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CATALOGUE

Power Workholding

Bore Clamps

Position Flexible Clamping Elements

Clamps and Clamping Cylinders

Hinge Clamps

Swing Clamps

Work Supports

Fixture Clamps

Centering | Positioning

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POWER WORKHOLDING

Elements and Systems for Power Workholding

Technical Information

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Position Flexible Clamping Elements

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with overload
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B 1.940
M30
single acting
max. 500 bar

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M30
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max. 500 bar

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max. 500 bar

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M26
single acting
max. 500 bar

B 1.942
M40
single acting
max. 500 bar

B 1.943
M30 – M60
single acting
max. 500 bar

B 1.944
M30 – M60
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max. 500 bar

B 1.9470
M26 – M45
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B 1.9471
M26 – M45
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B 1.9472
M26 with shaft
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max. 70 bar

B 1.9474
top flange
single acting
max. 70 bar

B 1.950
M45 – M90
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M45 – M90
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max. 500 bar

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single acting
max. 500 bar

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Concentric positioning and clamping elements

H 4.305
Concentric positioning and clamping elements

H 4.306
Concentric clamping elements

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Parallel slide centring element

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I 4.110
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I 4.111
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jaw width 65 mm

I 4.120
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jaw width 40 and 65 mm

I 4.130
position flexible
jaw width 40 mm

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J 7.201
external thread
bottom flange

J 7.202
block-type

J 7.203
top flange

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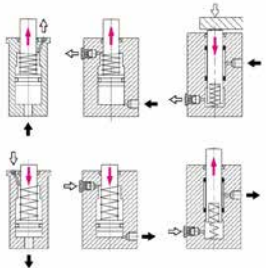


G 0.110
Venting of the spring area

G 2.140
Magnetic sensors for position monitoring

G 3.812
Spring clamping elements

General Characteristics of Hydraulic Equipment

Listing of characteristics	in accordance with VDI 3267 … 3284			
Terms and symbols	as per DIN ISO 1219			
Units	SI units, as per the "regulation regarding the law relating to units of measurement" dated June 26, 1970			
Dimensions without tolerances	General tolerances as per DIN ISO 2768-mH Deviating from this, the following apply: cast parts, dimensional variation GTB 16 as per DIN 1686 forged pieces, forge quality F as per DIN 7526			
Dimensional drawings	Unless otherwise stated, hydraulic elements are shown in off-position, i.e. without energy supply or in the case of clamping elements in the unclamped position.			
Mounting position	Any, if not otherwise stated			
Ambient temperature	$t_{u\,min.}$ = –10 °C $t_{u\,max.}$ = +50 °C			
Relative humidity	max. 70 %			
Transport, storage and operation	Not condensing or protected against condensation			
Temperature range of fluid	$t_{m\,min.}$ = +10 °C $t_{m\,max.}$ = +60 °C			
Oil recommendation	**Oil temperature [°C]**	**Hydraulic oil as per DIN 51524-2**	**Application**	
	10 – 40	HLP 22	Short-time operation (poppet valves)	
	15 – 50	HLP 32	Clamping fixtures (poppet valves)	
	20 – 60	HLP 46	Industrial hydraulics (spool valves)	
	Power units and systems: Observe the operating manuals and hydraulic circuit diagrams. Please contact us for other operating conditions.			
Oil filtering	Max. degree of pollution of the pressure fluid class 20/17/13 as per ISO 4406 The need for a fine filtration is indicated on the corresponding data sheet			
Seals	**Material**	**Trade name**	**Temperature range****	**Hydraulic fluid**
	NBR* (Nitrile-butadiene rubber)	e.g. Perbunan	–30 ... + 80 °C (100 °C)*** –10 ... + 55 °C	HLP HFA, HFB, HFC****
	FKM (fluoro rubber)	e.g. VITON®	–20 … + 80 °C (100 °C)*** –20 … + 150 °C (200 °C)***	HLP HFDU****
	FFKM (perfluoroelastomer)	ISOLAST® e.g. HTJ 8325	–10 … + 150 °C (250 °C)***	HFDR, HFDU****
	* Standard, unless otherwise stated on the data sheet. ** Generally applicable, unless otherwise stated on the data sheet. *** The temperature in brackets is a maximum value that must not be achieved simultaneously with the maximum operating pressure or the admissible lifting speed. Please contact us. **** Highly inflammable hydraulic fluids as per ISO 12922 When using these liquids, the respective manufacturer should be consulted, above all with regard to the maximum operating pressure and the sealing compatibility.			
Connecting thread	British standard pipe thread (Withworth form) with screw hole form X as per DIN 3852 sheet 2 (for cylindrical screwed plugs)			
Fittings	as per DIN 2353, screwed plugs form B as per DIN 3852 sheet 2 (sealing by knife edge) or form E as per DIN 3852 page 11 (sealing by soft seal). Do not use additional sealing materials such as Teflon ribbon!			
Hydraulic cylinders, hydraulic block cylinders	Data sheets B 1.2811, B 1.282, B 1.590, B 1.7385			
Connecting dimensions	Cylinders without stroke end cushioning: Flange mounting dimensions as per DIN ISO 6020 Cylinders with stroke end cushioning: As per DIN ISO 6020, however with the exception of the shorter overall length			
Adm. stroke speed	$v_{max.}$ = 0.50 m/s			
Piston stroke	according to the standard strokes as per DIN 323 R 10			
Leakage rate	When extending the piston rod, the double sealing lets pass only a micro-oil film to ensure the required lubrication of the seals and thus a high service life. Please note! The wiper avoids the entry of dirt and liquids in the hydraulic system. When retracting the piston rod, a part of the previously extended oil film will be wiped off by the pre-stressed wiper lip what can cause a small leakage over time. A visible leakage in the form of oil drops indicates a necessary replacement of wear parts. Static under pressure, all cylinders are leakage-free.			

Block cylinders, clamping cylinders

Adm. stroke speed	$v_{min.}$ = 0.01 m/s $v_{max.}$ = 0.25 m/s
Piston stroke	relatively short stroke, corresponding to the usage as clamping cylinder
Stroke reserve	include at least 20 % to guarantee safe clamping even with large workpiece tolerances and deformations.
Spring return force	generates an oil pressure between 1.5 and 5 bar, depending on the piston position. The counter pressure in the return line must not exceed 0.5 bar.
Life of the spring	To obtain an overall length as short as possible of the clamping cylinder, the return springs are not designed fatigue endurable for the maximum stroke and not for vibrating charges. Fatigue endurance can be expected for a stroke utilisation of 70 to 80 %.
Piston side load	The admissible piston side load depends on the operating conditions. 3 % of the nominal cylinder force must not be exceeded by no means (up to 50 mm stroke). Please contact us for the use of single-acting elements.
Leakage rate	Block cylinders, double acting When extending the piston rod, the double sealing lets pass only a micro-oil film to ensure the required lubrication of the seals and thus a high service life.
Operating pressure 500 bar	Clamping cylinders, single and double acting For sealing the piston and the rod, sturdy high-pressure seals are used, which let pass a thin residual oil film when extending the piston and thus increase the service life of seals and guides.
Operating pressure ≤ 200 bar	On request, softer seals can be installed in order to reduce the residual oil film on the piston rod. The wiper avoids the entry of dirt and liquids in the hydraulic system.
Please note!	When retracting the piston rod, a part of the previously extended oil film will be wiped off by the pre-stressed wiper lip what can cause a small leakage over time. A visible leakage in the form of oil drops on all cylinders indicates a necessary replacement of wear parts. Static under pressure, all cylinders are leakage-free.

Hinge clamps, swing clamps, work supports

Wiper systems

Wiper type:	**FKM wiper standard** series	**Metallic wiper edge** series	**Metallic wiper** option	**Special wiper** on request
Use in:				
Hinge clamps	✓	✓		✓
Swing clamps	✓		✓	✓
Work supports	✓	✓		✓
Protective effect with:				
Cooling and cutting fluids	•	(•)	(•)	(•)
Dirt, swarf	•	(•)	(•)	(•)
Coarse and/or hot swarf	• + →	•	•	–
Grinding swarf	•	(•)	–	(•)
Dry machining	•	(•)	–	(•)
Minimum quantity lubrication	•	(•)	–	(•)
Sticking particles	• + →	–	–	•

• = required
(•) = not required
– = not suitable
+ → = in addition, a wiper is required

FKM wiper	Very good wiping effect and temperature resistance. High chemical resistance against the most cooling and cutting fluids
Metallic wiper edge	Sharp-edged plunger or piston rod exit. Protects the subjacent FKM wiper against coarse and/or hot swarf. In dry machining applications, with minimum quantity lubrication or in case of accumulation of very small swarf, there can be a swarf holdup in the area of the metallic wiper edge. Remedy: Provide for regular cleaning or protective devices.
Metallic wiper	Optional equipment for swing clamps to protect the subjacent FKM wiper against coarse and/or hot swarf. Not suitable for dry machining or minimum quantity lubrication. With accumulation of smallest swarf or other particles that do not stick on the piston rod, the standard FKM wiper provides a sufficient protection.
Special wiper	If there is any danger that the smallest particles stick to the piston rod or dry, we offer other wiper solutions. Please contact us in time.

Clamping elements, work supports, hydraulic valves, power units and other hydraulic elements

indicated on the data sheets

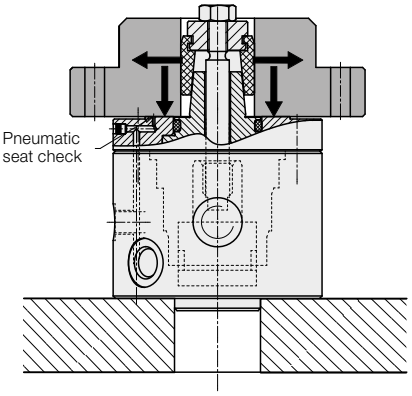
Bore Clamps

double-acting, pull-type, with and without centring function, for bore diameter 16 to 46 mm, max. operating pressure from 50 up to 350 bar

Advantages

- Clamping and supporting with one element
- Compact design
- High clamping force
- Repetitive accuracy 0.005 mm
- 5 optimised clamping ranges
- Hardened support face
- Pneumatic seat check
- Easy exchange of segment clamping bushings
- Centring at the bottom of the body
- Compensating and non-centring variants are available
- Oil supply optionnally by pipe threads or drilled channels
- Standard FKM seals
- Vulcanised segment clamping bushing

Function



Application

The bore clamp is particularly suitable for centring and clamping of workpieces with smooth machined bores ranging from 16 to 46 mm in diameter and a support surface square to the hole axis.

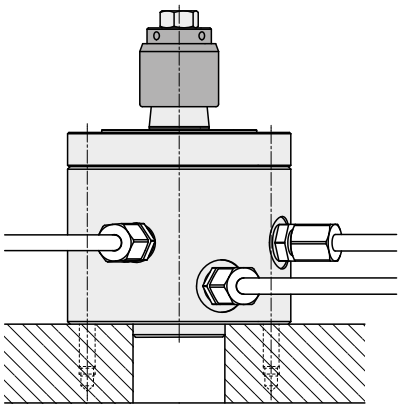
Description

The bore clamp is a combination of a double-acting pull-tpye cylinder equipped with a segment clamping bushing, which is pulled by a tie rod over a fixed cone. Thereby the segment clamping bushing expands radially to the bore diameter of the workpiece to be clamped.
By the simultaneous axial movement the workpiece is clamped onto the hardened support at the housing. The obtainable low-clamping force depends on the factor of friction within the bore and the operating pressure.
The sectioning of the complete clamping range from 16 to 46 mm in 5 sub-ranges (chart page 2) allows an optimum adaptation of tie rod, cone, workpiece support and operating pressure.
For detailed information on possible low-clamping forces and maximum operating pressures see charts and diagrams on page 2.

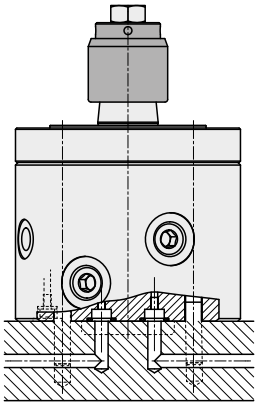
Important notes

Since the segment clamping bushings are operated by a tie rod, it is imperative to consider the max. operating pressure depending on the clamping range. A too high operating pressure will destroy the tie rod.
The maximum operating pressure for the segment clamping bushing is 80°C. Avoid clamping without workpiece, if possible.
Operating conditions and other data see data sheet A 0.100.

Pipe thread



Drilled channels



Centring function

- **Bore clamp with centring**
  Part no.: 4317X00

  Fixed centring cone

- **Bore clamp with compensation**
  Part no.: 4317X10

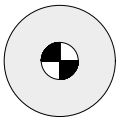
  Centring cone in one axial direction ± 0.5 mm movable

- **Bore clamp without centring**
  Part no.: 4317X20

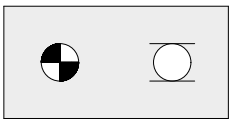
  Centring cone in all directions ± 0.5 mm movable

Applications

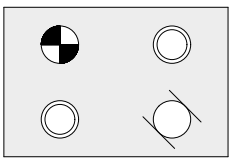
- Centre and clamp in 1 bore hole



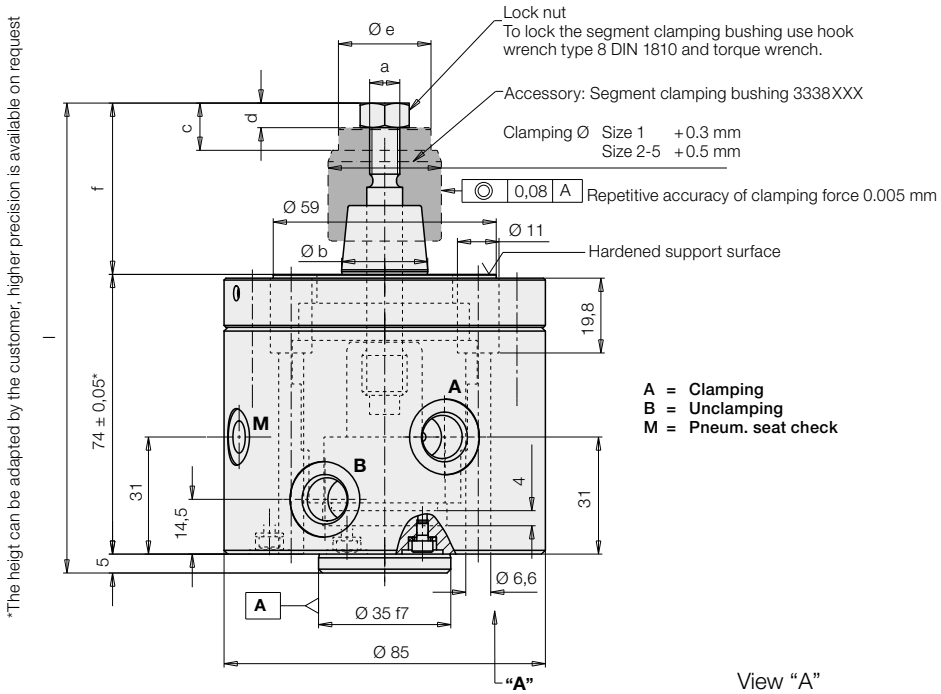
- Centre and clamp in 2 bore holes

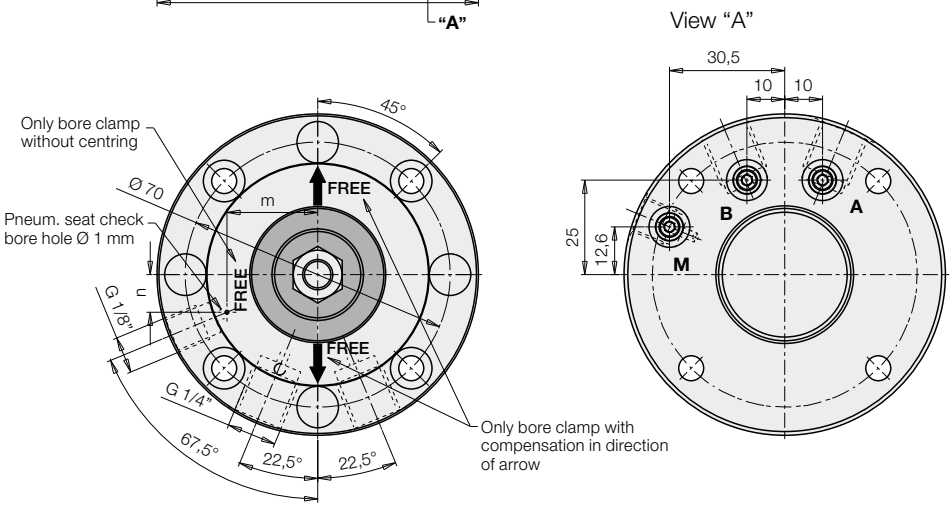


- Centre and clamp in more than 2 bore holes



Dimensions
Technical data





Materials

Housing	High alloy steel
Piston	Case-hardening steel
Workpiece support	Nitriding steel
Segment clamping bushing	Tool steel

Note

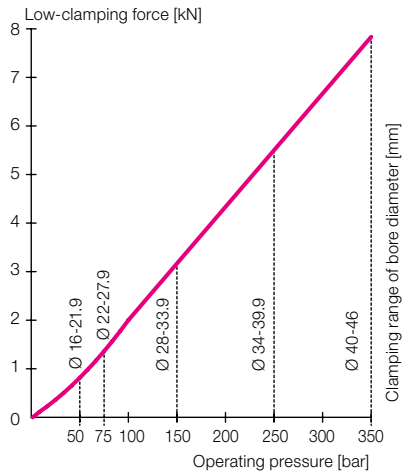
The bore clamps are delivered without segment clamping bushings.
These can be ordered separately as accessory.

Size	**(BG)**	**1**	**2**	**3**	**4**	**5**
Clamping range Ø	**[mm]**	**16–21.9**	**22–27.9**	**28–33.9**	**34–39.9**	**40–46**
Low-clamping force * approx.	[kN]	0.6	1.3	3.1	5.5	7.9
Specific expanding force** approx.	[N/bar]			250		
Max. operating pressure	**[bar]**	**50**	**75**	**150**	**250**	**350**
Max. oil volume Clamping/unclamping	[cm³]	2.45/4.02	2.45/4.02	2.45/4.02	2.45/4.02	2.45/4.02
a		M5	M6	M8	M10	M12
b	[mm]	12.8	16.8	22.8	28.8	34.8
c	[mm]	8	10	12.5	15	18
d	[mm]	4	5	6.5	8	10
e	[mm]	13.5	18.5	24.5	30.5	36.5
f	[mm]	39.5	43	45.5	54	57
l	[mm]	118.5	122	124.5	133	136
m	[mm]	15	15	24	24	24
n	[mm]	6	6	10	10	10
Tightening torque Lock nut	[Nm]	6	10	25	49	85
Max. flow rate	[cm³/s]	20	20	20	20	20
Weight	[kg]	2.8	2.9	3	3.1	3.2
Part no.						
with centring		**4317100**	**4317200**	**4317300**	**4317400**	**4317500**
with compensation		**4317110**	**4317210**	**4317310**	**4317410**	**4317510**
without centring		**4317120**	**4317220**	**4317320**	**4317420**	**4317520**

* Workpiece: steel, unhardened, dry. Surface finish Rmax. 3 µm

** Friction value µ = 0.1 (steel / steel dry) between centring cone and segment clamping bushing. With lubrication, the expansion force can double!

Low-clamping force*



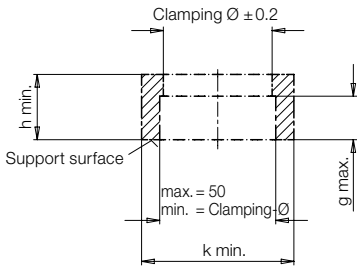
Accessory - segment clamping bushing

For each bore hole diameter within the clamping range the appropriate segment clamping bushing has to be selected:

Part no. 3338XXX (clamping Ø in 0.1 mm)
Example of ordering:
Clamping Ø: **16.0** **Part no. 3338160**
Clamping Ø: **34.8** **Part no. 3338348**

Workpiece dimensions and workpiece tolerance

The workpiece to be clamped should always contact the hardened support surface and cover at least in the zone of the bore hole a minimum surface of the segment clamping bushing. This is only guaranteed, if the relevant dimensions meet the requirements shown in the drawing.



Adjustment of the segment clamping bushing

Unclamp bore clamp (extended). Unscrew lock nut of the bore clamp and screw on segment clamping bushing onto the threaded rod. Check the diameter of the segment clamping bushing by means of a vernier calliper.
The diameter of the segment clamping bushing should be adjusted to approx. 0.1 mm up to 0.2 mm less than the clamping diameter to be in the position to insert easily the workpiece to be clamped. Clamping without workpiece should be avoided due to the overexpansion of the vulcanisation.

Tightening torque for the lock nut see chart on page 2.
When tightening the lock nut to hold the segment clamping bushing without this to adjust.

Size	**(BG)**	**1**	**2**	**3**	**4**	**5**
Clamping range Ø	**[mm]**	**16–21.9**	**22–27.9**	**28–33.9**	**34–39.9**	**40–46**
g max.	[mm]	12	12	12	15	15
h min.	[mm]	18	18	18	24	24
k min.	[mm]	35	35	55	55	55
Workpiece tolerance						
of selected clamping Ø	[mm]	−0.1... +0.3	−0.1 ... +0.5	−0.1 ... +0.5	−0.1 ... +0.5	−0.1 ... +0.5

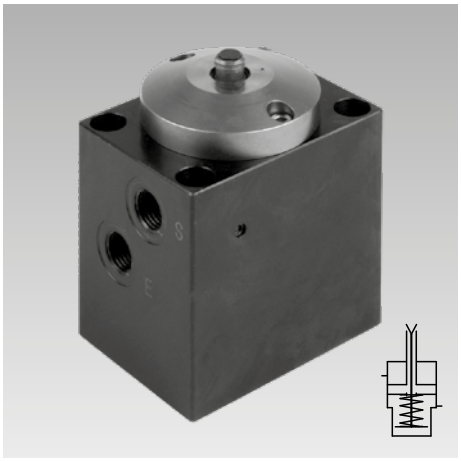
Standard stepping 1 mm (intermediate stepping on request)

Example:
Selected clamping diameter = 16 mm
Workpiece tolerance = – 0.1 up to +0.3 mm
Workpiece diameter = 15.9 up to 16.3 mm

Accessory for connection through drilled channels	
O-ring 8x1.5	**Part no. 3000343**
Screw plug with collar and hexagon socket	
G 1/4	**Part no. 3610191**
G 1/8	**Part no. 3610158**
Alternatively, sealing plug without collar with thread sealing ring	
G 1/4	**Part no. 0361987**
G 1/8	**Part no. 0361986**

Bore Clamps

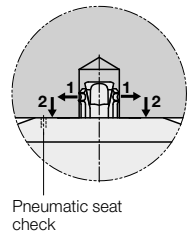
Block-type, without centring function, double acting, for bore diameter 7.8–17.7 mm, max. operating pressure 250 bar



Advantages

- Axial clamping in simple bore holes
- 5-sided machining possible
- Expand clamping bushing with spring force
- Hold workpiece without hydraulic pressure
- Clamp workpiece with adjustable hydraulics
- Hardened workpiece support
- Pneumatic seat check
- Connection for positive air pressure protection
- Standard FKM seals
- 2 sizes available
- Alternatively pipe connection or manifold-mounting connection

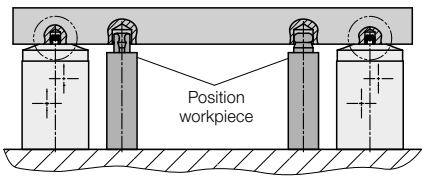
Function



1 Expand clamping bushing with spring force
Hold workpiece
Safety in case of pressure drop

2 Clamp workpiece with hydraulics
Adjustable clamping force

Pneumatic seat check



Application

The bore clamps are particularly suited for clamping of workpieces with smooth bore holes from diameter 7.8 to 17.7 mm in the support surface.

The required form-fit in the bore hole is obtained by the special profile of the hardened clamping bushings with penetrating points in the bore hole wall. Hardened materials cannot be clamped with these elements.

The workpiece is put directly onto the bore clamp and will not be deformed during clamping.

Since clamping is effected within the bore, the remaining surfaces are free for machining on 5 sides (see application example).

The size of the possible machining forces is certainly limited using this type of clamping, especially crosswise to the clamping surface.
Except the static friction force between the workpiece and the support, the bore clamp cannot compensate any side loads. Additional stops or positioning elements can help in such applications.

Workpiece sections that are subject to vibrations and deformations during machining, have to be additionally supported or clamped in a flexible (floating) position.

Functional description

See page 4.

Description

The bore clamp is a double-acting pull-type cylinder. An exchangeable clamping bushing is fixed to the piston.
The four segments of the clamping bushing are radially expanded with spring force by a pyramid-shaped clamping bolt. Thus the expansion force is always the same and independent of the hydraulic clamping pressure.
The workpiece is also held without hydraulics by means of the expanded clamping bushing.
Both pull-down of the workpiece and unclamping of the clamping bushing are hydraulically controlled.
Connecting the positive air pressure protection, the clamping bushing is protected against swarf and coolants.
In the hardened support surface for the workpiece there is a bore hole for the pneumatic seat check.

Important notes

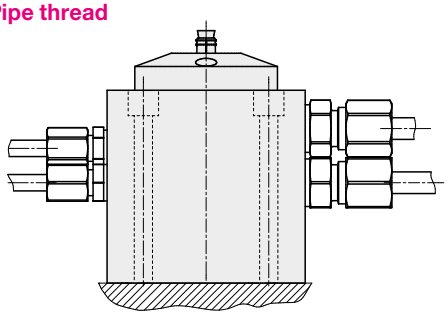
The bore clamp has no centring function.
The clamping bushing has to be protected against too high side loads during insertion or machining by suitable stops or centring bolts.
The required positioning precision is ± 0.2 mm.

The required penetration depth of the toothing depends on the strength of the material for the form-fit toothing with the workpiece. Therefore hardened or coated workpieces cannot be used.
The tapering of the bore hole should not exceed 3°. In case of doubt we recommend a clamping test.
Clean the support surface and blast clean the clamping bushing before every clamping cycle.
If swarf fall into an open clamping bore, blast air must be continuously switched on.
Clamping bushings and wiper should be exchanged after 100,000 operations.
Part numbers for complete clamping sets:
see chart on page 3.

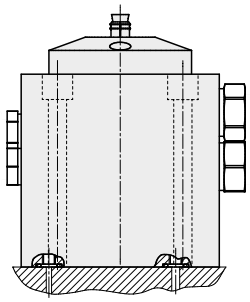
Operating conditions, tolerances and other data
see data sheet A 0.100.

Connecting possibilities

Pipe thread

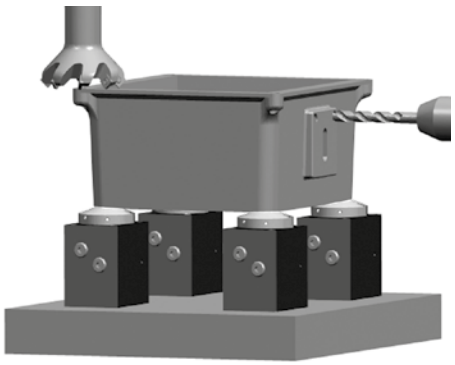


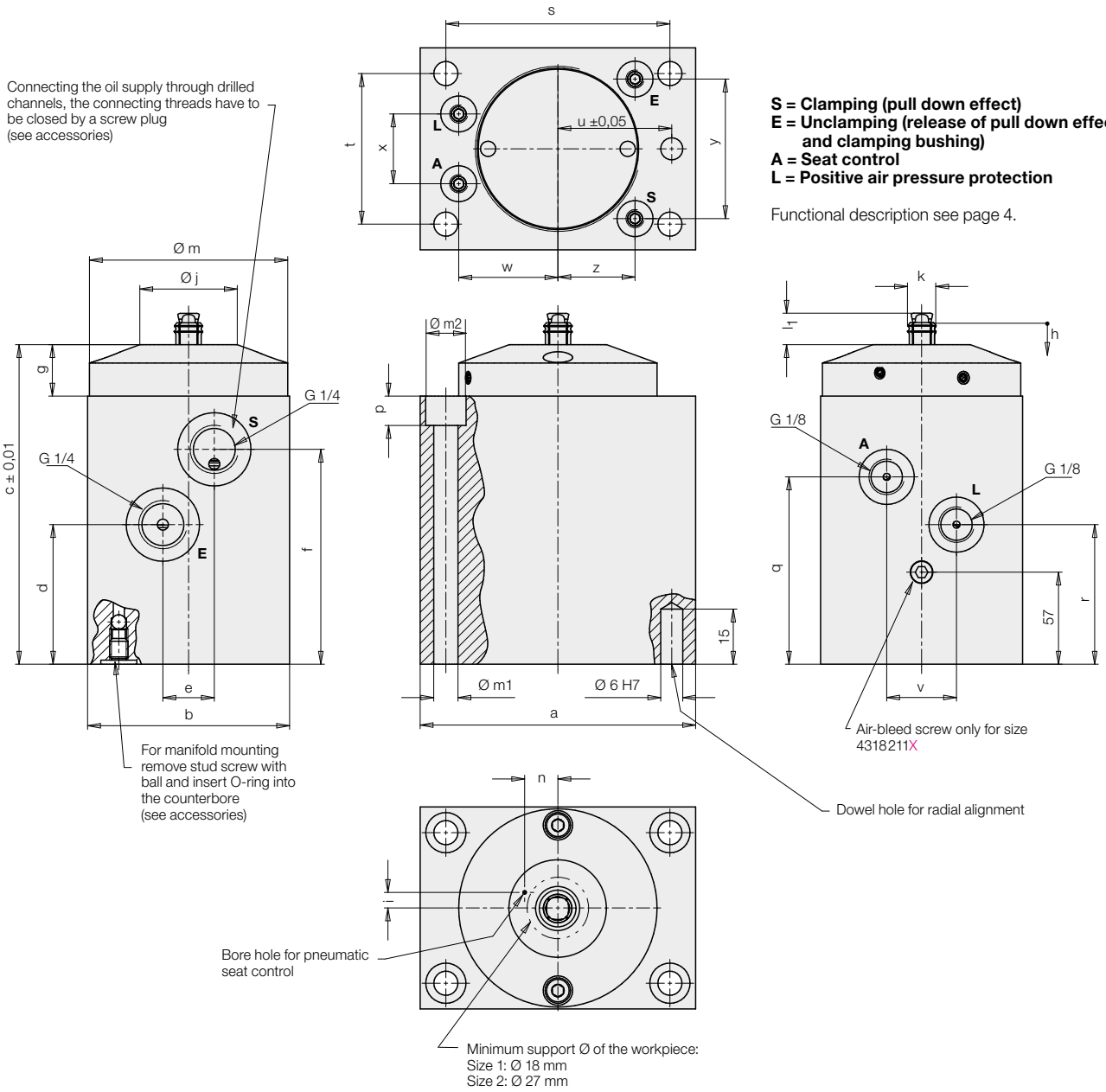
Drilled channels



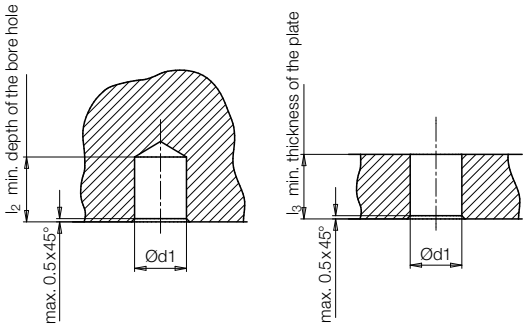
Application example

Machining of an oil sump from 5 sides





Demands on the bore hole in the workpiece



Adjusting Ø of the clamping bushing: k = d1 –0.2 mm

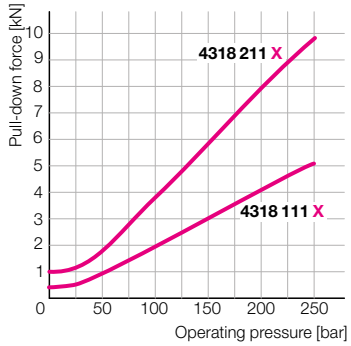
Technical data

			Size 1	Size 2
Part no. (**X** = Identification letter bore Ø)			**4318111X**	**4318211X**
Expansion force , radial		[kN]	approx. 9	approx. 14
Pull down force	at 100 bar	[kN]	2	3.9
	at 250 bar	[kN]	5.1	9.8
Clamping bushing, unclamping		[bar]	min. 100**	min. 100**
Max. oil volume	Clamping	[cm^3]	0.5	1
	Unclamping	[cm^3]	10	25
Max. flow rate		[cm^3/s]	25	50
a		[mm]	75	85
b		[mm]	55	63
c ±0.01		[mm]	87	111
d		[mm]	38	43
e		[mm]	14	17
f		[mm]	58.5	74.5
g		[mm]	14	16
h max. pull down stroke		[mm]	2	2
i		[mm]	4.2	5.9
j		[mm]	26.5	38.3
k Adjusting Ø of the clamping bushing		[mm]	d1 0.2	d1 0.2
l_1 max. (unclamped)		[mm]	10	13
l_2 min. depth of the bore hole		[mm]	10	13
l_3 min. thickness of the plate		[mm]	9	12
m		[mm]	54	63
m1		[mm]	6.6 (M6)	8.5 (M8)
m2		[mm]	11	15
n		[mm]	9	12.7
p		[mm]	8	9
q		[mm]	51	77
r		[mm]	38	77
s		[mm]	61	66
t		[mm]	41	46
u		[mm]	31	35
v		[mm]	19	23
w		[mm]	27	32
x		[mm]	19	23
y		[mm]	38	23
z		[mm]	21	30
Weight		[kg]	2.3	3.9

Part numbers for accessories for connection through drilled channels

O ring	[mm]	Ø 7x1.5	Ø 8x1.5
NBR		**3000342**	**3000343**
FKM		**3001077**	**3000275**
Screw plug G1/4 with hexagon head		**3300821**	**3300821**
Screw plug G1/8 with hexagon head		**3610047**	**3610047**
Screw plug G1/4 with socket head cap		**0361987**	**0361987**
Screw plug G1/8 with socket head cap		**0361986**	**0361986**

Pull-down force



* Consider the tolerance of the bore hole
** For operating pressures < 100 bar please contact us.

Bore hole Ø and part numbers

Size 1

Bore Ø* d1 in mm	Part no.
7.8 - 8.2	**4318111 A**
8.3 - 9.2	**4318111 B**
9.3 - 9.7	**4318111 C**
9.8 - 10.2	**4318111 D**
10.3 - 11.2	**4318111 E**

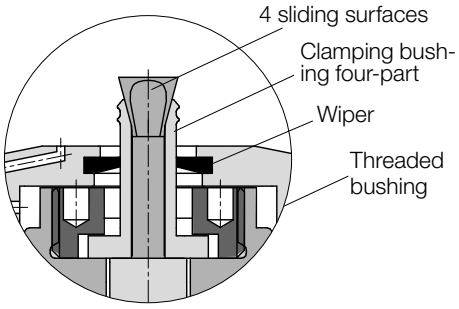
Size 2

Bore Ø* d1 in mm	Part no.
11.3 - 11.7	**4318211 F**
11.8 - 12.7	**4318211 G**
12.8 - 13.7	**4318211 H**
13.8 - 14.7	**4318211 K**
14.8 - 15.7	**4318211 L**
15.8 - 16.7	**4318211 M**
16.8 - 17.7	**4318211 N**

Article available on request

Spare clamping sets

The clamping sets contain all required components to replace the clamping bushings. Every clamping set consists of clamping bushing and wiper. Mounting or dismounting can be made on your own as per operating instructions.



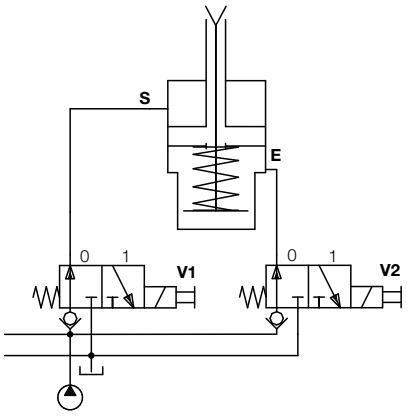
Size 1

Bore Ø* d1 in mm	Clamping set Part no.
7.8 - 8.2	**0431704 A**
8.3 - 9.2	**0431704 B**
9.3 - 9.7	**0431704 C**
9.8 - 10.2	**0431704 D**
10.3 - 11.2	**0431704 E**
Screw tool for threaded bushing	**2010911**

Size 2

Bore Ø* d1 in mm	Clamping set Part no.
11.3 - 11.7	**0431703 F**
11.8 - 12.7	**0431703 G**
12.8 - 13.7	**0431703 H**
13.8 - 14.7	**0431703 K**
14.8 - 15.7	**0431703 L**
15.8 - 16.7	**0431703 M**
16.8 - 17.7	**0431703 N**
Screw tool for threaded bushing	**2010912**

Hydraulic connection



Workpiece clamping

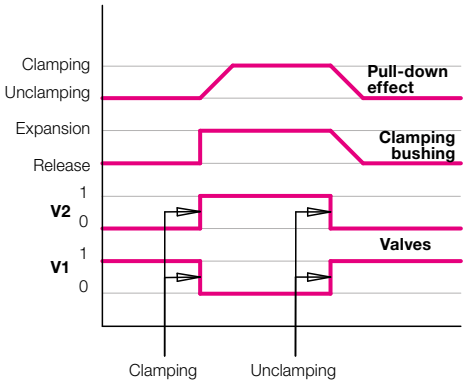
1. Put the workpiece onto the hardened support surfaces and position by external stops or pins, if required.
2. Start the clamping process by switching the valves.
3. With pressure relief of the unclamping port the clamping bushings will be radially expanded very quickly. According to the material, the toothing penetrates more or less deeply into the bore hole wall and a form fit will be obtained.
4. In case of pressure increase at the clamping port, the hydraulic piston pulls the expanded clamping bushing and thereby also the workpiece onto the support surface.

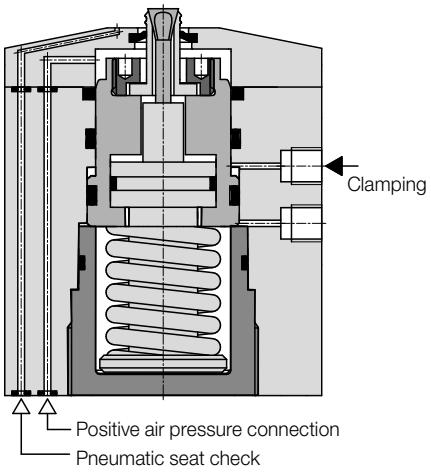
Workpiece unclamping

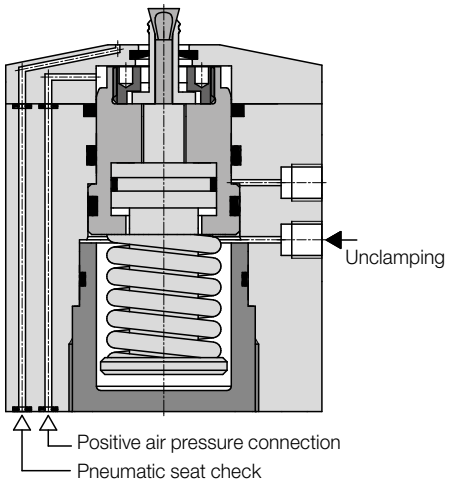
1. For unclamping a minimum pressure of 100 bar is required. In case of pressure increase at the unclamping port, the hydraulic piston returns to its off-position and the spring tension of the clamping bushing will be released. Very light workpieces can be slightly lifted.
2. Remove the workpiece.

Note:
For operating pressures < 100 bar please contact us.

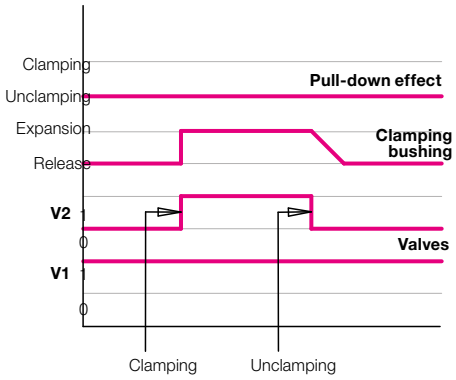
Function sequence







Clamping bushing only expansion



What happens in case of pressure drop of the clamping pressure?

In case of pressure drop the workpieces is no longer pulled onto the hardened support surface. The radial expansion of the clamping jaws and thereby the form fit with the workpiece are maintained by the spring tension.

What happens in case of pressure drop of the unclamping pressure?

The clamping bushing is expanded by spring force and can only be released with the minimum unclamping pressure of 100 bar. If there is no oil pressure the workpiece can neither be taken out nor a new workpiece can be inserted.

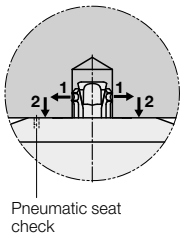
Bore Clamps

Flange type, without centring function, double acting, for bore diameter 7.8–17.7 mm, max.operating pressure 250 bar

Advantages

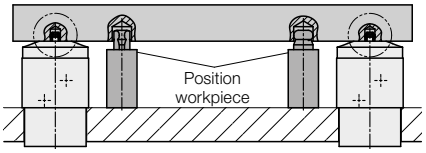
- Axial clamping in simple bore holes
- 5-sided machining possible
- Expand clamping bushing with spring force
- Hold workpiece without hydraulic pressure
- Clamp workpiece with adjustable hydraulics
- Hardened workpiece support
- Pneumatic seat check
- Connection for positive air pressure protection
- Standard FKM seals
- 2 sizes available

Function



1 Expand clamping bushing with spring force
Hold workpiece
Safety in case of pressure drop

2 Clamp workpiece with hydraulics
Adjustable clamping force



Application

The bore clamps are particularly suited for clamping of workpieces with smooth bore holes from diameter 7.8 to 17.7 mm in the support surface.

The required form-fit in the bore hole is obtained by the special profile of the hardened clamping bushings with penetrating points in the bore hole wall. Hardened materials cannot be clamped with these elements.

The workpiece is put directly onto the bore clamp and will not be deformed during clamping.

Since clamping is effected within the bore, the remaining surfaces are free for machining on 5 sides (see application example).

The size of the possible machining forces is certainly limited using this type of clamping, especially crosswise to the clamping surface.
Except the static friction force between the workpiece and the support, the bore clamp cannot compensate any side loads. Additional stops or positioning elements can help in such applications.

Workpiece sections that are subject to vibrations and deformations during machining, have to be additionally supported or clamped in a flexible (floating) position.

Functional description

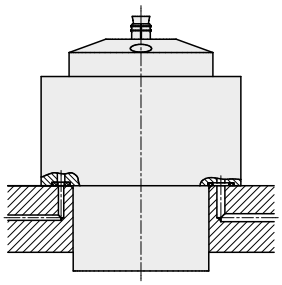
See page 4.

Description

The bore clamp is a double-acting pull-type cylinder. An exchangeable clamping bushing is fixed to the piston.
The four segments of the clamping bushing are radially expanded with spring force by a pyramid-shaped clamping bolt. Thus the expansion force is always the same and independent of the hydraulic clamping pressure.
The workpiece is also held without hydraulics by means of the expanded clamping bushing.
Both pull-down of the workpiece and unclamping of the clamping bushing are hydraulically controlled.
Connecting the positive air pressure protection, the clamping bushing is protected against swarf and coolants.
In the hardened support surface for the workpiece there is a bore hole for the pneumatic seat check.

Connecting possibilities

Drilled channels



Important notes

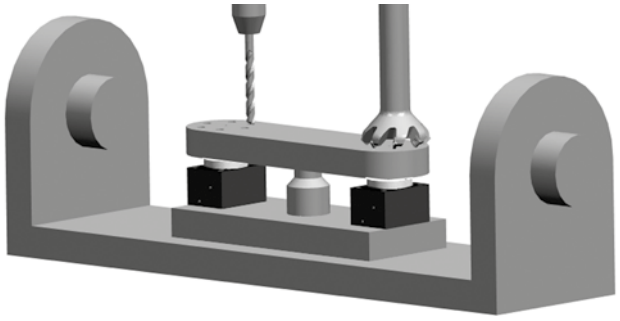
The bore clamp has no centring function.
The clamping bushing has to be protected against too high side loads during insertion or machining by suitable stops or centring bolts.
The required positioning precision is ± 0.2 mm.
The required penetration depth of the toothing depends on the strength of the material for the form-fit toothing with the workpiece. Therefore hardened or coated workpieces cannot be used.
The tapering of the bore hole should not exceed 3°.

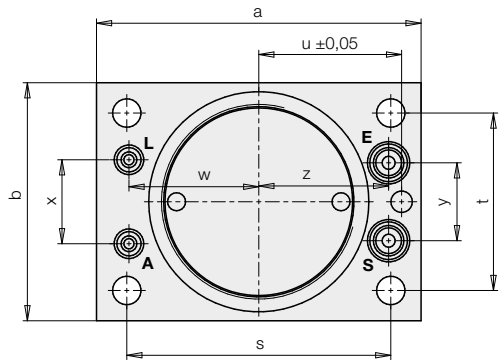
In case of doubt we recommend a clamping test.
Clean the support surface and blast clean the clamping bushing before every clamping cycle.
If swarf fall into an open clamping bore, blast air must be continuously switched on.
Clamping bushings and wiper should be exchanged after 100,000 operations.
Part numbers for complete clamping sets:
see chart on page 3.

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

Application example

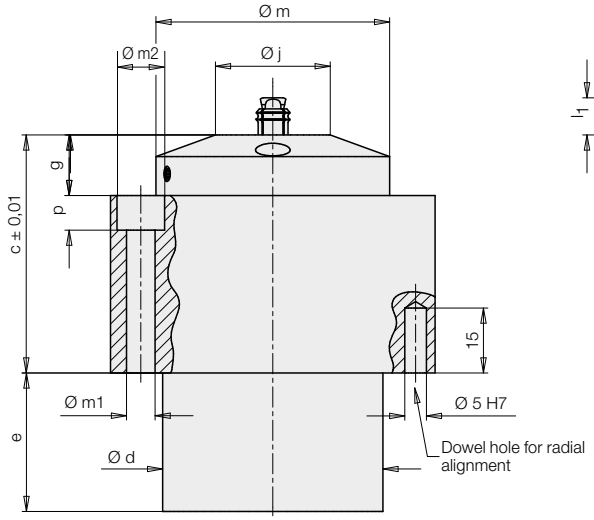
Machining of a plate from 5 sides on an indexing bridge

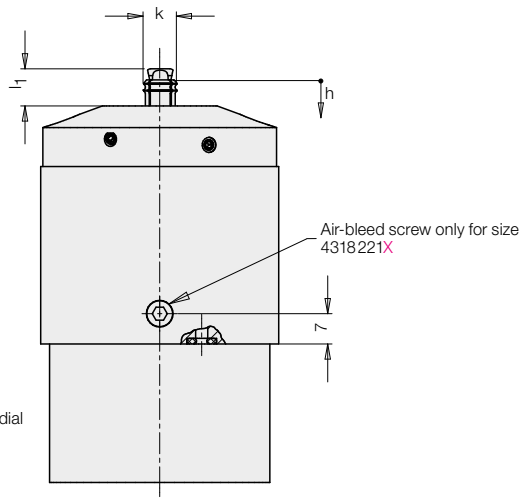


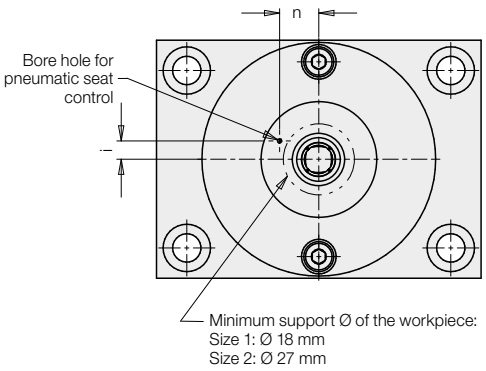


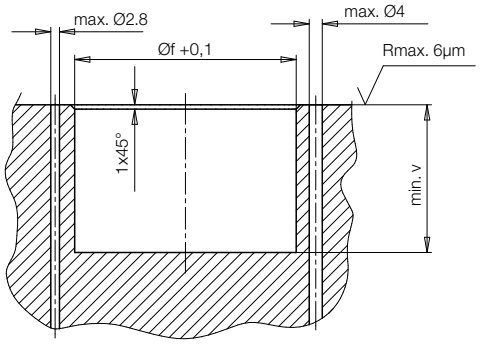
S = Clamping (pull down effect)
E = Unclamping (release of pull down effect and clamping bushing)
A = Seat control
L = Positive air pressure protection

Functional description see page 4.

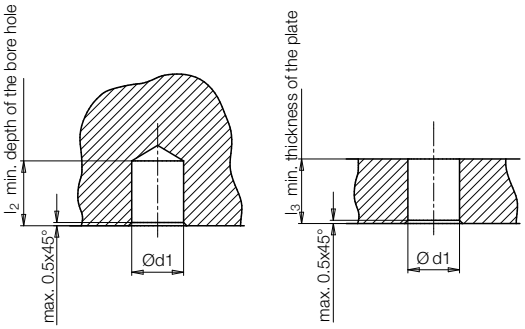


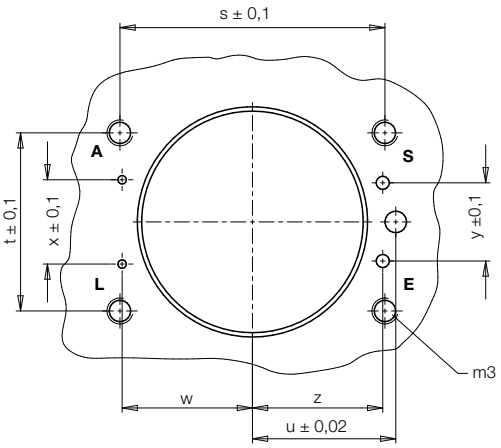






Demands on the bore hole in the workpiece





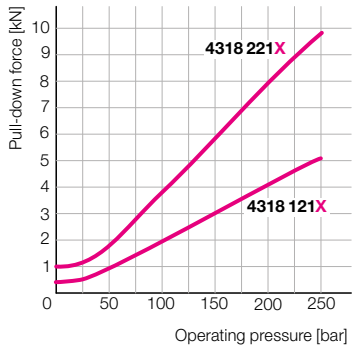
Adjusting Ø of the clamping bushing: k = d1 –0.2 mm

Technical data

			Size 1	Size 2
Part no. (**X** = Identification letter bore Ø)			**4318121X**	**4318221X**
Expansion force , radial		[kN]	approx. 9	approx. 14
Pull-down force	at 100 bar	[kN]	2	3.9
	at 250 bar	[kN]	5.1	9.8
Clamping bushing, unclamping		[bar]	min. 100**	min. 100**
Max. oil volume	Clamping	[cm^3]	0.5	1
	Unclamping	[cm^3]	10	25
Max. flow rate		[cm^3/s]	25	50
a		[mm]	75	85
b		[mm]	55	63
c ±0.01		[mm]	55	61
d		[mm]	50.9	57.9
e		[mm]	32	50
f		[mm]	51	58
g		[mm]	14	16
h max. pull-down stroke		[mm]	2	2
i		[mm]	4.2	5.9
j		[mm]	26.5	38.3
k Adjusting Ø of the clamping bushing		[mm]	d1 –0.2	d1 –0.2
l_1 max. height (unclamped)		[mm]	10	13
l_2 min. depth of the bore hole		[mm]	10	13
l_3 min. thickness of the plate		[mm]	9	12
m		[mm]	54	63
m1		[mm]	6.6	8.5
m2		[mm]	11	15
m3		[mm]	M6	M8
n		[mm]	9	12.7
p		[mm]	8	9
s		[mm]	61	66
t		[mm]	41	46
u		[mm]	33	36
v		[mm]	34	52
w		[mm]	30	32
x		[mm]	19.4	23
y		[mm]	18	24
z		[mm]	30	33.5
Weight		[kg]	1.8	2.9

Part numbers for spare O-ring			
2 x O-ring for port **A/L**	[mm]	Ø 3.68x1.78	Ø 3.68x1.78
NBR		**3000876**	**3000876**
FKM		**3000274**	**3000274**
2 x O-ring for port **E/S**		Ø 7x1.5	Ø 7x1.5
NBR		**3000342**	**3000342**
FKM		**3001077**	**3001077**

Pull-down force



* Consider the tolerance of the bore hole
** For operating pressures < 100 bar please contact us.

Bore hole Ø and part numbers

Size 1

Bore Ø* d1 in mm	Part no.
7.8 - 8.2	**4318121 A**
8.3 - 9.2	**4318121 B**
9.3 - 9.7	**4318121 C**
9.8 - 10.2	**4318121 D**
10.3 - 11.2	**4318121 E**

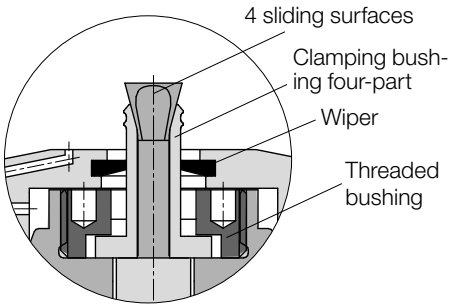
Size 2

Bore Ø* d1 in mm	Part no.
11.3 - 11.7	**4318221 F**
11.8 - 12.7	**4318221 G**
12.8 - 13.7	**4318221 H**
13.8 - 14.7	**4318221 K**
14.8 - 15.7	**4318221 L**
15.8 - 16.7	**4318221 M**
16.8 - 17.7	**4318221 N**

Article available on request

Spare clamping sets

The clamping sets contain all required components to replace the clamping bushings. Every clamping set consists of clamping bushing and wiper. Mounting or dismounting can be made on your own as per operating instructions.



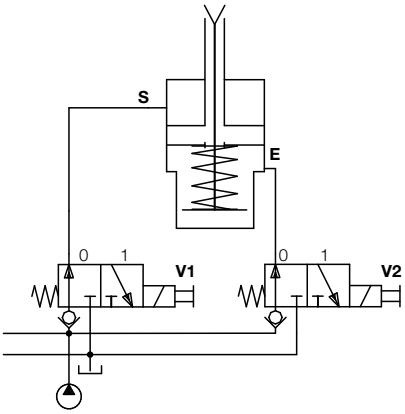
Size 1

Bore Ø* d1 in mm	Clamping set Part no.
7.8 - 8.2	**0431704 A**
8.3 - 9.2	**0431704 B**
9.3 - 9.7	**0431704 C**
9.8 - 10.2	**0431704 D**
10.3 - 11.2	**0431704 E**
Screw tool for threaded bushing	**2010911**

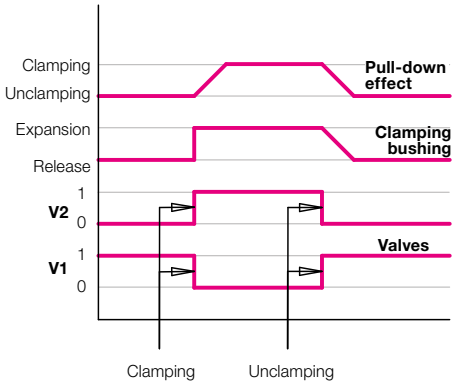
Size 2

Bore Ø* d1 in mm	Clamping set Part no.
11.3 - 11.7	**0431703 F**
11.8 - 12.7	**0431703 G**
12.8 - 13.7	**0431703 H**
13.8 - 14.7	**0431703 K**
14.8 - 15.7	**0431703 L**
15.8 - 16.7	**0431703 M**
16.8 - 17.7	**0431703 N**
Screw tool for threaded bushing	**2010912**

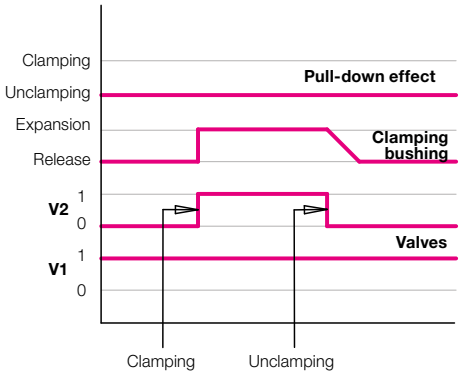
Hydraulic connection



Function sequence

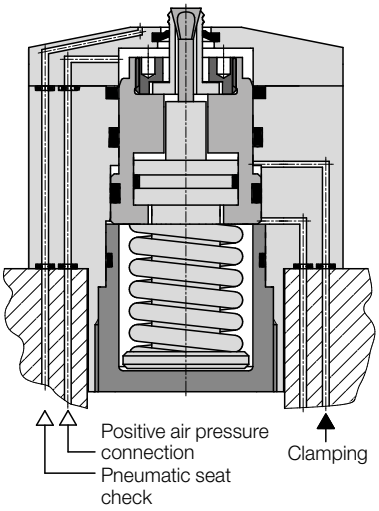


Clamping bushing only expansion



Workpiece clamping

1. Put the workpiece onto the hardened support surfaces and position by external stops or pins, if required.
2. Start the clamping process by switching the valves.
3. With pressure relief of the unclamping port the clamping bushings will be radially expanded very quickly. According to the material, the toothing penetrates more or less deeply into the bore hole wall and a form fit will be obtained.
4. In case of pressure increase at the clamping port, the hydraulic piston pulls the expanded clamping bushing and thereby also the workpiece onto the support surface.



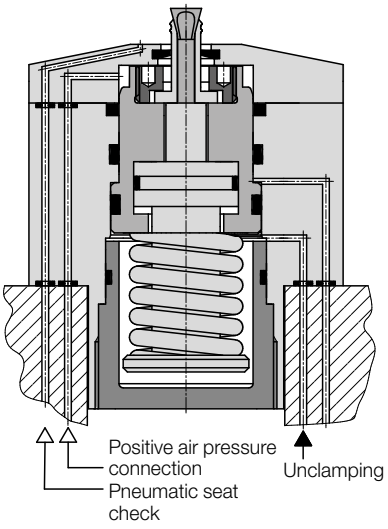
What happens in case of pressure drop of the clamping pressure?

In case of pressure drop the workpieces is no longer pulled onto the hardened support surface. The radial expansion of the clamping jaws and thereby the form fit with the workpiece are maintained by the spring tension.

Workpiece unclamping

1. For unclamping a minimum pressure of 100 bar is required. In case of pressure increase at the unclamping port, the hydraulic piston returns to its off-position and the spring tension of the clamping bushing will be released. Very light workpieces can be slightly lifted.
2. Remove the workpiece.

Note:
For operating pressures < 100 bar please contact us.



What happens in case of pressure drop of the unclamping pressure?

The clamping bushing is expanded by spring force and can only be released with the minimum unclamping pressure of 100 bar. If there is no oil pressure the workpiece can neither be taken out nor a new workpiece can be inserted.

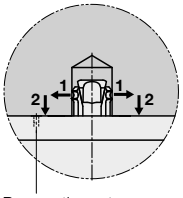
Bore Clamps

Cartridge type, without centring function, double acting, for bore diameter 7.8–17.7 mm, max.operating pressure 250 bar

Advantages

- Axial clamping in simple bore holes
- 5-sided machining possible
- Expand clamping bushing with spring force
- Hold workpiece without hydraulic pressure
- Clamp workpiece with adjustable hydraulics
- Hardened workpiece support
- Pneumatic seat check
- Connection for positive air pressure protection
- Standard FKM seals
- 2 sizes available

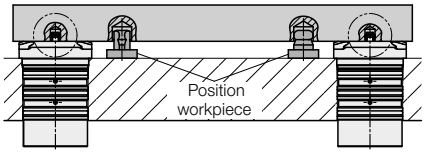
Function



Pneumatic seat check

1 Expand clamping bushing with spring force
Hold workpiece
Safety in case of pressure drop

2 Clamp workpiece with hydraulics
Adjustable clamping force



Application

The bore clamps are particularly suited for clamping of workpieces with smooth bore holes from diameter 7.8 to 17.7 mm in the support surface.

The required form-fit in the bore hole is obtained by the special profile of the hardened clamping bushings with penetrating points in the bore hole wall. Hardened materials cannot be clamped with these elements.

The workpiece is put directly onto the bore clamp and will not be deformed during clamping.

Since clamping is effected within the bore, the remaining surfaces are free for machining on 5 sides (see application example).

The size of the possible machining forces is certainly limited using this type of clamping, especially crosswise to the clamping surface.
Except the static friction force between the workpiece and the support, the bore clamp cannot compensate any side loads. Additional stops or positioning elements can help in such applications.

Workpiece sections that are subject to vibrations and deformations during machining, have to be additionally supported or clamped in a flexible (floating) position.

Functional description

See page 4.

Description

The bore clamp is a double-acting pull-type cylinder. An exchangeable clamping bushing is fixed to the piston.
The four segments of the clamping bushing are radially expanded with spring force by a pyramid-shaped clamping bolt. Thus the expansion force is always the same and independent of the hydraulic clamping pressure.
The workpiece is also held without hydraulics by means of the expanded clamping bushing.
Both pull-down of the workpiece and unclamping of the clamping bushing are hydraulically controlled.
Connecting the positive air pressure protection, the clamping bushing is protected against swarf and coolants.
In the hardened support surface for the workpiece there is a bore hole for the pneumatic seat check.

Important notes

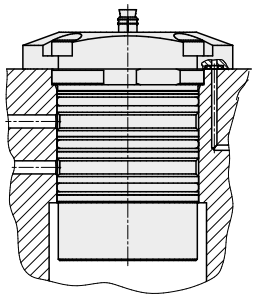
The bore clamp has no centring function.
The clamping bushing has to be protected against too high side loads during insertion or machining by suitable stops or centring bolts. The required positioning precision is ± 0.2 mm.

The required penetration depth of the toothing depends on the strength of the material for the form-fit toothing with the workpiece. Therefore hardened or coated workpieces cannot be used.
The tapering of the bore hole should not exceed 3°. In case of doubt we recommend a clamping test.
Clean the support surface and blast clean the clamping bushing before every clamping cycle.
If swarf fall into an open clamping bore, blast air must be continuously switched on.
Clamping bushings and wiper should be exchanged after 100,000 operations.
Part numbers for complete clamping sets:
see chart on page 3.

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

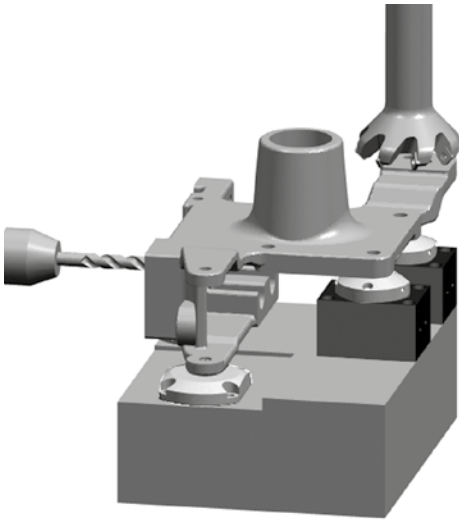
Connecting possibility

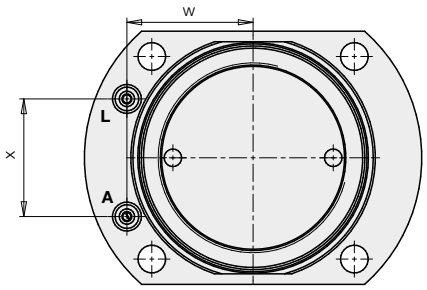
Drilled channels



Application example

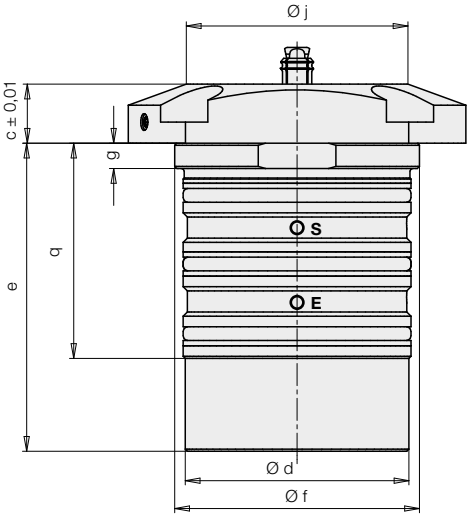
Machining of a cast part from 5 sides

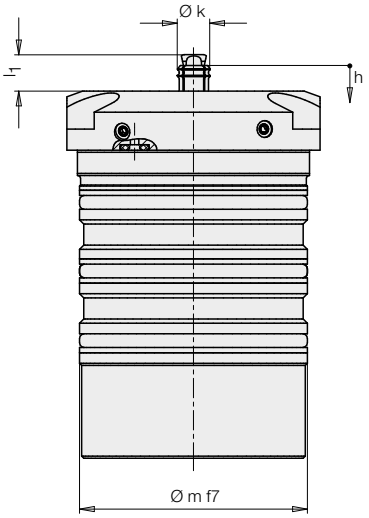


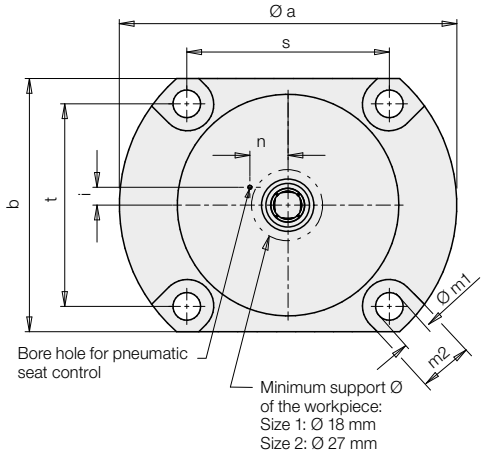


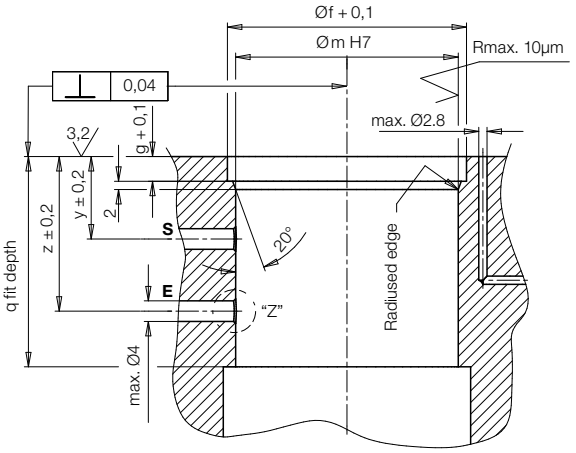
S = Clamping (pull down effect)
E = Unclamping (release of pull down effect and clamping bushing)
A = Seat control
L = Positive air pressure protection

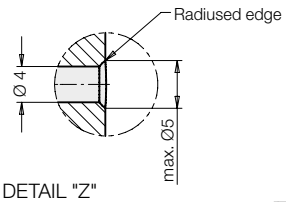
Functional description see page 4.





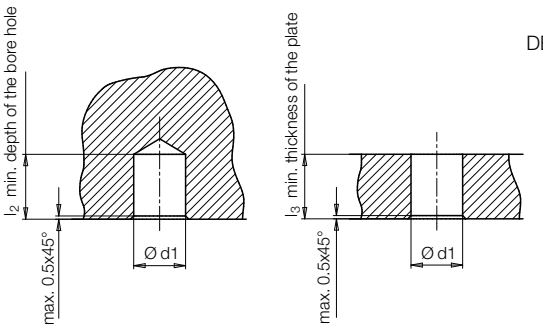


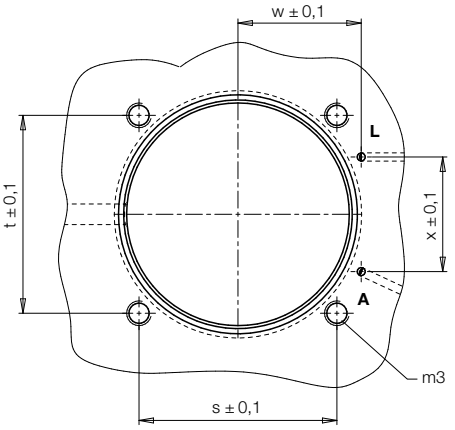




DETAIL "Z"

Demands on the bore hole in the workpiece





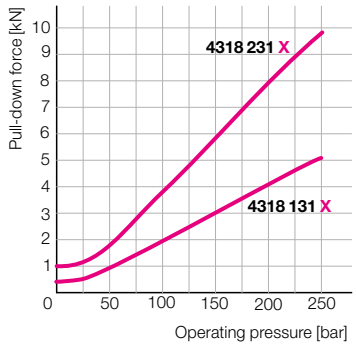
Adjusting Ø of the clamping bushing: k = d1 –0.2 mm

Technical data

			Size 1	Size 2
Part no. (**X** = Identification letter bore Ø)			**4318131X**	**4318231X**
Expansion force, radial		[kN]	approx. 9	approx. 14
Pull-down force	at 100 bar	[kN]	2	3.9
	at 250 bar	[kN]	5.1	9.8
Clamping bushing, unclamping		[bar]	min. 100**	min. 100**
Max. oil volume	Clamping	[cm^3]	0.5	1
	Unclamping	[cm^3]	10	25
Max. flow rate		[cm^3/s]	25	50
Ø a		[mm]	80	90
b		[mm]	60	68
c ±0.01		[mm]	14	16
Ø d		[mm]	53	59
e		[mm]	73	95
f		[mm]	58	68
g ± 0.1		[mm]	6	8
h max. pull-down stroke		[mm]	2	2
i		[mm]	4.2	6.3
Ø j		[mm]	52.5	62.5
Ø k Adjusting Ø of the clamping bushing		[mm]	d1 –0.2	d1 –0.2
l_1 max. height (unclamped)		[mm]	10	13
l_2 min. depth of the bore hole		[mm]	10	13
l_3 min. thickness of the plate		[mm]	9	12
Ø m		[mm]	54	60
Ø m1		[mm]	6.6	6.6
m2		[mm]	12.5	12.5
m3		[mm]	M6	M6
n		[mm]	9	13.6
q		[mm]	51	59,5
s		[mm]	48	55
t		[mm]	48	55
w		[mm]	29.9	35.4
x		[mm]	27.9	33
y		[mm]	20	21
z		[mm]	37.5	42
Weight, approx.		[kg]	1.5	2.4

Part numbers for spare O-ring			
2 x O-ring	[mm]	Ø 3.68x1.78	Ø 3.68x1.78
NBR		**3000876**	**3000876**
FKM		**3000274**	**3000274**

Pull-down force



* Consider the tolerance of the bore hole
** For operating pressures < 100 bar please contact us.

Bore hole Ø and part numbers

Size 1

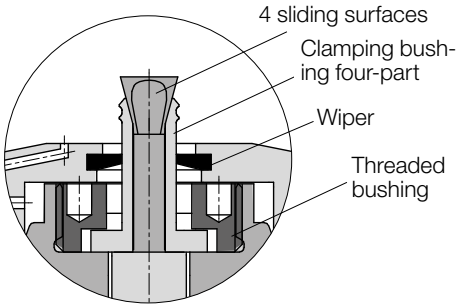
Bore Ø* d1 in mm	Part no.
7.8 - 8.2	**4318131 A**
8.3 - 9.2	**4318131 B**
9.3 - 9.7	**4318131 C**
9.8 - 10.2	**4318131 D**
10.3 - 11.2	**4318131 E**

Size 2

Bore Ø* d1 in mm	Part no.
11.3 - 11.7	**4318231 F**
11.8 - 12.7	**4318231 G**
12.8 - 13.7	**4318231 H**
13.8 - 14.7	**4318231 K**
14.8 - 15.7	**4318231 L**
15.8 - 16.7	**4318231 M**
16.8 - 17.7	**4318231 N**

Spare clamping sets

The clamping sets contain all required components to replace the clamping bushings. Every clamping set consists of clamping bushing and wiper. Mounting or dismounting can be made on your own as per operating instructions.



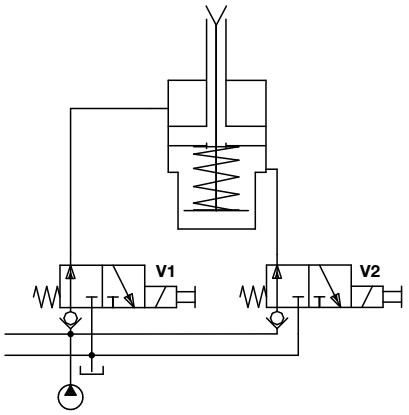
Size 1

Bore Ø* d1 in mm	Clamping set Part no.
7.8 - 8.2	**0431704 A**
8.3 - 9.2	**0431704 B**
9.3 - 9.7	**0431704 C**
9.8 - 10.2	**0431704 D**
10.3 - 11.2	**0431704 E**
Screw tool for threaded bushing	**2010911**

Size 2

Bore Ø* d1 in mm	Clamping set Part no.
11.3 - 11.7	**0431703 F**
11.8 - 12.7	**0431703 G**
12.8 - 13.7	**0431703 H**
13.8 - 14.7	**0431703 K**
14.8 - 15.7	**0431703 L**
15.8 - 16.7	**0431703 M**
16.8 - 17.7	**0431703 N**
Screw tool for threaded bushing	**2010912**

Hydraulic connection



Workpiece clamping

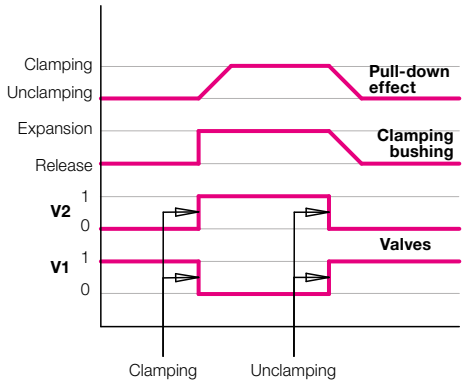
1. Put the workpiece onto the hardened support surfaces and position by external stops or pins, if required.
2. Start the clamping process by switching the valves.
3. With pressure relief of the unclamping port the clamping bushings will be radially expanded very quickly. According to the material, the toothing penetrates more or less deeply into the bore hole wall and a form fit will be obtained.
4. In case of pressure increase at the clamping port, the hydraulic piston pulls the expanded clamping bushing and thereby also the workpiece onto the support surface.

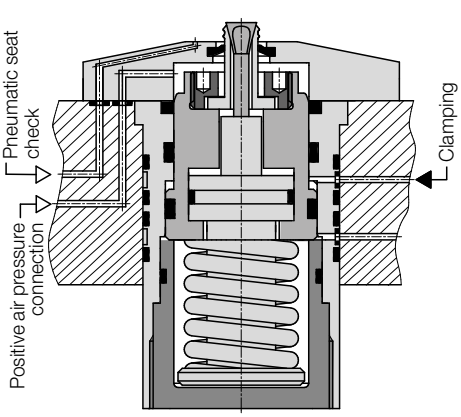
Workpiece unclamping

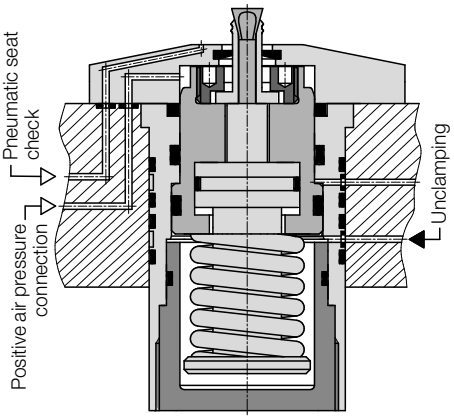
1. For unclamping a minimum pressure of 100 bar is required. In case of pressure increase at the unclamping port, the hydraulic piston returns to its off-position and the spring tension of the clamping bushing will be released. Very light workpieces can be slightly lifted.
2. Remove the workpiece.

Note:
For operating pressures < 100 bar please contact us.

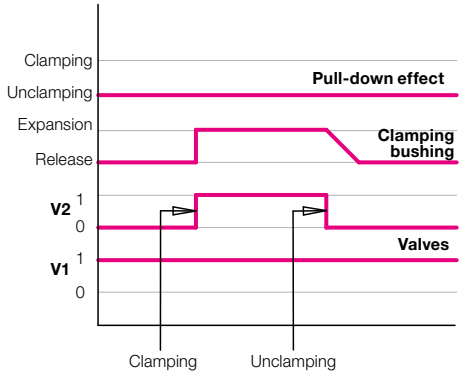
Function sequence







Clamping bushing only expansion



What happens in case of pressure drop of the clamping pressure?

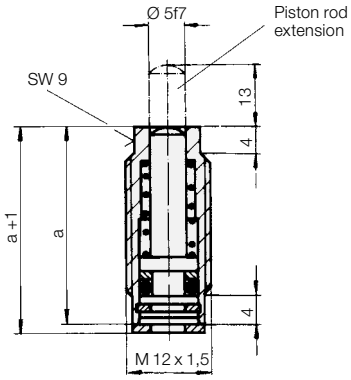
In case of pressure drop the workpieces is no longer pulled onto the hardened support surface. The radial expansion of the clamping jaws and thereby the form fit with the workpiece are maintained by the spring tension.

What happens in case of pressure drop of the unclamping pressure?

The clamping bushing is expanded by spring force and can only be released with the minimum unclamping pressure of 100 bar. If there is no oil pressure the workpiece can neither be taken out nor a new workpiece can be inserted.

Threaded-Body Cylinder

single acting with spring return
max. operating pressure 160/500 bar



Description

These threaded-body cylinders are particularly suitable for clamping of smaller workpieces in multiple clamping fixtures. The minimum cylinder pitch is only 15 mm.
Sealing is made with the supplied sealing ring in the threaded hole.
The sealing nut, delivered as accessory, allows adjustment of the cylinders 1458002 and 1458012 so that workpiece tolerances of more than 20 mm can be compensated.
Admissible seating torque of the sealing nut 25 Nm!
Threaded in the mounting body the cylinder can also be connected individually. Depending on wall strength and fixing method (thread or bore) a certain adjustment is possible.

Material

Piston material: casehardening steel, hardened
Cylinder body: free-cutting steel

Important notes

Threaded-body cylinders must not be subjected to a load in retracted position.
Cylinders have to be protected against direct influences of aggressive cutting lubricants and coolants.
Operating conditions, tolerances and other data see data sheet A 0.100.

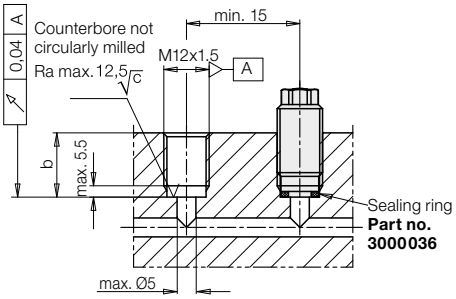
Piston Ø	[mm]	8	8
Stroke	[mm]	5	10
Clamping force 100 bar	[kN]	0.5	0.5
at 500 bar	[kN]	2.5	2.5
Min. operating pressure	[bar]	5	5
Oil volume/10 mm stroke	[cm^3]	0.5	0.5
Piston area	[cm^2]	0.5	0.5
Spring return force, min.	[N]	15	15
a	[mm]	27	40
b min.	[mm]	11	11
b max.	[mm]	24	37
c	[mm]	17	30
Max. seating torque	[Nm]	10	10
Weight	[g]	16	24
Part no. - with sealing ring		**1458001**	**1458002**
Part no. - with sealing ring and piston rod extension		**1458011**	**1458012**

Version with minimum leakage rate for operating pressure up to 160 bar
e.g. for applications with many operating cycles

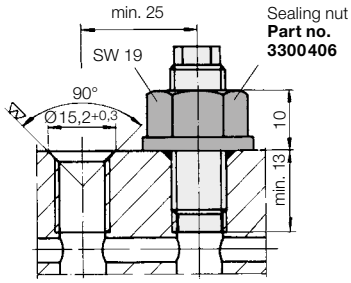
Part no. - with sealing ring	**1458101**	**1458102**
Part no. - with sealing ring and piston rod extension	**1458111**	**1458112**

Installation possibilities and accessories

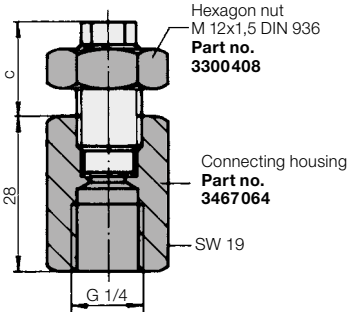
1. Screw-in thread and sealing ring



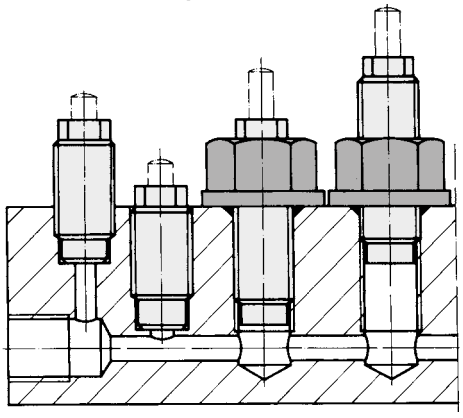
2. Screw-in thread and sealing nut

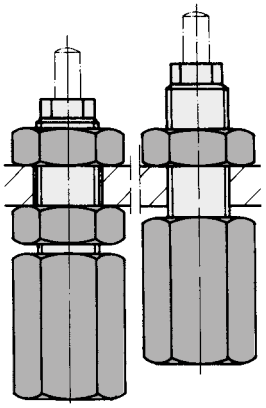


3. Connecting housing and lock nut



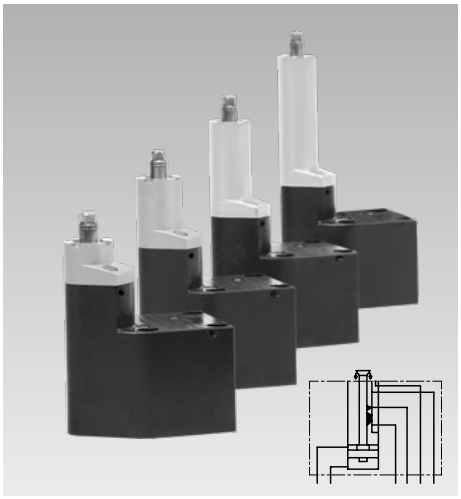
Installation examples





Bore Clamps Eccentric

Pneumatic seat check and clamping monitoring
bore holes Ø 8 – 12 mm, double acting, max. operating pressure 80 and 120 bar



Axial clamping in smooth bore holes

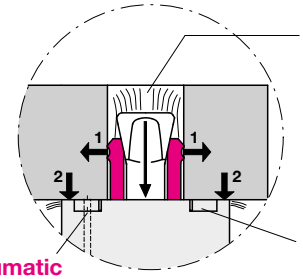
Machining from 5 sides

Reduced processing times

Higher precision by tools in standard length

Short tool paths

Clamping force up to 5 kN

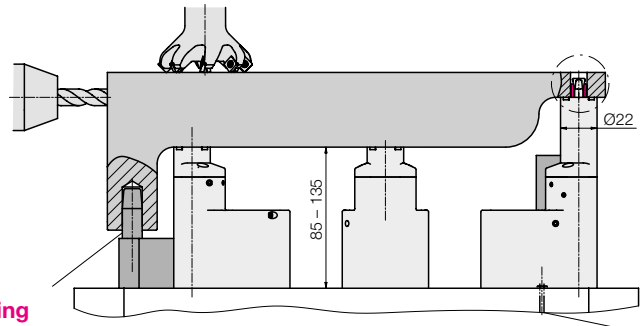


Positive air pressure protection

Clamping bolt and clamping bushing easily exchangeable

Hardened workpiece support

Pneumatic seat check

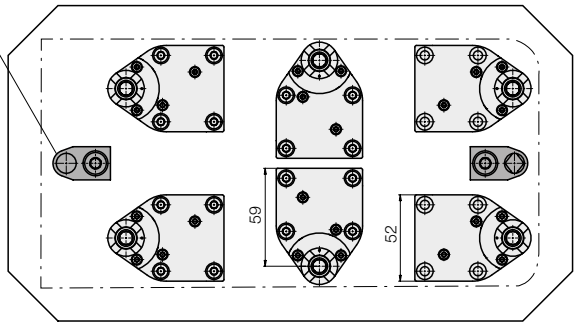


Different support heights

Eccentric design with small neck diameter

Positioning and side load absorption

2 x hydraulics 4 x pneumatics



Smaller fixtures and machine tables

Corrosion-protected components

Efficient swarf management

Application
The hydraulically-operated bore clamp is particularly suitable for clamping in workpieces with smooth bore holes in the support surface ranging from 8 to 12 mm in diameter.
The workpiece is placed directly onto the hardened supports of the bore clamp and is not deformed during clamping.
Since clamping is effected within the bore, the remaining surfaces are free for machining on 5 sides.

Description
The double-acting hydraulic cylinder operates a tie bolt that is eccentrically arranged at the edge of the housing in which the clamping bolt is safely engaged.
This conical clamping bolt expands the hardened clamping bushing so that its points penetrate the bore surface in the workpiece with a positive fit (see “Clamping principle”).
Clamping bolt and clamping bushing can be exchanged very quickly after loosening the workpiece support. The bore clamp can remain on the fixture and no hydraulic oil escapes.
All functions can be monitored pneumatically.
The use of the connection for positive air pressure protection prevents liquids and swarf from entering the clamping bushing.

Important notes
The bore clamp has no centring function. To insert and position the workpiece, suitable guides and centring bolts must be provided.
The centring bolts also have to absorb the occurring side loads during machining.
A distortion-free workpiece clamping is only guaranteed if the workpiece rests backlash-free on all bore clamps.
The specified clamping forces are only achieved if the points of the clamping bushing penetrate into the bore wall (see also "Clamping principle" and "Technical characteristics").
If swarf and liquids penetrate into an open clamping bore, positive air pressure must be continuously switched on.

Function
After pressurising, the conical clamping bolt will be retracted. The clamping bushing will be expanded and the points penetrate into the bore hole wall.
With the penetration of the points increases the hydraulic pressure and thus the clamping force.
During unclamping, the clamping bolt extends again. The clamping bushing is relieved and pulled together by a ring spring.

Functional safety
The functional safety is guaranteed if
- the workpiece material allows the clamping bushing to penetrate into the bore wall (see Technical characteristics);
- the diameter of the clamping bore is within the admissible tolerance range of the clamping bushing used;
- the clamping bore in the workpiece is round and perpendicular to the support surface;
- the workpiece rests on the entire surface perpendicular to the bore clamp;
- the support surfaces are free of dirt and swarf;
- the positive air pressure connection is switched on to blow away liquids and chips.

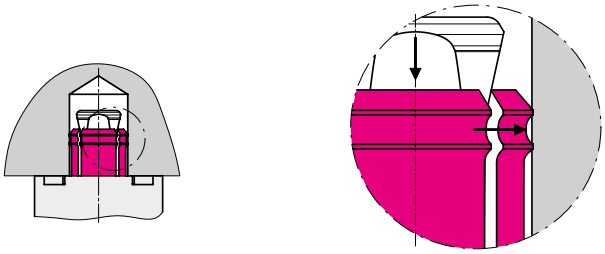
Function control
With bore clamps, visual control of the clamping process is not possible because they are concealed by the workpiece.
For this eccentric bore clamp, three pneumatic and one hydraulic control options are available as standard:
- Seat check
- Clamping monitoring
- Unclamping monitoring
- Operating pressure control by external pressure switches

We recommend the use of all control options so that information about the current operating status is available at all times.
A detailed description with a function chart and the hydraulic and pneumatic circuit diagram can be found on page 4.

Design with defined return of the clamping segments
On request

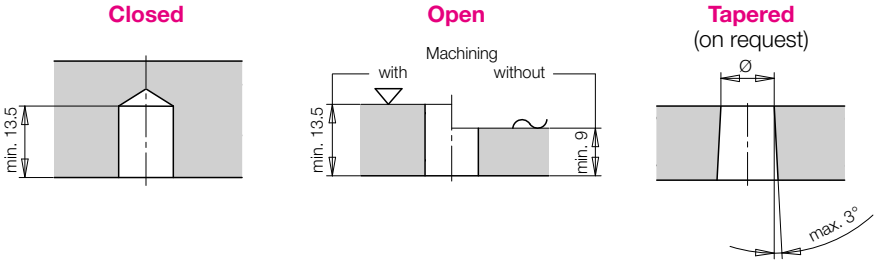
Clamping principle

To ensure that the workpiece is clamped onto the hardened workpiece support with the highest possible force, a positive connection must be established between the clamping bushing and the smooth bore wall.
During the clamping process, the conical clamping bolt spreads the hardened clamping bushing and the circumferential points penetrate into the softer workpiece material.
The penetration depth depends on the hardness of the material. Hardened, highly-tempered but also too soft materials are therefore not suitable (see "Technical characteristics").
In case of doubt, a clamping test should be carried out.



Clamping bore

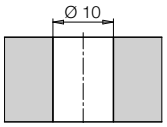
A closed clamping bore has the advantage that no swarf or liquids can get into the bore clamp through the clamping bushing during machining.
However, the positive air pressure connection can only be switched off if no liquid is present at the workpiece support.
With the open bore, however, the positive air pressure connection must remain permanently switched on.

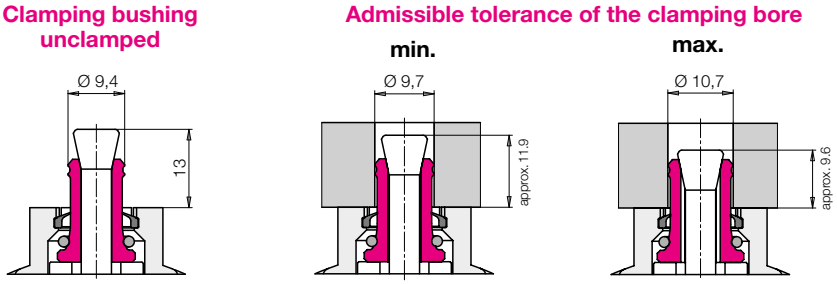


Clamping bushings

Example: clamping bore Ø 10 mm

Nominal diameter of the clamping bushing 10



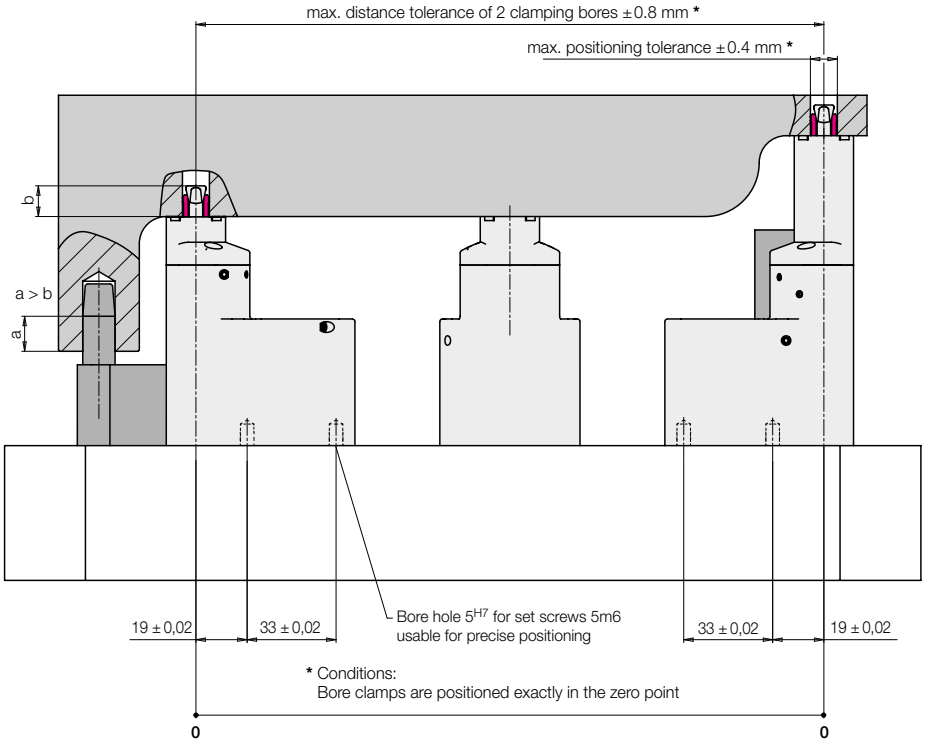


Workpiece loading and positioning

The workpiece is to be guided by insertion pins, especially during automatic loading by robots. The bore clamps have no centring function. Additional positioning pins (round and flattened) have the following functions:

- to bring workpieces into an exact machining position;
- to absorb side loads if these are greater than 10 % of the clamping force of the bore clamps.

The functions “Insert” and “Position” can be combined if the centring is long enough (see example a > b).

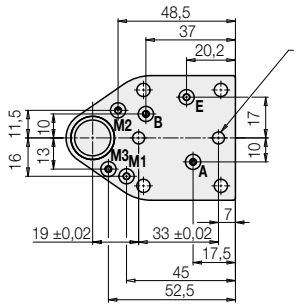


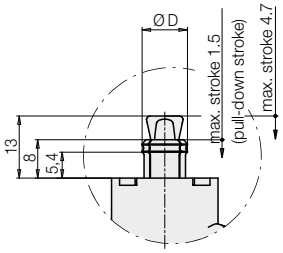
Positioning tolerance

Since the clamping bushing in the housing is radially movable, the workpiece can be positioned with a positioning tolerance of ± 0.4 mm.

Distance tolerance

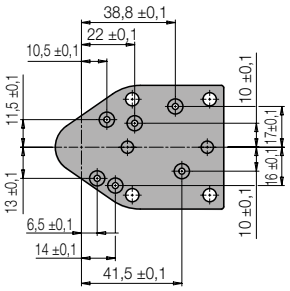
The distance tolerance of 2 clamping bores can be max. ± 0.8 mm if both bore clamps are positioned at the zero point (nominal dimension). This is made possible by using the two holes 5 ^{H7} in the flange surface of the bore clamps.

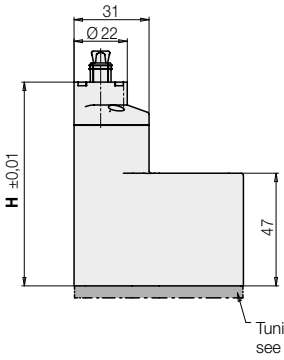


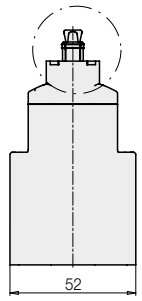


A = Clamping
B = Unclamping
M1 = Seat check
M2 = Unclamping monitoring
M3 = Clamping monitoring
E = Positive air pressure connection

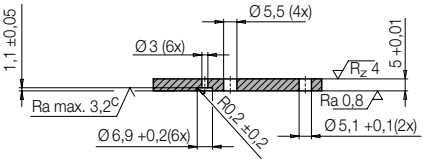
Accessory
Tuning plate
Part no. 0342002

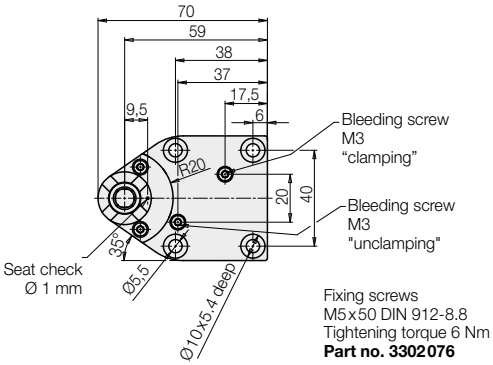




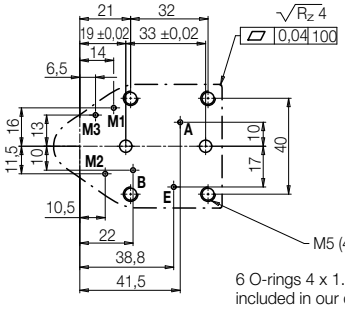


Connecting scheme
6 x connecting bore max. Ø3
4 x thread M5 x 10 deep
2 x positioning bore Ø 5H7

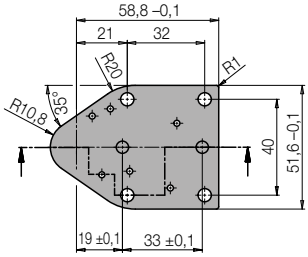




Fixing screws
M5 x 50 DIN 912-8.8
Tightening torque 6 Nm
Part no. 3302076



6 O-rings 4 x 1.5
included in our delivery

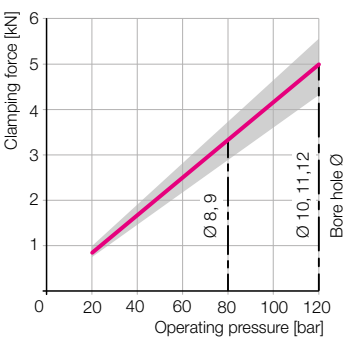


Weight 0.11 kg

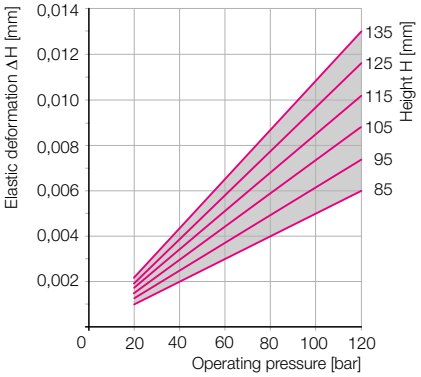
Bore hole Ø	[mm]	**8**	**9**	**10**	**11**	**12**
Usable clamping range Ø	[mm]	7.7 … 8.7	8.7 … 9.7	9.7 … 10.7	10.7 … 11.7	11.7 … 12.7
Max. clamping force +10 … –15 %	[kN]	**3.3**	**3.3**	**5**	**5**	**5**
Max. radial expansion force approx.	[kN]	8	8	14	14	14
Max. operating pressure	[bar]	**80**	**80**	**120**	**120**	**120**
Min. operating pressure	[bar]	20	20	20	20	20
Workpiece material max. hardness HB/HRc				250/25		
max. tensile strength	[N/mm²]			850		
Required positioning tolerance (see page 2)	[mm]			+/–0.4		
Max. out-of-roundness of the workpiece bore	[mm]			0.1		
Clamping bolt stroke	[mm]			4.7		
Clamping bushing stroke (pull-down clamping)	[mm]			max. 1.5		
Oil volume clamping / unclamping	[cm³]			4 / 3		
Adm. flow rate	[cm³/s]			25		
Hydraulic oil as per DIN 51524-2				HLP 32		
Temperature range	[°C]			0 … 80		
Recommended sensor air pressure (see page 4)	[bar]			2 … 4		
Recommended pressure for positive air pressure connection with / without function control	[bar]			max. 1 / 3		

Clamping force diagram

= Nominal value
= Tolerance range



Elastic deformation ΔH when clamping the workpiece



Part no. BCE1XX0 HXXXSZ

Bore hole Ø [mm] **BCE1XX0**	**Height H** [mm] **HXXXSZ**	Elastic deformation ΔH with load [µm / kN]	Weight [kg]
08	**085**	-1.60	1.20
09	**095**	-1.88	1.22
10	**105**	-2.16	1.24
11	**115**	-2.44	1.26
12	**125**	-2.72	1.28
	135	-3.00	1.30

Other sizes on request.

Pneumatic function controls

The bore clamp clamps the workpiece within smooth bores located in the support surface. A visual control of the clamping process is therefore impossible.
Three pneumatic function checks are available for this purpose:

- Seat check M1
  Signals the backlash-free contact of the workpiece on the hardened support and is therefore a prerequisite for initiating the clamping process.
- Unclamping monitoring M2
  Signals the unclamping position of the clamping bolt and thus the opening of the clamping bushing.
  Together with pressure switch P2, this is a prerequisite for unhindered loading and unloading of the workpiece.
- Clamping monitoring M3
  Signals that the clamping bolt is in the optimum clamping range and that the clamping bushing fits the diameter of the clamping bore.
  Together with the seat check M1 and the pressure switch P1, the signal serves for processing release.

Hydraulic function controls

- Clamping pressure P1
  Signals that the set operating pressure and the desired clamping force are applied.
  Together with the seat check M1 and the clamping monitoring M3, the signal serves for processing release.
- Unclamping pressure P2
  Signals that the tie rod is held in unclamping position by hydraulic pressure.
  Together with the unclamping monitoring M2 this is the release for the workpiece change.

Error message in clamping state

(see chart "Examples for ...")
Possible sources of error are

- clamping bore too large
- clamping bore out of tolerance
- clamping bore tapered or non-circular
- workpiece material too hard
- workpiece material too soft
- clamping bushing worn or defective
- clamping bolt defective

Signal conversion Pneumatics → Electrics

If a pneumatic bore is closed, the air pressure in the measuring system increases.
An electro-pneumatic measuring device can either measure the pressure increase or a drop of the air flow rate and convert it into an electrical signal.

Pneumatic pressure switch

Advantage: easy adjustment
To achieve a sufficient hysteresis of 1–2 bar, the air flow rate must be limited to approx. 12 l/min with a flow control valve. This adjustment is made with an additional flow sensor with digital flow rate display.

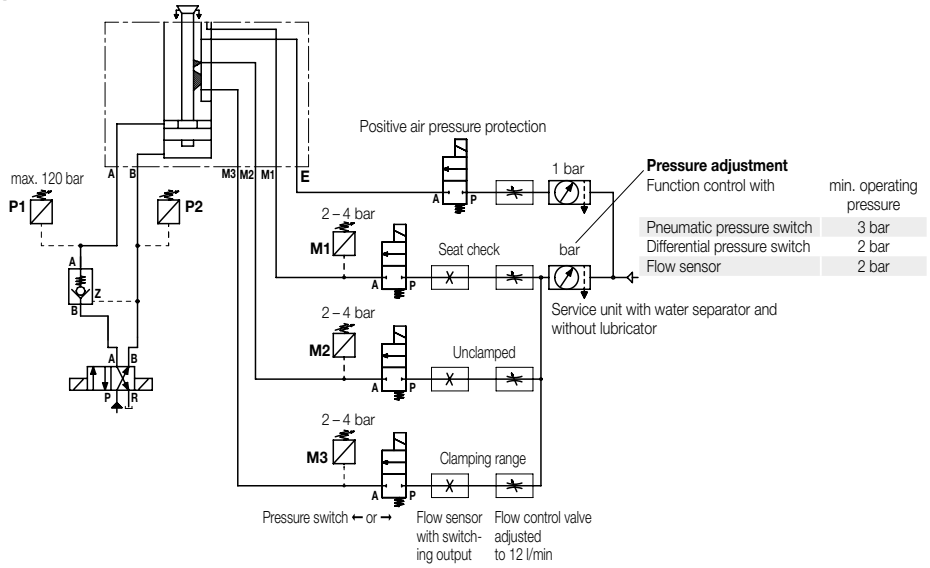
Differential pressure switch

Differential pressure switches (e.g. PEL System) require only 0.5 to 1.5 bar working pressure. The exact adjustment of a setting nozzle under practical conditions is required.

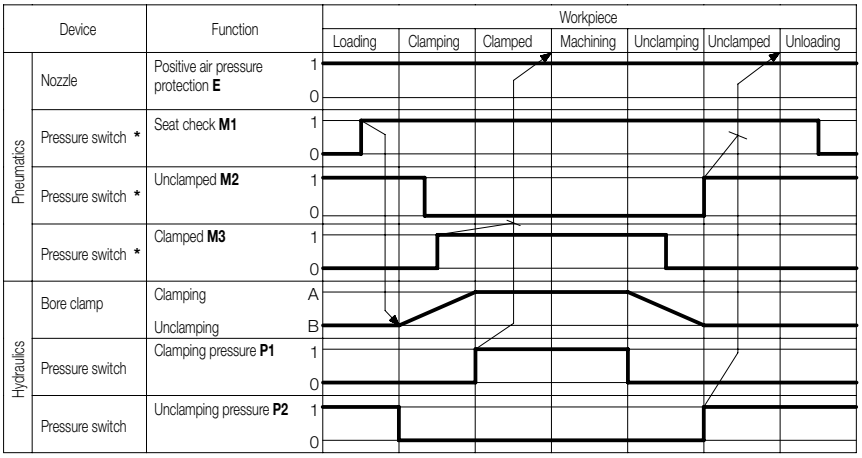
Flow sensor

A function control is also possible independent of pressure by measuring the flow rate. The flow sensor should have a digital display and one adjustable limit switch with a binary output (such as type SFAB of Festo).

Hydraulic and pneumatic circuit diagram with all function checks and positive air pressure connection



Function chart



* alternatively differential pressure switch or flow sensor

Examples for switching positions when using all control elements

Control elements		Status of control elements: Bore clamp			
		Unclamped and workpiece does not lie flat on the surface	Clamped Processing release	Error message in clamped state	
Seat check	**M1**	0	1	1	
Unclamping monitoring	**M2**	1	0	0	
Clamping monitoring	**M3**	0	1	0	← Error! (see text)
Clamping pressure	**P1**	0	1	1	
Unclamping pressure	**P2**	1	0	0	

Example

Six seat checks with 2 bar air pressure:

1. Cover all seat checks with one workpiece and measure the flow rate Qmin.
2. If one seat check is not covered, measure Qmax.
3. Enter and save
   switching threshold = 0.5 x (Qmax + Qmin).

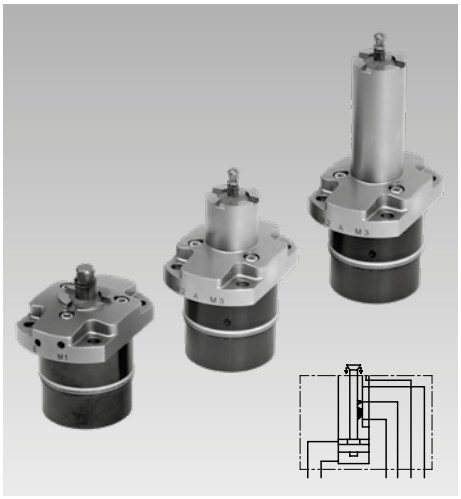
If the difference (Qmax – Qmin) is too small, increase the flow rate or reduce the number of bore clamps per sensor.

Number of bore clamps at a function control

For the monitoring of a function, e.g. the seat check, a group of max. 6 bore clamps can be connected to one measuring device.
The calibration of the switching pressure requires great care, because the measuring device has to recognize that, for example, only one of the 6 seat checks is not covered. It is not possible to see which one that is!

Bore Clamps

Pneumatic seat check and clamping monitoring, bore Ø 5.5 – 13 mm double acting, max. operating pressure 30, 80 and 120 bar



Axial clamping in smooth bore holes

Machining from 5 sides

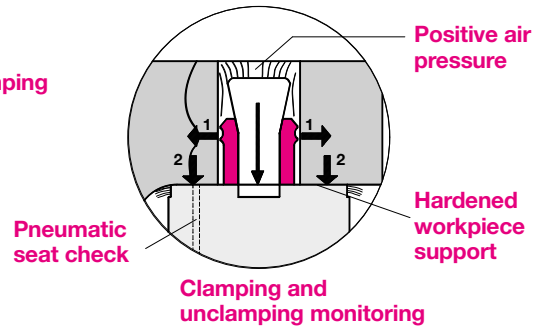
Distortion-free workpiece clamping

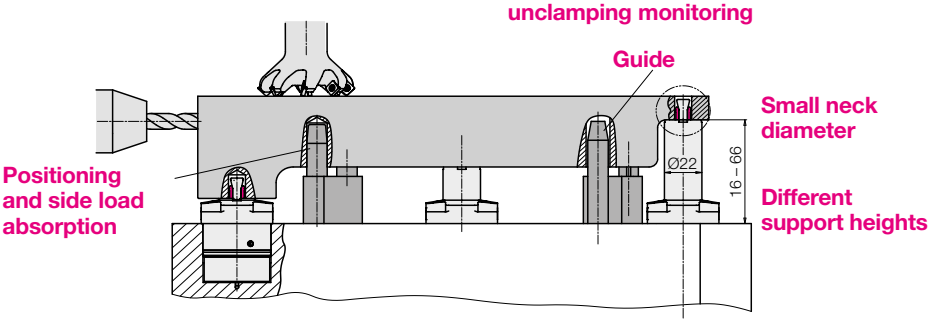
Higher precision by tools in standard length

Short tool paths

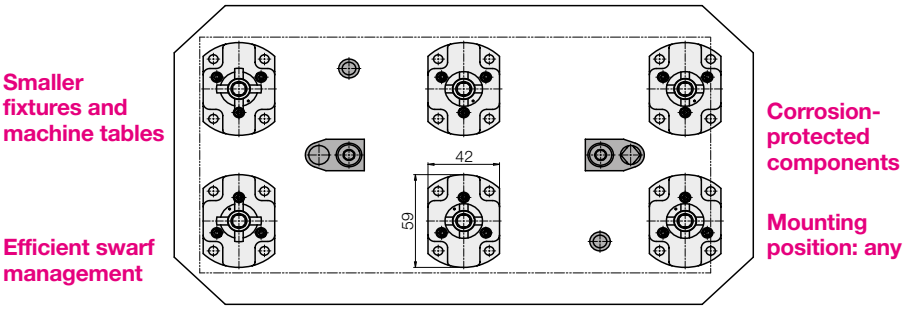
Reduced processing times

Clamping force up to 5 kN





2 x hydraulics 4 x pneumatics (if required)



Application

The hydraulically-operated bore clamp is particularly suitable for clamping in workpieces with smooth bore holes in the support surface ranging from 5.5 to 13 mm in diameter.
The workpiece is placed directly onto the hardened supports of the bore clamp and is not deformed during clamping.
Since clamping is effected within the bore, the remaining surfaces are free for machining on 5 sides.

Description

The double-acting hydraulic cylinder operates a conical clamping bolt centrally located in the housing, which expands the hardened clamping bushing. The expansion force causes the points to penetrate into the softer bore surface. This positive connection guarantees a secure clamping of the workpiece (see also “Clamping principle” on page 2).
All functions can be monitored pneumatically.
The use of the connection for positive air pressure protection can prevent liquids and swarf from entering the clamping bushing.

Important notes

The bore clamp has no centring function. To insert and position the workpiece, suitable guides and centring bolts must be provided (see page 2).
The centring bolts also have to absorb the occurring side loads during machining.
A distortion-free workpiece clamping is only guaranteed if the workpiece rests backlash-free on all bore clamps.
The specified clamping forces are only achieved if the points of the clamping bushing can penetrate into the bore wall. (see also “Technical characteristics” max. hardness).
If swarf and liquids penetrate into an open clamping bore, positive air pressure must be continuously switched on.

Function

After pressurising, the conical clamping bolt will be retracted. The clamping bushing will be expanded and the points penetrate into the bore hole wall.
With the penetration of the points increases the hydraulic pressure and thus the clamping force.
During unclamping, the clamping bolt extends again. The clamping bushing is relieved and pulled together by a ring spring.

Functional safety

The functional safety is guaranteed if

- the points of the clamping bushing can penetrate into the bore wall (see Technical characteristics workpiece material);
- the diameter of the clamping bore is within the admissible tolerance range of the clamping bushing used;
- the clamping bore in the workpiece is round and perpendicular to the support surface;
- the workpiece rests on the entire surface perpendicular to the bore clamp;
- the support surfaces are free of dirt and swarf;
- the positive air pressure connection is switched on to blow away liquids and chips.

Function control

With bore clamps, visual control of the clamping process is not possible because they are concealed by the workpiece.
For this reason, this bore clamp has three pneumatic and one hydraulic control option as standard:

- Seat check
- Clamping monitoring
- Unclamping monitoring
- Operating pressure control by external pressure switches

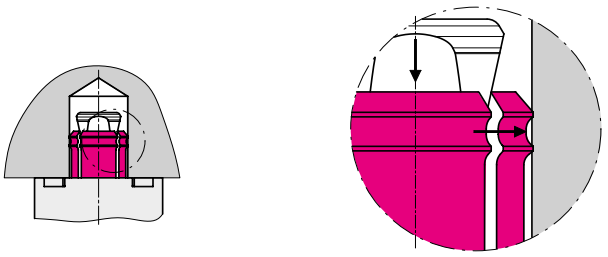
We recommend the use of all control options so that information about the current operating status is available at all times.
A detailed description with a function chart and the hydraulic and pneumatic circuit diagram can be found on page 4.

Design with defined return of the clamping segments

On request

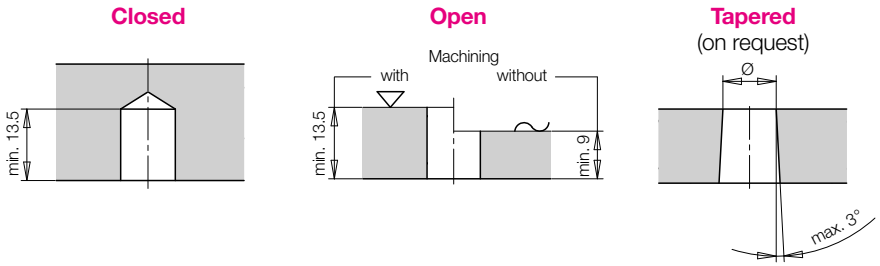
Clamping principle

To ensure that the workpiece is clamped onto the hardened workpiece support with the highest possible force, a positive connection must be established between the clamping bushing and the smooth bore wall.
During the clamping process, the conical clamping bolt spreads the hardened clamping bushing and the circumferential points penetrate into the softer workpiece material.
The penetration depth depends on the hardness of the material. Hardened, highly-tempered but also too soft materials are therefore not suitable (see "Technical characteristics").
In case of doubt, a clamping test should be carried out.



Clamping bore

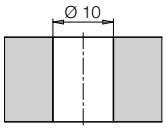
A closed clamping bore has the advantage that no swarf or liquids can get into the bore clamp through the clamping bushing during machining.
However, the positive air pressure connection can only be switched off if no liquid is present at the workpiece support.
With the open bore, however, the positive air pressure connection must remain permanently switched on.

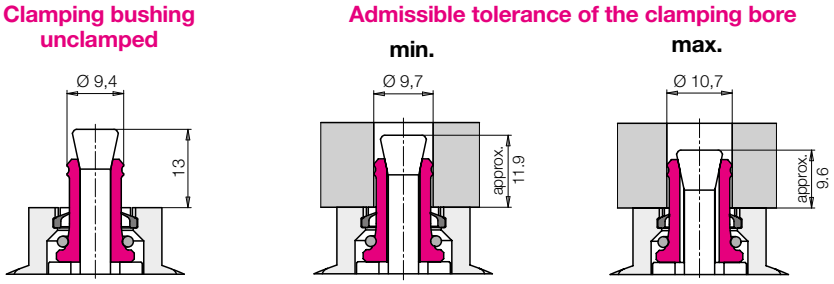


Clamping bushings

Example: Clamping bore Ø 10 mm

Nominal diameter of the clamping bushing 10



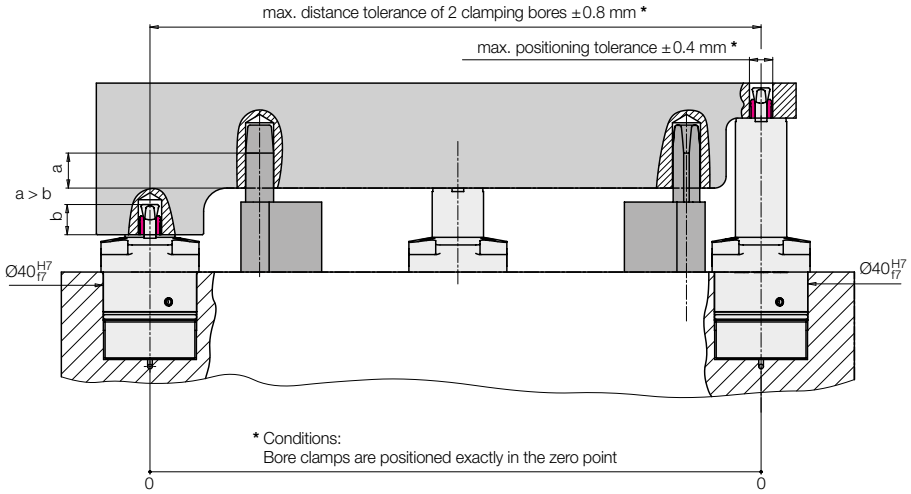


Workpiece loading and positioning

The workpiece is to be guided by insertion pins, especially during automatic loading by robots.
The bore clamps have no centring function.
Additional positioning pins (round and flattened) have the following functions

- to bring workpieces into an exact machining position;
- to absorb side loads if these are greater than 10 % of the clamping force of the bore clamps.

The functions “Insert” and “Position” can be combined if the centring is long enough (see example a > b).



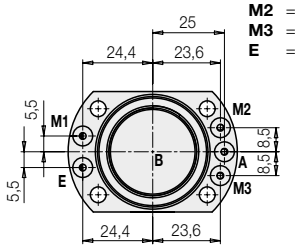
Positioning tolerance

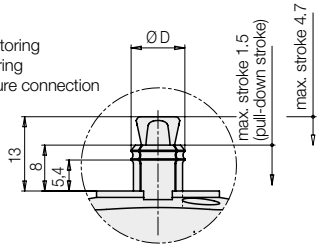
Since the clamping bushing in the housing is radially movable, the workpiece can be positioned with a positioning tolerance of ±0.4 mm.

Distance tolerance

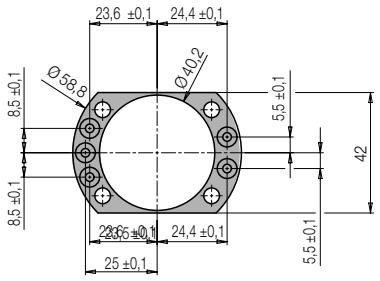
The distance tolerance of 2 clamping bores can be max. ±0.8 mm if both bore clamps are positioned at the zero point (nominal dimension).

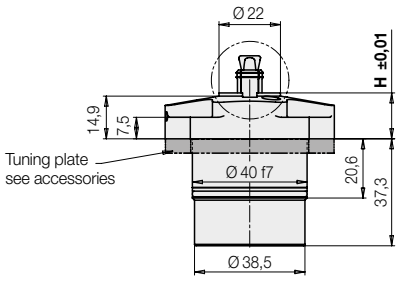
A = Clamping
B = Unclamping
M1 = Seat check
M2 = Unclamping monitoring
M3 = Clamping monitoring
E = Positive air pressure connection



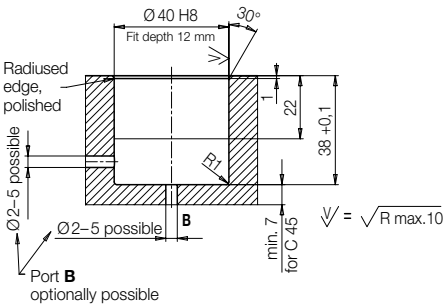


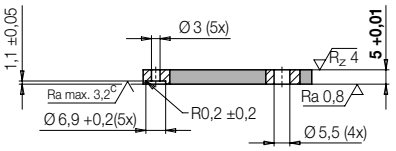
Accessory
Tuning plate
Part no. 0342003

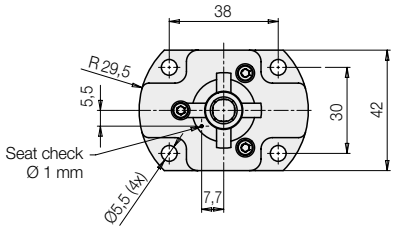




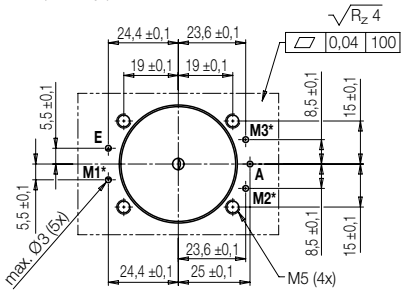
Connecting scheme





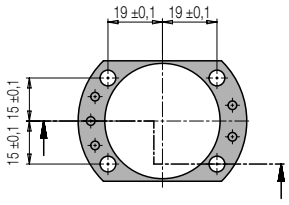


Fixing screws
M5 DIN 912-12.9
Tightening torque 10 Nm



5 O-rings 4 x 1.5
included in our delivery

* Bore holes only required
if control options are used.

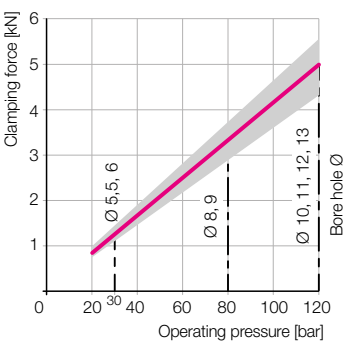


5 O-rings 4 x 1.5
included in our delivery

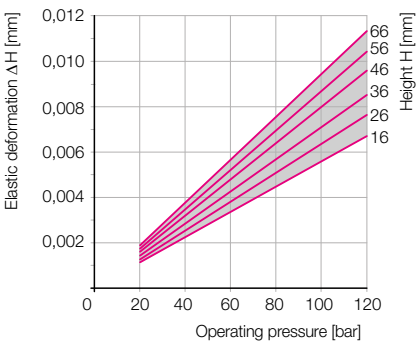
Bore hole Ø D	[mm]	**5.5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Usable clamping range Ø	[mm]	5.2...6.2	5.7...6.7	6.7...7.7	7.7...8.7	8.7...9.7	9.7...10.7	10.7...11.7	11.7...12.7	12.7...13.7
Max. clamping force approx.	[kN]	**1.2**	**1.2**	**3.3**	**3.3**	**3.3**	**5**	**5**	**5**	**5**
Max. radial expansion force approx.	[kN]	3	3	9	9	9	14	14	14	14
Max. operating pressure	[bar]	**30**	**30**	**80**	**80**	**80**	**120**	**120**	**120**	**120**
Min. operating pressure	[bar]					20				
Workpiece material max. hardness HRB/HRc						250/25				
max. tensile strength	[N/mm²]					850				
Required positioning tolerance (see page 2)	[mm]					+/–0.4				
Max. out-of-roundness of the workpiece bore	[mm]					0.1				
Clamping bolt stroke	[mm]					4.7				
Clamping bushing stroke (pull-down clamping)	[mm]					max. 1.5				
Oil volume clamping/unclamping	[cm³]					2.5 / 4				
Adm. flow rate	[cm³/s]					25				
Hydraulic oil as per DIN 51524-2						HLP 32				
Temperature range	[°C]					0…80				
Recommended sensor air pressure	[bar]					2…4				
Recommended pressure for positive air pressure with / without function control	[bar]					max. 1/3				

Clamping force diagram

= Nominal value
= Tolerance range



Elastic deformation ΔH when clamping the workpiece



Part no.
BCC1XXX HXXXSZ

Bore hole Ø	**Height H**	Weight approx.	Elastic deformation ΔH with load*
[mm] x 10	[mm]	[kg]	[µm / kN]
055	**016**	0.5	-0.7
060	**026**	0.53	-0.9
070	**036**	0.55	-1.1
080	**046**	0.57	-1.3
090	**056**	0.6	-1.5
100	**066**	0.62	-1.7
110			
120			
130			

* Load due to workpiece weight and machining forces

Other sizes on request.

Pneumatic function controls

The bore clamp clamps the workpiece within smooth bores located in the support surface. Visual control of the clamping process is therefore impossible.
Three pneumatic function checks are available for this purpose:

- Seat check M1
  Signals the backlash-free contact of the workpiece on the hardened support and is therefore a prerequisite for initiating the clamping process.
- Unclamping monitoring M2
  Signals the unclamping position of the clamping bolt and thus the opening of the clamping bushing.
  Together with pressure switch P2, this is a prerequisite for unhindered loading and unloading of the workpiece.
- Clamping monitoring M3
  Signals that the clamping bolt is in the optimum clamping range and that the clamping bushing fits the diameter of the clamping bore.
  Together with the seat check M1 and the pressure switch P1, the signal serves for processing release.

Hydraulic function controls

- Clamping pressure P1
  Signals that the set operating pressure and the desired clamping force are applied.
  Together with the seat check M1 and the clamping monitoring M3, the signal serves for processing release.
- Unclamping pressure P2
  Signals that the tie rod is held in unclamping position by hydraulic pressure.
  Together with the unclamping monitoring M2 this is the release for the workpiece change.

Error message in clamping state

(see chart "Example for ...")
Possible sources of error are

- Clamping bore too large
- Clamping bore out of tolerance
- Clamping bore tapered or non-circular
- Workpiece material too hard
- Workpiece material too soft
- Clamping bushing worn or defective
- Clamping bolt defective

Signal conversion Pneumatics → Electrics

If a pneumatic bore is closed, the air pressure in the measuring system increases.
An electro-pneumatic measuring device can either measure the pressure increase or a drop of the air flow rate and convert it into an electrical signal.

Pneumatic pressure switch

Advantage: Easy adjustment
To achieve a sufficient hysteresis of 1–2 bar, the air flow rate must be limited to approx. 12 l/min with a flow control valve. This adjustment is made with an additional flow sensor with digital flow rate display.

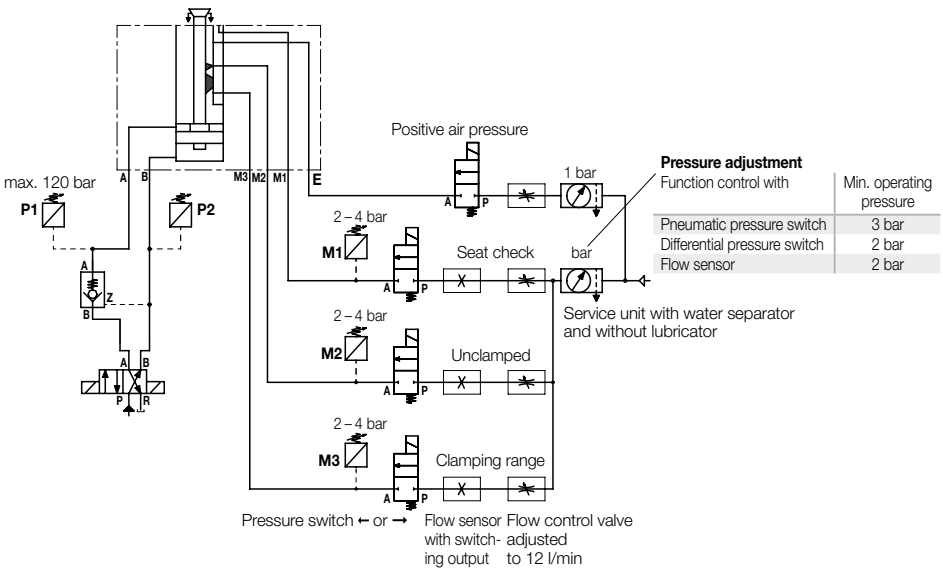
Differential pressure switch

Differential pressure switches (e.g. PEL System) require only 0.5 to 1.5 bar working pressure. The exact adjustment of a setting nozzle under practical conditions is required.

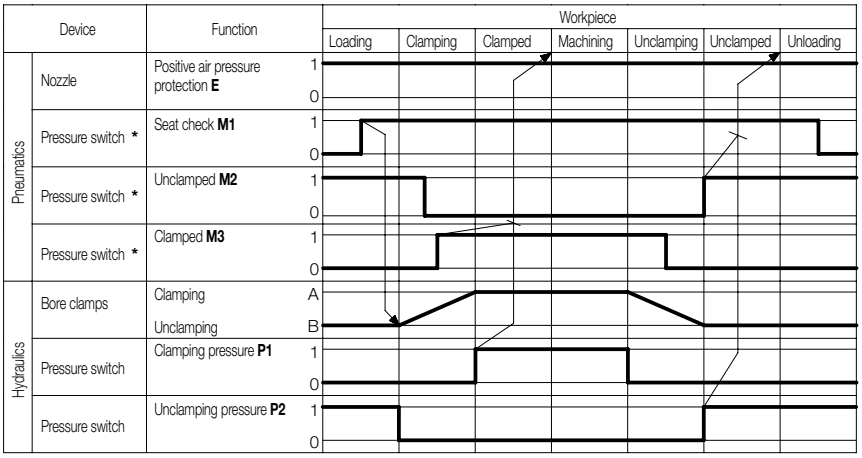
Flow sensor

A function control is also possible independent of pressure by measuring the flow rate. The flow sensor should have a digital display and one adjustable limit switch with a binary output (such as type SFAB of Festo).

Hydraulic and pneumatic circuit diagram with all function checks and positive air pressure connection.



Function chart



* alternatively differential pressure switch or flow sensor

Examples for switching positions when using all control elements

Control elements		Status of control elements: Bore clamps			
		Unclamped and workpiece does not lie flat on the surface	Clamped Processing release	Error message in clamped state	
Seat check	**M1**	0	1	1	
Unclamping monitoring	**M2**	1	0	0	
Clamping monitoring	**M3**	0	1	0	← Error! (see text)
Clamping pressure	**P1**	0	1	1	
Unclamping pressure	**P2**	1	0	0	

Example

Six seat checks with 2 bar air pressure:

1. Cover all seat checks with one workpiece and measure the flow rate Qmin.
2. If one seat check is not covered, measure Qmax.
3. Enter and save
   switching threshold = 0.5 x (Qmax + Qmin).

If the difference (Qmax – Qmin) is too small, increase the flow rate or reduce the number of bore clamps per sensor.

Number of bore clamps at a function control

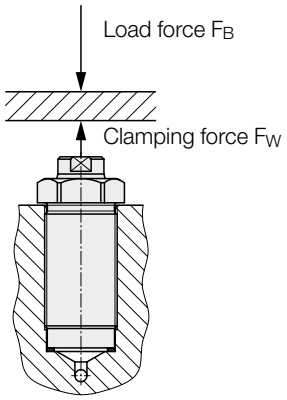
For the monitoring of a function, e.g. the seat check, a group of max. 6 bore clamps can be connected to one measuring device.
The calibration of the switching pressure requires great care, because the measuring device has to recognize that, for example, only one of the 6 seat checks is not covered. It is not possible to see which one that is!

Threaded-Body Cylinders with Locking Piston

single acting with spring return, max. operating pressure 500 bar

Advantages

- "Clamping" and supporting" with one element
- Admissible load force up to five times the clamping force
- Clamping with minimum deformation due to relatively little clamping force, but high retention force
- Particularly suitable for "floating clamping"
- Plunger design impedes penetration of fluids into the spring area
- Clamping rows with the narrowest cylinder spacing possible
- Fixtures without tubes are possible

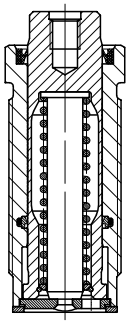


Application

Threaded-body cylinders with locking piston have a relatively little clamping force, but a high retention force in opposite direction. Therefore they are particularly suitable for clamping of thin-walled workpieces with minimum deformation as well as for "floating clamping".

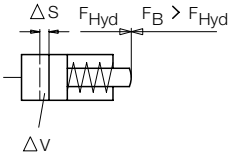
Description

Threaded-body cylinders with locking piston are single-acting plunger cylinders, similar to the design of the proved threaded-body cylinders as per data sheet B 1.461. When pressurising the element, the piston will be expanded and locked in the cylinder body.

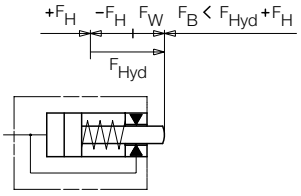


Function

If a load force F_B higher than the hydraulic clamping force F_{Hyd}, acts on a standard clamping cylinder, the piston will be pushed back due to the compressibility of the oil.

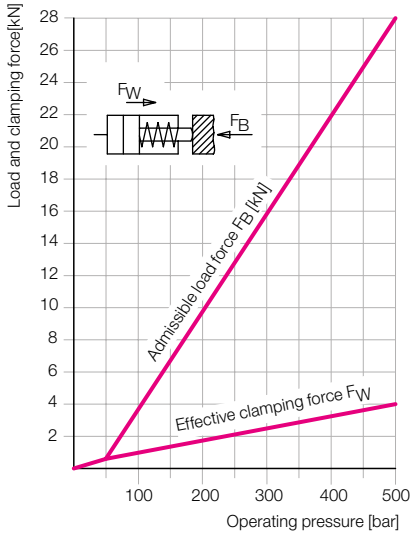


In such cases the operating pressure has to be increased or a larger clamping cylinder or additional work supports has to be used. The threaded-body cylinder with locking piston does not only clamp the workpiece, but compensates also the machining forces which are up to five times higher and are directed against the clamping force.

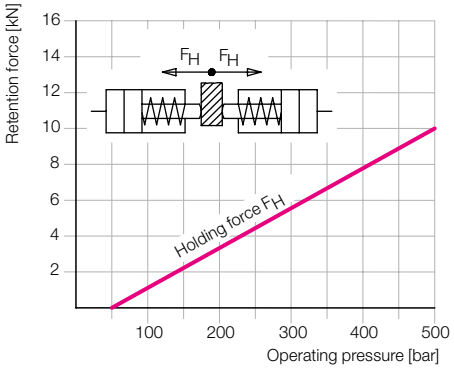


F_{Hyd} = Hydraulic clamping force
= Piston area x Oil pressure
F_W = Effective clamping force
= $F_{Hyd} - F_H$
F_H = Retention force, resulting from non-positive locking of the piston in the cylinder body
F_B = Load force against the clamping force, e.g. machining forces

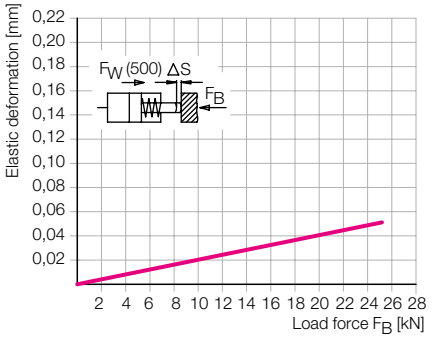
Effective clamping force and admissible load force



Retention force for "floating clamping"



Elastic deformation as a function of the load of the piston at an operating pressure of 500 bar

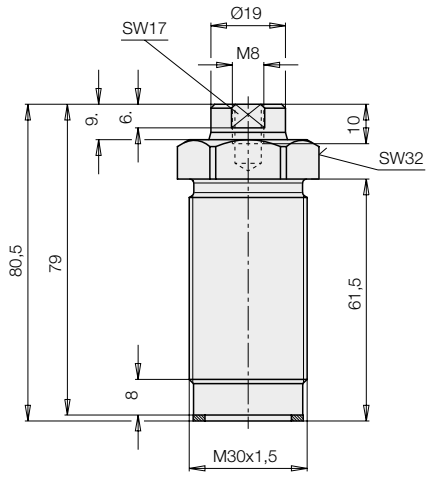


Materials

Cylinders:	High alloy steel, nitrated
Piston:	High alloy steel
Piston seal:	NBR
Wiper:	FKM
Flat sealing:	POM

Important notes

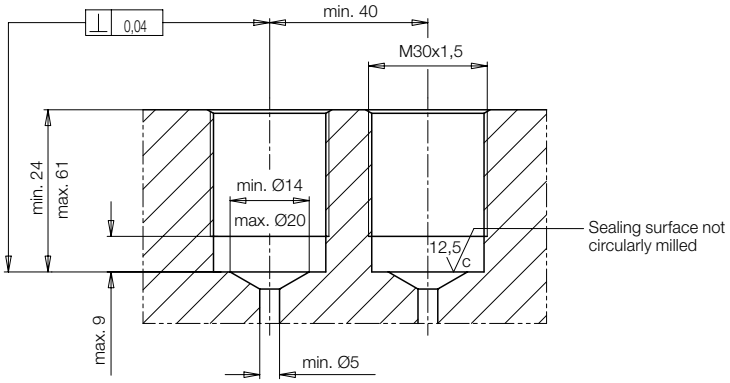
Threaded-body cylinders must not be subjected to a load in retracted position.
During installation, the tightening torque must be checked with a torque wrench.
Operating conditions, tolerances and other data see data sheet A 0.100.



Piston Ø	[mm]	20
Stroke	[mm]	10
Oil volume per 10 mm stroke	[cm³]	3.14
Max. clamping force* at 500 bar	[kN]	approx. 4.8
Max. load force* at 500 bar	[kN]	approx. 25
Max. operating pressure	[bar]	500
Min. operating pressure	[bar]	50
Recom. pressure range	[bar]	100…500
Elastic deformation*	[µm/kN]	2
Temperature range	[°C]	–10…+80
Tightening torque	[Nm]	60
Weight	[kg]	0.25
Part no.		**1462847**
Part no. spare sealing ring		**3000842**

***** see diagram on page 1

Location hole

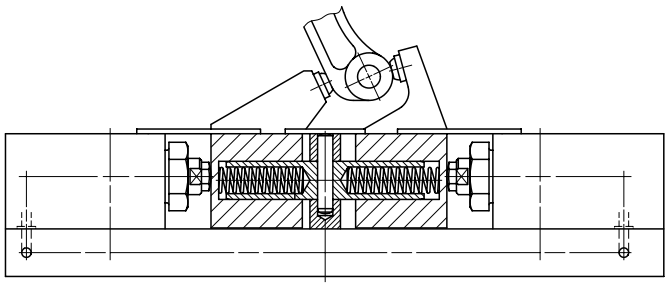


Application example

Simple collet for "floating clamping"

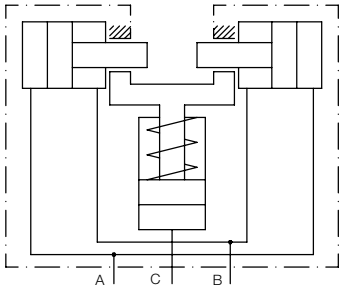
Two clamping bars with **threaded-body cylinders with locking piston** are fixed on a base plate and hydraulically connected by drilled channels. The axial block fixed in the centre is used as guide for both clamping jaws. An installed return spring moves the clamping jaws to its off-position. "Floating" clamping, i.e. the uniform and tongs-type contact at the workpiece independent of its position is possible due to the hydraulic pressure compensation between the cylinders.

Only different spring forces can influence the uniformity. After the pressure increase, the two locking pistons avoid a "further floating" of the clamping point.



Position Flexible Clamp

double acting, separate locking port
max. operating pressure 250 bar



Description

The position flexible clamp is a small vice with two movable jaws, which are operated by a common hydraulic port. Independently of its position within the clamping area, the workpiece will be clamped nipper-like (floating).
By means of a separate locking port, both jaws are hydraulically locked. The clamped workpiece can no longer “float”, if the machining forces are introduced.
Oil supply to the locking port can be controlled by a sequence valve or a second clamping circuit.

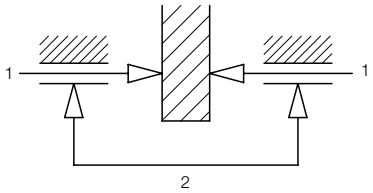
Application

Position flexible clamping elements can be used for supporting and clamping of unstable workpiece sections. They adapt themselves to the position of the clamping point without deforming them. They cushion vibrations and compensate machining forces from all directions.

Important notes

The upper face of the locking piston clamping element has to be checked from time to time with regard to contamination by swarf and cleaned, if required.
Already 2 mm difference in stroke can cause an one-sided displacing force of 10 N onto the workpiece.
Operating conditions, tolerances and other data see data sheet A 0.100.

Position flexible clamping



For machining in a clamping fixture in 3 levels, a workpiece will be positioned and clamped against a maximum of 5 support and location points.
If further sections of the workpiece have to be supported and clamped, additional work supports will be used, on top of which also clamping can be effected.

Problem: If the sections to be clamped are very unstable, already the contact of the support plunger causes deformation. If clamping will be made on these work supports, the caused deformation will not be calculable. Variations at the finish-machined workpiece will not be tolerable.

Solution: The use of position flexible clamping elements at such critical points can improve considerably the result.

If e.g. a small web has to be clamped, clamping jaws contact the workpiece from both sides with little force and position flexible. Condition is, that the web is within the clamping area. If the hydraulic pressure increases, the clamping force is built up uniformly and nipper-like at both sides, so that there will not be a displacement or deformation from the pre-determined position.
This is the so-called “floating” clamping, since both oppositely-arranged pistons would “float” in case of a workpiece displacement parallel to the piston axis.
After pressurising the separate locking port, the jaws are locked and are thereby in the position to compensate machining forces in all directions.

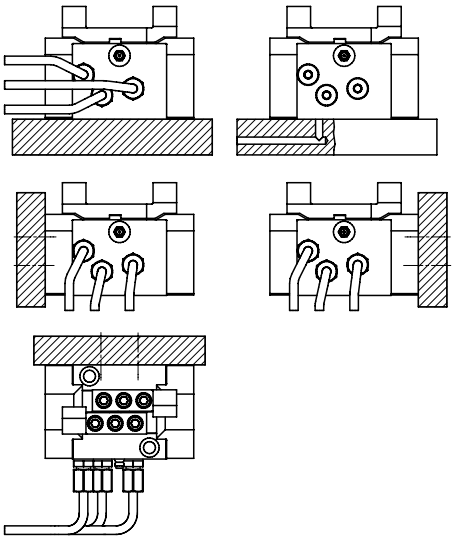
Application example

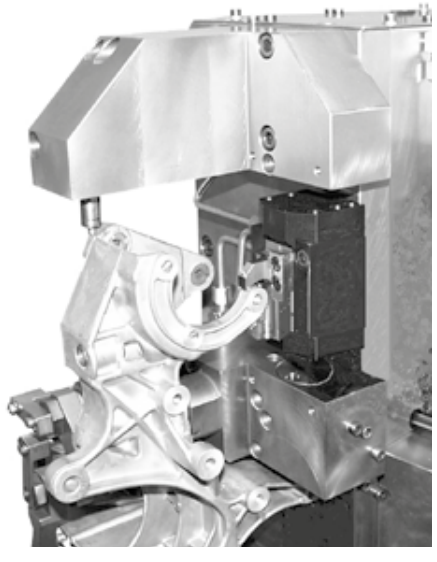
The figure shows a position flexible clamp for “floating clamping” of a self-supporting arm of a power unit support of the automotive industry, which has been fixed in its position by means of swing clamps as per data sheet B 1.880 and B 1.891.

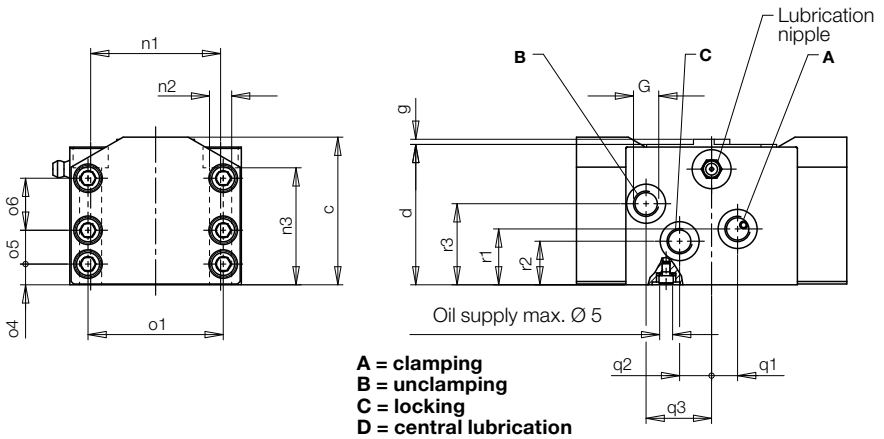
Advantages

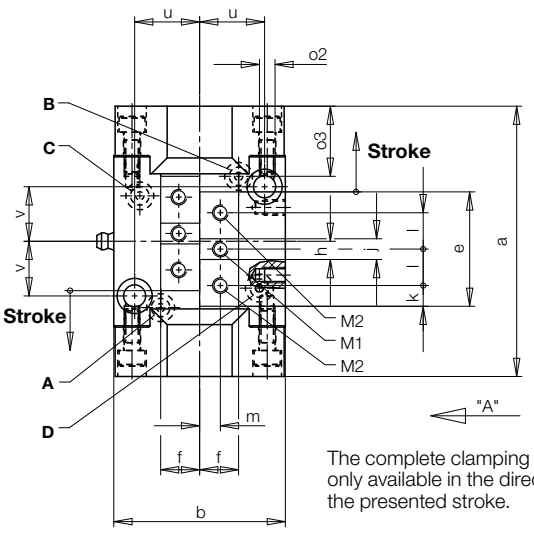
- Compact 2-jaws clamping element
- For exterior and interior clamping
- Clamping jaws easily adaptable
- Position flexible within the clamping range
- Can be adapted to big workpiece tolerances
- Very low displacement forces act on the workpiece (see: Important notes)
- Compensation of machining forces from all directions
- Double-acting clamping function
- Locking port can be controlled separately
- Mounting from 4 sides possible
- Oil supply alternatively via fittings or drilled channels
- Clamping slide can be greased

Installation and connecting possibilities

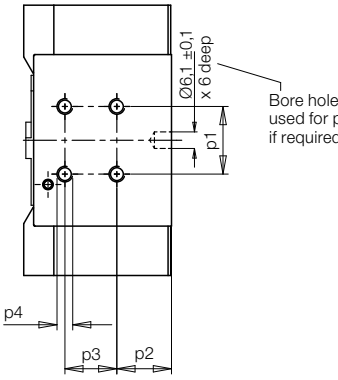






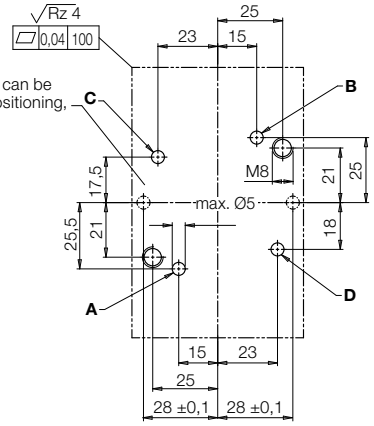


The complete clamping force is only available in the direction of the presented stroke.



View "A"

Bore holes can be used for positioning, if required



Clamping force at 250 bar	[kN]	7
Holding force at 250 bar	[kN]	4
Stroke, per clamping jaw	[mm]	6
Admissible flow rate	[cm³/s]	5
Oil volume clamping	[cm³]	3.8
Oil volume unclamping	[cm³]	1.4
Oil volume locking	[cm³]	0.6
a	[mm]	104
b	[mm]	66
c	[mm]	56.8
d	[mm]	54
e	[mm]	44
f	[mm]	15
G		G 1/8
g	[mm]	2
h	[mm]	7
j	[mm]	8 f7
k	[mm]	8
l	[mm]	14
M1 / M2 x depth of thread	[mm]	M 6x11 / M 6x9
m	[mm]	8
n1 / n2 / n3	[mm]	50 / Ø 8.5 / 45
o1 / o2 / o3 (≙ max. screw-in depth)	[mm]	52 / M6 / 27
o4 / o5 / o6	[mm]	8 / 13 / 20
p1 / p2 / p3 / p4 x depth of thread	[mm]	26 / 21 / 20 / M 6x8
q1 / q2 / q3	[mm]	10 / 12.3 / 25.2
r1 / r2 / r3	[mm]	21.5 / 16.8 / 31.2
u	[mm]	25
v	[mm]	21
Part no.		**4412974**

Accessories		**Part no.**
Plug G 1/8	(3 x required)	**3610158**
O-Ring 8x1.5	(4 x required)	**3000343**

Installation and connecting possibilities

The position flexible clamping element, can be fixed alternatively at the bottom (dimensions n1 up to n3, v, u), or at the back (dimensions p1 up to p4).

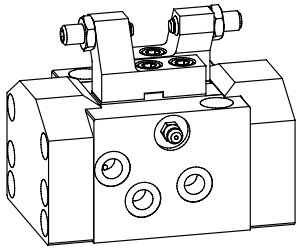
It can also be fixed at both sides. For this purpose per screw row with gauge for bore holes n1 two of the three available screws have to be removed and replaced by the fixing screws (dimensions o1 up to o6). These will hold the complete piston pressure and have to be screwed in at least to dimension o3 – 1 (2) mm.

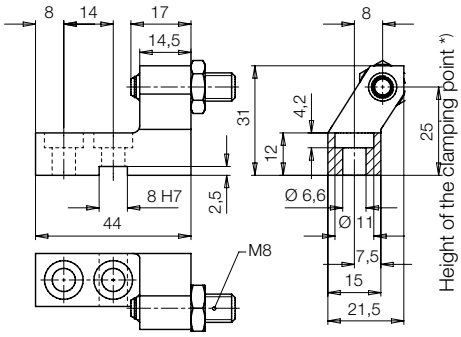
For manifold mounting remove socket head cap screws with USIT rings and screw-in plugs G 1/8 in the body.
O-rings and plugs see accessories.

Connecting scheme

For O-ring sealing

Example with clamping jaws





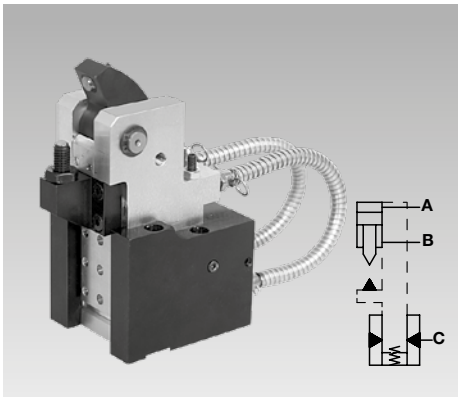
Clamping jaw for exterior clamping of a workpiece web with a thickness of 6 up to 14 mm (adjustable from 0 up to 18 mm).

*) Please consider for your own design of the clamping jaws, that a maximum height of the clamping point of 31 mm must not be exceeded.

Clamping jaw with swivel contact bolt
Part no. **3548447**

Position Flexible Clamping Claw

double acting, separate locking port, with optional position monitoring, max. operating pressure 250 bar



Application

Position flexible clamping elements can be used for supporting and clamping of unstable workpiece sections. They adapt themselves to the position of the clamping point without deforming them. They cushion vibrations and compensate machining forces from all directions.

Description

The position flexible clamping claw consists of a U-shaped mounting body and the displaceably embedded clamping unit with oil supply by two short high-pressure hoses with swarf protection.
In the movable clamping unit a double-acting hydraulic cylinder is integrated, whose clamping force is introduced through the clamping lever by 180° into the workpiece support. This support is height-adjustable to clamp workpieces of different thickness.
After the clamping process, the still displaceable clamping unit will be locked by a single-acting cylinder in the mounting body. In unclamped mode, the clamping lever swivels back so far that unimpeded loading and unloading of the clamping fixture can be effected. An inductive or pneumatic position monitoring can be delivered to control the clamping lever.

Position flexible clamping

For machining in a clamping fixture in 3 levels, a workpiece will be positioned and clamped against a maximum of 5 support and location points. If further sections of the workpiece have to be supported and clamped, additional work supports will be used, on top of which also clamping can be effected.

Problem: If the sections to be clamped are very unstable, the contact of the support plunger already causes deformation. If the following clamping is effected, the caused deformation will not be calculable. Variations at the finish-machined workpiece are not acceptable.

Solution: Using position flexible clamping elements at such critical points can considerably improve the result.

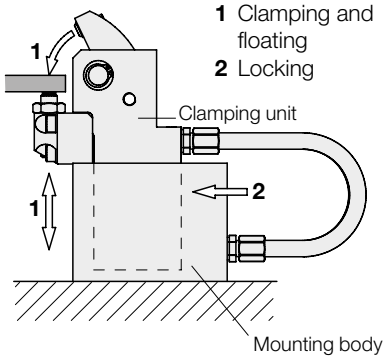
Advantages

- Clamps position flexibly within the pendulum range
- Workpiece support points are adjustable and mountable in 4 positions
- Unimpeded loading and unloading of the fixture
- Very low displacement forces act on the workpiece
- Adjustable zero position
- Compensation of machining forces from all directions
- Monitoring of the unclamping position and the end of the clamping stroke can be effected pneumatically or inductively
- The clamping lever can be swivelled into small recesses
- Double-acting clamping function
- The locking port can be controlled separately
- Oil supply alternatively via pipe threads or drilled channels
- Connecting hoses with swarf protection
- Air sealing connection to avoid entry of swarf and coolants

Example: (see figure on the top right)
A workpiece is clamped in a fixture. For machining a relatively unstable web, clamping with minimum deformation is required. A position flexible clamping claw is arranged so that the web is within the clamping range.
First, the clamping cylinder is controlled. By nipper-like “floating” clamping, the web will be clamped between the support and the clamping lever, i.e. the clamping unit adapts itself position flexibly to the height. The occurring displacing force in the mounting body will be minimised by the installed weight compensation.
Then the clamping unit is locked by a second clamping circuit or a sequence valve and can now compensate machining forces from all directions.

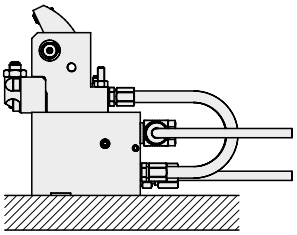
Important notes

The position flexible clamping claw has to be checked regularly about contamination by swarf and cleaned, if required. Regular lubricating reduces the displacing forces on the workpiece during clamping.
The smaller the distance between the workpiece and the workpiece support point, the smaller the displacing force onto the workpiece during clamping (see contact force).
Air sealing increases the life and the sensitivity of the clamping element.
The clamping unit made of aluminium has to be highly protected against abrasive swarf.

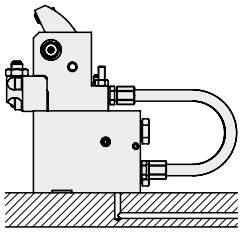


Connecting possibilities

Pipe thread

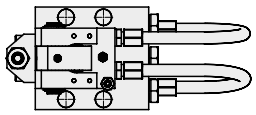


Drilled channels

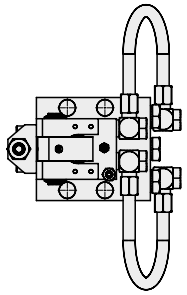


Design possibilities

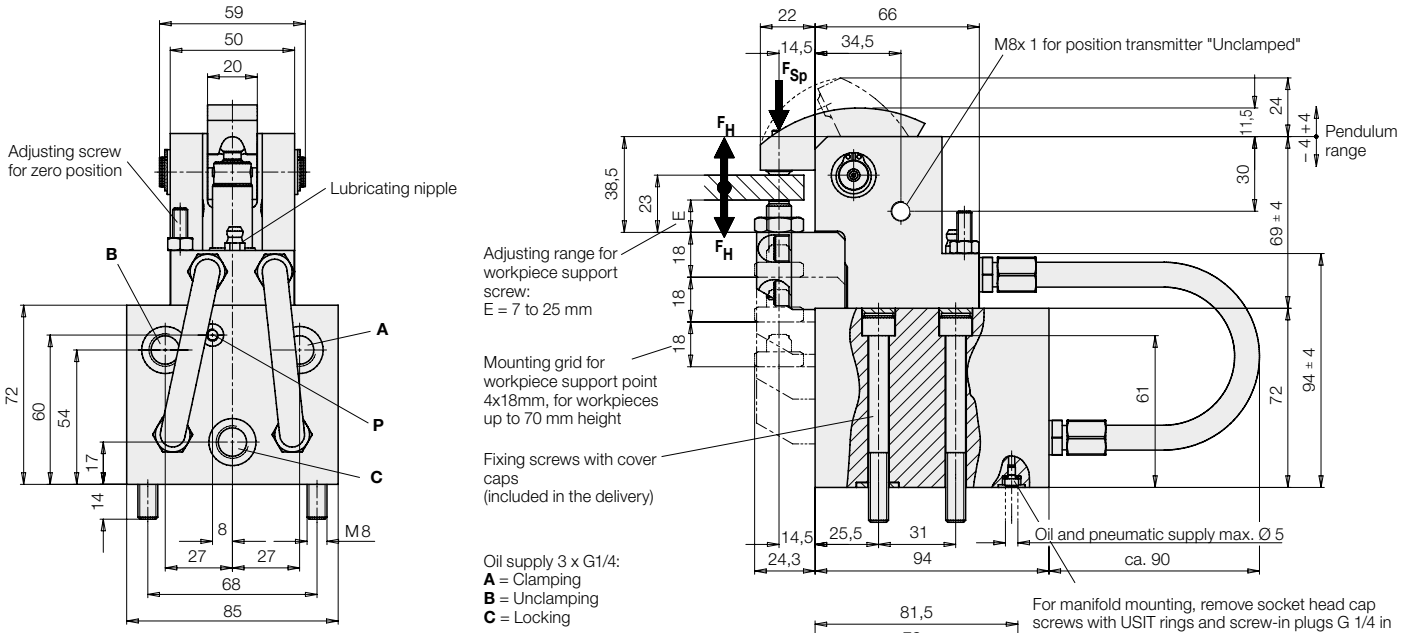
Hose at the back



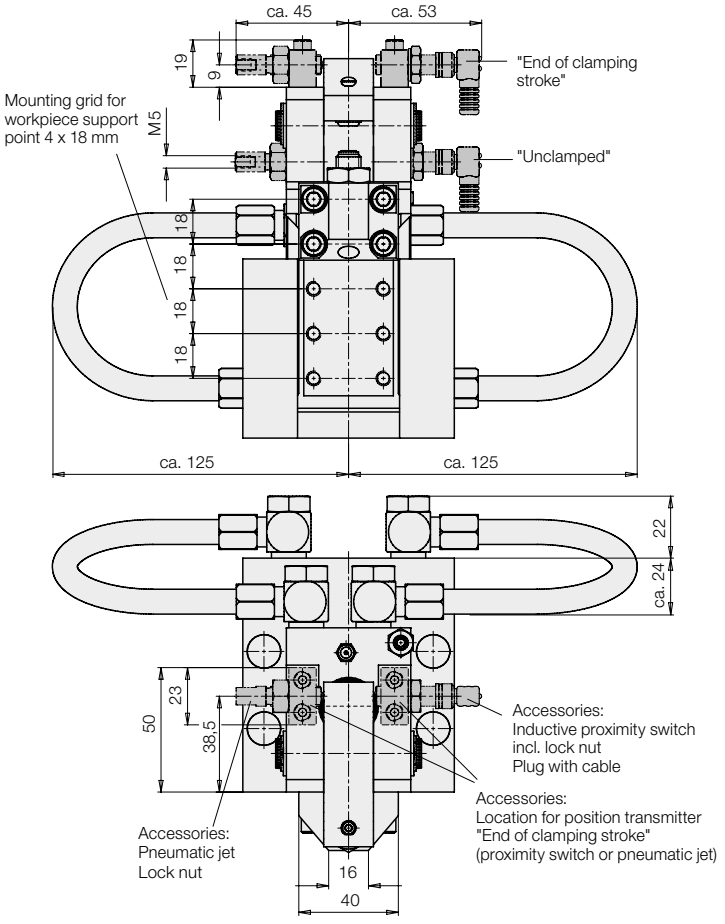
Hose at the side



Design: Hose at the back



Design: Hose at the side



Technical data

Clamping force F_{Sp} at 250 bar	[kN]	7.5
Retention force F_H at 250 bar	[kN]	10
Min. operating pressure	[bar]	50
Contact force*	[N]	0 – 30
Pendulum range	[mm]	±4
Oil volume clamping	[cm³]	13.5
Oil volume unclamping	[cm³]	8.0
Oil volume locking	[cm³]	0.2
Max. flow rate	[cm³/s]	15
Part no. Hose at the back		**4412977**
Part no. Hose at the side		**4412978**

* depending on the adjustment of the pendulum range

Accessories		Part no.
Screw plug G 1/4	3 off	**3300821**
O-ring 8 x 1.5	4 off	**3000275**
Inductive proximity switch		**3829263**
Plug with cable (5m)		**3829099**
Pneumatic jet with lock nut		**4412997**
Location for position transmitter "End of clamping stroke"		**4412984**

Article available on request

On request, we will check whether the article is still available.

Technical characteristics for inductive proximity switches

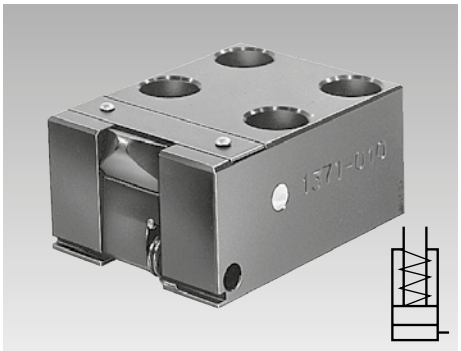
Operating voltage UB	10…30 V DC
Switching function	Interlock
Switching output	PNP
Material of housing	steel, corrosion resistant
Protection as per DIN 40050	IP 67
Ambient temperature	–25° … +70 °C
Type of connection	Connector
Protected against short circuits	yes

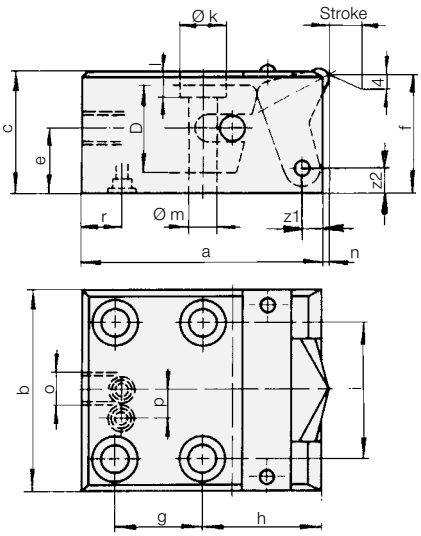
Materials

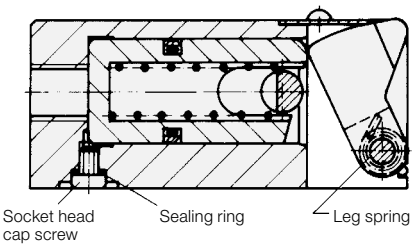
Clamping unit: Aluminium
Other parts: Steel
Sealings: FKM

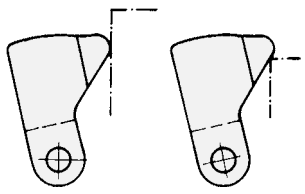
Low-Block Clamping Cylinder

single acting with spring return, max. operating pressure 500 bar









Clamping possibilities

Description

The preferred application of low-block clamping cylinders are clamping situations where workholding from above is not possible or necessary. The low-clamping effect is caused by the downward motion of the clamping point. The average horizontal force component is 94 % and the vertical force component is approx. 34 % of the nominal clamping force. The high vertical force guarantees that the workpieces are safely held down. The clamping lever is continuously hardened so that the shape of the clamping point can be adapted to the workpiece by regrinding.

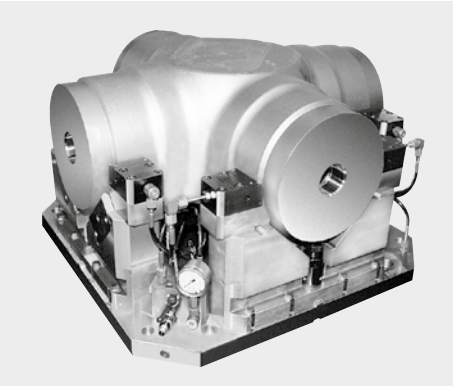
Material

Cylinder body material: Steel, black oxide
Clamping lever: 58 Cr V4, Hrc 54-58

Important notes

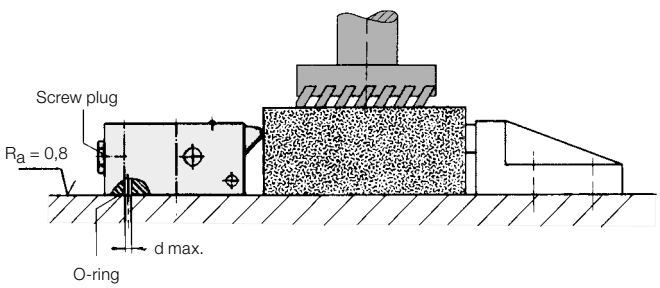
Cylinders have to be protected against direct influences of aggressive cutting lubricants and coolants.
Operating conditions, tolerances and other data see data sheet A 0.100.

Application example



Piston Ø D		[mm]	16	25	36
Stroke		[mm]	8	10	10
Clamping force at	100 bar	[kN]	1.7	4	8
	500 bar	[kN]	8.5	20	40
Oil volume per 10 mm stroke		[cm³]	2	4.9	10.2
a		[mm]	68	90	96
b		[mm]	50	60	80
c		[mm]	32	40	50
d max.		[mm]	6	6	6
e		[mm]	19	23	27
f		[mm]	31	39	49
g		[mm]	27	38	38
h		[mm]	32	42	46
i		[mm]	32	40	56
Ø k		[mm]	13.5	15	18
l		[mm]	8.5	9	11
Ø m		[mm]	8.5	9	11
n		[mm]	2	–	2
o			G 1/4	G 1/4	G 1/4
p		[mm]	–	–	14
r		[mm]	13	14	16
z1		[mm]	5.5	6	8
z2		[mm]	6	9	11
Weight		[kg]	0.9	1.15	2.1
Part no.			**1371010**	**1373010**	**1374010**
Accessories					
Screw plug G 1/4			**3610264**	**3610264**	**3610264**
O-ring 10 x 2			**3000347**	**3000347**	**3000347**
Spare seal ring			**3000536**	**3000536**	**3000546**
Clamping lever, one piece			**3542080**	**3542081**	**3542082**
Leg spring, spare part			**3715104**	**3715104**	**3716109**

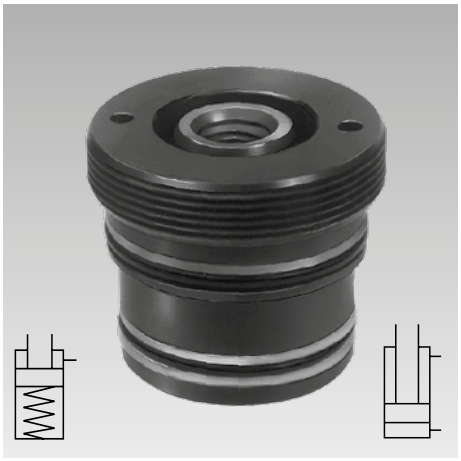
Article available on request



The hydraulic oil can optionally by supplied through tubes or drilled channels in the fixture body; 4 fixing screws are required.

Hydraulic Threaded-Body Clamping Module

pull-type, single and double acting, with anti-torsion device
max. operating pressure 500 bar



Element

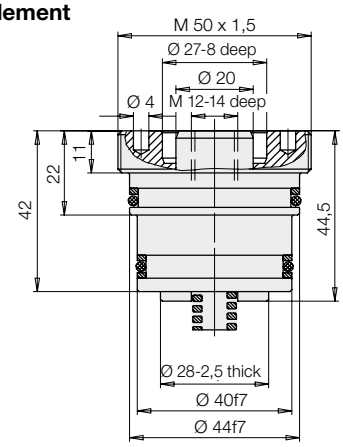
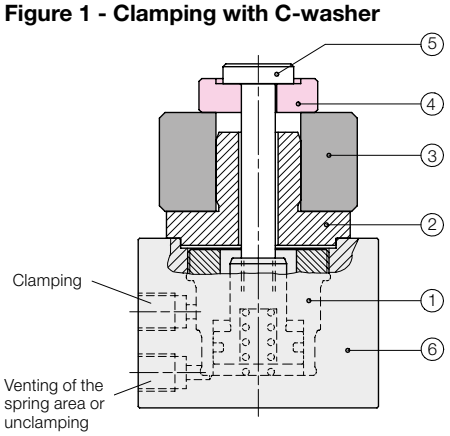


Figure 1 - Clamping with C-washer



① Clamping module ② Workpiece carrier
③ Workpiece ④ C-washer ⑤ Tie rod
⑥ Housing for clamping module

Application

The hydraulic threaded-body clamping module pull-type was developed for screwing in into:

- **standardized housings** (see page 2)
- **fixture bodies or manifold blocks** (see figure 2)
- **fixture base plates** or **intermediate plates for pallets** or **machine tool tables** (see page 2)

Application examples

Figure1 shows axial clamping of a workpiece **in connection with a C-washer** as per DIN 6371/6372. The hydraulic threaded-body clamping module is integrated in a standardized housing (dimensions see page 2).
The C-washer (loose part) has to be attached for each clamping process.

When clamping with **elastomer spring elements** (see figure 2) the workpiece has to be centered by a shoulder at the location flange, since only axial and radial clamping forces can be introduced by the elastomer spring element.

When using **disks** (see figure 3) centring is provided by the disks as the axial and radial forces are applied.

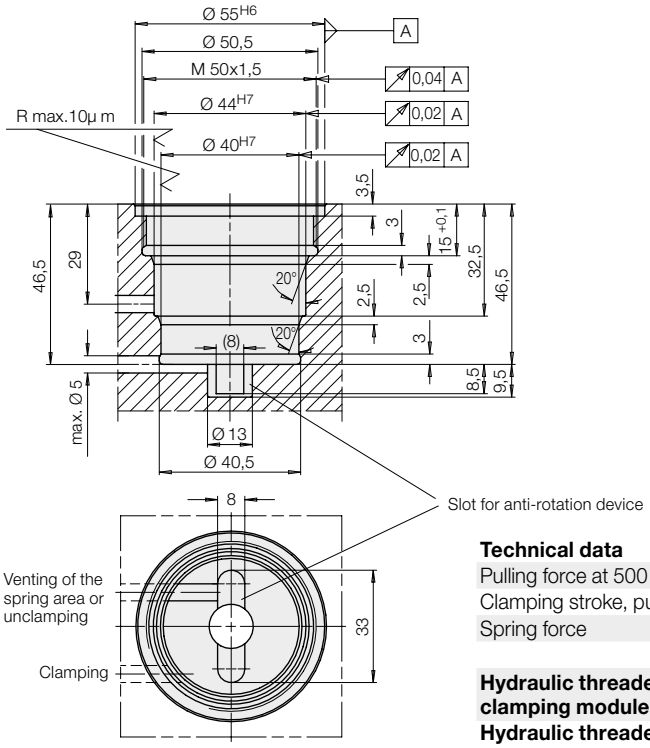
The decision, which clamping element has to be used, depends on the tolerance of the workpiece and the required axial retention forces.

Important notes

Operating conditions and other data see data sheet A 0.100.

In single-acting applications, please pay attention to the instructions for bleeding of the spring area on data sheet G 0.110.

Installation dimensions



Technical data

Pulling force at 500 bar	[kN]	24.5
Clamping stroke, pulling	[mm]	6.0
Spring force	[N]	80–200

	Part no.
Hydraulic threaded-body clamping module	**1574811**
Hydraulic threaded-body clamping module with housing (see page 2)	**1574812**

Figure 2 - Clamping with elastomer spring element

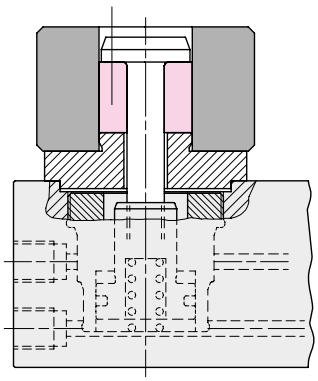
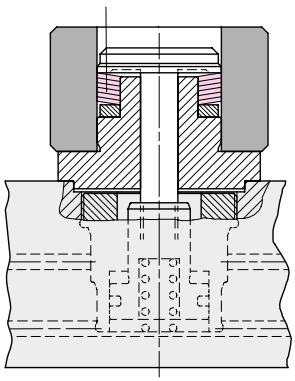
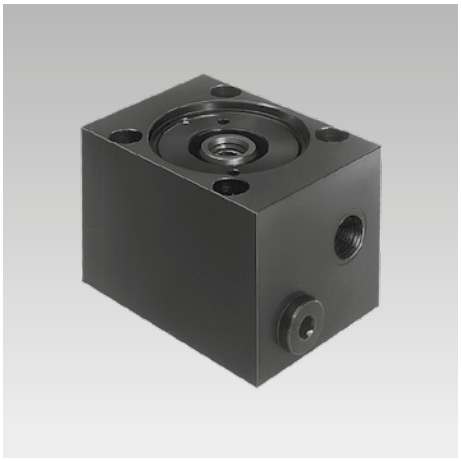
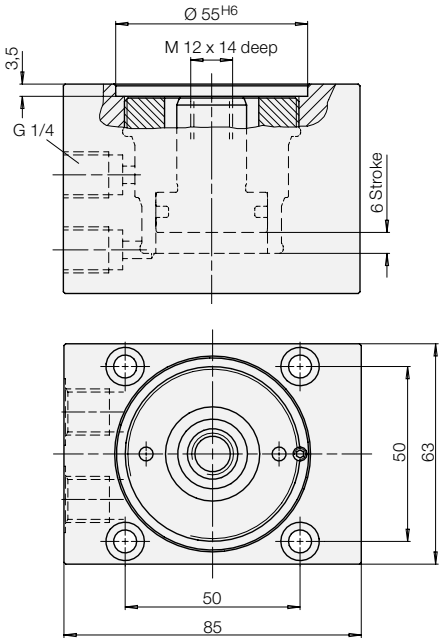


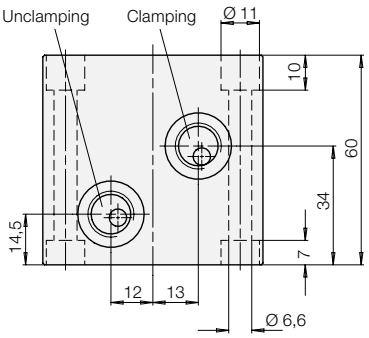
Figure 3 - Clamping with disk



Hydraulic threaded-body clamping module with housing

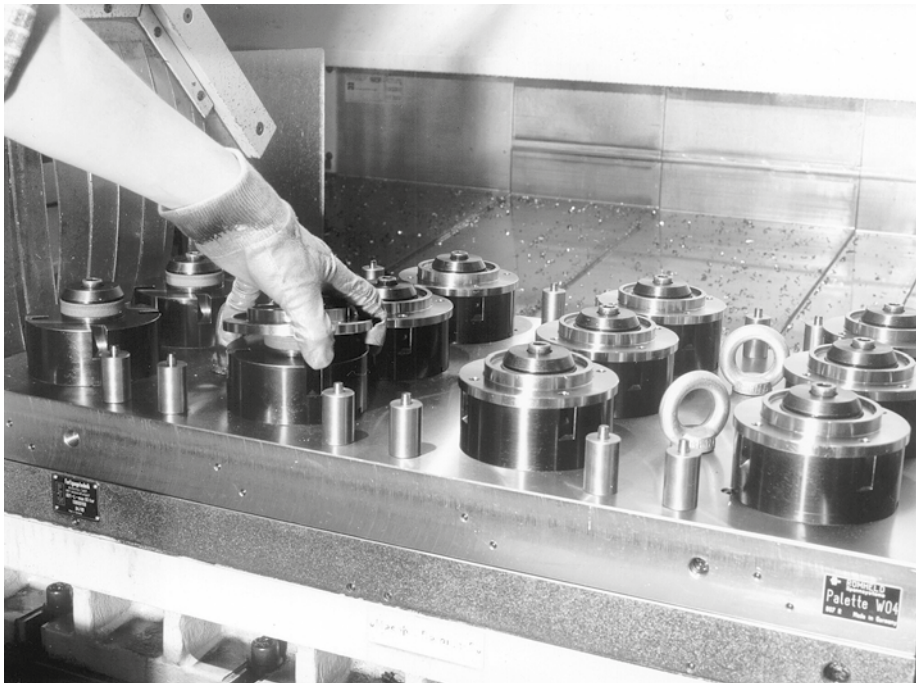






Hydraulic threaded-body clamping module with housing	Part no. 1574812

Application example

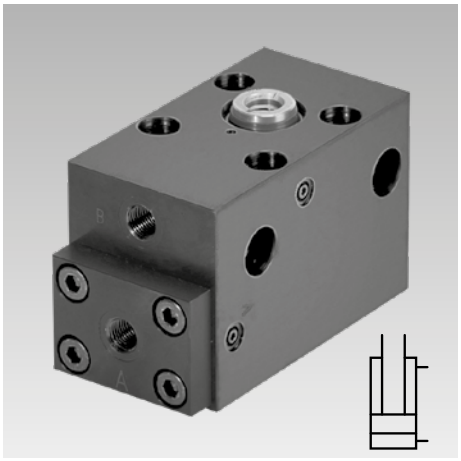


Installation of hydraulic clamping modules in the base plate of a multiple clamping fixture.

