# Sensing Link clamp

## Double acting 7 MPa

## model CLM

3 point sensor model
model CLM06-FT

Clamp sensor model
model CLM06-FC

Unclamp sensor model
model CLM06-FB

Compact model
model CLM06-FN

# Sensing Link clamp model CLM

## The extremely small sensing clamp can detect the loading miss and setting miss of a workpiece firmly.

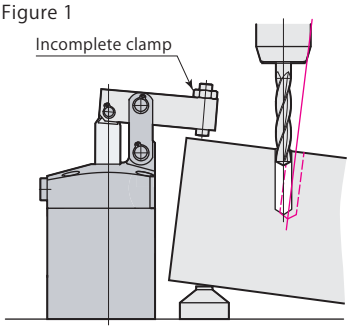
3 point sensor model

Clamp sensor model

Unclamp sensor model

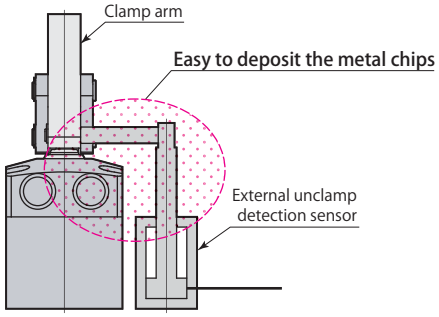
- Sensor model can prevent tool breakage and defective machining due to incomplete clamp. (Figure 1)
- Unclamp PAL sensor moves along with the piston rod and can positively detect unclamping point, thereby enabling a high-speed production line by fully synchronizing operation with workpiece lifters.
- Built-in sensors enable a compact and simple jig.
- Unclamp detection failure due to the metal chips deposit on an independent external detector can be reduced. (Figure 2)

