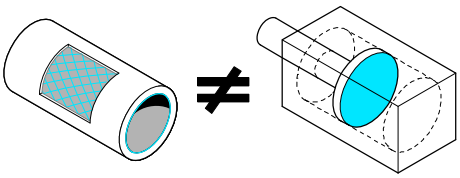
# Fluidic Muscle DMSP

# Fluidic Muscle DMSP

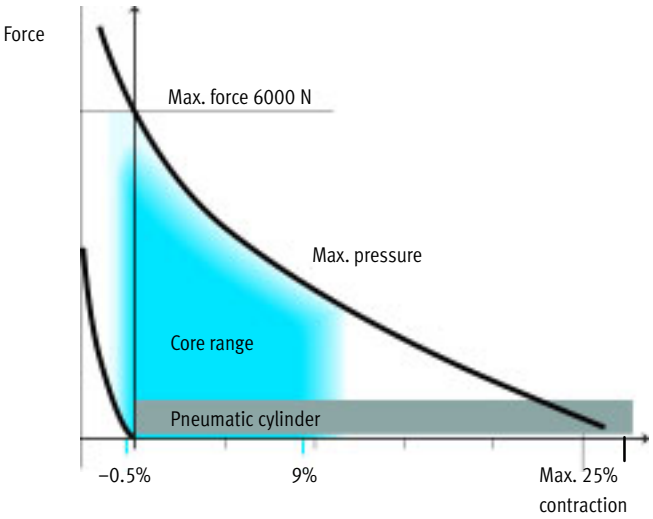
Key features

## Mode of operation

Fluidic Muscle is a tensile actuator which mimics the natural movement of a muscle. It consists of contractible tubing and appropriate connectors. The contractible tubing is made up of a rubber diaphragm with a non-crimped fibre made of aramid yarns on the inside. The diaphragm provides a hermetic seal enclosing the operating medium. The yarns serve as a reinforcement and transmit power. When internal pressure is applied, diaphragm extends in the circumferential direction. This creates a tensile force and a contraction motion in the longitudinal direction. The usable tensile force is at its maximum at the start of the contraction and then decreases with the stroke.



## Force profile and operating range




The muscle expands lengthways when it is pretensioned by an external force. When pressurised, on the other hand, the muscle contracts, i.e. its length decreases.

## Areas of application

### Clamping

- High force combined with a small diameter
- Insensitive to dirt
- Frictionless movement
- Hermetically sealed

### Vibrating and shaking

- Frequency up to 150 Hz
- Amplitude/frequency can be adjusted independently of each other
- Insensitive to dirt

### Pneumatic spring

- Adjustable spring force
- Frictionless movement
- Hermetically sealed
- Easy to handle

### Other

- Positioning using pressure
- High acceleration of a load

# Fluidic Muscle DMSP

Key features

**Fluidic Muscle DMSP with press-fitted connection** ➔ page 11

In the DMSP, the diaphragm is crimped by means of a sleeve and the adapters are integrated.

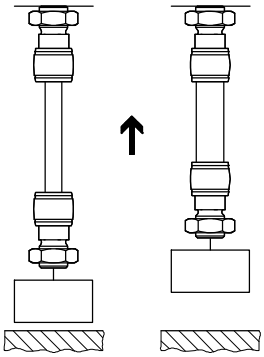
**Nominal length**

The nominal length of the Fluidic Muscle is defined in the non-pressurised, load-free state. It corresponds to the visible muscle length between the connections (➔ page 16).

**Single-acting actuator** Sizing examples ➔ page 20

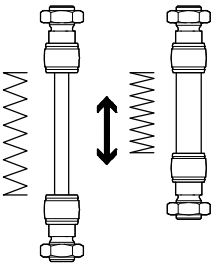
In the simplest case, the Fluidic Muscle operates as a single-acting actuator against a mechanical spring or a load. The mechanical spring pretensions the muscle out of its normal position when in the expanded, non-pressurised state. Ideal: 0.5% of nominal length. This operating state is ideal with regard to the technical properties of the Fluidic Muscle: in the unpressurised state, the diaphragm is not compressed. When pressurised, a muscle pretensioned in this way develops maximum force with optimum dynamic characteristics and minimum air consumption.
The most effective operating range is provided with contractions below 9%. The smaller the degree of contraction of the Fluidic Muscle, the more effectively it works.

Load = Constant



The muscle behaves like a spring when there is a change in external force: it follows the application of force. With the Fluidic Muscle, both the pretensioning force of this “pneumatic spring” and its spring stiffness can be varied. The Fluidic Muscle can be operated as a spring with constant pressure or constant volume. This produces different spring characteristics that enable the spring effect to be matched perfectly to the application.

Pressure/volume = Constant



- Note

If the muscle is fed with compressed air and the volume id blocked, the pressure in the muscle can increase significantly when the external force is varied.

# Fluidic Muscle DMSP

Key features

## Sizing

The simplest and most reliable way to ensure correct sizing is by going through the specialist department “Membrane Technologies” at Festo. Otherwise, calculation software is available to help you size the Fluidic Muscle. You can also use the force/displacement graphs to make a rough estimate.

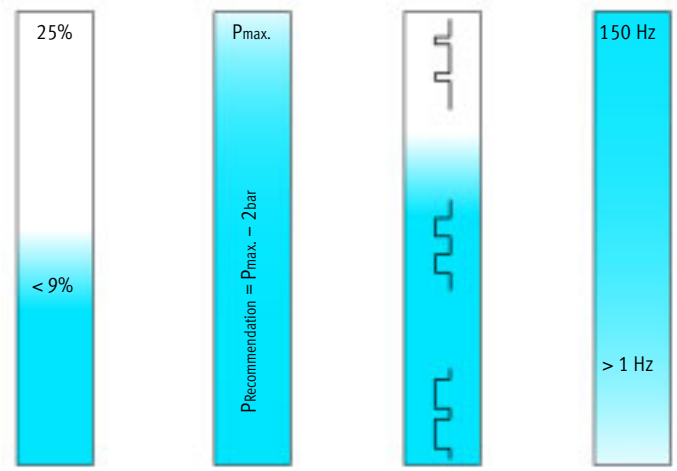
Sizing of the Fluidic Muscle is explained using examples ➔ page 20.

- Note

Do you need technical support?
We will be happy to help!

