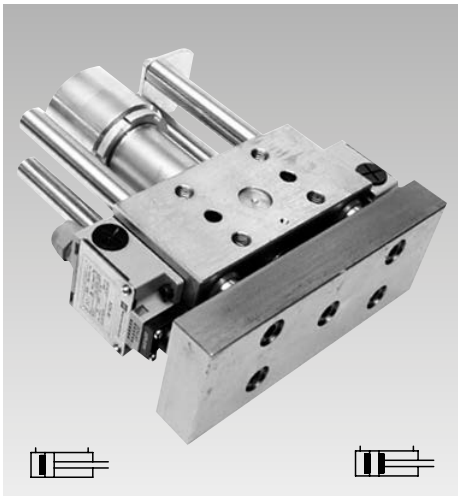
RS Hydraulic Slides

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

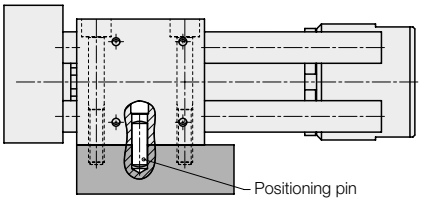


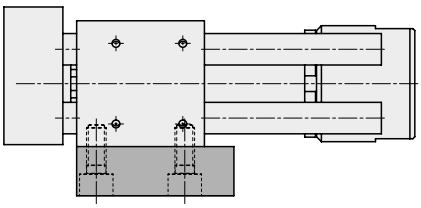
- **Standard version RSS**
  7 sizes with 7 stroke lengths
- **Reinforced version RSV**
  4 sizes with 7 stroke lengths
  Larger spacing and diameter of the guide rods for even higher loads
- **Larger force range up to 196 kN**
- **Piston speed up to 500 mm/s**
- **Stroke end cushioning**
  piston side (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

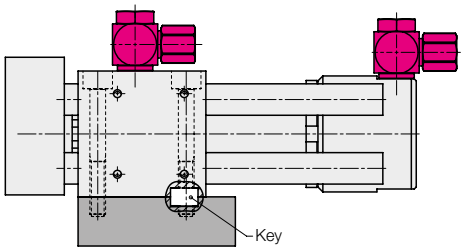
- Pressing
- Punching
- Bending
- Deburring
- Cutting
- Tool manufacture
- Mould making
- Metal forming
- Assembly technology

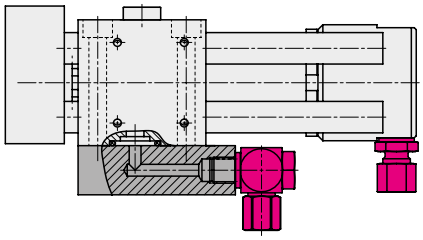
Fixing possibilities





Hydraulic connecting possibilities





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.

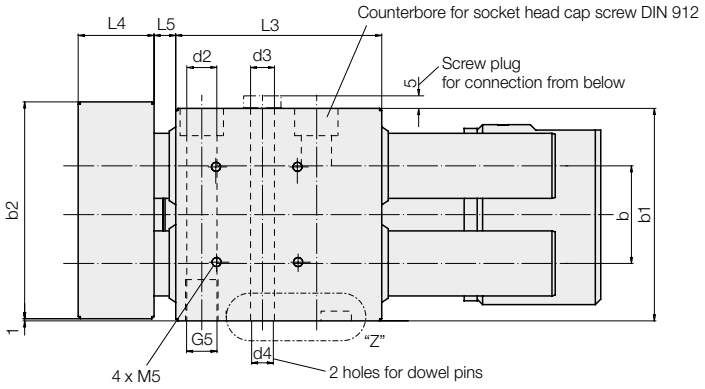
Materials

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.

