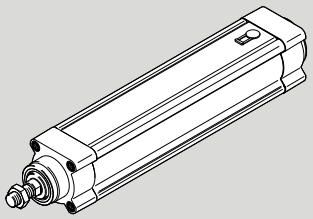
ESBF-BS, ESBF-LS
Electric cylinder



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www.festo.com

Instructions | Operating

8111672
2019-06c
[8111674]

8111672

1 Applicable documents

All available documents for the product ➔ www.festo.com/pk.

2 Safety

2.1 Safety instructions

– Observe labelling on the product.
– Prior to assembly, installation and maintenance work: Switch off power supply, ensure that it is off and secure it against being switched back on.
– Store the product in a cool, dry, UV-protected and corrosion-protected environment. Ensure that storage times are kept to a minimum.
– Observe tightening torques. Unless otherwise specified, the tolerance is ± 20 %.

2.2 Intended Use

The electric cylinder is intended to be used for positioning payloads in combination with tools or as a drive when external guides are used.

2.3 Training of qualified personnel

Installation, commissioning, maintenance and disassembly should only be conducted by qualified personnel. The qualified personnel must be familiar with installation of electrical control systems.

3 Further information

– Accessories ➔ www.festo.com/catalogue.
– Spare parts ➔ www.festo.com/spareparts.

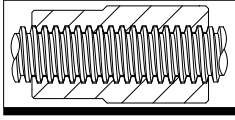
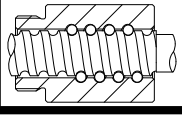
4 Service

Contact your regional Festo contact person if you have technical questions ➔ www.festo.com.

5 Product overview

5.1 Function

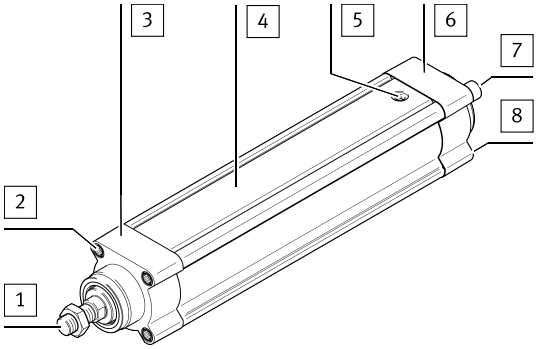
The electric cylinder converts the rotary motion of the mounted motor into a linear motion of the non-rotating piston rod. The lead screw converts the torque of the motor into a feed force. The linear movement of the piston rod is precisely guided by the guide in the bearing cap. Sensors enable the monitoring of end positions, reference position and intermediate position.

Lead screw ESBF-LS	Ball screw drive ESBF-BS
– Low speeds – Self-braking with de-energised motor (without brake)	– High speeds – High forces
	

Tab. 1 Overview of Lead Screw

5.2 Product Design

Product Design ESBF



1 Piston rod	5 Pressure compensation opening
2 Threaded hole for mounting	6 Drive cover
3 Bearing cap	7 Drive shaft
4 Cylinder profile	8 Threaded hole for motor mounting kit

Fig. 1 Product structure ESBF (example ESBF-BS)

6 Transport and Storage

NOTICE!

Unexpected and unbraked movement of components
- Secure moving components for transport.

Transport and Storage Conditions
– Take product weight into account ➔ 14 Technical data.
Weight › 25 kg: transport with a suitable hoist (cross-brace) or with two persons.
– Take the product focus into consideration.
– Store and transport the product in its original packaging.
– Store product in a cool, dry, shaded and corrosion protected environment.
– Store product in ambient conditions without oils, greases and degreasing vapours.
– Ensure short storage times.

7 Mounting

7.1 Safety

⚠ WARNING!

Risk of Injury due to Unexpected Movement of Components
For vertical or slanted mounting position: when power is off, moving parts can travel or fall uncontrolled into the lower end position.
- Bring moving parts of the product into a safe end position or secure them against falling.

7.2 Unpacking

1. Open the packaging.
2. Remove all transport materials (e.g. foils, caps, cardboard boxes).
3. Remove the product from the packaging and place it on the mounting surface.
4. Dispose of packaging and transport materials ➔ 13 Disposal.

7.3 Mounting the Motor

Lateral Force on the Drive Shaft
When mounting the motor and motor mounting kit, do not exceed the max. lateral force Fq of the drive shaft (for example toothed belt tension when mounting the parallel kit) ➔ 14.2 Characteristic Curves.

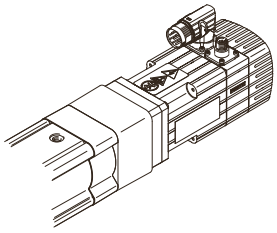


Fig. 2 Motor mounting

Requirement
– Only loosen screws or threaded pins that are described in the directions in the instruction manual.
– Provide sufficient space for connecting the pressure compensation ➔ Connecting Pressure Compensation (ESBF -...- S1 only).

1. Select the motor and motor mounting kit from Festo➔ www.festo.com/catalogue.
   When using other motors: observe the critical limits for forces, torques and velocities.
2. Fasten motor mounting kit, observe instructions ➔ www.festo.com/sp.
3. Fasten the motor without tension. Support large and heavy motors.

Connect motor cables only on completion of mounting.

