



ROEMHELD
HILMA ■ STARK

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



A 0.100

General characteristics
of hydraulic equipment

Bore Clamps



B 1.481

with and without
centring function



B 1.4841

Block-type
without centring function



B 1.4842

Flange-type version
without centring function



B 1.4843

Cartridge type
without centring function



B 1.485

Block-type
eccentric



B 1.486

with and without
centring function



B 1.487

Block-type
without centring function

Position Flexible Clamping Elements



B 1.711

Threaded-Body Cylinders
with locking piston



B 1.732

Position flexible clamps



B 1.733

**Position flexible
clamping claw**

Clamps and Clamping Cylinders



B 1.372

Low-block clamping cylinders
max. 500 bar



B 1.480

**Hydraulic threaded-body
clamping modules**
max. 500 bar



B 1.730

**Clamping and
supporting elements**
max. 300 bar



B 1.7441

Hollow cylinders
max. 500 bar



B 1.8231

Flat clamps
max. 500 bar



B 1.8233

Block clamps
max. 70/100 bar



B 1.8242

Slide pivot clamp
max. 350 bar

Hinge Clamps, Mini Hinge Clamps, Compact Clamps and Flat Lever Clamps



B 1.825

Hinge clamps
200 bar



B 1.8251

Hinge clamps
250 bar



B 1.8252

Mini hinge clamps
250 bar



B 1.8262

Mini hinge clamps
70 bar



B 1.8268

Hinge clamps
70 bar



B 1.827

Compact clamps
cartridge type



B 1.8271

Mini compact clamps



B 1.828

Compact clamps
flange design



B 1.829

Flat Lever Clamps
cartridge type



B 1.8291

Flat Lever Clamps
built-in and block-type

Electric Swing Clamps



B 1.8310

top flange



B 1.8320

parallel drive

Hydraulic Swing Clamps

 B 1.848 mini	 B 1.849 bottom flange, top flange, threaded-body type single acting	 B 1.8491 bottom flange, top flange, threaded-body type double acting	 B 1.8500 top flange position monitoring max. 70 bar	 B 1.8510 top flange position monitoring max. 120 bar
 B 1.852 cartridge type position monitoring max. 350 bar	 B 1.853 top flange position monitoring max. 350 bar	 B 1.854 top flange position monitoring max. 350 bar	 B 1.880 top flange with overload protection device max. 500 bar	 B 1.8801 top flange with reinforced swing mechanism max. 500 bar
 B 1.8802 pendulum eye or fork head top flange max. 500/160 bar	 B 1.8803 cartridge type with overload protection device max. 500 bar	 B 1.8805 piston rod locking position monitoring max. 250 bar	 B 1.8806 without swing stroke position monitoring max. 350 bar	 B 1.8807 without swing stroke with reinforced swing mechanism max. 250 bar
 B 1.881 bottom flange with overload protection device max. 500 bar	 B 1.8811 bottom flange with reinforced swing mechanism max. 500 bar	 B 1.8812 pendulum eye or fork head bottom flange max. 500/160 bar	 B 1.890 block-type with overload protection device max. 500 bar	 B 1.891 threaded-body type with overload protection device max. 500 bar
 B 1.892 threaded-body type with overload protection device max. 500 bar	 B 1.8921 threaded-body type with reinforced swing mechanism max. 500 bar			

Hydraulic Work Supports



B 1.900

round body
single acting
max. 500 bar



B 1.910

round body
single acting
max. 500 bar



B 1.911

round body
double acting
max. 500 bar



B 1.914

round body
single acting
max. 500 bar



B 1.921

block-type
single acting
max. 500 bar



B 1.930

block-type
double acting
max. 550/400 bar



B 1.940

M30
single acting
max. 500 bar



B 1.9401

M30
single acting
max. 500 bar



B 1.9402

M30
double acting
max. 500 bar



B 1.9405

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
single acting
max. 500 bar



B 1.9470

M26 – M45
single acting
max. 70 bar



B 1.9471

M26 – M45
double acting
max. 70 bar



B 1.9472

M26 with shaft
single acting
max. 70 bar



B 1.9474

top flange
single acting
max. 70 bar



B 1.950

M45 – M90
single acting
max. 500 bar



B 1.9501

M45 – M90
single acting
max. 500 bar



B 1.9503

top flange
single acting
max. 500 bar

Centering / Positioning



H 4.300

Concentric positioning
and clamping elements



H 4.305

Concentric positioning
and clamping elements



H 4.306

Concentric clamping
elements



H 4.307

Parallel slide
centring element



H 4.400

Concentric vise –
Power Clamp Centric

Fixture Clamps



I 4.112

Long Stroke

clamping against the fixed jaw
jaw width 40 and 65 mm



I 4.120

concentric clamping
jaw width 40 and 65 mm



I 4.130

position flexible
jaw width 40 mm

Pneumatic Swing Clamps



J 7.201

external thread
bottom flange



J 7.202

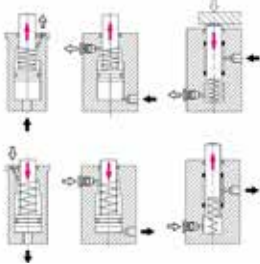
block-type



J 7.203

top flange

Accessories



G 0.110

Venting of the spring area



G 2.140

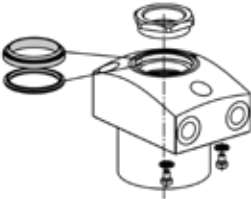
Magnetic sensors for position monitoring



G 3.812

Spring clamping elements

Services



S 0.001

Seal kits



S 1.000

Service Tools



S 1.100

Service Products



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	$t_{u \min.} = -10^{\circ}\text{C}$ $t_{u \max.} = +50^{\circ}\text{C}$		
Relative humidity	max. 70 %		
Transport, storage and operation	Not condensing or protected against condensation		
Temperature range of fluid	$t_{m \min.} = +10^{\circ}\text{C}$ $t_{m \max.} = +60^{\circ}\text{C}$		
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)*** HLP
	FKM (fluoro rubber)	e.g. VITON®	–10 ... + 55 °C HFA, HFB, HFC****
			–20 ... + 80 °C (100 °C)*** HLP
			–20 ... + 150 °C (200 °C)*** HFDR, HFDR****
	FFKM (perfluoroelastomer)	ISOLAST® e.g. HTJ 8325	–10 ... + 150 °C (250 °C)*** HFDR, HFDR****
	* 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	$v_{\max.} = 0.50 \text{ m/s}$		
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.		

General Characteristics of Hydraulic Equipment

Block cylinders, clamping cylinders

Adm. stroke speed	$v_{\min.} = 0.01 \text{ m/s}$ $v_{\max.} = 0.25 \text{ m/s}$
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. 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. 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. 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 <u>not</u> 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

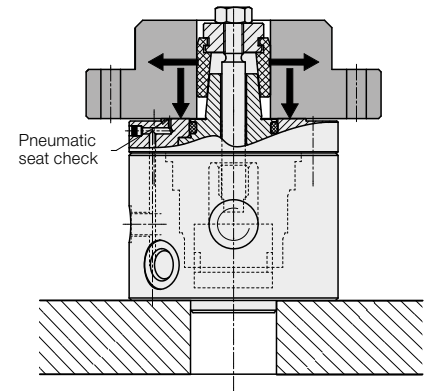
double-acting, pull-type, with and without centring function,
for bore diameter 16 to 46 mm, max. operating pressure from 50 up to 350 bar



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 optionally 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-type 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 axial 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 axial clamping forces and maximum operating pressures see charts and diagrams on page 2.

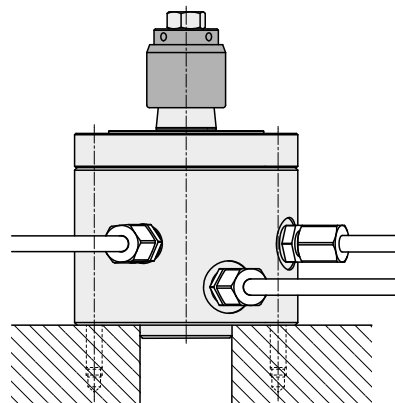
Important notes

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.

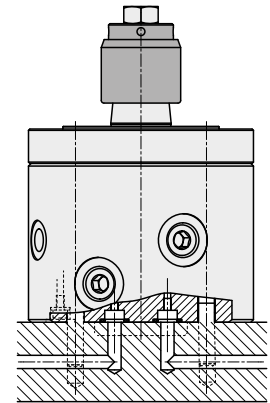
The maximum operating temperature for the segment clamping bushing is 80 °C. Avoid clamping without workpiece, if possible.

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

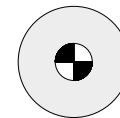
- Bore clamp without centring
Part no.: 4317X20



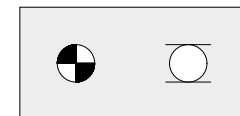
Centring cone in all directions
± 0.5 mm movable

Applications

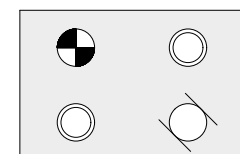
- Centre and clamp in 1 bore hole



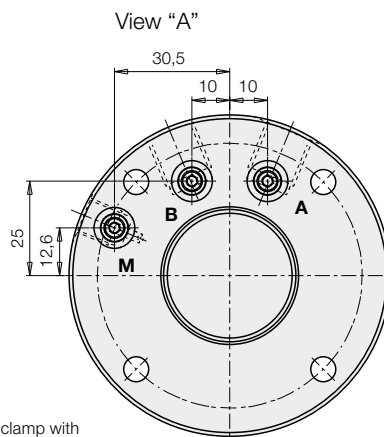
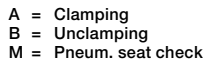
- Centre and clamp in 2 bore holes



- Centre and clamp in more than 2 bore holes



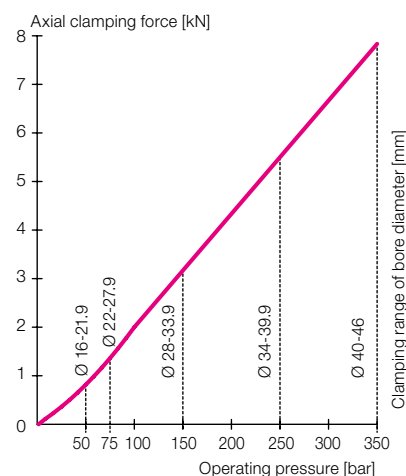
The height can be adapted by the customer, higher precision is available on request



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

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

Axial clamping force*



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

Accessories Workpiece Dimensions

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)

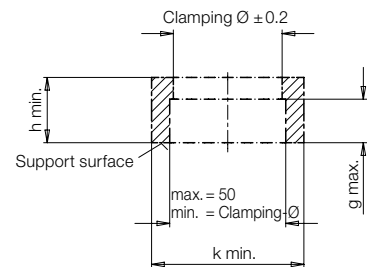
Example of ordering:

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.

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

Example:

Selected clamping diameter = 16 mm

Workpiece tolerance = –0.1 up to +0.3 mm

Workpiece diameter = 15.9 up to 16.3 mm

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.

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

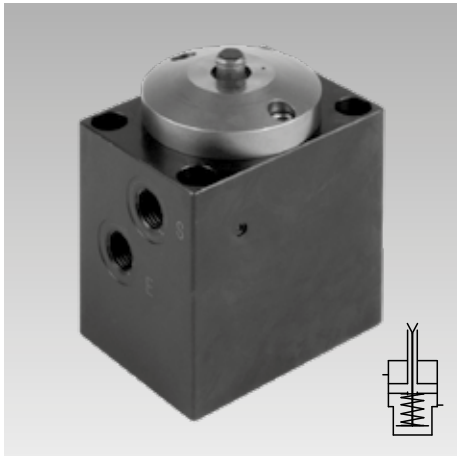
G 1/4 **Part no. 0361987**

G 1/8 **Part no. 0361986**



Bore Clamps

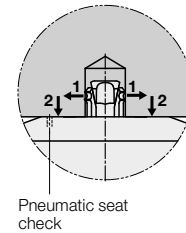
Block-type, without centring function, double acting, for bore diameter 7.8–17.7 mm, max. operating pressure 250 bar



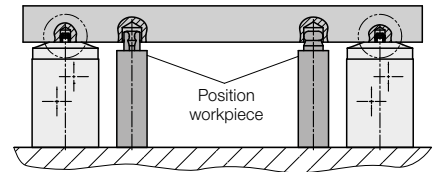
Advantages

- 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



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 tooling depends on the strength of the material for the form-fit tooling 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.

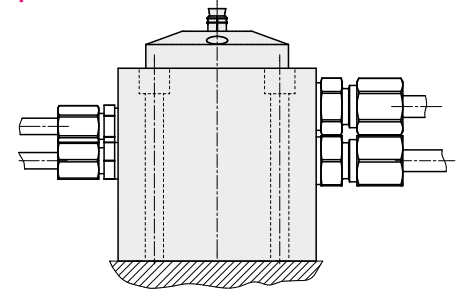
If swarf fall into an open clamping bore, blast air must be continuously switched on.

Clamping bushings and wiper should be exchanged after 100,000 operations.

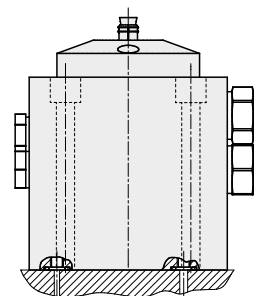
Part numbers for complete clamping sets: see chart on page 3

Connecting possibilities

Pipe thread



Drilled channels

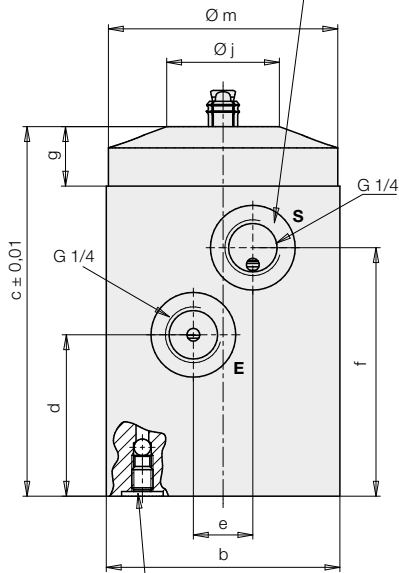


Application example

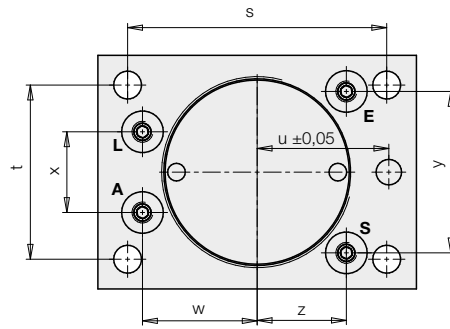
Machining of an oil sump from 5 sides



Connecting the oil supply through drilled channels, the connecting threads have to be closed by a screw plug (see accessories)

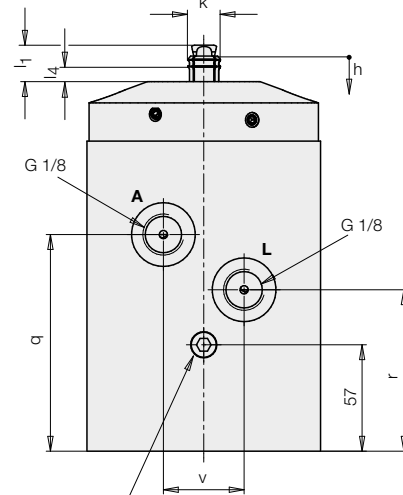
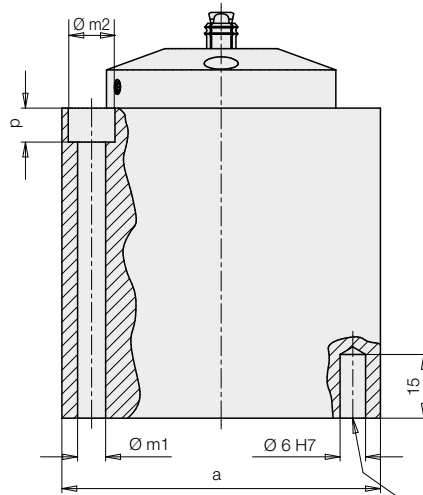


For manifold mounting remove stud screw with ball and insert O-ring into the counterbore (see accessories)



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

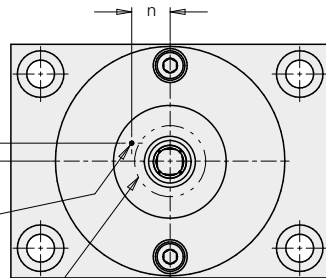
Functional description see page 4



Air-bleed screw only for size 4318211X

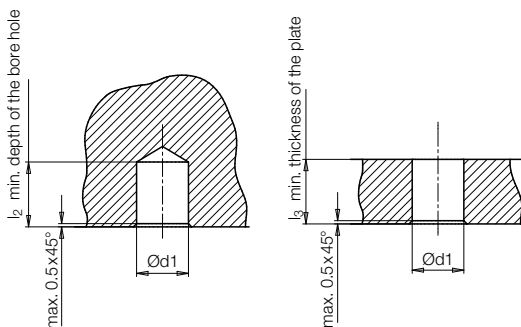
Dowel hole for radial alignment

Bore hole for pneumatic seat control



Minimum support Ø of the workpiece:
Size 1: Ø 18 mm
Size 2: Ø 27 mm

Demands on the bore hole in the workpiece



Adjusting Ø of the clamping bushing: $k = d1 - 0.2 \text{ mm}$

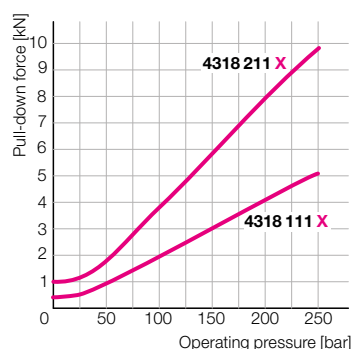
Technical data

Part no. (X = Identification letter bore Ø)			Size 1	Size 2
			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]	8.3	9.8
l ₂ min. depth of the bore hole		[mm]	10	11.5
l ₃ min. thickness of the plate		[mm]	9	11
l ₄		[mm]	3.2	3.7
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

Oring	[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.

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

Bore hole Ø and part numbers

Size 1

Bore Ø*

d1 in mm

Part no.
7.8 – 8.2
8.3 – 9.2
9.3 – 9.7
9.8 – 10.2
10.3 – 11.2

Size 2

Bore Ø*

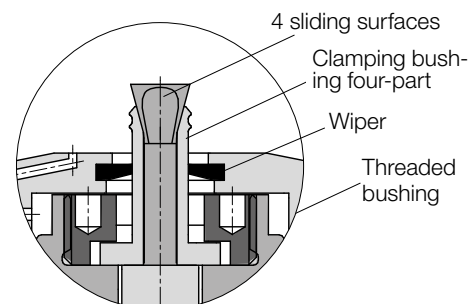
d1 in mm

Part no.
11.3 – 11.7
11.8 – 12.7
12.8 – 13.7
13.8 – 14.7
14.8 – 15.7
15.8 – 16.7
16.8 – 17.7

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
8.3 – 9.2
9.3 – 9.7
9.8 – 10.2
10.3 – 11.2
Screw tool for threaded bushing

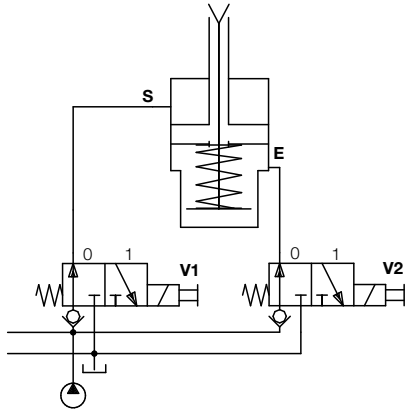
Size 2

Bore Ø*

d1 in mm

Clamping set Part no.
11.3 – 11.7
11.8 – 12.7
12.8 – 13.7
13.8 – 14.7
14.8 – 15.7
15.8 – 16.7
16.8 – 17.7
Screw tool for threaded bushing

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.

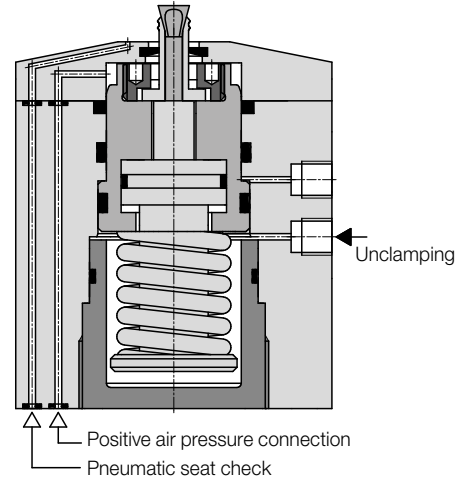
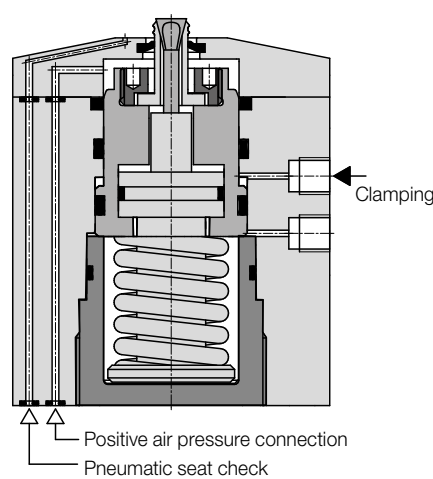
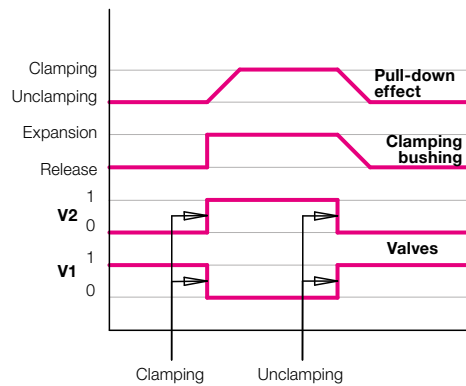
Workpiece unclamping

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.

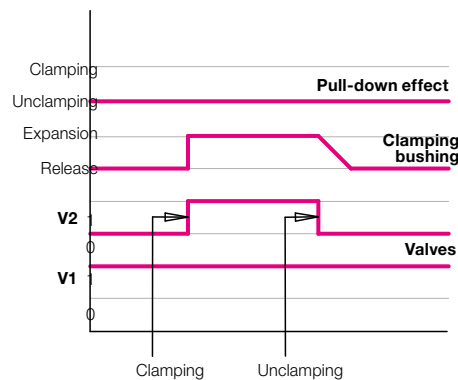
Note:

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.

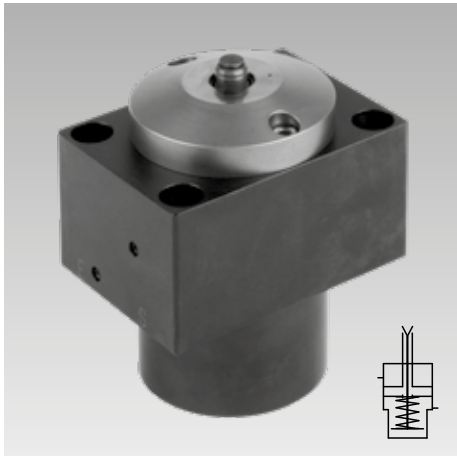
What happens in case of pressure drop of the unclamping pressure?

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

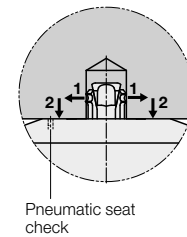
Flange type, without centring function, double acting,
for bore diameter 7.8–17.7 mm, max. operating pressure 250 bar



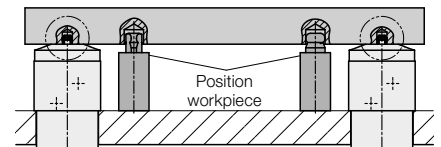
Advantages

- 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.

Important notes

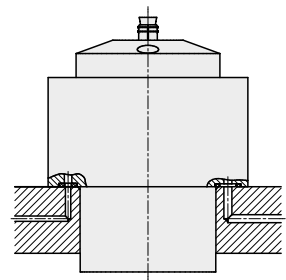
The bore clamp has no centring function.

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° .

Connecting possibilities

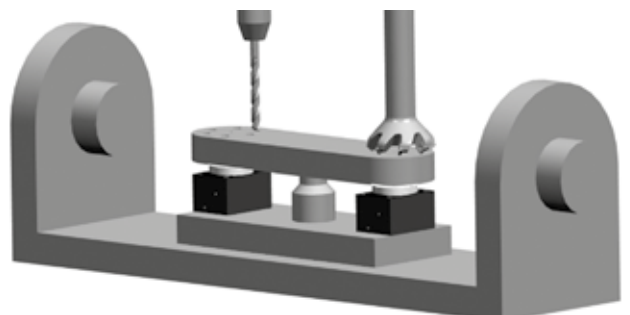
Drilled channels

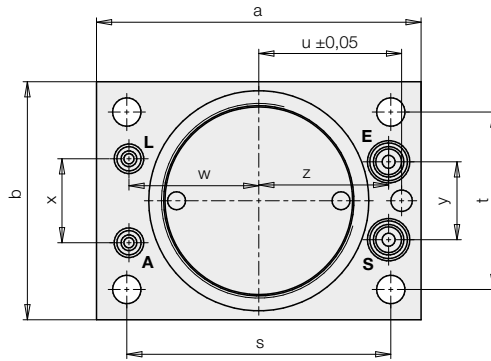


In case of doubt we recommend a clamping test. Clean the support surface and blast clean the clamping bushing before every clamping cycle. If swarf fall into an open clamping bore, blast air must be continuously switched on. Clamping bushings and wiper should be exchanged after 100,000 operations. Part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

Application example

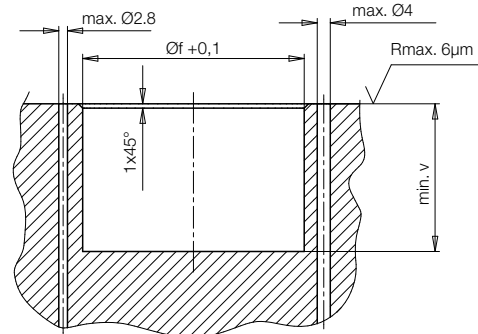
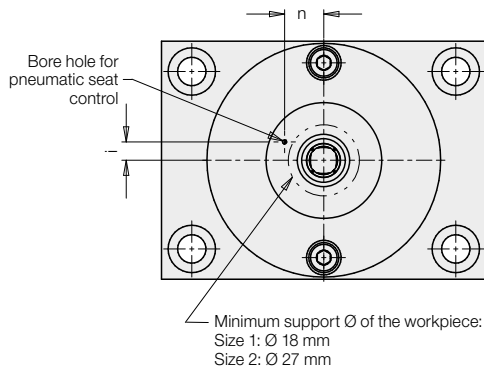
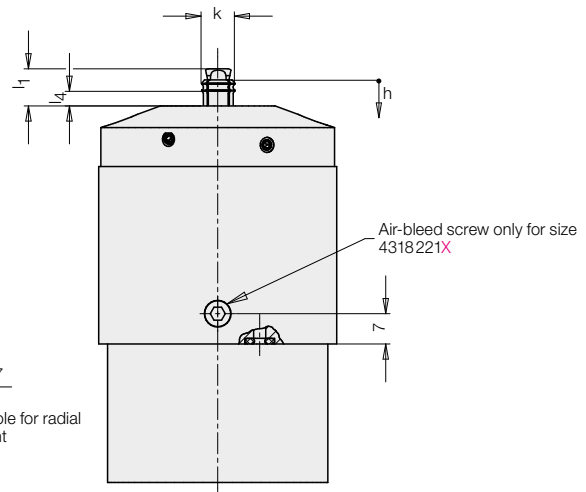
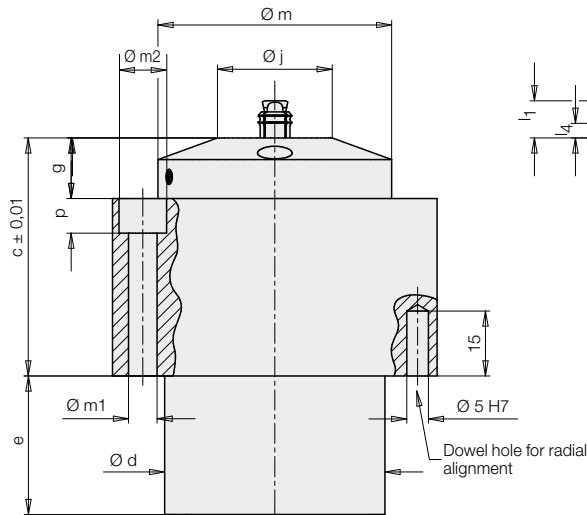
Machining of a plate from 5 sides on an indexing bridge



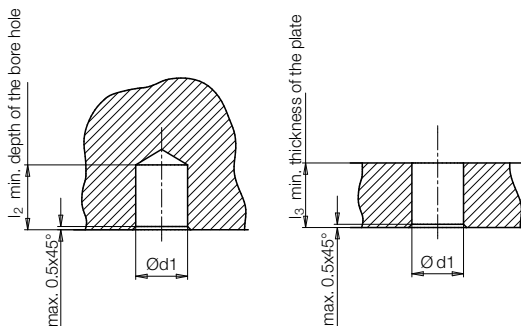


S = Clamping (pull down effect)
E = Unclamping (release of pull down effect and clamping bushing)
A = Seat control
L = Positive air pressure protection

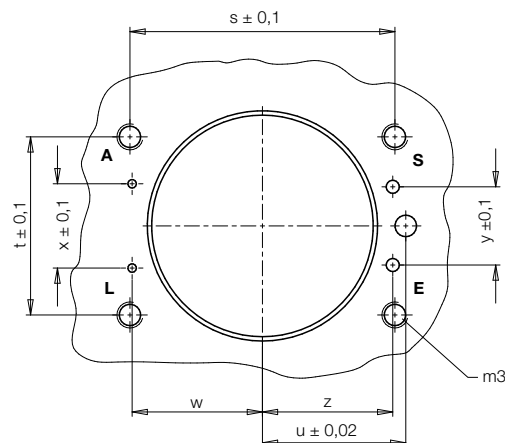
Functional description see page 4.



Demands on the bore hole in the workpiece



Adjusting Ø of the clamping bushing: $k = d1 - 0.2 \text{ mm}$



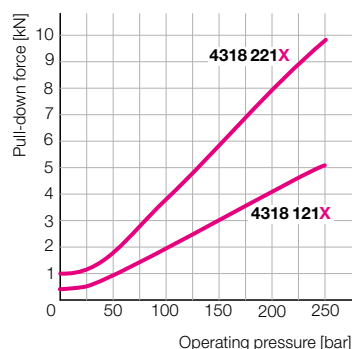
Technical data

			Size 1	Size 2
Part no. (X = Identification letter bore Ø)			4318 121X	4318 221X
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	[cm³]	0.5	1
	Unclamping	[cm³]	10	25
Max. flow rate	[cm³/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]		8.3	9.8
l ₂ min. depth of the bore hole	[mm]		10	11.5
l ₃ min. thickness of the plate	[mm]		9	11
l ₄	[mm]		3.2	3.7
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.

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

Bore hole Ø and part numbers

Size 1

Bore Ø* d1 in mm	Part no.
7.8 - 8.2	4318 121 A
8.3 - 9.2	4318 121 B
9.3 - 9.7	4318 121 C
9.8 - 10.2	4318 121 D
10.3 - 11.2	4318 121 E

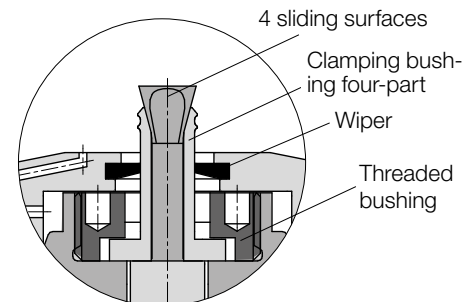
Size 2

Bore Ø* d1 in mm	Part no.
11.3 - 11.7	4318 221 F
11.8 - 12.7	4318 221 G
12.8 - 13.7	4318 221 H
13.8 - 14.7	4318 221 K
14.8 - 15.7	4318 221 L
15.8 - 16.7	4318 221 M
16.8 - 17.7	4318 221 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.



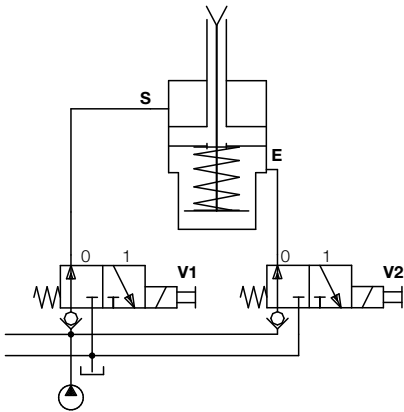
Size 1

Bore Ø* d1 in mm	Clamping set Part no.
7.8 - 8.2	0431 704 A
8.3 - 9.2	0431 704 B
9.3 - 9.7	0431 704 C
9.8 - 10.2	0431 704 D
10.3 - 11.2	0431 704 E
Screw tool for threaded bushing	2010911

Size 2

Bore Ø* d1 in mm	Clamping set Part no.
11.3 - 11.7	0431 703 F
11.8 - 12.7	0431 703 G
12.8 - 13.7	0431 703 H
13.8 - 14.7	0431 703 K
14.8 - 15.7	0431 703 L
15.8 - 16.7	0431 703 M
16.8 - 17.7	0431 703 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.

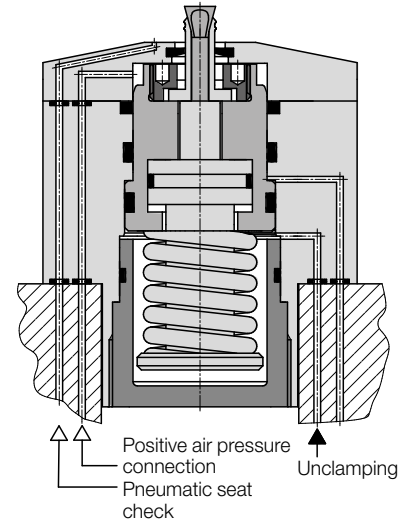
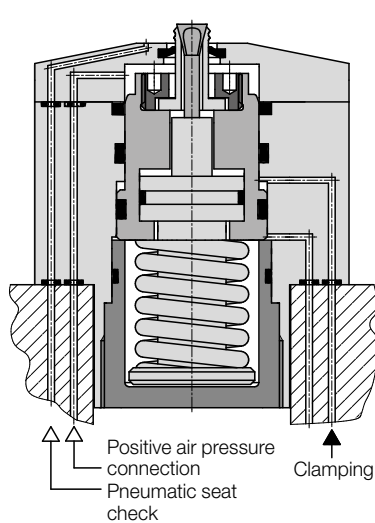
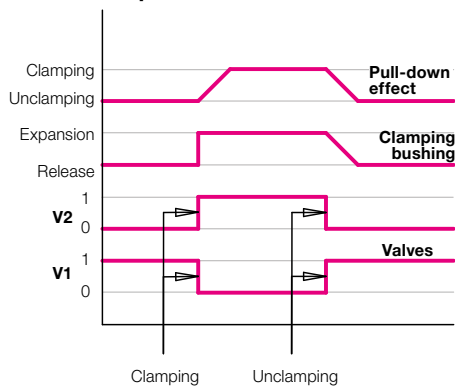
Workpiece unclamping

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.

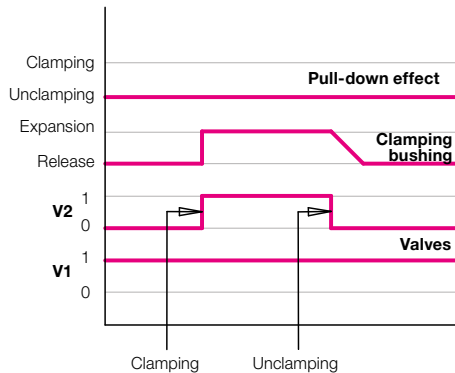
Note:

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.

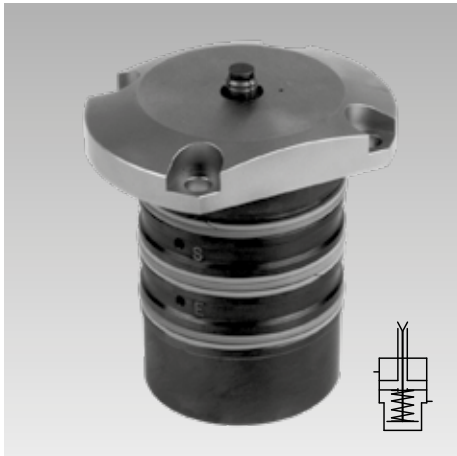
What happens in case of pressure drop of the unclamping pressure?

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

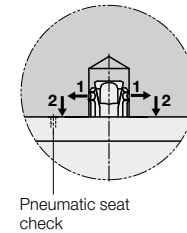
Cartridge type, without centring function, double acting, for bore diameter 7.8–17.7 mm, max. operating pressure 250 bar



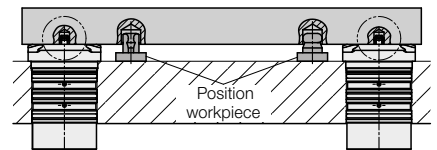
Advantages

- 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



- 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.

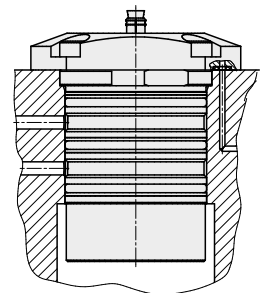
If swarf fall into an open clamping bore, blast air must be continuously switched on.

Clamping bushings and wiper should be exchanged after 100,000 operations.

Part numbers for complete clamping sets: see chart on page 3

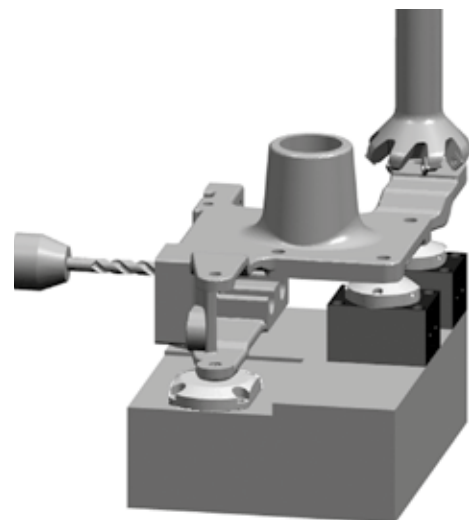
Connecting possibility

Drilled channels

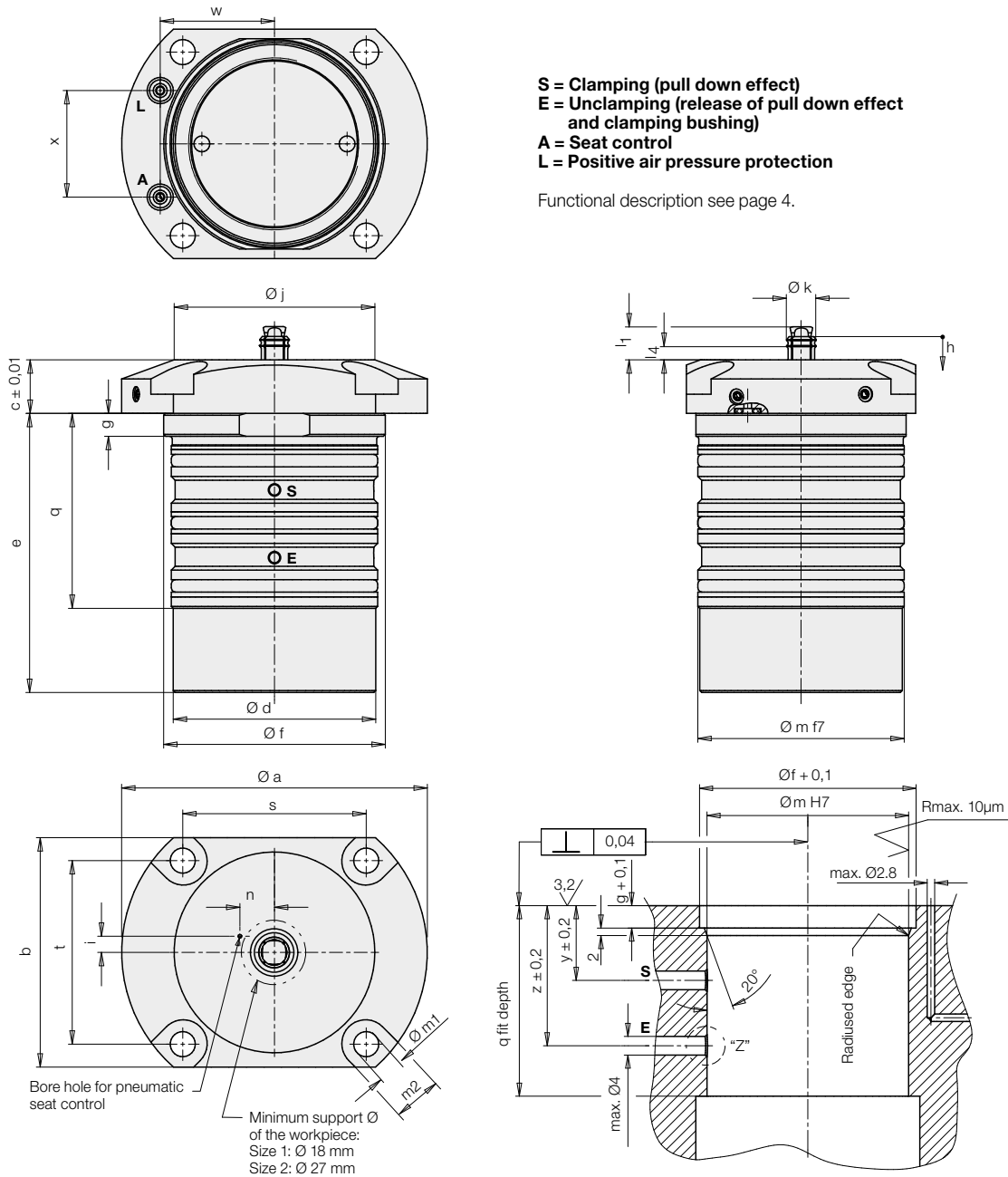


Application example

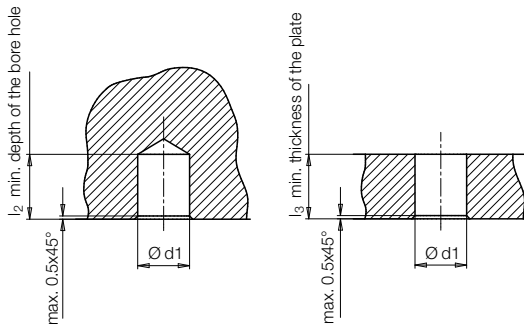
Machining of a cast part from 5 sides



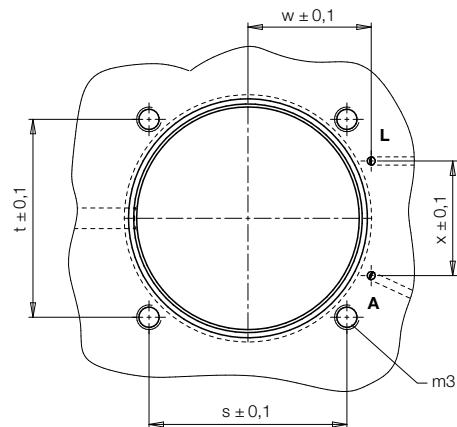
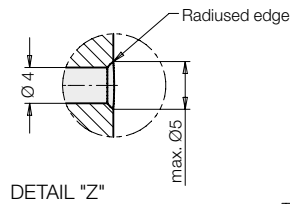
Dimensions



Demands on the bore hole in the workpiece



Adjusting $\varnothing$ of the clamping bushing: $k = d1 - 0,2$ mm



Dimensions Technical Data

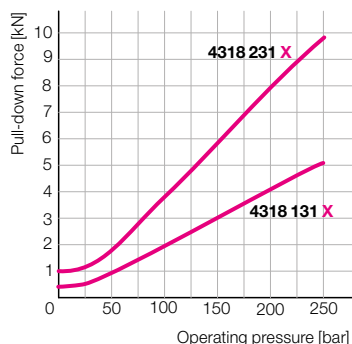
Technical data

		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 [cm³]	0.5	1
	Unclamping [cm³]	10	25
Max. flow rate	[cm³/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]	8.3	9.8
l ₂ min. depth of the bore hole	[mm]	10	11.5
l ₃ min. thickness of the plate	[mm]	9	11
l ₄	[mm]	3.2	3.7
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

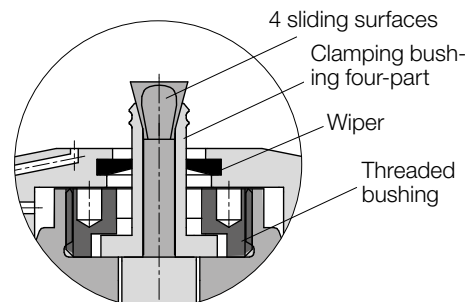
Size 2

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

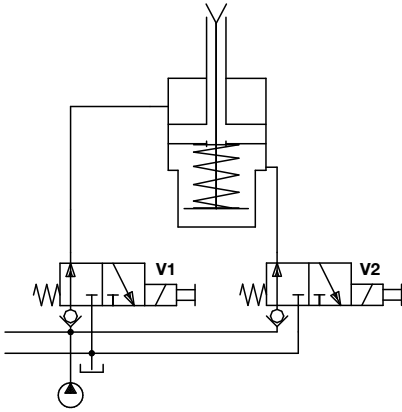
Size 2

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

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

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.

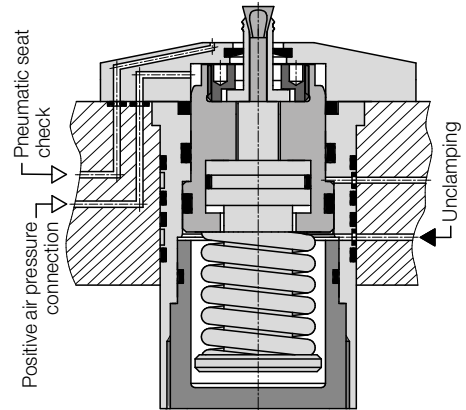
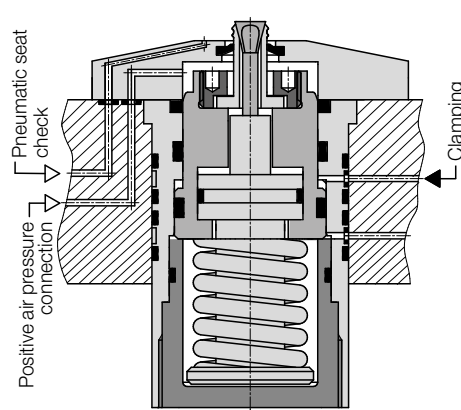
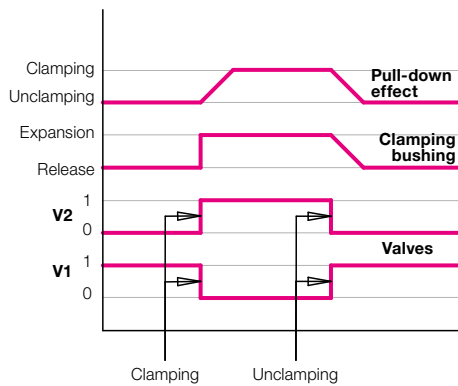
Workpiece unclamping

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.

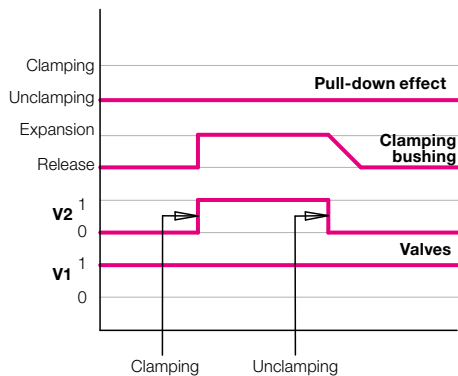
Note:

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 are 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.

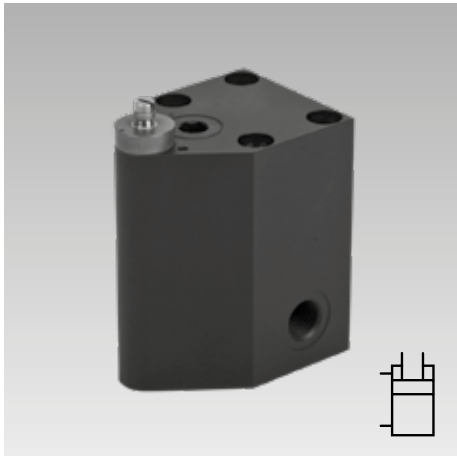
What happens in case of pressure drop of the unclamping pressure?

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 Clamp

**Block-type eccentric, double acting, for bore diameter 6.6 to 13.8 mm
max. operating pressure 250 bar**



Application

The patented bore clamp is particularly suitable for positioning and clamping of workpieces with bore holes from diameter 6.6 to 13.8 mm in the support face.

The workpiece is directly put onto the bore clamp, so that the remaining surfaces are free for 5-sided machining.

Due to its small and eccentric design the bore clamp can be placed very close to the workpiece contour.

According to the load additional clamping forces can be necessary, since the axial clamping force is relatively small (see page 3).

Description

In the body of the bore clamp a double-acting hydraulic cylinder is mounted. By screwing in the clamping screw the piston actuates via a dowel pin a drive pin that is eccentrically arranged at the edge of the housing.

The clamping ring is centred on a taper sleeve and held by the head of the clamping screw. The clamping screw is secured by means of a thread coating against loosening.

Penetration of liquids and swarf is avoided by the connection of positive air pressure protection.

Important notes

If liquids or swarf can penetrate, e.g. due to an open clamping bore, positive air pressure protection must be continuously switched on. In addition, the hardened support surface and the clamping ring should be blast cleaned before every clamping process.

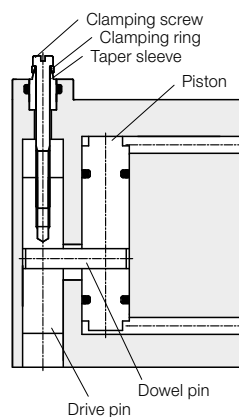
Clamping ring and clamping screws are wear parts and should be exchanged after approx. 10,000 actuations (see page 3).

The axial pulling force is non-positively transmitted, since the exterior diameter of the clamping ring is not profiled. Therefore the clamping bores should not be tapered.

Advantages

- Axial clamping in simple and smooth bore holes
- Low bore depths
- 5-sided machining possible
- 3 different clamping inserts "With centring" "With compensation" "Without centring"
- Additional centring elements are not required
- Repetitive accuracy 0.003 mm (with centring and compensation)
- Compact eccentric design
- Hardened support surface
- Pneumatic seat check
- Connection for positive air pressure protection
- Oil supply alternatively via pipe thread or vwdrilled channels

Function



Centring function

● Bore clamp with centring

Type 4319X1

- Fixed centring cone

● Bore clamp with compensation

Type 4319X2

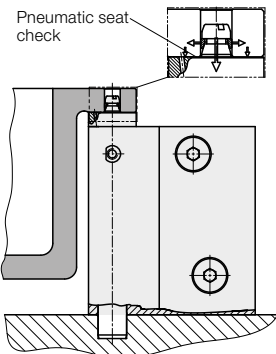
- Centring cone in one axial direction
± 0.2 mm movable

● Bore clamp without centring

Type 4319X3

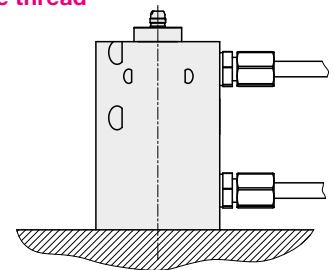
- Centring cone in all directions
± 0.25 mm movable

Operating conditions and other data see data sheet A 0.100.

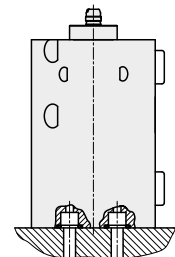


Connecting possibilities

Pipe thread

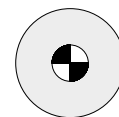


Drilled channels

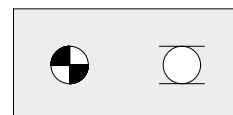


Applications

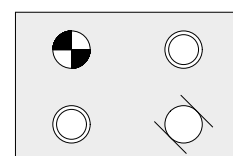
● Centre and clamp in 1 bore hole



● Centre and clamp in 2 bore holes

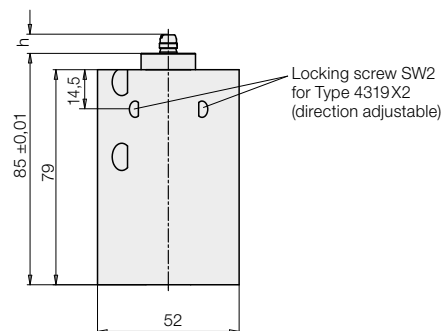
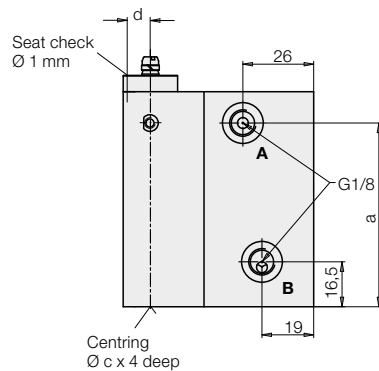
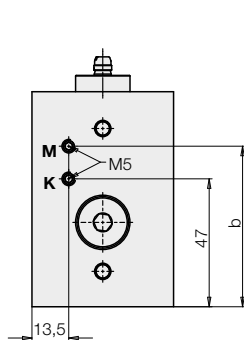
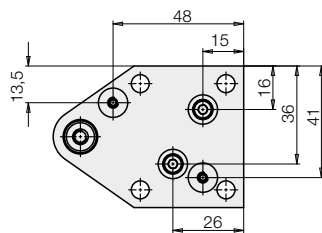


● Centre and clamp in more than 2 bore holes

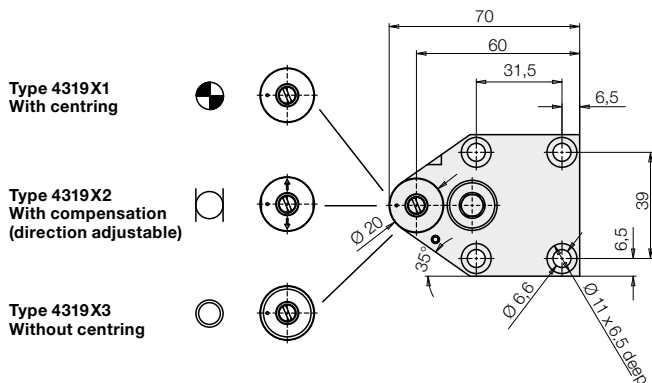
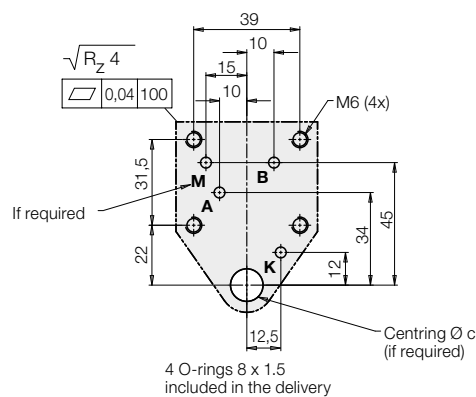


Dimensions Technical data

- A** = Clamping
B = Unclamping
K = Positive air pressure protection
M = Pneumatic seat check
 (if required)



Connecting scheme for manifold mounting
 Connection bore holes max. Ø 5 mm



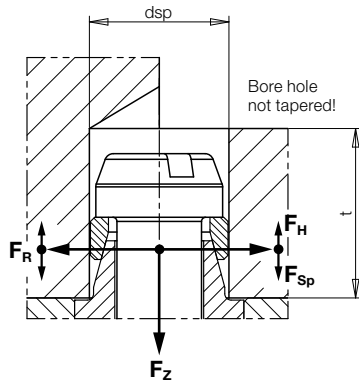
Clamping range Ø dsp		[mm]	6.6 – 6.8	9.0 – 9.2	11.0 – 11.3	13.5 – 13.8
Through hole Ø H13 as per DIN EN 20273-m		[mm]	6.6	9	11	13.5
for screw thread			M6	M8	M10	M12
Clamping screw			M4	M5	M6	M6
Max. pulling force (250 bar)		[kN]	3.8	3.8	6.3	6.3
Radial expansion force approx. *)		[kN]	3	3	5	5
Axial clamping force approx. *)		[kN]	see clamping force diagram page 3			
Axial retention force approx. *)		[kN]	see clamping force diagram page 3			
Max. operating pressure		[bar]	250	250	250	250
Min. operating pressure		[bar]	50	50	50	50
Oil volume clamping/unclamping		[cm³]	0.2	0.2	0.3	0.3
Max. flow rate		[cm³/s]	25	25	25	25
a		[mm]	67.5	67.5	58	58
b		[mm]	59	59	66	66
Ø c		[mm]	12 ^{H7}	12 ^{H7}	14 ^{H7}	14 ^{H7}
d		[mm]	7.3	7.3	8.1	8.1
h		[mm]	7.5	8.5	9.5	11
Weight approx.		[kg]	1.65	1.65	1.7	1.7
Part no.	With centring		431921A066	431921A090	431931A110	431931A135
	With compensation		431922A066	431922A090	431932A110	431932A135
	Without centring **)		431923A066	431923A090	431933A110	431933A135
For manifold-mounting connection						
O-ring 8 x 1.5 (NBR)			3000343	3000343	3000343	3000343
Screw plug G 1/8 (with hexagon socket)			3610158	3610158	3610158	3610158

*) Forces at the clamping point and important notes see page 3

Clamping force

Clamping bore hole • Spare parts

Forces at the clamping point



- F_z** Pulling force of the clamping screw
see chart page 2
- F_R** Radial expansion force of the clamping
ring see chart page 2
- F_{sp}** Axial clamping force (support force)
see clamping force diagram
- F_H** Axial retention force = workpiece lifting
force see clamping force diagram

Effective clamping force F_{sp}

The pulling force of the clamping screw acts onto the clamping ring, that will be expanded on the clamping taper and moves approx. 0.2-1 mm downwards.

As soon as the clamping ring gets in contact with the bore hole diameter a pull-down effect onto the support surface of the bore clamp results due to the sliding friction. The axial clamping force also depends on the friction coefficient μ .

Axial retention force F_H

The clamping ring contacts the bore diameter with the expansion force F_R. The axial clamping force also depends on the friction coefficient μ . The axial retention force is a little bit higher with "soft" materials (Al) than the clamping force F_{sp}. However when planning the system the values indicated in the clamping force diagram should not be exceeded for safety reasons.

Spare parts

Clamping range Ø	dsp [mm]	6.6–6.8	9–9.2	11–11.3	13.5–13.8
Min. clamping ring Ø	*) [mm]	6.5	8.9	10.9	13.4
Max. clamping ring Ø	**) [mm]	6.9	9.3	11.4	13.9
Min. bore depth Ø	tmin [mm]	8	9	10	11.5
Part no. (spare part)					
Clamping ring		3548815	3548633	3548634	3548639
Clamping ring + clamping screw		0354245	0354246	0354247	0354248
Adjusting sleeve		34101193	34101194	34101195	34101196

*) New condition

**) Max. diameter of adjusting sleeve

Adjust clamping ring

New bore clamps are adjusted to the ordered clamping range. (Do not adjust the clamping screw)!

After approx. 10,000 workpieces the clamping ring and the clamping screw should be replaced as a precaution.

Required parts:

New clamping ring and clamping screw as well as the appropriate adjusting sleeve (see chart).

1. Hydraulically move the bore clamp to clamping position.
2. Put the clamping ring onto the clamping taper. Pay attention to the correct position of the taper angle! (see drawing above).

3. Screw in the clamping screw just before getting in contact with the clamping ring.

4. Put on the adjusting sleeve.

5. Screw in the clamping screw until the clamping ring contacts the interior diameter of the adjusting sleeve. Tighten the clamping screw only slightly! (The thread is secured against loosening by means of the Tuflok coating).

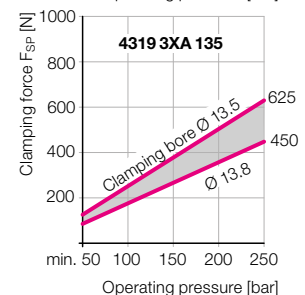
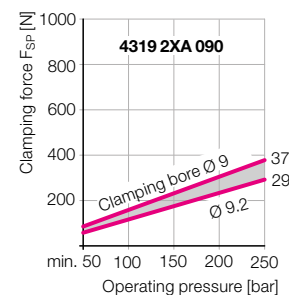
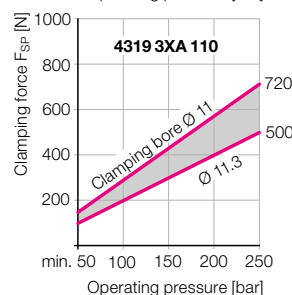
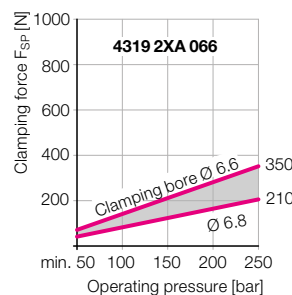
6. Move the bore clamp to the unclamping position and remove the adjusting sleeve.

Measuring conditions

Material C45+C

Wet machining

Clamping force diagram



Important note

In case of hardened workpieces and in very smooth and greased clamping bore holes, the clamping force can be close to zero.

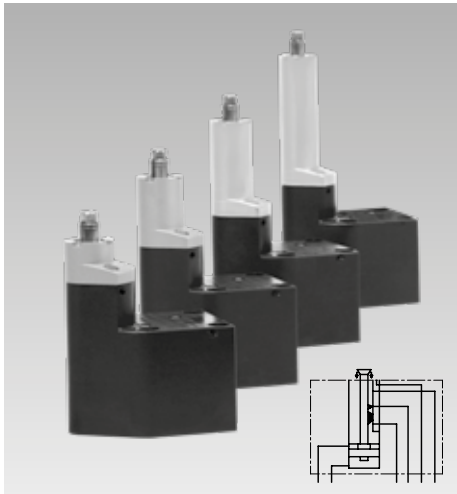
Remedy: Provide additional clamping elements, as e.g. swing clamps.



Bore Clamps Eccentric

Pneumatic seat check and clamping monitoring

bore holes Ø 8 – 12 mm, double acting, max. operating pressure 80 and 120 bar



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.

Axial clamping in smooth bore holes

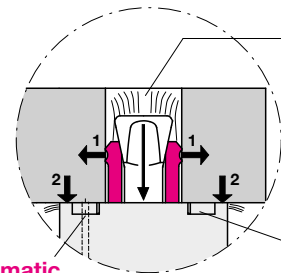
Machining from 5 sides

Reduced processing times

Higher precision by tools in standard length

Short tool paths

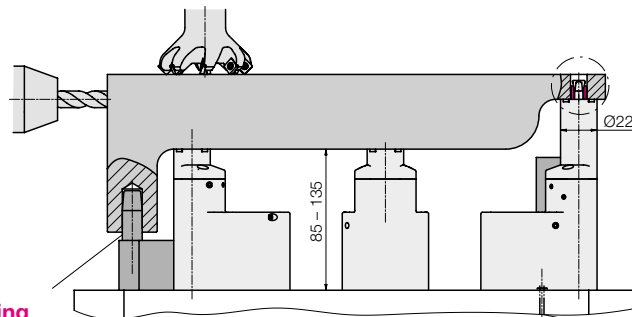
Clamping force up to 5 kN



Positive air pressure protection
Clamping bolt and clamping bushing easily exchangeable

Pneumatic seat check

Hardened workpiece support



Different support heights

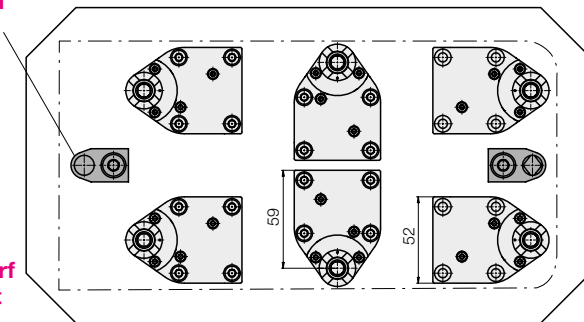
Eccentric design with small neck diameter

Positioning and side load absorption

Smaller fixtures and machine tables

2 x hydraulics
4 x pneumatics

Efficient swarf management



Corrosion-protected components

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.

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

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.

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

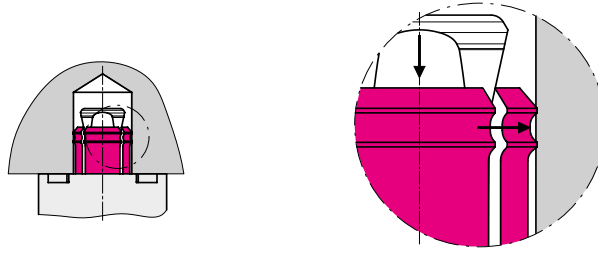
Clamping principle

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.

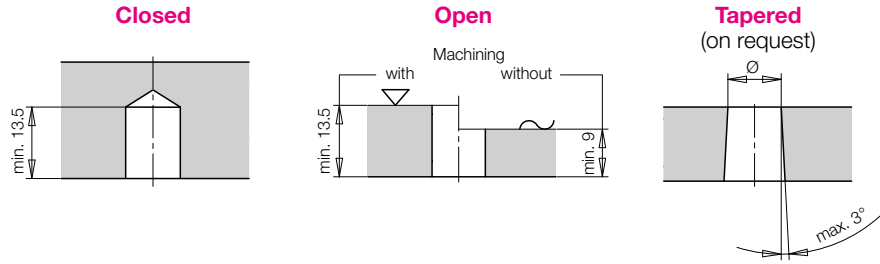


Clamping bore

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.

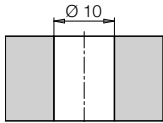
With the open bore, however, the positive air pressure connection must remain permanently switched on.



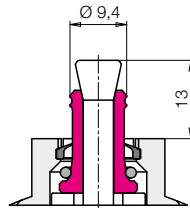
Clamping bushings

Example: clamping bore $\varnothing 10$ mm

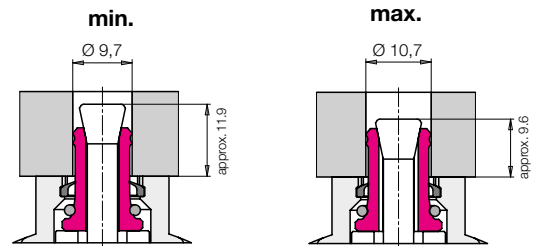
Nominal diameter of the clamping bushing 10



Clamping bushing unclamped



Admissible tolerance of the clamping bore

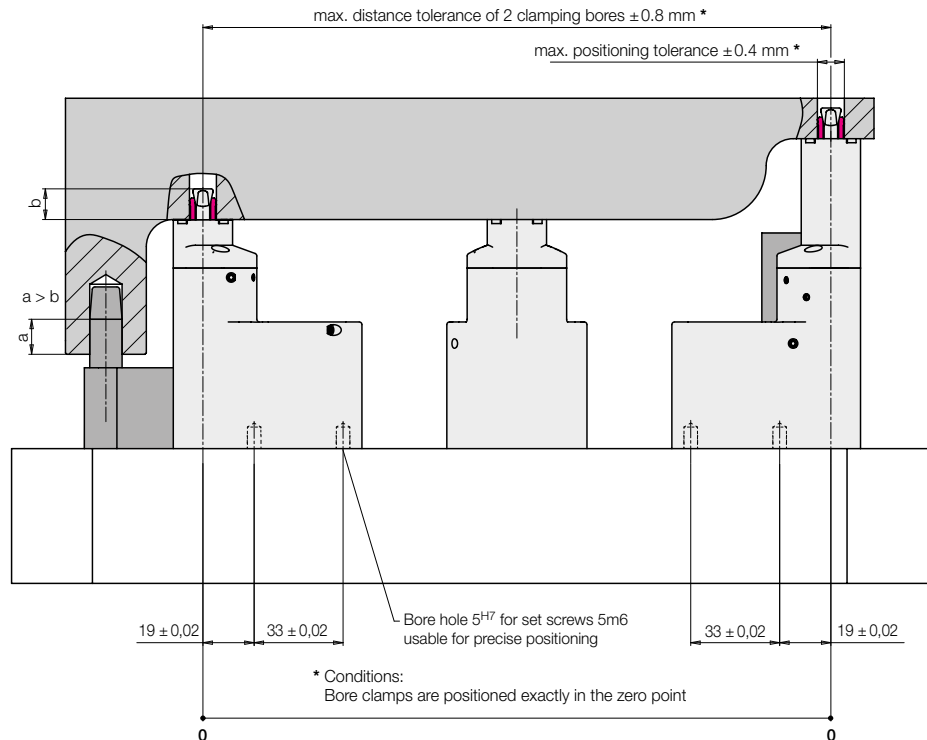


Workpiece loading and positioning

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 $a > b$).



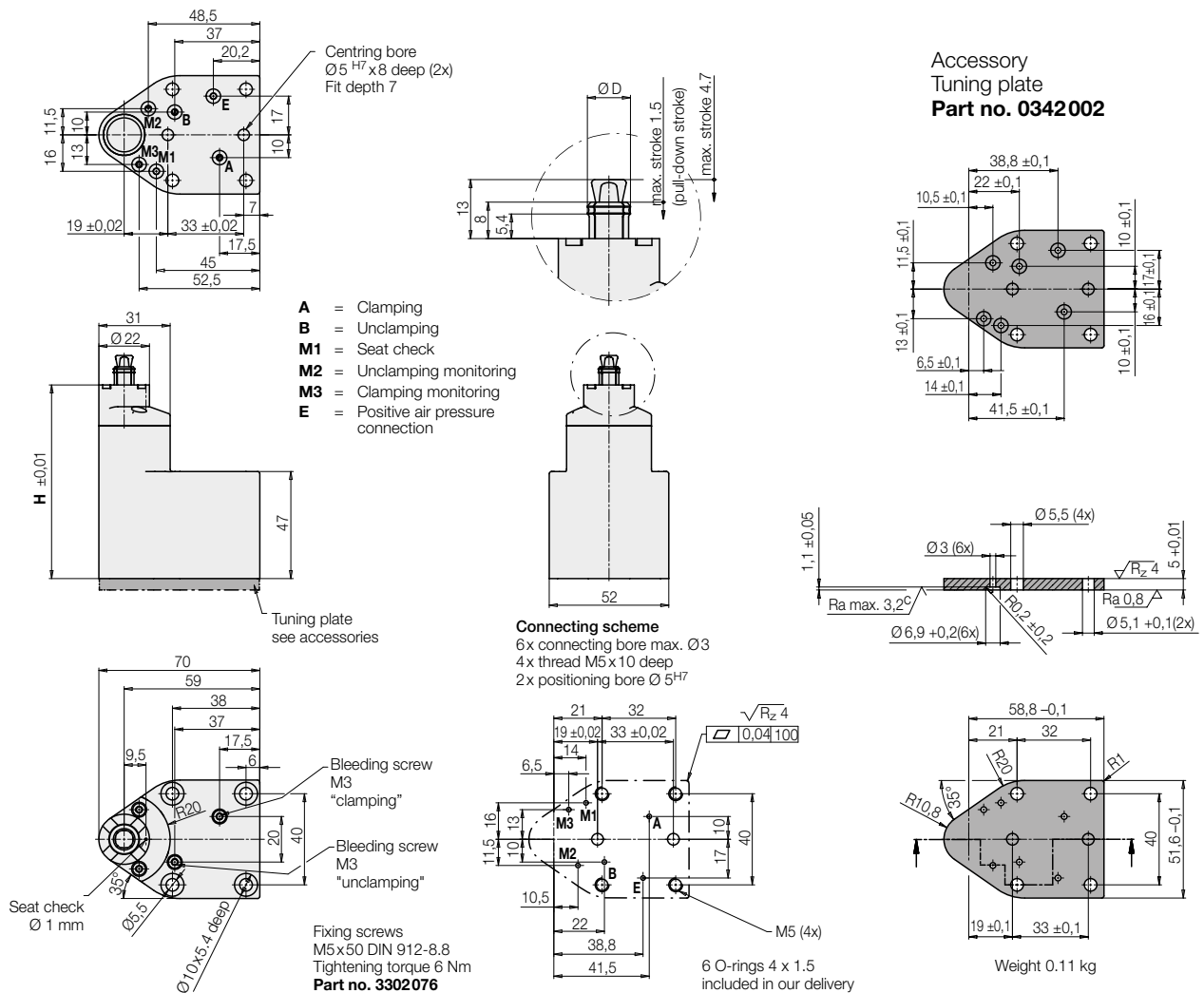
Positioning tolerance

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 5H7 in the flange surface of the bore clamps.

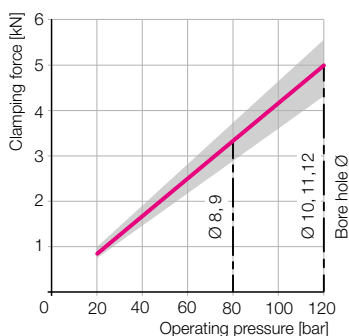
Technical Characteristics • Accessories



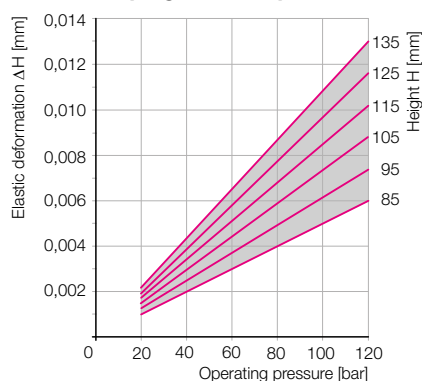
Bore hole Ø	[mm]	8	9	10	11	12
Usable clamping range Ø	[mm]	7.7 ... 8.7	8.7 ... 9.7	9.7 ... 10.7	10.7 ... 11.7	11.7 ... 12.7
Max. clamping force + 10 ... – 15 %	[kN]	3.3	3.3	5	5	5
Max. radial expansion force approx.	[kN]	8	8	14	14	14
Max. operating pressure	[bar]	80	80	120	120	120
Min. operating pressure	[bar]	20	20	20	20	20
Workpiece material				250/25		
max. hardness HB/HRC						
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 HXXSZ

[illegible]

[mm]	[mm]	with load [µm / kN]	[kg]
BCE1XX0	HXXSZ		
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.

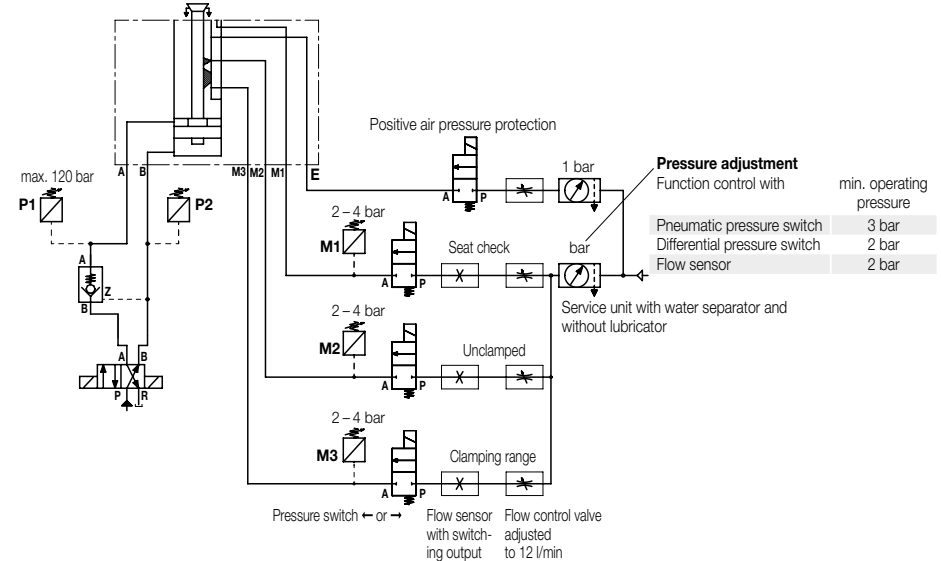
Differential pressure switch

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

Device	Function	Workpiece							
		Loading	Clamping	Clamped	Machining	Unclamping	Unclamped	Unloading	
Pneumatics	Nozzle	1							
	Pressure switch *	1							
	Pressure switch *	1							
	Pressure switch *	1							
Hydraulics	Bore clamp	A							
	Pressure switch	1							
	Pressure switch	1							
	Pressure switch	1							

* alternatively differential pressure switch or flow sensor

Examples for switching positions when using all control elements

Control elements		Status of control elements		
		Unclamped and workpiece does not lie flat on the surface	Bore clamp 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
Clamping pressure	P1	0	1	1
Unclamping pressure	P2	1	0	0

← **Error!**
(see text)

Example

Six seat checks with 2 bar air pressure:

1. Cover all seat checks with one workpiece and measure the flow rate Q_{min} .
 2. If one seat check is not covered, measure Q_{max} .
 3. Enter and save switching threshold = $0.5 \times (Q_{max} + Q_{min})$.
- If the difference ($Q_{max} - Q_{min}$) is too small, increase the flow rate or reduce the number of bore clamps per sensor.

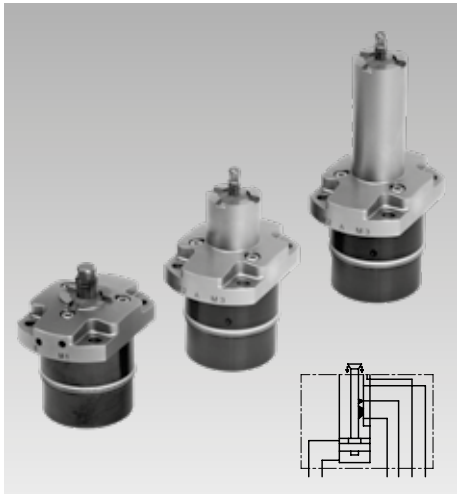
Number of bore clamps at a function control

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 $\varnothing$ 5.5 – 13 mm
double acting, max. operating pressure 30, 80 and 120 bar**



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.

Axial clamping in smooth bore holes

Machining from 5 sides

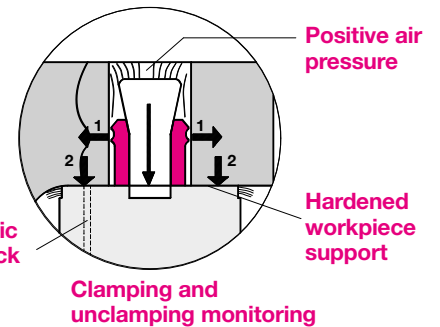
Distortion-free workpiece clamping

Higher precision by tools in standard length

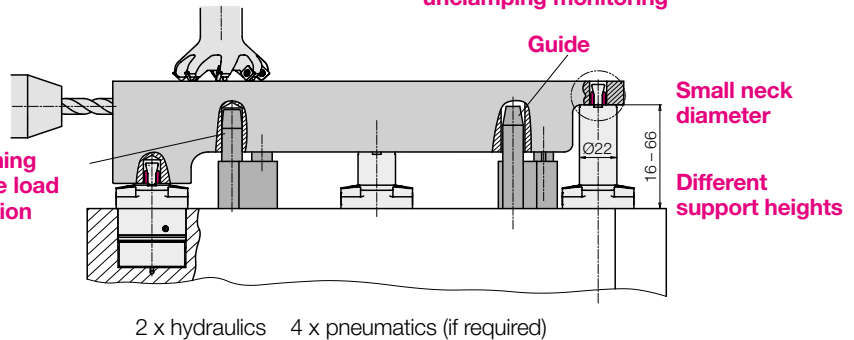
Short tool paths

Reduced processing times

Clamping force up to 5 kN

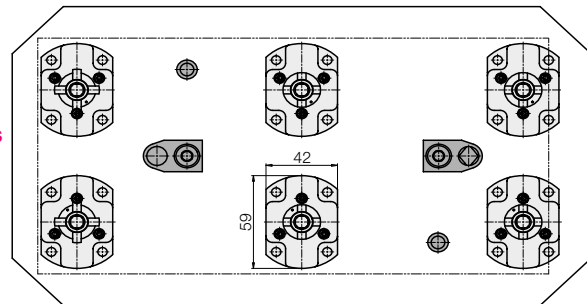


Positioning and side load absorption



Smaller fixtures and machine tables

Efficient swarf management



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

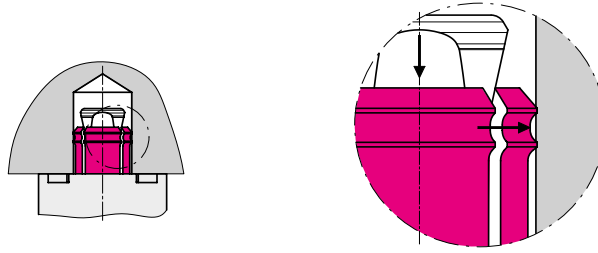
On request

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.

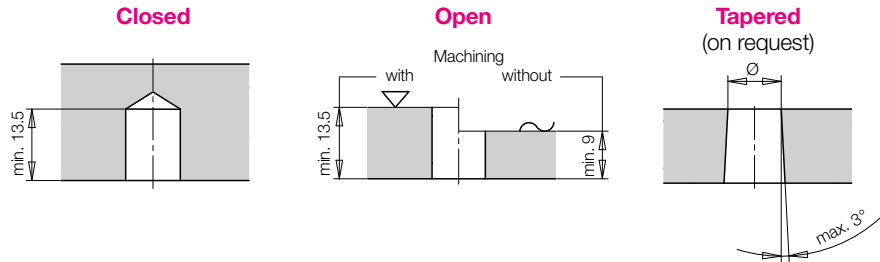


Clamping bore

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.

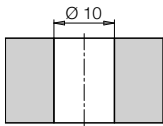
With the open bore, however, the positive air pressure connection must remain permanently switched on.



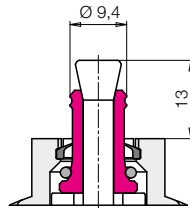
Clamping bushings

Example: Clamping bore $\varnothing 10$ mm

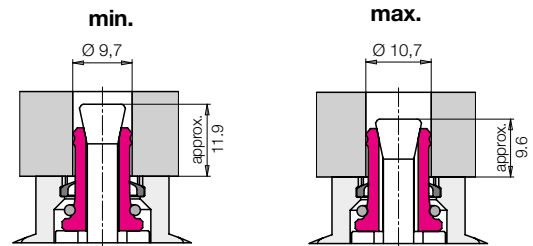
Nominal diameter of the clamping bushing 10



Clamping bushing unclamped



Admissible tolerance of the clamping bore



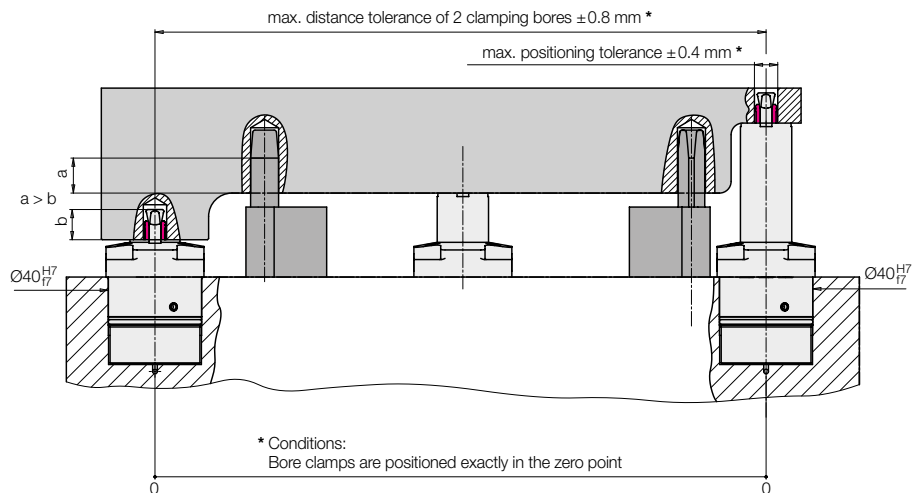
Workpiece loading and positioning

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 $a > b$).



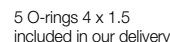
Positioning tolerance

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

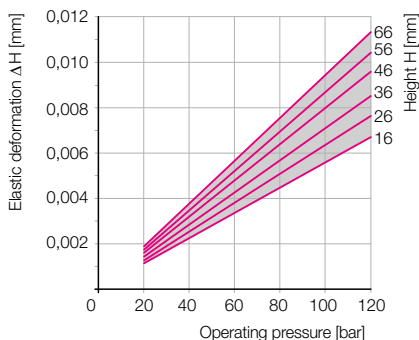
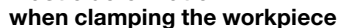
The distance tolerance of 2 clamping bores can be max. ± 0.8 mm if both bore clamps are positioned at the zero point (nominal dimension).

Dimensions



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				

**Elastic deformation ΔH
when clamping the workpiece**



* Load due to workpiece weight and machining forces

B 1.487 / 7-23



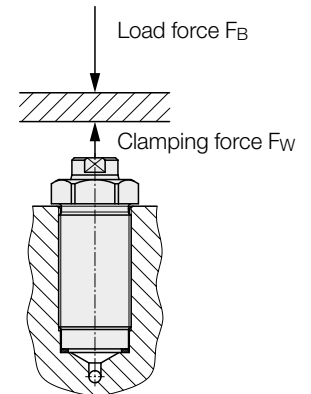
Threaded-Body Cylinders with Locking Piston

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

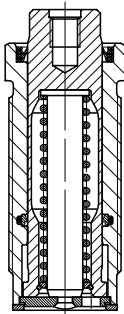


Application

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".

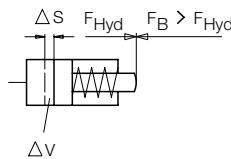
Description

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.

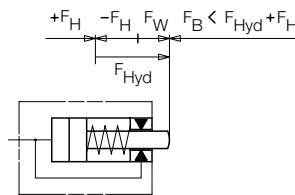


Function

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.



Materials

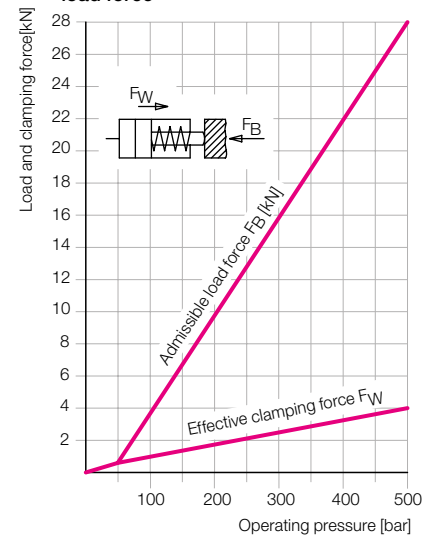
Cylinders: High alloy steel, nitrated
 Piston: High alloy steel
 Piston seal: NBR
 Wiper: FKM
 Flat sealing: POM

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

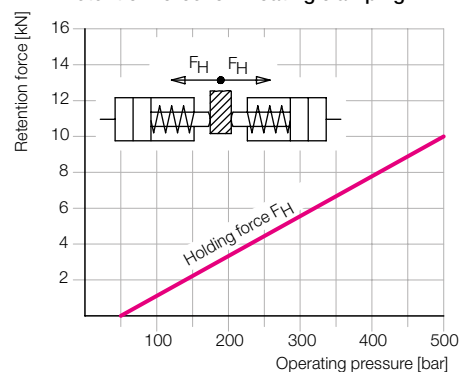
Important notes

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.

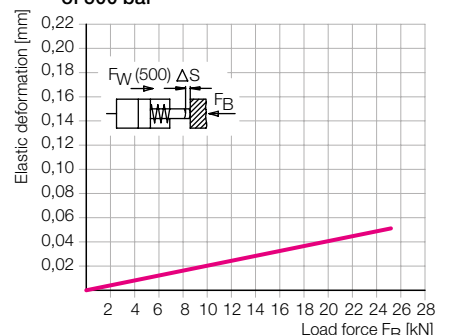
Effective clamping force and admissible load force



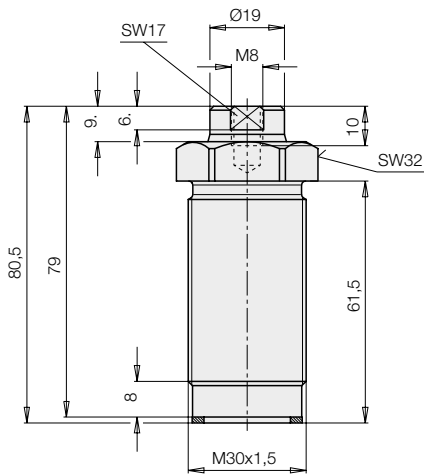
Retention force for "floating clamping"



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



Technical data
Application example

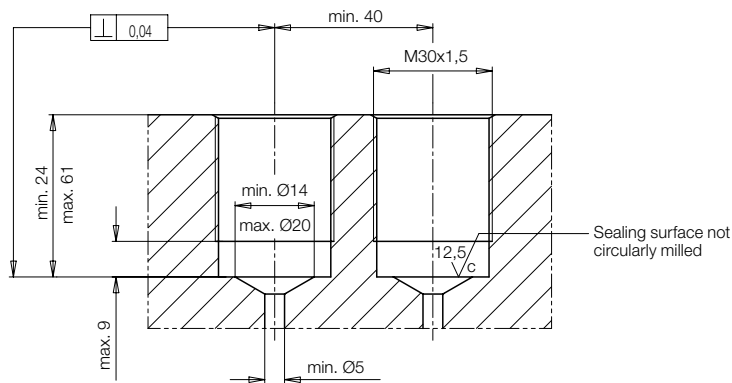


Piston Ø	[mm]	20
Stroke	[mm]	10
Oil volume per 10 mm stroke	[cm³]	3.14
Max. clamping force* at 500 bar	[kN]	approx. 4.8
Max. load force* at 500 bar	[kN]	approx. 25
Max. operating pressure	[bar]	500
Min. operating pressure	[bar]	50
Recom. pressure range	[bar]	100 ... 500
Elastic deformation*	[µm/kN]	2
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

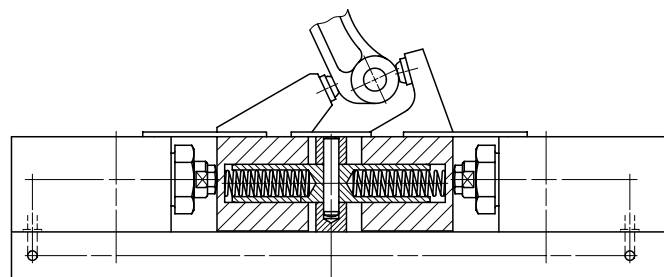


Application example

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.

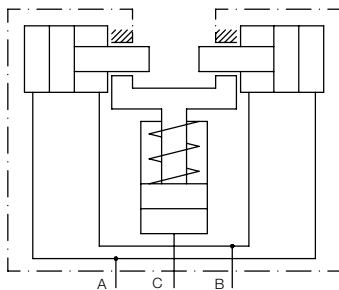
Only different spring forces can influence the uniformity. After the pressure increase, the two locking pistons avoid a "further floating" of the clamping point.



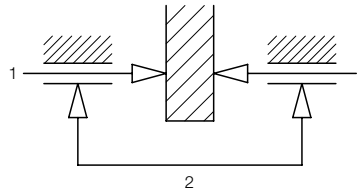


Position Flexible Clamps

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



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.

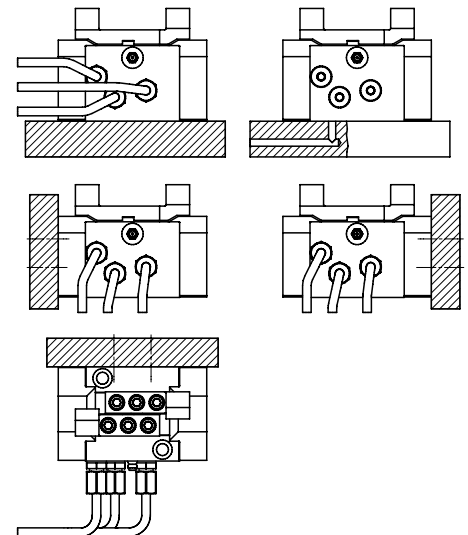
This is the so-called "floating" clamping, since both oppositely-arranged pistons would "float" in case of a workpiece displacement parallel to the piston axis.

After pressurising the separate locking port, the jaws are locked and are thereby in the position to compensate machining forces in all directions.

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



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.

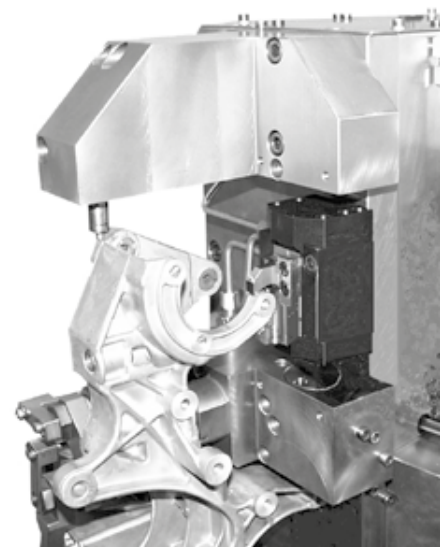
Important notes

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.

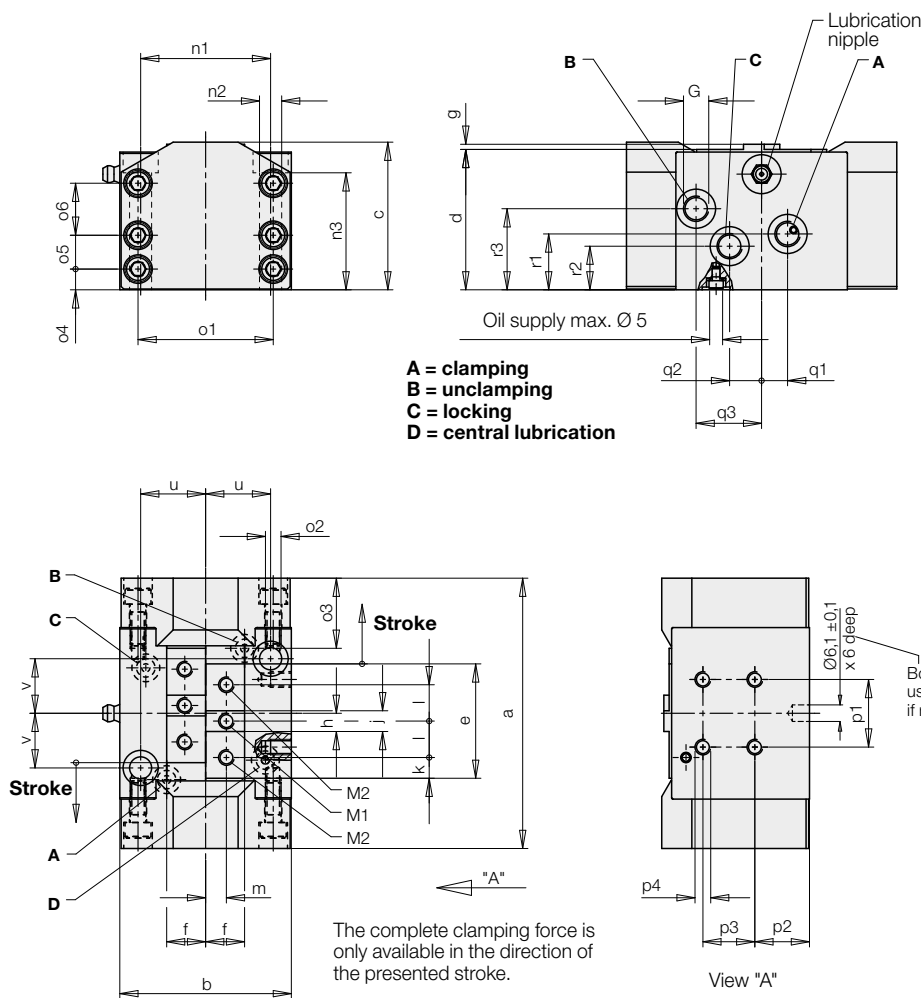
Already 2 mm difference in stroke can cause an one-sided displacing force of 10 N onto the workpiece.

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.



Technical Data Dimensions • Accessories



Installation and connecting possibilities

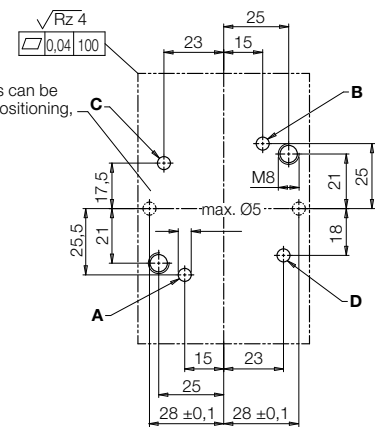
The position flexible clamping element, can be fixed alternatively at the bottom (dimensions n1 up to n3, v, u), or at the back (dimensions p1 up to p4).

It can also be fixed at both sides. For this purpose per screw row with gauge for bore holes o1 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



Stroke, per clamping jaw	[mm]	6	10
Clamping force at 250 bar	[kN]	7	
Holding force at 250 bar	[kN]	4	
Admissible flow rate	[cm³/s]	5	
Oil volume clamping	[cm³]	3.8	6.3
Oil volume unclamping	[cm³]	1.4	2.3
Oil volume locking	[cm³]		0.6
a	[mm]	104	124
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	9
j	[mm]	8 f7	
k	[mm]	8	
l	[mm]	14	
M1 / M2 x depth of thread	[mm]	M 6 x 11 / M 6 x 9	
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 6 x 8	
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	44121039

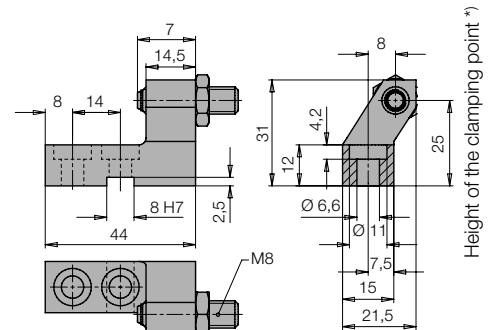
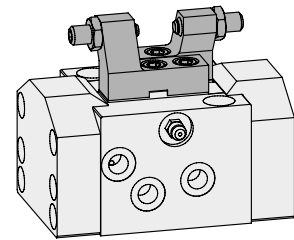
Accessories

Plug G 1/8	(3 x required)	3610158
O-Ring 8 x 1.5	(4 x required)	3000343

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

Accessory

Clamping jaw with swivel contact bolt
Part no. 3548447



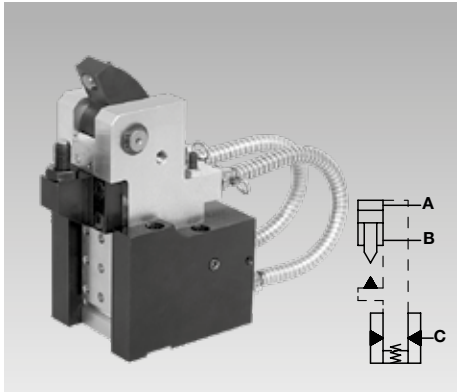
Clamping jaw for exterior clamping of a work-piece web with a thickness of 6 up to 14 mm (adjustable from 0 up to 18 mm).

*) 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.



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.

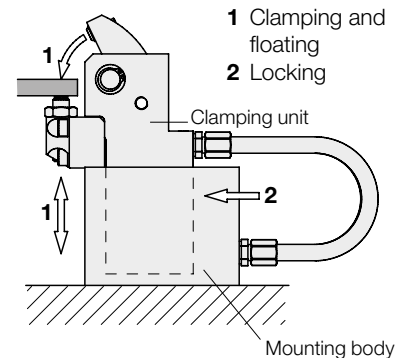
Important notes

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).

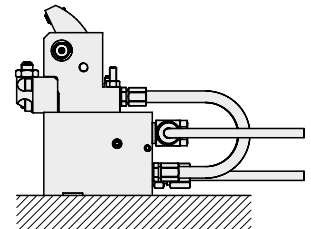
Air sealing increases the life and the sensitivity of the clamping element.

The clamping unit made of aluminium has to be highly protected against abrasive swarf.

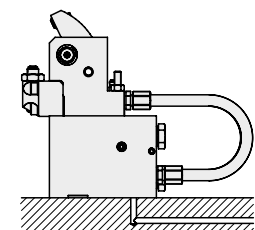


Connecting possibilities

Pipe thread

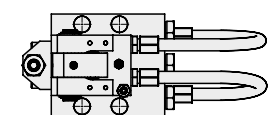


Drilled channels

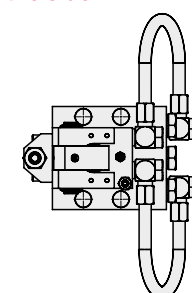


Design possibilities

Hose at the back

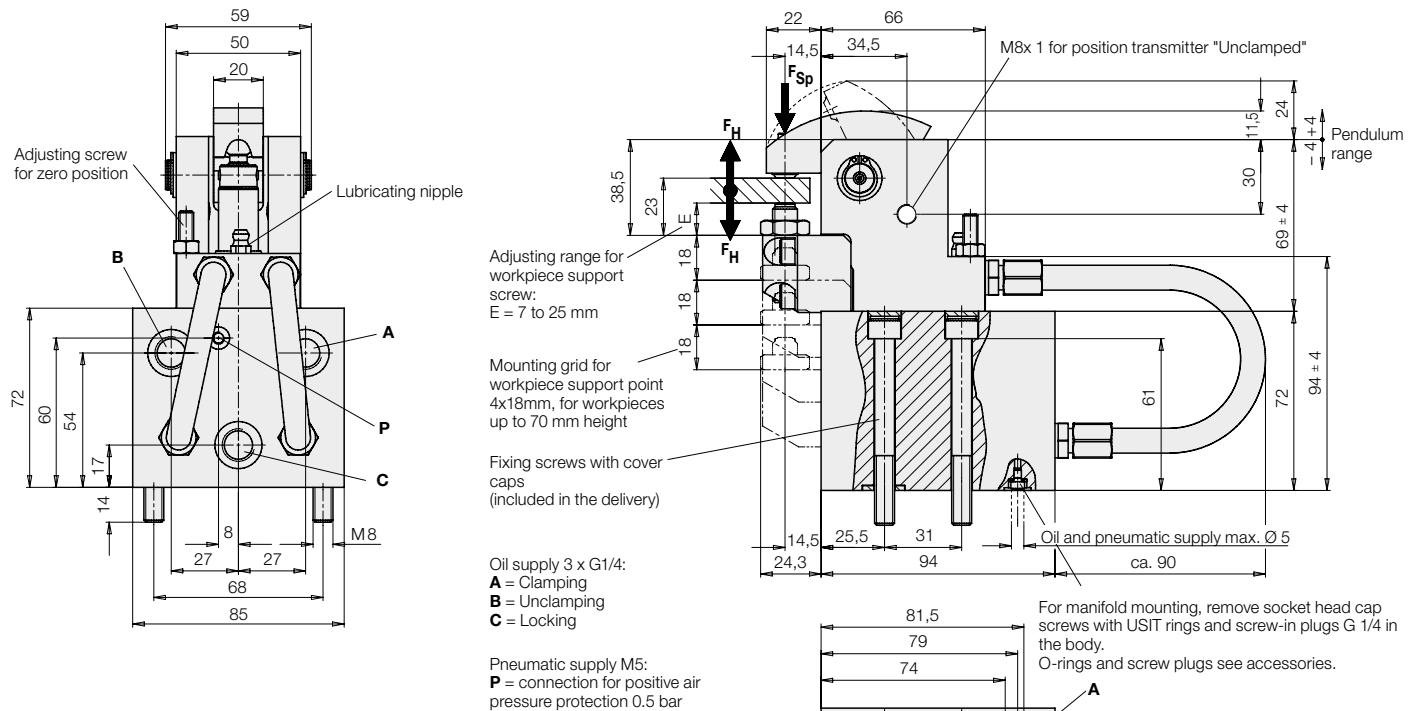


Hose at the side

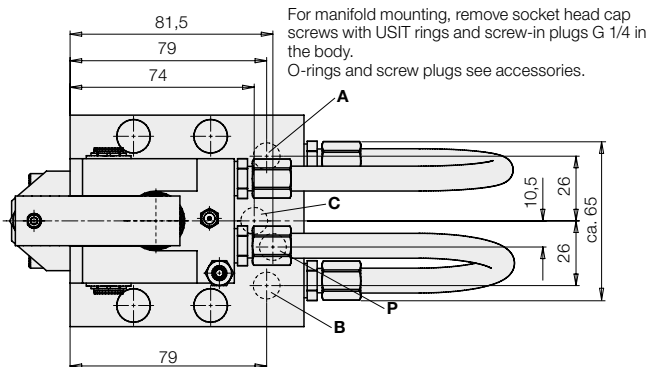
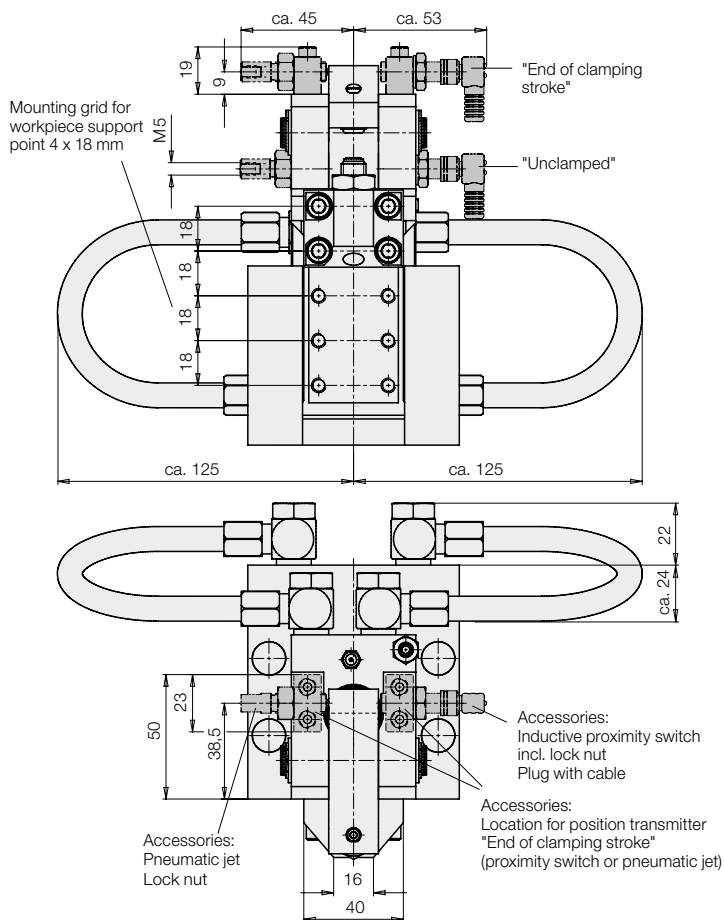


Dimensions Technical data • Accessories

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

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 U_B	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

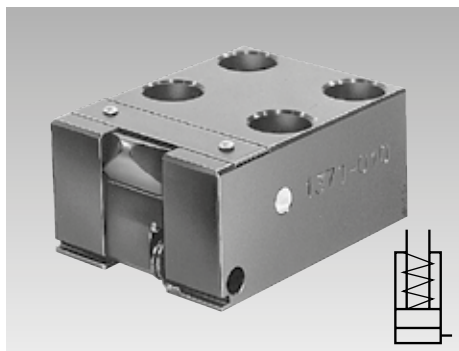
Materials

Clamping unit: Aluminium
Other parts: Steel
Sealings: FKM



Low-Block Clamping Cylinder

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



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

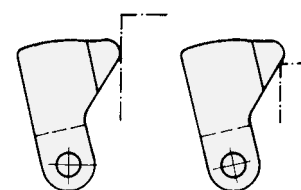
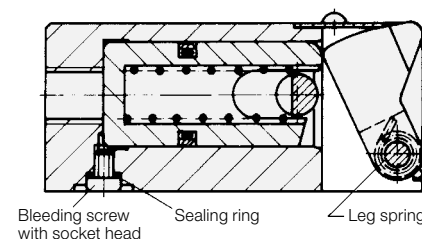
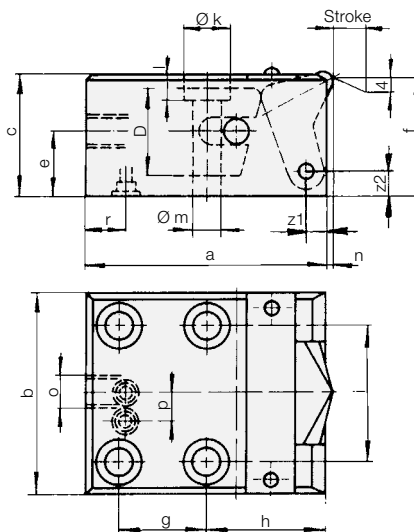
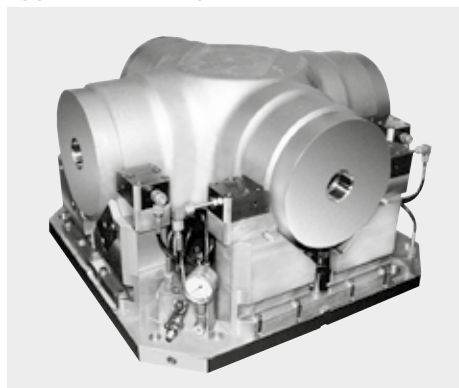
Cylinder body material: Steel, black oxide
Clamping lever: 58 Cr V4, Hrc 54-58

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.

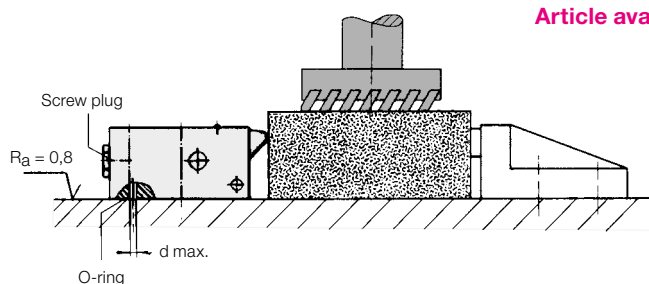
Application example



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 sealing ring (for bleeding screw)	3002847	3002847	3000546
Clamping lever, one piece	3542080	3542081	3542082
Leg spring, spare part	3715 104	3715 104	3716 109

Article available on request

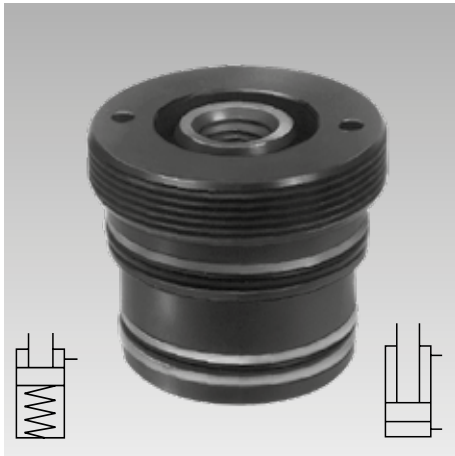


The hydraulic oil can optionally be supplied through tubes or drilled channels in the fixture body; 4 fixing screws are required.



Hydraulic Threaded-Body Clamping Module

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



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

Figure 1 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.

Element

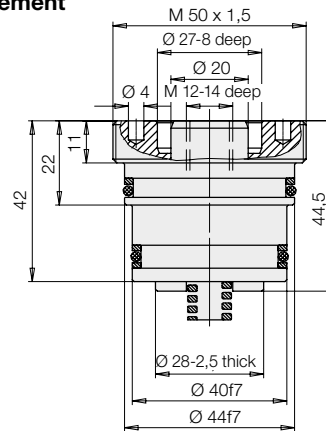
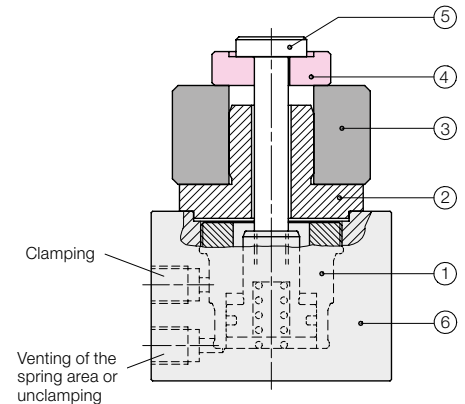
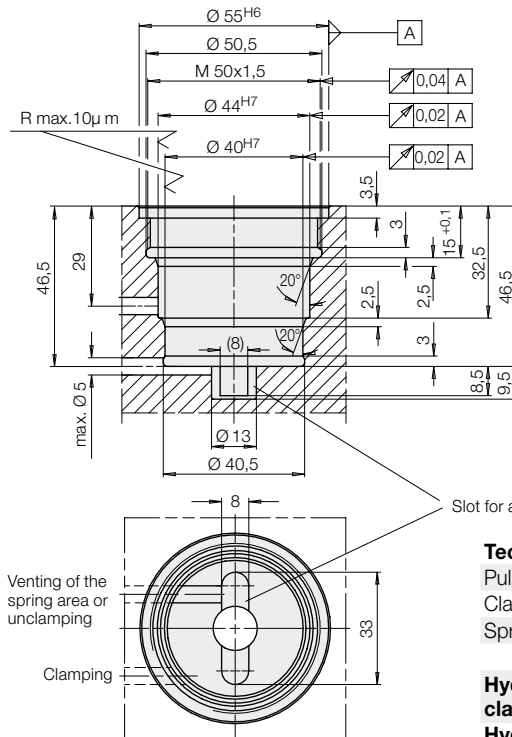


Figure 1 - Clamping with C-washer



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

Installation dimensions



Technical data

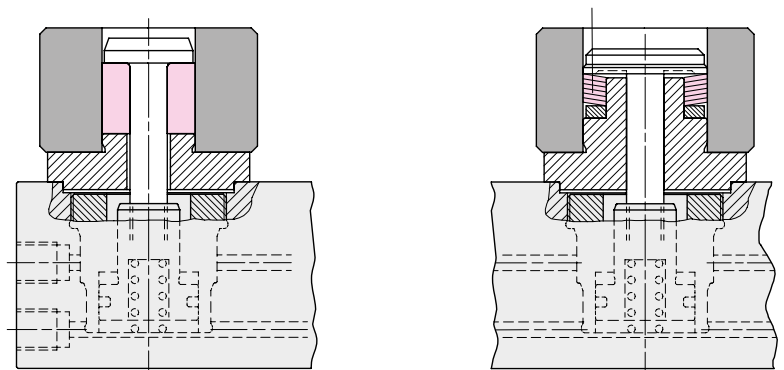
Pulling force at 500 bar	[kN]	24.5
Clamping stroke, pulling	[mm]	6.0
Spring force	[N]	80–200

Part no.

Hydraulic threaded-body clamping module	1574811
Hydraulic threaded-body clamping module with housing	1574812

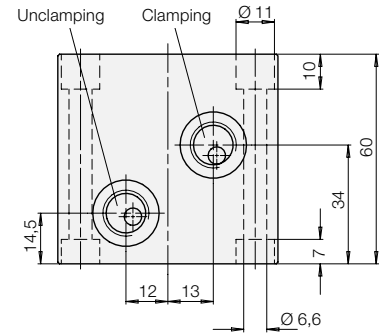
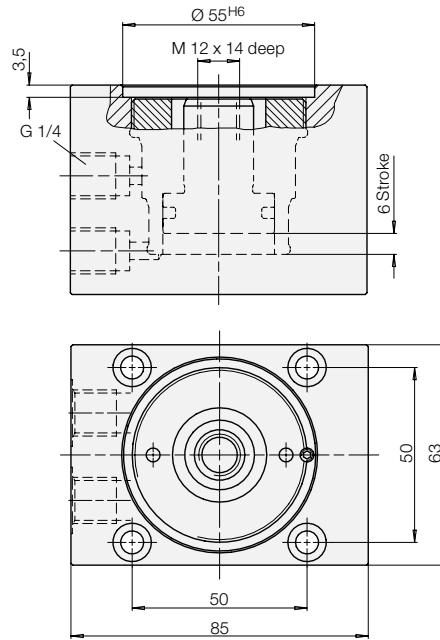
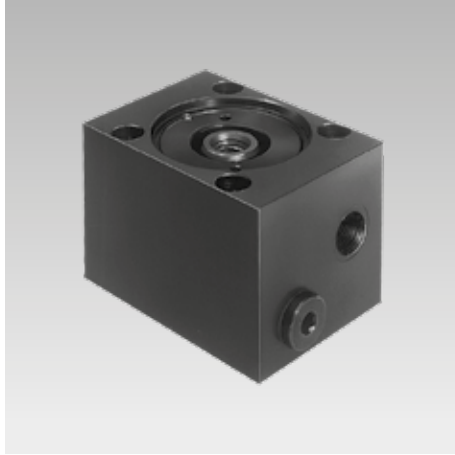
Figure 3 - Clamping with disk

Figure 2 - Clamping with elastomer spring element



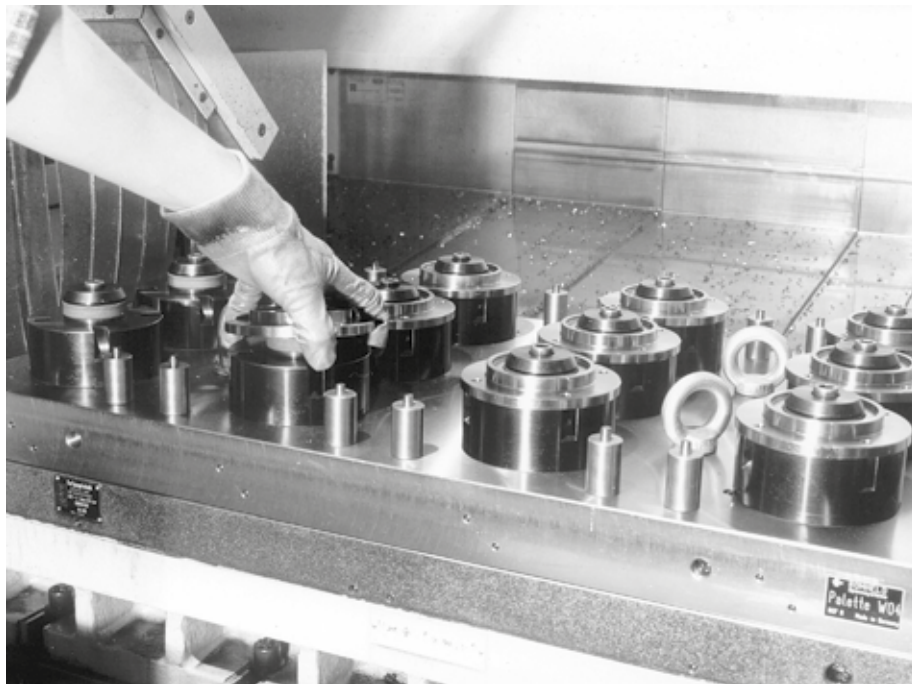
Dimensions Application example

Hydraulic threaded-body clamping module with housing



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

Application example



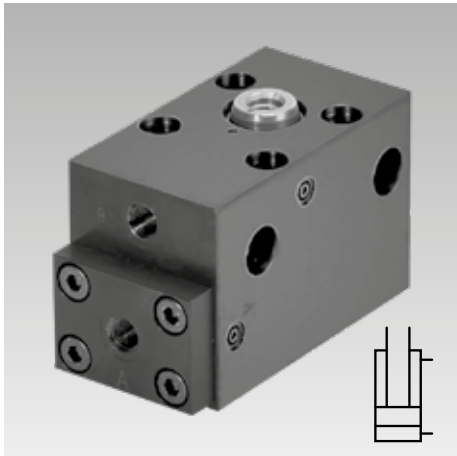
Installation of hydraulic clamping modules in the base plate of a multiple clamping fixture.

Transmission of the clamping force is made by an elastomer spring element $\varnothing 50 \times \varnothing 17 \times 32$ 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 with Fail-Safe Function double acting, max. operating pressure 300 bar



Advantages

- Fail-safe with fail-safe function
- Clamping and supporting function in one element
- Re-clamping with hydraulic pressure
- High clamping safety also in case of sudden pressure drop
- Cushioning of vibration
- Interchangeable contact bolts
- Multiple fixing possibilities
- Oil supply optionally by fittings or through drilled channels
- FKM seals as standard
- Maintenance free

Fail-safe function

The full clamping force is maintained both in the event of pressure drop and a complete pressure loss. This is achieved by a fail-safe, patented clamping of the clamping bolt.

Application

The piston of traditional clamping cylinders is pushed back, if the counter force is greater 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 fail-safe geometry – fail-safe function. Due to this, the following application possibilities exist:

- 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

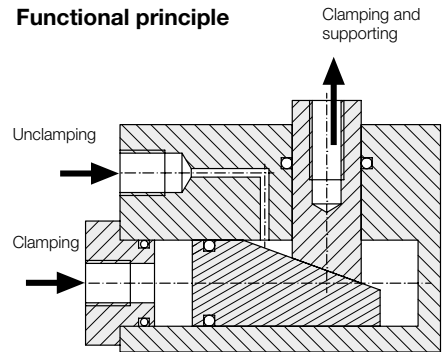
For all applications:

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 full clamping pressure is available.

Important notes

- The clamping bolt is secured against torsion, but cannot absorb continuous torque during operation.
- The clamping and supporting element is not suitable for use as a pull-type cylinder.
- If the clamping and supporting element is uncoupled from the oil supply after clamping, e.g. on pallets, we recommend to install an accumulator in order to guarantee a re-clamp effect.

Functional principle



Description

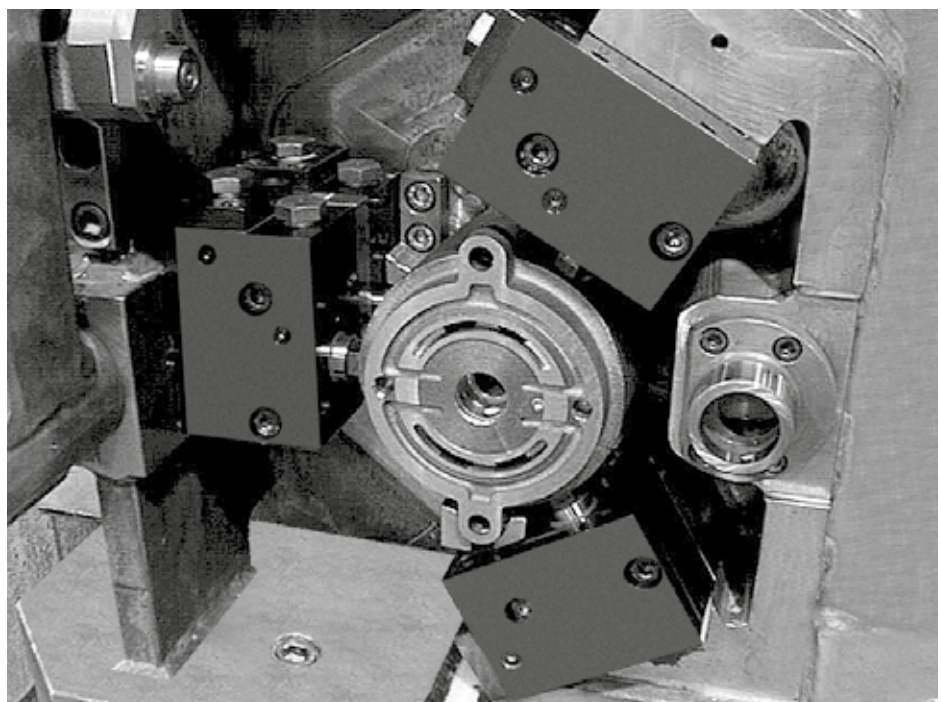
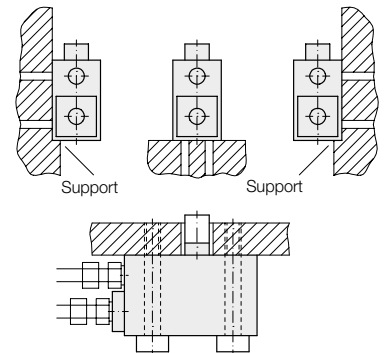
Forces that are directed against the clamping force, e.g. machining forces will be supported with negligible elasticity of the wedge-shaped piston. The counter force must not exceed the max. clamping force (see chart).

The clamping bolt is equipped with an internal thread to screw in contact bolts for height adjustment or adapted contact bolts for shape adjustment.

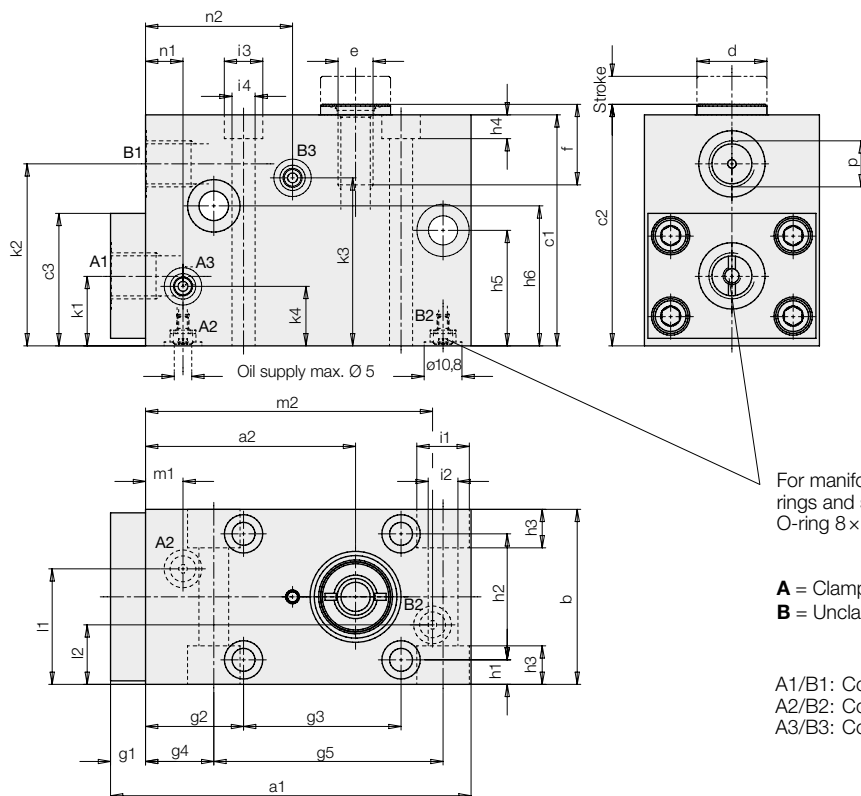
The housing allows for different fixing and connecting possibilities.

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 options



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 8 x 1.5, see accessories

A = Clamping
B = Unclamping

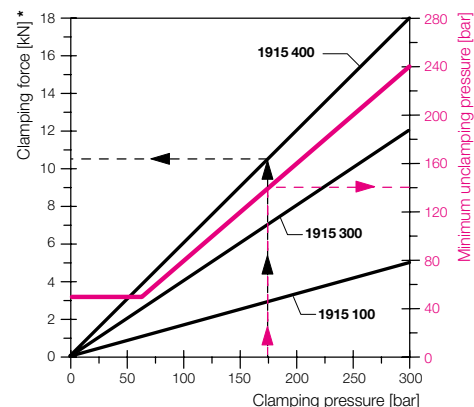
A1/B1: Connection for fittings
A2/B2: Connection with O-rings at the bottom
A3/B3: Connection with O-rings at both sides

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 fitting DL6 DIN 2353

Part no.	1915100	1915300	1915400
Accessories (not included in the delivery)			
O-ring (FKM) 8 x 1.5	3000275	3000275	3000275
Screw plug	3610047	3300821	3300821
Alternative			
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. This considerably reduces the friction coefficient and can increase the clamping force up to 75 %. Therefore the indicated clamping forces are minimum values. For unclamping the fail-safe function of the wedge clamping must be overcome. That is the reason the minimum unclamping pressure must be at least 80 % of the applied clamping pressure.

Product available on request



Hollow-Piston Cylinders

Version with internal thread

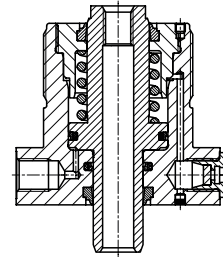
single and double acting, max. operating pressure 500 bar



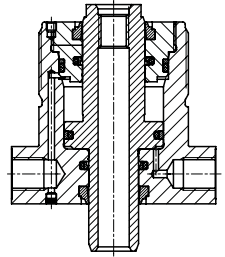
Advantages

- 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.

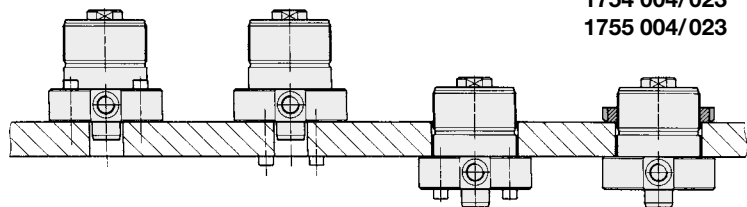
Important notes

For operating pressures exceeding 350 bar only bolts, studs, or screws of material 10.9 must be used.

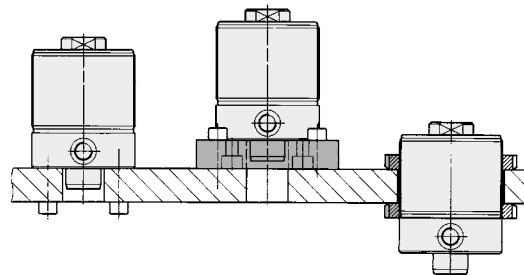
It is important to torque the lock nut used sufficiently to prevent damaging the piston threads. Penetration of aggressive cutting lubricants and coolants through the sintered metal air filter into the cylinder's interior should be avoided by appropriate arrangement or covering. Operating conditions, 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

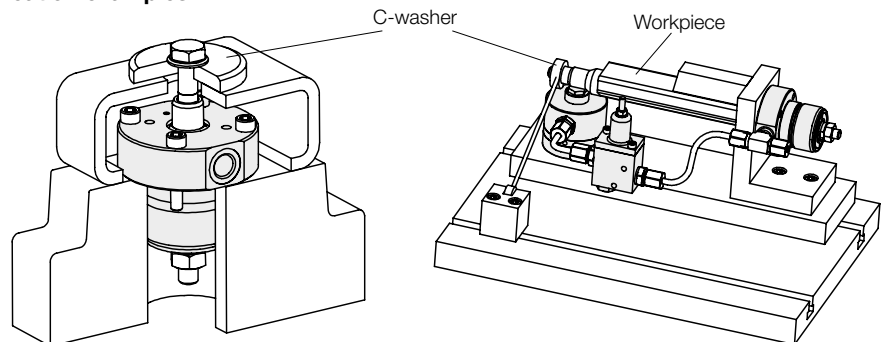


1752 004/023
1754 004/023
1755 004/023



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.

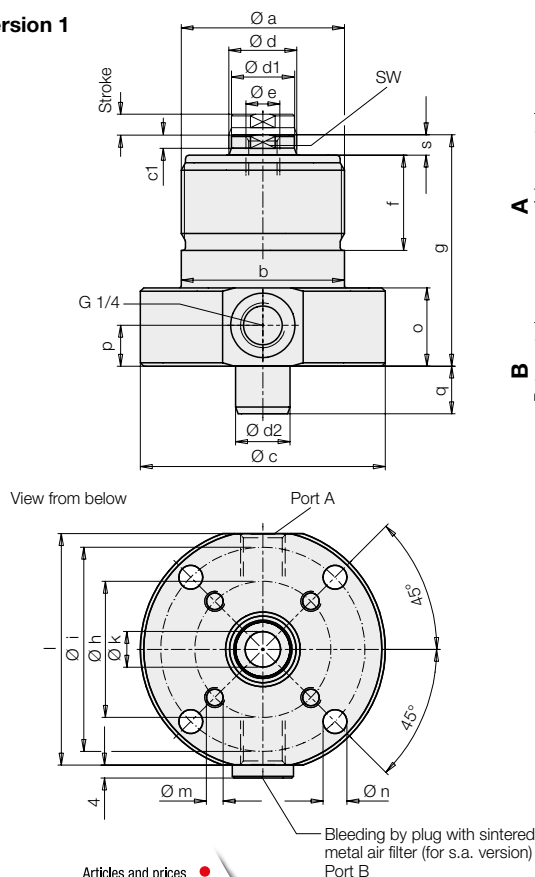
On the machine table, the workpiece is additionally supported by means of a work support in combination with a sequence valve (as per data sheet C 2.954).

The support plunger of the work support is retracted in off-position to facilitate workpiece loading. Contact is effected by means of spring force.

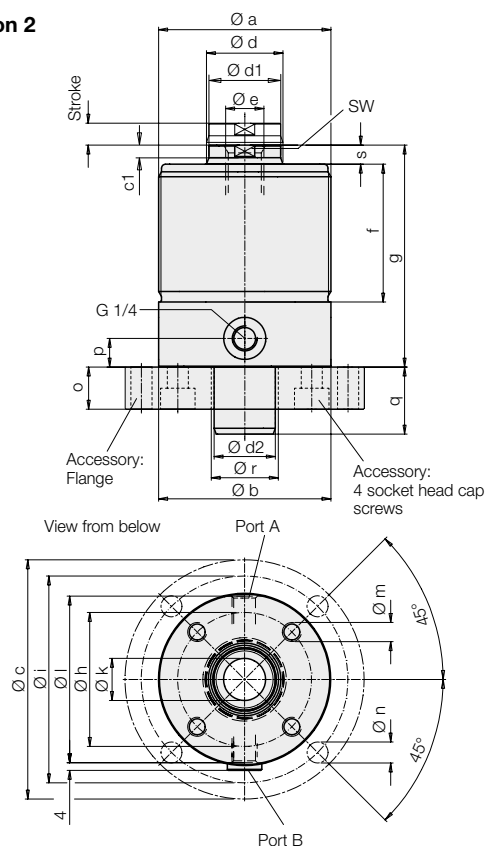
Compared to mechanical clamping, a time saving of 60% is achieved.

Technical Data

Version 1



Version 2



Articles and prices
on request

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	[cm ²]	2.01	6.03	9.42	14.73	23.13	37.7
Piston area - return stroke	[cm ²]	2.01	4.89	7.65	11.58	18.6	30.61
Oil volume per 10 mm stroke	[cm ³]	2.01	6.03	9.42	14.73	23.13	37.7
Oil volume per 10 mm return stroke	[cm ³]	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

				3456310	3456313	3456312
Flange						
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

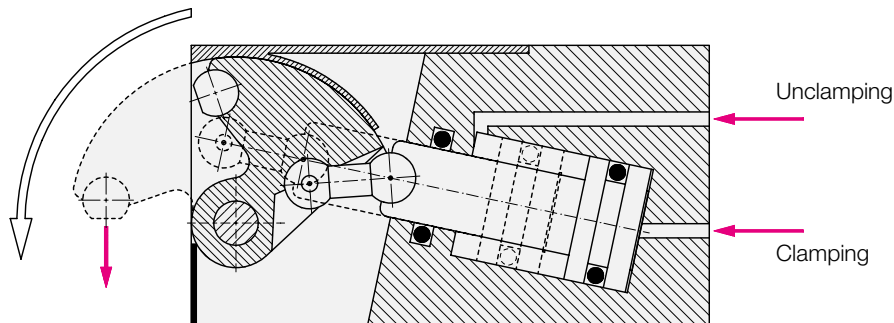
Article available on request

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



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.

