LinMot®

Installation Guide
Linear Motors

ENG

Montageanleitung
Linearmotoren

DE

P10-70 / P10-70-D01/02/03

Content

1 General information

1.1 Introduction

This manual includes instructions for the assembly, installation, maintenance, transport, and storage of linear motors. The document is intended for electricians, mechanics, service technicians, and warehouse staff.
Be sure to observe the general safety instructions as well as those in each chapter at all times.
Keep this manual accessible to the assigned staff.

1.2 Symbolerklärung

Triangular warning symbols warn against a danger.

Round command symbols tell what to do.

1.3 Qualified personnel

All work such as transport, installation, commissioning and service is only allowed to be carried out by qualified personnel. Qualified personnel in the sense of the safety instructions in this documentation are persons who are familiar with the transport, installation, assembly, commissioning and operation of the product and who have the appropriate qualifications.
This manual must be read carefully before transport, installation, commissioning, service and all safety-related information must be adhered to.

1.4 Liability

NTI AG (as manufacturer of LinMot linear motors and MagSpring products) excludes all liability for damages and expenses caused by incorrect use of the products. This also applies to false applications, which are caused by NTI AG's own data and notes, for example in the course of sales, support or application activities. It is the sole responsibility of the user to check the information and information provided by NTI AG regarding their safety-relevant correctness. In addition, the entire responsibility for safety-related product functionality lies exclusively with the user.Product warranties are void if products are used with stators, sliders, servo drives or cables not manufactured by NTI AG unless such use was specifically approved by NTI AG.
NTI AG’s warranty is limited to repair or replacement as stated in our standard warranty policy as described in our "terms and conditions" previously supplied to the purchaser of our equipment (please request copy of same if not otherwise available). Further reference is made to our general terms and conditions.

1.5 Copyright

2 Safety instructions

Contusions
Sliders contain neodynium magnets and have a strong attractive force.
Careless handling could cause fingers or skin to become pinched between sliders. This may lead to contusions, bruises, and bone fractures.
When handling sliders, wear thick protective gloves and keep a minimum distance between sliders. Refer to the "Minimum distance from slider" section for minimum distance.

Pacemaker / Implanted heart defibrillator
Sliders could affect the functioning of pacemakers and implanted heart defibrillators. For the duration of a strong approach to a magnetic field, these devices switch into test mode and will not function properly.

- If you wear one of those devices keep the following minimum distances between the pacemaker / defibrillator and slider:
  - Min. 250 mm (10") for slider Ø 27 mm and 28 mm (PL01-27 / 28 / PL1028)
  - Min. 150 mm (6") for slider Ø 19 mm and 20 mm (PL01-19 / 20)
  - Min. 100 mm (4") for slider Ø 12 mm (PL01-12)

- Inform others who wear these devices to comply with these minimum distances!

Caution - Risk of Electric Shock !
Before working, make sure that there are no extremely high voltages.

Fast-moving machine parts
The sliders of LinMot linear motors are fast-moving machine parts. All necessary precautions must be taken to prevent access during operation (provide covers, guards, etc.).

Automatic restart
The motors can start automatically under certain cricumstances!
If necessary, a corresponding warning symbol must be provided and protection against entering the hazardous area or a suitable safe electronic disconnection must be provided!

Risk of injury due to a defect or fault
For areas where a defect or fault can result in substantial property damage or even serious personal injury, additional external precautions must be taken or devices must be installed to ensure safe operation even if a defect or fault occurs (eg. suitable safe electronic disconnection, mechanical interlocks, barriers, etc.).

Magnetic field
Magnets integrated in the sliders produce a strong magnetic field. They could damage TVs, laptops, computer hard drives, credit and ATM cards, data storage media, mechanical watches, hearing aids, and speakers.

- Keep magnets away from devices and objects that could be damaged by strong magnetic fields.
- For the above mentioned objects, keep a minimum distance as described in the "Pacemaker / implanted defibrillator" section.
- For non-anti-magnetic watches, keep the double minimum distance.

Combustibility
When machining magnets, the drilling dust could easily ignite.
Machining the sliders and the magnets they contain is not permitted.

Burn hazard
The sliders of LinMot motors can reach temperatures of 80 °C, which may cause burns upon contact.

Grounding
All metal parts that are exposed to contact during any user operation or servicing and likely to become energized shall be reliably connected to the means for grounding.

Mechanical handling
Neodymium magnets are brittle and heat-sensitive.
Machining the sliders and the magnets they contain is not permitted.

- Colliding magnets could crack. Sharp splinters could be catapulted for several meters and cause eye injury.
- By machining the sliders, heat would result which demagnetises the magnets.

Slider
Linear Motor sliders must be handled with care, especially when not mounted inside the stator. Damaging or warping the slider can result in shortened life and/or failure of the motor. The slider is essentially a high-precision machine component consisting of neodymium magnets and plastic materials assembled in a thin steel tube. Do not use sliders which are already damaged on the surface (scratches, deformation, etc.). This can cause further damage to the stator.

Effects on people
According to the current level of knowledge, magnetic fields of permanent magnets do not have a measurable positive or negative effect on people. It is unlikely that permanent magnets constitute a health risk, but it cannot be ruled out entirely.

- For your own safety, avoid constant contact with magnets.
- Store large magnets at least one meter away from your body.

Temperature resistance
Keep slider away from unshielded flame or heat.
Temperature above 120°C will cause demagnetization.

3 Installation instructions

3.1 Operating conditions

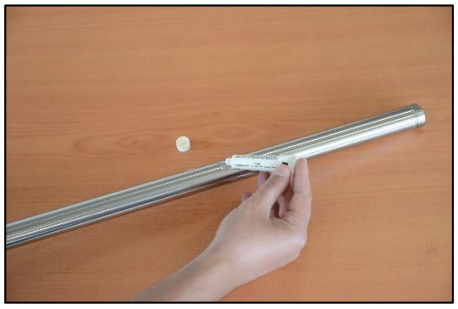
Maximum ambient temperature limits:
- 10 °C…80 °C

Internal temperature sensor error occurs at:
- 90 °C

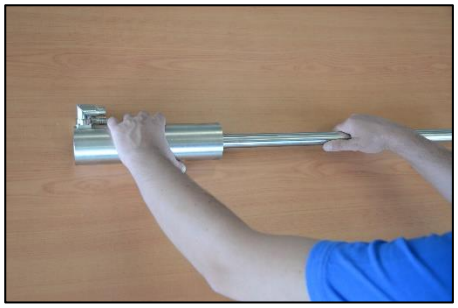
3.2 Instructions for installing the linear motor

Please attend to the safety instructions in chapter 2 during the assembling!

1. **Clean the slider with a paper towel.**

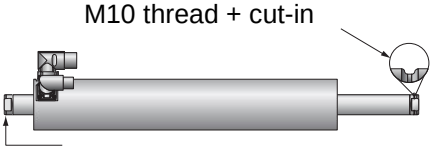


2. **Lubrication of the slider**
   Sliders with a length ≤ 500 mm are inserted without lubrication.
   Sliders with a length > 500 mm are lubricated with a grease amount of 4 g (0.14 oz) per meter, which is is about ½ of a hazel-nut.



3. **Insert the slider in the defined direction (see Assembly step 4.).**

   Attention! The slider is magnetically attracted.



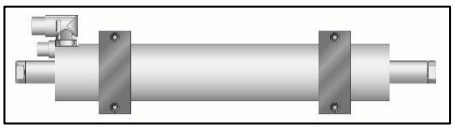
Attention! Slider back end should not be used for load mounting!

4. **Checking the installed direction of slider**
   After the installation, the front end of the slider with M 10 thread and cut-in is located at the opposite side of the stator from the cable exit.

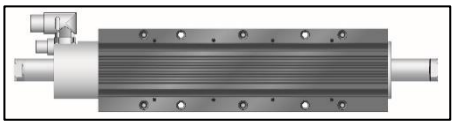
3.3 Mounting the stator

The stator is mounted by clamping. The LinMot flange (see the section 6 Accessories) or a similar flange can be used for this purpose. Most important is a broad clamping surface in order to provide good heat dissipation. Additionally, the cooling can be increased by a fan or liquid (water cooling), so that the continuous power is significantly improved.

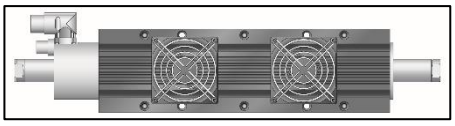
The flange clamp must not deform the stator.
Do not exceed max. torque of **16 Nm.**



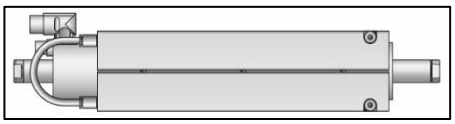
Incorrect mounting
Small contact area prevents cooling of the linear motor.



Correct mounting
Better heat dissipation with the LinMot flange.



Correct mounting
Forced air cooling with LinMot fan to increase the continuous force.

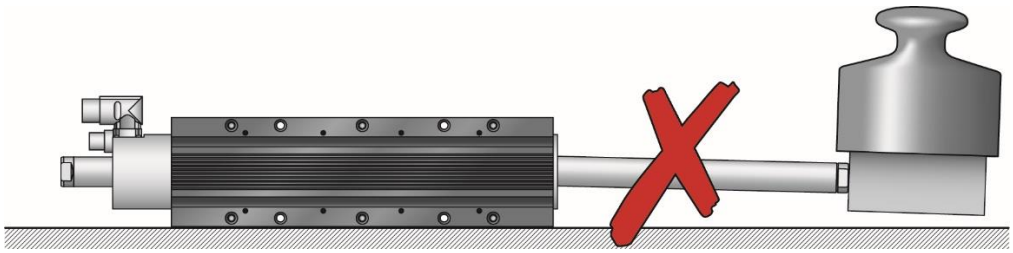


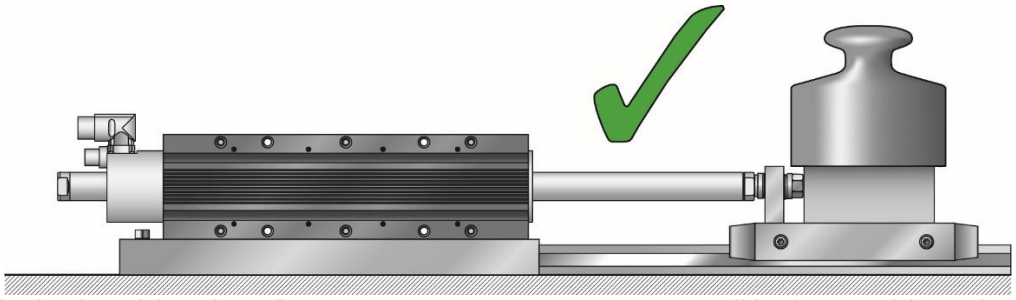
Correct mounting
Forced cooling with fluid cooling flange to increase the continuous force. More details in chapter 4 Fluid cooling.

3.4 Mounting the payload to the slider

The load is mounted as a fixed bearing using spherical washers and conical seats (see the section 6).

- To avoid shear force on slider and wear on stator, the payload has to be beared by a linear guide.
- Slider back end (M8 internal thread) should not be used for load mounting.





Slider back end (M8 thread) Slider front end (M10 thread)

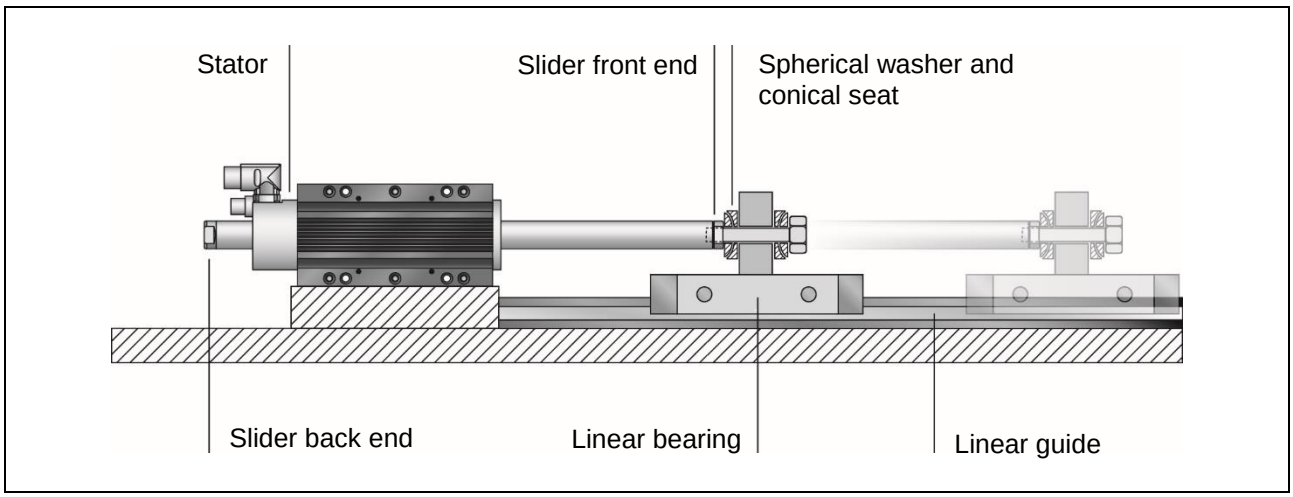
When attaching the load, the wrench for tightening the load must be used only on the load-facing side of the slider. Avoid torsional stress on slider (note the following figures).