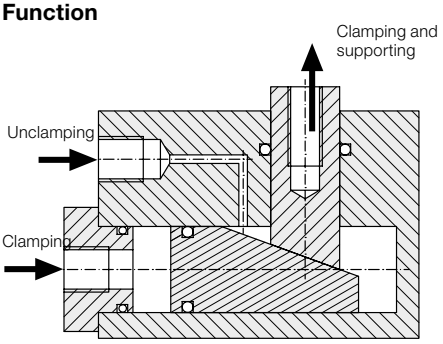
Transmission of the clamping force is made by an elastomer spring element Ø 50 x Ø 17 x 32 mm high. The workpieces are centred by the shoulder at the flange.

In such an arrangement for clamping neither a wrench is required nor a C-washer has to be handled.

Clamping and Supporting Element
self-locking, double acting, max. operating pressure 300 bar



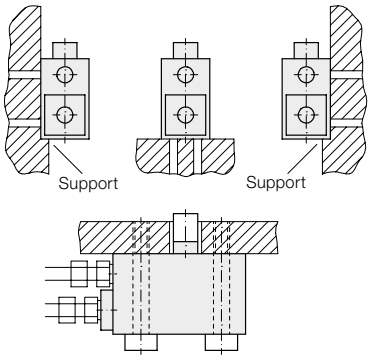
Advantages
- Clamping and support function in one element
- Self-locking wedge clamping
- Re-clamping with hydraulic pressure
- High clamping safety also in case of sudden pressure drop
- Cushioning of vibration
- Interchangeable contact bolts
- Many fixing possibilities
- Oil supply optionally by fittings or through drilled channels
- Standard FKM seals
- Maintenance free

Function


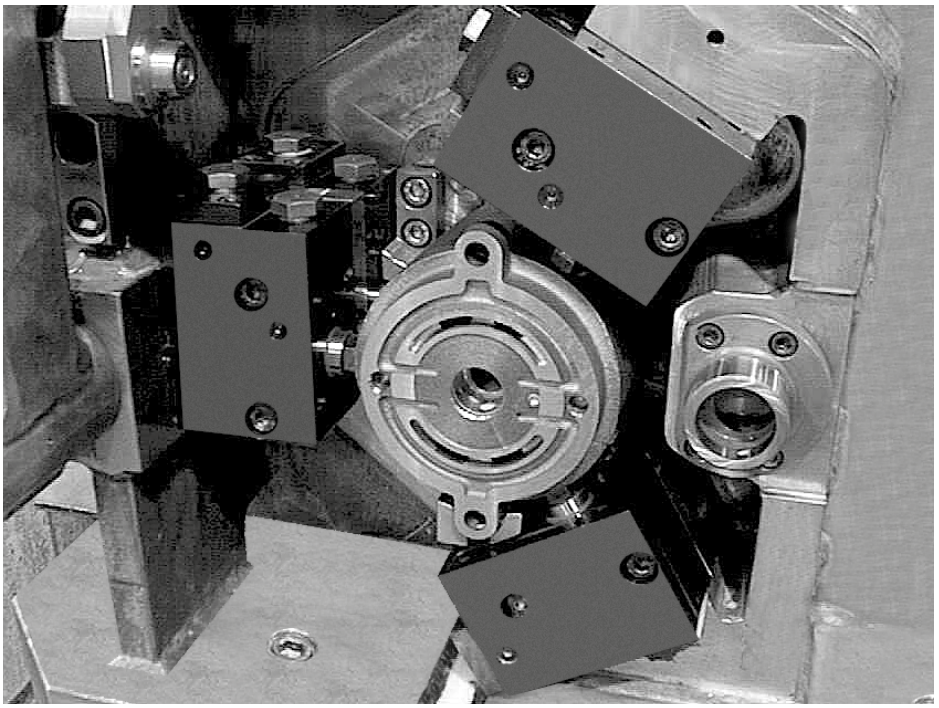
Application
The piston of traditional clamping cylinders is pushed back, if the counter force is bigger than the hydraulic clamping force. This is due to the compressibility of the hydraulic oil and the expansion of hydraulic hoses.
In the case of the clamping and supporting element this elasticity is avoided by the wedge-shaped cross piston with its self-locking geometry. Due to this fact there are the following possibilities of application:
- Workpieces must be firmly clamped even in case of a pressure drop in the hydraulic system
- Ribbings or webs of workpieces must be clamped by opposite clamping elements in a neutral position and then immovably locked.
- The machining forces are relatively high and directed against the clamping force
- Vibrations in the workpiece have to be cushioned

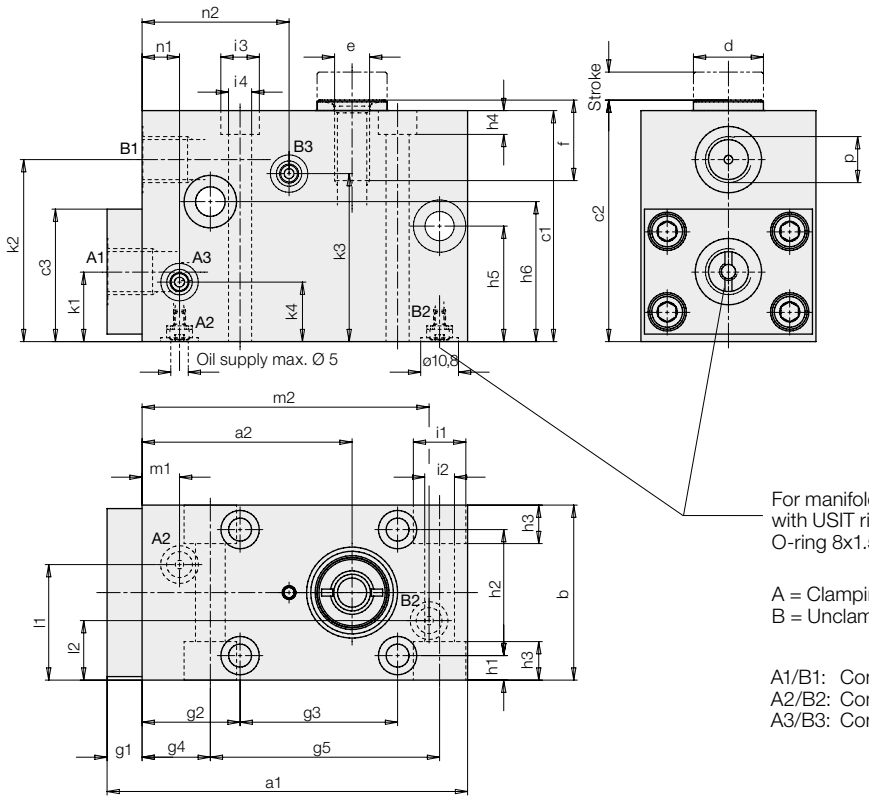
For all applications:
If the workpiece yields or the contact bolt digs deeper into the material due to machining forces or vibrations, the clamping and supporting element re-clamps provided that sufficient clamping pressure is available.

Description
The clamping and supporting element is a hydraulic clamping cylinder with mechanical locking according to the wedge principle.
Forces which are directed against the clamping force, e.g. machining forces will be supported with a negligible elasticity of the wedge-shaped piston. The counter force must not exceed the max. clamping force (see chart).
The clamping bolt is equipped with an interior thread to screw-in contact bolts for height adjustment or adapted contact bolts for shape adjustment.
The housing allows different fixing and connecting possibilities.
Oil supply is made at the front face with fittings or optionally through drilled channels with O-ring sealing at both sides or at the bottom.

Fixing possibilities


Important notes
- The clamping bolt is protected against torsion, but cannot compensate a permanent torque during operation.
- The clamping and supporting element is not suitable for the use as pull-type cylinder.
- If the clamping and supporting element is uncoupled from oil supply after clamping, e.g. on pallets, we recommend to install an accumulator in order to guarantee a re-clamping effect.
- Further operating conditions, tolerances and other data see data sheet A 0.100.





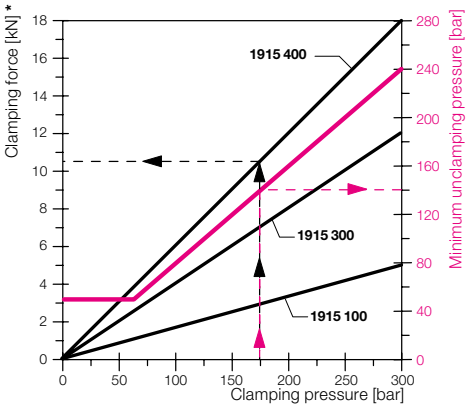
For manifold mounting remove socket head cap screws with USIT rings and screw-in 2 plugs G 1/4.
O-ring 8x1.5, see accessories

A = Clamping
B = Unclamping

A1/B1: Connection for fittings
A2/B2: Connection with O-rings at the bottom
A3/B3: Connection with O-rings at both sides

Clamping force *	[kN]	5	12	18
Max. operating pressure	[bar]	300	300	300
Oil volume clamping	[cm³]	2,8	10,8	26,5
Oil volume unclamping	[cm³]	2,2	8,3	22
Stroke	[mm]	5	8	12
a1	[mm]	85	103	127
a2	[mm]	47,2	60	71
b	[mm]	40	50	64
c1	[mm]	45	66	78
c2	[mm]	48	69	81
c3	[mm]	45	37,9	47,5
Ø d	[mm]	12	20	22
e	[mm]	M5	M10	M12
f	[mm]	10	23	24
g1	[mm]	15	10	12
g2	[mm]	24,5	28	41
g3	[mm]	39	45	44
g4	[mm]	24,5	28	26
g5	[mm]	39	57	75
h1	[mm]	6,5	7	9
h2	[mm]	27	36	46
h3	[mm]	11,5	11	11
h4	[mm]	12	6,8	9
h5	[mm]	38,5	40	52
h6	[mm]	8	40	52
Ø i1	[mm]	10,5	15	18
Ø i2	[mm]	6,5	8,5	10,5
Ø i3	[mm]	9,5	11	15
Ø i4	[mm]	5,5	6,6	8,5
k1	[mm]	18	20	25
k2	[mm]	36,5	52	64
k3	[mm]	10	52	64
k4	[mm]	22	20	25
l1	[mm]	25	33	40
l2	[mm]	16	17	24
m1	[mm]	9,7	10,7	10,7
m2	[mm]	60,5	85	105,5
n1	[mm]	9,7	10,7	10,7
n2	[mm]	44,2	42	52
P		G1/8*	G1/4	G1/4
* Use fittings DL6 DIN2353.				
Part no.		**1915100**	**1915300**	**1915400**
Accessories (not included in the delivery)				
O-Ring (FKM) 8x1,5		**3000275**	**3000275**	**3000275**
Screw-in plug		**3610047**	**3300821**	**3300821**
Alternatively				
Plug (flush screwable)		**0361986**	**0361987**	**0361987**
Contact bolt		**3614027**	**3614002**	**3614028**

Clamping force and unclamping pressure



Example:

Clamping and supporting element	1915400
Clamping pressure	175 bar
Clamping force	10,5 kN
Min. unclamping pressure	140 bar

***Important note**

With the wedge principle the effective clamping force depends on the friction of the sliding surfaces. After several thousand operations with load a smoothing of these sliding surfaces can be noticed, that reduces considerably the adhesion factor and can increase the clamping force up to 75%.
Therefore the indicated clamping forces are minimum values. For unclamping the self-locking of the wedge clamping must be overcome.
That is the reason why the minimum unclamping pressure must be at least 80% of the applied clamping pressure.

Article available on request

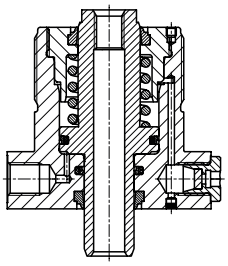
Hollow-Piston Cylinders

Version with internal thread
single and double acting, max. operating pressure 500 bar

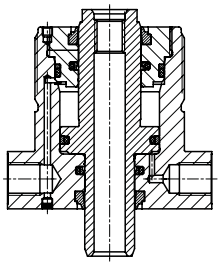
Advantages

- 6 sizes available
- Single or double acting optionally
- Pull force up to 188 kN
- Push force up to 153 kN
- Piston with through hole
- Internal thread for fixing threaded rods or contact bolts
- Conversion of existing fixtures to hydraulic clamping
- Many installation possibilities

Single acting with spring return



Double acting



Application

Hollow-piston cylinders are especially suitable for clamping workpieces that have a through hole or opening.

Description

The piston has a through hole with an internal thread. In connection with a standard tie rod and C-washer combination a variety of applications is possible (see application examples).
After the workpiece has been inserted and centred by hand, the C-washer can be pushed onto the tie rod and then clamped hydraulically.
Compared to mechanical clamping with clamping screws this has significant advantages:

- The clamping force can be hydraulically adjusted with precision and high repetitive accuracy.
- The operator can fully concentrate on the correct position of the workpiece.
- A significant time saving.

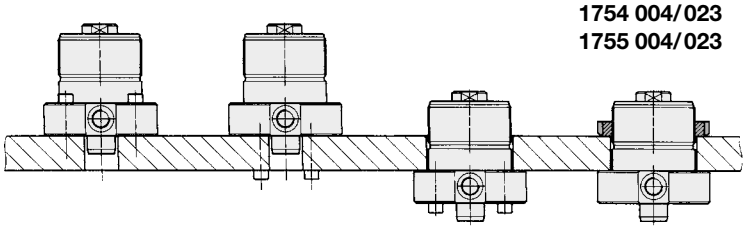
Equipped with a contact bolt (see data sheet G 3.800), the hollow piston cylinder can also be used for direct die clamping. The piston thread can be drilled open, if required.
If the hollow-piston cylinder is mounted onto movable parts, e.g. clamps, the hydraulic oil has to be supplied through a high-pressure hose.

Important notes

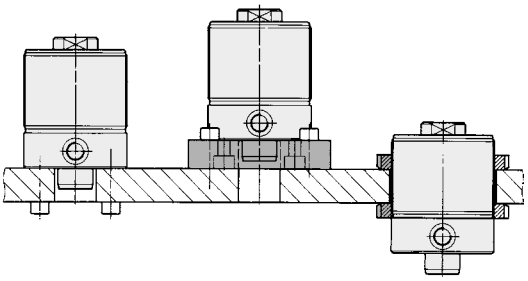
For operating pressures exceeding 350 bar only bolts, studs, or screws of material 10.9 must be used.
It is important to torque the lock nut used sufficiently to prevent damaging the piston threads.
Penetration of aggressive cutting lubricants and coolants through the sintered metal air filter into the cylinder's interior should be avoided by appropriate arrangement or covering.
Operating conditions, tolerances and other data see data sheet G 0.100.
When using single-acting hollow-piston cylinders, it is absolutely necessary to follow the instructions for bleeding of the spring area on data sheet G 0.110.

Installation possibilities

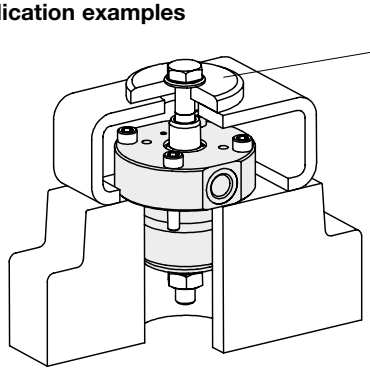
1752 004/023
1754 004/023
1755 004/023

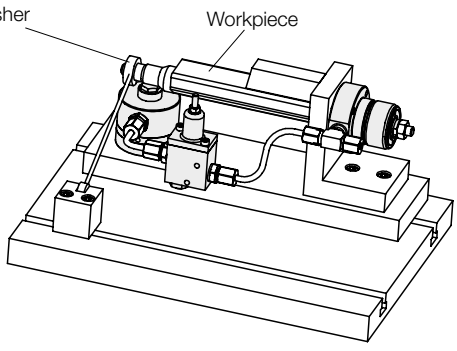


1756 004/023
1757 004/023
1758 004/023



Application examples

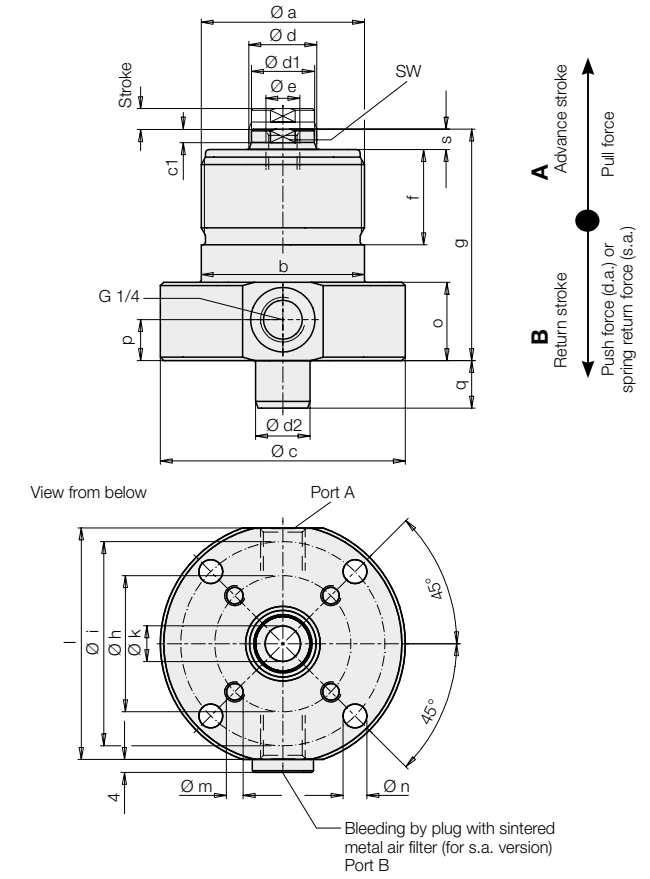




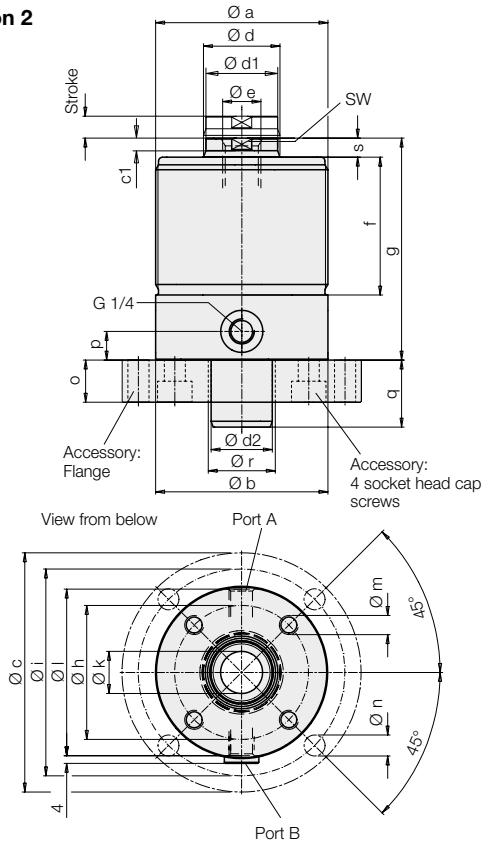
Hollow-piston cylinders in combination with push-pull bolt and "C"-washer can be used advantageously in many cases to clamp workpieces with centre openings.

On the machine table, the workpiece is additionally supported by means of a work support after clamping with a hollow-piston cylinder in combination with a sequence valve (as per data sheet C 2.954).
The support plunger of the work support is retracted in off-position to facilitate workpiece loading. Contact is effected by means of spring force.
Compared to mechanical clamping, a time saving of 60 % is achieved.

Version 1



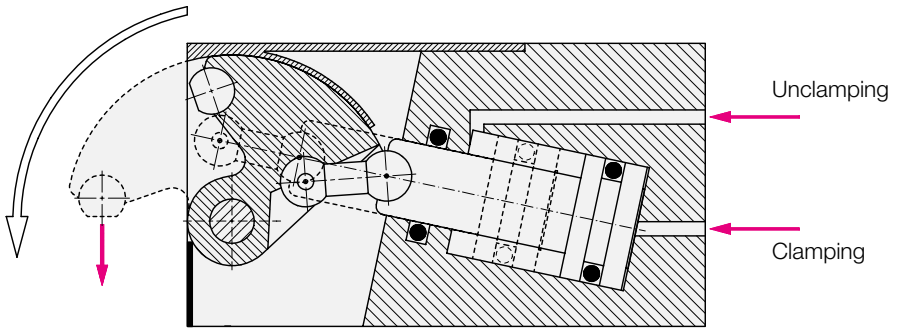
Version 2



Version		**1**	**1**	**1**	**2**	**2**	**2**
Piston diameter	[mm]	20	32	40	50	63	80
Pull force 100 bar	[kN]	2	6	9.4	14.7	23.1	37.7
Pull force 500 bar	[kN]	10	30	47	73.6	115.6	188.5
Push force 100 bar (d.a.)	[kN]	2	4.8	7.6	11.9	18.6	30.6
Push force 500 bar (d.a.)	[kN]	10	24	38	57.9	93	153
Spring return force (s.a.)	[kN]	0.09	0.2	0.27	0.38	0.47	0.95
Piston area - stroke	[cm²]	2.01	6.03	9.42	14.73	23.13	37.7
Piston area - return stroke	[cm²]	2.01	4.89	7.65	11.58	18.6	30.61
Oil volume per 10 mm stroke	[cm³]	2.01	6.03	9.42	14.73	23.13	37.7
Oil volume per 10 mm return stroke	[cm³]	2.01	4.89	7.65	11.58	18.6	30.61
Ø a	[mm]	M40x1.5	M48x1.5	M60x1.5	M75x1.5	M90x2	M120x2
Ø b	[mm]	–	48	60	75	90	120
Ø c	[mm]	65	72	85	105	125	160
Ø d	[mm]	12	20	25	32	40	50
Ø d1 x c1	[mm]	11x3.6	18.5x3.9	23.5x4.9	29.8x6	37.5x6.5	47.5x6.5
Ø d2	[mm]	12	16	20	25	32	40
Ø e x depth of thread	[mm]	M6x8	M10x12	M12x15	M16x20	M20x25	M24x30
f	[mm]	30	28	34	60	72	100
g	[mm]	58	68	80	94	116	137
Ø h	[mm]	30	40	50	60	70	98
Ø i	[mm]	52	60	72	90	108	140
Ø k	[mm]	6.5	10.5	12.5	16.5	21	25
Ø l	[mm]	60	68	82	72	87	117
Ø m x depth of thread	[mm]	M6x8	M6x8	M6x10	M8x10	M10x14	M12x15
Ø n	[mm]	7	7	7	9	11	13.5
o	[mm]	23	23	23	20	22	25
p	[mm]	12	12	12	12	15	15
q	[mm]	12	14	19	23	35	43
Ø r	[mm]				28	35	43
s	[mm]	5	6	7	9	10	10
SW	[mm]	10	17	22	27	36	46
Weight	[kg]	0.8	1.1	1.8	2.5	4.4	9.7
Single acting with spring return							
Stroke	**[mm]**	**6**	**8**	**10**	**12**	**16**	**20**
Part no.		**1752004**	**1754004**	**1755004**	**1756004**	**1757004**	**1758004**
Double acting							
Stroke	**[mm]**	**10**	**12**	**16**	**20**	**32**	**40**
Part no.		**1752023**	**1754023**	**1755023**	**1756023**	**1757023**	**1758023**
Accessories							
Flange					**3456310**	**3456313**	**3456312**
Socket head cap screw					**3301263**	**3300277**	**3300054**
Lock nut/DIN 1804/thread		M40x1.5	M48x1.5	M60x1.5	M75x1.5	M90x2	M120x2
Part no.		**3300699**	**3300324**	**3300411**	**3300673**	**3300412**	**3300134**

Flat Clamp

with optional position monitoring, double acting, max. operating pressure 500 bar



Application

The flat clamp is a compact and flat clamping element with large clamping stroke.
This clamp is designed for clamping of flat workpieces in fixtures on machine tools or for welding applications. It is well protected against coolants and swarf and resistant to welding spatter.

Description

The flat clamp is a double-acting hydraulic clamping element where the piston acts via a con-rod onto a clamping lever. In unclamped position, the clamping lever is completely retracted and the workpieces can easily be inserted from above. A clamping recess which is larger than the clamping lever is sufficient as clamping point.
The element compensates transverse forces at the clamping point. The clamping forces are introduced vertically to the base at the clamping height „h3“, therefore introducing no additional turning moments.

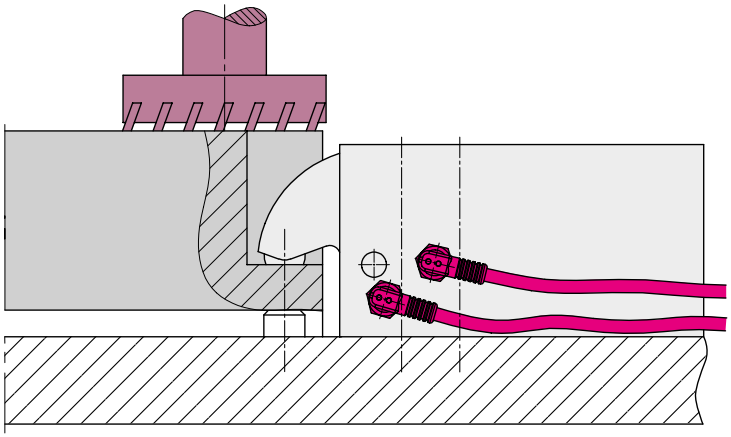
Advantages

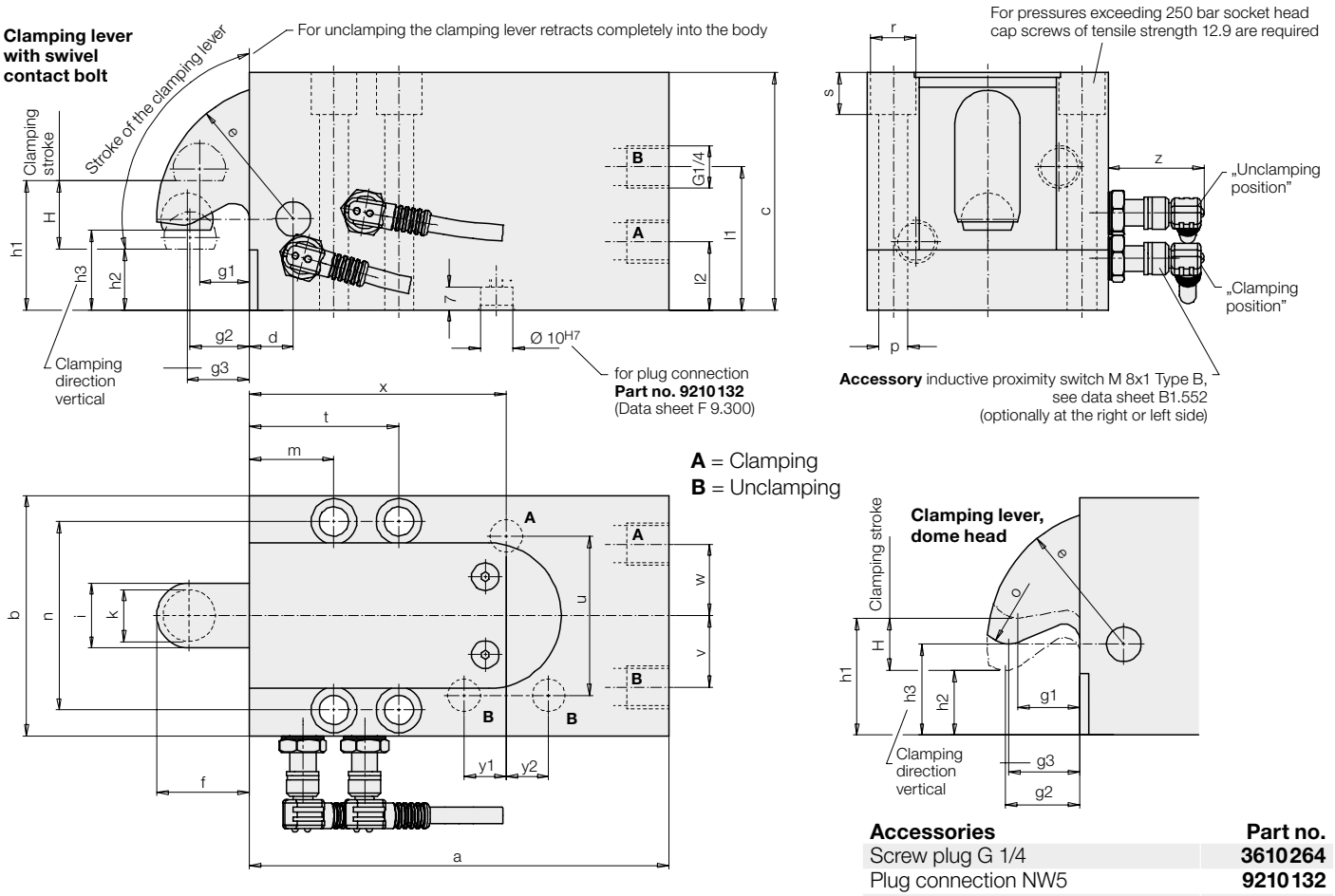
- flat and compact design
- high protection against swarf and welding spatter
- large clamping stroke
- clamping lever is completely retracted in unclamped mode
- transverse forces at the clamping point are compensated
- reduced maintenance
- Position monitoring, optional

Important notes

For metal-cutting and vertical mounting position (clamping lever upwards) it is recommended to remove the cover plate.
Operating conditions, tolerances and other data see data sheet A 0.100.

Application example with inductive position monitoring





Accessories	Part no.
Screw plug G 1/4	**3610264**
Plug connection NW5	**9210132**
Ind. proximity switch	**3829263**
Right angle plug with cable	**3829099**

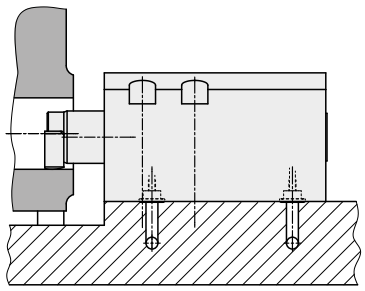
			Clamping lever dome head	with swivel contact bolt	dome head	with swivel contact bolt
Clamping force at h3/h1	100 bar	[kN]	2.1 / 2.4	2.3 / 2.5	3.7 / 4.1	3.8 / 4.1
	500 bar		10.5 / 12	11.5 / 12.5	18.5 / 20.5	19 / 20.5
H Clamping stroke max.		[mm]	12	9	16	10
Oil volume clamping	min./max. stroke	[cm³]	5.89 / 9.57	6.48 / 9.57	12.63 / 20.51	15.12 / 20.51
Oil volume unclamping	min./max. stroke	[cm³]	3.48 / 5.65	3.83 / 5.65	7.69 / 12.50	9.21 / 12.50
a		[mm]	108.5	108.5	129	129
b		[mm]	60	60	75	75
c		[mm]	58.5	58.5	73.5	73.5
d		[mm]	10	10	13.5	13.5
e		[mm]	34	34	42	42
f		[mm]	24	24	28.5	28.5
g1		[mm]	16	14	18	17.5
g2		[mm]	20	16	22.5	19
g3		[mm]	19.5	16	22	19
h1 Clamping height. max.		[mm]	30	28	38	34.5
h2 Clamping height. min.		[mm]	18	19	22	24.5
h3 Clamping height. vertical clamping direction		[mm]	21	20	28	26
i		[mm]	15	15	20	20
k		[mm]	–	12	–	16
l1		[mm]	45	45	44	44
l2		[mm]	30	30	21	21
m		[mm]	20.5	20.5	26	26
n		[mm]	47	47	58	58
o		[mm]	6	–	8	–
p		[mm]	6.6	6.6	8.5	8.5
r		[mm]	11	11	13.5	13.5
s		[mm]	12	12	13	13
t		[mm]	40.5	40.5	46	46
u ±0.02		[mm]	42	42	44	44
v		[mm]	19	19	22	22
w		[mm]	19	19	0	0
x		[mm]	76.5	76.5	66	66
y1 ±0.02		[mm]	13	13	–	–
y2 ±0.02		[mm]	–	–	10	10
z		[mm]	32	32	29	29
Part no.			**1824201**	**1824202**	**1824261**	**1824262**

Block Clamps

Versions with/without self-locking double acting, max. operating pressure 70/100 bar

Advantages

- Large retention force
- Flat design
- Clamping in small recesses and bore holes
- Suitable for machining from 5 sides
- 2 sizes with and without self-locking available
- Low pressure allows direct connection to the hydraulic system of the machine
- Contact bolts exchangeable
- Clamping direction 0 to 360° adjustable
- Alternatively pipe connection or manifold-mounting connection



Application

Hydraulic block clamps are particularly suitable for clamping of workpieces, that require a large free space for machining, and for applications where conventional clamps and swing clamps are too big.
Especially for the machining from five sides the reduced height of the block clamp and the possibility to immerge into a horizontal bore hole for clamping are of special advantage.
The block clamp with self-locking is preferably used on clamping pallets, that will be disconnected from the pressure generator after clamping.
The low operating pressure of 70 and/or 100 bar allows the direct connection to the low-pressure hydraulics of many machining machines.

Important notes

Block clamps must only be used for clamping of workpieces in industrial applications and may only be operated with hydraulic oil. They 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 the clamping bolt there is the danger of crushing. The manufacturer of the fixture or the machine is obliged to provide effective protection devices.

Operating instructions

When mounting the block clamp pay attention to careful bleeding (see page 2). The clamping bolt must effect its linear stroke to the clamping point without any impediments in order to avoid damages of the mechanics or at the workpiece.
In extended position, the clamping bolt is not protected against torsion so that the contact bolt can adapt itself to the workpiece contour.
In retracted position, the clamping bolt is turned back again to the angle position previously adjusted at the cover, if the deviation is smaller than ±8° (see also page 2).

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

Description

Block clamps are double acting hydraulic cylinders. The clamping bolt is supported by a ball bearing and can be swivelled. During the linear extending stroke the clamping bolt with the contact bolt is moved above the clamping point and then swivelled onto the clamping point by means of a wedge drive.
The version without self-locking has a smooth wedge surface and requires a constantly available oil pressure.
In the version with self-locking, the wedge drive is provided with a toothing to increase the factor of friction. Thus the clamping force is considerably smaller, but is maintained in the case of a pressure drop.
By twisting the clamping bolt together with the rear bottom cover every desired angle position can be adjusted (see also page 2).

Effective clamping force

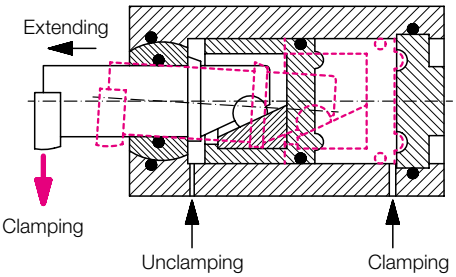
The clamping force is generated by a wedge drive and therefore depends on the friction of the sliding surfaces. The friction coefficient is not constant over the entire service life. At the beginning it is a little higher, i.e. the clamping force does not yet attain the set value. With increasing stroke cycles, the friction surfaces become smoother and the clamping force increases slowly. After some hundred thousand operations, the effective clamping force can exceed the nominal value by 10 to 30 % (see chart).
This characteristic of wedge drives must be taken into consideration for the fixture design, i.e.

1. The reduced clamping force in new condition must be sufficient for safe clamping of the workpiece.
2. With increasing clamping force the workpiece must not be inadmissibly deformed.

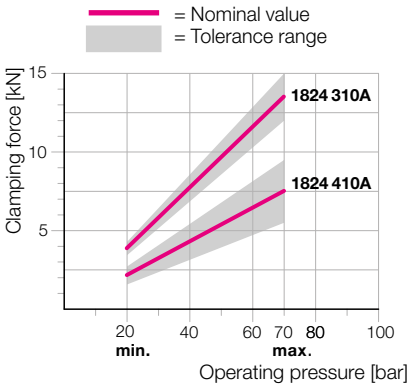
Conclusion: If an exactly reproducible clamping force is required, conventional clamping elements with direct piston drive must be used.

Position monitoring

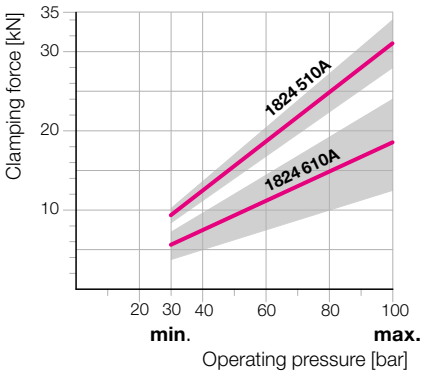
Versions with extended piston rod at the back and pneumatic position monitoring are available on request.



Clamping force diagram



1824310A without self-locking
1824410A with self-locking

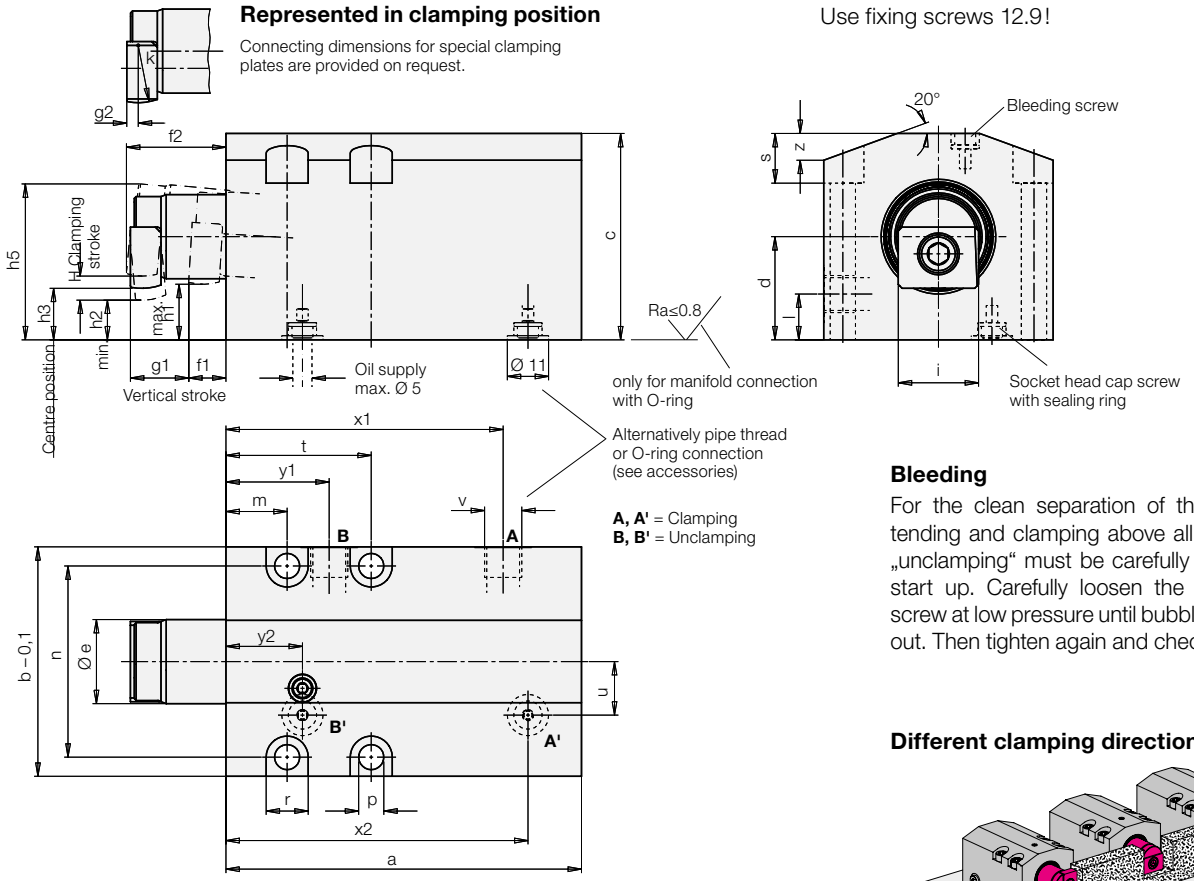


1824510A without self-locking
1824610A with self-locking

Represented in clamping position

Connecting dimensions for special clamping plates are provided on request.

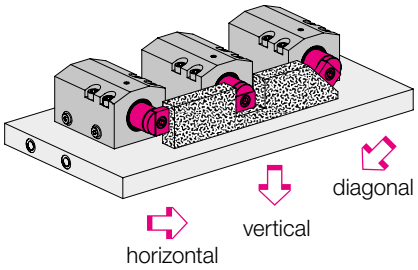
Use fixing screws 12.9!



Bleeding

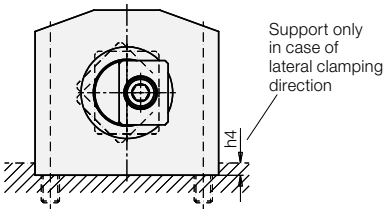
For the clean separation of the functions extending and clamping above all the connection „unclamping“ must be carefully bled during the start up. Carefully loosen the upper bleeding screw at low pressure until bubble-free oil comes out. Then tighten again and check density.

Different clamping directions

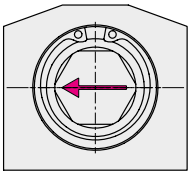


Clamping direction can optionally be in all directions vertically to the axis of the clamping lever. The clamping lever must be in retracted position and the cylinder cover must be rotated by the corresponding angle.
When adjusting the clamping direction at the cover, it has to be considered that the clamping direction of the contact bolt goes in the same direction.

Example: 90° counterclockwise



Back view



Claming function		without self-locking	with self-locking	without self-locking	with self-locking
Clamping force approx.*	[kN]	13.5	7.5	31	18.5
Max. operating pressure	[bar]	70	70	100	100
Min. operating pressure	[bar]	20	20	30	30
Oil volume Clamping / Unclamping	[cm³]	28.9/22.8	28.9/22.8	102/76.4	102/76.4
H max. clamping stroke.	[mm]	6	6	8	8
a	[mm]	93	93	126	126
b –0.1	[mm]	60	60	88	88
c	[mm]	54	54	75	75
d	[mm]	27	27	37.5	37.5
Ø e	[mm]	22	22	35	35
f1	[mm]	10	10	13	13
f2	[mm]	26	26	40.5	40.5
g1	[mm]	15	15	26	26
g2	[mm]	3	3	3	3
h1	[mm]	14	14	19	19
h2	[mm]	11	11	15	15
h3	[mm]	13.5	13.5	18.5	18.5
h4	[mm]	4	4	6	6
h5	[mm]	41	41	60	60
i	[mm]	21	21	34	34
k	[mm]	15	15	25	25
l	[mm]	12	12	13	13
m	[mm]	16	16	21	21
n	[mm]	50	50	72	72
p	[mm]	6.6	6.6	11	11
r	[mm]	11	11	18	18
s	[mm]	13	13	20	20
t	[mm]	38	38	53	53
u	[mm]	14	14	15	15
v		G 1/8	G 1/8	G 1/4	G 1/4
x1	[mm]	72.5	72.5	99	99
x2	[mm]	79	79	108	108
y1	[mm]	27	27	37	37
y2	[mm]	20	20	28	28
z	[mm]	7	7	10	10
Part no.		**1824310A**	**1824410A**	**1824510A**	**1824610A**

***** Effective clamping force see page 1

Accessories	Part no.
O-ring 8x1.5	**3000343**
Screw plug G 1/8	**3610047**
Screw plug G 1/4	**3300821**

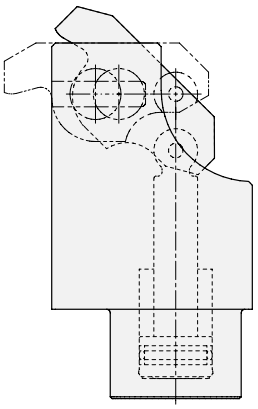
Slide Pivot Clamp

compact version, with optional position monitoring, double acting, max. operating pressure 350 bar

Advantages

- High clamping force, up to 10 kN
- Minimum dimensions
- High efficiency
- Increased rigidity allows compensation of transverse forces at the clamping point
- Unimpeded loading and unloading of the fixture
- Inductive or pneumatic monitoring of the clamping lever available as accessory
- Monitoring of the unclamping position and the usable clamping range is possible
- Clamping lever can be swivelled into small recesses
- Partially immersed mounting of the body
- Oil supply alternatively via fittings or drilled channels
- Long life due to metallic wiper to protect the piston rod

Function



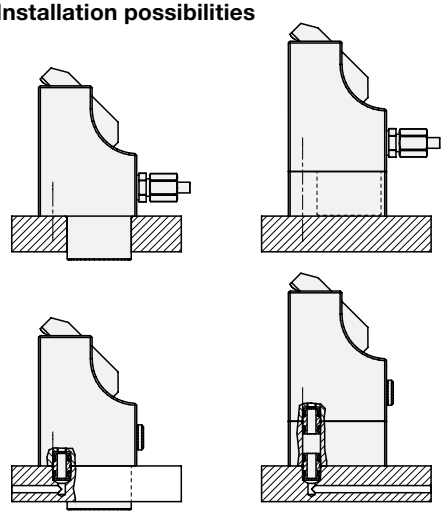
Description

In the case of the slide pivot clamp the piston force is deviated by 180° by the clamping lever and is available as clamping force with virtually no loss of efficiency. Kinematics of the slide pivot clamp allow sliding back of the clamping lever during unclamping for unimpeded insertion of the workpieces.
Position of the clamping lever can be monitored by inductive proximity switches or pneumatic jets.
The pivot slide clamp can be installed immersed up to the flange surface in a hole of the fixture body or via intermediate plates which are available as an accessory. For both solutions there is the possibility to supply the hydraulic oil not only by fitting connection but also via drilled channels in the fixture body.

Application

The slide pivot clamp has in relation to its base a very high clamping force. The clamps are particularly suitable for clamping tasks on machines with high performance and reduced space availability on the fixture. The workpieces can be inserted from above without any impediments. A clamping recess a little bit wider than the clamping lever is sufficient as clamping surface. This characteristic indicates their use for clamping of aluminium parts, which are very sensitive against deformation, with correspondingly reduced oil pressure.

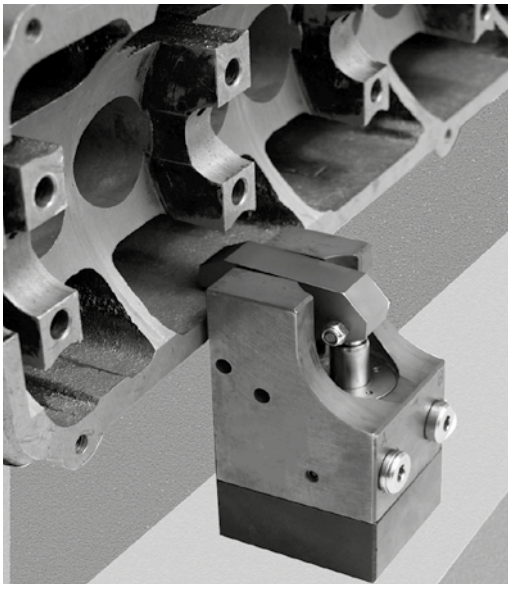
Installation possibilities

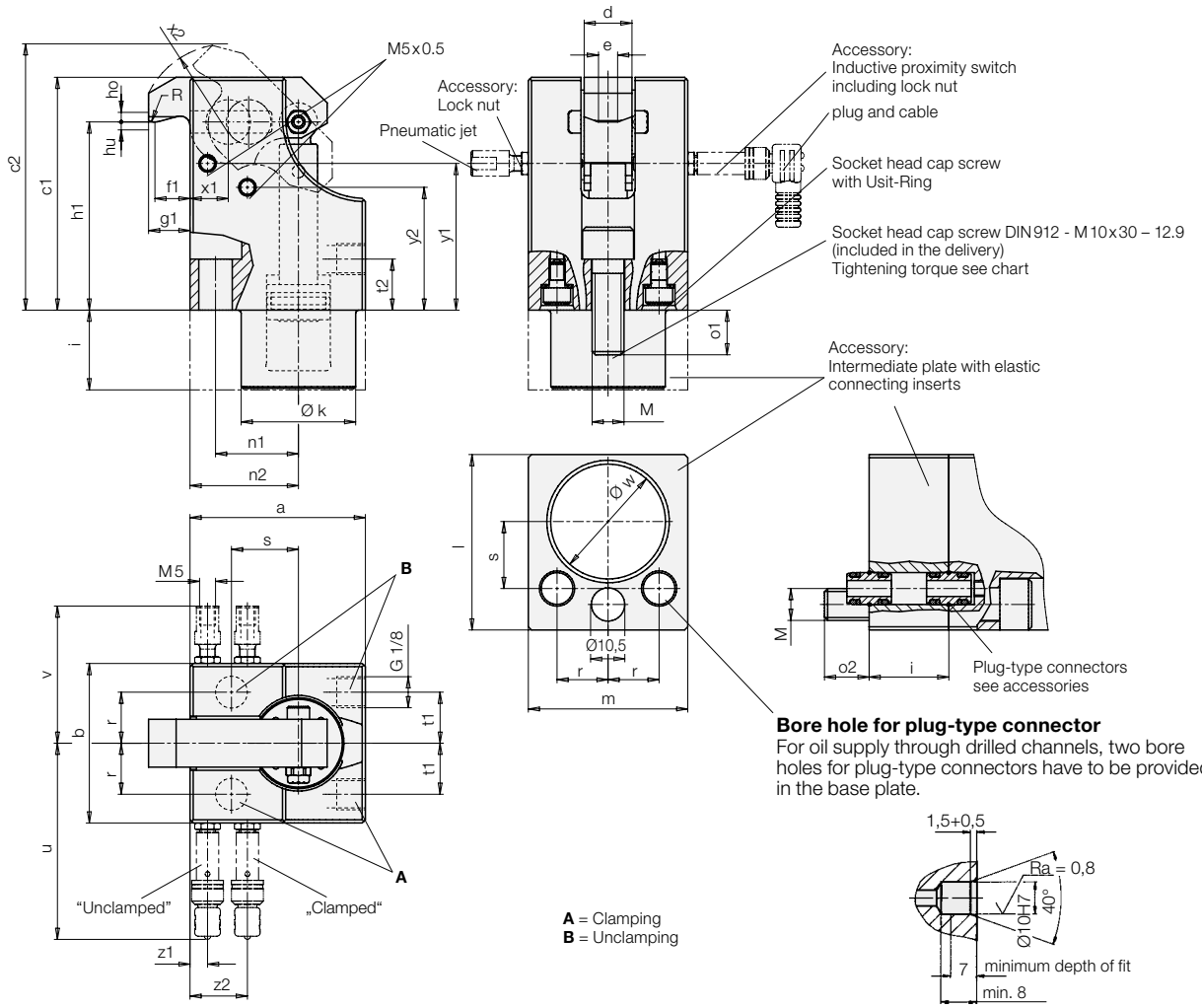


Important notes

The clamping lever must not be impeded during swivelling movement.
The slots of the sliding pad have to be checked from time to time with regard to contamination by swarf and cleaned, if required.
Operating conditions, tolerances and other data see data sheet A 0.100.

Metallic wiper standard





Bore hole for plug-type connector
For oil supply through drilled channels, two bore holes for plug-type connectors have to be provided in the base plate.

Clamping force F_{Sp} at 350 bar	[kN]	10
Oil volume clamping	[cm³]	6
Oil volume unclamping	[cm³]	4
Max. flow rate	[cm³/s]	10
a	[mm]	55
b	[mm]	50
c1 / c2	[mm]	73 / 83.5
d	[mm]	15
e	[mm]	6
f1	[mm]	11
g1	[mm]	13
h1	[mm]	59
ho / hu, upper / lower clamping point	[mm]	3.0 / 2.5
i	[mm]	25
Ø k	[mm]	35.9
l	[mm]	55
m	[mm]	50
M, socket head cap screw DIN912 / seating torque	[Nm]	M10 / 87
n1 / n2	[mm]	26 / 34
o1 / o2	[mm]	14 / 14
r ±0.02	[mm]	16
R	[mm]	5
s ±0.02	[mm]	21
t1 / t2	[mm]	16 / 16
u, approx.	[mm]	62
v, approx.	[mm]	43
Ø w +0.1, mounting hole	[mm]	36
x1 / x2	[mm]	12 / 28
y1 / y2	[mm]	46 / 38.5
z1 / z2	[mm]	5.5 / 18
Part no.		**1824040**

Article available on request
On request, we will check whether the article is still available.

For manifold mounting, remove socket head cap screws with USIT rings and 2 screw-in plugs G 1/8 in the body.

Accessory	**Part no.**
Screw plug G 1/8	**3610158**
Plug-type connector Required are: 2 off without or 4 off with intermediate plate	**9210132**
Induct. proximity switch	**3829198**
Plug + cable	**3829099**
Pneumatic jet	**3612033**
Lock nut	**3301803**
Intermediate plate for 1824040	**3456425**
Socket head cap screw DIN912-M10x55 12.9	**3300434**

Technical characterisitcs for inductif proximity switches

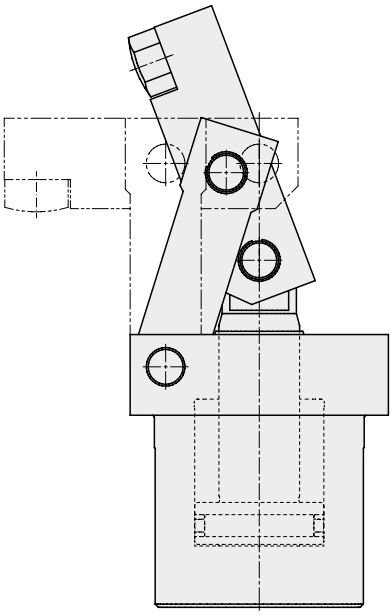
Operating voltage UB	10…30 V DC
Switching function	Interlock
Output	PNP
Filter body material	Stainless steel
Protection as per DIN 40050	IP 67
Environmental temperature	–25…+70 °C
Connection	Connector
LED Function display	Yes
Constant current max.	150 mA
Rated operating distance	0.8 mm
Protected against short circuits	Yes

Hinge Clamp
double acting, max. operating pressure 200 bar

Advantages

- Compact design
- Large clamping area of 6 mm
- The clamping lever is completely retracted in off-position
- Interchangeable contact bolts
- 3 clamping levers available
- Clamping lever can be adapted to the workpiece
- Mounting position: any
- Low-cost

Function



Description

When pressurising the element, the piston moves from the unclamped position upwards. The clamping lever swivels forward by means of the two links and at the same time downwards onto the workpiece.

The clamping lever is provided with an internal thread to accept a contact bolt, which can be easily exchanged.

Oil supply is made from the back by means of fittings.

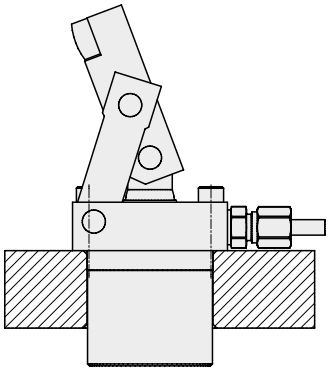
Application

The hinge clamp is a low-cost element with high clamping force for simple clamping tasks.

Workpieces can be easily inserted from above, since the clamping lever swivels completely behind the front edge of the element.

Due to the simple design of the components, clamping lever and contact bolts can be easily adapted to the workpiece.

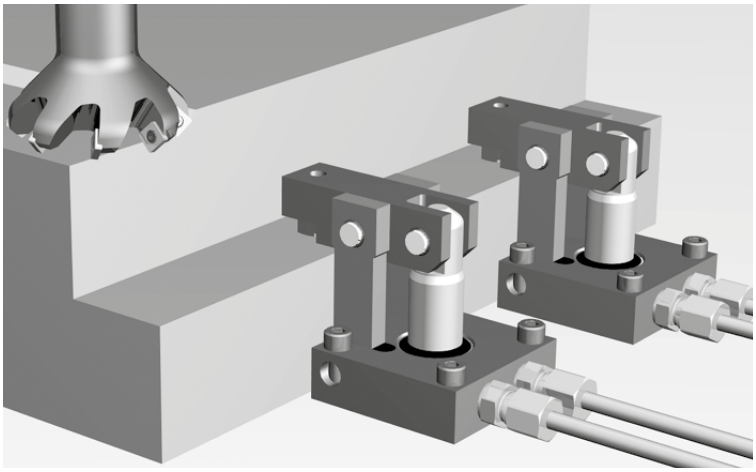
Installation

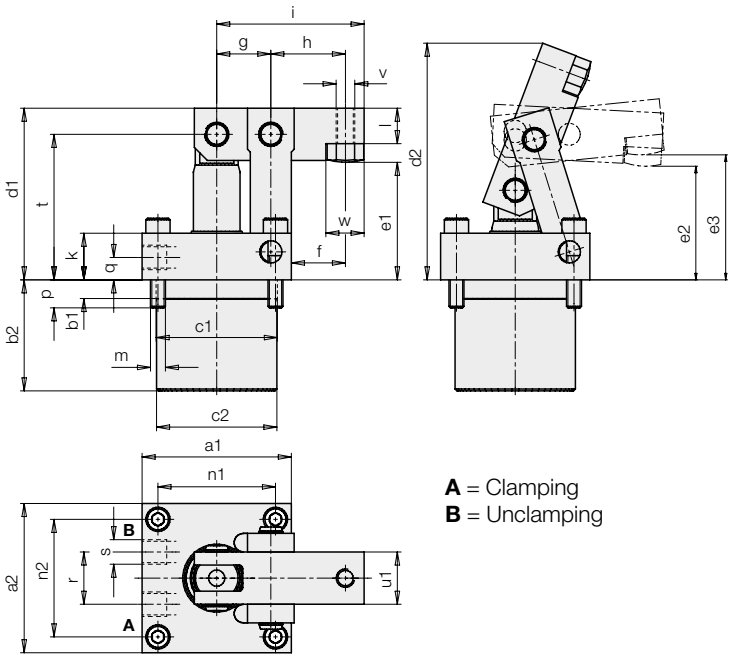


Important notes

Due to the open design, it should be checked regularly to see if the hinge clamp is contaminated by swarf and needs cleaning.

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





A = Clamping
B = Unclamping

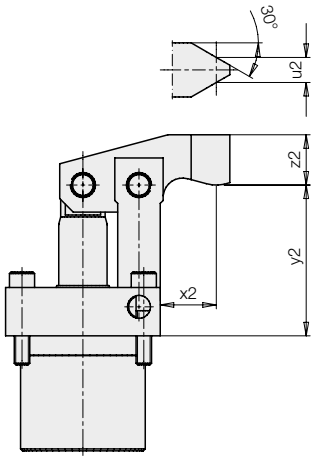
Accessories:
Swivel contact bolt M10 flat face,
see data sheet G 3.800,
dimension e1 – 8mm
Part no. 3614073

When using longer contact bolts or longer clamping levers, the clamping lever does not swivel completely behind the front edge of the body.

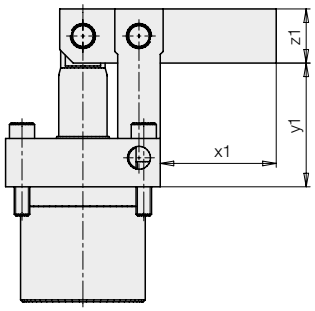
Clamping force	[kN]	18
Max. operating pressure	[bar]	200
Oil volume clamping	[cm³]	40,2
Oil volume unclamping	[cm³]	24,5
a1	[mm]	80
a2	[mm]	80
b1	[mm]	10
b2	[mm]	59,5
Ø c1 –0,2	[mm]	65
Ø c2 –0,5	[mm]	64,5
d1	[mm]	92
d2	[mm]	127
e1	[mm]	63
e2, lower clamping point	[mm]	61
e3, upper clamping point	[mm]	67
f	[mm]	29
g	[mm]	29
h	[mm]	40
i	[mm]	79
k	[mm]	25
l	[mm]	19
m		M8
n1	[mm]	63
n2	[mm]	63
p	[mm]	15
q	[mm]	12
r	[mm]	28
s		G 1/4
t	[mm]	78
u1	[mm]	28
u2	[mm]	13
v		M10
w	[mm]	20,5
x1	[mm]	60
x2	[mm]	29
y1	[mm]	64
y2	[mm]	78
z1	[mm]	28
z2	[mm]	26
Part no.		**1825500**

Article available on request

Hinge clamp with
cranked clamping lever
(Dimensions u2, x2, y2, z2)
Part no. 1825506



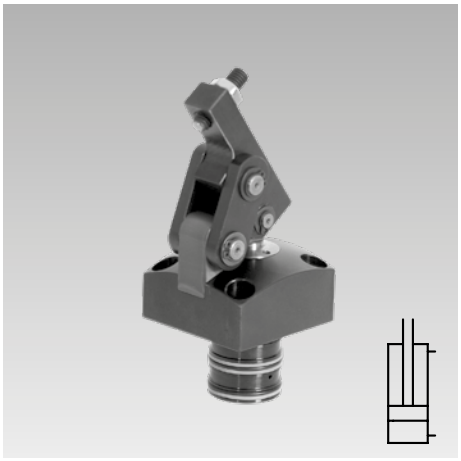
Hinge clamp with
clamping lever, long, unmachined
(Dimensions x1, y1, z1)
Part no. 1825505



Special features:
If the maximum clamping force has to be applied, the material of the assembly plate must have a minimum yield point of Re/Rp 0,2 ≥ 160 N/mm².

Hinge Clamps

with metallic wiper edge and optional position monitoring, double acting, max. operating pressure 250 bar



Application

The hinge clamp is a low-cost hydraulic clamping element with many installation and connecting possibilities.
If the clamping lever is completely retracted, unimpeded loading and unloading of the fixture can be effected. A clamping recess in the workpiece a little bit wider than the clamping lever is sufficient as clamping surface.
The special kinematics allow clamping nearly without side loads of workpieces which are very sensitive against deformation.

Description

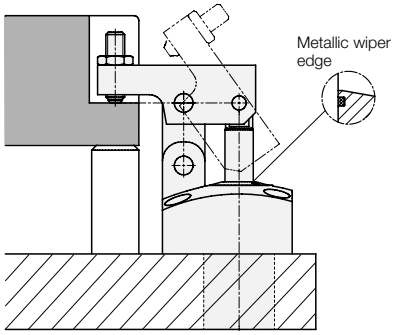
When pressurising the element, the piston moves upwards and swivels the clamping lever over the hinges forwards and at the same time downwards onto the workpiece.
The piston force is deviated by 180° and is available as clamping force with virtually no loss of efficiency.
If the level of the clamping surface is exactly on height h (see page 2), no side loads are introduced into the workpiece.
The bodies are recessible in the fixture up to the flange. Alternatively intermediate plates are available for height adjustment.
All versions are optionally available with extended piston rod and with inductive or pneumatic position monitoring.

Important notes

Hinge clamps must only be used for clamping of workpieces in industrial applications and may only be operated with hydraulic oil.
Hinge clamps can generate very high forces. The workpiece, the fixture or the machine must be in the position to compensate these forces. Considerable injuries can be caused to fingers during clamping and unclamping in the effective area of the clamping lever.
The manufacturer of the fixture or the machine is obliged to provide effective protection devices.
Hinge clamps have to be checked regularly on contamination by swarf and have to be cleaned.
Operating conditions, tolerances and other data see data sheet A 0.100.

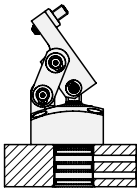
Advantages

- Compact design
- Body partially recessible
- Oil supply alternatively via pipe threads or drilled channels
- Unimpeded loading and unloading of the fixture
- The clamping lever can be swivelled into small recesses
- Clamping possible without side loads
- Long clamping lever adaptable to the workpiece
- Lever mechanism easy to clean
- Standard metallic wiper edge
- Standard FKM seals
- Inductive or pneumatic control of the clamping position and the clamping range optional

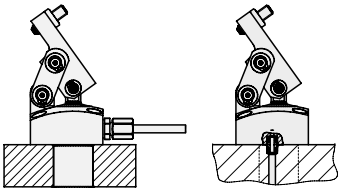


Installation and connecting possibilities

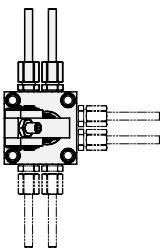
Cartridge type
for horizontally-drilled channels



Pipe thread at the back / Plug-type connector
Pipe thread, at the back — for vertically-drilled channels



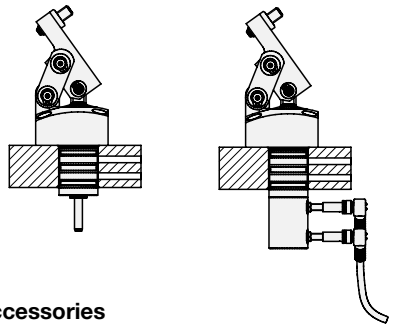
Pipe thread at 3 sides



Option

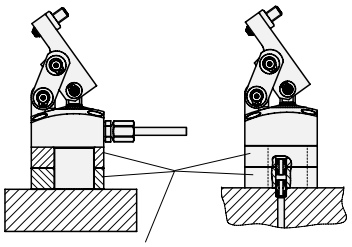
Extended piston rod
for all versions available

without position monitoring — with position monitoring



Accessories

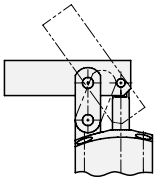
Intermediate plates
for all versions with pipe thread



Intermediate plates

Option

Long clamping lever
for all versions available.



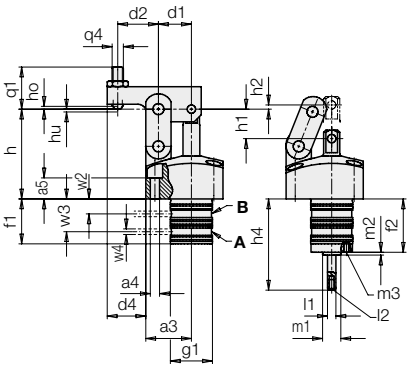
Alternatively all versions are also available without clamping lever.

Cartridge type

Clamping lever with swivel contact bolt

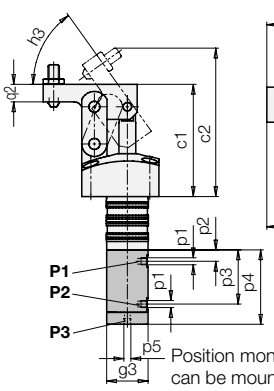
without clamping lever extended piston rod

1825 X11 **1825 X20**



Optionally
with pneumatic position monitoring

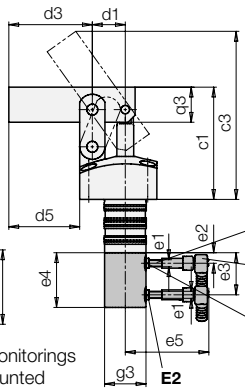
1825 X21P



Position monitorings can be mounted rotated by 4 x 90°

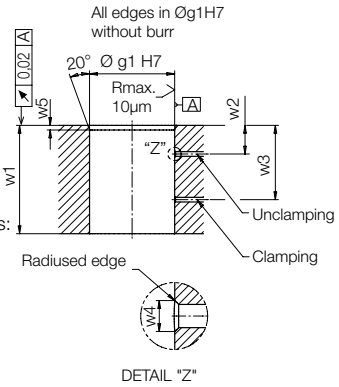
Optionally
with inductive position monitoring/ long clamping lever

1825 X22E



Accessories:
Inductive proximity switch
Plug and cable

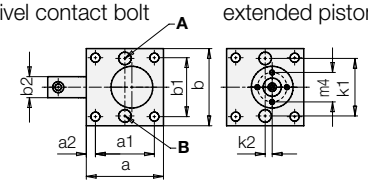
Location hole for cartridge type



Pipe thread at the back / plug-type connector

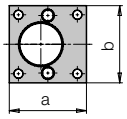
Clamping lever with swivel contact bolt

without clamping lever extended piston rod

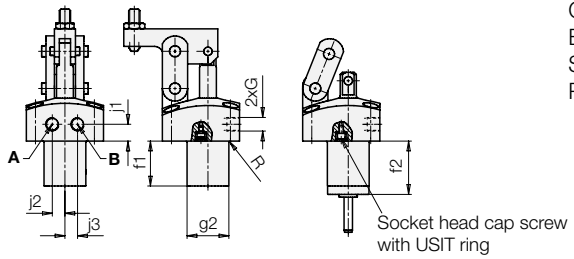


A = Clamping
B = Unclamping
E1 = Clamping range, inductive
E2 = Unclamped, inductive
P1 = Clamping range, pneum.
P2 = Unclamped, pneum.
P3 = Outlet air, pneum. position monitoring

Accessories:
Intermediate plates for versions with pipe threads



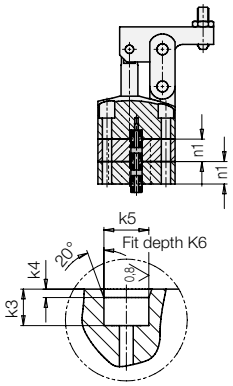
1825 X31 **1825 X40**



Materials

Clamping lever:	C45 + C (1.0503)
Body:	steel
Sealings:	FKM
Piston:	high alloy steel

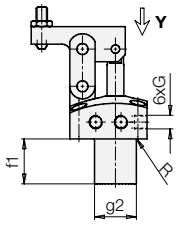
Accessories
Plug-type connector



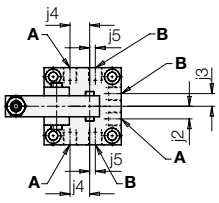
For oil supply through plug-type connectors, these bore holes have to be provided in the base plate.
Required accessory when using plug-type connectors: 2 x sealing plug or 2 x screw plug (see page 4)

Pipe thread at 3 sides

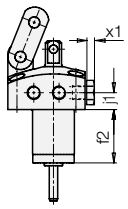
1825 X51
Clamping lever with swivel contact bolt



View Y



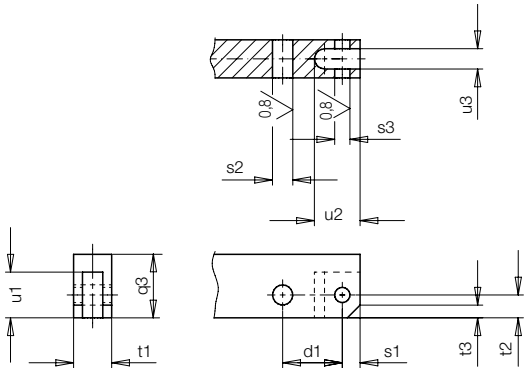
1825X60
Without clamping lever extended piston rod



4 x screw plug with sealing edge included in the delivery (dimension x 1)

Connecting dimensions for self-manufactured clamping levers

Size		1	2	3	4
d1	[mm]	23.5	33	37	43.5
q3	[mm]	25	40	50	55
s1	[mm]	7	10.5	13	16.5
s2	[mm]	Ø8 H7	Ø12 H7	Ø15 H7	Ø18 H7
s3	[mm]	Ø6 H7	Ø9 H7	Ø12 H7	Ø14 H7
t1	[mm]	15 –0.1	20 –0.1	25 –0.1	30 –0.1
t2	[mm]	9	16.5	20	20
t3	[mm]	5	8	12	12
t4	[mm]	5	8	32	32
u1	[mm]	18	27.5	35.5	40
u2	[mm]	18	24	31	40
u3	[mm]	8.1 + 0.1	10 +0.1	13 +0.1	18 +0.2



Size			1	2	3	4
Clamping force at a length of clamping lever	d2 and 250 bar	[kN]	3.8	9.7	14.4	21.5
Clamping force at a length of clamping lever with extended piston rod	d2 and 250 bar	[kN]	3.3	9.1	13.9	21
Oil volume clamping		[cm^3]	4.8	16.9	31.1	61.6
Oil volume clamping with extended piston rod		[cm^3]	4.1	16.0	30.0	60.2
Oil volume unclamping		[cm^3]	2.1	10.0	19.0	37.5
Admissible flow rate		[cm^3/s]	15.7	24.5	24.5	55
a		[mm]	55	70	85	100
a1		[mm]	42	56	69	81
a2		[mm]	6.5	7	8	9.5
a3		[mm]	32.5	46	52	60
a4		[mm]	4 x Ø 6.6	4 x Ø 9	4 x Ø 11	4 x Ø 13.5
a5		[mm]	15	18	21.5	30
b		[mm]	55	70	85	100
b1		[mm]	42	56	69	81
b2		[mm]	15	20	25	30
c1		[mm]	80	116	143	163
c2		[mm]	106	150	185	208
c3		[mm]	120	171	208	238.8
d1		[mm]	23.5	33	37	43.5
d2		[mm]	29	39.5	49	60.5
d3		[mm]	59.5	81.5	98	114
d4		[mm]	27.5	37.5	47.5	57.5
d5		[mm]	50.5	68.5	83	97.5
e1			M5x0.5	M5x0.5	M5x0.5	M5x0.5
e2		[mm]	7.5	9.7	11.6	14.5
e3		[mm]	30	41.9	46	58.3
e4		[mm]	39	49	55	68.5
e5		[mm]	approx. 60	approx. 60	approx. 60	approx. 60
f1		[mm]	32	43	44.5	52.5
f2		[mm]	38	49	50.5	58.5
G			G1/8	G1/8	G1/4	G1/4
Max. size of connecting fitting			6 L	8 S	10 L	10 L
g1		[mm]	Ø 30 f7	Ø 42 f7	Ø 52 f7	Ø 65 f7
g2		[mm]	Ø 29.8	Ø 41.8	Ø 51.8	Ø 64.8
g3		[mm]	Ø 29.5	Ø 39	Ø 39	Ø 39
h	ideal clamping point	[mm]	64	92.5	113	128
ho	upper end of the clamping range	[mm]	2	2.7	3.5	4.5
hu	lower end of the clamping range	[mm]	2	2.7	3.5	4.5
h1	piston stroke up to ideal clamping point	[mm]	21	30	33.5	41.5
h2	piston stroke up to the end of the clamping stroke	[mm]	3	4.5	5.2	7.5
h3		[°]	54.5	55.5	56	58.2
h4		[mm]	65	86.5	93	111
j1		[mm]	12	16	17	20
j2		[mm]	9	13.5	15.5	22
j3		[mm]	9	13.5	15.5	22
j4		[mm]	14	20	25	32
j5		[mm]	4	2	6	12
k1		[mm]	41 ± 0.02	55 ±0.02	68 ±0.02	80 ±0.02
k2		[mm]	5 ±0.05	0 ±0.05	0 ±0.05	0 ±0.05
k3		[mm]	6.5	6.5	6.5	8
k4		[mm]	1.5	1.5	1.5	1.5
k5		[mm]	Ø 8 H7	Ø 8 H7	Ø 8 H7	Ø 10 H7
k6		[mm]	5.5	5.5	5.5	7
l1		[mm]	Ø 6 f7	Ø 6 f7	Ø 6 f7	Ø 6 f7
l2			M4x7.5 deep	M4x7.5 deep	M4x7.5 deep	M4x7.5 deep
m1		[mm]	Ø 13 f7	Ø 13 f7	Ø 13 f7	Ø 13 f7
m2		[mm]	2	2	2	2
m3			M4x6 deep	M4x6 deep	M4x6 deep	M4x6 deep
m4		[mm]	21	27	27	27
n1		[mm]	16	21.5	22.5	26.5
p1			M5	M5	M5	M5
p2		[mm]	8.5	10.6	12.3	15.2
p3		[mm]	38.6	50.9	55.1	66.5
p4		[mm]	53	73	77	84
p5			M5	G1/4	G1/4	G1/4
q1		[mm]	30	40	50	50
q2		[mm]	12.5	20	25	28
q3		[mm]	25	40	50	55
q4			M8	M12	M16	M16
R		[mm]	0.8	0.8	1	0.8
w1		[mm]	min. 31.5	min. 41.5	min. 43.5	51.5
w2		[mm]	10.6	14.3	14.8	18
w3		[mm]	23.4	30.7	31.9	37.5
w4		[mm]	max. Ø 4	max. Ø 5.5	max. Ø 5.5	max. Ø 5.5
w5		[mm]	2.5 – 0.5	2.5 – 0.5	2.5 – 0.5	2.5 – 0.5
x1		[mm]	7	7	8	8
Weight approx.	**1825XX0**	[kg]	1.0	2.3	3.8	6.1
	1825XX1	[kg]	1.1	2.7	4.6	7.3
	1825XX2	[kg]	1.2	3.0	5.1	8.1

Calculations • Clamping force diagrams
Code for part numbers • Accessories

Calculations

1. Length L of clamping lever is known

1.1 Admissible operating pressure

$$p_{adm} = \frac{B}{\frac{C}{L}+1} \leq 250 \text{ bar} \quad [\text{bar}]$$

1.2 Effective clamping force

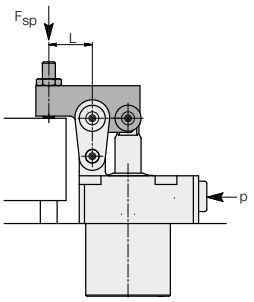
$$p_{adm} > 250 \text{ bar} \rightarrow F_{sp} = \frac{A}{L} * 250 \quad [\text{kN}]$$

$$p_{adm} < 250 \text{ bar} \rightarrow F_{sp} = \frac{A}{L} * p_{adm} \quad [\text{kN}]$$

2. Min. length of clamping lever

$$L_{min.} = \frac{C}{\frac{B}{p}-1} \quad [\text{mm}]$$

L, $L_{min.}$ = Length of clamping lever [mm]
p, $p_{adm.}$ = Operating pressure [bar]
A, B, C, = Constants as per chart



Constant

	1825 1	1825 2	1825 3	1825 4
A	0.449	1.54	2.827	5.193
A*	0.386	1.45	2.728	5.076
B	442.45	448.42	429.34	429.75
B*	514.86	475.83	444.98	420.08
C	22.325	31.35	35.15	43.5

A*, B* for version with switch rod

Example 1: Hinge clamp 1825 111
Operating pressure 200 bar
Standard clamping lever L = 29 mm

Effective clamping force

$$F_{Sp} = \frac{A}{L} * p = \frac{0.449}{29} * 200 = 3.1 \text{ kN}$$

Example 2: Hinge clamp 1825 110
Operating pressure 200 bar

Min. length of clamping lever

$$L_{min} = \frac{C}{\frac{B}{p}-1} = \frac{22.325}{\frac{442.45}{200}-1} = 18.4 \text{ mm}$$

Effective clamping force

$$F_{Sp} = \frac{A}{L} * p = \frac{0.449}{18.4} * 200 = 4.9 \text{ kN}$$

Example 3: Hinge clamp 1825 210
Special clamping lever L = 30 mm

Admissible operating pressure

$$p_{adm} = \frac{B}{\frac{C}{L}+1} = \frac{448.42}{\frac{31.35}{30}+1} = 219 \text{ bar}$$

Effective clamping force

$$F_{Sp} = \frac{A}{L} * p_{adm} = \frac{1.54}{30} * 219 = 11.25 \text{ kN}$$

Example 4: Hinge clamp 1825 310
Special clamping lever L = 118 mm

Admissible operating pressure

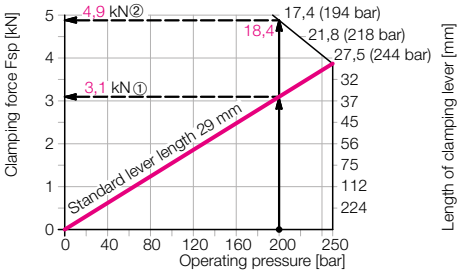
$$p_{adm} = \frac{B}{\frac{C}{L}+1} = \frac{429.34}{\frac{35.15}{118}+1} = 330.8 > 250 \text{ bar}$$

Effective clamping force
The max. operating pressure is 250 bar, thus

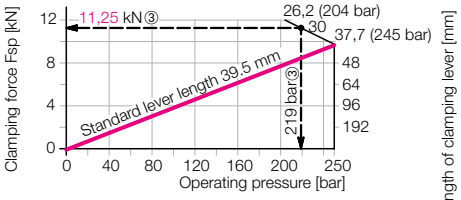
$$F_{Sp} = \frac{A}{L} * 250 = \frac{2.827}{118} * 250 = 6 \text{ kN}$$

Clamping force diagrams

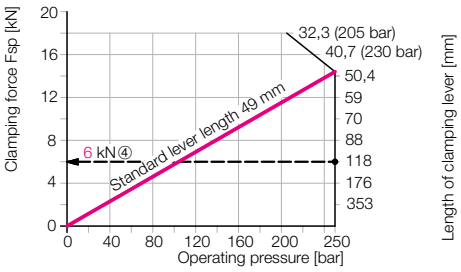
Size 1



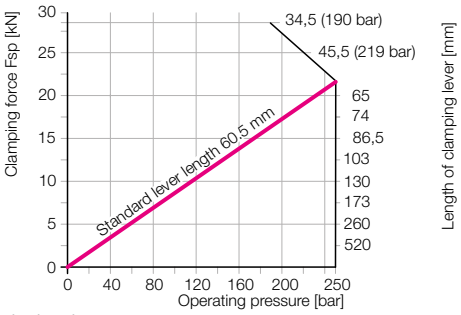
Size 2



Size 3



Size 4



Code for part numbers

1825 **X X X X** — Basic type

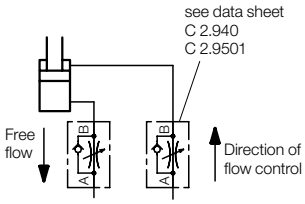
1 = Size 1
2 = Size 2
3 = Size 3
4 = Size 4

1 = cartridge type
2 = cartridge type with extended piston rod ◊
3 = pipe thread at the back / plug-type connector
4 = pipe thread at the back / plug-type connector with extended piston rod ◊
5 = pipe threads at three sides
6 = pipe threads at three sides with extended piston rod ◊

E = mounted position monitoring, inductive (without proximity switch)
P = mounted position monitoring, pneumatic

0 = without clamping lever
1 = clamping levers with swivel contact bolt
2 = long clamping lever, unmachined
Material: C45 + C (1.0503)

◊ A prerequisite for mounted position monitoring (addition: E or P)



Important note

Longer special clamping levers have a higher weight. Therefore the flow rate has to be considerably reduced to avoid damage of the mechanics in the stroke end positions.
A flow rate throttling always has to be effected in the supply line to the hinge clamp.

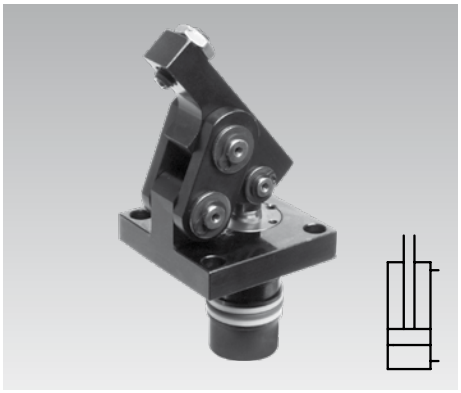
Accessories	Size	1	2	3	4
Intermediate plate (not for cartridge-type version)		**3456449** *)	**3456468** *)	**3456489** *)	**3456534** *)
Plug-type connector		**9210145**	**9210145**	**9210145**	**9210132**
Plug, flush screwable with hexagon socket		**0361986**	**0361986**	**0361987**	**0361987**
Screw plug with hexagon head		**3610047**	**3610047**	**3300821**	**3300821**
Pneumatic position monitoring, complete **)		**0353845**	**0353853**	**0353855**	**0353962**
Weight	[kg]	0.18	0.42	0.46	0.74
Inductive position monitoring, (without inductive proximity switches) **)		**0353846**	**0353854**	**0353856**	**0353963**
Weight	[kg]	0.26	0.62	0.65	0.58
Inductive proximity switch		**3829198**	**3829198**	**3829198**	**3829198**
Right angle plug with cable 5 m for inductive proximity switch		**3829099**	**3829099**	**3829099**	**3829099**

*) on request
**) Only mountable at 1825 X2X, -X4X, -X6X

Technical characteristics for inductive proximity switches 3829198

Operating voltage UB	10…30 V DC
Switching function	Interlock
Output	PNP
Material of housing	steel, corrosion resistant
Protection as per DIN 40050	IP 67
Ambient temperature	−25…+70 °C
Type of connection	Plug S49 M8x1
LED function display	yes
Constant current max.	100 mA
Rated operating distance	0.8 mm
Protected against short circuits	yes

Mini Hinge Clamp
with metallic wiper edge, double acting, max. operating pressure 250 bar



Application
The mini hinge clamp is a low-cost hydraulic clamping element for thin-walled workpieces and reduced space.

The special kinematics allow clamping nearly without side loads of workpieces which are very sensitive against deformation.

A clamping recess in the workpiece a little bit wider than the clamping lever is sufficient as clamping surface.

Description
When pressurising the element, the piston moves upwards and swivels the clamping lever over the hinges forwards and at the same time downwards onto the workpiece. The piston force is deviated by 180° and is available as clamping force with virtually no loss of efficiency.

During unclamping the clamping lever with swivel contact bolt will be swivelled behind the front edge of the flange, thereby unimpeded loading and unloading of the workpiece is possible.

Workpieces which are very sensitive against deformation are clamped nearly without cross loads, if the clamping surface is at the height of the bearing pins of the clamping lever (34 mm above the flange surface, see page 2).

The optionally available long clamping lever is provided for customer-specific adaptations.

Important notes
Hinge clamps must only be used for clamping of workpieces in industrial applications and may only be operated with hydraulic oil.

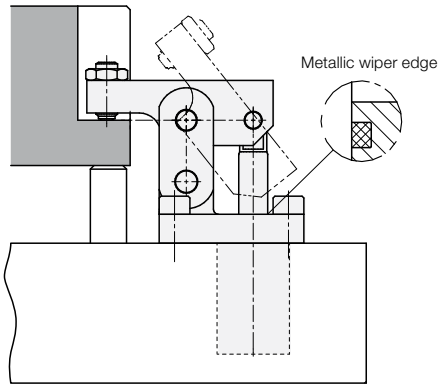
Hinge clamps can generate very high forces. The workpiece, the fixture or the machine must be in the position to compensate these forces.

Considerable injuries can be caused to fingers during clamping and unclamping in the effective area of the clamping lever.

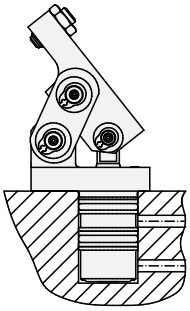
The manufacturer of the fixture or the machine is obliged to provide effective protective measures.

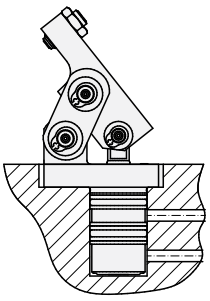
Hinge clamps have to be checked regularly on contamination by swarf and have to be cleaned. Operating conditions, tolerances and other data see data sheet A 0.100.

Advantages
- Compact design
- Body partially recessible
- Oil supply through drilled channels
- Unimpeded loading and unloading of the fixture when using clamping levers with swivel contact bolt
- Clamping lever can be swivelled into small recesses
- Clamping possible without side loads
- Two different clamping levers are available
- Long clamping lever adaptable to the workpiece
- Lever mechanism easy to clean
- Standard metallic wiper edge
- Standard FKM seals
- Mounting position: any

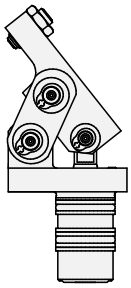


Installation and connecting possibilities
Cartridge type
for horizontally-drilled channels

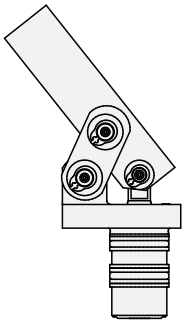




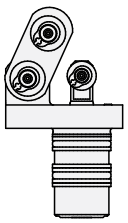
Options for clamping levers
Clamping lever with swivel contact bolt



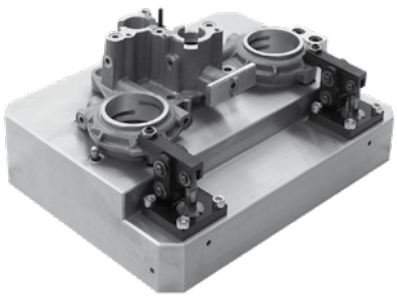
Long clamping lever



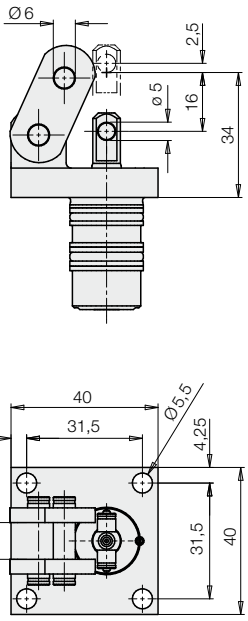
without clamping lever

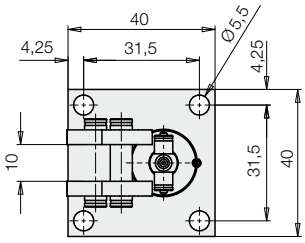


Application example

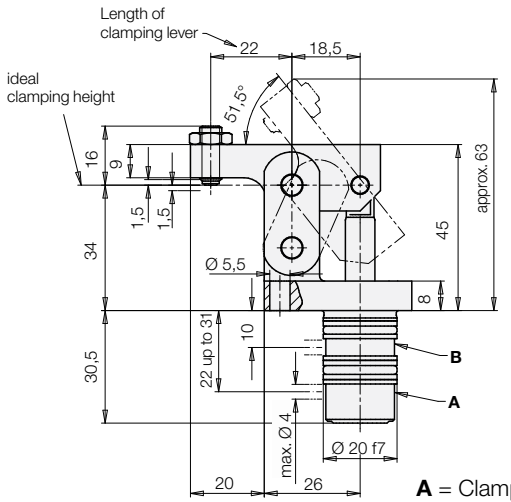


Without clamping lever
1825010



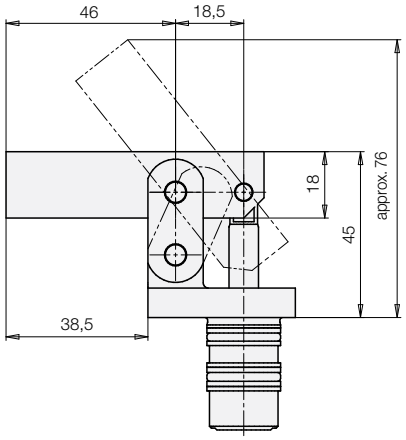


Clamping lever with contact bolt
1825011

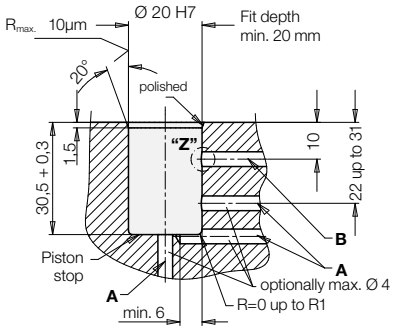


A = Clamping
B = Unclamping

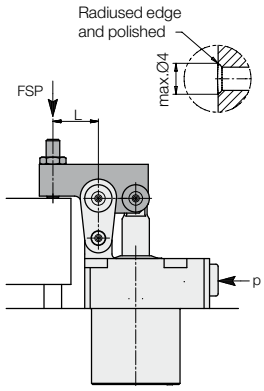
Long clamping lever
1825012



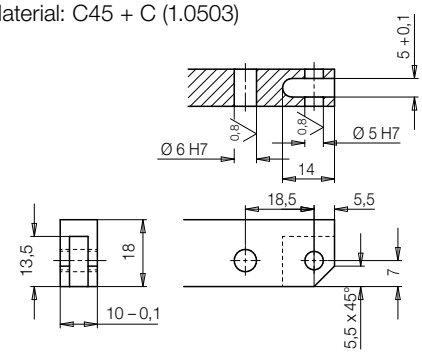
Location hole



DETAIL **"Z"**



Connecting dimensions for self-manufactured clamping levers
Material: C45 + C (1.0503)



Technical data

Clamping force		[kN]	2.2
Max. operating pressure		[bar]	250
Min. operating pressure		[bar]	10
Oil volume	Clamping	[cm³]	2.1
	Unclamping	[cm³]	1.2
Max. flow rate			
	Clamping	[cm³/s]	15
	Unclamping	[cm³/s]	8
Weight	**1825010**	[kg]	0.23
	1825011	[kg]	0.28
	1825012	[kg]	0.32

Calculations

1. Length L of clamping lever is known

1.1 Admissible operating pressure

$$p_{adm} = \frac{B}{\frac{C}{L} + 1} \leq 250 \quad [bar]$$

1.2 Effective clamping force

$p_{adm} > 250$ bar $\rightarrow F_{Sp} = \frac{A}{L} * 250$ [kN]

$p_{adm} < 250$ bar $\rightarrow F_{Sp} = \frac{A}{L} * p_{adm}$ [kN]

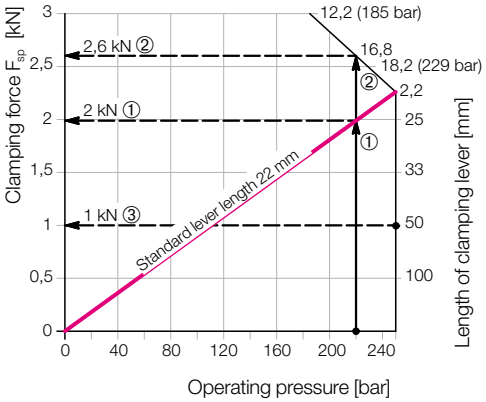
2. Min. length of clamping lever

$$L_{min.} = \frac{C}{\frac{B}{p} - 1} \quad [mm]$$

L, $L_{min.}$ = Length of clamping lever [mm]
p, p_{adm} = Operating pressure [bar]
A, B, C = Constants as per chart

Constant	18250
A	0.199
B	449.716
C	17.575

Clamping force diagram



<u>Example 1:</u> Hinge clamps 1825011
Operating pressure 220 bar
Standard clamping lever L = 22 mm

Effective clamping force

$$F_{Sp} = \frac{A}{L} * p = \frac{0.199}{22} * 220 = 2 \text{ kN}$$

<u>Example 2:</u> Hinge clamps 1825010
Operating pressure 220 bar

Min. length of clamping lever

$$L_{min.} = \frac{C}{\frac{B}{p} - 1} = \frac{17.575}{\frac{449.718}{220} - 1} = 16.8 \text{ mm}$$

Effective clamping force

$$F_{Sp} = \frac{A}{L} * p = \frac{0.199}{16.8} * 220 = 2.6 \text{ kN}$$

<u>Example 3:</u> Hinge clamps 1825010
Special clamping lever L = 50 mm

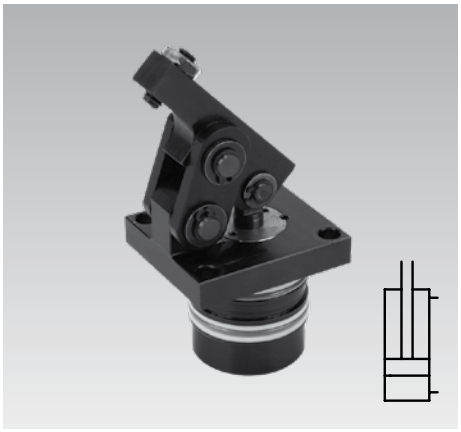
Admissible operating pressure

$$p_{adm} = \frac{B}{\frac{C}{L} + 1} = \frac{449.716}{\frac{17.575}{50} + 1} = 332 > 250 \text{ bar}$$

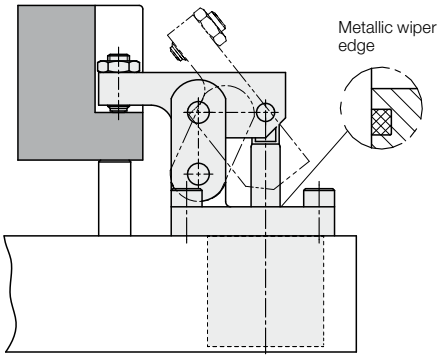
Effective clamping force
The max. operating pressure is 250 bar, thus

$$F_{Sp} = \frac{A}{L} * 250 = \frac{0.199}{50} * 250 = 1 \text{ kN}$$

Mini Hinge Clamps 70 bar
with metallic wiper edge, double acting, max. operating pressure 70 bar



Advantages
- High clamping force at low operating pressure
- Compact design
- Body partially recessible
- Oil supply through drilled channels
- Unimpeded loading and unloading of the fixture when using clamping levers with swivel contact bolt
- Clamping possible without side loads
- Two different clamping levers are available
- Long clamping lever adaptable to the workpiece
- Lever mechanism easy to clean
- Standard metallic wiper edge
- Standard FKM seals
- Mounting position: any

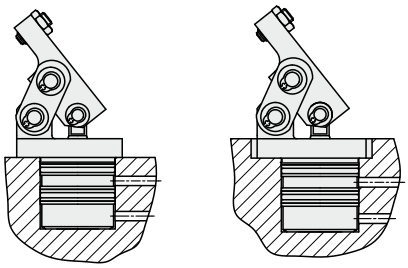


Application
The mini hinge clamp is a low-cost hydraulic clamping element for thin-walled workpieces and reduced space.
The special kinematics allow clamping nearly without side loads of workpieces which are very sensitive against deformation.
A clamping recess in the workpiece a little bit wider than the clamping lever is sufficient as clamping surface.
This line is designed for the direct connection to the machine hydraulics with a max. operating pressure of 70 bar.

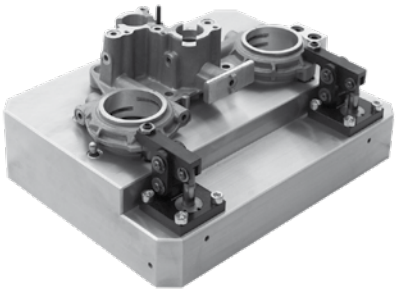
Description
When pressurising the element, the piston moves upwards and swivels the clamping lever over the hinges forwards and at the same time downwards onto the workpiece. The piston force is deviated by 180° and is available as clamping force with virtually no loss of efficiency. During unclamping the clamping lever with swivel contact bolt will be swivelled behind the front edge of the flange, thereby unimpeded loading and unloading of the workpiece is possible.
Workpieces which are very sensitive against deformation are clamped nearly without cross loads, if the clamping surface is at the height of the bearing pins of the clamping lever (34 mm above the flange surface, see page 2).
The optionally available long clamping lever is provided for customer-specific adaptations.

Important notes
Hinge clamps must only be used for clamping of workpieces in industrial applications and may only be operated with hydraulic oil.
Hinge clamps can generate very high forces. The workpiece, the fixture or the machine must be in the position to compensate these forces.
Considerable injuries can be caused to fingers during clamping and unclamping in the effective area of the clamping lever.
The manufacturer of the fixture or the machine is obliged to provide effective protective measures.
Hinge clamps have to be checked regularly on contamination by swarf and have to be cleaned.
Operating conditions, tolerances and other data see data sheet A 0.100.

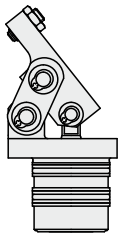
Installation and connecting possibilities
Cartridge type
for horizontally-drilled channels



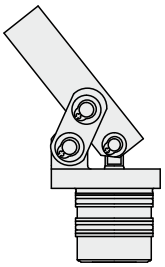
Application example



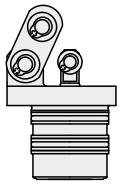
Options for clamping levers
Clamping lever with swivel contact bolt



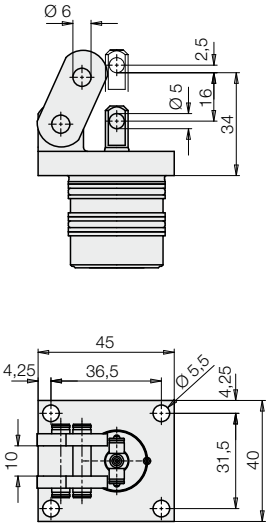
Long clamping lever



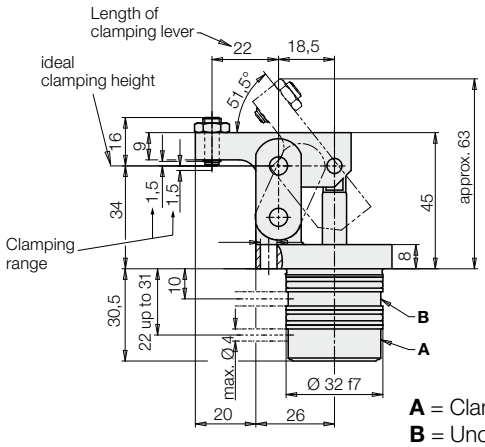
without clamping lever



Without clamping lever
1826010

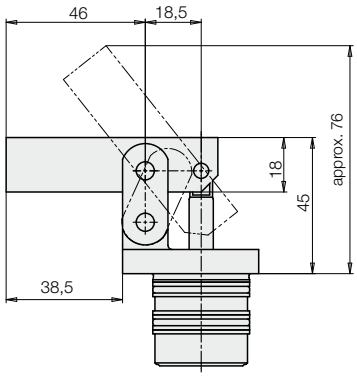


Clamping lever with contact bolt
1826011

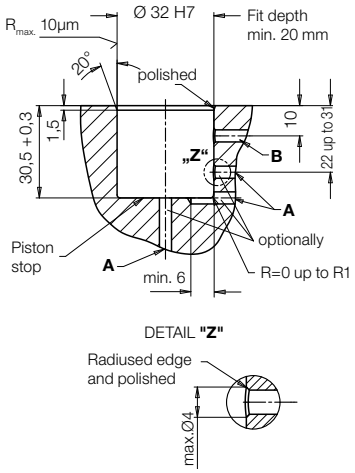


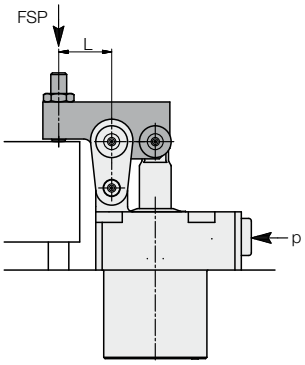
A = Clamping
B = Unclamping

Long clamping lever
1826012

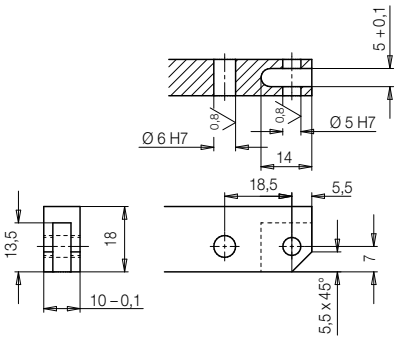


Location hole





Connecting dimensions for self-manufactured clamping levers
Material: C45 + C (1.0503)



Technical data

Clamping force		[kN]	2.3
Max. operating pressure		[bar]	70
Min. operating pressure		[bar]	10
Oil volume	Clamping	[cm³]	7.7
	Unclamping	[cm³]	6.8
Max. flow rate			
	Clamping	[cm³/s]	15
	Unclamping	[cm³/s]	15
Weight	**1826010**	[kg]	0.30
	1826011	[kg]	0.35
	1826012	[kg]	0.39

Calculations

1. Length L of clamping lever is known

1.1 Admissible operating pressure

$$p_{adm} = \frac{B}{\frac{C}{L} + 1} \leq 70 \quad [bar]$$

1.2 Effective clamping force

$p_{adm} > 70$ bar $\rightarrow F_{Sp} = \frac{A}{L} * 70$ [kN]

$p_{adm} < 70$ bar $\rightarrow F_{Sp} = \frac{A}{L} * p_{adm}$ [kN]

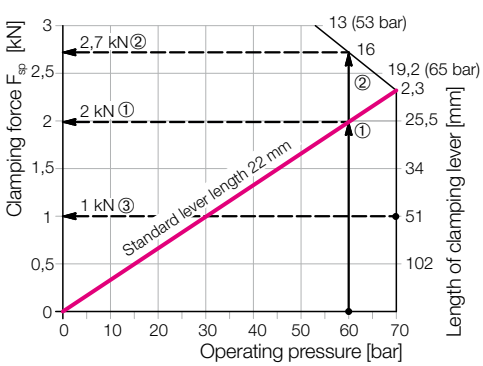
2. Min. length of clamping lever

$$L_{min.} = \frac{C}{\frac{B}{p} - 1} \quad [mm]$$

L, $L_{min.}$ = Length of clamping lever [mm]
p, p_{adm} = Operating pressure [bar]
A, B, C = Constants as per chart

Constant	182601
A	0.73
B	125.92
C	17.575

Clamping force diagram



Example 1: Hinge clamps 1826011
Operating pressure 60 bar
Standard clamping lever L = 22 mm

Effective clamping force

$$F_{Sp} = \frac{A}{L} * p = \frac{0.73}{22} * 60 = 2 \text{ kN}$$

Example 2: Hinge clamps 1826010
Operating pressure 60 bar

Min. length of clamping lever

$$L_{min.} = \frac{C}{\frac{B}{p} - 1} = \frac{17.575}{\frac{125.92}{60} - 1} = 16 \text{ mm}$$

Effective clamping force

$$F_{Sp} = \frac{A}{L} * p = \frac{0.73}{16} * 60 = 2.7 \text{ kN}$$

Example 3: Hinge clamps 1826010
Special clamping lever L = 51 mm

Admissible operating pressure

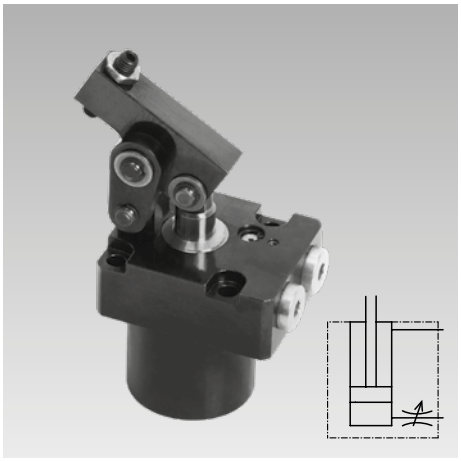
$$p_{adm} = \frac{B}{\frac{C}{L} + 1} = \frac{125.92}{\frac{17.575}{51} + 1} = 93.6 > 70 \text{ bar}$$

Effective clamping force
The max. operating pressure is 70 bar, thus

$$F_{Sp} = \frac{A}{L} * 70 = \frac{0.73}{51} * 70 = 1 \text{ kN}$$

Hinge Clamps 70 bar

with throttle valve, metallic wiper edge and optional position monitoring double acting, max. operating pressure 70 bar



Application

Hydraulic hinge 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.
A clamping recess in the workpiece a little bit wider than the clamping lever is sufficient as clamping surface.
The special kinematics allow clamping without side loads of workpieces which are very sensitive against deformation.
This series with an operating pressure of 70 bar is designed for the direct connection to the low-pressure hydraulics of machine tools.
In combination with the optional pneumatic or electrical position monitorings hinge clamps are particularly suitable for:

- Automatic manufacturing systems with very short cycle times
- Clamping fixtures with workpiece loading by handling systems
- Transfer lines
- Test systems for motors, gears and axes
- Assembly lines
- Special machine tools

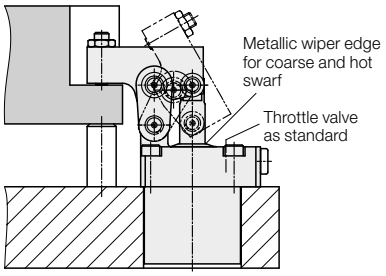
Description

The hinge clamp is a double acting hydraulic cylinder with integrated clamping lever. When pressurising the element, the piston moves upwards and swivels the clamping lever over the hinges forwards and at the same time downwards onto the workpiece. The piston force is deviated by 180° and, depending on the lever length, the force is available as clamping force (see page 4).
The kinematics are so designed that no side loads enter into the workpiece, if the clamping surface is at the same height as the centre of rotation of the clamping lever (see comparison "Forces at the clamping point").
The 3 available clamping directions (L, G, R) make it easier to adapt to the workpiece shape or the hydraulic connectivity.
All sizes are optionally available with switch rod for external position monitoring.
Electrical and pneumatic position monitorings for the clamping and unclamping position are available as accessories.

Important notes see page 6.

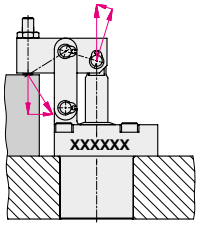
Advantages

- High clamping force in the low-pressure range
- Very short clamping time (min. 0.5 s)
- Throttle valve as standard, easily adjustable from the top
- Compact design partially recessible
- Lever bolt plain bearing
- 3 clamping directions selectable
- Clamping possible without side loads
- Clamping lever can be swivelled into small recesses
- Long clamping lever adaptable to the workpiece contour
- FKM wiper protected by metallic wiper edge
- Position monitoring available as accessory
- Mounting position: any

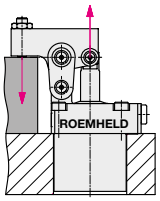


Forces at the clamping point

Conventional lever mechanism of other manufacturers

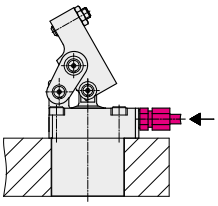


Lever mechanism without side loads ROEMHELD system

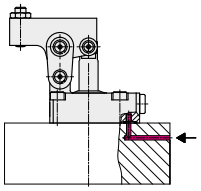


Installation and connecting possibilities

Pipe thread

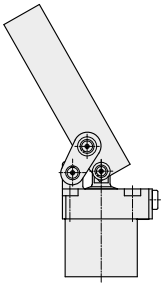


Drilled channels

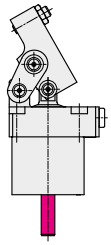


Versions

Without switch rod
(Option Long clamping lever)



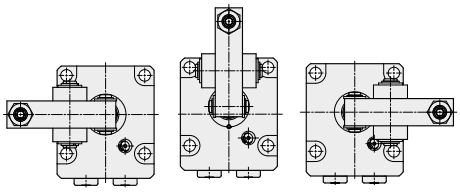
With switch rod



Clamping direction

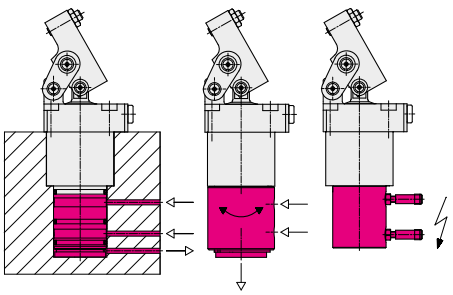
Code letters

L **G** **R**

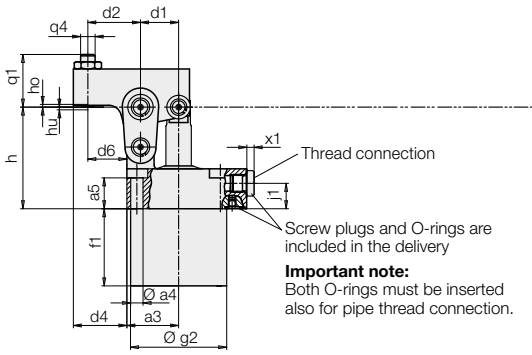


Accessories – position monitoring

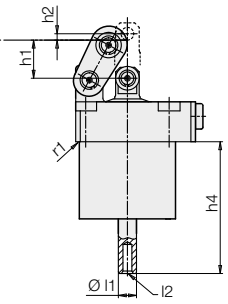
pneumatic **electrical**



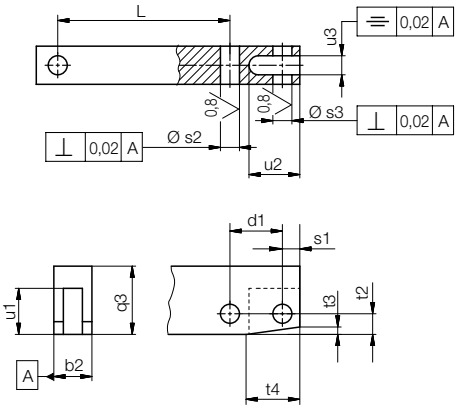
Without switch rod
1826G7X31
Clamping lever with contact bolt

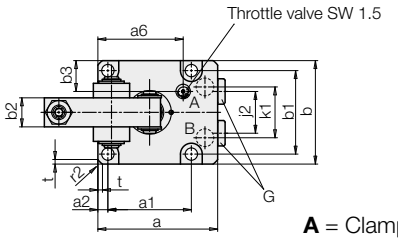


With switch rod
1826G7X40
Without clamping lever



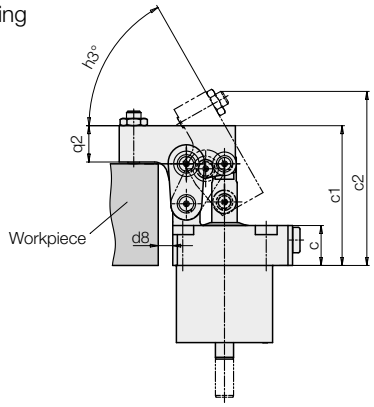
Connecting dimensions for self-manufactured clamping levers



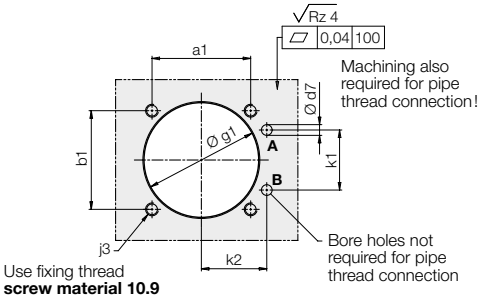


A = Clamping
B = Unclamping

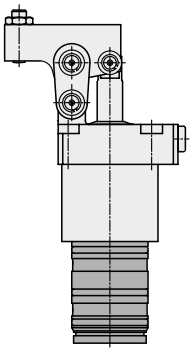
With switch rod
1826G7X41
Clamping lever with contact bolt



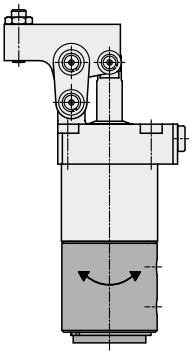
Connecting scheme



Accessories
Pneumatic position monitoring (page 5)
Cartridge type

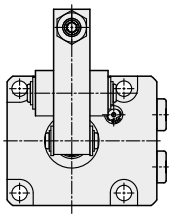


Pipe thread connection

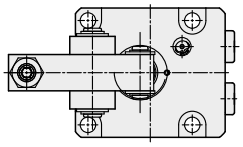


Clamping direction

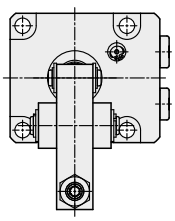
R



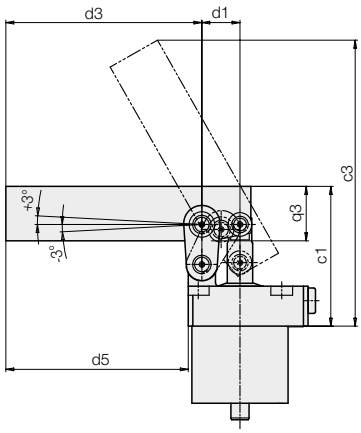
G



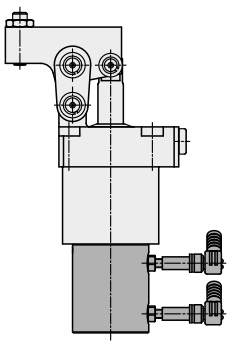
L



With switch rod
1826G7X42
Clamping lever, long



Inductive position monitoring (page 6)



X = code letter for part no.

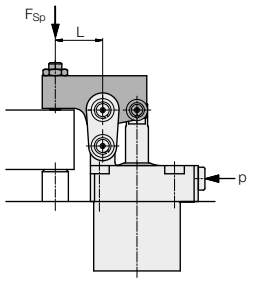
Technical data

Size			**1**	**2**	**3**	**4**	**5**
Max. clamping force	at length of clamping lever d2						
	without switch rod	[kN]	2.6	3.5	4.4	7.3	12.1
	with switch rod	[kN]	2.3	3.1	4	6.8	11.5
Piston force	without switch rod	[kN]	3.4	4.9	6.7	10.6	17.2
	with switch rod	[kN]	3	4.3	6.1	9.8	16.4
Piston Ø		[mm]	25	30	35	44	56
Piston rod Ø		[mm]	12	14	14	16	22
Piston stroke		[mm]	18.7	20.7	24	26	32
Piston area	clamping						
	without switch rod	[cm^2]	4.9	7.06	9.62	15.2	24.6
	with switch rod	[cm^2]	4.4	6.28	8.83	14	23.4
	unclamping	[cm^2]	3.77	5.52	8.08	13.1	20.8
Oil volume	clamping						
	without switch rod	[cm^3]	9.2	14.7	23.1	39.6	78.8
	with switch rod	[cm^3]	8.3	13	21.2	36.6	75.2
	unclamping	[cm^3]	7.1	11.45	19.4	34.3	66.7
Max. flow rate		[cm^3/s]	16	25	40	75	150
a		[mm]	55	60	66	82	96
a1		[mm]	35	40	46	56	68
a2		[mm]	5	5	5.5	7	9
a3		[mm]	22.5	25	28.5	35	43
Ø a4		[mm]	5.6	5.6	6.8	9	11
a5		[mm]	18	17	17	20	20
a6		[mm]	37.5	41	47	57	70.3
b		[mm]	45	50	57	70	86
b1		[mm]	35	40	46	56	68
b2 – 0.05		[mm]	12	12	16	19	22
b3		[mm]	15.5	14	17	20	24
c		[mm]	22	20.8	22	26	32
c1		[mm]	63.5	68.5	77	93	110
c2		[mm]	79.8	85.5	97	116.5	138.9
c3		[mm]	129.1	152.8	157.6	204	226.8
d1		[mm]	16.5	18.5	21	24.5	30.5
d2		[mm]	20	23.5	29	32	39
d3		[mm]	88	110.5	108	148.5	159.5
d4		[mm]	20	23	29.5	31.5	37.5
d5		[mm]	82	104	100.5	138	147
d6		[mm]	14	17	21.5	21.5	26.5
Ø d7 max.		[mm]	4	4	4	6	6
d8 min.		[mm]	3	4	7	7	8
f1		[mm]	33,5	39,5	42,5	47	55
G			G1/8	G1/8	G1/8	G1/4	G1/4
Ø g1 max.		[mm]	40	48	54	64	79
Ø g2 ±0.1		[mm]	39	47	53	63	78
h	ideal clamping point	[mm]	48.5	51.5	56	67	79
ho	upper end of the clamping range	[mm]	1	1.2	1.5	1.8	2
hu	lower end of the clamping range	[mm]	1.1	1.3	1.5	1.7	2.1
h1	stroke up to the ideal clamping point	[mm]	15.7	17.7	21	23	29
h2	stroke up to the end of the clamping stroke	[mm]	3	3	3	3	3
h3		[°]	57.6	58.6	60.4	57.6	57.4
h4	unclamping position	[mm]	60.2	68.2	72.6	78.1	93.6
j1		[mm]	12.5	12.8	14	14	14
j2		[mm]	20	22	23	30	38
j3	fixing thread		M5	M5	M6	M8	M10
k1		[mm]	22	24	28	36	45
k2		[mm]	25	28	30.5	36	42
Ø l1 f7		[mm]	8	10	10	12	12
l2			M5x15 deep	M6x11.5 deep	M6x11.5 deep	M8x16 deep	M8x16 deep
q1		[mm]	26	26	29	39	48
q2		[mm]	14	16	20	25	30
q3		[mm]	21.5	26	30	36.5	45
q4			M6	M6	M8	M10	M12
r1		[mm]	0.4	0.4	0.4	0.4	0.4
r2		[mm]	7	9	9	11	12
s1		[mm]	5.5	6	6	7	10
Ø s2 H7		[mm]	6	8	8	10	14
Ø s3 H7		[mm]	6	6	7	8	12
t		[mm]	2.4	3.9	2.5	4	4.7
t2		[mm]	6.5	9	9	10.5	14
t3		[mm]	4	3	4.3	5.1	6.6
t4		[mm]	4	17	22	22	31
u1		[mm]	14.5	17.5	17.5	19	28
u2		[mm]	16	16.5	17	19	26
u3 +0.1		[mm]	6.1	6.1	8.1	10.1	11.1
x1		[mm]	4	4	4	5	5
Weight		[kg]	1	1.2	1.5	2.6	4.5
Part no. without switch rod							
without clamping lever			**1826X7130**	**1826X7230**	**1826X7330**	**1826X7430**	**1826X7530**
Clamping lever with contact bolt			**1826X7131**	**1826X7231**	**1826X7331**	**1826X7431**	**1826X7531**
Clamping lever, long			**1826X7132**	**1826X7232**	**1826X7332**	**1826X7432**	**1826X7532**
Part no. with switch rod							
without clamping lever			**1826X7140**	**1826X7240**	**1826X7340**	**1826X7440**	**1826X7540**
Clamping lever with contact bolt			**1826X7141**	**1826X7241**	**1826X7341**	**1826X7441**	**1826X7541**
Clamping lever, long			**1826X7142**	**1826X7242**	**1826X7342**	**1826X7442**	**1826X7542**
Spare O-ring		[mm]	7x1.5	7x1.5	7x1.5	8x1.5	8x1.5
Part no.			**3000342**	**3000342**	**3000342**	**3000343**	**3000343**

X = Code letter see page 2

Clamping force diagrams

Calculation of the clamping force



1. Length L of clamping lever is known

1.1 Admissible operating pressure

$$p = \frac{B}{(C/L) + 1} \leq 70 \quad [bar]$$

1.2 Effective clamping force

$(p_{adm} > 70\ bar) \rightarrow F_{sp} = \frac{A}{L} * 70 \quad [kN]$

$(p_{adm} > 70\ bar) \rightarrow F_{sp} = \frac{A}{L} * p_{adm} \quad [kN]$

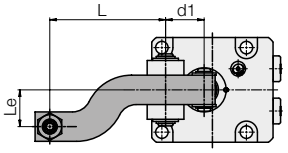
2. Min. length of clamping lever

$$L_{min.} = \frac{C}{(B/p) - 1} \quad [mm]$$

L, $L_{min.}$ = length of clamping lever [mm]
p, $p_{adm.}$ = operating pressure [bar]
A, B, C, = constants as per chart
A*, B* for version with switch rod

1826	71	72	73	74	75
A	0.73	1.18	1.82	3.35	6.76
A*	0.65	1.05	1.67	3.11	6.45
B	121.97	119.6	115.62	118.23	119.27
B*	135.89	134.4	125.9	127.73	125
C	14.85	16.65	18.9	22.05	27.45

Eccentric clamping lever



The diagrams show the admissible operating pressure for any combination of length L of clamping lever and the eccentricity Le.

Formula $p_{adm} = \frac{X * L}{(Y * Le) + L + Z}$ [bar]

L = length of clamping lever,
Le = eccentricity [mm]
X, Y, Z = constant as per chart
X* for version with switch rod

1826	71	72	73	74	75
X	127.77	125.12	120.69	123.6	124.75
X*	142.34	140.76	131.43	133.49	130.74
Y	3.666	3.7	3.5	3.379	3.588
Z	16.5	18.5	21	24.5	30.5

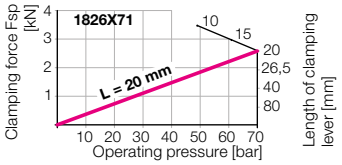
Example: Hinge clamp 1826G**72**
Special clamping lever L = 60 mm
Eccentricity Le = 45 mm
As per diagram: p_{adm} = approx. 30 bar
According to formula:

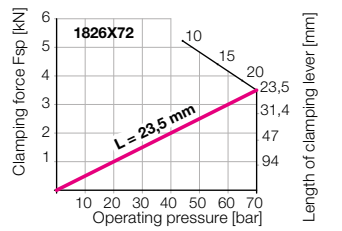
$$p_{adm} = \frac{X * L}{(y * Le) + L + Z} = \frac{125.12 * 60}{(3.7 * 45) + 60 + 18.5}$$

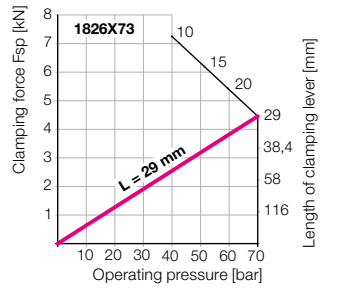
p_{adm} = 30.64 bar

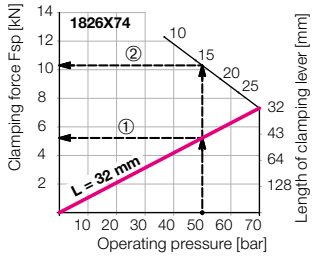
Effective clamping force (formula see above)

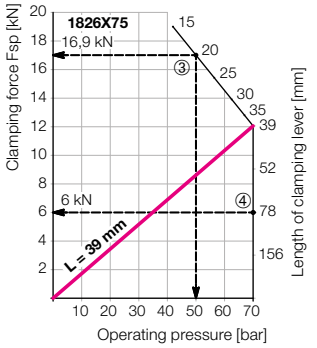
$$F_{Sp} = \frac{A}{L} * p_{adm} = \frac{1.18}{60} * 30.64 = 0.6\ kN$$











Example 1: Hinge clamp 1826G**74**32
p = 50 bar; L = 32 mm

Effective clamping force

$$F_{Sp} = \frac{A}{L} * p = \frac{3.35}{32} * 50 = 5.2\ kN$$

Example 2: Hinge clamp 1826G**74**32
p = 50 bar

Min. length of clamping lever

$$L_{min} = \frac{C}{(B/p) - 1} = \frac{22.05}{(118.23/50) - 1} = 16\ mm$$

Effective clamping force

$$F_{Sp} = \frac{A}{L} * p = \frac{3.35}{16} * 50 = 10.4\ kN$$

Example 3: Hinge clamp 1826G**75**32
Special clamping lever L = 20 mm

Admissible operating pressure

$$p_{adm} = \frac{B}{(C/L) + 1} = \frac{119.26}{(27.45/20) + 1} = 50.2\ bar$$

Effective clamping force

$$F_{Sp} = \frac{A}{L} * p_{adm} = \frac{6.76}{20} * 50.2 = 16.96\ kN$$

Example 4: Hinge clamp 1826G**75**32
Special clamping lever L = 78 mm

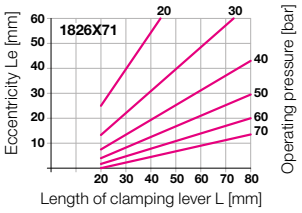
Admissible operating pressure

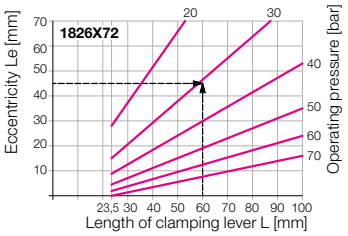
$$p_{adm} = \frac{B}{(C/L) + 1} = \frac{119.26}{(27.45/78) + 1} = 88.2\ bar$$

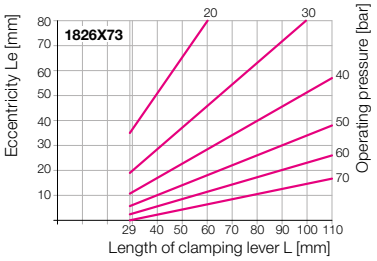
Effective clamping force
The max. operating pressure is 70 bar, thus

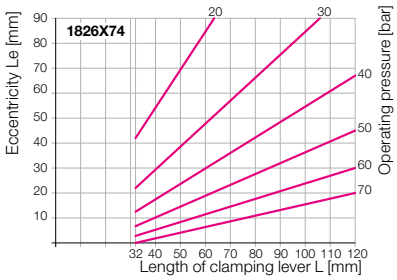
$$F_{Sp} = \frac{A}{L} * 70 = \frac{6.76}{78} * 70 = 6\ kN$$

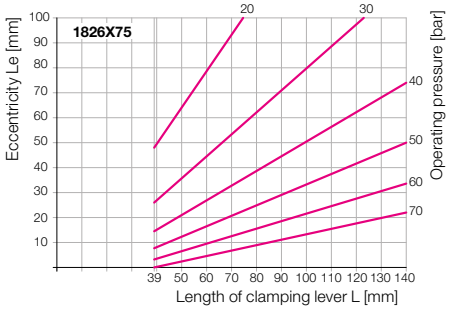
Admissible operating pressure p_{adm} at eccentric location of the clamping point











Important note

Depending on the eccentric load, there will be a one-sided wear of the bolts and an increasing torsion of the clamping lever around the longitudinal axis.
Recommendation: Regular visual inspection

Application

The pneumatic position monitoring signals the following conditions by closing two bore holes:

1. Piston retracted and clamping lever in off-position
2. Piston in clamping area and clamping lever in clamping position.

For each control function, a pneumatic line has to be provided at the clamping fixture.

Description

When moving to a switching position, the air pressure in the supply line increases and operates a differential pressure switch or an electro-pneumatic pressure switch.

Pneumatic port

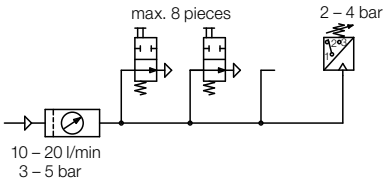
Cartridge type

The hinge clamp with the mounted position monitoring and inserted O-rings is put into the location hole and immediately ready for use.

Mounting body

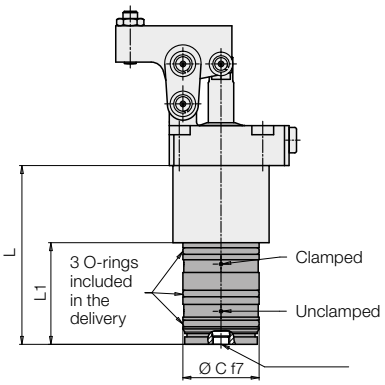
The mounting body is put onto the cartridge-type version and held by the supplied safety ring. The pneumatic ports M5 can be rotated by 360°.

Monitoring by pneumatic pressure switch

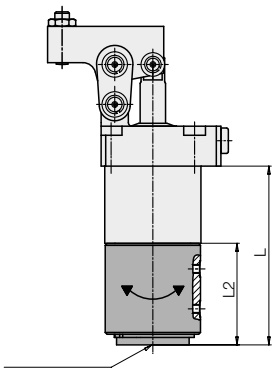


For the evaluation of the pneumatic pressure increase, standard pneumatic pressure switches can be used. With one pressure switch up to 8 position monitorings can be controlled (see circuit diagram).
It has to be considered that process-safe functioning of pneumatic controls is only guaranteed with throttled air pressure and air flow rate.

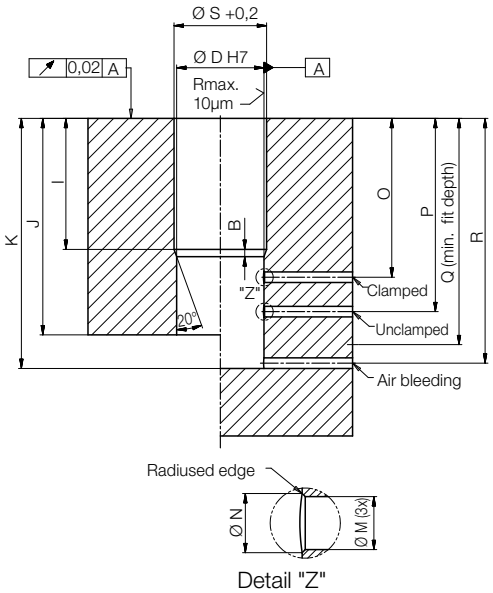
Cartridge type



Pipe thread connection

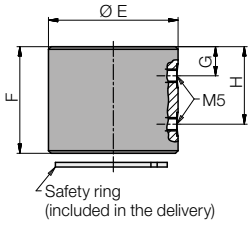


Location hole



Detail "Z"

Mounting body



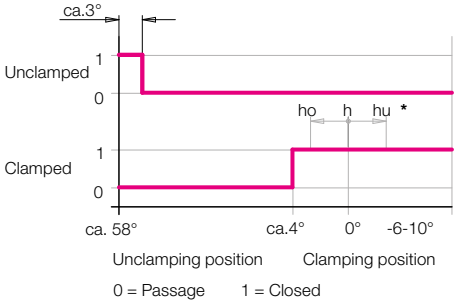
Technical data

Connection	Drilled channels or threads M5
Nominal diameter	2 mm
Max. air pressure	10 bar
Range of operating pressure	3…5 bar
Differential pressure*) at	
3 bar system pressure	min. 1.5 bar
5 bar system pressure	min. 3.5 bar
Air volume **)	10…20 l/min

*) Minimum pressure difference, if one or several position monitorings are not operated.

**) For measuring of the flow rate appropriate devices are available.

Function chart



Size		**1**	**2**	**3**	**4**	**5**
Ø A ±0.1	[mm]	39	47	53	63	78
B	[mm]	1.3	2	2	2	2
Ø C f7	[mm]	38	42	42	45	45
Ø D H7	[mm]	38	42	42	45	45
Ø E	[mm]	49	53	52.5	62.5	62.5
F	[mm]	40.3	46	50	54	60
G	[mm]	11	13	14	14	15
H	[mm]	29.3	33	36	40	45
I +0.2	[mm]	34	40	43	47.5	55.5
J min.	[mm]	78	87	91	100	114
K min.	[mm]	84	95	100	109	123
L	[mm]	82.5	93.5	98.5	107	121.5
L1	[mm]	49	54	56	60	66.5
L2	[mm]	46.15	53.85	55.8	59.8	65.8
Ø M	[mm]	4	4	4	4	4
Ø N	[mm]	5	5	5	5	5
O	[mm]	46	52	55.5	60	70.6
P	[mm]	65	74	80	86	100.5
Q min.	[mm]	77	85	90	98.5	113
R	[mm]	79.5	90.5	95.5	104	118.5
Ø S max.	[mm]	40	48	54	64	79
Part no.						
Cartridge type with 4 screws		**0353341**	**0353342**	**0353343**	**0353344**	**0353345**
Mounting body for retrofitting of the cartridge type		**0353341A**	**0353342A**	**0353343A**	**0353344A**	**0353345A**

***** Dimensions see page 2 and 3

Application

The electrical position monitoring signals the following conditions due to damping of two inductive proximity switches:

1. Piston retracted and clamping lever in off-position
2. Piston extended and clamping lever in off-position.

For each control function, an electrical line has to be provided at the clamping fixture.

Description

The electrical position monitoring can be easily retrofitted at all hinge clamps with switch rod (1826**X**7X**4**X) .

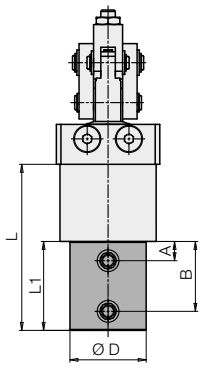
Included in our delivery are:

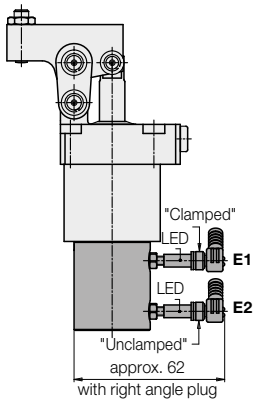
1 Signal sleeve with screw
1 Adapter with 4 countersunk screws
1 Control housing with 3 set screws
2 Inductive proximity switches with right angle plug (if ordered)

The signal sleeve is screwed onto the switch rod. The adapter is mounted with 4 countersunk screws at the bottom cover.
The control housing can be put onto the adapter in any angular position and locked with 3 set screws.
For information on adjustment of proximity switches, see operating manual.

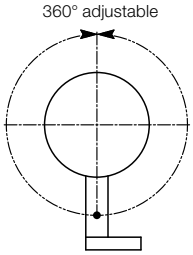
Important notes

Inductive position monitorings are not suitable for the use in coolant and swarf areas. According to the corresponding application conditions, safety measures have to be planned and checked later on.





Four fixing screws included in our delivery



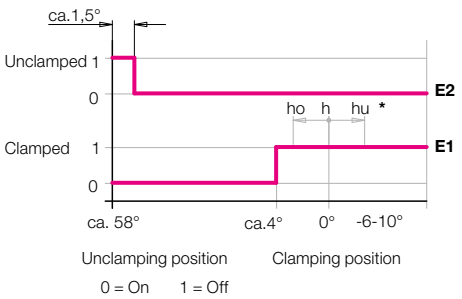
Possible position of the proximity switches

Technical data

Operating voltage	10…30 V DC
Max. residual ripple	10 %
Max. constant current	100 mA
Switching function	interlock
Output	PNP
Housing material	stainless steel
Thread	M 5 x 0.5
Code class	IP 67
Ambient temperature	–25…+70 °C
LED Function display	yes
Protected against short circuits	yes
Connection type	Plug
Length of cable	5 m

Size		**1**	**2**	**3**	**4**	**5**
A	[mm]	12.5	12.5	10.5	10	12
B	[mm]	35	37	38.5	42.5	50
Ø D	[mm]	33	42	42	45	45
L	[mm]	75.5	84.5	91.5	103.5	117
L1	[mm]	42	45	49	56.5	62
Part no.						
without switch		**0353351**	**0353352**	**0353353**	**0353354**	**0353355**
with switch and plug		**0353351S**	**0353352S**	**0353353S**	**0353354S**	**0353355S**
Spare parts						
Inductive proximity switch		**3829198**	**3829198**	**3829198**	**3829198**	**3829198**
Right angle plug with cable 5m		**3829099**	**3829099**	**3829099**	**3829099**	**3829099**

Function chart



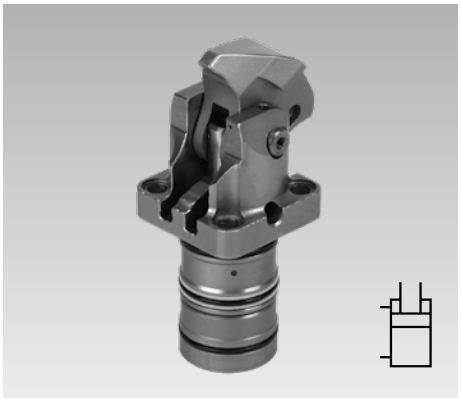
***** Dimensions see page 2 and 3

Important notes

Hinge clamps must only be used for clamping of workpieces in industrial applications and may only be operated with hydraulic oil.
Hinge clamps can generate very high forces. The workpiece, the fixture or the machine must be in the position to compensate these forces. Considerable injuries can be caused to fingers during clamping and unclamping in the effective area of the clamping lever.
The manufacturer of the fixture or the machine is obliged to provide effective protection devices.
Hinge clamps have to be checked regularly on contamination by swarf and have to be cleaned.
Operating conditions, tolerances and other data see data sheet A 0.100.

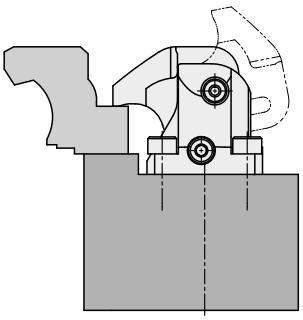
Compact Clamps

Cartridge type, pneumatic position monitoring optional, double acting, max. operating pressure 250 bar



Advantages

- Minimum dimensions
- Partially immersed body
- Mounting without pipes
- Metallic wiper edge for piston rod
- Clamping lever can be swivelled into small recesses
- Workpiece clamping without any side loads
- Unimpeded loading and unloading of the clamping fixture
- Long clamping lever adaptable to the workpiece
- Universal lever for adapting customised clamping levers
- Mounting position: any



Application

Compact clamps are designed for application in hydraulic clamping fixtures where oil supply is effected through drilled channels in the fixture body.
Due to the minimum space required, the compact clamp is especially suitable for clamping fixtures with little space for the installation of hydraulic clamping elements.
A clamping recess in the workpiece a little bit wider than the clamping lever is sufficient as clamping surface. Typical applications are:

- Rotary indexing fixtures in horizontal and vertical machining centres
- Clamping fixtures for machining of several sides and complete machining
- Multiple clamping fixtures with many workpieces that are closely arranged
- Test systems for motors, gears, etc.
- Assembly lines

Description

The hydraulic compact clamp is a double-acting pull-type cylinder where a part of the linear stroke is used to swing the clamping lever onto the workpiece.
The version with cover is inserted in open bore holes and enables the smallest possible building height.
The version without cover requires a closed pocket hole.

Available versions

1. **With pneumatic clamping monitoring** **180X 1XX**
   The clamping monitoring signals:
   "The clamping lever is within the usable clamping range and the workpiece is clamped with minimum clamping force (min. 70 bar)."
2. **With pneumatic unclamping monitoring** **180X 1XXA**
   The unclamping monitoring signals:
   "The clamping lever is within the unclamping range, starting approx. 10° before the final position."
3. **Without position monitoring** **180X 1XXB**

Pneumatic position monitoring see page 6

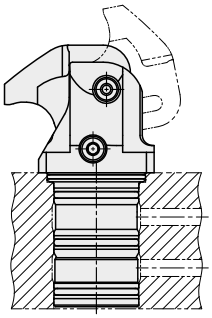
Important notes

(see page 5)

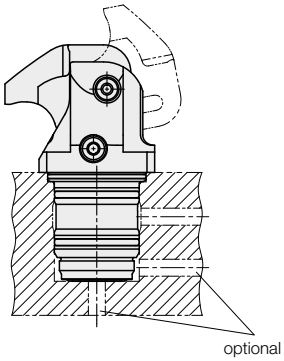
Installation and connecting possibilities

Drilled channels

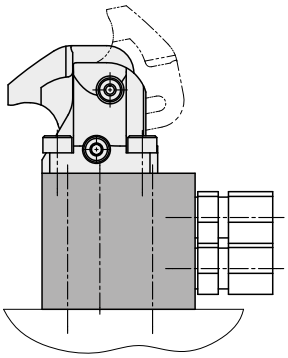
with cover



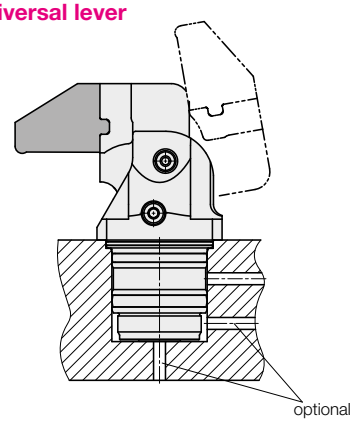
without cover



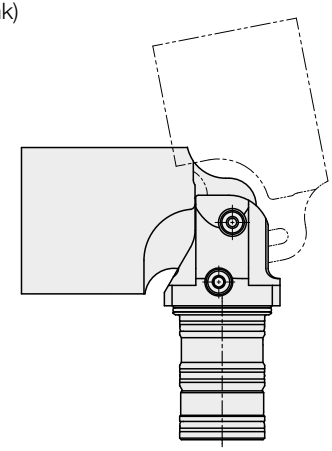
Pipe thread
with accessory
Mounting body



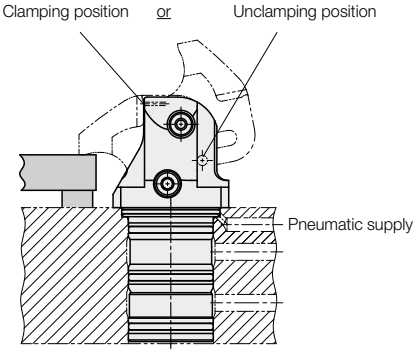
Universal lever



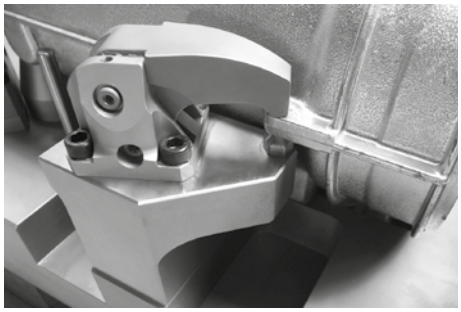
Long clamping lever
(blank)



Pneumatic position monitoring

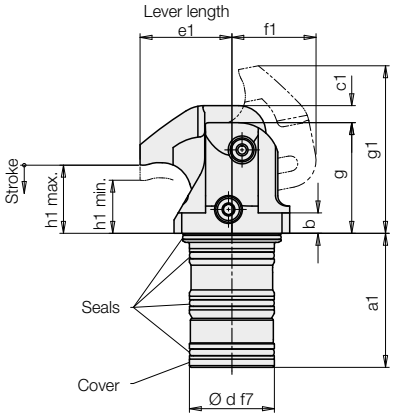


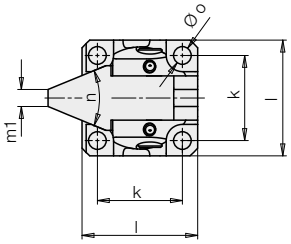
Application example



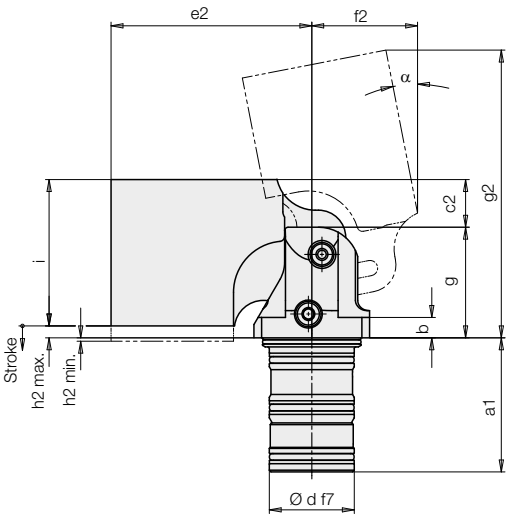
Clamping of a cast part

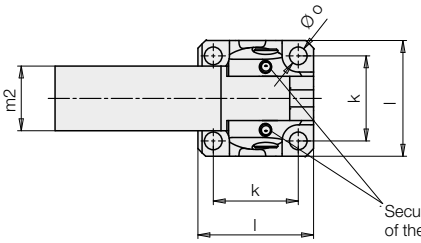
With cover
Short clamping lever 180X110





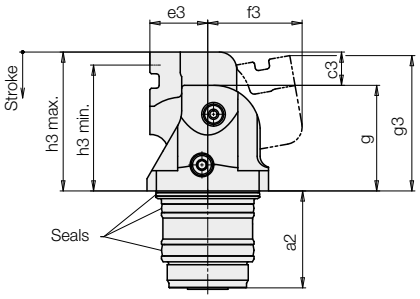
Long clamping lever (blank) **180X130**





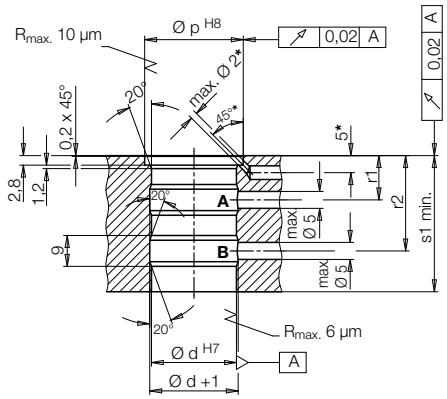
Secure set screw after assembly of the clamping lever with thread glue!

Without cover
Universal lever 180X150

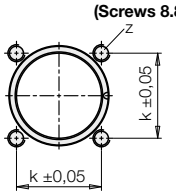


Pneumatic position monitoring
see page 6

Bore hole open (with cover)



(Screws 8.8)



Materials

Body	hardened, stainless
Clamping lever: short long (blank)	HRc 48 – 55, stainless X37 Cr Mo V5-1 hardened and tempered HRc 40 and nitrated
Seals	NBR and PUR (max. 80 °C)

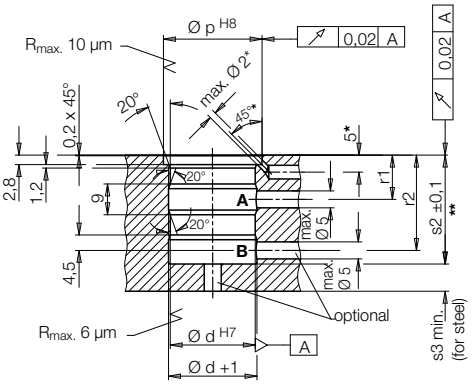
Accessories
Mounting body (see page 4)

A = Clamping
B = Unclamping

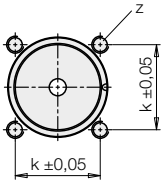
* Bore holes for pneumatic clamping and unclamping monitoring, only if required.

** Dimension s2 ±0.1 must be met, otherwise the piston will strike the bottom of the pocket hole.

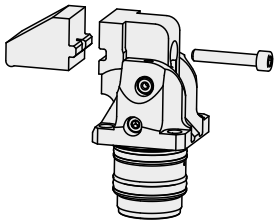
Pocket hole (without cover)



(Screws 12.9 required)

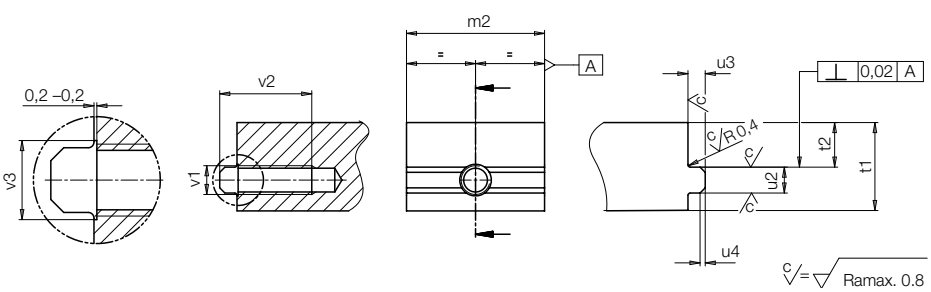


Universal lever



The compact clamp with universal lever and integrated swing mechanism enables the fixing of customised clamping levers, which are relatively easy to manufacture.
The fixing screw 12.9 included in our delivery. Tightening torque see chart page 3.

Connecting dimensions to the flange of the universal lever

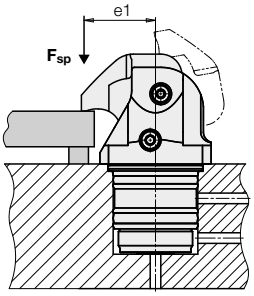


Technical data

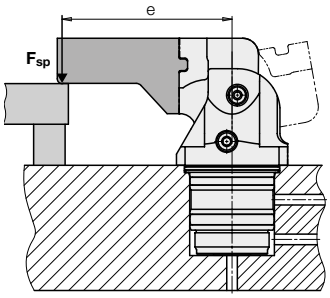
Size		**1**	**2**	**3**	**4**
Clamping force at 250 bar (short clamping lever)	[kN]	3.2	4.5	7.5	11.5
Max. stroke	[mm]	5	5	7	8.5
Clamping stroke, usable	[mm]	4.5	4.5	6.5	8
Piston Ø/piston rod Ø	[mm]	18 / 11	22 / 14	28 / 17	33 / 19
Oil volume clamping/unclamping	[cm^3]	2.3 / 3.6	3.2 / 5.4	6.4 / 10.2	10.5 / 15.7
Max. flow rate	[cm^3/s]	8	11	22	35
Minimum pressure without clamping monitoring	[bar]	20	20	20	20
with clamping monitoring	[bar]	70	70	70	70
with unclamping monitoring	[bar]	20	20	20	20
Min. air pressure	[bar]	3	3	3	3
α ±1	[°]	13.5	10.5	14	16
a1	[mm]	39.4	43	48.5	50.5
a2	[mm]	32	34	40.6	40.8
b	[mm]	6	7	10	10
c1	[mm]	5	5	7	8.5
c2	[mm]	14	12	7	8.5
c3	[mm]	14	16	16	22.5
Ød H7/f7	[mm]	25	32	40	45
e1	[mm]	27	28	36.5	36.5
e2	[mm]	59	60	67.5	67.5
e3	[mm]	17	20	22	22
f1	[mm]	24,7	25,9	31,3	33,8
f2	[mm]	30,7	30,5	31,3	33,8
f3	[mm]	34,3	37	40,4	48,1
g	[mm]	32,5	36,5	43	46
g1 max.*	[mm]	49,3	51	63	64,8
g2 min./max.*	[mm]	85 / 87,5	86 / 89,5	97,7 / 99,7	100,9 / 103
g3	[mm]	44	47,2	55,4	60,6
h1 min. / h1 max.	[mm]	15.5 / 20	15.5 / 20	15.5 / 22	15.5 / 23.5
h2 min. / h2 max.	[mm]	1 / 3.5	2 / 2.5	1 / 5.5	1 / 7
h3 min. / h3 max.	[mm]	42 / 46.5	48 / 52.5	52.5 / 59	60.5 / 68.5
i	[mm]	43	46	44.5	47.5
k	[mm]	25	31	36.5	41
l	[mm]	34	42	48	55
m1	[mm]	5	6	8	8
m2	[mm]	21	26	32	35
n	[°]	50.4	55.8	56.1	62
Ø o	[mm]	5.2	6.2	6.2	8.2
Ø p H8	[mm]	29	36	44	49
r1	[mm]	13	13	14	14
r2	[mm]	28	28	31	31
s1 min.	[mm]	40	43.5	49	51
s2 ±0,1	[mm]	32	34	40.6	40.8
s3 min.	[mm]	6	7	9	10
t1	[mm]	20	23	23	29
t2	[mm]	8.5	12	10	17
u2 –0,05	[mm]	4	5	6	6
u3	[mm]	2	3	4	4
u4	[mm]	0.9x45°	1x45°	1.3x45°	1.3x45°
v1 x v2	[mm]	M5 x 10	M5 x 10	M8 x 17	M8 x 17
Ø v3	[mm]	5.5	5.5	8.5	8.5
z	[mm]	M5	M6	M6	M8
With pneumatic clamping monitoring Version with cover					
Part no. - short clamping lever		**1801 110**	**1802 110**	**1803 110**	**1804 110**
Weight, approx.	[kg]	0.3	0.53	0.92	1.17
Part no. - long clamping lever (blank)		**1801 130**	**1802 130**	**1803 130**	**1804 130**
Weight, approx.	[kg]	0.57	0.88	1.4	1.7
Part no. - universal lever		**1801 150**	**1802 150**	**1803 150**	**1804 150**
Weight, approx.	[kg]	0.32	0.57	0.93	1.06
Version without cover**					
Part no. - short clamping lever		**1801 111**	**1802 111**	**1803 111*****	**1804 111**
Weight, approx.	[kg]	0.27	0.46	0.82	1.03
Part no. - long clamping lever (blank)		**1801 131**	**1802 131**	**1803 131*****	**1804 131**
Weight, approx.	[kg]	0.54	0.82	1.3	1.56
Part no. - universal lever		**1801 151**	**1802 151**	**1803 151*****	**1804 151**
Weight, approx.	[kg]	0.29	0.51	0.83	0.92
With pneumatic unclamping monitoring					
Part no. (version see above)		**1801 1XXA**	**1802 1XXA**	**1803 1XXA**	**1804 1XXA**
Without position monitoring					
Part no. (version see above)		**1801 1XXB**	**1802 1XXB**	**1803 1XXB**	**1804 1XXB**
Accessories					
Part no. - short clamping lever		**3548 1121**	**3548 1122**	**3548 1123**	**3548 1124**
Part no. - long clamping lever (blank)		**3548 1071**	**3548 1072**	**3548 1073**	**3548 1074**
Part no. - universal lever		**3548 4111**	**3548 4112**	**3548 4113**	**3548 4114**
Screw for universal lever	[mm]	M5x30 –12.9	M5x30 –12.9	M8x35 –12.9	M8x35 –12.9
Tightening torque	[Nm]	10	10	42	42
Part no.		**3301 1019**	**3301 1019**	**3301 468**	**3301 468**

* min. = height in unclamping position as presented. max. = max. height for swinging
** use screw material12.9; *** max. operating pressure 200 bar

Short clamping lever



Universal clamping lever



Calculation of the clamping force

1. Clamping lever length e is known

1.1 Admissible clamping force as a function of the clamping lever length e

$$F_{adm} = \frac{A}{e - B} \quad [kN]$$

1.2 Admissible operating pressure

$$p_{adm} = \frac{F_{adm} * 100}{C} \left(\frac{e - B}{D} + 1 \right) \quad [bar]$$

1.3 Effective clamping force at other pressure p

1.3.1 F_{adm} = and p_{adm} are known

$$F_{sp} = F_{adm} \frac{p}{p_{adm}} \leq F_{adm} \quad [kN]$$

1.3.2 In general:

$$F_{sp} = \frac{C}{\left(\frac{e - B}{D} + 1\right) * 100} * p \leq F_{adm} \quad [kN]$$

2. Maximum clamping lever length depending on the existing operating pressure

$$e_{max} = \frac{A}{(C * 0.01 * p) - E} + B \quad [mm]$$

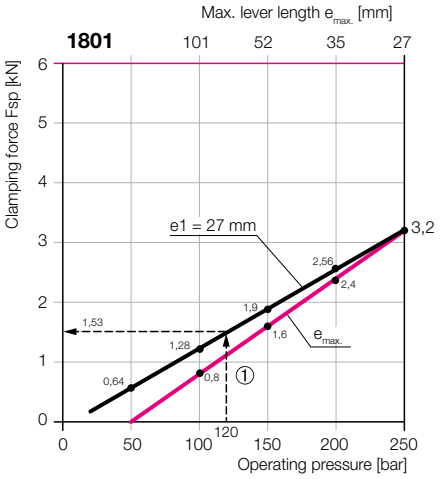
F_{sp}, $F_{adm.}$	= Clamping force	[kN]
e, e1, $e_{max.}$	= Clamping lever length	[mm]
p, $p_{adm.}$	= Operating pressure	[bar]
A…E	= Constants as per chart	

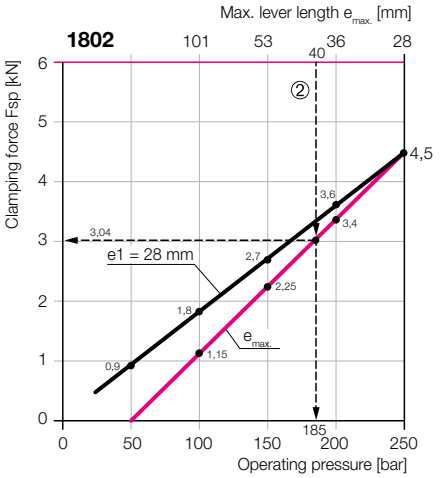
Enter the variables in the above units into the formulas

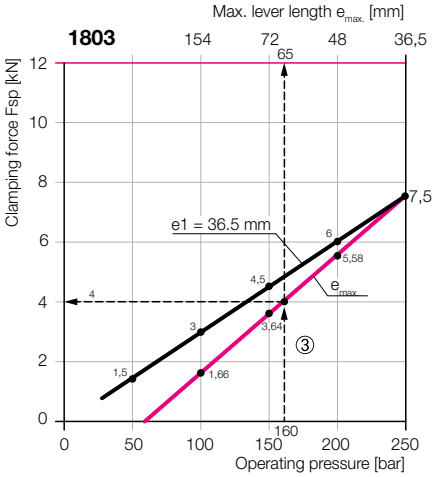
Constants

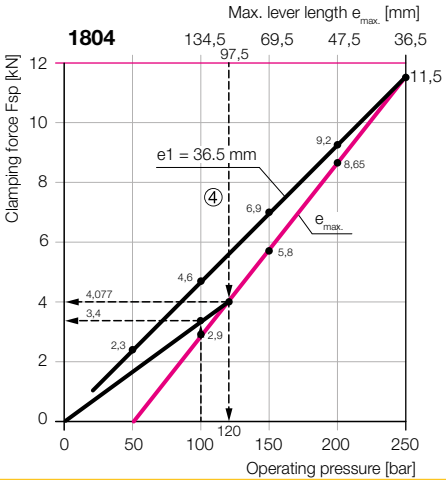
Size	1801	1802	1803	1804
A	80	112.5	251.3	385.3
B	2	3	3	3
C	1.594	2.262	3.888	5.718
D	101.7	97.62	113	138.1
E	0.787	1.152	2.224	2.789

Clamping force diagrams









Example ① Compact clamp 1801 110
Series clamping lever e1 = 27 mm
F_{adm} = 3.2 kN at p_{adm} = 250 bar
Operating pressure p = 120 bar

Effective clamping force

$$F_{Sp} = F_{adm} \frac{P}{p_{adm}} = 3.2 \frac{120}{250} = 1.536 \text{ kN}$$

alternative

$$F_{Sp} = \frac{C}{\left(\frac{e - B}{D} + 1\right) * 100} * p$$

$$F_{Sp} = \frac{1.594}{\left(\frac{27 - 2}{101,7} + 1\right) * 100} * 120$$

$$F_{Sp} = 1.535 \text{ kN}$$

Example ② Compact clamp 1802 110
Series clamping lever e = 40 mm

Admissible clamping force

$$F_{adm} = \frac{A}{e - B} = \frac{112.5}{40 - 3} = 3.04 \text{ kN}$$

Admissible operating pressure

$$p_{adm} = \frac{F_{adm} * 100}{C} * \left(\frac{e - B}{D} + 1 \right)$$

$$p_{adm} = \frac{3.04 * 100}{2.262} * \left(\frac{40 - 3}{97.62} + 1 \right)$$

$$p_{adm} = 185 \text{ bar}$$

Example ③ Compact clamp 1803 110
Operating pressure p = 160 bar
Special clamping lever

Maximum clamping lever length

$$e_{max} = \frac{A}{(C * 0.01 * p) - E} + B$$

$$e_{max} = \frac{251.3}{(3.888 * 0.01 * 160) - 2.224} + 3$$

$$e_{max} = 65.875 \text{ mm} \rightarrow 65 \text{ mm}$$

Maximum clamping force

$$F_{Sp} = \frac{C}{\left(\frac{e - B}{D} + 1\right) * 100} * p$$

$$F_{Sp} = \frac{3.888}{\left(\frac{65 - 3}{113} + 1\right) * 100} * 160$$

$$F_{Sp} = 4 \text{ kN}$$

Example ④ Compact clamp 1804 110
Special clamping lever e = 97.5 mm

Admissible clamping force

$$F_{adm} = \frac{A}{e - B} = \frac{385.3}{97.5 - 3} = 4.077 \text{ kN}$$

Admissible operating pressure

$$p_{adm} = \frac{F_{adm} * 100}{C} * \left(\frac{e - B}{D} + 1 \right)$$

$$p_{adm} = \frac{4.077 * 100}{5.718} * \left(\frac{97.5 - 3}{138.1} + 1 \right)$$

$$p_{adm} = 120 \text{ bar}$$

Effective clamping force at 100 bar

$$F_{Sp} = \frac{C}{\left(\frac{e - B}{D} + 1\right) * 100} * p$$

$$F_{Sp} = \frac{5.718}{\left(\frac{97,5 - 3}{138,1} + 1\right) * 100} * 100$$

$$F_{Sp} = 3.4 \text{ kN}$$

Admissible flow rate

The admissible flow rate as per the chart on page 3 refers to the “short” clamping lever. Thus the clamping time is approx. 0.6 seconds and the unclamping time approx. 1 second.
Longer clamping levers with larger mass moments of inertia cause higher loads on the swing mechanism, which results in higher wear. The end stop during unclamping is also critical. Therefore, the flow rate should be reduced with longer clamping levers according to the following formula:

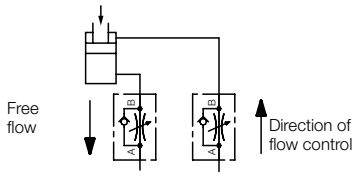
$$Q_L = Q_k * \sqrt{\frac{J_K}{J_L}} \ cm^3/s$$

Q_L = Adm. flow rate with longer special clamping lever
Q_K = Adm. flow rate with “short” clamping lever as per the chart on page 3
J_K = Moment of inertia of the “short” clamping lever (see chart)
J_L = Moment of inertia of the special clamping lever

$$\text{Clamping time } t_{Sp} = \frac{\text{Oil volume clamping } [cm^3]}{\text{Adm. flow rate } \frac{[cm^3]}{s}} \ [s]$$

Throttling of the flow rate

A flow rate throttling has to be effected in the supply line to the compact clamp. This avoids a pressure intensification and thereby pressures exceeding 250 bar.

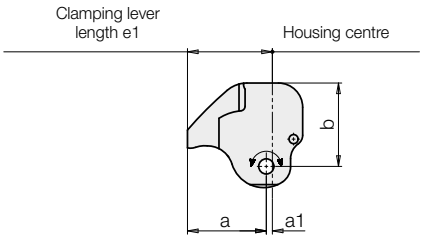


Determine the moment of inertia

Due to the complicated shape of the clamping levers, the mass moment of inertia can only be determined with the help of a CAD model in the computer.
Attention! The clamping lever length e always starts from the centre of the housing. As the examples show, the swing axis for determining the moment of inertia is offset by 1-2 mm. The exact position of the swing axis can be determined with the coordinates a and b.

Short clamping lever

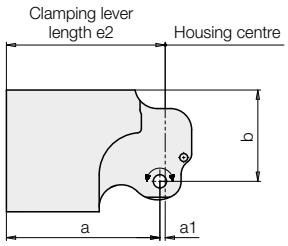
The moment of inertia in the chart is the starting point for the maximum flow rate and the shortest possible clamping time.



Size		1	2	3	4
e1	[mm]	27	28	36.5	36.5
a	[mm]	26	26	34.5	34.5
a1	[mm]	1	2	2	2
b	[mm]	25.5	27.5	33	36
Moment of inertia J_K	[kgmm²]	22	34	98	125

Long clamping lever (blank)

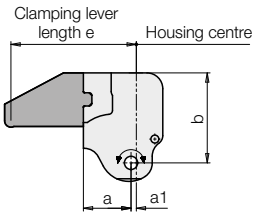
The blank is not a finished clamping lever. The value in the chart shows how high the maximum moment of inertia can rise.



Size		1	2	3	4
e2	[mm]	59	60	67.5	67.5
a	[mm]	58	58	65.5	65.5
a1	[mm]	1	2	2	2
b	[mm]	34.5	34.5	33	36
Moment of inertia J_L	[kgmm²]	576	756	1234	1477

Universal clamping lever

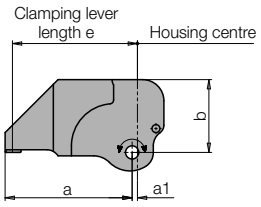
The universal clamping lever is supplemented by clamping arm provided by the customer and the fixing screw. A CAD model should be created in the assembled state to determine the moment of inertia.



Size		1	2	3	4
e	[mm]	Customer request			
a	[mm]	16	18	20	20
a1	[mm]	1	2	2	2
b	[mm]	34.5	38.5	42	50
Moment of inertia J_{L1}	[kgmm²]	Universal lever			
		35	63	146	220
+ extension J_{L2}	[kgmm²]	Determine with CAD model			

One-piece special clamping lever

A one-piece special clamping lever can only be manufactured at Römheld because exact contours are required for the swing mechanism and the pneumatic position monitoring.



Size		1	2	3	4
e	[mm]	Customer request			
a	[mm]	Customer request			
a1	[mm]	1	2	2	2
b	[mm]	25.5	27.5	33	36
Moment of inertia J_L	[kgmm²]	Determine with CAD model			

Important notes

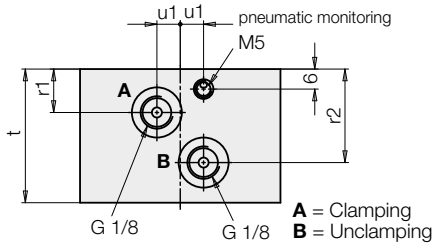
The compact clamps are designed exclusively for clamping of workpieces in industrial applications.
Hydraulic clamping elements can generate considerable forces. The workpiece, the fixture or the machine must be in the position to compensate these forces.
In the effective area of clamping lever there is the danger of crushing. The manufacturer of the fixture or the machine is obliged to provide effective protection devices.
During loading and unloading of the fixture a collision with the clamping lever has to be avoided. Remedy: Mount position adaptor.
The height of the flange surface of the compact clamp and the height of the clamping surface on the workpiece should be matched so that the clamping height is approximately in the middle of the usable clamping stroke.

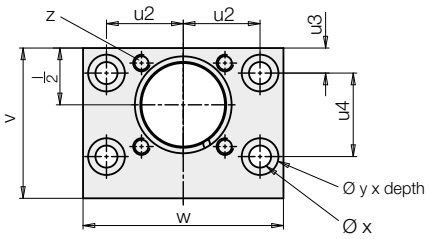
The compact clamp has to be checked regularly on contamination by swarf and has to be cleaned.
For dry machining, minimum quantity lubrication and in case of accumulation of very small swarf or particles, regular disassembly, cleaning and lubrication of the lever mechanism as per operating manual is required.

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

Mounting body

for version with
pipe thread and cover





Size		1	2	3	4
l	[mm]	34	42	48	55
r1	[mm]	13	13	14	14
r2	[mm]	28	28	31	31
t	[mm]	40	44	50	52
u1	[mm]	7	7.5	10	10
u2	[mm]	23	26	31	34
u3	[mm]	7.5	7.5	8	8
u4	[mm]	25	28	34	38
v	[mm]	45	50	58	63
w	[mm]	60	65	78	85
Ø x	[mm]	6.6	6.6	8.5	8.5
Ø y x depth	[mm]	11x7	11x7	13.5x9	13.5x9
z	[mm]	M5	M6	M6	M8
Weight, approx.	[kg]	0.61	0.75	1.16	1.4
Part no.		**3468381**	**3468382**	**3468383**	**3468384**

Pneumatic position monitoring

1. Pneumatic clamping monitoring

In the clamping area, the clamping lever slides downwards at two hardened surfaces of the body. In one of the surfaces there is the bore hole for the pneumatic clamping monitoring.
The clamping lever overruns the bore hole, but does not completely close it. Only when the workpiece is really clamped, the clamping lever supports itself on the sliding surface and the bore hole will be firmly closed.

The clamping monitoring signals:
- The clamping lever is in the usable clamping range and
- a workpiece is clamped.

Important note

Required minimum pressures for clamping monitoring:
Hydraulics 70 bar
Pneumatics 3 bar

2. Pneumatic unclamping monitoring

In the unclamping position the clamping lever closes a pneumatic bore hole.

Important note

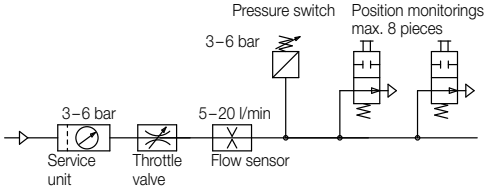
The compact clamp is available with "clamping monitoring" or "unclamping monitoring". The control of both positions is not possible since the minimum dimensions of the housing allow only one pneumatic connection.

Monitoring by pneumatic pressure switch

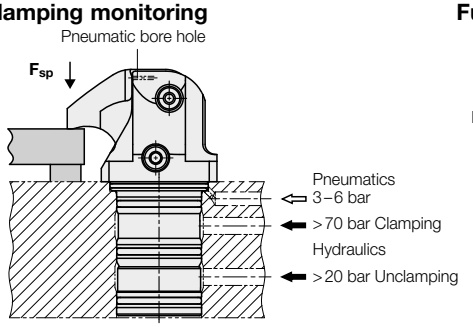
For the evaluation of the pneumatic pressure increase standard pneumatic pressure switches can be used.
With one pressure switch up to 8 compact clamps can be controlled.

Important note

Pneumatic position monitorings are only process-safe, when air pressure and air volume are precisely adjusted.
For measuring the air volume, appropriate devices are available. Please contact us.



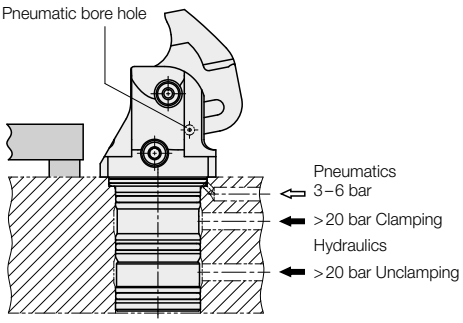
Clamping monitoring



Example for clamping position
Required switching pressure 4.5 bar
Pressure drop, if 1 compact clamp is not clamped approx. 2 bar

As per diagram:
Required flow rate approx. 10–13 l/min
(depending on the number of connected compact clamps)

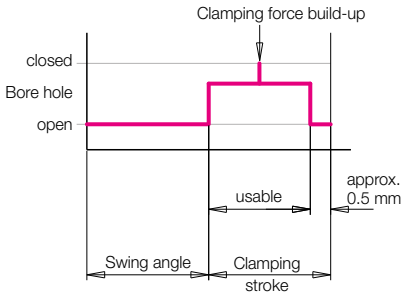
Unclamping monitoring

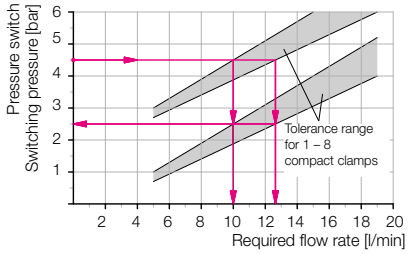


Example for unclamping position
Required switching pressure 4.5 bar
Pressure drop, if 1 compact clamp is not unclamped approx. 2 bar

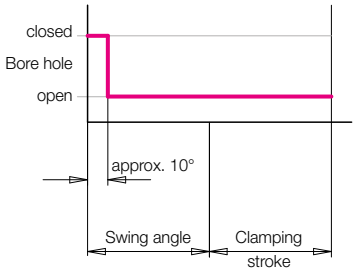
As per diagram:
Required flow rate approx. 8.5–10 l/min
(depending on the number of connected compact clamps)

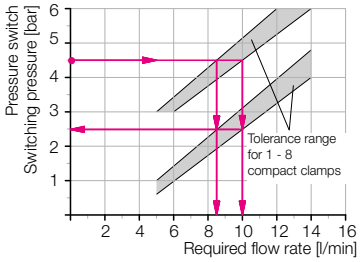
Function charts





Required flow rate depending on the switching pressure of the pneumatic pressure switch for a pressure drop Δp 2 bar

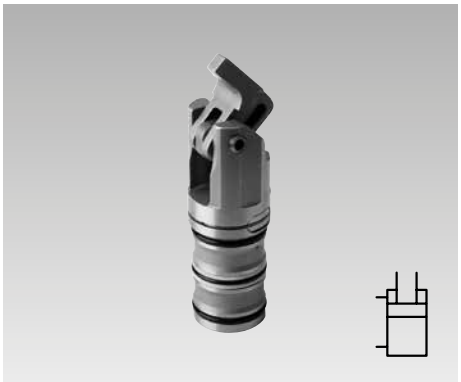




Required flow rate depending on the switching pressure of the pneumatic pressure switch for a pressure drop Δp 2 bar

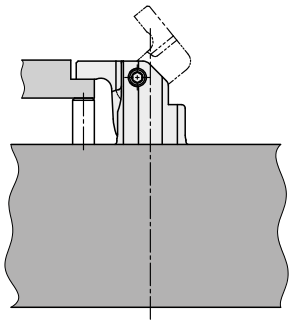
Mini Compact Clamp

Cartridge type, clamping force 1.3 kN
double acting, max. operating pressure 200 bar



Advantages

- Minimum dimensions (Ø 22 mm)
- Partially immersed body
- Space-saving integration by a patented fixing principle
- Housing can be rotated by 360°
- Mounting without pipes
- Workpiece clamping without any side loads
- Narrow clamping lever
- Metallic wiper edge
- Mounting position: any



Application

Mini compact clamps are designed for application in hydraulic clamping fixtures where oil supply is effected through drilled channels in the fixture body.

Thanks to the small housing diameter of only 22 mm, the mini compact clamp can be installed in places where up to now there was insufficient space for a hydraulic clamping element. In multiple clamping fixtures, the minimum distance between cylinders is 28 mm. A clamping recess in the workpiece a little bit wider than the clamping lever is sufficient for clamping.