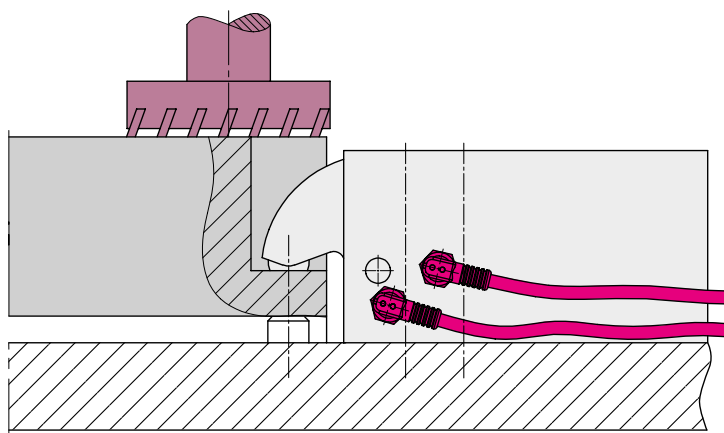
Advantages

- 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

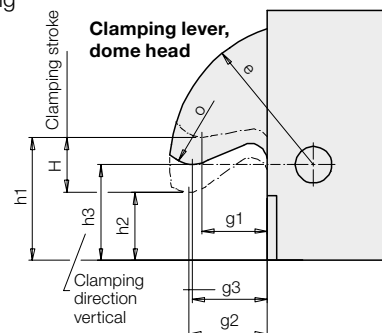
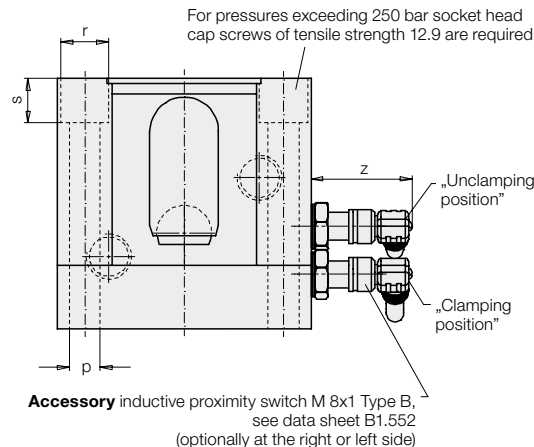
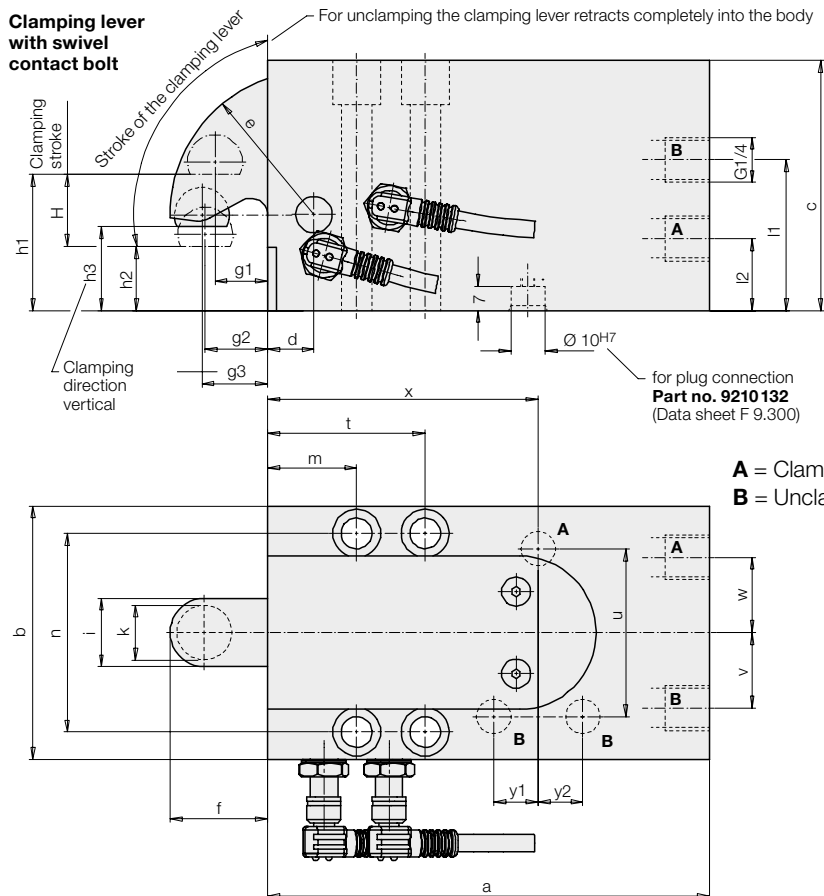
Important notes

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



Clamping lever with swivel contact bolt



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 500 bar	[kN]	2.1 / 2.4 10.5 / 12	2.3 / 2.5 11.5 / 12.5	3.7 / 4.1 18.5 / 20.5	3.8 / 4.1 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

without/with fail-safe function

double acting, max. operating pressure 70/100 bar



Fail-safe function

The full clamping force is maintained both in the event of pressure drop and a complete pressure loss. This is achieved by a fail-safe, patented clamping of the clamping bolt.

Application

Hydraulic block clamps are particularly suitable for clamping of workpieces that require a large clearance zone for machining, and for applications where conventional clamps and swing clamps are too big.

The low height of the block clamp and the ability to plunge into horizontal bores and clamp is particularly advantageous for 5-sided machining.

The block clamp with fail-safe function is used preferably on clamping pallets that will be disconnected from the pressure generator after clamping.

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 absorb these forces. There is a risk of crushing in the effective area of the clamping bolt.

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 secured against rotation so that the contact bolt can adapt itself to the workpiece contour. In retracted position, the clamping bolt is rotated back again to the angle position previously set on the cover, if the deviation is less than $\pm 8^\circ$ (see also page 2).

Advantages

- Fail-safe with fail-safe function
- High retention force
- Flat design
- Clamping in clamping recesses and bore holes
- Suitable for machining from 5 sides
- 2 sizes without and with fail-safe function available
- Low pressure allows direct connection to the hydraulic system of the machine
- Contact bolt interchangeable
- Clamping direction can be set between 0 and 360°
- Pipe connection or manifold-mounting connection can be selected

Description

Block clamps are single and 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 fail-safe function has a smooth wedge surface and requires oil pressure that is continuously available.

In the version with fail-safe function, the wedge drive is toothed to increase the friction factor. As a result, the clamping force is significantly lower, but is maintained when pressure drops.

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 is therefore greatly dependent 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).

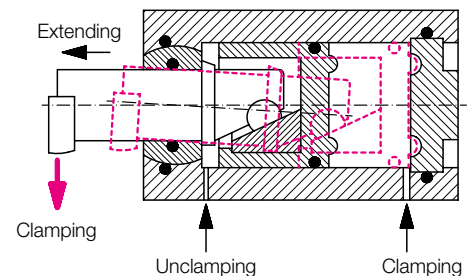
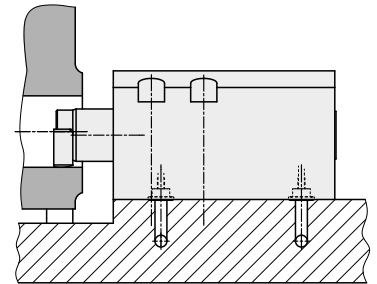
This characteristic of wedge drives must be taken into consideration during project planning, i.e.

1. The reduced clamping force in new condition must be sufficient to clamp the workpiece safely.
2. With increasing clamping force the workpiece must not be inadmissibly deformed.

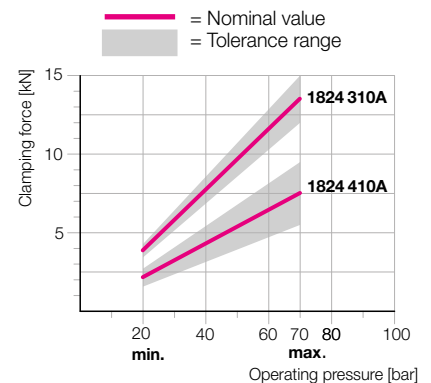
Conclusion: If a clamping force that can be reproduced exactly is required, conventional clamping elements with a direct piston drive must be used.

Position monitoring

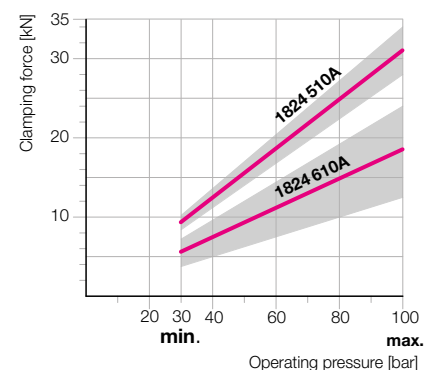
Versions with an extended piston rod at the back and pneumatic position monitoring are available on request.



Clamping force diagrams



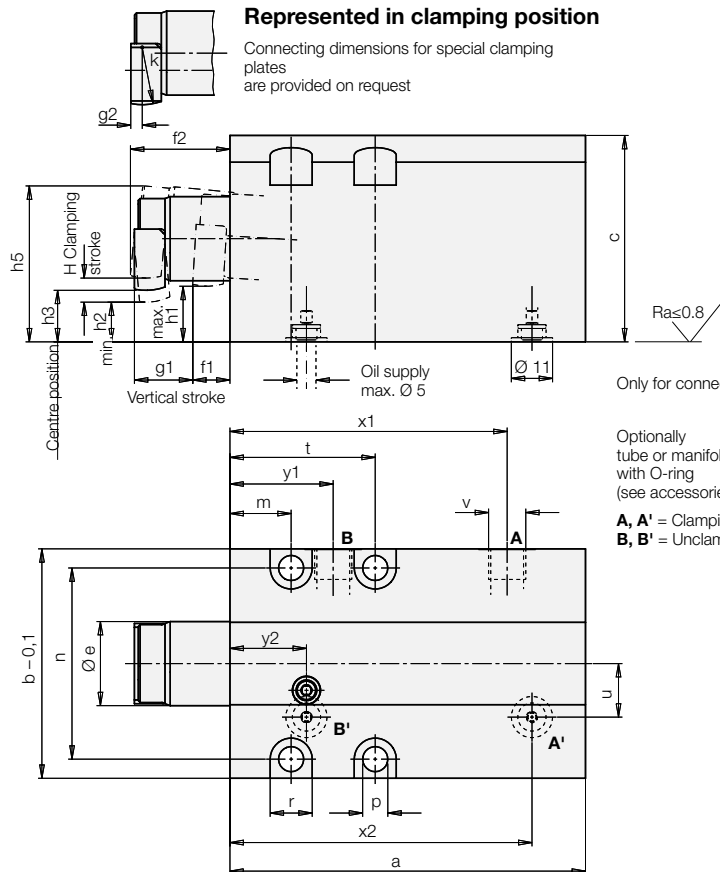
1824-310A without fail-safe function
 1824-410A with fail-safe function



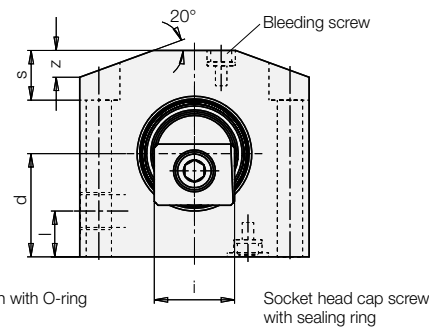
1824-510A without fail-safe function
 1824-610A with fail-safe function

Dimensions

Technical Data • Clamping Direction



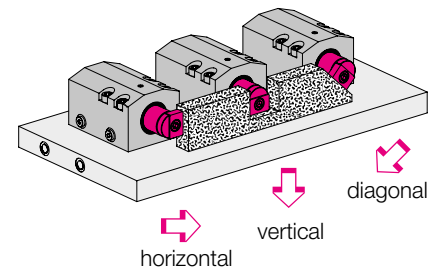
Use fixing screws 12.9!



Bleeding

To ensure clean separation of the extending and clamping functions, the "unclamping" connection in particular must be carefully bled during commissioning. Carefully loosen the upper bleeding screw at low pressure until bubble-free oil comes out. Then tighten again and check density.

Different clamping directions



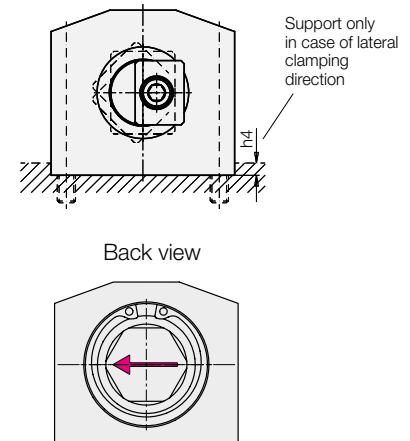
Fail-safe function

		Without	With	Without	With
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 Clamping stroke max.	[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

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

Example: 90° ccw



Accessories

O-ring 8 x 1.5	3000343
Screw plug G 1/8	3610047
Screw plug G 1/4	3300821

Part no.



Slide Pivot Clamp

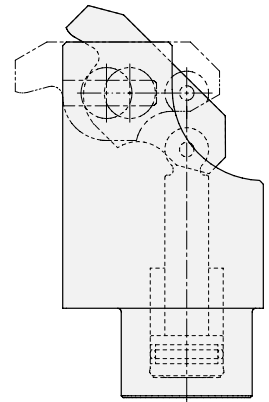
**compact version, with optional position monitoring,
double acting, max. operating pressure 350 bar**



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.

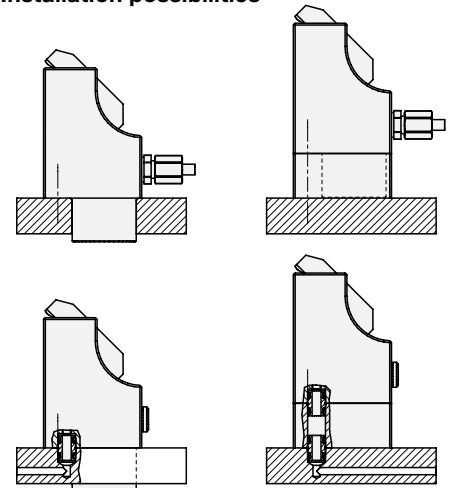
Position of the clamping lever can be monitored by inductive proximity switches or pneumatic jets.

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



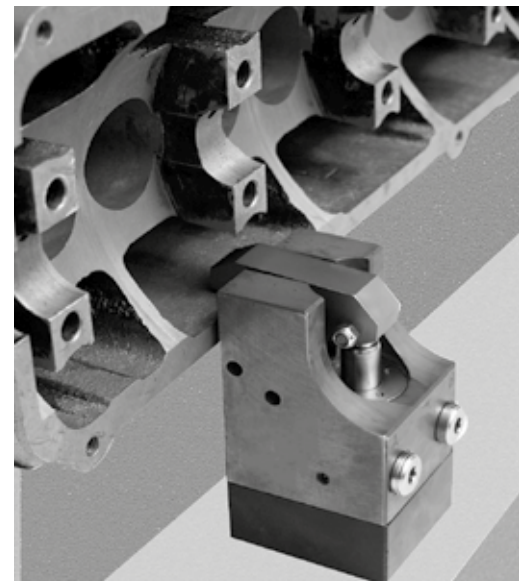
Important notes

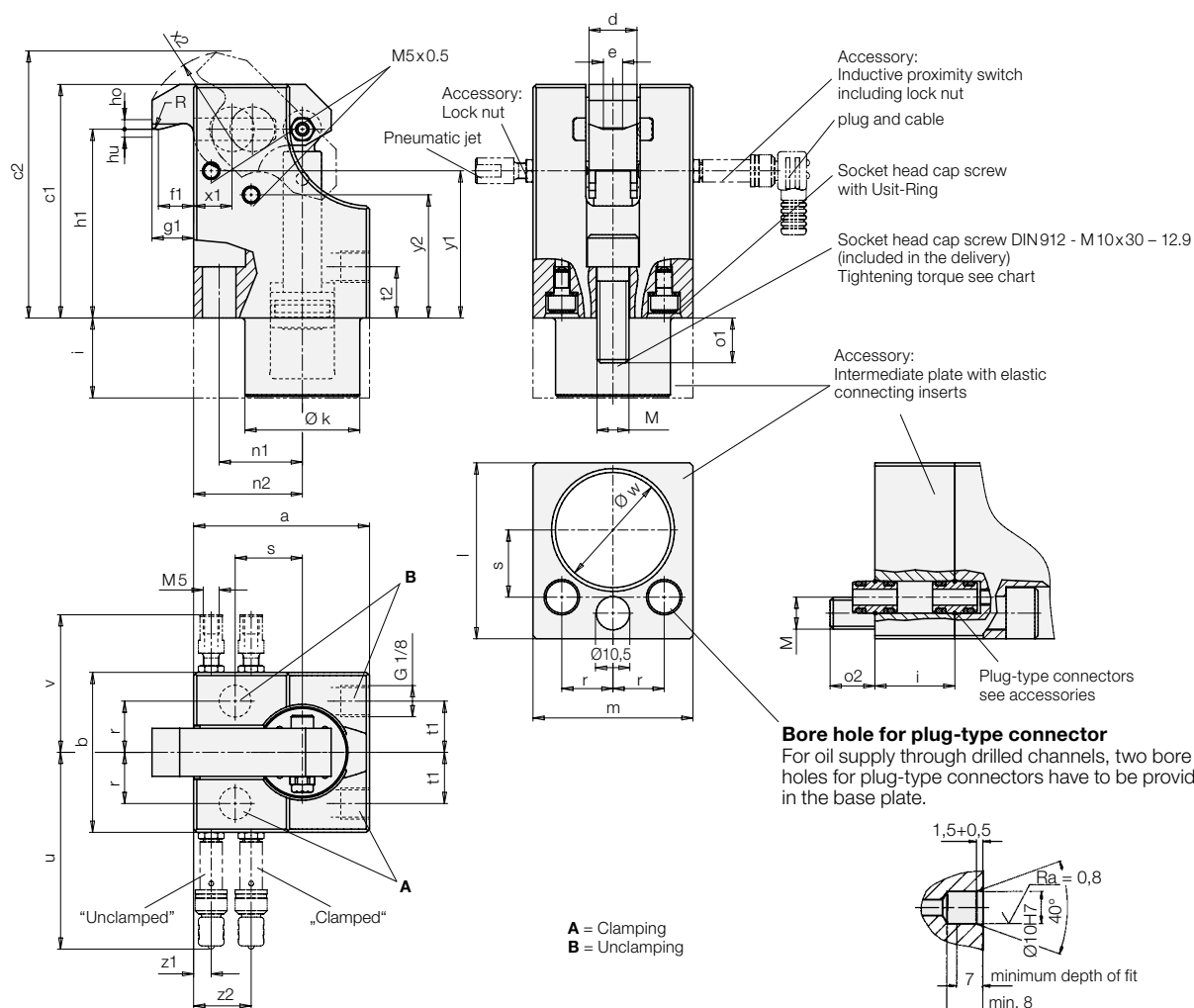
The clamping lever must not be impeded during swivelling movement.

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**





Clamping force F_{Sp} at 350 bar	[kN]	10
Oil volume clamping	[cm ³]	6
Oil volume unclamping	[cm ³]	4
Max. flow rate	[cm ³ /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 1824 040	3456425
Socket head cap screw	
DIN912 - M 10x55 12.9	3300434

Technical characteristics for inductive 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

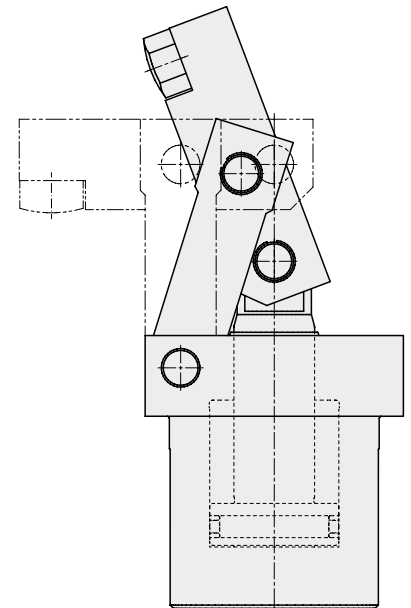
double acting, max. operating pressure 200 bar



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.

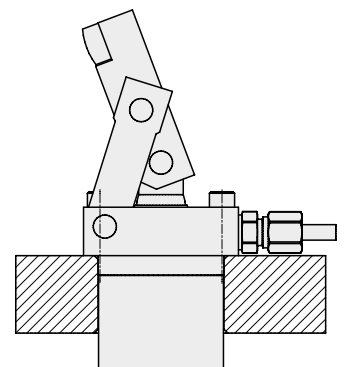
Application

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.

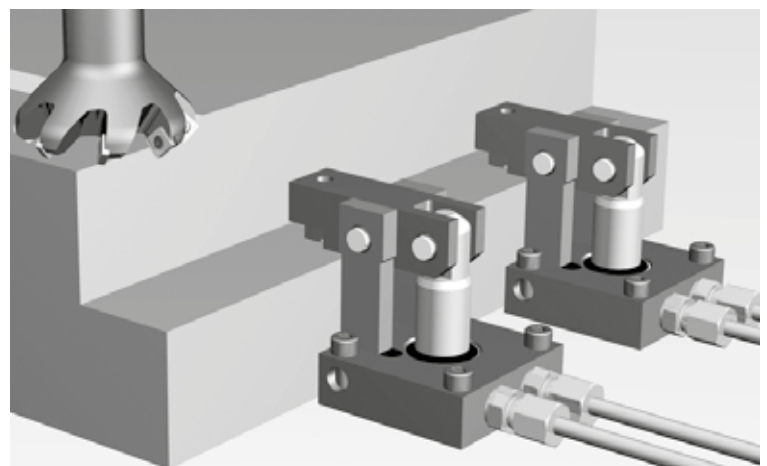
Installation

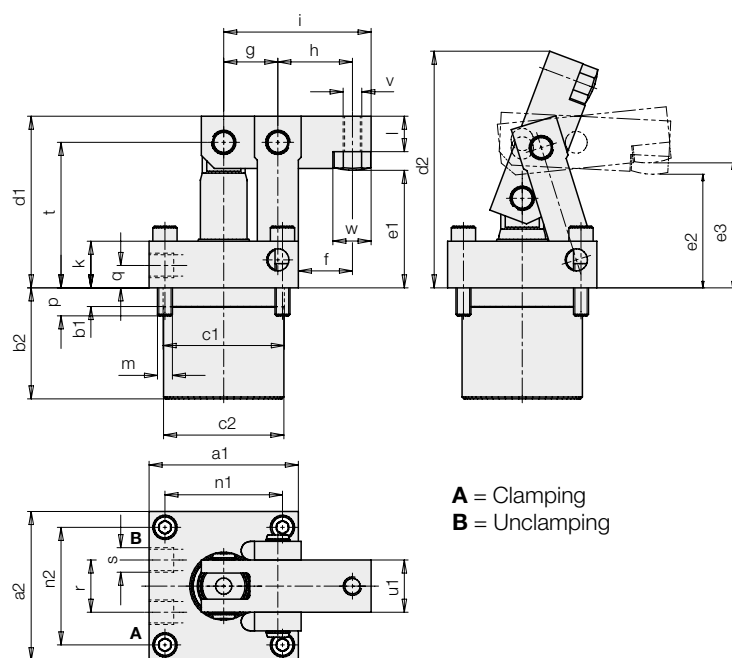


Important notes

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	[cm ³]	40,2
Oil volume unclamping	[cm ³]	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

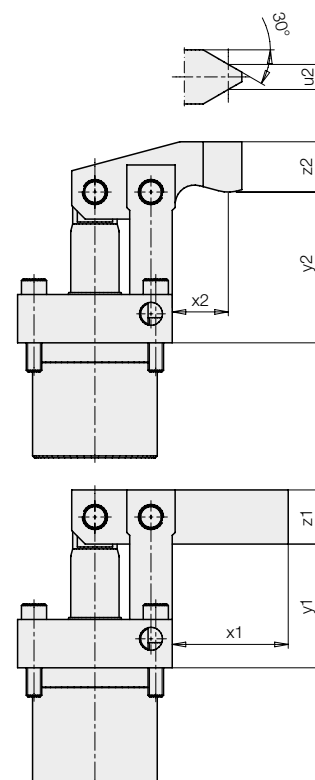
Part no. 1825500

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



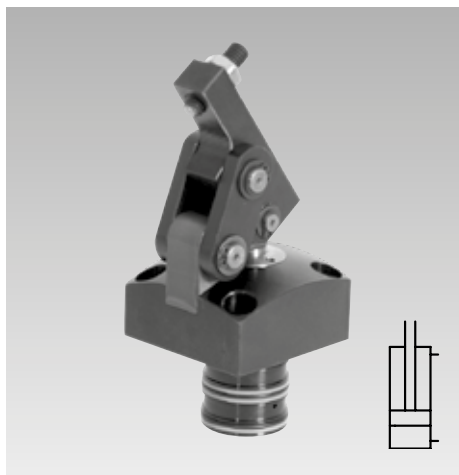
Special features:

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.



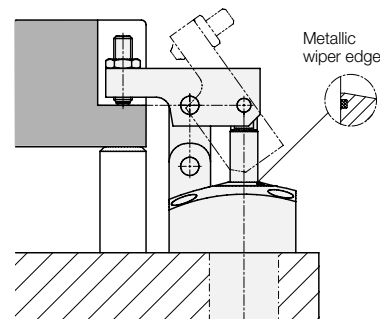
Hinge clamp

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



Advantages

- Compact design, partially recessible
- Clamping possible without side loads
- Standard metallic wiper edge
- FKM seals as standard



Special features

- Lever mechanism easy to clean
- Inductive or pneumatic monitoring possible

Materials

Body: C 45 + C black oxide

Seals: FKM

Clamping lever: C 45 + C

Piston: High alloy steel

Function

The piston force is deviated via sophisticated kinematics by 180° and is available as clamping force with virtually no loss of efficiency. If the level of the clamping surface is exactly at height *h* (see page 2), no side loads are channelled into the workpiece.

Versions

- 4 sizes

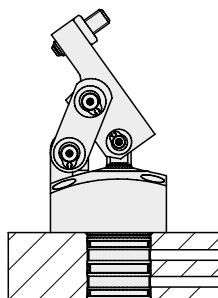
Accessories

- Intermediate plates
- Long clamping lever
- Add-on parts for inductive or pneumatic monitoring on request

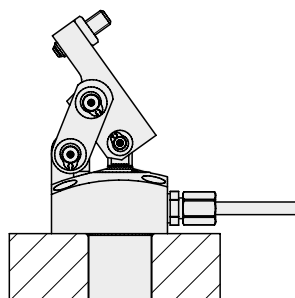
Installation and connecting possibilities

Cartridge type

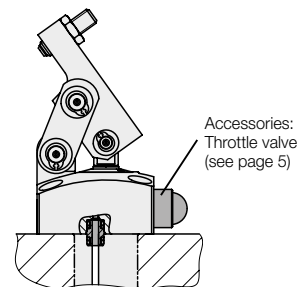
For horizontally-drilled channels



Pipe thread

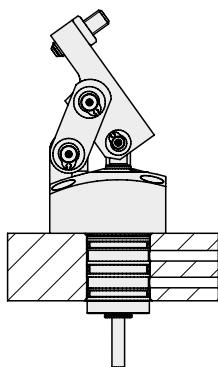


For vertically-drilled channels

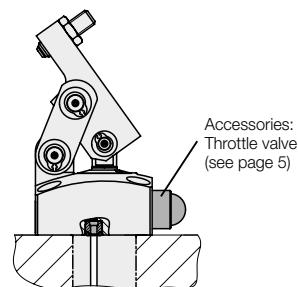
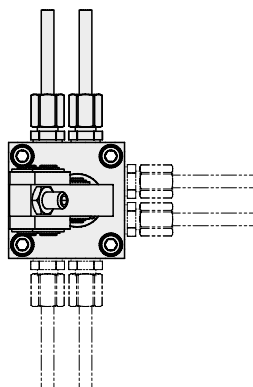


Oil supply by plug-type connectors

With extended piston rod



Possible from 3 sides



Oil supply by bushing for manifold connection
(for precision-machined support surface)

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

Code for part numbers Accessories • Technical data

Code for part numbers

- 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 thread on three sides
6 = Pipe thread on three sides with extended piston rod

◇ Condition for mounted position monitoring (addition: E or P)

Basic type 1825 X X X (X)

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

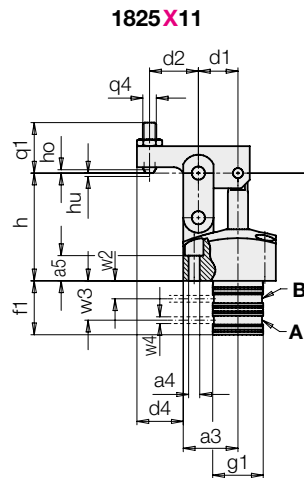
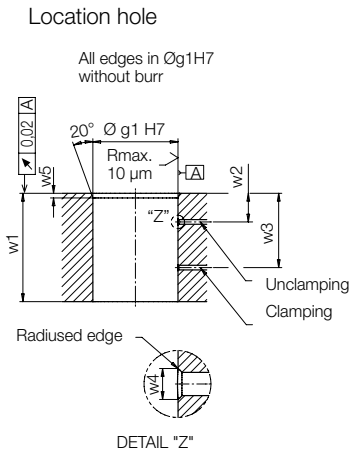
0 = without clamping lever
1 = clamping levers with swivel contact bolt
2 = long clamping lever, unmachined
Material: C45 + C (1.0503)

Cartridge type

Examples

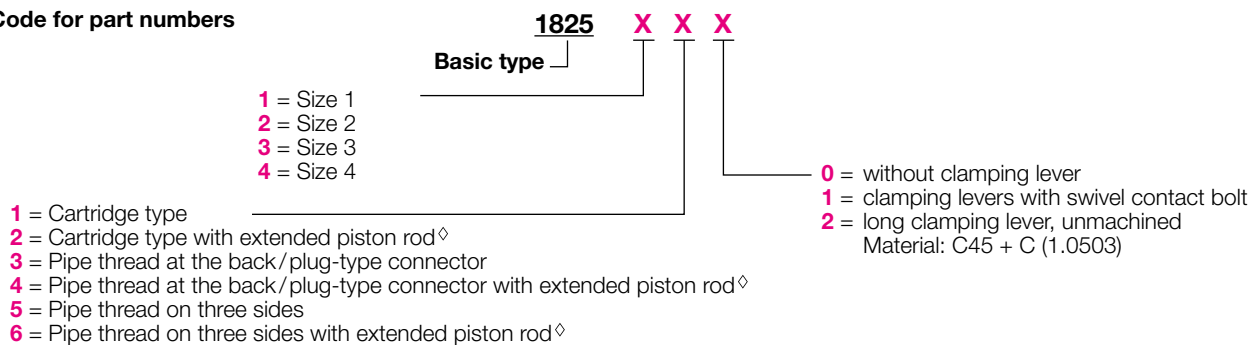
Clamping lever with swivel contact bolt

Without clamping lever and extended piston rod



Code for part numbers Accessories • Technical data

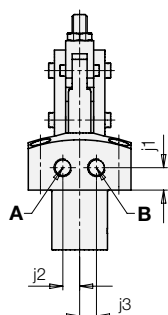
Code for part numbers



Pipe thread at the rear / plug-type connector

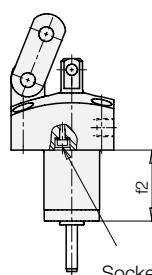
Clamping lever with
swivel contact bolt

1825 **X**31



Without clamping lever
extended piston rod

1825 **X**40

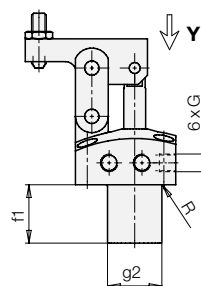


Socket head cap screw
with USIT ring

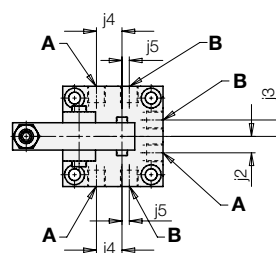
Pipe thread on three sides

Clamping lever with
swivel contact bolt

1825 **X**51

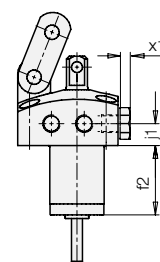


View Y



Without clamping lever
extended piston rod

1825 **X**60



4 × screw plug with sealing
edge included in the delivery
(dimension x1)

A = Clamping
B = Unclamping

Accessories for size

Plugs, flush screwable with hexagon socket

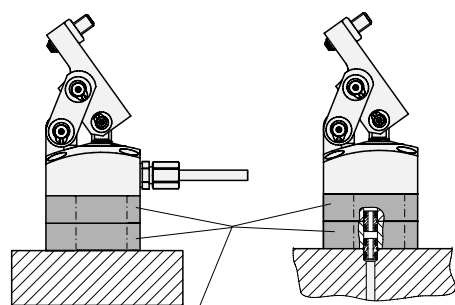
Screw plug with hexagon head

	1	2	3	4
Plugs, flush screwable with hexagon socket	0361 986	0361 986	0361 987	0361 987
Screw plug with hexagon head	3610 047	3610 047	3300 821	3300 821

Accessories

Intermediate plates

for all versions with pipe thread



Intermediate plates

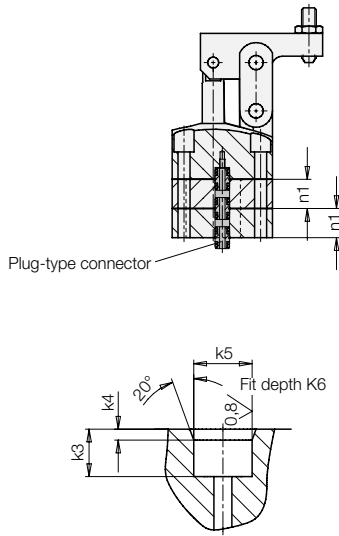
Accessories for size

Intermediate plate (not for cartridge-type version)

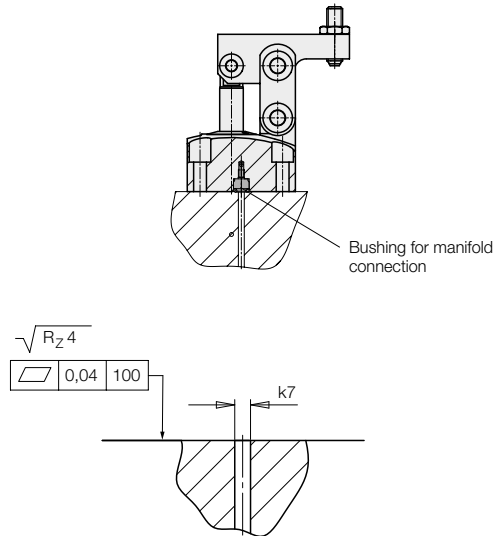
	1	2	3	4
Intermediate plate (not for cartridge-type version)	3456 449	3456 468	3456 489	3456 534

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

Plug-type connector



Bushing for manifold connection



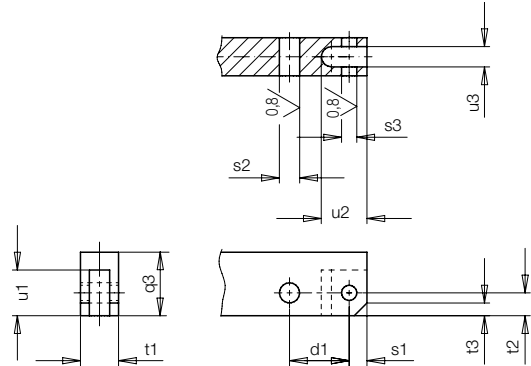
For oil supply through plug-type connectors, these bore holes have to be provided in the base plate.
Required accessory when using plug-type connectors:
2 x sealing plug or 2 x screw plug (see page 3)

Accessories for size

	1	2	3	4
Plug-type connector	9210 145	9210 145	9210 145	9210 132
Bushing for manifold connection	9210 166	9210 166	9210 166	9210 167

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



Accessories

Technical data

Accessory throttle valve

Throttle valves are used

- in order to reduce the actuation speed of the clamping arm
- in order to improve the synchronism of several hinge clamps

This application is only possible for connection through vertically drilled channels.

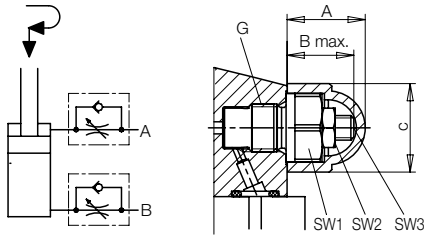
Important note

If throttling is too strong, the back pressure can trigger premature switching of pressure switches and sequence valves.

Hinge clamp

Size		1+2	3+4
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.		2957 209	2957 210

Hydraulic symbol

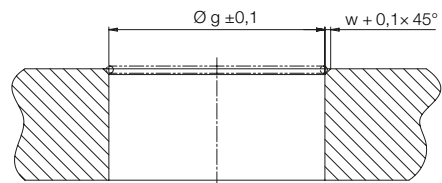
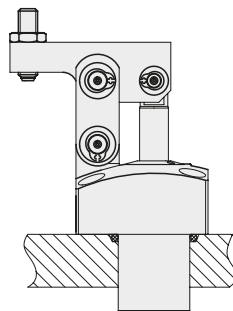


Sealing for holder

If a seal for the holder/basic fixture is necessary, we recommend use of an O-ring.

Note

Any reworking of the hinge clamp is not permitted!



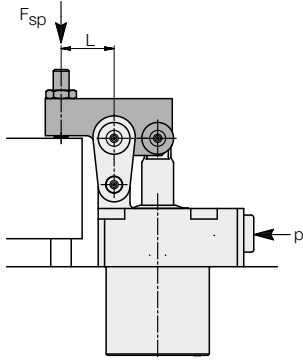
Size	1	2	3	4
Bore hole $g \pm 0.1$	30	42	52	65
Chamfer $w + 0.1 \times 45^\circ$	2.4	2.4	2.4	2.4
Recommendation O-ring	28.3 × 1.78	41 × 1.78	50.52 × 1.78	63.22 × 1.78

Technical data Dimensions

Size			1	2	3	4
Clamping force at clamping lever length d2 and 250 bar	[kN]		3.8	9.7	14.4	21.5
Clamping force at clamping lever length d2 and 250 bar	[kN]		3.3	9.1	13.9	21
With extended piston rod						
Oil volume, clamping	[cm³]		4.8	16.9	31.1	61.6
Oil volume, clamping	[cm³]		4.1	16.0	30.0	60.2
With extended piston rod						
Oil volume, unclamping	[cm³]		2.1	10.0	19.0	37.5
Admissible flow rate	[cm³/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 × Ø 6.6	4 × Ø 9	4 × Ø 11	4 × 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			M5×0.5	M5×0.5	M5×0.5	M5×0.5
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	10L
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
k7	[mm]		3	3	3	4
l1	[mm]		Ø 6 f7	Ø 6 f7	Ø 6 f7	Ø 6 f7
l2			M4×7.5 deep	M4×7.5 deep	M4×7.5 deep	M4×7.5 deep
m1	[mm]		Ø 13 f7	Ø 13 f7	Ø 13 f7	Ø 13 f7
m2	[mm]		2	2	2	2
m3			M4×6 deep	M4×6 deep	M4×6 deep	M4×6 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]		0.3	0.3	0.3	0.3
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.	[kg]	1825 XX0	1.0	2.3	3.8	6.1
	[kg]	1825 XX1	1.1	2.7	4.6	7.3
	[kg]	1825 XX2	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. clamping lever length

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

L, L_{min} = length of clamping lever [mm]

p, p_{adm} = operating pressure [bar]

A, B, C, = constants as per chart

Constant

	18251	18252	18253	18254
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. clamping lever length

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

Effective clamping force

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

Example 3: Hinge clamp 1825210

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 1825310

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

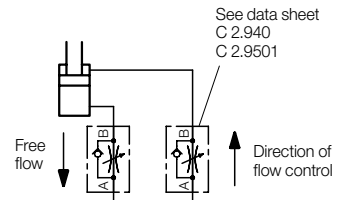
The max. operating pressure is 250 bar, thus

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

Important note

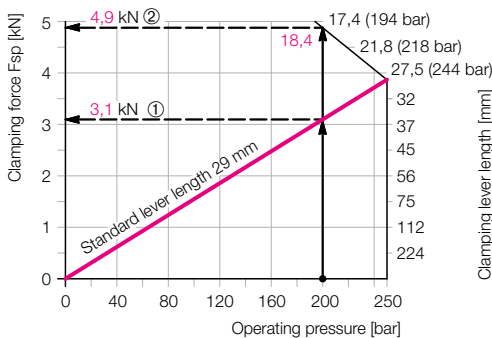
Longer special clamping levers have a greater weight. Therefore the flow rate has to be considerably reduced to avoid damage of the mechanics in the stroke end positions.

A flow rate throttling always has to be effected in the supply line to the hinge clamp.

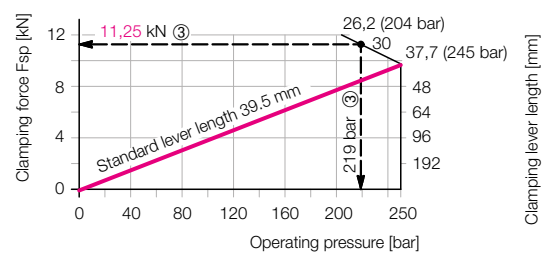


Clamping force diagrams

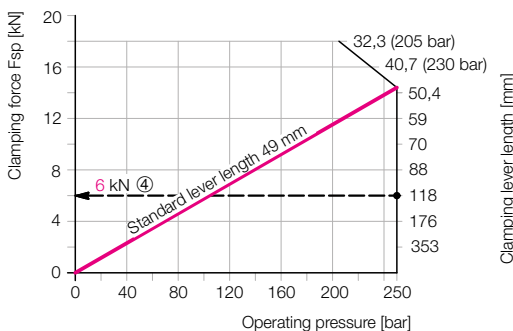
Size 1



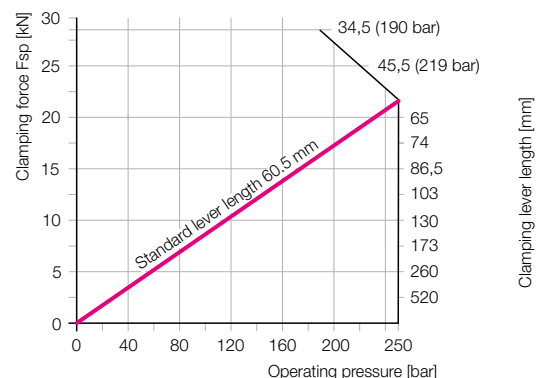
Size 2



Size 3



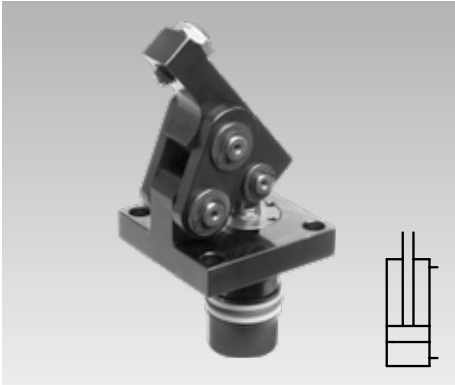
Size 4



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

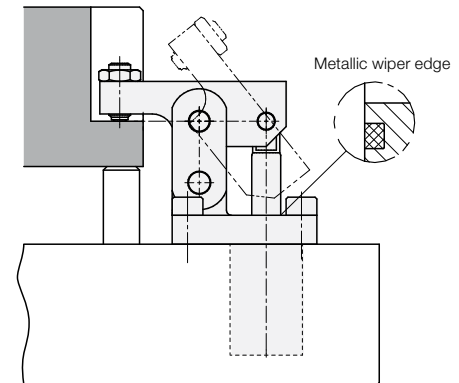


Mini Hinge Clamp with metallic wiper edge, double acting, max. operating pressure 250 bar



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



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.

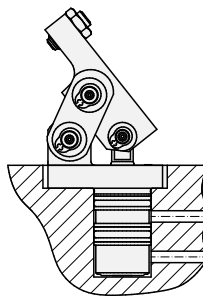
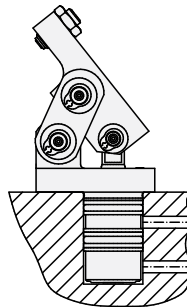
The manufacturer of the fixture or the machine is obliged to provide effective protective measures.

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.

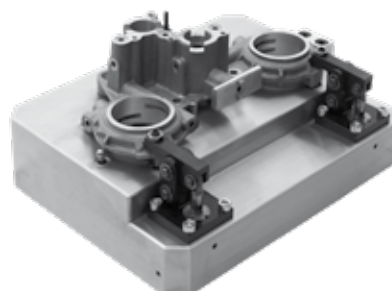
Installation and connecting possibilities

Cartridge type

for horizontally-drilled channels

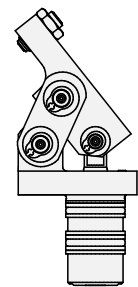


Application example

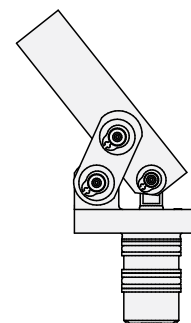


Options for clamping levers

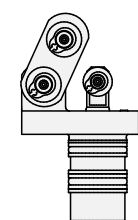
Clamping lever with swivel contact bolt



Long clamping lever

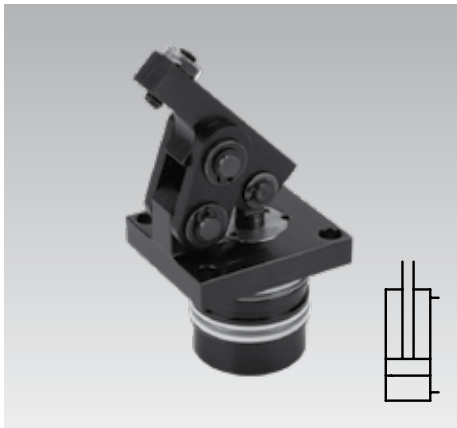


without clamping lever



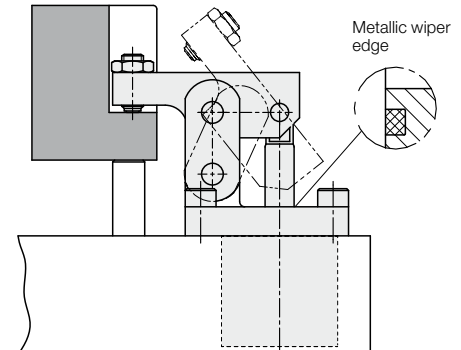


**Mini Hinge Clamps 70 bar/120 bar
with metallic wiper edge,
double acting, max. operating pressure 120 bar**



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 120 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.

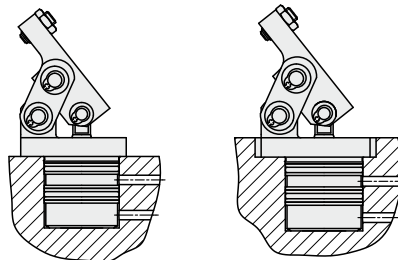
Considerable injuries can be caused to fingers during clamping and unclamping in the effective area of the clamping lever.

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

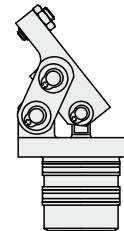
Cartridge type

for horizontally-drilled channels

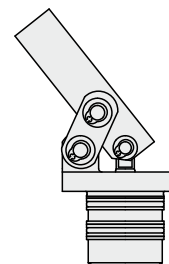


Options for clamping levers

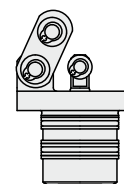
Clamping lever with swivel contact bolt



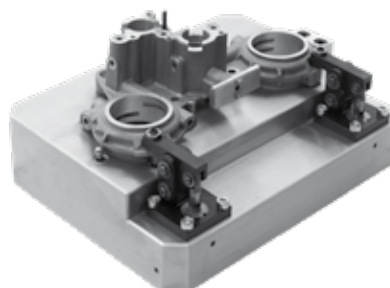
Long clamping lever



without clamping lever

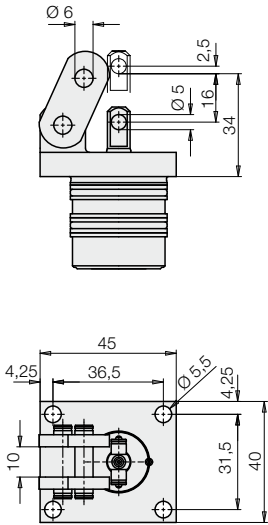


Application example



Dimensions Technical data

Without clamping lever 1826010



Technical data

Clamping force	[kN]	4
Max. operating pressure	[bar]	120
Min. operating pressure	[bar]	10
Oil volume	[cm³]	7.7
Unclamping	[cm³]	6.8
Max. flow rate	[cm³/s]	15
Clamping	[cm³/s]	15
Unclamping	[cm³/s]	15
Weight	[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

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

1.2 Effective clamping force

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

$$p_{adm} < 120 \text{ bar} \rightarrow F_{Sp} = \frac{A}{L} * p_{adm} \quad [\text{kN}]$$

2. Min. length of clamping lever

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

L, L_{min.} = Length of clamping lever

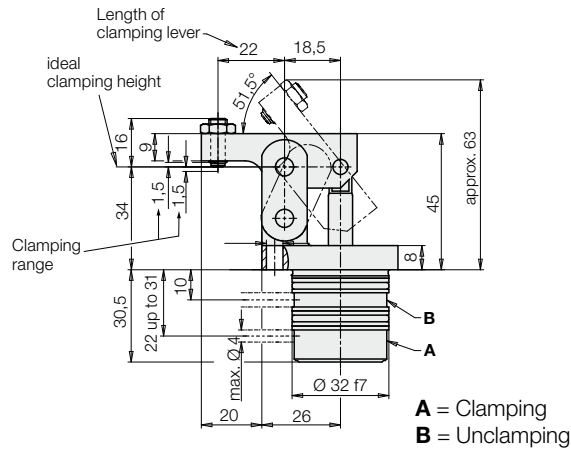
p, p_{adm} = Operating pressure

A, B, C = Constants as per chart

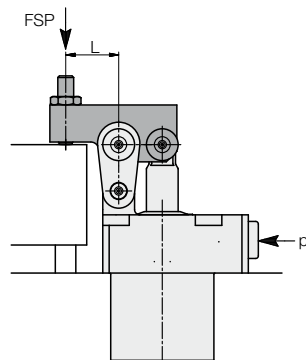
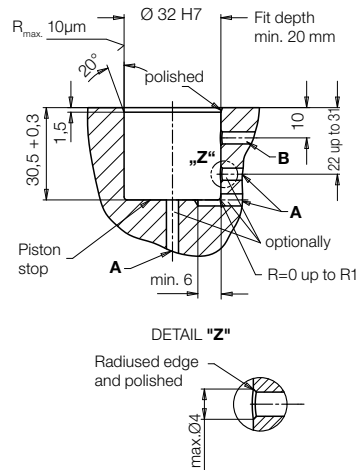
Constant 182601

A	0.73
B	125.92
C	17.575

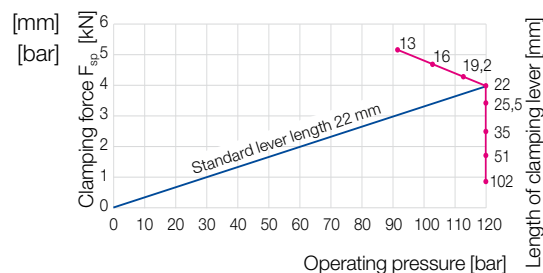
Clamping lever with contact bolt 1826011



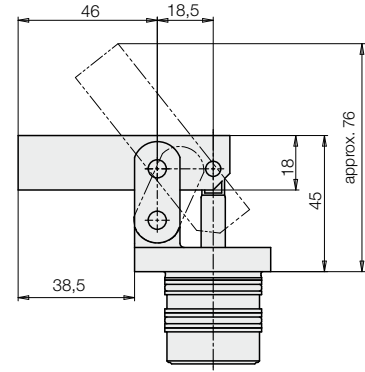
Location hole



Clamping force diagram

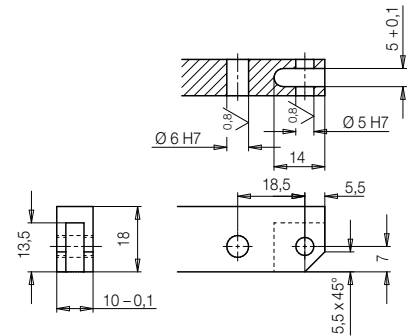


Long clamping lever 1826012



Connecting dimensions for self-manufactured clamping levers

Material: C45 + C (1.0503)



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

$$L_{min.} = \frac{C}{\frac{B}{p} - 1} = \frac{17.575}{\frac{215.863}{60} - 1} = 6.77 \text{ mm}$$

Effective clamping force

$$F_{Sp} = \frac{A}{L} * p = \frac{0.73}{6.77} * 60 = 6.5 \text{ kN}$$

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

Admissible operating pressure

$$p_{adm} = \frac{B}{\frac{C}{L} + 1} = \frac{215.863}{\frac{17.575}{51} + 1} = 160.54 > 120 \text{ bar}$$

Effective clamping force

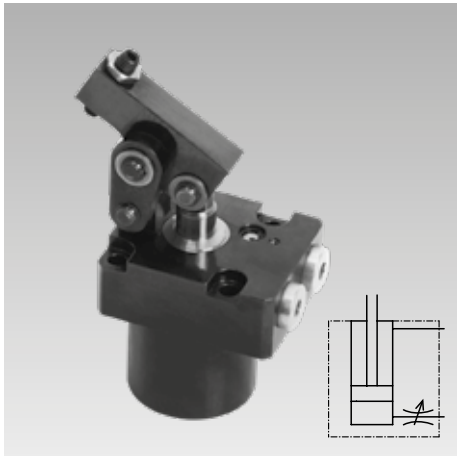
The max. operating pressure is 120 bar, thus

$$F_{Sp} = \frac{A}{L} * 120 = \frac{0.73}{51} * 120 = 1 \text{ kN}$$



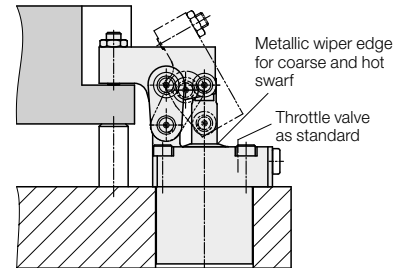
Hinge Clamps 70 bar

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



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 work-piece contour
- FKM wiper protected by metallic wiper edge
- Position monitoring available as accessory
- Mounting position: any



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 120 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").

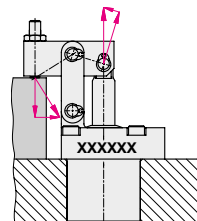
The 3 available clamping directions (L, G, R) make it easier to adapt to the workpiece shape or the hydraulic connectivity.

All sizes are optionally available with switch rod for external position monitoring.

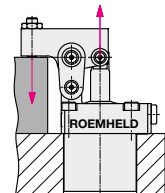
Electrical and pneumatic position monitorings for the clamping and unclamping position are available as accessories.

Forces at the clamping point

Conventional lever mechanism of other manufacturers

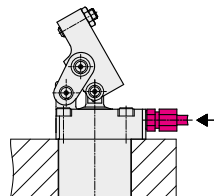


Lever mechanism without side loads ROEMHELD system

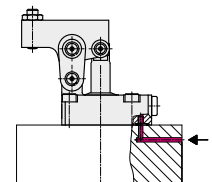


Installation and connecting possibilities

Pipe thread

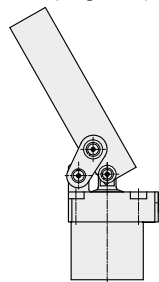


Drilled channels

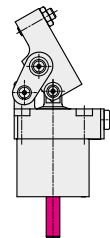


Versions

Without switch rod
(Option Long clamping lever)

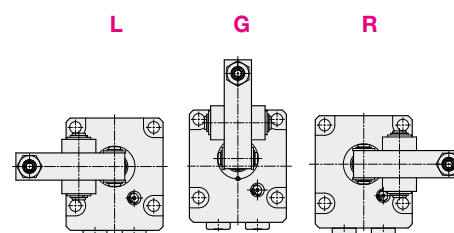


With switch rod



Clamping direction

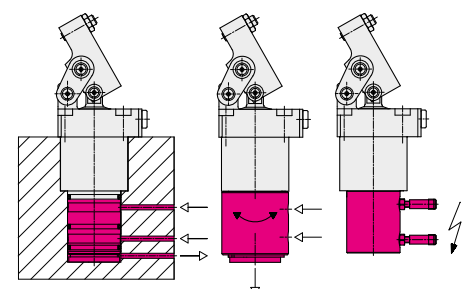
Code letters



Accessories – position monitoring

pneumatic

electrical

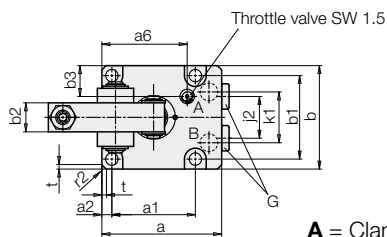
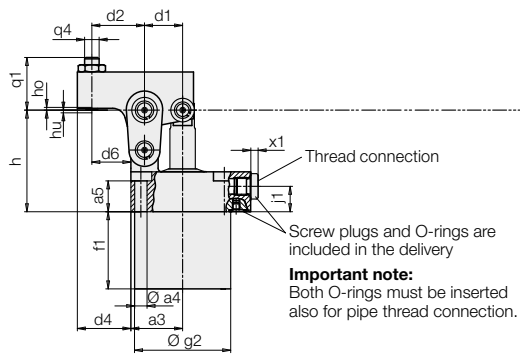


Important notes see page 6

Versions: without / with switch rod Dimensions • Accessories

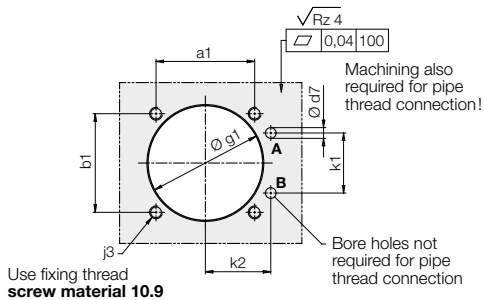
Without switch rod 1826G7X31

Clamping lever with contact bolt



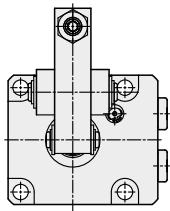
A = Clamping
B = Unclamping

Connecting scheme

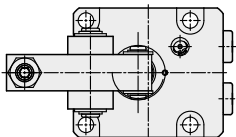


Clamping direction

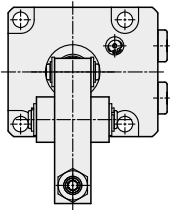
R



G



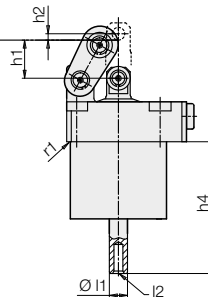
L



X = code letter for part no.

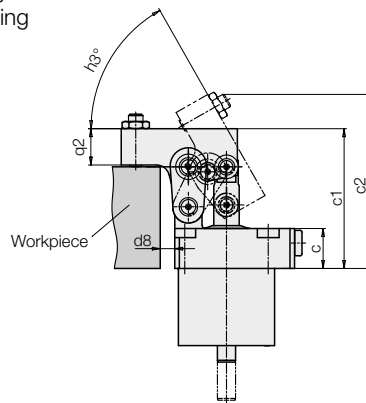
With switch rod 1826G7X40

Without clamping lever



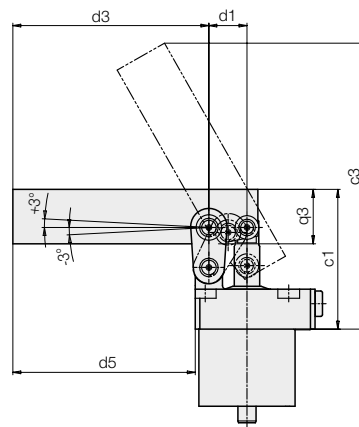
With switch rod 1826G7X41

Clamping lever with contact bolt

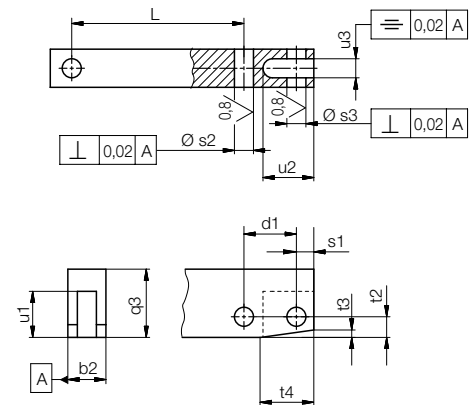


With switch rod 1826G7X42

Clamping lever, long

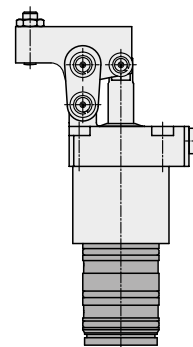


Connecting dimensions for self-manufactured clamping levers

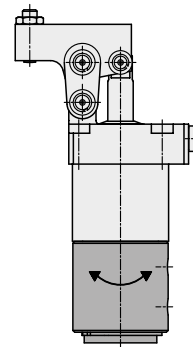


Accessories

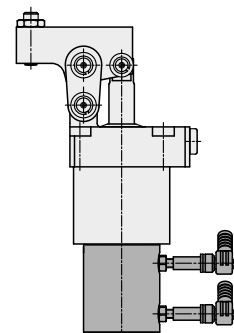
Pneumatic position monitoring (page 5)
Cartridge type



Pipe thread connection



Inductive position monitoring (page 6)



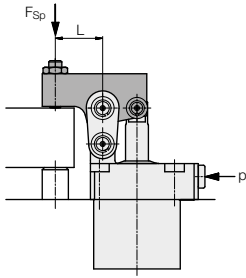
Technical Data

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
	with switch rod	[kN]	2.3	3.1	4	6.8
Piston force	without switch rod	[kN]	3.4	4.9	6.7	10.6
	with switch rod	[kN]	3	4.3	6.1	9.8
Piston Ø		[mm]	25	30	35	44
Piston rod Ø		[mm]	12	14	14	16
Piston stroke		[mm]	18.7	20.7	24	26
Piston area	clamping					
	without switch rod	[cm²]	4.9	7.06	9.62	15.2
	with switch rod	[cm²]	4.4	6.28	8.83	14
	unclamping	[cm²]	3.77	5.52	8.08	13.1
Oil volume	clamping					
	without switch rod	[cm³]	9.2	14.7	23.1	39.6
	with switch rod	[cm³]	8.3	13	21.2	36.6
	unclamping	[cm³]	7.1	11.45	19.4	34.3
Max. flow rate		[cm³/s]	16	25	40	75
a		[mm]	55	60	66	82
a1		[mm]	35	40	46	56
a2		[mm]	5	5	5.5	7
a3		[mm]	22.5	25	28.5	35
Ø a4		[mm]	5.6	5.6	6.8	9
a5		[mm]	18	17	17	20
a6		[mm]	37.5	41	47	57
b		[mm]	45	50	57	70
b1		[mm]	35	40	46	56
b2 – 0.05		[mm]	12	12	16	19
b3		[mm]	15.5	14	17	20
c		[mm]	22	20.8	22	26
c1		[mm]	63.5	68.5	77	93
c2		[mm]	79.8	85.5	97	116.5
c3		[mm]	129.1	152.8	157.6	204
d1		[mm]	16.5	18.5	21	24.5
d2		[mm]	20	23.5	29	32
d3		[mm]	88	110.5	108	148.5
d4		[mm]	20	23	29.5	31.5
d5		[mm]	82	104	100.5	138
d6		[mm]	14	17	21.5	21.5
Ø d7 max.		[mm]	4	4	4	6
d8 min.		[mm]	3	4	7	7
f1		[mm]	33.5	39.5	42.5	47
G			G1/8	G1/8	G1/8	G1/4
Ø g1 max.		[mm]	40	48	54	64
Ø g2 ±0.1		[mm]	39	47	53	63
h	ideal clamping point	[mm]	48.5	51.5	56	67
ho	upper end of the clamping range	[mm]	1	1.2	1.5	1.8
hu	lower end of the clamping range	[mm]	1.1	1.3	1.5	1.7
h1	stroke up to the ideal clamping point	[mm]	15.7	17.7	21	23
h2	stroke up to the end of the clamping stroke	[mm]	3	3	3	3
h3		[°]	57.6	58.6	60.4	57.6
h4	unclamping position	[mm]	60.2	68.2	72.6	78.1
j1		[mm]	12.5	12.8	14	14
j2		[mm]	20	22	23	30
j3	fixing thread		M5	M5	M6	M8
k1		[mm]	22	24	28	36
k2		[mm]	25	28	30.5	36
Ø l1 f7		[mm]	8	10	10	12
l2			M5x15 deep	M6x11.5 deep	M6x11.5 deep	M8x16 deep
q1		[mm]	26	26	29	39
q2		[mm]	14	16	20	25
q3		[mm]	21.5	26	30	36.5
q4			M6	M6	M8	M10
r1		[mm]	0.4	0.4	0.4	0.4
r2		[mm]	7	9	9	11
s1		[mm]	5.5	6	6	7
Ø s2 H7		[mm]	6	8	8	10
Ø s3 H7		[mm]	6	6	7	8
t		[mm]	2.4	3.9	2.5	4
t2		[mm]	6.5	9	9	10.5
t3		[mm]	4	3	4.3	5.1
t4		[mm]	4	17	22	22
u1		[mm]	14.5	17.5	17.5	19
u2		[mm]	16	16.5	17	19
u3 +0.1		[mm]	6.1	6.1	8.1	10.1
x1		[mm]	4	4	4	5
Weight		[kg]	1	1.2	1.5	2.6
Part no. without switch rod						
without clamping lever			1826X7130	1826X7230	1826X7330	1826X7430
Clamping lever with contact bolt			1826X7131	1826X7231	1826X7331	1826X7431
Clamping lever, long			1826X7132	1826X7232	1826X7332	1826X7432
Part no. with switch rod						
without clamping lever			1826X7140	1826X7240	1826X7340	1826X7440
Clamping lever with contact bolt			1826X7141	1826X7241	1826X7341	1826X7441
Clamping lever, long			1826X7142	1826X7242	1826X7342	1826X7442
Spare O-ring		[mm]	7x1.5	7x1.5	7x1.5	8x1.5
Part no.			3000342	3000342	3000342	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

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

1.2 Effective clamping force

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

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

2. Min. length of clamping lever

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

L, L_{min.} = length of clamping lever [mm]

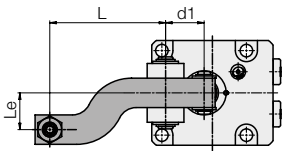
p, p_{adm.} = operating pressure [bar]

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.

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

L = length of clamping lever,

Le = eccentricity

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 1826G72

Special clamping lever L = 60 mm

Eccentricity Le = 45 mm

As per diagram: p_{adm} = approx. 30 bar

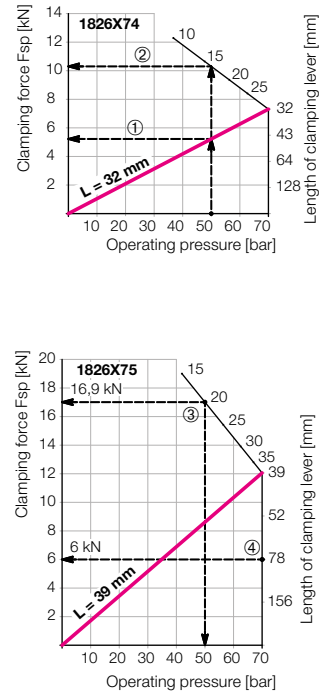
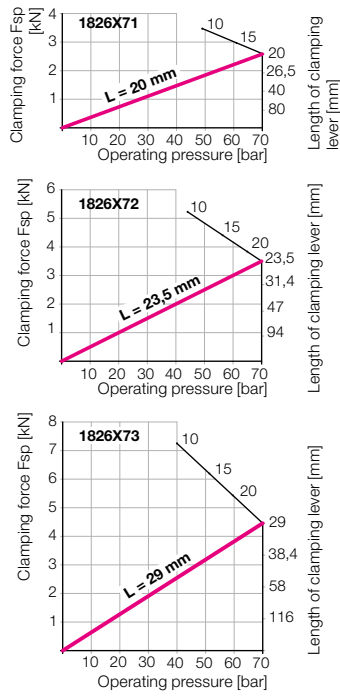
According to formula:

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

$$p_{adm} = 30.64 \text{ bar}$$

Effective clamping force (formula see above)

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



Example 1: Hinge clamp 1826G7432
p = 50 bar; L = 32 mm

Effective clamping force

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

Example 2: Hinge clamp 1826G7432
p = 50 bar

Min. length of clamping lever

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

Effective clamping force

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

Example 3: Hinge clamp 1826G7532

Special clamping lever L = 20 mm

Admissible operating pressure

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

Effective clamping force

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

Example 4: Hinge clamp 1826G7532

Special clamping lever L = 78 mm

Admissible operating pressure

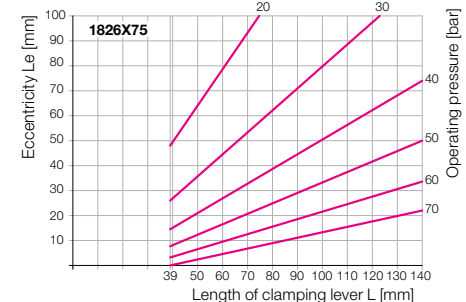
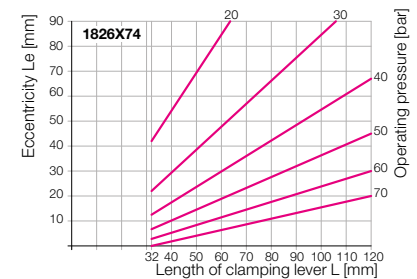
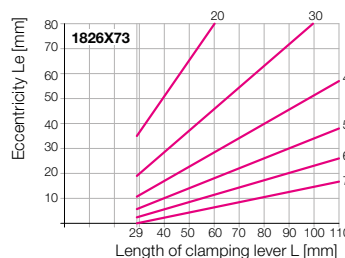
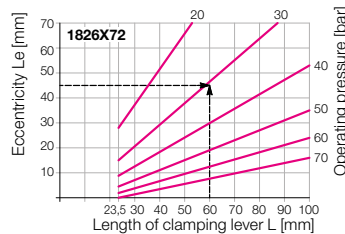
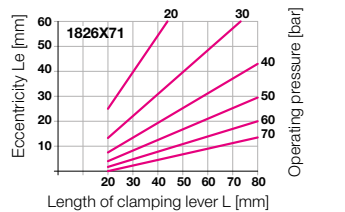
$$p_{adm} = \frac{B}{(C/L) + 1} = \frac{119.26}{(27.45/78) + 1} = 88.2 \text{ bar}$$

Effective clamping force

The max. operating pressure is 70 bar, thus

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

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

Accessories

Pneumatic Position Monitoring (not adjustable)

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

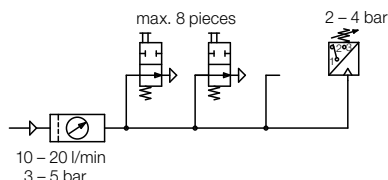
Cartridge type

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.

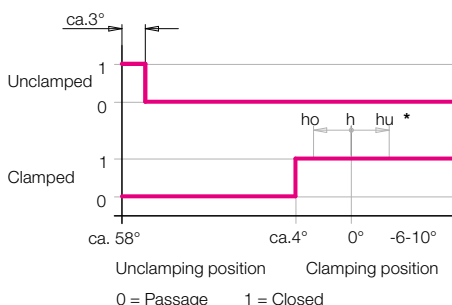
Technical data

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.

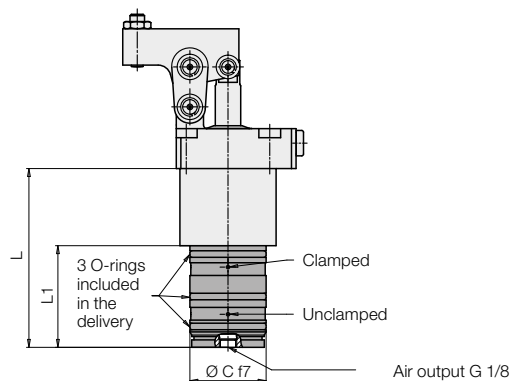
**) For measuring of the flow rate appropriate devices are available.

Function chart

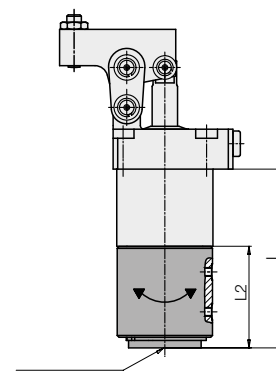


* Dimensions see page 2 and 3

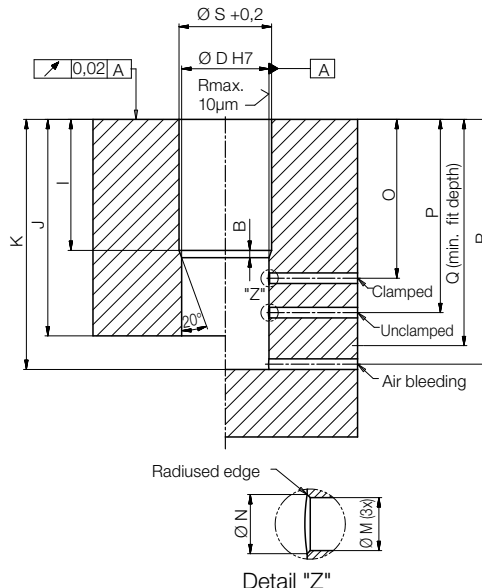
Cartridge type



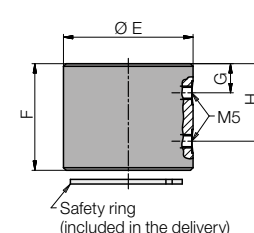
Pipe thread connection



Location hole



Mounting body



Size	1	2	3	4	5
Ø A ±0.1	39	47	53	63	78
B	1.3	2	2	2	2
Ø C f7	38	42	42	45	45
Ø D H7	38	42	42	45	45
Ø E	49	53	52.5	62.5	62.5
F	40.3	46	50	54	60
G	11	13	14	14	15
H	29.3	33	36	40	45
I +0.2	34	40	43	47.5	55.5
J min.	78	87	91	100	114
K min.	84	95	100	109	123
L	82.5	93.5	98.5	107	121.5
L1	49	54	56	60	66.5
L2	46.15	53.85	55.8	59.8	65.8
Ø M	4	4	4	4	4
Ø N	5	5	5	5	5
O	46	52	55.5	60	70.6
P	65	74	80	86	100.5
Q min.	77	85	90	98.5	113
R	79.5	90.5	95.5	104	118.5
Ø S max.	40	48	54	64	79

Part no.

Cartridge type	0353341	0353342	0353343	0353344	0353345
with 4 screws					
Mounting body	0353341A	0353342A	0353343A	0353344A	0353345A
for retrofitting of the cartridge type					

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 (1826X7X4X).

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.

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

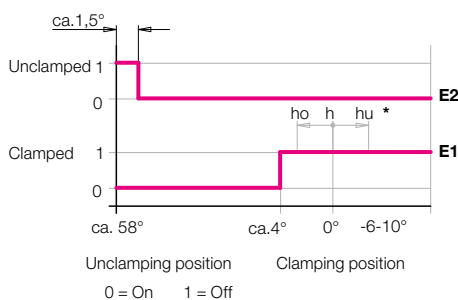
Part no.

without switch	0353351	0353352	0353353	0353354	0353355
with switch and plug	0353351S	0353352S	0353353S	0353354S	0353355S

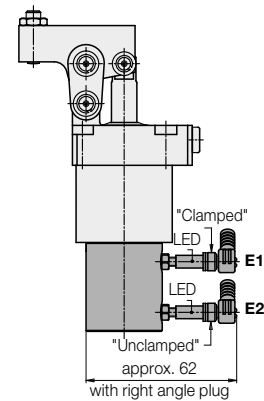
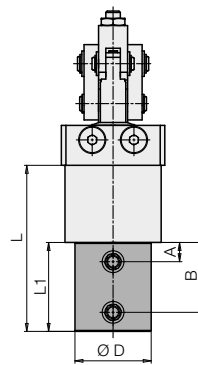
Spare parts

Inductive proximity switch	3829198	3829198	3829198	3829198	3829198
Right angle plug with cable 5m	3829099	3829099	3829099	3829099	3829099

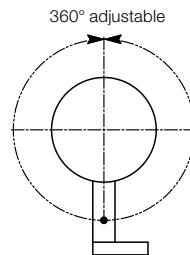
Function chart



* Dimensions see page 2 and 3



Four fixing screws included in our delivery



Possible position of the proximity switches

Important notes

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

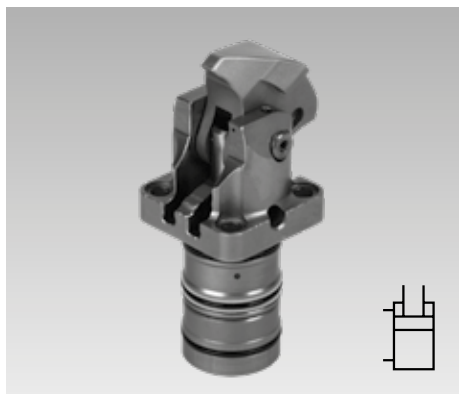
Hinge clamps can generate very high forces. The workpiece, the fixture or the machine must be in the position to compensate these forces. Considerable injuries can be caused to fingers during clamping and unclamping in the effective area of the clamping lever.

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.



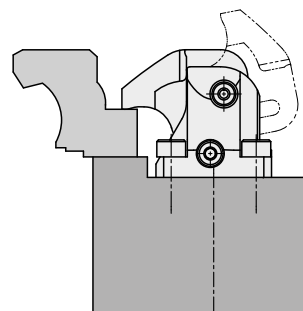
Compact Clamps

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 clamping 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

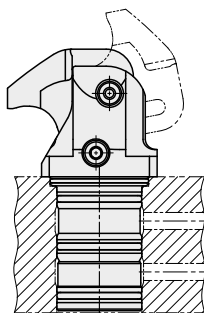
Important notes

(see page 5)

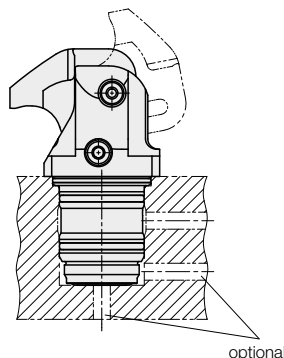
Installation and connecting possibilities

Drilled channels

with cover

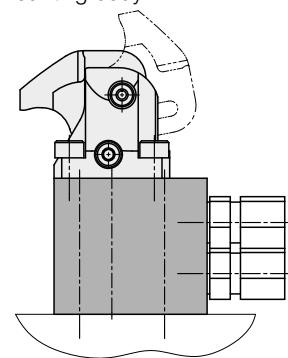


without cover

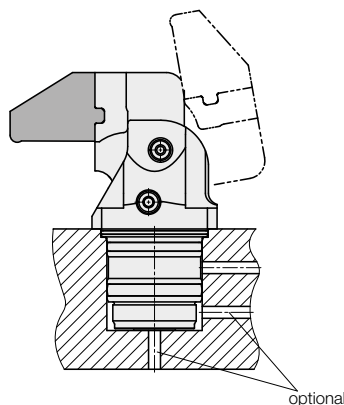


Pipe thread

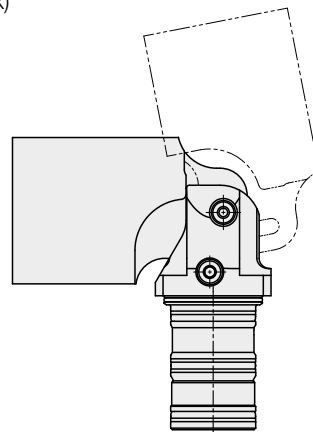
with accessory
Mounting body



Universal clamping lever

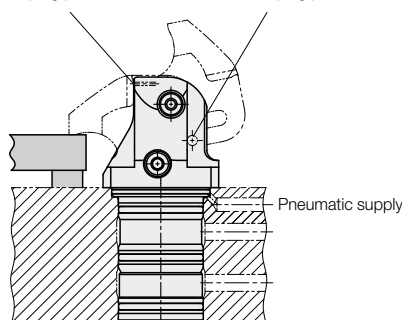


Long clamping lever (blank)



Pneumatic position monitoring

Clamping position or Unclamping position



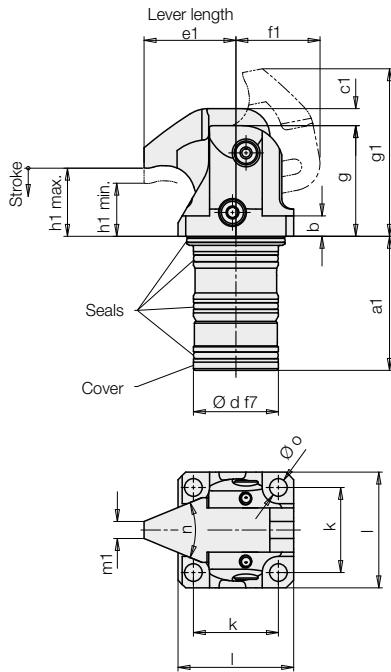
Application example



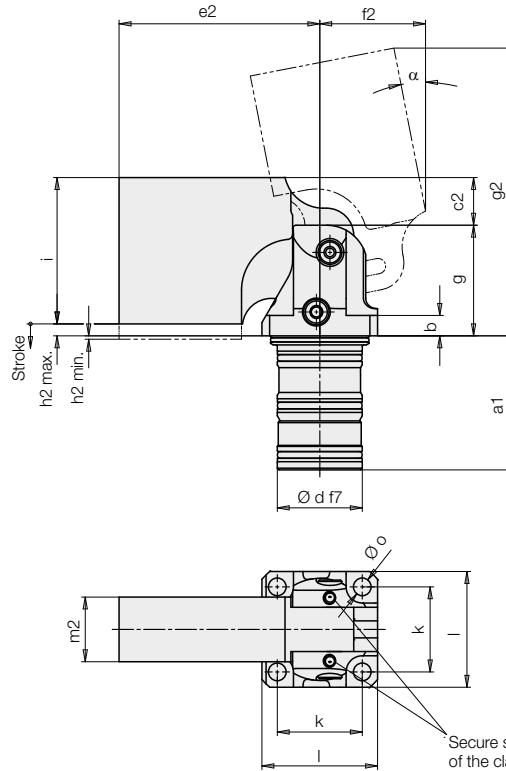
Clamping of a cast part

Dimensions

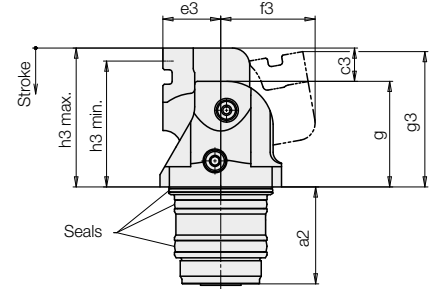
With cover Short clamping lever 180X110



Long clamping lever (blank) 180X130

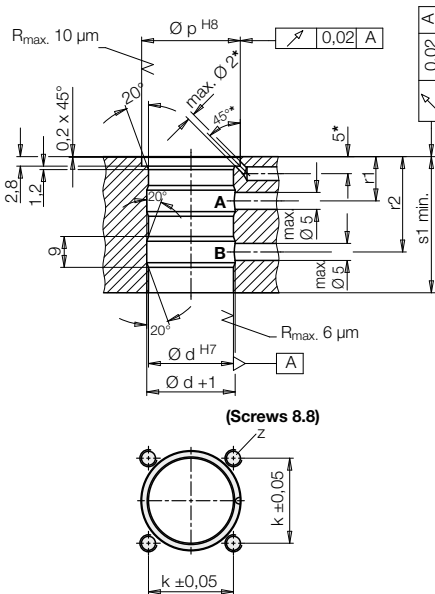


Without cover Universal clamping lever 180X150



Pneumatic position monitoring
see page 6

Bore hole open (with cover)



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)

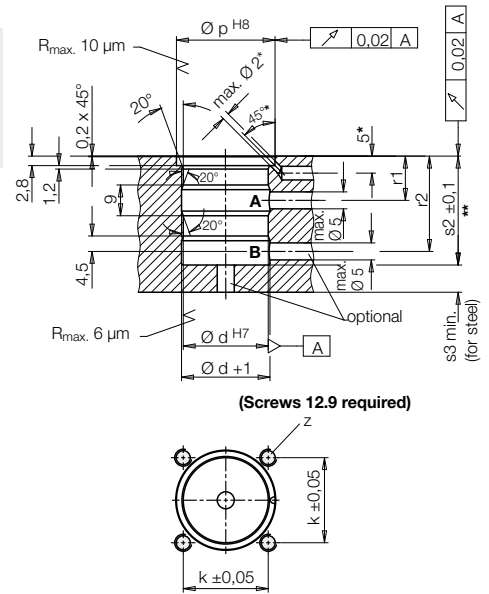
Accessories

Mounting body (see page 4)

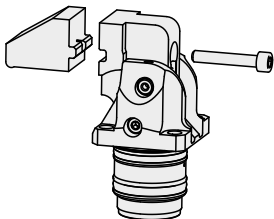
A = Clamping
B = Unclamping

- * Bore holes for pneumatic clamping and unclamping monitoring, only if required.
- ** Dimension s2 ±0.1 must be met, as the bottom of the pocket hole is the lower stop for the piston.

Pocket hole (without cover)

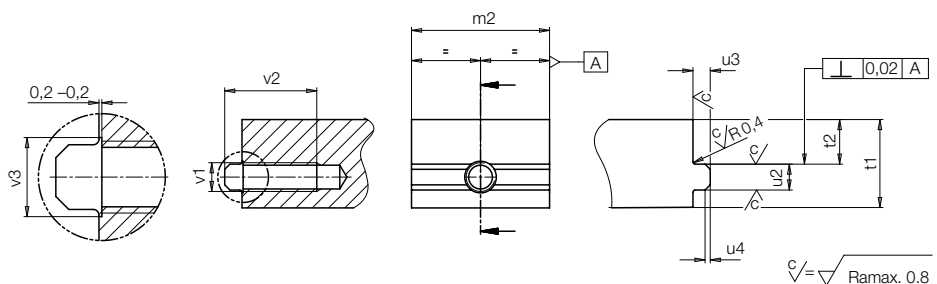


Universal clamping lever



The compact clamp with universal clamping 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 clamping 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	[cm³]	2.3 / 3.6	3.2 / 5.4	6.4 / 10.2	10.5 / 15.7
Max. flow rate	[cm³/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
$\alpha \pm 1$	[°]	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 clamping 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 clamping 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
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Accessories

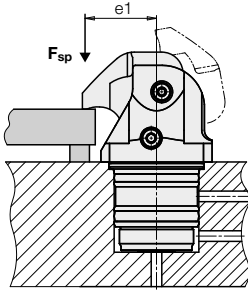
Part no. - short clamping lever		3548 1121	3548 1122	3548 1123	3548 1124
Part no. - long clamping lever (blank)		3548 1071	3548 1072	3548 1073	3548 1074
Part no. - universal clamping lever		3548 4111	3548 4112	3548 4113	3548 4114
Screw for universal clamping lever	[mm]	M5x30 -12.9	M5x30 -12.9	M8x35 -12.9	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

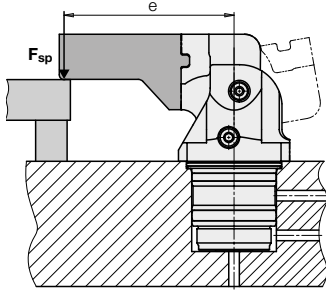
** use screw material 12.9; *** max. operating pressure 200 bar

Clamping Forces

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

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

1.2 Admissible operating pressure

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

1.3 Effective clamping force at other pressure p

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

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

1.3.2 In general:

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

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

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

F_{sp}, F_{adm} = Clamping force [kN]

$e, e1, e_{max}$ = Clamping lever length [mm]

p, p_{adm} = Operating pressure [bar]

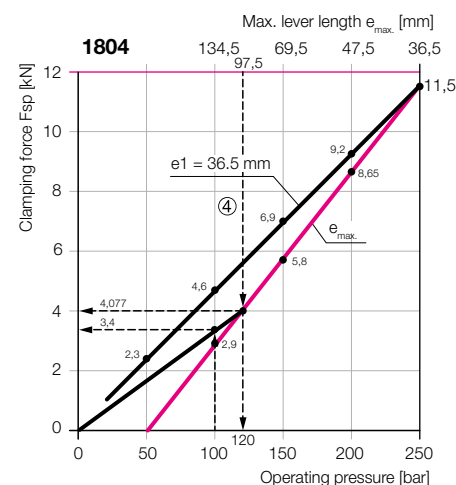
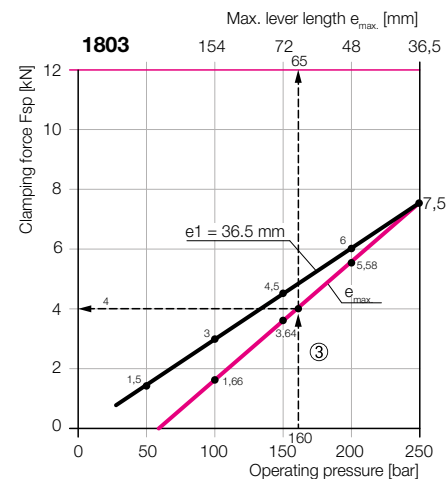
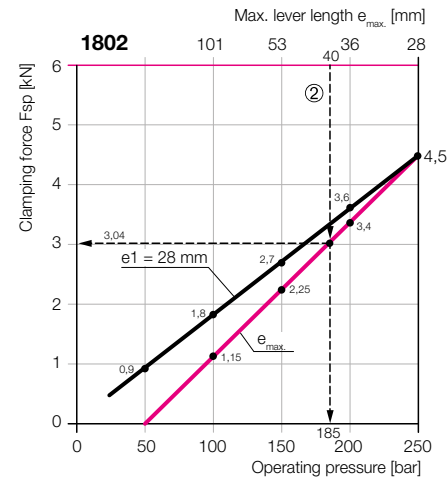
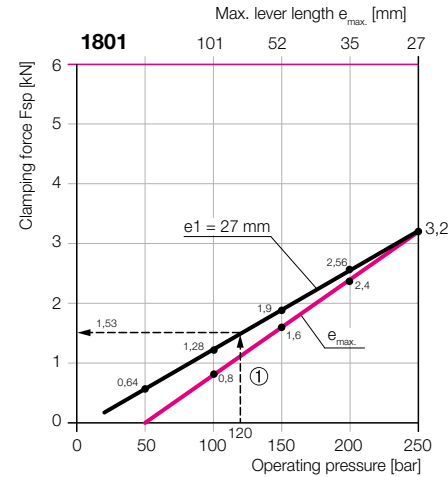
$A...E$ = Constants as per chart

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

$$F_{sp} = F_{adm} \frac{p}{p_{adm}} = 3.2 \cdot \frac{120}{250} = 1.536 \text{ kN}$$

alternative

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

$$F_{sp} = \frac{1.594}{\left(\frac{27 - 2}{101.7} + 1 \right) \cdot 100} \cdot 120$$

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

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

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

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

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

Example ③ Compact clamp 1803 110

Operating pressure $p = 160$ bar
Special clamping lever

Maximum clamping lever length

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

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

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

Maximum clamping force

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

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

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

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

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

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

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

Effective clamping force at 100 bar

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

$$F_{sp} = \frac{5.718}{\left(\frac{97.5 - 3}{138.1} + 1 \right) \cdot 100} \cdot 100$$

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

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:

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

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

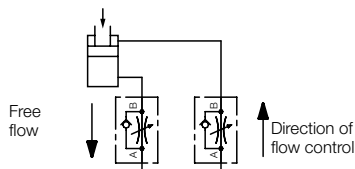
J_K = Moment of inertia of the "short" clamping lever (see chart)

J_L = Moment of inertia of the special clamping lever

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

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.



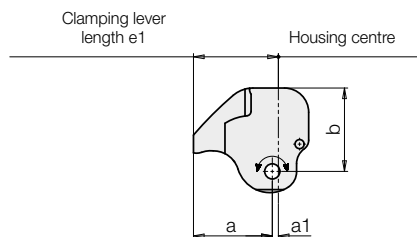
Determine the moment of inertia

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

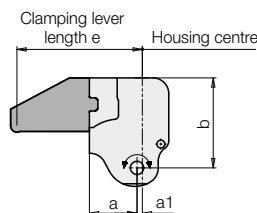
The moment of inertia in the chart is the starting point for the maximum flow rate and the shortest possible clamping time.



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	[kgmm ²]	22	34	98	125

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}	[kgmm ²]	49	97	170	294
+ extension J_{L2}	[kgmm ²]	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.

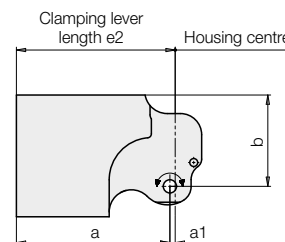
In the effective area of clamping lever there is the danger of crushing. The manufacturer of the fixture or the machine is obliged to provide effective protection devices.

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

Long clamping lever (blank)

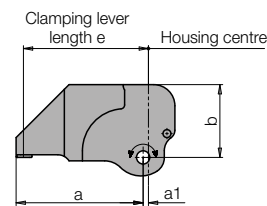
The blank is not a finished clamping lever. The value in the chart shows how high the maximum moment of inertia can rise.



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	[kgmm ²]	576	756	1234	1477

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	[kgmm ²]	Determine with CAD model			

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.

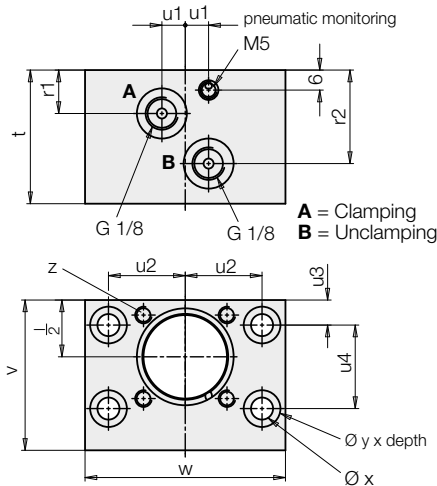
For dry machining, minimum quantity lubrication and in case of accumulation of very small swarf or particles, regular disassembly, cleaning and lubrication of the lever mechanism as per operating manual is required.

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

Mounting Body Pneumatic Position Monitoring

Mounting body

for version with
pipe thread and cover



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

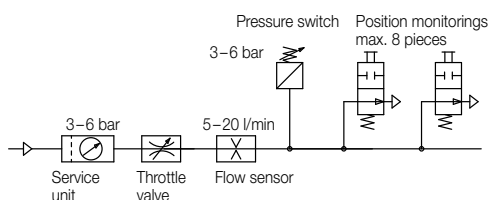
For the evaluation of the pneumatic pressure increase standard pneumatic pressure switches can be used.

With one pressure switch up to 8 compact clamps can be controlled.

Important note

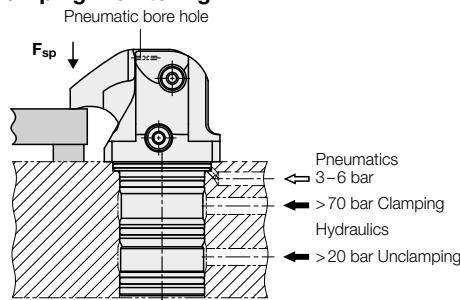
Pneumatic position monitorings are only process-safe, when air pressure and air volume are precisely adjusted.

For measuring the air volume, appropriate devices are available. Please contact us.



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]	11 x 7	11 x 7	13.5 x 9	13.5 x 9
z	[mm]	M5	M6	M6	M8
Weight, approx.	[kg]	0.61	0.75	1.16	1.4
Part no.		3468381	3468382	3468383	3468384

Clamping monitoring



Example for clamping position

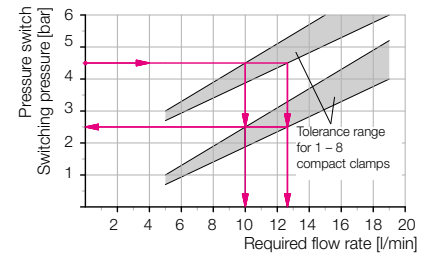
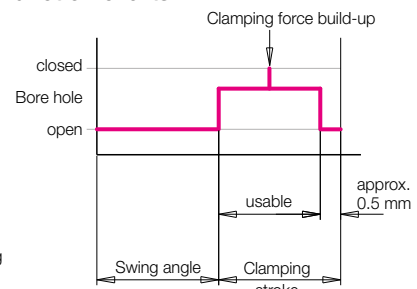
Required switching pressure 4.5 bar

Pressure drop, if 1 compact clamp is not clamped approx. 2 bar

As per diagram:

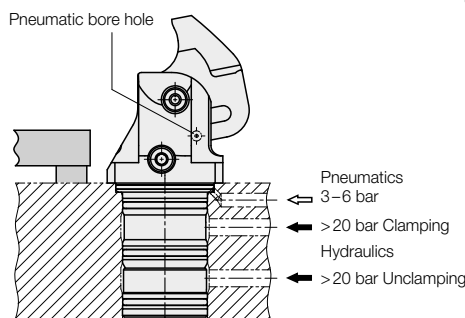
Required flow rate approx. 10-13 l/min
(depending on the number of connected compact clamps)

Function charts



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

Unclamping monitoring



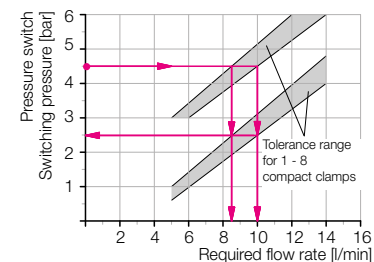
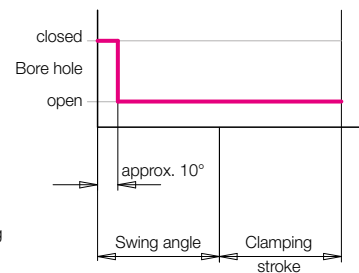
Example for unclamping position

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)

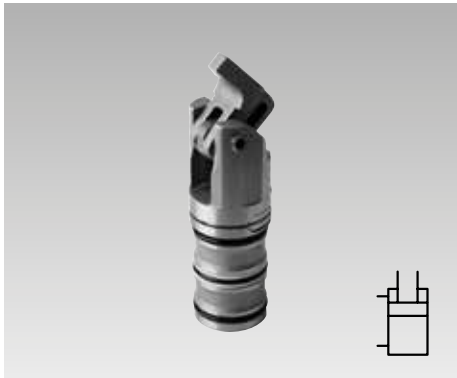


Required flow rate depending on the switching pressure of the pneumatic pressure switch for a pressure drop Δp 2 bar



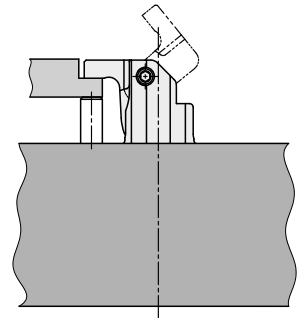
Mini Compact Clamp

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

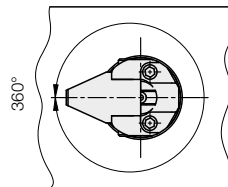
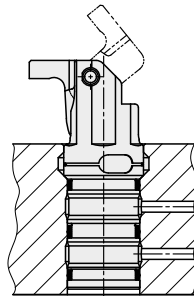
The hydraulic mini compact clamp is a double-acting pull-type cylinder where a part of the linear stroke is used to swing the clamping lever onto the workpiece. In order to minimise the dimensions, the usual flange for screw fixing is omitted.

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.

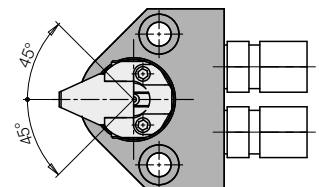
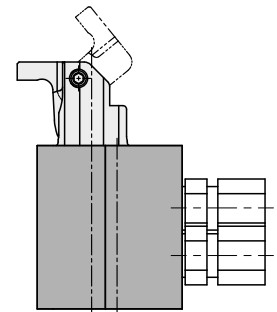
Installation and connecting possibilities

Drilled channels

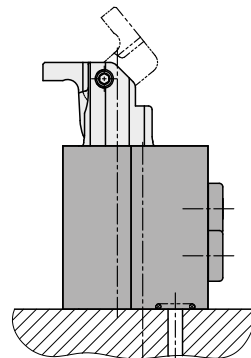


Pipe thread

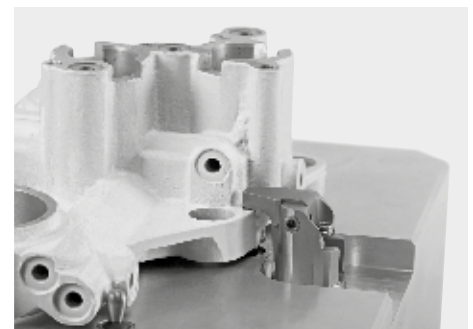
with accessory mounting body



with accessory mounting body



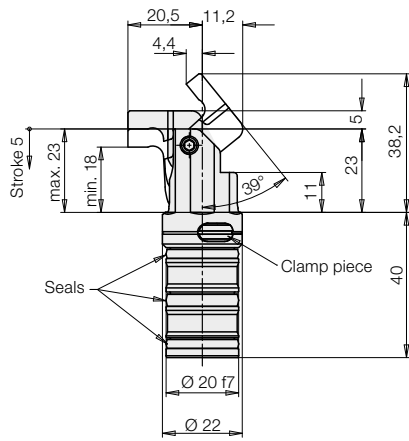
Application example



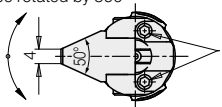
Clamping of a cast part

Dimensions

Technical Data • Accessories



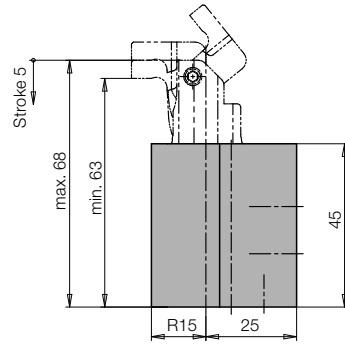
can be rotated by 360°



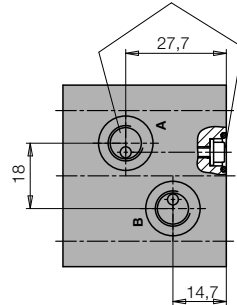
Expansion of the clamp pieces:
Set screws SW 2.5
Tightening torque 3 Nm

Accessory

Mounting body



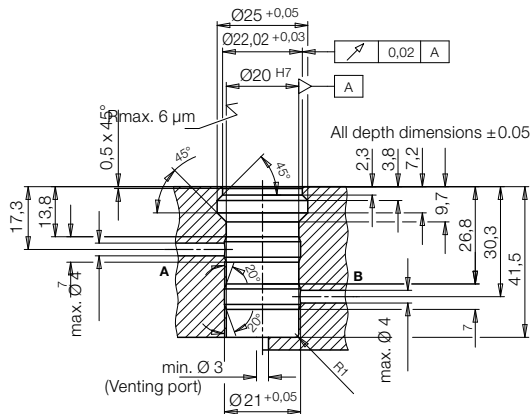
Screw plugs and O-rings are included in the delivery



Connecting thread G 1/8

Plastic covers see accessories

Cartridge-type hole



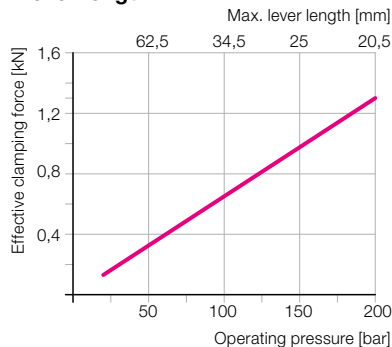
Technical data

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

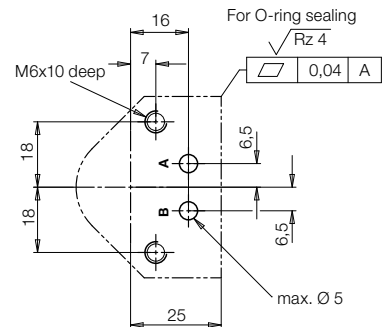
Mounting body		
Weight	[kg]	0.44
Part no.		0346821
Plastic cover Ø 11		
Part no.		3300685

Effective clamping force and max. lever length



Special levers are available on request.

Connecting scheme for drilled channels



A = Clamping
B = Unclamping

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

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.

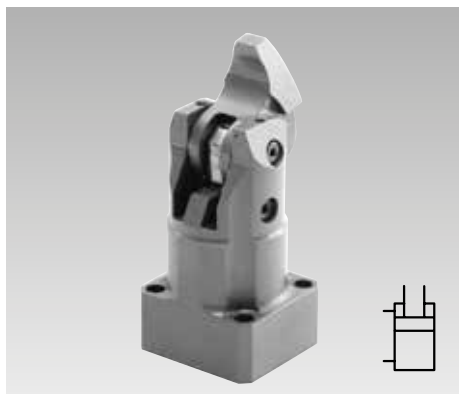
The mini compact clamp is not suitable for dry machining, minimum quantity lubrication and in case of accumulation of very small swarf.

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



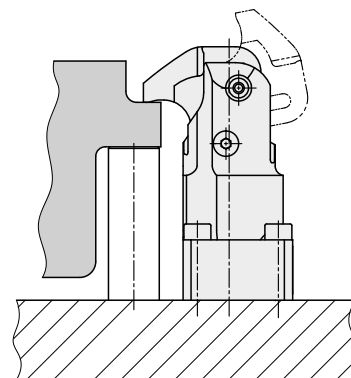
Compact Clamps

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 work-piece
- Universal clamping 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)

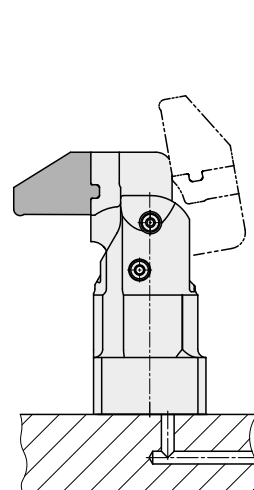
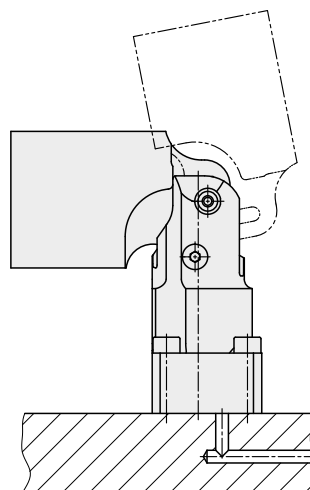
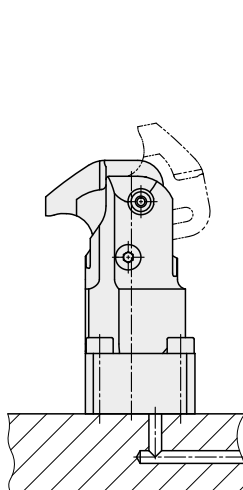
Installation and connecting possibilities

Drilled channels

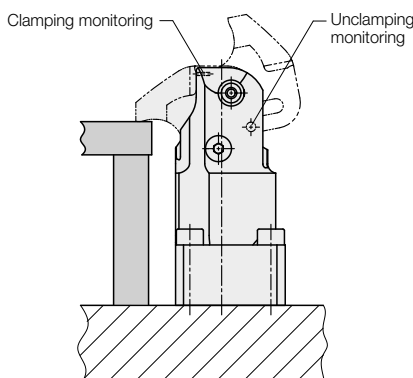
with short clamping lever

with long clamping lever (blank)

Universal clamping lever



Pneumatic position monitoring



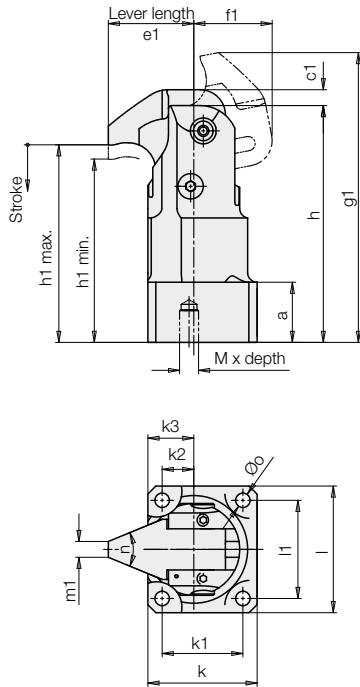
Application example



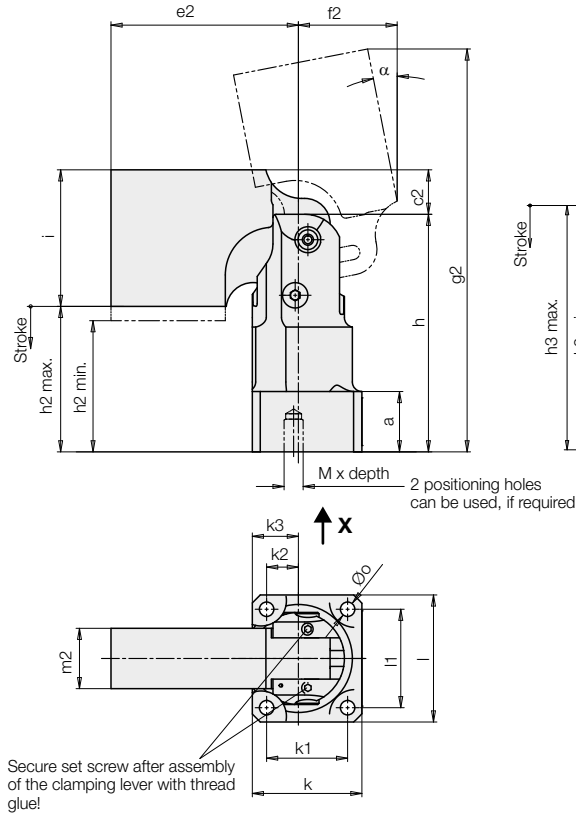
Clamping of a cast part with special clamping lever

Dimensions

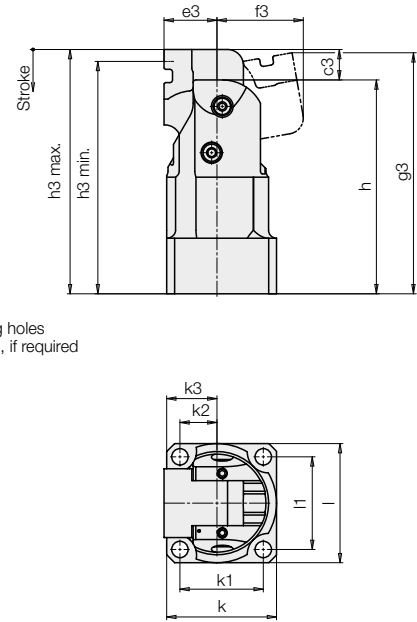
Short clamping lever 180X210



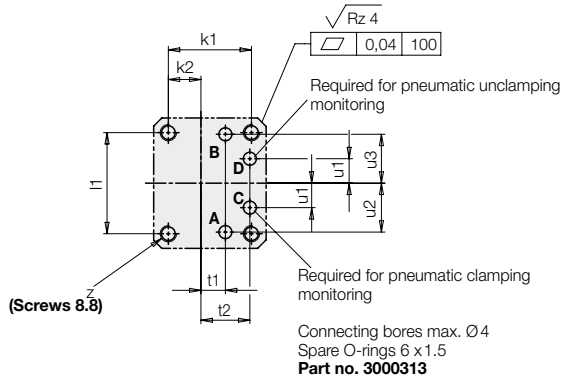
Long clamping lever (blank) 180X230



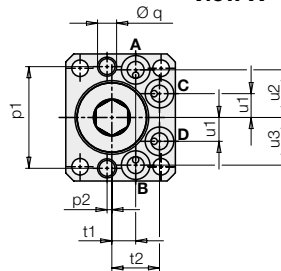
Universal clamping lever 180X250



Connecting scheme



View X



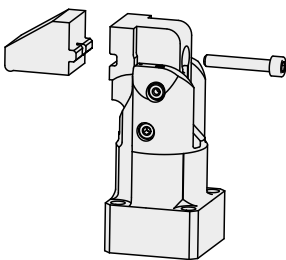
- A** = Clamping
- B** = Unclamping
- C** = Clamping monitoring
- D** = Unclamping monitoring

Materials

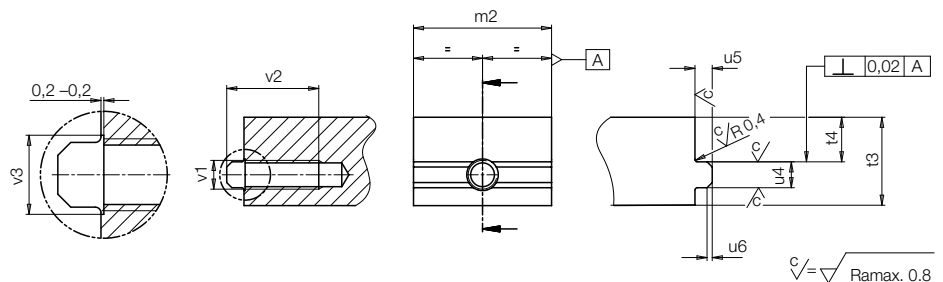
Body:	hardened, stainless
Clamping lever:	
short	HRc 48 – 55, stainless
long (blank)	X37 Cr Mo V5-1 hardened and tempered
	HRc 40 and nitrated
Seals:	NBR and PUR (max. 80°)

Pneumatic position monitoring see page 4

Universal clamping lever



Connecting dimensions to the flange of the universal clamping lever



The compact clamp with universal clamping 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.

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 [cm³]		2.3	3.2	6.4	10.5
Oil volume unclamping [cm³]		3.6	5.4	10.2	15.7
Max. flow rate [cm³/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 clamping 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
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Without position monitoring

Part no. (version see above)		1801 2XXB	1802 2XXB	1803 2XXB	1804 2XXB
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With clamping and unclamping monitoring

Part no. (version see above)		1801 2XXC	1802 2XXC	1803 2XXC	1804 2XXC
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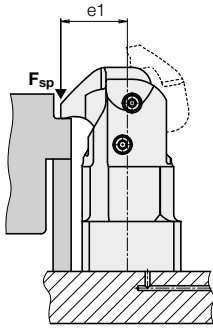
Accessories

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 clamping lever		3548 4111	3548 4112	3548 4113	3548 4114
Screw for Universal clamping 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

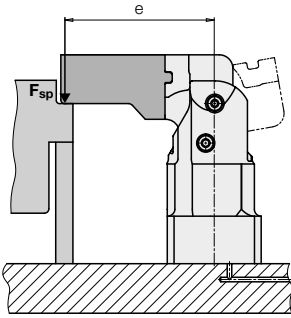
* min. = height in unclamping position as presented. max. = max. height for swing in

Clamping forces

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

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

1.2 Admissible operating pressure

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

1.3 Effective clamping force at other pressure p

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

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

1.3.2 In general:

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

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

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

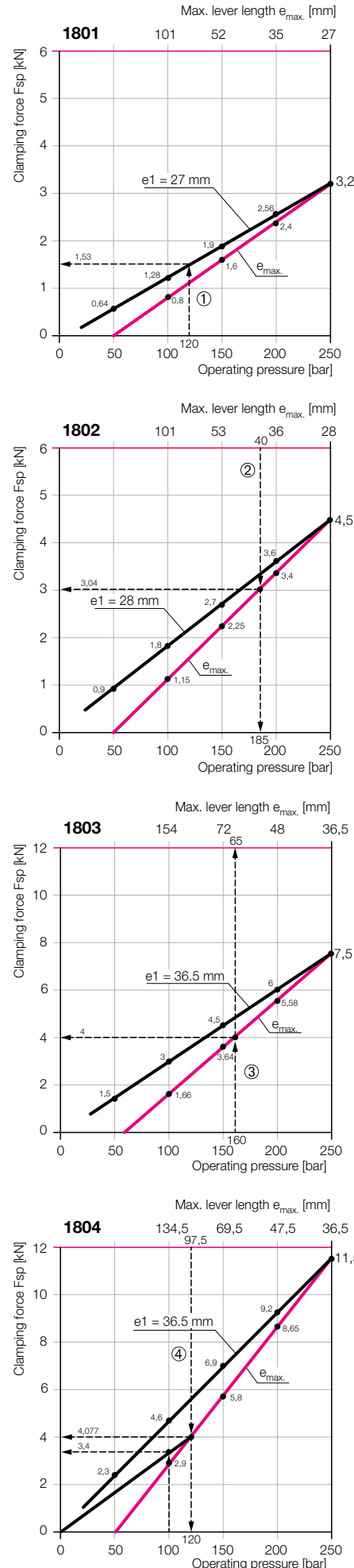
F_{sp}, F_{adm} = Clamping force [kN]
 $e, e1, e_{max}$ = Clamping lever length [mm]
 p, p_{adm} = Operating pressure [bar]
 $A \dots E$ = Constants as per chart

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 1801210
 Series clamping lever $e1 = 27 \text{ mm}$
 $F_{adm} = 3.2 \text{ kN}$ at $p_{adm} = 250 \text{ bar}$
 Operating pressure $p = 120 \text{ bar}$

Effective clamping force

$$F_{sp} = F_{adm} \frac{p}{p_{adm}} = 3.2 \cdot \frac{120}{250} = 1.536 \text{ kN}$$

alternative

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

$$F_{sp} = \frac{1.594}{\left(\frac{27 - 2}{101.7} + 1 \right) \cdot 100} \cdot 120$$

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

Example ② Compact clamp 1802210
 Series clamping lever $e = 40 \text{ mm}$

Admissible clamping force

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

Admissible operating pressure

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

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

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

Example ③ Compact clamp 1803210
 Operating pressure $p = 160 \text{ bar}$
 Special clamping lever

Maximum clamping lever length

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

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

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

Maximum clamping force

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

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

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

Example ④ Compact clamp 1804210
 Special clamping lever $e = 97.5 \text{ mm}$

Admissible clamping force

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

Admissible operating pressure

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

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

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

Effective clamping force at 100 bar

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

$$F_{sp} = \frac{5.718}{\left(\frac{97.5 - 3}{138.1} + 1 \right) \cdot 100} \cdot 100$$

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

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:

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

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

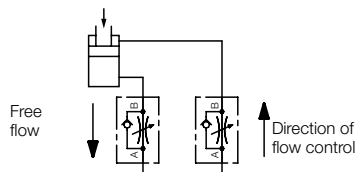
J_K = Moment of inertia of the "short" clamping lever (see chart)

J_L = Moment of inertia of the special clamping lever

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

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.



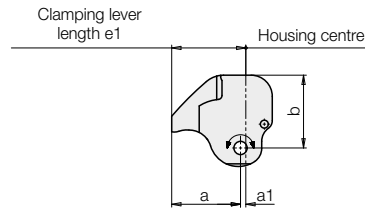
Determine the moment of inertia

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

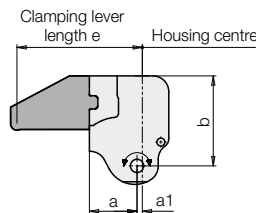
The moment of inertia in the chart is the starting point for the maximum flow rate and the shortest possible clamping time.



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	[kgmm ²]	22	34	98	125

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}	[kgmm ²]	49	97	170	294
+ extension J_{L2}	[kgmm ²]	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.

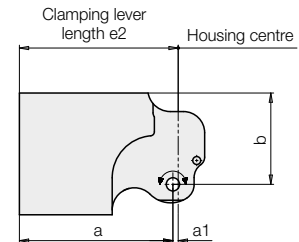
In the effective area of clamping lever there is the danger of crushing. The manufacturer of the fixture or the machine is obliged to provide effective protection devices.

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.

Long clamping lever (blank)

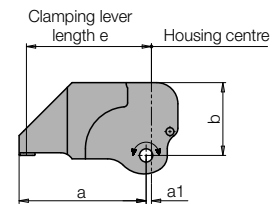
The blank is not a finished clamping lever. The value in the chart shows how high the maximum moment of inertia can rise.



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	[kgmm ²]	576	756	1234	1477

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	[kgmm ²]	Determine with CAD model			

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:

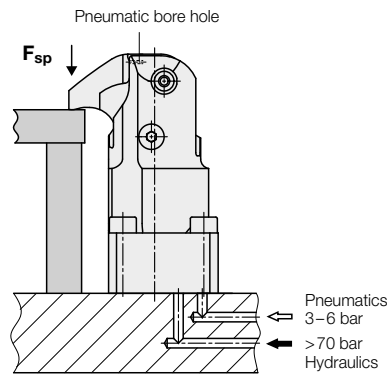
- The clamping lever is in the usable clamping range and
- a workpiece is clamped.

Important note

Required minimum pressures for clamping monitoring:

Hydraulics 70 bar
Pneumatics 3 bar

Clamping monitoring

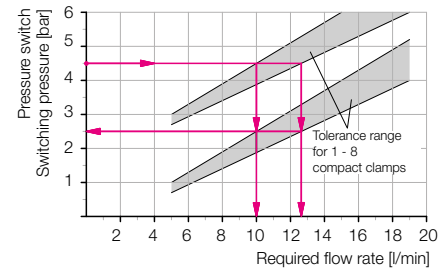
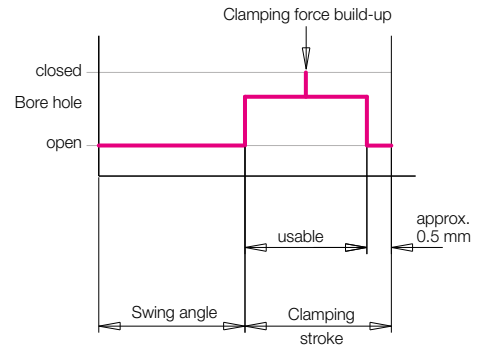


Example for clamping position

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

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

Function chart

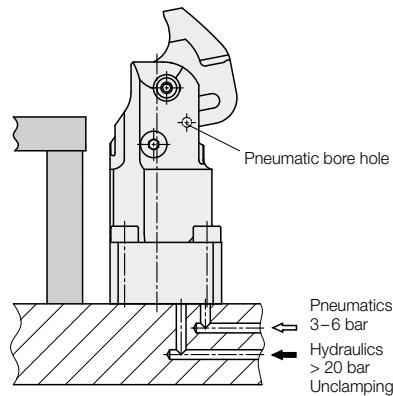


Required flow rate depending on the switching pressure of the pneumatic pressure switch for a pressure drop Δp 2 bar

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.

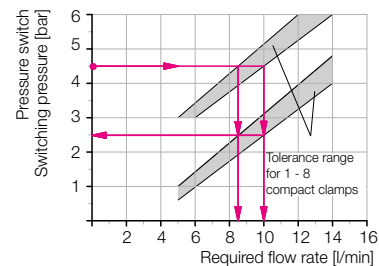
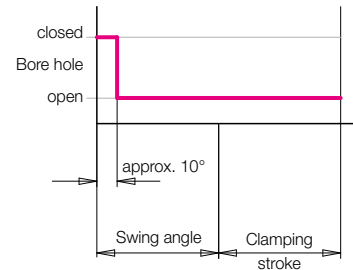
Unclamping monitoring



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 approx. 8.5-10 l/min
(depending on the number of connected compact clamps)



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

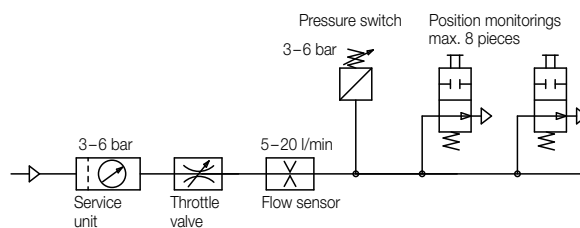
For the evaluation of the pneumatic pressure increase standard pneumatic pressure switches can be used.

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.





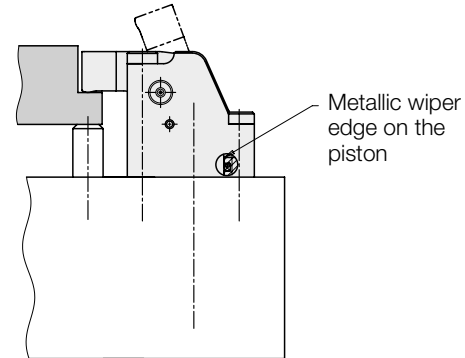
Flat Lever Clamps

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.

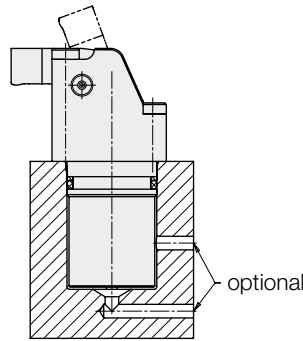
Double-acting versions are advantageous for time and cycle-dependent installations, since the return stroke is effected in a precisely defined time and the pneumatic position monitoring of the clamping lever is possible.

Advanced Link System

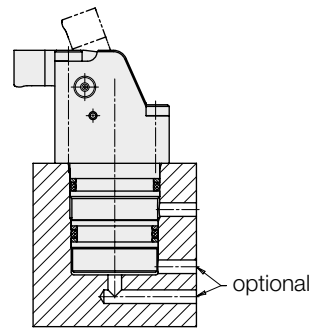
The newly developed lever kinematics enable trouble-free, process-safe operation.

Installation and connecting possibilities

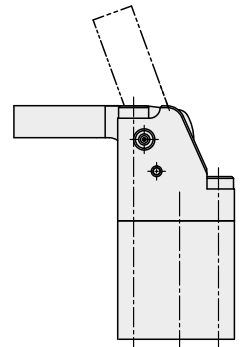
Single acting



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.

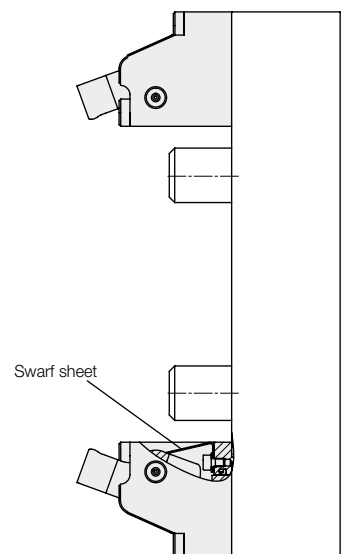
2.1 Without clamping lever, without position monitoring 18297X0D00
For the installation of a special clamping lever, which can be produced from the clamping lever blank.

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

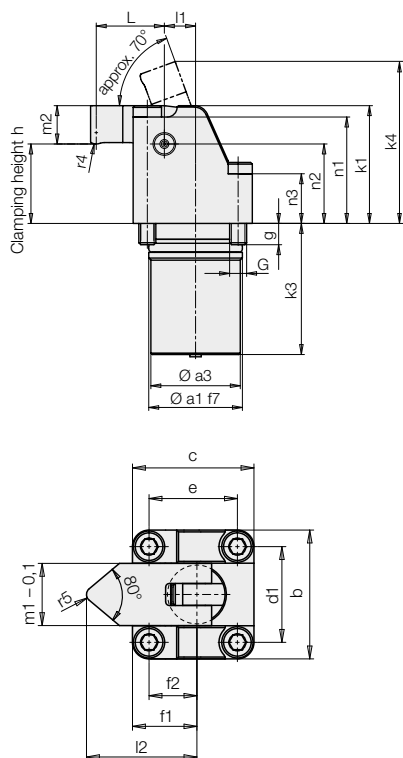


Installation instructions:

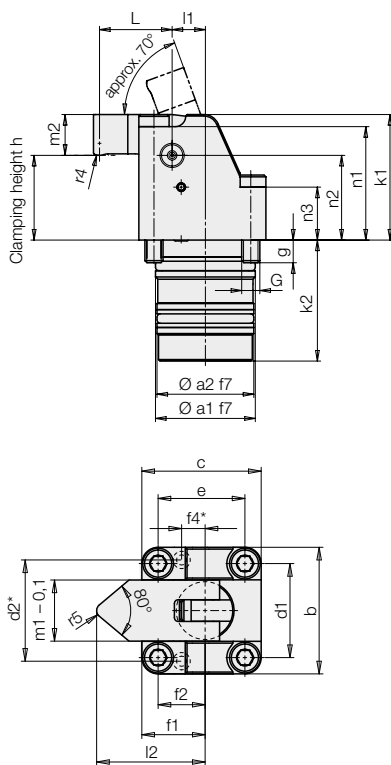
The flat lever clamp is suitable for any installation position. If the selected installation position can cause swarf nests to form in the swivel area of the clamping lever, the swarf sheet available as an accessory can be retrofitted.

Dimensions

Single acting 18297X0XX



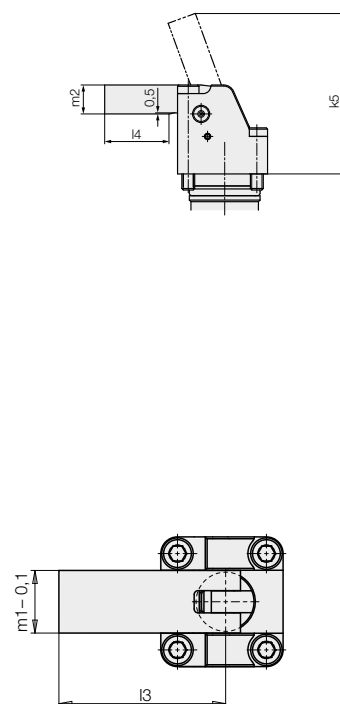
Double acting 18297X0XX



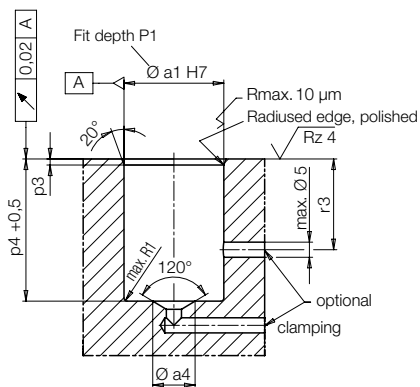
* Only available for position monitoring

Long clamping lever (blank) see accessories

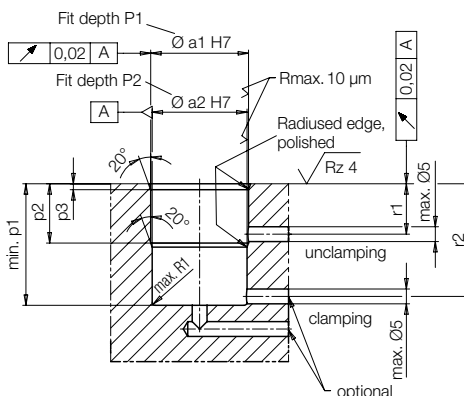
Material: 42CrMoS4 + QT nitrocarburized



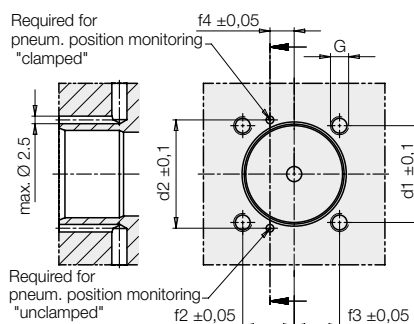
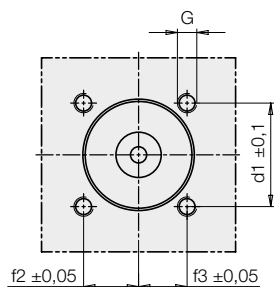
Location hole



Location hole



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



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		1829 710E00	1829 720E00	1829 730E00	1829 740E00
Weight, approx.	[kg]	0.263	0.544	1.040	1.861
Part no. with clamping lever length L		1829 710E18	1829 720E24	1829 730E28	1829 740E33
Weight, approx.	[kg]	0.305	0.630	1.225	2.180

Double acting, without clamping lever

Part no. without position monitoring		1829 710D00	1829 720D00	1829 730D00	1829 740D00
Part no. with position monitoring		1829 713D00	1829 723D00	1829 733D00	1829 743D00
Weight, approx.	[kg]	0.246	0.491	0.962	1.576

Double acting, with clamping lever

Part no. without position monitoring		1829 710D18	1829 720D24	1829 730D28	1829 740D33
Part no. with position monitoring		1829 713D18	1829 723D24	1829 733D28	1829 743D33
Weight, approx.	[kg]	0.288	0.577	1.147	1.895

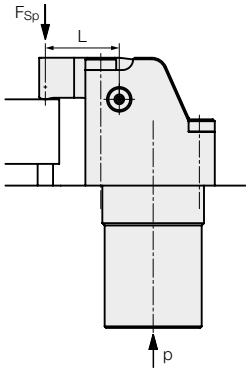
Accessories

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

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

1.2 Effective clamping force

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

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

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

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

2. Min. length of clamping lever

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

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

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

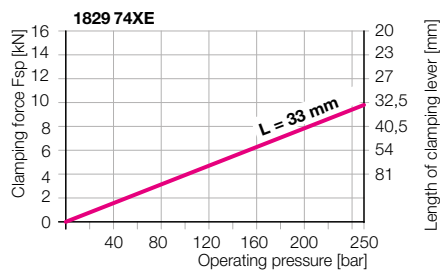
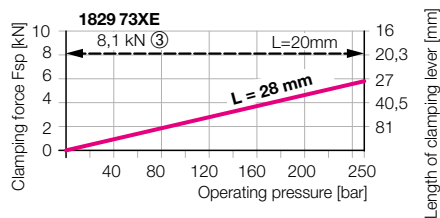
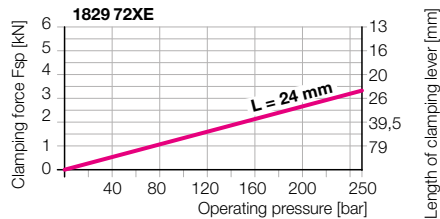
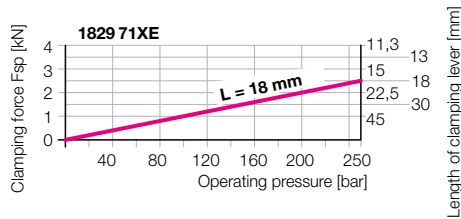
DA = double acting

SA = single acting

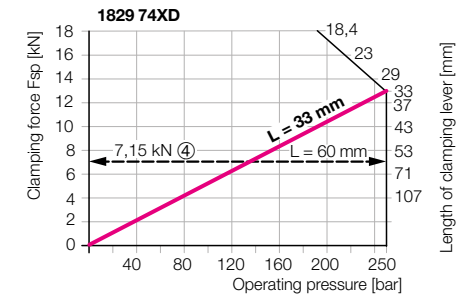
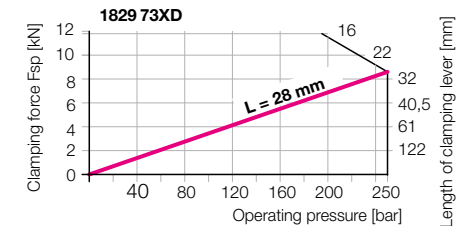
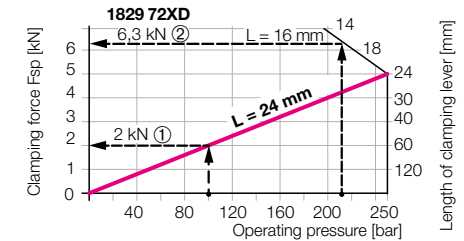
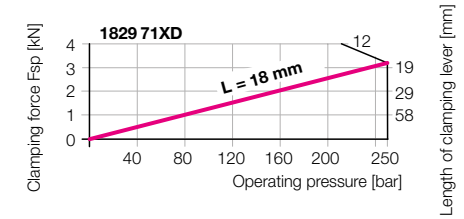
Constants

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 1829 723D24
p = 100 bar; L = 24 mm (standard)

Effective clamping force

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

Example 2: Flat lever clamp 1829 720D00
p = 210 bar

Min. length of clamping lever

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

Admissible operating pressure (review)

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

Effective clamping force at 210 bar

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

Example 3: Flat lever clamp 1829 730E00
Special clamping lever L = 20 mm

Admissible operating pressure

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

Effective clamping force at 250 bar

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

Example 4: Flat lever clamp 1829 740D00
Special clamping lever L = 60 mm

Admissible operating pressure

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

Effective clamping force at 250 bar

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

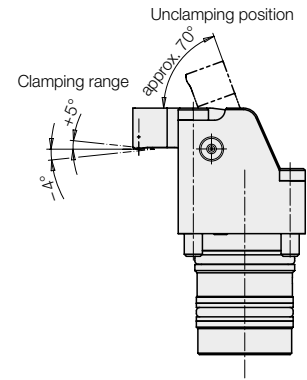
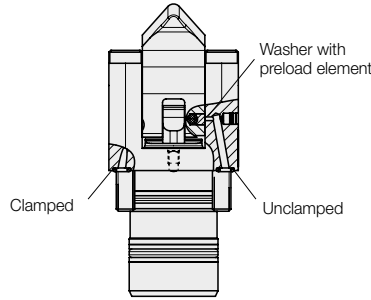
Pneumatic position monitoring

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!

