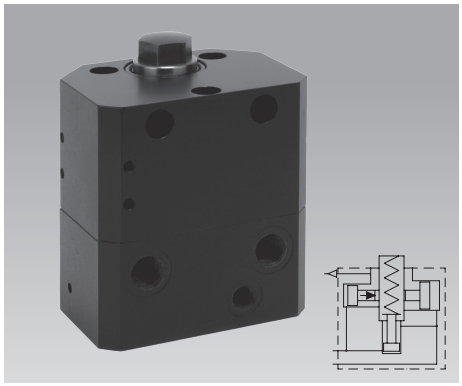
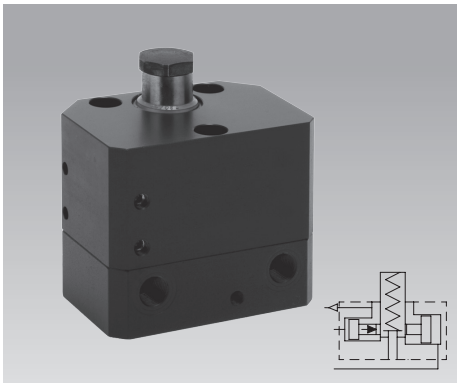
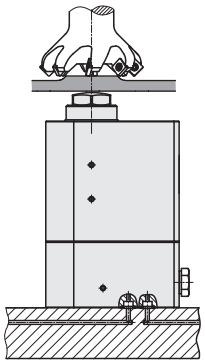
Work Supports with Fail-Safe Function

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, patented 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

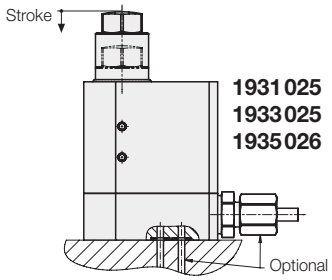
If there is any risk of fluids being sucked into the filter, a vent hose has to be connected to the vent port.
The standard contact bolt in the support plunger protects the interior against contamination. For the use of self-made contact bolts please observe the installation dimensions (see page 4).
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:

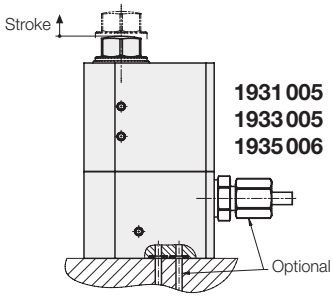
1. Off-position extended



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.

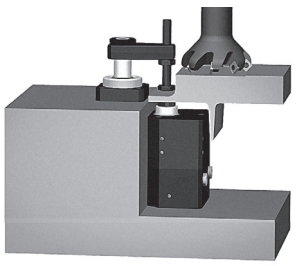
Advantage:
Unimpeded loading and unloading of the clamping fixture!

Advantages

- No yielding on the workpiece even when the pressure drops thanks to the patented 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

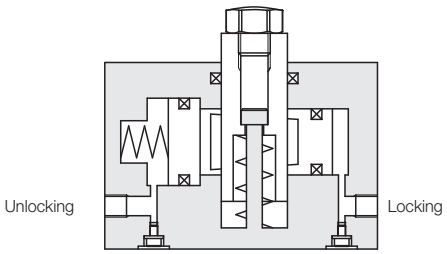
Manifold-mounted work support with swing clamp 1893 102 as per data sheet B 1.8803



Dimensioning see page 4

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

Functional principle

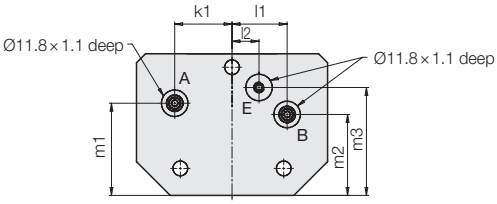


Clamping

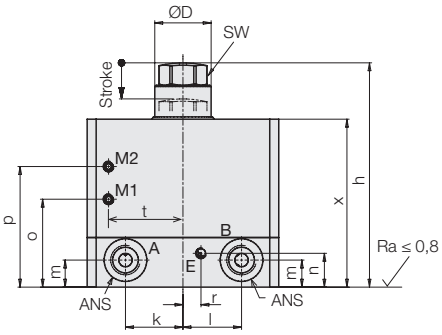
The support plunger is pushed back by the inserted workpiece, the spring force has to be overcome.
Due to the hydraulic pressure the wedge surface of the cross piston is moved against the support plunger and locks it.