Incorrect attachment
Torsional stress on slider!

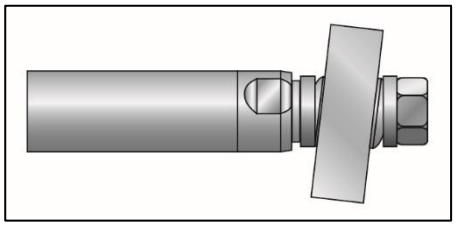
Correct attachment

Slider	Thread	Max. torque for screw
28 mm	M 8 (Slider back end)	25 Nm
	M 10 (Slider front end)	47 Nm

3.5 "Moving slider" installation

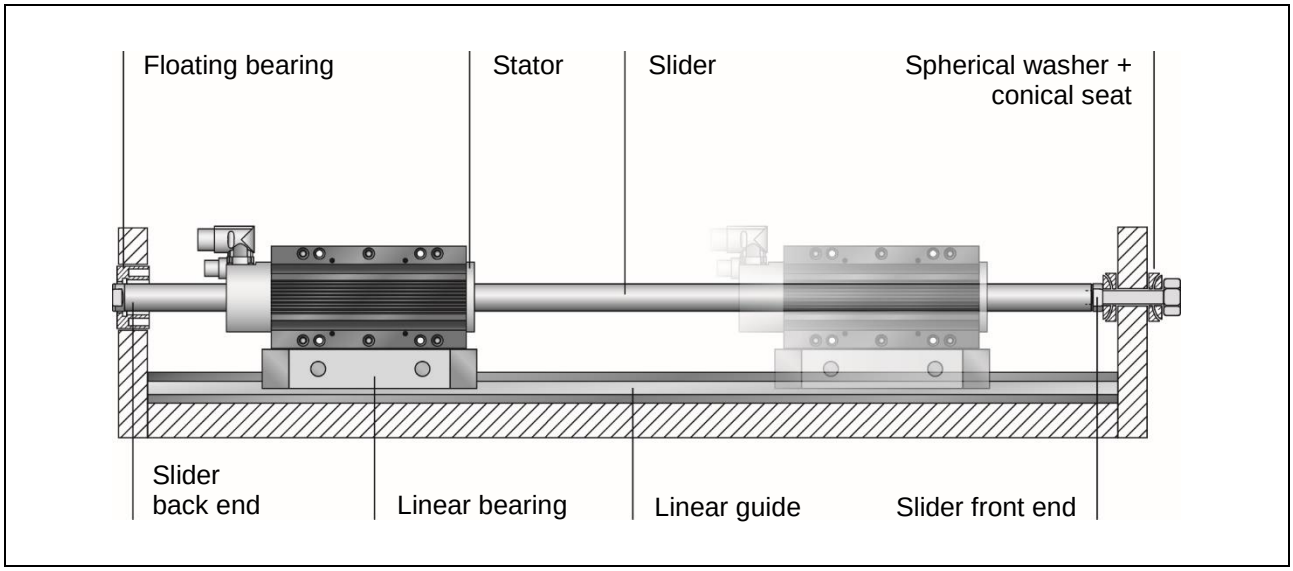


In a "moving slider" installation, the stator is fixed and the slider is the moving part.
The load, borne by a linear guide, is attached directly to the end of the slider. In order to compensate for misalignment, spherical axial bearings consisting of spherical washers and conical seats (see the section Slider mounting kits) are used to connect to the load. The mounting kit of slider and an oversized hole for the screw make it possible to adjust a radial and angle offset.



Mounted payload with radial and angle offset.

3.6 "Moving stator" installation



In "moving stator" applications, the slider is fixed and the stator is the moving part.
The load is attached to the stator, which is mounted on a linear guide. In order to avoid an overconstrained bearing mount and compensate for alignment errors, the slider may be mounted on one end in a fixed bearing with a spherical axial bearing. On the opposite end, the slider is mounted in a floating bearing. Mounting kits are available for mounting the slider (see the section Slider mounting kits).

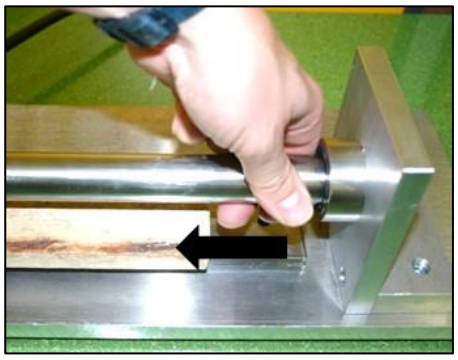
3.6.1 Assembling instruction

Please attend to the safety instructions in chapter 2 during the assembling!

If moving stator application is used, the minimum bending radius of the motor cable should be adhered to. See chapter Cable, section Technical Data.

1. **Mount stator to its support bearing.**

2. **Insert slider into stator.**



3. **Placing a spacer**
   Put a spacer (wood, plasic, aluminium with thickness 15 mm) between slider and linear guide. The spacer prevents injuries to the hands and damage to the slider surface!

4. **Installing the slider using the fixed bearing**
   The fixed bearing is screwed to the front end of the slider. **Important**! Do not tighten the screw yet!

5. Mount floating bearing

Imortant!
Do not tighten the screw!
The slider is allowed to extend into the floating bearing no more than 15 mm!

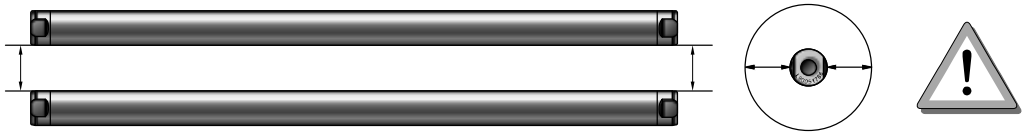
6. Move stator (back end) to the fixed end of slider, center slider in stator and tighten the screw.

7. Move stator (front side) to the floating bearing and tighten screws.

After the installation of the slider a safety label must be placed close to the slider.

3.7 Minimum distance from slider

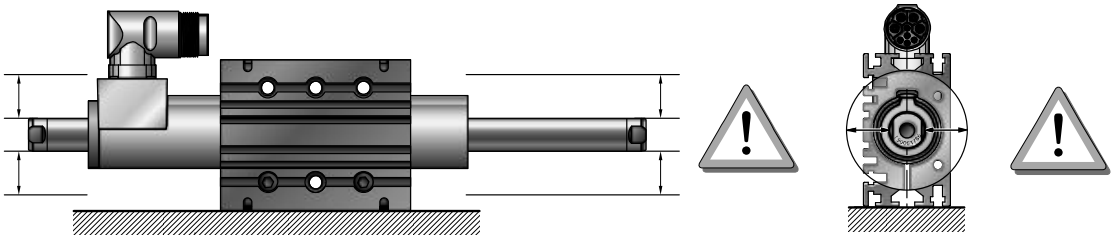
3.7.1 Minimum distance from slider to slider



The sliders are made of neodymium magnets and have a strong magnetic attraction.
It must be kept a minimum distance between the sliders. This minimized the risk of bruising and secondly, the sliders do not influence each other through their magnetic fields.

Type of slider	PL01	PL01-20 / PL01-19	PL01-28 / PL01-27	PL10-28
PL01-12	30 mm (1.18 in)			
PL01-20 / PL01-19		50 mm (1.97 in)		
PL01-28 / PL01-27			80 mm (3.15 in)	
PL10-28				70 mm (2.76 in)
The data are measured from slider center to slider center.				

3.7.2 Minimum distance from slider to metallic parts



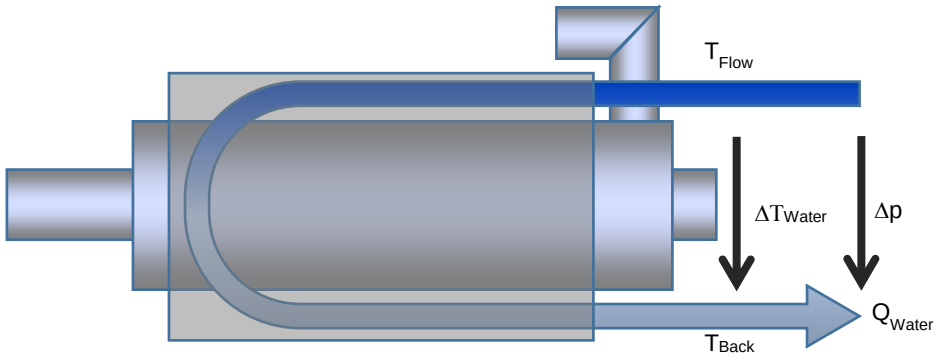
When installing linear motors in modules with metal parts near the slider, undesired forces can arise due to magnetic attraction or eddy currents. These generally manifest as erratic and jerky positioning, or reduced dynamics of the linear motor. In order to avoid this, minimum distances between the slider and any metal parts are to be observed whenever metal materials are used nearby.

Linear Motor	Minimum distance from slider surface to ferromagnetic parts (iron, steel, etc.)	Minimum distance from slider surface to non-ferromagnetic metallic parts (aluminum, bronze, stainless steel, etc.)
P10-70x…	20 mm	10 mm

4 Fluid cooling

The heat produced by the motor is dissipated by the liquid cooling. If the motor is operated with a liquid-cooling, the continuous force value increases many times in comparison with the self-cooling.

4.1 Design of water cooling



T_Flow	Flow temperature
T_Back	Return temperature
ΔT	T_Back-T_Flow
T_Water	Mean coolant temperature, Formula: (T_Flow + T_Back) / 2
Q_Water	Flow
Δp	Differential pressure

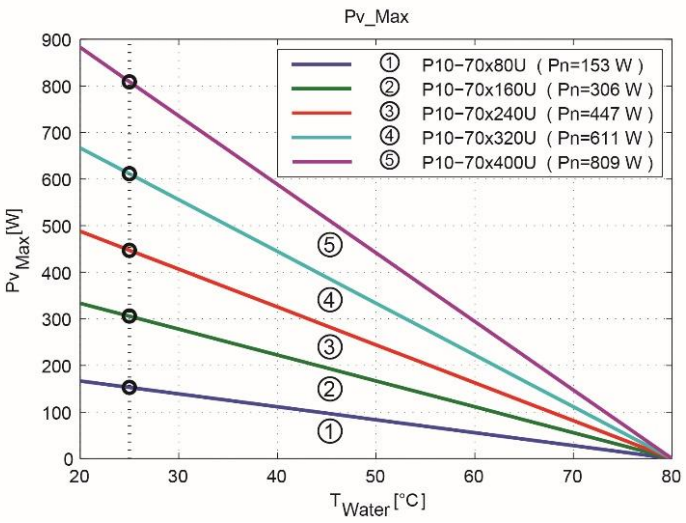
With the water cooling, the coolant is passed through the cooling circuit of the motor flange.

Starting from the adjusted mean coolant temperature T_Water all other parameters of the cooling circuit may be dimensioned based on the diagrams referred to:

- T_Water -> Pv_Max -> Q_Water -> Δ p

The design is illustrated by an example in the following.

4.1.1 Determination of the max. possible amount of cont. power dissipation Pv_Max

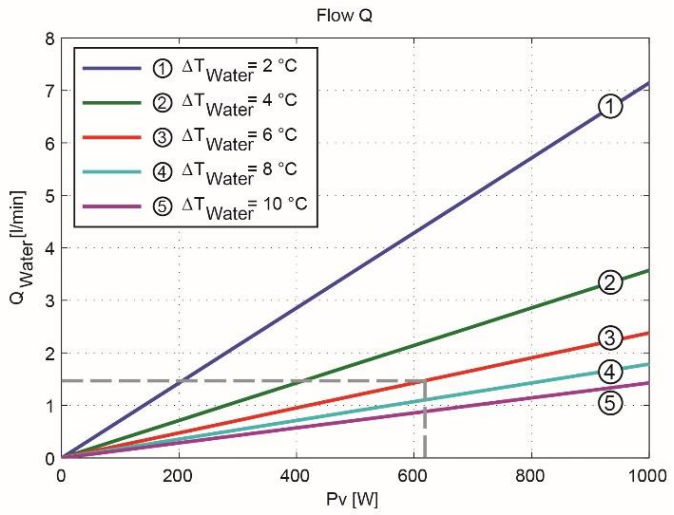


Example
- Motor: P10-70x320U
- T_Water: 25 °C

-> Pv_Max: 611 W

- If the temperature of the cooling liquid is chosen to be lower than the ambient temperature, there is a risk of condensation.
- When used and stored in a frost-prone area, corrosion protection (e.g. Clariant) has to be added.

