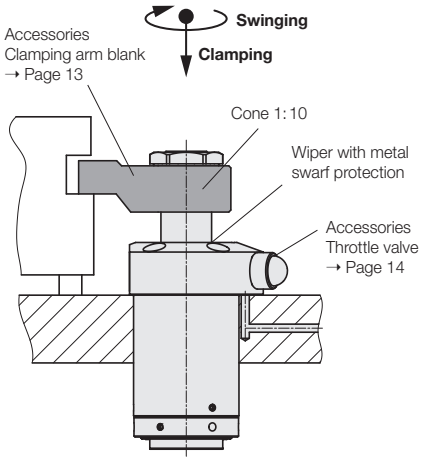
Swing Clamps without Swing Stroke

Top flange/bottom flange, reinforced swing mechanism, double acting, max. operating pressure 250 bar



Advantages

- Compact design partially recessible
- Compact design
- Extremely short clamping and unclamping times
- Swinging in into narrow recesses
- Wiper with metal swarf protection

Special features

- Reinforced swing mechanism
- Connections for pipe threads and drilled channels
- Radial anti-rotation device in the clamping stroke
- Indexing of clamping arm for repeatable alignment

Function

In this version without axial swing stroke, the clamping arm swivels in one plane and does not make any axial movement when swivelled.

Application

Hydraulic swing clamps are used for clamping workpieces when it is essential to keep the clamping points free for unrestricted fixture loading and unloading.

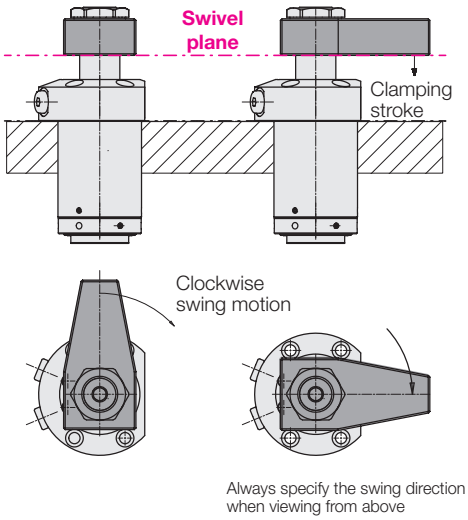
Reinforced swing mechanism

The reinforced swing mechanism ensures that the angle position of the clamping arm remains the same even if a slight collision with the workpiece during loading and unloading or during clamping occurs.

Behaviour during collision

If a collision while swinging from “unclamped” to “clamped” occurs, the swing clamp in the current swing position moves axially in the “clamping” direction without continuing to swing. This must be taken into account in the risk assessment and collision analysis.

Swinging without axial swing stroke



Always specify the swing direction when viewing from above

Radial anti-rotation device in the clamping stroke

With swivelling clamping devices, workpieces can also be machined overhead.
In the event of a sudden drop in clamping pressure, the radial anti-rotation device prevents the clamping arm from swivelling back.
The workpiece is then no longer clamped. However, a sensible arrangement of several swing clamps and workpiece positioning aids can prevent the workpiece from falling out of the fixture (see also the note in the operating manual).

Versions

- Top and bottom flange type
- 3 sizes
- Clamping arm seat with cone 1:10, pendulum eye or fork head
- 2 clamping strokes per size
- Right, left, or without swing motion
- Swing angle 0°, 15° to 75° and 90°
- Angle of clamping position selectable for pendulum eye or fork head

See code for part numbers → Page 12

Seals

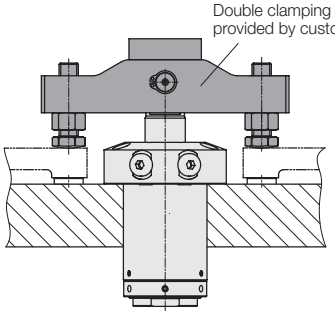
NBR = nitrile butadiene rubber

Accessories

- Clamping arm blank → Page 13
- Throttle valve → Page 14

Double clamping arm

This allows space-saving clamping of workpieces in multiple clamping fixtures.
Piston rods with pendulum eyes and fork heads are available so that optimally fitting double clamping arms can be attached.
For a newly designed double clamping arm, the moment of inertia must be determined to calculate the admissible flow rate using the formula on page 13.



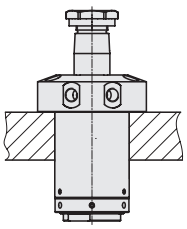
Operating conditions, tolerances and other data, see data sheet A 0.100.