Figure 1



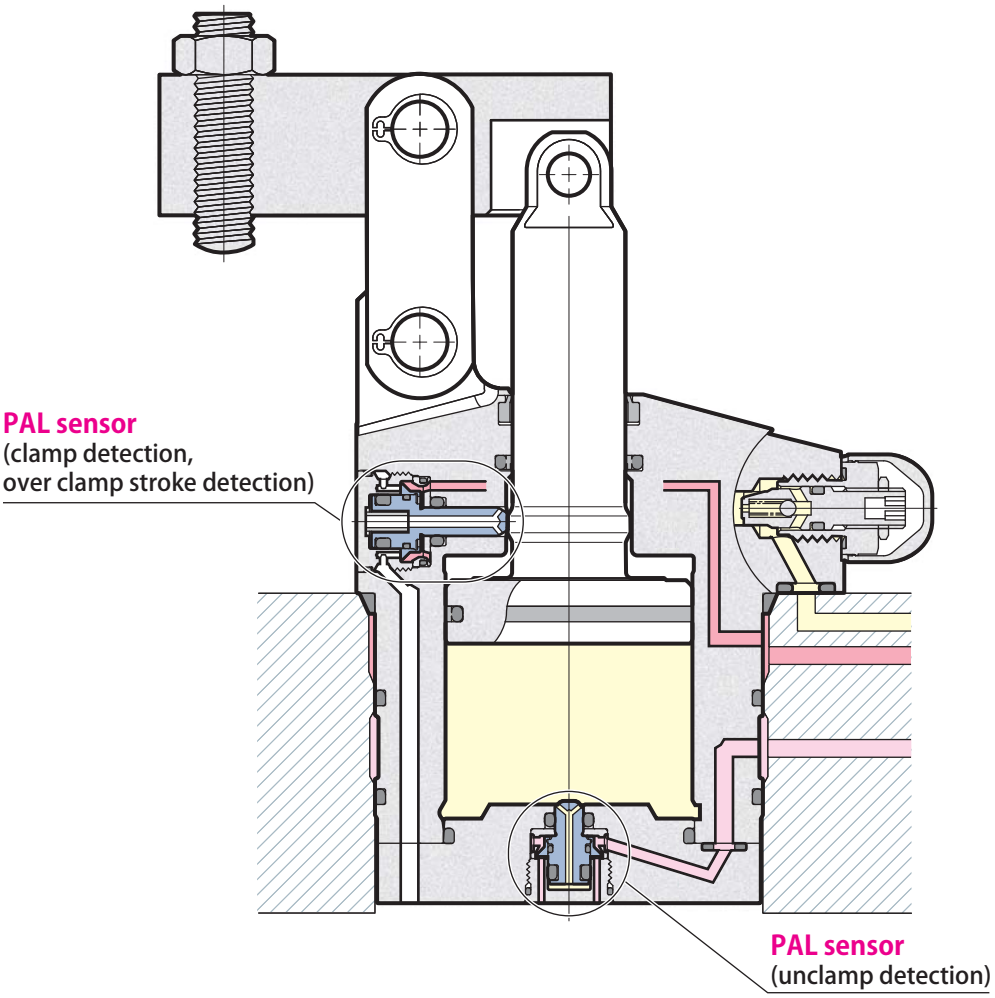

Machining failure due to incomplete clamp

Figure 2



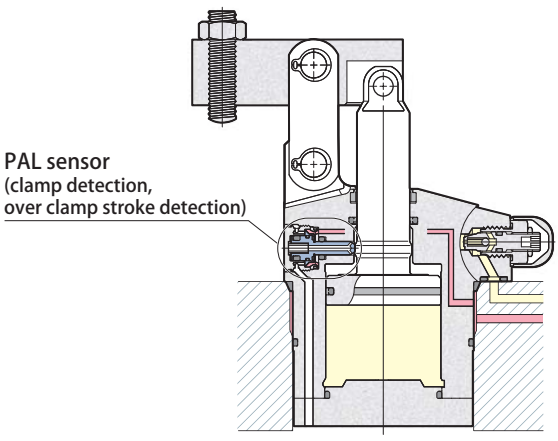
## 3 point sensor model

Clamp, Unclamp, Over clamp stroke (Incomplete clamp) detection



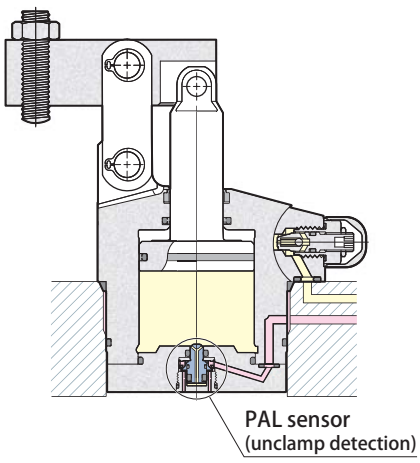

## Clamp sensor model

Clamp, Over clamp stroke (Incomplete clamp) detection




## Unclamp sensor model

Unclamp detection



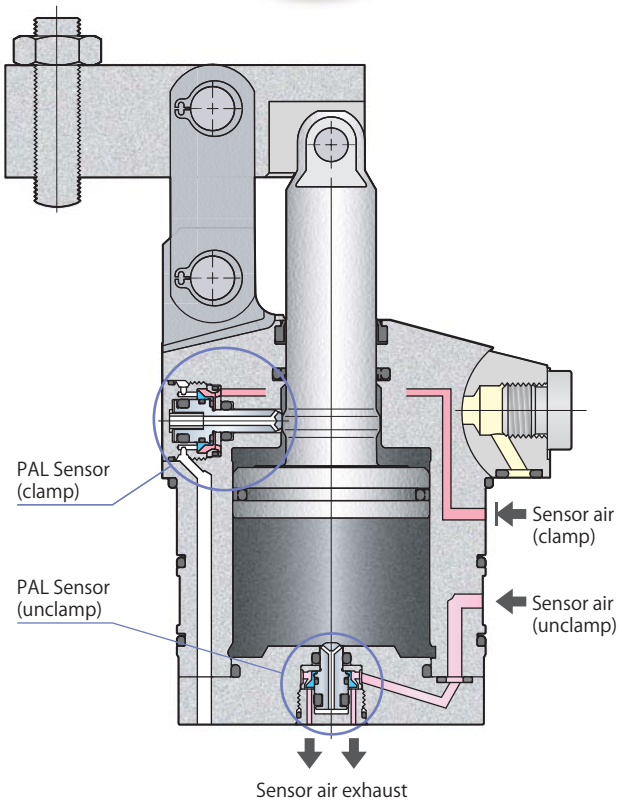
## 3 point sensor model T

Clamp, Unclamp, Over clamp stroke (Incomplete clamp) detection

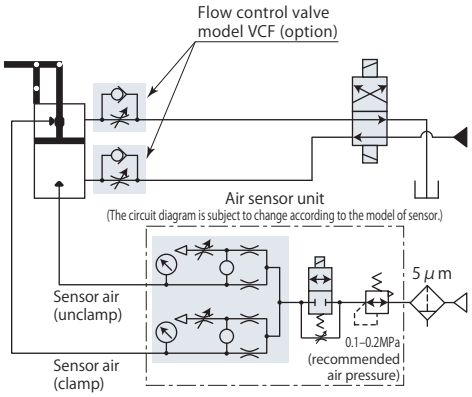
model **CLM□-□T** PAT.

The 3 point sensor model can detect the status of clamp, unclamp and over clamp stroke with just 2 circuits of air.

Refer to **pages →102–105** for the details.




### Hydraulic and pneumatic circuit diagram

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PAL sensor page → 102
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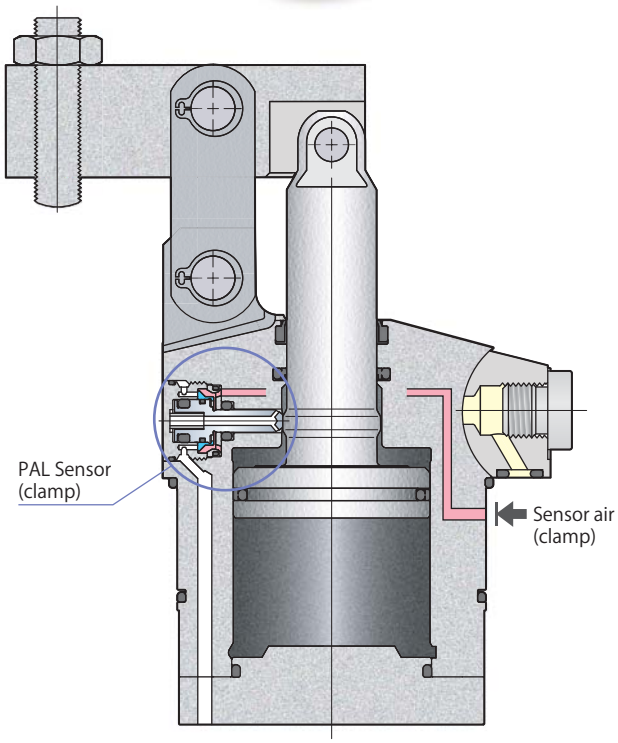
## Clamp sensor model C

Clamp, Over clamp stroke (Incomplete clamp) detection

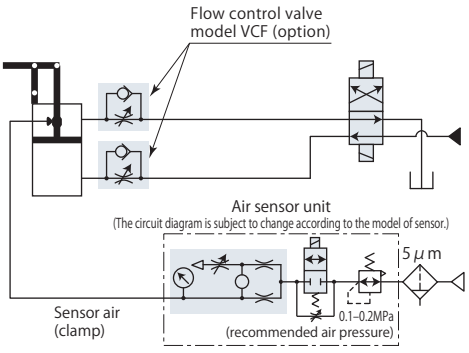
model **CLM□-□C** PAT.

