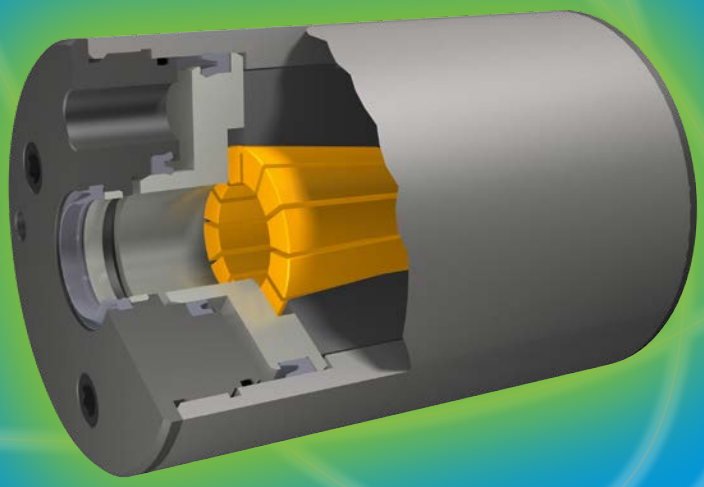
mayr®

your reliable partner

ROBA®-linearstop

Safety brake systems for gravity loaded axes



TÜV SÜD

Type 381

Construction and Development

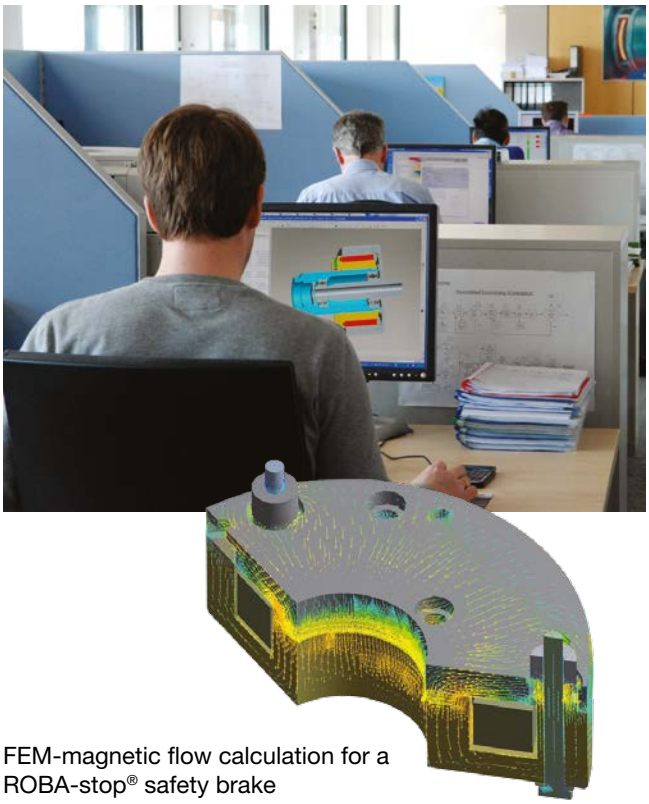
Innovations for Your Success

With our innovative and economical solutions, we are able to set new records in the field of power transmission. Our many worldwide patents prove our constant ambition of developing better and technologically superior products.

Highly qualified engineers, high-performance 3D-CAD-systems and the most up-to-date FEM calculation aids used in our Development and Construction departments mean that our business is perfectly equipped to offer our customers effective solutions.

Experts for all Power Transmission Questions

Exploit our know-how, gained by decades of experience in the development, production and application of power transmission products. Our experts in Construction and Development are happy to advise you personally and competently when selecting and dimensioning the drive solution you require.



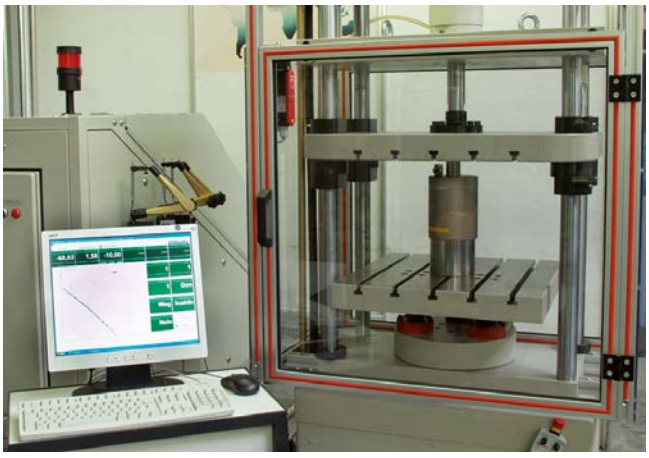
FEM-magnetic flow calculation for a ROBA-stop® safety brake

From Prototype to Finished Product

No mayr® product is released onto the market until it has proved its functional capabilities and reliability in extreme, long-term tests.

The spectrum of test stands is as varied as our range of products:

- ❒ Friction work test stands
- ❒ Wear test stands
- ❒ Noise measurement room with highly accurate noise measurement inspection devices
- ❒ Torque inspection stands up to 200.000 Nm
- ❒ Impact and alternating load test stands
- ❒ Force test stands
- ❒ Linear movement test stands
- ❒ Continuous performance test stands
- ❒ Magnetic flux measurement test stands
- ❒ High-speed test stands up to 20.000 rpm
- ❒ Misalignment and angular misalignment test stands
- ❒ Load and measurement test stands for DC motors



Product Data: Our 24-hour Service

Our website offers you detailed information 24 hours per day, 365 days per year with no delays. Here you can find not only the latest catalogues and technical documentation but also CAD-files for cost-saving construction of our products.

Unsurpassed - Our Standard Programme

For safety clutches, safety brakes, backlash-free shaft couplings and high-quality DC drives, we offer you a complete product range with market and branch optimised constructions and designs.

A Worldwide Presence

Our Sales and Service network is constantly expanding. We guarantee you and your customers almost all over the world local representation. With eight branch firms in France, Switzerland, Italy, England, Poland, the USA, Singapore and China as well as around 30 representatives and eight subsidiaries in Germany, we provide local service for our customers in all important industrial areas.

Total Quality Management

Product Quality

Every delivery which leaves our firm has been subjected to a careful quality inspection, meaning that you are able to rely 100 % on *mayr*® products. If required, we pre-adjust our clutches and brakes accurately to the requested values and confirm the product characteristics with an Inspection Report.

Quality Management

mayr® uses the term quality to describe its products and services. Certification of our quality management confirms the quality-consciousness of our colleagues at every level of the company.

Our integrated management system is certified according to **DIN EN ISO 9001:2000 (Quality)** and **DIN EN ISO 14001 (Environment)** and complies with the **OHSAS 18001/OHRIS (Occupational Health and Safety)** demands.

Individual and Flexible Logistics

Flexible and optimally qualified colleagues ensure that your order is delivered according to schedule and with the most appropriate delivery method. We take into account your individual packaging and dispatch regulations as a matter of course. Our modern high rack warehouse has a permanently available stock of our wide standard product selection.

And if you are really in a hurry, simply use our uniquely-quick basic product delivery service!