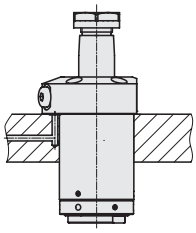
Connecting types

Top flange

Pipe thread and drilled channels

→ Page 3

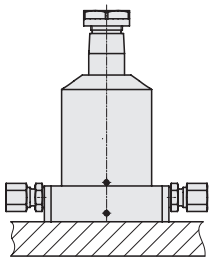


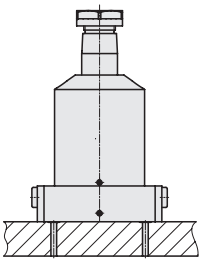


Bottom flange

Pipe thread and drilled channels

→ Page 4





Other versions: clamping arm seat

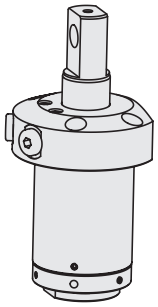
Top flange

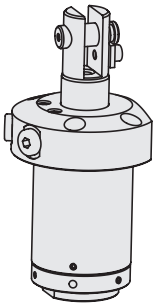
Pendulum eye

→ Page 6

Fork head

→ Page 9





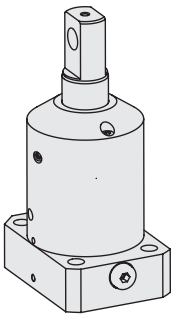
Bottom flange

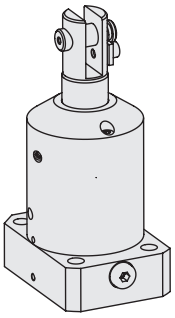
Pendulum eye

→ Page 7

Fork head

→ Page 10





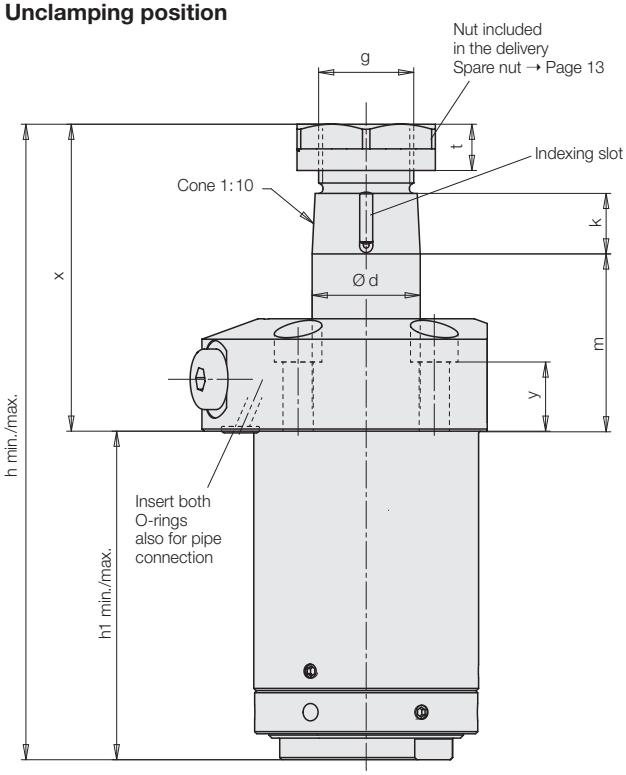
Technical data

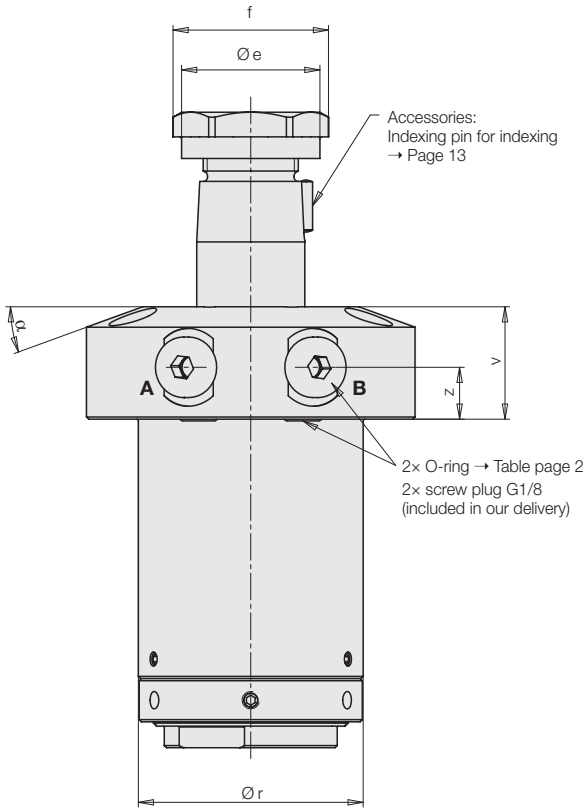
Size		**1**		**2**		**3**	
Piston/piston rod Ø	**[mm]**	**23/16**		**36/25**		**50/36**	
Clamping stroke	**[mm]**	**8**	**15**	**12**	**25**	**12**	**25**
Pulling force at 250 bar	**[kN]**	**5.3**		**13.1**		**23.6**	
Min. operating pressure	[bar]	20		20		20	
Piston ring area	[cm^2]	2.14		5.27		9.46	
Oil volume / clamping stroke mm	[cm^3]	0.21		0.53		0.95	
Oil volume / return stroke mm	[cm^3]	0.42		1.02		1.96	
Oil volume swinging 90°	[cm^3]	3.14		10.69		24.34	
Oil volume swinging 75°	[cm^3]	2.08		7.03		17.29	
Oil volume swinging 0°	[cm^3]	0.00		0.00		0.00	
Oil volume swing reduction between 75° and 15° in 5° increments	[cm^3]	0.12		0.38		1.01	
Spare O-ring	[mm]	6×1.5		6×1.5		8×1.5	
Part no. NBR		**3000313**		**3000313**		**3000343**	

Max. operating pressure depending on the clamping arm length e → Page 5

Operating conditions, tolerances and other data, see data sheet A 0.100.

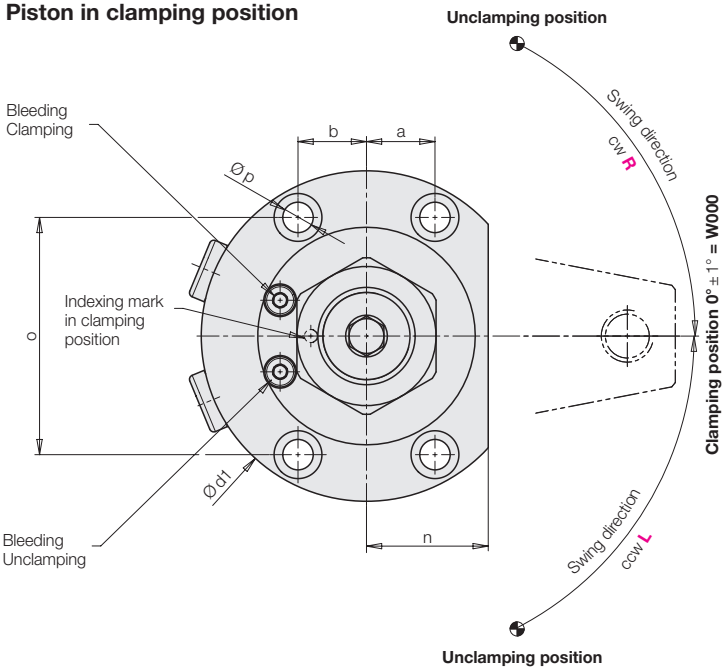
Unclamping position



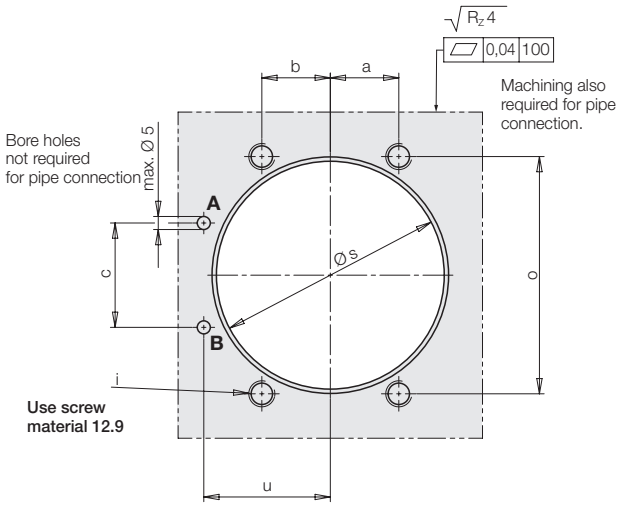


A = Clamping
B = Unclamping

Piston in clamping position



Connecting scheme



Clamping position

Angle of clamping position **W** = 0° (**W000**)
No other clamping position can be selected for the cone version.
The indexing mark is always opposite at 180°.

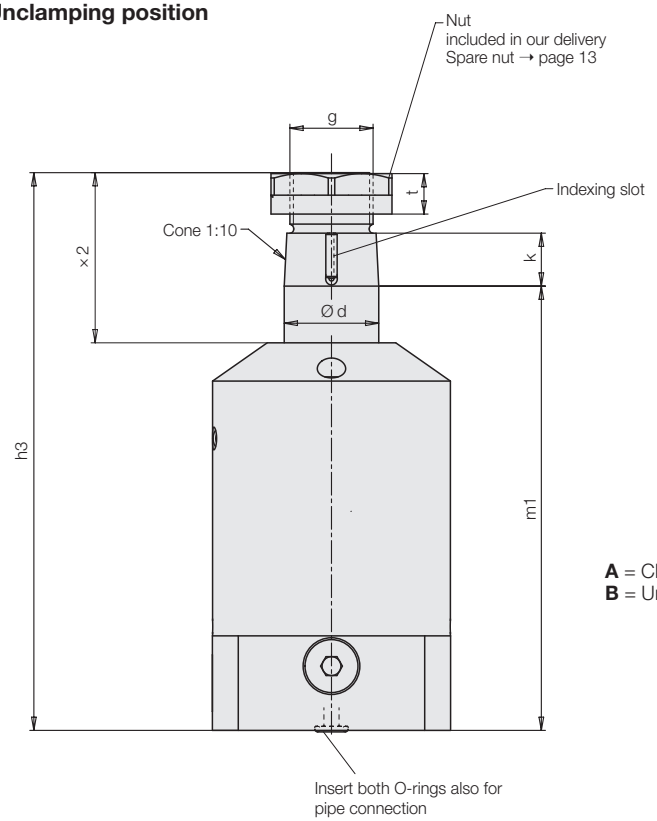
Swing angle

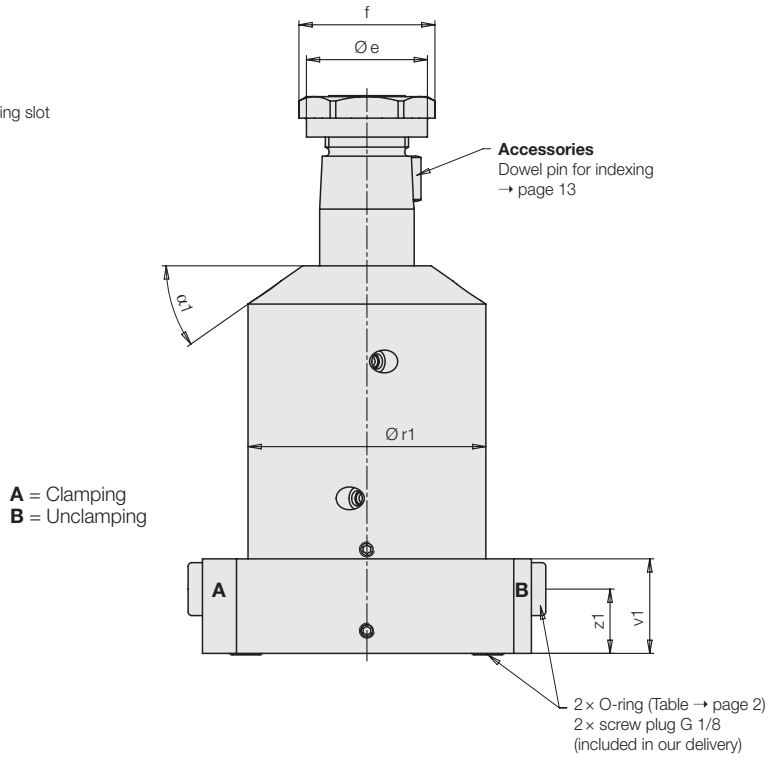
A swing angle of 0°, 15° to 75° in 5° increments
and 90° can be selected.
Tolerance of swing angle ±3° in unclamping position