The clamp sensor model can detect the status of clamp and over clamp stroke with just 1 circuit of air.

Refer to **pages →110–113** for the details.




### Hydraulic and pneumatic circuit diagram

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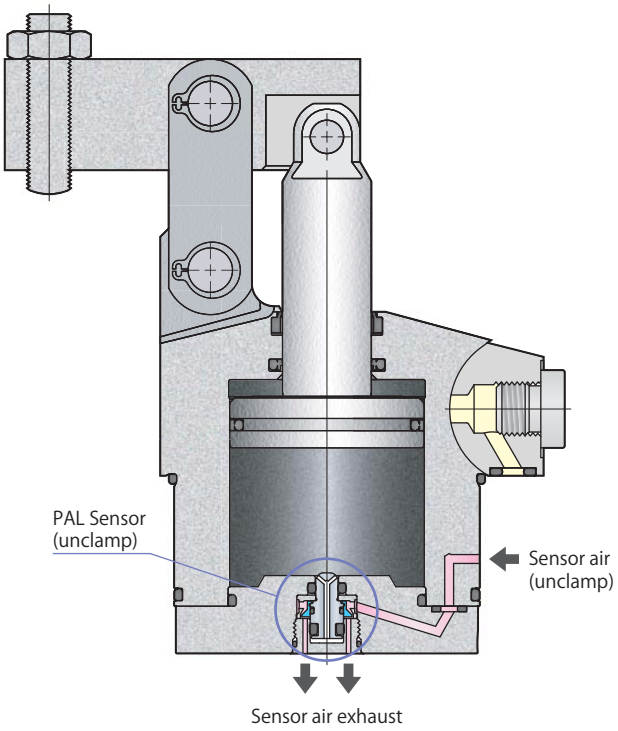
## Unclamp sensor model B

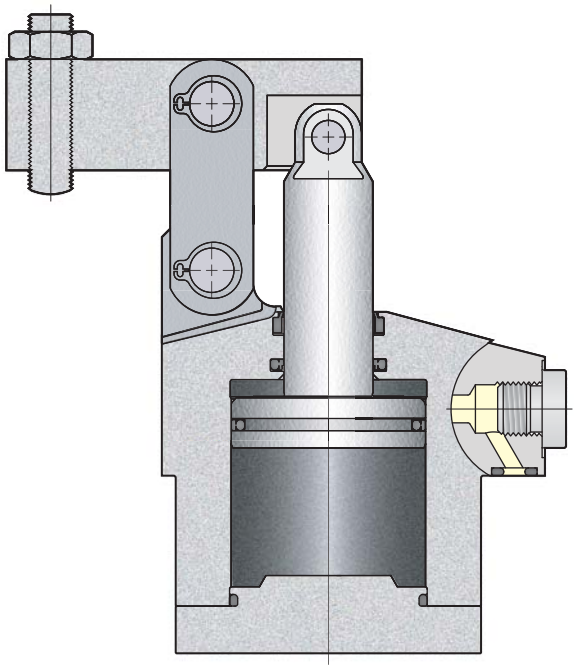
model **CLM□-□B** PAT.



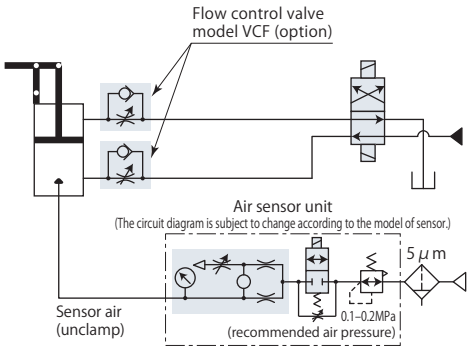

## Compact model N

model **CLM□-□N**

No sensors available on compact model



### Hydraulic and pneumatic circuit diagram





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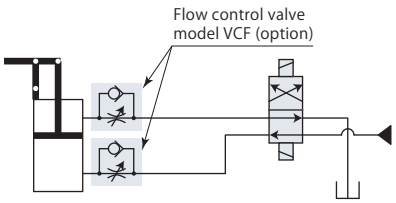
### Hydraulic circuit diagram





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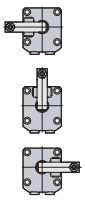
## Specifications

Size / Clamp arm mounting direction

CLM — 04 / 05 / 06 / 10 / 16

L : Left side
F : Front side
R : Right side



T : 3 point sensor model
Clamp, Unclamp, Over clamp stroke (Incomplete clamp) detection