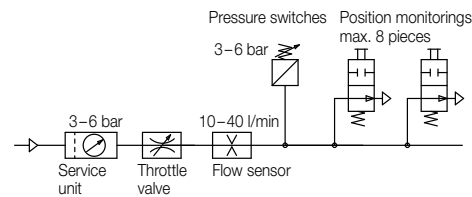
When mounting the clamping lever, the preload elements and the washers must be inserted into the provided bore holes in the clamping lever.

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

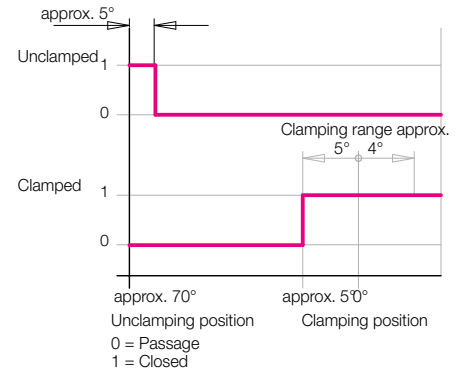
Monitoring by pneumatic pressure switch

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

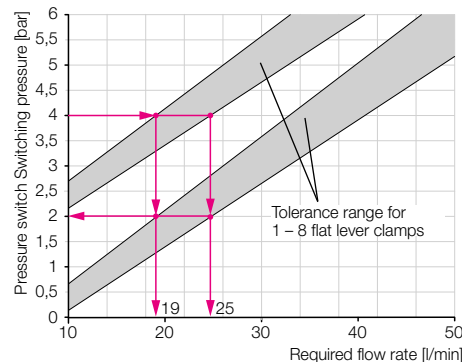
Pneumatic port



Function chart



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



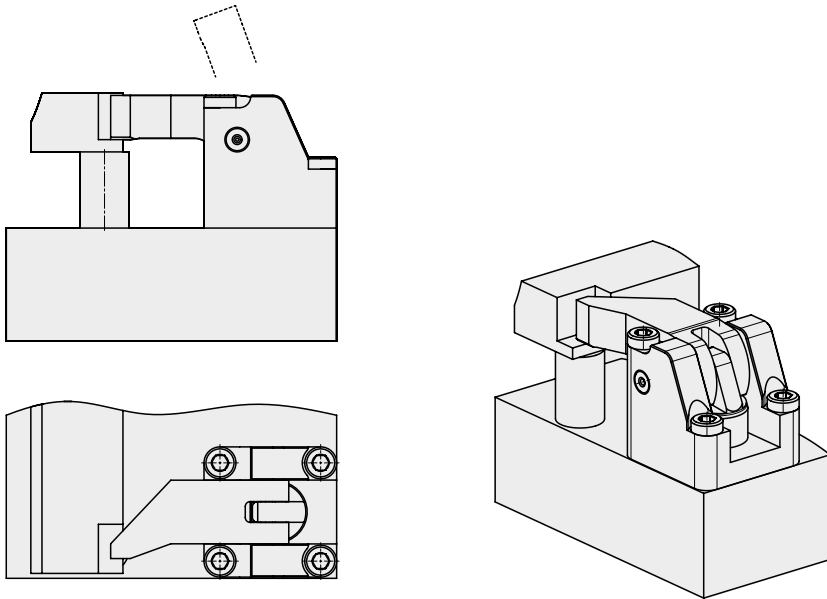
Example

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

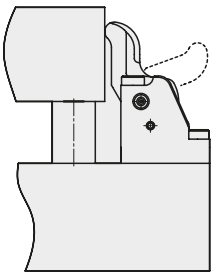
*) The pneumatic position monitoring is a metallic sealing system in which an air leakage of up to 1.5 l/min per element can occur when closed at 2 bar.

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



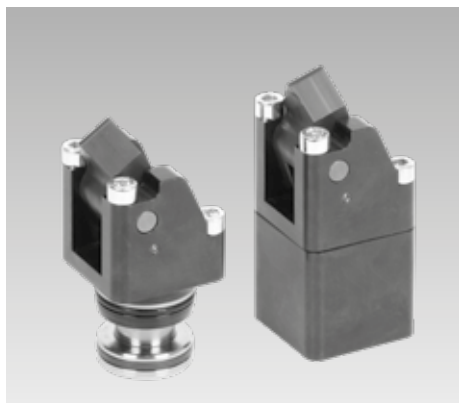
Lateral clamping of workpieces to eliminate the clearance





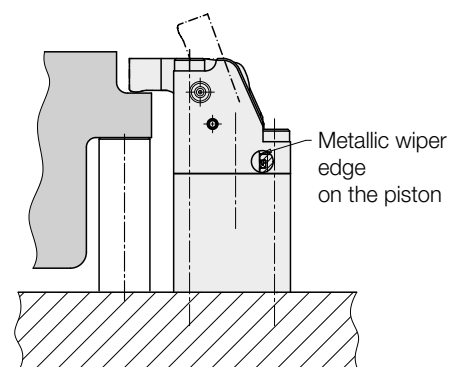
Flat Lever Clamps

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.

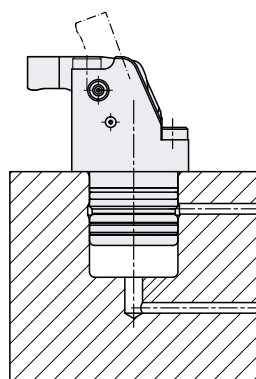
Important notes

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.

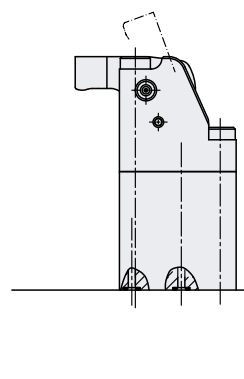
The manufacturer of the fixture or the machine is obliged to provide effective protection devices. The clamping lever must not be impeded during swivelling. The clamping height h must be in the indicated tolerance range. To permanently secure correct functioning, the flat lever clamps must be regularly 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

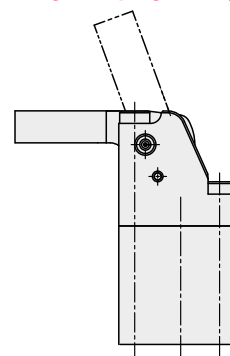
Built-in type



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

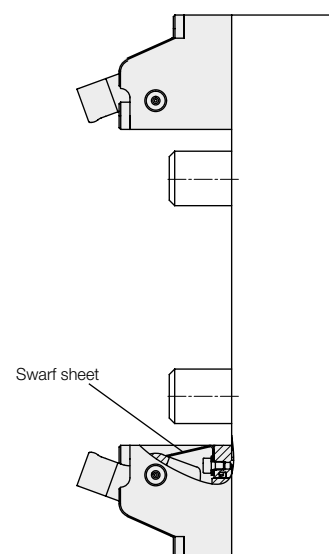
2.1 Without clamping lever 18295X3D00

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

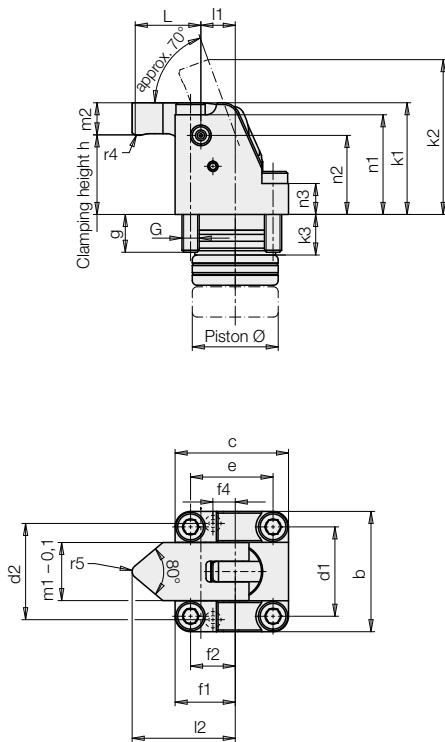


Installation instructions:

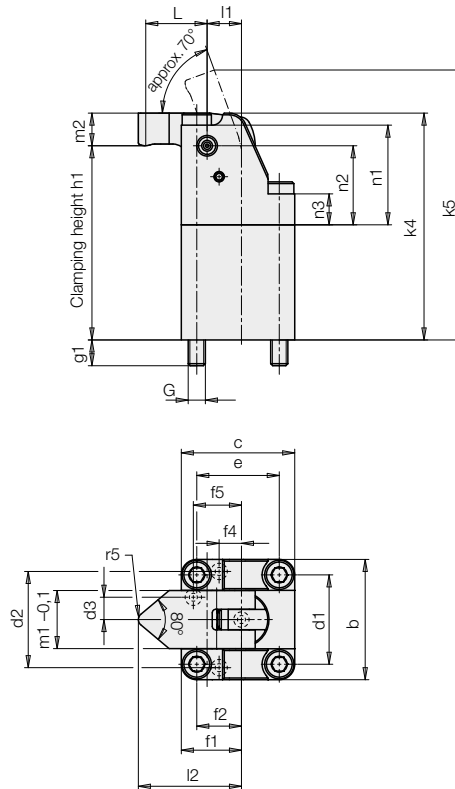
The flat lever clamp is suitable for any installation position. If the selected installation position can cause swarf nests to form in the swivel area of the clamping lever, the swarf sheet available as an accessory can be retrofitted.

Dimensions

Built-in type 1829 4X3 DXX

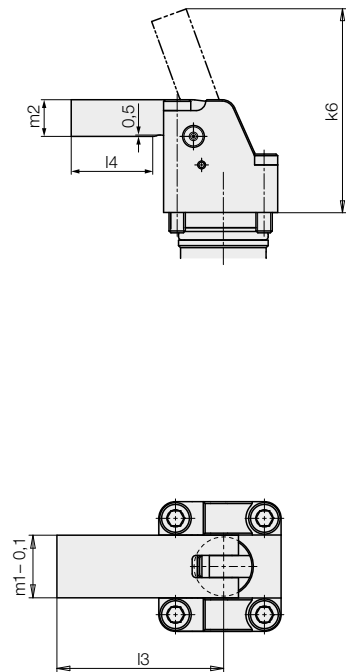


Block type 1829 5X3 DXX

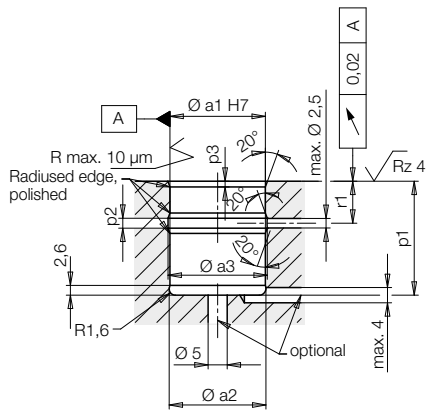


Long clamping lever (blank) see accessories

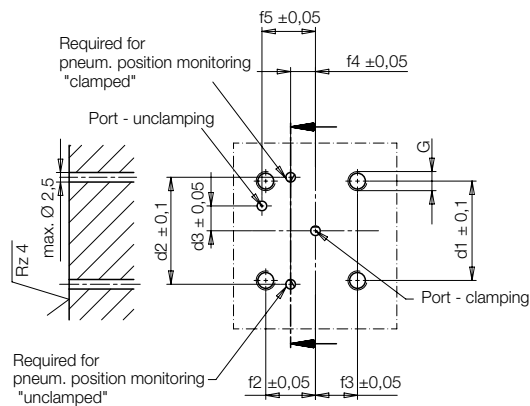
Material: 42 Cr Mo S4 + QT nitrocarburized



Location hole



Manifold-mounting surface

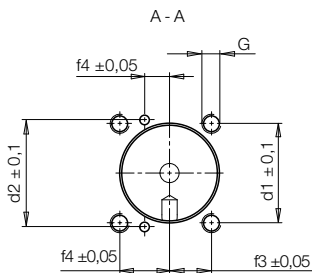


All required O-rings are included in the delivery.
Spare O-rings see chart.

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		[cm³]	4.66	9.25	18.85	28.63
Oil volume unclamping		[cm³]	2.75	5.64	11.49	14.15
Admissible flow rate		[cm³/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		1829 413D00	1829 423D00	1829 433D00	1829 443D00
Weight, approx.	[kg]	0.24	0.47	0.93	1.54
Part no. with clamping lever		1829 413D18	1829 423D24	1829 433D28	1829 443D33
Weight, approx.	[kg]	0.27	0.55	1.1	1.83

Block type

Part no. without clamping lever		1829 513D00	1829 523D00	1829 533D00	1829 543D00
Weight, approx.	[kg]	0.41	0.79	1.53	2.59
Part no. with clamping lever		1829 513D18	1829 523D24	1829 533D28	1829 543D33
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

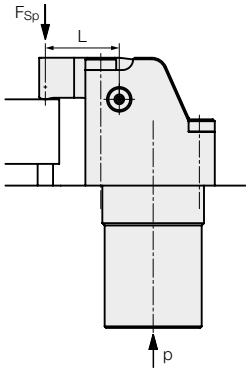
Spare O-rings

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

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

- 1.2 Effective clamping force

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

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

2. Min. length of clamping lever

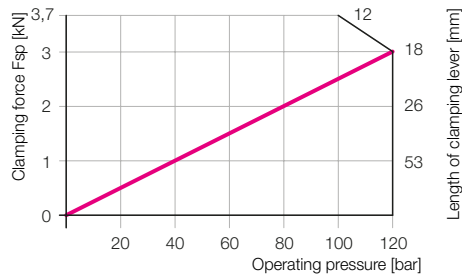
$$L_{min} = \frac{C}{\frac{B}{p} - 1} \quad [\text{mm}]$$

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

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



Example 1: Flat lever clamp 1829423D24

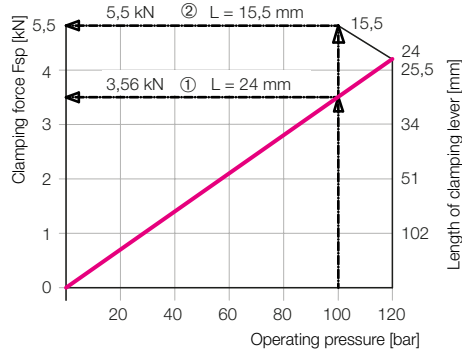
Operating pressure 100 bar

Standard clamping lever $L = 24$ mm

Effective clamping force at 100 bar

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

Size 2



Example 2: Flat lever clamp 1829523D00

Operating pressure 100 bar

Minimum length of clamping lever

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

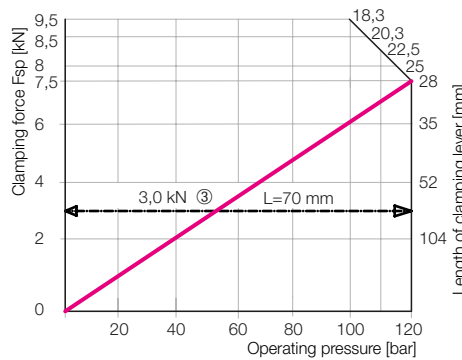
Admissible operating pressure (review)

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

Effective clamping force at 100 bar

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

Size 3



Example 3: Flat lever clamp 1829433D00

Special clamping lever $L = 70$ mm

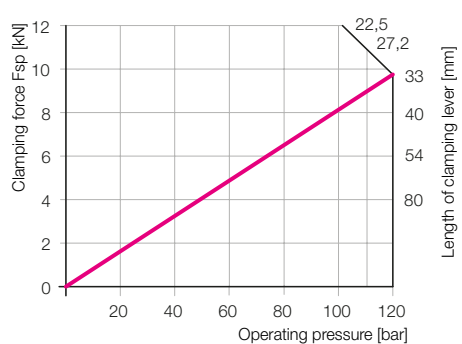
Admissible operating pressure

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

Effective clamping force at 120 bar

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

Size 4



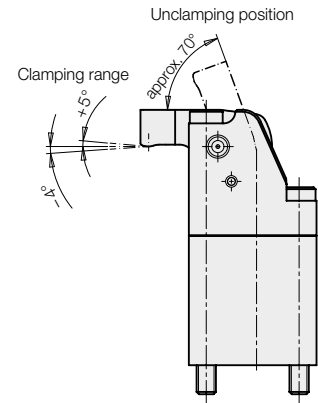
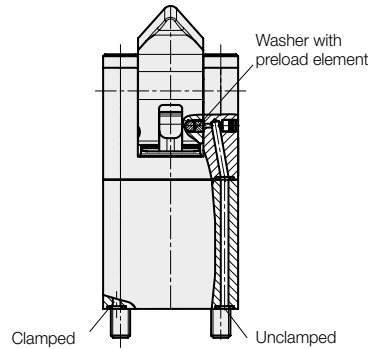
Pneumatic position monitoring

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!

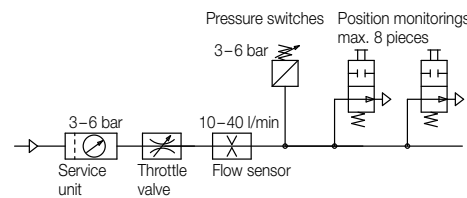
When mounting the clamping lever, the preload elements and the washers must be inserted into the provided bore holes in the clamping lever.

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

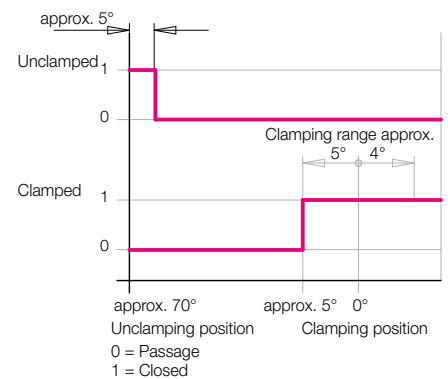
Monitoring by pneumatic pressure switch

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

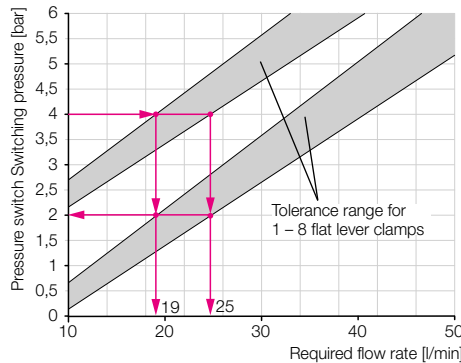
Pneumatic port



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 Clamp - Swing Clamp Version

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



Version

This electric clamp is an electrically operated swing clamp.

Application

Electric 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 clamping elements have to be controlled individually
- where the clamping force must be maintained also after the separation from the energy supply

Thus electric clamps are particularly suited for:

- Packaging industry
- Test systems
- Assembly equipments and robotics
- Automatic manufacturing systems

Description

The electric 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 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
- Clamping 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 clamp. When operating several electric 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 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.

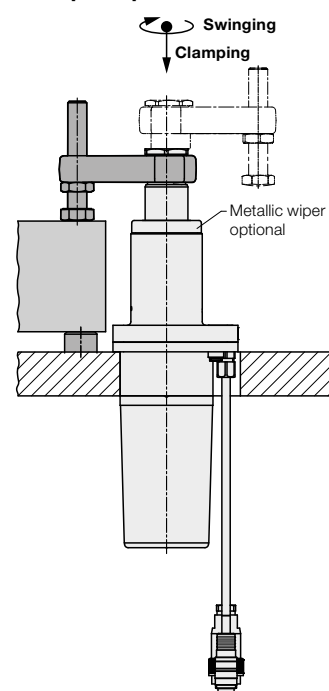
The manufacturer of the fixture or the machine is obliged to provide effective protection devices. During loading and unloading of the fixture and during clamping a collision with the clamping arm has to be avoided.

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 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.



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 clamp and a higher-level control.

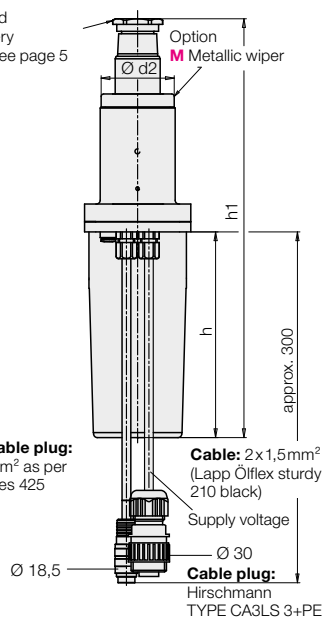
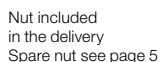
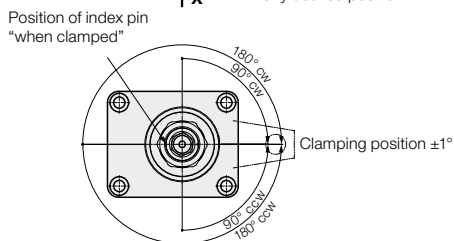
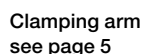
Advantages

- 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



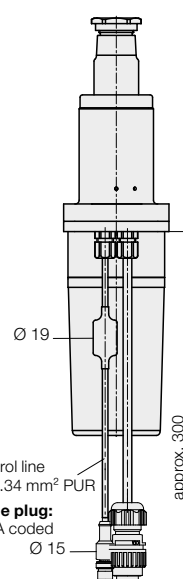
Cable + cable plug:
12x0.25 mm² as per
Binder series 425

Cable: 2x1,5mm²
(Lapp Ölflex sturdy
210 black)

Supply voltage

— Ø 30
Cable plug:
Hirschmann
TYPE CA3LS 3+PE

183XXXXXXMI



Control line
3 x 0.34 mm

Cable plug:

Maximum permissible cable length 30 m

Cable length Cable cross section

< 12 m	2 x 1.5 mm ²
< 20 m	2 x 2.5 mm ²
< 30 m	2 x 4 mm ²

control line

Part no. 3141992

Part no. 3823375 L 05000

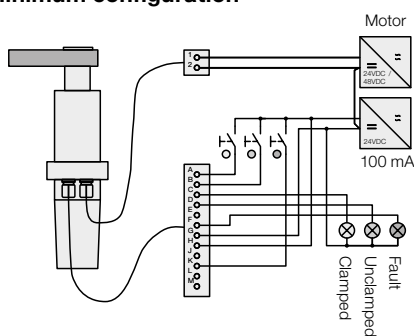
Supply line

Cable socket Hirschmann CA31 D

Part no. 3141 991



Connecting examples

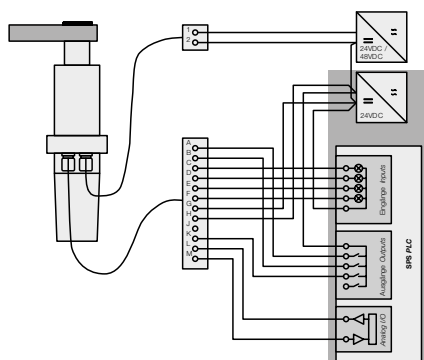


1 +24 V DC
2 GND (ground)

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



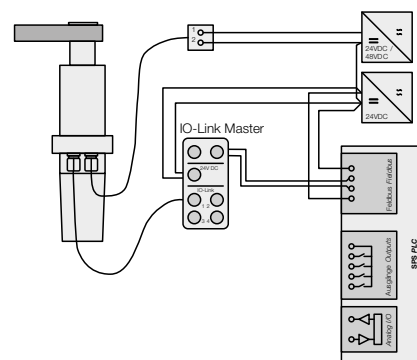
Pin Function

1	+24 V DC
2	GND (ground)

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



Supply voltage 24 V DC motor

- | | |
|---|--------------|
| 1 | +24 V DC |
| 2 | GND (ground) |

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

Use **IO-Link**
Universal · Smart · Easy

Dimensions • Technical Data

Electric 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	[kgm ²]	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

OI = 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

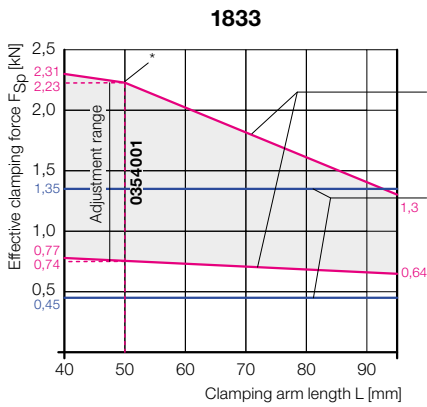
Important note

To guarantee a process-safe application, all technical requirements and general conditions must be carefully checked.

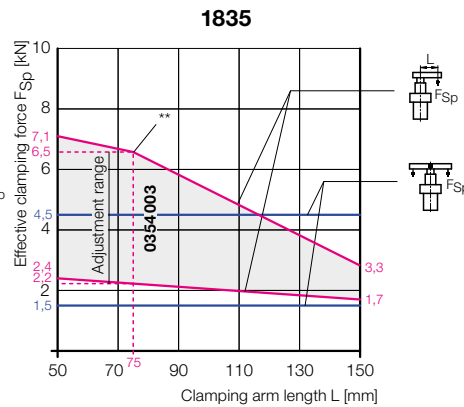
Please contact our technical consultants (on site or directly in product management, Phone +49 6405 89456).

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.



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



** 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 0354 001: $L = 50$ 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 0354 003: $L = 75$ 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

$S < \text{clamping stroke}$
The electric 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:

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

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:

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

Example

Accessory clamping arm 0354 001: $L = 50$ mm
As per diagram:
Max. clamping force 2.2 kN
Displacement force F_V 0.33 kN
With a friction coefficient $\mu = 0.4$, this is sufficient for a workpiece mass m :

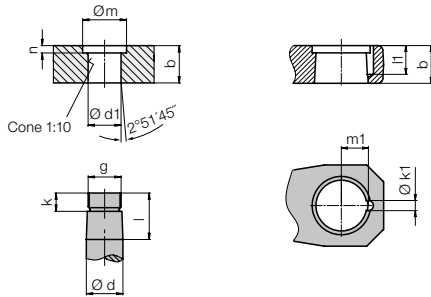
$$m = \frac{F_V}{g * \mu} = \frac{330 \text{ N}}{9.81 * 0.4} = 84 \text{ kg}$$

Example

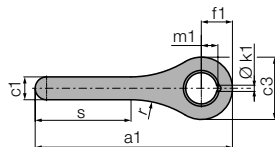
Accessory clamping arm 0354 003: $L = 75$ mm
As per diagram:
Max. clamping force 6.5 kN
Displacement force F_V 0.98 kN
With a friction coefficient $\mu = 0.4$, this is sufficient for a workpiece mass m :

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

Dimensions for special clamping arms and indexing

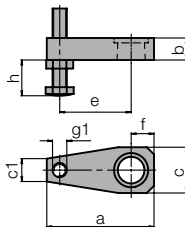


Clamping arm blank with indexing

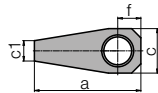


Clamping arm without indexing

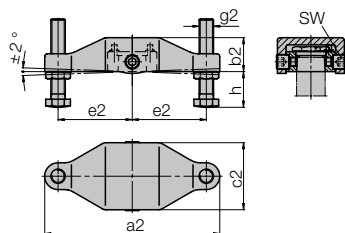
Clamping arm with contact bolt



Clamping arm without thread g1

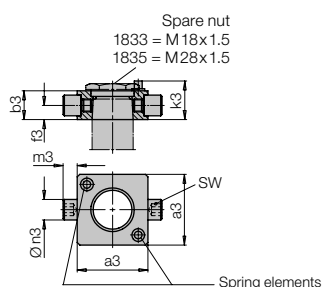


Double clamping arm complete with carrier GGG 40



Carrier for double clamping arm

42CrV4 hardened and tempered



Electric 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	[kgm ²]	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	[kgm ²]	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	[kgm ²]	0.00074	0.0035
Radial torque	[Nm]	0.1	0.5
Material: High alloy steel 1000 ... 1200 N/mm ²			
Double clamping arm, complete*		0354 131	0354 132
Weight, approx.	[kg]	0.83	2
Moment of inertia	[kg·m ²]	0.00120	0.00765
Carrier for double clamping arm		0354 141	0354 142
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		0341 231	0341 231
		3 m 6x6	6 m6x12
Indexing pin		3301 281	3300 325

* Complete with threaded bolt and spring elements

** Height stop surface for spring elements

Horizontal mounting position

The electric 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]

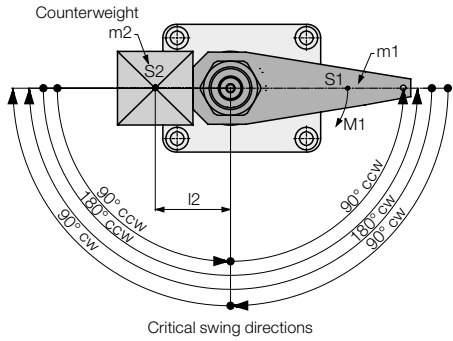
m2 = Mass of counterweight [kg]

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 swivelling speed has to be reduced. The setting is described in the operating manual.

Mounting position - horizontal





Electric Clamp - Swing Clamp Version

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



Version

This electric clamp is an electrically operated swing clamp.

Application

Electric 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 clamping elements have to be controlled individually
- where the clamping force must be maintained also after the separation from the energy supply

Thus electric clamps are particularly suited for:

- Packaging industry
- Test systems
- Assembly equipments and robotics
- Automatic manufacturing systems

Description

The electric 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 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
- Clamping 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 clamp. When operating several electric 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 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.

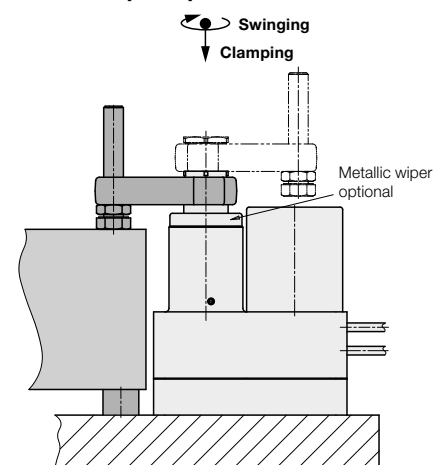
The manufacturer of the fixture or the machine is obliged to provide effective protection devices. During loading and unloading of the fixture and during clamping, collision with the clamping arm must be avoided.

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 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 clamp and a higher-level control.

Advantages

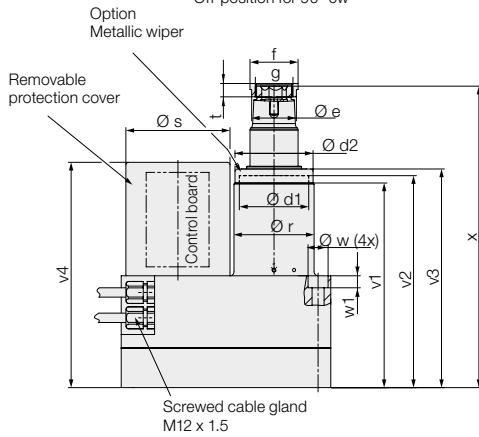
- Reduced cabling effort
- Simplified commissioning
- More extensive diagnostic options
- Interference immunity through digital signal transmission
- All settings can be made conveniently via the IO-Link interface

Technical information

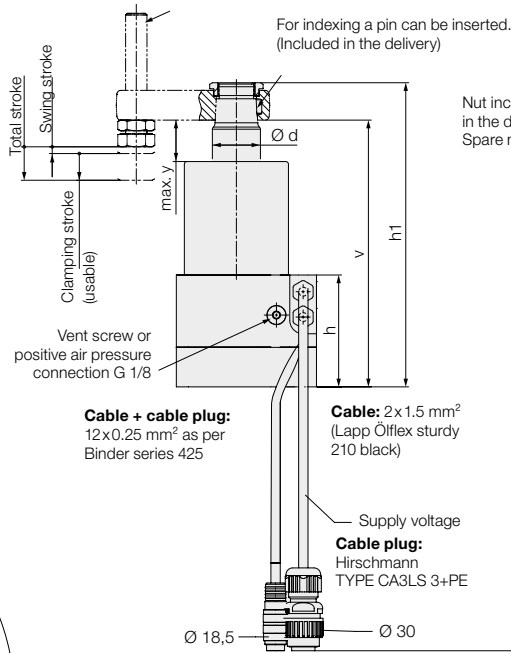
Further information on the application and operating conditions is available on request.

Clamping arm see page 4

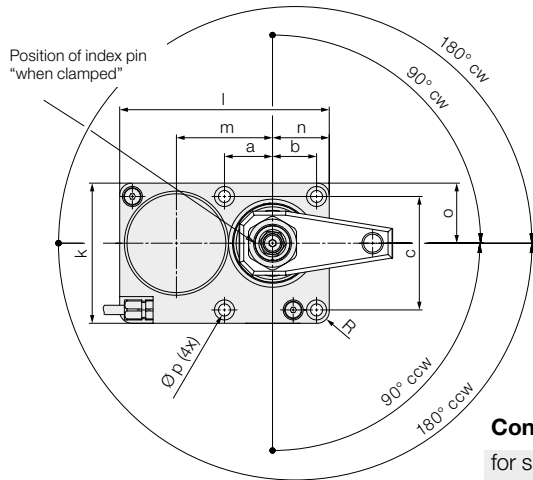
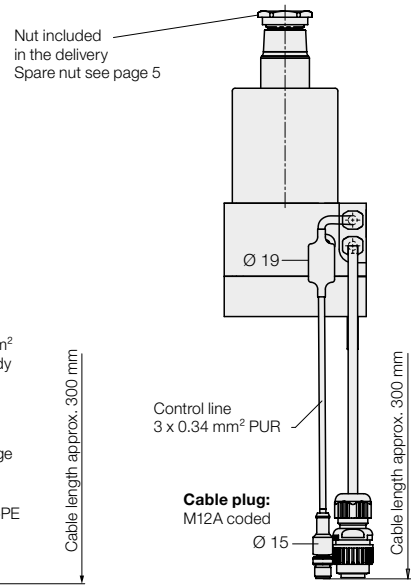
Off-position for 90° cw



1835CXXXX26P
1835CXXXX26PM



IO-Link connection
1835CXXXX26POI
1835CXXXX26PMI



Clamping position $\pm 1^\circ$

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. 3141992

Cable socket 5 m cable 12 POL.

Part no. 3823375 L 05000

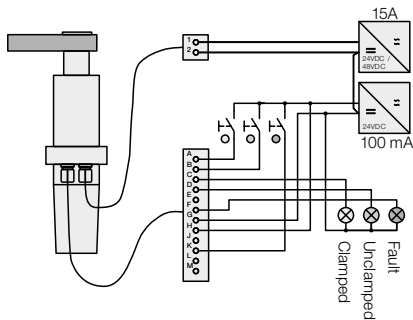
Supply line

Cable socket Hirschmann CA3LD

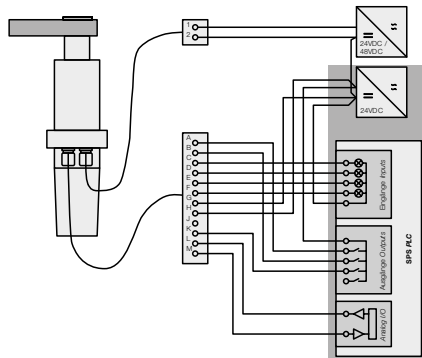
Part no. 3141 991



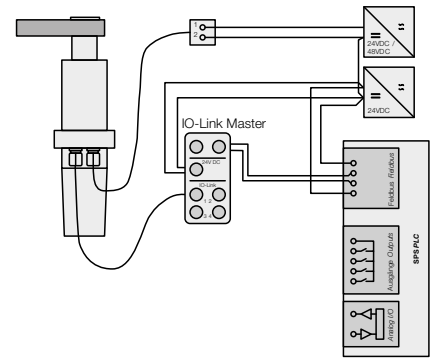
Connecting examples Minimum configuration



Programmable logic control PLC



IO-Link connection



Supply voltage 24 V DC - 15 A

- +24 V DC
- 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

Supply voltage 24 V DC - 15 A

Pin Function

- +24 V DC
- 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

Supply voltage 24 V DC - 15 A

- +24 V DC
- GND (ground)

Control line

- +24 V DC
- GND (ground)
- C/Q IO-Link

Use **IO-Link**
Universal · Smart · Easy

Electric 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	[kgm ²]	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 R26 PXX
Swing direction 90° counterclockwise	1835 C090 L26 PXX
Swing direction 180° clockwise	1835 C180 R26 PXX
Swing direction 180° counterclockwise	1835 C180 L26 PXX
0 degree	1835 C000 026 PXX

XX = Options
OI = 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.

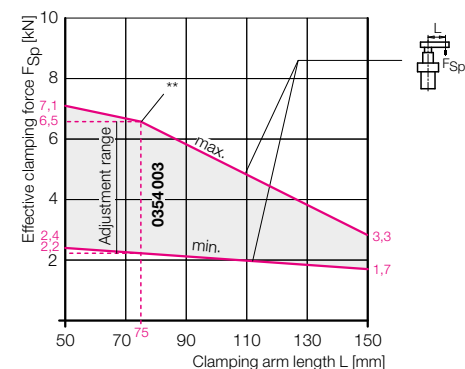
Please contact our technical consultants (on site or directly in product management, Tel.: +49 6405 89-456).

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.

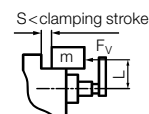
Example

Accessory clamping arm 0354 003: $L = 75$ 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 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:

$$F_v = F_{Sp} \cdot 15\% = 6.5 \text{ kN} \cdot 0.15 = 0.98 \text{ kN}$$

Example

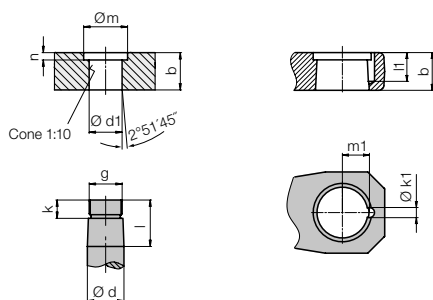
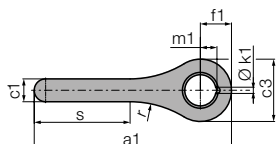
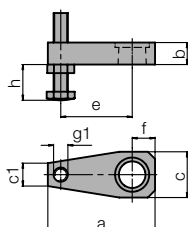
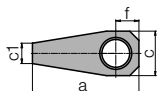
Accessory clamping arm 0354 003: $L = 75$ mm

As per diagram:

- Max. clamping force 6.5 kN
- Displacement force F_v 0.98 kN

With a friction coefficient $\mu = 0.4$, this is sufficient for a workpiece mass m :

$$m = \frac{F_v}{g \cdot \mu} = \frac{980 \text{ N}}{9.81 \cdot 0.4} = 250 \text{ kg}$$

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 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	[kgm ²]	0.002295
Radial torque	[Nm]	0.32

Clamping arm without thread g1**3921017**

Weight, approx.	[kg]	0.65
Moment of inertia	[kgm ²]	0.00134
Radial torque	[Nm]	0.20

Clamping arm blank**3548902A**

Weight, approx.	[kg]	0.95
Moment of inertia	[kgm ²]	0.0035
Radial torque	[Nm]	0.5
Material: High alloy steel 1000 ... 1200 N/mm ²		

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 clamp can be operated with the accessory clamping arm 0354 003 (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

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

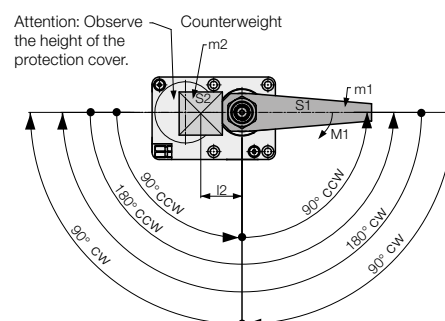
M1 = First-order torque around the piston axis (control of the CAD model) [kgm]

m2 = Mass of counterweight [kg]

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

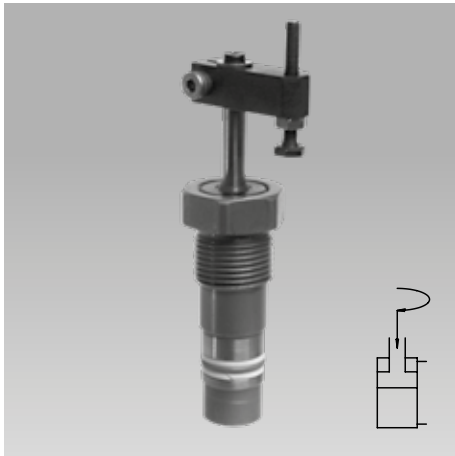
Important note

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



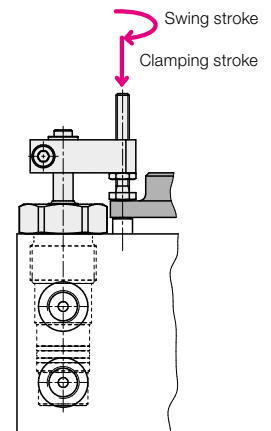
Mini Swing Clamps with Sturdy Swing Mechanism threaded-body type, double acting, max. operating pressure 150 bar



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.

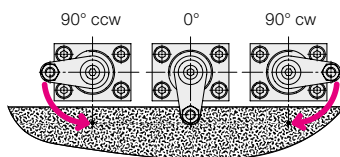
Mini swing clamps are particularly suitable for machining of thin-walled workpieces, which require only little clamping forces.

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.

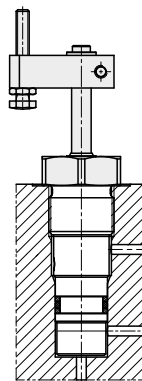
Important notes

- 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

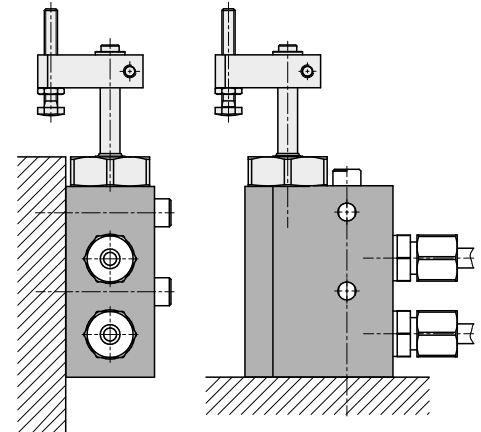
Threaded-body type

for horizontally-drilled channels

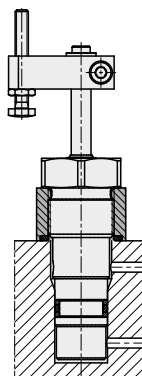


Pipe thread

with accessory built-in housing

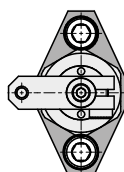
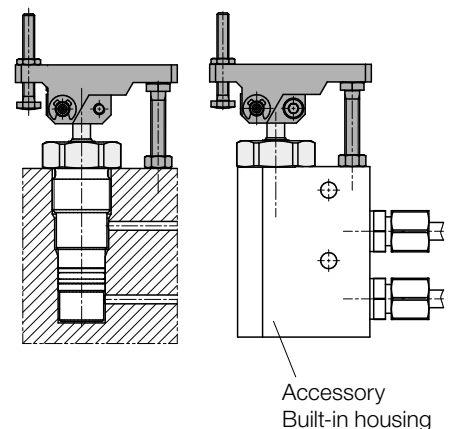


Installation as cartridge type with accessory fixing flange



Threaded-body type

with accessory clamping strap
for clamping with minimum deformation





Compact Swing Clamps

bottom flange, top flange, threaded-body type,
single acting, max. operating pressure 350 bar



① + ②



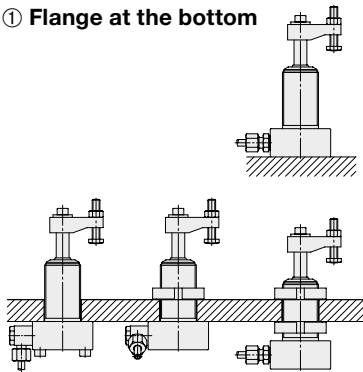
③ + ④



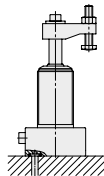
⑤

Connecting types

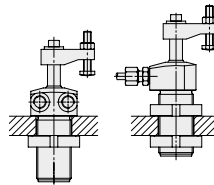
① Flange at the bottom



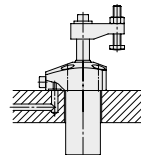
② Flange at the bottom with O-ring sealing



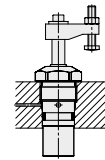
③ Flange at the top



④ Flange at the top with O-ring sealing



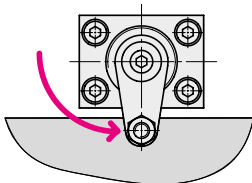
⑤ Threaded-body type



FKM wiper
standard

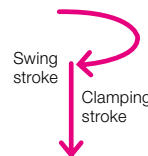
Application

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.



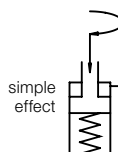
Function

This hydraulic clamping element is a pull-type cylinder where a part of the total stroke is used to swing the piston.



Version

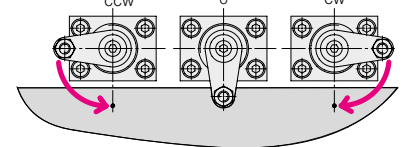
Only single-acting elements are available.



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.

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.

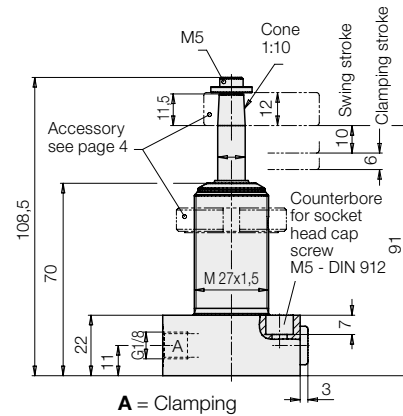
Technical data

Connecting types • Important notes

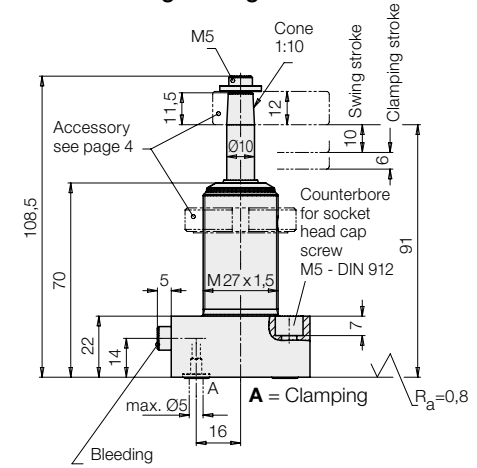
Technical data

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

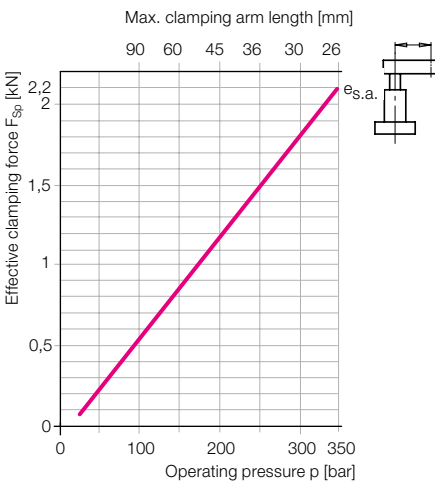
① Flange at the bottom



② Flange at the bottom with O-ring sealing

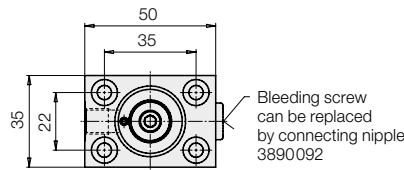


Clamping force diagram



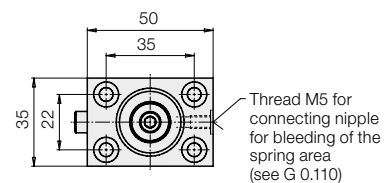
Material

Housing and piston are made of high alloy steel. By nitrating, wear is reduced and protection against corrosion increased. FKM seals.



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

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.)

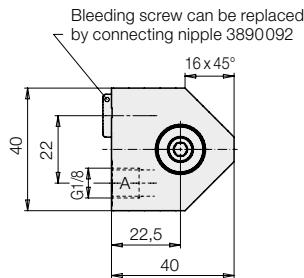
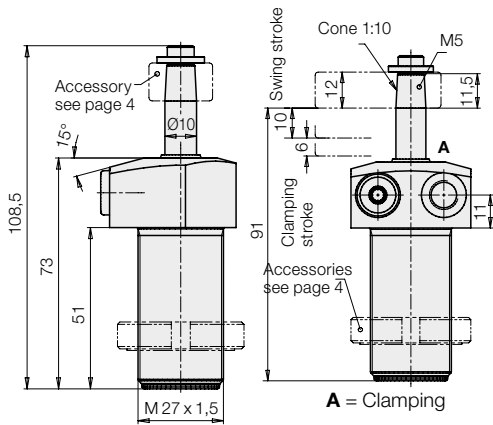
7. Venting of spring area

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.

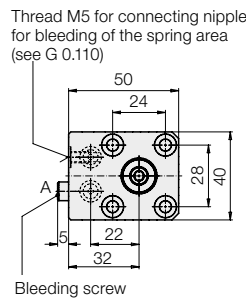
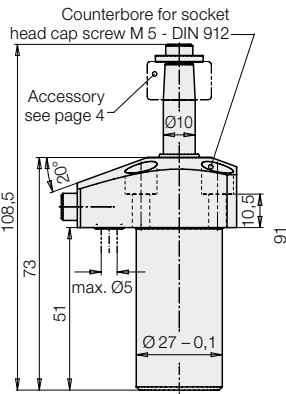
③ Flange at the top



Weight: 0,35 kg

Swing angle	Swing direction	Part no.
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

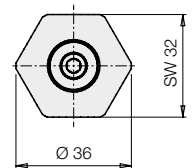
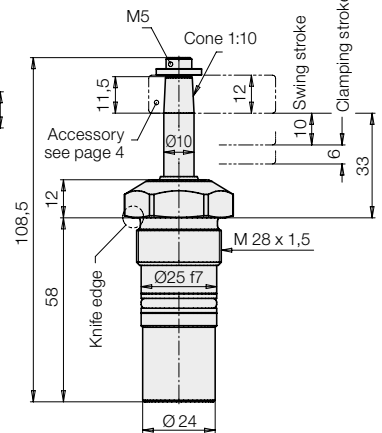


Weight: 0,42 kg

Swing angle	Swing direction	Part no.
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

⑤ Threaded-body type



Max. seating torque Nm 100

Weight: 0,27 kg

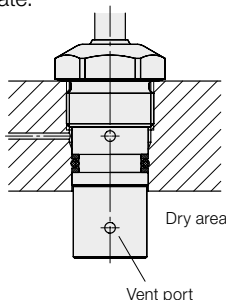
Swing angle	Swing direction	Part no.
0°	—	1849005
90°	cw	1849015
90°	ccw	1849025
60°	cw	1849035
60°	ccw	1849045
45°	cw	1849055
45°	ccw	1849065

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.

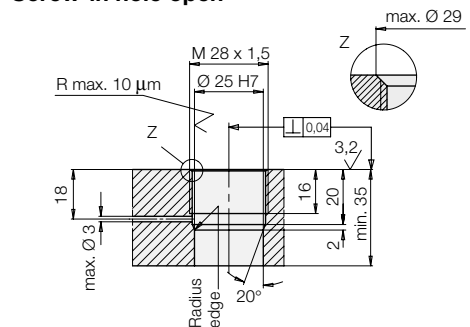
8. Bleeding

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.

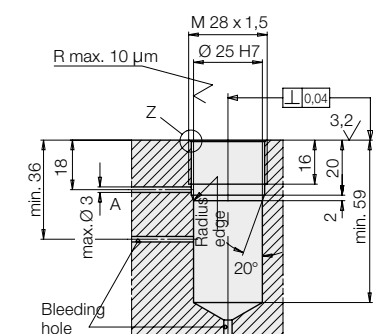
8.1 Flange at the bottom and at the top
Loosen carefully the union nut of the tube at low oil pressure and pump until bubblefree oil comes out. Retighten the union nut.

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.

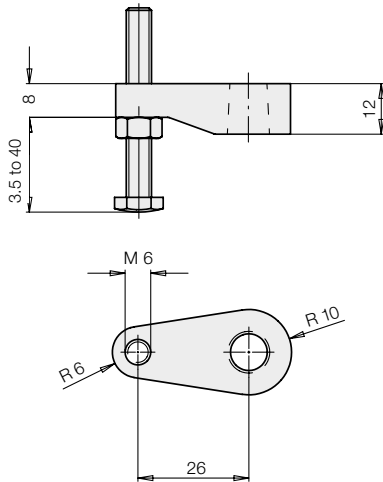
8.3 Threaded-body type
There is no possibility for bleeding at the element itself. Remedy: plug the oil channels in the fixture body at the end. If required, loosen the plugs carefully and pump at low oil pressure until bubblefree oil comes out. Retighten the plugs.



Screw-in hole closed

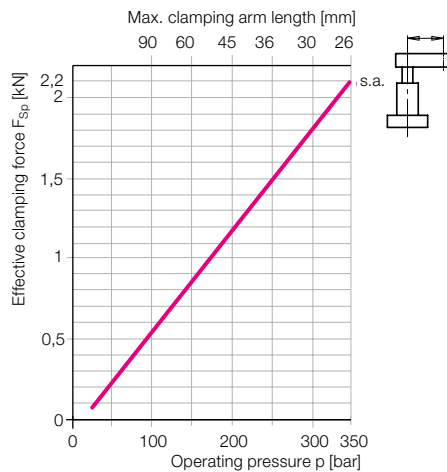


Clamping arm assembly, complete max. 350 bar



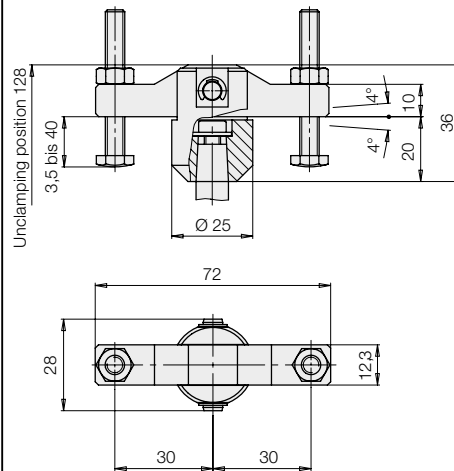
Part no. 0354057

Clamping force diagram



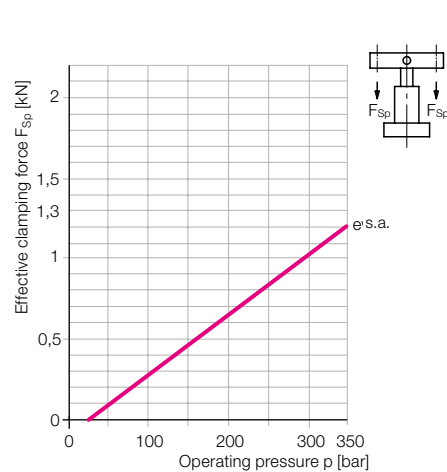
Double clamping arm, complete

Contact bolt – M 6 x 45
Part no. 3614 138



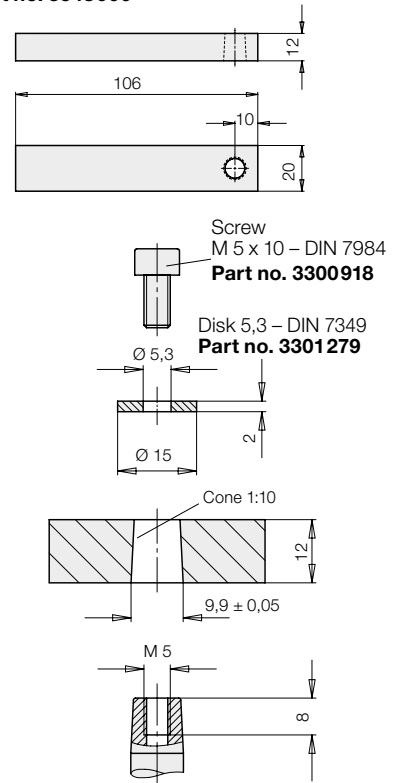
Part no. 0354082

Clamping force diagram

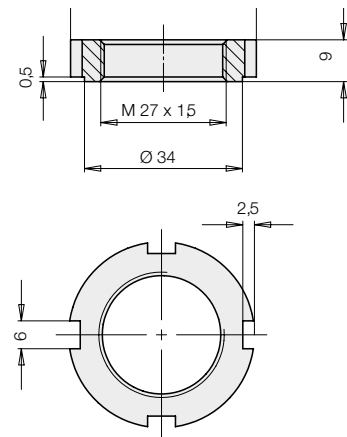


Connecting dimensions for special clamping arms

Clamping arm - blank
Part no. 3548900



Flange nut as per DIN 1804



Part no. 3527076

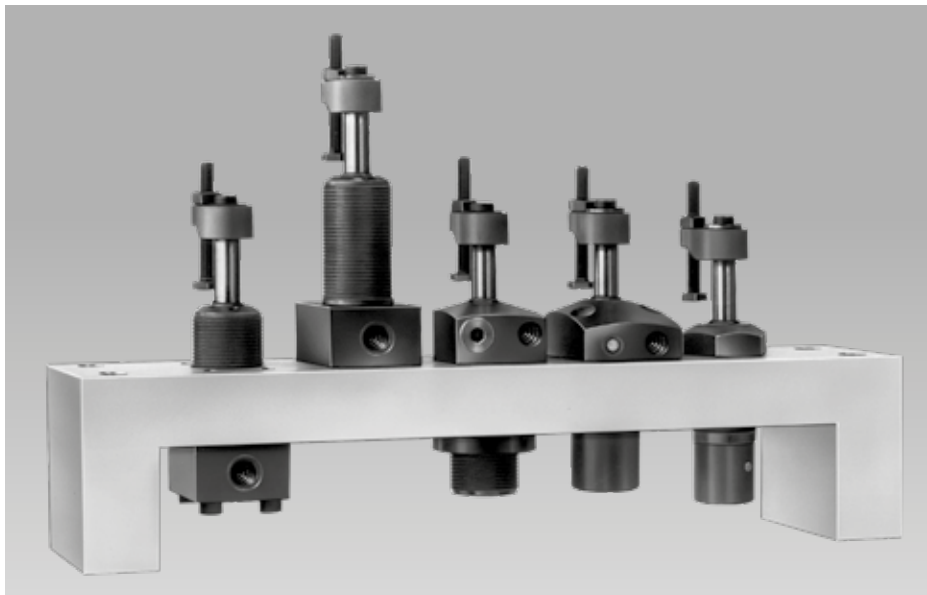
Tube male stud coupling for G1/8

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

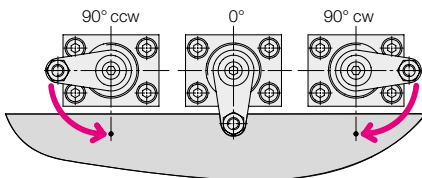
- High clamping force at low operating pressure
- Compact design
- Sturdy swing mechanism
- Metal-protected wiper
- FKM seals as standard
- Special swing angle in standard versions

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°).



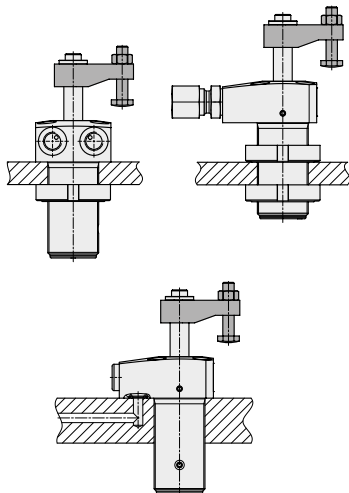
Accessories see page 4

- Clamping arm
- Lock nut

Connecting types

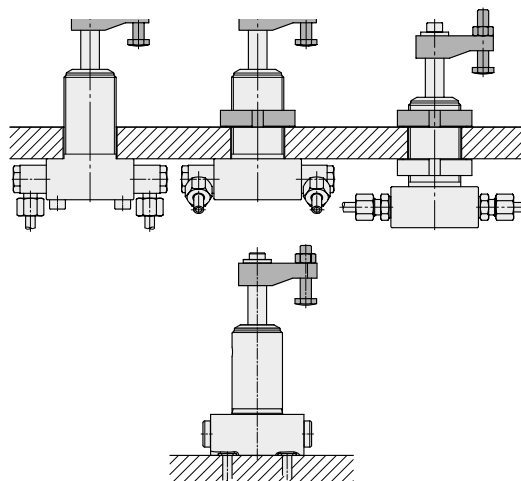
Top flange

pipe threads and drilled channels



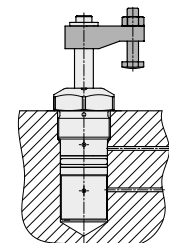
Bottom flange

Pipe thread and drilled channels



Threaded-body type

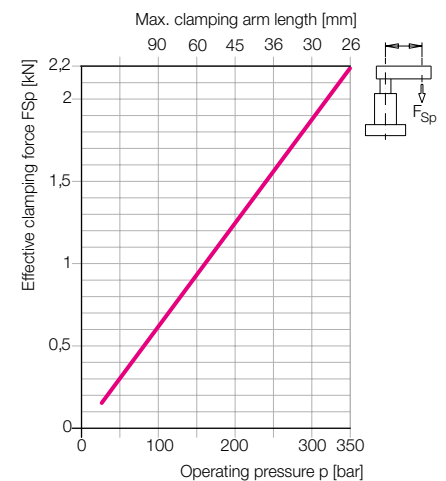
Drilled channels



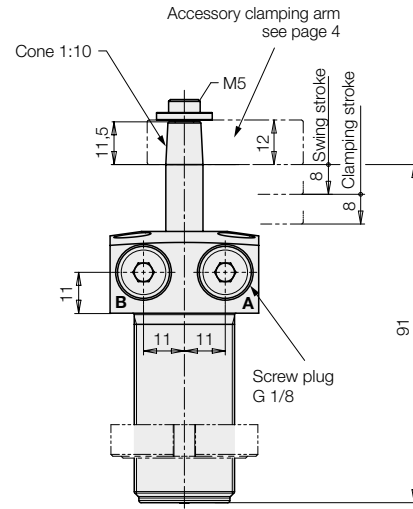
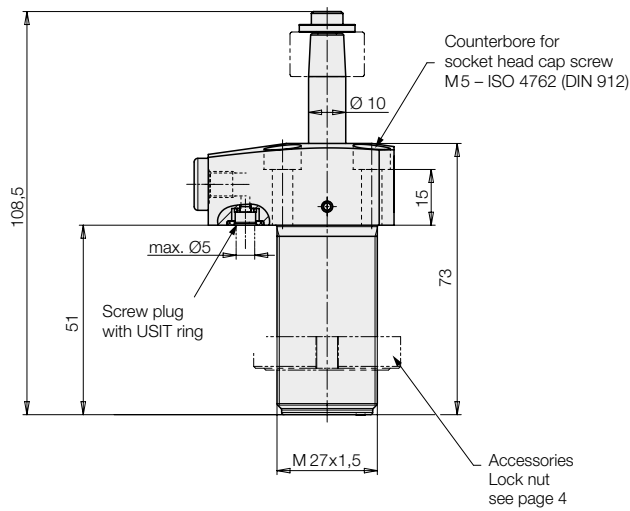
Technical data

Piston Ø	[mm]	14
Rod Ø	[mm]	10
Effective piston area		
Clamping	[cm ²]	0.754
Unclamping	[cm ²]	1.54
Required oil per stroke		
Clamping	[cm ³]	1.2
Unclamping	[cm ³]	2.5
Max. flow rate		
Clamping	[cm ³ /s]	5
Unclamping	[cm ³ /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

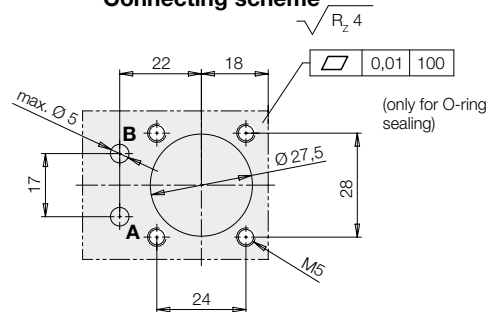
Clamping force diagram



Top flange



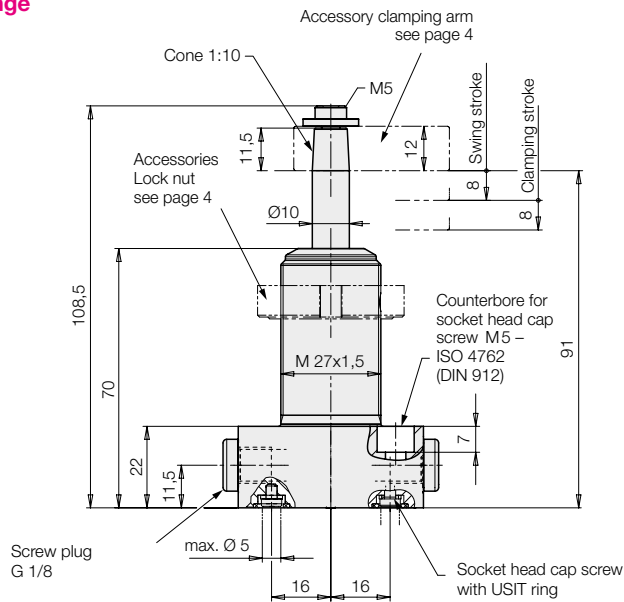
Connecting scheme



A = Clamping
B = Unclamping

Weight: 0.42 kg

Bottom flange



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):

for top flange: 8 × 1,5 mm,

Part no. 3000275

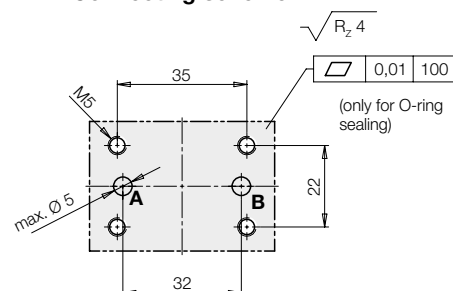
for top flange: 7 × 1,5 mm,

Part no. 3001077

A = Clamping
B = Unclamping

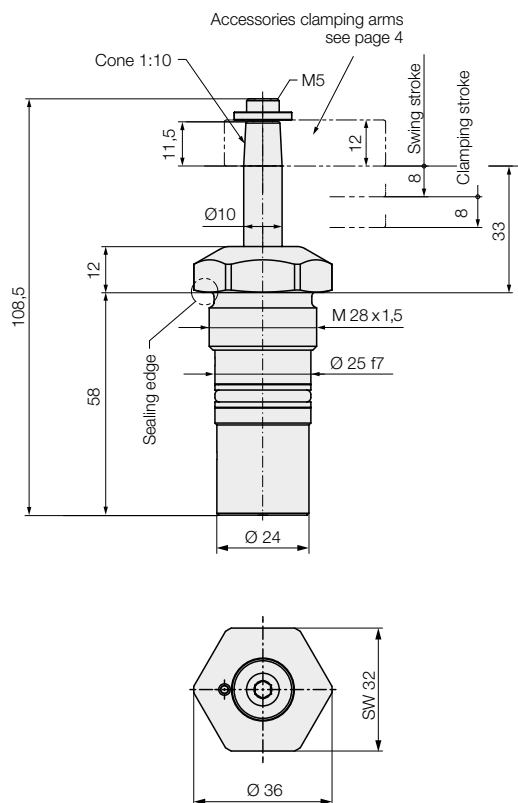
Weight: 0.42 kg

Connecting scheme



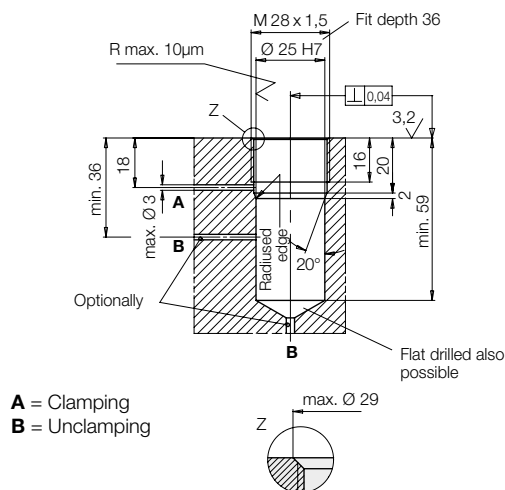
Threaded-body type Code for Part numbers

Threaded-body type



Weight: 0.27 kg

Location hole



Code for part numbers

V1SAFA XK6 X0XX H0XX FE

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° (without swing motion)

Clamping Stroke

- 08** = 8 mm: for swing angle 45°, 60° and 90°
 - 16** = 16 mm: for swing angle 0°
- At a swing angle of 0°, the clamping stroke of 16 mm corresponds to the total stroke of the swing clamp.

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**

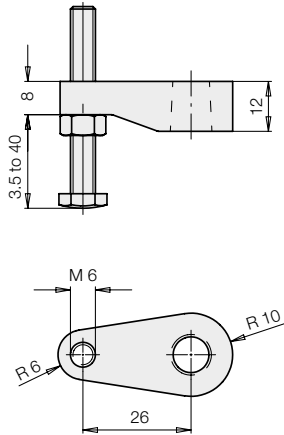
Part no.

V1SAFA SK6 R060 H008FE

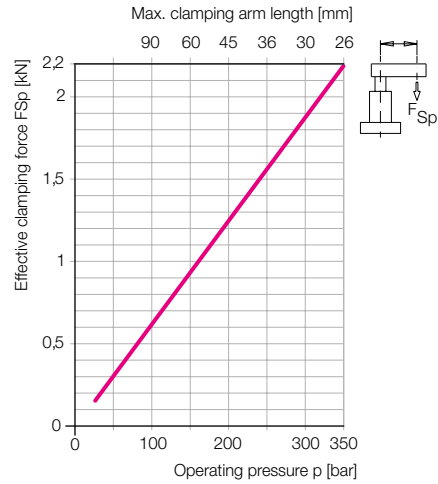
Operating conditions, tolerances and other data see data sheet A 0.100.

Clamping arm, complete max. 350 bar

Part no. 0354057

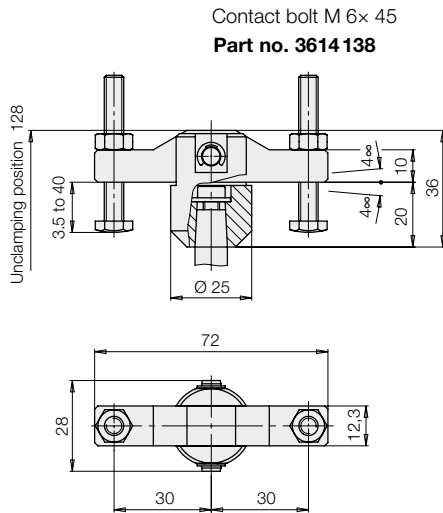


Clamping force diagram



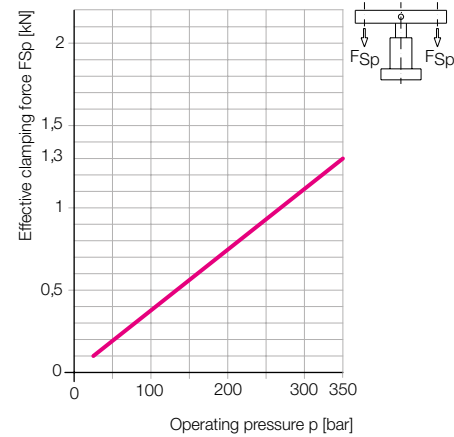
Double clamping arm, complete

Part no. 0354082



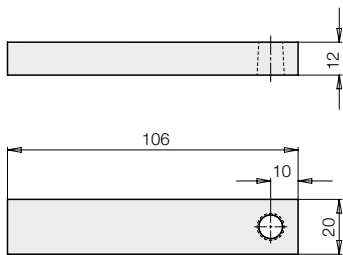
Contact bolt M 6 x 45
Part no. 3614138

Clamping force diagram

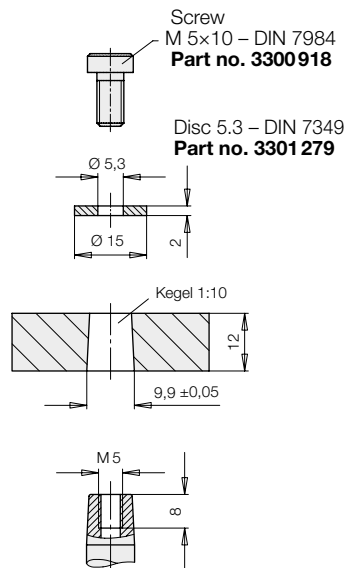


Clamping arm blank

Part no. 3548900

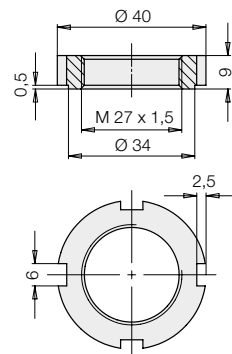


Dimensions for special clamping arms



Lock nut as per DIN 1804

Part no. 3527076



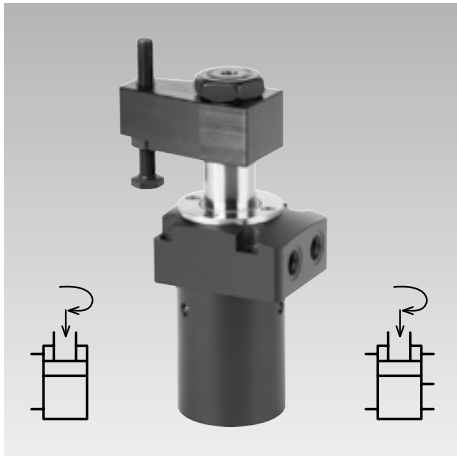
Seal kit, universal for all designs

Part-no. V1 SAF01 DFG0001



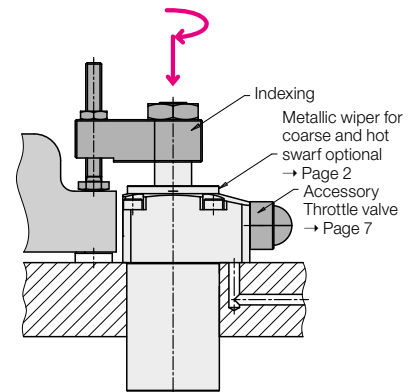
Swing clamp with reinforced swing mechanism

Position monitoring optional: pneumatically integrated/electrically attachable
Top flange type, double acting, operating pressure 70 bar/max. 120 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).

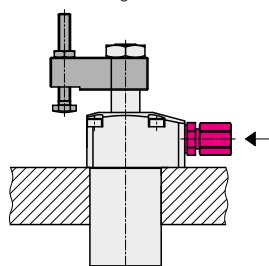
Important notes see page 2

Installation and connecting possibilities

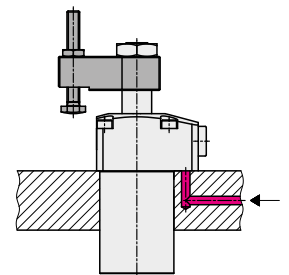
Pipe thread

without position monitoring

185XT → Page 2

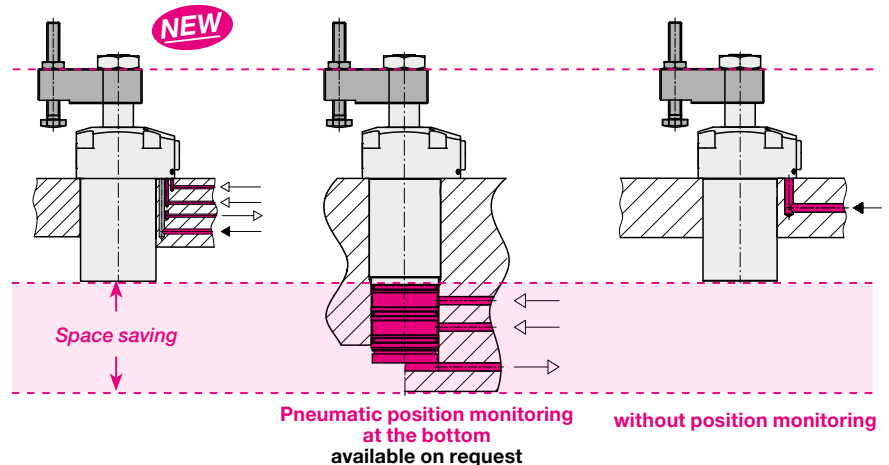


Drilled channels



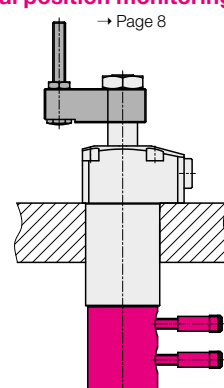
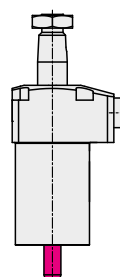
with integrated pneumatic position control

185XP → Page 4

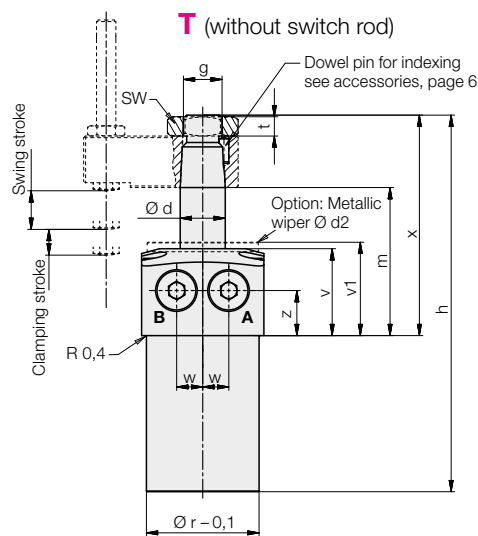


with switch rod for electrical position monitoring (see accessories)

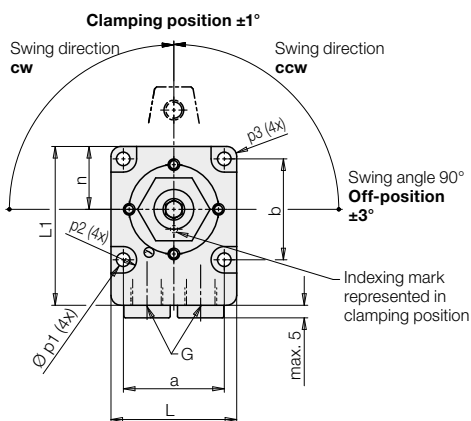
185XQ → Page 2



Versions T and Q Dimensions



A = Clamping
B = Unclamping



Swing angle

1. Swing angle 90° and 0° (standard)

Part no.

90° cw **185XX090RXX**
90° ccw **185XX090LXX**
0° **185XX0000XX**

2. Swing angle $\alpha < 90^\circ$

$\alpha = 15^\circ$ 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:

$$y = (90^\circ - \alpha^\circ) \cdot k \quad (k \text{ see chart page 3})$$

Dimension 8 ± 0.5 is lengthened by the value y.

Example:

Swing clamp **1856T090L27**
Desired swing angle **45° ccw**
Part no. **1856T045L27**

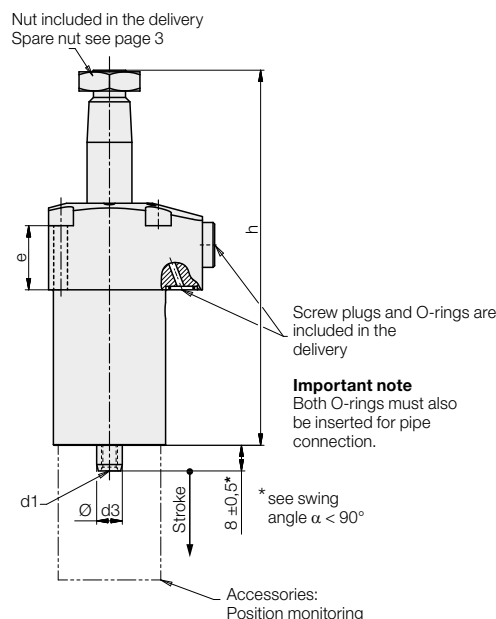
Shortening:

$$y = (90^\circ - 45^\circ) \cdot 0.125 \text{ mm/}^\circ = 5.625 \text{ mm}$$

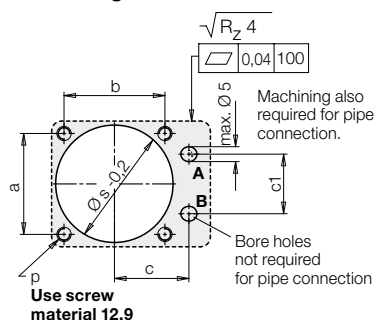
3. Swing angle $> 90^\circ$

Available on request!

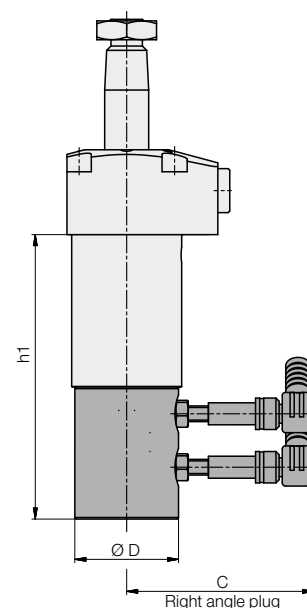
Q (with switch rod)



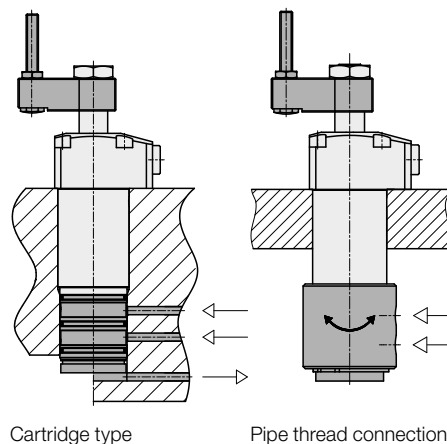
Connecting scheme



Electrical position monitoring (→ page 8)



Pneumatic position monitorings 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.

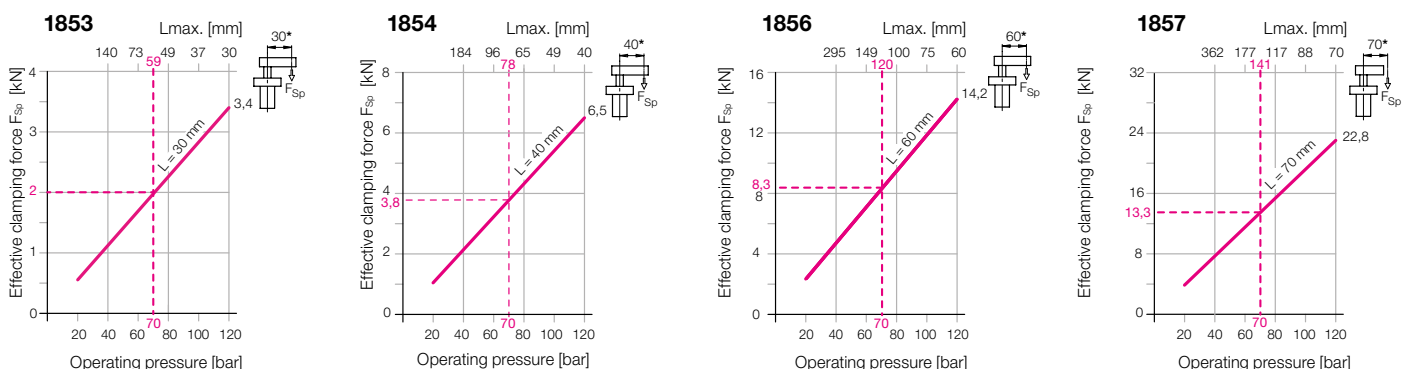
Versions T and Q
Technical Data • Dimensions

Swing clamps			1853	1854	1856	1857
Max. pulling force (70 bar)	[kN]		2.35	4.46	9.9	16.1
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	[cm³/s]	13.5	33.5	96	167
	Unclamping	[cm³/s]	20	53.5	145	255
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	13.4	38.3	66.7
Oil volume / return stroke	[cm³]		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	M8 x 16.0 deep	M8 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.	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]		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

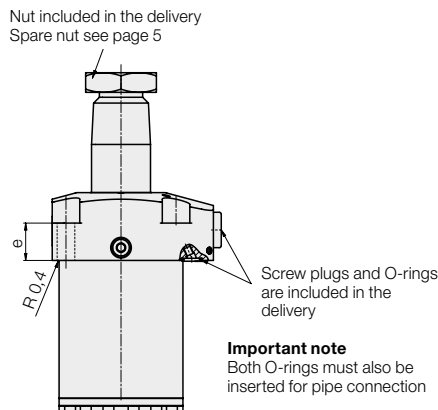
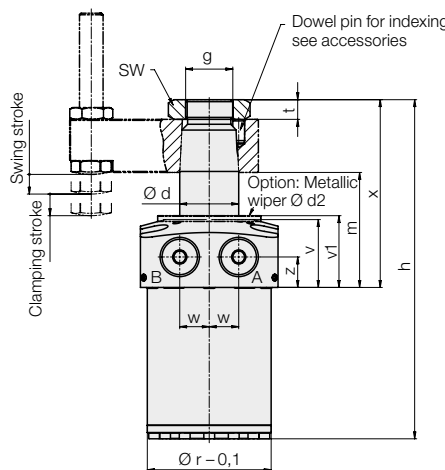
Metallic wiper **M** = option (see page 2)

Effective clamping force with accessory clamping arm as a function of the oil pressure



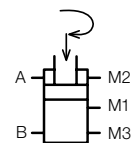
* Clamping force for other lengths see page 6

P (with integrated pneumatic position monitoring)

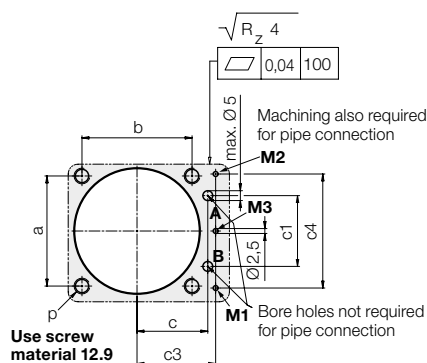
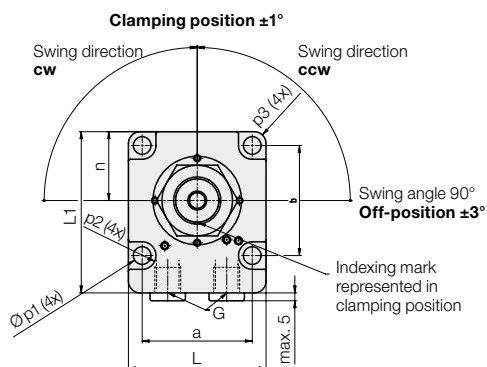


Important note
 Both O-rings must also be inserted for pipe connection

Connecting scheme



A = Clamping
B = Unclamping
M1 = Clamped (pneumatic)
M2 = Unclamped (pneumatic)
M3 = Outlet air (pneumatic)



Pneumatic position monitoring

Application

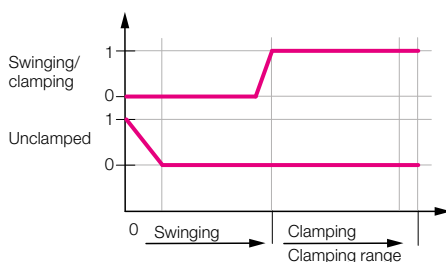
The pneumatic position monitoring signals the following conditions by closing two bore holes:

1. Piston extended and clamping arm in off-position.
2. Piston in clamping area and clamping arm in clamping position.

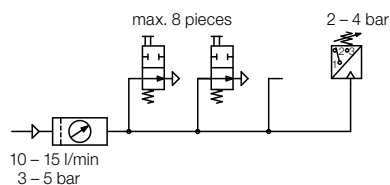
For each control function, a pneumatic line has to be provided at the clamping fixture.

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

Version P
Technical Data • Dimensions

Swing clamps			1853P	1854P	1856P	1857P
Max. pulling force (70 bar)	[kN]		2.35	4.46	9.9	16.1
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	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)	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				

Example: 1854P45R17

h 145 -4.7 = 140.3

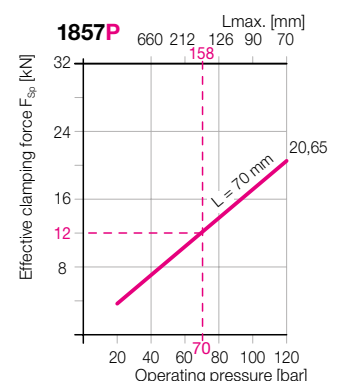
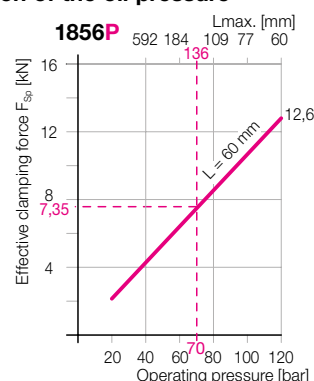
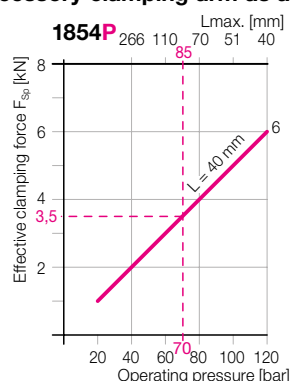
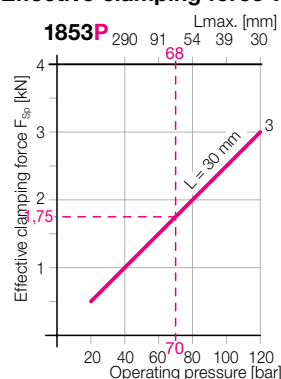
m 50 -4.7 = 45.3

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:

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

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

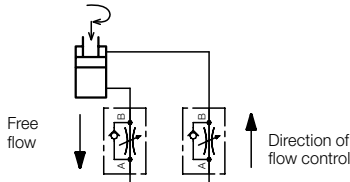
If the torques of inertia are not known, the admissible flow rate can be determined according to the following example:

Conditions: The special clamping arm is longer, has however the form (cross section) of the accessory clamping arm, as shown on page 6.

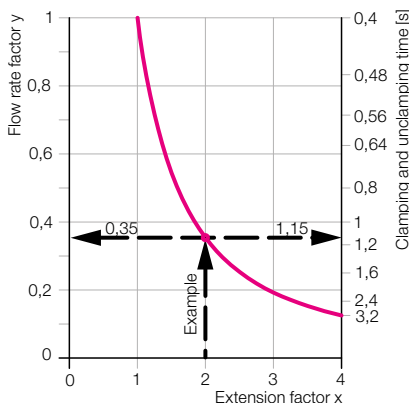
Example: Swing clamp 1853T090R16
 $L = 60 \text{ mm}$
 $e = 30 \text{ mm}$ as per above chart
 $Q_e = 13.5 \text{ cm}^3/\text{s}$

1. Extension factor $x = \frac{L}{e} = \frac{60 \text{ mm}}{30 \text{ mm}} = 2$
2. Flow rate factor as per diagram $\rightarrow y = 0.35$
3. Max. flow rate $Q_L = y \cdot Q_e = 0.35 \cdot 13.5 \text{ cm}^3/\text{s} = 4.7 \text{ cm}^3/\text{s}$
4. Min. clamping time as per diagram $\rightarrow$ 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

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

Admissible clamping force*)

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

Admissible operating pressure

$$p_{adm.} = \frac{D}{L} + E \leq 70 \quad [\text{bar}]$$

L = special length [mm] p = pressure [bar]

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

Example 1: Swing clamp 1853T090R16

Special clamping arm $L = 60 \text{ mm}$

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

$$F_{Sp} = \frac{p}{A + (B \cdot L)} = \frac{69}{29.68 + (0.177 \cdot 60)} = 1.71 \text{ kN}$$

Example 2: Swing clamp 1853P090R16

Special clamping arm $L = 70 \text{ mm}$

1. Admissible clamping force*)

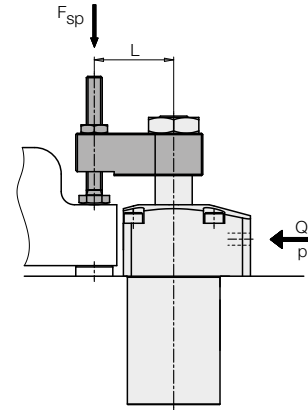
$$F_{adm.} = \frac{C}{L} = \frac{90}{70} = 1.29 \text{ kN}$$

2. Admissible operating pressure

$$p_{adm.} = \frac{D}{L} + E = \frac{2671}{70} + 30.8 = 69 \text{ bar} < 70$$

3. Effective clamping force

$$F_{Sp} = \frac{p}{A + (B \cdot L)} = \frac{69}{29.68 + (0.343 \cdot 70)} = 1.29 \text{ kN}$$



Example 3: Swing clamp 1853T090R16

Special clamping arm $L = 60 \text{ mm}$

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

$$F_{Sp} = \frac{p}{A + (B \cdot L)} = \frac{69}{29.68 + (0.177 \cdot 60)} = 1.71 \text{ kN}$$

Example 4: Swing clamp 1853P090R16

Special clamping arm $L = 60 \text{ mm}$

1. Admissible clamping force*)

$$F_{adm.} = \frac{C}{L} = \frac{90}{60} = 1.5 \text{ kN}$$

2. Admissible operating pressure

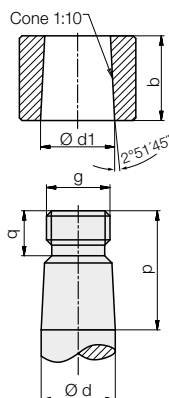
$$p_{adm.} = \frac{D}{L} + E = \frac{2671}{60} + 30.8 = 75.3 \text{ bar} < 120$$

3. Effective clamping force

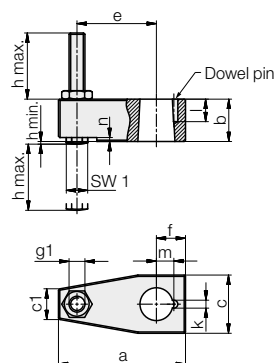
$$F_{Sp} = \frac{p}{A + (B \cdot L)} = \frac{75.3}{29.68 + (0.343 \cdot 60)} = 1.5 \text{ kN}$$

Accessory Clamping Arm • Throttle Valve

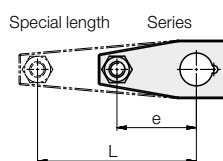
Dimensions for special clamping arms



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 mm 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

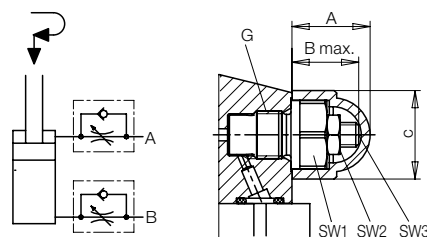
- in order to reduce the swing speed of the clamping arm
- in order to improve the synchronism of several swing clamps

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	1853	1856
	1854	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

Accessory Electrical Position Monitoring

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 (185XQ0XX).

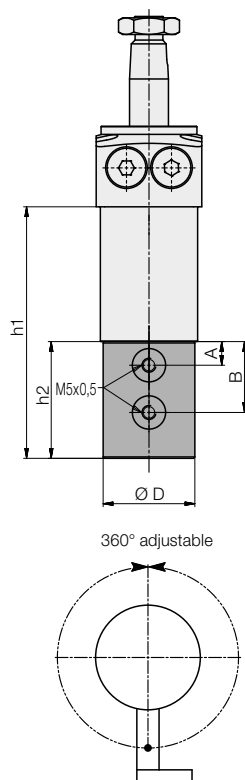
Included in our delivery are:

- 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)

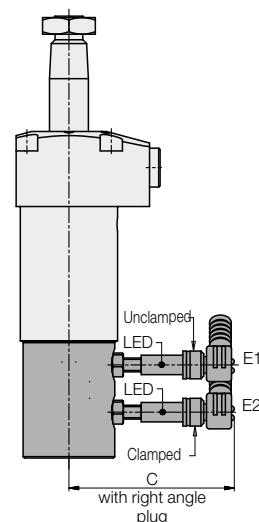
The signal sleeve is screwed onto the switch rod. The adapter is mounted with 4 countersunk screws on the bottom cover.

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.



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*)

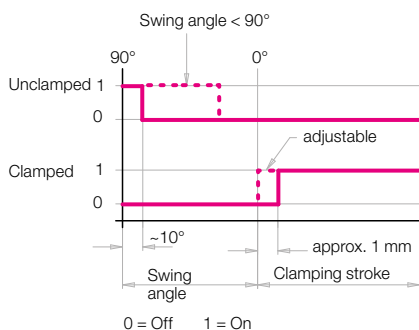
with switch and plug	03539200XX	03539260XX	03539300XX	03539430XX
without switch and plug	03539230XX	03539270XX	03539310XX	03539440XX

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 $\alpha < 90^\circ$ ")

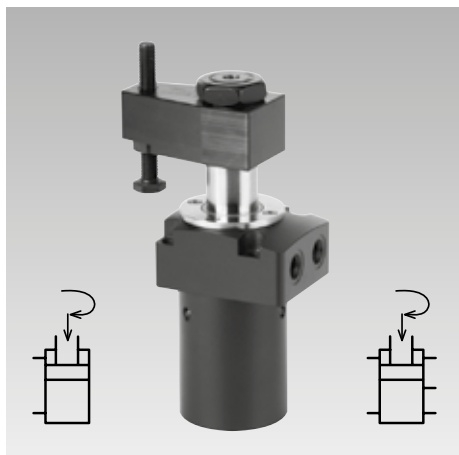
Function chart





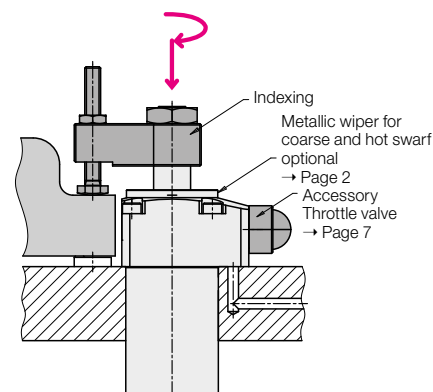
Swing clamp with reinforced swing mechanism

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).

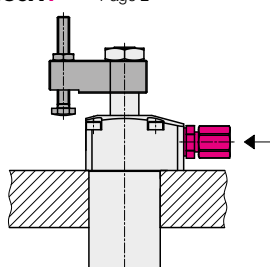
Important notes see page 2.

Installation and connecting possibilities

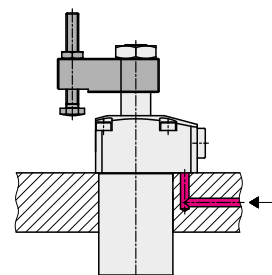
Pipe thread

without position monitoring

186XT → Page 2

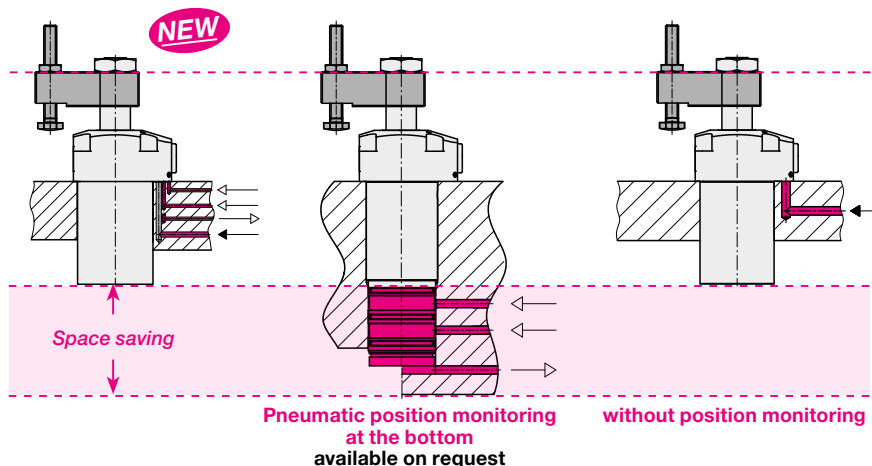


Drilled channels



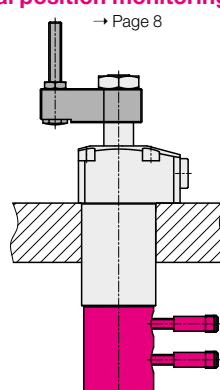
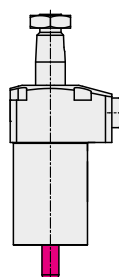
with integrated pneumatic position control

186XP → Page 4

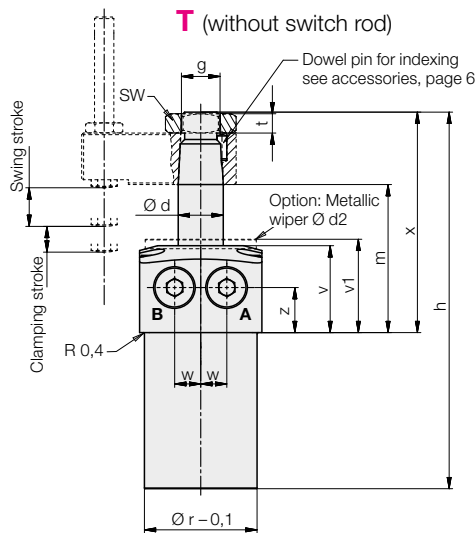


with switch rod for electrical position monitoring (see accessories)

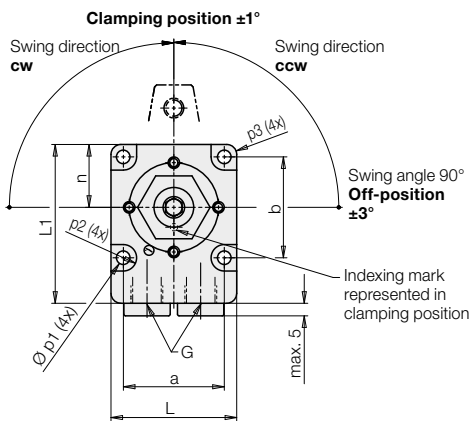
186XQ → Page 2



Versions T and Q Dimensions



A = Clamping
B = Unclamping



Swing angle

1. Swing angle 90° and 0° (standard)

Part no.

90° cw **186XX090RXX**
90° ccw **186XX090LXX**
0° **186XX0000XX**

2. Swing angle $\alpha < 90^\circ$

$\alpha = 15^\circ$ 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:

$$y = (90^\circ - \alpha^\circ) \cdot k \quad (k \text{ see chart page 3})$$

Dimension 8 ± 0.5 is lengthened by the value y.

Example:

Swing clamp **1866T090L27**
Desired swing angle **45° ccw**
Part no. **1866T045L27**

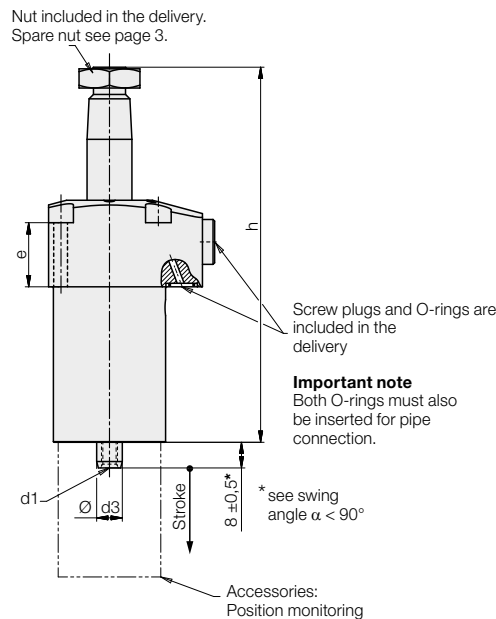
Shortening:

$$y = (90^\circ - 45^\circ) \cdot 0.125 \text{ mm/}^\circ = 5.625 \text{ mm}$$

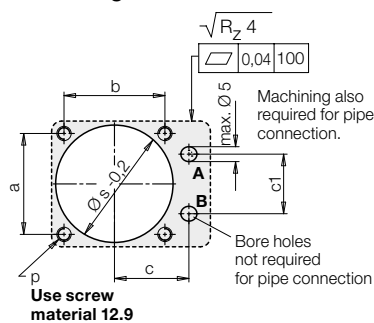
3. Swing angle $> 90^\circ$

Available on request!

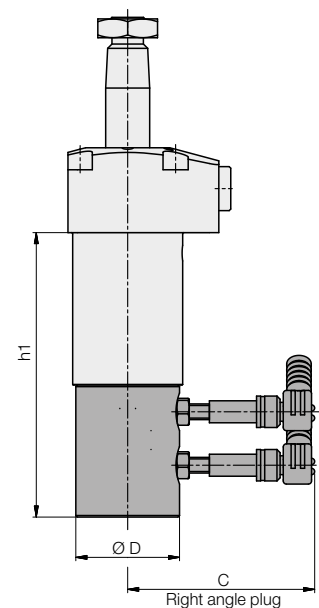
Q (with switch rod)



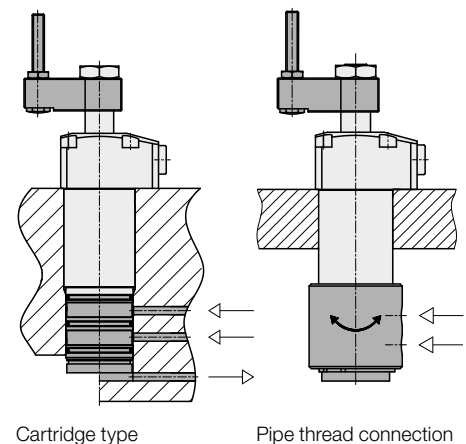
Connecting scheme



Electrical position monitoring (→ page 8)



Pneumatic position monitorings 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.

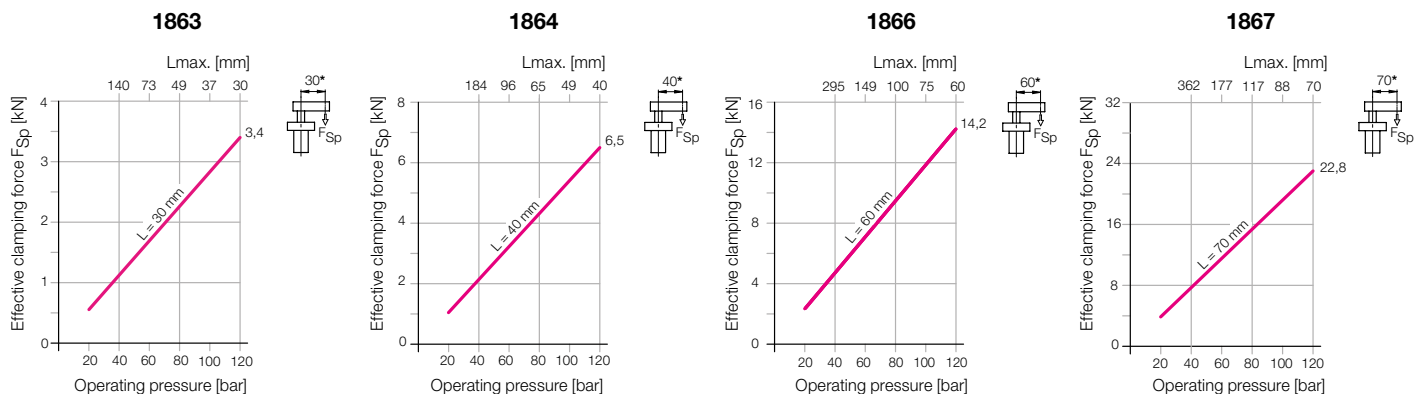
Versions T and Q
Technical Data • Dimensions

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	[cm³/s]	13.5	33.5	96	167
Piston area	Clamping	20	53.5	145	255
	Unclamping	3.36	6.37	14.16	23
Oil volume / stroke	[cm³]	5.4	13.4	38.3	66.7
	[cm³]	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

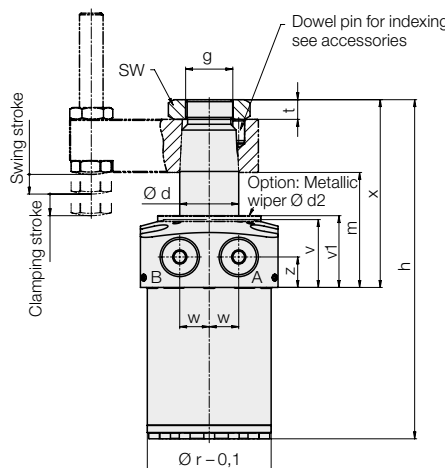
Metallic wiper **M** = option (see page 2)

Effective clamping force with accessory clamping arm as a function of the oil pressure

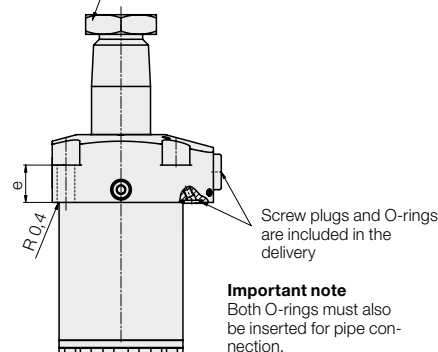


* Clamping force for other lengths see page 6

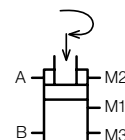
P (with integrated pneumatic position monitoring)



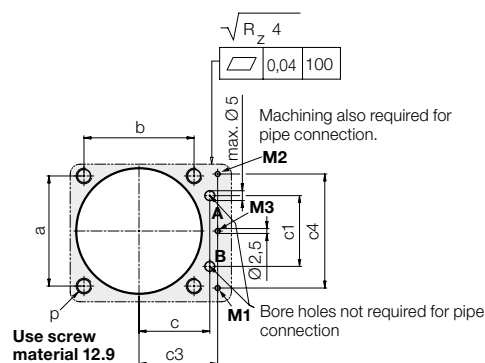
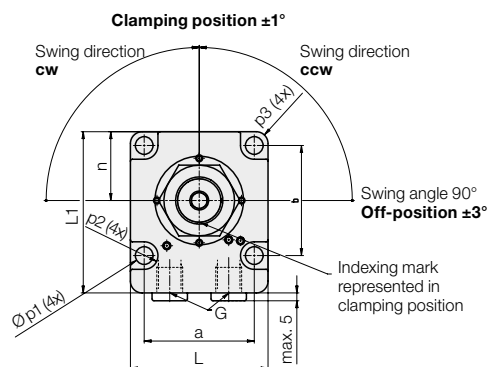
Nut included in the delivery.
Spare nut see page 5.



Important note
Both O-rings must also be inserted for pipe connection.



Connecting scheme



Pneumatic position monitoring

Application

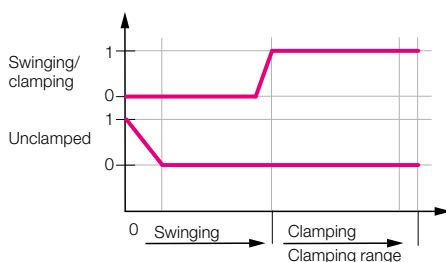
The pneumatic position monitoring signals the following conditions by closing two bore holes:

1. Piston extended and clamping arm in off-position.
2. Piston in clamping area and clamping arm in clamping position.

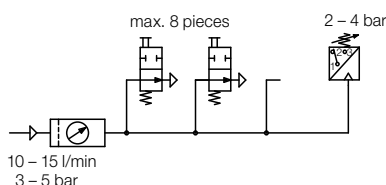
For each control function, a pneumatic line has to be provided at the clamping fixture.

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

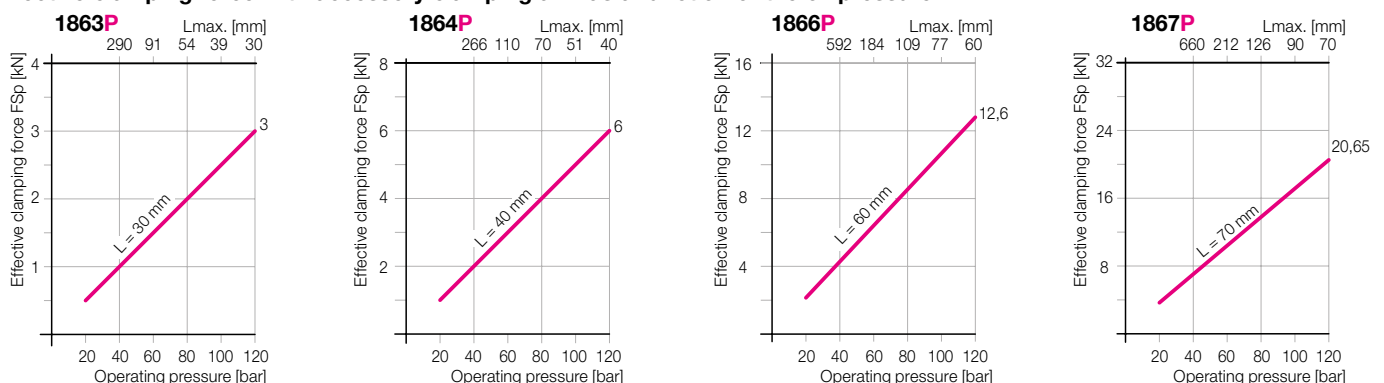
*) Minimum pressure difference, if one or several position monitorings are not operated

Version P
Technical data • Dimensions

Swing clamps			1863P	1864P	1866P	1867P
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 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				
90°	186XP90XXX	1863P	1864P	1866P	1867P	Example: 1864P45R17
60°	186XP60XXX	0	0	0	0	h 145 –4.7 = 140.3
45°	186XP45XXX	–3.5	–3.7	–4.9	–6.3	m 50 –4.7 = 45.3
0°	186XP000XX	–4.5	–4.7	–6.2	–8.2	x 84 –4.7 = 79.3
With metallic wiper ¹⁾	186XPXXXXXM	0	0	0	0	Total stroke 17 –4.7 = 12.3
						Swing stroke 9 –4.7 = 4.3
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

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. 0.4 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:

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

Q_e = Flow rate as per chart

Q_L = Flow rate with special clamping arm

J_L = Torque of inertia accessory clamping arm

J_e = Torque of inertia special clamping arm

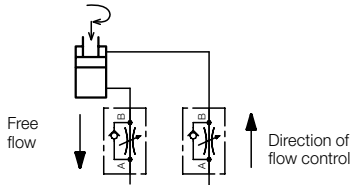
If the torques of inertia are not known, the admissible flow rate can be determined according to the following example:

Conditions: The special clamping arm is longer, has however the form (cross section) of the accessory clamping arm, as shown on page 6.

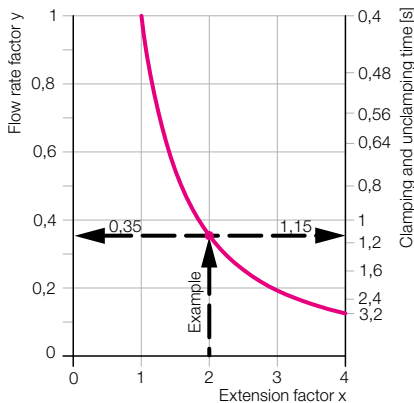
Example: Swing clamp 1863T090R16
 $L = 60 \text{ mm}$
 $e = 30 \text{ mm}$ as per above chart
 $Q_e = 13.5 \text{ cm}^3/\text{s}$

1. Extension factor $x = \frac{L}{e} = \frac{60 \text{ mm}}{30 \text{ mm}} = 2$
2. Flow rate factor as per diagram $\rightarrow y = 0.35$
3. Max. flow rate $Q_L = y \cdot Q_e = 0.35 \cdot 13.5 \text{ cm}^3/\text{s} = 4.7 \text{ cm}^3/\text{s}$
4. Min. clamping time as per diagram $\rightarrow$ 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

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

Admissible clamping force*)

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

Admissible operating pressure

$$p_{adm} = \frac{D}{L} + E \leq 120 \quad [\text{bar}]$$

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 $L = 60 \text{ mm}$

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

$$F_{Sp} = \frac{p}{A + (B \cdot L)} = \frac{69}{29.68 + (0.177 \cdot 60)} = 1.71 \text{ kN}$$

Example: Swing clamp 1863P090R16
 Special clamping arm $L = 60 \text{ mm}$

1. Admissible clamping force*)

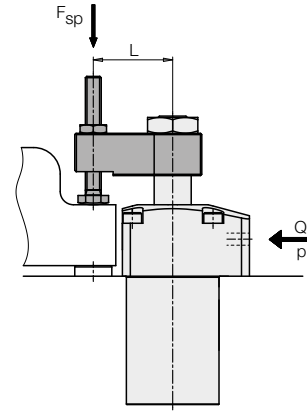
$$F_{adm} = \frac{C}{L} = \frac{90}{60} = 1.5 \text{ kN}$$

2. Admissible operating pressure

$$p_{adm} = \frac{D}{L} + E = \frac{2671}{60} + 30.8 = 75.3 \text{ bar} < 120$$

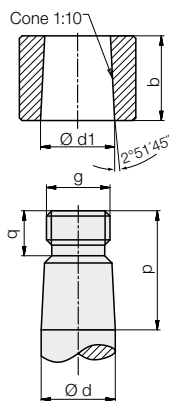
3. Effective clamping force

$$F_{Sp} = \frac{p}{A + (B \cdot L)} = \frac{75.3}{29.68 + (0.343 \cdot 60)} = 1.5 \text{ kN}$$

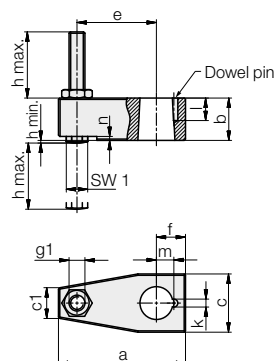


Accessory Clamping arm • Throttle valve

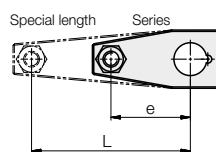
Dimensions for special clamping arms



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 [kg mm 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

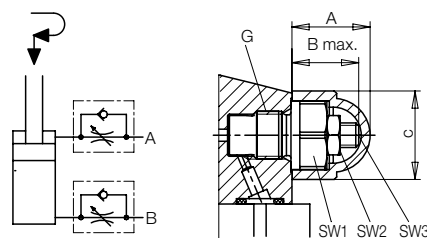
- in order to reduce the swing speed of the clamping arm
- in order to improve the synchronism of several swing clamps

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	1866
	1864	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

Accessory Electrical position monitoring

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 (186XQ0XX).

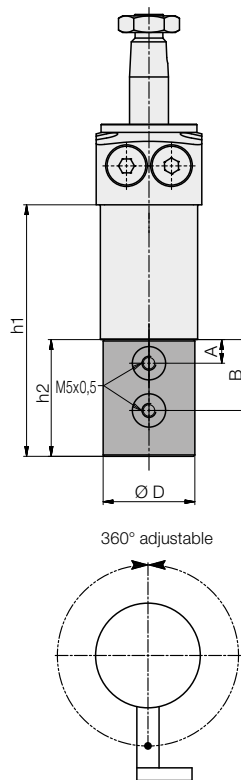
Included in our delivery are:

- 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)

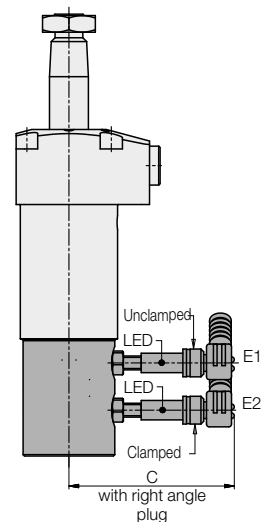
The signal sleeve is screwed onto the switch rod. The adapter is mounted with 4 countersunk screws on the bottom cover.

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.



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*)

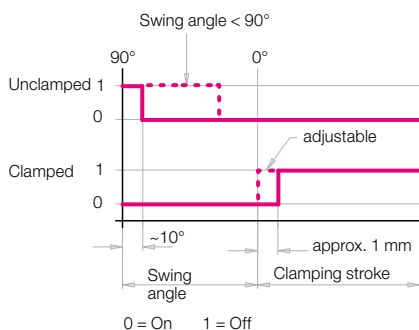
with switch and plug	03539200XX	03539260XX	03539300XX	03539430XX
without switch and plug	03539230XX	03539270XX	03539310XX	03539440XX

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 $\alpha < 90^\circ$ ")

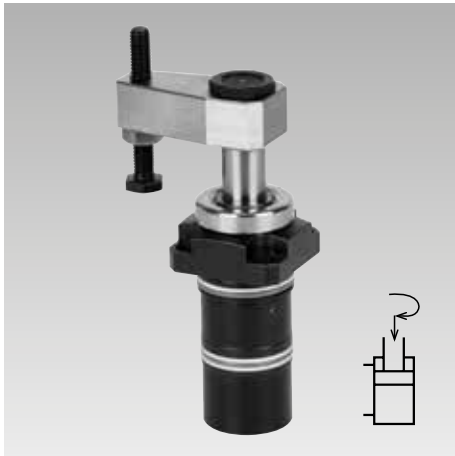
Function chart





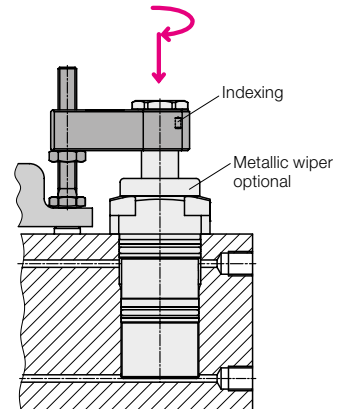
Swing Clamps with Sturdy Swing Mechanism

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

Description

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

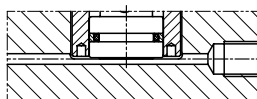
The favourable area ratio (piston/piston rod) allows high clamping forces already at relatively low oil pressures.

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.

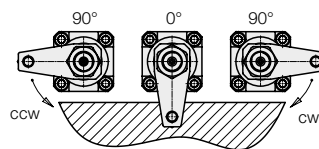
Version without bottom cover

Focusing on a short length, the bottom cover had been omitted. The piston contacts the bottom of the cartridge-type hole.



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).

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!

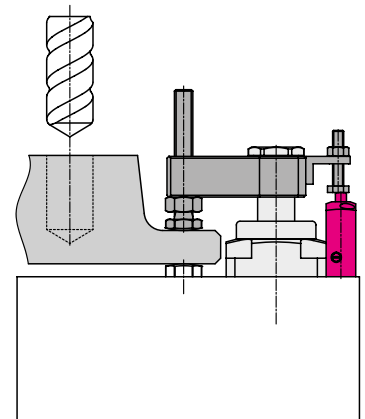
The metallic wiper is not suitable for dry machining or minimum quantity lubrication. Also in applications with very little grinding swarf, the standard FKM wiper has a better protection effect.

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.

Position monitoring as accessory

Clamping arm complete with angle bracket (page 4).

Pneumatic position monitoring (page 5).



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.

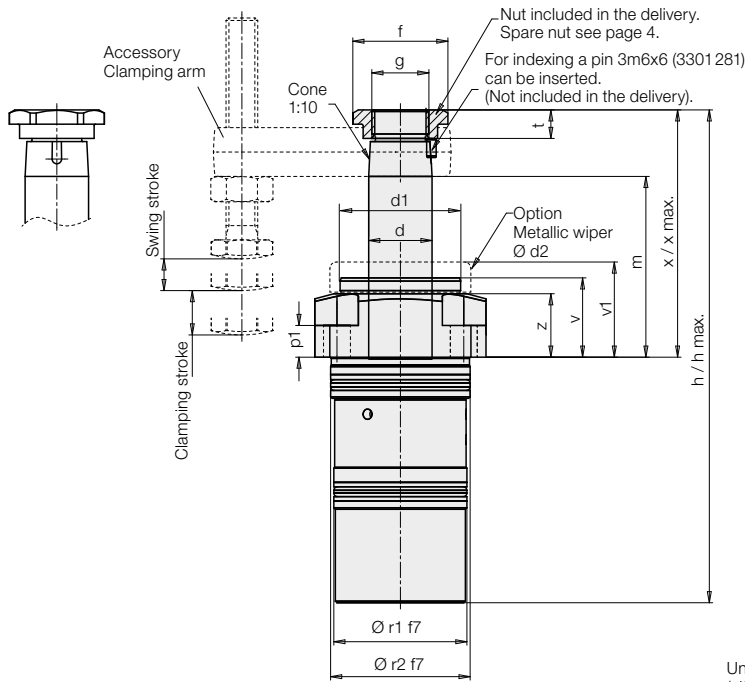
The swing clamp has no overload protection device. When mounting the clamping arm, the clamping arm or the hexagon socket in the piston have to be backed up for tightening or untightening the fixing nut.

During loading and unloading of the fixture and during clamping a collision with the clamping arm has to be avoided.

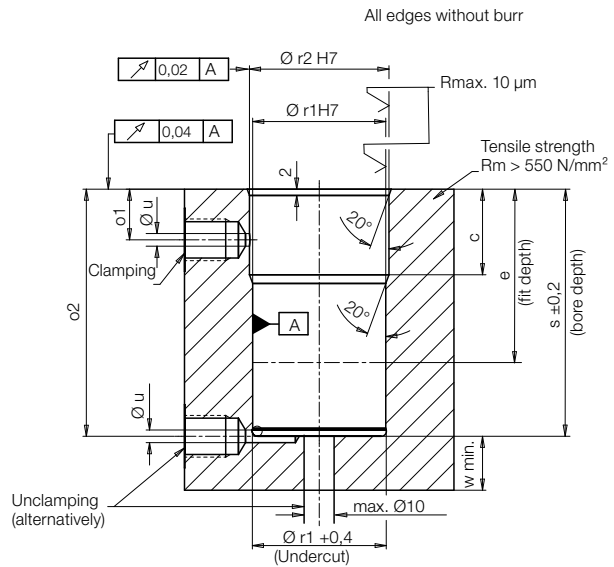
Remedy: Mount position adaptor.

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

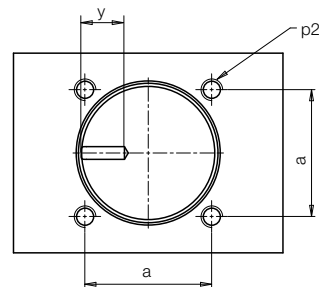
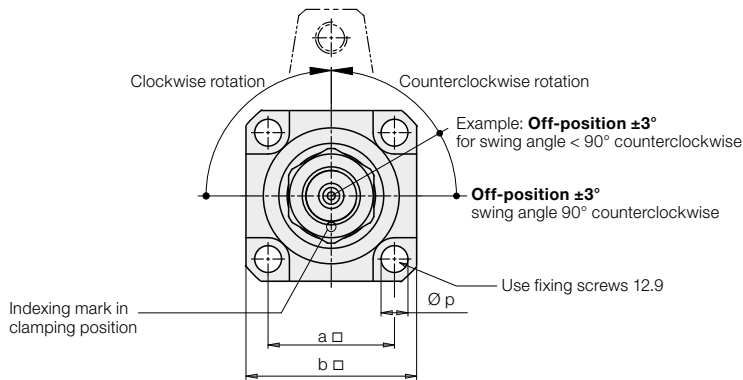
Dimensions Accessories



Location hole



Clamping position $\pm 1^\circ$



Swing angle

1. Swing angle 90° (standard)

Part no.	
90° cw	184XF090RXX
90° ccw	184XF090LXX
0°	184XF0000XX

2. Swing angle $\alpha < 90^\circ$

$\alpha = 15^\circ$ 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 :

$$y = (90^\circ - \alpha^\circ) * k \quad (k \text{ see chart page 3})$$

Example:

Swing clamp	1845F090L30
Desired swing angle	45° ccw
Part no.	1845F045L30

Shortening:

$$y = (90^\circ - \alpha^\circ) * 0.12 \text{ mm/}^\circ = 5.4 \text{ mm}$$

3. Swing angle $> 90^\circ$

Available on request!

Technical Data

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	[cm ³ /s]	10	14	32	57
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	15.90
Oil volume/stroke	[cm ³]	4.9	7.2	15.8	28.3
Oil volume/return stroke	[cm ³]	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.

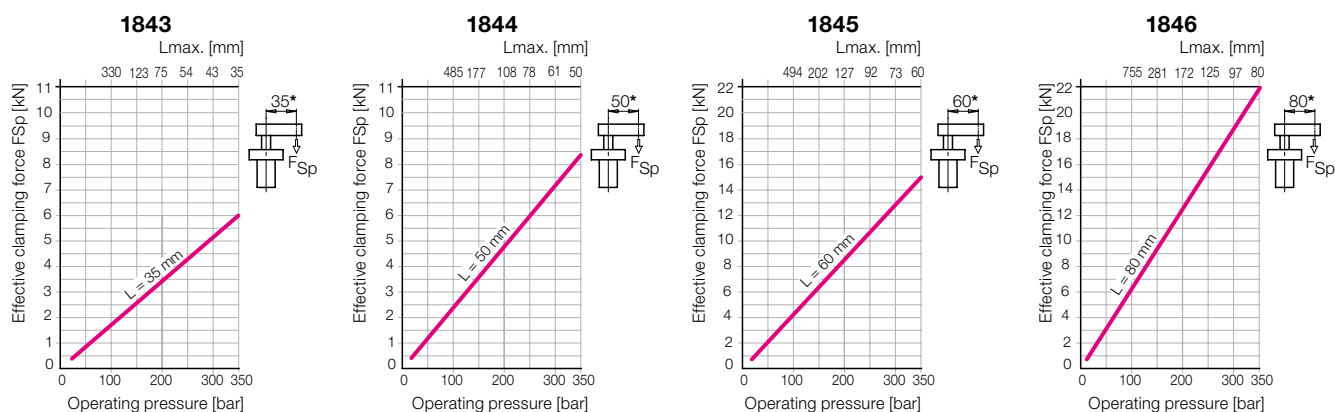
Clockwise rotation 90°	1843 F090 R23M	1844 F090 R24M	1845 F090 R30M	1846 F090 R36M
Counterclockwise rotation 90°	1843 F090 L23M	1844 F090 L24M	1845 F090 L30M	1846 F090 L36M
0 degree	1843 F000 023M	1844 F000 024M	1845 F000 030M	1846 F000 036M

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

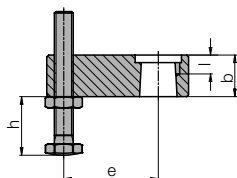


* Clamping force for other lengths see page 4.

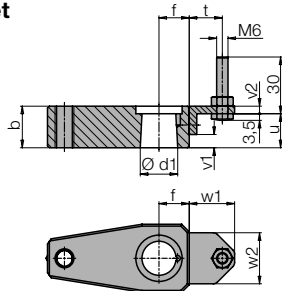
Accessories - Clamping Arms • Metallic Wipers

Calculation of the Flow Rate • Calculation of the Clamping Force

Clamping arm, max. 350 bar

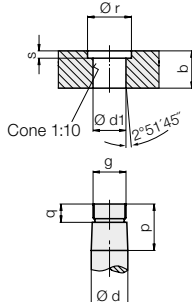


Clamping arm complete with angle bracket

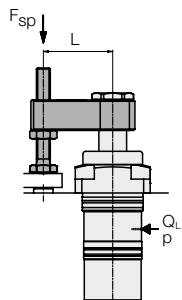


Special clamping arm

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

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

Q_L = Flow rate with special clamping arm

Q_e = Flow rate as per chart (page 3)

J_e = Moment of inertia of the clamping arm (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
Ø d f7	[mm]	16	20	25	32
Ø d1 +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

0354 152 **0354 153** **0354 154** **0354 155**

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

0354 156 **0354 157** **0354 158** **0354 159**

Angle bracket complete

0184 003 **0184 004** **0184 005** **0184 005**

Metallic wiper

0341 104 **0341 107** **0341 105** **0341 100**

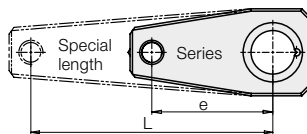
Spare nut

3527 092 **3527 014** **3527 099** **3527 015**

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

$L = 70 \text{ mm}$

$e = 35 \text{ mm}$ as per above chart

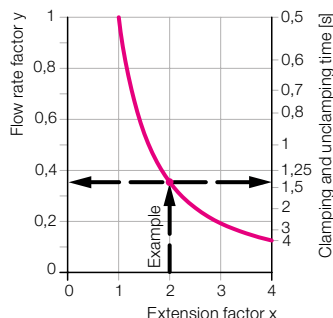
$Q_e = 10 \text{ cm}^3/\text{s}$ (as per chart page 3)

1. Extension factor $x = \frac{L}{e} = \frac{70 \text{ mm}}{35 \text{ mm}} = 2$

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

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

4. Min. clamping time as per diagram $\rightarrow$ approx. 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)

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

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

$L = 70 \text{ mm}$

1. Admissible clamping force

$$F_{adm} = \frac{C}{L} = \frac{210}{70} = 3 \text{ kN}$$

2. Admissible operating pressure

$$p_{adm} = \frac{D}{L} + E = \frac{9795}{70} + 70.26 = 210 \text{ bar}$$

Accessories

Pneumatic Position Monitoring (adjustable) • Throttling of the Flow Rate



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

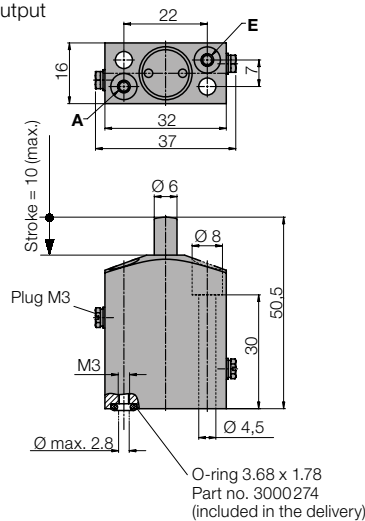
Connection	O-ring or thread M3
Nominal diameter	[mm] 2
Max. air pressure	[bar] 10
Range of operating pressure	[bar] 3...5
Differential pressure*) at	
3 bar system pressure	[bar] min. 1.5
5 bar system pressure	[bar] min. 3
Air flow rate **)	[l/min] 10...20
Actuating force ***)	[N/bar] 2.8
+ Spring force	[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.

