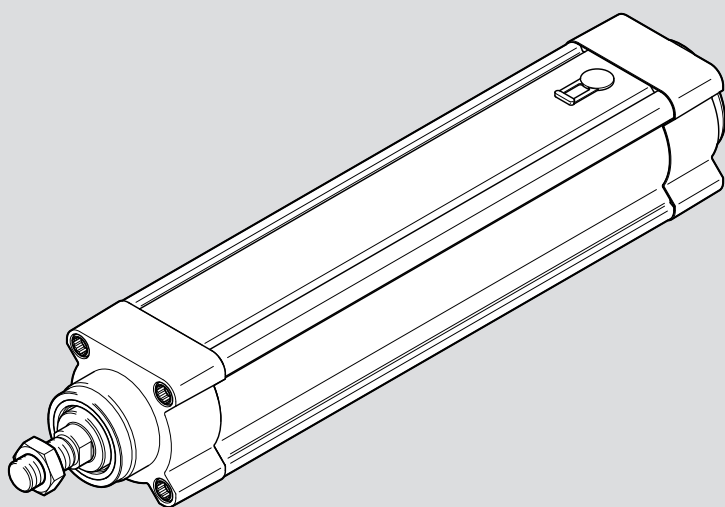


ESBF-BS/-LS

Electric cylinder

FESTO

Operating instructions



8227361

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2025-10e
[8227363]

Original instructions

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1 Applicable documents



All available documents for the product → www.festo.com/sp.

2 Safety

2.1 Safety instructions

- Observe the identifications on the product.
- Only use the product if it is in perfect technical condition.
- Before working on the product: Switch off the power supply, ensure that it is off and secure it against being switched on again.
- Store the product in a cool, dry environment protected from UV and corrosion. Keep storage times short.
- Store the product in ambient conditions without oils, greases and grease-dissolving vapours.

2.2 Intended use

The electric cylinder positions payloads or drives external guides.

2.3 Training of qualified personnel

Work on the product may only be carried out by qualified personnel who can evaluate the work and detect dangers. The qualified personnel have knowledge and experience in dealing with electric drive systems.

3 Additional information

- Contact the regional Festo contact if you have technical problems
→ www.festo.com.
- Accessories and spare parts → www.festo.com/catalogue.

4 Product overview

4.1 Product design

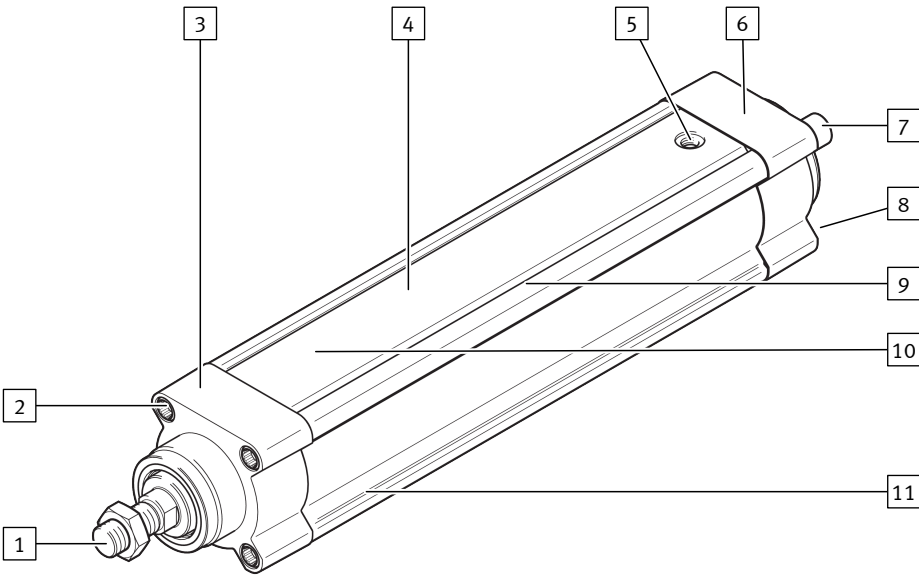


Fig. 1: ESBF-BS product design

- 1

Piston rod
- 2

Threaded hole for mounting
- 3

Bearing cap
- 4

Cylinder profile
- 5

Pressure compensation port
- 6

Drive cover
- 7

Drive shaft
- 8

Threaded hole for motor mounting kit
- 9

Interface for sensor bracket
- 10

Interface for sensor rail
- 11

Interface for profile mounting

4.2 Function

The electric cylinder converts the rotary motion of the mounted motor into a linear motion of the non-rotating piston rod. The screw drive 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 monitor end positions, reference position and intermediate position.

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

Tab. 1: Overview of Lead Screw

5 Transport

▲

WARNING

Risk of injury due to falling product

If the product is lifted incorrectly, it may fall and cut, crush or separate body parts.

•

Lift the product only with suitable load-bearing equipment.

- Store and transport the product in its original packaging. Observe the weight, the dimensions and the ambient conditions.
- Take the centre of gravity of the product into consideration.
- Store and transport the product in a horizontal position.

6 Mounting

6.1 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.

6.2 Mounting motor



Lateral Force on the Drive Shaft

When mounting the motor and the motor mounting kit, do not exceed the maximum transverse force F_R of the drive shaft, e.g. toothed belt tension when mounting the parallel kit → 12.2 Characteristic curves.

Axial kit EAMM-A	Parallel kit EAMM-U

Tab. 2: Mounting motor

Requirement

- Sufficient space for the pressure compensation connection. Note that this applies only to ESBF-...-S1.
1. Mount the motor and the motor mounting kit without tension. Support the heavy motor.
 2. Avoid torques on the drive cover. Support the motor if the maximum torque is exceeded.

