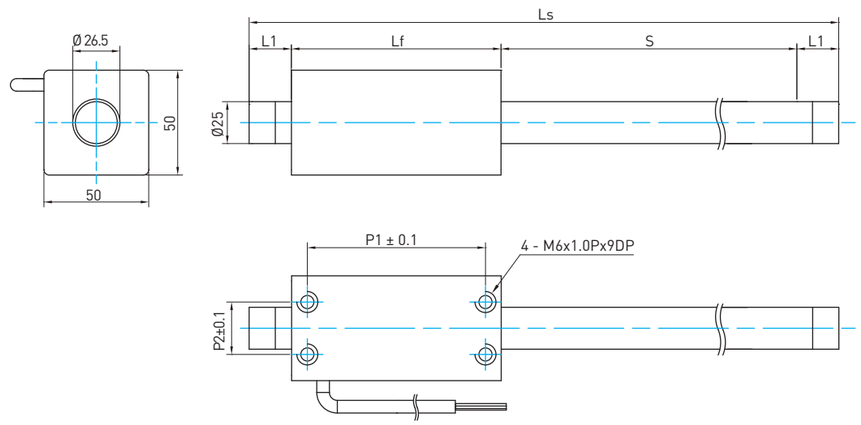
| | Symbol | Unit | LMTB2 | LMTB3 | LMTB4 |
|---|---|---|---|---|---|
| Continuous force | $F_c$ | N | 52 | 78 | 104 |
| Continuous current | $I_c$ | $A_{rms}$ | 1.3 | 1.3 | 1.3 |
| Peak force for 1 sec. | $F_p$ | N | 208 | 312 | 416 |
| Peak current for 1 sec. | $I_p$ | $A_{rms}$ | 5.2 | 5.2 | 5.2 |
| Force constant | $K_f$ | $N/A_{rms}$ | 40 | 60 | 80 |
| Electrical time constant | $K_e$ | ms | 1 | 1 | 1 |
| Resistance (line to line at 25°C) | $R_{25}$ | Ω | 16.0 | 24.0 | 32.4 |
| Inductance (line to line) | L | mH | 16.5 | 24.7 | 33.0 |
| 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) | $K_v$ | $V_{rms}/(m/s)$ | 22 | 33 | 44 |
| Motor constant (at 25°C) | $K_m$ | $N/\sqrt{W}$ | 8.2 | 10.0 | 11.6 |
| Thermal resistance | $R_{TH}$ | °C/W | 1.7 | 1.2 | 0.9 |
| Thermal switch | - | - | PTC 90 | | |
| Maximum DC bus voltage | - | $V_{DC}$ | 325 | | |
| Mass of forcer | $M_f$ | kg | 0.88 | 1.25 | 1.65 |
| 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 | $P_1xP_2$ | 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)<br>70 ((Stroke=750 mm~1300 mm)<br>100 ((Stroke=1350 mm~1550 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 LMTB forcers and stators



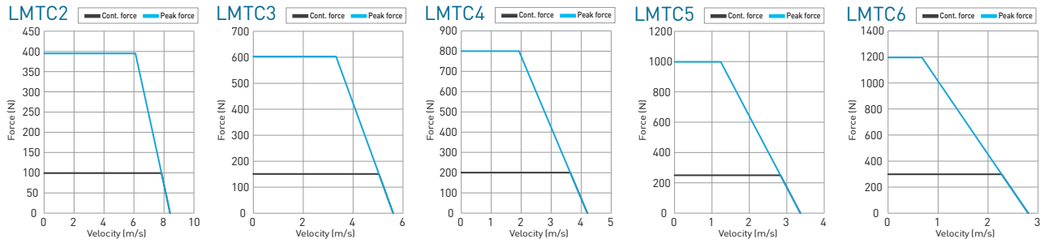
## 2.9.5 LMTC Series

**Table 2-9 LMTC Series specifications**

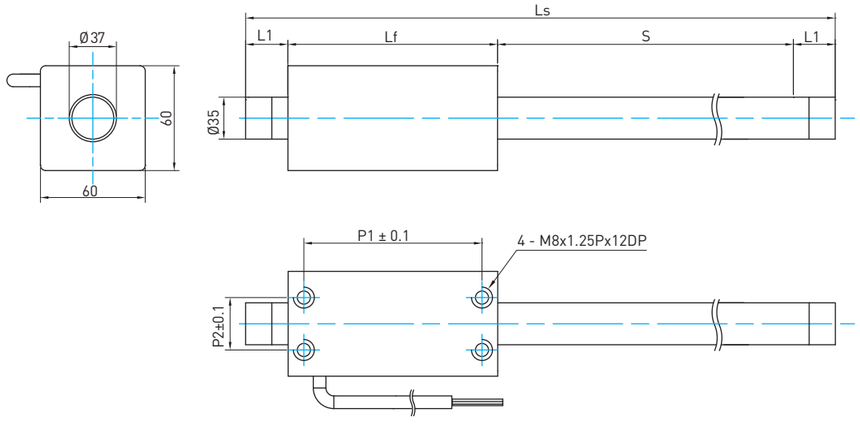
| | Symbol | Unit | LMTC2 | LMTC3 | LMTC4 | LMTC5 | LMTC6 |
|---|---|---|---|---|---|---|---|
| Continuous force | $F_c$ | N | 99 | 151 | 200 | 250 | 299 |
| Continuous current | $I_c$ | $A_{rms}$ | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 |
| Peak force for 1 sec. | $F_p$ | N | 395 | 603 | 801 | 998 | 1196 |
| Peak current for 1 sec. | $I_p$ | $A_{rms}$ | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 |
| Force constant | $K_f$ | $N/A_{rms}$ | 38 | 58 | 77 | 96 | 115 |
| 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 | 6.2 | 9.3 | 12.4 | 14.5 | 17.4 |
| Inductance (line to line) | L | mH | 7.2 | 10.8 | 14.7 | 17.3 | 20.7 |
| 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) | $K_v$ | $V_{rms}/(m/s)$ | 24.6 | 36.9 | 49.2 | 61.5 | 73.8 |
| Motor constant (at 25°C) | $K_m$ | $N/\sqrt{W}$ | 12.5 | 15.5 | 17.9 | 20.6 | 22.5 |
| Thermal resistance | $R_{TH}$ | °C/W | 1.1 | 0.7 | 0.6 | 0.4 | 0.3 |
| 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 | 4.0 |
| 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 | $P_1xP_2$ | 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)<br>70 Stroke=800 mm~1500 mm)<br>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 LMTC forcers and stators