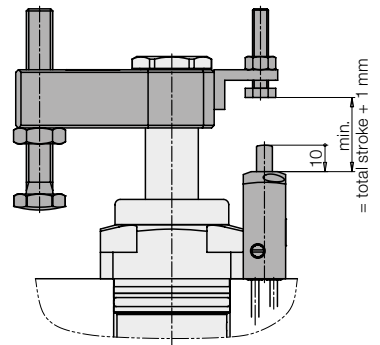
***) Port A closed.

E = Input
A = Output

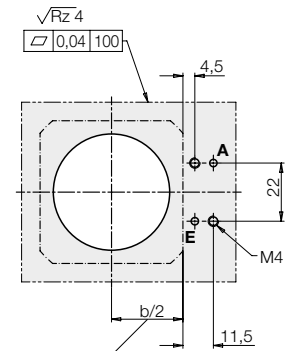


Mounting example

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.

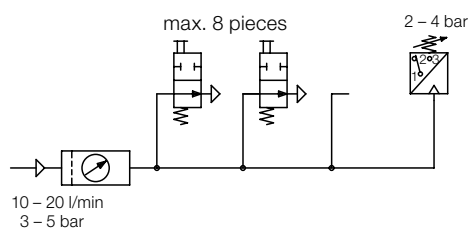
Important notes

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!

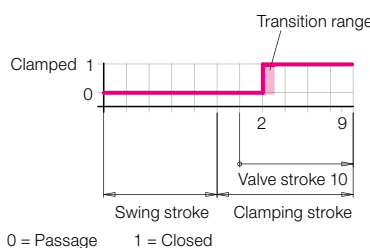
Functioning of the pneumatic position monitorings is only process-safe, if the air quantity and the system pressure are throttled. The nominal values are indicated below technical data.

Switching range 2 ÷ 9 mm



Part no. 0353921

Switching range 2 ÷ 10 mm



0 = Passage 1 = Closed

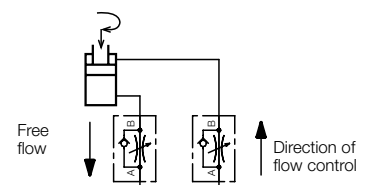
Part no. 0353937

Accessories

Insertion nipple fitting M3

Part no.

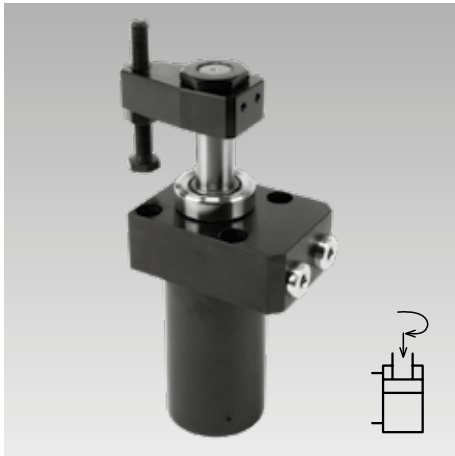
3890188





Swing Clamps with Sturdy Swing Mechanism

Top flange type, with optional position monitoring,
double acting, max. operating pressure 350 bar



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

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.

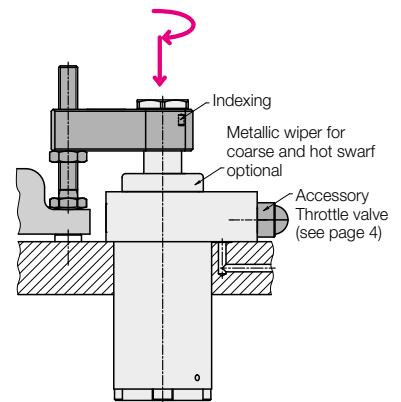
When using high flow rates the swing speed is limited by installed throttle points.

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).

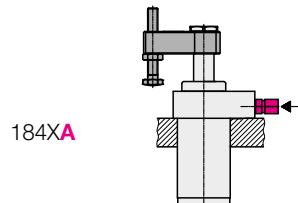
The different possibilities of the position monitoring are presented at the side.

Important notes see page 6.

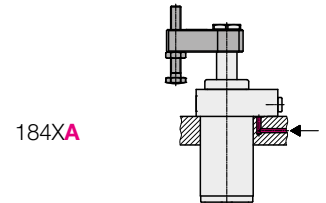


Installation and connecting possibilities

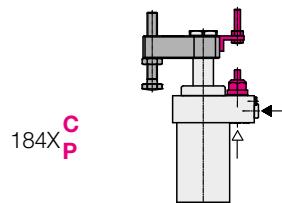
Pipe thread



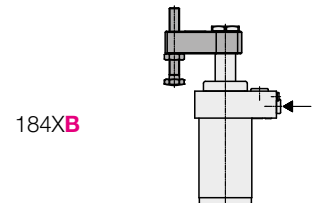
Drilled channels



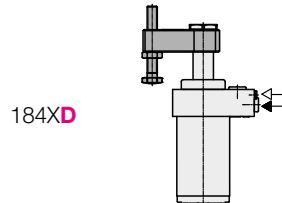
Pneumatic position monitoring integrated Monitoring of the clamping arm in clamping position (adjustable)



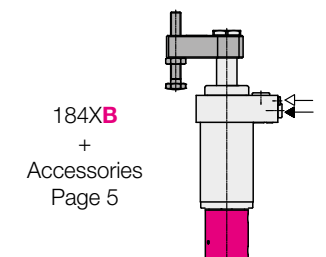
Position monitoring as accessories Switch rod for external sensors



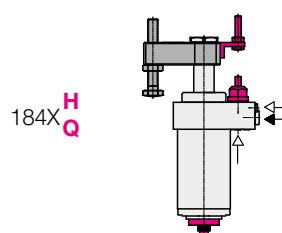
Monitoring of the piston in unclamping position



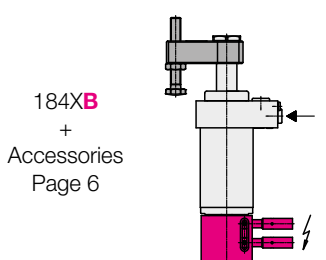
Pneumatic position monitoring in clamping and unclamping position



Both controls combined

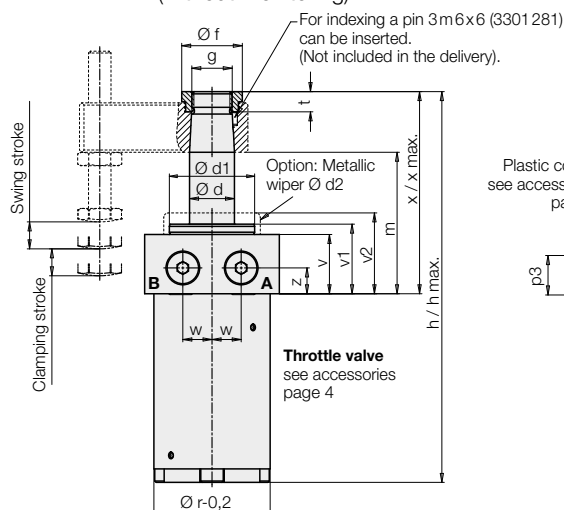


Electrical position monitoring in clamping and unclamping position



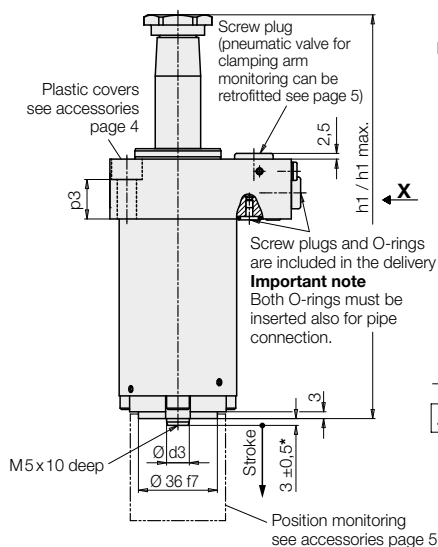
Versions: Code Letters **A, B, C, D, H, P, Q** Dimensions • Swing Angles

A (without monitoring)



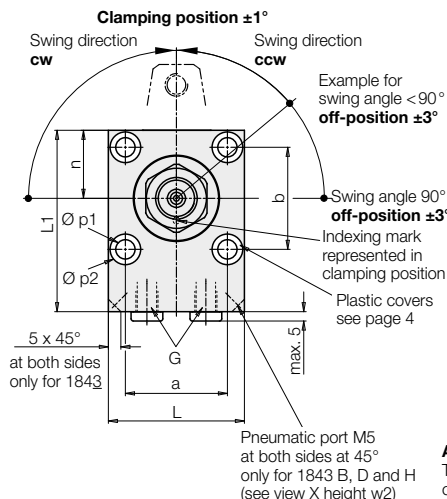
A = Clamping
B = Unclamping
E = Unclamped (pneumatic)
S = Clamped (pneumatic)

B (with switch rod)



(Monitoring "Clamped")

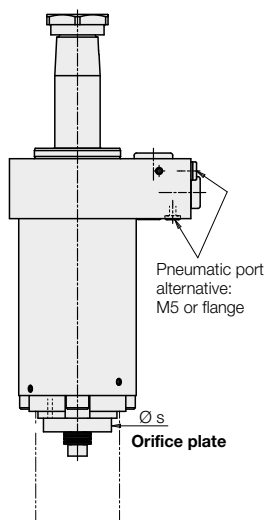
C Switching area $2 \div 9$ mm
P Switching area $2 \div 10$ mm



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.

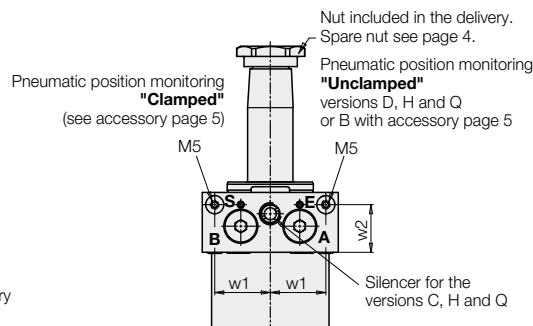
D (Monitoring "Unclamped")



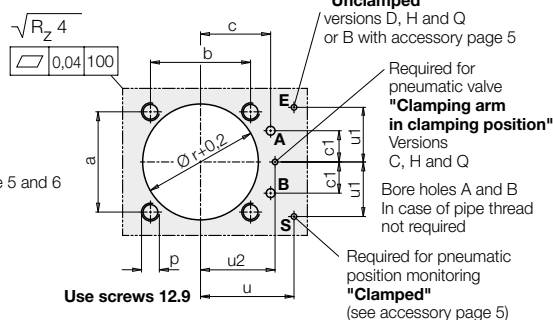
Important note

The lower part of the swing clamp must be protected against swarf and dirt for trouble-free functioning of the orifice plate.

View X



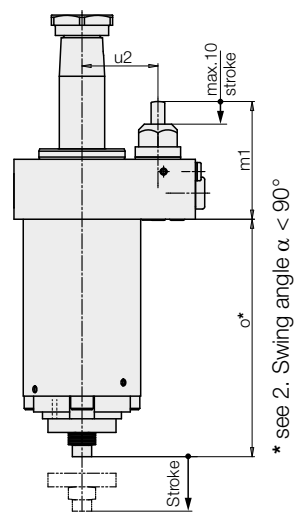
Connecting scheme



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

H (Combination C+D)

Q (Combination P+D)



Swing angle

1. Swing angle 90° (standard)

Part no.
184XX090RXXD
184XX090LXXD
184XX0000XXD

2. Swing angle $\alpha < 90^\circ$

$\alpha = 15^\circ$ 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:

$$y = (90^\circ - \alpha^\circ) \cdot k \quad (k \text{ see chart page 3})$$

Example:

Swing clamp
Desired swing angle
Part no.
1845A090L30D
45° ccw
1845A045L30D

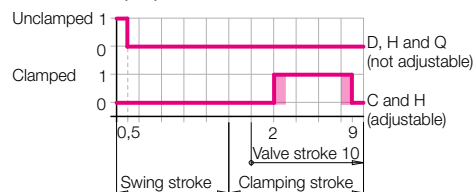
Shortening:

$$y = (90^\circ - 45^\circ) \cdot 0.12 \text{ mm}/^\circ = 5.4 \text{ mm}$$

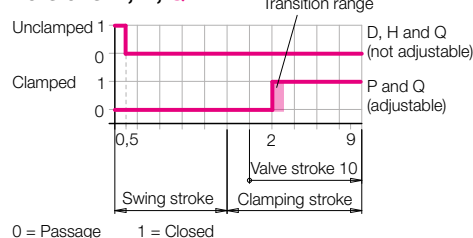
3. Swing angle $> 90^\circ$

Available on request!

Pneumatic position monitoring versions C, D, H



Versions P, D, Q



Technical Data

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	[cm³/s]	10	14	32	57	87
(see page 4)						
Effective Clamping	[cm³/s]	20	28	60	110	185
piston area	[cm²]	2.14	3.01	5.27	7.86	11.19
Oil volume / stroke	[cm³]	4.15	6.15	10.17	15.9	23.75
Oil volume / return stroke	[cm³]	4.9	7.2	15.8	28.3	43.7
Piston Ø	[mm]	9.6	14.8	30.5	57.2	92.7
a	[mm]	23	28	36	45	55
b	[mm]	37	45	54	66	76
c	[mm]	40	45	54	66	76
c1	[mm]	28.5	31.5	35	43	56
Ø d	[mm]	12	14	14	18	20.5
Ø d1	[mm]	16	20	25	32	40
Ø d2	[mm]	28	38	45	48	60
Ø d3	[mm]	33	42	54	54.5	75
Ø f	[mm]	10	10	12	12	12
g	[mm]	27	30	36	40	55
G	[mm]	M14x1.5	M18x1.5	M20x1.5	M28x1.5	M35x1.5
h	[mm]	G 1/8	G 1/8	G 1/4	G 1/4	G 1/4
h1	[mm]	161/162.3	174/175.8	203/204.8	233.5/233.9	254/255.7
k	[mm/°]	165/166.3	178/179.8	207/208.8	237.5/237.9	257/258.7
L	[mm]	0.091	0.093	0.12	0.152	0.183
L1	[mm]	50	62	75	88	100
m	[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	[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	1843 X090 R23DM	1844 X090 R24DM	1845 X090 R30DM	1846 X090 R36DM	1847 X090 R39DM
	Swing direction 90° ccw	1843 X090 L23DM	1844 X090 L24DM	1845 X090 L30DM	1846 X090 L36DM	1847 X090 L39DM
	0 degree	1843 X000 023DM	1844 X000 024DM	1845 X000 030DM	1846 X000 036DM	1847 X000 039DM

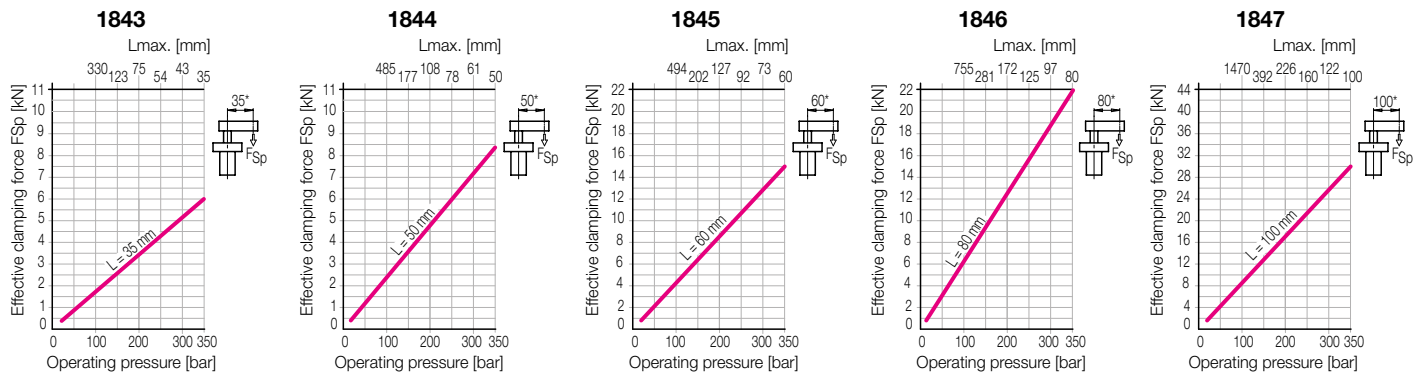
Code letter **X** see page 2.

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

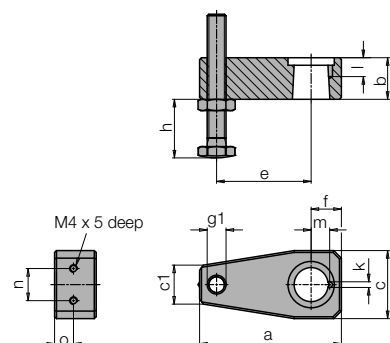


* Clamping force for other lengths see page 4.

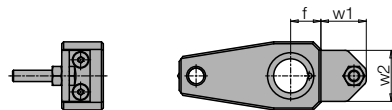
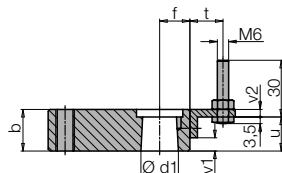
Accessories - Clamping Arms • Plastic Covers • Metallic Wipers • Flow Control Valves

Calculation of the Flow Rate • Calculation of the Clamping Force

Clamping arm, max. 350 bar

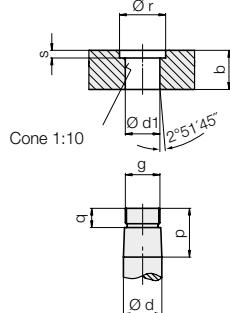


Clamping arm complete with angle

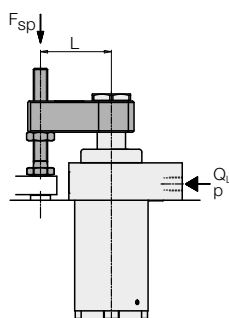


Special clamping arm

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

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

Q_L = Flow rate with special clamping arm

Q_e = Flow rate as per chart (page 3)

J_e = Moment of inertia of the clamping arm (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		0354 152	0354 153	0354 154	0354 155	0354 259
Weight, approx.	[kg]	0.19	0.39	0.69	1.43	2.64
Moment of inertia of J_e	[kgm ²]	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	[kgm ²]	0.00007	0.00033	0.00084	0.00298	0.00896
– complete with angle		0354 156	0354 157	0354 158	0354 159	0354 175
Angle bracket complete		0184 003	0184 004	0184 005	0184 005	0184 005
Plastic cover**		3300 685	3300 684	3300 683	3300 682	3300 682
Metallic wiper		0341 104	0341 107	0341 105	0341 100	0341 101
Spare nut		3527 092	3527 014	3527 099	3527 015	3527 048
Tightening torque	[Nm]	16	30	42	90	160

** Order 4 off per swing clamp

2.2. Accessory

Throttle valve

Throttle valves are used

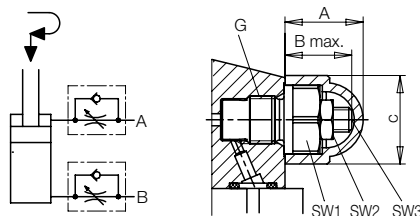
- in order to reduce the swing speed of the clamping arm;
- in order to improve the synchronism of several swing clamps.

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.

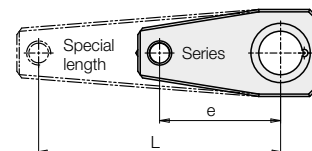
Hydraulic symbol



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.		2957 209	2957 210			

Special clamping arm



Clamping force and admissible operating pressure

Effective clamping force (general)

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

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	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

$L = 70 \text{ mm}$

1. Admissible clamping force

$$F_{adm} = \frac{C}{L} = \frac{210}{70} = 3 \text{ kN}$$

2. Admissible operating pressure

$$p_{adm} = \frac{D}{L} + E = \frac{9795}{70} + 70.26 = 210 \text{ bar}$$

Accessories for 184XB0XX • Pneumatic Position Monitoring (not adjustable) Pneumatic Valve

Application

A prerequisite for automated processes of work-piece 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.

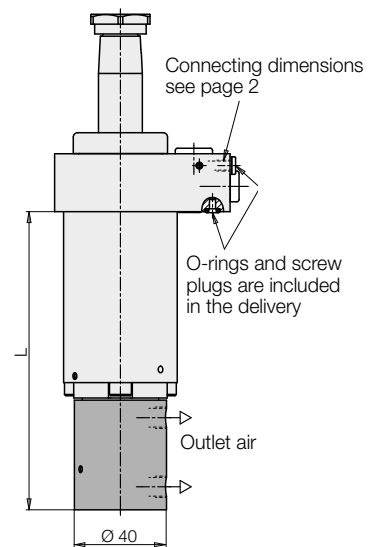
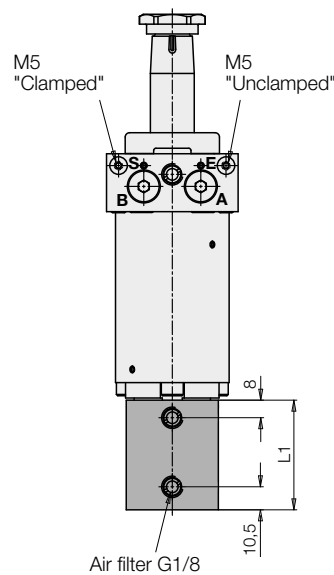
Pneumatic port

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.



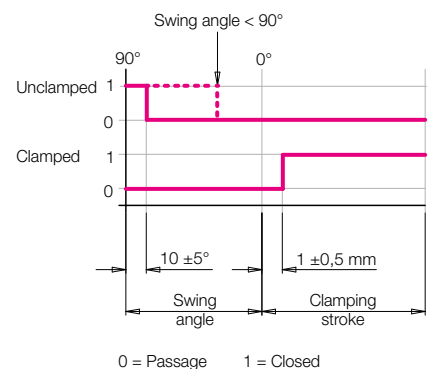
Technical data

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

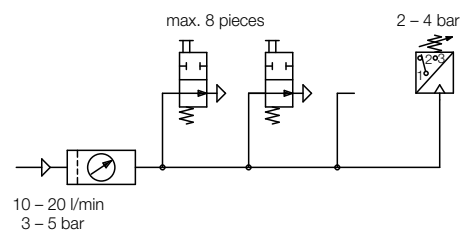
*) Required pressure drop if one or several position monitorings are not operated.

**) 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	03539130XX	03539130XX	03539140XX	03539160XX	03539560XX
(graduation of 5°)					

Pneumatic valve

Spare part for versions C, H, P and Q

Switching range 2 – 9 mm
Switching range 2 – 10 mm
Max. operating pressure
Max. tightening torque
Function charts see page 2.

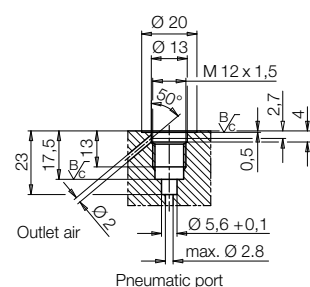
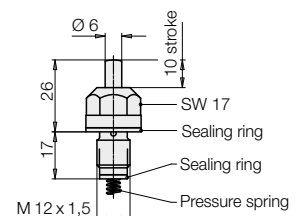
Part no.

0353933

0353934

10 bar

25 Nm



Accessory for 184XB0XX • 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

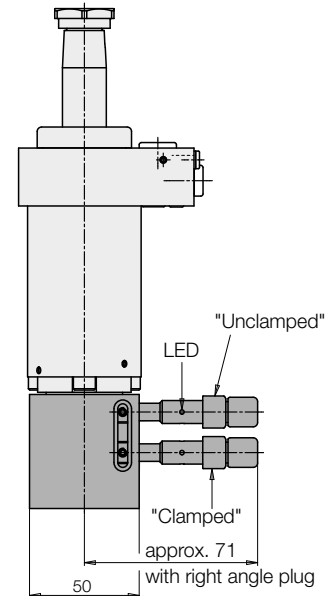
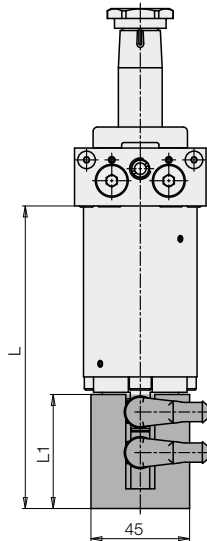
The electrical position monitoring consists of the housing with two adjustable inductive proximity switches and one switching cam fixed at the switch rod of the swing clamp.

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:

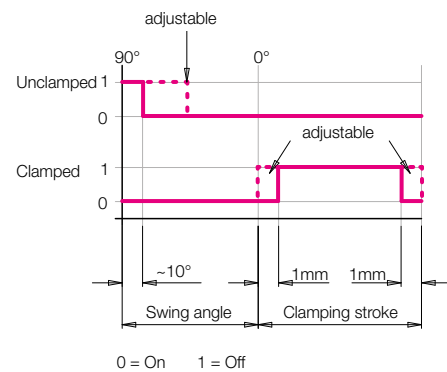
Careful design is required. According to the corresponding application conditions, safety measures have to be planned and checked later on. Inductive position monitorings are not suitable for the use in coolant and swarf areas.



Technical data

Operating voltage	10 ... 30 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.

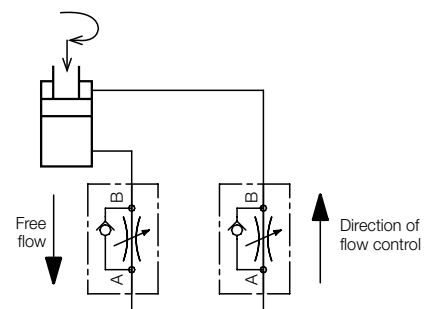
The metallic wiper can be delivered already mounted ("M") or as an accessory for retrofitting (see page 4).

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

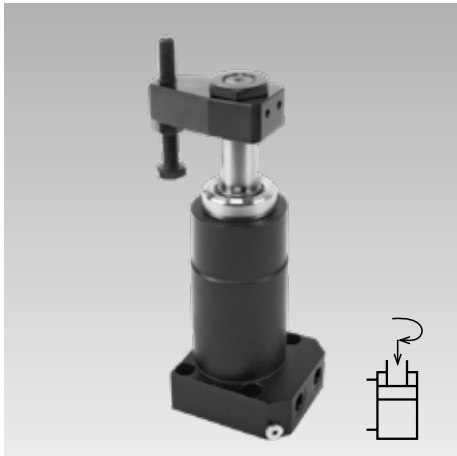
A flow rate throttling always has to be effected in the supply line to the swing clamp. This avoids a pressure intensification and thereby pressures exceeding 350 bar.





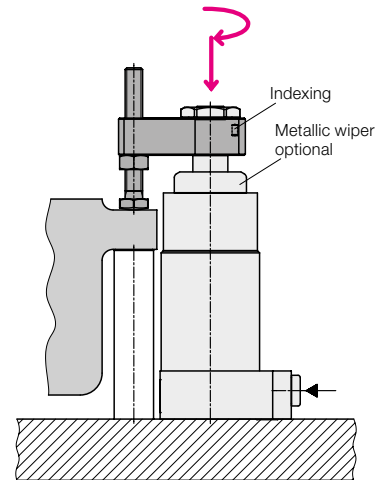
Swing Clamps with Sturdy Swing Mechanism

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.

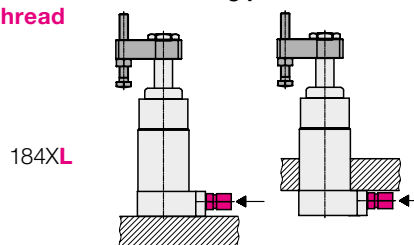
The FKM wiper at the piston rod can be protected against coarse and hot swarf by an optionally available metallic wiper (see page 6).

The different possibilities of the position monitoring are presented at the side.

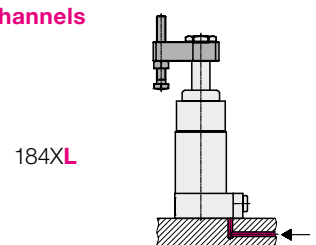
Important notes see page 6.

Installation and connecting possibilities

Pipe thread

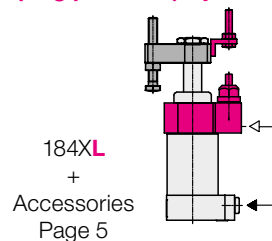


Drilled channels



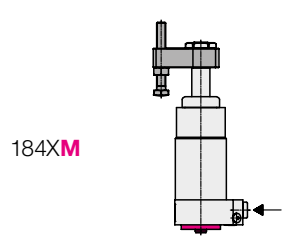
Pneumatic position monitoring

Monitoring of the clamping arm in clamping position (adjustable)

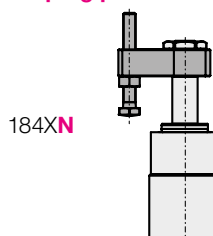


Position monitoring as accessories

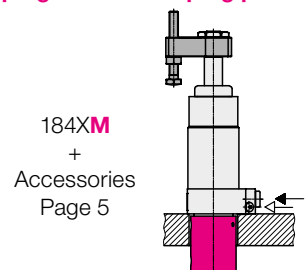
Switch rod for external sensors



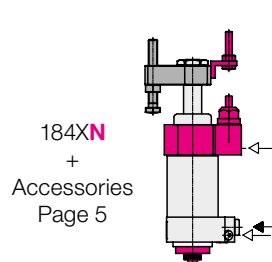
Monitoring of the piston in unclamping position



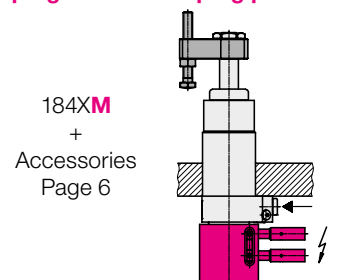
Pneumatic position monitoring in clamping and unclamping position



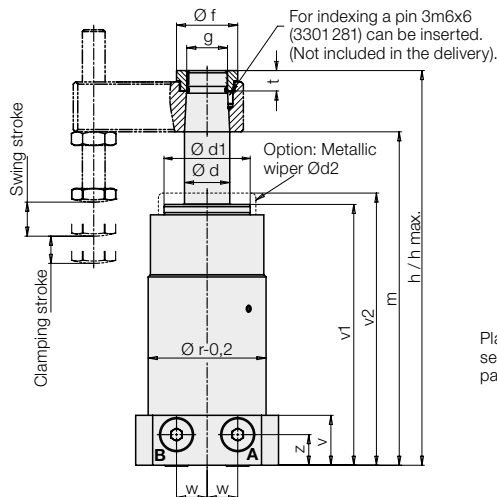
Both controls combined



Electrical position monitoring in clamping and unclamping position

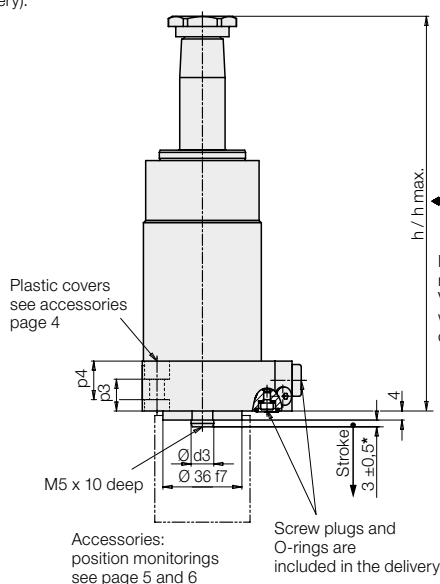


L (without monitoring)

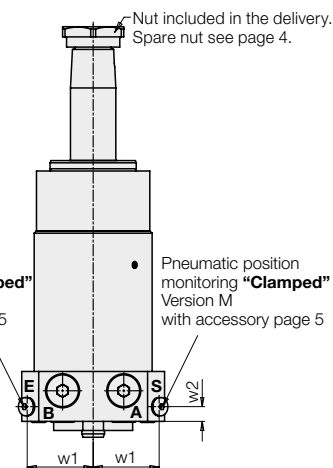


A = Clamping
B = Unclamping
E = Unclamped (pneumatic)
S = Clamped (pneumatic)

M (with switch rod)

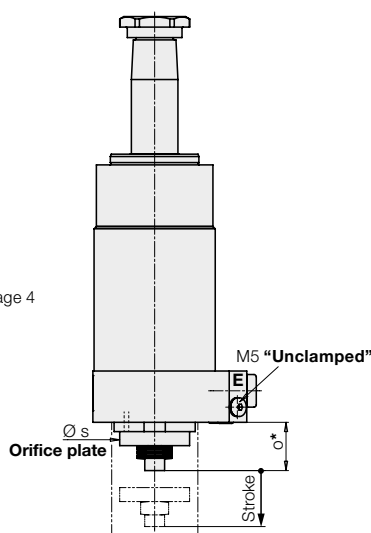


View X



Connecting scheme

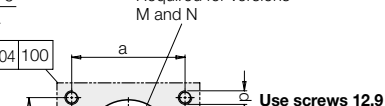
N (Monitoring "Unclamped")



For O-ring sealing:



Required for versions M and N



Bore holes A and B not required for pipe connection

Required for pneumatic position monitoring "Unclamped" Version M with accessory page 5 or version N

Required for pneumatic position monitoring "Clamped" Version M with accessory page 5

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.

184XX090RXX

184XX090LXX

184XX0000XX

90° cw

90° ccw

0°

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:

$$y = (90^\circ - \alpha^\circ) \cdot k \quad (k \text{ see chart page 3})$$

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**

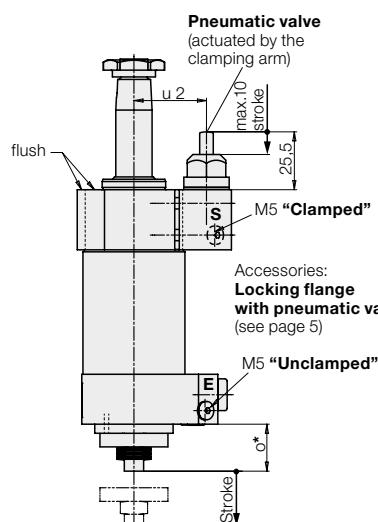
Shortening:

$$y = (90^\circ - 45^\circ) \cdot 0.12 \text{ mm}/^\circ = 5.4 \text{ mm}$$

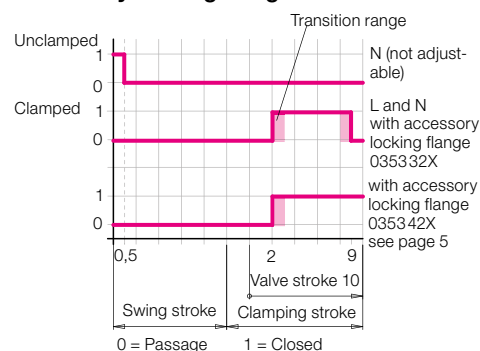
3. Swing angle > 90°

Available on request!

N (Monitoring "Unclamped" and "Clamped")



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.

* see 2. Swing angle α < 90°

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	[cm ³ /s]	10	14	32	57
(see page 4)	Clamping				
	Unclamping	20	28	60	110
Effective piston area	[cm ²]	2.14	3.01	5.27	7.86
	Clamping				
	Unclamping	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]	M14x1.5	M18x1.5	M20x1.5	M28x1.5
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

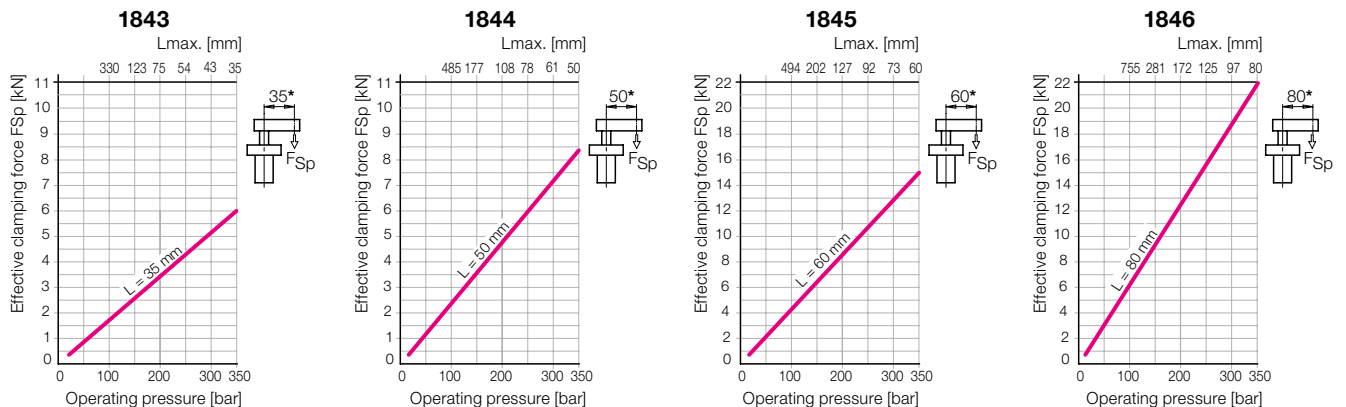
Code letter **X** see page 2.

M = Option metallic wiper (see also page 6)

¹⁾ h = upper edge piston / h max. = upper edge nut

²⁾ = lower edge clamping arm

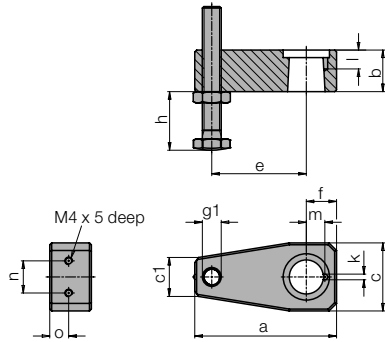
Effective clamping force with accessory clamping arm as a function of the oil pressure



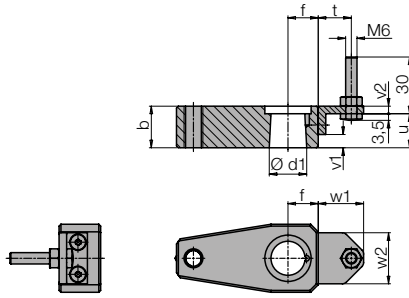
* Clamping force for other lengths see page 4.

Accessories - Clamping Arms • Plastic Covers • Metallic Wipers Calculation of the Flow Rate • Calculation of the Clamping Force

Clamping arm, max. 350 bar

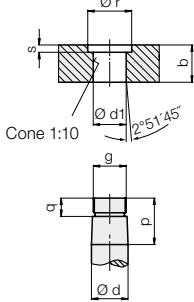


Clamping arm complete with angle

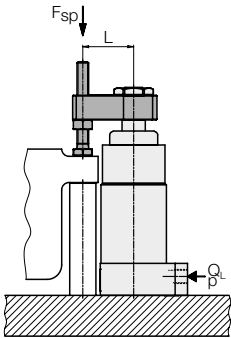


Special clamping arm

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

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

Q_L = Flow rate with special clamping arm

Q_e = Flow rate as per chart (page 3)

J_e = Moment of inertia of the clamping arm (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
Ø d f7	[mm]	16	20	25	32
Ø d1 +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

0354 152

0354 153

0354 154

0354 155

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

3548 660

3548 661

3548 803

3548 804

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

0354 167

0354 168

0354 158

0354 169

Angle bracket complete

0184 006

0184 007

0184 005

0184 008

Plastic cover**

3300 686

3300 685

3300 684

3300 684

Metallic wiper

0341 104

0341 107

0341 105

0341 100

Spare nut

3527 092

3527 014

3527 099

3527 015

Tightening torque [Nm]

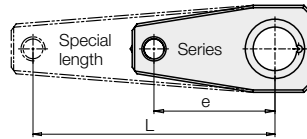
16

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

$L = 70 \text{ mm}$

$e = 35 \text{ mm}$ as per above chart

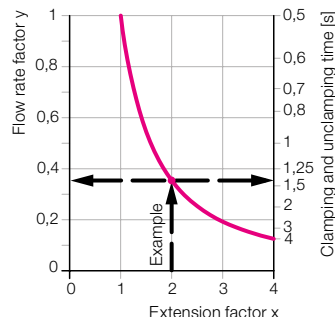
$Q_e = 10 \text{ cm}^3/\text{s}$ (as per chart page 3)

1. Extension factor $x = \frac{L}{e} = \frac{70 \text{ mm}}{35 \text{ mm}} = 2$

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

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

4. Min. clamping time as per diagram $\rightarrow$ approx. 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)

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

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

$L = 70 \text{ mm}$

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 184XMOXX • 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.

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

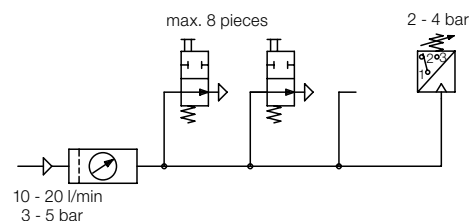
Drilled channels

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.

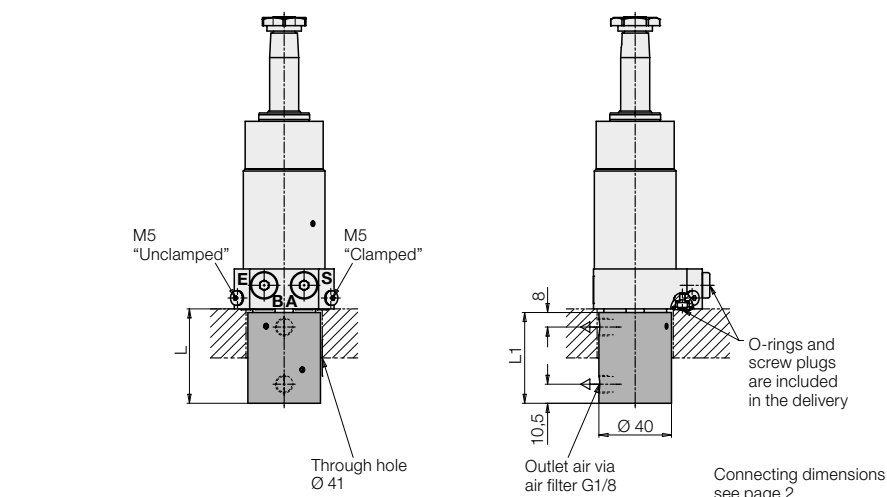
Hose connection

Remove the plugs M5 and screw-in connecting nipple M5 (accessory) Sealing to the flange area is made by the two O-rings.

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.

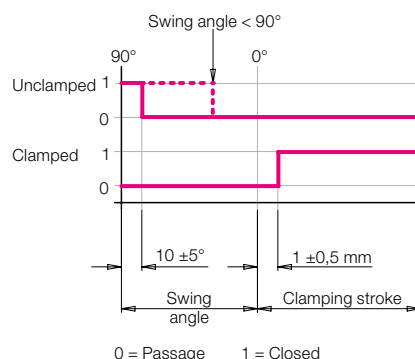


Technical data

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



Part no.

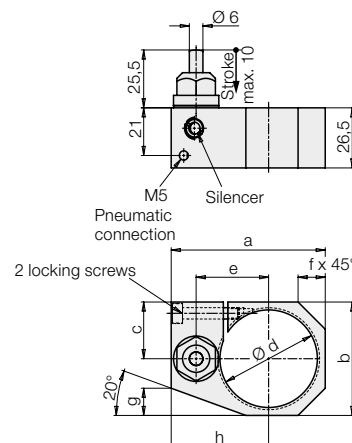
Swing clamps	1843MOXX	1844MOXX	1845MOXX	1846MOXX
L [mm]	52	52	75	75
L1 [mm]	50	50	73	73
Swing angle (see page 2)				
0 or 90°	0353913	0353913	0353914	0353916
15 to 75° = XX	03539130XX	03539130XX	03539140XX	03539160XX

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.

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.

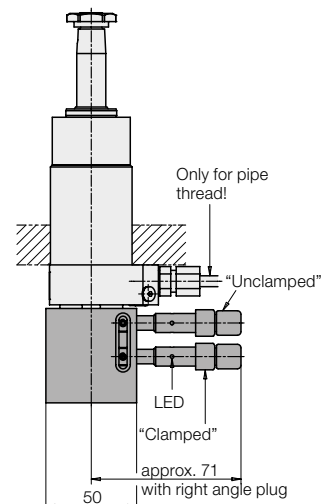
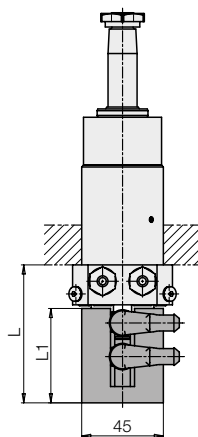
Operating conditions, tolerances and other data see data sheet A 0.100.

Technical data

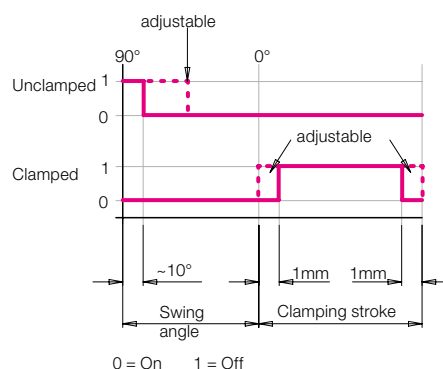
Operating voltage	10 ... 30 V DC
Max. residual ripple	15 %
Max. constant current	200 mA
Switching function	interlock
Output	PNP
Body material	stainless steel
Thread	M 8 x 1
Code class	IP 67
Environmental temperature	-25 ... +70 °C
LED Function display	yes
Protected against short circuits	yes
Connection type	Right angle plug
Length of cable	5 m

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



Function chart



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).

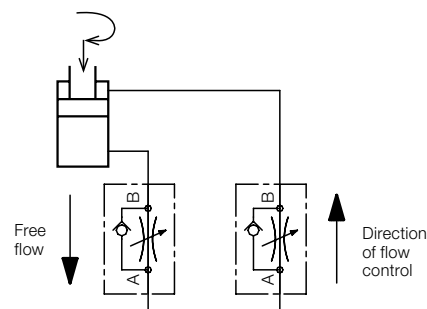
Attention!

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

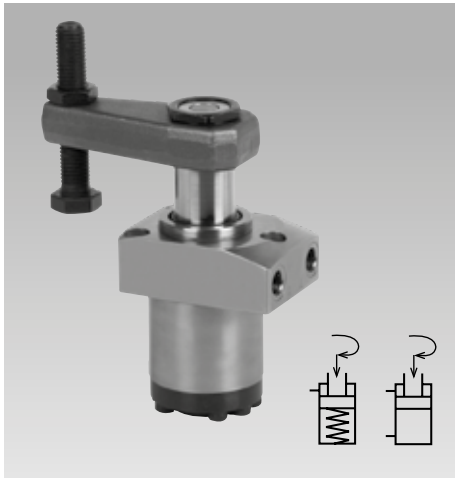
A flow rate throttling always has to be effected in the supply line to the swing clamp. This avoids a pressure intensification and thereby pressures exceeding 350 bar.





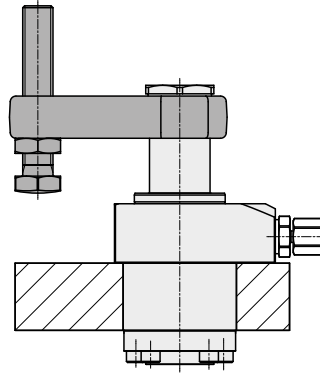
Swing Clamps with Overload Protection Device

top flange, single and double acting,
max. operating pressure 500 bar

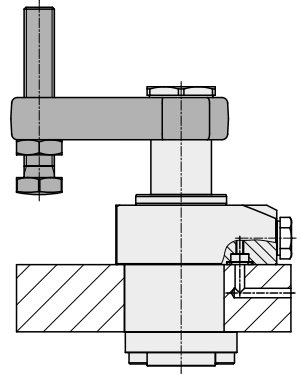


Hydraulic connecting possibilities

Pipe thread



Manifold mounting with O-ring sealing



Application

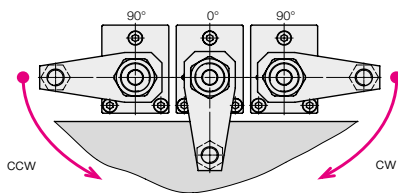
Hydraulic swing clamps are used for clamping of workpieces when it is essential to keep the clamping area free of straps and clamping components for unrestricted workpiece loading and unloading.

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°.

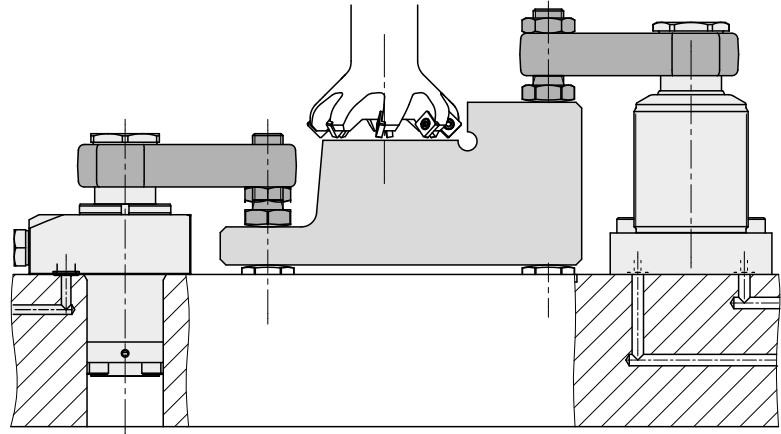
Special angles on request.

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.

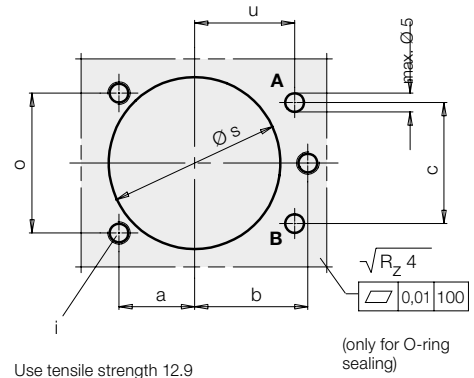
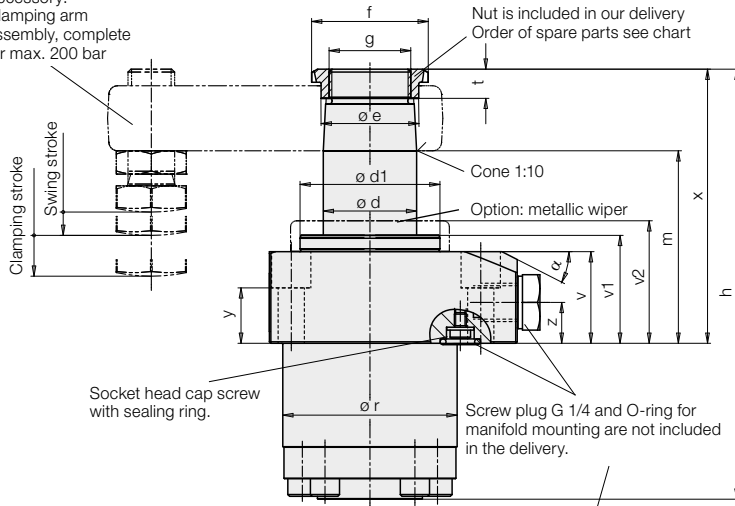
Further notes see Page 3.

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).

Dimensions Technical Data

Accessory:
Clamping arm
assembly, complete
for max. 200 bar



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)

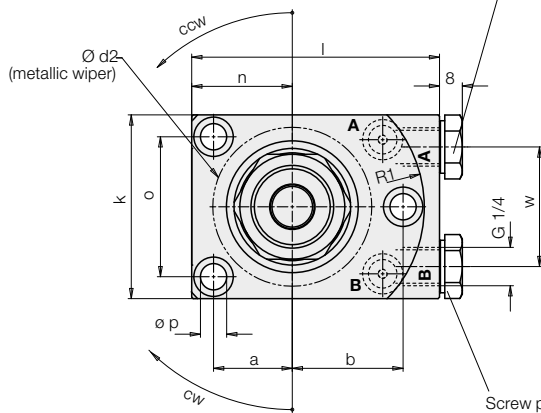
Single acting

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.

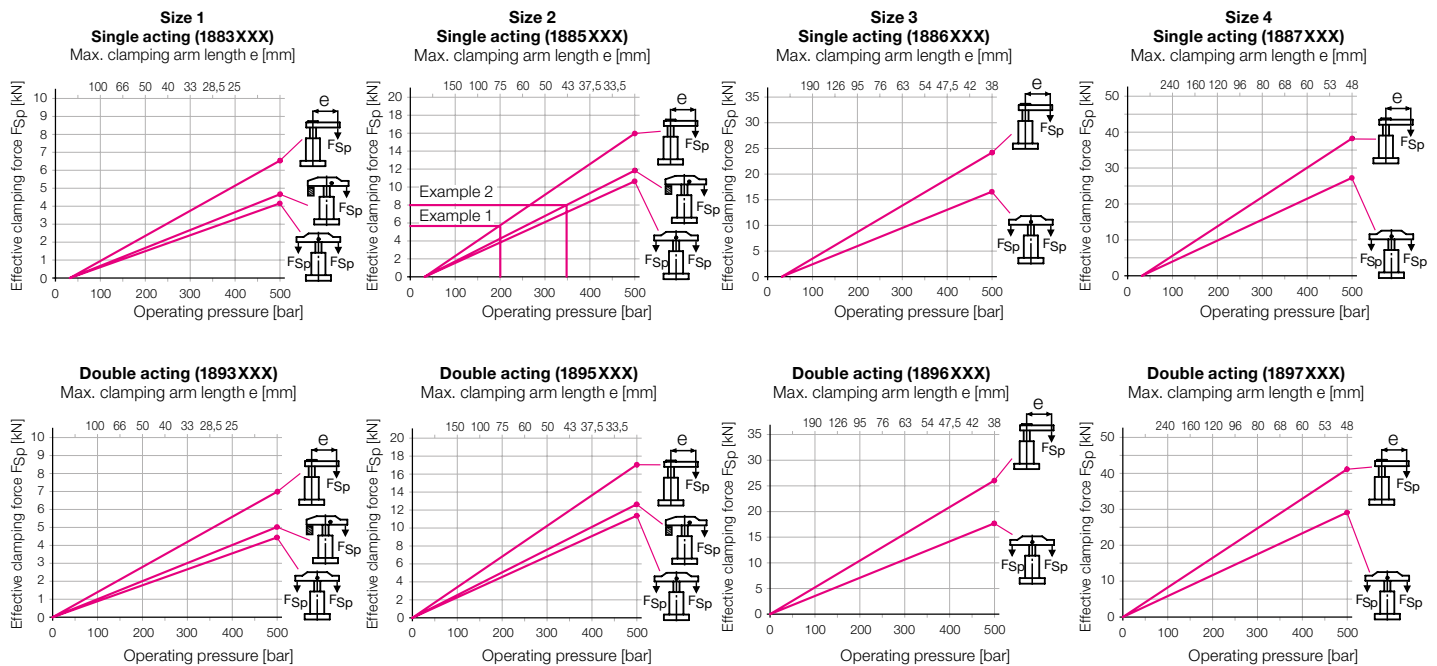
Double acting

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.



Screw plug with air filter by single acting swing clamps

Effective clamping force F_{Sp} as function of operating pressure p



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 0354 003 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 0354 002 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

Spare O-ring 10x2
Plug G 1/4

Part no.
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

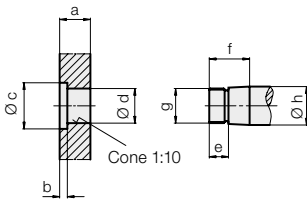
Loosen carefully the union nut of the pipe at low oil pressure and pump until bubblefree oil comes out. Retighten the union nut.

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. Retighten the plug.

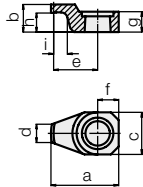
Accessories

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
18X6XXX	28	5	46	39,8	12	34	M 35x1,5	40
18X7XXX	34	6	56	49,8	13	40	M 45x1,5	50

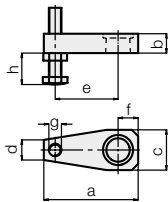
Clamping arm,
max. 300 bar



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

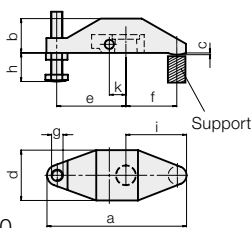


Swing clamp	a	b	c	d	e	f	g	h max.	h min.	Weight [kg]	Part no.
18X3XXX	75	16	32	16	50	16	M10	64	6	0,2	0354001
18X5XXX	115	23	48	22	75	25	M16	79	9	0,7	0354003
18X6XXX	140	28	60	28	95	30	M16	79	9	2,0	0354042
18X7XXX	178	34	78	40	120	40	M20	98	12	2,55	0354005

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

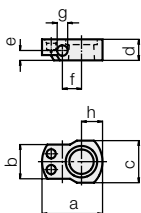
Clamping strap
assembly,
complete,
with carrier,
max. 500 bar



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

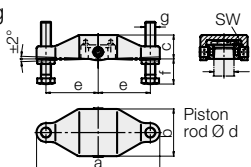
Carrier for special
clamping strap



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

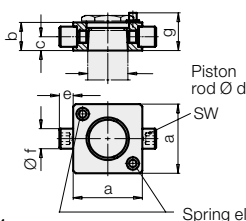
Double clamping
arm assembly,
complete,
with carrier,
max. 500 bar



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 Clamps with Reinforced Swing Mechanism

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

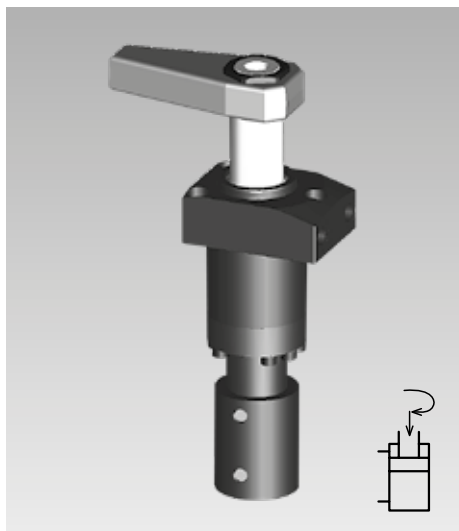


Figure with position monitoring

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.

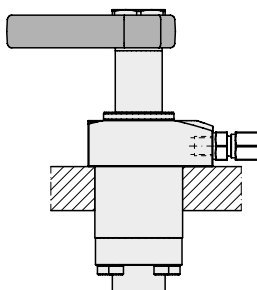
4. Further types of bodies

Flange at the bottom: data sheet B 1.8811

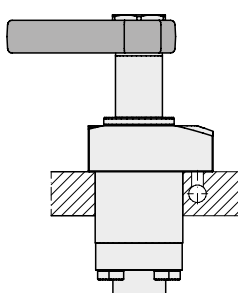
Threaded-body type: data sheet B 1.892

Connecting possibilities

Pipe thread

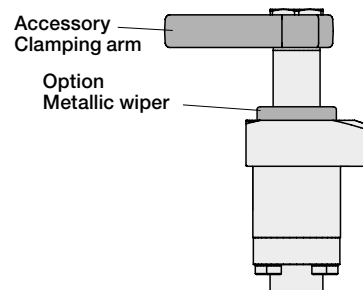


Drilled channels

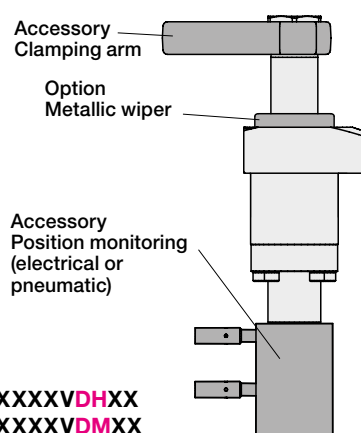


Versions

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

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.

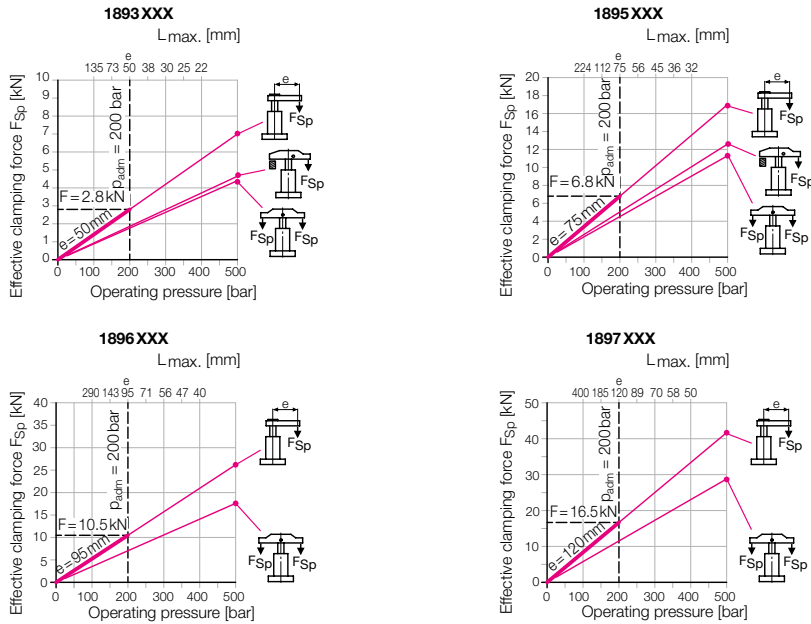
For interpretation of the pneumatic pressure we recommend to use a differential switch.

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 1.880.

Effective clamping force as function of the operating pressure with accessory clamping arm

Double acting 189X



Clamping force diagrams

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

1. Clamping arm complete (L = e)

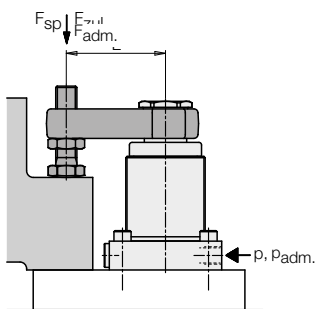
The clamping force can be read off up to the maximum operating pressure.
The clamping arm length L_{max} in the grid of 50 bar only allows for a rough estimate.
Exact values and the corresponding clamping forces can be calculated with the opposite formula.

2. Clamping strap assembly complete

clamping force up to 500 bar readable.

3. Double clamping arm complete

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



Double-acting swing clamps

Effective clamping force

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

Admissible clamping force*

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

Admissible operating pressure

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

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

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

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

Constant

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

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.

Example

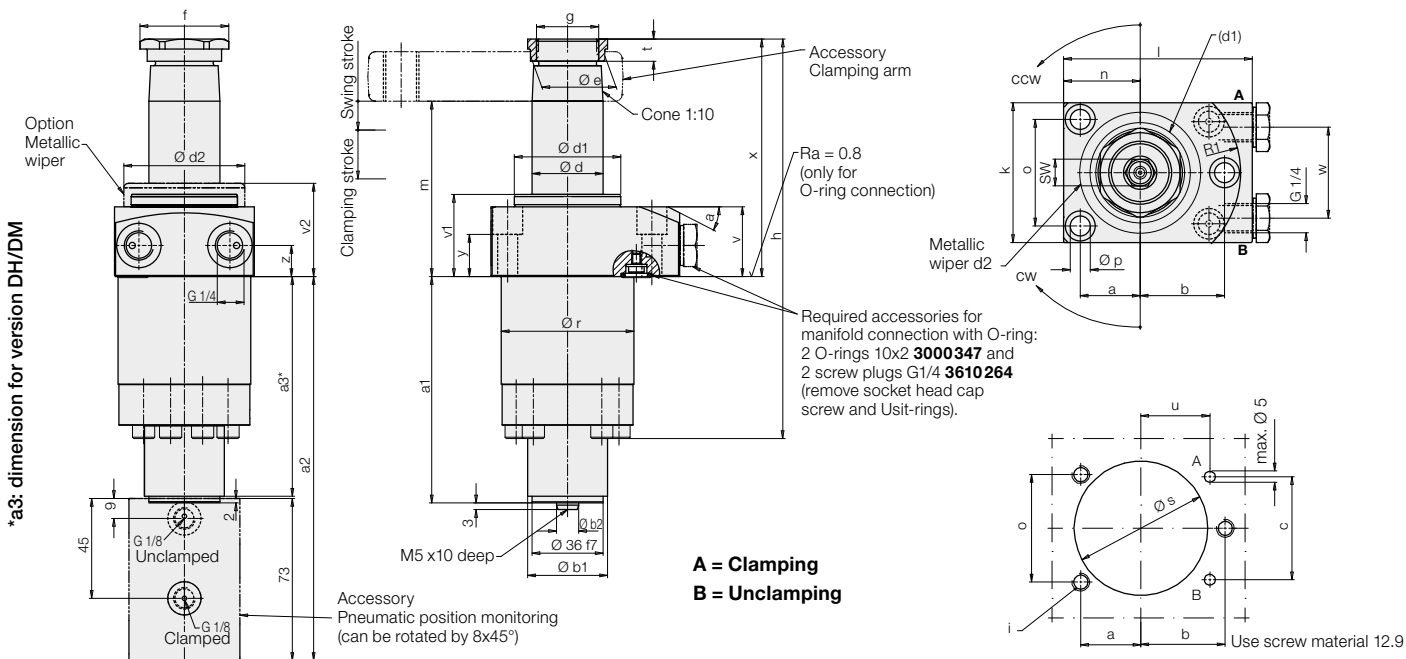
Swing clamp double acting 1895 104
Accessory clamping arm $e = 75 \text{ mm}$
Desired special length $L = 150 \text{ mm}$

1. Admissible clamping force

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

2. Admissible operating pressure

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



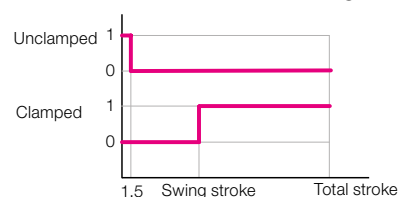
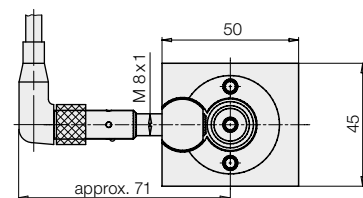
Clamping stroke	[mm]	22	20	20
Swing stroke	[mm]	13	16	18
Total stroke	[mm]	35	36	38
Operating pressure, min.	[bar]	30	30	30
Max. oil flow rate	[cm ³ /s]	20	36	55
Oil volume / stroke	[cm ³]	15.8	25.4	43.8
Oil volume / return stroke	[cm ³]	41.2	66.6	114.2
α	[°]	27	26	25
a	[mm]	27	37	42
a1	[mm]	102	116	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	1895 303 VXX35	1896 303 VXX36	1897 303 VXX38
Swing direction 90° ccw	1895 403 VXX35	1896 403 VXX36	1897 403 VXX38
0 degree	1895 443 VXX35	1896 443 VXX36	1897 443 VXX38

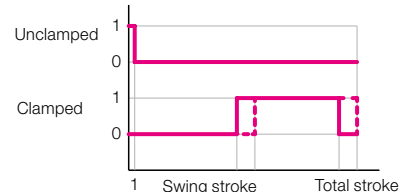
XX: Version

DH/DM = without/with metallic wiper without switch rod
MH/MM = without/with metallic wiper with switch rod

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



1 = Closed
0 = Passage



Swing angle (°)	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

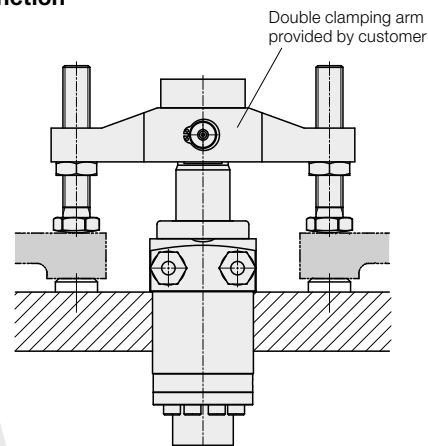
- Introduction of clamping force without side loads
- Compact design
- Double clamping arm facilitates multiple clamping of similar workpieces
- Pendulum eye for high clamping forces
- Fork head for simple clamping arms
- Alternatively pipe thread or drilled channels
- Reinforced swing mechanism
- FKM wiper standard
- Available with position monitoring

Connecting possibilities

- Pipe thread
- Drilled channels

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.

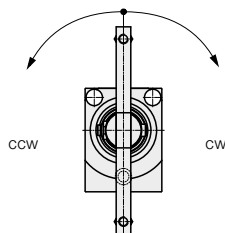
The version with pendulum eye or fork head allows simultaneous clamping of two workpieces with half clamping force.

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.

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).

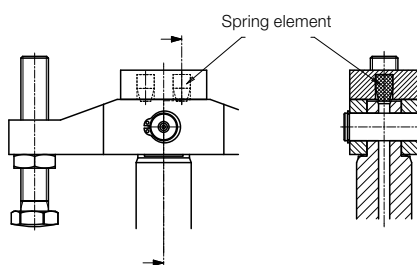
Description

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.

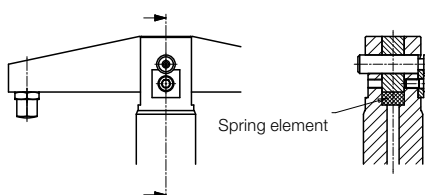
Pendulum eye

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

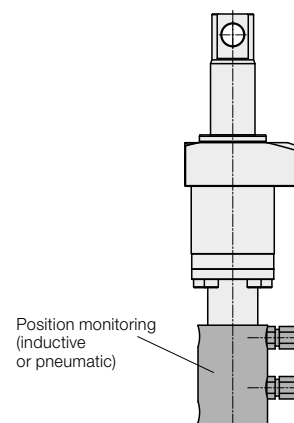
The fork head allows a max. operating pressure of 160 bar. Advantageous is the fact that relatively simple clamping arms can be manufactured from flat materials.



Option - metal wiper

The optionally available 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.

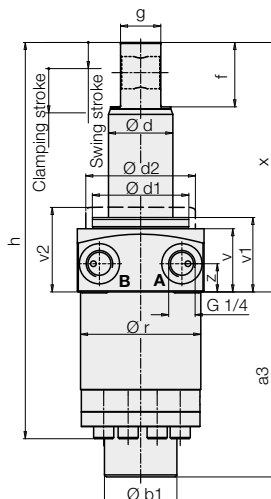
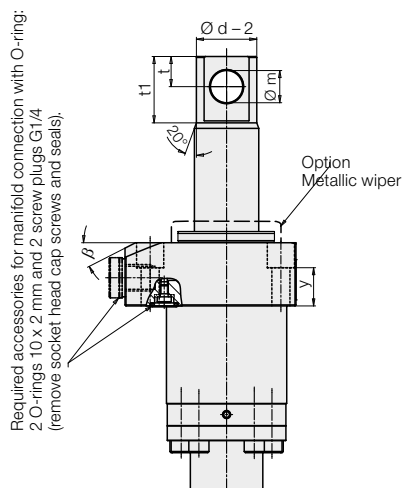
The double clamping arm in clamping position should preferably be at right angles to the piston axis to avoid overload of the spring element. Both contact bolts must only contact the workpiece after completion of the swing stroke.

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.

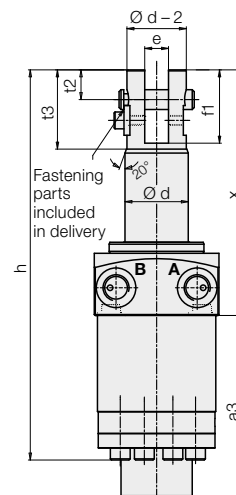
Dimensions Code for Part Numbers

Pendulum eye 189X 133X (500 bar)

without switch rod

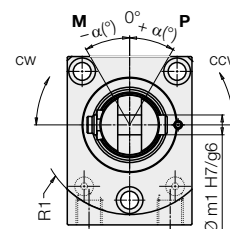


Fork head 189X 153X (160 bar)

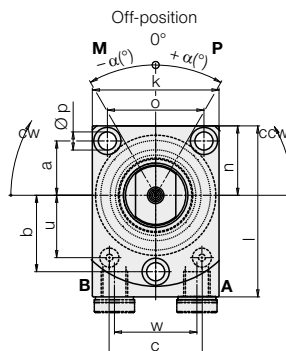
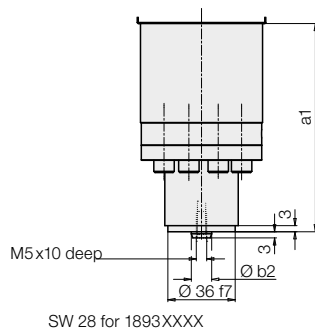


A = Clamping
B = Unclamping

Off-position



With switch rod 189X 1X2X



Accessory: position monitoring see page 4

Code for part numbers

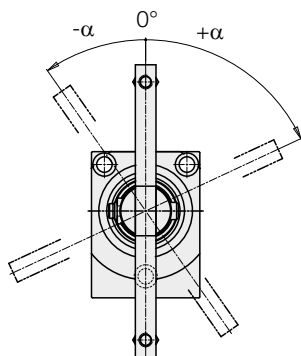
1 8 9 X 1 X X X X X X X

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°.



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 = Metallic wiper, mounted

Angle α for off-position

00 up to 90: 0° up to max. 90°
(graduation of 5°)

P (Plus) = + α see dimensional drawing

M (Minus) = - α

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 $\pm 1^\circ$

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. 18931330000M

2. Example of ordering

Piston rod diameter = 32 mm,
fork head,
with switch rod,
swing angle 60° counterclockwise,
off-position -30°,
metallic wiper mounted

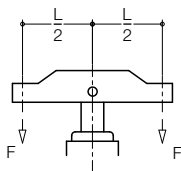
Part no. 18951525M30M

		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

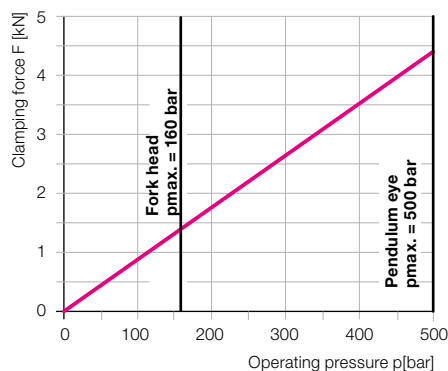
Accessories

Metallic wiper, complete (customer assembly)	0341 107	0341 100
O-Ring 10 x 2	3000347	3000347
Screw plug G 1/4	3610264	3610264

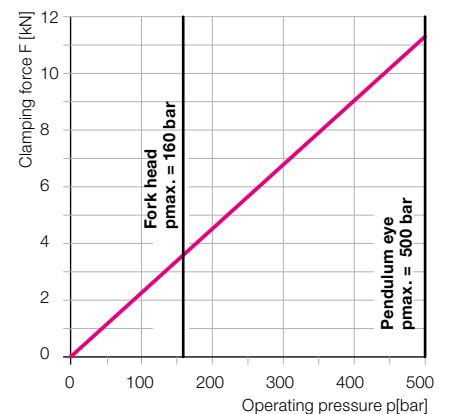
Clamping force F as a function of the operating pressure p



18931XXXX



18951XXXX



Accessory - Position Monitoring

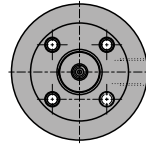
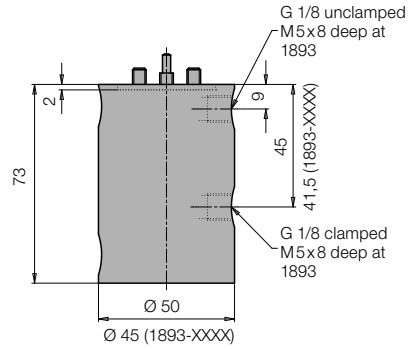
Delivery

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.

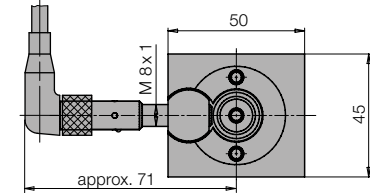
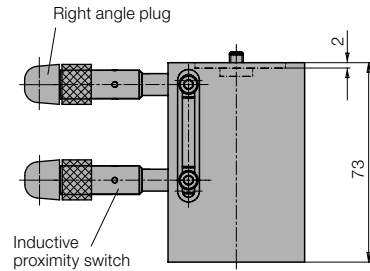
The housings can be mounted rotated by 2x180° (1893) or 8x45°.

Pneumatic position monitoring



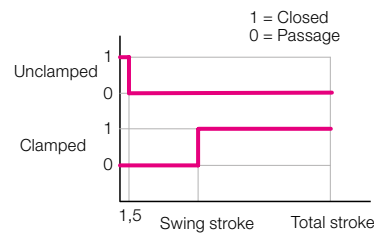
	for 1893	for 1895
Part no.	0353867	0353808

Electrical position monitoring

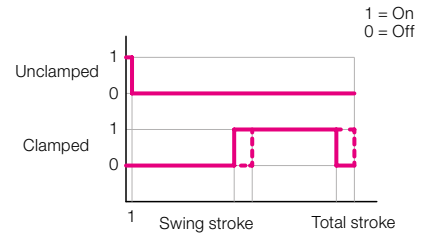


	for 1893	for 1895
Part no.	0353868	0353814

Function chart

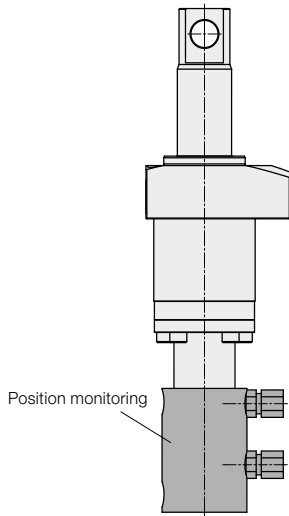


Function chart



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

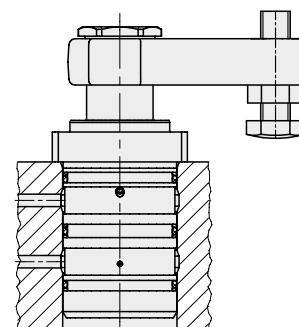


Advantages

- 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

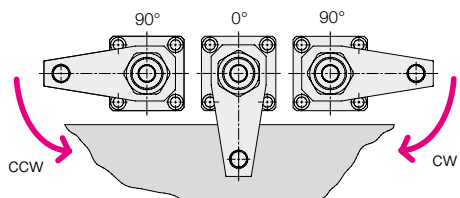
The units are available with clockwise and counterclockwise swing motion or without swing motion (0°). Starting from the off-position.

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.

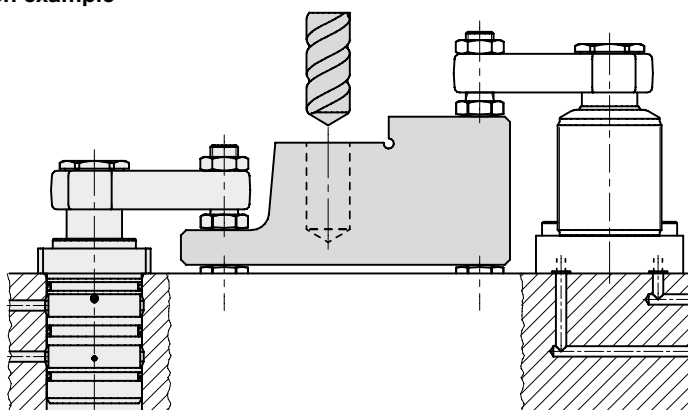
Part no.: Add only letter "M" to the part number of the swing clamp without metallic wiper.

Example of ordering:

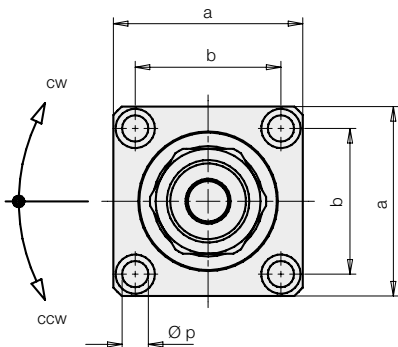
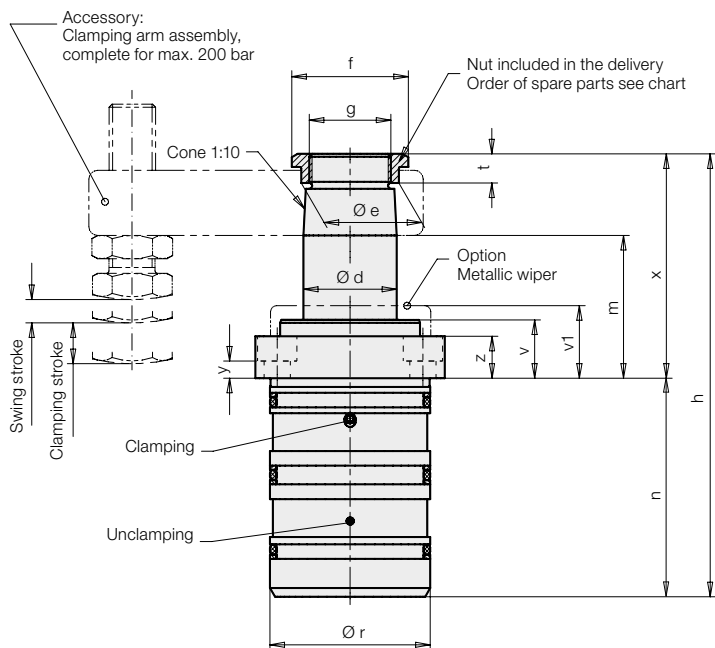
Swing clamp 1895202

with metallic wiper: **1895202M**

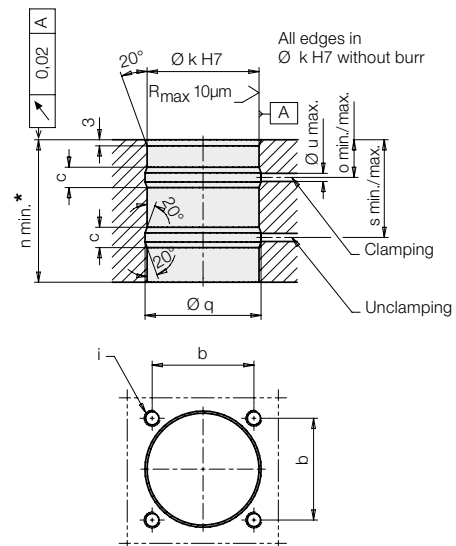
Application example



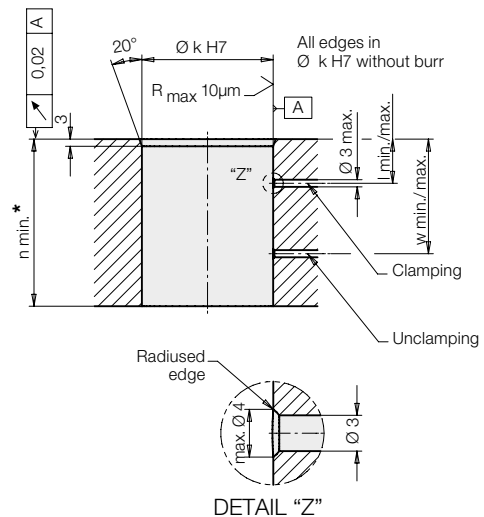
Dimensions Technical Data



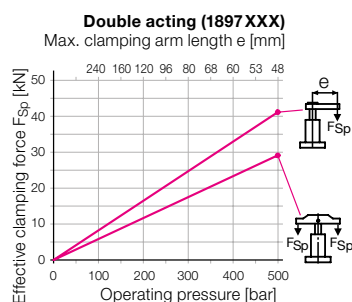
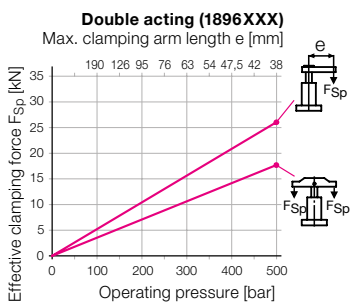
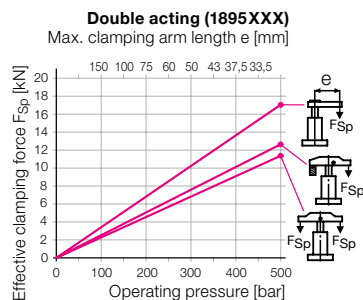
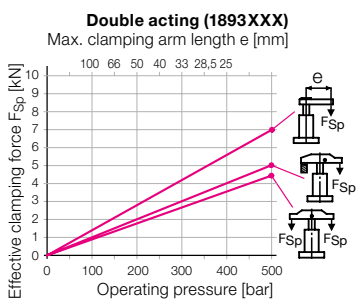
Location hole for oil bore $\varnothing 5 / \varnothing 6$



Location hole for oil bore $\varnothing 3$



Effective clamping force F_{Sp} as a function of the clamping pressure p



* Min. plate thickness to ensure sealing

Example 1: 1895 102

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 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 0354002 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	[cm³/s]	3.2	3.2	10	10	18.4	18.4	27.7	27.7
Oil volume / stroke	[cm³]	3.2	6	10	16	18.4	25.5	27.7	43
Oil volume / return stroke	[cm³]	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°	18XX00X
60°	18XX22X
45°	18XX33X

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.

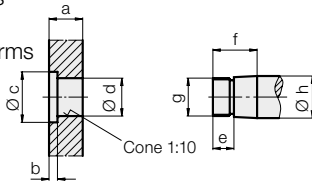
8. Bleeding

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.

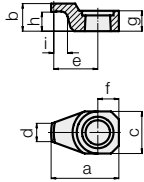
Accessories

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
18X6XXX	28	5	46	39.8	12	34	M 35x1.5	40
18X7XXX	34	6	56	49.8	13	40	M 45x1.5	50

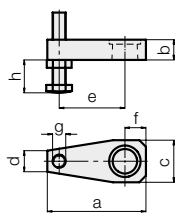
Clamping arm,
max. 300 bar



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	3548 238
18X5XXX	76	28	46	25	50	23	22.5	19	7	0.3	3548 236
18X6XXX	100	34	66	39	64	33	28	23	7	0.84	3548 301
18X7XXX	123	40	75	39	82.5	37.5	34	27	8	1.3	3548 302

Material: 42CrMo4

Clamping arm
assembly,
complete,
max. 200 bar

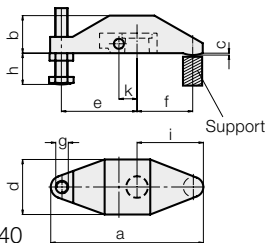


Swing clamp	a	b	c	d	e	f	g	h max.	h min.	Weight [kg]	Part no.
18X3XXX	75	16	32	16	50	16	M10	64	6	0.2	0354 001
18X5XXX	115	23	48	22	75	25	M16	79	9	0.7	0354 003
18X6XXX	140	28	60	28	95	30	M16	79	9	2.0	0354 042
18X7XXX	178	34	78	40	120	40	M20	98	12	2.55	0354 005

Swing clamp	a	b	c	d	f	Weight [kg]	Part no.
18X3XXX	75	16	32	16	16	0.18	3921 016
18X5XXX	115	23	48	22	25	0.65	3921 017
18X6XXX	140	28	60	28	30	1.85	3921 021
18X7XXX	178	34	78	40	40	2.3	3921 018

Material: 42CrMo4

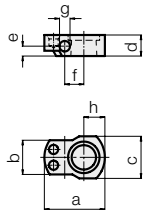
Clamping strap
assembly,
complete,
with carrier,
max. 500 bar



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	0354 000
18X5XXX	185	45	2	58.5	83	75	M16	79	9	87	21	1.58	0354 002

Material: GGG-40

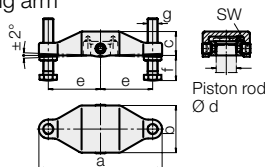
Carrier



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	3542 093
18X5XXX	59	32	40	23	13	21	10	22	0.16	3542 094
18X6XXX	82	44.5	58	28	17	28	12	34	0.5	3542 132
18X7XXX	90	56	68	34	21	33	14	36	0.65	3542 096

Material: 42CrMo4

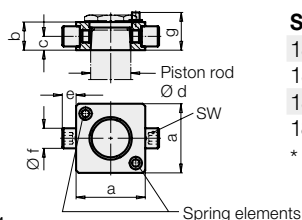
Double clamping arm
assembly,
complete,
with carrier,
max. 500 bar



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	0354 131
18X5XXX	196	75	38	32	83	15	79	M 16	8	2.11	0354 132
18X6XXX	216	85	47	40	92	15	79	M 16	8	3.17	0354 133
18X7XXX	236	105	56	50	100	19	98	M 20	8	5.24	0354 134

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	0354 141
18X5XXX	55	23	11	32	11	16	29	8	0354 142
18X6XXX	63	28	15	40	12	18	35	8	0354 143
18X7XXX	77	34	17	50	15	20	41	8	0354 144

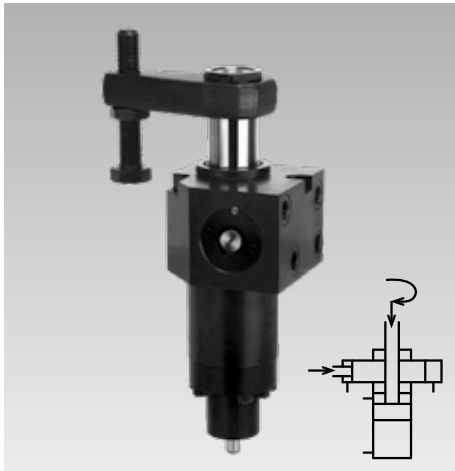
* Stop surface for spring elements

Material: 42CrMo4



Swing Clamp with Fail-Safe Function

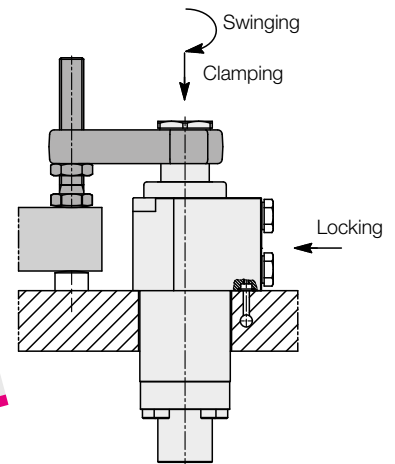
Top flange, reinforced swing mechanism, position monitoring optional, double acting, max. operating pressure 250 bar



Advantages

- High process safety
- Fail-safe with fail-safe function
- Reinforced swing mechanism
- Optional position monitoring, electrical or pneumatic
- Compact design
- Pipe thread or drilled channels can be selected
- Standard FKM wiper
- Metallic wiper optional

Metallic wiper optional



Fail-safe function

The full clamping force is maintained both in the event of pressure drop and a complete pressure loss.

This is achieved by fail-safe clamping of the piston rod via a double-acting wedge-shaped piston, which is controlled separately.

Clamping: 1. Swinging and clamping
2. Locking

Unclamping: 1. Release locking
2. Unclamping and retracting

Conditions: Before depressurising, the locking pressure must be available at least for 3 seconds.

Special features

Reinforced swing mechanism

The reinforced swing mechanism without overload protection device can withstand 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. Pneumatic and electrical position monitorings are available as accessories.

Option: metallic wiper

The optionally available metallic wiper protects the FKM wiper against mechanical damage.

Application

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

This series is particularly suited for

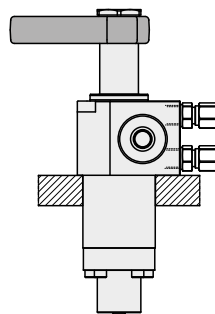
- Pallet changing systems
- Transfer lines
- Workpiece loading with handling systems
- Automatic manufacturing systems
- Assembly lines
- Test systems for motors, gears, axes, etc.

Information on control and important notes

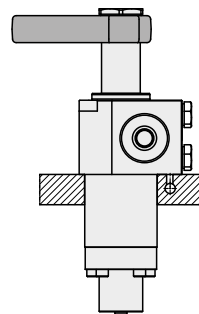
See page 4

Connecting possibilities

Pipe thread

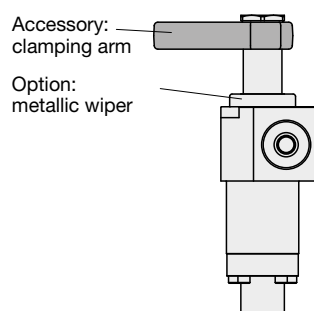


Drilled channels

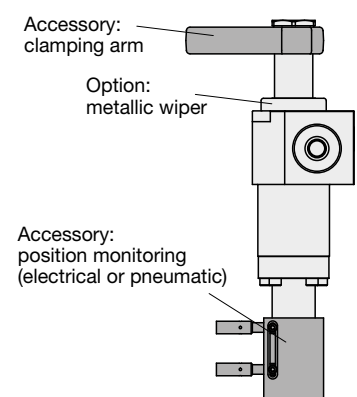


Versions

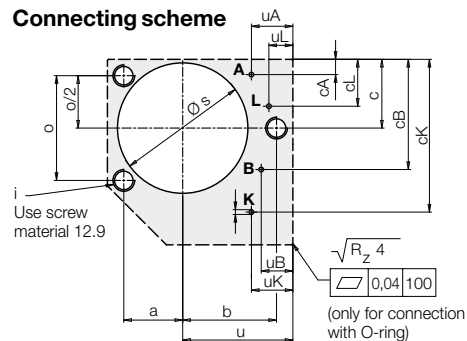
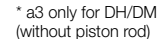
KDH, KDM: without switch rod



KMH, KMM: with switch rod



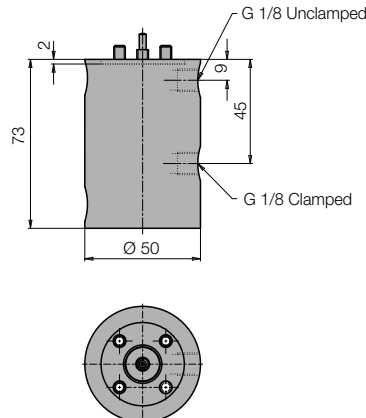
Operating conditions, tolerances and other data, see data sheet A 0.100.



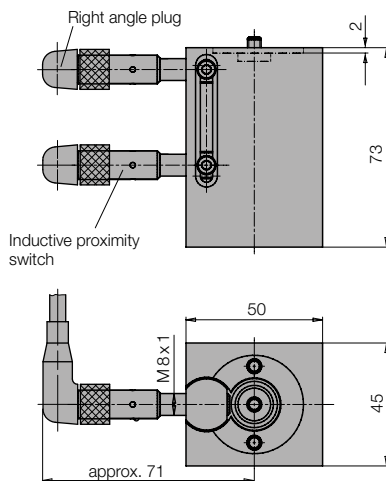
Ports A, B, K, L: max. Ø 6 mm

Accessory – position monitoring

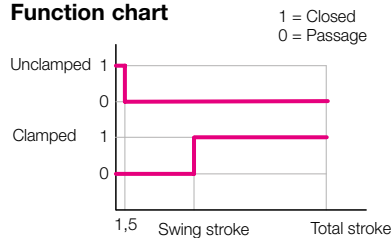
Pneumatic position monitoring



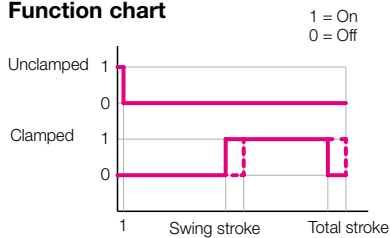
Electrical position monitoring



Function chart



Function chart



Delivery

The position monitorings are not delivered mounted at the swing clamp.
The housings can be mounted rotated by 8 x 45°. Fixing screws and the 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.	for 1895	for 1896
	0353808	0353809

Part no.	for 1895	for 1896
without switches	0353815	0353813
with standard switches	0353814	0353811

Part-no. (spare part)	
proximity switch	3829 077
Right angle plug	3829 088

For evaluation of the pneumatic position monitoring we recommend a differential pressure switch, which allows a parallel connection of max. 8 swing clamps.

Further proximity switches, see data sheet
B 1.552

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

Dimensions Technical data

Max. pull force 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	[cm³/s]	20	36
Oil volume/max. stroke	[cm³]	18.4	29.8
Oil volume/max. return stroke	[cm³]	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]	M28 × 1.5	M35 × 1.5
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°	1895 304 KXX35	1896 304 KXX36
Counterclockwise rotation 90°	1895 404 KXX35	1896 404 KXX36
0 degrees	1895 444 KXX35	1896 444 KXX36

* Upper edge nut

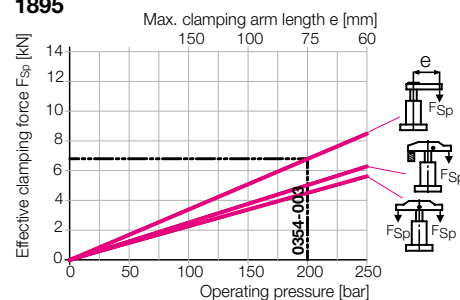
XX: Version **DH/DM** = without/with metallic wiper without switch rod
MH/MM = without/with metallic wiper with switch rod

Accessories	Part no.	Part no.
Metallic wiper, complete (spare part)	0341 100	0341 101
O-ring 8 x 1.5	3000 343	3000 343
Screw plug G 1/4	3300 821	3300 821
Spare nut / tightening torque	3527 015 / 90 Nm	3527 048 / 160 Nm

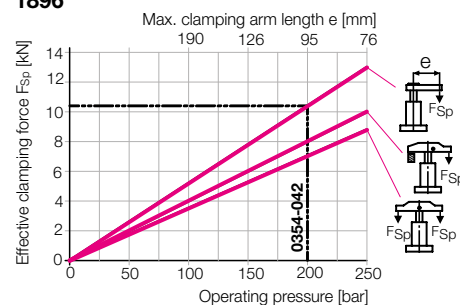
Operating conditions, tolerances and other data, see data sheet A 0.100.

Effective clamping force F_{Sp} as a function of the operating pressure p

1895



1896



Important note

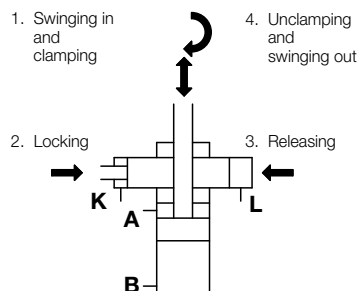
The clamping force diagrams are only valid, if "clamping" and "locking" are controlled separately (see page 4).

Clamping arms, accessories and special clamping arms, see data sheet B 1.881.

Key for available angles of rotation

Swing angle ($\pm 1^\circ$)	Part no.
90°	189XX04 KXXXXX
60°	189XX24 KXXXXX
45°	189XX34 KXXXXX

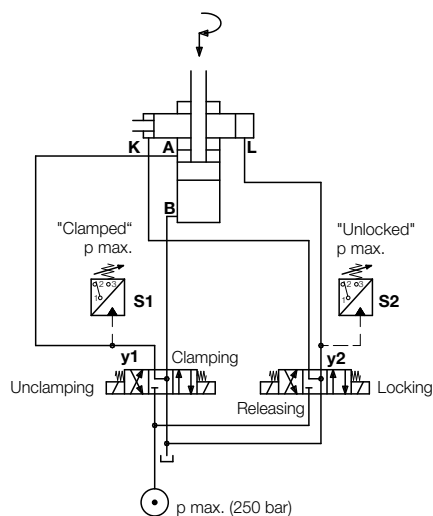
Function sequence



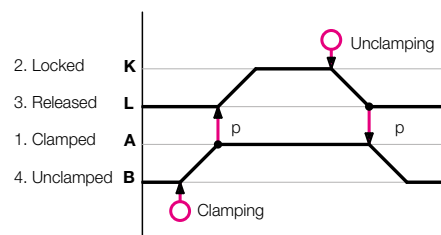
Hydraulic control

The control is effected by two separate double-acting switching circuits.

Sequence control by pressure switches



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 absorb 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 loosening 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.

Switching sequence

1. Starting position

y1 and y2 de-energised or
y1 "Unclamping"; y2 "Releasing"

2. Clamping

→ 1. y1 "Clamping"; y2 de-energised
→ 2. S1 = pmax → y2 "Locking"

3. Depressurise (as required)

The locking pressure must be applied for at least 3 seconds before the pressure is released.

→ y1 and y2 de-energised

4. Unclamping

→ 1. y2 "Releasing"
→ 2. S2 = pmax → y1 "Unclamping"



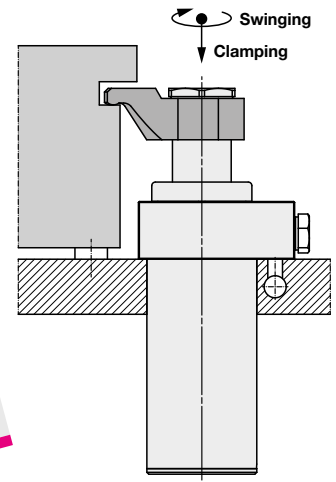
Swing Clamps without Swing Stroke

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



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

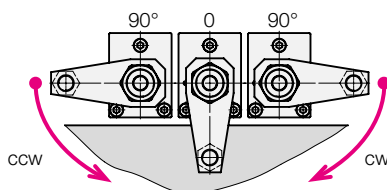
1. The piston rod is rotated together with the clamping arm without axial stroke (swing stroke) in the desired direction.
2. After swinging in the clamping arm above the clamping point, the linear clamping stroke will be effected.

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 counter-clockwise 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

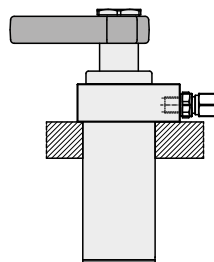
As an option, the swing clamps are available with an extended switch rod at the cylinder bottom. Here a control cam can be fixed to control the clamping and unclamping position. As accessories pneumatic and electrical position monitorings are available.

Option - Metallic wiper

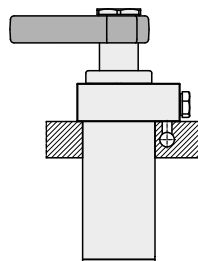
The optionally available metallic wiper protects the FKM wiper against mechanical damage.

Connecting possibilities

Pipe thread

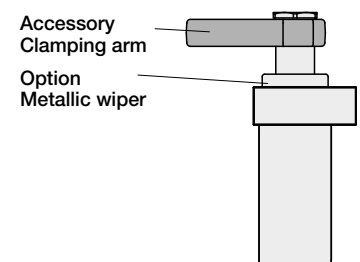


Drilled channels

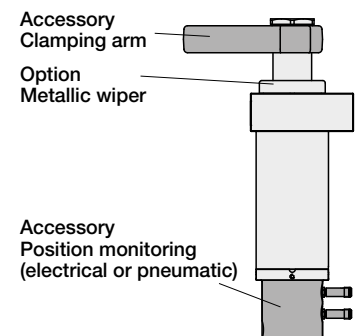


Versions

DH, DM: without switch rod



MH, MM: with switch rod



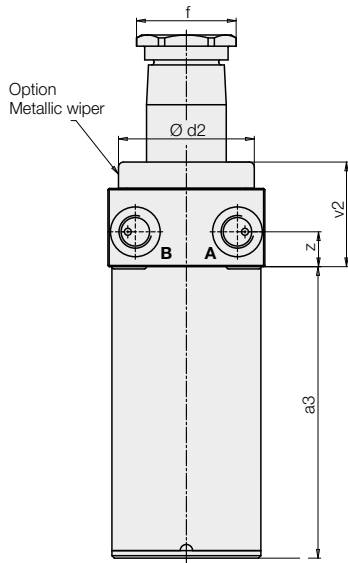
Important notes

See page 3.

Dimensions Technical Data

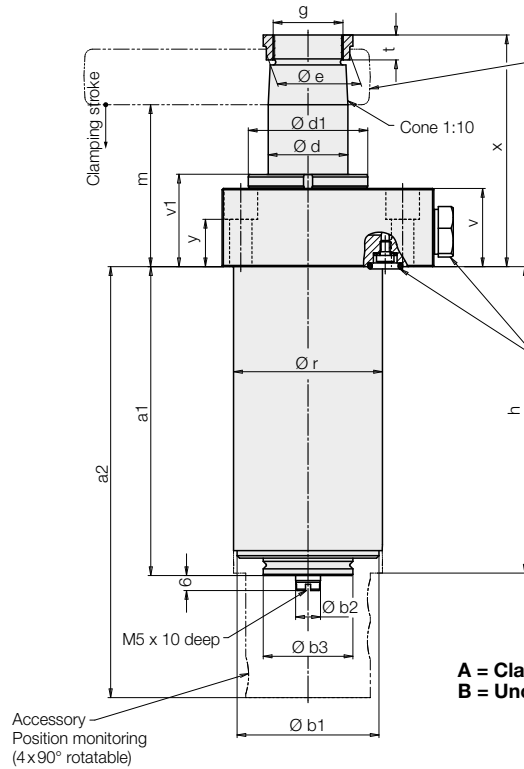
without switch rod

189X NXXX XX **DH**
DM

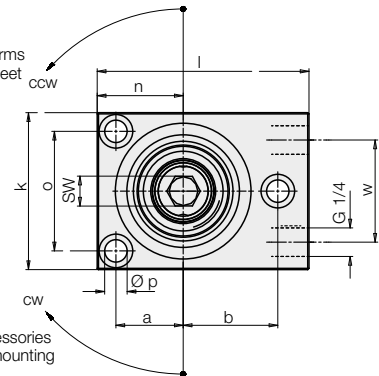


with switch rod

189X NXXX XX **MH**
MM

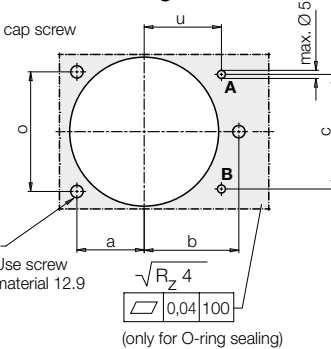


Accessory
Clamping arms
see data sheet
B 1.880



Required accessories
for manifold-mounting
connection:
2 O-rings 10x2 (3000347)
and 2 screw plugs
G 1/4 (3610006)
(remove socket head cap screw
and USIT-rings)

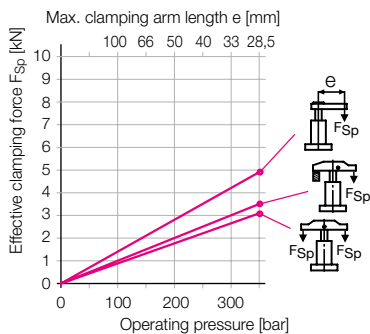
Connecting scheme



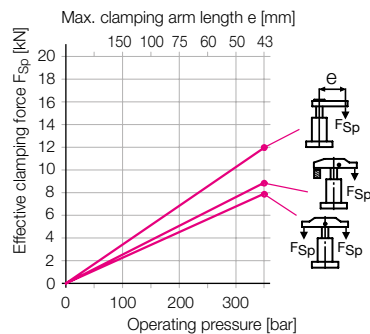
A = Clamping
B = Unclamping

Effective clamping force F_{Sp} as a function of the operating pressure p

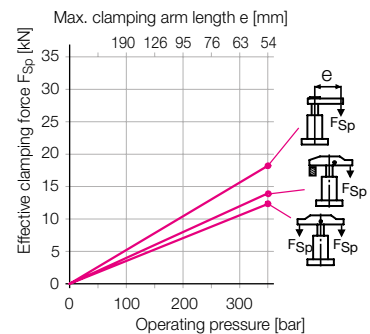
1893



1895



1896



Dimensions Technical Data

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]	M 18x1.5	M 28x1.5	M 35x1.5
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
Swing direction 90° ccw

1893 N90R 12XX
1893 N90L 12XX

1895 N90R 16XX
1895 N90L 16XX

1896 N90R 20XX
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.

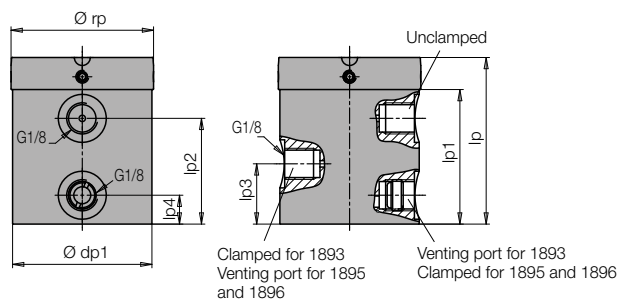
The swing clamp has no overload protection device. When mounting the clamping arm, the clamping arm or the hexagon socket in the piston have to be backed up for tightening and untightening the fixing nut. During loading and unloading of the fixture and during clamping a collision with the clamping arm has to be avoided.

Remedy: Mount position adaptor.

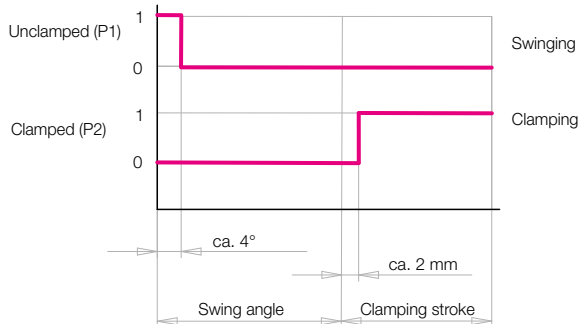
Operating conditions, tolerances and other data see data sheet A 0.100.

Accessories Position Monitoring

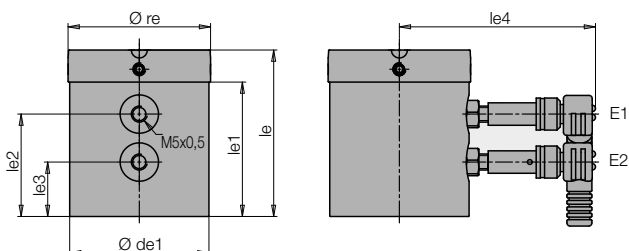
Pneumatic position monitoring



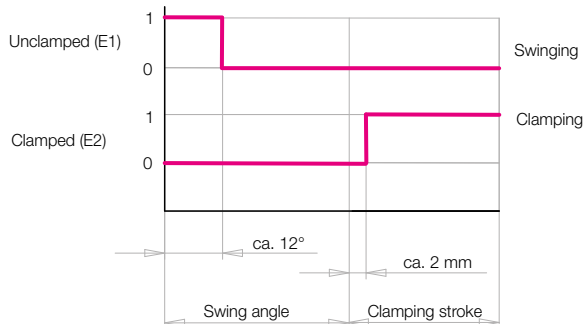
Function chart



Electrical position monitoring

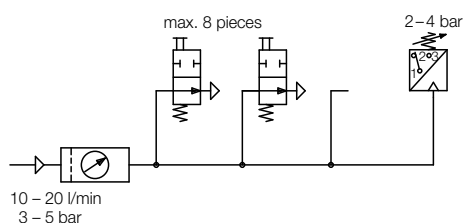


Function chart



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

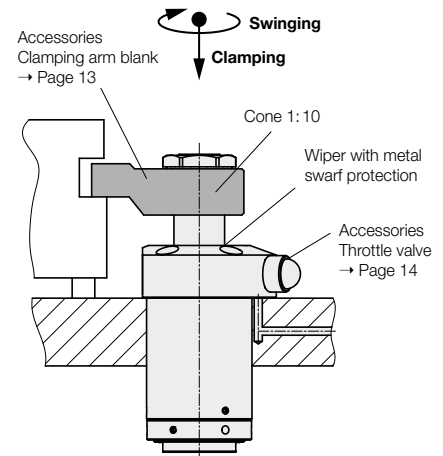
Installation

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 Clamps without Swing Stroke

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



Advantages

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

Special features

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

Function

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

Application

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

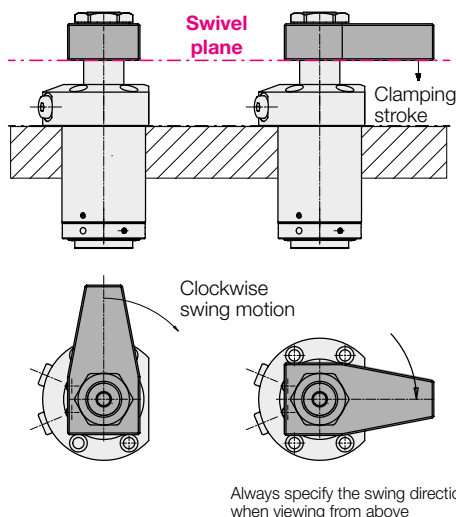
Reinforced swing mechanism

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

Behaviour during collision

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

Swinging without axial swing stroke



Radial anti-rotation device in the clamping stroke

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

Versions

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

See code for part numbers → Page 12

Seals

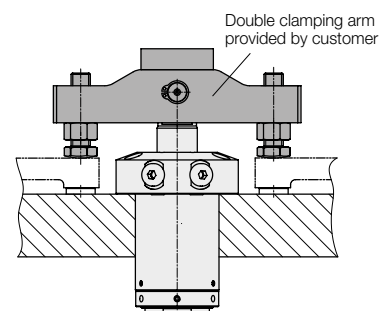
NBR = nitrile butadiene rubber

Accessories

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

Double clamping arm

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



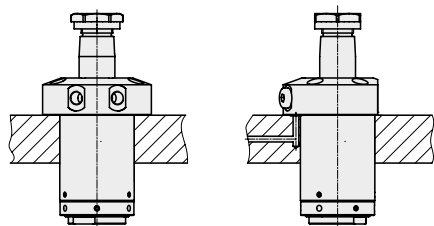
Operating conditions, tolerances and other data, see data sheet A 0.100.

Connecting types

Top flange

Pipe thread and drilled channels

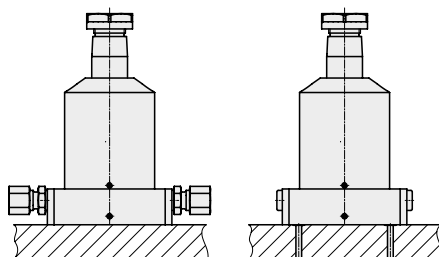
→ Page 3



Bottom flange

Pipe thread and drilled channels

→ Page 4



Other versions: clamping arm seat

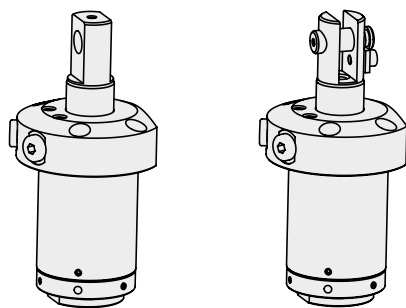
Top flange

Pendulum eye

→ Page 6

Fork head

→ Page 9



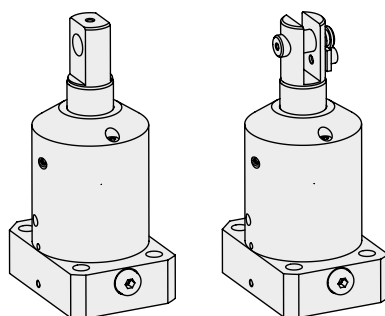
Bottom flange

Pendulum eye

→ Page 7

Fork head

→ Page 10



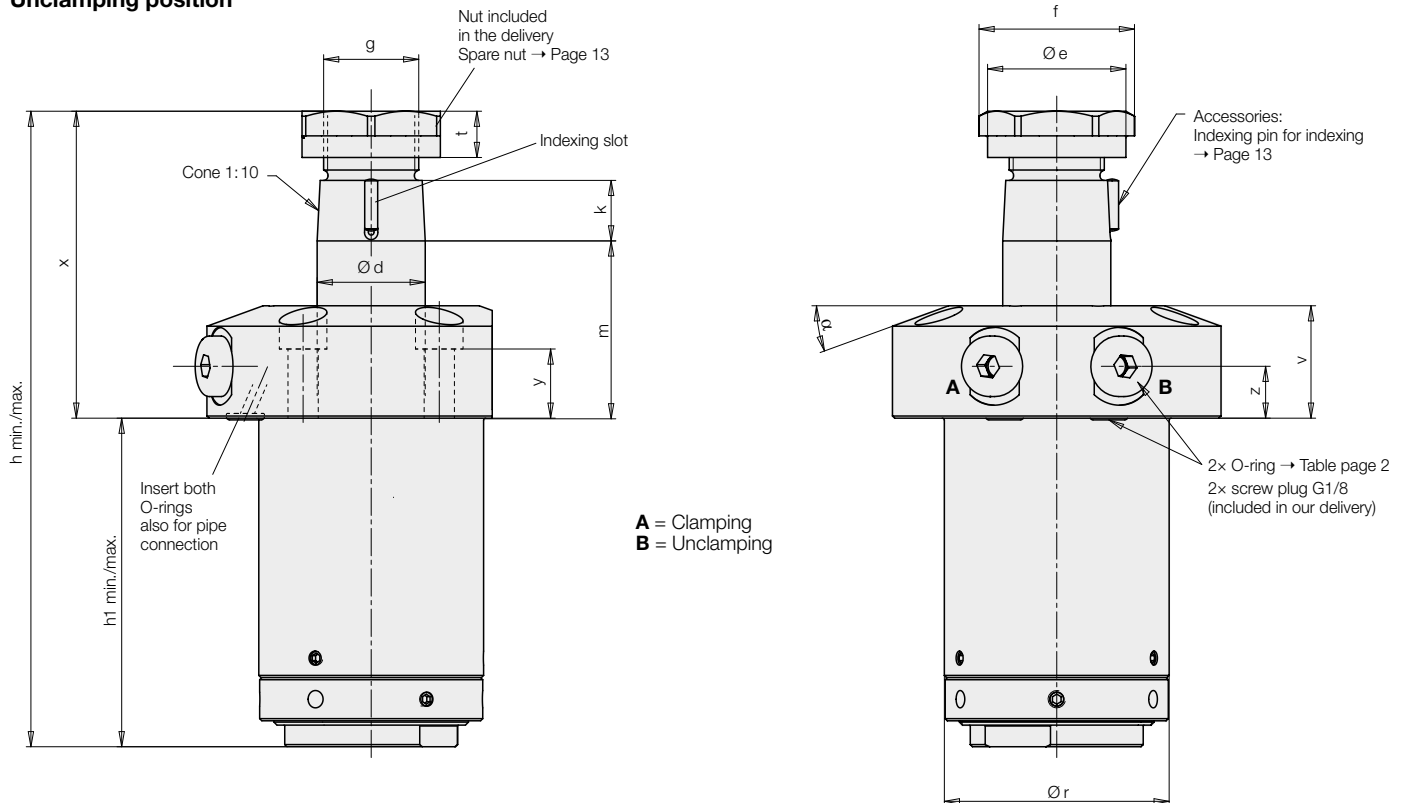
Technical data

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

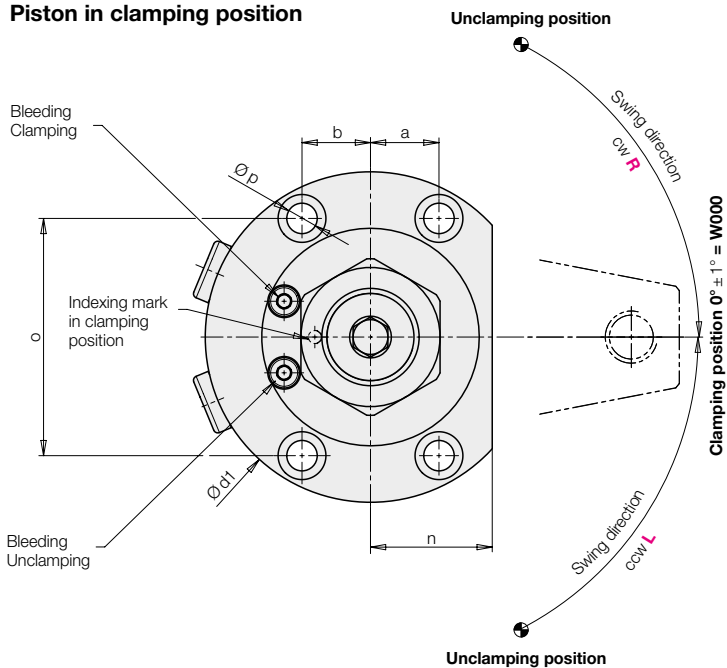
Max. operating pressure depending on the clamping arm length e → Page 5

Top Flange Clamping Arm Seat with **Cone 1:10**

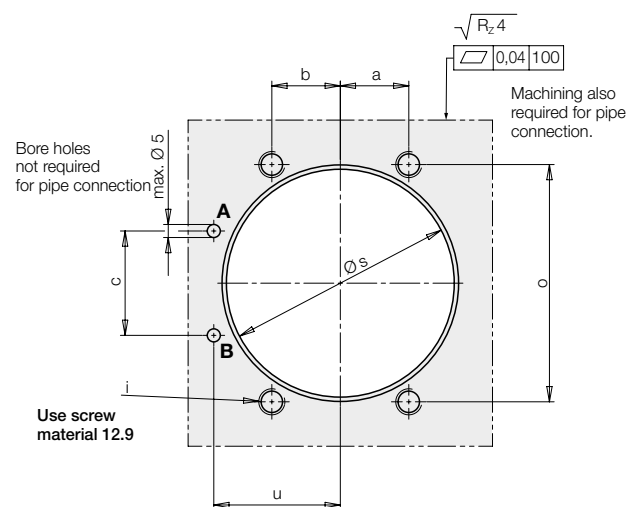
Unclamping position



Piston in clamping position



Connecting scheme



Clamping position

Angle of clamping position **W** = 0° (**W000**)

No other clamping position can be selected for the cone version.
The indexing mark is always opposite at 180°.

Swing angle

A swing angle of 0°, 15° to 75° in 5° increments and 90° can be selected.

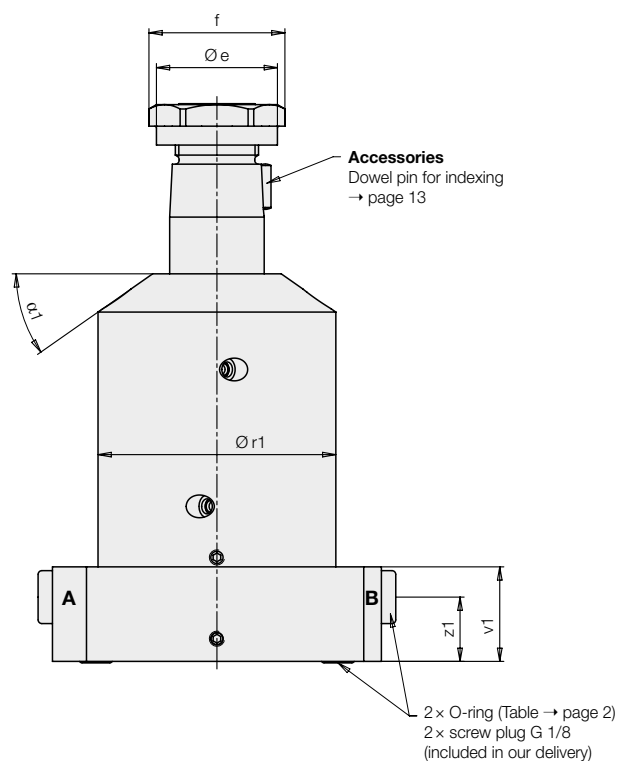
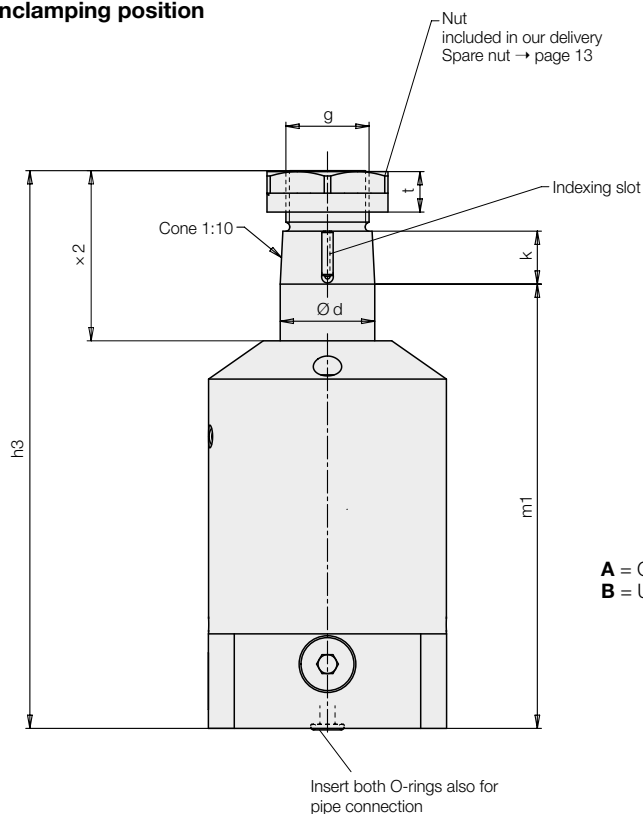
Tolerance of swing angle $\pm 3^\circ$ in unclamping position

Code for part numbers and examples → Page 12

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

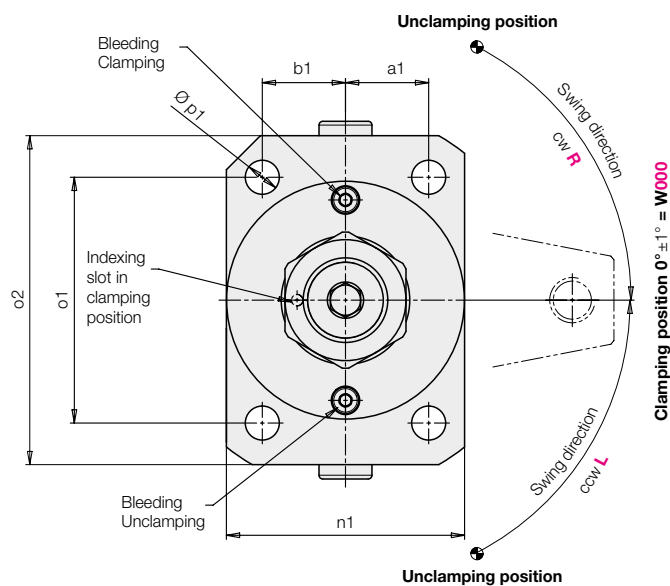
Bottom flange Clamping arm seat with cone 1:10

Unclamping position

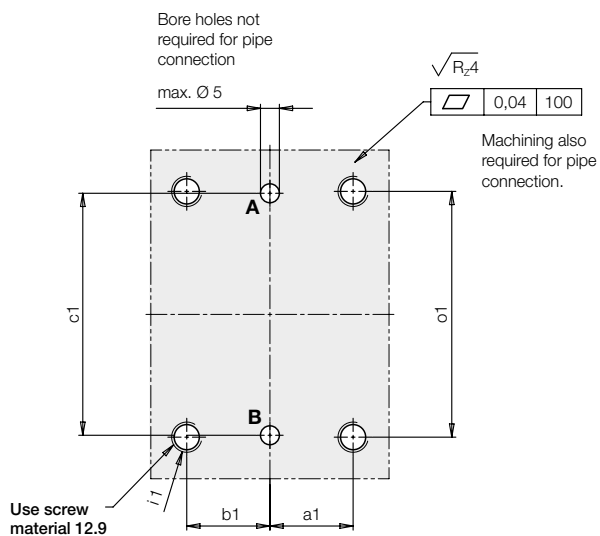


A = Clamping
B = Unclamping

Piston in clamping position



Connecting scheme



Clamping position

Angle of clamping position $W = 0^\circ$ (W000)

No other clamping position can be selected for the cone version.
The indexing mark is always opposite at 180° .

Swing angle

A swing angle of 0° , 15° to 75° in 5° increments and 90° can be selected.

Tolerance of swing angle $\pm 3^\circ$ in unclamping position

Code for part numbers and examples → Page 12

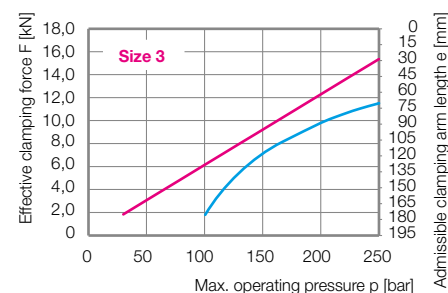
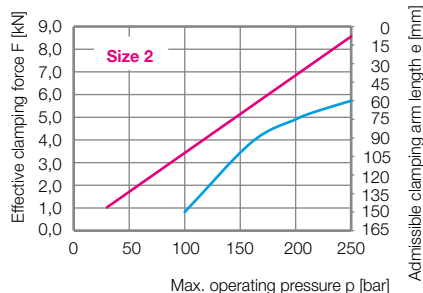
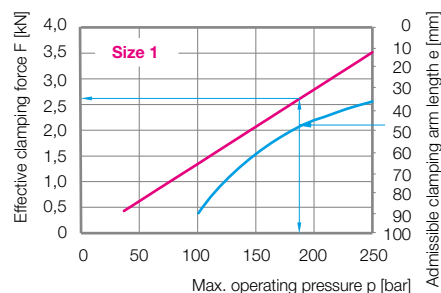
Operating conditions, tolerances and other data, see data sheet A 0.100.

Clamping arm seat with cone 1:10

Dimensions and technical data

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

Effective clamping force and admissible clamping arm length



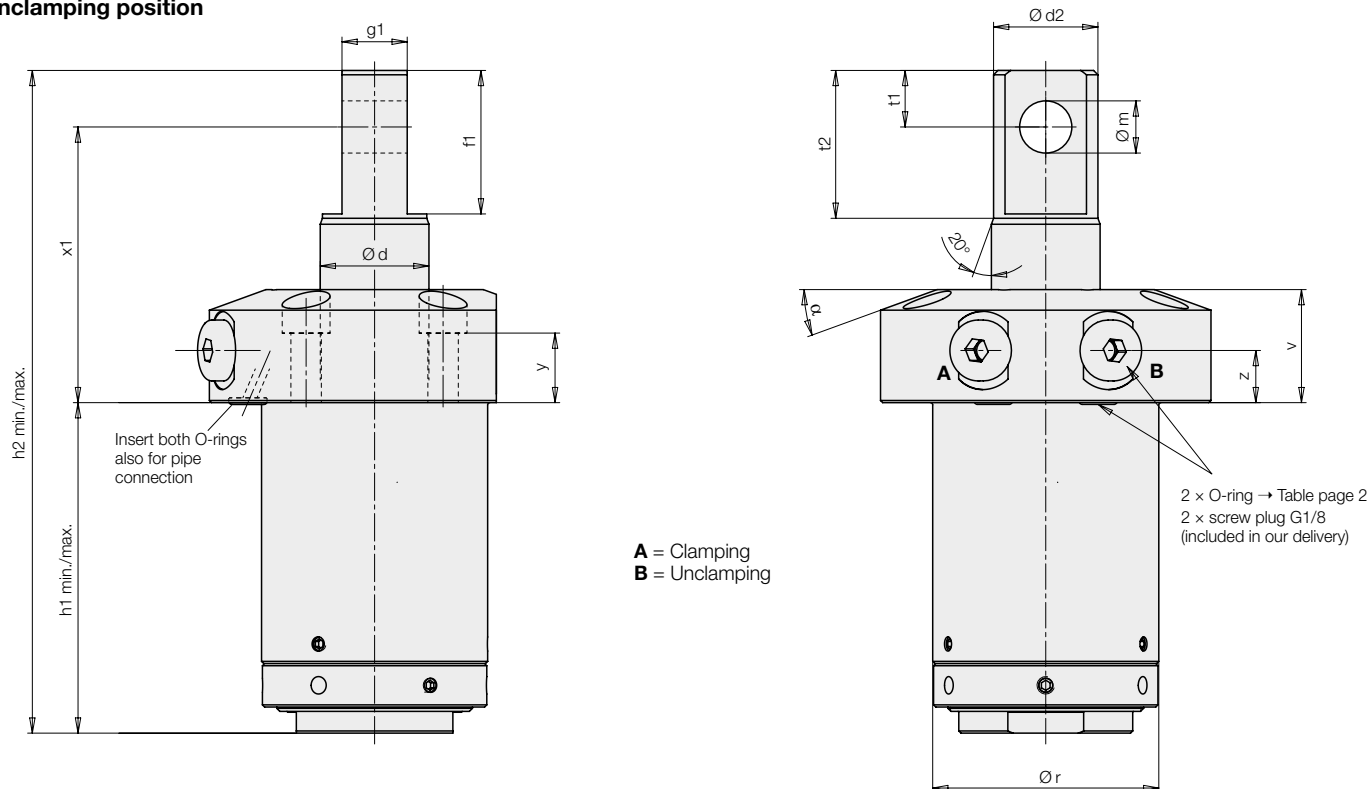
Example:

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

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

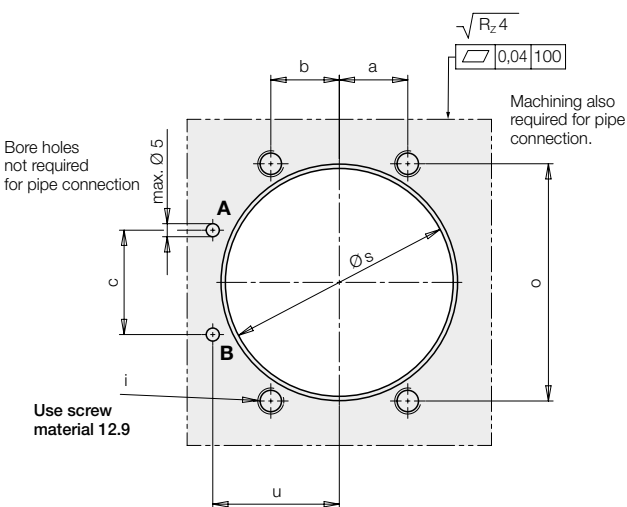
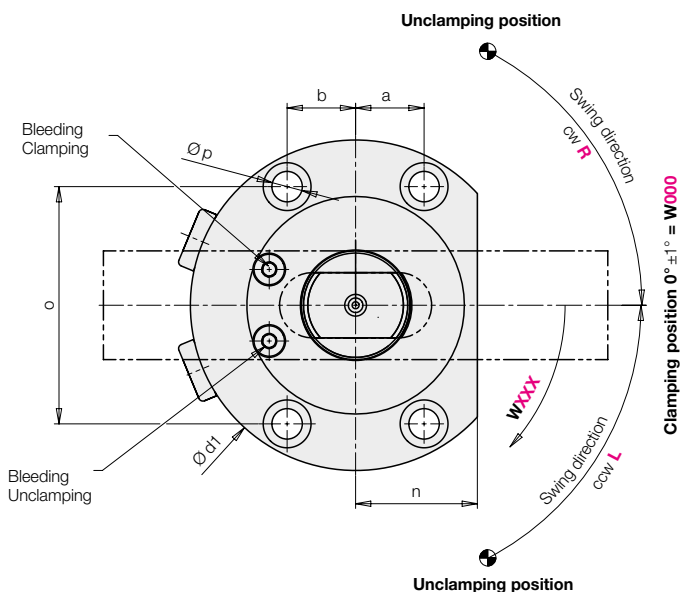
Top Flange Clamping Arm Seat with **Pendulum Eye**

Unclamping position



Piston in clamping position

Connecting scheme



Clamping position

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

Swing angle

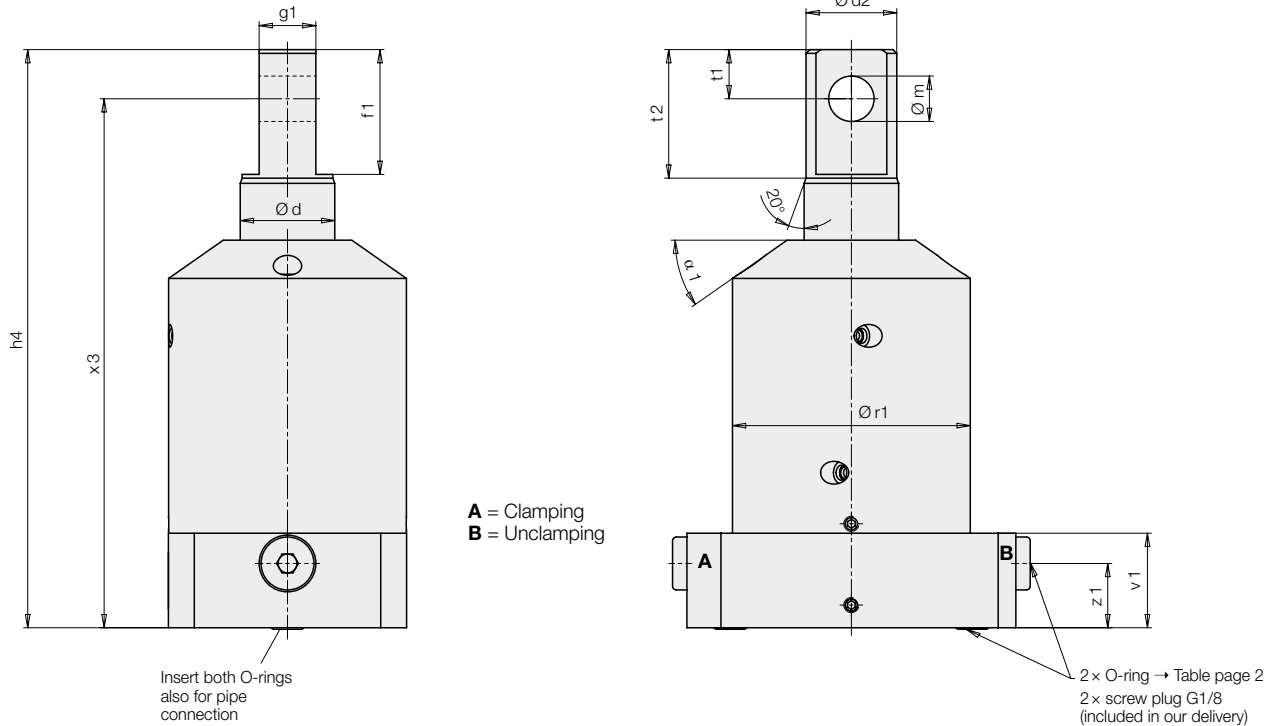
A swing angle of 0°, 15° to 75° in 5° increments, and 90° can be selected.