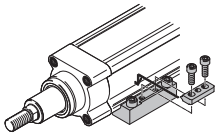
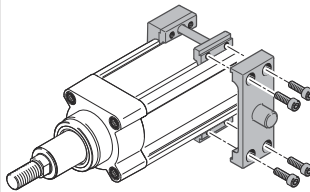
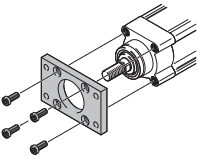
6.3 Mounting the cylinder



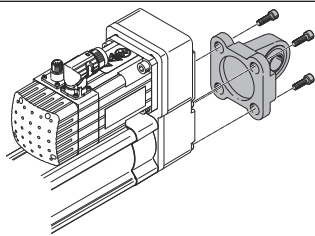
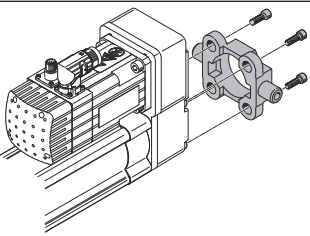
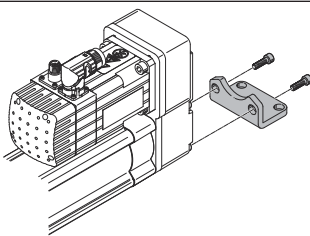
High mechanical loads on the mounting connections

If high parallel torques are applied to the drive system at the same time, this will result in 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 fastening or flange mounting EAHH-V2, the drive system must also be supported near the motor mounting.

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

Tab. 3: 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. 4: Overview of mounting components for parallel kit

Requirement

- Sufficient clearance for payload movement to avoid collisions with mounting components and sensor components. Only at ESBF-...-S1.
- Sufficient space for maintenance work.
- Sufficient space for the pressure compensation connection. Note that this applies only to ESBF-...-S1.
- The evenness of the mounting surface must not exceed 0.2 mm along the stroke length or the bearing surface.
- Mount the cylinder without tension or bending it

1. Place the mounting components on the support points.

2. Tighten the screws. Observe the maximum tightening torque and maximum screw-in depth.

ESBF-BS/-LS	-32	-40	-50	-63	-80	-100
Profile mounting EAHF-V2						
Thread	Assembly instructions ➔ www.festo.com/sp .					
Trunnion flange mounting kit DAMT-V1						
Thread	M5	M6	M6	M8	M8	M8
Max. tightening torque [Nm]	4 ⁺¹	8 ⁺¹	8 ⁺²	18 ⁺²	28 ⁺²	28 ⁺²
Direct fastening Flange mounting EAHH-V2 Foot mounting HNC, CRHNC Swivel flange DAMS, not for ESBF-BF-32 Trunnion flange ZNCF, CRZNG						
Thread	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						
Thread	Assembly instructions ➔ www.festo.com/sp .					

6.4 Mounting payload



Torque and transverse force on the piston rod

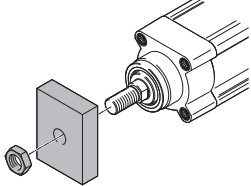
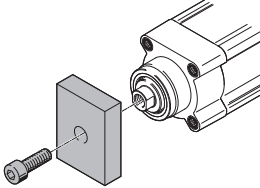
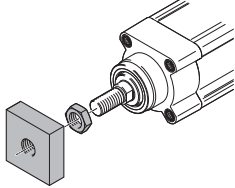
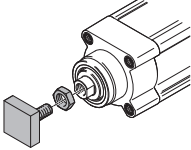
Operate the piston rod without torque and transverse force during commissioning.

Use an external guide if external torques are encountered.



Mounting payload on the piston rod

Do not exceed the maximum torque of the piston rod when mounting the payload. The maximum torque of the piston rod may only be used for a short time during mounting → Tab. Payload information.

ESBF	ESBF-...-F
Mounting via male thread	Mounting via female thread
with nut	with screw
– Guide unit EAGF - Assembly instructions → 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 	

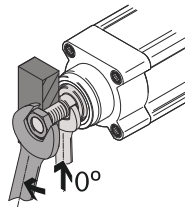
Tab. 5: Mounting payload overview

Requirement:

- Transverse forces and torques acting on the piston rod must be absorbed by an external guide, e.g. guide unit EAGF.
 - Lateral piston rod play occurring with high-precision positioning movements is absorbed by an external guide, e.g. guide unit EAGF.
 - Sufficient clearance for payload movement to avoid collisions with mounting components and sensor components.
 - Minimise guide load. Short lever arms from the piston rod thread to the point of force application and to the centre of mass of the payload.
 - When using an additional external guide, ensure that the electric cylinder and piston rod are aligned exactly parallel.
1. If necessary, screw the lock nut on the male thread of the piston rod or the payload.
 2. Position or screw the payload on the piston rod.

3. Mount the piston rod with an open-ended spanner at the spanner flat to prevent the tightening torque from acting on the piston rod. Tighten the screw, nut, or lock nut. Observe the maximum tightening torque and maximum screw-in depth.

ESBF-BS/-LS		-32	-40	-50	-63	-80	-100
Piston rod							
Spanner size $\curvearrowright$	[mm]	10	13	17	17	22	22
Max. torque	[Nm]	2.4	6.4	12	15	31	53
Piston rod with male thread ESBF							
Thread		M10x1.25	M12x1.25	M16x1.5		M20x1.5	
Piston rod with female thread ESBF -...- F							
Thread		M6	M8	M10	M10	M12	M12
Max. screw-in depth $t_{\max}$	[mm]	12	12	16	16	20	20



6.5 Mounting sensor

Mounting kit SMB	Mounting kit CRSMB	Sensor rail SAMH
– mounting on profile lug	– central mounting on the profile	– central mounting on the profile

Tab. 6: Overview of sensor mountings

Requirements:

- No uncontrolled overtravel of the end positions.
- No hard stop at the end positions.
- No contamination in the slots.
- Protect the sensor from external magnetic or ferritic influences with min. 10 mm distance from slot nuts.
- Only limit switches with a normally closed function offer protection in the event of sensor failure.

1. Mount the mounting kit or the sensor rail.
2. Align and mount the sensor.

6.6 Connecting pressure compensation with ESBF-...-S1



The standard version of the ESBF comes with a pressed-in sinter filter.

The pressure compensation port enables negative or excess pressure in the cylinder interior to be reduced. 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, e.g. excess pressure with maximum + 0.02 MPa (+ 0.2 bar, + 2.9 psi).

