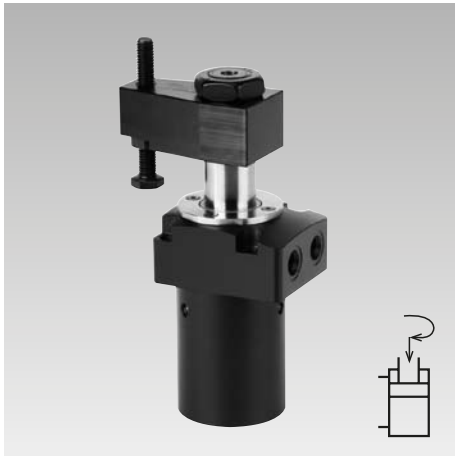# Swing Clamps with Sturdy Swing Mechanism
## Top flange type, with optional position monitoring, double acting, max. operating pressure 70 bar

**Advantages**
- 4 sizes available
- Compact design partially recessible
- High clamping force already at 70 bar
- Sturdy swing mechanism
- Very short clamping time
- 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
- Position monitoring available as accessory
- Mounting position: any



Indexing

Metallic wiper for coarse and hot swarf optional
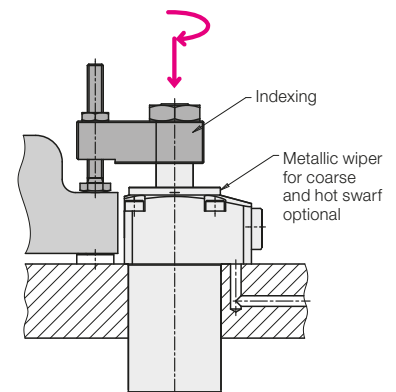
## Application

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.

This series obtains very high clamping forces already at 70 bar and can directly be connected to the low-pressure hydraulics of the machine tool. An additional power unit for power workholding is no longer necessary.

With the sturdy swing mechanism and the optional position monitoring 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
- 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.

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 and unloading or during clamping.

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 6).

The version with extended switch rod is provided for mounting of pneumatic or electrical position monitorings (accessory).
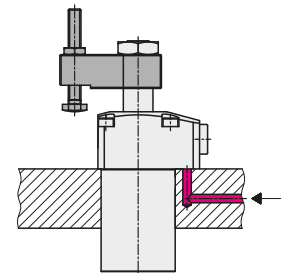
Important notes see page 6.

## Installation and connecting possibilities
### Pipe thread
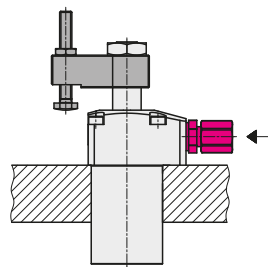
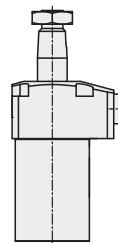

### Drilled channels



## Versions
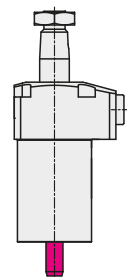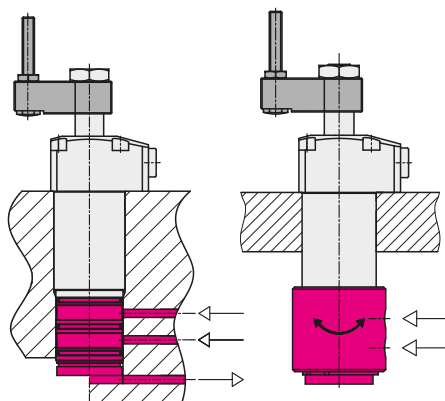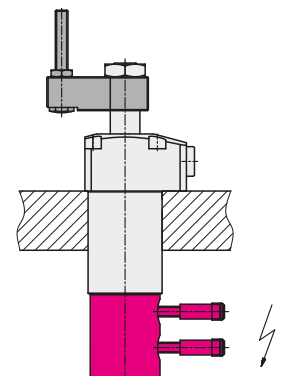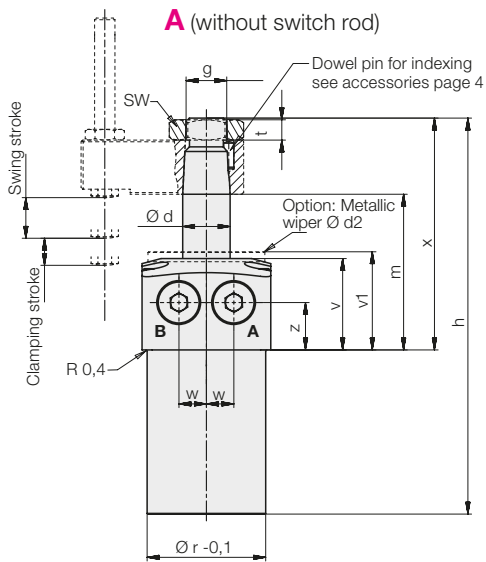### Without switch rod

