

Linear Actuator LA76

Data Sheet



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Preface

Dear User,

We are delighted that you have chosen a LINAK® product.

LINAK systems are high-tech products based on many years of experience in the manufacture and development of actuators, lifting columns, desk frames, electric control boxes, controls, batteries, accessories and chargers.

This User Manual does not address the end user. It is intended as a source of information for the equipment or system manufacturer only, and it will tell you how to install, use and maintain your LINAK electronics. The manufacturer of the end product has the responsibility to provide a User Manual, where relevant safety information from this manual is passed on to the end user.

We are convinced that your LINAK product/system will give you many years of problem-free operation.

Before our products leave the factory, they undergo both function and quality testing. Should you, nevertheless, experience problems with your product/system, you are always welcome to contact your supplier.

LINAK subsidiaries and some distributors situated all over the world have authorised service centres, which are always ready to help you. Locate your local contact information on the back page.

LINAK provides a warranty on all products. (See warranty section).

This warranty, however, is subject to correct use in accordance with the specifications, maintenance being done correctly, and any repairs being carried out at a service centre, which is authorised to repair LINAK products.

Changes in installation and use of LINAK systems can affect their operation and durability. The products may only be opened by authorised personnel.

This User Manual has been written based on the present technical knowledge. LINAK reserves the right to carry out technical modifications and keeps the associated information updated.

LINAK A/S

Terms of use

LINAK® takes great care in providing accurate and up-to-date information on its products. However, the user is responsible for determining the suitability of LINAK products for a specific application.

Due to continual development, LINAK products are subject to frequent modifications and changes. LINAK reserves the rights to conduct modifications, updates, and changes without any prior notice. For the same reason, LINAK cannot guarantee the correctness and actual status of imprinted information on its products.

LINAK uses its best efforts to fulfil orders. However, for the reasons mentioned above, LINAK cannot guarantee availability of any particular product at any given time. LINAK reserves the right to discontinue the sale of any product displayed on its website or listed in its catalogues or in other written material created and produced by LINAK, LINAK subsidiaries, or LINAK affiliates.

All sales are subject to the 'Standard Terms of Sale and Delivery for LINAK A/S' available on LINAK websites.

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Introduction

Versatile electric linear actuator that delivers both robustness and long-term reliability. It excels in challenging environments and is a wise choice for a wide array of industrial machinery and applications that require high-level performance.

Safety instructions

Please read this safety information carefully.

Be aware of the following three symbols throughout the document:



Warning!

Failing to follow these instructions can cause accidents resulting in serious personal injury.



Recommendations

Failing to follow these instructions can result in the actuator suffering damage or being ruined.



Additional information

Usage tips or additional information that is important in connection with the use of the actuator.

Furthermore, ensure that all staff who are to connect, mount, or use the actuator are in possession of the necessary information and that they have access to this document.

Persons who do not have the necessary experience or knowledge of the product/products must not use the product/products. Besides, persons with reduced physical or mental abilities must not use the product/products, unless they are under surveillance or they have been thoroughly instructed in the use of the apparatus by a person who is responsible for the safety of these persons.

Moreover, children must be under surveillance to ensure that they do not play with the product.

Before you start mounting/dismounting, ensure that the following points are observed:

- The actuator is not in operation.
- The actuator is free from loads that could be released during this work.

Before you put the actuator into operation, check the following:

- The actuator is correctly mounted as indicated in the relevant user instructions.
- The equipment can be freely moved over the actuator's whole working area.
- The actuator is connected to a mains electricity supply/transformer with the correct voltage and which is dimensioned and adapted to the actuator in question.
- Ensure that the voltage applied matches to the voltage specified on the actuator label.
- Ensure that the connection bolts can withstand the wear.
- Ensure that the connection bolts are secured safely.

During operation, please be aware of the following:

- Listen for unusual sounds and watch out for uneven running. Stop the actuator immediately if anything unusual is observed.
- Do not sideload the actuator.
- Only use the actuator within the specified working limits.
- Do not step on or kick the actuator.

When the equipment is not in use:

- Switch off the mains supply in order to prevent unintentional operation.
- Check regularly for extraordinary wear.

Classification

The equipment is not suitable for use in the presence of a flammable anaesthetic mixture with air or with oxygen or nitrous oxide.

Warnings

- Do not sideload the actuator.
- When mounting the actuator in the application ensure that the bolts can withstand the wear and that they are secured safely.
- If irregularities are observed, the actuator must be replaced.

**Recommendations**

- Do not place load on the actuator housing.
- Prevent impact or blows, or any other form of stress to the housing.
- Ensure that the cable cover is mounted correctly. Use 3.5 Nm torque.
- Ensure that the duty cycle and the usage temperatures for LA77 actuators are respected.
- Ensure that the cable cannot be squeezed, pulled or subjected to any other stress.
- Furthermore, it will be good practice to ensure that the actuator is fully retracted in the "normal" position. The reason is that there will be a vacuum inside the actuator if it is extended which over time can lead to water entering the actuator.

Features

- Protection class: IP66 for outdoor use (dynamic). Furthermore, the actuator can be washed down by a high pressure cleaner (IP69K - static)
- Highly efficient acme thread spindle
- Hand crank for manual operation
- Integrated brake with high self-lock ability
- Endplay: max. 3.5 mm
- Non-rotating piston rod eye
- Noise level: 73 dB (A). Measuring method: DS/EN ISO 3746 (actuator not loaded)
- Built-in Zero Point positioning
- Heavy duty aluminium housing for harsh conditions
- Hall effect sensor for precise positioning
- Current monitoring

Options in general

- 24 / 48 V DC Brushless motor
- Load from 500 N - 6,800 N depending on gear ratio and spindle pitch
- Max. speed 160 mm/sec. depending on gear ratio and spindle pitch
- Stroke length from 100 to 1,200 mm
- Back fixture turnable in steps of 30 degrees
- Exchangeable cables in different lengths
- When ordering AISI (304 and up) piston rod eye and back fixture, stainless steel screws are automatically included
- Endstop reached signals
- IC options (see specific interface user manuals at the [TECHLINE webpage](#) for Connection Diagrams and I/O Specifications) including:
 - I/O
 - Ethernet/IP
 - Modbus TCP/IP
 - Modbus RTU
 - IO-Link
 - CAN bus
 - CANopen
- PC configuration tool (Actuator Connect™)

Usage

- Duty cycle up to 600 mm stroke: max. 10% (2 min. drive and 18 min. rest)
- Duty cycle at 601-999 mm stroke: max. 5% (1 min. drive and 19 min. rest)
- Ambient operating temperature (AOT): Full performance from +5°C to +40°C
-30°C (reduced load 50%) to + 85°C (reduced duty cycle 10%)
-40°C (no load)
- Storage temperature:
(Actuator is not activated/connected) -40 °C to +70 °C
-40°C to +85°C for 72 hours
-55°C to +95°C for 24 hours for Standard platform
-55°C to +105°C for 24 hours for Integrated Control platform
Acclimatization before usage.
- Relative humidity:
(Actuator is not activated/connected) Full performance from 20 % to 80 % - non-condensing
- Cyclic state: 93 % to 98 % - non-condensing +25°C to +55°C for 12 hours
- Steady state 93 % to 95 % - non-condensing +40°C for 56 Days
- Atmospheric pressure: 700 to 1060 hPa
- Meters above sea level: Max. 3000 meters