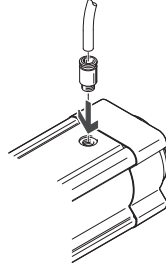


Fig. 2: Connecting pressure compensation, such as cylinder profile connection

Position of the pressure compensation port:

- ESBF-32/-40/-50-S1: in the drive cover
- ESBF-63/-80/-100-S1: in the cylinder profile

1. Remove the protective cap from the pressure compensation port.
2. Install the fittings.
3. Connect the hose.

7 Commissioning

⚠ WARNING

Risk of injury due to unexpected movement of components.

- Protect the positioning range from unwanted access.
- Keep foreign objects out of the positioning range.
- Perform commissioning with low dynamic response.



Block-shaped acceleration profiles without jerk limitation can have the following effects:

- High mechanical loads on the drive due resulting from high force peaks.
- Overshooting effects during positioning.
- Rise of the entire system.

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



When the motor is demounted, the motor encoder loses its absolute reference to the reference mark, e.g. by turning the motor drive shaft.

- Carry out a homing run every time the motor is mounted in order to establish the absolute reference between the motor encoder and the reference mark.



Torque and transverse force on the piston rod

Operate the piston rod without torque and transverse force during commissioning.

Use an external guide if external torques are encountered.



Running noises during operation

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

Requirements:

- For use with reduced particle emission. The product is cleaned → 9.3 Cleaning cylinder.
 - The motor encoder is referenced to the reference mark by homing.
 - The motor encoder has the absolute reference to the reference mark.
 - The direction of movement of the piston rod is determined by the direction of rotation of the motor.
 - The mounting of the drive system has been checked.
 - The installation on the motor has been checked.
 - There are no foreign objects within the range of motion of the drive system.
 - Maximum permissible feed force and drive torque as a function of acceleration, deceleration, e.g. with stop function or quick stop, speed, moving mass and mounting position, are not exceeded.
 - Axis is not mechanically overloaded and dynamic setpoint deviation is not exceeded as a result of force peaks, torque peaks or overshoot effects, e.g. over-running the end position.
- Overloads and overruns as a result of jerk limitation must be restricted by reduced acceleration and deceleration setpoints or optimised controller settings.
- No test run to mechanical end stops.
 - Software end positions ≥ 0.25 mm from the mechanical stops.

ESBF-BS/-LS	-32	-40	-50	-63	-80	-100
Max. stop speed [m/s]	0.01					
Max. stop energy [mJ]	0.03	0.05	0.07	0.15	0.38	0.60
Calculation of the stop energy E						
$E_{max} = \frac{v^2}{2} \left(m + \frac{J_R}{J_L} \right)$	– v = stop speed – m = mass of all linear moving components – J_R = mass moment of inertia of all rotating components – J_L = mass moment of inertia per kg payload					

Tab. 7: Speed and energy at the end positions

1. Start check run.
2. Select a permissible reference point for homing.
3. Start the homing with reduced speed setpoints, acceleration setpoints and deceleration setpoints.
4. Check that the piston rod runs through the complete travel cycle in the specified time.
 - ⇒ The piston rod stops the movement when it reaches a limit switch and the drive system is ready for operation.

8 Operation

⚠ WARNING

Risk of injury due to unexpected movement of components.

- Protect the positioning range from unwanted access.
- Keep foreign objects out of the positioning range.
- Perform commissioning with low dynamic response.



Torque on the piston rod

Operate the piston rod without torque during commissioning and during operation.

Use an external guide if external torques are encountered.



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 $\geq 2.5 \times$ spindle pitch.

9 Maintenance

9.1 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.

9.2 Checking reversing backlash with ESBF-LS

- Check the reversing backlash (reversal error) of the slide at every maintenance interval, e.g. lubrication interval. If the maximum permissible reversing backlash is exceeded, replace the axis.

ESBF-LS		-32-2.5P	-40-3P	-50-4P
Max. reversing backlash	[mm]	0.62	0.75	1

9.3 Cleaning cylinder

- If the piston rod is dirty, clean it with a clean, soft and lint-free cloth without cleaning agents and then apply the lubricant thinly to the piston rod.
- Clean the other product components with a clean, soft cloth and non-abrasive cleaning agents.

For use with reduced particle emission:

- Remove abraded particles and soil from the product:
 - Prior to initial commissioning
 - Regularly during operation

9.4 Lubricating cylinder

Lubrication interval and accessories

Lubrication	Drive screw	Piston rod	
	ESBF	ESBF	ESBF-...-F1
Lubrication interval	Lubrication for life	As required, e.g. if the grease coating is insufficient.	
Accessories ➔ www.festo.com/spareparts			
Lubrication point	—	Interface	
Lubricant	—	Roller bearing grease LUB-KC1, 684474	Roller bearing grease, suitable for use in the food industry LUB-E1

Tab. 8: Overview of lubrication intervals and accessories

10 Malfunctions

10.1 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 access.
- Keep foreign objects out of the positioning range.
- Perform commissioning with low dynamic response.

Malfunction	Cause	Remedy
Wear on the lead screw ESBF-LS.	Reversing backlash is too high.	– Contact local Festo Service. – Replace cylinder.
Loud running noises or vibrations or rough running of the cylinder.	Coupling distance too short.	– Observe the permissible coupling spacings → Assembly instructions of the motor mounting kit.
	Torsional stresses	– Install the cylinder free of tension. Make sure that the contact surface is flat → 6.3 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. speed, acceleration, ...
	Resonant oscillation of the cylinder.	– Change travel speed.
	Wear on bearing or guide.	– Contact local Festo Service. – Replace cylinder.
	Reversing backlash is too high.	– Contact local Festo Service. – Replace cylinder.

