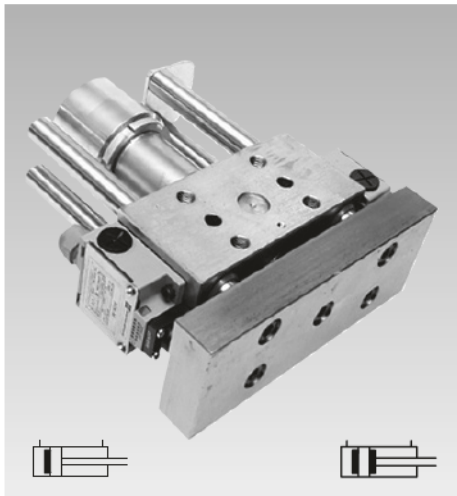




## RS Hydraulic Slides

with 4 guide rods, optional stroke end control  
double acting, max. operating pressure 250 bar



- **Standard version RSS**  
7 sizes with 7 stroke lengths
- **Reinforced version RSV**  
4 sizes with 7 stroke lengths  
Larger spacing and diameter of the guide rods for even higher loads
- **Larger force range up to 196 kN**
- **Piston speed up to 500 mm/s**
- **Stroke end cushioning**  
piston side (rear) standard  
rod side (front) optional
- **Seals NBR or FKM**
- **Stroke end control optional**  
2 mechanical limit switches with potential-free contacts
- **Pipe thread or manifold-mounting connection**
- **Fixation**  
Through holes from above or internal thread from below
- **Positioning**  
2 dowel holes or keyway
- **Front block optional**  
for fixing the tool
- **Guide rods chromium-plated**
- **Guide bushings high tensile**  
with PTFE coating
- **Maintenance free**
- **Special versions on request**

### Fields of application

- Pressing
- Punching
- Bending
- Deburring
- Cutting
- Tool manufacture
- Mould making
- Metal forming
- Assembly technology

### Description

The RS hydraulic slide is a compact hydraulic cylinder with 4 laterally-mounted guiding rods for compensation of high side loads and torques. A stable front plate is mounted on the guide rods and the piston rod, enabling the various tools to be securely fastened.

### Materials

The guide rods are made of high-tensile alloy steel and are chromium-plated. All other components are galvanized.

The front block made of St37k is not corrosion protected to facilitate machining.

### Important notes

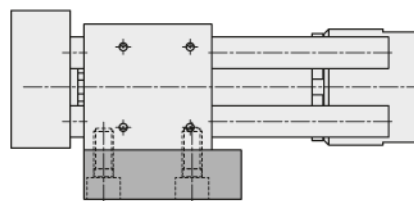
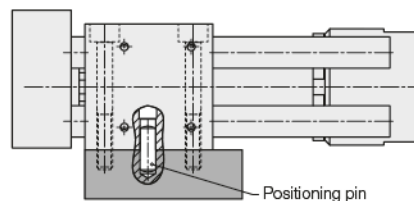
The RS hydraulic slide can generate considerable forces when extending and retracting. Due to the function-related arrangement of the front block with the tools attached to it and the guide rods, there is a very high risk of crushing. This also applies to setting mode.

The user or manufacturer of the machine or fixture is obliged to provide effective protection measures.

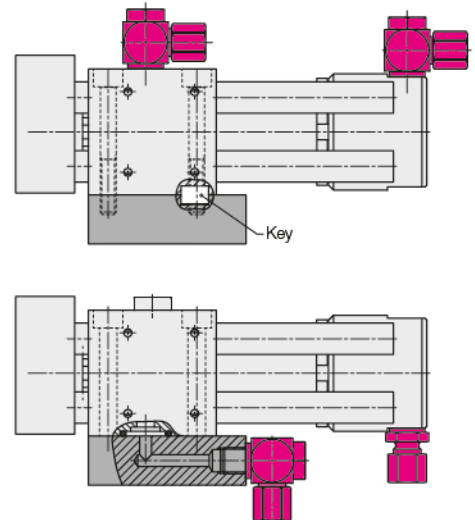
Recommendation: Tamper-proof safety devices with electrical locking control.

