

2 Linear motor

2.1 LMSA series Linear motor

The HIWIN synchronous linear motor LMSA is a larger thrust type of linear drive motor product. It features high thrust density and low cogging force.

The three-phase motor iron core is comprised of a primary side (forcer) and secondary side (stator) permanent magnets. The stator can be infinitely extended, so the stroke will be unrestricted.



- High dynamic response
- Low installation height
- UL and CE certifications
- Continuous force range from 103N to 1579N
- Peak force range from 289N to 4458N
- Installation height 34mm, 36mm

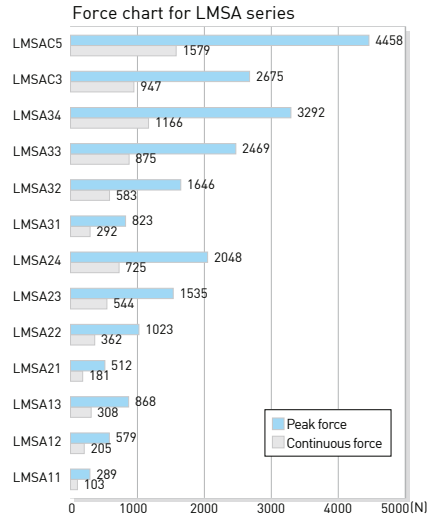


Table 2-1 LMSA series specifications

	Symbol	Unit	LMSA11	LMSA11L	LMSA12	LMSA12L	LMSA13	LMSA13L	LMSA21	LMSA21L	LMSA22	LMSA22L
Continuous force	F_c	N	103	103	205	205	308	308	181	181	362	362
Continuous current	I_c	A_{rms}	2.1	4.7	4.2	9.4	6.3	14.1	2.0	4.4	3.9	8.8
Peak force (1s)	F_p	N	289	289	579	579	868	868	512	512	1023	1023
Peak current (1s)	I_p	A_{rms}	6.3	14.1	12.7	28.3	19.0	42.4	5.9	13.1	11.8	26.3
Ultimate force (0.5s)	F_u	N	379	379	759	759	1138	1138	670	670	1341	1341
Ultimate current (0.5s)	I_u	A_{rms}	10.6	23.6	21.1	47.1	31.7	70.7	9.8	21.9	19.6	43.8
Force constant	K_f	N/A_{rms}	48.6	21.7	48.6	21.7	48.6	21.7	92.5	41.4	92.5	41.4
Attraction force	F_a	N	481	481	963	963	1444	1444	963	963	1926	1926
Maximum winding temperature	T_{max}	°C	120									
Electrical time constant	K_e	ms	4.4	4.3	4.5	4.1	4.4	4.0	4.6	4.6	4.9	4.6
Resistance (line to line · 25°C)	R_{25}	Ω	8.4	1.7	4.1	0.9	2.8	0.6	13.8	2.8	6.8	1.4
Resistance (line to line · 120°C)	R_{120}	Ω	11.6	2.3	5.7	1.2	3.9	0.8	19.0	3.9	9.4	1.9
Inductance (line to line)	L	mH	37.1	7.3	18.5	3.7	12.4	2.4	64.0	12.8	33.0	6.4
Pole pair pitch	2τ	mm	30									
Minimum bending radius of cable	R_{bend}	mm	69									
Back emf constant (line to line)	K_v	$V_{msf}/(m/s)$	28.1	12.6	28.1	12.6	28.1	12.6	53.4	23.9	53.4	23.9
Motor constant	K_m	N/\sqrt{W}	13.7	13.6	19.6	18.7	23.7	22.9	20.3	20.2	28.9	28.6
Thermal resistance	R_{TH}	°C/W	1.23	1.23	0.63	0.63	0.41	0.41	0.87	0.87	0.44	0.44
Thermal time constant	t_{TH}	s	1830	1830	2720	2720	4210	4210	2830	2830	4060	4060
Thermal switch	-	-	3 PTC SNM120 In Series									
Maximum DC bus voltage	-	V_{DC}	600									
Mass of forcer	M_f	kg	0.7	0.7	1.4	1.4	2.1	2.1	1.1	1.1	2.2	2.2
Unit mass of stator	M_s	kg/m	2.7	2.7	2.7	2.7	2.7	2.7	4.8	4.8	4.8	4.8
Width of stator	W_s	mm	52	52	52	52	52	86	86	86	86	86
Length of stator/Dimension N	L_s	mm	120mm/N=2, 180mm/N=3, 300mm/N=5									
Stator mounting distance	W_{st}	mm	42	42	42	42	42	42	74	74	74	74
Total installation height	H	mm	34	34	34	34	34	34	34	34	34	34