4.1.2 Determination of water flow Q

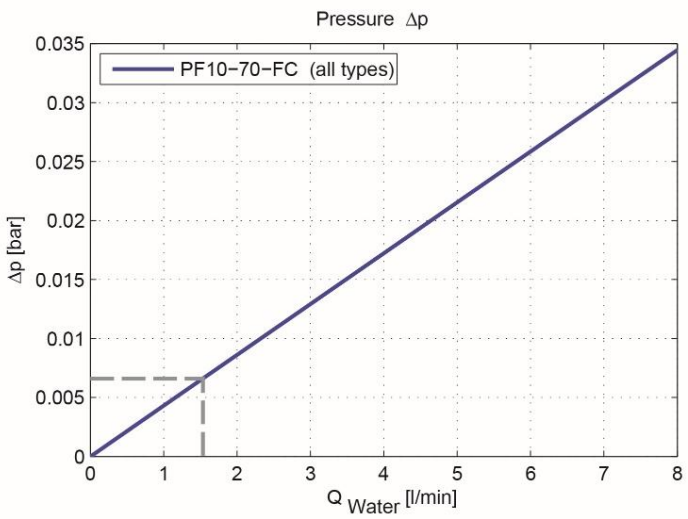


Example
- Pv: 611 W
- ΔT_Water: 6 °C

-> Q_Water: 1.5 l / min

To achieve a very regular cooling of the motor, the max. difference between flow and return temperature should not exceed 10 ° C.

4.1.3 Determination of water pressure Δ p



Example

- Q_Water: 1.5 l / min

-> Δp: 0.007 bar

The required water pressure to inject the required water flow depends on the hydraulic resistance of the cooling circuit.

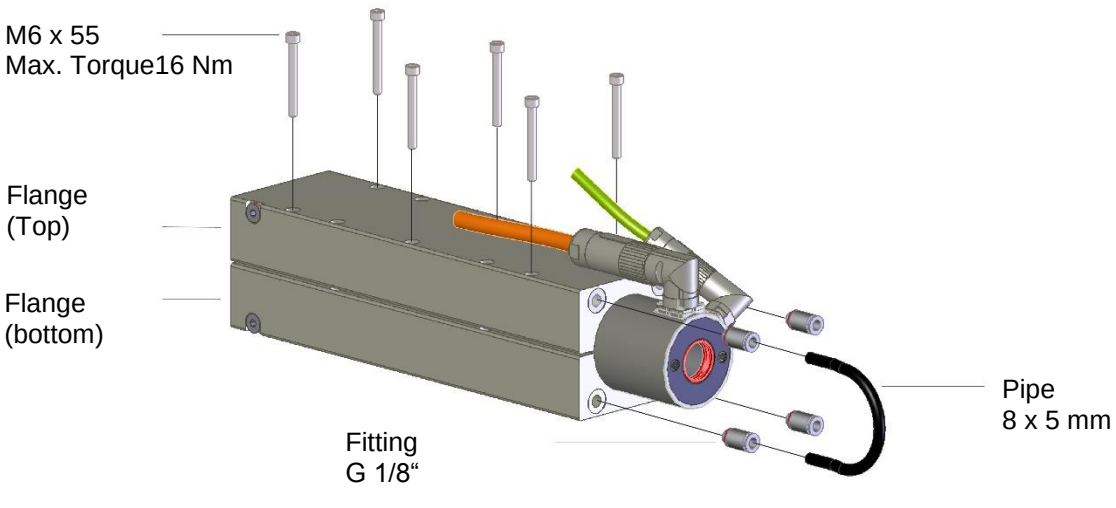
4.2 Corrosion protection

It is advised to add a corrosion protection into the cooling medium (water). A suitable agent can be, for example, Protectogen C Aqua by Clariant. Information of the mixing ratio between the cooling medium and the corrosion protection agent can be taken from the manufacturer's instructions.

- Mixing of various corrosion protection agents is to be avoided.
- Corrosion protection products must be matched to the materials of the cooling circuit (see table of materials in the cooling circuit).

Component	Material
Flange	Aluminium
Pipe	Polyurethane
Fittings	Brass nickel plated

4.3 Mounting



The fluid cooling flange consists of two half-shells. In both half-shells, a channel is incorporated, in which the cooling water can circulate in longitudinal direction. Via an external pipe connection, the channels of the two half-shells are connected in series.

Screw the half-shells by alternately tightening of the screws, which are lying across from each other. Thus, it can be avoided that a half-shell is borne on one side only.

5 Motor Cable

Do not connect or disconnect motor when there is power on the servo drive.
Use only original LinMot cable. Cables from other sources must be checked precisely before commissioning.
Incorrect connections can destroy the drive and stator.

5.1 Technical Data

The motor series P10-70 use various types of cables, which are used for power supply and signal power. All cables are high-flex cables (suitable for trailing chains) and are used for fixed and moving applications.

	Power cable		Sensor cable		
Type	KPS15-04	KPS15-04/04	KSS05-02/08	KSS05-02/13	KSS05-02/06
Used for	PS10-70 PS10-70-D01 PS10-70-D02	PS10-70-D03	PS10-70	PS10-70-D01 PS10-70-D02	PS10-70-D03
Minimum bending radius for fixed installation	50 mm (2 in)	60 mm (2.36 in)	50 mm (2 in)	45 mm (1.75 in)	60 mm (2.36 in)
Minimum bending radius when moving	100 mm (4 in) No torsion	120 mm (4.72 in) No torsion	100 mm (4 in) No torsion	90 mm (3.54 in) No torsion	120 mm (4.72 in) No torsion
Max. Cable length	30 m (may be limited by Servo Drive)				
Approval	UL / CSA 1000V	UL / CSA 1000V / 300V	UL / CSA 300V	UL / CSA 30V	UL / CSA 300V
Material	Wire isolation: TPE Jacket: PUR	Wire isolation: TPE Jacket: PUR	Wire isolation: TPE Jacket: PUR	Wire isolation: PE Jacket: PUR	Wire isolation: PP Jacket: PUR
Oil resistance	very good	very good	very good	very good	very good
Chemical resistance (to acids, alkalis, solvents, hydraulic fluid)	good	good	good	good	good
Outdoor durability	very good	very good	very good	very good	very good
Flammability	flame retardant	flame retardant	flame retardant	flame retardant	flame retardant

5.2 Options of power cable

5.2.1 Stator Series P10-70

Item	Description	Item-No.
KPS15-04-L/Q-3	Power trailing chain cable L/Q (3 m)	0150-2266
KPS15-04-L/Q-5	Power trailing chain cable L/Q (5 m)	0150-2261
KPS15-04-L/Q-8	Power trailing chain cable L/Q (8 m)	0150-2267
KPS15-04-L/Q-12	Power trailing chain cable L/Q (12 m)	0150-2268
KPS15-04-L/Q-	Special cable KPS15-04-L/Q-	0150-3388
KPS15-04-Q/Q-	Special cable KPS15-04-Q/Q-	0150-3414

5.2.2 Stator Series P10-70-D01 / D02

Item	Description	Item-No.
KPS15-04-..../Q-10	Power trailing chain cable .../Q, (10 m for D0x)	0150-2376
Special cable KPS15-04-./Q-	KPS15-04-./Q- (Custom length)	0150-3491
KPS15-04	Trailing chain cable power P10-70 (per m)	0150-2257

5.2.3 Stator Series P10-70-D03

Item	Description	Item-No.
KPS15-04/04..../Q-10	Power trailing chain cable .../Q, (10 m for D03)	0150-3654
Special cable KPS15-04/04-./Q-	KPS15-04/04-./Q- (Custom length)	0150-3579
KPS15-04/04	Trailing chain cable power P10-...-Dx3 (per m)	0150-2269

5.3 Options of sensor cables

5.3.1 Stator Series P10-70

Item	Description	Item-No.
KSS05-02/08-D15/J-3	Encoder trailing chain cable D15/J (3 m)	0150-2263
KSS05-02/08-D15/J-5	Encoder trailing chain cable D15/J (5 m)	0150-2262
KSS05-02/08-D15/J-8	Encoder trailing chain cable D15/J (8 m)	0150-2264
KSS05-02/08-D15/J-12	Encoder trailing chain cable D15/J (12 m)	0150-2265
KSS05-02/08-D15(f)-45°/J-	Special cable KSS05-02/08-D15(f)-45°/J-	0150-3389
KSS05-02/08-J/J-	Special cable KSS05-02/08-J/J-	0150-3415

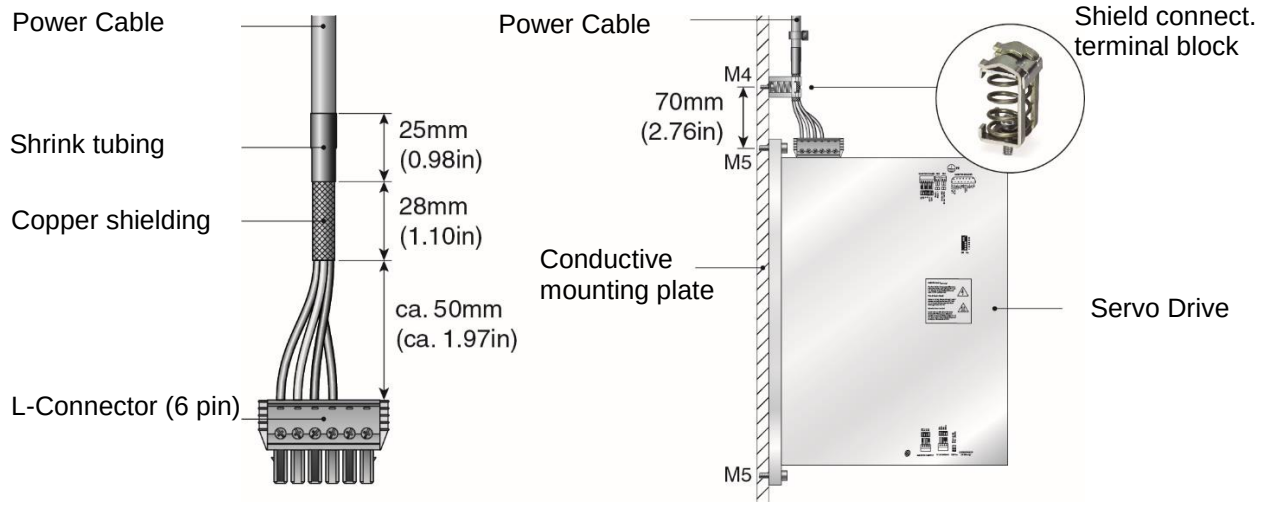
5.3.2 Stator Series P10-70-D01 / D02

Item	Description	Item-No.
KSS05-02/13-./J-10	Encoder trailing chain cable .../J, (10 m for D0x)	0150-2377
Special cable KSS05-02/13-./J-	KSS05-02/13-./J- (Custom length)	0150-3492
KSS05-02/13	Trailing chain cable encoder P10-...-Dxx (per m)	0150-2259

5.3.3 Stator Series P10-70-D03

Item	Description	Item-No.
KSS05-02/06-./J-10	Encoder trailing chain cable .../J, (10 m for D03)	0150-3655
Special cable KSS05-02/06-./J-	KSS05-02/06-./J- (Custom length)	0150-3611
KSS05-02/06	Trailing chain cable encoder P10-...-Dx3 (per m)	0150-2490

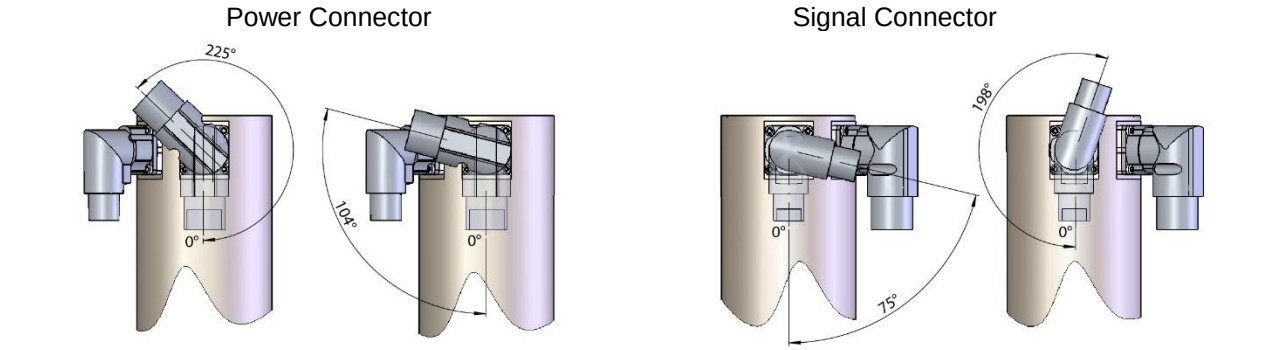
5.4 Attaching the cable shielding

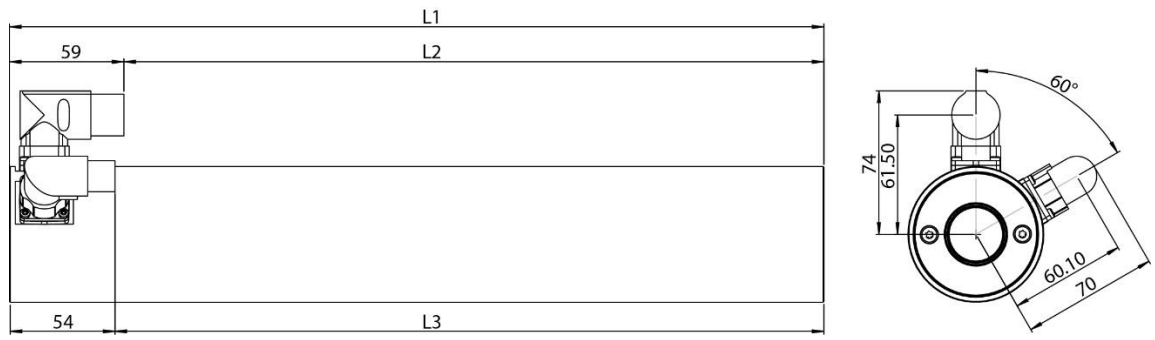


The power cable is supplied with a copper shielding (see illustration above). This prevents electrical and / or magnetic fields. The shielded part of the cable must be grounded via a connection to the back wall of the switchboard. The shielding has to be mounted holohedral to the connection part (see scheme above). The shield connection terminal block is offered as an accessory for power cables and must be ordered separately (Item-No. 0150-3631) However, the kind of attaching the cable shielding generally depends on the system of the switchboard manufacturer.