If the hydraulic slide moves against the internal cylinder stop during extending, the version with the stroke end cushioning on both sides should be used.

### Fixing possibilities



### Hydraulic connecting possibilities



### RS hydraulic slides on a deburring tool



Technical drawing of a 5/3-way directional control valve with manifold-mounting connection and keyway. The drawing includes a top view, a side view, and a detail 'Z' showing the manifold connection. Dimensions are given in mm.

**Top View Dimensions:**

- Overall width:  $a_1$
- Overall height:  $a_2$
- Port G1:  $\varnothing d_1$
- Port G2:  $\varnothing d_2$
- Port G3:  $\varnothing d_3$
- Port G4:  $\varnothing d_4$
- Limit switch L1:  $L_1$
- Limit switch L2:  $L_2$
- Limit switch L3:  $L_3$
- Limit switch L4:  $L_4$
- Limit switch L5:  $L_5$
- Limit switch L6:  $L_6$
- Limit switch L7:  $L_7$
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- Limit switch L99:  $L_{99}$
- Limit switch L100:  $L_{100}$

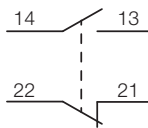
**Side View Dimensions:**

- Overall width:  $a_1$
- Overall height:  $a_2$
- Port G1:  $\varnothing d_1$
- Port G2:  $\varnothing d_2$
- Port G3:  $\varnothing d_3$
- Port G4:  $\varnothing d_4$
- Limit switch L1:  $L_1$
- Limit switch L2:  $L_2$
- Limit switch L3:  $L_3$
- Limit switch L4:  $L_4$
- Limit switch L5:  $L_5$
- Limit switch L6:  $L_6$
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- Limit switch L60:  $L_{60}$
- Limit switch L61:  $L_{61}$
- Limit switch L62:  $L_{62}$
- Limit switch L63:  $L_{63}$
- Limit switch L64:  $L_{64}$
- Limit switch L65

The RS hydraulic slide is optionally supplied with two mechanical limit switches mounted on the side of the housing (see code for part numbers). In the rear stroke end position, actuation is made directly by the front block.

In the front stroke end position, the 2nd limit switch is actuated by a control vane, which is always included in the delivery.

The mounting can be optionally on both sides.

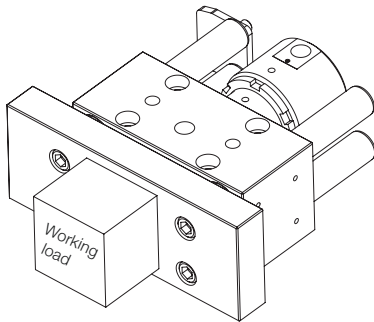


Switch	1 break and 1 make contact with jump function
Repetitive accuracy	0.05 mm
Contacts	A300; AC-15 U <sub>e</sub> = 240 V, I <sub>e</sub> = 3 A Q300; DC-13 U <sub>e</sub> = 350 V, I <sub>e</sub> = 0,27 A as per EN / IEC 60947-5-1 appendix A
Short circuit protection	10 A fuse type gG
Ambient temperature	-25...+70 °C
Code class	IP66 as per EN / IEC 60529 IK05 as per E 50102
Protection against accidental contact	Class 1 as per IEC 61140 and NF C20-030
Cable connection	3 x PG11 with sealing plug
Port	Screw terminals
Terminal capacity	min. 1x0.34 mm <sup>2</sup> max. 2x1.5 mm <sup>2</sup>