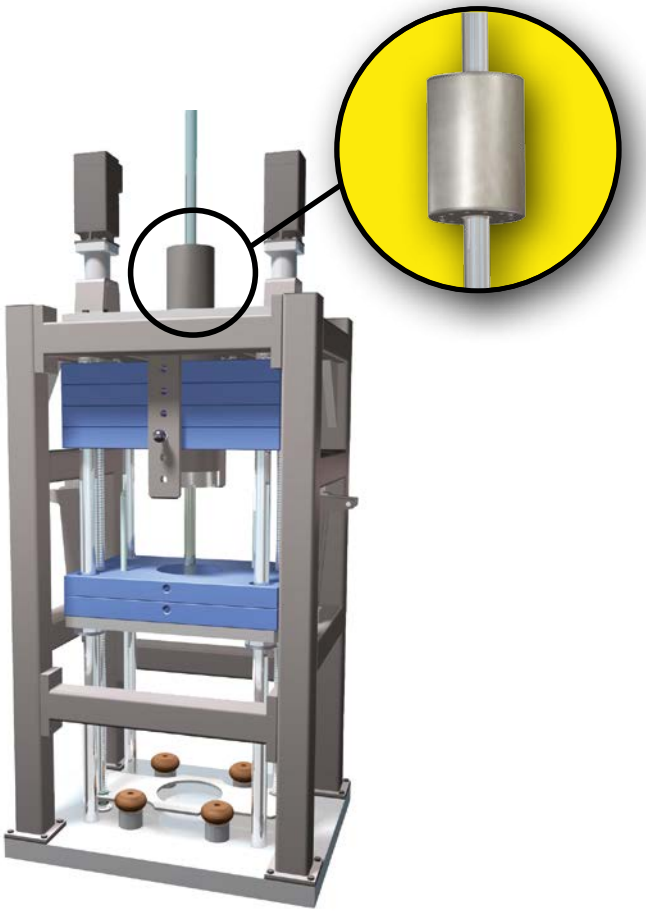
ROBA®-linearstop

The perfect safety brake for linear-moving axes

Versatile use as safety brake or clamping unit

As a new brake system, the ROBA®-linearstop offers unique possibilities for increasing the safety of machinery. As a compact brake unit it can be integrated into already existing machinery and system constructions easily, quickly and without extensive adjustment work. The unit having a direct effect on the rod brakes independently from the drive system.

Die ROBA®-linearstop pneumatic can be attached to standardized cylinders acc. ISO 15552.
The ROBA®-linearstop pneumatic is not only a holding device, but can also brake dynamically on a rod. The system has been designed according to the “Principles for the inspection and certification of pneumatic braking/holding devices with safety function for linear drives” of the German Trade Association Institute for Work Safety (BIA Berufsgenossenschaftliches Institut für Arbeitsschutz) and has been tested by the **TÜV-SÜD** (German Technical Inspectorate).
The new electromagnetic ROBA®-linearstop is designed as a clamping unit.



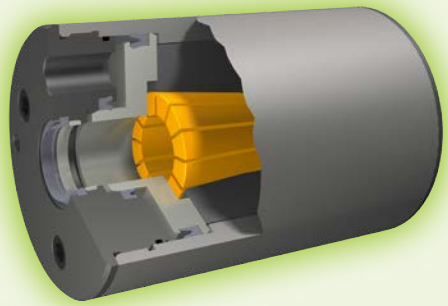
ROBA®-linearstop in an endurance test on a drop test stand
On the *mayr*®drop test stand specially designed for linear brakes, the braking force, dynamic braking path, switching times and position accuracy can be tested extensively.

Arrangement of the hydraulically actuated safety brake
ROBA®-linearstop in a universal lathe.
- Piston rod secured on one side

ROBA®-linearstop
Hydraulic – Pneumatic – Electromagnetic

Highlights and Advantages

- ❒ Safety brake system according to the fail-safe principle
- ❒ Backlash-free force transmission having an effect on both sides
- ❒ No self-reinforcement during clamping
- ❒ Clearing the clamping device is not necessary
- ❒ Maximum performance density
- ❒ Suitable for EMERGENCY STOP braking actions
- ❒ Suitable for dynamic braking actions
- ❒ Minimum reaction times
- ❒ Integrated switching condition monitoring possible
- ❒ Long service lifetime
- ❒ Can easily be integrated into existing constructions



ROBA®-linearstop hydraulic
Type 380.01 _.0

Clamps a piston rod via a spring-loaded device at the exact position required and backlash-free.
The brake is opened with a hydraulic pressure of 35 – 75 bar.
Suitable for EMERGENCY STOP braking actions.

Nominal holding force: 4000 – 50000 N

For data and description, please see pages 6/7.

ROBA®-linearstop pneumatic
Type 381. 0 _ _ . _ (acc. Trade Association test regulation)

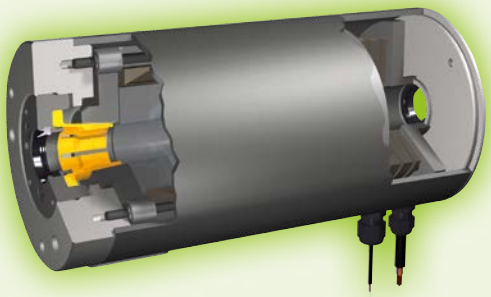
Clamps a piston rod via a spring-loaded device at the exact position required and backlash-free. The brake is opened with a pneumatic pressure of 4 – 6 bar.
Suitable for EMERGENCY STOP braking actions (tested by **TÜV-SÜD**, German Technical Inspectorate).

Type 381. 1 _ _ . _ for dynamic braking actions (acc. Trade Association test regulation)

Clamps and brakes a piston rod via a spring-loaded device at the exact position required and backlash-free. The brake is opened with a pneumatic pressure of 4 – 6 bar. If the Technical Data are observed, more than 20,000 dynamic braking actions are possible (tested by the **TÜV-SÜD**, German Technical Inspectorate).

Nominal holding force: 450 – 40000 N

For data and description, please see pages 8/9.



ROBA®-linearstop electromagnetic
Type 382.0_ _._

Clamps a piston rod via a spring-loaded device at the exact position required and backlash-free.
Brake is opened through electromagnetic actuation with DC current.

Nominal holding force: 200 – 17000 N

For data and description, please see pages 12/13.

ROBA®-linearstop hydraulic

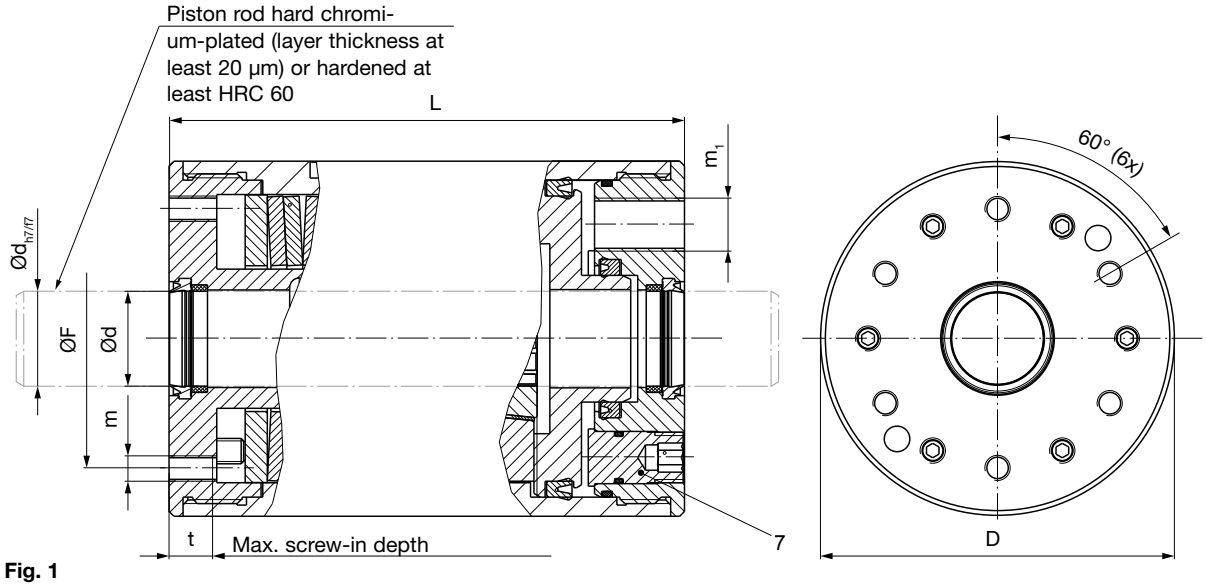


Fig. 1

State of Delivery

ROBA®-linearstop brakes are manufacturer-assembled ready for installation and set to the nominal holding force stipulated in the order.
If the customer does not stipulate a force adjustment in the order, the brake is set to the maximum nominal holding force acc. Table “Technical Data”.

