



# **Linear Motor Installation Guide**

**Ironless & Iron Core**

**Ver. 1.1**

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## Revision History

Revision	Date	Description	Remarks
1.0	July, 2018	Initial release	--
1.1	August, 2018	First revision	Change of wording.

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# 1. How to Use This Guide


Before operating the motor, please read through this manual carefully, especially the sections of Important Notice, Safety Notice, and Installation Notice.

## 2. Ironless Motor Installation

### 2.1 Before You Start

#### 2.1.1 Important Notice

-  Read carefully before you install or operate the motor. The manufacturer declines all responsibilities in case of accident or damage caused by improper use of the motor, by negligence of the instructions, or by usage conditions that differ from as described. See Disclaimer.
-  Magnetically sensitive objects—such as banking cards, pacemakers, or other magnetic information carriers—may be damaged if brought within 1 meter of the magnetic parts of linear motor.
-  Handle the linear motor parts carefully, packed or unpacked. Pay attention that the magnets of the stator are sensitive to mechanical shocks. Never drop a stator or release it in an uncontrolled way.
-  Do NOT expose magnets to temperatures higher than 70 °C. The magnets may be demagnetized.

5.  Unpack the product and check its integrity. If there is any defect, note down serial number and contact the dealer or manufacturer.

## 2.1.2 Safety Notice

### Strong magnetic field



1. The magnets of stator hold huge attraction forces toward soft magnetic object (such as iron). This force cannot be controlled by hand, it may cause serious dangers, such as crush injuries—especially fingers—or fractures. Do NOT carry any soft magnetic objects within 30 cm of stator.
2. Stators **do attract one another** while mounting. Make sure that the metal frame of a stator does not damage the magnets of neighbor stators.
3. When installing, do NOT use magnetic tools and screws.

## Caution



1. Installing and operating the motor has to be done by qualified professional personnel. If at any time and in any situation there is any doubt about the safety of motor, do not use it and contact your supplier.
2. Do not apply to the motor a continuous current that is over the rated limit.
3. The linear motor is powered by a servo drive. The motor may perform uncontrolled movements (such as free run) due to electricity cutout or fatal fault. Take mechanical precautions to avoid damage on the motor or machine in such events.
4. Cable maintenance:
  - Do NOT drag cables while taking up or placing a forcer.
  - To avoid electric shock, do NOT squeeze cables together.
  - Reserve space for cable bending radius when installing.  
Make sure cables will not interfere with other objects during motor operation; to prevent such case, drag chains are recommended.
5. During operation, if any abnormal smell, noise, smoke, heat, or unusual vibration occurs, stop the operation and shut down power immediately.
6. Use only isopropanol as cleaning agent. Using non-prescribed cleaning agent can damage forcer and stator.
7. cpc provides a year's warranty since ex-work date. It is not cpc's responsibility to repair or replace free of charge if the damage is caused by improper use (please refer to notes in this manual) or by natural disaster.



## Electricity



1. Before installing the motor, make sure the supply mains are earthed and operate in compliance with regulations in force.
2. When installing forcers, do NOT connect the power supply so as to avoid electric shock.
3. Make sure there is an effective Protective Earth (PE). Before connecting, ensure that there is no voltage at the wire terminal.
4. An earth connection does not work on non-conducting mounting surfaces like granite. In these cases, the protective earth must be established by an earthing wire.
5. Cut off voltage to clear the system before you carry out inspection or maintenance. Make sure there is no possibility of accidental connection.
6. Take measures against static electricity, such as gloves and shoes.

## Heat



1. Do not touch forcers or stators while machines are operating. Make sure the operation temperature complies with regulations.
2. If you need to remove a forcer after the machine stops running, wait first for the machine to cool down in room temperature to 25 °C to avoid burns.

## 2.2 Installation Notice for Ironless Linear Motor

- Install the base (see 2.2.1) first before installing the linear motor parts.
- The slider should be provided with blocks, dampers (or called stopper blocks), limit switch, and wiring to make sure its movement on the whole stroke is smooth, safe and well-positioned. See chapter 2.2.1.
- The ruler should be properly positioned and fastened on the base.
- Test operating the blocks and dampers, and check if the drag chain moves smoothly.
- Note the surface requirements of the base before installing the linear motor. See chapter 2.2.2.

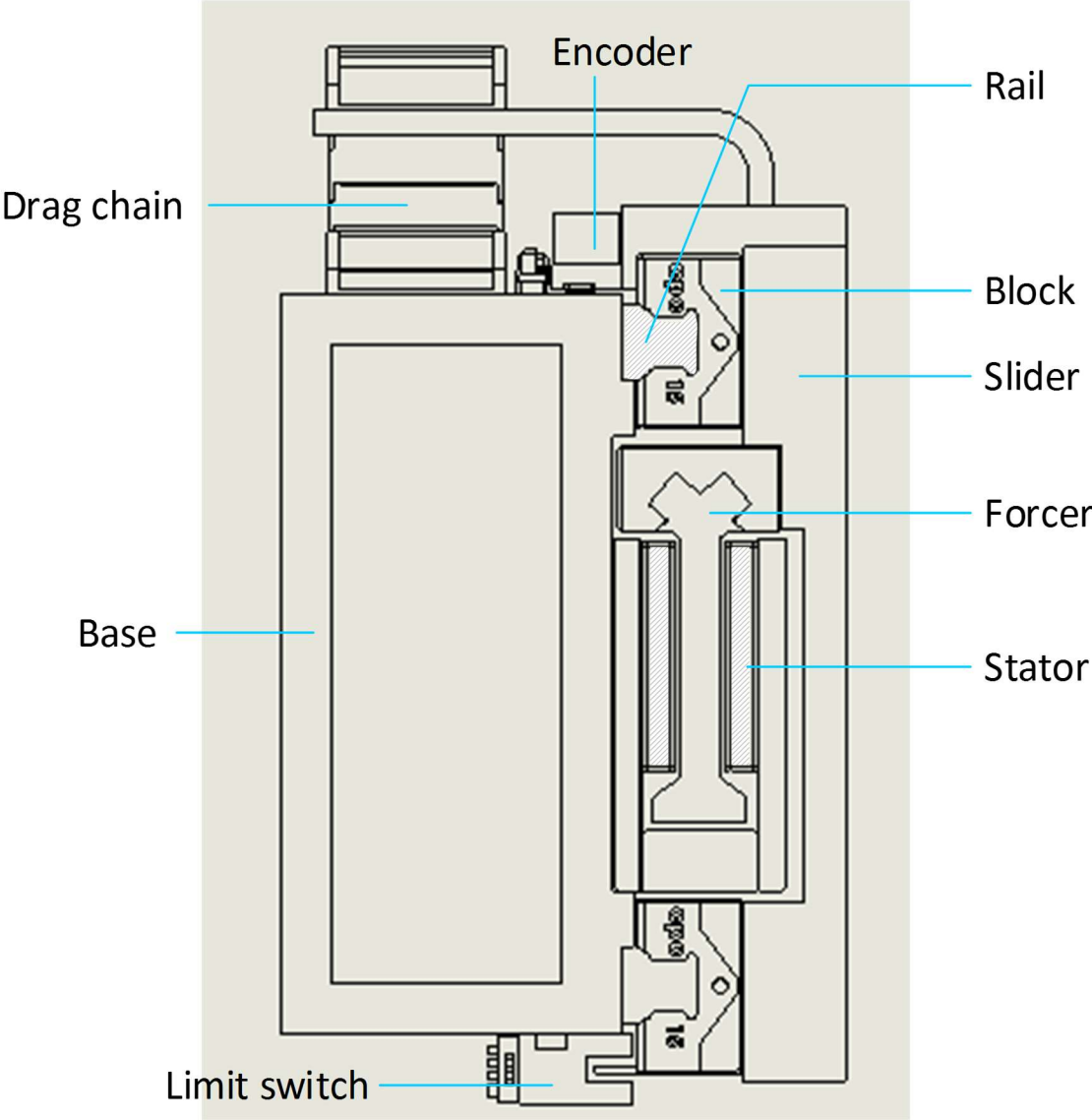
From a magnetic point of view, the installation order is not crucial because there is no attraction between the forcer and the stator at this moment.

