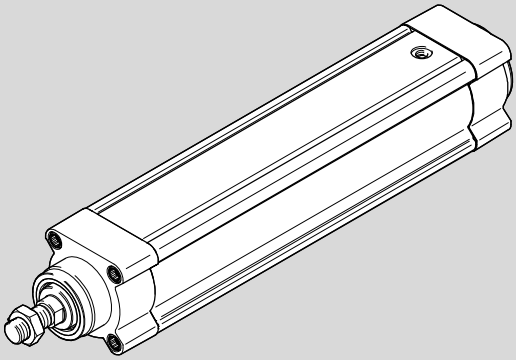
Electric cylinder

ESBF-BS/-LS-32 ... 100



FESTO

en Operating instructions

8076295
2018-12b
[8076297]

Translation of the original instructions

Symbols:

Warning

Installation and commissioning may only be performed in accordance with these instructions by technicians with appropriate qualifications.

Caution

Note

Environment

Accessories

English – Electric cylinder ESBF-BS/-LS-32 ... 100

Table of contents

Documentation on the product

For all available product documentation ➔ www.festo.com/pk

1 Design

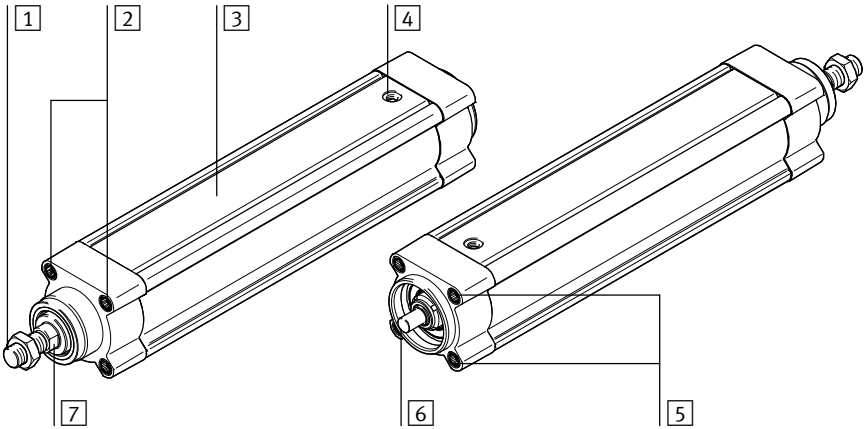


Fig. 1

1 piston rod
2 Thread for mounting
3 Cylinder profile
4 Pressure compensation opening (with ESBF-32...50 in input-end cylinder cover):
– with sintered filter
– with thread (on variant S1/F1)
5 Thread for motor connection
6 Drive shaft
7 Wrench flats for counter holding

2 Safety

2.1 Use for intended purpose

The electric cylinder is intended to be used for exact positioning of payloads in combination with tools or as a drive when external guides are used. The following product features are characteristic:
– low-speeds, self-retarding (ESBF-LS with lead screw)
– high speeds, high forces (ESBF-BS with ball screw).

2.2 General safety information

- Take into consideration the legal regulations applicable for the location.
- Only use the product if it is in its original status and in an excellent technical status.
- Use the product only within the defined values (➔ 12 Technical data and 13 characteristics curves)
- Take into account labelling on the product.
- Do not make any unauthorised modifications to the product.
- Observe other applicable documents.
- Take into consideration the ambient conditions at the location of use.
  Protect the product during storage and operation from the following:
  – Wetness or moisture
  – Corrosive coolant or other materials (e.g. ozone)
  – UV radiation
  – Oils, greases and grease-solvent vapours
  – Grinding dust
  – Glowing chips or sparks

2.3 Mounting and connecting

- Observe tightening torques. Unless otherwise specified, the tolerance is ±20 %.

2.4 Qualified specialists

Only qualified personnel may perform installation, commissioning, maintenance and disassembly of the product. The qualified personnel must be familiar with installation and operation of electrical and pneumatic control systems.

3 Function

A rotating thread drive (lead screw with ESBF-**LS** or ball screw with ESBF-**BS**) converts the rotary movement of a motor into a linear movement. The piston rod will then move backwards and forwards.
The piston rod is non-rotating. The position of the piston rod can be scanned with the aid of proximity sensors.

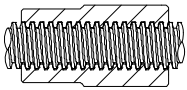


Fig. 2 ESBF-LS

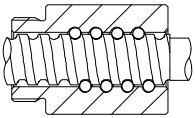


Fig. 3 ESBF-BS

Note
The ESBF-**LS** is self-braking. When the input torque is not applied, the piston rod will be braked.
The piston rod can, however, move involuntarily when:
- Vertical or diagonal mounting position of the ESBF-LS
- there is no holding torque on the drive shaft
- vibration

Note
The ESBF-**BS** is unbraked. When the input torque is not applied, the piston rod can be moved freely. Self-locking of the complete system can be achieved with motors with integrated holding brake or with high self-braking torque.