Important!

If installation is to be carried out without pressurization, the three emergency release screws (7) must be screwed in up to their limit (state of delivery).
Before initial operation, please read and observe the respective Installation and Operational Instructions.

Function

Due to the spring-loaded system, the fail-safe principle is guaranteed, and the **ROBA®-linearstop** works as a safety brake. For the required release pressure (operating pressure), please see table “Technical Data”.
The max. sliding speed is 2 m/s.

For permitted friction work in case of EMERGENCY STOP braking actions, please contact *mayr®* power transmission.

The spring-loaded, enclosed **ROBA®-linearstop**, which can be opened hydraulically, clamps a piston rod steplessly and backlash-free.

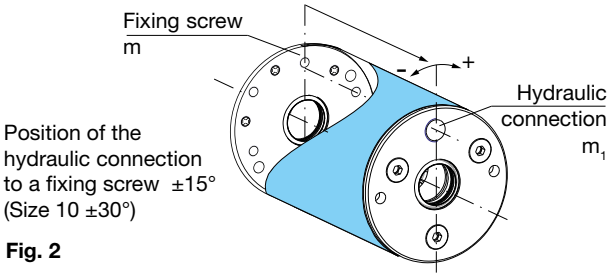


Fig. 2

Maintenance/Switching Frequency

The **ROBA®-linearstop** is designed for a switching frequency of 1.000.000 switchings (higher switching frequencies available on request).
The **ROBA®-linearstop** is mainly maintenance-free.
The piston rod must be checked regularly (at least every 6 months) for contamination with friction value-reducing materials; it must be cleaned, if necessary.
In case of major accumulation of dust and dirt, or in extreme ambient conditions, special maintenance work is required.
(Please contact *mayr®* power transmission).

Order Number

Standard (without additional part)	0
Switching condition monitoring (Fig. 4, Item 10)	1

Nominal holding force
see “Technical Data”

__	/	3	8	0	.	0	1	__	.	0	/	__	/	__						

Sizes 10 to 40

Operating pressure
see “Technical Data”

Example: Order number 10 / 380.010.0 / 40 / 6000

Technical Explanations

Technical Data			Size															
			10				20				30				40			
Nominal holding force [1] F_{Nenn}		[kN]	4	6	8	10	8	12	16	20	20	25	30	35	35	40	45	50
Operating pressure [2]	min.	[bar]	35	40	50	60	40	50	60	70	50	55	65	75	55	60	65	70
	max.	[bar]	150				150				160				160			
Weight		[kg]	4.9				11				14.7				26.8			
Threads for hydraulic connection	m_1		1/4”				3/8”				3/8”				3/8”			
Tightening torque against limit stop	Emergency release screw (7)	[Nm]	10															
Pressure medium			Use hydraulic oil acc. DIN 51524-1:2006-04															
Absorption volume		[cm³]	4				7				11				16			
Ambient temperature		[°C]	-10 to +60															

Dimensions [mm]	Size			
	10	20	30	40
D	91	112	140	170
d	30	30	40	50
F	63	82	115	135
L	131	163	172	189
m	6 x M8	6 x M8	6 x M10	6 x M16
t	14	14	14	25

1) Minimum holding force when the brake is not pressurised and when the brake rod is dry or moistened with mineral oil.
2) Please contact the company *mayr*® if
- a nominal holding force other than the one stated is required
- the required minimum operating pressure is not available.

Options (see also order number, page 6)

Switching condition monitoring
(Type 380.011.0)

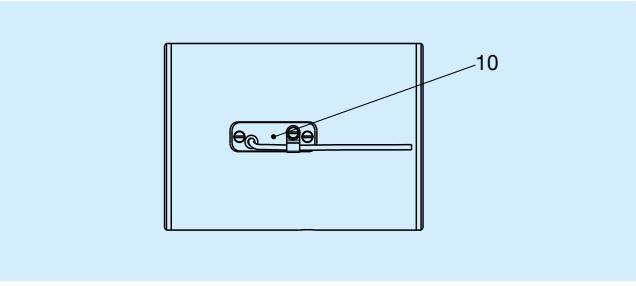


Fig. 4

Controls (Fig. 3)

The company *mayr*® recommends hydraulic controls as shown in Fig. 3. During every operating movement of the piston rod, the 3/2-directional control valve is switched electrically and the linear brake is released. In all other operating conditions, the piston rod is held by the linear brake.

Recommendation:

- Pressure fluctuations can be reduced through a non-return valve.
- In order to guarantee fastest possible switching of the brake, the largest possible line diameter should be used in the area of the return flow line. Furthermore, do not install any choke valves in this area and keep the hydraulic lines between the brake and the valve as short as possible!

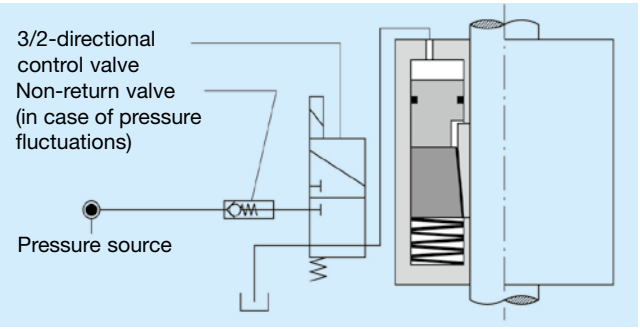


Fig. 3

Brake Rod

The *mayr*® power transmission recommends the use of piston rods.

Piston rod requirements

➔ see page 11

At higher loads, we recommend using a higher strength material.

Yield point	min. 520 N/mm² (e. g. 42CrMo4)