## Order code of magnet track (stator)

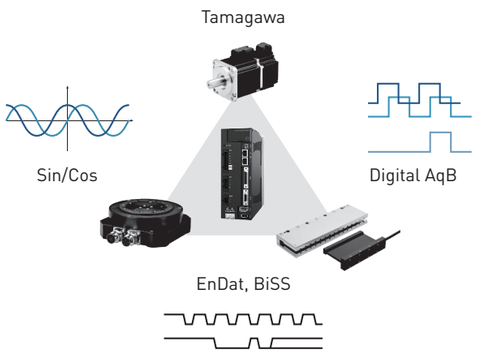
| Series | Diameter of stator | Model | Width of stator |
|---|---|---|---|
| LMT | A | S | □□□□ |
| | 2: 12 mm<br>6: 16 mm<br>A: 20 mm<br>BS: 25 mm<br>C: 35 mm | S: Standard<br>C: Customized | |

# 3 E Series Servo Drive

## 3.1 Drive

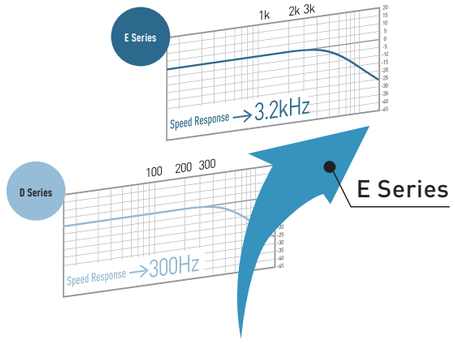
### 1 Supports Various Encoder / Motor Types

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



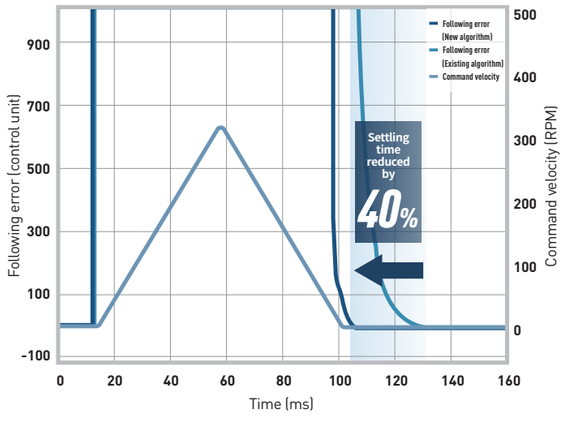

### 2 3.2 kHz Speed Response

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



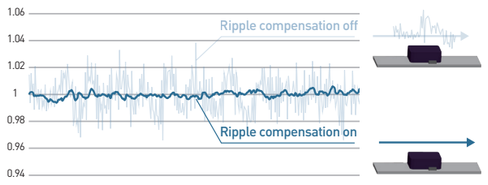

### 3 Fast In-Position Performance

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.



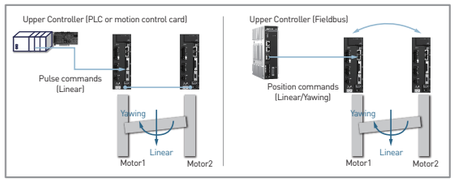

### 4 Ripple Compensation

Supresses 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.

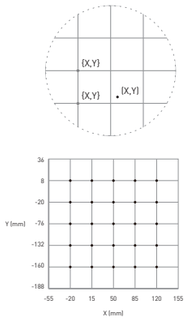
EtherCAT® PROFINET MECHATROLINK EtherNet/IP™

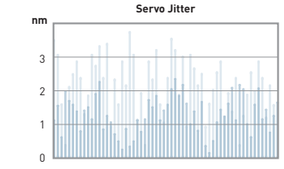
### 7 Built-in Multi-Motion Function

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.