**For electrical safety, the installation order of ironless linear motor is:**

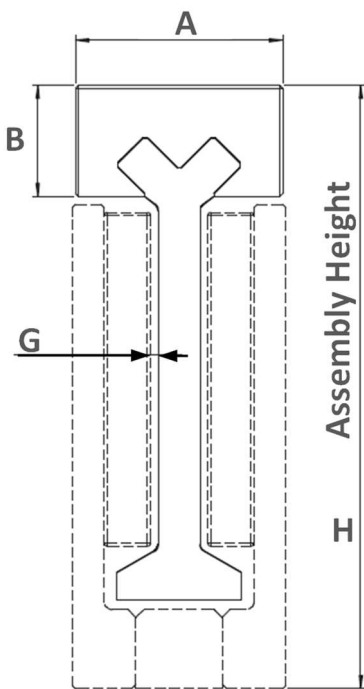
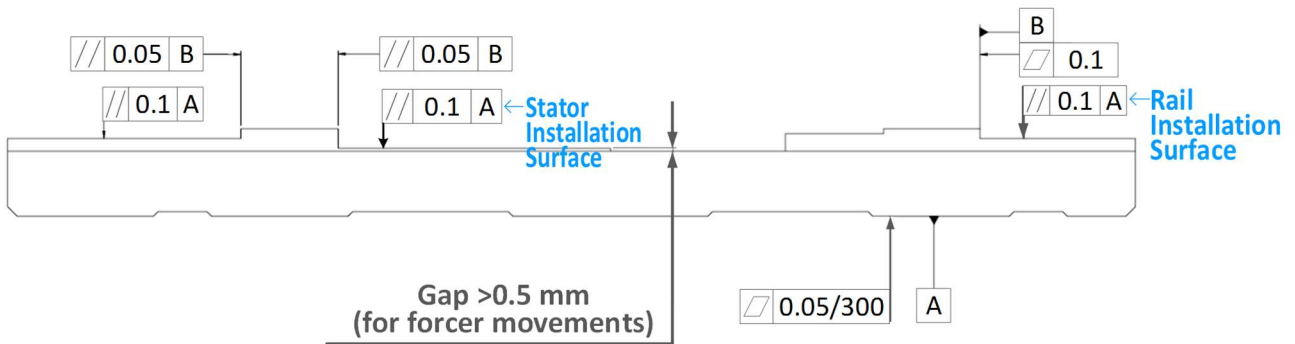
1. Install the forcer to the involved machine parts.
2. Mount the stator onto the base.
3. Connect cables to the forcer.

More detailed information is given in subsequent chapters.

### 2.2.1 System Assembly Diagram (example)



## 2.2.2 Installation Surface Tolerances



Model \ Size (mm)	A	B	G Air Gap	H Assembly Height ( $\pm 0.3$ )
PM	13.4	6.5	0.35	37.5
PA	22	9	1	52
PA-X	22	9	0.5	52
PB	32	16.5	1	87
PB-X	32	16.5	0.5	87
PD	51	22	1	138
PD-X	51	22	1	138
PDL	50	21	1	122
PE-X	38	15.5	1	95

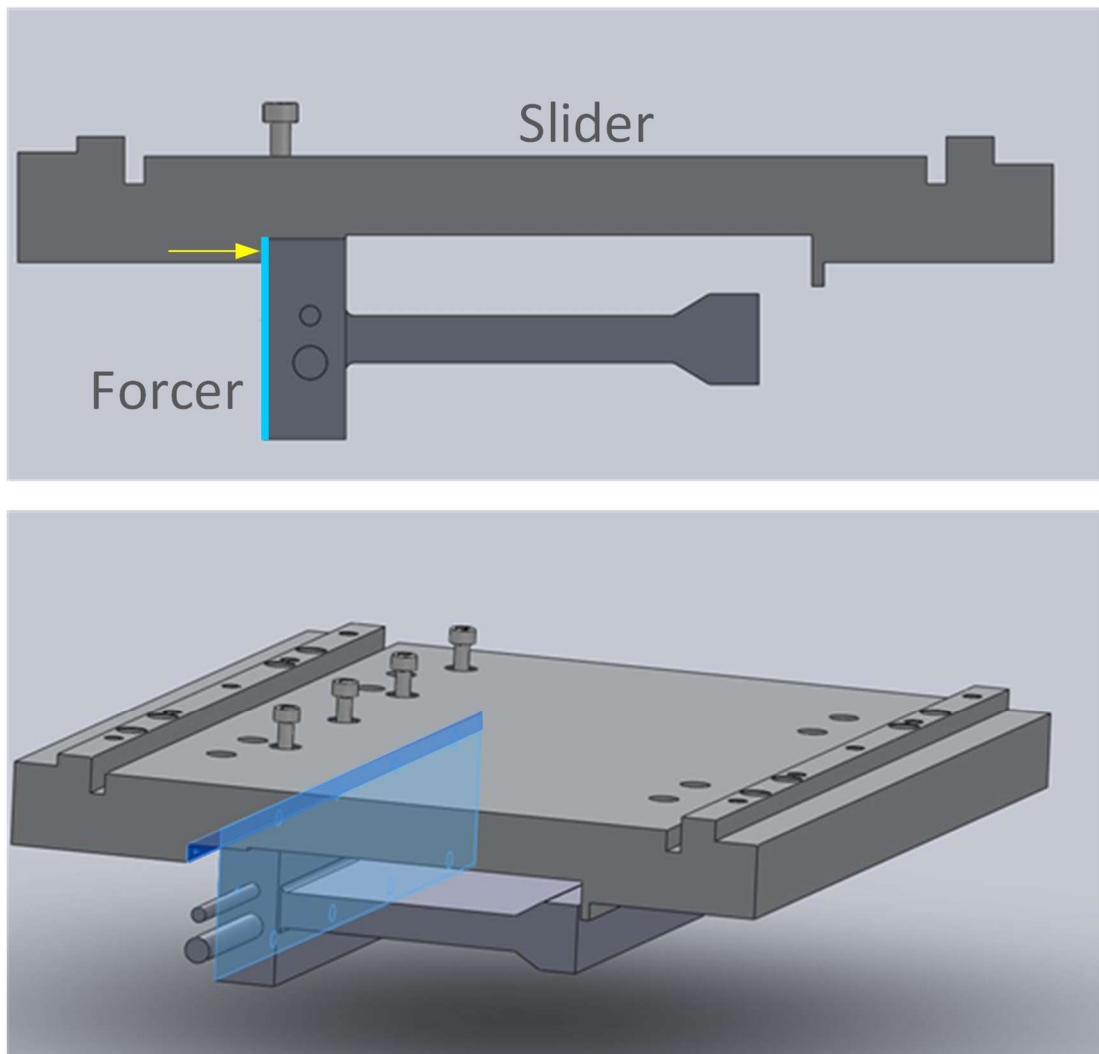
## 2.2.3 Installation Steps (Ironless)

### Step 1

Clean the base.

