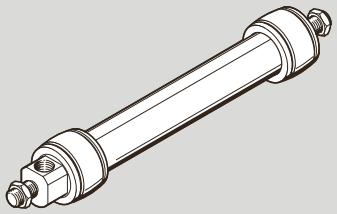
DMSP
Fluidic muscle



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Operating instructions

8144615
2020-11h
[8144617]

8144615

Translation of the original instructions

1 Applicable Documents

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

2 Safety

2.1 General safety instructions

– Only use the product in original status without unauthorised modifications.
– Only use the product if it is in perfect technical condition.
– Before working on the product, switch off the power supply and secure it against being switched on again.

2.2 Intended Use

The product is intended for installation in machines or automated systems.
The product can be used as a pneumatic drive element or spring element.
Load the product only with longitudinal tensile forces in compliance with the following specifications:
– Offset of the connections (angle tolerance and parallelism tolerance)
– Pretensioning of the product
– Max. permissible values for forces and applied loads.

2.3 Foreseeable Misuse

When compressed air is applied, the contraction diaphragm widens radially.
– Do not use diameter expansion for clamping tasks. Relative movement causes wear on the contraction diaphragm.
– Ensure sufficient lateral clearance.

2.4 Training of Qualified Personnel

Installation, commissioning, maintenance and disassembly of the product should only be performed by qualified personnel who are familiar with the installation of pneumatic systems.

3 Additional Information

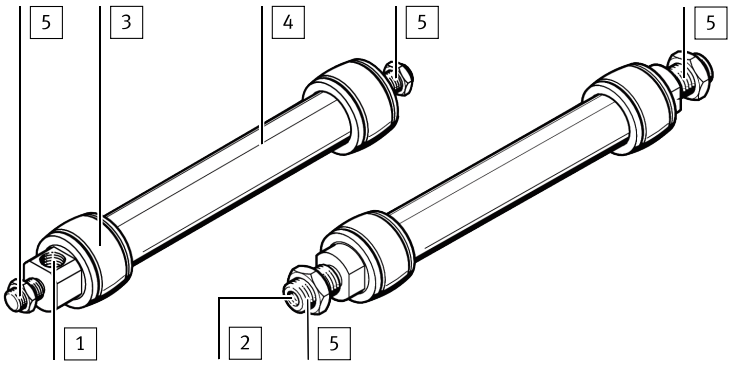
– Accessories ➔ www.festo.com/catalogue.

4 Service

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

5 Product overview

5.1 Structure



1 Pneumatic connection, radial
2 Pneumatic port, axial
3 Connection (flange, sleeve)
4 Contraction diaphragm
5 Mounting thread

Fig. 1 Product design

The product consists of a contraction diaphragm and connections for mounting. The diaphragm hermetically seals the operating medium. Depending on the design, the connections provide the pneumatic connection and/or a mounting thread for mounting.

5.2 Connecting elements

When using the product as a tensile actuator with attachment of connections 1 and 2 at both ends, the following connection elements are available to protect the contraction diaphragm to ensure compliance with parallelism and angle tolerances:
– Rod clevis with axial offset of mounting points.
– Rod eye with spherical offset of the mounting points.
– Coupling pieces with radial offset of the mounting points.
The connecting elements are attached to the front mounting thread 5.

6 Function

The product is a single-acting tensile actuator based on the biological muscle. When pressurised, the product contracts with tensile force F. The contraction diaphragm 4 expands in the circumferential direction. The maximum usable tensile force is reached at the beginning of the contraction and decreases with the stroke.

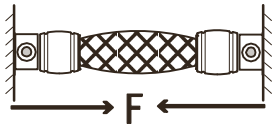


Fig. 2 Functional structure

The movement is transferred to the mounting points with mounting on both sides or via the 2nd connection for mounting on one side to the payload.

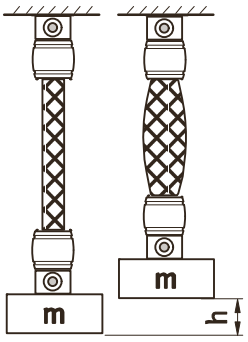


Fig. 3 Functional Principle

7 Mechanical installation

Increased wear of the contraction diaphragm due to buckling, compression, wrinkling

Reduction of the service life of the contraction diaphragm due to mechanical loads.
- Mount the product torsion-free.
- Observe angle and parallelism tolerances, including when using connecting elements.
- Ensure sufficient pretensioning in the unpressurised state.
- Do not exceed maximum pretensioning with attached payload.