Ordering example

76 120 200 A H C3 2 B = 6 1 6 G 3 0300 B C S 0 0 0

Actuator Type	76	= LA76		
Spindle Type	120	= 12 mm	200	= 20 mm
Stroke length	200	= ≤ 995 Length in mm (50-995)	Axx	= 10xx Length in mm (1,000-1,095)
	Bxx	= 11xx Length in mm (1,100-1,195)	C00	= 1,200 Length in mm
Safety	0	= No safety nut	A	= Safety nut
Feedback	0	= No feedback	0	= Hall Potentiometer, 2 wire
	A	= Hall potentiometer	H	= Dual Hall
	K	= Single Hall	X	= Special
Platform	<div> <div>9-pin</div> <div>Zero Point</div> <div>Zero Point with split supply</div> </div>			
	B3	= I/O (Basic)	A7	= CAN bus (J1939)
	C3	= I/O (Customised)	A8	= CAN bus (CANopen)
	F3	= I/O (Full)	0E	= Modbus TCP/IP
	B7	= CAN bus (J1939)	2E	= Ethernet/IP
	B8	= CAN bus (CANopen)		
	0B	= IO-Link		
	14	= Modbus RTU	XX	= Special
Motor type	2	= 24 V BLDC	4	= 48 V BLDC
IP	B	= IP66 - Reinforced house		
Motor type	=	= Brushless Direct Current (BLDC)		
Colour	6	= Dark olivish grey NCS S7000-N	X	= Special
Back fixture	1	= 0 degrees	3	= Ball eye
	A	= 30 degrees	4	= Outer thread
	B	= 60 degrees	5	= Inner thread
	2	= 90 degrees	6	= Rotated (30° interval)
	C	= 120 degrees	D	= 150 degrees
			X	= Special

Piston rod eye	1	= With slot	5	= Inner thread
	2	= Solid	6	= Ball eye
	4	= Outer thread	X	= Special
Option position	E	= Gear ratio 1:7	F	= Gear ratio 1:18
	G	= Gear ratio 1:31	H	= Gear ratio 1:46
Brake	1	= Push	2	= Pull
	3	= Push/Pull		
Built-in dimension	0300	= mm (min. length)	XXXX	= mm
Endstop reached output*	A	= A_HIGH / A_HIGH	B	= A_LOW / A_HIGH
	C	= A_HIGH / A_LOW	D	= A_LOW / A_LOW
	N	= LOW / LOW	X	= Special
Plug type	0	= No plug (when no cable is chosen)	H	= AMP
	J	= Deutsch (DT4)	K	= AMP Super Seal
	9	= Deutsch - Moulded	7	= AMP Super Seal - Moulded
	C	= Flying leads (when no connector is chosen)	U	= Power cable UL1203 US
	E	= M12 Ethernet Y-cable	M	= M12 Modbus cable
	L	= M12 IO-Link cable	X	= Special
Cable	0	= No cable selected	S	= Straight
			X	= Special
Parallel mode	0	= Not parallel	2-8	= Critical parallel (number of actuators in the parallel system)
SW Config.	0	= Standard software	X	= Special software
Not used	0	= Not used		

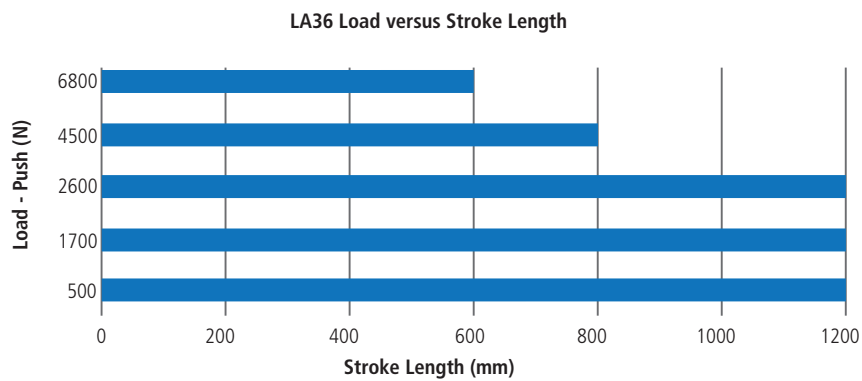
* A_High is active high and A_LOW is active low. HIGH is constant high and LOW is constant low.

Active high: The signal goes from low to high, when the endstop is reached.

Active low: The signal goes from high to low, when the endstop is reached.

Low: The signal stays low at all times.

Load vs stroke length



Please note:

500-1700 N is with 20 mm spindle pitch

500-6800 N is with 12 mm spindle pitch

- For applications that only operate in pull, the limitations are 1200 mm stroke and 6.800 N load.
- Safety factor 2.

The Actuator can be fitted with a safety nut in push. This safety nut is an auxillary nut moving with the main nut and supporting the load if the main nut breaks down. The actuator will then only be able to retract; thereby signaling that repair is required.



Technical specifications

24 V

Push/ pull max. (N)	Self- lock min. (N) Push/ pull	Pitch (mm/ spindle rev.)	Gear/ Ratio	Hall Resolution mm/count	End- play in mm	Typical speed (mm/s)		Regu- lated speed (mm/s)	Standard stroke lengths (mm) in steps of 50 mm	Typical amp. (A)	
						No load	Full load			No load	Full load
500***	1000	20	E 1:7	0.721	-	-	-	142	100-1200	2	12
1,700	2200	20	F 1:18	0.721	3.5	-	-	65	100-1200	1	12
2,600	3400	12	F 1:18	0.433	2.6	-	-	39	100-1200	1	12
4,500	5800	12	G 1:31	0.254	2.3	-	-	23	100-1200**	1	12
6,800	8,800	12	H 1:46	0.166	2.2	-	-	15	100-1200**	1	12

48 V

Push/ Pull max. (N)	Self- lock min. (N) Push/ Pull	Pitch (mm/ Spindle rev.)	Gear/ Ratio	Hall Resolution mm/count	End- play in mm	*Typical speed (mm/s)		Regu- lated speed (mm/s)	Standard stroke lengths (mm) in steps of 50 mm	*Typical amp. (A)	
						No load	Full load			No load	Full load
500***	1,000	20	E 1:7	0.721	-	-	-	142	100-1200	1	6
1,700	2,200	20	F 1:18	0.721	3.5	-	-	65	100-1200	1	6
2,600	3,400	12	F 1:18	0.433	2.6	-	-	39	100-1200	1	6
4,500	5,800	12	G 1:31	0.254	2.3	-	-	23	100-1200**	1	6
6,800	8,800	12	H 1:46	0.166	2.2	-	-	15	100-1200**	1	6

* The typical values can have a variation of $\pm 20\%$ on the current values and $\pm 10\%$ on the speed values. Measurements are made with an actuator in connection with a stable power supply and an ambient temperature at 20°C.

** There are limitations on the stroke length. If you need full load, please see "Load v. Stroke Length".

*** Note: Fully loaded actuators need a soft start in order to prevent the clutch from slipping when starting see: "Speed and current curves".



When using soft stop on a DC-motor, a short peak of higher voltage will be sent back towards the power supply. It is important when selecting the power supply that it does not turn off the output, when this backwards load dump occurs.

