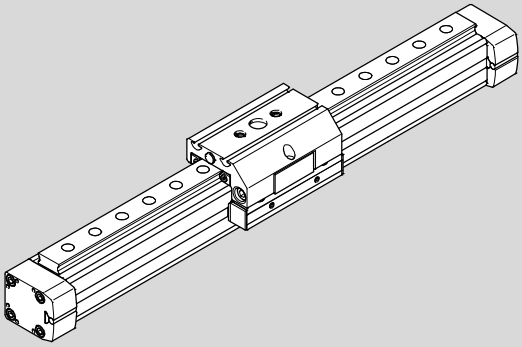
Positioning axis

DMES



FESTO

en Operating instructions

8075175
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[8075177]

Original instructions
DMES-EN

Identification of hazards and instructions on how to prevent them:

Danger
Immediate dangers which can lead to death or serious injuries

Warning
Hazards that can cause death or serious injuries

Caution
Hazards that can cause minor injuries

Other symbols:

Note
Material damage or loss of function

Recommendations, tips, references to other documentation

Essential or useful accessories

Information on environmentally sound usage

Text designations:
- Activities that may be carried out in any order

1. Activities that should be carried out in the order stated

– General lists

➔ Result of an action/References to more detailed information

English – Positioning axis DMES

Table of contents

1 Operating elements and connections

For all available product documentation ➔ www.festo.com/pk

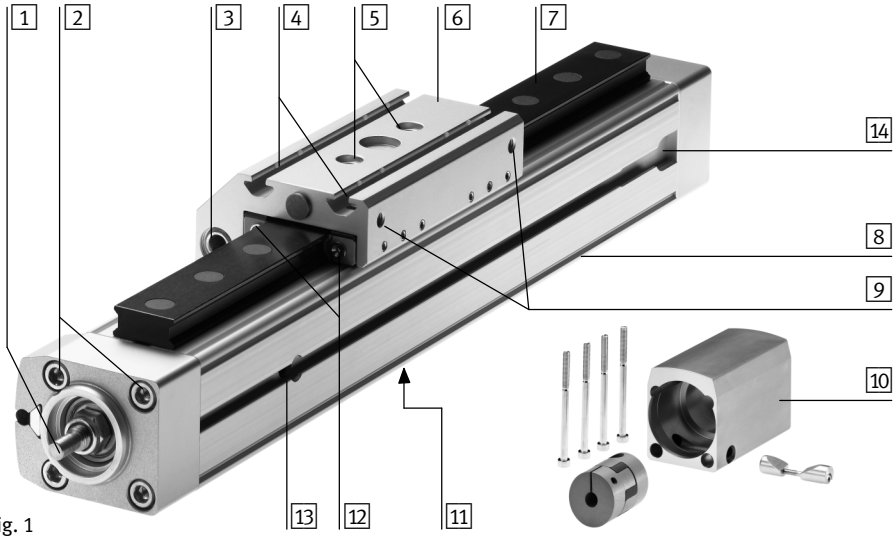


Fig. 1

1 Drive shaft
2 Mounting thread for motor mounting kit (DMES-25...-63)
3 Slide screws
4 Slots for mounting the payload (DMES-25...-63)
5 Centring recesses with thread
6 Slide
7 Guide rail
8 Corner profile for central supports (DMES-18, -25)
9 Mounting thread for switch lug
10 Motor mounting kit (➔ 11 Accessories)
11 Slot for proximity sensor
12 Lubricating nipple for roller guide (DMES-...-KF only)
13 Lubricating hole for spindle nut
14 Cut-out for inserting slot nuts (DMES-18, -25)

2 Function

A rotatable lead screw spindle converts a motor's rotation into linear motion, causing the piston to move backwards and forwards. The outer slide is driven by an axially rigid connection through a slot in the profile. A cover strip covers the slot in the profile.

Note
The DMES is self-braking: When the input torque is not applied, the slide will be braked. The slide, however, can move slowly if
– the DMES is mounted vertically,
– there is no holding torque at the drive pin,
– there are vibrations.
Only the complete system (DMES with MTR-DCI) is self-locking: If the input torque is not applied, the slide will be braked.

3 Application

The intended purpose of the DMES is the slow positioning of loads with high forces. It is permitted for the slide operating mode.

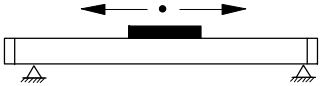


Fig. 2 Slide operation

- Please select the motors in our catalogue that are intended to be used in combination with the DMES ➔ www.festo.com/catalogue.
  Doing this will ensure you are operating two devices that are perfectly co-ordinated with one another.
- Observe the limit values for forces, torques and speeds (➔ 13 Technical data and 14 Characteristic curves).
  These limit values apply for continuous operation. During intermittent operation with sufficient cooling phases, the combination of force and speed may assume higher values in the short-term. However, the individual maximum values for force and speed may not be exceeded at any time.

4 Transport and storage

- Consider the weight of the product. The DMES weighs up to 85 kg depending on the design.
- The following should be observed with regard to storage:
  – Short storage times
  – Cool, dry, shaded and corrosion-resistant locations.