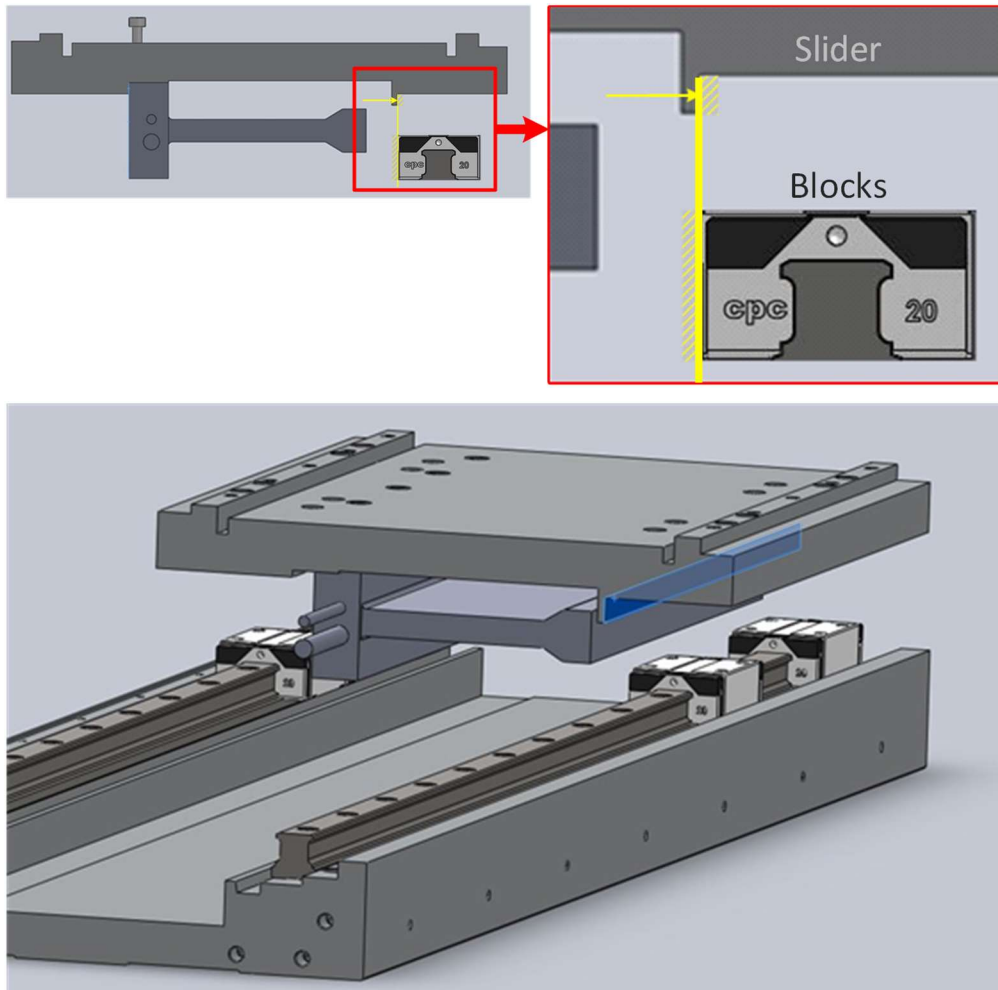
### Step 2 Forcer to Slider

Align the reference planes (shown in blue color) of forcer and slider.  
Next, install forcer to slider.



### Step 3 Slider to Blocks

- (1) On one end of base, align the reference planes of slider and blocks (see zoom-in window and the blue area); then install slider onto blocks.



- (2) Secure slider against unwanted movements.

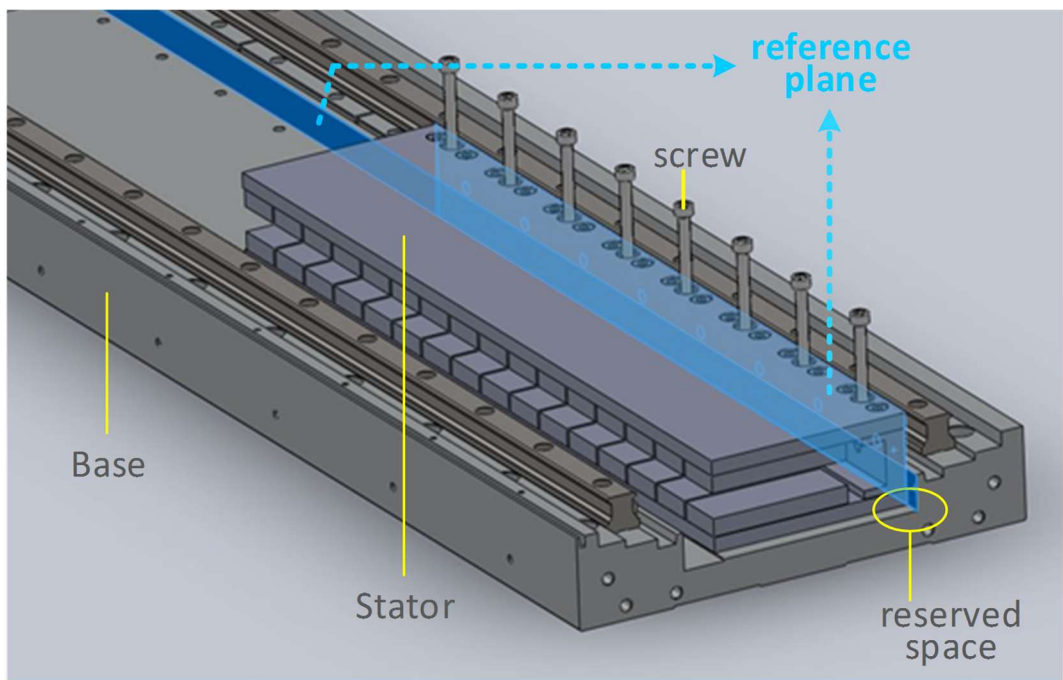
**Step 4** Install First Stator(s)

- (1) Remove spacer from one stator.



- (2) Reserve space on the edges of base for stopper blocks and dampers.

- (3) On **the other end** of base, align the reference planes (shown as dark/light blue areas) of the first stator and the base; then screw the first stator to the base.