- Select the corresponding motors from our catalogue (➔ www.festo.com/catalogue).
- Do not exceed the limit values for forces and speeds when using other motors (➔ 12 Technical data and 13 characteristics curves in Appendix).

4 Transport

- Take product weight into account (➔ 12 Technical data).
- Secure piston rod during transport and maintain it in load-free position.

5 Installation

5.1 Mechanical installation

Prerequisites

- Do not modify the screws and threaded pins.
  Exception: Direct request to make changes in these operating instructions.
- Mount the motor on the electric cylinder using a motor mounting kit (➔ Assembly instructions).
  Permitted motor mounting kits
  (➔ www.festo.com/catalogue).
- Connector motor cables only after the electric cylinder is mounted.

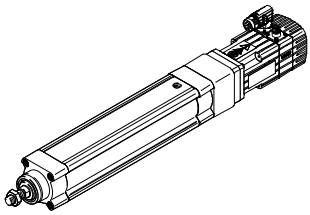


Fig. 4

Mounting position vertical or diagonal

WARNING
Uncontrolled moved masses caused by spindle nut fracture inside the ESBF or a toothed belt failure in parallel configuration EAMM-U (e.g. due to wear)
Injury from hard contact, impact, crushing.

- Check if protective measures are necessary to prevent damage (e.g. toothed latches, pins or emergency buffers).
  Where necessary, take suitable measures.

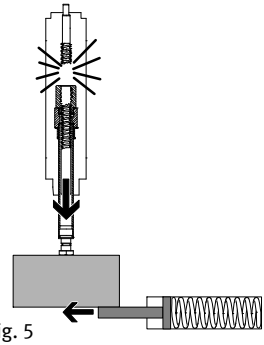


Fig. 5

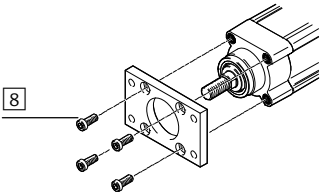
5.1.1 Mount product

Note
Pulling out of screws if cylinder is only mounted to the covers and the torque load around the collar is too great.
- If there are heavy loads, mount the cylinder to the profile with additional mounting components.

- Place ESBF as follows:
  – all control sections are accessible
  – Pressure compensating opening [4] (➔ Fig. 1) is not covered.

Interfaces for mounting components

on the cover
e.g. with flange mounting EAHH



on the profile
e.g. with profile mounting EAHF

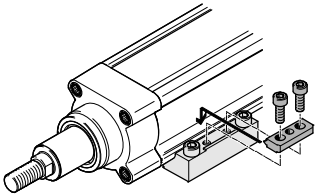


Fig. 6

- Select mounting components or accessories (➔ www.festo.com/catalogue).
- Mount the mounting components outside the positioning range (avoid collisions).
- Select mounting elements so that internal torques are braced against the housing during powerful acceleration phases.
- Mount cylinder without distortion and deflection.
- Tighten screws [8] uniformly to the specified tightening torque.

Size		32	40	50	63	80	100
Screw	[8]	M6	M6	M 8	M 8	M10	M10
Tightening torque	[Nm] corrie	6	6	12	12	25	25

Tab. 1

Note
If an EAGF guide unit is used:
- Mount construction kits for proximity switches outside the mounting area of the EAGF (➔ Assembly instructions).

5.1.2 Mount attachment components

Fitting hoses to pressure compensation opening

For pressurising and depressurising the pressure compensation opening on ESBF-...-S1/F1:

- Tighten suitable screw connection into the thread 4.
- Connect a tube for the supply and exhaust of fresh air.
  Alternatives to the routing of this hose:
  – in a protected area (dust-free and dry)
  – in a large expansion tank
  – with low positive pressure (max. 0.2 bar) as sealing air.

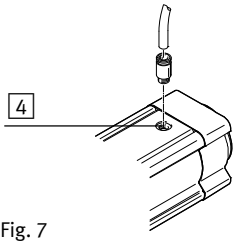


Fig. 7

Mount attachment component

- Place the centre of gravity of the attachment component, if possible, centrally to the piston rod.
- Transmit as little torque as possible to the piston rod. Brace against key surface 7. Excessively high torque can damage the mechanism inside the cylinder (➔ Tab. 2).
- Mount the attachment component to the piston rod.
  Do not exceed permitted level of transverse force (deflection of piston rod ➔ Appendix 13 characteristics curves).