## Technical data

<b>Available stroke lengths</b>	<b>50 / 75 / 100 / 125 / 150 / 175 / 200 mm</b> Special strokes on request		
<b>Stroke tolerance</b>	± 1 mm (Extended ±0.8 mm, retracted ±0.2 mm)		
<b>Operating pressure</b>	25 ... 250 bar		
<b>Max. piston speed</b>	up to 500 mm/s (see chart page 5)		
<b>Operating temperature</b>	NBR seals      -30 ... +100 °C FKM seals      -20 ... +150 °C		
<b>Hydraulic fluids</b>	<b>Hydraulic oil</b> HLP HFA, HFB, HFC HFDU (see data sheet A 0.100)	<b>Temperature range</b> -30 ... +100 °C -10 ... + 55 °C -20 ... +150 °C	<b>Seals</b> NBR, FKM NBR FKM
<b>Hydraulic stroke end cushioning</b>	On the piston side, i.e. effective when retracting the piston or optionally on the piston and piston rod side, i.e. effective in both stroke end positions.		
<b>Guide rods</b>	Chromium-plated and ground		
<b>Guide bushings</b>	High-tensile steel with PTFE coating for dry running, Maintenance free		
<b>Service life</b>	Depending on the torque load, the piston speed v and the slide temperature. Assuming a service life of 100 % at a slide temperature of 30 °C, it drops to 80 % at 60 °C and to approx. 40 % at 150 °C.		

The maximum working load at the front block with stroke end cushioning on both sides



Size	Maximum working load (tool mass mw) [kg]				
	Piston speed [mm/s]				
	100	200	300	400	500
<b>RSS3</b>	15	8	5	4	3
<b>RSS4</b>	60	30	20	15	12
<b>RSS5</b>	100	50	33	-	-
<b>RSS6 / RSV6</b>	300	150	-	-	-
<b>RSS7 / RSV7</b>	610	305	203	-	-
<b>RSS8 / RSV8</b>	1750	875	-	-	-
<b>RSS9 / RSV9</b>	4150	-	-	-	-

The data in the chart apply to the following operating data:

- Operating pressure 150 bar
- Oil viscosity 22 mm²/s (HLP 22 at 40 °C)
- Hydraulic slide with stroke end cushioning on both sides
- Max. piston speed as per chart on page 5

Important! If there is only piston-side cushioning, the working load must travel against an external stop when extending.

### Factors for other operating pressures

Operating pressure [bar]	25	50	100	150	200	250
$f_B$	2	1.5	1.2	1	0.7	0.5

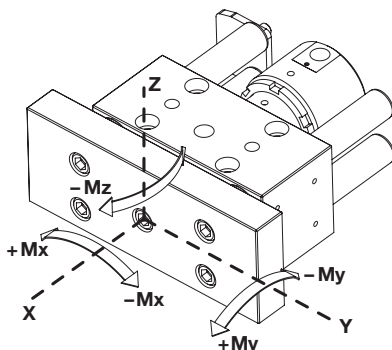
### Factors for other viscosity's

Oil viscosity [mm²/s]	9	22	32	46	68	100
$f_v$	0.6	1	1.2	1.5	2	3

### Calculation example - Hydraulic slide RSS6

Piston speed	200 mm/s → working load as per chart 150 kg
Operating pressure	100 bar → factor $f_B = 1.2$
Oil viscosity	46 mm²/s → factor $f_v = 1.5$
Maximum working load	$= 1.2 \cdot 1.5 \cdot 150 \text{ kg} = 270 \text{ kg}$

### Admissible torque load



Size	Admissible total torque Madm [Nm]
<b>RSS3</b>	360
<b>RSS4</b>	520
<b>RSS5</b>	740
<b>RSS6 / RSV6</b>	1210 / 1540
<b>RSS7 / RSV7</b>	1315 / 1995
<b>RSS8 / RSV8</b>	1935 / 2255
<b>RSS9 / RSV9</b>	2590 / 3240

Resulting maximum total torque for a punching tool:

$$M_{\max} = M_x + \sqrt{M_y^2 + M_z^2} \leq M_{\text{zul}} \quad [\text{Nm}]$$

$M_x$  = radial torque due to working load (m · g) around the X-axis

$M_y$  = bending moment due to working load and cutting force

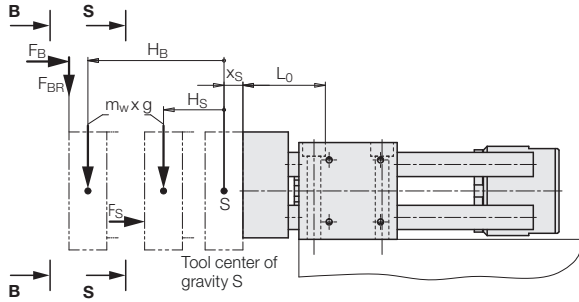
$M_z$  = bending moment due to cutting force around the Z-axis

$M_{\text{adm}}$  = as per the above chart

# Selection of a hydraulic slide for a punching and bending tool

**Task** Sheet metal parts are to be punched out and bent by 45° on the top side. The hydraulic slide is installed horizontally.