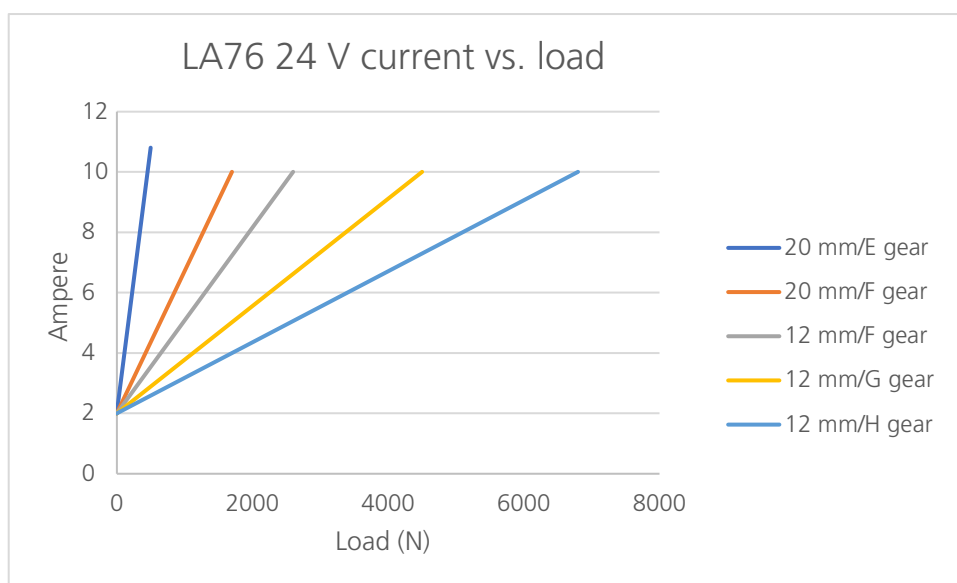
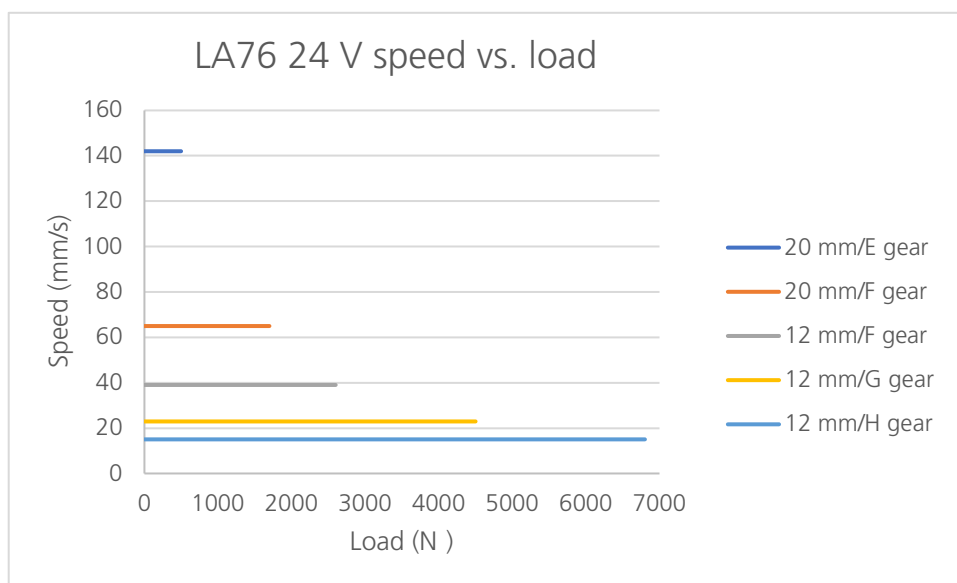
A Hall pulse consists of two Hall counts. A Hall count occurs every time the signal changes state (high to low or vice versa).



The typical values can have a variation of $\pm 20\%$ on the current values and $\pm 10\%$ on the speed values. Measurements are made with an actuator in connection with a stable power supply and an ambient temperature of 20°C.

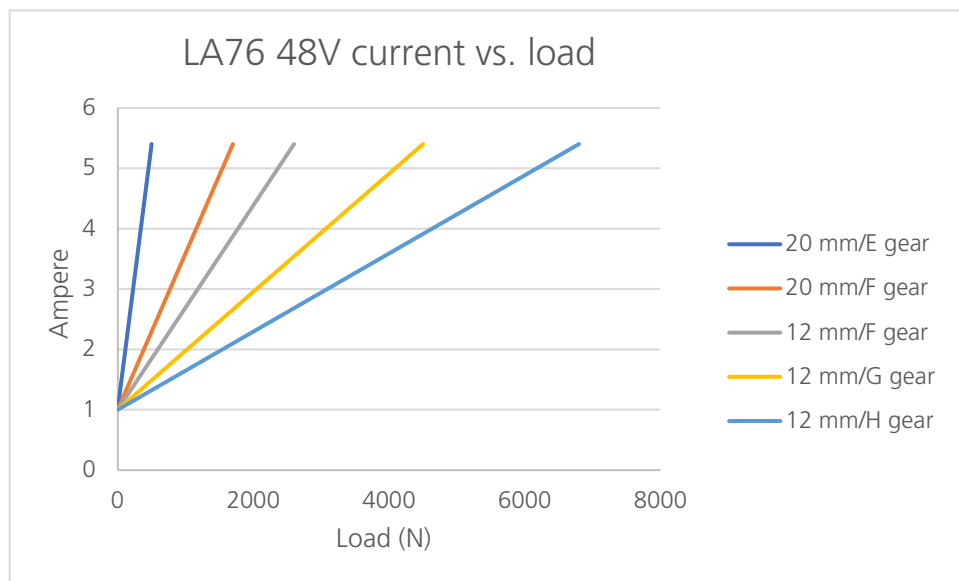
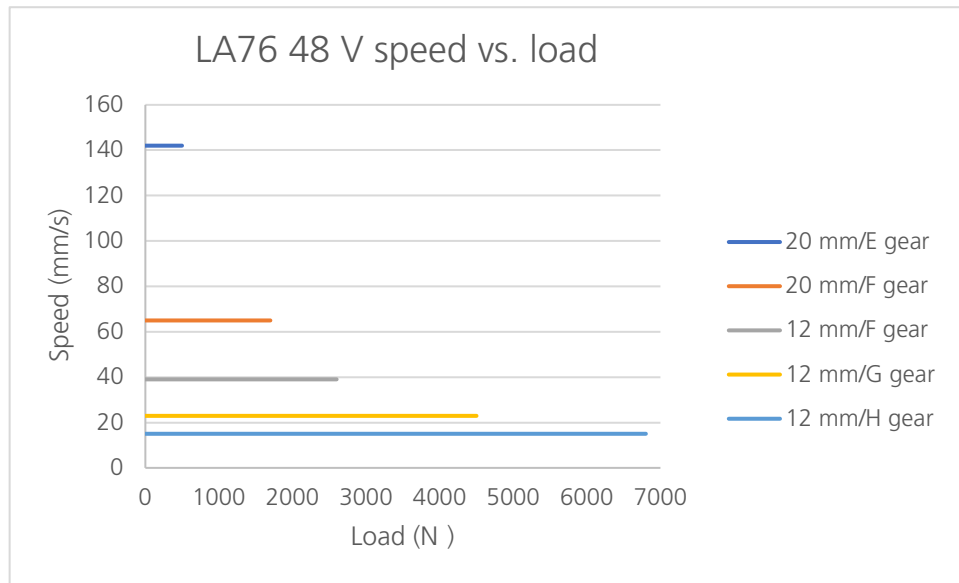
Speed and current curves

The values below are typical values and made with a stable power supply and an ambient temperature of 20°C.



Speed and current curves

The values below are typical values and made with a stable power supply and an ambient temperature of 20°C.



All measurements above describe the spindle pitch (e.g. 20mm) and the gear type (e.g. H gear) of the actuator.

Current limits

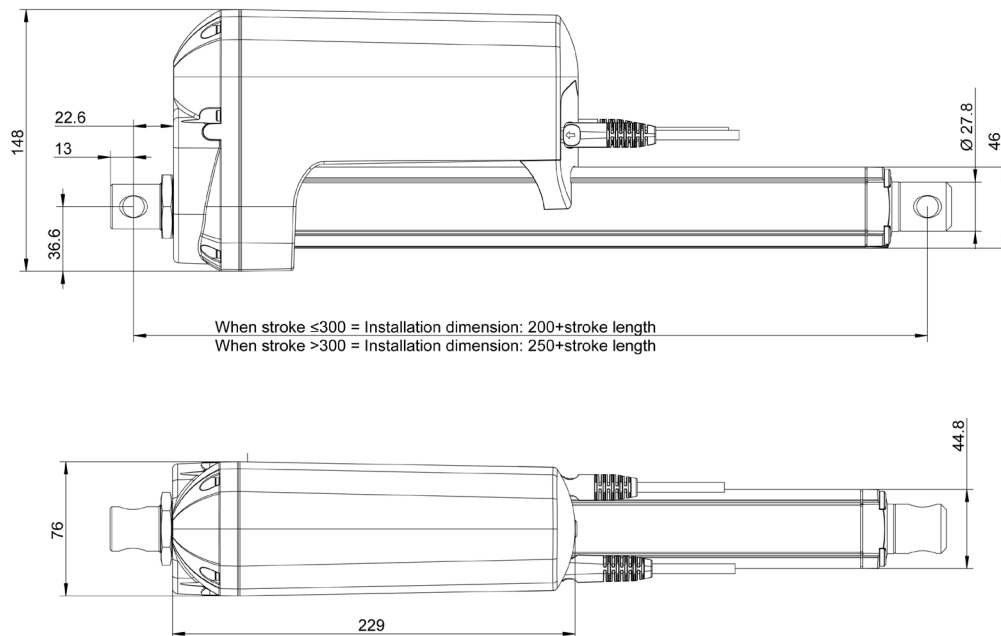
Platform	24 V	48 V	Reference temperature: 0°C
All	13 A	8 A	Above
	26 A	13 A	Below