Malfunction	Cause	Remedy
Loud running noises or vibrations or rough running of the cylinder.	Insufficient lubrication of the piston rod.	– Lubricate the piston rod ➔ Tab. 8 Overview of lubrication intervals and accessories.
Oscillations at the piston rod.	Operation at the resonance point of the cylinder.	– Change travel speed. – Change acceleration. – Increase cylinder stiffness, e.g. shorter support distances. – Change the payload geometry.
Long oscillations of the profile.	Resonant frequency of profile and payload too low.	– Increase cylinder stiffness, e.g. shorter support distances. – Change the payload geometry.
Piston rod does not move.	Coupling slips.	– Check the mounting of the shaft-hub connection ➔ Assembly instructions of the motor mounting kit.
	Loads are too high.	– Reduce forces and torques. Consider dynamics.
	Threaded drive blocked.	– Contact local Festo Service. – Replace cylinder.
	Pre-tension of toothed belt too high in parallel kit.	– Reduce the pre-tension of the toothed belt ➔ Assembly instructions for parallel kit.
	Operation at the lower ambient temperature limit.	– Optimise controller data, e.g. speed, acceleration, ... – Use gear unit.
	Piston rod stuck in the mechanical end position.	Manually releasing a jam: – Switch off the controller and lock it to prevent 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 drivetrain.	– Contact local Festo Service. – Replace cylinder.

Tab. 9: Overview of fault clearance

11 Removal

⚠ 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 mounted attachment component.
3. Remove the attached accessories.
4. Remove motor and mounting kit.
5. Remove the mounting attachments.
6. Observe transport information → 5 Transport.

12 Technical data

12.1 Technical data, mechanical

Additional information → www.festo.com/catalogue.

ESBF-BS		-32-5P	-32-10P	-40-5P	-40-10P	-40-16P
Design		Electric cylinder with ball screw				
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 rpm	[Nm]	0.1		0.2		
Maximum speed	[rpm]	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 (ESBF-...-S1)				
Max. permissible force on the drive shaft ➔ 12.2 Characteristic curves						
Max. lateral force Fq	[N]	115		130		
Max. permitted forces and torsional backlash on the piston rod						
Max. lateral force Fq	[N]	➔ 12.2 Characteristic curves				
Max. torsional backlash	[°]	± 0.25		± 0.20		

Tab. 10: Technical data, mechanical , EPRF-BS-32/-40

ESBF-BS		-50-5P	-50-10P	-50-20P	-63-5P	-63-10P	-63-25P
Design		Electric cylinder with ball screw					
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 rpm	[Nm]	0.3			0.4	0.45	0.5
Maximum speed	[rpm]	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					

ESBF-BS		-50-5P	-50-10P	-50-20P	-63-5P	-63-10P	-63-25P
Relative humidity	[%]	0 ... 95 (non-condensing)					
Ambient temperature	[°C]	0 ... +60					
Storage temperature	[°C]	−20 ... +60					
Degree of protection		IP40; IP65 (ESBF-...-S1)					
Max. permissible forces on the drive shaft ➔ 12.2 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]	➔ 12.2 Characteristic curves					
Max. torsional backlash	[°]	±0.15			±0.4		

Tab. 11: Technical data: mechanical, ESBF-BS-50/-63

ESBF-BS	-80-5P	-80-15P	-80-32P	-100-5P	-100-	-100-20P
Design	Electric cylinder with ball screw					
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 rpm [Nm]	0.5	0.6	0.65	0.7	0.9	1
Maximum speed [rpm]	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 (ESBF-...-S1)					
Max. permissible forces on the drive shaft ➔ 12.2 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]	➔ 12.2 Characteristic curves					
Max. torsional backlash [°]	±0.5			±0.5		

Tab. 12: Technical data: mechanical, ESBF-BS-80/-100

ESBF-LS	-32-2.5P	-40-3P	-50-4P
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 rpm [Nm]	0.1	0.2	0.3
Maximum speed [rpm]	1200	1000	750
Max. speed [m/s]	0.05		
Max. acceleration [m/s²]	2.5		
Repetition accuracy [mm]	± 0.05		
Max. reversing backlash [mm]	➔ 9.2 Checking reversing backlash with ESBF-LS		

ESBF-LS		-32-2.5P	-40-3P	-50-4P
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 (ESBF-...-S1)		
Max. permissible forces on the drive shaft ➔ 12.2 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]	➔ 12.2 Characteristic curves		
Max. torsional backlash	[°]	± 0.25	± 0.20	± 0.15

Tab. 13: Technical data: mechanical, ESBF-LS

12.2 Characteristic curves

Transverse load piston rod ESBF

Maximum transverse load F_q on the piston rod as a function of the piston rod length l (stroke + piston rod extension)

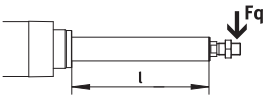


Fig. 3: Maximum transverse load F_q and piston rod length l

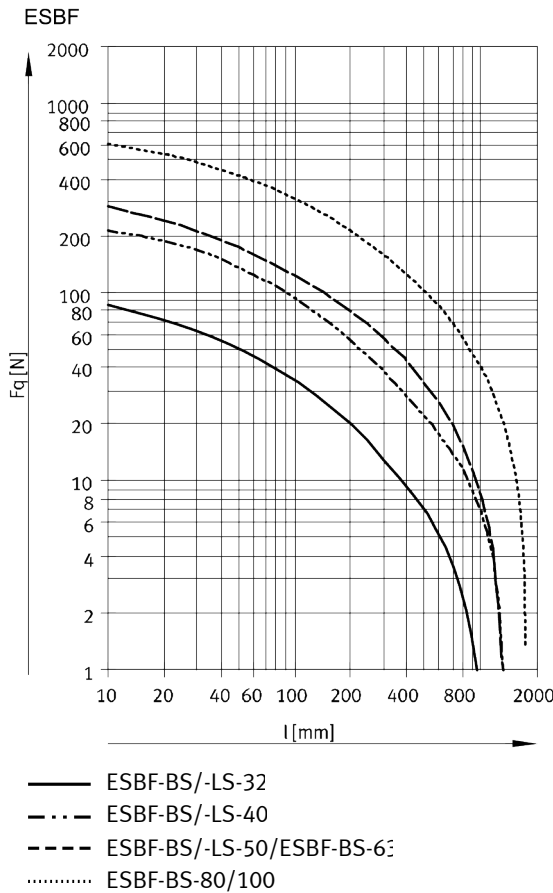


Fig. 4: ESBF, transverse load F_q as a function of the piston rod length l

Transverse load drive shaft ESBF

Maximum transverse load F_q on the drive shaft as a function of point of application x