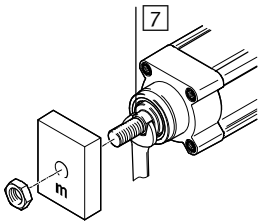


Fig. 8

Size	32	40	50	63	80	100
Piston rod thread						
Male thread	M10x1.25	M12x1.25	M16x1.5	M16x1.5	M20x1.5	M20x1.5
Female thread[1)]	M6	M 8	M10	M10	M12	M12
Width across flats 7 ⌀ [mm]	10	13	17	17	22	22
Max. torque [Nm] corrie	2.4	6.4	12	15	31	53

1) Only at ESBF-...-F

Tab. 2

5.1.3 Mount accessories

To protect the end positions against uncontrolled overtravel:

- Check whether proximity sensors are necessary (as safety limit switches or hardware limit switches).
- Use appropriate proximity switches, sensor strips or mounting construction kits. Proximity switches for polling the internal magnet must be arranged centrally on the flat profile surface (➔ www.festo.com/catalogue).
- Use proximity sensors with normally-closed function. These protect the ESBF from overrunning of the limit position if the proximity sensor cable is fractured.
- Avoid external influence caused by magnetic or ferritic parts in the vicinity of the proximity sensors.

6 Commissioning

WARNING
Unexpected movement of components.
Injury due to impact or pinching.
- Protect positioning range from access (e.g. with protective guards).
- Make sure that no foreign objects are present in the positioning range.
- Carry out commissioning with low speeds and torques.

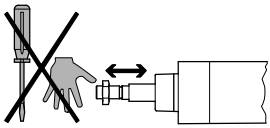


Fig. 9

Note
Incorrect set values for the braking ramp in STOP statuses
(e.g. EMERGENCY OFF, Quick Stop) result in an overloading of the spindle axis and can destroy it or drastically reduce its service life.
- Check the settings for all braking ramps in the controller or the higher-order control system (deceleration values and jerk).
- Ensure that the retardation values (brake retardation, retardation times) are set in such a way that the maximum input torque or “max. propulsion force” are not exceeded. Take the following into account:
  – Travel speed
  – Moving mass
  – Mounting position
- To design the spindle axis, use the Festo “Positioning Drives” design software (➔ www.festo.com).

Note
Block-shaped acceleration profiles (without jolt limitation) cause high peaks in the motive force that can lead to an overloading of the drive. In addition, positions outside the permissible range may occur as a result of overswing effects. A jolt-limited acceleration specification reduces vibrations in the entire system and has a positive effect on stress in the mechanical system.
- Check which closed-loop controller settings can be adapted (e.g. jerk limitation, smoothing of the acceleration profile).

Procedure	Purpose	Note
1. Check travel	Determine the approach direction of the motor.	Even with identical control, motors of the same design can turn in opposite directions due to different wiring. The spindle of the ESBF turns in a clockwise direction: when the drive shaft is turned in a clockwise direction, the piston rod moves in the direction of the motor.
2. Reference travel to reference switch / engine-end limit position	Compare the real situation to the image in the controller.	The reference run may only be performed towards the reference switch (➔ Operating instructions of the drive system). Start the reference run in accordance with the operating instructions for your motor drive system and limited to low dynamics (e.g. with a max. speed of 10 mm/s) up to the reference switch. Providing the permitted impact energy is not exceeded, ➔ Tab. 4) the reference run in conjunction with the servo motor may be made directly against the mechanical end position on the motor side.
3. Test run	Check the overall behaviour.	Check the following requirements: – The piston rod moves through the intended positioning cycle completely. – Piston rod stops as soon as it reaches a limit switch. After a successful test run, the electric cylinder is ready for operation.

Tab. 3

Size		32	40	50	63	80	100
Maximum impact energy (= ½ mass x speed^2)	[10^{-3} J]	0.03	0.05	0.07	0.15	0.38	0.60

Tab. 4

If the proximity sensors fail to respond:
(➔ 11 Troubleshooting and Proximity sensor operating instructions).

7 Maintenance and care

Fitting in a vertical or sloping position:

WARNING
Unexpected movement of components. Injury due to impacts or pinching.
When working on the product, switch off the controller and secure it to prevent it from being switched back on accidentally.
- Examine the toothed belt of the parallel kit regularly for wear (➔ Assembly instructions for the parallel kit).

Cleaning
- Clean the outside of the product with a soft cloth as required. Do not use aggressive cleaning agents (material specifications ➔ 12 Technical data).

Lubrication of the piston rod

Note
The piston rod must always have a layer of grease. A lack of grease causes the sealing ring to wear.