185X**A**



### With switch rod

185X**B**



## Accessories
### Pneumatic position monitoring



### Electrical position monitoring

Subject to modifications

## A (without switch rod)

Swing stroke

Clamping stroke

g

SW

Dowel pin for indexing
see accessories page 4

t

Ø d

Option: Metallic
wiper Ø d2

x

m

v

v1

z

B A

R 0,4

w w

Ø r -0,1

h

**A** = Clamping
**B** = Unclamping

## B (with switch rod)

Nut included in the delivery
Spare nut see page 3

h

e

Screw plugs
and O-rings are
included in the
delivery

d1

Ø d3

Stroke

8 ±0,5*

* see swing
angle α < 90°

Accessories:
Position monitoring
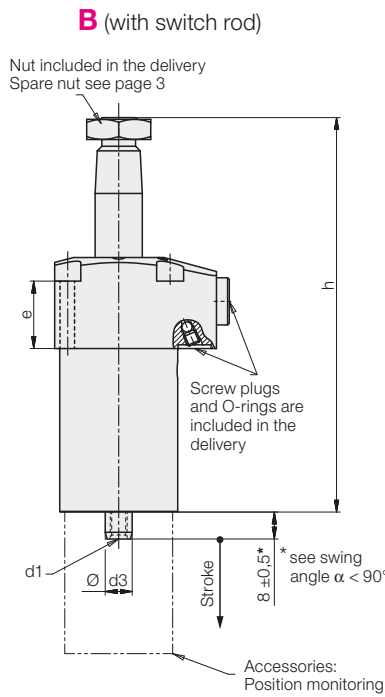
## Accessories
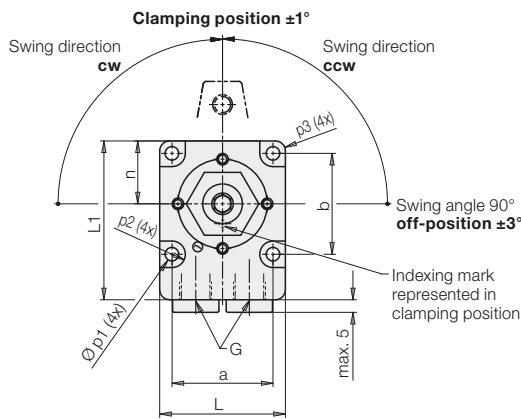### Pneumatic position monitoring (page 5)
cartridge type

h1

Ø C

Connection: pipe thread

h1

Ø E

### Electrical position monitoring (page 6)

h1

Ø D

C

Right angle plug

## Connecting scheme

Clamping position ±1°

Swing direction
**cw**

Swing direction
**ccw**

p3 (4x)

n

L1

p2 (4x)

b

Swing angle 90°
**off-position ±3°**

Indexing mark
represented in
clamping position

Ø p1 (4x)