Stroke and built-in tolerances

Platform	Stroke tolerance	Example for 200 mm stroke	BID tolerance	Example for 200 mm BID
All	+/- 2 mm	198 to 202 mm	+/- 2 mm	198 to 202 mm

Built-in dimensions

All dimensions are in mm

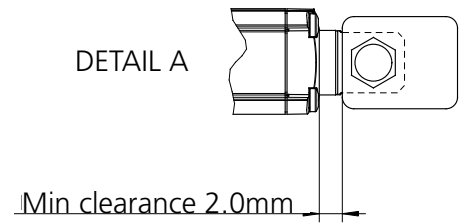
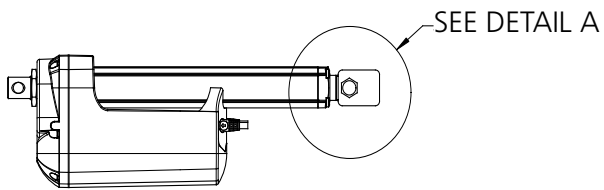


The above dimensions apply for all piston rod eyes and back fixtures.

Keep a clearance when mounting a bracket



When mounting a custom bracket on the moving part of the actuator, please observe the minimum clearance between bracket and cylinder top, when fully retracted, to avoid jamming and destruction of actuator drive train.



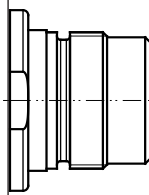
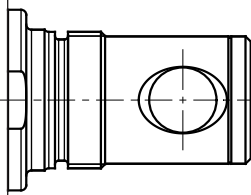
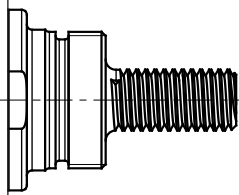
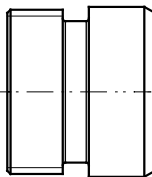
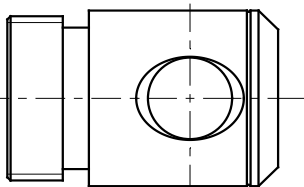
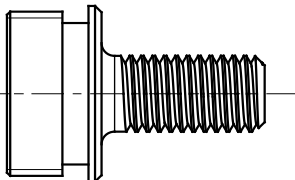
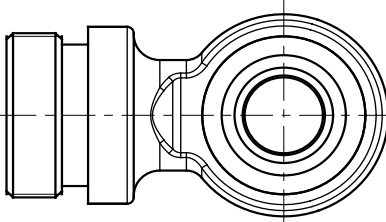
With Zero Point the minimum stroke is 70 mm

The Zero Point Initialisation Zone is located between 35-70 mm going from the most inward position.

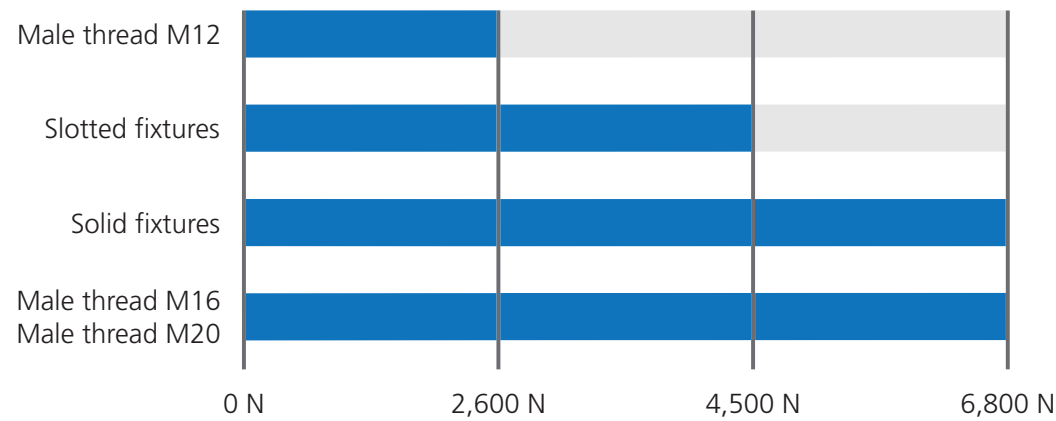
The movement passing the zone has to be stable for the initialisation to succeed. No virtual limits can be set in the initialisation zone.

Built-in dimensions

All dimensions are in mm

	Back fixture						
Length of stroke		<=300	>300	<=300	>300	<=300	>300
Piston rod eye		Inner thread - from the surface		Solid or slotted fixture - to center of the hole		Outer thread - from the surface	
	Inner thread - from the surface	189	239	195	245	180	230
	Solid or slotted fixture - to center of the hole	194	244	200	250	185	235
	Outer thread - from the surface	181	231	187	237	173	223
	Ball eye - to center of the hole	209	259	215	265	200	250

Durability for piston rod eyes and back fixtures



Blue = Full Lifetime

Grey = Reduced lifetime

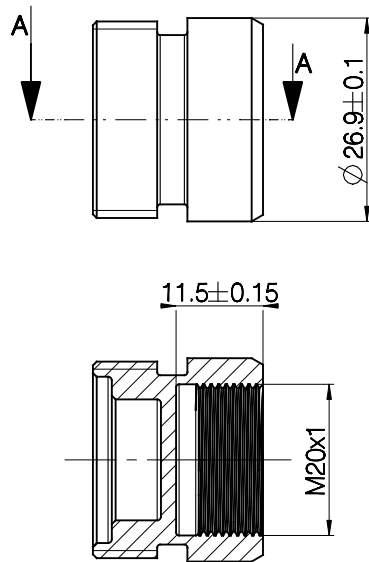
(If e.g. a Male thread M12 is used with an actuator with a larger load than 2,600 N and a Slotted fixture is used with an actuator with a larger load than 4,500 N their lifetime will be shorter than if the other fixtures are chosen).

Piston rod eyes

When ordering AISI (304 and up) piston rod eye and back fixture, stainless steel screws are automatically included.

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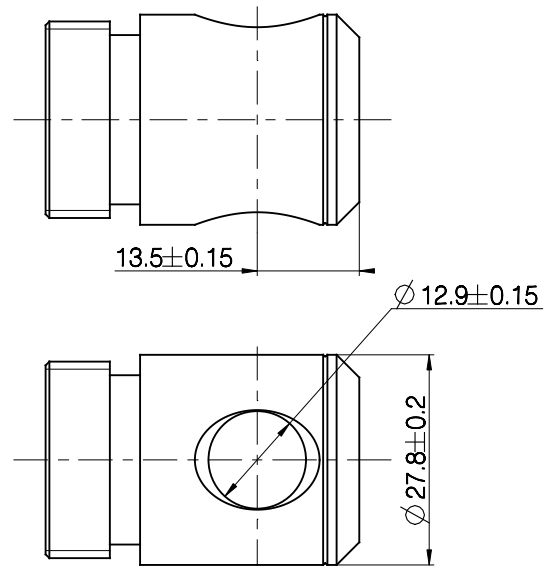
AISI 303