Typical applications are:

- Clamping fixtures for small workpieces and workpieces which are very sensitive against deformation
- Multiple clamping fixtures with many workpieces that are closely arranged
- Assembly fixtures
- Clamping fixtures for machining of several sides and complete machining
- Rotary indexing fixtures on horizontal and vertical machining centres

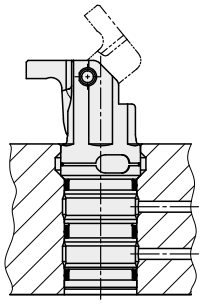
Description

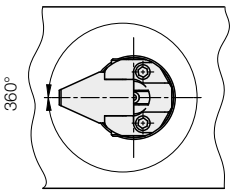
The hydraulic mini compact clamp is a double-acting pull-type cylinder where a part of the linear stroke is used to swing the clamping lever onto the workpiece. In order to minimise the dimensions, the usual flange for screw fixing is omitted.
Instead 2 clamp pieces engage in a radial slot in the cartridge-type hole. When mounting, these clamp pieces are radially expanded by set screws accessible from above. Thus, the clamping force is compensated by form fit and without clearance.

The mini compact clamp can be turned by 360° in the cartridge-type hole.

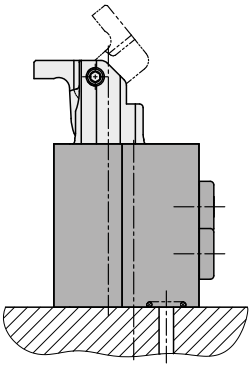
Installation and connecting possibilities

Drilled channels

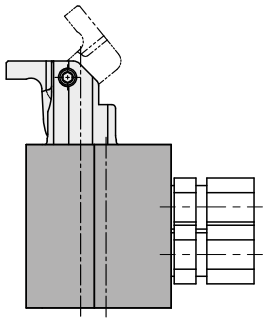


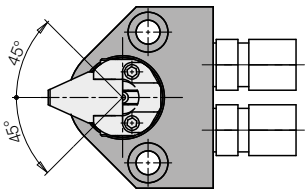


with accessory mounting body

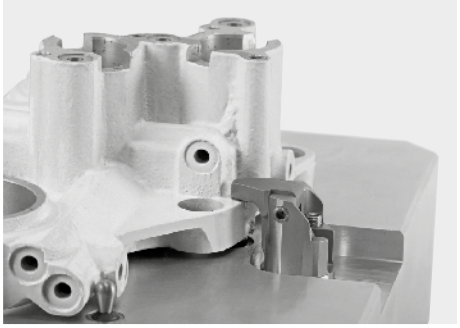


Pipe thread
with accessory mounting body

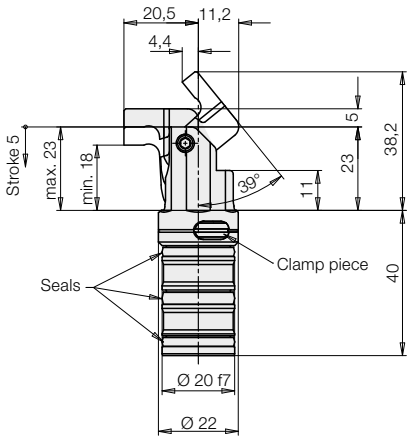


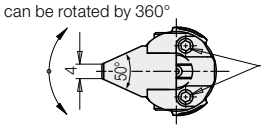


Application example



Clamping of a cast part

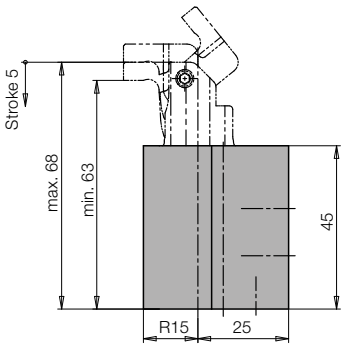




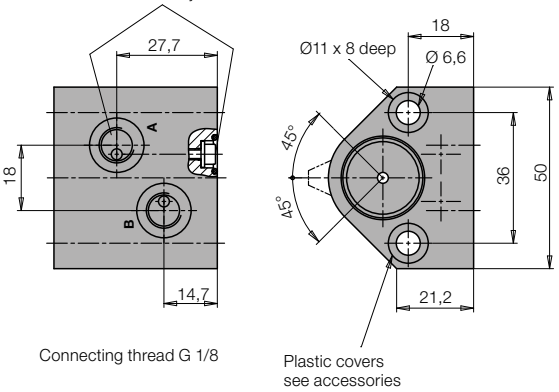
Expansion of the clamp pieces:
Set screws SW 2.5
Tightening torque 3 Nm

Accessory

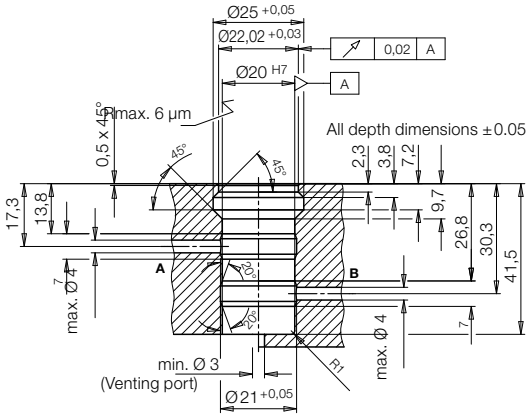
Mounting body



Screw plugs and O-rings are included in the delivery



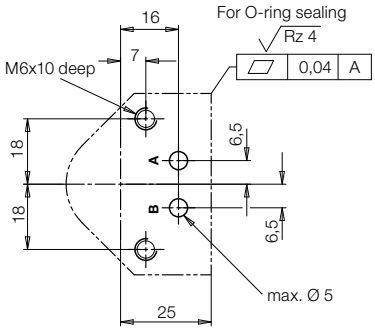
Cartridge-type hole



A = Clamping
B = Unclamping

Spare O-ring 8x1.5
Part no. 3000343

Connecting scheme for drilled channels



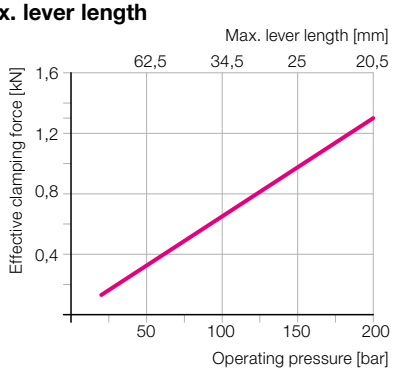
Technical data

Clamping force at 200 bar	[kN]	1.3
Stroke	[mm]	5
Piston Ø	[mm]	14
Rod Ø	[mm]	9
Oil volume clamping	[cm³]	approx. 1
unclamping	[cm³]	approx. 1.6
Max. flow rate	[cm³/s]	5
Min. operating pressure	[bar]	20
Weight	[kg]	approx. 0.13
Part no.		**1800110**

Accessories

Mounting body		
Weight	[kg]	0.44
Part no.		**0346821**
Plastic cover Ø 11		
Part no.		**3300685**

Effective clamping force and max. lever length



Special levers are available on request.

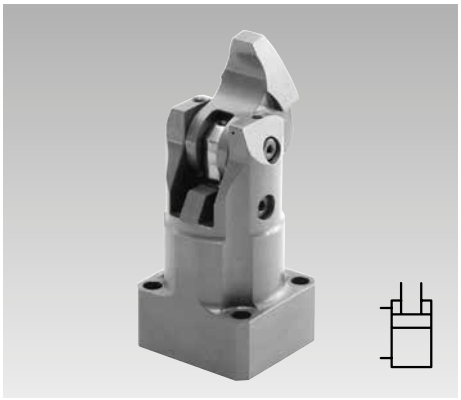
Important notes

Mini compact clamps must only be used for clamping of workpieces in industrial applications and may only be operated with hydraulic oil.
In the effective area of the piston rod and the clamping arm there is the danger of crushing. The manufacturer of the fixture or the machine is obliged to provide effective protection devices.
During loading and unloading of the fixture a collision with the clamping lever has to be avoided. Remedy: Mount position adaptor.
Due to the relatively small clamping stroke the height of the workpiece should be adapted so that the clamping point is approximately in the centre of the usable clamping stroke. By doing so a sufficient clamping reserve remains also in the case of larger workpiece tolerances.
The mini compact clamp has to be checked regularly on contamination by swarf and has to be cleaned, if required. In the case of increased swarf formation, the mini compact clamp must be included into the cleaning process with coolant.
The mini compact clamp is not suitable for dry machining, minimum quantity lubrication and in case of accumulation of very small swarf.

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

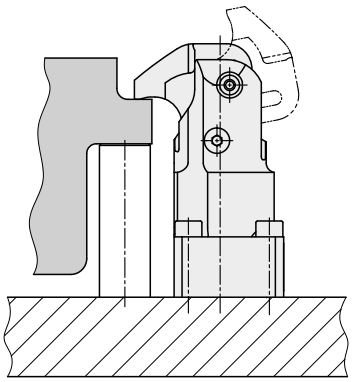
Compact Clamps

Manifold-mounting type, pneumatic position monitoring optional, double acting, max. operating pressure 250 bar



Advantages

- Minimum dimensions
- Mounting without pipes
- Metallic wiper edge for piston rod
- Clamping lever can be swivelled into small recesses
- Workpiece clamping without any side loads
- Unimpeded loading and unloading of the clamping fixture
- Long clamping lever adaptable to the workpiece
- Universal lever for adapting customised clamping levers
- Mounting position: any



Application

Compact clamps are designed for application in hydraulic clamping fixtures where oil supply is effected through drilled channels in the fixture body.
Due to the minimum space required, the compact clamp is especially suitable for clamping fixtures with little space for the installation of hydraulic clamping elements.
A clamping recess in the workpiece a little bit wider than the clamping lever is sufficient as clamping surface. Typical applications are:

- Rotary indexing fixtures in horizontal and vertical machining centres
- Clamping fixtures for machining of several sides and complete machining
- Multiple clamping fixtures with many workpieces that are closely arranged
- Test systems for motors, gears, etc.
- Assembly lines

Description

The hydraulic compact clamp is a double-acting pull-type cylinder where a part of the linear stroke is used to swing the clamping lever onto the workpiece.

Available versions

1. **With pneumatic clamping monitoring** **180X2XX**
   The clamping monitoring signals:
   "The clamping lever is within the usable clamping range and the workpiece is clamped with minimum clamping force (min. 70 bar)."
2. **With pneumatic unclamping monitoring** **180X2XXA**
   The unclamping monitoring signals:
   "The clamping lever is within the unclamping range, starting approx. 10° before the final position."
3. **Without position monitoring** **180X2XXB**
4. **With pneumatic clamping and unclamping monitoring** **180X2XXC**

Pneumatic position monitoring see page 6.

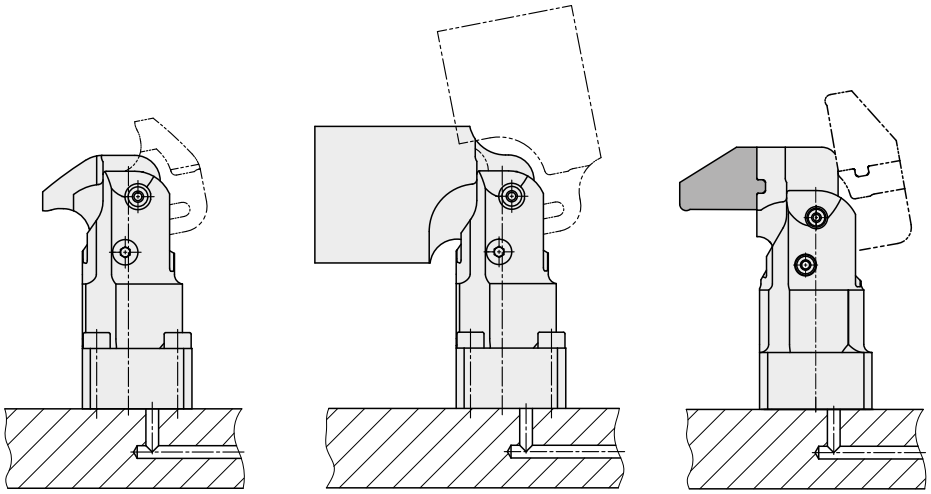
Important notes

(see page 5)

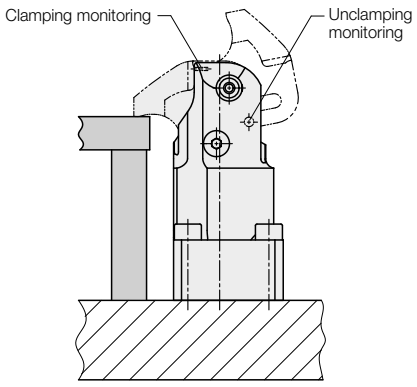
Installation and connecting possibilities

Drilled channels

with short clamping lever **with long clamping lever** (blank) **Universal lever**



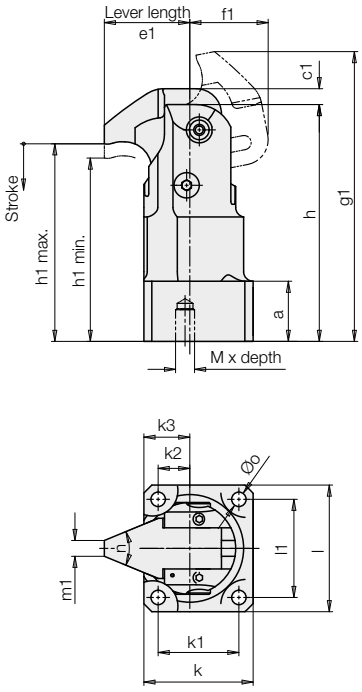
Pneumatic position monitoring



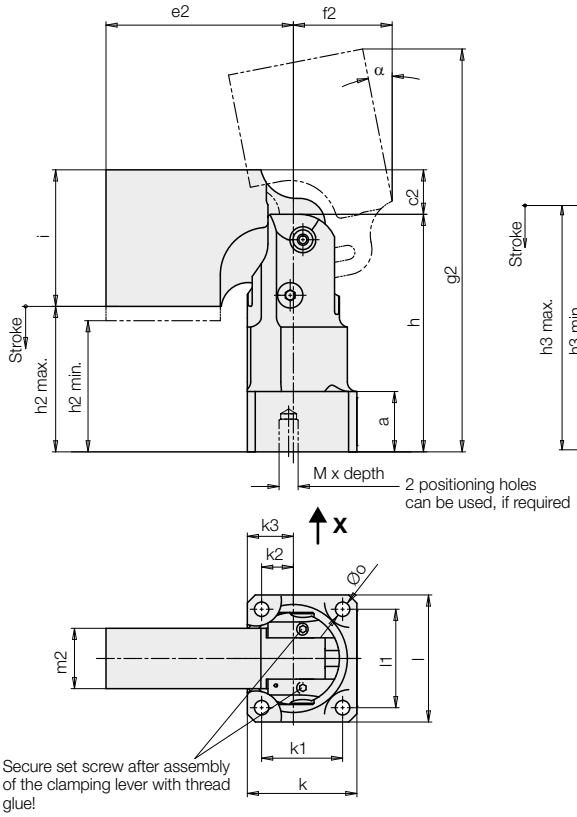
Application example

Clamping of a cast part with special clamping lever

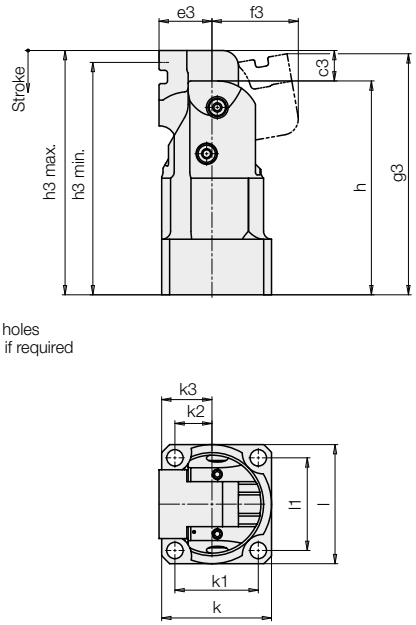
Short clamping lever 180X210



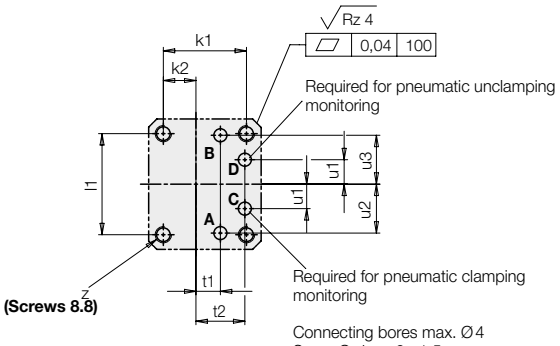
Long clamping lever (blank) 180X230



Universal lever 180X250

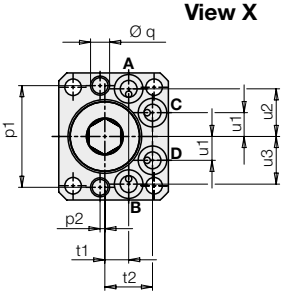


Connecting scheme



Connecting bores max. Ø 4
Spare O-rings 6 x 1.5
Part no. 3000313

View X



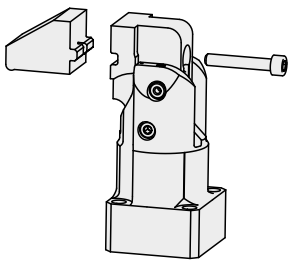
A = Clamping
B = Unclamping
C = Clamping monitoring
D = Unclamping monitoring

Materials

Body:	hardened, stainless
Clamping lever:	
short	HRc 48 – 55, stainless
long (blank)	X37 Cr Mo V5-1 hardened and tempered HRc 40 and nitrated
Seals:	NBR and PUR (max. 80°)

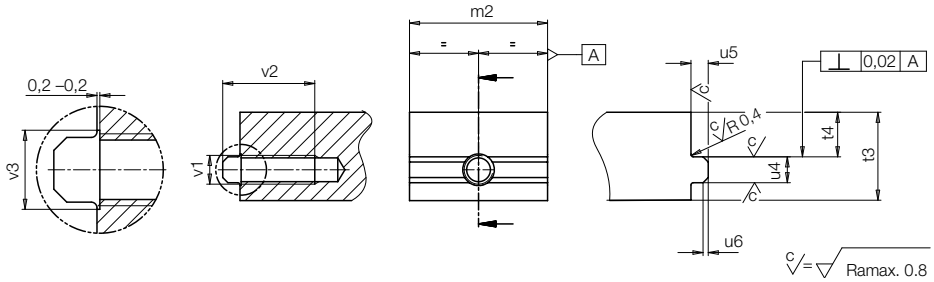
Pneumatic position monitoring see page 4.

Universal lever



The compact clamp with universal lever and integrated swing mechanism enables the fixing of customised clamping levers, which are relatively easy to manufacture.
The fixing screw 12.9 included in our delivery.
Tightening torque see chart page 3.

Connecting dimensions to the flange of the universal lever

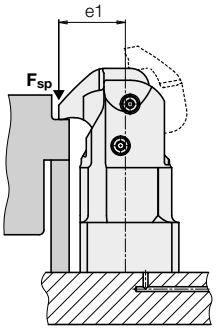


Technical data

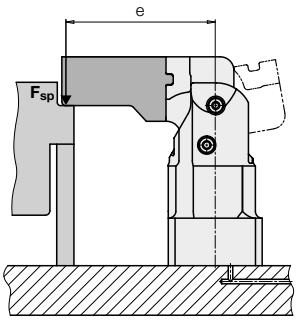
Size		**1**	**2**	**3**	**4**
Clamping force at 250 bar (short clamping lever)	[kN]	3.2	4.5	7.5	11.5
Max. stroke	[mm]	5	5	7	8.5
Clamping stroke, usable	[mm]	4.5	4.5	6.5	8
Piston Ø	[mm]	18	22	28	33
Rod Ø	[mm]	11	14	17	19
Oil volume clamping	[cm^3]	2.3	3.2	6.4	10.5
Oil volume unclamping	[cm^3]	3.6	5.4	10.2	15.7
Max. flow rate	[cm^3/s]	8	11	22	35
Min. operating pressure					
without clamping monitoring	[bar]	20	20	20	20
with clamping monitoring	[bar]	70	70	70	70
Min. air pressure	[bar]	3	3	3	3
α ±1	[°]	13.5	10.5	14	16
a	[mm]	19	21	24	24
c1	[mm]	5	5	7	8.5
c2	[mm]	14	12	7	8.5
c3	[mm]	14	16	16	22.5
e1	[mm]	27	28	36.5	36.5
e2	[mm]	59	60	67.5	67.5
e3	[mm]	17	20	22	22
f1	[mm]	24.7	25.9	31.3	33.8
f2	[mm]	30.7	30.5	31.3	33.8
f3	[mm]	34.3	37	40.4	48.1
g1 max.*	[mm]	91.6	95	115.2	117.3
g2 min. / max.*	[mm]	127.3/129.8	130.3/134	150.1/152	153.5/155.6
g3	[mm]	86.3	96.8	111.4	121.1
h	[mm]	74.8	80.8	95.4	98.6
h1 min. / h1 max.	[mm]	57.8 / 62.3	59.8 / 64.3	67.9 / 74.4	68.1 / 76.1
h2 min. / h2 max.	[mm]	41.3 / 45.8	42.3 / 46.8	51.4 / 57.9	51.6 / 59.6
h3 min. / h3 max.	[mm]	84.3 / 88.8	92.3 / 96.8	104.9 / 111.4	113.1 / 121.1
i	[mm]	43	46	44.5	47.5
k	[mm]	34.5	41.5	52	54
k1	[mm]	25.5	31.5	38	41
k2	[mm]	10	14	16	18
k3	[mm]	14.5	19	23	24.5
l	[mm]	40	45	58	59
l1	[mm]	31	35	44	46
m1	[mm]	5	6	8	8
m2	[mm]	21	26	32	35
n	[°]	50.4	55.8	56.1	62
Ø o	[mm]	5.2	6.2	8.2	8.2
p1 ±0.02	[mm]	32	35	44	48
p2 ±0.1	[mm]	1.5	0	0	3
Ø q +0.05 x depth	[mm]	6x9	6x9	8x17	8x17
t1	[mm]	7.5	8.5	10	11
t2	[mm]	15	16.7	21.5	21.2
t3	[mm]	20	23	23	29
t4	[mm]	8.5	12	10	17
u1	[mm]	7.5	9.2	12.5	13.5
u2	[mm]	15	16.8	20	23
u3	[mm]	15	16.8	20	22
u4 –0,05	[mm]	4	5	6	6
u5	[mm]	2	3	4	4
u6	[mm]	0.9x45°	1x45°	1.3x45°	1.3x45°
v1 x v2	[mm]	M5x10	M5x10	M8x17	M8x17
Ø v3	[mm]	5.5	5.5	8.5	8.5
z	[mm]	M5	M6	M8	M8
With pneumatic clamping monitoring					
Part no. - short clamping lever		**1801 210**	**1802 210**	**1803 210**	**1804 210**
Weight, approx.	[kg]	0.46	0.69	1.29	1.42
Part no. - long clamping lever (blank)		**1801 230**	**1802 230**	**1803 230**	**1804 230**
Weight, approx.	[kg]	0.74	1.05	1.77	1.93
Part no. - universal lever		**1801 250**	**1802 250**	**1803 250**	**1804 250**
Weight, approx.	[kg]	0.46	0.73	1.27	1.44
With pneumatic unclamping monitoring					
Part no. (version see above)		**1801 2XXA**	**1802 2XXA**	**1803 2XXA**	**1804 2XXA**
Without position monitoring					
Part no. (version see above)		**1801 2XXB**	**1802 2XXB**	**1803 2XXB**	**1804 2XXB**
With clamping and unclamping monitoring					
Part no. (version see above)		**1801 2XXC**	**1802 2XXC**	**1803 2XXC**	**1804 2XXC**
Accessories					
Part no. - short clamping lever		**3548 1121**	**3548 1122**	**3548 1123**	**3548 1124**
Part no. - long clamping lever (blank)		**3548 1071**	**3548 1072**	**3548 1073**	**3548 1074**
Part no. - universal lever		**3548 4111**	**3548 4112**	**3548 4113**	**3548 4114**
Screw for universal lever	[mm]	M5x30 –12.9	M5x30 –12.9	M8x35 –12.9	M8x35 –12.9
Tightening torque	[Nm]	10	10	42	42
Part no.		**3301 1019**	**3301 1019**	**3301 468**	**3301 468**

***** min. = height in unclamping position as presented. max. = max. height for swing in

Short clamping lever



Universal clamping lever



Calculation of the clamping force

1. Clamping lever length e is known

1.1 Admissible clamping force as a function of the clamping lever length e

$$F_{adm} = \frac{A}{e - B} \quad [kN]$$

1.2 Admissible operating pressure

$$p_{adm} = \frac{F_{adm} * 100}{C} \left(\frac{e - B}{D} + 1 \right) \quad [bar]$$

1.3 Effective clamping force at other pressure p

1.3.1 F_{adm} = and p_{adm} are known

$$F_{sp} = F_{adm} \frac{p}{p_{adm}} \leq F_{adm} \quad [kN]$$

1.3.2 In general:

$$F_{sp} = \frac{C}{\left(\frac{e - B}{D} + 1\right) * 100} * p \leq F_{adm} \quad [kN]$$

2. Maximum clamping lever length depending on the existing operating pressure

$$e_{max} = \frac{A}{(C * 0.01 * p) - E} + B \quad [mm]$$

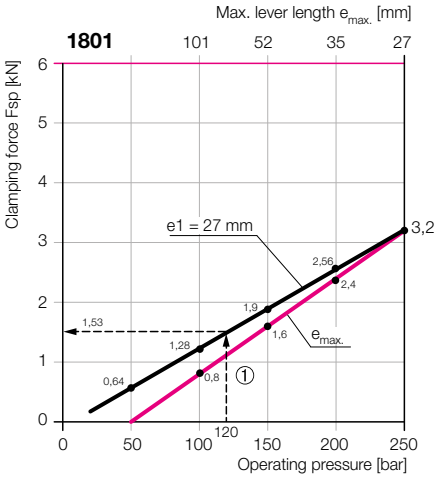
F_{sp}, $F_{adm.}$	= Clamping force	[kN]
e, e1, $e_{max.}$	= Clamping lever length	[mm]
p, $p_{adm.}$	= Operating pressure	[bar]
A…E	= Constants as per chart	

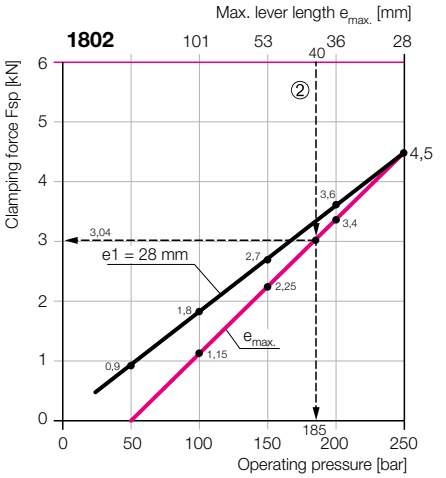
Enter the variables in the above units into the formulas

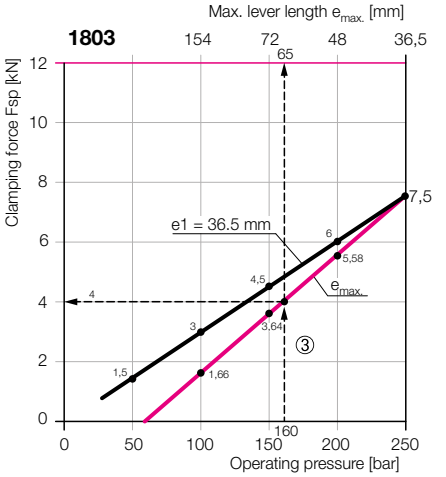
Constants

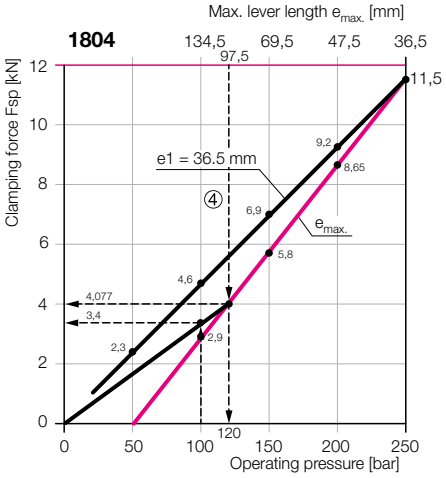
Size	1801	1802	1803	1804
A	80	112.5	251.3	385.3
B	2	3	3	3
C	1.594	2.262	3.888	5.718
D	101.7	97.62	113	138.1
E	0.787	1.152	2.224	2.789

Clamping force diagrams









Example ① Compact clamp 1801 210
Series clamping lever e1 = 27 mm
F_{adm} = 3.2 kN at p_{adm} = 250 bar
Operating pressure p = 120 bar

Effective clamping force

$$F_{Sp} = F_{adm} \frac{P}{p_{adm}} = 3.2 \frac{120}{250} = 1.536 \text{ kN}$$

alternative

$$F_{Sp} = \frac{C}{\left(\frac{e - B}{D} + 1\right) * 100} * p$$

$$F_{Sp} = \frac{1.594}{\left(\frac{27 - 2}{101,7} + 1\right) * 100} * 120$$

$$F_{Sp} = 1.535 \text{ kN}$$

Example ② Compact clamp 1802 210
Series clamping lever e = 40 mm

Admissible clamping force

$$F_{adm} = \frac{A}{e - B} = \frac{112.5}{40 - 3} = 3.04 \text{ kN}$$

Admissible operating pressure

$$p_{adm} = \frac{F_{adm} * 100}{C} * \left(\frac{e - B}{D} + 1 \right)$$

$$p_{adm} = \frac{3.04 * 100}{2.262} * \left(\frac{40 - 3}{97.62} + 1 \right)$$

$$p_{adm} = 185 \text{ bar}$$

Example ③ Compact clamp 1803 210
Operating pressure p = 160 bar
Special clamping lever

Maximum clamping lever length

$$e_{max} = \frac{A}{(C * 0.01 * p) - E} + B$$

$$e_{max} = \frac{251.3}{(3.888 * 0.01 * 160) - 2.224} + 3$$

$$e_{max} = 65.875 \text{ mm} \rightarrow 65 \text{ mm}$$

Maximum clamping force

$$F_{Sp} = \frac{C}{\left(\frac{e - B}{D} + 1\right) * 100} * p$$

$$F_{Sp} = \frac{3.888}{\left(\frac{65 - 3}{113} + 1\right) * 100} * 160$$

$$F_{Sp} = 4 \text{ kN}$$

Example ④ Compact clamp 1804 210
Special clamping lever e = 97.5 mm

Admissible clamping force

$$F_{adm} = \frac{A}{e - B} = \frac{385.3}{97.5 - 3} = 4.077 \text{ kN}$$

Admissible operating pressure

$$p_{adm} = \frac{F_{adm} * 100}{C} * \left(\frac{e - B}{D} + 1 \right)$$

$$p_{adm} = \frac{4.077 * 100}{5.718} * \left(\frac{97.5 - 3}{138.1} + 1 \right)$$

$$p_{adm} = 120 \text{ bar}$$

Effective clamping force at 100 bar

$$F_{Sp} = \frac{C}{\left(\frac{e - B}{D} + 1\right) * 100} * p$$

$$F_{Sp} = \frac{5.718}{\left(\frac{97,5 - 3}{138,1} + 1\right) * 100} * 100$$

$$F_{Sp} = 3.4 \text{ kN}$$

Admissible flow rate
Important notes

Admissible flow rate

The admissible flow rate as per the chart on page 3 refers to the “short” clamping lever. Thus the clamping time is approx. 0.6 seconds and the unclamping time approx. 1 second.
Longer clamping levers with larger mass moments of inertia cause higher loads on the swing mechanism, which results in higher wear. The end stop during unclamping is also critical. Therefore, the flow rate should be reduced with longer clamping levers according to the following formula:

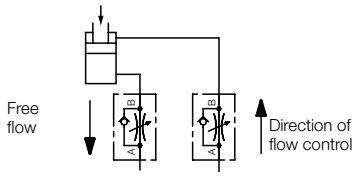
$$Q_L = Q_K * \sqrt{\frac{J_K}{J_L}} \ cm^3/s$$

Q_L = Adm. flow rate with longer special clamping lever
Q_K = Adm. flow rate with “short” clamping lever as per the chart on page 3
J_K = Moment of inertia of the “short” clamping lever (see chart)
J_L = Moment of inertia of the special clamping lever

$$\text{Clamping time } t_{Sp} = \frac{\text{Oil volume clamping } [cm^3]}{\text{Adm. flow rate } \frac{[cm^3]}{s}} \ [s]$$

Throttling of the flow rate

A flow rate throttling has to be effected in the supply line to the compact clamp. This avoids a pressure intensification and thereby pressures exceeding 250 bar.

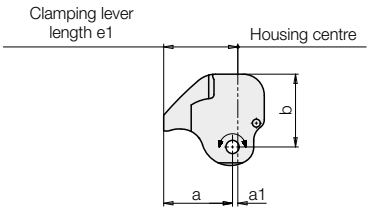


Determine the moment of inertia

Due to the complicated shape of the clamping levers, the mass moment of inertia can only be determined with the help of a CAD model in the computer.
Attention! The clamping lever length e always starts from the centre of the housing. As the examples show, the swing axis for determining the moment of inertia is offset by 1-2 mm. The exact position of the swing axis can be determined with the coordinates a and b.

Short clamping lever

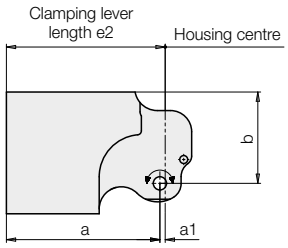
The moment of inertia in the chart is the starting point for the maximum flow rate and the shortest possible clamping time.



Size		1	2	3	4
e1	[mm]	27	28	36.5	36.5
a	[mm]	26	26	34.5	34.5
a1	[mm]	1	2	2	2
b	[mm]	25.5	27.5	33	36
Moment of inertia J_K	[kgmm²]	22	34	98	125

Long clamping lever (blank)

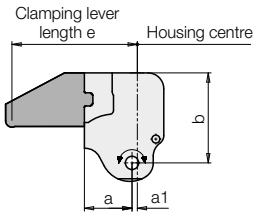
The blank is not a finished clamping lever. The value in the chart shows how high the maximum moment of inertia can rise.



Size		1	2	3	4
e2	[mm]	59	60	67.5	67.5
a	[mm]	58	58	65.5	65.5
a1	[mm]	1	2	2	2
b	[mm]	34.5	34.5	33	36
Moment of inertia J_L	[kgmm²]	576	756	1234	1477

Universal clamping lever

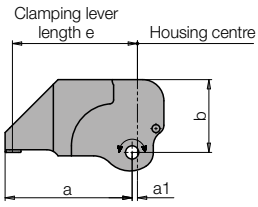
The universal clamping lever is supplemented by clamping arm provided by the customer and the fixing screw. A CAD model should be created in the assembled state to determine the moment of inertia.



Size		1	2	3	4
e	[mm]	Customer request			
a	[mm]	16	18	20	20
a1	[mm]	1	2	2	2
b	[mm]	34.5	38.5	42	50
Moment of inertia J_{L1}	[kgmm²]	Universal lever			
		35	63	146	220
+ extension J_{L2}	[kgmm²]	Determine with CAD model			

One-piece special clamping lever

A one-piece special clamping lever can only be manufactured at Römheld because exact contours are required for the swing mechanism and the pneumatic position monitoring.



Size		1	2	3	4
e	[mm]	Customer request			
a	[mm]	Customer request			
a1	[mm]	1	2	2	2
b	[mm]	25.5	27.5	33	36
Moment of inertia J_L	[kgmm²]	Determine with CAD model			

Important notes

The compact clamps are designed exclusively for clamping of workpieces in industrial applications.
Hydraulic clamping elements can generate considerable forces. The workpiece, the fixture or the machine must be in the position to compensate these forces.
In the effective area of clamping lever there is the danger of crushing. The manufacturer of the fixture or the machine is obliged to provide effective protection devices.
During loading and unloading of the fixture a collision with the clamping lever has to be avoided. Remedy: Mount position adaptor.
The height of the flange surface of the compact clamp and the height of the clamping surface on the workpiece should be matched so that the clamping height is approximately in the middle of the usable clamping stroke.

The compact clamp has to be checked regularly on contamination by swarf and has to be cleaned.
For dry machining, minimum quantity lubrication and in case of accumulation of very small swarf or particles, regular disassembly, cleaning and lubrication of the lever mechanism as per operating manual is required.

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

Pneumatic position monitoring

1. Pneumatic clamping monitoring

In the clamping area, the clamping lever slides downwards at two hardened surfaces of the body. In one of the surfaces there is the bore hole for the pneumatic clamping monitoring.
The clamping lever overruns the bore hole, but does not completely close it. Only when the workpiece is really clamped, the clamping lever supports itself on the sliding surface and the bore hole will be firmly closed.

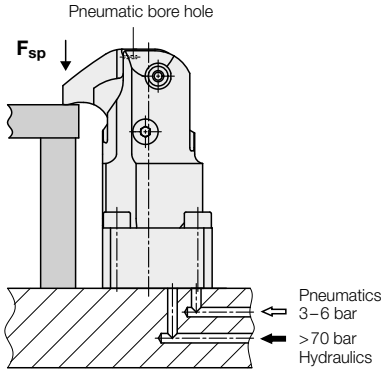
The clamping monitoring signals:
- The clamping lever is in the usable clamping range and
- a workpiece is clamped.

Important note

Required minimum pressures for clamping monitoring:

Hydraulics70 bar
Pneumatics3 bar

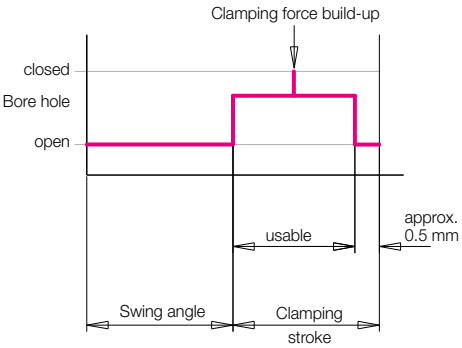
Clamping monitoring

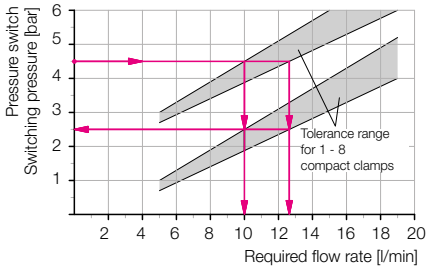


Example for clamping position

Required switching pressure	4.5 bar
Pressure drop, if 1 compact clamp is not clamped	approx. 2 bar
As per diagram:	
Required flow rate (depending on the number of connected compact clamps)	approx. 10-13 l/min

Function chart



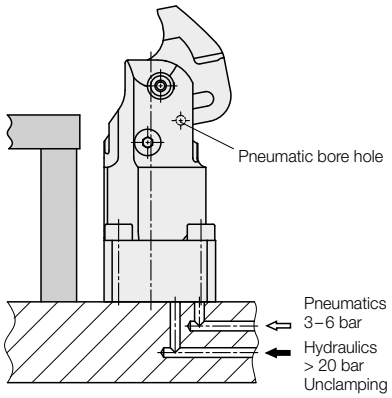


Required flow rate depending on the switching pressure of the pneumatic pressure switch for a pressure drop Δp 2 bar

2. Pneumatic unclamping monitoring

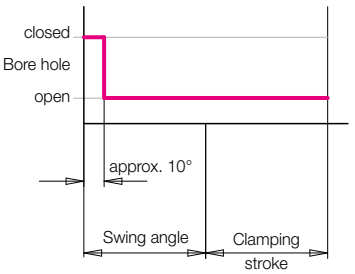
A disk which is pre-stressed by a spring element is mounted at the side of the clamping lever. This disk closes a pneumatic bore hole in unclamping position.

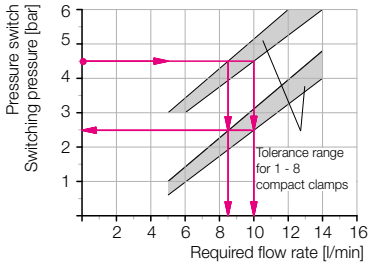
Unclamping monitoring



Example for unclamping position

Required switching pressure	4.5 bar
Pressure drop, if 1 compact clamp is not unclamped	approx. 2 bar
As per diagram:	
Required flow rate (depending on the number of connected compact clamps)	approx. 8.5–10 l/min





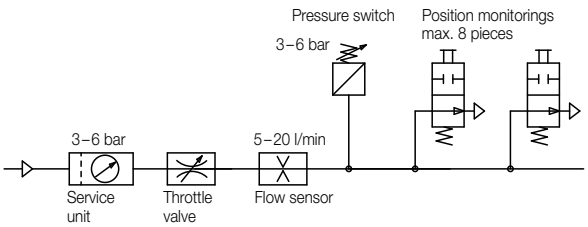
Required flow rate depending on the switching pressure of the pneumatic pressure switch for a pressure drop Δp 2 bar

Monitoring by pneumatic pressure switch

For the evaluation of the pneumatic pressure increase standard pneumatic pressure switches can be used.
With one pressure switch up to 8 compact clamps can be controlled.

Important note

Pneumatic position monitorings are only process-safe, when air pressure and air volume are precisely adjusted.
For measuring the air volume, appropriate devices are available. Please contact us.

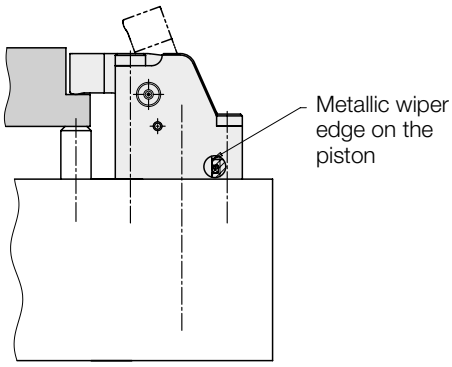


Flat Lever Clamps

Advanced Link System, pneumatic position monitoring optional single and double acting, max. operating pressure 250 bar

Advantages

- Minimum dimensions
- Partially immersed body
- Mounting without pipes
- Unimpeded loading and unloading of the fixture
- Workpiece clamping without any side loads
- Flat clamping lever can be swivelled into small recesses
- Long clamping lever (blank) adaptable to the workpiece
- Pneumatic control of the clamping lever position (optional only double acting)
- Metallic wiper edge for piston rod
- Swarf sheet retrofittable
- Mounting position: any



Application

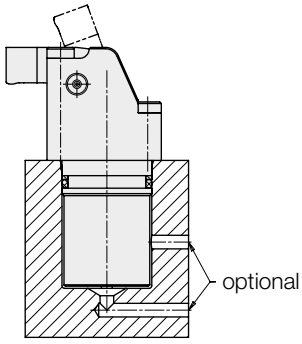
The flat lever clamp is a compact hydraulic clamping element for fixtures with oil supply through drilled channels.
Due to the minimum space required, the flat lever clamp is especially suitable for fixtures with little space for the installation of hydraulic clamping elements.
The flat clamping lever allows machining of surfaces that are only a few millimetres above the clamping point.
Double-acting versions are advantageous for time and cycle-dependent installations, since the return stroke is effected in a precisely defined time and the pneumatic position monitoring of the clamping lever is possible.

Advanced Link System

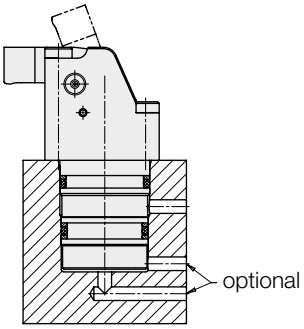
The newly developed lever kinematics enable trouble-free, process-safe operation.

Installation and connecting possibilities

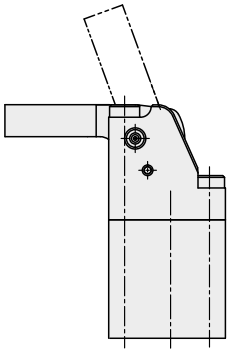
Single acting



Double acting



Long clamping lever (blank)



Description

When pressurising the flat lever clamp, a piston moves upwards against the rear edge of the clamping lever and swivels the clamping lever to the clamping position. The piston force is deviated by 180° onto the workpiece. The clamping force depends on the operating pressure and the length of the clamping lever.
When unclamping the flat lever clamp, the clamping lever is swivelled back to the off-position by means of a hook-shaped carrier on the piston. Unclamping is made either hydraulically or when using a single-acting element with spring force.
The pneumatic position monitoring allows the monitoring of both final positions of the clamping lever.

Important notes

Flat lever clamps must only be used for clamping of workpieces in industrial applications and may only be operated with hydraulic oil. Considerable injuries can be caused to fingers in the effective area of the clamping arm.
The manufacturer of the fixture or the machine is obliged to provide effective protection devices.
The clamping lever must not be impeded during swivelling. The clamping height h must be in the indicated tolerance range. To permanently secure correct functioning, the flat lever clamps must be regularly cleaned and greased. This applies especially for dry machining, minimum quantity lubrication and in case of accumulation of very small swarf.

Available versions

1. Single acting, without position monitoring

1.1 Without clamping lever 18297X0E00
For the installation of a special clamping lever, which can be produced from the clamping lever blank.

1.2 With clamping lever 18297X0EXX
The clamping lever with length L as per chart (page 3) is installed.

2. Double acting, without and with position monitoring
With the pneumatic position monitoring, the clamping and/or unclamping position is queried directly at the clamping lever.
A description can be found on page 5.

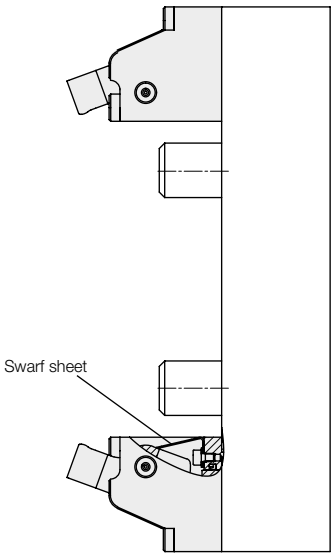
2.1 Without clamping lever, without position monitoring 18297X0D00
For the installation of a special clamping lever, which can be produced from the clamping lever blank.

2.2 Without clamping lever, with position monitoring 18297X3D00
The position monitoring can also be used with the clamping lever blank.

2.2 With clamping lever, without position monitoring 18297X0DXX
The clamping lever with length L as per chart (page 3) is installed.

2.3 With clamping lever, with position monitoring 18297X3DXX
The clamping lever with length L as per chart (page 3) is installed.

Application example

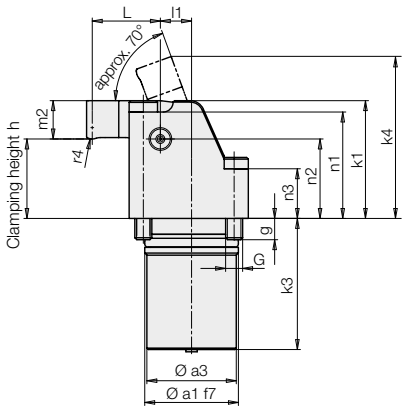


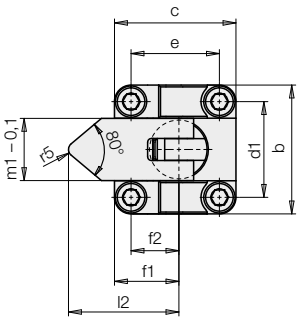
Installation instructions:

The flat lever clamp is suitable for any installation position. If the selected installation position can cause swarf nests to form in the swivel area of the clamping lever, the swarf sheet available as an accessory can be retrofitted.

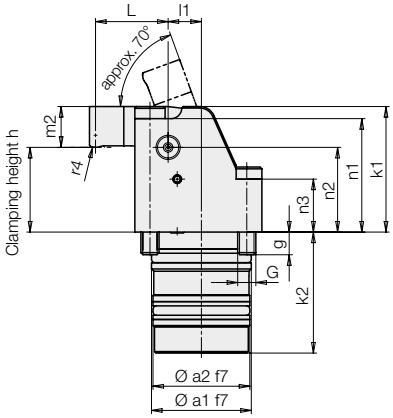
Dimensions

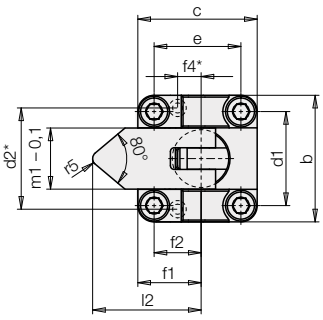
Single acting
1829 7X0EXX





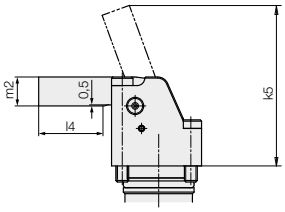
Double acting
1829 7X0DXX

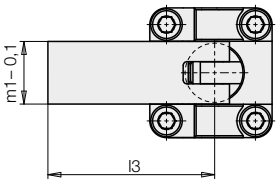




* Only available for position monitoring

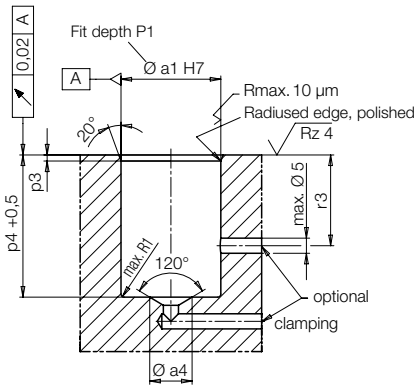
Long clamping lever (blank)
see accessories
Material: 42 Cr Mo S4 + QT nitrocarburized

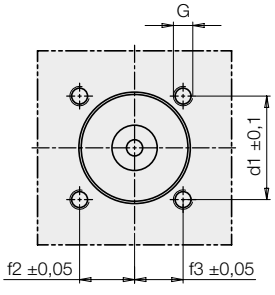




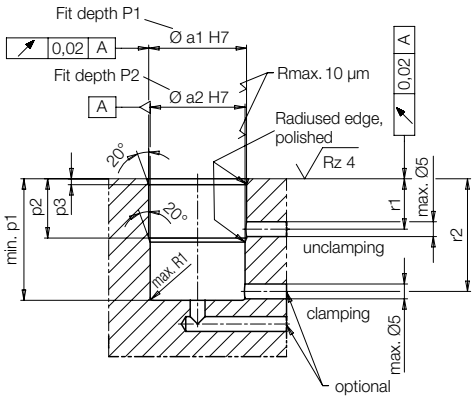
Fixing screws 10.9 – DIN 7984
Included in our delivery
Tightening torque see chart.

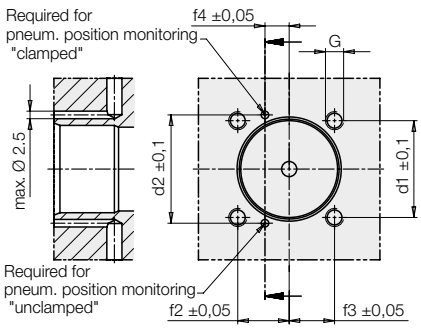
Location hole





Location hole





2 O-rings 3 x 1 (part no. 3001 758)
Included in our delivery

Pneumatic position monitoring see page 5

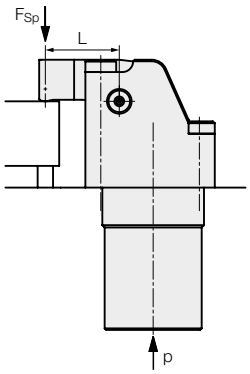
Technical data

Size			1	2	3	4
Clamping force at 250 bar	single acting	approx. [kN]	2.5	3.3	5.8	9.8
and length of clamping lever L	double acting	approx. [kN]	3.2	5	8.7	13
Piston Ø	single acting	[mm]	16	20	25	32
	double acting	[mm]	18/16	24/20	30/25	36/32
Piston stroke		[mm]	9.5	11.5	15	18
Oil volume clamping	single acting	[cm³]	1.9	3.6	7.4	14.5
	double acting	[cm³]	2.4	5.2	10.6	18.3
Oil volume unclamping	double acting	[cm³]	0.5	1.6	3.3	3.9
Adm. flow rate	single acting	[cm³/s]	4	7	13	32
Adm. flow rate	double acting	[cm³/s]	5	10	20	40
min. operating pressure		[bar]	20	20	20	20
Max. pressure in return line	single acting	[bar]	0.5	0.5	0.5	0.5
Tightening torque (screws 10.9 DIN 7984)		[Nm]	7	12	29	58
Ø a1 H7/f7		[mm]	25	33	40	46
Ø a2 H7/f7		[mm]	24	32	38	44
Ø a3		[mm]	23.8	31.5	37.5	43.5
Ø a4		[mm]	14	14	14	32
b		[mm]	35	42	53	66
c		[mm]	33	42	54	63
d1		[mm]	26	32	40	50
d2		[mm]	28	35.8	40	50
e		[mm]	24	32	41	47
f1		[mm]	17.5	22	29.5	37
f2		[mm]	13	17	23	29
f3		[mm]	11	15	18	18
f4		[mm]	6.5	8	12.5	15
G		[mm]	M5	M6	M8	M10
g		[mm]	11	7.5	11	13
h clamping height*		[mm]	23 +1.5/–1.2	28 +2/–1.6	36 +2.4/–1.9	41 +2.8/–2.3
k1		[mm]	32.5	41.5	54	64
k2		[mm]	34	40	46	48
k3		[mm]	38	46.2	45.3	63.5
k4 approx.		[mm]	45	57	72	83.5
k5 approx.		[mm]	59	75	94	110
L		[mm]	18	24	28	33
l1		[mm]	10	11	16	20
l2		[mm]	30	37	48	57
l3		[mm]	45	56	71	85
l4		[mm]	22	30	34	41.5
m1 –0.1		[mm]	16.9	20.9	25.9	32.9
m2		[mm]	9.5	13.5	18	22.5
n1		[mm]	29	37.5	49	57
n2		[mm]	23	28	36	41
n3		[mm]	9	17.5	24	32
Ø P1		[mm]	11	14	14	14
Ø P2		[mm]	34	32	34	40
p1 min.		[mm]	36	41	46.5	49
p2		[mm]	17	20	20	23.5
p3		[mm]	2	2	3	3
p4 +0.5		[mm]	39	47	46.5	64.5
r1		[mm]	14	17	16.5	18.5
r2		[mm]	33	35 – 38	40 – 44	44.5 – 46
r3		[mm]	16 – 36	17 – 44	17 – 44	18 – 61
r4		[mm]	4	4	8	8
r5		[mm]	2	2	4	4
Single acting, without position monitoring						
Part no. without clamping lever			**1829710E00**	**1829720E00**	**1829730E00**	**1829740E00**
Weight, approx.		[kg]	0.263	0.544	1.040	1.861
Part no. with clamping lever length L			**1829710E18**	**1829720E24**	**1829730E28**	**1829740E33**
Weight, approx.		[kg]	0.305	0.630	1.225	2.180
Double acting, without clamping lever						
Part no. without position monitoring			**1829710D00**	**1829720D00**	**1829730D00**	**1829740D00**
Part no. with position monitoring			**1829713D00**	**1829723D00**	**1829733D00**	**1829743D00**
Weight, approx.		[kg]	0.246	0.491	0.962	1.576
Double acting, with clamping lever						
Part no. without position monitoring			**1829710D18**	**1829720D24**	**1829730D28**	**1829740D33**
Part no. with position monitoring			**1829713D18**	**1829723D24**	**1829733D28**	**1829743D33**
Weight, approx.		[kg]	0.288	0.577	1.147	1.895
Accessories						
Part no. clamping lever length L			**0354 1025**	**0354 1026**	**0354 1027**	**0354 1028**
Weight, approx.		[kg]	0.042	0.086	0.185	0.319
Part no. long clamping lever (blank)			**0354 1029**	**0354 1030**	**0354 1031**	**0354 1032**
Weight, approx.		[kg]	0.066	0.140	0.290	0.537
Part no. swarf sheet			**035381404**	**035381405**	**035381406**	**035381407**

***** The clamping height h must be in the indicated tolerance range.

Clamping force diagrams

Calculations of the clamping force



1. Length L of clamping lever is known

1.1 Admissible operating pressure

DA $\quad p_{adm} = \dfrac{B}{(C/L)+1} \leq 250$ [bar]

SA $\quad p_{adm} = \dfrac{B^*}{(C/L)+1} + 5 \leq 250$ [bar]

1.2 Effective clamping force

DA $\quad (p_{adm} > 250\ bar)\ F_{sp} = \dfrac{A}{L} * 250$ [kN]

$\quad (p_{adm} \leq 250\ bar)\ F_{sp} = \dfrac{A}{L} * p$ [kN]

SA $\quad (p_{adm} > 250\ bar)\ F_{sp} = \dfrac{A^*}{L} * (250-5)$ [kN]

$\quad (p_{adm} \leq 250\ bar)\ F_{sp} = \dfrac{A^*}{L} * (p-5)$ [kN]

2. Min. length of clamping lever

DA $\quad L_{min.} = \dfrac{C}{(B/p)-1}$ [mm]

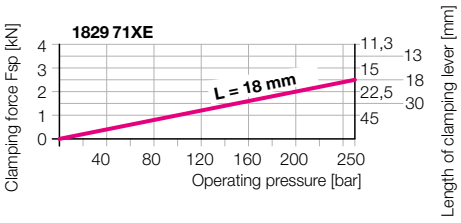
SA $\quad L_{min.} = \dfrac{C}{[B^*/(p-5)]-1}$ [mm]

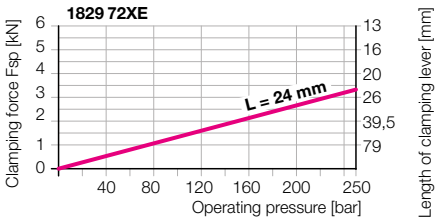
L, $L_{min.}$	= length of clamping lever	[mm]
p, $p_{adm.}$	= operating pressure	[bar]
A, B, C	= constants for DA	
A*, B*, C	= constants for SA	
DA	= double acting	
SA	= single acting	

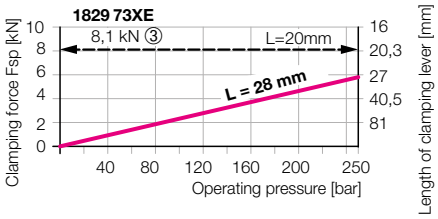
Constants

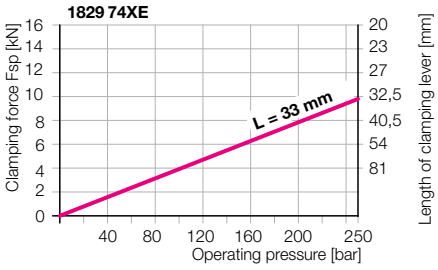
1829	71	72	73	74
A	0.23	0.48	0.975	1.716
A*	0.184	0.323	0.663	1.322
B	402.78	385.41	401.77	397.73
B*	509.76	555	578.57	503.37
C	11	13	17	19.5

Single acting

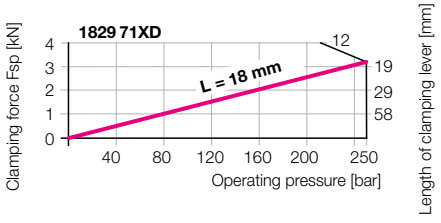


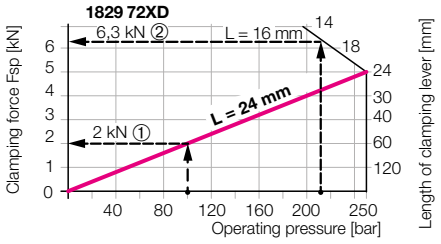


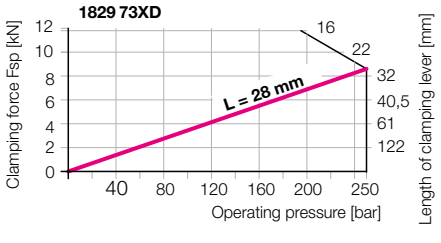


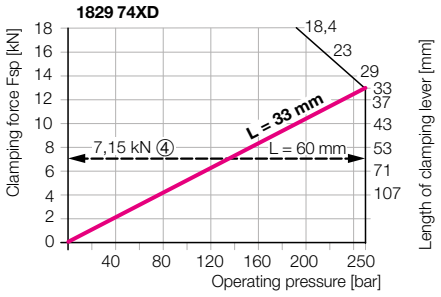


Double acting









Example 1: Flat lever clamp 1829723**D**24
p = 100 bar; L = 24 mm (standard)

Effective clamping force

$$F_{Sp} = \frac{A}{L} * p = \frac{0.48}{24} * 100 = 2\ kN$$

Example 2: Flat lever clamp 1829720**D**00
p = 210 bar

Min. length of clamping lever

$$L_{min} = \frac{C}{(B/p)-1} = \frac{13}{(385.41/210)-1} = 15.56 \rightarrow 16\ mm$$

Admissible operating pressure (review)

$$p_{adm} = \frac{B}{(C/L)+1} = \frac{385.41}{(13/16)+1} = 213\ bar$$

Effective clamping force at 210 bar

$$F_{Sp} = \frac{A}{L} * p = \frac{0.48}{16} * 210 = 6.3\ kN$$

Example 3: Flat lever clamp 1829730**E**00
Special clamping lever L = 20 mm

Admissible operating pressure

$$p_{adm} = \frac{B^*}{(C/L)+1} = \frac{578.57}{(17/20)+1} = 312\ bar > 250\ bar!$$

Effective clamping force at 250 bar

$$F_{Sp} = \frac{A^*}{L} * (p-5) = \frac{0.663}{20} * (250-5) = 8.12\ kN$$

Example 4: Flat lever clamp 1829740**D**00
Special clamping lever L = 60 mm

Admissible operating pressure

$$p_{adm} = \frac{B}{(C/L)+1} = \frac{397.73}{(19.5/60)+1} = 300\ bar > 250\ bar!$$

Effective clamping force at 250 bar

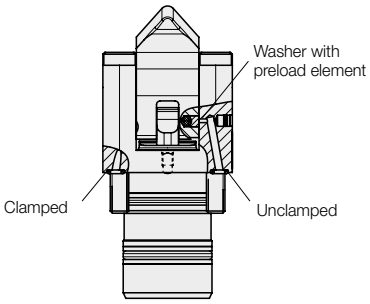
$$F_{Sp} = \frac{A}{L} * p = \frac{1.716}{60} * 250 = 7.15\ kN$$

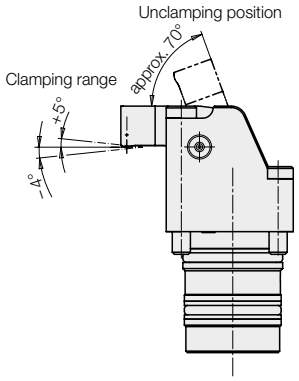
Pneumatic position monitoring

The double-acting flat lever clamps

1829 7X3DXX

are delivered with optional position monitoring. Depending on requirements, the compressed air is supplied via one or two drilled channels (see page 2).
The required O-rings in the flange are included in the delivery.





Description

On both sides of the clamping lever is a bore hole in which a washer with an elastic preload element is positioned.
In the guide for the clamping lever in the housing, two bore holes are arranged so that the clamping or unclamping position of the clamping lever will be closed by the preloaded washer.

Important note!

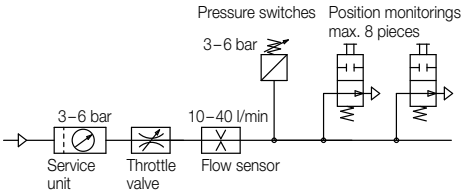
When mounting the clamping lever, the preload elements and the washers must be inserted into the provided bore holes in the clamping lever.

These parts are included in the delivery of all double-acting flat lever clamps that are delivered without the clamping lever.

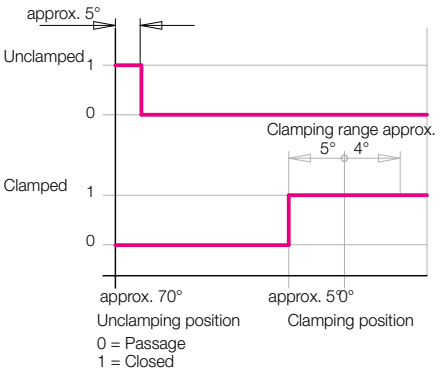
Monitoring by pneumatic pressure switch

For the evaluation of the pneumatic pressure increase standard pneumatic pressure switches can be used.

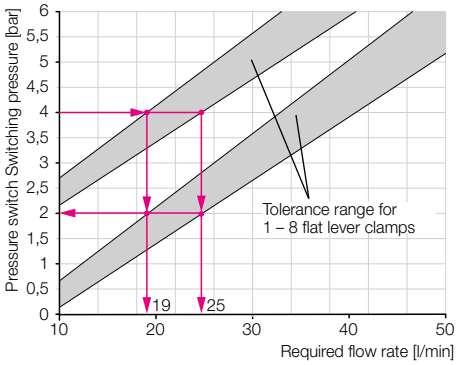
Pneumatic port



Function chart



Required flow rate depending on the switching pressure of the pneumatic pressure switch for a pressure drop Δp 2 bar

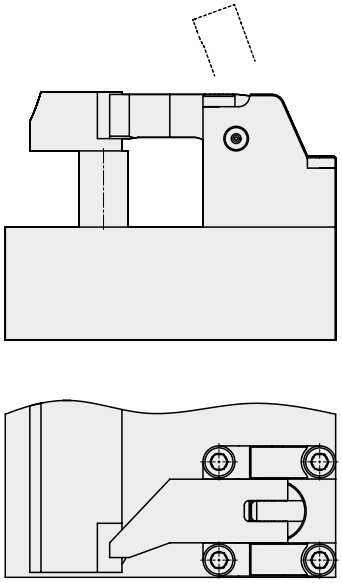


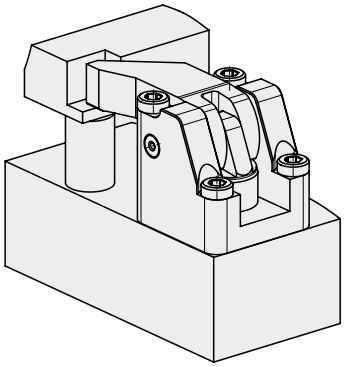
Example

Required switching pressure	4 bar
Pressure drop, if the clamping or unclamping position has not yet been reached.	2 bar
As per diagram: Required flow rate*	
1 element	approx. 19 l/min
8 elements	approx. 25 l/min

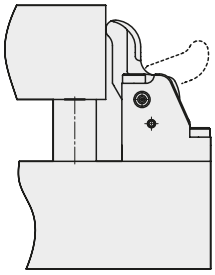
*) The pneumatic position monitoring is a metallic sealing system in which an air leakage of up to 1.5 l/min per element can occur when closed at 2 bar.
The amount of air leakage depends on the ambient conditions (cleanliness) and should be added to the required volume as per diagram.

Cranked clamping arm





Lateral clamping of workpieces to eliminate the clearance

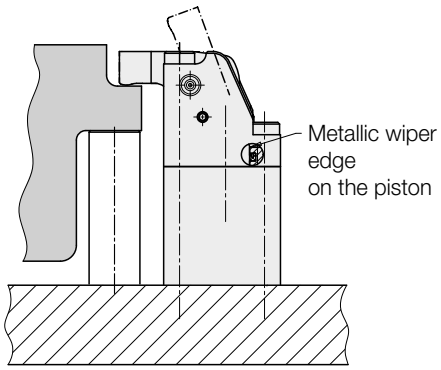


Flat Lever Clamps

Advanced Link System, pneumatic position monitoring built-in and block-type, double acting, max. operating pressure 120 bar

Advantages

- Minimum dimensions
- Mounting without pipes
- Unimpeded loading and unloading of the fixture
- Workpiece clamping without any side loads
- Flat clamping lever can be swivelled into small recesses
- Long clamping lever (blank) adaptable to the workpiece
- Pneumatic monitoring of the clamping lever position
- Metallic wiper edge at the piston rod
- Swarf sheet retrofittable
- Mounting position: any



Application

The flat lever clamp is a compact hydraulic clamping element for fixtures with oil supply through drilled channels. The flat clamping lever allows machining of surfaces that are only a few millimetres above the clamping point.
Double-acting versions are advantageous for time and cycle-dependent installations, since the return stroke is effected in a precisely defined time and the pneumatic position monitoring of the clamping lever is possible.
This series can be directly connected to the low pressure hydraulics of machine tools with 70 to 120 bar.

Advanced Link System

The newly developed lever kinematics enable trouble-free, process-safe operation.

Description

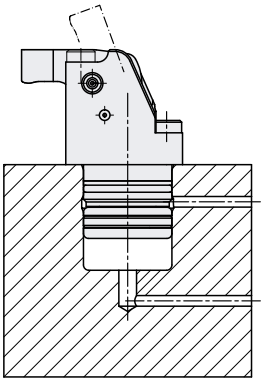
When pressurising the hinge clamp, the piston moves upwards against the rear edge of the clamping lever and swivels the clamping lever to the clamping position. The piston force is deviated by 180° onto the workpiece. The clamping force depends on the operating pressure and the length of the clamping lever.
When unclamping the flat lever clamp, the clamping lever is swivelled back to the off-position by means of a hook-shaped carrier on the piston. The pneumatic position monitoring allows the monitoring of both final positions of the clamping lever.

Important notes

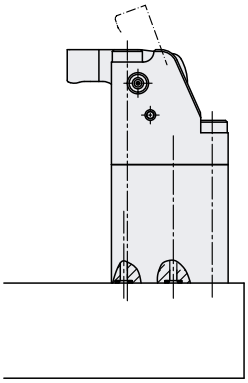
Flat lever clamps must only be used for clamping of workpieces in industrial applications and may only be operated with hydraulic oil. Considerable injuries can be caused to fingers in the effective area of the clamping arm.
The manufacturer of the fixture or the machine is obliged to provide effective protection devices.
The clamping lever must not be impeded during swivelling. The clamping height h must be in the indicated tolerance range. To permanently secure correct functioning, the flat lever clamps must be regularly cleaned and greased. This applies especially for dry machining, minimum quantity lubrication and in case of accumulation of very small swarf.

Installation and connecting possibilities

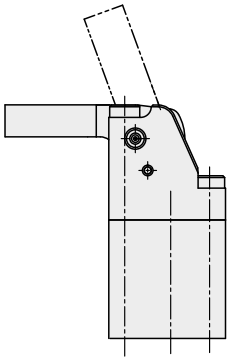
Built-in type



Block type



Long clamping lever (blank)



Available versions

1. Built-in type

1.1 Without clamping lever 18294X3D00
For the installation of a special clamping lever, which can be produced from the clamping lever blank.

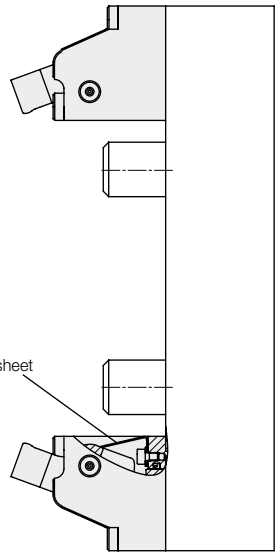
1.2 With clamping lever 18294X3DXX
The clamping lever with length L as per chart (page 3) is installed.

2. Block type

2.1 Without clamping lever 18295X3D00
For the installation of a special clamping lever, which can be produced from the clamping lever blank.

2.2 With clamping lever 18295X3DXX
The clamping lever with length L as per chart (page 3) is installed.

Application example

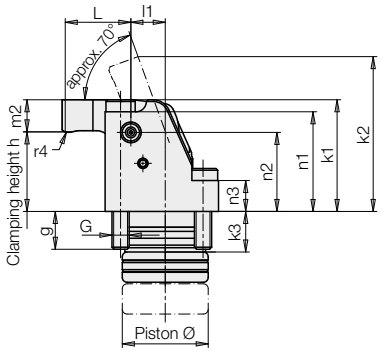


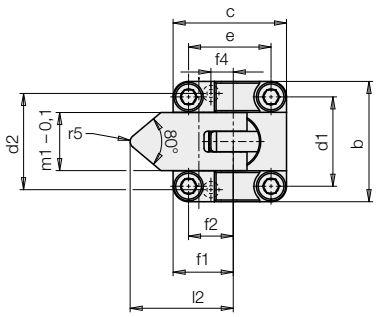
Installation instructions:

The flat lever clamp is suitable for any installation position. If the selected installation position can cause swarf nests to form in the swivel area of the clamping lever, the swarf sheet available as an accessory can be retrofitted.

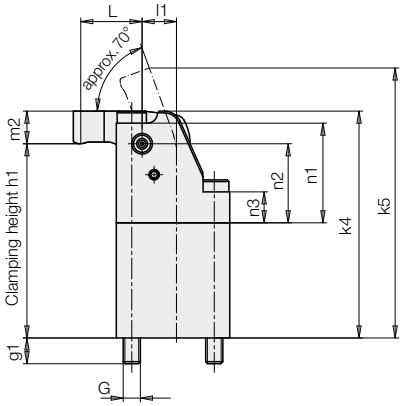
Dimensions

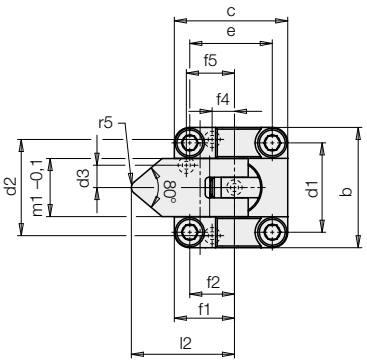
Built-in type
1829 4X3DXX



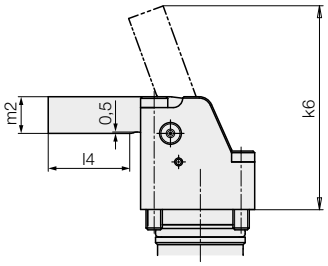


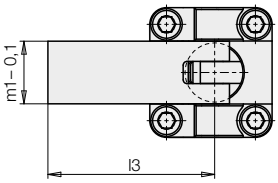
Block type
1829 5X3DXX



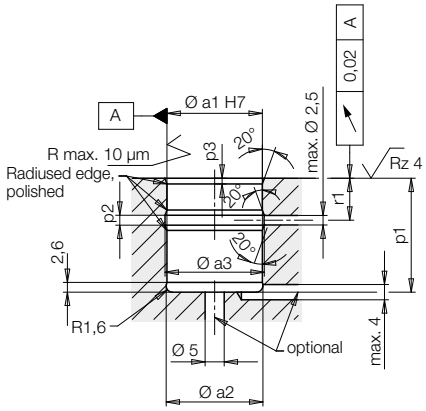


Long clamping lever (blank)
see accessories
Material: 42 Cr Mo S4 + QT nitrocarburized

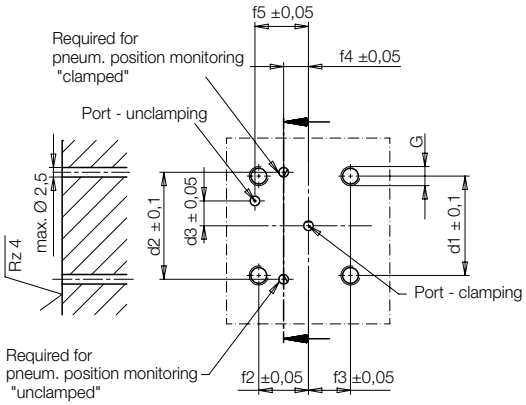


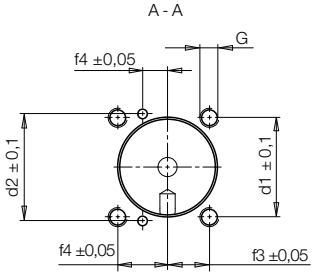


Location hole



Manifold-mounting surface





All required O-rings are included in the delivery.
Spare O-rings see chart.

Pneumatic position monitoring see page 5.

Fixing screws 8.8 - DIN 912 and 7984 are included in the delivery.

Tightening torque as per chart on page 3.

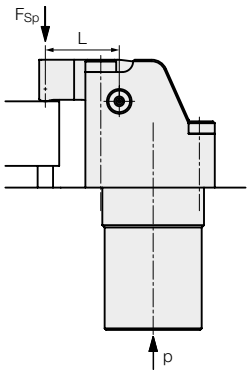
Technical data

Size			1	2	3	4
Clamping force approx.	at 120 bar	[kN]	2.96	4.27	7.41	9.75
and clamping lever length L	at 70 bar	[kN]	1.27	2.48	4.35	5.68
Piston / piston rod diameter		[mm]	25/16	32/20	40/25	45/32
Piston stroke		[mm]	9.5	11.5	15	18
Oil volume clamping		[cm^3]	4.66	9.25	18.85	28.63
Oil volume unclamping		[cm^3]	2.75	5.64	11.49	14.15
Admissible flow rate		[cm^3/s]	5	10	20	40
Min. operating pressure		[bar]	20	20	20	20
Tightening torque (screws 8.8)		[Nm]	4.7	10	25	39
a1 H7/f7		[mm]	25	32	40	45
a2		[mm]	25.4	32.4	40.4	45.4
a3 +0.2		[mm]	26	33	41	46
b		[mm]	35	42	53	66
c		[mm]	33	42	54	63
d1		[mm]	26	32	40	50
d2		[mm]	28	35.8	40	50
d3		[mm]	6.5	9.5	11.5	13
e		[mm]	24	32	41	47
f1		[mm]	17.5	22	29.5	37
f2		[mm]	13	17	23	29
f3		[mm]	11	15	18	18
f4		[mm]	6.5	8	12.5	15
f5		[mm]	14	18	20	25
G		[mm]	M5	M6	M8	M10
g		[mm]	11	9.5	14	13
g1		[mm]	7.5	12	14	18
h clamping height*		[mm]	23+1.5/−1.2	28+2/−1.6	36+2.4/−1.9	41+2.8/−2.3
h1 clamping height*		[mm]	56.5+1.5/−1.2	68.5+2/−1.6	81+2.4/−1.9	91+2.8/−2.3
k1		[mm]	32.5	41.5	54	64
k2 approx.		[mm]	45	57	72	83.5
k3		[mm]	11.8	15.25	15.05	14.75
k4		[mm]	66	82	99	114
k5 approx.		[mm]	78.5	97.5	117	133.5
k6 approx.		[mm]	59	75	94	110
L		[mm]	18	24	28	33
l1		[mm]	10	11	16	20
l2		[mm]	30	37	48	57
l3		[mm]	45	56	71	85
l4		[mm]	22	30	34	41.5
m1 −0.1		[mm]	16.9	20.9	25.9	32.9
m2		[mm]	9.5	13.5	18	22.5
n1		[mm]	29	35.5	46	57
n2		[mm]	23	28	36	41
n3		[mm]	9	17.5	24	32
P1 min.		[mm]	10	12.5	12.5	13
p1+/−0.1		[mm]	29.8	35.8	39.7	43.1
p2		[mm]	2.6	2.6	3.2	3.2
p3		[mm]	1.5	2.5	2.5	3
r1		[mm]	11	13.9	13.3	13.5
r4		[mm]	4	4	8	8
r5		[mm]	2	2	4	4
Built-in type						
Part no. without clamping lever			**1829413D00**	**1829423D00**	**1829433D00**	**1829443D00**
Weight, approx.		[kg]	0.24	0.47	0.93	1.54
Part no. with clamping lever			**1829413D18**	**1829423D24**	**1829433D28**	**1829443D33**
Weight, approx.		[kg]	0.27	0.55	1.1	1.83
Block type						
Part no. without clamping lever			**1829513D00**	**1829523D00**	**1829533D00**	**1829543D00**
Weight, approx.		[kg]	0.41	0.79	1.53	2.59
Part no. with clamping lever			**1829513D18**	**1829523D24**	**1829533D28**	**1829543D33**
Weight, approx.		[kg]	0.45	0.87	1.7	2.88
Accessories						
Part no. clamping lever length L			**0354 1025**	**0354 1026**	**0354 1027**	**0354 1028**
Weight, approx.		[kg]	0.042	0.086	0.185	0.319
Part no. long clamping lever (blank)			**0354 1029**	**0354 1030**	**0354 1031**	**0354 1032**
Weight, approx.		[kg]	0.066	0.14	0.29	0.537
Part no. swarf sheet			**0353 81404**	**0353 81405**	**0353 81406**	**0353 81407**
Spare O-rings						
for flange position monitoring			3x1	3x1	3x1	3x1
Part no.			**3001 758**	**3001 758**	**3001 758**	**3001 758**
for flange hydraulic port			3x1	3x1	2.9x1.78	3.68x1.78
Part no.			**3001 758**	**3001 758**	**3000 019**	**3000 876**

* The clamping height h must be in the indicated tolerance range.

Clamping force diagrams

Calculations of the clamping force



1. Length L of clamping lever is known

1.1 Admissible operating pressure

$$p_{adm} = \frac{B}{\frac{C}{L}+1} \quad \leq 120 \quad [bar]$$

1.2 Effective clamping force

$p_{adm} > 120$ bar $\quad F_{Sp} = \frac{A}{L} \times 120 \quad [kN]$

$p_{adm} \leq 120$ bar $\quad F_{Sp} = \frac{A}{L} \times p \quad [kN]$

2. Min. length of clamping lever

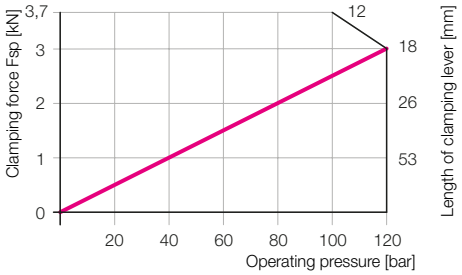
$$L_{min} = \frac{C}{\frac{B}{p}-1} \quad [mm]$$

L, $L_{min.}$	= length of clamping lever	[mm]
p, $p_{adm.}$	= Operating pressure	[bar]
A, B, C,	= constants	

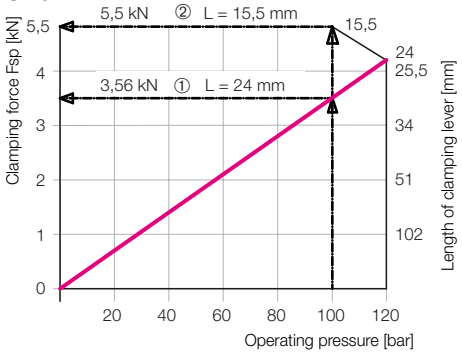
Constants

Size	1	2	3	4
A	0.443	0.853	1.74	2.681
B	193.33	185	192.85	190.91
C	11	13	17	19.5

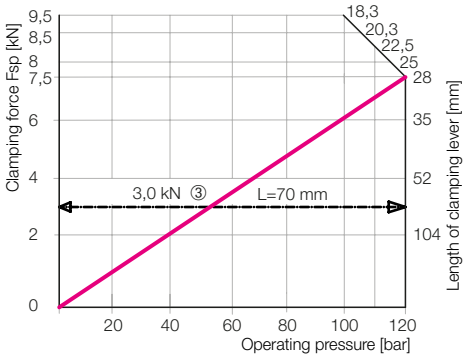
Size 1



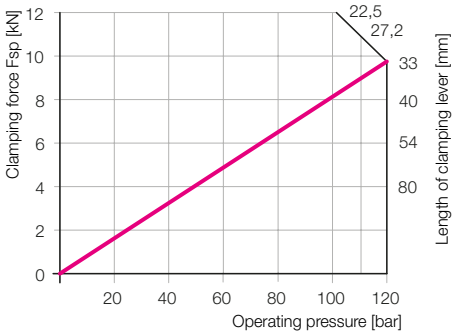
Size 2



Size 3



Size 4



Example 1: Flat lever clamp 1829423**D**24
Operating pressure 100 bar
Standard clamping lever L = 24 mm

Effective clamping force at 100 bar

$$F_{Sp} = \frac{A}{L} \times p = \frac{0.853}{24} \times 100 = 3.55 \text{ kN}$$

Example 2: Flat lever clamp 1829523**D**00
Operating pressure 100 bar

Minimum length of clamping lever

$$L_{min} = \frac{C}{\frac{B}{p}-1} = \frac{13}{\frac{185}{100}-1} = 15.29 \rightarrow 15.5 \text{ mm}$$

Admissible operating pressure (review)

$$p_{adm} = \frac{B}{\frac{C}{L}+1} = \frac{185}{\frac{13}{15.5}+1} = 100 \text{ bar}$$

Effective clamping force at 100 bar

$$F_{Sp} = \frac{A}{L} \times p = \frac{0.853}{15.5} \times 100 = 5.5 \text{ kN}$$

Example 3: Flat lever clamp 1829433**D**00
Special clamping lever L = 70 mm

Admissible operating pressure

$$p_{adm} = \frac{B}{\frac{C}{L}+1} = \frac{192.85}{\frac{17}{70}+1} = 155 \text{ bar} > 120 \text{ bar!}$$

Effective clamping force at 120 bar

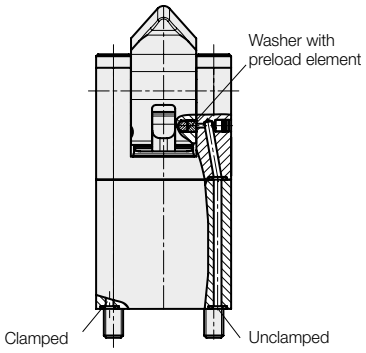
$$F_{Sp} = \frac{A}{L} \times p = \frac{1.74}{70} \times 120 = 3 \text{ kN}$$

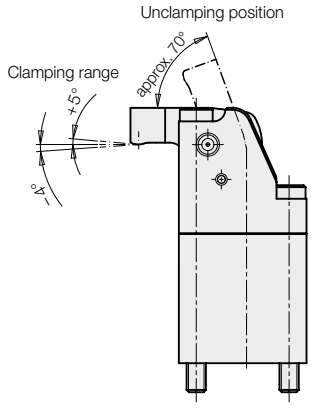
Pneumatic position monitoring

The double-acting flat lever clamps

1829XX3DXX

are delivered with standard position monitoring. Depending on requirements, the compressed air is supplied via one or two drilled channels (see page 2).
The required O-rings in the flange are included in the delivery.





Description

On both sides of the clamping lever is a bore hole in which a washer with an elastic preload element is positioned.
In the guide for the clamping lever in the housing, two bore holes are arranged so that the clamping or unclamping position of the clamping lever will be closed by the preloaded washer.

Important note!

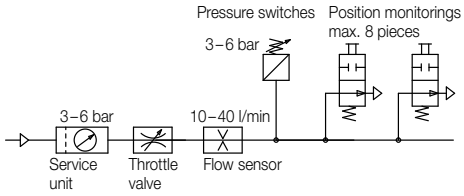
When mounting the clamping lever, the preload elements and the washers must be inserted into the provided bore holes in the clamping lever.

These parts are included in the delivery of all double-acting flat lever clamps that are delivered without the clamping lever.

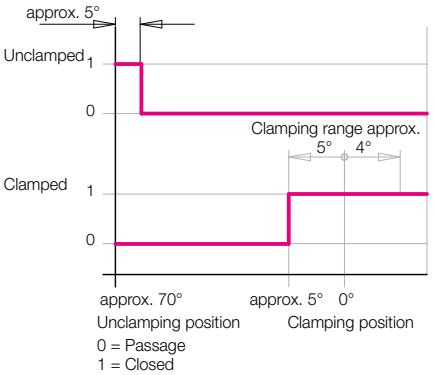
Monitoring by pneumatic pressure switch

For the evaluation of the pneumatic pressure increase standard pneumatic pressure switches can be used.

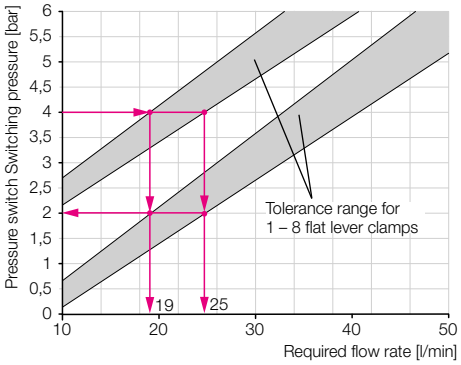
Pneumatic port



Function chart



Required flow rate depending on the switching pressure of the pneumatic pressure switch for a pressure drop Δp 2 bar



Example

Required switching pressure	4 bar
Pressure drop, if the clamping or unclamping position has not yet been reached.	2 bar
As per diagram: Required flow rate*	
1 element	approx. 19 l/min
8 elements	approx. 25 l/min

*) The pneumatic position monitoring is a metallic sealing system in which an air leakage of up to 1.5 l/min per element can occur when closed at 2 bar.
The amount of air leakage depends on the ambient conditions (cleanliness) and should be added to the required volume as per diagram.

Electric Swing Clamp

Top flange, position and clamping force monitoring, IO-Link connection optional DC voltage 24 V, minimum energy demand

Application

Electric swing clamps are used for clamping or holding of workpieces
- when the clamping and holding points shall be free for loading and unloading of the fixture
- when an extended functionality is required for automated systems
- when clamping elements have to be controlled individually
- where the clamping force must be maintained also after the separation from the energy supply

Thus electric swing clamps are particularly suited for:
- Packaging industry
- Test systems
- Special machines
- Assembly equipments and robotics
- Automatic manufacturing systems
- Clamping fixtures with workpiece loading via handling systems

Description

The electric swing clamp is driven by a wear-resistant brushless DC motor. The motor speed is transformed by means of a gear and a threaded spindle into the swing and stroke movement of the piston rod. For swinging the clamping arm by 180°, an axial stroke of only 3 mm is required. If the clamping arm collides during the swing motion with a workpiece, the mechanism is protected against overload. The direct current motor is automatically and immediately switched off. When unclamping, the clamping arm always swings back to the off-position.

Integrated control

The electronic control for the DC motor is on a board in the housing of the electric swing clamp.

Electric connection

Power supply and signal exchange for external control are transmitted by two short cables with plug-type connector. Cable sockets are available for the customer's connection (see connection accessories).

Safe touch voltage

The used DC voltage 24 V is considered to be a "low voltage" and thus it is not dangerous for people in case of contact.

Advantages

- High clamping force
- Adjustable clamping force
- Camping force control
- Can be controlled individually or in common
- High operating safety by self-locking spindle drive
- Mechanical reclamping by Belleville springs
- Swing angle up to 180° available
- Overload protection device in the case of collisions with the clamping arm
- Electrical position monitoring and extended self-monitoring with diagnostic options
- Clamping stroke control possible
- Low voltage 24 V
- Leakage free
- Maintenance free (500,000 cycles)
- Code class IP 67

Power supply

For motor and electronic control a DC voltage of 24 V with a residual ripple of max. 10 % is required.
For the DC motor, we recommend the use of a switching power supply with a current output in accordance with the specifications in the technical data per connected electric swing clamp. When operating several swing clamps at the same time, the line is to be enlarged correspondingly.
The electronic control has to be supplied by a separate power supply (24 V DC / 100 mA).

Adjusting ranges

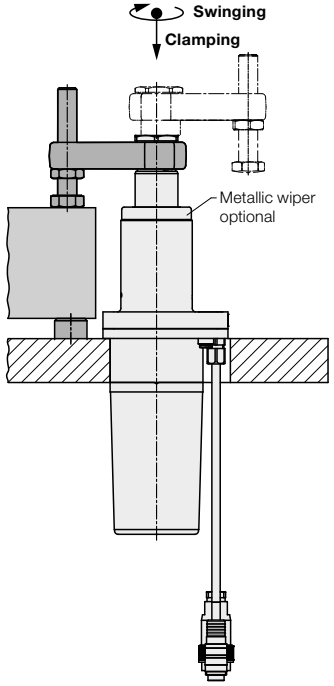
After removal of the protection cover, the following adjustments can be made on the control board:
- Clamping force
- Swing speed
- Compensation of the clamping arm elasticity

The clamping force can also be adjusted via analogue input.

Important notes

Electric swing clamps are designed exclusively for clamping or holding of workpieces in industrial applications. They can generate very high clamping 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.
During loading and unloading of the fixture and during clamping a collision with the clamping arm has to be avoided.
For the positioning of workpieces, the admissible displacement force as per diagram on page 4 has to be considered.
If there is any danger that fluids penetrate into the electric swing clamp, the screw plug at the venting port G 1/8 has to be removed and a vent hose has to be connected. The other end of the hose has to be placed to an absolutely dry area.
It is recommended to connect a dry positive air pressure protection with 0.2 bar.

Functional principle



Function control

Unclamped
- Clamping arm in off-position and unclamping process completed

Clamped
- Clamping arm within clamping area and clamping force obtained
- Clamping stroke control possible by output signal

Diagnostic options
- Extensive review on error conditions
- Signalling via error code (flashing signal) internally on control board or via external interface signal
- Error messages can be reset
- Review display after 500,000 cycles

You will find a complete description in the supplied operating manual.

Use IO-Link
Universal · Smart · Easy

Optionally with cable and 4-pin connector for connection to an IO-Link master. Via this interface, commands and information are exchanged between the electric swing clamp and a higher-level control.

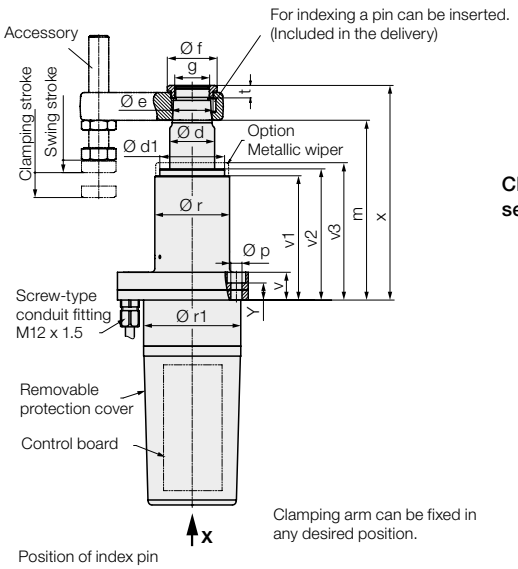
Advantages

- Reduced cabling effort
- Simplified commissioning
- More extensive diagnostic options
- Interference immunity through digital signal transmission
- All settings can be made conveniently via the IO-Link interface

Technical information

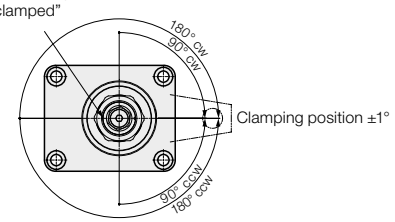
Further information on the application and operating conditions is available on request.

Off-position for 180 degree swing angle

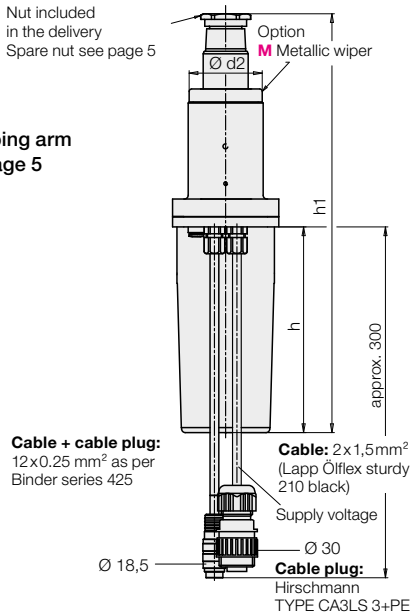


Clamping arm can be fixed in any desired position.

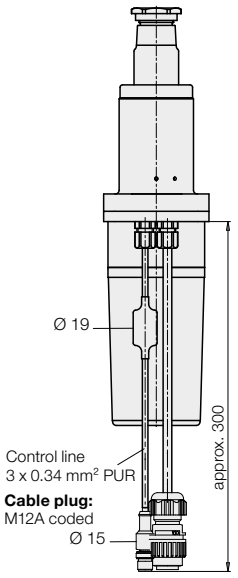
Position of index pin
"when clamped"



183XXXXXXXX
183XXXXXXXM



IO-Link connection
183XXXXXXX0I
183XXXXXXXMI



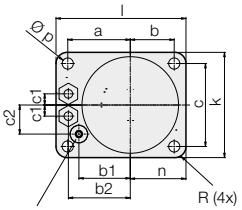
Connecting cable

Maximum permissible cable length 30 m

for supply of the DC motor	
Cable length	Cable cross section
< 12 m	2 x 1.5 mm²
< 20 m	2 x 2.5 mm²
< 30 m	2 x 4 mm²

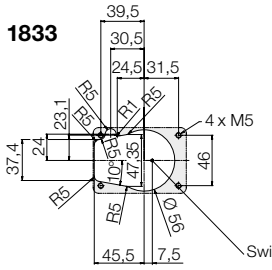
Connecting scheme

View X

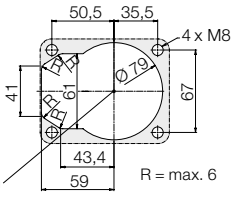


Venting screw
or positive air pressure protection
1833 = M5
1835 = G⅛

1833



1835



Accessory

control line

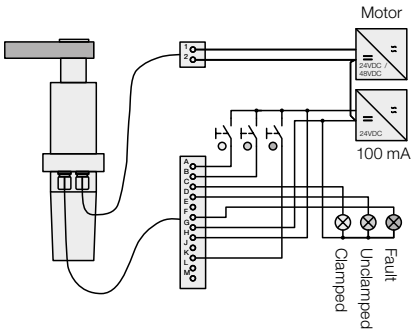
Cable socket customized to requirements 12 POL.
Part no. 3141992

Cable socket 5 m cable 12 POL.
Part no. 3823375 L 05000

Supply line

Cable socket Hirschmann CA3LD
Part no. 3141 991

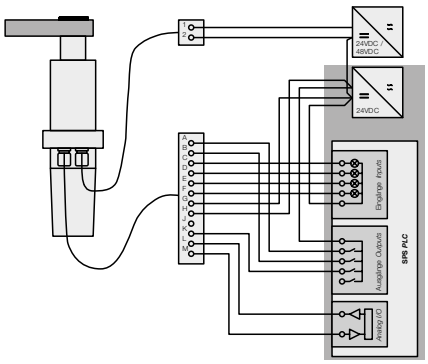
Connecting examples
Minimum configuration



Supply voltage 24 V DC motor
1 +24 V DC
2 GND (ground)

Control line
Pin Function
A Command clamping
B Command unclamping
C Message clamped
D Message unclamped
F Message error code
K Command error reset

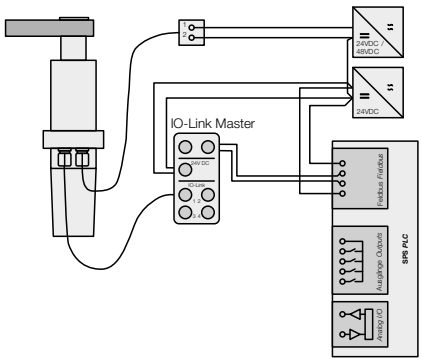
Programmable logic control PLC



Supply voltage 24 V DC motor
Pin Function
1 +24 V DC
2 GND (ground)

Control line
Pin Function
A Command clamping
B Command unclamping
C Message clamped
D Message unclamped
E Message number of cycles
F Message error code
G GND (ground)
H +24 V DC (control)
K Command error reset
L Analogue input clamping force (0–10 V)
M Analogue output clamping stroke (0–10 V)

IO-Link connection



IO-Link connection
Supply voltage 24 V DC motor
1 +24 V DC
2 GND (ground)

Control line
1 +24 V DC
3 GND (ground)
4 C/Q IO-Link

Use IO-Link
Universal · Smart · Easy

Electric Swing Clamp		**1833**	**1835**
Axial pulling force adjustable	[kN]	0.9 to 2.7	3 to 9
Effective clamping force	[kN]	see diagram	
Admissible displacement force	[kN]	see diagram	
Clamping stroke (usable)	[mm]	13	20
Swing stroke	[mm]	4	
Total stroke (mechanical)	[mm]	19	26
Swing angle	[°]	0°/90°/180° *	
Clamping time approx.	[s]	3**	
Unclamping time approx.	[s]	3**	
Special clamping arm			
Max. distance between piston axis and clamping point	[mm]	100	150
Max. radial torque M1	[Nm]	0.1	0.5
Max. moment of inertia	[kgm²]	0.0012	0.008
Nominal voltage	[V DC]	24	
Operating range	[V DC]	22 ...30	
Residual ripple	[%]	< 10	
Max. current consumption	[A]	8	15
Power consumption in standby mode approx.	[W]	1.2	
Duty cycle	[%]	25 (S3)	
Code class		IP 67	
Positive air pressure connection max.	[bar]	0.2	
Ambient temperature	[°C]	–5 … +40	
Mounting position		preferably vertical***	
Weight, approx.	[kg]	3.5	8
a	[mm]	39.5	50.5
b	[mm]	31.5	35.5
b1	[mm]	30.5	41.5
b2	[mm]	36.5	50
c	[mm]	46	67
c1	[mm]	11	9
c2	[mm]	24	23.5
Ø d	[mm]	25	36
Ø d1	[mm]	40 s7	52 s6
Ø d2	[mm]	42.8	58.5
Ø e	[mm]	23.5	33.5
f	[mm]	30	40
g	[mm]	M18 × 1.5	M28 × 1.5
h	[mm]	125.5	164.5
h1 +2	[mm]	259.7	336.9
i	[mm]	M5	M8
k	[mm]	60	85
l	[mm]	85	105
m –1	[mm]	115.2	146.4
n	[mm]	38.5	45
Ø p	[mm]	5.5	9
Ø r –0.1	[mm]	45	60
Ø r1	[mm]	55	78
t	[mm]	9	10
v	[mm]	22.3	22
v1	[mm]	79	99.5
v2	[mm]	83.6	105
v3	[mm]	88.6	110
x +2	[mm]	134.2	172.4
y	[mm]	16.6	13.5

Part no.		
Swing direction 90° clockwise	**1833A090R19XX**	**1835C090R26XX**
Swing direction 90° counterclockwise	**1833A090L19XX**	**1835C090L26XX**
Swing direction 180° clockwise	**1833A180R19XX**	**1835C180R26XX**
Swing direction 180° counterclockwise	**1833A180L19XX**	**1835C180L26XX**
0 degree	**1833A000019XX**	**1835C000026XX**

XX = Options
0I = IO-Link
M = Metallic wiper
MI = Metallic wiper + IO-Link

* Further swing angles are available on request (min. 45°)
** Further technical data available on request
*** For horizontal mounting position, please note page 6

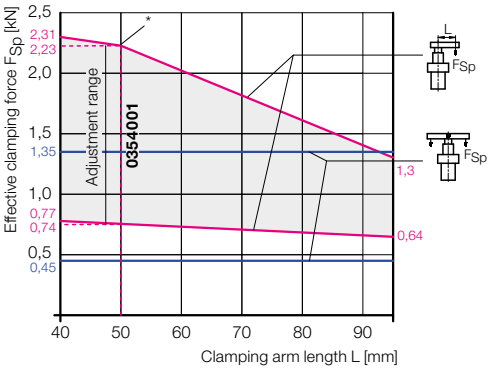
Important note

To guarantee a process-safe application, all technical requirements and general conditions must be carefully checked.
Please contact our technical consultants (on site or directly in product management, Phone +49 6405 89 456).

Effective clamping force F_{Sp} as a function of the clamping arm length L

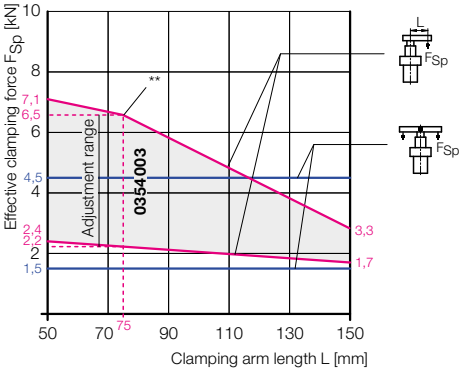
The effective clamping force is smaller the longer the clamping arm. For longer clamping arms, the clamping force must be reduced so that the admissible bending moment will not be exceeded. The adjustment of the clamping force is made on the control board or externally via the analogue input L. The default setting is suitable for the accessory clamping arm with contact bolt.

1833



* For clamping arm lengths > 50 mm, please observe the permissible setting parameters for the effective clamping force according to the operating instructions.

1835



** For clamping arm lengths > 75 mm, please observe the setting parameters permitted for the effective clamping force as specified in the operating instructions.

Example

Accessory clamping arm 0354001: L = 50 mm

As per diagram:

Max. clamping force 2.2 kN
Min. clamping force 0.74 kN

The clamping force is continuously adjustable.

Example

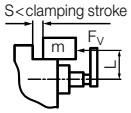
Accessory clamping arm 0354003: L = 75 mm

As per diagram:

Max. clamping force 6.5 kN
Min. clamping force 2.2 kN

The clamping force is continuously adjustable.

Permissible displacement force F_V for the horizontal positioning of a workpiece



The electric swing clamp can push, i.e. position a workpiece against fixed points. The permissible displacement force depends on the set clamping force and the length of the clamping arm. It equal to 15 % of the set clamping force.

A clamping arm with 50 mm centre distance to the clamping point is used. Trimmer F is set to 9. The trimmer E setting is not relevant for the calculation of the displacement force. According to the clamping force diagram, an effective clamping force is achieved at clamping point 2.2 kN. The permissible displacement force F_V is thus:

$F_V = F_{Sp} * 15\ \% = 2.2\ kN * 0.15 = 0.33\ kN$

A clamping arm with 75 mm centre distance to the clamping point is used. Trimmer F is set to 9. The trimmer E setting is not relevant for the calculation of the displacement force. According to the clamping force diagram, an effective clamping force is achieved at clamping point 6.5 kN. The permissible displacement force F_V is thus:

$F_V = F_{Sp} * 15\ \% = 6.5\ kN * 0.15 = 0.98\ kN$

Example

Accessory clamping arm 0354001: L = 50 mm

As per diagram:

Max. clamping force 2.2 kN
Displacement force F_V 0.33 kN

With a friction coefficient μ = 0.4, this is sufficient for a workpiece mass m:

$$m = \frac{F_V}{g * \mu} = \frac{330\ N}{9.81 * 0.4} = 84\ kg$$

Example

Accessory clamping arm 0354003: L = 75 mm

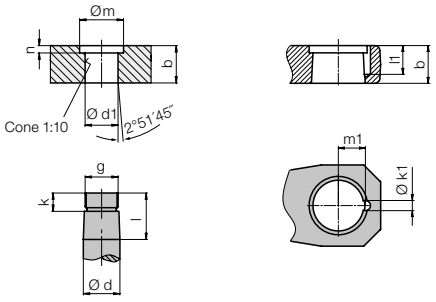
As per diagram:

Max. clamping force 6.5 kN
Displacement force F_V 0.98 kN

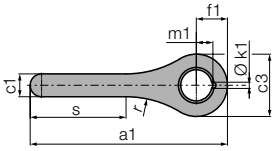
With a friction coefficient μ = 0.4, this is sufficient for a workpiece mass m:

$$m = \frac{F_V}{g * \mu} = \frac{980\ N}{9.81 * 0.4} = 250\ kg$$

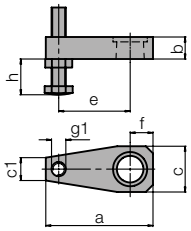
Dimensions for special clamping arms and indexing



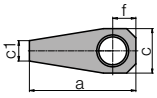
Clamping arm blank with indexing



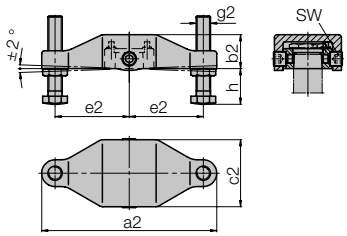
Clamping arm without indexing
Clamping arm with contact bolt



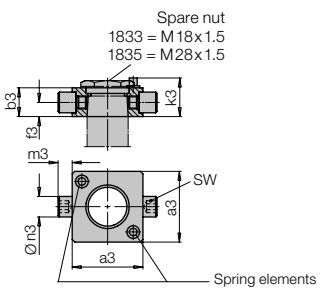
Clamping arm without thread g1



Double clamping arm complete with carrier
GGG 40



Carrier for double clamping arm
42CrV4 hardened and tempered



Electric Swing Clamp		**1833**	**1835**
a	[mm]	75	115
a1	[mm]	125	190
a2	[mm]	138	196
a3 ±0.1	[mm]	43	55
b	[mm]	16	23
b2	[mm]	28.5	38
b3 ±0.1	[mm]	16	23
c	[mm]	32	48
c1	[mm]	16	22
c2	[mm]	59	75
c3	[mm]	45	60
Ø d f7	[mm]	25	32
Ø d1 +0.05	[mm]	19.8	31.85
e	[mm]	50	75
e2	[mm]	60	83
f	[mm]	16	25
f1	[mm]	22.5	30
f3	[mm]	7.5	11
g	[mm]	M18×1.5	M28×1.5
g1	[mm]	M10	M16
g2	[mm]	M10	M16
h min ... max	[mm]	10 to 64	15 to 79
k	[mm]	10	12
Ø k1 +0.1	[mm]	3	6
k3**	[mm]	21.5	29
l	[mm]	21	28
l1	[mm]	13	17
Ø m	[mm]	24.5	34
m1 +0.05	[mm]	9.8	16
m3	[mm]	9	11
n	[mm]	4	5
Ø n3 g6	[mm]	10	16
r	[mm]	70	100
s	[mm]	52.7	92.3
SW	[mm]	5	8
Part no.			
Clamping arm with contact bolt		**0354001**	**0354003**
Weight, approx.	[kg]	0.25	0.8
Moment of inertia	[kgm²]	0.000320	0.002295
Radial torque	[Nm]	0.06	0.32
Clamping arm without thread g1		**3921016**	**3921017**
Weight, approx.	[kg]	0.2	0.65
Moment of inertia	[kgm²]	0.00018	0.00134
Radial torque	[Nm]	0.05	0.20
Clamping arm blank		**3548901A**	**3548902A**
Weight, approx.	[kg]	0.35	0.95
Moment of inertia	[kgm²]	0.00074	0.0035
Radial torque	[Nm]	0.1	0.5
Material: High alloy steel 1000 … 1200 N/mm²			
Double clamping arm, complete*		**0354131**	**0354132**
Weight, approx.	[kg]	0.83	2
Moment of inertia	[kg·m²]	0.00120	0.00765
Carrier for double clamping arm		**0354141**	**0354142**
Weight, approx.	[kg]	0.16	0.46
Spare nut		**3527014**	**3527015**
Max. tightening torque	[Nm]	60	90
Weight, approx.	[kg]	0.03	0.05
Metallic wiper		**0341231**	**0341231**
Indexing pin		3 m 6x6 **3301281**	6 m6x12 **3300325**

* Complete with threaded bolt and spring elements
** Height stop surface for spring elements

Horizontal mounting position

The electric swing clamp can be operated with the accessory clamping arm with contact bolt (e) in every mounting position.

In the case of longer and heavier special clamping arms, the permissible radial torque M1 * is exceeded, which can lead to malfunctions and increased wear.

Remedy:

Provide the clamping arm with a counterweight as explained in the opposite example.

* see table page 3

Clamping arm S1 with weight compensation S2

Required counterweight $m2 = \frac{M1}{l2}$ [kg]

M1 = First-order torque around the piston axis (control of the CAD model) [kgm]

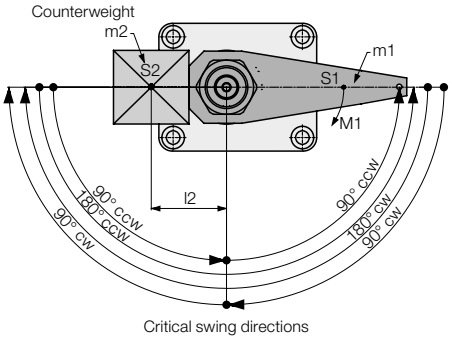
m2 = Mass of counterweight [kg]

l2 = Centre of gravity of the mass m2 [m]

Important note

The additional counterweight increases the moment of inertia J around the piston axis, what can be easily determined by querying of the CAD model. To avoid an overload of the swing drive, the flow rate has to be reduced. The setting is described in the operating manual.

Mounting position - horizontal



Electric Swing Clamp

Parallel drive, position and clamping force monitoring, IO-link connection optional DC voltage 24 V, minimum energy demand

Application

Electric swing clamps are used for clamping or holding of workpieces
- when the clamping and holding points shall be free for loading and unloading of the fixture
- when an extended functionality is required for automated systems
- when clamping elements have to be controlled individually
- where the clamping force must be maintained also after the separation from the energy supply

Thus electric swing clamps are particularly suited for:
- Packaging industry
- Test systems
- Special machines
- Assembly equipments and robotics
- Automatic manufacturing systems
- Clamping fixtures with workpiece loading via handling systems

Description

The electric swing clamp is driven by a wear-resistant brushless DC motor. The motor speed is transformed by means of a gear and a threaded spindle into the swing and stroke movement of the piston rod. For swinging the clamping arm by 180°, an axial stroke of only 3 mm is required.
If the clamping arm collides during the swing motion with a workpiece, the mechanism is protected against overload. The direct current motor is automatically and immediately switched off. When unclamping, the clamping arm always swings back to the off-position.

Integrated control

The electronic control for the DC motor is on a board in the housing of the electric swing clamp.

Electric connection

Power supply and signal exchange for external control are transmitted by two short cables with plug-type connector. Cable sockets are available for the customer's connection (see connection accessories).

Safe touch voltage

The used DC voltage 24 V is considered to be a "low voltage" and thus it is not dangerous for people in case of contact.

Advantages

- High clamping force
- Adjustable clamping force
- Camping force control
- Can be controlled individually or in common
- High operating safety by self-locking spindle drive
- Mechanical reclamping by Belleville springs
- Swing angle up to 180° available
- Overload protection device in the case of collisions with the clamping arm
- Electrical position monitoring and extended self-monitoring with diagnostic options
- Clamping stroke control possible
- Low voltage 24 V
- Leakage free
- Maintenance free (500,000 cycles)
- Code class IP 67

Power supply

For motor and electronic control a DC voltage of 24 V with a residual ripple of max. 10 % is required.
For the DC motor, we recommend the use of a switching power supply with a current output of 15 A per connected electric swing clamp. When operating several swing clamps at the same time, the line is to be enlarged correspondingly.
The electronic control has to be supplied by a separate power supply (24 V DC / 100 mA).

Adjusting ranges

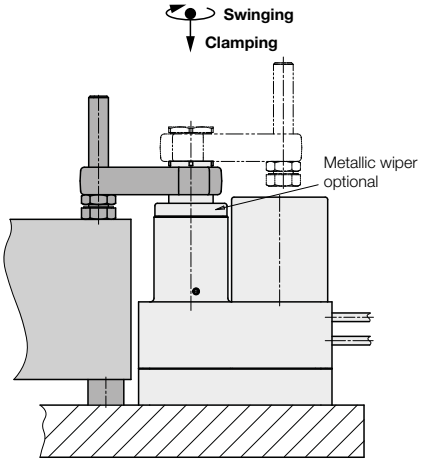
After removal of the protection cover, the following adjustments can be made on the control board:
- Clamping force
- Swing speed
- Compensation of the clamping arm elasticity

The clamping force can also be adjusted via analogue input.

Important notes

Electric swing clamps are designed exclusively for clamping or holding of workpieces in industrial applications. They can generate very high clamping 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.
During loading and unloading of the fixture and during clamping, collision with the clamping arm must be avoided.
For the positioning of workpieces, the admissible displacement force as per diagram on page 3 has to be considered.
If there is any danger that fluids penetrate into the electric swing clamp, the screw plug at the venting port G 1/8 has to be removed and a vent hose has to be connected. The other end of the hose has to be placed to an absolutely dry area.
It is recommended to connect a dry positive air pressure protection with 0.2 bar.

Functional principle



Function control

Unclamped

- Clamping arm in off-position and unclamping process completed

Clamped

- Clamping arm within clamping area and clamping force obtained
- Clamping stroke control possible by output signal

Diagnostic options

- Extensive review on error conditions
- Signalling via error code (flashing signal) internally on control board or via external interface signal
- Error messages can be reset
- Review display after 500,000 cycles

You will find a complete description in the supplied operating manual.

Use IO-Link
Universal · Smart · Easy

Optionally with cable and 4-pin connector for connection to an IO-Link master. Via this interface, commands and information are exchanged between the electric swing clamp and a higher-level control.

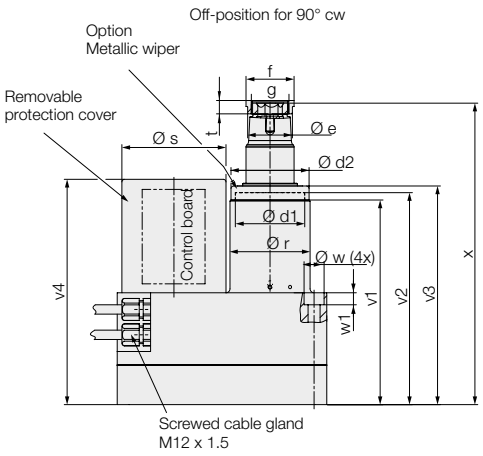
Advantages

- Reduced cabling effort
- Simplified commissioning
- More extensive diagnostic options
- Interference immunity through digital signal transmission
- All settings can be made conveniently via the IO-Link interface

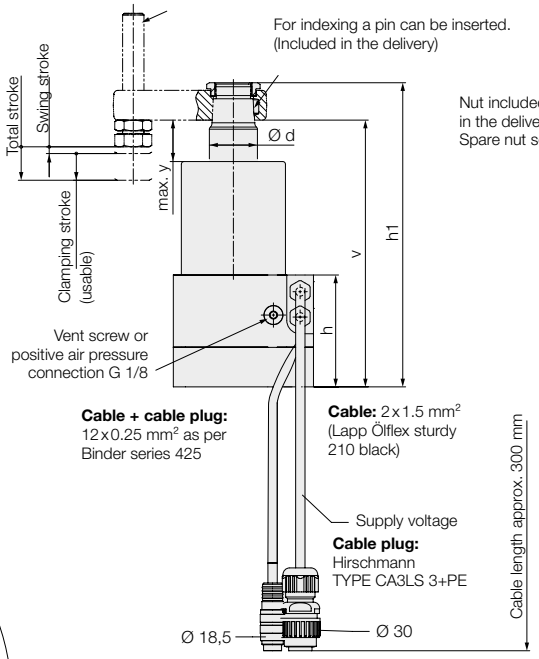
Technical information

Further information on the application and operating conditions is available on request.

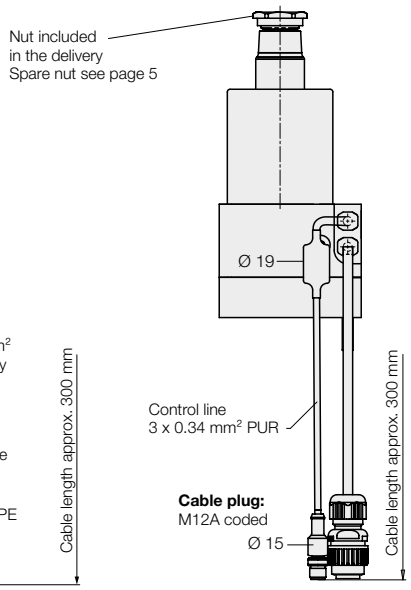
Clamping arm see page 4

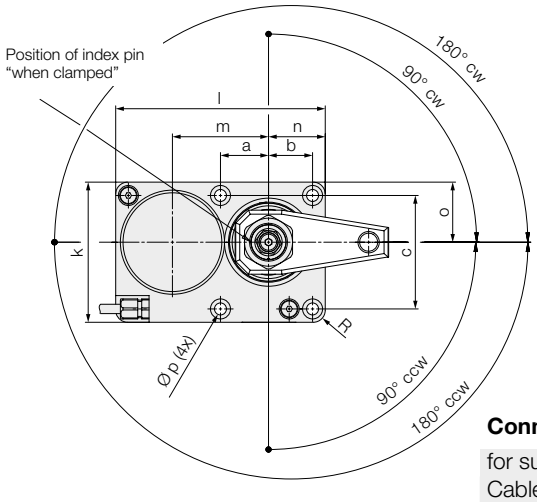


1835 CXXX X26P
1835 CXXX X26PM



IO-Link connection
1835 CXXX X26P0I
1835 CXXX X26PMI





Clamping position ±1°

Clamping arm can be fixed
in any desired position.

Connecting cable

for supply of the DC motor	
Cable length	Cable cross section
< 12 m	2 x 1.5 mm²
< 20 m	2 x 2.5 mm²
< 30 m	2 x 4 mm²

Accessory
control line

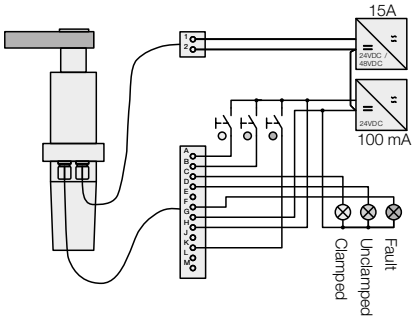
Cable socket customized to require-
ments 12 POL.
Part no. 3141 992

Cable socket 5 m cable 12 POL.
Part no. 3823 375 L 05000

Supply line

Cable socket Hirschmann CA3LD
Part no. 3141 991

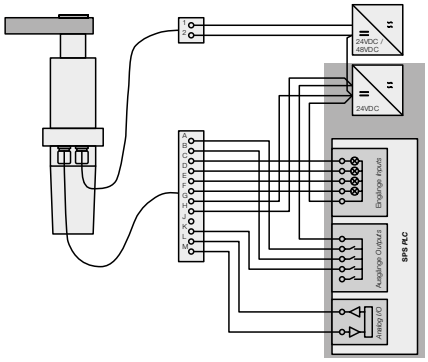
Connecting examples
Minimum configuration



Supply voltage 24 V DC - 15 A
1 +24 V DC
2 GND (ground)

Control line
Pin Function
A Command clamping
B Command unclamping
C Message clamped
D Message unclamped
F Message error code
K Command error reset

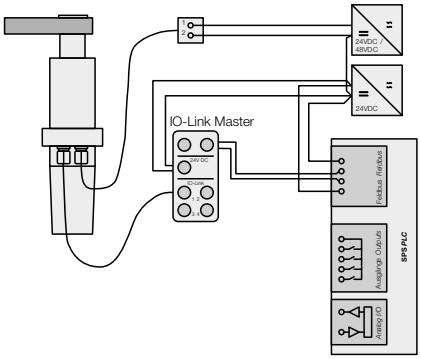
Programmable logic control PLC



Supply voltage 24 V DC - 15 A
Pin Function
1 +24 V DC
2 GND (ground)

Control line
Pin Function
A Command clamping
B Command unclamping
C Message clamped
D Message unclamped
E Message number of cycles
F Message error code
G GND (ground)
H +24 V DC (control)
K Command error reset
L Analogue input clamping force (0-10 V)
M Analogue output clamping stroke (0-10 V)

IO-Link connection



IO-Link connection
Supply voltage 24 V DC - 15 A
1 +24 V DC
2 GND (ground)

Control line
1 +24 V DC
3 GND (ground)
4 C/Q IO-Link

Use IO-Link
Universal · Smart · Easy

Electric Swing Clamp		1835
Axial pulling force adjustable	[kN]	3 … 9
Effective clamping force	[kN]	see diagram
Admissible displacement force	[kN]	see diagram
Clamping stroke (usable)	[mm]	20
Swing stroke	[mm]	4
Total stroke (mechanical)	[mm]	26
Swing angle	[°]	0°/90°/180° *
Clamping time approx.	[s]	3 **
Unclamping time approx.	[s]	3 **
Special clamping arm		
Max. clamping arm length	[mm]	150
Max. radial torque	[Nm]	0.5
Max. moment of inertia	[kgm²]	0.008
Nominal voltage	[V DC]	24
Operating range	[V DC]	22 to 30
Residual ripple	[%]	< 10
Max. current consumption	[A]	15
Power consumption in standby mode approx.	[W]	1.2
Duty cycle	[%]	25 (S3)
Code class		IP 67
Positive air pressure connection max.	[bar]	0.2
Ambient temperature	[°C]	−5 … +40
Mounting position		preferably vertical ***
Weight, approx.	[kg]	10.75
a	[mm]	36
b	[mm]	33
c	[mm]	85
Ø d	[mm]	36
Ø d1	[mm]	52
Ø d2	[mm]	58.5
Ø e	[mm]	33.5
f	[mm]	SW36
g	[mm]	M28 x 1.5
h	[mm]	83.8
h1 +2	[mm]	227.9
k	[mm]	105
l	[mm]	157
m	[mm]	72
n	[mm]	42.5
o	[mm]	45
Ø p	[mm]	9
Ø r – 0.1	[mm]	60
R	[mm]	9
Ø s	[mm]	78
v –1	[mm]	199.9
v1	[mm]	153.2
v2	[mm]	158.8
v3	[mm]	163.8
v4	[mm]	168.8
Ø w	[mm]	15
w1	[mm]	9
x +2	[mm]	225.9
y	[mm]	29

Part no.

Swing direction 90° clockwise	**1835 C090 R26P XX**
Swing direction 90° counterclockwise	**1835 C090 L26P XX**
Swing direction 180° clockwise	**1835 C180 R26P XX**
Swing direction 180° counterclockwise	**1835 C180 L26P XX**
0 degree	**1835 C000 026P XX**

XX = Options
0I = IO-Link
M = Metallic wiper
MI = Metallic wiper + IO-Link

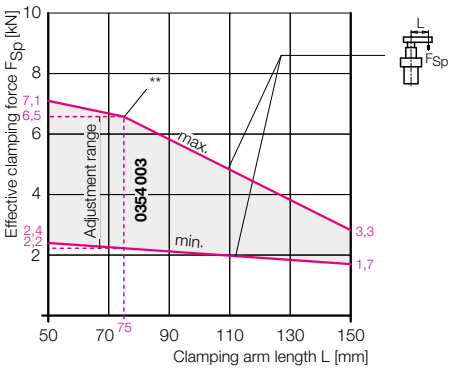
* More swing angles are available on request (min. 45°).
** Additional technical data is available on request
*** For horizontal mounting position, please see page 4.

Important note

To guarantee a process-safe application, all technical requirements and general conditions must be carefully checked.
Please contact our technical consultants (on site or directly in product management, Tel.: +49 6405 89-456).

Effective clamping force F_{Sp} as a function of the clamping arm length L

The effective clamping force is smaller the longer the clamping arm. For longer clamping arms, the clamping force must be reduced so that the admissible bending moment will not be exceeded.
The adjustment of the clamping force is made on the control board or externally via analogue input L.
The default setting of is suitable for the accessory clamping arm L = 75 mm.



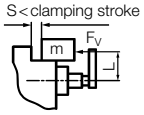
** For clamping arm lengths > 75 mm, please observe the setting parameters permitted for the effective clamping force as specified in the operating instructions.

Example

Accessory clamping arm 0354003: L = 75 mm

As per diagram:
- max. clamping force 6.5 kN
- min. clamping force 2.2 kN

The clamping force is continuously adjustable.



Permissible displacement force F_V for the horizontal positioning of a workpiece

The electric swing clamp can push, i.e. position a workpiece against fixed points.
The permissible displacement force depends on the set clamping force and the length of the clamping arm. It equal to 15 % of the set clamping force.

A clamping arm with 75 mm centre distance to the clamping point is used. Trimmer F is set to 9. The trimmer E setting is not relevant for the calculation of the displacement force. According to the clamping force diagram, an effective clamping force is achieved at clamping point 6.5 kN. The permissible displacement force F_V is thus:

$F_V = F_{Sp} * 15\ \% = 6.5\ kN * 0.15 = 0.98\ kN$

Example

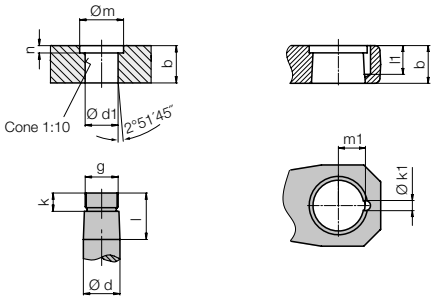
Accessory clamping arm 0354003: L = 75 mm

As per diagram:
Max. clamping force 6.5 kN
Displacement force F_V 0.98 kN

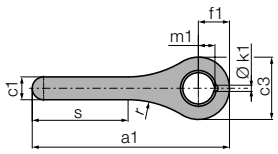
With a friction coefficient μ = 0.4, this is sufficient for a workpiece mass m:

$$m = \frac{F_V}{g * \mu} = \frac{980\ N}{9.81 * 0.4} = 250\ kg$$

Dimensions for special clamping arms and indexing

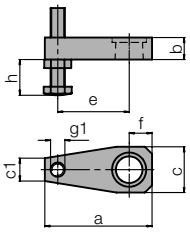


Clamping arm blank with indexing

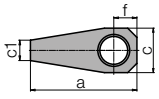


Clamping arm without indexing

Clamping arm with contact bolt



Clamping arm without thread g1



Electric Swing Clamp		**1835**
a	[mm]	115
a1	[mm]	190
b	[mm]	23
c	[mm]	48
c1	[mm]	22
c3	[mm]	60
Ød f7	[mm]	32
Ød1 +0.05	[mm]	31.85
e	[mm]	75
f	[mm]	25
f1	[mm]	30
g	[mm]	M28 x 1.5
g1	[mm]	M16
h min to max	[mm]	15 … 79
k	[mm]	12
Ø k1 +0.1	[mm]	6
l	[mm]	28
l1	[mm]	17
Ø m	[mm]	34
m1 +0.05	[mm]	16
n	[mm]	5
r	[mm]	100
s	[mm]	92.3

Part no.		
Clamping arm with contact bolt		**0354003**
Weight, approx.	[kg]	0.8
Moment of inertia	[kgm²]	0.002295
Radial torque	[Nm]	0.32
Clamping arm without thread g1		**3921017**
Weight, approx.	[kg]	0.65
Moment of inertia	[kgm²]	0.00134
Radial torque	[Nm]	0.20
Clamping arm blank		**3548902A**
Weight, approx.	[kg]	0.95
Moment of inertia	[kgm²]	0.0035
Radial torque	[Nm]	0.5
Material: High alloy steel 1000 … 1200 N/mm²		
Spare nut M28x1.5		**3527015**
Max. tightening torque	[Nm]	90
Weight, approx.	[kg]	0.05
Metallic wiper		**0341231**
Indexing pin		6 m 6x12 **3300325**

Horizontal mounting position

The electric swing clamp can be operated with the accessory clamping arm 0354003 (e=75 mm) in every mounting position.
In the case of longer and heavier special clamping arms, the admissible radial torque M1 of 0.4 Nm will be exceeded, which can lead to malfunctions and increased wear.
Remedy:
Provide the clamping arm with a counterweight as explained in the opposite example.

Clamping arm S1 with weight compensation S2

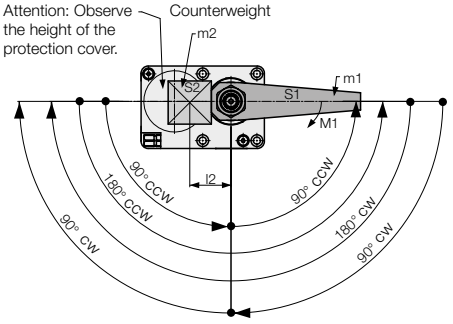
Required counterweight $m2 = \frac{M1}{l2}$ [kg]

M1 = First-order torque around the piston axis (control of the CAD model) [kgm]
m2 = Mass of counterweight [kg]
l2 = Centre of gravity of the mass m2 [m]

Important note

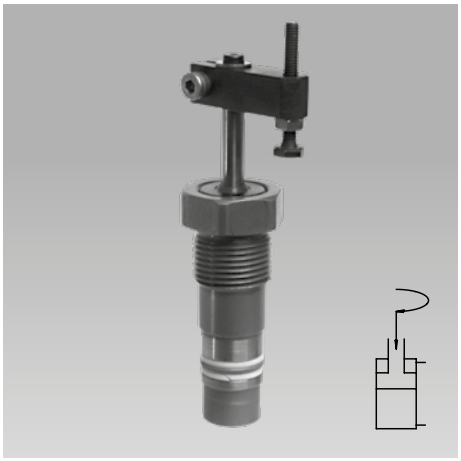
The additional counterweight increases the moment of inertia J around the piston axis, what can be easily determined by querying of the CAD model. To avoid an overload of the swing drive, the flow rate has to be reduced. The setting is described in the operating manual.

Mounting position - horizontal



Mini Swing Clamps with Sturdy Swing Mechanism

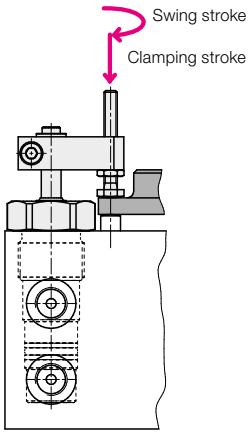
threaded-body type, double acting, max. operating pressure 150 bar



Advantages

- Minimum dimensions
- Double-acting function
- Sturdy swing mechanism
- Oil supply through drilled channels
- Built-in housing of tube connecting thread available
- Installation as cartridge type by accessory flange
- Simple fixing of clamping arm
- Clamping arm for clamping with minimum deformation available
- Unimpeded loading and unloading of the fixture
- Mounting position: variable
- Standard FKM seals
- Maintenance free

Clamping principle



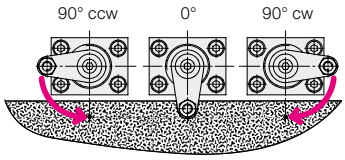
Application

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.
Mini swing clamps are particularly suitable for machining of thin-walled workpieces, which require only little clamping forces.
Mini swing clamps are an interesting alternative for pneumatic clamping elements, since they require less space.

Description

This double-acting mini swing clamp works as pull-type cylinder where a part of the total stroke is used to swing the piston.

Clockwise and counterclockwise versions are available with an swing angle of 90, 60 and 45 degrees. The 0 degree version can be used as push and pull-type cylinder with anti-rotation piston.



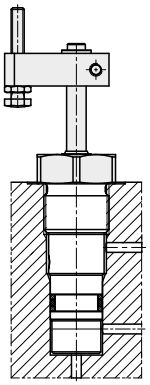
The clamping arms are locked on the piston rod. A safety screw avoids axial displacement.

Important notes

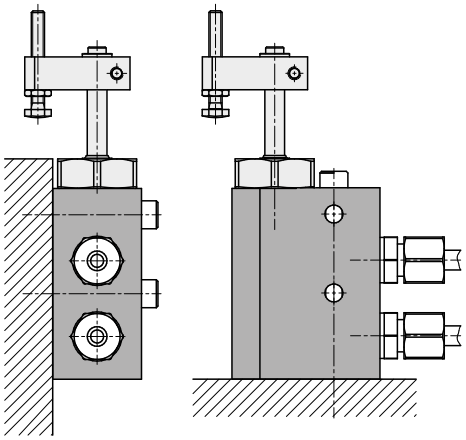
- Considerable injuries can be caused to fingers during clamping and unclamping in the effective area of the clamping arm.
- Remedy: protection device with electrical locking.
- Operating conditions, tolerances and other data see data sheet A 0.100.

Installation and connecting possibilities

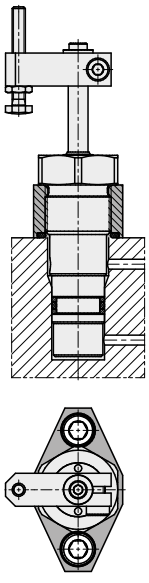
Threaded-body type
for horizontally-drilled channels



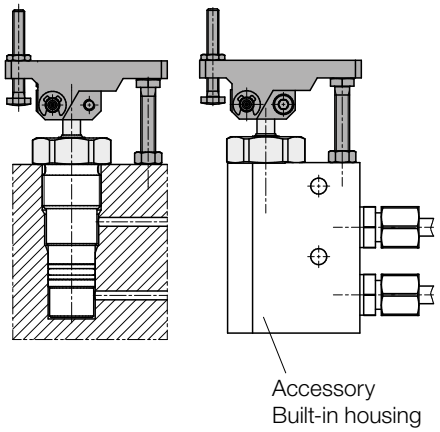
Pipe thread
with accessory built-in housing



Installation as cartridge type
with accessory fixing flange



Threaded-body type
with accessory clamping strap
for clamping with minimum deformation



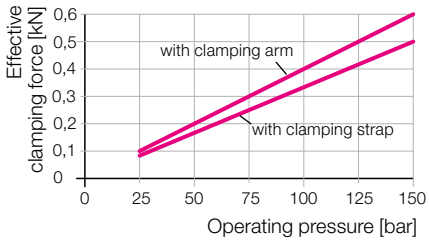
Technical data

Piston Ø	[mm]	10
Rod Ø	[mm]	6
Swing stroke	[mm]	10
Clamping stroke	[mm]	8
Total stroke	[mm]	18
Effective piston area		
Clamping	[cm²]	0,5
Unclamping	[cm²]	0,78
Required oil per stroke		
Clamping	[cm³]	0,91
Unclamping	[cm³]	1,42
Max. oil flow rate		
Clamping	[cm³/s]	6
Unclamping	[cm³/s]	10
Min. operating pressure	[bar]	25
Max. operating pressure	[bar]	150
Max. pulling force	[kN]	0,75
Effective clamping force	[kN]	see diagram
Weight	[kg]	0,12

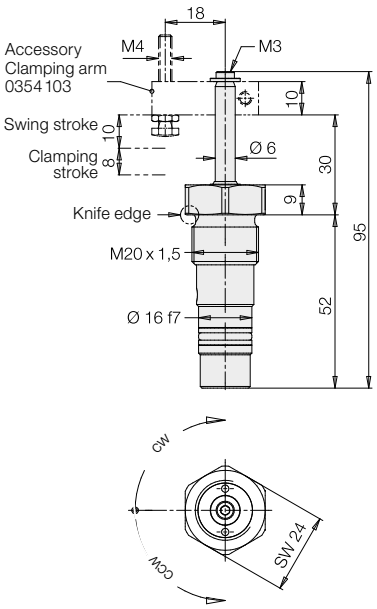
Part numbers

Swing angle	Swing direction	Part no.
90°	cw	**1848115**
90°	ccw	**1848125**
60°	cw	**1848135**
60°	ccw	**1848145**
45°	cw	**1848155**
45°	ccw	**1848165**
0°	-	**1848105**

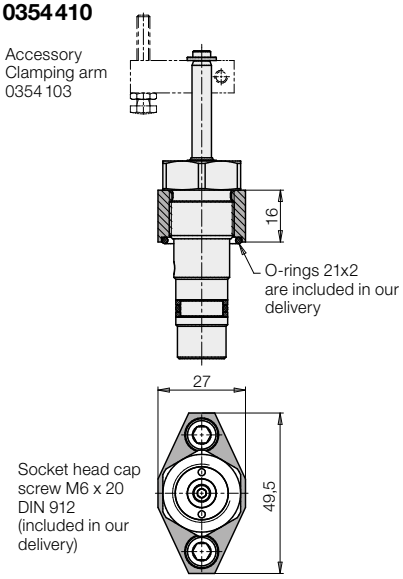
Clamping force diagram



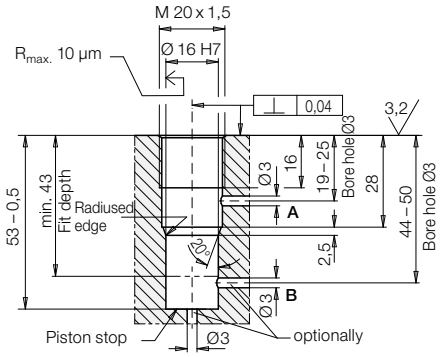
Dimensions



Accessory
Fixing flange
0354410

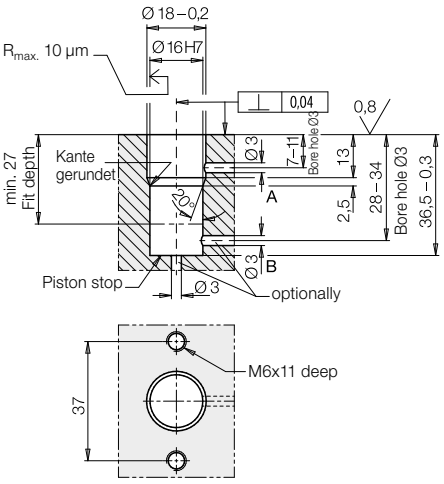


Porting details

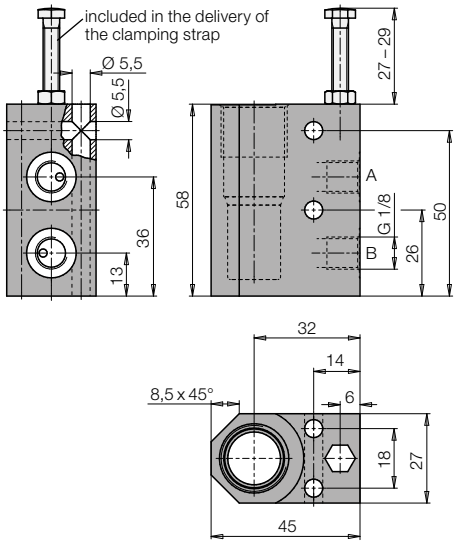


A = Clamping
B = Unclamping

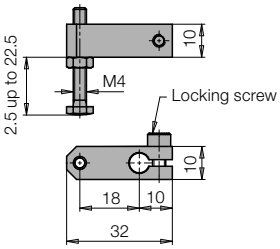
Cartridge-type hole



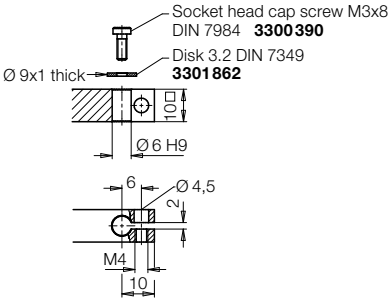
Accessory
Built-in housing
0346710



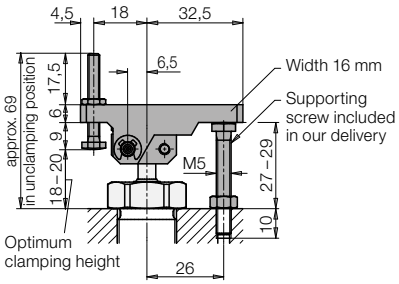
Accessory
Clamping arm
0354103



Dimensions for special clamping arms



Accessory
Clamping strap
for clamping with minimum deformation
0354230

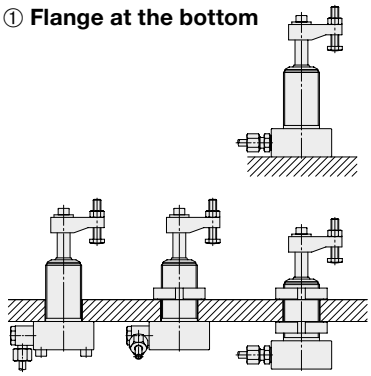


Compact Swing Clamps

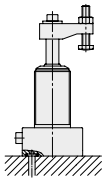
bottom flange, top flange, threaded-body type, single acting, max. operating pressure 350 bar

Connecting types

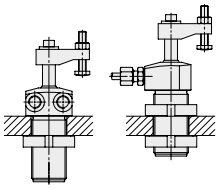
① **Flange at the bottom**



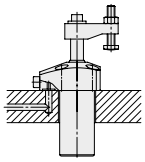
② **Flange at the bottom with O-ring sealing**



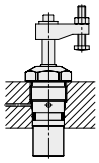
③ **Flange at the top**



④ **Flange at the top with O-ring sealing**



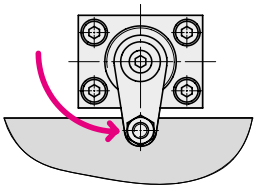
⑤ **Threaded-body type**



FKM wiper standard

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.

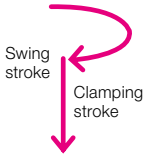


Important notes

Operating conditions, tolerances and other data see data sheet A 0.100.
It is absolutely necessary to follow the instructions for venting of the spring area on data sheet G 0.110.

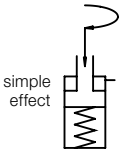
Function

This hydraulic clamping element is a pull-type cylinder where a part of the total stroke is used to swing the piston.



Version

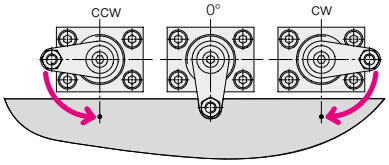
Only single-acting elements are available.



Double-acting elements see data sheet B 1.8491.

Swing direction

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



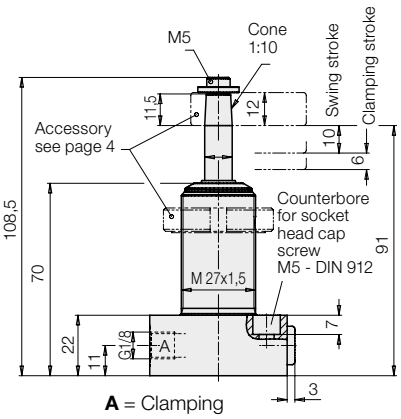
Adjustable swing direction

The swing direction of each swing clamp can also be changed, as described in the operating instructions.
Standard swing angles are 45°, 60° and 90° ±2°.
Special angles on request.
Other variants, as e.g. versions with metallic wiper on request.
0°-Version
Use as pure pull-type cylinder with a piston which is secured against torsion and which allows eccentric load as per clamping force diagram.

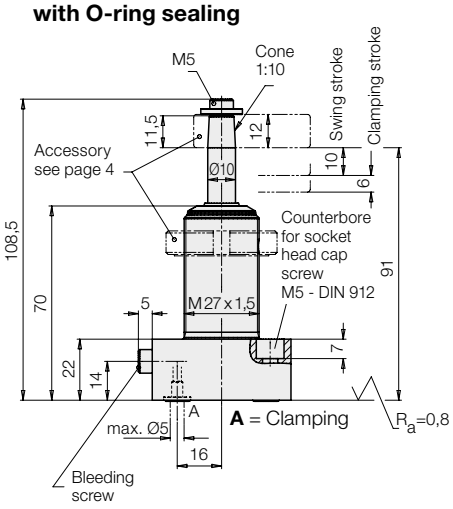
Technical data

Piston Ø	[mm]	14
Piston rod Ø	[mm]	10
Effective piston area	[cm^2]	0,754
Oil volume per stroke	[cm^3]	1,2
Max. oil flow rate	[cm^3/s]	2,5
Min. oper. pressure	[bar]	30
Max. oper. pressure	[bar]	350
Max. force to pull	[kN]	2,55
Effective clamping force	[kN]	see diagram
Spring force (s.a.)	[N]	40–89
Angle of rotation	[°]	(0,45,60,90) ± 2
Swing stroke	[mm]	10
Clamping stroke	[mm]	6
Total stroke	[mm]	16

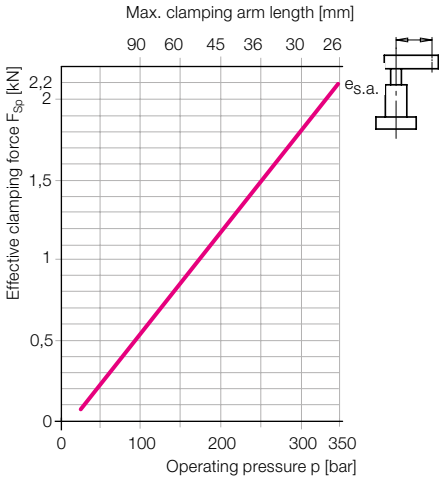
① Flange at the bottom

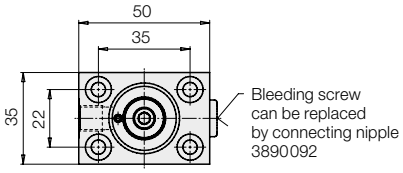


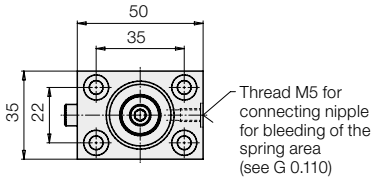
② Flange at the bottom with O-ring sealing



Clamping force diagram







Weight: 0,42 kg

Swing angle	Swing direction	Part no. Single acting
0°	–	**1849001**
90°	cw	**1849011**
90°	ccw	**1849021**
60°	cw	**1849031**
60°	ccw	**1849041**
45°	cw	**1849051**
45°	ccw	**1849061**

Weight: 0,42 kg

Swing angle	Swing direction	Part no. Single acting
0°	–	**1849002**
90°	cw	**1849012**
90°	ccw	**1849022**
60°	cw	**1849032**
60°	ccw	**1849042**
45°	cw	**1849052**
45°	ccw	**1849062**

Spare O-ring (FKM)
7 x 1,5 **3001077**

Material

Housing and piston are made of high alloy steel. By nitrating, wear is reduced and protection against corrosion increased.
FKM seals.

Important notes

1. Danger of injury

Hydraulic clamping elements can generate considerable forces.

Due to the 90° swing motion, the exact clamping and unclamping position cannot be determined in advance. Considerable injuries can be caused by squashing one's fingers in the effective area of the clamping arm. Remedy: protection device with electrical locking.

2. Maximum oil flow rate

In case of the maximum oil flow rate as per table the shortest possible clamping or unclamping time is 0.5 seconds.

If the flow rate of the pump divided by the number of swing clamps is higher than the indicated value in the table, the flow rate has to be throttled to avoid any overload and thereby high wear.

Throttling has to be made in the oil supply line to the swing clamp to rule out a possible pressure intensification. Use only flow control valves which allow oil return from the swing clamp without any impediments.

3. Unimpeded swing motion

This swing clamp does not have an overload protection device. Therefore the swing motion must not be impeded and the clamping arm may only contact the workpiece after completion of the swing stroke.

4. Clamping arm assembly

4.1 All types

When tightening and untightening the fixing screw, the clamping arm has to be backed up to avoid the introduction of moments to the piston rod and thereby any deterioration of the swing mechanism.

4.2 Threaded-body type

The clamping arm can only be fixed, after the housing is firmly screwed in, since the final position cannot be determined in advance.

5. Adjustment of pressure screw

The pressure screw may only contact the workpiece after completion of the swing motion. When tightening and untightening the fixing screw, the clamping arm has to be backed up (see 4.1).

6. Special clamping arms

When using special clamping arms with other lengths, the corresponding operating pressures as shown in the clamping force diagram must not be exceeded.

If longer clamping arms will be used, not only the operating pressure but also the flow rate have to be reduced (see 2.)

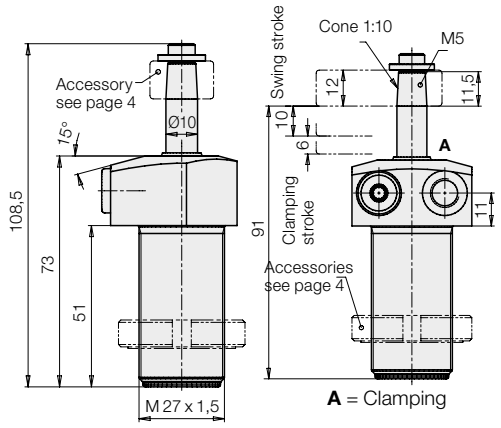
7. Venting of spring area

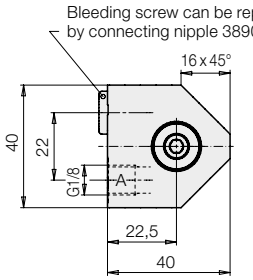
The spring area of single-acting swing clamps has to be vented to avoid troubles of functioning. A sintered metal air filter avoids penetration of contaminations.

If there is a possibility that cutting lubricants and coolants penetrate through the sintered metal air filter into the cylinder's interior, a vent hose has to be connected and be placed in a protected position. The different connecting possibilities are as follows:

7.1 Flange at the top and at the bottom
Instead of an air filter plug a fitting for connection of tubes and hoses may be used.

③ Flange at the top

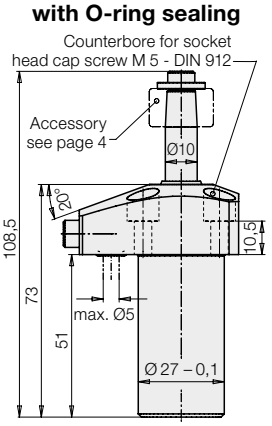


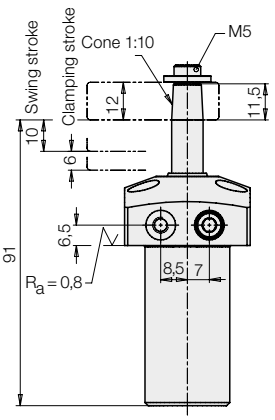


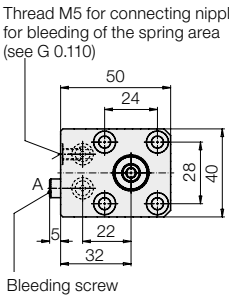
Weight: 0,35 kg

Swing angle	Swing direction	Part no. Single acting
0°	–	**1849003**
90°	cw	**1849013**
90°	ccw	**1849023**
60°	cw	**1849033**
60°	ccw	**1849043**
45°	cw	**1849053**
45°	ccw	**1849063**

④ Flange at the top with O-ring sealing





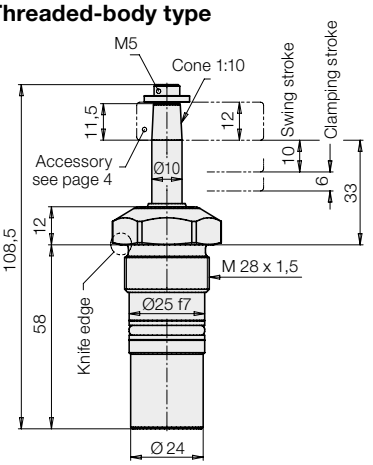


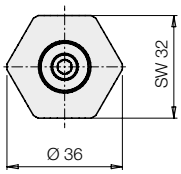
Weight: 0,42 kg

Swing angle	Swing direction	Part no. Single acting
0°	–	**1849004**
90°	cw	**1849014**
90°	ccw	**1849024**
60°	cw	**1849034**
60°	ccw	**1849044**
45°	cw	**1849054**
45°	ccw	**1849064**

Spare O-ring (FKM)
7 x 1,5 **3001077**

⑤ Threaded-body type



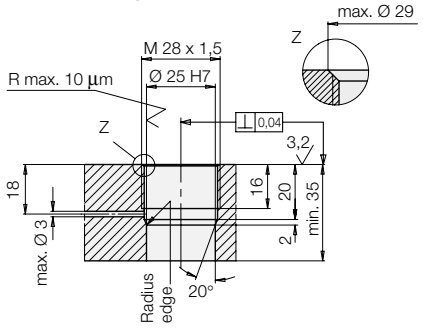


Max. seating torque Nm 100

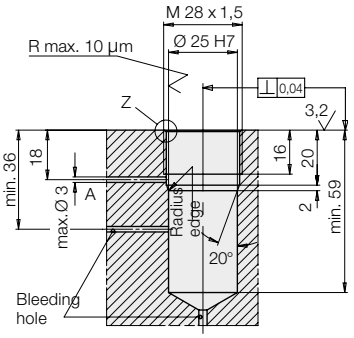
Weight: 0,27 kg

Swing angle	Swing direction	Part no. Single acting
0°	–	**1849005**
90°	cw	**1849015**
90°	ccw	**1849025**
60°	cw	**1849035**
60°	ccw	**1849045**
45°	cw	**1849055**
45°	ccw	**1849065**

Screw-in hole open

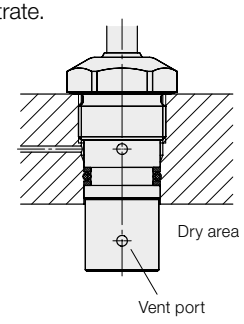


Screw-in hole closed



7.2 Flange with O-ring sealing
The connecting nipple 3610035 which fits to thread M5 is suitable for a plastic hose ND 6.

7.3 Threaded-body type
The air filter is integrated in the lower part of the housing. If the cylinders are mounted in plates as per drawing below (see figure), liquids must not penetrate.



Installation in a pocket hole is only possible, if a vent hole is provided in a determined area (see drawing). Also this bore hole has to be protected against penetration of liquids.

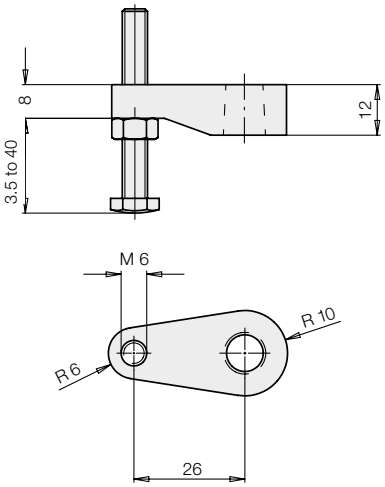
8. Bleeding
Air in the oil prolongs the clamping time considerably and leads to function troubles.
Therefore bleeding has to be effected during start up, as described as follows for the different types.

8.1 Flange at the bottom and at the top
Loosen carefully the union nut of the tube at low oil pressure and pump until bubblefree oil comes out. Retighten the union nut.

8.2 Flange with O-ring sealing
Loosen carefully the socket head cap screw M5 at low oil pressure and pump until bubblefree oil comes out. Retighten the screw.

8.3 Threaded-body type
There is no possibility for bleeding at the element itself. Remedy: plug the oil channels in the fixture body at the end. If required, loosen the plugs carefully and pump at low oil pressure until bubblefree oil comes out.
Retighten the plugs.

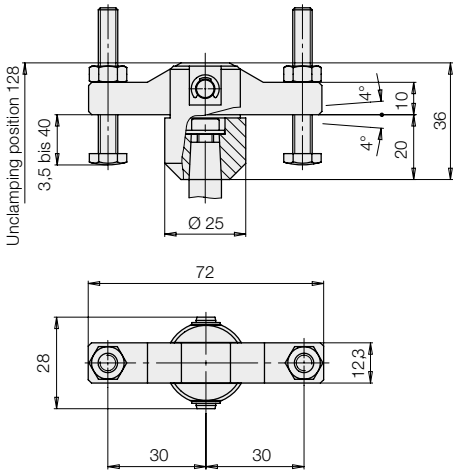
Clamping arm assembly, complete max. 350 bar



Part no. **0354057**

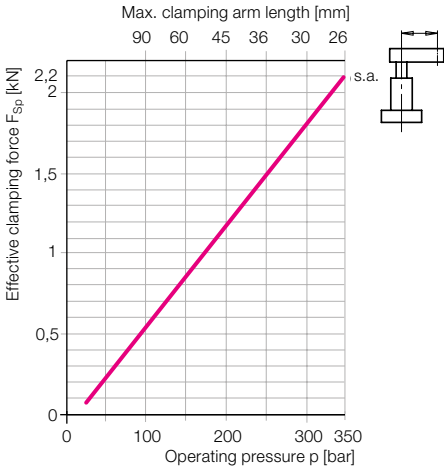
Double clamping arm, complete

Contact bolt – M 6 x 45
Part no. 3614138

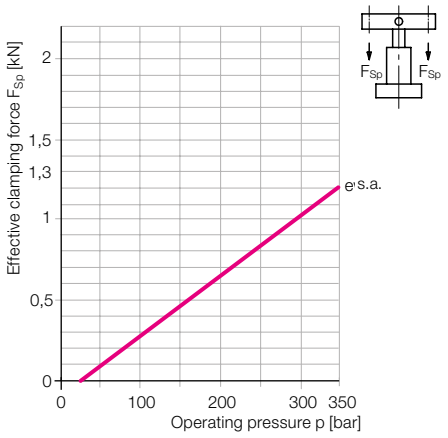


Part no. **0354082**

Clamping force diagram

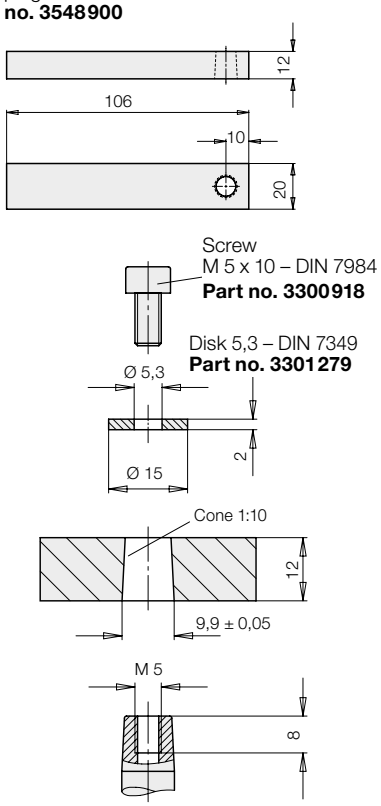


Clamping force diagram

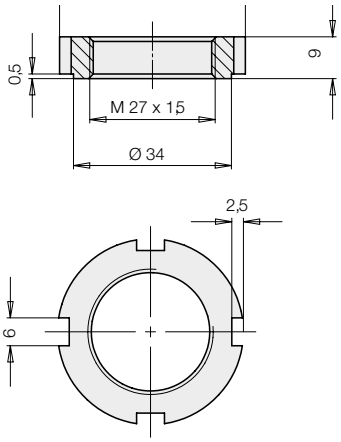


Connecting dimensions for special clamping arms

Clamping arm - blank
Part no. 3548900



Flange nut as per DIN 1804



Part no. **3527076**

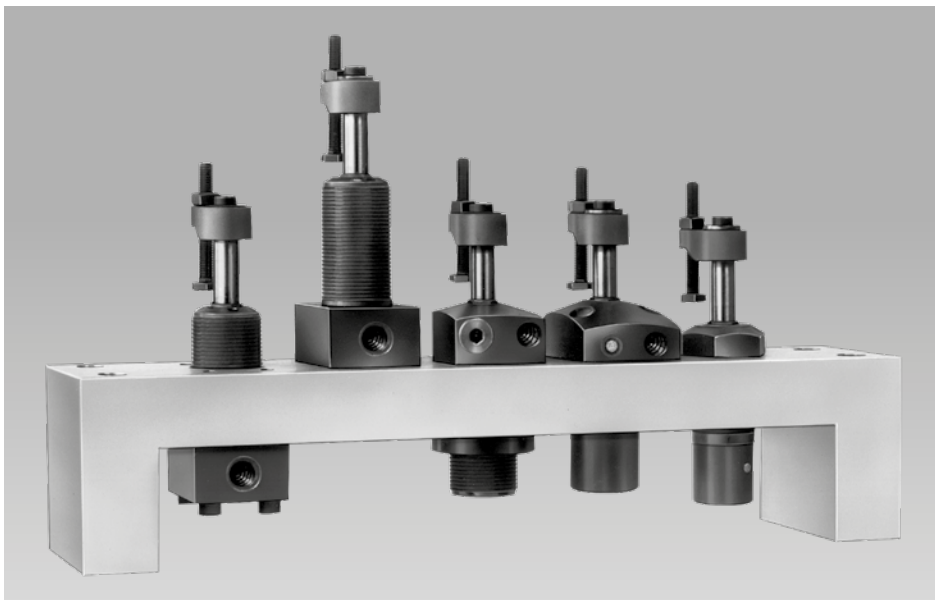
Tube male stud coupling for G1/8

ND [bar]	Designation	Part no.
250	D 8L G 1/8 ED	**9208075**
500	D 8S G 1/8 ED	**9208164**

Thread reducing adaptor

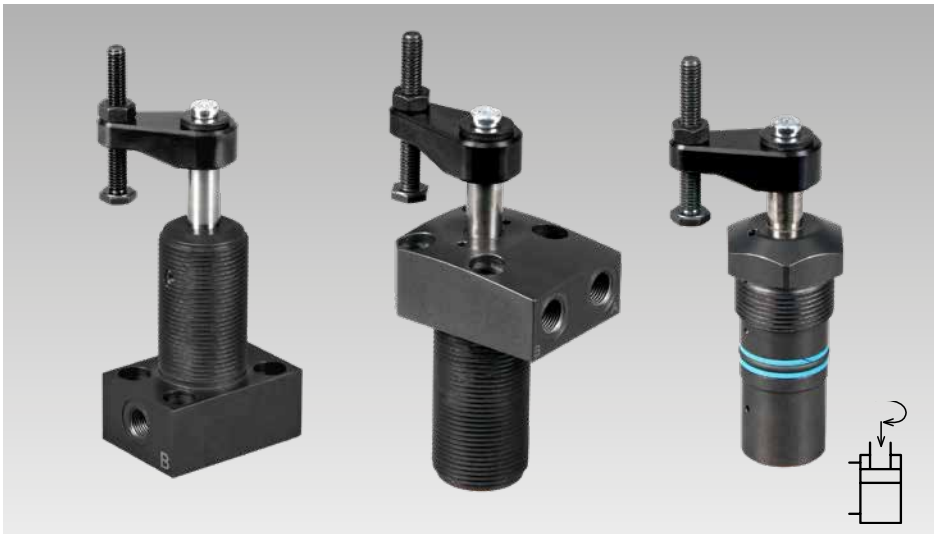
ND [bar]	Designation	Part no.
400	GWR 1/8 –1/4	**3613003**

Arrangement of the different connecting types



Compact swing clamps with robust sturdy swing mechanism

Bottom flange, top flange, threaded-body type, metal-protected wiper, double-acting, max. operating pressure 350 bar



Advantages

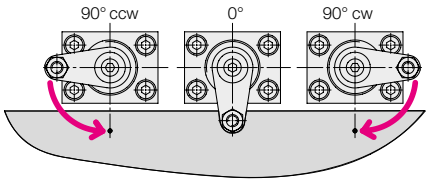
- High clamping force at low operating pressure
- Compact design
- Sturdy swing mechanism
- Metal-protected wiper
- FKM seals as standard
- Special swing angle in standard versions

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.

Swing direction

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



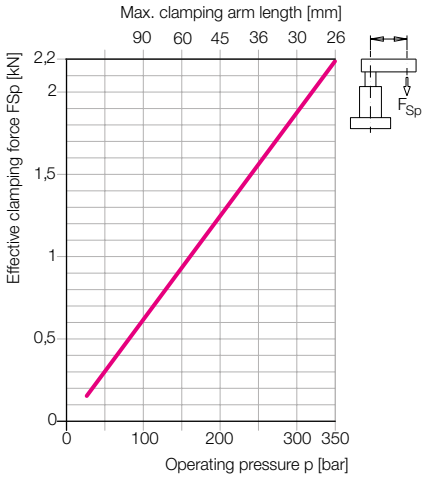
Accessories see page 4

- Clamping arm
- Lock nut

Technical data

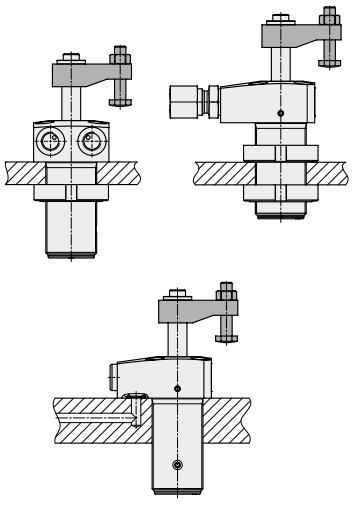
Piston Ø	[mm]	14
Rod Ø	[mm]	10
Effective piston area		
Clamping	[cm²]	0.754
Unclamping	[cm²]	1.54
Required oil per stroke		
Clamping	[cm³]	1.2
Unclamping	[cm³]	2.5
Max. flow rate		
Clamping	[cm³/s]	5
Unclamping	[cm³/s]	10
Min. operating press.	[bar]	30
Max. operating press.	[bar]	350
Max. pull force	[kN]	2.63
Effect. clamping force	[kN]	see diagram
Swing angle	[°]	(0, 45, 60, 90) ±2
Swing stroke	[mm]	8
Clamping stroke	[mm]	8
Total stroke	[mm]	16

Clamping force diagram

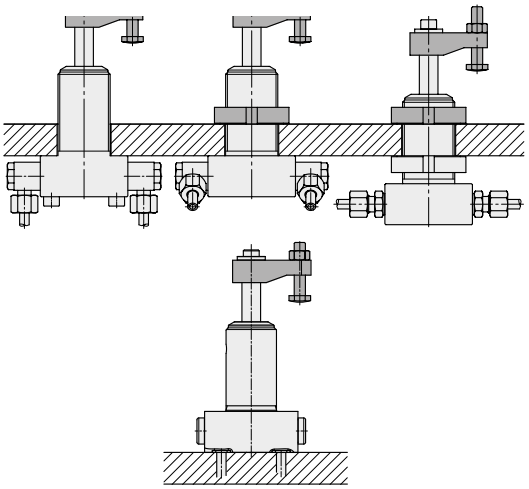


Connecting types

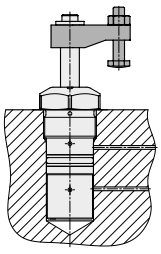
Top flange
pipe threads and drilled channels



Bottom flange
Pipe thread and drilled channels



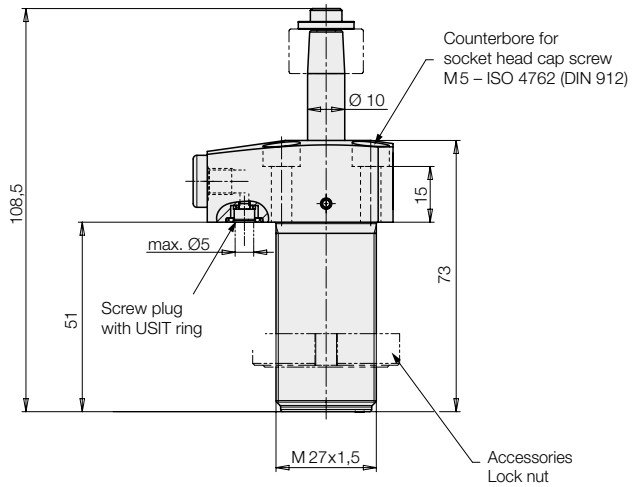
Threaded-body type
Drilled channels

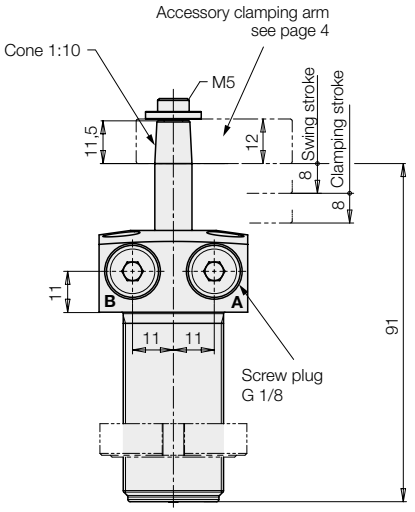


Operating conditions, tolerances and other data see data sheet A 0.100.

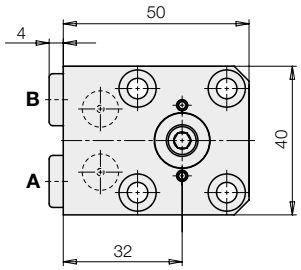
Top flange / bottom flange

Top flange



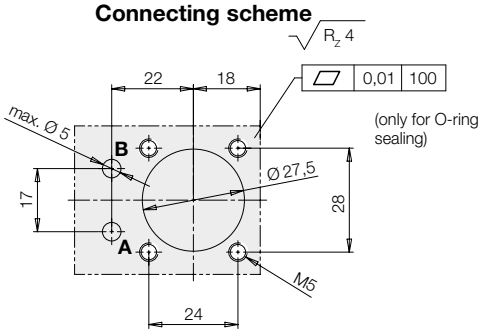


A = Clamping
B = Unclamping

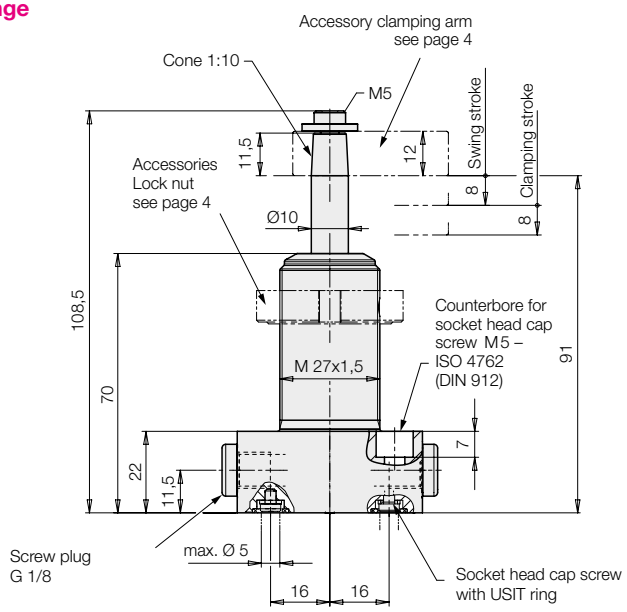


Weight: 0.42 kg

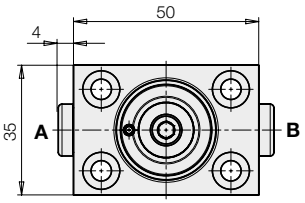
Connecting scheme



Bottom flange



A = Clamping
B = Unclamping

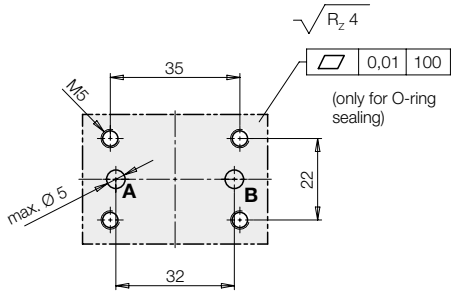


Weight: 0.42 kg

Delivery
Socket head cap screws, screw plugs, and O-rings for the connection with drilled channels are included in the delivery.

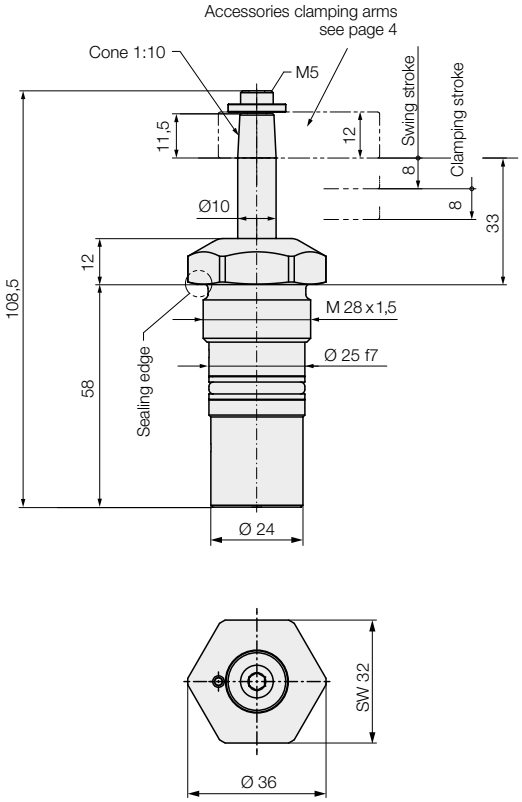
Spare O-ring (FKM) 7 × 1.5 mm
Part no. 3001 077

Connecting scheme

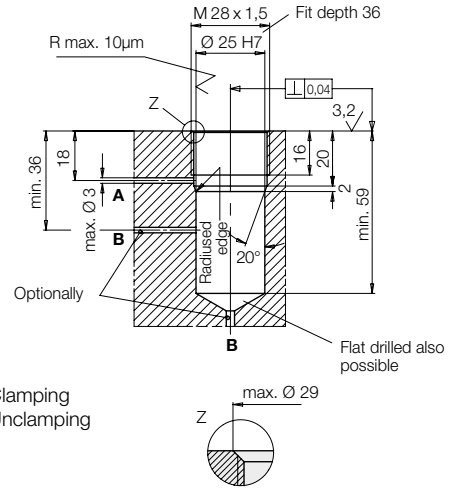


Operating conditions, tolerances and other data see data sheet A 0.100.

