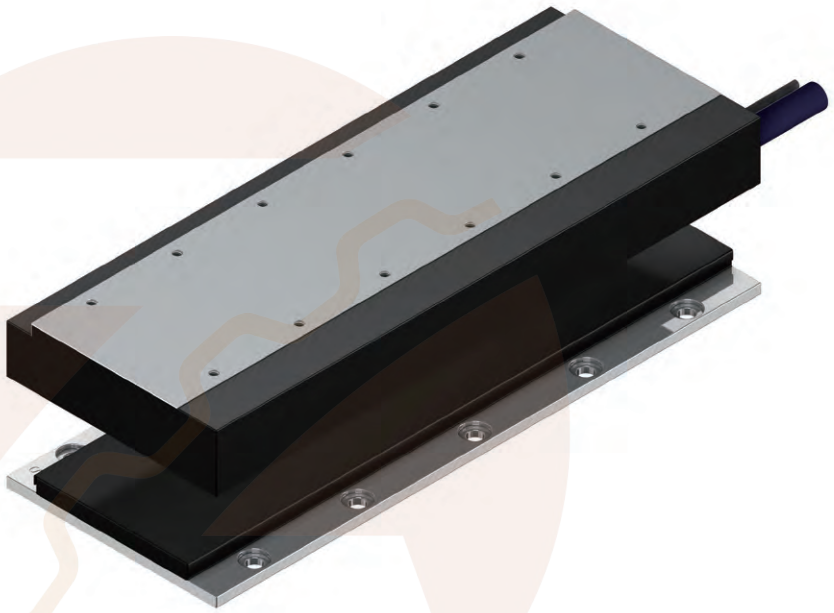
HIWIN®
Motion Control and System Technology



IRON-CORE Linear Motor

Installation Manual

CONTENTS

1. INSTALLATION AND SAFETY GUIDE

	**CAUTION**	**Before using this product, be sure to read and understand the user manual. Strictly adhere to the statements given in the manual. HIWIN is not responsible for any damage, accident, or injury caused by incorrect handling.**

- **Precautions and Warning**

1. Before installing and operating this product, perform a cosmetic inspection. If there are any signs of damage, please contact HIWIN customer service or local agent.
2. The product designs are based on structural calculations, computer simulations and experimental testing. Do not disassemble or modify product without permission from HIWIN.
3. Keep product out of reach of children.
4. Anyone with a pacemaker or A.I.C.D is prohibited from using this product.
5. The product should be operated only by personnel with experience and technical knowledge.

- **User Guide Criteria**

1. Stator assembly has strong magnet field, handle with care.
2. Keep magnetic storage media or precision instruments away from the product to avoid damage caused by magnetic fields. (i.e. magnetic scale, watch, credit card and magnetic response device).
3. Precautions should be taken for ESD (Electrostatic Discharge), like wearing gloves, shoes, etc.
4. The product should be installed and operated by specialized personnel.
5. During assembly, avoid using magnetic tools and screws.
6. During assembly of stator to system structure, keep any magnetic material at a distance to prevent the risk of injury to hands.
7. Put warning labels on the top surface of stator assembly for reminder of magnetic dangers.
8. Do not drag the cables while moving or placing the forcer and stator assembly.
9. Do not damage or bend the cables to avoid the electric shock.
10. Do not run the continuous current of forcer higher than specified in datasheet.
11. Be sure to confirm that there is no interference with other components in operation. Confirm that the cable bending radius is large enough to prevent reducing the life of the cables.
12. Do not touch the forcer and stator during operation.
13. Operate within specified temperature range.
14. Allow forcer to cool down sufficiently (in a 25℃ room temperature) before working around the product, to avoid burns.
15. When abnormal smell, noise, smokes and vibration are detected, press emergency stop button and turn off power.
16. The product can only be repaired by HIWIN engineers. Please send the product back to HIWIN if there are any unusual occurrences.
17. Do not change or disassemble the components yourself. HIWIN will not take responsibility for any accident or damage to the forcer and stator caused by this.

18. Clean stator surface by using disposable cotton rags and cleaning liquid such as isopropanol alcohol (95% Vol.). It is suggested to clean surface once every three months or once every two weeks in high fume formation rate facilities with machines such as PCB machines or drilling machines.
19. A one year guarantee is provided from the date of delivery. HIWIN will not be held responsible for replacing or maintaining product which has been incorrectly handled (please refer to the notes and instructions in the operation manual) or damaged from natural disasters.

