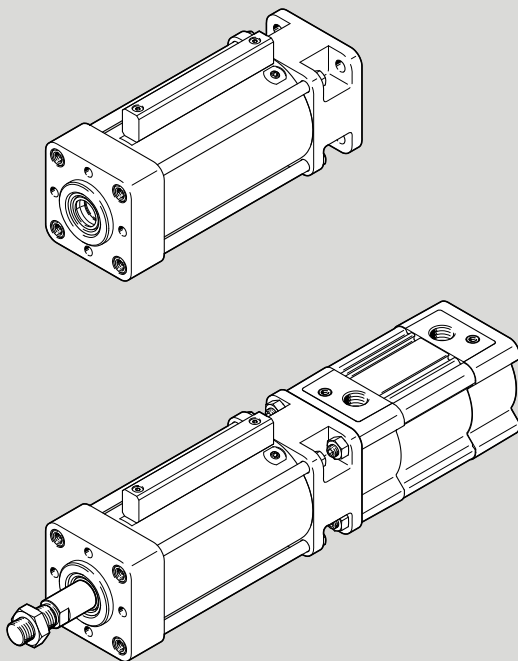


DACS-...-S/DFLC/DFLG-...-S

Holding brake; Cylinder with holding brake



FESTO

Operating instructions



8140127

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2020-08a
[8140129]

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1 About this document

1.1 Applicable documents



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

Document	Product	Contents
Assembly instructions	Proximity switch DADG-D-F8	Assembly

Tab. 1 Applicable documents

Definition of term

The holding brake DACS and the cylinder with holding brake DFLC/DFLG are also referred to as product in this operating instruction.

1.2 Specified standards

Version	
EN ISO 12100:2011-03	EN ISO 13849-1:2016-06
EN ISO 4414:2011-04	EN ISO 13849-2:2012-10

Tab. 2 Standards specified in the document

2 Safety

2.1 Safety instructions

- Only use the product in original status without unauthorised modifications.
- Only use the product if it is in perfect technical condition.
- Observe labelling on the product.
- Take into consideration the ambient conditions at the location of use.
- Store the product in a cool, dry, UV-protected and corrosion-protected environment. Ensure that storage times are kept to a minimum.
- Protect the product during storage and operation from the following:
 - Corrosive coolant or other materials (e.g. ozone)
 - Oils, greases and grease-solvent vapours
 - Grinding dust, glowing chips or sparks
- Prior to mounting, installation and maintenance work: Switch off compressed air supply and secure it from being switched back on.
- Observe tightening torques. Unless otherwise specified, the tolerance is $\pm 20\%$.

The operating modes must guarantee that the residual risk is less than or equal to the accepted risk (EN ISO 12100). The measures for risk reduction must be implemented in accordance with EN ISO 4414, EN ISO 12100 and EN ISO 13849-1.

Monitor/check the function of the entire system during use in accordance with the measures defined in the validation report (EN ISO 13849-2).

2.2 Intended use

The products are intended for installation in machines or automated systems and may be used only in the following ways:

- In the industrial sector without substances and ambient conditions that influence the materials used or the function
- In its original condition, without unauthorised modifications
- In perfect technical condition

The holding brake DACS and the cylinder with holding brake DFLC/DFLG are designed for the following applications:

- Retaining a piston rod by clamping with frictional locking
- Stopping the movement of a piston rod by clamping with frictional locking

The holding brake must be checked regularly → 12 Maintenance:

- Depending on the number of actuations, the holding brake and the piston rod must be checked for function and signs of wear at specified intervals.
- When using the holding brake to stop a movement:
After every shutdown, the holding brake including mounting and piston rod must also be checked for function, signs of wear and damage.

2.3 Foreseeable misuse

Foreseeable misuse includes:

- Outdoor use
- Use in oily or heavily polluted environments
- Bypassing of safety functions
- Positioning tasks
- Transmission of torques or transverse forces

2.4 Training of qualified personnel

Installation, commissioning, maintenance and disassembly should only be conducted by qualified personnel.

The skilled personnel must be familiar with the installation of pneumatic control systems.

3 Information on functional safety

3.1 Achievable safety rating

The products are intended for use in accordance with EN ISO 13849-1 as an element in a safety-related system up to category 1, Performance Level (PL) c.

For use in safety-related systems from category 2 onwards, additional measures are required which must be determined depending on the application.



It is only possible to determine whether the product is suitable for specific applications by also assessing further components of the subsystem.

3.2 Safety functions

The products have the following safety functions:

- Safety function 1: retaining a piston rod by clamping with frictional locking
- Safety function 2: stopping the movement of a piston rod by clamping with frictional locking

The safety functions are triggered by switching off the compressed air supply or by the failure of the compressed air supply.

3.3 Operating conditions

- General information on safe operation → 2 Safety.
- Ambient conditions and additional technical specifications → 16 Technical data.

3.4 Limitations of use

The operating life is limited to the service life parameter B_{10D} and to the operating life T_M

→ 3.5 Safety parameters according to EN ISO 13849-1 as the maximum.

3.5 Safety parameters according to EN ISO 13849-1

3.5.1 Service life

Type/size	DACS-16 DFLC-40	DACS-20 DFLC-63	DACS-25 DFLC-100	DACS-40 DFLG-160
Service life T_M [a]	20			

Tab. 3 Service life

3.5.2 Safety function 1

Retaining a piston rod by clamping with frictional locking

Type/size			DACS-16 DFLC-40	DACS-20 DFLC-63	DACS-25 DFLC-100	DACS-40 DFLG-160
Performance level (PL) in accordance with EN ISO 13849-1			PL c			
Category in accordance with EN ISO 13849-1			1			
Safety function 1 without load						
Service life value without load	B _{10D}	[million switching cycles]	2.0			
Mean time to dangerous failure (Mean Time to dangerous Failure)	MTTF _D	[a]	200 With exemplary actuation rate n _{op} = 100 000 switching cycles per year			
Average probability of dangerous failure per hour (Average probability of dangerous failure per hour)	PFH _D	[1/h]	0.57 × 10 ⁻⁶ With exemplary actuation rate n _{op} = 100 000 switching cycles per year Diagram: ➔ Fig.1			
Safety function 1 with load						
Service life value with load	B _{10D}	[million switching cycles]	1.0	1.0	0.9	0.7
Load/test force		[N]	754	1870	4712	12064
Mean time to dangerous failure (Mean Time to dangerous Failure)	MTTF _D	[a]	100	100	90	70
Average probability of dangerous failure per hour (Average probability of dangerous failure per hour)	PFH _D	[1/h]	1.14 × 10 ⁻⁶ 1.14 × 10 ⁻⁶ 1.27 × 10 ⁻⁶ 1.63 × 10 ⁻⁶ With exemplary actuation rate n _{op} = 100 000 switching cycles per year Diagram: ➔ Fig.2			

Tab. 4 Safety characteristic values for safety function 1

Safety function 1 without load: PFH_D dependent on the average actuation rate per year (n_{op})