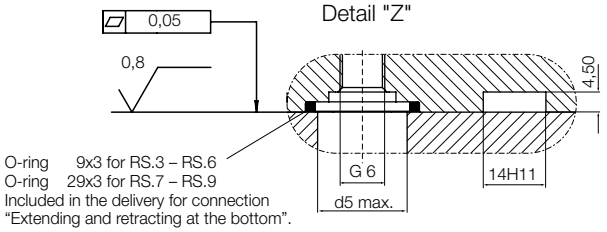
Important notes

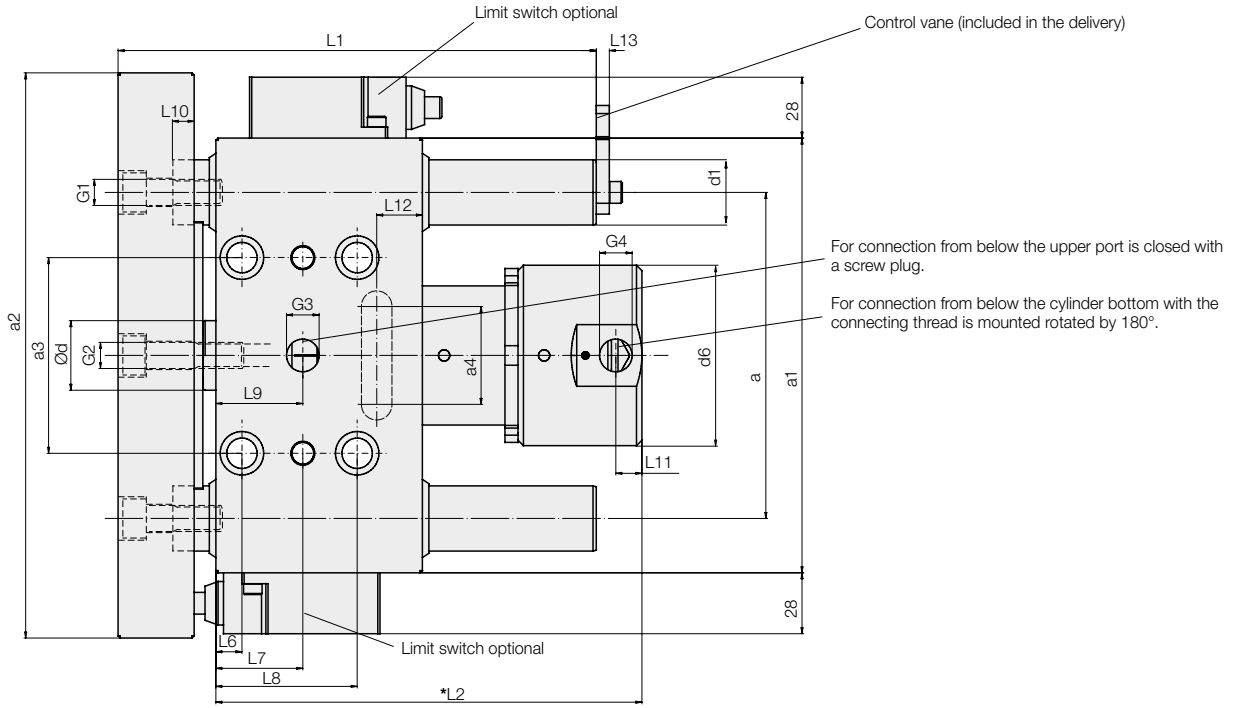
The RS hydraulic slide can generate considerable forces when extending and retracting. Due to the function-related arrangement of the front block with the tools attached to it and the guide rods, there is a very high risk of crushing. This also applies to setting mode.
The user or manufacturer of the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

RS hydraulic slides on a deburring tool



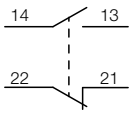
Connecting dimension for manifold-mounting connection and keyway





Limit switch

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.



Technical data

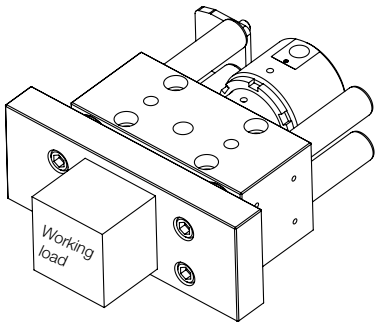
Switch	1 break and 1 make contact with jump function
Repetitive accuracy	0.05 mm
Contacts	A300; AC-15 Ue = 240 V, Ie = 3 A Q300; DC-13 Ue = 350 V, Ie = 0,27 A as per EN / IEC 60947-5-1 appendix A
Short circuit protection	10 A fuse type gG
Ambient temperature	–25….+70 °C
Code class	IP66 as per EN / IEC 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. 1 × 0.34 mm^2 max. 2 × 1.5 mm^2

Available stroke lengths	**50 / 75 / 100 / 125 / 150 / 175 / 200 mm** Special strokes on request
Stroke tolerance	± 1 mm Extended ± 0.8 mm, retracted ± 0.2 mm)
Operating pressure	25… 250 bar
Max. piston speed	up to 500 mm/s (see chart page 5)
Operating temperature	NBR seals –30….+100 °C FKM seals –20….+150 °C

Hydraulic fluids	**Hydraulic oil**	**Temperature range**	**Seals**
	HLP	–30….+100 °C	NBR, FKM
	HFA, HFB, HFC	–10 ….+ 55 °C	NBR
	HFDU	–20….+150 °C	FKM
	(see data sheet A0.100)		

