



Swing Clamp with Overload Protection Device
Bottom flange and threaded body,
single and double acting, max. operating pressure 500 bar



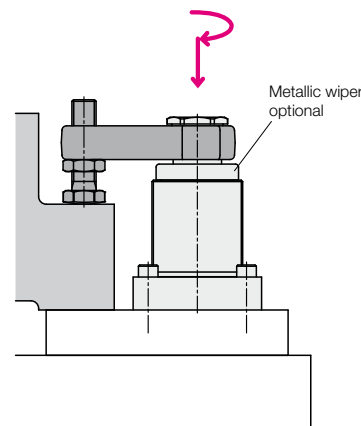
Advantages

- 4 sizes each with 3 clamping stroke lengths available
- Bottom flange or threaded mounting
- Pipe thread or drilled channels
- Single or double-acting function
- Standard FKM wiper
- Metallic wiper optional
- Various clamping arms as accessories

Overload protection device

The overload protection device is a spring-loaded disengageable coupling between piston and helix rod that protects the swing mechanism against damage in case of

- blocked swing motion
- too high swing speed
- improper fixing of clamping arm.



Application

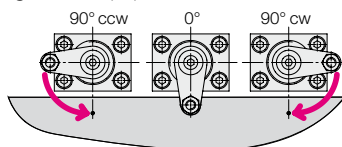
Hydraulic swing clamps are used for clamping of workpieces, when it is essential to keep the clamping area free of straps and clamping components for unrestricted workpiece loading and unloading.

Description

The hydraulic swing clamp is a pull-type cylinder where a part of the total stroke is used to swing the piston.

Swing direction

The units are available with clockwise and counterclockwise swing motion or without swing motion (0°).



Standard swing angle 90° ± 2°

Optionally swing angles of 60°, 45° and 0° are available.

Further swing angles in steps of 5° are available on request.

0°-Version

Use as pull-type cylinder with a piston which is secured against torsion and which allows eccentric load as per clamping force diagram.

Important notes!

Swing clamps must only be used for clamping of workpieces in industrial applications and may only be operated with hydraulic oil. They can generate very high forces. The workpiece, the fixture or the machine must be in the position to compensate these forces.

In the effective area of piston rod and clamping arm there is the danger of crushing. The manufacturer of the fixture or the machine is obliged to provide effective protection devices. The swing motion must not be impeded to avoid the disengagement of the overload protection device.

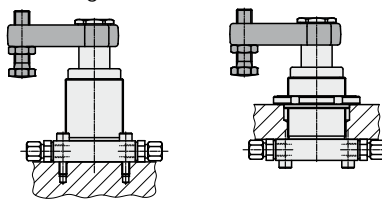
When using single-acting swing clamps, it is absolutely necessary to follow the instructions for venting of the spring area see data sheet G 0.110.

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

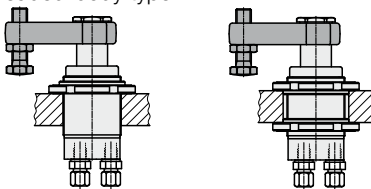
Installation and connecting possibilities

Pipe thread

Bottom flange

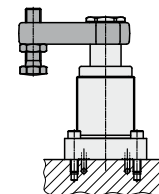


Threaded-body type



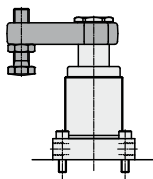
Wiper system see page 6.

Drilled channels

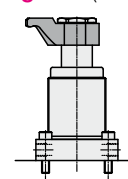


Accessories

Clamping arm with contact bolt (200 bar)

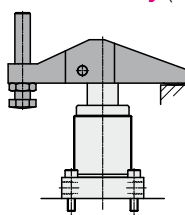


Cranked clamping arm (300 bar)

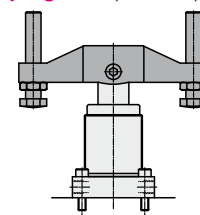


Note: Calculation of the effective clamping force see page 4

Clamping arm assembly (500 bar)



Double clamping arm (500 bar)