G

max. 5

a

L

For O-ring sealing:
$\sqrt{R_z\ 4}$

☐ 0,04 100

b

a

Ø s -0,2

max. Ø,5

A

B

c1

p

c

Bore holes
only as required

**Use screw
material 10.9**
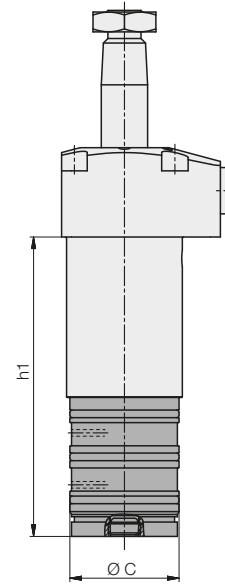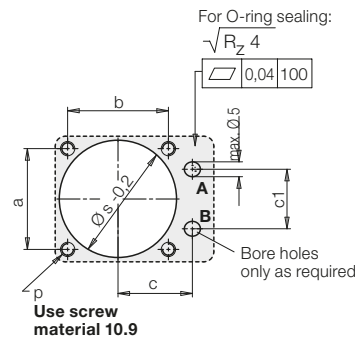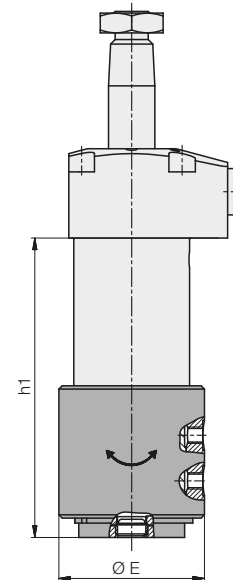
## Swing angle

### 1. Swing angle 90° and 0° (standard)

|  | Part no. |
|---|---|
| **90° cw** | **185X-X090-R**XX |
| **90° ccw** | **185X-X090-L**XX |
| **0°** | **185X-X000-0**XX |

### 2. Swing angle α < 90°

**α = 15° to 75°  in gradation of 5°**

By insertion of a distance plate the return stroke of the piston is reduced and thus the swing angle is reduced.

Clamping stroke and clamping position remain the same. The swing stroke and the dimensions h, m and x are reduced by y:

$y = (90° - α°) * k$      (k see chart page 3)

Dimension 8 ±0.5 is lengthened by the value y.

Example:
Swing clamp          1856-A090-L27
Desired swing angle   **45° ccw**
**Part no.**            **1856-A045-L**27
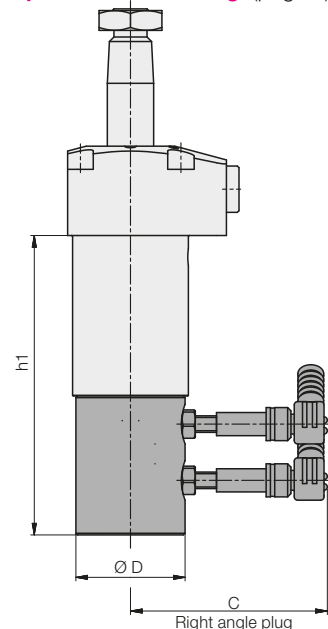
Shortening:
$y = (90° - 45°) * 0.125\ mm/° = 5.625\ mm$