2. MECHANISM INTERFACE ACCURACY

2.1 PRECISION OF LMS/LMSA/LMF/LMFA SERIES MECHANISM INSTALLATION

Observe dimension of the gap between forcer and stator after assembly. It will impact linear motor performance and reliability. A well designed positioning stage and proper tolerance value will improve the stability of products. The sectional view of typical linear motor stage plate and the suggested tolerance value are below. The flatness of installation interface with stator should be 0.02mm per 300mm (Refer to Fig. 1)

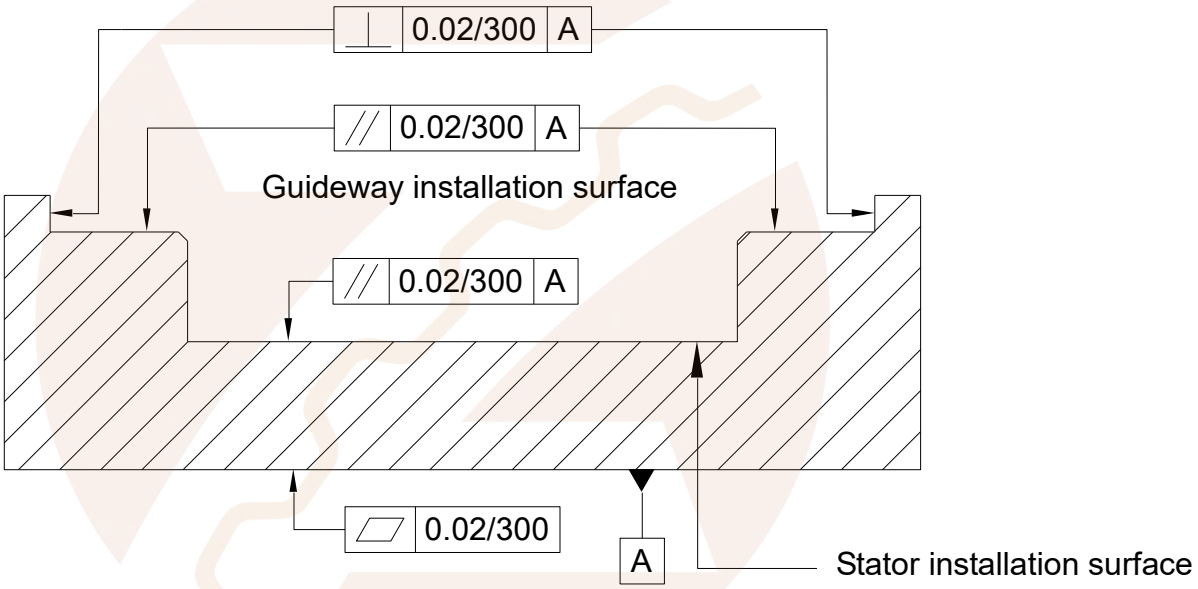


Fig. 1 The sectional view of plate

2.1 INSTALLATION DIMENSIONS FOR MOTOR

Observe the assembly total height H and the air gap G1 dimensions between forcer and stator after assembly, they will impact linear motor performance and reliability, please refer to the following tables (Table 1&Table 2). The types of stators are stainless cover and epoxy.

2.2.1 LMS/LMSA IRON-CORE LINEAR MOTOR

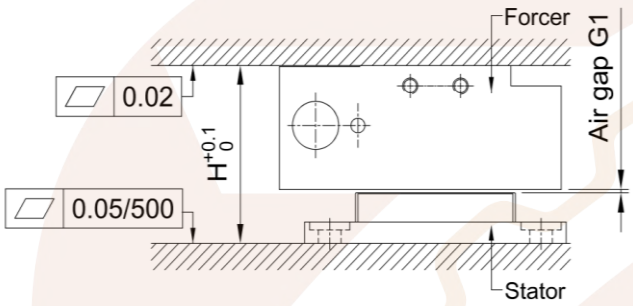


Fig. 2 LMS/LMSA linear motor assembly

TYPE	DIMENSIONS (mm)		
	H	G1	
		Stainless cover	Epoxy
LMS□3	55.2	0.7+0.4/-0.3	
LMS□7	57.4		
LMSA1□	34	0.6+0.35/-0.15	0.6±0.2
LMSA2□	34		
LMSA3□	36		