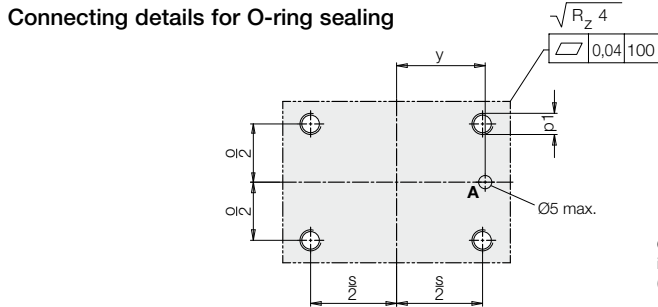
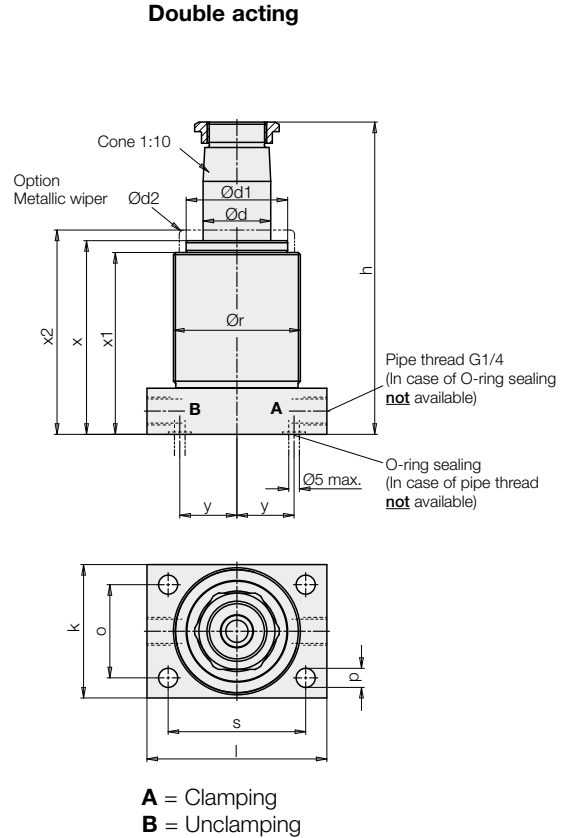
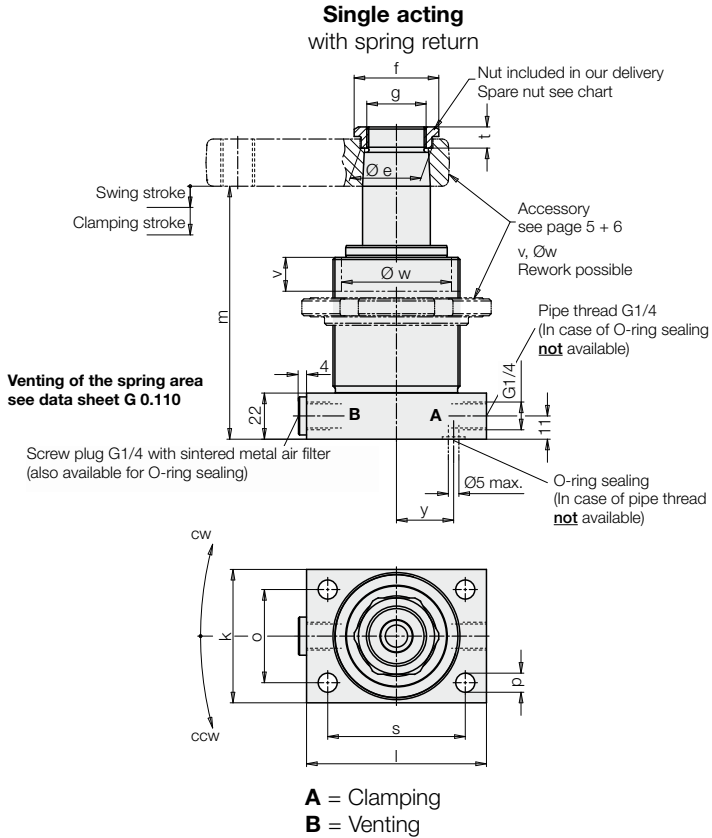


The asymmetric clamping arm assembly is based on a fixed datum. Very high clamping force at 500 bar

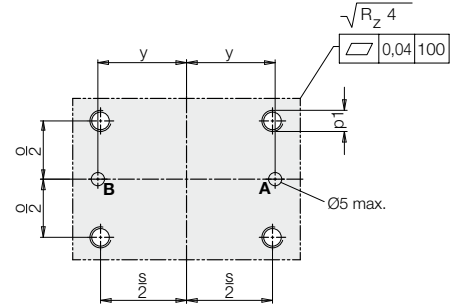
The symmetrical double clamping arm can clamp two workpieces simultaneously, the pulling force of the piston is halved. Built-in spring elements ensure horizontal off-position.