Threaded-body type



Location hole



A = Clamping
B = Unclamping

Weight: 0.27 kg

Code for part numbers

V1SAFA BK6 X0XX H008FE

Design
B = Top flange
G = Bottom flange
S = Threaded-body type

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

Swing angle
45 = 45°
60 = 60°
90 = 90°
00 = 0°

Ordering example 1

Top flange = **B**
Cw swing motion = **R**
Swing angle 45° = **45**

Part no.
V1SAFA BK6 R045 H008FE

Ordering example 2

Bottom flange = **G**
Ccw swing motion = **L**
Swing angle 90° = **90**

Part no.
V1SAFA GK6 L090 H008FE

Ordering example 3

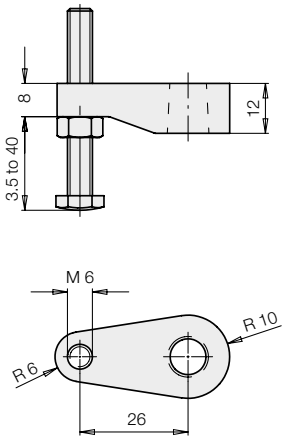
Threaded-body type = **S**
Cw swing motion = **R**
Swing angle 60° = **60**

Part no.
V1SAFA SK6 R060 H008FE

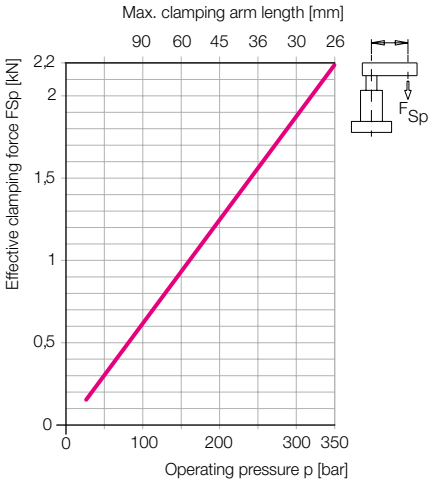
Operating conditions, tolerances and other data see data sheet A 0.100.

Clamping arm, complete
max. 350 bar

Part no. 0354057



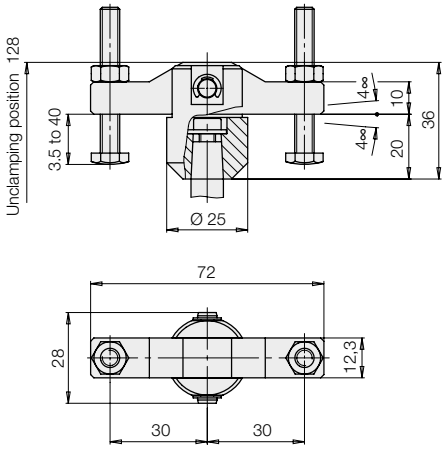
Clamping force diagram



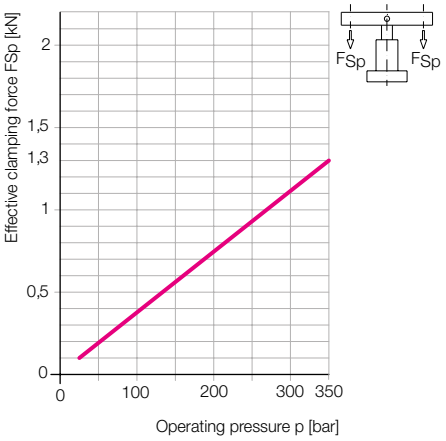
Double clamping arm, complete

Part no. 0354082

Contact bolt M 6× 45
Part no. 3614138

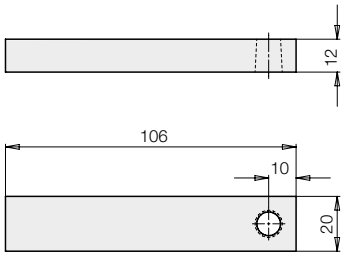


Clamping force diagram

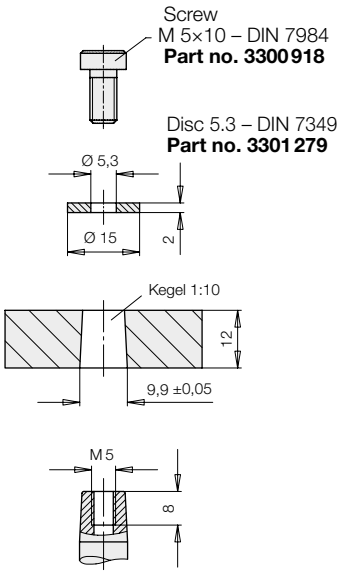


Clamping arm blank

Part no. 3548900

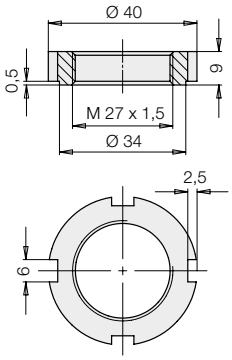


Dimensions for special clamping arms



Lock nut as per DIN 1804

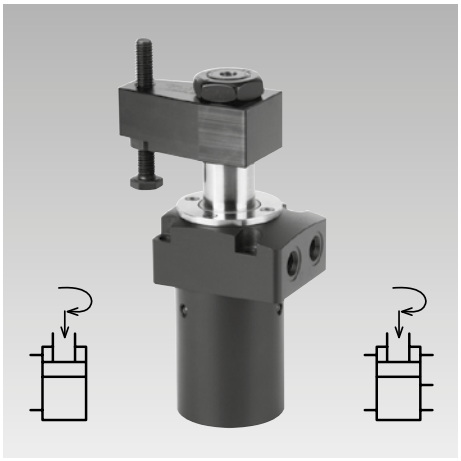
Part no. 3527076



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

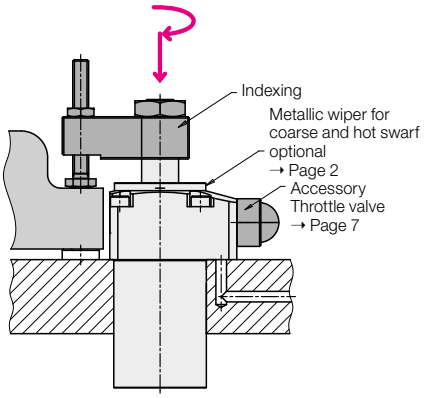
Swing clamp with reinforced swing mechanism

Position monitoring optional: pneumatically integrated / electrically attachable
Top flange type, double acting, max. operating pressure 70 bar



Advantages

- 4 sizes available
- Compact design partially recessible
- High clamping force already at 70 bar
- Extremely short clamping and unclamping times
- Accessory throttle valve, screw-in
- Indexing of clamping arm
- Standard FKM wiper
- Metallic wiper optional
- Pneumatic position monitoring integrated for type 185XP, standard
- Electrical position monitoring for type 185XQ, available as accessory
- Mounting position: any



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.
This series obtains very high clamping forces even at 70 bar and can directly be connected to the low-pressure hydraulics of the machine tools.
With the reinforced swing mechanism and the optional position monitorings these swing clamps are particularly suitable for:

- Automatic manufacturing systems with very short cycle times
- Clamping fixtures with workpiece loading by handling systems
- Transfer lines and assembly lines
- Test systems for motors, gears and axes
- Assembly lines
- Special machine tools

Description

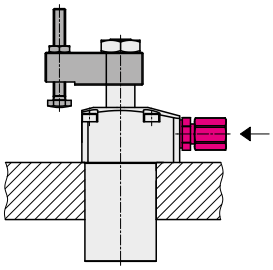
The hydraulic swing clamp is a pull-type cylinder where a part of the total stroke is used to swing the piston.
The reinforced swing mechanism ensures that the angle position of the clamping arm remains the same even if a slight collision with the workpiece during loading and unloading or during clamping occurs.
The angle position of the clamping arm is fixed with a dowel pin.
The FKM wiper at the piston rod can be protected against coarse and hot swarf by an optionally available metallic wiper (see page 2).
The version with extended switch rod is provided for mounting electrical position monitoring (accessory).

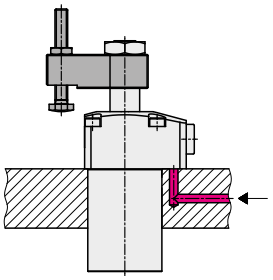
Important notes see page 2.

Installation and connecting possibilities

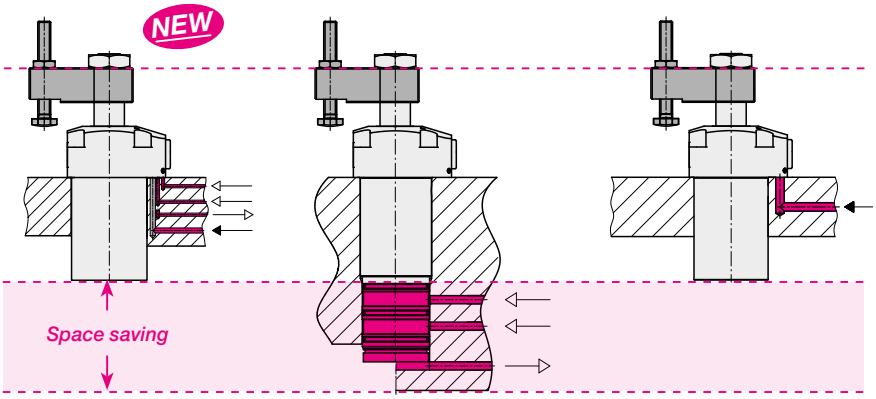
Pipe thread | **Drilled channels**

without position monitoring
185XT → Page 2





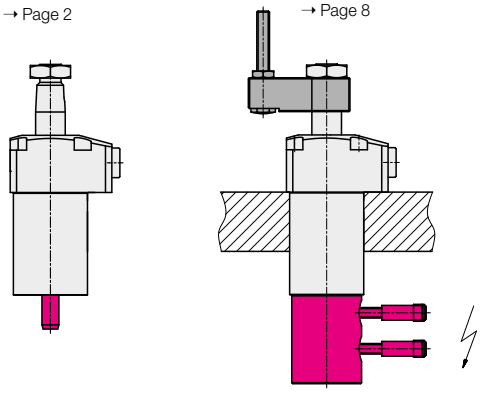
with integrated pneumatic position control
185XP → Page 4



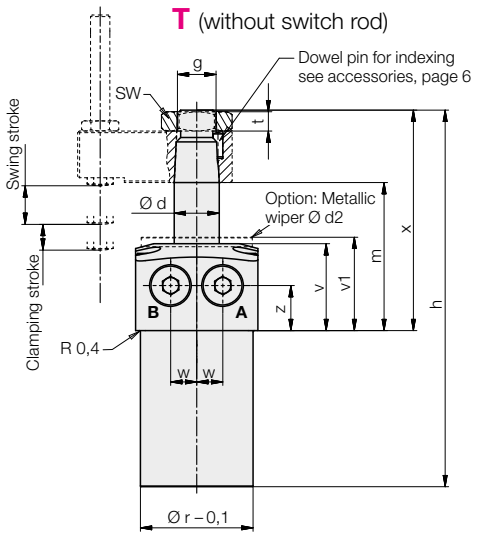
Pneumatic position monitoring at the bottom
available on request

without position monitoring

with switch rod for electrical position monitoring (see accessories)
185XQ → Page 2 → Page 8

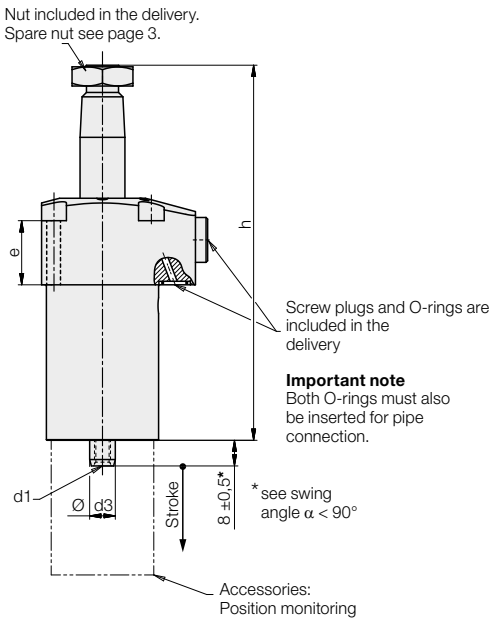


T (without switch rod)

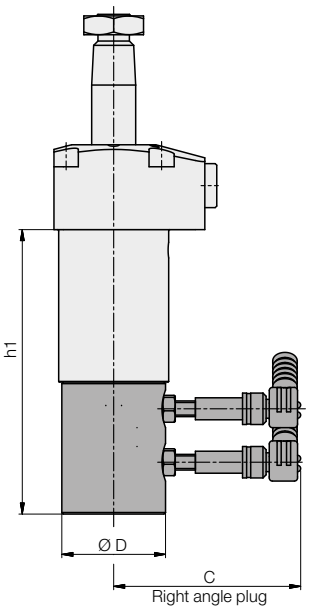


A = Clamping
B = Unclamping

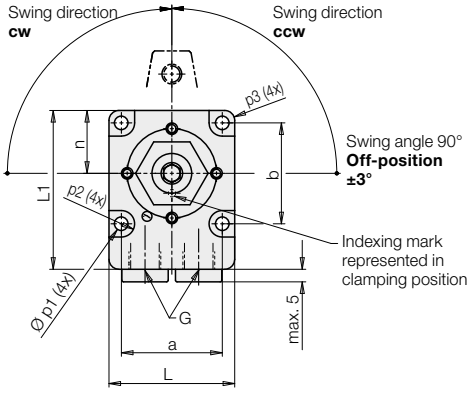
Q (with switch rod)



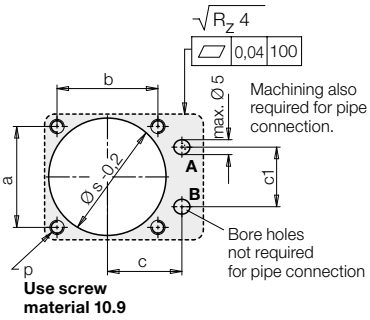
Electrical position monitoring (→ page 8)



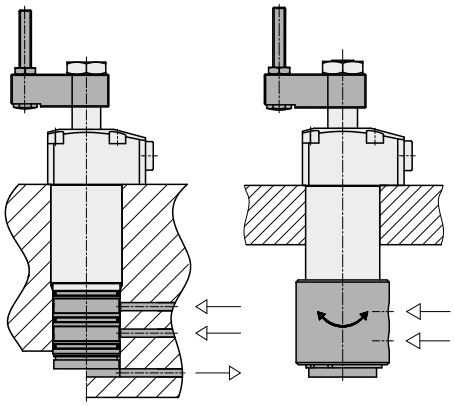
Clamping position ±1°



Connecting scheme



Pneumatic position monitorings
available on request



Cartridge type Pipe thread connection

Swing angle

1. Swing angle 90° and 0° (standard)

	Part no.
90° cw	**185X X090 RXX**
90° ccw	**185X X090 LXX**
0°	**185X X000 0XX**

2. Swing angle α < 90°

α = 15° to 75° in gradation of 5°

By insertion of a distance plate the return stroke of the piston is reduced and thus the swing angle is reduced.
Clamping stroke and clamping position remain the same. The swing stroke and the dimensions h, m and x are reduced by y:

y = (90° – α°) * k (k see chart page 3)

Dimension 8 ±0.5 is lengthened by the value y.

Example:

Swing clamp	1856T090L27
Desired swing angle	**45° ccw**
Part no.	**1856T045L27**

Shortening:
y = (90° – 45°) * 0.125 mm/° = 5.625 mm

3. Swing angle > 90°

Available on request!

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 clamp has no overload protection device. When mounting the clamping arm, the clamping arm or the hexagon socket in the piston have to be backed up for tightening or untightening the fixing nut.
During loading and unloading of the fixture and during clamping a collision with the clamping arm has to be avoided.
Remedy: Mount position adaptor.

Wiper system

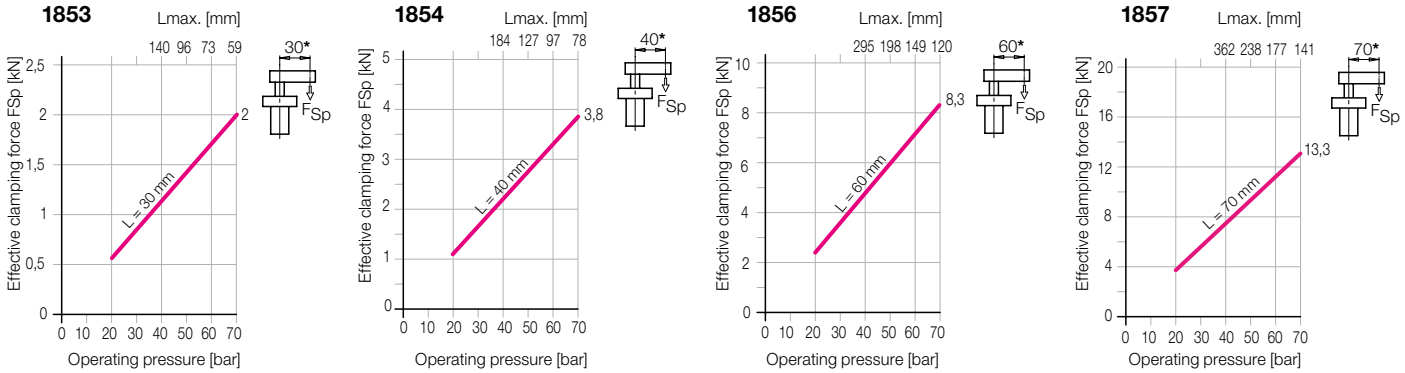
The standard FKM wiper has a high chemical resistance against most cooling and cutting fluids.
The optional metallic wiper protects the FKM wiper against mechanical damage due to big or hot swarf.
It consists of a radially floating wiping disk and a retaining disk.
The metallic wiper can be delivered already mounted ("**M**") or as an accessory for retrofitting (part no. see page 7).

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.

Swing clamps			**1853**	**1854**	**1856**	**1857**
Max. pulling force (70 bar)		[kN]	2.35	4.46	9.9	16.1
Effective clamping force		[kN]	see diagram or calculation of the clamping force on page 6			
Clamping stroke		[mm]	8	8	10	10
Swing stroke		[mm]	8	13	17	19
Total stroke		[mm]	16	21	27	29
Min. operating pressure		[bar]	20	20	20	20
Max. flow rate	Clamping	[cm^3/s]	13.5	33.5	96	167
	Unclamping	[cm^3/s]	20	53.5	145	255
Piston area	Clamping	[cm^2]	3.36	6.37	14.16	23
	Unclamping	[cm^2]	4.9	10.17	21.23	33.18
Oil volume / stroke		[cm^3]	5.4	13.4	38.3	66.7
Oil volume / return stroke		[cm^3]	7.9	21.4	57.4	102
Piston Ø		[mm]	25	36	52	65
a		[mm]	30.5	40	56	68
b		[mm]	30.5	40	56	68
c		[mm]	22.5	28	36	42
c1		[mm]	18	24	36	45
Ø d		[mm]	14	22	30	36
Ø d1		[mm]	M5x14.5 deep	M6 x 11.5 deep	M8x16.0 deep	M8x16.0 deep
Ø d2		[mm]	34.5	44.5	52.5	58.5
Ø d3 f7		[mm]	8	10	12	12
e		[mm]	20	19.5	19	23.5
SW		[mm]	SW 19	SW 27	SW 36	SW 46
g		[mm]	M12	M18 x 1.5	M24x1.5	M30x1.5
G			G 1/8	G 1/8	G 1/4	G 1/4
h		[mm]	117	149	178.5	203.5
h1		[mm]	90.5	110	132	141
k		[mm/°]	0.056	0.095	0.125	0.125
L		[mm]	38	50	70	86
L1		[mm]	48	60	82	96
m		[mm]	46	54	64.5	72.5
n		[mm]	19	25	35	43
p		[mm]	M4 (10.9)	M5 (10.9)	M8 (10.9)	M10 (10.9)
Ø p1		[mm]	4.3	5.5	9	11
p2		[mm]	4	5	7	9
p3		[mm]	3	3	6	7
Ø r –0.1		[mm]	35	47	63	78
Ø s –0.2		[mm]	36	48	64	79
t		[mm]	6	9	10	12
v		[mm]	27	29.5	34.5	39
v1		[mm]	29	31.5	36.5	41
w		[mm]	8.1	11	15	19
x		[mm]	68.5	88	101.5	119.5
z		[mm]	14	13.5	15.5	15.5
Weight, approx.		[kg]	0.7	1.5	3.0	5.0
Part no.	Swing direction 90° cw		**1853X090R16M**	**1854X090R21M**	**1856X090R27M**	**1857X090R29M**
	Swing direction 90° ccw		**1853X090L16M**	**1854X090L21M**	**1856X090L27M**	**1857X090L29M**
	0 degree		**1853X000016M**	**1854X000021M**	**1856X000027M**	**1857X000029M**
Spare O-ring		[mm]	7x1.5	7x1.5	8x1.5	8x1.5
Part no.			**3000342**	**3000342**	**3000343**	**3000343**
Spare nut DIN 936			M12	M18 x 1.5	M24x1.5	M30x1.5
Tightening torque		[Nm]	12	30	62	110
Part no.			**3302115**	**3301663**	**3302104**	**3302139**

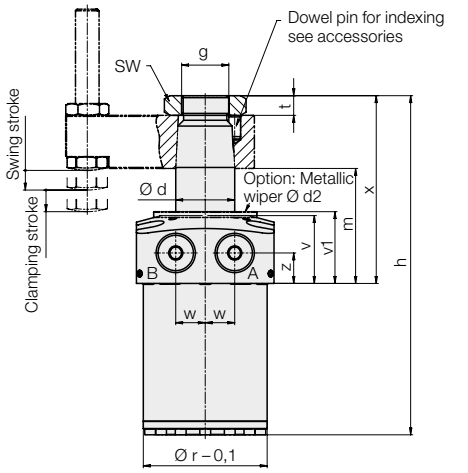
Code letter **X** see page 2
Metallic wiper **M** = option (see page 2)

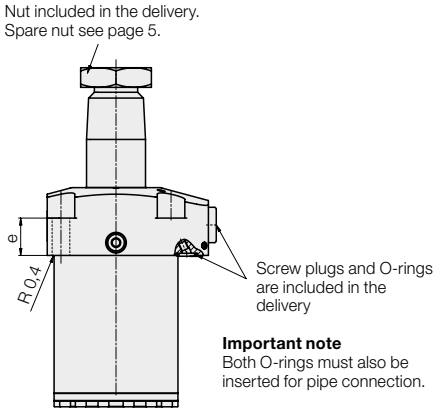
Effective clamping force with accessory clamping arm as a function of the oil pressure

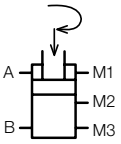


* Clamping force for other lengths see page 6

P (with integrated pneumatic position monitoring)

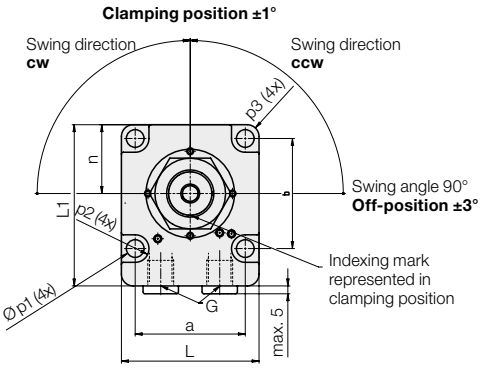


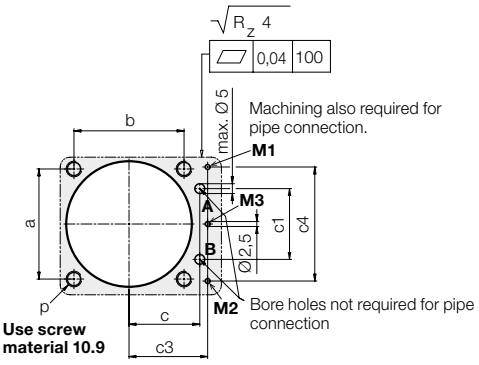




A = Clamping
B = Unclamping
M1 = Clamped (pneumatic)
M2 = Unclamped (pneumatic)
M3 = Outlet air (pneumatic)

Connecting scheme





Pneumatic position monitoring

Application

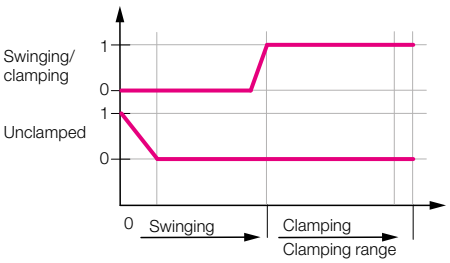
The pneumatic position monitoring signals the following conditions by closing two bore holes:

1. Piston extended and clamping arm in off-position.
2. Piston in clamping area and clamping arm in clamping position.

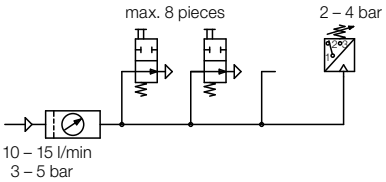
For each control function, a pneumatic line has to be provided at the clamping fixture.

Pneumatic diagram

0 = Passage
1 = No passage/closed



Monitoring by pneumatic pressure switch



For the evaluation of the pneumatic pressure increase, standard pneumatic pressure switches can be used. With one pressure switch up to 8 position monitorings can be monitored.
Note that reliable functioning of pneumatic monitoring is only guaranteed if the throttled air pressure and air flow rate are throttled.

Technical data

Port	Drilled channels
Nominal diameter	2 mm
Max. air pressure	10 bar
Range of operating pressure	3–5 bar
Differential pressure*) at 3 – 5 bar system pressure	min. 1.5 bar
Air flow rate	10– 15 l/min

*) Minimum pressure difference, if one or several position monitorings are not operated

Swing clamps			**1853P**	**1854P**	**1856P**	**1857P**
Max. pulling force (70 bar)		[kN]	2.35	4.46	9.9	16.1
Effective clamping force		[kN]	see diagram or calculation of the clamping force on page 6			
Clamping stroke		[mm]	8	8	10	10
Swing stroke		[mm]	8	9	11	15
Total stroke		[mm]	16	17	21	25
Min. operating pressure		[bar]	20	20	20	20
Min. clamping and unclamping times		[s]	0.5	0.5	0.5	0.5
Max. flow rate	Clamping	[cm^3/s]	10.8	21.6	60	115
	Unclamping	[cm^3/s]	15.8	34.6	89.2	166
Piston area	Clamping	[cm^2]	3.36	6.37	14.16	23
	Unclamping	[cm^2]	4.9	10.17	21.23	33.18
Oil volume / stroke		[cm^3]	5.4	10.8	29.8	57.5
Oil volume / return stroke		[cm^3]	7.9	17.3	44.6	83
Piston Ø		[mm]	25	36	52	65
a		[mm]	30.5	40	56	68
b		[mm]	30.5	40	56	68
c		[mm]	22.5	28	36	42
c1		[mm]	18	24	36	45
c3		[mm]	21	28	40	44.5
c4		[mm]	31.8	41	58	67
Ø d		[mm]	14	22	30	36
Ø d2		[mm]	34.5	44.5	52.5	58.5
e		[mm]	20	19.5	19	23.5
SW		[mm]	SW 19	SW 27	SW 36	SW 46
g		[mm]	M12	M18x1.5	M24x1.5	M30x1.5
G			G 1/8	G 1/8	G 1/4	G 1/4
h		[mm]	116.5	145	172.5	199.5
L		[mm]	38	50	70	86
L1		[mm]	48	60	82	96
m		[mm]	45.5	50	59	68.5
n		[mm]	19	25	35	43
p		[mm]	M4 (10.9)	M5 (10.9)	M8 (10.9)	M10 (10.9)
Ø p1		[mm]	4.3	5.5	9	11
Ø p2		[mm]	4	5	7	9
p3		[mm]	3	3	6	7
Ø r –0.1		[mm]	35	47	63	78
Ø s –0.2		[mm]	36	48	64	79
t		[mm]	6	9	10	12
v		[mm]	27	29.5	34.5	39
v1		[mm]	29	31.5	36.5	41
w		[mm]	8	11	15	19
x		[mm]	68	84	95.5	115.5
z		[mm]	14	13.5	15.5	15.5
Weight, approx.		[kg]	0.7	1.5	3.2	5.1
Part no.	Swing direction cw		**1853PXXR16**	**1854PXXR17**	**1856PXXR21**	**1857PXXR25**
	Swing direction ccw		**1853PXXL16**	**1854PXXL17**	**1856PXXL21**	**1857PXXL25**
	0°		**1853P00016**	**1854P00017**	**1856P00021**	**1857P00025**
Spare O-ring	2 x hydraulics	[mm]	5x1.5	7x1.5	8x1.5	8x1.5
Part no.			**3000340**	**3000342**	**3000343**	**3000343**
Spare O-ring	3 x pneumatics	[mm]	3x1	3x1	2.9x1.78	2.9x1.78
Part no.			**3001758**	**3001758**	**3000019**	**3000019**
Spare nut DIN 936			M12	M18x1.5	M24x1.5	M30x1.5
Tightening torque		[Nm]	12	30	62	110
Part no.			**3302115**	**3301663**	**3302104**	**3302139**

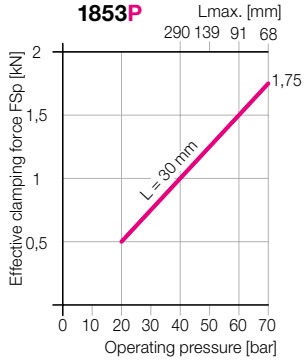
Length correction value for h, m, x, total stroke and swing stroke

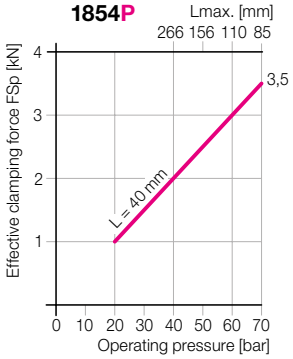
Swing angle	**Part no.**	**1853P**	**1854P**	**1856P**	**1857P**
90°	**185XP90XXX**	0	0	0	0
60°	**185XP60XXX**	–3.5	–3.7	–4.9	–6.3
45°	**185XP45XXX**	–4.5	–4.7	–6.2	–8.2
0°	**185XP000XX**	0	0	0	0
With metallic wiper [1]	**185XPXXXXXM**				

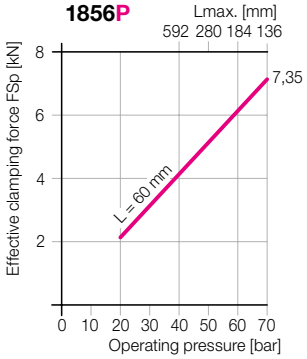
[1] Wiper system, see page 2

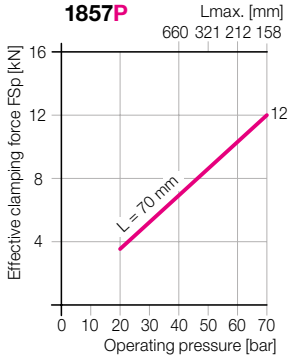
Example: **1854P45R17**
h 145 –4.7 = 140.3
m 50 –4.7 = 45.3
x 84 –4.7 = 79.3
Total stroke 17 –4.7 = 12.3
Swing stroke 9 –4.7 = 4.3

Effective clamping force with accessory clamping arm as a function of the oil pressure









* Clamping force for other lengths see page 6

Admissible flow rate

With the accessory clamping arm and the admissible flow rate as per the chart, the shortest clamping time is approx. 0.5 seconds.
Longer special clamping arms have a higher torque of inertia. To avoid an overload of the swing mechanism, the flow rate has to be reduced:

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

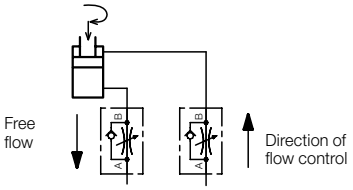
Q_e = Flow rate as per chart
Q_L = Flow rate with special clamping arm
J_e = Torque of inertia accessory clamping arm
J_L = Torque of inertia special clamping arm

If the torques of inertia are not known, the admissible flow rate can be determined according to the following example:
Conditions: The special clamping arm is longer, has however the form (cross section) of the accessory clamping arm, as shown on page 6.

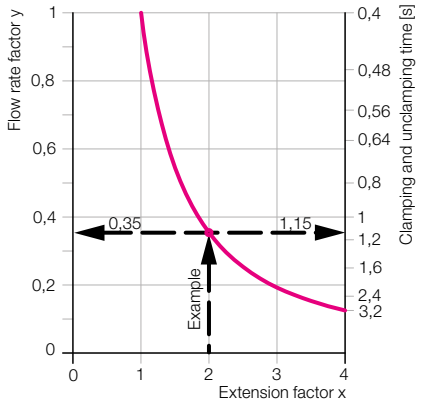
Example: Swing clamp 1853T090R16
L = 60 mm
e = 30 mm as per above chart
Q_e = 13.5 cm³/s

1. Extension factor $x = \frac{L}{e} = \frac{60\text{ mm}}{30\text{ mm}} = 2$
2. Flow rate factor as per diagram → y = 0.35
3. Max. flow rate $Q_L = y * Q_e = 0.35 * 13.5\text{ cm}^3/\text{s} = 4.7\text{ cm}^3/\text{s}$
4. Min. clamping time as per diagram → approx. 1.15 s

Throttling of the flow rate



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



Clamping force calculation

The clamping force diagram shows the effective clamping force with accessory clamping arm (L = e).
Versions **T** and **Q**: see page 3
Version **P**: see page 5

With longer clamping arms (L > e) the degree of efficiency is reduced. This is considered in the following calculation.
The constants (A–E) for the 4 sizes are shown in the following charts.

Versions T and Q

Constant	1853	1854	1856	1857
A	29.68	15.68	7.06	4.35
B	0.177	0.069	0.023	0.013
C	102.9	260.5	853.8	1596
D	3053	4087	6026	6939
E	18.2	17.86	19.55	20.86

Version P

Constant	1853	1854	1856	1857
A	29.68	15.68	7.06	4.35
B	0.343	0.108	0.041	0.021
C	90	240	756	1442
D	2671	3763	5335	6270
E	30.8	25.9	31	30.5

Effective clamping force

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

Admissible clamping force*)

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

Admissible operating pressure

$$p_{adm} = \frac{D}{L} + E \le 70 \quad [\text{bar}]$$

L = special length [mm] p = pressure [bar]

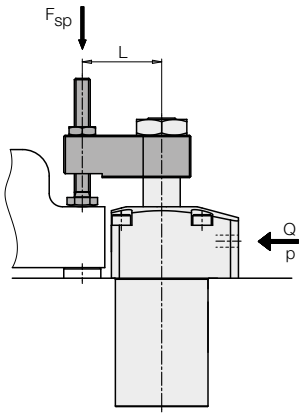
*) With a desired clamping arm length L the clamping force must not exceed the admissible value.

Example: Swing clamp 1853T090R16
Special clamping arm L = 60 mm

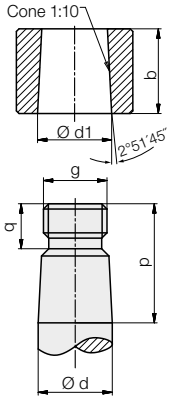
1. Admissible clamping force*)
$F_{adm} = \frac{C}{L} = \frac{102.9}{60} = 1.71\text{ kN}$
2. Admissible operating pressure
$p_{adm} = \frac{D}{L} + E = \frac{3053}{60} + 18.2 = 69\text{ bar} < 70$
3. Effective clamping force
$F_{Sp} = \frac{p}{A + (B * L)} = \frac{69}{29.68 + (0.177 * 60)} = 1.71\text{ kN}$

Example: Swing clamp 1853P090R16
Special clamping arm L = 70 mm

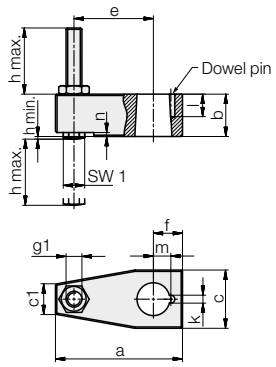
1. Admissible clamping force*)
$F_{adm} = \frac{C}{L} = \frac{90}{70} = 1.29\text{ kN}$
2. Admissible operating pressure
$p_{adm} = \frac{D}{L} + E = \frac{2671}{70} + 30.8 = 69\text{ bar} < 70$
3. Effective clamping force
$F_{Sp} = \frac{p}{A + (B * L)} = \frac{69}{29.68 + (0.343 * 70)} = 1.29\text{ kN}$



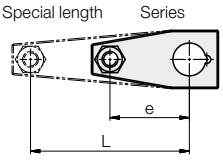
Dimensions for special clamping arms



Clamping arm with contact bolt



Special clamping arm



Flow rate and clamping force calculation, see page 6

Swing clamps		**1853**	**1854**	**1856**	**1857**
a	[mm]	48	65	96	114
b	[mm]	16	25	27	35
c	[mm]	22	34	52	60
c1	[mm]	12	19	31	36
Ø d	[mm]	14	22	30	36
Ø d1 –0.05	[mm]	14	22	30	36
e	[mm]	30	40	60	70
f	[mm]	11	17	25	30
g	[mm]	M12	M18 x 1.5	M24 x 1.5	M30 x 1.5
g1	[mm]	M6	M8	M12	M16
h min.	[mm]	1	1	1	1
h max.	[mm]	40	46	54	63
Ø k +0.1	[mm]	3	3	6	6
l +0.5	[mm]	8.5	8.5	12.5	12.5
m ±0.05	[mm]	6.6	10.3	15	18.1
n	[mm]	1.5	2.5	6	8
p	[mm]	22.5	34	37	47
q	[mm]	8.5	11.5	12.5	15.5
SW 1	[mm]	8	10	18	24
Moment of inertia of J_e	[kg mm²]	44	230	1284	3247
Part no.					
Clamping arm with contact bolt and dowel pin		**0354243**	**0354249**	**0354254**	**0354256**
Dowel pin		3 m 6x8	3 m 6x8	6 m 6x12	6 m 6x12
		3301854	**3301854**	**3300325**	**3300325**
Metallic wiper		**0341227**	**0341228**	**0341229**	**0341230**

Accessory
Throttle valve

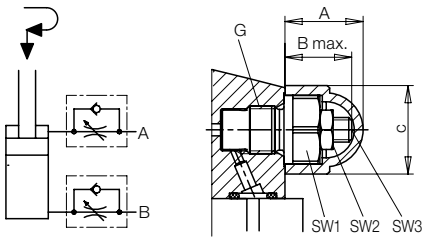
Throttle valves are used
- in order to reduce the swing speed of the clamping arm
- in order to improve the synchronism of several swing clamps

This application is only possible for manifold-mounting connection through drilled channels.

Important note

If throttling is too strong, the back pressure can trigger premature switching of pressure switches and sequence valves.

Hydraulic symbol



Swing clamps		**1853 1854**	**1856 1857**
A	[mm]	16	21
B max.	[mm]	13.5	17.5
C	[mm]	18	23.6
G		G 1/8	G 1/4
SW1	[mm]	14	19
Tightening torque	[Nm]	18	35
SW2	[mm]	8	8
SW3	[mm]	2.5	2.5
Weight	[kg]	0.025	0.036
Part no.		**2957209**	**2957210**

Application

The electrical position monitoring signals the following conditions due to damping of two inductive proximity switches:

1. Piston extended, clamping arm in off-position.
2. Piston in clamping area, clamping arm in clamping position.

For each control function, an electrical line has to be provided at the clamping fixture.

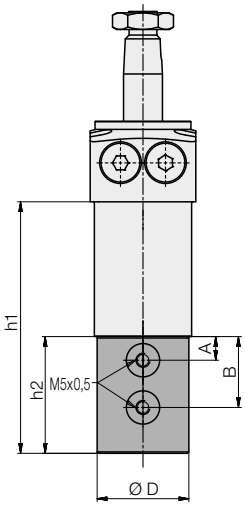
Description

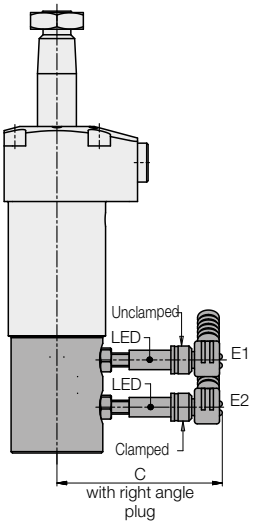
The electrical position monitoring can be easily retrofitted at all swing clamps with switch rod (185X**Q**0XX).

Included in our delivery are:

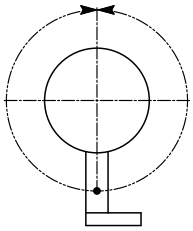
1 Signal sleeve with screw
1 Adapter with 4 countersunk screws
1 Control housing with 3 set screws
2 Inductive proximity switches with right angle plug (if ordered)

The signal sleeve is screwed onto the switch rod. The adapter is mounted with 4 countersunk screws on the bottom cover.
The control housing can be put onto the adapter in any angular position and locked with 3 set screws.
For information on adjustment of proximity switches, see operating manual.





360° adjustable



Possible position of the proximity switches

Important notes

Inductive position monitorings are not suitable for the use in coolant and swarf areas. According to the corresponding application conditions, safety measures have to be planned and checked later on.

Technical data

Operating voltage	10–30 V DC
Max. residual ripple	10 %
Max. constant current	100 mA
Switching function	interlock
Output	PNP
Material of housing	stainless steel
Thread	M 5 x 0.5
Code class	IP 67
Ambient temperature	–25 to + 70 °C
LED function display	Yes
Protected against short circuits	Yes
Type of connection	Connector
Length of cable	5 m

Swing clamps		**1853Q0XX**	**1854Q0XX**	**1856Q0XX**	**1857Q0XX**
A	[mm]	8.5	8.5	8.5	8.5
B	[mm]	25.5	30.5	37.5	39.5
C approx.	[mm]	59.5	61	62	62
Ø D	[mm]	33	42	45	45
h1	[mm]	90.5	110	132	141
h2	[mm]	42	49	55	57

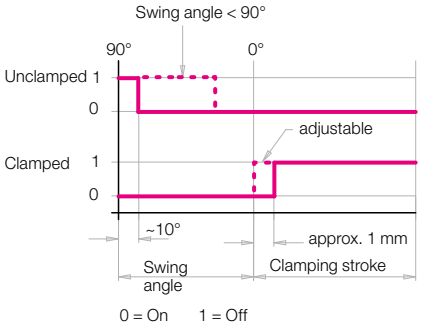
Part no. swing angle 0° or 90°				
with switch and plug	**0353920**	**0353926**	**0353930**	**0353943**
without switch and plug	**0353923**	**0353927**	**0353931**	**0353944**

Part no. 15° to 75° = XX*)				
with switch and plug	**03539200XX**	**03539260XX**	**03539300XX**	**03539430XX**
without switch and plug	**03539230XX**	**03539270XX**	**03539310XX**	**03539440XX**

Part no. spare parts				
Inductive proximity switch	**3829198**	**3829198**	**3829198**	**3829198**
Right angle plug 5 m	**3829099**	**3829099**	**3829099**	**3829099**

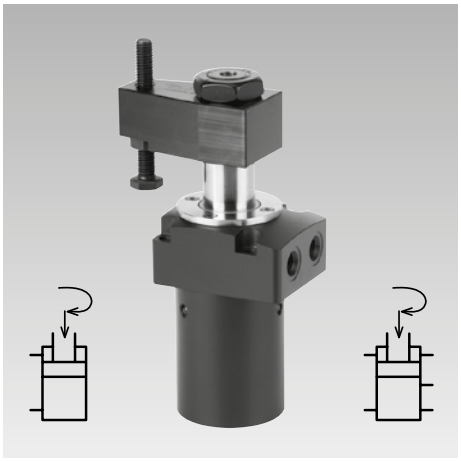
*) in gradation of 5° (see page 2, "swing angle α < 90°")

Function chart



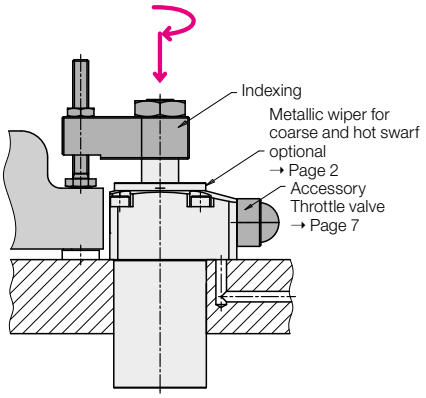
Swing clamp with reinforced swing mechanism

Position monitoring optional: pneumatically integrated / electrically attachable
Top flange type, double acting, max. operating pressure 120 bar



Advantages

- 4 sizes available
- Compact design partially recessible
- High clamping force already at 120 bar
- Extremely short clamping and unclamping times
- Accessory throttle valve, screw-in
- Indexing of clamping arm
- Standard FKM wiper
- Metallic wiper optional
- Pneumatic position monitoring integrated for type 186XP, standard
- Electrical position monitoring for type 186XQ, available as accessory
- Mounting position: any



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.
This series obtains very high clamping forces even at 120 bar and can directly be connected to the low-pressure hydraulics of the machine tools.
With the reinforced swing mechanism and the optional position monitorings these swing clamps are particularly suitable for:

- Automatic manufacturing systems with very short cycle times
- Clamping fixtures with workpiece loading by handling systems
- Transfer lines and assembly lines
- Test systems for motors, gears and axes
- Assembly lines
- Special machine tools

Description

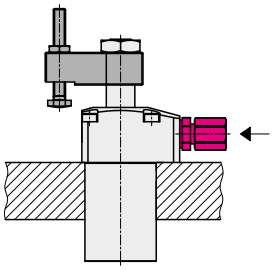
The hydraulic swing clamp is a pull-type cylinder where a part of the total stroke is used to swing the piston.
The reinforced swing mechanism ensures that the angle position of the clamping arm remains the same even if a slight collision with the workpiece during loading and unloading or during clamping occurs.
The angle position of the clamping arm is fixed with a dowel pin.
The FKM wiper at the piston rod can be protected against coarse and hot swarf by an optionally available metallic wiper (see page 2).
The version with extended switch rod is provided for mounting electrical position monitoring (accessory).

Important notes see page 2.

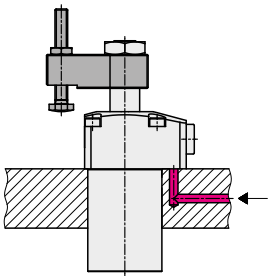
Installation and connecting possibilities

Pipe thread

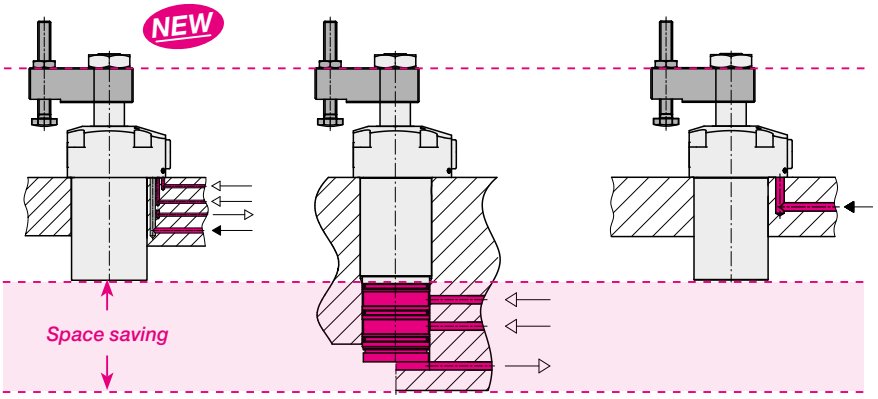
without position monitoring
186XT → Page 2



Drilled channels



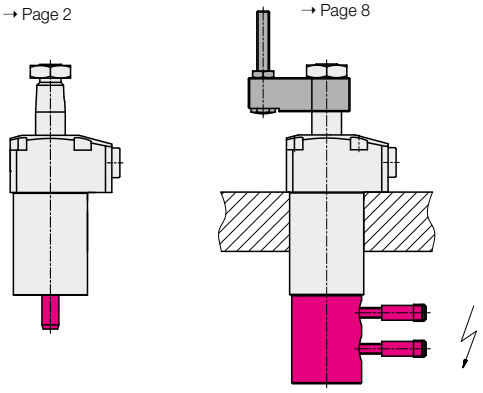
with integrated pneumatic position control
186XP → Page 4



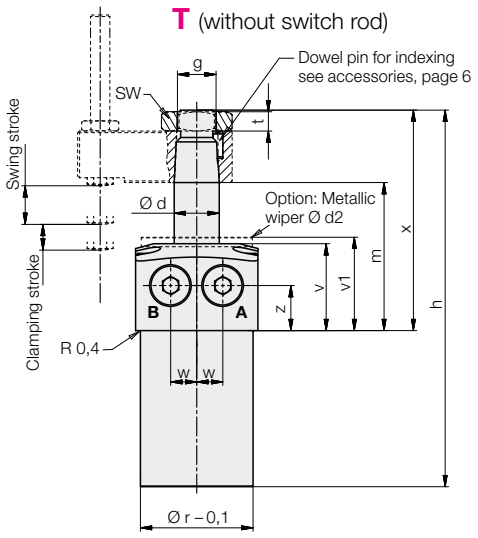
Pneumatic position monitoring at the bottom
available on request

without position monitoring

with switch rod for electrical position monitoring (see accessories)
186XQ → Page 2 → Page 8

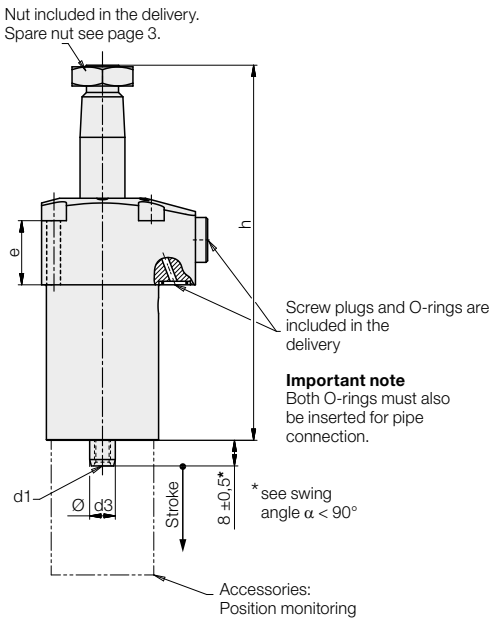


T (without switch rod)

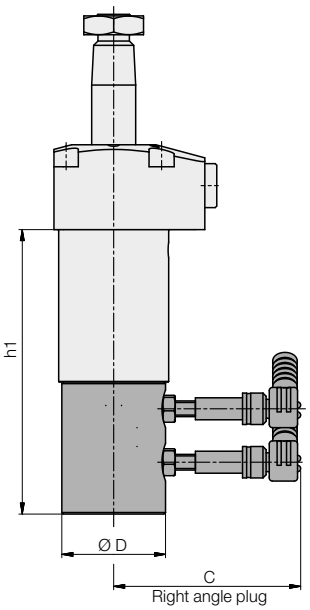


A = Clamping
B = Unclamping

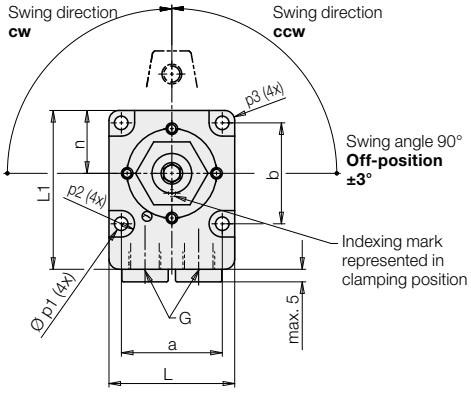
Q (with switch rod)



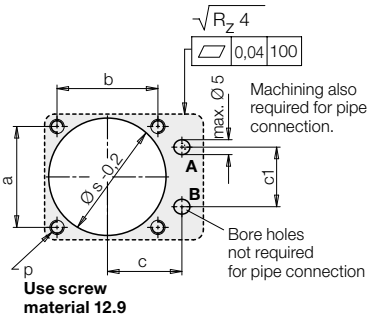
Electrical position monitoring (→ page 8)



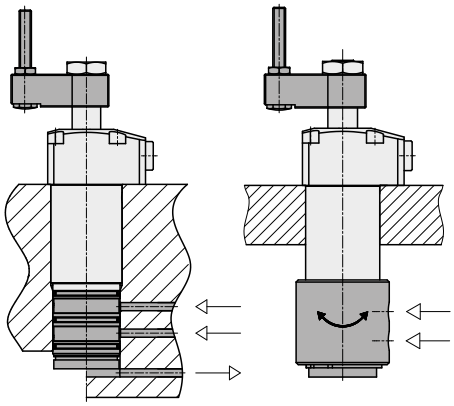
Clamping position ±1°



Connecting scheme



Pneumatic position monitorings
available on request



Cartridge type Pipe thread connection

Swing angle

1. Swing angle 90° and 0° (standard)

	Part no.
90° cw	**186X X090 RXX**
90° ccw	**186X X090 LXX**
0°	**186X X000 0XX**

2. Swing angle α < 90°

α = 15° to 75° in gradation of 5°

By insertion of a distance plate the return stroke of the piston is reduced and thus the swing angle is reduced.
Clamping stroke and clamping position remain the same. The swing stroke and the dimensions h, m and x are reduced by y:

y = (90° – α°) * k (k see chart page 3)

Dimension 8 ±0.5 is lengthened by the value y.

Example:

Swing clamp	1866T090L27
Desired swing angle	**45° ccw**
Part no.	**1866T045L27**

Shortening:
y = (90° – 45°) * 0.125 mm/° = 5.625 mm

3. Swing angle > 90°

Available on request!

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 clamp has no overload protection device. When mounting the clamping arm, the clamping arm or the hexagon socket in the piston have to be backed up for tightening or untightening the fixing nut.
During loading and unloading of the fixture and during clamping a collision with the clamping arm has to be avoided.
Remedy: Mount position adaptor.

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**") or as an accessory for retrofitting (part no. see page 7).

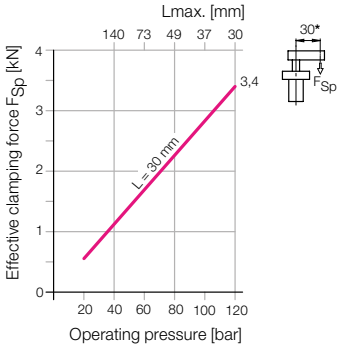
Attention!
The metallic wiper is not suitable for dry machining or minimum quantity lubrication. Also in applications with very little grinding swarf, the standard FKM wiper has a better protection effect.
If there is any danger that small particles stick to the piston rod, the metallic wiper disk can also be replaced by a hard plastic disk.

Swing clamps			**1863**	**1864**	**1866**	**1867**
Max. pulling force (120 bar)		[kN]	4.04	7.65	17	27.6
Effective clamping force		[kN]	see diagram or calculation of the clamping force on page 6			
Clamping stroke		[mm]	8	8	10	10
Swing stroke		[mm]	8	13	17	19
Total stroke		[mm]	16	21	27	29
Min. operating pressure		[bar]	20	20	20	20
Max. flow rate	Clamping	[cm^3/s]	13.5	33.5	96	167
	Unclamping	[cm^3/s]	20	53.5	145	255
Piston area	Clamping	[cm^2]	3.36	6.37	14.16	23
	Unclamping	[cm^2]	4.9	10.17	21.23	33.18
Oil volume / stroke		[cm^3]	5.4	13.4	38.3	66.7
Oil volume / return stroke		[cm^3]	7.9	21.4	57.4	102
Piston Ø		[mm]	25	36	52	65
a		[mm]	30.5	40	56	68
b		[mm]	30.5	40	56	68
c		[mm]	22.5	28	36	42
c1		[mm]	18	24	36	45
Ø d		[mm]	14	22	30	36
Ø d1		[mm]	M5 x 14.5 deep	M6 x 11.5 deep	M6 x 16.0 deep	M6 x 16.0 deep
Ø d2		[mm]	34.5	44.5	52.5	58.5
Ø d3 f7		[mm]	8	10	12	12
e		[mm]	20	19.5	19	23.5
SW		[mm]	SW 19	SW 27	SW 36	SW 46
g		[mm]	M12	M18 x 1.5	M24 x 1.5	M30 x 1.5
G			G 1/8	G 1/8	G 1/4	G 1/4
h		[mm]	117	149	178.5	203.5
h1		[mm]	90.5	110	132	141
k		[mm/°]	0.056	0.095	0.125	0.125
L		[mm]	38	50	70	86
L1		[mm]	48	60	82	96
m		[mm]	46	54	64.5	72.5
n		[mm]	19	25	35	43
p		[mm]	M4 (10.9)	M5 (10.9)	M8 (10.9)	M10 (10.9)
Ø p1		[mm]	4.3	5.5	9	11
p2		[mm]	4	5	7	9
p3		[mm]	3	3	6	7
Ø r –0.1		[mm]	35	47	63	78
Ø s –0.2		[mm]	36	48	64	79
t		[mm]	6	9	10	12
v		[mm]	27	29.5	34.5	39
v1		[mm]	29	31.5	36.5	41
w		[mm]	8.1	11	15	19
x		[mm]	68.5	88	101.5	119.5
z		[mm]	14	13.5	15.5	15.5
Weight, approx.		[kg]	0.7	1.5	3.0	5.0
Part no.	Clockwise rotation 90°		**1863X090R16M**	**1864X090R21M**	**1866X090R27M**	**1867X090R29M**
	Swing direction 90° ccw		**1863X090L16M**	**1864X090L21M**	**1866X090L27M**	**1867X090L29M**
	0 degree		**1863X000016M**	**1864X000021M**	**1866X000027M**	**1867X000029M**
Spare O-ring		[mm]	7 x 1.5	7 x 1.5	8 x 1.5	8 x 1.5
Part no.			**3000342**	**3000342**	**3000343**	**3000343**
Spare nut DIN 936			M12	M18 x 1.5	M24 x 1.5	M30 x 1.5
Tightening torque		[Nm]	12	30	62	110
Part no.			**3302115**	**3301663**	**3302104**	**3302139**

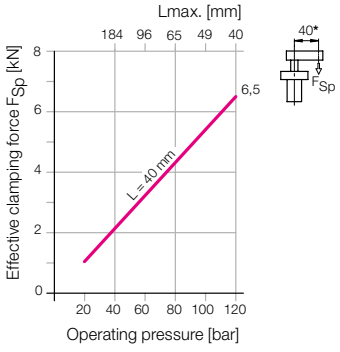
Code letter **X** see page 2
Metallic wiper **M** = option (see page 2)

Effective clamping force with accessory clamping arm as a function of the oil pressure

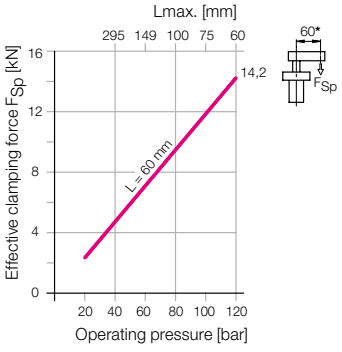
1863



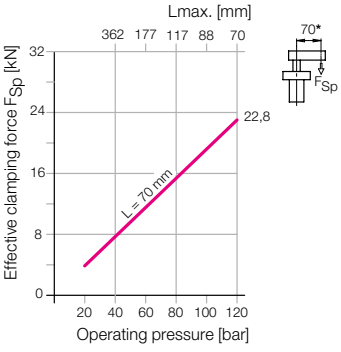
1864



1866

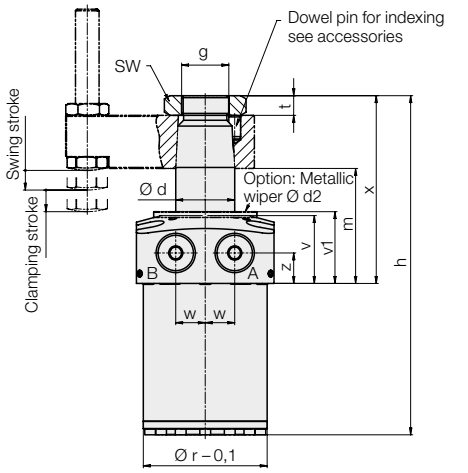


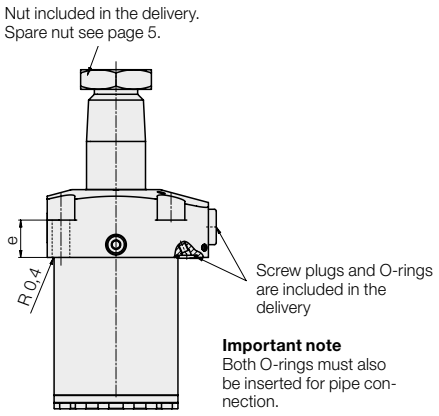
1867

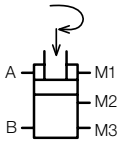


* Clamping force for other lengths see page 6

P (with integrated pneumatic position monitoring)

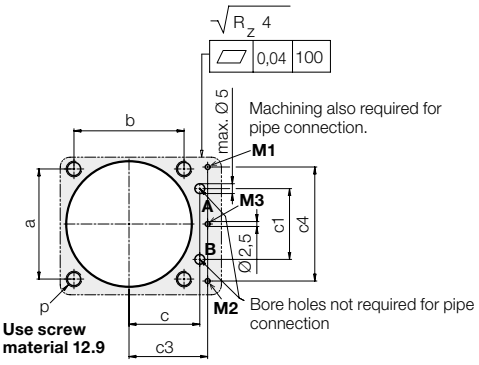


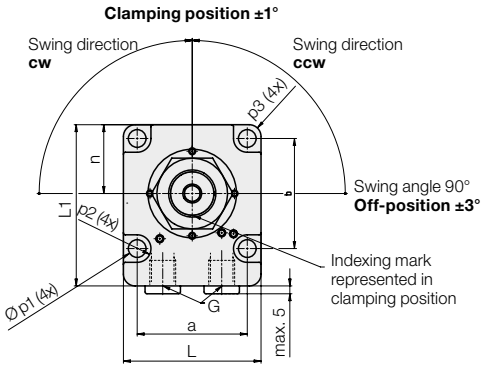




A = Clamping
B = Unclamping
M1 = Clamped (pneumatic)
M2 = Unclamped (pneumatic)
M3 = Outlet air (pneumatic)

Connecting scheme





Pneumatic position monitoring

Application

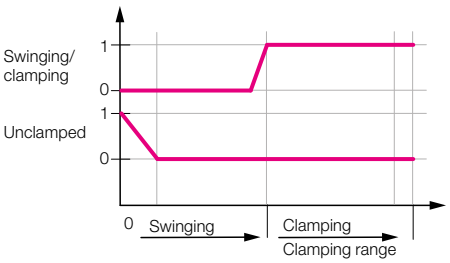
The pneumatic position monitoring signals the following conditions by closing two bore holes:

1. Piston extended and clamping arm in off-position.
2. Piston in clamping area and clamping arm in clamping position.

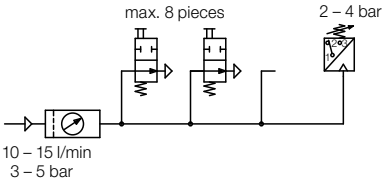
For each control function, a pneumatic line has to be provided at the clamping fixture.

Pneumatic diagram

0 = Passage
1 = No passage/closed



Monitoring by pneumatic pressure switch



For the evaluation of the pneumatic pressure increase, standard pneumatic pressure switches can be used. With one pressure switch up to 8 position monitorings can be monitored.
Note that reliable functioning of pneumatic monitoring is only guaranteed if the throttled air pressure and air flow rate are throttled.

Technical data

Port	Drilled channels
Nominal diameter	2 mm
Max. air pressure	10 bar
Range of operating pressure	3–5 bar
Differential pressure*) at 3 – 5 bar system pressure	min. 1.5 bar
Air flow rate	10– 15 l/min

*) Minimum pressure difference, if one or several position monitorings are not operated

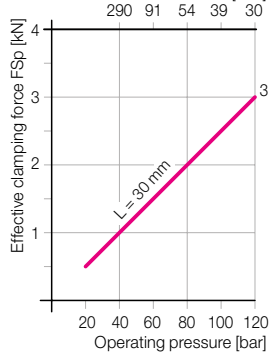
Swing clamps			**1863P**	**1864P**	**1866P**	**1867P**
Max. pulling force (70 bar)		[kN]	4.04	7.65	17	27.6
Effective clamping force		[kN]	see diagram or calculation of the clamping force on page 9			
Clamping stroke		[mm]	8	8	10	10
Swing stroke		[mm]	8	9	11	15
Total stroke		[mm]	16	17	21	25
Min. operating pressure		[bar]	20	20	20	20
Min. clamping and unclamping times		[s]	0.5	0.5	0.5	0.5
Max. flow rate	Clamping	[cm³/s]	10.8	21.6	60	115
	Unclamping	[cm³/s]	15.8	34.6	89.2	166
Piston area	Clamping	[cm²]	3.36	6.37	14.16	23
	Unclamping	[cm²]	4.9	10.17	21.23	33.18
Oil volume / stroke		[cm³]	5.4	10.8	29.8	57.5
Oil volume / return stroke		[cm³]	7.9	17.3	44.6	83
Piston Ø		[mm]	25	36	52	65
a		[mm]	30.5	40	56	68
b		[mm]	30.5	40	56	68
c		[mm]	22.5	28	36	42
c1		[mm]	18	24	36	45
c3		[mm]	21	28	40	44.5
c4		[mm]	31.8	41	58	67
Ø d		[mm]	14	22	30	36
Ø d2		[mm]	34.5	44.5	52.5	58.5
e		[mm]	20	19.5	19	23.5
SW		[mm]	SW 19	SW 27	SW 36	SW 46
g		[mm]	M12	M18x1.5	M24x1.5	M30x1.5
G			G 1/8	G 1/8	G 1/4	G 1/4
h		[mm]	116.5	145	172.5	199.5
L		[mm]	38	50	70	86
L1		[mm]	48	60	82	96
m		[mm]	45.5	50	59	68.5
n		[mm]	19	25	35	43
p		[mm]	M4 (10.9)	M5 (10.9)	M8 (10.9)	M8 (10.9)
Ø p1		[mm]	4.3	5.5	9	11
Ø p2		[mm]	4	5	7	9
p3		[mm]	3	3	6	7
Ø r –0.1		[mm]	35	47	63	78
Ø s –0.2		[mm]	36	48	64	79
t		[mm]	6	9	10	12
v		[mm]	27	29.5	34.5	39
v1		[mm]	29	31.5	36.5	41
w		[mm]	8	11	15	19
x		[mm]	68	84	95.5	115.5
z		[mm]	14	13.5	15.5	15.5
Weight, approx.		[kg]	0.7	1.5	3.2	5.1
Part no.	Swing direction cw		**1863PXXR16**	**1864PXXR17**	**1866PXXR21**	**1867PXXR25**
	Swing direction ccw		**1863PXXL16**	**1864PXXL17**	**1866PXXL21**	**1867PXXL25**
	0°		**1863P00016**	**1864P00017**	**1866P00021**	**1867P00025**
Spare O-ring	2 x hydraulics	[mm]	5 x 1.5	7x1.5	8x1.5	8x1.5
Part no.			**3000340**	**3000342**	**3000343**	**3000343**
Spare O-ring	3 x pneumatics	[mm]	3 x 1	3 x 1	2.9x1.78	2.9x1.78
Part no.			**3001758**	**3001758**	**3000019**	**3000019**
Spare nut DIN 936			M12	M18x1.5	M24x1.5	M30x1.5
Tightening torque		[Nm]	12	30	62	110
Part no.			**3302115**	**3301663**	**3302104**	**3302139**

Swing angle	**Part no.**	**Length correction value for h, m, x, total stroke and swing stroke**			
		1863P	**1864P**	**1866P**	**1867P**
90°	**186XP90XXX**	0	0	0	0
60°	**186XP60XXX**	–3.5	–3.7	–4.9	–6.3
45°	**186XP45XXX**	–4.5	–4.7	–6.2	–8.2
0°	**186XP000XX**	0	0	0	0
With metallic wiper [1]	**186XPXXXXXM**				

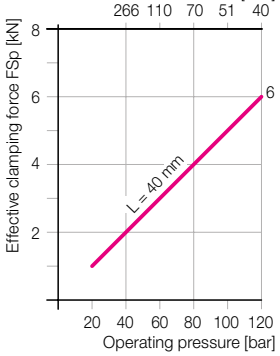
[1] Wiper system, see page 2

Example: **1864P45R17**
h 145 –4.7 = 140.3
m 50 –4.7 = 45.3
x 84 –4.7 = 79.3
Total stroke 17 –4.7 = 12.3
Swing stroke 9 –4.7 = 4.3

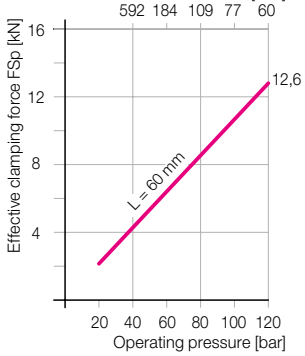
1863P



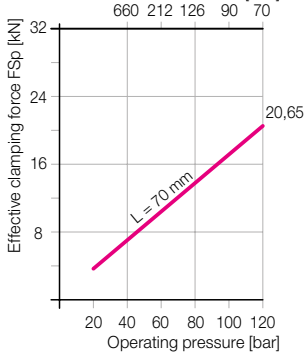
1864P



1866P



1867P



* Clamping force for other lengths see page 6

Admissible flow rate

With the accessory clamping arm and the admissible flow rate as per the chart, the shortest clamping time is approx. 0.4 seconds.
Longer special clamping arms have a higher torque of inertia. To avoid an overload of the swing mechanism, the flow rate has to be reduced:

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

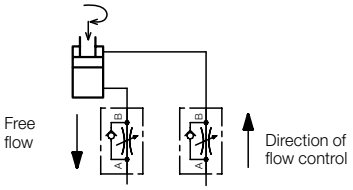
Q_e = Flow rate as per chart
Q_L = Flow rate with special clamping arm
J_e = Torque of inertia accessory clamping arm
J_L = Torque of inertia special clamping arm

If the torques of inertia are not known, the admissible flow rate can be determined according to the following example:
Conditions: The special clamping arm is longer, has however the form (cross section) of the accessory clamping arm, as shown on page 6.

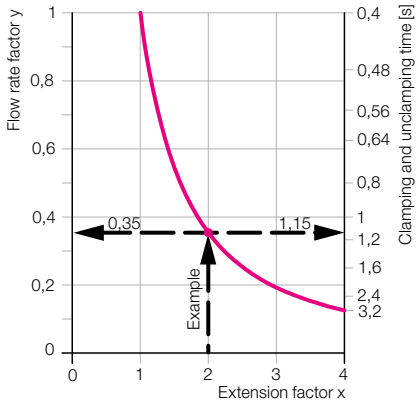
Example: Swing clamp 1863T090R16
L = 60 mm
e = 30 mm as per above chart
Q_e = 13.5 cm³/s

1. Extension factor $x = \frac{L}{e} = \frac{60\text{ mm}}{30\text{ mm}} = 2$
2. Flow rate factor as per diagram → y = 0.35
3. Max. flow rate $Q_L = y * Q_e = 0.35 * 13.5\text{ cm}^3/\text{s} = 4.7\text{ cm}^3/\text{s}$
4. Min. clamping time as per diagram → approx. 1.15 s

Throttling of the flow rate



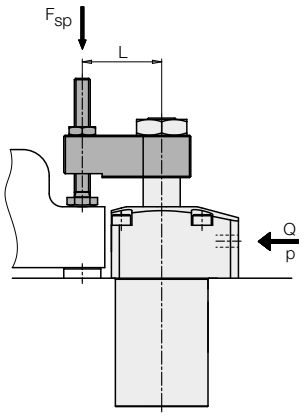
Adm. flow rate and clamping time as a function of the clamping arm extension



Clamping force calculation

The clamping force diagram shows the effective clamping force with accessory clamping arm (L = e).
Versions **T** and **Q**: see page 3
Version **P**: see page 5

With longer clamping arms (L > e) the degree of efficiency is reduced. This is considered in the following calculation.
The constants (A–E) for the 4 sizes are shown in the following charts.



Versions T and Q

Constant	1863	1864	1866	1867
A	29.68	15.68	7.06	4.35
B	0.177	0.069	0.023	0.013
C	102.9	260.5	853.8	1596
D	3053	4087	6026	6939
E	18.2	17.86	19.55	20.86

Version P

Constant	1863	1864	1866	1867
A	29.68	15.68	7.06	4.35
B	0.343	0.108	0.041	0.021
C	90	240	756	1442
D	2671	3763	5335	6270
E	30.8	25.9	31	30.5

Effective clamping force

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

Admissible clamping force*)

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

Admissible operating pressure

$$p_{adm} = \frac{D}{L} + E \le 120 \quad [\text{bar}]$$

L = special length [mm] p = pressure [bar]

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

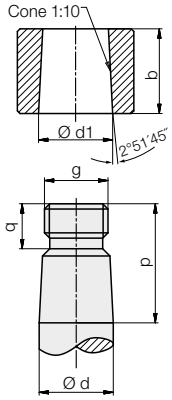
Example: Swing clamp 1863T090R16
Special clamping arm L = 60 mm

1. Admissible clamping force*)
$F_{adm} = \frac{C}{L} = \frac{102.9}{60} = 1.71\text{ kN}$
2. Admissible operating pressure
$p_{adm} = \frac{D}{L} + E = \frac{3053}{60} + 18.2 = 69\text{ bar} < 120$
3. Effective clamping force
$F_{Sp} = \frac{p}{A + (B * L)} = \frac{69}{29.68 + (0.177 * 60)} = 1.71\text{ kN}$

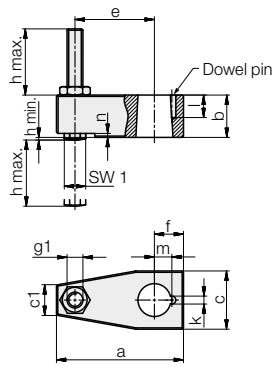
Example: Swing clamp 1863P090R16
Special clamping arm L = 60 mm

1. Admissible clamping force*)
$F_{adm} = \frac{C}{L} = \frac{90}{60} = 1.5\text{ kN}$
2. Admissible operating pressure
$p_{adm} = \frac{D}{L} + E = \frac{2671}{60} + 30.8 = 75.3\text{ bar} < 120$
3. Effective clamping force
$F_{Sp} = \frac{p}{A + (B * L)} = \frac{75.3}{29.68 + (0.343 * 60)} = 1.5\text{ kN}$

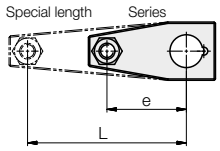
Dimensions for special clamping arms



Clamping arm with contact bolt



Special clamping arm



Flow rate and clamping force calculation, see page 6

Swing clamps		**1863**	**1864**	**1866**	**1867**
a	[mm]	48	65	96	114
b	[mm]	16	25	27	35
c	[mm]	22	34	52	60
c1	[mm]	12	19	31	36
Ø d	[mm]	14	22	30	36
Ø d1 –0.05	[mm]	14	22	30	36
e	[mm]	30	40	60	70
f	[mm]	11	17	25	30
g	[mm]	M12	M18 x 1.5	M24 x 1.5	M30 x 1.5
g1	[mm]	M6	M8	M12	M16
h min.	[mm]	1	1	1	1
h max.	[mm]	40	46	54	63
Ø k +0.1	[mm]	3	3	6	6
l +0.5	[mm]	8.5	8.5	12.5	12.5
m ±0.05	[mm]	6.6	10.3	15	18.1
n	[mm]	1.5	2.5	6	8
p	[mm]	22.5	34	37	47
q	[mm]	8.5	11.5	12.5	15.5
SW 1	[mm]	8	10	18	24
Moment of inertia of J_e	[kgmm^2]	44	230	1284	3247
Part no.					
Clamping arm with contact bolt and dowel pin		**0354243**	**0354249**	**0354254**	**0354256**
Dowel pin		3 m 6x8	3 m 6x8	6 m 6x12	6 m 6x12
		3301854	**3301854**	**3300325**	**3300325**
Metallic wiper		**0341227**	**0341228**	**0341229**	**0341230**

Accessory
Throttle valve

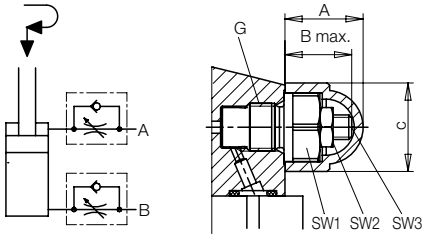
Throttle valves are used
- in order to reduce the swing speed of the clamping arm
- in order to improve the synchronism of several swing clamps

This application is only possible for manifold-mounting connection through drilled channels.

Important note

If throttling is too strong, the back pressure can trigger premature switching of pressure switches and sequence valves.

Hydraulic symbol



Swing clamps		**1863 1864**	**1866 1867**
A	[mm]	16	21
B max.	[mm]	13.5	17.5
C	[mm]	18	23.6
G		G 1/8	G 1/4
SW1	[mm]	14	19
Tightening torque	[Nm]	18	35
SW2	[mm]	8	8
SW3	[mm]	2.5	2.5
Weight	[kg]	0.025	0.036
Part no.		**2957209**	**2957210**

Application

The electrical position monitoring signals the following conditions due to damping of two inductive proximity switches:

1. Piston extended, clamping arm in off-position.
2. Piston in clamping area, clamping arm in clamping position.

For each control function, an electrical line has to be provided at the clamping fixture.

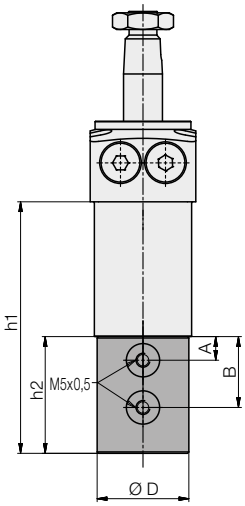
Description

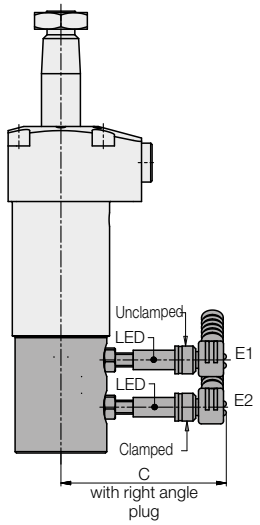
The electrical position monitoring can be easily retrofitted at all swing clamps with switch rod (186X**Q**0XX).

Included in our delivery are:

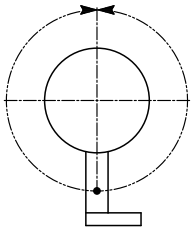
1 Signal sleeve with screw
1 Adapter with 4 countersunk screws
1 Control housing with 3 set screws
2 Inductive proximity switches with right angle plug (if ordered)

The signal sleeve is screwed onto the switch rod. The adapter is mounted with 4 countersunk screws on the bottom cover.
The control housing can be put onto the adapter in any angular position and locked with 3 set screws.
For information on adjustment of proximity switches, see operating manual.





360° adjustable



Possible position of the proximity switches

Important notes

Inductive position monitorings are not suitable for the use in coolant and swarf areas. According to the corresponding application conditions, safety measures have to be planned and checked later on.

Technical data

Operating voltage	10–30 V DC
Max. residual ripple	10 %
Max. constant current	100 mA
Switching function	interlock
Output	PNP
Material of housing	stainless steel
Thread	M 5 x 0.5
Code class	IP 67
Ambient temperature	–25 to + 70 °C
LED function display	Yes
Protected against short circuits	Yes
Type of connection	Connector
Length of cable	5 m

Swing clamps		**1863Q0XX**	**1864Q0XX**	**1866Q0XX**	**1867Q0XX**
A	[mm]	8.5	8.5	8.5	8.5
B	[mm]	25.5	30.5	37.5	39.5
C approx.	[mm]	59.5	61	62	62
Ø D	[mm]	33	42	45	45
h1	[mm]	90.5	110	132	141
h2	[mm]	42	49	55	57

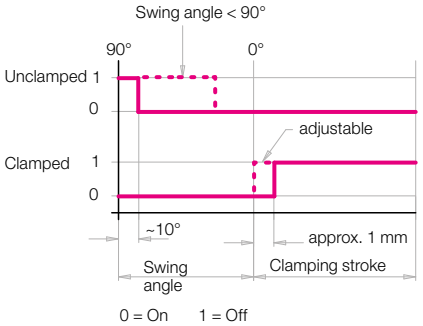
Part no. swing angle 0° or 90°				
with switch and plug	**0353920**	**0353926**	**0353930**	**0353943**
without switch and plug	**0353923**	**0353927**	**0353931**	**0353944**

Part no. 15° to 75° = XX*)				
with switch and plug	**03539200XX**	**03539260XX**	**03539300XX**	**03539430XX**
without switch and plug	**03539230XX**	**03539270XX**	**03539310XX**	**03539440XX**

Part no. spare parts				
Inductive proximity switch	**3829198**	**3829198**	**3829198**	**3829198**
Right angle plug 5 m	**3829099**	**3829099**	**3829099**	**3829099**

*) in gradation of 5° (see page 2, "swing angle α < 90°")

Function chart

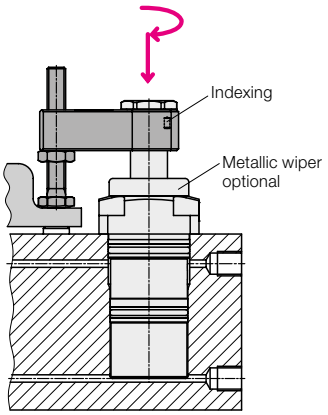


Swing Clamps with Sturdy Swing Mechanism

Cartridge type, position monitoring optional, double acting, max. operating pressure 350 bar

Advantages

- 4 sizes available
- Short version without bottom cover
- Minimum flange dimensions
- High clamping force at low pressures
- Sturdy swing mechanism
- Insensitive against high flow rates
- Indexing of the clamping arm in a specified position is possible
- Special swing angle easily realizable
- Standard FKM wiper
- Metallic wiper optional
- Mounting position: any



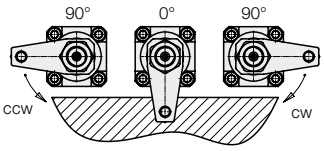
Application

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.
Due to the sturdy swing mechanism these swing clamps are particularly suited for:

- Automatic manufacturing systems
- Clamping fixtures with workpiece loading via handling systems
- Transfer lines
- Test systems for motors, gears and axes
- Assembly lines
- Special machine tools

Swing direction

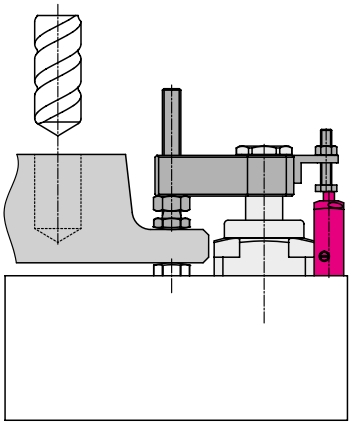
The units are available with clockwise and counterclockwise swing motion or without swing motion (0°).



The swing angle can be limited by the insertion of distance plates (see page 2).

Position monitoring as accessory

Clamping arm complete with angle bracket (page 4).
Pneumatic position monitoring (page 5).



Description

The hydraulic swing clamp is a pull-type cylinder where a part of the total stroke is used to swing the piston.
The favourable area ratio (piston/piston rod) allows high clamping forces already at relatively low oil pressures.
For high flow rates the swing speed is limited by an orifice in the clamping port. Thus, uniform clamping of several swing clamps is also possible when oil supply is effected through a common bore.
Due to the sturdy swing mechanism the angle position of the clamping arm remains the same after a slight collision with the workpiece during loading or unloading. Also a collision during the clamping process is not critical.

Wiper system

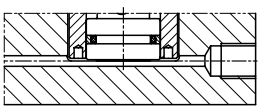
The standard FKM wiper has a high chemical resistance against most cooling and cutting fluids.
The optional metallic wiper protects the FKM wiper against mechanical damage due to big or hot swarf.
It consists of a radially floating wiping disk and a retaining disk.
The metallic wiper can be delivered already mounted ("M") or as an accessory for retrofitting (see page 4).

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.

Version without bottom cover

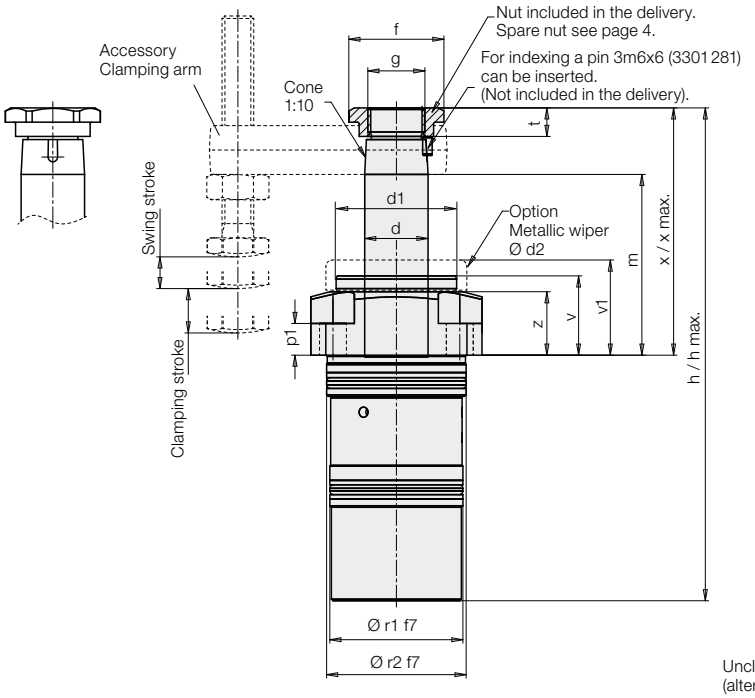
Focusing on a short length, the bottom cover had been omitted. The piston contacts the bottom of the cartridge-type hole.



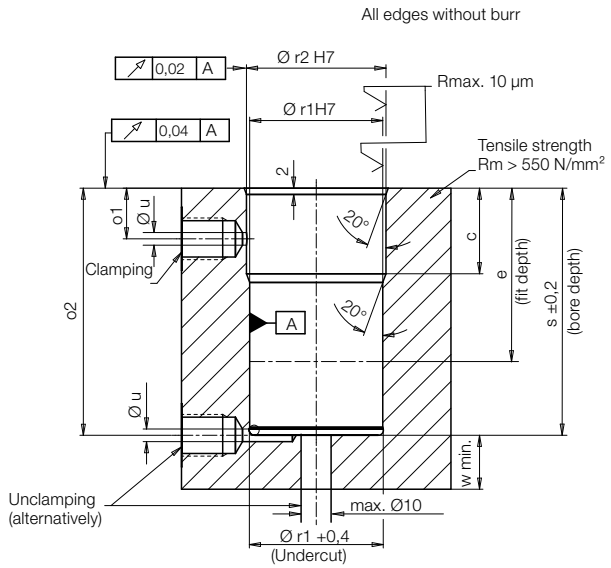
Important notes!

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 clamp has no overload protection device. When mounting the clamping arm, the clamping arm or the hexagon socket in the piston have to be backed up for tightening or untightening the fixing nut.
During loading and unloading of the fixture and during clamping a collision with the clamping arm has to be avoided.
Remedy: Mount position adaptor.

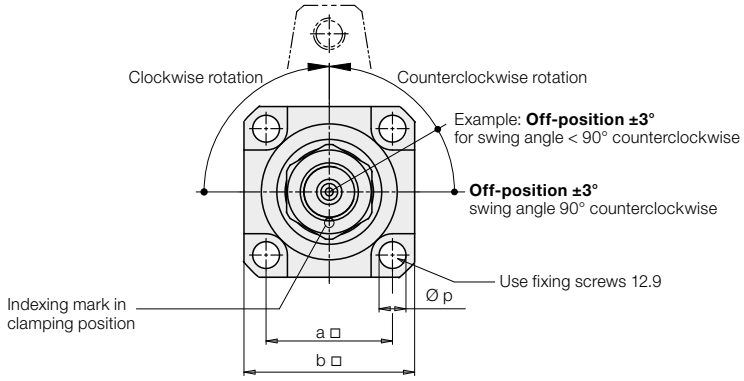
Operating conditions, tolerances and other data see data sheet A 0.100.

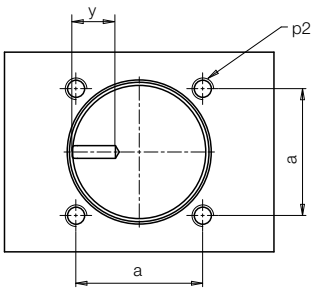


Location hole



Clamping position ±1°





Swing angle

1. Swing angle 90° (standard)

	Part no.
90° cw	**184X F090 R XX**
90° ccw	**184X F090 L XX**
0°	**184X F0000 XX**

2. Swing angle α < 90°

α = 15° to 75° in gradation of 5°

By insertion of a distance plate the return stroke of the piston is reduced and thus the swing angle is reduced.
Clamping stroke and clamping position remain the same. The swing stroke and the dimensions h, m and x are reduced by y:

$y = (90° - \alpha°) * k$ (k see chart page 3)

Example:

Swing clamp	1845 F090 L30
Desired swing angle	**45° ccw**
Part no.	**1845 F045 L30**

Shortening:
$y = (90° - \alpha°) * 0.12$ mm/° = 5.4 mm

3. Swing angle > 90°

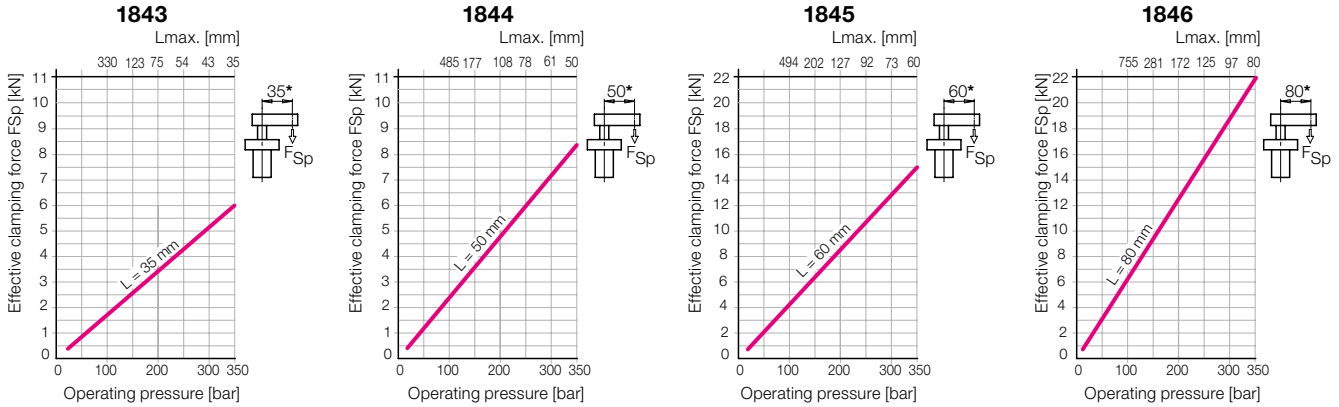
Available on request!

Max. pulling force	[kN]	7.5	10.5	18.4	27.5
Effective clamping force	[kN]		see diagram		
Clamping stroke	[mm]	12	12	15	15
Swing stroke	[mm]	11	12	15	21
Total stroke +0.4/-0.3	[mm]	23	24	30	36
Min. operating pressure	[bar]	30	30	30	30
Max. flow rate					
Clamping	[cm³/s]	10	14	32	57
Unclamping	[cm³/s]	20	28	60	110
Effective piston area					
Clamping	[cm²]	2.14	3.01	5.27	7.86
Unclamping	[cm²]	4.15	6.15	10.17	15.90
Oil volume/stroke	[cm³]	4.9	7.2	15.8	28.3
Oil volume/return stroke	[cm³]	9.6	14.8	30.5	57.2
Piston Ø	[mm]	23	28	36	45
a □	[mm]	33	40	50	57
b □	[mm]	43	54	67	77
c	[mm]	23	27	25	32
Ø d	[mm]	16	20	25	32
Ø d1	[mm]	28	38	45	48
Ø d2	[mm]	33	42	54	54.5
e (fit depth)	[mm]	45	50	53	53
Ø f	[mm]	27	30	36	40
g		M14x1.5	M18x1.5	M20x1.5	M28x1.5
h +0.4/-0.5 / h max.[1]	[mm]	150.5 / 151.8	161.5 / 163.3	188.5 / 190.3	216.9 / 217.4
k	[mm/°]	0.091	0.093	0.12	0.152
m +0.4/-0.7 [2]	[mm]	56.4	57.9	68.9	78.3
o1 min./max.	[mm]	16/17	16/23	20/20	21/26
o2 min./max.	[mm]	50/73	53/78	57/89	58/101
Ø p	[mm]	6.6	8.5	10.5	13.0
p1	[mm]	13	10	14	16
p2		M6	M8	M10	M12
Ø r1	[mm]	35	42	52	63
Ø r2	[mm]	36	44	55	65
s ±0.2	[mm]	73.3	78.3	89.3	101.3
t	[mm]	7.5	9	10	10
Ø u max.	[mm]	10	6	8	10
v	[mm]	25	25	29	34
v1 metallic wiper	[mm]	30	30	34	39
w min. [thickness of the bottom]	[mm]	14	16	16	20
x +0.3/-0.2 / x max.[1]	[mm]	78 / 79.2	84 / 85.8	100 / 101.6	116.5 /116.8
y min.	[mm]	8	9	10	12
z	[mm]	20	20	24.4	28.4
Weight, approx.	[kg]	0.9	1.4	2.3	3.65
Part no.					
Clockwise rotation 90°		**1843 F090 R23M**	**1844 F090 R24M**	**1845 F090 R30M**	**1846 F090 R36M**
Counterclockwise rotation 90°		**1843 F090 L23M**	**1844 F090 L24M**	**1845 F090 L30M**	**1846 F090 L36M**
0 degree		**1843 F000 023M**	**1844 F000 024M**	**1845 F000 030M**	**1846 F000 036M**

[1] h / x = upper edge piston h max. / x max. = upper edge nut
[2] m = lower edge clamping arm

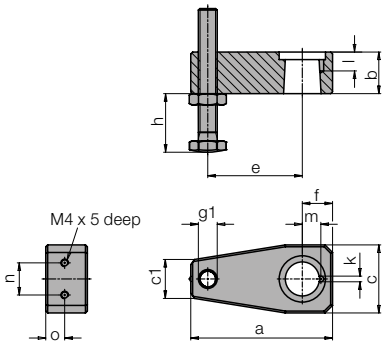
M = Option metallic wiper (see also page 1)

Effective clamping force with accessory clamping arm as a function of the oil pressure

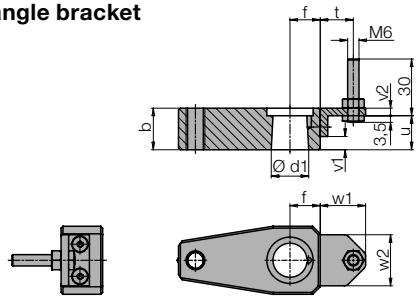


* Clamping force for other lengths see page 4.

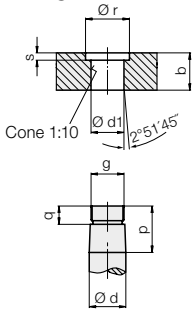
Clamping arm, max. 350 bar



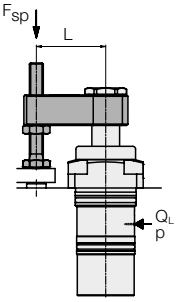
Clamping arm complete with angle bracket



Special clamping arm
1. Connecting dimensions



2. Admissible flow rate Q*



In the chart on page 3, the admissible flow rates for clamping and unclamping with the clamping arms (accessories) are specified. Longer special clamping arms have a higher torque of inertia. To avoid an overload of the swing mechanism, the flow rate has to be reduced:

2.1 Moments of inertia are known

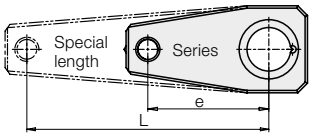
$$Q_L = Q_e * \sqrt{\frac{J_e}{J_L}} \text{ cm}^3/\text{s}$$

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 (accessory) with contact bolt (chart)
J_L = Moment of inertia special clamping arm

***** Only for vertical mounting position!

Swing clamps		**1843**	**1844**	**1845**	**1846**
a	[mm]	58	75	93	120
b	[mm]	17	22	26	32
c	[mm]	28	36	45	60
c1	[mm]	14	20	23	28
Ød f7	[mm]	16	20	25	32
Ød1 +0.1/+0.05	[mm]	15.8	19.8	24.8	31.8
e	[mm]	35	50	60	80
f	[mm]	16	16	22	26
g	[mm]	M14x1.5	M18x1.5	M20x1.5	M28x1.5
g1	[mm]	M8	M10	M12	M16
h min/max	[mm]	5/45	6/64	7/70	9/85
Ø k +0.1	[mm]	3	3	3	3
l +0.5	[mm]	9	10	10	10.5
m ±0.05	[mm]	7.8	9.8	12	15
n	[mm]	11	17	20	20
o	[mm]	6	10	12	20
p	[mm]	22.5	27	32	39
q	[mm]	9	10	11	12.7
Ø r	[mm]	20	24.5	31	34.5
s	[mm]	2.5	4	4	4.5
t	[mm]	11	17.5	19	19
u	[mm]	17	18	21	19
v1	[mm]	6	7	8	6
v2	[mm]	4	4	5	5
w1	[mm]	18	24	26	26
w2	[mm]	21	27	30	30
Part no. clamping arm					
– with contact bolt		**0354152**	**0354153**	**0354154**	**0354155**
Weight, approx.	[kg]	0.19	0.39	0.69	1.43
Moment of inertia of J_e	[kgm²]	0.00011	0.00046	0.0011	0.00398
– without thread g1		**3548660**	**3548661**	**3548803**	**3548804**
Weight, approx.	[kg]	0.16	0.34	0.62	1.28
Moment of inertia of J_e	[kgm²]	0.00007	0.00033	0.00084	0.00298
– complete with angle		**0354156**	**0354157**	**0354158**	**0354159**
Angle bracket complete		**0184003**	**0184004**	**0184005**	**0184005**
Metallic wiper		**0341104**	**0341107**	**0341105**	**0341100**
Spare nut		**3527092**	**3527014**	**3527099**	**3527015**
Tightening torque	[Nm]	16	30	42	90

Special clamping arm

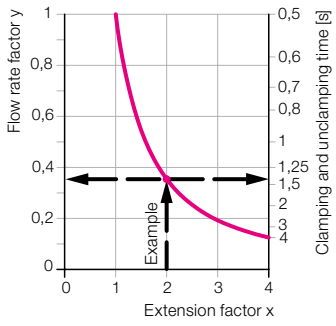


2.2 Moments of inertia not known

This simplified calculation is only applicable for clamping arms of the above shape.

Example: Swing clamps 1843
L = 70 mm
e = 35 mm as per above chart
Q_e = 10 cm³/s (as per chart page 3)

1. Extension factor $x = \frac{L}{e} = \frac{70\text{ mm}}{35\text{ mm}} = 2$
2. Flow rate factor as per diagram → y = 0.35
3. Max. flow rate $Q_L = y * Q_e = 0.35 * 10\text{ cm}^3/\text{s} = 3.5\text{ cm}^3/\text{s}$
4. Min. clamping time as per diagram → approx. 1.4 s



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

Clamping force and admissible operating pressure

Effective clamping force (general)

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

Admissible clamping force

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

Admissible operating pressure

$$p_{adm} = \frac{D}{L} + E \leq 350 \quad [\text{bar}]$$

L = special length [mm] p = pressure [bar]

A, B, C, D, E = constants as per chart

Constant	**1843**	**1844**	**1845**	**1846**
A	46.64	33.15	18.98	12.72
B	0.335	0.17	0.073	0.04
C	210	420	900	1760
D	9795	13926	17078	22386
E	70.26	71.33	65.44	70.36

Example: Swing clamps 1843
L = 70 mm

1. Admissible clamping force

$$F_{adm} = \frac{C}{L} = \frac{210}{70} = 3\text{ kN}$$

2. Admissible operating pressure

$$p_{adm} = \frac{D}{L} + E = \frac{9795}{70} + 70.26 = 210\text{ bar}$$

Application

The pneumatic position monitoring signals the following conditions by closing two bore holes:

Clamping arm in clamping position and piston in clamping area

By the pressure increase in the pneumatic line an electro-pneumatic pressure switch or a differential pressure switch can be actuated. These electrical switching devices are integrated in the electric control so that on the clamping fixture no electricity is required.

Description

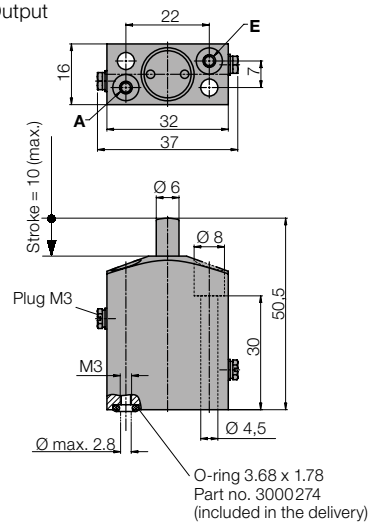
The control bolt is fitted with small clearance into the housing and is maintained by spring force in the off-position.
All components are made of stainless steel.
The pneumatic is preferably supplied and removed through drilled channels; this offers an optimum swarf protection.
Optionally, also pneumatic hoses NW2 can be connected.

Technical data

Connection		O-ring or thread M3
Nominal diameter	[mm]	2
Max. air pressure	[bar]	10
Range of operating pressure	[bar]	3 … 5
Differential pressure *) at		
3 bar system pressure	[bar]	min. 1.5
5 bar system pressure	[bar]	min. 3
Air flow rate **)	[l/min]	10 … 20
Actuating force ***)	[N/bar]	2.8
+ Spring force	[N]	6.5 … 13
Plunger stroke	[mm]	max. 10

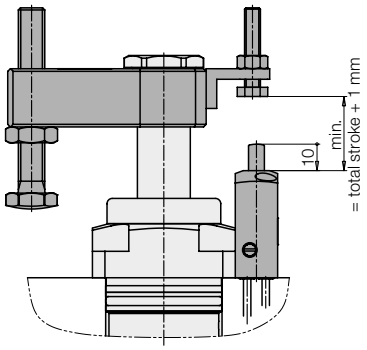
*) Pressure drop when controlling the function "Clamped", if one or several position monitorings are not operated.
**) For measuring the air flow rate appropriate devices are available. Please contact us.
***) Port A closed.

E = Input
A = Output

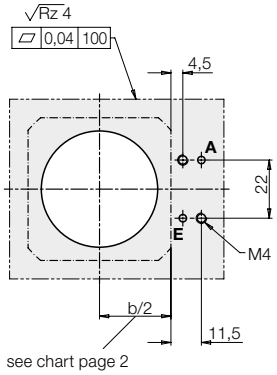


Mounting example

Attention!
Piston extended (unclamped) but clamping arm shown in clamping position.



Connecting scheme



2 connecting bores max. Ø 2.8

Pneumatic port

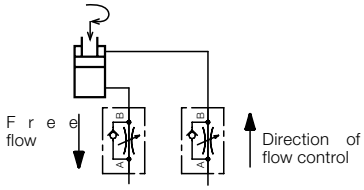
Drilled channels
The position monitoring is fixed to the above connecting scheme with inserted O-rings.
With the indicated distance dimensions the position monitoring is directly located at the flange of the swing clamp and has thus the correct distance for the operation of the clamping arm.
Hose connection
Remove the plugs M3 and screw-in the insertion nipple fitting M5 (accessory). The O-rings remain inserted for sealing at the flange-mounting surface.

Important notes

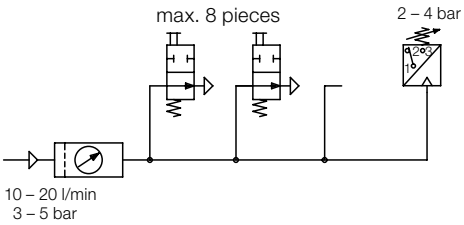
When adjusting the control cam it has to be considered that the control bolt will only be operated after completion of the swing stroke. Within the clamping range the control bolt should have a stroke reserve of approx. 1 mm also for idle strokes (without workpiece) to avoid mechanical damage.

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 350 bar.



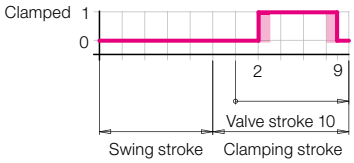
Monitoring by pneumatic pressure switch



For the evaluation of the pressure built-up standard electro-pneumatic pressure switches can be used.
It is possible to monitor up to 8 position monitorings connected in series (see circuit diagram).

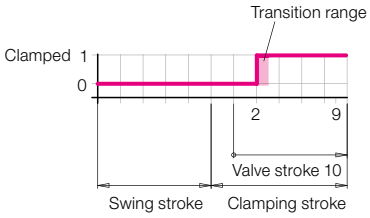
Please note!
Functioning of the pneumatic position monitorings is only process-safe, if the air quantity and the system pressure are throttled. The nominal values are indicated below technical data.

Switching range 2 ÷ 9 mm



Part no. 0353921

Switching range 2 ÷ 10 mm



0 = Passage 1 = Closed

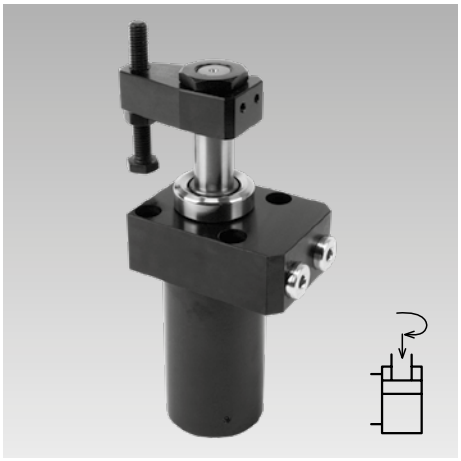
Part no. 0353937

Accessories

Insertion nipple fitting M3
Part no. **3890188**

Swing Clamps with Sturdy Swing Mechanism

Top flange type, with optional position monitoring, double acting, max. operating pressure 350 bar



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.
Due to the sturdy swing mechanism and the manifold possibilities of position monitoring these swing clamps are particularly suited for

- Automatic manufacturing systems
- Clamping fixtures with workpiece loading via handling systems
- Transfer lines
- Test systems for motors, gears and axes
- Assembly lines
- Special machine tools

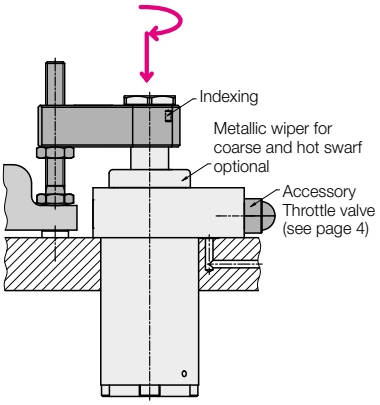
Description

The hydraulic swing clamp is a pull-type cylinder where a part of the total stroke is used to swing the piston.
The favourable area ratio (piston/piston rod) allows high clamping forces already at relatively low oil pressures.
Due to the sturdy swing mechanism the angle position of the clamping arm remains the same after a slight collision with the workpiece during loading or unloading. Also a collision during the clamping process is not critical.
When using high flow rates the swing speed is limited by installed throttle points.
For connection via drilled channels, adjustable throttle valves can be screwed instead of the screw plugs.
The FKM wiper at the piston rod can be protected against coarse and hot swarf by an optionally available metallic wiper (see page 6).
The different possibilities of the position monitoring are presented at the side.

Important notes see page 6.

Advantages

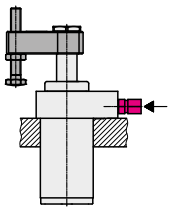
- 5 sizes available
- Compact design partially recessible
- High clamping force at low pressures
- Sturdy swing mechanism
- Insensitive against high flow rates
- Indexing of the clamping arm in a specified position is possible
- Special swing angle easily realisable
- Standard FKM wiper
- Metallic wiper optional
- Throttle valves available as accessory
- Screw counterbores coverable
- position monitoring available in six variants
- Hydraulic and pneumatic ports integrated in the flange
- Mounting position: any



Installation and connecting possibilities

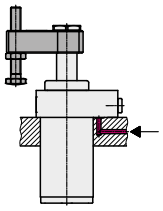
Pipe thread

184X**A**



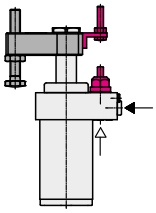
Drilled channels

184X**A**



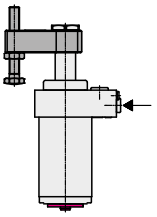
Pneumatic position monitoring integrated
Monitoring of the clamping arm in clamping position (adjustable)

184X**C**
P



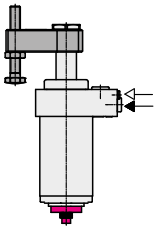
Position monitoring as accessories
Switch rod for external sensors

184X**B**



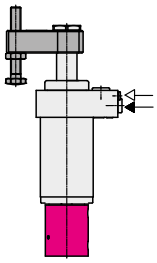
Monitoring of the piston in unclamping position

184X**D**



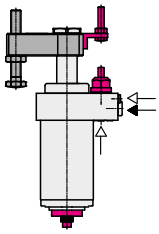
Pneumatic position monitoring in clamping and unclamping position

184X**B**
+
Accessories
Page 5



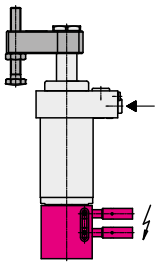
Both controls combined

184X**H**
Q

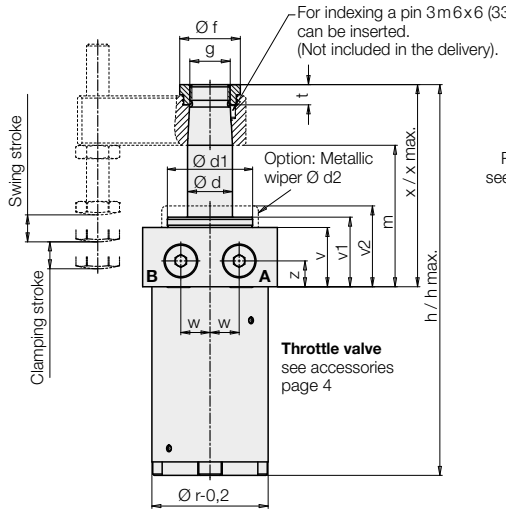


Electrical position monitoring in clamping and unclamping position

184X**B**
+
Accessories
Page 6

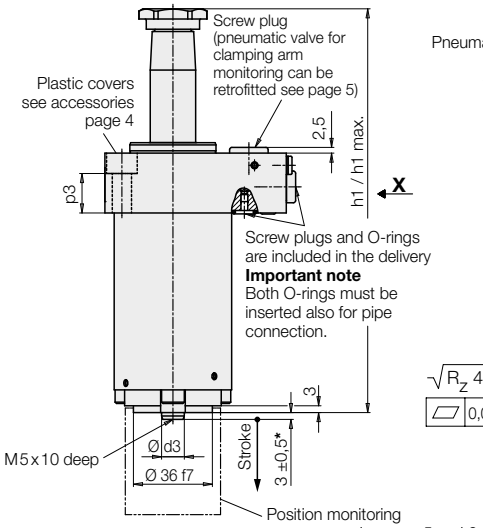


A (without monitoring)

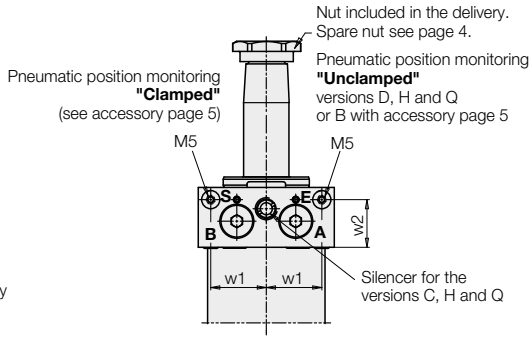


A = Clamping
B = Unclamping
E = Unclamped (pneumatic)
S = Clamped (pneumatic)

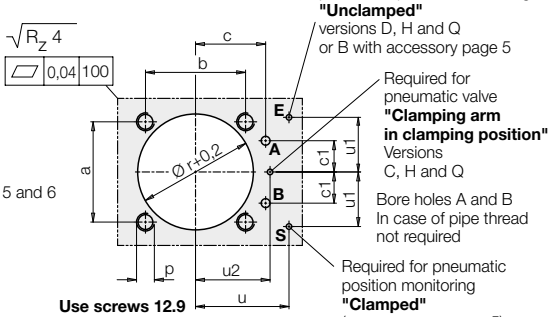
B (with switch rod)



View X

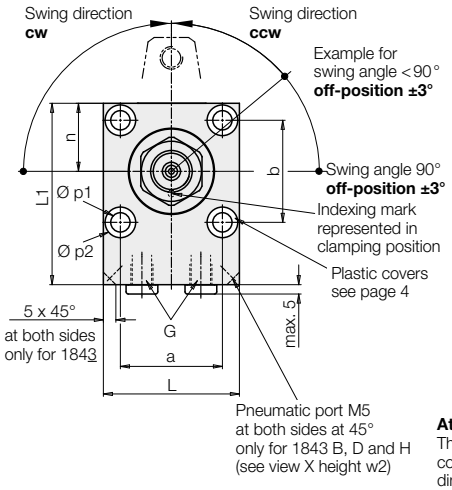


Connecting scheme

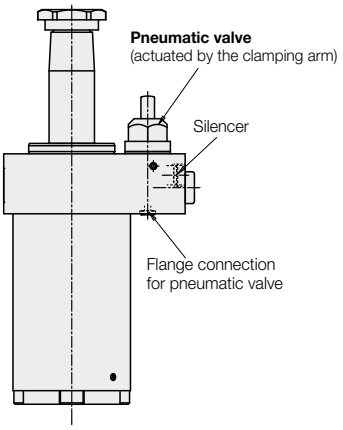


Connecting holes: 2 x hydraulics (A, B) max. Ø 5
Spare-O-ring 8 x 1.5 part no. 3000343
3 x pneumatics max. Ø 2.5 (only as required)
Spare-O-ring 3.68 x 1.78 part no. 3000334

Clamping position ±1°

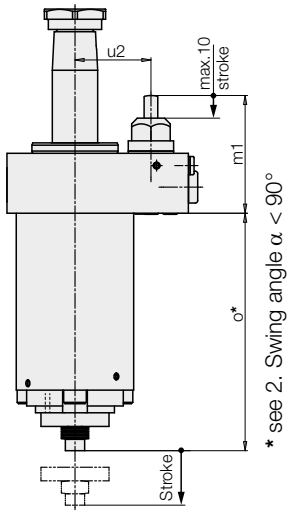


(Monitoring "Clamped")
C Switching area 2 ÷ 9 mm
P Switching area 2 ÷ 10 mm

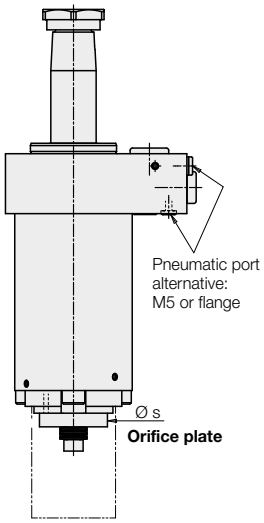


Attention danger of collision!
The contact bolt for the actuation of the pneumatic valve must be completely screwed into the angle bracket for start up (see page 4 dimension 3.5 mm)
The adjustment is made with clamped workpiece to approx. 5 mm valve stroke.

H (Combination C+D)
Q (Combination P+D)



D (Monitoring "Unclamped")



With pocket holes, connection S can be used for venting.

Important note
The lower part of the swing clamp must be protected against swarf and dirt for trouble-free functioning of the orifice plate.

Swing angle

1. Swing angle 90° (standard)

	Part no.
90° cw	**184X X090 RXXD**
90° ccw	**184X X090 LXXD**
0°	**184X X000 0XXD**

2. Swing angle α < 90°

α = 15° to 75° in gradation of 5°

By insertion of a distance plate the return stroke of the piston is reduced and thus the swing angle is reduced.
Clamping stroke and clamping position remain the same. The swing stroke and the dimensions h, h1, m and x are reduced by y:

y = (90°– α°) * k (k see chart page 3)

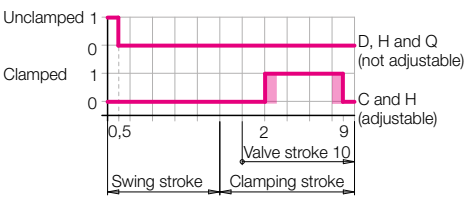
Example:

Swing clamp	1845 A090 L30D
Desired swing angle	**45° ccw**
Part no.	**1845 A045 L30D**

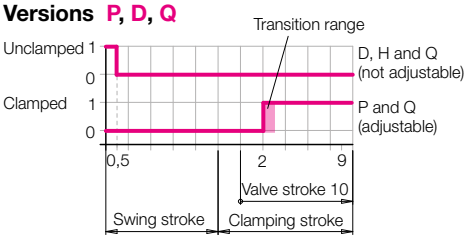
Shortening:
y = (90° – 45°) * 0.12 mm/° = 5.4 mm

3. Swing angle > 90°
Available on request!

Pneumatic position monitoring versions C, D, H



Versions P, D, Q



0 = Passage 1 = Closed

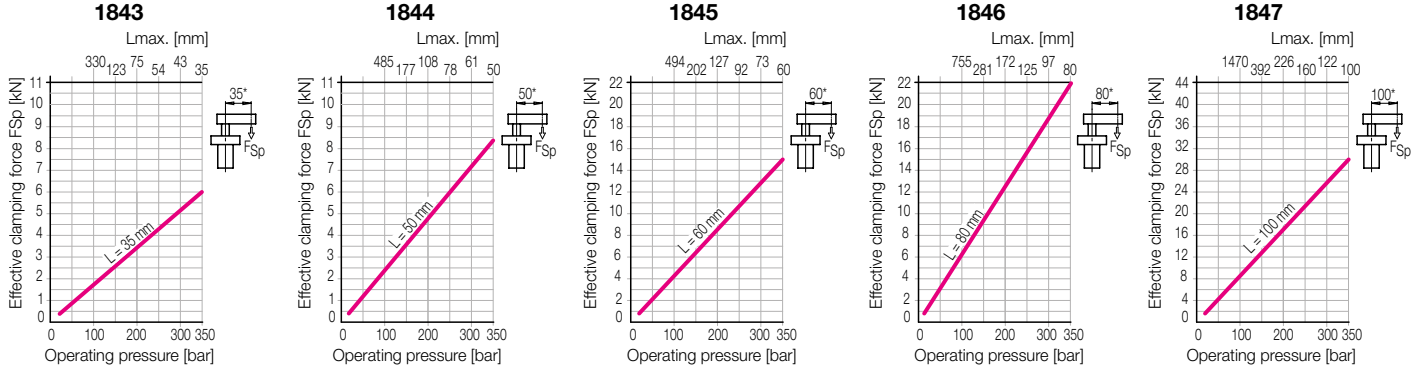
Max. pulling force (350 bar)		[kN]	7.5	10.5	18.4	27.5	39.1
Effective clamping force		[kN]	see diagram page 3 or calculation of the clamping force on page 4				
Clamping stroke		[mm]	12	12	15	15	15
Swing stroke		[mm]	11	12	15	21	24
Total stroke ± 0.2		[mm]	23	24	30	36	39
Min. operating pressure		[bar]	30	30	30	30	30
Max. flow rate	Clamping	[cm³/s]	10	14	32	57	87
(see page 4)	Unclamping	[cm³/s]	20	28	60	110	185
Effective	Clamping	[cm²]	2.14	3.01	5.27	7.86	11.19
piston area	Unclamping	[cm²]	4.15	6.15	10.17	15.9	23.75
Oil volume / stroke		[cm³]	4.9	7.2	15.8	28.3	43.7
Oil volume / return stroke		[cm³]	9.6	14.8	30.5	57.2	92.7
Piston Ø		[mm]	23	28	36	45	55
a		[mm]	37	45	54	66	76
b		[mm]	40	45	54	66	76
c		[mm]	28.5	31.5	35	43	56
c1		[mm]	12	14	14	18	20.5
Ø d		[mm]	16	20	25	32	40
Ø d1		[mm]	28	38	45	48	60
Ø d2		[mm]	33	42	54	54.5	75
Ø d3		[mm]	10	10	12	12	12
Ø f		[mm]	27	30	36	40	55
g		[mm]	M14x1.5	M18x1.5	M20x1.5	M28x1.5	M35x1.5
G			G 1/8	G 1/8	G 1/4	G 1/4	G 1/4
h +0.4/–0.3 / h max.[1]		[mm]	161/162.3	174/175.8	203/204.8	233.5/233.9	254/255.7
h1 +0.4/–0.3 / h1 max.[1]		[mm]	165/166.3	178/179.8	207/208.8	237.5/237.9	257/258.7
k		[mm/°]	0.091	0.093	0.12	0.152	0.183
L		[mm]	50	62	75	88	100
L1		[mm]	70	81	95	105	120
m +0.4/–0.7[2]		[mm]	62.4	63.9	74.9	80.3	84.8
m1		[mm]	52	52	56	56	56
n		[mm]	26.5	31	37	44	50
o		[mm]	98	105	118	136	146
p		[mm]	M6	M8	M10	M12	M12
Ø p1		[mm]	6.6	9	11	13	13
Ø p2 H13		[mm]	11	15	18	20	20
p3		[mm]	18.4	15.4	17.4	15.4	17.4
Ø r		[mm]	45	52	60	76	90
Ø s		[mm]	30	30	33	33	33
t		[mm]	7.5	9	10	10	11
u		[mm]	36.5	42	50	53	62
u1		[mm]	18.5	24.5	28	32	35
u2		[mm]	27	33.5	41.5	44.5	53.5
v		[mm]	26.4	26.4	30.4	30.4	30.4
v1		[mm]	31	31	35	36	36
v2		[mm]	36	36	40	41	41
w		[mm]	12	13	17	20	20.5
w1		[mm]	22.5	24.5	28	32	35
w2		[mm]	22	21	24.5	25	26
x +0.3/–0.2 / x max.[1]		[mm]	84/85.2	90/91.7	106/107.7	118.5/118.8	128/129.6
z		[mm]	11	11.5	12	12	15
Weight, approx.		[kg]	1.7	2.3	3.9	6	8.9
Part-no.	Swing direction 90° cw		**1843X090R23DM**	**1844X090R24DM**	**1845X090R30DM**	**1846X090R36DM**	**1847X090R39DM**
	Swing direction 90° ccw		**1843X090L23DM**	**1844X090L24DM**	**1845X090L30DM**	**1846X090L36DM**	**1847X090L39DM**
	0 degree		**1843X000023DM**	**1844X000024DM**	**1845X000030DM**	**1846X000036DM**	**1847X000039DM**

Code letter **X** see page 2. **M** = Option metallic wiper (see also page 6)

[1] h / h1 / x = upper edge piston h max. / h1 max. / x max. = upper edge nut

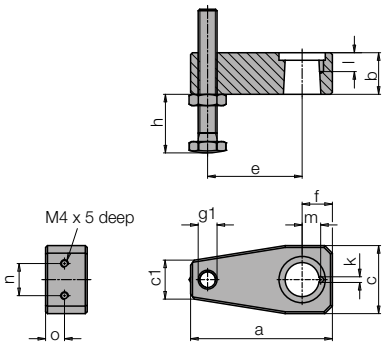
[2] m = lower edge clamping arm

Effective clamping force with accessory clamping arm as a function of the oil pressure

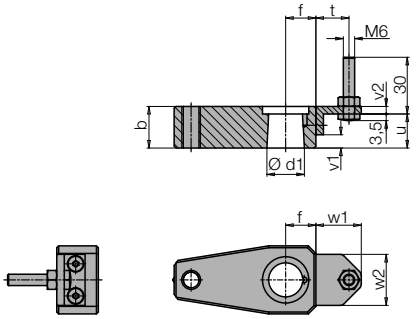


* Clamping force for other lengths see page 4.

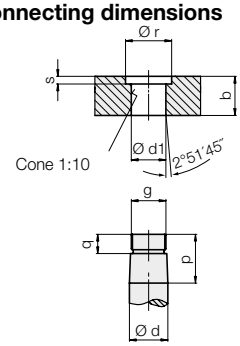
Clamping arm, max. 350 bar



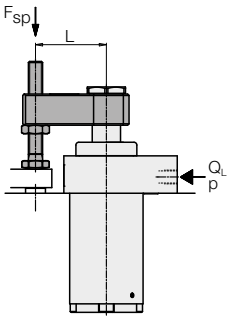
Clamping arm complete with angle



Special clamping arm
1. Connecting dimensions



2. Admissible flow rate Q*



In the chart on page 3, the admissible flow rates for clamping and unclamping with the clamping arms (accessories) are specified.
Longer special clamping arms have a higher torque of inertia. To avoid an overload of the swing mechanism, the flow rate has to be reduced:

2.1 Moments of inertia are known

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

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 (accessory) with contact bolt (chart)
J_L = Moment of inertia special clamping arm determined with the help of the CAD model in the computer

***** Only for vertical mounting position!

Swing clamps		**1843**	**1844**	**1845**	**1846**	**1847**
a	[mm]	58	75	93	120	154
b	[mm]	17	22	26	32	38
c	[mm]	28	36	45	60	72
c1	[mm]	14	20	23	28	36
Ø d f7	[mm]	16	20	25	32	40
Ø d1 +0.1/+0.05	[mm]	15.8	19.8	24.8	31.8	39.8
e	[mm]	35	50	60	80	100
f	[mm]	16	16	22	26	34
g	[mm]	M14x1.5	M18x1.5	M20x1.5	M28x1.5	M35x1.5
g1	[mm]	M8	M10	M12	M16	M20
h min/max	[mm]	5/45	6/64	7/70	9/85	12/100
Ø k +0.1	[mm]	3	3	3	3	3
l +0.5	[mm]	9.5	11	11	11.5	12
m ±0.05	[mm]	7.8	9.8	12	15	19
n	[mm]	11	17	20	20	20
o	[mm]	6	10	12	20	20
p	[mm]	22.5	27	32	39	44
q	[mm]	9	10	11	12.7	12.7
Ø r	[mm]	20	24.5	31	34.5	46
s	[mm]	2.5	4	4	4.5	5
t	[mm]	11	17.5	19	19	19
u	[mm]	17	18	21	19	25
v1	[mm]	6	7	8	6	12
v2	[mm]	4	4	5	5	5
w1	[mm]	18	24	26	26	26
w2	[mm]	21	27	30	30	30
Part no. Clamping arm						
– with contact bolt		**0354152**	**0354153**	**0354154**	**0354155**	**0354259**
Weight, approx.	[kg]	0.19	0.39	0.69	1.43	2.64
Moment of inertia of J_e	[kgm²]	0.00011	0.00046	0.0011	0.00398	0.01198
– without thread g1		**3548660**	**3548661**	**3548803**	**3548804**	**3548919**
Weight, approx.	[kg]	0.16	0.34	0.62	1.28	2.34
Moment of inertia of J_e	[kgm²]	0.00007	0.00033	0.00084	0.00298	0.00896
– complete with angle		**0354156**	**0354157**	**0354158**	**0354159**	**0354175**
Angle bracket complete		**0184003**	**0184004**	**0184005**	**0184005**	**0184005**
Plastic cover**		**3300685**	**3300684**	**3300683**	**3300682**	**3300682**
Metallic wiper		**0341104**	**0341107**	**0341105**	**0341100**	**0341101**
Spare nut		**3527092**	**3527014**	**3527099**	**3527015**	**3527048**
Tightening torque	[Nm]	16	30	42	90	160

** Order 4 off per swing clamp

2.2. Accessory
Throttle valve

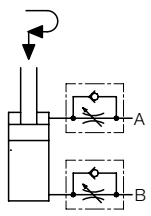
Throttle valves are used
- in order to reduce the swing speed of the clamping arm;
- in order to improve the synchronism of several swing clamps.

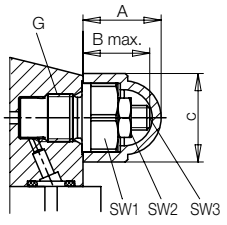
This application is only possible for manifold-mounting connection through drilled channels.

Important note

If throttling is too strong, the back pressure can trigger premature switching of pressure switches and sequence valves.

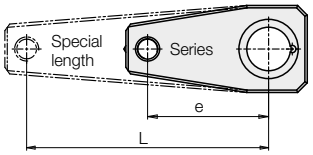
Hydraulic symbol





Swing clamps		**1843 1844**	**1845 1846 1847**
A	[mm]	16	21
B max.	[mm]	13.5	17.5
C	[mm]	18	23.6
G		G 1/8	G 1/4
SW1	[mm]	14	19
Tightening torque	**[Nm]**	**18**	**35**
SW2	[mm]	8	8
SW3	[mm]	2.5	2.5
Weight	[kg]	0.025	0.036
Part no.		**2957209**	**2957210**

Special clamping arm



Clamping force and admissible operating pressure

Effective clamping force (general)

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

Admissible clamping force

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

Admissible operating pressure

$$p_{adm} = \frac{D}{L} + E \leq 350 \quad [bar]$$

L = special length [mm] p = pressure [bar]

A, B, C, D, E = constants as per chart

Constant

	1843	**1844**	**1845**	**1846**	**1847**
A	46.64	33.15	18.98	12.72	8.93
B	0.335	0.17	0.073	0.04	0.027
C	210	420	900	1760	3000
D	9795	13926	17078	22386	26805
E	70.26	71.33	65.44	70.36	81.78

Example: Swing clamps 1843
L = 70 mm

1. Admissible clamping force

$$F_{adm} = \frac{C}{L} = \frac{210}{70} = 3 \text{ kN}$$

2. Admissible operating pressure

$$p_{adm} = \frac{D}{L} + E = \frac{9795}{70} + 70.26 = 210 \text{ bar}$$

Application

A prerequisite for automated processes of workpiece clamping are hydraulic clamping elements whose position can be monitored at any time.
The pneumatic position monitorings signal the following conditions by closing two bore holes:

1. Piston extended, clamping arm in off-position.
2. Piston in clamping area, clamping arm in clamping position.

By the pressure increase in the pneumatic line an electro-pneumatic pressure switch or a differential pressure switch can be actuated.
The electrical switching devices are integrated in the electric control so that on the clamping fixture no electricity is required.

Description

The pneumatic position monitoring consists of the stainless control housing with fit signal sleeve, to be connected to the switch rod of the swing clamp by means of the delivered screw. Four fixing screws are included in our delivery.

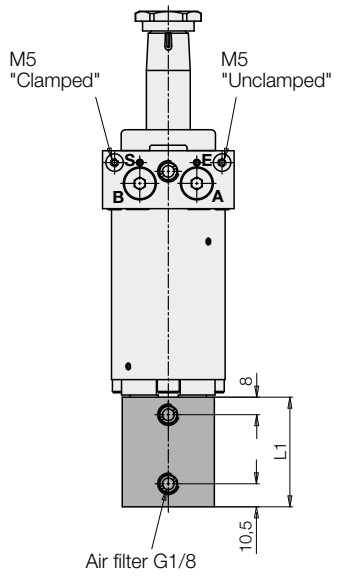
Pneumatic port

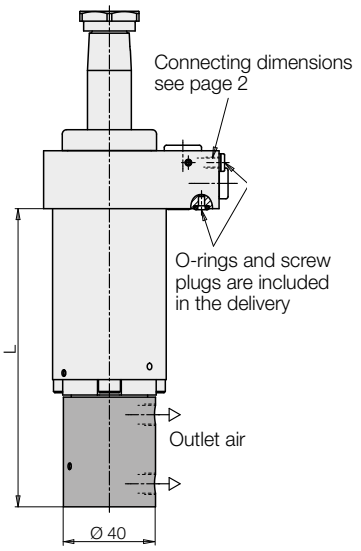
Drilled channels

The swing clamp with the mounted position monitoring is inserted into the location hole and is immediately ready for use with the mounted O-rings.

Hose connection

Remove the plugs M5 and screw-in connecting nipple M5 (accessory) Sealing to the flange area is made by the two O-rings.



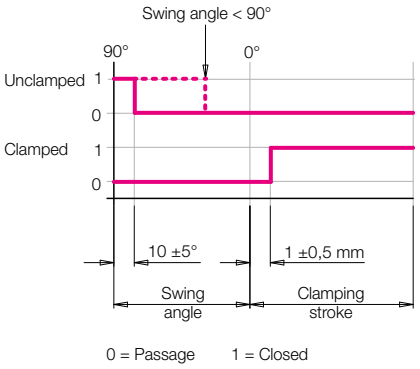


Technical data

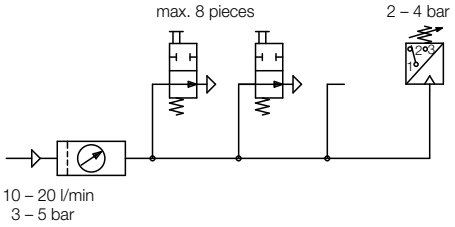
Port		O-ring or thread M5
Nominal diameter	[mm]	2
Max. air pressure	[bar]	10
Range of operating pressure	[bar]	3…5
Differential pressure *) at		
3 bar system pressure	[bar]	min. 1.5
5 bar system pressure	[bar]	min. 3.5
Air flow rate **)	[l/min]	10…20

*) Required pressure drop if one or several position monitorings are not operated.
**) For measuring the air flow rate appropriate devices are available. Please contact us.

Function chart



Monitoring by pneumatic pressure switch



For the evaluation of the pneumatic pressure built-up standard pneumatic pressure switches can be used. It is possible to monitor with one pressure switch up to 8 position monitorings connected in series (see circuit diagram).
It has to be considered that process-safe functioning of pneumatic position monitorings is only guaranteed with throttled air and system pressure. The nominal values are indicated below technical characteristics.

Part no.

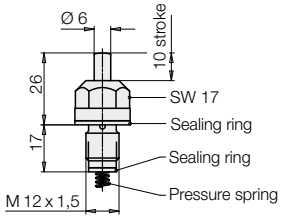
Swing clamps		1843B0XX	1844B0XX	1845B0XX	1846B0XX	1847B0XX
L	[mm]	129	136	172	190	200
L1	[mm]	50	50	73	73	73
Swing angle (see page 2)						
0 or 90°		**0353913**	**0353913**	**0353914**	**0353916**	**0353956**
15 to 75° = **XX** (graduation of 5°)		**03539130XX**	**03539130XX**	**03539140XX**	**03539160XX**	**03539560XX**

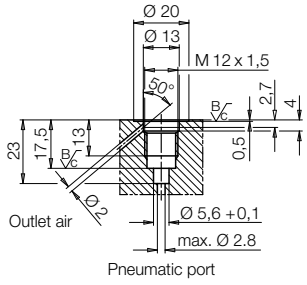
Pneumatic valve

Spare part for versions C, H, P and Q

	Part no.
Switching range 2 – 9 mm	**0353933**
Switching range 2 – 10 mm	**0353934**
Max. operating pressure	10 bar
Max. tightening torque	25 Nm

Function charts see page 2.



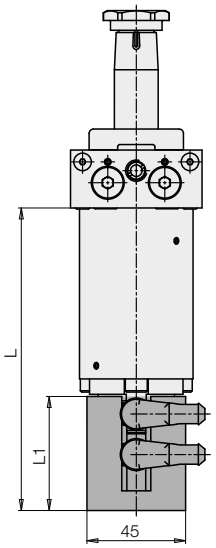


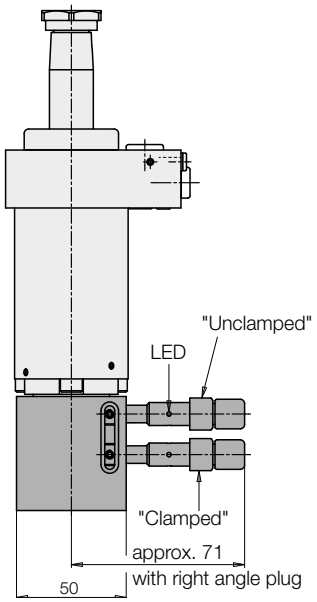
Application

Electrical position monitorings signal the following conditions due to damping of two inductive proximity switches:

1. Piston extended, clamping arm in off-position.
2. Piston in clamping area, clamping arm in clamping position.
3. Piston in final position, no workpiece inserted. ***)**

***)** If this function is not desired, e.g. in setting mode, the proximity switch can be adjusted so that the switch is still damped at the stroke end (see function chart).





Description

The electrical position monitoring consists of the housing with two adjustable inductive proximity switches and one switching cam fixed at the switch rod of the swing clamp.

The fixing screws are included in our delivery.

The housing can also be mounted turned by 180°. The radial distance of the proximity switches to the switching cam should be 0.5 mm. It is secured by means of a set screw M4. After untightening of the locking screw M4 the proximity switches can be axially displaced.

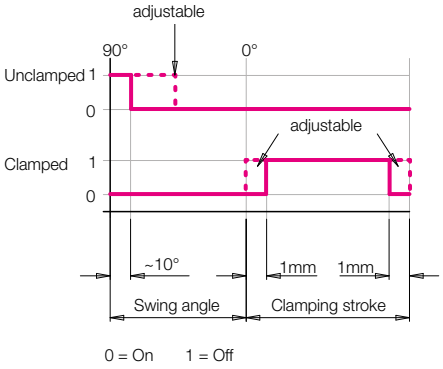
Please note:

Careful design is required. According to the corresponding application conditions, safety measures have to be planned and checked later on. Inductive position monitorings are not suitable for the use in coolant and swarf areas.

Technical data

Operating voltage	10…30 VDC
Max. residual ripple	15 %
Max. constant current	200 mA
Switching function	interlock
Output	PNP
Material of housing	stainless steel
Thread	M8x1
Code class	IP 67
Ambient temperature	–25…+70 °C
LED function display	yes
Protected against short circuits	yes
Type of connection	right angle plug
Length of cable	5 m

Function chart



Part no.

Swing clamps		1843B0XX	1844B0XX	1845B0XX	1846B0XX	1847B0XX
L	[mm]	131	138	172	190	200
L1	[mm]	52	52	73	73	73
With switch and plug		**0353905**	**0353905**	**0353915**	**0353915**	**0353915**
Without switch and plug		**0353906**	**0353906**	**0353917**	**0353917**	**0353917**

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 clamp has no overload protection device. When mounting the clamping arm, the clamping arm or the hexagon socket in the piston have to be backed up for tightening and untightening the fixing nut. During loading and unloading of the fixture and during clamping a collision with the clamping arm has to be avoided.

Remedy: Mount position adaptor.

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

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") or as an accessory for retrofitting (see page 4).

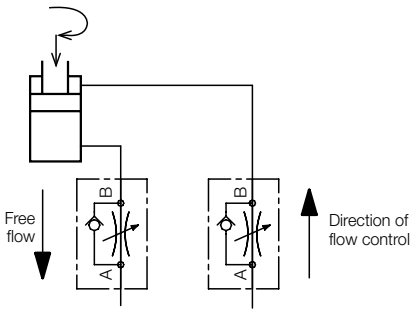
Attention!

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.

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 350 bar.

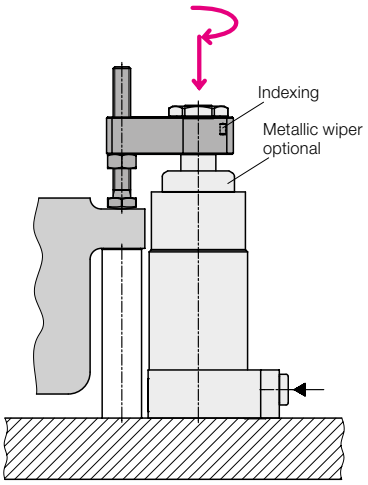


Swing Clamps with Sturdy Swing Mechanism

Bottom flange type, with optional position monitoring, double acting, max. operating pressure 350 bar

Advantages

- 4 sizes available
- Compact design partially recessible
- High clamping force at low pressures
- Sturdy swing mechanism
- Insensitive against high flow rates
- Indexing of the clamping arm in a specified position is possible
- Special swing angle easily realizable
- Standard FKM wiper
- Metallic wiper optional
- Screw counterbores coverable
- Position monitoring available in six variants
- Hydraulic and pneumatic ports integrated in the flange
- Mounting position: any



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.
Due to the sturdy swing mechanism and the manifold possibilities of position monitoring these swing clamps are particularly suited for

- Automatic manufacturing systems
- Clamping fixtures with workpiece loading via handling systems
- Transfer lines
- Test systems for motors, gears and axes
- Assembly lines
- Special machine tools

Description

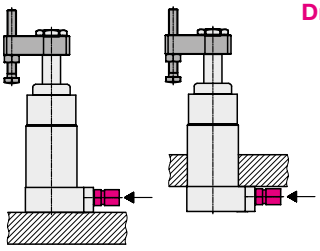
The hydraulic swing clamp is a pull-type cylinder where a part of the total stroke is used to swing the piston.
The favourable area ratio (piston/piston rod) allows high clamping forces already at relatively low oil pressures.
Due to the sturdy swing mechanism the angle position of the clamping arm remains the same after a slight collision with the workpiece during loading or unloading. Also a collision during the clamping process is not critical.
When using high flow rates the swing speed is limited by installed throttle points.
The FKM wiper at the piston rod can be protected against coarse and hot swarf by an optionally available metallic wiper (see page 6).
The different possibilities of the position monitoring are presented at the side.

Important notes see page 6.

Installation and connecting possibilities

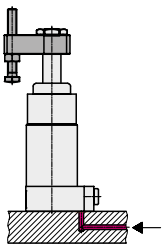
Pipe thread

184X**L**



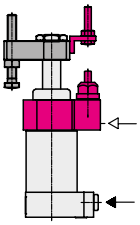
Drilled channels

184X**L**



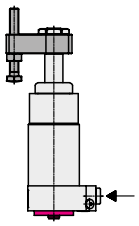
Pneumatic position monitoring
Monitoring of the clamping arm in clamping position (adjustable)

184X**L**
+
Accessories
Page 5



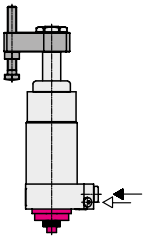
Position monitoring as accessories
Switch rod for external sensors

184X**M**



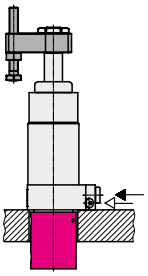
Monitoring of the piston in unclamping position

184X**N**



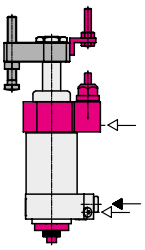
Pneumatic position monitoring in clamping and unclamping position

184X**M**
+
Accessories
Page 5



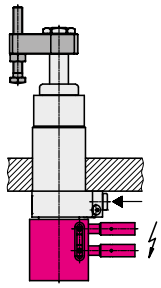
Both controls combined

184X**N**
+
Accessories
Page 5

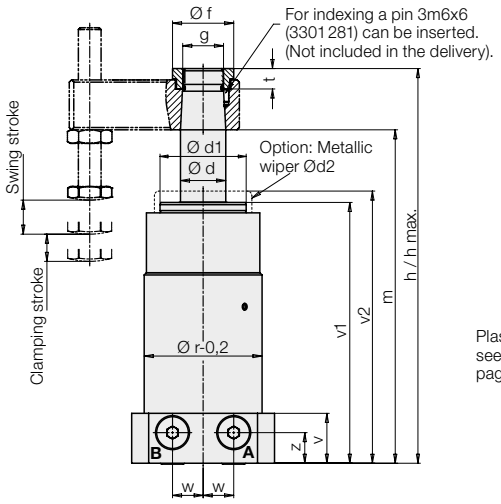


Electrical position monitoring in clamping and unclamping position

184X**M**
+
Accessories
Page 6

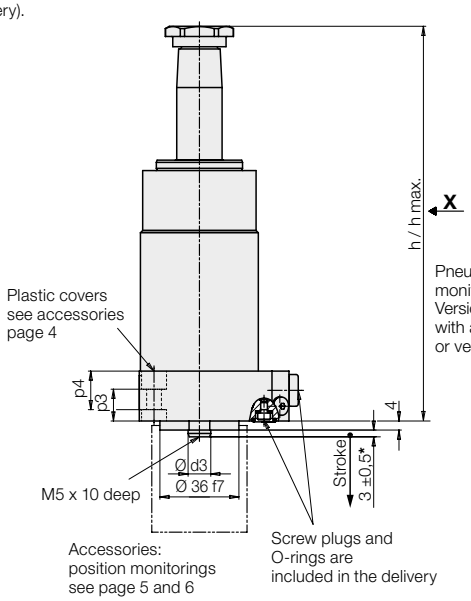


L (without monitoring)

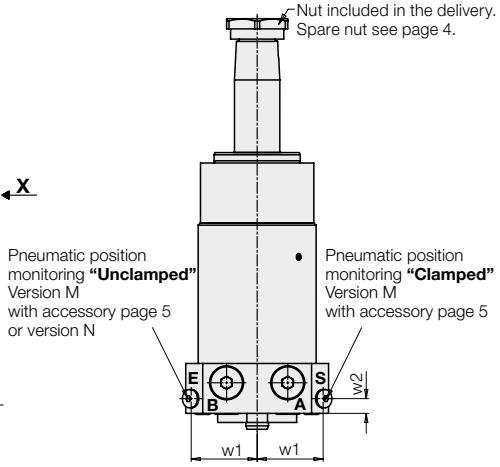


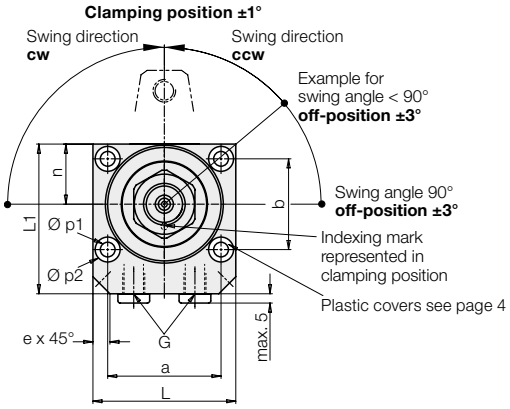
A = Clamping
B = Unclamping
E = Unclamped (pneumatic)
S = Clamped (pneumatic)

M (with switch rod)

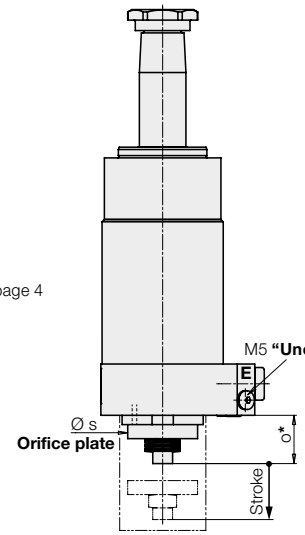


View X



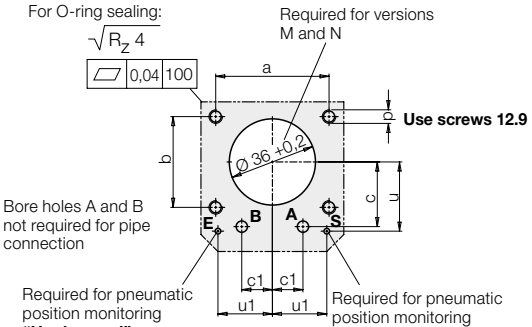


N (Monitoring "Unclamped")



With blind hole, port S can be used for venting.

Connecting scheme



Connecting holes: 2 x hydraulics (A, B) max. Ø 5
Spare O-ring 8x1,5 Part no. 3000343
2 x pneumatics (E, S) max. Ø 2.5 (only as required)
Spare O-ring 3.68x1.78 Part no. 3000334

Swing angle

1. Swing angle 90° (standard)

	Part no.
90° cw	**184XX090RXX**
90° ccw	**184XX090LXX**
0°	**184XX0000XX**

2. Swing angle α < 90°

α = 15° to 75° in gradation of 5°

By insertion of a distance plate the return stroke of the piston is reduced and thus the swing angle is reduced.
Clamping stroke and clamping position remain the same. The swing stroke and the dimensions h, h1, and m are reduced by y:

y = (90° – α°) * k (k see chart page 3)

Dimensions 3 ±0.5 and o of the switch rod are lengthened by the value y.

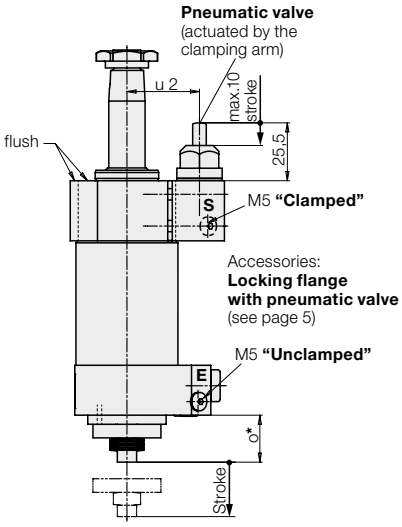
Example:

Swing clamp	1845L090L30
Desired swing angle	**45° ccw**
Part no.	**1845L045L30**

Shortening:
y = (90° – 45°) * 0.12 mm/° = 5.4 mm

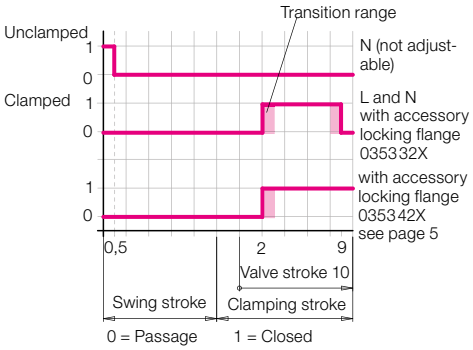
3. Swing angle > 90°
Available on request!

N (Monitoring "Unclamped" and "Clamped")



***** see 2. Swing angle α < 90°

Pneumatic position monitoring for versions L and N with accessory locking flange



Attention danger of collision!

The contact bolt for the actuation of the pneumatic valve must be completely screwed into the angle bracket for start up (see page 4 dimension 3.5 mm)
The adjustment is made with clamped workpiece to approx. 5 mm valve stroke.

Important note!

The lower part of the swing clamp must be protected against swarf and dirt for trouble-free functioning of the orifice plate.

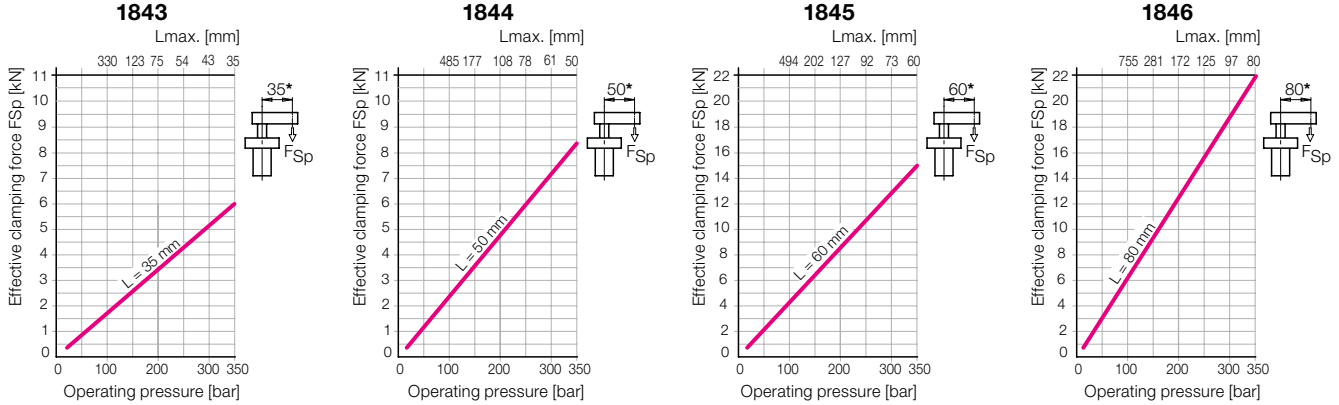
Technical data

Max. pulling force (350 bar)		[kN]	7.5	10.5	18.4	27.5
Effective clamping force		[kN]	see diagram page 3 or calculation of the clamping force on page 4			
Clamping stroke		[mm]	12	12	15	15
Swing stroke		[mm]	11	12	15	21
Total stroke ±0.2		[mm]	23	24	30	36
Min. operating pressure		[bar]	30	30	30	30
Max. flow rate	Clamping	[cm^3/s]	10	14	32	57
(see page 4)	Unclamping	[cm^3/s]	20	28	60	110
Effective piston area	Clamping	[cm^2]	2.14	3.01	5.27	7.86
	Unclamping	[cm^2]	4.15	6.15	10.17	15.9
Oil volume / stroke		[cm^3]	4.9	7.2	15.8	28.3
Oil to return		[cm^3]	9.6	14.8	30.5	57.2
Piston Ø		[mm]	23	28	36	45
a		[mm]	44	50	60	68
b		[mm]	35	40	46	62
c		[mm]	26	28.5	28.5	35.5
c1		[mm]	11	13.5	14	17
Ø d		[mm]	16	20	25	32
Ø d1		[mm]	28	38	45	48
Ø d2		[mm]	33	42	54	54.5
Ø d3		[mm]	10	10	12	12
e		[mm]	8.5	7.5	9	8 x 50°
Ø f		[mm]	27	30	36	40
g		[mm]	M14 x 1.5	M18 x 1.5	M20 x 1.5	M28 x 1.5
G			G 1/8	G 1/8	G 1/4	G 1/4
h +0.4/–0.3/h max.[1]		[mm]	161 / 162.3	174 / 175.8	203 / 204.8	233.5 / 233.9
k		[mm/°]	0.091	0.093	0.12	0.152
L		[mm]	55	63	77	85
L1		[mm]	60	66	75	90
m +0.5/–0.8[2]		[mm]	139.3	147.8	171.8	195.3
n		[mm]	23	26.5	31.5	39.5
o		[mm]	21	21	21	21
p		[mm]	M5	M6	M8	M8
Ø p1		[mm]	5.5	6.5	9	9
Ø p2 H13		[mm]	10	11	15	15
p3		[mm]	15	14	14	14
p4		[mm]	18	17	18	18
Ø r		[mm]	45	52	60	76
Ø s		[mm]	30	30	33	33
t		[mm]	7.5	9	10	10
u		[mm]	27	30.5	35	43
u1		[mm]	21	24	29	32.5
u2		[mm]	32	36	41	48
v		[mm]	22	22	25	25
v1		[mm]	108	115	132	151
v2		[mm]	113	120	137	156
w		[mm]	11	13.5	14	17
w1		[mm]	25	28.5	33.5	36
w2		[mm]	6	6.5	7	7
z		[mm]	13	13.5	14	14
Weight, approx.		[kg]	1.7	2.3	3.4	5.7
Part no.	Clockwise rotation 90°		**1843 X090 R23M**	**1844 X090 R24M**	**1845 X090 R30M**	**1846 X090 R36M**
	Swing direction 90° ccw		**1843 X090 L23M**	**1844 X090 L24M**	**1845 X090 L30M**	**1846 X090 L36M**
	0 degree		**1843 X000 023M**	**1844 X000 024M**	**1845 X000 030M**	**1846 X000 036M**

Code letter **X** see page 2.
[1] h = upper edge piston / h max. = upper edge nut
[2] = lower edge clamping arm

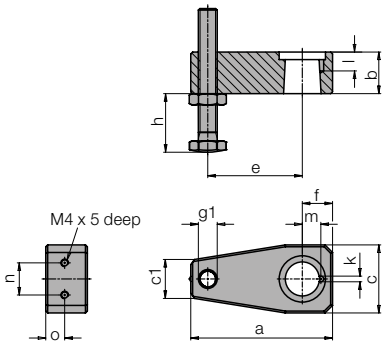
M= Option metallic wiper (see also page 6)

Effective clamping force with accessory clamping arm as a function of the oil pressure

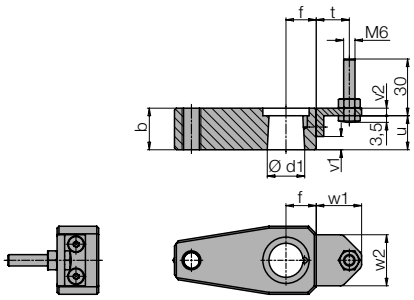


* Clamping force for other lengths see page 4.

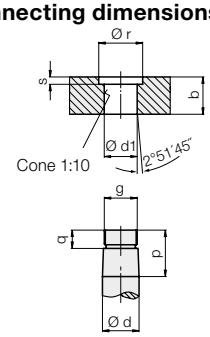
Clamping arm, max. 350 bar



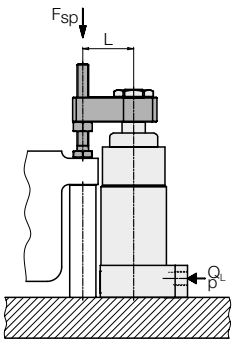
Clamping arm complete with angle



Special clamping arm
1. Connecting dimensions



2. Admissible flow rate Q*



In the chart on page 3, the admissible flow rates for clamping and unclamping with the clamping arms (accessories) are specified. Longer special clamping arms have a higher torque of inertia. To avoid an overload of the swing mechanism, the flow rate has to be reduced:

2.1 Moments of inertia are known

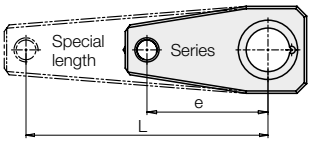
$$Q_L = Q_e * \sqrt{\frac{J_e}{J_L}} \text{ cm}^3/\text{s}$$

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 (accessory) with contact bolt (chart)
J_L = Moment of inertia special clamping arm

***** Only for vertical mounting position!

Swing clamps		**1843**	**1844**	**1845**	**1846**
a	[mm]	58	75	93	120
b	[mm]	17	22	26	32
c	[mm]	28	36	45	60
c1	[mm]	14	20	23	28
Ød f7	[mm]	16	20	25	32
Ød1 +0.1/+0.05	[mm]	15.8	19.8	24.8	31.8
e	[mm]	35	50	60	80
f	[mm]	16	16	22	26
g	[mm]	M14x1.5	M18x1.5	M20x1.5	M28x1.5
g1	[mm]	M8	M10	M12	M16
h min/max	[mm]	5/45	6/64	7/70	9/85
Ø k +0.1	[mm]	3	3	3	3
l +0.5	[mm]	9.5	11	11	11.5
m ±0.05	[mm]	7.8	9.8	12	15
n	[mm]	11	17	20	20
o	[mm]	6	10	12	20
p	[mm]	22.5	27	32	39
q	[mm]	9	10	11	12.7
Ø r	[mm]	20	24.5	31	34.5
s	[mm]	2.5	4	4	4.5
t	[mm]	16	20	19	22
u	[mm]	17	18	21	19
v1	[mm]	6	7	8	6
v2	[mm]	4	4	5	5
w1	[mm]	23	26.5	26	29
w2	[mm]	21	27	30	30
Part no. Clamping arm					
– with contact bolt		**0354152**	**0354153**	**0354154**	**0354155**
Weight, approx.	[kg]	0.19	0.39	0.69	1.43
Moment of inertia of J_e	[kgm²]	0.00011	0.00046	0.0011	0.00398
– without thread g1		**3548660**	**3548661**	**3548803**	**3548804**
Weight, approx.	[kg]	0.16	0.34	0.62	1.28
Moment of inertia of J_e	[kgm²]	0.00007	0.00033	0.00084	0.00298
– complete with angle		**0354167**	**0354168**	**0354158**	**0354169**
Angle bracket complete		**0184006**	**0184007**	**0184005**	**0184008**
Plastic cover**		**3300686**	**3300685**	**3300684**	**3300684**
Metallic wiper		**0341104**	**0341107**	**0341105**	**0341100**
Spare nut		**3527092**	**3527014**	**3527099**	**3527015**
Tightening torque	[Nm]	16	30	42	90

Special clamping arm



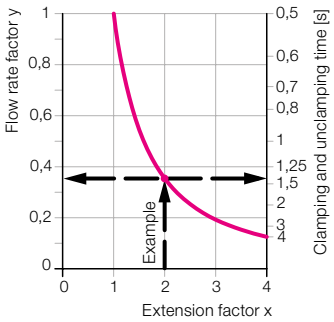
**Order 4 off swing clamps

2.2 Moments of inertia not known

This simplified calculation is only applicable for clamping arms of the above shape.

Example: Swing clamps 1843
L = 70 mm
e = 35 mm as per above chart
Q_e = 10 cm³/s (as per chart page 3)

1. Extension factor $x = \frac{L}{e} = \frac{70\text{ mm}}{35\text{ mm}} = 2$
2. Flow rate factor as per diagram → y = 0.35
3. Max. flow rate $Q_L = y * Q_e = 0.35 * 10\text{ cm}^3/\text{s} = 3.5\text{ cm}^3/\text{s}$
4. Min. clamping time as per diagram → approx. 1.4 s



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

Clamping force and admissible operating pressure

Effective clamping force (general)

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

Admissible clamping force

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

Admissible operating pressure

$$p_{adm} = \frac{D}{L} + E \leq 350 \quad [\text{bar}]$$

L = special length [mm] p = pressure [bar]

A, B, C, D, E = constants as per chart

Constant	**1843**	**1844**	**1845**	**1846**
A	46.64	33.15	18.98	12.72
B	0.335	0.17	0.073	0.04
C	210	420	900	1760
D	9795	13926	17078	22386
E	70.26	71.33	65.44	70.36

Example: Swing clamps 1843
L = 70 mm

1. Admissible clamping force
$F_{adm} = \frac{C}{L} = \frac{210}{70} = 3\text{ kN}$

2. Admissible operating pressure
$p_{adm} = \frac{D}{L} + E = \frac{9795}{70} + 70.26 = 210\text{ bar}$

Accessory for 184XM0XX • Pneumatic position monitoring (not adjustable)
Locking flange (adjustable)

Application

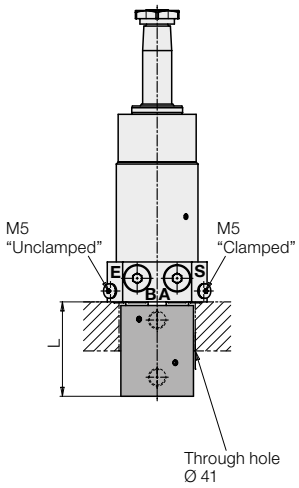
A prerequisite for automated processes of workpiece clamping are hydraulic clamping elements whose position can be monitored at any time.

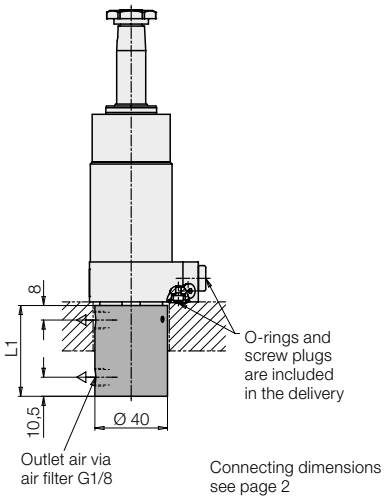
The pneumatic position monitorings signal the following conditions by closing two bore holes:

1. Piston extended, clamping arm in off-position.
2. Piston in clamping area, clamping arm in clamping position.

By the pressure increase in the pneumatic line an electro-pneumatic pressure switch or a differential pressure switch can be actuated.

The electrical switching devices are integrated in the electric control so that on the clamping fixture no electricity is required.





Connecting dimensions
see page 2

Description

The pneumatic position monitoring consists of the stainless control housing with fit signal sleeve, to be connected to the switch rod of the swing clamp by means of the delivered screw. Four fixing screws are included in our delivery.

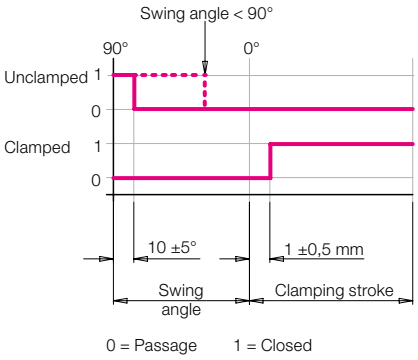
Technical data

Connection		O-ring or thread M5
Nominal diameter	[mm]	2
Max. air pressure	[bar]	10
Range of operating pressure	[bar]	3…5
Differential pressure***)** at		
3 bar system pressure	[bar]	min. 1.5
5 bar system pressure	[bar]	min. 3.5
Air flow rate ****)**	[l/min]	10…20

***)** Required pressure drop if one or several position monitorings are not operated.

****)** For measuring of the flow rate appropriate devices are available. Please contact us.

Function chart



Pneumatic port

Drilled channels

The swing clamp with the mounted position monitoring is inserted into the location hole and is immediately ready for use with the mounted O-rings.

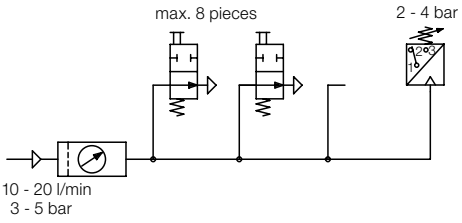
Hose connection

Remove the plugs M5 and screw-in connecting nipple M5 (accessory) Sealing to the flange area is made by the two O-rings.

Part no.

Swing clamps		1843M0XX	1844M0XX	1845M0XX	1846M0XX
L	[mm]	52	52	75	75
L1	[mm]	50	50	73	73
Swing angle (see page 2)					
0 or 90°		**0353913**	**0353913**	**0353914**	**0353916**
15 to 75° = **XX**		**03539130XX**	**03539130XX**	**03539140XX**	**03539160XX**

Monitoring by pneumatic pressure switch



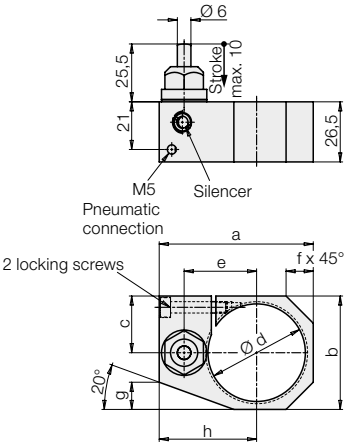
For the evaluation of the pneumatic pressure built-up standard pneumatic pressure switches can be used. It is possible to monitor with one pressure switch up to 8 position monitorings connected in series (see circuit diagram). It has to be considered that process-safe functioning of pneumatic position monitorings is only guaranteed with throttled air and system pressure. The nominal values are indicated below technical data.

Locking flange with pneumatic valve

With the integrated pneumatic valve the clamping position can be monitored directly at the clamping arm.

The fixing at the swing is made by tightening both locking screws.

The precise adjustment is made in clamping position with clamped workpiece. The valve tappet has to be pushed by approx. 5 mm (function chart see page 2).



Swing clamps		**1843**	**1844**	**1845**	**1846**
a	[mm]	68	76	85.5	100
b	[mm]	50	58	66	82
c	[mm]	25	29	33	41
Ød	[mm]	43	50	58	74
e	[mm]	32	36	41.5	48
f	[mm]	12	16	18	22
g	[mm]	12	14	16	18
h	[mm]	43	47	52.5	89
Switching area 2 ÷ 9 mm					
Part no. complete		**0353320**	**0353321**	**0353322**	**0353323**
Pneumatic valve*		**0353933**	**0353933**	**0353933**	**0353933**
Switching area 2 ÷ 10 mm					
Part no. complete		**0353420**	**0353421**	**0353422**	**0353423**
Pneumatic valve*		**0353934**	**0353934**	**0353934**	**0353934**

***** Installation dimensions for pneumatic valve see B 1.853 page 5

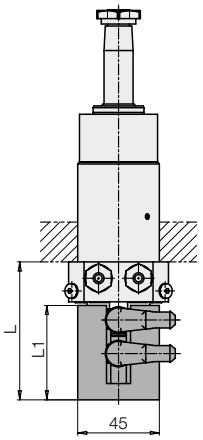
Accessory for 184XM0XX • Electrical position monitoring (adjustable)
Important notes • Wiper system • Throttling of flow rate

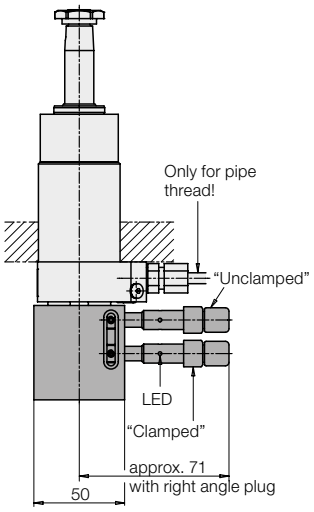
Application

Electrical position monitorings signal the following conditions due to damping of two inductive proximity switches:

1. Piston extended, clamping arm in off-position.
2. Piston in clamping area, clamping arm in clamping position.
3. Piston in final position, no workpiece inserted. ***)**

***)** If this function is not desired, e.g. in setting mode, the proximity switch can be adjusted so that the switch is still damped at the stroke end (see function chart).





Description

The electrical position monitoring consists of the housing with two adjustable inductive proximity switches and one switching cam fixed at the switch rod of the swing clamp.
The fixing screws are included in our delivery.
The housing can also be mounted turned by 180°. The radial distance of the proximity switches to the switching cam should be 0.5 mm. It is secured by means of a set screw M4. After untightening of the locking screw M4 the proximity switches can be axially displaced.

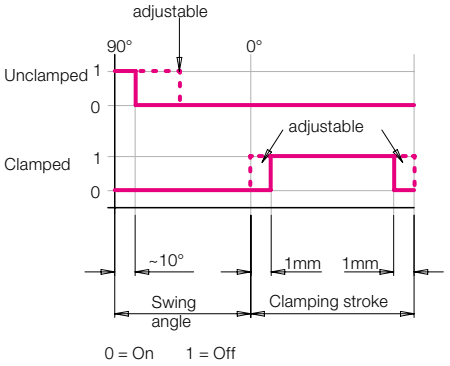
Please note:

Careful design is required. According to the corresponding application conditions, safety measures have to be planned and checked later on.
Inductive position monitorings are not suitable for the use in coolant and swarf areas.

Technical data

Operating voltage	10 … 30 V DC
Max. residual ripple	15 %
Max. constant current	200 mA
Switching function	interlock
Output	PNP
Body material	stainless steel
Thread	M 8 x 1
Code class	IP 67
Environmental temperature	–25 … +70 °C
LED Function display	yes
Protected against short circuits	yes
Connection type	Right angle plug
Length of cable	5 m

Function chart



Part no.

Swing clamps		1843M0XX	1844M0XX	1845M0XX	1846M0XX
L	[mm]	76	76	100	100
L1	[mm]	52	52	73	73
With switch and plug		**0353905**	**0353905**	**0353915**	**0353915**
Without switch and plug		**0353906**	**0353906**	**0353917**	**0353917**

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 clamp has no overload protection device. When mounting the clamping arm, the clamping arm or the hexagon socket in the piston have to be backed up for tightening and untightening the fixing nut. During loading and unloading of the fixture and during clamping a collision with the clamping arm has to be avoided.

Remedy: Mount position adaptor.

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

Wiper system

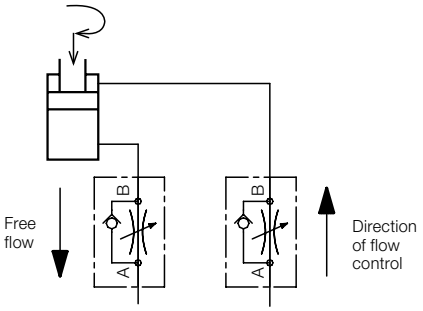
The standard FKM wiper has a high chemical resistance against most cooling and cutting fluids.
The optional metallic wiper protects the FKM wiper against mechanical damage due to big or hot swarf.
It consists of a radially floating wiping disk and a retaining disk.
The metallic wiper can be delivered already mounted ("M") or as an accessory for retrofitting (see page 4).

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.

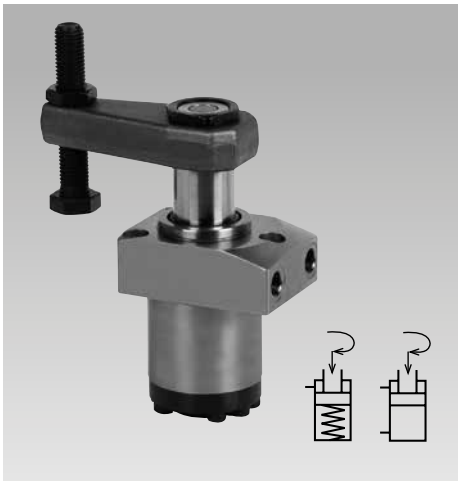
Throttling of the flow rate

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 350 bar.



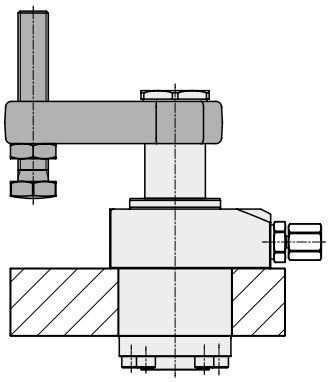
Swing Clamps with Overload Protection Device

top flange, single and double acting, max. operating pressure 500 bar

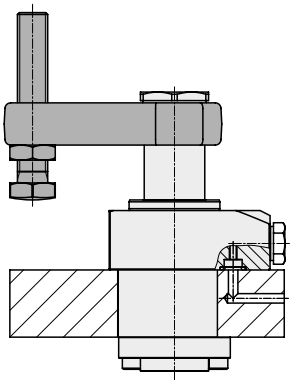


Hydraulic connecting possibilities

Pipe thread



Manifold mounting with O-ring sealing



Application

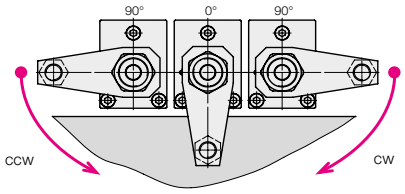
Hydraulic swing clamps are used for clamping of workpieces when it is essential to keep the clamping area free of straps and clamping components for unrestricted workpiece loading and unloading.

Function

This hydraulic clamping element 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°). Starting from the off-position.



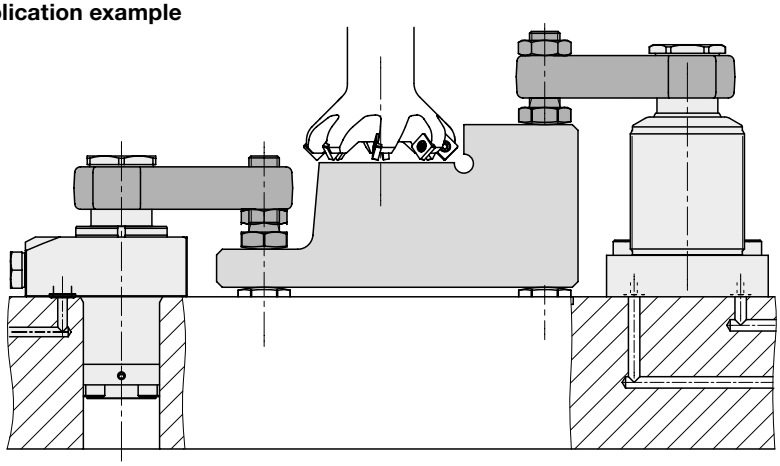
Standard swing angles

are 45°, 60° and 90° ±2°.
Special angles on request.
Other variants, as e.g. versions with metallic wiper on request

0°-Version

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

Application example



Overload protection device

An integrated mechanical overload protection device prevents damage to the swing mechanism when striking an object within the 90° rotation, clamping or unclamping alike, or in case of incorrect mounting of the clamping arm.