Membrane Technologies
➔membrantechnologie@festo.com

Efficient range




Contraction | Operating pressure | Motion sequence | Frequency

- Note

- Kinking, compression or torsion are not permissible
  ➔ lead to failure of the diaphragm
- Pretensioning by up to 0.5% will prevent kinking and compression
- Avoid unpressurised state
  ➔ residual pressure up to 0.5 bar

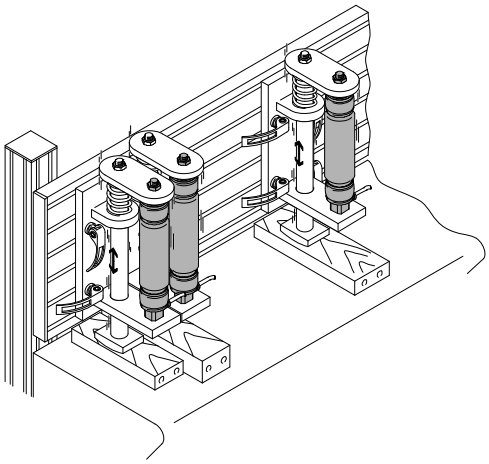
# Fluidic Muscle DMSP

Application examples

**Successful areas of application**
**Clamping**

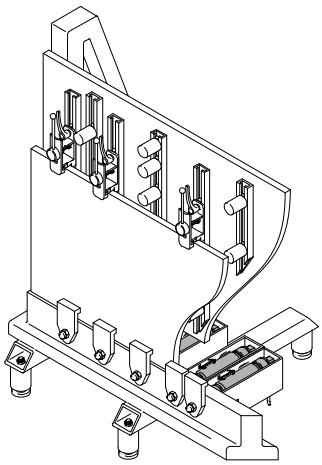
- High force combined with a small diameter
- Insensitive to dirt
- Frictionless movement
- Hermetically sealed

## Clamping workpieces



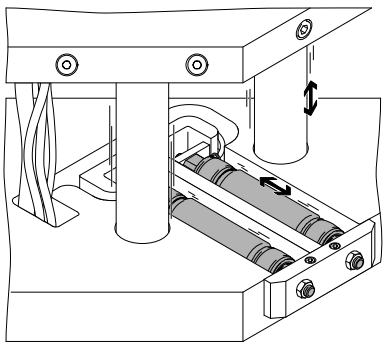
High forces combined with a small diameter? Not a problem for the Fluidic Muscle.
Thanks to its small diameter, it can be integrated and used in the smallest of spaces, e.g. when clamping workpieces. It has an initial force 10 times higher than that of a conventional pneumatic cylinder.

## Clamping metal sheets



The Fluidic Muscle enables large and unwieldy workpieces, such as plates, walls and side covers, to be easily clamped so they can be machined (turning, drilling, milling). This brings out the muscle's outstanding characteristics, such as high force combined with a small diameter, frictionless and thus jerk-free movement, insensitivity to dirt (swarf, abraded particles) and hermetically sealed design.

## Clamping parts to be joined



In joining processes such as those that take place in welding machines, the components to be welded are held in place by the Fluidic Muscle during the joining procedure. Here, too, the muscle can make the most of its high force combined with a small diameter.

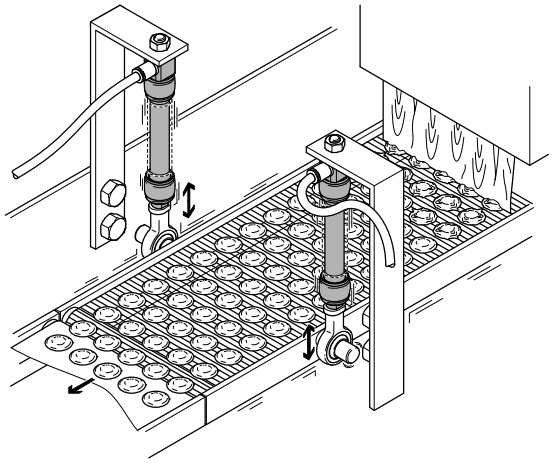
# Fluidic Muscle DMSP

Application examples

**Successful areas of application**
**Vibrating and shaking**

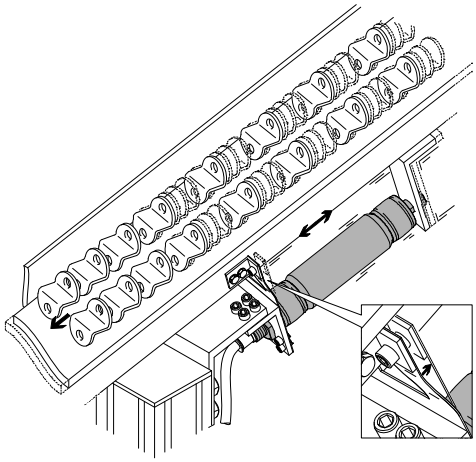
- Frequency up to 150 Hz
- Amplitude/frequency can be adjusted independently of each other
- Insensitive to dirt

Distributing



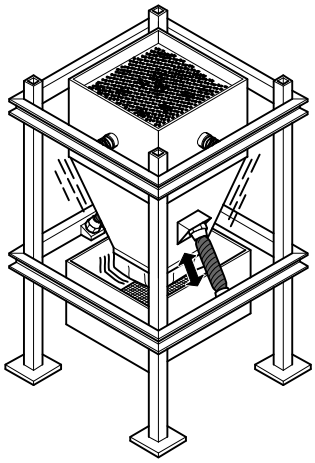
When a viscous coating agent is applied to a fixed substance carrier, a vibrating support is required to ensure even distribution over the surface. In the case of strokes of less than 1 mm, the Fluidic Muscle can achieve cycle rates of up to 150 Hz.

Conveying



The Fluidic Muscle is exceptionally well suited to transporting or aligning parts. Amplitude and cycle rate can be adjusted simply and independently of each other. The muscle's flexibility makes it possible to set the optimum conveying speed for any conveying process.

Releasing



Hoppers and silos are often susceptible to problems, such as a “jamming arch” forming during feeding. In practice, discharge aids such as vibrators or knockers are used to prevent such a jam from forming. This function can be implemented with the help of the Fluidic Muscle. The frequency can be set in an infinitely adjustable manner up to 150 Hz, independently of the amplitude. This guarantees a continuous conveying process.