Dimensions

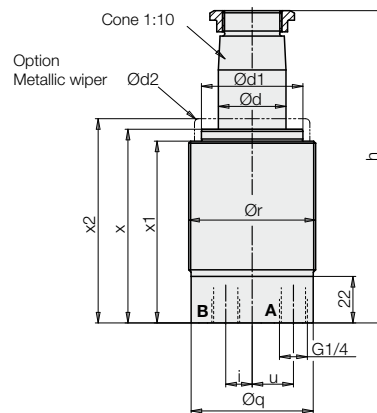
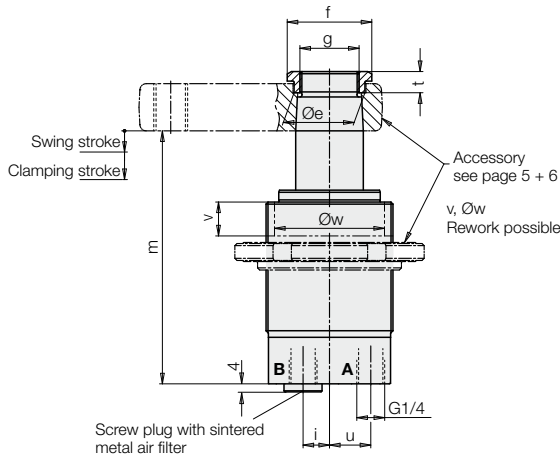
Flange type with pipe thread G 1/4 or with O-ring sealing (see chart)



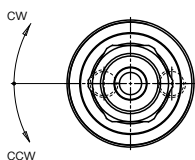
O-rings 8 x 1.5 included in our delivery (Spare part 3000.343)



Threaded-body version with pipe thread G 1/4



(Venting of the spring area see data sheet A.0110)



Mounting position

Mounting preferred in vertical position!
Horizontal mounting position is possible with accessory clamping arm (page 5 + 6), but additional flow rate throttling is required to avoid the response of the overload protection device. That is the reason why heavier clamping arms cannot be used!

Material

Piston	High alloy steel, nitrated or chromium-plated to size
Body	High alloy steel, nitrated
Sealings	NBR, PTFE (on request FKM)
Wiper	FKM
Metallic wiper	Nitriding steel

