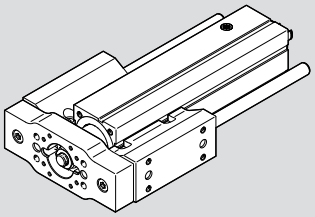
EPCC-BS-KF
Electric cylinder



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Operating instructions

8172511
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[8172513]

8172511

Translation of the original instructions

1 Applicable documents

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

Document	Product	Contents
Assembly instructions	Guide unit EAGF-P2-KF	–

Tab. 1: Applicable document

2 Safety

2.1 Safety instructions

- Observe labelling on the product.
- Before working on the product, switch off the power supply 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 with guide unit is used as intended for positioning payloads in connection with tools.

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 Function

The electric cylinder converts the rotary motion of the mounted motor into a linear motion of the piston rod. The drive screw converts the torque of the motor into a feed force. The linear movement of the piston rod is guided by two guide rods of the guide unit. Sensors monitor end positions, reference position and intermediate position.

4.2 Product design

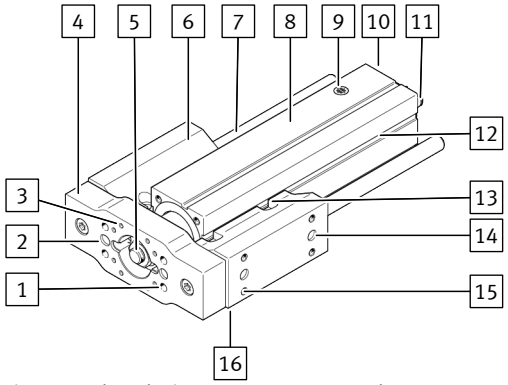


Fig. 1: Product design EPCC-BS-KF, example EPCC-BS-45-100-10P-A-KF

1 Through-hole for attachment component
2 Centring hole for attachment component
3 Threaded hole for attachment component
4 Yoke plate
5 Piston rod with male thread or female thread
6 Guide housing
7 Guide rod
8 Cylinder profile
9 Sealing air connection with filter element
10 Interface for motor mounting kit
11 Drive hub
12 Slot for sensor bracket
13 Through-hole for mounting
14 Centring hole for mounting
15 Threaded hole for mounting
16 Threaded hole and centring hole for mounting

5 Transport

NOTICE

Unexpected and unbraked movement of components

- Secure moving components for 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 Assembly

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.

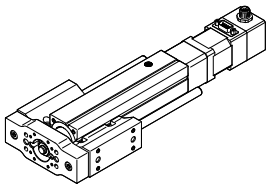
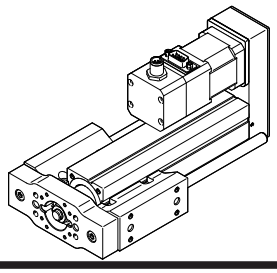
6.2 Unpacking product

1. Open 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.

6.3 Mounting motor

Transverse load on the drive hub

When mounting the motor and motor mounting kit, do not exceed the maximum transverse load F_R of the drive hub, e.g. toothed belt tension when mounting the parallel kit ➔ 12.1 Technical data, mechanical.

Axial kit EAMM-A	Parallel kit EAMM-U
	Mount the motor only on a side without a guide rod. 

Tab. 2: Overview of motor mountings

Requirement
- Only loosen screws or threaded pins that are described in the directions in the instruction manuals.
- Sufficient space for reaching and mounting the sealing air connection ➔ 6.6 Mounting accessories.

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

Connect motor cables only on completion of mounting.

6.4 Fasten cylinder with guide

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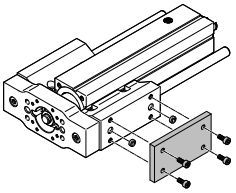
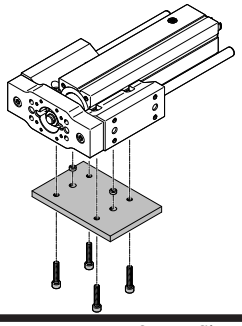
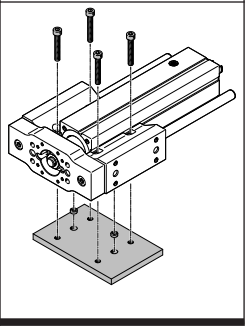
High mechanical loads on the mounting connections
If high parallel torques are applied to the drive system at the same time, this will result in high mechanical loads at the mounting interfaces.
- If the mounting position is inclined or horizontal with direct fastening, the drive system will require additional support near the motor mounting.