Table 2-1 LMSA series specifications

	Symbol	Unit	LMSA23	LMSA23L	LMSA24	LMSA24L	LMSA31	LMSA31L	LMSA32	LMSA32L	LMSA33	LMSA33L
Continuous force	F_c	N	544	544	725	725	292	292	583	583	875	875
Continuous current	I_c	A_{rms}	5.9	13.1	7.8	17.5	2.0	4.5	4.0	8.9	6.0	13.4
Peak force (1s)	F_p	N	1535	1535	2048	2048	823	823	1646	1646	2469	2469
Peak current (1s)	I_p	A_{rms}	17.6	39.4	23.5	52.5	6.0	13.4	12.0	26.8	18.0	40.2
Ultimate force (0.5s)	F_u	N	2011	2011	2682	2682	1079	1079	2157	2157	3236	3236
Ultimate current (0.5s)	I_u	A_{rms}	29.4	65.7	39.2	87.6	10.0	22.3	20.0	44.7	30.0	67.0
Force constant	K_f	N/A_{rms}	92.5	41.4	92.5	41.4	145.8	65.2	145.8	65.2	145.8	65.2
Attraction force	F_a	N	2888	2888	3851	3851	1444	1444	2888	2888	4333	4333
Maximum winding temperature	T_{max}	°C	120									
Electrical time constant	K_e	ms	4.9	4.8	4.6	4.7	4.9	4.9	4.9	4.9	4.9	5.0
Resistance (line to line · 25°C)	R_{25}	Ω	4.6	0.9	3.5	0.7	19.2	4.0	9.6	2.0	6.4	1.3
Resistance (line to line · 120°C)	R_{120}	Ω	6.3	1.2	4.8	0.9	26.5	5.5	13.2	2.8	8.8	1.8
Inductance (line to line)	L	mH	22.4	4.3	16.0	3.2	94.1	19.6	47.1	9.8	31.3	6.5
Pole pair pitch	2τ	mm	30									
Minimum bending radius of cable	R_{bend}	mm	69									
Back emf constant (line to line)	K_v	$V_{msf}/(m/s)$	53.4	23.9	53.4	23.9	84.2	37.7	84.2	37.7	84.2	37.7
Motor constant	K_m	N/\sqrt{W}	35.2	35.6	40.6	40.8	27.2	26.6	38.4	37.7	47.0	46.7
Thermal resistance	R_{TH}	°C/W	0.29	0.29	0.22	0.22	0.60	0.60	0.30	0.30	0.20	0.20
Thermal time constant	t_{TH}	s	5080	5080	-	-	4540	4540	5740	5740	5580	5580
Thermal switch	-	-	3 PTC SNM120 In Series									
Maximum DC bus voltage	-	V_{DC}	600									
Mass of forcer	M_f	kg	3.3	3.3	4.4	4.4	1.9	1.9	3.8	3.8	5.7	5.7
Unit mass of stator	M_s	kg/m	4.8	4.8	4.8	4.8	8.5	8.5	8.5	8.5	8.5	8.5
Width of stator	W_s	mm	86	86	86	86	116	116	116	116	116	116
Length of stator/Dimension N	L_s	mm	120mm/N=2, 180mm/N=3, 300mm/N=5									
Stator mounting distance	W_{st}	mm	74	74	74	74	104	104	104	104	104	104
Total installation height	H	mm	34	34	34	34	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.