Table 1. LMS/LMSA assembly dimensions

2.2.2 LMF/LMFA LINEAR MOTOR WITH WATER-COOLING

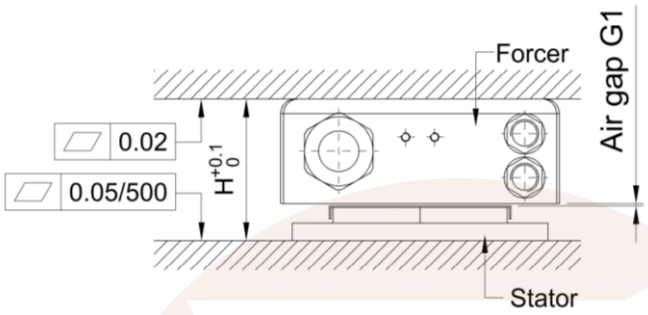


Fig. 3 LMF/LMFA linear motor assembly

TYPE	DIMENSIONS (mm)		
	H	G1	
		Stainless cover	Epoxy
LMF0□	48.5	0.9+0.4/-0.3	1.4±0.2
LMF1□	48.5		
LMF2□	50.5		
LMF(A)3□	64.1		
LMF(A)4□	66.1		
LMF(A)5□	64.1		
LMF(A)6□	66.1		

Table 2. LMF/LMFA assembly dimensions

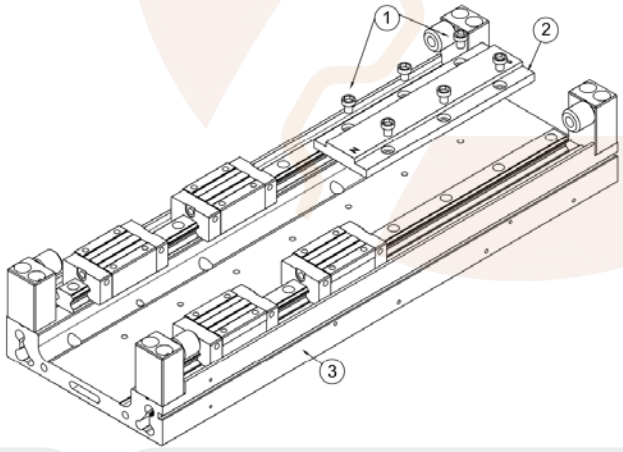
3. INSTALLATION STEPS - LMS/LMSA/LMF/LMFA IRON-CORE LINEAR MOTOR

Note：There is a strong magnet field between forcer and stator (hundreds of kilograms). Technician should follow the following instructions to handle with care.

3.1 INSTALLATION OF THE STATOR

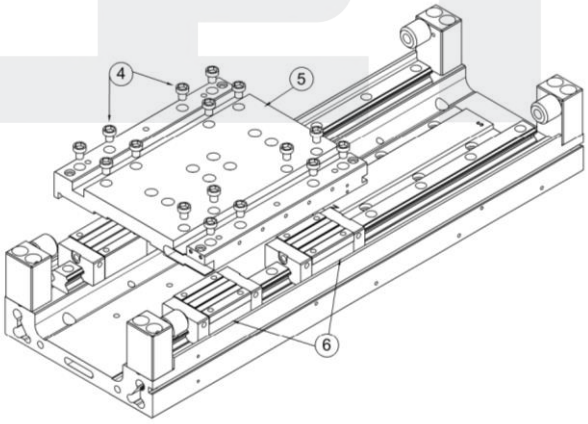
Install one side of stator. Please note the flatness of guideway and stator. Install stator ② on stage ③ by using screw ① .

Note:
1. Warning label of stator is required to be placed on the top surface of stator.
2. The max. borehole depth of stator screw should be in accord with the screw holes of stage. For min. borehole depth of stator screws, please refer to Appendix A.