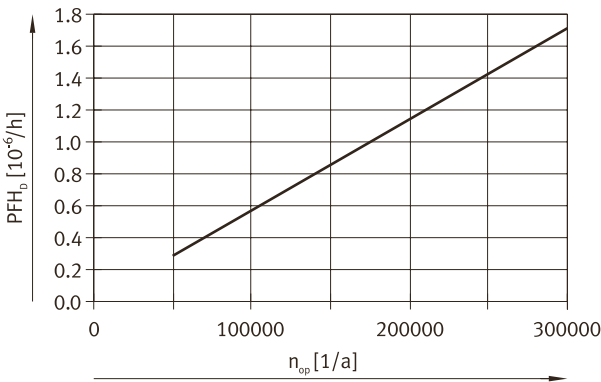


Fig. 1 Characteristic curve for safety function 1 without load

Calculation example

Exemplary actuation rate n_{op} = 100 000 switching cycles per year

Service life value B_{10D} = 2 000 000 switching cycles

Characteristic value	Formula	Calculation example with result
Mean time to dangerous failure (MTTF _D)	$MTTF_D = \frac{B_{10D}}{0,1 \times n_{op}}$	$MTTF_D = \frac{2\,000\,000}{0,1 \times 100\,000\, 1/a} = 200\, a$
Average probability of dangerous failure per hour PFH _D	$PFH_D = \frac{1}{8760\, h/a \times MTTF_D}$	$PFH_D = \frac{1}{8760\, h/a \times 200\, a} = 0,57 \times 10^{-6}\, 1/h$

Tab. 5 Calculation example of safety function 1 without load

Safety function 1 with load: PFH_D dependent on the average actuation rate per year (n_{op})

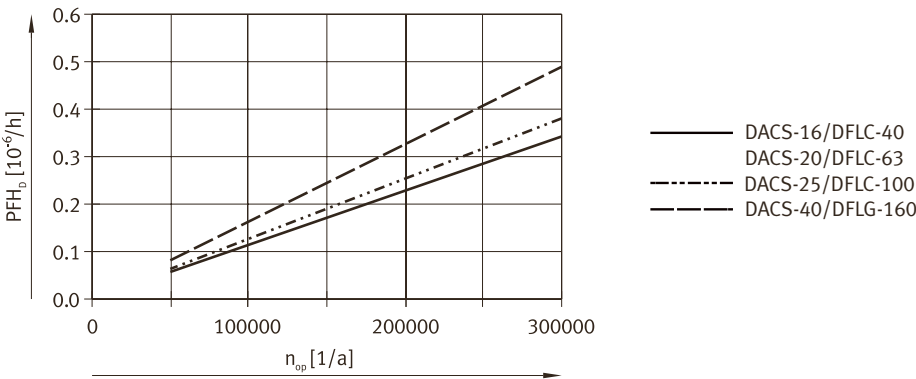


Fig. 2 Characteristic curves for safety function 1 with load

Calculation example for DACS-16 / DFLC-40; DACS-20 / DFLC-63

Exemplary actuation rate n_{op} = 100 000 switching cycles per year

Service life value B_{10D} = 1 000 000 switching cycles

Characteristic value	Formula	Calculation example
Mean time to dangerous failure (MTTF _D)	$MTTF_D = \frac{B_{10D}}{0,1 \times n_{op}}$	$MTTF_D = \frac{1\,000\,000}{0,1 \times 100\,000\,1/a} = 100\,a$
Average probability of dangerous failure per hour PFH _D	$PFH_D = \frac{1}{8760\,h/a \times MTTF_D}$	$PFH_D = \frac{1}{8760\,h/a \times 100\,a} = 1,14 \times 10^{-6}\,1/h$

Tab. 6 Calculation example of safety function 1 with load

3.5.3 Safety function 2

Stopping the movement of a piston rod by clamping with frictional locking

Type/size	DACS-16 DFLC-40	DACS-20 DFLC-63	DACS-25 DFLC-100	DACS-40 DFLG-160
Performance level (PL) in accordance with EN ISO 13849-1	PL c			
Category in accordance with EN ISO 13849-1	1			
Service life value B_{100} [switching cycles]	2000			
Braking energy [J]	44	123	230	770
Mean time to dangerous failure (Mean Time to dangerous Failure) $MTTF_D$ [a]	100 With exemplary actuation rate $n_{op} = 200$ switching cycles per year			
Average probability of dangerous failure per hour (Average probability of dangerous failure per hour) PFH_D [1/h]	1.14×10^{-6} With exemplary actuation rate $n_{op} = 200$ switching cycles per year Diagram: → Fig.3			

Tab. 7 Safety characteristic values for safety function 2

PFH_D dependent on the average actuation rate per year (n_{op})

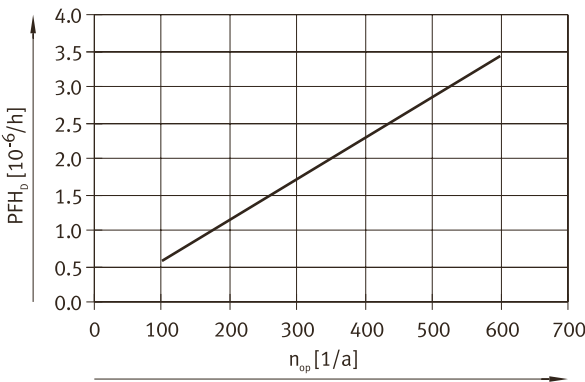


Fig. 3 Characteristic curve for safety function 2

Calculation example

Exemplary actuation rate $n_{op} = 200$ switching cycles per year

Service life value $B_{10D} = 2\,000$ switching cycles

Characteristic value	Formula	Calculation example
Mean time to dangerous failure (MTTF _D)	$MTTF_D = \frac{B_{10D}}{0,1 \times n_{op}}$	$MTTF_D = \frac{2\,000}{0,1 \times 200\,1/a} = 100\,a$
Average probability of dangerous failure per hour PFH _D	$PFH_D = \frac{1}{8760\,h/a \times MTTF_D}$	$PFH_D = \frac{1}{8760\,h/a \times 100\,a} = 1,14 \times 10^{-6}\,1/h$

Tab. 8 Calculation example safety function 2

4 Further information

- Accessories → www.festo.com/catalogue.
- Spare parts → www.festo.com/spareparts.

5 Service

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

6 Product overview

6.1 Function

Function of the holding brake DACS

The holding of a piston rod and the stopping of the movement of a piston rod is effected by a pre-loaded spring assembly which acts on the internal clamping collet.

In the event of exhausting or compressed air failure, the spring-loaded clamping collet causes the piston rod used by the customer or the round material to be blocked.

The spring-loaded system guarantees the fail-safe principle.

Releasing the clamp:

When the supply port is pressurised with compressed air, the clamping collet is opened by the pneumatically driven release mechanism.

The piston rod or round material can then move freely in both axial directions.

For safety reasons, the clamping collet cannot be adjusted or manually unlocked.

Function of the cylinder with holding brake DFLC/DFLG

The function of the cylinder with holding brake DFLC/DFLG corresponds to that of the holding brake DACS.