Code for part numbers and examples → Page 12

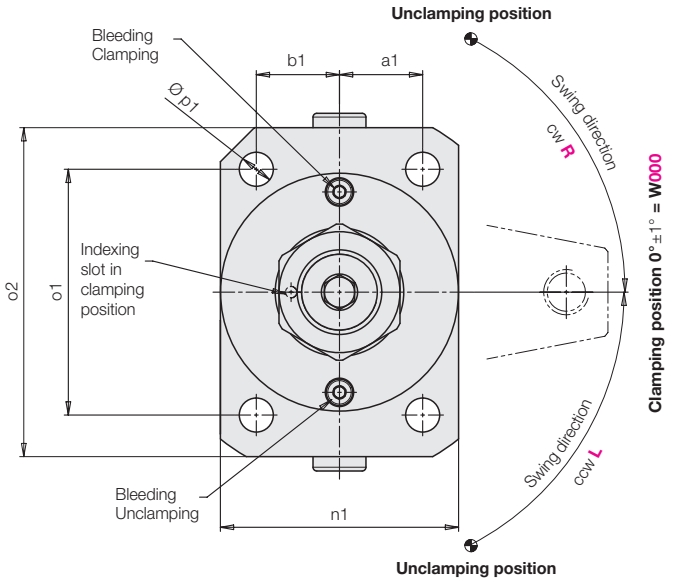
Operating conditions, tolerances and other data, see data sheet A 0.100.

Unclamping position

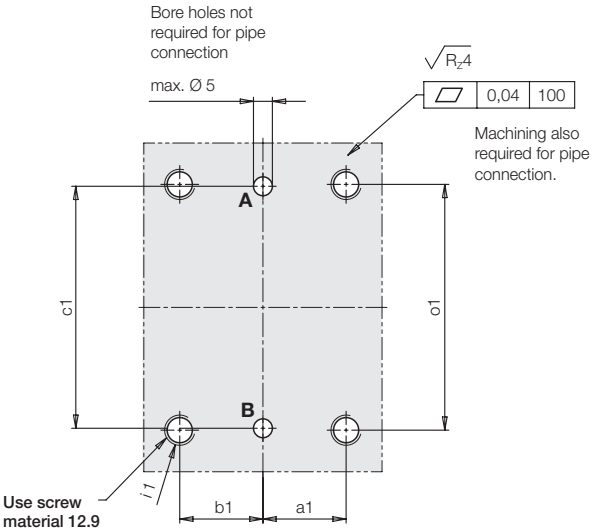




Piston in clamping position



Connecting scheme



Clamping position

Angle of clamping position **W** = 0° (**W000**)
No other clamping position can be selected for the cone version.
The indexing mark is always opposite at 180°.

Swing angle

A swing angle of 0°, 15° to 75° in 5° increments
and 90° can be selected.
Tolerance of swing angle ±3° in unclamping position

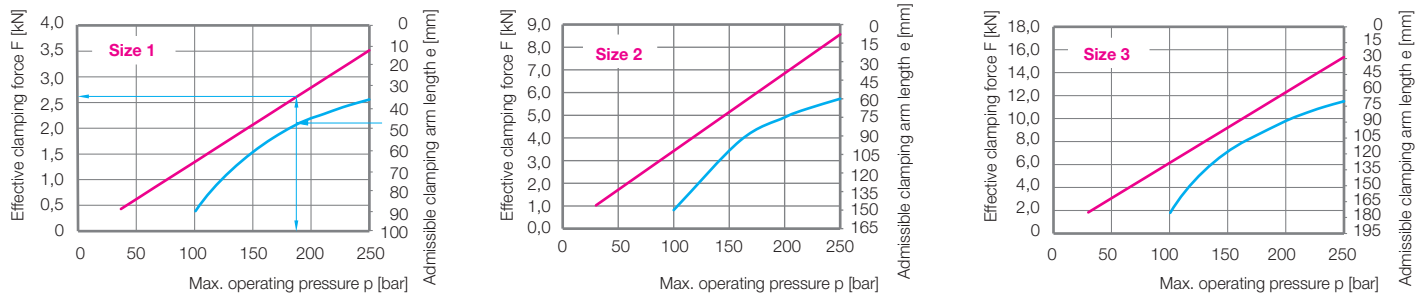
Code for part numbers and examples → Page 12

Operating conditions, tolerances and other data, see data sheet A 0.100.

Clamping arm seat with cone 1:10
Dimensions and technical data

Size		1		2		3	
Piston/piston rod Ø	**[mm]**	**23/16**		**36/25**		**50/36**	
Clamping stroke	[mm]	8	15	12	25	12	25
Pulling force at 250 bar	[kN]	5.3		13.1		23.6	
Min. operating pressure	[bar]	20		20		20	
Piston ring area	[cm²]	2.14		5.27		9.46	
Oil volume / clamping stroke mm	[cm³/mm]	0.21		0.53		0.95	
Oil volume / return stroke mm	[cm³/mm]	0.42		1.02		1.96	
Oil volume swinging at 90°	[cm³]	3.14		10.69		24.34	
Oil volume swinging at 75°	[cm³]	2.08		7.03		17.29	
Oil volume swinging 0°	[cm³]	0		0		0	
Oil volume swing reduction below 75° to 15° in 5° increments	[cm³]	0.12		0.38		1.01	
Max. adm. flow rate	[l/min]			Diagrams see page 13			
Min. swing times	[s]			Diagrams see page 13			
Ød	[mm]	16		25		36	
Øe	[mm]	19		32		46	
f	[mm]	27		36		53.1	
g	[mm]	M14×1.5		M22×1.5		M30×1.5	
k	[mm]	13.5		14		20	
t	[mm]	7.5		10.7		12	
SW	[mm]	24		32		46	
Top flange							
Weight, approx.	[kg]	0.8	0.9	1.9	2.3	4.6	5.4
Flange bevel α	[°]	10		20		15	
a	[mm]	11.75		15.75		22.5	
b	[mm]	11.75		15.75		22.5	
c	[mm]	18		24		34.5	
Ø d1	[mm]	62		76		110	
h min.	[mm]	115.5	136.5	146	185	187	226
h max.	[mm]	116	137	147	186	188	227
h1 min.	[mm]	60.5	74.5	75	101	104	130
h1 max.	[mm]	61	75	76	102	105	131
i	[mm]	M5		M6		M10	
m +0.7 −0.3	[mm]	32.5	39.5	41	54	45	58
n	[mm]	19		28		38	
o	[mm]	40.7		54.56		77.94	
Ø p	[mm]	5.8		7		12	
Ø r	[mm]	36		52		72	
Ø s ±0.2	[mm]	36.4		52.4		72.4	
u	[mm]	21.7		29.1		41.5	
v	[mm]	22		26		28	
x	[mm]	55	62	71	84	83	96
y	[mm]	13		16		11	
z	[mm]	10		12		11	
Bottom flange							
Weight, approx.	[kg]	1.18	1.35	2.7	3.27	5.65	6.55
Flange bevel α1	[°]	25		35		25	
a1	[mm]	15		22		30	
b1	[mm]	15		22		30	
c1	[mm]	48		64		86	
h3	[mm]	117.1	138.1	147.5	186.5	188.7	227.7
i1	[mm]	M6		M8		M12	
m1 +0.4 −0.1	[mm]	94.6	115.6	117.5	156.5	150.7	189.7
n1	[mm]	45		63		80	
o1	[mm]	50		65		86	
o2	[mm]	70		87		108	
Øp1	[mm]	7		9		13	
Ør1 −0.2	[mm]	44.9		62.9		79.8	
v1	[mm]	20		25		27.5	
x2	[mm]	33	40	45	58	55	68
z1	[mm]	11		17		17.5	

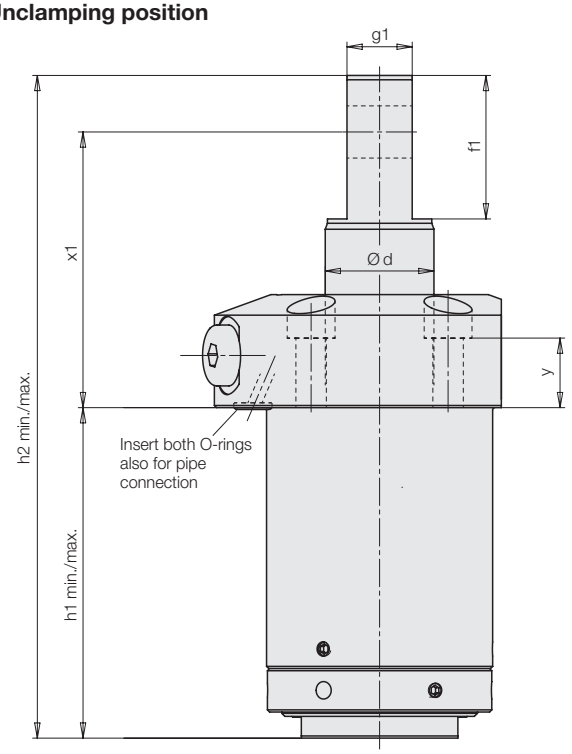
Effective clamping force and admissible clamping arm length