SECTION A-A

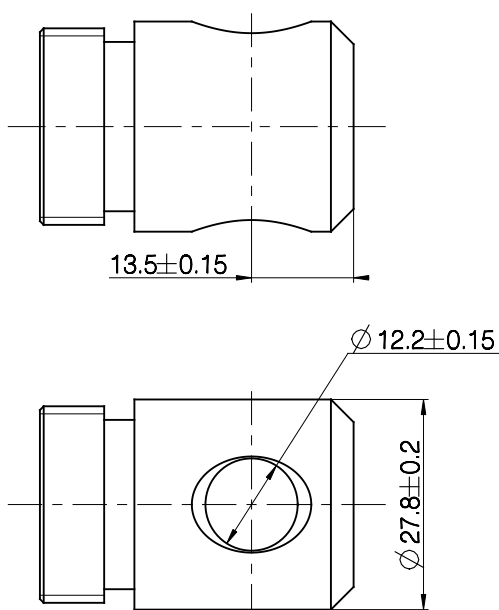
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Free-cutting steel galvanised surface



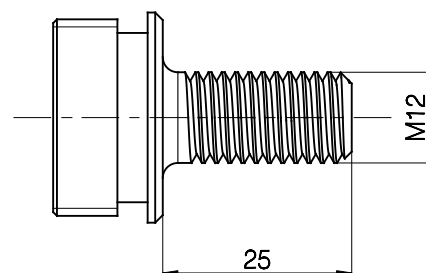
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Free-cutting steel galvanised surface



LINAK P/N: 0361224

AISI 303

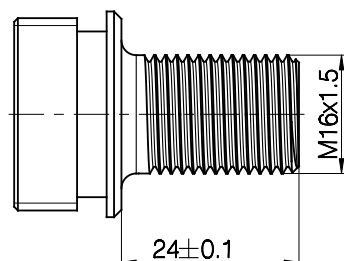


The piston rod eye is only allowed to turn 0 - 90 degrees.

Piston rod eyes

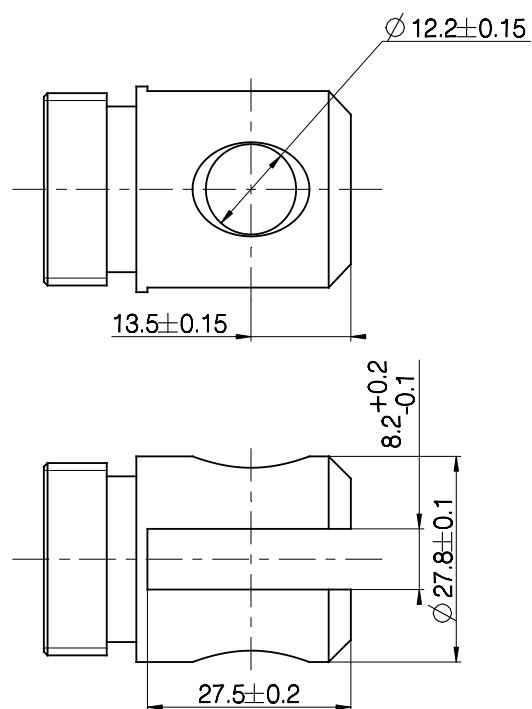
LINAK P/N: 0361135

AISI 303



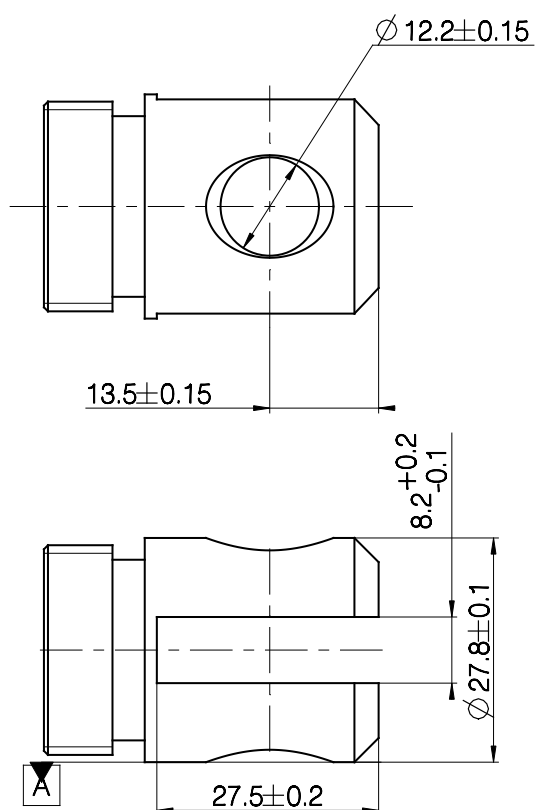
LINAK P/N: 0361138

Free-cutting steel galvanised surface



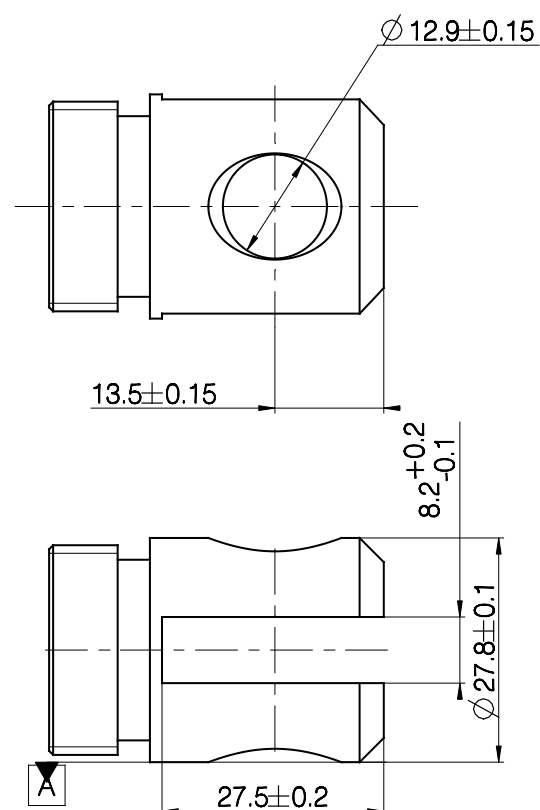
LINAK P/N: 0361260

AISI 304



LINAK P/N: 0361275

AISI 304

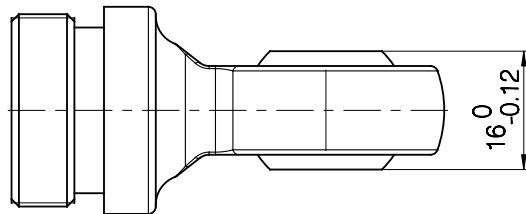
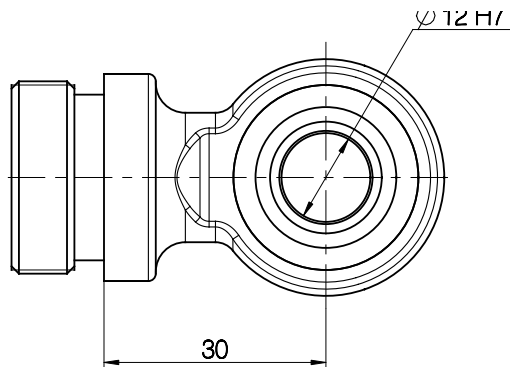


Piston rod eyes

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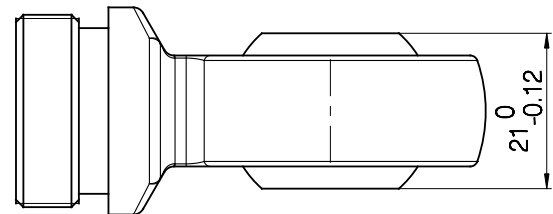
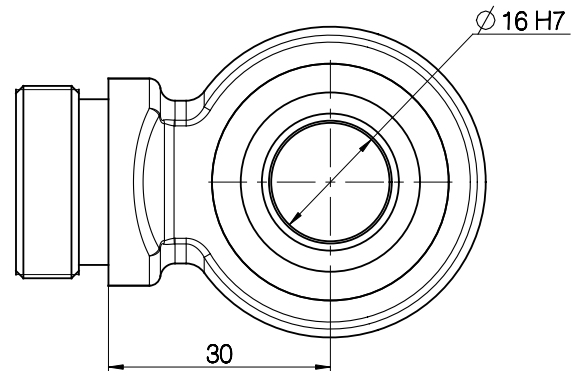
Max. load 6,800 N in pull

AISI 304



LINAK P/N: 0361351

AISI 304

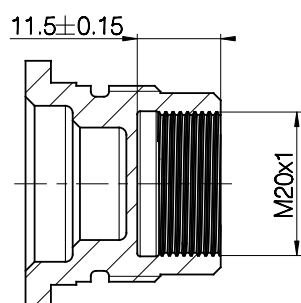
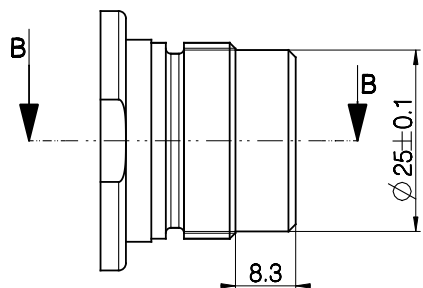


The piston rod eye is only allowed to turn 0 - 90 degrees.