ROBA®-linearstop pneumatic

Can be attached to standardized cylinders acc. ISO 15552

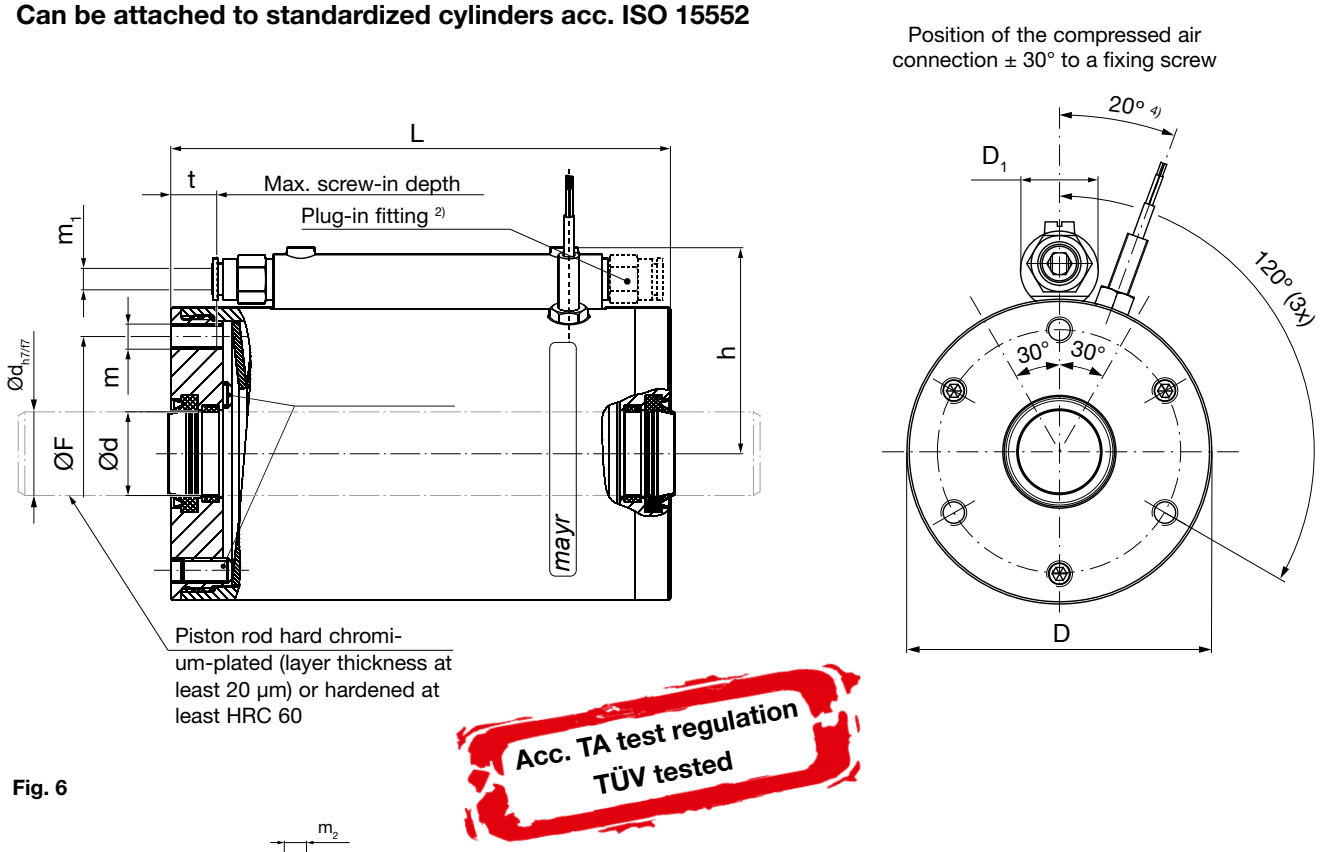


Fig. 6

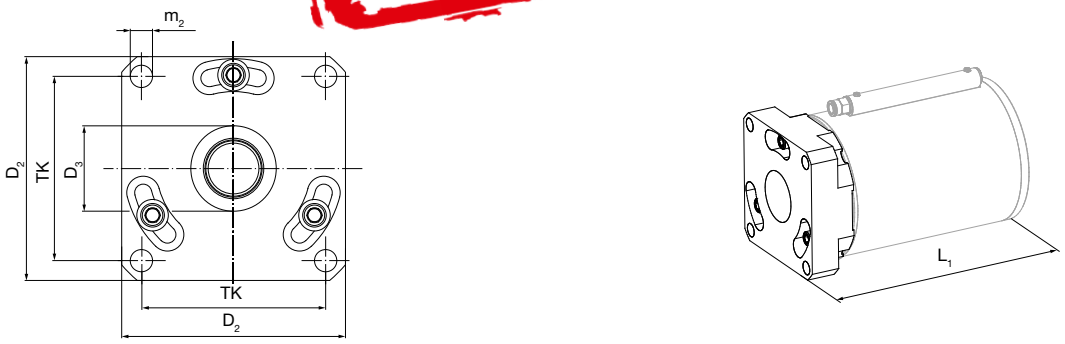


Fig. 7: Adaptor for standardized cylinder (can be attached to standardized cylinder acc. ISO 15552)

Order Number

Standard	0	**0**	Standard	
Switching condition monitoring	1	**1**	Adaptor for standard cylinder 3)	

__ / 3 8 1 . __ __ __ . __ / __ / __

Size 1)						
20 to 80	Clamping unit / Brake unit	**0 / 1**	**Nominal holding force**	Operating pressure	Nominal holding force
			0 Standard **1** Increased **2** Maximum	see “Technical Data”	

Example: Order number 60 / 381.121.0 / 5.0 / 10900

1) For other construction sizes, please contact *mayr*® power transmission
2) The plug-in fitting can be screwed onto both sides (not available on size 20 and 30)
3) Size 40 with adaptor for standard cyclinder can only be delivered with elbow connector (see “Options”)
4) On size 20 = 30°, on size 30 = 25°

Technical Data			Size					
			20	30	40	60	70	80
Nominal holding force [1) 2) 4)] (minimum holding force) **F_{Nenn} [N]** (the nominal holding force is adjusted at the place of manufacture depending on the existing operating pressure [3)])	**4.0 bar**	**Type 381._0_._**	450	800	1500	4600	7500	12500
		Type 381._1_._	625	1100	2100	6300	10000	17500
		Type 381._2_._	750	1400	2650	8200	13000	23000
	4.5 bar	**Type 381._0_._**	525	950	1800	5300	8500	14500
		Type 381._1_._	725	1250	2400	7300	11600	20000
		Type 381._2_._	875	1600	3050	9500	15200	26500
	5.0 bar	**Type 381._0_._**	575	1050	2000	6000	9600	16500
		Type 381._1_._	800	1450	2700	8300	13300	23500
		Type 381._2_._	1000	1800	3500	10900	17500	30500
	5.5 bar	**Type 381._0_._**	650	1200	2250	6700	10800	18500
		Type 381._1_._	900	1550	3000	9400	15000	26000
		Type 381._2_._	1100	2000	3950	12300	19700	35000
	6.0 bar	**Type 381._0_._**	700	1300	2500	7500	12000	21000
		Type 381._1_._	975	1750	3400	10500	16700	30000
		Type 381._2_._	1200	2200	4400	13800	22500	40000
Max. operating pressure	**[bar]**		8					
Weight	**[kg]**	**Type 381._0_._**	0.81	1.2	2	6	10.5	19
		Type 381._1_._	0.9	1.4	2.3	6.6	11.5	21
		Type 381._2_._	1.0	1.5	2.5	7.1	12.5	23
Air consumption per switching procedure in standard litres at 6.0 bar	**[cm³]**	**Type 381._0_._**	25	45	83	244	389	635
		Type 381._1_._	34	60	111	325	519	847
		Type 381._2_._	42	75	139	406	648	1058
Plug-in fitting m[1]	**[mm]**	**Tube outer diameter**	6	6	8	10	10	12
Pressure medium			Compressed air quality acc. ISO 8573-1 Class 4					
Ambient temperature	**[°C]**		-10 to +60					

1) Type 381.0 Nominal holding force when the brake is not pressurized, and with the piston rod dry or moistened with mineral oil.
2) Type 381.1 Nominal holding force when the brake is not pressurized, and with a dry piston rod.
3) Please contact the company *mayr*® if
- a nominal holding force other than the one stated is required
- the required minimum operating pressure is not available.

4) At a switching frequency > 200.000, please reckon with a nominal holding force reduction of 20 %.