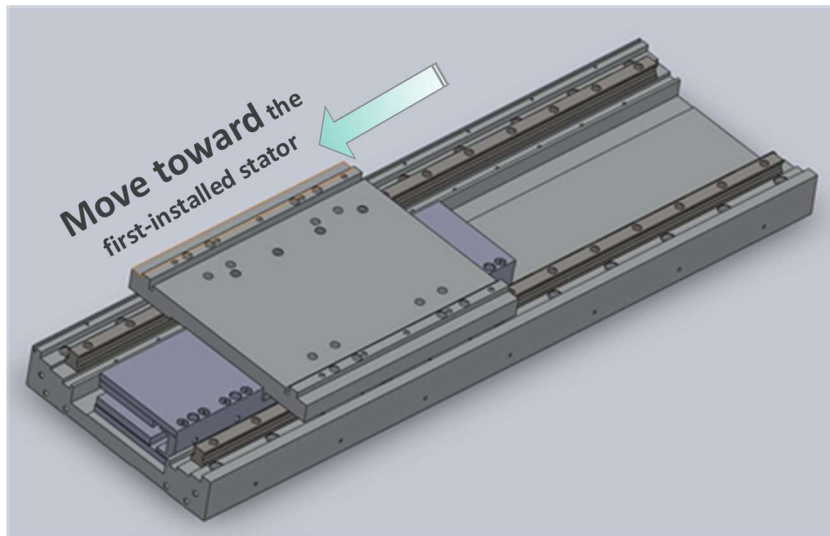


- (4) If slider is longer than a (piece of) stator, install multiple stators until their total length is within this range:

$$\text{slider} \leq \text{stators} < (\text{slider} + \text{one stator})$$

### Step 5 Move slider to one end

- (1) Gently move slider above the whole area of the first-installed stator(s).  
Make sure slider does not exceed this area.



- (2) Install the remaining stators **next to** the first-installed stator(s),

### Alignment Description

Make sure that the forcer and the stator do not interfere with each other and that the air gap between them meet as described by the table in chapter 2.2.2.

### Temperature Protection

The cpc ironless linear motor uses PTC temperature sensor with threshold at **110 °C**. See **Appendix C1** for temperature-resistance chart.



# 3. Ironcore Motor Installation

## 3.1 Before You Start

1. Read chapter 2.1.1 and 2.1.2 carefully.
2. Keep the forcer of ironcore motor at least **30 cm away** from the stator.

**Caution:**

The forcer of ironcore motor contains magnetic material.

## 3.2 Installation Notice for Ironcore Linear Motor

- Prepare an Allen Key set before installing. It is for screwing up the forcer as well as the metal plate of stator.
- Use non-magnetic tools to avoid damage to forcer and stators.
- Prepare specific tools to connect wire terminals to the power and the sensor cable. Consult your wire terminal supplier about what tool is required.
- **Note:**  
Install the base before installing linear motor parts. The rail as well as the ruler should be properly positioned and fastened on the base.  
Further, the slider should be provided with blocks, dampers (or called stopper blocks), limit switch, and wiring to make sure its movement on the whole stroke is smooth, safe and well-positioned. See chapter 3.2.1.

**Order of installing ironcore linear motors:**

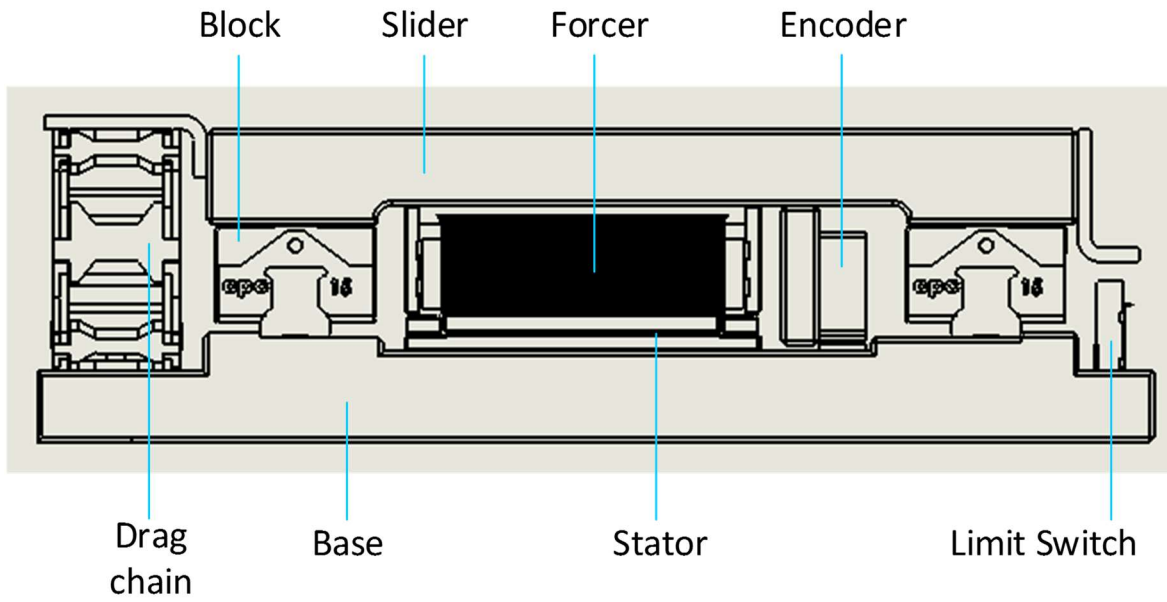
1. Install forcer to slider.
2. Move slider to one end. Secure slider from unwanted movements.
3. On the other end, away from the forcer, install the first piece(s) of stator to the base.

**Make sure stators are covered with protection plates. Keep stators at least 10 cm away from forcer.**

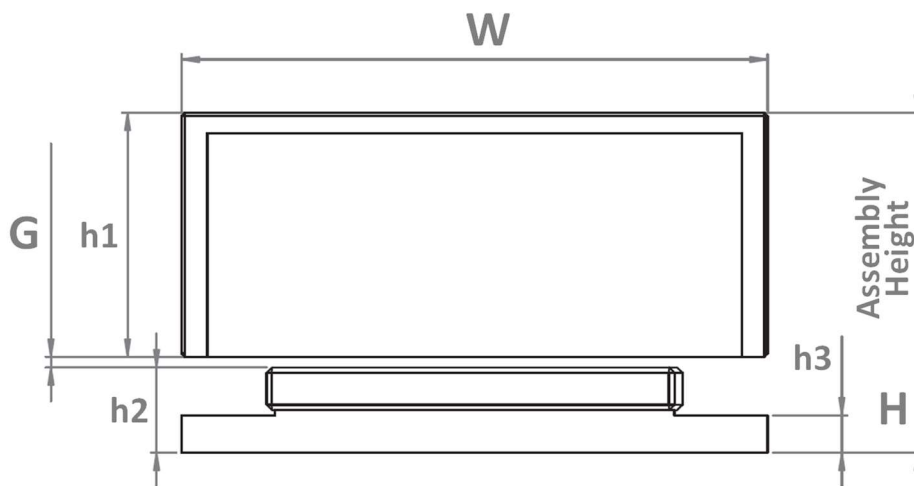
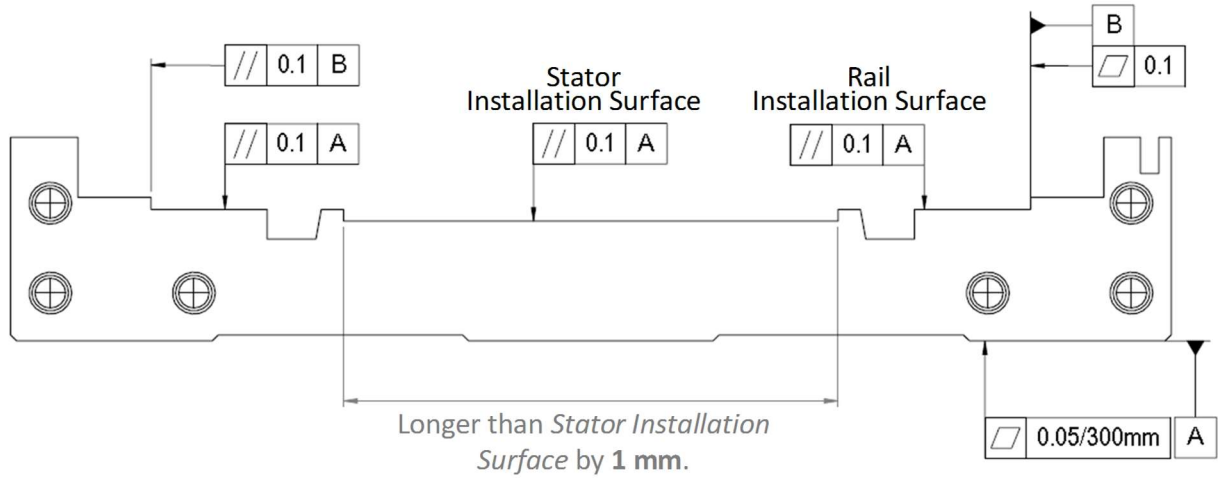
4. Remove the protection plates from the newly-installed stator(s).
5. Move slider slowly above the newly-installed stator(s). Secure slider from unwanted movements.
6. Mount the rest of stators; **make sure stators are covered with protection plates.**
7. (Optional): Install and earth the stainless cover plate.
8. (Optional): Connect the water-cooling.
9. Connect the wirings.