Back fixtures

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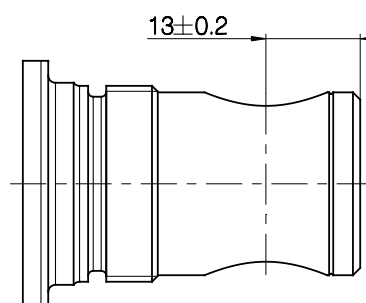
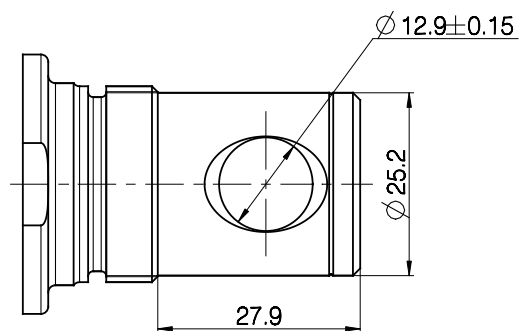
AISI 303



SECTION B-B

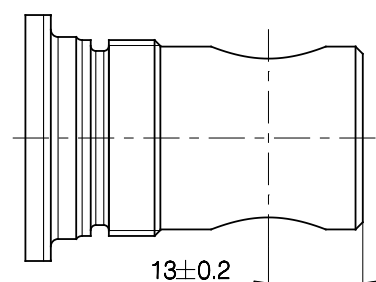
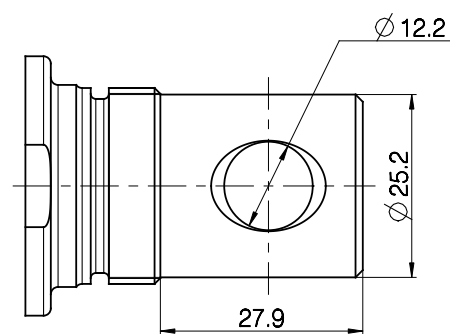
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Free-cutting steel galvanised surface



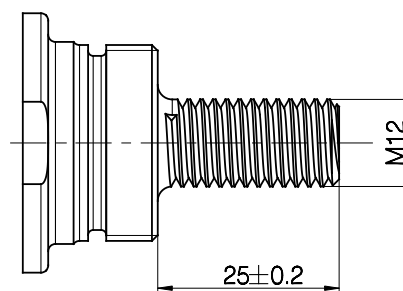
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Free-cutting steel galvanised surface



LINAK P/N: 0361753

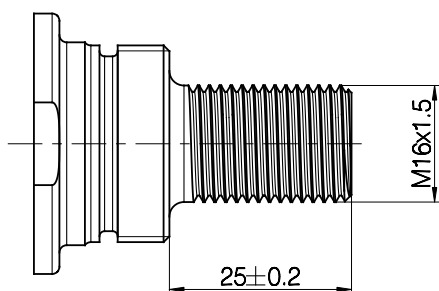
AISI 303



Back fixtures

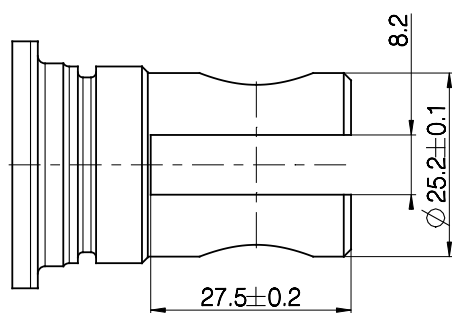
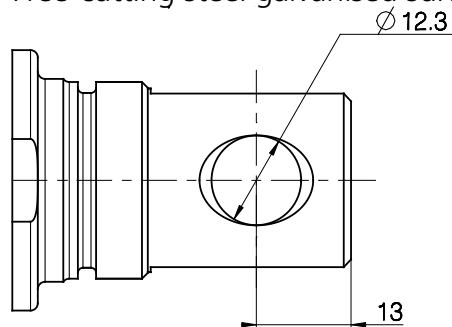
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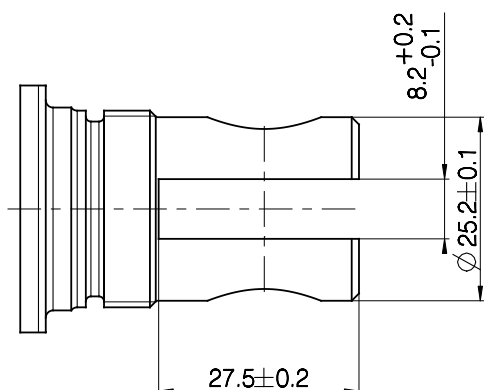
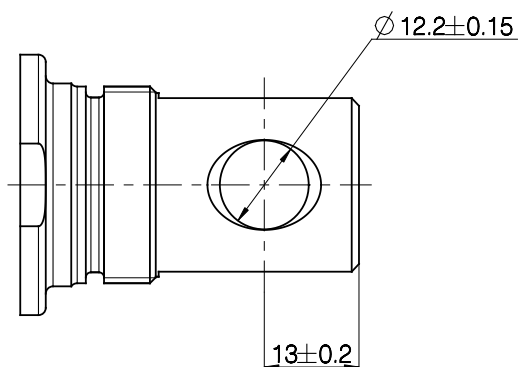
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Free-cutting steel galvanised surface



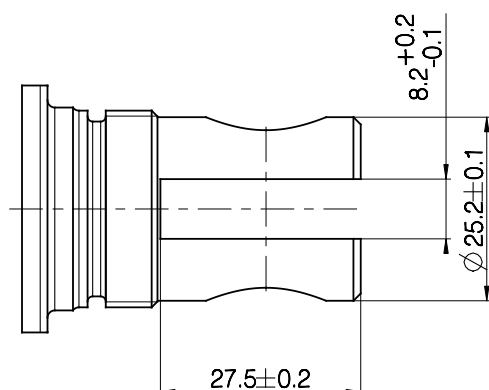
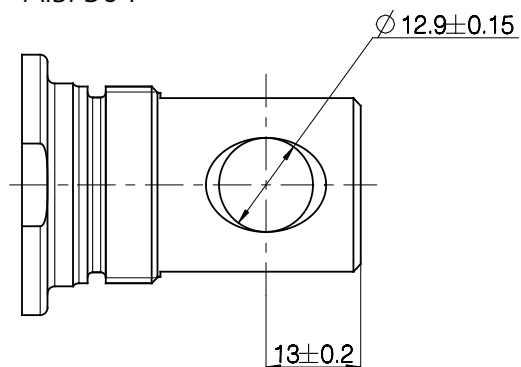
LINAK P/N: 0361742