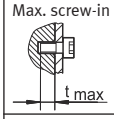
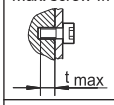
Requirement
- No collision in the range of motion of the attachment component with motor, mounting components and sensor components.
- Sufficient space to reach maintenance interfaces.
- Sufficient space for reaching and mounting the sealing air connection.
- Flat mounting surface maximum 0.2 mm over 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 the maximum tightening torque and screw-in depth.

For additional information, contact your local Festo Service.

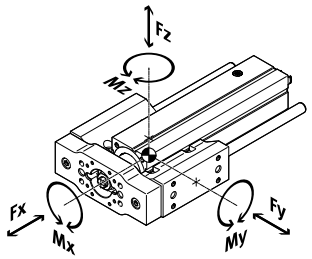
Direct fastening		
Guide housing, lateral	Guide housing, bottom	
Mounting via thread	Mounting via thread	Mounting via through-hole
		

Tab. 3: Overview of mounting components for profile

Size		32	45	60
Direct fastening, lateral via thread				
Screw		M5	M5	M5
Max. tightening torque	[Nm]	5.2	5.2	5.2
Max. screw-in depth t_{max} 	[mm]	8.5	12	10
Centring hole and centring element	[mm]	∅7	∅7	∅7
Centring hole tolerance		H8	H8	H8
Direct fastening, bottom via thread				
Screw		M5	M5	M5
Max. tightening torque	[Nm]	5.2	5.2	5.2
Max. screw-in depth t_{max} 	[mm]	12	12	10
Centring hole and centring element	[mm]	∅7	∅7	∅7
Centring hole tolerance		H8	H8	H8
Direct fastening, bottom via through-hole				
Screw		M4	M5	M6
Centring hole and centring element	[mm]	∅4	∅5	∅7
Centring hole tolerance		H8	H8	H8

Tab. 4: Information for mounting components

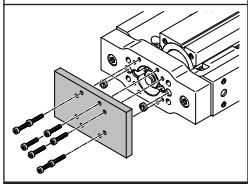
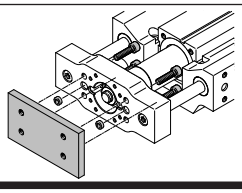
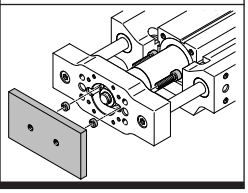
6.5 Mounting attachment component

Collision-free	Guide load
	

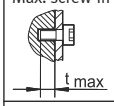
Tab. 5: Requirement for attachment components

Requirement:
- No collision in the range of motion of the attachment component with motor, mounting components and sensor components.
- Minimise guide load. Short lever arms from the centre of the yoke plate ◔ to the force application points and centre of gravity of the attachment components.

1. Select accessories ➔ www.festo.com/catalogue.
2. Place centring components in centring holes.
3. Position attachment component on the yoke plate.
4. Tighten retaining screws.
   Observe the maximum tightening torque and screw-in depth.

Direct fastening		
Yoke plate		
Mounting via thread	Mounting via through-hole, outside	Mounting via through-hole, inside
		

Tab. 6: Overview of attachment components

Size		32	45	60
Direct fastening via thread				
Screw		M3	M3	M4
Max. tightening torque	[Nm]	1.2	1.2	2.8
Max. screw-in depth t_{max} 	[mm]	7	7	9
Centring hole and centring element	[mm]	∅7	∅7	∅7
Centring hole tolerance		H8	H8	H8
Direct fastening via through-hole, outside				
Screw		M4	M5	M5
Centring hole and centring element		∅7	∅7	∅7
Centring hole tolerance		H8	H8	H8
Direct fastening via through-hole, inside				
Screw		M4	M5	M5
Centring hole and centring element		∅7	∅7	∅7
Centring hole tolerance		H8	H8	H8

Tab. 7: Information on attachment components

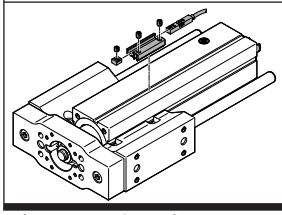
6.6 Mounting accessories

Requirement
- No collision with mounting and sensor components in the movement space of the attachment component.

Function
- Protection against uncontrolled overtravel of the end positions.
- Referencing to reference switch or end position.
- Query of end positions or intermediate positions.
- Prevention of hard impacts at the end positions.
- Prevention of contamination in the slots.

1. Select accessories ➔ www.festo.com/catalogue.
2. Mount the sensor (reference or query):
   - Mount sensor rail or mounting kit.
   - Align sensor and mount it at the switching position.
   - Fasten cable.