The holding brake in the cylinder with holding brake DFLC/DFLG is connected to a double-acting pneumatic cylinder and the spring-loaded clamping collet acts on the piston rod of the cylinder.

6.2 Product design

Holding brake DACS

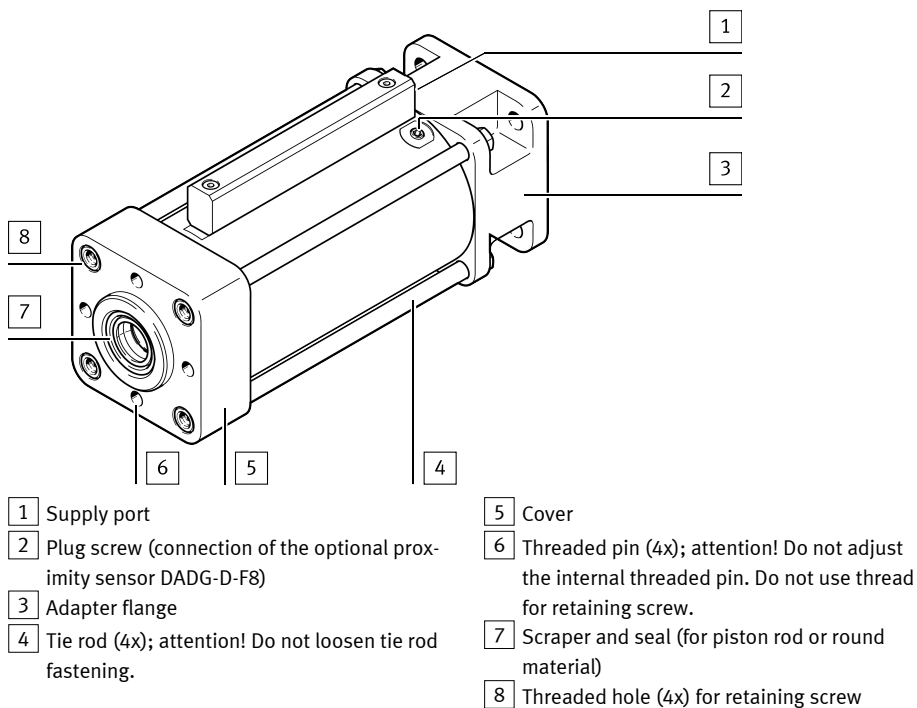


Fig. 4 Product design (DACS-20-AS shown)

Cylinder with holding brake DFLC/DFLG

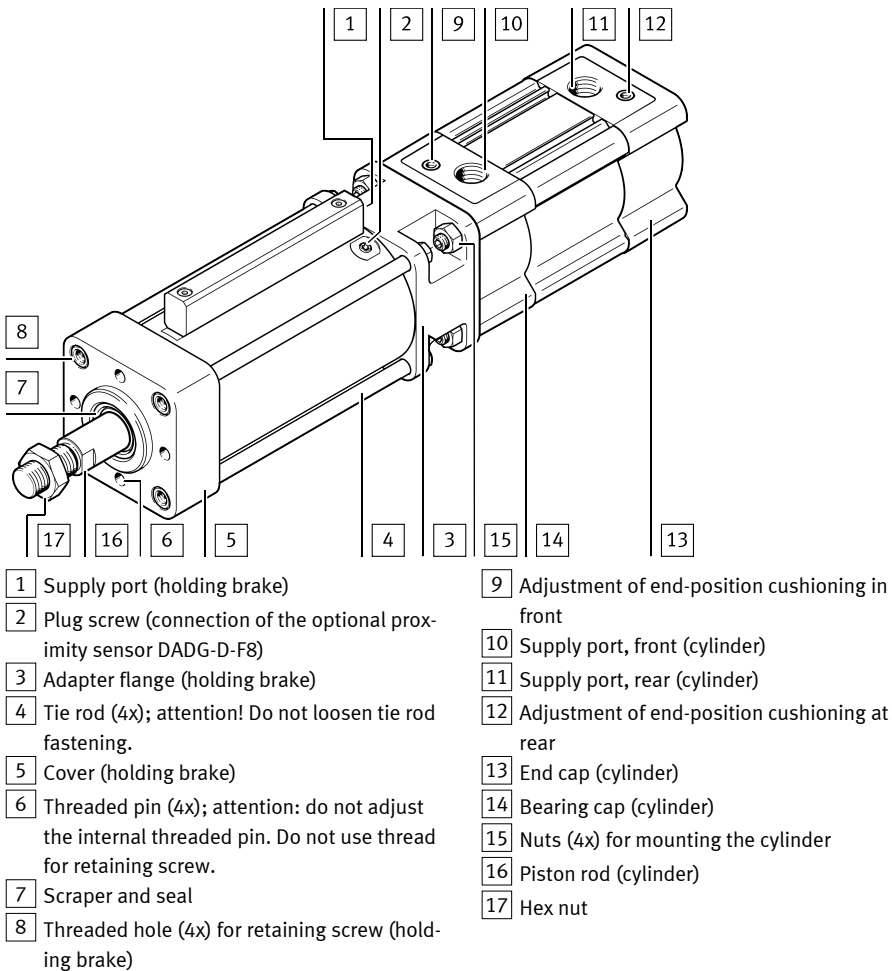


Fig. 5 Product design (DFLC-63 shown)

7 Transport

CAUTION!

Danger of crushing

Depending on the version, the product weighs up to 50 kg.

Body parts can be crushed if the product falls.

- Secure the product against falling.
-
- Take product weight into account → 16 Technical data.

8 Assembly

8.1 Assembly

8.1.1 Mounting the holding brake on the cylinder

WARNING!

Risk of injury due to failure of the clamping function.

Unacceptable readjustment or disassembly of the holding brake can lead to failure of the clamping function and lengthen the path to stopping a movement.

- Do not adjust or unscrew the threaded pins in the cover of the holding brake.
 - Do not disassemble holding brake; do not loosen tie rod fastening.
-

CAUTION!

Danger of crushing

Depending on the version, the product weighs up to 50 kg.

Body parts can be crushed if the product falls.