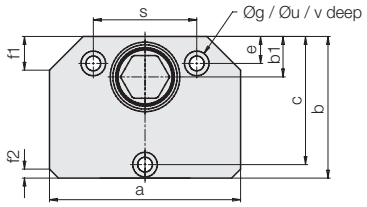
Unclamping

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.



A = Locking
B = Unlocking





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.

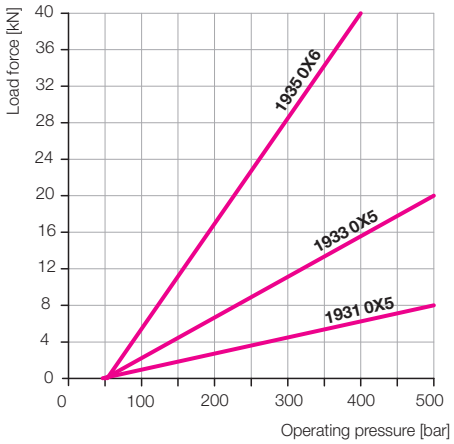
Connecting hole max. Ø 7 mm. Screw in plug G 1/4 or G 1/8 **(part no. 3610264 or 3610263)**.

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).

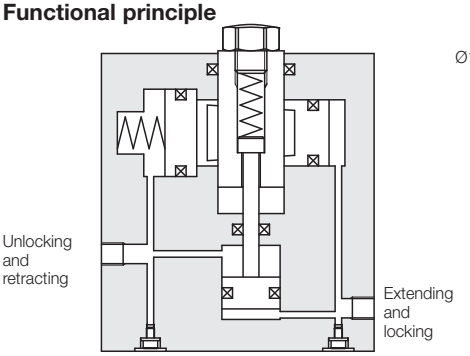
Admissible load force as a function of the operating pressure



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.		**1931025**	**1933025**	**1935026**
Accessories (not included in the delivery)				
Part no. O-ring (FKM) 9 × 1.5		**3001305**	**3001305**	**3001305**
Part no. Plug		**3610263**	**3610264**	**3610264**

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

Functional principle

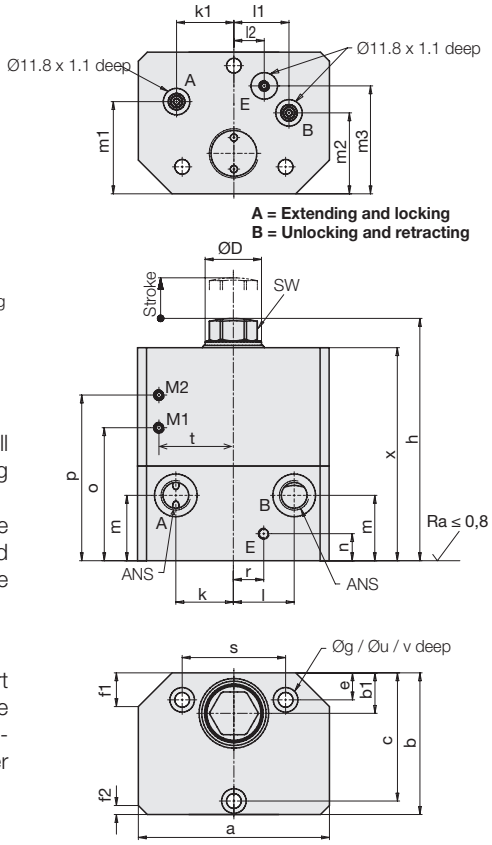


Clamping

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 9 x 1.5 **(part no. 3001 305)** into the counterbore.