5 Requirements for product use

Make sure that the following specifications are observed:

- Compare the limit values specified in these operating instructions with those of your application (e.g. forces, torques, temperatures, loads, speeds).
  Operation of the product in compliance with the relevant safety regulations is contingent on adherence to the load limits.
- Take into consideration the ambient conditions at the location of use.
  Corrosive elements in the environment (e.g. ozone) reduce the service life of the product.
- Comply with the regulations of the trade associations and the German Technical Control Board (TÜV) and the VDE or corresponding national conditions.

- Remove transport packaging such as foils (polyethylene) and cardboard. The material used in the packaging has been specifically chosen for its recyclability (exception: Oil paper = residual waste).

Warning
Apply power to the drive motor, at first limited to low speeds and torques. This prevents uncontrolled movements.

- Use the DMES in its original state without undertaking any unauthorised modifications.

6 Installation

6.1 Mechanical installation

- Do not modify the screws and threaded pins if not directly requested to do so in these operating instructions.
- Mount the motor onto the axis ➔ Assembly instructions for the motor mounting kit recommended in the catalogue.

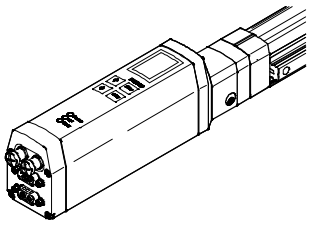


Fig. 3

- Please note that the IP protection class depends on the mounting position:
  - Diagonal or horizontal with cover strip at the top; vertical: IP40
  - Diagonal or horizontal with cover strip at the bottom: IP42

➔

Note

Danger of screws being pulled out if the axis is only mounted to the covers.

- Secure the axis to the profile with additional mounting components.

- Use the marked slots when mounting the drive ➔ Fig. 4.

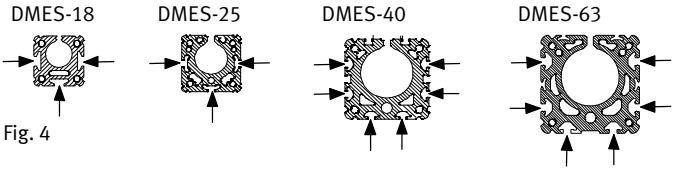


Fig. 4

- Position the product in such a way that its operating elements are accessible (e.g. relubrication openings).
- Install product without tension or distortions.
- Fasten product to a mounting surface with flatness of 0.05 % of the stoke length, but max. 0.2 mm.
  For gantry applications, attention must also be paid to parallel alignment or product heights in alignment of the axes.
  For additional information, contact your local Festo Service.

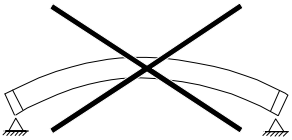


Fig. 5

For products with large stroke lengths:

- Use the central supports (➔ 11 Accessories).
  The diagrams in the appendix (➔ 14 Characteristic curves) show the deflections that will result depending on the mounting position, support spacing and payload.

When mounting central supports:

- Place the central supports on the DMES in accordance with Fig. 6.
  For DMES-40/63: If the device is tilted, the slot nuts of the central supports will slide into the slot at any point on the profile.
- Tighten the mounting screws evenly.

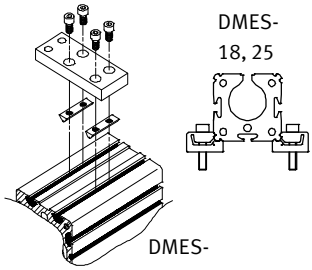


Fig. 6

- Make sure that the central supports are outside the positioning range of the slide.

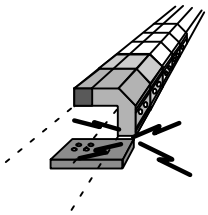


Fig. 7

For installation in a vertical or inclined position:

Warning
Uncontrolled payload in the event of a power failure or spindle nut fracture.
Injury due to impacts or pinching.

- Take appropriate safety measures to prevent damage as a result of spindle nut fracture (e.g. toothed latches, bolts or an emergency buffer).
- If the maximum permitted axial play is exceeded, replace the spindle nut and the spindle if necessary.

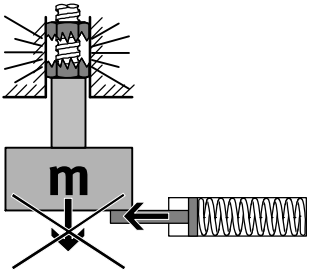


Fig. 9

6.2 Installation of the payload

- Place the payload in such a way that the break-down torque resulting from force F (parallel to the axis of motion) and lever arm “a” remains small.

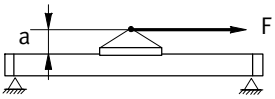
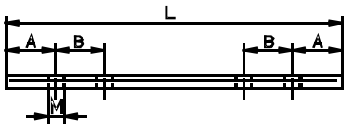


Fig. 10

Other fastening possibilities:

1. On the slide: With slot nuts NSTL-... in the slots (4 in Fig. 1).

NSTL	25	40	63	Legend
L	100	166	229	
A	13	25	30	
B	15	20	35	
M	M5	M5	M8	

Tab. 1 Dimensions of slot nuts type NSTL-...