C : Clamp sensor model
Clamp, Over clamp stroke (Incomplete clamp) detection

B : Unclamp sensor model

N : Compact model

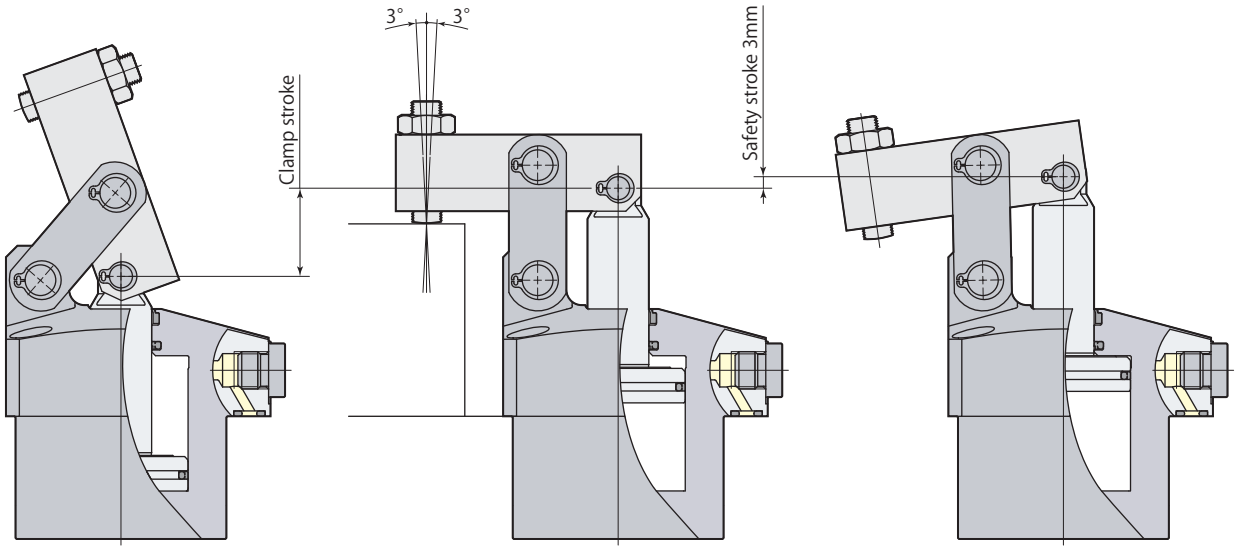
Contact Pascal for the details of bottom piping specification.

| Model | | | CLM04 | CLM05 | CLM06 | CLM10 | CLM16 |
|---|---|---|---|---|---|---|---|
| Cylinder force (hydraulic pressure 7MPa) | | kN | 3.7 | 5.0 | 6.7 | 11.1 | 16.6 |
| Cylinder inner diameter | | mm | 26 | 30 | 35 | 45 | 55 |
| Rod diameter | | mm | 12 | 14 | 16 | 20 | 22 |
| Effective area (clamp) | | $cm^2$ | 5.3 | 7.1 | 9.6 | 15.9 | 23.8 |
| Full stroke | | mm | 20.5 | 23.5 | 26 | 29.5 | 35 |
| Clamp stroke*1 | | mm | 17.5 | 20.5 | 23 | 26.5 | 32 |
| Safety stroke | | mm | 3 | 3 | 3 | 3 | 3 |
| Max. oil flow rate | | L/min | 1.1 | 1.7 | 2.6 | 5.1 | 9.1 |
| Cylinder capacity | Clamp | $cm^3$ | 10.9 | 16.6 | 25.0 | 46.9 | 83.2 |
| | Unclamp | $cm^3$ | 8.6 | 13.0 | 19.8 | 37.7 | 69.9 |
| Mass | CLM□-□T, C | kg | 0.7 | 1.1 | 1.4 | 2.3 | 3.2 |
| | CLM□-□B, N | kg | 0.6 | 0.9 | 1.2 | 2.0 | 3.0 |
| Recommended tightening torque of mounting screws*2 | | N·m | 7 | 7 | 12 | 12 | 29 |

- Pressure range : 1.5–7 MPa (model CLM-T, CLM-C, CLM-B), 0.5–7 MPa (model CLM-N)
- Proof pressure : 10.5 MPa
- Operating temperature : 0–70 ℃
- Fluid used : General mineral based hydraulic oil (ISO-VG32 equivalent)
- Seals are resistant to chlorine-based cutting fluid. (not thermal resistant specification)

*1 : Indicates a distance from unclamping position to clamping point.
*2 : ISO R898 class 12.9

When clamping the workpiece, the clamp arm should be situated like the sketch as shown below. (Clamping point)
Please avoid any non-axial force such as the bending moment toward the piston rod. (Allowable angle ±3°)

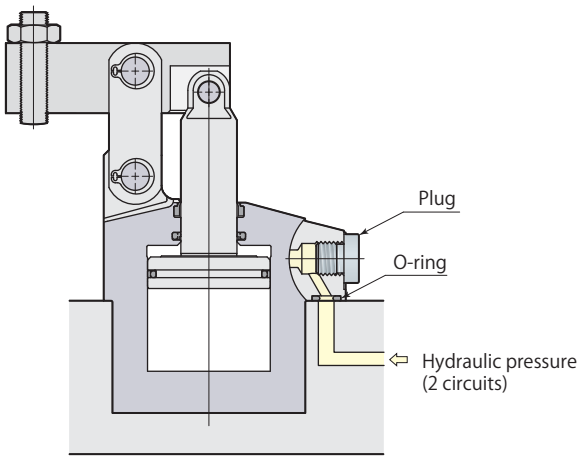



Unclamp | Clamping point | Over clamp stroke (Full stroke)