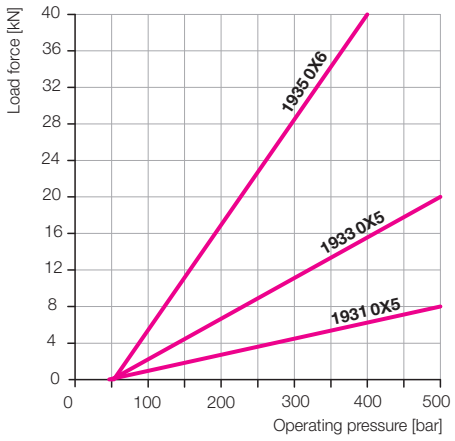
Connecting hole max. Ø 7 mm. Screw in plug G 1/4 or G 1/8 **(part no. 3610 264 or 3610 263)**.

2. Pneumatic position monitoring

To operate the position monitoring, remove the set screws (M5) and screw in insertion nipple fitting **(part no. 3890 091)**
or L insertion nipple fitting **(part no. 3890 094)**.

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]	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	[cm^3]	1.8	7.3	11.5
Max. oil volume return stroke	[cm^3]	1.6	9.5	14.2
Max. admissible flow rate	[cm^3/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.		**1931 005**	**1933 005**	**1935 006**
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.

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.

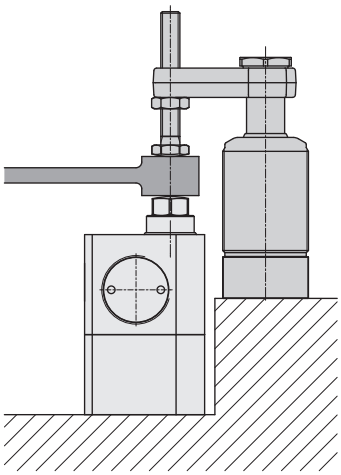
Load force ≥ 2 × clamping force

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: (including reserve)	3.8 kN

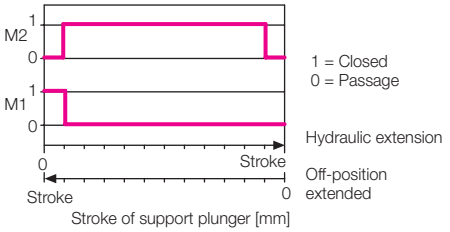
Pneumatic position monitoring

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

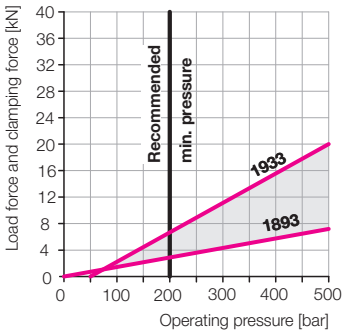


For process-safe functioning of position monitoring, air pressure and air volume must be adjusted.

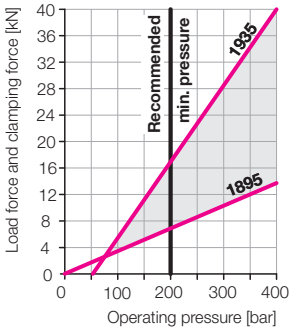
Nominal values: Air pressure 2.5 bar
Flow rate 12 l/min

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

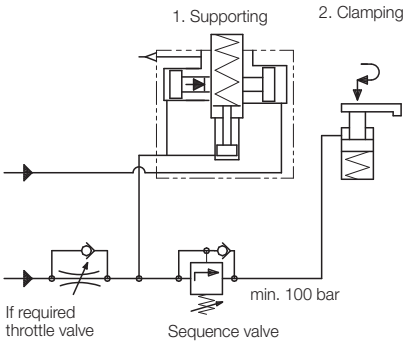


Important note

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.

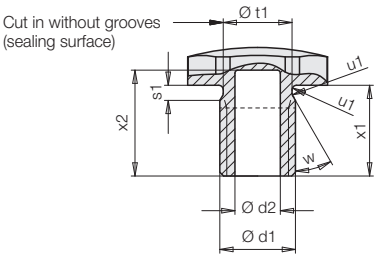
Control of clamping sequence

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.	**3001674**	**3001869**	**3000103**

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