5.5 Rotatability of motor connectors

The power connector and signal connector can be rotated in both directions. (see illustration below).

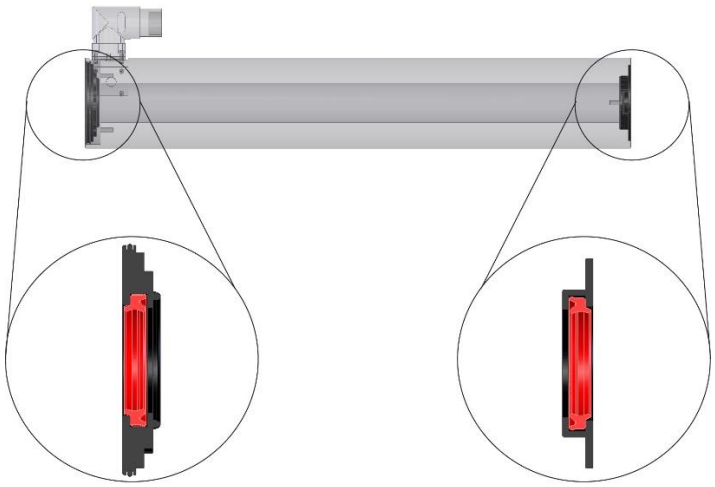




Stator	L1 [mm / in]	L2 [mm / in]	L3 [mm / in]
PS10-70x80	180 / 7.09	121 / 4.77	125.5 / 4.94
PS10-70x160	260 / 10.24	201 / 7.92	205.6 / 8.1
PS10-70x240	340 / 13.39	281 / 11.07	285.5 / 11.24
PS10-70x320	420 / 16.54	361 / 14.22	365.5 / 14.4
PS10-70x400	500 / 19.69	441 / 17.37	445.5 / 17.55

6 Accessories

6.1 Wiper with exchangeable end piece



End piece (back) with wiper

End piece (front) with wiper

The stators are equipped as standard with wipers. This simplifies maintenance and the maintenance cycles can be extended. The wiper effects that the lubricant is dispensed metered and does not leak outside of the stator. The lubricant is less dirty.

If the end piece (front) is firmly casted, it can not be replaced. In this case, only the wiper * is substituted.

Ordering information

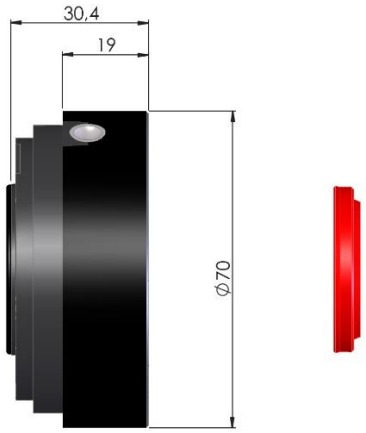
Item	Description	Item-No.
PA10-AV70	Stator end piece front side with wiper	0150-3560
PA10-AH70	Stator end piece back side with wiper	0150-3561
PAW 01-28*	Wiper for PL01-28	0150-3133

6.2 Wiper with lubricant depot

Lubricant depot with wiper

If the stators are equipped with lubricant depot, lubrication can be optimally regulated. It releases only as much lubricant as necessary. The maintenance is simplified and maintenance cycles are extended.

If a lubricant depot is installed, the required longitudinal installation space for the stator will be enlarged to 19 mm (rear) and 27.5 mm (front).



Lubricant depot Wiper

Material

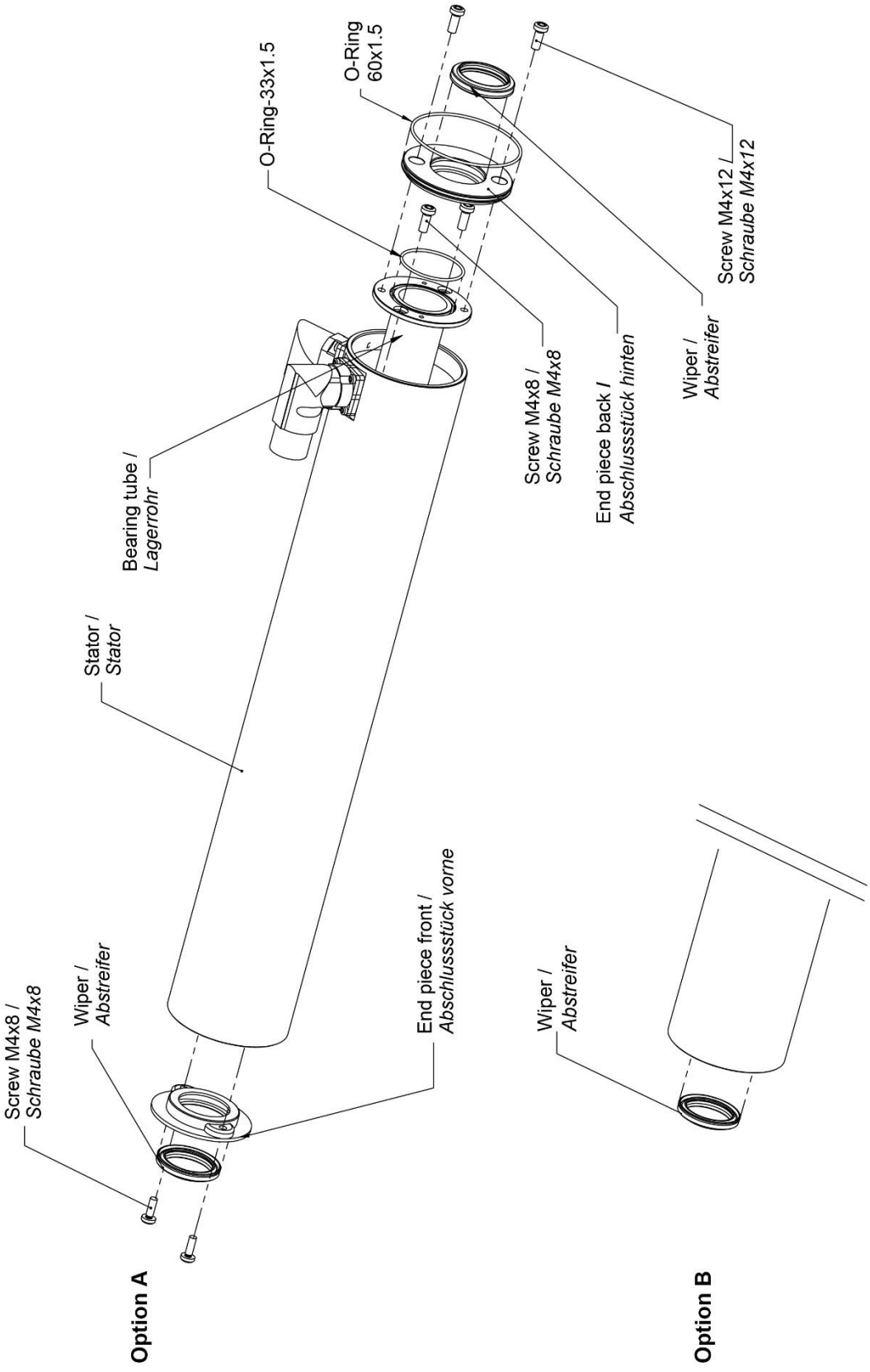
Fettdepot: Ryton
Wiper: H-PU

Ordering information

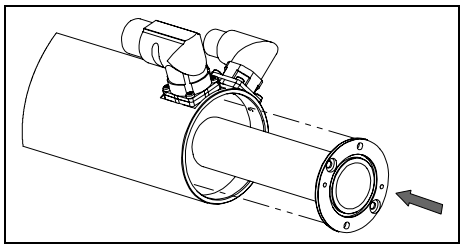
Item	Description	Item-No.
PA10-70/28	Lubricant depot for PS10-70 with wiper + Lubricant (6 ml)	0150-3543

6.3 Bearing kit with exchangeable end pieces

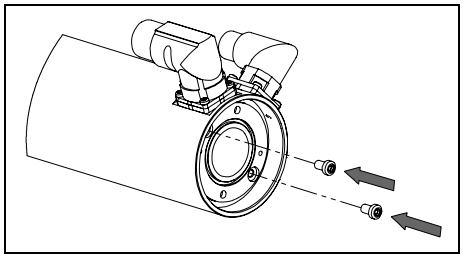
6.3.1 Overview



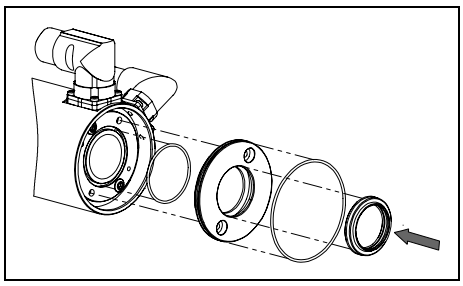
6.3.2 Mounting



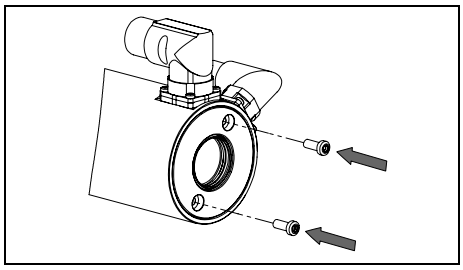
1. **Insert bearing tube.**
   Bearing tube is already lubricated with initial lubricant.



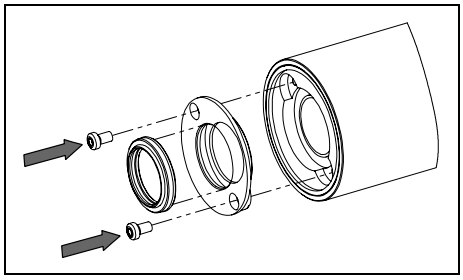
2. **Tighten the fastening screws with 2.4 Nm.**
   Screws are already coated with threadlocker (Tuflok).



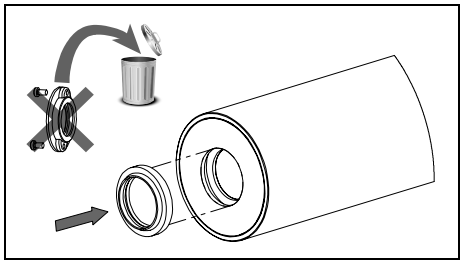
3. **Assemble end piece (back).**
   The end piece, the seals and the wiper are assembled and positioned on the stator.



4. **Tighten the fastening screws with 2.4 Nm.**
   Screws are already coated with threadlocker (Tuflok).



5. **<u>Option A:</u> Assemble end piece (front).**
   Assemble the end piece with the wiper and tighten it with fastening screws (2.4 Nm torque). Screws are already coated with threadlocker (Tuflok).