## Manifold piping and G port piping are available.

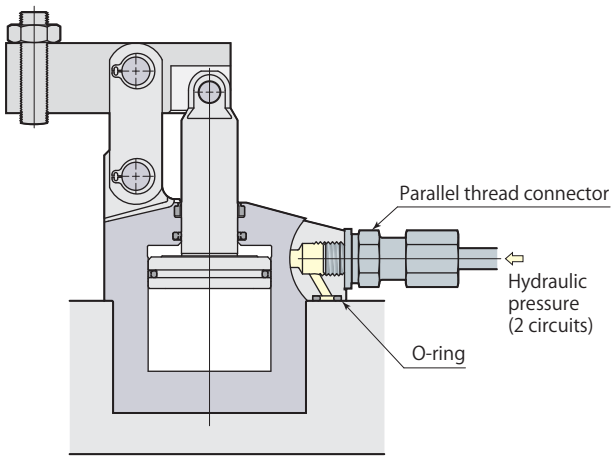
### Manifold piping

When choosing manifold piping, a flow control valve (model VCF) and an air bleeding valve (model VCE) are mountable on the G ports of the clamp.




### G port piping

Remove plugs when choosing G port piping. (O-ring must be used.) Refer to **page →208** for details on G port piping flareless fitting. The flow control valve and the air bleeding valve should be installed in the middle of oil path.




### Flow control valve model VCF

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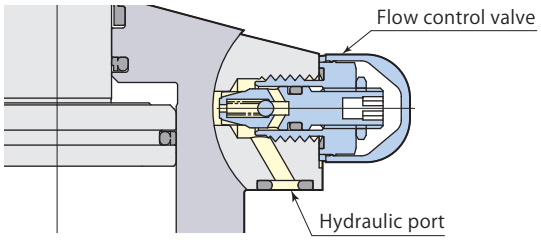


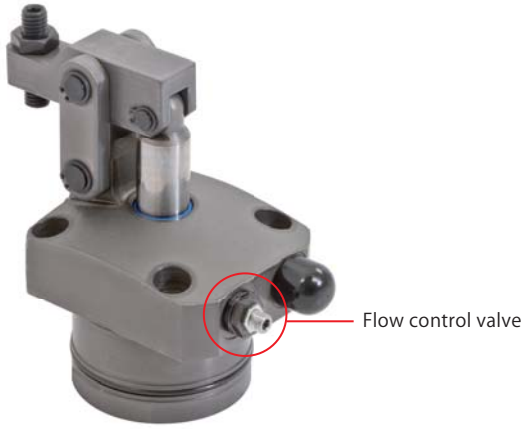


### Air bleeding valve model VCE

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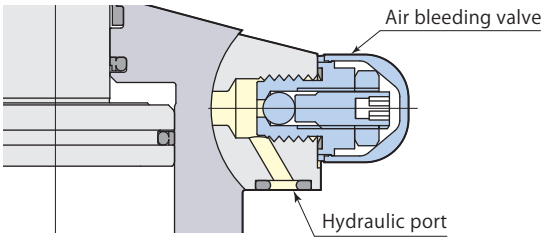
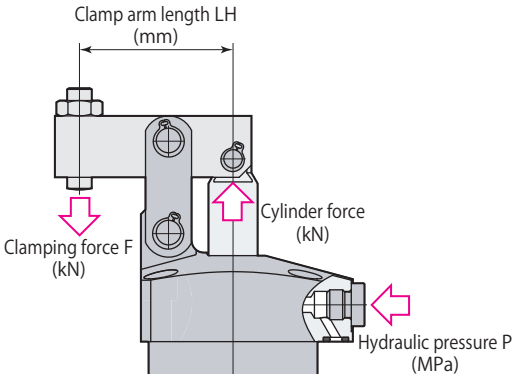




● In case of mounting flow control valve model VCF on the G port of the clamp, air bleeding valve should be installed in the piping to the clamp. (VCE Mounting details. Refer to **page →156**)

## Performance diagram



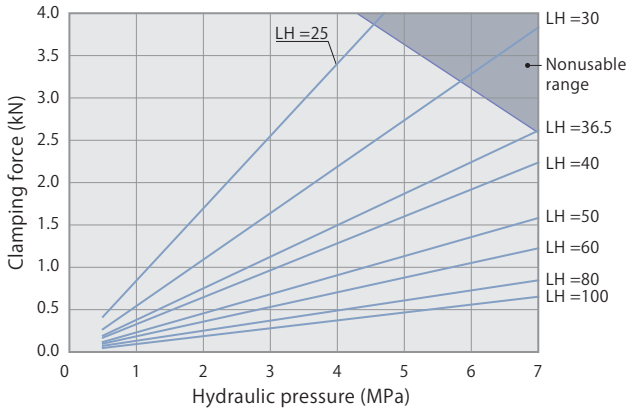

Clamping force varies depending on the clamp arm length (LH) and hydraulic pressure (P).

Clamping force calculation formula
F = Coefficient 1 × P/(LH - Coefficient 2)
F : Clamping force P : Hydraulic pressure LH : Clamp arm length

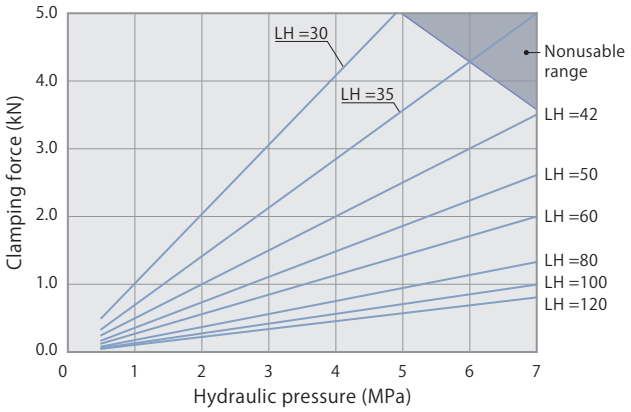
CLM06 with clamp arm length (LH) = 50 mm at hydraulic pressure of 7 MPa, Clamping force F is calculated by
18.18×7/(50-21.0)=4.4 kN

Do not use the clamp in the nonusable range. It may cause damage of link mechanism.