## 1. Position and direction of the punching and bending forces



## 2. Required specifications

Available operating pressure	$p_B = 200 \text{ bar}$
Desired piston speed	$v_K = 200 \text{ mm/s}$
Kinematic oil viscosity HLP46	$\nu = 46 \text{ mm}^2/\text{s}$

### Punching tool

Tool mass	$m_W = 32 \text{ kg}$
Distance of the center of mass from the front block	$x_S = 45 \text{ mm}$
Distance of the center of mass in x-direction	$l_x = 30 \text{ mm}$
Distance of the line center of gravity (cutting punch) from the slide axis	$l_y = 40 \text{ mm}$
Distance of the line center of gravity (cutting punch) from the center axis	$l_z = 12 \text{ mm}$
Required cutting force	$F_S = 35000 \text{ N}$
Piston stroke to end of cutting	$H_S = 60 \text{ mm}$

### Bending tool

Distance of the bending edge from the slide axis	$l_y = -100 \text{ mm}$
Required bending force	$F_B = 5500 \text{ N}$
Resulting bending force when bending by 45° (directed downwards)	$F_{BR} = 4000 \text{ N}$
Piston stroke to end of bending	$H_B = 110 \text{ mm}$

## 3. Selection of the size

Required cutting force	$F_S = 35000 \text{ N}$
Max. operating pressure	$p_B = 200 \text{ bar}$
Min. piston area	$A_{\min} = \frac{F_S}{p_B} = \frac{35000 \text{ N}}{200 \text{ bar} \cdot 10} = 17.5 \text{ cm}^2$
→ Chart page 5 → Piston area stroke to extend	→ 19.63 cm <sup>2</sup>
→ <b>Standard RSS6</b>	
Min. operating pressure	$p_{\min} = \frac{F_S}{A_{RS.6}} = \frac{35000 \text{ N}}{19.63 \text{ cm}^2 \cdot 10} = 178.3 \text{ bar}$

### Result

The size RSS6 generates a piston force of 35000 N at an operating pressure of 178.3 bar.

## 4. Checking the maximum working load at the front block

Tool mass	$m_W = 32 \text{ kg}$
Piston speed	$v_K = 200 \text{ mm/s}$
→ Chart page 3 → <b>RSS6</b> → $m_{W\max}$	$= 150 \text{ kg} > 32 \text{ kg}$
Consideration of the factors $f_B$ and $f_v$	
→ Operating pressure 200 bar → $f_B = 0.7$	
→ Kin. oil viscosity $46 \frac{\text{mm}^2}{\text{s}}$ → $f_v = 1.5$	
Max. working load $m_{W\max}$	$= 150 \text{ kg} \cdot 0.7 \cdot 1.5 = 157 \text{ kg} > 32 \text{ kg}$

### Result

A tool mass of 32 kg is no problem for the RSS6 hydraulic slide with stroke end cushioning on both sides.