2. On the slide: With centring sleeves/pins (➔ 11 Accessories) on the centring recesses/threads (5 in Fig. 1).
   Observe the maximum screw-in depth T and tightening torque (➔ Tab. 2).

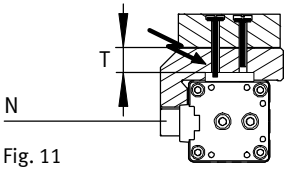


Fig. 11

Size		18	25		40		63	
Screw		M5	M6		M6		M6	
Max. screw-in depth T	[mm]	10	12.5		12.5		20.5	
Tightening torque	[Nm]	6	10		10		10	
Centring hole	[mm]	Ø 5^{H7}	Ø 9^{H7}	Ø 4^{G7}	Ø 9^{H7}	Ø 25^{G7}	Ø 9^{H7}	Ø 25^{G7}

Tab. 2

3. For DMES without a slide:
   On the through-holes of the driver (“N” in Fig. 11).

For payloads with their own guide:

- Adjust the guides of the payload and DMES so that they are exactly parallel.
  You will then avoid overloading the guide (wear).

For hard and stiff payloads (steel):

Note

If the aluminium slide is bent against a curved payload, the service life of the guide will be reduced.

- Make sure that the mounting surface of the payload is not bent more than as follows:
  – KF: b ≤ 0.01 mm

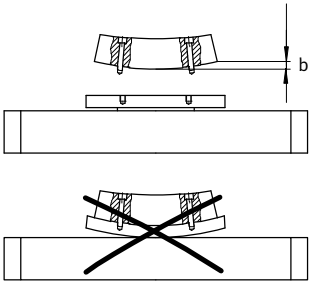


Fig. 12

For load geometries with projection in the longitudinal direction of the slide:

- Make sure that the payload does not strike against the motor.

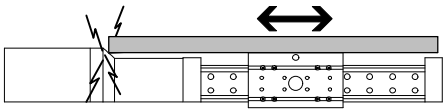


Fig. 13

For motor unit MTR-DCI:

- Twist the motor unit if required ➔ Assembly instructions for the motor mounting kit 10.

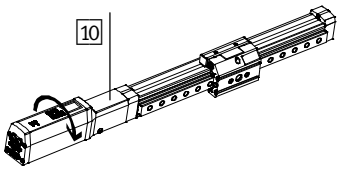


Fig. 14

6.3 Installing the external accessories

To protect the end positions against uncontrolled overtravel:

- Check whether proximity sensors are necessary (hardware limit switches).

If proximity sensors are used as limit switches:

- Use proximity sensors with normally-closed function.
  These protect a DMES with a fractured proximity sensor cable from overrunning the end position.

If proximity sensors are used as reference switches:

- Use proximity sensors that correspond to the input of the controller being used.

If you are using magnetically-actuated proximity sensors:

- Use the slots ➔ Fig. 15.
- Note that the magnet is situated asymmetrically on the inner slide (on the side facing away from the motor).
- Avoid external influences from magnetic or ferritic parts in the vicinity of the proximity sensors (minimum distance of 10 mm from the slot nuts).
- For DMES-25: Only place proximity sensors in the lateral slots. The magnetic field in the lower slot is very weak.
- For DMES-40: Only place the proximity sensors SMT-8 (high response sensitivity) in the lateral slots. The magnetic field in the upper slots is very strong (danger of multiple switchings).

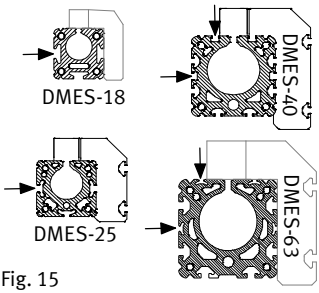


Fig. 15

If you are using inductive proximity sensors:

- Use switch lugs, sensor brackets and proximity sensors (➔ 11 Accessories).
- Use hammer-head screws for fastening the sensor supports in the slot.
  The T-head bolts require the cut-out on the cylinder barrel as a guide opening. You can bring the hammer-head screw into the holding position by turning it 90°.

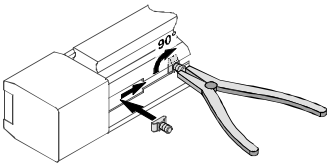


Fig. 16

To avoid contamination:

- Use cover rails (➔ 11 Accessories) as slot covers in all unused slots.

7 Commissioning

Warning
Moving loads can cause personal injury and material damage (risk of crushing).
- Make sure that, in the path of the moving components
  - nobody can place his/her hand in the path of the moving components (e.g. through use of protective guards)
  - there are no foreign objects in the path of the moving components.

It should not be possible to touch the DMES until the load has come to a complete standstill.