Technical data Part numbers

	18X3			18X5			18X6			18X7		
Swing clamps												
Max. pulling force at 500 bar												
single acting approx. [kN]	8.4			21.4			33.8			55.8		
double-acting approx. [kN]	8.83 8.83 8.83			22.6 22.6 22.6			35.3 35.3 35.3			57.6 57.6 57.6		
Effective clamping force [kN]	see diagram and calculation of the clamping force on page 4											
Clamping stroke [mm]	11	25	50	13	25	50	15	25	50	15	25	50
Swing stroke [mm]	8 10 10			9 10 10			11 11 11			10 13 13		
Total stroke ± 0.2 [mm]	19 35 60			22 35 60			26 36 61			25 38 63		
Declutch moment of overload protection [Nm]	3.5 3.5 3.5			11 11 11			17 17 17			22*/30 30 30		
Min. operating pressure												
single acting [bar]	40			40			35			30		
double acting [bar]	20 20 20			20 20 20			20 20 20			20 20 20		
Adm. flow rate (page 5)												
Clamping [cm³/s]	3.4 3.4 3.4			10 10 10			18.4 18.4 18.4			29 29 29		
Unclamping** [cm³/s]	9.4 9.4 9.4			27.7 27.7 27.7			51 51 51			78 78 78		
Piston area												
Clamping [cm²]	1.767			4.524			7.069			11.537		
Unclamping [cm²]	4.909			12.56			19.635			31.172		
Oil volume / stroke												
Clamping [cm³]	3.4 6.2 10.6			10 16 27.2			18.4 25.5 43.2			29 44 73		
Unclamping** [cm³]	9.4 17.2 29.5			27.7 44 76			51 71 120			78 119 197		
Piston Ø [mm]	25			40			50			63		
Rod Ø d [mm]	20			32			40			50		
Ø d1 [mm]	38			48			60			70		
Ø d2 [mm]	42			54.5			75			87		
Ø e [mm]	23.5			33.5			45			55.5		
f [mm]	SW 27			SW 36			Ø 55			Ø 68		
g [mm]	M18x1.5			M28x1.5			M35x1.5			M45x1.5		
h ± 0.25 [mm]	126.5 158.5 208.5			147.5 173.5 223.5			172 192 242			183 209 259		
h max**** [mm]	128.6 160.6 210.6			149.2 175.2 225.2			174.3 194.3 244.3			184.7 210.7 260.7		
i [mm]	12			12.5			19			25.5		
k [mm]	45			63			80			90		
l [mm]	65			85			100			115		
m ± 1 [mm]	106.3 138.3 188.3			119.9 145.9 195.9			138.9 158.9 208.9			143.3*** 169.3*** 219.3***		
o [mm]	30			44			60			68		
Ø p [mm]	6.5			8.5			13.5			16		
p1 [mm]	M 6			M 8			M 12			M 14		
Ø q [mm]	42.7			57.7			77			87.5		
r [mm]	M45x1.5			M60x1.5			M80x2			M90x2		
s [mm]	50			65			80			90		
t [mm]	9			10			11			12		
u [mm]	12			19.5			26.5			34		
v max. [mm]	11			17			20			28		
Ø w min.***** [mm]	32/42			50/55			60/75			70/87		
x [mm]	80 96 121			90.5 103.5 128.5			103 113 138			111 124 149		
x1 [mm]	75.4 91.4 116.4			84.9 97.9 122.9			97.4 107.4 132.4			105.4 118.4 143.4		
x2 +0.5/-0.4 [mm]	85 101 126			95.5 108.5 133.5			108 118 143			116 129 154		
y [mm]	15			28			31			37.5		
Flange with G1/4												
Single acting												
Swing direction cw	18831X4			18851X4			18861X4			18871X4		
Swing direction ccw	18832X4			18852X4			18862X4			18872X4		
Weight, approx. [kg]	1.2			2.4			4.6			6.2		
Double acting												
Swing direction cw	18931X4	18931X8	18931X9	18951X4	18951X8	18951X9	18961X4	18961X8	18961X9	18971X4	18971X8	18971X9
Swing direction ccw	18932X4	18932X8	18932X9	18952X4	18952X8	18952X9	18962X4	18962X8	18962X9	18972X4	18972X8	18972X9
Weight, approx. [kg]	1.2 1.4 1.7			2.3 2.6 3.0			4.5 4.9 5.6			6.2 6.6 7.5		
Threaded body type												
Single acting												
Swing direction cw	18833X4			18853X4			18863X4			18873X4		
Swing direction ccw	18834X4			18854X4			18864X4			18874X4		
Weight, approx. [kg]	1.0			2.0			4.2			5.6		
Double acting												
Swing direction cw	18933X4	18933X8	18933X9	18953X4	18953X8	18953X9	18963X4	18963X8	18963X9	18973X4	18973X8	18973X9
Swing direction ccw	18934X4	18934X8	18934X9	18954X4	18954X8	18954X9	18964X4	18964X8	18964X9	18974X4	18974X8	18974X9
Weight, approx. [kg]	1.0 1.2 1.4			1.9 2.2 2.6			3.9 4.3 5			5.6 6.0 6.9		
Flange with O-ring sealing												
Single acting												
Swing direction cw	18835X4			18855X4			18865X4			18875X4		
Swing direction ccw	18836X4			18856X4			18866X4			18876X4		
Weight, approx. [kg]	1.2			2.4			4.6			6.2		
Double acting												
Swing direction cw	18935X4	18935X8	18935X9	18955X4	18955X8	18955X9	18965X4	18965X8	18965X9	18975X4	18975X8	18975X9
Swing direction ccw	18936X4	18936X8	18936X9	18956X4	18956X8	18956X9	18966X4	18966X8	18966X9	18976X4	18976X8	18976X9
Weight, approx. [kg]	1.2 1.4 1.7			2.4 2.6 3.0			4.5 4.9 5.6			6.2 6.6 7.5		
Spare parts												
Metallic wiper**	0341107			0341100			0341101			0341102		
Spare nut / tightening torque	3527014/30 Nm			3527015/90 Nm			3527048/160 Nm			3527016/260 Nm		
O-ring 8x1.5	3000343			3000343			3000343			3000343		