## 5. Calculation of the torques during punching

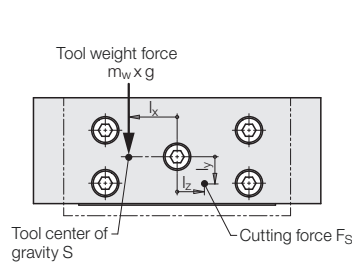
### 5.1 Bending moment by working load $m_W$

$$M_{yW} = m_W \cdot g \cdot (L_0 + x_S + H_S) \\ = 32 \text{ kg} \cdot 9.81 \frac{\text{m}}{\text{s}^2} \cdot (64.5 \text{ mm} + 45 \text{ mm} + 60 \text{ mm}) \cdot \frac{1 \text{ m}}{1000 \text{ mm}} \\ M_{yW} = 53.2 \text{ Nm}$$

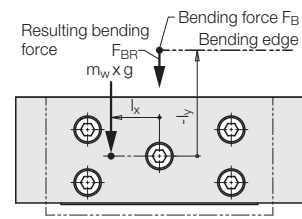
### 5.2 Radial torque by working load $m_W$

$$M_x = m_W \cdot g \cdot l_x \\ = 32 \text{ kg} \cdot 9.81 \frac{\text{m}}{\text{s}^2} \cdot 30 \text{ mm} \cdot \frac{1 \text{ m}}{1000 \text{ mm}} \\ M_x = 9.4 \text{ Nm}$$

### S – S punching stroke



### B – B bending stroke



## 5.3 Bending moment due to cutting force $F_S$

$$M_{yS} = F_S \cdot l_y \\ = 35000 \text{ N} \cdot 40 \text{ mm} \cdot \frac{1 \text{ m}}{1000 \text{ mm}} \\ M_{yS} = 1400 \text{ Nm} \\ M_z = F_S \cdot l_z \\ = 35000 \text{ N} \cdot 12 \text{ mm} \cdot \frac{1 \text{ m}}{1000 \text{ mm}} \\ M_z = 420 \text{ Nm}$$

## 5.4 Addition of torques $M_y$

$$M_y = M_{yW} + M_{yS} \\ = 53.2 \text{ Nm} + 1400 \text{ Nm} \\ M_y = 1453 \text{ Nm}$$

## 5.5 Resulting max. total torque $M_{\max}$

$$M_{\max} = M_x + \sqrt{M_y^2 + M_z^2} \\ M_{\max} = 9.4 \text{ Nm} + \sqrt{1453^2 + 420^2} \\ M_{\max} = 1522 \text{ Nm} > M_{\text{adm}} = 1210 \text{ Nm (as per chart page 3)} \\ \text{That is too little !!!}$$

## 5.6 Result

As per chart for RSS6 →  $M_{\text{adm}} = 1210 \text{ Nm}$   
Selected is **RSV6** →  $M_{\text{adm}} = 1540 \text{ Nm}$

## 6. Calculation of the torques during bending

### 6.1 Bending moment by working load $m_W$

$$M_{yW} = m_W \cdot g \cdot (L_0 + x_S + H_B) \\ = 32 \text{ kg} \cdot 9.81 \frac{\text{m}}{\text{s}^2} \cdot (57 \text{ mm} + 45 \text{ mm} + 110 \text{ mm}) \cdot \frac{1 \text{ m}}{1000 \text{ mm}} \\ M_{yW} = 66.5 \text{ Nm}$$

### 6.2 Radial torque by working load $m_W$

$$M_x = m_W \cdot g \cdot l_x \\ = 32 \text{ kg} \cdot 9.81 \frac{\text{m}}{\text{s}^2} \cdot 30 \text{ mm} \cdot \frac{1 \text{ m}}{1000 \text{ mm}} \\ M_x = 9.4 \text{ Nm}$$

### 6.3 Bending moment by bending force $F_B$

$$M_{yB} = F_B \cdot l_y \\ = 5500 \text{ N} \cdot (-100) \text{ mm} \cdot \frac{1 \text{ m}}{1000 \text{ mm}} \\ M_{yB} = -550 \text{ Nm}$$

### 6.4 Bending moment due to resulting bending force $F_{BR}$ when bending by 45° (directed downwards)

$$M_{yBR} = F_{BR} \cdot (L_0 + x_S + H_B) \\ = 4000 \text{ N} \cdot (57 \text{ mm} + 45 \text{ mm} + 110 \text{ mm}) \cdot \frac{1 \text{ m}}{1000 \text{ mm}} \\ M_{yBR} = 848 \text{ Nm}$$