- Secure the product against falling.
-

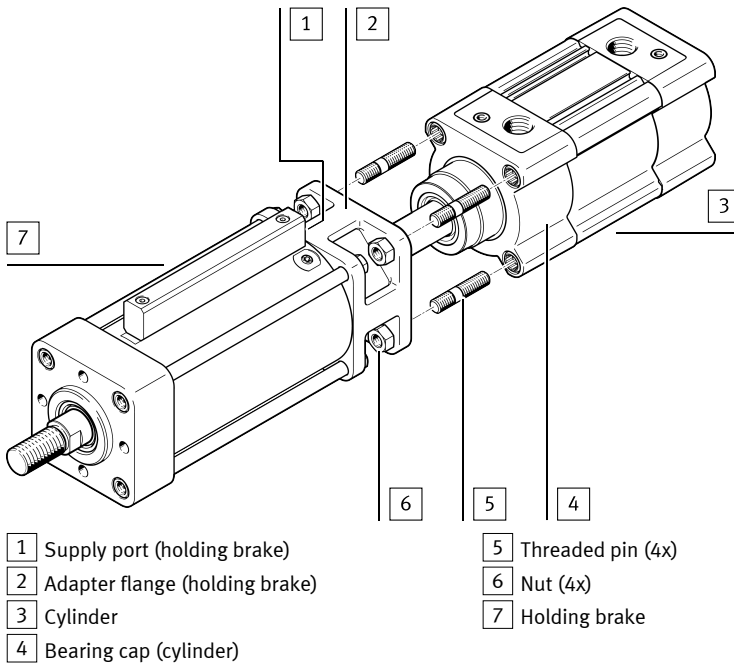


Fig. 6 Mounting the holding brake on the cylinder

1. Screw threaded pins with sufficient strength class into the bearing cap of the cylinder. Observe table specifications → Tab. 9 Holding brake on cylinder.
2. Connect the compressed air supply to the holding brake.
3. Pressurise the holding brake to at least 3.8 bar.
 ↳ The internal clamping collet is released.
4. Clean the piston rod.
5. Push the holding brake over the piston rod of the cylinder up to the gap-free contact on the bearing cap of the cylinder.
6. Screw the nuts onto the threaded pins → Tab. 9 Holding brake on cylinder. Do not tighten the nuts yet.
7. Exhaust the holding brake.
 ↳ The holding brake centres itself on the piston rod.
8. Tighten the nuts to the specified tightening torque → Tab. 9 Holding brake on cylinder.

Size	DACS-16	DACS-20	DACS-25	DACS-40
Threaded pin/nut	4x M6	4x M8	4x M10	4x M16
– Strength class	≥ 8.8			
– Screw-in depth [mm]	≥ 16	≥ 16	≥ 17	≥ 24
– Tightening torque [Nm]	4	6	15	80

Tab. 9 Holding brake on cylinder

8.1.2 Mounting the holding brake on round material

WARNING!

Risk of injury due to failure of the clamping function.

Unacceptable readjustment or disassembly of the holding brake can lead to failure of the clamping function and lengthen the path to stopping a movement.

- Do not adjust or unscrew the threaded pins in the cover of the holding brake.
- Do not disassemble holding brake; do not loosen tie rod fastening.

CAUTION!

Danger of crushing

Depending on the version, the product weighs up to 50 kg.

Body parts can be crushed if the product falls.

- Secure the product against falling.

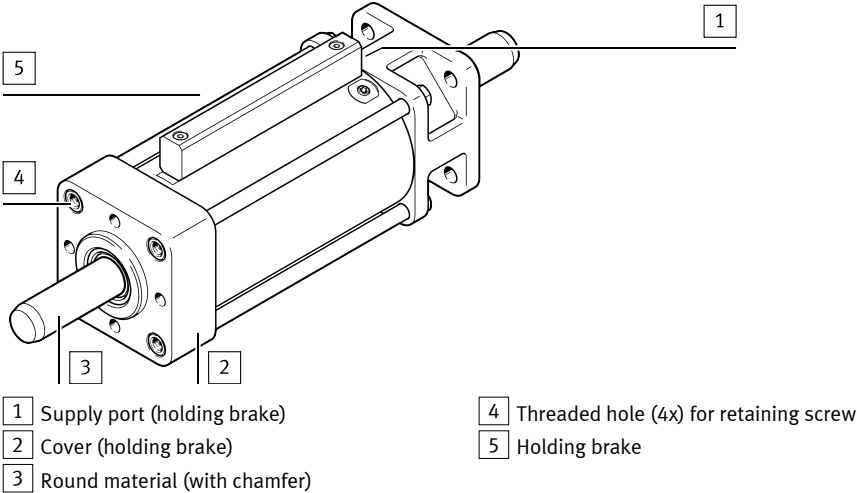


Fig. 7 Holding brake on round material

1. Observe specifications for round material → 16 Technical data.
2. Connect the compressed air supply to the holding brake.
3. Pressurise the holding brake to at least 3.8 bar.
↳ The internal clamping collet is released.
4. Clean round material.
5. Push the holding brake over the chamfered end of the round material.
6. Select screws with sufficient strength class. Observe maximum screw-in depth
→ Tab. 10 Holding brake on round material.
Further mounting options → 8.2 Installation.
7. Screw the screws into the threaded holes [4] in the cover of the holding brake. Do not tighten screws yet.
8. Exhaust the holding brake.
↳ The holding brake centres itself on the round material.
9. Tighten screws to the specified tightening torque → Tab. 10 Holding brake on round material.

Size		DACS-16	DACS-20	DACS-25	DACS-40
Screw		4x M6	4x M8	4x M10	4x M16
– Strength class		≥ 8.8			
– Screw-in depth	[mm]	≤ 13	≤ 14.5	≤ 14.5	≤ 21
– Tightening torque	[Nm]	5	8	15	105

Tab. 10 Holding brake on round material

8.2 Installation



Permissible mounting when using the holding brake to stop movements

When stopping movements, higher forces and loads arise:

The fastening elements must be suitable for the forces occurring.

- Only mount the holding brake directly on the machine frame or install it with the flange mounting FNC/FNG → 8.2.2 Vertical installation of the cylinder with holding brake.
-

8.2.1 Horizontal installation of the cylinder with holding brake



For horizontal installation when using the holding brake for holding, the foot mounting HNC/HNG available as an accessory is recommended → www.festo.com/catalogue.

The HNC/HNG foot mounting is not approved for use with the holding brake to stop movements.

The piston rod may only be loaded in the direction of movement.

The piston rod must not be used to transmit transverse forces or torques.



With the flexo coupling available as an accessory, transverse forces or bending moments on the piston rod can be prevented → www.festo.com/catalogue.

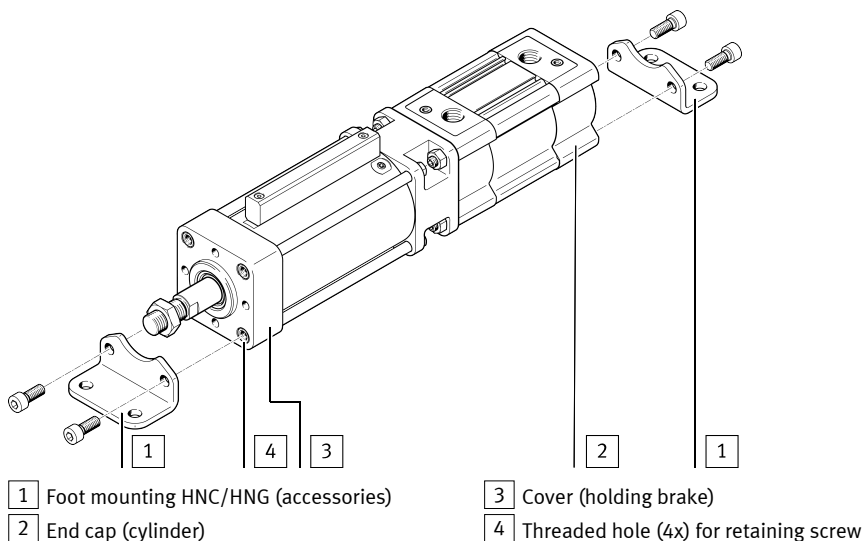


Fig. 8 Horizontal installation with foot mounting HNC/HNG

1. Mount a foot mounting HNC/HNG to each of the threaded holes in the cover of the holding brake and in the end cap of the cylinder.
Please note the strength class of the screws, screw depth and tightening torque
→ Tab. 11 Mounting elements for horizontal mounting position.
2. Place cylinder with holding brake at the intended installation location and fasten.
Only use screws with sufficient strength class (8.8 or higher) for fastening.