Tolerance of swing angle $\pm 3^\circ$ in unclamping position

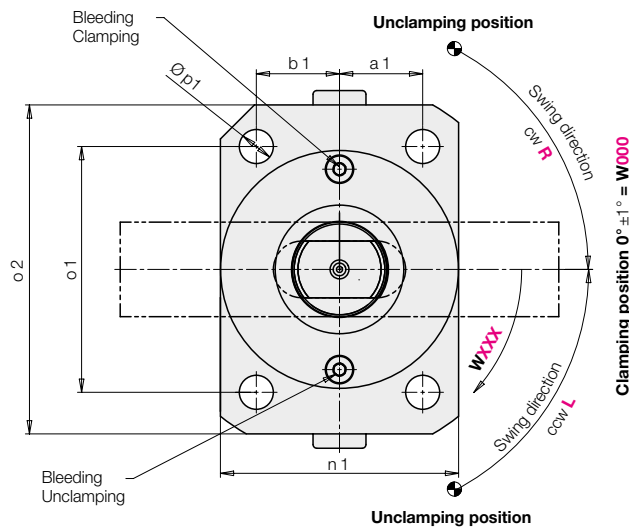
Code for part numbers and examples → Page 12

Bottom Flange Clamping Arm Seat with Pendulum Eye

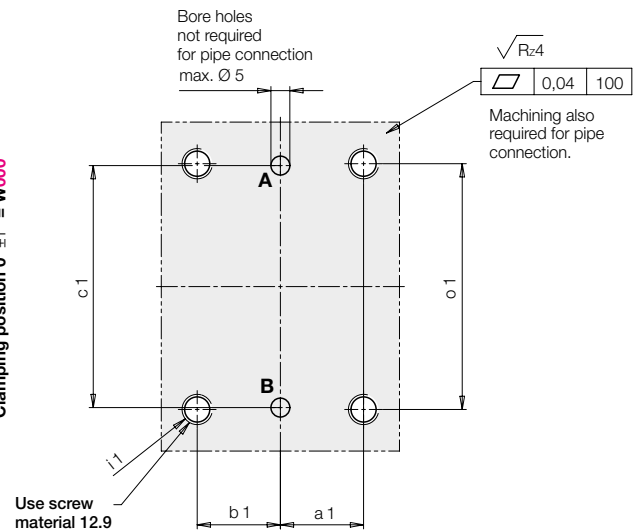
Unclamping position



Piston in clamping position



Connecting scheme



Clamping position

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

Swing angle

A swing angle of 0° , 15° to 75° in 5° increments, and 90° can be selected.

Tolerance of swing angle $\pm 3^\circ$ in unclamping position

Code for part numbers and examples → Page 12

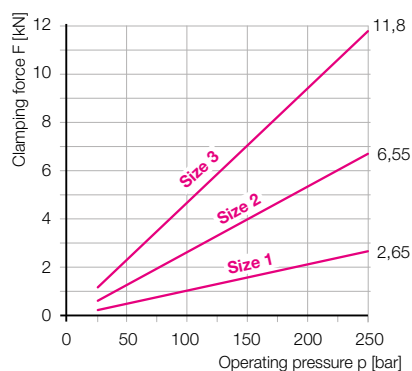
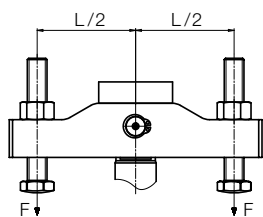
Clamping Arm Seat with **Pendulum Eye** Dimensions and Technical Data

Size		1	2	3
Piston/piston rod Ø		23/16	36/25	50/36
Clamping stroke	[mm]	8	15	25
Pulling force at 250 bar	[kN]	5.3	13.1	23.6
Min. operating pressure	[bar]	20	20	20
Piston ring area	[cm ²]	2.14	5.27	9.46
Oil volume / clamping stroke mm	[cm ³ /mm]	0.21	0.53	0.95
Oil volume / return stroke mm	[cm ³ /mm]	0.42	1.02	1.96
Oil volume swinging at 90°	[cm ³]	3.14	10.69	24.34
Oil volume swinging at 75°	[cm ³]	2.08	7.03	17.29
Oil volume swinging 0°	[cm ³]	0	0	0
Oil volume swing reduction below 75° to 15° in 5° increments	[cm ³]	0.12	0.38	1.01
Max. adm. flow rate	[l/min]	Diagrams see page 13		
Min. swing times	[s]	Diagrams see page 13		
Ød	[mm]	16	25	36
Ød2	[mm]	15.5	24	34
f1	[mm]	23	33	50
Øm H7/g6		8	12	16
t1	[mm]	10	13	20
t2	[mm]	24	34	50.5

Top flange	Weight, approx.	[kg]	0.8	0.9	1.9	2.3	4.6	5.4
	Flange bevel α	[°]	10		20		15	
	a	[mm]	11.75		15.75		22.5	
	b	[mm]	11.75		15.75		22.5	
	c	[mm]	18		24		34.5	
	Ø d1	[mm]	62		76		110	
	g1 f7	[mm]	10		15		25	
	h1 min.	[mm]	60.5	74.5	75	101	104	130
	h1 max.	[mm]	61	75	76	102	105	131
	h2 min.	[mm]	117.5	138.5	151.4	190.4	202	241
	h2 max.	[mm]	118	139	152.4	191.4	203	242
	i	[mm]	M5		M6		M10	
	n	[mm]	19		28		38	
	o	[mm]	40.7		54.56		77.94	
	Ø p	[mm]	5.8		7		12	
	Ø r	[mm]	36		52		72	
	Ø s ±0.2	[mm]	36.4		52.4		72.4	
	u	[mm]	21.7		29.1		41.5	
	v	[mm]	22		26		28	
	x1 +0.7 -0.6	[mm]	47	54	63.4	76.4	78	91
	y	[mm]	13		16		11	
	z	[mm]	10		12		11	

Bottom flange	Weight, approx.	[kg]	1.17	1.33	2.65	3.24	5.58	6.5
	Flange bevel α 1	[°]	25		35		25	
	a1	[mm]	15		22		30	
	b1	[mm]	15		22		30	
	c1	[mm]	48		64		86	
	h4	[mm]	119.1	140.1	152.9	191.9	203.7	242.7
	i1	[mm]	M6		M8		M12	
	n1	[mm]	45		63		80	
	o1	[mm]	50		65		86	
	o2	[mm]	70		87		108	
	Øp1	[mm]	7		9		13	
	Ør1 -0.2	[mm]	44.9		62.9		79.8	
	v1	[mm]	20		25		27.5	
	x3 ±0.4	[mm]	109.1	130.1	139.9	178.9	183.7	222.7
	z1	[mm]	11		17		17.5	

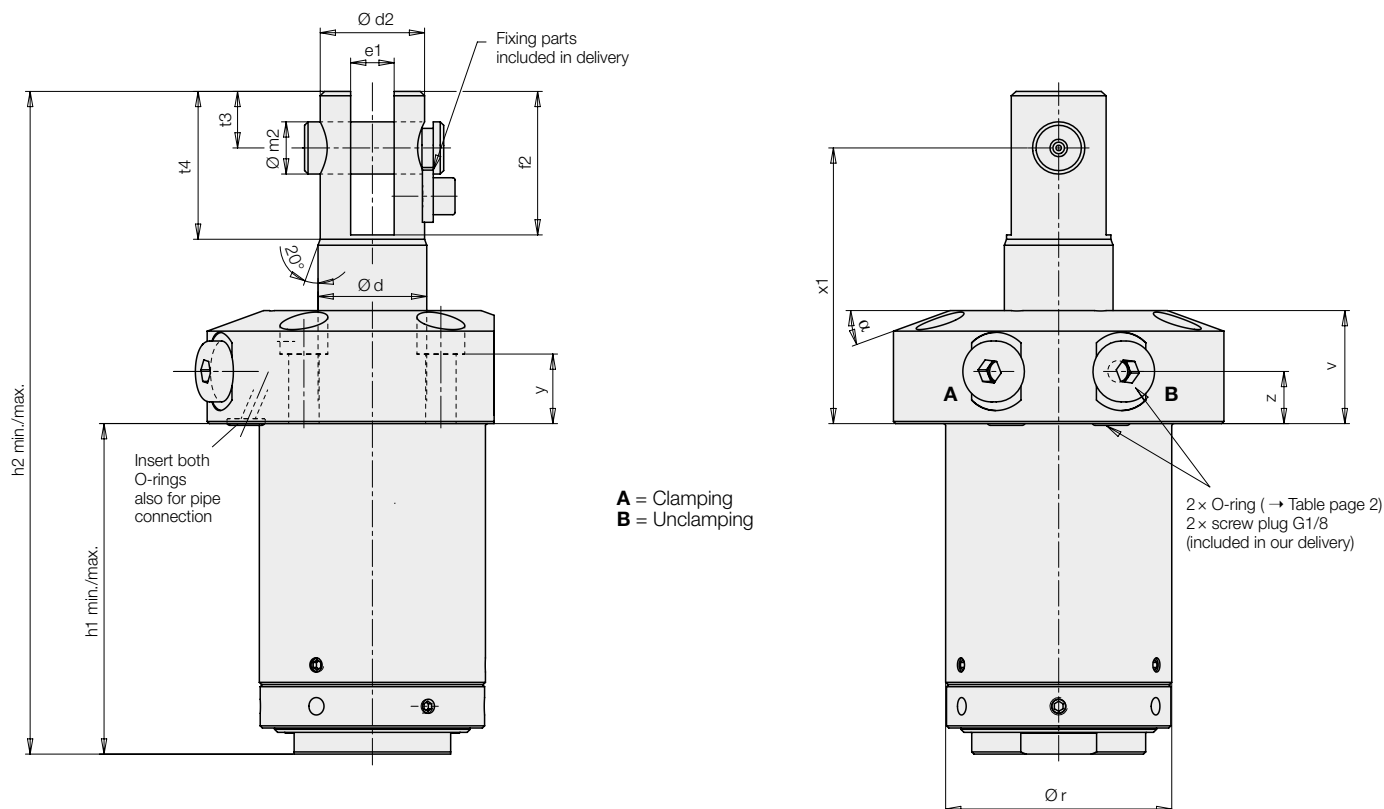
Effective clamping force F as a function of the operating pressure p



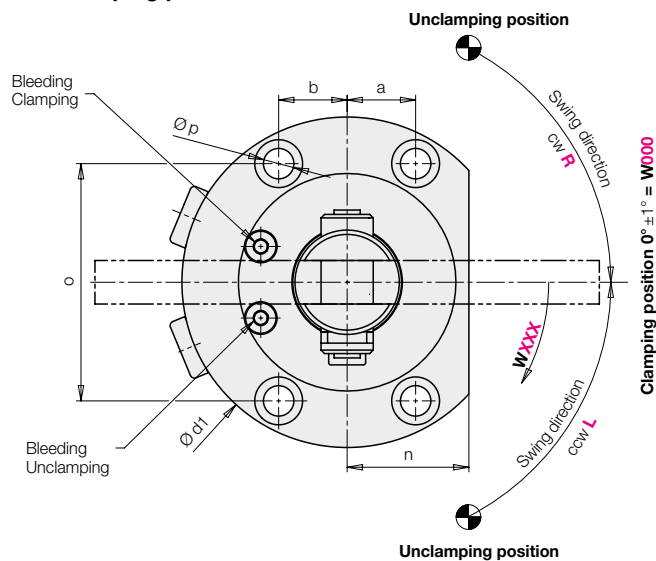
Operating conditions, tolerances and other data, see data sheet A 0.100.

Top Flange Clamping Arm Seat with Fork Head

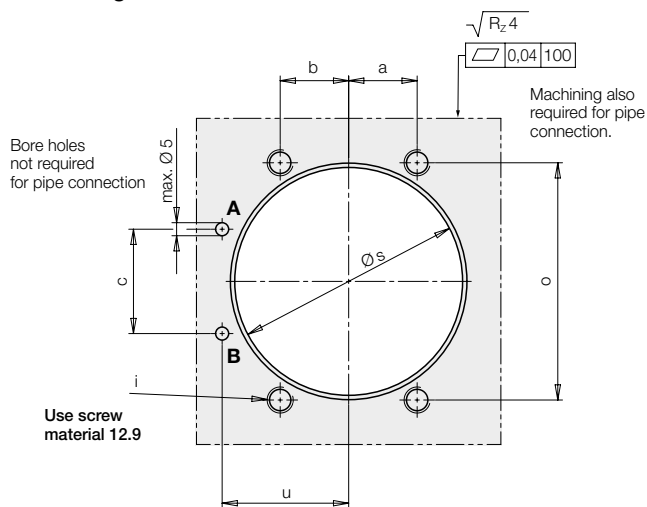
Unclamping position



Piston in clamping position



Connecting scheme



Clamping position

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

Swing angle

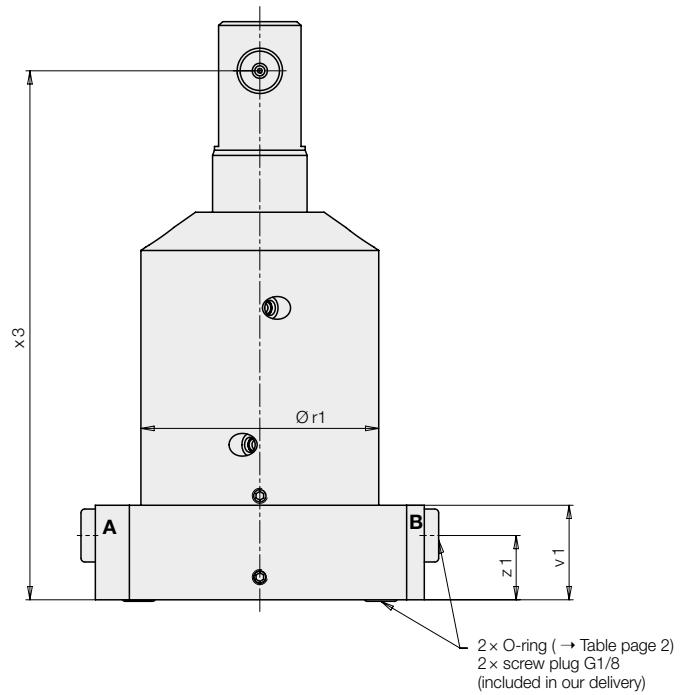
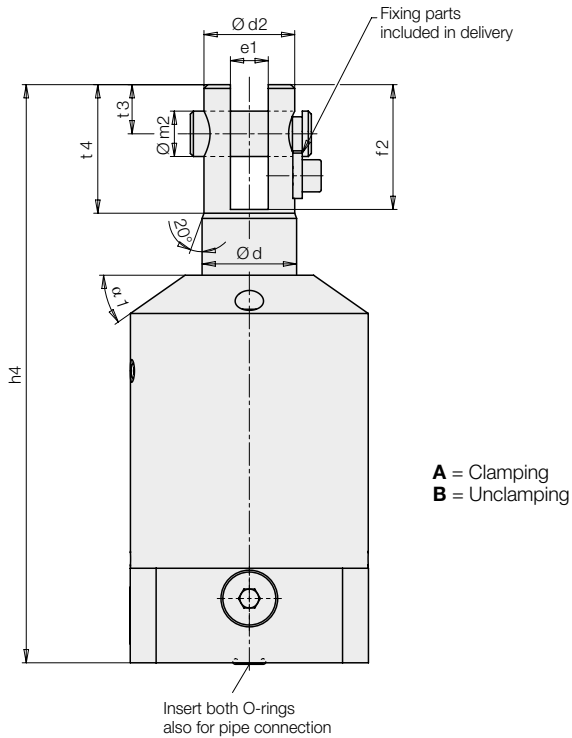
A swing angle of 0° , 15° to 75° in 5° increments, and 90° can be selected.
Tolerance of swing angle $\pm 3^\circ$ in unclamping position

Code for part numbers and examples → Page 12

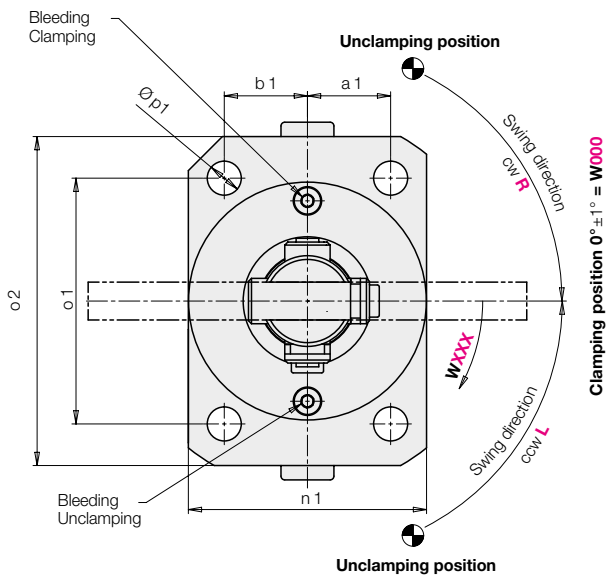
Operating conditions, tolerances and other data, see data sheet A 0.100.

Bottom flange Clamping arm seat with fork head

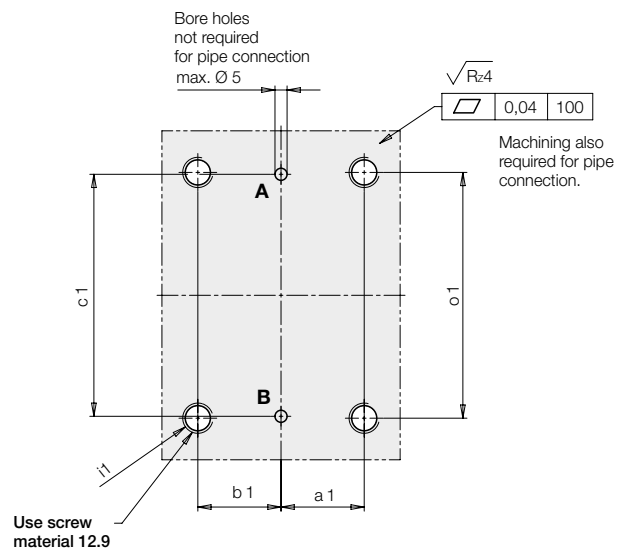
Unclamping position



Piston in clamping position



Connecting scheme



Clamping position

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

Swing angle

A swing angle of 0° , 15° to 75° in 5° increments, and 90° can be selected.

Tolerance of swing angle $\pm 3^\circ$ in unclamping position

Code for part numbers and examples → Page 12

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

Clamping arm seat with fork head

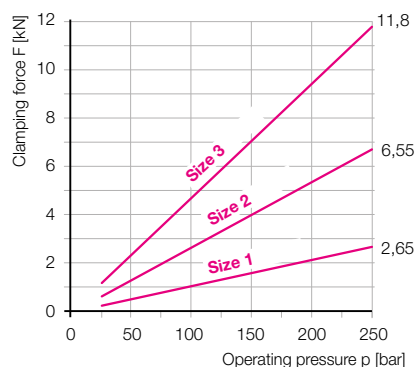
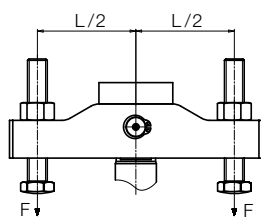
Dimensions and technical data

Size		1	2	3
Piston/piston rod Ø		23/16	36/25	50/36
Clamping stroke	[mm]	8	15	12
Pulling force at 250 bar	[kN]	5.3	13.1	23.6
Min. operating pressure	[bar]	20	20	20
Piston ring area	[cm ²]	2.14	5.27	9.46
Oil volume / clamping stroke mm	[cm ³ /mm]	0.21	0.53	0.95
Oil volume / return stroke mm	[cm ³ /mm]	0.42	1.02	1.96
Oil volume swinging at 90°	[cm ³]	3.14	10.69	24.34
Oil volume swinging at 75°	[cm ³]	2.08	7.03	17.29
Oil volume swinging 0°	[cm ³]	0	0	0
Oil volume swing reduction below 75° to 15° in 5° increments	[cm ³]	0.12	0.38	1.01
Max. adm. flow rate	[l/min]	Diagrams see page 13		
Min. swing times	[s]	Diagrams see page 13		
Ød	[mm]	16	25	36
Ød2	[mm]	15.5	24	34
e1 +0.1	[mm]	6.01	10.01	12.01
f2	[mm]	23.5	33	50
Ø m2 H7/g6	[mm]	8	12	14
t3	[mm]	10	13	20
t4	[mm]	24	34	50.5

Top flange	Weight, approx.	[kg]	0.8	0.9	1.9	2.3	4.6	5.4
	Flange bevel α	[°]	10		20		15	
	a	[mm]	11.75		15.75		22.5	
	b	[mm]	11.75		15.75		22.5	
	c	[mm]	18		24		34.5	
	Ø d1	[mm]	62		76		110	
	h1 min.	[mm]	60.5	74.5	75	101	104	130
	h1 max.	[mm]	61	75	76	102	105	131
	h2 min.	[mm]	117.5	138.5	151.4	190.4	202	241
	h2 max.	[mm]	118	139	152.4	191.4	203	242
	i	[mm]	M5		M6		M10	
	n	[mm]	19		28		38	
	o	[mm]	40.7		54.56		77.94	
	Ø p	[mm]	5.8		7		12	
	Ø r	[mm]	36		52		72	
	Ø s ± 0.2	[mm]	36.4		52.4		72.4	
	u	[mm]	21.7		29.1		41.5	
	v	[mm]	22		26		28	
	x1 +0.7 –0.6	[mm]	47	54	63.4	76.4	78	91
	y	[mm]	13		16		11	
	z	[mm]	10		12		11	

Bottom flange	Weight, approx.	[kg]	1.17	1.33	2.65	3.22	5.55	6.5
	Flange bevel α 1	[°]	25		35		25	
	a1	[mm]	15		22		30	
	b1	[mm]	15		22		30	
	c1	[mm]	48		64		86	
	h4	[mm]	119.1	140.1	152.9	191.9	203.7	242.7
	i1	[mm]	M6		M8		M12	
	n1	[mm]	45		63		80	
	o1	[mm]	50		65		86	
	o2	[mm]	70		87		108	
	Ø p1	[mm]	7		9		13	
	Ø r1 –0.2	[mm]	44.9		62.9		79.8	
	v1	[mm]	20		25		27.5	
	x3 ±0.4	[mm]	109.1	130.1	139.9	178.9	183.7	222.7
	z1	[mm]	11		17		17.5	

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



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

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

Size

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

Design

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

Clamping arm seat

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

Swing direction

R = clockwise
L = counterclockwise
0 = without swing motion

Swing angle

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

Angle of clamping position

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

Clamping stroke

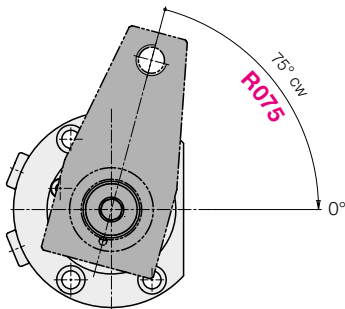
For size 1 (**D**)
008 = 8 mm
015 = 15 mm
 For sizes 2 and 3 (**L** and **R**)
012 = 12 mm
025 = 25 mm
 Clamping stroke limit upon request

Ordering example 1

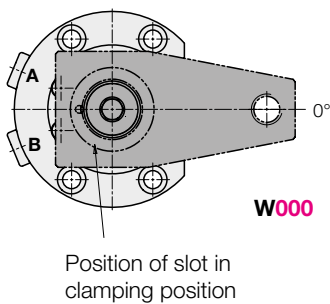
Size 2 = **L**
 Top flange = **B**
 Cone 1:10 = **K**
 Cw swing motion = **R**
 Swing angle 75° = **075**
 Clamping stroke: 12 mm = **012**
 Clamping position 0° = **000**

Part no.
V1SAA LBK5 R075 H012 W000 ONE

Unclamped



Clamped

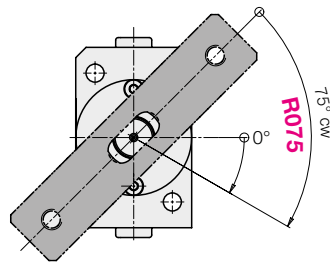


Ordering example 2

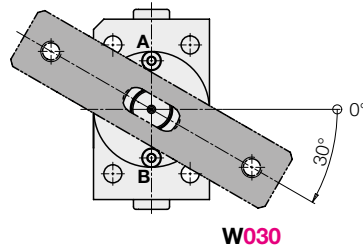
Size 1 = **D**
 Bottom flange = **G**
 Pendulum eye = **P**
 Cw swing motion = **R**
 Swing angle 75° = **075**
 Clamping stroke: 8 mm = **008**
 Clamping position 30° = **030**

Part no.
V1SAA DGP5 R075 H008 W030 ONE

Unclamped



Clamped

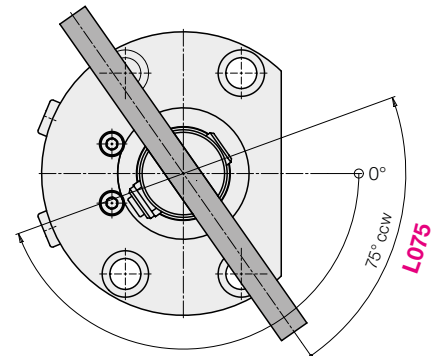


Ordering example 3

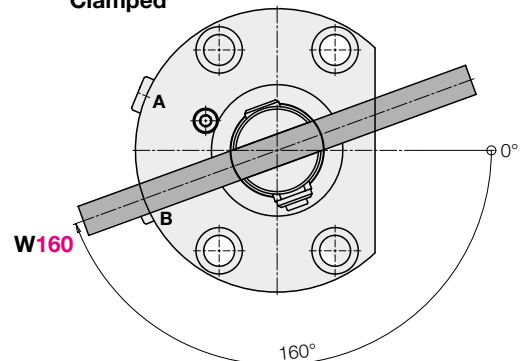
Size 3 = **R**
 Top flange = **B**
 Fork head = **G**
 Ccw swing motion = **L**
 Swing angle 75° = **075**
 Clamping stroke: 25 mm = **025**
 Clamping position 160° = **160**

Part no.
V1SAA RBG5 L075 H025 W160 ONE

Unclamped



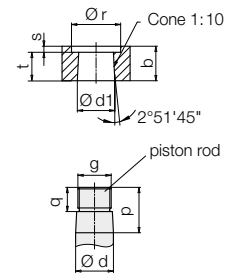
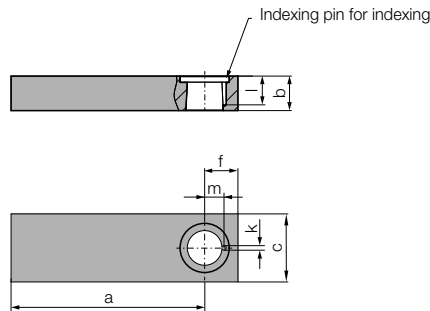
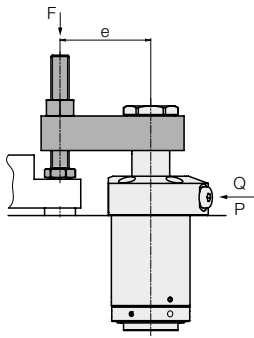
Clamped



Cone 1:10• Accessories

Clamping arm blank

Clamping arm blank for swing clamps



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

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

Moment of inertia of the clamping arm

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

Diagram of swing time

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

Calculation of the 90° swing time:

$$t_{\min} = 1 \text{ s} \cdot \sqrt{\frac{J_e}{J_L}} \geq 1 \text{ s} \quad [\text{s}]$$

Calculation of the admissible flow rate:

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

Q_e = max. flow rate for the standard clamping arm according to table $[\text{cm}^3/\text{s}]$

J_e = moment of inertia of the standard clamping arm according to table $[\text{kg} \cdot \text{mm}^2]$

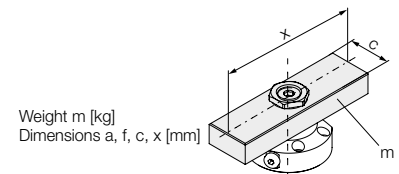
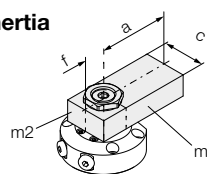
J_L = moment of inertia of the desired clamping arm $[\text{kg} \cdot \text{mm}^2]$

Type		BG1 (V1SA ADX)	BG2 (V1SA ALX)	BG3 (V1SA ARX)
a	[mm]	90	150	175
b	[mm]	17	22.8	29.5
c	[mm]	28	45	60
Ø d f7	[mm]	16	25	36
Ø d1 -0.05 / -0.1	[mm]	16	25	36
e max. at 250 bar	[mm]	35	60	70
f	[mm]	16	22	30
g	[mm]	M14 x 1.5	M22 x 1.5	M30 x 1.5
Ø k +0.05	[mm]	3	3	4
l +0.5	[mm]	9.5	18	18
m ±0.05	[mm]	7.8	12.8	17.5
p	[mm]	22.5	30	38
q	[mm]	9	16	18
Ø r	[mm]	20	32.5	47
s	[mm]	2.5	4	4
t	[mm]	14.5	18.8	25.5
Weight	[kg]	0.37	1.29	2.6
Moment of inertia of J_e	$[\text{kg} \cdot \text{mm}^2]$	936	9,292	25,694
Part no.				
Clamping arm blank		35484215	35484216	35484217
Spare nut				
Tightening torque	[Nm]	16	50	110
Dowel pin				
	[mm]	3301281 Ø3x6	3301708 Ø3x12	3300195 Ø4x12

Short standard clamping arm

Max. flow rate Q_e	$[\text{cm}^3/\text{s}]$	3.14	10.69	24.34
Moment of inertia of J_e	$[\text{kg} \cdot \text{mm}^2]$	100	1,450	3,250
Min. swing time	[s]	1	1	1

Moment of inertia

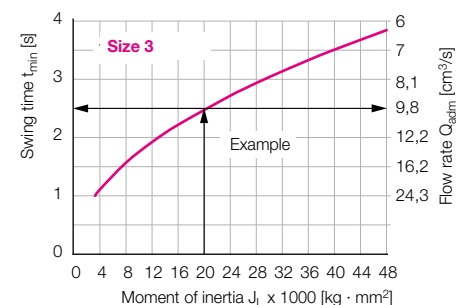
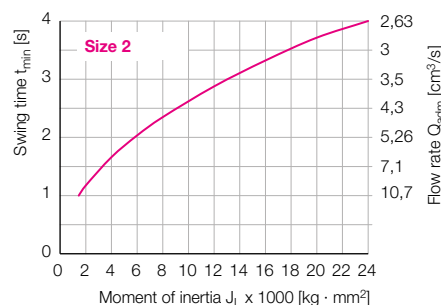
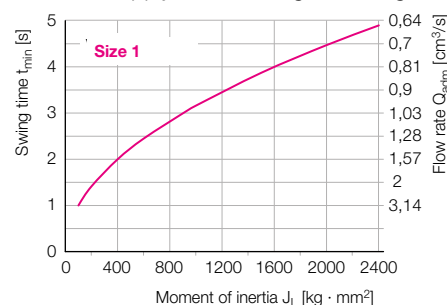


$$J_L = m_1 \frac{4a^2 + c^2}{12} + m_2 \frac{4f^2 + c^2}{12} \quad [\text{kg} \cdot \text{mm}^2]$$

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

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

Illustrations apply to swivel angle 15° or greater



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

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

Example: $J_L = 20,000 \text{ kg} \cdot \text{mm}^2$
 $\rightarrow t_{\min} = 2.5 \text{ s} \rightarrow Q_{\text{adm}} 9.8 \text{ cm}^3/\text{s}$

Application

These throttle valves are used

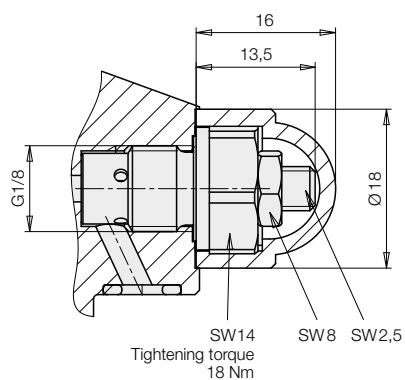
- in order to reduce the swing speed of the clamping arm
- in order to improve the synchronism of several swing clamps

Important notes

This application is only possible when using drilled ducts as connections because the throttle valves are screwed into the existing G1/8 pipe connections.

In the case of strong throttling, increasing back pressure upstream of the throttle valve can trigger premature switching of pressure switches and sequence valves.

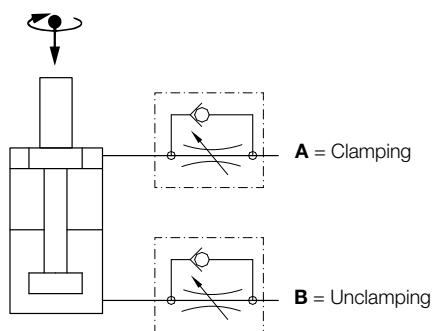
Dimensions



Weight 0.025 kg

Part no. 2957 209

Hydraulic symbols





Swing Clamp with Overload Protection Device

Bottom flange and threaded body, single and double acting, max. operating pressure 500 bar



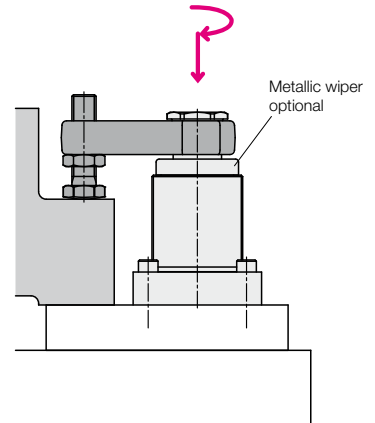
Advantages

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

Overload protection device

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

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



Application

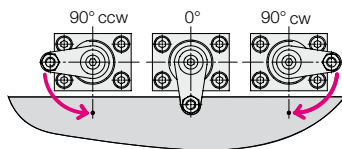
Hydraulic swing clamps are used for clamping of workpieces, when it is essential to keep the clamping area free of straps and clamping components for unrestricted workpiece loading and unloading.

Description

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

Swing direction

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



Standard swing angle 90° ± 2°

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

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

0°-Version

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

Important notes

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

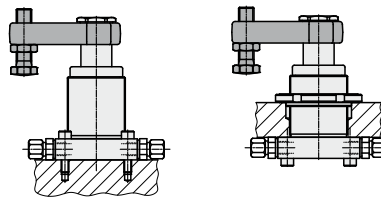
In the effective area of piston rod and clamping arm there is the danger of crushing. The manufacturer of the fixture or the machine is obliged to provide effective protection devices. The swing motion must not be impeded to avoid the disengagement of the overload protection device.

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

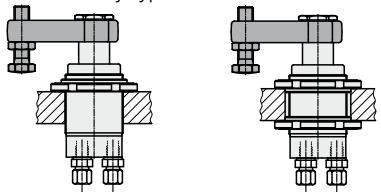
Installation and connecting possibilities

Pipe thread

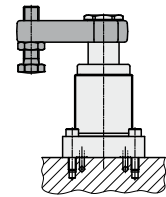
Bottom flange



Threaded-body type

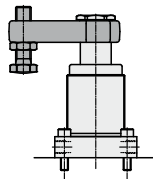


Drilled channels



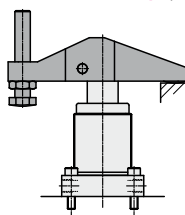
Accessories

Clamping arm with contact bolt (200 bar)



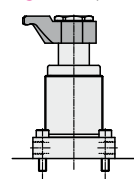
Note: Calculation of the effective clamping force see page 4

Clamping arm assembly (500 bar)

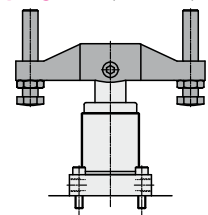


The asymmetric clamping arm assembly is based on a fixed datum.
Very high clamping force at 500 bar

Cranked clamping arm (300 bar)

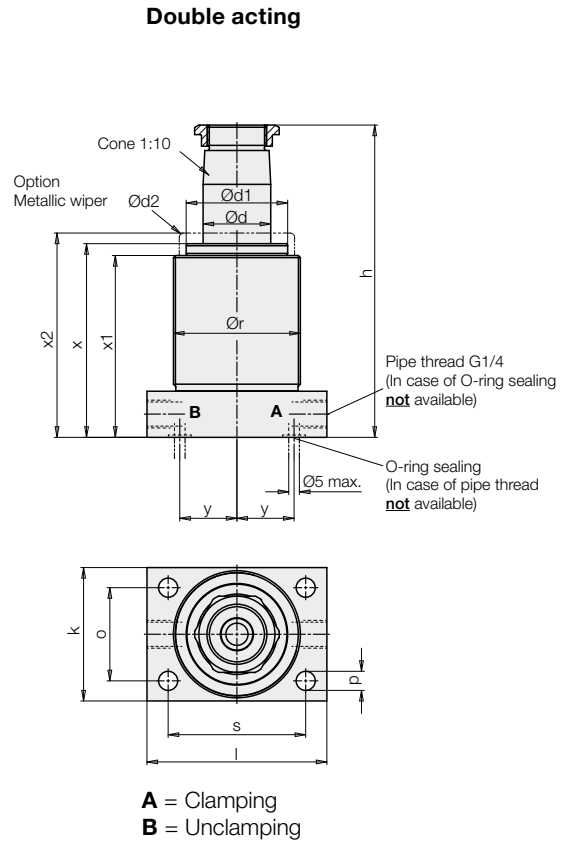
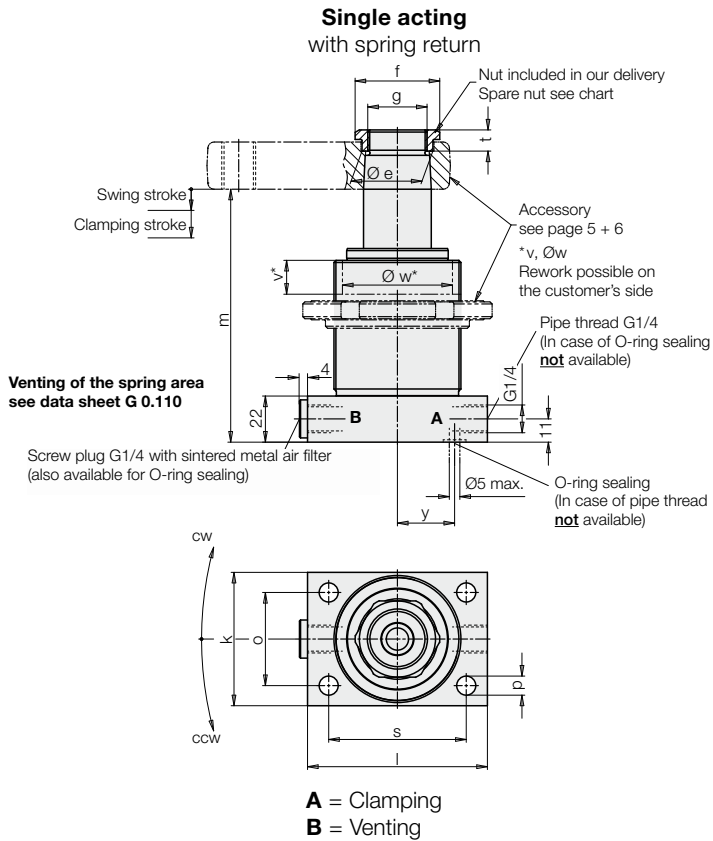


Double clamping arm (500 bar)

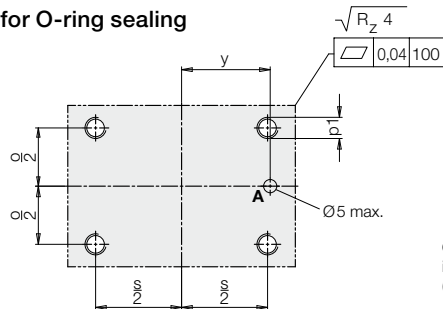


The symmetrical double clamping arm can clamp two workpieces simultaneously, the pulling force of the piston is halved. Built-in spring elements ensure horizontal off-position.

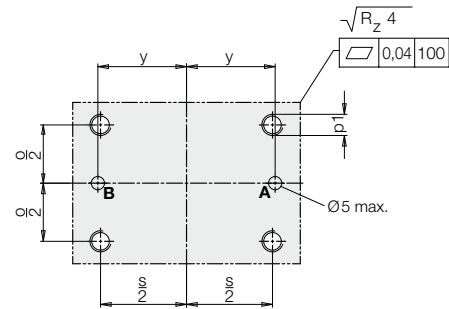
Flange type with pipe thread G 1/4 or with O-ring sealing (see chart)



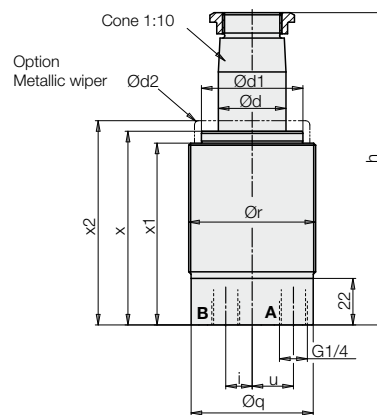
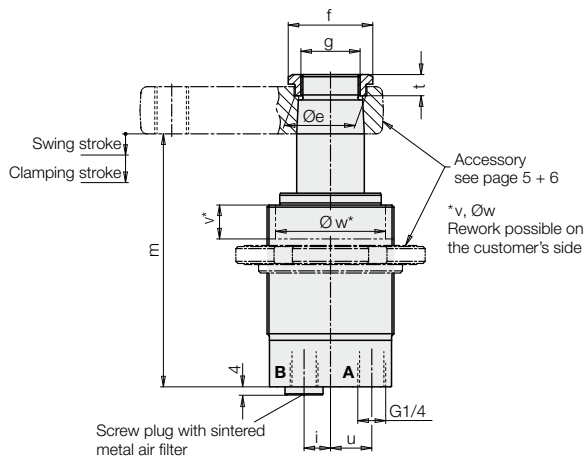
Connecting details for O-ring sealing



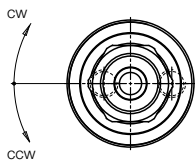
O-rings 8 x 1.5
included in our delivery
(Spare part 3000343)



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	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	13	25	50	15	25	50	15	25	50
Swing stroke				[mm]	8	10	9	10	10	11	11	11	10	13	13
Total stroke ±0.2				[mm]	19	35	22	35	60	26	36	61	25	38	63
Declutch moment of overload protection				[Nm]	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
Adm. flow rate (page 5)															
Clamping				[cm³/s]	3.4	3.4	10	10	10	18.4	18.4	18.4	29	29	29
Unclamping**				[cm³/s]	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	16	27.2	18.4	25.5	43.2	29	44	73
Unclamping**				[cm³]	9.4	17.2	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	147.5	173.5	223.5	172	192	242	183	209	259
h max. ****				[mm]	128.6	160.6	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	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 –0,5 min. *****				[mm]		32/42		50/55			60/75			70/87	
x				[mm]	80	96	90.5	103.5	128.5	103	113	138	111	124	149
x1				[mm]	75.4	91.4	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	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	18951X4	18951X8	18951X9	18961X4	18961X8	18961X9	18971X4	18971X8	18971X9
Swing direction ccw					18932X4	18932X8	18952X4	18952X8	18952X9	18962X4	18962X8	18962X9	18972X4	18972X8	18972X9
Weight, approx.				[kg]	1.2	1.4	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	18953X4	18953X8	18953X9	18963X4	18963X8	18963X9	18973X4	18973X8	18973X9
Swing direction ccw					18934X4	18934X8	18954X4	18954X8	18954X9	18964X4	18964X8	18964X9	18974X4	18974X8	18974X9
Weight, approx.				[kg]	1.0	1.2	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	18955X4	18955X8	18955X9	18965X4	18965X8	18965X9	18975X4	18975X8	18975X9
Swing direction ccw					18936X4	18936X8	18956X4	18956X8	18956X9	18966X4	18966X8	18966X9	18976X4	18976X8	18976X9
Weight, approx.				[kg]	1.2	1.4	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
 90° **18XX0X0X**
 60° **18XX0X2X**
 45° **18XX0X3X**
With metallic wiper** **189XXXM** (see also page 6)

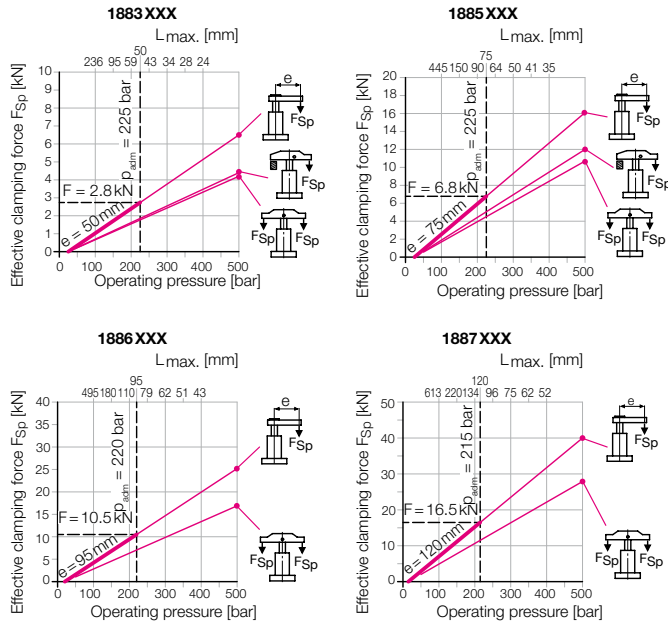
Key
 Without swing angle (0°)
 Flange with G1/4 **18XX24X**
 Threaded-body type **18XX44X**
 Flange with O-ring sealing **18XX64X**

* only single acting
 ** only double acting
 *** with clamping arm assembly 0354.004 +3 mm
 **** Upper edge nut
 ***** without/with metallic wiper

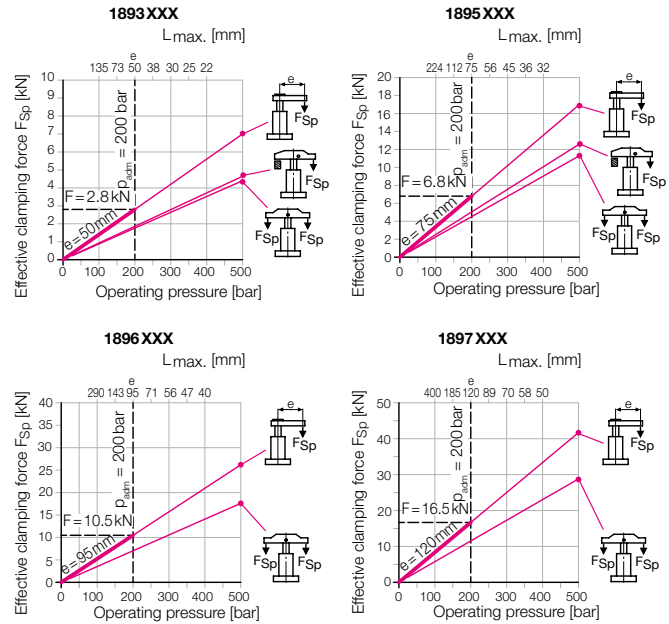
Available on request: • Other swing angles • FKM seals • Without overload protection

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

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

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

Admissible clamping force *

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

Admissible operating pressure

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

L = Clamping arm length [mm]

p = Pressure [bar]

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

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

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

Example

Swing clamp single acting 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

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

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

Clamping force diagrams

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

1. Clamping arm complete (L = e)

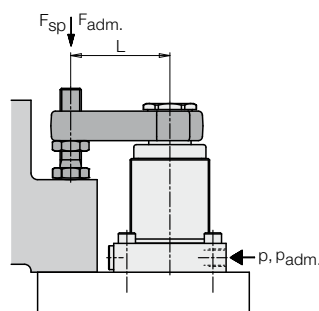
The clamping force can be read off up to the maximum operating pressure.

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.



Double-acting swing clamps

Effective clamping force

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

Admissible clamping force*

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

Admissible operating pressure

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

L = Clamping arm length [mm]

p = Pressure [bar]

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

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

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

Example

Swing clamp double acting 1895 104
Accessory clamping arm e = 75 mm
Desired special length L = 150 mm

1. Admissible clamping force

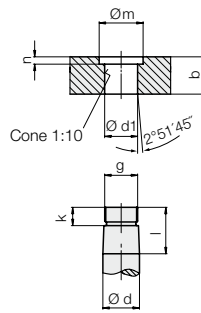
$$F_{adm} = \frac{C}{L} = \frac{510}{150} = 3.4 \text{ kN}$$

2. Admissible operating pressure

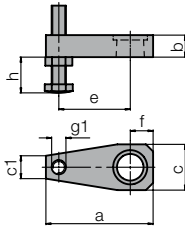
$$p_{adm} = \frac{D}{L} + E = \frac{11273}{150} + 49.7 = 125 \text{ bar}$$

Accessory - Clamping Arm Admissible Flow Rate • Calculation

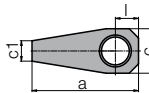
Dimensions for special clamping arms



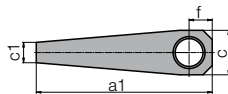
Clamping arm with contact bolt (200 bar)



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
Ød f7	[mm]	20	32	40	50
Ød1 +0.05	[mm]	19.85	31.85	39.85	49.85
e	[mm]	50	75	95	120
f	[mm]	16	25	30	40
g	[mm]	M18x1.5	M28x1.5	M35x1.5	M45x1.5
g1	[mm]	M10	M16	M16	M20
h min...max	[mm]	10...64	15...79	15...79	19...98
k	[mm]	10	12	12	13
l	[mm]	21	28	34	40
Øm	[mm]	24	34	46	56
n	[mm]	4	5	5	6

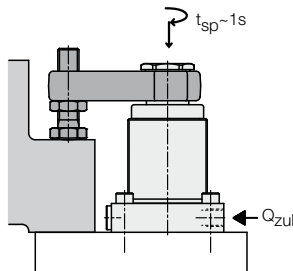
Part no. Clamping arm

with contact bolt	0354 001	0354 003	0354 042	0354 005
Weight, approx. [kg]	0.26	0.8	1.3	2.7
Moment of inertia of J_e [kg·m ²]	0.00032	0.002295	0.005212	0.017184
without thread g1	3921 016	3921 017	3921 021	3921 018
Weight, approx. [kg]	0.18	0.65	1.85	2.3
Moment of inertia [kg·m ²]	0.00018	0.00134	0.00387	0.01294
Blank	3548 901	3548 902	3548 903	3548 904
Weight, approx. [kg]	0.36	1.15	2.1	4.4
Moment of inertia [kg·m ²]	0.00043	0.00798	0.02343	0.07863

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

Admissible flow rate*

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



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

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

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

Q_L = Flow rate with special clamping arm

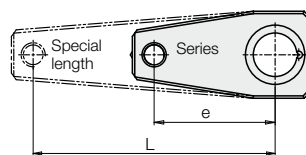
Q_e = Flow rate as per chart (page 3)

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

J_L = Moment of inertia special clamping arm

Simplified calculation

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



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

Swing clamp 1895 104

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

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

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

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

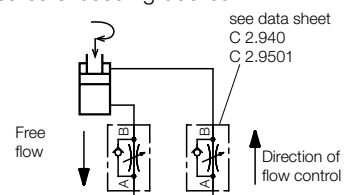
$$2. \text{ Flow rate factor as per diagram } \rightarrow y = 0.35$$

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

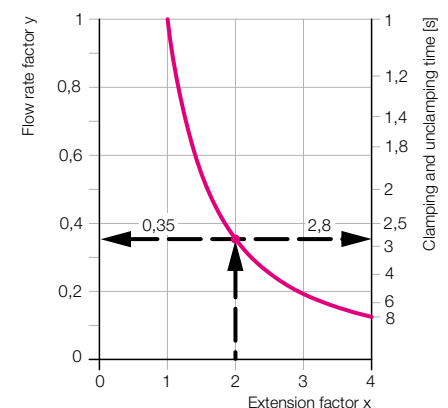
$$4. \text{ Min. clamping time as per diagram } \rightarrow \text{approx. } 2.8 \text{ s}$$

Throttling of the flow rate

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



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



* Only for vertical mounting position!

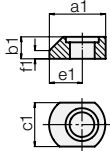
Operating conditions, tolerances and other data see data sheet A 0.100

Accessory – Clamping Arm

Clamping Arm Assembly • Double Clamping Arm • Flanged Nut • Wiper System

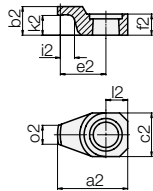
Clamping arm short

42CrMo4, max. 500 bar



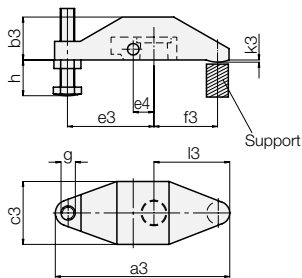
Cranked clamping arm

42CrMo4, max. 300 bar



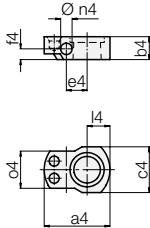
Clamping arm assembly complete with carrier

GGG 40, max. 500 bar



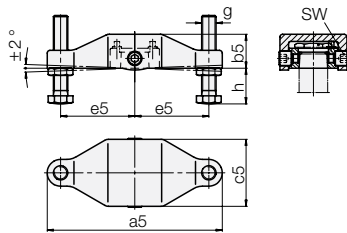
Carrier for clamping arm assembly

42CrMo4



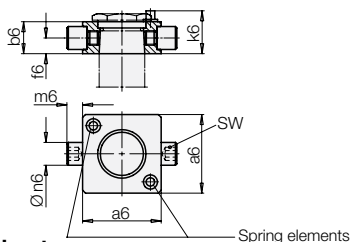
Double clamping arm complete with carrier

GGG 40, max. 500 bar

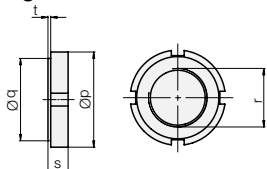


Carrier for double clamping arm

42CrMo4



Flanged nut



Swing clamps

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

Part no.

Clamping arm short		3548 159	3548 165	3548 304	3548 163
Weight, approx.	[kg]	0.05	0.23	0.5	0.88
Cranked clamping arm		3548 238	3548 236	3548 301	3548 302
Weight, approx.	[kg]	0.11	0.3	0.84	1.3
Clamping arm assembly complete		0354 000	0354 002		
Weight, approx.	[kg]	0.66	1.7		
Carrier for clamping arm assembly		3542 093	3542 094	3542 132	3542 096
Weight, approx.	[kg]	0.08	0.18	0.5	0.7
Double clamping arm		0354 131	0354 132	0354 133	0354 134
Weight, approx.	[kg]	0.9	2	3	5.3
Carrier for double clamping arm*		0354 141	0354 142	0354 143	0354 144
Weight, approx.	[kg]	0.21	0.46	0.67	1.4
Flanged nut		3527 020	3527 021	3527 049	3527 022
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

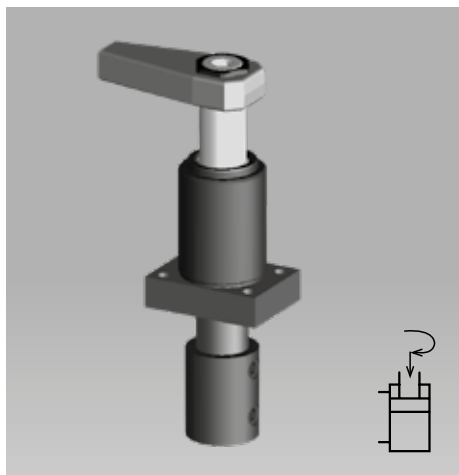


Figure with position monitoring

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

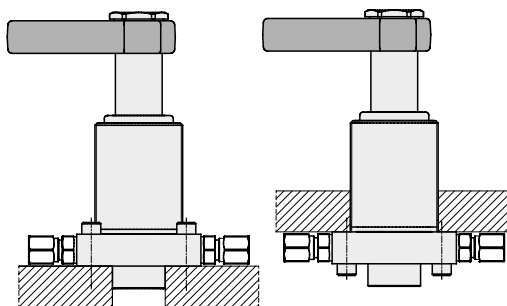
4. Further types of bodies

Flange at the top: data sheet B 1.8801

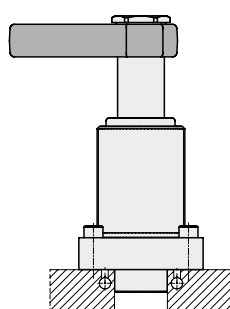
Threaded-body type: data sheet B 1.8921

Connecting possibilities

Pipe thread

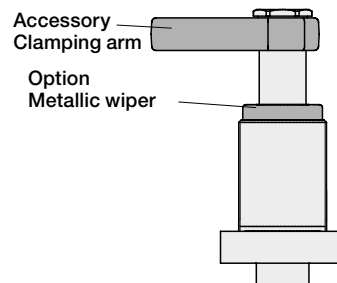


Drilled channels

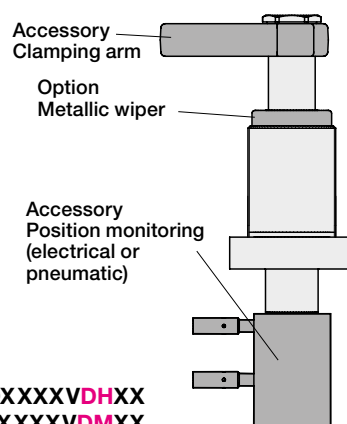


Versions

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.

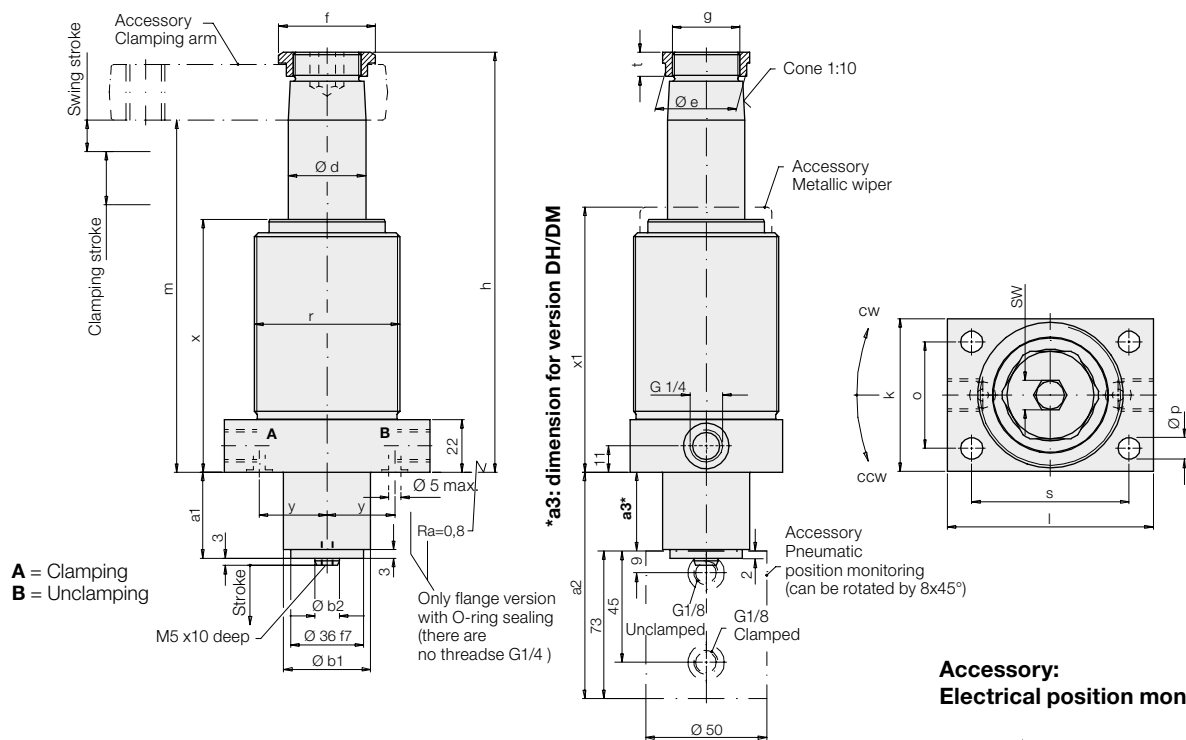
For interpretation of the pneumatic pressure we recommend to use a differential switch.

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.

Dimensions

Technical Data • Accessories



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

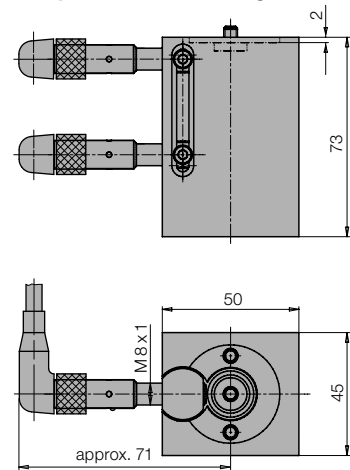
XX: Version

DH/DM = without/with metallic wiper without switch rod
MH/MM = without/with metallic wiper with switch rod

Accessories

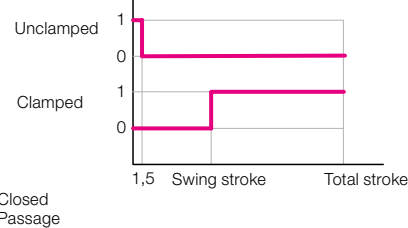
Pneumatic position monitoring, complete	0353808	0353809	0353810
Electrical position monitoring			
- without switch	0353815	0353813	0353813
- with standard switch and angle plug	0353814	0353811	0353811
Metallic wiper, complete (spare part)	0341100	0341101	0341102

Accessory: Electrical position monitoring



Function charts

Pneumatic monitoring



Electrical monitoring



Code number for available swing angles

Swing angle (± 1°)	Part no.
90°	189X X0X VXXXX
60°	189X X2X VXXXX
45°	189X X3X VXXXX



Swing Clamps with Reinforced Swing Mechanism

bottom flange, position monitoring optional,
pendulum eye/fork head, max. operating pressure 500/160 bar



Advantages

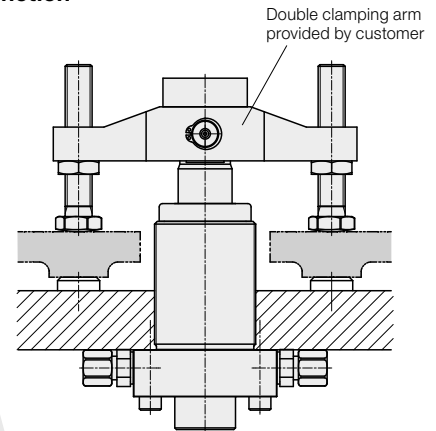
- Introduction of clamping force without side loads
- Compact design
- Double clamping arm facilitates multiple clamping of similar workpieces
- Pendulum eye for high clamping forces
- Fork head for simple clamping arms
- Alternatively pipe thread or drilled channels
- Reinforced swing mechanism
- FKM wiper standard
- Available with position monitoring

Connecting possibilities

- Pipe thread
- Drilled channels

Metallic wiper optional

Function



Double clamping arm provided by customer

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.

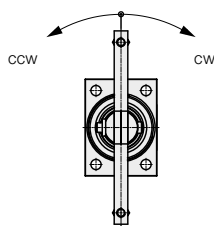
The version with pendulum eye or fork head allows simultaneous clamping of two workpieces with half clamping force.

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.



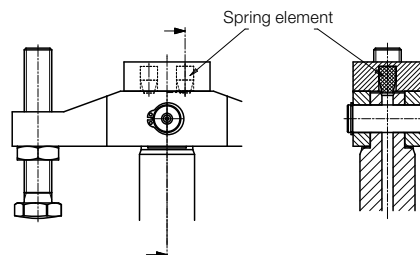
Description

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.

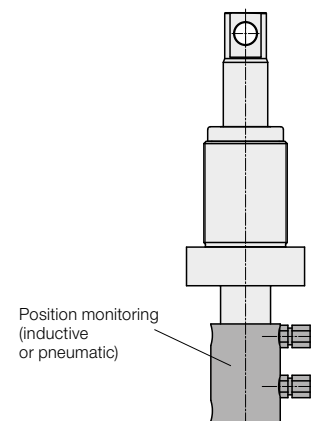
For both versions a springy element is required in order to maintain the double clamping arm in the unclamped position in horizontal position.

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.



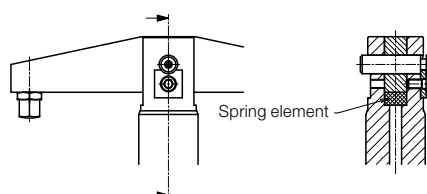
Swing clamp with optional position monitoring (accessory)



Position monitoring (inductive or pneumatic)

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 available metallic wiper protects the FKM wiper against mechanical damage due to big or hot swarfs.

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.

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).

Technical Data

		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 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)		0341 107	0341 100
O-Ring 8x1.5		3000 343	3000 343
Screw plug G 1/4		3610 264	3610 264

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:

$$Q_2 = Q_1 \times \sqrt{\frac{J_1}{J_2}} \quad [\text{cm}^3/\text{s}]$$

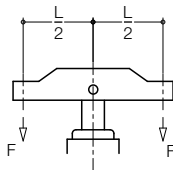
Q_1 = Adm. flow rate (chart value)

Q_2 = Adm. flow rate with the moment of inertia of the new clamping arm J_2

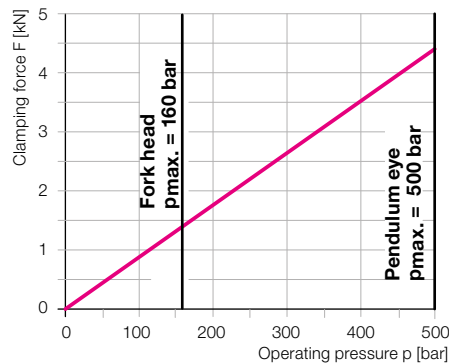
J_1 = Moment of inertia (chart value)

J_2 = Moment of inertia of the new clamping arm

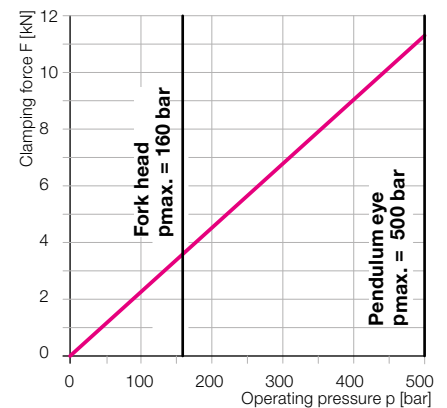
Clamping force F as a function of the operating pressure p



1893 1XXXX



1895 1XXXX



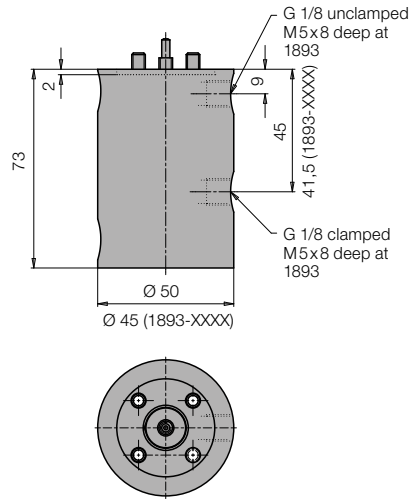
Delivery

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.

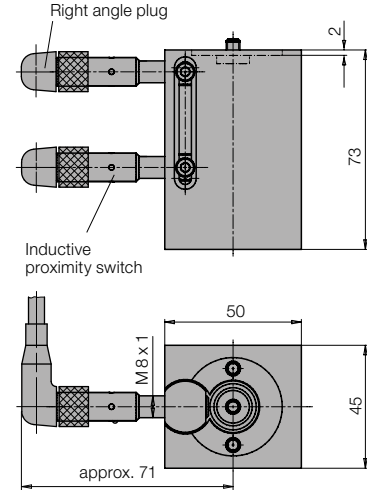
The housings can be mounted rotated by 2x180° (1893) or 8x45°.

Pneumatic position monitoring

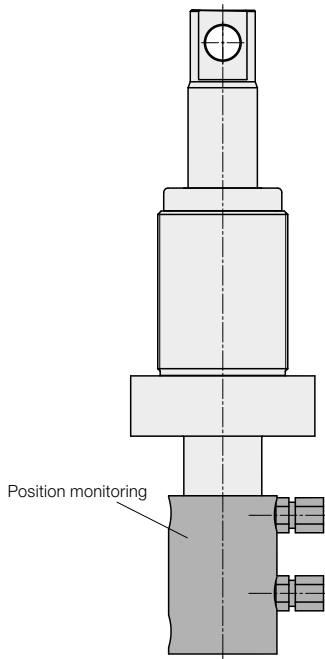


	for 1893	for 1895
Part no.	0353867	0353808

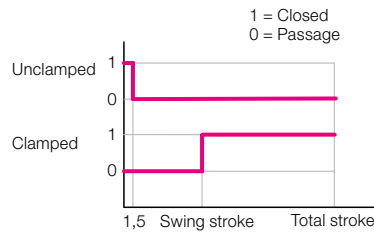
Electrical position monitoring



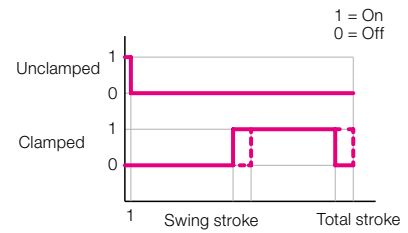
	for 1893	for 1895
Part no.	0353868	0353814



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 work-piece 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.

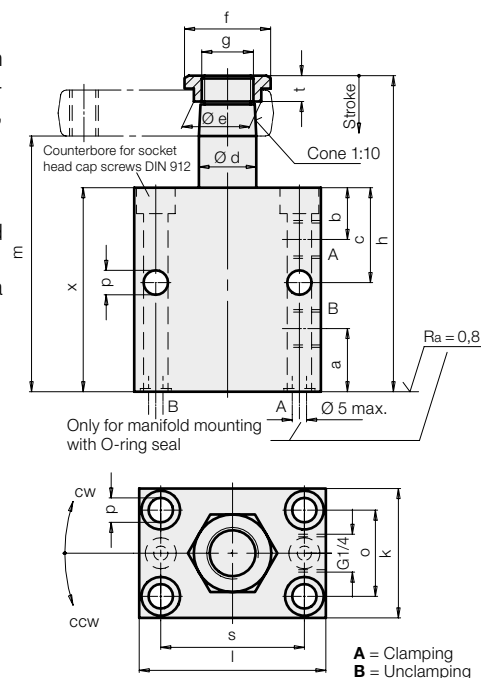
Overload protection device

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.



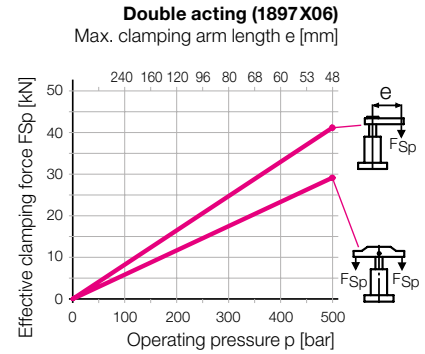
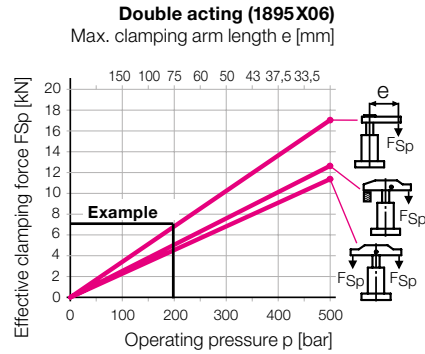
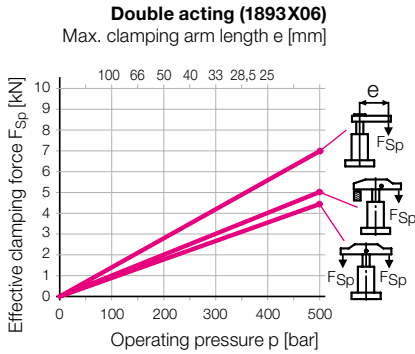
Total stroke	[mm]	14	16	20
Swing stroke	[mm]	7	8	9
Clamping stroke	[mm]	7	8	11
Operating pressure	[bar]	30	30	30
Max. oil flow rate*	[cm³/s]	3.2	10	27.7
Oil volume / stroke	[cm³]	2.5	7.3	23
Oil volume / return stroke	[cm³]	6.8	20	62
a	[mm]	22	25	26
b	[mm]	18	24	30
c	[mm]	33	40	50
Ø d	[mm]	20	32	50
Ø 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		

Code numbers for available swing angles

Swing angle	Part no.
90°	189XX06
60°	189XX26
45°	189XX36

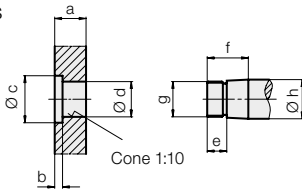
* The max. oil flow rate is valid for vertical mounting position in connection with standard clamping arms. In the case that other mounting positions and/or other clamping arms are used, the oil flow rate has to be reduced as necessary. A possibly required flow control **has to be** made by flow control 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



Example: 1895 106 An operating pressure p of 200 bar in connection with standard clamping arm 0354 003 of arm length $L = 75$ mm results in an effective clamping force F_{Sp} of 7 kN.

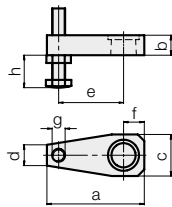
Dimensions
for special
clamping
arms



Swing clamp

	a	b	c	$\varnothing c$	$\varnothing d^{+0.10}_{+0.05}$	e	f	g	$\varnothing h_{17}$
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

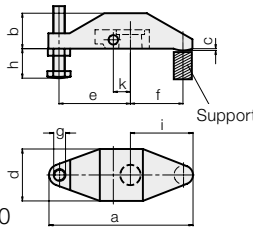
without
thread

Swing clamp

	a	b	c	d	e	f	g	h max.	h min.	Weight [kg]	Part no.
1893XX6	75	16	32	16	50	16				0.18	3921016
1895XX6	115	23	48	22	75	25				0.65	3921017
1897XX6	178	34	78	40	120	40				2.3	3921018

Material: 42CrMo4

Clamping strap
assembly,
complete,
with carrier,
max. 500 bar

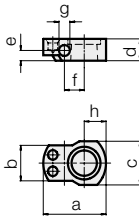


Swing clamp

	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

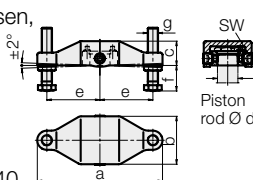


Swing clamp

	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



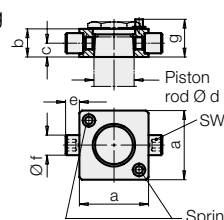
Piston
rod $\varnothing d$

Swing clamp

	a	b	c	$\varnothing d$	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



Piston
rod $\varnothing d$

Spring elements

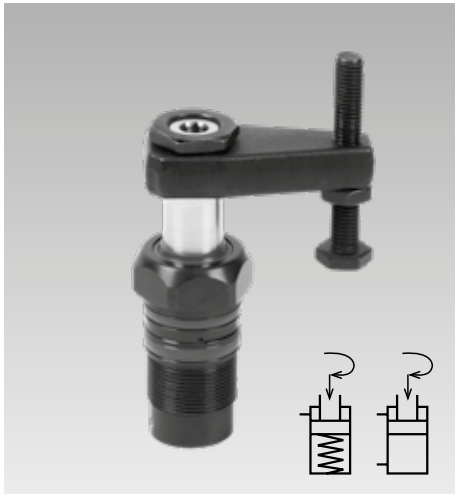
Swing clamp

	a ± 0.1	b	c	$\varnothing d$	e	$\varnothing f^{g6}$	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

Material:
42CrMo4

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 $90^\circ \pm 2^\circ$. 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.

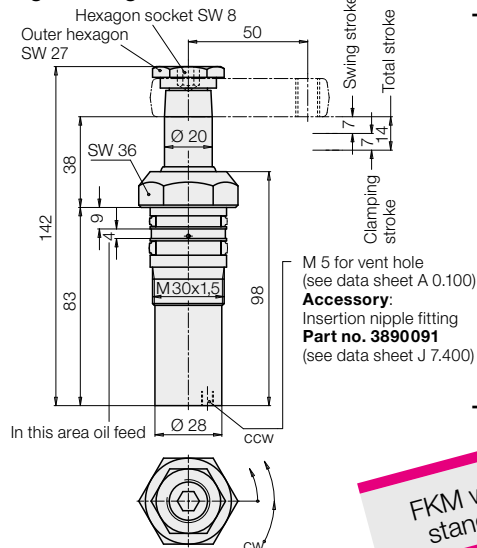
Important notes

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.

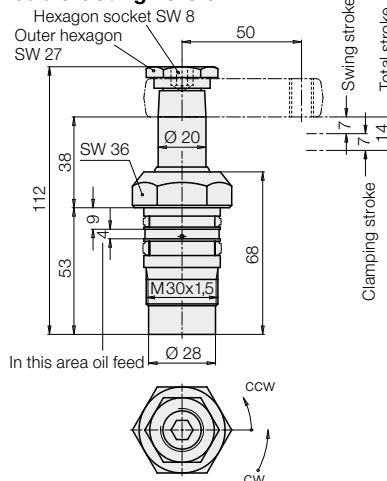
Operating conditions, tolerances and other data
see data sheet A 0.100.

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



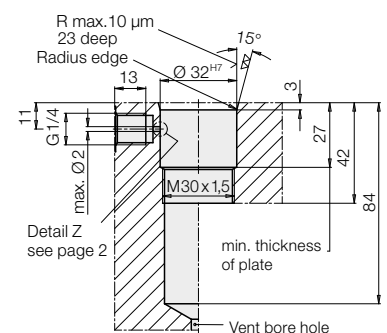
Effective piston area	1.01 cm ²
Piston area ratio	◇ 4,1
Swing stroke	7 mm
Clamping stroke	7 mm
Total stroke	14 mm
Oil volume / stroke	1.5 cm ³
Oil volume / return stroke	6 cm ³
Max. oil flow rate*	1.5 cm ³ /s
Seating torque	60 Nm
Min. actuation pressure to swing	◇ 30 bar 50 bar
Single acting	Part no.
Swing direction 90° cw **	1881 102
Swing direction 90° ccw**	1881 202
0-degree	1881 242
Double acting	Part no.
Swing direction 90° cw**	1891 101
Swing direction 90° ccw**	1891 201
0-degree	1891 241
Seal kit, external seals	0131 530
◇ valid for double-acting version	

* Max. oil flow rate

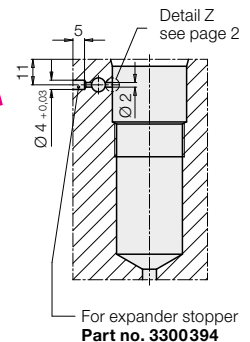
Max. Oil Flow Rate
In case of the maximum oil flow rate as per chart the shortest possible clamping time is 1 second. If the flow rate of the pump divided by the number of swing clamps is higher than the indicated value in the chart, the flow rate has to be throttled to avoid any overload and thereby 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

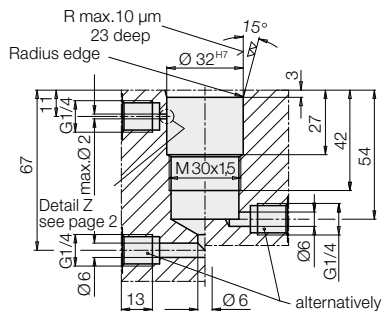
Single-acting version – Individual connection



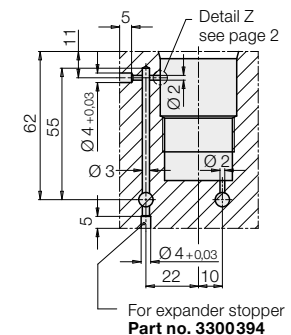
- **Series connection**



Double-acting version – Individual connection



- Series connection



Code numbers for available swing angles

** Swing angle	Part no.
90°	18X1X0X
60°	18X1X2X
45°	18X1X3X

Mounting Instructions Accessories

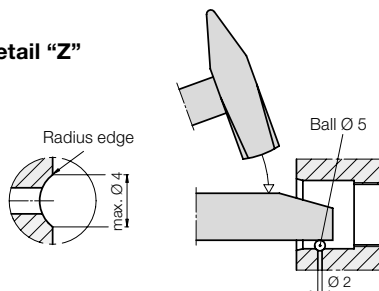
Mounting instructions

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:

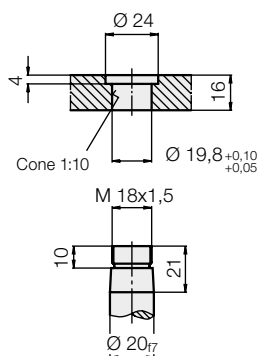
1. By means of a diameter 6 spherical grinder and a hand drill, the thread is deburred according to detail "Z".
2. A diameter 5 steel ball is gauged with a light hammer blow as shown in the figure below.

A final check with a finger shows best whether the transitions are smooth and free of burrs.

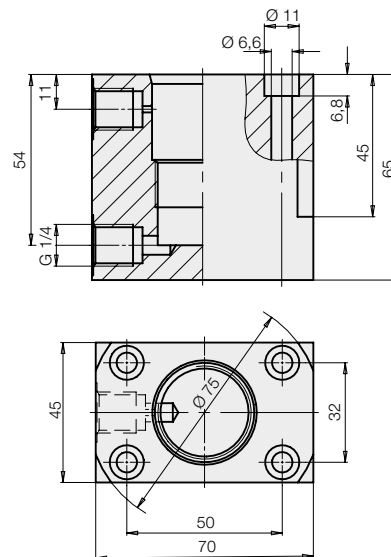
Detail "Z"



Strap attachment dimensions



Connecting housing for double acting swing clamp Part no. 3467 143



Clamping arm



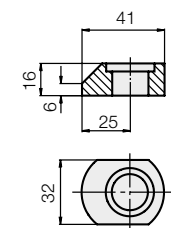
Clamping arm, complete



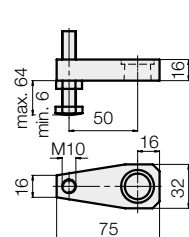
Clamping strap, complete



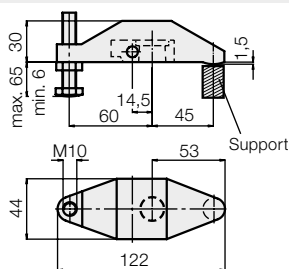
Double clamping arm assembly, complete



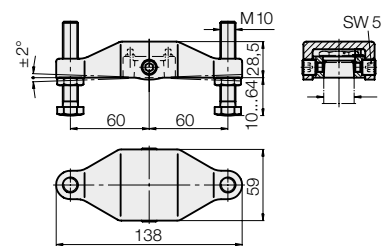
Weight [kg] 0.08
Part no. 3548 159



Weight [kg] 0.2
Part no. 0354001
Weight [kg] 0.18
Part no. 3921016
(without thread M 10)



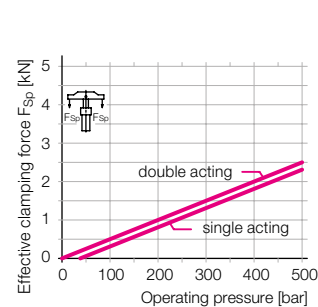
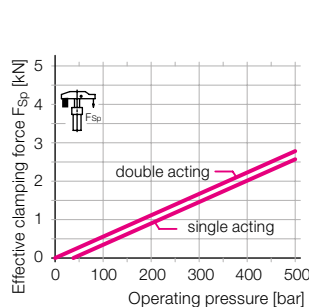
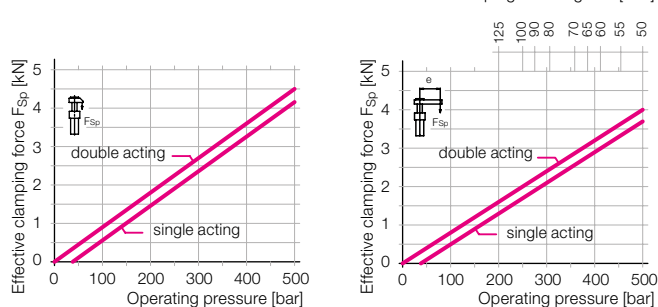
Weight [kg] 0.57
Part no. 0354000



Weight [kg] 0.83
Part no. 0354131

Effective clamping force as a function of max. operating pressure p

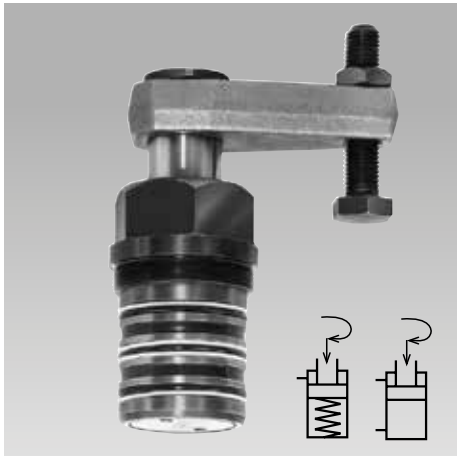
Max. clamping arm length e [mm]





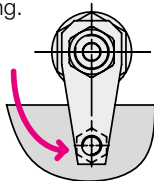
Swing Clamps with Overload Protection Device

threaded-body type, single and double acting,
max. operating pressure 500 bar



Application

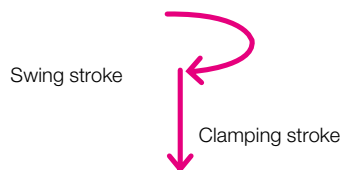
Hydraulic swing clamps are used for clamping of workpieces when it is essential to keep the clamping area free of straps and clamping components for unrestricted workpiece loading and unloading.



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 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

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

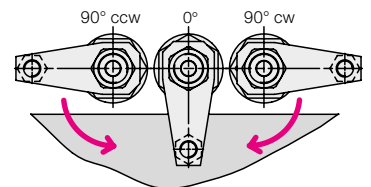
Important notes

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°.

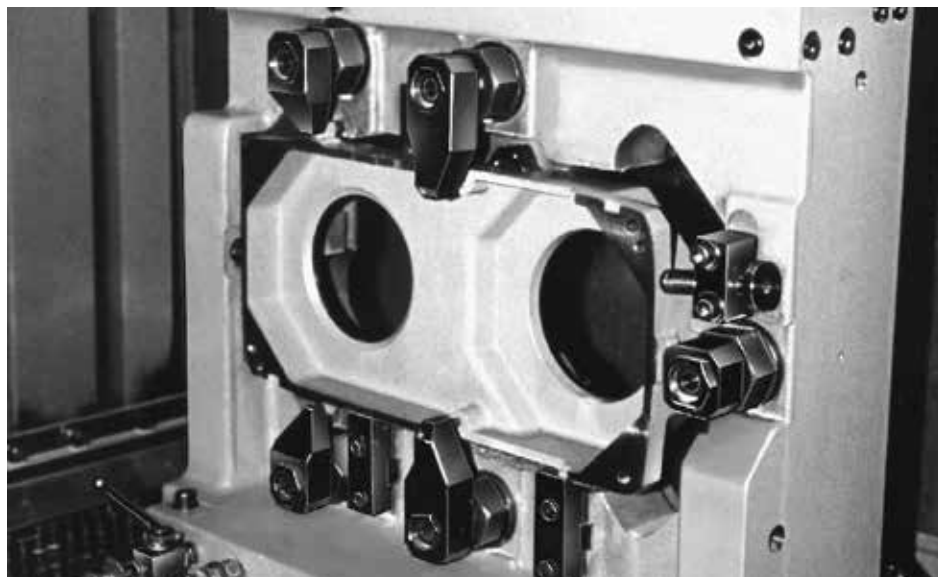
Special angles on request.

Other variants, as e.g. versions with metallic wiper on request.

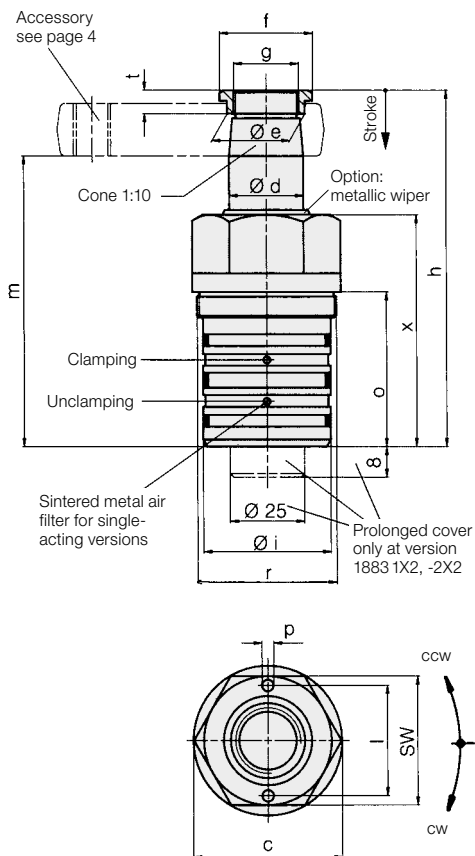
0°-Version

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

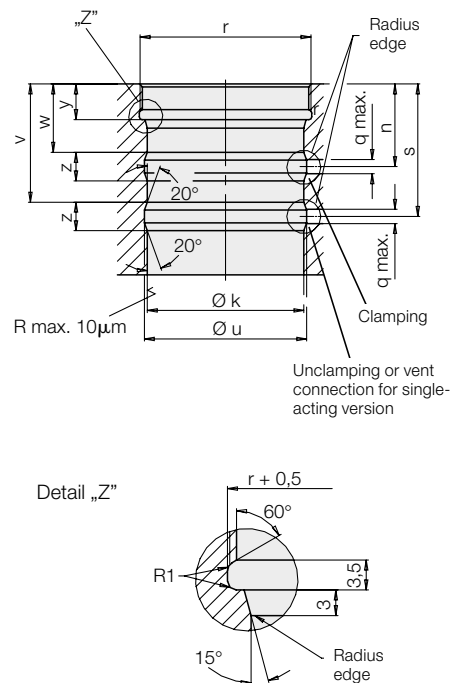
Application example



Dimensions Technical Data



Manifold mounting hole



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)Ø
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

Part no., single acting

Swing direction cw	1883 102	1885 102	1887 102
Swing direction ccw	1883 202	1885 202	1887 202

Part no., double acting

Swing direction cw	1893 101	1895 101	1897 101
Swing direction ccw	1893 201	1895 201	1897 201

Seal kit for external seals	0131 524	0131 526	0131 528
-----------------------------	-----------------	-----------------	-----------------

Other swing angles

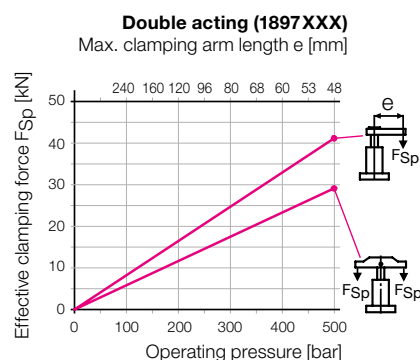
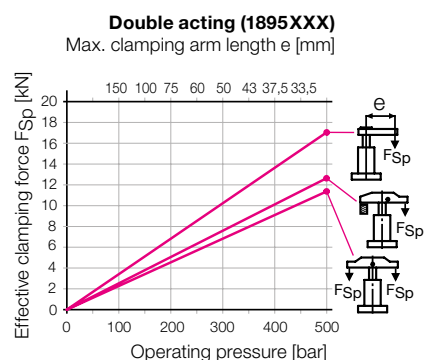
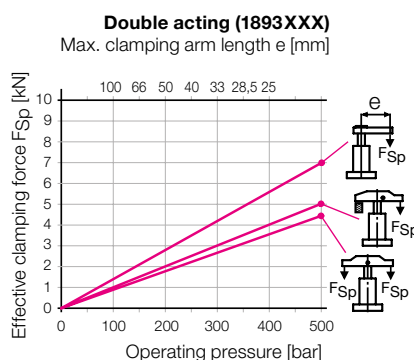
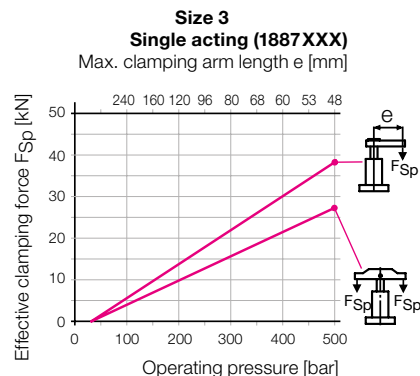
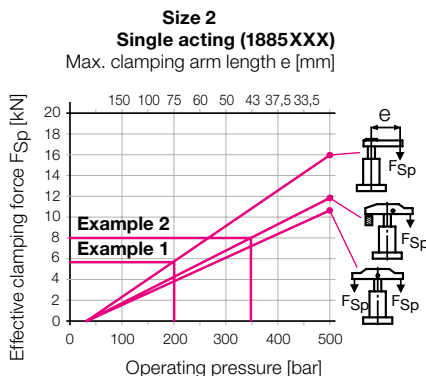
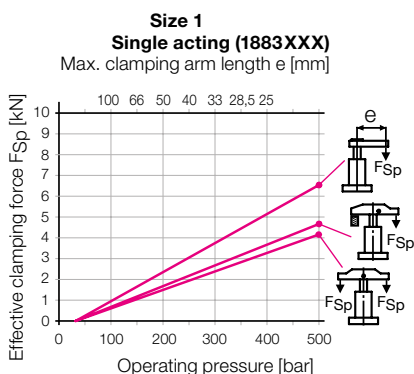
Swing angle	Part no.
90°	18XX X0X
60°	18XX X2X
45°	18XX X3X
0°	18XX 14X

Ø (145-1) for clamping arm 0354 004

* 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



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 0354003 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 0354002 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

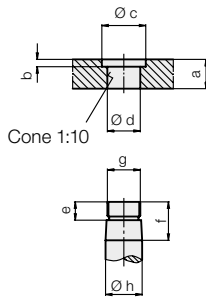
The spring area of single-acting swing clamps has to be vented to avoid problems in functioning. A sintered metal air filter avoids penetration of contaminations. If there is a possibility that cutting lubricants and coolants penetrate through the sintered metal air filter into the cylinder's interior, 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.

Accessories

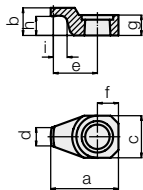
Dimensions
for special
clamping arms



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

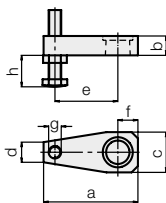


Swing clamp

	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

Material: 42CrMo4

Clamping arm
assembly,
complete,
max. 200 bar



with
thread
without
thread

Swing clamp

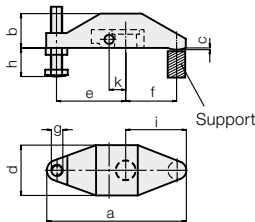
	a	b	c	d	e	f	g	h max.	h min.	Weight [kg]	Part no.
18X3XXX	75	16	32	16	50	16	M10	64	6	0.2	0354001
18X5XXX	115	23	48	22	75	25	M16	79	9	0.7	0354003
18X7XXX	178	34	78	40	120	40	M20	98	12	2.55	0354005

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

Material: 42CrMo4

Clamping strap
assembly,
complete,
with carrier,
max. 500 bar

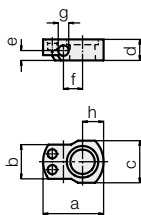


Swing clamp

	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 for special
clamping strap

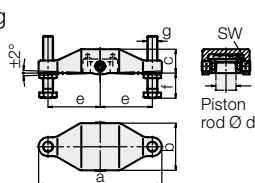


Swing clamp

	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

Material: 42CrMo4

Double clamping
arm assembly,
complete,
with carrier,
max. 500 bar

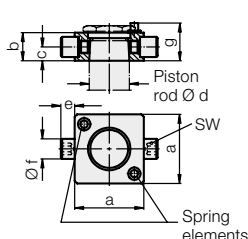


Swing clamp

	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
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
18X7XXX	77	34	17	50	15	20	41	8	0354144

* Stop surface for spring elements

Material: 42CrMo4



Swing Clamps with Reinforced Swing Mechanism

threaded-body type, position monitoring optional,
double acting, max. operating pressure 500 bar

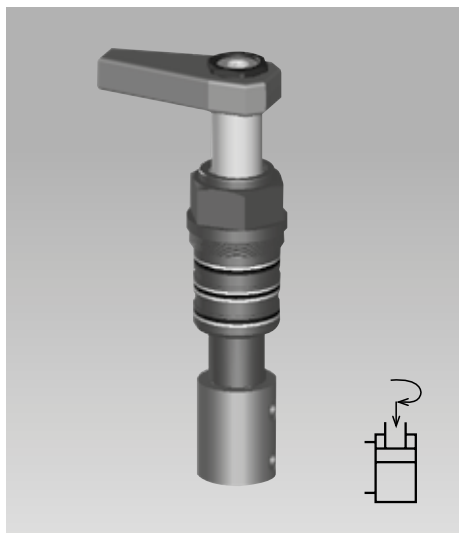


Figure with position monitoring

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

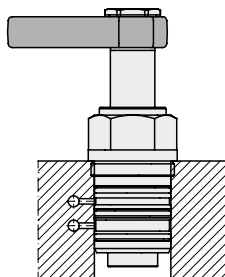
Description

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

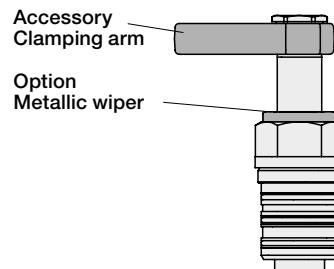
Connecting possibility

Drilled channels

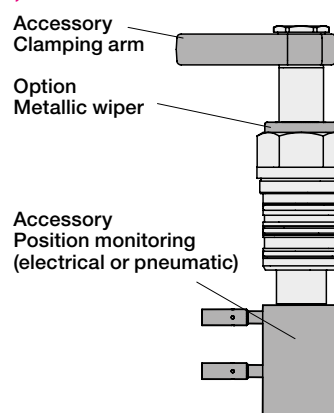


Ausführungen

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.

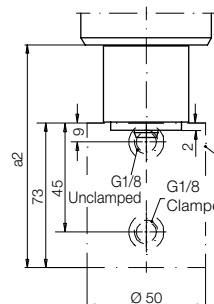
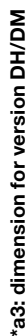
For interpretation of the pneumatic pressure we recommend to use a differential switch.

Parallel connection for up to 8 swing clamps is possible. For a greater number there are special solutions. Please contact us.

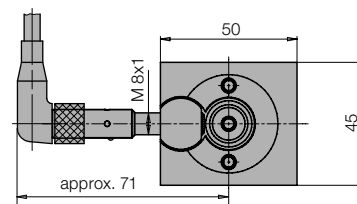
Further important notes see data sheet B 1.892.

Dimensions

Technical Data • Accessories



Accessory:
Electrical position monitoring



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

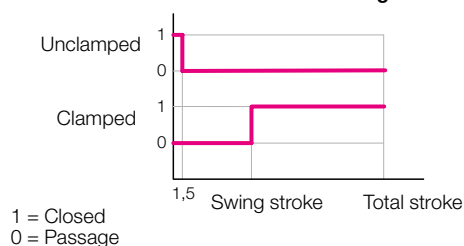
XX: Version **DH/DM** = without/with metallic wiper without switch rod
 MH/MM = without/with metallic wiper with switch rod

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)	0341 100	0341 102

Function charts

Pneumatic monitoring



1 = Closed
0 = Passage

Electrical monitoring



Code numbers for available swing angles	
Swing angle ($\pm 1^\circ$)	Part no.

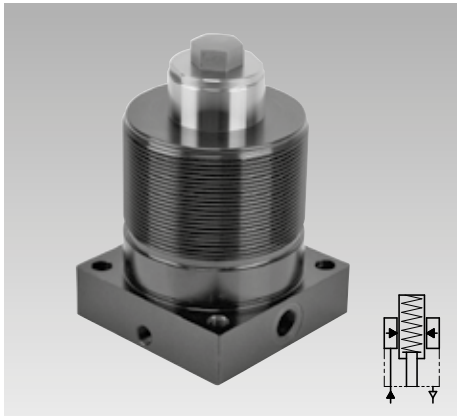
90°	189X00VXXXX
60°	189X02VXXXX
45°	189X03VXXXX

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.

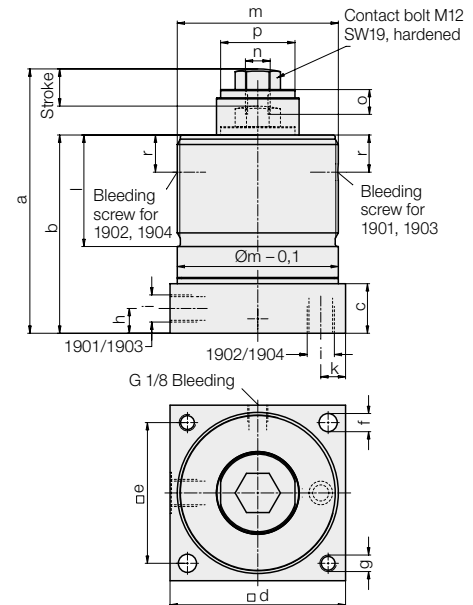
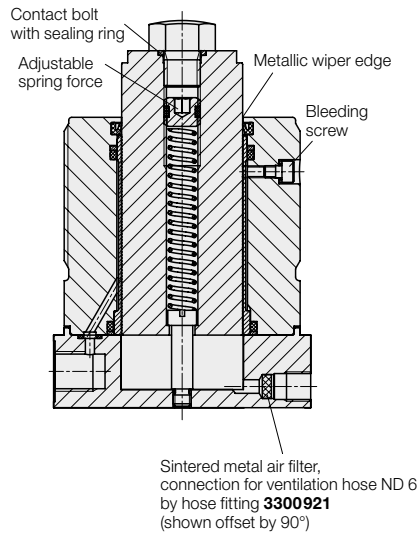
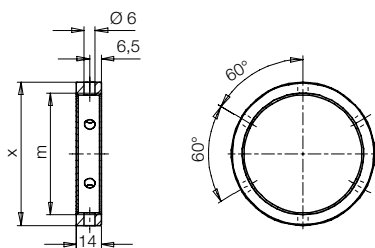
In dry machining applications, with minimum quantity lubrication or in case of accumulation of very small swarf, there can be a swarf holdup in the area of the metallic wiper edge.

Remedy: Regular cleaning.

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

Accessory

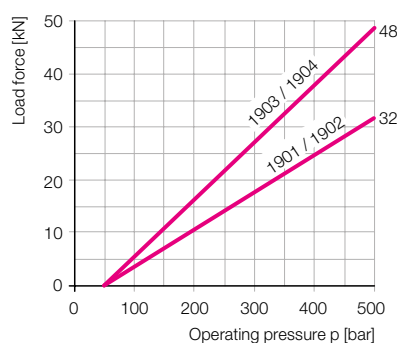
Capstan nut



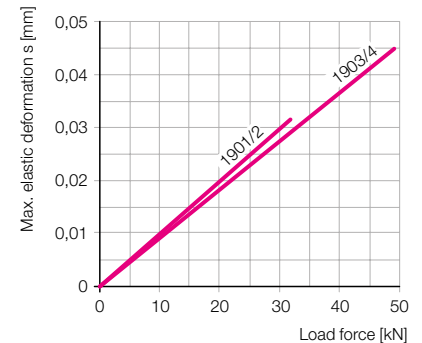
Connection		at the side	at the bottom	at the side	at the bottom
Bolt Ø	[mm]	32	32	40	40
Stroke	$\begin{smallmatrix} +0.8 \\ -0.6 \end{smallmatrix}$ [mm]	16	16	18	18
Adm. load force	[kN]	32	32	48	48
Recom. mini. pressure	[bar]	100	100	100	100
a	$\begin{smallmatrix} +1.4 \\ -1.2 \end{smallmatrix}$ [mm]	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



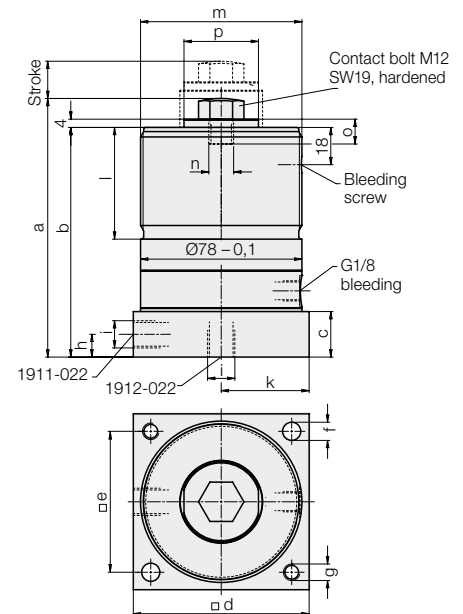
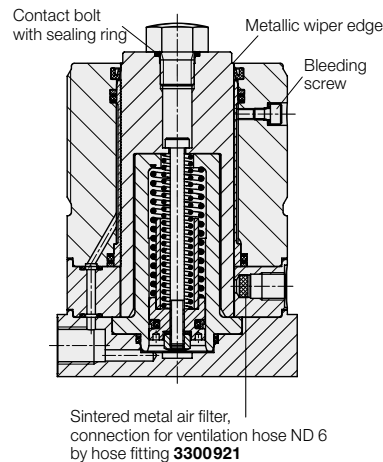
Max. elastic deformations s as a function of support force F max. operating pressure 500 bar





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.

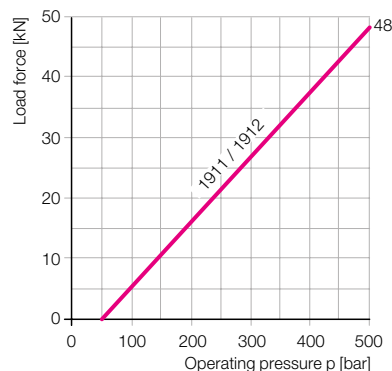
Work supports must only be operated with a sealed contact bolt.

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.

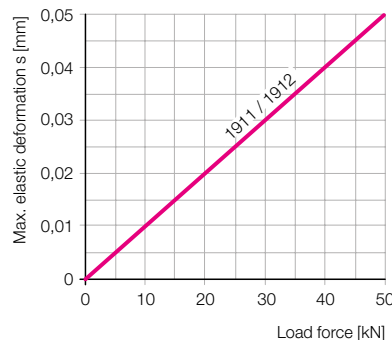
Remedy: Regular cleaning.

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



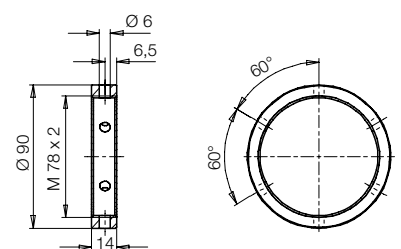
Connection		at the side	at the bottom
Bolt Ø	[mm]	40	40
Stroke	^{+0.4} _{-0.2} [mm]	18	18
Adm. load force	[kN]	48	48
Oil volume/stroke	[cm ³]	5.7	5.7
Max. flow rate	[cm ³ /s]	70	70
Recom. mini. pressure	[bar]	100	100
Plunger contact force	[N]	(60 – 100)*	
a	^{+1.2} _{-0.9} [mm]	125	130.5
b	[mm]	111	116.5
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



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 1911 006, 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.

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.

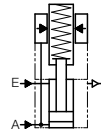
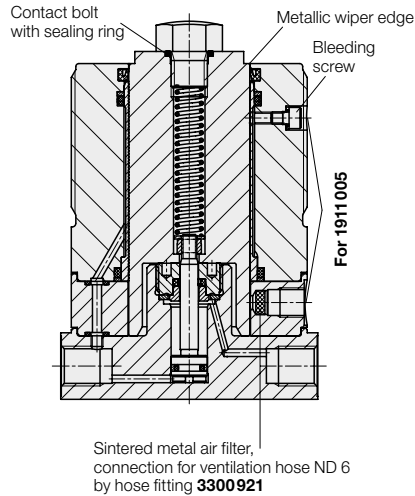
Work supports are not suitable to compensate side loads.

Work supports must only be operated with a sealed contact bolt.

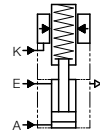
In dry machining applications, with minimum quantity lubrication or in case of accumulation of very small swarf, there can be a swarf holdup in the area of the metallic wiper edge.

Remedy: Regular cleaning.

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



A = Extending
+ Locking
E = Retracting



A = Extending
E = Retracting
K = Locking

Part no.

1911 005

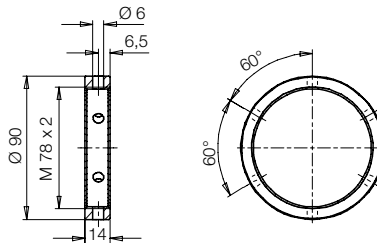
1911 006

Accessories

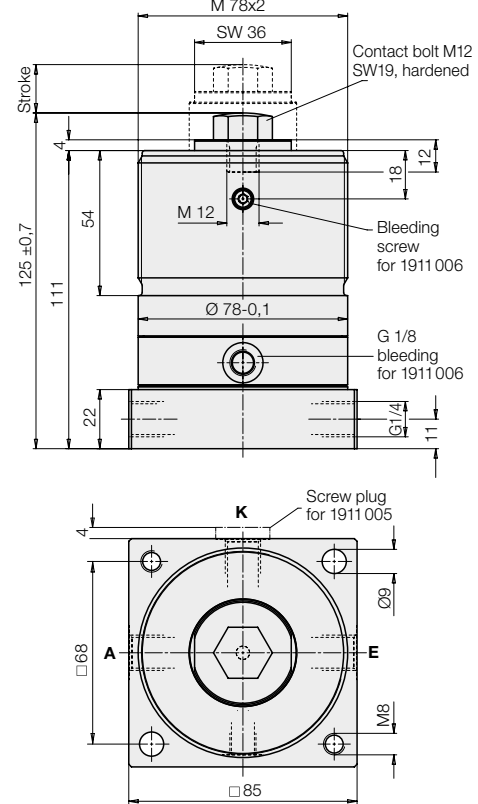
Capstan nut

Part no.

3522007

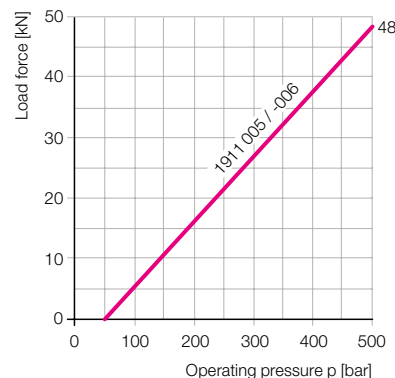


Dimension drawing for 1911 006

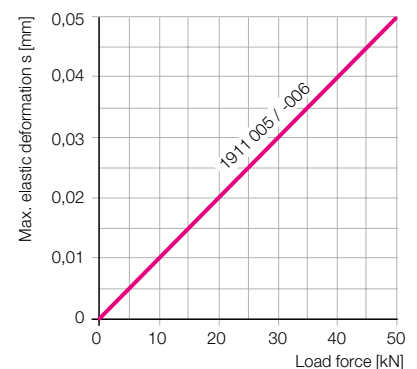


Bolt Ø	[mm]	40
Stroke	[mm]	18 ^{+0.7} _{-0.6}
Adm. load force	100 bar [kN]	5
	500 bar [kN]	48
Plunger contact force	[N]	50 – 100
Recom. mini. pressure supporting	[bar]	100
Recom. mini. pressure retracting	[bar]	20
Oil volume/stroke	[cm ³]	2
Max. flow rate	[cm ³ /s]	25
Weight	[kg]	4.1

Admissible load F as a function of the operating pressure p



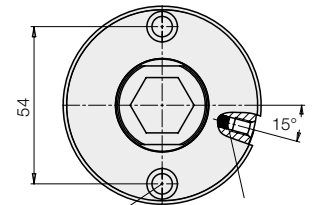
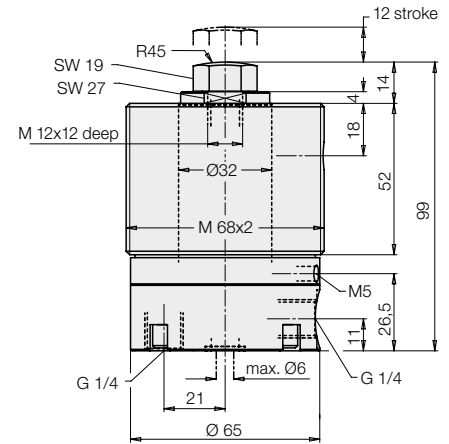
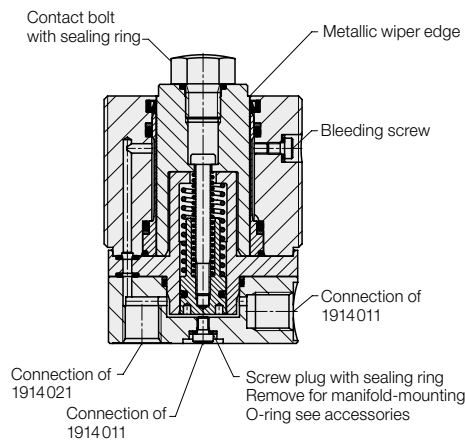
Max. elastic deformations s as a function of support force F





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

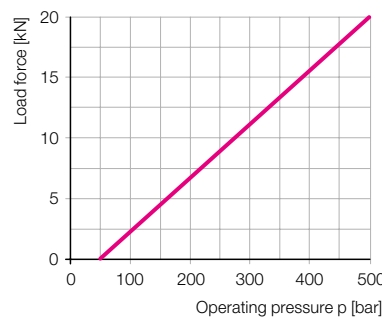
The support plunger is retracted in off-position. When pressurised, the support plunger moves against the inserted workpiece by means of spring force. With increasing oil pressure, the support plunger locks hydraulically. After the system has been unclamped, the support plunger returns to the off-position.

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.

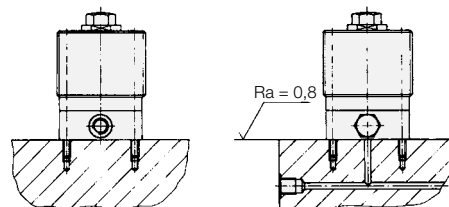
The internal part of the work support is protected against dust and swarf by a sintered metal air filter.

Admissible load F as a function of the operating pressure p



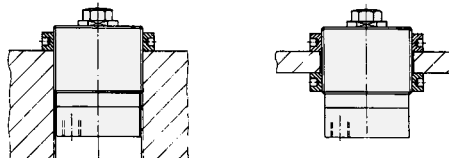
Installation examples 1914011

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	[cm ³]	2.5
Max. flow rate	[cm ³ /s]	35
Recom. minimum pressure	[bar]	100
Elastic deformation with load and 500 bar	[µm/kN]	1.3
Weight	[kg]	2.0

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.

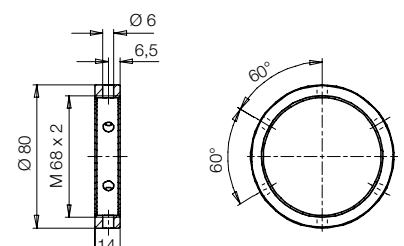
	Part no.
Connection at the side	1914011
Connection at the bottom	1914021

Article available on request

Accessories

O-ring 10x2	3000347
Screw plug G 1/4	3610264
Capstan nut M68x2	3522008
Spare sealing ring (for bleeding screw)	3002847
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



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:

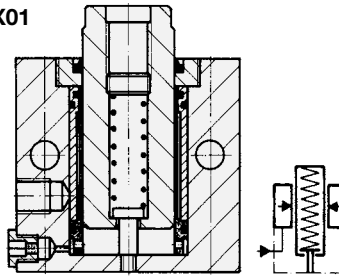
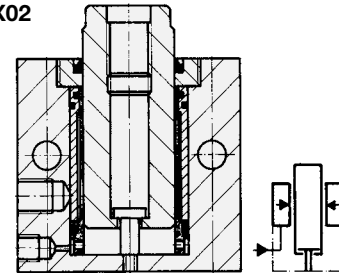
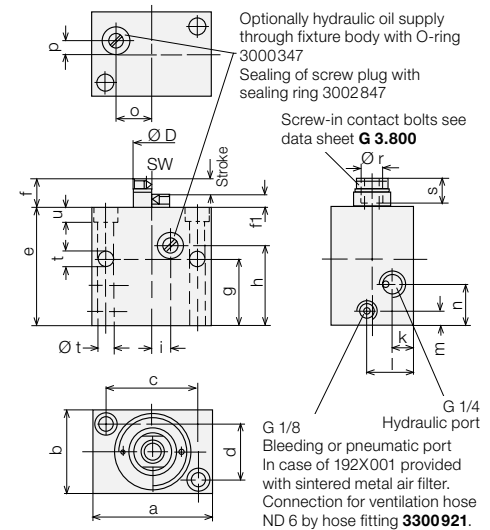
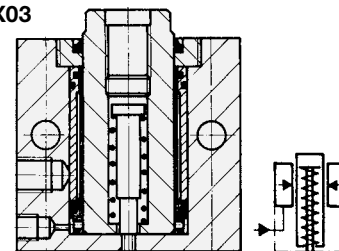
- 1. Spring advanced;** plunger extended in off-position
 - 2. Air pressure advanced;** without spring return
 - 3. Air pressure advanced;** with spring return
- The pneumatically-actuated plunger allows precise setting of the plunger contact force by means of a pressure reducing valve. If a danger exists of sucking fluids through the pneumatic port, on the spring-advanced unit, a vent hose should be connected.

Important notes

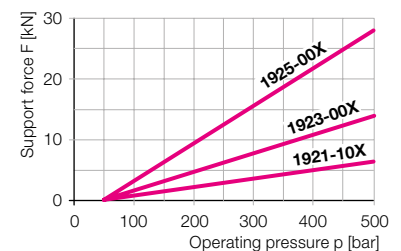
Work supports are not suitable to compensate side loads.

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.

192X X01

192X X02

192X X03


Admissible load F as function of the operating pressure p

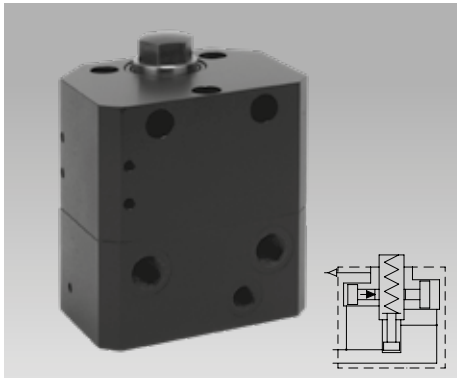


Plunger Ø D	[mm]	16	20	35
Stroke	[mm]	6	8	10
Support force at 500 bar	[kN]	7	12.5	28
Spring force min.	[N]	8	13.5	19.2
Spring force max.	[N]	10	17	24
Plunger contact force at 1 bar air pressure (deduct spring force if necessary)	[N]	20.1	31.4	96.2
Recom. min. oil pressure	[bar]	100	100	100
a	[mm]	60	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		1921 101	1923 001	1925 001
Air pressure		1921 102	1923 002	1925 002
Air pressure with spring return		1921 103	1923 003	1925 003
Accessories Screw plug G 1/4		3610 264	3610 264	3610 264
O-ring 10x2		3000 347	3000 347	3000 347
Spare seal ring		3002 847	3002 847	3002 847
Contact bolt, dome head (see G 3.800)		3614 002	3614 028	3614 003



Work Supports with Fail-Safe Function

with pneumatic position monitoring, 3 sizes, 2 function types, double acting, max. operating pressure 500/400 bar



Fail-safe function

The position of the support plunger is maintained both in the event of pressure drop and a complete pressure loss. This is achieved by a fail-safe clamping of the support plunger.

Application

Hydraulic work supports are used to support workpieces and prevent vibration and deflection during machining.

The hydraulic locking occurs together with hydraulic clamping of the workpiece or independently of it.

Thanks to the fail-safe function, 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 risk of fluids being sucked into the filter, a vent hose has to be connected to the vent port.

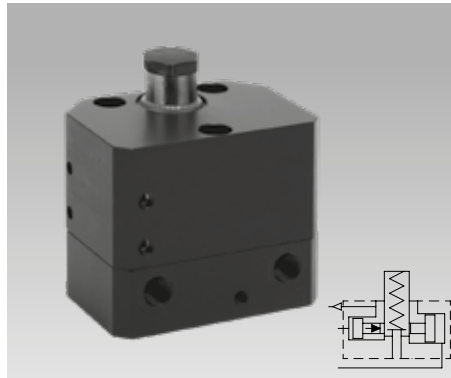
The standard contact bolt in the support plunger protects the interior against contamination. For the use of self-made contact bolts please observe the installation dimensions (see page 4).

The pressure required to unlock the support plunger is the same as that for clamping.

Support and clamping forces must be in alignment, so that there is sufficient force reserve available for the work support to absorb the machining forces (see page 4).

The fail-safe function is not form fit. The introduction of vibrating machining forces must be avoided.

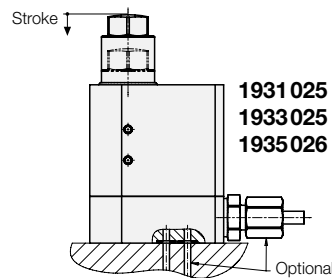
For the admissible load force, see the diagrams (pages 2 and 3).



Function

There are two variants for positioning the support plunger on the workpiece:

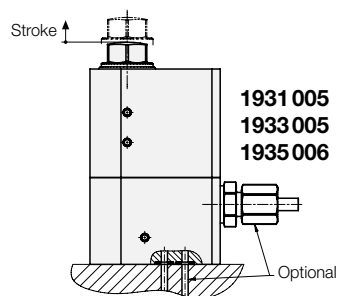
1. Off-position extended



When loading the fixture, the support plunger is pushed back by the workpiece and makes contact with the workpiece by spring force. Hydraulic locking can then be initiated. During unclamping the support plunger will be unlocked and extends with spring force when the workpiece is removed.

Advantage: Compact design

2. Off-position retracted



When pressurising the element, the support plunger extends with spring force against the workpiece. Locking then takes place automatically.

Advantage:

Unimpeded loading and unloading of the clamping fixture!

Advantages

- No yielding on the workpiece even when the pressure drops thanks to the fail-safe 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 work support (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 monitoring as well as hydraulic retraction of the support plunger (193X-00X)
- Mounting position: any
- FKM seals as standard

Application example

Manifold-mounted work support with swing clamp 1893 102 as per data sheet B 1.8803

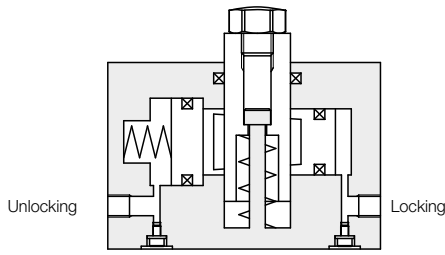


Dimensioning see page 4

Function Type: Spring Force

Off-position Extended • Contact by Spring Force

Functional principle



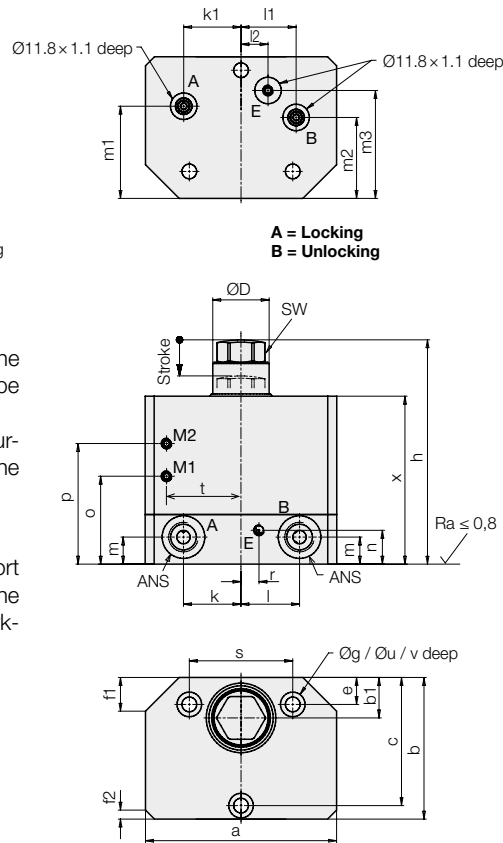
Clamping

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 locks it.

Unclamping

The pressure required to unlock the support plunger is the same as that for clamping. The support plunger makes contact with the workpiece until it is taken out of the fixture.



Notes:

1. Manifold mounting

For manifold mounting remove screw with sealing ring (see bottom) and insert O-ring 9×1.5 (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

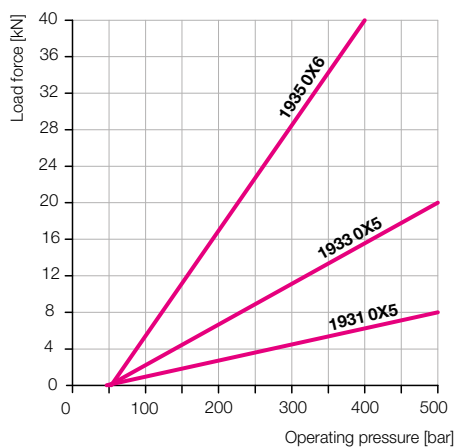
To operate the position monitoring, remove the set screws (M5) and screw in insertion nipple fitting (part no. 3890091) or L insertion nipple fitting (part no. 3890094).

M1 – support plunger retracted, thread M5

M2 – support plunger extended, thread M5

E – do not close bleeding port, thread M5 (see Important notes).

Admissible load force as a function of the operating pressure



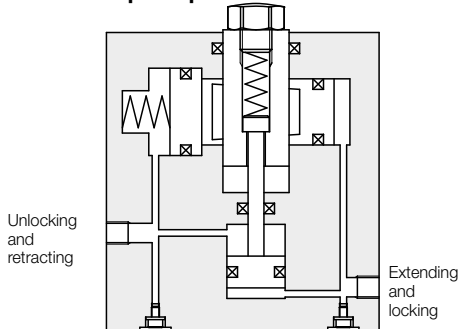
Max. operating pressure	[bar]	500	500	400
Load force at 500/400 bar	[kN]	8	20	40
Support plunger Ø D	[mm]	16	25	40
Stroke of support plunger	[mm]	8	12	20
a	[mm]	70	85	140
Port		G1/8	G1/4	G1/4
b	[mm]	48	63	105
b1	[mm]	13	18	36
c	[mm]	42	57	95
e	[mm]	6	12	16
f1 × 45°	[mm]	10	15	22
f2 × 45°	[mm]	4	4	4
g	[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 force/spring force	[N]	15 to 22	23 to 50	55 to 110
Recommended minimum pressure	[bar]	100	100	100
Max. oil volume stroke/locking	[cm³]	0.2	4.9	7.5
Max. oil volume return stroke	[cm³]	0.3	8.4	11.7
Max. admissible flow rate	[cm³/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.		1931 025	1933 025	1935 026
Accessories (not included in the delivery)				
Part no. O-ring (FKM) 9×1.5		3001 305	3001 305	3001 305
Part no. Plug		3610 263	3610 264	3610 264

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

Function Type: Hydraulic Pressure with Spring Force

Hydraulic Extension • Contact by Spring Force

Functional principle



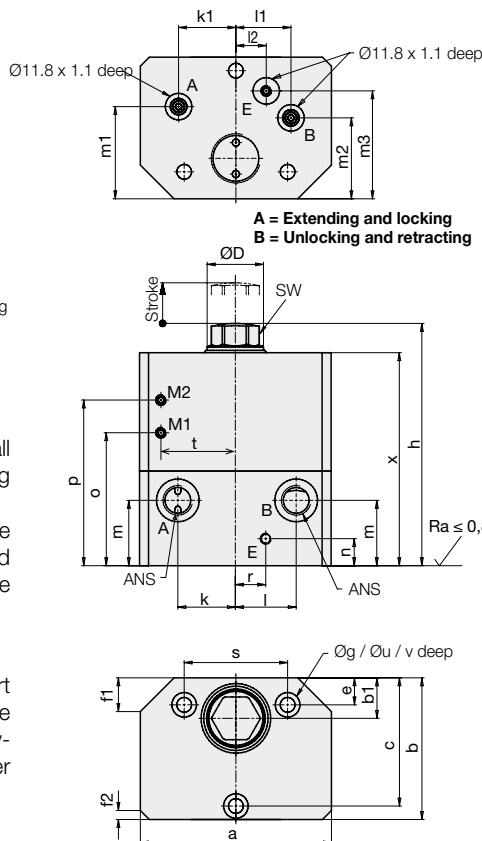
Clamping

The support plunger is extended by the small piston and applied to 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

The pressure required to unlock the support plunger is the same as that for clamping. At the same time the small piston is retracted by hydraulic pressure and takes the support plunger with it.



Notes:

1. Manifold mounting

For manifold mounting remove screw with sealing ring (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

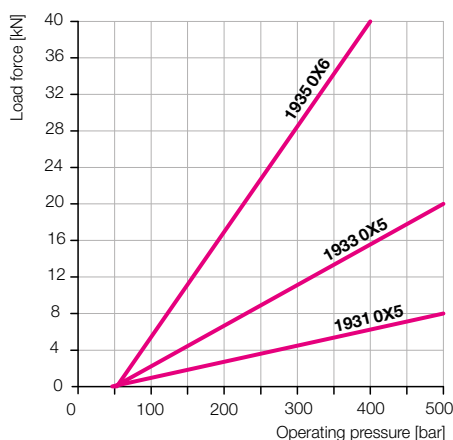
To operate the position monitoring, remove the set screws (M5) and screw in insertion nipple fitting (part no. 3890091) or L insertion nipple fitting (part no. 3890094).

M1 – support plunger retracted, thread M5

M2 – support plunger extended, thread M5

E – do not close bleeding 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 Ø D	[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]	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 force/spring force	[N]	15 to 22	23 to 50	55 to 110
Recommended minimum pressure	[bar]	100	100	100
Max. oil volume stroke/locking	[cm³]	1.8	7.3	11.5
Max. oil volume return stroke	[cm³]	1.6	9.5	14.2
Max. admissible flow rate	[cm³/s]	25	25	25
Max. elastic deformation 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) 9 x 1.5

3001305

3001305

3001305

Part no. plug

3610263

3610264

3610264

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

Combination with Clamping Elements Control/Position Monitoring • Self-manufactured Contact Bolts

Combinations of work supports with swing clamps of the same size

The admissible work support load force has always to be dimensioned so that the clamping force of the clamping elements in use and the static and dynamic machining forces can be safely absorbed.

Admissible load force

- Clamping force
- Safety (reserve)
- = Possible machining force

On principle the work support load force should be at least twice the clamping element clamping force.

Load force $\geq 2 \times$ clamping force

If the total of all occurring forces exceeds the admissible load force, the support plunger of the work support will be pushed back and the work support becomes damaged.

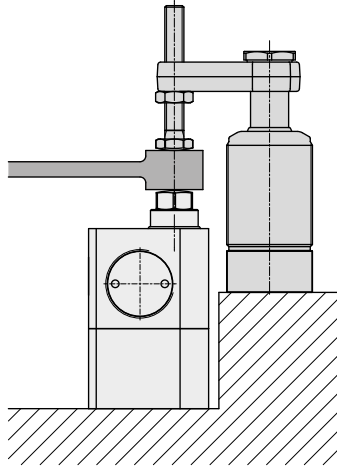
For combinations of work supports with swing clamps (see example), this condition should be met at 200 bar.

There is no suitable swing clamp available for the smallest size 1931. With the swing clamp 1891 XXX the operating pressure would have to amount to 500 bar! For both larger work supports, there are suitable swing clamps as shown in the graphs below.

The vertical distance of the two straight lines in the coloured area indicates the resulting maximum possible machining force including reserve.