Dimensions [mm]		Size					
		20	30	40	60	70	80
D		46	56	70	110	140	178
D_1		15	15	18	21	24	25
d		16	20	20	25	32	40
F		34	44	56	90	112	142
h		37.3	42.3	52.8	75.9	94.4	113.9
L	Type 381._0_._	110.5	114.5	119.5	140.5	161	187
	Type 381._1_. _	129.2	133.7	138.7	162.5	187	216.8
	Type 381._2_._	147.9	152.9	157.9	184.5	213	246.6
m		3 x M5	3 x M6	3 x M6	3 x M8	3 x M10	3 x M12
t		13.5	12.5	12.5	13.5	13.5	16.5

Adaptor for Standard Cylinder acc. ISO 15552

Dimensions [mm]	Size					
	20	30	40	60	70	80
D_2	54	65	72.5	109	136	175
D_3	35.5	40.5	45.5	55.5	60.5	65.5
L_1	**L** + 29	**L** + 39	**L** + 30	**L** + 39	**L** + 48	**L** + 57
m_2	4 x M6	4 x M8	4 x M8	4 x M10	4 x M12	4 x M16
TK	38	46.5	56.5	89	110	140
Suitable for standard-based cylinder [piston Ø]	40	50	63	100	125	160

We reserve the right to make dimensional and constructional alterations.

ROBA®-linearstop pneumatic

Technical Explanations

State of Delivery

ROBA®-linearstop brakes are manufacturer-assembled ready for installation and set to the nominal holding force stipulated in the order.

Before initial operation, please read and observe the respective Installation and Operational Instructions.

Function

The spring-loaded, enclosed ROBA®-linearstop (Type 381.0_ _ _), which can be opened pneumatically, clamps a piston rod steplessly and backlash-free.
The ROBA®-linearstop (Type 381.1_ _ _) clamps and brakes a piston rod steplessly and backlash-free.
Due to the spring-loaded system, the fail-safe principle is guaranteed, and the **ROBA®-linearstop** works as a safety brake. For the required operating pressure, please see Table "Technical Data".
The max. sliding speed is 2 m/s.

Maintenance/Switching Frequency

The **ROBA®-linearstop** is designed for a switching frequency of 2.000.000 switchings (higher switching frequencies available on request).
The **ROBA®-linearstop** is mainly maintenance-free.
The piston rod must be checked regularly (at least every 6 months) for contamination with friction value-reducing materials; it must be cleaned, if necessary.
In case of major accumulation of dust and dirt, or in extreme ambient conditions, special maintenance work is required.

(Please contact *mayr®* power transmission).

Controls (Fig. 8)

The piston space is filled with compressed air, thus suspending the spring force. The compressed air in the piston space is deduced in case of power failure. The spring force has an effect on the clamping element. The piston rod clamps/ brakes reliable and safely.
The mayr® power transmission recommends the following pneumatic control units.

Controls for switching time-related applications
Recommendation!
For applications to optimize the switching time
(reduction of the braking distance)

Controls for safety-related applications
Recommendation!
For applications to optimize the safety
(in case of danger to people)

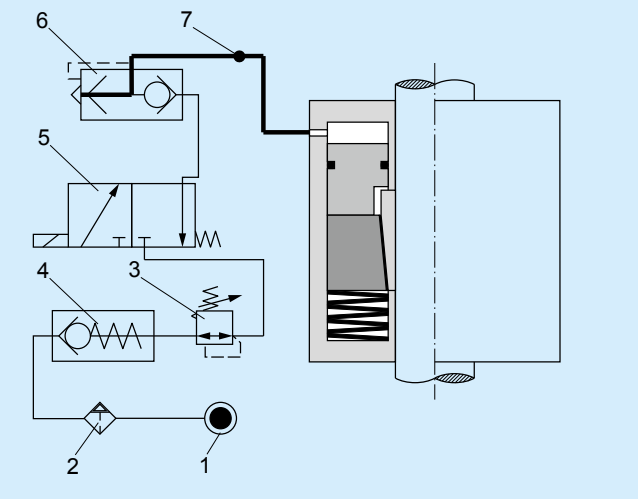


Fig. 8

Item	Name
1	Pressure source 4 – 6 bar
2	Maintenance unit
3	Pressure reducer (switching time-related application)
4	Non-return valve (in case of pressure fluctuations)
5	3/2-directional control valve
6	Quick-action ventilating valve (switching time-related application)
7	Pressure switch (safety-related applications)

Please find a detailed description in the respective Installation and Operational Instructions (go to www.mayr.com).

Options (available on request)

Wear monitoring
(proximity switch)

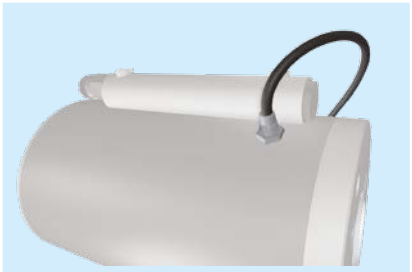


Fig. 9

Adaptor
(both sides)

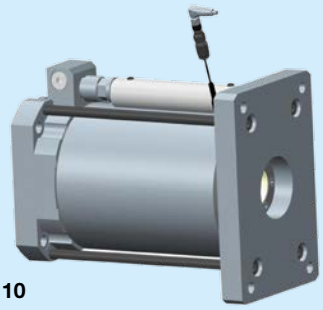


Fig. 10

Elbow connector
(for pneumatic connection)

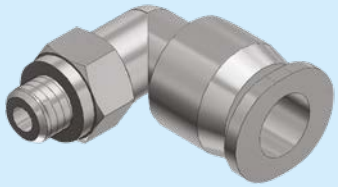


Fig. 11

Design
with increased corrosion protection

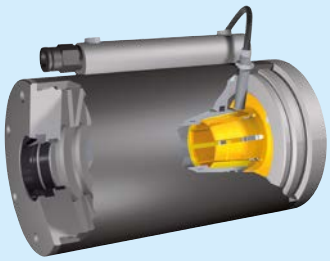


Fig. 12

Connection for sealing air

Fig. 13

Installation
(on both sides)

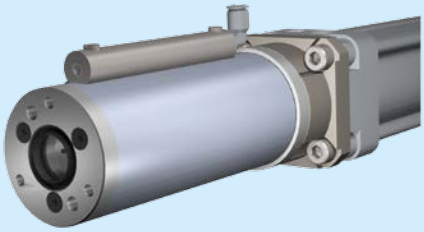


Fig. 14

Positioning flange

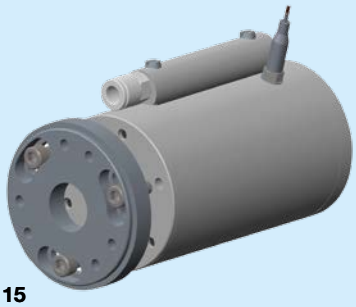


Fig. 15

Brake Rod

The *mayr*® power transmission recommends the use of piston rods.

Piston rod requirements*

	Steel, hard chromium-plated	Steel, hardened
Layer thickness	at least 20 µm	-
Hardness	-	at least HRC 60
Surface quality	Ra < 0.4 µm	
Yield point	min. 400 N/mm² (e.g. C45)	

Diameter tolerance	
Type 380, 381	h7 to f7
Type 382	f7

*) Piston rods are available as piece goods. Please contact the sales employee responsible or the company *mayr*® directly.

For the installation of the brake, we recommend an insertion chamfer (rounded edges) on the piston rod of min. 3 x 20 ° (Figure 16).

Friction value reducing residues on the piston rod must be avoided. Danger of load crashes.