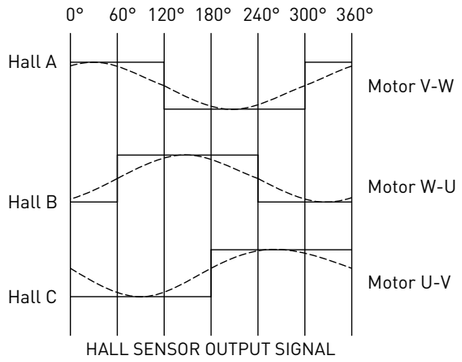




SCAN ME
Optimal Produce Selection Tool

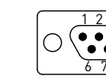
SCAN ME
Catalog Download

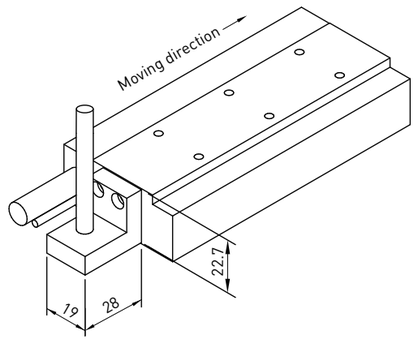
## 3.2 LM Hall Sensor

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



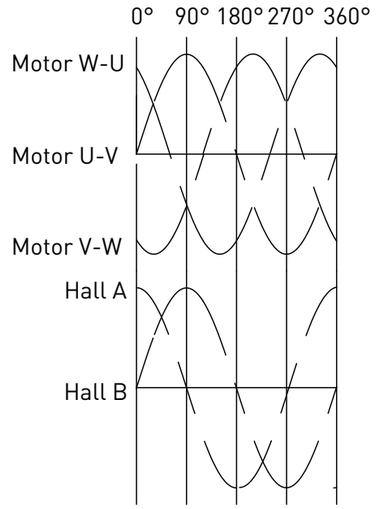

Connector Encoder
D-Sub male 9 channel plug

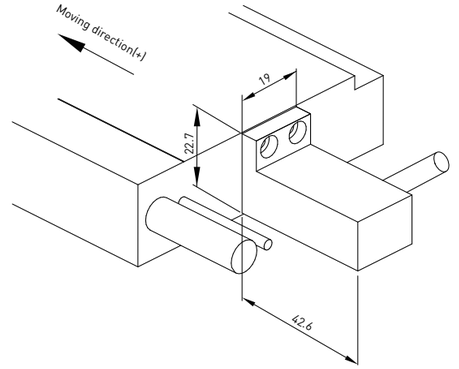



| Digital connector - LMAHSA | | Digital wire - LMAHSA-W | |
|---|---|---|---|
| Signal | connector | Signal | Color |
| Vcc | 1 | Vcc | Brown |
| Hall A(out) | 2 | Hall A(out) | White |
| Hall B(out) | 3 | Hall B(out) | Gray |
| Hall C(out) | 4 | Hall C(out) | Yellow |
| GND | 5 | GND | Green |
| ⏚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

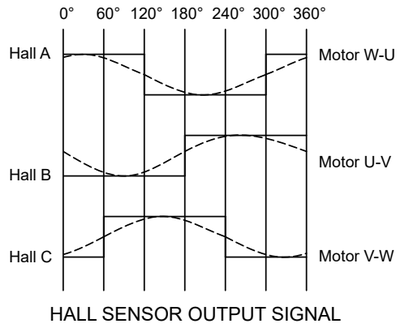
### LMSA1~C / LMSA1-Z~3-Z hall sensor-LMAHSAA-D



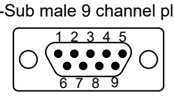

| Analogy - LMAHSAA-D | |
|---|---|
| Signal | Color |
| +5V | Brown |
| A+ | Red |
| A- | Blue |
| B+ | Yellow |
| B- | Green |
| GND | White |
| ⏚ | Shield |

## LMFA0-2 hall sensor-LMAHF1

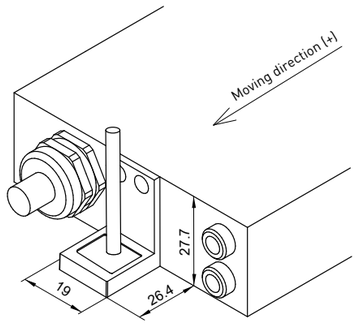



HALL SENSOR OUTPUT SIGNAL

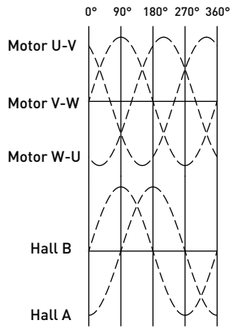
Connector Encoder
D-Sub male 9 channel plug

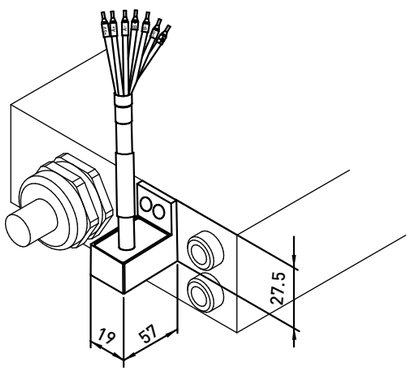



| Digital connector - LMAHF1 | | Digital wire - LMAHF1-W | |
|---|---|---|---|
| Signal | connector | Signal | Color |
| Vcc | 1 | Vcc | Brown |
| Hall A(out) | 2 | Hall A(out) | White |
| Hall B(out) | 3 | Hall B(out) | Gray |
| Hall C(out) | 4 | Hall C(out) | Yellow |
| GND | 5 | GND | Green |
| ⏚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




## LMFA0-2 hall sensor-LMAHF1-D

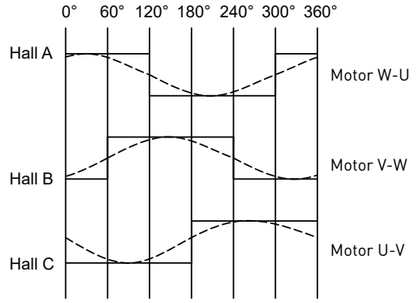



| Analogy - LMAHFA1-D | |
|---|---|
| Signal | Color |
| +5V | Brown |
| A+ | Red |
| A- | Blue |
| B+ | Yellow |
| B- | Green |
| GND | White |
| ⏚ | Shield |