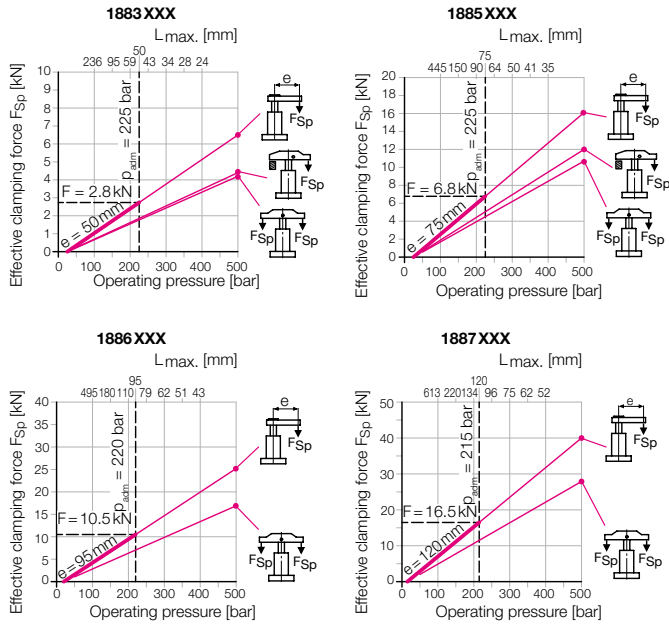
Swing angle	Key	Without swing angle (0°)	Key	* only single acting
90°	18XX0X0	Flange with G1/4	18XX24X	** only double acting
60°	18XX2X2	Threaded-body type	18XX44X	*** with clamping arm assembly 0354004 +3 mm
45°	18XX3X3	Flange with O-ring sealing	18XX64X	**** Upper edge nut
With metallic wiper**	189XXXXM (see also page 6)			***** without/with metallic wiper

Available on request: • Other swing angles, • FKM seals, • Without overload protection

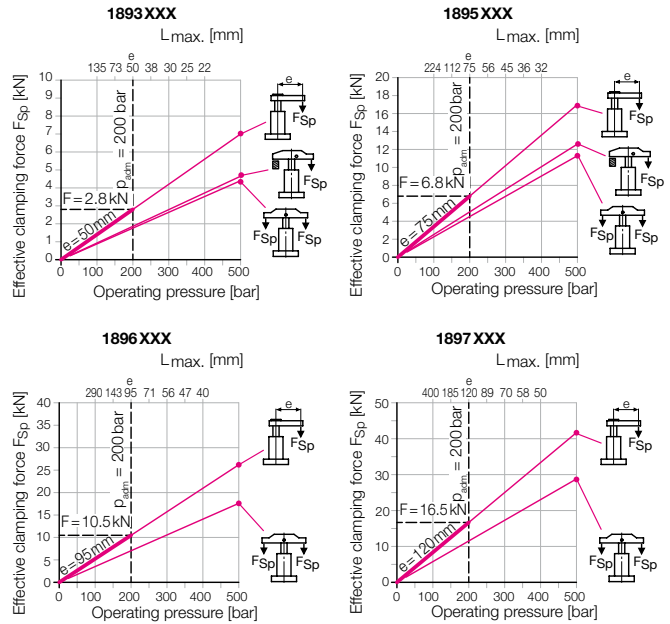
Clamping forces

Effective clamping force as function of the operating pressure with accessory clamping arm (page 5)

Single acting 188X*



Double acting 189X



*) In the case of single-acting swing clamps, the spring force has to be considered.

Single-acting swing clamps

Effective clamping force

$$F_{Sp} = \frac{p - F}{A + (B * L)} \leq F_{adm} \quad [\text{kN}]$$

Admissible clamping force *

$$F_{adm} = \frac{C}{L} \quad [\text{kN}]$$

Admissible operating pressure

$$p_{adm} = \frac{D}{L} + E + F \quad [\text{bar}]$$

L = Clamping arm length [mm]
p = Pressure [bar]

*) With a desired clamping arm length L the clamping force must not exceed the admissible value.

The constants (A...F) for the 4 sizes are shown in the chart.

Constant	1883	1885	1886	1887
A	56.59	22.1	14.15	8.67
B	0.297	0.097	0.0514	0.0288
C	140	510	997.5	1980
D	7923	11273	14111	17162
E	41.54	49.7	51.47	57
F	25	25	20	15

Example

Swing clamp single acting 1885104
Accessory clamping arm e = 75 mm
Desired special length L = 150 mm

1. Admissible clamping force

$$F_{adm} = \frac{C}{L} = \frac{510}{150} = 3.4 \text{ kN}$$

2. Admissible operating pressure

$$p_{adm} = \frac{D}{L} + E + F = \frac{11273}{150} + 49.7 + 25 = 150 \text{ bar}$$

Clamping force diagrams

Course of the effective clamping force for the most important accessories of clamping arms:

1. Clamping arm complete (L = e)

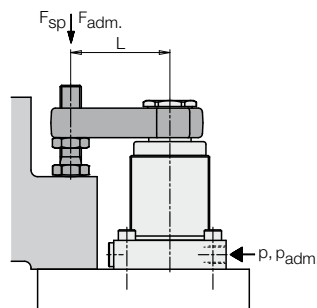
The clamping force can be read off up to the maximum operating pressure.