Metallic wiper optional

Material

By nitrating wear is reduced and protection against corrosion increased.

Piston material:	High alloy steel
Cylinder body:	High alloy steel
Seals:	NBR
Wiper:	FKM

Note!

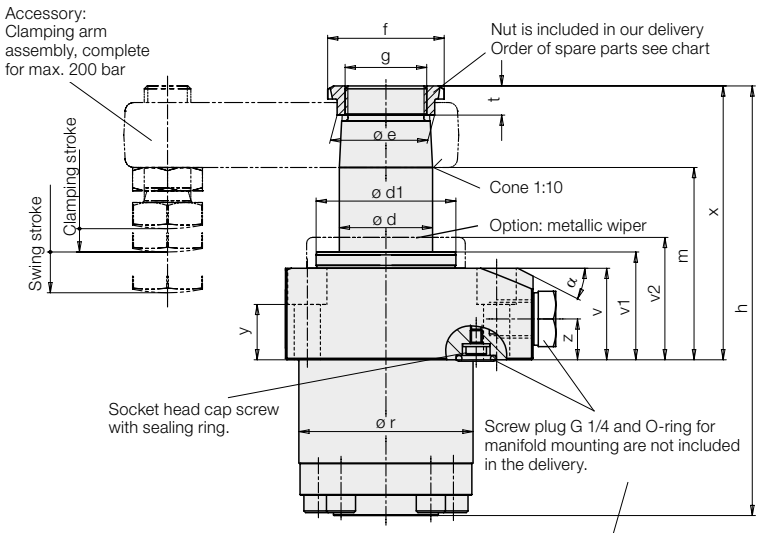
Operating conditions, tolerances and other data see data sheet A 0.100.

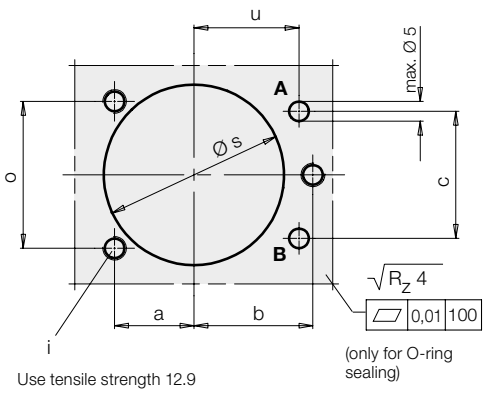
When using single-acting swing clamps, it is absolutely necessary to follow the instructions for venting of the spring area on data sheet G 0.110.

Further notes see Page 3.

Option: metallic wiper

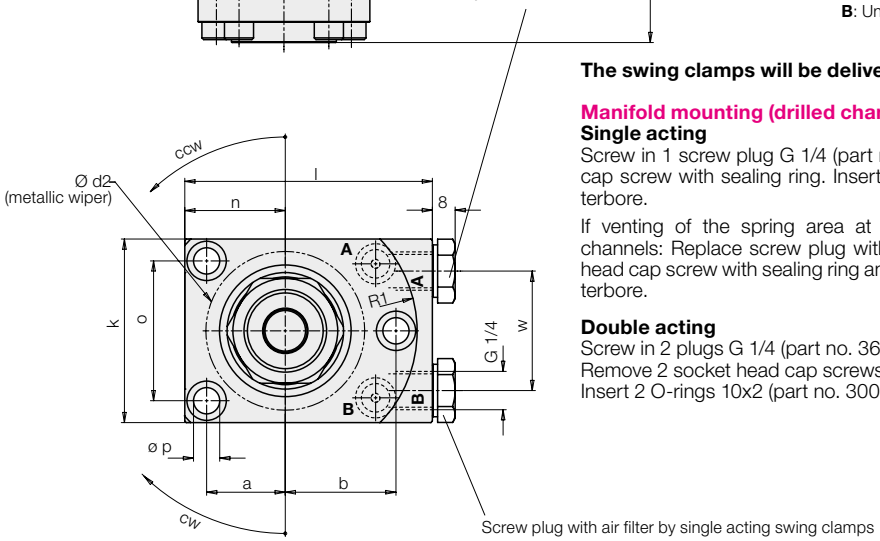
These swing clamps are also delivered with mounted metallic wiper that protect the subjacent FKM wiper against swarf (see page 2 and 3).





A: Clamping
B: Venting (single acting)
B: Unclamping (double acting)

The swing clamps will be delivered ready for the connection of pipes.



Manifold mounting (drilled channels)

Single acting

Screw in 1 screw plug G 1/4 (part no. 3610264) in port A and remove socket head cap screw with sealing ring. Insert 1 O-ring 10x2 (part no. 3000347) in the counterbore.

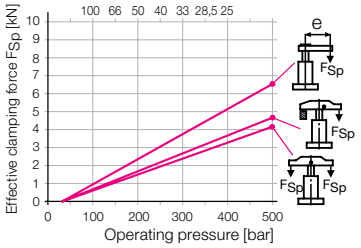
If venting of the spring area at port B shall also be effected through drilled channels: Replace screw plug with air filter by screw plug G 1/4. Remove socket head cap screw with sealing ring and insert O-ring 10x2 (part no. 3000347) in counterbore.

Double acting

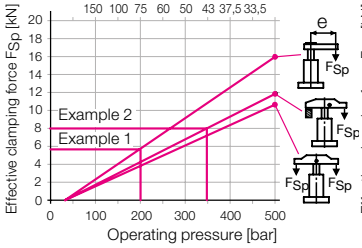
Screw in 2 plugs G 1/4 (part no. 3610264).
Remove 2 socket head cap screws with sealing ring.
Insert 2 O-rings 10x2 (part no. 3000347) in the counterbore.

Effective clamping force F_{Sp} as function of operating pressure p

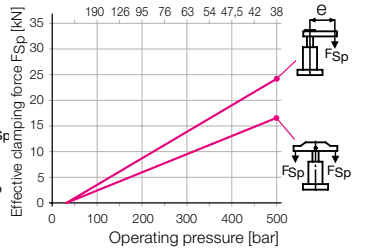
Size 1
Single acting (1883XXX)
Max. clamping arm length e [mm]



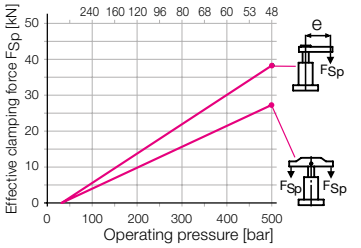
Size 2
Single acting (1885XXX)
Max. clamping arm length e [mm]



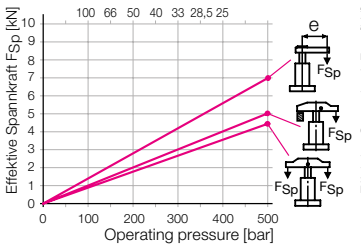
Size 3
Single acting (1886XXX)
Max. clamping arm length e [mm]



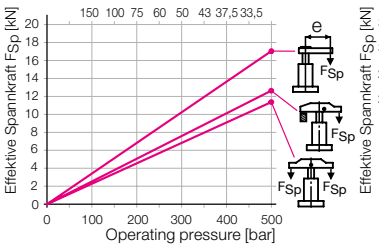
Size 4
Single acting (1887XXX)
Max. clamping arm length e [mm]



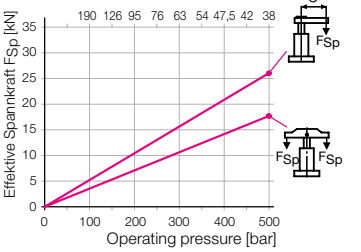
Double acting (1893XXX)
Max. clamping arm length e [mm]



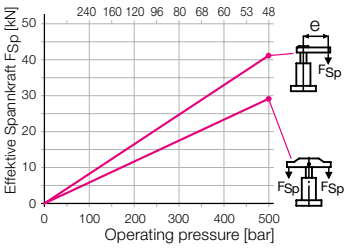
Double acting (1895XXX)
Max. clamping arm length e [mm]



Double acting (1896XXX)
Max. clamping arm length e [mm]



Double acting (1897XXX)
Max. clamping arm length e [mm]



Note:

The clamping force of single-acting swing clamps is reduced by the opposite-directed spring return force.
For this reason the clamping force is slightly lower than that of double-acting swing clamps.

Example 1: 1885 103 single acting.
An operating pressure p of 200 bar in connection with standard clamping arm 0354003 of max. arm length L = 75 mm results in an effective clamping force F_{Sp} of 5.8 kN.

Example 2: 1885 103 single acting.
For a desired effective clamping force F_{Sp} of 8 kN and use of a swing clamp 1885 103 with a standard clamping strap 0354002 an operating pressure p of 345 bar is required.

Dimensions
Technical Data

		Size 1			Size 2			Size 3			Size 4		
Clamping stroke	[mm]	11	25	50	14	25	50	15	25	50	15	25	50
Swing stroke	[mm]	7	9	9	8	10	10	11	11	11	9	12	12
Total stroke	[mm]	18	34	59	22	35	60	26	36	61	24	37	62
Operating pressure to swing min.	[bar]	30	30	30	30	30	30	30	30	30	30	30	30
Max. oil flow rate	[cm³/s]	3,2	3,2	3,2	10	10	10	18,4	18,4	18,4	27,7	27,7	27,7
Oil volume/stroke	[cm³]	3,2	6	10,5	10	16	27,2	18,4	25,5	43,2	27,7	43	72
Oil volume/return stroke	[cm³]	8,8	17	29	27,7	44	76	51	71	120	75	116	194
α	[°]	12	12	12	27	27	27	26	26	26	25	25	25
a	[mm]	20	20	20	27	27	27	37	37	37	42	42	42
b	[mm]	30	30	30	38	38	38	50	50	50	55	55	55
c	[mm]	32	32	32	46	46	46	62	62	62	75	75	75
Ø d	[mm]	20	20	20	32	32	32	40	40	40	50	50	50
Ø d1	[mm]	38	38	38	48	48	48	60	60	60	70	70	70
Ø d2	[mm]	42	42	42	54,5	54,5	54,5	75	75	75	87	87	87
Ø e	[mm]	23,5	23,5	23,5	33,5	33,5	33,5	45	45	45	55,5	55,5	55,5
f	[mm]	30	30	30	40	40	40	55	55	55	68	68	68
g	[mm]	M 18x1,5	M 18x1,5	M 18x1,5	M 28x1,5	M 28x1,5	M 28x1,5	M 35x1,5	M 35x1,5	M 35x1,5	M 45x1,5	M 45x1,5	M 45x1,5
h	[mm]	126,5	158,5	208,5	147,5	173,5	223,5	172	192	242	182	208	258
i	[mm]	M 6	M 6	M 6	M 8	M 8	M 8	M 10	M 10	M 10	M 12	M 12	M 12
k	[mm]	50	50	50	63	63	63	85	85	85	95	95	95
l	[mm]	70	70	70	85	85	85	110	110	110	125	125	125
m –1	[mm]	57	73	98	66	79	104	70	80	105	69	82	107
n	[mm]	26,5	26,5	26,5	34,5	34,5	34,5	47	47	47	55	55	55
o	[mm]	37	37	37	48	48	48	65	65	65	72	72	72
Ø p	[mm]	6,6	6,6	6,6	9	9	9	11	11	11	14	14	14
Ø r ± 0,1	[mm]	44,8	44,8	44,8	59,8	59,8	59,8	79,8	79,8	79,8	89,8	89,8	89,8
R1	[mm]	36	36	36	45,3	45,3	45,3	59,5	59,5	59,5	66	66	66
Ø s +1	[mm]	45	45	45	60	60	60	80	80	80	90	90	90
t	[mm]	9	9	9	10	10	10	11	11	11	12	12	12
u	[mm]	26,5	26,5	26,5	31	31	31	40	40	40	45	45	45
v	[mm]	26,4	26,4	26,4	31,4	31,4	31,4	29,4	29,4	29,4	29,4	29,4	29,4
v1	[mm]	31	31	31	37	37	37	35	35	35	35	35	35
v2	[mm]	36	36	36	42	42	42	40	40	40	40	40	40
w	[mm]	28	28	28	41	41	41	55	55	55	70	70	70
x	[mm]	78	94	119	94	107	132	104	114	139	109	122	147
y	[mm]	18	18	18	19	19	19	15	15	15	14	14	14
z	[mm]	14	14	14	14	14	14	12	12	12	12	12	12
Declutch moment of overload protection	[Nm]	3,5	3,5	3,5	11	11	11	17	17	17	22/30**	22/30**	22/30**
Single acting 90°													
Part no.													
Swing direction cw		**1883103**			**1885103**			**1886103**			**1887103**		
Swing direction ccw		**1883203**			**1885203**			**1886203**			**1887203**		
0-degree		**1883243**			**1885243**			**1886243**			**1887243**		
Double acting 90°													
Part-no													
Swing direction cw		**1893103**	**1893303**	**1893503**	**1895103**	**1895303**	**1895503**	**1896103**	**1896303**	**1896503**	**1897103**	**1897303**	**1897503**
Swing direction ccw		**1893203**	**1893403**	**1893603**	**1895203**	**1895403**	**1895603**	**1896203**	**1896403**	**1896603**	**1897203**	**1897403**	**1897603**
0-degree		**1893243**	**1893443**	**1893643**	**1895243**	**1895443**	**1895643**	**1896243**	**1896443**	**1896643**	**1897243**	**1897443**	**1897643**
Metallic wiper complete (spare part)		**0341107**			**0341100**			**0341101**			**0341102**		
Spare nut		**3527014**			**3527015**			**3527048**			**3527016**		

** single acting/double acting

Code numbers for available swing angles

Swing angles	Part no.
90°	**18XXX0X**
60°	**18XXX2X**
45°	**18XXX3X**

	Part no.
Spare O-ring 10x2	**3000347**
Plug G 1/4	**3610264**

Option metallic wiper
for double-acting swing clamps
Part no.: 189XXXXM

Important notes

1. Danger of injury
Hydraulic clamping elements can generate considerable forces. Due to the 90° swing motion, the exact clamping and unclamping position cannot be determined in advance. Considerable injuries can be caused to fingers in the effective area of the clamping arm. Remedy: protection device with electrical locking.

2. Admissible oil flow rate
In case of the admissible oil flow rate as per table the shortest possible clamping time is 1 second. If the flow rate of the pump divided by the number of swing clamps is higher than the indicated value in the chart, the flow rate has to be throttled to avoid any overload and thereby high wear. Throttling has to be made in the oil supply line to the swing clamp to rule out a possible pressure intensification. Use only flow control valves which allow oil return from the swing clamp without any impediments.

3. Unimpeded swing motion
The swing motion must not be impeded and the clamping arm may only contact the workpiece after completion of the swing stroke.

4. Clamping arm assembly
When tightening and untightening the fixing screw, the clamping arm has to be backed up to avoid the introduction of moments to the piston rod.

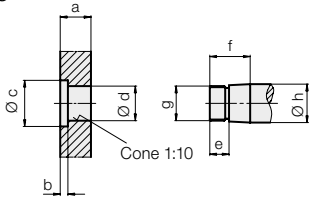
5. Adjustment of contact bolt
The contact bolt may only contact the workpiece after completion of the swing motion. When tightening and untightening the fixing screw, the clamping arm has to be backed up (see 4.).

6. Special clamping arms
When using special clamping arms with other lengths, the corresponding operating pressures as shown in the clamping force diagram must not be exceeded. If longer clamping arms will be used, not only the operating pressure but also the flow rate have to be reduced (see 2.).

7. Venting of spring area
The spring area of single-acting swing clamps has to be vented to avoid function problems. A sintered metal air filter avoids penetration of contaminations. If there is a possibility that cutting lubricants and coolants penetrate through the sintered metal air filter into the cylinder's interior, a vent hose has to be connected and be placed in a protected position (see data sheet G 0.110).

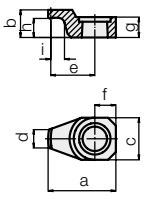
8. Bleeding
Air in the oil prolongs the clamping time considerably and leads to function troubles. Therefore bleeding has to be effected during start up.
8.1 Pipe thread
Loosen carefully the union nut of the pipe at low oil pressure and pump until bubblefree oil comes out. Retigthen the union nut.
8.2 Flange with O-ring sealing for manifold mounting
Loosen carefully the plug G 1/4 at low oil pressure and pump until bubblefree oil comes out. Retigthen the plug.

Dimensions for special clamping arms



Swing clamp	a	b	Ø c	Ø $d^{+0,10}_{+0,05}$	e	f	g	Ø h_{f7}
18X3XXX	16	4	24	19,8	10	21	M 18 x 1,5	20
18X5XXX	23	5	34	31,8	12	28	M 28 x 1,5	32
18X6XXX	28	5	46	39,8	12	34	M 35 x 1,5	40
18X7XXX	34	6	56	49,8	13	40	M 45 x 1,5	50

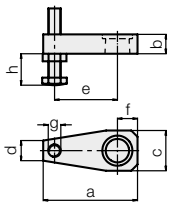
Clamping arm, max. 300 bar



Material: 42CrMo4

Swing clamp	a	b	c	d	e	f	g	h	i	Weight [kg]	Part no.
18X3XXX	51,5	21	32	14	33,5	16	15,5	14,5	7	0,11	**3548238**
18X5XXX	76	28	46	25	50	23	22,5	19	7	0,3	**3548236**
18X6XXX	100	34	66	39	64	33	28	23	7	0,84	**3548301**
18X7XXX	123	40	75	39	82,5	37,5	34	27	8	1,3	**3548302**

Clamping arm assembly, complete, max. 200 bar



Material: 42CrMo4

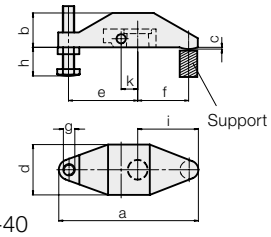
with thread

Swing clamp	a	b	c	d	e	f	g	h max.	h min.	Weight [kg]	Part no.
18X3XXX	75	16	32	16	50	16	M10	64	6	0,2	**0354001**
18X5XXX	115	23	48	22	75	25	M16	79	9	0,7	**0354003**
18X6XXX	140	28	60	28	95	30	M16	79	9	2,0	**0354042**
18X7XXX	178	34	78	40	120	40	M20	98	12	2,55	**0354005**

without thread

Swing clamp	a	b	c	d	f	Weight [kg]	Part no.
18X3XXX	75	16	32	16	16	0,18	**3921016**
18X5XXX	115	23	48	22	25	0,65	**3921017**
18X6XXX	140	28	60	28	30	1,85	**3921021**
18X7XXX	178	34	78	40	40	2,3	**3921018**

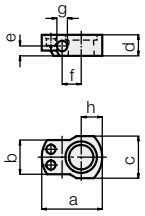
Clamping strap assembly, complete, with carrier, max. 500 bar



Material: GGG-40

Swing clamp	a	b	c	d	e	f	g	h max.	h min.	i	k	Weight [kg]	Part no.
18X3XXX	122	30	1,5	44	60	45	M10	64	6	53	14,5	0,57	**0354000**
18X5XXX	185	45	2	58,5	83	75	M16	79	9	87	21	1,58	**0354002**

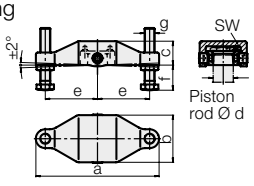
Carrier for special clamping strap



Material: 42CrMo4

Swing clamp	a	b	c	d	e	f	g^{H7}	h	Weight [kg]	Part no.
18X3XXX	46	26	32	16	7,5	14,5	8	16	0,08	**3542093**
18X5XXX	59	32	40	23	13	21	10	22	0,16	**3542094**
18X6XXX	82	44,5	58	28	17	28	12	34	0,5	**3542132**
18X7XXX	90	56	68	34	21	33	14	36	0,65	**3542096**

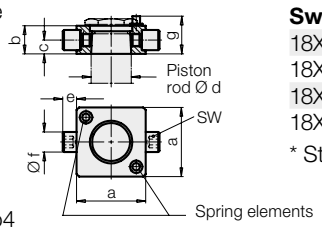
Double clamping arm assembly, complete, with carrier, max. 500 bar



Material: GGG-40

Swing clamp	a	b	c	Ø d	e	f min.	f max.	g	SW	Weight [kg]	Part no.
18X3XXX	138	59	28,5	20	60	10	64	M 10	5	0,83	**0354131**
18X5XXX	196	75	38	32	83	15	79	M 16	8	2,11	**0354132**
18X6XXX	216	85	47	40	92	15	79	M 16	8	3,17	**0354133**
18X7XXX	236	105	56	50	100	19	98	M 20	8	5,24	**0354134**

Carrier, complete with threaded bolt and spring clamping elements



Material: 42CrMo4

Swing clamp	$a^{\pm 0,1}$	b	c	Ø d	e	$Øf^{g6}$	g*	SW	Part no.
18X3XXX	43	16	7,5	20	9	10	21,5	5	**0354141**
18X5XXX	55	23	11	32	11	16	29	8	**0354142**
18X6XXX	63	28	15	40	12	18	35	8	**0354143**
18X7XXX	77	34	17	50	15	20	41	8	**0354144**

* Stop surface for spring elements

Swing Clamps with Reinforced Swing Mechanism

top flange, position monitoring optional, double acting, max. operating pressure 500 bar

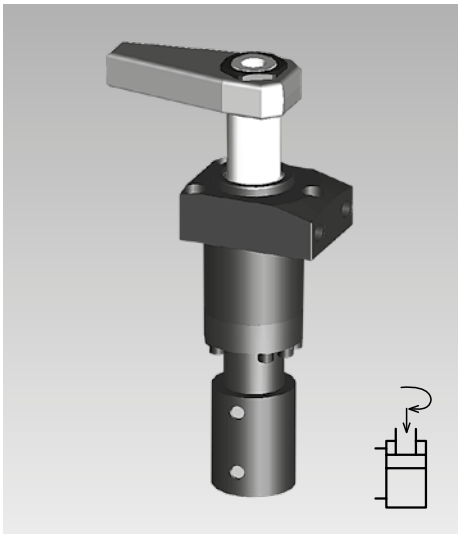


Figure with position monitoring

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. Due to the sturdy swing mechanism and the extended switch rod they are particularly suited for

- Clamping fixtures with workpiece loading via handling systems
- Transfer lines
- Test systems for motors, gears, axes, etc.
- Automatic manufacturing systems
- Assembly lines

Description

This line is a further development of the proved ROEMHELD swing clamps with the aim to improve process safety in linked clamping systems. The most important data are as follows:

1. Omission of the overload protection device
In the case of a slight collision with the clamping arm during loading and unloading of the fixture, the angular position of the clamping arm will be maintained. Less critical are the weight of the clamping arm or an increased swing speed.

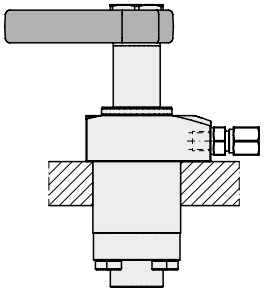
2. Reinforced swing mechanism
The reinforced swing mechanism endures a collision of the clamping arm with the workpiece during clamping up to a pressure of 100 bar.

3. FKM wiper
This wiper has a high chemical resistance when using aggressive cutting fluids.

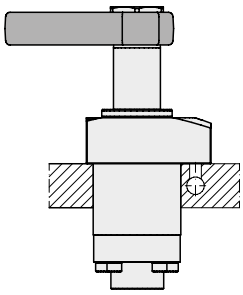
4. Further types of bodies
Flange at the bottom: data sheet B 1.8811
Threaded-body type: data sheet B 1.892

Connecting possibilities

Pipe thread

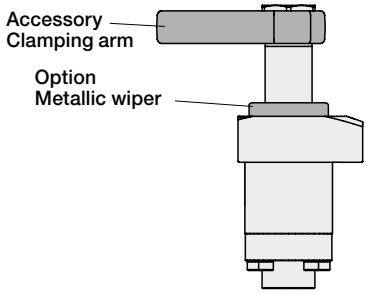


Drilled channels

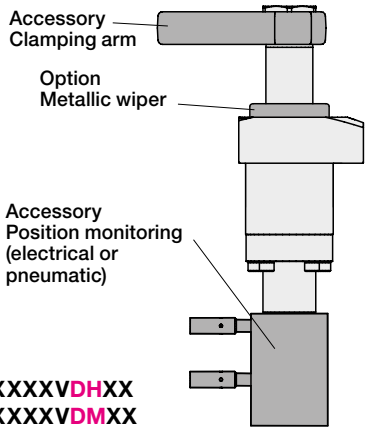


Versions

DH, DM: without switch rod



MH, MM: with switch rod



Part numbers

Without switch rod, without metallic wiper:	**189XXXXVDHXX**
Without switch rod, with metallic wiper:	**189XXXXVDMXX**
With switch rod, without metallic wiper:	**189XXXXVMHXX**
With switch rod, with metallic wiper:	**189XXXXVMMXX**

Metallic wiper optional

Options

Switch rod for position monitoring

The helix rod protrudes through the cover and allows thereby a pneumatic or electrical monitoring of the piston position outside the swarf area. As an accessory a pneumatic position monitoring is available; the brass control slide being displaced in a stainless housing. The slide opens and closes bore holes, so that a pressure switch or a differential pressure switch can signal the position ”Clamped” and ”Unclamped”.
It is also possible to realise this monitoring directly in the fixture body by means of drilled channels. An electrical position monitoring with inductive proximity switches is also available (see page 2).

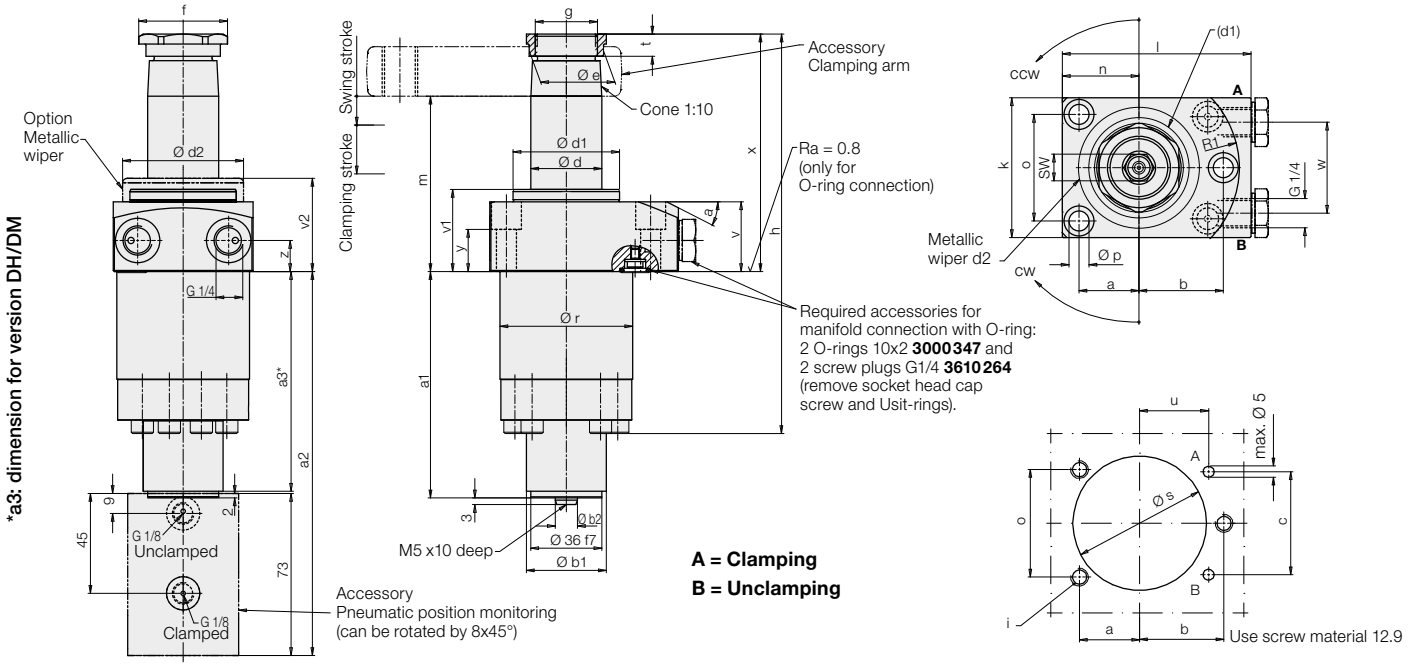
Metallic wiper

This wiper protects the FKM wiper against mechanical damage, e.g. by hot swarf. The swing clamp body is prepared for mounting of the metallic wiper. The wiper consists of a radially floating wiping disk and a retaining disk which will be pressed onto the existing collar.

Important notes

Due to the missing overload protection device, assembly and disassembly of the clamping arm has to be made carefully despite the reinforced swing mechanism. When tightening and untightening the fixing nut, the clamping arm or the hexagon socket in the piston has to be backed up. It is recommended to effect tightening and untightening in the swivel area. Frequent collisions with the clamping arm in radial direction have to be avoided.
For interpretation of the pneumatic pressure we recommend to use a differential switch.
Parallel connection for up to 8 swing clamps is possible. For a greater number there are special solutions. Please contact us.

Further important notes see data sheet B 1.880.



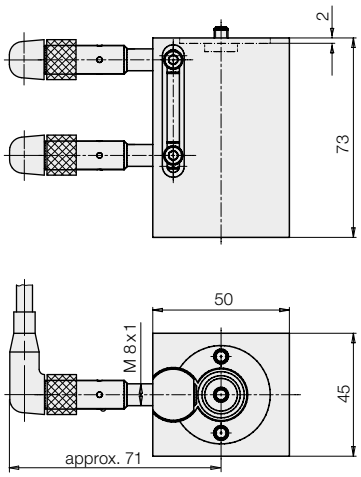
Clamping stroke	[mm]	22	20	20
Swing stroke	[mm]	13	16	18
Total stroke	[mm]	35	36	38
Operating pressure, min.	[bar]	30	30	30
Max. oil flow rate	[cm³/s]	20	36	55
Oil volume / stroke	[cm³]	15.8	25.4	43.8
Oil volume / return stroke	[cm³]	41.2	66.6	114.2
α	[°]	27	26	25
a	[mm]	27	37	42
a1	[mm]	102	116	128
a2	[mm]	173	187	199
a3*	[mm]	92	103	103
b	[mm]	38	50	55
Ø b1	[mm]	36	45	45
Ø b2 f7	[mm]	10	12	12
c	[mm]	46	62	75
Ø d	[mm]	32	40	50
Ø d1	[mm]	48	60	70
Ø d2	[mm]	54.5	75	87
Ø e	[mm]	33.5	45	55.5
f	[mm]	40	55	68
g	[mm]	M28x1.5	M35x1.5	M45x1.5
h	[mm]	181	204	207
i	[mm]	M 8	M 10	M 12
k	[mm]	63	85	95
l	[mm]	85	110	125
m –1	[mm]	79	80	82
n	[mm]	34.5	47	55
o	[mm]	48	65	72
Ø p	[mm]	9	11	14
Ø r –0.1	[mm]	59.8	79.8	89.8
R1	[mm]	45.3	59.5	66
Ø s +1	[mm]	60	80	90
t	[mm]	10	11	12
u	[mm]	31	40	45
v	[mm]	31.4	29.4	29.4
v1	[mm]	37	35	35
v2	[mm]	42	40	40
w	[mm]	41	55	70
x	[mm]	107	114	122
y	[mm]	19	15	14
z	[mm]	14	12	12
SW	[mm]	12	17	17
		Part no.	**Part no.**	**Part no.**
Swing direction 90° cw		**1895303VXX35**	**1896303VXX36**	**1897303VXX38**
Swing direction 90° ccw		**1895403VXX35**	**1896403VXX36**	**1897403VXX38**
0 degree		**1895443VXX35**	**1896443VXX36**	**1897443VXX38**

XX: Version **DH/DM = without/with metallic wiper without switch rod**
MH/MM = without/with metallic wiper with switch rod

Accessories

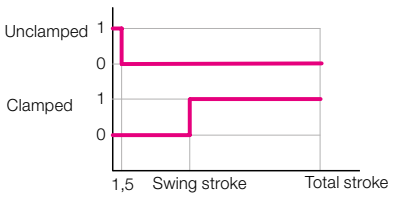
Pneumatic position monitoring, complete	**0353808**	**0353809**	**0353810**
Electrical position monitoring			
– without switch	**0353815**	**0353813**	**0353813**
– with standard switch and angle plug	**0353814**	**0353811**	**0353811**
Metallic wiper, complete (spare part)	**0341100**	**0341101**	**0341102**

Accessory:
Electrical position monitoring



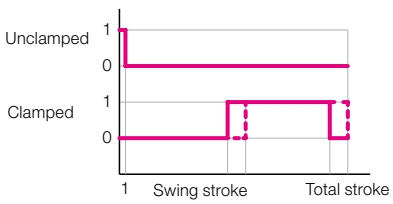
Function charts

Pneumatic monitoring



1 = Closed
0 = Passage

Elektrische Kontrolle



Code numbers for available swing angles

Swing angle (±1°)	Part no.
90°	**189XX0XVXXXX**
60°	**189XX2XVXXXX**
45°	**189XX3XVXXXX**

Clamping force diagrams and other accessories: see data sheet B 1.880. Further proximity switches: see data sheet B 1.552.

Swing Clamps with Reinforced Swing Mechanism

top flange, position monitoring optional, double acting, pendulum eye/fork head, max. operating pressure 500/160 bar

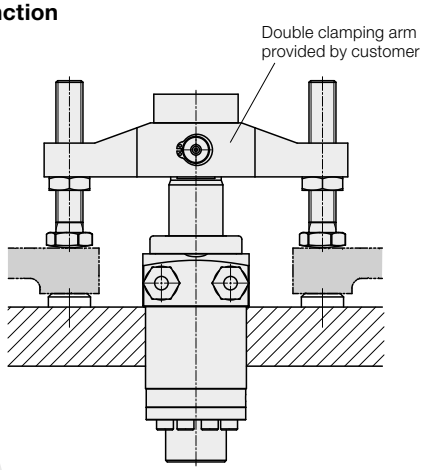
Advantages

- Introduction of clamping force without side loads
- Compact design
- Double clamping arm facilitates multiple clamping of similar workpieces
- Pendulum eye for high clamping forces
- Fork head for simple clamping arms
- Alternatively pipe thread or drilled channels
- Reinforced swing mechanism
- FKM wiper standard
- Available with position monitoring

Connecting possibilities

- Pipe thread
- Drilled channels

Function



Metallic wiper optional

Application

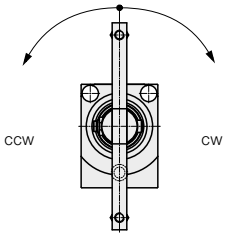
Hydraulic swing clamps are used for clamping of workpieces, when it is essential to keep the clamping area free of straps and clamping components for unrestricted workpiece loading and unloading.
The version with pendulum eye or fork head allows simultaneous clamping of two workpieces with half clamping force.

Function

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

Swing direction

The swing clamps are available with clockwise or counterclockwise swing motion. Off-position is the extended piston position.



Process safety

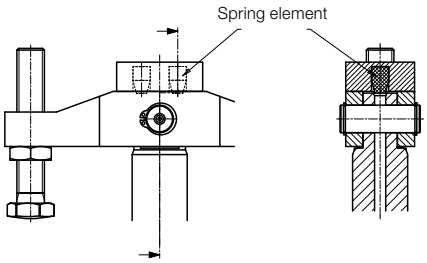
To improve the process safety when using heavy double clamping arms the swing mechanism has been reinforced and an overload protection device has not been realised.
During clamping the reinforced swing mechanism endures a collision of the clamping arm with the workpiece up to a pressure of 100 bar.
All versions are also available with a switch rod at the cylinder bottom. The control cams are mounted at this rod to control the clamping and unclamping position with limit switches or pneumatically.
Adaptable position monitorings for inductive or pneumatic control are available as accessory (page 4).

Description

The piston end of this swing clamp is designed as pendulum eye or fork head. By means of a double clamping arm 2 workpieces can be clamped at the same time.
For both versions a springy element is required in order to maintain the double clamping arm in the unclamped position in horizontal position.

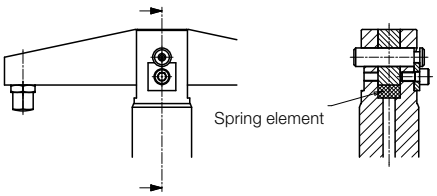
Pendulum eye

The sturdy pendulum eye can transmit high clamping forces up to a max. operating pressure of 500 bar. The double clamping arm has to be dimensioned according to the load.



Fork head

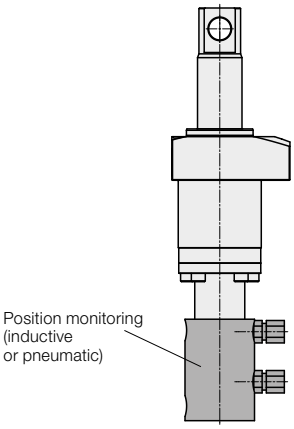
The fork head allows a max. operating pressure of 160 bar. Advantageous is the fact that relatively simple clamping arms can be manufactured from flat materials.



Option - metal wiper

The optionally availabe metallic wiper protects the FKM wiper against mechanical damage due to big or hot swarfs.

Swing clamp with optional position monitoring (accessory)



Important notes

Danger of injury

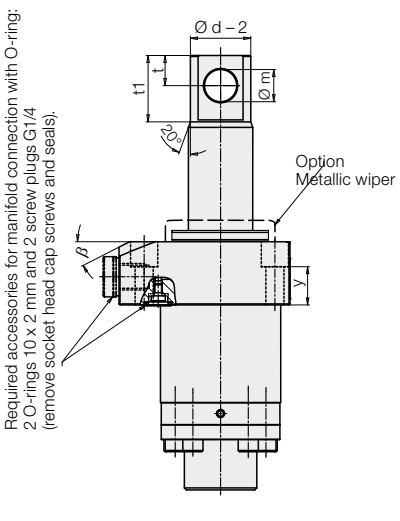
Hydraulic clamping elements generate high clamping forces. Considerable injuries can be caused to fingers in the effective area of the double clamping arm.
Remedy: mount protection devices.
Operating conditions, tolerances and other data see data sheet A 0.100.

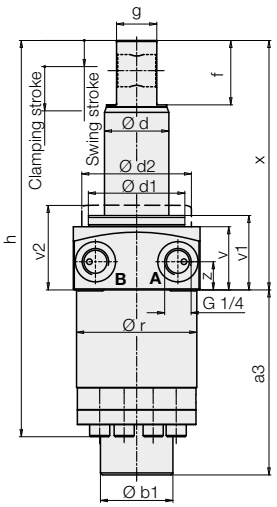
Clamping arm

Due to the missing overload protection device a collision with the clamping arm during loading and unloading of the fixture must be avoided.
Remedy: mount position adaptor.
The double clamping arm in clamping position should preferably be at right angles to the piston axis to avoid overload of the spring element.
Both contact bolts must only contact the workpiece after completion of the swing stroke.
Please consider: 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 3.

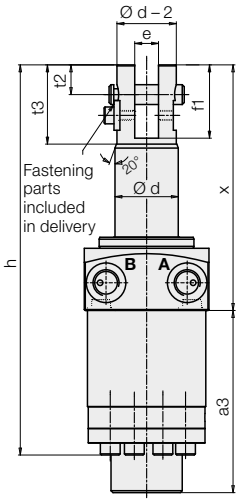
Dimensions
Code for part numbers

Pendulum eye 189X133X (500 bar)
without switch rod



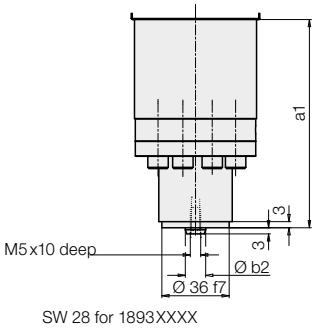


Fork head 189X153X (160 bar)

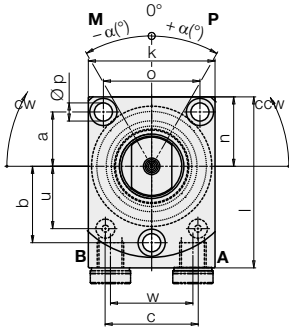


A = Clamping
B = Unclamping

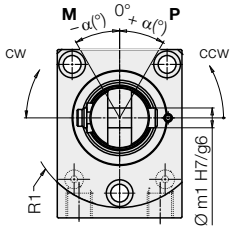
With switch rod 189X1X2X



Off-position

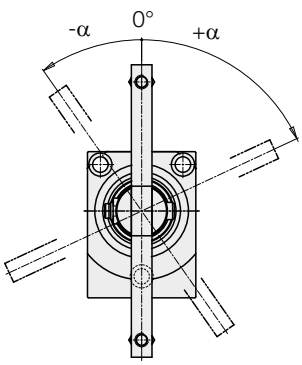


Off-position



Accessory: position monitoring see page 4.

Off-position
(unclamped extended position)
The fixing of the clamping arm with pendulum eye or fork head does not allow an adjustment of the off-position as possible in case of cone fixation. Therefore the desired off-position has to be indicated when placing the order.
The angle α can be selected in steps of 5°.



Code for part numbers

1 8 9 X 1 X X X X X X X

Piston rod Ø d
3 = 20 mm
5 = 32 mm

3 = Pendulum eye
5 = Fork head

2 = with switch rod
3 = without switch rod

M = Metalic wiper, mounted

Angle α for off-position
00 up to 90: 0° up to max. 90°
(graduation of 5°)

P (Plus) = +α
M (Minus) = –α
see dimensional drawing
0 = α = 0°

0 = 90° clockwise swing motion
1 = 90° counterclockwise swing motion
2 = 75° clockwise swing motion
3 = 75° counterclockwise swing motion
4 = 60° clockwise swing motion
5 = 60° counterclockwise swing motion
6 = 45° clockwise swing motion
7 = 45° counterclockwise swing motion
8 = 30° clockwise swing motion
9 = 30° counterclockwise swing motion

Swing angle ± 1°

1. Example of ordering
Piston rod diameter = 20 mm,
pendulum eye,
without switch rod,
swing angle 90° clockwise,
off-position 0°,
metallic wiper mounted
Part no. 1893 1330 000M

2. Example of ordering
Piston rod diameter = 32 mm,
fork head,
with switch rod,
swing angle 60° counterclockwise,
off-position –30°,
metallic wiper mounted
Part no. 1895 1525 M30M

		1893	1895
Clamping stroke	[mm]	25	22
Swing stroke	[mm]	9	13
Total stroke	[mm]	34	35
Operating pressure, min.	[bar]	30	30
Adm. flow rate	[cm³/s]	8	20
for moment of inertia	[kgm²]	0.00032	0.002295
Effective piston area			
Clamping	[cm²]	1.76	4.52
Unclamping	[cm²]	4.9	12.56
Oil volume/stroke	[cm³]	6	15.8
Oil volume/return stroke	[cm³]	16.7	44
β	[°]	12	27
a	[mm]	20	27
a1	[mm]	94	102
a3	[mm]	84	92
b	[mm]	30	38
Ø b1	[mm]	22	36
Ø b2 f7	[mm]	10	10
c	[mm]	32	46
Ø d	[mm]	20	32
Ø d1	[mm]	38	48
Ø d2	[mm]	42	54.5
e +0.1	[mm]	8	12
f	[mm]	20	32
f1	[mm]	26	37
g f7	[mm]	12	20
h	[mm]	182	197
k	[mm]	50	63
l	[mm]	70	85
Ø m H7	[mm]	10	16
Ø m1 H7	[mm]	6	10
n	[mm]	26.5	34.5
o	[mm]	37	48
Ø p	[mm]	6.6	9
Ø r −0.1	[mm]	44.8	59.8
R1	[mm]	36	45.3
t	[mm]	9	15
t1	[mm]	21	33
t2	[mm]	10	15
t3	[mm]	29	40
u	[mm]	26.5	31
v	[mm]	26.4	31.4
v1	[mm]	31	37
v2	[mm]	36	42
w	[mm]	28	41
x	[mm]	104.5	124
y	[mm]	18	19
z	[mm]	14	14

Accessories

Metallic wiper, complete (customer assembly)	**0341107**	**0341100**
O-Ring 10 x 2	**3000347**	**3000347**
Screw plug G 1/4	**3610264**	**3610264**

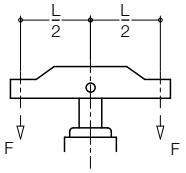
Admissible flow rate

The admissible flow rate indicated in the chart applies to the use of double clamping arms whose moment of inertia does not exceed the chart value.
The clamping time is thus approx. 0.8 seconds and the unclamping time approx. 2 seconds.
For new clamping arms with a different moment of inertia, the admissible flow rate can be calculated using the following formula:

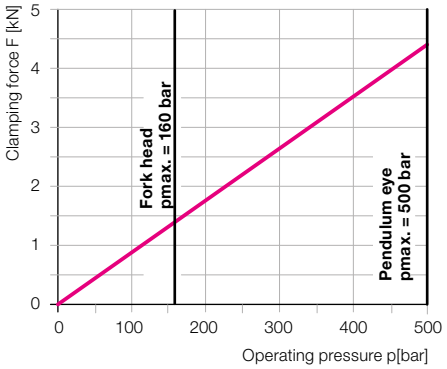
$$Q_2 = Q_1 \times \sqrt{\frac{J_1}{J_2}} \quad [cm^3/s]$$

Q_1 = Adm. flow rate (chart value)
Q_2 = Adm. flow rate with the moment of inertia of the new clamping arm J2
J_1 = Moment of inertia (chart value)
J_2 = Moment of inertia of the new clamping arm

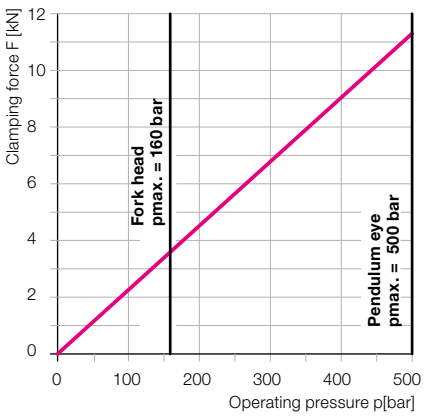
Clamping force F as a function of the operating pressure p



18931XXXX

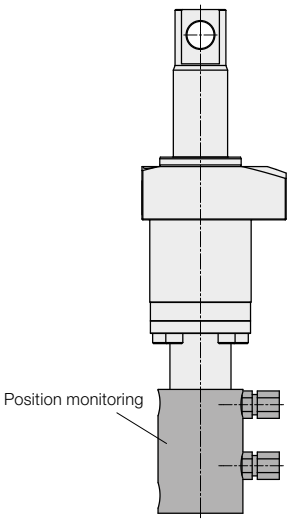


18951XXXX

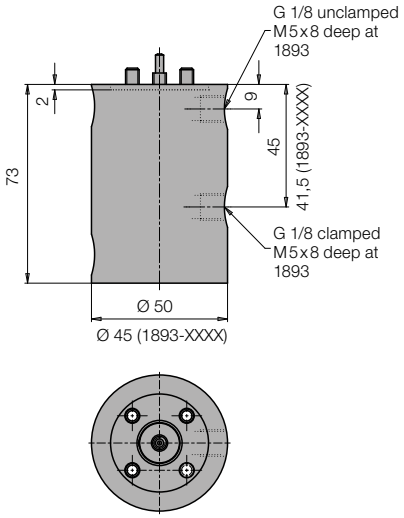


Delivery

The position monitorings are not delivered mounted at the swing clamp.
Fixing screws and signal sleeve are included in the delivery.
Electrical position monitorings are delivered with 2 inductive proximity switches and 2 right angle plugs.
The housings can be mounted rotated by 2x180° (1893) or 8x45°.

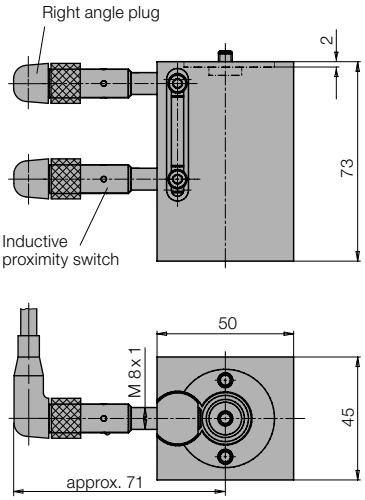


Pneumatic position monitoring



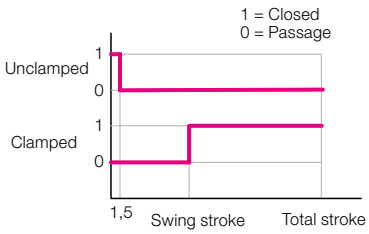
	for 1893	for 1895
Part no.	**0353867**	**0353808**

Electrical position monitoring

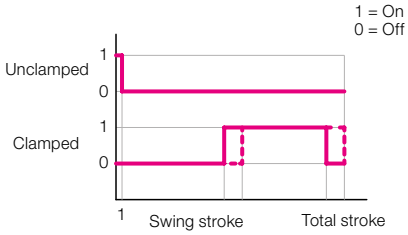


	for 1893	for 1895
Part no.	**0353868**	**0353814**

Function chart



Function chart

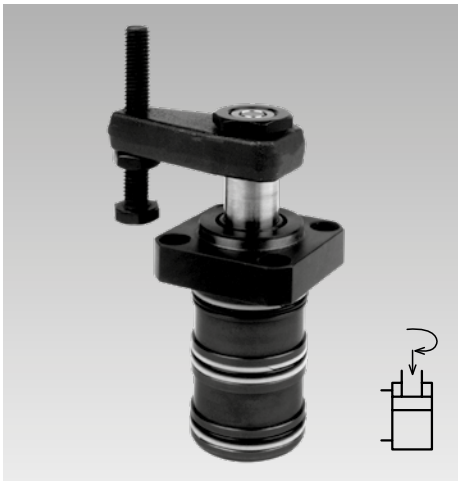


Technical data for proximity switches

Voltage	10…30 V DC
Residual ripple max.	15 %
Constant current max.	200 mA
Switching function	interlock
Output	PNP
Body material	stainless steel
Code class	IP 67
Environmental temperature	–25…+70°C
Connection	plug
Length of cable	5 m
LED function display	Yes
Protected against short circuits	Yes

Swing Clamps with Overload Protection Device

cartridge type, double acting, max. operating pressure 500 bar

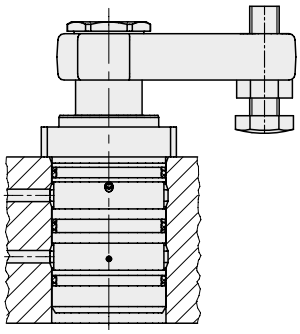


Advantages

- Compact design
- Double-acting function
- Unimpeded loading and unloading of the fixture
- Mounting position: variable
- Body partially recessible
- Counterbore for flange of the body can be easily manufactured by a milling cutter, since the flange has rounded edges
- Oil supply through drilled channels
- FKM wiper standard
- Metallic wiper for protection of the piston rod available

Connecting possibility

Drilled channels



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.

Function

This hydraulic clamping element is a pull-type cylinder where a part of the total stroke is used to swing the piston.

Swing direction

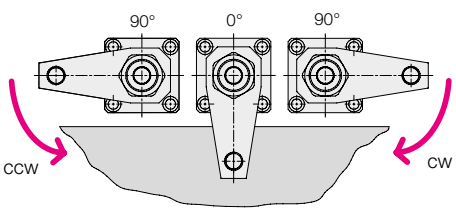
The units are available with clockwise and counterclockwise swing motion or without swing motion (0°). Starting from the off-position.

Standard swing angles are 45°, 60° and 90° ±2°.

Special angles on request.

0°-Version

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



Overload protection device

An integrated mechanical overload protection device prevents damage to the swing mechanism when striking an object within the 90° swing motion, clamping or unclamping alike, or in case of incorrect mounting of the clamping arm.

Material

By nitrating wear is reduced and protection against corrosion increased.
Piston material: high alloy steel.
Cylinder body: free cutting steel.

Important notes

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

Metallic wiper optional

Option: metallic wiper

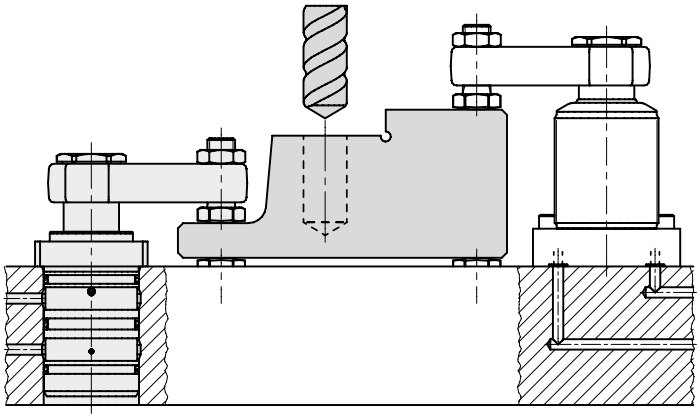
In addition to the FKM wiper all double-acting swing clamps can be equipped with a metallic wiper.

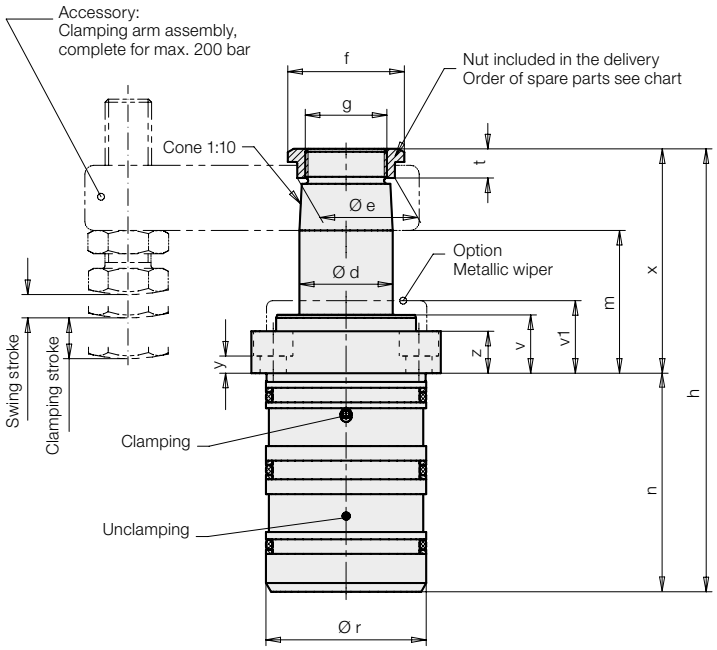
Part no.: Add only letter “M” to the part number of the swing clamp without metallic wiper.

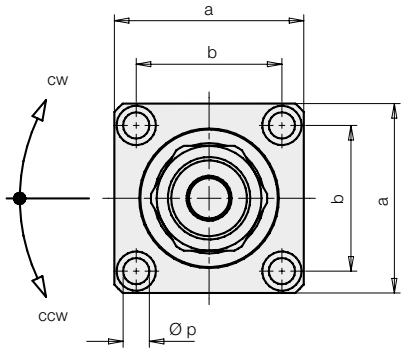
Example of ordering:

Swing clamp 1895202
with metallic wiper: **1895202M**

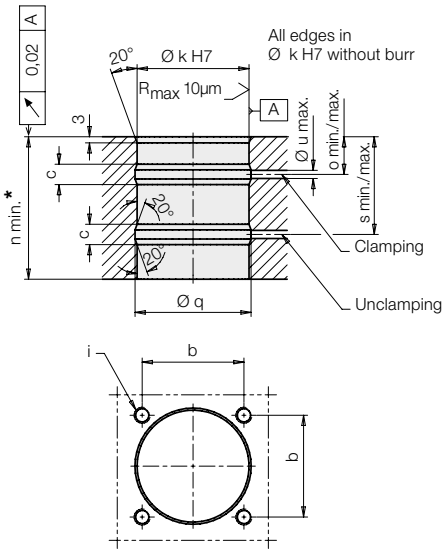
Application example



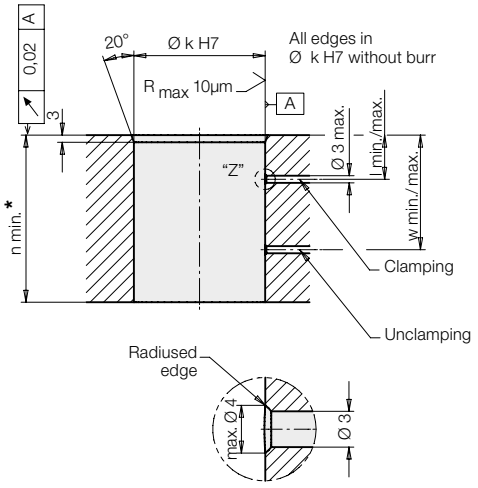




Location hole for oil bore Ø 5 / Ø 6



Location hole for oil bore Ø 3

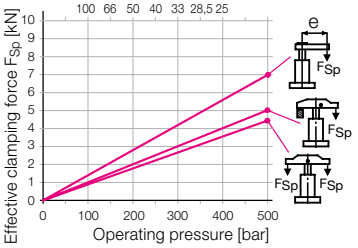


DETAIL "Z"

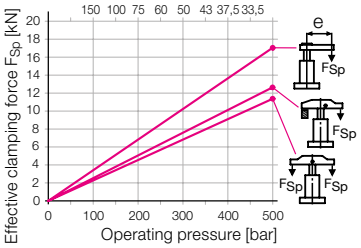
***** Min. plate thickness to ensure sealing

Effective clamping force F_{Sp} as a function of the clamping pressure p

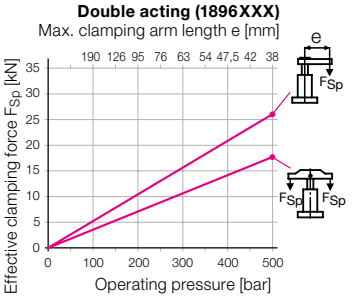
Double acting (1893XXX)
Max. clamping arm length e [mm]



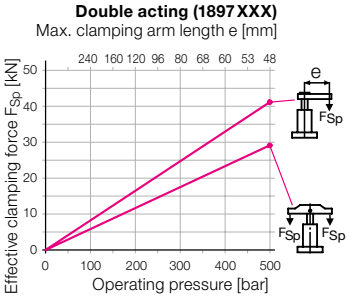
Double acting (1895XXX)
Max. clamping arm length e [mm]



Double acting (1896XXX)
Max. clamping arm length e [mm]



Double acting (1897XXX)
Max. clamping arm length e [mm]



Example 1: 1895 102
An operating pressure p of 200 bar in connection with standard clamping arm 0354 003 of max. arm length L = 75 mm results in an effective clamping force F_{Sp} of 6.8 kN.

Example 2: 1895 102
For a desired effective clamping force F_{Sp} of 8 kN and use of a swing clamp 1895 102 with a standard clamping strap 0354 002 an operating pressure p of 320 bar is required.

Dimensions
Technical data

		Size 1		Size 2		Size 3		Size 4	
Clamping stroke	[mm]	11	25	14	25	15	25	15	25
Swing stroke	[mm]	7	9	8	10	11	11	9	12
Total stroke	[mm]	18	34	22	35	26	36	24	37
Operating pressure. min.	[bar]	30	30	30	30	30	30	30	30
Max. oil flow rate	[cm^3/s]	3.2	3.2	10	10	18.4	18.4	27.7	27.7
Oil volume / stroke	[cm^3]	3.2	6	10	16	18.4	25.5	27.7	43
Oil volume / return stroke	[cm^3]	8.8	17	27.7	44	51	71	75	116
Ø d	[mm]	20	20	32	32	40	40	50	50
a	[mm]	55	55	65	65	85	85	100	100
b	[mm]	40	40	50	50	65	65	75	75
c	[mm]	10	10	10	10	12	12	12	12
Ø e	[mm]	23.5	23.5	33.5	33.5	45	45	55.5	55.5
f	[mm]	30	30	40	40	55	55	68	68
g	[mm]	M 18 x 1.5	M 18 x 1.5	M 28 x 1.5	M 28 x 1.5	M 35 x 1.5	M 35 x 1.5	M 45 x 1.5	M 45 x 1.5
h	[mm]	125.5	157.5	152	178	172	192	183	209
i	[mm]	M 6	M 6	M 8	M 8	M 10	M 10	M 12	M 12
Ø k H7	[mm]	42	42	55	55	70	70	85	85
l min. / max.	[mm]	13.5/21.5	13.5/21.5	14.5/22.5	14.5/22.5	15.5/26.5	15.5/26.5	18.5/29.5	18.5/29.5
m –1	[mm]	43	59	49	62	60	70	62	75
n / n min.	[mm]	61.5/60	77.5/76	75/66	88/79	78/72	88/82	81/76	94/89
o min. / max.	[mm]	16/19	16/19	17/20	17/20	19/23	19/23	22/ 26	22/ 26
Ø p	[mm]	6.6	6.6	9	9	11	11	14	14
Ø q	[mm]	44	44	57	57	72	72	87	87
Ø r f7	[mm]	42	42	55	55	70	70	85	85
s min. / max.	[mm]	41.5/44.5	41.5/60.5	46.5/49.5	46.5/62.5	49.5/53.5	49.5/63.5	52/56	52/69
t	[mm]	9	9	10	10	11	11	12	12
Ø u max.	[mm]	5	5	5	5	6	6	6	6
v	[mm]	18	18	20	20	25	25	29	29
v1	[mm]	23	23	25	25	30	30	34	34
w min. / max.	[mm]	39/47	39/63	44/52	44/65	45.5/56.5	45.5/66.5	48.5/59.5	48.5/72.5
x	[mm]	64	80	77	90	94	104	102	115
y	[mm]	6.5	6.5	6	6	8.5	8.5	10.5	10.5
z	[mm]	13.4	13.4	14.4	14.4	19.4	19.4	23.4	23.4
Declutch moment of overload protection	[Nm]	3.5	3.5	11	11	17	17	30	30

Double acting

Part no.								
Swing direction 90° cw	**1893102**	**1893302**	**1895102**	**1895302**	**1896102**	**1896302**	**1897102**	**1897302**
Swing direction 90° ccw	**1893202**	**1893402**	**1895202**	**1895402**	**1896202**	**1896402**	**1897202**	**1897402**
0 degree	**1893242**	**1893442**	**1895242**	**1895442**	**1896242**	**1896442**	**1897242**	**1897442**
Spare nut	**3527014**		**3527015**		**3527048**		**3527016**	
Metallic wiper (spare part)	**0341107**		**0341100**		**0341101**		**0341102**	

Code numbers for available swing angles

Swing angle	Part no.
90°	**18XXX0X**
60°	**18XXX2X**
45°	**18XXX3X**

Option - metallic wiper
Part no.: 189XXXXM

Important notes

1. Danger of injury

Hydraulic clamping elements can generate considerable forces. Due to the 90° swing motion, the exact clamping and unclamping position cannot be determined in advance. Considerable injuries can be caused to fingers in the effective area of the clamping arm. Remedy: protection device with electrical locking.

2. Admissible oil flow rate

In case of the admissible oil flow rate as per chart the shortest possible clamping time is 1 second.
If the oil volume is bigger, the overload protection device can snap out. Due to the oil supply through drilled channels, throttling will be nearly impossible. Therefore this line is equipped with a standard throttle bore hole in the body. Thereby a more regular motion of several connected swing clamps will be obtained and the flow rate limited. Nevertheless an additional throttling can be required when using longer clamping arms with bigger weight to avoid snapping out of the overload protection device.

3. Unimpeded swing motion

The swing motion must not be impeded and the clamping arm may only contact the workpiece after completion of the swing stroke.

4. Clamping arm assembly

When tightening and untightening the lock nut, the clamping arm has to be backed up to avoid the introduction of moments to the piston rod and thereby any deterioration of the swing mechanism.

5. Adjustment of contact bolt

The contact bolt may only contact the workpiece after completion of the swing motion. When tightening and untightening the fixing screw, the clamping arm as to be backed up (see 4.)

6. Special clamping arm

When using special clamping arms with other lengths, the corresponding operating pressures as shown in the clamping force diagram must not be exceeded.
If longer clamping arms will be used, not only the operating pressure but also the flow rate have to be reduced (see 2.).

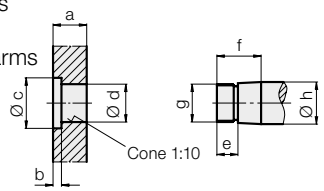
7. Option: metallic wiper

This wiper protects the FKM wiper against mechanical damage, e.g. by hot swarf. The swing clamp body is prepared for mounting of the metallic wiper. The wiper consists of a radially floating wiping disk and a retaining disk which will be pressed onto the existing collar.

8. Bleeding

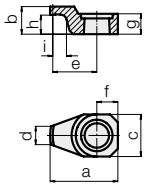
Air in the oil prolongs the clamping time considerably and leads to function troubles. Therefore bleeding has to be effected during start up.
In case of drilled channels provide additional bleeding screws.

Dimensions for special clamping arms



Swing clamp	a	b	Ø c	Ø d $^{+0.10}_{+0.05}$	e	f	g	Ø h_{f7}
18X3XXX	16	4	24	19.8	10	21	M 18 x 1.5	20
18X5XXX	23	5	34	31.8	12	28	M 28 x 1.5	32
18X6XXX	28	5	46	39.8	12	34	M 35 x 1.5	40
18X7XXX	34	6	56	49.8	13	40	M 45 x 1.5	50

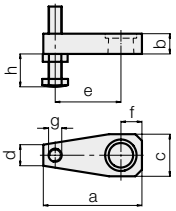
Clamping arm, max. 300 bar



Swing clamp	a	b	c	d	e	f	g	h	i	Weight [kg]	Part no.
18X3XXX	51.5	21	32	14	33.5	16	15.5	14.5	7	0.11	**3548238**
18X5XXX	76	28	46	25	50	23	22.5	19	7	0.3	**3548236**
18X6XXX	100	34	66	39	64	33	28	23	7	0.84	**3548301**
18X7XXX	123	40	75	39	82.5	37.5	34	27	8	1.3	**3548302**

Material: 42CrMo4

Clamping arm assembly, complete, max. 200 bar



with thread

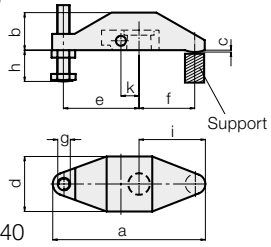
Swing clamp	a	b	c	d	e	f	g	h max.	h min.	Weight [kg]	Part no.
18X3XXX	75	16	32	16	50	16	M10	64	6	0.2	**0354001**
18X5XXX	115	23	48	22	75	25	M16	79	9	0.7	**0354003**
18X6XXX	140	28	60	28	95	30	M16	79	9	2.0	**0354042**
18X7XXX	178	34	78	40	120	40	M20	98	12	2.55	**0354005**

without thread

Swing clamp	a	b	c	d	f	Weight [kg]	Part no.
18X3XXX	75	16	32	16	16	0.18	**3921016**
18X5XXX	115	23	48	22	25	0.65	**3921017**
18X6XXX	140	28	60	28	30	1.85	**3921021**
18X7XXX	178	34	78	40	40	2.3	**3921018**

Material: 42CrMo4

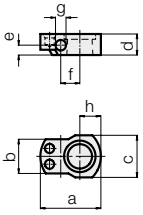
Clamping strap assembly, complete, with carrier, max. 500 bar



Swing clamp	a	b	c	d	e	f	g	h max.	h min.	i	k	Weight [kg]	Part no.
18X3XXX	122	30	1.5	44	60	45	M10	64	6	53	14.5	0.57	**0354000**
18X5XXX	185	45	2	58.5	83	75	M16	79	9	87	21	1.58	**0354002**

Material: GGG-40

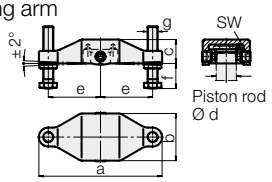
Carrier



Swing clamp	a	b	c	d	e	f	g^{H7}	h	Weight [kg]	Part no.
18X3XXX	46	26	32	16	7.5	14.5	8	16	0.08	**3542093**
18X5XXX	59	32	40	23	13	21	10	22	0.16	**3542094**
18X6XXX	82	44.5	58	28	17	28	12	34	0.5	**3542132**
18X7XXX	90	56	68	34	21	33	14	36	0.65	**3542096**

Material: 42CrMo4

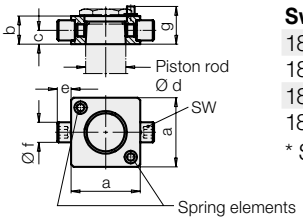
Double clamping arm assembly, complete, with carrier, max. 500 bar



Swing clamp	a	b	c	Ø d	e	f min.	f max.	g	SW	Weight [kg]	Part no.
18X3XXX	138	59	28.5	20	60	10	64	M 10	5	0.83	**0354131**
18X5XXX	196	75	38	32	83	15	79	M 16	8	2.11	**0354132**
18X6XXX	216	85	47	40	92	15	79	M 16	8	3.17	**0354133**
18X7XXX	236	105	56	50	100	19	98	M 20	8	5.24	**0354134**

Material: GGG-40

Carrier, complete with threaded bolt and spring clamping elements



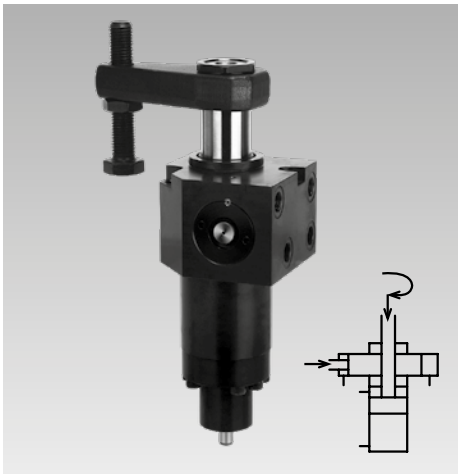
Swing clamp	a ±0,1	b	c	Ø d	e	Ø f_{g6}	g*	SW	Part no.
18X3XXX	43	16	7.5	20	9	10	21.5	5	**0354141**
18X5XXX	55	23	11	32	11	16	29	8	**0354142**
18X6XXX	63	28	15	40	12	18	35	8	**0354143**
18X7XXX	77	34	17	50	15	20	41	8	**0354144**

* Stop surface for spring elements

Material: 42CrMo4

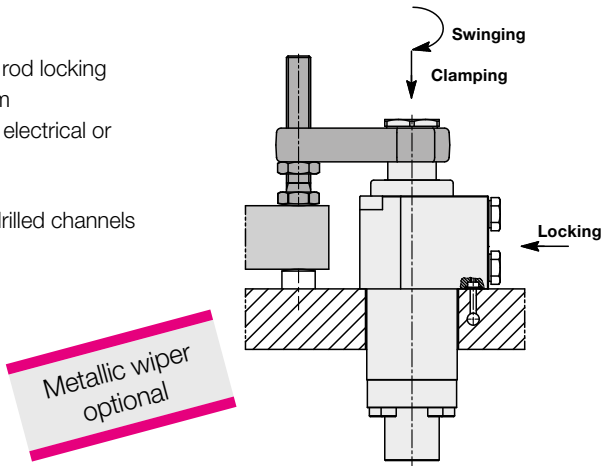
Swing Clamp with Piston Rod Locking

Top flange, reinforced swing mechanism, position monitoring optional, double acting, max. operating pressure 250 bar



Advantages

- High process safety
- Self-locking patented piston rod locking
- Reinforced swing mechanism
- Optional position monitoring electrical or pneumatic
- Compact design
- Alternatively pipe thread or drilled channels
- Standard FKM wiper
- Metallic wiper optional



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.
The version with piston rod locking maintains the clamping force also after a pressure drop.

This series is particularly suited for

- Pallet changing systems
- Transfer lines
- Workpiece change with handling systems
- Automatic manufacturing systems
- Assembly lines
- Test systems for motors, gears, axis ...

Function

The hydraulic swing clamp is a pull-type cylinder where a part of the total stroke is used to swing the piston. The piston rod locking is made by a separately-controlled double-acting wedge-shaped piston.

Clamping: 1. Swinging and clamping
2. Locking

Unclamping: 1. Release locking
2. Unclamping and swinging back

Self-locking

The wedge-shaped piston is designed as a self-locking piston so that the swing clamp can be depressurised after clamping. The previously generated clamping force will be maintained.
Conditions: Before depressurising, the locking pressure must be available at least for 3 seconds.

Control and important notes

See page 4.

Special features

Self-locking piston rod locking
The patented piston rod locking is made by friction locking by a separately-controllable double-acting wedge-shaped piston with self-locking. In the case of a pressure drop or complete pressure reduction, the clamping force will be maintained.

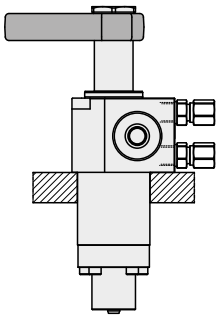
Reinforced swing mechanism
The reinforced swing mechanism without overload protection device endures a collision with the workpiece during clamping up to a pressure of 100 bar.

Accessory - Position monitoring
As an option, the swing clamps are available with an extended switch rod at the cylinder bottom. Here a control cam can be fixed to control the clamping and unclamping position. As accessories pneumatic and electrical position monitorings are available.

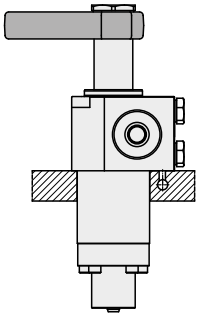
Option: metallic wiper
The optionally available metallic wiper protects the FKM wiper against mechanical damage.

Connecting possibilities

Pipe thread

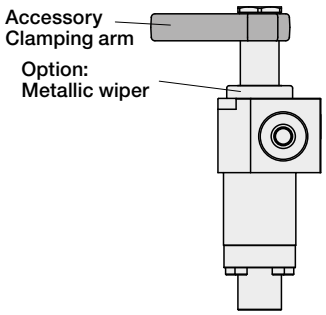


Drilled channels

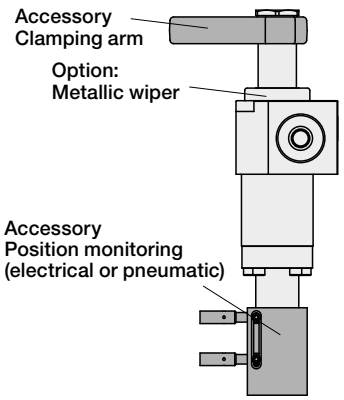


Versions

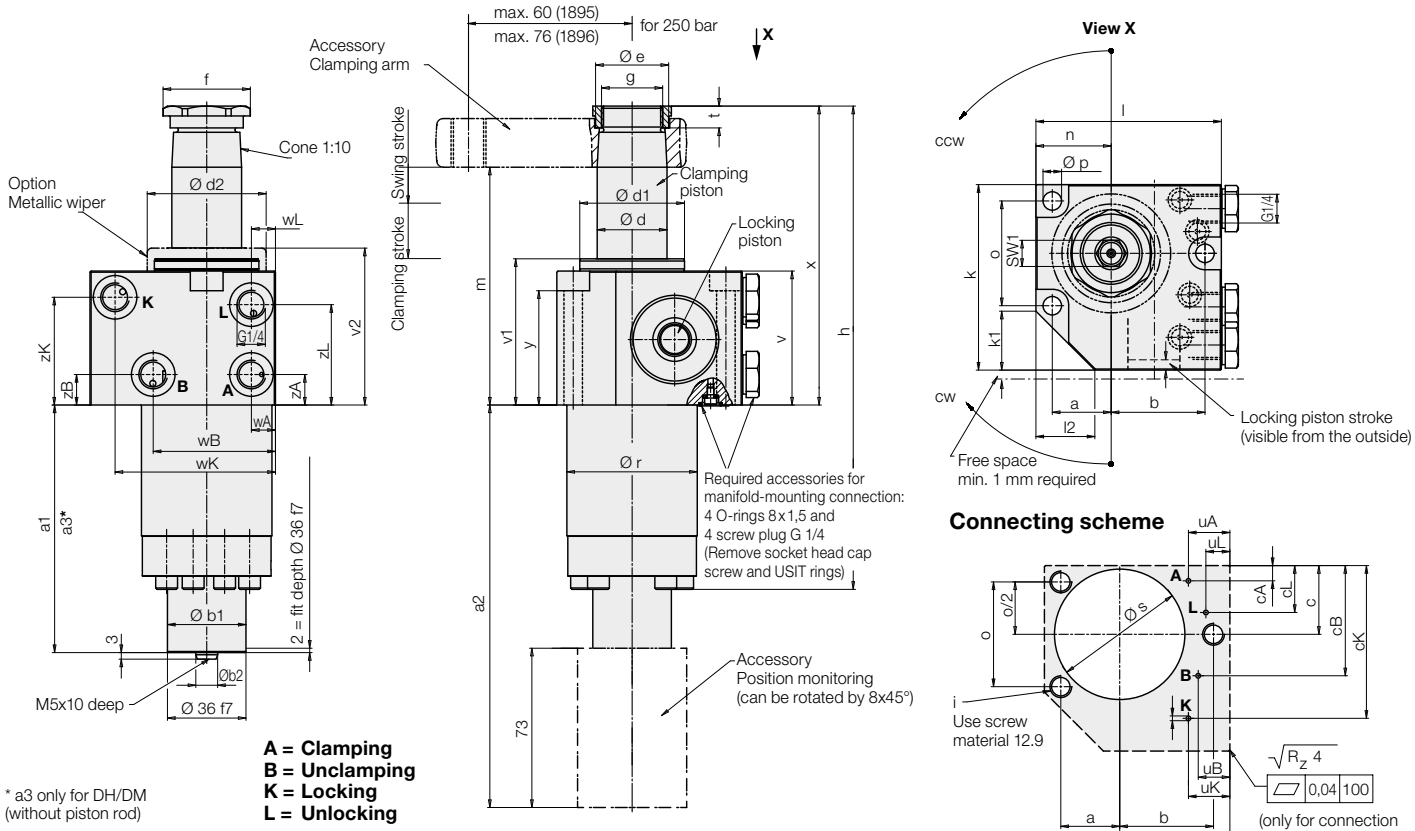
KDH, KDM: without switch rod



KMH, KMM: with switch rod



Dimensions
Position monitoring

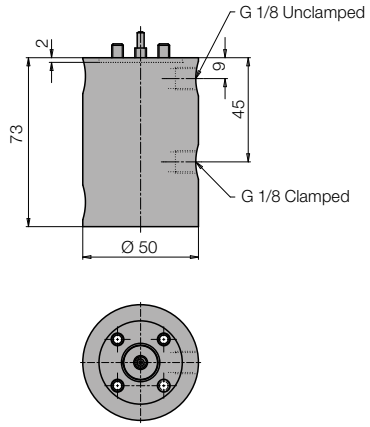


Connecting scheme

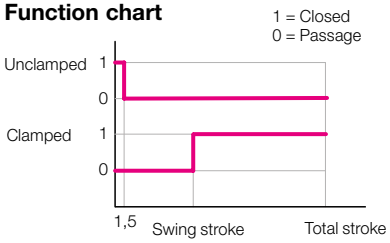
Ports A, B, K, L: max. Ø 6 mm

Accessory - Position monitoring

Pneumatic position monitoring



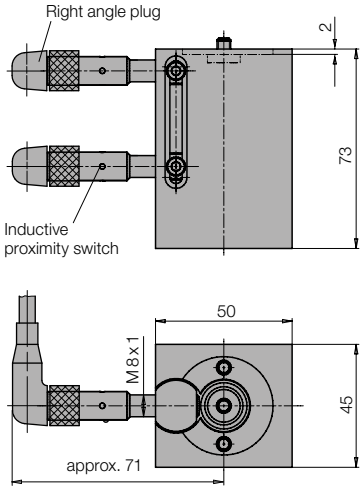
Function chart



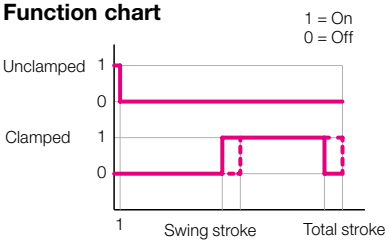
Part no.	for 1895	for 1896
	0353808	0353809

For the evaluation of the pneumatic position monitoring we recommend a differential pressure switch, which allows a parallel connection of max. 8 swing clamps.

Electrical position monitoring



Function chart



Part no.	for 1895	for 1896
without switch	0353815	0353813
with standard switches	0353814	0353811

Technical data for proximity switches

Operating voltage	10…30 V DC
Residual ripple max.	15 %
Constant current max.	200 mA
Switching function	interlock
Output	PNP
Body material	stainless steel
Code class	IP 67
Environmental temperature	–25…+70 °C
Connection type	Plug
Length of cable	5 m
LED Function display	Yes
Protected against short circuits	Yes

Delivery

The position monitorings are not delivered mounted at the swing clamp.
The housings can be mounted rotated by 8x45°.
Fixing screws and signal sleeve are included in the delivery.
Electrical position monitorings with standard switches are delivered with 2 inductive proximity switches and 2 right angle plugs.

Part no. O-ring (spare part)	
Proximity switch	3829077
Right angle plug	3829088

Further proximity switches see data sheet B 1.552

Max. force to pull at 250 bar	[kN]	11.3	17.6
Effective clamping force	[kN]	see diagram	
Clamping stroke	[mm]	22	20
Swing stroke	[mm]	13	16
Total stroke	[mm]	$35^{+0,4}_{-0,3}$	$36^{+0,3}_{-0,2}$
Min. operating pressure	[bar]	30	30
Max. flow rate	[cm^3/s]	20	36
Oil volume/max.stroke	[cm^3]	18.4	29.8
Oil volume/max. return stroke	[cm^3]	44.4	72.9
a	[mm]	27	37
a1 only MH/MM	[mm]	113.5	129
a2	[mm]	184.5	200
a3* only DH/DM	[mm]	103.5	116
b	[mm]	43	55
Ø b1	[mm]	36	45
Ø b2 f7	[mm]	10	12
c	[mm]	31.5	40.5
cA	[mm]	7	9.5
cB	[mm]	50.5	72
cK	[mm]	70	89.5
cL	[mm]	21.5	25
Ø d	[mm]	32	40
Ø d1	[mm]	48	60
Ø d2	[mm]	54.5	75
Ø e	[mm]	33.5	45
f	[mm]	40	55
g	[mm]	M28x1.5	M35x1.5
h	[mm]	221.5	253.8
i	[mm]	M 8	M 10
k	[mm]	85	110
k1	[mm]	27	35
l	[mm]	85	110
l2	[mm]	27	35
m ±1	[mm]	109.4	117.9
n	[mm]	34.5	47
o	[mm]	48	65
Ø p	[mm]	8.5	10.5
Ø r −0.1	[mm]	59.8	79.8
Ø s +1	[mm]	60	80
t	[mm]	10	11
u	[mm]	50.5	63
uA	[mm]	19	23
uB	[mm]	14.5	12.5
uK	[mm]	19	21
uL	[mm]	11	12.5
v	[mm]	61.4	66.4
v1	[mm]	67	72
v2	[mm]	71.9	76.9
wA	[mm]	11	13
wB	[mm]	56	66.5
wK	[mm]	66	89.5
wL	[mm]	11	13
$x^{+0,6}_{-0,5}$	[mm]	137	151
x max.*	[mm]	139	153.6
y	[mm]	52.4	55.4
zA	[mm]	14	12
zB	[mm]	14	55.5
zK	[mm]	50.4	55.5
zL	[mm]	46	41
SW1	[mm]	12	17
		Part no.	**Part no.**
Clockwise rotation 90°		**1895304KXX35**	**1896304KXX36**
Counterclockwise rotation 90°		**1895404KXX35**	**1896404KXX36**
0 degree		**1895444KXX35**	**1896444KXX36**

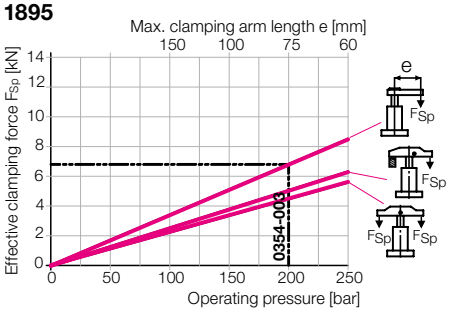
* Upper edge nut

XX: Version **DH/DM = without/with metallic wiper without switch rod**
MH/MM = without/with metallic wiper with switch rod

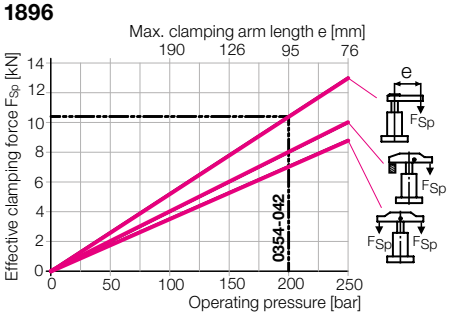
Accessory	**Part no.**	**Part no.**
Metallic wiper, complete (spare part)	**0341100**	**0341101**
O-ring 8x1.5	**3000343**	**3000343**
Screw plug G 1/4	**3300821**	**3300821**
Spare nut / tightening torque	**3527015**/90 Nm	**3527048**/160 Nm

Effective clamping force F_{Sp} as a function of the operating pressure p

1895



1896



Important note

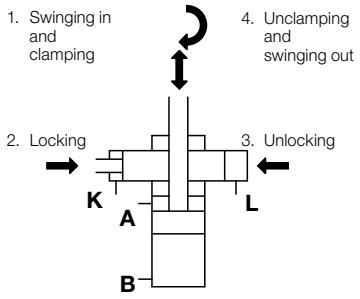
The clamping force diagrams are only valid, if "clamping" and "locking" are are controlled separately (see page 4).

Clamping arms, accessories and special clamping arms see data sheet B 1.881.

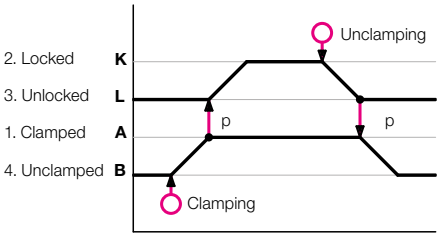
Key for available angles of rotation

Angle of rotation (±1°)	**Part no.**
90°	**189XX04KXXXX**
60°	**189XX24KXXXX**
45°	**189XX34KXXXX**

Function sequence



Function chart



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 clamp has no overload protection device. When mounting the clamping arm, the clamping arm or the hexagon socket in the piston have to be backed up for tightening and untightening the fixing nut.

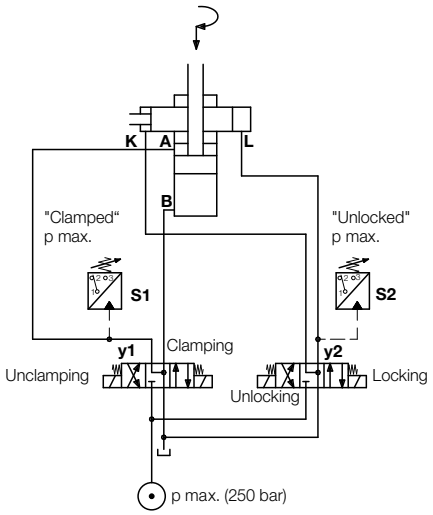
During loading and unloading of the fixture and during clamping a collision with the clamping arm has to be avoided. Remedy: Mount position adaptor.

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

Hydraulic control

The control is effected by two separate double-acting switching circuits.

Sequence control by pressure switches

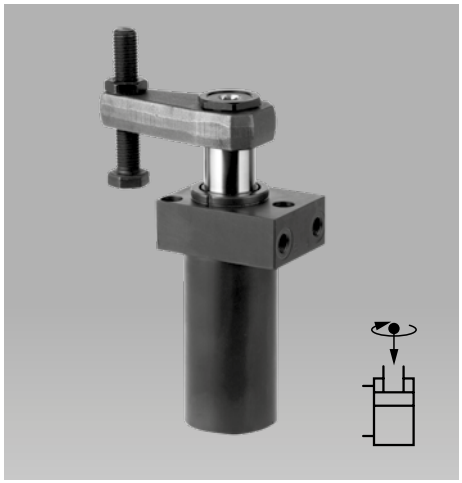


Switching sequence

1. **Starting position**
   y1 and y2 de-energised or
   y1 "Unclamping"; y2 "Unlocking"
2. **Clamping**
   ➔ 1. y1 "Clamping"; y2 de-energised
   ➔ 2. S1 = pmax ➔ y2 "Locking"
3. **Depressurise (as required)**
   Before depressurising, the locking pressure must be available at least for 3 seconds.
   ➔ y1 and y2 de-energised
4. **Unclamping**
   ➔ 1. y2 "Unlocking"
   ➔ 2. S2 = pmax ➔ y1 "Unclamping"

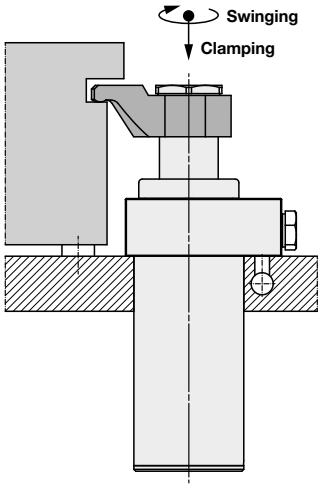
Swing Clamps without Swing Stroke

Top flange, reinforced swing mechanism, position monitoring optional, double acting, max. operating pressure 350 bar



Advantages

- Swing motion without axial stroke
- Swinging in into small recesses
- Compact flange design
- Reinforced swing mechanism
- Optional position monitoring electrical or pneumatic
- Alternatively pipe thread or drilled channels
- Standard FKM wiper
- Metallic wiper optional



Metallic wiper optional

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.
Using this version without swing stroke, the clamping arm swings in one level and thereby allows the clamping of workpieces in recesses that are only insignificantly higher than the clamping arm.

Function

The swing clamp without swing stroke is a double-acting pull-type cylinder where a part of the piston stroke is used to swing the piston rod without axial stroke.

Clamping

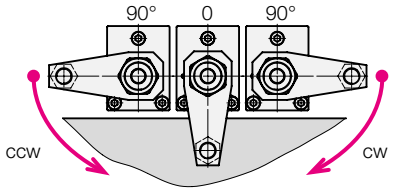
1. The piston rod is rotated together with the clamping arm without axial stroke (swing stroke) in the desired direction.
2. After swinging in the clamping arm above the clamping point, the linear clamping stroke will be effected.

Unclamping

1. For the linear return stroke, the clamping arm is lifted from the clamping point.
2. The piston rod swings the clamping arm without axial stroke back to the off-position.

Swing direction

Optionally available with clockwise or counterclockwise swing motion.



Standard swing angle is 90°

Special swing angles between 20° and 70° are available on request.

Special features

Swinging without axial stroke

This version can clamp workpieces in recesses that are only insignificantly higher than the clamping arm.

Reinforced swing mechanism

The reinforced swing mechanism without overload protection device endures a collision of the clamping arm with the workpiece during clamping up to a pressure of 100 bar.

Accessory - Position monitoring

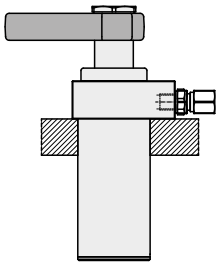
As an option, the swing clamps are available with an extended switch rod at the cylinder bottom. Here a control cam can be fixed to control the clamping and unclamping position. As accessories pneumatic and electrical position monitorings are available.

Option - Metallic wiper

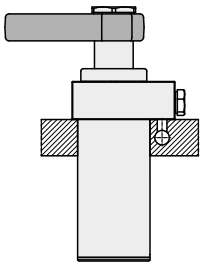
The optionally available metallic wiper protects the FKM wiper against mechanical damage.

Connecting possibilities

Pipe thread

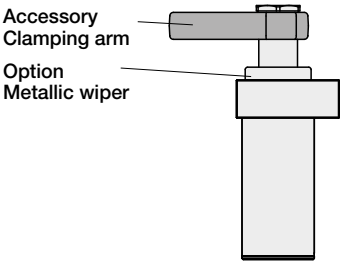


Drilled channels

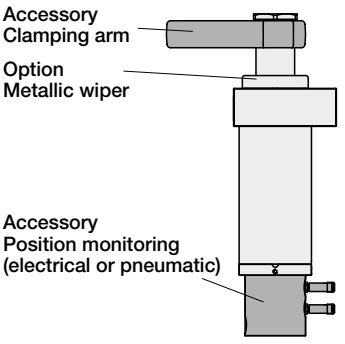


Versions

DH, DM: without switch rod



MH, MM: with switch rod



Important notes

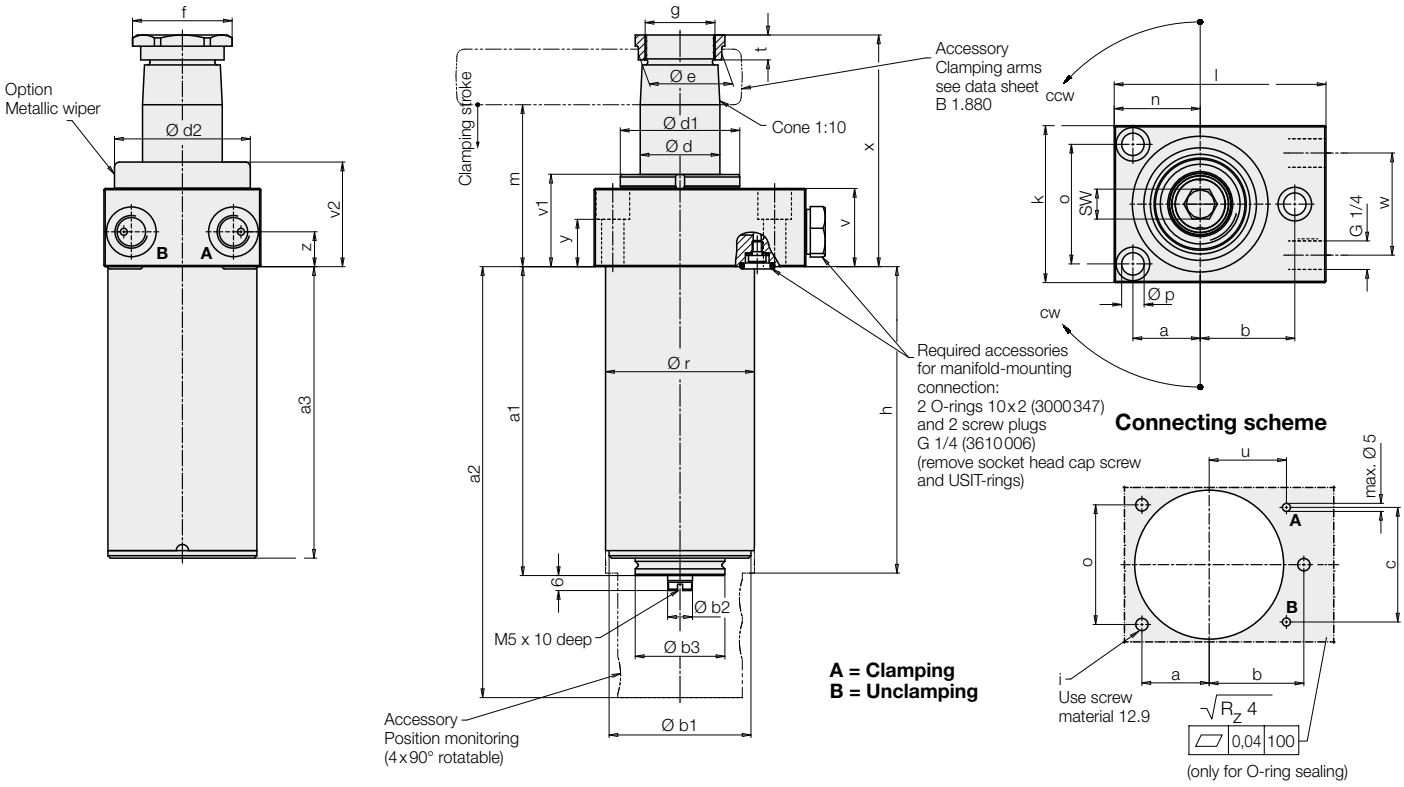
See page 3.

without switch rod

189X NXXX XX DH DM

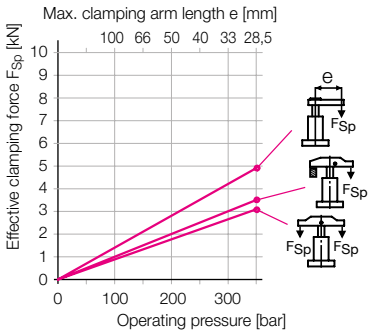
with switch rod

189X NXXX XX MH MM

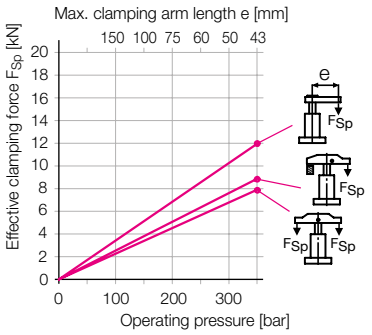


Effective clamping force F_{Sp} as a function of the operating pressure p

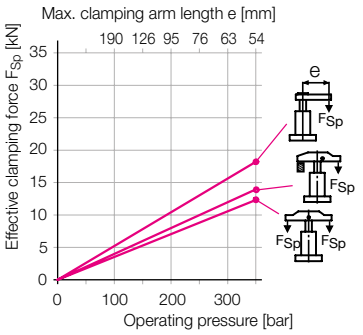
1893



1895



1896



Size		1893	1895	1896
Max. force to pull at 350 bar	[kN]	6.1	15.8	24.7
Effective clamping force	[kN]		see diagram	
Clamping stroke	[mm]	12	16	20
Min. operating pressure	[bar]	50	50	50
Max. oil flow rate*	[cm³/s]	5…9	5…32	5…60
Oil required for swinging	[cm³]	3.5	14.6	26.7
clamping stroke	[cm³]	2.1	7.2	14.1
Total clamping	[cm³]	5.6	21.8	40.8
Oil volume for unclamping stroke	[cm³]	5.9	20.1	39.3
ditto with switch rod	[cm³]	4.9	18.8	37.7
swinging back	[cm³]	3.5	14.6	26.7
Total unclamping	[cm³]	9.4	34.7	66
ditto with switch rod	[cm³]	8.4	33.4	64.4
a	[mm]	20	27	37
a1	[mm]	107.5	132.5	175.6
a2	[mm]	148.5	181.5	230.6
a3	[mm]	99.5	125.5	168.6
b	[mm]	30	38	50
Ø b1	[mm]	41.8	57	77
Ø b2 f7	[mm]	10	10	10
Ø b3 f7	[mm]	30	36	36
c	[mm]	32	46	62
Ø d	[mm]	20	32	40
Ø d1	[mm]	38	48	60
Ø d2	[mm]	43	54.5	75
Ø e	[mm]	23.5	33.5	45
f	[mm]	30	40	55
g	[mm]	M18x1.5	M28x1.5	M35x1.5
h	[mm]	106.5	131.5	174.6
i	[mm]	M 6	M 8	M 10
k	[mm]	50	63	85
l	[mm]	70	85	110
m –1	[mm]	55	65	67
n	[mm]	26.5	34.5	47
o	[mm]	37	48	65
Ø p	[mm]	6.6	9	11
Ø r –0.1	[mm]	44.8	59.8	79.8
Ø s +1	[mm]	45	60	80
t	[mm]	9	10	11
u	[mm]	26.5	31	40
v	[mm]	26.4	31.4	29.4
v1	[mm]	31	37	35
v2	[mm]	36	42	40
w	[mm]	28	41	55
x	[mm]	76	93	101
y	[mm]	18	19	15
z	[mm]	14	14	12
SW	[mm]	8	12	17

Part no.			
Swing direction 90° cw	**1893 N90R 12XX**	**1895 N90R 16XX**	**1896 N90R 20XX**
Swing direction 90° ccw	**1893 N90L 12XX**	**1895 N90L 16XX**	**1896 N90L 20XX**

Special swing angles between 20° and 70° are available on request.

XX: Version

DH = without switch rod, without metallic wiper
DM = without switch rod, with metallic wiper
MH = with switch rod, without metallic wiper
MM = with switch rod, with metallic wiper

***** Do not use manually operated pumps as a continuous flow is required.

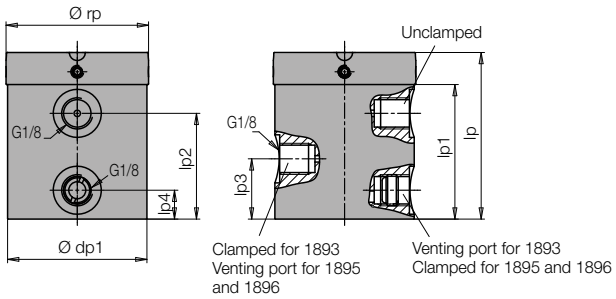
Clamping arms and other accessories see data sheet B 1.880.

Important notes

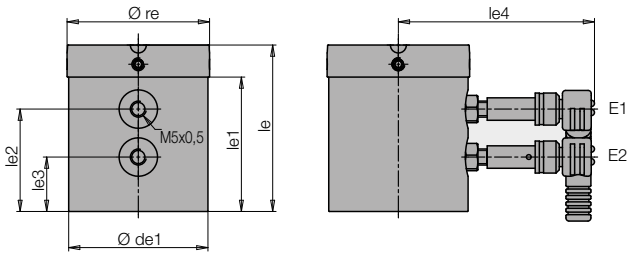
Swing clamps must only be used for clamping of workpieces in industrial applications and may only be operated with hydraulic oil. They can generate very high forces. The workpiece, the fixture or the machine must be in the position to compensate these forces.
In the effective area of piston rod and clamping arm, there is the danger of crushing.
The manufacturer of the fixture or the machine is obliged to provide effective protection devices.

The swing clamp has no overload protection device. When mounting the clamping arm, the clamping arm or the hexagon socket in the piston have to be backed up for tightening and untightening the fixing nut. During loading and unloading of the fixture and during clamping a collision with the clamping arm has to be avoided.
Remedy: Mount position adaptor.
Operating conditions, tolerances and other data see data sheet A 0.100.

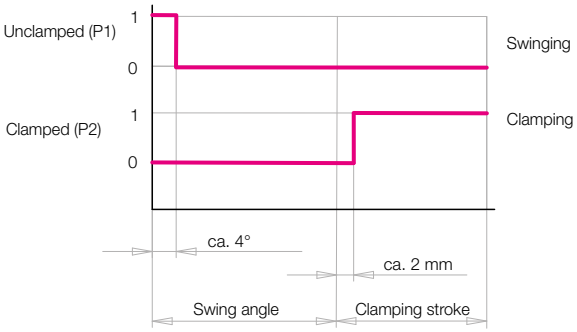
Pneumatic position monitoring



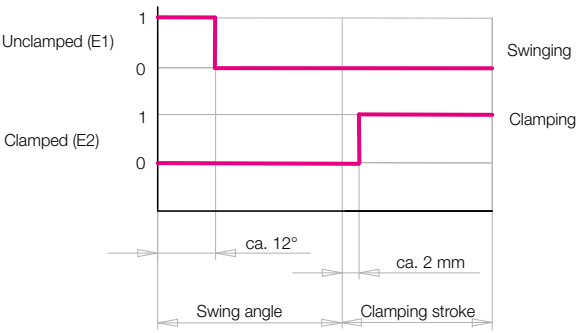
Electrical position monitoring



Function chart

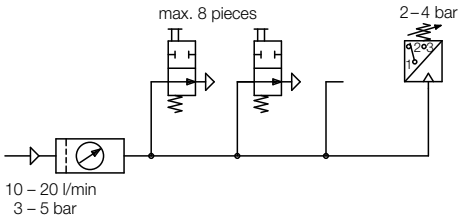


Function chart



Size		**1893**	**1895**	**1896**
lp	[mm]	52	59	65
lp1	[mm]	42	50	56
lp2	[mm]	33	40	46
lp3	[mm]	18.8	22.8	23.8
lp4	[mm]	9	9	11
Ø rp	[mm]	44.5	59.8	79.8
dp1	[mm]	43.5	50	50
le	[mm]	52	59	65
le1	[mm]	42	50	56
le2	[mm]	32	40	46
le3	[mm]	17	22	22
le4	[mm]	approx. 62	approx. 62	approx. 62
Ø re	[mm]	44.5	59.8	79.8
de1	[mm]	43.5	50	50
Part no.				
Pneumatic position monitoring, complete		**0353896**	**0353892**	**0353903**
Electrical position monitoring				
- without switch		**0353897**	**0353893**	**0353902**
- with standard switch		**0353909**	**0353908**	**0353907**

Monitoring by pneumatic pressure switch



For the evaluation of the pneumatic pressure build-up, standard pneumatic pressure switches can be used. It is possible to monitor with one pressure switch up to 8 position monitorings connected in series (see circuit diagram).
It has to be considered that process-safe functioning of pneumatic position monitorings is only guaranteed with throttled air and system pressure. The nominal values are indicated below technical characteristics.

Technical data for pneumatic pressure switches

Port		G 1/8
Nominal diameter	[mm]	2
Max. air pressure	[bar]	10
Range of operating pressure	[bar]	3…5
Differential pressure* at 3 bar system pressure	[bar]	min. 1.5
Differential pressure* at 5 bar system pressure	[bar]	min. 3.5
Air flow rate**	[l/min]	10…20

* Pressure drop when controlling the function "Clamped", if one or several position monitorings are not operated.

** For measuring the air flow rate, appropriate devices are available. Please contact us.

Delivery

The position monitorings are not delivered mounted at the swing clamp. The body, the signal sleeve and two inductive proximity switches with plug are included in the delivery.

Technical data for inductive proximity switches

Operating voltage UB	10…30 VDC
Switching function	interlock
Output	PNP
Material of housing	steel, corrosion resistant
Protection as per DIN 40050	IP 67
Ambient temperature	–25…+70 °C
Type of connection	Plug S49 M8x1
LED function display	yes
Constant current max.	100 mA
Rated operating distance	0.8 mm
Protected against short circuits	yes
Part no.	**3829198**
Right angle plug with cable 5 m	**3829099**

Installation

The control cam can be mounted at the switch rod in 4 x 90° position, thus allowing a 4 x 90° rotation of the position monitoring. The position monitoring is exactly centred at the swing clamp and is fixed after radial adjustment of the unclamping position with four threaded pins.

Swing Clamp with Overload Protection Device

Bottom flange and threaded body, single and double acting, max. operating pressure 500 bar

Application

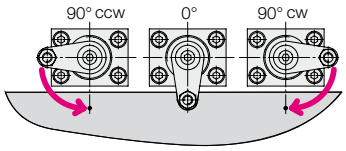
Hydraulic swing clamps are used for clamping of workpieces, when it is essential to keep the clamping area free of straps and clamping components for unrestricted workpiece loading and unloading.

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!

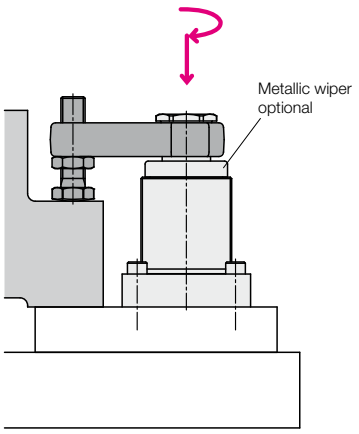
Swing clamps must only be used for clamping of workpieces in industrial applications and may only be operated with hydraulic oil. They can generate very high forces. The workpiece, the fixture or the machine must be in the position to compensate these forces.
In the effective area of piston rod and clamping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

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

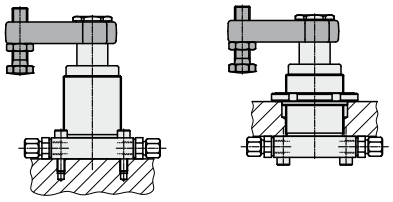
The overload protection device is a spring-loaded disengageable coupling between piston and helix rod that protects the swing mechanism against damage in case of
- blocked swing motion
- too high swing speed
- improper fixing of clamping arm.



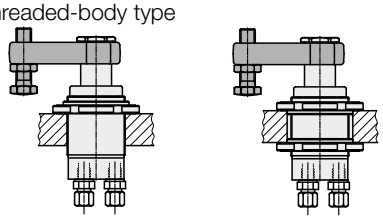
Wiper system see page 6.

Installation and connecting possibilities

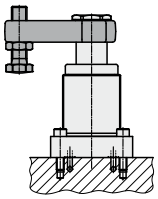
Pipe thread
Bottom flange



Threaded-body type

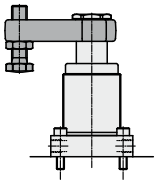


Drilled channels



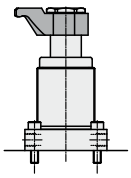
Accessories

Clamping arm with contact bolt (200 bar)

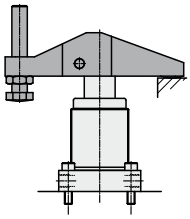


Note: Calculation of the effective clamping force see page 4

Cranked clamping arm (300 bar)

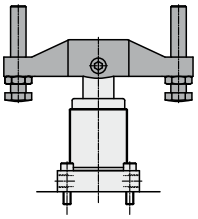


Clamping arm assembly (500 bar)



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

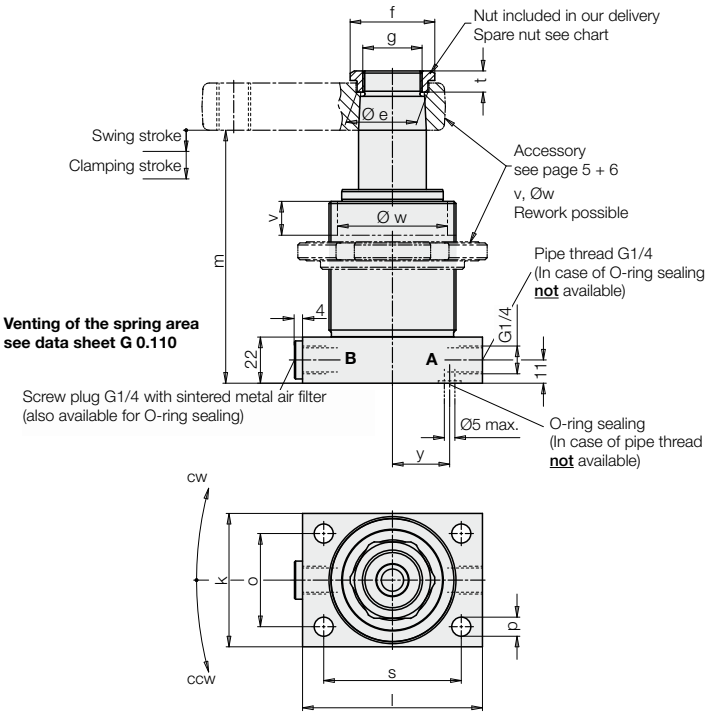
Double clamping arm (500 bar)



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.

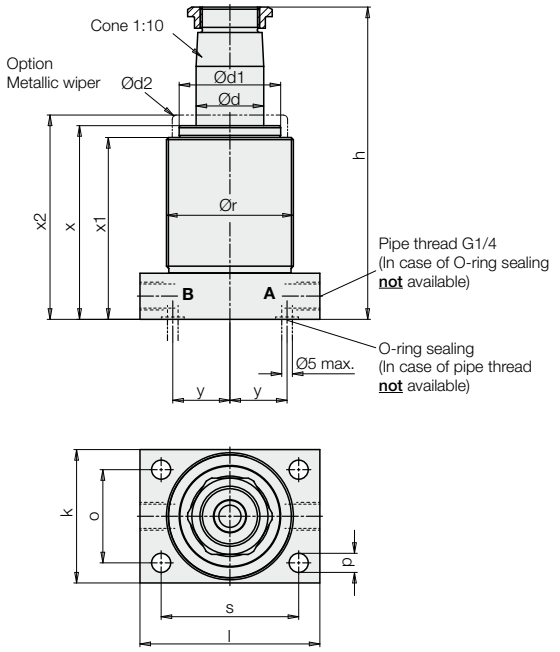
Flange type with pipe thread G 1/4 or with O-ring sealing (see chart)

Single acting
with spring return



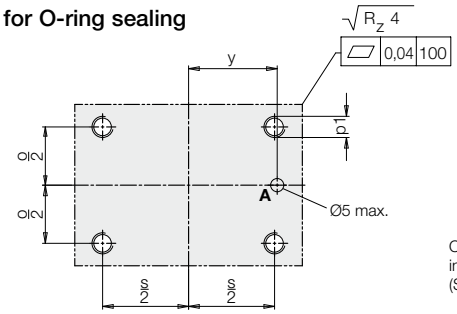
A = Clamping
B = Venting

Double acting

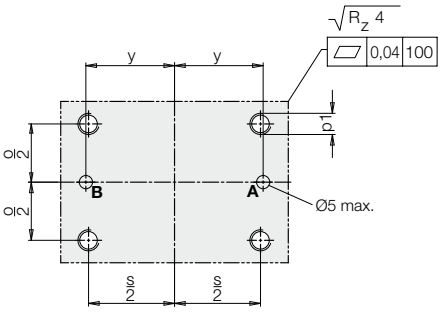


A = Clamping
B = Unclamping

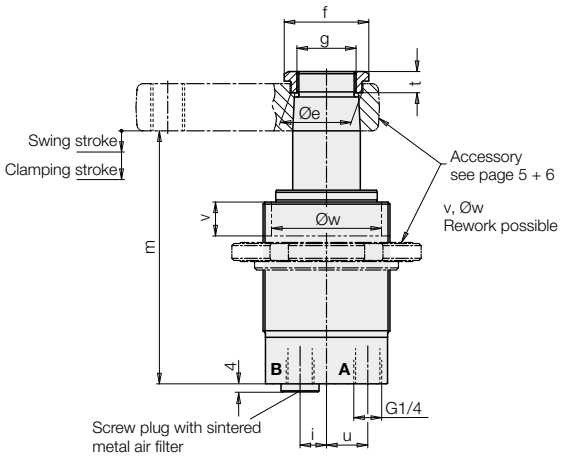
Connecting details for O-ring sealing



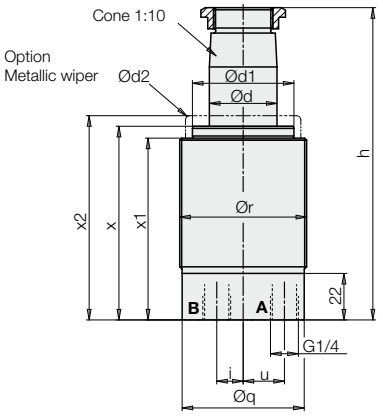
O-rings 8 x 1.5
included in our delivery
(Spare part 3000343)

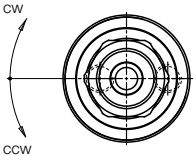


Threaded-body version with pipe thread G 1/4



**(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

Swing clamps		**18X3**			**18X5**			**18X6**			**18X7**		
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**
90°	**18XXX0X**
60°	**18XXX2X**
45°	**18XXX3X**
With metallic wiper**	**189XXXXM** (see also page 6)

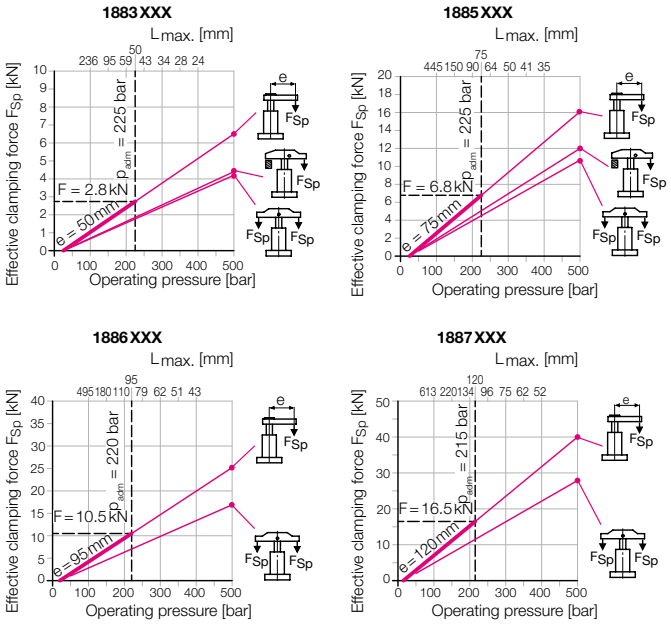
Without swing angle (0°)	**Key**
Flange with G1/4	**18XX24X**
Threaded-body type	**18XX44X**
Flange with O-ring sealing	**18XX64X**

* only single acting
** only double acting
*** with clamping arm assembly 0354004 +3 mm
**** Upper edge nut
***** without/with metallic wiper

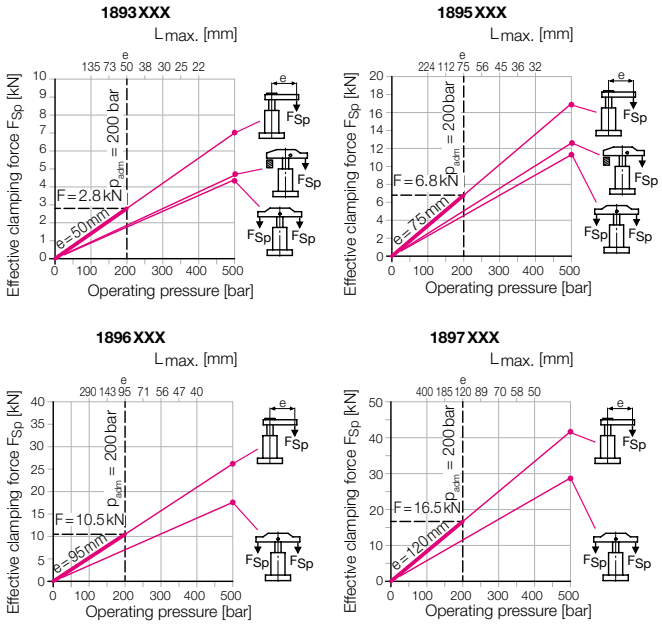
Available on request: • Other swing angles, • FKM seals, • Without overload protection

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

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

Admissible clamping force *

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

Admissible operating pressure

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

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 1885 104
Accessory clamping arm e = 75 mm
Desired special length L = 150 mm

1. Admissible clamping force

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

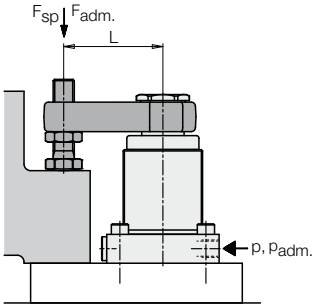
2. Admissible operating pressure

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

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 Lmax 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

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

Admissible clamping force*

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

Admissible operating pressure

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

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 1895 104
Accessory clamping arm e = 75 mm
Desired special length L = 150 mm

1. Admissible clamping force

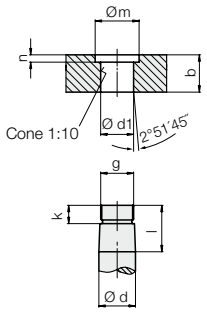
$$F_{adm} = \frac{C}{L} = \frac{510}{150} = 3.4 \text{ kN}$$

2. Admissible operating pressure

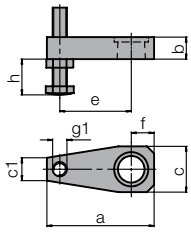
$$p_{adm} = \frac{D}{L} + E = \frac{11273}{150} + 49.7 = 125 \text{ bar}$$

Accessory - Clamping Arm
Admissible flow rate • Calculation

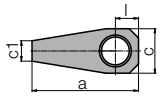
Dimensions for special clamping arms



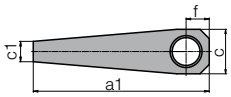
Clamping arm with contact bolt (200 bar)



Clamping arm without thread g1



Clamping arm blank



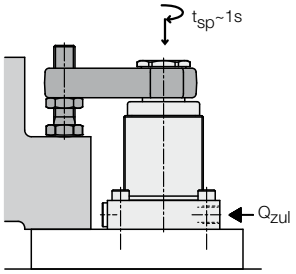
Swing clamps		**18X3**	**18X5**	**18X6**	**18X7**
a	[mm]	75	115	140	178
a1	[mm]	125	190	235	298
b	[mm]	16	23	28	34
c	[mm]	32	48	60	78
c1	[mm]	16	22	28	40
Ø d f7	[mm]	20	32	40	50
Ø d1 +0.05	[mm]	19.85	31.85	39.85	49.85
e	[mm]	50	75	95	120
f	[mm]	16	25	30	40
g	[mm]	M18x1.5	M28x1.5	M35x1.5	M45x1.5
g1	[mm]	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
Ø m	[mm]	24	34	46	56
n	[mm]	4	5	5	6

Part no. Clamping arm					
with contact bolt		**0354001**	**0354003**	**0354042**	**0354005**
Weight, approx.	[kg]	0.26	0.8	1.3	2.7
Moment of inertia of J_e	[kg·m²]	0.00032	0.002295	0.005212	0.017184
without thread g1		**3921016**	**3921017**	**3921021**	**3921018**
Weight, approx.	[kg]	0.18	0.65	1.85	2.3
Moment of inertia	[kg·m²]	0.00018	0.00134	0.00387	0.01294
Blank		**3548901**	**3548902**	**3548903**	**3548904**
Weight, approx.	[kg]	0.36	1.15	2.1	4.4
Moment of inertia	[kg·m²]	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:

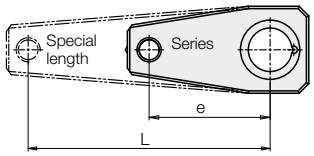
$$Q_L = Q_e * \sqrt{\frac{J_e}{J_L}} \text{ cm}^3/\text{s}$$

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

***** Only for vertical mounting position!

Simplified calculation

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



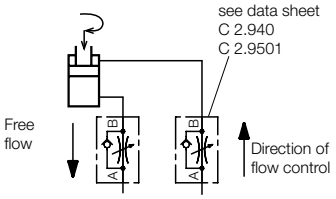
By means of the opposite diagram, the admissible flow rate can be determined, as the following example shows:

Swing clamp 1895104
Special length L = 150 mm
As per chart above e = 75 mm
(as per chart on page 3) Q_{adm} = 10 cm³/s

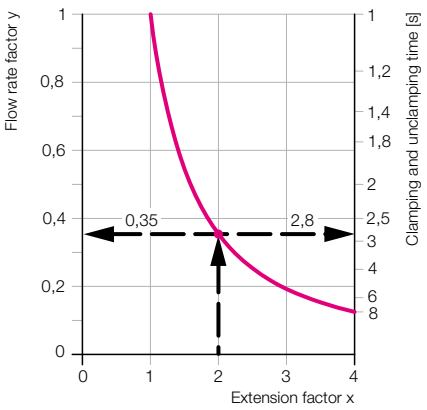
1. Extension factor $x = \frac{L}{e} = \frac{150 \text{ mm}}{75 \text{ mm}} = 2$
2. Flow rate factor as per diagram → y = 0.35
3. Max. flow rate $Q_L = y * Q_{adm} = 0.35 * 10 \text{ cm}^3/\text{s} = 3.5 \text{ cm}^3/\text{s}$
4. Min. clamping time as per diagram → approx. 2.8 s

Throttling of the flow rate

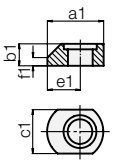
A flow rate throttling always has to be effected in the supply line to the swing clamp. This avoids a pressure intensification and thereby pressures exceeding 500 bar.



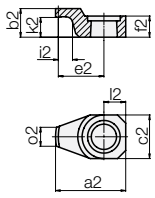
Adm. flow rate and clamping time as a function of the clamping arm extension



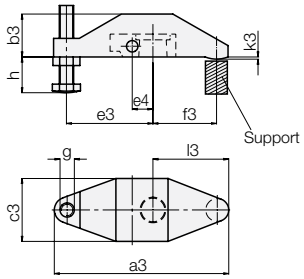
Clamping arm short
42CrMo4, max. 500 bar



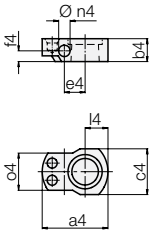
Cranked clamping arm
42CrMo4, max. 300 bar



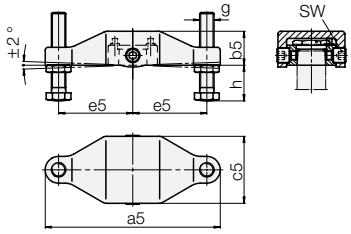
Clamping arm assembly complete with carrier
GGG 40, max. 500 bar



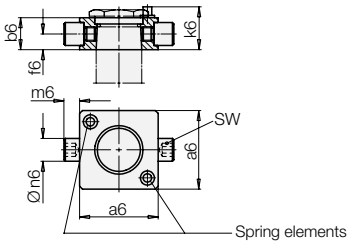
Carrier for clamping arm assembly
42CrMo4



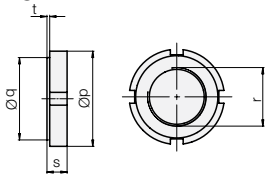
Double clamping arm complete with carrier
GGG 40, max. 500 bar



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
Ø n4 H7	[mm]	8	10	12	14
Ø n6 g6	[mm]	10	16	18	20
o2	[mm]	14	25	39	39
o4	[mm]	26	32	44.5	56
Ø p	[mm]	68	90	115	130
Ø q –0.2	[mm]	52	68	90	100
r	[mm]	M45 x 1.5	M60 x 1.5	M80 x 2	M90 x 2
s	[mm]	12	13	16	16
t	[mm]	3	4	5	5
SW	[mm]	5	8	8	8
Part no.					
Clamping arm short		**3548159**	**3548165**	**3548304**	**3548163**
Weight, approx.	[kg]	0.05	0.23	0.5	0.88
Cranked clamping arm		**3548238**	**3548236**	**3548301**	**3548302**
Weight, approx.	[kg]	0.11	0.3	0.84	1.3
Clamping arm assembly complete		**0354000**	**0354002**		
Weight, approx.	[kg]	0.66	1.7		
Carrier for clamping arm assembly		**3542093**	**3542094**	**3542132**	**3542096**
Weight, approx.	[kg]	0.08	0.18	0.5	0.7
Double clamping arm		**0354131**	**0354132**	**0354133**	**0354134**
Weight, approx.	[kg]	0.9	2	3	5.3
Carrier for double clamping arm*		**0354141**	**0354142**	**0354143**	**0354144**
Weight, approx.	[kg]	0.21	0.46	0.67	1.4
Flanged nut		**3527020**	**3527021**	**3527049**	**3527022**
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.

Swing Clamps with Reinforced Swing Mechanism

bottom flange, position monitoring optional, double acting, max. operating pressure 500 bar

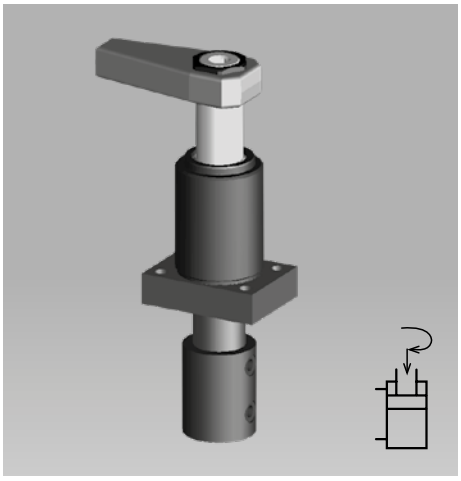


Figure with position monitoring

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. Due to the sturdy swing mechanism and the extended switch rod they are particularly suited for

- Clamping fixtures with workpiece loading via handling systems
- Transfer lines
- Test systems for motors, gears, axes, etc.
- Automatic manufacturing systems
- Assembly lines

Description

This line is a further development of the proved ROEMHELD swing clamps with the aim to improve process safety in linked clamping systems. The most important data are as follows:

1. Omission of the overload protection device
In the case of a slight collision with the clamping arm during loading and unloading of the fixture, the angular position of the clamping arm will be maintained. Less critical are the weight of the clamping arm or an increased swing speed.

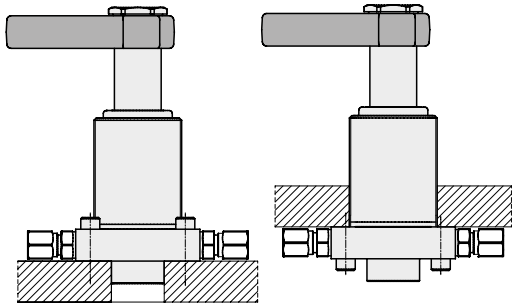
2. Reinforced swing mechanism
The reinforced swing mechanism endures a collision of the clamping arm with the workpiece during clamping up to a pressure of 100 bar.

3. FKM wiper
This wiper has a high chemical resistance when using aggressive cutting fluids

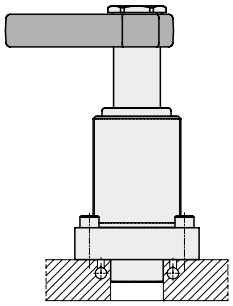
4. Further types of bodies
Flange at the top: data sheet B 1.8801
Threaded-body type: data sheet B 1.8921

Connecting possibilities

Pipe thread

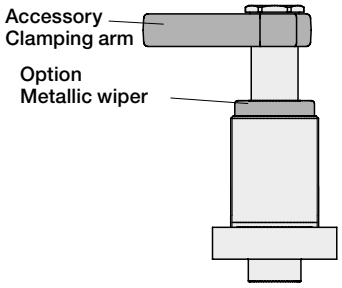


Drilled channels

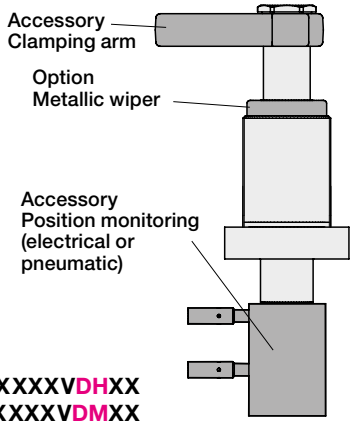


Versions

DH, DM: without switch rod



MH, MM: with switch rod



Part numbers

Without switch rod, without metallic wiper:	**189XXXXVDHXX**
Without switch rod, with metallic wiper:	**189XXXXVDMXX**
With switch rod, without metallic wiper:	**189XXXXVMHXX**
With switch rod, with metallic wiper:	**189XXXXVMMXX**

Options

Switch rod for position monitoring

The helix rod protrudes through the cover and allows thereby a pneumatic or electrical control of the piston position outside the swarf area.
As an accessory a pneumatic position monitoring is available; the brass control slide being displaced in a stainless housing. The slide opens and closes bore holes, so that a pressure switch or a differential pressure switch can signal the position "Clamped" and "Unclamped".
It is also possible to realise this monitoring directly in the fixture body by means of drilled channels. An electrical position monitoring with inductive proximity switches is also available (see page 2).

Metallic wiper

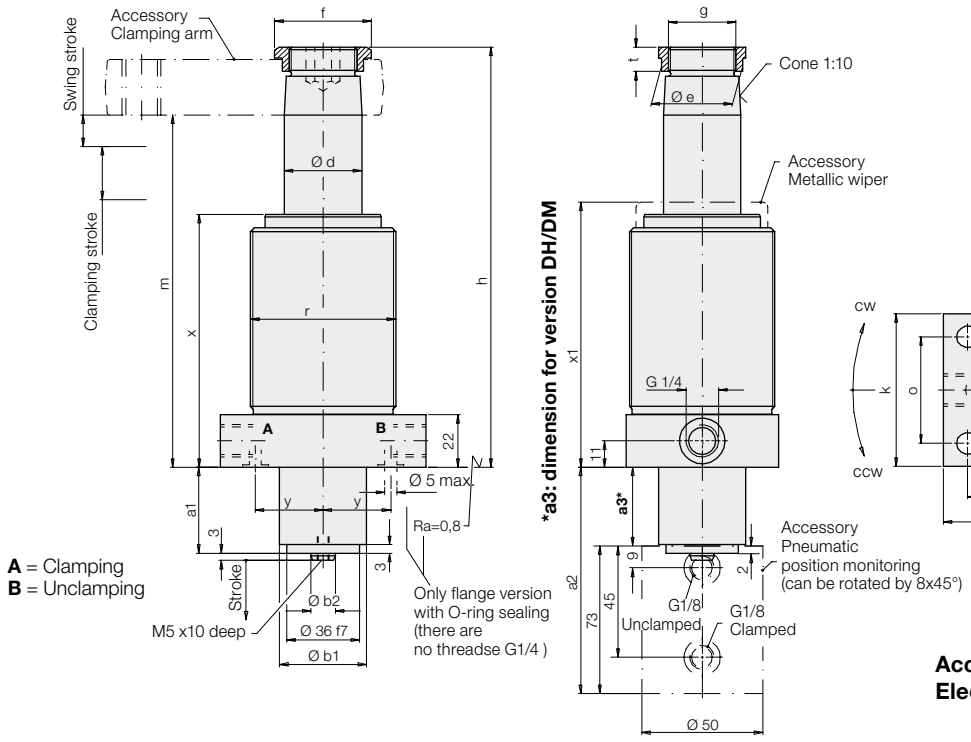
This wiper protects the FKM wiper against mechanical damage, e.g. by hot swarf. The swing clamp body is prepared for mounting of the metallic wiper. The wiper consists of a radially floating wiping disk and a retaining disk which will be pressed onto the existing collar.

Metallic wiper optional

Important notes

Due to the missing overload protection device, assembly and disassembly of the clamping arm has to be made carefully despite the reinforced swing mechanism. When tightening and untightening the fixing nut, the clamping arm or the hexagon socket in the piston has to be backed up. It is recommended to effect tightening and untightening in the swivel area. Frequent collisions with the clamping arm in radial direction have to be avoided.
For interpretation of the pneumatic pressure we recommend to use a differential switch.
Parallel connection for up to 8 swing clamps is possible. For a greater number there are special solutions. Please contact us.

Further important notes see data sheet B 1.881.

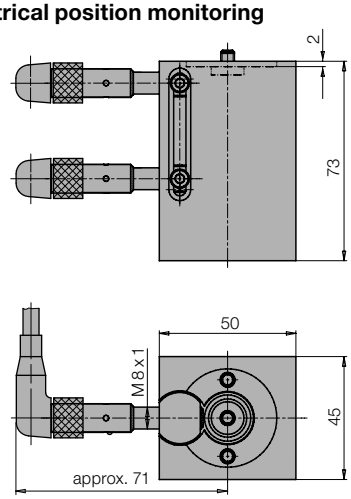


Clamping stroke	[mm]	22	20	20
Swing stroke	[mm]	13	16	18
Total stroke	[mm]	35	36	38
Operating pressure, min.	[bar]	30	30	30
Max. oil flow rate	[cm³/s]	20	36	55
Oil volume/stroke	[cm³]	15.8	25.4	43.8
Oil volume/return stroke	[cm³]	41.2	66.6	114.2
a1	[mm]	35.5	38	41
a2	[mm]	106.5	109	112
a3*	[mm]	25.5	25	16
Ø b1 –0.1	[mm]	36	45	45
Ø b2 f7	[mm]	10	12	12
Ø d	[mm]	32	40	50
Ø e	[mm]	33.5	45	55.5
f	[mm]	40	55	68
g	[mm]	M28x1.5	M35x1.5	M45x1.5
h	[mm]	173.5	192	209
k	[mm]	63	80	90
l	[mm]	85	100	115
m –1	[mm]	145.5	158	169
o	[mm]	44	60	68
Ø p	[mm]	8.5	13.5	16
r	[mm]	M60x1.5	M80x2	M90x2
s	[mm]	65	80	90
t	[mm]	10	11	12
x	[mm]	103.5	113	124
x1	[mm]	108.5	118	129
y	[mm]	28	31	37.5
SW	[mm]	12	17	17
Part no. flange type				
Swing direction 90° cw		**1895108VXX35**	**1896108VXX36**	**1897108VXX38**
Swing direction 90° ccw		**1895208VXX35**	**1896208VXX36**	**1897208VXX38**
0 degree		**1895248VXX35**	**1896248VXX36**	**1897248VXX38**
Part no. flange type for manifold mounting with O-ring sealing				
Swing direction 90° cw		**1895508VXX35**	**1896508VXX36**	**1897508VXX38**
Swing direction 90° ccw		**1895608VXX35**	**1896608VXX36**	**1897608VXX38**
0 degree		**1895648VXX35**	**1896648VXX36**	**1897648VXX38**

XX: Version **DH/DM = without/with metallic wiper without switch rod**
MH/MM = without/with metallic wiper with switch rod

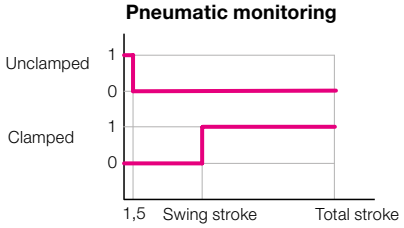
Accessories			
Pneumatic position monitoring, complete	**0353808**	**0353809**	**0353810**
Electrical position monitoring			
– without switch	**0353815**	**0353813**	**0353813**
– with standard switch and angle plug	**0353814**	**0353811**	**0353811**
Metallic wiper, complete (spare part)	**0341100**	**0341101**	**0341102**

Accessory:
Electrical position monitoring



Function charts

Pneumatic monitoring



1 = Closed
0 = Passage

Electrical monitoring

Code number for available swing angles

Swing angle (±1°)	Part no.
90°	**189XX0XVXXXX**
60°	**189XX2XVXXXX**
45°	**189XX3XVXXXX**

Clamping force diagrams and other accessories: see data sheet B 1.881. Further proximity switches: see data sheet B 1.552.

Swing Clamps with Reinforced Swing Mechanism

bottom flange, position monitoring optional, pendulum eye/fork head, max. operating pressure 500/160 bar

Advantages

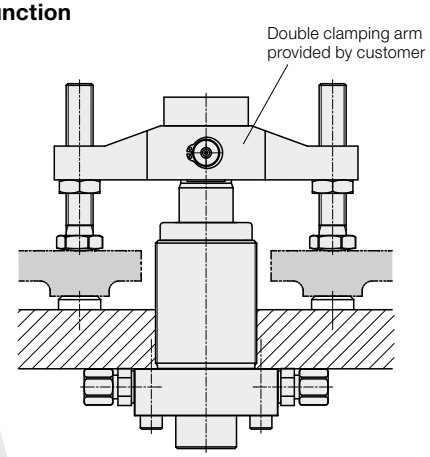
- Introduction of clamping force without side loads
- Compact design
- Double clamping arm facilitates multiple clamping of similar workpieces
- Pendulum eye for high clamping forces
- Fork head for simple clamping arms
- Alternatively pipe thread or drilled channels
- Reinforced swing mechanism
- FKM wiper standard
- Available with position monitoring

Connecting possibilities

- Pipe thread
- Drilled channels

Metallic wiper optional

Function



Application

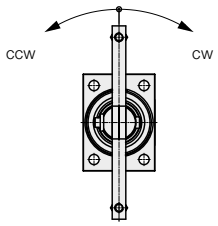
Hydraulic swing clamps are used for clamping of workpieces, when it is essential to keep the clamping area free of straps and clamping components for unrestricted workpiece loading and unloading.
The version with pendulum eye or fork head allows simultaneous clamping of two workpieces with half clamping force.

Function

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

Direction of rotation

The swing clamps are available with clockwise or counterclockwise swing motion.
Off-position is the extended piston position.



Process safety

To improve the process safety when using heavy double clamping arms the swing mechanism has been reinforced and an overload protection device has not been realised.
During clamping the reinforced swing mechanism endures a collision of the clamping arm with the workpiece up to a pressure of 100 bar.
All versions are also available with a switch rod at the cylinder bottom. The control cams are mounted at this rod to control the clamping and unclamping position with limit switches or pneumatically.
Adaptable position monitorings for inductive or pneumatic control are available as accessory (page 4).

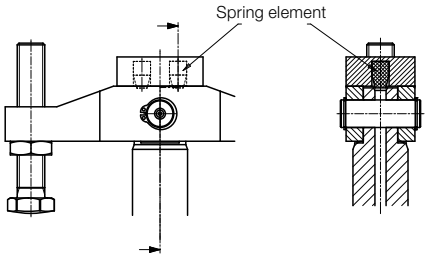
Description

The piston end of this swing clamp is designed as pendulum eye or fork head. By means of a double clamping arm 2 workpieces can be clamped at the same time.

For both versions a springy element is required in order to maintain the double clamping arm in the unclamped position in horizontal position.

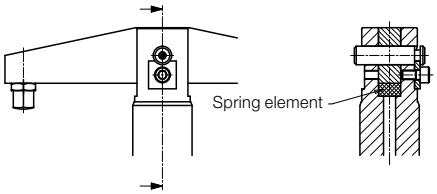
Pendulum eye

The sturdy pendulum eye can transmit high clamping forces up to a max. operating pressure of 500 bar. The double clamping arm has to be dimensioned according to the load.



Fork head

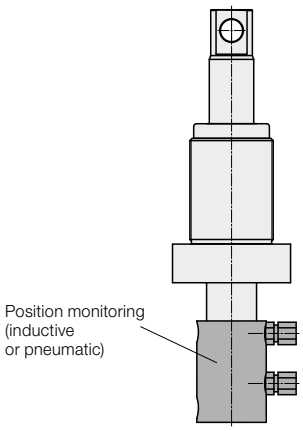
The fork head allows a max. operating pressure of 160 bar. Advantageous is the fact that relatively simple clamping arms can be manufactured from flat materials.



Option: metal wiper

The optionally availabe metallic wiper protects the FKM wiper against mechanical damage due to big or hot swarfs.

Swing clamp with optional position monitoring (accessory)



Important notes

Danger of injury

Hydraulic clamping elements generate high clamping forces. Considerable injuries can be caused to fingers in the effective area of the double clamping arm.
Remedy: mount protection devices.

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

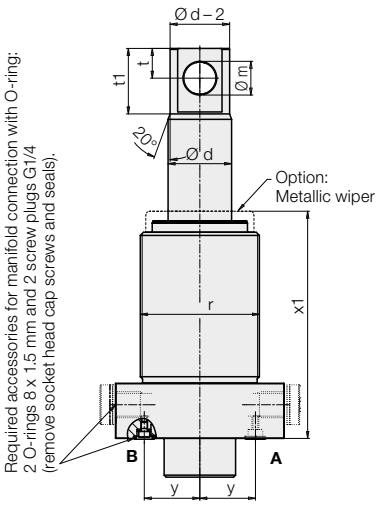
Clamping arm

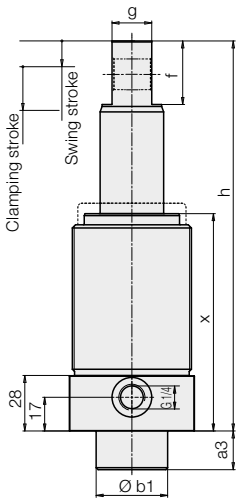
Due to the missing overload protection device a collision with the clamping arm during loading and unloading of the fixture must be avoided.
Remedy: mount position adaptor.

The double clamping arm in clamping position should preferably be at right angles to the piston axis to avoid overload of the spring element. Both contact bolts must only contact the workpiece after completion of the swing stroke.
Please consider: 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 3.

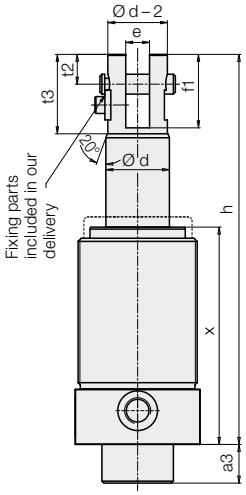
Dimensions
Part no.

Pendulum eye 189X137X (500 bar)
without switch rod



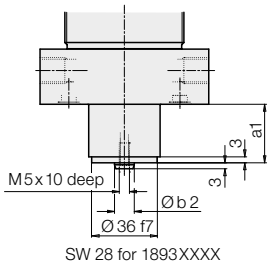


Fork head 189X157X (160 bar)

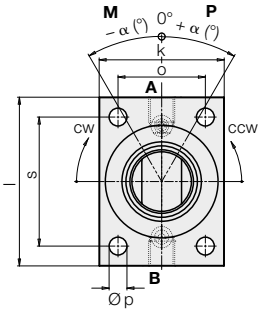


A = Clamping
B = Unclamping

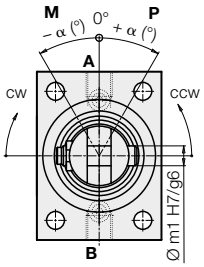
With switch rod 189X1X6X



Off-position

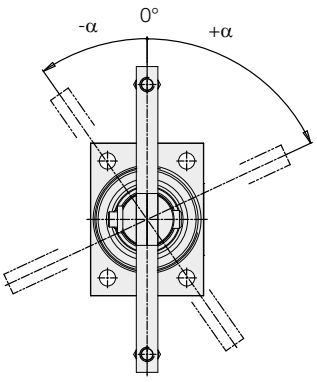


Off-position



Accessory: position monitoring see page 4.

Off-position
(unclamped extended position)
The fixing of the clamping arm with pendulum eye or fork head does not allow an adjustment of the off-position as possible in case of cone fixation. Therefore the desired off-position has to be indicated when placing the order. The angle α can be selected in steps of 5°.



Part no.

1 8 9 X 1 X X X X X X X

M = Metalic wiper, mounted

Angle a for off-position
00 up to 90: 0° up to max. 90°
(graduation of 5°)

P (Plus) = + α
M (Minus) = – α
0 = α = 0°
see dimensional drawing

Piston rod Ø d
3 = 20 mm
5 = 32 mm

3 = Pendulum eye
5 = Fork head

6 = with switch rod
7 = without switch rod

Swing angle ± 1°
0 = 90° clockwise swing motion
1 = 90° counterclockwise swing motion
2 = 75° clockwise swing motion
3 = 75° counterclockwise swing motion
4 = 60° clockwise swing motion
5 = 60° counterclockwise swing motion
6 = 45° clockwise swing motion
7 = 45° counterclockwise swing motion
8 = 30° clockwise swing motion
9 = 30° counterclockwise swing motion

1. Example of ordering
Piston rod diameter = 20 mm,
pendulum eye,
without switch rod,
swing angle 90° clockwise,
off-position 0°,
metallic wiper mounted
Part no.: 1893 1370 000M

2. Example of ordering
Piston rod diameter = 32 mm,
fork head,
with switch rod,
swing angle 60° counterclockwise,
off-position –30 °,
metallic wiper mounted
Part no.: 1895 1565 M30M

		1893	1895
Clamping stroke	[mm]	25	22
Swing stroke	[mm]	9	13
Total stroke	[mm]	34	35
Operating pressure, min.	[bar]	30	30
Adm. flow rate for moment of inertia	[cm³/s] [kgm²]	8 0.00032	20 0.002295
Effective piston area			
Clamping	[cm²]	1.76	4.52
Unclamping	[cm²]	4.9	12.56
Oil volume/stroke	[cm³]	6	15.8
Oil to return	[cm³]	16.7	44
a1	[mm]	10	29.5
a3	[mm]	-	19.5
Ø b1 –0.1	[mm]	-	36
Ø b2 f7	[mm]	10	10
Ø d	[mm]	20	32
e +0.1	[mm]	8	12
f	[mm]	20	32
f1	[mm]	26	37
g f7	[mm]	12	20
h	[mm]	188.5	196.5
k	[mm]	45	63
l	[mm]	90	85
Ø m H7	[mm]	10	16
Ø m1 H7	[mm]	6	10
o	[mm]	30	44
Ø p	[mm]	6.5	9
r	[mm]	M45x1.5	M60x1.5
s	[mm]	50	65
t	[mm]	9	15
t1	[mm]	21	33
t2	[mm]	10	15
t3	[mm]	29	40
x	[mm]	115.5	109.5
x1	[mm]	120.5	114.5
y	[mm]	29.5	28
Accessories			
Metallic wiper, complete (customer assembly)		**0341107**	**0341100**
O-Ring 8x1.5		**3000343**	**3000343**
Screw plug G 1/4		**3610264**	**3610264**

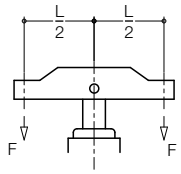
Admissible flow rate

The admissible flow rate indicated in the chart applies to the use of double clamping arms whose moment of inertia does not exceed the chart value.
The clamping time is thus approx. 0.8 seconds and the unclamping time approx. 2 seconds.
For new clamping arms with a different moment of inertia, the admissible flow rate can be calculated using the following formula:

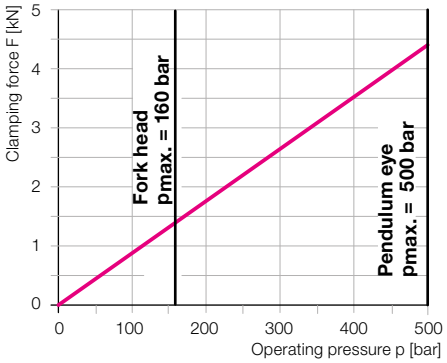
$$Q_2 = Q_1 \times \sqrt{\frac{J_1}{J_2}} \quad [cm^3/s]$$

Q_1 = Adm. flow rate (chart value)
Q_2 = Adm. flow rate with the moment of inertia of the new clamping arm J2
J_1 = Moment of inertia (chart value)
J_2 = Moment of inertia of the new clamping arm

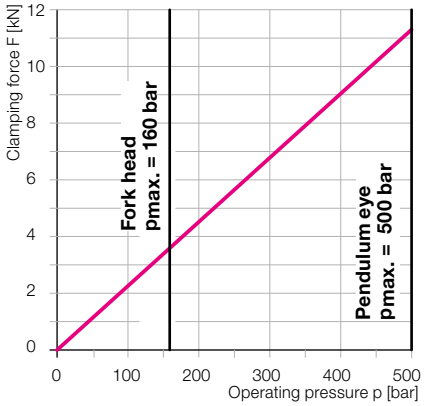
Clamping force F as a function of the operating pressure p



1893 1XXXX

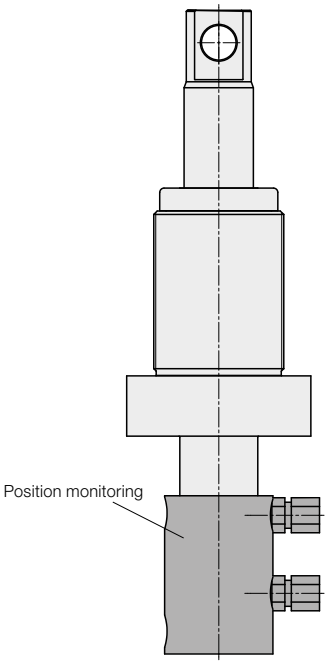


1895 1XXXX

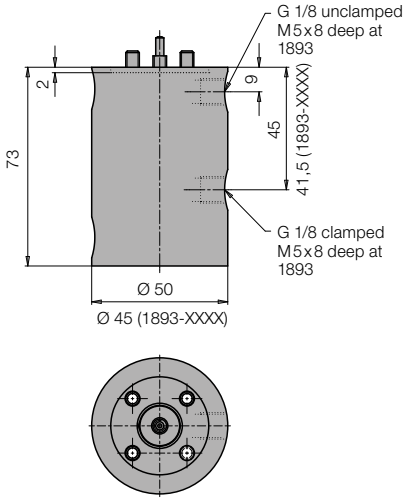


Delivery

The position monitorings are not delivered mounted at the swing clamp.
Fixing screws and signal sleeve are included in the delivery.
Electrical position monitorings are delivered with 2 inductive proximity switches and 2 right angle plugs.
The housings can be mounted rotated by 2x180° (1893) or 8x45°.

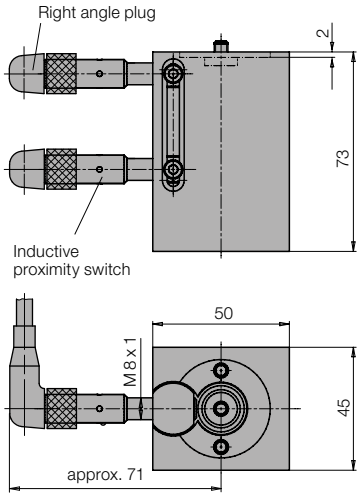


Pneumatic position monitoring



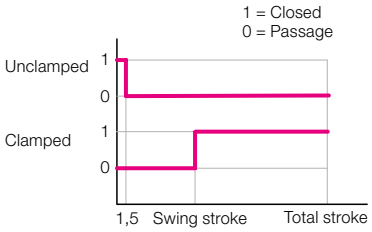
	for 1893	for 1895
Part no.	**0353867**	**0353808**

Electrical position monitoring

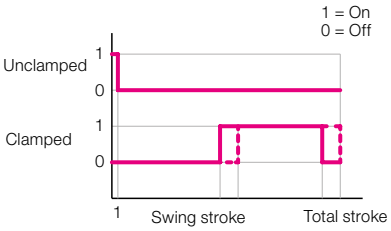


	for 1893	for 1895
Part no.	**0353868**	**0353814**

Function chart



Function chart



Technical data for proximity switches

Voltage	10…30 V DC
Residual ripple max.	15 %
Constant current max.	200 mA
Switching function	interlock
Output	PNP
Body material	stainless steel
Code class	IP 67
Environmental temperature	–25…+70 °C
Connection	Plug
Length of cable	5 m
LED function display	Yes
Protected against short circuits	Yes

Swing Clamps with Overload Protection Device
block type, double acting, max. operating pressure 500 bar

Application
These swing clamps are used when it is required to keep the fixture workpiece area free of straps and clamping components for unrestricted workpiece loading and unloading.

Function
This hydraulic clamping element is a pull-type cylinder, where a part of the total stroke is used to swing the piston (swing stroke).
The larger part of the stroke is available as clamping stroke.

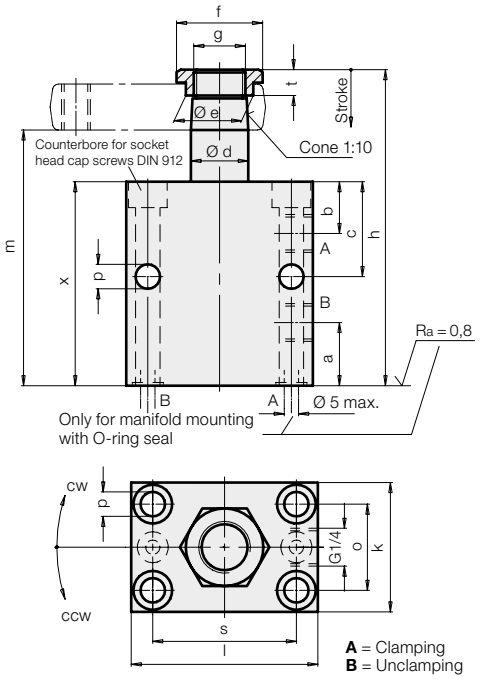
Versions
The units are available in three standard sizes, optionally with clockwise or counterclockwise swing motion, and for each size three versions of standard clamping arms are available (see accessories, page 2).
Mounting of these clamping arms at any angle with 360°.
Standard swing angles of rotation are 45°, 60°, and 90° ±2°. Other variants, as e.g. versions with metallic wiper on request.
All units are equipped with piston rod wipers.
These double-acting swing clamps are also available in versions with minimum leakage rate. Please contact us!

Danger of injury
Hydraulic clamping elements can generate considerable forces.
Due to the 90° swing motion, the exact clamping and unclamping position cannot be determined in advance. Considerable injuries can be caused by squashing one's fingers in the effective area of the clamping arm.
Remedy: protection device with electrical locking.

Materials
By nitrating piston and housing, wear is reduced and protection against corrosion increased.
Piston material and cylinder body: High alloy steel.

Overload protection device
An integrated mechanical overload protection device prevents damage to the swivel mechanism when striking an object within 90° rotation, clamping or unclamping alike.

Important notes
For manifold mounting without ports G 1/4 and the both cross holes Ø p.
Operating conditions, tolerances and other data see data sheet A 0.100.



Total stroke	[mm]	14	16	20
Swing stroke	[mm]	7	8	9
Clamping stroke	[mm]	7	8	11
Operating pressure	[bar]	30	30	30
Max. oil flow rate*	[cm³/s]	3.2	10	27.7
Oil volume / stroke	[cm³]	2.5	7.3	23
Oil volume / return stroke	[cm³]	6.8	20	62
a	[mm]	22	25	26
b	[mm]	18	24	30
c	[mm]	33	40	50
Ø d	[mm]	20	32	50
Ø e	[mm]	23.5	33.5	55.5
f	[mm]	30	40	68
g	[mm]	M18x1.5	M28x1.5	M45x1.5
h	[mm]	110	139	174
k	[mm]	45	63	95
l	[mm]	65	85	125
m	[mm]	89	111	134
o	[mm]	30	40	65
p	[mm]	8.5	10.5	17
s	[mm]	50	63	95
t	[mm]	9	10	12
x	[mm]	71	91	110
Weight	[kg]	1.5	3.4	7.2
Swing direction cw	**Part no.**	**1893106**	**1895106**	**1897106**
Swing direction ccw	**Part no.**	**1893206**	**1895206**	**1897206**
0-degree	**Part no.**	**1893246**	**1895246**	**1897246**
Type for manifold mounting with O-ring seal				
Swing direction cw	**Part no.**	**1893506**	**1895506**	**1897506**
Swing direction ccw	**Part no.**	**1893606**	**1895606**	**1897606**
0-degree	**Part no.**	**1893646**	**1895646**	**1897646**
Spare O-ring 8x1.5	**Part no.**	**3000343**		

FKM wiper standard

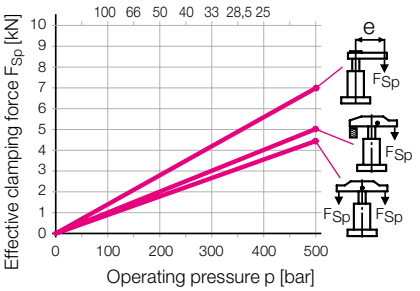
Code numbers for available swing angles

Swing angle	Part no.
90°	189XX**0**6
60°	189XX**2**6
45°	189XX**3**6

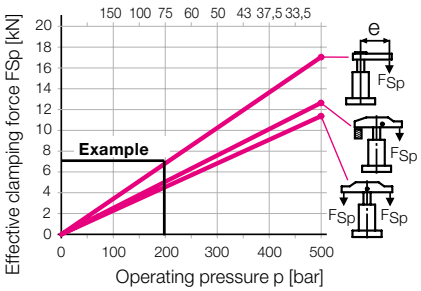
* The max. oil flow rate is valid for vertical mounting position in connection with standard clamping arms. In the case that other mounting positions and/or other clamping arms are used, the oil flow rate has to be reduced as necessary. A possibly required flow control **has to be** made by flow control valves in the clamping line as well as in the unclamping line (stroke/return stroke).

Effective clamping force F_{Sp} as a function of max. operating pressure p

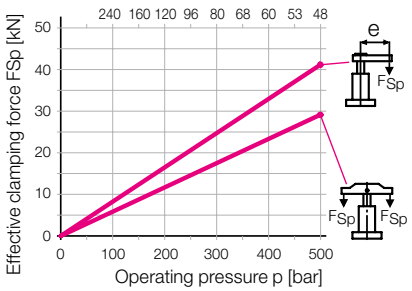
Double acting (1893X06)
Max. clamping arm length e [mm]



Double acting (1895X06)
Max. clamping arm length e [mm]

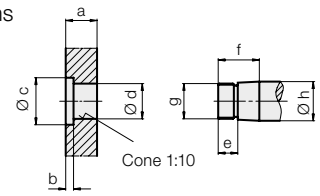


Double acting (1897X06)
Max. clamping arm length e [mm]



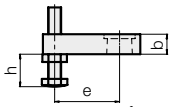
Example: 1895 106 An operating pressure p of 200 bar in connection with standard clamping arm 0354 003 of arm lenght L = 75 mm results in an effective clamping force FSp of 7 kN.

Dimensions for special clamping arms



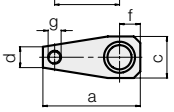
Swing clamp	a	b	Ø c	Ø d $^{+0.10}_{+0.05}$	e	f	g	Ø h_{f7}
1893XX6	16	4	24	19.8	10	21	M 18x1.5	20
1895XX6	23	5	34	31.8	12	28	M 28x1.5	32
1897XX6	34	6	56	49.8	13	40	M 45x1.5	50

Clamping arm assembly, complete max. 200 bar



with thread

Swing clamp	a	b	c	d	e	f	g	h max.	h min.	Weight [kg]	Part no.
1893XX6	75	16	32	16	50	16	M10	64	6	0.2	**0354001**
1895XX6	115	23	48	22	75	25	M16	79	9	0.7	**0354003**
1897XX6	178	34	78	40	120	40	M20	98	12	2.55	**0354005**

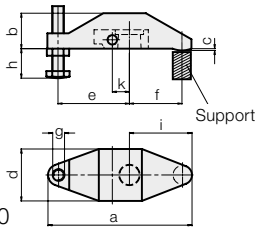


without thread

Swing clamp	a	b	c	d	f	Weight [kg]	Part no.
1893XX6	75	16	32	16	16	0.18	**3921016**
1895XX6	115	23	48	22	25	0.65	**3921017**
1897XX6	178	34	78	40	40	2.3	**3921018**

Material: 42CrMo4

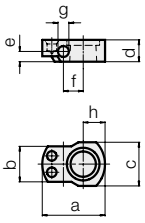
Clamping strap assembly, complete, with carrier, max. 500 bar



Swing clamp	a	b	c	d	e	f	g	h max.	h min.	i	k	Weight [kg]	Part no.
1893XX6	122	30	1.5	44	60	45	M10	64	6	53	14.5	0.57	**0354000**
1895XX6	185	45	2	58.5	83	75	M16	79	9	87	21	1.58	**0354002**

Material: GGG-40

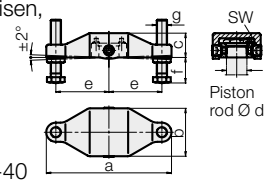
Carrier for special clamping strap



Swing clamp	a	b	c	d	e	f	g^{H7}	h	Weight [kg]	Part no.
1893XX6	46	26	32	16	7.5	14.5	8	16	0.08	**3542093**
1895XX6	59	32	40	23	13	21	10	22	0.16	**3542094**
1897XX6	90	56	68	34	21	33	14	36	0.65	**3542096**

Material: 42CrMo4

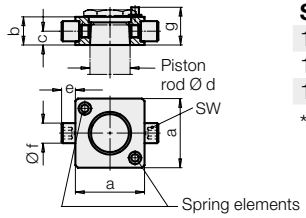
Doppelspanneisen, komplett, mit Träger, max. 500 bar



Swing clamp	a	b	c	Ø d	e	f min.	f max.	g	SW	Weight [kg]	Part no.
18X3XXX	138	59	28.5	20	60	10	64	M 10	5	0.83	**0354131**
18X5XXX	196	75	38	32	83	15	79	M 16	8	2.11	**0354132**
18X7XXX	236	105	56	50	100	19	98	M 20	8	5.24	**0354134**

Material: GGG-40

Double clamping arm assembly, complete, with carrier, max. 500 bar

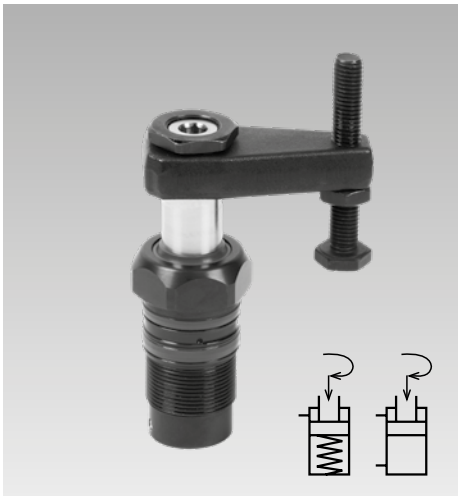


Swing clamp	$a^{\pm 0.1}$	b	c	Ø d	e	$Øf^{g6}$	g*	SW	Part no.
18X3XXX	43	16	7.5	20	9	10	21.5	5	**0354141**
18X5XXX	55	23	11	32	11	16	29	8	**0354142**
18X7XXX	77	34	17	50	15	20	41	8	**0354144**

* Stop surface for spring elements

Swing Clamps with Overload Protection Device

threaded-body type, single and double acting, max. operating pressure 500 bar



Application

These hydraulic swing clamps are used when it is required to keep the fixture workpieces area free of straps and clamping components for unrestricted workpiece loading and unloading.

Description

This design allows the use of swing clamps even in restricted places. The threaded-body swing clamp can be sunk directly into the fixture up to the hexagon. Oil feed through two holes, allowing for 3 fitting and hose connections:

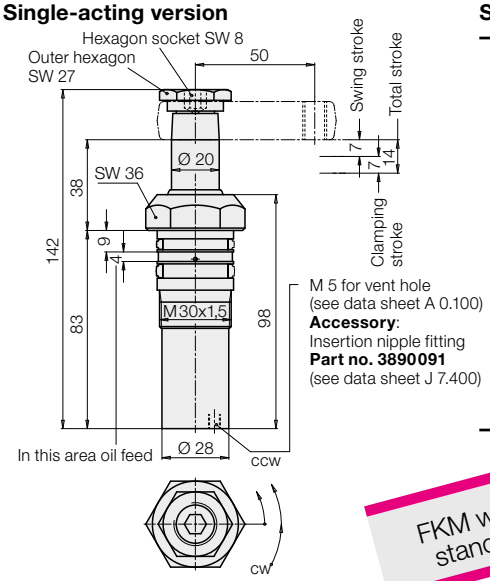
1. **Individual connection**
   With only one swing clamp being used, both connections can be tapped directly.
2. **Series connection**
   If several swing clamps arranged in a row are required, the arrangement and size of holes shown below must be complied with. Instead of the expander stopper also, of course, an G 1/4 plug **(Part no. 3610006)** may be used.
3. **Connecting housing**
   By means of the connecting housing available as an accessory, the swing clamps can be individually fixed with screws and piped (page 2)

Standard swing angles are 45°, 60°, and 90° ±2°. Mounting of the clamping arms can be made in any angular position.
All units are equipped with piston rod wipers and with an overload protection device which catches at every 180° angle. This is the initial position for the swing motion.

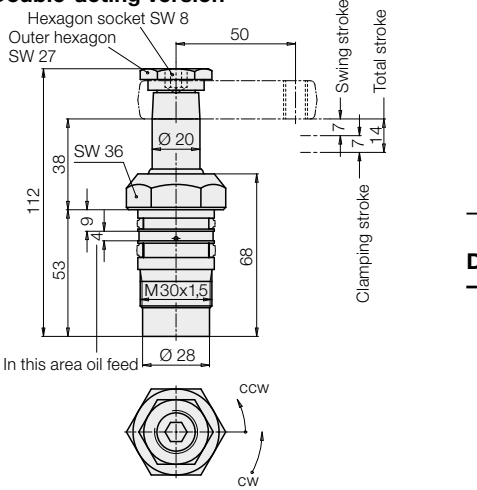
Important notes

Due to the screwed mounting, this initial position cannot be predetermined. Therefore, the clamping arm can only be fixed when the housing has been screwed in tight. The hexagon socket of the piston is used for counterholding when the clamping arm is tightened by means of the flanged nut.
Operating conditions, tolerances and other data see data sheet A 0.100.
When using single-acting swing clamps, it is absolutely necessary to follow the instructions for venting of the spring area on data sheet G 0.110.

Single-acting version



Double-acting version



Effective piston area	1.01 cm²
Piston area ratio	◊ 4,1
Swing stroke	7 mm
Clamping stroke	7 mm
Total stroke	14 mm
Oil volume / stroke	1.5 cm³
Oil volume / return stroke	6 cm³
Max. oil flo w rate*	1.5 cm³/s
Seating torque	60 Nm
Min. actuation pressure to swing	◊ 30 bar 50 bar
Single acting	**Part no.**
Swing direction 90° cw **	**1881102**
Swing direction 90° ccw**	**1881202**
0-degree	**1881242**
Double acting	**Part no.**
Swing direction 90° cw**	**1891101**
Swing direction 90° ccw**	**1891201**
0-degree	**1891241**
Seal kit, external seals	**0131530**

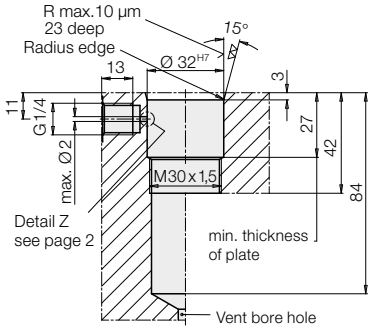
◊ valid for double-acting version

*** Max. oil flow rate**
In case of the maximum oil flow rate as per chart the shortest possible clamping time is 1 second. If the flow rate of the pump divided by the number of swing clamps is higher than the indicated value in the chart, the flow rate has to be throttled to avoid any overload and thereby high wear. Throttling has to be made in the oil supply line to the swing clamp to rule out a possible pressure intensification. Use only flow control valves which allow oil return from the swing clamp without any impediments.

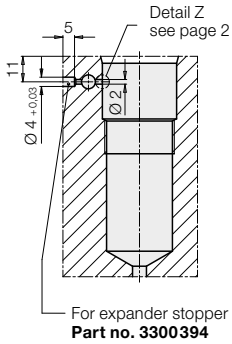
Mounting instructions, accessories and clamping force diagram see page 2

FKM wiper standard

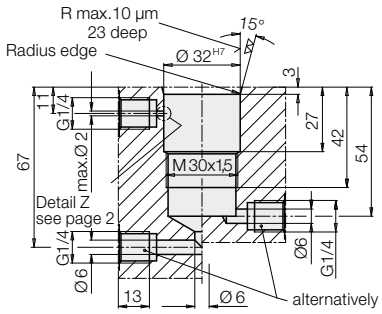
Single-acting version – Individual connection



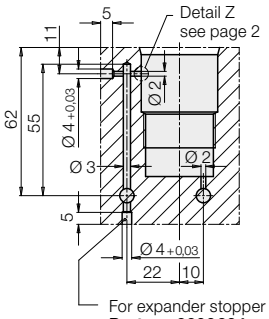
– Series connection



Double-acting version – Individual connection



– Series connection



Code numbers for available swing angles

** Swing angle	Part no.
90°	18X1 X**0**X
60°	18X1 X**2**X
45°	18X1 X**3**X

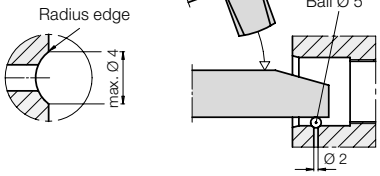
Mounting instructions

The screw-in thread must be cut with utmost care, especially in the area of the two joints. The round-off of the oil feed hole shown in detail “Z” is necessary or the lower O-ring will be damaged when screwed in. For this purpose there are two possibilities:

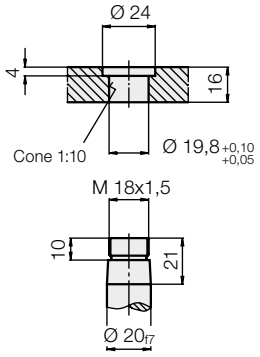
1. By means of a diameter 6 spherical grinder and a hand drill, the thread is deburred according to detail “Z”.
2. A diameter 5 steel ball is gauged with a light hammer blow as shown in the figure below.

A final check with a finger shows best whether the transitions are smooth and free of burrs.

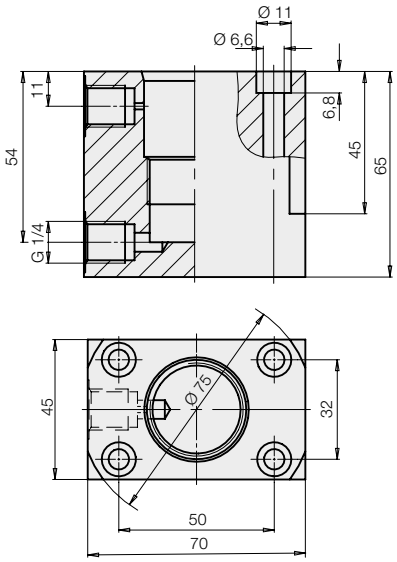
Detail “Z”



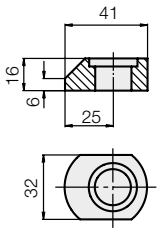
Strap attachment dimensions



Connecting housing
for double acting swing clamp
Part no. 3467143

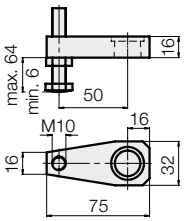


Clamping arm



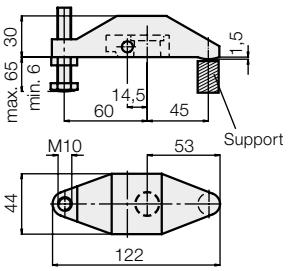
Weight [kg] 0.08
Part no. 3548159

Clamping arm, complete



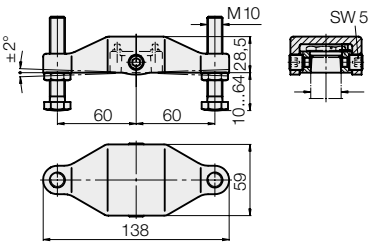
Weight [kg] 0.2
Part no. 0354001
Weight [kg] 0.18
Part no. 3921016
(without thread M 10)

Clamping strap, complete



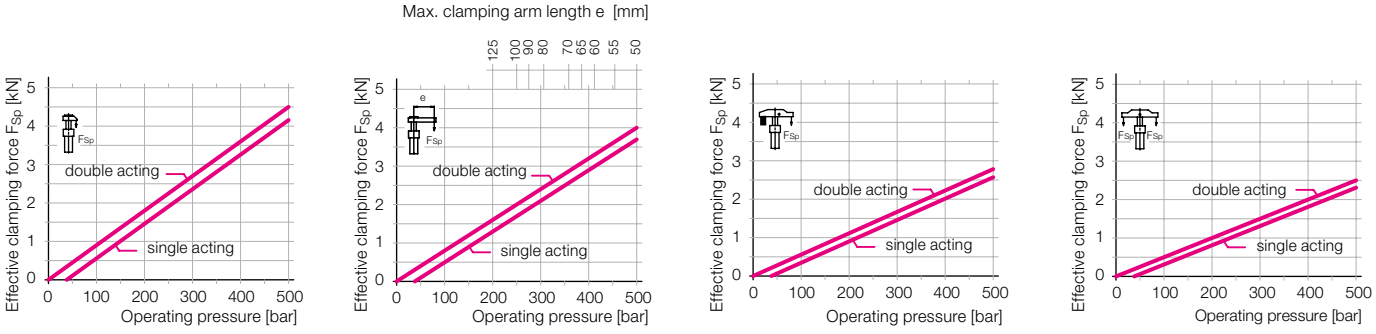
Weight [kg] 0.57
Part no. 0354000

Double clamping arm assembly, complete



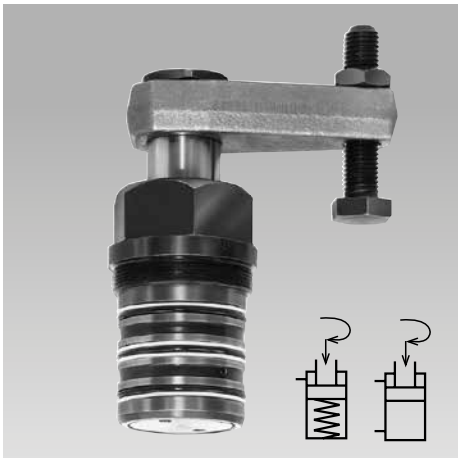
Weight [kg] 0.83
Part no. 0354131

Effective clamping force as a function of max. operating pressure p



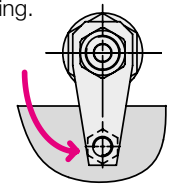
Swing Clamps with Overload Protection Device

threaded-body type, single and double acting, max. operating pressure 500 bar



Application

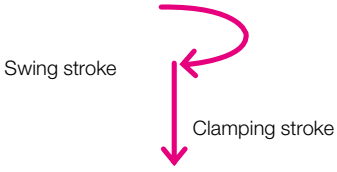
Hydraulic swing clamps are used for clamping of workpieces when it is essential to keep the clamping area free of straps and clamping components for unrestriced workpiece loading and unloading.