7.4 Mounting the Cylinder

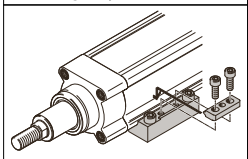
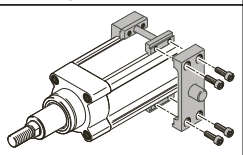
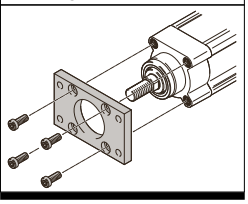
i

High Mechanical Loads on the Mounting Connections
If high rectified torques are applied to the drive system at the same time, this leads to high mechanical loads at the mounting interfaces.
- The foot mounting HNC, CRHNC should only be used in combination with the profile mounting EAHF.
- In the case of an inclined or horizontal mounting position with direct mounting or flange mounting EAHH-V2, the drive system must be additionally supported near the motor mounting.

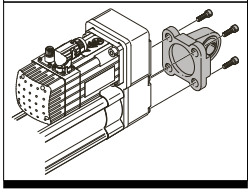
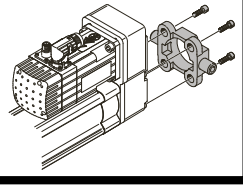
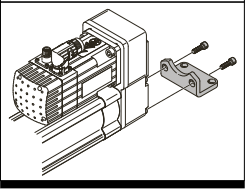
Requirement
– No collision in the movement space of the attachment component with mounting and sensor components.
– Sufficient space for reaching and mounting the pressure compensation port.
– Flatness of the mounting surface max. 0.2 mm over the stroke length of the bearing surface.
– No distortion or bending when installing the product.

1. Select mounting attachments ➔ www.festo.com/catalogue.
2. Place the mounting attachments on the support points.
3. Tighten retaining screws.
   Observe max. tightening torque and max. screw-in depth.

For additional information, contact your local Festo Service.

Profile mounting EAHF-V2	**Trunnion flange mounting kit DAMT-V1**	**Direct mounting Flange mounting EAHH-V2**
Profile		Bearing cap
Mounting via profile	Mounting via thread	Mounting via thread
		

Tab. 2 Overview of Mounting Components for Bearing Caps and Profile

Swivel flange DAMS, SNC..., CRSNCS	**Trunnion flange ZNCF, CRZNG**	**Foot mounting HNC, CRHNC**
Parallel kit		
Mounting via thread	Mounting via thread	Mounting via thread
		

Tab. 3 Overview of Mounting Components for Parallel Kit

Size		**32**	**40**	**50**	**63**	**80**	**100**
Profile mounting EAHF-V2							
Screw		Instruction manual ➔ www.festo.com/sp.					
Trunnion flange mounting kit DAMT-V1							
Screw		M5	M6	M6	M8	M8	M8
Max. tightening torque	[Nm]	4^{+1}	8^{+1}	8^{+2}	18^{+2}	28^{+2}	28^{+2}
Direct mounting Flange mounting EAHH-V2 Foot mounting HNC, CRHNC Swivel flange DAMS (not ESBF-BF-32) Trunnion flange ZNCF, CRZNG							
Screw		M6	M6	M8	M8	M10	M10
Max. tightening torque	[Nm]	6	6	12	12	25	25
Max. screw-in depth t_{max} 	[mm]	16	16	17	17	17	17
Swivel flange SNC..., CRSNCS							
Screw		Instruction manual ➔ www.festo.com/sp.					

Tab. 4 Information on Mounting Attachments

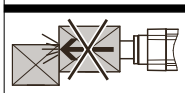
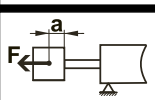
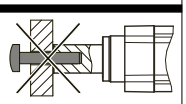
7.5 Mounting the Attachment Component

i

Torque on the Piston Rod
During commissioning and operation, the piston rod may only be operated without torque.
If external torques occur, an external guide must be used.

i

Mounting the Attachment Component on the Piston Rod
When attaching the attachment component, do not exceed the max. torque of the piston rod. The max. torque of the piston rod may only be used for a short time during mounting ➔ Tab. 7 Information on Attachment Components.

Collision-free	**Torque-free**	**Centre of gravity and tilting moment**	**Max. screw-in depth**
			

Tab. 5 Requirement for Attachment Component

Requirement
– No collision in the movement space of the attachment component with mounting and sensor components.
– No lateral force or torque on the piston rod.
  Absorb external forces and torques via an external guide.
– Position of the centre of gravity and tilting moment (force F parallel to the axis of movement) of the attachment component centrally and close to the piston rod (short lever arm a).
– The maximum screw-in depth of the retaining screws is not exceeded.

1. Select accessories ➔ www.festo.com/catalogue.
2. Screw the lock nut onto the male thread of the piston rod or attachment component.
3. Rotate or place the attachment component on the piston rod.
4. Tighten retaining screws or lock nut.
   The tightening torque must not act on the piston rod. Counterhold with a suitable tool on the spanner flat of the piston rod.
   Observe max. tightening torque and max. screw-in depth.

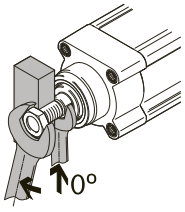
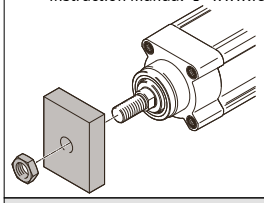
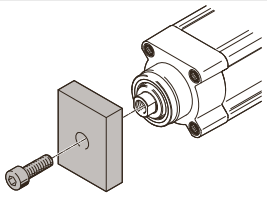
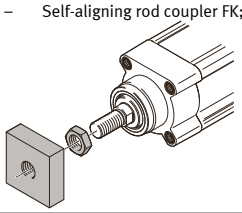
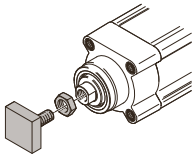


Fig. 3 Torque-free mounting

When using an additional external guide, ensure that the electric cylinder and piston rod are parallel and aligned exactly.