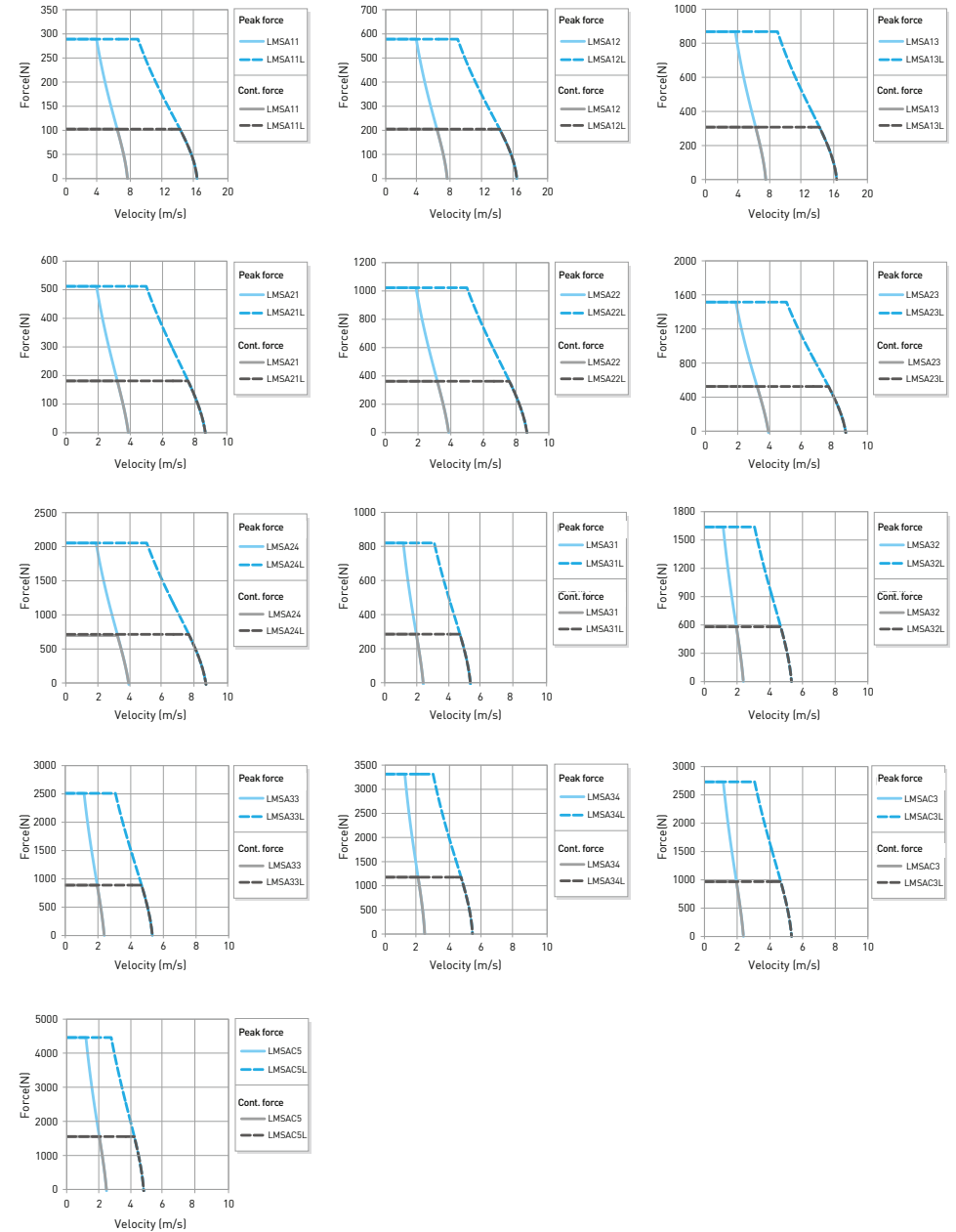
Table 2-1 LMSA series specifications

	Symbol	Unit	LMSA34	LMSA34L	LMSAC3	LMSAC3L	LMSAC5	LMSAC5L
Continuous force	F_c	N	1166	1166	947	947	1579	1579
Continuous current	I_c	A_{rms}	8.0	17.9	6.0	13.4	10.0	22.3
Peak force (1s)	F_p	N	3292	3292	2675	2675	4458	4458
Peak current (1s)	I_p	A_{rms}	24.0	53.6	18.0	40.2	30.0	67.0
Ultimate force (0.5s)	F_u	N	4314	4314	3505	3505	5842	5842
Ultimate current (0.5s)	I_u	A_{rms}	40.0	89.4	30.0	67.0	50.0	111.7
Force constant	K_f	N/A_{rms}	145.8	65.2	157.9	70.7	157.9	70.7
Attraction force	F_a	N	5777	5777	4694	4694	7823	7823
Maximum winding temperature	T_{max}	$^{\circ}C$	120					
Electrical time constant	K_e	ms	4.9	4.9	5.0	5.0	5.0	5.0
Resistance (line to line · 25 $^{\circ}C$)	R_{25}	Ω	4.8	1.0	6.8	1.4	4.1	0.8
Resistance (line to line · 120 $^{\circ}C$)	R_{120}	Ω	6.6	1.4	9.4	1.9	5.7	1.1
Inductance (line to line)	L	mH	23.5	4.9	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	$V_{rms}/(m/s)$	84.2	37.7	91.2	40.8	91.2	40.8
Motor constant	K_m	N/\sqrt{W}	54.3	53.3	49.3	49.5	63.7	63.9
Thermal resistance	R_{TH}	$^{\circ}C/W$	0.15	0.14	0.19	0.19	0.11	0.11
Thermal time constant	t_{TH}	s	-	-	-	-	-	-
Thermal switch	-	-	3 PTC SNM120 In Series					
Maximum DC bus voltage	-	V_{DC}	600					
Mass of forcer	M_f	kg	7.6	7.6	6.3	6.3	10.5	10.5
Unit mass of stator	M_s	kg/m	8.5	8.5	9.7	9.7	9.7	9.7
Width of stator	W_s	mm	116	116	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	114	114	114	114
Total installation height	H	mm	36	36	36	36	36	36