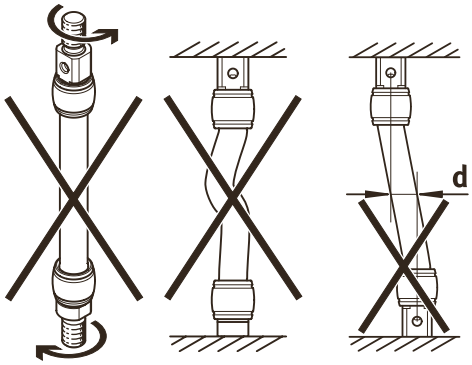


Fig. 4 Unfavourable mechanical stresses

Size		5	10	20	40
Mounting position		any			
Maximum permissible offset of connections					
Angle tolerance		< 1°			
Parallelism tolerance		Nominal length[1] < 400 mm: ± 0.5% Nominal length > 400 mm: ≤2 mm			
Max. permissible pretensioning of the nominal length[1]	[%]	1	3	4	5
Max. permissible contraction of the nominal length[1]	[%]	20	25		
Max. permissible payload, freely suspended	[kg]	5	30	80	250
Max. diameter expansion	[mm]	12	24	40	80

1) Nominal length is the visible area of the unloaded contraction diaphragm.

Tab. 1 Technical data, installation

Type/size	5	10	20	40
DMSP-... -AM	M8	M16x1.5	M20x1.5	M30x1.5
DMSP-... -CF	M4	–	–	–
DMSP-...-CM/-RM	M6	M8	M10x1.25	M16x1.5

Tab. 2 Mounting thread

Type/size		5	10	20	40
DMSP-... -AM	[mm]	8.4	17	21	31
DMSP-... -CF	[mm]	4.3	–	–	–
DMSP-...-CM/-RM	[mm]	6.4	8.4	10.5	17

Tab. 3 Through-holes for coupling piece, recommended through-hole tolerance [H12]

Type/size		5	10	20	40
DMSP-... -AM	[Nm]	7 ... 10	15 ... 19	23 ... 28	100 ... 110
DMSP-... -CF	[Nm]	2.5 ... 3	–	–	–
DMSP-...-CM/-RM	[Nm]	4 ... 6	7 ... 10	12 ... 16	50 ... 55

Tab. 4 Max. permissible tightening torque

Mount product on both sides

1. Mount the product in such a way that the central axes of the connections are aligned.
2. Maintain sufficient lateral clearance. For this, observe the diameter expansion during contraction.
3. Secure screw connections with screw locking agent (SSM).
   – Up to size 10: SSM for low strength
   – From size 20: SSM for high strength

Mount the payload at one end

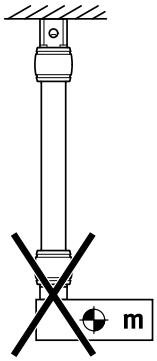


Fig. 5 Mount the payload at one end

1. Mount payload m with a coupling piece so the central axes of the connections are aligned. This requires noting the centre of gravity of the payload.
2. Secure screw connections with screw locking agent (SSM).
   – Up to size 10: SSM for low strength
   – From size 20: SSM for high strength

8 Pneumatic installation

Connect pneumatic supply cables

- Screw fitting into the radial port 1 or the axial port 2.

9 Commissioning

⚠ 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.

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Increased wear of the contraction diaphragm due to buckling, compression, wrinkling

Reduction of the service life of the contraction diaphragm due to mechanical loads.

- Mount the product torsion-free.
- Observe angle and parallelism tolerances, including when using connecting elements.
- Ensure sufficient pretensioning in the unpressurised state.
- Do not exceed maximum pretensioning with attached payload.

i

Increased wear of the contraction diaphragm due to excessive pretensioning

Damage to the contraction diaphragm due to excessive pretensioning.

- Maintain operating pressure range.
- Protect the contraction diaphragm from damaging environmental influences, e.g. exposure to UV radiation or ozone.

Commissioning

1. Establish pneumatic supply. Pressurise the product slowly.
2. Test function of product:

   For all uses:
   – No leakage occurs.
   – Pretensioning and operating temperature of the contraction diaphragm are within the tolerances.

   When used as a tension actuator:
   – Tensile force F is reached.
3. Interrupt pneumatic supply. To do this, slowly exhaust the product.

10 Maintenance

i

Increased wear of the contracting diaphragm

- Reduce inspection intervals in the event of severe stress on the contraction diaphragm, e.g.. UV radiation, ozone, high temperatures.

- Check the product regularly for correct function. Select a suitable interval, depending on the operating pressure, degree and frequency of the contraction, uniformity of the motion sequence:

Test interval	Test	Symptom	Maintenance work
Regularly	Visual inspection	Contraction diaphragm: stress cracks, other damage.	Replace product.
		Contraction diaphragm: exposed or damaged fibres.	
	Audible check	Air leaks audibly.	Pneumatic connection: check for tightness.
			Contraction diaphragm: replace product.