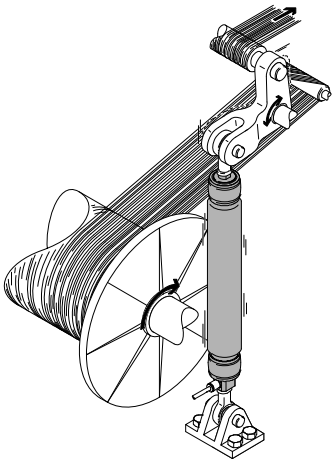
# Fluidic Muscle DMSP

Application examples

**Successful areas of application**
**Pneumatic spring**

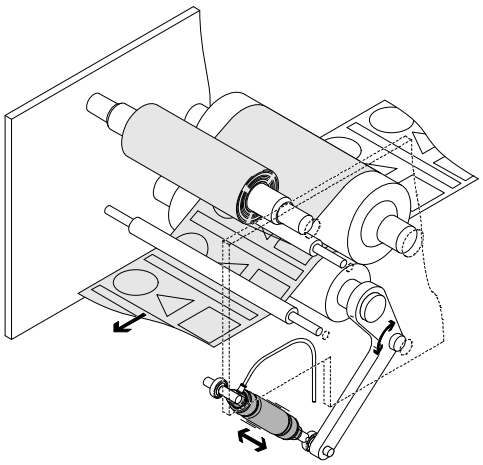
- Adjustable spring force
- Frictionless movement
- Hermetically sealed
- Easy to handle

## Stress equalisation



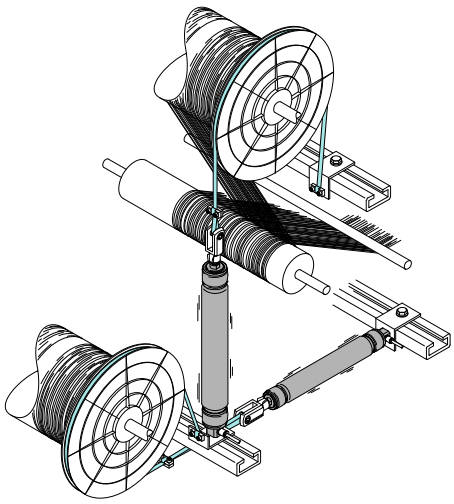
In all applications in which threads, films, papers or tapes are transported or wound and unwound using rollers, high stresses develop (peak stresses) and the continuous material being transported can tear. With its adjustable spring force and frictionless movement, the Fluidic Muscle can absorb these stresses. The muscle stands out because of the simple adjustment of the spring strength by means of the pressure and hence by its ease of use. Changes to the process require a change of the mechanical spring and weights. The Fluidic Muscle is an excellent replacement for existing solutions using loads and mechanical springs.

## Adjustable contact pressure



The Fluidic Muscle is exceptionally well suited to pressing on rollers. The contact pressure can be varied using the operating pressure. The design means that components do not become stuck and there are thus no peak forces. The Fluidic Muscle is hermetically sealed and can be disconnected from the compressed air supply. It will nevertheless continue to perform its function.

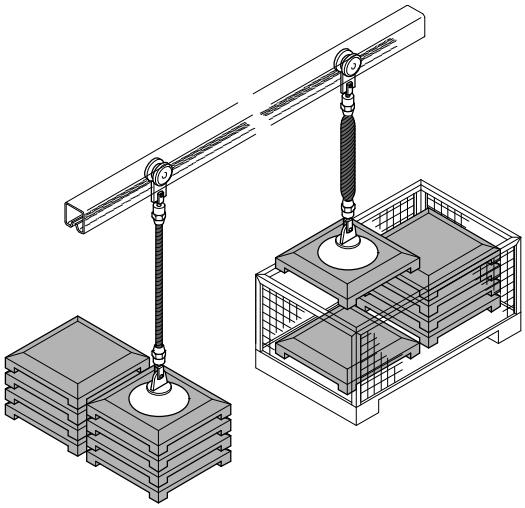
## Brakes for tension regulation



The spring properties of the Fluidic Muscle make it exceptionally well suited to regulating the thread tension when winding threads. The tension in the threads is always as high as it needs to be for the process in question. This means that the optimum thread tension is always available, leading to better protection of the threads and counteracting wear on all components.

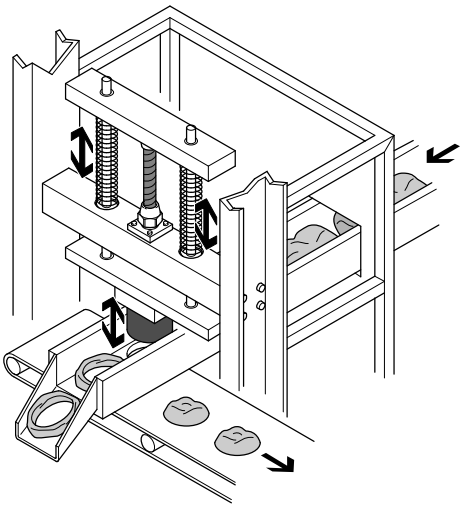
## Other possible applications

### Lifting aid



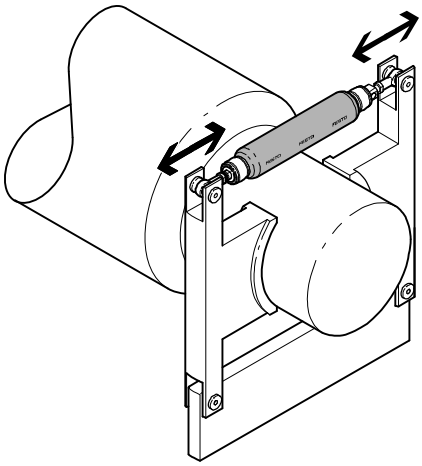
Achieving intermediate positions? Very simple, using pressure regulation: the workpieces can be raised or lowered as required by pressurising or exhausting the muscle via a hand lever valve. Muscle lengths up to 9 m facilitate various types of application.

### Punching



Very high cycle rates can be achieved with the muscle, on the one hand because of its low weight and on the other because it has no moving parts (e.g. a piston). The simple design – one muscle pretensioned using two springs – replaces a complicated toggle lever clamping system using cylinders.

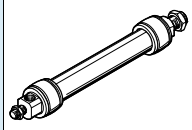
### Emergency stop device



The Fluidic Muscle is setting benchmarks in applications that require fast response times. The emergency stop for rollers demands both speed and a high initial force. This can prevent risks to the operator in the event of malfunctions.

# Fluidic Muscle DMSP

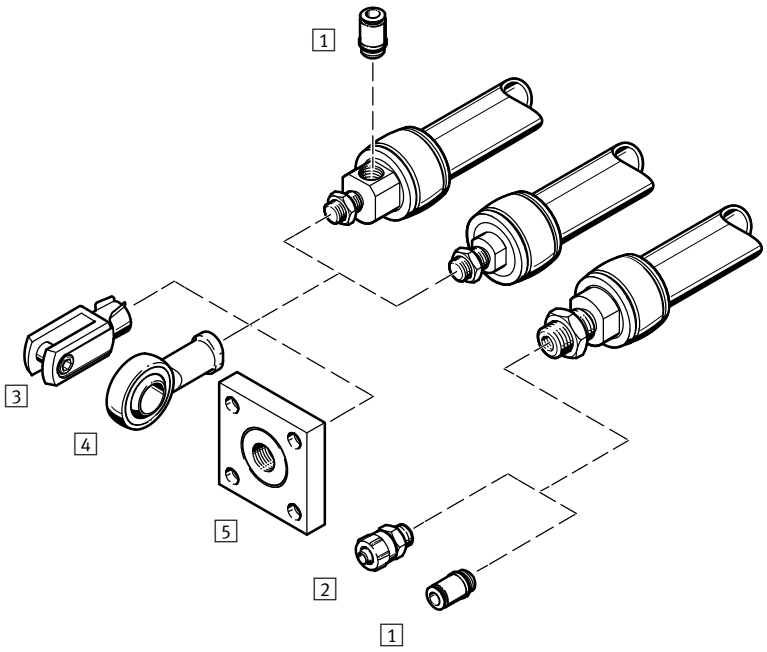
Product range overview

| Function | Version | I.D. [mm] | Nominal length [mm] | Lifting force [N] |
|---|---|---|---|---|
| **Single-acting, pulling** | **Fluidic Muscle with press-fitted connection** | | | |
| |  | 5 | 30 … 1000 | 0 … 140 |
| | | 10 | 40 … 9000 | 0 … 630 |
| | | 20 | 60 … 9000 | 0 … 1500 |
| | | 40 | 120 … 9000 | 0 … 6000 |