ESBF-...	**ESBF-...-F**
Mounting via male thread	Mounting via female thread
With nut	With screw
– Guide unit EAGF Instruction manual ➔ www.festo.com/sp. 	
With lock nut	With lock nut
– Rod eye SGS, CRSGS – Rod clevis SG, CRSG – Coupling piece KSZ – Self-aligning rod coupler FK; CRFK 	

Tab. 6 Overview of Attachment Component

Size		32	40	50	63	80	100
Piston rod							
Width across flats ⌀	[mm]	10	13	17	17	22	22
Max. torque	[Nm]	2.4	6.4	12	15	31	53
Piston rod with male thread ESBF -...							
Nut, lock nut		M10x1.25	M12x1.25	M16x1.5		M20x1.5	
Piston rod with female thread ESBF -...- F							
Screw, lock nut		M6	M8	M10	M10	M12	M12
Max. screw-in depth t_{max} 	[mm]	12	12	16	16	20	20

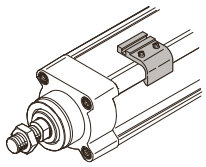
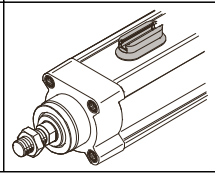
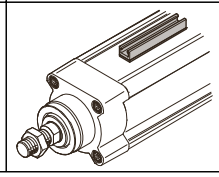
Tab. 7 Information on Attachment Components

7.6 Mounting Accessories

Requirement
- No collision in the movement space of the attachment component with mounting and sensor components.
- Protection against uncontrolled overtravel of the end positions.
- Homing to reference switch or end position.
- Query of end positions or intermediate positions.

1. Select accessories ➔ www.festo.com/catalogue.
2. Mount the sensor (reference or query):
   - Mount the sensor rail or mounting kit (depending on the type of mounting).
   - Align sensor and fasten it to the switching position.

Instruction manuals ➔ www.festo.com/sp.

Mounting kit SMB	Mounting kit CRSMB	Sensor rail SAMH
– Mounting on profile nose	– Central mounting on the profile	– Central mounting on the profile
		
– Protect the sensor from external magnetic or ferritic influences (e.g. min. 10 mm distance to slot nuts). – Preferably use hardware limit switches with normally closed function (protection guaranteed even in case of sensor failure). Instruction manual ➔ www.festo.com/sp.		

Tab. 8 Overview of Sensor Mountings

Connecting Pressure Compensation (ESBF -...- S1 only)

i

The standard version of the ESBF is supplied with a press-fitted sinter filter.

The pressure compensation hole permits the reduction of negative or excess pressure in the cylinder interior. Pressure compensation may only take place in clean ambient air.

Alternatives to Pressure Compensation via the Environment:
- Operation in a dust-free and dry area
- Connection to a large expansion tank
- Connection of sealing air (for example excess pressure with max. 0.2 bar).

Position of the pressure compensation port:
- ESBF-32/40/50: in the drive cover
- ESBF-63/80/100: in the cylinder profile

1. Remove protective cap.
2. Mount the screw fitting and connect the hose.

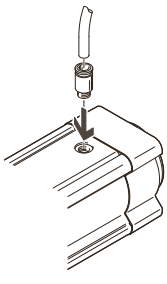


Fig. 4 Mount fitting (example: cylinder profile connection)

8 Commissioning

8.1 Safety

⚠ WARNING!

Risk of injury due to unexpected movement of components.
- Protect the positioning range from unwanted intervention.
- Keep foreign objects out of the positioning range.
- Perform commissioning with low dynamic response.

8.2 Performing Commissioning

i

When the motor is removed, the motor encoder loses its absolute reference to the reference mark (e.g. by turning the motor drive shaft).
- Carry out a homing run after every motor mounting in order to establish the absolute reference between the motor encoder and the reference mark.

i

Block-shaped acceleration profiles (without jerk limitation) can have the following effects:
- High mechanical loads on the lead screw due to high force peaks.
- Overshooting effects during positioning.
- Swinging up of the entire system

Recommendation: Reduce high force peaks in the acceleration and deceleration phases by using the jerk limitation.

i

Torque on the Piston Rod

During commissioning and operation, the piston rod may only be operated without torque.
If external torques occur, an external guide must be used.

i

Running Noises During Operation

Identically constructed electric cylinders can generate different running noises depending on the mode of operation, type of mounting, installation environment and components.

Requirement
- Mounting of the drive system checked.
- Installation and wiring of the motor checked.
- No foreign objects in the movement space of the propulsion system.
- No exceeding of the max. permissible feed force and drive torque as a function of acceleration, deceleration (e.g. stop function, quick stop), velocity, moving mass and mounting position.
- No mechanical overload of the cylinder and dynamic setpoint deviation not exceeded (e.g. overrunning the end position) due to force and torque peaks or overshoot effects.
  Limit overloads and overruns by jerk limitation, lower acceleration and deceleration setpoints or optimised controller settings.
- Control and homing travel at reduced velocity, acceleration and deceleration setpoints.
- No test drive to mechanical end stops.
- Software end positions ≥0.25 mm away from the mechanical stops.

Procedure	Purpose	Note

1. Check run	Determine the direction of travel of the piston rod	– Direction of movement of piston rod (clockwise spindle):
		  – Retracting: Rotate cylinder drive shaft clockwise.
		  – Extending: Rotate cylinder drive shaft anti-clockwise.
		– The direction of movement of the piston rod for positive and negative position values depends on the mounting position of the motor on the cylinder.
		– Adapt a required reversal of direction of rotation via parameters in the controller or controller.