The clamping arm length L_max in the grid of 50 bar only allows for a rough estimate. Exact values and the corresponding clamping forces can be calculated with the opposite formula.

2. Clamping strap assembly complete
clamping force up to 500 bar readable.

3. Double clamping arm complete

Clamping force up to 500 bar corresponds to half the pulling force of the swing clamp.



Calculation of the clamping force

The clamping arm of a swing clamp generates a moment and thus a load acts on the piston guide. This additional friction force reduces the clamping force. The longer the clamping arm, the worse is the efficiency.

This has been considered in the opposite calculations. The constants were determined by measurements.

Important! The input of the variables must be made in the specified units.

Double-acting swing clamps

Effective clamping force

$$F_{Sp} = \frac{p}{A + (B * L)} \leq F_{adm} \quad [\text{kN}]$$

Admissible clamping force*

$$F_{adm} = \frac{C}{L} \quad [\text{kN}]$$

Admissible operating pressure

$$p_{adm} = \frac{D}{L} + E \quad [\text{bar}]$$

L = Clamping arm length [mm]
p = Pressure [bar]

*) With a desired clamping arm length L the clamping force must not exceed the admissible value.

The constants (A...E) for the 4 sizes are shown in the chart.

Constant	1893	1895	1896	1897
A	56.59	22.1	14.15	8.67
B	0.297	0.097	0.0514	0.0288
C	140	510	997.5	1980
D	7923	11273	14111	17162
E	41.54	49.7	51.47	57

Example

Swing clamp double acting 1895104
Accessory clamping arm e = 75 mm
Desired special length L = 150 mm

1. Admissible clamping force

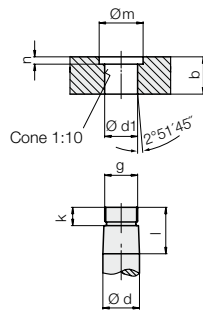
$$F_{adm} = \frac{C}{L} = \frac{510}{150} = 3.4 \text{ kN}$$

2. Admissible operating pressure

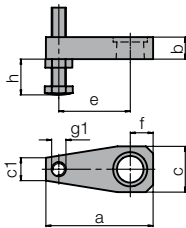
$$p_{adm} = \frac{D}{L} + E = \frac{11273}{150} + 49.7 = 125 \text{ bar}$$

Accessory - Clamping Arm Admissible flow rate • Calculation

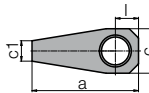
Dimensions for special clamping arms



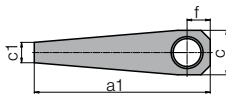
Clamping arm with contact bolt (200 bar)



Clamping arm without thread g1



Clamping arm blank



Swing clamps		18X3	18X5	18X6	18X7
a	[mm]	75	115	140	178
a1	[mm]	125	190	235	298
b	[mm]	16	23	28	34
c	[mm]	32	48	60	78
c1	[mm]	16	22	28	40
Ød f7	[mm]	20	32	40	50
Ød1 + 0.05	[mm]	19.85	31.85	39.85	49.85
e	[mm]	50	75	95	120
f	[mm]	16	25	30	40
g	[mm]	M18x1.5	M28x1.5	M35x1.5	M45x1.5
g1	[mm]	M10	M16	M16	M20
h min...max	[mm]	10...64	15...79	15...79	19...98
k	[mm]	10	12	12	13
l	[mm]	21	28	34	40
Øm	[mm]	24	34	46	56
n	[mm]	4	5	5	6

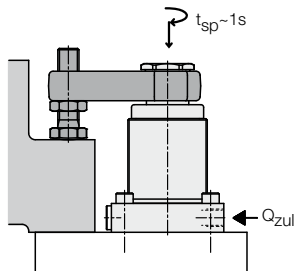
Part no. Clamping arm

	0354 001	0354 003	0354 042	0354 005
with contact bolt				
Weight, approx. [kg]	0.26	0.8	1.3	2.7
Moment of inertia of J_e [kg·m ²]	0.00032	0.002295	0.005212	0.017184
without thread g1				
Weight, approx. [kg]	0.18	0.65	1.85	2.3
Moment of inertia [kg·m ²]	0.00018	0.00134	0.00387	0.01294
Blank				
Weight, approx. [kg]	0.36	1.15	2.1	4.4
Moment of inertia [kg·m ²]	0.00043	0.00798	0.02343	0.07863