| I.D. [mm] | Max. permissible pretensioning | Max. permissible contraction | Operating pressure [bar] | ➔ Page/Internet |
|---|---|---|---|---|
| **Fluidic Muscle with press-fitted connections** | | | | |
| 5 | 1% of nominal length | 20% of nominal length | 0 … 6 | 11 |
| 10 | 3% of nominal length | 25% of nominal length | 0 … 8 | |
| 20 | 4% of nominal length | 25% of nominal length | 0 … 6 | |
| 40 | 5% of nominal length | 25% of nominal length | 0 … 6 | |

# Fluidic Muscle DMSP

Peripherals overview




**Accessories**

| | | Description | Size | | | | ➔ Page/Internet |
|---|---|---|---|---|---|---|---|
| | | | 5 | 10 | 20 | 40 | |
| 1 | Push-in fittings QSM/QS | For connecting compressed air tubing with standard outside diameters | ■ | ■ | ■ | ■ | qs |
| 2 | Quick connectors CK | For connecting compressed air tubing with standard internal diameters | – | ■ | ■ | ■ | ck |
| 3 | Rod clevis SG | Permits swivel motion of the Fluidic Muscle in one plane | ■ | ■ | ■ | ■ | 19 |
| 4 | Rod eye SGS | With spherical bearing | ■ | ■ | ■ | ■ | 19 |
| 5 | Coupling pieces KSZ | To compensate for radial deviations | ■ | ■ | ■ | ■ | 19 |
| | Coupling pieces KSG | To compensate for radial deviations | – | ■ | ■ | ■ | 19 |

# Fluidic Muscle DMSP

Type codes

| DMSP | – | 5 | – | 500N | – | RM | – | CM | – | |
|---|---|---|---|---|---|---|---|---|---|---|

| Drive function | |
|---|---|
| Single-acting, pulling | |
| DMSP | Fluidic Muscle |

| I.D. [mm] |
|---|

| Nominal length [mm] | |
|---|---|
| ...N | 30 ... 9000 |

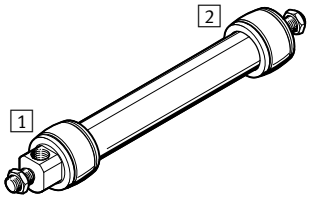
| First connection | |
|---|---|
| RM | Pneumatic connection, radial |
| AM | Pneumatic connection, axial |

| Second connection | |
|---|---|
| RM | Pneumatic connection, radial |
| AM | Pneumatic connection, axial |
| CM | No pneumatic connection, with male thread |
| CF | No pneumatic connection, with female thread |

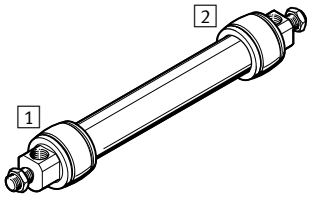
| Operating instructions | |
|---|---|
| – | Standard |
| DN | Express waiver – no operating instructions to be included (already available) |

**Variants**

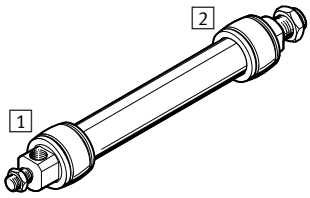
DMSP-...-RM-CM
1 Radial connection
2 No connection, with male thread



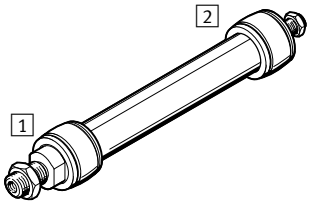

DMSP-...-RM-RM
1 Radial connection
2 Radial connection



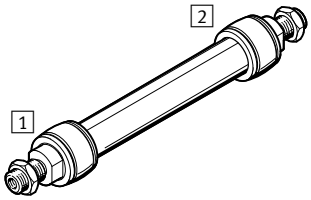

DMSP-...-RM-AM
1 Radial connection
2 Axial connection



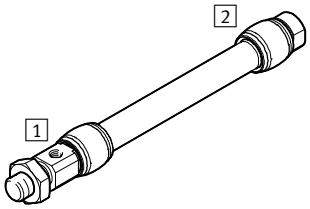

DMSP-...-AM-CM
1 Axial connection
2 No connection, with male thread



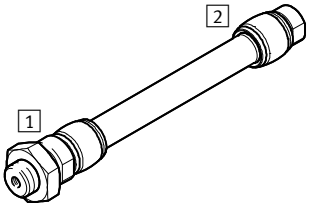

DMSP-...-AM-AM
1 Axial connection
2 Axial connection




DMSP-...-RM-CF (DMSP-5)
1 Radial connection
2 No connection, with female thread




DMSP-...-AM-CF (DMSP-5)
1 Axial connection
2 No connection, with female thread



# Fluidic Muscle DMSP

Technical data

Size
5 … 40

Nominal length
30 … 9000 mm

Lifting force
0 … 6000 N

| General technical data | | | | | |
|---|---|---|---|---|---|
| Size | | 5 | 10 | 20 | 40 |
| Pneumatic connection | | M3 | G1/8 | G1/4 | G3/8 |
| Design | | Contracting diaphragm | | | |
| Mode of operation | | Single-acting, pulling | | | |
| I.D. | [mm] | 5 | 10 | 20 | 40 |
| Nominal length | [mm] | 30 … 1000 | 40 … 9000 | 60 … 9000 | 120 … 9000 |
| Stroke | [mm] | 0 … 200 | 0 … 2250 | 0 … 2250 | 0 … 2250 |
| Max. additional load, freely suspended | [kg] | 5 | 30 | 80 | 250 |
| Max. permissible pretensioning[1)] | | 1% of nominal length | 3% of nominal length | 4% of nominal length | 5% of nominal length |
| Max. permissible contraction | | 20% of nominal length | 25% of nominal length | | |
| Max. perm. offset of connections | | Angle tolerance: ≤ 1.0° | | | |
| | | Parallelism tolerance: ± 0.5 % (up to 400 mm nominal length), ≤ 2 mm (from 400 mm nominal length) | | | |
| Type of mounting | | Via accessories | | | |
| Mounting position | | Any (an external guide is required if lateral forces occur) | | | |