2. Homing	Determination of the reference point and adjustment of the dimensional reference system – During the initial start-up procedure – After replacement of the motor	Permissible reference points: – Towards reference switch. Travel at reduced velocity ➔ 14 Technical data. – Against the end position on the motor side. Do not exceed maximum values ➔ Tab. 10 Speed and Energy in the End Positions. Further information ➔ Instruction manual of the drive system, www.festo.com/sp.
3. Test run	Checking the operating conditions	Check application requirements: – Piston rod travels through the complete travel cycle in the specified time. – The piston rod stops travel when a limit switch or software end positions are reached.
After a successful test run, the drive system is ready for operation.		

Tab. 9 Commissioning Steps

Size		32	40	50	63	80	100
Max. stop velocity	[m/s]	0.01					
Max. stop energy	[mJ]	0.03	0.05	0.07	0.15	0.38	0.60
		(= ½ mass x speed²)					

Tab. 10 Speed and Energy in the End Positions

9 Operation

⚠ WARNING!

Risk of injury due to unexpected movement of components.
- Protect the positioning range from unwanted intervention.
- Keep foreign objects out of the positioning range.
- Perform commissioning with low dynamic response.

i

Torque on the Piston Rod
During commissioning and operation, the piston rod may only be operated without torque.
If external torques occur, an external guide must be used.

i

Lubrication Run During Operation
Observe the following lubrication travel intervals.
- With working stroke less than 2 x spindle pitch... P:
  – Perform a lubrication run within 10 travel cycles with a minimum stroke of ≥2.5 x spindle pitch.

10 Maintenance

10.1 Safety

⚠ WARNING!

Unexpected movement of components.
Injury due to impacts or crushing.
- Before working on the product, switch off the control and secure it to prevent it from being switched back on accidentally.

10.2 Checking the Cylinder Elements

Checking the Reversing Backlash (ESBF-LS only)
- Check the reversing backlash of the piston rod at every maintenance interval (e.g. lubrication interval).
  If the max. permissible reversing backlash is exceeded, the cylinder should be replaced.

Size		32	40	50
Spindle pitch ...P		2.5	3	4
Max. reversing backlash	[mm]	0.62	0.75	1

Tab. 11 Max. Permissible Reversing Backlash, ESBF-LS-32/40/50

10.3 Cleaning

Clean the product with a soft cloth. Do not use aggressive cleaning agents.

10.4 Lubrication

Lubrication Interval and Accessories

Lubrication	Lead screw	Piston rod	
	ESBF-...	ESBF-...	ESBF-...-F1
Lubrication interval	Lubrication for life	If required, e.g. if the grease layer is too low.	
Accessories ➔ www.festo.com/spareparts			
Lubrication point	–	Surface	
Lubricant	–	Roller bearing grease LUB-KC1	Roller bearing grease, suitable for use in the food industry LUB-E1

Tab. 12 Overview of Lubrication Intervals and Accessories

11 Malfunctions

11.1 Fault Clearance

⚠ WARNING!

Unexpected movement of components.
Injury due to impacts or crushing.
- Before working on the product, switch off the control and secure it to prevent it from being switched back on accidentally.

⚠ WARNING!

Risk of injury due to unexpected movement of components.
- Protect the positioning range from unwanted intervention.
- Keep foreign objects out of the positioning range.
- Perform commissioning with low dynamic response.

Malfunction	Possible cause	Remedy
Wear on the lead screw ESBF-LS.	Reversing backlash is too large.	– Contact local Festo Service. – Replace cylinder ➔ www.festo.com/catalogue.
Loud running noises or vibrations or rough running of the cylinder.	Coupling distance too short.	Observe permissible coupling spacings ➔ Instruction manual for motor mounting kit, www.festo.com/sp.
	Tensions	– Install the cylinder so it is free of tension. Note the flatness of the contact surface ➔ 7.4 Mounting the Cylinder. – Change the layout of the attachment component (e.g. payload). – Align cylinder and attached guide element parallel to each other. – Use external guide.
	Current controller settings.	Optimise controller data (e.g. velocity, acceleration, ...).
	Resonant oscillation of the cylinder.	Change the travel velocity.
	Wear on bearing or guide.	– Contact local Festo Service. – Replace cylinder ➔ www.festo.com/catalogue.
	Reversing backlash is too large.	– Contact local Festo Service. – Replace cylinder ➔ www.festo.com/catalogue.
	Insufficient lubrication of the piston rod.	Lubricate the piston rod ➔ Tab. 12 Overview of Lubrication Intervals and Accessories.
Oscillations at the piston rod.	Operation at the resonance point of the cylinder.	– Change the travel velocity. – Change the acceleration. – Increase the cylinder rigidity (for example shorter support distances). – Change the payload geometry.
Long oscillations of the profile.	Resonant frequency of profile and payload too low.	– Increase the cylinder rigidity (for example shorter support distances). – Change the payload geometry.
Piston rod does not move.	Coupling slips.	Check the mounting of the shaft-hub connection ➔ Instruction manual for the motor mounting kit, www.festo.com/sp.
	Loads too high.	Reduce forces and torques. Consider dynamics.
	Threaded drive blocked.	– Contact local Festo Service. – Replace cylinder ➔ www.festo.com/catalogue.
	Pre-tension of toothed belt too high in parallel kit.	Reduce the pretension of the toothed belt ➔ Instruction manual for parallel kit, www.festo.com/sp.
	Operation at the lower ambient temperature limit.	– Optimise controller data (e.g. velocity, acceleration, ...). – Use gear unit.
	Piston rod stuck in the mechanical end position.	Manually Releasing a Jam: – Switch off the controller and safeguard it from being switched on again unintentionally. – Remove motor and motor mounting kit. – Rotate drive shaft freely.
Overruns the end position.	Sensor does not switch.	Check sensor, installation and parameterisation.
Idling torque too high.	Wear in the drive train.	– Contact local Festo Service. – Replace cylinder ➔ www.festo.com/catalogue.