AISI 304

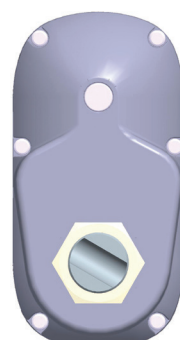
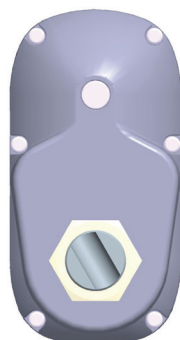
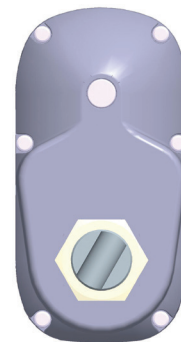
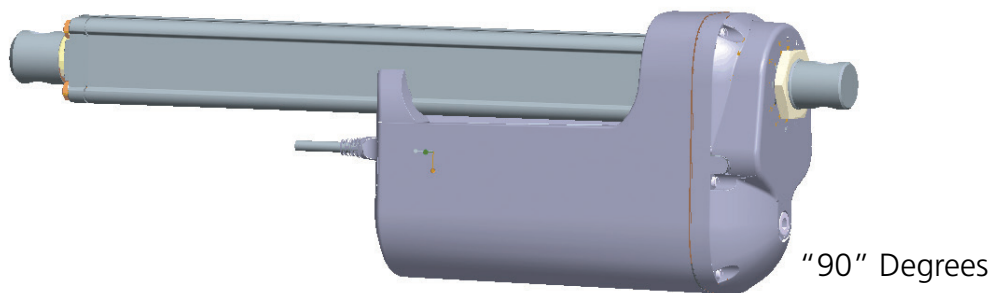
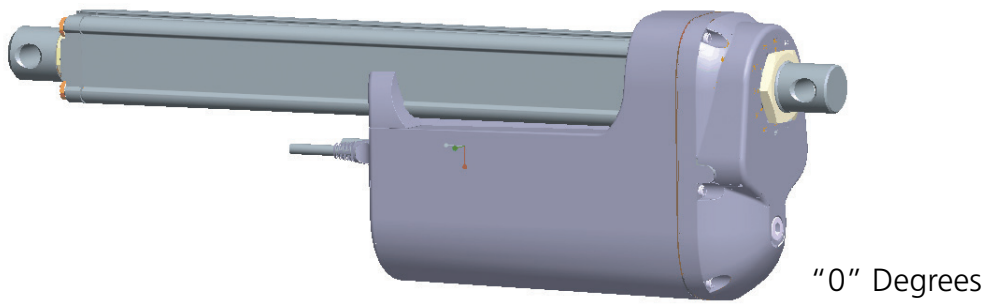


LINAK P/N: 0361743

AISI 304

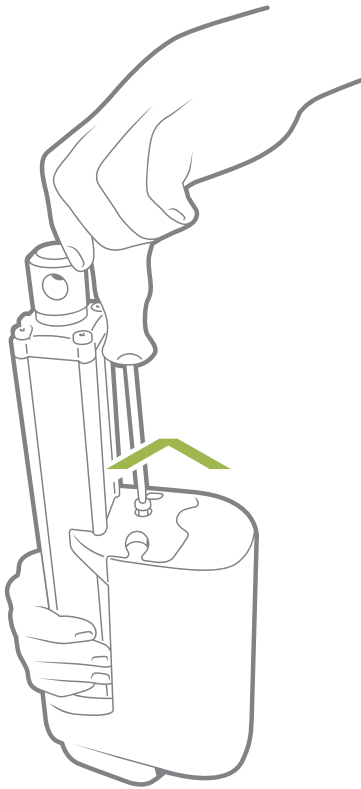


Back fixture orientation

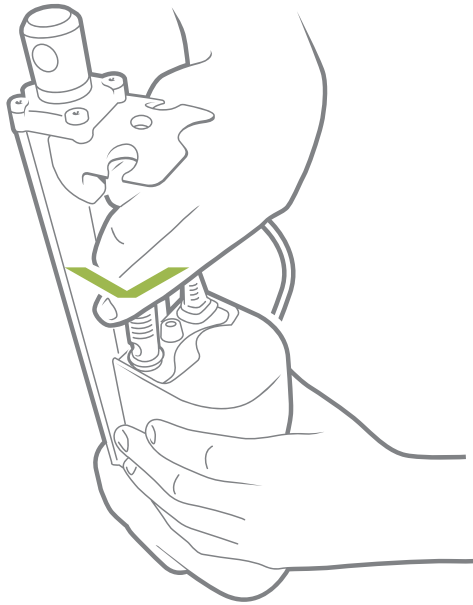


NB. All with tolerance of $\pm 4^\circ$

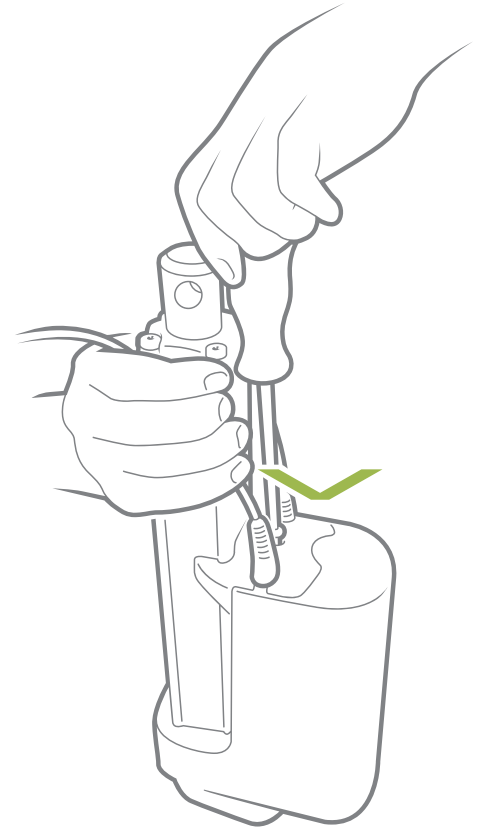
Cable mounting



1. Unscrew the cover and remove the two blind plugs.



2. Plug in the power cable and/or the signal cable.



3. Slide the cover onto the actuator.

The torque of the cover screw is approx. 3.5 ± 0.3 Nm TORX 25IP



When changing the cables on a LINAK® actuator, it is important that this is done carefully, in order to protect the plugs and pins. Before the new cable is mounted, we recommend that the socket is greased with Vaseline®, to keep the high IP protection and ensure an easy mounting. Please be sure that the plug is in the right location and fully pressed in before the cable lid is mounted.

Remove the tinned cable end when the cable end is mechanically connected. The tinned end is only to be used when a soldered connection is made.

Please note that if the cables are mounted and dismantled more than 3 times, the plugs can be damaged. Therefore, we recommend that such cables are discarded and replaced. Also note that the cables should not be used for carrying the actuator.

We recommend taking some precaution and designing the wire connection in a way, where the cable end is kept inside a closed, protected area to guarantee the high IP protection.

Cables

Power cable dimensions

LINAK® P/N 0367046

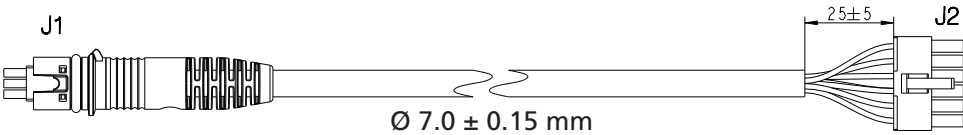
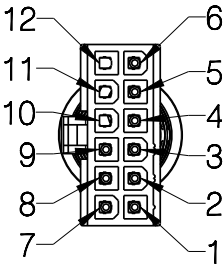
Colour	Outer dimensions	Core mm²	AWG*
Brown	Ø2.8 mm	2.0	14
Blue	Ø2.8 mm	2.0	14



9-pin Signal cable dimensions

LINAK P/N 0368543

Colour	Outer dimensions	Core mm²	AWG*	Pin
Orange	Ø1.5 mm	0.5	20	5
Black	Ø1.5 mm	0.5	20	1
Red	Ø1.5 mm	0.5	20	2
Light Blue	Ø1.5 mm	0.5	20	6
Yellow	Ø1.5 mm	0.5	20	3
Green	Ø1.5 mm	0.5	20	4
Grey	Ø1.5 mm	0.5	20	0
Violet	Ø1.5 mm	0.5	20	7
White	Ø1.5 mm	0.5	20	8