Hydraulic stroke end cushioning	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.
Guide rods	Chromium-plated and ground
Guide bushings	High-tensile steel with PTFE coating for dry running, Maintenance free
Service life	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 m_W) [kg]**				
	Piston speed [mm/s]				
	100	**200**	**300**	**400**	**500**
RSS3	15	8	5	4	3
RSS4	60	30	20	15	12
RSS5	100	50	33	-	-
RSS6 / RSV6	300	150	-	-	-
RSS7 / RSV7	610	305	203	-	-
RSS8 / RSV8	1750	875	-	-	-
RSS9 / RSV9	4150	-	-	-	-

The data in the chart apply to the following operating data:
- Operating pressure 150 bar
- Oil viscosity 22 mm^2/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

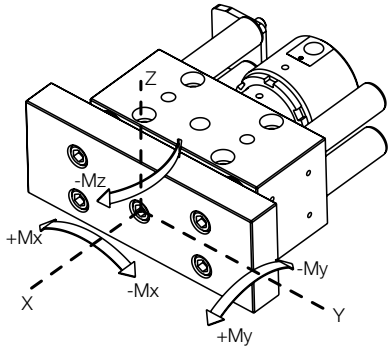
Factors for other viscosity's

Oil viscosity [mm^2/s]	9	22	32	46	68	100
$f\nu$	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 mm^2/s → factor $f\nu$ = 1.5
Maximum working load	= 1.2 · 1.5 · 150 kg = 270 kg

Admissible torque load



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

Resulting maximum total torque for a punching tool:

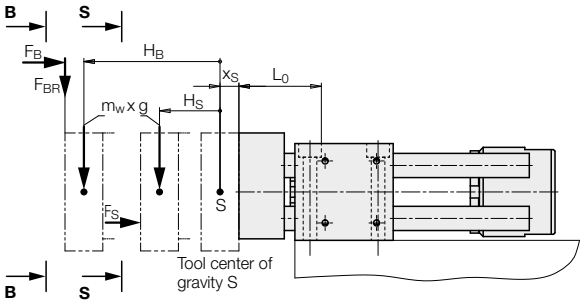
$$M_{max} = M_x + \sqrt{M_y^2 + M_z^2} \leq M_{zul} \quad [Nm]$$

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_{adm} = as per the above chart

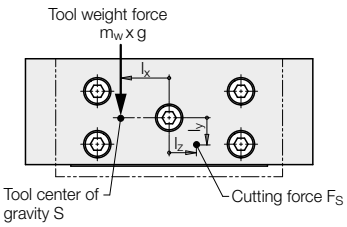
Selection of a hydraulic slide for a punching and bending tool

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

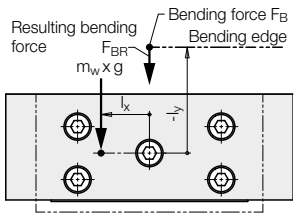
1. Position and direction of the punching and bending forces



S – S punching stroke



B – B bending stroke



2. Required specifications

Available operating pressure	p_B	= 200 bar
Desired piston speed	v_K	= 200 mm/s
Kinematic oil viscosity HLP46	ν	= 46 mm²/s
Punching tool		
Tool mass	m_W	= 32 kg
Distance of the center of mass from the front block	x_S	= 45 mm
Distance of the center of mass in x-direction	l_x	= 30 mm
Distance of the line center of gravity (cutting punch) from the slide axis	l_y	= 40 mm
Distance of the line center of gravity (cutting punch) from the center axis	l_z	= 12 mm
Required cutting force	F_S	= 35000 N
Piston stroke to end of cutting	H_S	= 60 mm
Bending tool		
Distance of the bending edge from the slide axis	l_y	= -100 mm
Required bending force	F_B	= 5500 N
Resulting bending force when bending by 45° (directed downwards)	F_{BR}	= 4000 N
Piston stroke to end of bending	H_B	= 110 mm

3. Selection of the size

Required cutting force $F_S = 35000$ N

Max. operating pressure $p_B = 200$ bar

Min. piston area $A_{min} = \frac{F_S}{p_B} = \frac{35000\ N}{200\ bar \cdot 10} = 17.5\ cm^2$

→ Chart page 5 → Piston area stroke to extend → 19.63 cm²

→ **Standard RSS6**

Min. operating pressure $p_{min} = \frac{F_S}{A_{RS.6}} = \frac{35000\ N}{19.63\ cm^2 \cdot 10} = 178.3\ bar$