Tab. 13 Overview of Fault Clearance

11.2 Repair

– Observe the instructions for dismantling ➔ 12 Disassembly.
– Send the electric cylinder to the Festo repair service.
– Information about spare parts and accessories
  ➔ www.festo.com/spareparts.

12 Disassembly

⚠ WARNING!

Unexpected movement of components.
Injury due to impacts or crushing.
- Before working on the product, switch off the control and secure it to prevent it from being switched back on accidentally.

⚠ WARNING!

Risk of Injury due to Unexpected Movement of Components
For vertical or slanted mounting position: when power is off, moving parts can travel or fall uncontrolled into the lower end position.
- Bring moving parts of the product into a safe end position or secure them against falling.

1. Disconnect electrical installations.
2. Remove the attached accessories.
3. Remove motor and mounting kit.
4. Remove the mounting attachments.
5. Observe transport information ➔ 6 Transport and Storage.

13 Disposal

Dispose of the product and packaging according to the valid provisions of environmentally sound recycling.

14 Technical data

14.1 Technical Data, Mechanical

i

For sizing of the electric cylinder, use the PositionDrives engineering software ➔ www.festo.com/sp.

ESBF-BS-32/40

Size		32		40		
Spindle pitch ...P		5	10	5	10	16
Constructive design		Electric cylinder with ball screw drive				
Mounting position		Any				
Max. feed force F	[kN]	1		3		2.6
Max. driving torque [Nm]	[Nm]	1.1	2	3	5.6	7.7
No-load driving torque at n = 200 1/min	[Nm]	0.1		0.2		
Max. rotational speed	[1/min]	6600		4800		4500
Max. speed	[m/s]	0.55	1.1	0.4	0.8	1.2
Max. acceleration	[m/s²]	5	15	5	15	25
Repetition accuracy	[mm]	± 0.01		± 0.01		
Feed constant	[mm/rev]	5	10	5	10	16
Duty cycle	[%]	100				
Relative humidity	[%]	0 ... 95 (non-condensing)				
Ambient temperature	[°C]	0 ... +60				
Storage temperature	[°C]	–20 ... +60				
Degree of protection		IP40; IP65 (S1)				
Max. permissible forces on the drive shaft ➔ 14.2 Characteristic Curves						
Max. lateral force Fq	[N]	115		130		
Max. permitted forces and torsional backlash on the piston rod						
Max. lateral force Fq	[N]	➔ 14.2 Characteristic Curves				
Max. torsional backlash	[°]	± 0.25		± 0.20		

Tab. 14 General Date, ESBF-BS-32/40

ESBF-BS-50/63

Size		50			63		
Spindle pitch ...P		5	10	20	5	10	25
Constructive design		Electric cylinder with ball screw drive					
Mounting position		Any					
Max. feed force F	[kN]	5		4.5	7		6
Max. driving torque	[Nm]	4.8	9.2	16.3	7	13.1	26.5
No-load driving torque at n = 200 1/min	[Nm]	0.3			0.4	0.45	0.5
Max. rotational speed	[1/min]	3600			3250	3220	3260
Max. speed	[m/s]	0.3	0.6	2	0.27	0.53	1.35
Max. acceleration	[m/s²]	5	15	25	5	15	25
Repetition accuracy	[mm]	±0.01			±0.015	±0.01	
Feed constant	[mm/rev]	5	10	20	5	10	25
Duty cycle	[%]	100					
Relative humidity	[%]	0 ... 95 (non-condensing)					
Ambient temperature	[°C]	0 ... +60					
Storage temperature	[°C]	–20 ... +60					
Degree of protection		IP40; IP65 (S1)					
Max. permissible forces on the drive shaft ➔ 14.2 Characteristic Curves							
Max. lateral force Fq	[N]	300			700		
Max. permitted forces, torques and torsional backlash on the piston rod							
Max. lateral force Fq	[N]	➔ 14.2 Characteristic Curves					
Max. torsional backlash	[°]	±0.15			±0.4		

Tab. 15 General Data, ESBF-BS-50/63

ESBF-BS-80/100

Size		80			100		
Spindle pitch ...P		5	15	32	5	20	40
Constructive design		Electric cylinder with ball screw drive					
Mounting position		Any					
Max. feed force F	[kN]	12		10	17		14.5
Max. driving torque	[Nm]	11.9	33.7	56.6	16.9	63.7	102.6
No-load driving torque at n = 200 1/min	[Nm]	0.5	0.6	0.65	0.7	0.9	1
Max. rotational speed	[1/min]	2530	2515		2010		
Max. speed	[m/s]	0.21	0.62	1.34	0.16	0.67	1.34
Max. acceleration	[m/s²]	5	15	25	5	15	25
Repetition accuracy	[mm]	±0.01					
Feed constant	[mm/rev]	5	15	32	5	20	40
Duty cycle	[%]	100					
Relative humidity	[%]	0 ... 95 (non-condensing)					
Ambient temperature	[°C]	0 ... +60					
Storage temperature	[°C]	–20 ... +60					
Degree of protection		IP40; IP65 (S1)					
Max. permissible forces on the drive shaft ➔ 14.2 Characteristic Curves							
Max. lateral force Fq	[N]	1100			1100		
Max. permitted forces, torques and torsional backlash on the piston rod							
Max. lateral force Fq	[N]	➔ 14.2 Characteristic Curves					
Max. torsional backlash	[°]	±0.5			±0.5		