1) The max. pretensioning is achieved when the max. permissible freely suspended payload is attached.

| Operating and environmental conditions | | | | | |
|---|---|---|---|---|---|
| Size | | 5 | 10 | 20 | 40 |
| Operating pressure | [bar] | 0 … 6 | 0 … 8 | 0 … 6 | 0 … 6 |
| Operating medium | | Compressed air according to ISO 8573-1:2010 [7:–:–] | | | |
| Note on operating/pilot medium | | Lubricated operation possible (in which case lubricated operation will always be required) | | | |
| Ambient temperature | [°C] | –5 … +60 | | | |
| Corrosion resistance class CRC[1)] | | 2 | | | |
| Certification | | TÜV | | | |

1) Corrosion resistance class CRC 2 to Festo standard FN 940070
Moderate corrosion stress. Indoor applications in which condensation may occur. External visible parts with primarily decorative requirements for the surface and which are in direct contact with the ambient atmosphere typical for industrial applications.

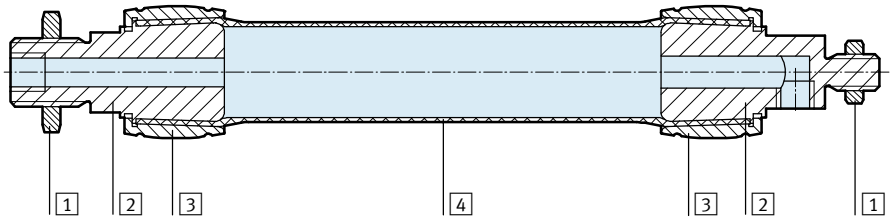
| Forces [N] at max. permissible operating pressure | | | | |
|---|---|---|---|---|
| Size | 5 | 10 | 20 | 40 |
| Theoretical force[1)] | 140 | 630 | 1500 | 6000 |

1) For minimum nominal length, the force is reduced by approx. 10%.

| Weight [g] | | | | |
|---|---|---|---|---|
| Size | 5 | 10 | 20 | 40 |
| Product weight for 0 m length | | | | |
| DMSP-...-RM-CM | 10 | 58 | 169 | 675 |
| DMSP-...-RM-RM | 11 | 66 | 182 | 707 |
| DMSP-...-RM-AM | 12 | 75 | 202 | 767 |
| DMSP-...-AM-CM | 12 | 66 | 189 | 735 |
| DMSP-...-AM-AM | 14 | 83 | 222 | 827 |
| DMSP-...-RM-CF | 7 | – | – | – |
| DMSP-...-AM-CF | 9 | – | – | – |
| Additional weight per 1 m length | 27 | 94 | 178 | 340 |

**Materials**

Sectional view




| Fluidic Muscle | | |
|---|---|---|
| 1 | Nut | Galvanised steel |
| 2 | Flange | Clear anodised wrought aluminium alloy |
| 3 | Sleeve | Clear anodised wrought aluminium alloy |
| 4 | Diaphragm | AR, CR |
| | Note on materials | RoHS-compliant |
| | | Free of copper and PTFE |
| | | Contains paint-wetting impairment substances |

## Permissible force F [N] as a function of the contraction h [%] of the nominal length

Force/displacement diagrams and sizing ranges

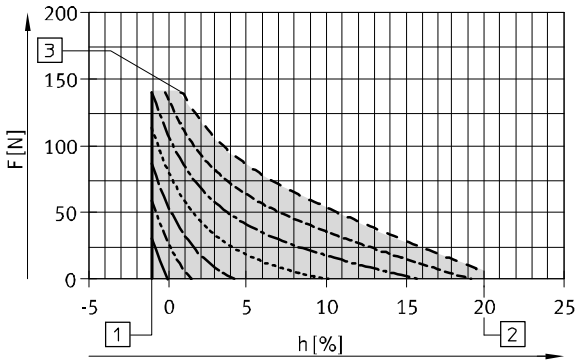
The limits specified in the technical data must be complied with when using the Fluidic Muscle. The graphs below illustrate the operating range of the Fluidic Muscle as a function of the diameter, within the limits shown below.

### Using the graphs

1. The upper limit of the grey area indicates the maximum permissible force.
2. The right limiting curve of the grey area indicates the maximum permissible operating pressure.
3. The right vertical limit of the grey area indicates the maximum permissible contraction.
4. The left limit of the grey area indicates the load limit of the muscle in terms of the maximum permissible pretensioning.

### Operating range DMSP-5-100N-...

Sizing examples ➔ page 20



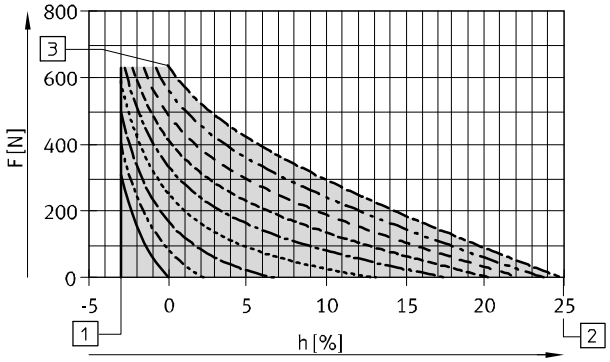

- 0 bar
- 1 bar
- 2 bar
- 3 bar
- 4 bar
- 5 bar
- 6 bar

1 Max. permissible pretensioning
2 Max. permissible contraction
3 Theoretical force (140 N) at max. operating pressure

Permissible operating range

### Operating range DMSP-10-100N-...

Sizing examples ➔ page 20




- 0 bar
- 1 bar
- 2 bar
- 3 bar
- 4 bar
- 5 bar
- 6 bar
- 7 bar
- 8 bar

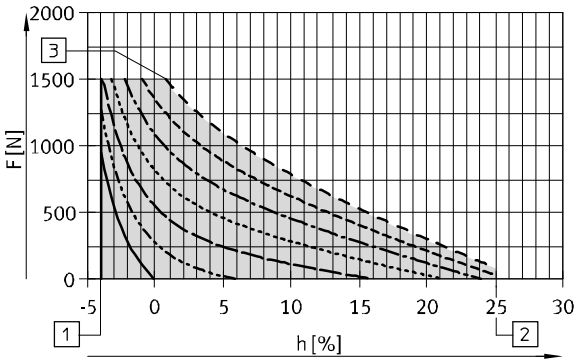
1 Max. permissible pretensioning
2 Max. permissible contraction
3 Theoretical force (630 N) at max. operating pressure

Permissible operating range

**Permissible force F [N] as a function of the contraction h [%] of the nominal length**

Operating range DMSP-20-200N-...