**See further installation details in subsequent chapters.**

### 3.2.1 System Assembly Diagram (example)



### 3.2.2 Installation Surface Tolerances



Size(mm)	W	G	H	h1	h2	h3
Model	Assembly Width	Air Gap	Assembly Height			
CA-55 / 75 / 115	55 / 75 / 115	1	32	23	8	3.5
CB-60 / 80 / 120	60 / 80 / 120	1	45	35	9	3.5
CC-60 / 80 / 120	64 / 84 / 124	1	55	44	10	3.5

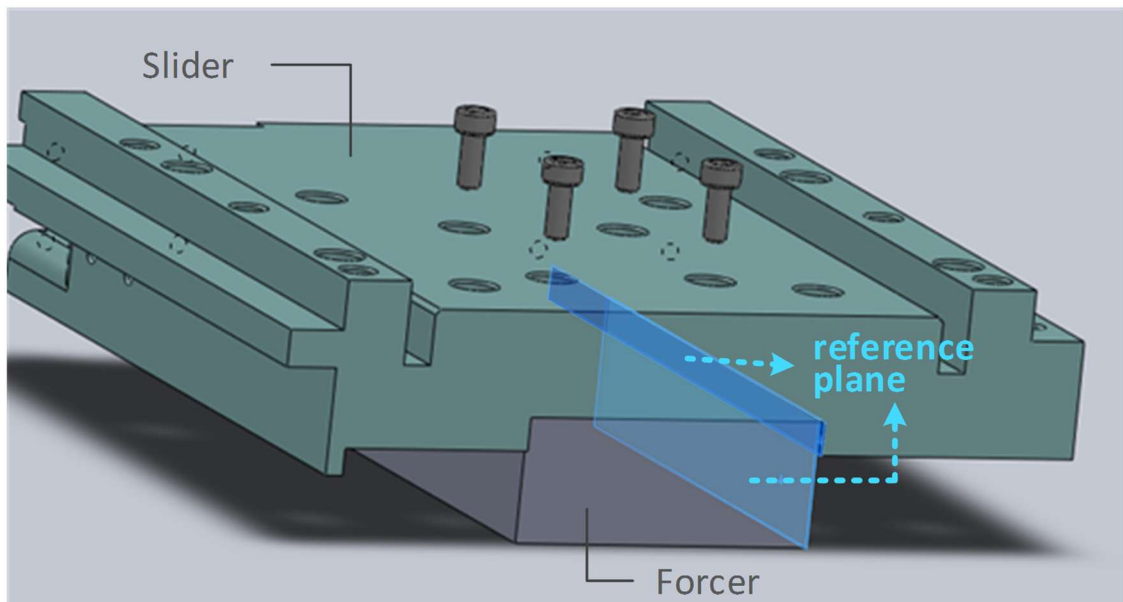
### 3.2.3 Installation Steps (Ironcore)

#### Step 1

Clean the base.

#### Step2 Forcer to Slider

Align the reference planes (shown as blue areas) of forcer and slider.  
Install forcer to slider.



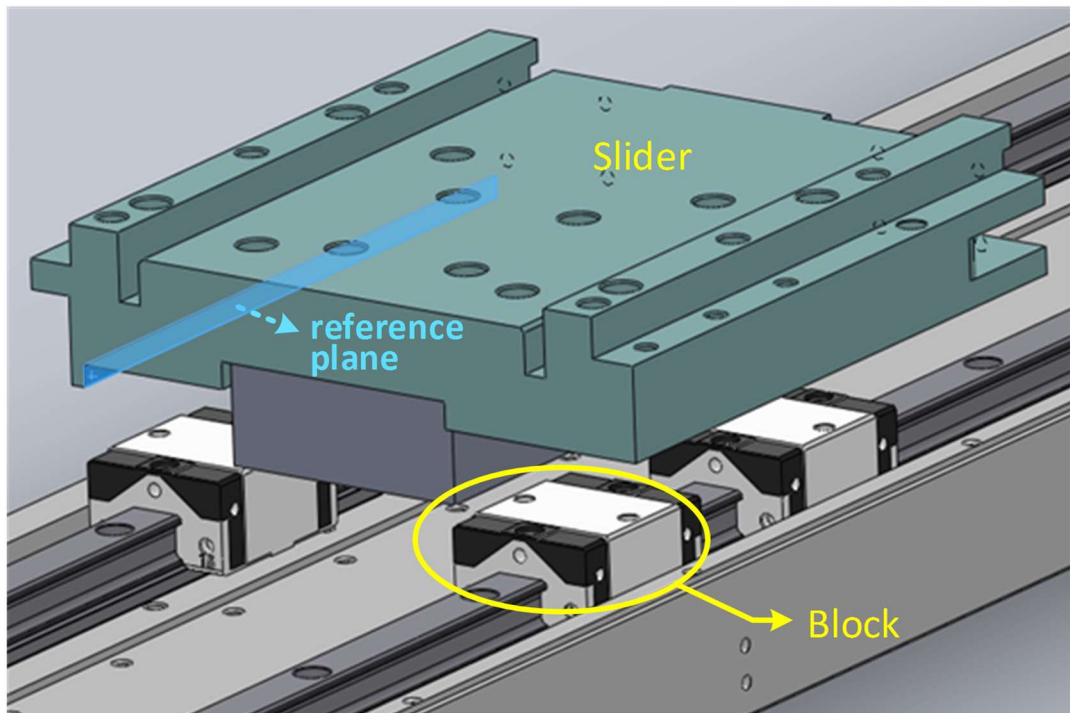
### Step 3    Slider to Blocks

**Note:**

**The forcer of ironcore linear motor contains magnetic materials.**

**Make sure no stators are around during this step.**

- (1) On one end of the base, align the reference planes (shown as the blue area) of slider and blocks; then install slider to blocks.