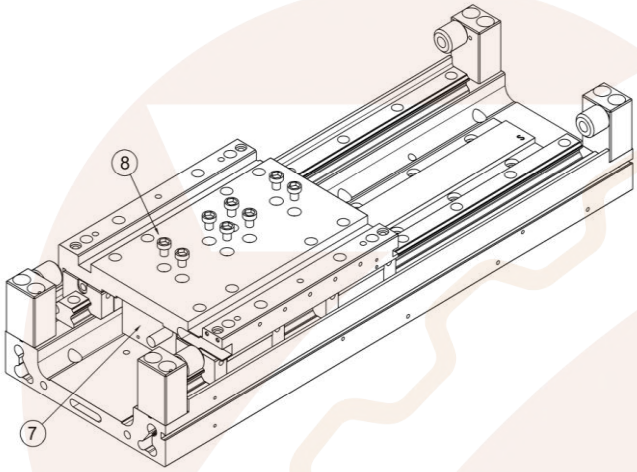
3.2 INSTALLATION OF THE FORCER PLATE AND FORCER

Install forcer plate ⑤ on a guide block ⑥ by using screw ④ .



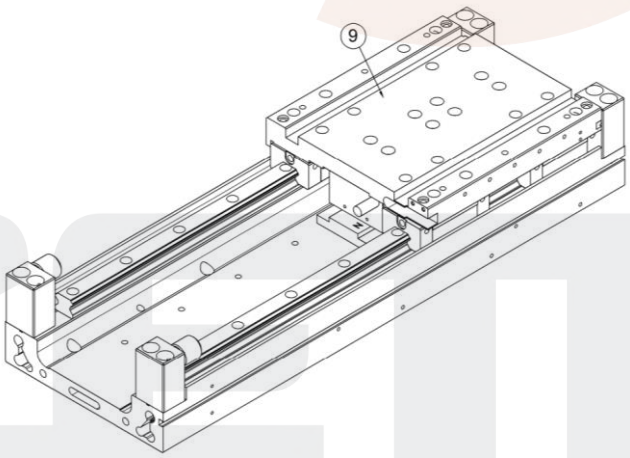
Install forcer ⑦ on forcer plate by using screw ⑧ .

Note:
1. Observe the dimensions between forcer and stator after assembling, they will impact cogging force and thrust of motor. Please refer to (2.2.1-2.2.2).
2. Refer to Appendix B for the max. threaded hole depth of forcer. Refer to Appendix C for borehole depth of forcer screws.



3.3 MOVE FORCER PLATE AND FORCER

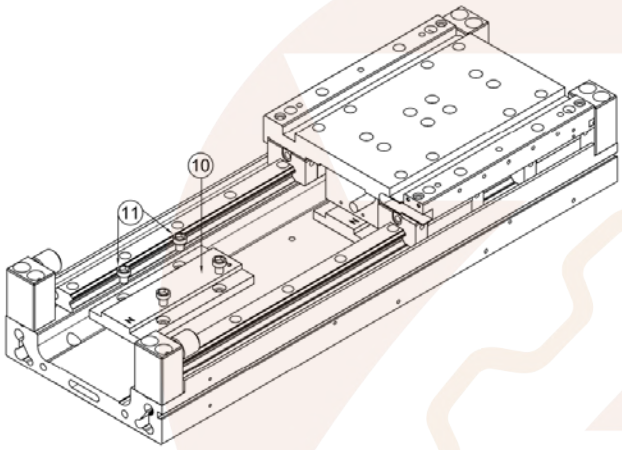
Move forcer plate ⑨ to other side to ease installation of stator.



3.4 INSTALLTION OF STATOR

Install stator ⑩ on stage by using screw ⑪. Check that the forcer can move freely over the entire stroke after assembly is finished.

Note:
1. The max. borehole depth of stator screw should be in accord with the screw holes of stage; For min. borehole depth of stator screws, please refer to Appendix A.
2. Refer to Appendix D for screw torques table to assemble stator and forcer.

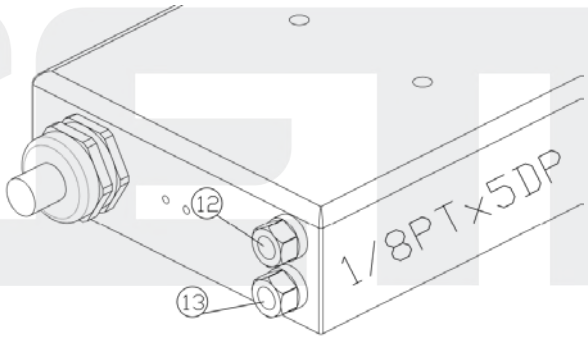


3.5 INSTALLATION OF QUICK COUPLING (FOR LMF/LMFA)

Water-cooling connection ⑫ is the inlet hole.