## 6.5 Max. load during bending $M_{\max}$

$$M_{\max} = M_{yW} + M_x + M_{yB} + M_{yBR} \\ = 66.5 \text{ Nm} + 9.4 \text{ Nm} - 550 \text{ Nm} + 848 \text{ Nm} \\ M_{\max} = 373.9 \text{ Nm} < M_{\text{adm}} = 1540 \text{ Nm for RSV6 (as per chart page 3)}$$

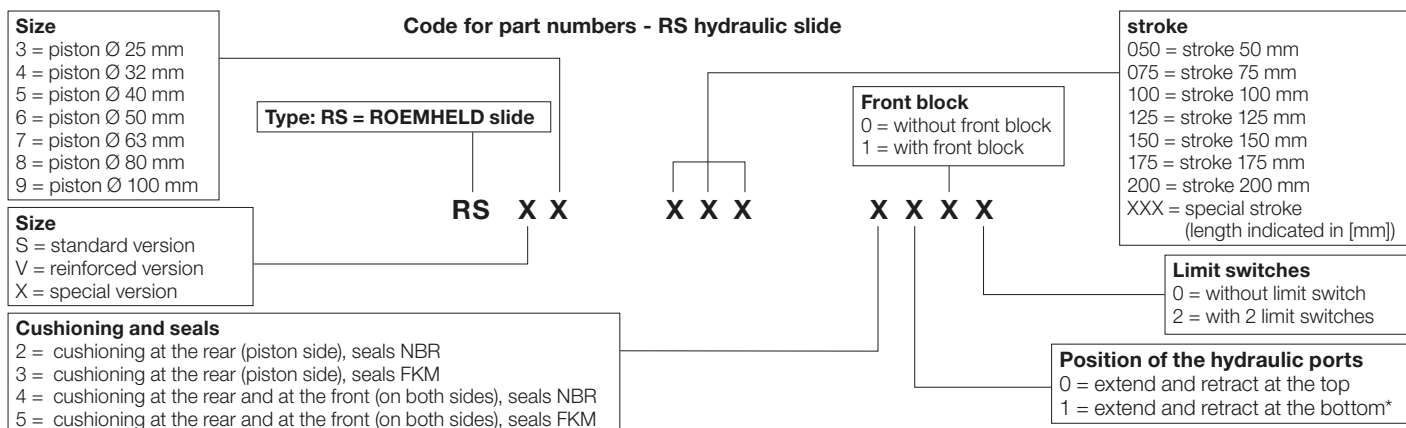
## 6.6 Result

The hydraulic slide RSV6 is loaded with only 374 Nm when bending the workpiece. The decisive factor for the selection of the hydraulic slide is the max. bending moment during punching  $M_{\max} = 1522 \text{ Nm}$ !