Tab. 5 Maintenance intervals and maintenance work

- Clean product with water or soap suds (max. 60 °C).

11 Fault clearance

Fault clearance, pneumatic

Fault description	Cause	Remedy
Premature wear of the contraction diaphragm	Operating temperature too high.	– Pneumatic connection: use a sufficiently dimensioned connection or a product variant with a second pneumatic connection. – Pneumatic connection: exchange compressed air cyclically.
Compressed air escapes audibly.	Leakage	– Pneumatic connection: tighten connections or replace connection fitting. – Contraction diaphragm: replace product.
Mounting at one end: payload m is not lifted.	Insufficient operating pressure.	– Increase operating pressure.
Mounting at both ends: tensile force F is not reached.	The max. achievable tensile force of the size used is smaller than the required force.	– Use a different size.
Speed is not reached.	Insufficient operating pressure.	– Product: use a different size. – Pneumatic connection: check compressed air supply. Use shorter connecting cables.
	Insufficient compressed air supply.	– Pneumatic connection: use sufficiently dimensioned valve.

Tab. 6 Fault clearance, pneumatic

12 Disassembly

1. Exhaust product.
2. Replace product.

13 Disposal

ENVIRONMENT!

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

14 Technical data

14.1 Technical data, general

Technical data		
Design		Fibre-reinforced contraction diaphragm
Permissible temperature range	[°C]	–5 ... +60
Storage and operation		
Storage temperature	[°C]	Max. +30
Ambient conditions, storage, operation		Protection from UV radiation, corrosion by coolant, corrosion by ozone (e.g. in the vicinity of electric motors, welders, copiers), thermal stress due to rising ambient or operating temperature, oils, greases and grease-dissolving vapours, glowing chips or sparks.
Humidity	[%]	< 60

Tab. 7 Technical data, general

Materials	
Contraction diaphragm	Chloroprene/aramid
Flange, sleeve	Wrought aluminium alloy, colourless anodised
Nut	Galvanised steel

Tab. 8 Materials

14.2 Technical data, pneumatic

Size		5	10	20	40
Operating medium		Compressed air to ISO 8573-1:2010 [7:–:–]			
Permitted operating pressure	[MPa]	0 ... 0.6	0 ... 0.8	0 ... 0.6	
	[psi]	0 ... 87	0 ... 116	0 ... 87	
	[bar]	0 ... 6	0 ... 8	0 ... 6	
Connecting thread pneum. Connection		M3	G1/8	G1/4	G3/8
Contraction diaphragm inside diameter	[mm]	5	10	20	40
Theoretical force at max. permissible operating pressure[1)]	[N]	140	630	1500	6000
Reduced force in connection with the rod eye SGS or rod clevis SG	[N]	-	-	-	4000
Normal leakage	[l/h]	< 1			

1) The force is reduced by approx. 10% at minimum nominal length.

Tab. 9 Technical data, pneumatic

Reduced force

The mounting thread has a fatigue strength with dynamically varying load in connection with the rod eye SGS or rod clevis SG if reduced force is applied.
The fatigue strength is defined with the following marginal conditions.

- Rated load
- Frictional torque at μ = 0.2
- 10 million load cycles

14.3 Characteristic curves

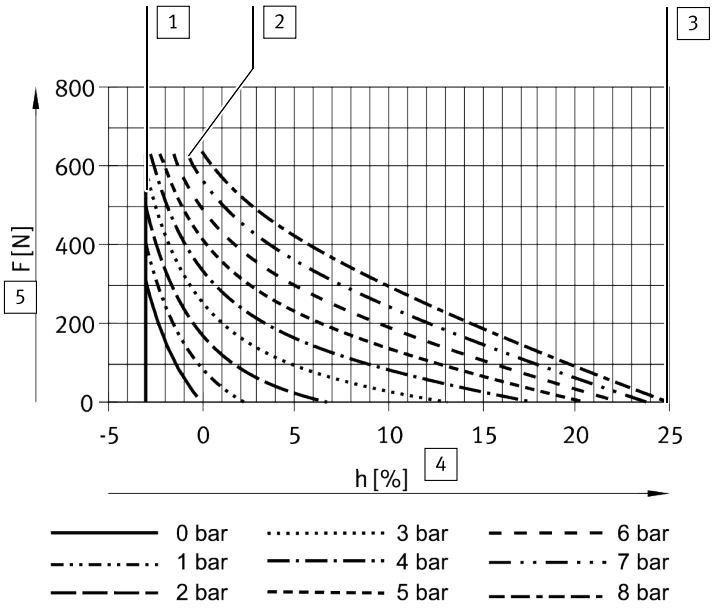
Theoretical force

The theoretical force F [N] can be determined with the "characteristic curve" graph depending on the contraction h [%] of the nominal lengths. The nominal length is the visible area of the unloaded contraction diaphragm.