Tab. 16 General Data, ESBF-BS-80/100

ESBF-LS-32/40/50

Size		32	40	50
Spindle pitch ...P		2.5	3	4
Constructive design		Electric cylinder with lead screw		
Mounting position		Any		
Max. feed force F	[kN]	0.6	1	1.6
Max. driving torque	[Nm]	1.1	2.4	4.8
No-load driving torque at n = 200 1/min	[Nm]	0.1	0.2	0.3
Max. rotational speed	[1/min]	1200	1000	750
Max. speed	[m/s]	0.05		
Max. acceleration	[m/s²]	2.5		
Repetition accuracy	[mm]	± 0.05		
Max. reversing backlash	[mm]	➔ 10.2 Checking the Cylinder Elements		
Feed constant	[mm/rev]	2.5	3	4
Duty cycle	[%]	100		
Relative humidity	[%]	0 ... 95 (non-condensing)		
Ambient temperature	[°C]	0 ... +50		
Storage temperature	[°C]	–20 ... +60		
Degree of protection		IP40; IP65 (S1)		
Max. permissible forces on the drive shaft ➔ 14.2 Characteristic Curves				
Max. lateral force Fq	[N]	115	130	300
Max. permitted forces, torques and torsional backlash on the piston rod				
Max. lateral force Fq	[N]	➔ 14.2 Characteristic Curves		
Max. torsional backlash	[°]	± 0.25	± 0.20	± 0.15

Tab. 17 General Data, ESBF-LS

	ESBF-BS						ESBF-LS		
Size	32	40	50	63	80	100	32	40	50
Materials									
Note on materials	RoHS-compliant Contains PWIS								
Cylinder barrel	Anodised aluminium								
Drive cover Bearing cap	Aluminium			Die-cast aluminium			Aluminium		
	coated								
Piston rod	High-alloy steel								
Spindle	Rolling bearing steel						Steel, high strength		
Spindle nut	Rolling bearing steel						Polyoxymethylene with polytetrafluoroethylene		
Ball bearing	High-alloy steel								
Screws	Galvanised steel								

		ESBF-BS						ESBF-LS		
Size		32	40	50	63	80	100	32	40	50
Weight										
Basic weight with 0 mm stroke	[kg]	0.78	1.24	1.98	3.17	7.39	11.1	0.67	1.08	1.72
Additional weight per 1000 mm stroke	[kg]	3.3	4.7	6.5	8.7	15.5	19.3	3.4	4.8	6.7

Tab. 18 Materials and weight

14.2 Characteristic Curves

Lateral Force Piston Rod ESBF -...
Max. lateral force Fq on the piston rod as a function of the piston rod length l (stroke + piston rod extension)

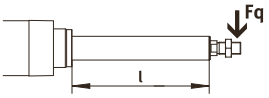
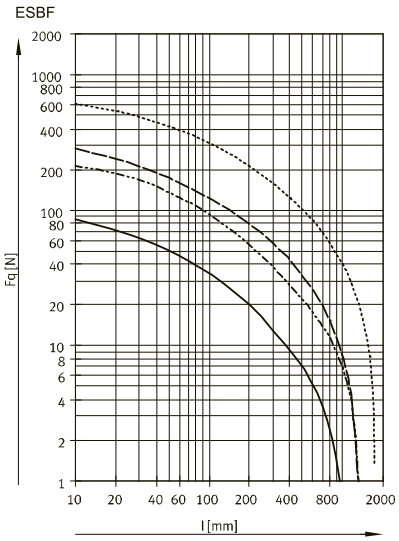


Fig. 5 Max. lateral force Fq and piston rod length l



—— ESBF-BS / LS-32 ---- ESBF-BS / LS-50 / ESBF-BS-63

-·-·- ESBF-BS / LS-40 ····· ESBF-BS-80/100

Fig. 6 ESBF, lateral force Fq as a function of piston rod length l

Lateral Force Drive shaft ESBF -...
Max. lateral force Fq on the drive shaft as a function of point of application x

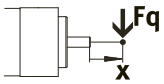
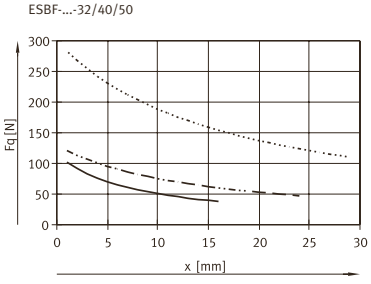


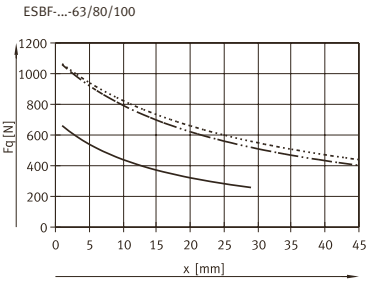
Fig. 7 Max. lateral force Fq and point of application x



—— ESBF-BS / LS-32 ····· ESBF-BS / LS-50

-·-·- ESBF-BS / LS-40

Fig. 8 ESBF-BS / LS-32/40/50, lateral force Fq as a function of point of application x



—— ESBF-BS-63 ····· ESBF-BS-100

-·-·- ESBF-BS-80

Fig. 9 ESBF-BS-63/80/100, lateral force Fq as a function of point of application x