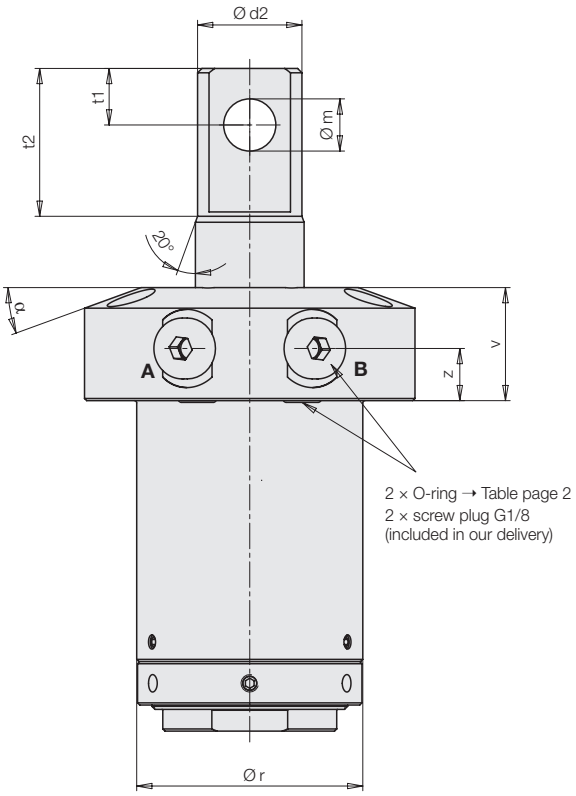


Example:
Clamping arm length 47 mm, max. operating pressure 187 bar, effective clamping force 2.6 kN

Operating conditions, tolerances and other data, see data sheet A 0.100.

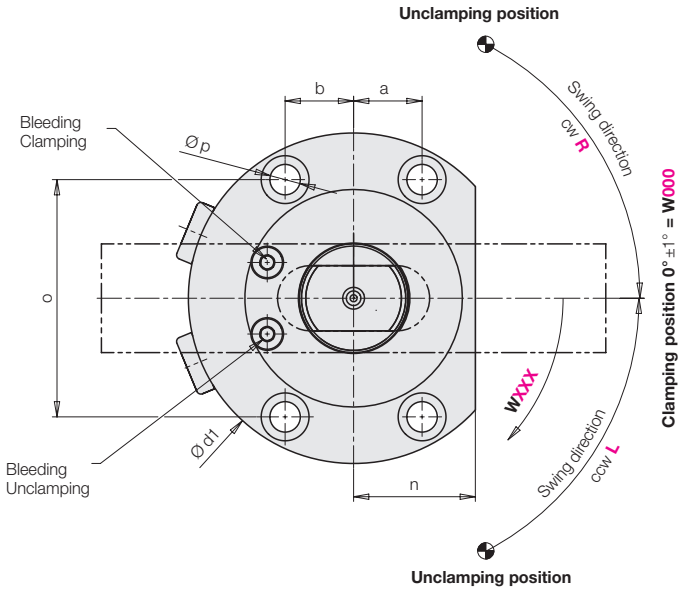
Unclamping position



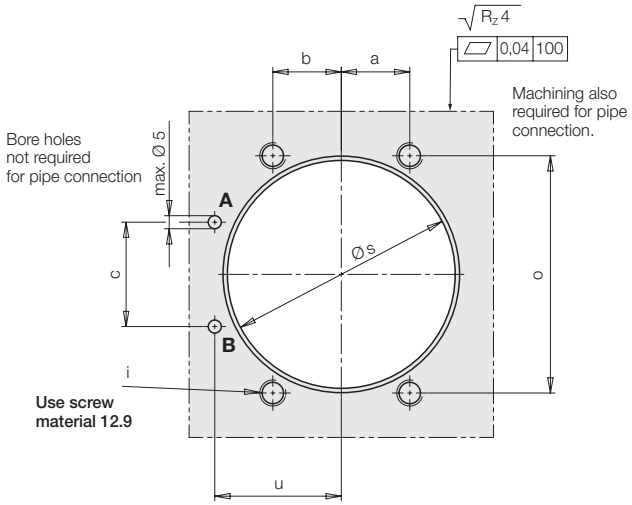


A = Clamping
B = Unclamping

Piston in clamping position



Connecting scheme



Clamping position

The angle of clamping position W can be selected between 0° and 175° in 5° increments (**W000 … W175**).

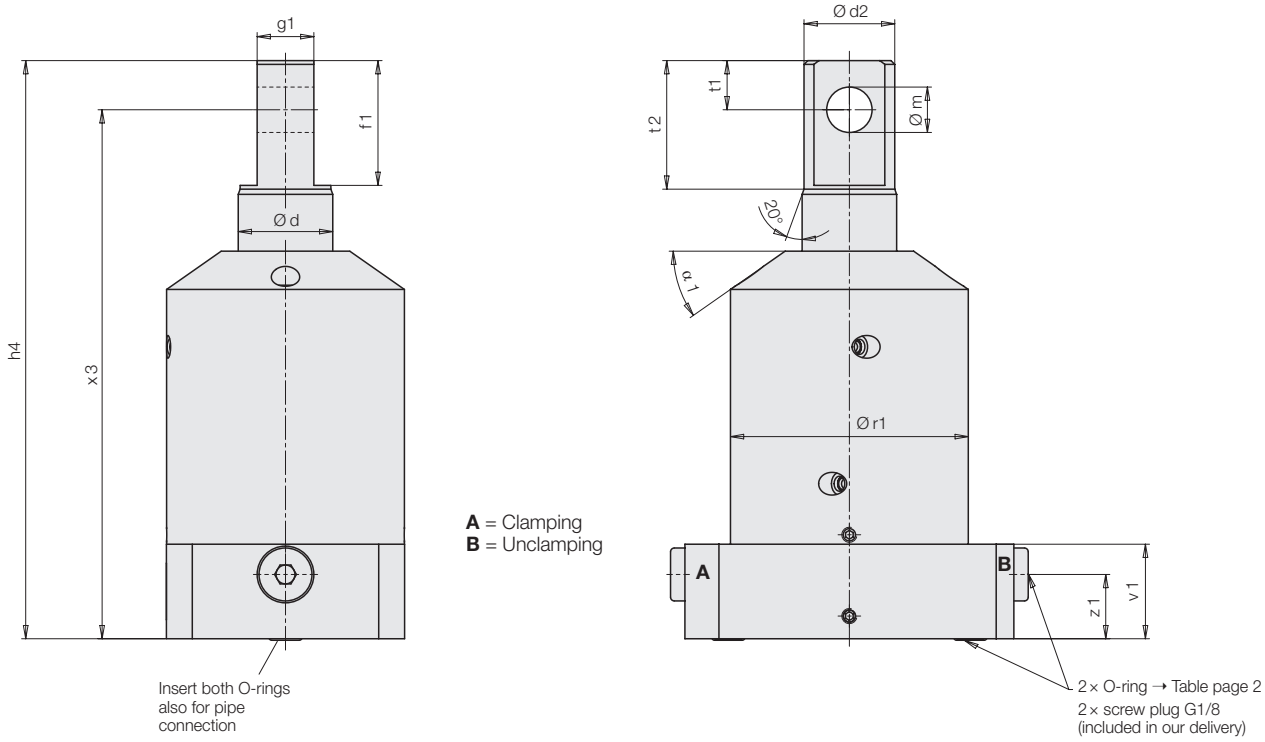
Swing angle

A swing angle of 0°, 15° to 75° in 5° increments, and 90° can be selected.
Tolerance of swing angle ±3° in unclamping position

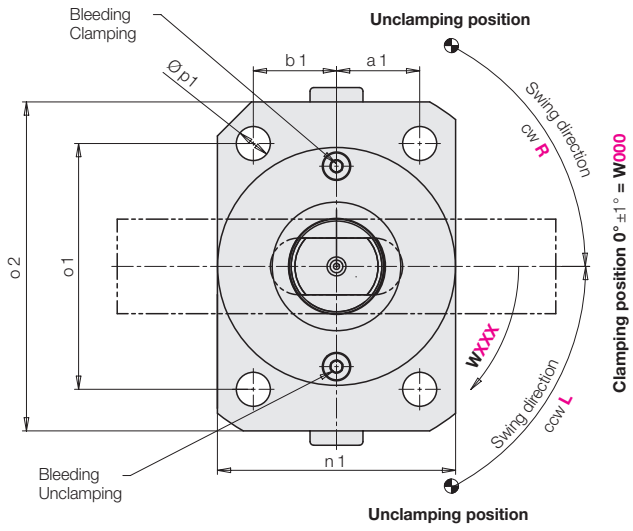
Code for part numbers and examples → Page 12

Operating conditions, tolerances and other data, see data sheet A 0.100.