### 3. Swing angle > 90°
Available on request!

## Important notes see page 6.

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

# Technical data

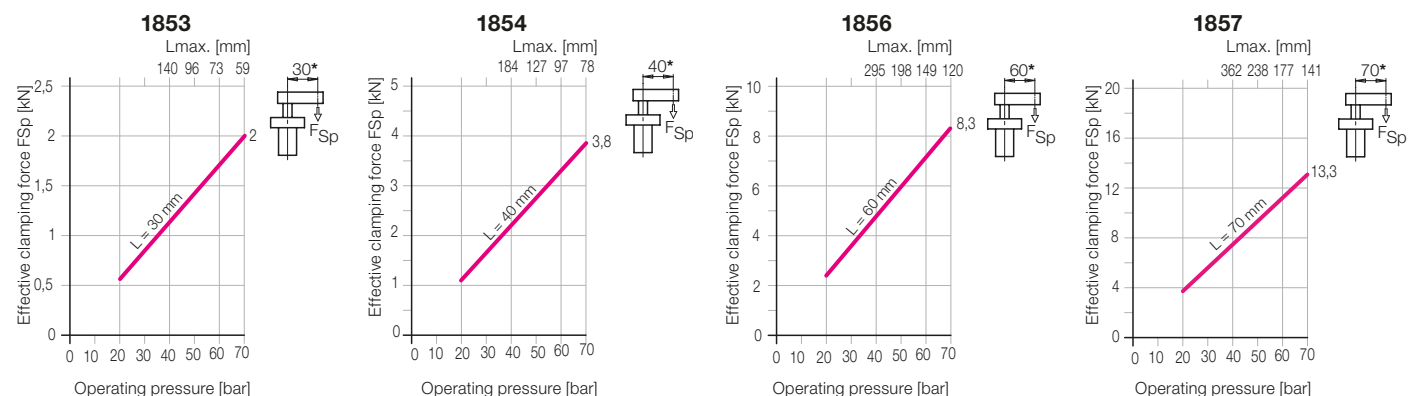| | | | | | | |
|---|---|---|---|---|---|---|
| Max. pulling force (70 bar) | | [kN] | 2.35 | 4.46 | 9.9 | 16.1 |
| Effective clamping force | | [kN] | see diagram or calculation of the clamping force on page 4 | | | |
| Clamping stroke | | [mm] | 8 | 8 | 10 | 10 |
| Swing stroke | | [mm] | 8 | 13 | 17 | 19 |
| Total stroke | | [mm] | 16 | 21 | 27 | 29 |
| Operating pressure, min. | | [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 to return | | [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 | | **1853-X090-R16M** | **1854-X090-R21M** | **1856-X090-R27M** | **1857-X090-R29M** |
| | Swing direction 90° ccw | | **1853-X090-L16M** | **1854-X090-L21M** | **1856-X090-L27M** | **1857-X090-L29M** |
| | 0 degree | | **1853-X000-016M** | **1854-X000-021M** | **1856-X000-027M** | **1857-X000-029M** |
| Spare O-ring | | [mm] | 7 x 1.5 | 7 x 1.5 | 8 x 1.5 | 8 x 1.5 |
| **Part no.** | | | **3000-342** | **3000-342** | **3000-343** | **3000-343** |
| Spare nut DIN 936 | | | M12 | M18x1.5 | M24x1.5 | M30x1.5 |
| Tightening torque | | [Nm] | 12 | 30 | 62 | 110 |
| **Part no.** | | | **3302-115** | **3301-663** | **3302-104** | **3302-139** |

Code letter **X** see page 2.
**M** = Option metallic wiper (see also page 6)

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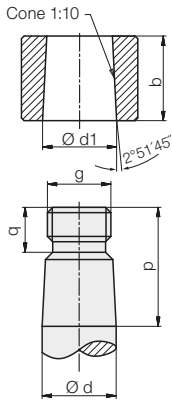


1853  Lmax. [mm] 140 96 73 59 — 30*

1854  Lmax. [mm] 184 127 97 78 — 40*

1856  Lmax. [mm] 295 198 149 120 — 60*

1857  Lmax. [mm] 362 238 177 141 — 70*

* Clamping force for other lengths see page 4.

## Dimensions for special clamping arms

Cone 1:10



2°51'45"

## Clamping arm, max. 70 bar



Dowel pin

## Special clamping arm



Special length
Series

$F_{Sp}$
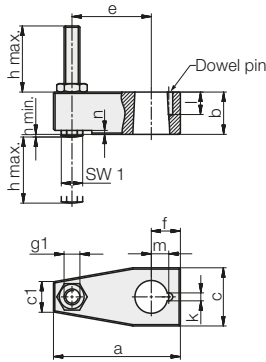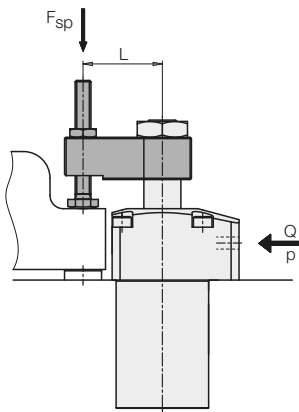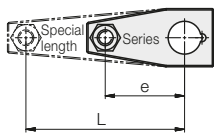