If required, or if the component no longer has a layer of grease (e.g. after cleaning)
- Grease the surface of the piston rod [1].
  - Grease on the standard variant: LUB-KC1
  - Grease on variant F1: LUB-E1

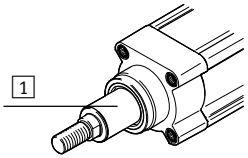


Fig. 10

Functional test
On electric cylinder with lead screw **ESBF-LS**:

WARNING
Unexpected movement of components. Injury due to impacts or pinching.
If a worn lead screw (ESBF-LS) breaks on a vertically or diagonally fitted ESBF, the work mass will fall down.
- Replace the ESBF if the maximum permitted reversing play is exceeded:

- **Reversing backlash-During maintenance work, always measure** (reversing play) on the piston rod whenever wear is found on the lead screw. Maximum reversing play permitted is:

Size	32	40	50
Max. permissible axial play	0.62 mm	0.75 mm	1.0 mm

Tab. 5

On electric cylinder with ball screw **ESBF-BS**:
Possible wear leads in the long term to increased noise and later to blockage of the ball screw.

8 Disassembly and repair

WARNING
Unexpected movement of components.
Injury due to impacts or pinching.
- When working on all products, switch off the controller and secure it to prevent it from being switched back on accidentally.
- Observe notes on transport (➔ 4 Transport).

- Remove motor cables and mounting components.

In case of repair:
- Send product to Festo or contact Festo Service (➔ www.festo.com/sp).
  Festo carries out the required repairs, fine adjustments and checks.

9 Disposal

- Dispose of the packaging and the product at the end of its useful life through environmentally friendly recycling in accordance with applicable specifications.

10 Accessories

Note
- Choose accessories from our catalogue (➔ www.festo.com/catalogue).

11 Troubleshooting

Malfunction	Possible cause	Remedy
Reversing play too great (➔ Tab. 5)	Wear in lead screw	Replace the ESBF-LS
Running noises or vibrations	Tension	Install ESBF so it is free of tension (evenness of the bearing surface: ≤ 0.2 mm)
		Lubricate the piston rod (➔ 7 Maintenance and care)
		Modify travel speed
	Incorrect regulator settings	Change the controller parameters (only on servo systems)
	Wear	Replace ESBF-BS
Piston rod does not move	Jamming in mechanical end position (e.g. after homing at too high a speed or after improper travel into an end position during operation)	– To release a jam manually: 1. Switch off power, 2. Remove motor and coupling housing, 3. Turn drive shaft to release it – Reduce speed for reference travel – Set software end positions at least 0.25 mm away from the mechanical end positions (the stops)
	Loads too high	– Reduce effective load – Reduce travel speed – Send the ESBF to Festo for repairs
	When using the parallel kit, the pretension on the toothed belt is too high	Reduce the pretension on the toothed belt (➔ Assembly instructions for the parallel kit)
	Ambient temperature too low (increased breakaway torque in initial run due to increasing viscosity of the lubricants in the spindle system)	– Reduce effective load – Reduce travel speed – In the case of servo motors, it may be necessary to allow higher peak current (➔ Operating instructions for the motor) – Adjust ambient temperature – Interpose gearbox to generate higher torque With interposed gearbox – Adapt lubricant
	Wear on ball drive	Replace ESBF-BS

Tab. 6

12 Technical data

Electric cylinder ESBF-LS-32 ... 50

Size		**LS-32**	**LS-40**	**LS-50**
Spindle pitch		**2.5**	**3**	**4**
Design		Electric cylinder with lead screw:		
Assembly position		any		
Ambient temperature	[°C]	0 ... +60		
Storage temperature	[°C]	–20 ... +60		
Degree of protection				
–		IP40		
K1		IP65		
Relative air humidity	[%]	0 ... 95 (non-condensing)		
Feed force F	[kN]	➔ Chapter “Characteristic curves” in the appendix		
Max. tensile force F	[kN]	0.6	1	1.6
Max. driving torque	[Nm] corrie	1.1	2.4	4.8
Max. radial force on the drive shaft	[N]	115	130	300
No-load driving torque[1)2)]	[Nm] corrie	0.1	0.2	0.3
Max. speed	[m/s]	0.05		
Max. rotational speed	[rpm]	1200	1000	750
Max. acceleration	[m/s^2]	2.5		
Feed constant (spindle pitch)[2)]	[mm/rev]	2.5	3	4
Repetition accuracy	[mm]	± 0.05		
Reversing backlash[3)]	[mm]	<0.1		
Max. angle of rotation at the piston rod	[°]	± 0.25	± 0.20	± 0.15
Note on materials		Contains PWIS (paint-wetting impairment substances)		
Information on materials				
Cylinder barrel, cover		Aluminium,		
Ball bearing, screws, spindles		Steel		
Piston rod		Stainless steel		
Spindle nut		POM		
Weight				
With 0 mm stroke	[kg]	0.667	1.079	1.716
Per 10 mm stroke	[kg]	0.034	0.048	0.067