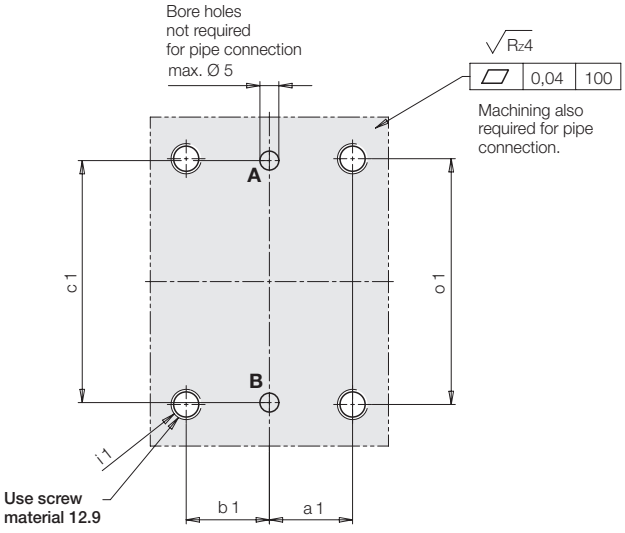
Unclamping position



Piston in clamping position



Connecting scheme



Clamping position

The angle of clamping position W can be selected between 0° and 175° in 5° increments (**W000 … W175**).

Swing angle

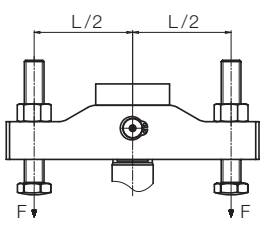
A swing angle of 0°, 15° to 75° in 5° increments, and 90° can be selected.
Tolerance of swing angle ±3° in unclamping position

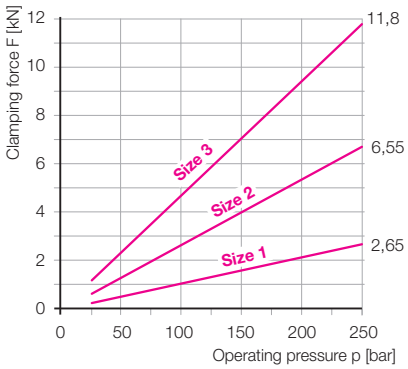
Code for part numbers and examples → Page 12

Operating conditions, tolerances and other data, see data sheet A 0.100.

Size		1		2		3	
Piston/piston rod Ø	**[mm]**	**23/16**		**36/25**		**50/36**	
Clamping stroke	[mm]	8	15	12	25	12	25
Pulling force at 250 bar	[kN]	5.3		13.1		23.6	
Min. operating pressure	[bar]	20	20	20	20	20	20
Piston ring area	[cm^2]	2.14		5.27		9.46	
Oil volume / clamping stroke mm	[cm^3/mm]	0.21		0.53		0.95	
Oil volume / return stroke mm	[cm^3/mm]	0.42		1.02		1.96	
Oil volume swinging at 90°	[cm^3]	3.14		10.69		24.34	
Oil volume swinging at 75°	[cm^3]	2.08		7.03		17.29	
Oil volume swinging 0°	[cm^3]	0		0		0	
Oil volume swing reduction below 75° to 15° in 5° increments	[cm^3]	0.12		0.38		1.01	
Max. adm. flow rate	[l/min]			Diagrams see page 13			
Min. swing times	[s]			Diagrams see page 13			
Ød	[mm]	16		25		36	
Ød2	[mm]	15.5		24		34	
f1	[mm]	23		33		50	
Øm H7/g6		8		12		16	
t1	[mm]	10		13		20	
t2	[mm]	24		34		50.5	
Top flange							
Weight, approx.	[kg]	0.8	0.9	1.9	2.3	4.6	5.4
Flange bevel α	[°]	10		20		15	
a	[mm]	11.75		15.75		22.5	
b	[mm]	11.75		15.75		22.5	
c	[mm]	18		24		34.5	
Ø d1	[mm]	62		76		110	
g1 f7	[mm]	10		15		25	
h1 min.	[mm]	60.5	74.5	75	101	104	130
h1 max.	[mm]	61	75	76	102	105	131
h2 min.	[mm]	117.5	138.5	151.4	190.4	202	241
h2 max.	[mm]	118	139	152.4	191.4	203	242
i	[mm]	M5		M6		M10	
n	[mm]	19		28		38	
o	[mm]	40.7		54.56		77.94	
Ø p	[mm]	5.8		7		12	
Ø r	[mm]	36		52		72	
Ø s ±0.2	[mm]	36.4		52.4		72.4	
u	[mm]	21.7		29.1		41.5	
v	[mm]	22		26		28	
x1 +0.7 −0.6	[mm]	47	54	63.4	76.4	78	91
y	[mm]	13		16		11	
z	[mm]	10		12		11	
Bottom flange							
Weight, approx.	[kg]	1.17	1.33	2.65	3.24	5.58	6.5
Flange bevel α1	[°]	25		35		25	
a1	[mm]	15		22		30	
b1	[mm]	15		22		30	
c1	[mm]	48		64		86	
h4	[mm]	119.1	140.1	152.9	191.9	203.7	242.7
i1	[mm]	M6		M8		M12	
n1	[mm]	45		63		80	
o1	[mm]	50		65		86	
o2	[mm]	70		87		108	
Øp1	[mm]	7		9		13	
Ør1 −0.2	[mm]	44.9		62.9		79.8	
v1	[mm]	20		25		27.5	
x3 ±0.4	[mm]	109.1	130.1	139.9	178.9	183.7	222.7
z1	[mm]	11		17		17.5	

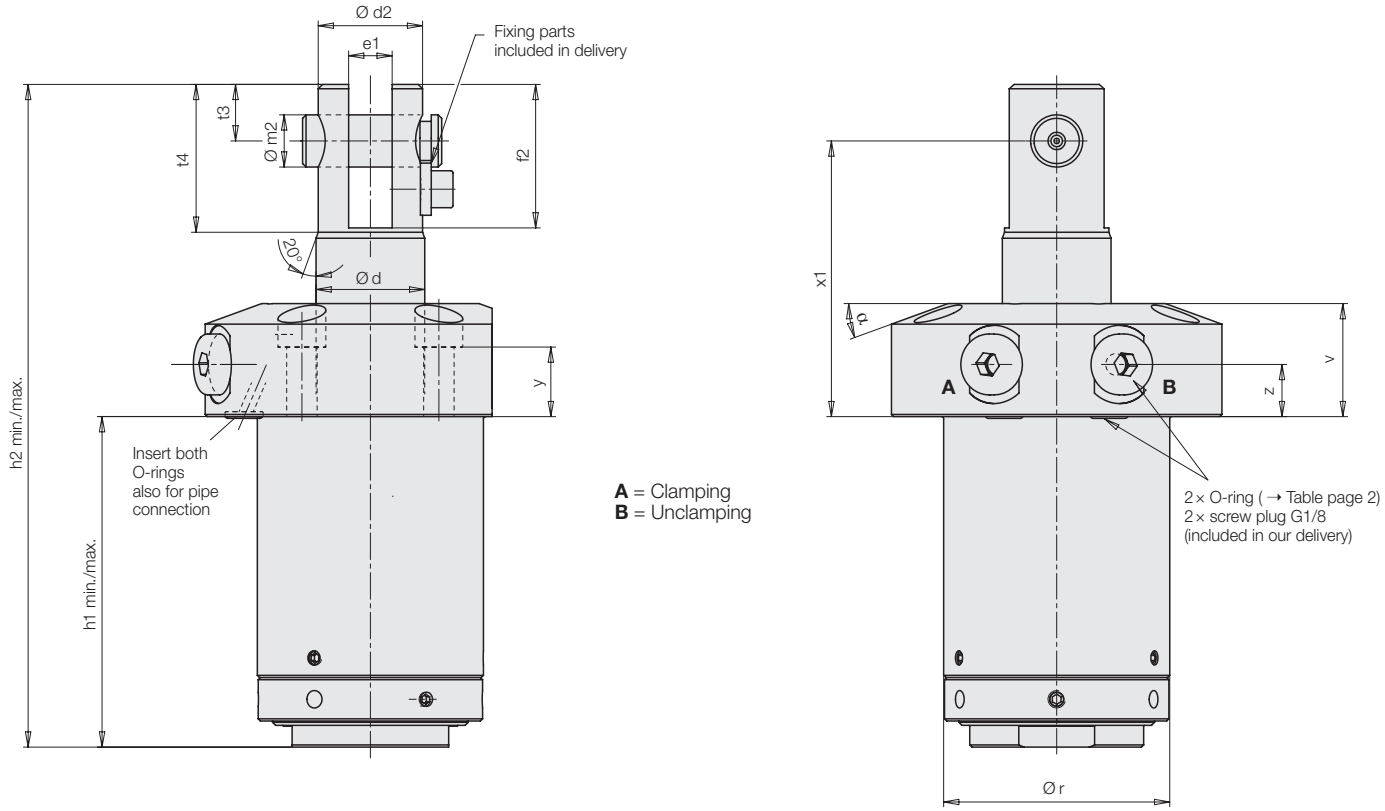
Effective clamping force F as a function of the operating pressure p