Water-cooling connection ⑬ is the outlet hole.

Note:
1. Use torque wrench(maximum torque should not over 100 kgf-cm) to install quick coupling(1/8 Pipe Thread) into water-cooling connector. Bind quick coupling(1/8 Pipe Thread) with white thread seal tape to avoid leaking. Improper installation may cause the water-cooling connector to be damaged or broken.
2. Max. pressure of water-cooling loop: 10 bar.



3.6 FLOW RATE OF WATER-COOLING SYSTEM (FOR LMF/LMFA)

The flow rates of LMF/LMFA linear motor with water-cooling system are in the following table. The internal diameter of LMF 0~2 series is 4mm and LMF(A) 3~6 series is 6mm.

Type	Flow rate(L/min)	Internal diameter(mm)
LMF01	3.3	4
LMF02	3.3	
LMF03	3.3	
LMF11	3.3	
LMF12	3.7	
LMF13	3.7	
LMF14	3.7	
LMF21	4.0	
LMF22	4.0	
LMF23	4.0	
LMF24	4.0	
LMF(A)31	4.0	6
LMF(A)32	5.2	
LMF(A)33	5.7	
LMF(A)34	6.2	
LMF(A)41	5.2	
LMF(A)42	5.2	
LMF(A)43	5.7	
LMF(A)44	6.2	
LMF(A)52	6.3	
LMF(A)53	6.8	
LMF(A)54	7.3	
LMF(A)62	6.8	
LMF(A)63	7.3	
LMF(A)64	7.8	

APPENDIX A. MINIMUM BOREHOLE DEPTH OF STATOR SCREW

(Refer to DIN912, bolt strength class 10.9)

Material	EN GJL-250	EN GJL-300	EN GJS-600-3	G-ALZN10Si8Mg	St 37	St 50
Borehole depth	1.4˙d	1.3˙d	0.7˙d	2.8˙d	1.8˙d	1.3˙d

APPENDIX B. SPECIFICATION OF THREADED HOLE FOR FORCER AND STATOR

Forcer of LMS series	
LMS□3/□7(L)	M6x1Px9DP
Stator of LMS series	
LMS□S□	Φ6.5THRU;Φ11x4DP

Forcer of LMSA series	
LMSA□□(L)	M4x0.7Px4DP
Stator of LMSA series	
LMSA1S□(E)	Φ4.5THRU;Φ8x1.5DP
LMSA2S□(E)	Φ5.5THRU;Φ10x1.5DP
LMSA3S□(E)	Φ5.5THRU;Φ10x3.5DP

Forcer of LMF/LMFA series	
LMF0□(L)~ LMF2□(L)	Φ6x3DP;M5x0.8Px10DP
LMF(A)3□(L)~ LMF(A)6□(L)	Φ9x3DP;M8x1.25Px11DP
Stator of LMF/LMFA series	
LMF0S□(E)	Φ4.5THRU;Φ8x2DP
LMF1S□(E)	Φ5.5THRU;Φ10x1.5DP
LMF2S□(E)	Φ5.5THRU;Φ10x3.5DP
LMF3S□(E) LMF4S□(E)	Φ9THRU;Φ15x6DP
LMF5S□(E) LMF6S□(E)	Φ9THRU;Φ15x6DP Φ6.5THRU;Φ10.5x6DP

APPENDIX C. MINIMUM BOREHOLE DEPTH OF FORCER SCREW

Series	Borehole depth
LMSA	0.9˙d
LMS/LMF/LMFA	1.2˙d

APPENDIX D. TABLE OF SCREW TORQUES FOR ASSEMBLY OF FORCER AND STATOR

(Refer to DIN912, bolt strength class 10.9)

Screw size	Torque (kgf-cm)
M3x0.5P	18.66
M4x0.7P	43.54
M5x0.8P	88.1
M6x1.0P	149.89
M8x1.25P	363.01