Feed Force – Feed Speed ESBF -...
Max. feed force F as a function of the feed speed v

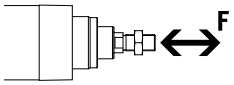
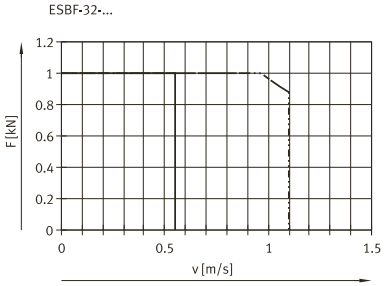
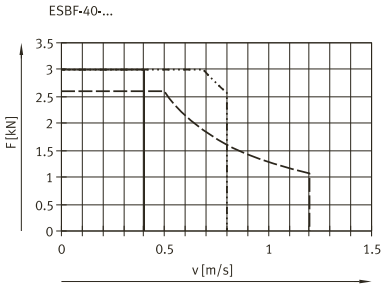


Fig. 10 Feed force F



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

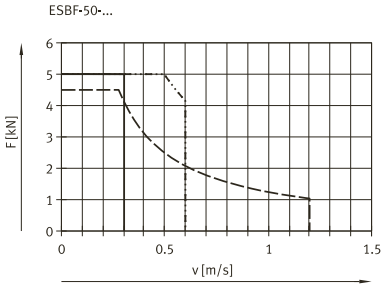
Fig. 11 ESBF-BS-32, feed force F as a function of the feed speed v



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

-·-·- ESBF-BS-40-...-10P

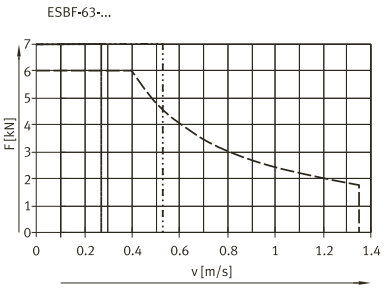
Fig. 12 ESBF-BS-40, feed force F as a function of the feed speed v



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

-·-·- ESBF-BS-50-...-10P

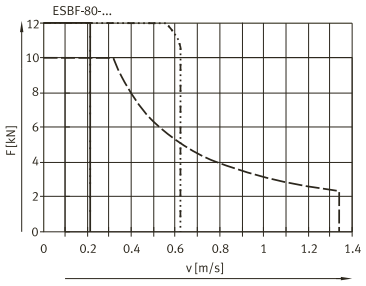
Fig. 13 ESBF-BS-50, feed force F as a function of the feed speed v



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

-·-·- ESBF-BS-63-...-10P

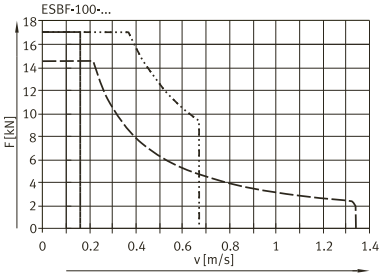
Fig. 14 ESBF-BS-63, feed force F as a function of the feed speed v



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

-·-·- ESBF-BS-80-...-15P

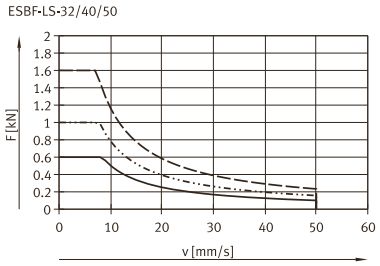
Fig. 15 ESBF-BS-80, feed force F as a function of the feed speed v



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

-·-·- ESBF-BS-100-...-20P

Fig. 16 ESBF-BS-100, feed force F as a function of the feed speed v



—— ESBF-LS-32-...-2.5P ---- ESBF-LS-50-...-4P

-·-·- ESBF-LS-40-...-3P

Fig. 17 ESBF-LS-32/40/50, feed force F as a function of the feed speed v

Pressure Force – Piston Rod Length ESBF -...
Max. pressure force F as a function of the piston rod length l (stroke + piston rod extension)

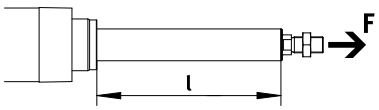
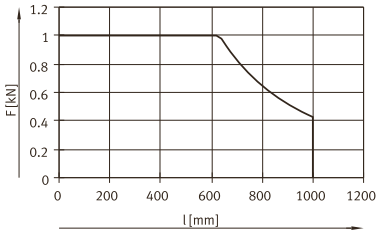
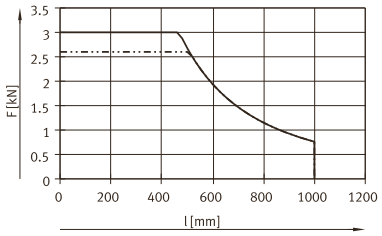


Fig. 18 Pressure force F and piston rod length l



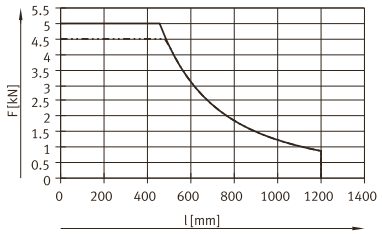
—— ESBF-BS-32 -...- 5P/10P

Fig. 19 ESBF-BS-32, pressure force F as a function of the piston rod length l



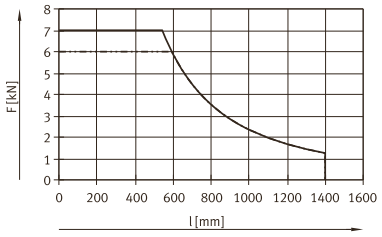
—— ESBF-BS-40 -...- 5P/10P -·-·- ESBF-BS-40-...-16P