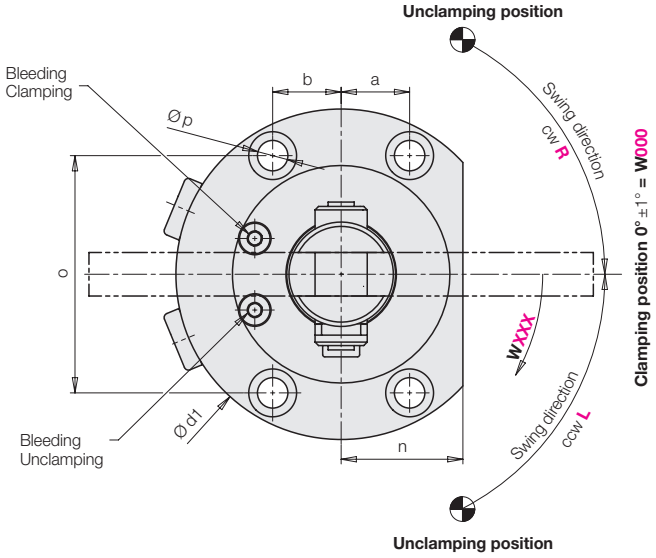


Operating conditions, tolerances and other data, see data sheet A 0.100.

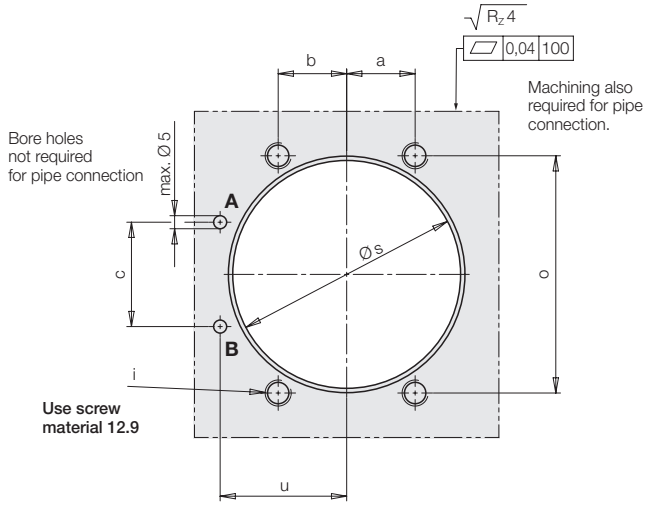
Unclamping position



Piston in clamping position



Connecting scheme



Clamping position

The angle of clamping position **W** can be selected between 0° and 175° in 5° increments (**W000 … W175**).

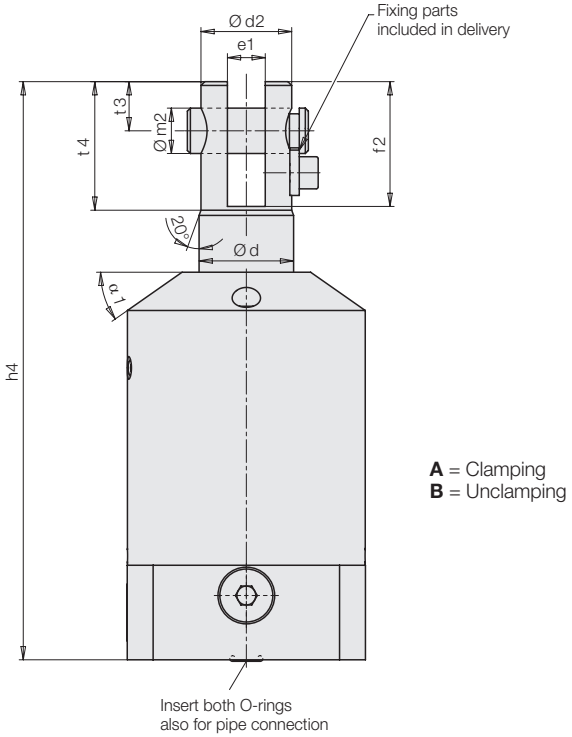
Swing angle

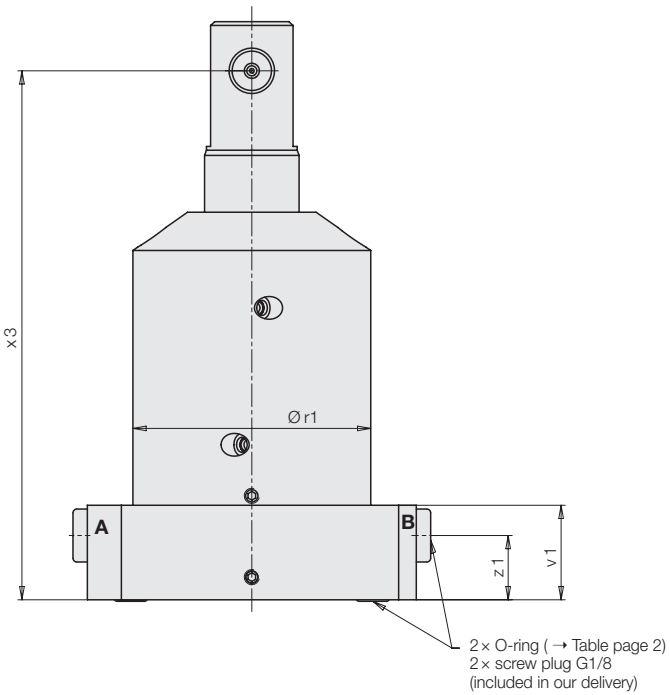
A swing angle of 0°, 15° to 75° in 5° increments, and 90° can be selected.
Tolerance of swing angle ±3° in unclamping position

Code for part numbers and examples → Page 12

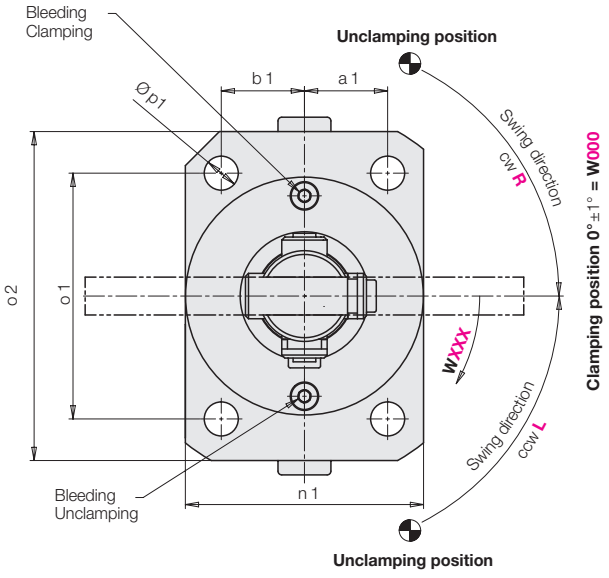
Operating conditions, tolerances and other data, see data sheet A 0.100.