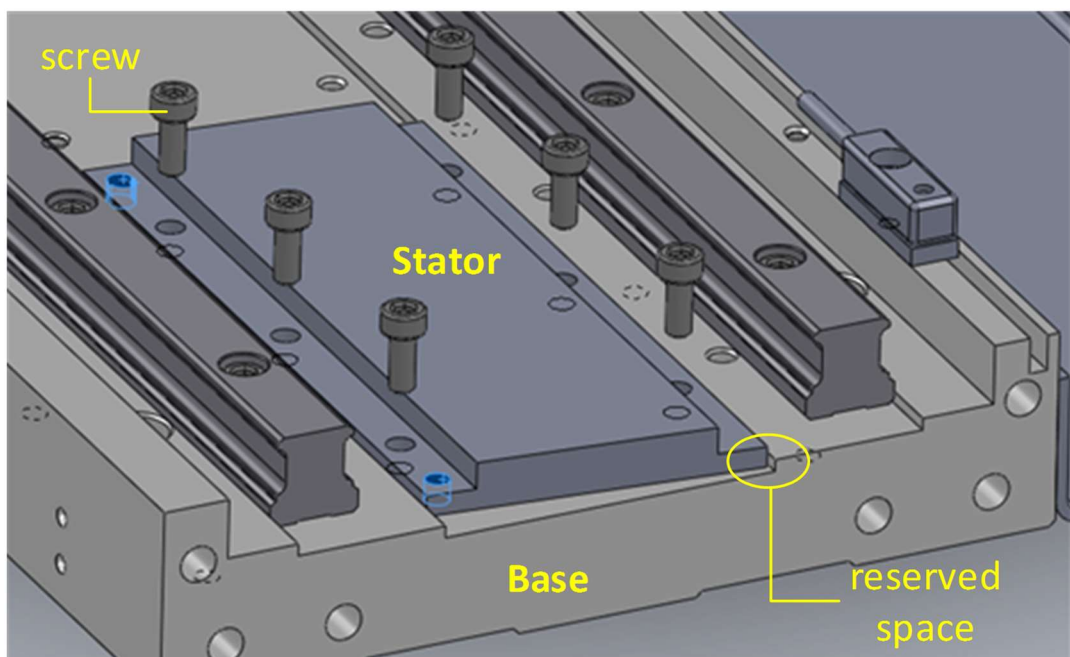
- (2) **Secure the slider from unwanted movements.**

#### Step 4 Install First Stator(s)

**Note:**

**Cover stators with protection plates at ALL times when installing stators.**

- (1) Reserve space on the edges of base for stopper blocks and bumpers.
- (2) On **the other end** of the base (away from the forcer), screw the first stator to the base.



- (3) If slider is longer than one (piece of) stator, install multiple stators until their total length is within this range:

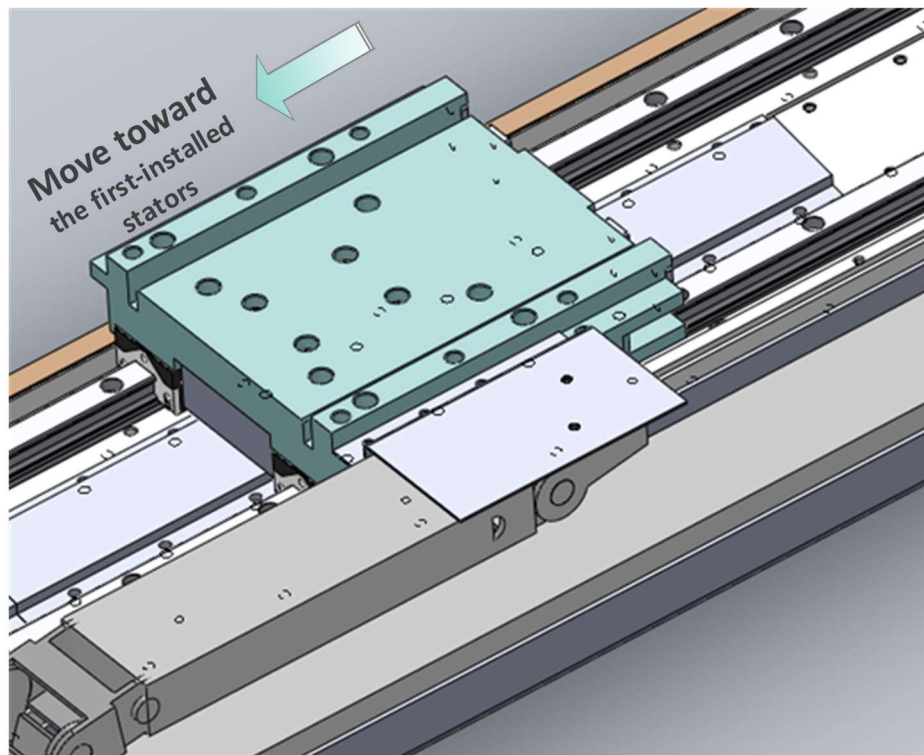
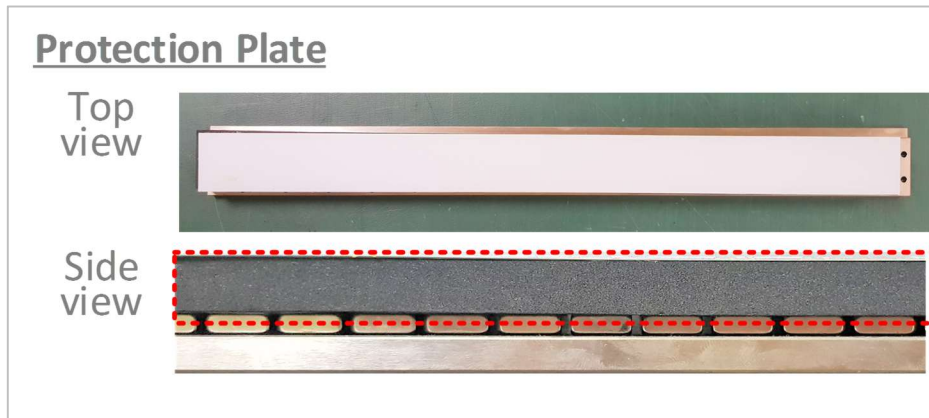
$$[\text{slider} \leq \text{stators} < (\text{slider} + \text{one stator})].$$

- (4) Cover exposed stators with protection plates.

## Step 5 Move slider to one end

- (1) Remove protection plates from the first-installed stator(s).