Clamping arms and strap type clamps are fastened to the piston rod by means of a taper shank and socket connection.

Function

This hydraulic clamping element is a pull-type cylinder where a part of the total stroke is used to swing the piston.



Overload protection devise

An integrated mechanical overload protection device prevents damage to the swing mechanism when striking an object within the 90° rotation, clamping or unclamping alike, or in case of incorrect mounting of the clamping arm.

Metallic wiper optional

Option metallic wiper

In addition to the FKM wiper all double-acting swing clamps can be equipped with a metallic wiper.
Part no.: Add only letter “M” to the part number of the swing clamp without metallic wiper.

Example of ordering:
Swing clamp 1893 101
with metallic wiper: **1893 101M**

Version

The units are available in three standard sizes, and for each size three versions of standard clamping arms are available (see accessories, page 4). Mounting of these clamping arms at any angle within 360°.
All units are equipped with piston rod wipers.

Materials

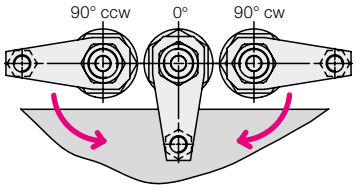
By nitrating piston and housing, wear is reduced and protection against corrosion increased.
Piston material: High alloy steel
Cylinder body: Free-cutting steel

Important notes

Operating conditions, tolerances and other data see data sheet A 0.100.
It is absolutely necessary to follow the instructions for venting of the spring area on data sheet G 0.110.

Swing direction

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

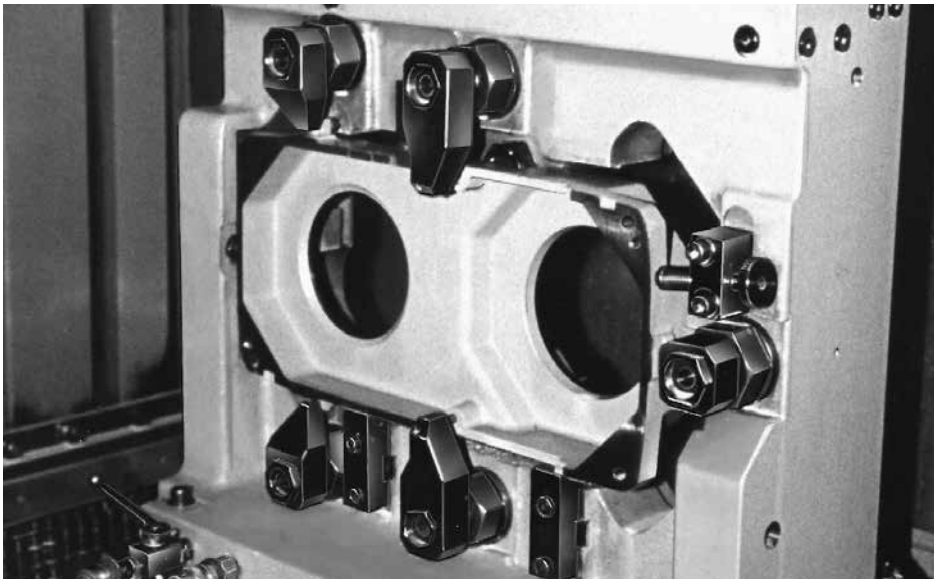


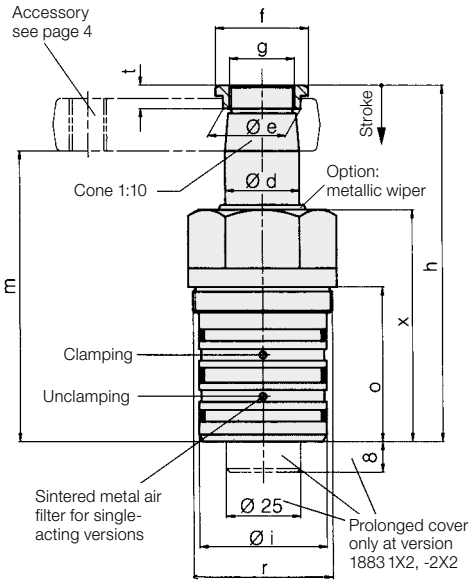
Standard swing angles are 45°, 60°, and 90° ±2°.
Special angles on request.
Other variants, as e.g. versions with metallic wiper on request.

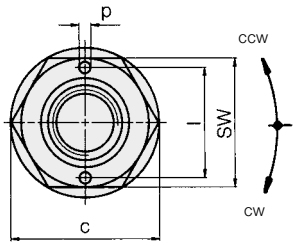
0°-Version

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

Application example

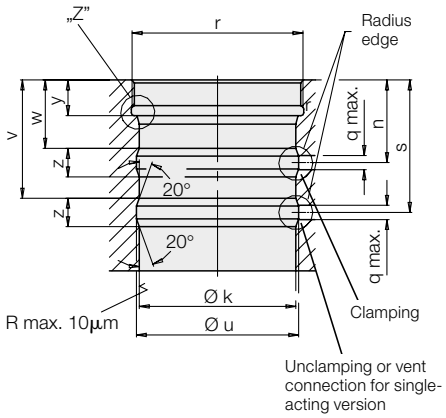


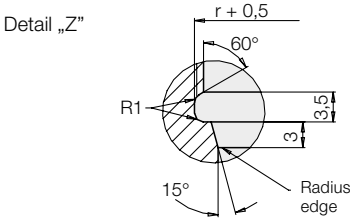




Oil volume / stroke	[cm³]	3.2	10.0	27.7
Oil volume / return stroke	[cm³]	8.8	27.7	74.8
Total stroke	[mm]	18	22	24
Swing stroke	[mm]	7	8	9
Clamping stroke	[mm]	11	14	15
Operating pressure to swing min.	[bar]	30	30	30
Max. oil flow rate*	[cm³/s]	3.2	10.0	27.7
c	[mm]	52	64	100
Ø d	[mm]	20	32	50
Ø e	[mm]	23.5	33.5	55.5
f	[mm]	30	40	68
g	[mm]	M 18 x 1.5	M 28 x 1.5	M 45 x 1.5
h	[mm]	112	152	182
Ø i f7	[mm]	42	55	85
Ø k H7	[mm]	42	55	85
l	[mm]	-	-	80
m	[mm]	91-1	124-1	142-1 (145-1)◊
n	[mm]	24	29	41
o	[mm]	53	66	96
Ø p/deep	[mm]	-	-	8/9
Ø q max.	[mm]	5	5	6
r	[mm]	M 45 x 1.5	M 60 x 1.5	M 90 x 2
s	[mm]	41	46.5	64
t	[mm]	9	10	12
Ø u	[mm]	44	57	87
v	[mm]	37	41.5	59
w	[mm]	20	24	36
x	[mm]	70	99	116
y	[mm]	10.5	12.5	20.5
z	[mm]	8	10	10
SW	[mm]	46	55	95

Manifold mounting hole





Part no., single acting		
Swing direction cw	**1883102**	**1885102**	**1887102**
Swing direction ccw	**1883202**	**1885202**	**1887202**
Part no., double acting		
Swing direction cw	**1893101**	**1895101**	**1897101**
Swing direction ccw	**1893201**	**1895201**	**1897201**
Seal kit for external seals	**0131524**	**0131526**	**0131528**

Other swing angles

Swing angle	Part no.
90°	18XXX**0**X
60°	18XXX**2**X
45°	18XXX**3**X
0°	18XX1**4**X

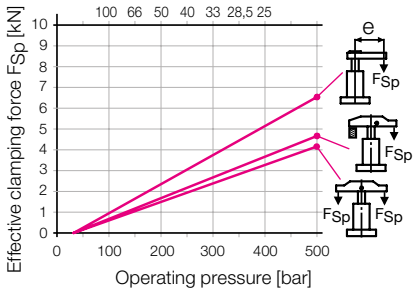
◊ (145-1) for clamping arm 0354004

***** See page 3:
Max. oil flow rate

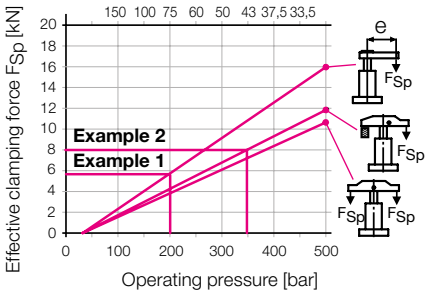
Option metallic wiper
for double-acting swing clamps
Partn no.: 189XXXXM

Effective clamping force F_{Sp} as function of operating pressure p

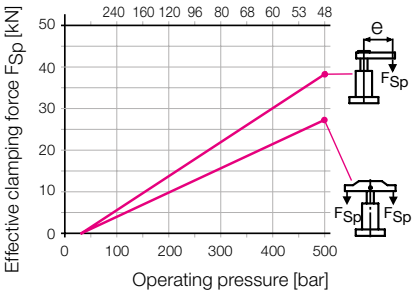
Size 1
Single acting (1883XXX)
Max. clamping arm length e [mm]



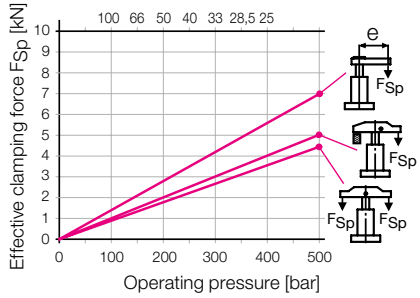
Size 2
Single acting (1885XXX)
Max. clamping arm length e [mm]



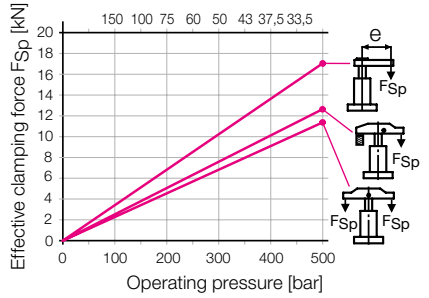
Size 3
Single acting (1887XXX)
Max. clamping arm length e [mm]



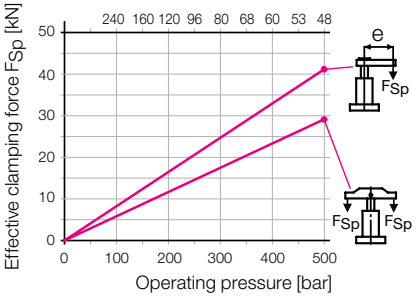
Double acting (1893XXX)
Max. clamping arm length e [mm]



Double acting (1895XXX)
Max. clamping arm length e [mm]



Double acting (1897XXX)
Max. clamping arm length e [mm]



Note:
The clamping force of single-acting swing clamps is reduced by the opposite-directed spring return force.
For this reason the clamping force is slightly lower than that of double-acting swing clamps.

Example 1: 1885 102 single acting.
An operating pressure p of 200 bar in connection with standard clamping arm 0354 003 of max. arm length L = 75 mm results in an effective clamping force F_{Sp} of 5.8 kN.

Example 2: 1885 102 single acting.
For a desired effective clamping force F_{Sp} of 8 kN and use of a swing clamp 1885 102 with a standard clamping strap 0354 002 an operating pressure p of 345 bar is required.

Important notes

1. Danger of injury
Hydraulic clamping elements can generate considerable forces.
Due to the 90° swing motion, the exact clamping and unclamping position cannot be determined in advance. Considerable injuries can be caused to fingers in the effective area of the clamping arm.
Remedy: protection device with electrical locking.

2. Maximum oil flow rate
In case of the maximum oil flow rate as per chart the shortest possible clamping time is 1 second. If the flow rate of the pump divided by the number of swing clamps is higher than the indicated value in the chart, the flow rate has to be throttled to avoid snapping out of the overload protection device. In the case that the mounting position is not vertical and/or heavy clamping arms are used, the flow rate has to be further reduced, if required. Throttling has to be made in the oil supply line to the swing clamp to rule out a possible pressure intensification.
Use only flow control check valves which allow oil return from the swing clamps without any impediments, as e.g. the flow-control swivel banjo coupling 9208 129 on page C 2.9501.
During unclamping the maximum oil flow rate can be 2.8 higher than the indicated value in the chart, because the piston area is correspondingly bigger.

3. Unimpeded swing motion
The swing motion must not be impeded and the clamping arm may only contact the workpiece after completion of the swing stroke.

4. Clamping arm assembly
In case of this threaded-body type the clamping arm can only be fixed, after firm screwing in of the housing, since the final position cannot be determined in advance.
When tightening and untightening the fixing screw , the clamping arm has to be backed up to avoid the introduction of moments to the piston rod.

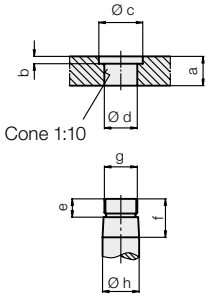
5. Adjustment of contact bolt
The contact bolt may only contact the workpiece after completion of the swing motion. When tightening and untightening the fixing screw, the clamping arm has to be backed up (see 4.).

6. Special clamping arms
When using special clamping arms with other lengths, the corresponding operating pressures as shown in the clamping force diagram must not be exceeded. If longer clamping arms will be used, not only the operating pressure but also the flow rate have to be reduced (see 2.).

7. Venting of spring area
The spring area of single-acting swing clamps has to be vented to avoid problems in functioning. A sintered metal air filter avoids penetration of contaminations. If there is a possibility that cutting lubricants and coolants penetrate through the sintered metal air filter into the cylinder's interior, a vent hose has to be connected and be placed in a protected position (see data sheet G 0.110).

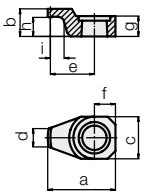
8. Bleeding
Air in the oil prolongs the clamping time considerably and leads to function problems.
Therefore bleeding has to be effected during start up. The threaded-body swing clamp has no possibility for bleeding at the element itself.
Remedy: plug the oil channels in the fixture body at the end. If required, loosen the plugs carefully and pump at low oil pressure until bubblefree oil comes out. Retighten the plugs.

Dimensions for special clamping arms



Swing clamp	a	b	Ø c	Ø d $^{+0,10}_{+0,05}$	e	f	g	Ø h^{f7}
18X3XXX	16	4	24	19.8	10	21	M 18x1,5	20
18X5XXX	23	5	34	31.8	12	28	M 28x1,5	32
18X7XXX	34	6	56	49.8	13	40	M 45x1,5	50

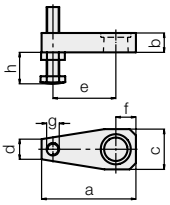
Clamping arm, max. 300 bar



Material: 42CrMo4

Swing clamp	a	b	c	d	e	f	g	h	i	Weight [kg]	Part no.
18X3XXX	51.5	21	32	14	33.5	16	15.5	14.5	7	0.11	**3548238**
18X5XXX	76	28	46	25	50	23	22.5	19	7	0.30	**3548236**
18X7XXX	123	40	75	39	82.5	37.5	34	27	8	1.30	**3548302**

Clamping arm assembly, complete, max. 200 bar



Material: 42CrMo4

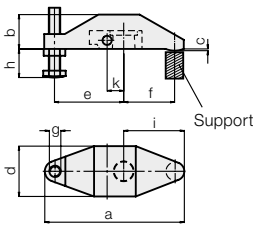
with thread

Swing clamp	a	b	c	d	e	f	g	h max.	h min.	Weight [kg]	Part no.
18X3XXX	75	16	32	16	50	16	M10	64	6	0.2	**0354001**
18X5XXX	115	23	48	22	75	25	M16	79	9	0.7	**0354003**
18X7XXX	178	34	78	40	120	40	M20	98	12	2.55	**0354005**

without thread

Swing clamp	a	b	c	d		f				Weight [kg]	Part no.
18X3XXX	75	16	32	16		16				0.18	**3921016**
18X5XXX	115	23	48	22		25				0.65	**3921017**
18X7XXX	178	34	78	40		40				2.3	**3921018**

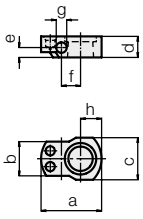
Clamping strap assembly, complete, with carrier, max. 500 bar



Material: GGG-40

Swing clamp	a	b	c	d	e	f	g	h max.	h min.	i	k	Weight [kg]	Part no.
18X3XXX	122	30	1.5	44	60	45	M10	64	6	53	14.5	0.57	**0354000**
18X5XXX	185	45	2	58.5	83	75	M16	79	9	87	21	1.58	**0354002**

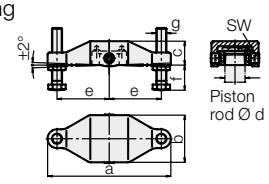
Carrier for special clamping strap



Material: 42CrMo4

Swing clamp	a	b	c	d	e	f	g^{H7}	h	Weight [kg]	Part no.
18X3XXX	46	26	32	16	7.5	14.5	8	16	0.08	**3542093**
18X5XXX	59	32	40	23	13	21	10	22	0.16	**3542094**
18X7XXX	90	56	68	34	21	33	14	36	0.65	**3542096**

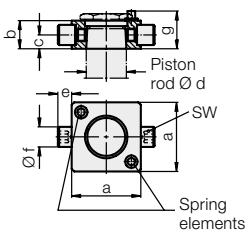
Double clamping arm assembly, complete, with carrier, max. 500 bar



Material: GGG-40

Swing clamp	a	b	c	Ø d	e	f min.	f max.	g	SW	Weight [kg]	Part no.
18X3XXX	138	59	28.5	20	60	10	64	M 10	5	0.83	**0354131**
18X5XXX	196	75	38	32	83	15	79	M 16	8	2.11	**0354132**
18X7XXX	236	105	56	50	100	19	98	M 20	8	5.24	**0354134**

Carrier, complete with threaded bolt and spring clamping elements



Material: 42CrMo4

Swing clamp	a$^{\pm 0,1}$	b	c	Ø d	e	Ø f^{g6}	g*	SW	Part no.
18X3XXX	43	16	7.5	20	9	10	21.5	5	**0354141**
18X5XXX	55	23	11	32	11	16	29	8	**0354142**
18X7XXX	77	34	17	50	15	20	41	8	**0354144**

***** Stop surface for spring elements

Swing Clamps with Reinforced Swing Mechanism

threaded-body type, position monitoring optional, double acting, max. operating pressure 500 bar

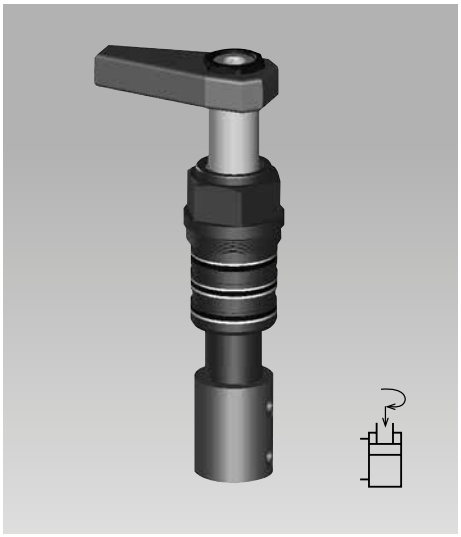


Figure with position monitoring

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. Due to the sturdy swing mechanism and the extended switch rod they are particularly suited for

- Clamping fixtures with workpiece loading via handling systems
- Transfer lines
- Test systems for motors, gears, axes, etc.
- Automatic manufacturing systems
- Assembly lines

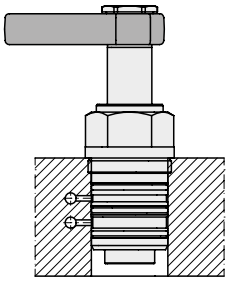
Description

This line is a further development of the proved ROEMHELD swing clamps with the aim to improve process safety in linked clamping systems. The most important data are as follows:

1. Omission of the overload protection device
   In the case of a slight collision with the clamping arm during loading and unloading of the fixture, the angular position of the clamping arm will be maintained. Less critical are the weight of the clamping arm or an increased swing speed.
2. Reinforced swing mechanism
   The reinforced swing mechanism endures a collision of the clamping arm with the workpiece during clamping up to a pressure of 100 bar.
3. FKM wiper
   This wiper has a high chemical resistance when using aggressive cutting fluids
4. Further types of bodies
   Flange at the bottom: data sheet B 1.8811
   Flange at the top: data sheet B 1.8801

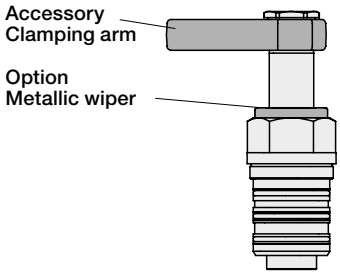
Connecting possibility

Drilled channels

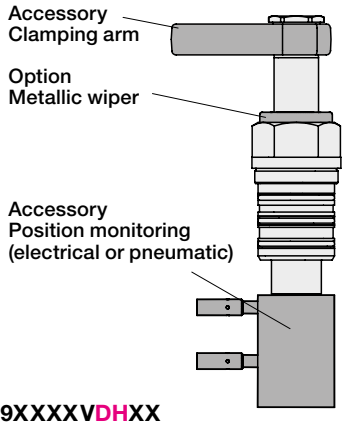


Ausführungen

DH, DM: without switch rod



MH, MM: with switch rod



Part numbers

Without switch rod, without metallic wiper:	**189XXXXVDHXX**
Without switch rod, with metallic wiper:	**189XXXXVDMXX**
With switch rod, without metallic wiper:	**189XXXXVMHXX**
With switch rod, with metallic wiper:	**189XXXXVMMXX**

Options

Switch rod for position monitoring

The helix rod protrudes through the cover and allows thereby a pneumatic or electrical monitoring of the piston position outside the swarf area. As an accessory a pneumatic position monitoring is available; the brass control slide being displaced in a stainless housing.
The slide opens and closes bore holes, so that a pressure switch or a differential pressure switch can signal the position "Clamped" and "Unclamped". It is also possible to realise this monitoring directly in the fixture body by means of drilled channels. An electrical position monitoring with inductive proximity switches is also available (see page 2).

Metallic wiper

This wiper protects the FKM wiper against mechanical damage, e.g. by hot swarf.
The swing clamp body is prepared for mounting of the metallic wiper. The wiper consists of a radially floating wiping disk and a retaining disk which will be pressed onto the existing collar.

Metallic wiper optional

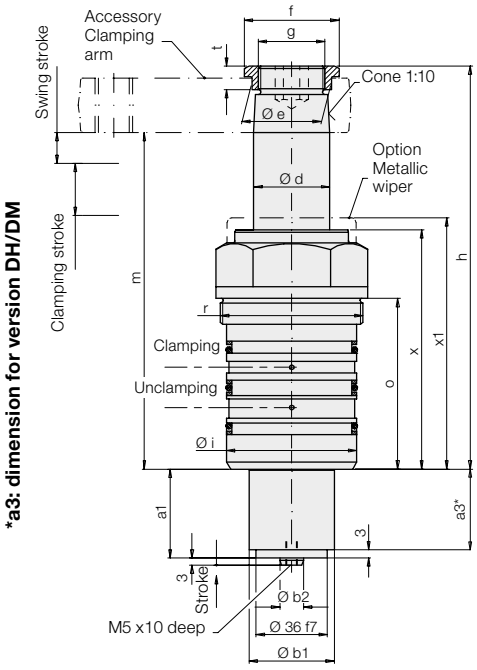
Important notes

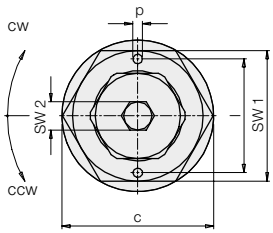
Due to the missing overload protection device, assembly and disassembly of the clamping arm has to be made carefully despite the reinforced swing mechanism. When tightening and untightening the fixing nut, the clamping arm or the hexagon socket in the piston has to be backed up. It is recommended to effect tightening and untightening in the swivel area. Frequent collisions with the clamping arm in radial direction have to be avoided.

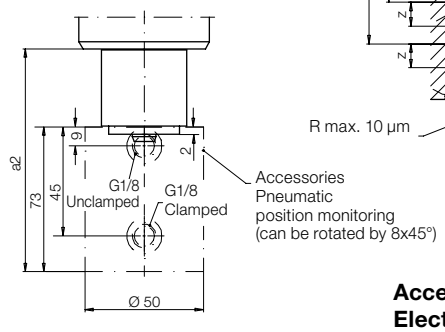
For interpretation of the pneumatic pressure we recommend to use a differential switch.

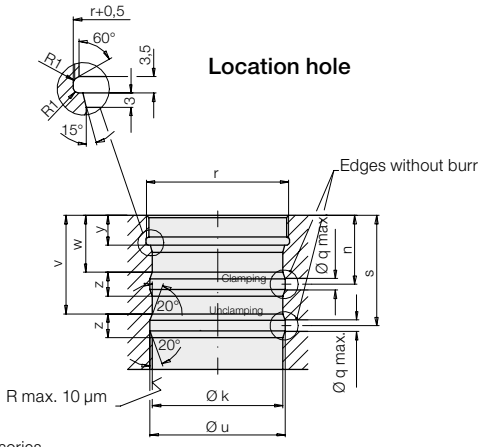
Parallel connection for up to 8 swing clamps is possible. For a greater number there are special solutions. Please contact us.

Further important notes see data sheet B 1.892.









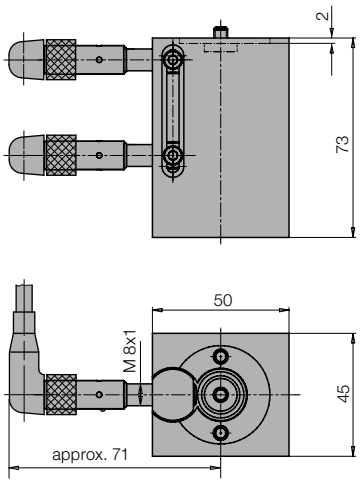
Clamping stroke	[mm]	22	20
Swing stroke	[mm]	13	18
Total stroke	[mm]	35	38
Operating pressure, min.	[bar]	30	30
Max. oil flow rate	[cm³/s]	20	55
Oil volume / stroke	[cm³]	15.8	43.8
Oil volume / return stroke	[cm³]	41.2	114.2
a1	[mm]	38	41
a2	[mm]	108	112
a3*	[mm]	28	28
Ø b1	[mm]	36	45
Ø b2 f7	[mm]	10	12
Ø c	[mm]	64	100
Ø d	[mm]	32	50
Ø e	[mm]	33.5	55.5
f	[mm]	40	68
g	[mm]	M28x1.5	M45x1.5
h	[mm]	171	209
Ø i f7	[mm]	55	85
Ø k H7	[mm]	55	85
l	[mm]	–	80
m –1	[mm]	143	169
n	[mm]	29	41
o	[mm]	72	109
Ø p / deep	[mm]	–	8 / 9
Ø q max.	[mm]	5	6
r	[mm]	M60x1.5	M90x2
s	[mm]	46.5	64
t	[mm]	10	12
Ø u	[mm]	57	87
v	[mm]	41.5	59
w	[mm]	24	36
x	[mm]	101	124
x1	[mm]	106	129
y	[mm]	12.5	20.5
z	[mm]	10	10
SW 1	[mm]	55	95
SW 2	[mm]	12	17
		Part no.	**Part no.**
Swing direction 90° cw		**1895101VXX35**	**1897101VXX38**
Swing direction 90° ccw		**1895201VXX35**	**1897201VXX38**
0 degree		**1895241VXX35**	**1897241VXX38**

XX: Version **DH/DM = without/with metallic wiper without switch rod**
MH/MM = without/with metallic wiper with switch rod

Accessories

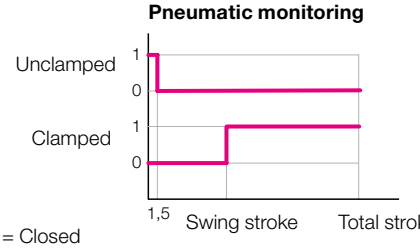
Pneumatic position monitoring, complete	**0353808**	**0353810**
Electrical position monitoring		
– without switch	**0353815**	**0353813**
– with standard switch and angle plug	**0353814**	**0353811**
Metallic wiper, complete (spare part)	**0341100**	**0341102**

Accessory:
Electrical position monitoring



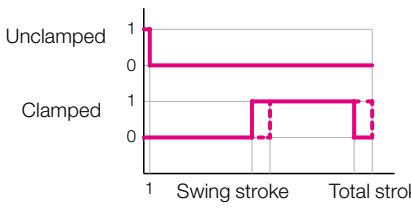
Function charts

Pneumatic monitoring



1 = Closed
0 = Passage

Electrical monitoring



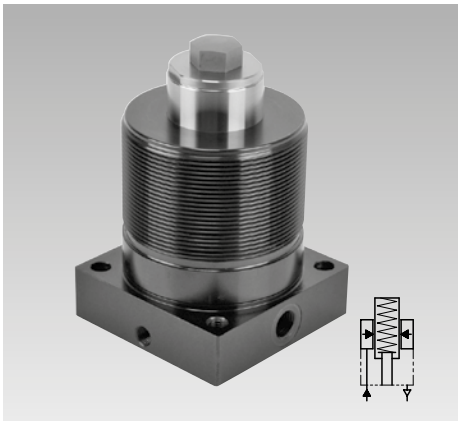
Code numbers for available swing angles

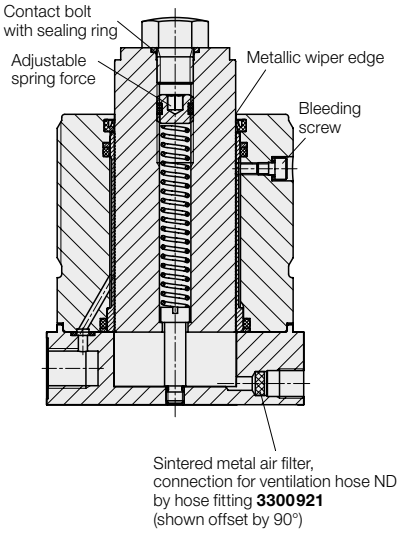
Swing angle (±1°)	Part no.
90°	**189XX0XVXXXX**
60°	**189XX2XVXXXX**
45°	**189XX3XVXXXX**

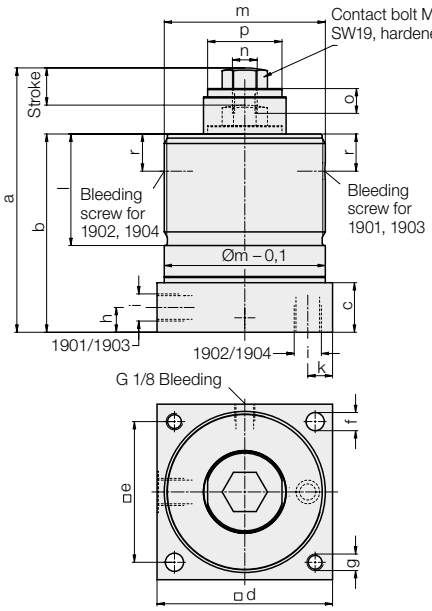
Clamping force diagrams and other accessories see data sheet B 1.892. Further proximity switches see data sheet B 1.552.

Work Supports

Off-position extended – contact by spring force, single acting, max. operating pressure 500 bar







Application

Hydraulic work supports are used to provide a self-adjusting rest for the workpiece during the machining operations. They compensate the workpiece surface irregularities, also deflection and vibration under machining loads.

Description

The spring-loaded support plunger positions itself against the workpiece with a light spring force.
Hydraulic locking is made together with hydraulic clamping of the workpiece, or independently. The support plunger is provided with female thread to enable the use of threaded pieces for height adjustment. Oil supply can alternatively be effected from the side or from below. The internal part of the work support is protected against dust and swarf by a sintered metal air filter.
Spring force 10 – 90 N, adjustable depending on the stroke.

Important notes!

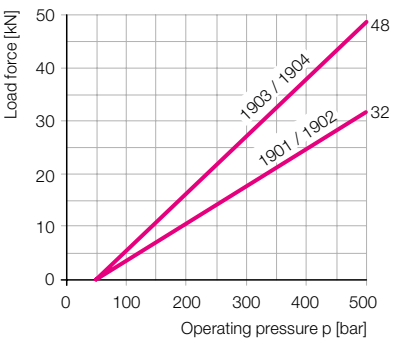
If there is any danger of fluids being sucked into the filter, a vent hose has to be connected.
Spring force should not be used to lift workpieces.
Contact bolts and extensions with large weight can influence the functions of this component.
Work supports are not suitable to compensate side loads.
Work supports must only be operated with a sealed contact bolt.
In dry machining applications, with minimum quantity lubrication or in case of accumulation of very small swarf, there can be a swarf holdup in the area of the metallic wiper edge.
Remedy: Regular cleaning.

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

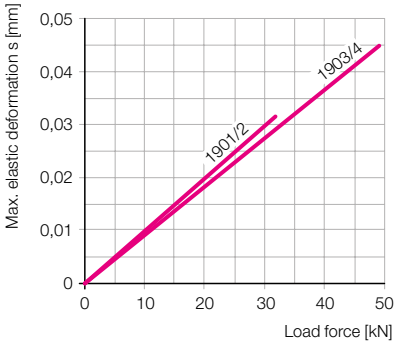
Connection		at the side	at the bottom	at the side	at the bottom
Bolt Ø	[mm]	32	32	40	40
Stroke $^{+0.8}_{-0.6}$	[mm]	16	16	18	18
Adm. load force	[kN]	32	32	48	48
Recom. mini. pressure	[bar]	100	100	100	100
a $^{+1.4}_{-1.2}$	[mm]	122	122	127.8	127.8
b	[mm]	90	90	96	96
c	[mm]	24	24	24	24
d	[mm]	75	75	85	85
e	[mm]	57	57	68	68
Øf	[mm]	7	7	8.8	8.8
g	[mm]	M 6	M 6	M 8	M 8
h	[mm]	12	–	12	–
i		G 1/4	G 1/4	G 1/4	G 1/4
k	[mm]	–	12	–	12
l	[mm]	40	40	54	54
m	[mm]	M 68 x 2	M 68 x 2	M 78 x 2	M 78 x 2
n	[mm]	M 12	M 12	M 12	M 12
o	[mm]	12	12	12	12
p	[mm]	27	27	36	36
r	[mm]	20	20	18	18
x	[mm]	Ø 80	Ø 80	Ø 90	Ø 90
Weight, approx.	[kg]	2.75	2.75	3.8	3.8
Part no.		**1901002**	**1902002**	**1903002**	**1904002**
Accessory Capstan nut		**3522008**	**3522008**	**3522007**	**3522007**

Article available on request

Admissible load F as a function of the operating pressure p

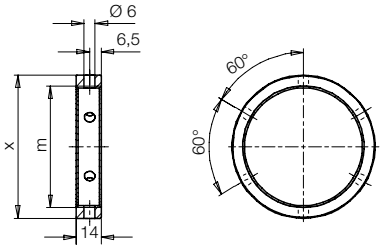


Max. elastic deformations s as a function of support force F max. operating pressure 500 bar



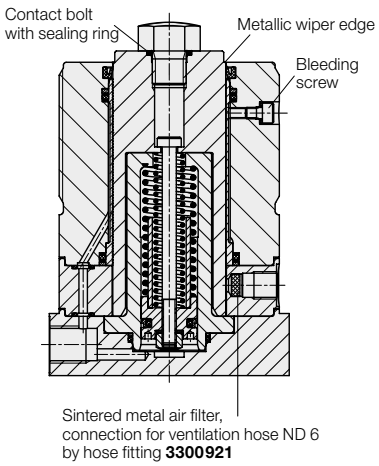
Accessory

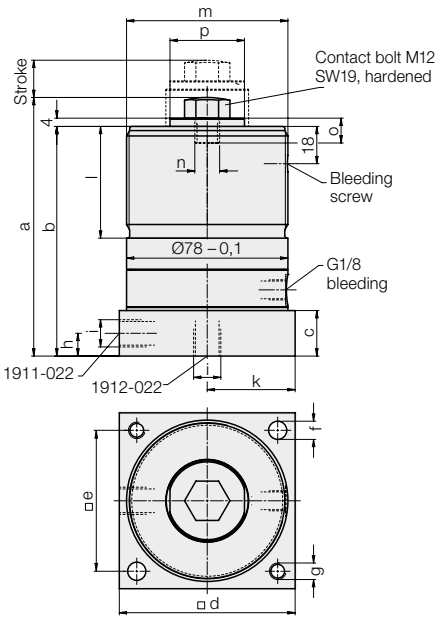
Capstan nut



Work Supports

Extending hydraulically – contact by spring force, single acting with spring return, max. operating pressure 500 bar





Application

Hydraulic work supports are used to provide a self-adjusting rest for the workpiece during the machining operations. They compensate the workpiece surface irregularities, also deflection and vibration under machining loads.

Description

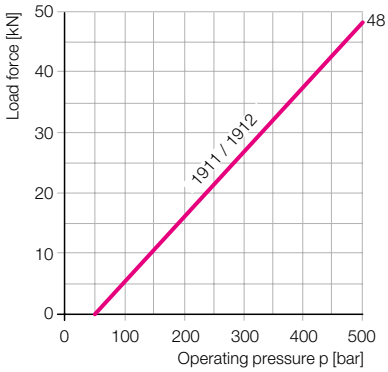
The support plunger is retracted in off-position. When pressurised, the support plunger moves against the inserted workpiece by means of spring force. With increasing oil pressure, the support plunger locks hydraulically. After the system has been unclamped, the support plunger returns to the off-position.
The support plunger is provided with female thread to enable the use of threaded pieces for height adjustment.
Oil supply can alternatively be effected from the side or from below.
The internal part of the work support is protected against dust and swarf by a sintered metal air filter.

Important notes

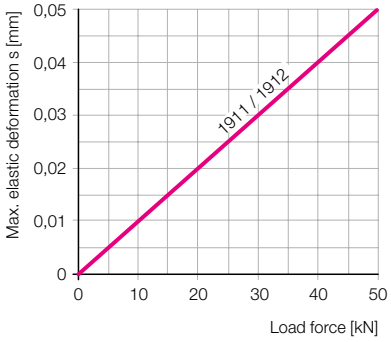
If there is any danger of fluids being sucked into the filter, a vent hose has to be connected.
Spring force should not be used to lift workpieces.
Contact bolts and extensions with large weight can influence the functions of this component.
Work supports are not suitable to compensate side loads.
Work supports must only be operated with a sealed contact bolt.
In dry machining applications, with minimum quantity lubrication or in case of accumulation of very small swarf, there can be a swarf holdup in the area of the metallic wiper edge.
Remedy: Regular cleaning.

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

Admissible load F as a function of the operating pressure p



Max. elastic deformations s as a function of support force F max. operating pressure 500 bar

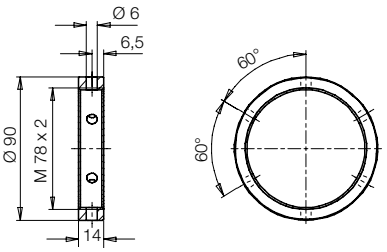


Connection		at the side	at the bottom
Bolt Ø	[mm]	40	40
Stroke $^{+0.4}_{-0.2}$	[mm]	18	18
Adm. load force	[kN]	48	48
Oil volume/stroke	[cm³]	5.7	5.7
Max. flow rate	[cm³/s]	70	70
Recom. mini. pressure	[bar]	100	100
Plunger contact force	[N]	(60 – 100)*	
a $^{+1.2}_{-0.9}$	[mm]	125	130.5
b	[mm]	111	116.5
c	[mm]	22	26.5
d	[mm]	85	85
e	[mm]	68	68
Øf	[mm]	8.8	8.8
g	[mm]	M 8	M 8
h	[mm]	11	–
i		G 1/4	G 1/4
k	[mm]	–	42.5
l	[mm]	54	54
Ø m	[mm]	M78x2	M78x2
n	[mm]	M12	M12
o	[mm]	12	12
p	[mm]	36	36
Weight	[kg]	4.2	4.2
Part no.		**1911022**	**1912022**

***** stroke-dependent

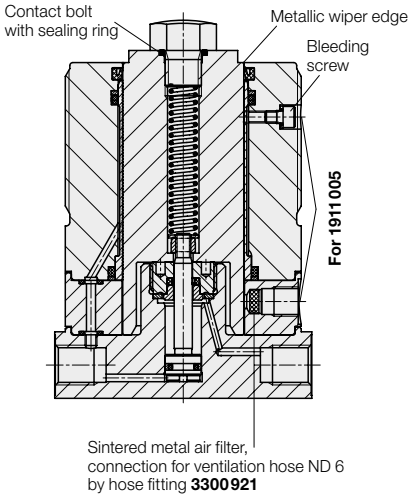
Accessory

Capstan nut		
Part no.	**3522007**	**3522007**

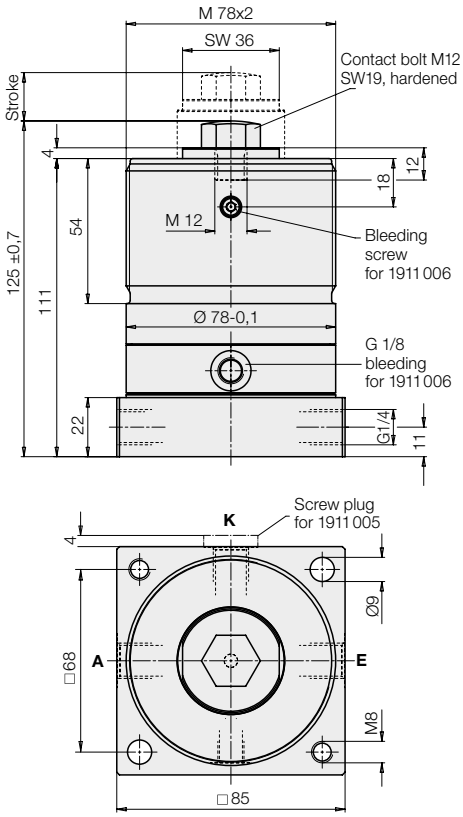


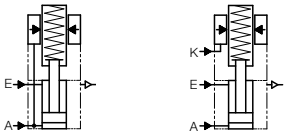
Work Supports

Extending hydraulically – contact by spring force, double acting, max. operating pressure 500 bar



Dimension drawing for 1911006





A = Extending + Locking	A = Extending
E = Retracting	E = Retracting
	K = Locking
Part no.	
1911005	**1911006**

Application

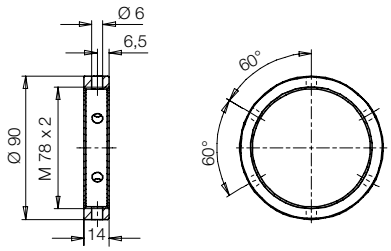
Hydraulic work supports are used to provide a self-adjusting rest for the workpiece during the machining operations. They compensate the workpiece surface irregularities, also deflection and vibration under machining loads.
It is recommended to use double-acting elements if applied in larger hydraulic clamping fixtures with long lines, especially if the return oil is cycled and has to return in a predetermined time.

Description

This hydraulic work support contains a double-acting sliding cylinder. The support plunger is retracted in off-position.
When pressurised at “A”, the piston pushes the support plunger against the inserted workpiece by means of spring force. As soon as the piston has touched the internal stop, the pressure rises and the support plunger is hydraulically locked.
With type 1911006, it is possible to effect locking separately through port "K".
For unclamping, port “A” is depressurised and port “E” is pressurised. The locking is released so that the hydraulic piston can pull back the support plunger to the off-position.
The internal part of the work support is protected against dust and swarf by a sintered metal air filter.

Accessories

Capstan nut
Part no. **3522007**



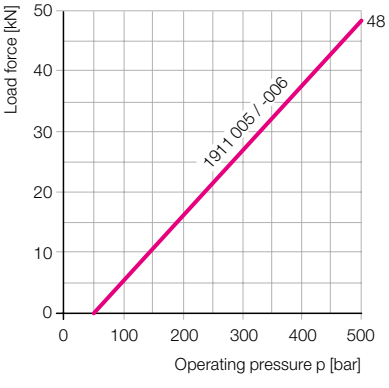
Bolt Ø		[mm]	40
Stroke		[mm]	18 $^{+0.7}_{-0.6}$
Adm. load force	100 bar	[kN]	5
	500 bar	[kN]	48
Plunger contact force		[N]	50 – 100
Recom. mini. pressure supporting		[bar]	100
Recom. mini. pressure retracting		[bar]	20
Oil volume/stroke		[cm³]	2
Max. flow rate		[cm³/s]	25
Weight		[kg]	4.1

Important notes

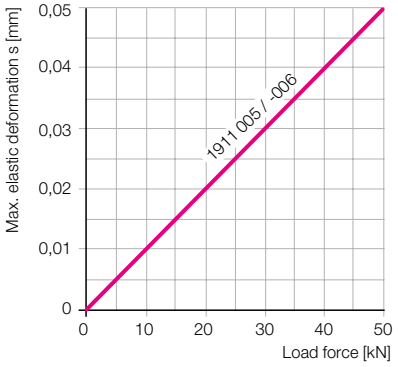
If there is any danger of fluids being sucked into the filter, a vent hose has to be connected.
The contact bolt must only be removed if it is replaced by another contact bolt with 12 mm thread length.
Spring force should not be used to lift workpieces.
Contact bolts and extensions with large weight can influence the function of this component.
Work supports are not suitable to compensate side loads.
Work supports must only be operated with a sealed contact bolt.
In dry machining applications, with minimum quantity lubrication or in case of accumulation of very small swarf, there can be a swarf holdup in the area of the metallic wiper edge.
Remedy: Regular cleaning.

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

Admissible load F as a function of the operating pressure p

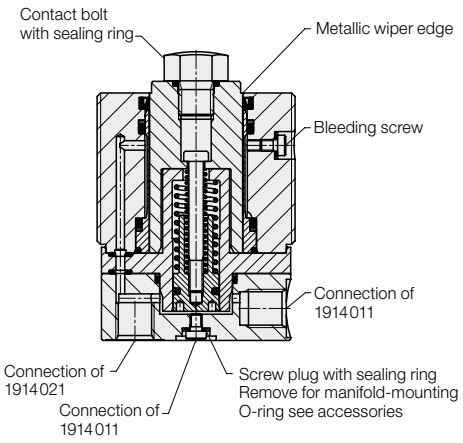


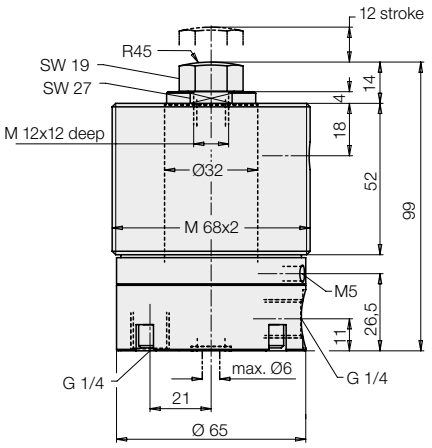
Max. elastic deformations s as a function of support force F

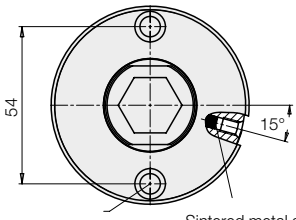


Work Supports

Extending hydraulically – contact by spring force, single acting with spring return, max. operating pressure 500 bar







Bore hole and counterbore Ø 7/ Ø 10.5x7 deep for socket head cap screw ISO4762 M6x85

Sintered metal air filter, connection possibility for ventilation hose ND6 by hose fitting M5 (see G 0.110)

Application

Hydraulic work supports are used to provide a self-adjusting rest for the workpiece during the machining operations. They compensate the workpiece surface irregularities, also deflection and vibration under machining loads.

Description

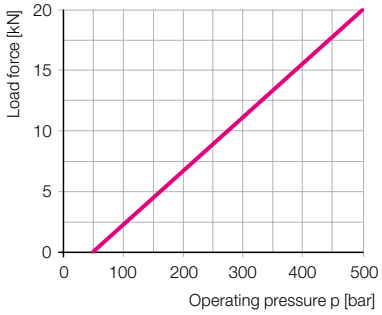
The support plunger is retracted in off-position. When pressurised, the support plunger moves against the inserted workpiece by means of spring force. With increasing oil pressure, the support plunger locks hydraulically. After the system has been unclamped, the support plunger returns to the off-position.
The support plunger is provided with female thread to enable the use of threaded pieces for height adjustment.
Oil supply can alternatively be effected from the side or from below.
The internal part of the work support is protected against dust and swarf by a sintered metal air filter.

Important notes

If there is any danger of fluids being sucked into the filter, a vent hose has to be connected.
Spring force should not be used to lift workpieces.
Contact bolts and extensions with large weight can influence the functions of this component.
Work supports are not suitable to compensate side loads.
Work supports must only be operated with a sealed contact bolt.
In dry machining applications, with minimum quantity lubrication or in case of accumulation of very small swarf, there can be a swarf holdup in the area of the metallic wiper edge.
Remedy: Regular cleaning.

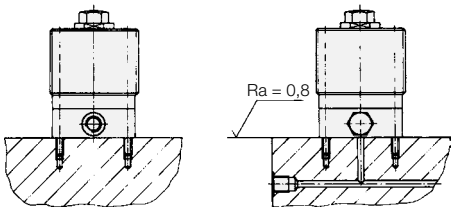
Operating conditions, tolerances and other data see data sheet A 0.100.

Admissible load F as a function of the operating pressure p



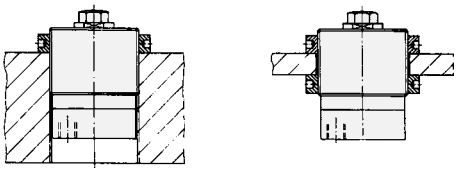
Installation examples 1914011

Oil supply of version 1914011 can optionally be effected by lateral pipe connection or from below through a drilled channel in the fixture base plate. For this purpose, the screw plug with sealing ring is removed, an O-ring 10x2 is inserted and the lateral connection is closed with the screw plug G 1/4.



Installation examples 1914021

Oil supply of version 1914021 is effected by a pipe connection at the bottom.
The lateral pipe connection is closed with a sealing plug.



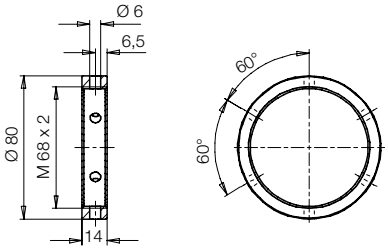
Bolt Ø	[mm]	32
Plunger stroke	[mm]	12
Plunger contact force	[N]	30 – 60
Oil volume / stroke	[cm³]	2.5
Max. flow rate	[cm³/s]	35
Recom. minimum pressure	[bar]	100
Elastic deformation with load and 500 bar	[µm/kN]	1.3
Weight	[kg]	2.0

	Part no.
Connection at the side	**1914011**
Connection at the bottom	**1914021**

Article available on request

Accessories	
O-ring 10x2	**3000347**
Screw plug G 1/4	**3610264**
Capstan nut M68x2	**3522008**
Spare sealing ring (for contact bolt)	**3000536**
Contact bolt M12x12	**3614028**
Insertion nipple fitting M5	**3890091**

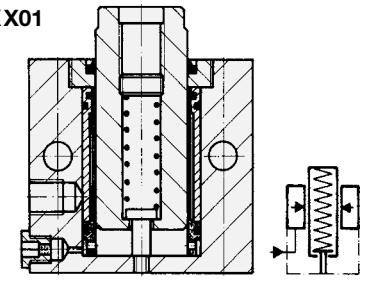
Accessory: Capstan nut



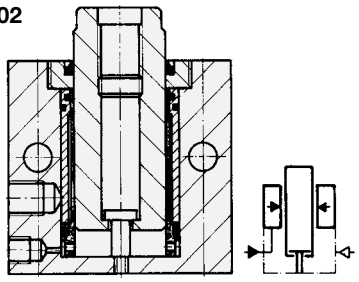
Work Supports

contact by spring force or air pressure, single acting, max. operating pressure 500 bar

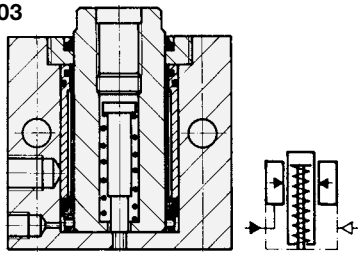
192X X01

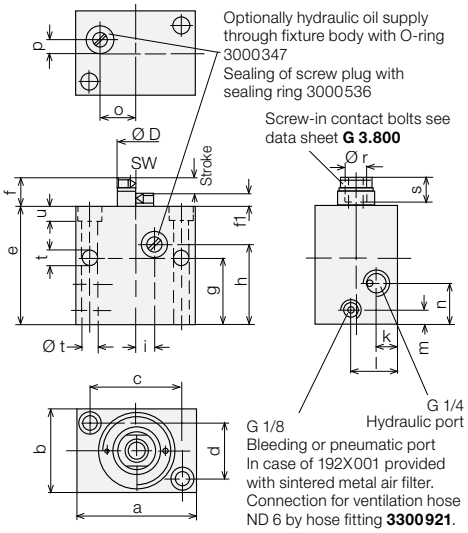


192X X02

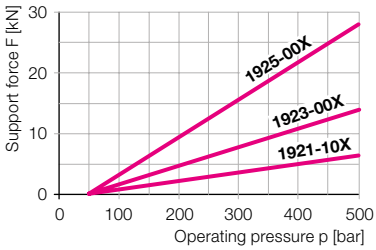


192X X03





Admissible load F as function of the operating pressure p



Application

Hydraulic work supports are used to provide a self-adjusting rest for the workpiece during the machining operations. They compensate the workpiece surface irregularities, also deflection and vibration under machining loads.

Installation

The universal block cylinder shape allows vertical and horizontal mounting, with oil feed via normal pipe connection or by manifold mounting direct to the fixture through drilled channels in the fixture body.

Function

Hydraulic locking is made together with hydraulic clamping of the workpiece, or independently. The support plunger is provided with female thread to enable the use of threaded pieces for height adjustment.

There are three variations of plunger actuation:

1. Spring advanced; plunger extended in off-position

2. Air pressure advanced; without spring return

3. Air pressure advanced; with spring return

The pneumatically-actuated plunger allows precise setting of the plunger contact force by means of a pressure reducing valve. If a danger exists of sucking fluids through the pneumatic port, on the spring-advanced unit, a vent hose should be connected.

Important notes

Work supports are not suitable to compensate side loads.

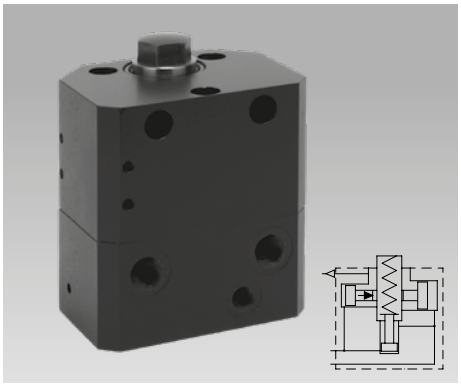
Operating conditions, tolerances and other data see data sheet A 0.100.

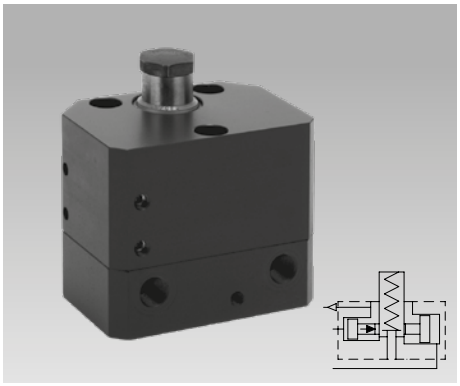
It is absolutely necessary to follow the instructions for venting of the spring area on data sheet G 0.110.

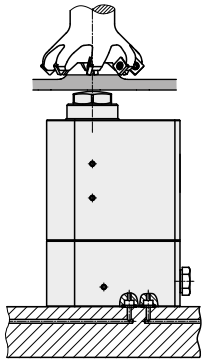
Plunger Ø D	[mm]	16	20	35
Stroke	[mm]	6	8	10
Support force at 500 bar	[kN]	7	12.5	28
Spring force min.	[N]	8	13.5	19.2
Spring force max.	[N]	10	17	24
Plunger contact force at 1 bar air pressure (deduct spring force if necessary)	[N]	20.1	31.4	96.2
Recom. min. oil pressure	[bar]	100	100	100
a	[mm]	60	65	85
b	[mm]	35	45	63
c	[mm]	40	50	63
d	[mm]	22	30	40
e	[mm]	56	64	79
f	[mm]	12	15	20
f1	[mm]	6	7	10
g	[mm]	26	36	39
h	[mm]	36	43	52
i	[mm]	7	10	12
k	[mm]	12.5	11.5	20.5
l	[mm]	17.5	25.5	39.5
m	[mm]	8.5	8	8
n	[mm]	38	22	25
o	[mm]	14.5	19	25
p	[mm]	5	7	11
Ø r	[mm]	M 10	M 12	M 16
s	[mm]	14	14	21
Ø t	[mm]	6.5	8.5	10.5
u	[mm]	6	8	10
SW	[mm]	13	17	27
Weight	[kg]	0.8	1.2	2.6
Part no.				
Extended by: Spring force		**1921101**	**1923001**	**1925001**
Air pressure		**1921102**	**1923002**	**1925002**
Air pressure with spring return		**1921103**	**1923003**	**1925003**
Accessories Screw plug G 1/4		**3610264**	**3610264**	**3610264**
O-ring 10x2		**3000347**	**3000347**	**3000347**
Spare seal ring		**3000536**	**3000536**	**3000536**
Contact bolt, dome head (see G 3.800)		**3614002**	**3614028**	**3614003**

Work Support, Self-Locking

with pneumatic position monitoring, 3 sizes, 2 types of function, double acting, max. operating pressure 500/400 bar







Application

Hydraulic work supports are used to provide a self-adjusting rest for the workpiece during the machining operations. They compensate the workpiece surface irregularities, also vibration and deflection under machining loads.

Hydraulic locking is made together with hydraulic clamping of the workpiece, or independently.

Due to the self-locking function of the support plunger, these work supports are particularly suitable for:

- Manufacturing systems with pallet store
- Clamping fixtures with workpiece loading via handling systems
- Transfer lines
- Automatic manufacturing systems
- Assembly lines
- Indexing machines
- Special machine tools

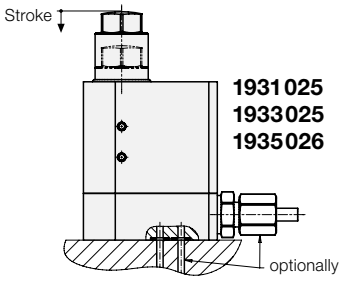
Important notes

If there is any danger of fluids being sucked into the filter, a vent hose has to be connected at the venting port.
The standard contact bolt in the support plunger protects the interior against contamination. For the use of self-manufactured contact bolts please consider the installation dimensions (see page 4).
For unlocking of the support plunger the same pressure as for clamping is required.
Support and clamping forces have to be adapted to each other, so that there will be sufficient force reserve available for the work support to absorb the machining forces (see page 4).
The self-locking is not positive. The introduction of vibrating machining forces has to be avoided. Admissible load force see diagrams (page 2 and 3).
Operating conditions, tolerances and other data see data sheet A 0.100.

Function

For the plunger contact at the workpiece there are two variants:

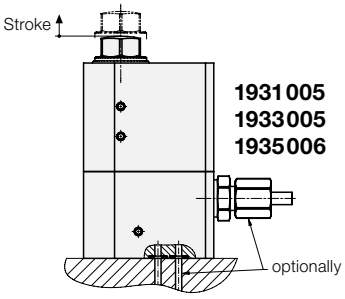
1. Off-position extended



When loading the fixture, the support plunger is pushed back by the workpiece and contacts the workpiece by spring force. Then hydraulic locking can be effected. During unclamping the support plunger will be unlocked and moved forward by a little spring force when unloading the workpiece.

Advantage: Compact design.

2. Off-position retracted



When pressurising the element, the support plunger moves forward with a light spring force against the workpiece. Then locking is automatically effected.

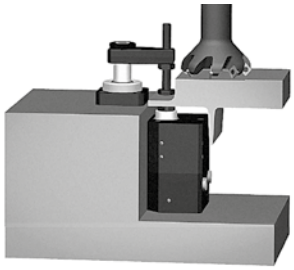
Advantage: Unimpeded loading and unloading of the clamping fixture!

Advantages

- No yielding at the workpiece, even if pressure drops, due to patented locking with self-locking function.
- Very little elasticity of the support plunger.
- No axial displacement of the support plunger during locking.
- Compensation of side loads, if a clamping element clamps directly onto the workpiece (see application example).
- Optimum adaptation to the workpiece due to asymmetrical shape of the body.
- Little contact force to the workpiece due to spring force.
- Oil supply optionally via fittings or drilled channels
- High process safety due to integrated pneumatic position control as well as hydraulic retraction of the support plunger (193X00X)
- Mounting position: any
- Standard FKM seals

Application example

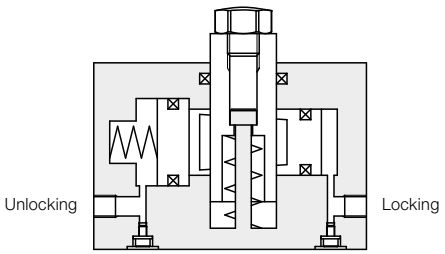
Manifold-mounted work support with swing clamp 1893102
as per data sheet B 1.8803.



Dimensioning see page 4.

Type of function: Spring force
Off-position extended • Contact by spring force

Function



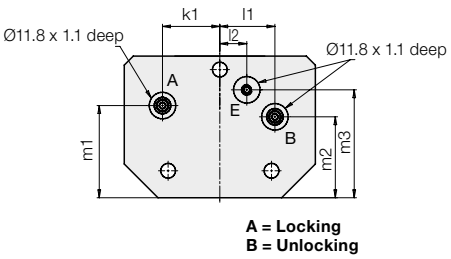
Clamping

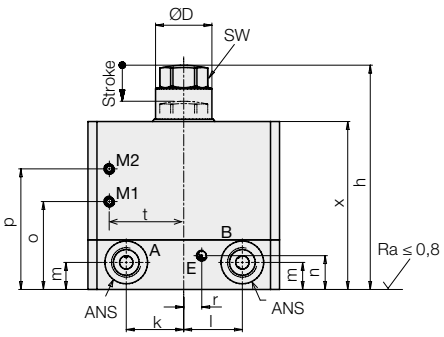
The support plunger is pushed back by the inserted workpiece, the spring force has to be overcome.

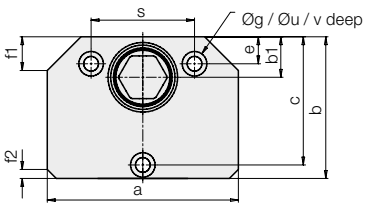
Due to the hydraulic pressure the wedge surface of the cross piston is moved against the support plunger and thereby the support plunger is locked.

Unclamping

For unlocking of the support plunger the same pressure as for clamping is required. The support plunger contacts the workpiece until it is taken out of the fixture.







Notes:

1. Manifold-mounting

For manifold mounting remove screw with sealing (see bottom) and insert O-ring 9x1.5 **(Part no. 3001305)** into the counterbore.

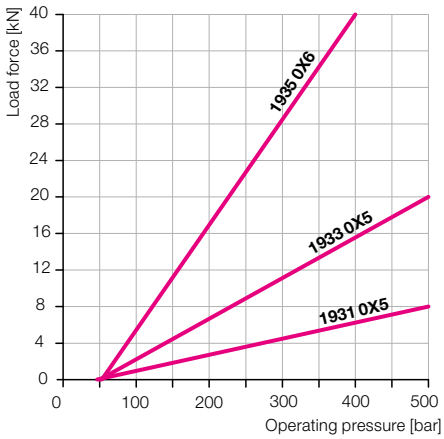
Connecting hole max. Ø 7 mm. Screw in plug G 1/4 or G 1/8 **(Part no. 3610264 or 3610263)**.

2. Pneumatic position monitoring

To operate the position monitoring, remove the set screws (M5) and screw in insertion nipple fitting **(Part no. 3890091)** or L-type insertion nipple fitting **(Part no. 3890094)**.

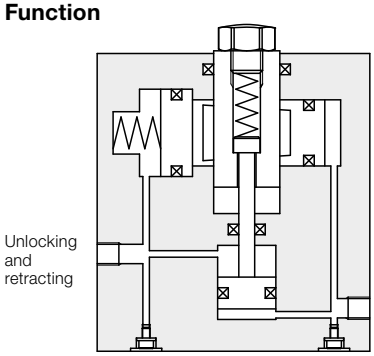
M1 – support plunger retracted, thread M5.
M2 – support plunger extended, thread M5.
E – do not close venting port, thread M5 (see important notes).

Admissible load force as a function of the operating pressure



Max. operating pressure	**[bar]**	**500**	**500**	**400**
Load force at 500/400 bar	[kN]	8	20	40
Support plunger ØD	[mm]	16	25	40
Stroke of support plunger	[mm]	8	12	20
a	[mm]	70	85	140
Port		G1/8	G1/4	G1/4
b	[mm]	48	63	105
b1	[mm]	13	18	36
c	[mm]	42	57	95
e	[mm]	6	12	16
f1 x 45°	[mm]	10	15	22
f2 x 45°	[mm]	4	4	4
g	[mm]	5,5	6,6	10,5
h	[mm]	76,5	99,5	156,5
k	[mm]	22	25,5	44
k1	[mm]	22	25,5	44
l	[mm]	22	26	44
l1	[mm]	20	24,5	49
l2	[mm]	0	12,0	15
m	[mm]	14	12	15
m1	[mm]	36	41	65
m2	[mm]	22	36	44
m3	[mm]	31,5	48	80
n	[mm]	7	15	15
o	[mm]	28,5	38	58,6
p	[mm]	43	53,5	85,5
r	[mm]	6	9	15
s	[mm]	36	46	80
t	[mm]	26	33	60
u	[mm]	10	11	18
v	[mm]	11	15	27
x	[mm]	60	74,5	120
SW	[mm]	17	19	30
Contact/spring force	[N]	15 up to 22	23 up to 50	55 up to 110
Recommended minimum pressure	[bar]	100	100	100
Max. oil volume stroke / locking	[cm^3]	0,2	4,9	7,5
Max. oil volume return stroke	[cm^3]	0,3	8,4	11,7
Max. flow rate	[cm^3/s]	25	25	25
Max. elastic deformation during load	[µm/kN]	0,7	1,5	1
Weight	[kg]	1,4	2,8	12,5
Part no.		**1931025**	**1933025**	**1935026**
Accessories (not included in the delivery)				
Part no. O-ring (FKM) 9 x 1,5		**3001305**	**3001305**	**3001305**
Part no. plug		**3610263**	**3610264**	**3610264**

Function

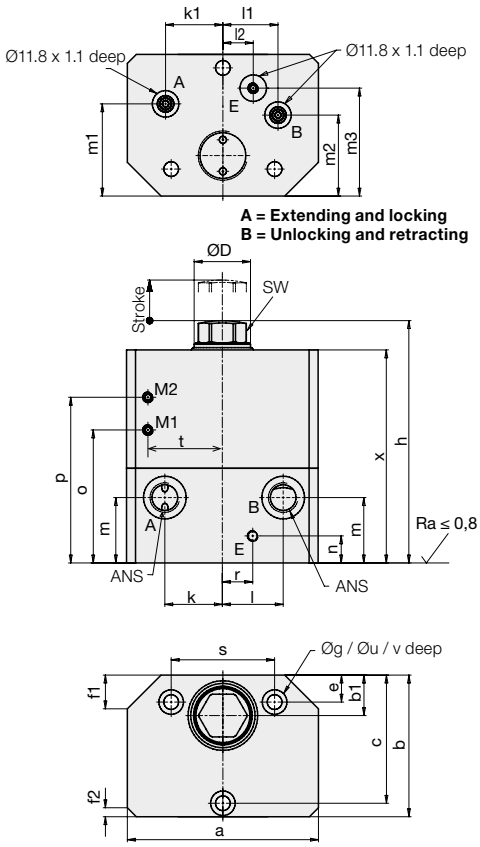


Clamping

The support plunger is extended by a small piston and contacts the workpiece with spring force.
Due to the increasing hydraulic pressure the wedge surface of the cross piston is moved against the support plunger and thereby the support plunger is locked.

Unclamping

For unlocking of the support plunger the same pressure as for clamping is required. At the same time the small piston is retracted by hydraulic pressure and takes the support plunger along.



Notes:

1. Manifold-mounting

For manifold mounting remove screw with sealing (see bottom) and insert O-ring 9x1.5 **(Part no. 3001305)** into the counterbore.

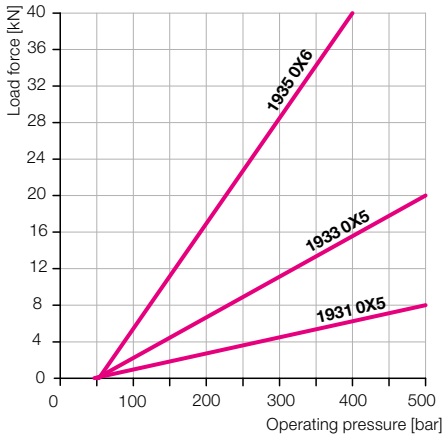
Connecting hole max. Ø 7 mm. Screw in plug G 1/4 or G 1/8 **(Part no. 3610264 or 3610263)**.

2. Pneumatic position monitoring

To operate the position monitoring, remove the set screws (M5) and screw in insertion nipple fitting **(Part no. 3890091)** or L-type insertion nipple fitting **(Part no. 3890094)**.

M1 – support plunger retracted, thread M5.
M2 – support plunger extended, thread M5.
E – do not close venting port, thread M5 (see important notes).

Admissible load force as a function of the operating pressure



Max. operating pressure	**[bar]**	**500**	**500**	**400**
Load force at 500/400 bar	[kN]	8	20	40
Support plunger ØD	[mm]	16	25	40
Stroke of support plunger	[mm]	8	12	20
a	[mm]	70	85	140
Anschluss		G1/8	G1/4	G1/4
b	[mm]	48	63	105
b1	[mm]	13	18	36
c	[mm]	42	57	95
e	[mm]	6	12	16
f1 x 45°	[mm]	10	15	22
f2 x 45°	[mm]	4	4	4
g	[mm]	5,5	6,6	10,5
h	[mm]	86,5	107,5	163,5
k	[mm]	22	25,5	44
k1	[mm]	22	25,5	44
l	[mm]	22	27	44
l1	[mm]	20	24,5	49
l2	[mm]	0	13,5	15
m	[mm]	30	29	20
m1	[mm]	36	41	65
m2	[mm]	22	36	44
m3	[mm]	31,5	48	80
n	[mm]	15	12	35
o	[mm]	46,5	58	85,6
p	[mm]	61	73,5	112,5
r	[mm]	14,5	13,5	15
s	[mm]	36	46	80
t	[mm]	26	33	60
u	[mm]	10	11	18
v	[mm]	11	15	27
x	[mm]	78	94,5	147
SW	[mm]	17	19	30
Contact/spring force	[N]	15 up to 22	23 up to 50	55 up to 110
Recommended minimum pressure	[bar]	100	100	100
Max. oil volume stroke / locking	[cm^3]	1,8	7,3	11,5
Max. oil volume return stroke	[cm^3]	1,6	9,5	14,2
Max. flow rate	[cm^3/s]	25	25	25
Max. elastic deformations during load	[µm/kN]	0,7	1,5	1
Weight	[kg]	1,8	3,5	15,5
Part no.		**1931005**	**1933005**	**1935006**
Accessories (not included in the delivery)				
Part no. O-ring (FKM) 9x1.5		**3001305**	**3001305**	**3001305**
Part no. plug		**3610263**	**3610264**	**3610264**

Combinations of work supports with swing clamps of the same size

The admissible load force of work supports has always to be dimensioned so that the clamping force of the used clamping elements and the static and dynamic machining forces can be safely compensated.

Admissible load force
– Clamping force
– Safety (reserve)
= Possible machining force

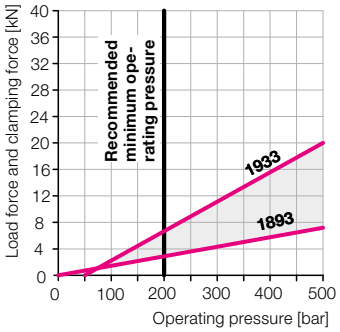
On principle the load force of the work supports should be at least twice the clamping force of the clamping elements.

Load force ≥ 2 x clamping force

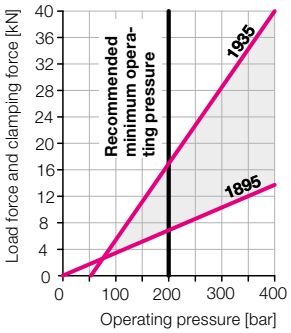
If the total of all occuring forces exceeds the admissible load force, the support plunger of the work support will be pushed back and the work support will be damaged.

For combinations of work supports with swing clamps (see example), this condition should be met at 200 bar.
For the smallest size 1931 there is no suitable swing clamp available. With the swing clamp 1891XXX the operating pressure would have to amount to 500 bar! For both larger work supports, there are suitable swing clamps as shown in the below charts.
The vertical distance of the two straight lines in the area of the colorised surface indicates the resulting maximally possible machining force including reserve.

Size 1933



Size 1935

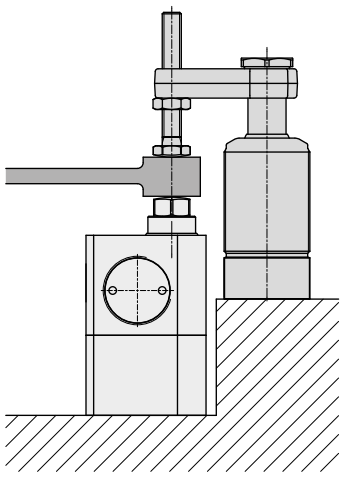


Important note

The admissible load forces as per the diagram are static. The machining forces can also generate vibrations which exceed by far the mean value. For this reason a corresponding safety factor has to be taken into account.

Example

The swing clamp 1893104 (data sheet B 1.881) clamps a workpiece onto the work support 1933005.



For size 1933 the following can be taken from the diagram:

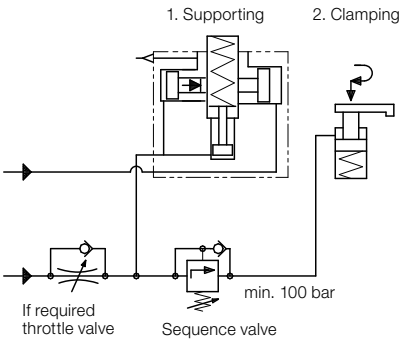
Minimum operating pressure:	200 bar
Load force at 200 bar:	6,6 kN
Clamping force at 200 bar:	2,8 kN

Possible machining force at 200 bar:

Admissible load force:	6,6 kN
– Clamping force:	– 2,8 kN
= Possible machining force: (including reserve)	3,8 kN

Control of clamping sequence

The sequence – supporting and clamping – has to be controlled as a function of the pressure, e.g. by a sequence valve.



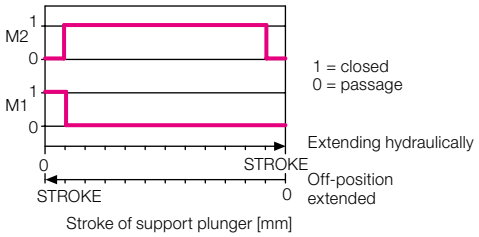
The sequence valve has to be adjusted to an opening pressure above the intersection of the two straight lines in the diagram.
If due to a too high flow rate a throttle valve is required, installation should be made as shown in the hydraulic circuit diagram.

Pneumatic position monitoring

With the pneumatic position monitoring the following messages can be realised:

M1 – support plunger retracted
M2 – support plunger within the useable working area

Function chart

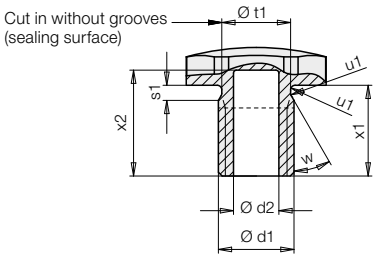


For process-safe functioning of the position monitoring, air pressure and air volume must be adapted.

Nominal values: Air pressure 2.5 bar
Flow rate 12 l/min

The measurable differential pressure depends on jet diameter, leakage, pressure, flow rate and pipe length. It should be approx. 1.8 bar.
For the interpretation, we recommend a pneumatic differential pressure switch, which can monitor up to 8 work supports. Also pneumatic pressure switches can be used. According to the number of the connected work supports, air pressure or flow rate have to be adapted possibly.

Required dimensions for self-made contact bolts



Work support	1931	1933	1935
Ød1	M10	M12	M20
Ød2	6	-	-
x1	12	9	12
x2	14	-	-
s1	2	3	4
t1	9,1 ±0,05	9,4 ±0,05	16,5 ±0,05
u1	R0,6	R0,4	R0,6
w	30°	39 to 60°	39 to 60°
O-ring	9x1	9x2	15,54x2,62
Part no.	**3001674**	**3001869**	**3000103**

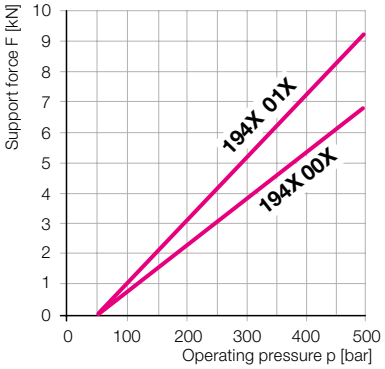
Threaded-Body Work Supports
max. operating pressure 500 bar

General technical data

Plunger Ø	[mm]	16
Stroke	[mm]	8 (15)
Adm. support force at 500 bar		
194X00X	[kN]	6.5
194X01X	[kN]	9.5
Recom. minimum oil pressure	[bar]	100
Seating torque	[Nm]	60
Weight approx	[kg]	0.25

Mounting dimensions, accessories and application examples see reverse page

Admissible load F as function of the operating pressure p



Application

Hydraulic work supports are used to provide a self-adjusting rest for the workpiece during the machining operations. They compensate the workpiece surface irregularities, also deflection and vibration under machining loads. Two sizes are available. The threaded-body design of the elements allows direct installation in clamping fixtures, in horizontal or vertical mounting position, and thereby a space-saving arrangement. Hydraulic oil is fed through drilled channels in the fixture body. Hydraulic locking is made together with hydraulic clamping of the workpiece, or independently.

There are three variations of plunger actuation:

1. **Spring advanced;** plunger extended in off-position.
2. **Air pressure advanced;** plunger retracted in off-position. The pneumatically-actuated plunger allows precise setting of the plunger contact force by means of a pressure reducing valve.
3. **Hydraulic pressure and spring advanced;** plunger retracted in off-position It moves forward with a light spring force against the workpiece, when hydraulic pressure is applied.

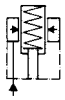
Combination possibilities

The work supports 194X01X can be combined with the swing clamps as per data sheet B 1.891. (Example see reverse page).

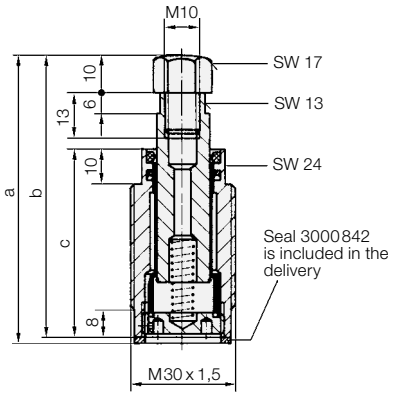
Important notes!

Work supports are not suitable to compensate side loads.
Operating conditions, tolerances and other data see data sheet A 0.100.

Contact by spring forcet

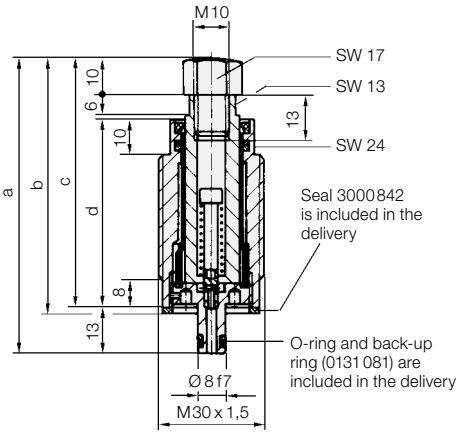


a	[mm]	80.5	90.5
b	[mm]	79	89
c	[mm]	54	64
Spring force min./max.	[N]	8/13	8/13
Part no.		**1940000**	**1940010**

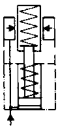


Contact by air pressure

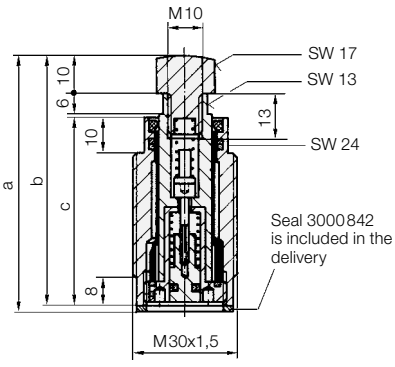
a	[mm]	84	94
b	[mm]	72.5	82.5
c	[mm]	71	81
d	[mm]	54	64
Spring force min./max.	[N]	20/30	20/30
Plunger contact force at 1 bar air pressure (deduct spring force if necessary)	[N]	20	20
Part no.		**1941000**	**1941010**



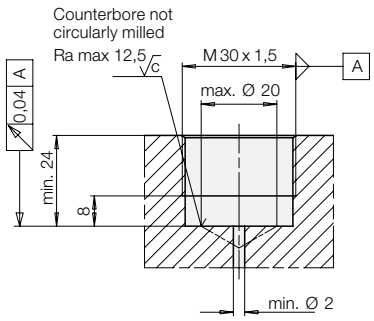
Contact by oil pressure



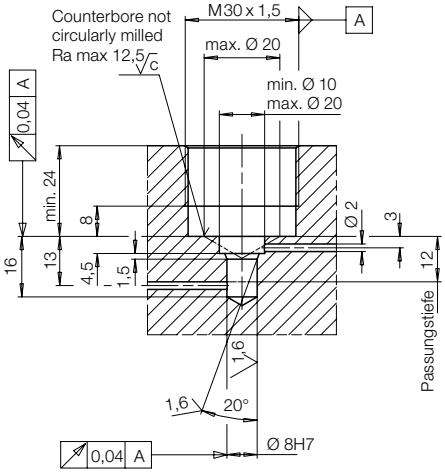
Stroke	[mm]	8	15	8	15
a	[mm]	72,5	79,5	82,5	89,5
b	[mm]	71	78	81	88
c	[mm]	54	61	64	71
Spring force min./max.	[N]		10/23		10/23
Max. oil flow rate	[cm³/s]		25		25
Part no.	Stroke 8	**1942000**		**1942010**	
	Stroke 15	**1942005**		**1942015**	



Installation dimensions 19400X0/19420X0

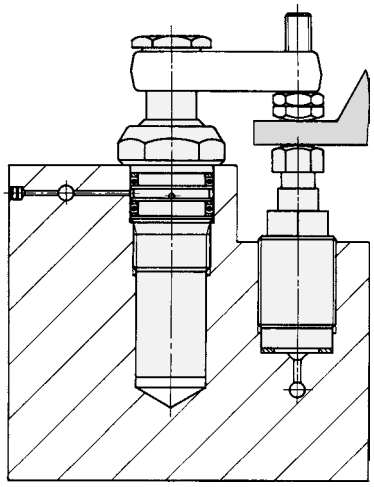


Installation dimensions 19410X0



Combination possibility

Threaded-body work support
with threaded-body swing clamps
as per data sheet B 1.891

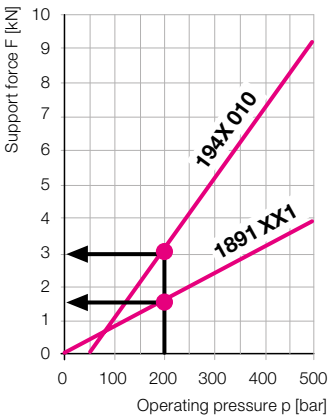


Support and clamping forces have to be adapted to each other, so that there will be sufficient force reserve available for the threaded-body work support to absorb the machining forces.

Thumb rule: Support force ≥ 2 x opposing force

The required minimum pressure is 200 bar.

The diagram below shows the graphs of the clamping and support forces for the 2 possible combinations.



Example

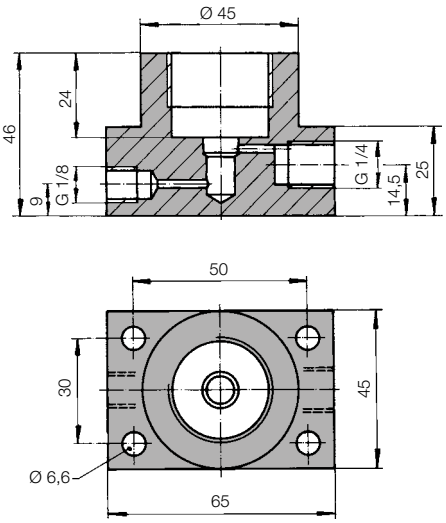
Swing clamp 1891XX1 clamps against threaded-body work support 194X010.
Operating pressure 200 bar.

	Support force	3.0 kN
–	Clamping force	1.5 kN
=	possible opposing force	1.5 kN

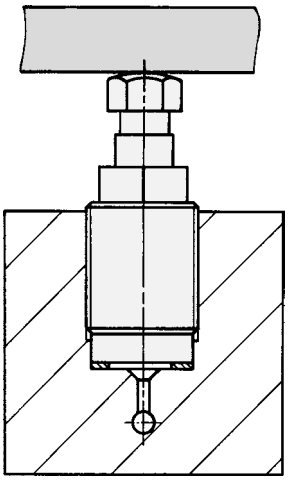
Accessories

Mounting body **Part no. 3467086** as per data sheet B 1.460 or

body with pneumatic connection
Part no. 3467112

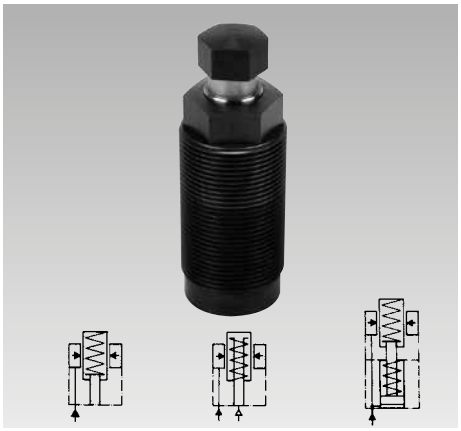


Installation example



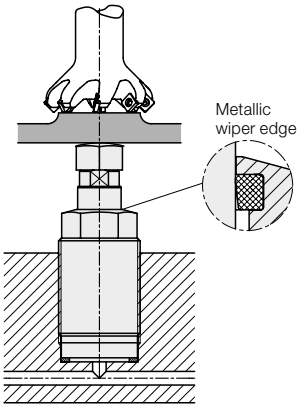
Threaded-Body Work Support

M 30 x 1.5, metallic wiper edge, 2 sizes, 3 types of function, single acting, max. operating pressure 500 bar



Advantages

- Space-saving threaded-body version
- 2 sizes
- 3 types of function
- Contact force by spring or pneumatically adjustable (1941 0X2)
- Load force 6.5 or 9.5 kN
- Metallic wiper edge and FKM wiper
- Corrosion-resistant interior parts
- Mounting body as accessory



Application

Hydraulic work supports are used to provide a self-adjusting rest for the workpiece during the machining operations. They compensate the workpiece surface irregularities, also vibration and deflection under machining loads.
The threaded-body design allows for space-saving and direct installation into the fixture body. Oil supply is made through drilled channels.

Description

In the body of the threaded-body work support a thin-walled locking bush is integrated, which locks cylindrically around the freely-movable support plunger when pressurising the element with hydraulic oil.

1. Spring force
2. Air pressure
3. Oil pressure combined with spring force

The elements are protected against penetration of swarf by a metallic wiper edge and are sealed against liquids.

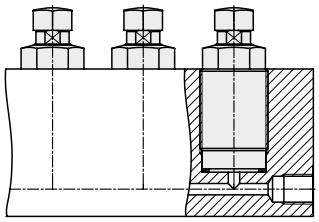
Important notes!

Work supports are not suitable to compensate side loads. The support plunger must not be stressed by tensile load.
The admissible load force is valid for static or dynamic load. Machining forces can generate vibrations, whose amplitude exceeds far an average value, and this can cause yielding of the support plunger. Remedy: increase the safety factor or the number of work supports.
In case of accumulation of very small grinding swarf there can be a swarf holdup in the area of the metallic wiper edge. Remedy: Regular cleaning in this area.
Work supports must only be operated with a sealed contact bolt. For special versions of contact bolts we can provide you a drawing with the interior contour.

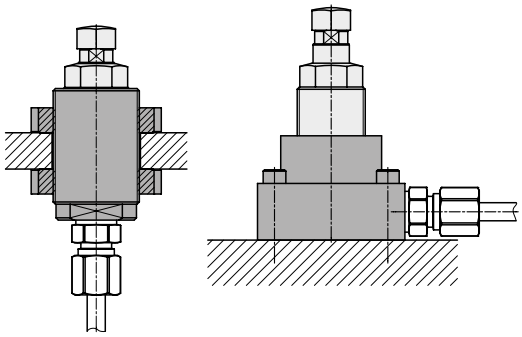
Operating conditions, tolerances and other data see data sheet A 0.100.

Installation and connecting possibilities

Drilled channels



Pipe thread
with accessory mounting body
with exterior thread with flange



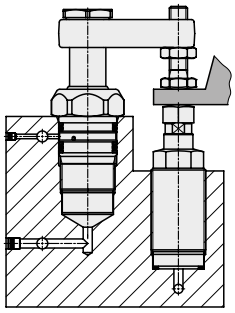
Combination with clamping elements

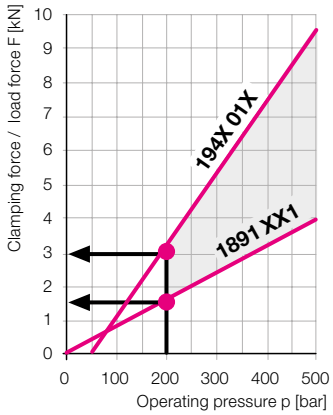
Load and clamping forces have to be adapted to each other, so that there will be sufficient force reserve available for the threaded-body work support to absorb the machining forces.

Rough estimate:

Min. load force ≥ 2 x clamping force

The opposite diagram shows the course of the load and clamping force for the possible combination of 194X01X with a threaded-body swing clamp 1891XX1 as per data sheet B 1.891. The vertical distance of the two straight lines in the area of the colorised surface indicates the maximally possible machining force including reserve.





Example

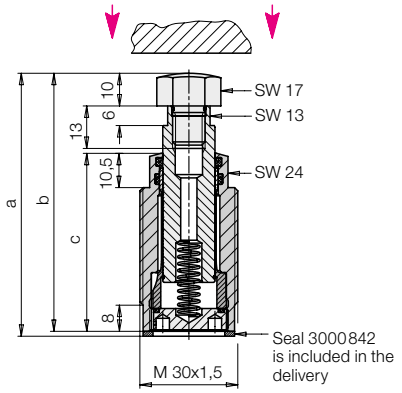
Threaded-body swing clamp 1891 101 and threaded-body work support 1942 012.
Operating pressure 200 bar
As per diagram:

Adm. load force	3,0 kN
– Clamping force	1,5 kN
Possible machining force	1,5 kN

If this force is not sufficient the work support can also be supplied with 500 bar. The pressure for the swing clamp will be reduced.

Spring force

Off-position: Plunger extended
Contact with spring force

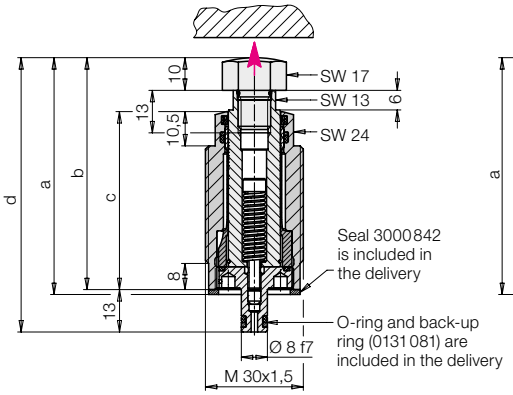


Adm. load	[kN]	6.5	9.5
Stroke	**[mm]**	**8**	**8**
a	[mm]	80.5	90.5
b	[mm]	79	89
c	[mm]	54.5	64.5
Spring force min./max.	[N]	7/12	7/12
Part no.		**1940002**	**1940012**

Accessory	Part no.
Mounting body flange	**3467111**
Mounting body M38x1.5	**3467086**
Lock nut M38x1.5	**3300088**

Air pressure

Off-position: Plunger retracted
Extend and contact with air pressure

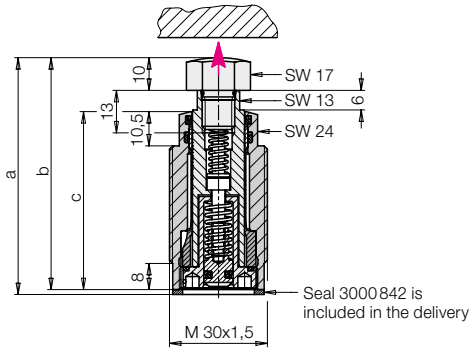


Adm. load	[kN]	6.5	9.5
Stroke	**[mm]**	**8**	**8**
a	[mm]	72.5	82.5
b	[mm]	71	81
c	[mm]	54.5	64.5
d	[mm]	84	94
Spring force min./max.	[N]	20/30	20/30
Part no.		**1941002**	**1941012**

	Part no.
Mounting body flange	**3467112**

Oil pressure combined with spring force

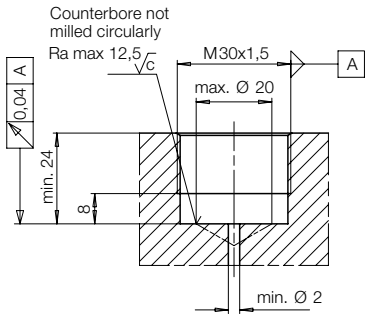
Off-position: Plunger retracted
Extend with hydraulic and contact with spring force



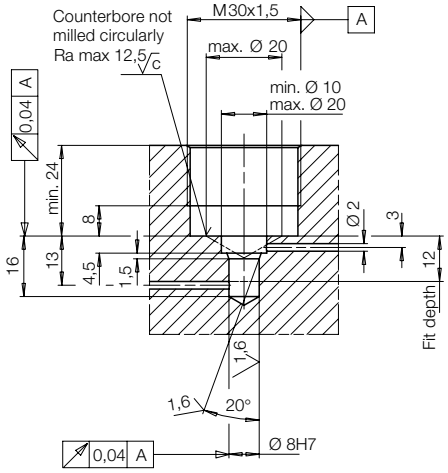
Adm. load	[kN]	6.5	6.5	9.5	9.5
Stroke	**[mm]**	**8**	**15**	**8**	**15**
a	[mm]	72.5	79.5	82.5	89.5
b	[mm]	71	78	81	88
c	[mm]	54.5	64.5	64.5	71.5
Spring force min./max.	[N]	16/33	10/22	16/33	10/22
Part no.	**1942**	**-002**	**-007**	**-012**	**-017**

	Part no.
Mounting body flange	**3467111**
Mounting body M38x1.5	**3467086**
Lock nut M38x1.5	**3300088**
Sharp-edged orifice Ø 0.5 mm	**3420386**

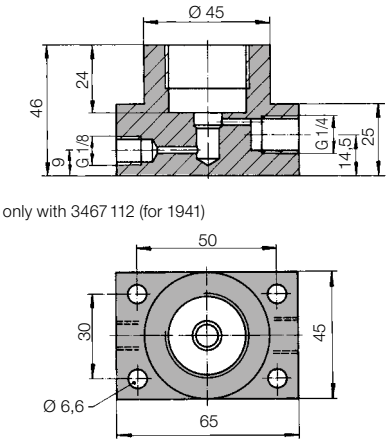
Porting details for 1940 and 1942



Porting details for 1941



Mounting body flange

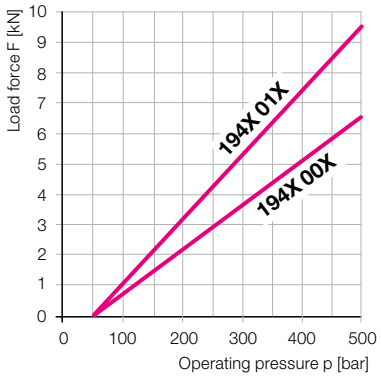


Technical data

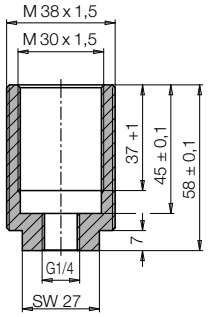
Support plunger Ø	[mm]	16
Stroke	[mm]	8/15
Required oil per stroke	[cm³]	0.5/1
Admissible flow rate*	[cm³/s]	25
Plunger contact force at 1 bar Luftdruck (1941) (Federkraft abziehen!)	[N]	20
Recommended mini. pressure	[bar]	100
Elastic deformation with load and 500 bar	[mm/kN]	0.004
Max. operating temperature	[°C]	80
Seating torque	[Nm]	60
Weight, approx.	[kg]	0.3

***** If required insert sharp-edged orifice Ø 0.5 mm in sealing ring (see accessory 1942)

Admissible load force F as function of the operating pressure p

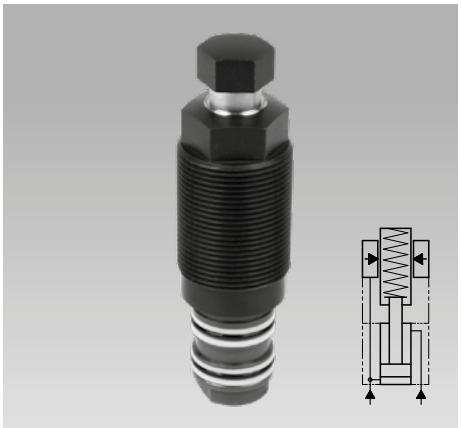


Mounting body M38x1.5



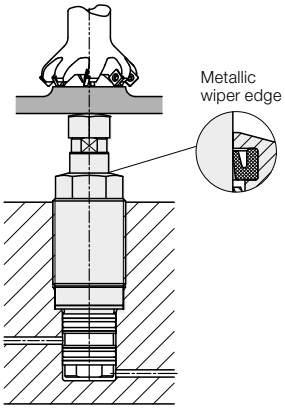
Threaded-Body Work Supports

M 30 x 1.5, with metallic wiper edge, 4 sizes, double acting, max. operating pressure 500 bar



Advantages

- High process safety by double-acting function
- 4 sizes
- Space-saving threaded-body version
- Contact force by spring
- Load force up to 6.5 or 9.5 kN
- Metallic wiper edge and FKM wiper
- Corrosion-resistant interior parts



Application

Hydraulic work supports are used to provide a self-adjusting rest for the workpiece during the machining operations. They compensate the workpiece surface irregularities, also vibration and deflection under machining loads.
The threaded-body design allows for space-saving and direct installation into the fixture body. Oil supply is made through drilled channels.
In case of the double-acting version the return stroke of the support plunger is effected in a precisely defined time, that is above all advantageous in cycle-dependent installations.

Description

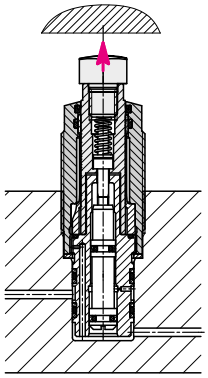
In the body of the threaded-body work support a thin-walled locking bush is integrated, which locks cylindrically around the freely-movable support plunger when pressurising the element with hydraulic oil.
The support plunger is extended and retracted by means of a small double-acting cylinder. The threaded-body work supports are protected against swarf by a metallic wiper and sealed against liquids.

Important notes

Work supports are not suitable to compensate side loads. The support plunger must not be stressed by tensile load.
The admissible load force is valid for static or dynamic load. Machining forces can generate vibrations, whose amplitude far exceeds an average value, and this can cause yielding of the support plunger. Remedy: increase the safety factor or the number of work supports.
In case of accumulation of very small grinding swarf there can be a swarf holdup in the area of the metallic wiper edge. Remedy: regular cleaning in this area.
Work supports must only be operated with a sealed contact bolt.
For special versions of contact bolts, we can provide you with a drawing showing the interior contour.
Operating conditions, tolerances and other data see data sheet A 0.100.

Function

The support plunger is retracted in off-position. When pressurised the piston of the double-acting cylinder extends and the support plunger contacts the already clamped workpiece with spring force.
The support plunger will be locked by the increasing hydraulic pressure and can compensate forces in axis direction.
For unclamping the pressure will be reduced and the return line will be supplied with pressure.
The piston returns to its off-position and retracts the support plunger.

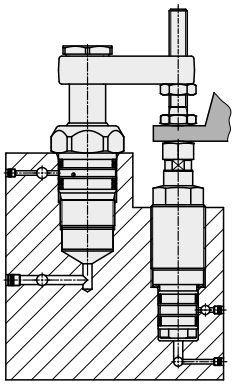


Combination with clamping elements

Load and clamping forces have to be adapted to each other, so that there will be sufficient force reserve available for the threaded-body work support to absorb the machining forces.
Rough estimate:

Min. load force ≥ 2 x clamping force

The opposite diagram shows the course of the load and clamping force for the possible combination of 194X11X with a threaded-body swing clamp 1891XX1 as per data sheet B 1.891. The vertical distance of the two straight lines in the area of the colorised surface indicates the maximally possible machining force including reserve.

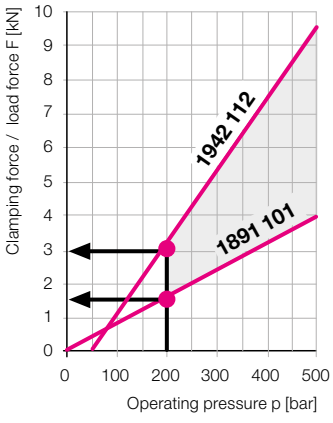


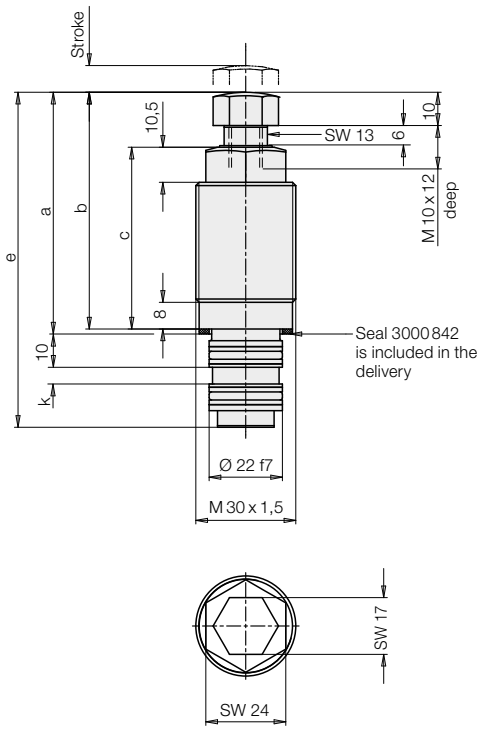
Example

Threaded-body swing clamp 1891 101 and threaded-body work support 1942 112.
Operating pressure 200 bar
As per diagram:

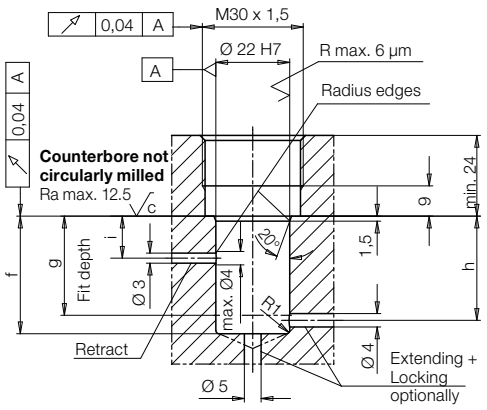
Adm. load	3.0 kN
– Clamping force	1.5 kN
Possible machining force	1.5 kN

If this force is not sufficient the work support can also be supplied with 500 bar. The pressure for the swing clamp will be reduced.





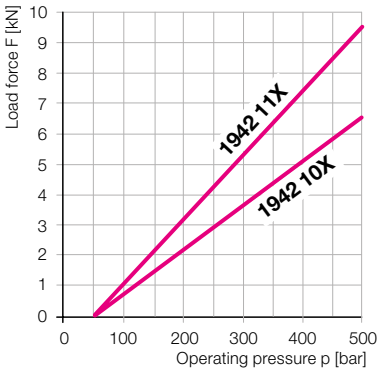
Porting details



Technical data

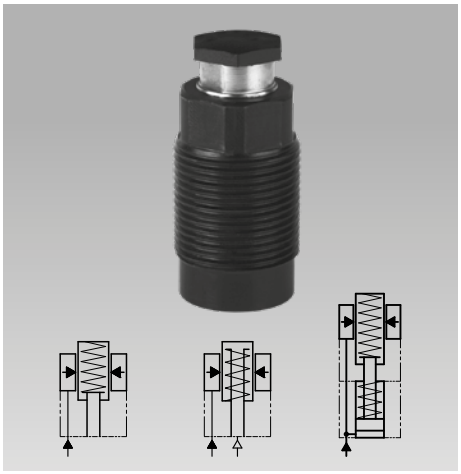
Adm. load force [500 bar]	[kN]	6.5	6.5	9.5	9.5
Stroke	[mm]	8	15	8	15
Support plunger Ø	[mm]	16	16	16	16
Oil volume extend	[cm³]	0.7	1.2	0.7	1.2
retract	[cm³]	0.2	0.3	0.2	0.3
Admissible flow rate	[cm³/s]	25	25	25	25
Recommended min. pressure	[bar]	100	100	100	100
Minimum pressure to retract	[bar]	20	20	20	20
Spring force min./max.	[N]	16/33	10/22	16/33	10/22
Elastic deformation with load and 500 bar	[µm/kN]	4	4	4	4
Max. operating temperature	[°C]	80	80	80	80
Tightening torque	[Nm]	60	60	60	60
a	[mm]	72.5	79.5	82.5	89.5
b	[mm]	71	78	81	88
c	[mm]	54.5	61.5	64.5	71.5
e	[mm]	100.5	113	110.5	123
f	[mm]	29.5	35	29.5	35
g	[mm]	24	29.5	24	29.5
h	[mm]	26.5	32	26.5	32
i	[mm]	13	14.5	13	14.5
k	[mm]	5	8	5	8
Weight approx.	[kg]	0.32	0.36	0.36	0.40
Part no.		**1942102**	**1942107**	**1942112**	**1942117**

Admissible load force F as a function of the operating pressure p



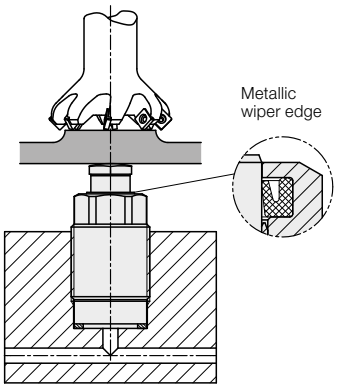
Threaded-Body Work Supports

M 26 x 1.5, with metallic wiper edge, 3 types of function, single acting, max. operating pressure 350 bar



Advantages

- Minimum dimensions
- Minimum distance of the support points 30 mm
- 3 types of function
- Contact force by spring or pneumatically adjustable (1941 900)
- Load force up to 4 kN
- Metallic wiper edge and FKM wiper
- Hardened and sealed contact bolt
- Corrosion-resistant interior parts



Application

Hydraulic work supports are used to provide a self-adjusting rest for the workpiece during the machining operations. They compensate the workpiece surface irregularities, also vibration and deflection under machining loads.
The threaded-body design allows for space-saving and direct installation into the fixture body. Oil supply is made through drilled channels.

Description

In the body of the threaded-body work support a thin-walled locking bush is integrated, which locks cylindrically around the freely-movable support plunger when pressurising the element with hydraulic oil.
There are three variations of plunger actuation:

1. Spring force
2. Air pressure
3. Oil pressure combined with spring force

The elements are protected against penetration of swarf by a metallic wiper edge and sealed against liquids.

Important notes

Work supports are not suitable to compensate side loads. The support plunger must not be stressed by tensile load.

The admissible load force is valid for static or dynamic load. Machining forces can generate vibrations, whose amplitude far exceeds an average value, and this can cause yielding of the support plunger. Remedy: increase the safety factor or the number of work supports.

In case of accumulation of very small grinding swarf there can be a swarf holdup in the area of the metallic wiper edge. Remedy: regular cleaning in this area.

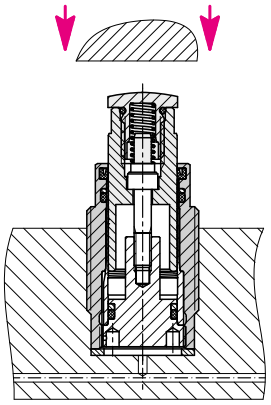
Work supports must only be operated with a sealed contact bolt. For special versions of contact bolts, we can provide you with a drawing showing the interior contour.

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

Types of function

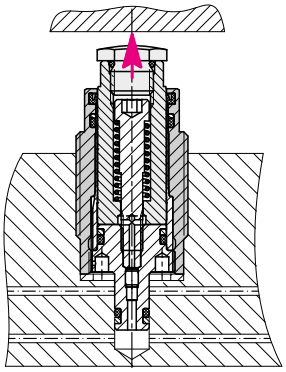
Spring force

The support plunger is maintained in the extended position by spring force.
When inserting the workpiece into the fixture, the support plunger is pushed back and contacts the surface to be supported with spring force.
If the workpiece is clamped, the increasing hydraulic pressure locks the support plunger and thus forces in axis direction can be compensated.
After unclamping the support plunger still contacts the workpiece with spring force, until the workpiece will be unloaded from the fixture.



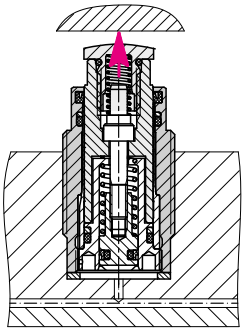
Air pressure

The support plunger is maintained in the retracted position by spring force.When pneumatically pressurised the support plunger moves against the already clamped workpiece. The contact force can be adjusted by means of a pneumatic pressure reducing valve.
The support plunger will be locked by hydraulic pressure and can compensate forces in axis direction.For unclamping hydraulic and air pressure will be released and the support plunger retracts by spring force to its off-position.

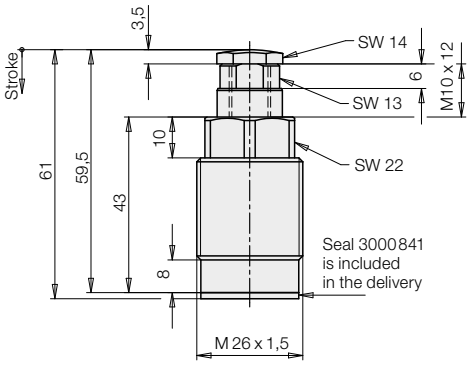


Oil pressure combined with spring force

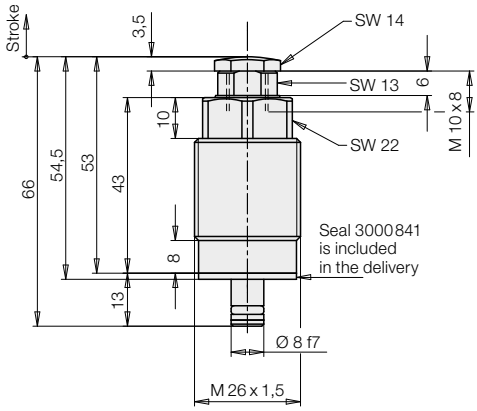
The support plunger is maintained in the retracted position by spring force.
When hydraulically pressurised the small piston extends and the support plunger contacts the already clamped workpiece with spring force.
The support plunger will be locked by the increasing hydraulic pressure and can compensate forces in axis direction.
For unclamping hydraulic pressure will be released. The small piston retracts by spring force to its off-position and also retracts the support plunger.



Spring force
Part no. 1940900

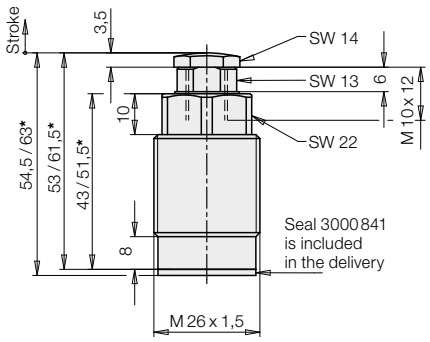


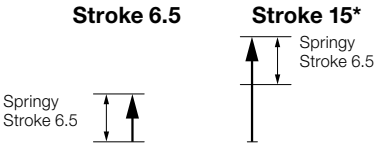
Air pressure
Part no. 1941900



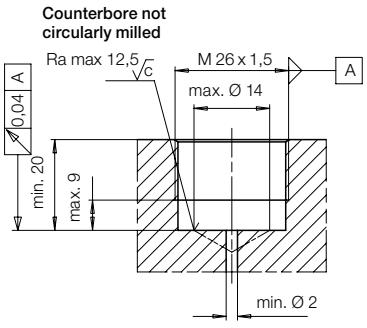
Oil pressure combined with spring force

Part no.	1942900	1942925
	Stroke 6.5	Stroke 15*

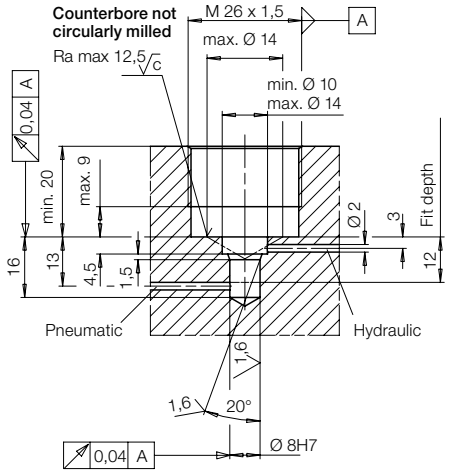




Porting details for 1940 and 1942



Porting details for 1941



Accessories for 1942900 and 1942925

Sharp-edged orifice Ø 0.5

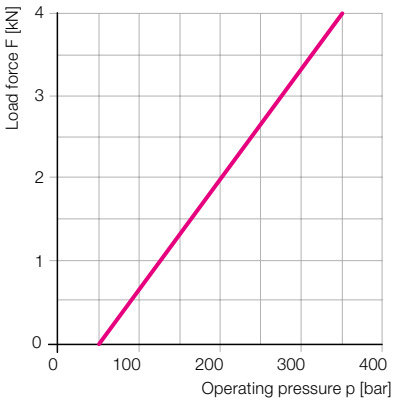
Part no. 3420395

Technical data

Adm. load force (350 bar)		[kN]	4
Support plunger Ø		[mm]	16
Stroke	(1940900, 1941900, 1942900)	[mm]	6.5
	(1942925)	[mm]	15
Springy stroke*		[mm]	6.5
Required oil per stroke	(1942900)	[cm³]	0.42
	(1942925)	[cm³]	0.96
Admissible flow rate	(1942 9XX)	[cm³/s]	25
Max. operating pressure		[bar]	350
Recommended minimum pressure		[bar]	100
Plunger contact force at 1 bar air pressure (1941900, deduct spring force)		[N]	20
Spring force min./max.		[N]	15/25
Elastic deformation with load and 350 bar		[µm/kN]	3
Max. operating temperature		[°C]	80
Max. seating torque		[Nm]	50
Weight approx.		[kg]	0.2

* In the range of the springy stroke the support plunger contacts the workpiece with spring force.

Admissible load force F as a function of the operating pressure p

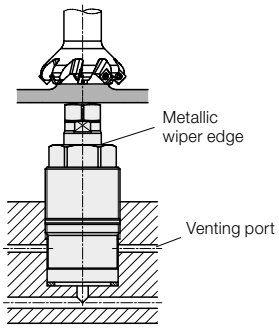


Threaded-Body Work Support

M 40 x 1.5, with metallic wiper edge, single acting, max. operating pressure 500 bar

Advantages

- Space-saving threaded-body version
- 3 types of operation
- Contact force by spring or pneumatically adjustable (1941 201)
- Load force up to 15 kN
- Metallic wiper edge and FKM wiper
- Venting of the spring area
- Connection of positive air pressure protection is possible
- Mounting body as accessory
- Connection of positive air pressure protection up to 4 bar is possible



Application

Hydraulic work supports are used to provide a self-adjusting rest for the workpiece during the machining operations. They compensate the workpiece surface irregularities, also vibration and deflection under machining loads. The threaded-body design allows for space-saving and direct installation into the fixture body. Oil supply is made through drilled channels.

Description

In the body of the threaded-body work support a thin-walled locking bush is integrated, which locks cylindrically around the freely-movable support plunger when pressurising the element with hydraulic oil.
For contact of the support plunger at the workpiece there are 3 possibilities (description see page 2):
1. Spring force
2. Air pressure advanced
3. Oil pressure combined with spring force

The elements are protected against penetration of swarf by a metallic wiper edge and sealed against liquids. A mounting body for pipe threads or drilled channels is available as accessory.

Important notes

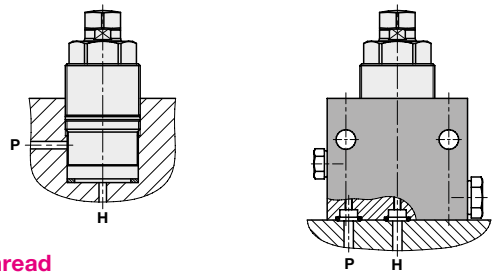
Work supports are not suitable to compensate side loads. The admissible load force as per diagram on page 2 is static. Machining forces can generate vibrations, whose amplitude exceeds far an average value, and this can cause yielding of the support plunger.
Remedy: increase the safety factor or the number of work supports.
M12 special contact bolts must have a thread length of 12 mm.

Positive air pressure connection

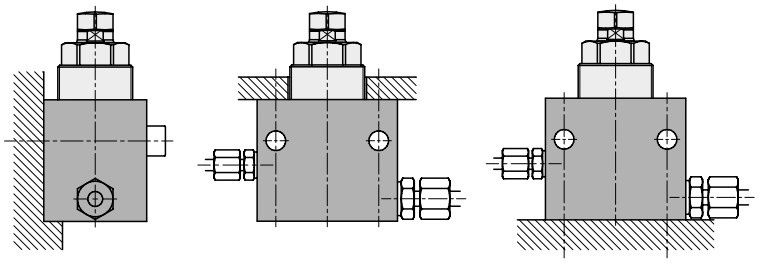
To guarantee functioning of the work supports, a vent port is imperative. No liquids may enter the end of the bore hole (see also data sheet G 0.110 „Venting of the spring area“).
It is recommended to connect positive air pressure protection. While locking the support plunger, the positive air pressure must not exceed 4 bar. If the support plunger is not locked, the positive air pressure must be reduced to a maximum of 0.2 bar.
The positive air pressure connection must be free of oil and water.

Installation and connecting possibilities

Drilled channels with accessory and mounting body



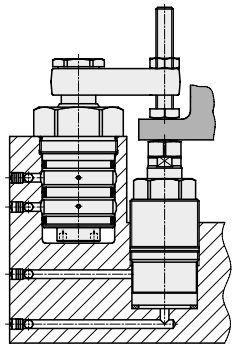
Pipe thread
with accessory mounting body



Combination with clamping elements

Support and clamping forces have to be adapted to each other, so that there will be sufficient force reserve available for the threaded-body work support to absorb the machining forces.

Rough estimate:
Support force ≥ 2 x clamping force

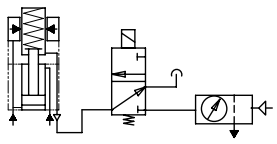


Example

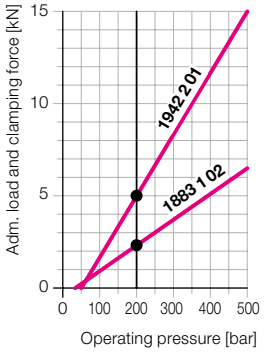
Threaded-body swing clamp 1883 102 and threaded-body work support 1942 201.
Operating pressure 200 bar (because of the clamping arm)
As per diagram:

Adm. load force	5.0 kN
– Clamping force	2.3 kN
Possible machining force	2.7 kN

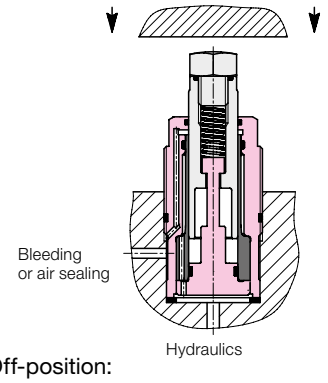
To get a higher support force, the threaded-body work support can be supplied with 500 bar and the pressure for the swing clamp can be reduced.



Connection of positive air pressure protection



Part no. 1940201

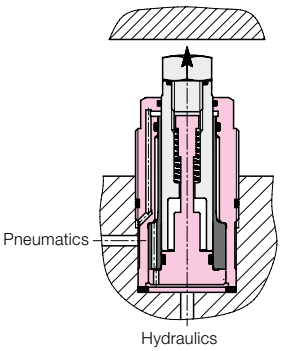


Off-position:
Plunger extended
Contact with spring force

The support plunger is pushed back by the inserted workpiece, the spring force has to be overcome.

The support plunger will be locked by hydraulic pressure and can compensate forces in axis direction.
After unclamping the support plunger contacts still the workpiece with spring force, until the workpiece will be unloaded from the fixture.

Part no. 1941201

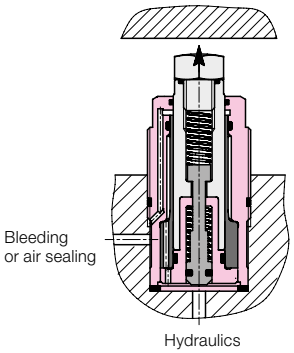


Off-position:
Plunger retracted
Extend and contact with air pressure

The support plunger contacts the workpiece by air pressure. The contact force is proportional to the air pressure less spring return force.

The support plunger will be locked by hydraulic pressure and can compensate forces in axis direction.
For unclamping hydraulic and air pressure will be released and the support plunger retracts by spring force to its off-position.

Part no. 1942201

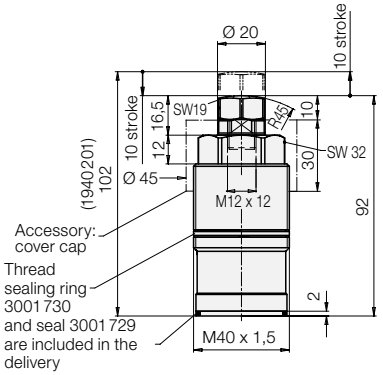


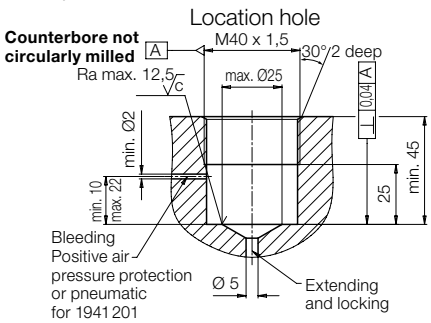
Off-position:
Plunger retracted
Extend with hydraulics
Contact with spring force

The support plunger is extended by a hydraulically pressurised small piston and contacts the workpiece with spring force.

The support plunger will be locked by the increasing hydraulic pressure and can compensate forces in axis direction.
For unclamping hydraulic pressure will be released. The small piston retracts by spring force to its off-position and also retracts the support plunger.

Technical data		
Support plunger Ø	[mm]	20
Stroke	[mm]	10
Adm. load force at 500 bar	[kN]	15
Recommended minimum pressure	[bar]	100
Spring force min./max.	[N]	20/32
Plunger contact force at 1 bar air pressure (deduct spring force!)	[N]	31
Max. air pressure for positive air pressure protection	[bar]	0,2
Required oil per stroke (1942201)	[cm³]	1
Admissible oil flow rate (1942201)	[cm³/s]	25
Seating torque	[Nm]	100
Weight approx.	[kg]	0,6

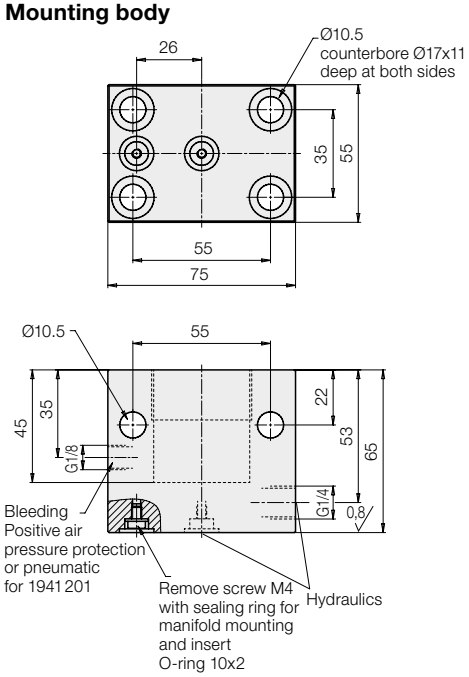




Before mounting!
Location hole oil free and dry.

Accessories	**Part no.**
Mounting body	**0346801**
O-ring 10x2	**3000347**
Spare sealing ring 38/30x2	**3001729**
Spare thread sealing ring	**3001730**
Screw plug G1/4	**3610264**
Screw plug G1/8	**3610263**
Cover cap	**35371009**

Mounting body



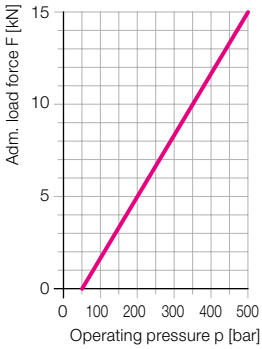
Sharp-edged orifice 0.6 mm for 1942201

If the flow rate is larger than 25 cm³/s (1.5 l/min), malfunctions may occur.
By the installation of the sharp-edged orifice and a special sealing ring the extending speed of the support plunger is reduced.

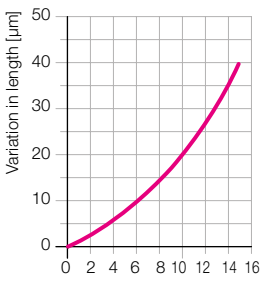
Part no. 0341108

Please note:
The standard sealing ring 38/30x2 cannot longer be used. The sealing ring 3002035 delivered with the sharp-edged orifice is 1 mm thicker, so that the measure of length increases from 92 to 93 mm.
The sharp-edge orifice has to be inserted in the location hole so that letter A is pointing upwards.

Admissible load force F as a function of the operating pressure p.

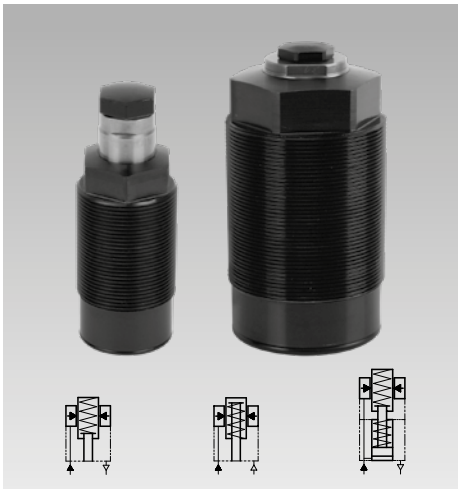


Variation in length of the support plunger during load.



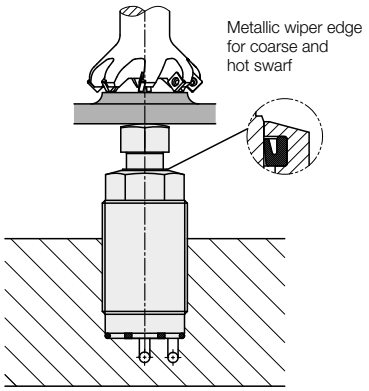
Threaded-Body Work Supports

3 function types, with metallic wiper edge, optional contact control single acting, max. operating pressure 500 bar



Advantages

- Space-saving threaded-body version
- 4 sizes available
- Load force up to 42 kN
- Workpiece contact by spring force or pneumatically adjustable (type 1941)
- Optional pneumatic contact control
- Metallic wiper edge
- Protected FKM wiper
- Inner parts protected against corrosion
- Venting of the spring area
- Connection of positive air pressure protection possible
- Protection cap available as accessory
- Integrated orifice for flow rate limitation (type 1942)
- Mounting position: any
- Connection of positive air pressure protection up to 4 bar is possible



Application

Hydraulic work supports are used to provide a self-adjusting rest for workpieces and avoid their vibration and deflection under machining loads.
The threaded-body design allows for space-saving and direct installation into the fixture body. Hydraulic oil supply and venting are made via drilled channels.

Description

In the body of the threaded-body work supports a thin-walled locking bush is integrated, which locks cylindrically around the freely-movable support plunger when pressurising the element with hydraulic oil.
There are three variations of plunger actuation:

1. Spring force
2. Pneumatically
3. Hydraulically and spring force

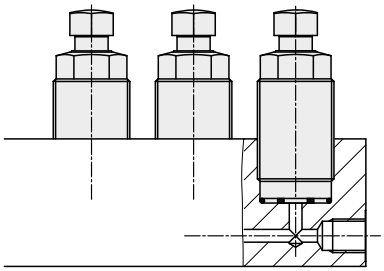
The correct contact at the workpiece can be controlled with the optional pneumatic contact control.
The body with metallic wiper edge protects the subjacent FKM wiper against coarse and hot swarf.

Important notes

Work supports are not suitable to compensate side loads. The support plunger must not be stressed by tensile load.
The admissible load force as per diagram is valid for static and dynamic load.
Machining forces can generate vibrations, whose amplitude exceeds far an average value, and this can cause yielding of the support plunger.
Remedy: Increase the safety factor or the number of work supports.
In dry machining applications, with minimum quantity lubrication or in case of accumulation of very small swarf, there can be a swarf hold-up in the area of the metallic wiper edge.
Remedy: Regular cleaning or mount protection cap (see page 2).
Operating conditions, tolerances and other data see data sheet A 0.100.

Installation and connecting possibilities

Drilled channels



Function

Description on page 2 and page 5.

Pneumatic contact control

Description see page 5.

Combination with clamping elements

With this combination, clamping and machining forces will add up:
clamping force
\+ max. machining force
= minimum support force x safety factor
Rough calculation from practice:
Required support force ≥ 2 x clamping force
To increase the safety, a support force as high as possible should be achieved

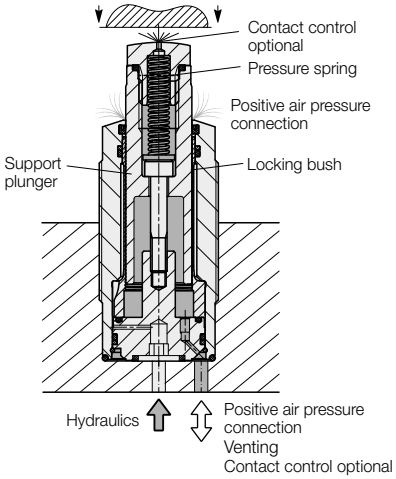
- by using a larger work support
  or
- by using the max. operating pressure of 500 bar by installing a little intensifier (e.g. data sheet D 8.756), in the supply line of the work supports

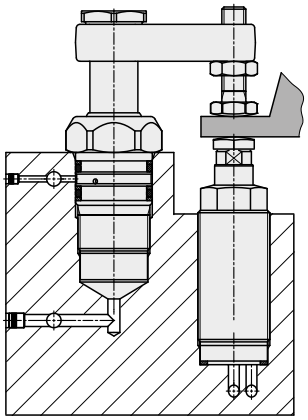
Positive air pressure connection

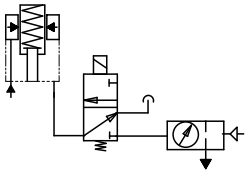
To guarantee functioning of the work supports, a vent port is imperative. No liquids may enter the end of the bore hole (see also data sheet G 0.110 „Venting of the spring area“).
It is recommended to connect positive air pressure protection. While locking the support plunger, the positive air pressure must not exceed 4 bar. If the support plunger is not locked, the positive air pressure must be reduced to a maximum of 0.2 bar.
The positive air pressure connection must be free of oil and water.

Example type 1940 XXX

Support plunger in off-position extended

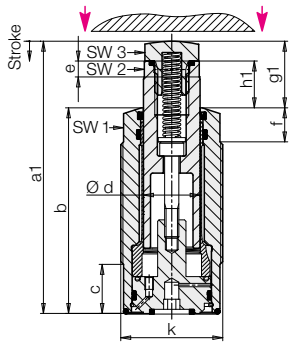






Connection of positive air pressure protection

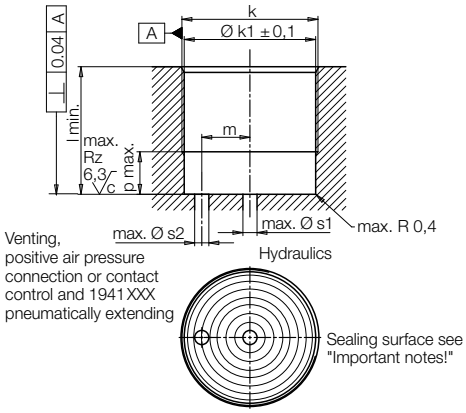
Spring force
Part no. 1940 XXX



Off-position:
Support plunger extended
Contact by spring force

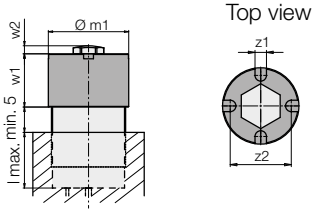
When inserting the workpiece, the support plunger is pushed back, the spring force has to be overcome (see page 4).
The support plunger will be locked by hydraulic pressure and can compensate forces in axis direction.
After unclamping, the support plunger still contacts the workpiece with spring force, until the workpiece will be unloaded from the fixture.

Porting details

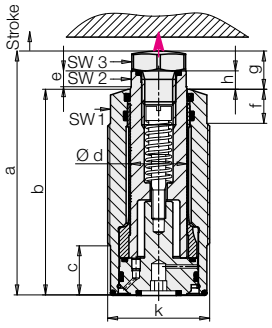


Important notes!
Machining
The code letter c in the surface finish symbol for the sealing surface stands for a concentric groove direction (see drawing), that is given in case of a lowered sealing surface.
In the case of circularly milled surfaces leakages can occur, since the grooves run at right angle to the sealing surface.
Pay attention when mounting:
The location hole must be dry and oil-free to ensure that no liquids penetrate into the spring area of the work supports.
When exchanging work supports:
To get a dry location hole, the hydraulic oil in drilled channels must be removed.

Protection cap (accessories)
The protection cap is fixed by means of the standard contact bolt to the support plunger.
It shall be used above all, if a strong coolant jet is directed onto the support plunger or the wiper edge.



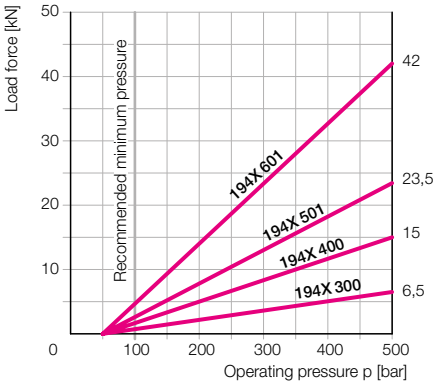
Pneumatically
Part no. 1941 XXX



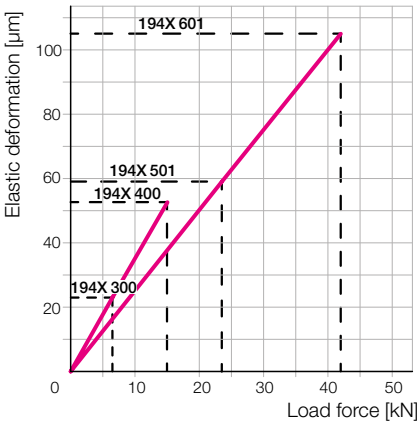
Off-position:
Support plunger retracted
Extend and contact with air pressure

The support plunger contacts the workpiece by air pressure. The contact force is proportional to the air pressure less spring return force (see page 4).
The support plunger will be locked by hydraulic pressure and can compensate forces in axis direction.
For retraction, hydraulic and air pressure will be released and the support plunger retracts by spring force to its off-position.

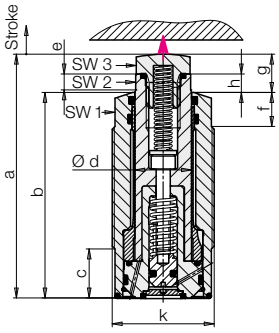
Adm. load force F
as a function of the operating pressure p



Elastic deformation with load force F and operating pressure 500 bar



Hydraulically and spring force
Part no. 1942 XXX

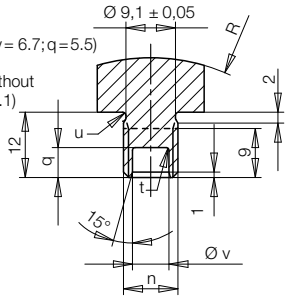


Off-position:
Support plunger retracted
Extend with hydraulics
Contact by spring force

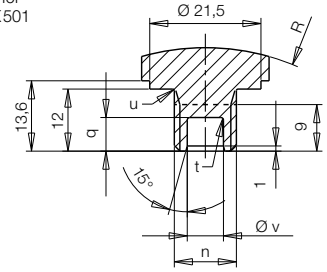
The support plunger is extended by a hydraulically pressurised small piston and contacts the workpiece with spring force.
The support plunger will be locked by increasing hydraulic pressure and can compensate forces in axis direction.
For retraction, the hydraulic pressure will be released. The small piston retracts by spring force to its off-position and also retracts the support plunger.

Required dimensions for self-made contact bolts

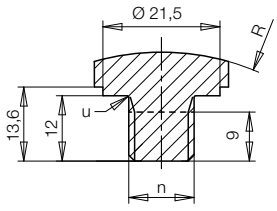
Valid for
1940 300
1941 300 (Øv = 6.7; q = 5.5)
1942 300
194X 400 (without undercut Ø 9.1)



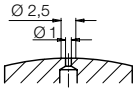
Valid for
194X 501



Valid for
194X 601



Contact bolt for contact control



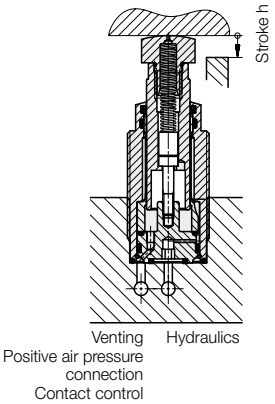
Adm. load force (500 bar)	**[kN]**	**6.5**		**15**	**23.5**	**42**
Support plunger Ød	[mm]	16		20	28	32
Stroke	**[mm]**	**8**	**15**	**10**	**10**	**16**
Recommended minimum pressure	[bar]	100		100	100	100
Type						
1940 Spring contact force min./max.	[N]	10/13	–	14/25	22/35	34/64
Recommended pressure for positive air pressure connection	[bar]	0.2	–	0.2	0.2	0.2
1941 Pneumatic contact force at 1 bar	[N]	20	–	31.4	61.5	80
minus spring return force min./max.	[N]	24.5/35	–	19/31	22/35	31/52
1942 Spring contact force min./max.	[N]	10/13	10/23	14/25	22/35	32/61
Spring return force min./max.	[N]	19/39	16/57	30/52	47/69	67/88
Max. pressure of positive air pressure connection	[bar]	0.2		0.2	0.2	0.2
Max. return pressure	[bar]	1		1	1	1
Required oil per stroke	[cm³]	0.5	1	0.8	1.54	3.22
Elastic deformation with load and 500 bar operating temperature	[µm/kN]	3.5		3.5	2.5	2.5
Operating temperature	[°C]	0…70		0…70	0…70	0…70
Tightening torque	[Nm]	60		100	200	400
a	[mm]	75.5	82.5	86	90	115
a1	[mm]	83.5		96	100	131
b	[mm]	59	66	72.5	78	102.5
c	[mm]	8.5		17.5	20.5	20.5
e	[mm]	6		5.6	3	4
f	[mm]	10.5		12	12	18
g	[mm]	16.5		13.5	12	12.5
g1	[mm]	24.5		23.5	22	28.5
h	[mm]	6.5		6.5	4	4.5
h1	[mm]	14.5		16.5	14	20.5
k	[mm]	M30x1.5		M36x1.5	M48x1.5	M60x1.5
Ø k1	[mm]	28.4		34.4	46.4	58.4
l min.	[mm]	21		35	42	46
l max.	[mm]	37.5		49	53.5	65.5
m	[mm]	10		12	17	22
Ø m1	[mm]	35		40	52	65
n	[mm]	M10		M12	M12	M12
p max.	[mm]	8		15	18	18
q	[mm]	19		15	6.5	–
Ø s1 max.	[mm]	8		10	14	16
Ø s2 max.	[mm]	2		4	5	5
t	[mm]	0.5		0.2	0.5	–
u	[mm]	0.6		0.3	0.3	0.3
Ø v	[mm]	6		6.9	7	–
w1	[mm]	28		30	30	43
w2	[mm]	10		7	6.4	6.4
z1	[mm]	5		6	8	8
z2	[mm]	28		32	43	53
R	[mm]	35		45	45	45
SW1	[mm]	24		30	41	50
SW2	[mm]	13		17	22	27
SW3	[mm]	17		19	22	22
Weight, approx.	[kg]	0.32	0.35	0.55	1.0	2.3
Part no.						
Contact by spring force		**1940300P**	**–**	**1940400P**	**1940501P**	**1940601P**
Pneumatically extended		**1941300P**	**–**	**1941400P**	**1941501P**	**1941601P**
Hydraulically extended and spring force		**1942300P**	**1942305P**	**1942400P**	**1942501P**	**1942601P**

P = Option contact control (see also page 5)

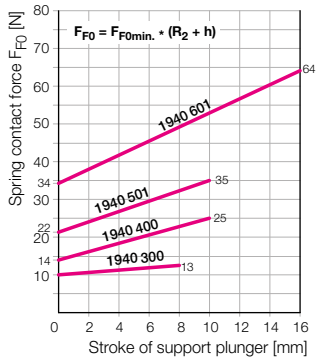
Accessories					
Protection cap (splash guard)	**3546110**	**3546111**	**3546112**	**3546113**
Weight protection cap	[kg]	0.023	0.025	0.032	0.062
Contact bolt for contact control	**3614390**	**3614389**	**3614391**	**3614418**
Contact bolt without contact control	**3614330**	**3614388**	**3614420**	**3614419**

Contact forces on the workpiece

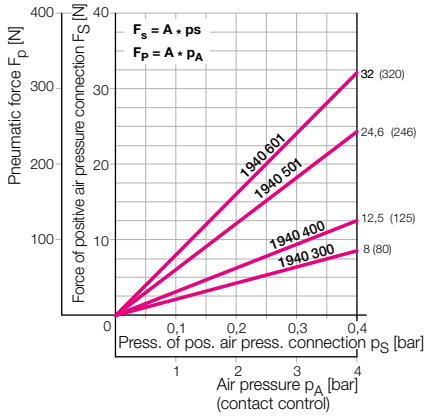
Spring force
Part no. 1940 XXX



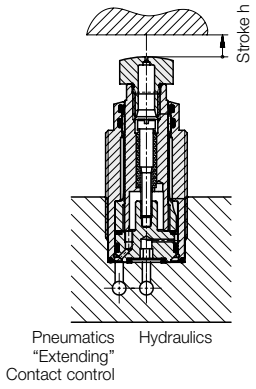
Spring contact force F_{F0} as a function of the stroke of the support plunger h



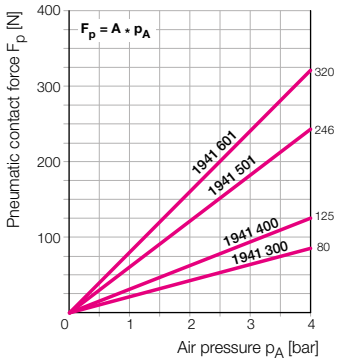
Pneumatic contact forces (F_S, F_P) as a function of the air pressures (p_S, p_A)



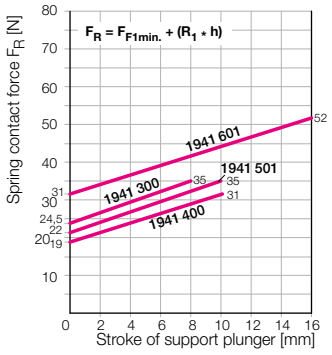
Pneumatically
Part no. 1941 XXX



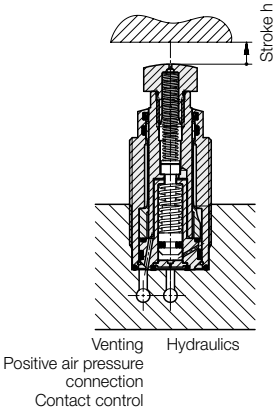
Pneumatic contact force F_p as a function of the air pressure p_A



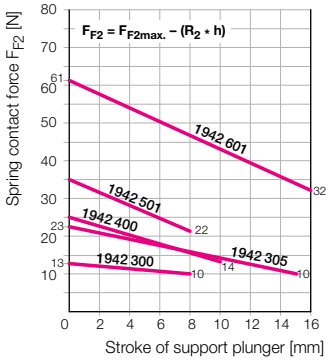
Spring return force F_R as a function of the stroke of the support plunger h



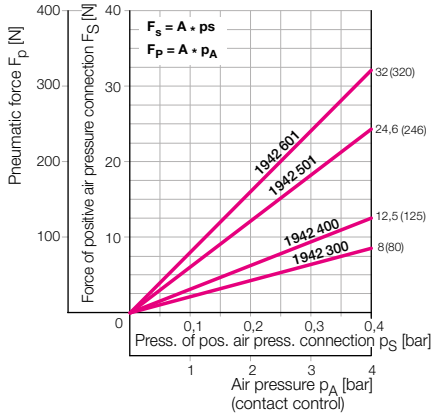
Spring force
Part no. 1942 XXX



Spring contact force F_{F2} as a function of the stroke of the support plunger h



Pneumatic contact forces (F_S, F_P) as a function of the air pressures (p_S, p_A)



Constant

1940-	**300**	**400**	**501**	**601**
F_{F0}min.	10	14	22	34
R_2	0.364	1.103	1.34	1.82
A	20.1	31.4	61.5	80
Weight force*				
Support plunger [N]	0.5	1.3	2.5	3.9
Protection cap [N]	0.23	0.25	0.32	0.62

Constant

1941-	**300**	**400**	**501**	**601**
F_{F1}min.	24	19	22	31
R_1	1.34	1.26	1.26	1.3
A	20.1	31.4	61.5	80
Weight force*				
Support plunger [N]	0.5	1.3	2.5	3.9
Protection cap [N]	0.23	0.25	0.32	0.62

Constant

1942-	**300**	**305**	**400**	**501**	**601**
F_{F2}max.	13	23	25	35	61
R_2	0.364	0.875	1.103	1.34	1.82
A	20.1	20.1	31.4	61.5	80
Weight force*					
Sup. plunger [N]	0.5	0.6	1.3	2.5	3.9
Prot. cap [N]	0.23	0.23	0.25	0.32	0.62

***** For vertical installation: top [-], down [+]. See examples.

Example Work support 1940 300
Protection cap 3546 110
Vertical upward installation
Pres. of pos. air pres. con. 0.2 bar
Stroke of support plunger h = 4 mm

spring force $F_{F0} = F_{F0\,min.} + (R_2 * h)$
$F_{F0} = 10 + (0.364 * 4) = 11.45$ N
+force of pos. air pres. con. $F_S = A * p_S = 20.1 * 0.2 = 4.02$ N
– weight force support plunger = 0.50 N
– weight force protection cap = 0.23 N
contact force = 14.74 N

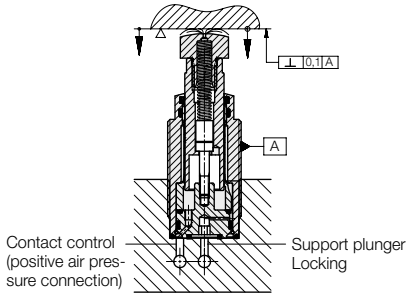
Example Work support 1941 501
Vertical upward installation
Air pressure 1.5 bar
Stroke of support plunger h = 7 mm

pneumatic force
$F_p = A * p_A = 61.5 * 1.5 = 92.25$ N
– spring return force F_R
$F_R = F_{F1\,min.} + (R_1 * h) = 22 + (1.26 * 7) = 30.82$ N
– weight force support plunger = 2.50 N
contact force = 58.93 N

Example Work support 1942 400**P**
Vertical upward installation
Contact control 2 bar
Stroke of support plunger h = 4 mm

spring force
$F_{F2} = F_{F2\,max.} - (R_2 * h) = 25 - (1.103 * 4) = 20.58$ N
+ pneumatic contact force F_p
$F_P = A * p_A = 31.4 * 2 = 62.80$ N
– weight force support plunger = 1.30 N
contact force = 82.08 N

1940 XXXP



Off-position:
Support plunger extended with spring force.
Positive air pressure connection of 0.2 bar switched on, if required.

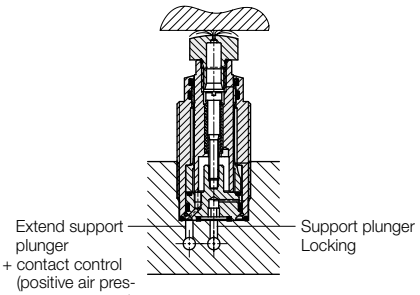
Function sequence
Workpiece loading
and clamping on fixed points.

Switch on contact control
After the message "support plungers are in contact"
Hydraulic clamping of support plungers.

Machining of the workpiece
Switch off contact control or reduce pressure of positive air pressure connection to 0,2 bar.

Alternative
Leave the contact control continuously switched on.
Advantage:
Acts as a positive air pressure connection.
Disadvantages:
Higher contact force of support plunger
Signals workpiece contact before the workpiece is clamped to fixed points.

1941 XXXP



Off-position:
Support plunger retracted with spring force.
Positive air pressure connection of 0.2 bar switched on, if required.

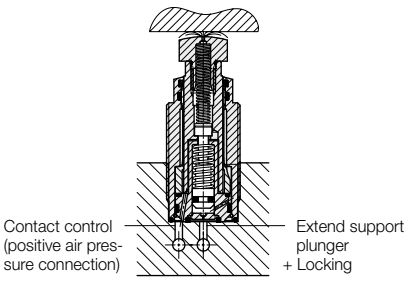
Function sequence
Workpiece loading
and clamping on fixed points.

Switch on pneumatic pressure to extend and contact control
Support plungers move pneumatically against the workpiece
After the message "support plungers are in contact"
Hydraulic clamping of support plungers.

Machining of the workpiece
Switch off contact control or reduce pressure of positive air pressure connection to 0,2 bar.

Important note!
Before unclamping, switch off pneumatic pressure and contact control or reduce pressure of positive air pressure connection to 0.2 bar to allow retraction of the support plunger by spring force.

1942 XXXP



Off-position:
Support plunger retracted with spring force.
Positive air pressure connection of 0.2 bar switched on, if required.

Function sequence
Workpiece loading
and clamping on fixed points.

Switch on hydraulics for support plunger
Support plungers extend hydraulically, they are in contact with the workpiece by spring force and are hydraulically locked.

Switch on contact control
After the message "support plungers are in contact"

Machining of the workpiece
Switch off contact control or reduce pressure of positive air pressure connection to 0,2 bar.

Important note!
Before unclamping, switch off pneumatic pressure for contact control or reduce pressure of positive air pressure connection to 0.2 bar to allow retraction of the support plunger by spring force.

Limits of application

The pneumatic contact control can only be used if
- the contact surface at the workpiece is square to the axis of the work support.
- the contact surface is machined.
- the air is free of oil and water.

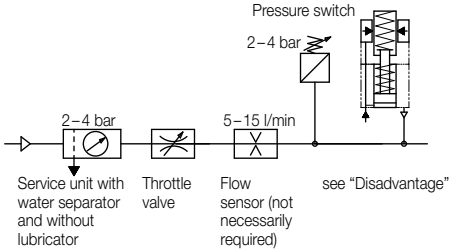
Signal conversion: pneumatic - electric

If the contact bolt is in contact with the workpiece, the little nozzle will be closed.
An electro-pneumatic measuring device can either measure the pressure increase or a drop of the air flow rate.

1. Pressure switch

Advantage
Easy adjustment.

Disadvantage
When contacting the workpiece, the tightness of the nozzle depends on the surface quality of the contact surface and depending on the workpiece more or less large changes in air pressure are possible. With an increasing number of work supports, the pressure differences will decrease and this makes the process-safe setting of a pressure switch more difficult.

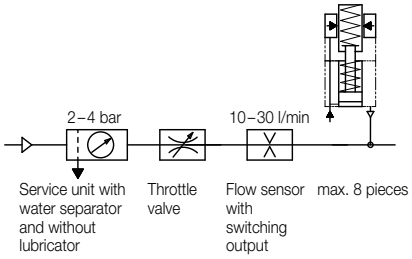


Recommendation
If several work supports have to be controlled, a flow measurement is preferable.

2. Flow meter

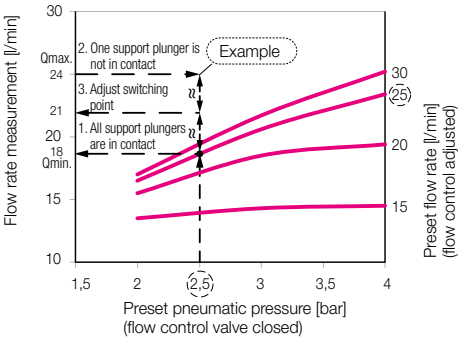
The flow meter should have a digital display and at least one adjustable limit switch with a binary output (e.g. type SFAB of FESTO).
Advantages
For the flow measurement, an air pressure of 2 to 4 bar is sufficient so that the support plunger contact force at the workpiece is still relatively low.
Simple adjustment of the switching point:
1. Measure the flow rate (Qmin) when all support plungers are in contact with the workpiece.
2. Repeat the measurement if 1 support plunger has no contact (Qmax).
3. Enter and save
   switching point = 0.5 x (Qmin + Qmax).

Disadvantages
If the difference (Qmax – Qmin) is too small, increase the flow rate or reduce the number of support points per sensor.



Alternatives
The air gap sensor SOPA from FESTO has an integrated compressed air preparation, as well as two solenoid valves for measuring air and positive air pressure connection.
The device can be expanded to 4 measuring circuits.

Diagram for switching point determination
for flow meters with built-in limit switch as a function of the flow rate and the pneumatic pressure. The curves were determined in the test and apply for the following situation:
"In clamped mode, at least one work support of maximum 8 off is not correctly in contact with the workpiece."



Example 8 work supports 1942 400P

Preset pneumatic pressure	2.5 bar
Preset flow rate	25 l/min

As per diagram:

Flow rate, if all work supports are in contact	approx. 18 l/min
Flow rate, if at least one support plunger is not in contact	approx. 24 l/min
Switching point	= 0.5 * (18 + 24) = 21 l/min

The limit switch at the flow meter is adjusted to 21 l/min.

3. Differential pressure switch

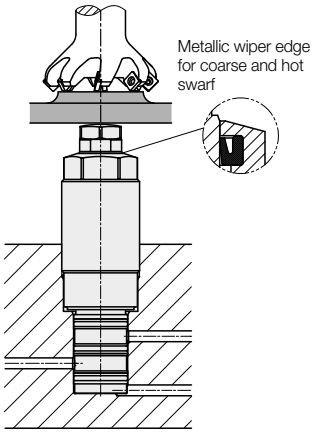
Differential pressure switches (e.g. PEL-System) require only 0.5 to 1.5 bar working pressure.
The exact adjustment of a setting nozzle under practical conditions is required.

Threaded-Body Work Supports

with metallic wiper edge, optional contact control double acting, max. operating pressure 500 bar

Advantages

- High process safety by double-acting function
- Space-saving threaded-body version
- 4 sizes available
- Load force up to 42 kN
- Workpiece contact by spring force
- Optional pneumatic contact control
- Metallic wiper edge
- Protected FKM wiper
- Protection cap available as accessory
- Inner parts protected against corrosion
- Venting of the spring area
- Connection of positive air pressure protection possible
- Installed orifice for flow rate limitation
- Mounting position: any



Application

Hydraulic work supports are used to provide a self-adjusting rest for workpieces and avoid their vibration and deflection under machining loads.
The threaded-body design allows for space-saving and direct installation into the fixture body. Hydraulic oil supply and venting are made via drilled channels.
In case of the double-acting version the return stroke of the support plunger is effected in a precisely defined time, that is above all advantageous in cycle-dependent installations.

Description

In the body of the threaded-body work support a thin-walled locking bush is integrated, which locks cylindrically around the freely-movable support plunger when pressurising the element with hydraulic oil.
The support plunger is extended and retracted by means of a small double-acting cylinder.
Contact to the workpiece is made by spring force.
A pneumatic contact control is available as an option.
The body with metallic wiper edge protects the subjacent FKM wiper against coarse and hot swarf.

Important notes!

Work supports are not suitable to compensate side loads. The support plunger must not be stressed by tensile load.

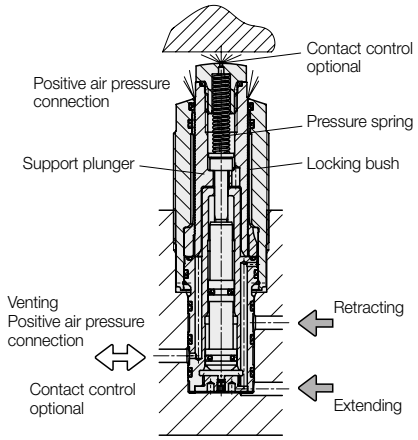
The admissible load force as per diagram is valid for static and dynamic load.
Machining forces can generate vibrations, whose amplitude exceeds far the average value, and this can cause yielding of the support plunger.
Remedy: Increase the safety factor or the number of work supports.

In dry machining applications, with minimum quantity lubrication or in case of accumulation of very small swarf, there can be a swarf holdup in the area of the metallic wiper edge.
Remedy: Regular cleaning or mount protection cap (see page 2).

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

Function

The support plunger is retracted in off-position. When pressurised, the piston of the double-acting cylinder extends against an internal stop and the support plunger contacts the already clamped workpiece with spring force.
The support plunger will be radially locked by the thin-walled locking bush with increasing hydraulic pressure and can then compensate forces in axis direction.
For unclamping, the hydraulic pressure is decreased and the locking bush releases the support plunger. At the same time, the return line is pressurised and the piston retracts the support plunger back to the off-position.

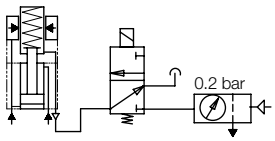


Venting port

To guarantee safe functioning, a vent port is imperative. It is important that no liquids can penetrate into the venting system.

Positive air pressure connection

By connecting a slight overpressure of max. 0.2 bar to the venting system, the work support is effectively protected against the penetration of liquids.
If the support plunger is retracted, the positive air pressure connection can be switched off.



Important note

The positive air pressure must be free of oil and water.

Pneumatic contact control

Description see page 4.

Combination with clamping elements

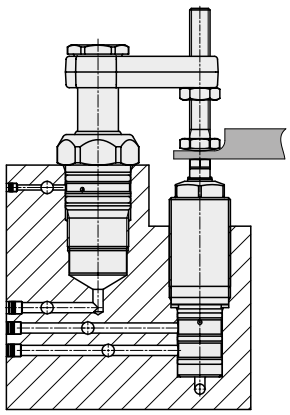
With this combination, clamping and machining forces will add up:

Clamping force
\+ max. machining force
= minimum support force x safety factor

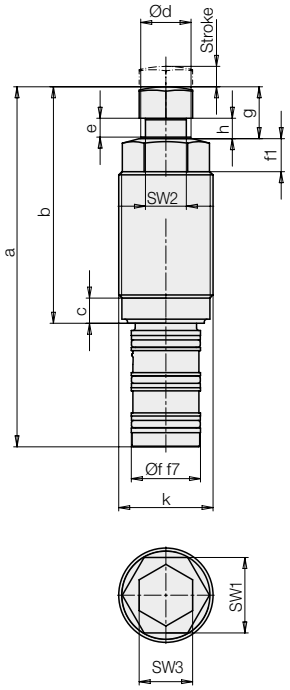
Rough calculation from practice:
Required support force ≥ 2 x clamping force

To increase the safety, a support force as high as possible should be achieved

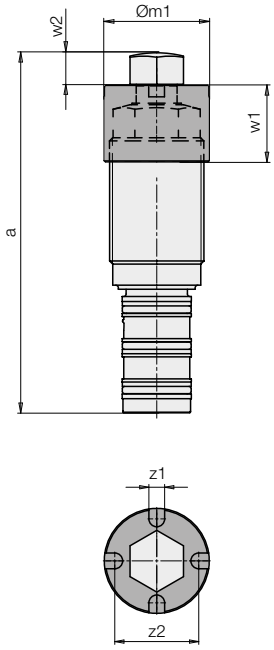
- by using a larger work support
  or
- by using the max. operating pressure of 500 bar by installing a little intensifier (e.g. data sheet D 8.756), in the supply line of the work supports



Part no. 1942XXX

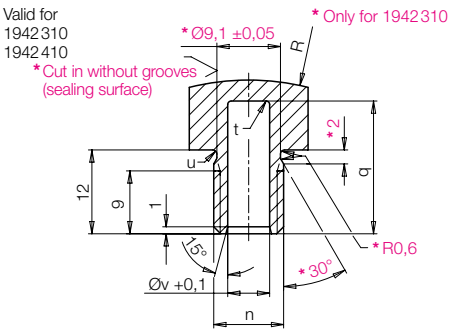


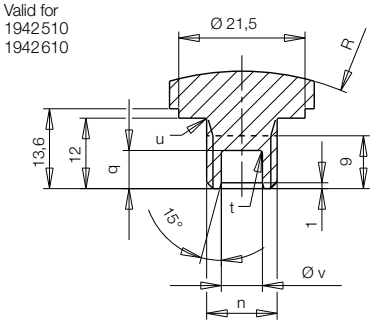
Protection cap (accessory)



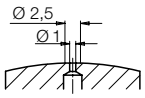
The protection cap is fixed by means of the standard contact bolt to the support plunger.
It shall be used above all, if a strong coolant jet is directed onto the support plunger or the wiper edge.

Dimensions for self-made contact bolts

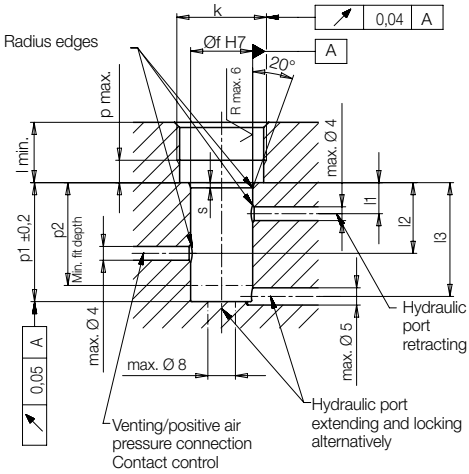




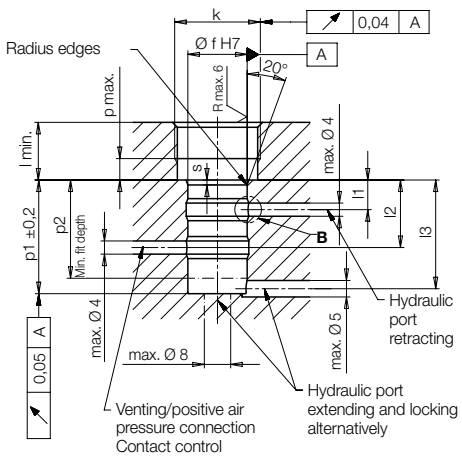
Contact bolt for contact control



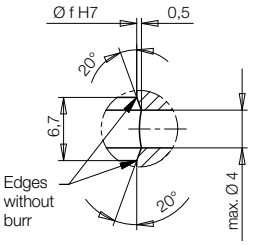
Porting details
with radiused connecting bores



Porting details
with entering slopes



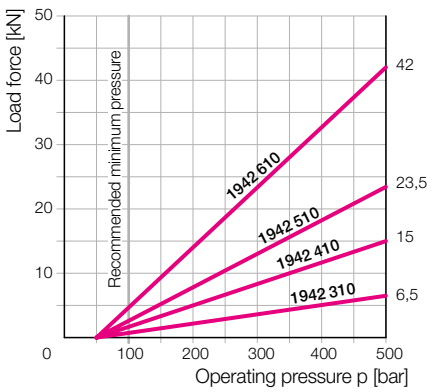
Detail "B"



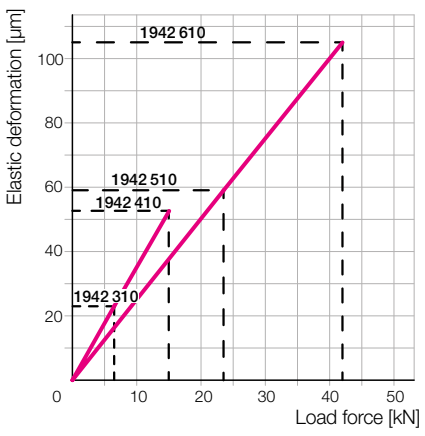
Pay attention when mounting:
The location hole must be dry and oil-free to ensure that no liquids penetrate into the spring area of the work supports.

When exchanging work supports:
To get a dry location hole, the hydraulic oil in drilled channels must be removed.

Adm. load force F as a function of the operating pressure p



Elastic deformation with load force F and operating pressure 500 bar



Technical data

Adm. load force (500bar)	**[kN]**	**6.5**	**15**	**23.5**	**42**
Support plunger Ød	[mm]	16	20	28	32
Stroke	[mm]	8	10	10	16
Oil volume extending retracting	[cm³] [cm³]	0.63 0.12	1.13 0.35	1.13 0.35	3.22 0.75
Recommended minimum pressure (support)	[bar]	100	100	100	100
Minimum pressure retracting	[bar]	20	20	20	20
Max. air pressure for positive air pressure connection	[bar]	0.2	0.2	0.2	0.2
Spring contact force min./max.	[N]	10/13	14/25	22/35	32/61
Elastic deformation with load and 500bar	[µm/kN]	3.5	3.5	2.5	2.5
Operating temperature	[°C]	0…70	0…70	0…70	0…70
Tightening torque	[Nm]	60	100	200	400
a	[mm]	114.5	124.5	131.5	158
b	[mm]	75.2	85.7	89.7	114.6
c	[mm]	8	17	20	20
e	[mm]	6	5.6	3	4
Ø f H7 / f7	[mm]	22	25	30	35
f1	[mm]	10.5	12	12	18
g	[mm]	16.5	13.5	12	12.5
h	[mm]	6.5	6.5	4	4.5
k	[mm]	M30x1.5	M36x1.5	M48x1.5	M60x1.5
l min.	[mm]	21	31	39	40
l1	[mm]	11.5	11.5	12.5	13
l2	[mm]	24	24	26	26.5
l3	[mm]	37	36.5	39.5	40
Ø m1	[mm]	35	40	52	65
n	[mm]	M10	M12	M12	M12
p max.	[mm]	8	12	18	16
p1 ±0.2	[mm]	38.5	38	41	42.5
p2	[mm]	35	34.5	37.5	38.5
q	[mm]	19	15	6.5	–
s	[mm]	1.5	2	2	2
t	[mm]	R 0.5	R 0.2	R 0.5	–
u	[mm]	R 0.6	R 0.3	R 0.3	R 0.3
Øv	[mm]	6	6.9	7	–
w1	[mm]	28	30	30	43
w2	[mm]	10	7	6.4	6.4
z1	[mm]	5	6	8	8
z2	[mm]	28	32	43	53
SW1	[mm]	24	30	41	50
SW2	[mm]	13	17	22	27
SW3	[mm]	17	19	22	22
R	[mm]	35	45	45	45
Weight, approx.	[kg]	0.47	0.68	1.23	2.45
Part no.		**1942310**	**1942410**	**1942510**	**1942610**
Part no. with contact control (see also page 4)		**1942310P**	**1942410P**	**1942510P**	**1942610P**
Contact bolt for contact control		**3614390**	**3614389**	**3614391**	**3614418**
Contact bolt without contact control		**3614330**	**3614388**	**3614420**	**3614419**
Protection cap		**3546110**	**3546111**	**3546112**	**3546113**
Weight protection cap	[kg]	0.023	0.025	0.032	0.062

Contact force of the support plunger
Pneumatic contact control

The double-acting work support is equipped with a venting port, that can also be pressurised with positive air pressure as described on page 1.
This port can also be used for the installation of a workpiece contact control for the support plunger.
Prerequisite is a small sensor hole in the hardened contact bolt. There are 2 possibilities:

1. When placing a new order
Order work supports with contact control as per chart on page 3:
Part no. 1942X10P

2. Exchange of the contact bolts
The contact bolts with and without sensor hole are dimensionally identical and therefore also replaceable on site.
The part nos. are indicated in the chart on page 3.

Important note

The pneumatic contact control can only be used if
- the contact surface at the workpiece is square to the axis of the work support.
- the contact surface is machined.
- the air is free of oil and water.

Contact force of the support plunger

The contact force depends on the spring contact force (see diagram) and the pneumatic contact force (see diagram) when using positive air pressure connection or contact control.
In the case of vertical mounting position, the weight force can be deduced from the support plunger + contact bolt and the optional protection cap.

$$F_{An} = F_F + F_p - (F_{Sb} + F_{Sk})^* \quad [N]$$
( )* only vertical installation

1. Spring contact force

$$F_F = F_{max} - (R * h) \quad [N]$$

2. Pneumatic contact force**

$$F_p = A * p \quad [N]$$

3. Weight force support plunger + contact bolt

F_{Sb} see constant [N]

4. Weight force protection cap (accessory)

F_{Sk} see constant [N]

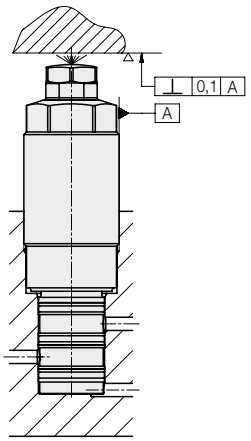
F_{max} = max. spring force (h = 0) [N]
R = Spring constant [N/mm]
A = Constant for bolt surface [–]
p = Pneumatic pressure (positive air pressure connection or contact control) [bar]

Constant

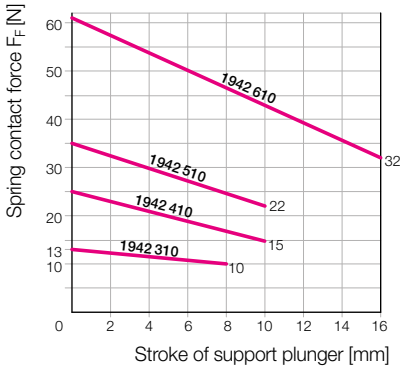
1942		310	410	510	610
Fmax	[N]	13.6	25.9	35.2	60
R	[N/mm]	0.364	1.103	1.34	1.82
A		20.1	31.4	61.5	80
F_{Sb}	[N]	0.5	1.3	2.5	3.9
F_{Sk}	[N]	0.23	0.25	0.32	0.62

Before unclamping, switch off the pneumatic pressure for contact control or reduce the positive air pressure to 0.2 bar.

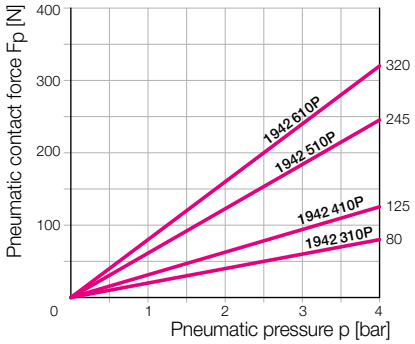
** Is only considered, if the pneumatic pressure is switched on before locking the support plunger.



Spring contact force as a function of the support plunger stroke



Pneumatic spring contact force as a function of the pneumatic pressure



Example 1 Work support 1942 410
Protection cap 3546 111
Vertical upward installation
Support plunger stroke 5 mm
Positive air press. connection 0.2 bar**

Spring force	$F_F = F_{max} - (R * h)$		
	$F_F = 25 - (1{,}103 * 5)$	=	19.4 N
+ Pos. air press. con.	$F_p = A * p = 31.4 * 0.2$	=	6.3 N
- Weight force support plunger		=	1.3 N
- Weight force protection cap		=	0.25 N
Contact force		=	24.15 N

Example 2 Work support 1942 510P
Vertical upward installation
Support plunger stroke 7 mm
Pneumatic pressure 3 bar**

Spring force	$F_F = F_{max} - (R * h)$		
	$F_F = 35 - (1{,}34 * 7)$	=	25.6 N
+ Pneumatics	$F_p = A * p = 61.5 * 3$	=	184.5 N
- Weight force support plunger		=	2.5 N
Contact force		=	207.6 N

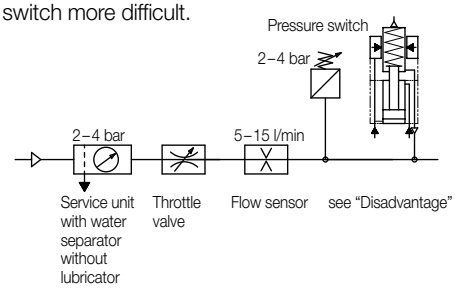
Signal conversion: Pneumatic - electric

If the contact bolt is in contact with the workpiece, the little nozzle will be closed.
An electro-pneumatic measuring device can either measure the pressure increase or a drop of the air flow rate.

1. Pressure switch

Advantage
Easy adjustment.

Disadvantage
When contacting the workpiece, the tightness of the nozzle depends on the surface quality of the contact surface and depending on the workpiece more or less large changes in air pressure are possible. With an increasing number of work supports, the pressure differences will decrease and this makes the process-safe setting of a pressure switch more difficult.



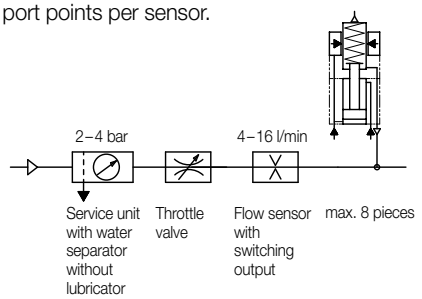
Recommendation
If several work supports have to be controlled, a flow measurement is preferable.

2. Flow meter

The flow meter should have a digital display and at least one adjustable limit switch with a binary output (e.g. type SFAB of FESTO).

Advantages
For the flow measurement, an air pressure of 2 to 4 bar is sufficient so that the support plunger contact force at the workpiece is still relatively low.
Simple adjustment of the switching point:
1. Measure the flow rate (Qmin) when all support plungers are in contact with the workpiece.
2. Repeat the measurement if 1 support plunger has no contact (Qmax).
3. Enter and save the switching threshold = 0.5 x (Qmin + qmax).

Disadvantages
If the difference (Qmax – Qmin) is too small, increase the flow rate or reduce the number of support points per sensor.