Adm. flow rate and clamping time as a function of the clamping arm extension



Flow rate factor y / Clamping and unclamping time [s]

0,35   1,15

Example

Extension factor x
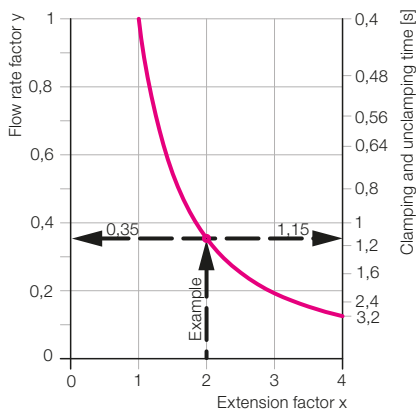
| Swing clamps | | 1853 | 1854 | 1856 | 1857 |
|---|---|---|---|---|---|
| a | [mm] | 48 | 65 | 96 | 114 |
| b | [mm] | 16 | 25 | 27 | 35 |
| c | [mm] | 22 | 34 | 52 | 60 |
| c1 | [mm] | 12 | 19 | 31 | 36 |
| Ø d | [mm] | 14 | 22 | 30 | 36 |
| Ø d1 −0.05 | [mm] | 14 | 22 | 30 | 36 |
| e | [mm] | 30 | 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 $J_e$ | [kgmm²] | 44 | 230 | 1284 | 3247 |
| **Part no.** | | | | | |
| Clamping arm with contact bolt and dowel pin | | **0354-243** | **0354-249** | **0354-254** | **0354-256** |
| Dowel pin | | 3 m 6 x 8 **3301-854** | 3 m 6 x 8 **3301-854** | 6 m 6 x 12 **3300-325** | 6 m 6 x 12 **3300-325** |
| Metallic wiper | | **0341-227** | **0341-228** | **0341-229** | **0341-230** |

## Admissible flow rate

With the accessory clamping arm and the admissible flow rate as per chart (page 3) the shortest clamping time is approx. 0.4 seconds. Longer special clamping arms have a higher torque of inertia. To avoid an overload of the swing mechanism, the flow rate has to be reduced:

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

$Q_e$ = Flow rate as per chart (page 3)
$Q_L$ = 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 the left.

**Example:** Swing clamp 1853-A090-R16
L = 60 mm
e = 30 mm as per above chart
$Q_e$ = 13.5 cm³/s (as per chart page 3)

1. Extension factor $\quad x = \dfrac{L}{e} = \dfrac{60 \, mm}{30 \, mm} = 2$

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

3. Max. flow rate
$Q_L = y * Q_e = 0.35 * 13.5 \, cm^3/s = 4.7 \, cm^3/s$

4. Min. clamping time
as per diagram $\quad \rightarrow \quad$ approx. 1.15 s

## Throttling of the flow rate



Free flow

Direction of flow control
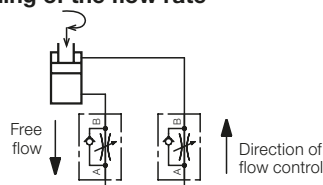
## Calculation of the clamping force

The diagrams on page 3 show the effective clamping force with accessory clamping arm (L = e).
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 chart.

| 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 |

Effective clamping force

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

Admissible clamping force*)

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

Admissible operating pressure

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

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 1853-A090-R16
Special clamping arm L = 60 mm

1. Admissible clamping force*)

$$F_{adm} = \frac{C}{L} = \frac{102.9}{60} = 1.71 \, kN$$

2. Admissible operating pressure

$$p_{adm} = \frac{D}{L} + E = \frac{3053}{60} + 18.2 = 69 \, bar < 70$$

3. Effective clamping force

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

## 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.

## 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 swing 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

max. 8 pieces
2 – 4 bar
10 – 20 l/min
3 – 5 bar
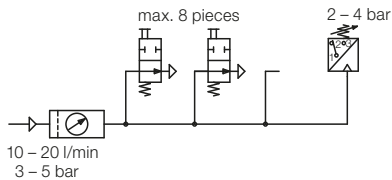
For the evaluation of the pneumatic pressure increase, standard pneumatic pressure switches can be used. With one pressure switch up to 8 position monitorings can be controlled (see circuit diagram).