Gently move\* the slider above the whole area of first-installed stators, make sure the slider does not exceed this area. (\*: **Be careful, huge attraction is between forcer and stator!**)



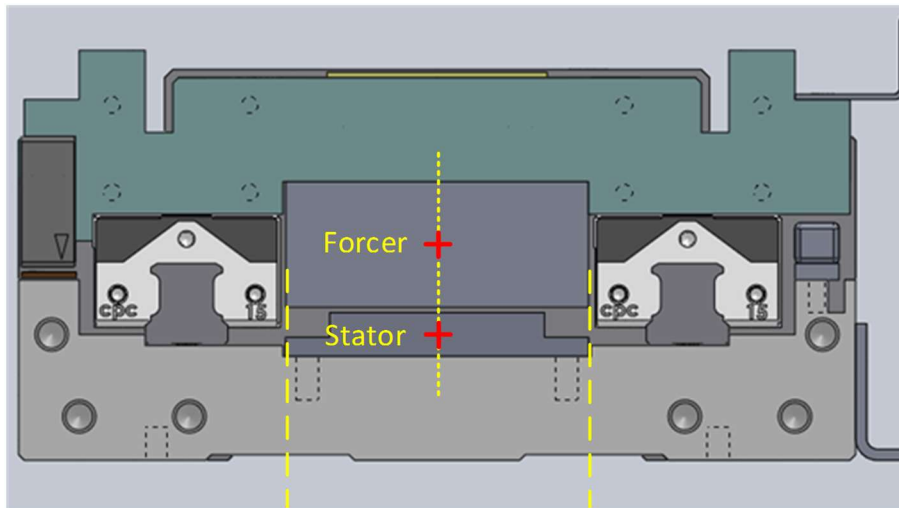
- (2) Cover the exposed stators with protection plates.
- (3) Next to the first-installed stators, install the remaining stators **without** removing protection plates.  
Wait until **all** stators are installed to remove protection plates.



### Alignment Description

The cpc design seeks to best eliminate installation hassles. As a result, there will not be size offset after aligning the forcer center with the stator center.

You will get optimal performance by simply aligning the symmetric centers of the forcer and the stator.



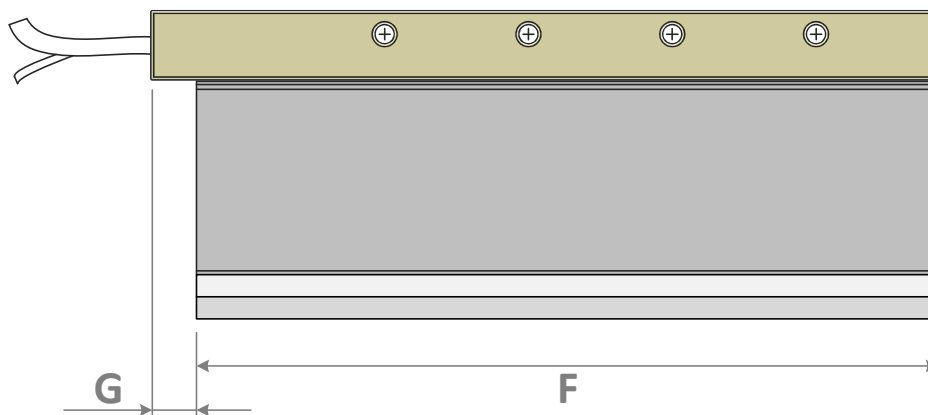
### Temperature Protection

There are 2 options of temperature sensor for **ironcore** linear motors:

- PTC sensor with threshold at 110° C (see **Appendix C1**).
- Sensor KTY84/130, only applicable for ironcore motors (see **Appendix C2**).

# Appendix

## Appendix A1: Ironless motor—Forcer effective area



Model		PM		
		2	4	6
Length (mm)				
Cable side	G	5		
Effective area	F	35	65	95

Model		PA, PA-X				
		1	2	3	4	5
Length (mm)						
Cable side	G	6				
Effective area	F	44	74	104	134	164

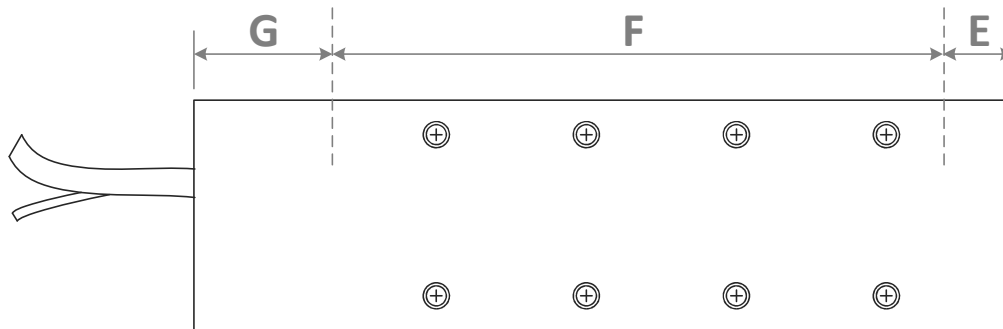
Model		PB, PB-X					
		2	3	4	5	6	8
Length (mm)							
Cable side	G	6					
Effective area	F	74	104	134	164	194	254

Model		PD, PD-X				
		2	4	6	8	10
Length (mm)						
Cable side	G	3				
Effective area	F	143	263	383	503	623

Model		PDL			
		2	4	6	8
Length (mm)					
Cable side	G	5			
Effective area	F	143	263	383	503

Model		PE-X			
		2	4	6	8
Length (mm)					
Cable side	G	5			
Effective area	F	143	263	383	503