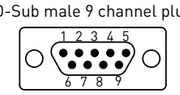


## LMFA/LMFP3-6 hall sensor-LMAHF2

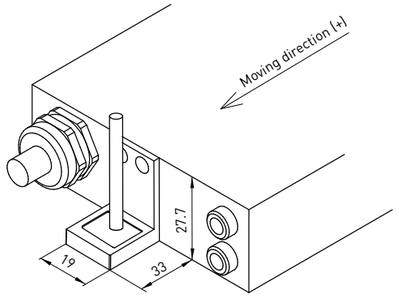



HALL SENSOR OUTPUT SIGNAL

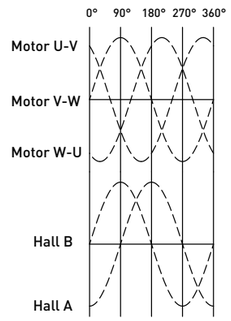
Connector Encoder
D-Sub male 9 channel plug

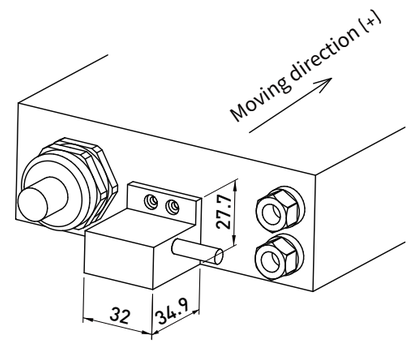



| Digital connector - LMAHF2 | | Digital wire - LMAHF2-W | |
|---|---|---|---|
| Signal | connector | Signal | Color |
| Vcc | 1 | Vcc | Brown |
| Hall B(out) | 2 | Hall B(out) | White |
| Hall C(out) | 3 | Hall C(out) | Gray |
| Hall A(out) | 4 | Hall A(out) | Yellow |
| GND | 5 | GND | Green |
| ⏚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



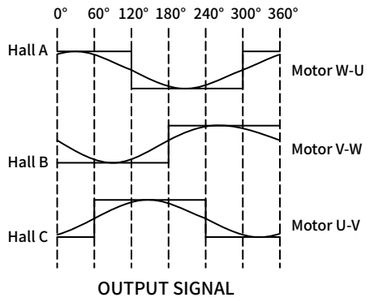

## LMFA/LMFP3-6 hall sensor-LMAHF2-D



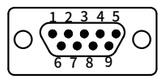




| Analogy- LMAHFA2-D | |
|---|---|
| Signal | Color |
| +5V | Brown |
| A+ | Red |
| A- | Blue |
| B+ | Yellow |
| B- | Green |
| GND | White |
| ⏚ | Shield |

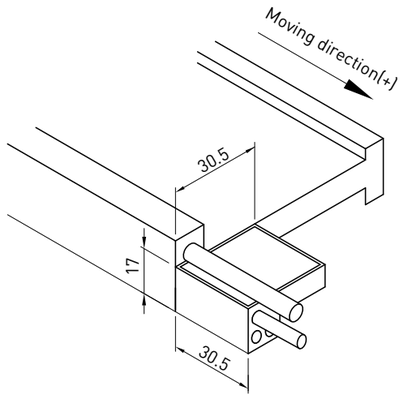
## LMCA/B/C hall sensor - LMAHC



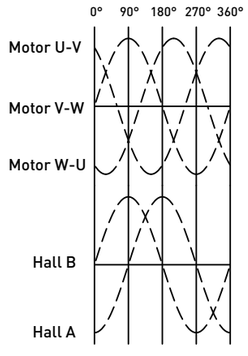

Connector Encoder
D-Sub male 9 channel plug



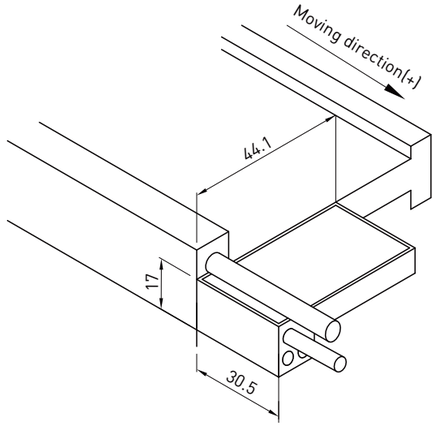

| Digital connector - LMAHC | | Digital wire - LMAHC-W | |
|---|---|---|---|
| Signal | connector | Signal | Color |
| Vcc | 1 | Vcc | Brown |
| Hall A(out) | 2 | Hall A(out) | White |
| Hall B(out) | 3 | Hall B(out) | Gray |
| Hall C(out) | 4 | Hall C(out) | Yellow |
| GND | 5 | GND | Green |
| ⏚ |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




## LMCA/B/C hall sensor - LMAHCA-D

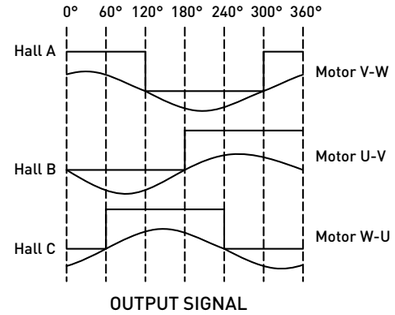



| Analogy - LMAHCA-D | |
|---|---|
| Signal | Color |
| Vcc | Brown |
| A+ | Red |
| A- | Blue |
| B+ | Yellow |
| B- | Green |
| GND | White |
| ⏚ | Shield |