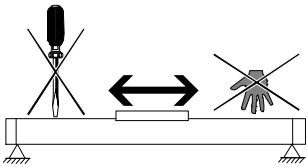


Fig. 17

Note
Incorrect specification values for the braking ramp in STOP statuses (e.g. EMERGENCY OFF, Quick Stop) result in an overloading of the linear axis and can destroy it or drastically reduce service life.
- Check the settings for all braking ramps in your controller or the higher-order control system (deceleration values and jerk).
- Taking the travel speed, moveable load and mounting position into account, make sure that the delay values (brake delay and delay times) are set in such a way that the maximum drive torque or feed force of the linear axis used is not exceeded.
- Use the “PositioningDrives” sizing software to design the linear axis
  ➔ www.festo.com.

Note
Block-shaped acceleration profiles (without jolt limitation) cause high peaks in the motive force that can lead to an overloading of the drive. In addition, positions outside the permissible range may occur as a result of overswing effects. A jolt-limited acceleration specification reduces vibrations in the entire system and has a positive effect on stress in the mechanical system.
- Check which closed-loop controller settings can be adapted (e.g. jerk limitation, smoothing of the acceleration profile).

Check travel	Homing	Test run
Determining the approach direction of the motor	Comparing the real situation with the image in the controller	Checking the overall behaviour

Tab. 3 Definitions

1. Start a **check travel** and limit it to low dynamic response.
   In spite of equal control, even motors of the same type sometimes turn in the opposite direction due to the circuitry. The spindle of the DMES turns in a clockwise direction. When the drive trunnion is turned clockwise, the slide moves in the direction of the motor.
2. Start **homing** limited to low dynamic response. Only go as far as the end stop on the motor side. Providing the permitted impact energy is not exceeded, homing may be made directly against the mechanical end position.
   Maximum impact energy (= ½ load x speed^2):
   – DMES-18: Max. 0.12 x 10^{-3} J
   – DMES-25: Max. 0.3 x 10^{-3} J
   – DMES-40: Max. 1.0 x 10^{-3} J
   – DMES-63: Max. 3 x 10^{-3} J
3. Start a **test run** and limit it to low dynamic response.
4. Check whether the DMES fulfils the following requirements:
   – The slide must be able to move through the complete intended positioning cycle.
   – The slide must stop as soon as it reaches a limit switch.
5. If the proximity sensors fail to respond, see ➔ 12 Troubleshooting and the operating instructions for the proximity sensors.

8 Operation

Warning
Moving loads can cause personal injury and material damage (risk of crushing).
- Make sure that, in the path of the moving components
  - nobody can place his/her hand (e.g. through a protective guard),
  - there are no foreign objects in the path of the moving components.

  It should not be possible to touch the DMES until the load has come to a complete standstill.

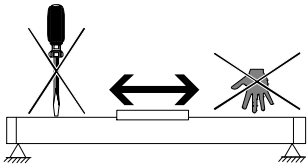


Fig. 18

For installation in a vertical or inclined position:

Warning
Injury to people and material damage!
In the event of a spindle nut fracture (e.g. due to wear) inside the DMES, the work load will slide down.
- Check whether additional external safety measures to protect against spindle nut fracture are necessary (e.g. toothed latches or movable bolts).
- Replace the spindle nut and if necessary spindle if the permitted axial play is exceeded.

If the motor turns in the wrong direction:

Note
The motor MTR-DCI is rotatable ➔ Assembly instructions for the motor mounting kit [10].
The reference position will then be lost.
- Start homing to reference the positioning cycle anew ➔ 7 Commissioning.

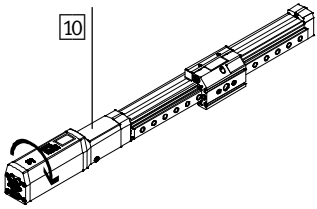


Fig. 19

9 Maintenance and care

Each time maintenance is carried out:

- Check the **reversing play (axial play)** of the slide for wear of the spindle nut. Maximum axial play permitted is:

DMES-18	DMES-25	DMES-40	DMES-63
0.37 mm	0.62 mm	1.0 mm	1.5 mm

If the maximum permitted axial play is exceeded:

Warning
If a worn spindle nut breaks on a vertical or sloping DMES, the work load will fall. Uncontrolled payloads can cause personal injury and material damage (risk of crushing).
- Send the DMES to Festo for repairs.

- Make sure that the connection between the driver and the slide is set free of play and tension.
  Fig. 20 shows the critical points.
  The backlash-free setting is accomplished using the slide screws [3] in Fig. 1.

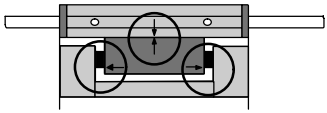


Fig. 20

Cleaning and maintenance:

- Clean the cover strip and guide rail if required with a soft cloth. Cleaning agents: All non-abrasive agents.
- Lubricate the cover strip and the guide rail (...-KF) if the layer of grease is no longer sufficient.
- Use for:
  – the cover strip: Lubricating grease
  – the guide rail ...-KF: Roller bearing grease
  (➔ 11 Accessories).

Fig. 21

Lubricating the spindle and spindle nut:

1. Observe the lubricating intervals: Every 35 km.
   Reduce the lubricating intervals for traversing distances < 50 mm.
2. Take out the blanking screw from the lubricating hole [13]
   (➔ Fig. 1).
3. Move the slide into the lubricating position on the motor side until the lubricating hole in the spindle nut is accessible through the housing bore.