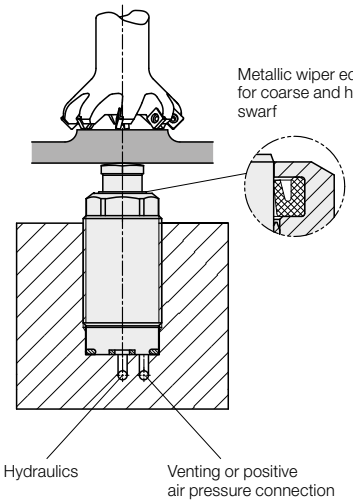
Alternatives
The air gap sensor SOPA from FESTO has an integrated compressed air preparation, as well as two solenoid valves for measuring air and positive air pressure connection.
The device can be expanded to 4 measuring circuits.

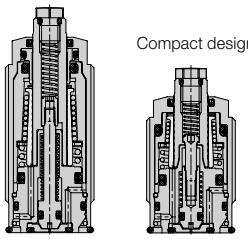
3. Differential pressure switch

Differential pressure switches (e.g. PEL-System) require only 0.5 to 1.5 bar working pressure.
The exact adjustment of a setting nozzle under practical conditions is required.

Threaded-Body Work Supports
with metallic wiper edge, 4 sizes single acting, max. operating pressure 70 bar

Advantages
- High support force at 70 bar
- 4 sizes available
- Sizes 1 and 2 are available in 2 lengths
- Space-saving threaded-body version
- Metallic wiper edge and FKM wiper
- Connection for venting and positive air pressure protection
- Interior parts protected against corrosion
- Standard flow rate throttle
- Mounting body as accessory
- Mounting position: any
- Connection of positive air pressure protection up to 4 bar is possible



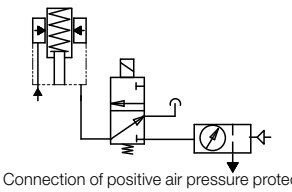


Application
Hydraulic work supports are used to provide a self-adjusting rest for workpieces and avoid their vibration and deflection under machining loads. This series offers very high support forces already at 70 bar and can directly be connected to the low-pressure hydraulic of the machine tool.

Description
The support plunger is hydraulically extended by a small piston and contacts the workpiece with spring force. The pressure spring can be easily exchanged. Locking of the support plunger through the slotted clamping sleeve is made by means of a ring-shaped conical hydraulic piston where the locking force is transmitted by a low-friction ball shell.
Unlocking and retracting of the support plunger is made by spring force.

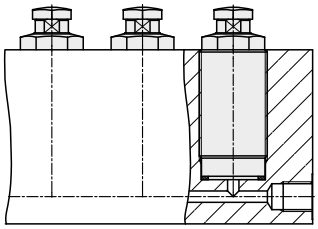
Important notes
Work supports are not suitable to compensate side loads. The support plunger must not be stressed by tensile load.
The admissible load force is valid for static or dynamic load. Machining forces can generate vibrations, whose amplitude exceeds far an average value, and this can cause yielding of the support plunger.
Operating conditions, tolerances and other data see data sheet A 0.100.

Positive air pressure connection
To guarantee functioning of the work supports, a vent port is imperative. No liquids may enter the end of the bore hole (see also data sheet G 0.110 „Venting of the spring area“).
It is recommended to connect positive air pressure protection. While locking the support plunger, the positive air pressure must not exceed 4 bar. If the support plunger is not locked, the positive air pressure must be reduced to a maximum of 0.2 bar.
The positive air pressure connection must be free of oil and water.

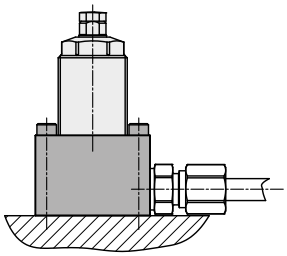


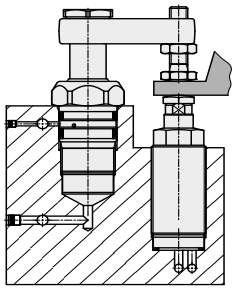
Connection of positive air pressure protection

Installation and connecting possibilities
Drilled channels



Pipe thread
with accessory mounting body





Combination with clamping elements
If clamping will be made onto the work supports, the clamping force must be adjusted to the admissible load, so that there will be still a sufficient reserve to compensate the machining forces.

Rough estimate:

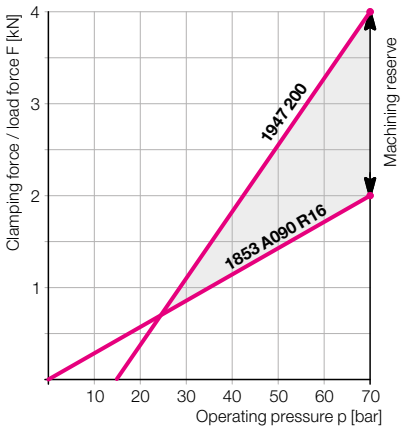
Min. load force ≥ 2 x clamping force

Example
Threaded-body work support 1947 200
Swing clamp 1853 A090 R16
Operating pressure 70 bar

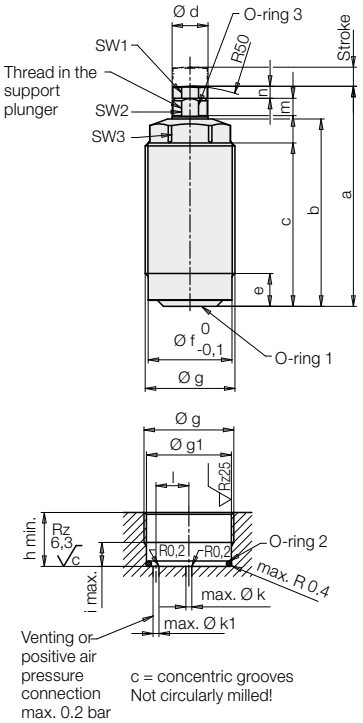
As per diagram:

Adm. load	4.0 kN
– Effective clamping force	2.0 kN
Reserve for machining force	2.0 kN

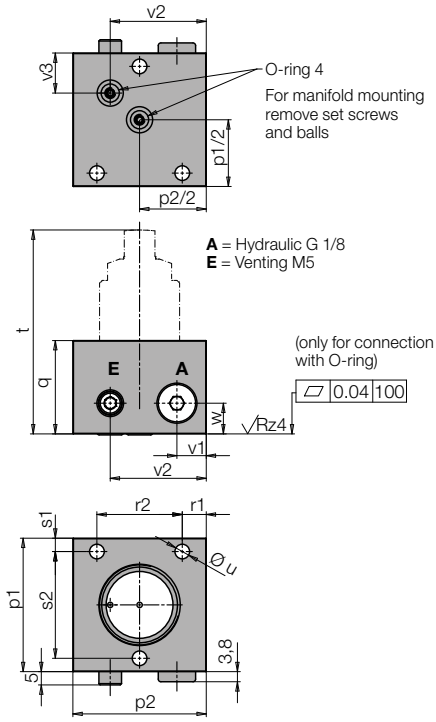
If this is not sufficient, the pressure for the swing clamp has to be reduced.



Size		1 short	1	2 short	2	3	4
Adm. load force (70 bar)	[kN]	1	3	2	4	5.5	10
Load force at p (bar)	[kN]	0.019xp–0.30	0.053xp–0.68	0.035xp–0.46	0.07xp–0.91	0.096xp–1.25	0.175xp–2.28
Support plunger Ø d	[mm]	10	10	12	12	15	16
Stroke	[mm]	5	6.5	6	8	8	10
Required oil per stroke	[cm3]	0.5	0.6	0.6	0.9	1.3	2
Admissible flow rate	[cm³/s]	25	25	25	25	25	25
Recommended minimum pressure	[bar]	25	25	25	25	25	25
Max. pressure in the return line	**[bar]**	**1**	**1**	**1**	**1**	**1**	**1**
Spring force min./max.	[N]	3.7 / 6.6	3.7 / 9.5	5.8/10.9	7.0 / 12.0	9.7 / 14.8	8.5 / 14.8
Elastic deformation with load and 70 bar	[µm/kN]	10	9	8.5	6	6	3.5
Operating temperature	[°C]	0…70	0…70	0…70	0…70	0…70	0…70
Tightening torque	[Nm]	32	32	50	50	63	80
Weight, approx.	[kg]	0.15	0.2	0.2	0.25	0.35	0.75
a	[mm]	48.5	66	52	73	69	82
b	[mm]	40	57	41	62	58	71
c	[mm]	34	49	34	54	49	62
e	[mm]	8.5	8.5	9.5	9.5	9.5	9.5
Ø f – 0.1	[mm]	24	24	28	28	34	43
g	[mm]	M26x1.5	M26x1.5	M30x1.5	M30x1.5	M36x1.5	M45x1.5
Ø g1	[mm]	24.5	24.5	28.5	28.5	34.5	43.5
h min.	[mm]	16	16	17	17	18	21
i max.	[mm]	7	7	9	9	8	8.5
Ø k max.	[mm]	8	8	10	10	10	12
Ø k1 max.	[mm]	2.5	2.5	3	3	5	6
l	[mm]	9.5	9.5	11	11	13	15
m	[mm]	5	5	6	6	6	6
n	[mm]	3	3	4	4	4	4
p1	[mm]	45	45	50	50	60	70
p2	[mm]	45	45	50	50	50	55
q	[mm]	35	35	35	35	35	35
r1	[mm]	6.5	6.5	9	9	6	8.5
r2	[mm]	32	32	32	32	38	38
s1	[mm]	4.5	4.5	5	5	6	6
s2	[mm]	36	36	40	40	48	58
t	[mm]	65.5	83	69	90	84	97
Øu	[mm]	5.5	5.5	5.5	5.5	6.5	6.5
v1	[mm]	8.5	8.5	11	11	11	13.5
v2	[mm]	32	32	36	36	38	42.5
v3	[mm]	12.5	12.5	15	15	20	25
w	[mm]	11.5	11.5	11.5	11.5	11.5	11.5
SW 1	[mm]	8	8	10	10	11	11
SW 2	[mm]	8	8	10	10	13	13
SW 3	[mm]	22	22	24	24	30	36
Thread in the support plunger		M6x8	M6x8	M8x12	M8x13	M10x13	M10x13
Part no.		**1947102**	**1947100**	**1947202**	**1947200**	**1947300**	**1947400**
Accessories							
Mounting body complete		**0346809**	**0346809**	**0346810**	**0346810**	**0346811**	**0346812**
Spare parts							
O-ring 1		**3002264**	**3002264**	**3000335**	**3000335**	**3000005**	**3000028**
O-ring 2		**3002170**	**3002170**	**3001640**	**3001640**	**3002171**	**3002172**
O-ring 3		**3002167**	**3002167**	**3001526**	**3001526**	**3000275**	**3000275**
O-ring 4		**3000342**	**3000342**	**3000342**	**3000342**	**3000342**	**3000342**



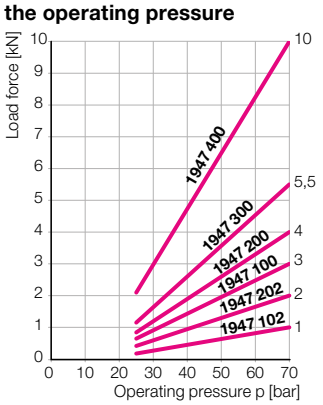
Mounting body (Accessory)



Mounting body complete (Accessory)

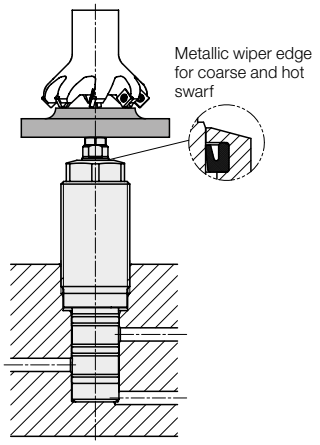
In combination with mounting bodies, the threaded-body work supports become individual components ready for installation.
For pipe connection, there are connecting threads G 1/8 and M5 for hydraulics and venting.
A manifold-mounting connection with thrilled channels is also possible. For this purpose, the screw plugs in the manifold-mounting surface will be removed and the supplied O-rings inserted in the counterbores. The pipe connections remain closed. O-rings and screw plugs are included in the delivery.

Load force as a function of the operating pressure



Threaded-Body Work Supports
with metallic wiper edge, double acting, max. operating pressure 70 bar

Advantages
- High process safety by double-acting function
- Space-saving threaded-body version
- 4 sizes available
- Load force up to 10 kN at 70 bar
- Workpiece contact by spring force
- Metallic wiper edge
- Protected FKM wiper
- Inner parts protected against corrosion
- Venting of the spring area
- Connection of positive air pressure protection possible
- Installed orifice for flow rate limitation
- Mounting position: any



Application
Hydraulic work supports are used to provide a self-adjusting rest for workpieces and avoid their vibration and deflection under machining loads.
This series offers high support forces already at 70 bar and can directly be connected to the low-pressure hydraulics of the machine tool.
In case of the double-acting version, the return stroke of the support plunger is effected in a precisely defined time, that is above all advantageous in cycle-dependent installations.

Description
The support plunger is hydraulically extended and retracted by means of a small double-acting cylinder. Contact to the workpiece is made by spring force. The pressure can be easily exchanged.
Locking of the support plunger through the slotted clamping sleeve is made by means of a ring-shaped conical hydraulic piston where the locking force is transmitted by a low-friction ball shell. Unlocking of the support plunger is made by spring force.

Important notes!
Work supports are not suitable to compensate side loads. The support plunger must not be stressed by tensile load.
The admissible load force is valid for static or dynamic load. Machining forces can generate vibrations, whose amplitude exceeds far an average value, and this can cause yielding of the support plunger.

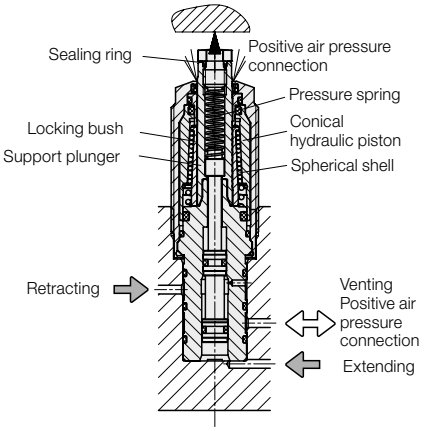
Remedy: Increase the safety factor or the number of work supports.

Work supports must only be operated with a sealed contact bolt.
In dry machining applications, with minimum quantity lubrication or in case of accumulation of very small swarf, there can be a swarf holdup in the area of the metallic wiper edge.

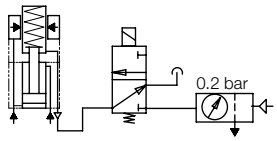
Remedy: Regular cleaning.

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

Function
The support plunger is retracted in off-position. When pressurised, the piston of the double-acting cylinder extends against an internal stop and the support plunger contacts the already clamped workpiece with spring force.
With continuing pressure increase, the conical hydraulic piston moves downwards. The support plunger will be radially locked by the slotted locking bush using a low-friction spherical shell and can then compensate load forces in axis direction.
For unclamping, hydraulic pressure will be released. The conical hydraulic piston is pushed upwards by spring force, whereby the locking of the support plunger disengages. At the same time, the return line is pressurised and the piston of the double-acting cylinder retracts the support plunger back to the off-position.



Venting port
To guarantee safe functioning, a vent port is imperative. It is important that no liquids can penetrate into the venting system.



Positive air pressure connection
By connecting a slight overpressure of max. 0.2 bar, the venting system is effectively protected against the penetration of liquids.
If the support plunger is retracted, the positive air pressure connection can be switched off.

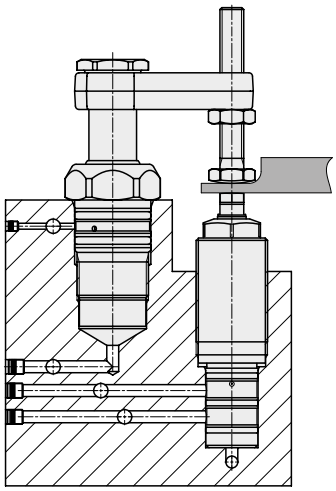
Important note
The positive air pressure must be free of oil and water.

Combination with clamping elements
With this combination, clamping and machining forces will add up:

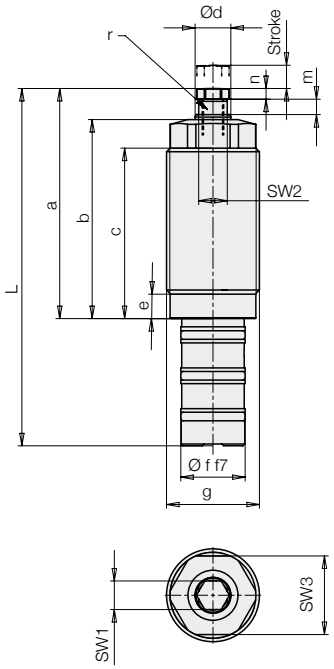
Clamping force
\+ max. machining force
= minimum support force x safety factor

Rough calculation from practice:
Required support force ≥ 2 x clamping force

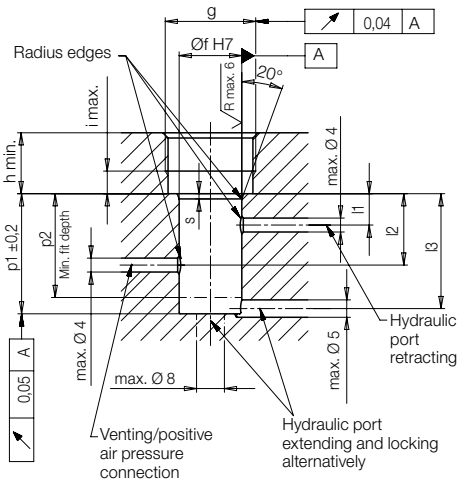
To increase the safety, a support force as high as possible should be achieved by
- using a larger work support
- utilising the max. operating pressure
- using a smaller clamping element or reducing the clamping pressure



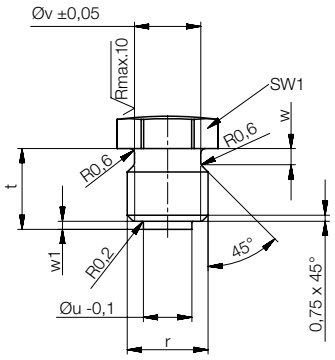
Part no. 1947 X10



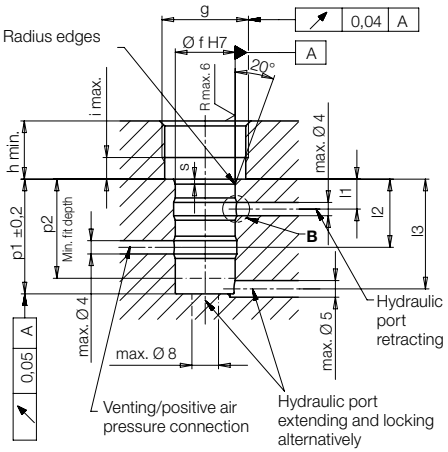
Location hole
with radiused connecting bores



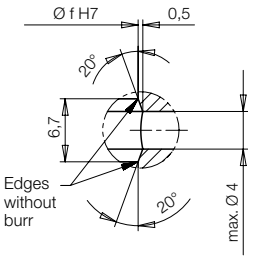
Dimensions for self-made contact bolts



Location hole
with entering slopes



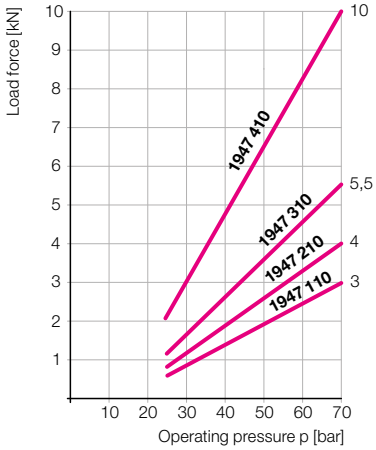
Detail "B"



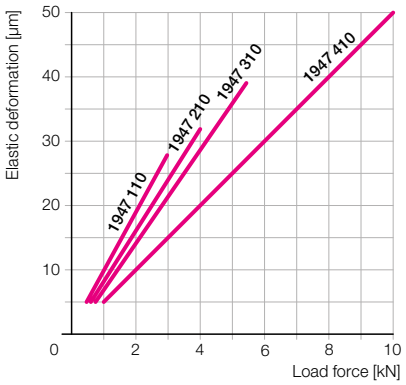
Pay attention when mounting:
The location hole must be dry and oil-free to ensure that no liquids penetrate into the spring area of the work supports.

When exchanging work supports:
To get a dry location hole, the hydraulic oil in drilled channels must be removed.

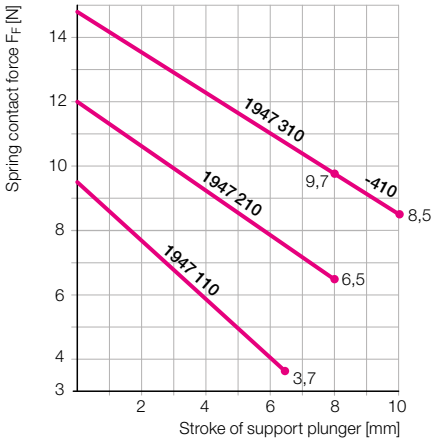
Adm. load force F
As a function of the operating pressure p



Elastic deformation with load force F and operating pressure 70 bar



Spring contact force F_F as a function of the support plunger stroke h



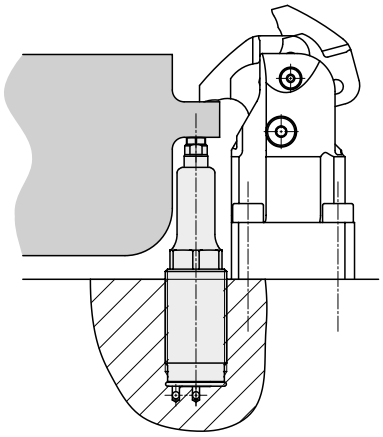
Adm. load force (70bar)	**[kN]**	**3**	**4**	**5.5**	**10**
Load force at p (bar)	[kN]	0.053xp–0.68	0.07xp–0.91	0.096xp–1.25	0.175xp–2.28
Support plunger Ød	[mm]	10	12	15	16
Stroke	[mm]	6.5	8	8	10
Oil volume extending	[cm^3]	0.7	1	1.1	1.9
retracting	[cm^3]	0.07	0.1	0.12	0.35
Recommended minimum pressure	[bar]	25	25	25	25
Spring force min./max.	[N]	3.7/9.5	7.0/12.0	9.7/14.8	8.5/14.8
Elastic deformation with load and 70bar	[µm/kN]	9	8	7	5
Operating temperature	[°C]	0…70	0…70	0…70	0…70
Tightening torque	[Nm]	32	50	63	80
L	[mm]	100	107	109	120
a	[mm]	64.4	71.55	68.4	80.6
b	[mm]	55.7	60.6	56.5	69.5
c	[mm]	47.7	52.6	47.5	60.5
e	[mm]	7	8	8	8
Øf H7/f7	[mm]	18	22	24	28
g	[mm]	M26x1.5	M30x1.5	M36x1.5	M45x1.5
h min.	[mm]	17.5	20.5	19	20
i max.	[mm]	7	8	8	8.5
l1	[mm]	9	10	11	11.5
l2	[mm]	20.5	21.5	23.5	24
l3	[mm]	33	33	38	37
m	[mm]	4.3	5	6.8	6
n	[mm]	3	4	4	4
p1	[mm]	34.5	34.5	39	38.5
p2	[mm]	30	31	34	34
r thread in the support plunger x depth		M6x10	M8x11	M10x11	M10x11
s	[mm]	1.5	1.5	2	2
t	[mm]	8	10	10	10
Ø u	[mm]	3.1	5	6	6
Ø v	[mm]	4.5	6	8.2	8.2
w	[mm]	1.5	2	2	2
w1	[mm]	0.5	1	1	1
SW1	[mm]	8	10	11	11
SW2	[mm]	8	10	13	13
SW3	[mm]	22	24	30	36
Weight, approx.	[kg]	0.25	0.4	0.5	0.8
Part no.		**1947110**	**1947210**	**1947310**	**1947410**

Threaded-Body Work Supports

with metallic wiper edge, shaft length 20 – 100 mm single and double acting, max. operating pressure 70 bar

Advantages

- Load force up to 3 kN at 70 bar
- Side load up to 0.3 kN admissible
- Space-saving threaded-body version
- Support in recesses and cavities
- Shaft lengths up to 100 mm available
- High process safety by double-acting function
- Workpiece contact by spring force
- Metallic wiper edge
- Protected FKM wiper
- Inner parts protected against corrosion
- Venting of the spring area
- Connection of positive air pressure protection possible
- Installed orifices for flow rate limitation
- Mounting position: any



Application

Hydraulic work supports are used to provide a self-adjusting rest for workpieces and avoid their vibration and deflection under machining loads.
This series offers high support forces already at 70 bar and can directly be connected to the low-pressure hydraulics of the machine tool.
The selectable extension with a shaft diameter of only 16 mm enables the support of surfaces in recesses and cavities that otherwise would be inaccessible.
In case of the double-acting version, the return stroke of the support plunger is effected in a precisely defined time, that is above all advantageous in cycle-dependent installations.

Description

The support plunger is hydraulically extended and retracted by means of a small single or double-acting cylinder. Contact to the workpiece is made by spring force. The pressure spring can be easily exchanged.
The support plunger is additionally guided in the area of the shaft diameter and can therefore absorb side loads up to 300 N.

Important notes

The admissible load force is valid for static or dynamic load. The support plunger must not be stressed by tensile load.
Machining forces can generate vibrations, whose amplitude exceeds far an average value, and this can cause yielding of the support plunger.

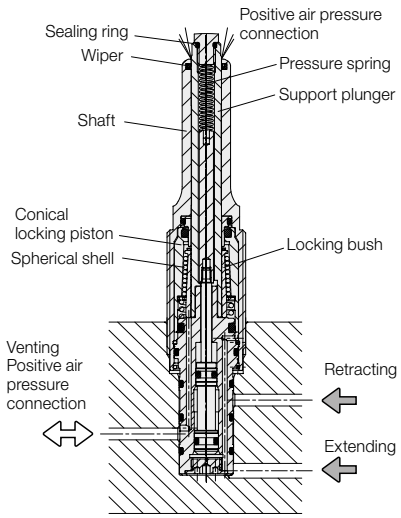
Remedy: increase the safety factor or the number of work supports.

Work supports must only be operated with a sealed contact bolt.
In dry machining applications, with minimum quantity lubrication or in case of accumulation of very small swarf, there can be a swarf holdup in the area of the metallic wiper edge.
Remedy: regular cleaning.

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

Function

The support plunger is retracted in off-position. When pressurised, the piston of the single or double-acting cylinder extends against an internal stop and the support plunger contacts the already clamped workpiece with spring force.
With continuing pressure increase, the conical hydraulic piston moves downwards. The support plunger will be radially locked by the slotted locking bush using a low-friction spherical shell and can then absorb load forces in axis direction.
For unclamping, hydraulic pressure will be released. The conical hydraulic piston is pushed upwards by spring force, whereby the locking of the support plunger disengages.
The single-acting piston retracts the support plunger with spring force to its off-position.
This takes place quicker with the double-acting version.



Venting port

To guarantee safe functioning, a vent port is imperative.

Positive air pressure connection

By connecting a slight overpressure of max. 0.2 bar, the venting system is effectively protected against the penetration of liquids.

Combination with clamping elements

In the above example the machining force is to be added to the clamping force of the compact clamp:

clamping force
\+ max. machining force
= minimum support force x safety factor

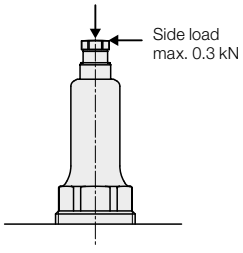
Rough calculation from practice:
Required support force ≥ 2 x clamping force

To increase the safety, a support force as high as possible should be achieved by

- using a larger work support
- utilising the max. operating pressure
- using a smaller clamping element or reducing the clamping pressure

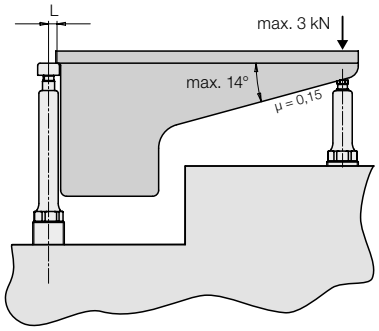
Admissible loads

Max. load force up to 3 kN



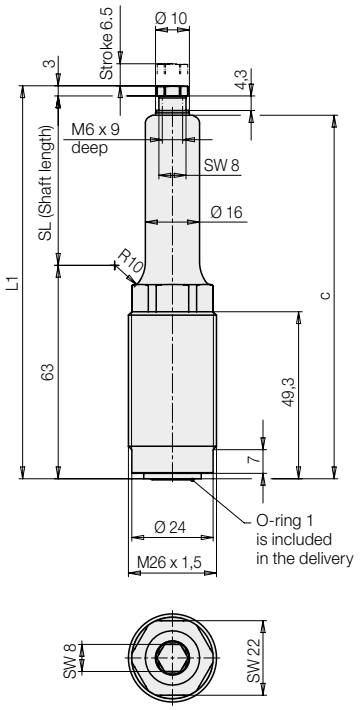
Example

Load of the support plunger by side loads (see diagram on page 3)



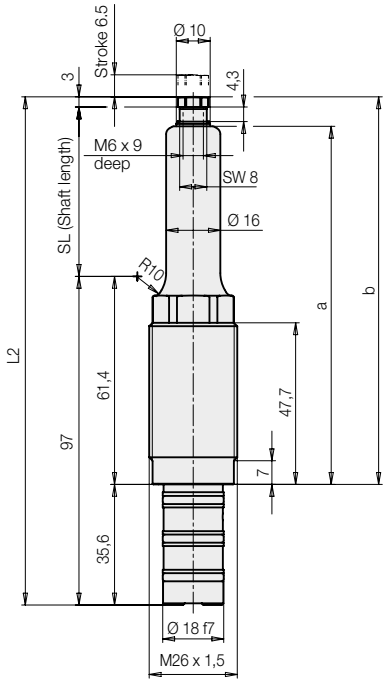
Single acting

Part no. 1947100S106XX0

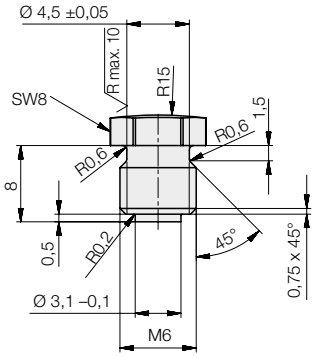


double acting

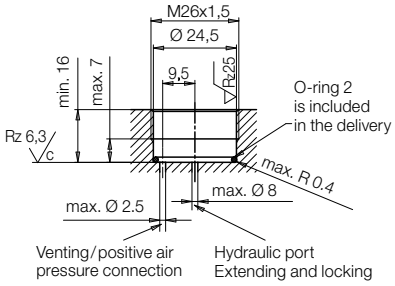
Part no. 1947110S106XX0

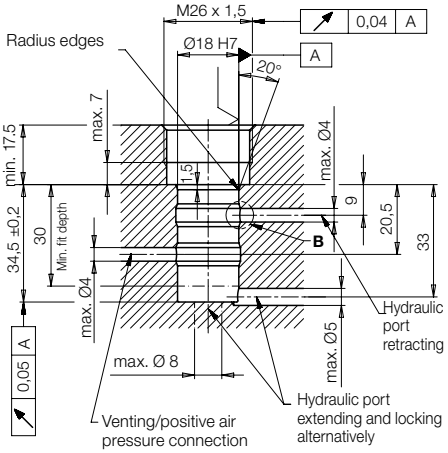


Dimensions for self-made contact bolts

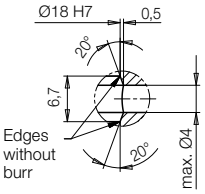


Location holes

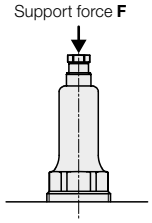


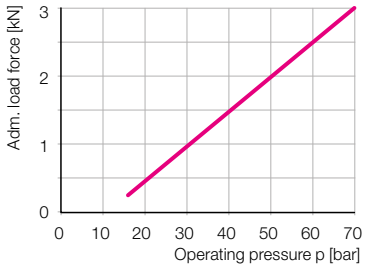


Detail B

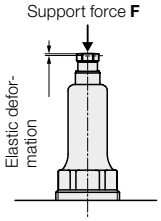


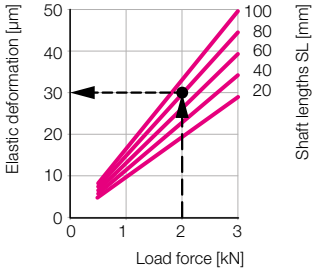
Admissible load F as a function of the operating pressure p





Elastic deformation with load force F and operating pressure 70 bar for shaft lengths 20 – 100 mm





Example

Work support 1947110S106080

Operating pressure	p	= 70 bar
Load force	F	= 2 kN
Shaft length	SL	= 80 mm

As per diagram:
Elastic deformation approx. 30 µm

Adm. load force (70 bar)			**[kN]**	**3**
Load force F at p (bar)			[kN]	0.053 x p – 0.68
Support plunger Ø d			[mm]	10
Stroke			[mm]	6.5
Oil volume	extending	single acting	[cm³]	0.6
	extending	double acting	[cm³]	0.7
	retracting	double acting	[cm³]	0.07
Recommended minimum pressure			[bar]	25
Max. pressure in return line		single acting	[bar]	1
		double acting	[bar]	2.5
Spring force min./max.			[N]	3.7/9.5
Elastic deformation Load force F at 70 bar			[µm/kN]	$\frac{(SL + 31)}{11.7}$ + 5.33
Operating temperature			[°C]	0 … 70
Tightening torque			[Nm]	32
SL (available shaft lengths)			[mm]	**20|30|40|50|60|70|80|90|100**
L1			[mm]	SL + 66
L2			[mm]	SL + 100
a			[mm]	SL + 55.7
b			[mm]	SL + 64.4
c			[mm]	SL + 57.3

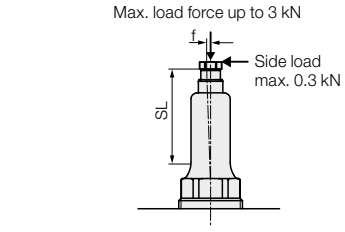
Single acting		**Part no.**
Shaft lengths 20	[mm]	**1947100S106020**
Shaft lengths 30	[mm]	**1947100S106030**
Shaft lengths 40	[mm]	**1947100S106040**
Shaft lengths 50	[mm]	**1947100S106050**
Weight, approx.	[kg]	0.27 up to 0.32

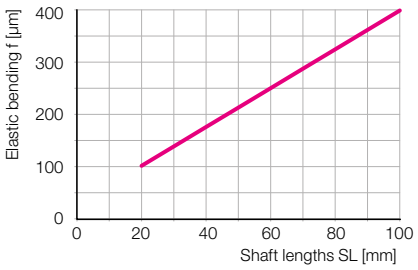
Double acting		**Part no.**
Shaft lengths 20	[mm]	**1947110S106020**
Shaft lengths 30	[mm]	**1947110S106030**
Shaft lengths 40	[mm]	**1947110S106040**
Shaft lengths 50	[mm]	**1947110S106050**
Shaft lengths 60	[mm]	**1947110S106060**
Shaft lengths 70	[mm]	**1947110S106070**
Shaft lengths 80	[mm]	**1947110S106080**
Shaft lengths 90	[mm]	**1947110S106090**
Shaft lengths 100	[mm]	**1947110S106100**
Weight, approx.	[kg]	0.32 up to 0.37

Spare parts	**Part no.**
O-ring 1 10.82 x 1.78 (single acting)	**3001 013**
O-ring 2 21.95 x 1.78 (single acting)	**3002 170**
Seal kit, external seals (double acting)	**0132 927**

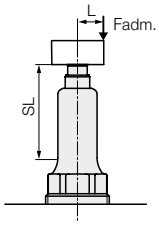
Article available on request
On request, we will check whether the article is still available.

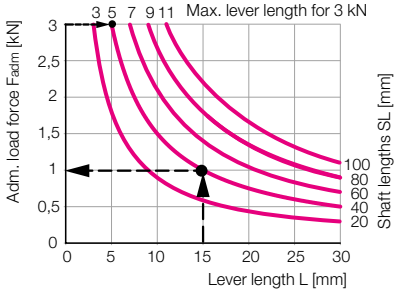
Elastic bending f at the admissible side load of 0.3 kN and an operating pressure of 70 bar as a function of the shaft length SL





Adm. load force Fadm at an operating pressure of 70 bar as a function of lever length L and the shaft length SL





Example
Work support 1947 110S 106040

Operating pressure	p	=	70 bar
Lever length	L	=	15 mm
Shaft length	SL	=	40 mm

As per diagram:
Adm. load 1 kN

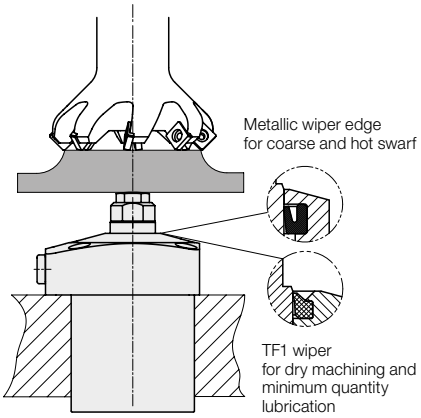
Up to which lever length can the work support absorb the max. side load of 3 kN?
As per diagram: max. lever length 5 mm

Work Supports

Top flange type, metallic wiper edge or TF1 wiper single acting, max. operating pressure 70 bar

Advantages

- Load force up to 25 kN
- Space-saving version
- 2 sizes available
- Alternatively metallic wiper edge or TF1 wiper
- Contact force of the support plunger selectable
- Inner parts protected against corrosion
- Alternatively pipe thread or drilled channels
- Flow control valve available as accessory
- Connection for venting and positive air pressure protection
- Mounting position: any
- Connection of positive air pressure protection up to 4 bar is possible



Application

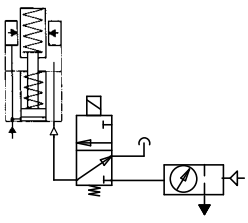
Hydraulic work supports are used to provide a self-adjusting rest for workpieces and avoid their vibration and deflection under machining loads. This series offers very high support forces already at 70 bar and can directly be connected to the low-pressure hydraulic of the machine tool. Due to their compact design they can be arranged in a very limited space. Oil supply is made through drilled channels or pipe thread.

Description

The support plunger is hydraulically extended by a small piston and contacts the workpiece with spring force. The contact spring can be easily exchanged.
Locking of the support plunger is made through the slotted clamping sleeve and by means of a ring-shaped conical hydraulic piston where the locking force is transmitted by a low-friction ball shell.
Unlocking and retracting of the support plunger is made by spring force.

Positive air pressure connection

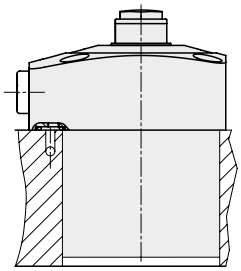
To guarantee functioning of the work supports, a vent port is imperative. No liquids may enter the end of the bore hole (see also data sheet G 0.110 „Venting of the spring area“).
It is recommended to connect positive air pressure protection. While locking the support plunger, the positive air pressure must not exceed 4 bar. If the support plunger is not locked, the positive air pressure must be reduced to a maximum of 0.2 bar.
The positive air pressure connection must be free of oil and water.



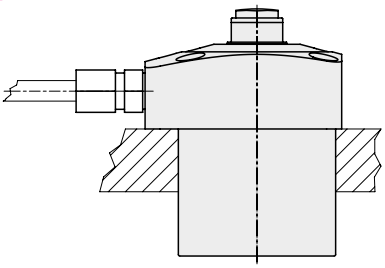
Connection of positive air pressure protection

Installation and connecting possibilities

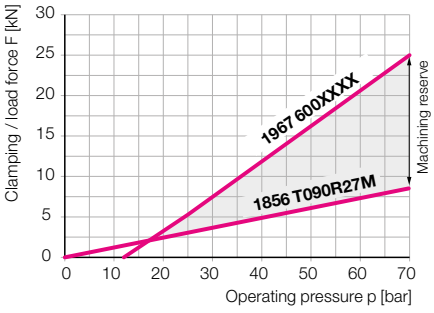
Drilled channels



Pipe thread



Clamping / load force as a function of the operating pressure



Important notes

Work supports are not suitable to compensate side loads. The support plunger must not be stressed by tensile load.
The admissible load force is valid for static or dynamic load. Machining forces can generate vibrations, whose amplitude exceeds far an average value, and this can cause yielding of the support plunger.
Operating conditions, tolerances and other data see data sheet A 0.100

Combination with clamping elements

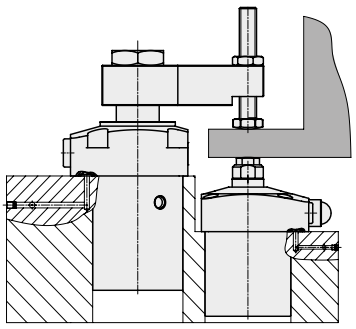
With this combination, clamping and machining forces will add up:

Clamping force
\+ max. machining force
= minimum support force x safety factor

Rough calculation from practice:
Required support force ≥ 2 x clamping force

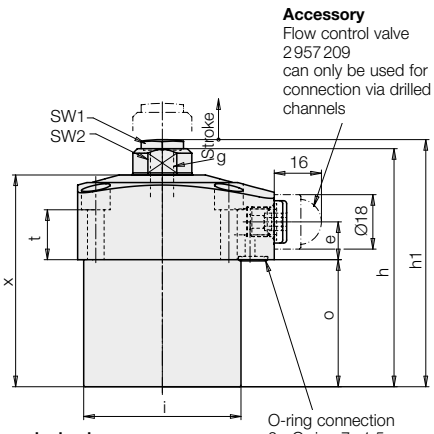
To increase the safety, a support force as high as possible should be achieved by

- using a larger work support
- utilising the max. operating pressure
- using a smaller clamping element or reducing the clamping pressure

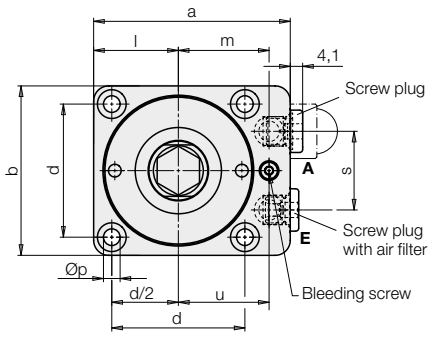


Example

Work support 1967 600 XXXX max. load force at 70 bar and swing clamp 1856 T090 R27M as per data sheet B 1.8500	25.0 kN
– Effective clamping force at 70 bar	8.3 kN
= Reserve for machining force	16.7 kN

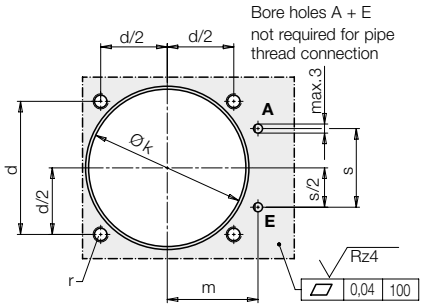


Important note
Both O-rings must be inserted also for pipe thread connection.

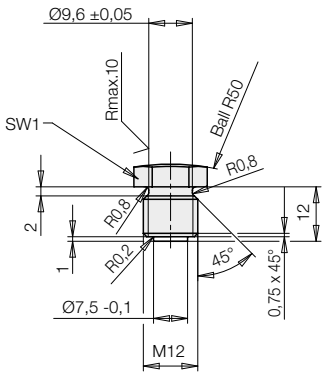


A = hydraulics G 1/8
E = venting or positive air pressure connection G 1/8

Connecting scheme



Dimensions for self-made contact bolts

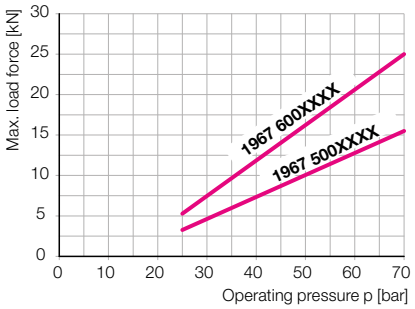


Max. load force at 70 bar	**[kN]**	**15.5**	**25**
Load force at p (bar)	[kN]	0.272 x p – 3.54	0.439 x p – 5.70
Support plunger Ø D	[mm]	20	22
Stroke	[mm]	12	14
Required oil per stroke	[cm³]	3.5	5
Admissible flow rate	[cm³/s]	25	25
Recommended minimum pressure	[bar]	25	25
Max. pressure in the return line	**[bar]**	**1**	**1**
Elastic deformation with load and 70 bar	[µm/kN]	2.5	2.5
Operating temperature	[°C]	0 … 70	0 … 70
a	[mm]	65	75
b	[mm]	56	65
d	[mm]	44	52
e	[mm]	12.5	12.5
g x depth	[mm]	M 12 x 12	M 12 x 12
h	[mm]	78.7	97
h1	[mm]	81.7	102
Ø i	[mm]	52 –0.2	60 –0.2
Ø k	[mm]	52 +0.3/+0.1	60 +0.3/+0.1
l	[mm]	28	32.5
m	[mm]	30	33.5
o	[mm]	42	57
Ø p	[mm]	5.5	6.5
r		M 5	M 6
Tightening torque	[Nm]	5.9	10
s	[mm]	26	30
t	[mm]	16.5	15.9
u	[mm]	30	36
x	[mm]	70	87
SW1	[mm]	14	14
SW2	[mm]	17	19
Wiper and metallic wiper edge		**M**	**M**
Plunger contact force min./max.	[N]	4 / 14	4 / 12
Part no.		**1967500M112**	**1967600M114**
Plunger contact force min./max.	[N]	11 / 17	10 / 15
Part no.		**1967500M312**	**1967600M314**
Plunger contact force min./max.	[N]	12 / 28	16 / 28
Part no.		**1967500M512**	**1967600M514**
TF1 wiper		**B**	**B**
Plunger contact force min./max.	[N]	11/17	10/15
Part no.		**1967500B312**	**1967600B314**
Plunger contact force min./max.	[N]	12/28	16/28
Part no.		**1967500B512**	**1967600B514**
Accessory			
Flow control valve G 1/8		**2957209**	**2957209**
Screw plug G 1/8		**3610158**	**3610158**

Connecting possibilities (see page 1)

1. Pipe thread
1.1 Dry environment
Port E: Screw plug with air filter
1.2 Wet environment
Port E: Fitting G1/8 with pipe laid in a dry place
2. Drilled channels
2.1 Wet environment
Port A: Screw plug G1/8 or flow control valve 2957209 (accessory)
Port E: Screw plug with air filter
2.2 Wet environment
Port A: see 2.1
Port E: Screw plug G 1/8 3610158 (accessory)

Adm. load force F as a function of the operating pressure p



Threaded-Body Work Supports
max. operating pressure 500 bar

Application
Hydraulic work supports are used to provide a self-adjusting rest for the workpiece during the machining operations. They compensate the workpiece surface irregularities, also deflection and vibration under machining loads.

Function
Hydraulic locking is made together with hydraulic clamping of the workpiece, or independently.
Three different sizes are available. Each of these can be combined with swing clamps as per data sheet B 1.881 or B 1.892 (see combination possibilities).

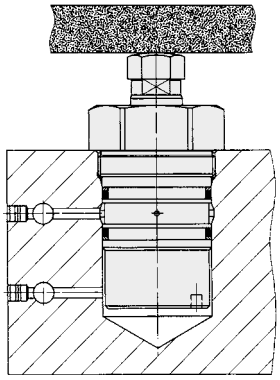
Installation
The threaded-body design of the elements allows direct installation in clamping fixtures, in horizontal or vertical mounting position, and thereby a space-saving arrangement. Hydraulic oil is fed through drilled channels in the fixture body.

Important note!
Work supports are not suitable to compensate side loads.
Operating conditions, tolerances and other data see data sheet A 0.100.
It is absolutely necessary to follow the instructions for venting of the spring area on data sheet G 0.110.

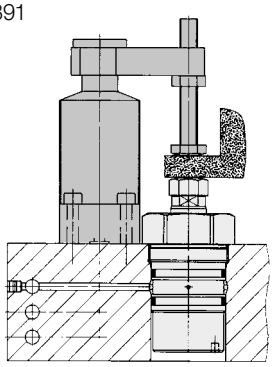
There are three variations of plunger actuation:
1. Spring advanced; plunger extended in off-position (see page 2).

2. Air pressure advanced; plunger retracted in off-position. The pneumatically-actuated plunger allows precise setting of the plunger contact force by means of a pressure reducing valve (see page 3).

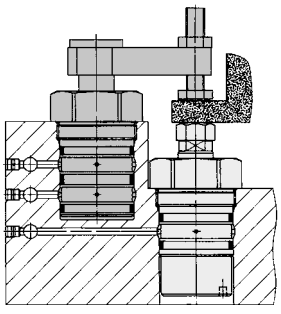
3. Hydraulic pressure and spring advanced; plunger retracted in off-position It moves forward with a light spring force against the workpiece, when hydraulic pressure is applied (see page 4).

Installation example


Combination possibilities
Threaded-body work support combined with flange-mounted swing clamps as per data sheet B 1.891



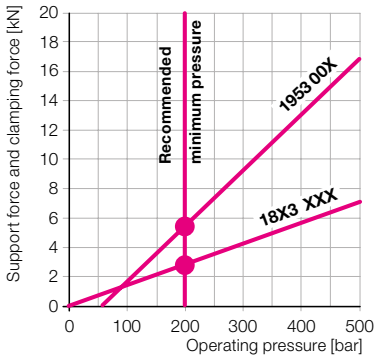
Threaded-body work support combined with threaded-body swing clamps as per data sheet B 1.892

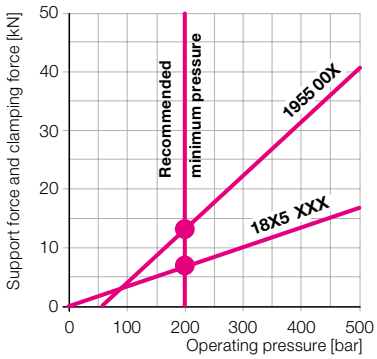


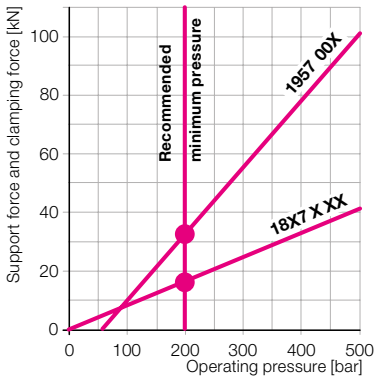
Important note
Support and clamping forces have to be adapted to each other, so that there will be sufficient force reserve available for the threaded-body work support to absorb the machining forces.

Thumb rule: Support force ≥ 2 x opposing force

The diagrams below show the graphs of the clamping and support forces for the 3 possible combinations.



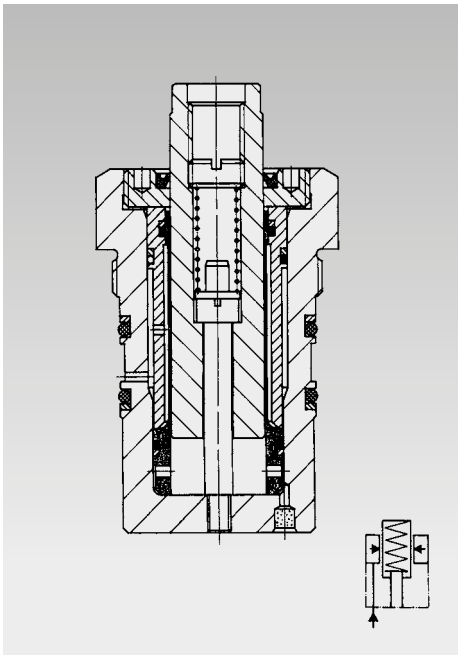


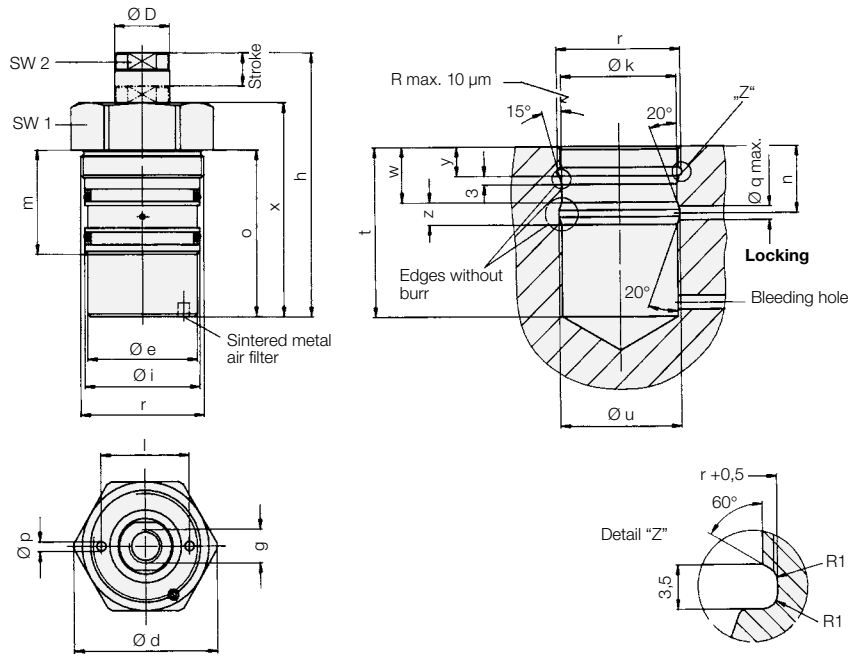


Example
Swing clamps 1895506 clamps against threaded-body work support 1955002.
Operating pressure 200 bar.

Support force	14 kN
Clamping force	– 7 kN
	7 kN = possible opposing force

Version: off-position extended, contact by spring force
max. operating pressure 500 bar





The support plunger is extended in off-position.

When the workpiece is inserted the plunger is pushed back. The contact force of the installed pressure spring depends on the stroke of the plunger. Afterwards the plunger is hydraulically locked.

The support plunger is provided with female thread to enable the use of threaded pieces for height adjustment.

The internal part of the work support is protected against dust and swarf by a sintered metal air filter. Liquids must not be sucked in by the filter. A corresponding protection cover has to be provided.

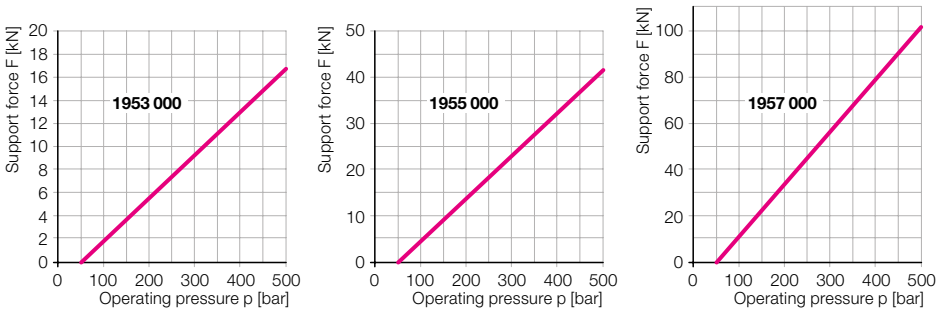
It is absolutely necessary to follow the instructions for venting of the spring area on data sheet G 0.110.

The support plunger must always be protected against penetration of contamination by a contact bolt (see accessory) or a plug.

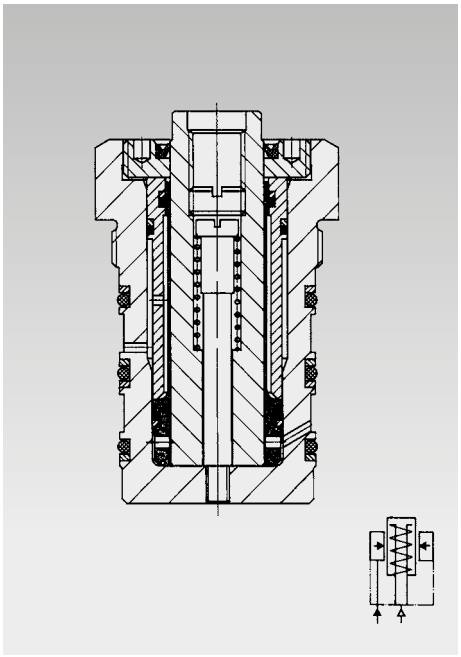
Plunger Ø D	[mm]	20	32	50
Stroke	[mm]	12	16	20
Support force at 200/500 bar	[kN]	5.6/16.8	14/42	34/102
Plunger contact force min./ max.	[N]	15/25	30/60	50/100
Ø d	[mm]	52	64	100
Ø e	[mm]	41	53	83
g x depth of thread	[mm]	M12x12	M12x12	M16x20
h	[mm]	95	119	174
Ø i f7	[mm]	42	55	85
Ø k H7	[mm]	42	55	85
l	[mm]	–	–	86
m	[mm]	36	45	60
n	[mm]	24	29	41
o	[mm]	60	66	126
Ø p / deep	[mm]	–	–	8/9
Ø q max.	[mm]	5	5	6
r	[mm]	M45x1.5	M60x1.5	M90x2
t	[mm]	61	67	127
Ø u	[mm]	44	57	87
w	[mm]	20	24	36
x	[mm]	77	99	146
y	[mm]	10.5	12.5	20.5
z	[mm]	8	10	10
SW 1	[mm]	46	55	95
SW 2	[mm]	17	27	41
Part no.		**1953000**	**1955000**	**1957000***
Spare seals – Seal kit for external seals		**0131525**	**0131527**	**0131529**
Accessory – Contact bolt, dome head as per data sheet G 3.800		**3614028**	**3614028**	**3614003**

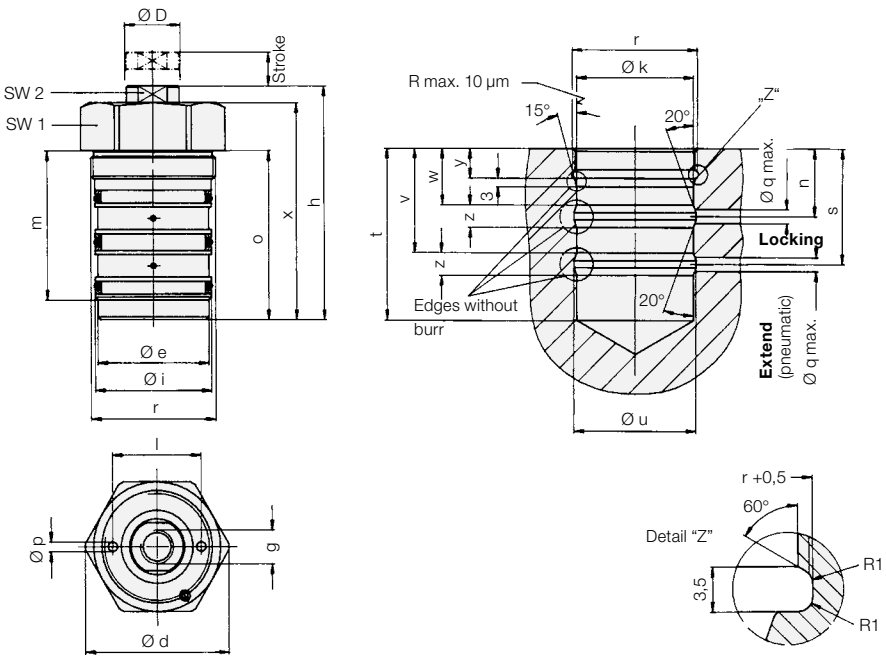
***** with metallic wiper edge

Adm. support force F as function of the operating pressure p



Version: extend and contact by air pressure
max. operating pressure 500 bar





The support plunger is retracted in off-position.

The pneumatically-actuated plunger allows precise setting of the plunger contact force by means of a pressure reducing valve.

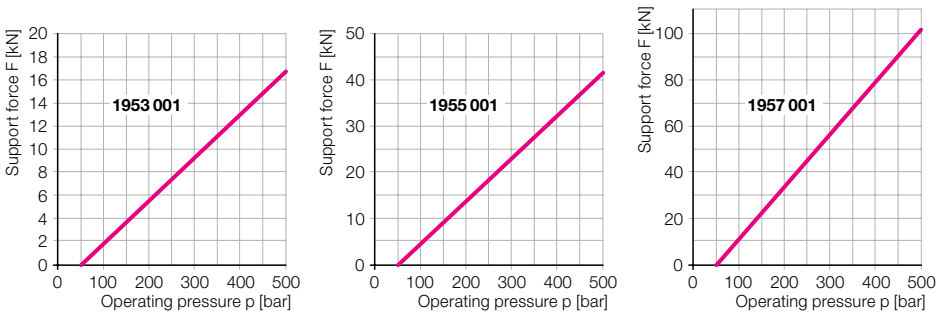
The support plunger is provided with female thread to enable the use of threaded pieces for height adjustment.

The support plunger must always be protected against penetration of contamination by a contact bolt (see accessory) or a plug.

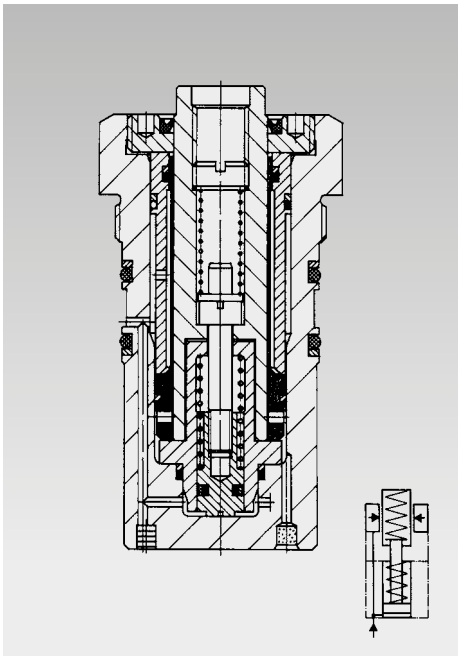
Plunger Ø D	[mm]	20	32	50
Stroke	[mm]	12	16	20
Support force at 200/500 bar	[kN]	5.6/16.8	14/42	34/102
Spring force min./max.	[N]	15/25	30/60	50/100
Plunger contact force at 1 bar air pressure (deduct spring force, if necessary)	[N]	31	80	196
Ø d	[mm]	52	64	100
Ø e	[mm]	41	53	83
g x depth of thread	[mm]	M12x12	M12x12	M16x20
h	[mm]	83	103	154
Ø i f7	[mm]	42	55	85
Ø k H7	[mm]	42	55	85
l	[mm]	–	–	86
m	[mm]	53	64	85
n	[mm]	24	29	41
o	[mm]	60	66	126
Ø p / deep	[mm]	–	–	8/9
Ø q max.	[mm]	5	5	6
r	[mm]	M45x1.5	M60x1.5	M90x2
s	[mm]	41	46.5	64
t	[mm]	61	67	127
Ø u	[mm]	44	57	87
v	[mm]	37	41.5	59
w	[mm]	20	24	36
x	[mm]	77	99	146
y	[mm]	10.5	12.5	20.5
z	[mm]	8	10	10
SW 1	[mm]	46	55	95
SW 2	[mm]	17	27	41
Part no		**1953001**	**1955001**	**1957001***
Spare seals – Seal kit for external seals		**0131524**	**0131526**	**0131528**
Accessory – Contact bolt, dome head as per data sheet G 3.800		**3614028**	**3614028**	**3614003**

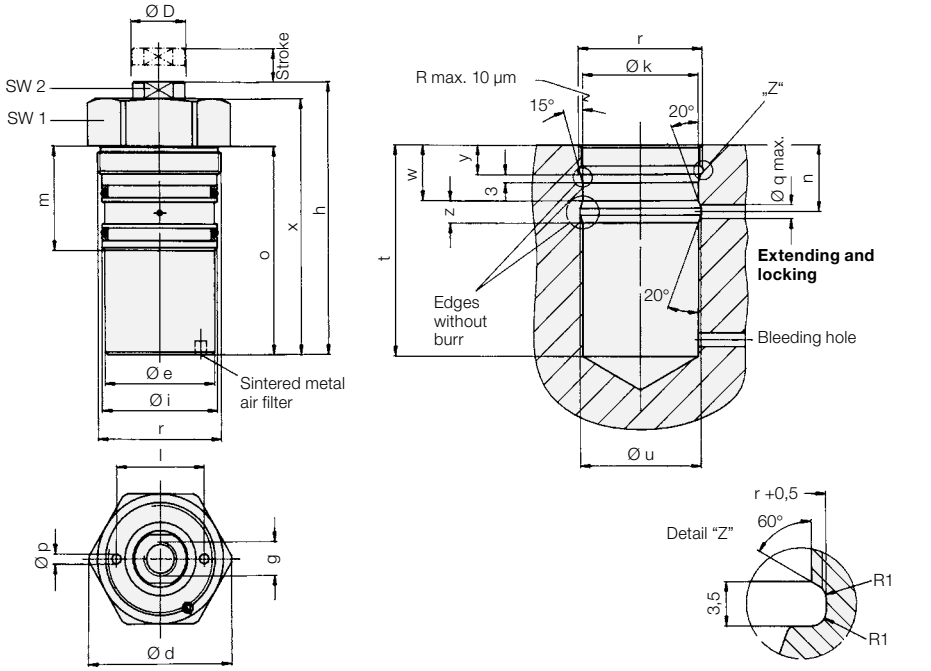
***** with metallic wiper edge

Adm. support force F as function of the operating pressure p



Version: extending hydraulically, contact by spring force
max. operating pressure 500 bar





The support plunger is retracted in off-position.

When pressurised the support plunger moves against the inserted workpiece by means of light spring force. The contact force of the installed pressure spring depends on the stroke of the plunger. With increasing oil pressure, the plunger locks hydraulically.

After the system has been unclamped, the support plunger returns to off-position. The support plunger is provided with female thread to enable the use of threaded pieces for height adjustment.

The internal part of the work support is protected against dust and swarf by a sintered metal air filter. Liquids must not be sucked in by the filter. A corresponding protection cover has to be provided.

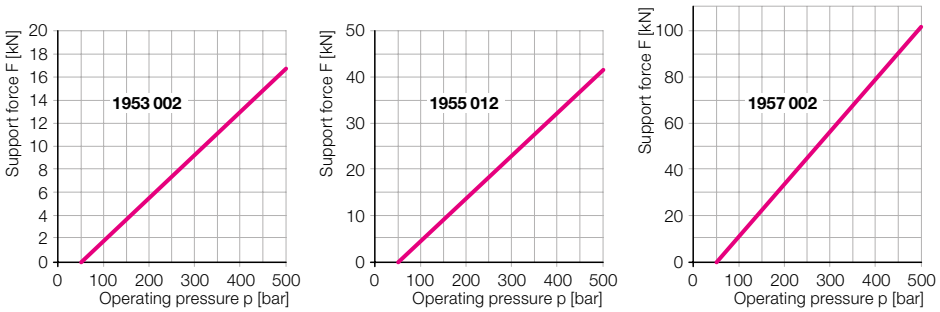
It is absolutely necessary to follow the instructions for venting of the spring area on data sheet G 0.110.

The support plunger must always be protected against penetration of contamination by a contact bolt (see accessory) or a plug.

Plunger Ø D	[mm]	20	32	50
Stroke	[mm]	12	16	20
Support force at 200/500 bar	[kN]	5.6/16.8	14/42	34/102
Plunger contact force min./max.	[N]	15/25	30/60	50/100
Max. oil flow rate	[cm^3/sec]	25	35	100
Required oil per stroke	[cm^3]	1.0	3.3	9.8
Ø d	[mm]	52	64	100
Ø e	[mm]	41	53	83
g x depth of thread	[mm]	M12x12	M12x12	M16x20
h	[mm]	98	120	172
Ø i f7	[mm]	42	55	85
Ø k H7	[mm]	42	55	85
l	[mm]	–	–	86
m	[mm]	36	45	60
n	[mm]	24	29	41
o	[mm]	75	83	144
Ø p/deep	[mm]	–	–	8/9
Ø q max.	[mm]	5	5	6
r	[mm]	M45x1.5	M60x1.5	M90x2
t	[mm]	76	84	145
Ø u	[mm]	44	57	87
w	[mm]	20	24	36
x	[mm]	92	116	164
y	[mm]	10.5	12.5	20.5
z	[mm]	8	10	10
SW 1	[mm]	46	55	95
SW 2	[mm]	17	27	41
Part no.		**1953002**	**1955012**	**1957002***
Spare seals – Seal kit for external seals		**0131525**	**0131527**	**0131529**
Accessory – Contact bolt, dome head as per data sheet G 3.800		**3614028**	**3614028**	**3614003**

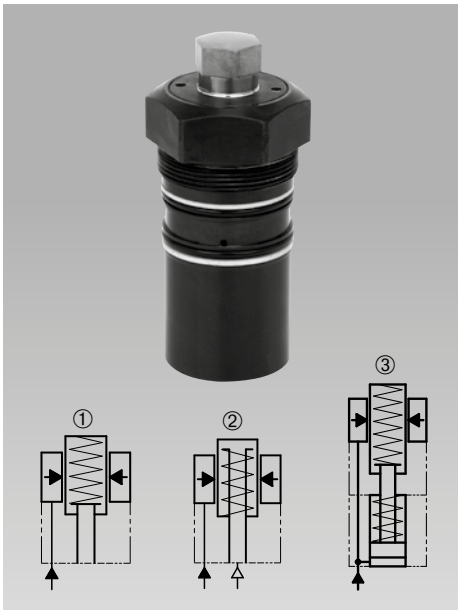
***** with metallic wiper edge

Adm. support force F as function of the operating pressure p



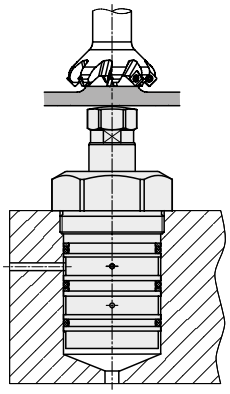
Threaded-Body Work Supports

with metallic wiper edge, 3 sizes, 3 types of function, single acting, max. operating pressure 500 bar



Advantages

- Space-saving threaded-body version
- 3 sizes
- 3 types of function
- Contact force by spring or pneumatically adjustable (195X021)
- Load force up to 100 kN
- Venting for spring area universally connectable
- Metallic wiper edge and FKM wiper
- Connection of positive air pressure protection is possible
- Support plunger and interior parts protected against corrosion
- Connection of positive air pressure protection up to 4 bar is possible



Application

Hydraulic work supports are used to provide a self-adjusting rest for the workpiece during the machining operations. They compensate the workpiece surface irregularities, also vibration and deflection under machining loads.
The threaded-body design allows for space-saving and direct installation into the fixture body. Oil supply is made through drilled channels.

Description

In the body of the threaded-body work support a thin-walled locking bush is integrated, which locks cylindrically around the freely-movable support plunger when pressurising the element with hydraulic oil.
The elements are protected against penetration of swarf by a metallic wiper edge and sealed against liquids. The venting port allows also the connection of positive air pressure protection.

Important notes

Work supports are not suitable to compensate side loads. The support plunger must not be stressed by tensile load. The admissible load force is valid for static or dynamic load. Machining forces can generate vibrations, whose amplitude exceeds far an average value, and this can cause yielding of the support plunger.
Operating conditions, tolerances and other data see data sheet A 0.100.

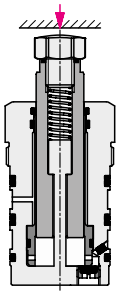
Positive air pressure connection

To guarantee functioning of the work supports, a vent port is imperative. No liquids may enter the end of the bore hole (see also data sheet G 0.110 „Venting of the spring area“).
It is recommended to connect positive air pressure protection. While locking the support plunger, the positive air pressure must not exceed 4 bar. If the support plunger is not locked, the positive air pressure must be reduced to a maximum of 0.2 bar.
The positive air pressure connection must be free of oil and water.

Types of function

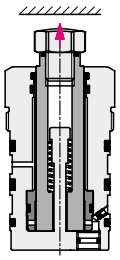
1. Spring advanced

Page 2



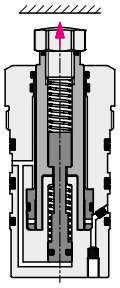
2. Air pressure advanced

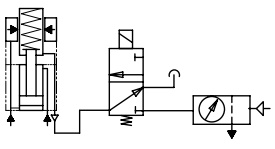
Page 3



3. Hydraulic pressure and spring advanced

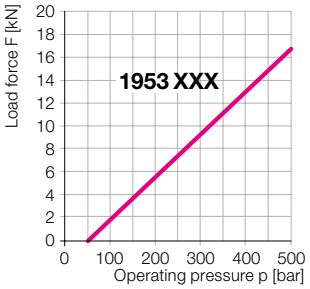
Page 4

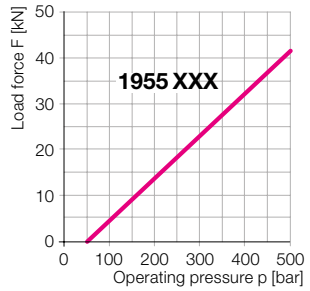


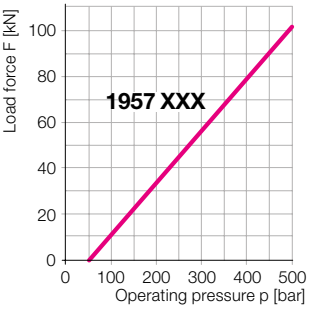


Connection of positive air pressure protection

Admissible load force as a function of the operating pressure

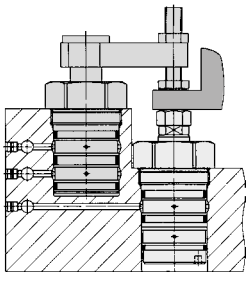




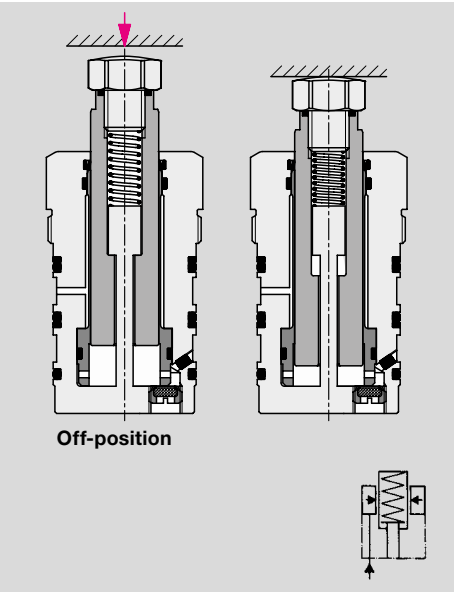


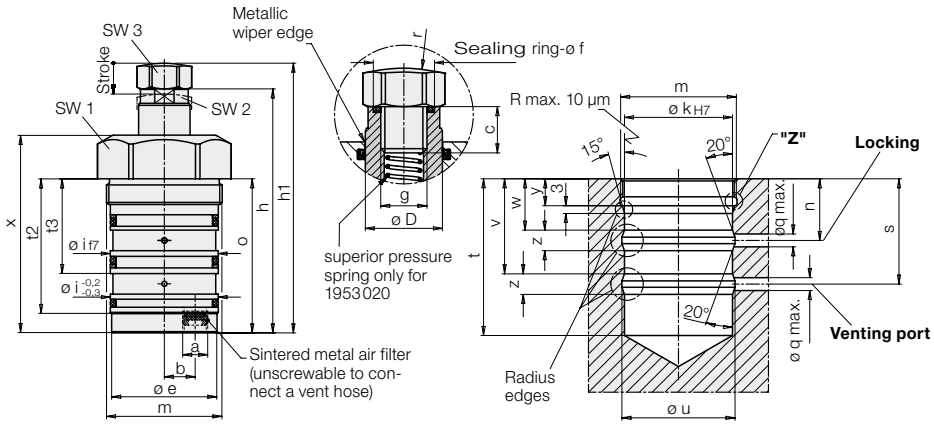
Combination with clamping elements

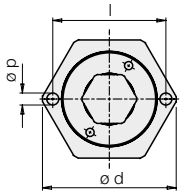
Page 5

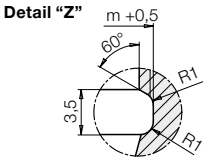


Type of function: Spring advanced
off-position extended, contact by spring force



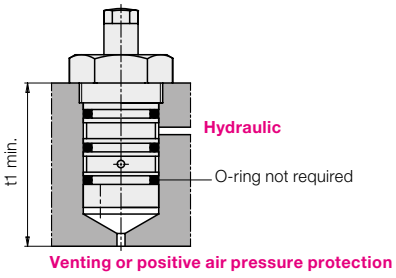




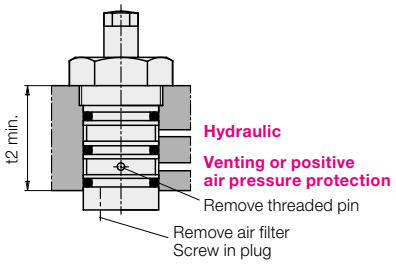


The support plunger is pushed back by the inserted workpiece, the spring force has to be overcome.
The support plunger will be locked by hydraulic pressure and can compensate forces in axis direction.
After unclamping the support plunger contacts still the workpiece with spring force, until the workpiece will be unloaded from the fixture.

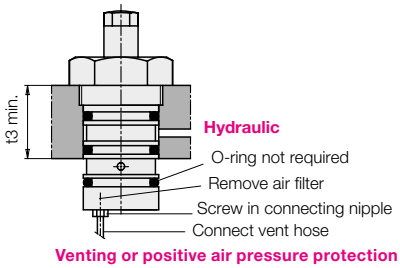
1. Venting via pocket hole



2. Venting via drilled channels



3. Venting via hoses



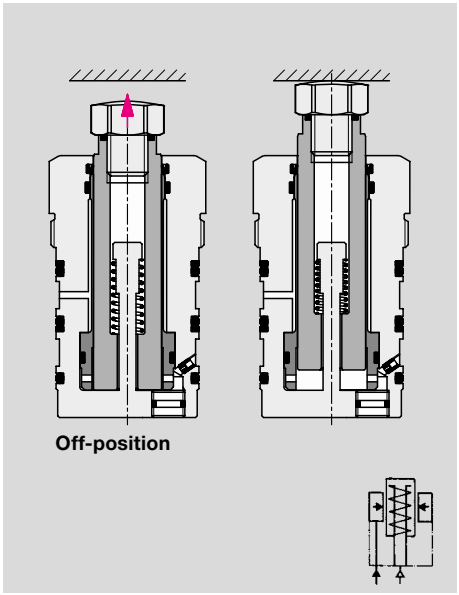
Support plunger Ø D	[mm]	20	32	50
Stroke	[mm]	12	16	20
Load force at 200/500 bar	[kN]	5.6/16.8	14/42	34/102
Plunger contact force min./max.	[N]	15/25	30/60	50/100
Elastic deformation at 500 500 bar*	[mm/kN]	0.004	0.003	0.002
a	[mm]	G 1/8	G 1/8	G 1/4
b	[mm]	12	18	30.5
c	[mm]	12	12	20
Ø d	[mm]	52	64	100
Ø e	[mm]	41	53	83
Ø f	[mm]	15.9	15.9	19.6
g	[mm]	M12	M12	M16
h	[mm]	95	119	174
h1	[mm]	105	129	184
Ø i f7	[mm]	42	55	85
Ø k H7	[mm]	42	55	85
l	[mm]	–	–	86
m	[mm]	M45x1.5	M60x1.5	M90x2
n	[mm]	24	29	41
o	[mm]	60	66	126
Ø p / deep	[mm]	–	–	8/9
Ø q max.	[mm]	5	5	6
r	[mm]	45	45	60
s	[mm]	41	46.5	64
t	[mm]	61	67	127
t1	[mm]	75	85	155
t2	[mm]	52	58	80
t3	[mm]	36	43	60
Ø u	[mm]	44	57	87
v	[mm]	37	41.5	59
w	[mm]	20	24	36
x	[mm]	77	99	146
y	[mm]	10.5	12.5	20.5
z	[mm]	8	10	10
SW 1	[mm]	46	55	95
SW 2	[mm]	17	27	41
SW 3	[mm]	19	19	24
Part no.		**1953020**	**1955020**	**1957020**
Spare seals - Seal kit for external seals		**0132384**	**0132385**	**0132386**
Spare sealing ring for contact bolt		**3001731**	**3001731**	**3002018**

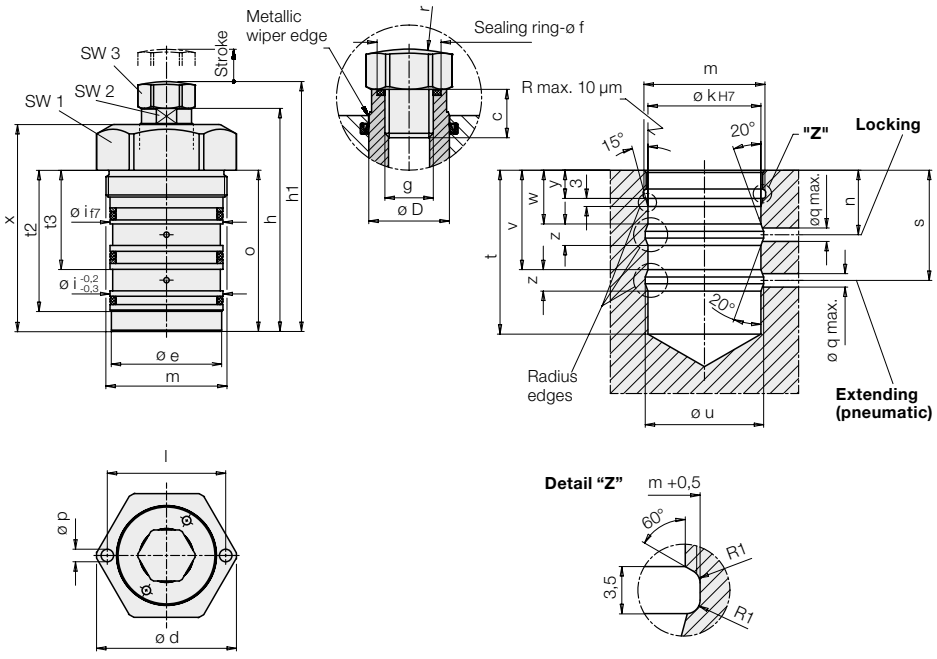
Accessory for venting

Type of venting 1**	Air filter Threaded pin M3x4	**3302008** **3301461**	**3302008** **3301461**	**3302009** **3301461**
Type of venting 2	Plug	**0361986**	**0361986**	**0361987**
Type of venting 3	Connecting nipple Plastic hose	**3890092** **3890131**	**3890092** **3890131**	**3890093** **3890131**

* during load ** Included in the delivery

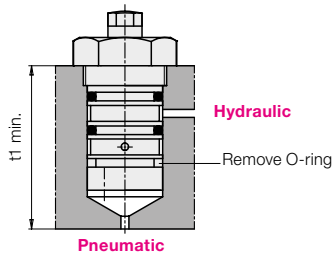
Type of function: Air pressure advanced
extend and contact by air pressure



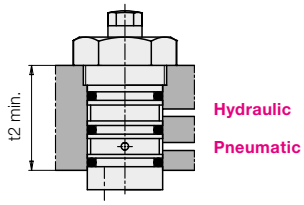


The support plunger contacts the workpiece by air pressure. The contact force is proportional to the air pressure less spring return force.
The support plunger will be locked by hydraulic pressure and can compensate forces in axis direction.
For unclamping hydraulic and air pressure will be released and the support plunger retracts by spring force to its off-position.

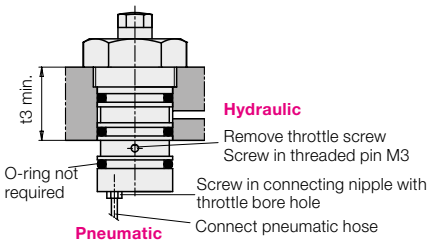
1. Pneumatic via pocket hole



2. Pneumatik über gebohrte Kanäle



3. Pneumatic via hoses



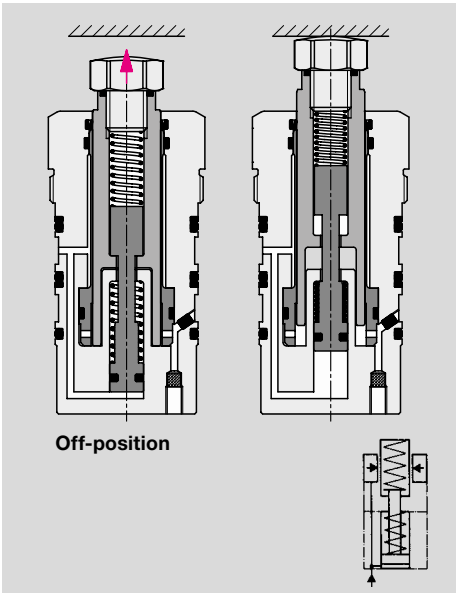
Support plunger Ø D	[mm]	20	32	50
Stroke	[mm]	12	16	20
Load force at 200/500 bar	[kN]	5,6/16,8	14/42	34/102
Spring force min./max.	[N]	15/25	30/60	50/100
Plunger contact force at 1 bar air pressure (deduct spring force if necessary)	[N]	31	80	196
Elastic deformation at 500 bar*	[mm/kN]	0,004	0,003	0,002
a	[mm]	G 1/8	G 1/8	G 1/4
b	[mm]	12	18	30,5
c	[mm]	12	12	20
Ø d	[mm]	52	64	100
Ø e	[mm]	41	53	83
Ø f	[mm]	15,9	15,9	19,6
g	[mm]	M12	M12	M16
h	[mm]	83	103	154
h1	[mm]	93	113	164
Ø i f7	[mm]	42	55	85
Ø k H7	[mm]	42	55	85
l	[mm]	–	–	86
m	[mm]	M45x1,5	M60x1,5	M90x2
n	[mm]	24	29	41
o	[mm]	60	66	126
Ø p / deep	[mm]	–	–	8/9
Ø q max.	[mm]	5	5	6
r	[mm]	45	45	60
s	[mm]	41	46,5	64
t	[mm]	61	67	127
t1	[mm]	75	85	155
t2	[mm]	52	58	80
t3	[mm]	36	43	60
Ø u	[mm]	44	57	87
v	[mm]	37	41,5	59
w	[mm]	20	24	36
x	[mm]	77	99	146
y	[mm]	10,5	12,5	20,5
z	[mm]	8	10	10
SW 1	[mm]	46	55	95
SW 2	[mm]	17	27	41
SW 3	[mm]	19	19	24
Part no.		**1953021**	**1955021**	**1957021**
Spare seals - Seal kit for external seals		**0132384**	**0132385**	**0132386**
Spare sealing ring for contact bolt		**3001731**	**3001731**	**3002018**

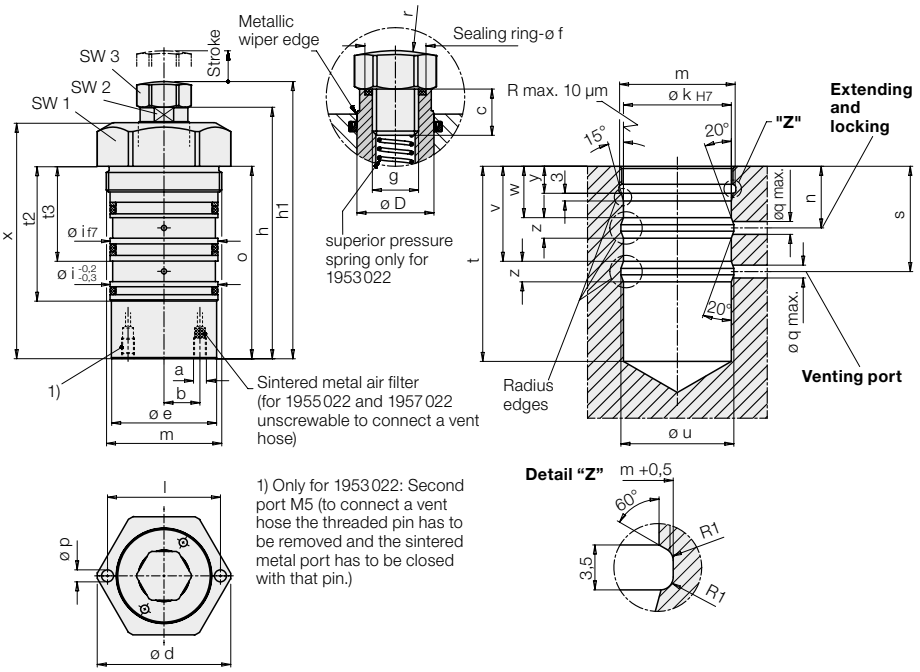
Accessory for venting

Type of venting 1+2**	Plug	**0361986**	**0361986**	**0361987**
	Throttle screw	**3610151**	**3610150**	**3610154**
	Connecting nipple	**3890190**	**3890191**	**3890192**
Type of venting 3	Threaded pin M3x4	**3301461**	**3301461**	**3301461**
	Plastic hose	**3890131**	**3890131**	**3890131**

* during load ** Included in the delivery

Type of function: Hydraulic pressure and spring advanced
extending hydraulically, contact by spring force

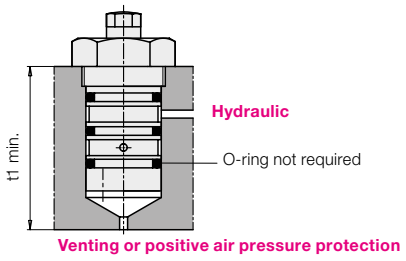




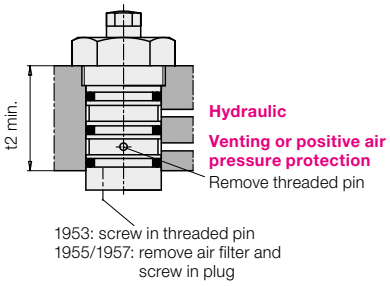
1) Only for 1953022: Second port M5 (to connect a vent hose the threaded pin has to be removed and the sintered metal port has to be closed with that pin.)

The support plunger is extended by a hydraulically pressurised small piston and contacts the workpiece with spring force.
The support plunger will be locked by the increasing hydraulic pressure and can compensate forces in axis direction.
For unclamping hydraulic pressure will be released. The small piston retracts by spring force to its off-position and also retracts the support plunger.

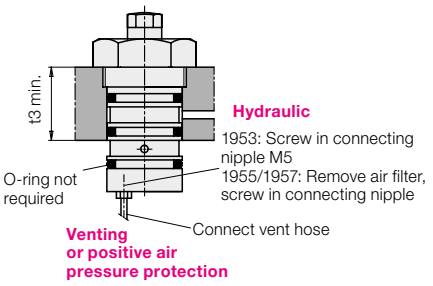
1. Venting via pocket hole



2. Venting via drilled channels



3. Venting via hoses



Support plunger Ø D	[mm]	20	32	50
Stroke	[mm]	12	16	20
Load force at 200/500 bar	[kN]	5.6/16.8	14/42	34/102
Plunger contact force min./max.	[N]	15/25	30/60	50/100
Admissible oil flow rate	[cm³/sec]	25	35	100
Required oil per stroke	[cm³]	1.0	3.3	9.8
Elastic deformation at 500 bar*	[mm/kN]	0.004	0.003	0.002
a	[mm]	M5	G 1/8	G 1/4
b	[mm]	14	18	30.5
c	[mm]	12	12	20
Ø d	[mm]	52	64	100
Ø e	[mm]	41	53	83
Ø f	[mm]	15.9	15.9	19.6
g	[mm]	M12	M12	M16
h	[mm]	98	120	172
h1	[mm]	108	130	182
Ø i f7	[mm]	42	55	85
Ø k H7	[mm]	42	55	85
l	[mm]	–	–	86
m	[mm]	M45x1.5	M60x1.5	M90x2
n	[mm]	24	29	41
o	[mm]	75	83	144
Ø p / deep	[mm]	–	–	8/9
Ø q max.	[mm]	5	5	6
r	[mm]	45	45	60
s	[mm]	41	46.5	64
t	[mm]	76	84	145
t1	[mm]	90	102	172
t2	[mm]	52	58	80
t3	[mm]	36	43	60
Ø u	[mm]	44	57	87
v	[mm]	37	41.5	59
w	[mm]	20	24	36
x	[mm]	92	116	164
y	[mm]	10.5	12.5	20.5
z	[mm]	8	10	10
SW 1	[mm]	46	55	95
SW 2	[mm]	17	27	41
SW 3	[mm]	19	19	24
Part no.		**1953022**	**1955022**	**1957022**
Spare seals – Seal kit for external seals		**0132384**	**0132385**	**0132386**
Spare sealing ring for contact bolt		**3001731**	**3001731**	**3002018**

Accessory for venting

Type of venting 1**	Air filter	**3302008**	**3302008**	**3302009**
	Threaded pin M3x4	**3301461**	**3301461**	**3301461**
Type of venting 2	Threaded pin M5x6	**3301300**	**–**	**–**
	Plug	**–**	**0361986**	**0361987**
Type of venting 3	Connecting nipple	**3890091**	**3890092**	**3890093**
	Plastic hose	**3890131**	**3890131**	**3890131**

* during load ** Included in the delivery

Dimensioning of the load force of work supports

The admissible load force of work supports has always to be dimensioned so that the clamping force of the used clamping elements and the static and dynamic machining forces can be safely compensated.

Admissible load force
– Clamping force
– Safety (reserve)
= Possible machining force

If the total of all occuring forces exceeds the admissible load force, the support plunger of the work support will be pushed back and the work support will be damaged.

Ratio of load force to clamping force

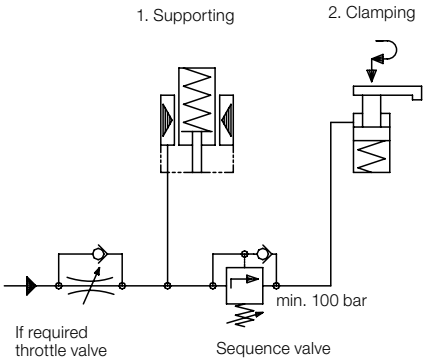
On principle the load force of the work supports should be at least twice the clamping force of the clamping elements.

Load force ≥ 2 x clamping force

Clamping onto the work support

Control of clamping sequence

The sequence – supporting and clamping – has to be controlled as a function of the pressure, e.g. by a sequence valve.

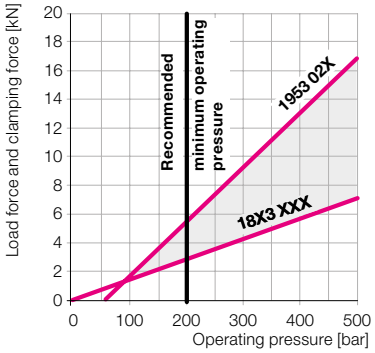


The sequence valve has to be adjusted to an opening pressure above the intersection of the two straight lines in the diagram.
If due to a too high flow rate a throttle valve is required, installation should be made as shown in the hydraulic circuit diagram.

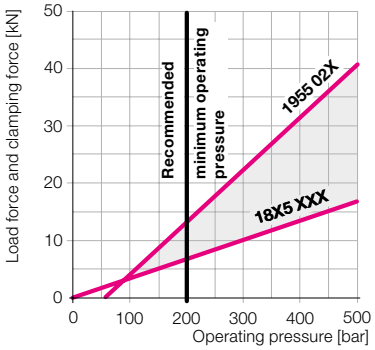
Combinations work supports with swing clamps of the same size

To get a load force twice the clamping force, for all 3 sizes of work supports an operating pressure of at least 200 bar is required.
The vertical distance of the two straight lines in the area of the colorised surface indicates the resulting maximally possible machining force including reserve.

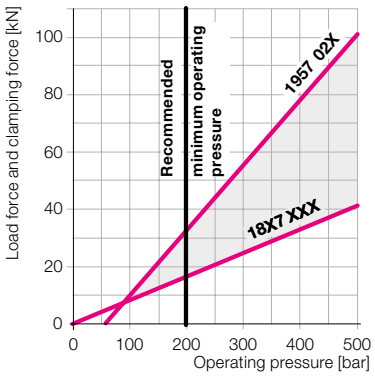
Size 1953



Size 1955



Size 1957

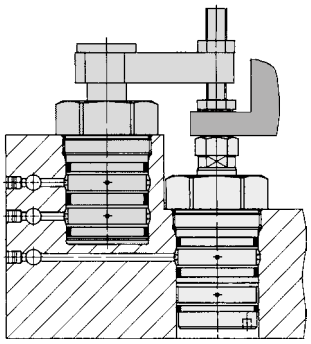


Important note

The admissible load forces as per the diagram are static. The machining forces can also generate vibrations which exceed by far the mean value. For this reason a corresponding safety factor has to be taken into account.

Example

The threaded-body swing clamp 1895 101 (data sheet B 1.892) clamps a workpiece onto the work support 1955 022.



For size 1955 the following can be taken from the diagram:

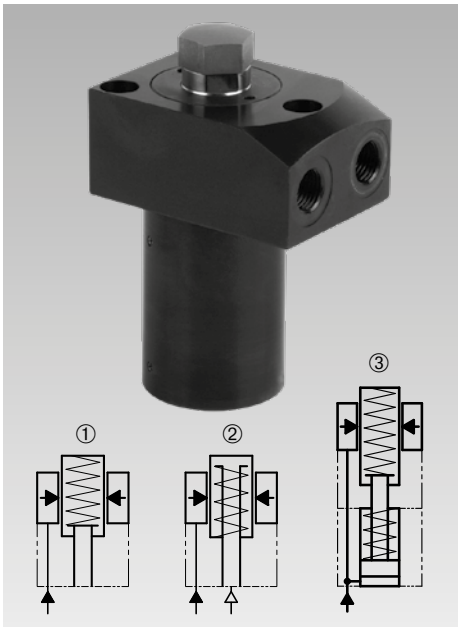
Minimum operating pressure:	200 bar
Load force at 200 bar:	14 kN
Clamping force at 200 bar:	7 kN

Possible machining force at 200 bar:

Admissible load force:	14 kN
– Clamping force:	– 7 kN
= Possible machining force: (including reserve)	7 kN

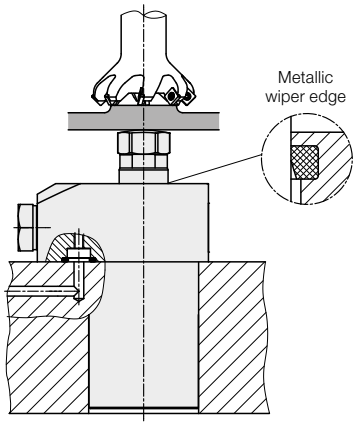
Work supports

Top flange type with metallic wiper edge, 3 sizes, 3 types of function, single acting, max. operating pressure 500 bar



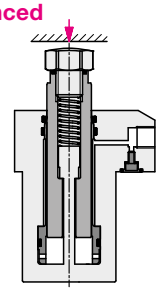
Advantages

- Space-saving version
- 3 sizes
- 3 types of function
- Contact force by spring or pneumatically adjustable (195X321)
- Load force up to 100 kN
- Alternatively pipe thread or drilled channels
- Metallic wiper edge and FKM wiper
- Connection of positive air pressure protection is possible
- Support plunger and interior parts protected against corrosion
- Connection of positive air pressure protection up to 4 bar is possible

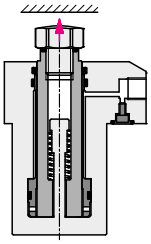


Types of function

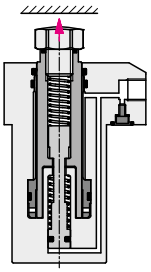
1. Spring advanced
Page 2



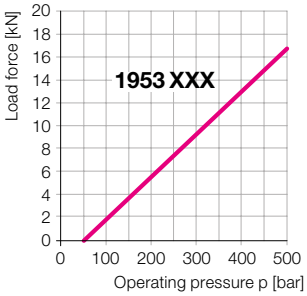
2. Air pressure advanced
Page 3

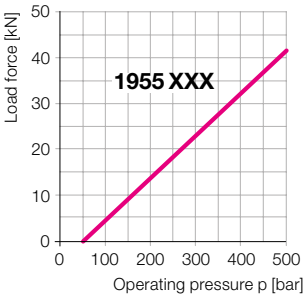


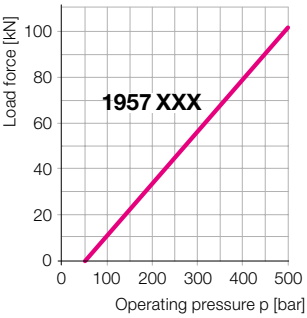
3. Hydraulic pressure and spring advanced
Page 4



Admissible load force as a function of the operating pressure







Application

Hydraulic work supports are used to provide a self-adjusting rest for the workpiece during the machining operations. They compensate the workpiece surface irregularities, also vibration and deflection under machining loads.
The top flange type allows for space-saving and direct installation into the fixture body. Oil supply is made through drilled channels or pipe thread.

Description

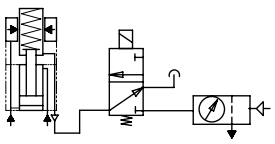
In the body of the work support a thin-walled locking bush is integrated, which locks cylindrically around the freely-movable support plunger when pressurising the element with hydraulic oil.
The elements are protected against penetration of swarf by a metallic wiper edge and sealed against liquids. The venting port allows also the connection of positive air pressure protection.

Important notes

Work supports are not suitable to compensate side loads. The support plunger must not be stressed by tensile load. The admissible load force is valid for static or dynamic load. Machining forces can generate vibrations, whose amplitude exceeds far an average value, and this can cause yielding of the support plunger.
Operating conditions, tolerances and other data see data sheet A 0.100.

Positive air pressure connection

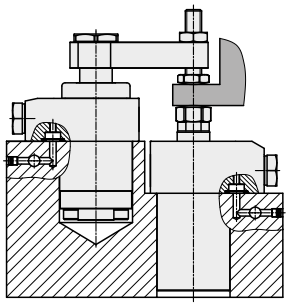
To guarantee functioning of the work supports, a vent port is imperative. No liquids may enter the end of the bore hole (see also data sheet G 0.110 „Venting of the spring area“).
It is recommended to connect positive air pressure protection. While locking the support plunger, the positive air pressure must not exceed 4 bar. If the support plunger is not locked, the positive air pressure must be reduced to a maximum of 0.2 bar.
The positive air pressure connection must be free of oil and water.



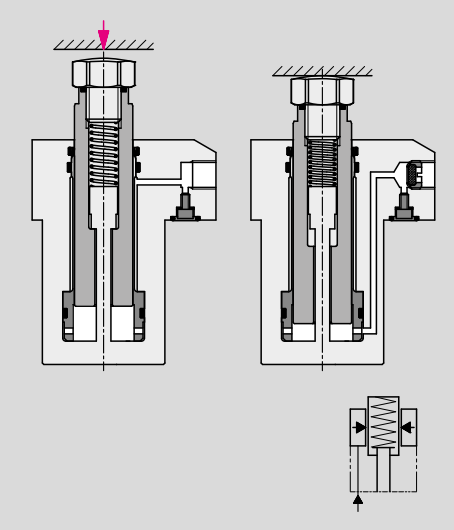
Connection of positive air pressure protection

Combination with clamping elements

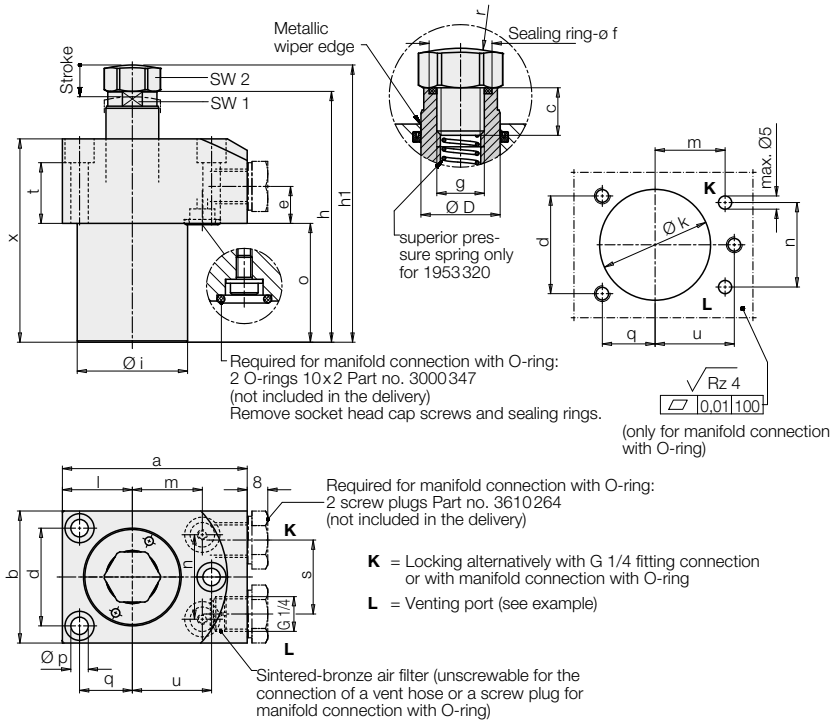
Page 5



Type of function: Spring advanced
off-position extended, contact by spring force

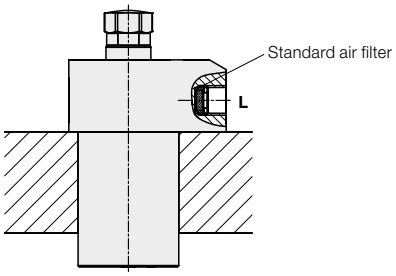


The support plunger is pushed back by the inserted workpiece, the spring force has to be overcome.
The support plunger will be locked by hydraulic pressure and can compensate forces in axis direction.
After unclamping the support plunger contacts still the workpiece with spring force, until the workpiece will be unloaded from the fixture.



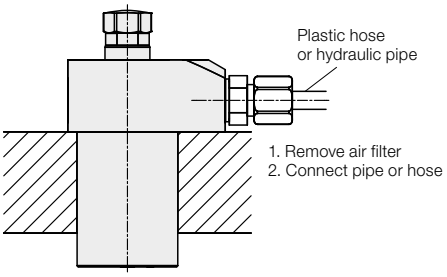
Venting port

1. Dry machining

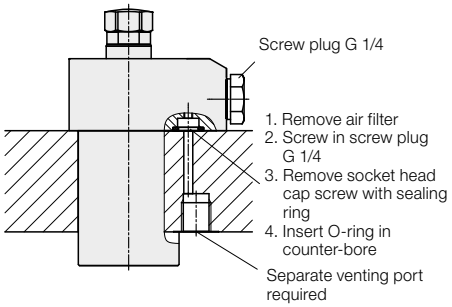


2. Wet machining

Pipe thread



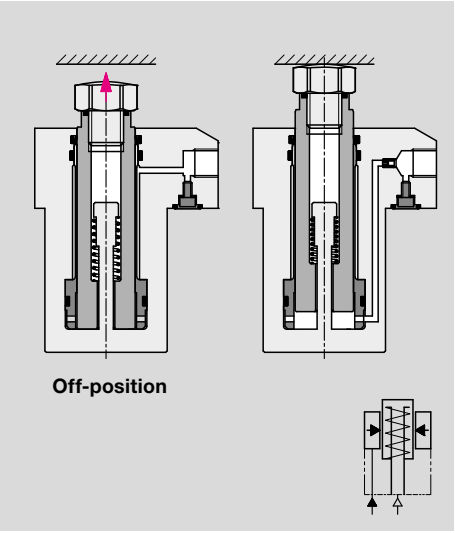
Manifold-mounting connection



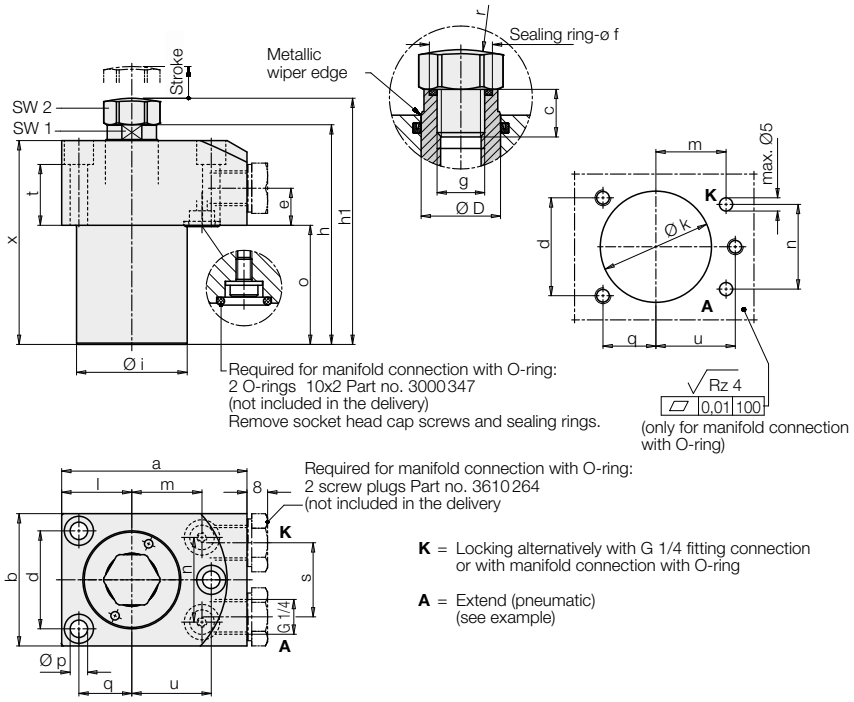
Support plunger Ø D	[mm]	20	32	50
Stroke	[mm]	12	16	20
Load force at 200/500 bar	[kN]	5,6/16,8	14/42	34/102
Plunger contact force min./max.	[N]	15/25	30/60	50/100
Elastic deformation at 500 bar	[µm/kN]	4,5	2,8	1,8
a	[mm]	70	85	125
b	[mm]	50	63	95
c	[mm]	12	12	20
d	[mm]	37	48	72
e	[mm]	14	18	15
Ø f	[mm]	15,9	15,9	19,6
g	[mm]	M 12	M 12	M 16
h	[mm]	95	119	174
h1	[mm]	105	129	184
Ø i ± 0,1	[mm]	44,8	59,8	89,8
Ø k +1	[mm]	45	60	90
l	[mm]	26,5	34,5	55
m	[mm]	26,5	31	45
n	[mm]	32	46	75
o	[mm]	45	59	106
Ø p	[mm]	6,6	8,5	14
q	[mm]	20	27	42
r	[mm]	45	45	60
s	[mm]	28	41	70
t	[mm]	23	29	26
u	[mm]	30	38	55
x	[mm]	77	99	146
SW 1	[mm]	17	27	41
SW 2	[mm]	19	19	24
Part no.		**1953320**	**1955320**	**1957320**
Spare O-ring 10 x 2 mm		**3000347**	**3000347**	**3000347**
Screw plug G 1/4		**3610264**	**3610264**	**3610264**
Spare sealing ring for contact bolt		**3001731**	**3001731**	**3002018**

Recommendation

Positive air pressure protection can be connected to the venting port. The pressure of the positive air pressure protection increases the contact force of the support plunger.

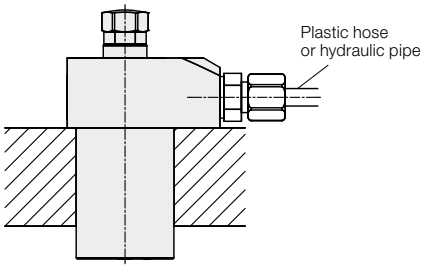


The support plunger contacts the workpiece by air pressure. The contact force is proportional to the air pressure less spring return force. The support plunger will be locked by hydraulic pressure and can compensate forces in axis direction.
For unclamping hydraulic and air pressure will be released and the support plunger retracts by spring force to its off-position.

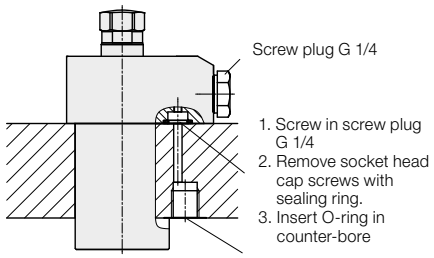


Pneumatic port

Fitting connection



Manifold-mounting connection

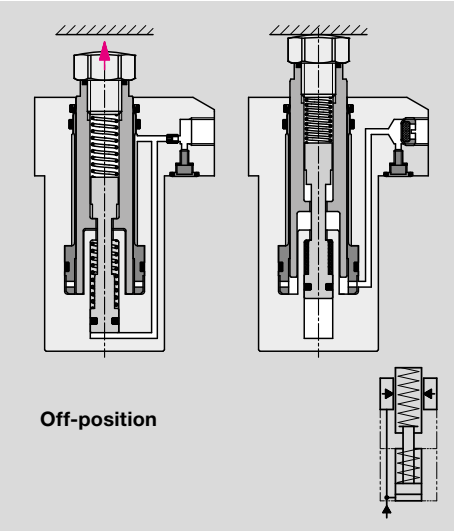


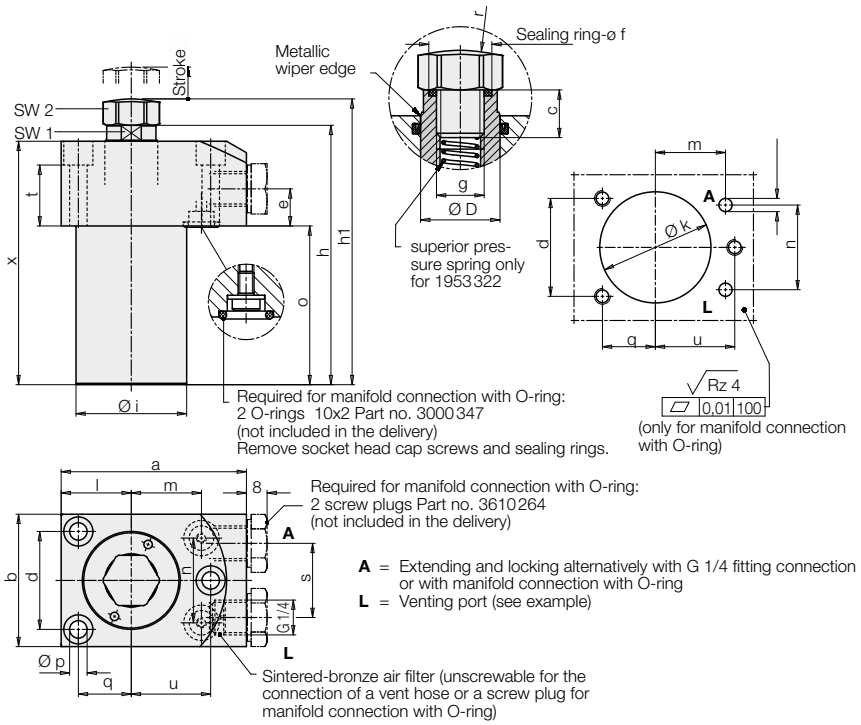
Support plunger Ø D	[mm]	20	32	50
Stroke	[mm]	12	16	20
Load force at 200/500 bar	[kN]	5,6/16,8	14/42	34/102
Spring force min./max.	[N]	15/25	30/60	50/100
Plunger contact force at 1 bar air pressure (deduct spring force if necessary)	[N]	31	80	196
Elastic deformation at 500 bar	[µm/kN]	4,5	2,8	1,8
a	[mm]	70	85	125
b	[mm]	50	63	95
c	[mm]	12	12	20
d	[mm]	37	48	72
e	[mm]	14	18	15
Ø f	[mm]	15,9	15,9	19,6
g	[mm]	M 12	M 12	M 16
h	[mm]	83	103	154
h1	[mm]	93	113	164
Ø i ±0,1	[mm]	44,8	59,8	89,8
Ø k +1	[mm]	45	60	90
l	[mm]	26,5	34,5	55
m	[mm]	26,5	31	45
n	[mm]	32	46	75
o	[mm]	45	59	106
Ø p	[mm]	6,6	8,5	14
q	[mm]	20	27	42
r	[mm]	45	45	60
s	[mm]	28	41	70
t	[mm]	23	29	26
u	[mm]	30	38	55
x	[mm]	77	99	146
SW 1	[mm]	17	27	41
SW 2	[mm]	19	19	24
Part no.		**1953321**	**1955321**	**1957321**
Spare O-ring 10x2 mm		**3000347**	**3000347**	**3000347**
Screw plug G 1/4		**3610264**	**3610264**	**3610264**
Spare sealing ring for contact bolt		**3001731**	**3001731**	**3002018**

Recommendation

The pneumatic air for the extension of the support plunger can also be used as positive air pressure protection. For retraction the port must be depressurised.

Type of function: Hydraulic pressure and spring advanced
extending hydraulically, contact by spring force

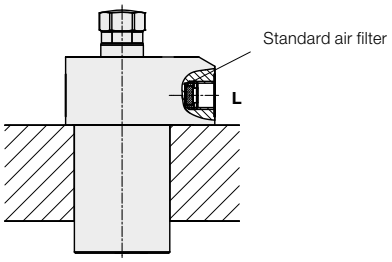




The support plunger is extended by a hydraulically pressurised small piston and contacts the workpiece with spring force.
The support plunger will be locked by the increasing hydraulic pressure and can compensate forces in axis direction.
For unclamping hydraulic pressure will be released. The small piston retracts by spring force to its off-position and also retracts the support plunger.

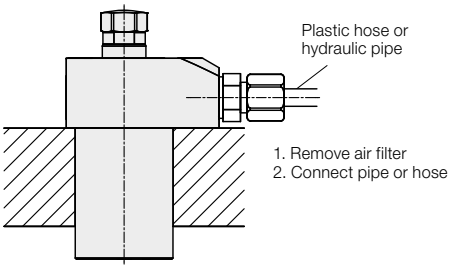
Venting port

1. Dry machining

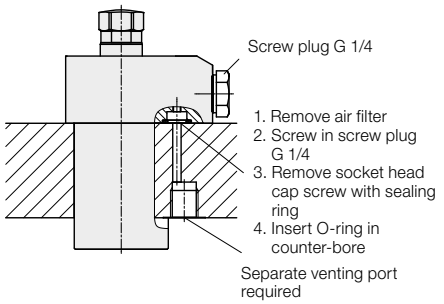


2. Wet machining

Pipe thread



Manifold-mounting connection



Support plunger Ø D	[mm]	20	32	50
Stroke	[mm]	12	16	20
Load force at 200/500 bar	[kN]	5,6/16,8	14/42	34/102
Plunger contact force min./max.	[N]	15/25	30/60	50/100
Admissible oil flow rate	[cm3/sec]	25	35	100
Required oil per stroke	[cm3]	1,0	3,3	9,8
Elastic deformation at 500 bar*	[mm/kN]	4,5	2,8	1,8
a	[mm]	70	85	125
b	[mm]	50	63	95
c	[mm]	12	12	20
d	[mm]	37	48	72
e	[mm]	14	18	15
Ø f	[mm]	15,9	15,9	19,6
g	[mm]	M12	M12	M16
h	[mm]	98	120	172
h1	[mm]	108	130	182
Ø i ±0,1	[mm]	44,8	59,8	89,8
Ø k +1	[mm]	45	60	90
l	[mm]	26,5	34,5	55
m	[mm]	26,5	31	45
n	[mm]	32	46	75
o	[mm]	60	76	124
Ø p	[mm]	6,6	8,5	14
q	[mm]	20	27	42
r	[mm]	45	45	60
s	[mm]	28	41	70
t	[mm]	23	29	26
u	[mm]	30	38	55
x	[mm]	92	116	164
SW 1	[mm]	17	27	41
SW 2	[mm]	19	19	24
Part no.		**1953322**	**1955322**	**1957322**
Spare O-ring 10x2 mm		**3000347**	**3000347**	**3000347**
Screw plug G 1/4		**3610264**	**3610264**	**3610264**
Spare sealing ring for contact bolt		**3001731**	**3001731**	**3002018**

Recommendation

Positive air pressure protection can be connected to the venting port. The pressure of the positive air pressure protection increases the contact force of the support plunger. For unclamping the positive air pressure protection must be switched off.

Dimensioning of the load force of work supports

The admissible load force of work supports has always to be dimensioned so that the clamping force of the used clamping elements and the static and dynamic machining forces can be safely compensated.

Admissible load force
– Clamping force
– Safety (reserve)
= Possible machining force

If the total of all occuring forces exceeds the admissible load force, the support plunger of the work support will be pushed back and the work support will be damaged.

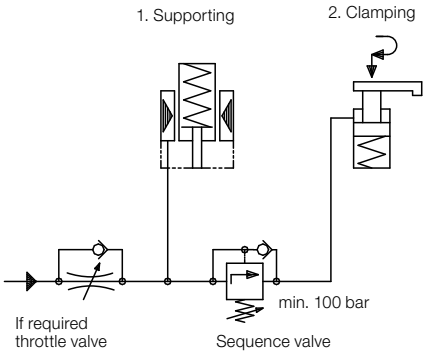
Ratio of load force to clamping force

On principle the load force of the work supports should be at least twice the clamping force of the clamping elements.

Load force ≥ 2 x clamping force

Clamping onto the work support Control of clamping sequence

The sequence – supporting and clamping – has to be controlled as a function of the pressure, e.g. by a sequence valve.

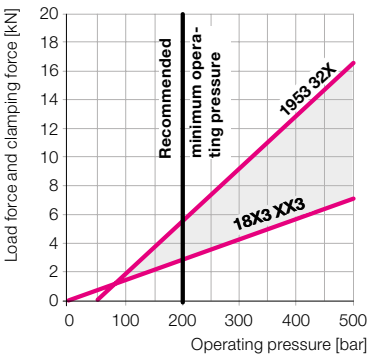


The sequence valve has to be adjusted to an opening pressure above the intersection of the two straight lines in the diagram.
If due to a too high flow rate a throttle valve is required, installation should be made as shown in the hydraulic circuit diagram.

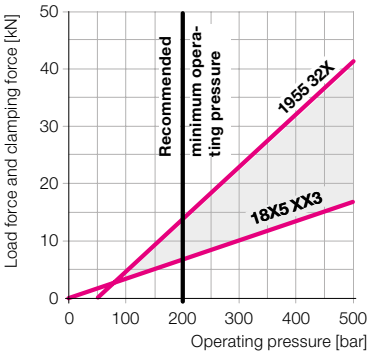
Combinations work supports with swing clamps of the same size

To get a load force twice the clamping force, for all 3 sizes of work supports an operating pressure of at least 200 bar is required.
The vertical distance of the two straight lines in the area of the colorised surface indicates the resulting maximally possible machining force including reserve.

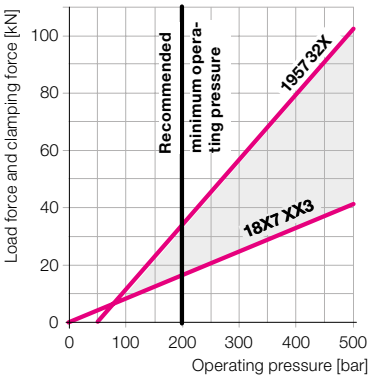
Size 1953



Size 1955



Size 1957

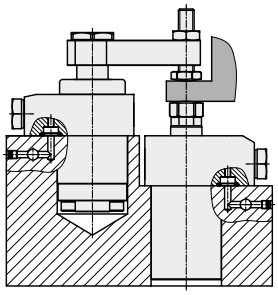


Important note

The admissible load forces as per the diagram are static. The machining forces can also generate vibrations which exceed by far the mean value. For this reason a corresponding safety factor has to be taken into account.

Example

The swing clamp 1895 103 (data sheet B 1.880) clamps a workpiece onto the work support 1955 322.



For size 1955 the following can be taken from the diagram:

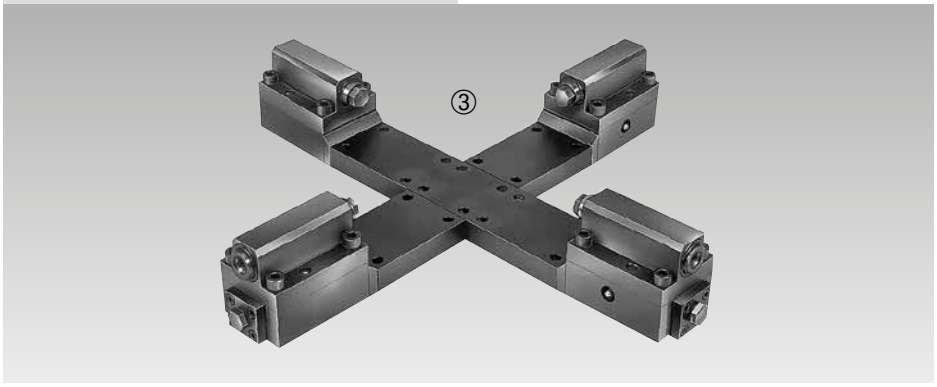
Minimum operating pressure:	200 bar
Load force at 200 bar:	14 kN
Clamping force at 200 bar:	7 kN

Possible machining force at 200 bar:

Admissible load force:	14 kN
– Clamping force:	–7 kN
= Possible machining force: (including reserve)	7 kN

Concentric Positioning and Clamping Elements

with variable range of clamping, hydraulically operated double acting, max. operating pressure 500 bar



Figures

① Double clamping element for concentric interior clamping

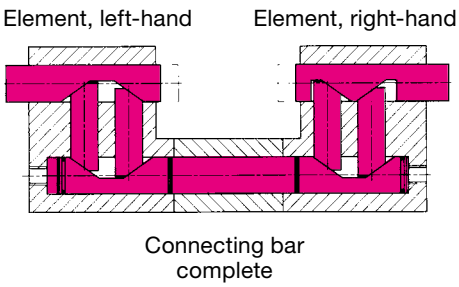
② Double clamping element with prolonged connecting bar for exterior clamping

③ By means of the double clamping elements modular fixtures can be composed which position and clamp concentrically in several dimensions, e.g. in direction of the x- and y-axis.

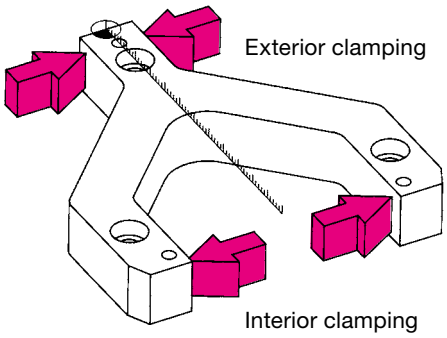
Description

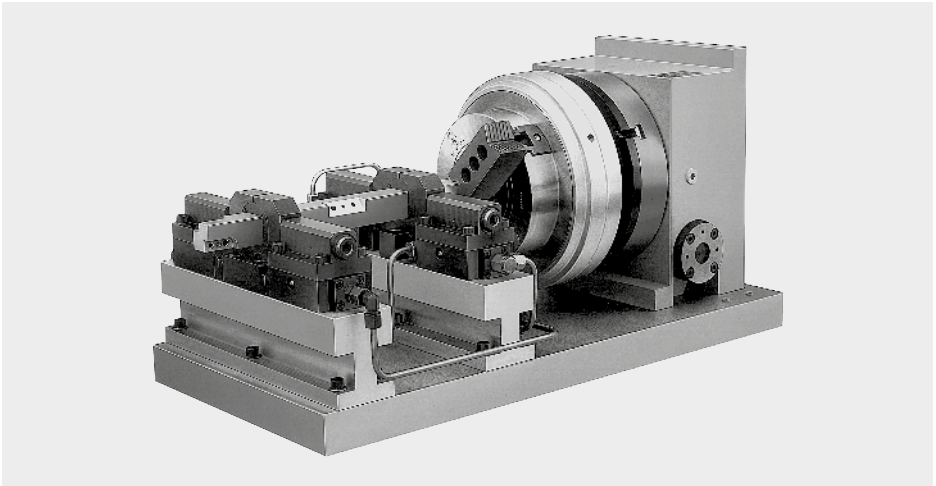
Concentric positioning and clamping with two or three-jaw chucks on stationary fixtures is nothing new. In many applications, however, it is not possible to place the relatively large chuck bodies on the fixture. Often the smaller clamping strokes are an additional obstacle.
In our development, the individual parts can be connected to a two or multiple-element version. In the multiple-jaw version, each pair of jaws clamps independently of the remaining ones, thereby concentric clamping is obtained.
The opening can be determined by means of a connecting bar. The clamping strokes of the several sizes are designed such that manual or automatic loading and unloading can be effected to clamp blanks with large tolerances. Also single-acting elements are available on request.

Active principle



Clamping possibilities

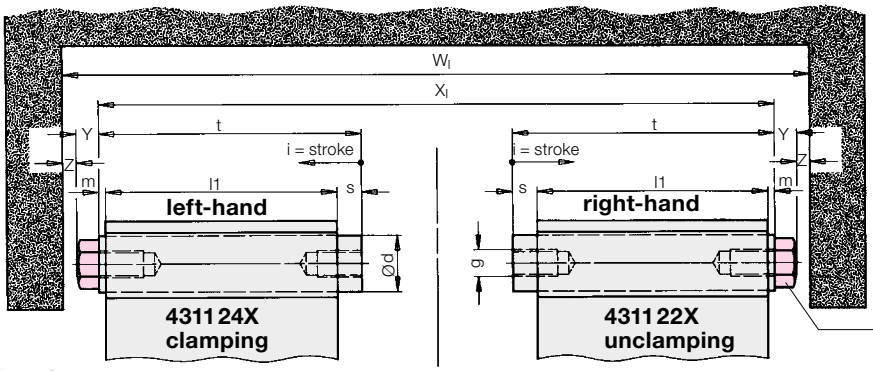




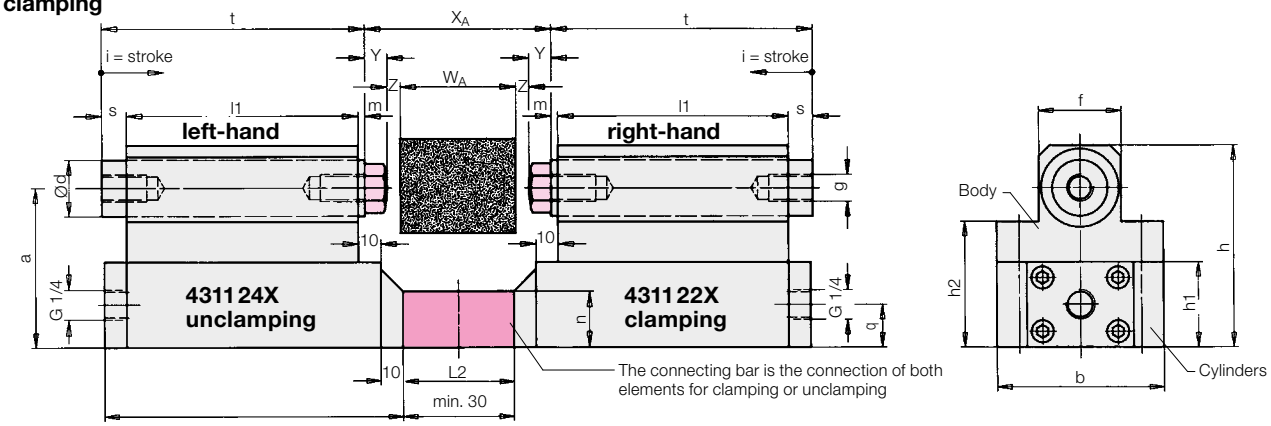
Application example

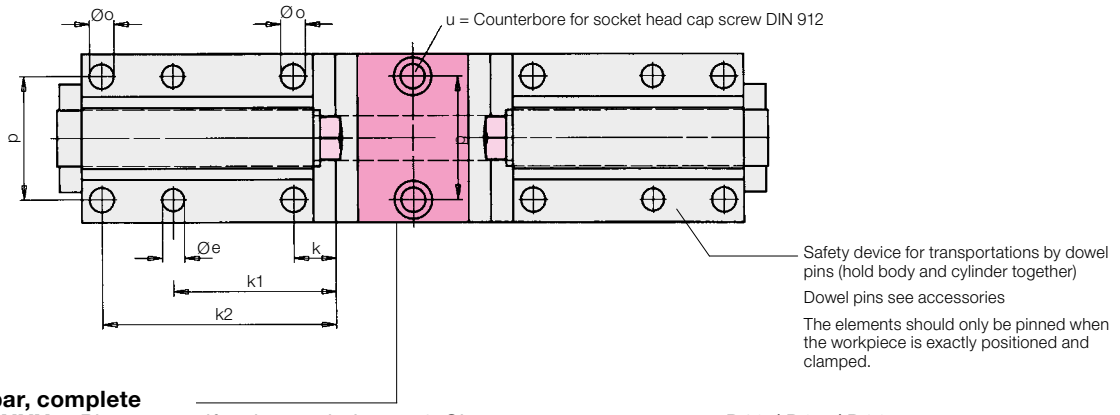
The flexible clamping unit is used to clamp bars which can be machined in every position, e.g. drilled, milled, threaded, etc.
In conjunction with a pneumatic two-jaw chuck the rotary indexing table is used to determine the machining position of the workpiece.
The two-jaw chuck and the right-hand concentric clamping element keep the bars in the exact working position.
The floating clamping element in the centre supports the bar. For this purpose it must work in a floating way, that means without centring function, what can be obtained by omitting the connecting bar.
(Available on request)

– Interior clamping



– Exterior clamping





Connecting bar, complete
Part no. 0432XXX Please specify when ordering: 1. Size D16 / D25 / D32
2. Length of connecting bar L2 / L3 / L4 = ___ mm

After ordering a connecting bar, you will receive an installation drawing that shows the position of the fixing screws.

Calculation of the length of connecting bar L

Size	2 elements	3 elements + crossing for 3 elements	4 elements + crossing for 4 elements
D 16	$L2 = X2_{I/A} - X2\,min_{I/A} + 30$	$L3 = \frac{X3_{I/A} - X3\,min_{I/A}}{2} + 24.2$	$L4_{a/b} = \frac{X4_{I/A\,(a/b)} - X4\,min_{I/A}}{2} + 20$
D 25	$L2 = X2_{I/A} - X2\,min_{I/A} + 30$	$L3 = \frac{X3_{I/A} - X3\,min_{I/A}}{2} + 26$	$L4_{a/b} = \frac{X4_{I/A\,(a/b)} - X4\,min_{I/A}}{2} + 20$
D 32	$L2 = X2_{I/A} - X2\,min_{I/A} + 30$	$L3 = \frac{X3_{I/A} - X3\,min_{I/A}}{2} + 26$	$L4_{a/b} = \frac{X4_{I/A\,(a/b)} - X4\,min_{I/A}}{2} + 25$

Dimension X... for

Interior clamping	$X2_I = W_I - 2Y - 2Z$	$X3_I = W_I - 2Y - 2Z$	$X4_{I\,(a/b)} = W_{I\,(a/b)} - 2Y - 2Z$
Exterior clamping	$X2_A = W_A + 2Y + 2Z$	$X3_A = W_A + 2Y + 2Z$	$X4_{A\,(a/b)} = W_{A\,(a/b)} + 2Y + 2Z$

W_I, $W_{I\,(a/b)}$ = workpiece inside dimension
W_A, $W_{A\,(a/b)}$ = workpiece outside dimension
(a/b) = only applies to crossing for 4 elements
For rectangular section (a x b) two different lengths of connecting bars L_a and L_b are required

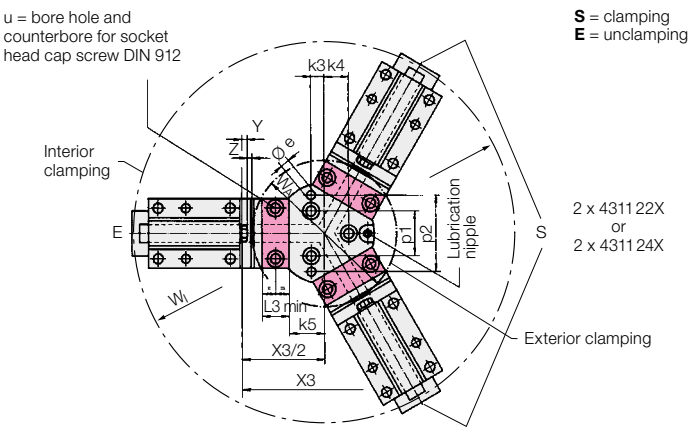
$X2\,min_I$, $X3\,min_I$, $X4\,min_I$ = minimum dimension interior clamping (chart)
$X2\,min_A$, $X3\,min_A$, $X4\,min_A$ = minimum dimension exterior clamping (chart) (bolt retracted without contact bolt)

Y = height contact bolt

Z = ideal stroke per clamping bolt up to the workpiece (< clamping stroke)

Size		**D 16**	**D 25**	**D 32**
Clamping force per pair of elements	[kN]	5	12	20
at max. operating pressure	[bar]	500	500	500
A centre height	[mm]	52	71	87
			Larger centre height on request	
b	[mm]	62	75	86
Piston/bolt Ø d	[mm]	16	25	32
E Ø pin hole	[mm]	8 H7	10 H7	12 H7
f	[mm]	28	37	45
g	[mm]	M 8 x 18	M 12 x 30	M 16 x 22
h	[mm]	66	90	111
h1	[mm]	27	38	47
h2	[mm]	41	56	72
i clamping stroke	[mm]	6	8	8
k	[mm]	18.5	19	22.5
k1 ±0.05	[mm]	58.5	73	81.5
k2	[mm]	83.5	105	117.5
k3	[mm]	12	15	18
k4	[mm]	22	30	35
k5	[mm]	32	40	50
l	[mm]	117	134	152
l1	[mm]	82	104	120
m	[mm]	2	3	3
n	[mm]	20	25	30
o Ø	[mm]	9	11	13
p ±0.02 (only Ø e)	[mm]	45	55	65
p1	[mm]	40	52	60
p2	[mm]	68	86	100
q	[mm]	14	19	24
s	[mm]	8	11	11
t	[mm]	92	118	134
u (counterbore for)	[mm]	M 8	M 10	M 12
$X2_{min.I}$ / $X2_{min.A}$	[mm]	238/66	284/64	316/64
$X3_{min.I}$ / $X3_{min.A}$	[mm]	320.4/148.4	386/166	438/186
$X4_{min.I}$ / $X4_{min.A}$	[mm]	310/138	369/149	422/170
$L2_{min.}$	[mm]	30	30	30
$L3_{min.}$	[mm]	24.2	26	26
$L4_{min.}$	[mm]	20	20	25
Weight	[kg]	2.2	4.5	9
Element, right-hand	**Part no.**	**4311 221**	**4311 222**	**4311 223**
Element, left-hand	**Part no.**	**4311 241**	**4311 242**	**4311 243**
Crossing for 3 elements	**Part no.**	**0432 300**	**0432 301**	**0432 302**
Crossing for 4 elements	**Part no.**	**0432 400**	**0432 401**	**0432 402**
Accessories				
Contact bolt (y = 10 mm)	**Part no.**	**3614 001**	**3614 028**	**3614 003**
Dowel pin DIN 6325	**Part no.**	**3300 313**	**3300 489**	**3300 617**

Crossing for 3 elements

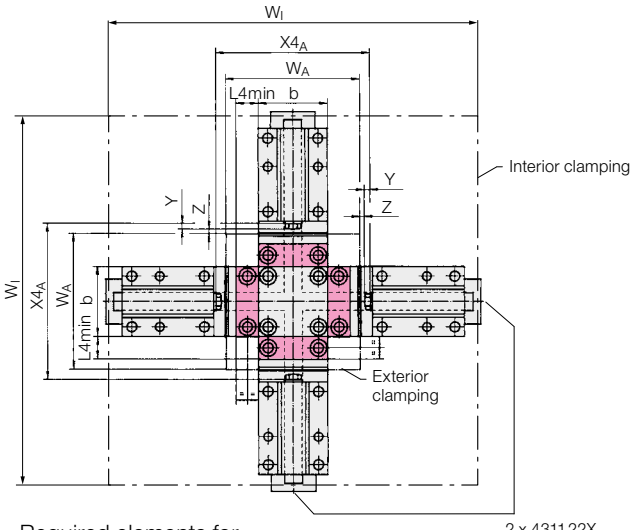


Required elements for

Exterior clamping		**Interior clamping**	
2 elements	**4311 22X**	1 element	**4311 22X**
1 element	**4311 24X**	2 elements	**4311 24X**
1 crossing for 3 elements	**0432 30X**	1 crossing for 3 elements	**0432 30X**
3 connecting bars L3	**0432 XXX**	3 connecting bars L3	**0432 XXX**

The 3 connecting bars must have the same length.

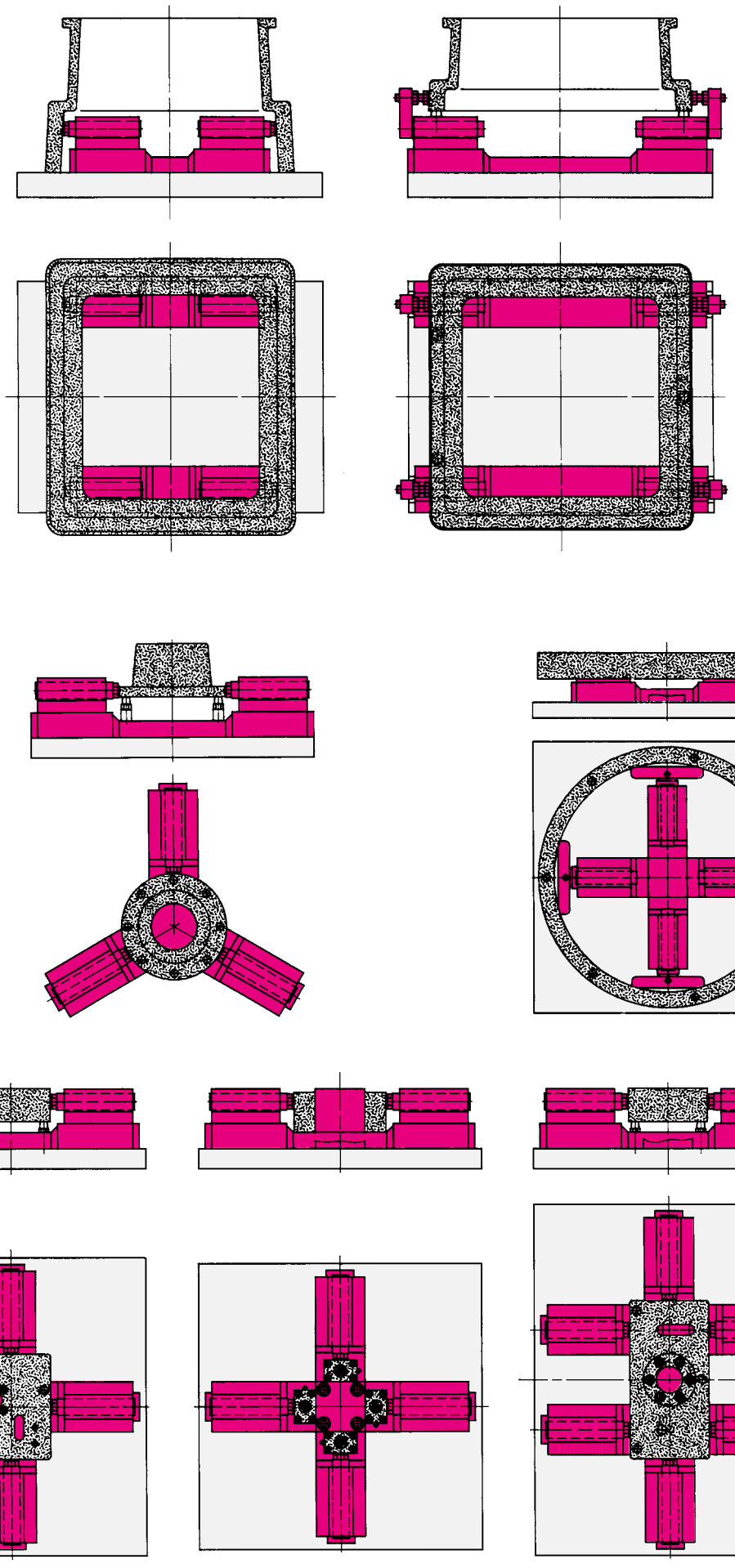
Crossing for 4 elements



Required elements for

Exterior or interior clamping	
2 elements	**4311 22X**
2 element	**4311 24X**
1 crossing for 4 elements	**0432 40X**
4 connecting bar L4(a/b)	**0432 XXX**

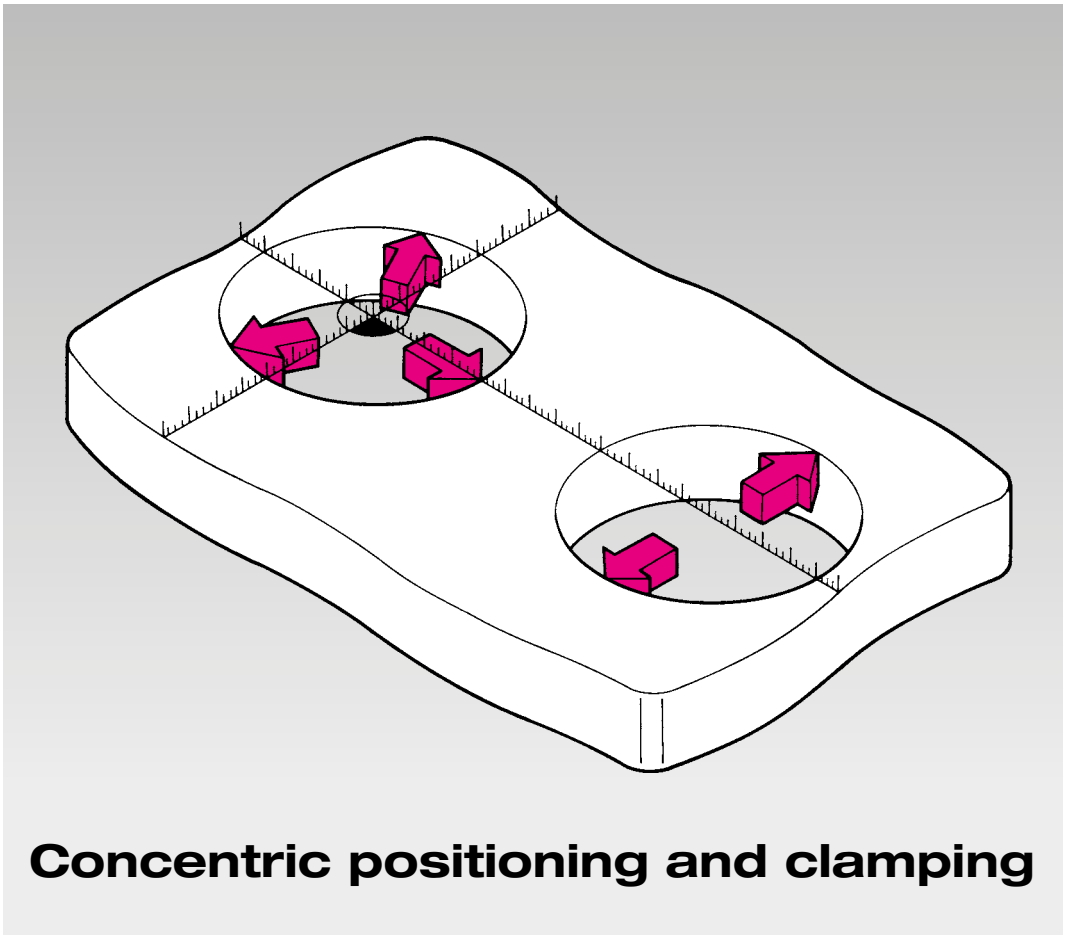
For a rectangular section, always 2 connecting bars have the same length.



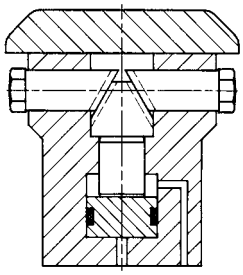
Concentric Positioning and Clamping Elements

2 and 3-point positioning, double acting, hydraulically operated
max. operating pressure 250 bar

Diameters from 25 mm to 177 mm

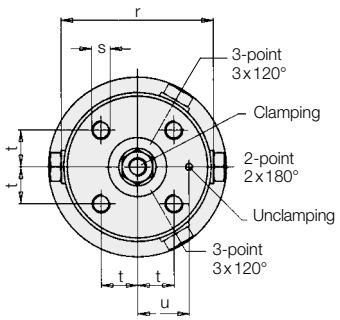


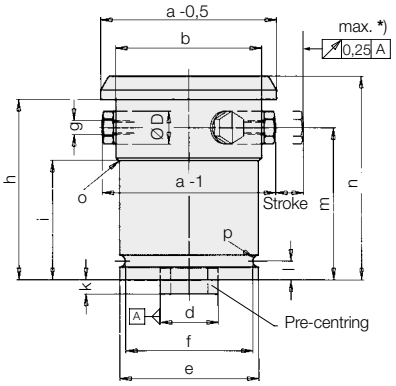
Concentric positioning and clamping



Version 431200X, -02X, -05X, -07X

Version 43121XX, -2XX, -3XX, -4XX





Clamping Ø a	Part no. 2-point elements	Part no. 3-point elements
25 – 29	**4312000**	**4312025**
28 – 32	**001**	**026**
32 – 36	**002**	**027**
36 – 40	**4312050**	**4312075**
39 – 43	**051**	**076**
42 – 46	**052**	**077**
45 – 49	**053**	**078**
48 – 52	**054**	**079**
51 – 55	**055**	**080**
54 – 59	**4312100**	**4312150**
58 – 63	**101**	**151**
62 – 67	**102**	**152**
67 – 72	**103**	**153**
71 – 76	**104**	**154**
76 – 84	**4312200**	**4312250**
83 – 91	**201**	**251**
90 – 98	**202**	**252**
98 – 109	**4312300**	**4312350**
109 – 120	**301**	**351**
119 – 130	**302**	**352**
130 – 145	**4312400**	**4312450**
141 – 156	**401**	**451**
152 – 167	**402**	**452**
163 – 177	**403**	**453**

Description

Workpieces with cast or machined bores, reliefs or break-outs, can be easily loaded to the fixture with the concentric positioning and clamping elements and concentrically clamped or positioned for machining. Overtolerance conditions can be avoided and clamping tasks can be completely solved by an ingenious combination of 2 and 3-point elements. Various mounting and connecting possibilities extend the use for multiple applications. Different sizes and correspondingly adapted contact bolts allow exact adaptation to the required clamping diameter.

Important notes

The pre-centring with the supplied bushing (Ød) allows a positioning precision of max. 0.125 mm. The values for positioning and repetitive accuracy specified in the chart can only be obtained by determining the virtual NOMINAL position (zero point). Both options are also shown visually on page 4. The prerequisites and the influence of the workpiece weight on the positioning accuracy are also described.
These concentric clamping elements are not only suitable for the use on lathes.

Elements for clamping diameters bigger than Ø 177 mm are available on request.

		431200X 431202X	431205X 431207X	43121XX	43122XX	43123XX	43124XX
Clamping range Ø	[mm]	25–36	36–55	54–76	76–98	98–130	130–177
Clamping force at 100 bar	[kN]	4	4	3	7	11	17
at 250 bar	[kN]	10	10	7	17	28	44
Adm. positioning force at a minimum pressure of 100 bar (see page 4)	[kN]	1.6	1.6	1.1	2.7	4.5	7.0
Positioning accuracy*	[mm]	0.02	0.02	0.02	0.025	0.025	0.03
Repetitive accuracy *	[mm]	0.04	0.04	0.04	0.05	0.05	0.06
Minimum operating pressure	[bar]	20	20	20	20	20	20
Max. operating pressure	[bar]	250	250	250	250	250	250
Oil volume / mm advance stroke	[cm^3]	0.35	0.35	0.35	0.85	1.39	2.17
/ mm return stroke	[cm^3]	0.15	0.15	0.15	0.50	0.84	1.33
Tightening torque - contact bolt	[Nm]	–	15	10	10	15	20
Bolt Ø D	[mm]	14	14	12	14	18	22
Stroke	[mm]	2.5	2.5	3	4.5	6	8
Ø b	[mm]	24	35	45	65	85	115
Ø d j6	[mm]	16	16	16	25	32	40
Ø e –0.1	[mm]	45	45	45	60	74	90
Ø f –0.1	[mm]	40	40	40	54	67	81
g x depth of thread	[mm]	–	M 8 x 6	M 6 x 8	M 6 x 12	M 8 x 16	M 10 x 20
h	[mm]	64	64	57	68	80	91
i	[mm]	28	28	–	41	47	52
k	[mm]	6	6	6	6	6	7
l	[mm]	8	8	8	9	10	12
m	[mm]	51	51	45	56	64	72
n	[mm]	66.5	72	65	77	91	105
o	[mm]	R 6	R 6	–	R 0,5	R 2,5	R 2,5
p	[mm]	2.6	2.6	2.6	3.1	3.6	4.6
r	[mm]	–	29	45	65	85	115
s x depth of thread	[mm]	M 6 x 12	M 6 x 12	M 6 x 12	M 8 x 16	M 10 x 20	M 12 x 24
t	[mm]	11.3	11.3	11.3	15.6	19.1	23.3
u	[mm]	16.8	16.8	16.8	22	27	33
Weight	[kg]	0.5	0.7	1.1	1.8	3.6	7.2

***** see “Important notes” and the explanation on page 4

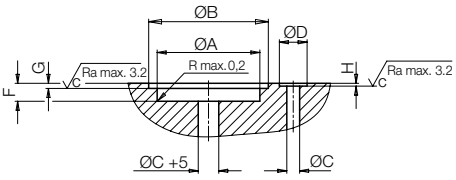
Order information

The elements except (4312 000/-025) are supplied with short, dome-head and hardened contact bolts as standard.
Please indicate on your order the corresponding workpiece diameter as well as the tolerances.

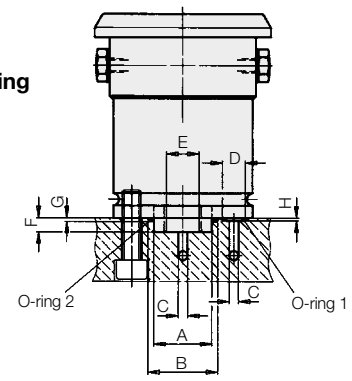
Clamping examples

see page 4.

Centring and sealing for direct mounting, mounting by segments and mounting by ball nut

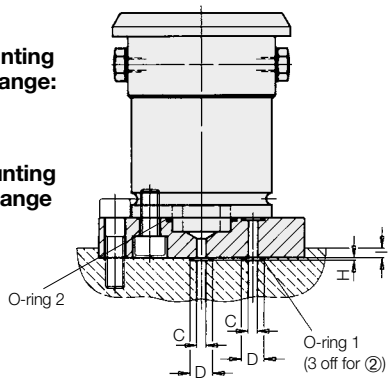


① **Direct mounting**

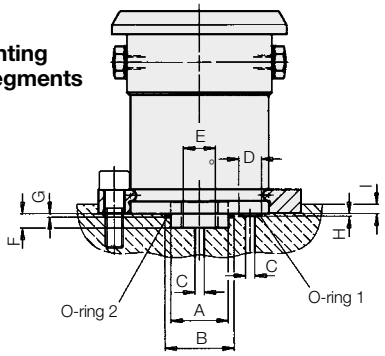


② **Mounting by flange:**

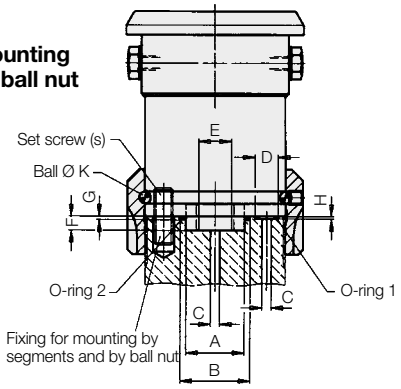
③ **Mounting by flange G ¼**



④ **Mounting by segments**

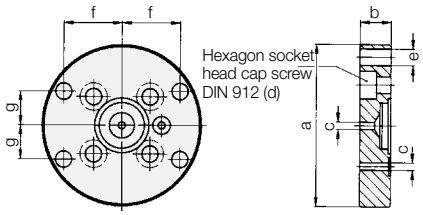


⑤ **Mounting by ball nut**



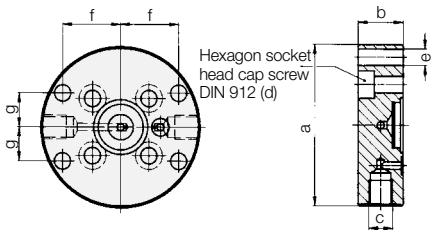
O-rings for mounting variants ① ② ③ ④ ⑤ (not included in the delivery)

for elements	A H7	B +0,2	C	D +0,2	E	F −0,1	G ±0,05	H ±0,05	K	I	O-ring 1	**Part no.**	O-ring 2	**Part no.**
43120XX	16	20.6	3	7.8	8	6	1.3	1.1	5	4	5 x 1.5	**3000340**	17.17 x 1.78	**3000663**
43121XX	16	20.6	3	7.8	8	6	1.3	1.1	5	4	5 x 1.5	**3000340**	17.17 x 1.78	**3000663**
43122XX	25	30.0	4	9.8	14	6	1.5	1.1	6	4	7 x 1.5	**3000342**	26.00 x 2.00	**3000769**
43123XX	32	36.6	5	10.8	16	6	1.3	1.1	7	4	8 x 1.5	**3000343**	33.05 x 1.78	**3001238**
43124XX	40	46.6	5	10.8	18	7	2.0	1.1	9	4	8 x 1.5	**3000343**	40.95 x 2.62	**3000944**



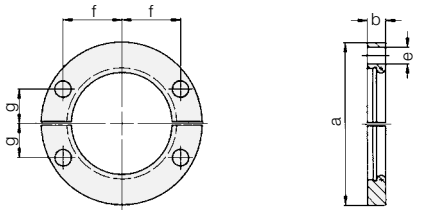
Mounting by flange ②

for elements	a h7	b	c	d	e	f	g	**Part no.**
43120XX	68	15	3	M 6 x 16	Ø 6.6	24.2	14.0	**3456033**
43121XX	68	15	3	M 6 x 16	Ø 6.6	24.2	14.0	**3456033**
43122XX	88	17	4	M 8 x 20	Ø 9.0	32.0	18.5	**3456035**
43123XX	110	20	5	M 10 x 25	Ø 11.0	39.8	23.0	**3456037**
43124XX	130	22	5	M 12 x 25	Ø 13.5	47.6	27.5	**3456038**



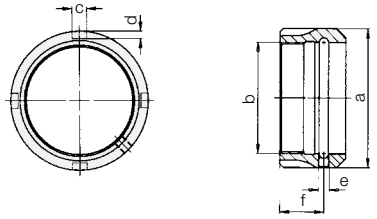
Mounting by flange G ¼ ③

for elements	a h7	b	c	d	e	f	g	**Part no.**
43120XX	68	30	G ¼	M 6 x 35	Ø 6.6	24.2	14.0	**3456042**
43121XX	68	30	G ¼	M 6 x 35	Ø 6.6	24.2	14.0	**3456042**
43122XX	88	30	G ¼	M 8 x 35	Ø 9.0	32.0	18.5	**3456043**
43123XX	110	30	G ¼	M 10 x 35	Ø 11.0	39.8	23.0	**3456044**
43124XX	130	30	G ¼	M 12 x 35	Ø 13.5	47.6	27.5	**3456045**



Mounting by segments ④

for elements	a	b	e	f	g	**Part no.**
43120XX	68	10.1	Ø 6.6	24.2	14.0	**3533240**
43121XX	68	10.1	Ø 6.6	24.2	14.0	**3533240**
43122XX	88	11.6	Ø 9.0	32.0	18.5	**3533241**
43123XX	110	13.1	Ø 11.0	39.8	23.0	**3533242**
43124XX	130	16.1	Ø 13.5	47.6	27.5	**3533243**



Mounting by ball nut (with balls and set screws) ⑤

for elements	a	b	c	d	e	f	**Part no.**
43120XX	63	M 48 x 1.5	8	3.5	M 6	22	**0352762**
43121XX	63	M 48 x 1.5	8	3.5	M 6	22	**0352762**
43122XX	78	M 60 x 1.5	8	3.5	M 8	25	**0352763**
43123XX	94	M 75 x 2.0	10	4.0	M 10	27	**0352765**

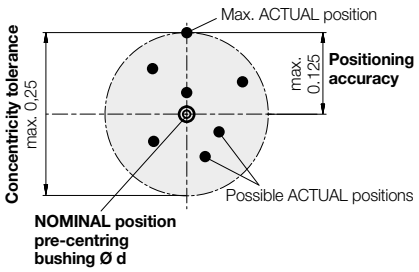
Positioning accuracy
Clamping examples

Definition

The **positioning accuracy** is the deviation of the ACTUAL position from the NOMINAL position.
The **repetitive accuracy** indicates the range of the reached position when a NOMINAL position is repeatedly approached from the same starting position.

1. Pre-centring with bushing Ø d

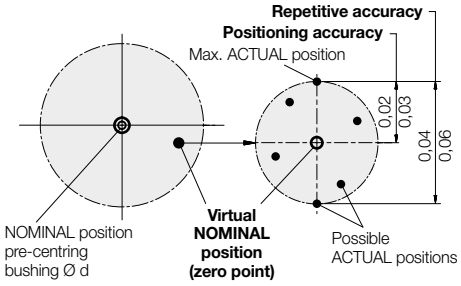
Due to component tolerances, the contact bolts have a concentricity tolerance of max. 0.25 mm (see dimensional drawing on page 2). If a workpiece is centred and clamped, the positioning accuracy is 0.125 mm (see sketch) in the worst case.



If further workpieces are inserted and clamped in the same way, the position accuracy will reach approximately the same value again.

2. Determine the virtual NOMINAL position

2.1 Centre and clamp a workpiece (sample part). This must be done in the same way as later in production.
2.2 Use the measuring probe to scan the clamped hole and determine the virtual zero point (hole centre).
2.3 Program the machine control accordingly.
The advantage of this method is that a high positioning accuracy (0.02 - 0.03 mm) and repetitive accuracy (0.04 - 0.06 mm) can be expected (see chart on page 2).



3. Requirements

To ensure that all other similar workpieces in a series have the same virtual zero point, the following criteria must be met:

- The workpieces must always be moved from the same starting position and in the same way into the clamping position.
- The centring bore should be absolutely cylindrical.
- The centring bore should not have a concentricity error to the NOMINAL position.

4. Influence of the workpiece weight

High workpiece weights reduce the positioning accuracy and increase the wear of the centring bolts since

- in the case of vertical installation, the centring element has to apply the friction force that can be up to 25% of the workpiece weight.
- in the case of horizontal installation, the centring element must lift the workpiece a little.

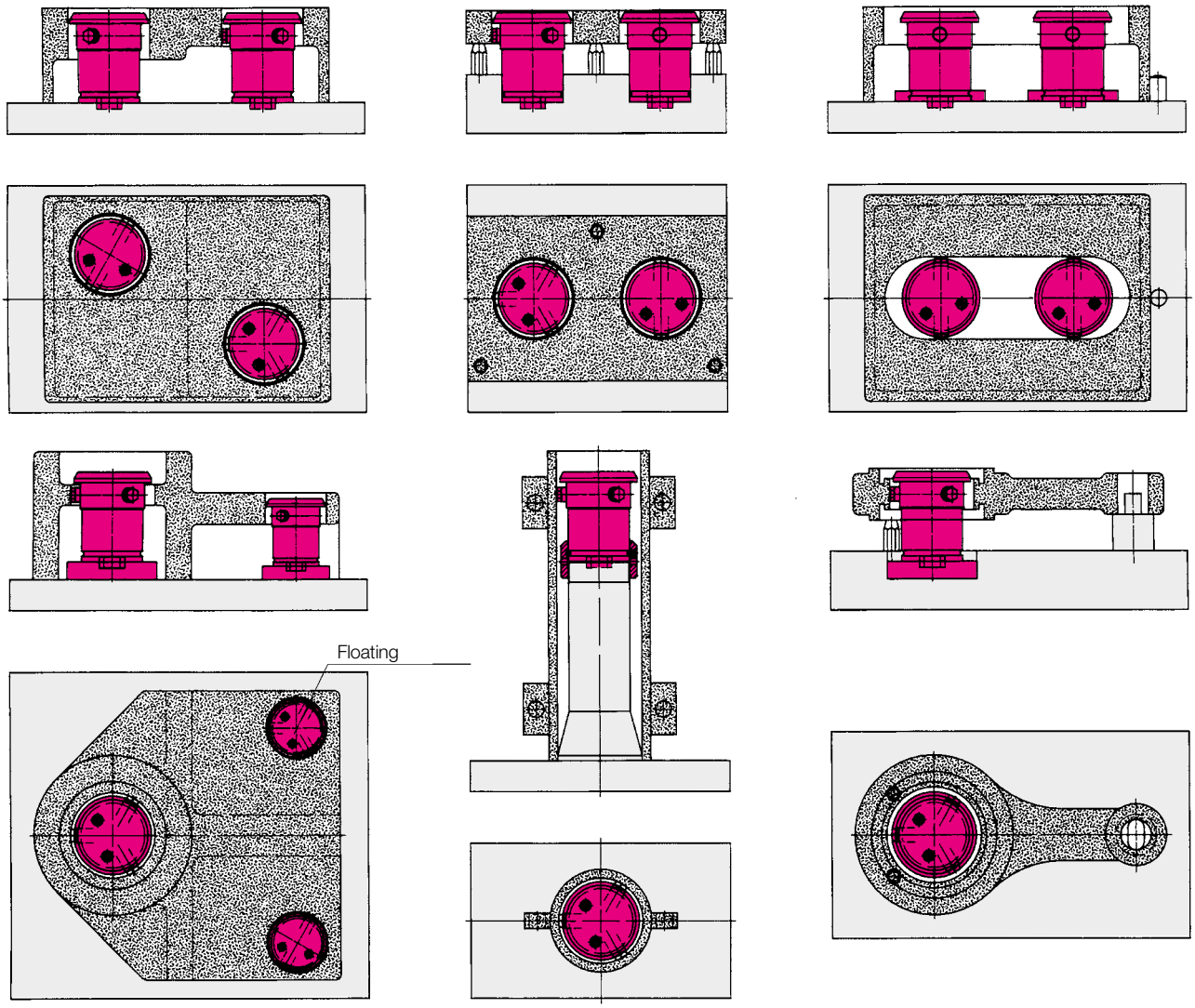
5. Admissible positioning force

For the cases mentioned above, we have indicated an admissible positioning force in the chart on page 2. The corresponding workpiece weights are mechaincally tolerable.
To enable the position accuracy according to the chart page 2, it is necessary to

- determine the virtual NOMINAL position according to point 2
- meet the requirements according to point 3.

6. Clamping examples

A number of examples where the weight of the workpieces is negligible can be found on this page.



Concentric Clamping Elements

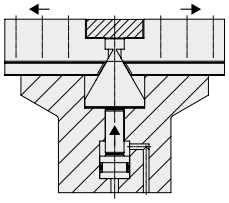
2 and 3-point interior clamping, for interchangeable clamping jaws Ø 16 – 121 mm, double acting, max. operating pressure 250 bar

Application

This hydraulically-operated concentric clamping element can be equipped with especially low clamping jaws to receive workpieces with interior centrings of low depth.
Suitable workpieces can directly rest on the clamping jaws so that additional support points are not required.
With a combination of 2 and 3-point elements, workpieces with 2 centring holes can be exactly positioned.

Description

The 2 or 3 base jaws are coupled to a cone-shaped contact bolt in the centre of the housing, that is driven by a double acting hydraulic piston.



To obtain the required synchronization accuracy all parts are manufactured with high precision.
The nitrated base jaws have 3 fixing threads. Depending on the desired centring diameter, the accordingly adjusted clamping jaws can always by fixed with at least 2 screws.
The exact position of the clamping jaws is secured with 2 drill bushings.

Important notes

The concentric clamping elements are not only suitable for the use on turning machines.
If a workpiece is clamped by one concentric clamping element only, a tilting torque is produced by radial machining forces. Please pay attention to the chapter "Admissible machining forces" on page 2.
In the effective area of the clamping jaws there is the danger of crushing. The manufacturer of the fixture or the machine is obliged to provide effective protection devices.

Advantages

- Ideal for 5-sided machining
- Suitable for low centring depths
- Clamping jaws can be adapted to the workpiece
- Workpiece support on clamping jaws possible
- Centring repeatability 0.02 mm
- Stroke of clamping jaws 10 mm
- Connection for positive air pressure protection
- Pneumatic stroke end control
- Optional pneumatic contact control

Positive air pressure connection

The standard positive air pressure protection keeps the hole centre free of swarf, so that the base jaws can freely return.

Pneumatic stroke end control

The positive air pressure protection can also be used for the control of the unclamping position. The returning clamping jaws close in their end position the bore hole of the positive air pressure connection.

Optional contact control

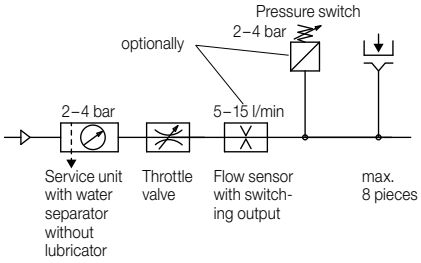
In the version with contact control, pneumatic pressure is supplied to one of the base jaws, which is then transmitted into the clamping jaw. In the crowned clamping surface there is a small bore hole. If a workpiece is clamped correctly, it closes the bore hole.

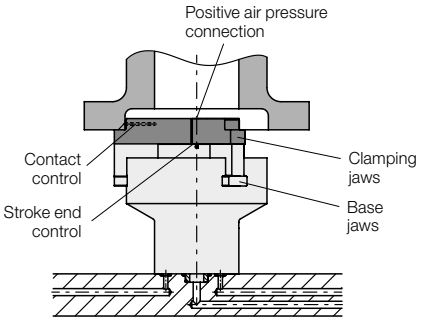
Signal conversion: Pneumatic - electric

An electro-pneumatic measuring device can either signal the pressure increase or a drop of the air flow rate.

1. Pressure switch
   The pressure switch signals the pressure increase when closing a blow hole. It is important that the pressure difference between open and closed blow hole is big enough to get a process-safe message.
2. Flow meter
   The flow meter signals the drop of the air flow rate when closing a blow hole.

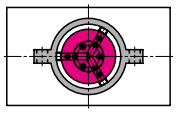
The flow meter should have a digital display and one adjustable limit switch (e.g. type SFAB of FESTO).
The switching threshold is set to a mean value between open and closed nozzle.
We recommend flow measurement, if only one pneumatic line is available for several elements.



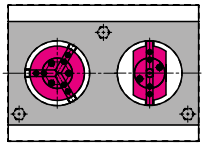


Applications

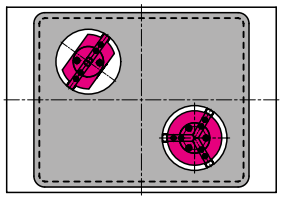
- Centre and clamp in 1 bore hole



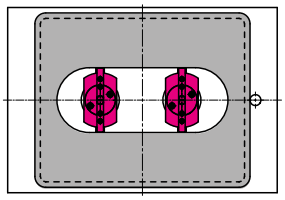
- Centre and clamp in 2 bore holes



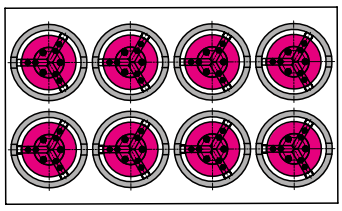
- Diagonally centre and clamp in 2 bore holes



- Centre and clamp in longitudinal holes



- Multiple clamping fixture



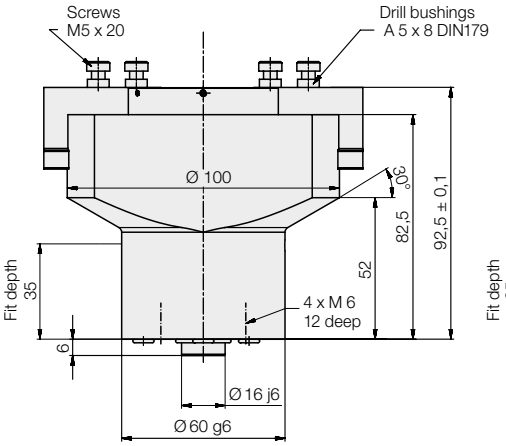
Technical data and dimensions
Admissible machining forces

Technical data

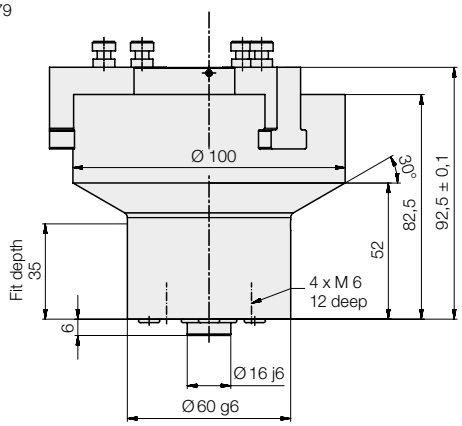
Max. clamping force in total approx.	[kN]	**5**
Max. clamping force per jaw approx.		
2-point / 3-point	[kN]	2.5 / 1.67
Max. operating pressure	[bar]	250
Min. operating pressure	[bar]	20
Stroke of clamping jaws	[mm]	10
Centring repeatability	[mm]	0.02
Oil volume/clamping stroke	[cm³]	3.5
Oil volume/return stroke	[cm³]	1.6
Weight		
2-point / 3-point approx.	[kg]	2.54 / 2.60
Part no. 2-point		**4312620P**
Part no. 3-point		**4312630P**

P = Pneumatic contact control (optional)

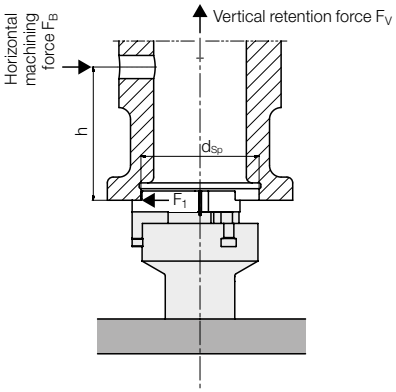
2-point
4312620P



3-point
4312630P



Admissible machining forces



Vertical retention force

The concentric clamping element generates only horizontal clamping forces. Vertical (uplift) retention forces can only be transmitted non-positively by friction.
The largest vertical retention force is

$$F_V = \mu * F_{Sp} \quad [kN]$$

with μ ~ 0.2: $F_V \sim 0.2 * F_{Sp}$ [kN]

Admissible horizontal machining force

Depending on the height of attack of the machining force over the support surface, a tilting torque is generated and thus also a vertical uplift force, which has to be compensated non-positively by friction between the clamping jaw and the workpiece. In the most unfavourable angle position, the admissible machining force is

$$F_{Badm} \leq \frac{F_1 * 0.75\, d_{Sp} * \mu}{h} \leq F_1 \quad [kN]$$

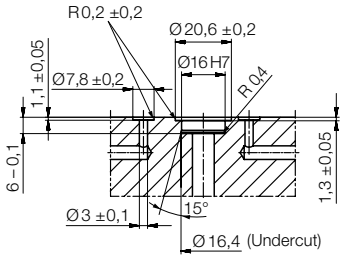
with $F_1 = 20 * p$ and μ ~ 0,2 results:

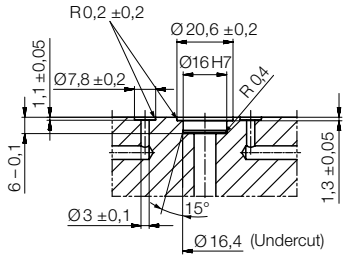
$$F_{Badm} \leq \frac{3 * p * d_{Sp}}{h} \leq F_1 \quad [kN]$$

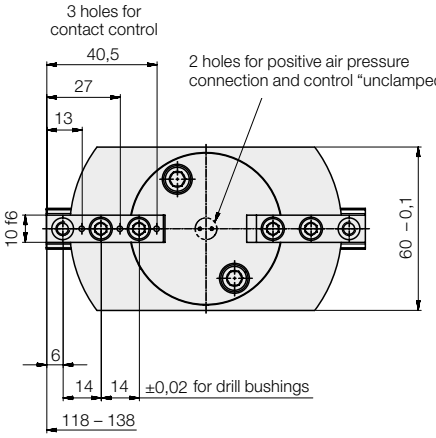
μ =	Coefficient of friction between the clamping jaw and the workpiece	[-]
p =	Operating pressure	[bar]
F_{Sp} =	Total clamping force	[kN]
F_1 =	Clamping force per jaw	[kN]
d_{Sp} =	Clamping diameter	[mm]
h =	Height of the machining force above the support surface	[mm]

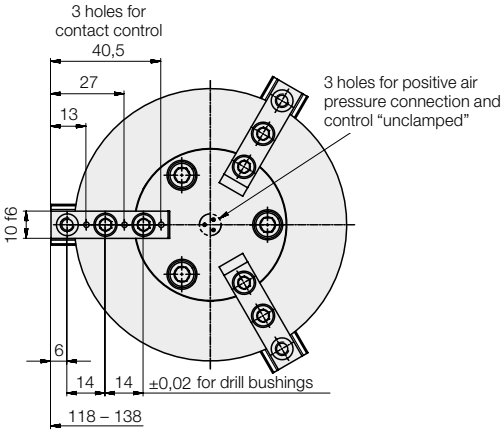
If the machining forces are higher, the workpiece can be supported on the side. The concentric clamping element can also be used to only centre a workpiece and to clamp with additional elements on external fixed points.