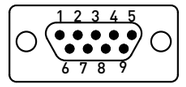




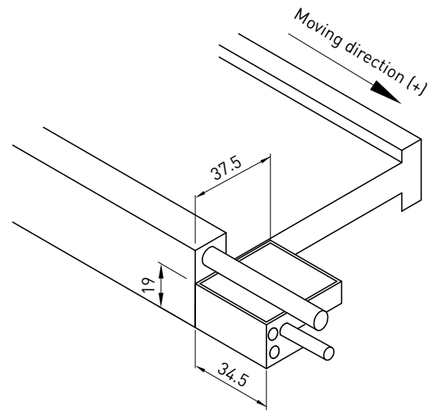

## LMCD/E hall sensor - LMAHC2



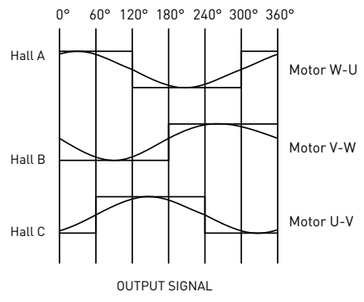

Connector Encoder
D-Sub male 9 channel plug



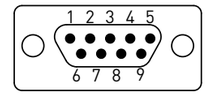

| Digital connector - LMAHC2 | | Digital wire - LMAHC2-W | |
|---|---|---|---|
| Signal | connector | Signal | Color |
| Vcc | 1 | Vcc | Brown |
| Hall A(out) | 2 | Hall A(out) | White |
| Hall B(out) | 3 | Hall B(out) | Gray |
| Hall C(out) | 4 | Hall C(out) | Yellow |
| GND | 5 | GND | Green |
| ⏚ | Case | ⏚ | Shield |



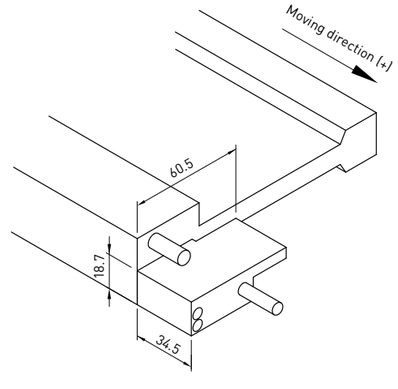

## LMCF hall sensor - LMAHC3



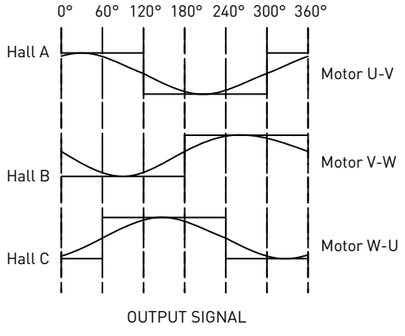

Connector Encoder
D-Sub male 9 channel plug

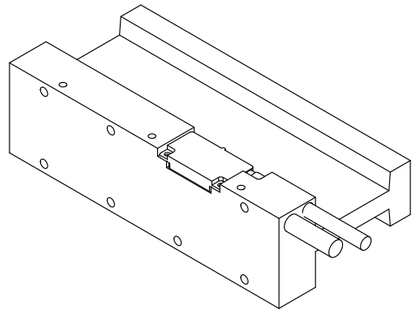



| Digital connector - LMAHC3 | | Digital wire - LMAHC3-W | |
|---|---|---|---|
| Signal | connector | Signal | Color |
| Vcc | 1 | Vcc | Brown |
| Hall A(out) | 2 | Hall A(out) | White |
| Hall B(out) | 3 | Hall B(out) | Gray |
| Hall C(out) | 4 | Hall C(out) | Yellow |
| GND | 5 | GND | Green |
| ⏚ | Case | ⏚ | Shield |



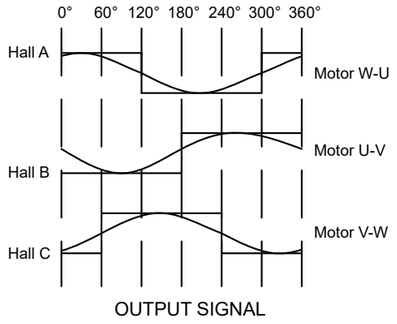
## LMC-EFC/E/F hall sensor - LMAHEF3-W



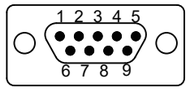



| Digital wire - LMAHEF3-W | |
|---|---|
| Signal | Color |
| Vcc | Brown |
| Hall A(out) | White |
| Hall B(out) | Gray |
| Hall C(out) | Yellow |
| GND | Green |
| ⏚ | Shield |

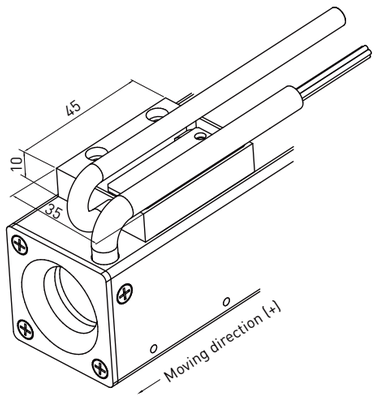
## LMTA hall sensor-LMDHTA




Connector Encoder
D-Sub male 9 channel plug

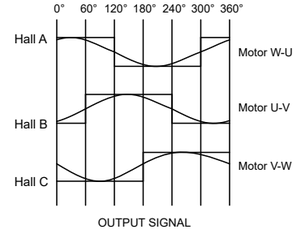



| Digital connector - LMDHTA | | Digital wire - LMDHTA-W | |
|---|---|---|---|
| Signal | connector | Signal | Color |
| Vcc | 1 | Vcc | Brown |
| Hall A(out) | 2 | Hall A(out) | White |
| Hall B(out) | 3 | Hall B(out) | Gray |
| Hall C(out) | 4 | Hall C(out) | Yellow |
| GND | 5 | GND | Green |
| ⏚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