Type/size	DACS-16 DFLC-40	DACS-20 DFLC-63	DACS-25 DFLC-100	DACS-40 DFLG-160
Foot mounting (accessories)	HNC-40	HNC-63	HNC-100	HNG-160
Screw	4x M6	4x M8	4x M10	4x M16
– Strength class	≥ 8.8			
– Screw-in depth [mm]	8.5 ... 13	9.5 ... 14	10.5 ... 14.5	14.5 ... 21
– Tightening torque [Nm]	5	8	15	105

Tab. 11 Mounting elements for horizontal mounting position

8.2.2 Vertical installation of the cylinder with holding brake

i
The FNC/FNG flange mounting available as an accessory is recommended for vertical installation
→ www.festo.com/catalogue.

The piston rod may only be loaded in the direction of movement.
The piston rod must not be used to transmit transverse forces or torques.

i
With the flexo coupling available as an accessory, transverse forces or bending moments on the piston rod can be prevented → www.festo.com/catalogue.

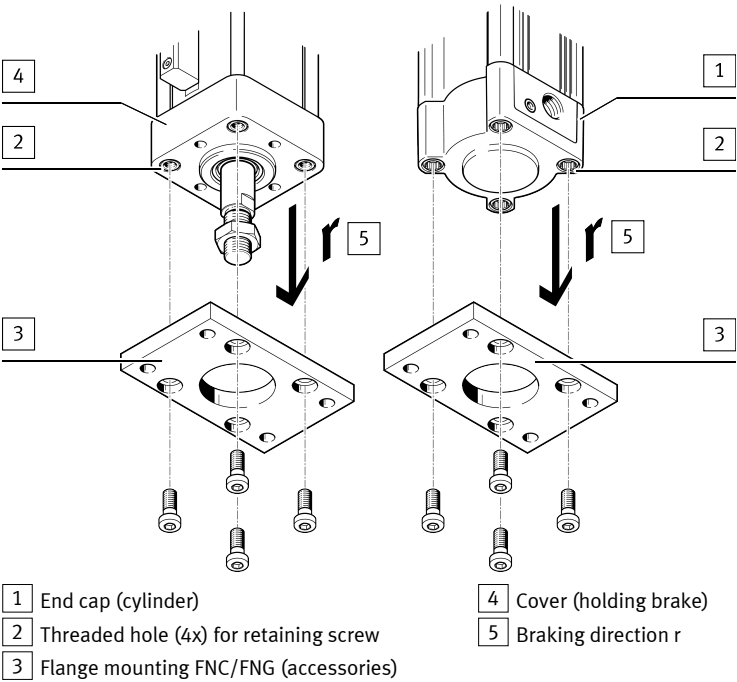


Fig. 9 Vertical installation with flange mounting FNC/FNG

NOTICE!

Overload of fastening elements

If weight forces and braking forces of the product act in the same direction, the flange mounting bolts may crack.

The product may detach from the machine frame, fall or tip over.

- Select the correct orientation for vertical installation.
- Observe permissible braking direction.

1. Mount the flange mounting FNC/FNG to the threaded holes in the holding brake cover or to the end cap of the cylinder, depending on the mounting position.
Please note the strength class of the screws, screw depth and tightening torque
➔ Tab. 11 Mounting elements for horizontal mounting position.
2. Place cylinder with holding brake at the intended installation location and fasten.
Only use screws with sufficient strength class (8.8 or higher) for fastening.

Type/size	DACS-16 DFLC-40	DACS-20 DFLC-63	DACS-25 DFLC-100	DACS-40 DFLG-160
Flange mounting (accessories)	FNC-40	FNC-63	FNC-100	FNG-160

Type/size	DACS-16 DFLC-40	DACS-20 DFLC-63	DACS-25 DFLC-100	DACS-40 DFLG-160
Screw	4x M6	4x M8	4x M10	4x M16
– Strength class	≥ 8.8			
– Screw-in depth [mm]	8.5 ... 13	9.5 ... 14	10.5 ... 14.5	14.5 ... 21
– Tightening torque [Nm]	5	8	15	105

Tab. 12 Mounting elements for vertical mounting position

8.3 Mounting the attachment component

- Fasten the attachment component to the piston rod of the cylinder using the hex nut.
Wet the hex nut with screw lock compound.

8.4 Mounting the accessories

The DADG-D-F8 proximity sensor is available as an accessory for monitoring the condition of the holding brake → www.festo.com/catalogue.

- Mount the proximity sensor DADG-D-F8 in the holding brake according to the separate documentation.

Various proximity sensors are available as accessories for detecting the position of the cylinder and the piston rod → www.festo.com/catalogue.

- Place the proximity sensor in the grooves of the cylinder according to the separate documentation and fasten it in the desired switching positions.

9 Installation

Preparation

- Check whether the following accessories are required for the pneumatic actuator:

Designation	Type	Function
Delockable check valve	HGL	For time-limited blocking of the compressed air discharge from a chamber of the pneumatic actuator
		Redundancy with “stop function”
Compensation reservoir	VZS	Reduction of pressure fluctuations in the downstream compressed air line

Tab. 13 Accessories

- Use a one-way flow control valve type (e.g. GRLZ or GRLA) directly in the relevant supply port.
- Select control of the cylinder for the specific application.

Example for control

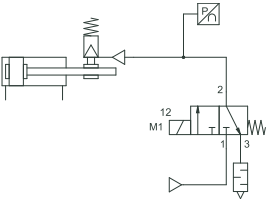


Fig. 10

Attaching tubing for holding brake and cylinder

- 1. Remove covers, if present, from the supply ports.
- 2. Check whether there are any dirt particles or foreign bodies in the connections and tubing lines. If necessary, clean with suitable agents.
- 3. Use short tubing lines where possible. This will reduce switching times.
- 4. Attach hoses to the supply port of the holding brake in accordance with EN ISO 4414.

Size	DACS-16	DACS-20	DACS-25	DACS-40
Supply port	G1/8	G1/8	G3/8	G3/8

Tab. 14 Supply port for holding brake DACS

- 5. Connect hoses of the supply ports of the cylinder according to EN ISO 4414.

Size	DFLC-40	DFLC-63	DFLC-100	DFLG-160
Supply ports	G1/4	G3/8	G1/2	G3/4

Tab. 15 Supply ports of cylinder DFLC/DFLG

10 Commissioning

10.1 Test run

The test run serves to adjust the speed and the pneumatic cushioning.