Sizing examples ➔ page 20



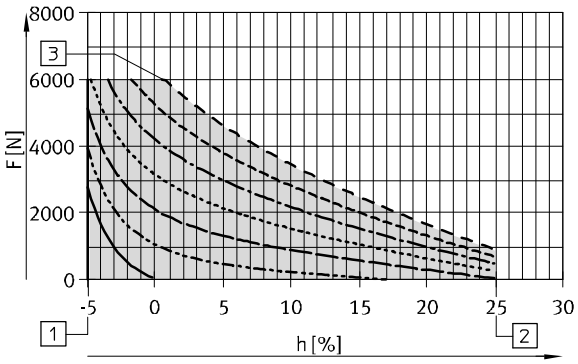

0 bar
1 bar
2 bar
3 bar
4 bar
5 bar
6 bar

1 Max. permissible pretensioning
2 Max. permissible contraction
3 Theoretical force (1500 N) at max. operating pressure

Permissible operating range

Operating range DMSP-40-400N-...

Sizing examples ➔ page 20




0 bar
1 bar
2 bar
3 bar
4 bar
5 bar
6 bar

1 Max. permissible pretensioning
2 Max. permissible contraction
3 Theoretical force (6000 N) at max. operating pressure

Permissible operating range

Note

The actual value of the force as a factor of the contraction can vary according to the product characteristics and the ambient conditions present.
The deviation can be compensated if the pressure is adapted up to the maximum permissible operating pressure.

The simplest and most reliable way to ensure correct sizing is by going through the specialist department “Membrane Technologies” at Festo.
We can take all the crucial parameters for your application into consideration.

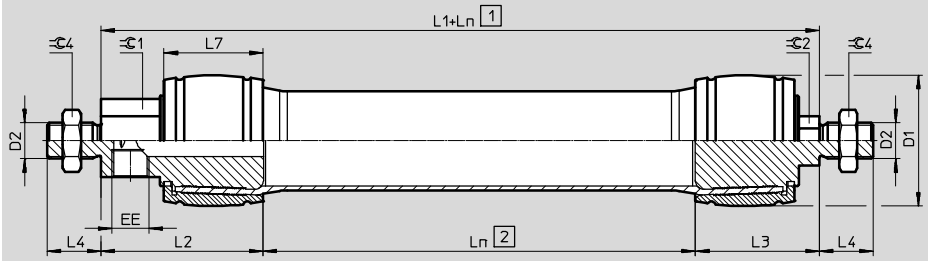
We will be happy to help!

Membrane Technologies
➔membrantechnologie@festo.com

## Dimensions

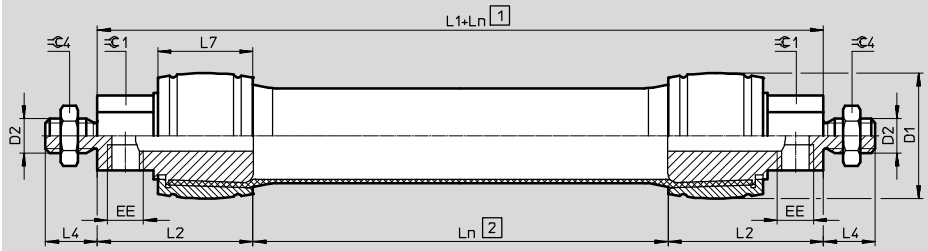
Download CAD data ➔ **www.festo.com**

DMSP-...-RM-CM – pneumatic connection, radial – no connection, with male thread



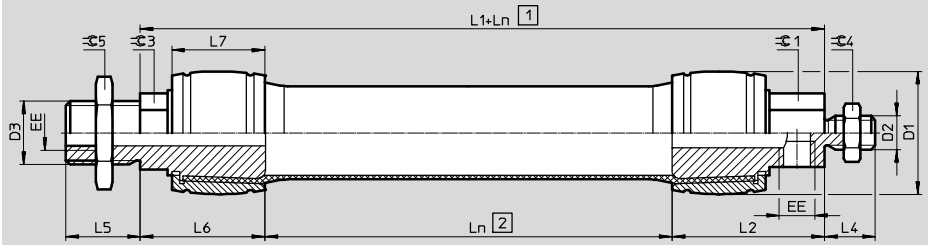

1 Installed length
2 Nominal length

DMSP-...-RM-RM – pneumatic connection, radial – pneumatic connection, radial



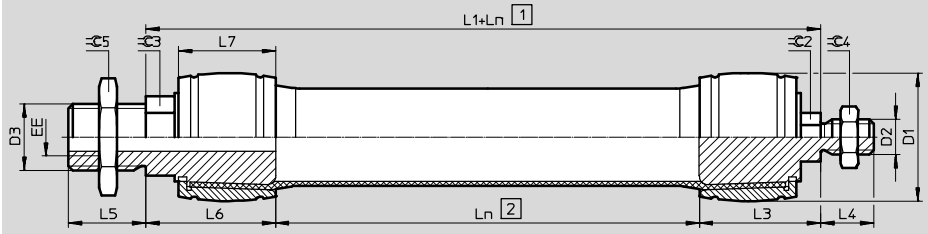

1 Installed length
2 Nominal length

DMSP-...-AM-RM – pneumatic connection, axial – pneumatic connection, radial




1 Installed length
2 Nominal length

DMSP-...-AM-CM – pneumatic connection, axial – no connection, with male thread




1 Installed length
2 Nominal length

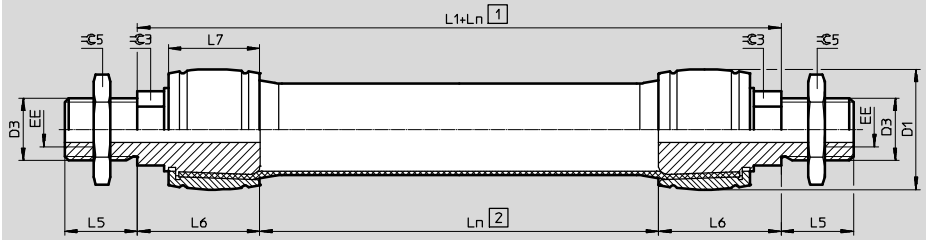
| Size | D1 | D2 | D3 | EE[2] | Ln[1] | | L1 | | | | L2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | max. | | | | min. | max. | RM-CM | RM-RM | AM-RM | AM-CM | |
| 5 | 11 | M6 | M8 | M3 | 30 | 1000 | 33 | 37 | 33 | 29 | 18.5 |
| 10 | 22 | M8 | M16x1.5 | G1/8 | 40 | 9000 | 62 | 72 | 63 | 53 | 36 |
| 20 | 35 | M10x1.25 | M20x1.5 | G1/4 | 60 | | 95 | 113 | 97 | 79 | 56.5 |
| 40 | 57 | M16x1.5 | M30x1.5 | G3/8 | 120 | | 127 | 144 | 131 | 114 | 72 |

| Size | L3 | L4 | L5 | L6 | L7 | ⌀1[2] | ⌀2[2] | ⌀3[2] | ⌀4 | ⌀5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 14.5 | 10 | 10 | 14.5 | 10 | 8 | 8 | 10 | 13 | 13 |
| 10 | 26 | 15 | 16 | 27 | 19 | 17 | 10 | 17 | 13 | 24 |
| 20 | 38.5 | 20 | 18 | 40.5 | 30 | 19 | 12 | 20 | 17 | 30 |
| 40 | 55 | 24 | 35 | 59 | 44 | 30 | 19 | 30 | 24 | 46 |