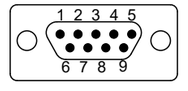




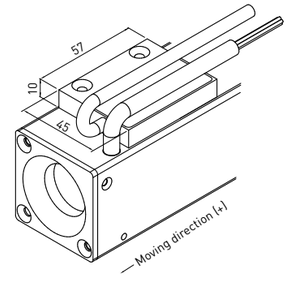

## LMTB hall sensor-LMDHTB



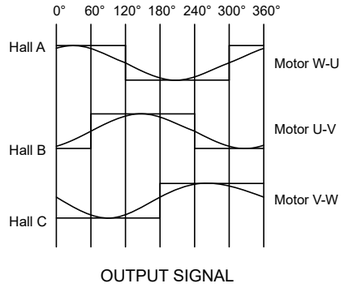

Connector Encoder
D-Sub male 9 channel plug



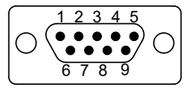

| Digital connector - LMDHTB | | Digital wire - LMDHTB-W | |
|---|---|---|---|
| Signal | connector | Signal | Color |
| Vcc | 1 | Vcc | Brown |
| Hall A(out) | 2 | Hall A(out) | White |
| Hall B(out) | 3 | Hall B(out) | Gray |
| Hall C(out) | 4 | Hall C(out) | Yellow |
| GND | 5 | GND | Green |
| ⏚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



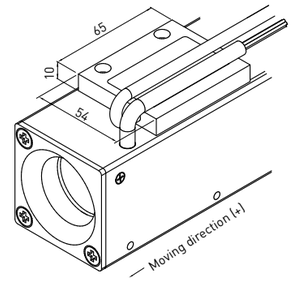

## LMTC hall sensor-LMDHTC



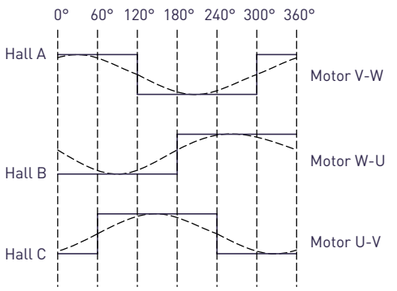

Connector Encoder
D-Sub male 9 channel plug



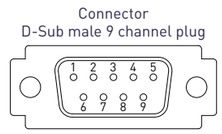

| Digital connector - LMDHTC | | Digital wire - LMDHTC-W | |
|---|---|---|---|
| Signal | connector | Signal | Color |
| Vcc | 1 | Vcc | Brown |
| Hall A(out) | 2 | Hall A(out) | White |
| Hall B(out) | 3 | Hall B(out) | Gray |
| Hall C(out) | 4 | Hall C(out) | Yellow |
| GND | 5 | GND | Green |
| ⏚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



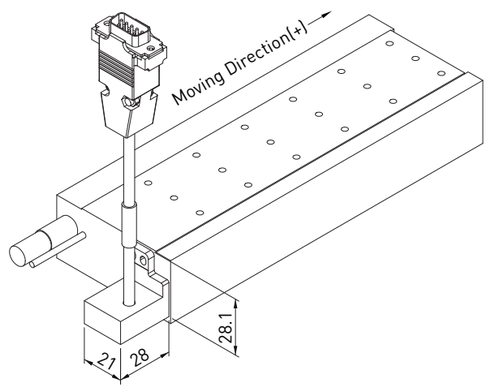
## LME Hall sensor - LME-A - LMAH-EA-D-□□□-7-0



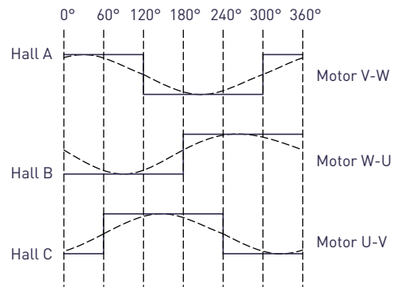

HALL SENSOR OUTPUT SIGNAL




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

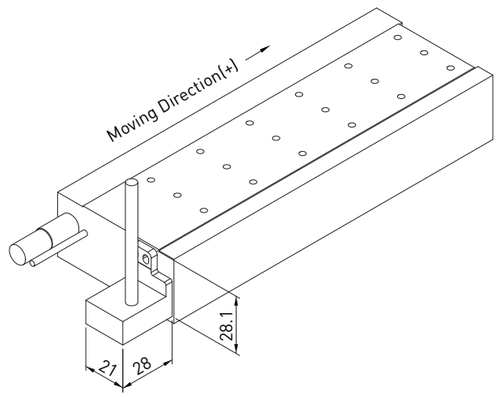



## LME Hall sensor - LME-A - LMAH-EA-D-□□□-0-0

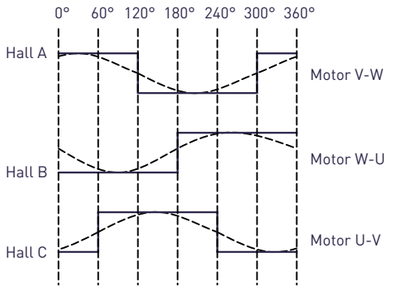



HALL SENSOR OUTPUT SIGNAL

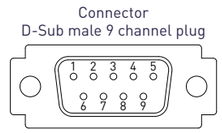
| Signal cable | |
|---|---|
| Signal | Color |
| Vcc | Brown |
| Hall A(out) | Red |
| Hall B(out) | Gray |
| Hall C(out) | Yellow |
| GND | White |
| ⏚ | Isolation net |