WARNING!

Risk of injury due to unexpected advancing of the piston rod.

When the holding brake is released, the piston rod can advance abruptly and injure persons, especially when the mounting position is vertical, due to the applied weight.

- Before releasing the holding brake: apply pressure to both sides of the cylinder or balance the forces on the piston of the drive cylinder.

1. First completely screw in the screws of the upstream one-way flow control valves and the pneumatic cushioning on the cylinder, then unscrew about one rotation.
2. Pressurise the complete system slowly, e.g. with the soft start valve HEL.
3. Pressurise cylinders simultaneously at both supply ports.
 - ↳ This prevents an uncontrolled movement in the direction of the unpressurised cylinder chamber during execution of the next step.
4. Pressurise holding brake at the supply port to at least 3.8 bar.
 - ↳ In some circumstances, the piston rod will move slowly into the advanced end position.
5. Start test run at low switching frequency and low speed.
6. Repeat the test run, increasing the speed incrementally until the specified operating speed is reached.
 - ↳ If set correctly, the payload (e.g. the moved machine part) should reach the end position without a hard stop.
7. In the test run, check whether the following settings need to be modified:
 - Speed of the payload
 - Pneumatic cushioning
8. After completing the required adjustments, terminate the test run.

10.2 Functional tests

The following functional tests are a prerequisite for safe operation and must be carried out during commissioning and in accordance with the use of the product as described below.

 **WARNING!**

Risk of injury due to unexpected advancing of the piston rod.

When the holding brake is released, the piston rod can advance abruptly and injure persons, especially when the mounting position is vertical, due to the applied weight.

- Before releasing the holding brake: apply pressure to both sides of the cylinder or balance the forces on the piston of the drive cylinder.

1. Carry out functional tests regularly → 12 Maintenance.
2. Observe the following when performing the functional tests:
 - The test force or test pressure must be at least equal to the force or pressure in the application or the specification in the risk assessment for the application.
 - The test force must not be greater than the maximum static holding force
→ 16 Technical data.
3. Carry out the appropriate functional test depending on the mounting position and the weight force (case 1, 2 or 3):

Case	Mounting position	Weight force	Procedure
1	Horizontal mounting position	Without additional weight force	→ 10.2.1 Test for horizontal mounting position without additional weight force
2	Vertical mounting position	With additional weight force suspended	→ 10.2.2 Test for vertical mounting position with additional suspended weight
3	Vertical mounting position	With additional weight force standing	→ 10.2.3 Test for vertical mounting position with additional weight, standing orientation

Tab. 16 Overview of functional tests dependent on the mounting position and weight force

Deviating applications (e.g. slanted mounting position) are not shown.

It may be necessary to make calculations for a specific application and carry out a specific test for that.

10.2.1 Test for horizontal mounting position without additional weight force

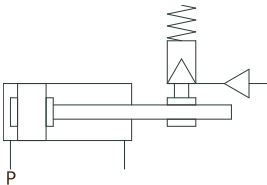


Fig. 11

Type/size	DACS-16 DFLC-40	DACS-20 DFLC-63	DACS-25 DFLC-100	DACS-40 DFLG-160
Test force [N] (effective force, advancing) at 8 bar	1005	2493	6282	16085

Tab. 17 Test force for horizontal mounting position

Static functional test

Prerequisite: the holding brake is open (pressurised).

1. Place the piston rod in the retracted end position.
2. Exhaust the supply port at the holding brake.
 - ↳ The clamping is active.
3. Pressurise the cylinder chamber of the DFLC/DFLG in the advancing direction at maximum pressure $P = 8$ bar, while simultaneously exhausting the cylinder chamber in the retracting direction (opposite chamber).

The test duration with the test load / test pressure should be 60 s.

- ↳ The test force acts on the piston rod → Tab. 17 Test force for horizontal mounting position. The piston rod must not move axially during the test.

i

The holding brake was tested in new condition before delivery for a maximum axial movement of the piston rod of 0.5 mm.

Dynamic functional test

NOTICE!

Increased wear due to too frequent dynamic functional test.

The planned service life of the holding brake can thus be greatly reduced.

- Carry out a dynamic functional test only if the safety function is intended to stop a movement and one of the following cases exists:
 - Risk assessment or risk assessment
 - Initial commissioning
 - Process change (e. g. increase in payload, change in ambient conditions)
- In all other cases, carry out the static functional test to assess the clamping performance.

Prerequisite: the holding brake is open (pressurised).

1. Place the piston rod in the retracted end position.
2. Pressurise the cylinder chamber of the DFLC/DFLG in the advancing direction at maximum pressure $P = 8$ bar, while simultaneously exhausting the cylinder chamber in the retracting direction (opposite chamber).

Test force: ➔ Tab. 17 Test force for horizontal mounting position

↪ Movement begins.

The max. permissible travel speed must not be exceeded.

3. Exhaust the supply port at the holding brake.
The test duration with the test load / test pressure should be 60 s.
 - ↪ The clamping and stopping of the movement begins. The piston rod stops. The piston rod must not move any further during the test.
4. Determine the path from the exhaust start signal until the piston rod is at rest.
 - ↪ This path corresponds to the stopping distance. The stopping distance must be less than the tolerable stopping distance according to the risk assessment.
The stopping distance depends on the load and the ambient conditions (e.g. temperature, oil on the piston rod, number of switching cycles, speed, mass, operating pressure and control).

10.2.2 Test for vertical mounting position with additional suspended weight

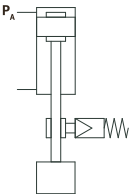


Fig. 12

- Calculate the required test pressure P_A using the following formula:

$$P_A = \frac{(F_P - m \times g)}{A} \times 10$$

The test pressure P_A to be applied may not exceed 8 bar.
With the calculation result $P_A > 8$ bar: only the maximum permissible operating pressure of 8 bar may be applied as the test pressure.

Symbol	Description	Unit
P_A	Test pressure	[bar]
F_P	Test force	[N]
m	Payload	[kg]
g	Acceleration due to gravity	[9.81 m/s ²]
A	Piston surface	[mm ²]

Tab. 18

Type/size	DACS-16 DFLC-40	DACS-20 DFLC-63	DACS-25 DFLC-100	DACS-40 DFLG-160
Test force F_P [N]	1350	3300	8200	17000
Piston surface A [mm ²] advancing direction	1257	3117	7854	20106

Tab. 19

Static functional test

Prerequisite: the holding brake is open (pressurised).

1. Place the piston rod in the retracted end position.
2. Exhaust the supply port at the holding brake.
 - ↪ The clamping is active.
3. Pressurise the cylinder chamber of the DFLC/DFLG in the advancing direction at test pressure P_A , while simultaneously exhausting the cylinder chamber in the retracting direction (opposite chamber).

The test duration with the test load / test pressure should be 60 s.

- ↪ The piston rod must not move axially during the test.

i

The holding brake was tested in new condition before delivery for a maximum axial movement of the piston rod of 0.5 mm.

Dynamic functional test

NOTICE!