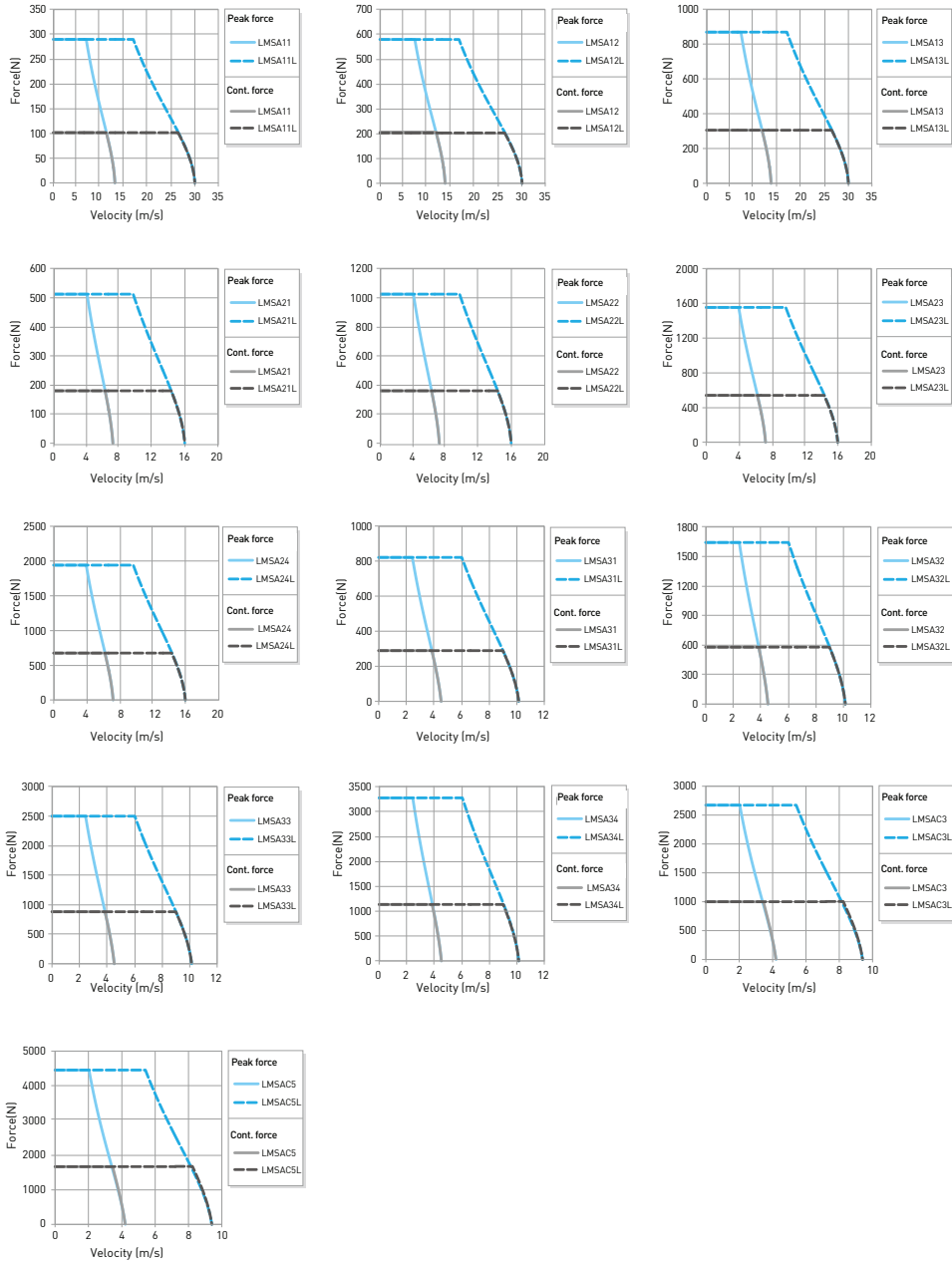
Note: 1. The data of this table are values without forced cooling.
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2.1.1 LMSA series F-V curves