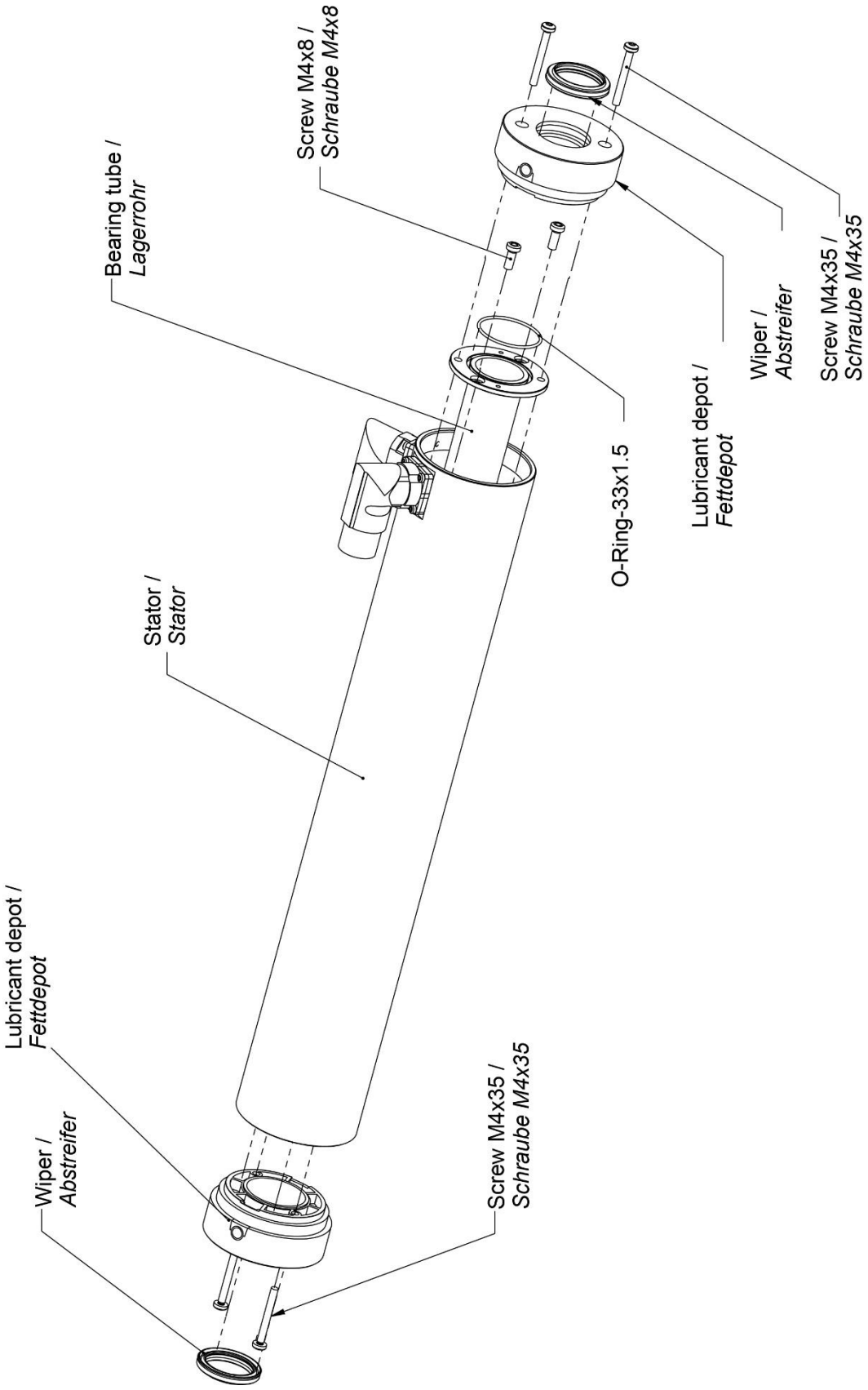
5. **<u>Option B:</u> Exchange wiper.**

   Important! For motors with casted end piece only the wiper has to be exchanged!

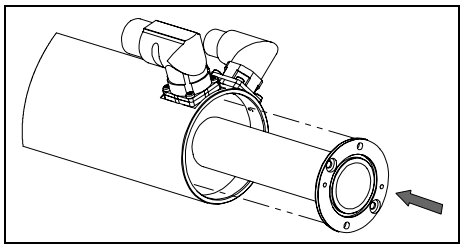
The bearing sets for the stators PS10-70 can be found under http://shop.linmot.com/D/linearmotoren-zubehör/.

6.4 Bearing kit with lubricant depot

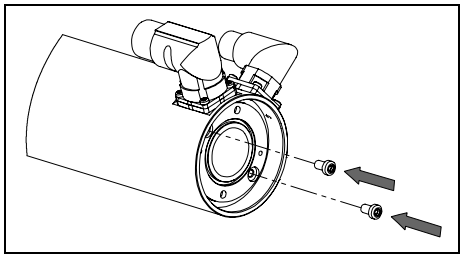
6.4.1 Overview



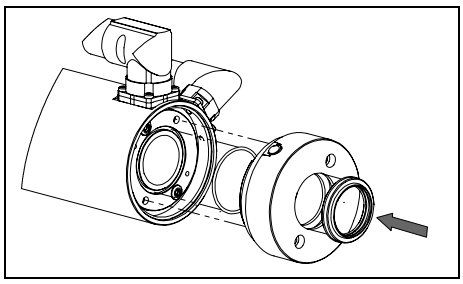
6.4.2 Mounting



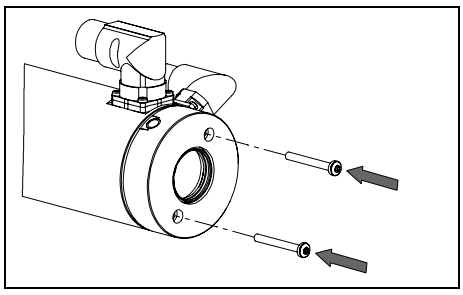
1. **Insert bearing tube.**
   Bearing tube is already lubricated with initial lubricant.



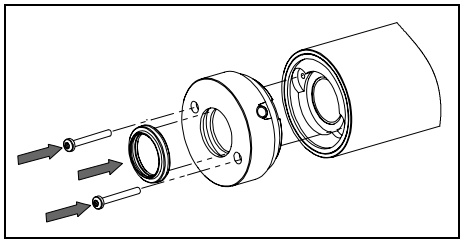
2. **Tighten the fastening screws with 2.4 Nm.**
   Screws are already coated with threadlocker (Tuflok).



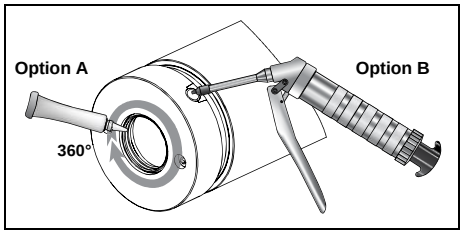
3. **Assemble lubricant depot (back).**
   The lubricant depot, the seal and the wiper are assembled and positioned on the stator.



4. **Tighten the fastening screws with 2.4 Nm.**
   Screws are already coated with threadlocker (Tuflok).



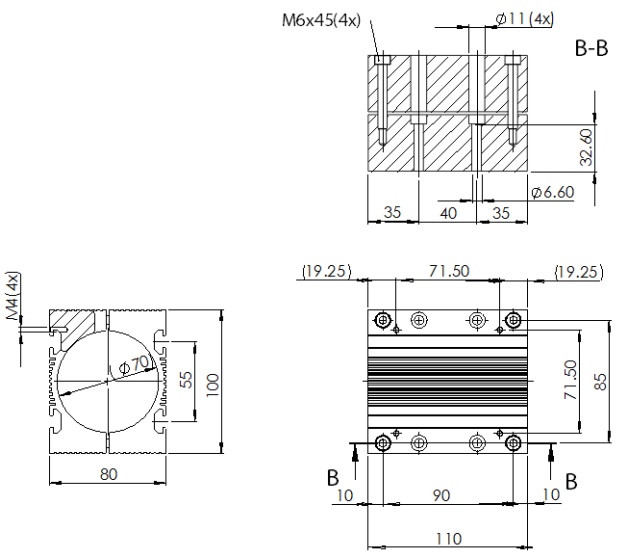
5. **Insert lubricant depot (front).**
   Assemble the lubricant depot with the wiper and tighten it with fastening screws (2.4 Nm torque). Screws are already coated with threadlocker (Tuflok).



6. **Lubrication**
   Application of the lubricant on the surface behind the used wiper (Option A) or via the grease nipple with a hand press (Option B).

Item	Description	Item-No.
PA10-70/28	Lubricant depot for PS10-70 with wiper + lubricant (6 ml) ***Important!*** *Mounting kit must be ordered separately.*	0150-3543

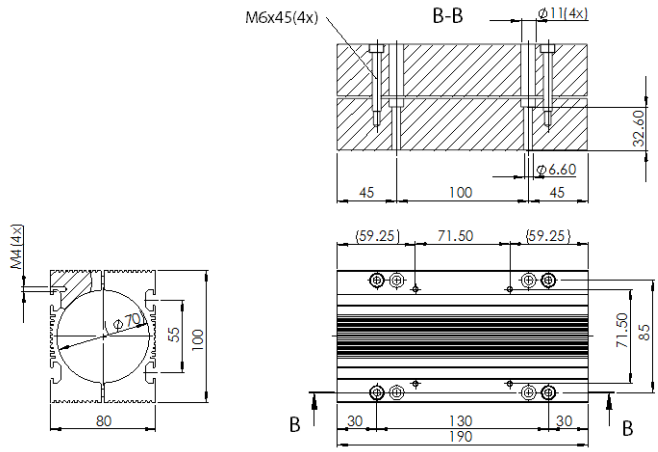
6.5 Mounting flanges



Max. Torque
Screws: 12 Nm (8.85 lbf ft)

Fan assembly
Number (Standard): 1
Number (Max.): 1

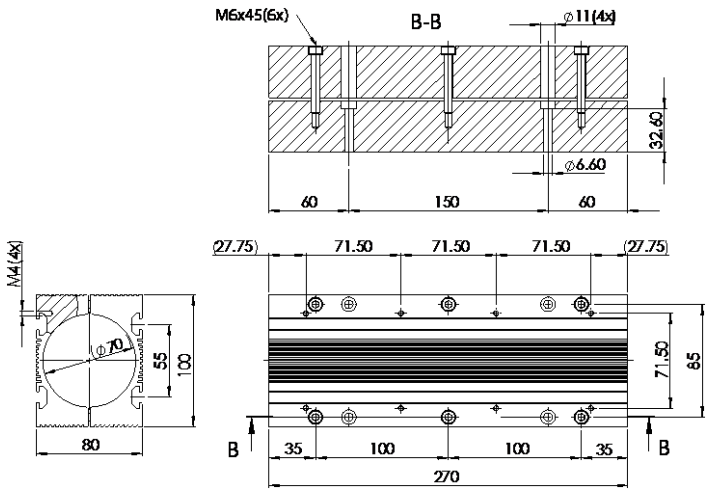
Article	Description	Weight [g / oz]	Item-No
PF10-70x110	Flange for PS10-70x80	1015 / 35.8	0150-2272



Max. Torque
Screws: 12 Nm (8.85 lbf ft)

Fan assembly
Number (Standard): 1
Number (Max.): 1

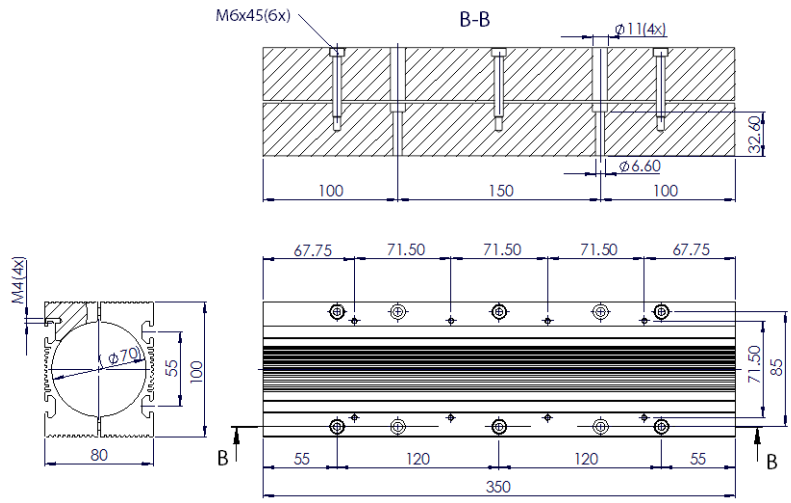
Article	Description	Weight [g / oz]	Item-No
PF10-70x190	Flange for PS10-70x160	1776 / 62.6	0150-2273



Max. Torque
Screws: 12 Nm (8.85 lbf ft)