Deviations between theoretical force and actual force

The theoretical force may deviate by up to 10%.

- Deviations are possible due to the following factors: Material, production fluctuation, nominal length.
- Balance the force by increasing the operating pressure to the maximum permissible operating pressure.



1 Maximum permissible pretensioning
2 Maximum theoretical force
3 Maximum permissible contraction
4 Contraction h
5 Force F

Fig. 6 Sample diagram

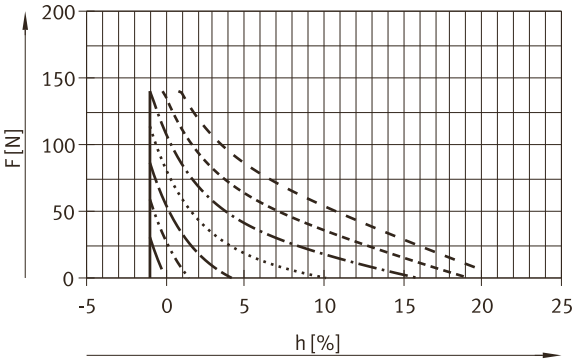


Fig. 7 Characteristic curves DMSP-5

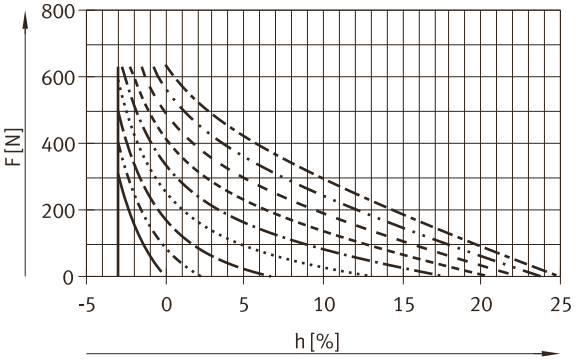


Fig. 8 Characteristic curves DMSP-10

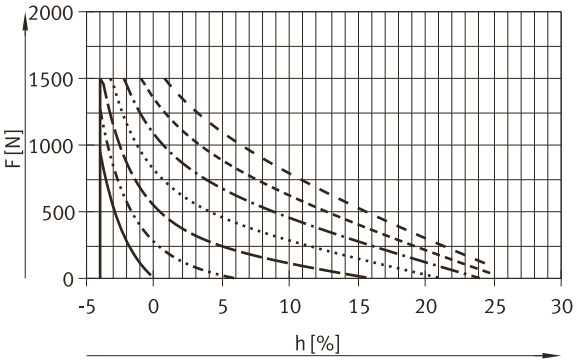


Fig. 9 Characteristic curves DMSP-20

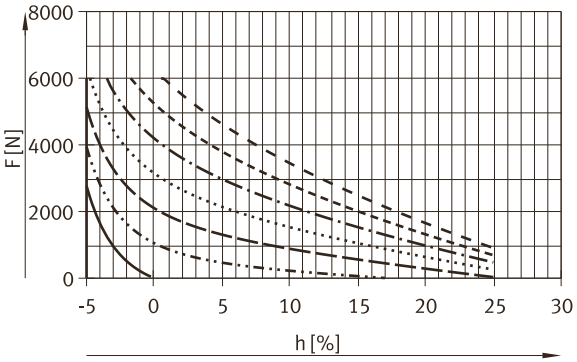


Fig. 10 Characteristic curves DMSP-40

Service life

Factors that greatly reduce the service life c of the contraction diaphragm:

- Increasing contraction h with rising operating pressure,
- Greater pretensioning with increasing applied load m (payload).

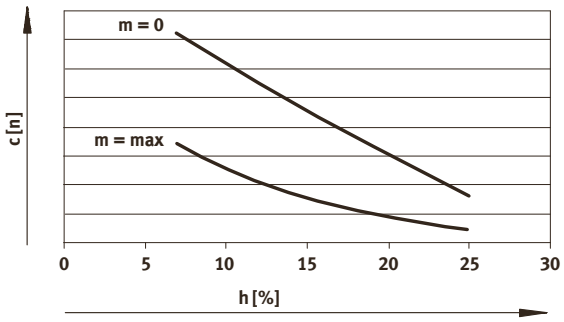


Fig. 11 Service life