Material: High alloy steel 1000...1200 N/mm²

Admissible flow rate*

In the chart on page 3, the admissible flow rates for clamping and unclamping are specified. They only apply when using the accessory clamping arm with contact bolt. The swing clamps with a clamping stroke up to 15 mm thus have a clamping time of 1 second.



Longer special clamping arms are heavier and have a higher moment of inertia.

To avoid disengagement of the overload protection device, the flow rate must be reduced as per the following formula:

$$Q_L = Q_e \cdot \sqrt{\frac{J_e}{J_L}} \text{ cm}^3/\text{s}$$

Q_L = Flow rate with special clamping arm

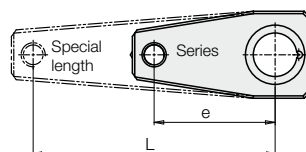
Q_e = Flow rate as per chart (page 3)

J_e = Moment of inertia of the clamping arm with contact bolt (see chart)

J_L = Moment of inertia special clamping arm

Simplified calculation

The special clamping arm is only a prolonged version of the accessory clamping arm with contact bolt, as shown below:



By means of the opposite diagram, the admissible flow rate can be determined, as the following example shows:

Swing clamp 1895 104

Special length $L = 150 \text{ mm}$

As per chart above $e = 75 \text{ mm}$

(as per chart on page 3) $Q_{adm} = 10 \text{ cm}^3/\text{s}$

1. Extension factor $x = \frac{L}{e} = \frac{150 \text{ mm}}{75 \text{ mm}} = 2$

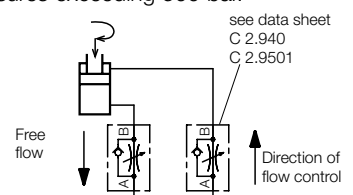
2. Flow rate factor as per diagram $\rightarrow y = 0.35$

3. Max. flow rate $Q_L = y \cdot Q_{adm} = 0.35 \cdot 10 \text{ cm}^3/\text{s} = 3.5 \text{ cm}^3/\text{s}$

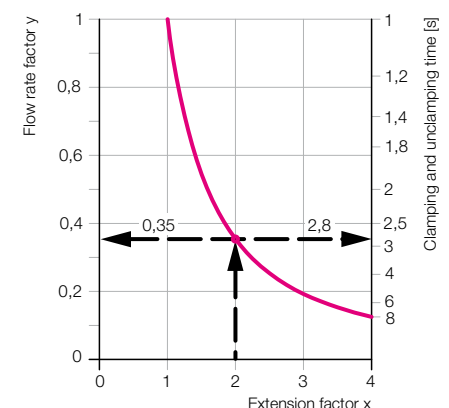
4. Min. clamping time as per diagram \rightarrow approx. 2.8 s

Throttling of the flow rate

A flow rate throttling always has to be effected in the supply line to the swing clamp. This avoids a pressure intensification and thereby pressures exceeding 500 bar.



Adm. flow rate and clamping time as a function of the clamping arm extension



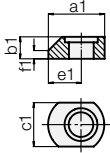
* Only for vertical mounting position!

Accessory – Clamping Arm

Clamping arm assembly • Double clamping arm • Flanged nut • Wiper system

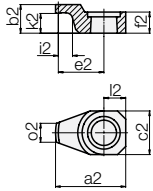
Clamping arm short

42CrMo4, max. 500 bar



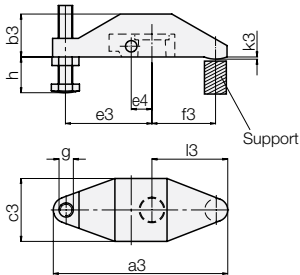
Cranked clamping arm

42CrMo4, max. 300 bar



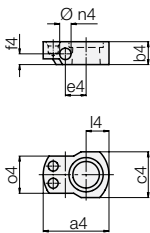
Clamping arm assembly complete with carrier