Fan assembly
Number (Standard): 1
Number (Max.): 2

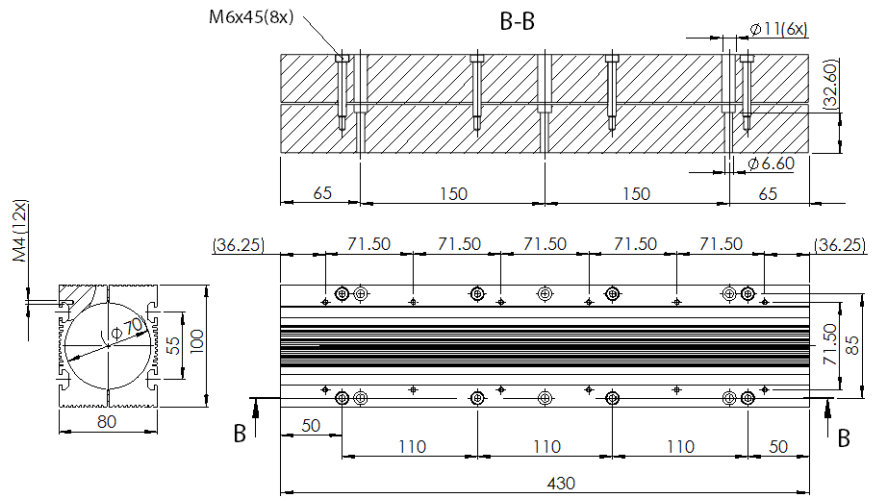
Article	Description	Weight [g / oz]	Item-No
PF10-70x270	Flange for PS10-70x240	2550 / 89.9	0150-2274



Max. Torque
Screws: 12 Nm (8.85 lbf ft)

Fan assembly
Number (Standard): 2
Number (Max.): 2

Article	Description	Weight [g / oz]	Item-No
PF10-70x350	Flange for PS10-70x320	3311 / 116.8	0150-2290

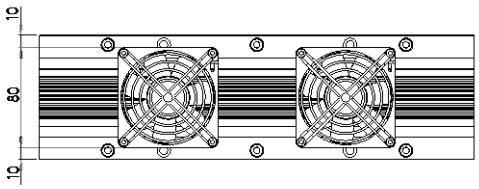


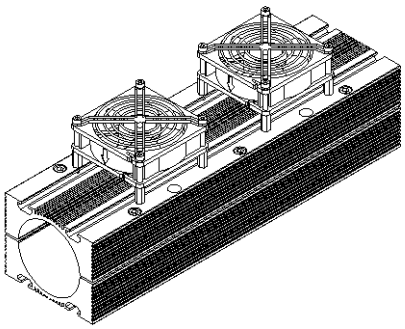
Max. Torque
Screws: 12 Nm
(8.85 lbf ft)

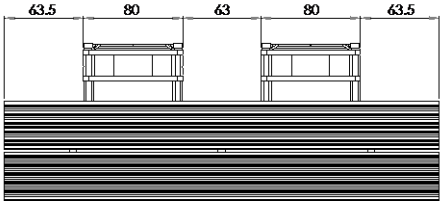
Fan assembly
Number (Standard): 2
Number (Max.): 3

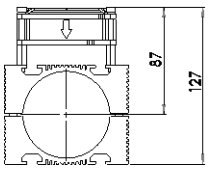
Article	Description	Weight [g / oz]	Item-No
PF10-70x430	Flange for PS10-70x400	4056 / 143.1	0150-2276

6.6 Fan kits for flanges







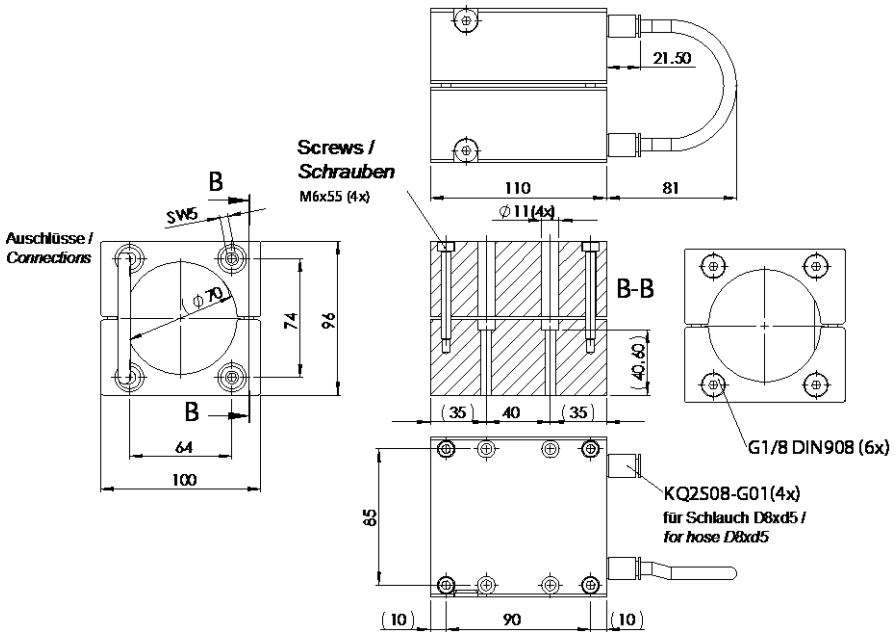


Power Supply Fan
24 VDC, 120 mA

Air flow
80 m³ / h

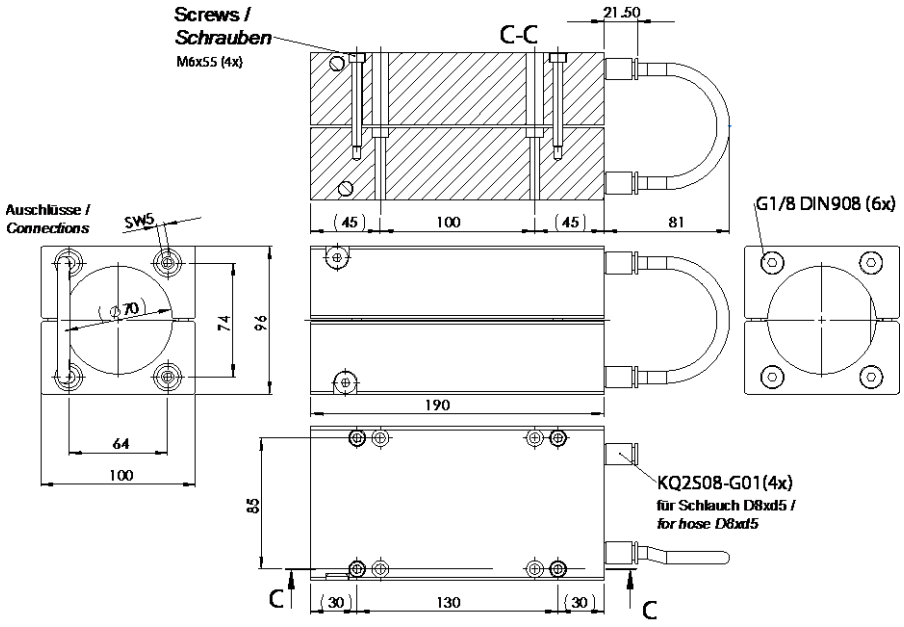
Item	Description	Item-No.
HV01-37 / 48	Fan Kit for H01-37 / 48 and PF02-37 / 48 composed of: 1 x Fan, 4 x cylinder screw M4 x 30, 4 x square nut M4, 4 x spacer M4 x 16	0150-5051

6.7 Fluid cooling flanges



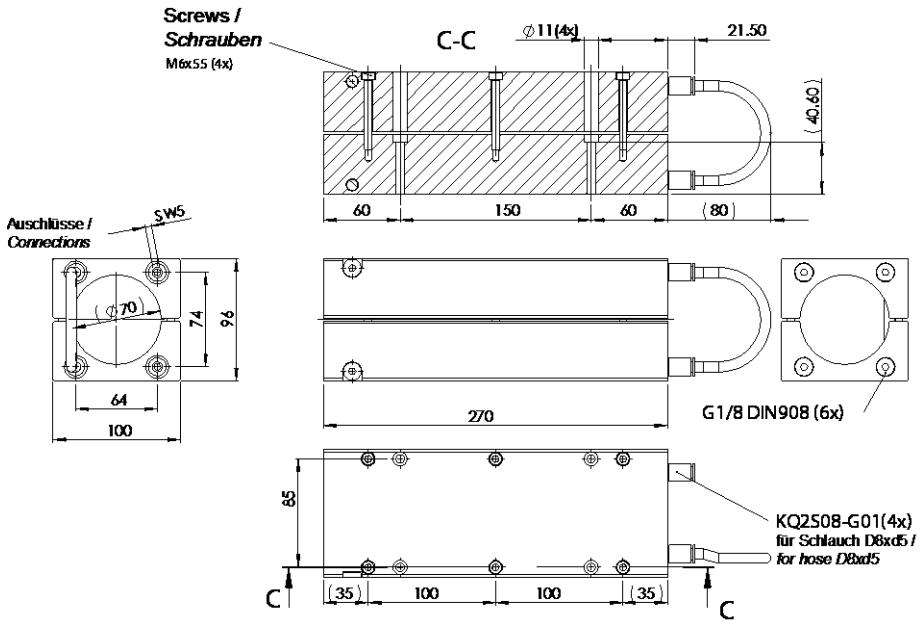
Max. Torque
Screws: 12 Nm
(8.85 lbf ft)

Article	Description	Weight [g / oz]	Item-No
PF10-70x110-FC	Flange for PS10-70x80 fluid cooling	1641 / 57.9	0150-2291



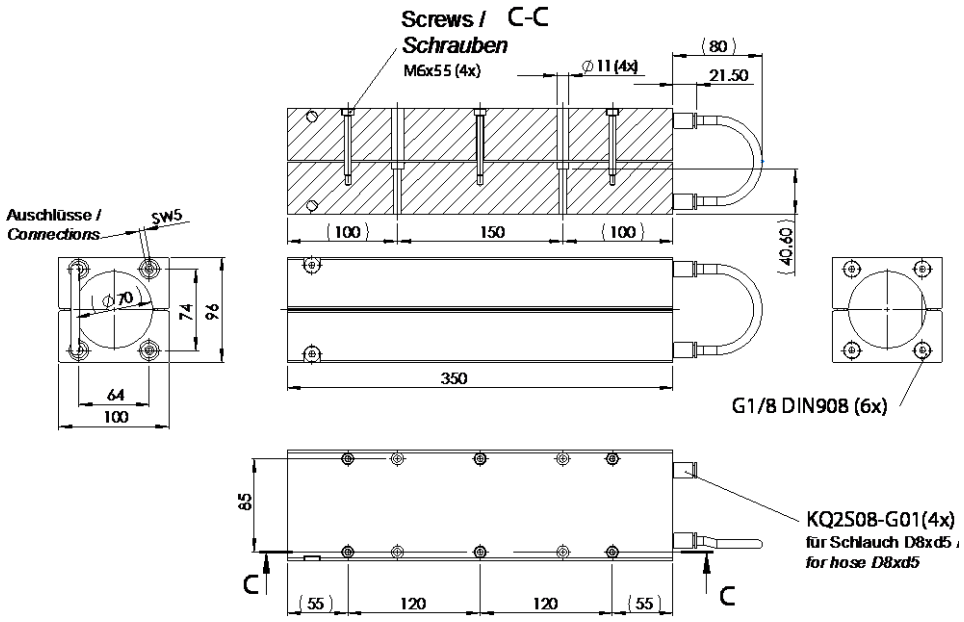
Max. Torque
Screws: 12 Nm
(8.85 lbf ft)

Article	Description	Weight [g / oz]	Item-No
PF10-70x190-FC	Flange for PS10-70x160 fluid cooling	2825 / 99.6	0150-2292



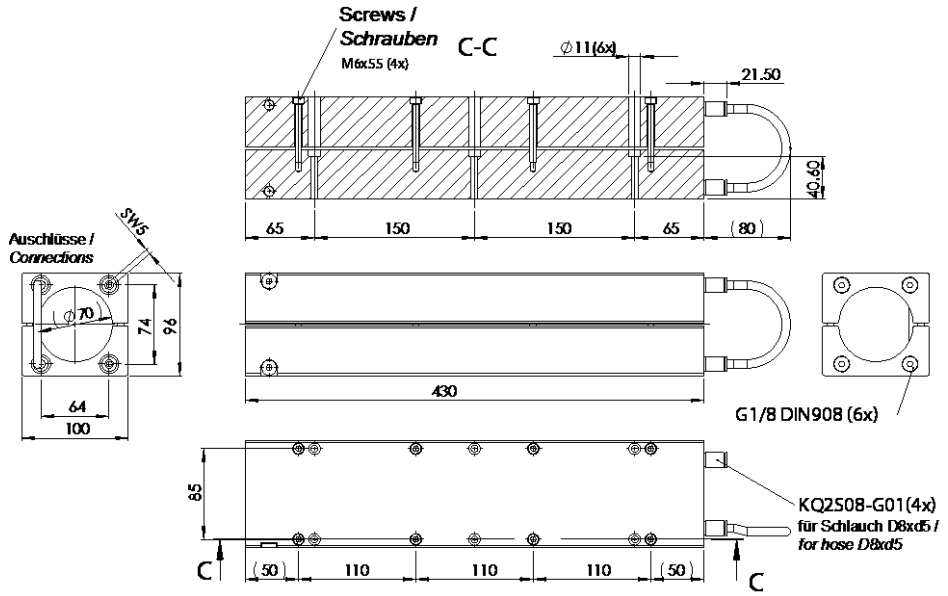
Max. Torque
Screws: 12 Nm
(8.85 lbf ft)