4. Grease the DMES via the lubricating hole (grease gun, lubrication adapter and lubricating grease: ➔ 11 Accessories).
5. Move the slide along the complete positioning path in order to distribute the grease evenly.

Lubrication of the linear roller bearing DMES-...-KF:

The roller bearings do not need to be relubricated under normal operating conditions
(lubricating interval every 5000 km).

- Lubricate the roller bearings, however:
  - In a dusty and contaminated environment
  - For nominal strokes < 50 mm
  - If the DMES is > 3 years old
- Grease the slide bearings at all lubrication nipples 12. Roller bearing grease and grease gun with pinpoint nozzle (➔ 11 Accessories).
- Move the slide the complete travel distance during lubrication in order to distribute the grease evenly inside.

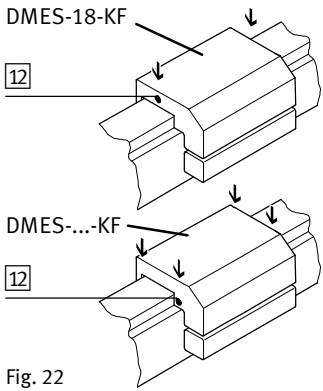


Fig. 22

10 Repair

- Recommendation: Send the DMES to our repair service.
  This will ensure that special attention is given to the necessary fine tuning and testing.
- Information about spare parts and accessories ➔ www.festo.com/spareparts.

11 Accessories

Note

- Please select the corresponding accessories from our catalogue ➔ www.festo.com/catalogue.

Designation	Type	Part number/manufacturer
Grease gun with needle-pointed nozzle	LUB-1	647 958[1)]
Lubrication adapter, axial output (for spindle nut)	LUB-1-TR-I	647 959[1)]
Lubrication adapter, radial output (for roller guide)	LUB-1-TR-L	647 960[1)]
Lubricating grease	LUB-KC1	from Festo[1)]
Roller bearing grease for DMES-...-KF	Rhenus Norlith STM 2	Rhenus Lub GmbH & Co. KG

1) ➔ Spare-parts catalogue at www.festo.com/spareparts

Tab. 4

12 Troubleshooting

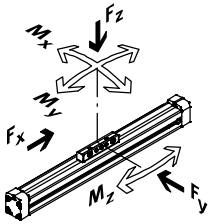
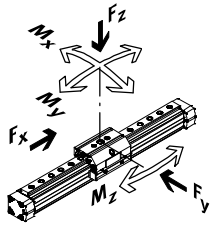
Malfunction	Possible cause	Remedy
Axial play too large (“Maintenance and care”)	Wear	– Send the DMES to Festo for repair
Squeaking noises or vibrations	Distortions	– Install the DMES so it is free of tension (evenness of the bearing surface: ≤ 0.2 mm) – Grease the DMES (➔ 9 Maintenance and care) – Modify travel speed
Slide does not move	Ambient temperature too low (increased breakaway torque in initial run due to increasing viscosity of the lubricants in the spindle system)	– Reduce load mass – Reduce travel speed – In the case of servo motors, it may be necessary to allow higher peak current (➔ Operating instructions for the motor) – Adjust ambient temperature

Tab. 5

13 Technical data

Type	DMES-18	DMES-25	DMES-40	DMES-63
Design	Positioning axis with rotatable spindle			
Permissible temperature range	0 ... +50 °C (ambient temperature)			
Installation position	Any			
Degree of protection	IP40 or IP42 depending on the mounting position (➔ 6.1 Mechanical installation)			
Evenness of the bearing surface	≤ 0.2 mm			
Speed	Max. 50 mm/s			
Feed constant[1)]	1.5 mm / revolution	2.5 mm / revolution	4 mm / revolution	6 mm / revolution
Repetition accuracy[2)]	±0.05 mm			±0.07 mm
Position elasticity[3)]	1/1700 mm/N	1/2300 mm/N	1/4200 mm/N	1/5600 mm/N
Axial play (new)	≤ 0.1 mm			
Axial play (defective)[4)]	Max. 0.37 mm	Max. 0.62 mm	Max. 1.0 mm	Max. 1.5 mm

1) Nominal value: Varies due to component tolerances.
2) Based on DIN 230 T2.
3) Elastic deformation of the DMES in an axial direction when in a blocked position (automatic locking or blocked drive trunnion); the value is to be multiplied by the respective load Fx (payload).
4) ➔ 9 Maintenance and care