Example

Swing clamp 1893 104 (data sheet B 1.881) clamps a workpiece onto work support 1933 005.



For size 1933 the following can be seen on the chart:

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: 3.8 kN
(including reserve)

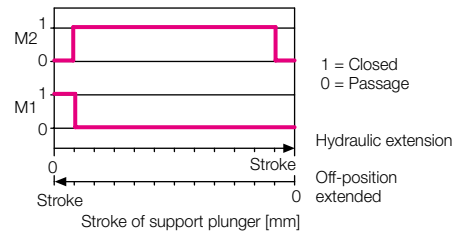
Pneumatic position monitoring

With the pneumatic position monitoring the following messages can be issued:

M1 – support plunger retracted

M2 – support plunger within the usable working area

Function chart



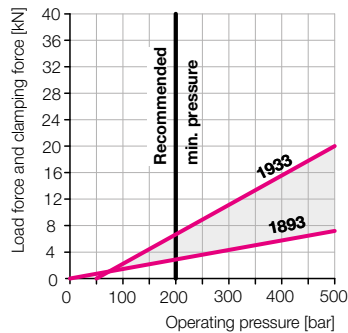
For process-safe functioning of position monitoring, air pressure and air volume must be adjusted.

Nominal values: Air pressure 2.5 bar
Flow rate 12 l/min

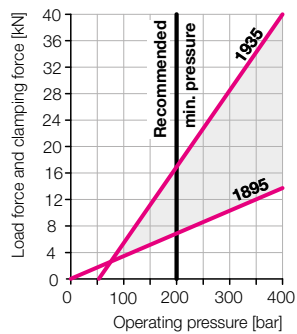
The measurable differential pressure depends on jet diameter, leakage, pressure, flow rate and cable length. It should be approx. 1.8 bar.

For evaluation, we recommend a pneumatic differential pressure switch, which can monitor up to 8 work supports. Pneumatic pressure switches can also be used. According to the number of the connected work supports, air pressure or flow rate may have to be adjusted.

Size 1933

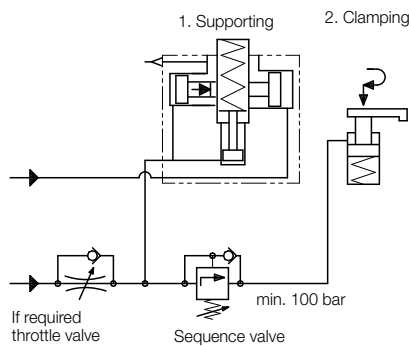


Size 1935



Control of clamping sequence

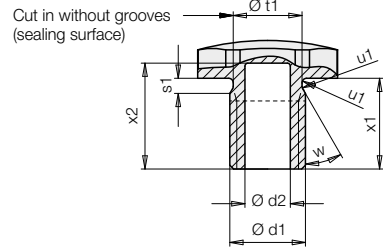
The sequence – supporting and clamping – has to be controlled as a function of the pressure, e.g. by a sequence valve.



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 flow rate that is too high, a throttle valve is required, installation should be carried out as shown in the hydraulic circuit diagram.

Required dimensions for self-manufactured contact bolts



Work support	1931	1933	1935
Ø d1	M10	M12	M20
Ø d2	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	9 × 1	9 × 2	15.54 × 2.62
Part no.	3001 674	3001 869	3000 103

Important note

The admissible load forces as per the diagram are static. The machining forces can also generate vibrations which exceed by far the average value. For this reason a corresponding safety factor has to be taken into account.

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

Threaded-Body Work Supports

max. operating pressure 500 bar

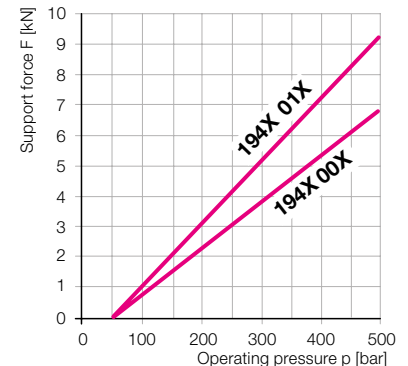


General technical data

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:

- Spring advanced;** plunger extended in off-position.
- 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.
- 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 force



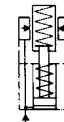
a	[mm]	80.5	90.5
b	[mm]	79	89
c	[mm]	54	64
Spring force min./max.	[N]	8/13	8/13
Part no.		1940000	1940010

Contact by air pressure

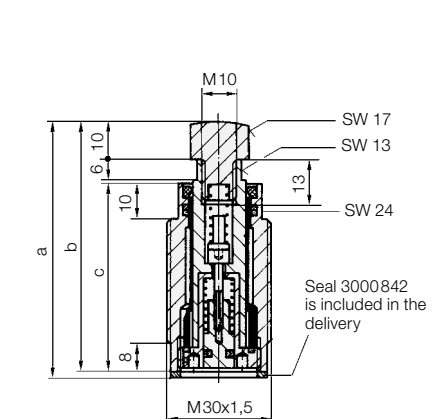
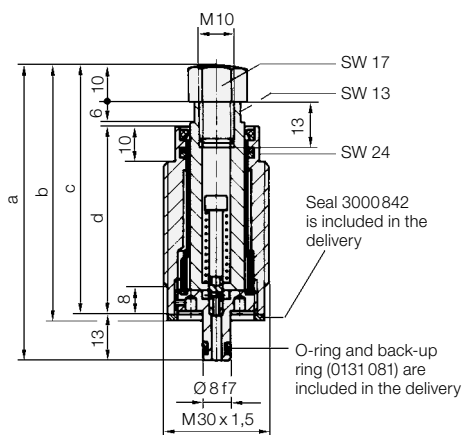
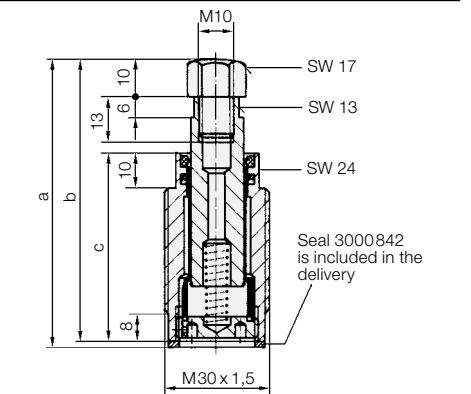


a	[mm]	84	94
b	[mm]	72.5	82.5
c	[mm]	71	81
d	[mm]	54	64
Spring force min./max.	[N]	20/30	20/30
Plunger contact force at 1 bar air pressure (deduct spring force if necessary)	[N]	20	20
Part no.		1941000	1941010

Contact by oil pressure



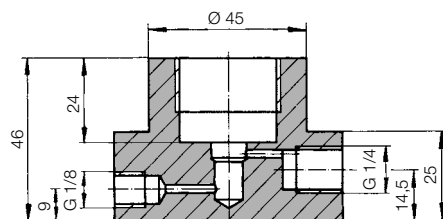
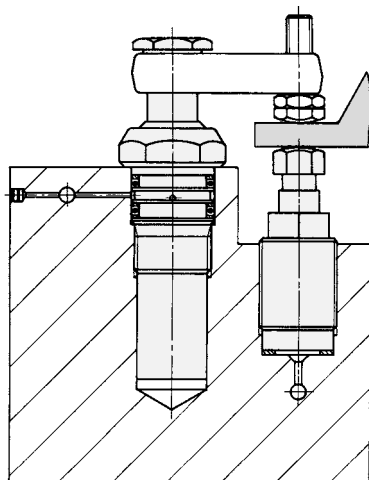
Stroke	[mm]	8	15	8	15
a	[mm]	72.5	79.5	82.5	89.5
b	[mm]	71	78	81	88
c	[mm]	54	61	64	71
Spring force min./max.	[N]	10/23		10/23	
Max. oil flow rate	[cm³/s]		25		25
Part no.	Stroke 8	1942000	1942010		
	Stroke 15	1942005	1942015		



Combination possibility

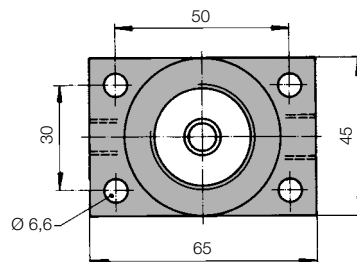
Accessories

Part no. 3467 112



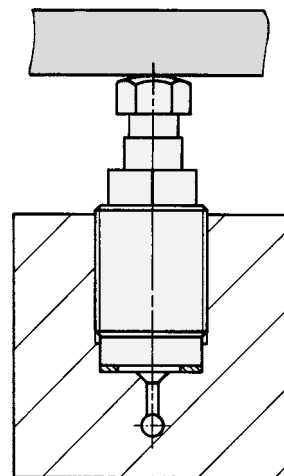
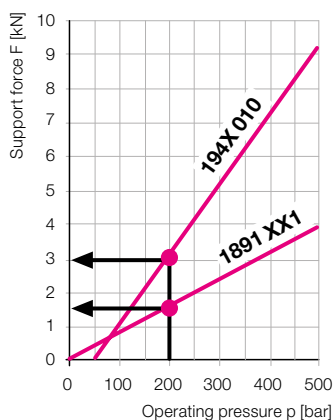
Technical drawing of a shaft-housing assembly in cross-section. The drawing includes the following details:

- Shaft:**
 - Diameter: $\varnothing 8H7$
 - Surface finish: $Ra \max 0,04$
- Housing:**
 - Bore diameter: $\max. \varnothing 20$
 - Counterbore diameter: $\min. \varnothing 10$
 - Counterbore depth: 12
 - Surface finish of bore: $Ra \max 12,5$
 - Surface finish of counterbore: $Ra \max 0,04$
- Dimensions and Fit:**
 - Shaft length: 16
 - Housing bore length: 13
 - Counterbore length: 8
 - Shaft to bore clearance: 0,04
 - Counterbore to shaft clearance: 0,04
 - Fit: $M30 \times 1,5$
- Material Properties:**
 - Material: $1,6$
 - Hardness: 20°



The diagram below shows the graphs of the clamping and support forces for the 2 possible combinations.

Installation example



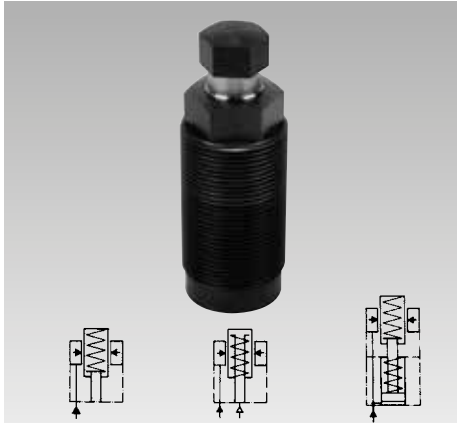
Operating pressure 200 bar.

Support force	3.0 kN
– Clamping force	1.5 kN
= possible opposing force	1.5 kN



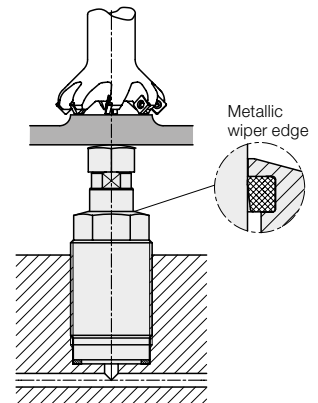
Threaded-Body Work Support

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.

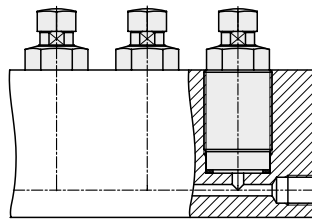
In case of accumulation of very small grinding swarf there can be a swarf holdup in the area of the metallic wiper edge. Remedy: Regular cleaning in this area.

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.

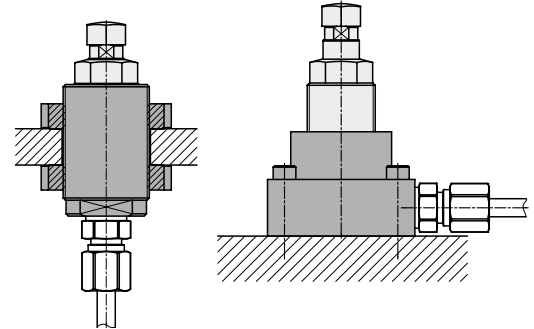
Installation and connecting possibilities

Drilled channels



Pipe thread

with accessory mounting body with exterior thread with flange



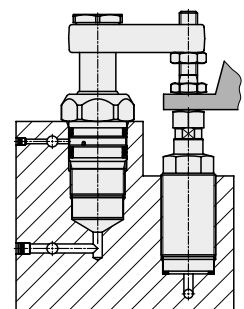
Combination with clamping elements

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 $\geq 2 \times$ 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 coloured surface indicates the maximally possible machining force including reserve.

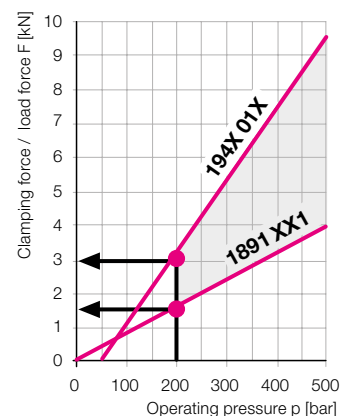


Example

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

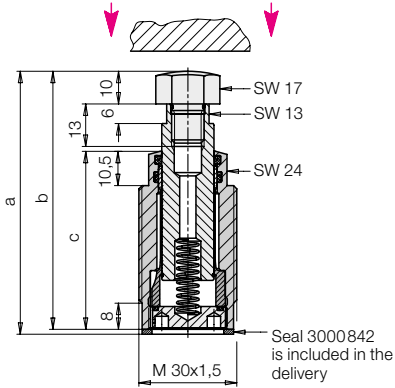
If this force is not sufficient the work support can also be supplied with 500 bar. The pressure for the swing clamp will be reduced.



Dimensions Technical Data • Accessories

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

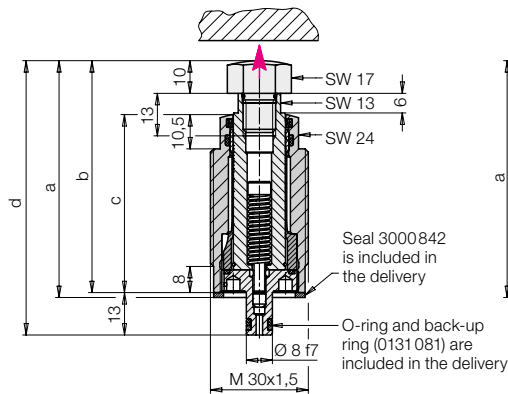
Spring force			
min./max.	[N]	7/12	7/12
Part no.		1940002	1940012

Accessory

Mounting body flange	Part no.	3467111
Mounting body M38x1.5	Part no.	3467086
Lock nut M38x1.5	Part no.	3300088

Air pressure

Off-position: Plunger retracted
Extend and contact with air pressure

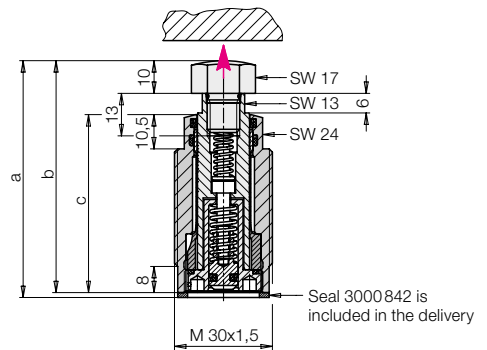


Adm. load	[kN]	6.5	9.5
Stroke	[mm]	8	8
a	[mm]	72.5	82.5
b	[mm]	71	81
c	[mm]	54.5	64.5
d	[mm]	84	94

Spring force			
min./max.	[N]	20/30	20/30
Part no.		1941002	1941012

Oil pressure combined with spring force

Off-position: Plunger retracted
Extend with hydraulic and contact with spring force



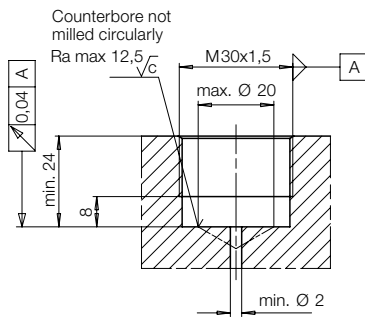
Adm. load	[kN]	6.5	6.5	9.5	9.5
Stroke	[mm]	8	15	8	15
a	[mm]	72.5	79.5	82.5	89.5
b	[mm]	71	78	81	88
c	[mm]	54.5	64.5	64.5	71.5

Spring force					
min./max.	[N]	16/33	10/22	16/33	10/22
Part no.		1942 -002	-007	-012	-017

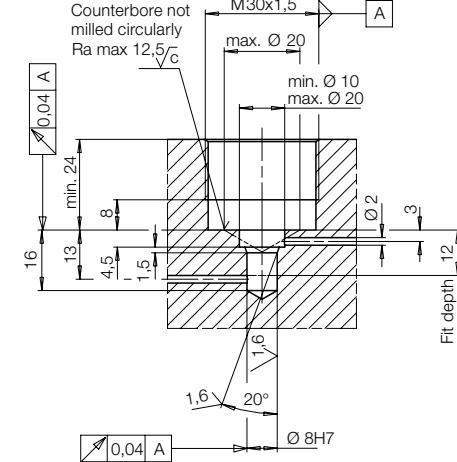
Mounting body flange	Part no.	3467112
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Mounting body flange	Part no.	3467111
Mounting body M38x1.5	Part no.	3467086
Lock nut M38x1.5	Part no.	3300088
Sharp-edged orifice Ø 0.5 mm	Part no.	3420386

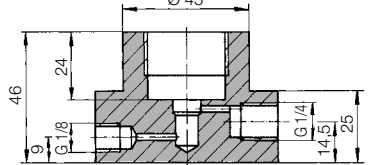
Porting details for 1940 and 1942



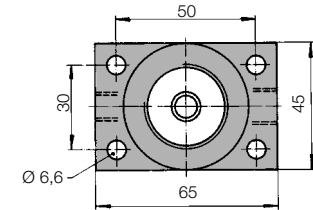
Porting details for 1941



Mounting body flange



only with 3467112 (for 1941)

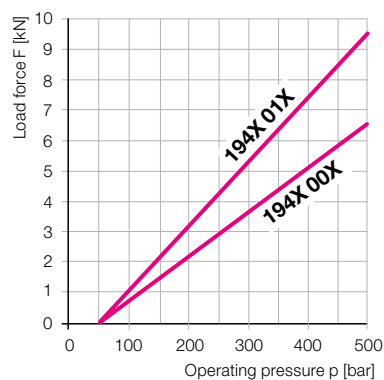


Technical data

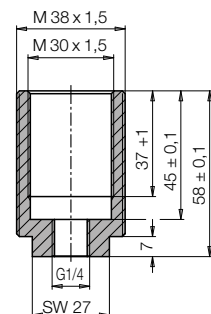
Support plunger Ø	[mm]	16
Stroke	[mm]	8/15
Required oil per stroke	[cm³]	0.5/1
Admissible flow rate*	[cm³/s]	25
Plunger contact force at 1 bar Luftdruck (1941) (Federkraft abziehen!)	[N]	20
Recommended mini. pressure	[bar]	100
Elastic deformation with load and 500 bar	[mm/kN]	0.004
Max. operating temperature	[°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



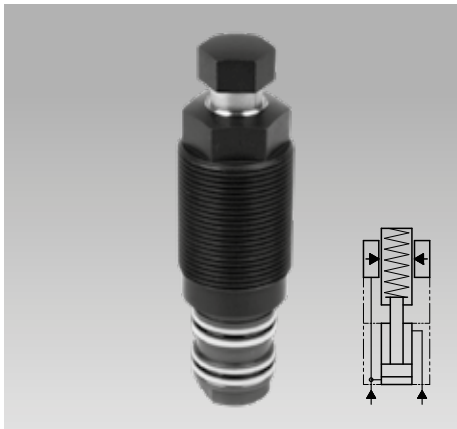
Mounting body M38x1.5





Threaded-Body Work Supports

M 30×1.5, 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 $\geq 2 \times$ 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

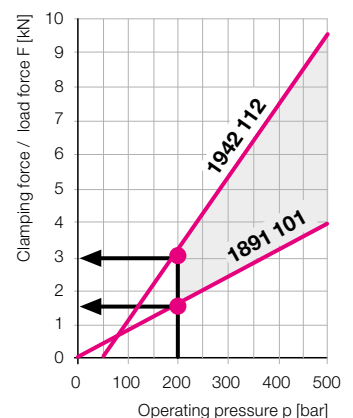
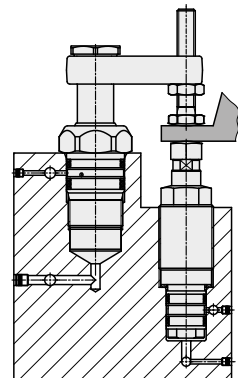
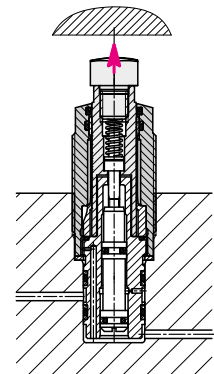
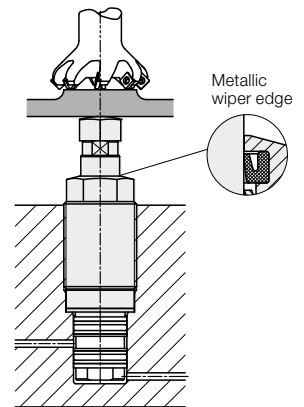
Threaded-body swing clamp 1891 101 and threaded-body work support 1942 112.

Operating pressure 200 bar

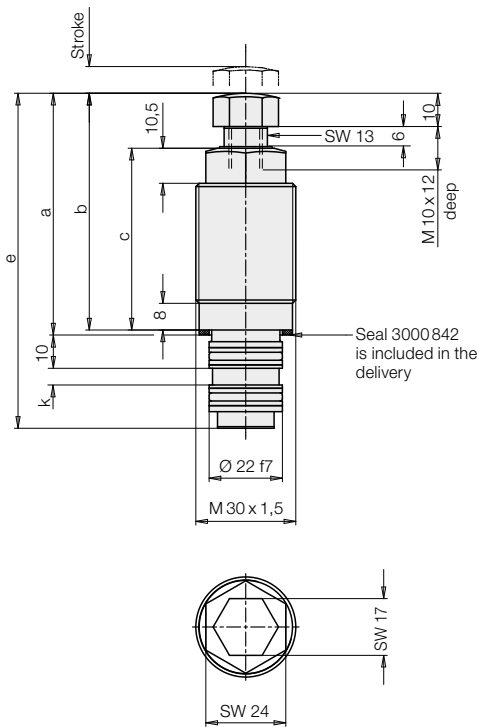
As per diagram:

Adm. load	3.0 kN
– Clamping force	1.5 kN
Possible machining force	1.5 kN

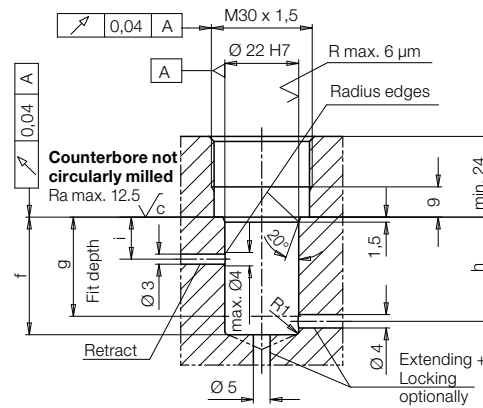
If this force is not sufficient the work support can also be supplied with 500 bar. The pressure for the swing clamp will be reduced.



Dimensions Technical Data



Porting details

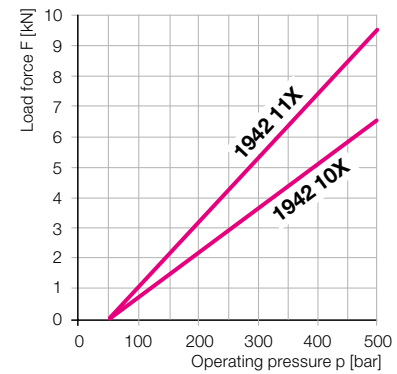


Technical data

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. **1942 102** **1942 107** **1942 112** **1942 117**

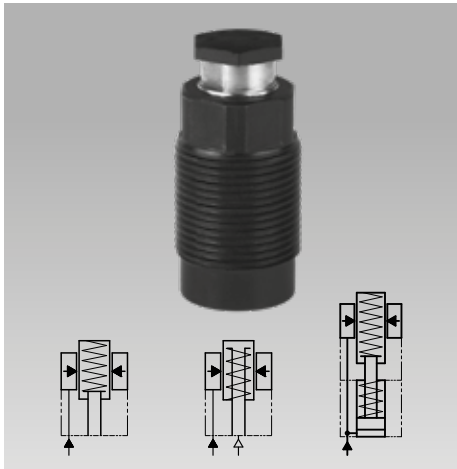
Admissible load force F as a function of the operating pressure p





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.

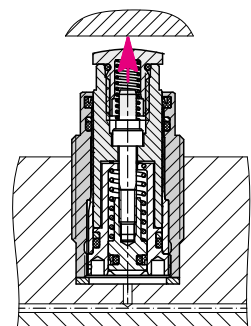
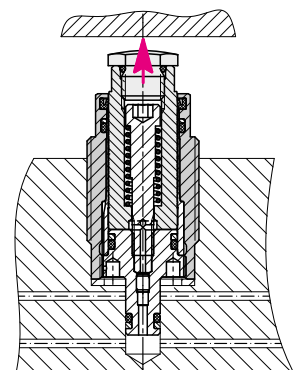
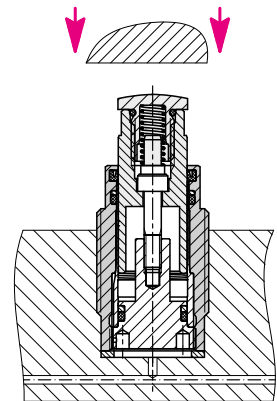
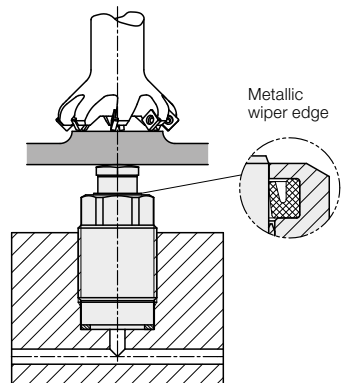
Oil pressure combined with spring force

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.

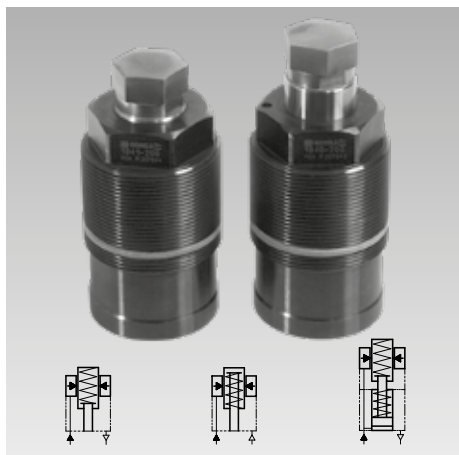
For unclamping hydraulic pressure will be released. The small piston retracts by spring force to its off-position and also retracts the support plunger.





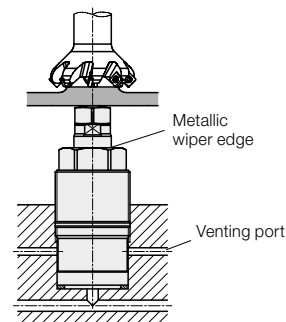
Threaded-Body Work Support

M 40 x 1.5, with metallic wiper edge,
single acting, max. operating pressure 500 bar



Advantages

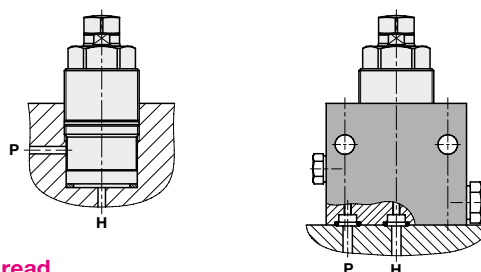
- Space-saving threaded-body version
- 3 types of operation
- Contact force by spring or pneumatically adjustable (1941 201)
- Load force up to 15 kN
- Metallic wiper edge and FKM wiper
- Venting of the spring area
- Connection of positive air pressure protection is possible
- Mounting body as accessory
- Connection of positive air pressure protection up to 4 bar is possible



Installation and connecting possibilities

Drilled channels

with accessory and mounting body



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

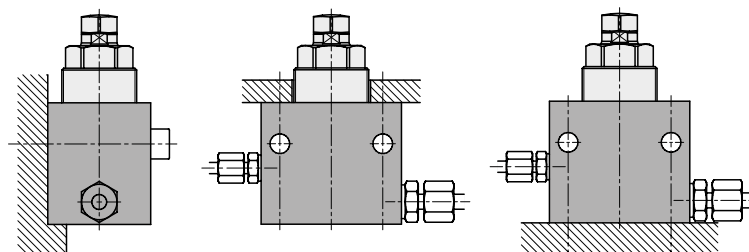
To guarantee functioning of the work supports, a vent port is imperative. No liquids may enter the end of the bore hole (see also data sheet G 0.110 „Venting of the spring area“).

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.

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 $\geq 2 \times$ clamping force

Example

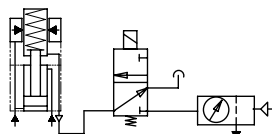
Threaded-body swing clamp 1883 102 and threaded-body work support 1942 201.

Operating pressure 200 bar (because of the clamping arm)

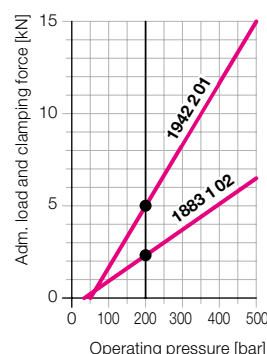
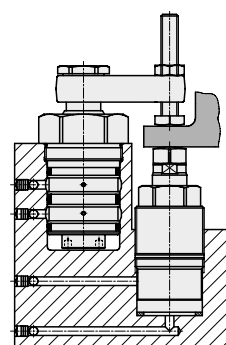
As per diagram:

Adm. load force	5.0 kN
– Clamping force	2.3 kN
Possible machining force	2.7 kN

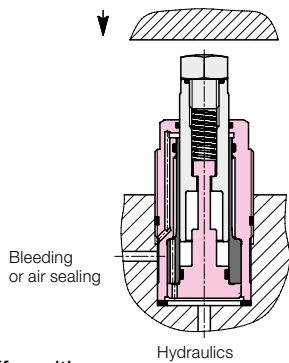
To get a higher support force, the threaded-body work support can be supplied with 500 bar and the pressure for the swing clamp can be reduced.



Connection of positive air pressure protection



Part no. 1940201



Off-position:
Plunger extended
Contact with spring force

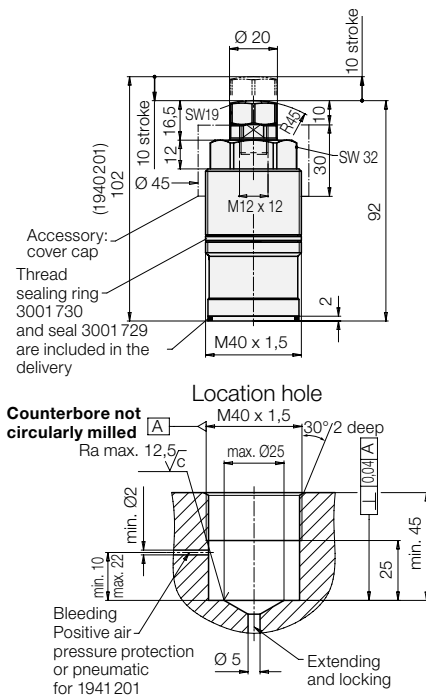
The support plunger is pushed back by the inserted workpiece, the spring force has to be overcome.

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.

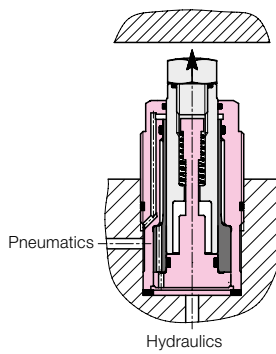
Technical data

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)	[cm ³]	1
Admissible oil flow rate (1942201)	[cm ³ /s]	25
Seating torque	[Nm]	100
Weight approx.	[kg]	0,6



Before mounting!
Location hole oil free and dry.

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.

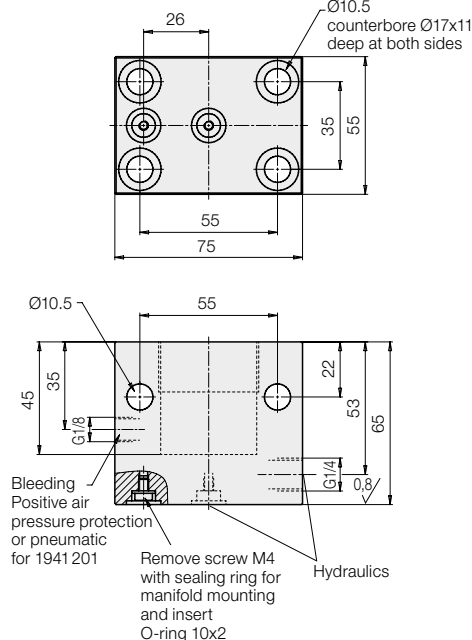
The support plunger will be locked by hydraulic pressure and can compensate forces in axis direction.

For unclamping hydraulic and air pressure will be released and the support plunger retracts by spring force to its off-position.

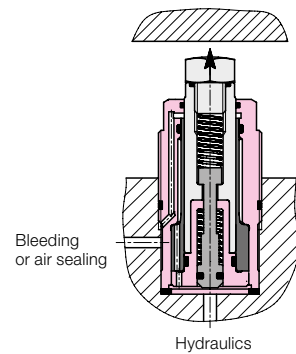
Accessories

Mounting body	Part no. 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



Part no. 1942201



Off-position:
Plunger retracted
Extend with hydraulics
Contact with spring force

The support plunger is extended by a hydraulically pressurized 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.

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.

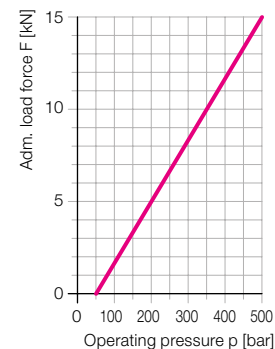
Part no. 0341108

Please note:

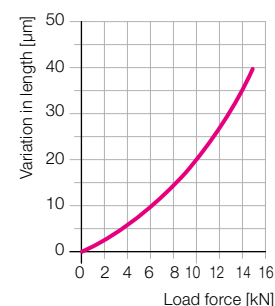
The standard sealing ring 38/30x2 cannot longer be used. The sealing ring 3002035 delivered with the sharp-edged orifice is 1 mm thicker, so that the measure of length increases from 92 to 93 mm.

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

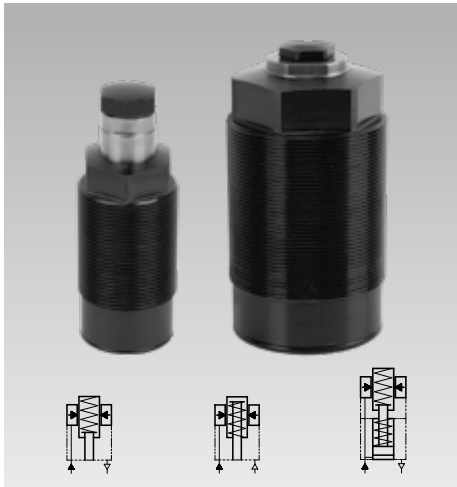


Variation in length of the support plunger during load.



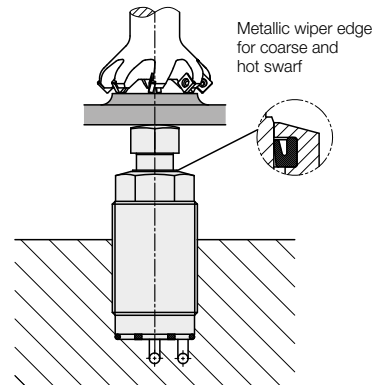
Threaded-Body Work Supports

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.

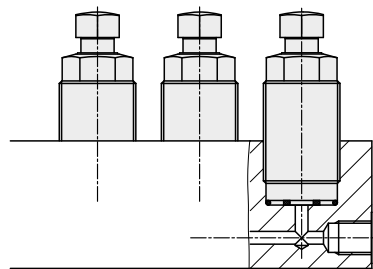
In dry machining applications, with minimum quantity lubrication or in case of accumulation of very small swarf, there can be a swarf hold-up in the area of the metallic wiper edge.

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:

$$\begin{aligned} &\text{clamping force} \\ &+ \text{max. machining force} \end{aligned}$$

$$= \text{minimum support force} \times \text{safety factor}$$

Rough calculation from practice:

Required support force $\geq 2 \times$ 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

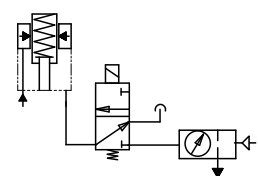
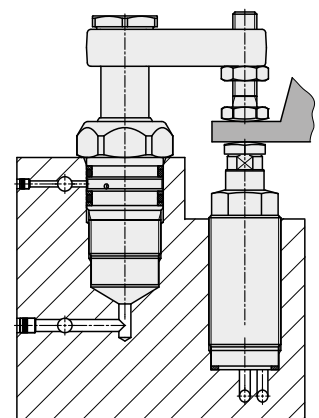
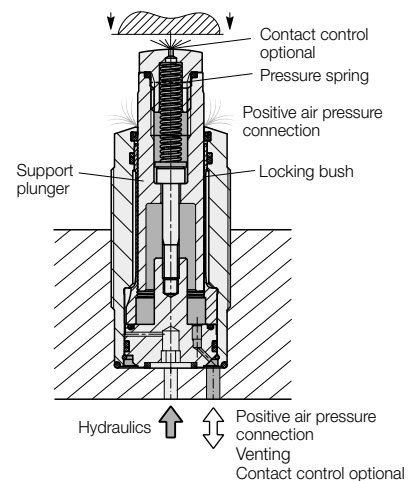
To guarantee functioning of the work supports, a vent port is imperative. No liquids may enter the end of the bore hole (see also data sheet G 0.110 „Venting of the spring area“).

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.

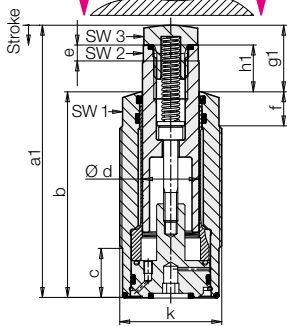
Example type 1940XXX

Support plunger in off-position extended



Connection of positive air pressure protection

Spring force
Part no. 1940XXX



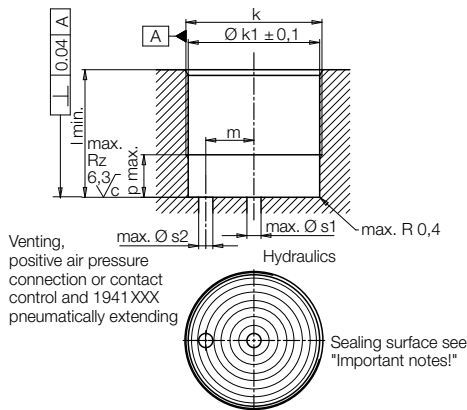
Off-position:
Support plunger extended
Contact by spring force

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:

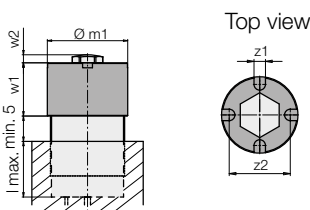
The location hole must be dry and oil-free to ensure that no liquids penetrate into the spring area of the work supports.

When exchanging work supports:

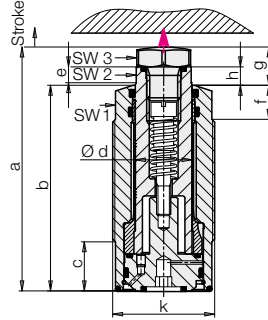
To get a dry location hole, the hydraulic oil in drilled channels must be removed.

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. 1941XXX



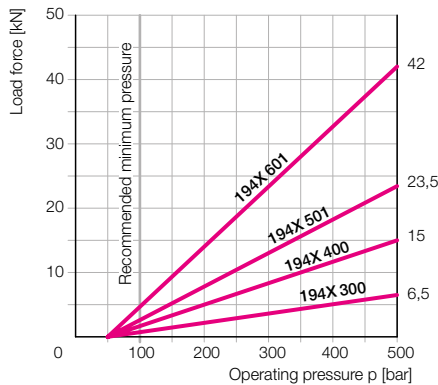
Off-position:
Support plunger retracted
Extend and contact with air pressure

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).

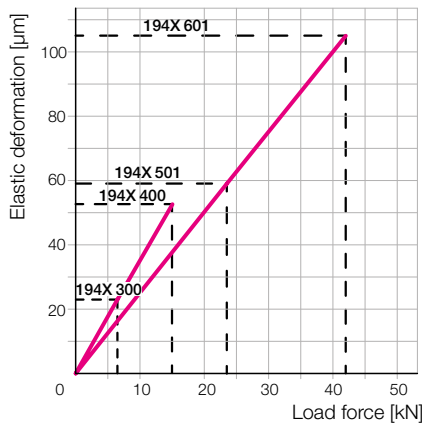
The support plunger will be locked by hydraulic pressure and can compensate forces in axis direction.

For retraction, hydraulic and air pressure will be released and the support plunger retracts by spring force to its off-position.

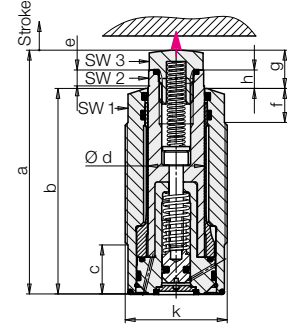
Adm. load force F
as a function of the operating pressure p



Elastic deformation with load force F and operating pressure 500 bar



Hydraulically and spring force
Part no. 1942XXX



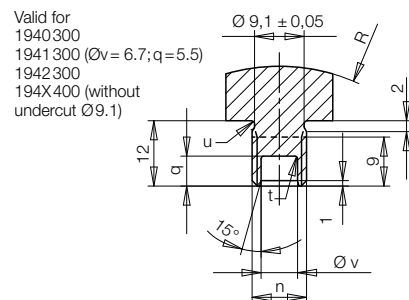
Off-position:
Support plunger retracted
Extend with hydraulics
Contact by spring force

The support plunger is extended by a hydraulically pressurised small piston and contacts the workpiece with spring force.

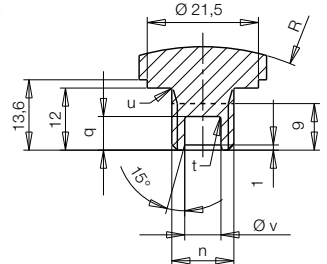
The support plunger will be locked by increasing hydraulic pressure and can compensate forces in axis direction.

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.

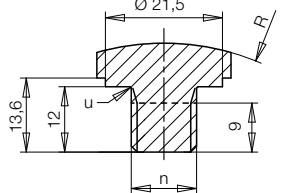
Required dimensions for self-made contact bolts



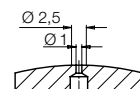
Valid for
1940300
1941300 (Øv = 6.7; q = 5.5)
1942300
194X400 (without undercut Ø9.1)



Valid for
194X501



Contact bolt for contact control



Technical data

Accessories • Dimensions

Adm. load force (500 bar)		[kN]	6.5		15	23.5	42
Support plunger Ø d		[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. Recommended pressure for positive air pressure connection	[N] [bar]	10/13 0.2	– –	14/25 0.2	22/35 0.2	34/64 0.2
1941	Pneumatic contact force at 1 bar minus spring return force min./max.	[N] [N]	20 24.5/35	– –	31.4 19/31	61.5 22/35	80 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	1940 300P	–	1940 400P	1940 501P	1940 601P
Pneumatically extended	1941 300P	–	1941 400P	1941 501P	1941 601P
Hydraulically extended and spring force	1942 300P	1942 305P	1942 400P	1942 501P	1942 601P

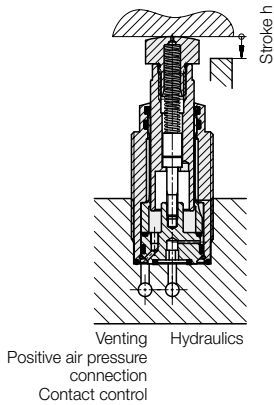
P = Option contact control (see also page 5)

Accessories

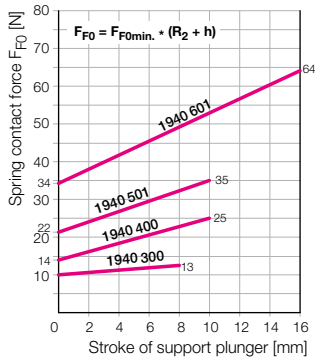
Protection cap (splash guard)	3546 110	3546 111	3546 112	3546 113
Weight protection cap	[kg] 0.023	0.025	0.032	0.062
Contact bolt for contact control	3614 390	3614 389	3614 391	3614 418
Contact bolt without contact control	3614 330	3614 388	3614 420	3614 419

Contact forces on the workpiece

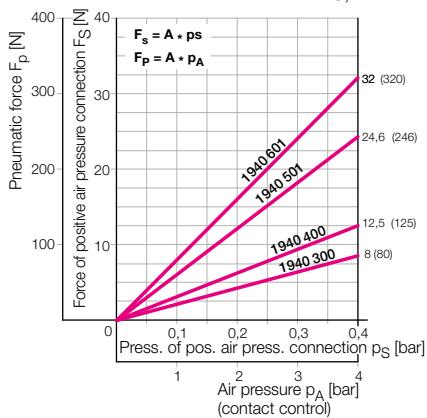
Spring force Part no. 1940XXX



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)



Constant

1940-	300	400	501	601
$F_{F0min.}$	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

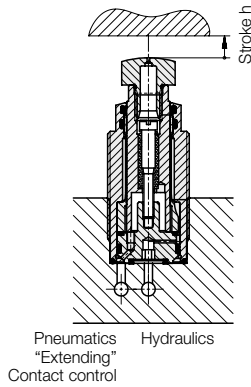
* For vertical installation: top [-], down [+]. See examples.

Example

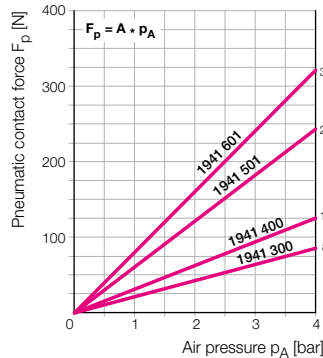
Work support 1940300
Protection cap 3546110
Vertical upward installation
Pres. of pos. air pres. con. 0.2 bar
Stroke of support plunger h = 4 mm

spring force $F_{F0} = F_{F0min.} + (R_2 * h)$	
$F_{F0} = 10 + (0.364 * 4)$	= 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

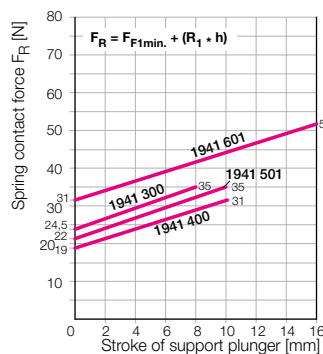
Pneumatically Part no. 1941XXX



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



Constant

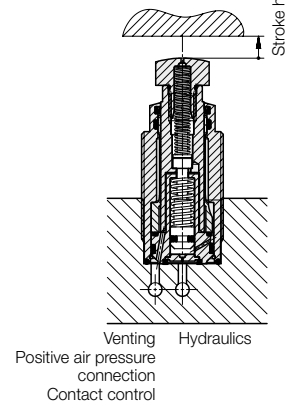
1941-	300	400	501	601
$F_{R1min.}$	24	19	22	31
R_1	1.34	1.26	1.26	1.3
A	20.1	31.4	61.5	80
Weight force*				
Support plunger [N]	0.5	1.3	2.5	3.9
Protection cap [N]	0.23	0.25	0.32	0.62

Example

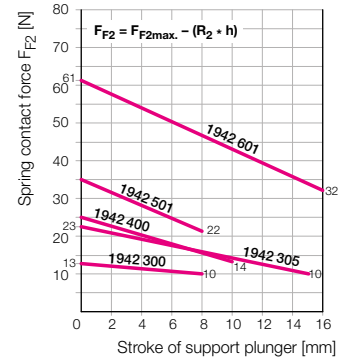
Work support 1941 501
Vertical upward installation
Air pressure 1.5 bar
Stroke of support plunger h = 7 mm

pneumatic force $F_P = A * p_A = 61.5 * 1.5$	= 92.25 N
- spring return force F_R	
$F_R = F_{R1min.} + (R_1 * h) = 22 + (1.26 * 7)$	= 30.82 N
- weight force support plunger	= 2.50 N
contact force	= 58.93 N

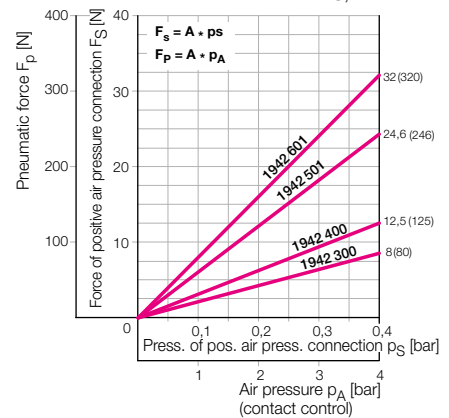
Spring force Part no. 1942XXX



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

1942-	300	305	400	501	601
$F_{F2max.}$	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

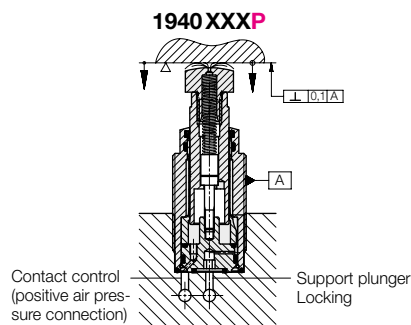
Example

Work support 1942400P
Vertical upward installation
Contact control 2 bar
Stroke of support plunger h = 4 mm

spring force $F_{F2} = F_{F2max.} - (R_2 * h) = 25 - (1.103 * 4)$	= 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

Pneumatic contact control

Function sequence • Signal conversion



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.

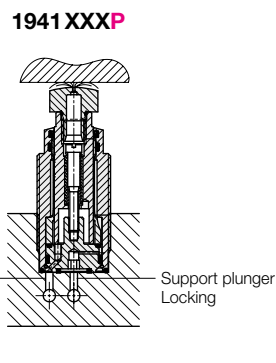
Alternative

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.



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

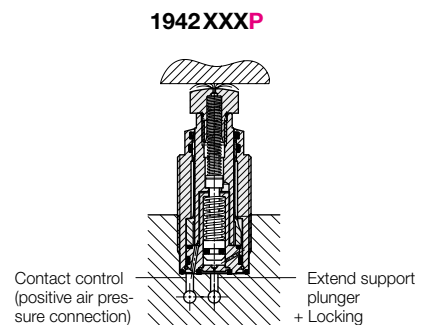
After the message "support plungers are in contact"
Hydraulic clamping of support plungers.

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.



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.

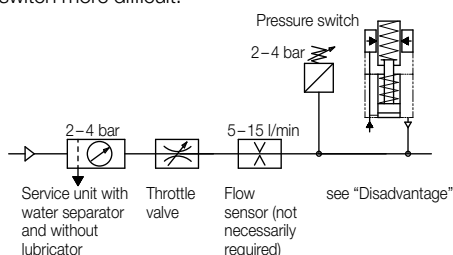
1. Pressure switch

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).

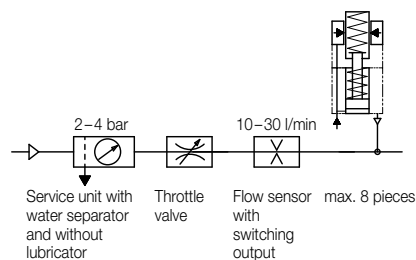
Advantages

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 (Q_{min}) when all support plungers are in contact with the workpiece.
2. Repeat the measurement if 1 support plunger has no contact (Q_{max}).
3. Enter and save
switching point = $0.5 \times (Q_{min} + Q_{max})$.

Disadvantages

If the difference ($Q_{max} - Q_{min}$) is too small, increase the flow rate or reduce the number of support points per sensor.



Alternatives

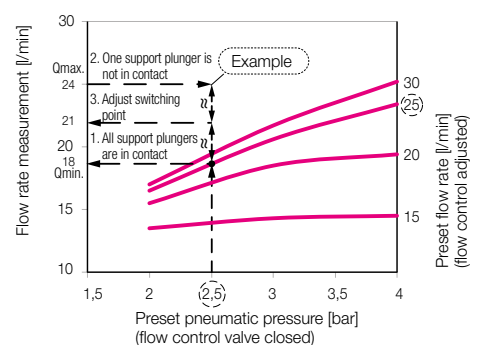
The air gap sensor SOPA from FESTO has an integrated compressed air preparation, as well as two solenoid valves for measuring air and positive air pressure connection.

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 = $0.5 \times (18 + 24) = 21$ 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



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.

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

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.

Pneumatic contact control

Description see page 4.

Combination with clamping elements

With this combination, clamping and machining forces will add up:

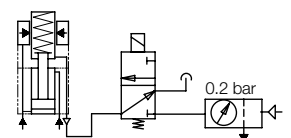
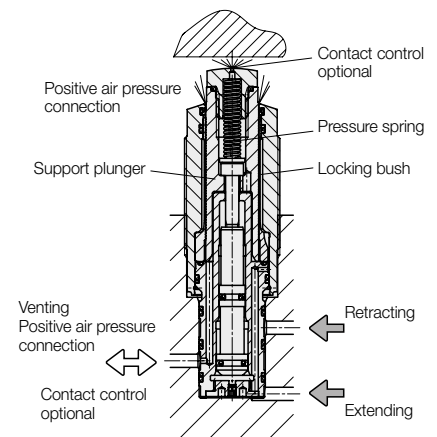
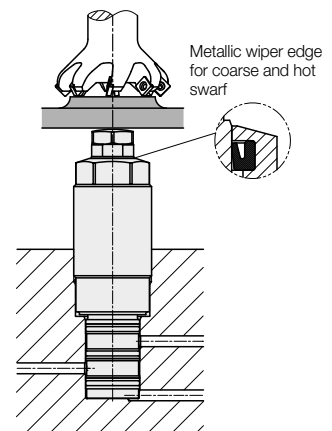
$$\begin{aligned} &\text{Clamping force} \\ &+ \text{max. machining force} \\ &= \text{minimum support force} \times \text{safety factor} \end{aligned}$$

Rough calculation from practice:

Required support force $\geq 2 \times$ clamping force

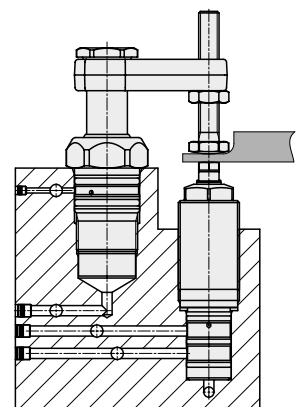
To increase the safety, a support force as high as possible should be achieved

- 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



Important note

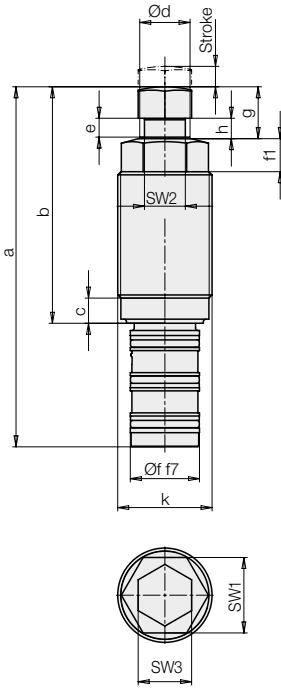
The positive air pressure must be free of oil and water.



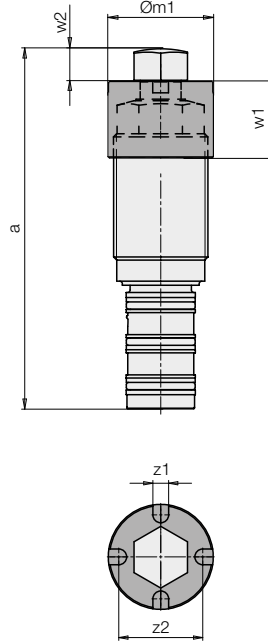
Technical Data

Accessories • Dimensions

Part no. 1942XXX



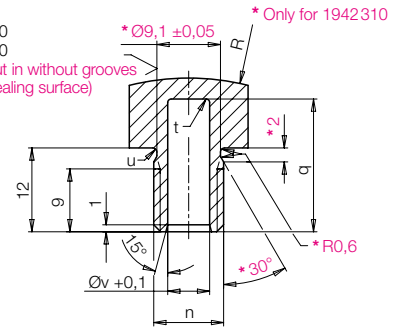
Protection cap (accessory)



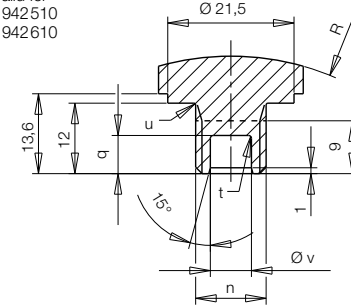
Dimensions for self-made contact bolts

Valid for
1942310
1942410

*Cut in without grooves
(sealing surface)

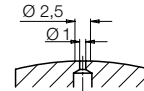


Valid for
1942510
1942610



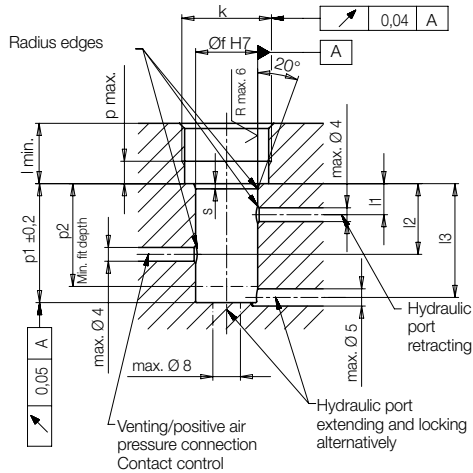
The protection cap is fixed by means of the standard contact bolt to the support plunger. It shall be used above all, if a strong coolant jet is directed onto the support plunger or the wiper edge.

Contact bolt for contact control



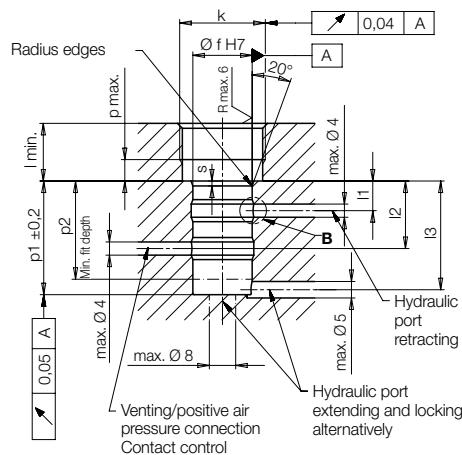
Porting details

with radiused connecting bores

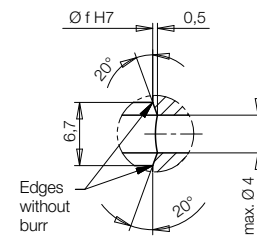


Porting details

with entering slopes



Detail "B"



Pay attention when mounting:

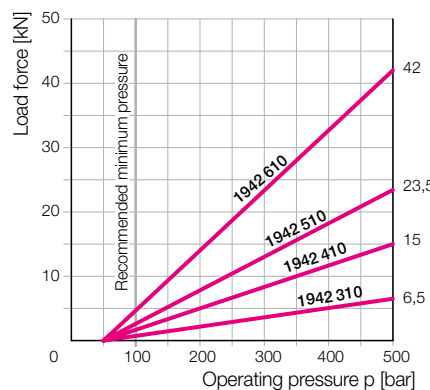
The location hole must be dry and oil-free to ensure that no liquids penetrate into the spring area of the work supports.

When exchanging work supports:

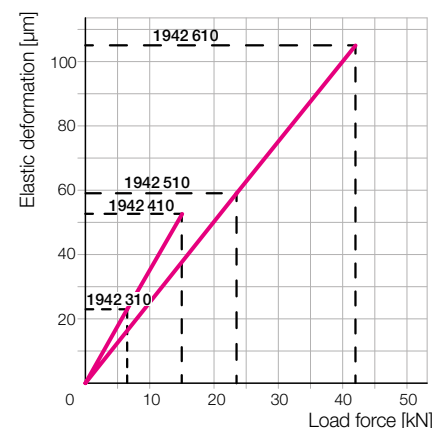
To get a dry location hole, the hydraulic oil in drilled channels must be removed.

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 Ø d	[mm]	16	20	28	32
Stroke	[mm]	8	10	10	16
Oil volume extending	[cm³]	0.63	1.13	1.13	3.22
retracting	[cm³]	0.12	0.35	0.35	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
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
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)		1942310 P	1942410 P	1942510 P	1942610 P
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

$$F_F = F_{\max} - (R \cdot h) \quad [N]$$

2. Pneumatic contact force**

$$F_p = A \cdot p \quad [N]$$

3. Weight force support plunger + contact bolt

$$F_{Sb} \text{ see constant} \quad [N]$$

4. Weight force protection cap (accessory)

$$F_{Sk} \text{ see constant} \quad [N]$$

$$F_{\max} = \text{max. spring force (h = 0)} \quad [N]$$

$$R = \text{Spring constant} \quad [N/mm]$$

$$A = \text{Constant for bolt surface} \quad [-]$$

$$p = \text{Pneumatic pressure} \quad [bar]$$

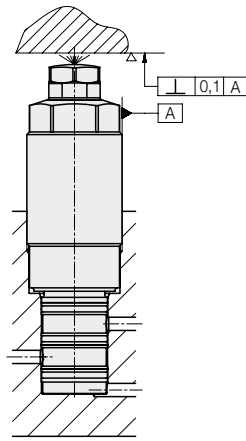
(positive air pressure connection or contact control)

Constant

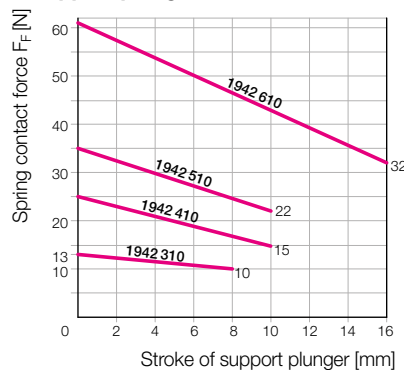
1942	310	410	510	610
F _{max} [N]	13.6	25.9	35.2	60
R [N/mm]	0.364	1.103	1.34	1.82
A	20.1	31.4	61.5	80
F _{Sb} [N]	0.5	1.3	2.5	3.9
F _{Sk} [N]	0.23	0.25	0.32	0.62

Before unclamping, switch off the pneumatic pressure for contact control or reduce the positive air pressure to 0.2 bar.

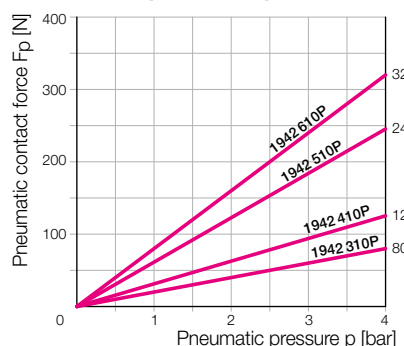
** Is only considered, if the pneumatic pressure is switched on before locking the support plunger.



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**

$$\text{Spring force } F_F = F_{\max} - (R \cdot h)$$

$$F_F = 25 - (1.103 \cdot 5) = 19.4 \text{ N}$$

$$+ \text{ Pos. air press. con. } F_p = A \cdot p = 31.4 \cdot 0.2 = 6.3 \text{ N}$$

$$- \text{ Weight force support plunger } = 1.3 \text{ N}$$

$$- \text{ Weight force protection cap } = 0.25 \text{ N}$$

$$\text{Contact force} = 24.15 \text{ N}$$

Example 2 Work support 1942 510P
Vertical upward installation
Support plunger stroke 7 mm
Pneumatic pressure 3 bar**

$$\text{Spring force } F_F = F_{\max} - (R \cdot h)$$

$$F_F = 35 - (1.34 \cdot 7) = 25.6 \text{ N}$$

$$+ \text{ Pneumatics } F_p = A \cdot p = 61.5 \cdot 3 = 184.5 \text{ N}$$

$$- \text{ Weight force support plunger } = 2.5 \text{ N}$$

$$\text{Contact force} = 207.6 \text{ N}$$

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.

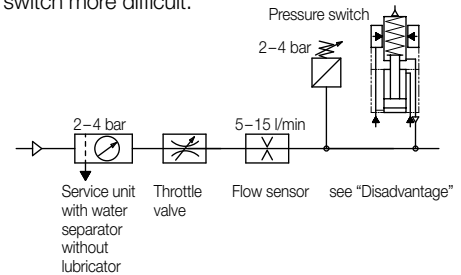
1. Pressure switch

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).

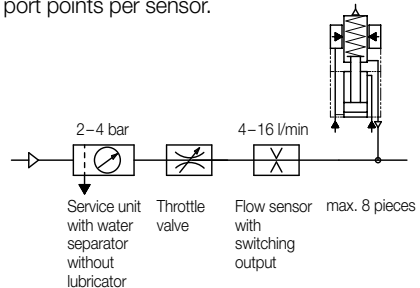
Advantages

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 (Q_{min}) when all support plungers are in contact with the workpiece.
2. Repeat the measurement if 1 support plunger has no contact (Q_{max}).
3. Enter and save the switching threshold = 0.5 x (Q_{min} + q_{max}).

Disadvantages

If the difference (Q_{max} - Q_{min}) 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.

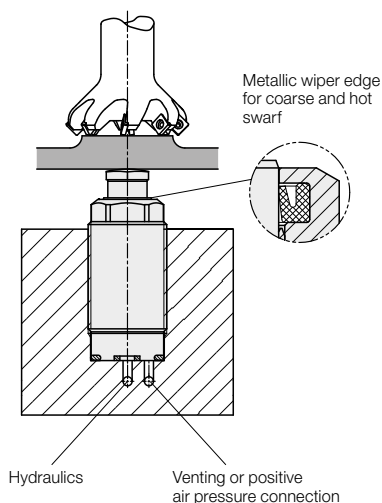


Threaded-Body Work Supports with metallic wiper edge, 4 sizes single acting, max. operating pressure 70 bar



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.

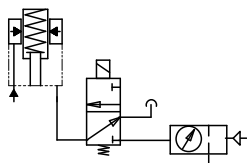
Operating conditions, tolerances and other data see data sheet A 0.100.

Positive air pressure connection

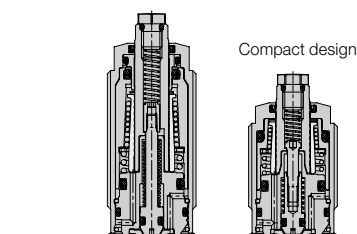
To guarantee functioning of the work supports, a vent port is imperative. No liquids may enter the end of the bore hole (see also data sheet G 0.110 „Venting of the spring area“).

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.

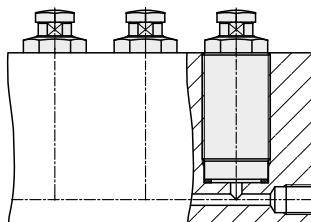


Connection of positive air pressure protection



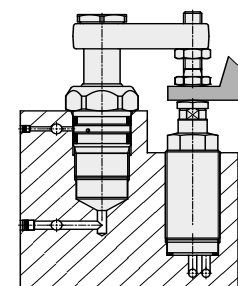
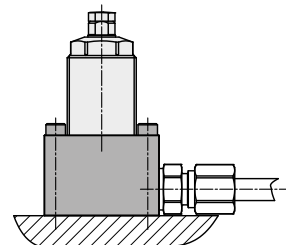
Installation and connecting possibilities

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:

$$\text{Min. load force} \geq 2 \times \text{clamping force}$$

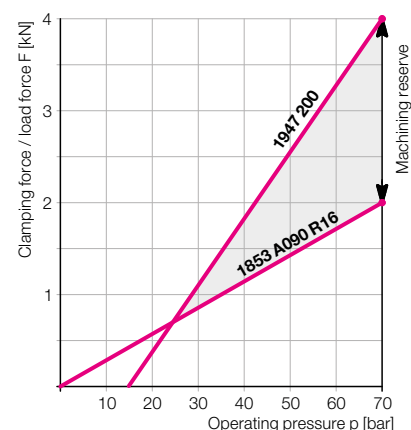
Example

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.

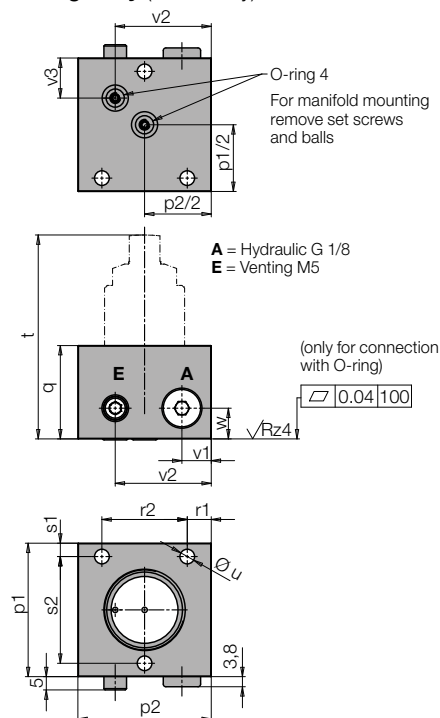
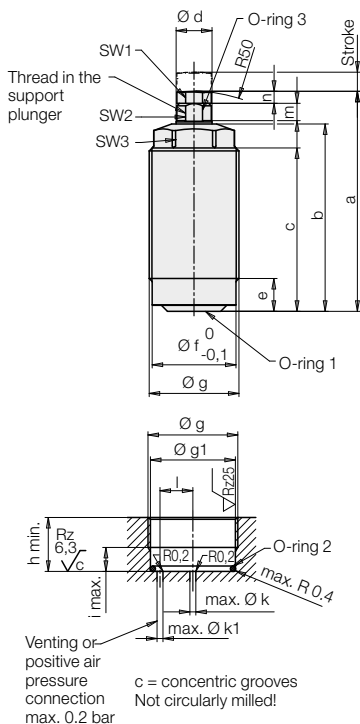


Dimensions

Technical Data • Accessories

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	[cm ³]	0.5	0.6	0.6	0.9	1.3	2
Admissible flow rate	[cm ³ /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
Ø u	[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)

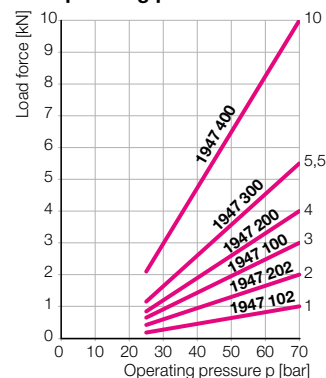


Mounting body complete (Accessory)

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



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.

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

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.

Combination with clamping elements

With this combination, clamping and machining forces will add up:

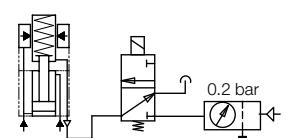
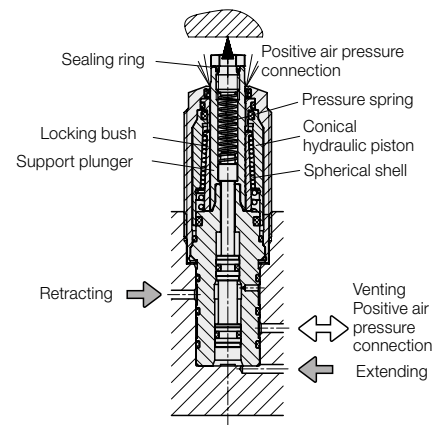
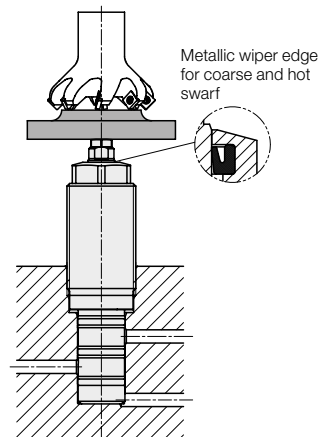
$$\begin{aligned} &\text{Clamping force} \\ &+ \text{max. machining force} \\ &= \text{minimum support force} \times \text{safety factor} \end{aligned}$$

Rough calculation from practice:

Required support force $\geq 2 \times$ clamping force

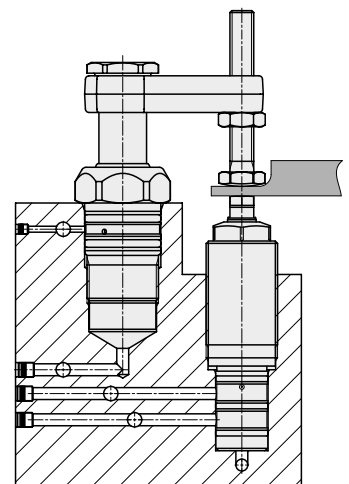
To increase the safety, a support force as high as possible should be achieved by

- using a larger work support
- utilising the max. operating pressure
- using a smaller clamping element or reducing the clamping pressure

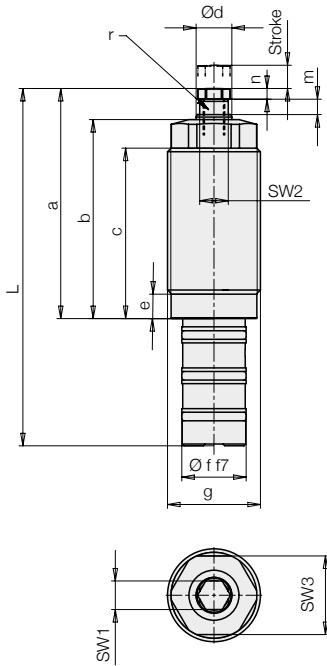


Important note

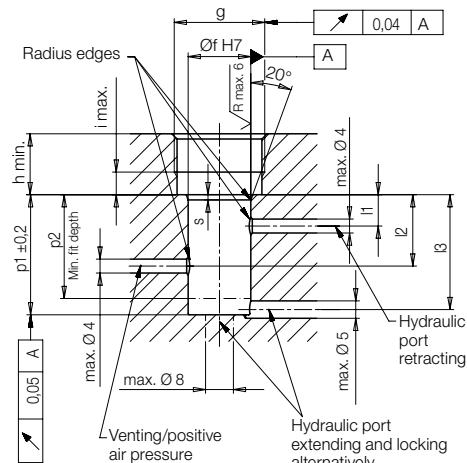
The positive air pressure must be free of oil and water.



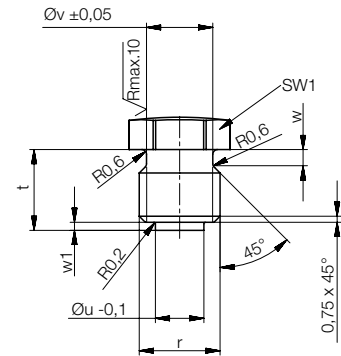
Part no. 1947X10



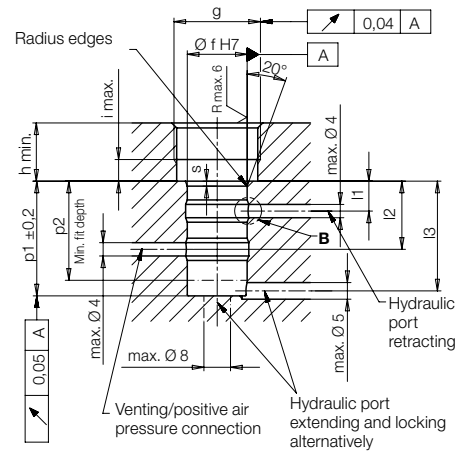
Location hole
with radiused connecting bores



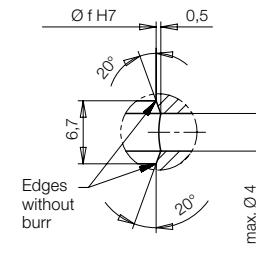
Dimensions for
self-made contact bolts



Location hole
with entering slopes



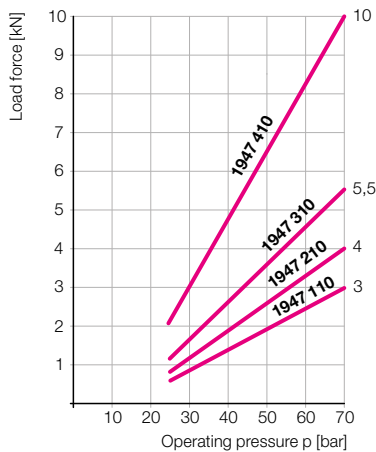
Detail "B"



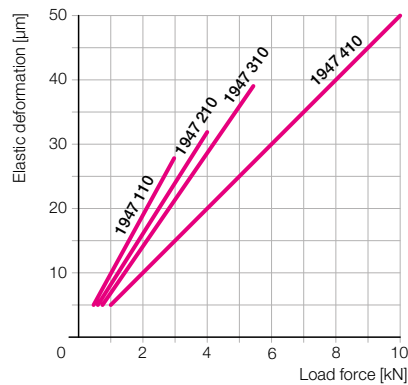
Pay attention when mounting:
The location hole must be dry and oil-free to ensure that no liquids penetrate into the spring area of the work supports.

When exchanging work supports:
To get a dry location hole, the hydraulic oil in drilled channels must be removed.

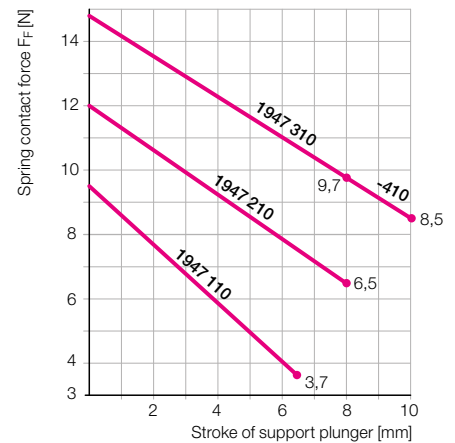
Adm. load force F
As a function of the operating pressure p



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



Technical data

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 Ø d	[mm]	10	12	15	16
Stroke	[mm]	6.5	8	8	10
Oil volume extending	[cm³]	0.7	1	1.1	1.9
retracting	[cm³]	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
Ø f 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.		1947 110	1947 210	1947 310	1947 410



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:

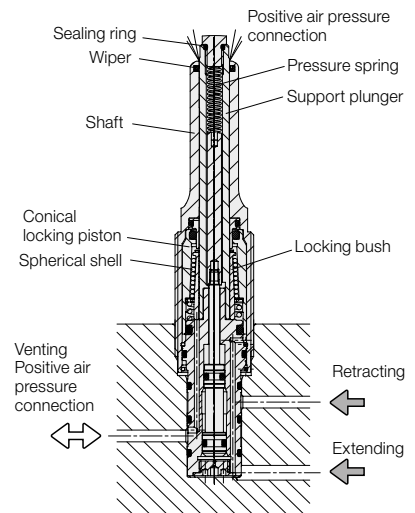
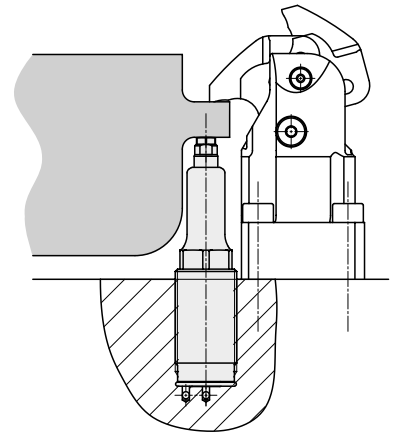
$$\begin{aligned} & \text{clamping force} \\ & + \text{max. machining force} \\ & = \text{minimum support force} \times \text{safety factor} \end{aligned}$$

Rough calculation from practice:

Required support force $\geq 2 \times$ clamping force

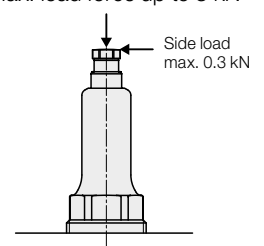
To increase the safety, a support force as high as possible should be achieved by

- using a larger work support
- utilising the max. operating pressure
- using a smaller clamping element or reducing the clamping pressure



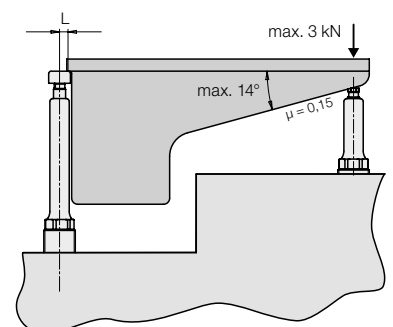
Admissible loads

Max. load force up to 3 kN



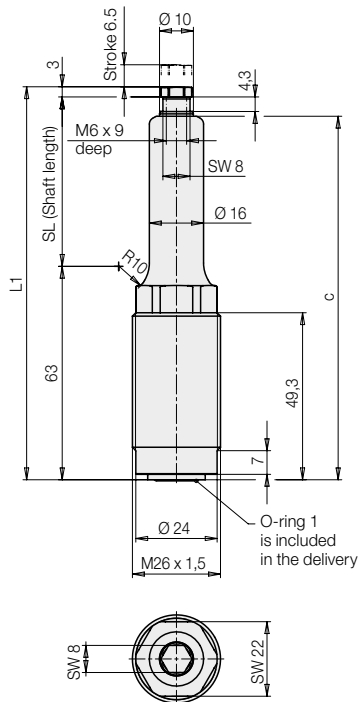
Example

Load of the support plunger by side loads (see diagram on page 3)



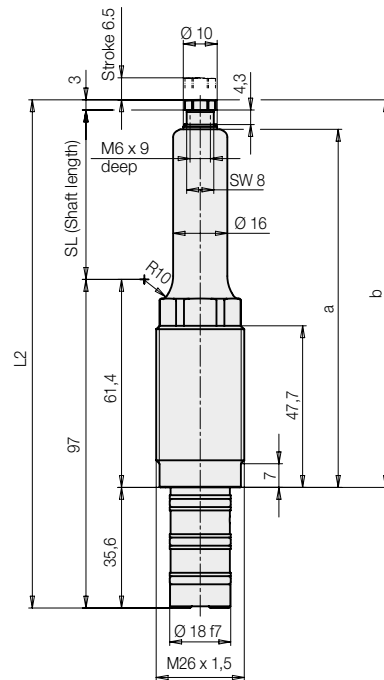
Single acting

Part no. 1947 100 S106 XX0



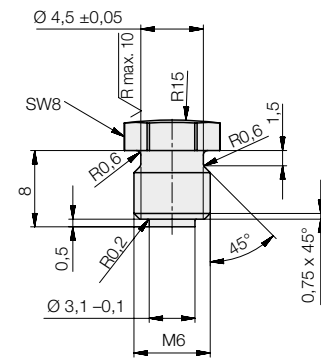
double acting

Part no. 1947110S106XX0

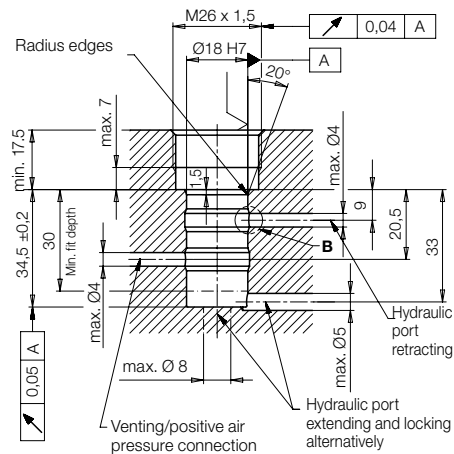
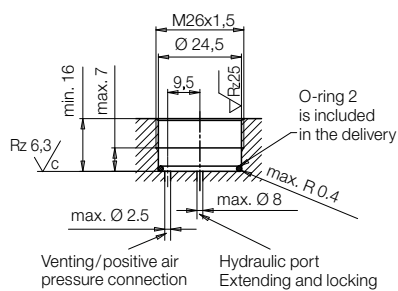


Dimensions for

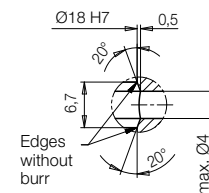
self-made contact bolts



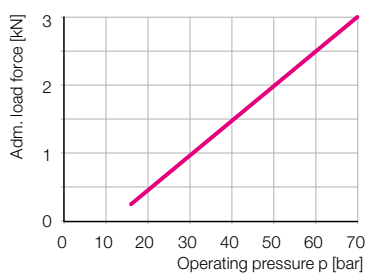
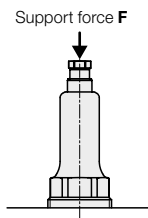
Location holes



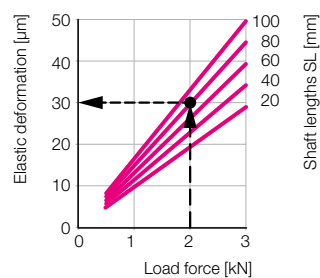
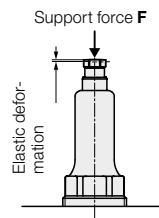
Detail B



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 1947 110S106080

Operating pressure $p = 70 \text{ bar}$

Load force $F = 2 \text{ kN}$

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 Ød			[mm]	10
Stroke			[mm]	6.5
Oil volume	extending	single acting	[cm ³]	0.6
	extending	double acting	[cm ³]	0.7
	retracting	double acting	[cm ³]	0.07
Recommended minimum pressure			[bar]	25
Max. pressure in return line			[bar]	1
			[bar]	2.5
Spring force min./max.			[N]	3.7/9.5
Elastic deformation			[µm/kN]	$\frac{(SL + 31)}{11.7} + 5.33$
Load force F at 70 bar				
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

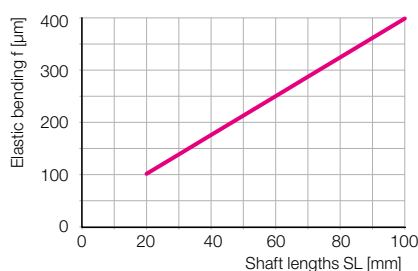
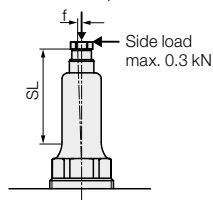
			Part no.
O-ring 1 10.82 x 1.78 (single acting)			3001 013
O-ring 2 21.95 x 1.78 (single acting)			3002 170
Seal kit, external seals (double acting)			0132 927

Article available on request

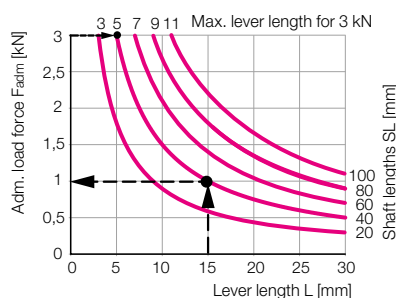
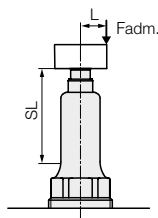
On request, we will check whether the article is still available.

**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**

Max. load force up to 3 kN



**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 1947110S106040**

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



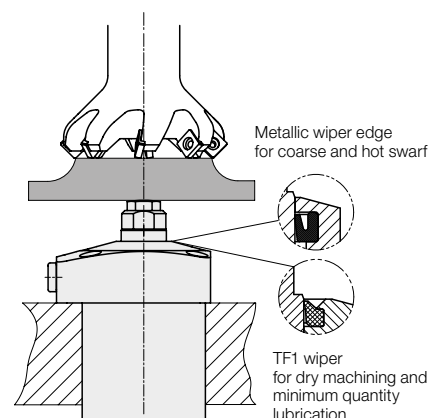
Work Supports

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.

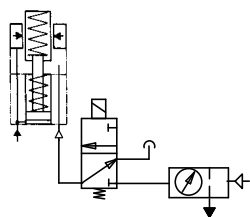
Unlocking and retracting of the support plunger is made by spring force.

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.

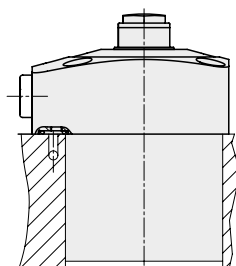
The positive air pressure connection must be free of oil and water.



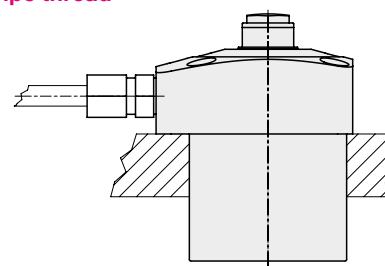
Connection of positive air pressure protection

Installation and connecting possibilities

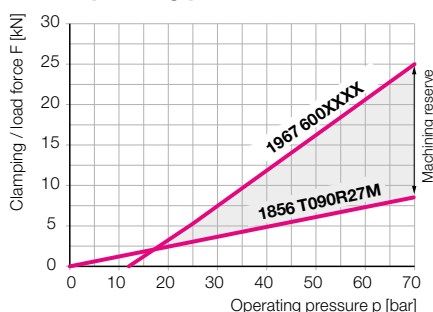
Drilled channels



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:

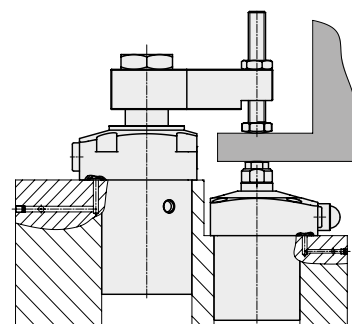
$$\begin{aligned} &\text{Clamping force} \\ &+ \text{max. machining force} \\ &= \text{minimum support force} \times \text{safety factor} \end{aligned}$$

Rough calculation from practice:

Required support force $\geq 2 \times$ 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



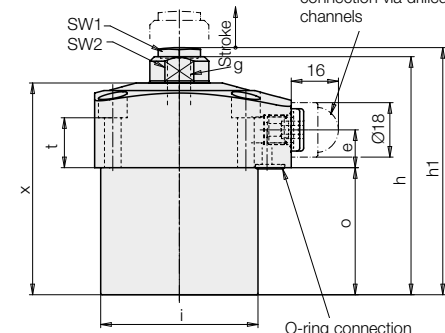
Example

Work support 1967 600XXXX
 max. load force at 70 bar 25.0 kN
 and
 swing clamp 1856 T090R27M
 as per data sheet B 1.8500
 – Effective clamping force at 70 bar 8.3 kN
 = Reserve for machining force 16.7 kN

Dimensions

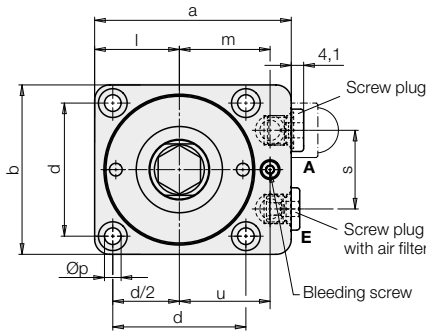
Technical Data • Accessories

Accessory
Flow control valve
2957 209
can only be used for
connection via drilled
channels



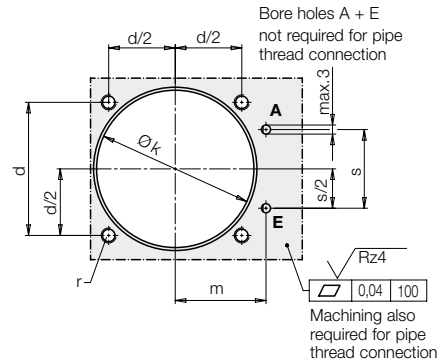
Important note
Both O-rings must be inserted also
for pipe thread connection.

O-ring connection
2 x O-ring 7 x 1.5
included in the delivery

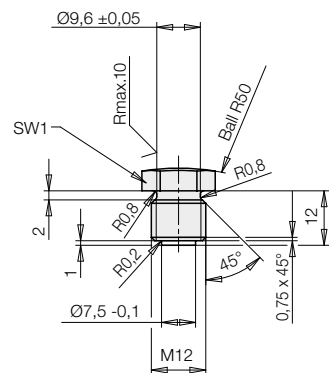


A = hydraulics G 1/8
E = venting or positive air pressure connection G 1/8

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 ØD	[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
Øi	[mm]	52 -0.2	60 -0.2
Øk	[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
Øp	[mm]	5.5	6.5
r		M5	M6
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	2957 209	2957 209
Screw plug G 1/8	3610 158	3610 158

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
2957 209 (accessory)

Port E: Screw plug with air filter

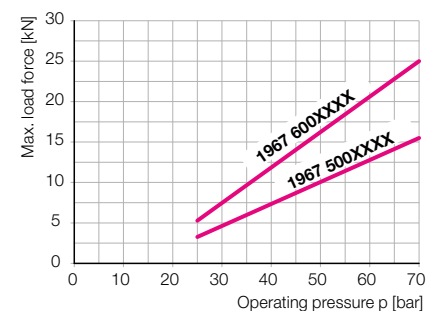
2.2 Wet environment

Port A: see 2.1

Port E: Screw plug G 1/8

3610 158 (accessory)

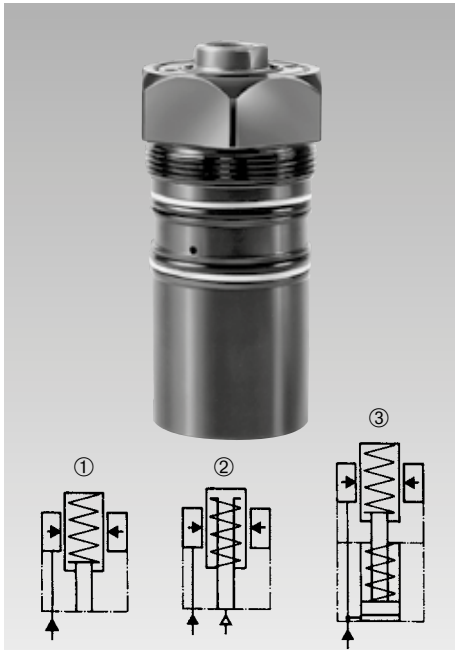
Adm. load force F as a function of the operating pressure p





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.

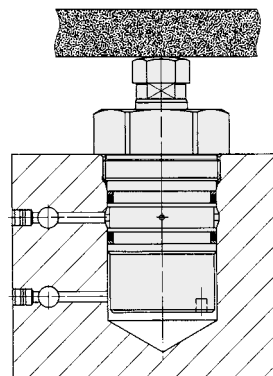
There are three variations of plunger actuation:

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).

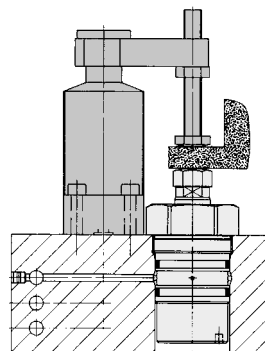
3. Hydraulic pressure and spring advanced; plunger retracted in off-position. It moves forward with a light spring force against the workpiece, when hydraulic pressure is applied (see page 4).

Installation example

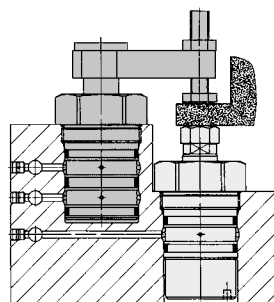


Combination possibilities

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

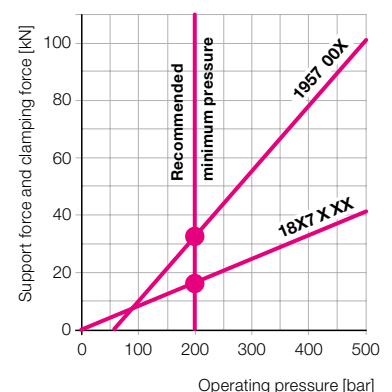
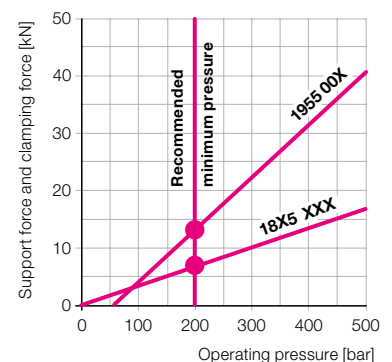
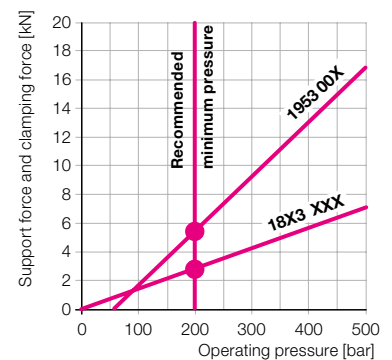


Important note

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 $\geq 2 \times$ opposing force

The diagrams below show the graphs of the clamping and support forces for the 3 possible combinations.



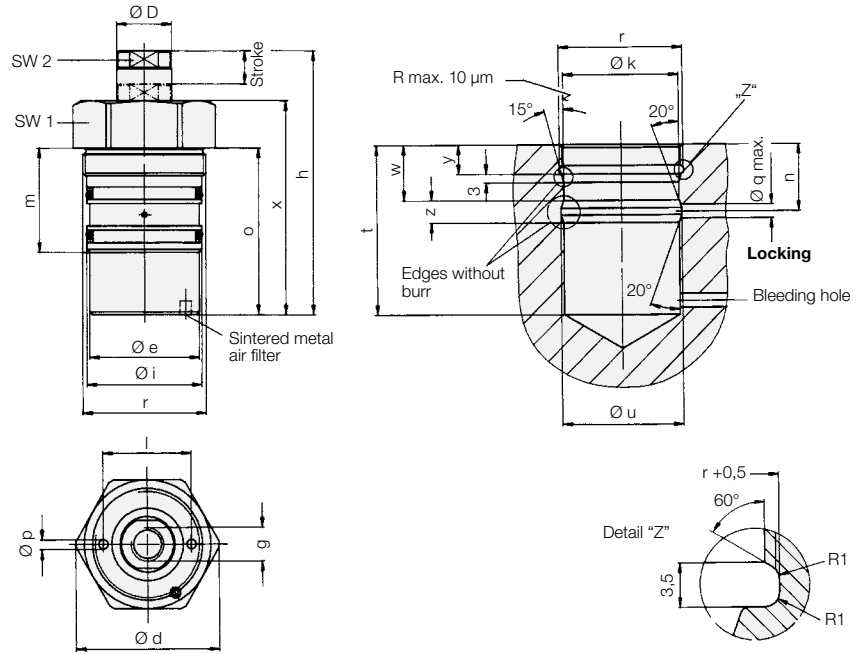
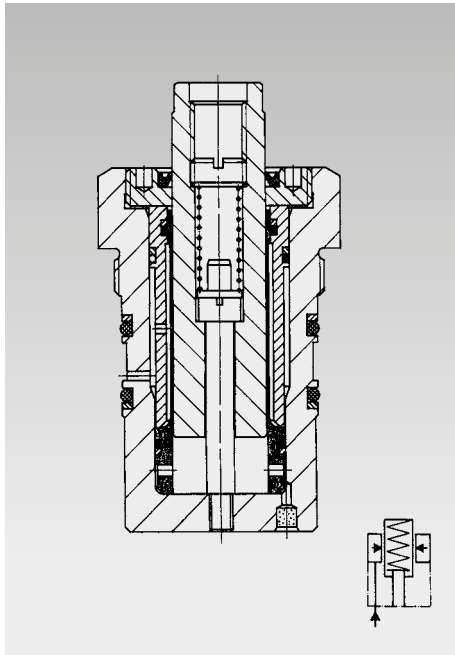
Example

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.

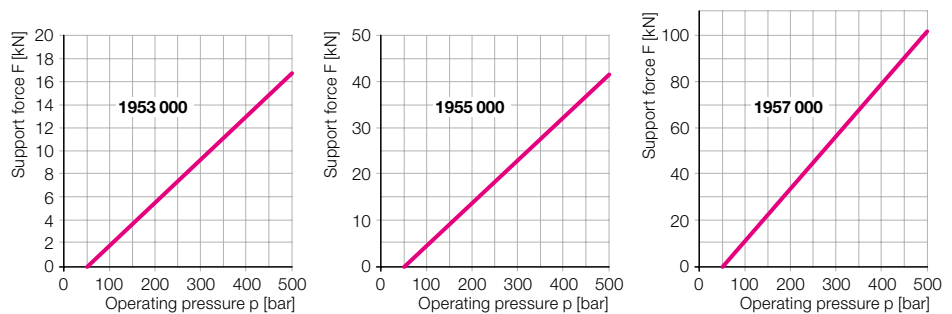
It is absolutely necessary to follow the instructions for venting of the spring area on data sheet G 0.110.

The support plunger must always be protected against penetration of contamination by a contact bolt (see accessory) or a plug.

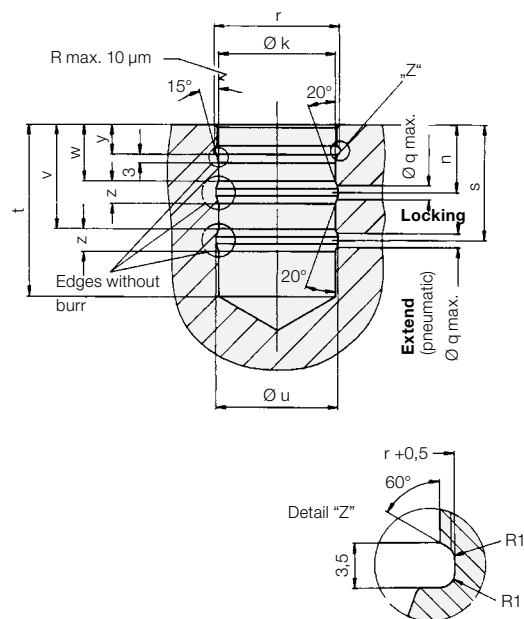
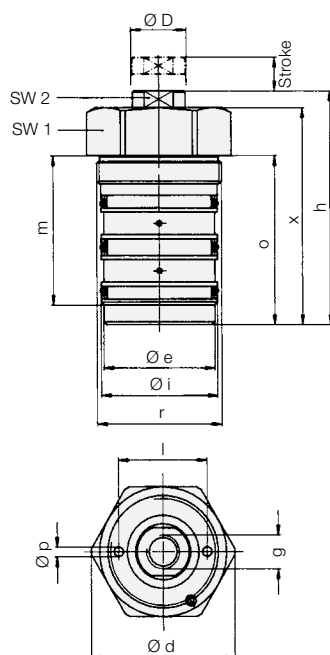
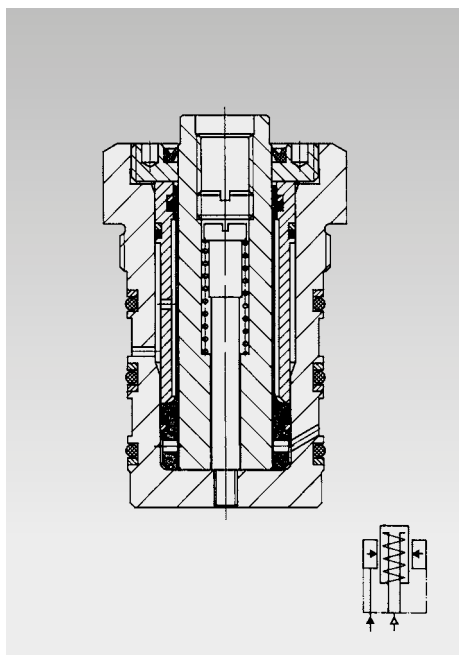
Plunger Ø D	[mm]	20	32	50
Stroke	[mm]	12	16	20
Support force at 200/500 bar	[kN]	5.6/16.8	14/42	34/102
Plunger contact force min./ max.	[N]	15/25	30/60	50/100
Ø d	[mm]	52	64	100
Ø e	[mm]	41	53	83
g x depth of thread	[mm]	M 12x12	M 12x12	M 16x20
h	[mm]	95	119	174
Ø i f7	[mm]	42	55	85
Ø k H7	[mm]	42	55	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		0131 525	0131 527	0131 529
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

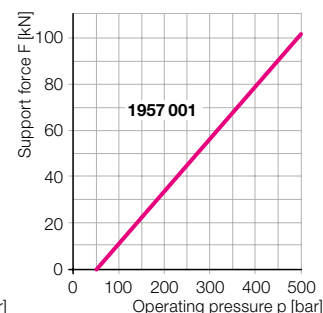
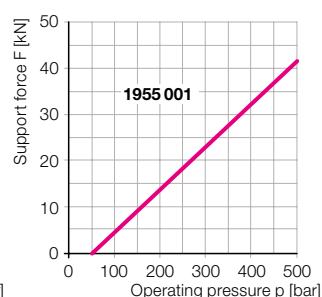
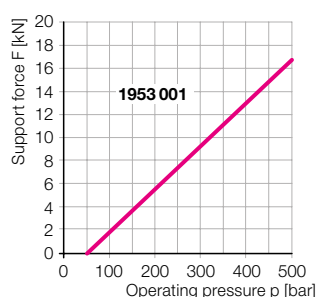


The support plunger is retracted in off-position.
 The pneumatically-actuated plunger allows precise setting of the plunger contact force by means of a pressure reducing valve.
 The support plunger is provided with female thread to enable the use of threaded pieces for height adjustment.
 The support plunger must always be protected against penetration of contamination by a contact bolt (see accessory) or a plug.

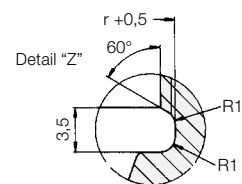
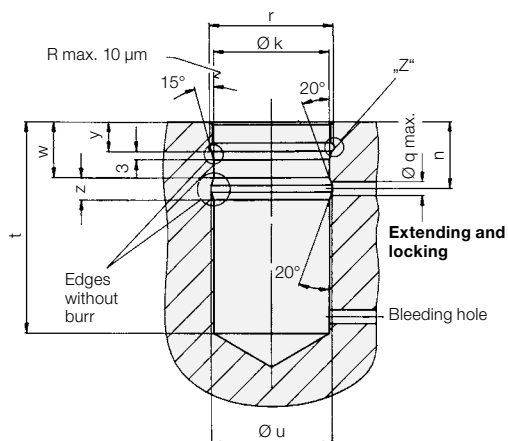
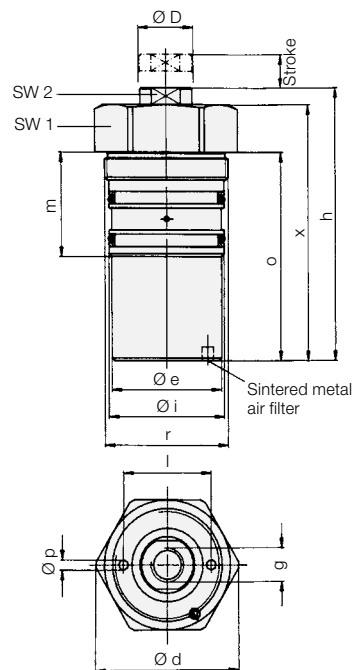
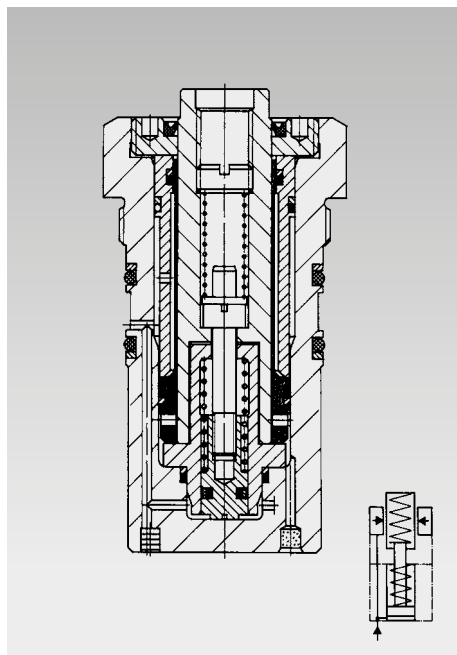
Plunger Ø D	[mm]	20	32	50
Stroke	[mm]	12	16	20
Support force at 200/500 bar	[kN]	5.6/16.8	14/42	34/102
Spring force min./max.	[N]	15/25	30/60	50/100
Plunger contact force at 1 bar air pressure (deduct spring force, if necessary)	[N]	31	80	196
Ø d	[mm]	52	64	100
Ø e	[mm]	41	53	83
g x depth of thread	[mm]	M 12x12	M 12x12	M 16x20
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.

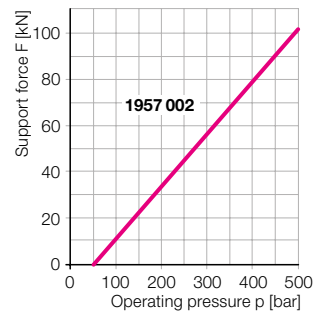
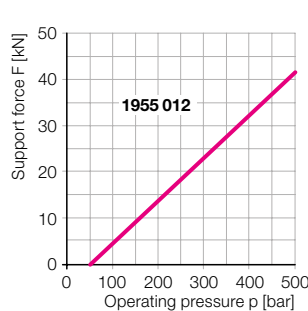
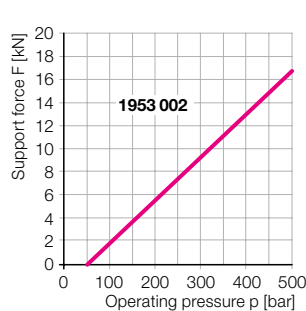
It is absolutely necessary to follow the instructions for venting of the spring area on data sheet G 0.110.

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

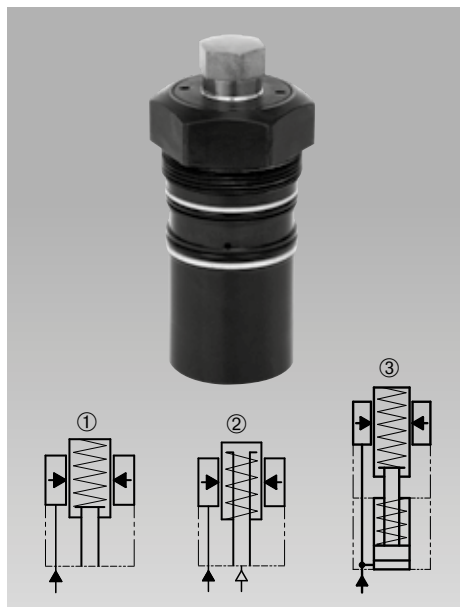
Adm. support force F as function of the operating pressure p





Threaded-Body Work Supports

with metallic wiper edge, 3 sizes, 3 types of function,
single acting, max. operating pressure 500 bar



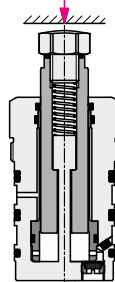
Advantages

- 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

Types of function

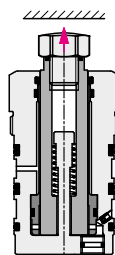
1. Spring advanced

Page 2



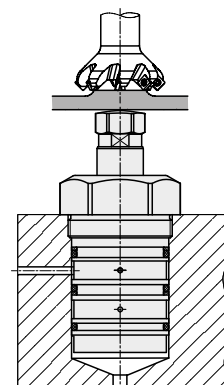
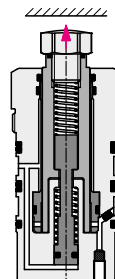
2. Air pressure advanced

Page 3

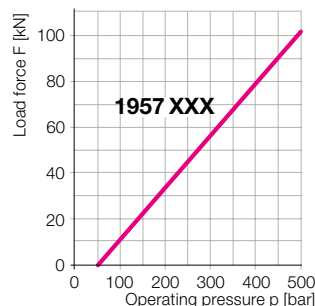
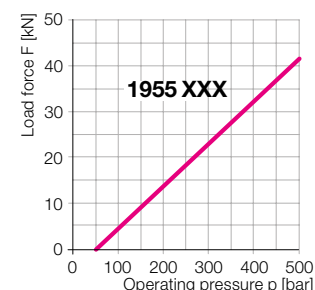
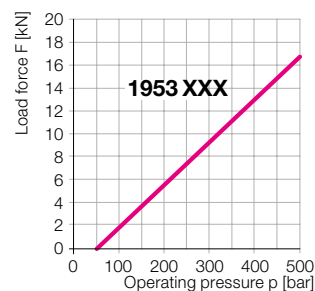


3. Hydraulic pressure and spring advanced

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 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

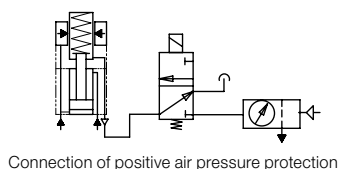
Work supports are not suitable to compensate side loads. The support plunger must not be stressed by tensile load. The admissible load force is valid for static or dynamic load. Machining forces can generate vibrations, whose amplitude exceeds far an average value, and this can cause yielding of the 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.

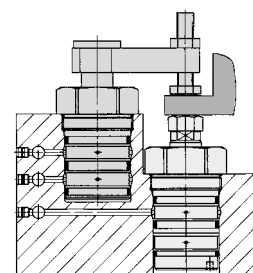
The positive air pressure connection must be free of oil and water.



Connection of positive air pressure protection

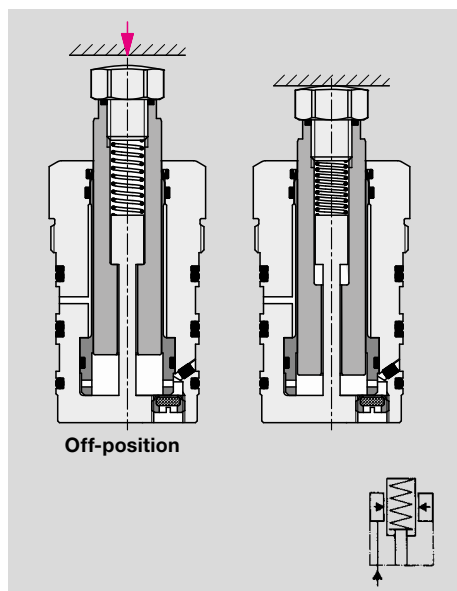
Combination with clamping elements

Page 5



Type of Function: Spring Advanced

Off-position Extended, Contact by Spring Force

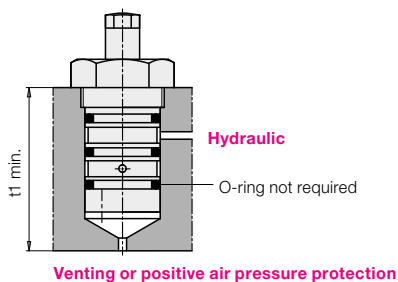


The support plunger is pushed back by the inserted workpiece, the spring force has to be overcome.

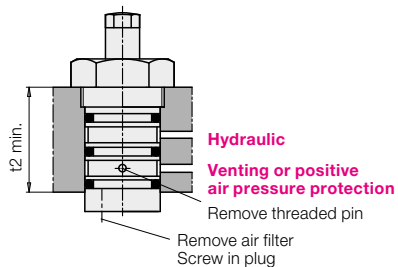
The support plunger will be locked by hydraulic pressure and can compensate forces in axis direction.

After unclamping the support plunger contacts still the workpiece with spring force, until the workpiece will be unloaded from the fixture.

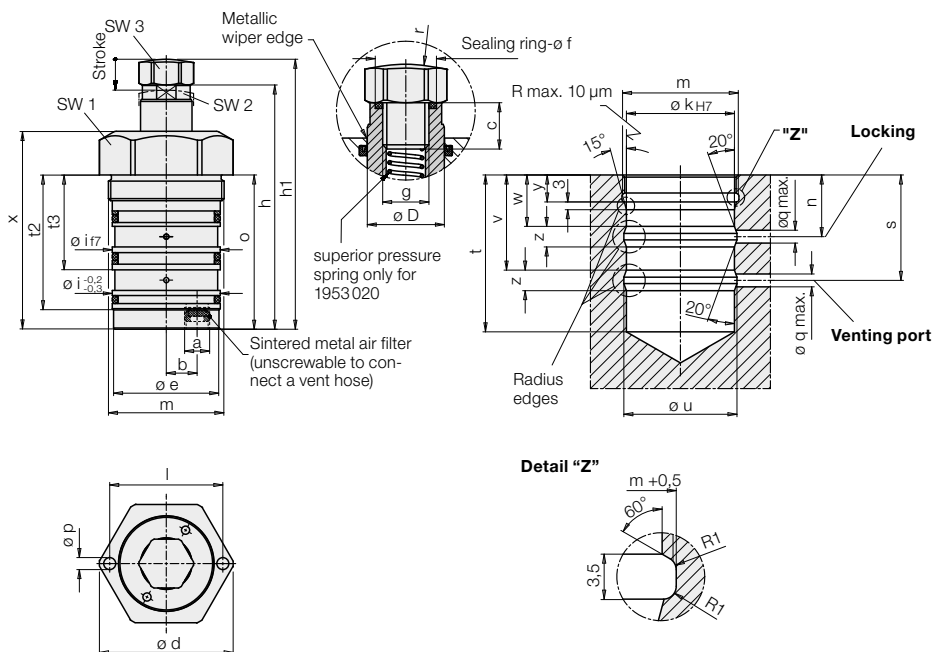
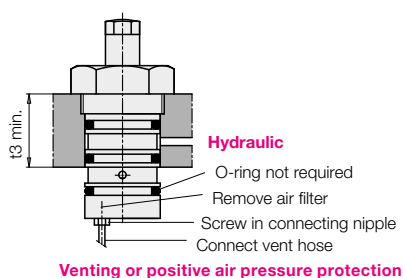
1. Venting via pocket hole



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.	1953 020	1955 020	1957 020
Spare seals - Seal kit for external seals	0132 384	0132 385	0132 386
Spare sealing ring for contact bolt	3001 731	3001 731	3002 018

Accessory for venting

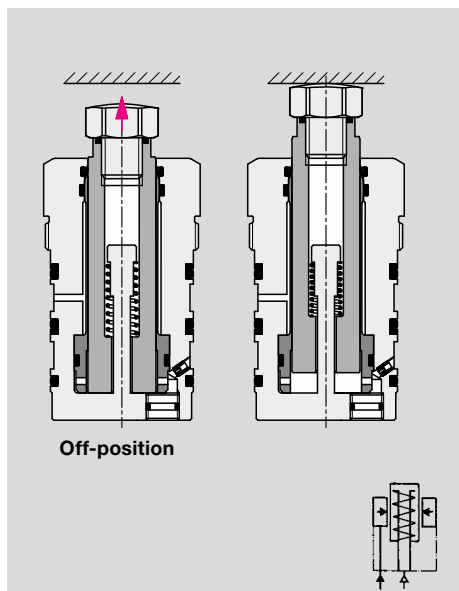
Type of venting 1**	Air filter	3302 008	3302 008	3302 009
	Threaded pin M3x4	3301 461	3301 461	3301 461
Type of venting 2	Plug	0361 986	0361 986	0361 987
Type of venting 3	Connecting nipple	3890 092	3890 092	3890 093
	Plastic hose	3890 131	3890 131	3890 131

* during load

** Included in the delivery

Type of Function: Air Pressure Advanced

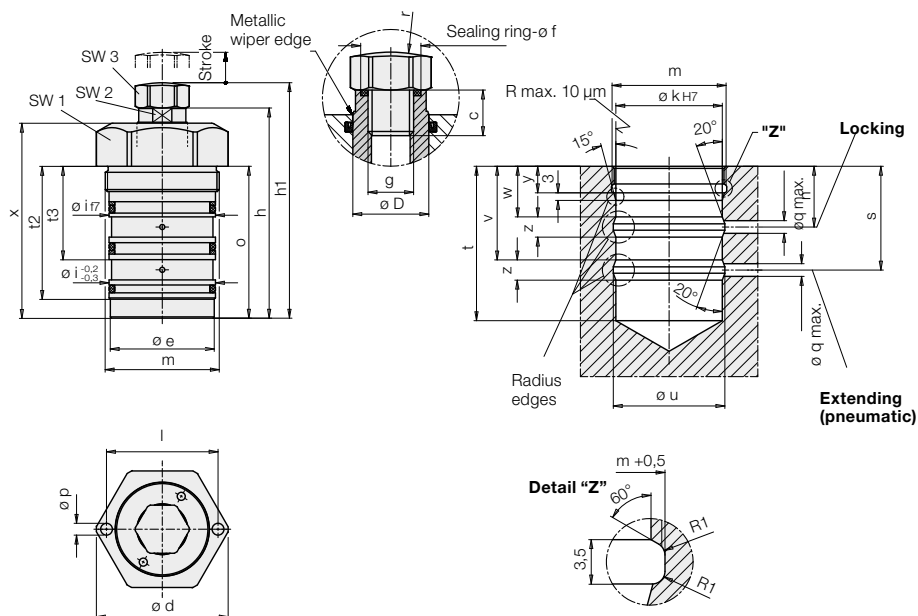
Extend and Contact by Air Pressure



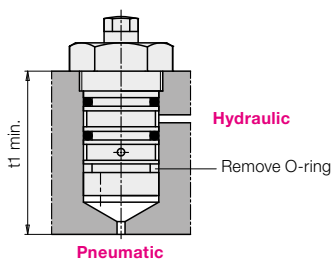
The support plunger contacts the workpiece by air pressure. The contact force is proportional to the air pressure less spring return force.

The support plunger will be locked by hydraulic pressure and can compensate forces in axis direction.

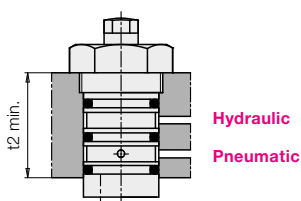
For unclamping hydraulic and air pressure will be released and the support plunger retracts by spring force to its off-position.



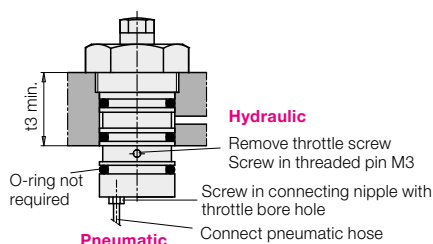
1. Pneumatic via pocket hole



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

Extending Hydraulically, Contact by Spring Force



For unclamping hydraulic pressure will be released. The small piston retracts by spring force to its off-position and also retracts the support plunger.

Hydraulic

- O-ring not required

Venting or positive air pressure protection

Hydraulic

Venting or positive air pressure protection

Remove threaded pin

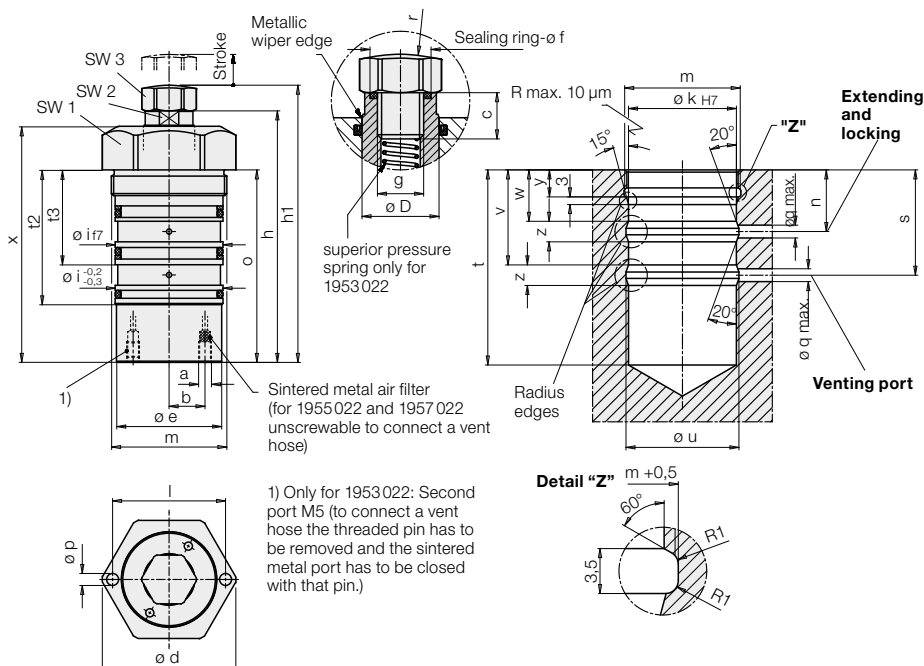
1953: screw in threaded pin
1955/1957: remove air filter and
screw in plug

Hydraulic

1953: Screw in connecting nipple M5
1955/1957: Remove air filter screw in connecting nipple

Connect vent hose

or positive air
pressure protection



1) Only for 1953 022: 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.)

Detail "Z" shows a 60° angle, a dimension of 3,5, and a radius R1.

Accessory for venting

* 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 occurring 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

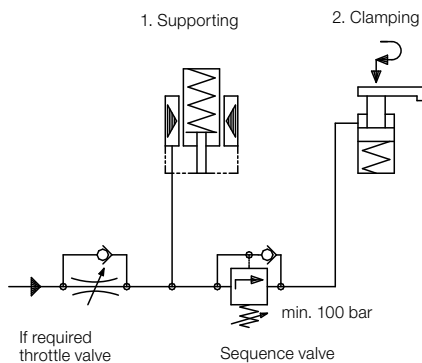
On principle the load force of the work supports should be at least twice the clamping force of the clamping elements.

Load force $\geq 2 \times$ 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.

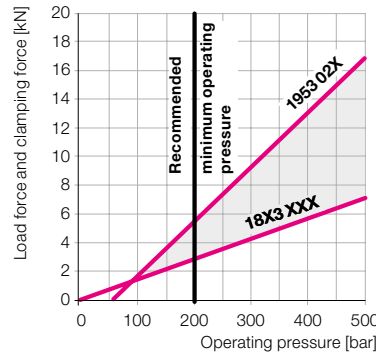
If due to a too high flow rate a throttle valve is required, installation should be made as shown in the hydraulic circuit diagram.

Combinations work supports with swing clamps of the same size

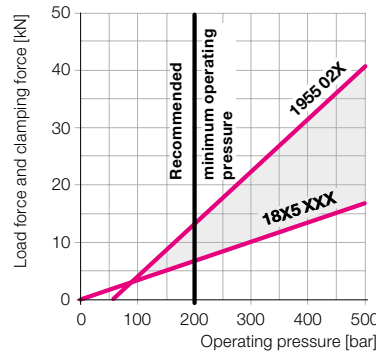
To get a load force twice the clamping force, for all 3 sizes of work supports an operating pressure of at least 200 bar is required.

The vertical distance of the two straight lines in the area of the coloured surface indicates the resulting maximally possible machining force including reserve.

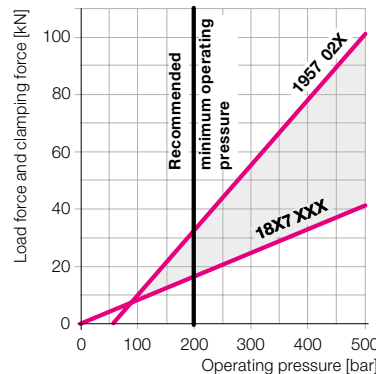
Size 1953



Size 1955



Size 1957

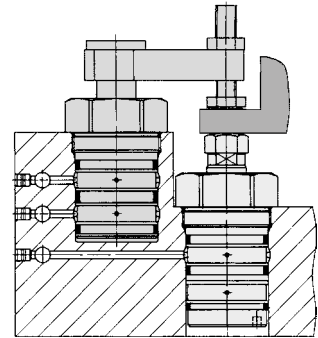


Important note

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

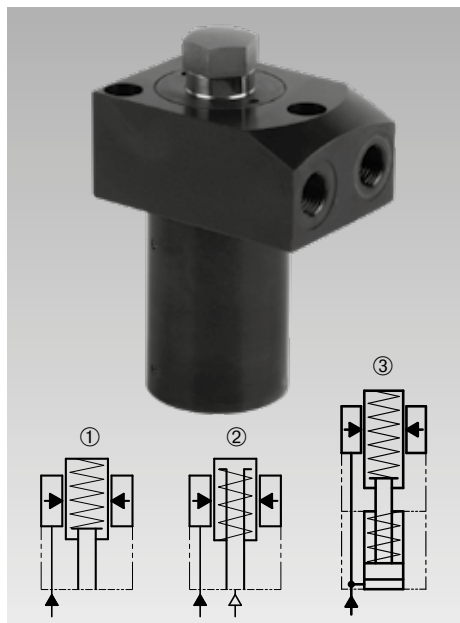
Possible machining force at 200 bar:

Admissible load force:	14 kN
- Clamping force:	- 7 kN
= Possible machining force:	7 kN
(including reserve)	



Work Supports

Top flange type with metallic wiper edge, 3 sizes, 3 types of function, single acting, max. operating pressure 500 bar



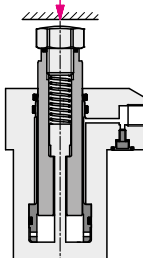
Advantages

- 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

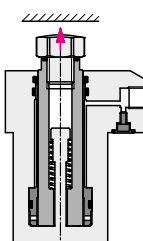
1. Spring advanced

Page 2



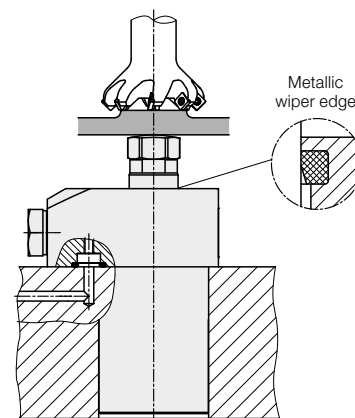
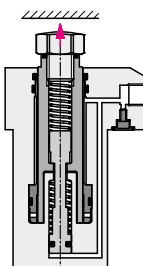
2. Air pressure advanced

Page 3

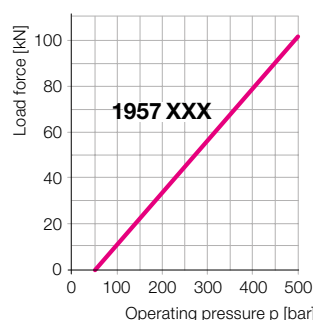
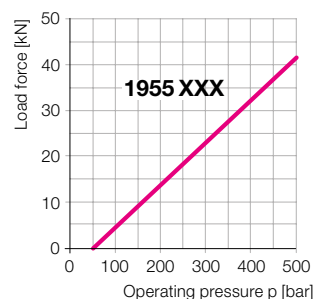
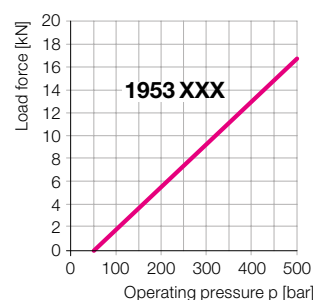


3. Hydraulic pressure and spring advanced

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

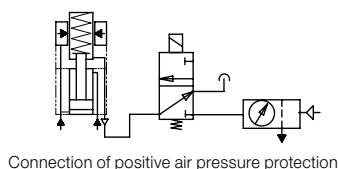
Work supports are not suitable to compensate side loads. The support plunger must not be stressed by tensile load. The admissible load force is valid for static or dynamic load. Machining forces can generate vibrations, whose amplitude exceeds far an average value, and this can cause yielding of the 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.

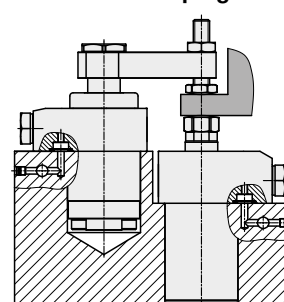
The positive air pressure connection must be free of oil and water.



Connection of positive air pressure protection

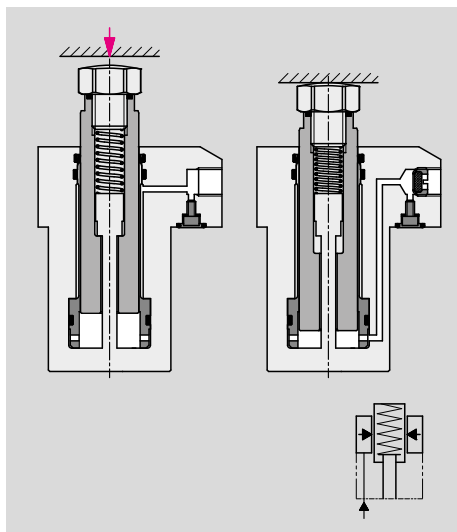
Combination with clamping elements

Page 5



Type of Function: Spring Advanced

Off-position Extended, Contact by Spring Force



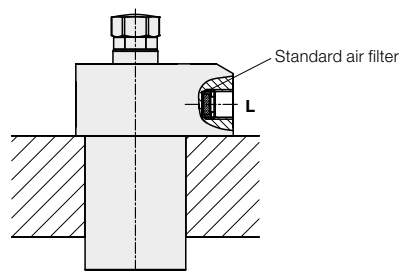
The support plunger is pushed back by the inserted workpiece, the spring force has to be overcome.

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.

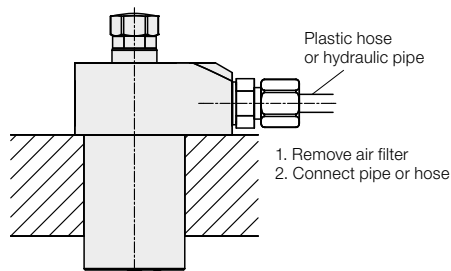
Venting port

1. Dry machining

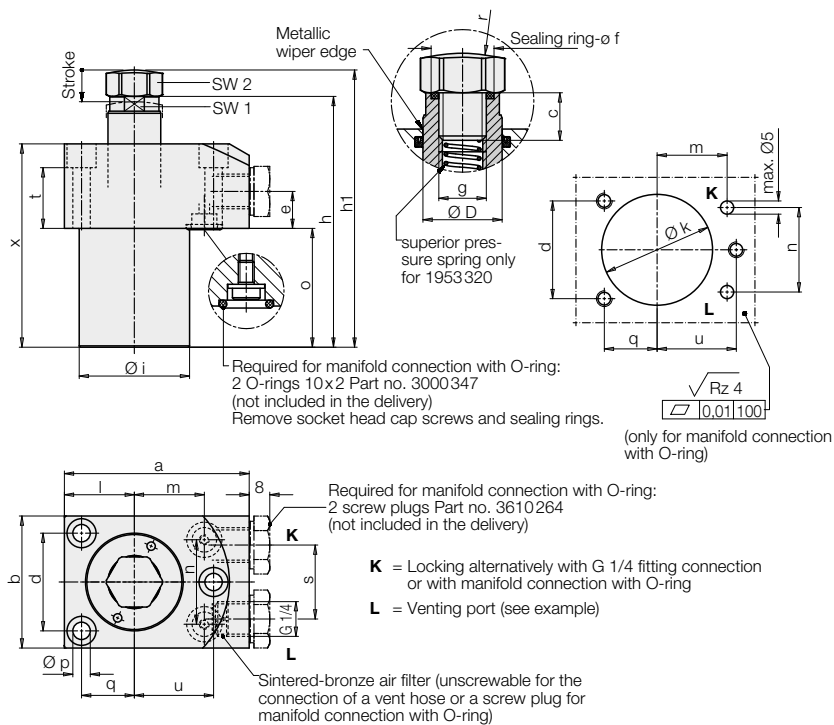
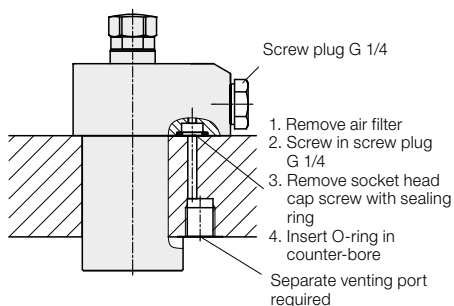


2. Wet machining

Pipe thread



Manifold-mounting connection



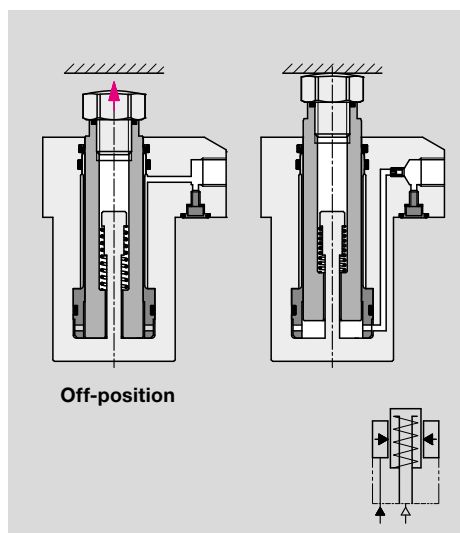
Support plunger Ø D	[mm]	20	32	50
Stroke	[mm]	12	16	20
Load force at 200/500 bar	[kN]	5,6/16,8	14/42	34/102
Plunger contact force min./max.	[N]	15/25	30/60	50/100
Elastic deformation at 500 bar	[µm/kN]	4,5	2,8	1,8
a	[mm]	70	85	125
b	[mm]	50	63	95
c	[mm]	12	12	20
d	[mm]	37	48	72
e	[mm]	14	18	15
Ø f	[mm]	15,9	15,9	19,6
g	[mm]	M12	M12	M16
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.