Article	Description	Weight [g / oz]	Item-No
PF10-70x270-FC	Flange for PS10-70x240 fluid cooling	4000 / 141	0150-2293



Max. Torque
Screws: 12 Nm
(8.85 lbf ft)

Article	Description	Weight [g / oz]	Item-No
PF10-70x350-FC	Flange for PS10-70x320 fluid cooling	5185 / 182.9	0150-2294

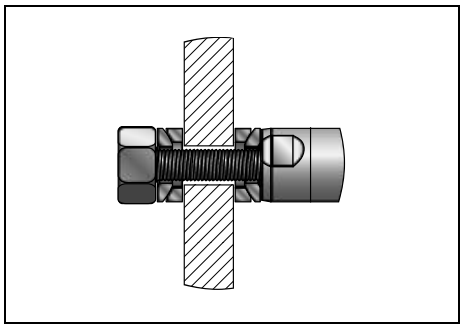


Max. Torque
Screws: 12 Nm
(8.85 lbf ft)

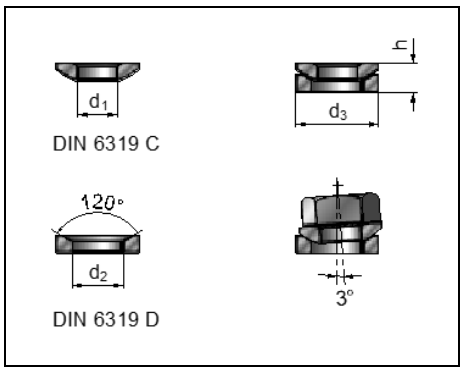
Article	Description	Weight [g / oz]	Item-No
PF10-70x430-FC	Flange for PS10-70x400 fluid cooling	6325 / 223.1	0150-2295

6.8 Slider mounting kits

6.8.1 Fixed bearing



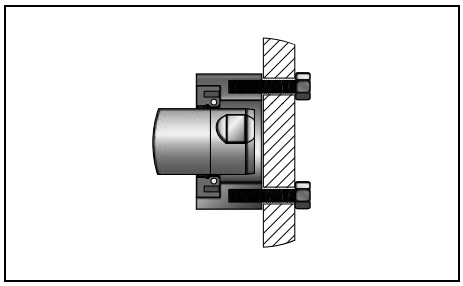
Slider mounting kit consists of a spring washer, a pair of spherical washers, and a pair of conical seats. It allows the slider to be fixed in the direction of motion. It also helps to compensate for radial and angle offset.



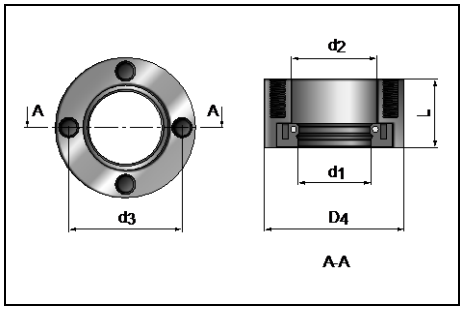
Material
Spherical washer / conical seat: case hardened steel

Item	Item No.	Slider	Thread	d1	d2	d3	h
PLF01-28	0150-3087	28mm	M10	10.5mm (0.41in)	12mm (0.47in)	21mm (0.83in)	6.5mm (0.26in)
PLF01-28 (Stainless-st.)	0150-3297	28mm	M10	10.5mm (0.41in)	12mm (0.47in)	21mm (0.83in)	6.5mm (0.26in)

6.8.2 Floating bearing



Floating bearing assembly that permits radial adjustment of slider position and permits a small amount of radial and axial movement.



Material

Housing:	Stainless steel 1.4305
Bearing:	Nitrile butadiene rubber
	Spring steel DIN17223

Item	Item No.	Slider	Thread	d1	d2	d3	D4	L
PLL01-28	0150-3094	28mm	M5	28mm (1.10in)	32mm (1.26in)	40mm (1.57in)	48mm (1.89in)	20mm (0.79in)

6.8.3 Complete mounting kit

This kit provides one set of mounting parts for each end of the slider.

Ordering information

Item	Description	Item-No.
PLM01-28-MK	Mounting kit for PL01-28 slider composed of: 1 Spherical washer & conical seat (0150-3087) 1 Floating Bearing (0150-3094) 1 Socket hd. cap screw * DIN 912 / M10, L=35 mm (L=1.38 in) 4 Socket hd. cap screw * DIN 912 / M5, L=20 mm (L=0.78 in)	0150-3095
** For use with 12 mm (1/2 in) thick mounting plates.*		

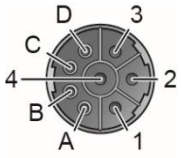
7 Maintenance and test instructions

7.1 Stator connector assignment

Do not connect or disconnect motor when there is power on the servo drive.
Use only original LinMot cable. Cables from other sources must be checked precisely before commissioning.
Incorrect connections can destroy the drive and stator.

7.1.1 Power Connector

Shielded motor cable d = 1.5 mm²

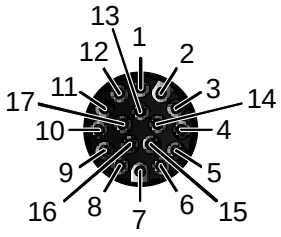


Pin	P10-70	P10-70-D01 / D02	Wire Color
1	Phase U	Phase U	Red
2	Protective Earth	Protective Earth	Yellow-Green
3	Phase W	Phase W	Green
4	Phase V	Phase V	Blue
A	n.c.	n.c.	-
B	n.c.	n.c.	-
C	n.c.	n.c.	-
D	n.c.	n.c.	-

Pin	P10-70-D03	Wire Color
1	Phase U	1 / Black
2	Protective Earth	Yellow-Green
3	Phase W	3 / Black
4	Phase V	2 / Black
A	KTY +	5 / Black
B	KTY -	6 / Black
C	n.c.	7 / Black
D	n.c.	8 / Black

7.1.2 Sensor Connector

Shielded twisted pair
Encoder Kabel d = 0.5 mm² / 0.25 mm²



Pin	P10-70	Wire Color
1	+5VDC	Red
2	GND	Black
3	Sense +5V	White
4	Sense GND	Brown
5	Motor Link C +	Pink
6	Motor Link C -	Grey
7	Sin +	Yellow
8	Sin -	Orange
9	Cos +	Green
10	Cos -	Blue
11 bis 17	n. c.	-

Pin	P10-70-D01	P10-70-D02	Wire Color
1	3…13 VDC	3…13 VDC	White
2	GND	GND	Brown
3	Sense Vcc (optional)	Sense Vcc (optional)	Green
4	Sense GND (optional)	Sense GND (optional)	Yellow
5	Do not connect	Do not connect	-
6	Do not connect	Do not connect	-
7	Sine +	Sine +	Grey
8	Sine -	Sine -	Pink
9	Cosine +	Cosine +	Blue
10	Cosine -	Cosine -	Red
11	Ref +	Ref +	Black
12	Ref -	Ref -	Purple
13	Hall U	Hall U	Grey-Red
14	Hall V	Hall V	Red-Blue
15	Hall W	Hall W	White-Green
16	Temp + (KTY84/130 Char.)*	Temp + (PTC 400/20k Char.)*	Yellow-Brown
17	Temp - (KTY84/130 Char.)*	Temp - (PTC 400/20k Char.)*	White-Yellow

* Temperatur circuit
The temperature evaluation circiut must be powered from the encoder supply and must be at the same potential. The grounds of the temperature evaluation circuit and the encoder have to be connected. The encoder must have been powered on for at least 50 ms, before valid temperatures can be measured. If the encoder is powered off, 200k Ohms are measured between Pins 16 and 17. The maximum voltage between Pin 16 and 17 must not exceed 16 VDC. The maximum current must not exceed 15 mA.

Pin	P10-70-D03	Wire Color
1	3…13 VDC	Red
2	GND	Black
3	Sense Vcc (optional)	White
4	Sense GND (optional)	Brown
5	Do not connect	-
6	Do not connect	-
7	Sine +	Yellow
8	Sine -	Orange
9	Cosine +	Green
10	Cosine -	Blue
11	n. c.	n. c.
12	n. c.	n. c.
13	n. c.	n. c.
14	Do not connect	n. c.
15	n. c.	n. c.
16	n. c.	n. c.
17	n. c.	n. c.

7.2 Stator checking

The following tables show the resistive value between the different connector pins for each stator type. If the value is not within a range of +/- 10% the stator may be damaged (temperature of the stator for all measurements: 20°C).

PS10-70x80U-BL-QJ (0150-1291) **PS10-70x80U-BL-QJ-D01 (0150-2282)**
PS10-70x80U-BL-QJ-D02 (0150-2360) **PS10-70x80U-BL-QJ-D03 (0150-2708)**

Phase U / Phase V	Pin 1 / Pin 4	12.8 Ω @ 20 °C
Phase V / Phase W	Pin 4 / Pin 3	12.8 Ω @ 20 °C
Phase W / Phase U	Pin 3 / Pin 1	12.8 Ω @ 20 °C
Casing	Any phases / Casing	> 200 MΩ @ 20 °C
KTY + / KTY - (only Series D03)	Pin A / Pin B	581 ± 26 Ω @ 20 °C 603 ± 26 Ω @ 25 °C

PS10-70x160U-BL-QJ (0150-1292) **PS10-70x160U-BL-QJ-D01 (0150-2283)**
PS10-70x160U-BL-QJ-D02 (0150-2361) **PS10-70x160U-BL-QJ-D03 (0150-2709)**

Phase U / Phase V	Pin 1 / Pin 4	8.1 Ω @ 20 °C
Phase V / Phase W	Pin 4 / Pin 3	8.1 Ω @ 20 °C
Phase W / Phase U	Pin 3 / Pin 1	8.1 Ω @ 20 °C
Casing	Any phases / Casing	> 200 MΩ @ 20 °C
KTY + / KTY - (only Series D03)	Pin A / Pin B	581 ± 26 Ω @ 20 °C 603 ± 26 Ω @ 25 °C

PS10-70x240U-BL-QJ (0150-1293) **PS10-70x240U-BL-QJ-D01 (0150-2284)**
PS10-70x240U-BL-QJ-D02 (0150-2362) **PS10-70x240U-BL-QJ-D03 (0150-2710)**

Phase U / Phase V	Pin 1 / Pin 4	6.2 Ω @ 20 °C
Phase V / Phase W	Pin 4 / Pin 3	6.2 Ω @ 20 °C
Phase W / Phase U	Pin 3 / Pin 1	6.2 Ω @ 20 °C
Casing	Any phases / Casing	> 200 MΩ @ 20 °C
KTY + / KTY - (only Series D03)	Pin A / Pin B	581 ± 26 Ω @ 20 °C 603 ± 26 Ω @ 25 °C

PS10-70x320U-BL-QJ (0150-1284) **PS10-70x320U-BL-QJ-D01 (0150-2285)**
PS10-70x320U-BL-QJ-D02 (0150-2343) **PS10-70x320U-BL-QJ-D03 (0150-2711)**

Phase U / Phase V	Pin 1 / Pin 4	5.4 Ω @ 20 °C
Phase V / Phase W	Pin 4 / Pin 3	5.4 Ω @ 20 °C
Phase W / Phase U	Pin 3 / Pin 1	5.4 Ω @ 20 °C
Casing	Any phases / Casing	> 200 MΩ @ 20 °C
KTY + / KTY - (only Series D03)	Pin A / Pin B	581 ± 26 Ω @ 20 °C 603 ± 26 Ω @ 25 °C

PS10-70x400U-BL-QJ (0150-1294) **PS10-70x400U-BL-QJ-D01 (0150-2286)**
PS10-70x400U-BL-QJ-D02 (0150-2363) **PS10-70x400U-BL-QJ-D03 (0150-2712)**

Phase U / Phase V	Pin 1 / Pin 4	6.8 Ω @ 20 °C
Phase V / Phase W	Pin 4 / Pin 3	6.8 Ω @ 20 °C
Phase W / Phase U	Pin 3 / Pin 1	6.8 Ω @ 20 °C
Casing	Any phases / Casing	> 200 MΩ @ 20 °C
KTY + / KTY - (only Series D03)	Pin A / Pin B	581 ± 26 Ω @ 20 °C 603 ± 26 Ω @ 25 °C

7.3 Maintenance of linear motors

The stators will be shipped with an initial lubrication. Maintenance will only be required if the motors run 'dry' or there is a heavy pollution of the motors.Under normal industrial conditions (5 day, 8 h / day) one inspection every 3 months is adequate. The inspection cycle must be shortened if severe motor loads or deviating conditions exist. These conditions are for example:

- Permanent fouling
- Direct sunshine
- Low Humidity
- Outdoor operation
- Increased operating temperature

7.3.1 Mounting

Sliders with a length ≤ 500 mm (20 in) are to be inserted in a clean contition in the stator.
Sliders with a length > 500 mm (20 in) must be lubricated with LU02. 4 g of lubricant per meter slider is enough to create a film of lubricant on the surface of the sliders. 4 g (0.14 oz) is about ½ of a hazel-nut. The grease can be applied by hand or with a soft paper towel.
If wipers are used then the inner side of the seals of the wipers must be lubricated as well.