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

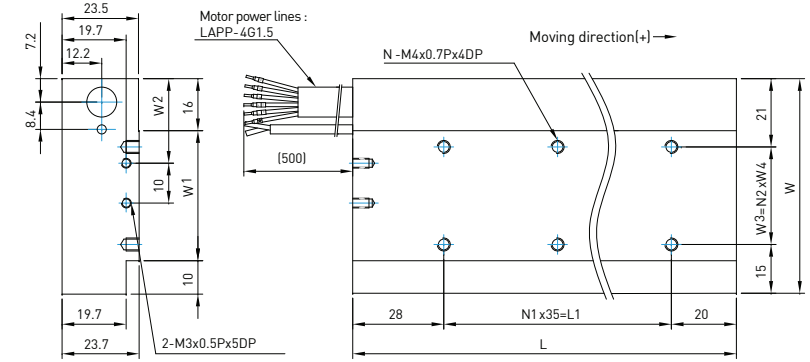


■ Force and velocity curve (DC bus voltage = 600 V_{DC})



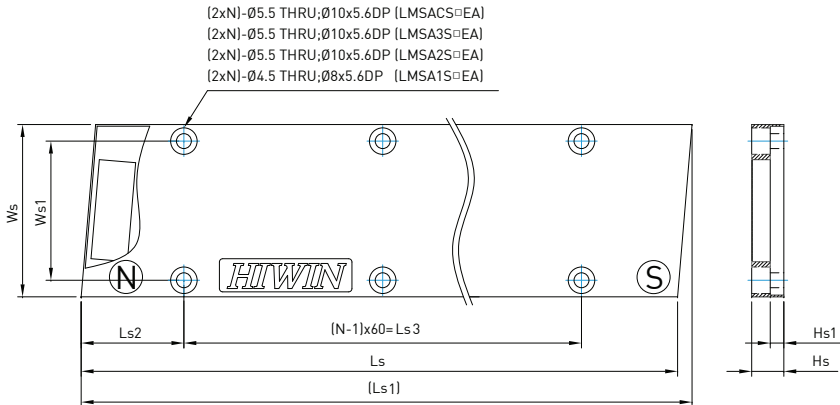
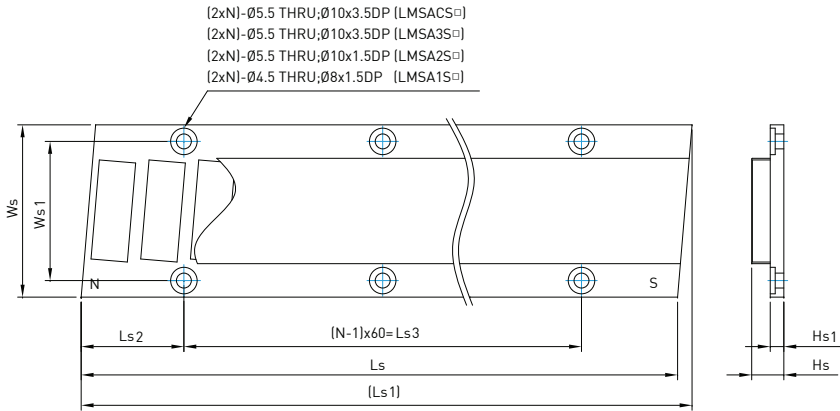
2.1.2 LMSA series forcers and stators dimensions