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 $m_W = 32$ kg

Piston speed $v_K = 200$ mm/s

→ Chart page 3 → **RSS6** → $m_{Wmax} = 150\ kg > 32\ kg$

Consideration of the factors f_B and $f\nu$

→ Operating pressure 200 bar → $f_B = 0.7$

→ Kin. oil viscositiy $46\frac{mm^2}{s}$ → $f_\nu = 1.5$

Max. working load $m_{Wmax} = 150\ kg \cdot 0.7 \cdot 1.5 = 157\ kg > 32\ kg$

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

$M_{yW} = m_W \cdot g \cdot (L_0 + x_S + H_S)$

$= 32\ kg \cdot 9.81\frac{m}{s^2} \cdot (64.5\ mm + 45\ mm + 60\ mm) \cdot \frac{1\ m}{1000\ mm}$

$M_{yW} = 53.2$ Nm

5.2 Radial torque by working load m_W

$M_x = m_W \cdot g \cdot l_x$

$= 32\ kg \cdot 9.81\frac{m}{s^2} \cdot 30\ mm \cdot \frac{1\ m}{1000\ mm}$

$M_x = 9.4$ Nm

5.3 Bending moment due to cutting force F_S

$M_{yS} = F_S \cdot l_y$

$= 35000\ N \cdot 40\ mm \cdot \frac{1\ m}{1000\ mm}$

$M_{yS} = 1400$ Nm

$M_z = F_S \cdot l_z$

$= 35000\ N \cdot 12\ mm \cdot \frac{1\ m}{1000\ mm}$

$M_z = 420$ Nm

5.4 Addition of torques M_Y

$M_y = M_{yW} + M_{yS}$

$= 53.2\ Nm + 1400\ Nm$

$M_y = 1453$ Nm

5.5 Resulting max. total torque M_{max}

$M_{max} = M_x + \sqrt{M_y^2 + M_z^2}$

$M_{max} = 9.4\ Nm + \sqrt{1453^2 + 420^2}\ Nm$

$M_{max} = 1522\ Nm > M_{adm} = 1210$ Nm (as per chart page 3)

That is too little !!!

5.6 Result

As per chart for RSS6 → $M_{adm} = 1210$ Nm

Selected is RSV6 → $M_{adm} = 1540$ Nm

6. Calculation of the torques during bending

6.1 Bending moment by working load m_W

$M_{yW} = m_W \cdot g \cdot (L_0 + x_S + H_B)$

$= 32\ kg \cdot 9.81\frac{m}{s^2} \cdot (57\ mm + 45\ mm + 110\ mm) \cdot \frac{1\ m}{1000\ mm}$

$M_{yW} = 66.5$ Nm

6.2 Radial torque by working load m_W

$M_x = m_W \cdot g \cdot l_x$

$= 32\ kg \cdot 9.81\frac{m}{s^2} \cdot 30\ mm \cdot \frac{1\ m}{1000\ mm}$

$M_x = 9.4$ Nm

6.3 Bending moment by bending force F_B

$M_{yB} = F_B \cdot l_y$

$= 5500\ N \cdot (-100)\ mm \cdot \frac{1\ m}{1000\ mm}$

$M_{yB} = -550$ Nm

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

$M_{yBR} = F_{BR} \cdot (L_0 + x_S + H_B)$

$= 4000\ N \cdot (57\ mm + 45\ mm + 110\ mm) \cdot \frac{1\ m}{1000\ mm}$

$M_{yBR} = 848$ Nm

6.5 Max. load during bending M_{max}

$M_{max} = M_{yW} + M_x + M_{yB} + M_{yBR}$

$= 66.5\ Nm + 9.4\ Nm - 550\ Nm + 848\ Nm$

$M_{max} = 373.9\ Nm < M_{adm} = 1540$ 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 Mmax = 1522 Nm!

Standard **Reinforced** **Standard strokes**	**[mm]**	**RSS3** **–**	**RSS4** **–**	**RSS5** **–** **50 / 75 / 100 / 125 / 150 / 175 / 200**	**RSS6** **RSV6**	**RSS7** **RSV7**	**RSS8** **RSV8**	**RSS9** **RSV9**
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 100 bar	[kN]	4.91	8.04	12.56	19.63	31.17	50.26	78.54
250 bar	[kN]	12.2	20.1	31.4	49	77.9	125.6	196.3
Pull force 100 bar	[kN]	2.9	4.9	7.65	11.59	18.6	30.63	50.26
250 bar	[kN]	7.2	12.2	19.2	29	46.6	76.5	125.7
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
Ød1$_{f7}$	[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.