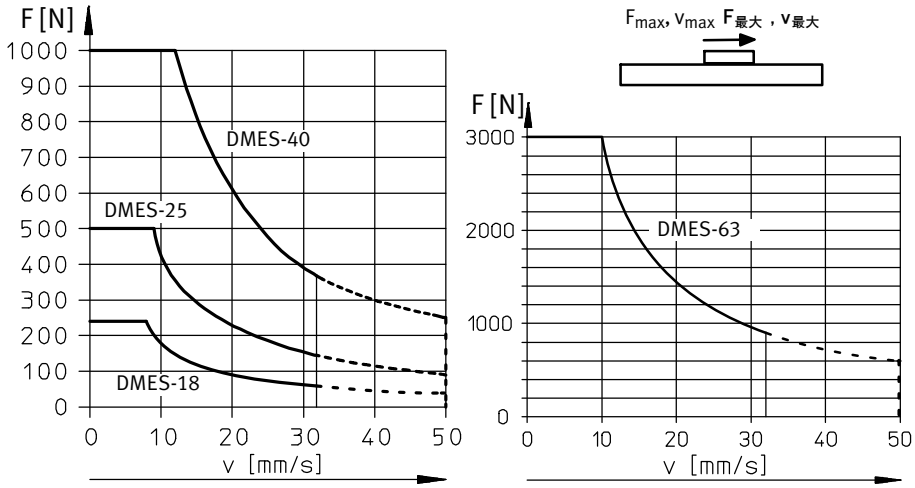
Type	DMES-18	DMES-25	DMES-40	DMES-63
Maximum forces and torques				
Feed force and Input torque	➔ Appendix, page 19 (max. axial forces ...) and page 20 (max. input torques ...)			
Max. radial force on drive shaft	40 N	75 N	250 N	800 N
	Variant DMES without slide			
	F_y = 36 N F_z = 80 N M_x = 0.4 Nm M_y = 2 Nm M_z = 0.7 Nm	F_y = 80 N F_z = 100 N M_x = 1.3 Nm M_y = 4 Nm M_z = 1.6 Nm	F_y = 92 N F_z = 390 N M_x = 2.2 Nm M_y = 20 Nm M_z = 4.6 Nm	F_y = 300 N F_z = 900 N M_x = 12 Nm M_y = 80 Nm M_z = 22 Nm
	Variant DMES-...-KF with roller bearing guide (GA ≙ GK)			
	$F_{y,z}$ = 930 N M_x = 7 Nm $M_{y,z}$ = 23 Nm (GK) = 45 Nm (GV)	$F_{y,z}$ = 2600 N (GK) = 3080 N (GV) M_x = 45 Nm $M_{y,z}$ = 85 Nm (GK) = 170 Nm (GV)	$F_{y,z}$ = 4300 N (GK) = 7300 N (GV) M_x = 160 Nm (GK) = 170 Nm (GV) $M_{y,z}$ = 330 Nm (GK) = 660 Nm (GV)	$F_{y,z}$ = 6600 N (GK) F_y = 13900 N (GV) F_z = 14050 N (GV) M_x = 400 Nm (GK) = 580 Nm (GV) $M_{y,z}$ = 910 Nm (GK) = 1820 Nm (GV)
Condition for combined loads	$\frac{\lvert Mx\rvert}{Mx_{max}} + \frac{\lvert My\rvert}{My_{max}} + \frac{\lvert Mz\rvert}{Mz_{max}} + \frac{\lvert Fy\rvert}{Fy_{max}} + \frac{\lvert Fz\rvert}{Fz_{max}} \leq 1$			
Materials	Cylinder profile, end cap, slide, piston: Wrought aluminium alloy Lead screw spindle, ball bearing, cover strip, guide rail KF: Steel Spindle nut: POM, PTFE Internal stops: PA			

Tab. 6

14 Characteristic curves

14.1 F_{max}, v_{max}

EN: Maximum axial forces F_{max} and speeds v_{max}



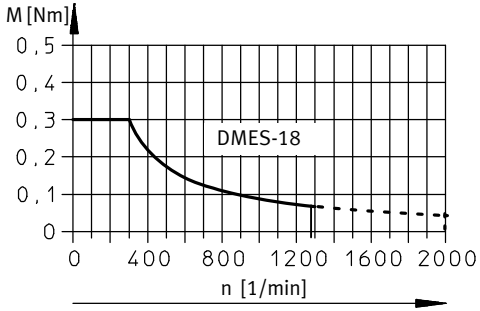
Recommended

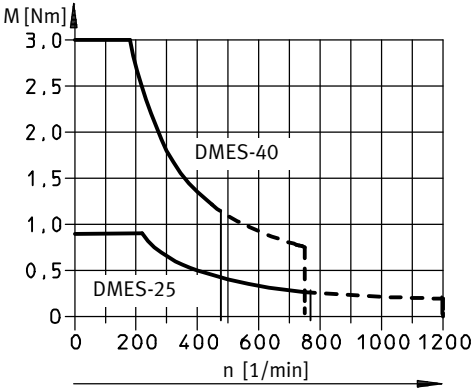
Permitted

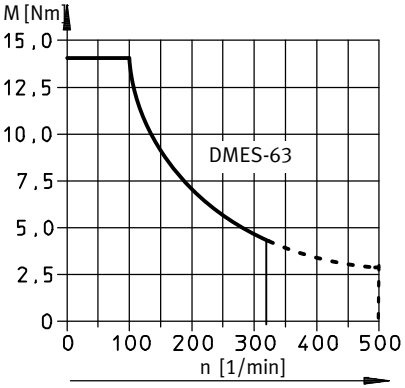
Permitted with low switch-on duration with adequate cooling phases.