Fig. 16 Piston rod with insertion chamfer

ROBA®-linearstop electromagnetic

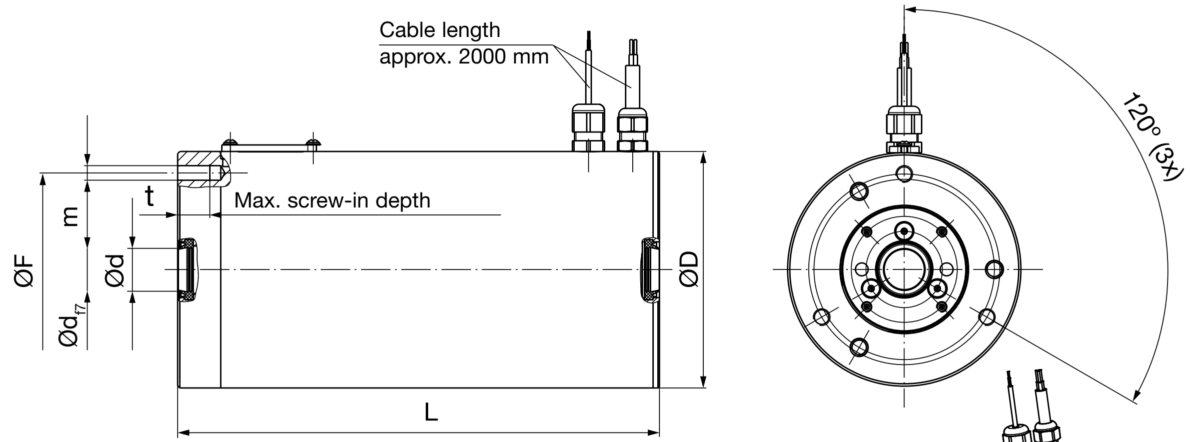
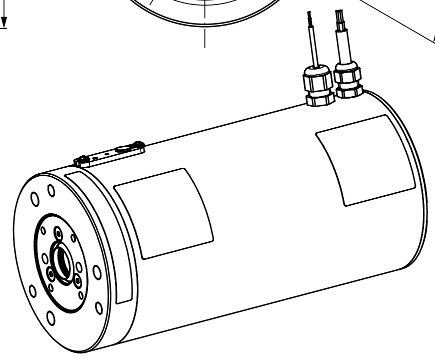


Fig. 17

Piston rod hard chromium-plated (layer thickness at least 20 µm) or hardened at least HRC 60



Technical Explanations

State of Delivery

ROBA®-linearstop brakes are manufacturer-assembled ready for installation and set to the nominal holding force stipulated in the order.

Before initial operation, please read and observe the respective Installation and Operational Instructions.

Function

Due to the spring-loaded system, the fail-safe principle is guaranteed, and the **ROBA®-linearstop** works as a safety brake.
The max. sliding speed is 2 m/s.

For permitted friction work in case of EMERGENCY STOP braking actions, please contact *mayr*® power transmission.

The spring-loaded, enclosed ROBA®-linearstop, which can be opened electromagnetically, clamps a piston rod steplessly and backlash-free.

Maintenance/Switching Frequency

The **ROBA®-linearstop** is designed for a switching frequency of 200.000 switchings (higher switching frequencies available on request).
The **ROBA®-linearstop** is mainly maintenance-free.
The piston rod must be checked regularly (at least every 6 months) for contamination with friction value-reducing materials; it must be cleaned, if necessary.
In case of very dusty or dirty conditions or in extreme ambient conditions, special maintenance work is necessary (please contact the manufacturers).

Order Number

Standard **0** Switching condition monitoring **1**	**0** Standard	with ROBA®-multiswitch (Article number)

__ / 3 8 2 . 0 __ __ . 0 / __ / __ / __

Size [1]		Nominal holding force	Coil nominal voltage [3]	
20 40 60 80 [2]	Clamping unit **0**	**0** Standard **1** Increased **2** Maximum	52 [VDC] other voltages available on request	Nominal holding force see "Technical Data"

Example: Order number 60 / 382.021.0 / 52 / 6500 / with ROBA®-multiswitch (Art. 8225580) No. 8____)

1) For other construction sizes, please contact *mayr*® power transmission
2) In preparation
3) Brake operation only possible with overexcitation and reduced voltage

Technical Data		Type	Size 20	40	60	80
Nominal holding force [1)2)] (Minimum holding force) F_{Nenn}	[N]	382.00_._	180	600	1800	4500
		382.01_._	360	1300	4000	10500
		382.02_._	550	2100	6500	17000
Weight	[kg]	382.00_._	0.9	2.4	3.4	14
		382.01_._	1.3	3.2	6.8	20
		382.02_._	1.7	4	10.3	26.3
Electrical power [W]	P_N	382.00_._	8.4	12.1	19.8	42
	P_O		133	191	314	665
	P_H		2.8	4	6.6	14
	P_N	382.01_._	16.7	24	40	84
	P_O		265	382	628	1329
	P_H		5.6	8	13.2	28
	P_N	382.02_._	25.1	36	59	126
	P_O		398	573	941	1994
	P_H		8.3	12	19.8	42
Max. switching frequency	[1/min]		3			
Ambient temperature	[°C]		-20 to +40			

Dimensions [mm]	Type	Size 20	40	60	80
D		50	75	110	160
d		10	12	20	25
F		42	56	90	140
L	382.00_._	95	107	132	155
	382.01_._	132	148	178	213
	382.02_._	169	189	224	270
m		3xM5	3xM6	3xM8	3 x M12
t		8	10	15	14

ROBA®-multiswitch	
Sizes 20 – 60	Article number 8225580
Size 80	Article number 8237887

We reserve the right to make dimensional and constructional alterations.

1) Minimum holding force when the brake is de-energised, and with the piston rod dry or moistened with mineral oil.
2) Please contact *mayr*® power transmission if
- a nominal holding force other than the one stated is required.
- a construction length other than the one stated is required.

Brake Rod

The *mayr*® power transmission recommends the use of piston rods.

Piston rod requirements

➔ see page 11

Electrical connection

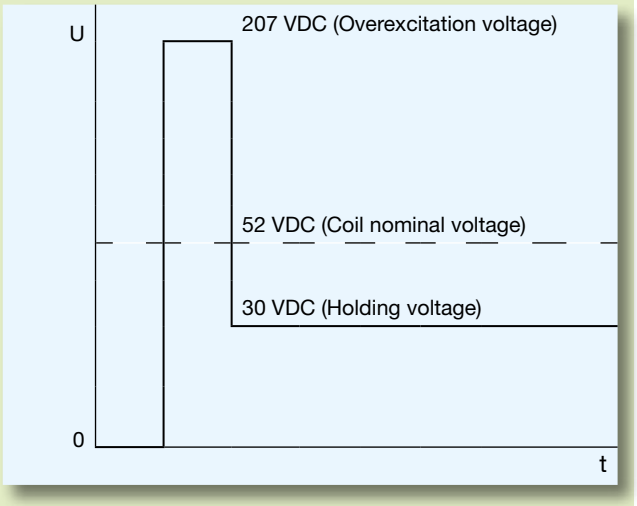
mayr® recommends the use of **ROBA®-multiswitch** (see Table).

ROBA®-multiswitch fast switching modules are used in order to connect ROBA®-linearstop Type 382.0_ _._ to AC voltage supplies

- Connection to 230 VAC
  (other connection voltages available on request)
- Overexcitation voltage 207 VDC *
- Holding voltage 30 VDC *

Fig. 18

In case of operation of the brake without ROBA®-multiswitch, please consult *mayr*® power transmission.