Type of Function: Air Pressure Advanced

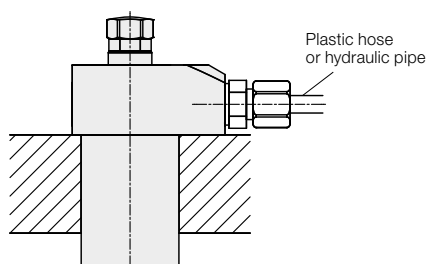
Extend and Contact by Air Pressure



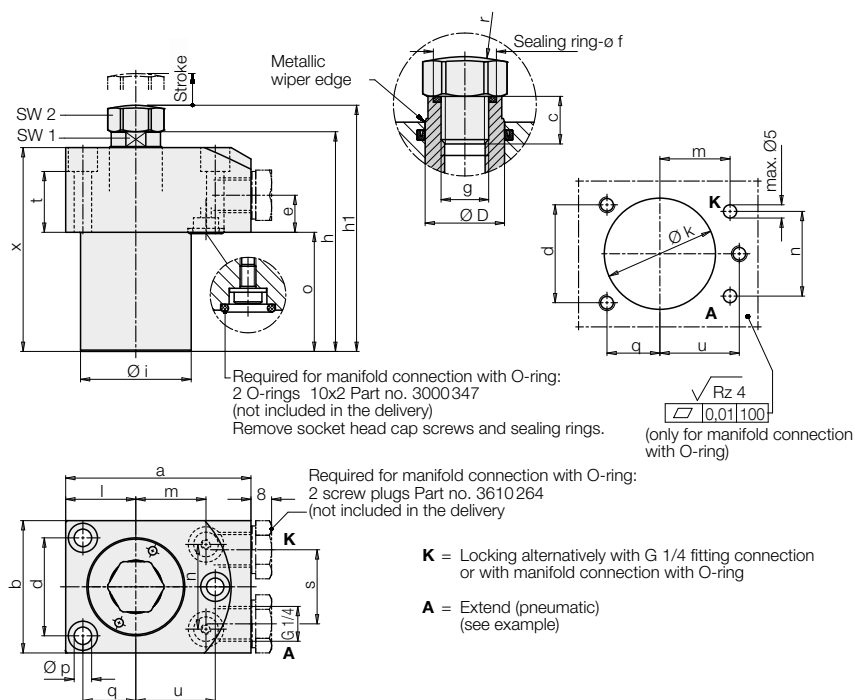
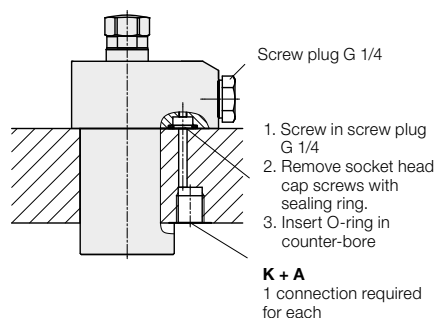
The support plunger contacts the workpiece by air pressure. The contact force is proportional to the air pressure less spring return force. The support plunger will be locked by hydraulic pressure and can compensate forces in axis direction.

For unclamping hydraulic and air pressure will be released and the support plunger retracts by spring force to its off-position.

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.

Extending Hydraulically, Contact by Spring Force

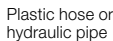


For unclamping hydraulic pressure will be released. The small piston retracts by spring force to its off-position and also retracts the support plunger.

1. Dry machining



Pipe thread



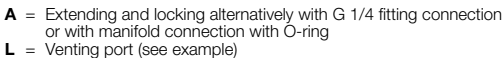
1. Remove air filter
2. Connect pipe or hose

Manifold-mounting connection



1. Remove air filter
2. Screw in screw plug G 1/4
3. Remove socket head cap screw with sealing ring
4. Insert O-ring in counter-bore

Separate venting port required



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

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.

$$\begin{aligned} &\text{Admissible load force} \\ &- \text{Clamping force} \\ &- \text{Safety (reserve)} \\ &= \text{Possible machining force} \end{aligned}$$

If the total of all occurring forces exceeds the admissible load force, the support plunger of the work support will be pushed back and the work support will be damaged.

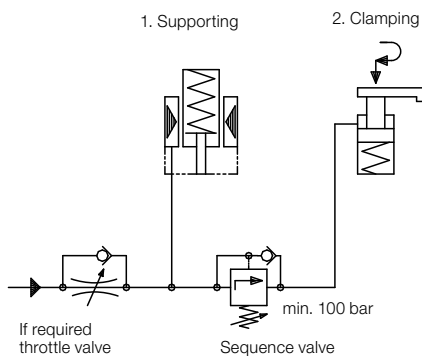
Ratio of load force to clamping force

On principle the load force of the work supports should be at least twice the clamping force of the clamping elements.

Load force $\geq 2 \times$ 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.



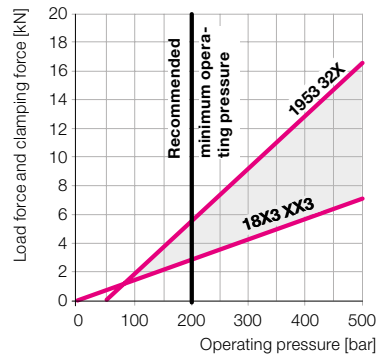
The sequence valve has to be adjusted to an opening pressure above the intersection of the two straight lines in the diagram. If due to a too high flow rate a throttle valve is required, installation should be made as shown in the hydraulic circuit diagram.

Combinations work supports with swing clamps of the same size

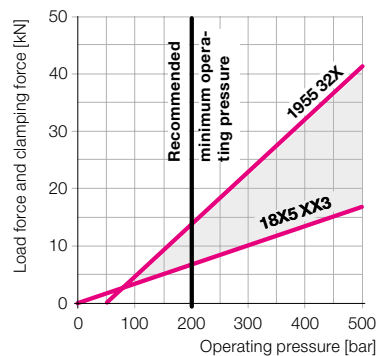
To get a load force twice the clamping force, for all 3 sizes of work supports an operating pressure of at least 200 bar is required.

The vertical distance of the two straight lines in the area of the colorised surface indicates the resulting maximally possible machining force including reserve.

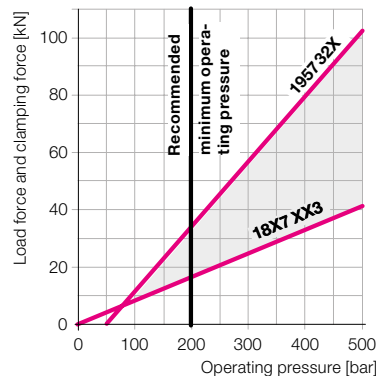
Size 1953



Size 1955



Size 1957

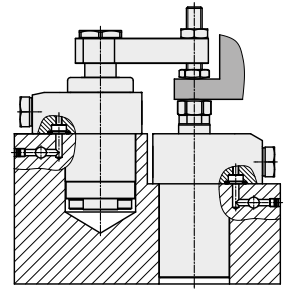


Important note

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:

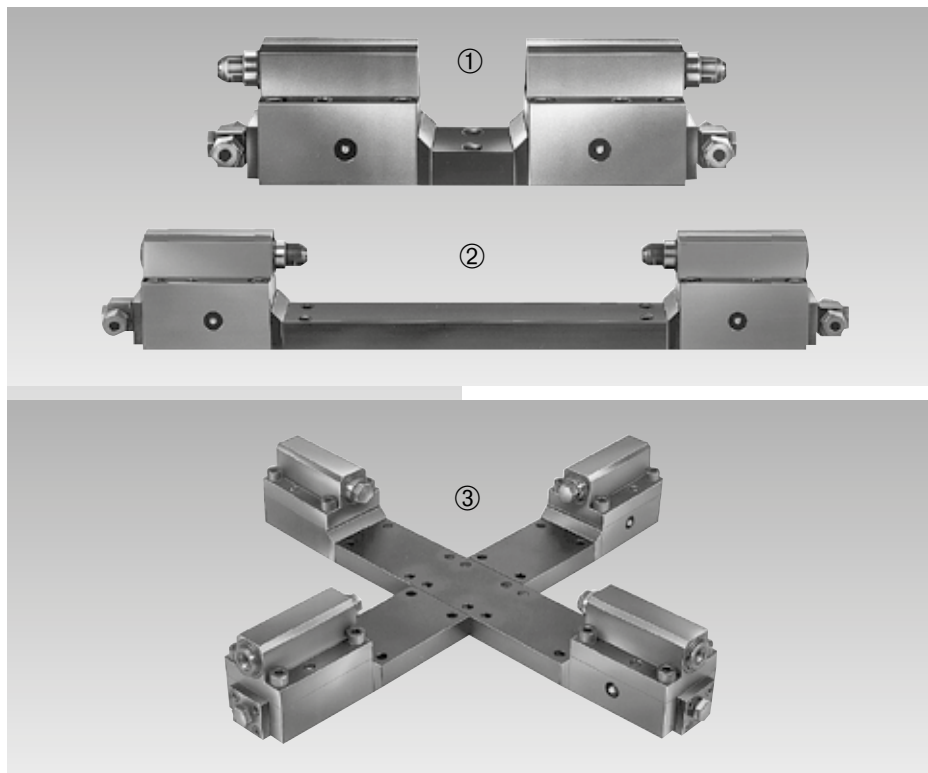
Minimum operating pressure: 200 bar
Load force at 200 bar: 14 kN
Clamping force at 200 bar: 7 kN

Possible machining force at 200 bar:

Admissible load force: 14 kN
– Clamping force: – 7 kN
= Possible machining force: 7 kN (including reserve)



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.

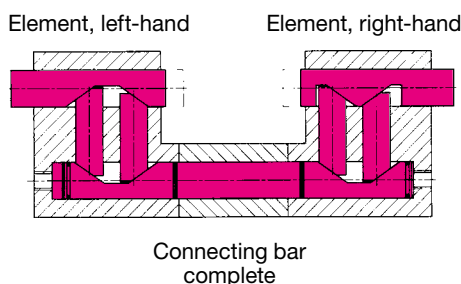
Description

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.

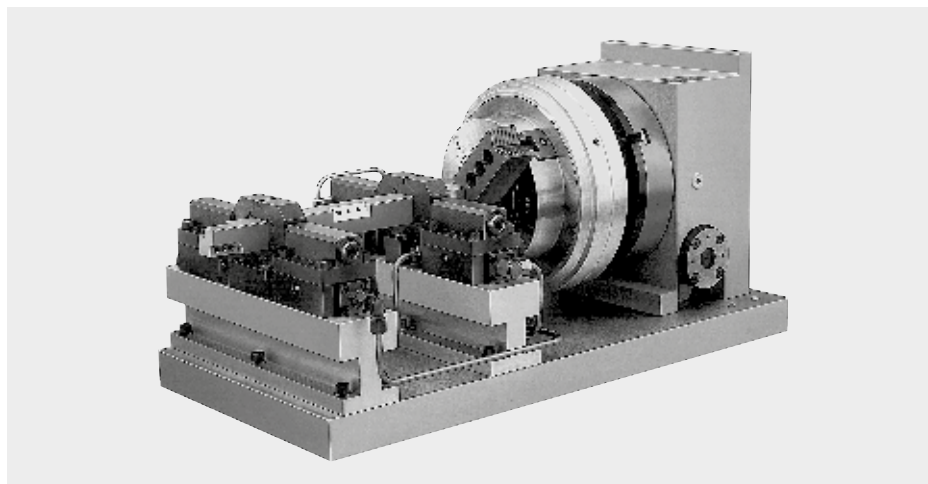
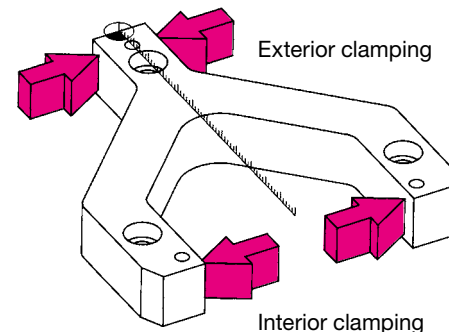
In our development, the individual parts can be connected to a two or multiple-element version. In the multiple-jaw version, each pair of jaws clamps independently of the remaining ones, thereby concentric clamping is obtained.

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.

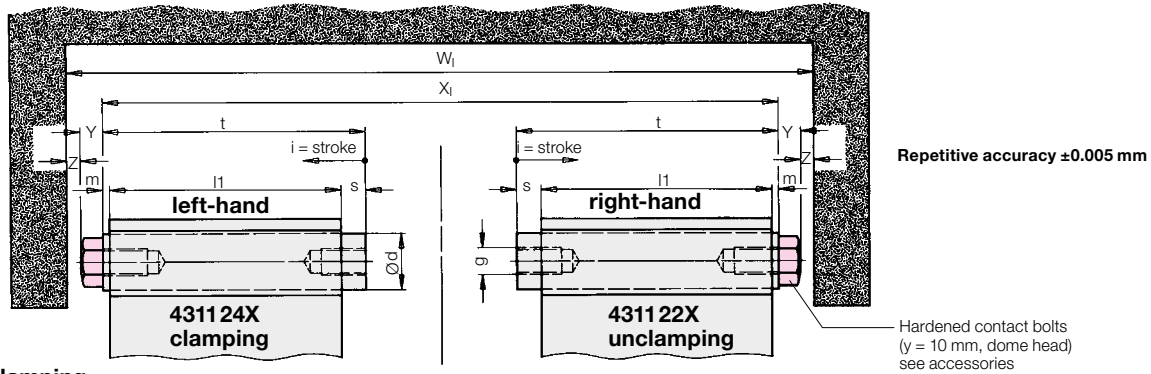
The two-jaw chuck and the right-hand concentric clamping element keep the bars in the exact working position.

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.

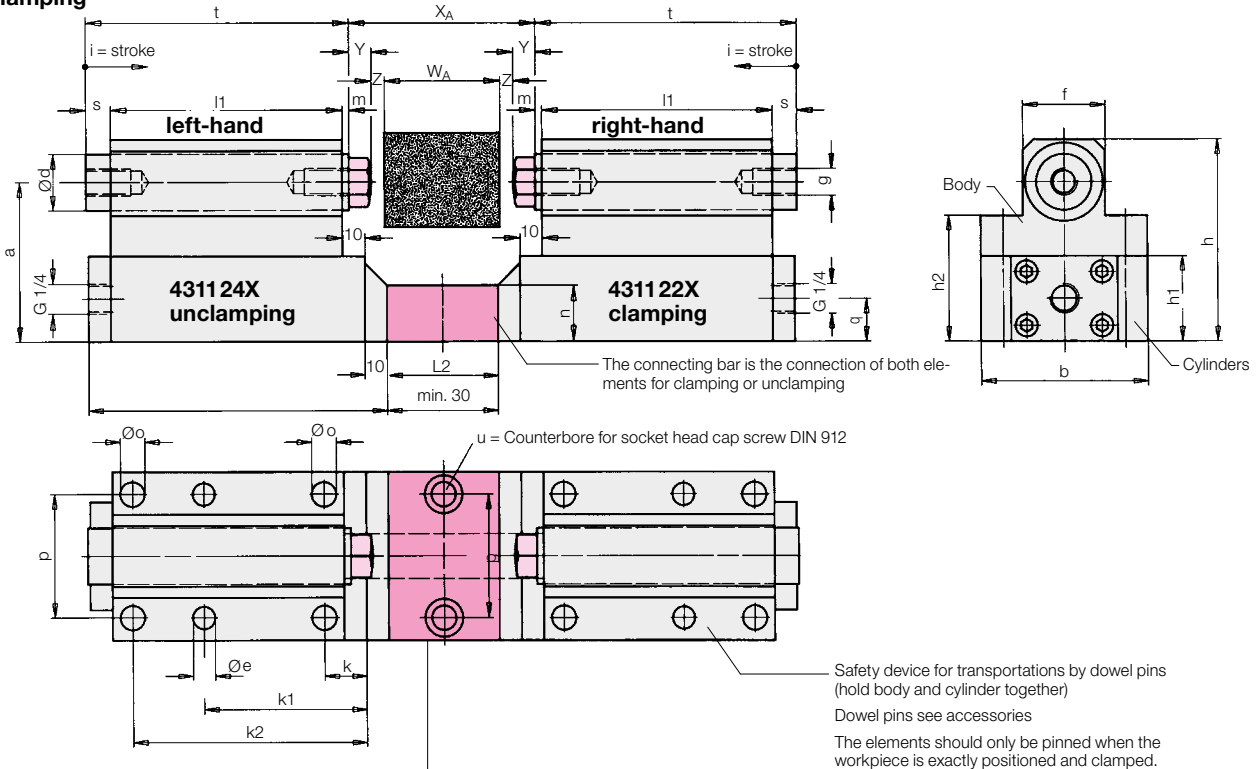
(Available on request)



– 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

$X2_{min_I}, X3_{min_I}, X4_{min_I}$ = minimum dimension interior clamping (chart)

$W_A, W_{A(a/b)}$ = workpiece outside dimension

$X2_{min_A}, X3_{min_A}, X4_{min_A}$ = minimum dimension exterior clamping (chart)

(a/b) = only applies to crossing for 4 elements

(bolt retracted without contact bolt)

For rectangular section (a x b) two different lengths of connecting bars L_a and L_b are required

Y = height contact bolt

Z = ideal stroke per clamping bolt up to the workpiece (< clamping stroke)

Size		D16	D25	D32
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. ₁ / X2 min. _A	[mm]	238/66	284/64	316/64
X3 min. ₁ / X3 min. _A	[mm]	320.4/148.4	386/166	438/186
X4 min. ₁ / 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

Article available on request

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

Accessories

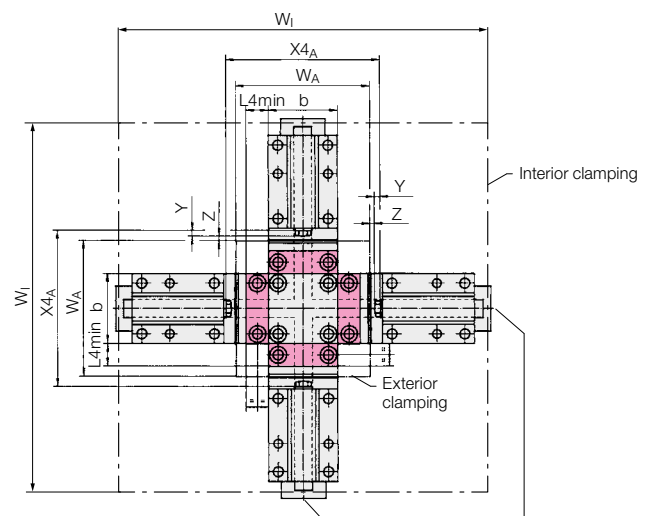
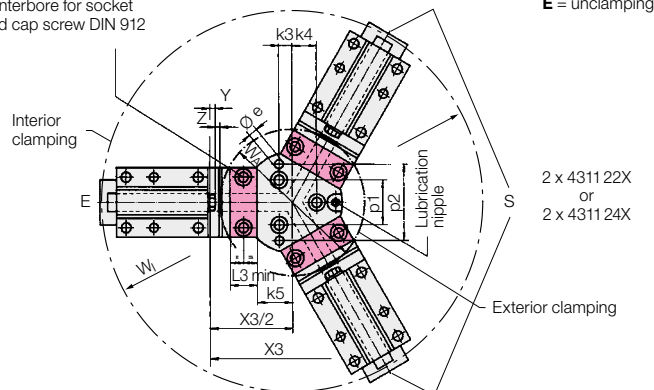
Contact bolt (y = 10 mm)

Part no.**3614001****3614028****3614003**

Dowel pin DIN 6325

Part no.**3300313****3300489****3300617****Crossing for 3 elements****Crossing for 4 elements**

u = bore hole and counterbore for socket head cap screw DIN 912



Required elements for

Exterior clamping

2 elements

4311 22X

1 element

4311 24X

1 crossing for 3 elements

0432 30X

3 connecting bars L3

0432 XXX

The 3 connecting bars must have the same length.

Interior clamping

1 element

4311 22X

2 elements

4311 24X

1 crossing for 3 elements

0432 30X

3 connecting bars L3

0432 XXX

Required elements for

Exterior or interior clamping

2 elements

4311 22X

2 element

4311 24X

1 crossing for 4 elements

0432 40X

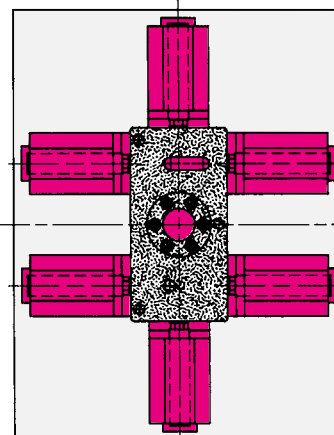
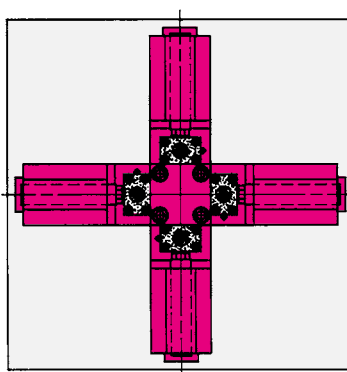
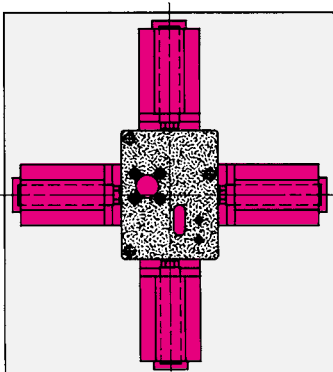
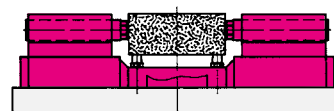
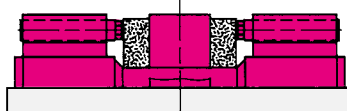
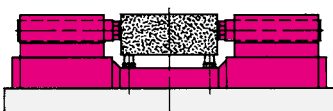
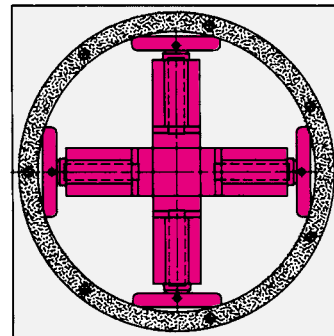
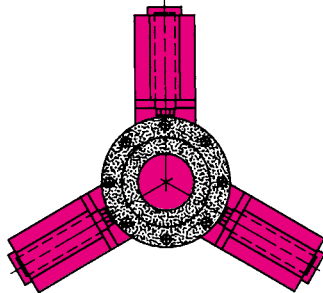
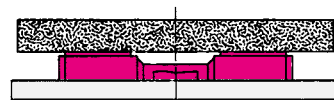
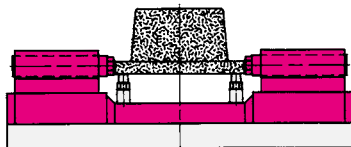
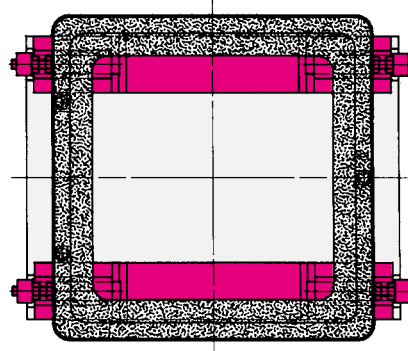
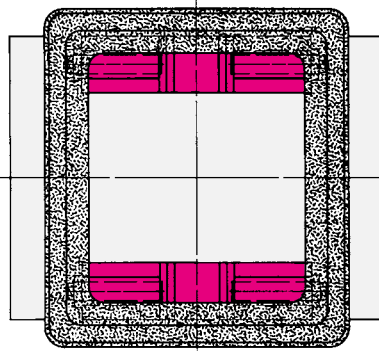
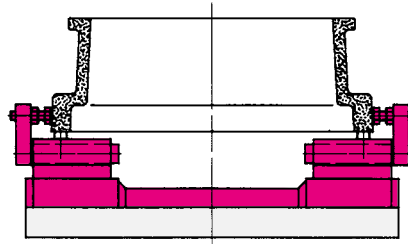
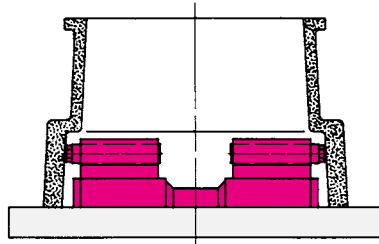
4 connecting bar L4(a/b)

0432 XXX

For a rectangular section, always 2 connecting bars have the same length.

2 x 4311 22X

S for exterior clamping**E** for interior clamping

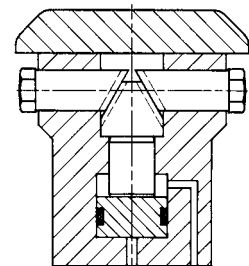
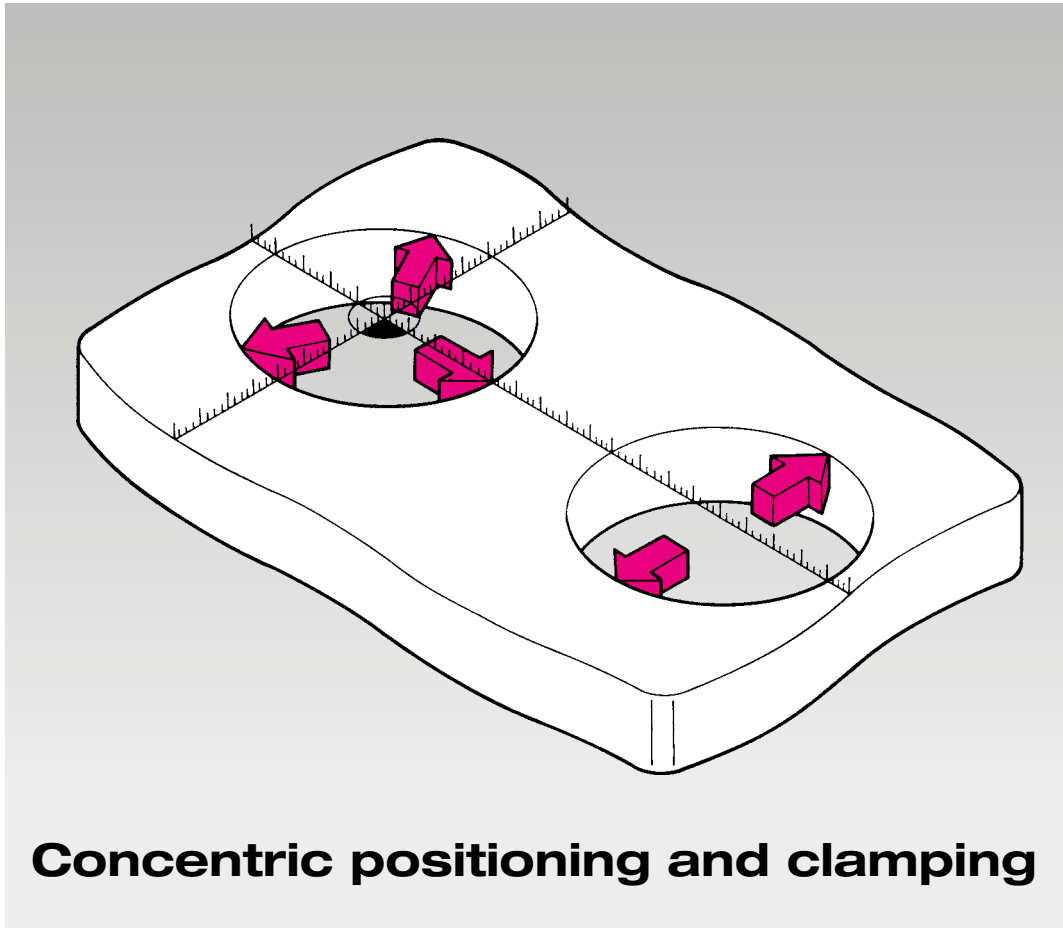




Concentric Positioning and Clamping Elements

2 and 3-point positioning, double acting, hydraulically operated
 max. operating pressure 250 bar

Diameters from 25 mm to 177 mm



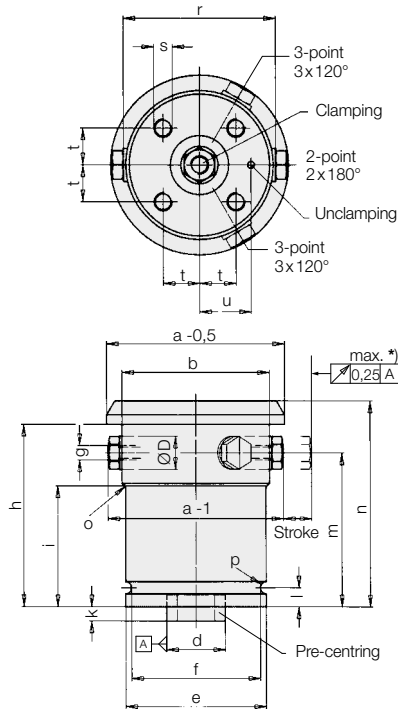
2 and 3-Point Concentric Positioning and Clamping Elements



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	[cm³]	0.35	0.35	0.35	0.85	1.39	2.17
/ mm return stroke	[cm³]	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 j 6	[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

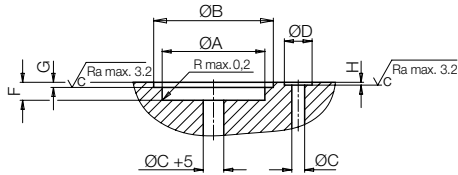
Order information

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.

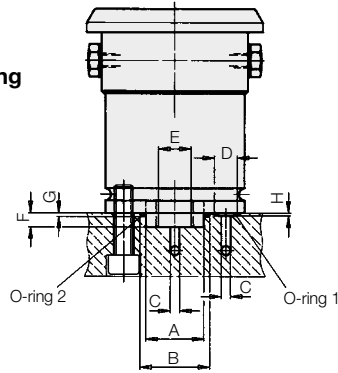
Clamping examples

see page 4.

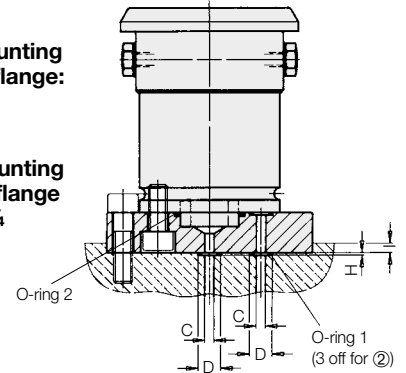
Centring and sealing for direct mounting, mounting by segments and mounting by ball nut



① Direct mounting

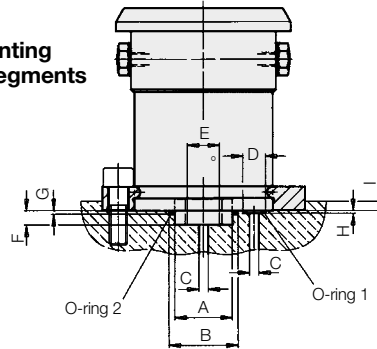


② Mounting by flange:

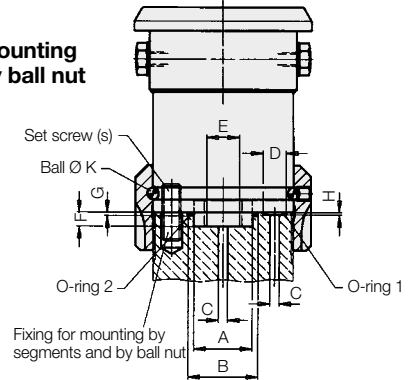


③ Mounting by flange G ¼

④ Mounting by segments

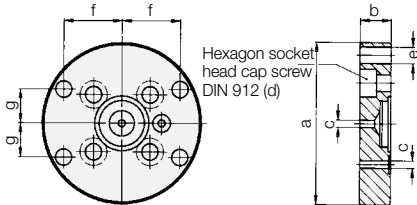


⑤ Mounting by ball nut



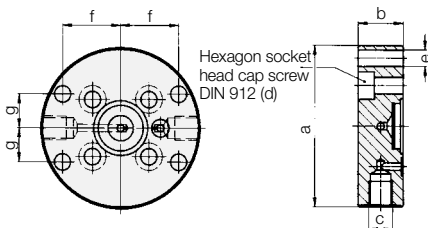
O-rings for mounting variants ① ② ③ ④ ⑤ (not included in the delivery)

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



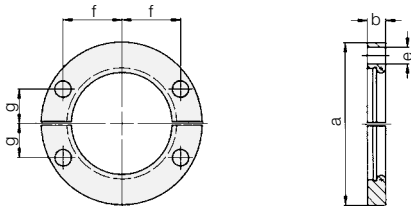
Mounting by flange ②

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



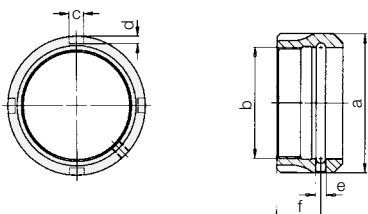
Mounting by flange G ¼ ③

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

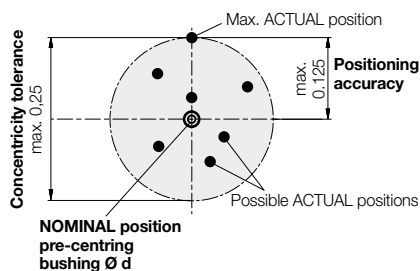
Positioning Accuracy Clamping Examples

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 $\varnothing d$

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.



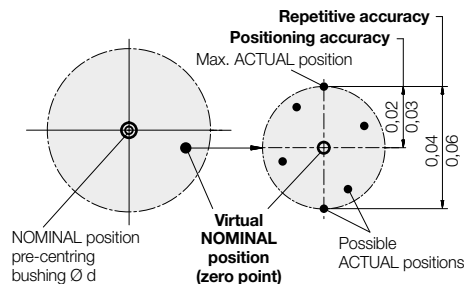
If further workpieces are inserted and clamped in the same way, the position accuracy will reach approximately the same value again.

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

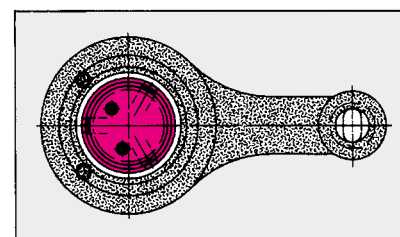
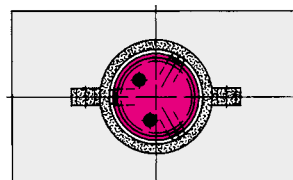
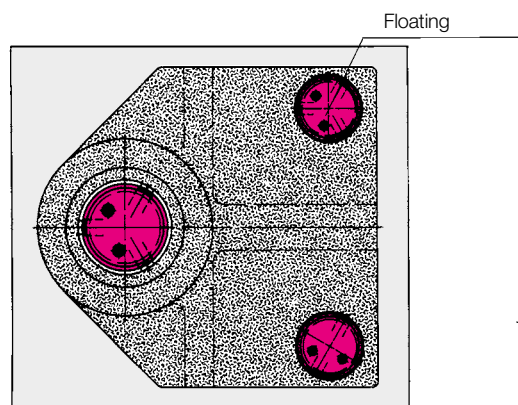
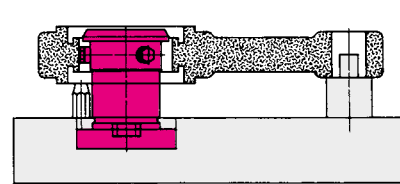
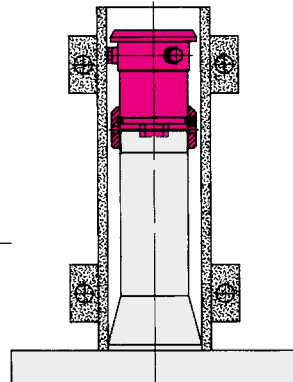
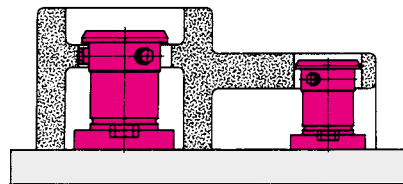
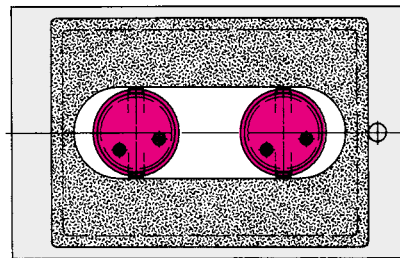
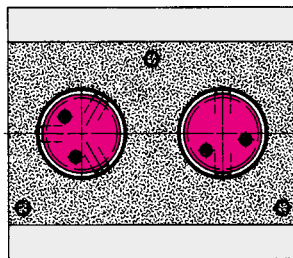
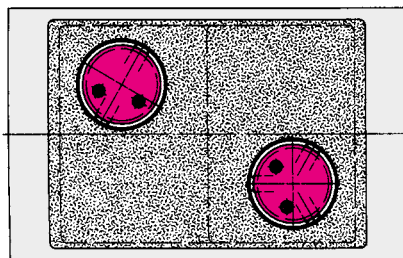
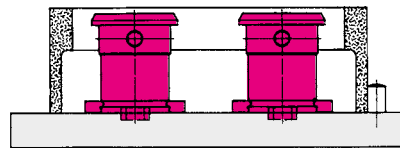
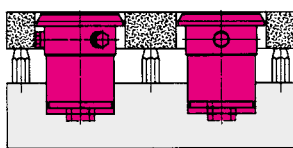
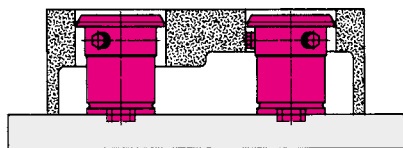
For the cases mentioned above, we have indicated an admissible positioning force in the chart on page 2. The corresponding workpiece weights are mechanically tolerable.

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

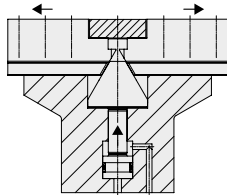
This hydraulically-operated concentric clamping element can be equipped with especially low clamping jaws to receive workpieces with interior centrings of low depth.

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 be 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 work-piece
- 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.

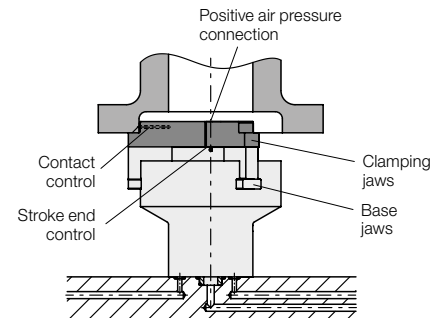
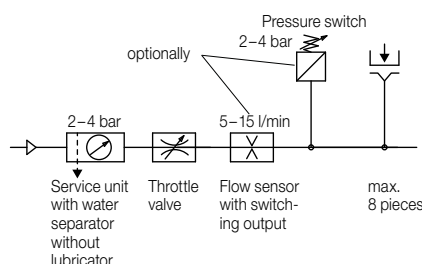
2. Flow meter

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).

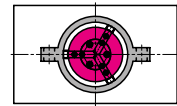
The switching threshold is set to a mean value between open and closed nozzle.

We recommend flow measurement, if only one pneumatic line is available for several elements.

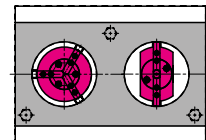


Applications

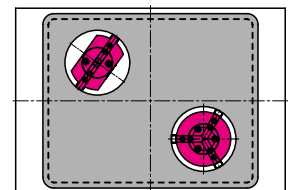
- Centre and clamp in 1 bore hole



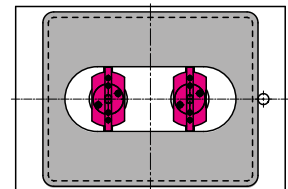
- Centre and clamp in 2 bore holes



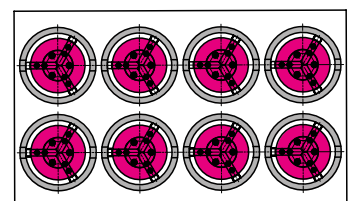
- Diagonally centre and clamp in 2 bore holes



- 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

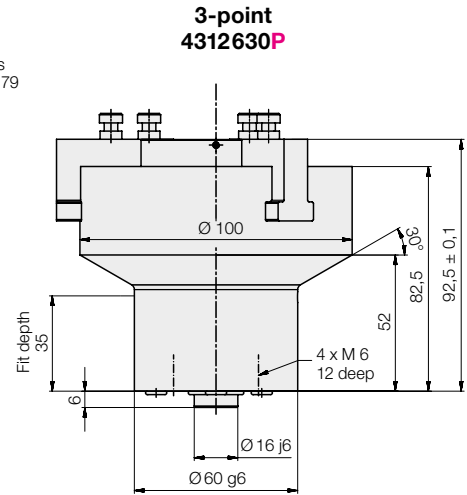
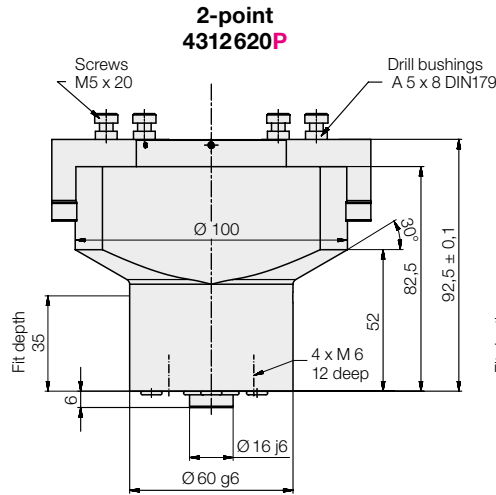
Weight

2-point / 3-point approx. [kg] 2.54 / 2.60

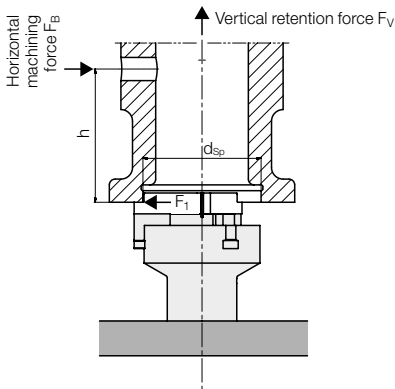
Part no. 2-point **4312620P**

Part no. 3-point **4312630P**

P = Pneumatic contact control (optional)



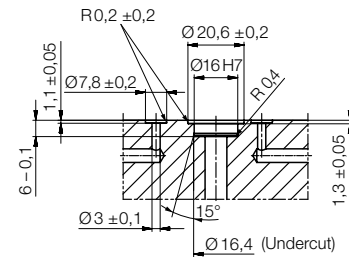
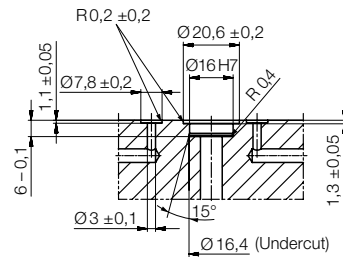
Admissible machining forces



Included in our delivery:

1 x O-ring 17.17 x 1.78 (3000663)

3 x O-ring 5 x 1.5 (3000340)



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

$$F_V = \mu \cdot F_{Sp} \quad [\text{kN}]$$

with $\mu \sim 0.2$: $F_V \sim 0.2 \cdot F_{Sp} \quad [\text{kN}]$

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

$$F_{\text{Badm}} \leq \frac{F_1 \cdot 0.75 \cdot d_{Sp} \cdot \mu}{h} \leq F_1 \quad [\text{kN}]$$

with $F_1 = 20 \cdot p$ and $\mu \sim 0.2$ results:

$$F_{\text{Badm}} \leq \frac{3 \cdot p \cdot d_{Sp}}{h} \leq F_1 \quad [\text{kN}]$$

μ = Coefficient of friction between the clamping jaw and the workpiece [-]

p = Operating pressure [bar]

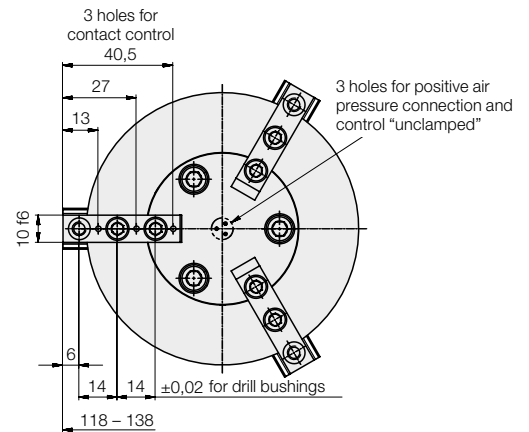
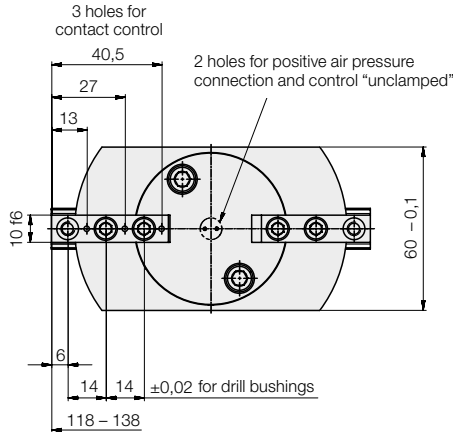
F_{Sp} = Total clamping force [kN]

F_1 = Clamping force per jaw [kN]

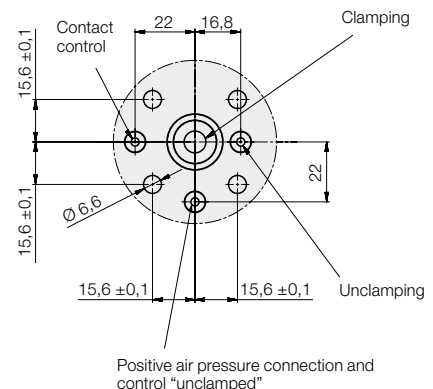
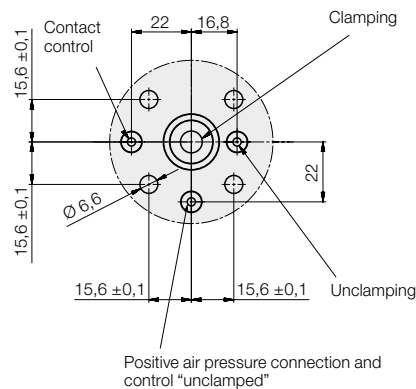
d_{Sp} = Clamping diameter [mm]

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.



Connecting scheme

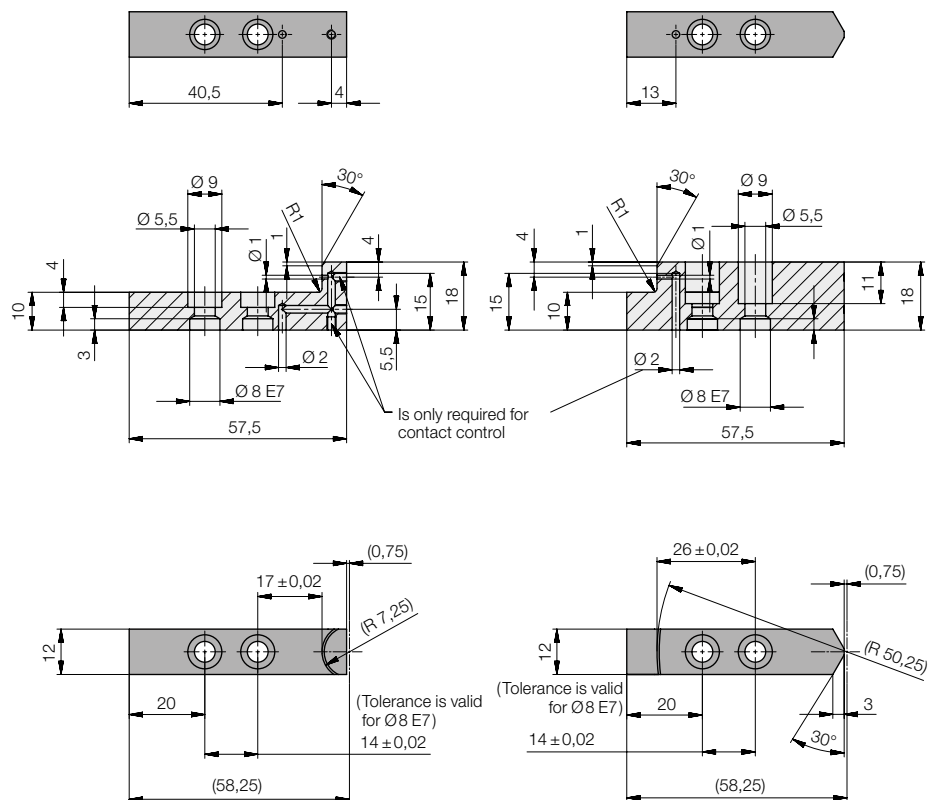


Examples for Clamping Jaws

Clamping jaws for manufacturing dimensions

for clamping Ø 17 – 35 mm **(4312620P)**

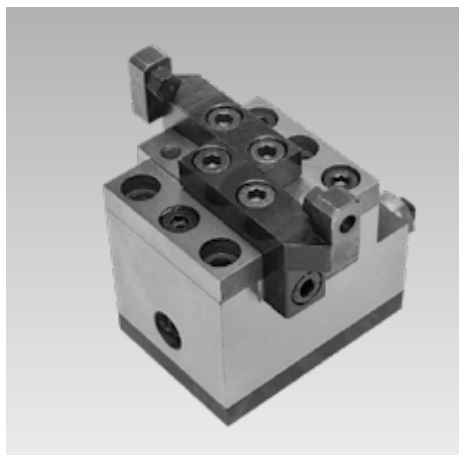
for clamping Ø 103 – 121 mm **(4312630P)**





Parallel Slide Centering Element

double acting, max. operating pressure 500 bar



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

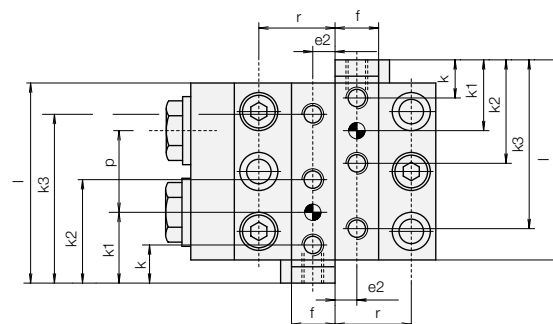
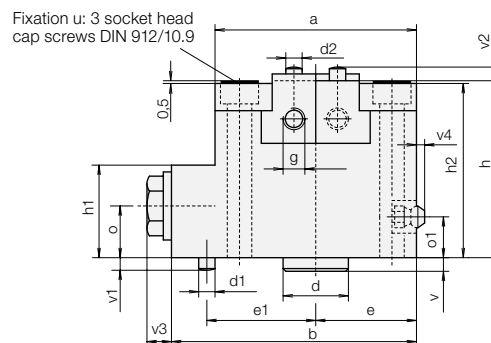
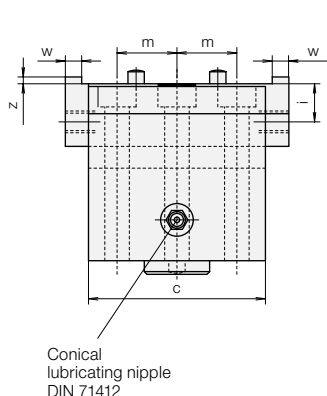
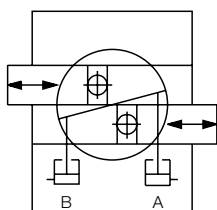
- Thanks to the compact overall dimensions the element is suitable for installation in any hydraulic clamping system.

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 centering 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

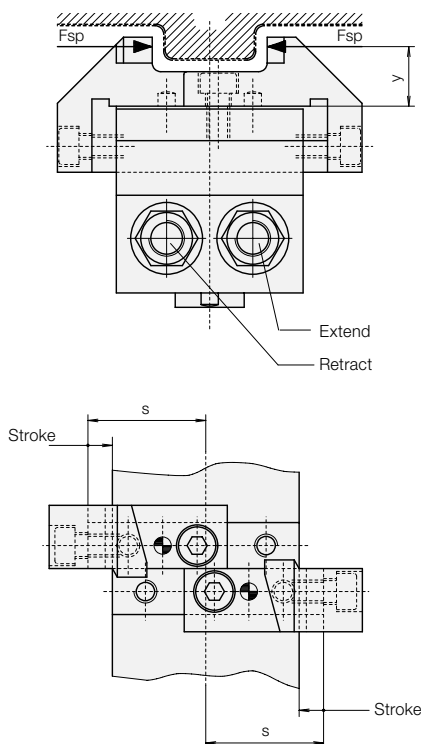


Position of clamping slides for interior and exterior clamping see page 2

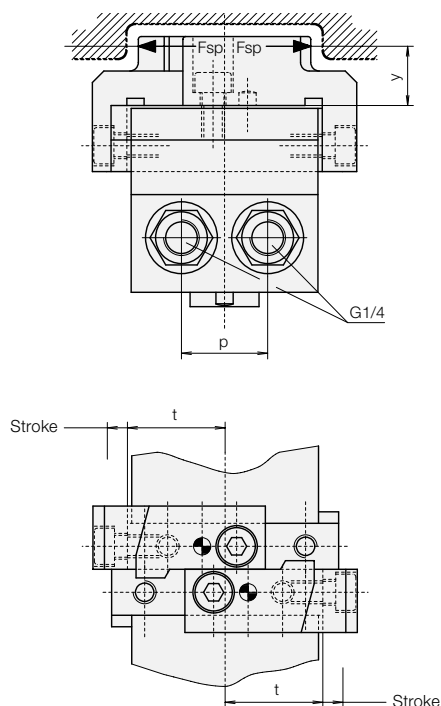
Centering repeatability ± 0.02 mm

Clamping force/jaw F_{Sp} at y	[kN]	2.8	5.0	8.8
Stroke/jaw	[mm]	6	7	8
Piston $\varnothing$	[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	[cm ³]	0.16	0.28	0.47
Part no.		4316120	4316160	4316200

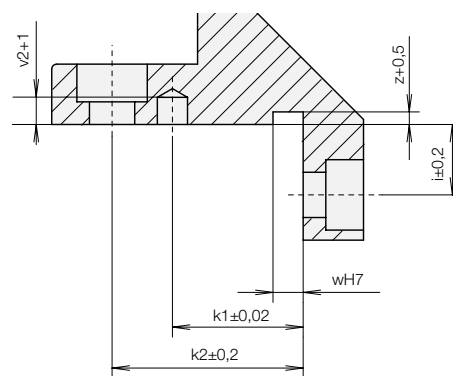
Exterior clamping



Interior clamping



Example of clamping jaw (to be manufactured by the customer)

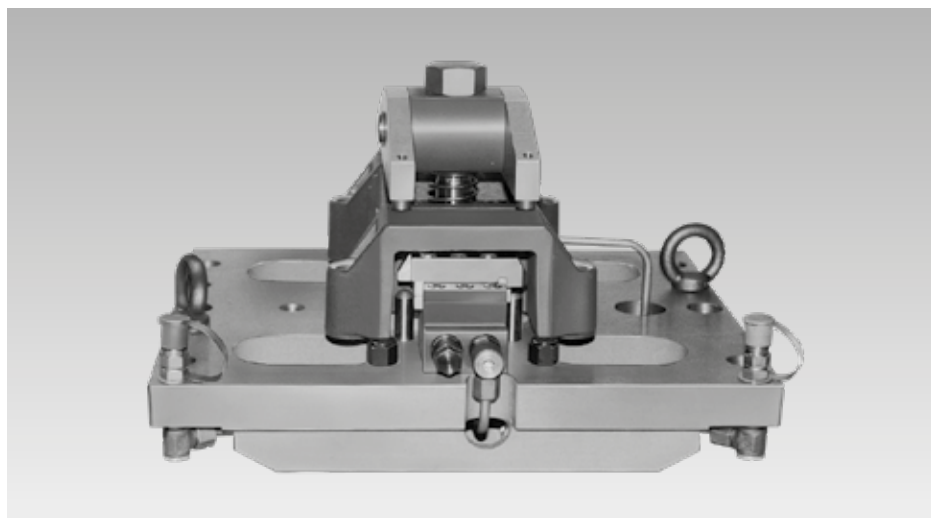


p	[mm]	26	30	37
s	[mm]	35	41	47.5
t	[mm]	29	34	39.5
y applic. of force	[mm]	20	24	28

Hint

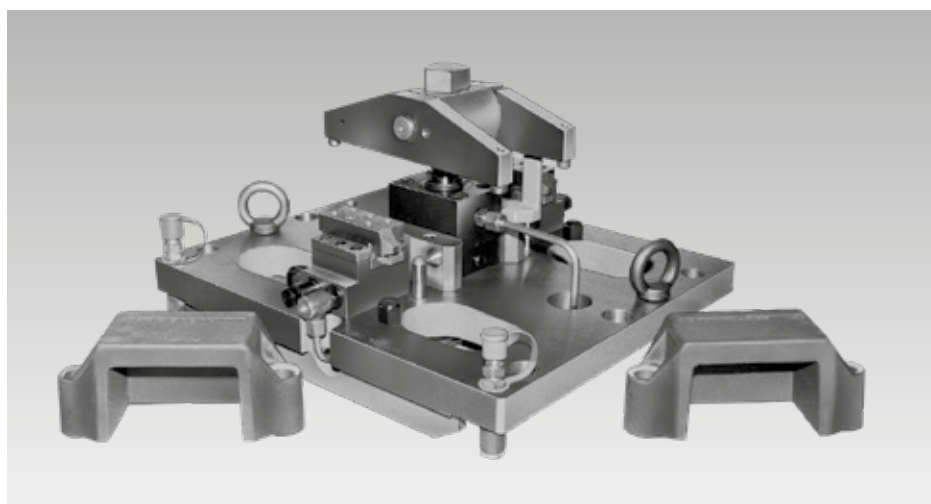
In case of $2 \times y$ the clamping force will be reduced by 6% (friction loss).

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.

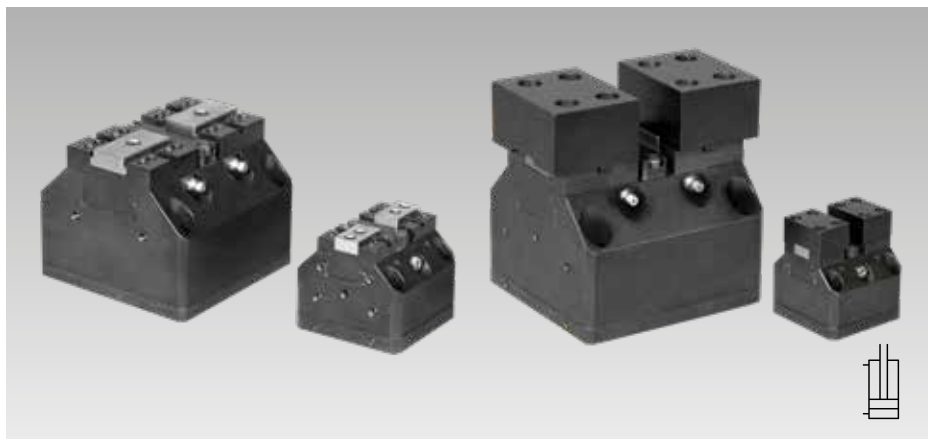

ROEMHELD

HILMA ■ STARK

H 4.400

Concentric Vise - Power Clamp Centric

Block-type, hydraulically or pneumatically operated, double acting, size 64 and 100 mm, max. clamping force: 4.0 – 20.3 kN



Advantages

- Space-saving thanks to compact design
- Very high rigidity
- Low-wear due to hardened surfaces
- Repetitive clamping accuracy 0.005 mm
- Suitable for interior or exterior clamping
- Manifold mounting and pipe thread as standard
- Connection for positive air pressure protection as standard

Application

These pneumatically or hydraulically operated concentric vices can position and clamp workpieces with an accuracy of ± 0.005 mm.

They are ideally suited for the series production of precision workpieces on single or multiple-clamping fixtures. The double-acting cylinder function enables both interior and exterior clamping of workpieces.

Description

The housings of the centric vices have a square-shaped design. Therefore, a clamping piston with a large diameter can be installed, which enables an exceptionally high clamping force in the pneumatic concentric vise. The piston force is transmitted backlash-free to the two base jaws synchronously and concentrically.

All concentric vices have an internal flow rate limitation.

Positive air pressure connection

The most reliable protection against the penetration of liquids and dirt particles is the application of oil- and water-free positive air pressure with a slight overpressure of max. 1 bar.

Versions

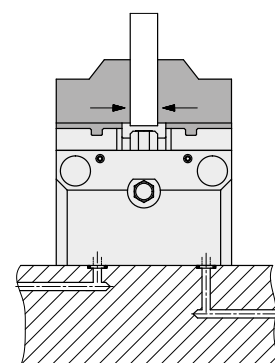
- 2 sizes: 64 and 100 mm
- Hydraulically or pneumatically operated
- Max. clamping force:
 - BG 64 – hydraulic: 4.8 kN
 - BG100 – hydraulic: 20.3 kN
 - BG 64 – pneumatic: 4.0 kN
 - BG100 – pneumatic: 14.0 kN

Options on request

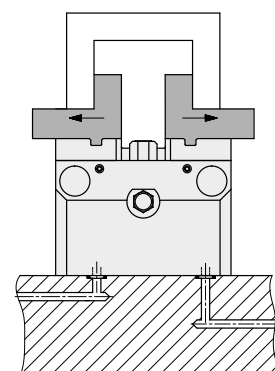
- Pneumatic workpiece contact control
- Port for central lubrication
- Electrical stroke end control
- Rapid-clamping jaw system

Delivery

- Concentric vise
- Clamping sleeves for precise alignment of the concentric vise
- Locking screws for concentric vise
- Blind plugs to close the fixing screw bore holes



Exterior clamping application

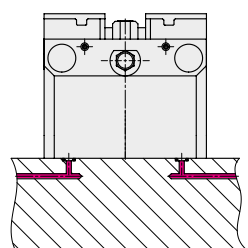


Interior clamping application

Options on request

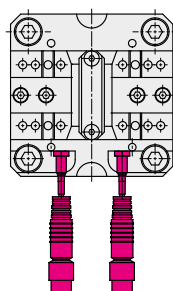
Port for central lubrication

see page 6



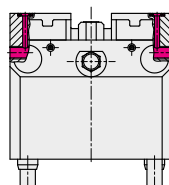
Electrical stroke end control

see page 6



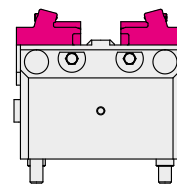
Pneumatic workpiece contact control

see page 7



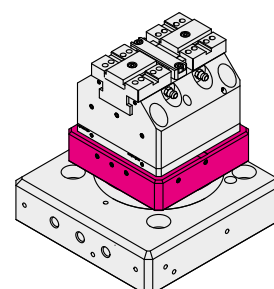
Rapid-clamping jaw system

see page 7



Zero point adaptation

on request



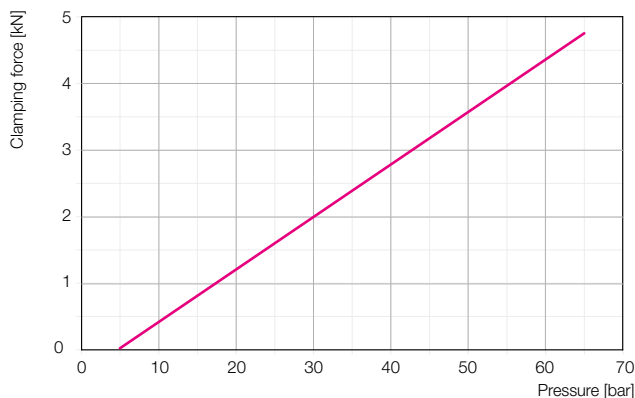
Operating conditions, tolerances and other data see data sheet A0.100.

Technical data

Max. clamping force	[kN]	4.8
Max. operating pressure	[bar]	65
Min. operating pressure	[bar]	5
Stroke per clamping jaw	[mm]	2.5
Clamping range	[mm]	0 – 55
Weight	[kg]	1.4
Temperature range	[°C]	5 – 60

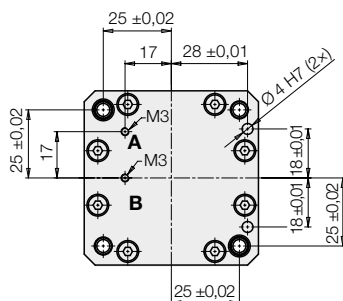
Part no.	4ZBAAA00000
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Clamping force diagram

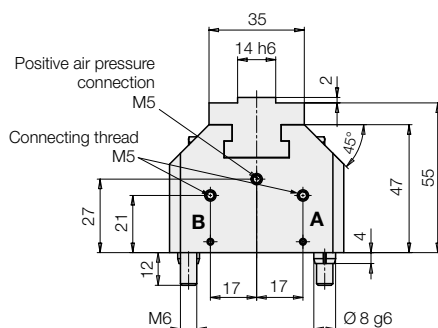
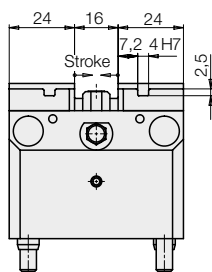


The specified clamping force acts at maximum pressure and is used to calculate side loads that can be transferred. Only half of the specified clamping force may be used to determine the transferable machining forces that can be transferred across a clamping jaw.

Dimensions



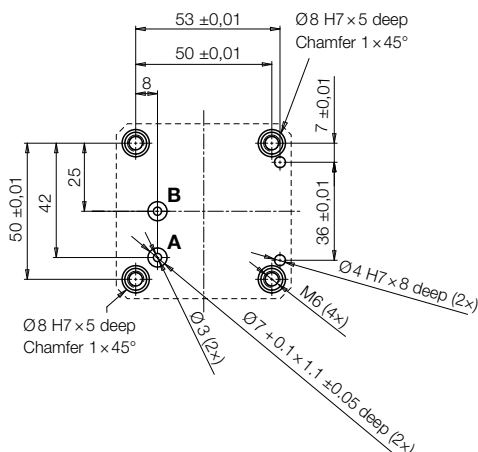
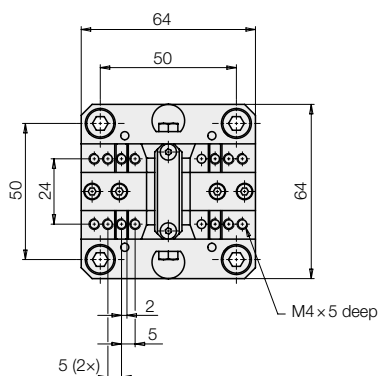
Exterior clamping:
A = Clamping / **B** = Unclamping
Interior clamping:
B = Clamping / **A** = Unclamping



4x socket head cap screw
DIN 912 – M6x40
(included in our delivery)

2x dowel pin
DIN 13337 – 8 x 18
(included in our delivery)

Connecting scheme



Alternatively, the concentric vise can also be aligned with 2 x Ø4 mm dowel pins.

Required accessories for manifold connection with O-ring (see accessories page 10): 2 x O-rings 4 x 1.5

Hydraulic Version Size 100

Technical Data • Dimensions

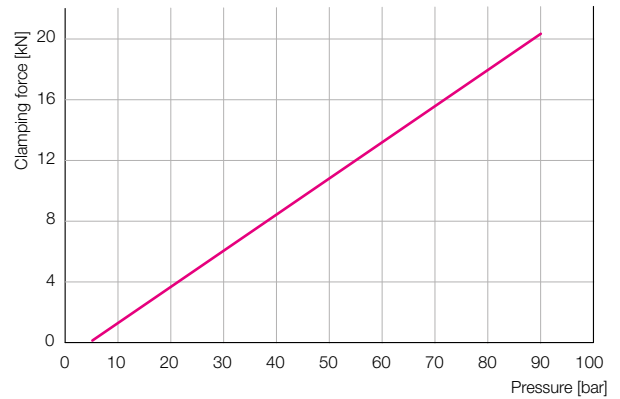
Technical data

Max. clamping force	[kN]	20.25
Max. operating pressure	[bar]	90
Min. operating pressure	[bar]	5
Stroke per clamping jaw	[mm]	3
Clamping range	[mm]	0 – 90
Weight	[kg]	5
Temperature range	[°C]	5 – 60

Part no.

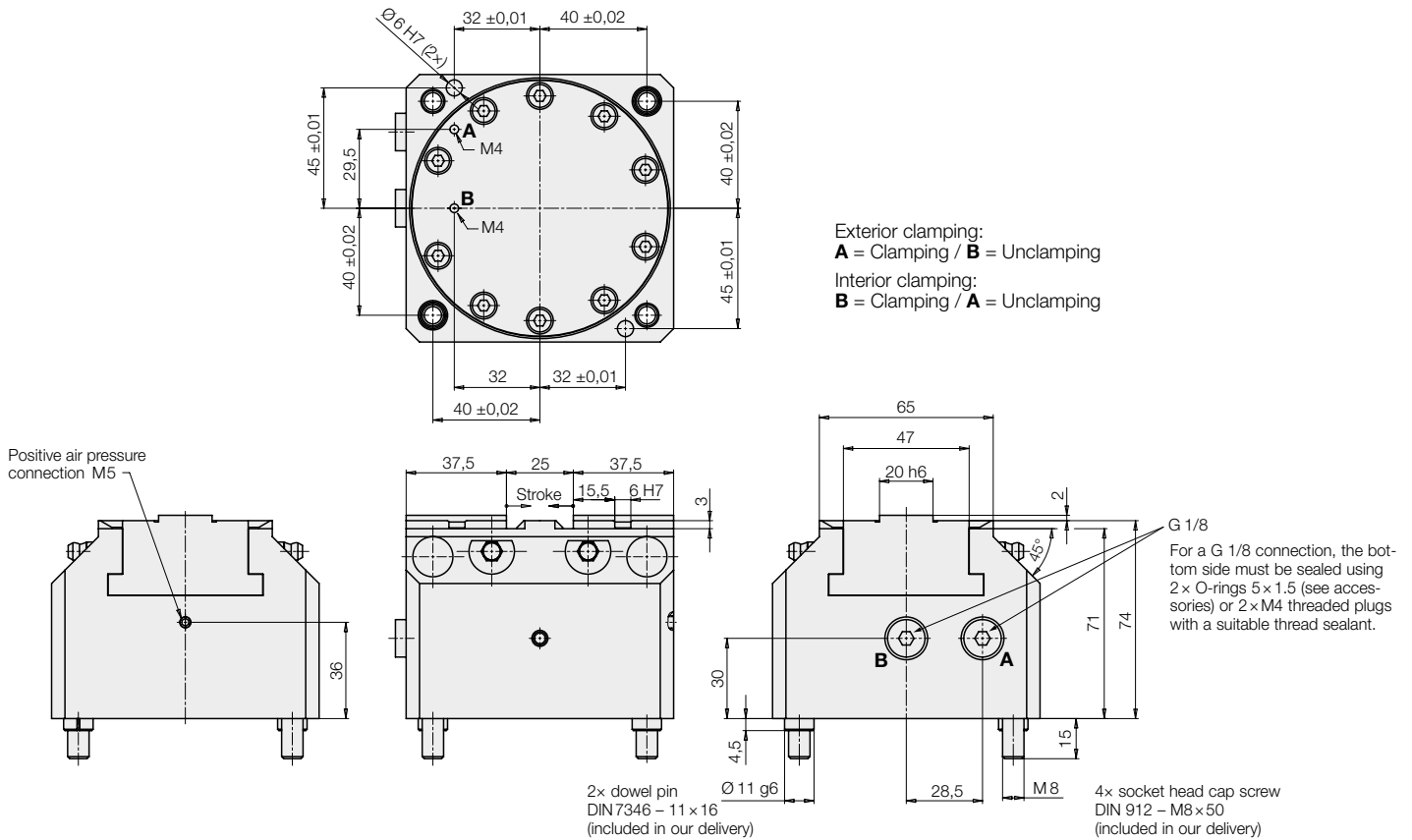
4ZBAAAB00000

Clamping force diagram



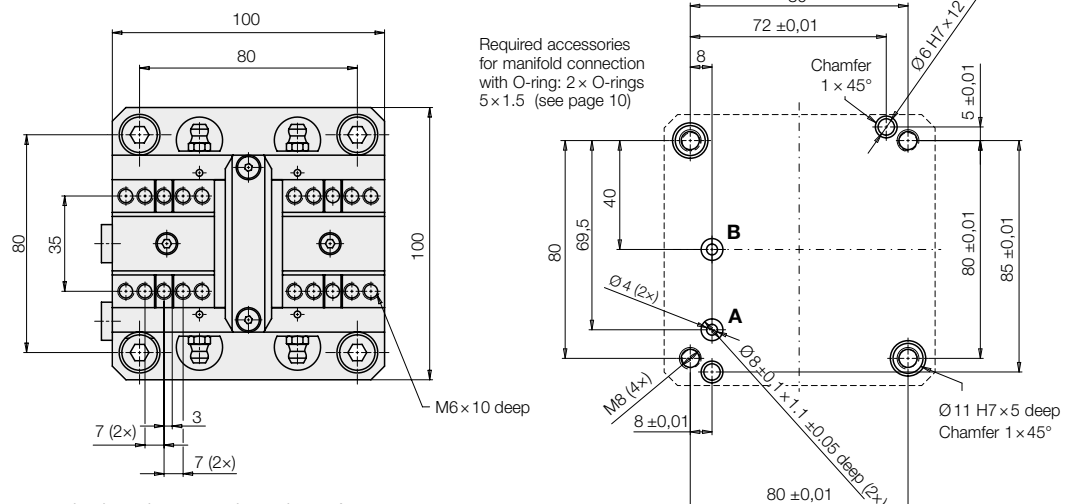
The specified clamping force acts at maximum pressure and is used to calculate side loads that can be transferred. Only half of the specified clamping force may be used to determine the transferable machining forces that can be transferred across a clamping jaw.

Dimensions



Alternatively, the concentric vise can also be aligned with 2 x Ø 6 mm dowel pins.

Connecting scheme



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

Pneumatic Version Size 64

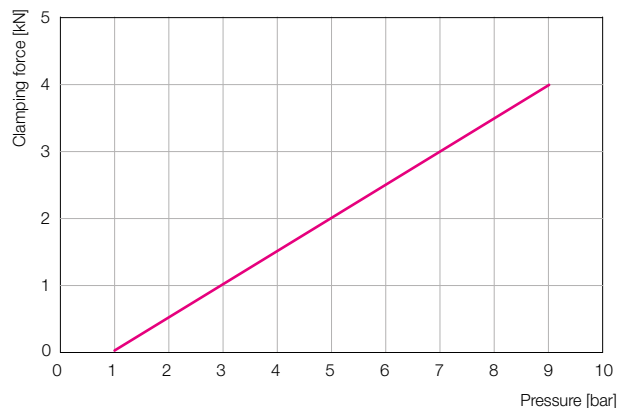
Technical Data • Dimensions

Technical data

Max. clamping force	[kN]	4
Max. operating pressure	[bar]	9
Min. operating pressure	[bar]	1
Stroke per clamping jaw	[mm]	2.5
Clamping range	[mm]	0 – 55
Weight	[kg]	1.2
Temperature range	[°C]	5 – 60

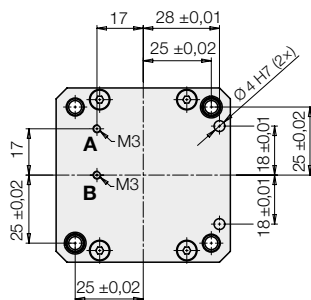
Part no. **4ZBACAA00000**

Clamping force diagram



The specified clamping force acts at maximum pressure and is used to calculate side loads that can be transferred. Only half of the specified clamping force may be used to determine the transferable machining forces that can be transferred across a clamping jaw.

Dimensions

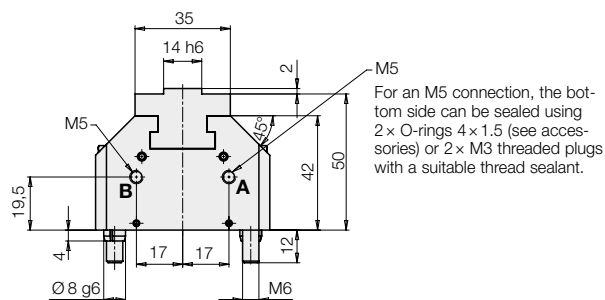
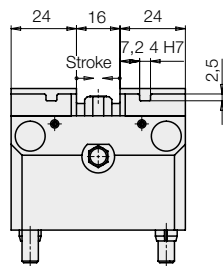
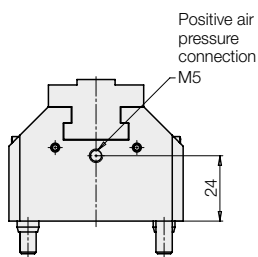


Exterior clamping:

A = Clamping / **B** = Unclamping

Interior clamping:

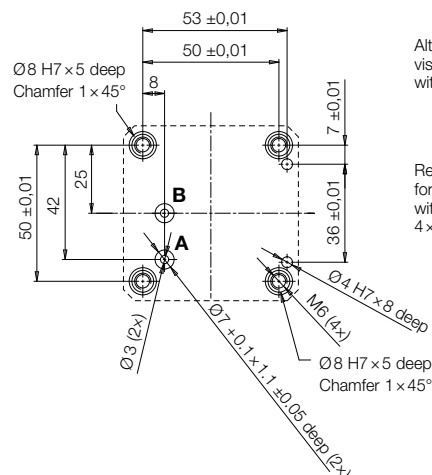
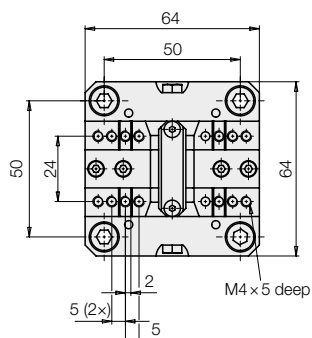
B = Clamping / **A** = Unclamping



2 x dowel pin
DIN 13337 – 8 x 18
(included in our delivery)

4 x socket head cap screw
DIN 912 – M6 x 35
(included in our delivery)

Connecting scheme



Alternatively, the concentric vise can also be aligned with 2 x Ø4 mm dowel pins.

Required accessories for manifold connection with O-ring: 2 x O-rings 4 x 1.5 (see page 10)

Pneumatic Version Size 100

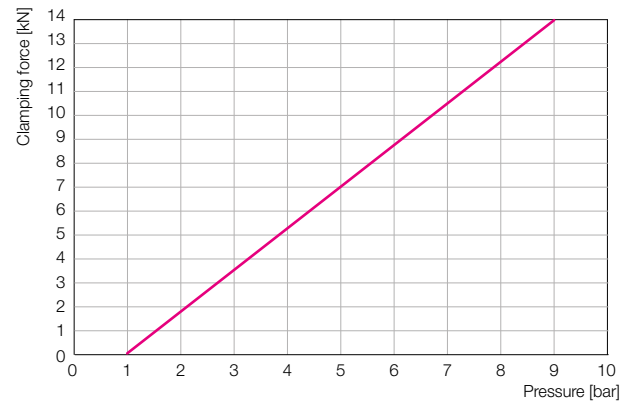
Technical Data • Dimensions

Technical data

Max. clamping force	[kN]	14
Max. operating pressure	[bar]	9
Min. operating pressure	[bar]	1
Stroke per clamping jaw	[mm]	2.5
Clamping range	[mm]	0 – 90
Weight	[kg]	4
Temperature range	[°C]	5 – 60

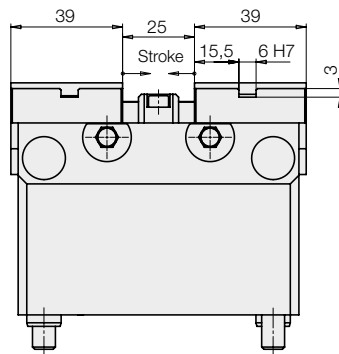
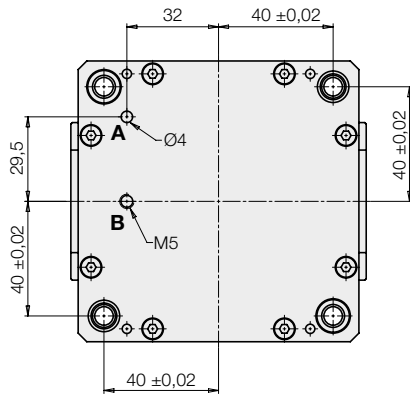
Part no. **4ZBACAB00000**

Clamping force diagram



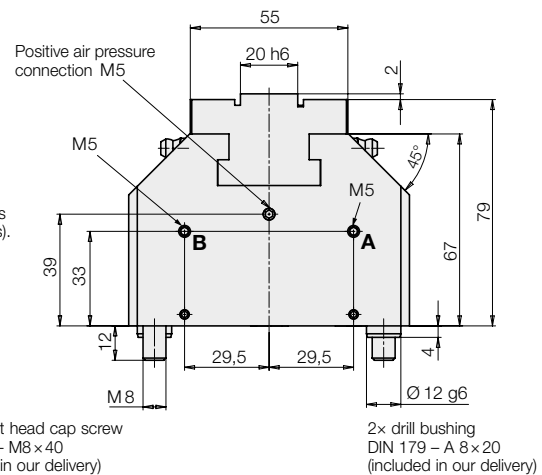
The specified clamping force acts at maximum pressure and is used to calculate side loads that can be transferred. Only half of the specified clamping force may be used to determine the transferable machining forces that can be transferred across a clamping jaw.

Dimensions



For an M5 connection, the bottom side can be sealed using 2 x O-rings 5 x 1.5 (see accessories).

Exterior clamping:
A = Clamping / B = Unclamping
Interior clamping:
B = Clamping / A = Unclamping

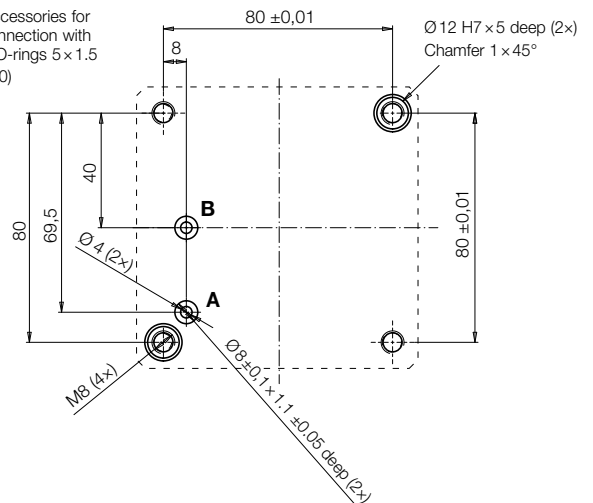


4 x socket head cap screw
DIN 912 – M8 x 40
(included in our delivery)

2 x drill bushing
DIN 179 – A 8 x 20
(included in our delivery)

Connecting scheme

Required accessories for manifold connection with O-ring: 2 x O-rings 5 x 1.5 (see page 10)



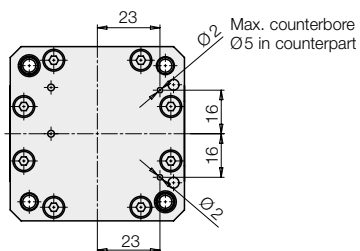
Operating conditions, tolerances and other data see data sheet A 0.100.

Options on Request

Port for Central Lubrication • Electrical Stroke End Control

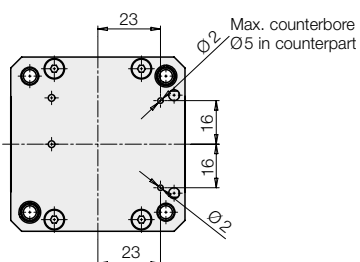
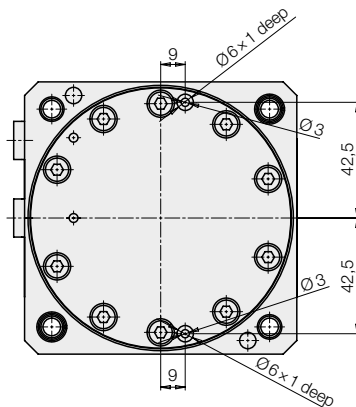
Port for central lubrication

Size 64

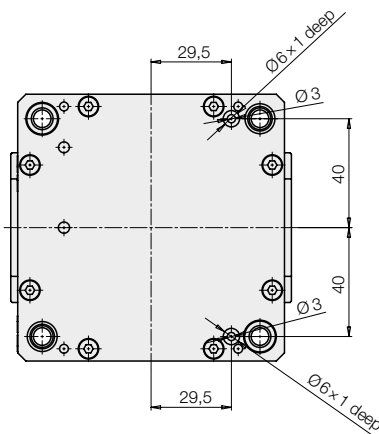


Hydraulic

Size 100



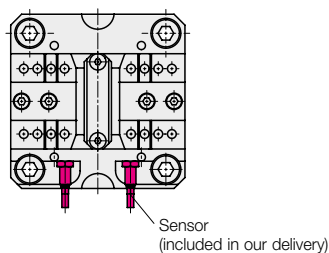
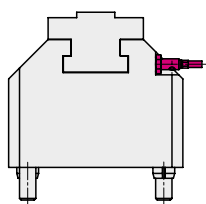
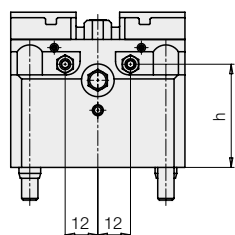
Pneumatic



Electrical stroke end control with proximity switch

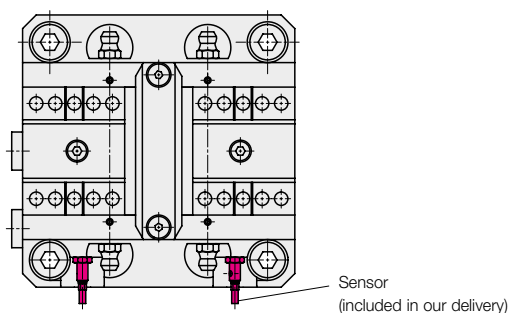
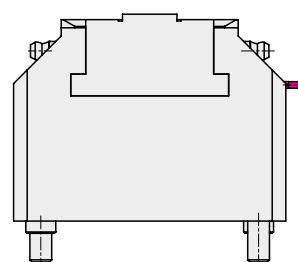
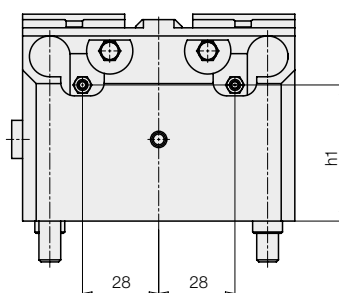
Size 64

Version		Hydraulic	Pneumatic
h	[mm]	37.9	32.9



Size 100

Version		Hydraulic	Pneumatic
h1	[mm]	50	53.5



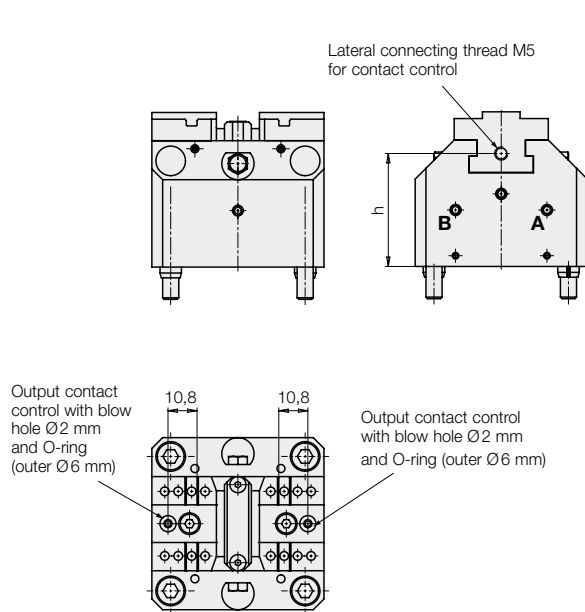
Operating conditions, tolerances and other data see data sheet A 0.100.

Option on Request Pneumatic Workpiece Contact Control

Pneumatic workpiece contact control

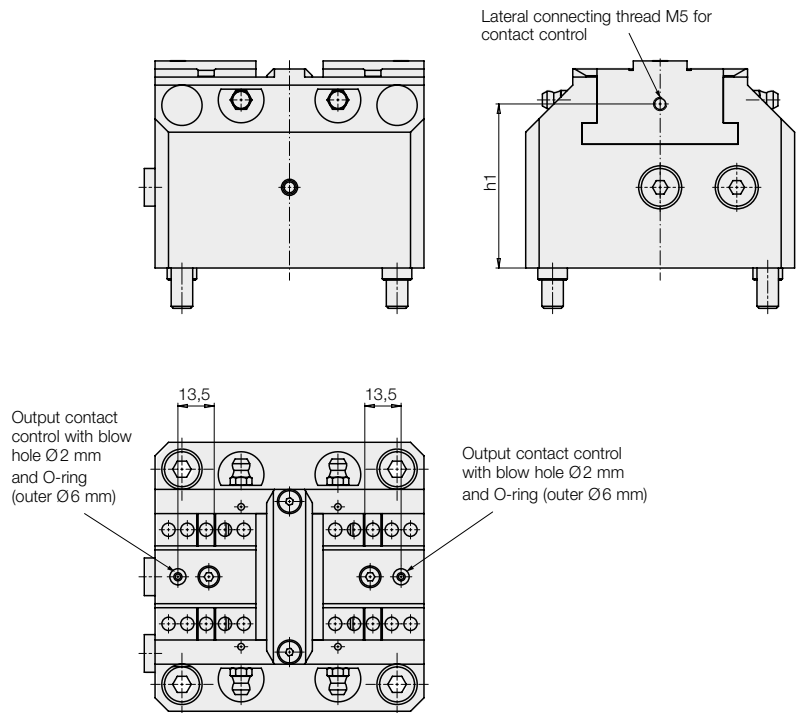
Size 64

Version		Hydraulic	Pneumatic
h	[mm]	42	37



Size 100

Version		Hydraulic	Pneumatic
h1	[mm]	61	64



In the version with pneumatic workpiece contact control, pneumatic pressure is fed into both base jaws via the M5 lateral connecting thread, which is then transferred to the clamping jaw by means of an O-ring sealing. The blow hole in the clamping jaw should not be larger than Ø2 mm.

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 switches

The pressure switch signals the pressure increase when closing a blow hole.

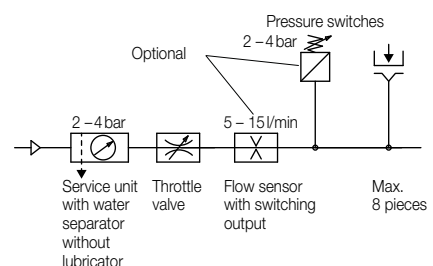
It is important that the pressure difference between the open and closed blow hole is big enough to receive a process-safe message.

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 the open and closed nozzle.

We recommend flow measurement if only one pneumatic line is available for several elements.



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

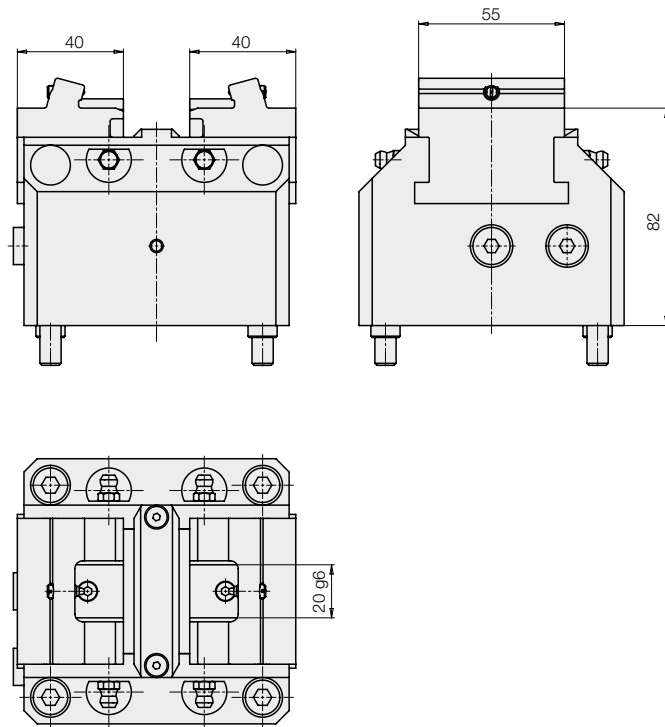
Option on Request Rapid-Clamping Jaw System

Rapid-clamping jaw system

Size 100

Hydraulic version

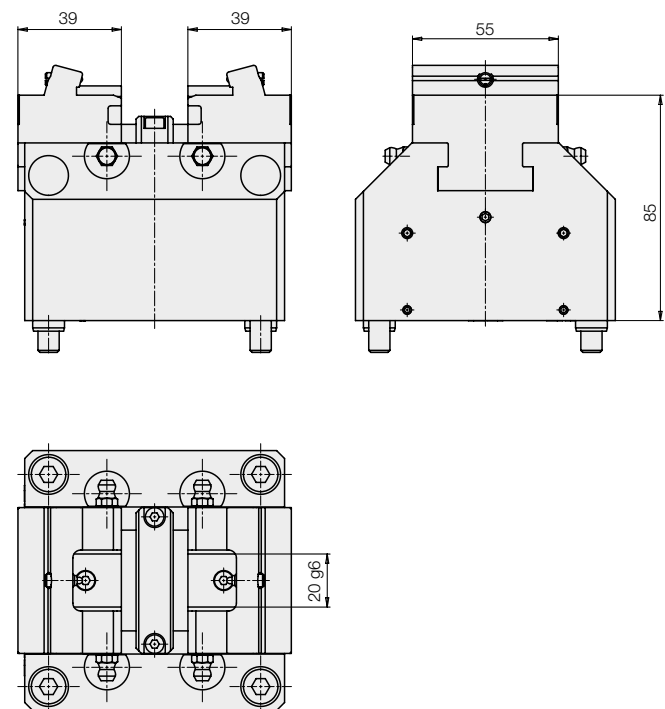
For additional dimensions and technical data on the hydraulic version, see page 3.



Size 100

Pneumatic version

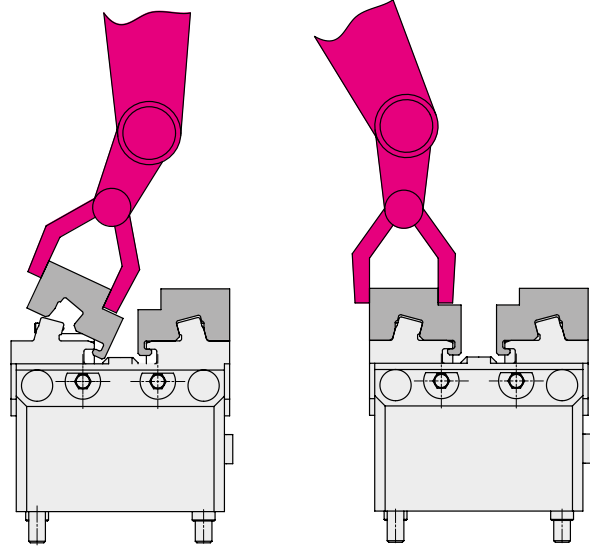
For additional dimensions and technical data on the pneumatic version, see page 5.



Automated change of clamping jaws

Description

The rapid-clamping jaw system is ideal for quick manual changeover of the clamping jaws and especially for automated clamping jaw changes by the robot, as shown in the example for exterior clamping. The interface must be designed differently for interior clamping.



Quick-release jaw is pre-positioned

Quick-release jaw in position

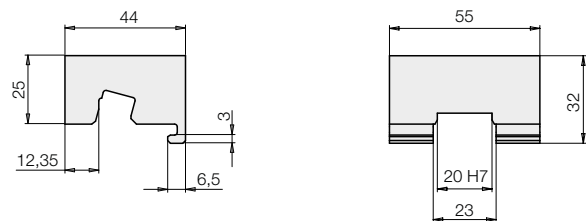
Functional principle

The clamping jaw is pre-fixed in the base jaw by a contact piece. When clamping a workpiece, both clamping jaws are pressed against the bevel of the base jaw. This ensures a secure hold when changing workpieces so additional fixing screws are not needed.

Quick-release jaws blank

Material: 16MnCr5 soft

Size 100



Max. jaw height 25 mm at max. operating pressure

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

Accessories

O-rings	Part no.
O-ring 4 × 1.5	3002167
O-ring 5 × 1.5	3001147

Spare parts	Part no.
Blind plugs, chamfered Ø 11.3 mm for size 64	35381481
Blind plugs, chamfered Ø 15.3 mm for size 100	35381480

Seal kits	Part no.
Size 64 hydraulic	01321161
Size 100 hydraulic	01321162
Size 64 pneumatic	01321159
Size 100 pneumatic	01321160

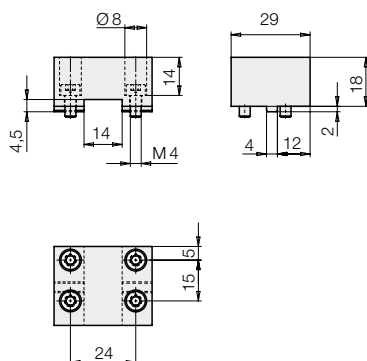
Clamping jaws blank

Material: 16MnCr5 soft
Fixing screws included in delivery

Size 64

Part no. 35381473

1 set (2 pieces) clamping jaw blanks



Max. jaw height 18 mm at max. operating pressure

Special lubricating grease 500g cartridge

The special lubricating grease is characterized by the following properties:

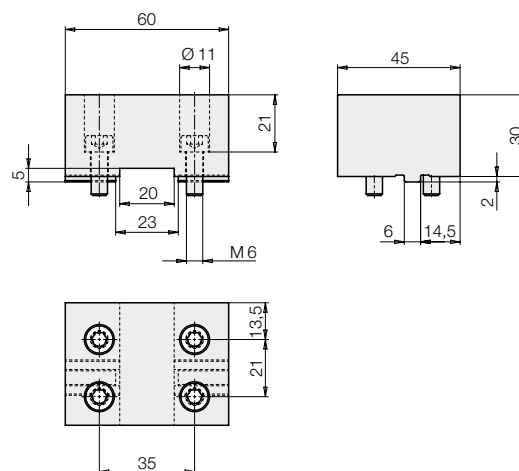
- Highest lubrication performance
- Very high pressure resistance
- Prevention of stick-slip
- Constant low coefficients of friction, especially with high surface pressure
- Imparts emergency running properties
- Good corrosion protection

Part no. 9001800

Size 100

Part no. 35381474

1 set (2 pieces) clamping jaw blanks

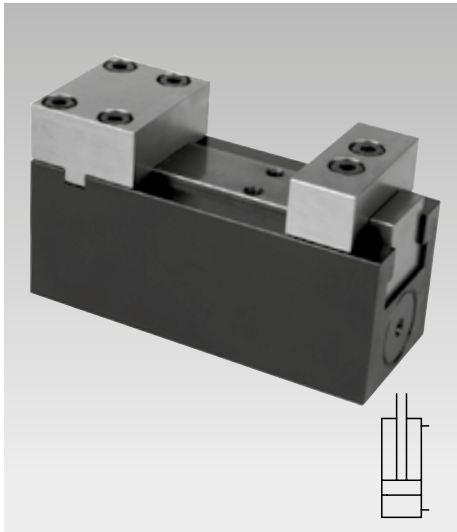


Max. jaw height 30 mm at max. operating pressure



Hydraulic Vises, Long Stroke

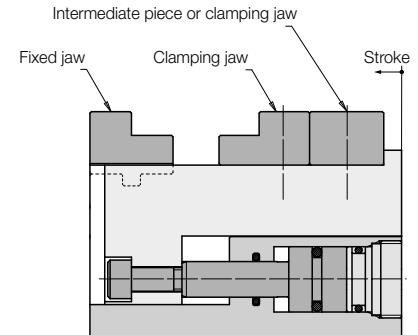
clamping against the fixed jaw, double acting,
max. operating pressure 250 bar



Advantages

- Very compact design
- High rigidity and precision
- Long strokes
- Double-acting function
- Fixtures without pipes possible
- Exchangeable jaws
- Pneumatic contact or seat check in the fixed jaw possible
- Good swarf protection
- Port for central lubrication
- Mounting position: any

Functional principle



Application

Hydraulic vises, also called 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.

Hydraulic vises are especially suitable for series manufacturing in automated mode.

The double-acting cylinder function combined with central lubrication and good swarf protection guarantees high process safety.

Description

The hydraulic vise with fixed jaw consists of a very small base body with integrated hydraulic cylinder which actuates the movable jaw.

All threads and ports are at the bottom to enable 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. Blanks of clamping jaws that can be adapted to the workpiece contour are also available as an accessory.

The fixed jaw can be equipped with a pneumatic seat check.

Important notes

The hydraulic vise 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.

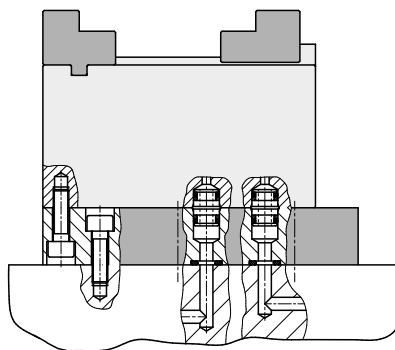
Size 1 (see page 2)

Jaw width	[mm]	40
Clamping stroke	[mm]	30
Max. clamping force	[kN]	9.5

Size 2 (see page 4)

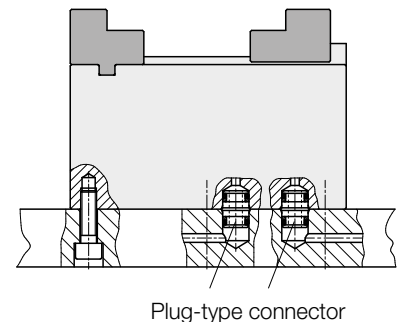
Jaw width	[mm]	65
Clamping stroke	[mm]	40
Max. clamping force	[kN]	15

Fixing from above with accessory adaptor plate Drilled channels

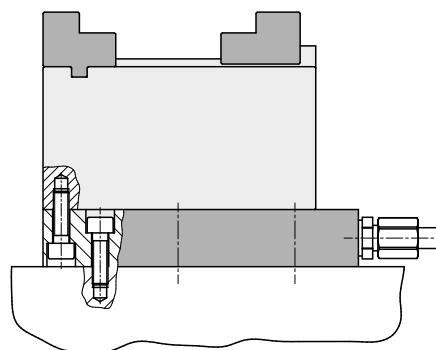


Fixing from below

Drilled channels

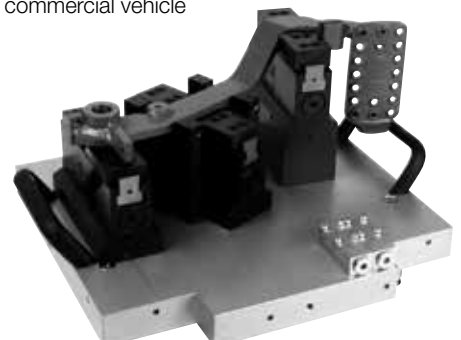


Pipe thread



Application example

Clamping fixture for a pedal of a commercial vehicle



Technical Data • Accessory • Dimensions

Size 1

Technical data

Clamping force max.	[kN]	9.5
Clamping stroke	[mm]	30
Jaw width	[mm]	40
Max. flow rate	[cm ³ /s]	25
Operating volume		
Clamping	[cm ³]	15
Unclamping	[cm ³]	12
Weight	[kg]	approx. 2.24

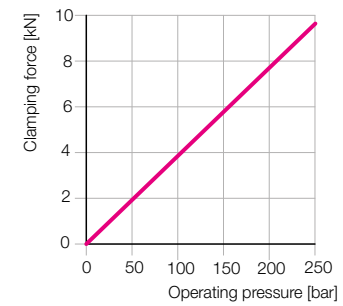
Part no.	4413031
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Adaptor plate (accessory)

Weight	[kg]	approx. 1.8
Part no.		0441 303

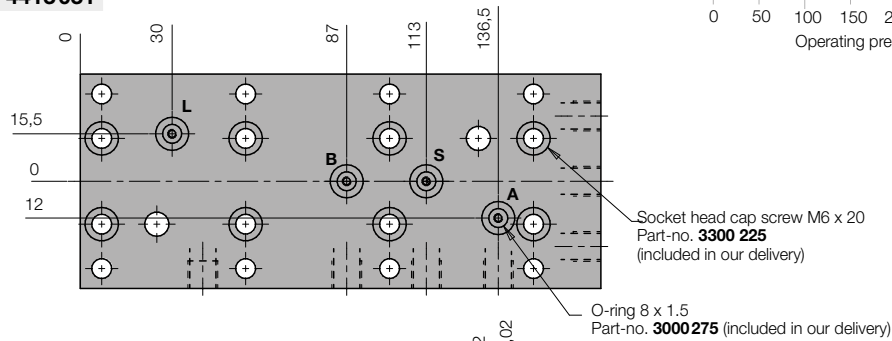
Clamping force diagram

(Height of the clamping jaw 15 mm)

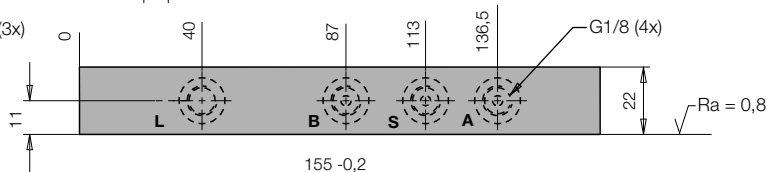
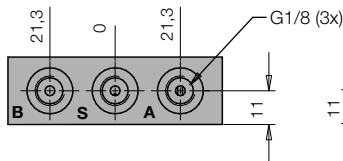
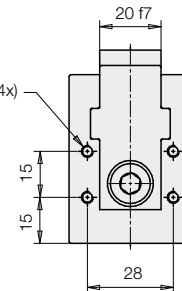
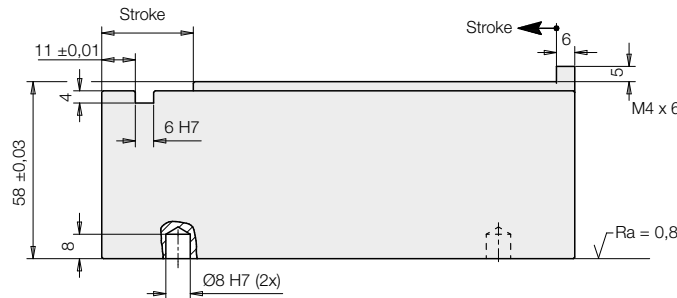
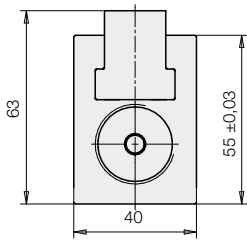
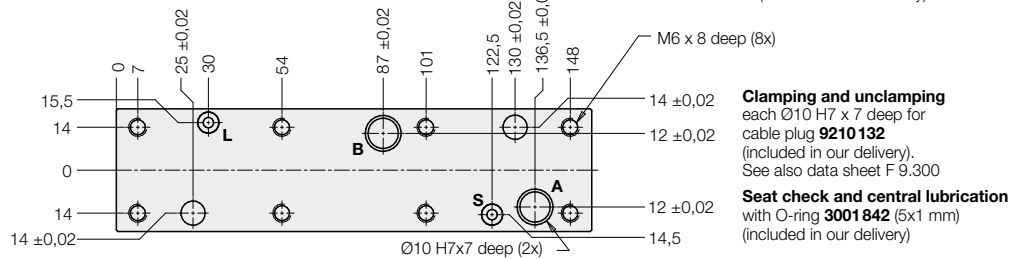


Accessories: Adaptor plate

View from below

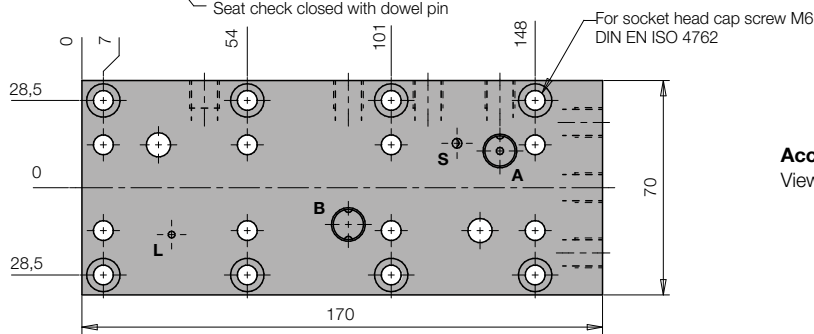
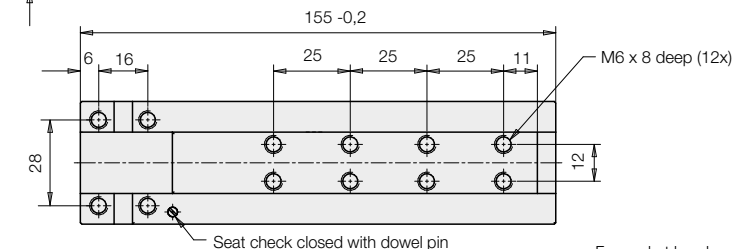


A = Clamping
B = Unclamping
S = Central lubrication
L = Air for seat check



Accessories: Adaptor plate

Side views



Accessories: Adaptor plate

View from above

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

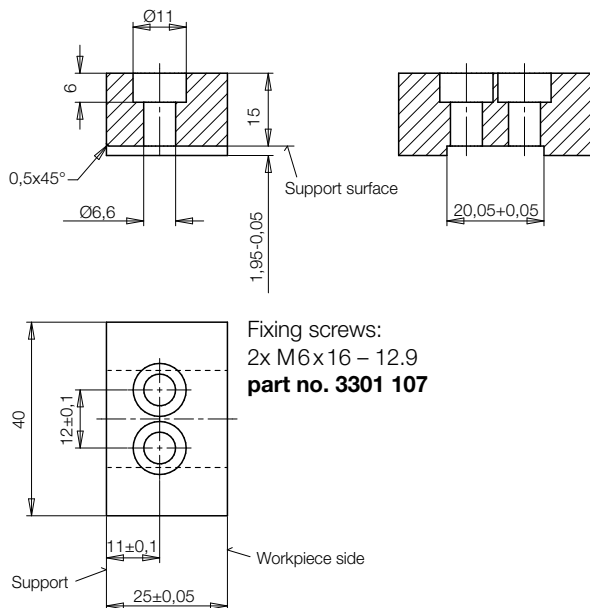
Size 1: Jaw Width 40 mm

Accessories

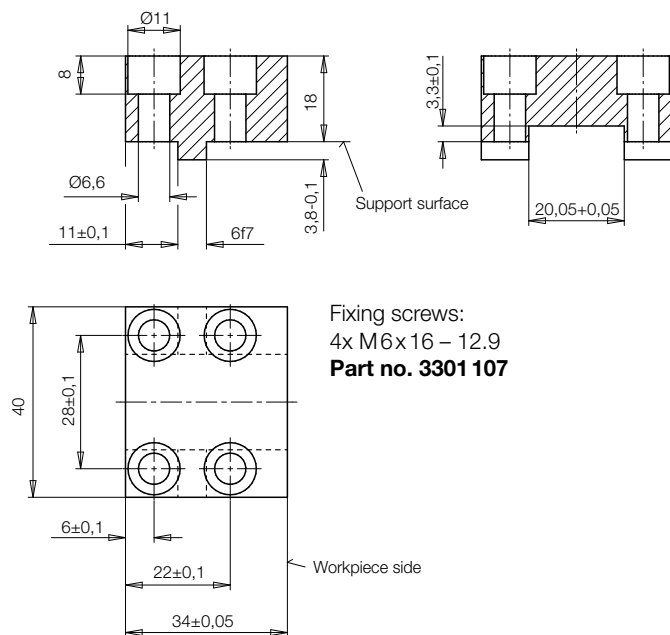
Accessory – clamping jaws

Versions	Clamping jaw blanks
Material	16 MnCr5 smooth

Clamping jaw: Part no. 3548070



Fixed jaw: Part no. 3548071



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 chart below.

If the operating pressure is lower, the clamping jaws and the fixed jaws can be designed higher as per the below diagram.

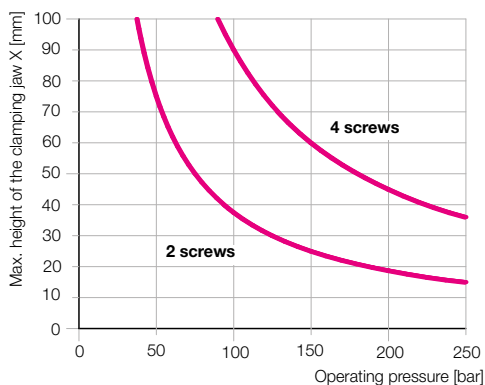
Important note

The clamping jaws must always be supported by the provided support, since the fixing screws are not in the position to compensate for the generated clamping forces.

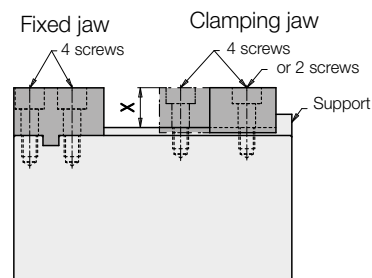
Max. height of the clamping jaws X at max. operating pressure of 250 bar

Fixing screws for clamping jaws	M6 x 16 – 12.9
X [mm] with 2 screws	15
X [mm] with 4 screws	36

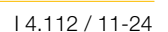
Max. height of the clamping jaw X as a function of the operating pressure



Fixing of the clamping jaws



Technical Data • Accessory • Dimensions

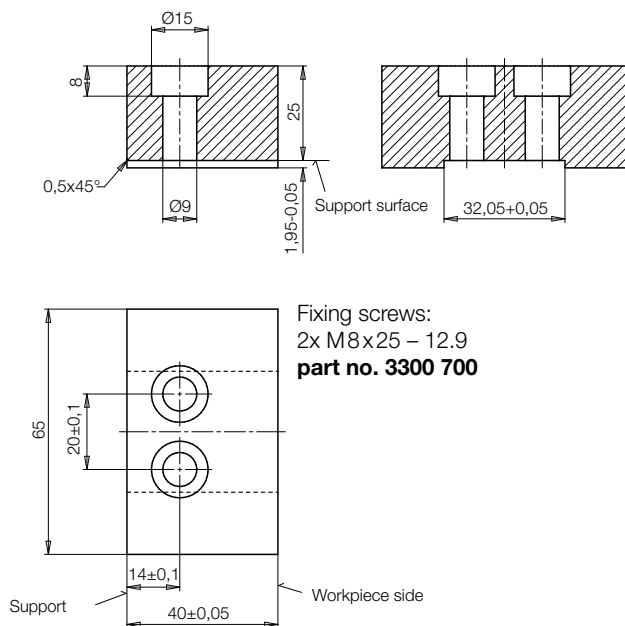


Size 2: Jaw Width 65 mm Accessories

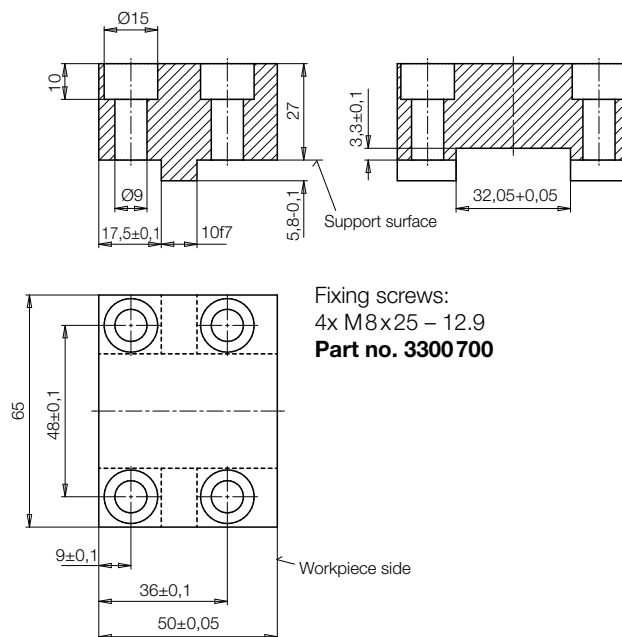
Accessory – clamping jaws

Versions	Clamping jaw blanks
Material	16 MnCr5 smooth

Clamping jaw Part no. 3548080



Fixed jaw Part no. 3548081



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 chart below.

If the operating pressure is lower, the clamping jaws and the fixed jaws can be designed higher as per the below diagram.

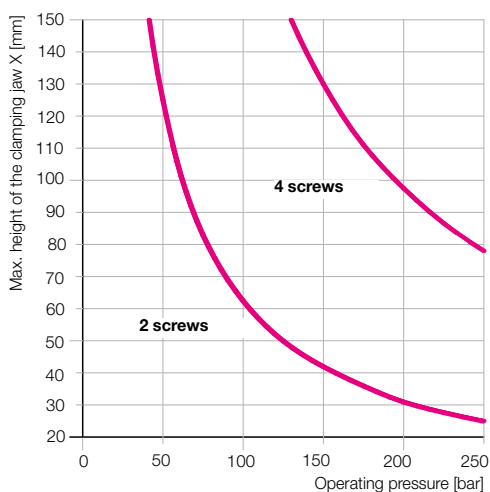
Important note

The clamping jaws must always be supported by the provided support, since the fixing screws are not in the position to compensate for the generated clamping forces.

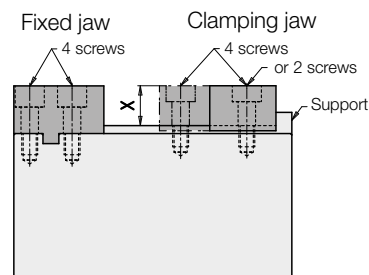
Max. height of the clamping jaws X at max. operating pressure of 250 bar

Fixing screws for clamping jaws	M8 x 25 – 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



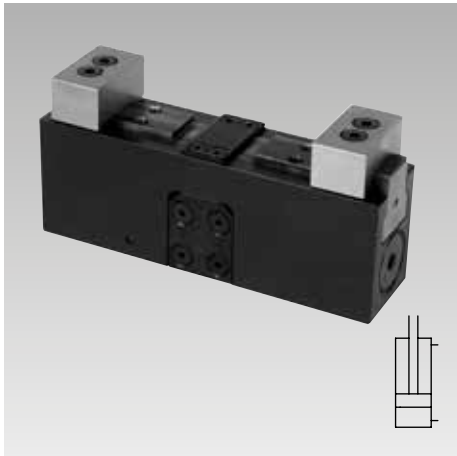
Fixing of the clamping jaws





Hydraulic Vises, Concentric Clamping

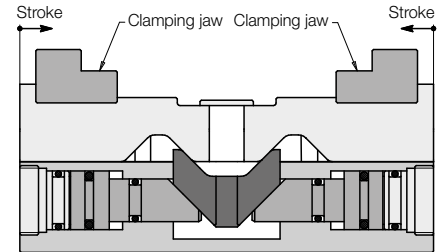
max. clamping force 6.5 and 9 kN, jaw width 40 and 65 mm,
 double acting, max. operating pressure 250 bar



Advantages

- Very compact design
- High rigidity
- Retention force – high clamping force
- Repetitive clamping accuracy ± 0.02 mm
- 2 sizes
- Length of the stroke 2 x 5 and 2 x 8 mm
- Double-acting function
- Fixtures without pipes possible
- Exchangeable jaws
- Good swarf protection
- Port for central lubrication
- Mounting position: any

Functional principle



Application

Hydraulic vises, also called 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.

Hydraulic vises are especially suitable for series manufacturing in automated mode.

The double-acting cylinder function combined with central lubrication and good swarf protection guarantees high process safety.

Description

The hydraulic vise with a concentric clamping function consists of a very slim basic body with 2 integrated hydraulic cylinders. The piston forces are transferred 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 enable 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. Blanks of clamping jaws that can be adapted to the workpiece contour are also available as an accessory.

Important notes

The concentric clamping vise is only suitable for exterior clamping.

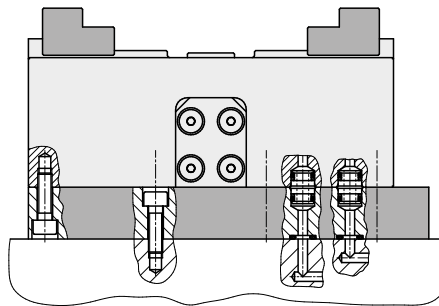
Lubricate at the latest after 500 clamping cycles the clamping slide via the central lubrication.

Never use the complete clamping stroke to guarantee safe clamping of the workpiece. Max. operating temperature 80 °C.

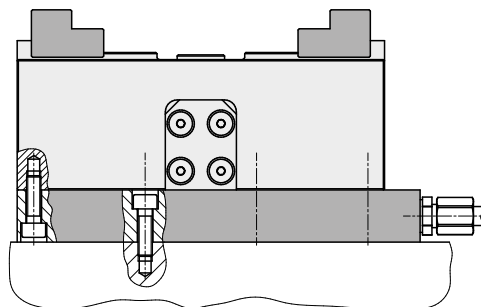
Fixing from above

with accessory adaptor plate

Drilled channels

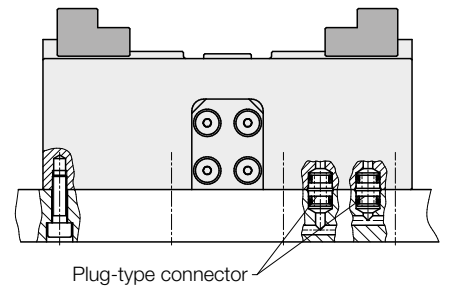


Pipe thread



Fixing from below

Drilled channels

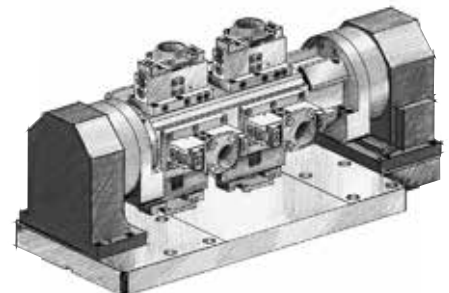


Accessories

Clamping jaws and adaptor plate are not included in the delivery of the clamping vise and have to be ordered separately as accessory.

Application example

Concentric clamping of 8 flanges on a rotary indexing fixture.



Clamping Force 6.5 kN • Clamping Stroke 2 x 5 mm

Technical Data • Accessory • Dimensions

Part no. 4413051

Technical data

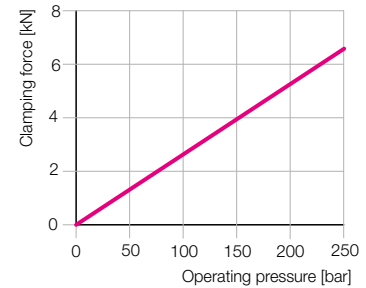
Clamping force / jaw	[kN]	6.5
Retention force	[kN]	8
Release force	[kN]	0.5
Min. pressure	[bar]	10
Clamping stroke	[mm]	2 x 5
Repetitive clamping accuracy	[mm]	±0.02
Jaw width	[mm]	40
Max. flow rate	[cm³/s]	25
Stroke volume Clamping	[cm³]	6.4
Unclamping	[cm³]	3.2
Weight	[kg]	approx. 2.4

Adaptor plate (accessory)

Weight	[kg]	approx. 1.9
Part no.		0441 305

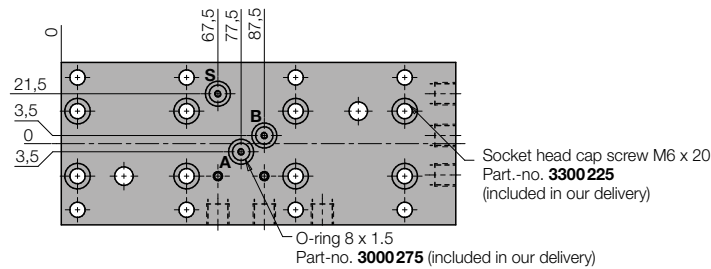
Clamping force diagram

(Height of the clamping jaw 15 mm)



Accessories: Adaptor plate

View from below



Clamping and unclamping

each Ø10 H7 x 7 deep for 4 x cable plug **9210132** (included in our delivery). See also data sheet F 9.300

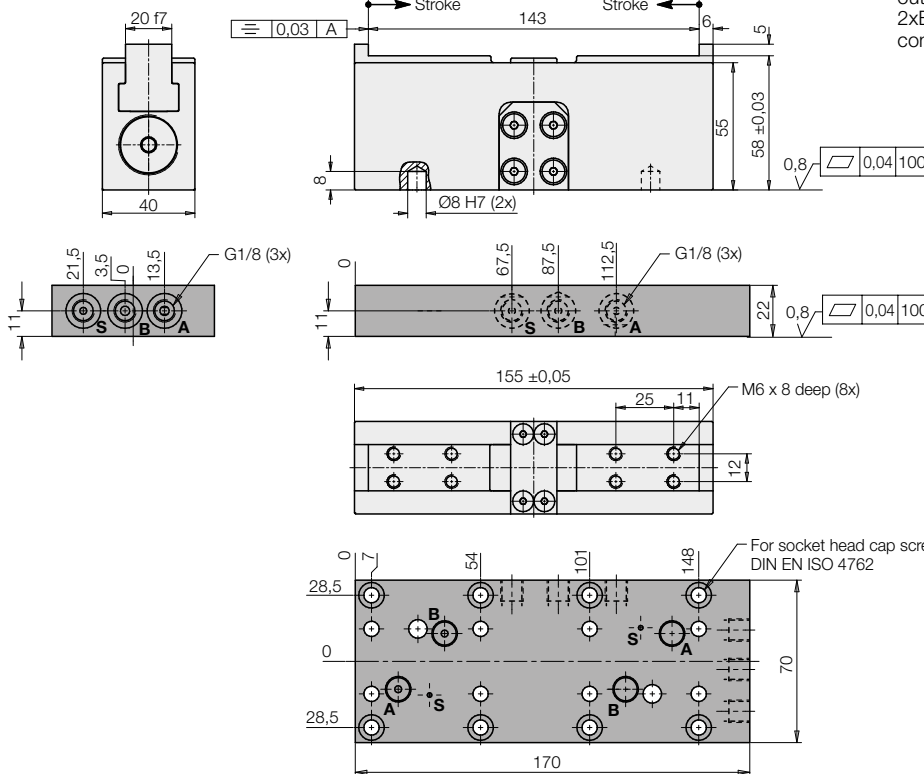
Central lubrication

2 x with O-ring **3001842** (5x1 mm) (included in our delivery)

Important note

If the vise is manifold-mounted without adaptor plate, all 6 ports (2xA, 2xB, 2xS) have to be individually connected.

A = Clamping
B = Unclamping
S = Central lubrication



Accessories: Adaptor plate

Side views

Accessories: Adaptor plate

View from above

Clamping Force 9 kN • Clamping Stroke 2 x 8 mm
Technical Data • Accessory • Dimensions

Part no. 4413 151

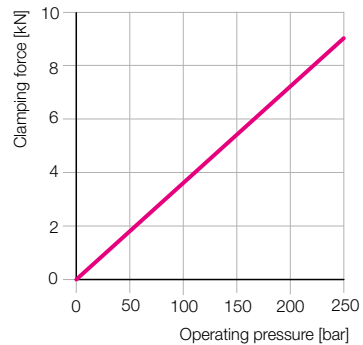
Technical data

Clamping force / jaw	[kN]	9
Retention force	[kN]	15
Release force	[kN]	0.5
Min. pressure	[bar]	10
Clamping stroke	[mm]	2 × 8
Repetitive clamping accuracy	[mm]	±0.02
Jaw width	[mm]	65
Max. flow rate	[cm ³ /s]	50
Stroke volume	[cm ³]	14.2
Clamping		
Unclamping	[cm ³]	6.0
Weight	[kg]	approx. 6

Adaptor plate (Accessory)

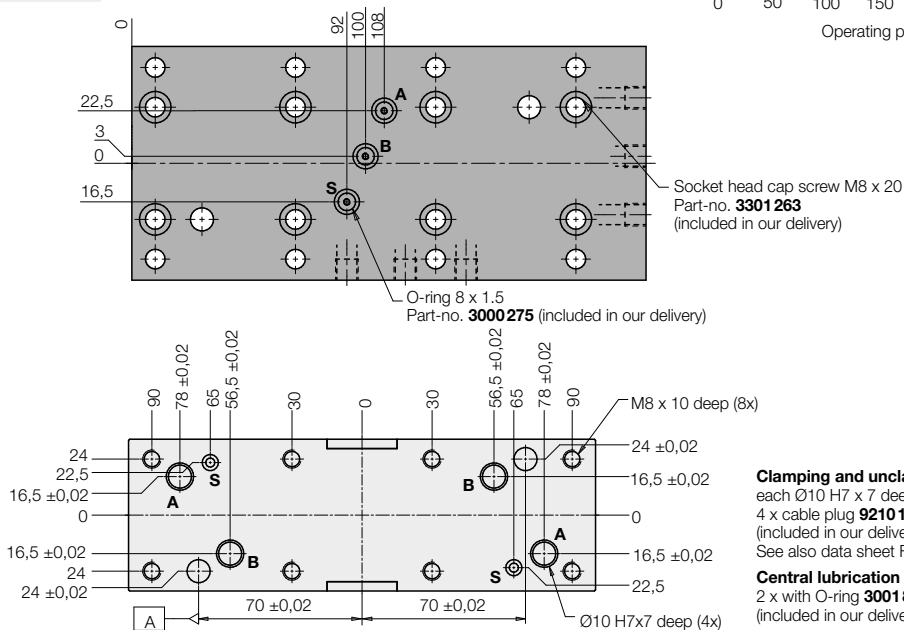
Weight	[kg]	approx. 3.5
Part no.		0441 315

Clamping force diagram
(Height of the clamping jaw 25 mm)



Accessories: Adaptor plate

View from below



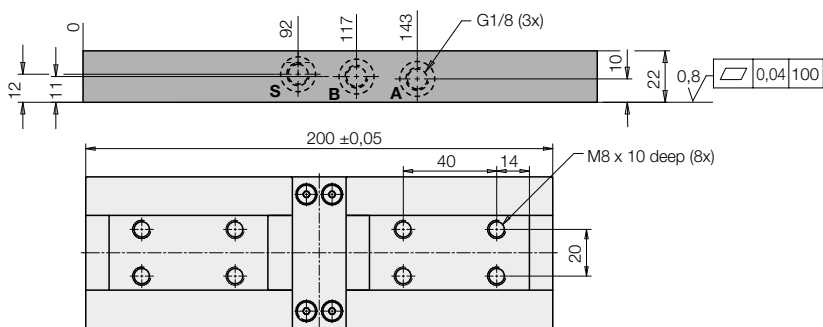
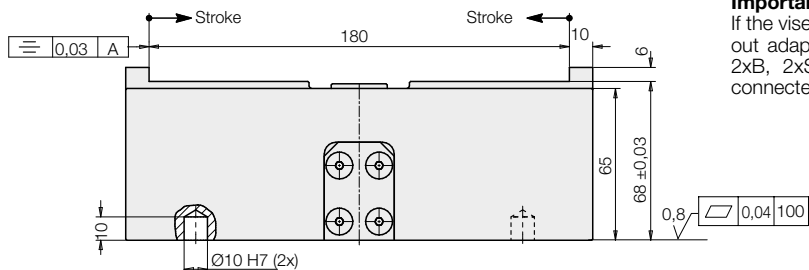
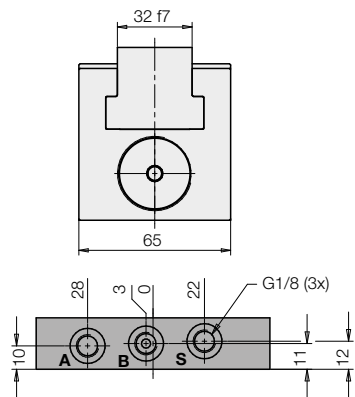
A = Clamping
B = Unclamping
S = Central lubrication

Clamping and unclamping
each Ø10 H7 x 7 deep for
4 x cable plug **9210132**
(included in our delivery).
See also data sheet F 9.300

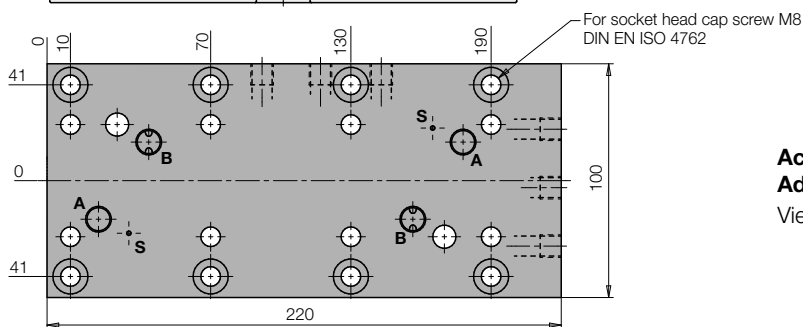
Central lubrication
2 x with O-ring **3001842** (5x1 mm)
(included in our delivery)

Important note

If the vise is manifold-mounted without adaptor plate, all 6 ports (2xA, 2xB, 2xS) have to be individually connected.