Instruction manuals ➔ www.festo.com/sp.

Sensor bracket EAPM	
Mounting via profile groove	
	– It is not possible to mount the sensor bracket on the side in the area of the guide housing. – Protect the sensor from external magnetic or ferritic influences, e.g. min. 10 mm distance to slot nuts. – Preferably use hardware limit switches with N/C contact function to guarantee protection in the event of a sensor failure. Instruction manual ➔ www.festo.com/sp

Tab. 8: Overview of sensor mounting

Connecting sealing air

The use of sealing air at approx. ± 0.02 MPa (± 0.2 bar, ± 2.9 psi) reduces or prevents subsequent contamination:
- The application of negative pressure minimises the release of abraded particles into the environment.
- The application of overpressure reduces the penetration of dirt into the drivetrain.

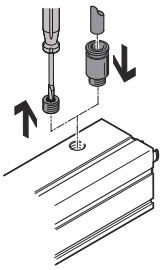


Fig. 2: Mounting fitting

1. Remove the filter element from the threaded hole.
2. Mount the screw fitting and connect the hose.

Size		32	45	60
Thread		M5	G 1/8	G 1/4
Max. screw-in depth	[mm]	5	7	7
Max. tightening torque	[Nm]	1.4	5	8

Tab. 9: Information on sealing air connection

7 Commissioning

7.1 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.

7.2 Commissioning procedure

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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.
- Rise of the entire system.

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

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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 every time the motor is mounted in order to establish the absolute reference between the motor encoder and the reference mark.

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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.

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

Steps	Purpose	Note

1. Check travel	Determine the direction of travel of the piston rod	– Direction of movement of piston rod, clockwise spindle:
		  – Retracting: rotate drive shaft clockwise.
		  – Advancing: rotate 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, e.g. parallel or axial kit.
		– Set a required reversal of direction of rotation via parameters in the servo drive 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 ➔ 12 Technical data.
		– towards end position:
		  do not exceed maximum values ➔ Tab. 11 Speed and energy at the end positions.
		Additional information ➔ Instruction manual of the drive system, ➔ www.festo.com/sp.

3. Test run	Checking the operating conditions	Check application requirements: – Piston rod runs through the complete travel cycle in the specified time. – The piston rod stops travel when a limit switch or software end position is reached.
After a successful test run, the drive system is ready for operation.		

Tab. 10: Commissioning steps

Size		32	45	60
Max. stop velocity	[m/s]	0.01		
Max. stop energy	[mJ]	3.6	12	24
Calculation of the maximum stop energy				
$E_{max} = \frac{v^2}{2}\left(m + \frac{J_R}{J_L}\right)$		– v = max. stop velocity – 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 Additional information ➔ www.festo.com/catalogue.		

Tab. 11: Speed and energy at the end positions

8 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.

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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 x 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 Cleaning

- 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.

9.3 Lubrication

Lubrication interval and accessories

Lubrication	Drive screw	Guide rods	Piston rod
Lubrication interval	Lubrication for life	Lubrication for life	As required, e.g. if the grease coating is insufficient.
Accessories			
Lubrication point	—	—	Interface
Lubricant	—	—	ELKALUB VP 922, ChemieTechnik, Vöhringen

Tab. 12: 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 intervention.
- Keep foreign objects out of the positioning range.
- Perform commissioning with low dynamic response.

Malfunction	Possible cause	Remedy
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.
	Torsional stresses	– Install guide unit free of tension. Make sure that the contact surface is flat ➔ 6.4 Fasten cylinder with guide. – Change the layout of the attachment component, e.g. payload.
	Current controller settings	Optimise controller values, e.g. velocity, acceleration, etc.
	Resonant vibration of the cylinder	Change the travel velocity.
	Wear on bearing or drive screw	– Contact local Festo Service. – Replace cylinder ➔ www.festo.com/catalogue.
	Insufficient lubrication of the piston rod	Lubricate piston rod ➔ 9.3 Lubrication.
Vibrations in the guide	Operation at the resonance point of the guide	– Change the travel velocity. – Change the acceleration. – 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 ➔ Instruction manual of 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 pre-tension 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 jammed at 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.
Position sensing not reproducible	Sensor switches several times	– Contact local Festo Service.
Idling torque too high	Wear in the drivetrain	– Contact local Festo Service. – Replace cylinder ➔ www.festo.com/catalogue.

Tab. 13: Overview of fault clearance

11 Demounting

⚠ WARNING

Unexpected movement of components
Injury due to impact or crushing.
- Before working on the product: secure the slide to prevent unintentional movement.