14.2 M_{max}, n_{max}

EN: Max. input torques M_{max} and rotational speeds n_{max} [Rpm]







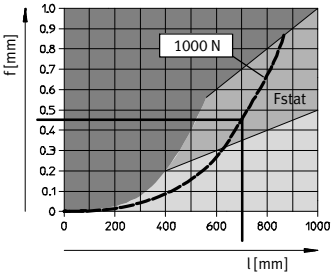
——— Recommended

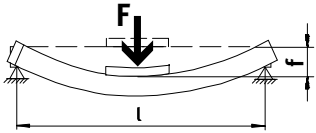
— — — Permitted:

Permitted with low switch-on duration with adequate cooling phases..

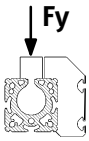
14.3 Deflection

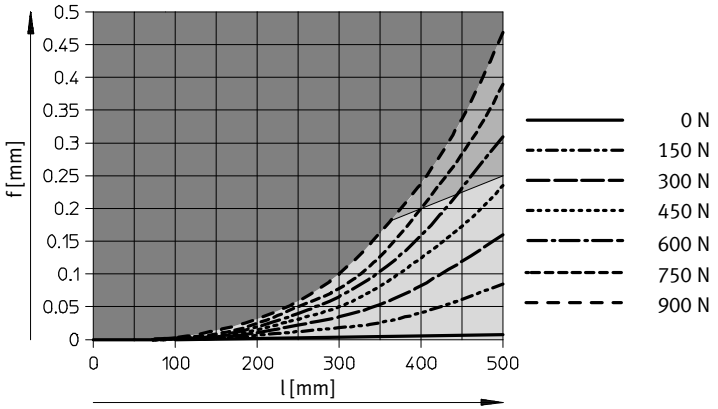
- EN: Reading example for the following diagrams
  With a loading of 1000 N and a distance of 700 mm between supports the DMES-... will bend 0.45 mm.
  F_{stat}: In the "F_{stat}" range only static loadings are permitted (slide stands still).



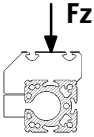


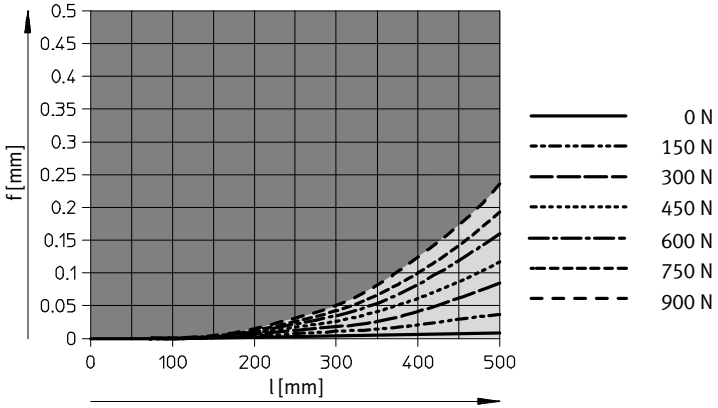
DMES-18-KF (Fy)





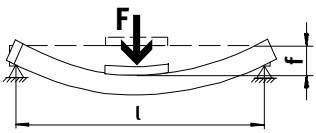
DMES-18-KF (Fz)



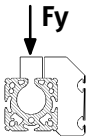


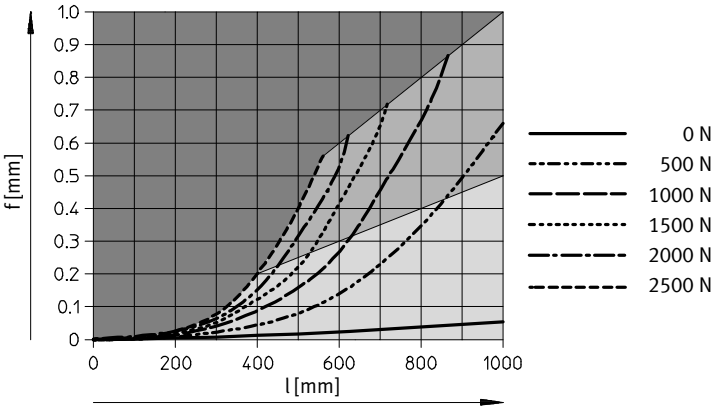
not permitted

F_{stat} Load is only permissible during standstill

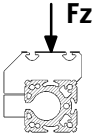


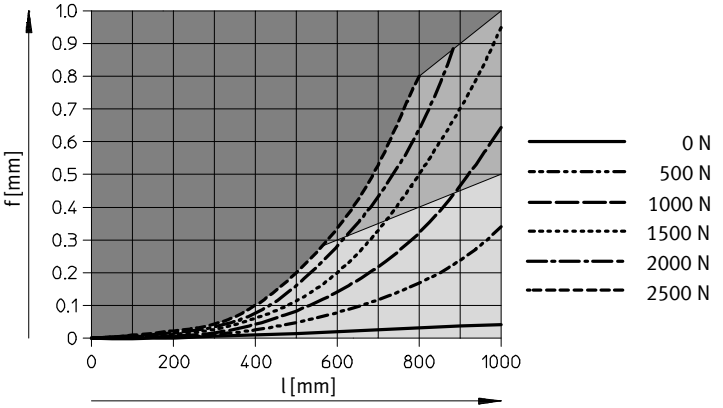
DMES-25-KF (Fy)