1) At a spindle speed of 200 rpm

2) Nominal value, varies due to component tolerances

3) In new condition, max. permitted reversing play (➔ 7 Care and maintenance)

Tab. 7

Electric cylinder ESBF-BS-32 ... 50

Size		BS-32		BS-40			BS-50		
Spindle pitch		**5**	**10**	**5**	**10**	**16**	**5**	**10**	**20**
Design		Electric cylinder with ball screw							
Assembly position		any							
Ambient temperature	[°C]	0 ... +60							
Storage temperature	[°C]	–20 ... +60							
Degree of protection									
–		IP40							
K1		IP65							
Relative air humidity	[%]	0 ... 95 (non-condensing)							
Feed force F	[kN]	➔ Chapter “Characteristic curves” in the appendix							
Max. tensile force F	[kN]	1		3		2.6	5		4.5
Max. driving torque	[Nm] corrie	1.1	2	3	5.6	7.7	4.8	9.2	16.3
Max. radial force on the drive shaft	[N]	115		130			300		
No-load driving torque[1)2)]	[Nm] corrie	0.1		0.2			0.3		
Max. speed	[m/s]	0.55	1.1	0.4	0.8	1.2	0.3	0.6	1.2
Max. rotational speed	[rpm]	6600		4800			3600		
Max. acceleration	[m/s^2]	5	15	5	15	25	5	15	25
Feed constant (spindle pitch)[2)]	[mm/rev.]	5	10	5	10	16	5	10	20
Repetition accuracy	[mm]	± 0.01							
Reversing backlash[3)]	[mm]	<0.03	<0.04	<0.03		<0.04	<0.03		<0.04
Max. angle of rotation at the piston rod	[°]	± 0.25		± 0.20			± 0.15		
Note on materials		Contains PWIS (paint-wetting impairment substances)							
Information on materials									
Cylinder barrel, cover		Aluminium,							
Screwing		Steel							
Piston rod		Stainless steel							
Spindle, spindle nut, ball bearing		Rolled steel							
Weight									
With 0 mm stroke	[kg]	0.781		1.237			1.982		
Per 10 mm stroke	[kg]	0.033		0.047			0.065		

1) At a spindle speed of 200 rpm

2) Nominal value, varies due to component tolerances

3) In new condition

Tab. 8

Electric cylinder ESBF-BS-63 ... 100

Size		BS-63			BS-80			BS-100		
Spindle pitch		**5**	**10**	**25**	**5**	**15**	**32**	**5**	**20**	**40**
Design		Electric cylinder with ball screw								
Assembly position		any								
Ambient temperature	[°C]	0 ... +60								
Storage temperature	[°C]	–20 ... +60								
Degree of protection										
–		IP40								
K1		IP65								
Relative air humidity	[%]	0 ... 95 (non-condensing)								
Feed force F	[kN]	➔ Chapter “Characteristic curves” in the appendix								
Max. tensile force F	[kN]	7	7	6	12	12	10	17	17	14.5
Max. driving torque	[Nm] corrie	7	13.1	26.5	11.9	33.7	56.6	16.9	63.7	102.6
Max. radial force on the drive shaft	[N]	700			1100			1100		
No-load driving torque[1)2)]	[Nm] corrie	0.4	0.45	0.5	0.5	0.6	0.65	0.7	0.9	1.0
Max. speed	[m/s]	0.27	0.53	1.35	0.21	0.62	1.34	0.16	0.67	1.34
Max. rotational speed	[rpm]	3250	3220	3260	2530	2515	2515	2010	2010	2010
Max. acceleration	[m/s^2]	5	15	25	5	15	25	5	15	25
Feed constant (spindle pitch)[2)]	[mm/rev.]	5	10	25	5	15	32	5	20	40
Repetition accuracy	[mm]	±0.015	±0.01							
Reversing backlash[3)]	[mm]	<0.03		<0.04	<0.03		<0.04	<0.03		<0.04
Max. angle of rotation at the piston rod	[°]	±0.4			±0.5			±0.5		
Note on materials		Contains PWIS (paint-wetting impairment substances)								
Information on materials										
Cylinder barrel, cover		Aluminium,								
Screwing		Steel								
Piston rod		Stainless steel								
Spindle, spindle nut, ball bearing		Rolled steel								
Weight										
With 0 mm stroke	[kg]	3.17			7.39			11.12		
Per 10 mm stroke	[kg]	0.087			0.155			0.193		