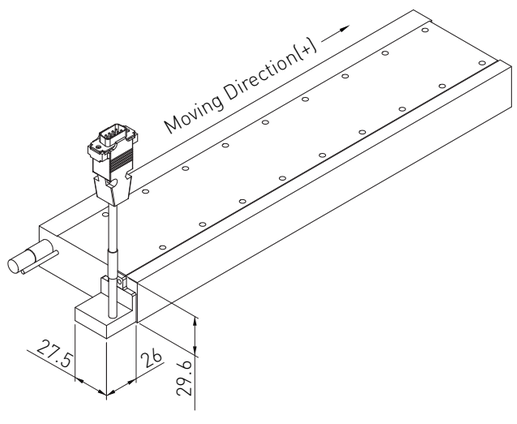

## LME Hall sensor - LME-B - LMAH-EB-D-□□□-7-0



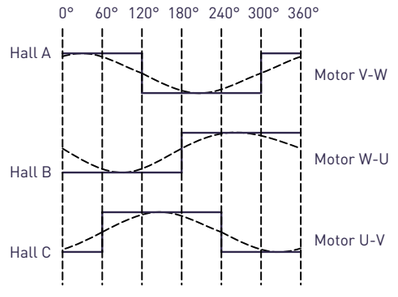

HALL SENSOR OUTPUT SIGNAL




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

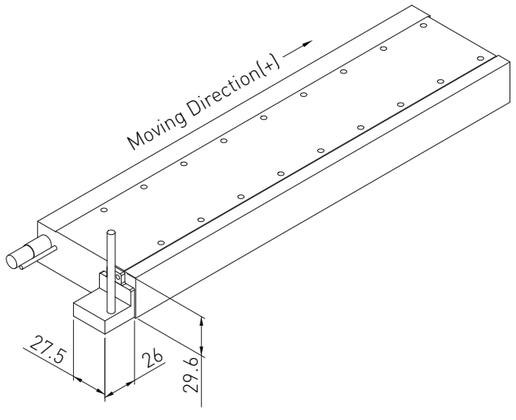



## LME Hall sensor - LME-B - LMAH-EB-D-□□□-0-0



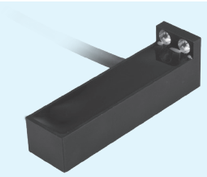

HALL SENSOR OUTPUT SIGNAL

| 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.



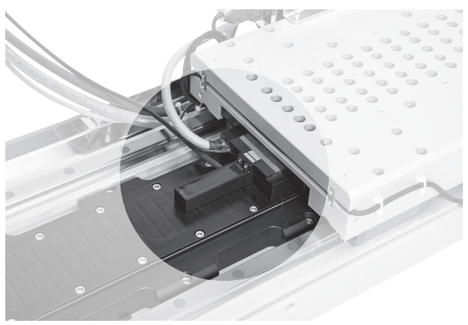
- Use in conjunction with iron core linear motor.
- Replace linear scale, magnetic scale encoders.
- Easy for assembly.
- Suitable to applications with general precision requirements for point-to-point long stroke.
- Excellent dust-resistant, oil-resistant and water-resistant.

| | 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 ±5μm.

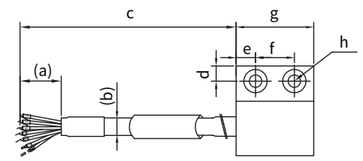
## Model Description

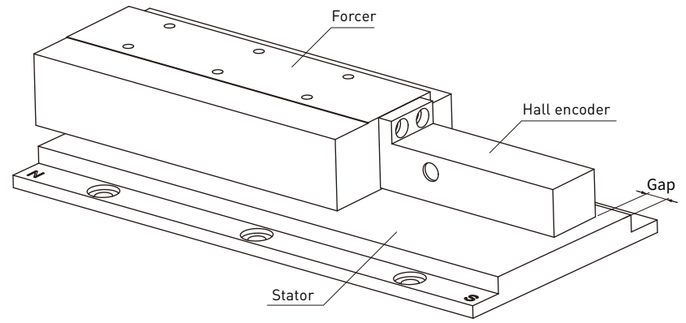
| Series | Specification | Signal | Cable length |
|---|---|---|---|
| LMAE | SA | A | 05 |
| | SA: operate with LMSA1~C/ LMSA1-Z~3-Z linear motor<br>F1: operate with LMFA0~2/ LMFP24 linear motor<br>F2: operate with LMFA3~6/ LMFP3~6 linear motor | A: incremental analog signal | 05: 0.5 m<br>10: 1 m<br>30: 3 m<br>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/s$^2$)
V: velocity (mm/s)
$M_L$: loading (kg)
g: gravitation acceleration (mm/s$^2$)
$F_p$: 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 ($A_{rms}$)
$V_0$: 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.

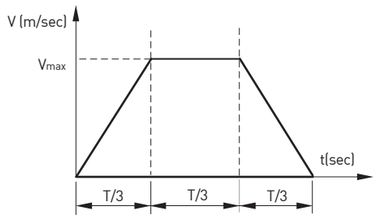
**Motion equation**
Basic kinematics equations are described as follows:

$$V = V_0 + aT$$

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

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.

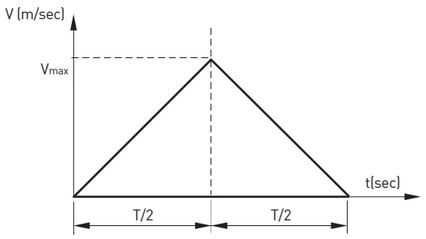



$$V_{max} = 1.5 \times \frac{X}{T} \quad (\text{Because } X = \frac{V}{2} \times \frac{T}{3} + V \times \frac{T}{3} + \frac{V}{2} \times \frac{T}{3})$$

$$a_{max} = \frac{V_{max}}{T/3} = \frac{4.5X}{T^2}$$

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.