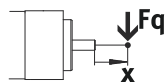


Fig. 5: Maximum lateral force F_q and point of application x

ESBF-...-32/40/50

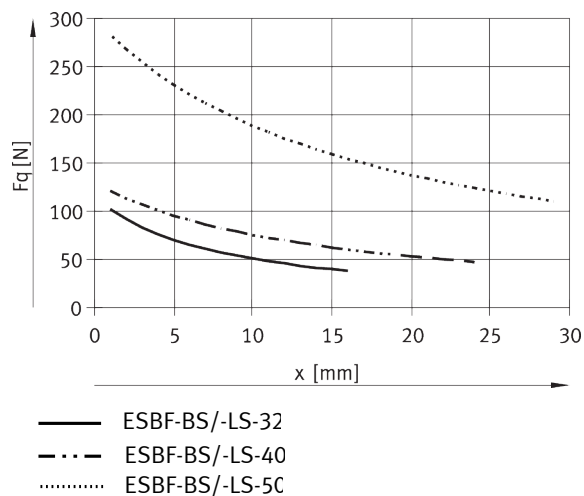


Fig. 6: ESBF-BS/LS-32/40/50, transverse load F_q as a function of the point of application x

ESBF-...-63/80/100

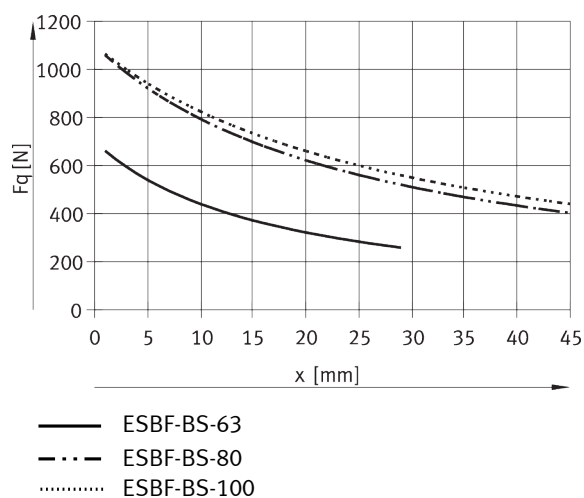


Fig. 7: ESBF-BS-63/80/100, transverse load F_q as a function of the point of application x