Time Diagram: Operation of the brake

For opening of the ROBA®-linearstop, it is switched on with overexcitation voltage, meaning with a substantially higher voltage than the coil nominal voltage.

On being switched on, the ROBA®-multiswitch briefly emits a rectified 90 % of the applied mains voltage to the magnetic coil (overexcitation voltage).

The overexcitation time - until it is switched to a holding voltage of 30 VDC - is set to 0.5 s.

* On further designs, deviating values are possible, please observe the values stated on the type tag.

Brake Dimensioning Type 380.01 _.0 / Type 381._ _ _._ / Type 382.0 _ _.0

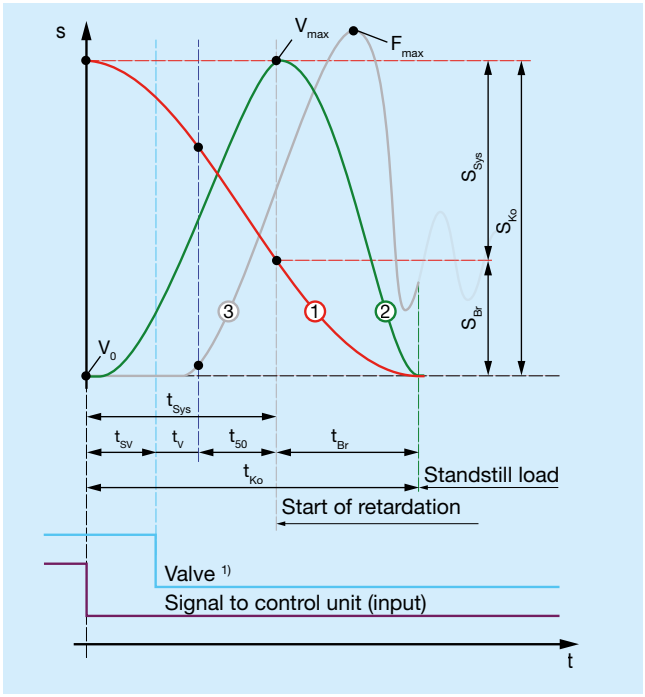


Diagram 1: Switching / Braking Times / Distances

Name

1		Distance
2		Speed
3		Axial force
β	[°]	Angular position 0° (horizontal) to 90° (vertical)
a_B	[m/s²]	**Acceleration** of the downward-moving load, dependent on the angular position
a_v	[m/s²]	Retardation
g	[m/s²]	Gravitational acceleration (9.81 m/s²)
F_{Br}	[N]	Braking force for dynamic calculation
$F_{erf.}$	[N]	Required holding force
F_{Nenn}	[N]	Nominal holding force (minimum holding force)
F_{NGes}	[N]	Total nominal holding force (one or more brakes)
F_{max}	[N]	Maximum holding force
m	[kg]	Load mass
S_{Br}	[m]	**Braking distance:** Distance from the beginning of the retardation up to the standstill of the load
S_{Sys}	[m]	**System distance:** Distance travelled by the load until the retardation begins.
S_{Ko}	[m]	**Stopping distance:** Distance from the signal interruption up to standstill of the load
t_{50}	[s]	Brake switching time
t_V 1)	[s]	Valve switching time (not applicable for Type 382.0 _ _._)
t_{SV}	[s]	Switching time control unit (signal processing time)
t_{Sys}	[s]	System switching time
t_{Br}	[s]	Brake braking time
t_{Ko}	[s]	**Stopping time:** Time from the signal interruption up to standstill of the load
Q_r	[J]	Friction work per braking action

General

When selecting the brake, the nominal holding force must be greater or equal to the required holding force.

$$F_{Nenn} \geq F_{erf.} \quad [N]$$

Dimensioning for dynamic braking (EMERGENCY STOP)

For safety reasons, at least the weight load of the masses to be held +100 % reserve must be provided.

The larger the ratio of the nominal holding force to the required holding force, the shorter the stopping distance (for the same technical conditions)

The minimum required holding force can be calculated with the following formula:

$$F_{erf.} = \frac{m \times g}{0.5} \quad [N]$$

Dimensioning for static holding (clamping)

For safety reasons, at least the minimum weight load of the masses to be held +20 % reserve must be provided.

The minimum required holding force can be calculated with the following formula:

$$F_{erf.} = \frac{m \times g}{0.8} \quad [N]$$

The stopping distance / stopping time of the load to be braked is strongly dependent on the following influences:

- Switching time control unit (signal processing)
- Switching time of the control valve 1)
- switching time of the brake
- Cross-section and length of the lines

The larger the sum of the switching times, the later the retardation of the load occurs (due to longer periods of acceleration). The stopping distance / the stopping time becomes longer (with constant holding force).

Please ensure sufficient dimensioning of the components of your system which may be placed under heavy loads during acceleration / retardation as a result of dynamic braking actions.

Name

$Q_{r\,zul.}$	[J]	Permitted friction work per braking action
$Q_{r\,ges.}$	[J]	Total friction work up to wear end (one or more brakes)
V_0	[m/s]	Initial speed
V_{max}	[m/s]	Maximum speed
$Z_{zul.}$		Number of braking actions up to wear end

If you have any questions, please contact *mayr*®-power transmission.

1) With the exception of Type 382.0_ _._

Calculation example (dynamic braking)

Data:		
Angular position piston rod	β	= 90° (vertical axis)
Mass	m	= 800 kg
Initial speed	V_0	= 0.5 m/s
Valve switching time	t_V	= 0.016 s
Switching time control system	t_{SV}	= 0.020 s
Existing operating pressure		= 5 bar

1. Pre-selection of braking force

$$F_{erf.} = \frac{m \times g}{0.5} \quad [N]$$

$$F_{erf.} = \frac{800 \times 9.81}{0.5} = \mathbf{15696} \quad [N]$$

Selected: ROBA®-linearstop Size 70, Type 381.12_._

Nominal holding force $\mathbf{F_{Nenn} = 17500\ N}$ at 5 bar operating pressure (from Table "Technical Data")

2. Calculation of the stopping distance /stopping time

Checking the selected brake size

Acceleration of the load

$$a_B = g \times \sin(\beta) = 9.81 \times \sin(90°) = \mathbf{9.81}\ [m/s^2]$$

System distance

$$S_{Sys} = V_0 \times t_{Sys} + a_B \times t_{Sys}^2 \times 0.5 \quad [m]$$

$$S_{Sys} = 0.5 \times 0.096 + 9.81 \times 0.096^2 \times 0.5 = \mathbf{0.093}\ [m]$$

$$t_{Sys} = t_{50} + t_V + t_{SV} = 0.060 + 0.016 + 0.02 = 0.096\ [s]$$

Braking distance

$$S_{Br} = \frac{V_{max}^2}{2 \times \left(\frac{F_{NGes}}{m} - a_B\right)} = \frac{1.44^2}{2 \times 12.065} = \mathbf{0.086}\ [m]$$

$$V_{max} = V_0 + a_B \times t_{Sys} = 0.5 + 9.81 \times 0.096 = 1.44\ [m/s]$$

Stopping distance

$$S_{Ko} = S_{Br} + S_{Sys} = 0.086 + 0.093 = \mathbf{0.179}\ [m]$$

Stopping time

$$t_{Ko} = t_{Br} + t_{Sys} = 0.119 + 0.096 = \mathbf{0.215}\ [s]$$

$$t_{Br} = \frac{V_{max}}{\frac{F_{NGes}}{m} - a_B} = \frac{1.44}{\frac{17500}{800} - 9.81} = 0.119\ [s]$$