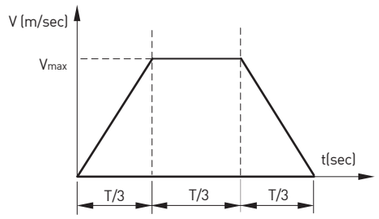
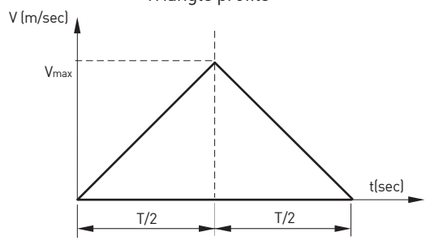



$$V_{max} = 2 \times \frac{X}{T}$$

$$a_{max} = \frac{4X}{T^2}$$

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**

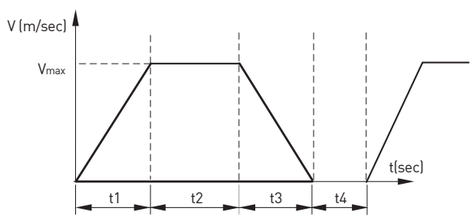
| | 1/3 -1/3-1/3 Trapezoid profile | Triangle profile |
|---|---|---|
| |   |   |
| V | $1.5 \times \frac{X}{T}$ | $2 \times \frac{X}{T}$ , or $\sqrt{a \times X}$ |
| a | $\frac{4.5X}{T^2}$ | $\frac{4X}{T^2}$ |
| t | $\frac{X}{V_{max}} + \frac{V_{max}}{a}$ ( if $\frac{X}{V_{max}} \geq \frac{V_{max}}{a}$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

**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 $t_4$ 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 Ie 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.

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

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

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)

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

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

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

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

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

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

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

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

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

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

# 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:

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

$E_{dec}$ (joules): Energy returned by the deceleration
$J_t$ (kg $m^2$ ): Load inertia on the motor shaft plus the motor inertia
$\omega_1$ (radians /sec): Shaft speed at the start of deceleration
$\omega_2$ (radians /sec): Shaft speed at the end of deceleration
$I_e$: effective current (Arms)

**Linear motor**:

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

$E_{dec}$ (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.**

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

$P_{motor}$ (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
$E_{moter} = P_{moter} T_{decel}$
$E_{motor}$ (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**

$E_{returned} = E_{dec} - E_{motor}$
$E_{returned}$ (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.**

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

$W_{capacity}$ (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.**

$E_{regen} = E_{returned} - E_{amp}$
$E_{regen}$ (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.**

$P_{pulse} = E_{regen} / T_{decel}$
$P_{pulse}$ (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.**

$R = V2_{regen} / P_{pulse\ max}$
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 $m/s^2$
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:**

$F = ma = 86 \times 5 = 430\,(N)$

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

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

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

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

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

$\because E_{returned} > W_{capacity}$

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

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

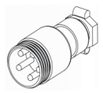
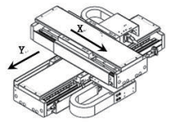
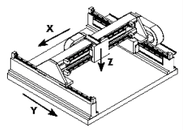
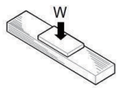
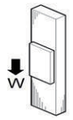
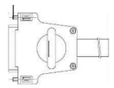
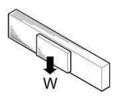
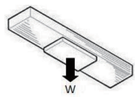
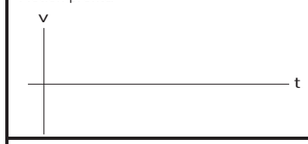
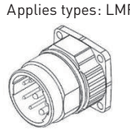
$$R = \frac{V_{regen}^2}{P_{pulse}} = \frac{390^2}{180.05} = 844.77\,(ohms)$$

**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 100W. The total resistance value is 136 ohms, and power capacity is 200W. The resistance order number is 050100700001.**

# Appendix C: Inquiry form

Fields marked with asterisk(*) are required. Date: _____

| | |
|---|---|
| Customer name: _____<br>Email : _____<br>Tel: _____ Fax: _____ | Contact HIWIN:<br>Job description:<br>Business owners: |

| | | | |
|---|---|---|---|
| *Industry/Application | _____ | Multi-forcers | □Yes, quantity: _____ pcs □No |
| *Operational environment | □Indoor, general 25℃<br>□Cleaning room, class: _____<br>□Vacuum, class: _____<br>□Others:_____ | *Movement | □Point to point movement □Scanning |
| | | Safety requirements | □CE □UL □Other _____ |
| *Stage type | □Single □XY axis □Dual axis Bridge<br>□Gantry(single-driven)<br>□Gantry(dual-driven) □Others:_____ | Travel time | _____ sec |
| | | Dwelling time | _____ sec |
| *Payload | □Mass: _____ kg | Drive | Voltage: □110V □220V □Other: _____ V |
| External force (N) | X-axis _____ Y-axis _____ Z-axis _____ | Hall sensor | □Yes · □Digital signal □Analog signal □No |
| *Max. speed (m/s) | X-axis _____ Y-axis _____ Z-axis _____ | The type of forcer power cable, the standard is cable (as shown in the figure below) | |
| *Max. acceleration (m/s²) | X-axis _____ Y-axis _____ Z-axis _____ | □ Cable<br>Applies to all types.  | □ 90° connector<br>Applies types: LMFx, LMTE  |
| *Stroke (m) | X-axis _____ Y-axis _____ Z-axis _____ | □ Cable + round connector<br>Applies types: LMFx  | LMC, LMT  |
| *Stage installation   | □Horizon<br>Axis: _____  | □Vertical<br>Axis: _____  | □ Cable + D-sub<br>Applies types: LMSA, LMC-EFE, LMC-EFF, LMCF<br>External thread  |
| | □Hang<br>Axis: _____  | □Upside-down<br>Axis: _____  | |
| Motion profile:  | | Others: | □ Cable + Metal connector<br>Applies types: LMFA, LMFP  |

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

FME0138-04



MEMO

**MEMO**

# Linear Motor Technical Information

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