Included in our delivery:
1 x O-ring 17.17 x 1..78 **(3000663)**
3 x O-ring 5 x 1.5 **(3000340)**

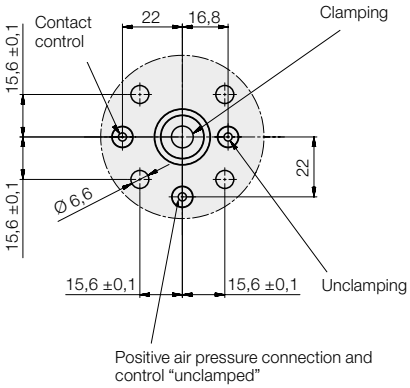


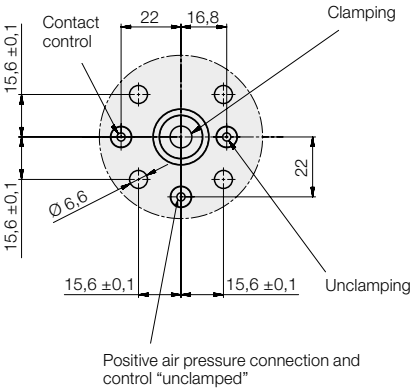






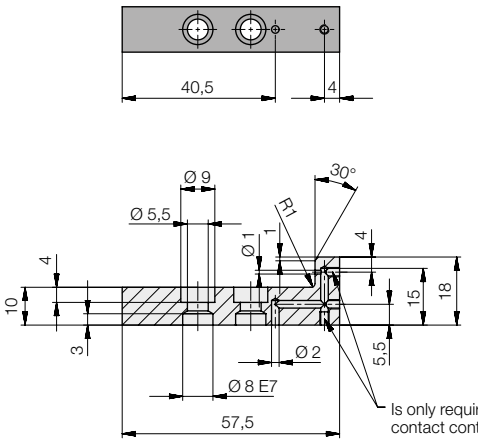
Connecting scheme



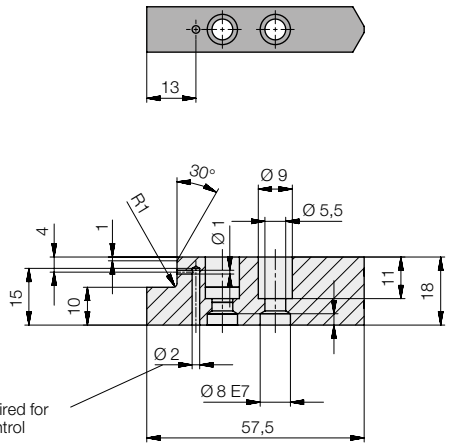


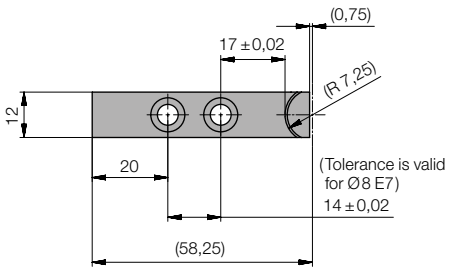
Clamping jaws for manufacturing dimensions

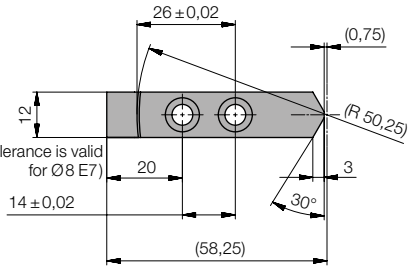
for clamping Ø 17 – 35 mm **(4312620P)**



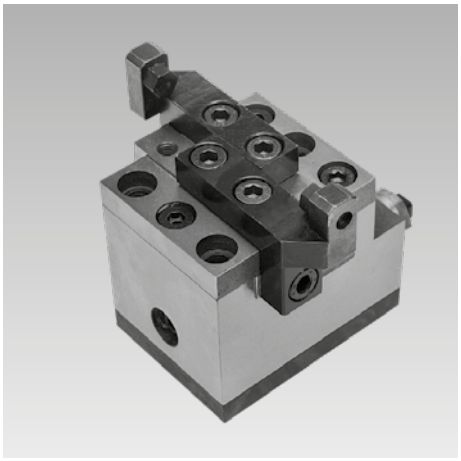
for clamping Ø 103 – 121 mm **(4312630P)**

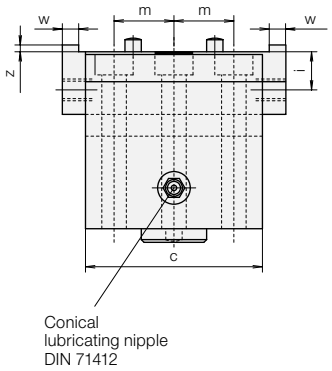


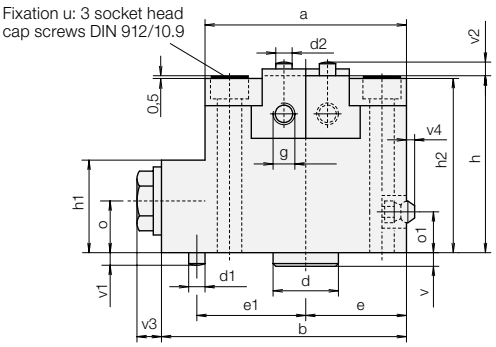


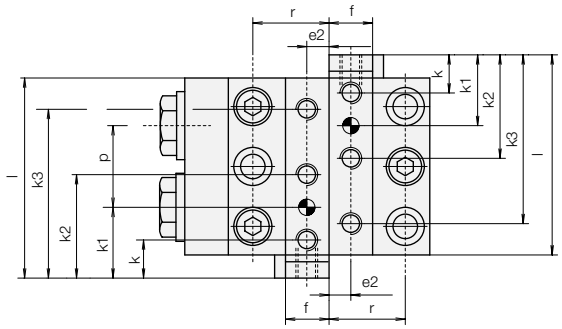


Parallel Slide Centering Element
double acting, max. operating pressure 500 bar









Position of clamping slides for interior and exterior clamping see page 2

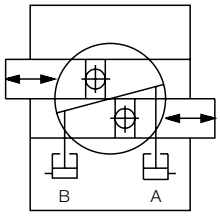
Application
This element is used in clamping systems in order to centre workpieces with small complicated contours and ribbing serving as a base for the definition of tolerances.

Description
By a clever arrangement of the centre of rotation to the hydraulic piston the retaining force of a clamping jaw is three times higher than the clamping force. If only one clamping jaw acts at the workpiece, the clamping force is twice as large. This happens as long as the workpiece is moved to the centre.

Advantage
- Thanks to the compact overall dimensions the element is suitable for installation in any hydraulic clamping system.

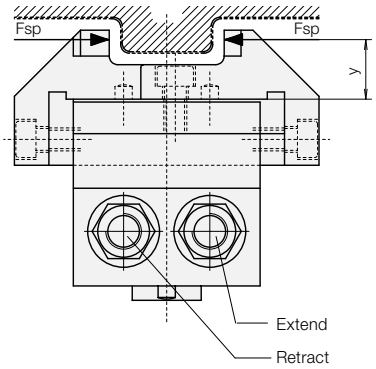
Clamping jaws
The clamping jaws, to be manufactured by the customer according to the special application, are precisely positioned at the clamping slide by means of a centre pin and a lateral key. The clamping jaws are fixed from above by means of 3 screws and from the side by 1 screw.
The above figure shows a parallel slide centring element with clamping jaws and contact bolts. The clamping process is effected from the inside to the outside (interior clamping).

Representation of principle
Double-acting parallel slide centering element

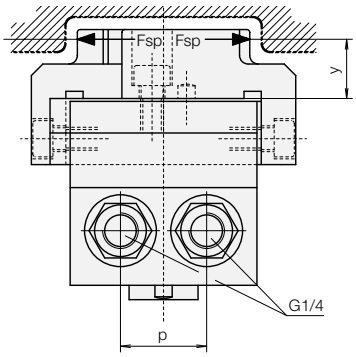


Centering repeatability ±0.02 mm				
Clamping force/jaw F_{Sp} at y	[kN]	2.8	5.0	8.8
Stroke/jaw	[mm]	6	7	8
Piston Ø	[mm]	12	16	20
a	[mm]	62	74	90
b	[mm]	82	90	105
c	[mm]	55	65	75
d h6	[mm]	22	24	26
d1 m6	[mm]	6	8	8
d2 m6	[mm]	6	6	8
e	[mm]	31	37	45
e1 ±0.02	[mm]	40	40	50
e2 ±0.1	[mm]	7	9	11
f	[mm]	13	16	20
g	[mm]	M 6 x 10	M 8 x 11	M 10 x 13
h	[mm]	56	65	76
h1	[mm]	31	34	42
h2	[mm]	55	64	75
i	[mm]	12	14	17
k	[mm]	12	14	17
k1 ±0.02	[mm]	22	26	31
k2	[mm]	32	38	45
k3	[mm]	52	62	73
l	[mm]	62.5	73.5	85
m	[mm]	20	22	27
o	[mm]	16	19	21
o1	[mm]	13	15	15
r	[mm]	23	28	34
u 3x	[mm]	M 6 x 60	M 8 x 70	M 10 x 80
v	[mm]	4	5	5
v1	[mm]	5	6	6
v2	[mm]	5	5	6
v3	[mm]	9	9	7
v4	[mm]	3	0	0
w j7	[mm]	5	6	8
z	[mm]	2.2	2.5	3
Weight	[kg]	1.7	2.7	4.4
Oil volume per mm clamping slide stroke	[cm³]	0.16	0.28	0.47
Part no.		**4316120**	**4316160**	**4316200**

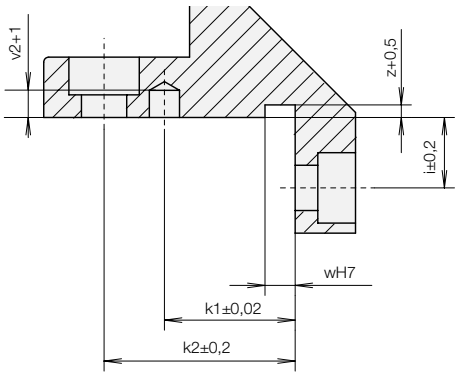
Exterior clamping

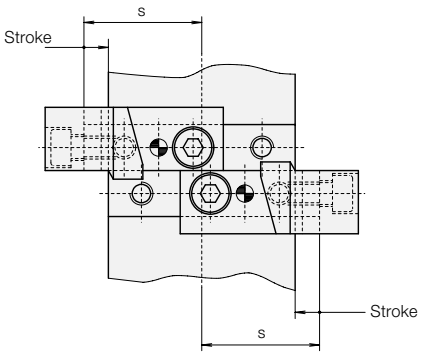


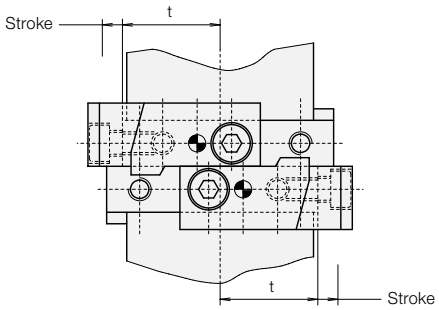
Interior clamping



Example of clamping jaw (to be manufactured by the customer)





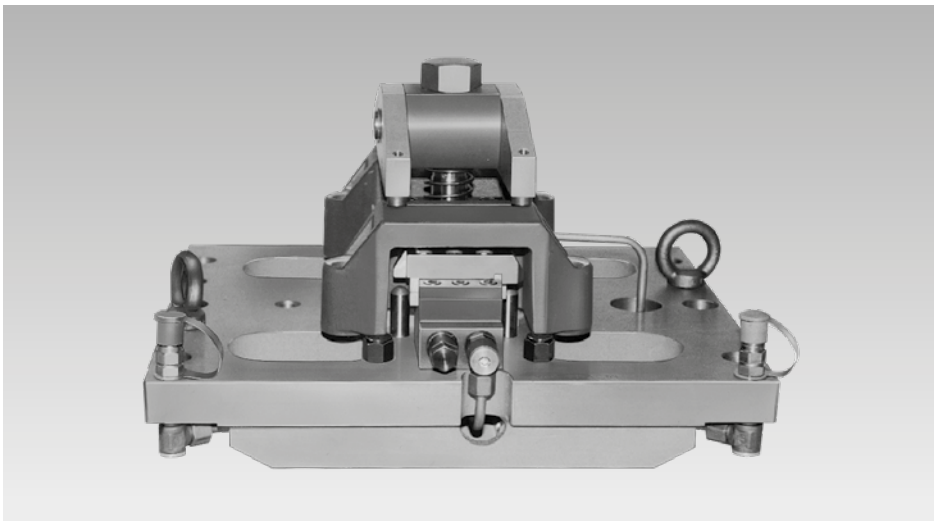


p	[mm]	26	30	37
s	[mm]	35	41	47.5
t	[mm]	29	34	39.5
y applic. of force	[mm]	20	24	28

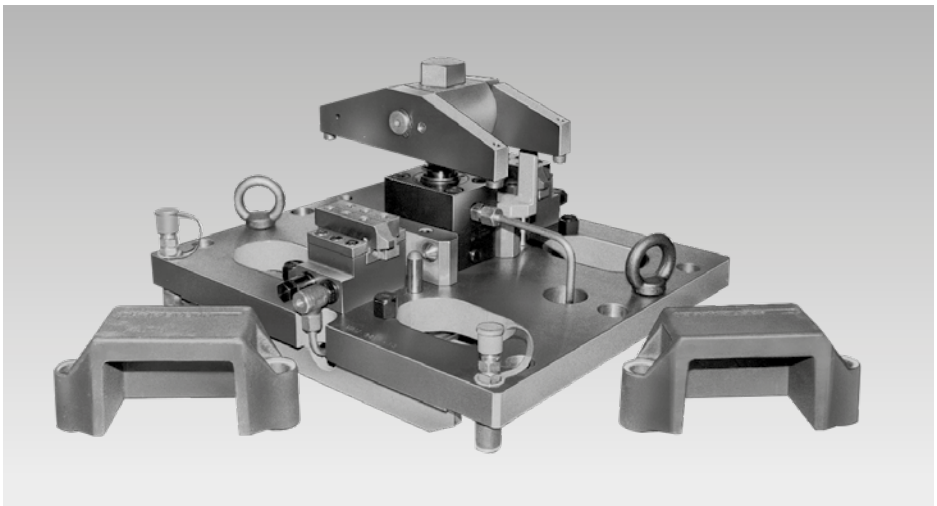
Hint

In case of 2 x y the clamping force will be reduced by 6 % (friction loss).

Application example



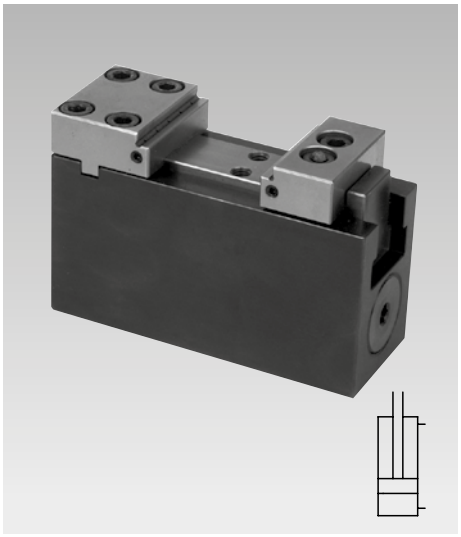
The opposite figure shows a hydraulically-operated fixture for concentric positioning and clamping of two casted housings, whose interior surfaces are due to functional reasons have to be concentrically arranged to the machined holes.
The machining of the interior surfaces could be avoided thanks to the use of concentric clamping elements.



The clamping fixture in plate constructions installed on a vertical machining centre with rotary indexing table and trunnion bearing.

Fixture Clamp with Fixed Jaw

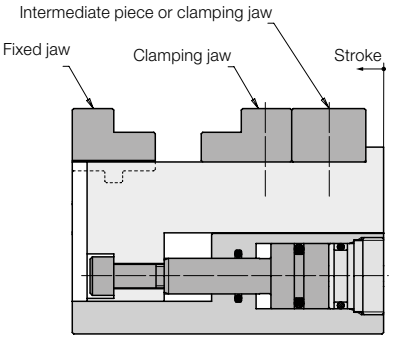
max. clamping force 9.5 kN, jaw width 40 mm, double acting, max. operating pressure 250 bar



Advantages

- Very compact design
- High rigidity and precision
- Strokes 5 and 30 mm
- Double-acting function
- Fixtures without tubes possible
- Exchangeable jaws
- Pneumatic contact or seat control in the fixed jaw possible
- Good swarf protection
- Port for central lubrication
- Mounting position: variable

Function



Application

The fixture clamps are used for machining of dimensionally stable workpieces in single or multiple clamping fixtures.
Due to their compact design they can be arranged in a very limited space.
Fixture clamps are especially suitable for series manufacturing in automated mode.
The double-acting cylinder function combined with central lubrication and good swarf protection guarantees a high process safety.

Description

The fixture clamp with fixed jaw consists of a very small basic body with integrated hydraulic cylinder which actuates the movable jaw.
All threads and ports are at the bottom to allow a space-saving arrangement of several clamping points in a very limited space.
If fixing from below is not possible an adaptor plate for manifold mounting or tube connection is available. As accessory also blanks of clamping jaws are available for adaptation to the workpiece contour.
The fixed jaw can be equipped with a pneumatic seat control.

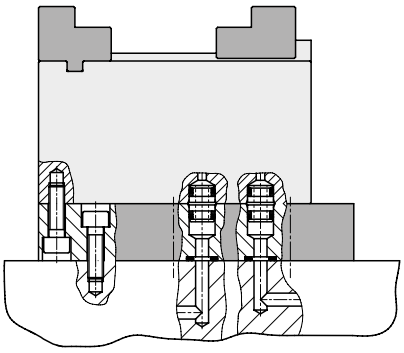
Important notes

The fixture clamp is only suitable for exterior clamping.
Lubricate at the latest after 500 clamping cylces the clamping slide via the central lubrication.
Never use the complete clamping stroke to guarantee safe clamping of the workpiece.
Max. operating temperature 80 °C.
Operating conditions and other data see data sheet A 0.100.

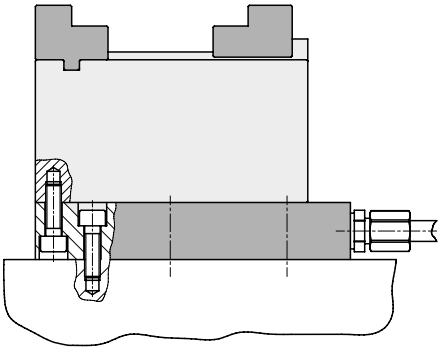
Fixing from above

with accessory adaptor plate

Drilled channels

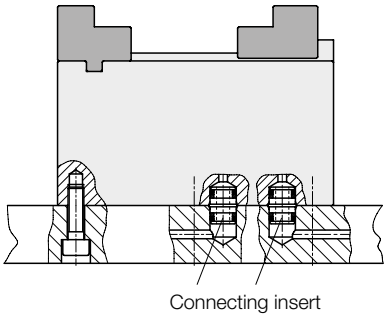


Fitting connection



Fixing from below

Drilled channels

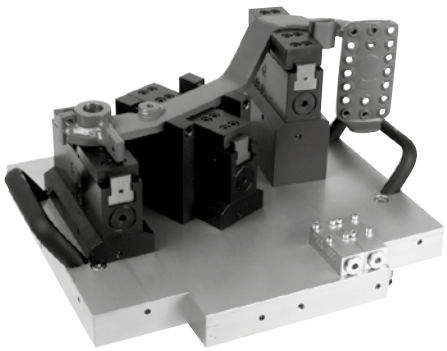


Accessories

Fixed jaw, clamping jaws and adaptor plate are not included in the delivery of the fixture clamp and have to be ordered separately as accessory.

Application example

Clamping fixture for a pedal of a freight vehicle.



Clamping stroke 5 mm: Part no. 4413001

Technical data

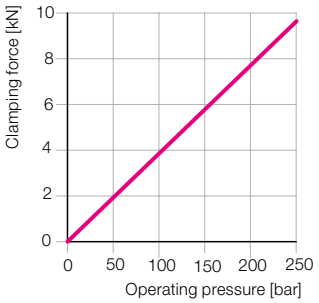
Clamping force max.	[kN]	9.5
Clamping stroke	[mm]	5
Jaw width	[mm]	40
Max. flow rate	[cm³/s]	25
Stroke volume Clamping	[cm³]	2.5
Unclamping	[cm³]	1.9
Weight approx.	[kg]	1.66

Adaptor plate (accessory)

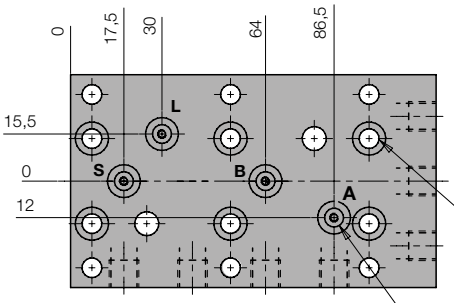
Weight approx.	[kg]	1.3
Part no.		**0441300**

Article available on request

Clamping force diagram
(Height of the clamping jaw 15 mm)

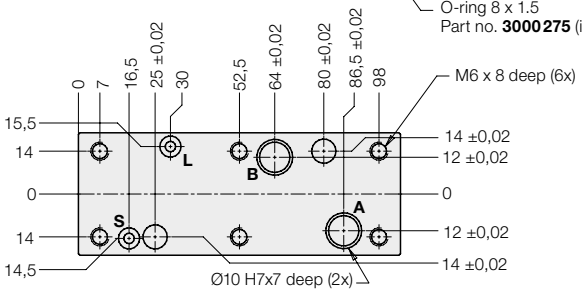


Accessory: adaptor plate
View from below



Socket head cap screw M6 x 20
Part no. **3300225**
(included in the delivery)

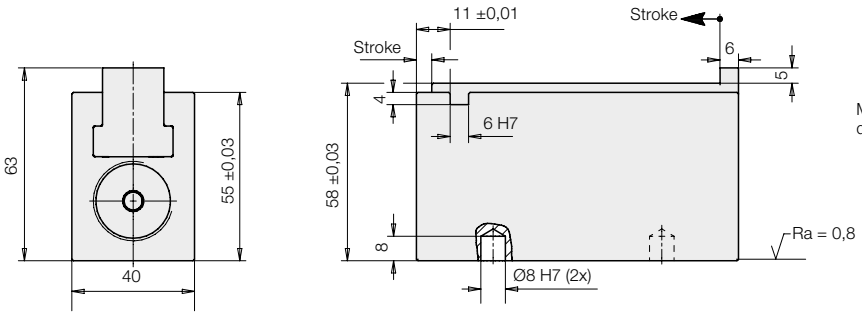
O-ring 8 x 1.5
Part no. **3000275** (included in the delivery)

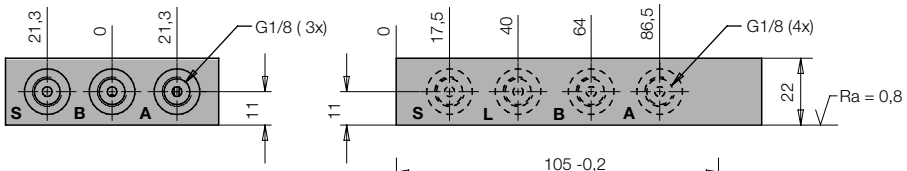


A = Clamping
B = Unclamping
S = Central lubrication
L = Air for seat control

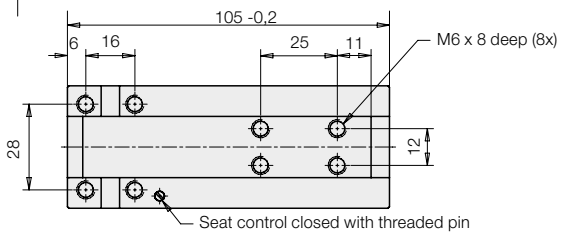
Clamping and unclamping
each Ø10 H7 x 7 deep for connecting insert **9210132** (included in the delivery), see also page F 9.300

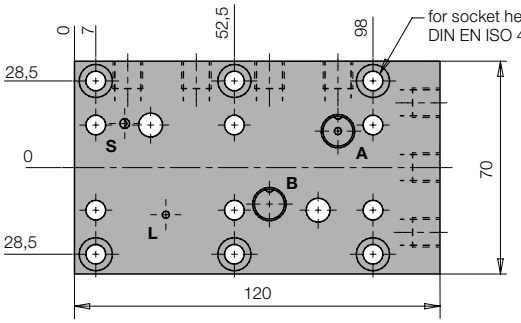
Seat control and central lubrication
with O-ring **3001842** (5x1 mm) (included in the delivery)





Accessory: adaptor plate
Side views





Accessory: adaptor plate
View from above

Clamping stroke 30 mm: Part no. 4413031

Technical data

Clamping force max.	[kN]	9.5
Clamping stroke	[mm]	30
Jaw width	[mm]	40
Max. flow rate	[cm³/s]	25
Stroke volume Clamping	[cm³]	15
Unclamping	[cm³]	12
Weight approx.	[kg]	2.24

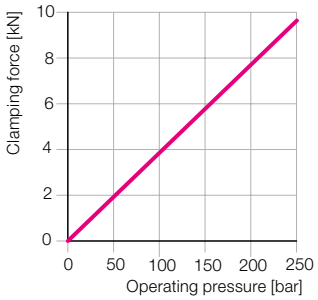
Adaptor plate (accessory)

Weight approx.	[kg]	1.8
Part no.		**0441303**

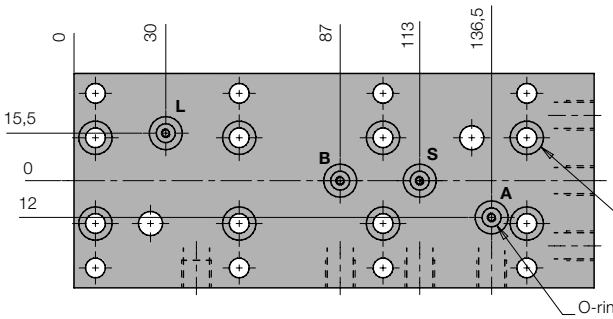
Article available on request

Clamping force diagram

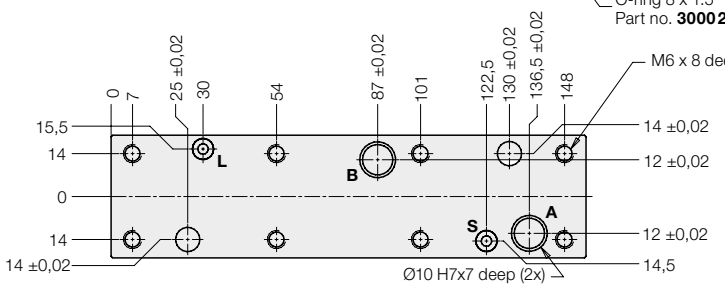
(Height of the clamping jaw 15 mm)



Accessory: adaptor plate
View from below

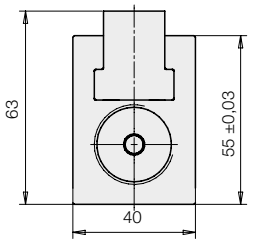


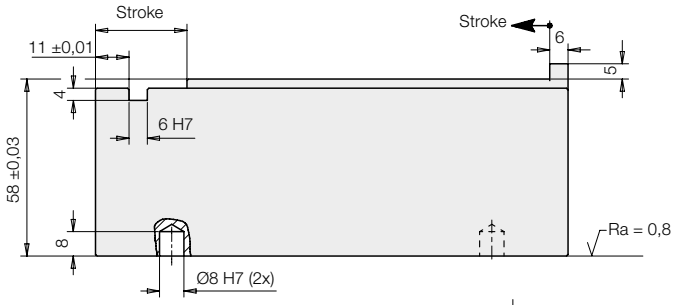
A = Clamping
B = Unclamping
S = Central lubrication
L = Air for seat control

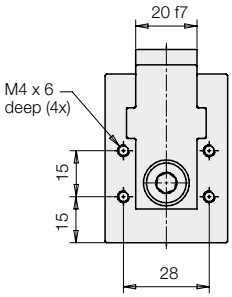


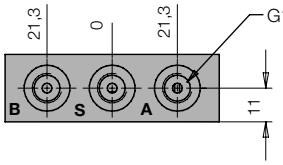
Clamping and unclamping
each Ø10 H7 x 7 deep for connecting insert **9210132** (included in the delivery), see also page F 9.300

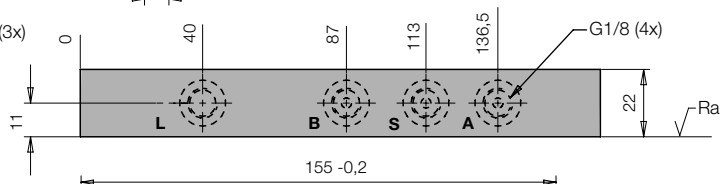
Seat control and central lubrication
with O-ring **3001842** (5x1 mm) (included in the delivery)



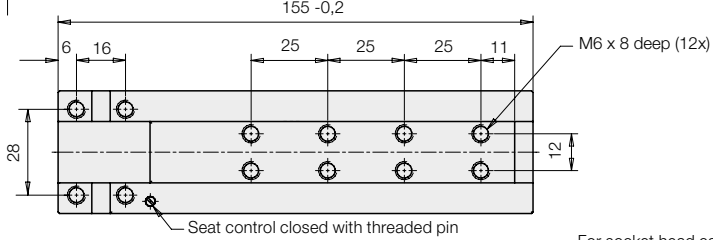


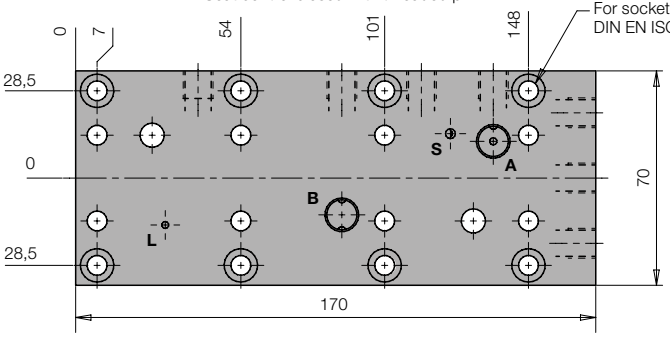






Accessory: adaptor plate
Side views



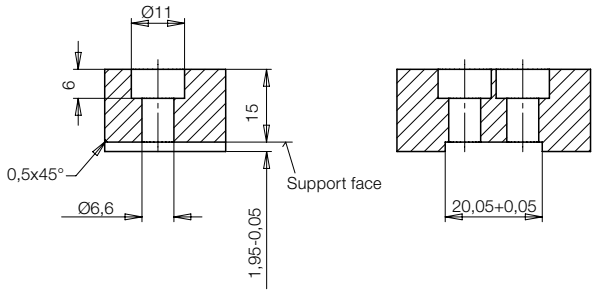


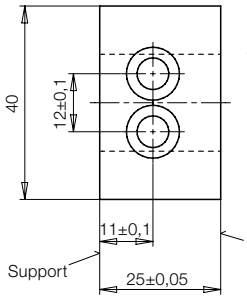
Accessory: adaptor plate
View from above

Accessory - clamping jaws

Versions	Clamping jaw blanks
Material	16 MnCr5 smooth

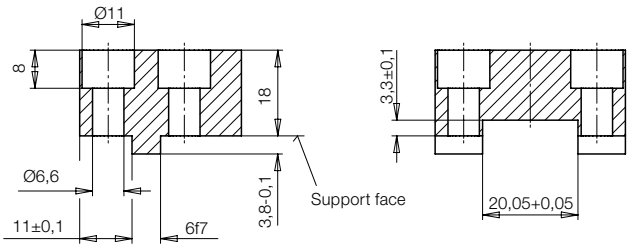
Clamping jaw: **Part no. 3548070**

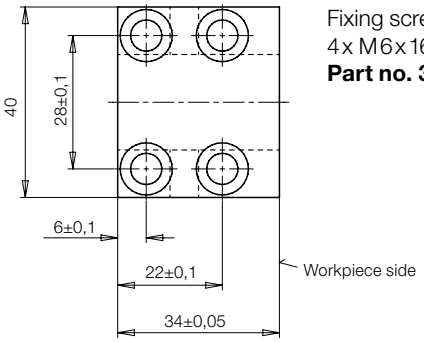




Fixing screws:
2 x M6 x 16 12.9
Part no. 3301 107

Fixed jaw: **Part no. 3548071**
Article available on request





Fixing screws:
4 x M6 x 16 12.9
Part no. 3301 107

Self-made clamping jaws

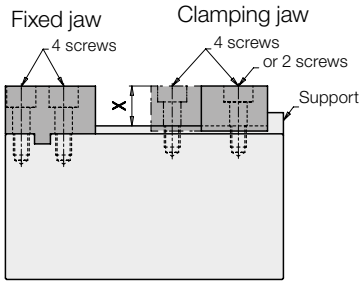
Clamping jaws and fixed jaws are manufactured according to the contour of the workpiece to be clamped.
The max. height of the clamping jaw X at 250 bar operating pressure is indicated in the below chart.
If the operating pressure is lower, the clamping jaws and the fix jaws can be designed higher as per the below diagram.

Important note
The clamping jaws must always be supported by the provided support, since the fixing screws are not in the position to compensate the generated clamping forces.

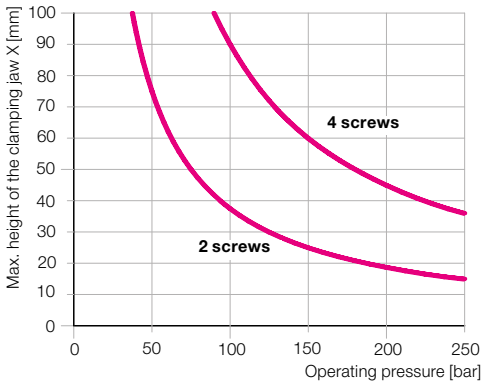
Max. height of the clamping jaws X at max. operating pressure of 250 bar

Fixing screws for clamping jaws	M6 x 16 – 12.9
X [mm] with 2 screws	15
X [mm] with 4 screws	36

Fixing of the clamping jaws

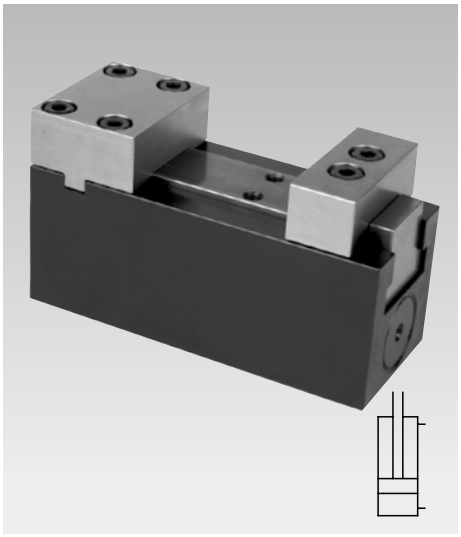


Max. height of the clamping jaw X as a function of the operating pressure



Fixture clamp with fixed jaw

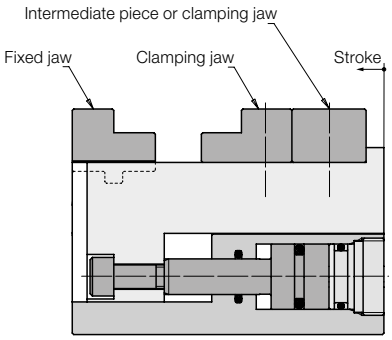
max. clamping force 15 kN, jaw width 65 mm, double acting, max. operating pressure 250 bar



Advantages

- Very compact design
- High rigidity and precision
- Strokes 5 and 45 mm
- Double-acting function
- Fixtures without tubes possible
- Exchangeable jaws
- Pneumatic contact or seat control in the fixed jaw possible
- Good swarf protection
- Port for central lubrication
- Mounting position: variable

Function



Application

The fixture clamps are used for machining of dimensionally stable workpieces in single or multiple clamping fixtures.
Due to their compact design they can be arranged in a very limited space.
Fixture clamps are especially suitable for series manufacturing in automated mode.
The double-acting cylinder function combined with central lubrication and good swarf protection guarantees a high process safety.

Description

The fixture clamp with fixed jaw consists of a very small basic body with integrated hydraulic cylinder which actuates the movable jaw.
All threads and ports are at the bottom to allow a space-saving arrangement of several clamping points in a very limited space.
If fixing from below is not possible an adaptor plate for manifold mounting or tube connection is available. As accessory also blanks of clamping jaws are available for adaptation to the workpiece contour.
The fixed jaw can be equipped with a pneumatic seat control.

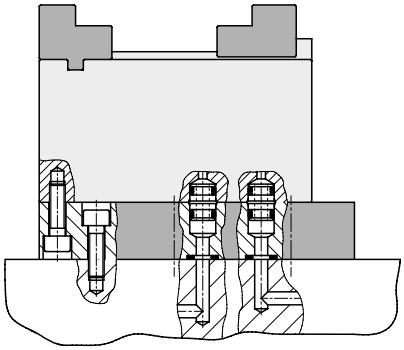
Important notes

The fixture clamp is only suitable for exterior clamping.
Lubricate at the latest after 500 clamping cycles the clamping slide via the central lubrication.
Never use the complete clamping stroke to guarantee safe clamping of the workpiece.
Max. operating temperature 80 °C.
Operating conditions and other data see data sheet A 0.100.

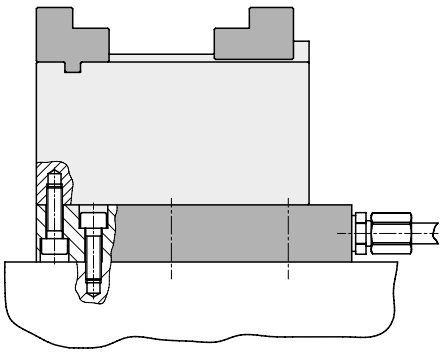
Fixing from above

with accessory adaptor plate

Drilled channels

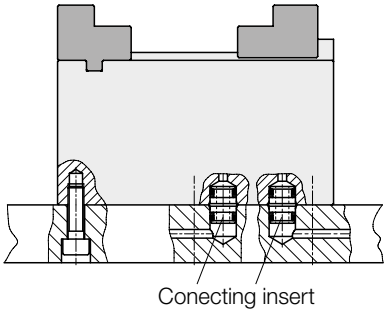


Fitting connection



Fixing from below

Drilled channels

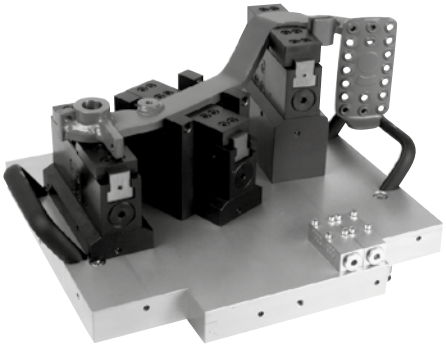


Accessories

Fixed jaw, clamping jaws and adaptor plate are not included in the delivery of the fixture clamp and have to be ordered separately as accessory.

Application example

Clamping fixture for a pedal of a freight vehicle.



Part no. 4413101

Technical data

Clamping force max.		[kN]	15
Clamping stroke		[mm]	5
Jaw width		[mm]	65
Max. flow rate		[cm³/s]	40
Stroke volume	Clamping	[cm³]	4
	Unclamping	[cm³]	3
Weight approx.		[kg]	5.05

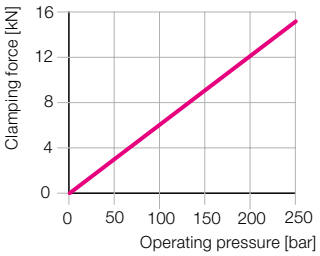
Adaptor plate (accessory)

Weight approx.	[kg]	3.1
Part no.		**0441310**

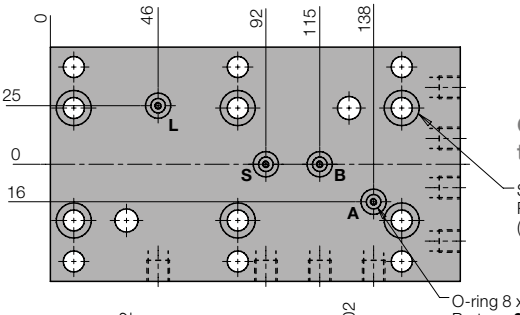
Article available on request

Clamping force diagram

(Height of the clamping jaw 25 mm)



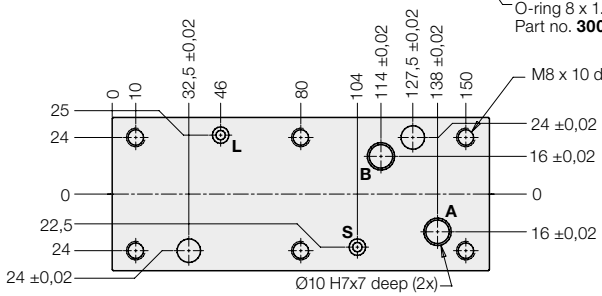
Accessory: adaptor plate
View from below



On request, we will check whether the article is still available.

Socket head cap screw M8 x 25
Part no. **3301583**
(included in the delivery)

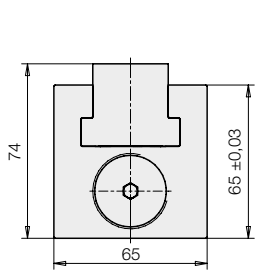
O-ring 8 x 1.5
Part no. **3000275** (included in the delivery)

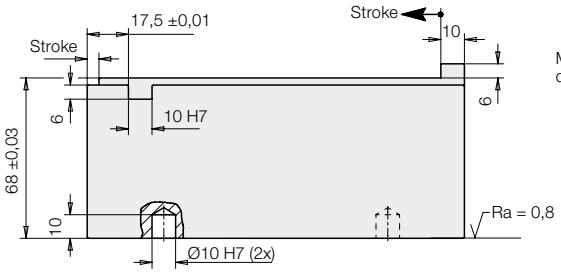


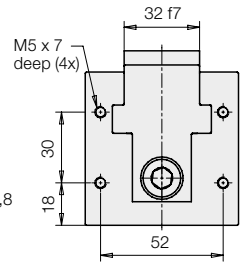
A = Clamping
B = Unclamping
S = Central lubrication
L = Air for seat control

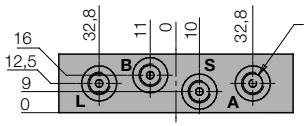
Clamping and unclamping
each Ø10 H7 x 7 deep for connecting insert **9210132** (included in the delivery), see also page F 9.300

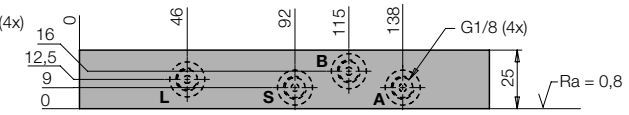
Seat control and central lubrication
with O-ring **3001842** (5x1 mm) (included in the delivery)



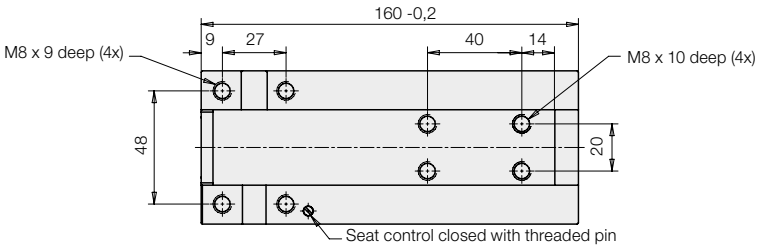


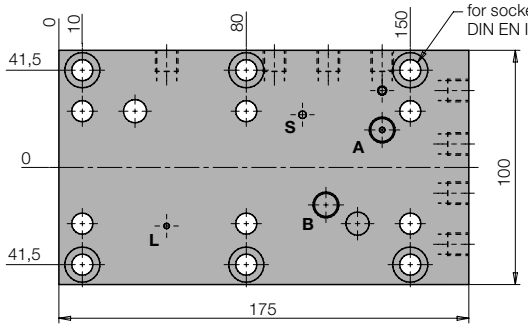






Accessory: adaptor plate
Side views





Accessory: adaptor plate
View from above

Part no. 4413131

Technical data

Clamping force max.		[kN]	15
Clamping stroke		[mm]	45
Jaw width		[mm]	65
Max. flow rate		[cm³/s]	40
Stroke volume	Clamping	[cm³]	36
	Unclamping	[cm³]	27
Weight approx.		[kg]	ca. 7.0

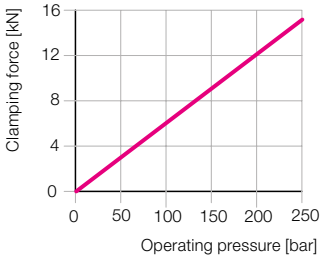
Adaptor plate (accessory)

Weight approx.	[kg]	3.8
Part no.		**0441313**

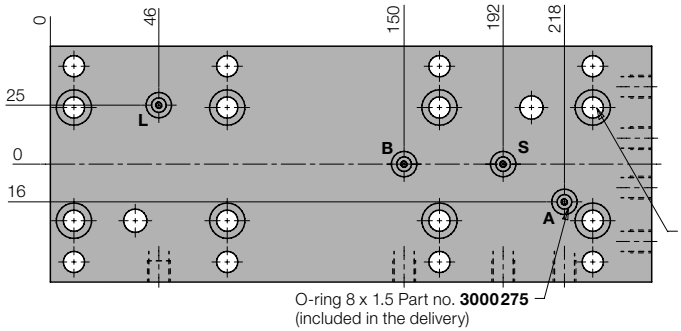
Article available on request

Clamping force diagram

(Height of the clamping jaw 25 mm)



Accessory: adaptor plate
View from below

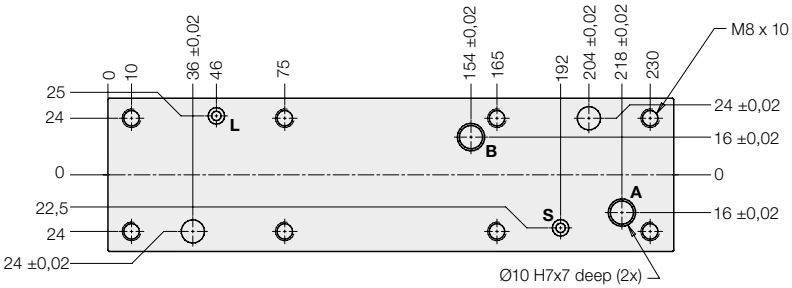


O-ring 8 x 1.5 Part no. **3000275**
(included in the delivery)

On request, we will check whether the article is still available.

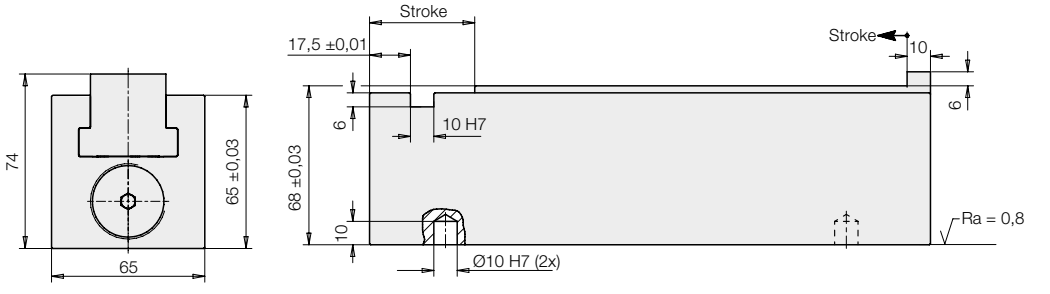
Socket head cap screw M8x25
Part no. 3301583
(included in the delivery)

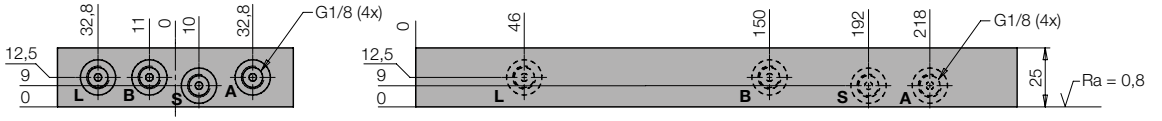
A = Clamping
B = Unclamping
S = Central lubrication
L = Air for seat control



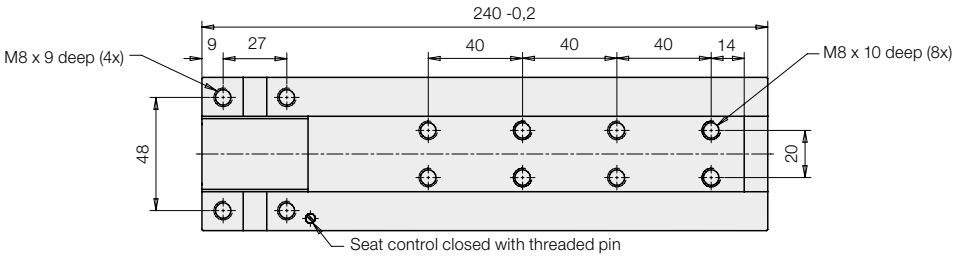
Clamping and unclamping
each Ø10 H7 x 7 deep for connecting insert **9210132**
(included in the delivery),
see also page F 9.300

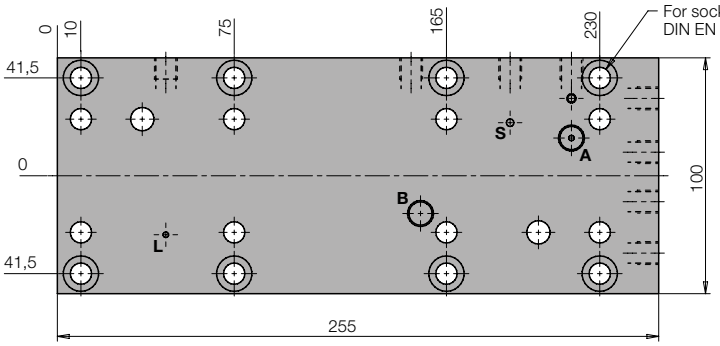
Seat control and central lubrication
with O-ring **3001842** (5 x 1 mm)
(included in the delivery)





Accessory: adaptor plate
Side views



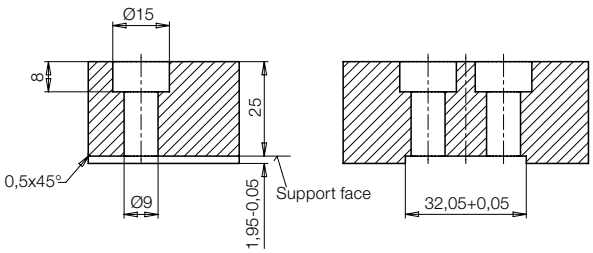


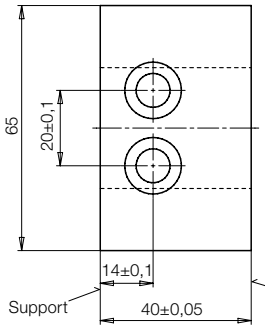
Accessory: adaptor plate
View from above

Accessory - clamping jaws

Versions	Clamping jaw blanks
Material	16 MnCr5 smooth

Clamping jaw: **Part no. 3548080**



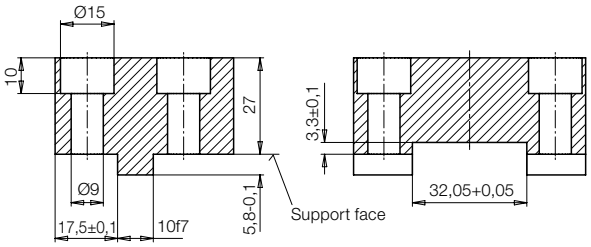


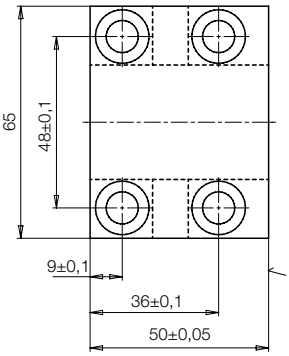
Fixing screws:
2x M8x25 12.9
Part no. 3300700

On request, we will check whether the article is still available.

On request, we will check whether the article is still available.

Fixed jaw: **Part no.** 3548081





Fixing screws
4x M8x25 12.9
Part no. 3300700

On request, we will check whether the article is still available.

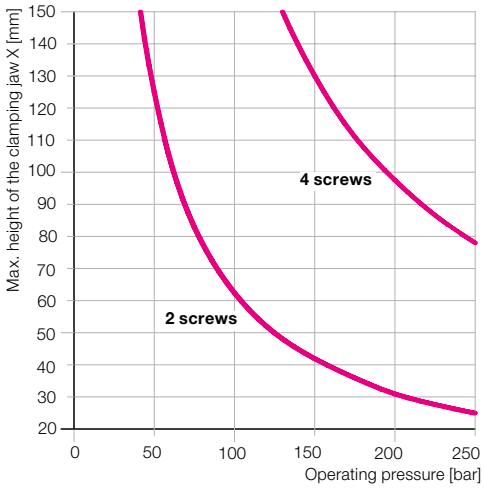
Self-made clamping jaws

Clamping jaws and fixed jaws are manufactured according to the contour of the workpiece to be clamped.
The max. height of the clamping jaw X at 250 bar operating pressure is indicated in the below chart.
If the operating pressure is lower, the clamping jaws and the fix jaws can be designed higher as per the below diagram.

Max. height of the clamping jaws X at max. operating pressure of 250 bar

Fixing screws for clamping jaws	M8x25 – 12.9
X [mm] with 2 screws	25
X [mm] with 4 screws	78

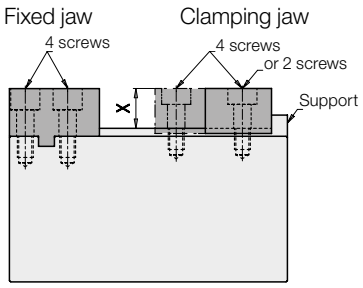
Max. height of the clamping jaw X as a function of the operating pressure



Important note

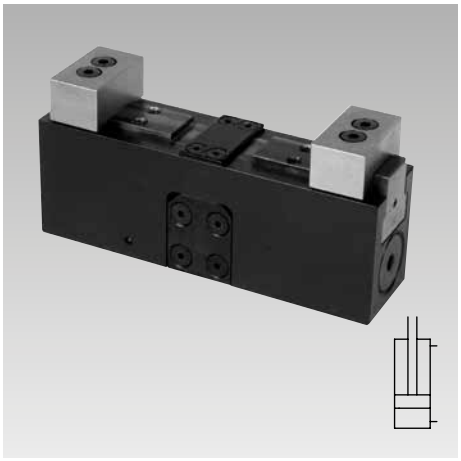
The clamping jaws must always be supported by the provided support, since the fixing screws are not in the position to compensate the generated clamping forces.

Fixing of the clamping jaws



Fixture clamp, concentric clamping

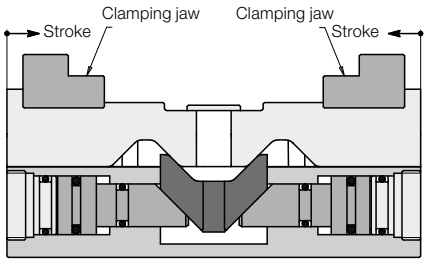
max. clamping force 6.5 kN and 9 kN, jaw width 40 and 65 mm double acting, max. operating pressure 250 bar



Advantages

- Very compact design
- High rigidity
- Retention force higher than clamping force
- Repetitive accuracy ±0.02 mm
- 2 sizes
- Strokes 2 x 5 and 2 x 8 mm
- Double-acting function
- Fixtures without tubes possible
- Exchangeable jaws
- Good swarf protection
- Port for central lubrication
- Mounting position: variable

Function



Application

The fixture clamps are used for machining of dimensionally stable workpieces in single or multiple clamping fixtures.
Due to their compact design they can be arranged in a very limited space. Fixture clamps are especially suitable for series manufacturing in automated mode.
The double-acting cylinder function combined with central lubrication and good swarf protection guarantees a high process safety.

Description

The fixture clamp with concentric clamping function consists of a very slim basic body with 2 integrated hydraulic cylinders.
The piston forces are transfered via a guided connecting link to the two clamping slides so that a centric synchronism is obtained.
All threads and ports are at the bottom to allow a space-saving arrangement of several clamping points in a very limited space.
If fixing from below is not possible an adaptor plate for manifold mounting or tube connection is available. As accessory also blanks of clamping jaws are available for adaptation to the workpiece contour.

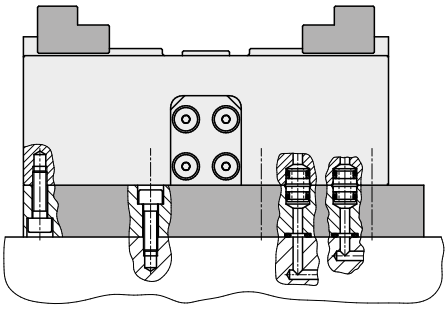
Important notes

The fixture clamp is only suitable for exterior clamping.
Lubricate at the latest after 500 clamping cycles the clamping slide via the central lubrication.
Never use the complete clamping stroke to guarantee safe clamping of the workpiece.
Max. operating temperature 80 °C.
Operating conditions and other data see data sheet A 0.100.

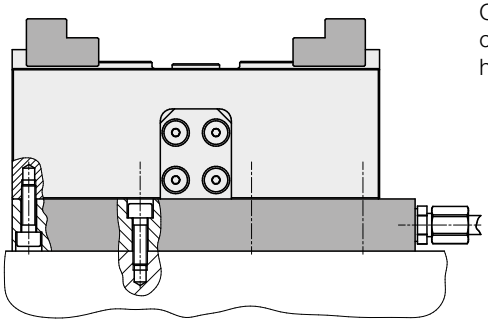
Fixing from above

with accessory adaptor plate

Drilled channels

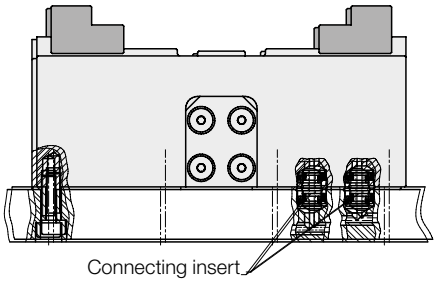


Fitting connection



Fixing from below

Drilled channels

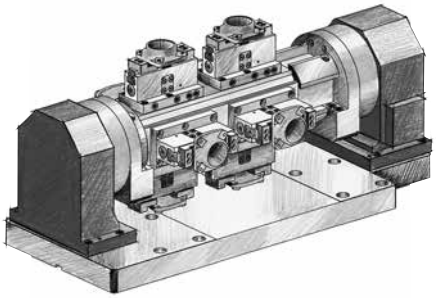


Accessories

Clamping jaws and adaptor plate are not included in the delivery of the fixture clamp and have to be ordered separately as accessory.

Application example

Concentric clamping of 8 flanges on a rotary indexing fixture.



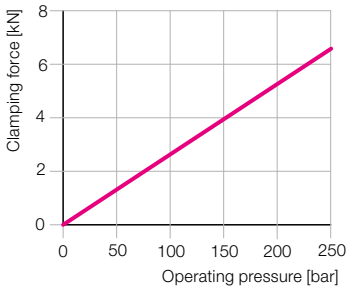
Part no. 4413051

Technical data			
Clamping force / jaw		[kN]	6.5
Retention force		[kN]	8
Release force		[kN]	0.5
Min. operating pressure		[bar]	10
Clamping stroke		[mm]	2 x 5
Repetitive accuracy of clamping		[mm]	±0.02
Jaw width		[mm]	40
Max. flow rate		[cm³/s]	25
Stroke volume	Clamping	[cm³]	6.4
	Unclamping	[cm³]	3.2
Weight		[kg]	appr. 2.4

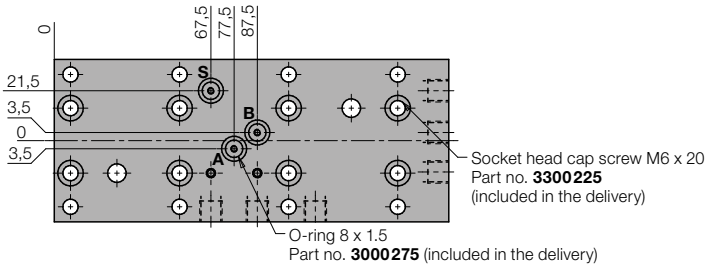
Adaptor plate (accessory)

Weight	[kg]	approx. 1.9
Part no.		**0441305**

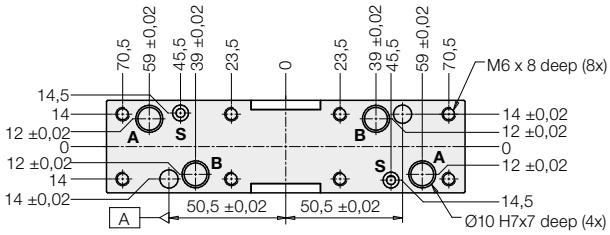
Clamping force diagram
(Height of the clamping jaw 15 mm)



Accessory: adaptor plate
View from below



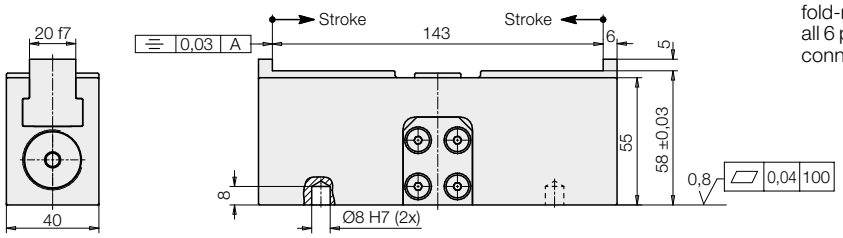
A = Clamping
B = Unclamping
S = Central lubrication

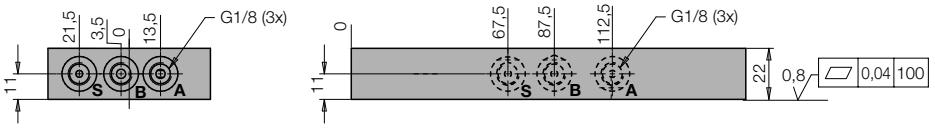


Clamping and unclamping
each Ø10 H7 x 7 deep for
4 x connecting insert **9210132**
(included in the delivery),
see also page F 9.300

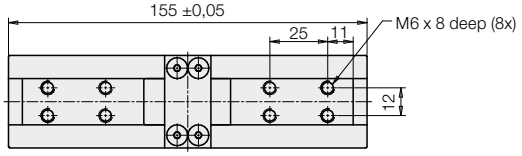
Central lubrication
2 x with O-ring **3001842** (5x1 mm)
(included in the delivery)

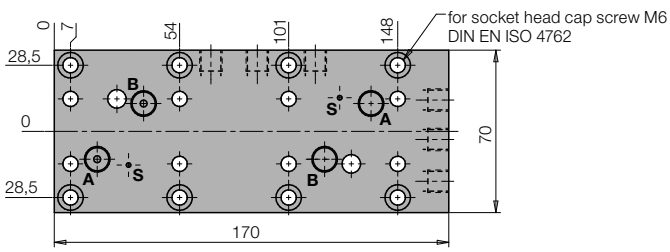
Important note!
If the fixture clamp is directly manifold-mounted without adaptor plate, all 6 ports (2xA, 2xB, 2xS) have to be connected individually.





Accessory: adaptor plate
Side views





Accessory: adaptor plate
View from above

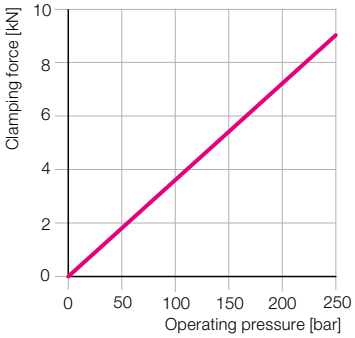
Part no. 4413151

Technical data			
Clamping force / jaw		[kN]	9
Retention force		[kN]	15
Release force		[kN]	0.5
Min. operating pressure		[bar]	10
Clamping stroke		[mm]	2 x 8
Repetitive accuracy of clamping		[mm]	±0.02
Jaw width		[mm]	65
Max. flow rate		[cm³/s]	50
Stroke volume	Clamping	[cm³]	14.2
	Unclamping	[cm³]	6.0
Weight		[kg]	appr. 6

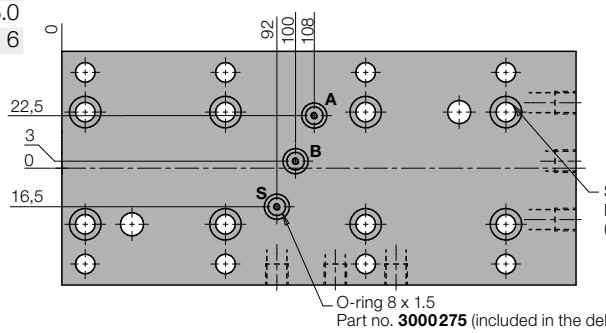
Adaptor plate (accessory)

Weight	[kg]	ca. 3.5
Part no.		**0441315**

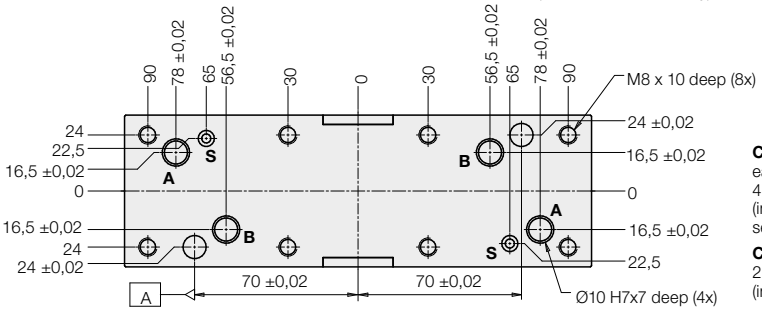
Clamping force diagram
(Height of the clamping jaw 25 mm)



Accessory: adaptor plate
View from below



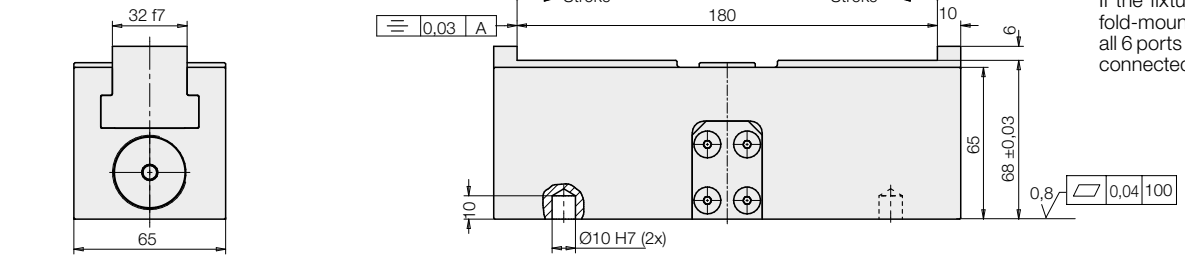
A = Clamping
B = Unclamping
S = Central lubrication

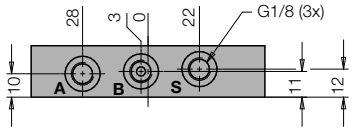


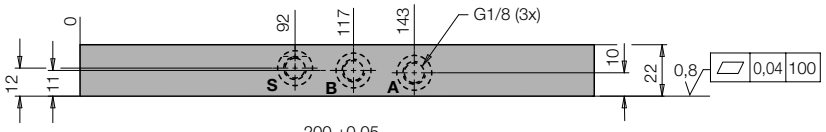
Clamping and unclamping
each Ø10 H7 x 7 deep for
4 x connecting insert **9210132**
(included in the delivery),
see also page F 9.300

Central lubrication
2 x with O-ring **3001842** (5x1 mm)
(included in the delivery)

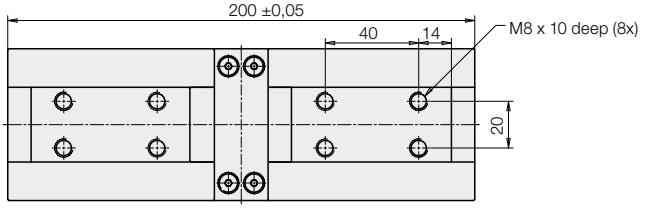
Important note
If the fixture clamp is directly manifold-mounted without adaptor plate, all 6 ports (2xA, 2xB, 2xS) have to be connected individually.

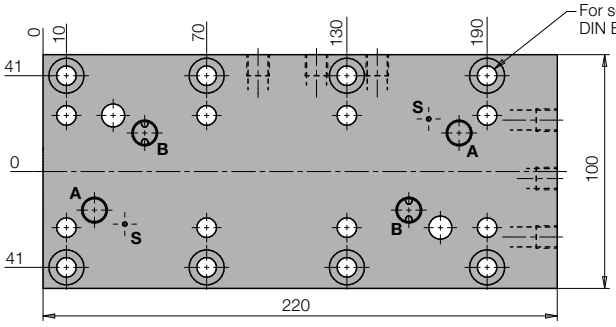






Accessory: adaptor plate
Side views

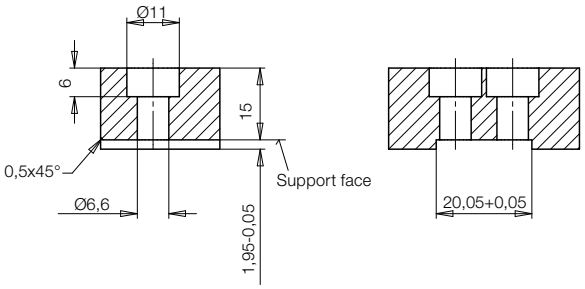


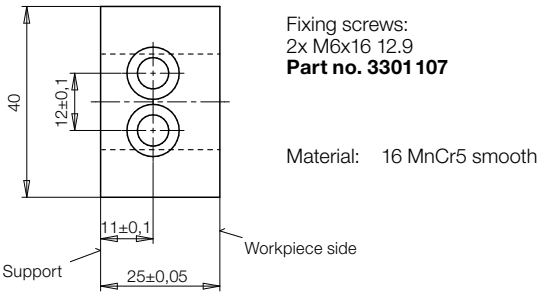


Accessory adaptor plate
View from above

For fixture clamp 4413051

Clamping jaw blank 40 mm
Part no. 3548070



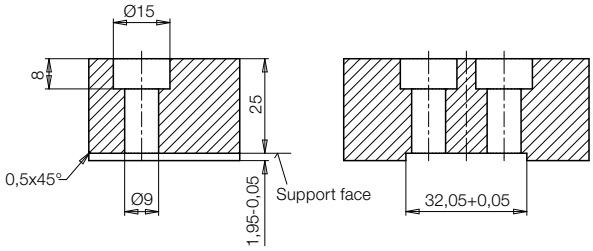


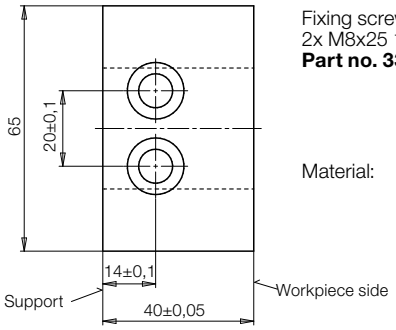
Fixing screws:
2x M6x16 12.9
Part no. 3301107

Material: 16 MnCr5 smooth

For fixture clamp 4413151

Clamping jaw blank 65 mm
Part no. 3548080





Fixing screws:
2x M8x25 12.9
Part no. 3300625

Material: 16 MnCr5 smooth

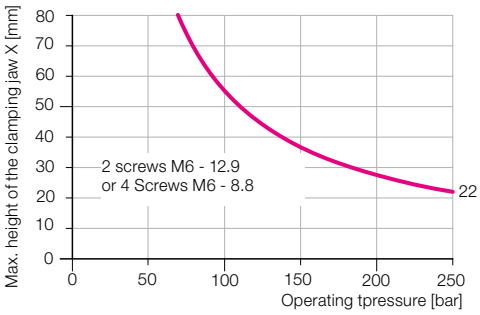
Self-made clamping jaws

Clamping jaws are manufactured according to the contour of the workpiece to be clamped.
The max. height of the clamping jaw X at 250 bar operating pressure is indicated in the below diagrams.

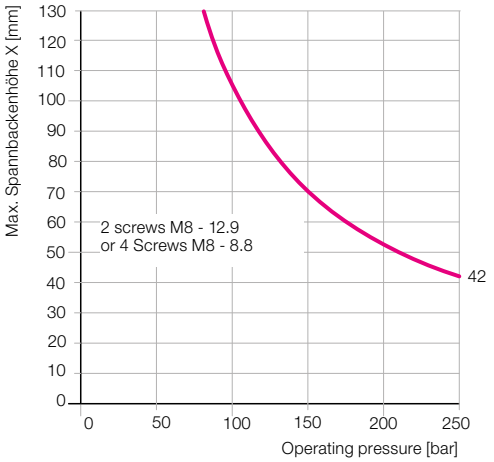
Important note

The clamping jaws must always contact the provided support, since the fixing screws are not in the position to compensate the generated clamping forces.

Max. height of the clamping jaw X for 4413051 as a function of the operating pressure

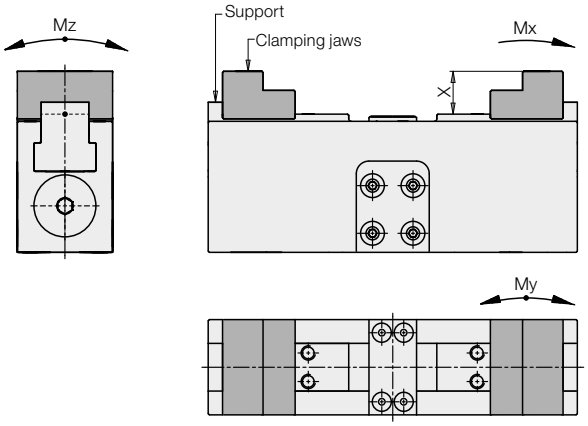


Max. height of the clamping jaw X for 4413151 as a function of the operating pressure



Admissible torques acting on the clamping jaws

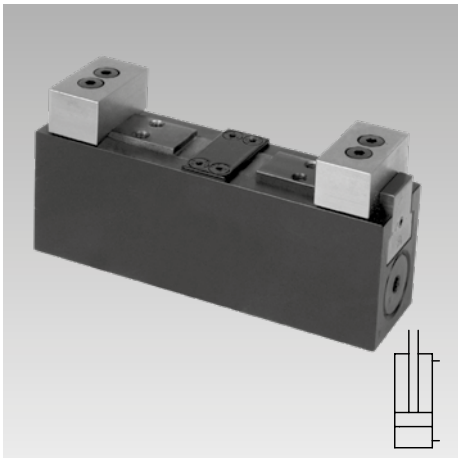
Mx = 140 Nm
My = 120 Nm
Mz = 120 Nm



Mx = 375 Nm
My = 200 Nm
Mz = 200 Nm

Fixture Clamp, Position Flexible

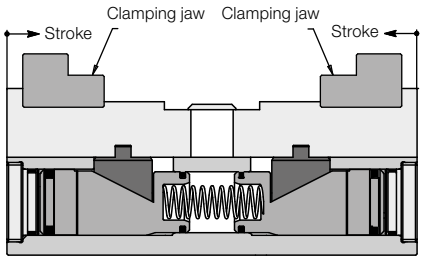
max. clamping force 8 kN, jaw width 40 mm
double acting, max. operating pressure 250 bar



Advantages

- Very compact design
- High stiffness
- High clamping force with low contact forces
- Position flexible within the clamping range
- Double-acting function
- Fixtures without pipes possible
- Exchangeable jaws
- Good swarf protection
- Port for central lubrication
- Mounting position: any

Function



Application

Position-flexible fixture clamps can additionally clamp and support a workpiece, which is already positioned and clamped in fixed stops, at unstable workpiece sections.
Due to their compact design they can be arranged in a very limited space.
Fixture clamps are especially suitable for series manufacturing in automated mode.
The double-acting cylinder function combined with central lubrication and good swarf protection guarantees a high process safety.

Description

The fixture clamp with position-flexible clamping function consists of a very slim basic body with 2 integrated hydraulic cylinders.

The piston forces are transmitted by two channels to the two clamping slides that can be moved independently from each other. During clamping both clamping slides contact the workpiece nearly without force (see page 3).

Only after that the clamping pressure and thereby the clamping force increases. Due to wedging of the clamping slides these are protected against displacement. Thereby the workpiece is floatingly held without deformation.

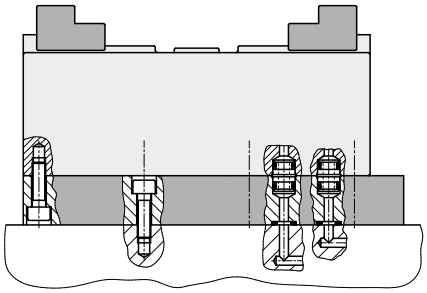
All threads and ports are at the bottom to allow a space-saving arrangement of several clamping points in a very limited space. If fixing from below is not possible an adaptor plate for manifold mounting or tube connection is available.

As accessory also blanks of clamping jaws are available for adaptation to the workpiece contour.

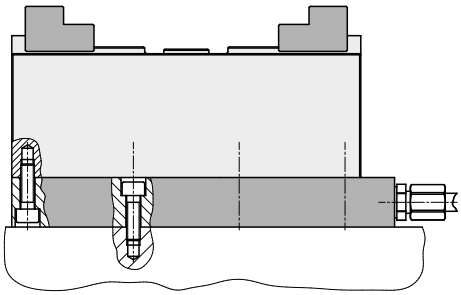
Fixing from above

with accessory adaptor plate

Drilled channels

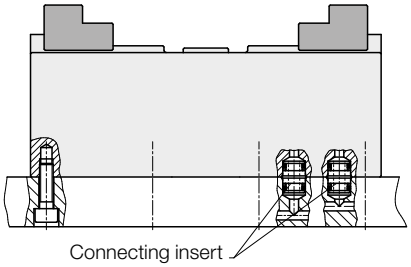


Pipe thread



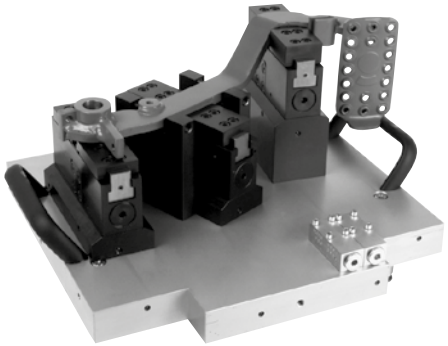
Fixing from below

Drilled channels



Application example

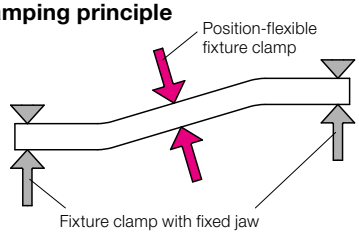
Clamping fixture for a pedal of a freight vehicle.



Accessories

Clamping jaws and adaptor plate are not included in the delivery of the fixture clamp and have to be ordered separately as accessory.

Clamping principle



Part no. 4413080

Technical data

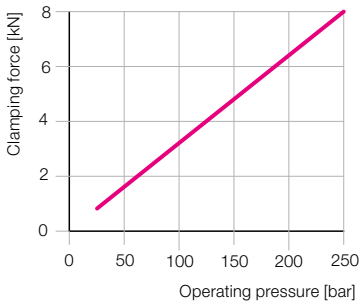
Clamping force at 250 bar	[kN]	8
Retention force at 250 bar	[kN]	10
Min. operating pressure	[bar]	25
Min. unclamping pressure		0,5 x clamping pressure
Clamping stroke	[mm]	2 x 8
Jaw width	[mm]	40
Max. flow rate*	[cm³/s]	17
Stroke volume Clamping	[cm³]	8.4
Unclamping	[cm³]	7
Weight	[kg]	approx 2.5

* See page 3 “Position-flexible clamping”

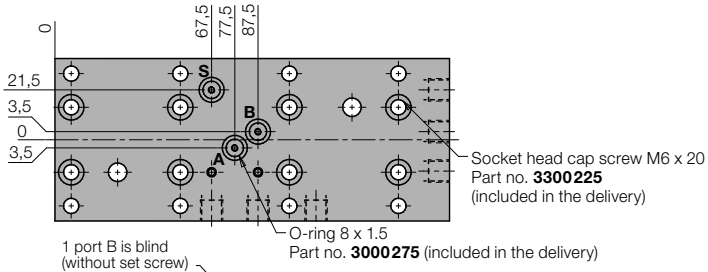
Adaptor plate (accessory

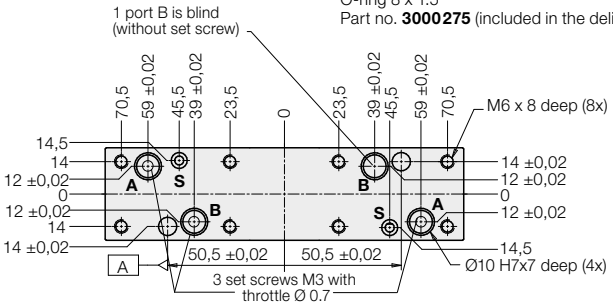
Weight	[kg]	approx. 1,9
Part no.		**0441305**

Clamping force diagram
(Height of the clamping jaw 15 mm)



Accessory: Adaptor plate
View from below



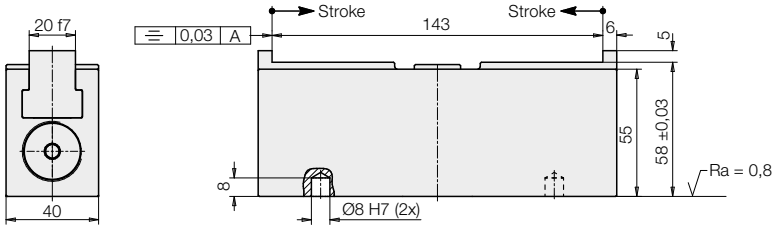


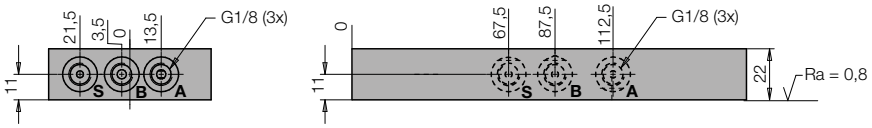
A = Clamping
B = Unclamping
S = Central lubrication

Clamping and unclamping
each Ø10 H7 x 7 deep for
4 x connecting insert **9210132**
(included in the delivery),
see also page F 9.300

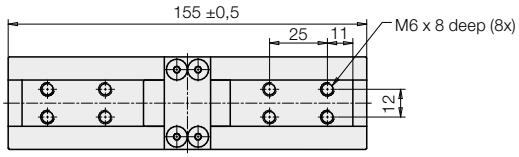
Central lubrication
2 x with O-ring **3000876** (3.68x1.78 mm)
(included in the delivery)

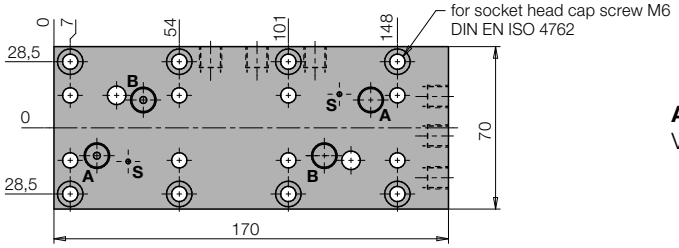
Important note
If the fixture clamp is manifold-mounted without adaptor plate, all 5 ports (2xA, 1xB, 2xS) have to be individually connected.





Accessory: Adaptor plate
Side views





Accessory: Adaptor plate
View from above

Important notes
The fixture clamp is only suitable for exterior clamping.
Lubricate the clamping slide via the central lubrication at the latest after 500 clamping cycles. (Recommended: slide way oil ISO 69)
Never use the complete clamping stroke to guarantee safe clamping of the workpiece.
Max. operating temperature 80 °C.
Operating conditions and other data see data sheet A 0.100.

Self-made clamping jaws

Clamping jaws are manufactured according to the contour of the workpiece to be clamped.
The max. height of the clamping jaw X at 250 bar operating pressure is indicated in the opposite chart.
If the operating pressure is lower, the clamping jaws can be designed higher as per the opposite diagram.

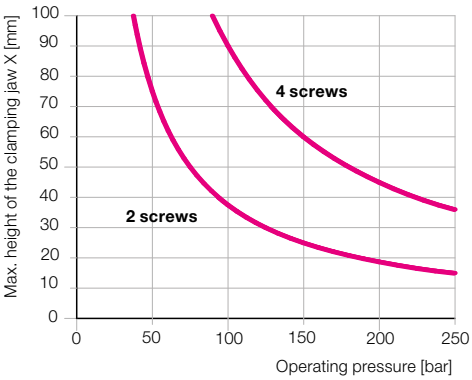
Max. height of the clamping jaws X at max. operating pressure of 250 bar

Fixing screws for clamping jaws	M6x16 - 12.9
X [mm] with 2 screws	15
X [mm] with 4 screws	36

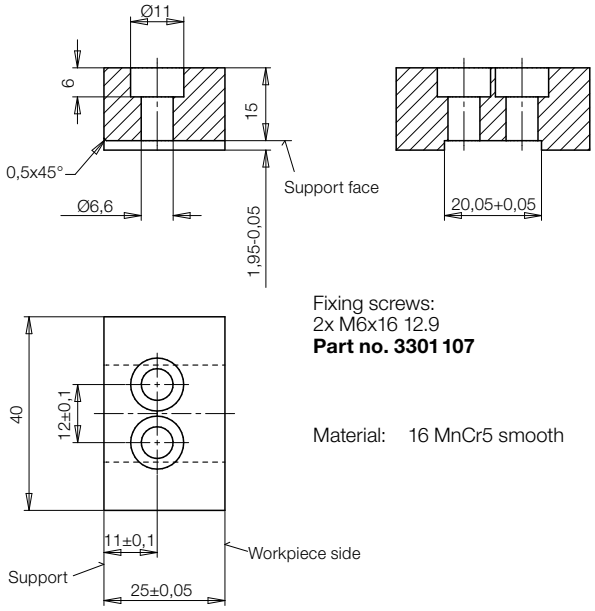
Important note

The clamping jaws must always be supported by the provided support, since the fixing screws are not in the position to compensate the generated clamping forces.

Max. height of the clamping jaw X as a function of the operating pressure



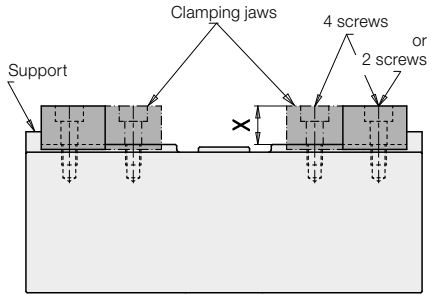
Clamping jaw blank 40 mm
Part no. 3548070



Fixing screws:
2x M6x16 12.9
Part no. 3301107

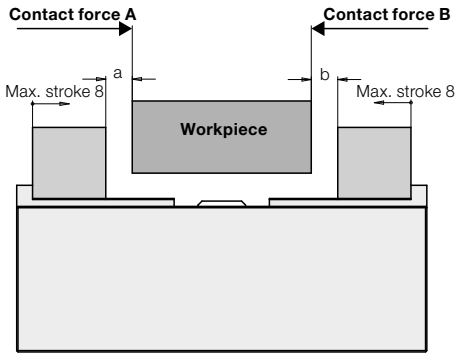
Material: 16 MnCr5 smooth

Fixing of the clamping jaws



Position-flexible clamping

1. Position of the workpiece within the clamping range



Limit dimensions: a max. = 7 mm
b max. = 7 mm

Recommendation:

Place the position-flexible fixture clamp as symmetrically as possible to the workpiece, so that the clamping jaws realise approximately the same stroke and also the smallest possible stroke.

2. Possible contact forces during clamping

Due to the slightly different factors of friction and an internal bracing spring the two clamping jaws do not uniformly contact the workpiece. One clamping jaw always hurries on ahead. This can already lead in case of very unstable sections to a deformation.
The possible contact force can be taken from the diagram.

3. Max. flow rate

With a max. flow rate of 17 cm^3/s the clamping time is approx. 0.5 seconds. For unstable workpieces and / or heavy clamping jaws the flow rate in the supply line should be throttled so that the clamping jaws contact the workpiece as „smoothly“ as possible.
If required, the two set screws M3 (Ø 0.7) in the ports A can be replaced.

Contact force as a function of the stroke difference (a-b) or (b-a)

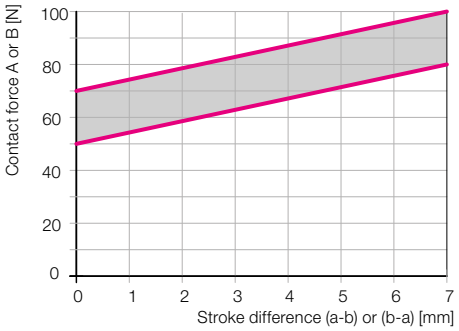
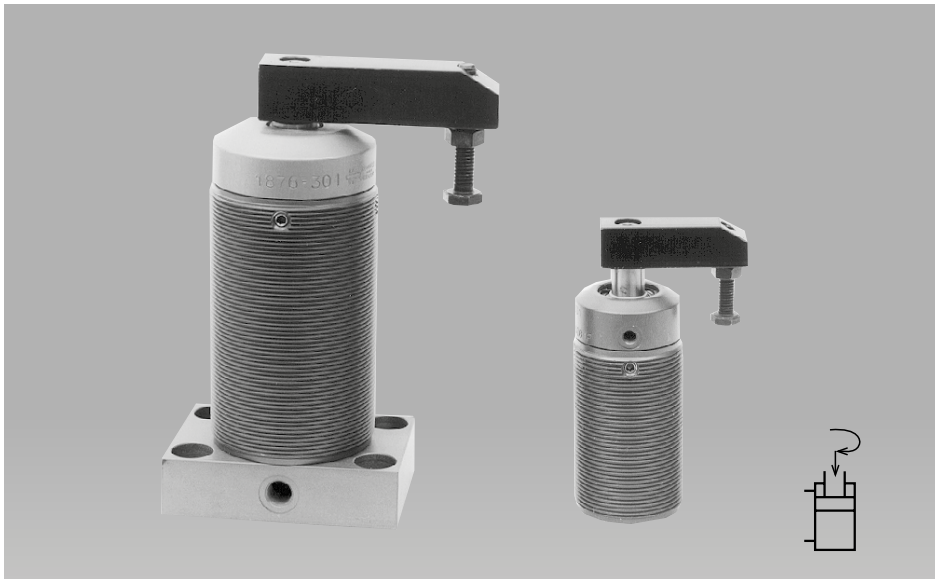


Diagram valid for horizontal mounting position. For vertical arrangement the weight of the clamping jaws has to be considered.

Pneumatic Swing Clamp

for adjustable magnetic sensors
double acting, max. operating pressure 7 bar



The opposite figure shows a pneumatic swing clamp.
Clamping arm and flange are accessories

Pneumatic swing clamp with accessories

1. Clamping arm (page 3)
2. Magnetic sensor with hose clamp (page 4)
3. Y-cable (see page G 2.140)

Application

Pneumatic swing clamps are used for applications which require only low clamping forces.
The installed magnetic piston allows monitoring of clamping and unclamping position.

Description

When pressurising the element, the clamping arm swings and lowers by 90° to the clamping position and then lowers to the clamping point. The position monitoring gives the required information regarding the position of the piston, but not regarding the position of the clamping arm. Monitoring is made by electronic sensors (see accessory) which detect the magnetic field of the magnetic piston. The switching points can be continuously adjusted by displacement of the magnetic sensors.

Special features

When adjusting the clamping screw it has to be considered that for the swing motion a part of the total stroke is required.
Make sure that the swing motion can be effected without any interference.
When using special clamping arms with other lengths, the corresponding operating pressures as shown in the clamping force diagram must not be exceeded.

Pneumatic accessories

see data sheet J 7.400

Installation

On fixtures flange-type swing clamps (flange is an accessory) or threaded versions with corresponding collar nuts can be easily adjusted to different workpiece heights.

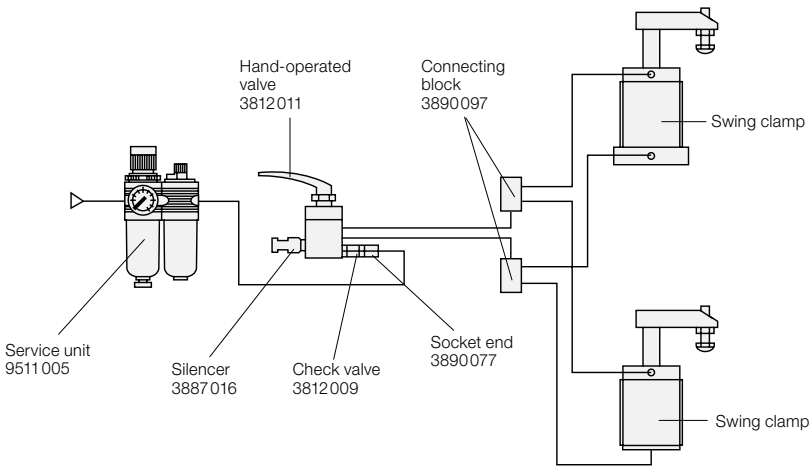
Material

The swing clamps are supplied in corrosion resistant quality. Guide bushing, housing, piston, and flange are made of hardcoated aluminium. The piston rod is made of corrosion resistant steel.

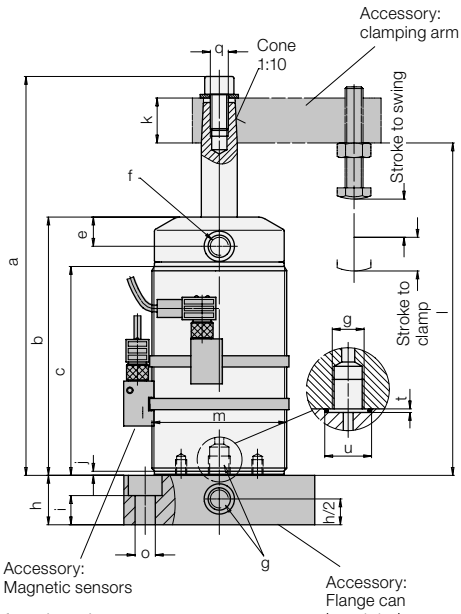
Important note

Operating of these pneumatic elements has to be effected with an additional service unit in order to guarantee that the clamping elements are supplied with correctly prepared compressed air.

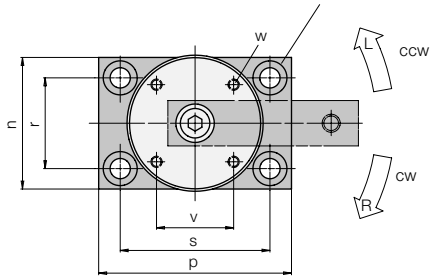
Connecting example



Technical data
Dimensions • Effective clamping force



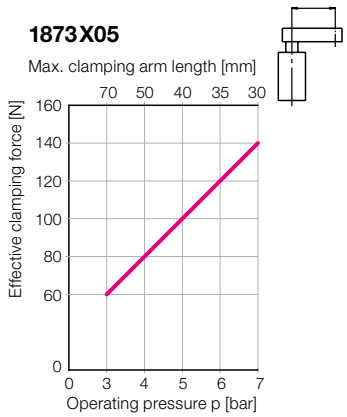
f = clamping
g = unclamping



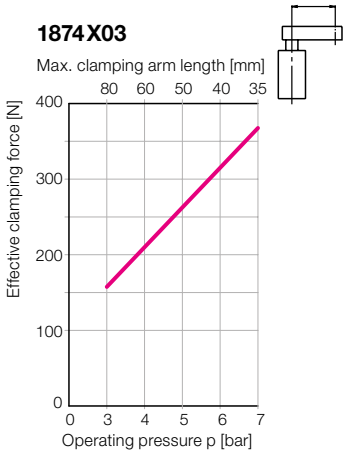
Piston Ø		**[mm]**	**20**	**32**	**40**	**50**	**63**
Piston rod Ø		[mm]	8	12	16	20	25
Stroke to swing		[mm]	7.5	9.5	17	18	23
Stroke to clamp		[mm]	7	9	15	15	18
Pulling force at	4 bar	[N]	105.5	276.4	422.2	659.7	1050.5
* air pressure	5 bar	[N]	131.9	345.5	527.7	824.6	1313.1
	6 bar	[N]	158.3	414.6	633.3	989.6	1575.8
Min. operating pressure		[bar]			3		
Max. operating pressure		[bar]			7		
Angle of rotation		[°]			90° ± 2°		
Weight		[kg]	0.20	0.30	0.70	0.90	2.1
a		[mm]	114.3	133.1	182.6	198.5	240.5
b		[mm]	75	86.5	115	125	156
c		[mm]	58.5	67.5	93	101	124
e		[mm]	9.5	12	13	13	17
f		[mm]	M5	M5	G 1/8	G 1/8	G 1/4
g		[mm]	M5	M5	G 1/8	G 1/8	G 1/4
h		[mm]	12	16	22	22	25
i		[mm]	5.5	9.5	13	13	14
j		[mm]	2	2	2	2	2
☐ k		[mm]	12	16	20	25	30
l		[mm]	97.5	109.5	153	159	198
m		[mm]	M30x1.5	M40x1.5	M50x1.5	M60x1.5	M80x1.5
n		[mm]	30	38	50	58	75
o		[mm]	6.6	6.6	9	9	11
p		[mm]	60	65	80	85	110
q		[mm]	M4	M6	M8	M12	M10
r		[mm]	17	23	30	40	55
s		[mm]	43	50	60	66	88
t		[mm]	1.1	1.1	1.1	1.1	1.5
Ø u		[mm]	9.8	9.8	14.3	14.3	19.8
☐ v		[mm]	14.2	17.6	26.88	34	38.9
w		[mm]	M4x5.5	M5x5	M5x7	M5x7	M8x10
Clockwise rotation							
Part No.			**1873305**	**1874303**	**1875303**	**1876303**	**1877303**
Counterclockwise rotation							
Part No.			**1873405**	**1874403**	**1875403**	**1876403**	**1877403**
Accessory: flange							
Part No.			**0345403**	**0345404**	**0345405**	**0345406**	**0345407**

* Effective clamping force see diagram

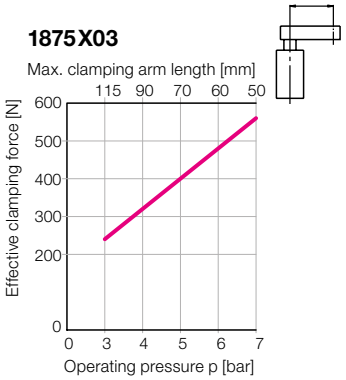
1873X05



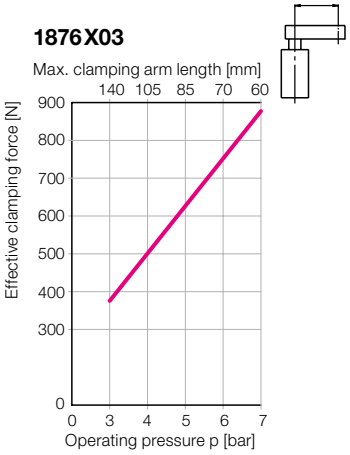
1874X03



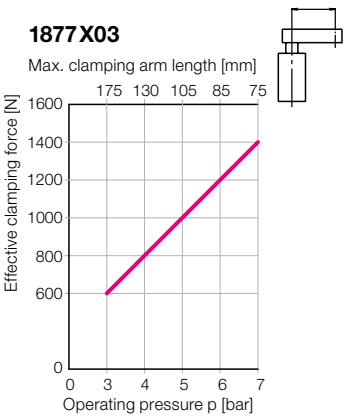
1875X03



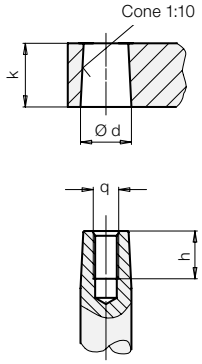
1876X03



1877X03

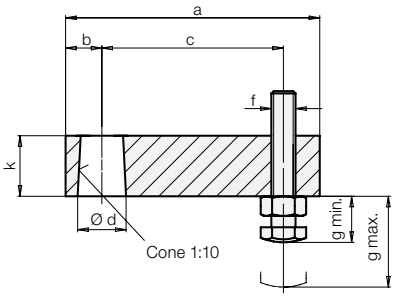


Seat of clamping arm (dimensions)



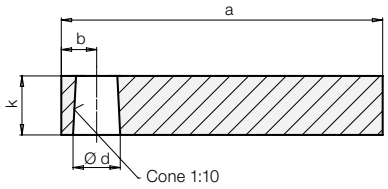
Swing clamp	Ø d + 0.05	□ k	h	q
1873 X05	7.85	12	9	M 4
1874 X03	11.85	16	15	M 6
1875 X03	15.85	20	19	M 8
1876 X03	19.85	25	18	M 12
1877 X03	24.85	30	25	M 10

Clamping arm



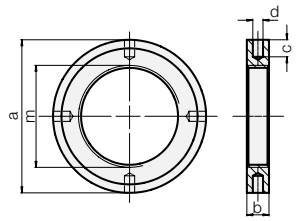
Swing clamp	a	b	c	Ø d + 0.05	f	g min.	g max.	□k	Part no.
1873 X05	42	7	30	7.85	M 4	8	20.5	12	**0187 324**
1874 X03	52	10	35	11.85	M 6	12	17.5	16	**0187 424**
1875 X03	70	12	50	15.85	M 6	12	28.5	20	**0187 524**
1876 X03	82	14	60	19.85	M 8	15	25	25	**0187 624**
1877 X03	104	18	75	24.85	M 10	19	36.5	30	**0187 724**

Clamping arms for special versions



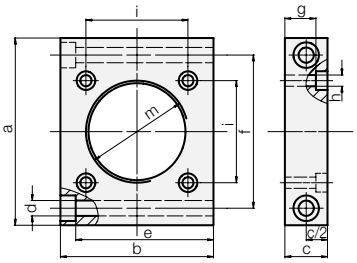
Swing clamp	a	b	Ø d + 0.05	□k	Part no.
1873 X05	62	7	7.85	12	**3548 355**
1874 X03	72	10	11.85	16	**3548 356**
1875 X03	95	12	15.85	20	**3548 357**
1876 X03	116	14	19.85	25	**3548 353**
1877 X03	143	18	24.85	30	**3548 358**

Flanged nut



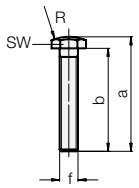
Swing clamp	Ø a	b	c	Ø d	m	Part no.
1873 X05	50	10	7	4 x 5	M30 x 1.5	**3527 071**
1874 X03	62	12	8	4 x 6	M40 x 1.5	**3527 040**
1875 X03	75	13	10	6 x 6	M50 x 1.5	**3527 041**
1876 X03	90	13	10	6 x 6	M60 x 1.5	**3527 042**
1877 X03	115	16	12	6 x 8	M80 x 1.5	**3527 043**

Threaded nut



Swing clamp	a	b	c	Ø d	e	f	g	Ø h	i	m	Part no.
1873 X05	65	55	15	5.5	49.3	50	10.4	4.5	30	M30 x 1.5	**3527 073**
1874 X03	80	65	15	5.5	59.3	60	10.4	4.5	40	M40 x 1.5	**3527 044**
1875 X03	95	75	20	6.6	68.2	75	14.3	5.5	50	M50 x 1.5	**3527 045**
1876 X03	110	90	25	9	81	90	18.2	6.6	60	M60 x 1.5	**3527 046**
1877 X03	140	120	25	11	109	115	16	9	75	M80 x 1.5	**3527 047**

Contact bolts, dome head



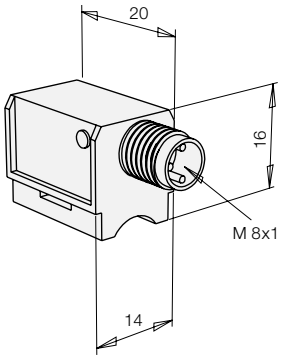
Swing clamp	a	b	f	R	SW	Part no.
1873 X05	32.5	30	M 4	15	7	**3614 141**
1874 X03	33.5	30	M 6	20	10	**3614 137**
1875 X03	48.5	45	M 6	20	10	**3614 138**
1876 X03	50	45	M 8	20	13	**3614 139**
1877 X03	66.5	60	M 10	35	17	**3614 140**

Compared with traditional reed switches the electronic magnetic sensors offer the following advantages:

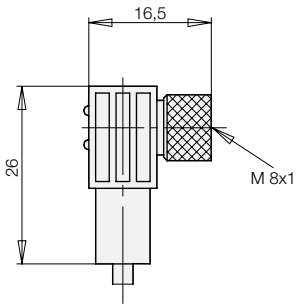
- Indifference to shock and vibration
- Bounce-free output signal
- Only one switching point
- Wear resistant
- Protection against reverse battery
- Protected against short circuits

Electric connection is made as per traditional inductive proximity switches.
Up to four magnetic sensors can be connected in series.
The magnetic sensor is mounted at the swing clamp body with a hose clamp.

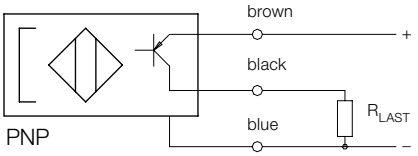
Electronic magnetic sensor



Connecting cable with right angle plug



Connecting scheme

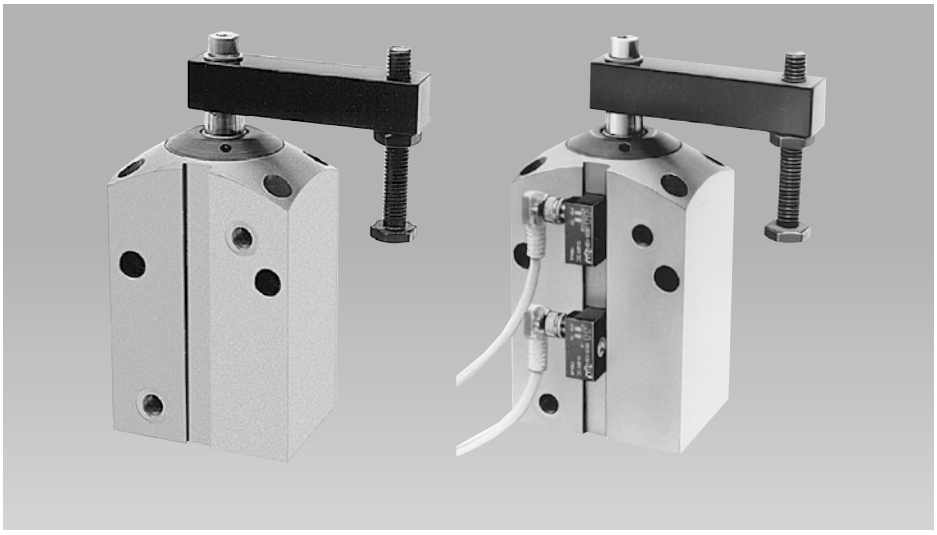


Hose clamp for swing clamp	Part no.
1873 X05	**3829 132**
1874 X03	**3829 133**
1875 X03	**3829 120**
1876 X03	**3829 134**
1877 X03	**3829 135**

Technical data	Electronic magnetic sensor	Connecting cable with right angle plug
Cylinder body material	PA 12 - GF 30; yellow	
Voltage	10 – 30 V DC	10 – 30 V DC
Residual ripple	max. 10 %	
Current load I_{LAST}	200 mA	
Current consumption	< 2 mA	
Voltage drop (max. load)	< 1.8 V	
Output	pnp, interlock	
Protected against short circuits	yes	
Protection against reverse battery	installed	
Switching frequency	1 kHz	
Switching hysteresis	< 1 mm	
Protection as per DIN 40050	IP 67	IP 67
Environmental temperature	–25 °C up to +70 °C	–25 °C up to +90 °C
Plug connection	M8 x 1 plug	M8 x 1 plug
LED	Function display (red)	Voltage (green) Function display (yellow)
Cable, length of cable		PUR, 5 m
Part No. (1 off)	**3829 119**	**3829 099**

Pneumatic Swiwng Clamp

block-type, for adjustable magnetic sensors double acting, max. operating pressure 7 bar



Advantages

- Compact design
- Easy adjustment of switching point positions
- Diverse mounting possibilities
- 5 standard sizes are available
- optionally with thread connection or for manifold mounting with O-ring sealing

Application

Pneumatic swing clamps are used for applications which require only low clamping forces.
The installed magnetic piston allows monitoring of clamping and unclamping position.

Description

When pressurising the element, the clamping arm swings and lowers by 90° to the clamping position and then lowers to the clamping point.
The position monitoring gives the required information regarding the position of the piston, but not regarding the position of the clamping arm. Monitoring is made by electronic sensors (see accessory) which detect the magnetic field of the magnetic piston. The switching points can be continuously adjusted by displacement of the magnetic sensors.

Special features

When adjusting the clamping screw it has to be considered that for the swing motion a part of the total stroke is required.
Make sure that the swing motion can be effected without any interference.
When using special clamping arms with other lengths, the corresponding operating pressures as shown in the clamping force diagram must not be exceeded.

Pneumatic accessories

see data sheet J 7.400.

Installation

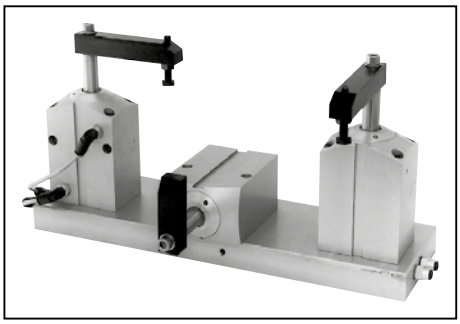
The block-type offers universal mounting possibilities.

Material

The swing clamps are supplied in corrosion resistant quality. Guide bushing, housing, piston, and flange are made of hardcoated aluminium.
The piston rod is made of corrosion resistant steel.

Important notes

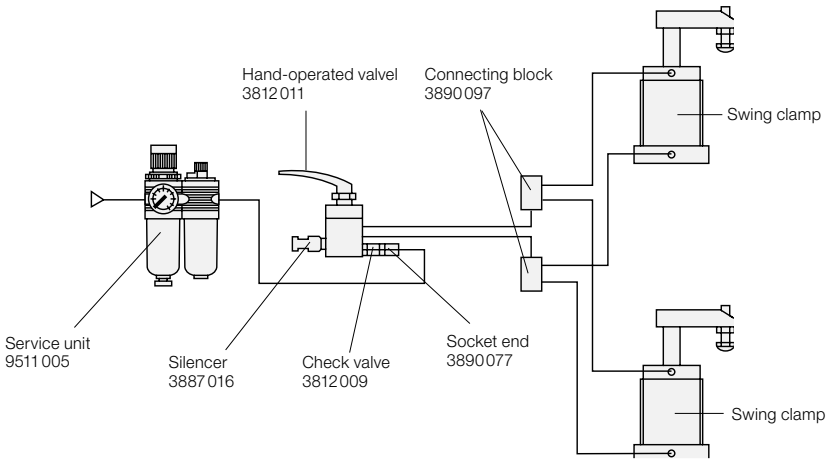
Operating of these pneumatic elements has to be effected with an additional service unit in order to guarantee that the clamping elements are supplied with correctly prepared compressed air.
Operating conditions, tolerances and other data see data sheet A 0.100.

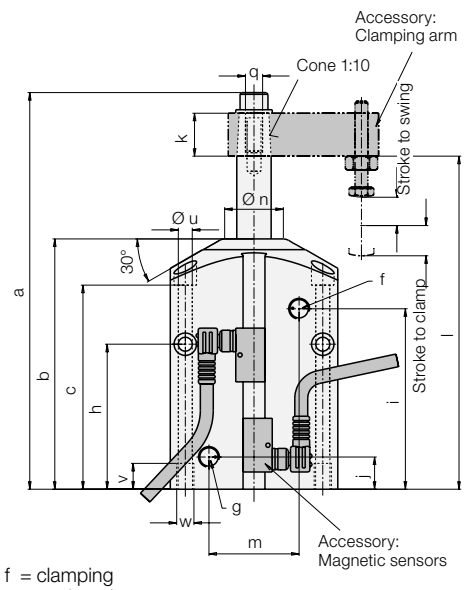


Versions

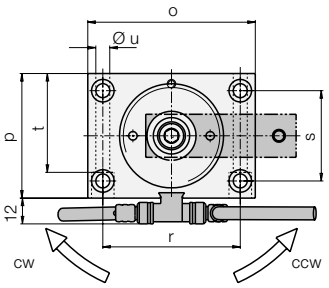
- Versions with pipe thread (Figure at the left-hand side) see page 2
- Manifold mounting with O-ring sealing Version **K** (Figure in the centre), see page 3
- Manifold mounting with O-ring sealing Version **B** (Figure at the right-hand side), see page 3

Connection example





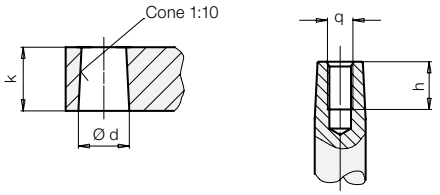
f = clamping
g = unclamping



Piston Ø	[mm]	20	32	40	50	63
Pistron rod Ø	[mm]	8	12	16	20	25
Stroke to swing	[mm]	7.5	9.5	17	18	23
Stroke to clamp	[mm]	7	9	15	15	18
Pulling force at 4 bar	[N]	105.5	276.4	422.2	659.7	1050.5
* air 5 bar	[N]	131.9	345.5	527.7	824.6	1313.1
pressure 6 bar	[N]	158.3	414.6	633.3	989.6	1575.8
Min. operating pressure	[bar]			3		
Max. operating pressure	[bar]			7		
Angle of rotation	[°]			90° ± 2°		
Weight	[kg]	0.35	0.8	1.3	2.0	3.33
a	[mm]	120.5	143	189.5	203.5	239.5
b	[mm]	76	94.5	120.5	130	150
c	[mm]	55.5	72	99	104	118
f	[mm]	M5	M5	G 1/8	G 1/8	G 1/4
g	[mm]	M5	M5	G 1/8	G 1/8	G 1/4
h	[mm]	41	59.5	71.5	76	80
i	[mm]	53.5	63	88	95	100
j	[mm]	17	20	19	17.5	18
☒ k	[mm]	12	16	20	25	30
l	[mm]	103.5	119.5	159	164	197
m	[mm]	22	28	42	44	58
Ø n	[mm]	14	24	30	38	42
o	[mm]	54	68	80	90	106
p	[mm]	35	52	60	70	85
q	[mm]	M4	M6	M8	M12	M10
r	[mm]	40	55	64	72	86
s	[mm]	22	38	42	48	66
t	[mm]	25	40	46	50	70
Ø u	[mm]	5.5	6.5	6.5	8.5	8.5
v	[mm]	10	12	12	15	15
w	[mm]	M8	M8	M8	M10	M10
Clockwise rotation						
Part no.		**1873106**	**1874106**	**1875106**	**1876106**	**1877106**
Counterclockwise rotation						
Part no.		**1873206**	**1874206**	**1875206**	**1876206**	**1877206**

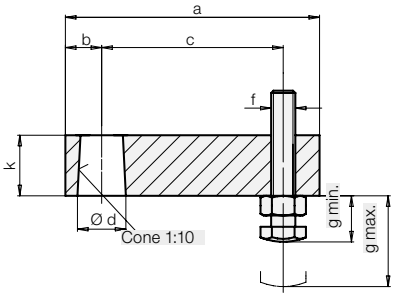
***** Effective clamping force see diagram (page 3, column 1)

Seat of clamping arm



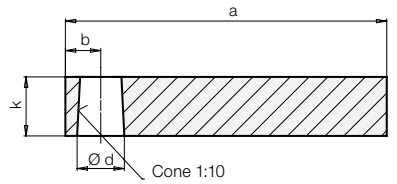
Swing clamp	Ø d +0.05	☐ k	h	q
1873X06	7.85	12	9	M 4
1874X06	11.85	16	15	M 6
1875X06	15.85	20	19	M 8
1876X06	19.85	25	18	M 12
1877X06	24.85	30	25	M 10

Clamping arm



Swing clamp	a	b	c	Ø d +0.05	f	g min.	g max.	☐ k	Part no.
1873X06	54	7	42	7.85	M 4	8	28	12	**0187326**
1874X06	68	10	52	11.85	M 6	12	27	16	**0187426**
1875X06	78	12	58	15.85	M 6	12	42	20	**0187526**
1876X06	90	14	68	19.85	M 8	15	42	25	**0187626**
1877X06	110	18	80	24.85	M10	19	56	30	**0187726**

Clamping arms for special versions



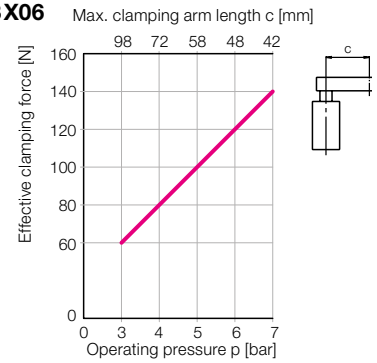
Swing clamp	a	b	Ø d +0.05	☐ k	Part no.
1873X06	62	7	7.85	12	**3548355**
1874X06	72	10	11.85	16	**3548356**
1875X06	95	12	15.85	20	**3548357**
1876X06	116	14	19.85	25	**3548353**
1877X06	143	18	24.85	30	**3548358**

Contact bolt, dome head

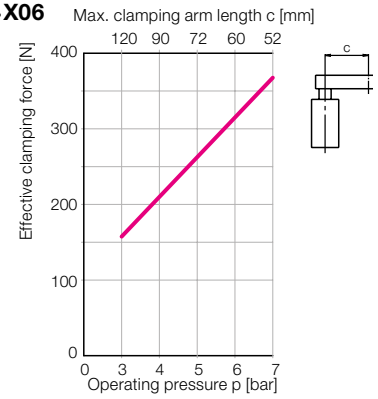
Swing clamp	a	b	f	R	SW	Part no.
1873X06	32.5	30	M 4	15	7	**3614141**
1874X06	33.5	30	M 6	20	10	**3614137**
1875X06	48.5	45	M 6	20	10	**3614138**
1876X06	50	45	M 8	20	13	**3614139**
1877X06	66.5	60	M 10	35	17	**3614140**

Effective clamping force

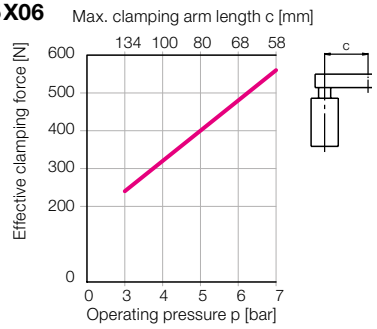
1873 X06



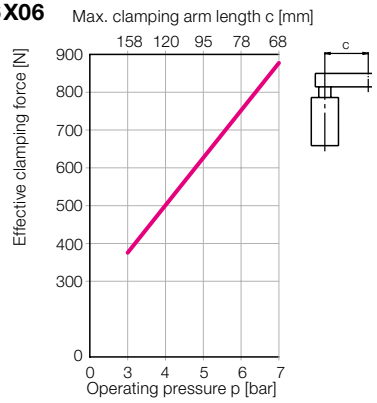
1874 X06



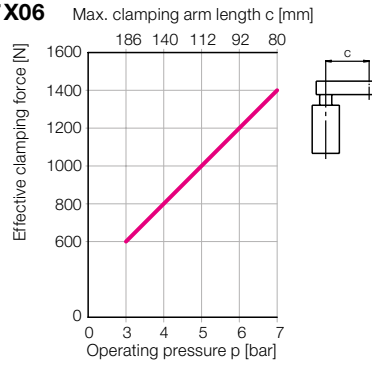
1875 X06



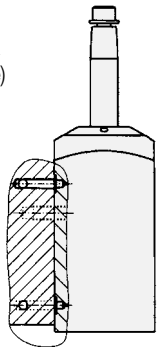
1876 X06



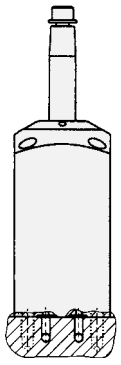
1877 X06

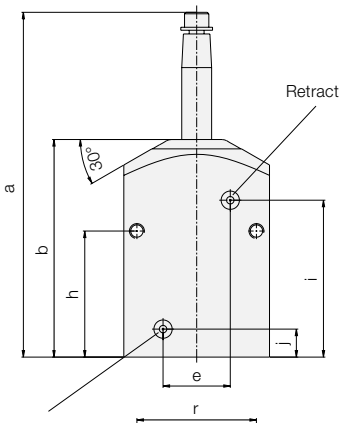


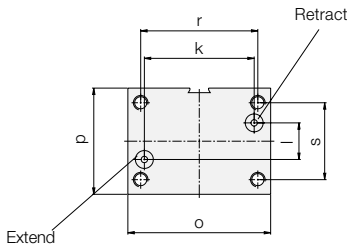
Version K
(Broad side)

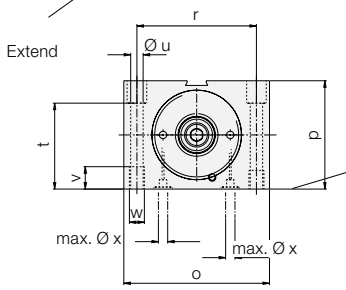


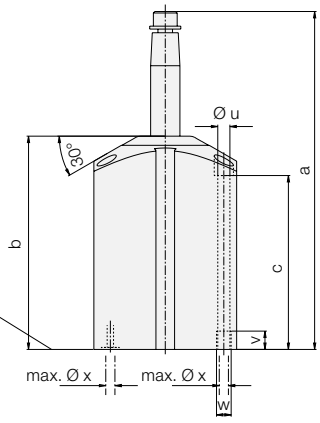
Version B
(Bottom side)











Swing clamp

Clockwise rotation		**1873 106X**	**1874 106X**	**1875 106X**	**1876 106X**	**1877 106X**
Counterclockwise rotation		**1873 206X**	**1874 206X**	**1875 206X**	**1876 206X**	**1877 206X**
Piston Ø	[mm]	20	32	40	50	63
Piston rod Ø	[mm]	8	12	16	20	25
a	[mm]	120.5	143	189.5	203.5	239
b	[mm]	76	94.5	120.5	130	150
c	[mm]	55.5	72	99	104	118
e	[mm]	16	28	36	44	58
h	[mm]	41	59.5	71.5	76	80
i	[mm]	53.5	63	88	95	100
j	[mm]	20	20	19	17.5	18
k	[mm]	39	53	60	72	86
l	[mm]	–	14	20	20	20
o	[mm]	54	68	80	90	106
p	[mm]	35	52	60	70	85
r	[mm]	40	55	64	72	86
s	[mm]	22	38	42	48	66
t	[mm]	25	40	46	50	70
Ø u	[mm]	5.5	6.5	6.5	8.5	8.5
v	[mm]	10	12	12	15	15
w	[mm]	M8	M8	M8	M10	M10
max. Ø x	[mm]	5	5	5	5	5
Dimensions O-ring	[mm]	7x1.5	7x1.5	7x1.5	7x1.5	7x1.5
Part no., spare O-ring		**3000342**	**3000342**	**3000342**	**3000342**	**3000342**

O-rings are included in delivery. Other dimensions see page 2.

Order:

Please add the corresponding identification letter to the **Part no.** of the required pneumatic block-type swing clamp: **K** or **B**

Example of ordering:

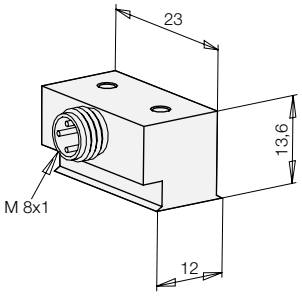
Pneumatic block-type swing clamp 1875-106 with air supply on the broad side
Part no. 1875-106 K

Compared with traditional reed switches the electronic magnetic sensors offer the following advantages:

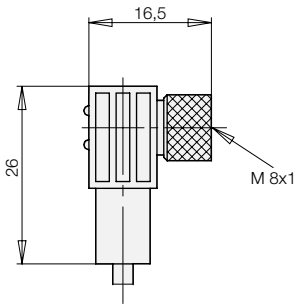
- Indifference to shock and vibration
- Bounce-free output signal
- Only one switching point
- Wear resistant
- Protection against reverse battery
- Protected against short circuits

Electric connection is made as per traditional inductive proximity switches; up to four magnetic sensors can be connected in series.
Minimum distance of the switching points: 6 mm.

Electronic magnetic sensor



Connecting cable with right angle plug

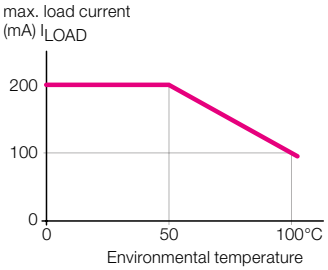


Important notes

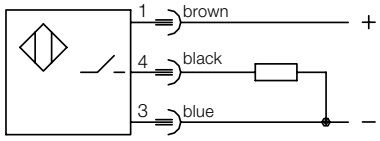
Steel can influence the magnetic field of the magnetic piston and thereby the position of the switching points. If there is the same influence for each stroke (e.g. because of adjoining steel components) it can be compensated by displacing the magnetic sensors. But if the influence differs from stroke to stroke, as e.g. in the case of swarf, a cover has to be provided 30 mm over the magnetic sensors. Covers have to be provided to protect the cylinders against ferritic swarf.

Further information about voltage supply for position controls see data sheet A 0.120.

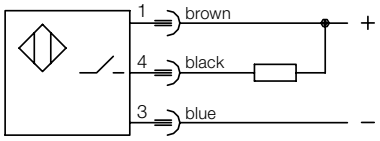
Temperature curve



Connecting scheme



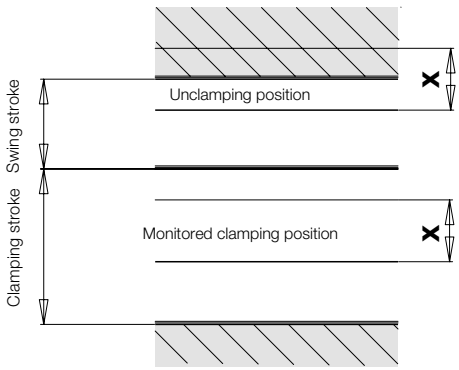
pnp (+) switching



npn (–) switching

Technical data	Electronic magnetic sensor		Connection cable with right angle plug	
Cylinder body material	aluminium black lacquered			
Voltage	10 – 30 V DC		10 – 30 V DC	
Residual ripple	max. 10%			
Current load I_{LOAD}	200 mA – up to 50 °C 150 mA – at 75 °C 100 mA – at 100 °C			
Current consumption	< 15 mA			
Voltage drop (max. load)	< 2 V			
Protected against short circuits	yes			
Protection against reverse battery	installed			
Switching frequency	1 kHz			
Switching hysteresis	3 mm			
Protection as per 40050	IP 67		IP 67	
Environmental temperature	–25 °C up to +100 °C		–25 °C up to +90 °C	
Plug connection	M8 plug		M8 plug	
LED	no		Voltage (green) Function display (yellow)	
Cable, length of cable			PUR, 5 m	
Output (interlock)	**pnp**	**npn**	**pnp**	**npn**
Part no.	**3829234**	**3829240**	**3829099**	**3829124**

Range of magnetic signal



Type	≈ x [mm]
1873 X06	4
1874 X06	4
1875 X06	5
1876 X06	6
1877 X06	7

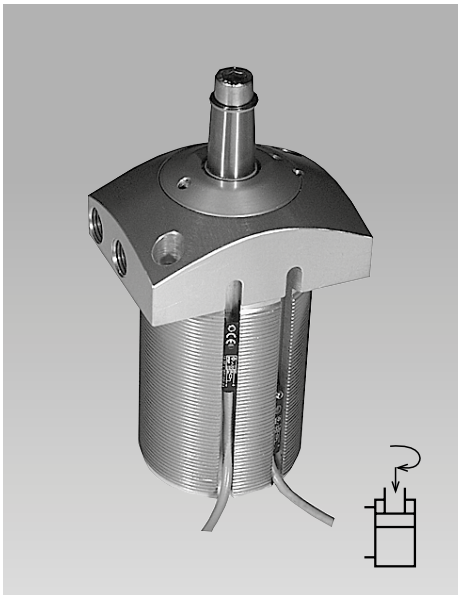
Further accessory

see data sheet G 2.140

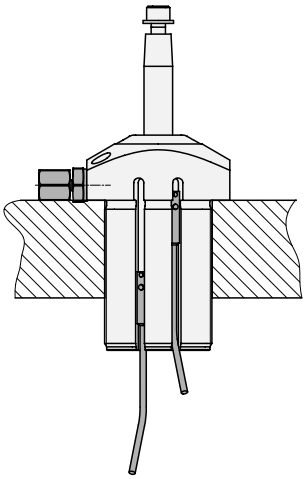
- Pin-and-socket connector
- Y-distributor
- Reversing plug
- Voltage regulator

Pneumatic Swing Clamp

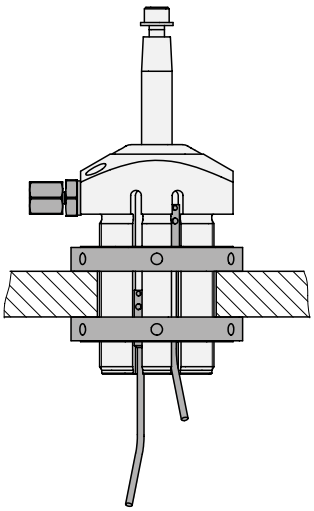
top flange-type, for adjustable magnetic sensors double acting, max. operating pressure 7 bar



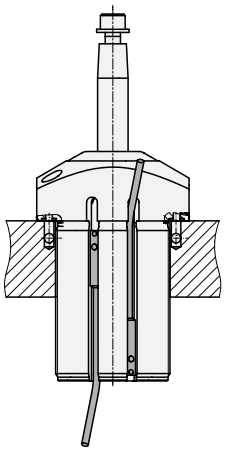
Installation examples



Connecting thread, mounted with socket head cap screw



Connecting thread, height adjustment by collar nuts



Manifold mounting with O-ring sealing, air supply through drilled channels in the fixture plate

Application

Pneumatic swing clamps are used for applications which require only low clamping forces. The installed magnetic piston allows monitoring of clamping and unclamping position.

Description

When pressurising the element, the clamping arm swings and lowers by 90° to the clamping position and then lowers to the clamping point. The position monitoring gives the required information regarding the position of the piston, but not regarding the position of the clamping arm. Monitoring is made by electronic sensors (see accessory) which detect the magnetic field of the magnetic piston. The switching points can be continuously adjusted by displacement of the magnetic sensors.

Special features

When adjusting the clamping screw it has to be considered that for the swing motion a part of the total stroke is required. Make sure that the swing motion can be effected without any interference. When using special clamping arms with other lengths, the corresponding operating pressures as shown in the clamping force diagram must not be exceeded.

Installation

On fixtures flange-type swing clamps or threaded versions with corresponding collar nuts can be easily adjusted to different workpiece heights.

Material

The swing clamps are supplied in corrosion resistant quality. Guide bushing, housing and piston are made of hardcoated aluminium. The piston rod is made of corrosion resistant steel.

Important notes

Operating of these pneumatic elements has to be effected with an additional service unit in order to guarantee that the clamping elements are supplied with correctly prepared compressed air.
Operating conditions, tolerances and other data see data sheet A 0.100.

Advantages

- Low built-in design possible
- Height adjustment by threaded body and collar nut
- Flange mounting by socket head cap screws
- 5 standard sizes are available
- optionally with thread connection or for manifold mounting with O-ring sealing

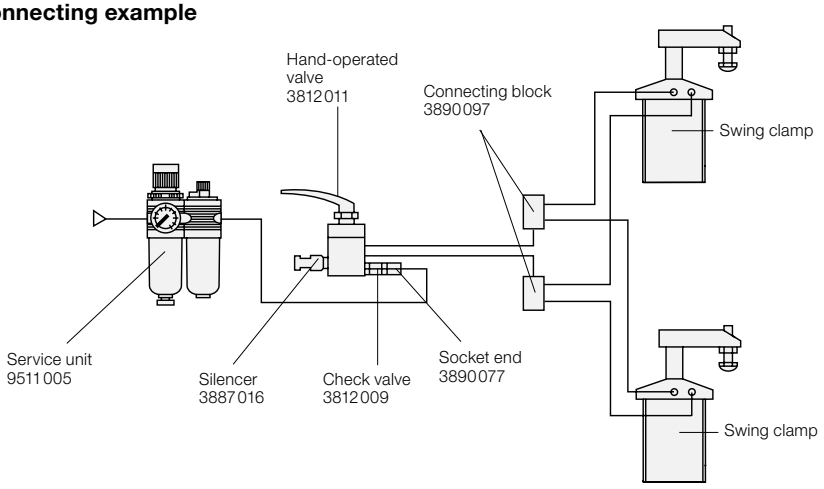
Versions

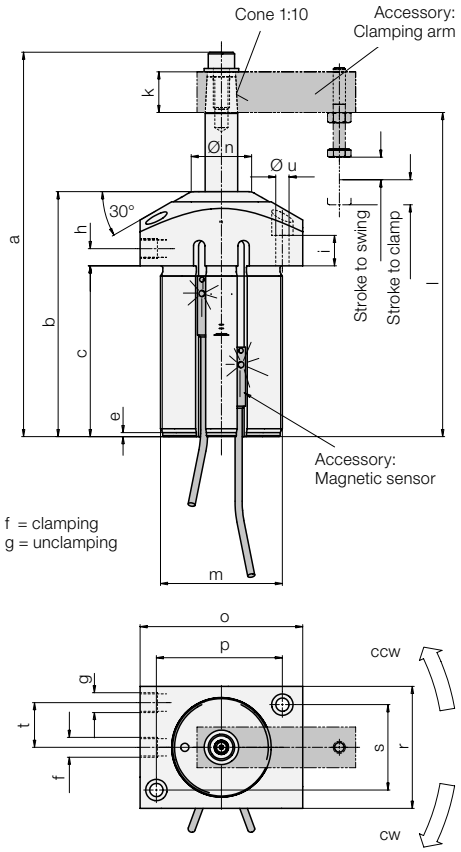
- Threaded body for height adjustment
- Manifold mounting with O-ring sealing

Pneumatic accessories

see data sheet J 7.400.

Connecting example

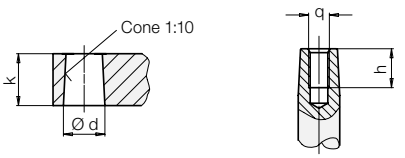




Piston Ø	[mm]	20	32	40	50	63
Piston rod Ø	[mm]	8	12	16	20	25
Stroke to swing	[mm]	7.5	9.5	17	18	23
Stroke to clamp	[mm]	7	9	15	15	18
Force to pull at 4 bar	[N]	105.5	276.4	422.2	659.7	1050.5
* air 5 bar	[N]	131.9	345.5	527.7	824.6	1313.1
pressure 6 bar	[N]	158.3	414.6	633.3	989.6	1575.8
Min. operating pressure	[bar]			3		
Max. operating pressure	[bar]			7		
Angle of rotation	[°]			90° ± 2°		
Weight	[kg]	0.3	0.6	1.0	1.5	2.6
a	[mm]	120	143	189	202	239.5
b	[mm]	76	94.5	120.5	130	150
c	[mm]	48	61	84	85	91
e	[mm]	2	2	2	2	2
f	[mm]	M5	M5	G 1/8	G 1/8	G 1/4
g	[mm]	M5	M5	G 1/8	G 1/8	G 1/4
h	[mm]	6	6.5	8.5	10	13
i	[mm]	7.5	11	15	19	27
□ k	[mm]	12	16	20	25	30
l	[mm]	103.5	119.5	159	164	197
m	[mm]	M40x1.5	M52x1.5	M60x1.5	M70x1.5	M85x2
Ø n	[mm]	14	24	30	38	42
o	[mm]	60	68	80	90	106
p	[mm]	44	54	62	72	86
r	[mm]	40	52	60	70	85
s	[mm]	25	36	42	48	66
t	[mm]	12.8	15	22	23	30.3
Ø u	[mm]	5.5	6.5	6.5	8.5	8.5
Direction of rotation cw						
Part no.		**1873103**	**1874103**	**1875103**	**1876103**	**1877103**
Direction of rotation ccw						
Part no.		**1873203**	**1874203**	**1875203**	**1876203**	**1877203**

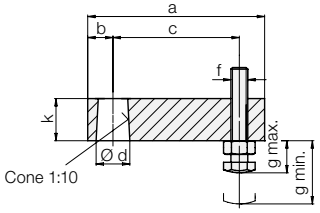
* Effective clamping force see diagram (page 3)

Seat of clamping arm



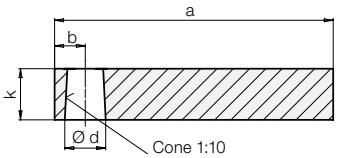
Swing clamp	Ø d + 0.05	□ k	h	q
1873X03/ -X05	7.85	12	9	M 4
1874X03/ -X05	11.85	16	15	M 6
1875X03/ -X05	15.85	20	19	M 8
1876X03/ -X05	19.85	25	18	M 12
1877X03/ -X05	24.85	30	25	M 10

Clamping arm



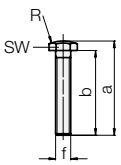
Swing clamp	a	b	c	Ø d + 0.05	f	g min.	g max.	□ k	Part no.
1873X03/ -X05	54	7	42	7.85	M 4	8	28	12	**0187326**
1874X03/ -X05	68	10	52	11.85	M 6	12	27	16	**0187426**
1875X03/ -X05	78	12	58	15.85	M 6	12	42	20	**0187526**
1876X03/ -X05	90	14	68	19.85	M 8	15	42	25	**0187626**
1877X03/ -X05	110	18	80	24.85	M10	19	56	30	**0187726**

Clamping arms for special versions



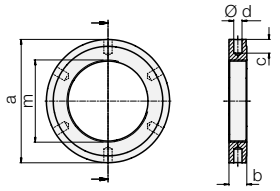
Swing clamp	a	b	Ø d + 0.05	□ k	Part no.
1873X03/ -X05	62	7	7.85	12	**3548355**
1874X03/ -X05	72	10	11.85	16	**3548356**
1875X03/ -X05	95	12	15.85	20	**3548357**
1876X03/ -X05	116	14	19.85	25	**3548353**
1877X03/ -X05	143	18	24.85	30	**3548358**

Contact bolts, dome head



Swing clamp	a	b	f	R	SW	Part no.
1873X03/ -X05	32.5	30	M 4	15	7	**3614141**
1874X03/ -X05	33.5	30	M 6	20	10	**3614137**
1875X03/ -X05	48.5	45	M 6	20	10	**3614138**
1876X03/ -X05	50	45	M 8	20	13	**3614139**
1877X03/ -X05	66.5	60	M10	35	17	**3614140**

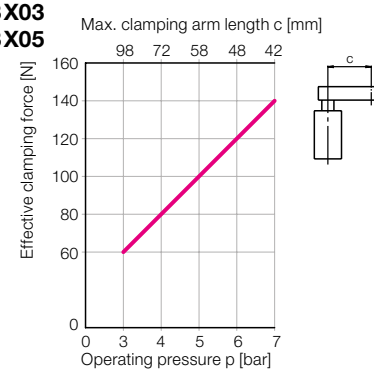
Flange nut



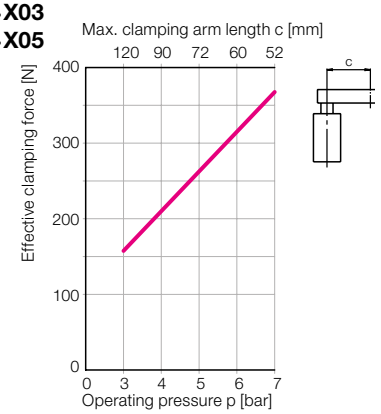
Swing clamp	Ø a	b	c	Ø d	m	Part no.
1873X03	62	12	8	4x6	M 40x1.5	**3527040**
1874X03	80	13	10	6x6	M 52x1.5	**3527082**
1875X03	90	13	10	6x6	M 60x1.5	**3527042**
1876X03	100	14	12	6x8	M 70x1.5	**3527083**
1877X03	120	16	12	6x8	M 85x2.0	**3527084**

Effective clamping force

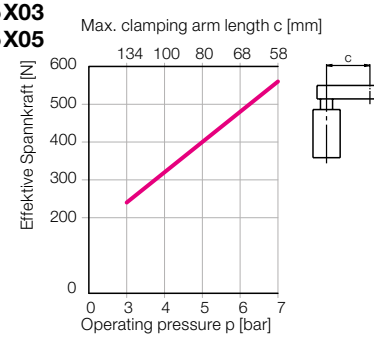
1873 X03
1873 X05



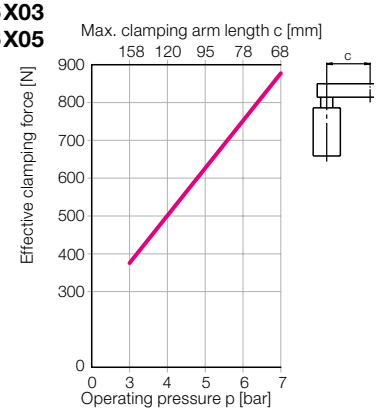
1874 X03
1874 X05



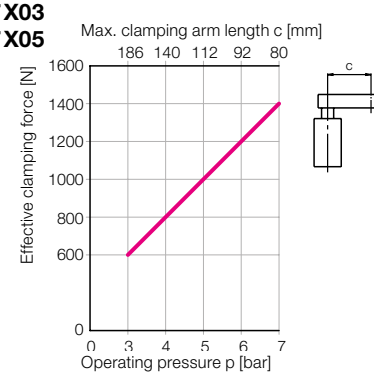
1875 X03
1875 X05

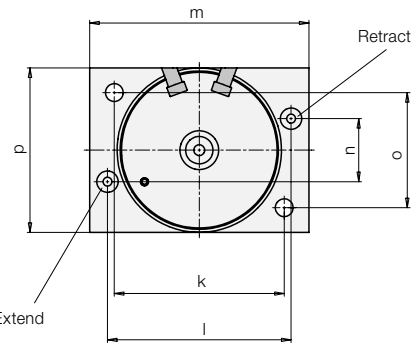


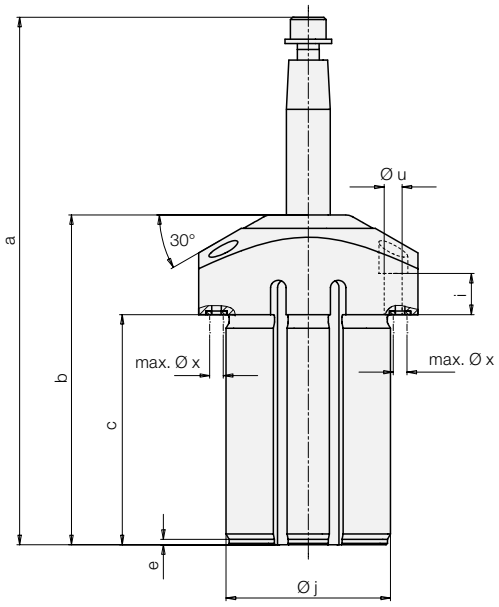
1876 X03
1876 X05



1877 X03
1877 X05







Clamping force Schwenkspanner

Clockwise rotation Counterclockwise rotation		**1873 105** **1873 205**	**1874 105** **1874 205**	**1875 105** **1875 205**	**1876 105** **1876 205**	**1877 105** **1877 205**
Piston Ø	[mm]	20	32	40	50	63
Piston rod Ø	[mm]	8	12	16	20	25
a	[mm]	120	143	189	202	239.5
b	[mm]	76	94.5	120.5	130	150
c	[mm]	48	61	84	85	91
e	[mm]	2	2	2	2	2
i	[mm]	7.5	11	15	19	27
Ø j	[mm]	40	52	60	70	85
k	[mm]	44	54	62	72	86
l	[mm]	47	56	67	76	90
m	[mm]	60	68	80	90	106
n	[mm]	18	27	23	36	40
o	[mm]	25	36	42	48	66
p	[mm]	40	52	60	70	85
Ø u	[mm]	5.5	6.5	6.5	8.5	8.5
max. Ø x	[mm]	3.5	3.5	3.5	5	5
Piston rod Ø		4.47x1.78	4.47x1.78	4.47x1.78	7x1.5	7x1.5
Part no. spare O-ring		**3000 968**	**3000 968**	**3000 968**	**3000 342**	**3000 342**

O-rings are included in delivery. Other dimensions see page 2.

Compared with traditional reed switches the electronic magnetic sensors offer the following advantages:

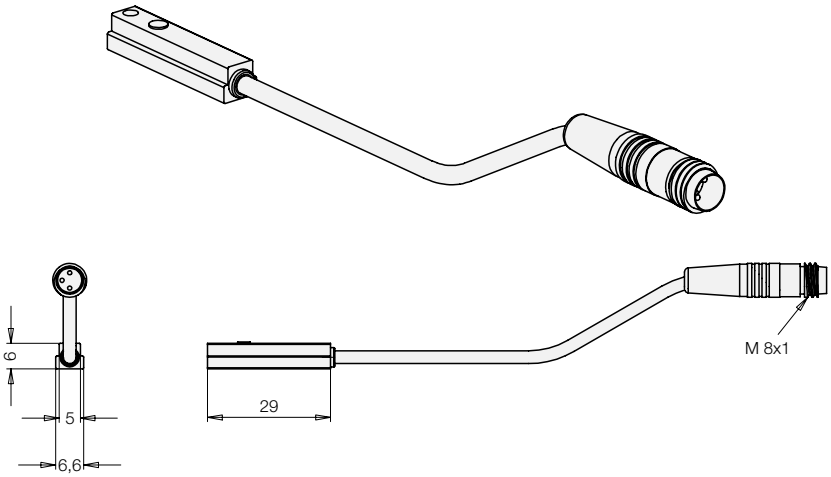
- Indifference to shock and vibration
- Bounce-free output signal
- Only one switching point
- Wear resistant
- Protection against reverse battery
- Protected against short circuits

Electric connection is made as per traditional inductive proximity switches; up to four magnetic sensors can be connected in series.

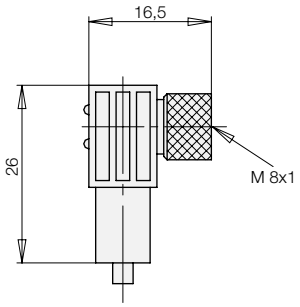
Important notes

Steel can influence the magnetic field of the magnetic piston and thereby the position of the switching point. If the pneumatic swing clamp is flange mounted on a steel plate, the sensor has to be adjusted by displacement in the mounted condition. If the magnetic sensor is outside of a protecting bore hole and is exposed to changing influences of adjacent steel parts, e.g. swarf, protection for 30 mm has to be provided.

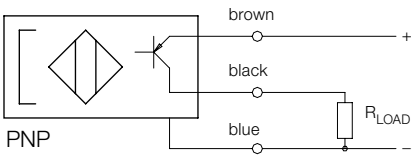
Electronic magnetic sensor



Connecting cable with coupling



Connecting scheme



Technical data	**Electronic magnetic sensor**	**Connecting cable with coupling**
Cylinder body material	PA 6	
Voltage	10 – 30 V DC	10 – 30 V DC
Residual ripple	max. 10%	
Current load I_{LOAD}	200 mA	
Current consumption	≤ 25 mA	
Protected against short circuits	yes	
Protection against reverse battery	installed	
Switching hysteresis	typ. 1.5 mm	
Protection as per IEC 529	IP 65	IP 67
Environmental temperature	–25°C up to +70°C	–25°C up to +90°C
Plug connection	M8 plug	M8 coupling
Function display	LED (yellow)	LED (yellow)
Voltage	no	LED (green)
Cable, length of cable	0.26 m	PUR, 5 m
Output	pnp	
Part no. (1 off)	**3829147**	**3829099**

Further accessories

see data sheet G 2.140

- Pin-and-socket connector
- Y-distributor
- Reversing plug
- Voltage regulator

Accessories for Venting of the Spring Area
of single-acting clamping elements and work supports

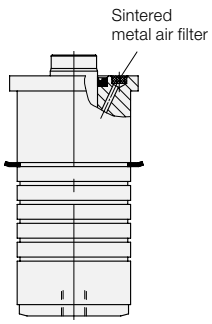
Introduction

Due to increased use of coolants and cutting fluids in metal cutting machining there is also an increased danger that some very aggressive fluids penetrate into the spring areas of single-acting clamping elements and work supports, causing malfunctions.
It is important to realize these problems already in the period of design. The following versions show possible solutions to the above problems.

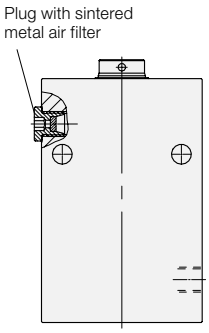
Catalogue elements with venting of the spring area

Single-acting clamping elements

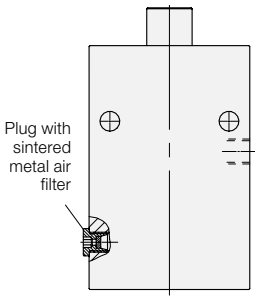
without venting port



with venting port



Work supports



See data sheets:

Single-acting clamping elements without venting port	Single-acting clamping elements with venting port	Work supports	
B 1.310	**B 1.309**	**B 1.900**	**B 1.943**
B 1.480	**B 1.5091**	**B 1.910**	**B 1.944**
	B 1.570	**B 1.911**	**B 1.9470**
	B 1.7441	**B 1.914**	**B 1.9471**
	B 1.849	**B 1.921**	**B 1.9472**
	B 1.880	**B 1.9401**	**B 1.950**
	B 1.881	**B 1.9405**	**B 1.9501**
	B 1.891	**B 1.942**	**B 1.9503**
	B 1.892		

Why venting has to be made?

Excess pressure or depression in the spring area change the spring forces which leads to malfunctions.

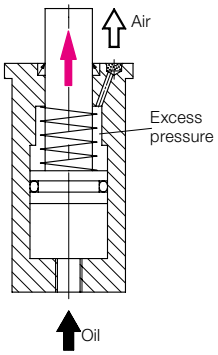
Formation of condensation water promotes rust formation and can lead to a complete failure of the elements.

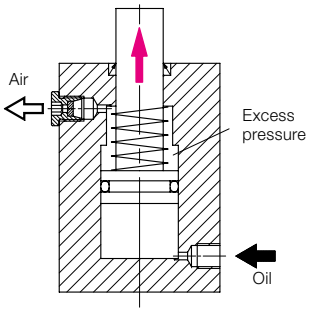
Leakages of hydraulic seals must drain off to the exterior without pressure, otherwise there will be malfunctions.

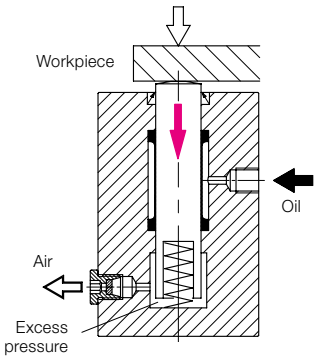
Dust and swarf are retained by sintered metal air filters.

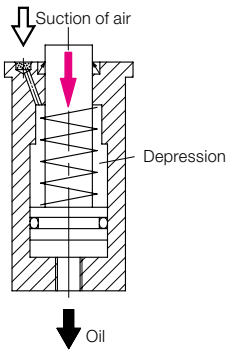
Liquids are the real problem, because they are drawn off through the air filter. Thereby the breathing spring area is reduced, a higher excess pressure or depression is caused and the function is impaired.

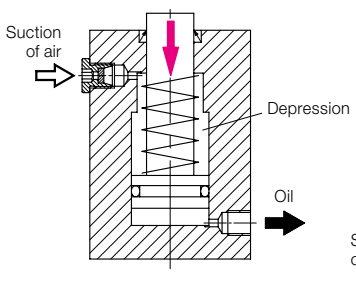
What happens during venting?

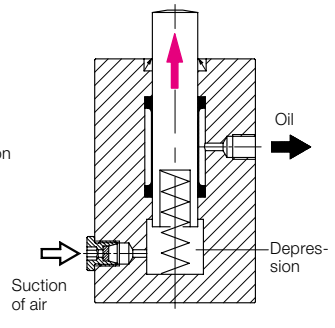








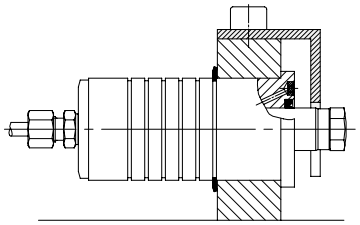




Precautions

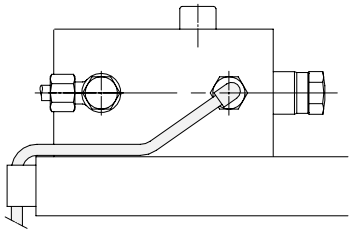
If there is the danger that liquids enter the system, you have to prevent it.

Cover



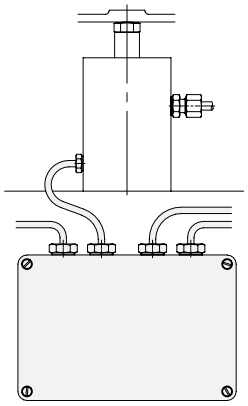
Clamping elements without venting port can be covered, but due to the nowadays usual quantities of coolants this does not seem to be successfull. In such applications you should use other clamping elements, preferably double-acting elements.

Venting hose



Connection of a venting hose is indicated if the opening is displaced to a point where no liquid can penetrate.

Closed venting system



The spring area shall be increased by the connection of an additional area so that only a little excess pressure or depression will be generated so that neither the functioning of the elements will be influenced nor liquids will be drawn off. Electric wiring boxes provided with connecting threads for venting hoses proved to be worthwhile. The volume of this “additional area” should be **ten times the stroke volume** of all connected elements.

Important note

In the case of temperature variations, condensation water can precipitate in a closed ventilation system. Possibly also coolants can enter into the system through the connected clamping elements and work supports.

Recommendation

Open the empty housing regularly (depending on the operating conditions) and dry the interior.

Venting accessory

Plastic hose

for the following connecting elements	Part no.
black	**3890131**

Insertion nipple fitting

Size	Part no.
M 5	**3890091**
1/8	**3890092**
1/4	**3890093**

L-insertion nipple fitting

swivelling Size	Part no.
M 5	**3890094**
1/8	**3890095**
1/4	**3890096**

L-insertion nipple distributor

Part no.
3890097

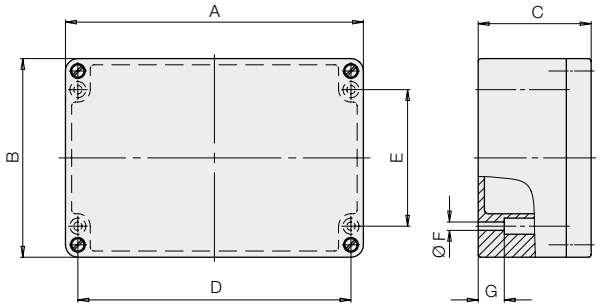
Hose connection L-piece 90°

Part no.
3890098

Steel tubes and fittings

see data sheet F 9.300

Empty housing, material: aluminium, grey lacquered



Volume [cm³]		400	1,600	2,800
A	[mm]	125	160	260
B	[mm]	80	160	160
C	[mm]	57	91	91
D	[mm]	113	140	240
E	[mm]	52	110	110
Ø F	[mm]	4.3	6.3	6.3
G	[mm]	10	21	21
Part no.		**6350907**	**3141188**	**6355833**

Calculation example for a clamping fixture with the elements below

Quantity	Element	Piston / bolt Ring-Ø [mm]	Stroke [mm]	Air volume per stroke [cm³]
1	Block cylinder 1513000	25/16	8	2.3
2	Swing clamp 1885104	40	22	55.3
2	Threaded work support 1957002	50	20	78.5
Total				**136.1**

Selection of empty housing:

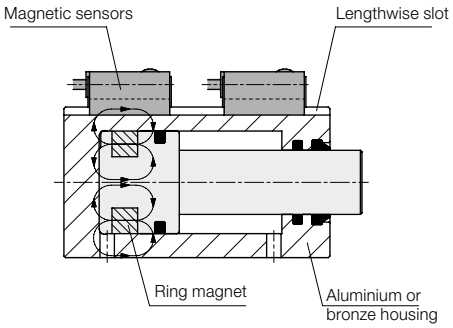
136.1 x factor 10 = **1,361 cm³**

suitable empty housing (1,600 cm³)

Part no. 3141188

Magnetic Sensors for Position Monitoring
of block cylinders and pneumatic swing clamps

Advantages
- Compact design, minimum space requirement
- Adjustable switching points by displacement of the sensor
- Monitoring of several positions
- Indifference to shock and vibration
- Bounce-free output signal
- Only one switching point
- Wear resistant
- Protected against reverse battery
- Protected against short circuits
- Sensor locking with 2 screws

Function


Application
Magnetic sensors are used for position monitoring of block cylinders and pneumatic swing clamps of the following data sheets:
- Block cylinders with aluminium or bronze housing B 1.554
- Block cylinder with guide housing B 1.738
- Pneumatic swing clamp J 7.202

Monitoring of several positions
In the two lengthwise slots of the cylinder body several sensors can be fixed (depending on the length of the slot or the stroke).
In one slot, the minimum distance between the switching points is 6 mm; with two slots it is 3 mm.

Influencing the magnetic field with adjacent, magnetisable components (e.g. steel parts)
In order to guarantee perfect functioning, it is recommended to maintain a distance of at least 25 to 30 mm between magnetic sensor and magnetisable components. The function is indeed possible with a smaller distance but this depends highly on the individual circumstances for fitting. Thus ordinary steel bolts can also normally be used for fastening the cylinder. In borderline cases, screws of non-magnetisable steel (e.g. VA screws) can cause an improvement in the magnetic field.

Influencing the magnetic field with adjacent magnetic sensors
If several cylinders with magnetic sensors are installed directly adjacent to one another, the magnetic sensors can have a reciprocal influence and malfunctions occur. Troubles of functioning can occur. A magnetisable steel sheet can help, placed between the cylinders or magnetic sensors as a shield.

Demands on voltage supply
Frequently a simple two-phase bridge connection is used, as it is often used for contactor or relay control. Such a connection is not suitable for voltage supply of position monitorings! In figure 1 the progression of the output voltage of such a connection is represented over time. You can recognise that the voltage obtains temporarily the zero point. An electronic system could not function correctly in this case. In addition, you see that the peak values of the voltage exceed considerably their mean value.

The electronic can be destroyed by too high peak spikes.

Usually voltmeters or multimeters measure the mean value of the voltage. The peak value is increased approx. by factor 1.5. A measure of quality of a d.c. voltage is the residual ripple. An ideal d.c.voltage, as it is generated by a battery, has a residual ripple of 0%, the above described two-phase bridge connection obtains a residual ripple of 48%. 10% is admissible!

The residual ripple can be improved by topping a sufficiently-designed capacitor. This is called “smoothing” of the voltage. But thereby the mean value of the d.c. voltage is increased. Therefore it is recommended to provide a “smoothed” voltage supply when planning an installation.

Incorrect: **Correct:**

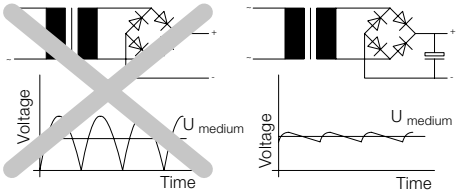
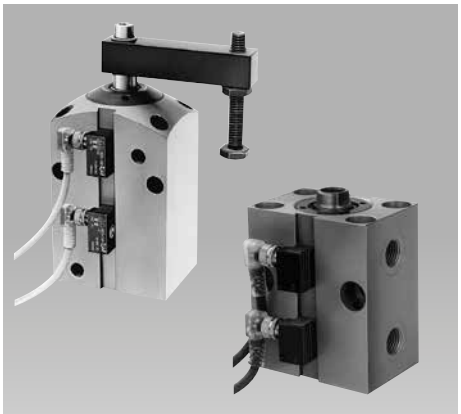


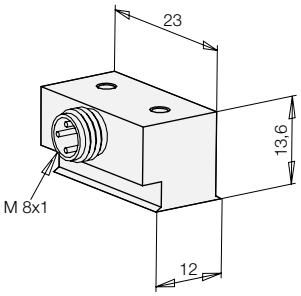
Figure 1: Generation of supply voltage

Description/Function
Electronic magnetic sensors allow position monitoring of the pistons of cylinders with non-magnetisable housings (aluminium or bronze).
An annular permanent magnet is fixed to the piston, and its magnetic field is detected by an electronic magnetic sensor.
The magnetic sensors are fixed outside in the lengthwise slots of the cylinder body. The switching points are adjustable by displacement of the magnetic sensors in the lengthwise slots of the body.

Spikes
A danger for position monitorings are elements with high inductivity, which are operated with the same voltage supply as the position monitorings. Such elements, as e.g. solenoid valves, contactors and motors can generate high and high-energy peak spikes, which are transmitted by the voltage supply to the position monitorings.
Therefore critical elements have to be screened. For this purpose recovery diodes or RC-networks are indicated, which are mounted directly at the sources of interference. An alternative solution is the separated voltage supply for position monitorings and critical consumers.

Application examples


Dimensions



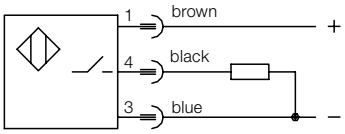
Electric connection

Electric connection is made as per traditional inductive proximity switches.
Up to four magnetic sensors can be connected in series.

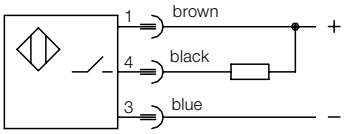
Switching hysteresis of approx. 3 mm and path

This has to be considered already when adjusting the magnetic sensors. For static pistons, the magnetic sensor must always be pushed forward to the piston from the opposite direction.
Magnetic sensors with short path are available on request.

Connecting scheme



pnp = plus switching

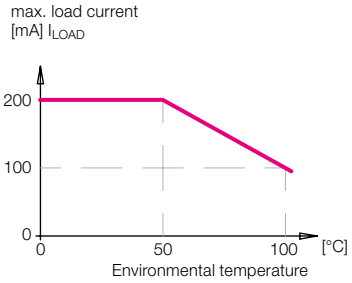


npn = minus switching

Technical data

Body material	aluminium black anodised	
Voltage	10 – 30 V DC	
Residual ripple	max. 10 %	
Current load I_{LOAD}	200 mA – up to 50 °C 150 mA – at 75 °C 100 mA – at 100 °C	
Current consumption	< 15 mA	
Voltage drop (max. load)	< 2 V	
Protected against short circuits	yes	
Protection against reverse battery	installed	
Switching frequency	1 kHz	
Switching hysteresis	3 mm	
Protection as per DIN 40050	IP 67	
Environmental temperature	–25 °C up to +100 °C	
Port	M8 plug	
LED	no	
Output (interlock)	**pnp**	**npn**
Part no. (1 off)	**3829234**	**3829240**

Temperature curve



Maximum operating temperature

- Magnetic sensor +100 °C
- Permanent magnet: +100 °C
- Connecting cable with right angle plug: +90 °C

Magnetic sensors for an operating temperature up to 120°C are available on request.

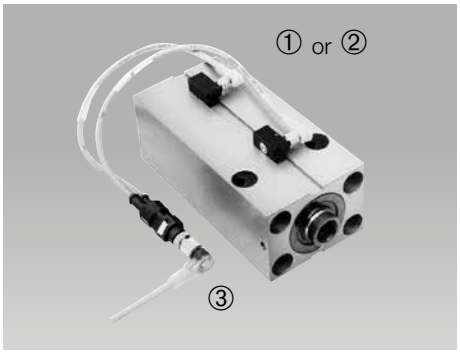
Connecting cable

With angle plug M8

Technical data

Port	M8 plug, knee-type	
Voltage	10 – 30 V DC	
Protection as per DIN 40050	IP 67	
Environmental temperature	– 25 °C to +90 °C	
LED: Voltage Function display	(green) (yellow)	
Cable, length of cable	PUR, 5 m	
Output (interlock)	**pnp**	**npn**
Part no. (1 off)	**3829099**	**3829124**

Y-distributor pnp



The Y-distributor allows connection of two proximity switches or magnetic sensors at a four-pole plug-type connector M12. For each cylinder only one cable has to be placed.
For easier adjustment of the switching points the right angle plugs M8 are equipped with two LEDs each, which indicate the operating voltage and the switching position. Plug-type connector M12 is equipped with three LEDs.

① Y-distributor with cable 0.3 m
with 2 right angle plugs M8 with 2 LED each and 1 plug-type connector M12 with 3 LED
Part no. 3829 118

② Y-distributor with cable 0.3 m
with 2 straight plugs M8 without LED and 1 plug-type connector M12 with 3 LED
Part no. 3829 125

③ Right angle plug M12 with 3 LED
5 m 4-wire cable for common connection of the Y-distributor
Part no. 3829 106

With pnp angle plug M12

① Right angle plug M12 with 2 LED
3 m 3-wire cable for common connection of the Y-distributor
Part no. 3829049

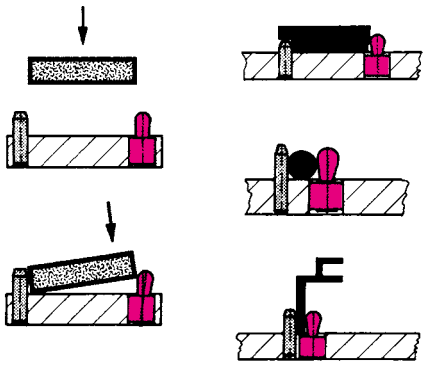
② Straight plug M12 without LED
5 m 3-wire cable for common connection of the Y-distributor
Part no. 3829078

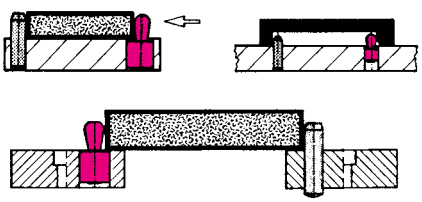
Technical data

Voltage	10 – 30 V DC
Protection as per DIN 40050	IP 67
Environmental temperature	– 25 °C to +90 °C
LED: Voltage Function display	(green) (yellow)

Spring Clamping Element
10 - 300 N, with and without sealing

These spring clamping elements are designed for quicker, safer and more economic workpiece positioning and clamping within clamping range of 10-300 N.

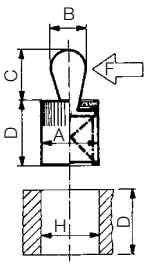


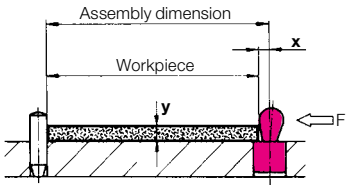


Function
The clamping force is generated by displacement of a spring-loaded pin. Clamping force and clamping path are indicated in the chart.

Materials
Body: aluminium
Pressure pin: steel case hardened and galvanised

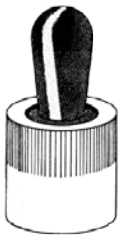
With sealing
Elements of range 3112 1XX are equipped with additional sealing against swarf and coolants and are particularly suitable for its application in the metal cutting machining.

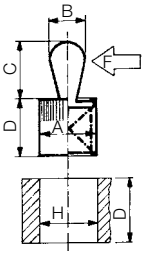


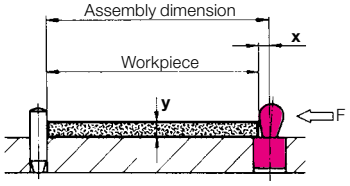


A	B	C -1	D	H	F [N]	y=1.0 X	y=2.0 X	y=3.0 X	y=4.5 X	y=6.0 X	y=8.0 X	y≥10.0 X	Weight [g]	Part no.
6	3	4	7	6H11	10	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1	**3112120**
					20								1	**3112121**
					40								1	**3112122**
10	5	6	12	10H11	20		1.5	1.7	1.7	1.7	1.7	1.7	2	**3112123**
					50								2	**3112124**
					100								2	**3112125**
10	6	10	12	10H11	40				1.7	1.9	1.9	1.9	2	**3112126**
					75								2	**3112127**
					150								2	**3112128**
12	8	13	14	12H11	50					2.4	2.6	2.6	8	**3112129**
					100								8	**3112130**
					200								8	**3112131**
16	10	16	18	16H11	100						3.1	3.4	16	**3112132**
					200								16	**3112133**
					300								16	**3112134**

Without sealing
Elements of range 3122 2XX without the extra sealing are suitable for assembly and welding.



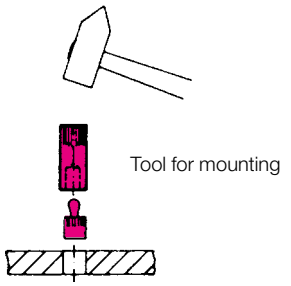




A	B	C -1	D	H	F [N]	y=1.0 X	y=2.0 X	y=3.0 X	y=4.5 X	y=6.0 X	y=8.0 X	y≥10.0 X	Weight [g]	Part no.
6	3	5.0	7	6H11	10	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1	**3112000**
					20								1	**3112001**
					40								1	**3112002**
10	5	7.7	11	10H11	20		1.5	1.7	1.7	1.7	1.7	1.7	2	**3112003**
					50								2	**3112004**
					100								2	**3112005**
10	6	11.6	11	10H11	40				1.7	1.9	1.9	1.9	2	**3112006**
					75								2	**3112007**
					150								2	**3112008**
12	8	15.1	13	12H11	50					2.4	2.6	2.6	8	**3112009**
					100								8	**3112010**
					200								8	**3112011**
16	10	18.2	17	16H11	100						3.1	3.4	16	**3112012**
					200								16	**3112013**
					300								16	**3112014**

Mounting

Tools as per chart opposite are available for mounting. Insertion into bore hole can be effected by hammer or press (see fig.).

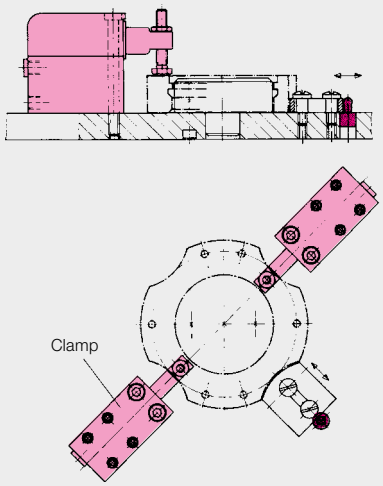


Tools for mounting

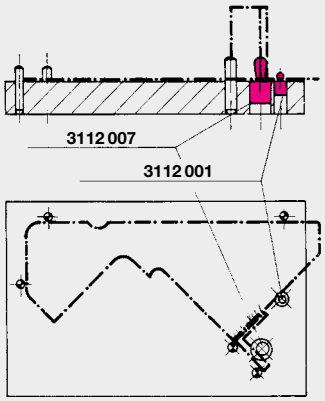
5 sizes as per dimension B as per chart page 1.

	Part no.
3	**3112140**
5	**3112141**
6	**3112142**
8	**3112143**
10	**3112144**

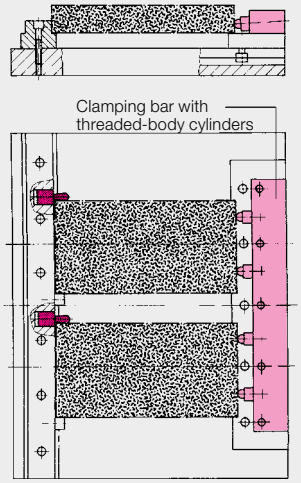
Application examples



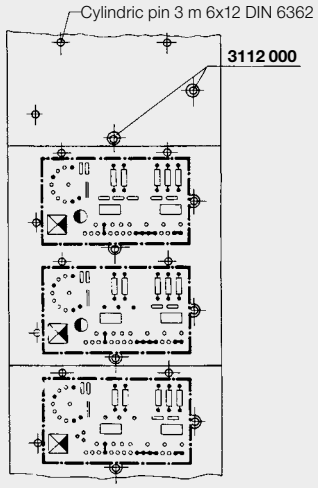
Drilling fixture



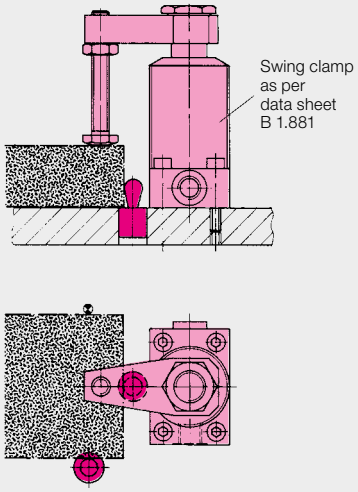
Welding fixture



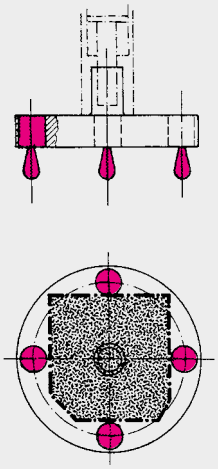
Multiple clamping fixture



Printed-board assembly



Positioning and clamping fixtures



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Römheld GmbH
Friedrichshütte
Römheldstraße 1–5
35321 Laubach
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Phone +49 6405 89-0
info@roemheld.de
www.roemheld.com

ROEMHELD North America
927 Horan Dr. Fenton
MO 63026
USA

Phone 1-800-827-2526
or (636) 386-8022
info@roemheld-usa.com
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