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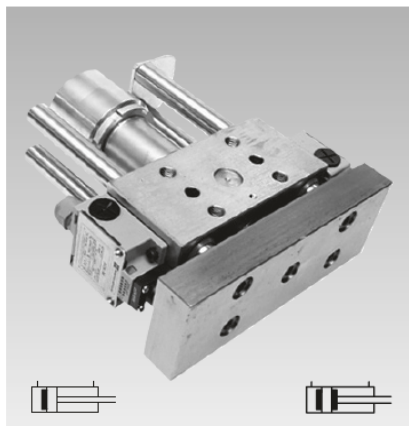enquiries@hyquip.co.uk ✉
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**ROEMHELD**
HILMA ▪ STARK

Issue 1-21 E

# B 1.7385

## 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.
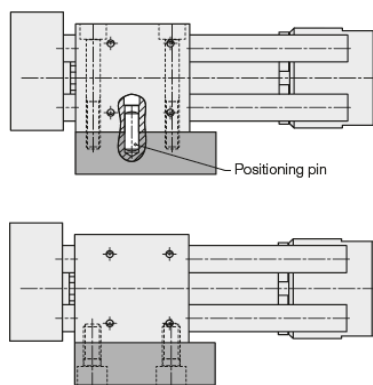
### Important notes
The RS hydraulic slide can generate considerable forces when extending and retracting. Due to the function-related arrangement of the front block with the tools attached to it and the guide rods, there is a very high risk of crushing. This also applies to setting mode.
The user or manufacturer of the machine or fixture is obliged to provide effective protection measures.
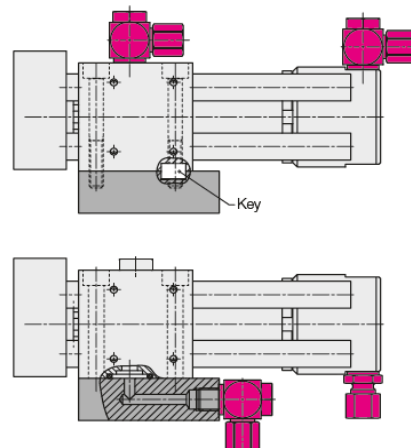Recommendation: Tamper-proof safety devices with electrical locking control.
If the hydraulic slide moves against the internal cylinder stop during extending, the version with the stroke end cushioning on both sides should be used.
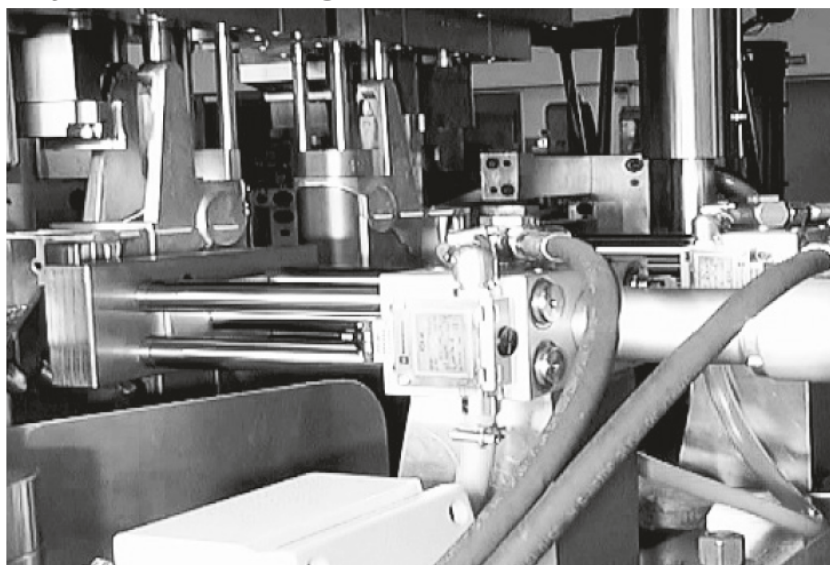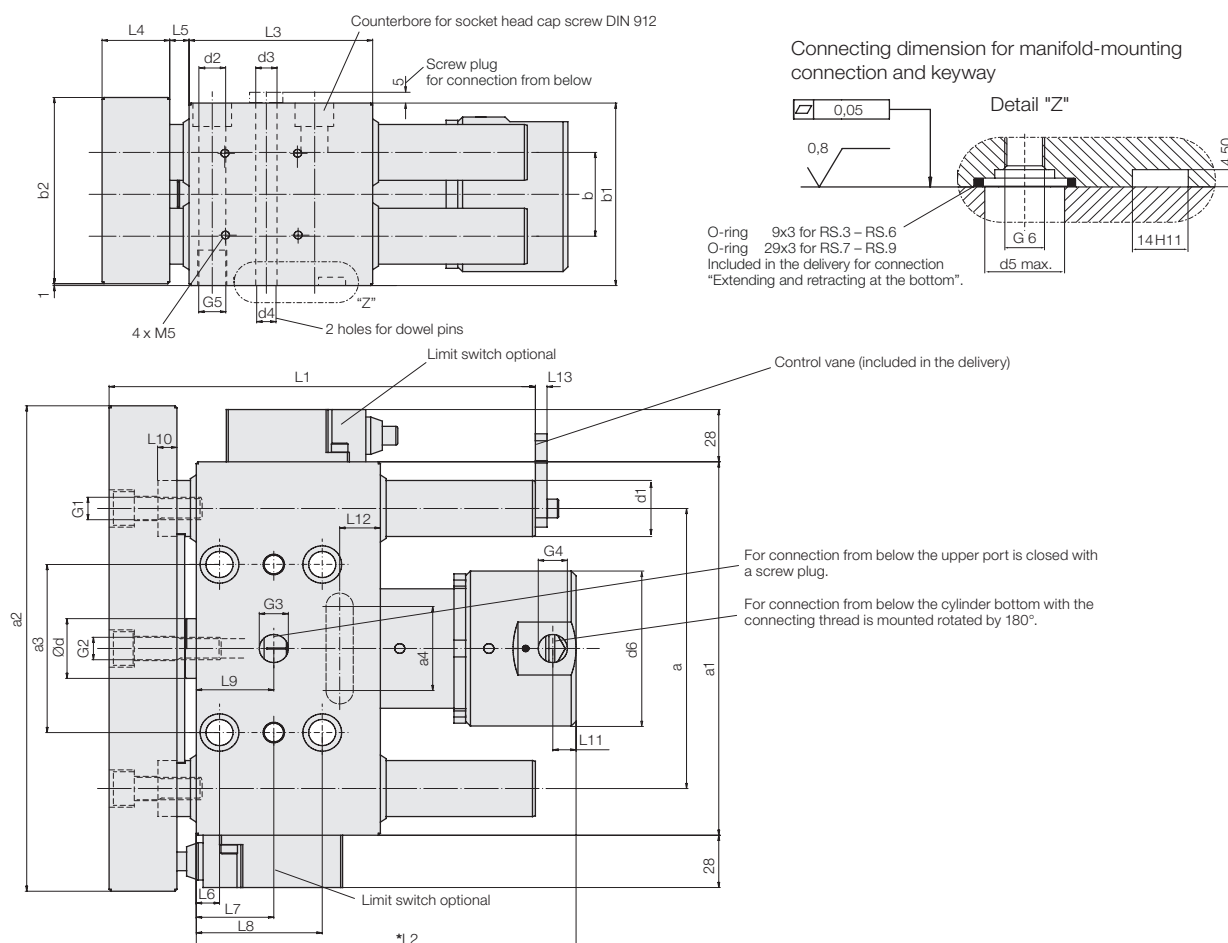
### Fixing possibilities