Feed force – feed speed ESBF

Maximum feed force F as a function of the feed speed v

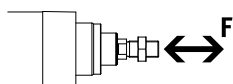


Fig. 8: Feed force F

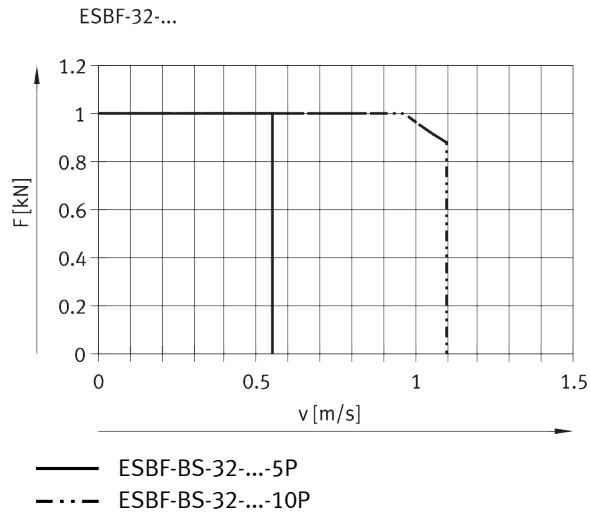


Fig. 9: ESBF-BS-32, feed force F as a function of the feed speed v

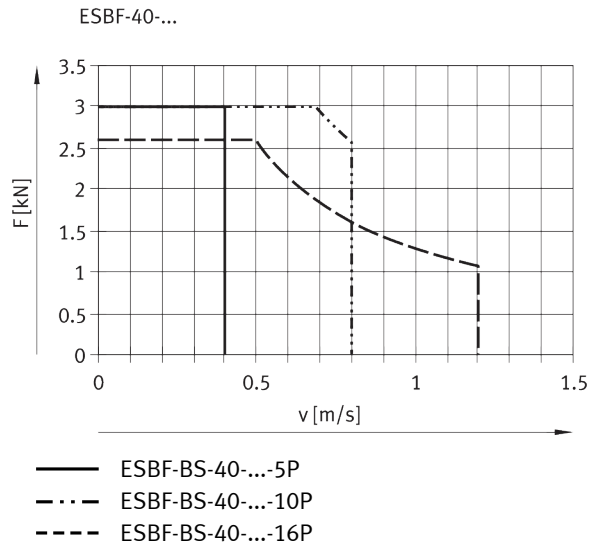


Fig. 10: ESBF-BS-40, feed force F as a function of the feed speed v

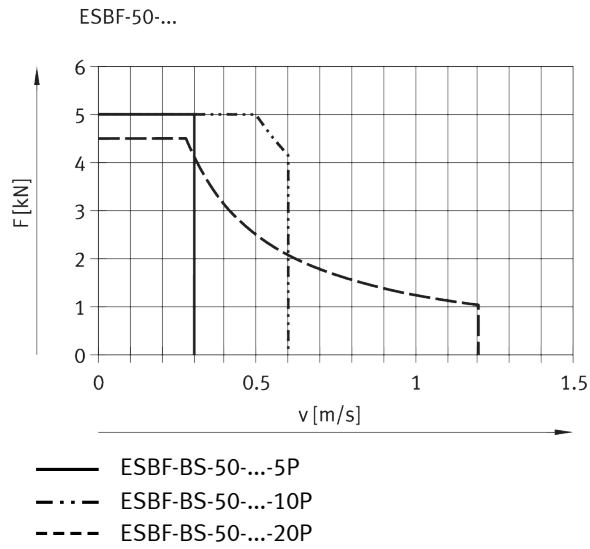


Fig. 11: ESBF-BS-50, feed force F as a function of the feed speed v

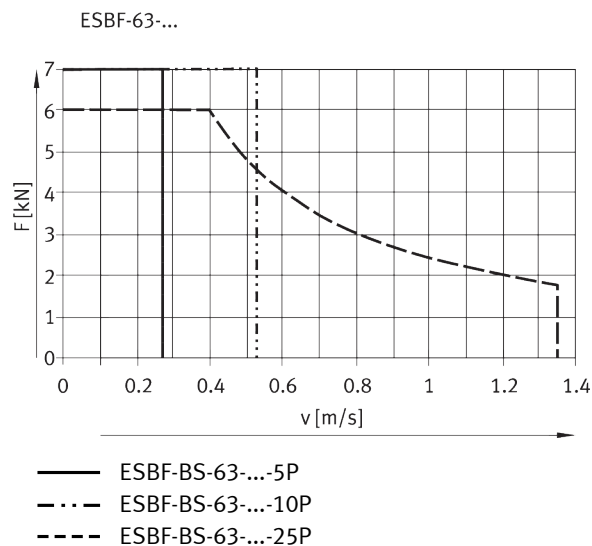


Fig. 12: ESBF-BS-63, feed force F as a function of the feed speed v

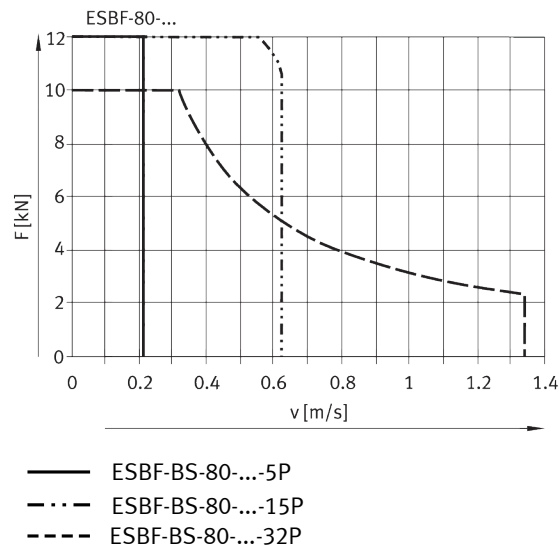


Fig. 13: ESBF-BS-80, feed force F as a function of the feed speed v

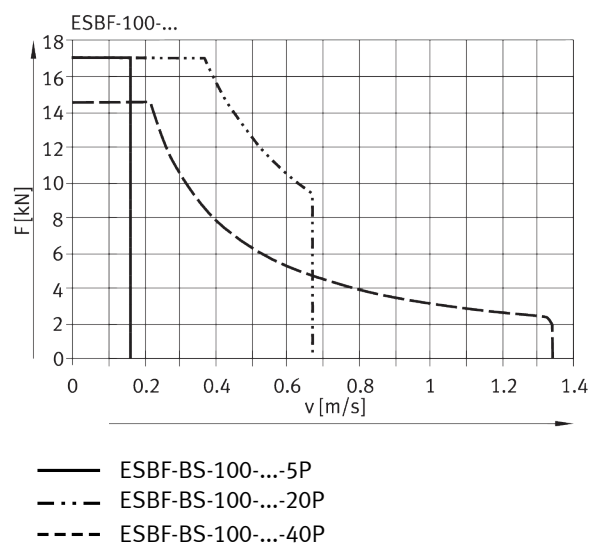


Fig. 14: ESBF-BS-100, feed force F as a function of the feed speed v

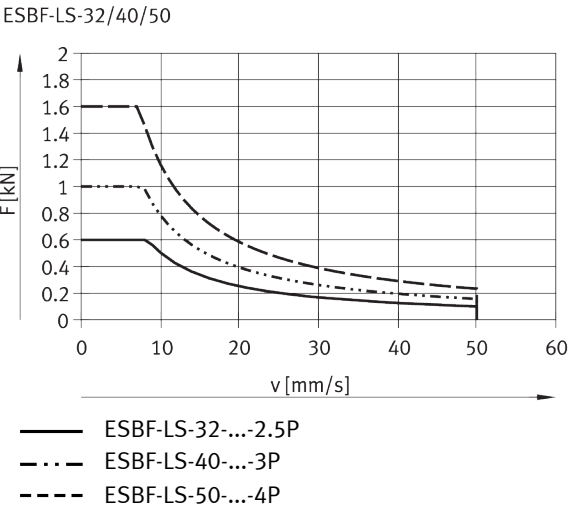


Fig. 15: ESBF-LS-32/40/50, feed force F as a function of the feed speed v

Pressure force – piston rod length ESBF

Maximum pressure force F as a function of the piston rod length l (stroke + piston rod extension)