1) At a spindle speed of 200 rpm

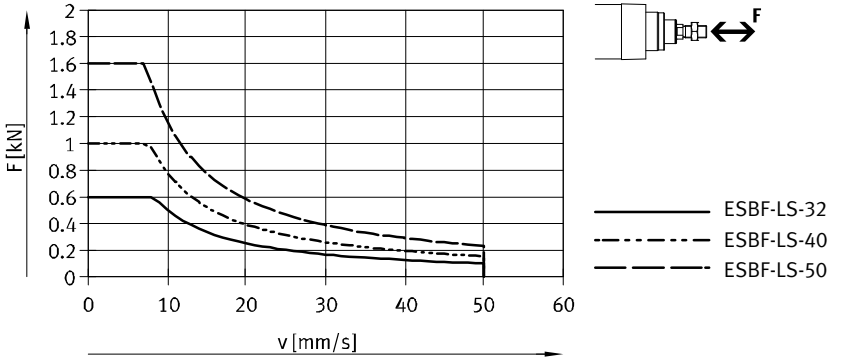
2) Nominal value, varies due to component tolerances

3) In new condition

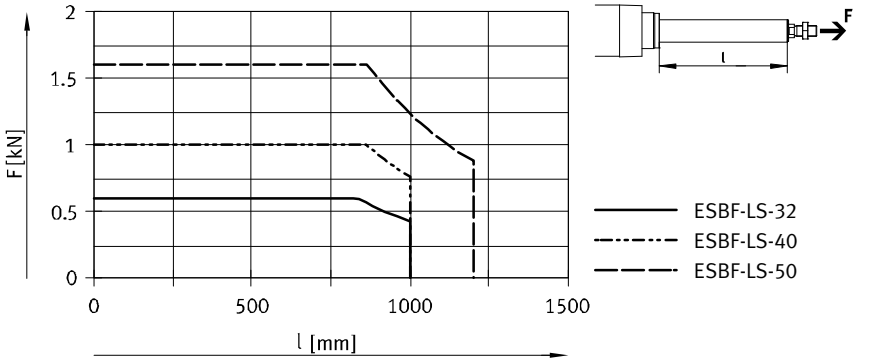
Tab. 9

13 Characteristic curves

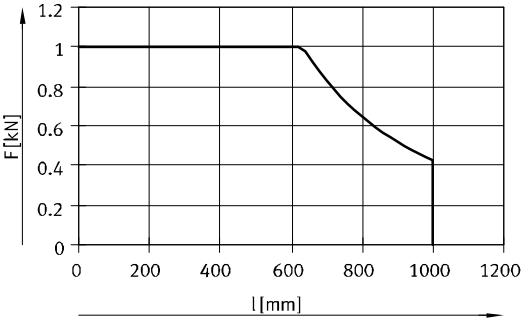
1. Max. feed force F as a function of stroke length v for ESBF-LS