It has to be considered that process-safe functioning of pneumatic controls is only guaranteed with throttled air pressure and air flow rate.
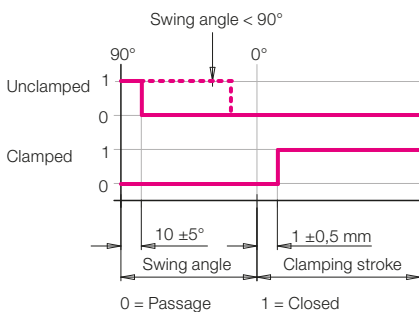
## Technical data

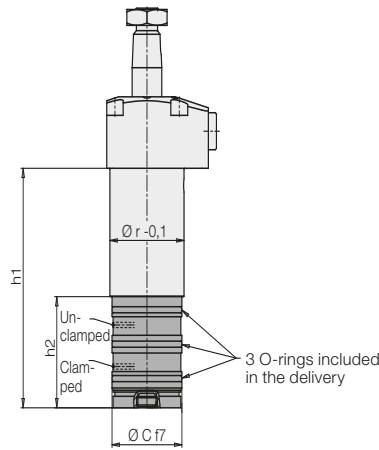| Connection | Drilled channels or threads M5 |
|---|---|
| Nominal diameter | 2 mm |
| Max. air pressure | 10 bar |
| Range of operating pressure | 3…5 bar |
| Differential pressure*) at | |
| 3 bar system pressure | min. 1.5 bar |
| 5 bar system pressure | min. 3.5 bar |
| Air volume **) | 10…20 l/min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

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

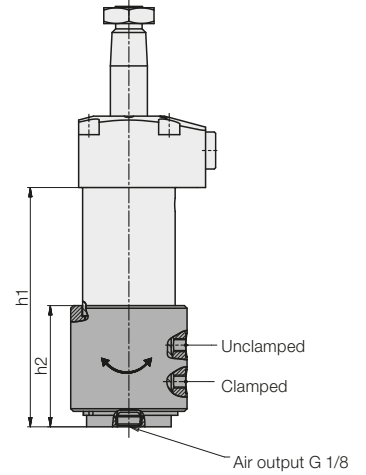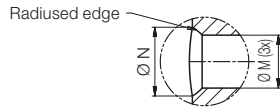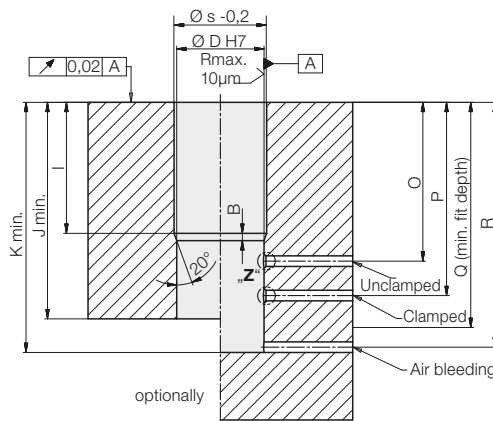**) For measuring of the flow rate appropriate devices are available.