Increased wear due to too frequent dynamic functional test.

The planned service life of the holding brake can thus be greatly reduced.

- Carry out a dynamic functional test only if the safety function is intended to stop a movement and one of the following cases exists:
 - Risk assessment or risk assessment
 - Initial commissioning
 - Process change (e. g. increase in payload, change in ambient conditions)
 - In all other cases, carry out the static functional test to assess the clamping performance.
-

Prerequisite: the holding brake is open (pressurised).

1. Place the piston rod in the retracted end position.
2. Pressurise the cylinder chamber of the DFLC/DFLG in the advancing direction at test pressure P_A , while simultaneously exhausting the cylinder chamber in the retracting direction (opposite chamber).
 - ↪ Movement begins.
 - The max. permissible travel speed must not be exceeded.
3. Exhaust the supply port at the holding brake.

The test duration with the test load / test pressure should be 60 s.

 - ↪ The clamping and stopping of the movement begins. The piston rod stops. The piston rod must not move any further during the test.
4. Determine the path from the exhaust start signal until the piston rod is at rest.
 - ↪ This path corresponds to the stopping distance. The stopping distance must be less than the tolerable stopping distance according to the risk assessment.

The stopping distance depends on the load and the ambient conditions (e.g. temperature, oil on the piston rod, number of switching cycles, speed, mass, operating pressure and control).

10.2.3 Test for vertical mounting position with additional weight, standing orientation

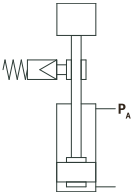


Fig. 13

- Calculate the required test pressure P_A using the following formula:

$$P_A = \frac{(F_P - m \times g)}{A} \times 10$$

The test pressure P_A to be applied may not exceed 8 bar.
With the calculation result $P_A > 8$ bar: only the maximum permissible operating pressure of 8 bar may be applied as the test pressure.

Symbol	Description	Unit
P_A	Test pressure	[bar]
F_P	Test force	[N]
m	Payload	[kg]
g	Acceleration due to gravity	[9.81 m/s ²]
A	Piston surface	[mm ²]

Tab. 20

Type/size	DACS-16 DFLC-40	DACS-20 DFLC-63	DACS-25 DFLC-100	DACS-40 DFLG-160
Test force F_P [N]	1350	3300	8200	17000
Piston surface A [mm ²] retracting direction	1056	2803	7363	18850

Tab. 21

Static functional test

Prerequisite: the holding brake is open (pressurised).

1. Place the piston rod in the advanced end position.
2. Exhaust the supply port at the holding brake.
 - ↳ The clamping is active.
3. Pressurise the cylinder chamber of the DFLC/DFLG in the retracting direction at test pressure P_A , while simultaneously exhausting the cylinder chamber in the advancing direction (opposite chamber).

The test duration with the test load / test pressure should be 60 s.

- ↳ The piston rod must not move axially during the test.

i

The holding brake was tested in new condition before delivery for a maximum axial movement of the piston rod of 0.5 mm.

Dynamic functional test

NOTICE!

Increased wear due to too frequent dynamic functional test.

The planned service life of the holding brake can thus be greatly reduced.

- Carry out a dynamic functional test only if the safety function is intended to stop a movement and one of the following cases exists:
 - Risk assessment or risk assessment
 - Initial commissioning
 - Process change (e. g. increase in payload, change in ambient conditions)
 - In all other cases, carry out the static functional test to assess the clamping performance.
-

Prerequisite: the holding brake is open (pressurised).

1. Place the piston rod in the advanced end position.
2. Pressurise the cylinder chamber of the DFLC/DFLG in the retracting direction at test pressure P_A , while simultaneously exhausting the cylinder chamber in the advancing direction (opposite chamber).
 - ↳ Movement begins.
 - The max. permissible travel speed must not be exceeded.
3. Exhaust the supply port at the holding brake.

The test duration with the test load / test pressure should be 60 s.

 - ↳ The clamping and stopping of the movement begins. The piston rod stops. The piston rod must not move any further during the test.
4. Determine the path from the exhaust start signal until the piston rod is at rest.
 - ↳ This path corresponds to the stopping distance. The stopping distance must be less than the tolerable stopping distance according to the risk assessment.
 - The stopping distance depends on the load and the ambient conditions (e.g. temperature, oil on the piston rod, number of switching cycles, speed, mass, operating pressure and control).

11 Operation

WARNING!

Risk of injury due to failure of the clamping function.

Depending on the load, wear or contamination, the clamping function may fail and the path to stopping a movement may gradually become longer.

- Carry out regular functional tests of the holding brake to guarantee the safety functions.
- Keep the piston rod as free of grease and dirt as possible.
- Observe the permissible service life of the holding brake.

WARNING!

Risk of injury due to unexpected advancing of the piston rod.

When the holding brake is released, the piston rod can advance abruptly and injure persons, especially when the mounting position is vertical, due to the applied weight.

- Before releasing the holding brake: apply pressure to both sides of the cylinder or balance the forces on the piston of the drive cylinder.

1. Carry out maintenance work at the specified intervals → 12 Maintenance.
2. After each stoppage of the movement, for example in the event of a compressed air failure or an emergency stop: check operational reliability → 10.2 Functional tests.

If the payload is changed

- Comply with load limits → 16 Technical data.

Exhausting the holding brake

- Exhaust the holding brake at least once a day.

12 Maintenance

WARNING!

Risk of injury due to unexpected advancing of the piston rod.

When the holding brake is released, the piston rod can advance abruptly and injure persons, especially when the mounting position is vertical, due to the applied weight.

- Before releasing the holding brake: apply pressure to both sides of the cylinder or balance the forces on the piston of the drive cylinder.

WARNING!

Risk of injury due to unexpected movement of the product.

Pneumatic energy can cause unexpected movement of the product.

- Before working on the product, switch off the compressed air supply and secure it against being switched on again.
- Exhaust system parts, if necessary.

Action	Testing/processing	Interval
Functional tests: – Static functional test – Dynamic functional test	Observe the procedure: ➔ 10.2 Functional tests The following signs of wear must not occur: – Piston rod/round material slips through. – Increased operating noise.	– At least once a month – every 100 000 switching cycles – after every movement stop (triggering of safety function 2; e.g. in case of emergency stop) For use in gravity-loaded axes during operation: – every 8 hours Different intervals can be defined depending on the risk assessment of the application and the selected category according to DIN EN ISO 13849.
Visual inspections		In the following cases the intervals must be shortened: – high ambient temperature – heavy accumulation of dirt – proximity of grease-dissolving liquids or vapours – oily environment – high masses – high frequency of clamping (switching cycles)
– Scraper and seal	The scraper and seal must not show any signs of wear, otherwise dirt may penetrate.	
– Piston rod/round material	Check piston rod/round material for contamination and wear.	
– Pneumatics	Check tightness of connections and connecting cables.	
Cleaning	Clean the holding brake/cylinder with holding brake with a soft cloth. Clean piston rod/round material. Do not use aggressive cleaning agents for cleaning.	

Tab. 22 Maintenance work and intervals

If the product does not achieve the required properties in the tests or shows damage: → 13.2 Repair.