■ Dimensions of forcers



Type	L	L1	W	W1	W2	W3	W4	N	N1	N2
LMSA11	118	70	56	30	26	20	20	6	2	1
LMSA12	223	175	56	30	26	20	20	12	5	1
LMSA13	328	280	56	30	26	20	20	18	8	1
LMSA21	118	70	86	60	41	50	50	6	2	1
LMSA22	223	175	86	60	41	50	50	12	5	1
LMSA23	328	280	86	60	41	50	50	18	8	1
LMSA24	433	385	86	60	41	50	50	24	11	1
LMSA31	118	70	116	90	56	80	40	9	2	2
LMSA32	223	175	116	90	56	80	40	18	5	2
LMSA33	328	280	116	90	56	80	40	27	8	2
LMSA34	433	385	116	90	56	80	40	36	11	2
LMSAC3	328	280	123.5	97.5	59.75	80	40	27	8	2
LMSAC5	538	490	123.5	97.5	59.75	80	40	45	14	2

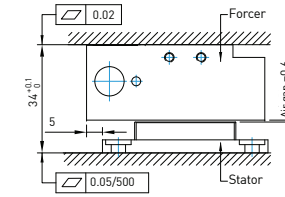
■ Dimensions of stators



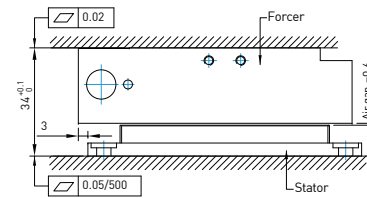
Type	Ls	Ls1	Ls2	Ls3	Ws	Ws1	Hs	Hs1	N
LMSA1S1(EA)	120	124.36	31	60	52	42	9.7	4.1	2
LMSA1S2(EA)	180	184.36	31	120	52	42	9.7	4.1	3
LMSA1S3(EA)	300	304.36	31	240	52	42	9.7	4.1	5
LMSA2S1(EA)	120	122.7	30.57	60	86	74	9.7	4.1	2
LMSA2S2(EA)	180	182.7	30.57	120	86	74	9.7	4.1	3
LMSA2S3(EA)	300	302.7	30.57	240	86	74	9.7	4.1	5
LMSA3S1(EA)	120	123.04	30.37	60	116	104	11.7	6.1	2
LMSA3S2(EA)	180	183.04	30.37	120	116	104	11.7	6.1	3
LMSA3S3(EA)	300	303.04	30.37	240	116	104	11.7	6.1	5
LMSACS1(EA)	120	123.3	30.37	60	126	114	11.7	6.1	2
LMSACS2(EA)	180	183.3	30.37	120	126	114	11.7	6.1	3
LMSACS3(EA)	300	303.3	30.37	240	126	114	11.7	6.1	5

■ Mounting tolerances

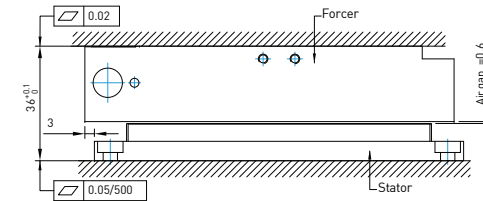
LMSA1□series



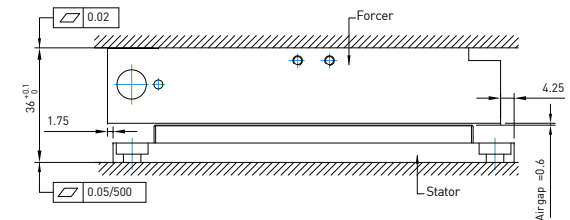
LMSA2□series



LMSA3□series



LMSAC□series



2.1.3 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	1: 56mm 2: 86mm 3: 116mm C: 123.5mm	1: 118mm 2: 223mm 3: 328mm 4: 433mm 5: 538mm	None: Standard L: Low back EMF

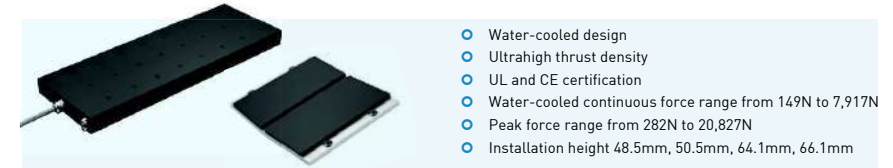
2.1.4 Order code of magnet track (stator)

Series	Type	Width of stator	Model	Length of forcer	Magnet package
LM	SA	1	S	1	EA
Linear motor	Linear motor type	1: 56mm 2: 86mm 3: 116mm C: 126mm	S: Standard C: Customize	1: 120mm 2: 180mm 3: 300mm	EA: Epoxy None: Cover plate

2.2 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 20,000N. 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.



Force chart for LMFA series