Retardation (for system dimensioning)

$$a_v = \frac{F_{NGes} \times 2.5}{m - g} = \frac{17500 \times 2.5}{800 - 9.81} = \mathbf{55.37}\ [m/s^2]$$

$$\text{Load} = \frac{a_v}{g} = \frac{55.37}{9.81} = \mathbf{5.6}\ [g]$$

3. Friction work (Type 381.1_ _._)

Friction work per braking action

$$Q_r = m \times a_B \times S_{Br} + 0.5 \times m \times V_{max}^2 \quad [J]$$

$$Q_r = 800 \times 9.81 \times 0.086 + 0.5 \times 800 \times 1.44^2\ [J]$$

$$Q_r = \mathbf{1504}\ (< Q_{r\,zul} = 12948)\ [J]$$

Number of braking actions up to wear end

$$Z_{zul.} = \frac{Q_{r\,ges}}{Q_r}$$

$$Z_{zul.} = \frac{5.85 \times 10^6}{1504} = \mathbf{3890}\ \text{dynamic braking actions}$$

ROBA®-linearstop hydraulic

Switching times (Type 380.00 _.0)			Size			
			10	20	30	40
Switching time, brake	t_{50}	[s]	0.030	0.045	0.055	0.065

ROBA®-linearstop pneumatic

Friction Work and Switching Times (Type 381.1_ _._) 1)			Size					
			20	30	40	60	70	80
Permitted total friction work up to wear end 2)	$Q_{r\,ges.}$	[10^6 J]	0.36	0.75	1.14	3.6	5.85	10.35
Maximum permitted friction work per braking action 2)	$Q_{r\,zul.}$	[J]	579	1049	2097	7361	12948	24708
Switching time, brake	t_{50}	[s]	0.037	0.038	0.035	0.050	0.060	0.070

1) For friction work Type 381.0_ _._, please contact *mayr*® power transmission. The switching times also apply for Type 381.0_ _._.
2) For higher friction work / total friction work, please contact *mayr*® power transmission.

ROBA®-linearstop electromagnetic

Switching times (Type 382.0_ _._)			Size			
			20	40	60	80
Switching time, brake	t_{50}	[s]	0.030	0.030	0.035	0.045

Headquarters

Chr. Mayr GmbH + Co. KG
Eichenstraße 1, D-87665 Mauerstetten
Tel.: +49 83 41/8 04-0, Fax: +49 83 41/80 44 21
www.mayr.com, E-Mail: info@mayr.com

mayr®
your reliable partner

Service Germany

Baden-Württemberg
Esslinger Straße 7
70771 Leinfelden-Echterdingen
Tel.: 07 11/45 96 01 0
Fax: 07 11/45 96 01 10

Bavaria
Eichenstraße 1
87665 Mauerstetten
Tel.: 0 83 41/80 41 04
Fax: 0 83 41/80 44 23

Chemnitz
Bornaer Straße 205
09114 Chemnitz
Tel.: 03 71/4 74 18 96
Fax: 03 71/4 74 18 95

Franken
Unterer Markt 9
91217 Hersbruck
Tel.: 0 91 51/81 48 64
Fax: 0 91 51/81 62 45

Hagen
Im Langenstück 6
58093 Hagen
Tel.: 0 23 31/78 03 0
Fax: 0 23 31/78 03 25

Kamen
Lünener Straße 211
59174 Kamen
Tel.: 0 23 07/23 63 85
Fax: 0 23 07/24 26 74

North
Schiefer Brink 8
32699 Extertal
Tel.: 0 57 54/9 20 77
Fax: 0 57 54/9 20 78

Rhine-Main
Hans-Böckler-Straße 6
64823 Groß-Umstadt
Tel.: 0 60 78/7 82 53 37
Fax: 0 60 78/9 30 08 00

Branch office

China
Mayr Zhangjiagang
Power Transmission Co., Ltd.
Fuxin Road No.7, Yangshe Town
215637 Zhangjiagang
Tel.: 05 12/58 91-75 67
Fax: 05 12/58 91-75 66
info@mayr-ptc.cn

Great Britain
Mayr Transmissions Ltd.
Valley Road, Business Park
Keighley, BD21 4LZ
West Yorkshire
Tel.: 0 15 35/66 39 00
Fax: 0 15 35/66 32 61
sales@mayr.co.uk

France
Mayr France S.A.S.
Z.A.L. du Minopole
Rue Nungesser et Coli
62160 Bully-Les-Mines
Tel.: 03.21.72.91.91
Fax: 03.21.29.71.77
contact@mayr.fr

Italy
Mayr Italia S.r.l.
Viale Veneto, 3
35020 Saonara (PD)
Tel.: 0498/79 10 20
Fax: 0498/79 10 22
info@mayr-italia.it

Singapore
Mayr Transmission (S) PTE Ltd.
No. 8 Boon Lay Way Unit 03-06,
TradeHub 21
Singapore 609964
Tel.: 00 65/65 60 12 30
Fax: 00 65/65 60 10 00
info@mayr.com.sg

Switzerland
Mayr Kupplungen AG
Tobeläckerstraße 11
8212 Neuhausen am Rheinfall
Tel.: 0 52/6 74 08 70
Fax: 0 52/6 74 08 75
info@mayr.ch

USA
Mayr Corporation
10 Industrial Avenue
Mahwah
NJ 07430
Tel.: 2 01/4 45-72 10
Fax: 2 01/4 45-80 19
info@mayrcorp.com

Representatives

Australia
Regal Beloit Australia Pty Ltd.
19 Corporate Ave
03178 Rowville, Victoria
Australien
Tel.: 0 3/92 37 40 00
Fax: 0 3/92 37 40 80
salesAUvic@regalbeloit.com

India
National Engineering
Company (NENCO)
J-225, M.I.D.C.
Bhosari Pune 411026
Tel.: 0 20/27 13 00 29
Fax: 0 20/27 13 02 29
nenco@nenco.org

Japan
MATSUI Corporation
2-4-7 Azabudai
Minato-ku
Tokyo 106-8641
Tel.: 03/35 86-41 41
Fax: 03/32 24 24 10
k.goto@matsui-corp.co.jp

Netherlands
Groneman BV
Amarilstraat 11
7554 TV Hengelo OV
Tel.: 074/2 55 11 40
Fax: 074/2 55 11 09
aandrijftechniek@groneman.nl

Poland
Wamex Sp. z o.o.
ul. Pozaryskiego, 28
04-703 Warszawa
Tel.: 0 22/6 15 90 80
Fax: 0 22/8 15 61 80
wamex@wamex.com.pl

South Korea
Mayr Korea Co. Ltd.
15, Yeondeok-ro 9beon-gil
Seongsan-gu
51571 Changwon-si
Gyeongsangnam-do. Korea
Tel.: 0 55/2 62-40 24
Fax: 0 55/2 62-40 25
info@mayrkorea.com

Taiwan
German Tech Auto Co., Ltd.
No. 28, Fenggong Zhong Road,
Shengang Dist.,
Taichung City 429, Taiwan R.O.C.
Tel.: 04/25 15 05 66
Fax: 04/25 15 24 13
abby@zfgta.com.tw

Czech Republic
BMC - TECH s.r.o.
Hviezdoslavova 29 b
62700 Brno
Tel.: 05/45 22 60 47
Fax: 05/45 22 60 48
info@bmc-tech.cz

More representatives:

Austria, Belgium, Brazil, Canada, Denmark, Finland, Greece, Hongkong, Hungary, Indonesia, Israel, Luxembourg, Malaysia, New Zealand, Norway, Philippines, Romania, Russia, Slovakia, Slovenia, South Africa, Spain, Sweden, Thailand, Turkey

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