⚠ 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 mounted accessories.
4. Remove motor and mounting kit.
5. Remove mounting attachments.
6. Observe transport information ➔ 5 Transport.

12 Technical data

12.1 Technical data, mechanical

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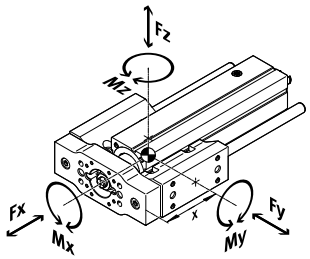
Use the Festo sizing software for sizing the drive ➔ www.festo.com/sp.

Additional information ➔ www.festo.com/catalogue.

EPCC-BS-32/45/60-...-KF

Size		32		45		60	
Spindle pitch		3P	8P	3P	10P	5P	12P
Design		Electric cylinder with ball screw					
Guide		Recirculating ball bearing guide					
Mounting position		any					
Max. feed force F_x	[N]	150		450		1000	
Max. driving torque	[Nm]	0.15	0.3	0.4	0.9	1.2	2.4
No-load driving torque	[Nm]	0.065	0.095	0.08	0.16	0.235	0.325
Max. rotational speed	[rpm]	3750		3600		3000	
Max. velocity	[m/s]	0.188	0.5	0.18	0.6	0.25	0.6
Max. acceleration	[m/s²]	5	15	5	15	5	15
Repetition accuracy	[mm]	± 0.02					
Feed constant	[mm/rev]	3	8	3	10	5	12
Duty cycle	[%]	100					
Relative humidity	[%]	0 ... 95 (non-condensing)					
Ambient temperature	[°C]	0 ... +60					
Storage temperature	[°C]	–20 ... +60					
Degree of protection		IP40					
Max. permissible force on the drive hub							
Max. transverse load F_R	[N]	75		180		230	
Max. permissible forces, torques and distance from the guide centre							
Fx, stat	[N]	150		450		1000	
Fy, stat	[N]	355		415		510	
Fz, stat	[N]	355		415		510	
Mx, stat	[Nm]	13		19		27	
My, stat	[Nm]	9		12		20	
Mz, stat	[Nm]	9		12		20	
Fx, dyn	[N]	150		450		1000	
Fy, dyn	[N]	160		320		380	
Fz, dyn	[N]	160		320		380	
Mx, dyn	[Nm]	6		15		20	
My, dyn	[Nm]	4		10		15	
Mz, dyn	[Nm]	4		10		15	
X, add with stroke	[mm]	54		63		76	
Calculating the load comparison factor							

Size	32		45		60	
Spindle pitch	3P	8P	3P	10P	5P	12P
fv	$\|Fx\| \le Fx_{max}$ $\frac{\|F_{y_{dyn}}\|}{F_{y_{dyn.max}}} + \frac{\|F_{z_{dyn}}\|}{F_{z_{dyn.max}}} + \frac{\|M_{x_{dyn}}\|}{M_{x_{dyn.max}}} + \frac{\|M_{y_{dyn}}\|}{M_{y_{dyn.max}}} + \frac{\|M_{z_{dyn}}\|}{M_{z_{dyn.max}}} \le 1$ 					

Tab. 14: General data, EPCC-BS-32/45/60-...-KF

EPCC-BS-32/45/60-...-KF

Size		32	45	60
Materials				
Guide housing Yoke plate Cylinder barrel		Anodised aluminium		
Guide rod		Tempered steel, hard chrome-plated		
Piston rod		High-alloy steel		
Spindle Spindle nut		Bearing steel		
Weight				
Basic weight at 0 mm stroke	[kg]	0.838	1.592	2.728
Added weight per 10 mm stroke	[kg]	0.032	0.053	0.087

Tab. 15: Materials and weight

12.2 Characteristic curves

Additional information ➔ www.festo.com/catalogue.

Transverse load on the yoke plate EPCC-BS-KF

Maximum transverse load Fy, Fz on the yoke plate as a function of the piston rod length l.

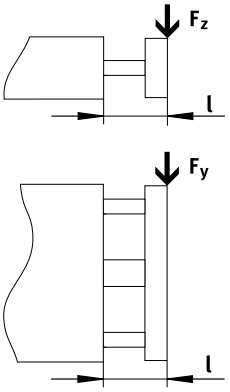


Fig. 3: Maximum transverse load Fy, Fz and piston rod length l.