Accessories:
Adaptor plate
Side views

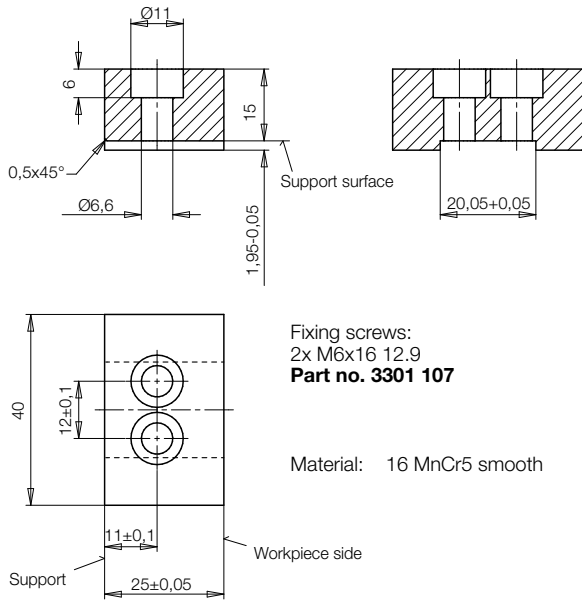


Accessories:
Adaptor plate
View from above

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

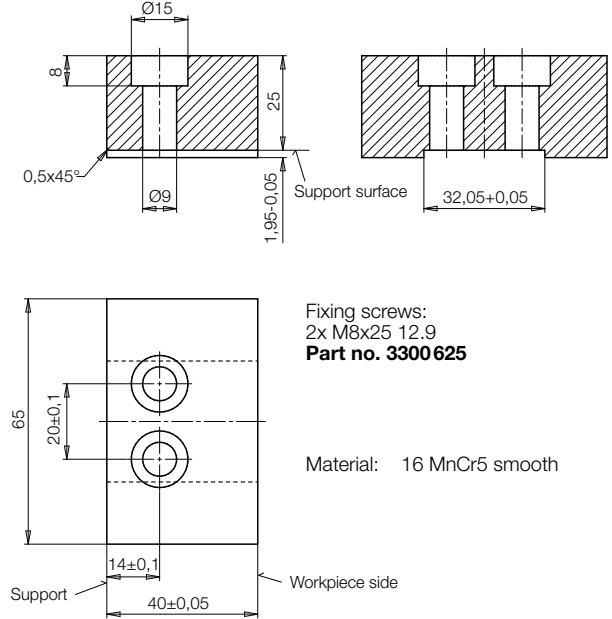
For vise 4413051

Clamping jaw blank 40 mm
Part-no. 3548070



For vise 4413151

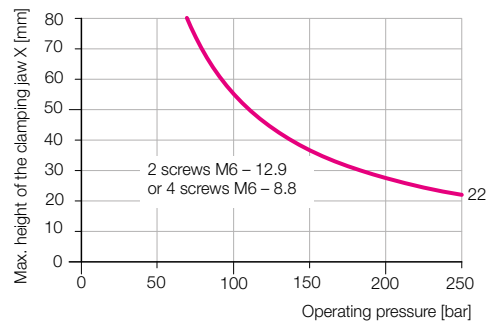
Clamping jaw blank 65 mm
Part-no. 3548080



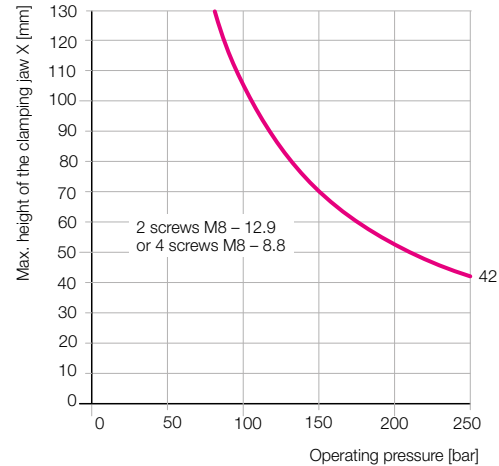
Self-made clamping jaws

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 charts below.

Max. height of the clamping jaw X for 4413051 as a function of the operating pressure

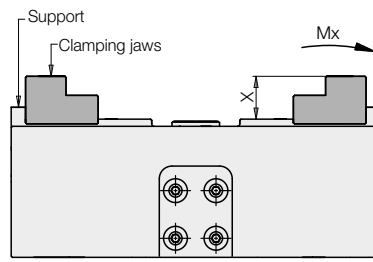
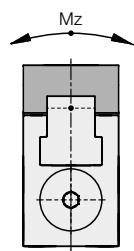


Max. height of the clamping jaw X for 4413151 as a function of the operating pressure

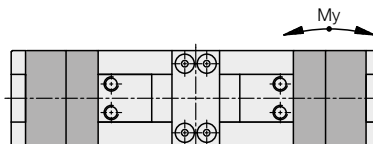


Permissible torques on the clamping jaws

Mx = 140 Nm
My = 120 Nm
Mz = 120 Nm



Mx = 375 Nm
My = 200 Nm
Mz = 200 Nm

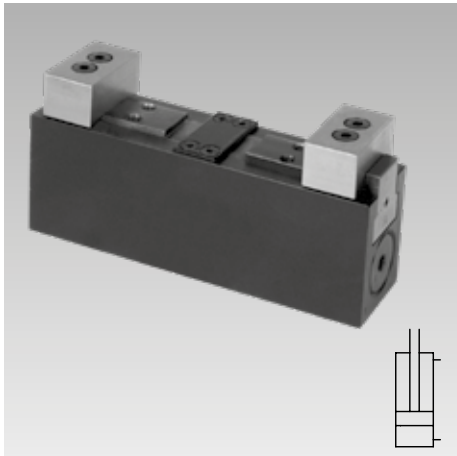


Operating conditions and other data, see data sheet A 0.100.



Hydraulic Vises, Position Flexible Clamping

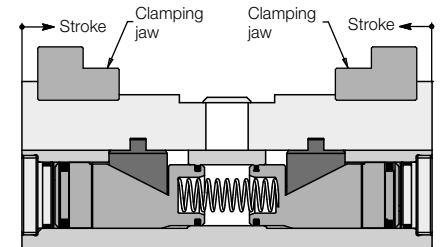
max. clamping force 8 kN, jaw width 40 mm,
double acting, max. operating pressure 250 bar



Advantages

- Very compact design
- High rigidity
- 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

Functional principle



Application

Position-flexible, hydraulic vises 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 an extremely space-saving manner. Hydraulic vises are especially suitable for series manufacturing in automated mode.

The double-acting cylinder function combined with central lubrication and good swarf protection guarantees high process safety.

Description

The hydraulic vise 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 of each other. During clamping, both clamping slides contact the workpiece with almost no force (see page 3).

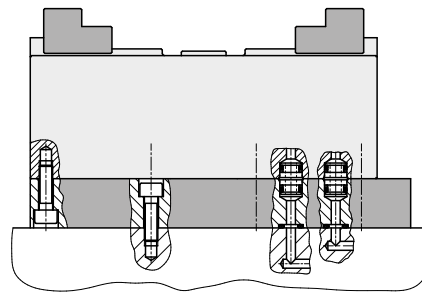
Only then the clamping pressure and thereby the clamping force increases. The wedging of the clamping slides protects them against displacement. Thus, the workpiece is held floating without deformation.

All threads and ports are at the bottom to enable 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. Blanks of clamping jaws that can be adapted to the workpiece contour are also available as an accessory.

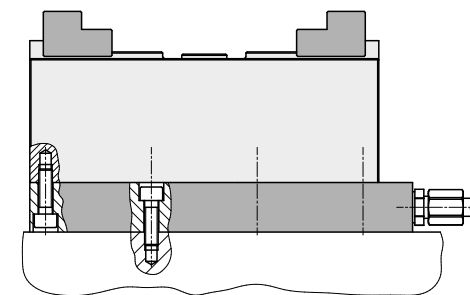
Fixing from above

with accessory adaptor plate

Drilled channels

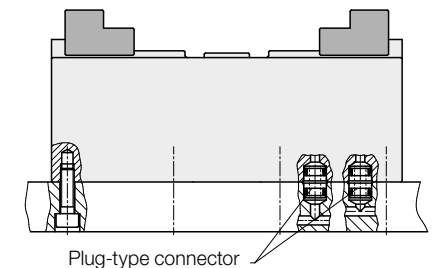


Pipe thread



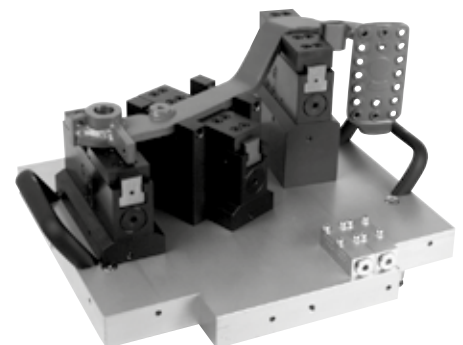
Fixing from below

Drilled channels



Application example

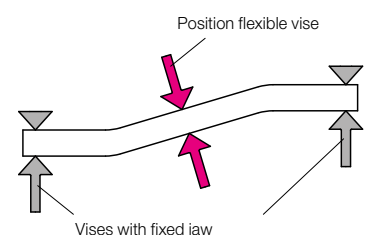
Clamping fixture for a pedal of a commercial vehicle



Accessories

Clamping jaws and adaptor plate are not included in the delivery of the clamping vise and have to be ordered separately as accessory.

Clamping principle



Accessories Position Flexible Clamping

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.

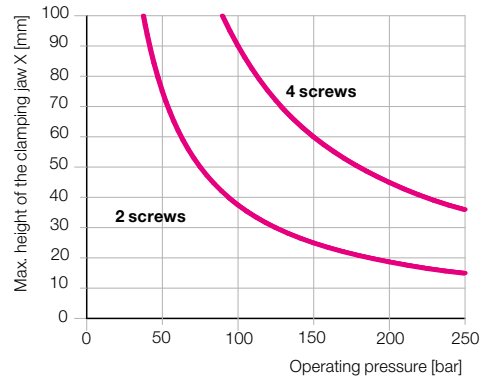
Max. height of the clamping jaws X at max. operating pressure of 250 bar

Fixing screws for clamping jaws	M 6 × 16 – 12.9
X [mm] with 2 screws	15
X [mm] with 4 screws	36

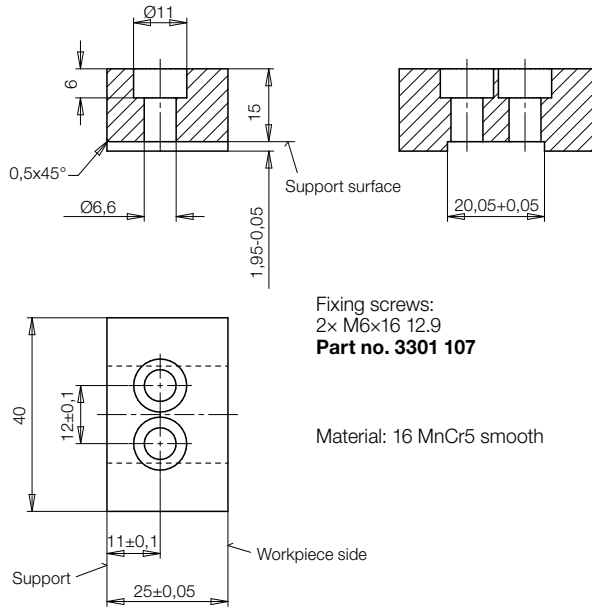
Important note

The clamping jaws must always be supported by the provided support, since the fixing screws are not in the position to compensate for the generated clamping forces.

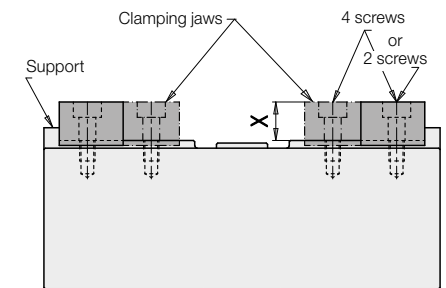
Max. height of the clamping jaw X as a function of the operating pressure



Clamping jaw blank 40 mm Part-no. 3548 070

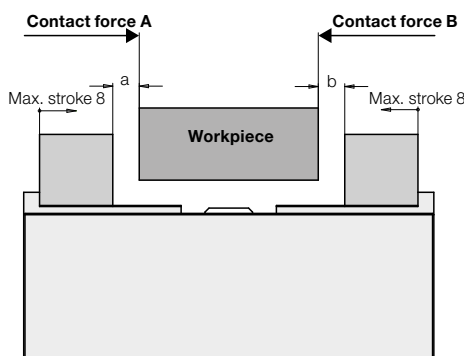


Fixing of the clamping jaws



Position flexible clamping

1. Position of the workpiece within the clamping range



Limit dimensions: a max. = 7 mm
b max. = 7 mm

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 make contact with the workpiece. One clamping jaw is always ahead. With very unstable workpieces, this can already lead to deformation. The possible contact force can be seen in the chart.

3. Max. flow rate

With a max. flow rate of 17 cm³/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 make contact with 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)

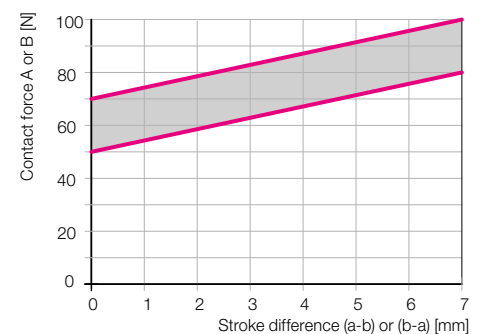


Chart valid for horizontal mounting position; for vertical arrangement, the weight of the clamping jaws must be taken into account.

Recommendation

Place the position flexible vise as symmetrically as possible to the workpiece, so that the clamping jaws realise approximately the same stroke and also the smallest possible stroke.



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

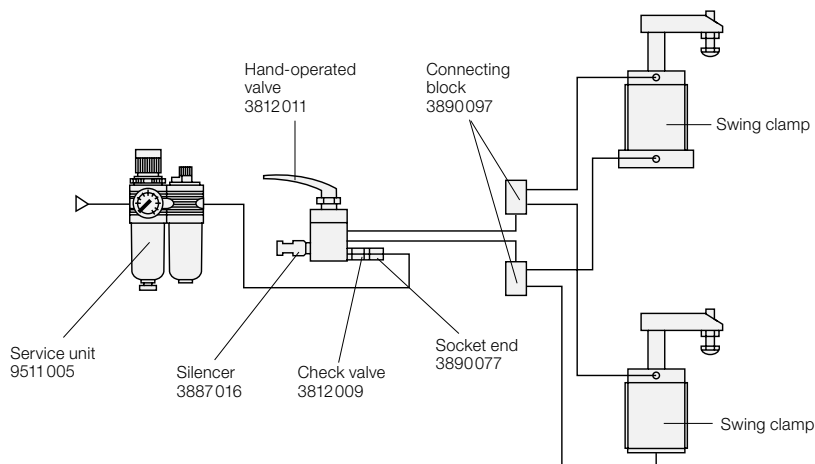
The swing clamps are supplied in corrosion resistant quality. Guide bushing, housing, piston, and flange are made of hardcoated aluminium. The piston rod is made of corrosion resistant steel.

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.

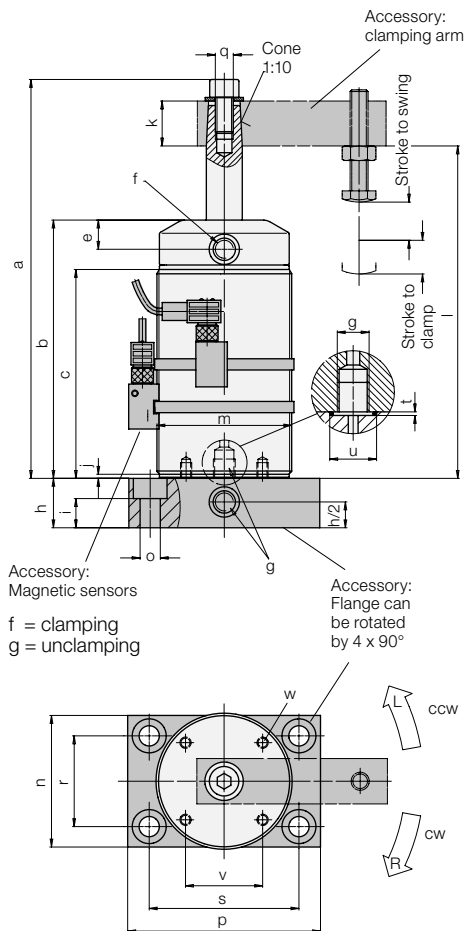


Connecting example



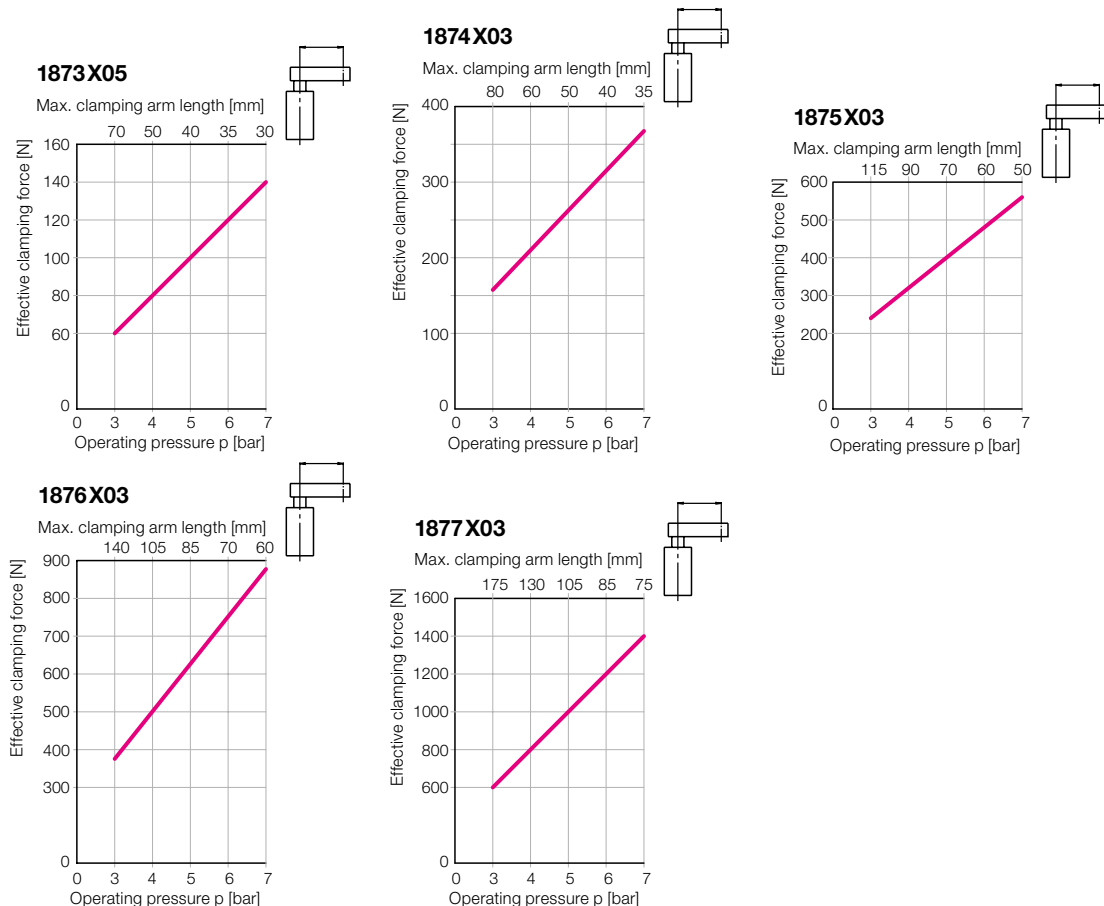
Technical Data

Dimensions • Effective Clamping Force



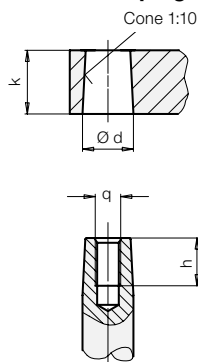
Piston Ø	[mm]	20	32	40	50	63
Piston rod Ø	[mm]	8	12	16	20	25
Stroke to swing	[mm]	7.5	9.5	17	18	23
Stroke to clamp	[mm]	7	9	15	15	18
Pulling force at 4 bar	[N]	105.5	276.4	422.2	659.7	1050.5
* air pressure 5 bar	[N]	131.9	345.5	527.7	824.6	1313.1
6 bar	[N]	158.3	414.6	633.3	989.6	1575.8
Min. operating 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



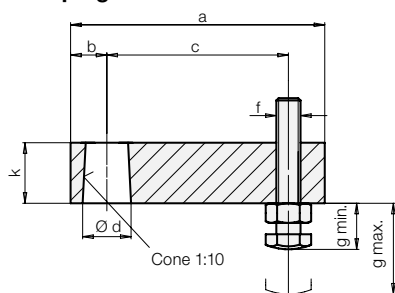
Accessory: Clamping Arms • Mounting Parts

Seat of clamping arm (dimensions)



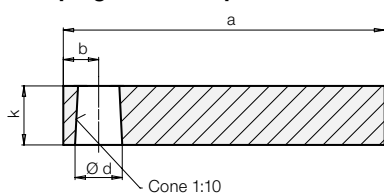
Swing clamp	$\varnothing d + 0.05$	$\square k$	h	q
1873X05	7.85	12	9	M 4
1874X03	11.85	16	15	M 6
1875X03	15.85	20	19	M 8
1876X03	19.85	25	18	M 12
1877X03	24.85	30	25	M 10

Clamping arm



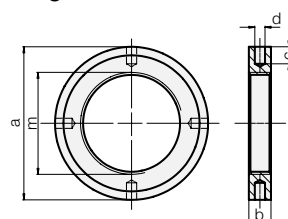
Swing clamp	a	b	c	$\varnothing d + 0.05$	f	$g \text{ min.}$	$g \text{ max.}$	$\square k$	Part no.
1873X05	42	7	30	7.85	M 4	8	20.5	12	0187324
1874X03	52	10	35	11.85	M 6	12	17.5	16	0187424
1875X03	70	12	50	15.85	M 6	12	28.5	20	0187524
1876X03	82	14	60	19.85	M 8	15	25	25	0187624
1877X03	104	18	75	24.85	M 10	19	36.5	30	0187724

Clamping arms for special versions



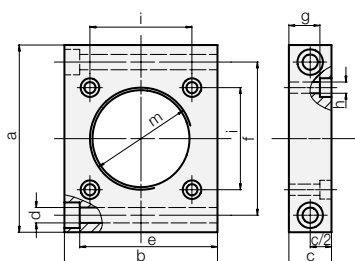
Swing clamp	a	b	$\varnothing d + 0.05$	$\square k$	Part no.
1873X05	62	7	7.85	12	3548355
1874X03	72	10	11.85	16	3548356
1875X03	95	12	15.85	20	3548357
1876X03	116	14	19.85	25	3548353
1877X03	143	18	24.85	30	3548358

Flanged nut



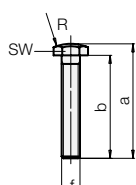
Swing clamp	$\varnothing a$	b	c	$\varnothing d$	m	Part no.
1873X05	50	10	7	4 x 5	M30 x 1.5	3527071
1874X03	62	12	8	4 x 6	M40 x 1.5	3527040
1875X03	75	13	10	6 x 6	M50 x 1.5	3527041
1876X03	90	13	10	6 x 6	M60 x 1.5	3527042
1877X03	115	16	12	6 x 8	M80 x 1.5	3527043

Threaded nut



Swing clamp	a	b	c	$\varnothing d$	e	f	g	$\varnothing h$	i	m	Part no.
1873X05	65	55	15	5.5	49.3	50	10.4	4.5	30	M30 x 1.5	3527073
1874X03	80	65	15	5.5	59.3	60	10.4	4.5	40	M40 x 1.5	3527044
1875X03	95	75	20	6.6	68.2	75	14.3	5.5	50	M50 x 1.5	3527045
1876X03	110	90	25	9	81	90	18.2	6.6	60	M60 x 1.5	3527046
1877X03	140	120	25	11	109	115	16	9	75	M80 x 1.5	3527047

Contact bolts, dome head



Swing clamp	a	b	f	R	SW	Part no.
1873X05	32.5	30	M 4	15	7	3614 141
1874X03	33.5	30	M 6	20	10	3614 137
1875X03	48.5	45	M 6	20	10	3614 138
1876X03	50	45	M 8	20	13	3614 139
1877X03	66.5	60	M 10	35	17	3614 140

Accessory Magnetic Sensors

Compared with traditional reed switches the electronic magnetic sensors offer the following advantages:

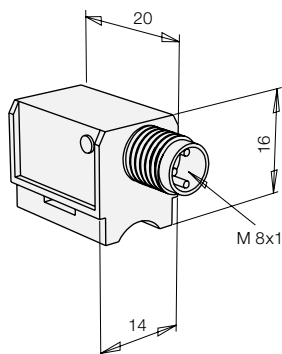
- Indifference to shock and vibration
- Bounce-free output signal
- Only one switching point
- Wear resistant
- Protection against reverse battery
- Protected against short circuits

Electric connection is made as per traditional inductive proximity switches.

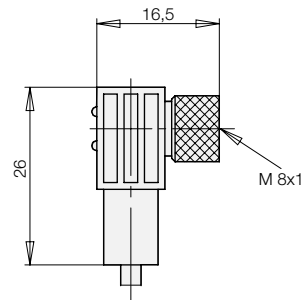
Up to four magnetic sensors can be connected in series.

The magnetic sensor is mounted at the swing clamp body with a hose clamp.

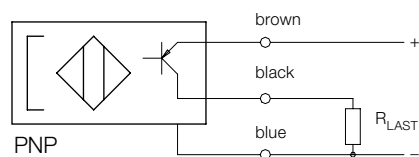
Electronic magnetic sensor



Connecting cable with right angle plug



Connecting scheme



Hose clamp for swing clamp

Part no.

1873X05	3829 132
1874X03	3829 133
1875X03	3829 120
1876X03	3829 134
1877X03	3829 135

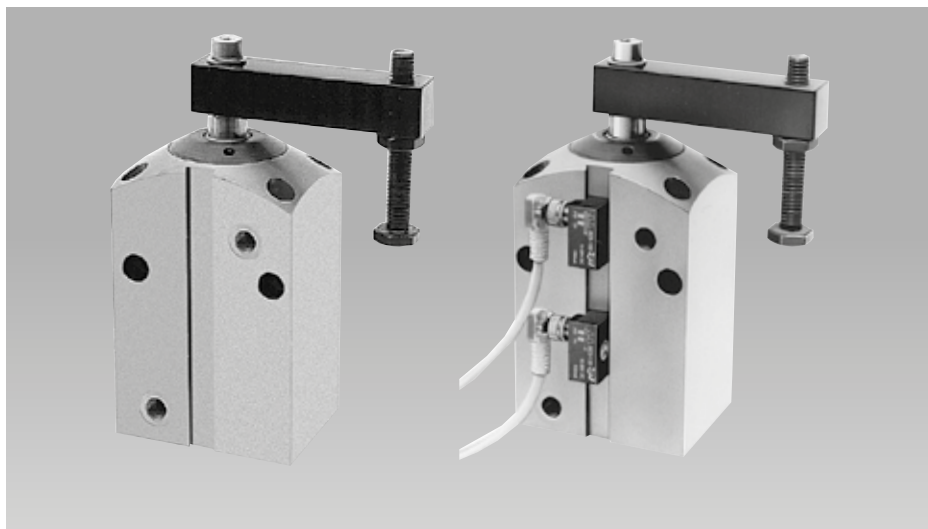
Technical data

	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 Swiwing 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.

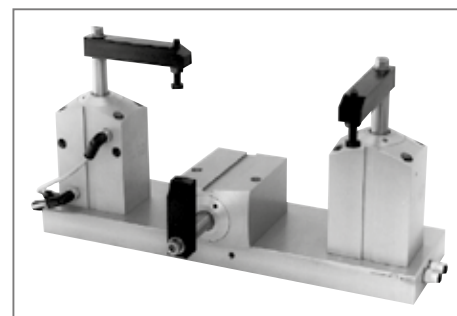
Material

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.

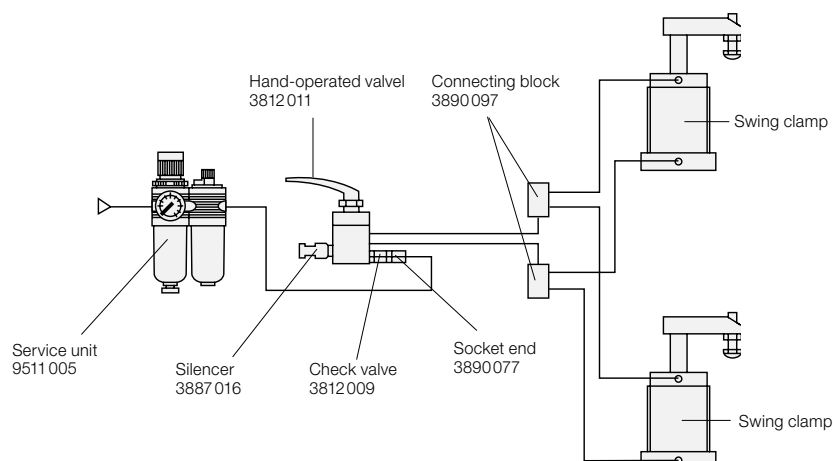
Operating conditions, tolerances and other data see data sheet A 0.100.



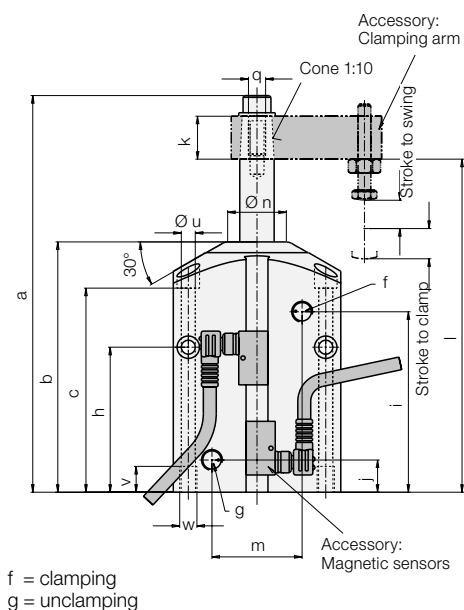
Versions

- 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



Threaded Body Technical Data • Accessories



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 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

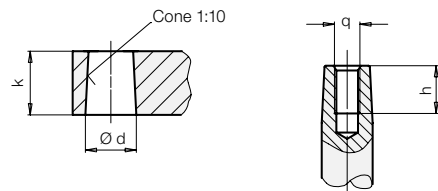
Part no. 1873 106 1874 106 1875 106 1876 106 1877 106

Counterclockwise rotation

Part no. 1873 206 1874 206 1875 206 1876 206 1877 206

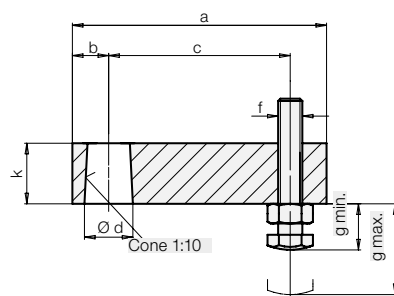
* Effective clamping force see diagram (page 3, column 1)

Seat of clamping arm



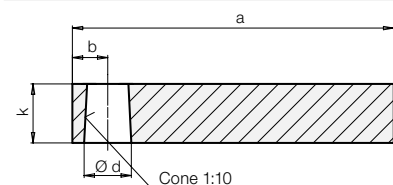
Swing clamp	Ø d + 0.05	□ k	h	q
1873X06	7.85	12	9	M 4
1874X06	11.85	16	15	M 6
1875X06	15.85	20	19	M 8
1876X06	19.85	25	18	M 12
1877X06	24.85	30	25	M 10

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	3548358
1877X06	143	18	24.85	30	3548359

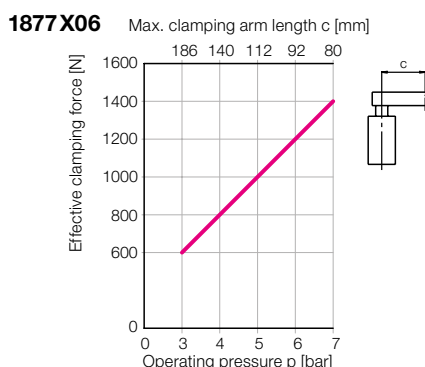
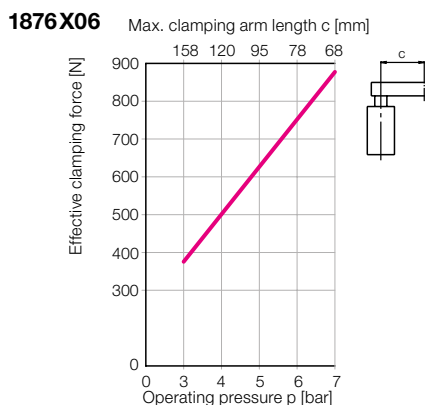
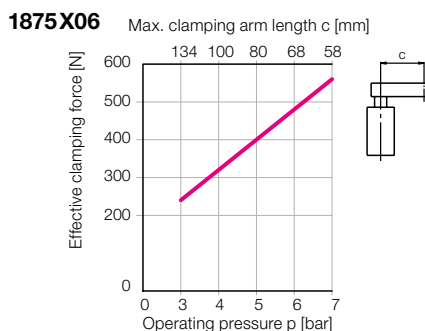
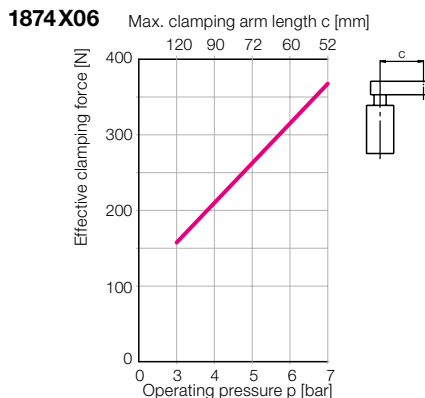
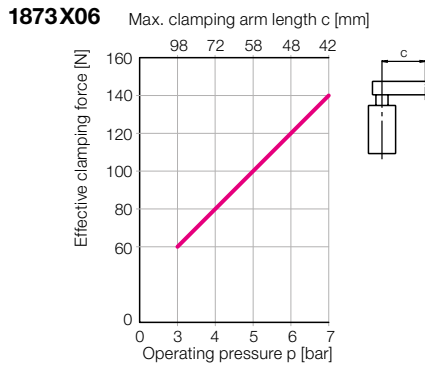
Contact bolt, dome head

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

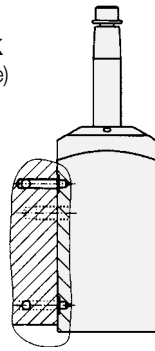
Manifold Mounting with O-ring Sealing

Technical Data

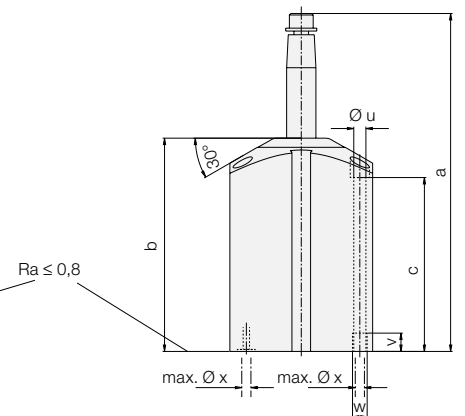
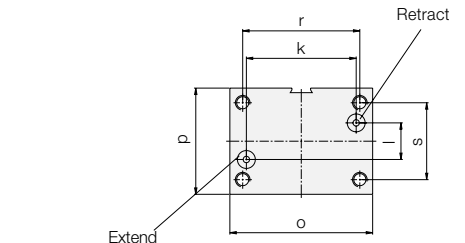
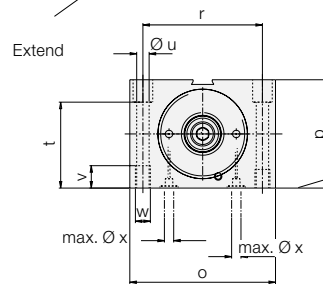
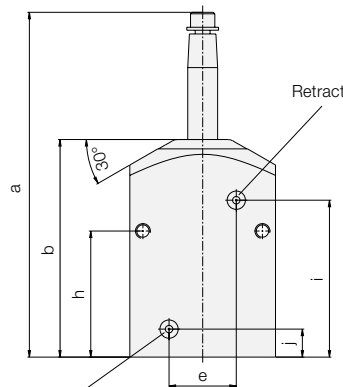
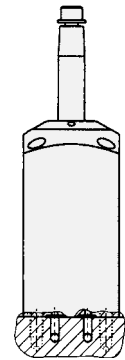
Effective clamping force



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

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

Accessory: Magnetic Sensors

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

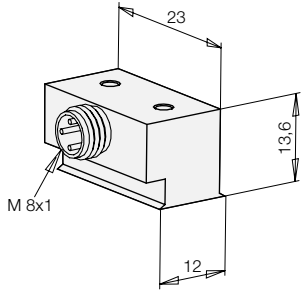
Electric connection is made as per traditional inductive proximity switches; up to four magnetic sensors can be connected in series. Minimum distance of the switching points: 6 mm.

Important notes

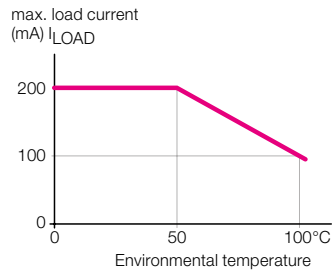
Steel can influence the magnetic field of the magnetic piston and thereby the position of the switching points. If there is the same influence for each stroke (e.g. because of adjoining steel components) it can be compensated by displacing the magnetic sensors. But if the influence differs from stroke 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.

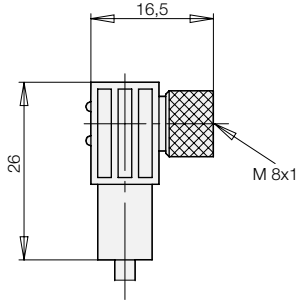
Electronic magnetic sensor



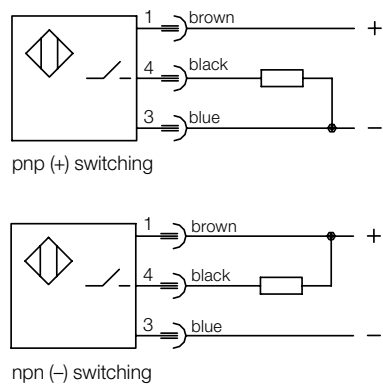
Temperature curve



Connecting cable with right angle plug



Connecting scheme



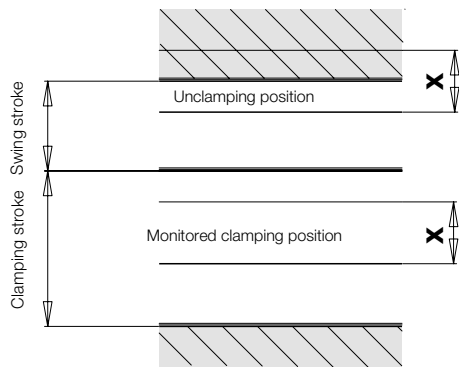
Technical data

	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) PUR, 5 m	
Cable, length of cable				
Output (interlock)	pnp	nnp	pnp	nnp
Part no.	3829234	3829240	3829099	3829124

Further accessory

- see data sheet G 2.140
- Pin-and-socket connector
 - Y-distributor
 - Reversing plug
 - Voltage regulator

Range of magnetic signal

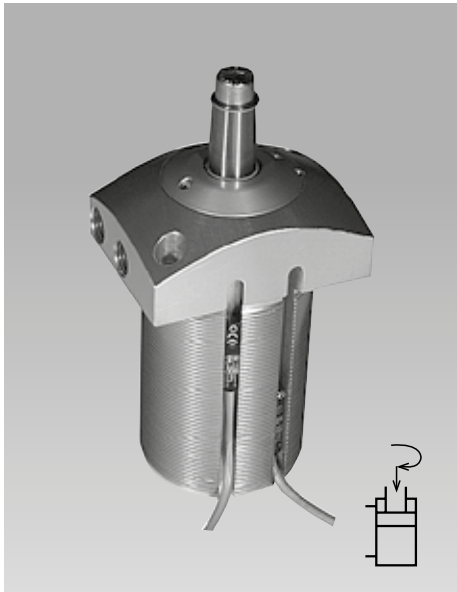


Type	≈ x [mm]
1873 X06	4
1874 X06	4
1875 X06	5
1876 X06	6
1877 X06	7

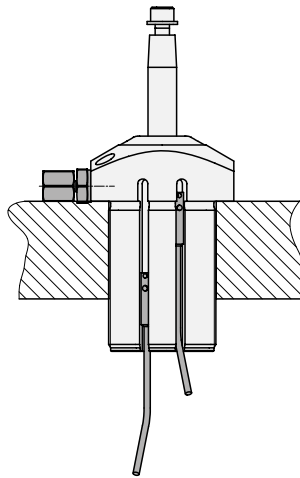


Pneumatic Swing Clamp

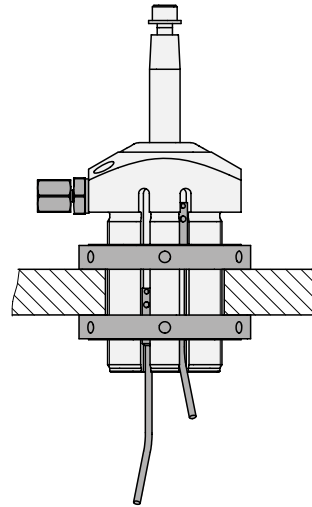
top flange-type, for adjustable magnetic sensors
 double acting, max. operating pressure 7 bar



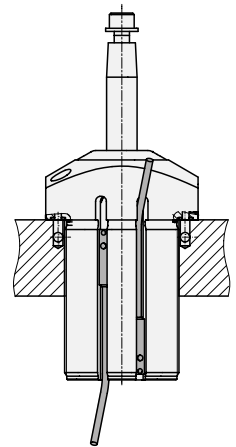
Installation examples



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

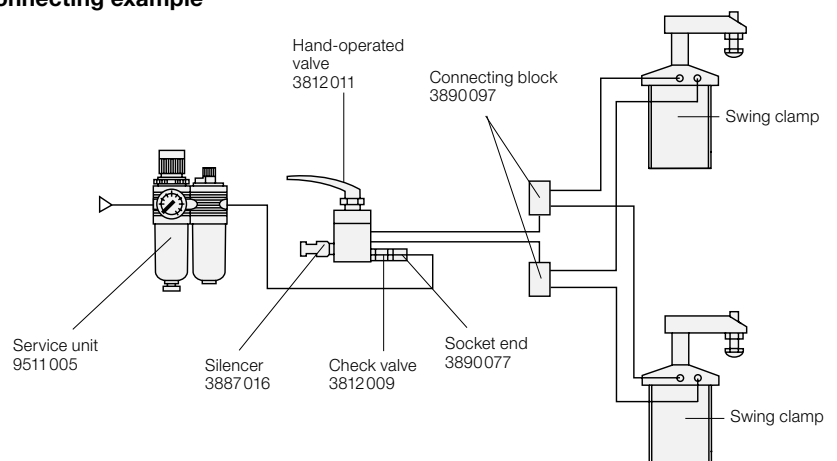
Versions

- Threaded body for height adjustment
- Manifold mounting with O-ring sealing

Pneumatic accessories

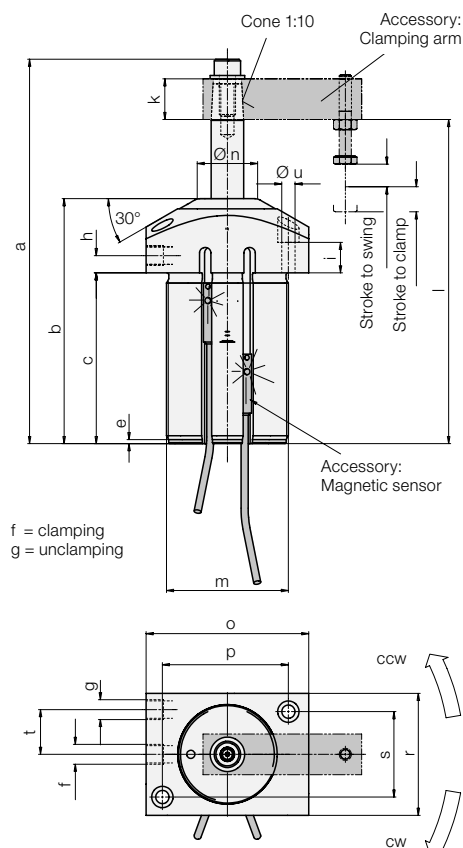
see data sheet J 7.400.

Connecting example



Threaded Body

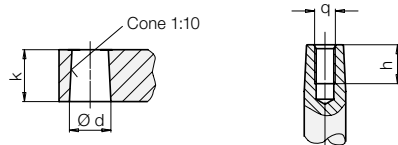
Technical Characteristics • Accessories



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.		1873 103	1874 103	1875 103	1876 103	1877 103
Direction of rotation ccw						
Part no.		1873 203	1874 203	1875 203	1876 203	1877 203

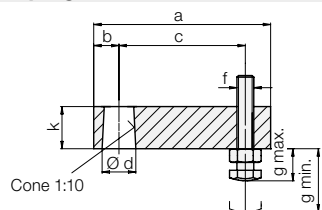
* Effective clamping force see diagram (page 3)

Seat of clamping arm



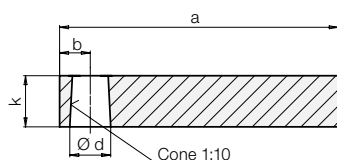
Swing clamp	Ø d + 0.05	□ k	h	q
1873 X03/ -X05	7.85	12	9	M 4
1874 X03/ -X05	11.85	16	15	M 6
1875 X03/ -X05	15.85	20	19	M 8
1876 X03/ -X05	19.85	25	18	M 12
1877 X03/ -X05	24.85	30	25	M 10

Clamping arm



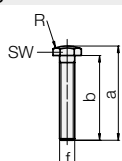
Swing clamp	a	b	c	Ø d + 0.05	f	g min.	g max.	□ k	Part no.
1873 X03/ -X05	54	7	42	7.85	M 4	8	28	12	0187 326
1874 X03/ -X05	68	10	52	11.85	M 6	12	27	16	0187 426
1875 X03/ -X05	78	12	58	15.85	M 8	12	42	20	0187 526
1876 X03/ -X05	90	14	68	19.85	M 10	15	42	25	0187 626
1877 X03/ -X05	110	18	80	24.85	M 10	19	56	30	0187 726

Clamping arms for special versions



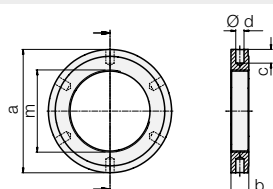
Swing clamp	a	b	Ø d + 0.05	□ k	Part no.
1873 X03/ -X05	62	7	7.85	12	3548 355
1874 X03/ -X05	72	10	11.85	16	3548 356
1875 X03/ -X05	95	12	15.85	20	3548 357
1876 X03/ -X05	116	14	19.85	25	3548 353
1877 X03/ -X05	143	18	24.85	30	3548 358

Contact bolts, dome head



Swing clamp	a	b	f	R	SW	Part no.
1873 X03/ -X05	32.5	30	M 4	15	7	3614 141
1874 X03/ -X05	33.5	30	M 6	20	10	3614 137
1875 X03/ -X05	48.5	45	M 6	20	10	3614 138
1876 X03/ -X05	50	45	M 8	20	13	3614 139
1877 X03/ -X05	66.5	60	M 10	35	17	3614 140

Flange nut



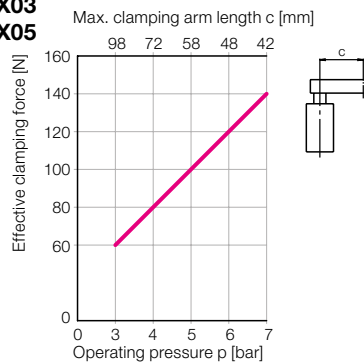
Swing clamp	Ø a	b	c	Ø d	m	Part no.
1873 X03	62	12	8	4x6	M 40x1.5	3527 040
1874 X03	80	13	10	6x6	M 52x1.5	3527 082
1875 X03	90	13	10	6x6	M 60x1.5	3527 042
1876 X03	100	14	12	6x8	M 70x1.5	3527 083
1877 X03	120	16	12	6x8	M 85x2.0	3527 084

Manifold Mounting with O-ring Sealing Technical Data

Effective clamping force

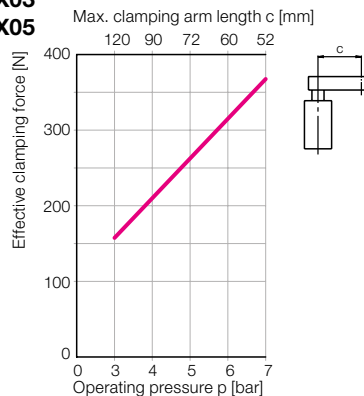
1873X03

1873X05



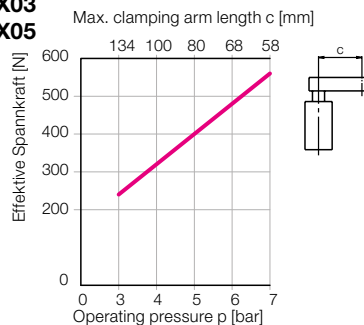
1874X03

1874X05



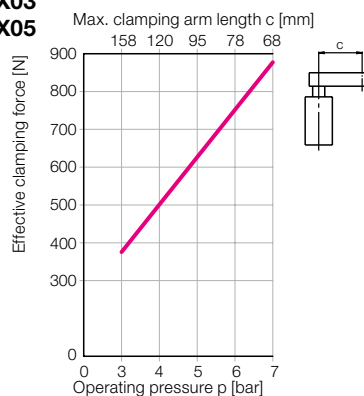
1875X03

1875X05



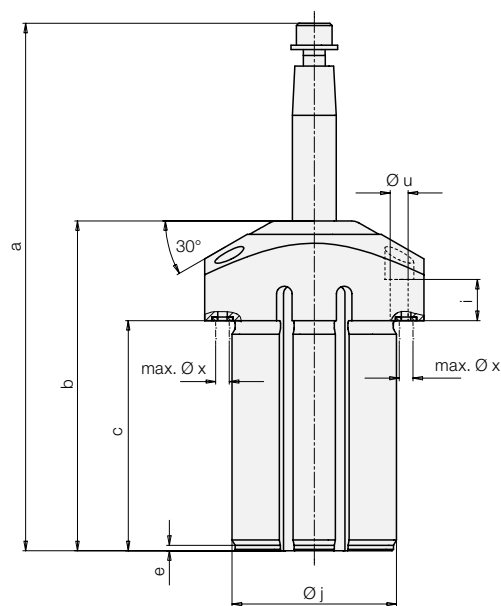
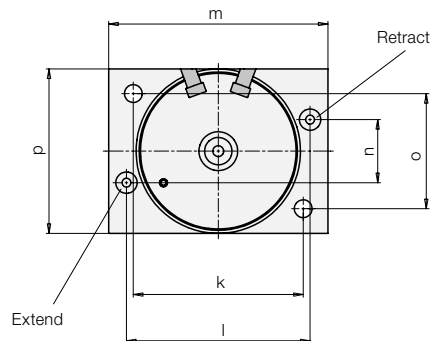
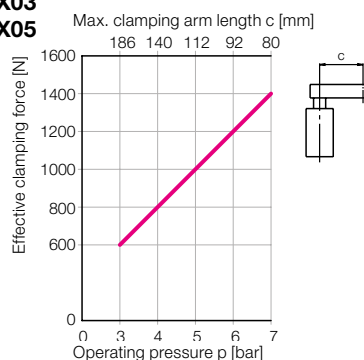
1876X03

1876X05



1877X03

1877X05



Clamping force Schwenkspanner

Clockwise rotation

Counterclockwise rotation

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		3000968	3000968	3000968	3000342	3000342

O-rings are included in delivery. Other dimensions see page 2.

Accessory: Magnetic Sensors

Compared with traditional reed switches the electronic magnetic sensors offer the following advantages:

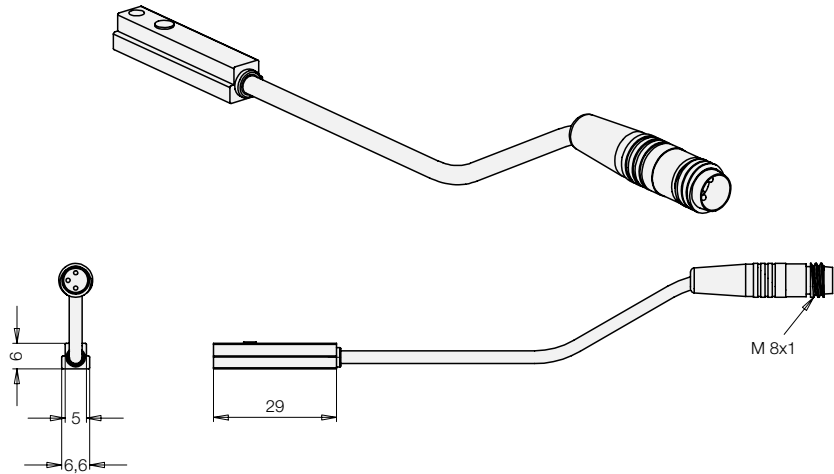
- Indifference to shock and vibration
- Bounce-free output signal
- Only one switching point
- Wear resistant
- Protection against reverse battery
- Protected against short circuits

Electric connection is made as per traditional inductive proximity switches; up to four magnetic sensors can be connected in series.

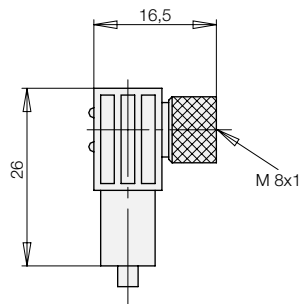
Important notes

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.

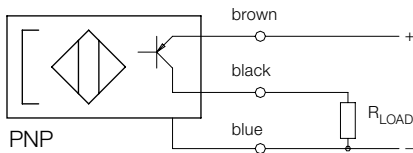
Electronic magnetic sensor



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)	3829 147	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

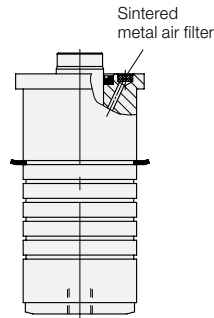
Due to increased use of coolants and cutting fluids in metal cutting machining there is also an increased danger that some very aggressive fluids penetrate into the spring areas of single-acting clamping elements and work supports, causing malfunctions.

It is important to realize these problems already in the period of design. The following versions show possible solutions to the above problems.

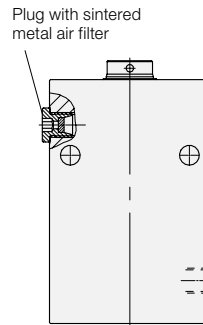
Catalogue elements with venting of the spring area

Single-acting clamping elements

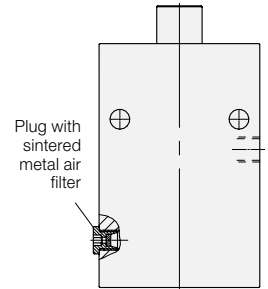
without venting port



with venting port



Work supports



See data sheets:

B 1.310
B 1.480

B 1.309
B 1.5091
B 1.570
B 1.7441
B 1.849
B 1.880
B 1.881
B 1.891
B 1.892

B 1.900
B 1.910
B 1.911
B 1.914
B 1.921
B 1.9401
B 1.9405
B 1.942
B 1.943
B 1.944
B 1.9470
B 1.9471
B 1.9472
B 1.950
B 1.9501
B 1.9503

Why venting has to be made?

Excess pressure or depression in the spring area change the spring forces which leads to malfunctions.

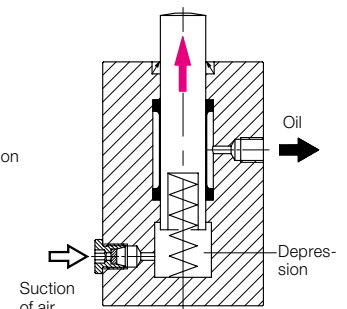
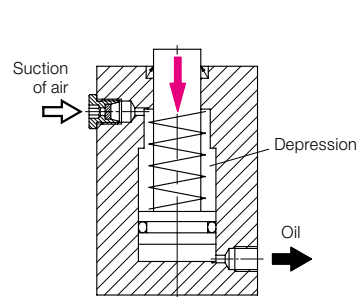
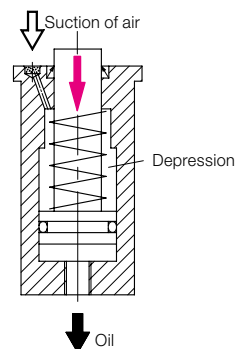
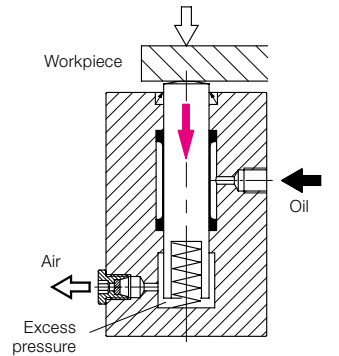
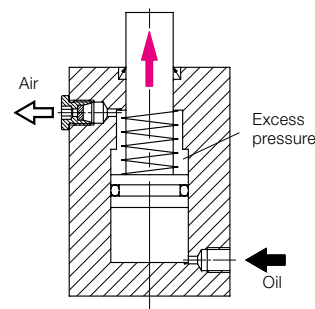
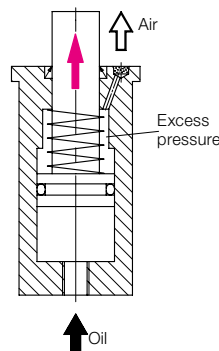
Formation of condensation water promotes rust formation and can lead to a complete failure of the elements.

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.

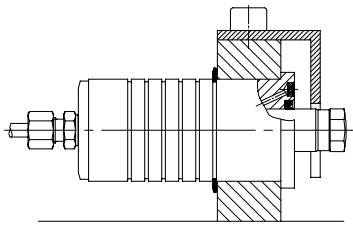
What happens during venting?



Precautions

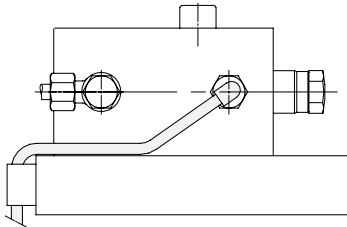
If there is the danger that liquids enter the system, you have to prevent it.

Cover



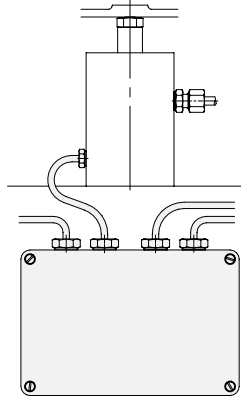
Clamping elements without venting port can be covered, but due to the nowadays usual quantities of coolants this does not seem to be successful. In such applications you should use other clamping elements, preferably double-acting elements.

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

black **Part no. 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

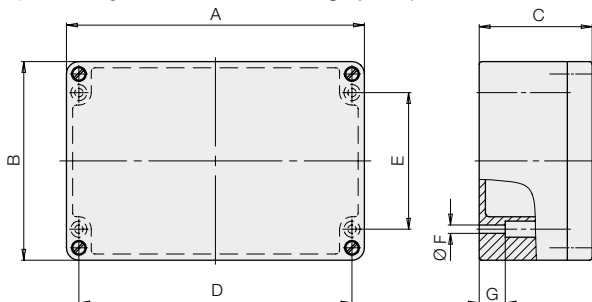
Hose connection L-piece 90°

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

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.

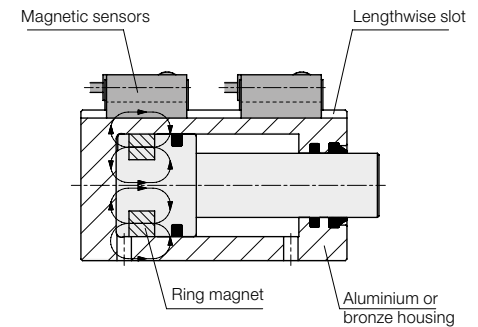
Influencing the magnetic field with adjacent, magnetisable components (e.g. steel parts)

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.

Function



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.

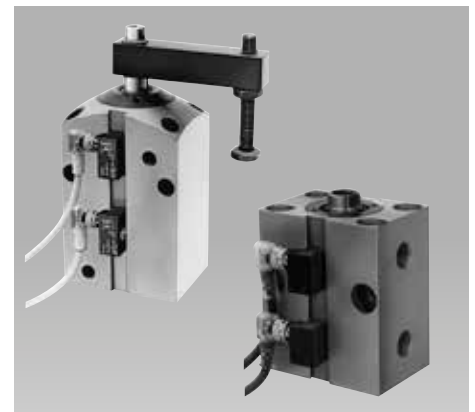
The magnetic sensors are fixed outside in the lengthwise slots of the cylinder body. The switching points are adjustable by displacement of the magnetic sensors in the lengthwise slots of the body.

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



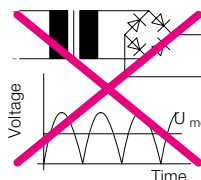
Demands on voltage supply

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:

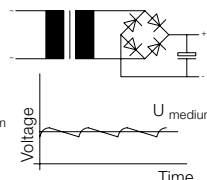
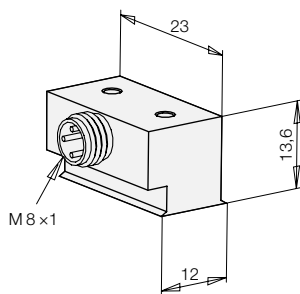


Figure 1: Generation of supply voltage

Dimensions

Technical Data • Accessories

Dimensions



Electric connection

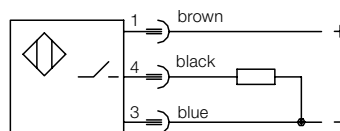
Electric connection is made as per traditional inductive proximity switches.
Up to four magnetic sensors can be connected in series.

Switching hysteresis of approx. 3 mm and path

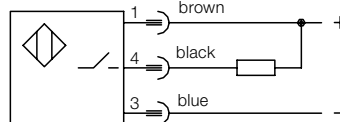
This has to be considered already when adjusting the magnetic sensors. For static pistons, the magnetic sensor must always be pushed forward to the piston from the opposite direction.

Magnetic sensors with short path are available on request.

Connecting scheme



pnp = plus switching



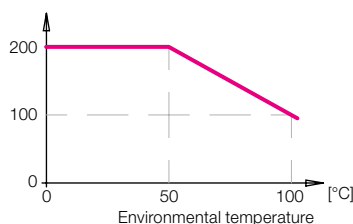
npn = minus switching

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

max. load current
[mA] I_{LOAD}



Maximum operating temperature

- Magnetic sensor +100 °C
- Permanent magnet: +100 °C
- Connecting cable with right angle plug: +90 °C

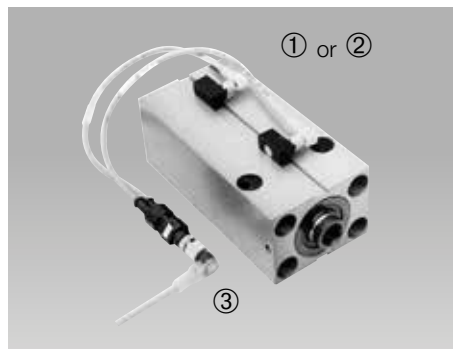
Magnetic sensors for an operating temperature up to 120 °C are available on request.

Connecting cable

With angle plug M8



Y-distributor pnp



With pnp angle plug M12



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	(green)	
Function display	(yellow)	
Cable, length of cable	PUR, 5 m	
Output (interlock)	pnp	npn
Part no. (1 off)	3829099	3829124

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. 3829118

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. 3829125

③ Right angle plug M12 with 3 LED 5 m 4-wire cable for common connection of the Y-distributor
Part no. 3829106

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

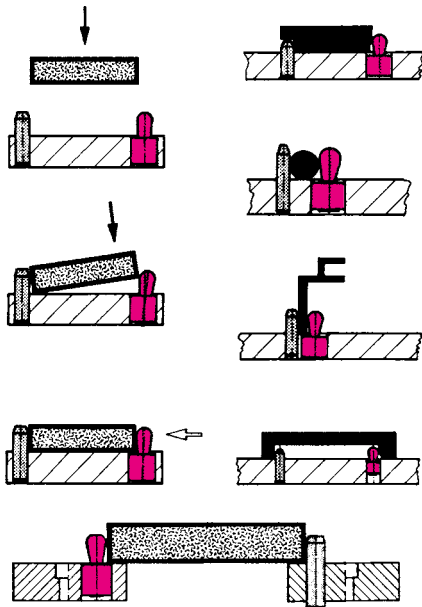
Voltage	10 – 30 V DC
Protection as per DIN 40050	IP 67
Environmental temperature	–25 °C to +90 °C
LED: Voltage	(green)
Function display	(yellow)



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

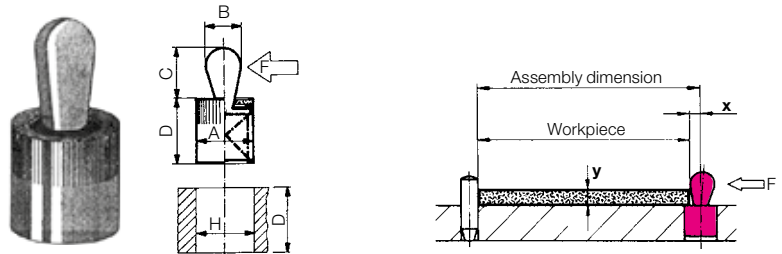
The clamping force is generated by displacement of a spring-loaded pin. Clamping force and clamping path are indicated in the chart.

Materials

Body: aluminium
Pressure pin: steel case hardened and galvanised

With sealing

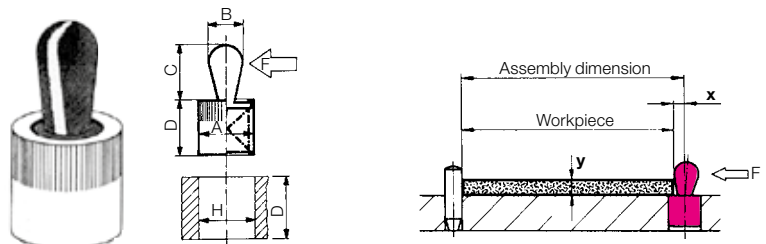
Elements of range 3112 1XX are equipped with additional sealing against swarf and coolants and are particularly suitable for its application in the metal cutting machining.



A	B	C	D	H	F	y=1.0	y=2.0	y=3.0	y=4.5	y=6.0	y=8.0	y≥10.0	Weight	Part no.
		-1			[N]	X	X	X	X	X	X	X	[g]	
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
					20								2	3112123
10	5	6	12	10H11	50		1.5	1.7	1.7	1.7	1.7	1.7	2	3112124
					100								2	3112125
					40								2	3112126
10	6	10	12	10H11	75				1.7	1.9	1.9	1.9	2	3112127
					150								2	3112128
					50								8	3112129
12	8	13	14	12H11	100					2.4	2.6	2.6	8	3112130
					200								8	3112131
					100								16	3112132
16	10	16	18	16H11	200						3.1	3.4	16	3112133
					300								16	3112134

Without sealing

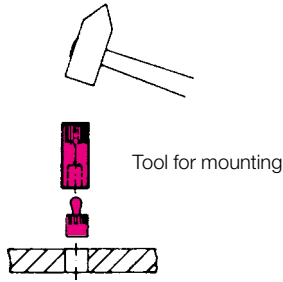
Elements of range 3122 2XX without the extra sealing are suitable for assembly and welding.



A	B	C	D	H	F	y=1.0	y=2.0	y=3.0	y=4.5	y=6.0	y=8.0	y≥10.0	Weight	Part no.
		-1			[N]	X	X	X	X	X	X	X	[g]	
					10								1	3112000
6	3	5.0	7	6H11	20	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1	3112001
					40								1	3112002
					20								2	3112003
10	5	7.7	11	10H11	50		1.5	1.7	1.7	1.7	1.7	1.7	2	3112004
					100								2	3112005
					40								2	3112006
10	6	11.6	11	10H11	75				1.7	1.9	1.9	1.9	2	3112007
					150								2	3112008
					50								8	3112009
12	8	15.1	13	12H11	100					2.4	2.6	2.6	8	3112010
					200								8	3112011
					100								16	3112012
16	10	18.2	17	16H11	200						3.1	3.4	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.).

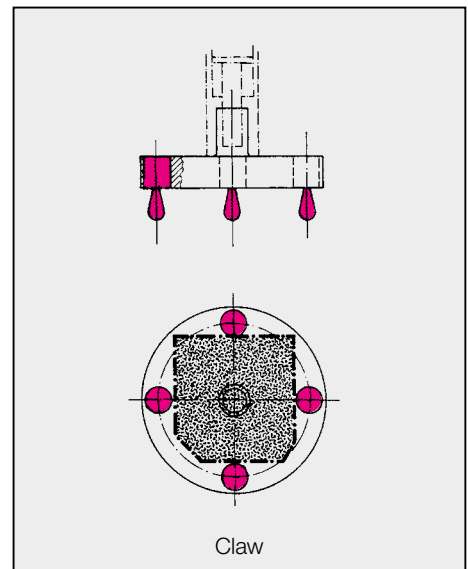
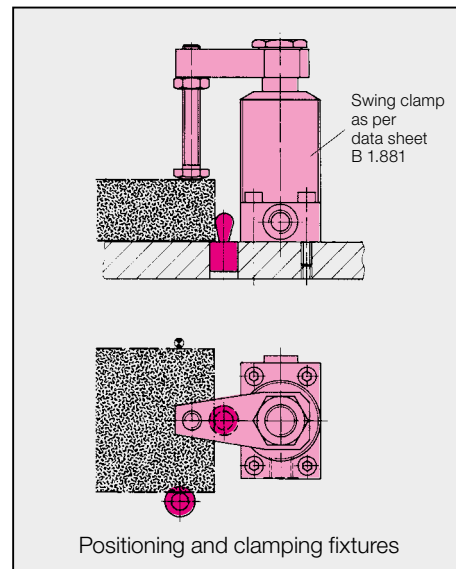
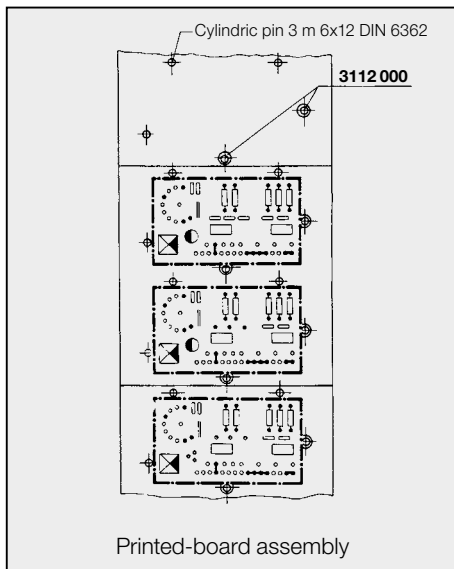
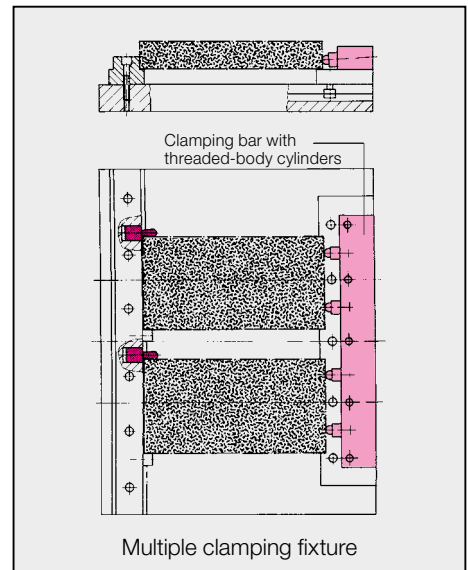
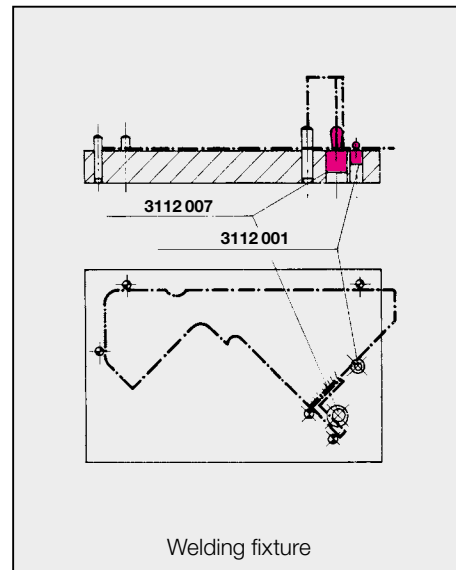
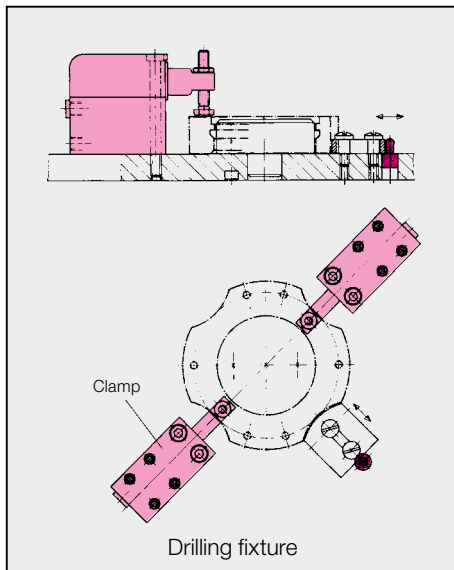


Tools for mounting

5 sizes as per dimension B as per chart page 1.

	Part no.
3	3112 140
5	3112 141
6	3112 142
8	3112 143
10	3112 144

Application examples





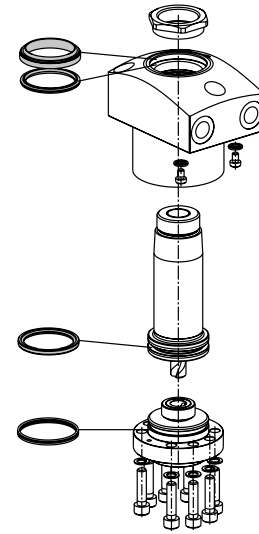
Seal Kits

Assignment of seal kits to hydraulic elements



Example:
Swing clamp
Part no. 1895 103

corresponding seal kit
Part no. 0131 840



D = type of seal kit:

S = standard; A = seal kit for external seals (is included in standard)

Part no.	Sheet	Seal kit	D	Part no.	Sheet	Seal kit	D	Part no.	Sheet	Seal kit	D	Part no.	Sheet	Seal kit	D
0353 341	B1.8267	0132 587	S	0461 022	F9.461	0132 428	S	1343 1X5	B1.309	0131 154	S	1472 001	B1.470	0131 532	A
0353 342	B1.8267	0132 588	S	0974 000	F9.426	0131 514	S	1343 1X6	B1.309	0131 441	S	1472 011	B1.470	0131 783	S
0353 343	B1.8267	0132 589	S	1072 010	B1.462	5700 005	S	1344 1X5	B1.309	0131 156	S	1472 011	B1.470	0131 786	A
0353 344	B1.8267	0132 590	S	1073 010	B1.462	5700 006	S	1344 1X6	B1.309	0131 442	S	1473 001	B1.470	0131 473	S
0353 345	B1.8267	0132 590	S	1074 010	B1.462	5700 007	S	1345 1X5	B1.309	0131 158	S	1473 001	B1.470	0131 533	A
0460 637	F9.430	0131 398	S	1075 020	B1.462	5700 008	S	1345 1X6	B1.309	0131 443	S	1473 011	B1.470	0131 641	S
0460 638	F9.430	0131 398	S	1283 0X5	B1.2811	0132 290	S	1346 1X5	B1.309	0131 160	S	1473 011	B1.470	0131 787	A
0460 654	F9.430	0131 994	S	1284 0X5	B1.2811	0132 291	S	1346 1X6	B1.309	0131 444	S	1474 001	B1.470	0131 474	S
0460 655	F9.430	0131 995	S	1285 0X5	B1.2811	0132 292	S	1347 1X5	B1.309	0131 166	S	1474 001	B1.470	0131 534	A
0460 656	F9.428	0131 691	S	1286 0X5	B1.2811	0132 293	S	1347 1X6	B1.309	0131 445	S	1474 011	B1.470	0131 784	S
0460 659	F9.428	0131 691	S	1287 0X5	B1.2811	0132 294	S	1371 010	B1.372	0131 073	S	1474 011	B1.470	0131 788	A
0460 666	F9.426	0131 389	S	1288 0X5	B1.2811	0132 295	S	1372 800	B1.711	0132 227	S	1475 001	B1.470	0131 924	S
0460 667	F9.426	0131 512	S	1293 10XXXX	B1.282	0131 963	S	1373 010	B1.372	0131 074	S	1475 001	B1.470	0131 925	A
0460 682	F9.428	0131 398	S	1293 11XXXX	B1.282	0131 964	S	1374 010	B1.372	0131 075	S	1475 011	B1.470	0131 926	S
0460 691	F9.428	0131 398	S	1293 12XXXX	B1.282	0131 963	S	1401 010	B1.494	0131 815	S	1475 011	B1.470	0131 927	A
0460 692	F9.428	0131 398	S	1293 13XXXX	B1.282	0131 964	S	1402 010	B1.494	0132 039	S	1491 000	B1.490	0131 121	S
0460 703	F9.428	0131 398	S	1294 10XXXX	B1.282	0131 965	S	1403 010	B1.494	0132 132	S	1492 000	B1.490	0131 121	S
0460 711	F9.428	0132 119	S	1294 11XXXX	B1.282	0131 966	S	1404 010	B1.494	0132 053	S	1493 000	B1.490	0131 123	S
0460 712	F9.428	0132 119	S	1294 12XXXX	B1.282	0131 965	S	1405 010	B1.494	0132 134	S	1494 000	B1.490	0131 123	S
0460 713	F9.428	0132 120	S	1294 13XXXX	B1.282	0131 966	S	1428 001	B1.4301	0131 103	S	1511 0X0	B1.5091	0131 131	S
0460 714	F9.428	0132 120	S	1295 10XXXX	B1.282	0131 967	S	1430 101	B1.4301	0131 761	S	1511 0X0K/L	B1.5091	0131 191	S
0460 725	F9.430	0131 774	S	1295 11XXXX	B1.282	0131 968	S	1431 001	B1.4301	0131 762	S	1511 0X1	B1.5091	0131 432	S
0460 727	F9.430	0131 398	S	1295 12XXXX	B1.282	0131 967	S	1433 001	B1.4301	0131 763	S	1511 0X1K/L	B1.5091	0131 454	S
0460 728	F9.430	0131 398	S	1295 13XXXX	B1.282	0131 968	S	1434 001	B1.4301	0132 319	S	1511 0X5	B1.5091	0131 131	S
0460 729	F9.428	0131 398	S	1296 10XXXX	B1.282	0131 969	S	1450 000	B1.450	0131 091	S	1511 0X5B/S	B1.5091	0131 191	S
0460 730	F9.430	0131 774	S	1296 11XXXX	B1.282	0131 970	S	1451 000	B1.450	0131 092	S	1511 0X6	B1.5091	0131 432	S
0460 731	F9.430	0131 398	S	1296 12XXXX	B1.282	0131 969	S	1453 000	B1.450	0131 093	S	1511 0X6B/S	B1.5091	0131 454	S
0460 735	F9.430	0131 691	S	1296 13XXXX	B1.282	0131 970	S	1454 000	B1.450	0132 319	S	1512 801	B1.711	0132 659	S
0460 736	F9.430	0131 691	S	1297 10XXXX	B1.282	0131 971	S	1458 0X1	B1.458	0131 101	S	1513 0X0	B1.5091	0131 133	S
0460 740	F9.430	0131 398	S	1297 11XXXX	B1.282	0131 972	S	1458 0X2	B1.458	0131 101	S	1513 0X0K/L	B1.5091	0131 192	S
0460 743	F9.428	0131 398	S	1297 12XXXX	B1.282	0131 971	S	1458 1X1	B1.458	0131 095	S	1513 0X1	B1.5091	0131 433	S
0460 751	F9.428	0132 372	S	1297 13XXXX	B1.282	0131 972	S	1458 1X2	B1.458	0131 095	S	1513 0X1K/L	B1.5091	0131 455	S
0460 763	F9.430	0131 691	S	1298 10XXXX	B1.282	0131 973	S	1459 0X1	B1.459	0131 103	S	1513 0X5	B1.5091	0131 133	S
0460 771	F9.428	0132 119	S	1298 11XXXX	B1.282	0131 974	S	1459 1X1	B1.459	0131 096	S	1513 0X5B/S	B1.5091	0131 192	S
0460 772	F9.428	0132 120	S	1298 12XXXX	B1.282	0131 973	S	1460 0XX	B1.460	0131 111	S	1513 0X6	B1.5091	0131 433	S
0460 776	F9.428	0131 691	S	1298 13XXXX	B1.282	0131 974	S	1460 1XX	B1.461	0131 104	S	1513 0X6B/S	B1.5091	0131 455	S
0460 777	F9.428	0132 210	S	1309 020	B1.310	0131 051	S	1461 0XX	B1.460	0131 113	S	1514 1X0	B1.5091	0131 135	S
0460 814	F9.428	0131 398	S	1311 1X5	B1.309	0131 131	S	1461 1XX	B1.461	0131 105	S	1514 1X0K/L	B1.5091	0131 193	S
0460 818	F9.428	0131 774	S	1311 1X6	B1.309	0131 432	S	1462 0XX	B1.460	0131 115	S	1514 1X1	B1.5091	0131 434	S
0460 819	F9.428	0131 774	S	1313 020	B1.310	0131 052	S	1462 1XX	B1.461	0131 106	S	1514 1X1K/L	B1.5091	0131 456	S
0460 830	F9.428	0131 691	S	1313 0X5	B1.309	0131 133	S	1462 610	B1.464	0132 057	S	1514 1X5	B1.5091	0131 135	S
0460 831	F9.428	0132 372	S	1313 0X6	B1.309	0131 433	S	1462 610	B1.464	0132 105	A	1514 1X5B/S	B1.5091	0131 193	S
0460 832	F9.428	0131 774	S	1314 1X5	B1.309	0131 135	S	1462 847	B1.711	0132 514	S	1514 1X6	B1.5091	0131 434	S
0460 833	F9.428	0131 774	S	1314 1X6	B1.309	0131 434	S	1463 0XX	B1.460	0131 117	S	1514 1X6B/S	B1.5091	0131 456	S
0460 834	F9.428	0131 399	S	1315 020	B1.310	0131 053	S	1463 1XX	B1.461	0131 107	S	1515 0X0	B1.5091	0131 137	S
0460 835	F9.428	0132 372	S	1315 0X5	B1.309	0131 137	S	1463 610	B1.464	0132 058	S	1515 0X0K/L	B1.5091	0131 194	S
0460 836	F9.428	0131 399	S	1315 0X6	B1.309	0131 435	S	1463 610	B1.464	0132 106	A	1515 0X1	B1.5091	0131 435	S
0460 837	F9.428	0131 399	S	1316 060	B1.310	0131 055	S	1464 0XX	B1.460	0131 119	S	1515 0X1K/L	B1.5091	0131 457	S
0460 838	F9.428	0131 399	S	1316 0X5	B1.309	0131 139	S	1464 1XX	B1.461	0131 108	S	1515 0X5	B1.5091	0131 137	S
0460 839	F9.428	0132 119	S	1316 0X6	B1.309	0131 436	S	1464 610	B1.464	0132 059	S	1515 0X5B/S	B1.5091	0131 194	S
0460 841	F9.428	0132 120	S	1317 0X5	B1.309	0131 141	S	1464 610	B1.464	0132 107	A	1515 0X6	B1.5091	0131 435	S
0460 847	F9.428	0132 211	S	1317 0X6	B1.309	0131 437	S	1471 001	B1.470	0131 471	S	1515 0X6B/S	B1.5091	0131 457	S
0460 884	F9.428	0132 209	S	1341 1X5	B1.309	0131 151	S	1471 001	B1.470	0131 531	A	1516 0X0	B1.5091	0131 139	S
0461 011	F9.461	0132 427	S	1341 1X6	B1.309	0131 440	S	1471 011	B1.470	0131 571	S	1516 0X0K/L	B1.5091	0132 683	S
0461 012	F9.461	0132 428	S	1341 3X5	B1.309	0131 151	S	1471 011	B1.470	0131 785	A	1516 0X1	B1.5091	0131 436	S
0461 021	F9.461	0132 427	S	1341 3X6	B1.309	0131 440	S	1472 001	B1.470	0131 472	S	1516 0X1K/L	B1.5091	0132 687	S

D = type of seal kit:
S = standard; A = seal kit for external seals (is included in standard)

Part no.	Sheet	Seal kit	D	Part no.	Sheet	Seal kit	D	Part no.	Sheet	Seal kit	D	Part no.	Sheet	Seal kit	D
1516 0X5	B1.5091	0131 139	S	1538 1X6B	B1.520	0132 701	S	1545 260L	B1.542	0132 724	S	1547 56X	B1.553	0131 445	S
1516 0X5B/S	B1.5091	0132 683	S	1539 156B	B1.520	0132 703	S	1545 261L	B1.542	0132 725	S	1547 56XB/K/L/S	B1.553	0132 699	S
1516 0X6	B1.5091	0131 436	S	1539 1X0K/L	B1.520	0132 703	S	1545 265	B1.542	0131 213	S	1548 1X0	B1.5094	0131 167	S
1516 0X6B/S	B1.5091	0132 687	S	1539 1X6	B1.520	0131 447	S	1545 265B/S	B1.542	0132 724	S	1548 1X0K/L	B1.5094	0132 700	S
1517 0X0	B1.5091	0131 141	S	1541 1X0	B1.5094	0131 151	S	1545 266	B1.542	0131 451	S	1548 1X1	B1.5094	0131 446	S
1517 0X0K/L	B1.5091	0131 196	S	1541 1X0K/L	B1.5094	0132 689	S	1545 266B/S	B1.542	0132 725	S	1548 1X1K/L	B1.5094	0132 701	S
1517 0X1	B1.5091	0131 437	S	1541 1X1	B1.5094	0131 440	S	1545 40X	B1.552	0131 578	S	1548 1X5	B1.5094	0131 167	S
1517 0X1K/L	B1.5091	0131 459	S	1541 1X1K/L	B1.5094	0132 690	S	1545 40XB/K/S	B1.552	0132 761	S	1548 1X5B/S	B1.5094	0132 700	S
1517 0X5	B1.5091	0131 141	S	1541 1X5	B1.5094	0131 151	S	1545 41X	B1.554	0131 158	S	1548 1X6	B1.5094	0131 446	S
1517 0X5B/S	B1.5091	0131 196	S	1541 1X5B/S	B1.5094	0132 689	S	1545 41XB/K/L/S	B1.554	0132 694	S	1548 1X6B/S	B1.5094	0132 701	S
1517 0X6	B1.5091	0131 437	S	1541 1X6	B1.5094	0131 440	S	1545 42X	B1.554	0131 443	S	1548 21X	B1.5094	0131 446	S
1517 0X6B/S	B1.5091	0131 459	S	1541 1X6B/S	B1.5094	0132 690	S	1545 42XB/K/L/S	B1.554	0132 695	S	1548 21XB/L/S	B1.5094	0132 701	S
1518 0X0	B1.5091	0131 143	S	1543 1X0	B1.5094	0131 154	S	1545 45X	B1.553	0131 158	S	1548 40X	B1.552	0131 581	S
1518 0X0K/L	B1.5091	0131 197	S	1543 1X0K/L	B1.5094	0131 155	S	1545 45XB/K/L/S	B1.553	0132 694	S	1548 40XB/K/S	B1.552	0132 764	S
1518 0X1	B1.5091	0131 438	S	1543 1X1	B1.5094	0131 441	S	1545 46X	B1.553	0131 443	S	1549 1X0	B1.5094	0131 168	S
1518 0X1K/L	B1.5091	0131 462	S	1543 1X1K/L	B1.5094	0132 691	S	1545 46XB/K/L/S	B1.553	0132 695	S	1549 1X0K/L	B1.5094	0132 702	S
1518 0X5	B1.5091	0131 143	S	1543 1X5	B1.5094	0131 154	S	1545 51X	B1.554	0131 158	S	1549 1X1	B1.5094	0131 447	S
1518 0X5B/S	B1.5091	0131 197	S	1543 1X5B/S	B1.5094	0131 155	S	1545 51XB/K/L/S	B1.554	0132 694	S	1549 1X1K/L	B1.5094	0132 703	S
1518 0X6	B1.5091	0131 438	S	1543 1X6	B1.5094	0131 441	S	1545 52X	B1.554	0131 443	S	1549 1X5	B1.5094	0131 168	S
1518 0X6B/S	B1.5091	0131 462	S	1543 1X6B/S	B1.5094	0132 691	S	1545 52XB/K/L/S	B1.554	0132 695	S	1549 1X5B/S	B1.5094	0132 702	S
1519 0X0	B1.5091	0131 145	S	1543 210	B1.5094	0131 441	S	1545 55X	B1.553	0131 158	S	1549 1X6	B1.5094	0131 447	S
1519 0X0K/L	B1.5091	0131 198	S	1543 210B/L/S	B1.5094	0132 691	S	1545 55XB/K/L/S	B1.553	0132 694	S	1549 1X6B/S	B1.5094	0132 703	S
1519 0X1	B1.5091	0131 439	S	1543 260L	B1.542	0132 722	S	1545 56X	B1.553	0131 443	S	1549 21X	B1.5094	0131 447	S
1519 0X1K/L	B1.5091	0131 463	S	1543 261L	B1.542	0132 723	S	1545 56XB/K/L/S	B1.553	0132 695	S	1549 21XB/L/S	B1.5094	0132 703	S
1519 0X5	B1.5091	0131 145	S	1543 265	B1.542	0131 200	S	1546 1X0	B1.5094	0131 160	S	1549 40X	B1.552	0131 582	S
1519 0X5B/S	B1.5091	0131 198	S	1543 265B/S	B1.542	0132 722	S	1546 1X0K/L	B1.5094	0132 696	S	1549 40XB/K/S	B1.552	0132 765	S
1519 0X6	B1.5091	0131 439	S	1543 266	B1.542	0131 449	S	1546 1X1	B1.5094	0131 444	S	1550 1X0	B1.5094	0132 070	S
1519 0X6B/S	B1.5091	0131 463	S	1543 266B/S	B1.542	0132 723	S	1546 1X1K/L	B1.5094	0132 697	S	1550 1X0K/L	B1.5094	0132 704	S
1523 XX0K/L	B1.530	0132 745	S	1543 40X	B1.552	0131 177	S	1546 1X5	B1.5094	0131 160	S	1550 1X1	B1.5094	0132 071	S
1523 XX1K/L	B1.530	0132 746	S	1543 40XB/K/S	B1.552	0132 759	S	1546 1X5B/S	B1.5094	0132 696	S	1550 1X1K/L	B1.5094	0132 705	S
1523 XX5	B1.530	0132 162	S	1543 41X	B1.554	0131 154	S	1546 1X6	B1.5094	0131 444	S	1550 1X5	B1.5094	0132 070	S
1523 XX5B/S	B1.530	0132 745	S	1543 41XB/K/L/S	B1.554	0131 155	S	1546 1X6B/S	B1.5094	0132 697	S	1550 1X5B/S	B1.5094	0132 704	S
1523 XX6	B1.530	0132 163	S	1543 42X	B1.554	0131 441	S	1546 21X	B1.5094	0131 444	S	1550 1X6	B1.5094	0132 071	S
1523 XX6B/S	B1.530	0132 746	S	1543 42XB/K/L/S	B1.554	0132 691	S	1546 21XB/L/S	B1.5094	0132 697	S	1550 1X6B/S	B1.5094	0132 705	S
1524 XX0K/L	B1.530	0132 747	S	1543 45X	B1.553	0131 154	S	1546 260L	B1.542	0132 726	S	1550 21X	B1.5094	0132 071	S
1524 XX1K/L	B1.530	0132 748	S	1543 45XB/K/L/S	B1.553	0131 155	S	1546 261L	B1.542	0132 727	S	1550 21XB/L/S	B1.5094	0132 705	S
1524 XX5	B1.530	0132 164	S	1543 46X	B1.553	0131 441	S	1546 265	B1.542	0131 214	S	1550 40X	B1.552	0131 583	S
1524 XX5B/S	B1.530	0132 747	S	1543 46XB/K/L/S	B1.553	0132 691	S	1546 265B/S	B1.542	0132 726	S	1550 40XB/K/S	B1.552	0132 766	S
1524 XX6	B1.530	0132 165	S	1543 51X	B1.554	0131 154	S	1546 266	B1.542	0131 452	S	1551 0X0	B1.5094	0131 170	S
1524 XX6B/S	B1.530	0132 748	S	1543 51XB/K/L/S	B1.554	0131 155	S	1546 266B/S	B1.542	0132 727	S	1551 0X0K/L	B1.5094	0132 706	S
1525 XX0K/L	B1.530	0132 749	S	1543 52X	B1.554	0131 441	S	1546 40X	B1.552	0131 579	S	1551 0X1	B1.5094	0131 464	S
1525 XX1K/L	B1.530	0132 750	S	1543 52XB/K/L/S	B1.554	0132 691	S	1546 40XB/K/S	B1.552	0132 762	S	1551 0X1K/L	B1.5094	0132 707	S
1525 XX5	B1.530	0132 166	S	1543 55X	B1.553	0131 154	S	1546 41X	B1.554	0131 160	S	1551 0X5	B1.5094	0131 170	S
1525 XX5B/S	B1.530	0132 749	S	1543 55XB/K/L/S	B1.553	0131 155	S	1546 41XB/K/L/S	B1.554	0132 696	S	1551 0X5B/S	B1.5094	0132 706	S
1525 XX6	B1.530	0132 167	S	1543 56X	B1.553	0131 441	S	1546 42X	B1.554	0131 444	S	1551 0X6	B1.5094	0131 464	S
1525 XX6B/S	B1.530	0132 750	S	1543 56XB/K/L/S	B1.553	0132 691	S	1546 42XB/K/L/S	B1.554	0132 697	S	1551 0X6B/S	B1.5094	0132 707	S
1526 XX0K/L	B1.530	0132 751	S	1544 1X0	B1.5094	0131 156	S	1546 45X	B1.553	0131 160	S	1551 21X	B1.5094	0131 464	S
1526 XX1K/L	B1.530	0132 752	S	1544 1X0K/L	B1.5094	0132 692	S	1546 45XB/K/L/S	B1.553	0132 696	S	1551 21XB/L/S	B1.5094	0132 707	S
1526 XX5	B1.530	0132 168	S	1544 1X1	B1.5094	0131 442	S	1546 46X	B1.553	0131 444	S	1552 0X5	B1.5094	0131 176	S
1526 XX5B/S	B1.530	0132 751	S	1544 1X1K/L	B1.5094	0132 693	S	1546 46XB/K/L/S	B1.553	0132 697	S	1552 0X6	B1.5094	0131 465	S
1526 XX6	B1.530	0132 169	S	1544 1X5	B1.5094	0131 156	S	1546 51X	B1.554	0131 160	S	1552 21X	B1.5094	0131 465	S
1526 XX6B/S	B1.530	0132 752	S	1544 1X5B/S	B1.5094	0132 692	S	1546 51XB/K/L/S	B1.554	0132 696	S	1564 1X5	B1.560	0132 040	S
1527 XX0K/L	B1.530	0132 753	S	1544 1X6	B1.5094	0131 442	S	1546 52X	B1.554	0131 444	S	1565 1X5	B1.560	0132 041	S
1527 XX1K/L	B1.530	0132 754	S	1544 1X6B/S	B1.5094	0132 693	S	1546 52XB/K/L/S	B1.554	0132 697	S	1566 1X5	B1.560	0132 042	S
1527 XX5	B1.530	0132 170	S	1544 21X	B1.5094	0131 442	S	1546 55X	B1.553	0131 160	S	1571 105	B1.570	0131 151	S
1527 XX5B/S	B1.530	0132 753	S	1544 21XB/L/S	B1.5094	0132 693	S	1546 55XB/K/L/S	B1.553	0132 696	S	1571 106	B1.570	0131 440	S
1527 XX6	B1.530	0132 171	S	1544 260L	B1.542	0132 692	S	1546 56X	B1.553	0131 444	S	1573 105	B1.570	0131 154	S
1527 XX6B/S	B1.530	0132 754	S	1544 261L	B1.542	0132 693	S	1546 56XB/K/L/S	B1.553	0132 697	S	1573 106	B1.570	0131 441	S
1528 XX0K/L	B1.530	0132 755	S	1544 265	B1.542	0131 156	S	1547 1X0	B1.5094	0131 166	S	1574 105	B1.570	0131 169	S
1528 XX1K/L	B1.530	0132 756	S	1544 265B/S	B1.542	0132 692	S	1547 1X0K/L	B1.5094	0132 698	S	1574 106	B1.570	0131 453	S
1528 XX5	B1.530	0132 172	S	1544 266	B1.542	0131 442	S	1547 1X1	B1.5094	0131 445	S	1574 81X	B1.480	0131 791	S
1528 XX5B/S	B1.530	0132 755	S	1544 266B/S	B1.542	0132 693	S	1547 1X1K/L	B1.5094	0132 699	S	1574 81X	B1.480	0131 790	A
1528 XX6	B1.530	0132 173	S	1544 40X	B1.552	0131 577	S	1547 1X5	B1.5094	0131 166	S	1575 105	B1.570	0131 158	S
1528 XX6B/S	B1.530	0132 756	S	1544 40XB/K/S	B1.552	0132 760	S	1547 1X5B/S	B1.5094	0132 698	S	1575 106	B1.570	0131 443	S
1529 XX0K/L	B1.530	0132 757	S	1544 41X	B1.554	0131 156	S	1547 1X6	B1.5094	0131 445	S	1576 105	B1.570	0131 160	S
1529 XX1K/L	B1.530	0132 758	S	1544 41XB/K/L/S	B1.554	0132 692	S	1547 1X6B/S	B1.5094	0132 699	S	1576 106	B1.570	0131 444	S
1529 XX5	B1.530	0132 174	S	1544 42X	B1.554	0131 442	S	1547 21X	B1.5094	0131 445	S	1577 105	B1.570	0131 166	S
1529 XX5B/S	B1.530	0132 757	S	1544 42XB/K/L/S	B1.554	0132 693	S	1547 21XB/L/S	B1.5094	0132 699	S	1577 106	B1.570	0131 445	S
1529 XX6	B1.530	0132 175	S	1544 45X	B1.553	0131 156	S	1547 270L	B1.542	0132 728	S	1578 105	B1.570	0131 167	S
1529 XX6B/S	B1.530	0132 758	S	1544 45XB/K/L/S	B1.553	0132 692	S	1547 271L	B1.542	0132 729	S	1578 106	B1.570	0131 446	S
1531 1X0K/L	B1.520	0132 690	S	1544 46X	B1.553	0131 442	S	1547 275							

D = type of seal kit:

S = standard; A = seal kit for external seals (is included in standard)

Part no.	Sheet	Seal kit	D	Part no.	Sheet	Seal kit	D	Part no.	Sheet	Seal kit	D	Part no.	Sheet	Seal kit	D
1752004	B1.7441	0131 928	S	1843 F0XXX23(M)	B1.852	0132 507	A	1875 106	J7.202	0131 847	S	1893 5X6	B1.890	0131 268	S
1752023	B1.7441	0131 944	S	1843 H0XXX23(M)	B1.853	0132 477	S	1875 203	J7.203	0131 847	S	1893 5X8(M)	B1.881	0131 261	S
1754 004	B1.7441	0131 929	S	1843 L0XXX23(M)	B1.854	0132 518	S	1875 205	J7.203	0131 920	S	1893 5X9(M)	B1.881	0131 261	S
1754 023	B1.7441	0131 694	S	1843 M0XXX23(M)	B1.854	0132 519	S	1875 206	J7.202	0131 847	S	1893 6X4(M)	B1.881	0131 261	S
1755 004	B1.7441	0131 930	S	1843 N0XXX23(M)	B1.854	0132 519	S	1875 303	J7.201	0131 847	S	1893 6X6	B1.890	0131 268	S
1755 023	B1.7441	0131 695	S	1843 P0XXX23(M)	B1.853	0132 476	S	1875 403	J7.201	0131 847	S	1893 6X8(M)	B1.881	0131 261	S
1756 004	B1.7441	0131 931	S	1843 Q0XXX23(M)	B1.853	0132 477	S	1876 103	J7.203	0131 848	S	1893 6X9(M)	B1.881	0131 261	S
1756 023	B1.7441	0131 947	S	1844 A0XXX24(M)	B1.853	0132 478	S	1876 105	J7.203	0131 921	S	1893 XX1(M)	B1.892	0131 259	S
1757 004	B1.7441	0131 932	S	1844 B0XXX24(M)	B1.853	0132 479	S	1876 106	J7.202	0131 848	S	1893 XX1(M)	B1.892	0131 524	A
1757 023	B1.7441	0131 948	S	1844 C0XXX24(M)	B1.853	0132 480	S	1876 203	J7.203	0131 848	S	1893 XX2(M)	B1.8803	0131 259	S
1758 004	B1.7441	0131 933	S	1844 D0XXX24(M)	B1.853	0132 479	S	1876 205	J7.203	0131 921	S	1893 XX2(M)	B1.8803	0131 524	A
1758 023	B1.7441	0131 698	S	1844 F0XXX24(M)	B1.852	0132 496	S	1876 206	J7.202	0131 848	S	1893 XX3(M)	B1.880	0131 826	S
1800 110	B1.8271	0132 988	A	1844 H0XXX24(M)	B1.852	0132 508	A	1876 303	J7.201	0131 848	S	1895 133X000(M)	B1.8802	0132 602	S
1801 11X	B1.827	0132 430	S	1844 I0XXX24(M)	B1.853	0132 481	S	1876 403	J7.201	0131 848	S	1895 153X000(M)	B1.8802	0132 602	S
1801 11X	B1.827	0132 431	A	1844 L0XXX24(M)	B1.854	0132 520	S	1877 103	J7.203	0131 849	S	1895 1X1VMX35	B1.8921	0132 009	S
1801 13X	B1.827	0132 430	S	1844 M0XXX24(M)	B1.854	0132 521	S	1877 105	J7.203	0131 922	S	1895 1X1VMX35	B1.8921	0131 526	A
1801 13X	B1.827	0132 431	A	1844 N0XXX24(M)	B1.854	0132 521	S	1877 106	J7.202	0131 849	S	1895 1X4(M)	B1.881	0131 275	S
1801 2X0	B1.828	0132 536	S	1844 P0XXX24(M)	B1.853	0132 480	S	1877 203	J7.203	0131 849	S	1895 1X6	B1.890	0131 279	S
1802 11X	B1.827	0132 432	S	1844 Q0XXX24(M)	B1.853	0132 481	S	1877 205	J7.203	0131 922	S	1895 1X8(M)	B1.881	0131 275	S
1802 11X	B1.827	0132 433	A	1845 A0XXX30(M)	B1.853	0132 482	S	1877 206	J7.202	0131 849	S	1895 1X8VDMX35	B1.8811	0131 275	S
1802 13X	B1.827	0132 432	S	1845 B0XXX30(M)	B1.853	0132 483	S	1877 303	J7.201	0131 849	S	1895 1X8VMX35	B1.8811	0132 003	S
1802 13X	B1.827	0132 433	A	1845 C0XXX30(M)	B1.853	0132 484	S	1877 403	J7.201	0131 849	S	1895 1X9(M)	B1.881	0131 275	S
1802 2X0	B1.828	0132 537	S	1845 D0XXX30(M)	B1.853	0132 483	S	1881 1X2	B1.891	0131 257	S	1895 2X1VMX35	B1.8921	0132 009	S
1803 11X	B1.827	0132 434	S	1845 F0XXX30(M)	B1.852	0132 497	S	1881 1X2	B1.891	0131 530	A	1895 2X1VMX35	B1.8921	0131 526	A
1803 11X	B1.827	0132 435	A	1845 G0XXX30(M)	B1.852	0132 509	A	1881 2X2	B1.891	0131 257	S	1895 2X4(M)	B1.881	0131 275	S
1803 13X	B1.827	0132 434	S	1845 H0XXX30(M)	B1.853	0132 485	S	1881 2X2	B1.891	0131 530	A	1895 2X6	B1.890	0131 279	S
1803 13X	B1.827	0132 435	A	1845 L0XXX30(M)	B1.854	0132 522	S	1883 1X2	B1.892	0131 573	S	1895 2X8(M)	B1.881	0131 275	S
1803 2X0	B1.828	0132 538	S	1845 M0XXX30(M)	B1.854	0132 523	S	1883 1X2	B1.892	0131 524	A	1895 2X8VDMX35	B1.8811	0131 275	S
1804 11X	B1.827	0132 436	S	1845 N0XXX30(M)	B1.854	0132 523	S	1883 1X4	B1.881	0131 271	S	1895 2X8VMX35	B1.8811	0132 003	S
1804 11X	B1.827	0132 437	A	1845 P0XXX30(M)	B1.853	0132 484	S	1883 2X2	B1.892	0131 573	S	1895 2X9(M)	B1.881	0131 275	S
1804 13X	B1.827	0132 436	S	1845 Q0XXX30(M)	B1.853	0132 485	S	1883 2X2	B1.892	0131 524	A	1895 3X3VDMX35	B1.8801	0132 602	S
1804 13X	B1.827	0132 437	A	1846 A0XXX36(M)	B1.853	0132 486	S	1883 2X4	B1.881	0131 271	S	1895 3X3VMX35	B1.8801	0131 997	S
1804 2X0	B1.828	0132 539	S	1846 B0XXX36(M)	B1.853	0132 487	S	1883 3X4	B1.881	0132 027	S	1895 3X4(M)	B1.881	0131 275	S
1824 040	B1.8242	0132 234	S	1846 C0XXX36(M)	B1.853	0132 488	S	1883 4X4	B1.881	0132 027	S	1895 3X4KDMX35	B1.8805	0132 999	S
1824 061	B1.8241	0132 223	S	1846 D0XXX36(M)	B1.853	0132 487	S	1883 5X4	B1.881	0131 254	S	1895 3X8(M)	B1.881	0131 275	S
1824 081	B1.8241	0132 223	S	1846 F0XXX36(M)	B1.852	0132 498	S	1883 6X4	B1.881	0131 254	S	1895 3X9(M)	B1.881	0131 275	S
1824 111	B1.8241	0132 224	S	1846 G0XXX36(M)	B1.852	0132 510	A	1883 XX3	B1.880	0131 836	S	1895 4X3VDMX35	B1.8801	0132 602	S
1824 131	B1.8241	0132 224	S	1846 H0XXX36(M)	B1.853	0132 489	S	1885 1X2	B1.892	0131 574	S	1895 4X3VMX35	B1.8801	0131 997	S
1824 161	B1.8241	0132 225	S	1846 L0XXX36(M)	B1.854	0132 524	S	1885 1X2	B1.892	0131 526	A	1895 4X4(M)	B1.881	0131 275	S
1824 181	B1.8241	0132 225	S	1846 M0XXX36(M)	B1.854	0132 525	S	1885 1X4	B1.881	0131 272	S	1895 4X4KDMX35	B1.8805	0132 999	S
1824 20X	B1.8231	0132 077	S	1846 N0XXX36(M)	B1.854	0132 525	S	1885 2X2	B1.892	0131 574	S	1895 4X8(M)	B1.881	0131 275	S
1824 26X	B1.8231	0132 054	S	1846 P0XXX36(M)	B1.853	0132 488	S	1885 2X2	B1.892	0131 526	A	1895 4X9(M)	B1.881	0131 275	S
1824 310A	B1.8233	0131 906	S	1846 Q0XXX36(M)	B1.853	0132 489	S	1885 2X4	B1.881	0131 272	S	1895 5X4(M)	B1.881	0131 262	S
1824 410A	B1.8233	0131 906	S	1848 1X5	B1.848	0132 207	S	1885 3X4	B1.881	0131 272	S	1895 5X6	B1.890	0131 269	S
1824 510A	B1.8233	0131 907	S	1849 0X1	B1.849	0131 723	S	1885 4X4	B1.881	0131 272	S	1895 5X8(M)	B1.881	0131 262	S
1824 610A	B1.8233	0131 907	S	1849 0X2	B1.849	0131 724	S	1885 5X4	B1.881	0131 255	S	1895 5X8VDMX35	B1.8811	0131 262	S
1825 01X	B1.8252	0132 304	S	1849 0X3	B1.849	0131 723	S	1885 6X4	B1.881	0131 255	S	1895 5X8VMX35	B1.8811	0132 004	S
1825 01X	B1.8252	0132 305	A	1849 0X4	B1.849	0131 724	S	1885 XX3	B1.880	0131 837	S	1895 5X9(M)	B1.881	0131 262	S
1825 11X	B1.8251	0132 297	S	1849 0X5	B1.849	0131 725	S	1886 1X4	B1.881	0131 589	S	1895 6X4(M)	B1.881	0131 262	S
1825 11X	B1.8251	0132 299	A	1849 0X5	B1.849	0131 833	A	1886 2X4	B1.881	0131 589	S	1895 6X6	B1.890	0131 269	S
1825 12X(E/P)	B1.8251	0132 300	S	1850 1X1	B1.8491	0132 072	S	1886 3X4	B1.881	0131 589	S	1895 6X8(M)	B1.881	0131 262	S
1825 12X(E/P)	B1.8251	0132 299	A	1850 1X2	B1.8491	0132 073	S	1886 4X4	B1.881	0131 589	S	1895 6X8VDMX35	B1.8811	0131 262	S
1825 13X	B1.8251	0132 298	S	1850 1X3	B1.8491	0132 072	S	1886 5X4	B1.881	0131 590	S	1895 6X8VMX35	B1.8811	0132 004	S
1825 14X(E/P)	B1.8251	0132 301	S	1850 1X4	B1.8491	0132 073	S	1886 6X4	B1.881	0131 590	S	1895 6X9(M)	B1.881	0131 262	S
1825 15X	B1.8251	0132 298	S	1850 1X5	B1.8491	0132 074	S	1886 XX3	B1.880	0131 838	S	1895 XX1(M)	B1.892	0131 264	S
1825 16X(E/P)	B1.8251	0132 301	S	1850 1X5	B1.8491	0131 833	A	1887 1X2	B1.892	0131 575	S	1895 XX1(M)	B1.892	0131 526	A
1825 21X	B1.8251	0132 373	S	1853 Q0XXX16(M)	B1.8500	0132 579	S	1887 1X2	B1.892	0131 528	A	1895 XX1VDMX35	B1.8921	0131 264	S
1825 21X	B1.8251	0132 374	A	1853 T0XXX16(M)	B1.8500	0132 578	S	1887 1X4	B1.881	0131 273	S	1895 XX1VDMX35	B1.8921	0131 526	A
1825 22X(E/P)	B1.8251	0132 440	S	1854 Q0XXX21(M)	B1.8500	0132 581	S	1887 2X2	B1.892	0131 575	S	1895 XX2(M)	B1.8803	0131 264	S
1825 22X(E/P)	B1.8251	0132 374	A	1854 T0XXX21(M)	B1.8500	0132 580	S	1887 2X2	B1.892	0131 528	A	1895 XX2(M)	B1.8803	0131 526	A
1825 23X	B1.8251	0132 441	S	1856 Q0XXX27(M)	B1.8500	0132 583	S	1887 2X4	B1.881	0131 273	S	1895 XX3(M)	B1.880	0131 840	S
1825 24X(E/P)	B1.8251	0132 442	S	1856 T0XXX27(M)	B1.8500	0132 582	S	1887 3X4	B1.881	0131 273	S	1896 1X3(M)	B1.880	0131 841	S
1825 25X	B1.8251	0132 441	S	1857 Q0XXX29(M)	B1.8500	0132 585	S	1887 4X4	B1.881	0131 273	S	1896 1X4(M)	B1.881	0131 287	S
1825 26X(E/P)	B1.8251	0132 442	S	1857 T0XXX29(M)	B1.8500	0132 584	S	1887 5X4	B1.881	0131 256	S	1896 1X8(M)	B1.881	0131 287	S
1825 31X	B1.8251	0132 445	S	1863 Q0XXX16(M)	B1.8510	0132 579	S	1887 6X4	B1.881	0131 256	S	1896 1X8VDMX36	B1.8811	0131 287	S
1825 31X	B1.8251	0132 452	A	1863 T0XXX16(M)	B1.8510	0132 578	S	1887 XX3	B1.880	0131 839	S	1896 1X8VMX36	B1.8811	0132 005	S
1825 32X(E/P)	B1.8251	0132 446	S	1864 Q0XXX21(M)	B1.8510	0132 581	S	1891 1X1	B1.891	0131 277	S	1896 1X9(M)	B1.881	0131 287	S
1825 32X(E/P)	B1.8251	0132 452	A	1864 T0XXX21(M)	B1.8510	0132 580	S	1891 1X1	B1.891	0131 530	A	1896 2X4(M)	B1.881	0131 287	S
1825 33X	B1.8251	0132 447	S	1866 Q0XXX27(M)	B1.8510	0132 583	S	1891 2X1	B1.891	0131 277	S	1896 2X8(M)	B1.881	0131 287	S
1825 34X(E/P)	B1.8251	0132 448	S	1866 T0XXX27(M)	B1.8510	0132 582	S	1891 2X1	B1.891	0131 530	A	1896 2X8VDMX36	B1.8811	0131 287	S
1825 35X	B1.8251	0132 447	S	1867 Q0											

D = type of seal kit:
S = standard; A = seal kit for external seals (is included in standard)

Part no.	Sheet	Seal kit	D	Part no.	Sheet	Seal kit	D	Part no.	Sheet	Seal kit	D	Part no.	Sheet	Seal kit	D
1896 5X9(M)	B1.881	0131 288	S	1941 010	B1.940	0131 081	A	1957 022	B1.9501	0132 471	S	9281 135	F9.280	0132 740	S
1896 6X4(M)	B1.881	0131 288	S	1941 012	B1.9401	0132 369	S	1957 022	B1.9501	0132 386	A	9281 136	F9.280	0132 732	S
1896 6X8(M)	B1.881	0131 288	S	1941 012	B1.9401	0131 081	A	1957 320	B1.9503	0132 665	S	9282 105	F9.281	0132 734	S
1896 6X8VDX36	B1.8811	0131 288	S	1941 201	B1.942	0132 413	S	1957 321	B1.9503	0132 665	S	9282 205	F9.281	0132 735	S
1896 6X8VMX36	B1.8811	0132 006	S	1941 300(P)	B1.943	0132 642	S	1957 322	B1.9503	0132 666	S	9284 036	F9.280	0132 561	S
1896 6X9(M)	B1.881	0131 288	S	1941 400(P)	B1.943	0132 643	S	2953 100	C2.9533	0132 272	S	9284 135	F9.280	0132 737	S
1896 XX2(M)	B1.8803	0132 083	S	1941 501(P)	B1.943	0132 644	S	2953 400	C2.952	0131 677	S	9284 205	F9.281	0132 738	S
1896 XX2(M)	B1.8803	0132 085	A	1941 601(P)	B1.943	0132 645	S	2954 420	C2.954	0131 537	S	9284 305	F9.281	0132 739	S
1897 1X1VMX38	B1.8921	0132 010	S	1941 900	B1.9405	0132 787	S	2954 427	C2.954	0131 539	S	9286 135	F9.280	0132 741	S
1897 1X1VMX38	B1.8921	0131 528	A	1942 000	B1.940	0131 324	S	2954 428	C2.954	0131 540	S	9286 205	F9.281	0132 627	S
1897 1X4(M)	B1.881	0131 276	S	1942 002	B1.9401	0132 370	S	2954 429	C2.954	0131 538	S	9286 305	F9.281	0132 628	S
1897 1X6	B1.890	0131 280	S	1942 005	B1.940	0131 324	S	2954 440	C2.954	0131 537	S	9290 101	F9.290	0131 870	S
1897 1X8(M)	B1.881	0131 276	S	1942 007	B1.9401	0132 370	S	2954 441	C2.954	0131 539	S	9290 102	F9.290	0131 869	S
1897 1X8VDX38	B1.8811	0131 276	S	1942 010	B1.940	0131 324	S	2954 442	C2.954	0131 540	S	9295 601	J7.490	0131 687	S
1897 1X8VMX38	B1.8811	0132 007	S	1942 012	B1.9401	0132 370	S	2954 449	C2.954	0131 538	S	9295 602	J7.490	0131 688	S
1897 1X9(M)	B1.881	0131 276	S	1942 015	B1.940	0131 324	S	3829 030	B1.520	0132 819	S	9296 101	F9.290	0131 870	S
1897 2X1VMX38	B1.8921	0132 010	S	1942 017	B1.9401	0132 370	S	3829 180	B1.520	0132 817	S	9296 102	F9.290	0131 869	S
1897 2X1VMX38	B1.8921	0131 528	A	1942 102	B1.9402	0132 423	S	3829 204	B1.520	0132 817	S	9296 601	J7.490	0131 687	S
1897 2X4(M)	B1.881	0131 276	S	1942 102	B1.9402	0132 125	A	3829 227	B1.520	0132 818	S	9296 602	J7.490	0131 688	S
1897 2X6	B1.890	0131 280	S	1942 107	B1.9402	0132 423	S	3829 228	B1.520	0132 818	S	9297 601	J7.490	0131 687	S
1897 2X8(M)	B1.881	0131 276	S	1942 107	B1.9402	0132 125	A	4311 2X1	H4.300	0131 550	S	9297 602	J7.490	0131 688	S
1897 2X8VDX38	B1.8811	0131 276	S	1942 112	B1.9402	0132 423	S	4311 2X2	H4.300	0131 552	S	9298 101	F9.290	0131 870	S
1897 2X8VMX38	B1.8811	0132 007	S	1942 112	B1.9402	0132 125	A	4311 2X3	H4.300	0131 554	S	9298 102	F9.290	0131 869	S
1897 2X9(M)	B1.881	0131 276	S	1942 117	B1.9402	0132 423	S	4312 00X	H4.305	0131 675	S	9298 601	J7.490	0131 687	S
1897 3X3VDX38	B1.8801	0131 842	S	1942 117	B1.9402	0132 125	A	4312 02X	H4.305	0131 675	S	9298 602	J7.490	0131 688	S
1897 3X3VMX38	B1.8801	0131 999	S	1942 201	B1.942	0132 412	S	4312 05X	H4.305	0131 710	S	929X 002	F9.290	0131 460	S
1897 3X4(M)	B1.881	0131 276	S	1942 300(P)	B1.943	0132 646	S	4312 07X	H4.305	0131 710	S	929X 0X1	F9.290	0131 461	S
1897 3X8(M)	B1.881	0131 276	S	1942 305(P)	B1.943	0132 646	S	4312 080	H4.305	0131 710	S	9740 025	F9.426	0131 514	S
1897 3X9(M)	B1.881	0131 276	S	1942 310(P)	B1.944	0132 919	S	4312 1XX	H4.305	0131 685	S	9740 802	F9.426	0131 913	S
1897 4X3VDX38	B1.8801	0131 842	S	1942 310(P)	B1.944	0132 923	A	4312 2XX	H4.305	0131 733	S	RM3X XXXX	B1.7384	0131 441	S
1897 4X3VMX38	B1.8801	0131 999	S	1942 400(P)	B1.943	0132 647	S	4312 3XX	H4.305	0131 738	S	RM3X XXXXB	B1.7384	0132 691	S
1897 4X4(M)	B1.881	0131 276	S	1942 410(P)	B1.944	0132 920	S	4312 4XX	H4.305	0131 739	S	RM4X XXXX	B1.7384	0131 442	S
1897 4X8(M)	B1.881	0131 276	S	1942 410(P)	B1.944	0132 924	A	4316 120	H4.307	0132 013	S	RM4X XXXXB	B1.7384	0132 693	S
1897 4X9(M)	B1.881	0131 276	S	1942 501(P)	B1.943	0132 641	S	4316 160	H4.307	0132 015	S	RM5X XXXX	B1.7384	0131 443	S
1897 5X4(M)	B1.881	0131 263	S	1942 510(P)	B1.944	0132 921	S	4316 200	H4.307	0132 017	S	RM5X XXXXB	B1.7384	0132 695	S
1897 5X6	B1.890	0131 270	S	1942 510(P)	B1.944	0132 925	A	4317 1X0	B1.481	0132 808	S	RM6X XXXX	B1.7384	0131 444	S
1897 5X8(M)	B1.881	0131 263	S	1942 601(P)	B1.943	0132 648	S	4317 2X0	B1.481	0132 808	S	RM6X XXXXB	B1.7384	0132 697	S
1897 5X8VDX38	B1.8811	0131 263	S	1942 610(P)	B1.944	0132 922	S	4317 3X0	B1.481	0132 810	S	RS3X XXX 2XXX	B1.7385	RS3DP	S
1897 5X8VMX38	B1.8811	0132 008	S	1942 610(P)	B1.944	0132 926	A	4317 4X0	B1.481	0132 810	S	RS3X XXX 3XXX	B1.7385	RS3DV	S
1897 5X9(M)	B1.881	0131 263	S	1942 900	B1.9405	0132 555	S	4317 5X0	B1.481	0132 810	S	RS3X XXX 4XXX	B1.7385	RS3DP	S
1897 6X4(M)	B1.881	0131 263	S	1942 925	B1.9405	0132 555	S	4318 111X	B1.4841	0132 349	S	RS3X XXX 5XXX	B1.7385	RS3DV	S
1897 6X6	B1.890	0131 270	S	1947 110	B1.9471	0132 927	A	4318 121X	B1.4842	0132 350	S	RS4X XXX 2XXX	B1.7385	RS4DP	S
1897 6X8(M)	B1.881	0131 263	S	1947 110 XXXXXX	B1.9472	0132 927	A	4318 131X	B1.4843	0132 351	S	RS4X XXX 3XXX	B1.7385	RS4DV	S
1897 6X8VDX38	B1.8811	0131 263	S	1947 200	B1.9470	0132 827	S	4318 131X	B1.4843	0132 654	A	RS4X XXX 4XXX	B1.7385	RS4DP	S
1897 6X8VMX38	B1.8811	0132 008	S	1947 210	B1.9471	0132 928	A	4318 211X	B1.4841	0132 352	S	RS4X XXX 5XXX	B1.7385	RS4DV	S
1897 6X9(M)	B1.881	0131 263	S	1947 310	B1.9471	0132 929	A	4318 221X	B1.4842	0132 353	S	RS5X XXX 2XXX	B1.7385	RS5DP	S
1897 XX1(M)	B1.892	0131 260	S	1947 400	B1.9470	0132 825	S	4318 231X	B1.4843	0132 354	S	RS5X XXX 3XXX	B1.7385	RS5DV	S
1897 XX1(M)	B1.892	0131 528	A	1947 410	B1.9471	0132 930	A	4318 231X	B1.4843	0132 586	A	RS5X XXX 4XXX	B1.7385	RS5DP	S
1897 XX1VDX38	B1.8921	0131 260	S	1953 000	B1.950	0131 490	S	4319 2XAXXX	B1.485	0132 501	S	RS5X XXX 5XXX	B1.7385	RS5DV	S
1897 XX1VDX38	B1.8921	0131 528	A	1953 000	B1.950	0131 525	A	4319 3XAXXX	B1.485	0132 502	S	RS6X XXX 2XXX	B1.7385	RS6DP	S
1897 XX2(M)	B1.8803	0131 260	S	1953 001	B1.950	0131 491	S	4412 974	B1.732	0132 161	S	RS6X XXX 3XXX	B1.7385	RS6DV	S
1897 XX2(M)	B1.8803	0131 528	A	1953 001	B1.950	0131 524	A	4412 977	B1.733	0132 392	S	RS6X XXX 4XXX	B1.7385	RS6DP	S
1897 XX3(M)	B1.880	0131 842	S	1953 002	B1.950	0131 492	S	4412 978	B1.733	0132 392	S	RS6X XXX 5XXX	B1.7385	RS6DV	S
1901 002	B1.900	0132 984	S	1953 002	B1.950	0131 525	A	4413 051	I4.120	0132 543	S	RS7X XXX 2XXX	B1.7385	RS7DP	S
1902 002	B1.900	0132 984	S	1953 020	B1.9501	0132 466	S	4413 080	I4.130	0132 786	S	RS7X XXX 3XXX	B1.7385	RS7DV	S
1903 002	B1.900	0132 744	S	1953 020	B1.9501	0132 384	A	4413 151	I4.120	0132 541	S	RS7X XXX 4XXX	B1.7385	RS7DP	S
1904 002	B1.900	0132 744	S	1953 021	B1.9501	0132 466	S	4606 130	F9.426	0131 513	S	RS7X XXX 5XXX	B1.7385	RS7DV	S
1911 005	B1.911	0132 743	S	1953 021	B1.9501	0132 384	A	4606 131	F9.426	0131 513	S	RS8X XXX 2XXX	B1.7385	RS8DP	S
1911 006	B1.911	0132 743	S	1953 022	B1.9501	0132 467	S	4606 135	F9.426	0131 512	S	RS8X XXX 3XXX	B1.7385	RS8DV	S
1911 022	B1.910	0132 742	S	1953 022	B1.9501	0132 384	A	4606 230	F9.426	0131 387	S	RS8X XXX 4XXX	B1.7385	RS8DP	S
1912 022	B1.910	0132 742	S	1953 320	B1.9503	0132 661	S	4606 231	F9.426	0131 387	S	RS8X XXX 5XXX	B1.7385	RS8DV	S
1915 100	B1.730	0132 283	S	1953 321	B1.9503	0132 661	S	4606 232	F9.426	0131 388	S	RS9X XXX 2XXX	B1.7385	RS9DP	S
1915 300	B1.730	0132 128	S	1953 322	B1.9503	0132 662	S	4606 235	F9.426	0131 389	S	RS9X XXX 3XXX	B1.7385	RS9DV	S
1915 400	B1.730	0132 148	S	1955 000	B1.950	0131 493	S	5112 303	B1.311	0131 603	S	RS9X XXX 4XXX	B1.7385	RS9DP	S
1921 10X	B1.921	0131 315	S	1955 000	B1.950	0131 527	A	5112 403	B1.311	0131 604	S	RS9X XXX 5XXX	B1.7385	RS9DV	S
1923 00X	B1.921	0131 312	S	1955 001	B1.950	0131 494	S	5112 503	B1.311	0131 605	S	RSV6 XXX 2XXX	B1.7385	RS6DP	S
1925 00X	B1.921	0131 313	S	1955 001	B1.950	0131 526	A	5112 603	B1.311	5700 077	S	RSV6 XXX 3XXX	B1.7385	RS6DV	S
1931 005	B1.930	0132 266	S	1955 012	B1.950	0132 192	S	5112 703	B1.311	0131 607	S	RSV6 XXX 4XXX	B1.7385	RS6DP	S
1931 025	B1.930	0132 267	S	1955 012	B1.950	0131 527	A	81XX XXX	D8.021	3887 107	S	RSV6 XXX 5XXX	B1.7385	RS6DV	S
1933 005	B1.930	0132 268	S	1955 020	B1.9501	0132 468	S	8405 XXX	D8.0115	0131 390	S	RSV7 XXX 2XXX	B1.7385	RS7DP	S
1933 025	B1.930	0132 269	S	1955 020	B1.9501	0132 385	A	8601 2X1	D8.602	0132 188	S	RSV7 XXX 3XXX	B1.7385	RS7DV	S
1935 006	B1.930	0132 270	S	1955 021	B1.9501	0132 468	S	8753 200	D8.753	0131 732	S	RSV7 XXX 4XXX	B1.7385	RS7DP	S
1935 026	B1.930	0132 271	S	1955 021	B1.9501	0132 385	A	8753 201	D8.753						



Service Tools

Tools for the assembly of seals



Advantages

- Optimally suitable special tools for the assembly and disassembly of seals for hydraulic elements

Tools

- Picker set 5
- Calibration sleeves for external seals
- Calibration mandrels for internal seals

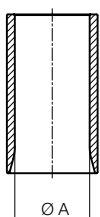
Picker set 5



Picker set for seal disassembly, contains 5 special tools in an envelope bag. With these differently shaped, hook-shaped tools, seals can be removed from the sealing grooves. The tools are specially rounded at the tip to protect the seals.

Part no. 9001900

Calibration sleeves for external seals

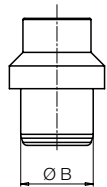


Precisely fitting sleeves for the corresponding exterior diameter with special inlet beaks for calibrating newly mounted external seals. The tool is used to return previously expanded seals to their original seal diameter. When assembling the hydraulic element, the calibration sleeve prevents subsequent assembly damage caused by seals protruding from the groove.

Ø A [mm]	Part no.
10	9001 100
12	9001 127
14	9001 130
16	9001 103
20	9001 106
23	9001 133
25	9001 109
26	9001 136
28	9001 139

Ø A [mm]	Part no.
32	9001 112
33	9001 142
35	9001 145
40	9001 115
50	9001 118
52	9001 148
56	9001 151
63	9001 121

Changeable calibration mandrels for internal seals



Combination tool for seal and wiper assembly

Precisely fitting mandrel for the corresponding interior diameter with special inlet beaks for calibrating newly mounted interior seals. The tool is used to return seals previously expanded for assembly to their original seal diameter. This process prevents subsequent sealing or assembly damage caused by seals protruding from the groove during the assembly of the hydraulic element.

A special stop surface is available for the assembly of a wiper which must be pressed into the groove on the element head. With this surface, the wiper can be safely inserted into the groove.

Attention:

Can only be used in combination with the holder for changeable calibration mandrels. The holder is needed only once and fits for all changeable calibration mandrels.

Ø B [mm]	Part no.	Ø B [mm]	Part no.
10	9001 203	32	9001 215
16	9001 206	40	9001 218
20	9001 209	50	9001 224
25	9001 212	63	9001 227

Holder for changeable calibration mandrels



Holder for sealing and wiper tool

The basic tool for setting the wipers is required as a basic tool for every changeable calibration mandrel. Suitable for all changeable calibration mandrels.

Part no. 9001 200

Hydraulic tool case "Comfort 31"



Calibration and assembly tools:

17 calibration sleeves, 8 exchangeable calibration mandrels plus holder, Picker set 5, instructions

Part no. 9001 940

Content:

1. Calibration sleeves for piston seals

1 x size 10 - Part no. 9001 100	1 x size 32 - Part no. 9001 112
1 x size 12 - Part no. 9001 127	1 x size 33 - Part no. 9001 142
1 x size 14 - Part no. 9001 130	1 x size 35 - Part no. 9001 145
1 x size 16 - Part no. 9001 103	1 x size 40 - Part no. 9001 115
1 x size 20 - Part no. 9001 106	1 x size 50 - Part no. 9001 118
1 x size 23 - Part no. 9001 133	1 x size 52 - Part no. 9001 148
1 x size 25 - Part no. 9001 109	1 x size 56 - Part no. 9001 151
1 x size 26 - Part no. 9001 136	1 x size 63 - Part no. 9001 121
1 x size 28 - Part no. 9001 139	

2. Holder for changeable calibration mandrels Part no. 9001 200

3. Changeable calibration mandrels

1 x size 10 - Part no. 9001 203	1 x size 32 - Part no. 9001 215
1 x size 16 - Part no. 9001 206	1 x size 40 - Part no. 9001 218
1 x size 20 - Part no. 9001 209	1 x size 50 - Part no. 9001 224
1 x size 25 - Part no. 9001 212	1 x size 63 - Part no. 9001 227

4. Picker set 5 Part no. 9001 900



Service Products

Quality oils and greases as lubricants, accessories



Advantages

- Proven quality oils and greases as lubricants for plain and roller bearings (e.g. wedge clamps)

Oils and greases

- Bed way oil
- Multi-purpose grease
- High-temperature grease

Accessories

- Oil can
- Hopper
- Grease gun

Bed way oil

Bed way oil DeLuTec BD 68

Lubricant to reduce friction, wear and noise of machines.
Delivery in metal container

1 litre **Part no. 9001 721**
5 litres **Part no. 9001 724**

Oil can, round



This lubricator is suitable for lubricating moving parts or for supplying lubricant when working in various operating positions due to the double pump station. A high flexibility when working in different positions is made possible by the combination of main and head pump as well as the gravity guided, rotatably mounted suction piston. In addition, the pump design achieves a very fine dosage of the lubricant. For universal use, the lubricator can be filled with lubricants of different viscosities. Durability and robustness are promoted by the stable aluminium container and the double pump station made of brass.

Material: aluminium
Capacity: 500 ml

Consumables for the article:

Bed way oil 1 litre Part no. 9001 721
Bed way oil 5 litres Part no. 9001 724

Hydraulic oil HLP and components for hydraulic assembly work, such as e.g. pipe fittings can be found in the data sheet F 9.300.

Part no. 9001 927

Hopper



Hopper Ø 200 mm with flexible pipe

- High overflow edge for splash protection
- Resistant to oil, petrol and acids
- With exchangeable brass fine sieve
- Flexible removable metal spout
- Capacity 3200 ml

Part no. 9001 936

Bearing grease cartridge 400 g



Multi-purpose grease

Lithium saponified multi-purpose grease with high thermal and mechanical resistance and good water resistance.

It contains active ingredients to increase ageing resistance and corrosion protection as well as special high-pressure additives to reduce mechanical wear.

Ideal for the lubrication of rolling and plain bearings of all designs and sizes with low or high speeds on motor and commercial vehicles, tractors, agricultural machinery and construction equipment of all kinds. Due to its structure, the grease can easily be conveyed through long pipelines. This makes it also suitable for use in central lubrication systems. It can be used in the temperature range between – 25 °C and + 130 °C.

- High thermal and mechanical resistance
- Walk and shear resistant
- Largely water resistant
- Good lubricity over a wide temperature range
- Excellent corrosion protection properties
- Good ageing resistance, thus long-term application possible
- Easy to transport through long pipelines
- Special high-pressure additives reduce mechanical wear
- Universal use
- Combines the favourable properties of soda and lime greases and thus contributes to the reduction of the variety diversity in operation

We recommend this grease for lubricating our wedge clamps.

Part no. 9001 727

Bearing grease cartridge 400 g



High-temperature grease

High temperature greases are greases that must withstand high operating temperatures, suitable for applications with a continuous limit temperature of up to + 90 °C.

It can be used in a temperature range between – 40 °C to + 160 °C.

For rolling bearings in couplings, electric motors, traction motors, generators and motor vehicles. It has very good low temperature properties and very good stability in vertical shaft applications at high temperatures.

- Universal application - moderate to high load
- Low outside temperatures
- Possible over a wide temperature range

We recommend this grease for lubricating our wedge clamps in hot environments.

Part no. 9001 730

Grease gun case



Grease gun case incl. grease gun for 400 g cartridges and connection nipples with oil-resistant insert

Content: lever grease gun, nozzle tube with hydraulic mouthpiece, quick-change nozzle tube with sliding coupling, quick-change nozzle tube with cardan mouthpiece, quick-change hose, pointed mouthpiece, hollow mouthpiece

Consumables for the article:

Bearing grease cartridge 400 g	– 25 °C up to + 130 °C	Part no. 9001 727
Bearing grease cartridge 400 g	– 40 °C up to + 160 °C	Part no. 9001 730

Part no. 9001 933

Grease gun



As a replacement: grease gun for 400 g cartridges

Robust all-steel design, painted silver.

Short-stroke system, stepless piston rod fixing, filling/venting valve, ergonomic handle.

Capacity:	400 ml
Max. operating pressure:	400 bar
Connecting thread:	M10 x 1
Flow rate per stroke:	2.0 cm³

Part no. 9001 930



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