The holding brake and the cylinder with holding brake are lubricated for life.
 Additional lubrication is not necessary.

13 Malfunctions

13.1 Fault clearance

Malfunction	Possible cause	Remedy
Clamp does not open.	Holding brake is leaking.	Send holding brake with error description to Festo.
	Insufficient operating pressure.	Increase the operating pressure; observe the maximum permissible pressure.
Hard stops at the end position of the cylinder	Speed is too high.	Reduce velocity.
	Cushioning is insufficient.	Increase cushioning or use additional external cushioning components.
	Payload is too great.	Reduce payload.
Piston rod / round material slips through.	Payload is too great.	Reduce payload.
	Speed is too high.	Reduce speed or additionally brake with working valves.
	Operating pressure on cylinder is too high.	Reduce operating pressure or change control.
	Piston rod / round material is dirty.	Clean piston rod/round material and protect from contamination → 12 Maintenance.
	Piston rod or round material does not meet the quality requirements.	Comply with specifications for the quality of the piston rod or round material → 16 Technical data.
	The holding brake clamping collet is worn out or the clamping mechanism is defective.	Replace holding brake or send to Festo with fault description.
Malfunctions in position sensing	Incorrect position of proximity sensors.	Correct position of proximity sensors.
	Wrong type of proximity sensor used.	Use suitable proximity sensors → www.festo.com/catalogue .
	Proximity sensor is faulty.	Replace proximity sensor.
	Magnetic or magnetised components are near the proximity sensor.	Use components made of non-magnetic materials.

Tab. 23

13.2 Repair

WARNING!

Risk of injury due to failure of the clamping function.

Unacceptable readjustment or disassembly of the holding brake can lead to failure of the clamping function and lengthen the path to stopping a movement.

- Do not adjust or unscrew the threaded pins in the cover of the holding brake.
- Do not disassemble holding brake; do not loosen tie rod fastening.

Holding brake DACS

The holding brake cannot be repaired. If repair is required, send the holding brake to Festo.

Cylinder with holding brake DFLC/DFLG

The holding brake cannot be repaired. If repair is required, send the cylinder with holding brake to Festo.

The pneumatic cylinder can be repaired. Repair manual DSBC/DSBG → www.festo.com/spareparts.

If the pneumatic cylinder requires repair: disconnect the cylinder from the holding brake

CAUTION!

Danger of crushing

Depending on the version, the product weighs up to 50 kg.

Body parts can be crushed if the product falls.

- Secure the product against falling.
1. Disconnect the pneumatic cylinder from the compressed air supply.
 2. Pressurise holding brake at the supply port to at least 3.8 bar → 6.2 Product design.
↳ The inner clamping collet is released.
 3. On the adapter flange of the holding brake: unscrew the nuts on the threaded pins of the pneumatic cylinder.
 4. If applicable, remove existing mounting components on the pneumatic cylinder.
 5. Pull pneumatic cylinder with piston rod out of the holding brake.

After repairing the pneumatic cylinder: → 8.1.1 Mounting the holding brake on the cylinder.

14 Disassembly

CAUTION!

Danger of crushing

Depending on the version, the product weighs up to 50 kg.

Body parts can be crushed if the product falls.

- Secure the product against falling.
1. Disconnect the product from the compressed air supply.
 2. Remove supply ports and retaining screws.

15 Disposal

 ENVIRONMENT!

Send the packaging and product for environmentally sound recycling in accordance with the current regulations → www.festo.com/sp.

16 Technical data

Type/size	DACS-16 DFLC-40	DACS-20 DFLC-63	DACS-25 DFLC-100	DACS-40 DFLG-160
Clamping type	Clamps with frictional locking by spring-loaded clamping collet			
Mounting position	any			
Operating medium	Compressed air in accordance with ISO 8573-1:2010 [7:4:4]			
Operating pressure				
Release pressure [bar]	≥ 3.8			
Holding brake				
Operating pressure [bar]	3.8 ... 8			
Holding brake				
Operating pressure [bar]	0.6 ... 8			
Cylinder				
Temperature				
Ambient temperature [°C]	−20 ... +80	−20 ... +80	−10 ... +80	−20 ... +80
Storage temperature [°C]	−20 ... +80			
Piston rod/round material				
Diameter [mm]	16	20	25	40
– Tolerance	h7 ... f7			
Quality	Hardness: at least HRC 60 or hard chromium-plated (min. thickness 20 μm) Surface roughness Rt: maximum 4 μm			
Lead-in chamfer	3 mm wide 15° chamfer at the end of the piston rod/round material			
Holding force of the holding brake				
Holding force, static [N]	1350	3300	8200	17000

Type/size	DACS-16 DFLC-40	DACS-20 DFLC-63	DACS-25 DFLC-100	DACS-40 DFLG-160
Information	If these values are exceeded, slippage may occur. Dynamic forces occurring during operation must not exceed the static holding force. Environmental influences (e.g. oil mist) can reduce the holding force. Once the number of switching cycles exceeds > 200 000, a reduction of approx. 20% must be expected.			
Theoretical payload of the cylinder				
Extending at 6 bar [N]	754	1870	4712	12064
Retracting at 6 bar [N]	633	1682	4418	11310
Extending at 8 bar [N]	1005	2493	6282	16085
Retracting at 8 bar [N]	844	2242	5890	15080
Max. permissible speed of travel				
Holding brake DACS [m/s]	2			
Cylinder with holding brake DFLC/DFLG [m/s]	1			
Vibration and shock (without payload)				
Vibration	In accordance with IEC 60068 (Part 2-6): severity level 1			
Shock	In accordance with IEC 60068 (Part 2-27): severity level 1			
Continuous shock	In accordance with IEC 60068 (Part 2-29): – Acceleration: 150 m/s ² – Duration: 6 ms – Shocks per direction: 1000			
CE marking				
CE marking (➔ Declaration of Conformity)	In accordance with EU Machinery Directive			
Holding brake materials				
Adapter flange; cover; air connection	Aluminium alloy			
Housing; tie rods; clamping collet; screws; nuts	Steel			
Seals	NBR, PUR, FKM			

Technical data

Type/size	DACS-16 DFLC-40	DACS-20 DFLC-63	DACS-25 DFLC-100	DACS-40 DFLG-160
Cylinder materials				
Cylinder barrel; cylinder end cap; piston	Aluminium alloy			
Piston rod; tie rods (DFLG); bolts; nuts	Steel			
Seals	NBR, POM, PUR			
Product weight of holding brake DACS				
Product weight [kg]	1.48	3.14	12.83	34.50
Product weight of cylinder with holding brake DFLC/DFLG				
Basic weight [kg]	2.93	6.19	19.12	49.66
– Additional per 10 mm stroke [kg]	0.037	0.073	0.110	0.208
Moving mass of cylinder with holding brake DFLC/DFLG				
Basic weight [kg]	0.50	0.96	1.94	7.09
– Additional per 10 mm stroke [kg]	0.016	0.025	0.039	0.097

Tab. 24 Technical data

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