Positioning pin



### Hydraulic connecting possibilities



Key



### RS hydraulic slides on a deburring tool



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Subject to modifications

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## Dimensions
## Limit switch

Counterbore for socket head cap screw DIN 912

Screw plug for connection from below

Connecting dimension for manifold-mounting connection and keyway

Detail "Z"

O-ring 9x3 for RS.3 – RS.6
O-ring 29x3 for RS.7 – RS.9
Included in the delivery for connection "Extending and retracting at the bottom".

4 x M5

2 holes for dowel pins

Limit switch optional

Control vane (included in the delivery)

For connection from below the upper port is closed with a screw plug.

For connection from below the cylinder bottom with the connecting thread is mounted rotated by 180°.

Limit switch optional

### 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.
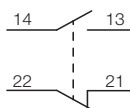
### Technical data

| | |
|---|---|
| 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 x 0.34 mm$^2$ |
| | max. 2 x 1.5 mm$^2$ |

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# HYQUIP

## Technical data

| | |
|---|---|
| **Available stroke lengths** | 50 / 75 / 100 / 125 / 150 / 175 / 200 mm<br>Special strokes on request |
| **Stroke tolerance** | ± 1 mm<br>(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<br>FKM seals −20 … + 150 °C |
| **Hydraulic fluids** | Hydraulic oil     Temperature range     Seals<br>HLP              −30 … + 100 °C      NBR, FKM<br>HFA, HFB, HFC   −10 … + 55 °C       NBR<br>HFDU           −20 … + 150 °C      FKM<br>(see data sheet A 0.100) |
| **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,<br>Maintenance free |
| **Service life** | Depending on the torque load, the piston speed v and the slide temperature.<br>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**
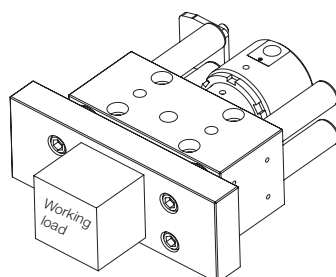


| Size | Maximum working load (tool mass $m_W$) [kg] | | | | |
|---|---|---|---|---|---|
| | Piston speed [mm/s] | | | | |
| | 100 | 200 | 300 | 400 | 500 |
| **RSS3** | 15 | 8 | 5 | 4 | 3 |
| **RSS4** | 60 | 30 | 20 | 15 | 12 |
| **RSS5** | 100 | 50 | 33 | - | - |
| **RSS6 / RSV6** | 300 | 150 | - | - | - |
| **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 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 |
|---|---|---|---|---|---|---|
| $f\nu$ | 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 mm²/s | → factor $f\nu$ = 1.5 |
| Maximum working load | = 1.2 · 1.5 · 150 kg = 270 kg | |