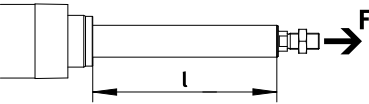


Fig. 16: Pressure force F and piston rod length l

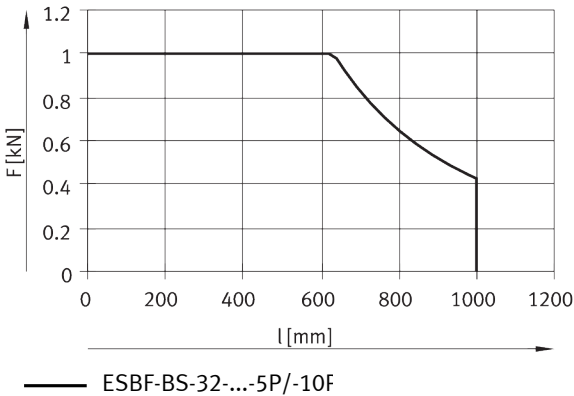


Fig. 17: ESBF-BS-32, pressure force F as a function of the piston rod length l

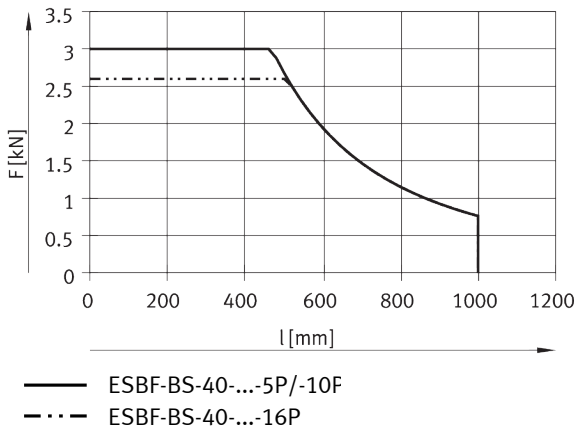


Fig. 18: ESBF-BS-40, pressure force F as a function of the piston rod length l

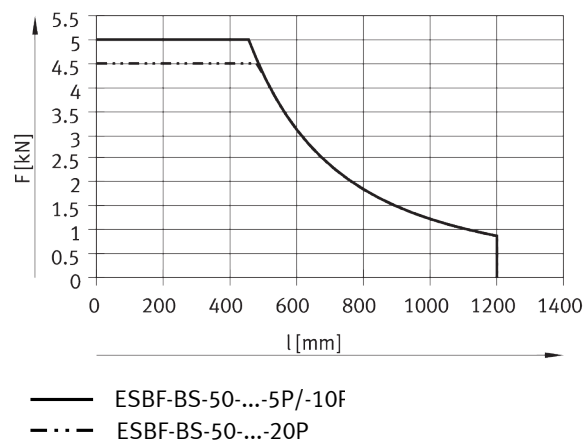


Fig. 19: ESBF-BS-50, pressure force F as a function of the piston rod length l

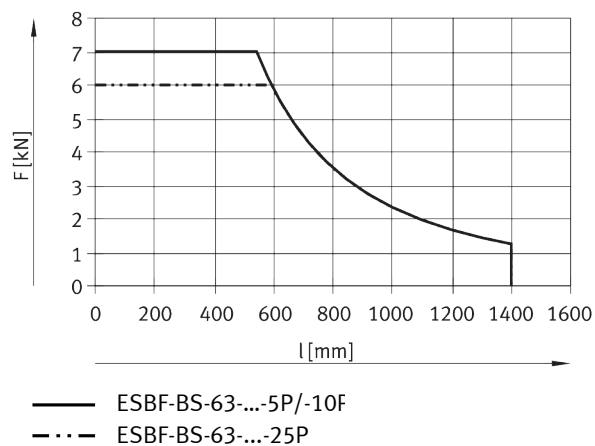


Fig. 20: ESBF-BS-63, pressure force F as a function of the piston rod length l

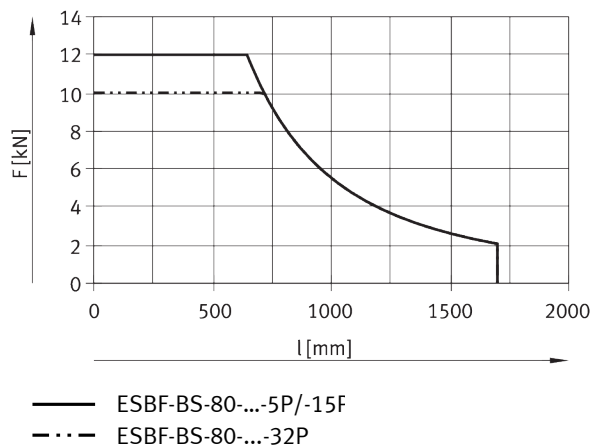


Fig. 21: ESBF-BS-80, pressure force F as a function of the piston rod length l

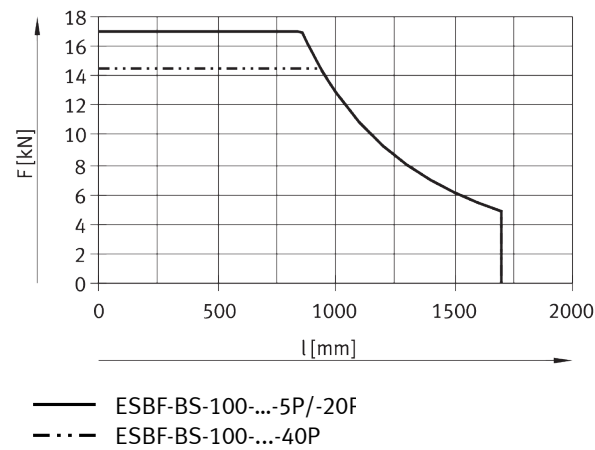


Fig. 22: ESBF-BS-100, pressure force F as a function of the piston rod length l
ESBF-LS-32/40/50-

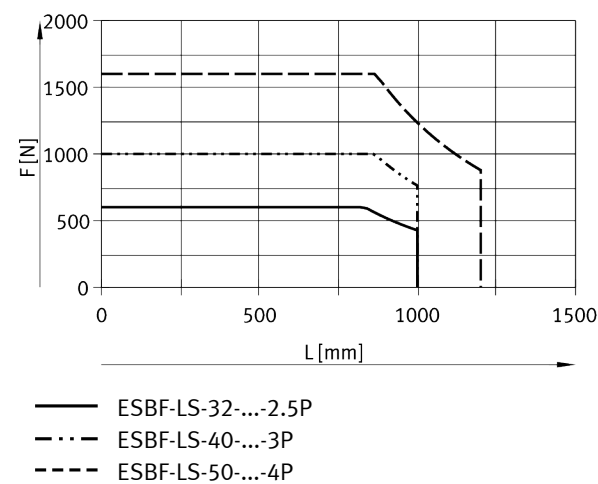


Fig. 23: ESBF-LS-32/40/50, pressure force F as a function of the piston rod length l