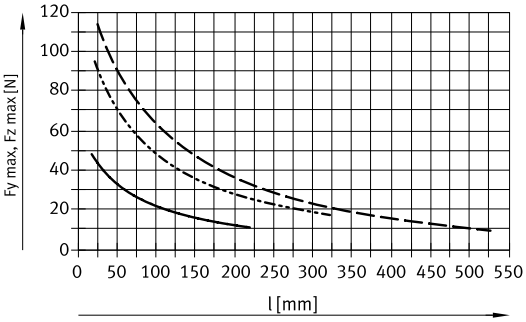


Fig. 4: EPCC-BS-KF, maximum transverse load Fy, Fz as a function of the piston rod length l

— EPCC-BS-32-...-KF — — EPCC-BS-60-...-KF

-·-· EPCC-BS-45-...-KF

Deflection of the yoke plate EPCC-BS-KF

Deflection f of the yoke plate as a function of the dead weight force F and the piston rod length l.

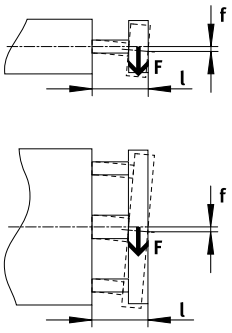


Fig. 5: Deflection f, dead weight force F and piston rod length l

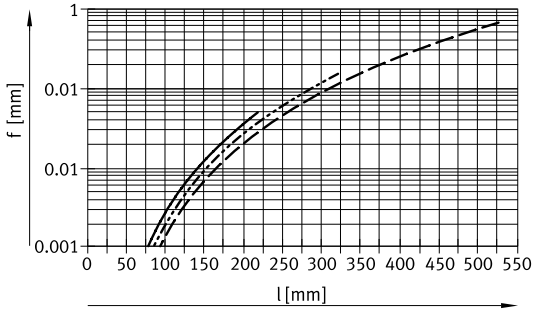


Fig. 6: EPCC-BS-KF, deflection f as a function of the piston rod length l

— EPCC-BS-32-...-KF — — EPCC-BS-60-...-KF

-·-· EPCC-BS-45-...-KF

Deflection f of the yoke plate as a function of the transverse load Fy, Fz and the piston rod length l

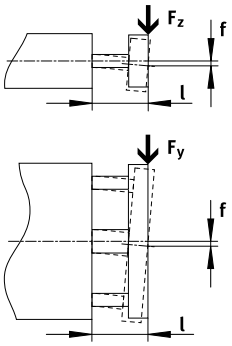


Fig. 7: Deflection f, transverse load Fy, Fz and piston rod length l

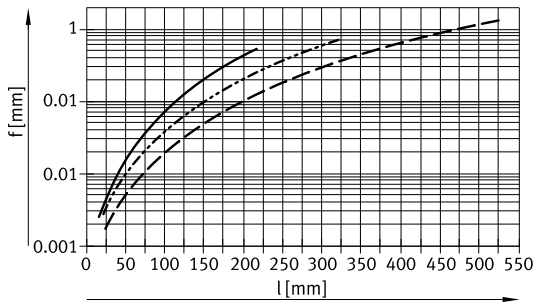


Fig. 8: EPCC-BS-KF, deflection f as a function of the piston rod length l

— EPCC-BS-32-...-KF (F = 10N) — — EPCC-BS-60-...-KF (F = 10N)

-·-· EPCC-BS-45-...-KF (F = 10N)

Tilt of the yoke plate EPCC-BS-KF

Angle of inclination α of the yoke plate as a function of the torque M and the piston rod length l.

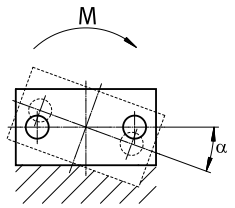


Fig. 9: Pitch α and torque M.

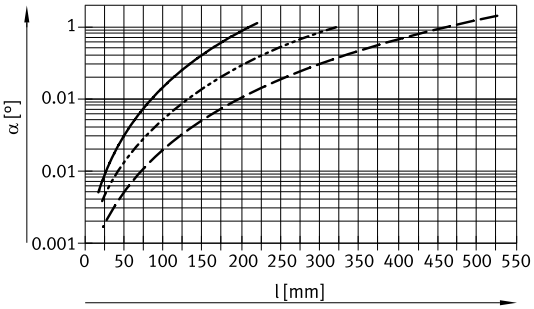


Fig. 10: EPCC-BS-KF, angle of inclination α as a function of the piston rod length l

EPCC-BS-32-...-KF (M = 2 Nm)

EPCC-BS-60-...-KF (M = 2 Nm)

EPCC-BS-45-...-KF (M = 2 Nm)