**Admissible torque load**
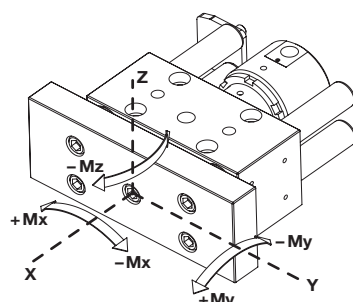


| Size | Admissible total torque Madm [Nm] |
|---|---|
| **RSS3** | 360 |
| **RSS4** | 520 |
| **RSS5** | 740 |
| **RSS6 / RSV6** | 1210 / 1540 |
| **RSS7 / RSV7** | 1315 / 1995 |
| **RSS8 / RSV8** | 1935 / 2255 |
| **RSS9 / RSV9** | 2590 / 3240 |

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

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# HYQUIP

## 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 | $\nu$ | = 46 mm²/s |

**Punching tool**

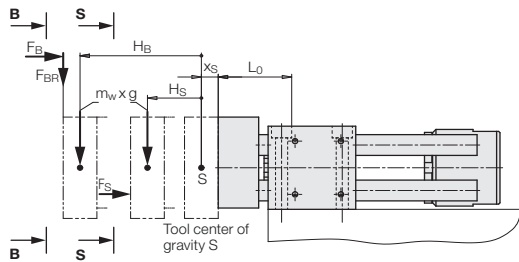| | | |
|---|---|---|
| Tool mass | $m_W$ | = 32 kg |
| Distance of the center of mass from the front block | $x_S$ | = 45 mm |
| Distance of the center of mass in x-direction | $l_x$ | = 30 mm |
| Distance of the line center of gravity (cutting punch) from the slide axis | $l_y$ | = 40 mm |
| Distance 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   $A_{min} = \dfrac{F_s}{p_B} = \dfrac{35000\ N}{200\ bar \cdot 10} = 17.5\ cm^2$

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

→   **Standard RSS6**

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

**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 · 0.7 · 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 $m_W$

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

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

**$M_{yW}$ = 53.2 Nm**

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

$M_x = m_W \cdot g \cdot l_x$

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

**$M_x$ = 9.4 Nm**
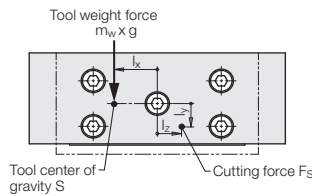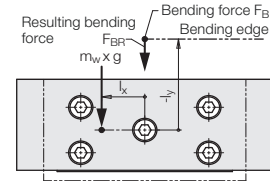
### 5.3 Bending moment due to cutting force $F_S$

$M_{yS} = F_S \cdot l_y$

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

**$M_{yS}$ = 1400 Nm**

$M_z = F_S \cdot l_z$

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

**$M_z$  = 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 $m_W$

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

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

**$M_{yW}$ = 66.5 Nm**

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

$M_x = m_W \cdot g \cdot l_x$

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

**$M_x$  = 9.4 Nm**

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

$M_{yB} = F_B \cdot l_y$

$= 5500\ N \cdot (–100)\ mm \cdot \dfrac{1\ m}{1000\ mm}$

**$M_{yB}$ = −550 Nm**

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

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

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

**$M_{yBR}$ = 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!

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# Technical data
# Code for part numbers

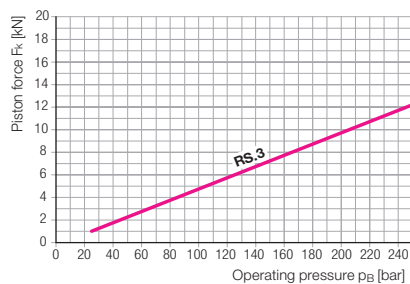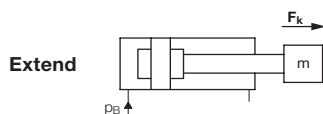| Standard<br>Reinforced<br>Standard strokes | [mm] | RSS3<br>–<br> | RSS4<br>–<br> | RSS5<br>–<br>50 / 75 / 100 / 125 / 150 / 175 / 200 | RSS6<br>RSV6 | RSS7<br>RSV7 | RSS8<br>RSV8 | RSS9<br>RSV9 |
|---|---|---|---|---|---|---|---|---|
| Piston Ø | [mm] | 25 | 32 | 40 | 50 | 63 | 80 | 100 |
| Piston 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 |
| 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.

## 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**

RS X X    X X X    X X X X

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

**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

**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])

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

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

**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

**Knowledge is POWER – Motion Force Control is our Business**

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# Piston force and piston speed

### 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**

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