# Appendix B1: Ironcore motor—Forcer effective area

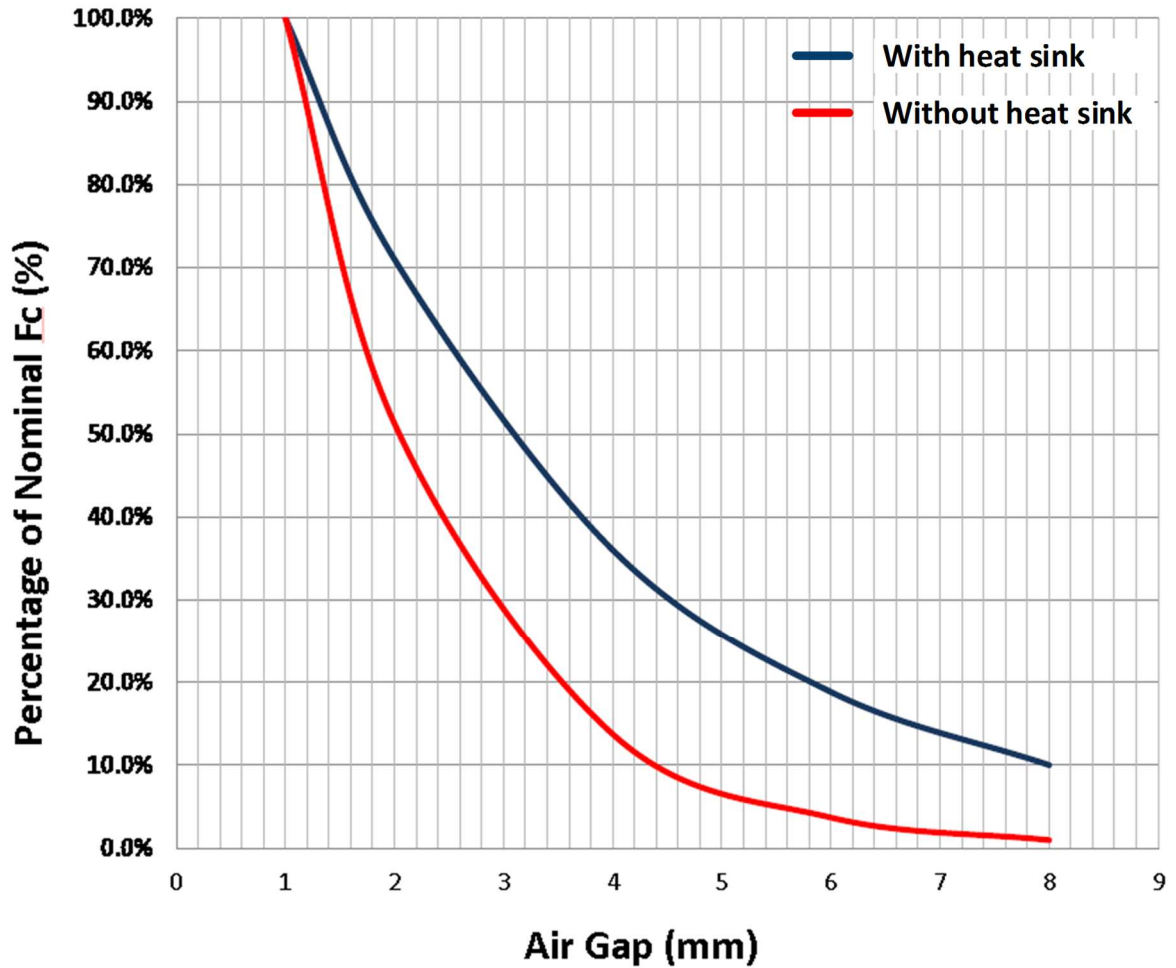


Length (mm) \ Model		CA		
		2	4	6
End	E	8.5		
Cable side	G	17		
Effective area	F	71.5	151.5	231.5

Length (mm) \ Model		CB		
		2	4	6
End	E	8		
Cable side	G	16		
Effective area	F	106	226	346

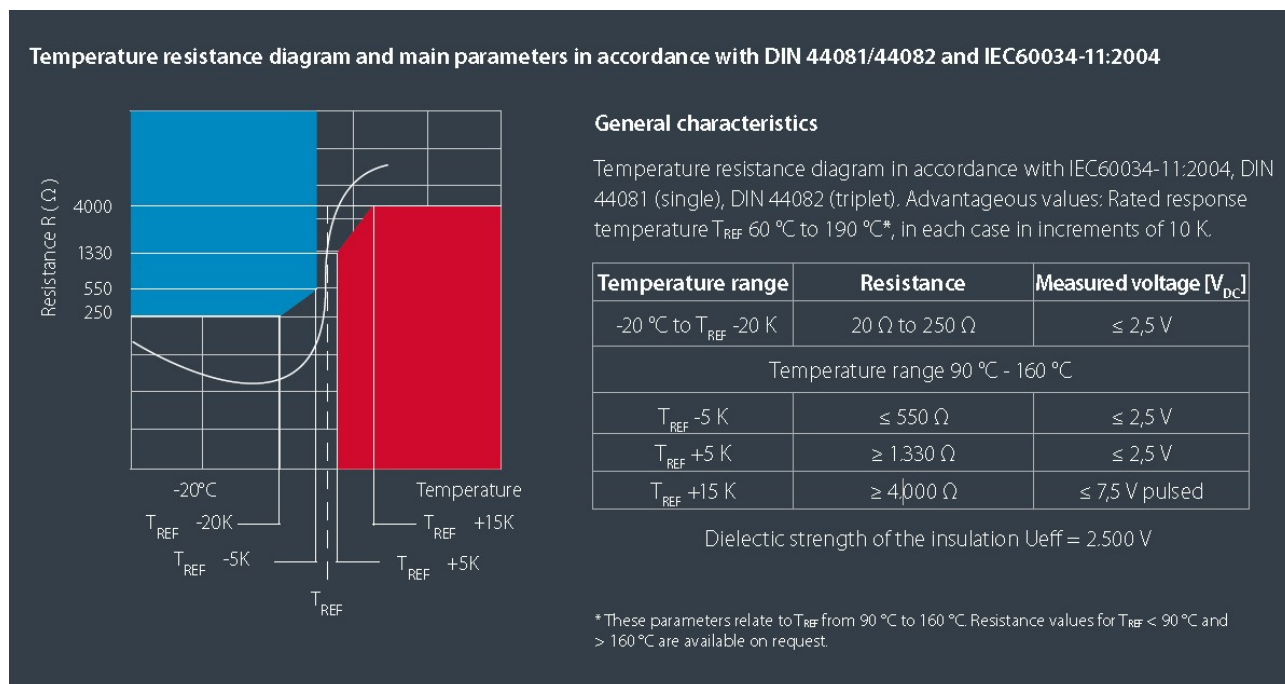
Length (mm) \ Model		CC		
		2	4	6
End	E	9		
Cable side	G	17		
Effective area	F	136	288	424

## Appendix B2: Ironcore motor—Graph of Air gap and Force



## Appendix C1: Temperature sensor—PTC

Below is information from the original supplier of PTC temperature sensor. cpc uses a temperature threshold of 110 °C.



## Appendix C2: Temperature sensor—KTY84/130

**Note:** This component is applicable **ONLY to Ironcore motors.**

Ambient Temperature		Temp. Coeff. (%/K)	Resistance ( $\Omega$ )			Temp. Error (K)
(°C)	(°F)		Min.	Typ.	Max.	
-40	-40	0.84	340	359	379	±6.48
-30	-22	0.83	370	391	411	±6.36
-20	-4	0.82	403	424	446	±6.26
-10	14	0.8	437	460	483	±6.16
0	32	0.79	474	498	522	±6.07
10	50	0.77	514	538	563	±5.98
20	68	0.75	555	581	607	±5.89
25	77	0.74	577	603	629	±5.84
30	86	0.73	599	626	652	±5.79
40	104	0.71	645	672	700	±5.69
50	122	0.7	694	722	750	±5.59
60	140	0.68	744	773	801	±5.47
70	158	0.66	797	826	855	±5.34
80	176	0.64	852	882	912	±5.21
90	194	0.63	910	940	970	±5.06
100	212	0.61	970	1000	1030	±4.9
110	230	0.6	1029	1062	1096	±5.31
120	248	0.58	1089	1127	1164	±5.73
130	266	0.57	1152	1194	1235	±6.17
140	284	0.55	1216	1262	1309	±6.63
150	302	0.54	1282	1334	1385	±7.1
160	320	0.53	1350	1407	1463	±7.59
170	338	0.52	1420	1482	1544	±8.1
180	356	0.51	1492	1560	1628	±8.62
190	374	0.49	1566	1640	1714	±9.15
200	392	0.48	1641	1722	1803	±9.71
210	410	0.47	1719	1807	1894	±10.28
220	428	0.46	1798	1893	1988	±10.87
230	446	0.45	1879	1982	2085	±11.47
240	464	0.44	1962	2073	2184	±12.09
250	482	0.44	2046	2166	2286	±12.73
260	500	0.42	2132	2261	2390	±13.44
270	518	0.41	2219	2357	2496	±14.44
280	536	0.38	2304	2452	2600	±15.94
290	554	0.34	2384	2542	2700	±18.26
300	572	0.29	2456	2624	2791	±22.12