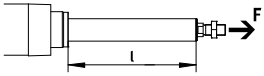


2. Max. compressive force F as a function of dimension l for ESBF-LS

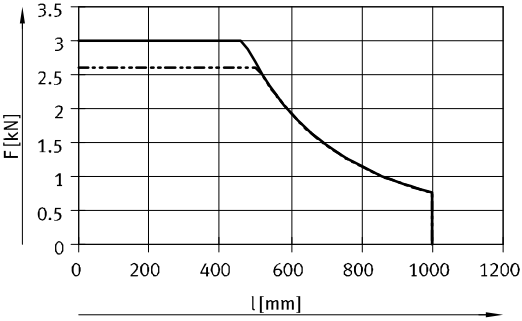


3. Max. compressive force F as a function of dimension l for ESBF-LS

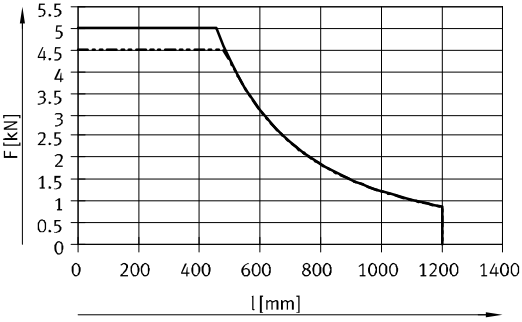




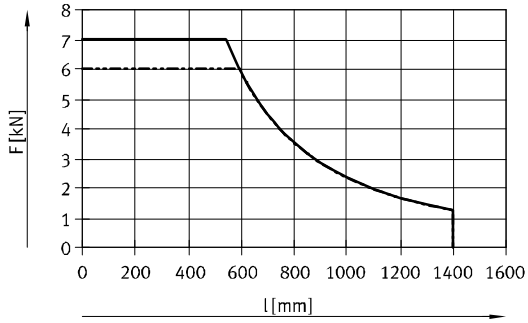
ESBF-BS-32-...-5P/10P

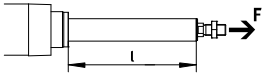


ESBF-BS-40-...-5P/10P
ESBF-BS-40-...-16P

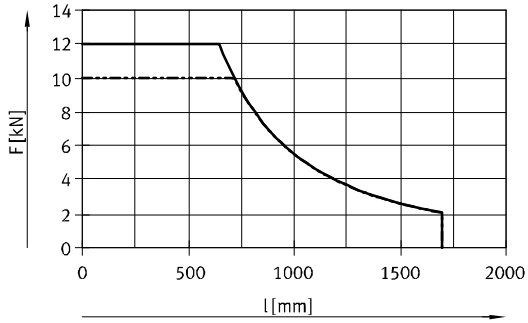


ESBF-BS-50-...-5P/10P
ESBF-BS-50-...-20P

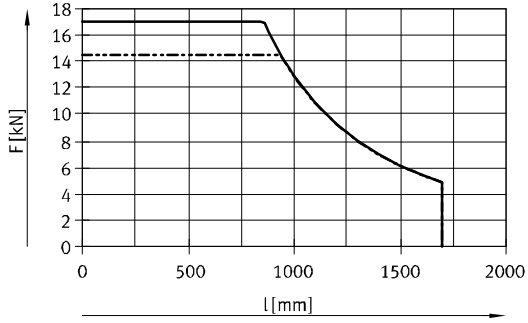




ESBF-BS-63-...-5P/10P
ESBF-BS-63-...-25P

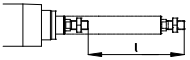


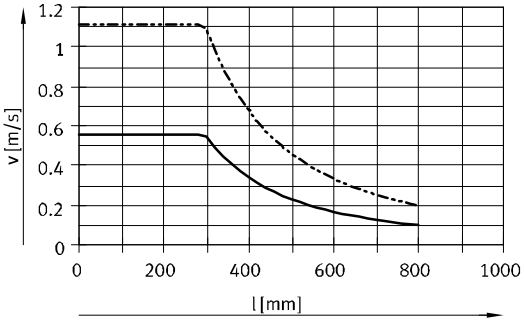
ESBF-BS-80-...-5P/15P
ESBF-BS-80-...-32P



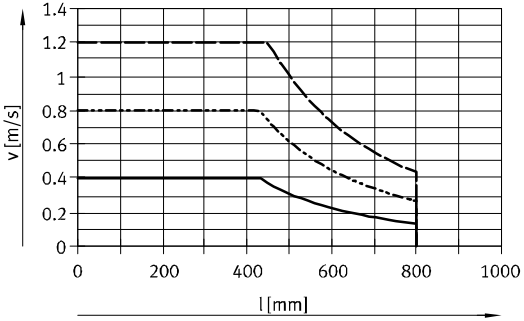
ESBF-BS-100-...-5P/20P
ESBF-BS-100-...-40P