Basically, it must be ensured that only a thin film of grease is applied. 4 g of grease per 1000 mm of slider length is sufficient for this purpose. Over lubrication leads to a gumming of the grease, which appears particularly at higher operating temperatures! In this case, a complete cleaning of the motor has to be made.

7.3.2 Inspection

Inspections have to be executed according to the operating condition and the load of motors. Following points have to be checked during inspection:

a) Is a film of lubricant on the slider? If not -> Lubrication
b) Is the wiper (if existent) without visible wear? If not -> Replace wipers
c) Is the lubricant homogeneous and not decomposed? In case of negation -> Cleaning (stator, slider) + Lubrication
d) Can the slider be moved easily? If not -> Cleaning (stator, slider) + Lubrication

7.3.3 Cleaning

- Pull the sliders carefully out of the stator.
  Attention! Strong magnetic attraction forces (note safety instructions on page 5)!
  Use non magnetic material (e.g. wood) to cover close-by iron constructions.

- Clean slider and stator with a soft disposable paper, ideally with the help of LU06 cleaning spray (or methylated spirits or alcohol).
- Afterwards, lubricate the bore of the stators with about 2-3 g (0.1 oz) grease LU02.
  There should only be a slight film of lubricant.
  Note: Do not over lubricate!
- Finally, slider should be lubricated according to the chapter 'mounting'.

7.3.4 Cleaning agent / Lubricant

For the cleaning of LinMot stators and sliders cleaning agent spray LU06 is recommended.
To improve the sliding characteristics between the stainless steel surface of the slider and the plastic slide bearing the LinMot lubricant LU02 is prescribed.

Ordering information

Item	Description	Item-No.
LU06-250	Klüberfood NH1 4-002 Spray* (250 ml)	0150-2394
LU02-08	Lubricant for linear motors ** (8 g)	0150-1953
LU02-50	Lubricant for linear motors ** (50 g)	0150-1954
LU02-1000	Lubricant for linear motors ** (1000 g)	0150-1955

** LinMot Spray LU06 corresponds to KLÜBERFOOD NH1 4-002 which was developed for the food processing industry.*
*** LinMot LU02 Lubricant corresponds to KLÜBERSYNTH UH1 14-31 which was developed for the food processing industry.*

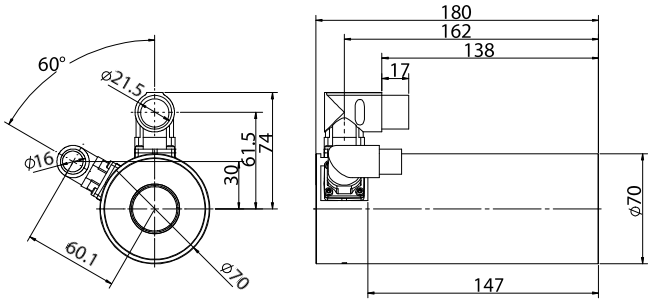
8 Storage, transport, installation altitude

- Sliders are to be stored and transported only in the plastic containers (with cardboard inlay) provided for this purpose, or already installed and secured in LinMot P stators.
- Remove the slider from this plastic containers only for assembling.
- The storage area must be dry, dust-free, frost-free and vibration-free.
- The relative air humidity should be less than 60 %.
- Prescribed storage temperature: -15 °C…70 °C
- The motor must be protected against extreme weather conditions.
- The air in the storage area must not contain any harmful gases.
- The max. installation altitude is 2'000 m (for higher values contact LinMot) above sea level.
- From 1'000 m, derating of 1 °C per 100 m is to be considered for air cooling.

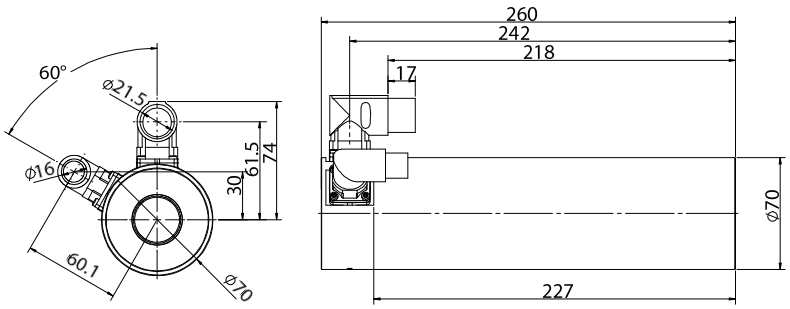
9 Dimensions

9.1 Stator

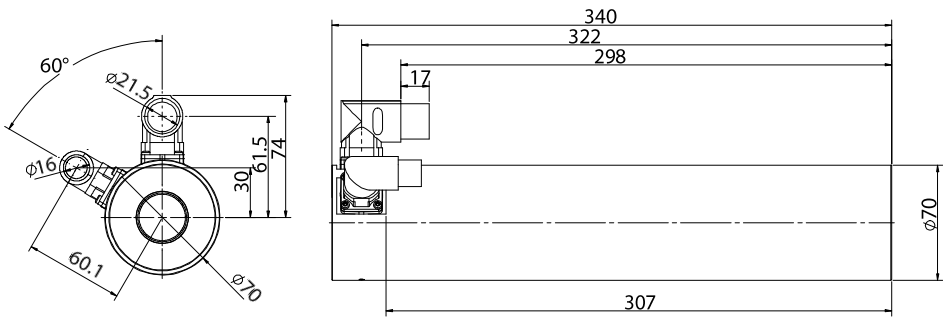
9.1.1 PS10-70x80



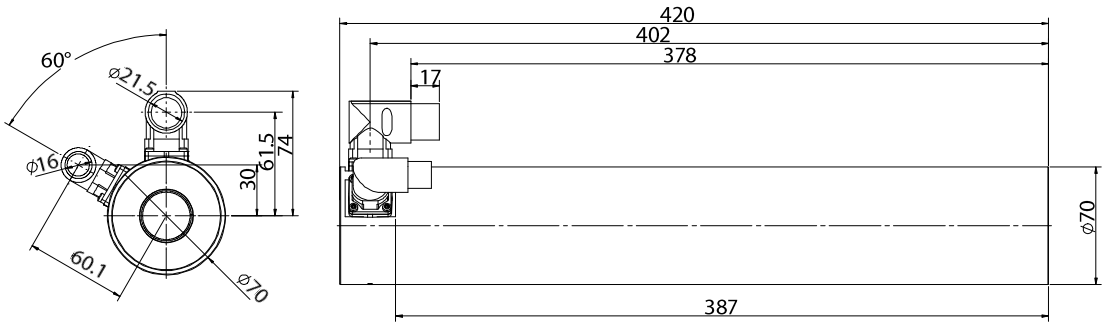
9.1.2 PS10-70x160



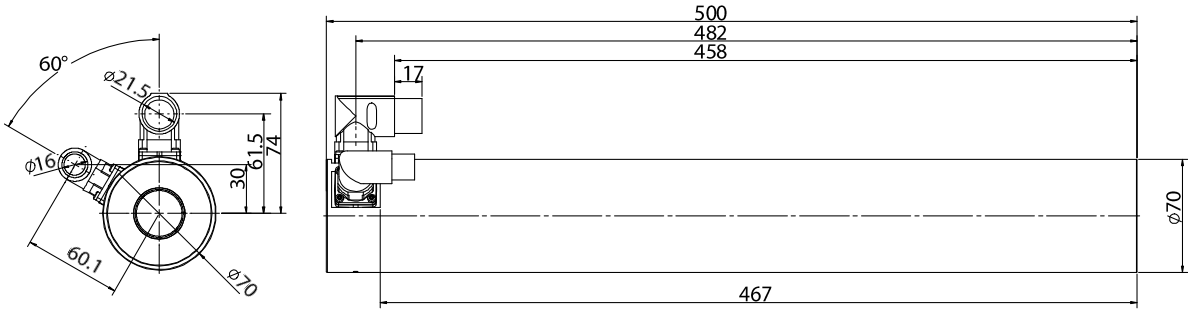
9.1.3 PS10-70x240



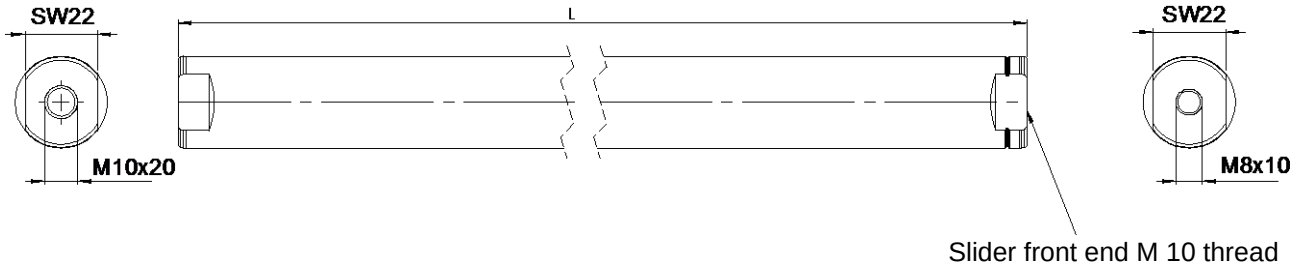
9.1.4 PS10-70x320



9.1.5 PS10-70x400



9.2 Slider



Item	Item-No.	Length L [mm / in]
PL10-28x290/240	0150-2193	290 / 11.42
PL10-28x390/340	0150-2194	390 / 15.36
PL10-28x490/440	0150-2195	490 / 19.3
PL10-28x590/540	0150-2196	590 / 23.42
PL10-28x690/640	0150-2197	690 / 27.18
PL10-28x790/740	0150-2198	790 / 31.11
PL10-28x890/840	0150-2199	890 / 35.05
PL10-28x990/940	0150-2203	990 / 39
PL10-28x1190/1140	0150-2204	1190 / 46.87
PL10-28x1390/1340	0150-2205	1390 / 54.75
PL10-28x1590/1540	0150-2206	1590 / 62.62
PL10-28x1790/1740	0150-2207	1790 / 70.5
PL10-28x1990/1940	0150-2208	1990 / 78.38

10 Declaration of Conformity and CE-marking

Wir
We
Nous

NTI AG
Bodenaeckerstrasse 2
8957 Spreitenbach

erklären in alleiniger Verantwortung, dass das Produkt
declare under our sole responsibility that the product
declarons sous notre seule responsabilité que le produit

Product	Item-No.	Product	Item-No.
PS10-70x80U-BL-QJ	0150-1291	PS10-70x320U-BL-QJ-D11	0150-2716
PS10-70x160U-BL-QJ	0150-1292	PS10-70x400U-BL-QJ-D11	0150-2717
PS10-70x240U-BL-QJ	0150-1293	PS10-70x80U-BL-QJ-D02	0150-2360
PS10-70x320U-BL-QJ	0150-1284	PS10-70x160U-BL-QJ-D02	0150-2361
PS10-70x400U-BL-QJ	0150-1294	PS10-70x240U-BL-QJ-D02	0150-2362
PS10-70x80U-BL-QJ-D01	0150-2282	PS10-70x320U-BL-QJ-D02	0150-2343
PS10-70x160U-BL-QJ-D01	0150-2283	PS10-70x400U-BL-QJ-D02	0150-2363
PS10-70x240U-BL-QJ-D01	0150-2284	PS10-70x80U-BL-QJ-D03	0150-2708
PS10-70x320U-BL-QJ-D01	0150-2285	PS10-70x160U-BL-QJ-D03	0150-2709
PS10-70x400U-BL-QJ-D01	0150-2286	PS10-70x80U-BL-QJ-D03	0150-2710
PS10-70x80U-BL-QJ-D11	0150-2713	PS10-70x320U-BL-QJ-D03	0150-2711
PS10-70x160U-BL-QJ-D11	0150-2714	PS10-70x400U-BL-QJ-D03	0150-2712
PS10-70x240U-BL-QJ-D11	0150-2715		

konform ist mit den Anforderungen der Richtlinien,
is conform to the provisions of directives,
est conformé aux exigences des directives,

2014/35/EU (LVD) + 2014/30/EU (EMCD)

gestützt auf die folgenden Normen,
based on the following standards,
base aux normes suivants,

LVD	**EN61800-5-1:2007**
EMCD	**EN61000-6-2:2005** **EN61000-6-4:2007**

Jahr der CE-Kennzeichnung:
Year of CE marking:
Annee du marquage CE: **2013**

Spreitenbach, 10.03.2017

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Dr.-Ing. Marco Hitz
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