1) Tolerance < 100 mm ±1 mm, 100 ... 400 mm ±1%, > 400 mm ±4 mm.
2) Parallel orientation of the spanner flats on the left and right connection side can lead to deviations (for production reasons).

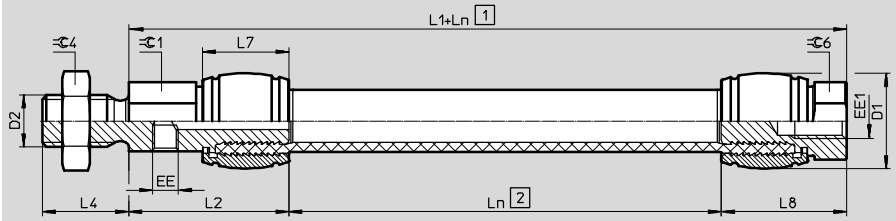
**Dimensions** Download CAD data ➔ **www.festo.com**

DMSP-...-AM-AM – pneumatic connection, axial – pneumatic connection, axial



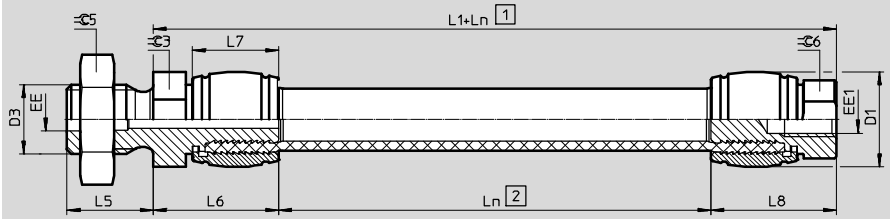

1 Installed length
2 Nominal length

DMSP-...-RM-CF – pneumatic connection, radial – no connection, with female thread




1 Installed length
2 Nominal length

DMSP-...-AM-CF – pneumatic connection, axial – no connection, with female thread




1 Installed length
2 Nominal length

| Size | D1 | D2 | D3 | EE | EE1 | Ln[1] | | L1 | | | L2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | max. | | | | | min. | max. | AM-AM | RM-CF | AM-CF | |
| 5 | 11 | M6 | M8 | M3 | M4 | 30 | 1000 | 29 | 33 | 29 | 18.5 |
| 10 | 22 | M8 | M16x1.5 | G1/8 | – | 40 | 9000 | 54 | – | – | 36 |
| 20 | 35 | M10x1.25 | M20x1.5 | G1/4 | – | 60 | | 81 | – | – | 56.5 |
| 40 | 57 | M16x1.5 | M30x1.5 | G3/8 | – | 120 | | 118 | – | – | 72 |

| Size | L4 | L5 | L6 | L7 | L8 | ⌀1[2] | ⌀3[2] | ⌀4 | ⌀5 | ⌀6 |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 10 | 10 | 14.5 | 10 | 14.5 | 8 | 10 | 13 | 13 | 8 |
| 10 | 15 | 16 | 27 | 19 | – | 17 | 17 | 13 | 24 | – |
| 20 | 20 | 18 | 40.5 | 30 | – | 19 | 20 | 17 | 30 | – |
| 40 | 24 | 35 | 59 | 44 | – | 30 | 30 | 24 | 46 | – |

1) Tolerance < 100 mm ±1 mm, 100 ... 400 mm ±1%, > 400 mm ±4 mm.
2) Parallel orientation of the spanner flats on the left and right connection side can lead to deviations (for production reasons).

| **Diameter expansion at maximum contraction** | | | | |
|---|---|---|---|---|
| Size | 5 | 10 | 20 | 40 |
| [mm] | 12 | 24 | 40 | 80 |

# Fluidic Muscle DMSP

Ordering data – Modular products

FESTO

**Ordering table**

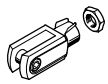
| Size | | 5 | 10 | 20 | 40 | Condi-tions | Code | | Entry code |
|---|---|---|---|---|---|---|---|---|---|
| M | Module no. | **3733012** | **541403** | **541404** | **541405** | | | | |
| | Function | Fluidic Muscle with press-fitted connection | | | | | **DMSP** | | DMSP |
| | Size [mm] | 5 | 10 | 20 | 40 | | **-...** | | |
| | Nominal length [mm] | 30 ... 1000 | 40 ... 9000 | 60 ... 9000 | 120 ... 9000 | | **-... N** | | -... N |
| | First connection | Radial, male thread<br>Mounting thread/supply port<br>M6 / M3 | M8 / G1/8 | M10x1.25 / G1/4 | M16x1.5 / G3/8 | | **-RM** | | |
| | | Axial, male thread<br>Mounting thread/supply port<br>M8 / M3 | M16x1.5 / G1/8 | M20x1.5 / G1/4 | M30x1.5 / G3/8 | | **-AM** | | |
| | Second connection | Closed, male thread<br>Mounting thread<br>M6 | M8 | M10x1.25 | M16x1.5 | | **-CM** | | |
| | | Closed, female thread<br>Mounting thread<br>M4 | – | | | | **-CF** | | |
| | | Radial, male thread<br>Mounting thread/supply port<br>M6 / M3 | M8 / G1/8 | M10x1.25 / G1/4 | M16x1.5 / G3/8 | | **-RM** | | |
| | | Axial, male thread<br>Mounting thread/supply port<br>M8 / M3 | M16x1.5 / G1/8 | M20x1.5 / G1/4 | M30x1.5 / G3/8 | | **-AM** | | |
| | Operating instructions | Standard | | | | | | | |
| | | Express waiver – no operating instructions to be included (already available) | | | | | **-DN** | | |