Feed speed – stroke
ESBF-BS

Maximum feed speed v as a function of the stroke l

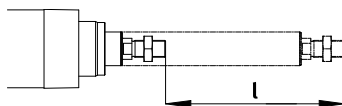


Fig. 24: Stroke length l

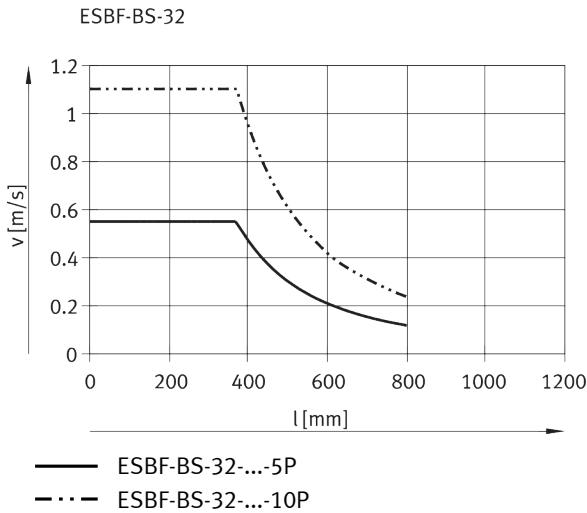


Fig. 25: ESBF-BS-32, feed speed v as a function of the stroke l

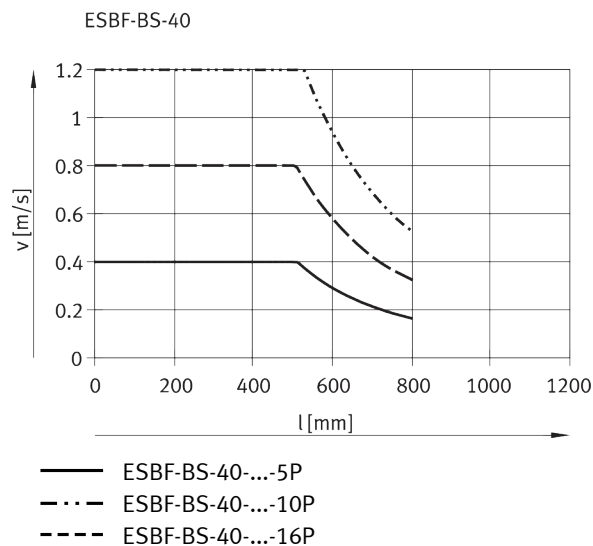


Fig. 26: ESBF-BS-40, feed speed v as a function of the stroke l

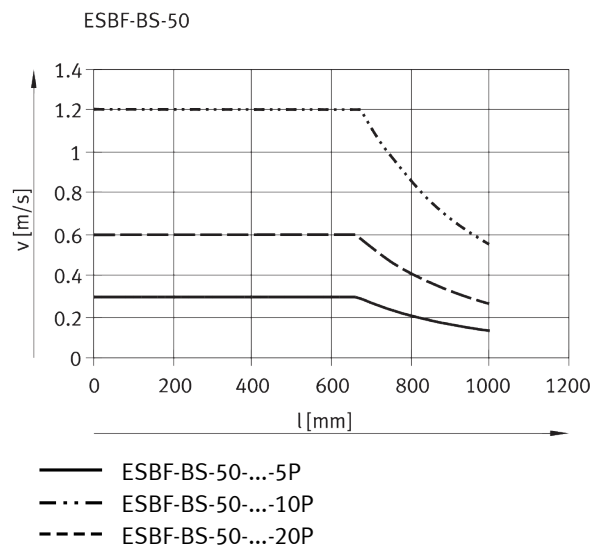


Fig. 27: ESBF-BS-50, feed speed v as a function of the stroke l

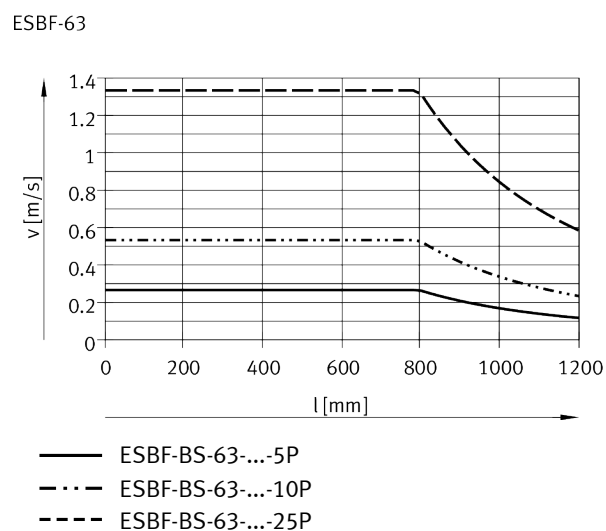


Fig. 28: ESBF-BS-63, feed speed v as a function of the stroke l

ESBF-80

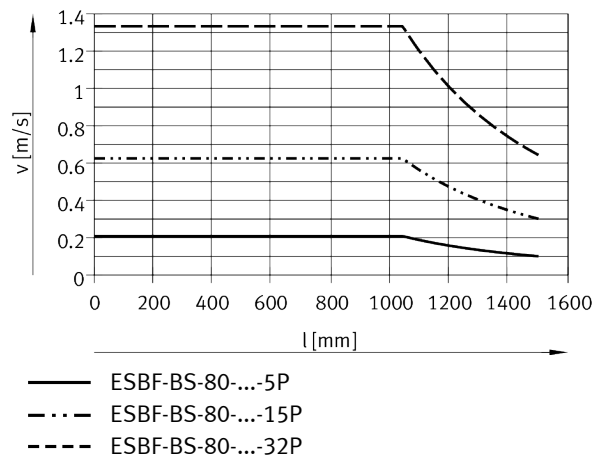


Fig. 29: ESBF-BS-80, feed speed v as a function of the stroke l

ESBF-100

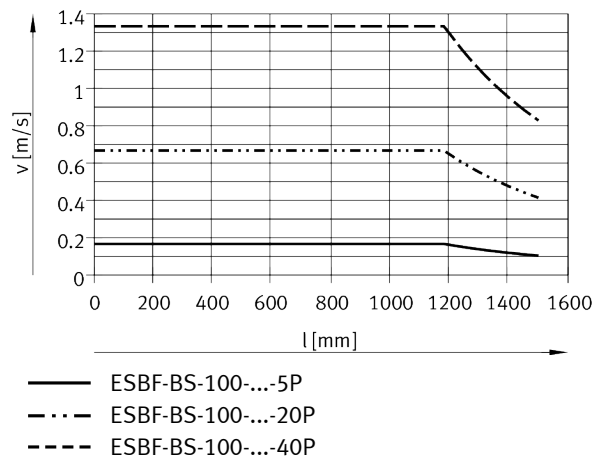


Fig. 30: ESBF-BS-100, feed speed v as a function of the stroke l

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