Cable kit article numbers

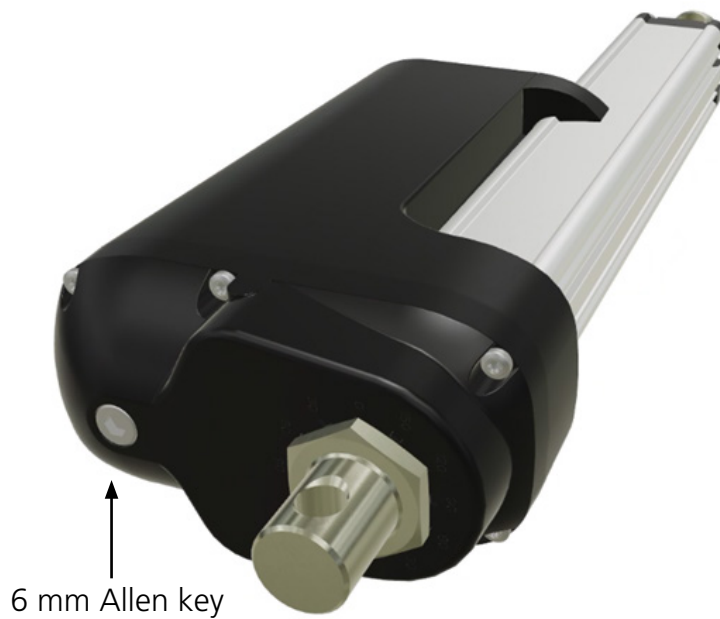
Actuator Connect™ cable kits:				
System	Article no.	Connection	Includes	Colour
All Actuators with 9-pin e.g. I/O: Basic, Customised and Full & CAN bus / CanOpen	0367996	Signal-power + RJ45	(Adapter + USB2Lin)	Grey

Latest versions of Actuator Connect can be downloaded at the [LINAK/TECHLINE](#) page.

*AWG: American Wire Gauge

Manual hand crank

The manual hand crank can be used in the case of a power failure and is only intended for emergency use.



The cover over the Allen key socket must be unscrewed before the Allen key can be inserted and the hand crank operated.

Hand crank torque: 6-8 Nm

Hand crank RPM: Max. 65

Piston rod movement per turn:

	12 mm	20 mm
Gear F	11 mm	18 mm
Gear G	6 mm	10 mm
Gear H	4 mm	7 mm
Gear E	-	27 mm



- The power supply has to be disconnected during manual operation.
- If the actuator is operated as a hand crank, it must only be operated by hand - otherwise there is a potential risk of overloading and thereby damaging the actuator. Do NOT use power tools to operate the hand crank!
- After using the hand crank, the ingress protection IP66 cannot be maintained.
- After using the hand crank, always return the actuator to the most inward position. Failing to do so can damage the actuator or the application it is used for.
- Actuators with absolute positioning must be initialised after use of the manual hand crank, because their positioning will be displaced when the power is disconnected.

Environmental tests – Climatic

Test	Specification	Comment
Cold Test	EN60068-2-1 (Ab)	Storage at low temperature: Temperature: -40 °C Duration: 72 h Not connected Tested at room temperature.
	EN60068-2-1 (Ad)	Storage at low temperature: Temperature: -30 °C Duration: 2 h Actuator is not activated/connected. Tested at low temperature.
Dry Heat	EN60068-2-2 (Bb)	Storage at high temperature: Temperature: +90 °C Duration: 72 h Actuator is not activated/connected. Tested at room temperature
	EN60068-2-2 (Bd)	Storage at high temperature: Temperature: +70 °C Duration: 1000 h Actuator is not activated/connected Tested at high temperature. Operating at high temperature: Temperature: +60 °C Int. max. 17 % Duration: 700 h Actuator is activated Tested at high temperature.
Change of Temperature	EN60068-2-14 (Na)	Rapid change of temperature: High temperature: +100 °C in 60 minutes. Low temperature: -30 °C in 60 minutes. Transition time: <10 seconds Duration: 100 cycles Actuator is not activated/connected. Tested at room temperature.
	EN60068-2-14 (Nb)	Controlled change of temperature: Temperature change 5 °C pr. minute High temperature: +70 °C in 60 minutes. Low temperature: -30 °C in 30 minutes. 130 minutes pr. Cycle. Duration: 1.000 cycles (90 days) Actuator is not activated/connected. Tested at 250, 500 and 1,000 cycles at low and high temperatures.

Test	Specification	Comment
Damp Heat	EN60068-2-30 (Db)	Damp heat, Cyclic: Relative humidity: 93-98 % High temperature: +55 °C in 12 hours Low temperature: +25 °C in 12 hours Duration: 21 cycles * 24 hours Actuator is not activated/connected. Tested within 1 hour after condensation, after upper temperature has been reached.
	EN60068-2-3 (Ca)	Damp heat, Steady state: Relative humidity: 93-95 % Temperature: +40 ± 2 °C Duration: 56 days Actuator is not activated/connected. Tested within one hour after exposure.
Salt Mist	EN60068-2-52 (Kb)	Salt spray test: Salt solution: 5 % sodium chloride (NaCl) 4 spraying periods, each of 2 hours. Humidity storage 7 days after each. Actuator not activated/connected. Exposure time: 500 hours
Degrees of Protection	EN60529 – IP66	IP6X - Dust: Dust-tight, No ingress of dust. Actuator is not activated. IPX6 – Water: Ingress of water in quantities causing harmful effects is not allowed. Duration: 100 litres pr. minute in 3 minutes Actuator is not activated. IPX6 –Connected actuator: Actuator is driving out and in for 3 min. 100 (l/min) jet of water is placed at the wiper ring for 3 (min). IPX6 –Connected actuator and push 6800 (N) Actuator is driving out and in for 3 min. and Push 6800 (N) at the end-pos. 100 (l/min.) jet of water is placed at the wiper ring for 3 min.
	DIN40050 – IP69K	High pressure cleaner: Water temperature: +80 °C Water pressure: 80 bar Spray angle: 45 ° Spray distance: 100 mm Duration: From any direction 10 seconds of spraying followed by 10 seconds rest. Actuator is not activated. Ingress of water in quantities causing harmful effects is not allowed.
	DUNK test	The actuator has been warmed up to 115 °C for 20 hours. After this it is cooled down in 20 °C salt water. Cooling time: 5 minutes Opened for checking salt deposit and water.
Chemicals	BS7691 / 96 hours	Diesel 100 % Hydraulic oil 100 % Ethylene Glucol 50 % Urea Nitrogen saturated solution Liquid lime 10 % (Super- Cal) NPK Fertilizer (NPK 16-4-12) saturated Tested for corrosion.

Environmental tests - Mechanical

Test	Specification	Comment
Free Fall		<u>Free fall from all sides:</u> Height of fall: 0.4 meter onto steel. Actuator not activated/connected.
Vibration	EN60068-2-36 (Fdb)	<u>Random vibration:</u> Short time test: 6.29 g RMS Actuator is not connected. Long time test: 7.21 g RMS Actuator is not connected. Duration: 2 hours in each direction
	EN 60068-2-6 (Fc)	<u>Sinus vibration:</u> Frequency 5-25 Hz: Amplitude = 3.3 mm pp Frequency 25-200 Hz: Acceleration 4 g Number of directions: 3 (X-Z-Y) Duration: 2 hours in each direction. Actuator is not activated.
Bump	EN60068-2-29 (Eb)	<u>Bump test:</u> Level: 40 g Duration: 6 milliseconds Number of bumps: 500 shocks in each of 6 directions. Actuator is not connected.
Shock	EN60068-2-27 (Ea)	<u>Shock test:</u> Level: 100 g Duration: 6 milliseconds Number of bumps: 3 shocks in each of 6 directions. Actuator is not connected.

Environmental tests - Electrical

Test	Specification	Comment
Emission	EN61000-6-4	Level is inside limits for 12 V motor.
Automotive Transients	ISO 7637	Load dump test only accepted on motor power connection.
Regulation No. 10		Directive on electromagnetic compatibility of sub-assembly for automotive applications.

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