GGG 40, max. 500 bar



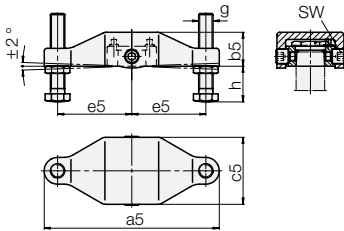
Carrier for clamping arm assembly

42CrMo4



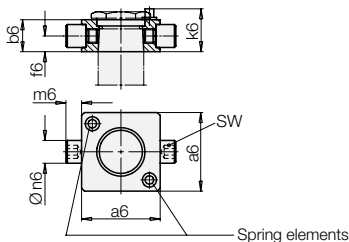
Double clamping arm complete with carrier

GGG 40, max. 500 bar

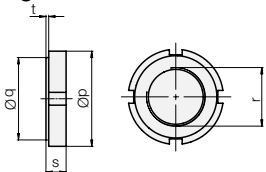


Carrier for double clamping arm

42CrMo4



Flanged nut



Swing clamps

		18X3	18X5	18X6	18X7
a1	[mm]	41	61	76	90
a2	[mm]	51.5	76	100	123
a3	[mm]	122	185	–	–
a4	[mm]	46	59	82	90
a5	[mm]	138	196	216	236
a6 ±0.1	[mm]	43	55	63	77
b1	[mm]	16	23	28	34
b2	[mm]	21	28	34	40
b3	[mm]	30	45	–	–
b4	[mm]	16	23	28	34
b5	[mm]	28.5	38	47	56
b6	[mm]	16	23	28	34
c1	[mm]	32	48	60	78
c2	[mm]	32	46	66	75
c3	[mm]	44	58.5	–	–
c4	[mm]	32	40	58	68
c5	[mm]	59	75	85	105
e1	[mm]	25	37	45	52
e2	[mm]	33.5	50	64	82.5
e3	[mm]	60	83	–	–
e4	[mm]	14.5	21	28	33
e5	[mm]	60	83	92	100
f1	[mm]	6	6	11	14
f2	[mm]	15.5	22.5	28	34
f3	[mm]	45	75	–	–
f4	[mm]	7.5	13	17	21
f6	[mm]	7.5	11	15	17
g	[mm]	M10	M16	M16	M20
h min...max	[mm]	10...64	15...79	15...79	19...98
i2	[mm]	7	7	7	8
k2	[mm]	14.5	19	23	27
k3	[mm]	1.5	2	–	–
k6 **	[mm]	21.5	29	35	41
l2	[mm]	16	23	33	37.5
l3	[mm]	53	87	–	–
l4	[mm]	16	22	34	36
m6	[mm]	9	11	12	15
Øn4 H7	[mm]	8	10	12	14
Øn6 g6	[mm]	10	16	18	20
o2	[mm]	14	25	39	39
o4	[mm]	26	32	44.5	56
Øp	[mm]	68	90	115	130
Øq -0.2	[mm]	52	68	90	100
r	[mm]	M45x1.5	M60x1.5	M80x2	M90x2
s	[mm]	12	13	16	16
t	[mm]	3	4	5	5
SW	[mm]	5	8	8	8

Part no.

	3548 159	3548 165	3548 304	3548 163
Clamping arm short				
Weight, approx. [kg]	0.05	0.23	0.5	0.88
Cranked clamping arm				
Weight, approx. [kg]	0.11	0.3	0.84	1.3
Clamping arm assembly complete				
Weight, approx. [kg]	0.66	1.7		
Carrier for clamping arm assembly				
Weight, approx. [kg]	0.08	0.18	0.5	0.7
Double clamping arm				
Weight, approx. [kg]	0.9	2	3	5.3
Carrier for double clamping arm*				
Weight, approx. [kg]	0.21	0.46	0.67	1.4
Flanged nut				
Max. tightening torque [Nm]	250	500	1100	1400
Weight, approx. [kg]	0.15	0.25	0.4	0.6

*) complete with threaded bolt and spring elements

**) Height stop surface for spring elements

Wiper system

The standard FKM wiper has a high chemical resistance against most cooling and cutting fluids.

The optional metallic wiper protects the FKM wiper against mechanical damage due to big or hot swarf.

It consists of a radially floating wiping disk and a retaining disk.

The metallic wiper can be delivered already mounted ("M") for double-acting swing clamps or as an accessory for retrofitting (see page 3).

Attention!

The metallic wiper is not suitable for dry machining or minimum quantity lubrication. Also in applications with very little grinding swarf, the standard FKM wiper has a better protection effect.

If there is any danger that small particles stick to the piston rod, the metallic wiper disk can also be replaced by a hard plastic disk.