Fig. 20 ESBF-BS-40, pressure force F as a function of the piston rod length l



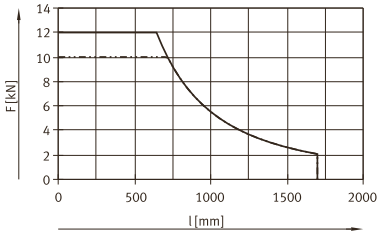
—— ESBF-BS-50 -...- 5P/10P -·-·- ESBF-BS-50-...-20P

Fig. 21 ESBF-BS-50, pressure force F as a function of the piston rod length l



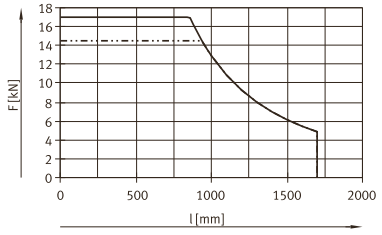
—— ESBF-BS-63-... -5P / 10P -·-·- ESBF-BS-63-...-25P

Fig. 22 ESBF-BS-63, pressure force F as a function of the piston rod length l



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

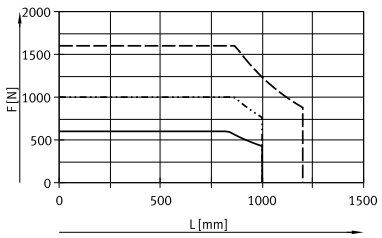
Fig. 23 ESBF-BS-80, pressure force F as a function of the piston rod length l



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

Fig. 24 ESBF-BS-100, pressure force F as a function of the piston rod length l

ESBF-LS-32/40/50-



—— ESBF-LS-32-...-2.5P ---- ESBF-LS-50-...-4P

-·-·- ESBF-LS-40-...-3P

Fig. 25 ESBF-LS-32/40/50, pressure force F as a function of the piston rod length l

Feed Speed – Stroke ESBF-BS
Max. feed speed v as a function of the stroke l

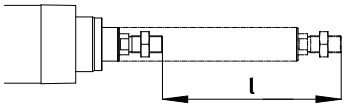
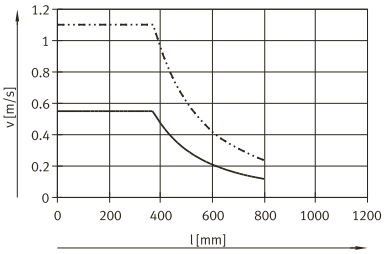


Fig. 26 Stroke length l

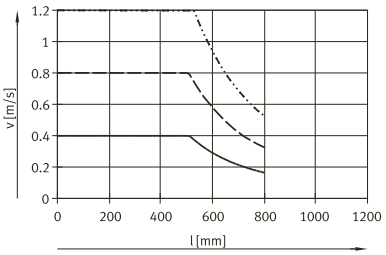
ESBF-BS-32



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

Fig. 27 ESBF-BS-32, feed speed v as a function of the stroke l

ESBF-BS-40

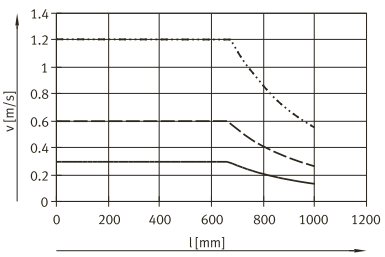


—— ESBF-BS-40-...-5P ---- ESBF-BS-40-...-16P

-·-·- ESBF-BS-40-...-10P

Fig. 28 ESBF-BS-40, feed speed v as a function of the stroke l

ESBF-BS-50

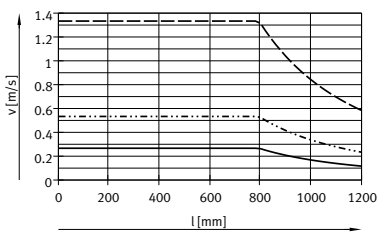


—— ESBF-BS-50-...-5P ---- ESBF-BS-50-...-20P

-·-·- ESBF-BS-50-...-10P

Fig. 29 ESBF-BS-50, feed speed v as a function of the stroke l

ESBF-63

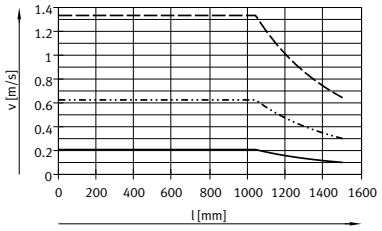


—— ESBF-BS-63-...-5P ---- ESBF-BS-63-...-25P

-·-·- ESBF-BS-63-...-10P

Fig. 30 ESBF-BS-63, feed speed v as a function of the stroke l

ESBF-80

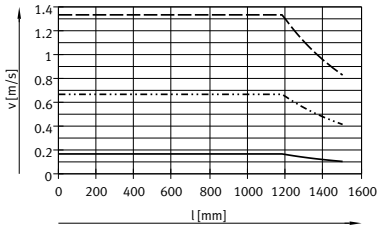


—— ESBF-BS-80-...-5P ---- ESBF-BS-80-...-32P

-·-·- ESBF-BS-80-...-15P

Fig. 31 ESBF-BS-80, feed speed v as a function of the stroke l

ESBF-100



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

-·-·- ESBF-BS-100-...-20P

Fig. 32 ESBF-BS-100, feed speed v as a function of the stroke l