Unclamping position

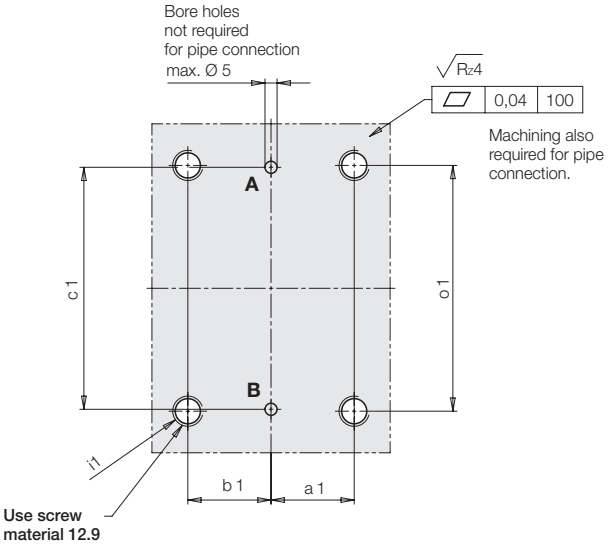




Piston in clamping position



Connecting scheme



Clamping position

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Tolerance of swing angle ±3° in unclamping position

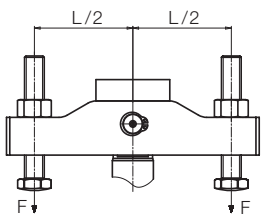
Code for part numbers and examples → Page 12

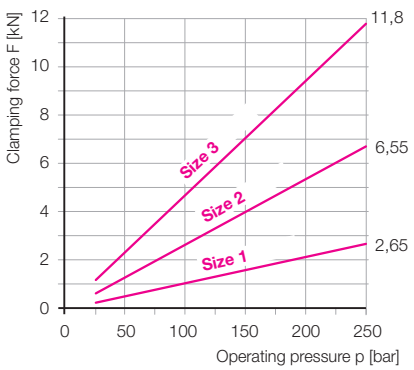
Operating conditions, tolerances and other data, see data sheet A 0.100.

Clamping arm seat with fork head
Dimensions and technical data

Size		1		2		3	
Piston/piston rod Ø	**[mm]**	**23/16**		**36/25**		**50/36**	
Clamping stroke	[mm]	8	15	12	25	12	25
Pulling force at 250 bar	[kN]	5.3		13.1		23.6	
Min. operating pressure	[bar]	20	20	20	20	20	20
Piston ring area	[cm²]	2.14		5.27		9.46	
Oil volume / clamping stroke mm	[cm³/mm]	0.21		0.53		0.95	
Oil volume / return stroke mm	[cm³/mm]	0.42		1.02		1.96	
Oil volume swinging at 90°	[cm³]	3.14		10.69		24.34	
Oil volume swinging at 75°	[cm³]	2.08		7.03		17.29	
Oil volume swinging 0°	[cm³]	0		0		0	
Oil volume swing reduction below 75° to 15° in 5° increments	[cm³]	0.12		0.38		1.01	
Max. adm. flow rate	[l/min]			Diagrams see page 13			
Min. swing times	[s]			Diagrams see page 13			
Ød	[mm]	16		25		36	
Ød2	[mm]	15.5		24		34	
e1 +0.1	[mm]	6.01		10.01		12.01	
f2	[mm]	23.5		33		50	
Ø m2 H7/g6	[mm]	8		12		14	
t3	[mm]	10		13		20	
t4	[mm]	24		34		50.5	
Top flange							
Weight, approx.	[kg]	0.8	0.9	1.9	2.3	4.6	5.4
Flange bevel α	[°]	10		20		15	
a	[mm]	11.75		15.75		22.5	
b	[mm]	11.75		15.75		22.5	
c	[mm]	18		24		34.5	
Ø d1	[mm]	62		76		110	
h1 min.	[mm]	60.5	74.5	75	101	104	130
h1 max.	[mm]	61	75	76	102	105	131
h2 min.	[mm]	117.5	138.5	151.4	190.4	202	241
h2 max.	[mm]	118	139	152.4	191.4	203	242
i	[mm]	M5		M6		M10	
n	[mm]	19		28		38	
o	[mm]	40.7		54.56		77.94	
Ø p	[mm]	5.8		7		12	
Ø r	[mm]	36		52		72	
Ø s ± 0.2	[mm]	36.4		52.4		72.4	
u	[mm]	21.7		29.1		41.5	
v	[mm]	22		26		28	
x1 +0.7 −0.6	[mm]	47	54	63.4	76.4	78	91
y	[mm]	13		16		11	
z	[mm]	10		12		11	
Bottom flange							
Weight, approx.	[kg]	1.17	1.33	2.65	3.22	5.55	6.5
Flange bevel α1	[°]	25		35		25	
a1	[mm]	15		22		30	
b1	[mm]	15		22		30	
c1	[mm]	48		64		86	
h4	[mm]	119.1	140.1	152.9	191.9	203.7	242.7
i1		M6		M8		M12	
n1	[mm]	45		63		80	
o1	[mm]	50		65		86	
o2	[mm]	70		87		108	
Ø p1	[mm]	7		9		13	
Ø r1 −0.2	[mm]	44.9		62.9		79.8	
v1	[mm]	20		25		27.5	
x3 ±0.4	[mm]	109.1	130.1	139.9	178.9	183.7	222.7
z1	[mm]	11		17		17.5	

Effective clamping force F as a function of the operating pressure p





Operating conditions, tolerances and other data, see data sheet A 0.100.

Code for part numbers

V1SAA X X X 5 X XXX H XXX W XXX 0 N E

Size
D = Size 1 (Ø23/16 – 5.3 kN)
L = Size 2 (Ø36/25 – 13.1 kN)
R = Size 3 (Ø50/36 – 23.6 kN)

Design
B = Top flange with O-ring and pipe thread
G = Bottom flange with O-ring and pipe thread

Clamping arm seat
K = Cone 1:10 → Page 3–5
P = Pendulum eye → Pages 6–8
G = Fork head → Pages 9–11

Swing direction
R = clockwise
L = counterclockwise
0 = without swing motion

Swing angle
015 = 15°
020 = 20°
025 = 25°
030 = 30°
035 = 35°
040 = 40°
045 = 45°
050 = 50°
055 = 55°
060 = 60°
065 = 65°
070 = 70°
075 = 75°
090 = 90°
000 = 0°(without swing motion)

Clamping stroke
For size 1 (D)
008 = 8 mm
015 = 15 mm
For sizes 2 and 3 (L and R)
012 = 12 mm
025 = 25 mm
Clamping stroke limit upon request

Angle of clamping position
For cone 1:10
000 = 0°
For pendulum eye and fork head
000 to **175** = 0° to 175°
in graduation of 5°

Ordering example 1

Size 2	= **L**
Top flange	= **B**
Cone 1:10	= **K**
Cw swing motion	= **R**
Swing angle 75°	= **075**
Clamping stroke: 12 mm	= **012**
Clamping position 0°	= **000**

Part no.
V1SAA LBK5 R075 H012 W000 0NE

Ordering example 2

Size 1	= **D**
Bottom flange	= **G**
Pendulum eye	= **P**
Cw swing motion	= **R**
Swing angle 75°	= **075**
Clamping stroke: 8 mm	= **008**
Clamping position 30°	= **030**

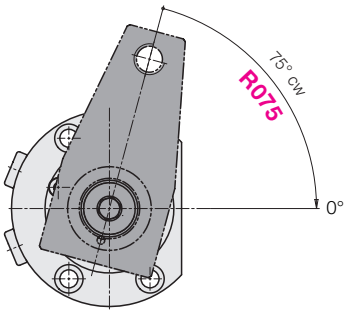
Part no.
V1SAA DGP5 R075 H008 W030 0NE

Ordering example 3

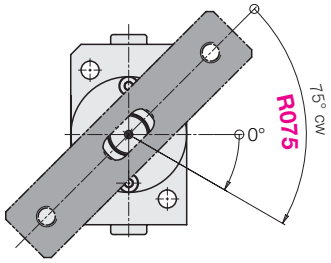
Size 3	= **R**
Top flange	= **B**
Fork head	= **G**
Ccw swing motion	= **L**
Swing angle 75°	= **075**
Clamping stroke: 25 mm	= **025**
Clamping position 160°	= **160**