## Technical data Code for part numbers

Standard Reinforced		RSS3	RSS4	RSS5	RSS6	RSS7	RSS8	RSS9
Standard strokes		–	–	–	RSV6	RSV7	RSV8	RSV9
[mm]		50 / 75 / 100 / 125 / 150 / 175 / 200						
Piston Ø	[mm]	25	32	40	50	63	80	100
Piston rod Ø	[mm]	16	20	25	32	40	50	60
Piston area								
Stroke to extend	[cm²]	4.91	8.04	12.56	19.63	31.17	50.26	78.54
Stroke to retract	[cm²]	2.9	4.9	7.65	11.59	18.6	30.63	50.26
Push force	[kN]	4.91	8.04	12.56	19.63	31.17	50.26	78.54
100 bar	[kN]	12.2	20.1	31.4	49	77.9	125.6	196.3
250 bar	[kN]							
Pull force	[kN]	2.9	4.9	7.65	11.59	18.6	30.63	50.26
100 bar	[kN]	7.2	12.2	19.2	29	46.6	76.5	125.7
250 bar	[kN]							
Oil volume per 10 mm stroke								
Stroke to extend	[cm³]	4.91	8.04	12.56	19.63	31.17	50.26	78.54
Stroke to retract	[cm³]	2.9	4.9	7.65	11.59	18.6	30.63	50.26
Max. flow rate								
Stroke to extend	[cm³/s]	245	402	420	420	1000	1000	1000
Stroke to retract	[cm³/s]	145	245	255	248	596	609	640
Max. piston speed	[mm/s]	500	500	333	214	320	200	127
a ±0.02	[mm]	95	110	125	150	175	200	220
	[mm]	–	–	–	260	260	285	320
a1	[mm]	130	150	170	200	225	260	280
	[mm]	–	–	–	340	340	360	400
a2	[mm]	190	210	230	260	285	320	340
	[mm]	–	–	–	400	400	420	460
a3	[mm]	65	65	80	90	120	134	153
	[mm]	–	–	–	200	200	210	230
a4	[mm]	29	29	29	45	60	90	110
	[mm]	–	–	–	80	100	150	180
b ±0.02	[mm]	35	40	43	45	54	54	90
	[mm]	–	–	–	55	60	70	70
b1	[mm]	64	74	84	98	124	124	158
	[mm]	–	–	–	118	128	148	158
b2	[mm]	70	80	90	100	125	125	160
	[mm]	–	–	–	120	130	150	160
Ød1f7	[mm]	16	20	25	30	30	40	40
	[mm]	–	–	–	35	35	45	50
Ød2	[mm]	9	11	11	14	14	17.5	17.5
Ød3	[mm]	9	11	11	11	11	13	13
Ød4H7	[mm]	8	10	10	10	10	12	12
Ød5 max.	[mm]	7	7	7	7	25	25	25
Ød6	[mm]	59	64	74	83	100	123.5	150
G1		M10	M10	M12	M12	M16	M16	M20
G2		M10	M10	M12	M12	M16	M20	M24
G3		G1/4	G3/8	G3/8	G3/8	G1/2	G1/2	G1/2
G4		G1/4	G3/8	G3/8	G3/8	G1/2	G1/2	G1/2
G5		M10	M12	M12	M16	M16	M20	M20
G6		M10x1	M10x1	M10x1	M10x1	M16x1.5	M16x1.5	M16x1.5
L0	[mm]	50	59.5	59.5	64.5	70.5	73	73
	[mm]	–	–	–	57	73	72	73
L1 + stroke	[mm]	117	120	125	145	159	159	175
L2 + stroke*	[mm]	approx. 97	approx. 102	approx. 100	approx. 121	approx. 144	approx. 155	approx. 163
L3	[mm]	65	75	80	95	100	100	119
L4	[mm]	30	30	30	35	40	40	40
L5	[mm]	approx. 7	approx. 10	approx. 10	approx. 10	approx. 11	approx. 11	approx. 11
L6	[mm]	10	12	12	12	17	17	20
L7	[mm]	32	35	40	40	46	46	55
L8	[mm]	55	60	68	65	75	75	90
L9	[mm]	29	32	31	40	39	46	54
L10	[mm]	10	10	10	10	12	12	12
L11	[mm]	10	12	12	12	18	20	23
L12	[mm]	11	15	18	21	21	18	24
L13	[mm]	6	6	6	6	6	6	6

\* For stroke 50 is L2 = stroke + table value + 25 mm.

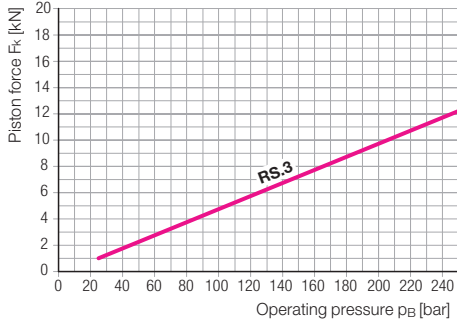
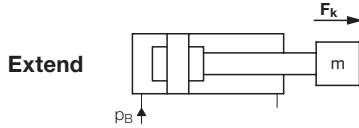


\* Manifold-mounting connection at the front, pipe thread at the rear



# Piston force and piston speed

**Piston force  $F_K$  as a function of the operating pressure  $p_B$**



**Piston speed  $v$  as a function of the flow rate  $Q$**