M Mandatory data

**Transfer order code**

| | DMSP | – | | – | ... N | – | | – | | – | |
|---|---|---|---|---|---|---|---|---|---|---|---|

**Ordering data** Technical data ➔ Internet: piston-rod attachment

| Description | For size | Part No. | Type |
|---|---|---|---|
| Rod eye SGS | | | |
|  | 5 | **9254** | **SGS-M6** |
| | 10 | **9255** | **SGS-M8** |
| | 20 | **9261** | **SGS-M10x1,25** |
| | 40 | **9263** | **SGS-M16x1,5**[1)] |
| Rod clevis SG | | | |
|  | 5 | **3110** | **SG-M6** |
| | 10 | **3111** | **SG-M8** |
| | 20 | **6144** | **SG-M10x1,25** |
| | 40 | **6146** | **SG-M16x1,5**[1)] |

| Description | For size | Part No. | Type |
|---|---|---|---|
| Coupling piece KSG | | | |
|  | 5 | – | |
| | 10 | – | |
| | 20 | **32963** | **KSG-M10x1,25** |
| | 40 | **32965** | **KSG-M16x1,5** |
| Coupling piece KSZ | | | |
|  | 5 | **36123** | **KSZ-M6** |
| | 10 | **36124** | **KSZ-M8** |
| | 20 | **36125** | **KSZ-M10x1,25** |
| | 40 | **36127** | **KSZ-M16x1,5** |

Note

1) If there is a dynamic load on the DMSP40, the technical data will be subject to restrictions because of the accessories.
Fundamentals: rated load, friction torque where μ = 0.2:
- Endurance limit at 6000 N: 1 million load cycles (higher values on request)
- Endurance limit at 4000 N: 10 million load cycles

**Example 1**

Lifting a constant load

The muscle is to be used to lift a constant load of 60 kg, free of forces, from a supporting surface, and raise it a distance of 10 mm. The compressed air supply provides a maximum of 6 bar.

The size (diameter and nominal length) of the Fluidic Muscle needs to be determined.

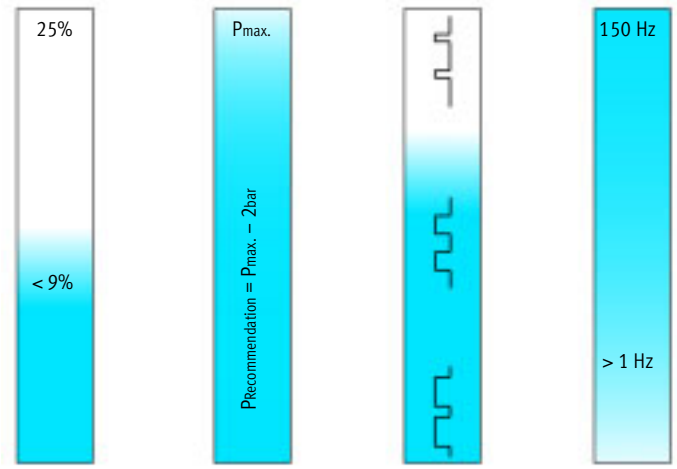
- - Note

The simplest and most reliable way to ensure correct sizing is by going through the specialist department “Membrane Technologies” at Festo.
We can take all the crucial parameters for your application into consideration.
We will be happy to help!
Membrane Technologies
➔membrantechnologie@festo.com

| General conditions | | Values |
|---|---|---|
| Required force at rest | [N] | 0 |
| Required stroke | [mm] | 10 |
| Required force in contracted state | [N] | Approx. 600 |
| Max. possible operating pressure | [bar] | 6 |

Choice of parameters

Efficient range




Contraction | Operating pressure | Motion sequence | Frequency

Solution

| Steps | Selection | Input parameters | Result |
|---|---|---|---|
| **Step 1:** | | | |
| Calculation of nominal length (stroke 10 mm/contraction 5%) | 200 mm | | |
| Choice of operating pressure ($p_{max.}$ – 2 bar) | 4 bar | | |
| **Step 2:** | | | |
| Input of values into engineering tool | Nominal length: | 200 mm | |
| | Stroke: | 10 mm | |
| | Operating pressure: | 4 bar | |
| Intermediate result for force | Size: | 20 mm | |
| | | | 674 N |
| **Step 3:** | | | |
| Adjustment of input values | Operating pressure: | 3.7 bar | |
| Result: | | | 609 N |

**Example 2**

Use as a tension spring

In this example, the muscle is to be used as a tension spring.

The size (diameter and nominal length) of the Fluidic Muscle needs to be determined.

Note

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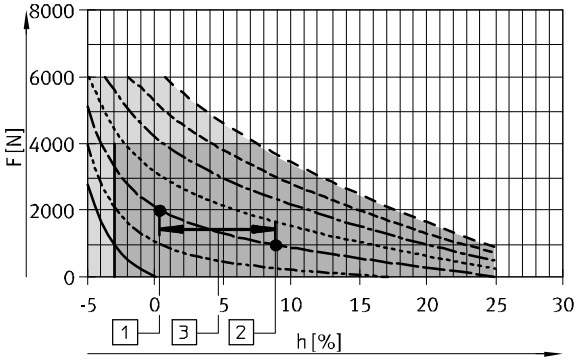
We can take all the crucial parameters for your application into consideration.
We will be happy to help!
Membrane Technologies
➔ membrantechnologie@de.festo.com

If you are determining the size yourself, you must follow this recommendation: contraction < 9%, operating pressure $p_{Recommendation} = p_{max.} - 2$ bar, see choice of parameters

| General conditions | | Values |
|---|---|---|
| Required force in extended state | [N] | 2000 |
| Required force in contracted state | [N] | 1000 |
| Required stroke (spring length) | [mm] | 50 |
| Operating pressure | [bar] | 2 |

Solution

| | | |
|---|---|---|
| **Step 1**<br>**Determine the required muscle size** | Determine the most suitable muscle diameter on the basis of the required force. | The required force is 2000 N, therefore a DMSP-40-... is selected. |
| **Step 2**<br>**Enter load point 1** | Load point 1 is entered into the force/displacement diagram for the DMSP-40-.... | Force F = 2000 N<br>Pressure p = 2 bar |
| **Step 3**<br>**Enter load point 2** | Load point 2 is entered into the force/displacement diagram. | Force F = 1000 N<br>Pressure p = 2 bar |
| **Step 4**<br>**Read the length change** | The change in the length of the muscle is read off between the load points on the X-axis (contraction in %). | Result:<br>8.7% contraction. |
| **Step 5**<br>**Calculate the nominal length** | The required nominal muscle length for a stroke of 50 mm is obtained by dividing by the contraction in %. | Result:<br>50 mm / 8.7% ~ 575 mm. |
| **Step 6**<br>**Result** | The nominal length of the muscle to be ordered is 575 mm. | For use as a tension spring with a force of 2000 N and a spring travel of 50 mm, a DMSP-40-575N-... is required. |




0 bar
1 bar
2 bar
3 bar
4 bar
5 bar
6 bar

1 Load point 1
2 Load point 2
3 Change in length = 8.7%