Part no.
V1SAA RBG5 L075 H025 W160 0NE

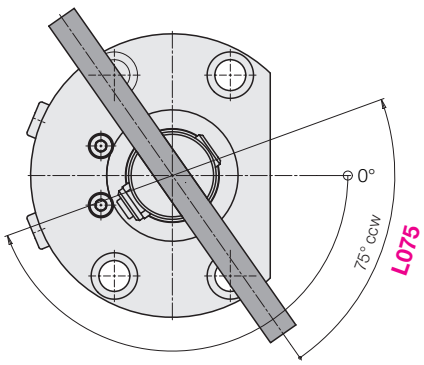
Unclamped



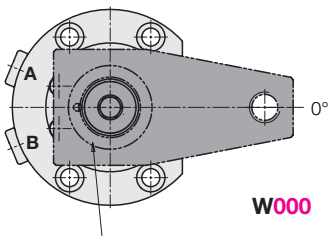
Unclamped



Unclamped

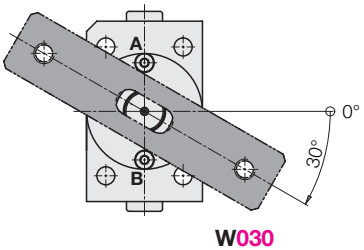


Clamped

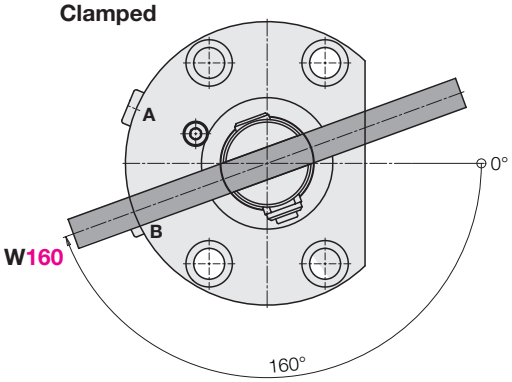


Position of slot in clamping position

Clamped

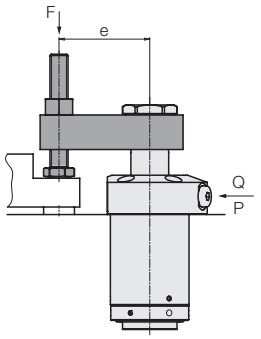


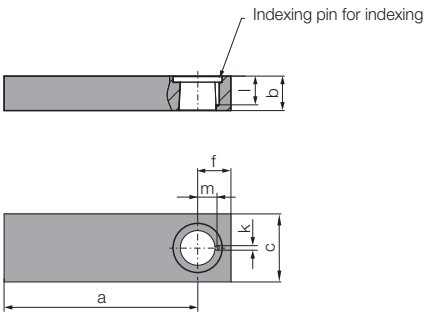
Clamped

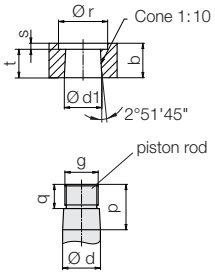


Operating conditions, tolerances and other data, see data sheet A 0.100.

Clamping arm blank for swing clamps







The cone seat is part of the clamping arm blank with the required precision. Adapting to the workpiece clamping points is achieved by

- Shortening to the required clamping arm length
- A thread for a hardened contact bolt, which can also be adjustable
- Bevelling on the sides and top/bottom for better swarf flow and to reduce the mass moment of inertia

Moment of inertia of the clamping arm

To prevent the swing mechanism from overload, the swing speed must be reduced by throttling the flow rate depending on the moment of inertia of the clamping arm in use (see Accessory Throttle valve→ page 14).

Diagram of swing time

This is based on a short standard clamping arm with a moment of inertia J_e and a swivel time of 1 second.

Calculation of the 90° swing time:

$$t_{min} = 1\ s * \sqrt{\frac{J_L}{J_e}} \geq 1\ s \qquad [s]$$

Calculation of the admissible flow rate:

$$Q_{adm} = Q_e * \sqrt{\frac{J_e}{J_L}} \leq Q_e \qquad [cm^3/s]$$

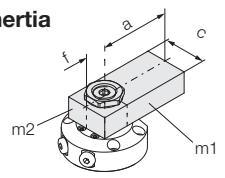
Q_e = max. flow rate for the standard clamping arm according to table [cm³/s]

J_e = moment of inertia of the standard clamping arm according to table [kg · mm²]

J_L = moment of inertia of the desired clamping arm [kg · mm²]

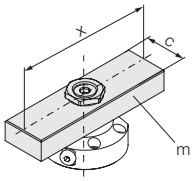
Type		BG1 (V1SA ADX)	BG2 (V1SA ALX)	BG3 (V1SA ARX)
a	[mm]	90	150	175
b	[mm]	17	22.8	29.5
c	[mm]	28	45	60
Ø d f7	[mm]	16	25	36
Ød1 –0.05 / –0.1	[mm]	16	25	36
e max. at 250 bar	[mm]	35	60	70
f	[mm]	16	22	30
g	[mm]	M14 x 1.5	M22 x 1.5	M30 x 1.5
Ø k +0.05	[mm]	3	3	4
l +0.5	[mm]	9.5	18	18
m ±0.05	[mm]	7.8	12.8	17.5
p	[mm]	22.5	30	38
q	[mm]	9	16	18
Ø r	[mm]	20	32.5	47
s	[mm]	2.5	4	4
t	[mm]	14.5	18.8	25.5
Weight	[kg]	0.37	1.29	2.6
Moment of inertia of J_e	[kg · mm²]	936	9,292	25,694
Part no.				
Clamping arm blank		**3548 4215**	**3548 4216**	**3548 4217**
Spare nut		**3527 092**	**3527 129**	**3527 126**
Tightening torque	[Nm]	16	50	110
Dowel pin		**3301 281**	**3301 708**	**3300 195**
	[mm]	Ø3x6	Ø3x12	Ø4x12
Short standard clamping arm				
Max. flow rate Q_e	[cm³/s]	3.14	10.69	24.34
Moment of inertia of J_e	[kg · mm²]	100	1,450	3,250
Min. swing time	[s]	1	1	1

Moment of inertia



$$J_L = m1 \frac{4a^2 + c^2}{12} + m2 \frac{4f^2 + c^2}{12} \qquad [kg \cdot mm^2]$$

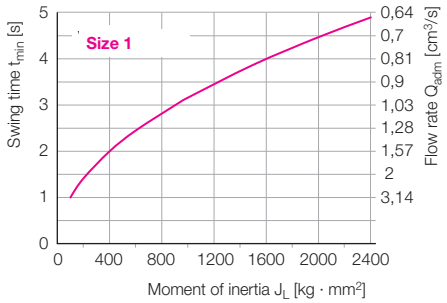
Weight m [kg]
Dimensions a, f, c, x [mm]

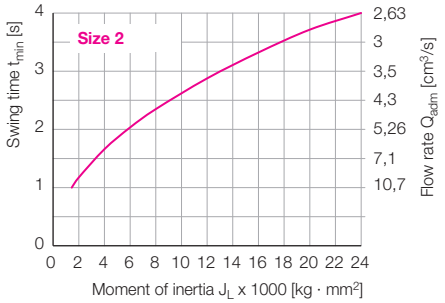


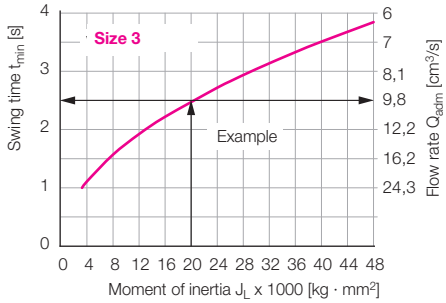
$$J_L = m \frac{x^2 + c^2}{12} \qquad [kg \cdot mm^2]$$

Min. swing time and admissible flow rate dependent on the moment of inertia of the clamping arm

Illustrations apply to swivel angle 15° or greater







Max. operating pressure depending on the clamping arm length e → Page 5
Operating conditions, tolerances and other data, see data sheet A 0.100.

Example: J_L = 20,000 kg · mm²
→ t_{min} = 2.5 s → Q_{adm} 9.8 cm³/s

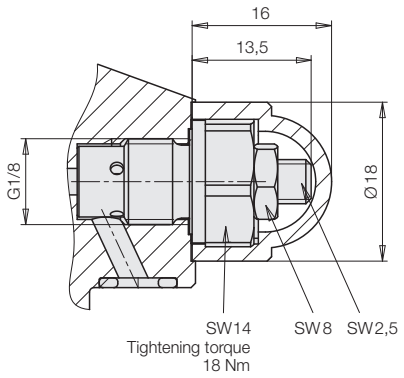
Application

These throttle valves are used
- in order to reduce the swing speed of the clamping arm
- in order to improve the synchronism of several swing clamps

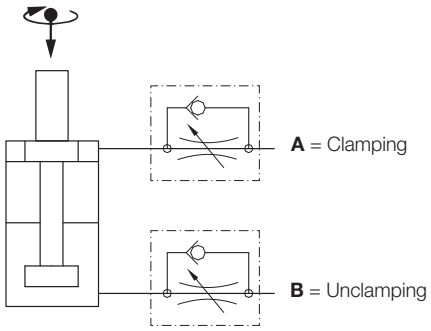
Important notes

This application is only possible when using drilled ducts as connections because the throttle valves are screwed into the existing G1/8 pipe connections.
In the case of strong throttling, increasing back pressure upstream of the throttle valve can trigger premature switching of pressure switches and sequence valves.

Dimensions



Hydraulic symbols



Weight 0.025 kg

Part no. 2957209

Operating conditions, tolerances and other data, see data sheet A 0.100.