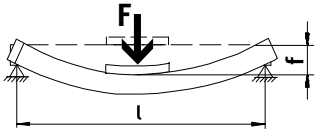
DMES-25-KF (Fz)



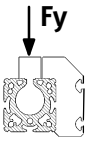


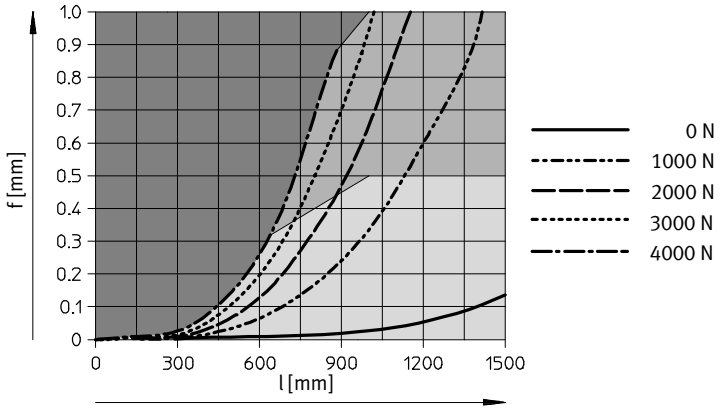
not permitted

F_{stat} Load is only permissible during standstill

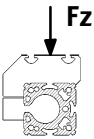


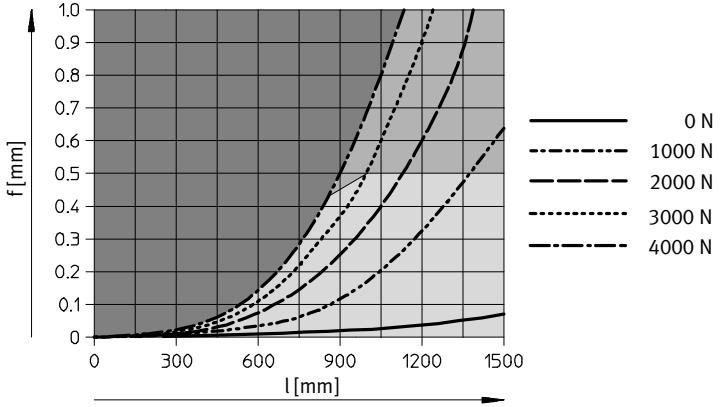
DMES-40-KF (Fy)





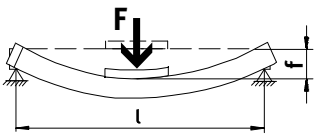
DMES-40-KF (Fz)



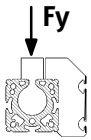


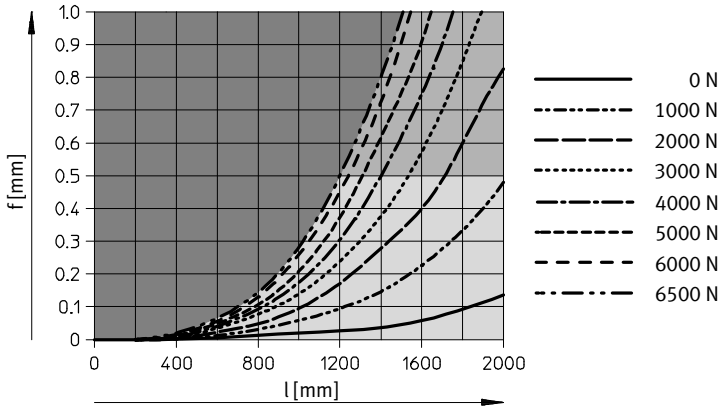
not permitted

F_{stat} Load is only permissible during standstill

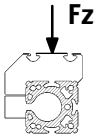


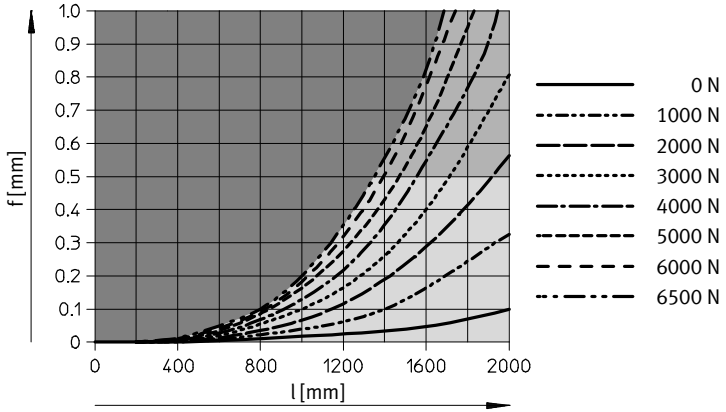
DMES-63-KF (Fy)





DMES-63-KF (Fz)





not permitted

F_{stat} Load is only permissible during standstill

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