Code for part numbers - RS hydraulic slide

Size
3 = piston Ø 25 mm
4 = piston Ø 32 mm
5 = piston Ø 40 mm
6 = piston Ø 50 mm
7 = piston Ø 63 mm
8 = piston Ø 80 mm
9 = piston Ø 100 mm

Type: RS = ROEMHELD slide

Size
S = standard version
V = reinforced version
X = special version

RS X X X X X X X X

Front block
0 = without front block
1 = with front block

stroke
050 = stroke 50 mm
075 = stroke 75 mm
100 = stroke 100 mm
125 = stroke 125 mm
150 = stroke 150 mm
175 = stroke 175 mm
200 = stroke 200 mm
XXX = special stroke
(length indicated in [mm])

Limit switches
0 = without limit switch
2 = with 2 limit switches

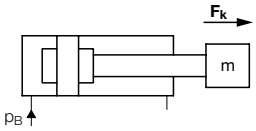
Cushioning and seals
2 = cushioning at the rear (piston side), seals NBR
3 = cushioning at the rear (piston side), seals FKM
4 = cushioning at the rear and at the front (on both sides), seals NBR
5 = cushioning at the rear and at the front (on both sides), seals FKM

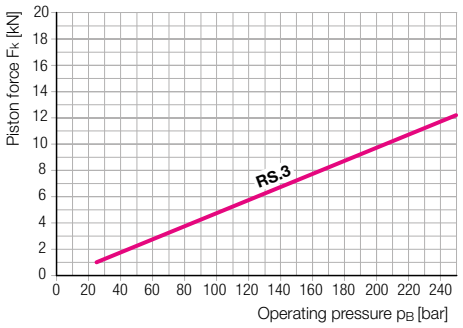
Position of the hydraulic ports
0 = extend and retract at the top
1 = extend and retract at the bottom*

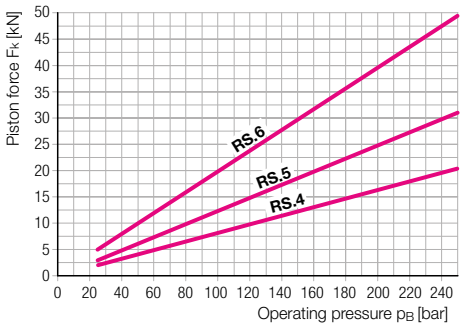
*) Manifold-mounting connection at the front, pipe thread at the rear

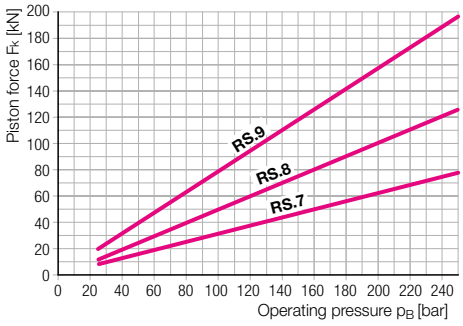
Piston force F_K as a function of the operating pressure p_B

Extend



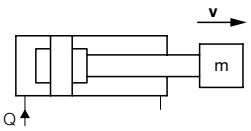


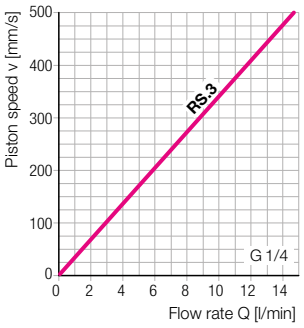


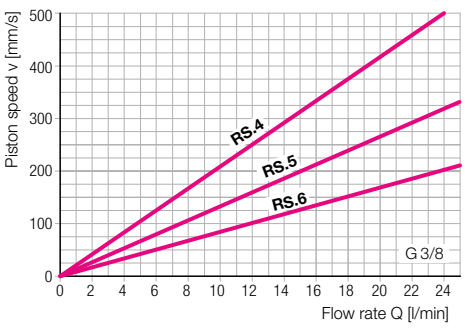


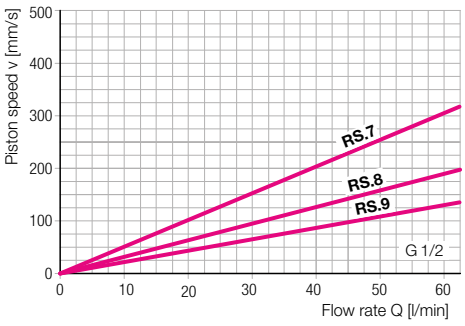
Piston speed v as a function of the flow rate Q

Extend









Retract