## Function chart

Swing angle < 90°

90°  0°

Unclamped 1 / 0

Clamped 1 / 0

10 ±5°
Swing angle

1 ±0,5 mm
Clamping stroke

0 = Passage  1 = Closed

**Cartridge type**

Ø r -0,1
h1
h2
Un-clamped
Clamped
3 O-rings included in the delivery
Ø C f7

**Connection: pipe thread**

h1
h2
Unclamped
Clamped
Air output G 1/8

**Location hole**

Ø s -0,2
Ø D H7
Rmax. 10µm
A
0,02 A
A
K min.
J min.
I min.
B
20°
Z
O
P
Q (min. fit depth)
R
Unclamped
Clamped
Air bleeding
optionally

**Detail "Z"**

Radiused edge
Ø N
Ø M (3x)

**mounting body**

Ø E
F
G
H
M5
Safety ring (included in the delivery)
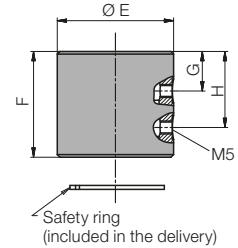
| Swing clamps | | 1853B0XX | 1854B0XX | 1856B0XX | 1857B0XX |
|---|---|---|---|---|---|
| Ø A | [mm] | 35 | 47 | 63 | 78 |
| B | [mm] | 2.5–0.5 | 2.5–05 | 2.5–0.5 | 2.5–0.5 |
| Ø C f7 | [mm] | 33 | 42 | 45 | 45 |
| Ø D H7 | [mm] | 33 | 42 | 45 | 45 |
| Ø E | [mm] | 44 | 53 | 56 | 56 |
| Ø F | [mm] | 40 | 47 | 48.8 | 50.8 |
| G | [mm] | 14.95 | 16.35 | 13.4 | 14.05 |
| H | [mm] | 28.75 | 33.35 | 35.4 | 36.75 |
| h1 | [mm] | 90.5 | 110 | 132 | 141 |
| h2 | [mm] | 42 | 49 | 55 | 57 |
| I | [mm] | 49.5 | 62 | 78 | 85 |
| J min. | [mm] | 83 | 101.5 | 123.5 | 132.5 |
| K min | [mm] | 94.5 | 114 | 136 | 145 |
| Ø M | [mm] | 4 | 4 | 4 | 4 |
| Ø N | [mm] | 5 | 5 | 5 | 5 |
| O | [mm] | 60 | 73.5 | 89.5 | 96.5 |
| P | [mm] | 73 | 90.5 | 111.5 | 118.5 |
| Q min. | [mm] | 85 | 103 | 125 | 134 |
| R | [mm] | 92.5 | 112 | 134 | 143 |
| Ø r -0,1 | [mm] | 35 | 47 | 63 | 78 |
| Ø s -0,2 | [mm] | 36 | 48 | 64 | 79 |

**Part no. Cartridge type**

| Swing angle | 1853B0XX | 1854B0XX | 1856B0XX | 1857B0XX |
|---|---|---|---|---|
| 0° or 90° | 0353-918 | 0353-924 | 0353-928 | 0353-941 |
| 15° to 75° = **XX**\*) | 0353-918-0**XX** | 0353-924-0**XX** | 0353-928-0**XX** | 0353-941-0**XX** |

**Part no. Mounting body for retrofitting of the cartridge type**

| | 0353-950 | 0353-951 | 0353-952 | 0353-953 |
|---|---|---|---|---|

*) in gradation of 5° (see page 2, "swing angle α < 90°")

## Application

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

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

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

## Description

The electrical position monitoring can be easily retrofitted at all swing clamps with switch rod (185X**B**0XX).

Included in our delivery are:

1 Signal sleeve with screw
1 Adapter with 4 countersunk screw
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.
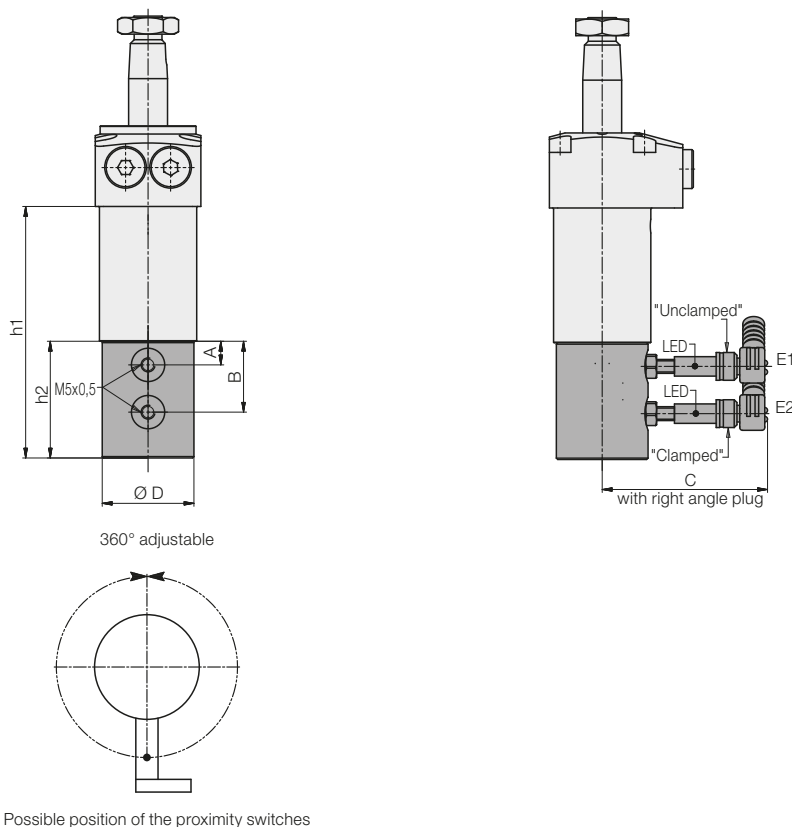
## Important notes

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 |
| Body material | stainless steel |
| Thread | M 5 x 0.5 |
| Code class | IP 67 |
| Environmental temperature | −25…+70 °C |
| LED Function display | yes |
| Protected against short circuits | yes |
| Connection type | Plug |
| Length of cable | 5 m |

## Function chart

360° adjustable

Possible position of the proximity switches

with right angle plug
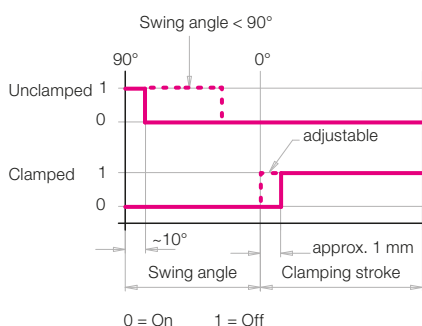
| Swing clamps | | 1853B0**XX** | 1854B0**XX** | 1856B0**XX** | 1857B0**XX** |
|---|---|---|---|---|---|
| A | [mm] | 8.5 | 8.5 | 8.5 | 8.5 |
| B | [mm] | 25.5 | 30.5 | 37.5 | 39.5 |
| C approx. | [mm] | 59.5 | 61 | 62 | 62 |
| Ø D | [mm] | 33 | 42 | 45 | 45 |
| h1 | [mm] | 90.5 | 110 | 132 | 141 |
| h2 | [mm] | 42 | 49 | 55 | 57 |
| **Part no.  Swing angle 0° or 90°** | | | | | |
| with switch and plug | | **0353-920** | **0353-926** | **0353-930** | **0353-943** |
| without switch and plug | | **0353-923** | **0353-927** | **0353-931** | **0353-944** |
| **Part no.  15° to 75° = XX*)** | | | | | |
| with switch and plug | | **0353-920-0XX** | **0353-926-0XX** | **0353-930-0XX** | **0353-943-0XX** |
| without switch and plug | | **0353-923-0XX** | **0353-927-0XX** | **0353-931-0XX** | **0353-944-0XX** |
| **Part no.  Spare parts** | | | | | |
| Inductive proximity switch | | **3829-198** | **3829-198** | **3829-198** | **3829-198** |
| Right angle plug 5 m | | **3829-099** | **3829-099** | **3829-099** | **3829-099** |

*) in gradation of 5° (see page 2, "swing angle $\alpha < 90°$")

## 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 (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.