4. Feed speed v as a function of stroke length l for ESBF-BS

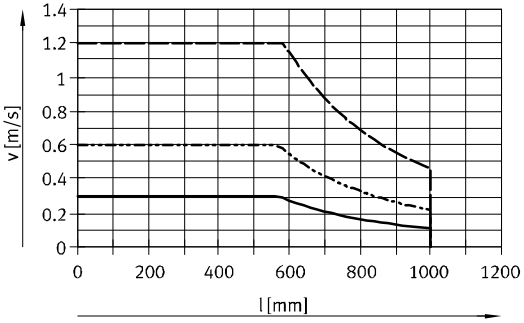




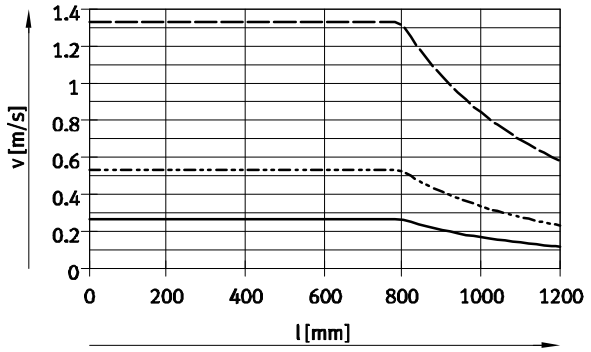
ESBF-BS-32-...-5P
ESBF-BS-32-...-10P



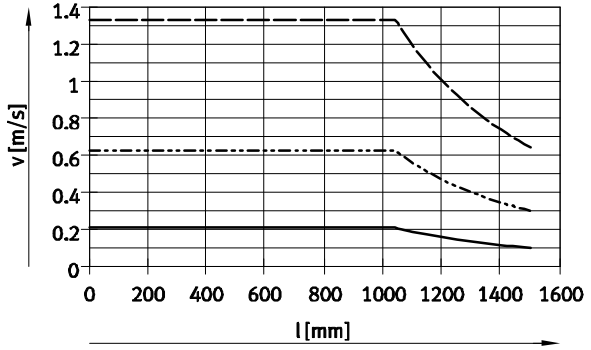
ESBF-BS-40-...-5P
ESBF-BS-40-...-10P
ESBF-BS-40-...-16P



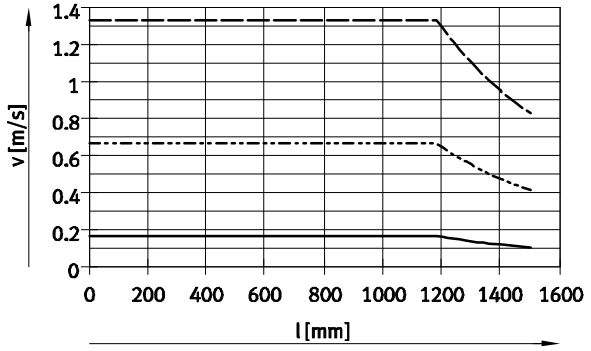
ESBF-BS-50-...-5P
ESBF-BS-50-...-10P
ESBF-BS-50-...-20P



ESBF-BS-63-...-5P
ESBF-BS-63-...-10P
ESBF-BS-63-...-25P

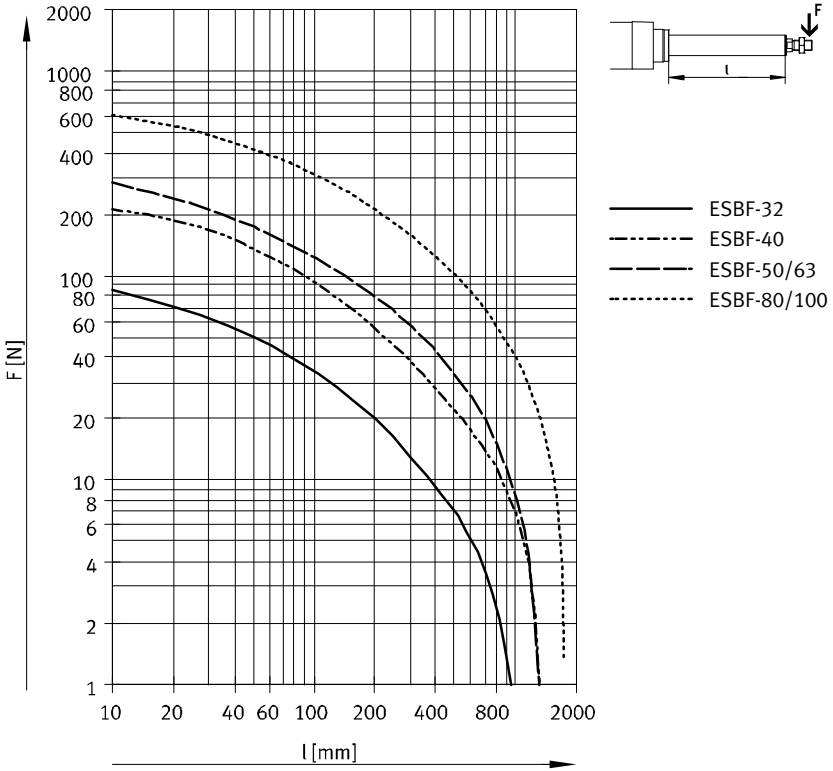


ESBF-BS-80-...-5P
ESBF-BS-80-...-15P
ESBF-BS-80-...-32P



ESBF-BS-100-...-5P
ESBF-BS-100-...-20P
ESBF-BS-100-...-40P

5. Max. lateral force F as a function of dimension l for ESBF-LS/BS



Copyright:
Festo AG & Co. KG
Ruiter Straße 82
73734 Esslingen
Germany

Phone:
+49 711 347-0

Fax:
+49 711 347-2144

E-mail:
service_international@festo.com

Internet:
www.festo.com