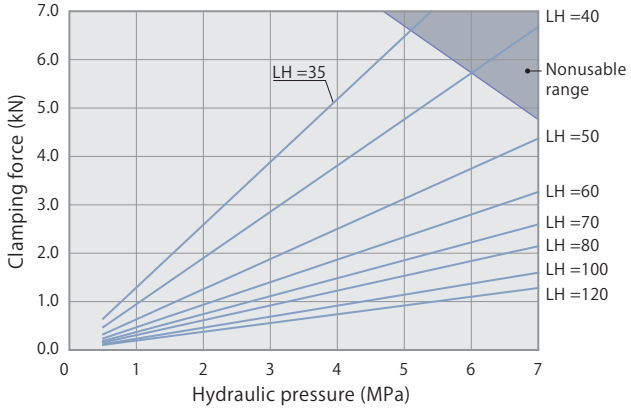
### model CLM04



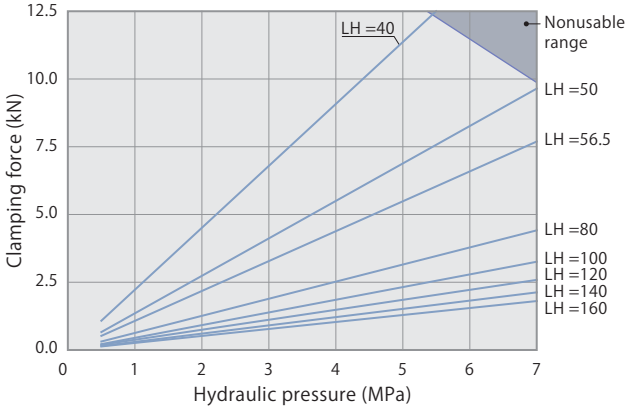

### model CLM05



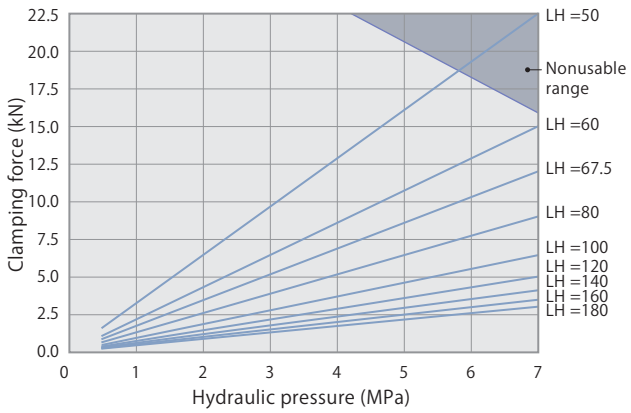

### model CLM06




### model CLM10




### model CLM16



## Performance table

**model CLM04** Clamping force F=7.65×P/(LH-16.0)

| Hydraulic pressure MPa | Cylinder force kN | Clamping force kN / Clamp arm length LH mm | | | | | | | | Min. arm length Min. LH mm |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 25 | 30 | 36.5 | 40 | 50 | 60 | 80 | 100 | |
| 7 | 3.7 | | | 2.6 | 2.2 | 1.6 | 1.2 | 0.8 | 0.6 | 36.5 |
| 6.5 | 3.5 | | | 2.4 | 2.1 | 1.5 | 1.1 | 0.8 | 0.6 | 34 |
| 6 | 3.2 | | | 2.2 | 1.9 | 1.3 | 1.0 | 0.7 | 0.5 | 31 |
| 5.5 | 2.9 | | 3.0 | 2.1 | 1.8 | 1.2 | 1.0 | 0.7 | 0.5 | 29 |
| 5 | 2.7 | | 2.7 | 1.9 | 1.6 | 1.1 | 0.9 | 0.6 | 0.5 | 27 |
| 4.5 | 2.4 | 3.8 | 2.5 | 1.7 | 1.4 | 1.0 | 0.8 | 0.5 | 0.4 | 25 |
| 4 | 2.1 | 3.4 | 2.2 | 1.5 | 1.3 | 0.9 | 0.7 | 0.5 | 0.4 | 24 |
| 3.5 | 1.9 | 3.0 | 1.9 | 1.3 | 1.1 | 0.8 | 0.6 | 0.4 | 0.3 | ↑ |
| 3 | 1.6 | 2.5 | 1.6 | 1.1 | 1.0 | 0.7 | 0.5 | 0.4 | 0.3 | ↑ |
| 2.5 | 1.3 | 2.1 | 1.4 | 0.9 | 0.8 | 0.6 | 0.4 | 0.3 | 0.2 | ↑ |
| 2 | 1.1 | 1.7 | 1.1 | 0.7 | 0.6 | 0.4 | 0.3 | 0.2 | 0.2 | ↑ |
| 1.5 | 0.8 | 1.3 | 0.8 | 0.6 | 0.5 | 0.3 | 0.3 | 0.2 | 0.1 | ↑ |
| 1 | 0.5 | 0.8 | 0.5 | 0.4 | 0.3 | 0.2 | 0.2 | 0.1 | 0.1 | ↑ |
| 0.5 | 0.3 | 0.4 | 0.3 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 24 |
| Max. pressure MPa | | 4.5 | 5.8 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | |

indicates nonusable range

**model CLM05** Clamping force F=11.77×P/(LH-18.5)

| Hydraulic pressure MPa | Cylinder force kN | Clamping force kN / Clamp arm length LH mm | | | | | | | | Min. arm length Min. LH mm |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 30 | 35 | 42 | 50 | 60 | 80 | 100 | 120 | |
| 7 | 5.0 | | | 3.5 | 2.6 | 2.0 | 1.3 | 1.0 | 0.8 | 42 |
| 6.5 | 4.6 | | | 3.3 | 2.4 | 1.8 | 1.2 | 0.9 | 0.8 | 39 |
| 6 | 4.2 | | | 3.0 | 2.2 | 1.7 | 1.1 | 0.9 | 0.7 | 36 |
| 5.5 | 3.9 | | 3.9 | 2.8 | 2.1 | 1.6 | 1.1 | 0.8 | 0.6 | 33 |
| 5 | 3.5 | | 3.6 | 2.5 | 1.9 | 1.4 | 1.0 | 0.7 | 0.6 | 31 |
| 4.5 | 3.2 | 4.6 | 3.2 | 2.3 | 1.7 | 1.3 | 0.9 | 0.6 | 0.5 | 29 |
| 4 | 2.8 | 4.1 | 2.9 | 2.0 | 1.5 | 1.1 | 0.8 | 0.6 | 0.5 | 27 |
| 3.5 | 2.5 | 3.6 | 2.5 | 1.8 | 1.3 | 1.0 | 0.7 | 0.5 | 0.4 | ↑ |
| 3 | 2.1 | 3.1 | 2.1 | 1.5 | 1.1 | 0.9 | 0.6 | 0.4 | 0.3 | ↑ |
| 2.5 | 1.8 | 2.6 | 1.8 | 1.3 | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | ↑ |
| 2 | 1.4 | 2.0 | 1.4 | 1.0 | 0.7 | 0.6 | 0.4 | 0.3 | 0.2 | ↑ |
| 1.5 | 1.1 | 1.5 | 1.1 | 0.8 | 0.6 | 0.4 | 0.3 | 0.2 | 0.2 | ↑ |
| 1 | 0.7 | 1.0 | 0.7 | 0.5 | 0.4 | 0.3 | 0.2 | 0.1 | 0.1 | ↑ |
| 0.5 | 0.4 | 0.5 | 0.4 | 0.3 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 27 |
| Max. pressure MPa | | 4.9 | 5.9 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | |

indicates nonusable range

**model CLM06** Clamping force F=18.18×P/(LH-21.0)

| Hydraulic pressure MPa | Cylinder force kN | Clamping force kN / Clamp arm length LH mm | | | | | | | | Min. arm length Min. LH mm |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 35 | 40 | 50 | 60 | 70 | 80 | 100 | 120 | |
| 7 | 6.7 | | | 4.4 | 3.3 | 2.6 | 2.2 | 1.6 | 1.3 | 48 |
| 6.5 | 6.3 | | | 4.1 | 3.0 | 2.4 | 2.0 | 1.5 | 1.2 | 44 |
| 6 | 5.8 | | | 3.8 | 2.8 | 2.2 | 1.8 | 1.4 | 1.1 | 41 |
| 5.5 | 5.3 | | 5.3 | 3.4 | 2.6 | 2.0 | 1.7 | 1.3 | 1.0 | 38 |
| 5 | 4.8 | 6.5 | 4.8 | 3.1 | 2.3 | 1.9 | 1.5 | 1.2 | 0.9 | 35 |
| 4.5 | 4.3 | 5.8 | 4.3 | 2.8 | 2.1 | 1.7 | 1.4 | 1.0 | 0.8 | 33 |
| 4 | 3.8 | 5.2 | 3.8 | 2.5 | 1.9 | 1.5 | 1.2 | 0.9 | 0.7 | 31 |
| 3.5 | 3.4 | 4.5 | 3.3 | 2.2 | 1.6 | 1.3 | 1.1 | 0.8 | 0.6 | ↑ |
| 3 | 2.9 | 3.9 | 2.9 | 1.9 | 1.4 | 1.1 | 0.9 | 0.7 | 0.6 | ↑ |
| 2.5 | 2.4 | 3.2 | 2.4 | 1.6 | 1.2 | 0.9 | 0.8 | 0.6 | 0.5 | ↑ |
| 2 | 1.9 | 2.6 | 1.9 | 1.3 | 0.9 | 0.7 | 0.6 | 0.5 | 0.4 | ↑ |
| 1.5 | 1.4 | 1.9 | 1.4 | 0.9 | 0.7 | 0.6 | 0.5 | 0.3 | 0.3 | ↑ |
| 1 | 1.0 | 1.3 | 1.0 | 0.6 | 0.5 | 0.4 | 0.3 | 0.2 | 0.2 | ↑ |
| 0.5 | 0.5 | 0.6 | 0.5 | 0.3 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 31 |
| Max. pressure MPa | | 5.0 | 5.9 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | |

indicates nonusable range

**model CLM10** Clamping force F=35.07×P/(LH-24.5)

| Hydraulic pressure MPa | Cylinder force kN | Clamping force kN / Clamp arm length LH mm | | | | | | | | Min. arm length Min. LH mm |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 40 | 50 | 56.5 | 80 | 100 | 120 | 140 | 160 | |
| 7 | 11.1 | | 9.6 | 7.7 | 4.4 | 3.3 | 2.6 | 2.1 | 1.8 | 50 |
| 6.5 | 10.3 | | 8.9 | 7.1 | 4.1 | 3.0 | 2.4 | 2.0 | 1.7 | 46 |
| 6 | 9.5 | | 8.3 | 6.6 | 3.8 | 2.8 | 2.2 | 1.8 | 1.6 | 43 |
| 5.5 | 8.7 | | 7.6 | 6.0 | 3.5 | 2.6 | 2.0 | 1.7 | 1.4 | 41 |
| 5 | 8.0 | 11.3 | 6.9 | 5.5 | 3.2 | 2.3 | 1.8 | 1.5 | 1.3 | 38 |
| 4.5 | 7.2 | 10.2 | 6.2 | 4.9 | 2.8 | 2.1 | 1.7 | 1.4 | 1.2 | 36 |
| 4 | 6.4 | 9.1 | 5.5 | 4.4 | 2.5 | 1.9 | 1.5 | 1.2 | 1.0 | ↑ |
| 3.5 | 5.6 | 7.9 | 4.8 | 3.8 | 2.2 | 1.6 | 1.3 | 1.1 | 0.9 | ↑ |
| 3 | 4.8 | 6.8 | 4.1 | 3.3 | 1.9 | 1.4 | 1.1 | 0.9 | 0.8 | ↑ |
| 2.5 | 4.0 | 5.7 | 3.4 | 2.7 | 1.6 | 1.2 | 0.9 | 0.8 | 0.6 | ↑ |
| 2 | 3.2 | 4.5 | 2.8 | 2.2 | 1.3 | 0.9 | 0.7 | 0.6 | 0.5 | ↑ |
| 1.5 | 2.4 | 3.4 | 2.1 | 1.6 | 0.9 | 0.7 | 0.6 | 0.5 | 0.4 | ↑ |
| 1 | 1.6 | 2.3 | 1.4 | 1.1 | 0.6 | 0.5 | 0.4 | 0.3 | 0.3 | ↑ |
| 0.5 | 0.8 | 1.1 | 0.7 | 0.5 | 0.3 | 0.2 | 0.2 | 0.2 | 0.1 | 36 |
| Max. pressure MPa | | 5.4 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | |

indicates nonusable range

**model CLM16** Clamping force F=64.15×P/(LH-30.0)

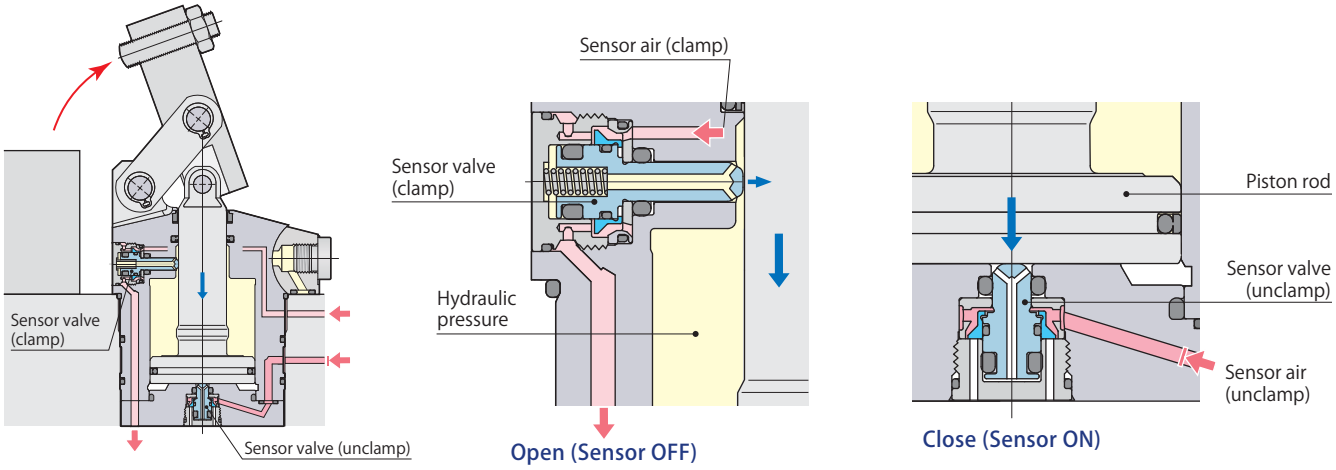
| Hydraulic pressure MPa | Cylinder force kN | Clamping force kN / Clamp arm length LH mm | | | | | | | | | Min. arm length Min. LH mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 50 | 60 | 67.5 | 80 | 100 | 120 | 140 | 160 | 180 | |
| 7 | 16.6 | | 15.0 | 12.0 | 9.0 | 6.4 | 5.0 | 4.1 | 3.5 | 3.0 | 59 |
| 6.5 | 15.4 | | 13.9 | 11.1 | 8.3 | 6.0 | 4.6 | 3.8 | 3.2 | 2.8 | 55 |
| 6 | 14.3 | | 12.8 | 10.3 | 7.7 | 5.5 | 4.3 | 3.5 | 3.0 | 2.6 | 52 |
| 5.5 | 13.1 | 17.6 | 11.8 | 9.4 | 7.1 | 5.0 | 3.9 | 3.2 | 2.7 | 2.4 | 49 |
| 5 | 11.9 | 16.0 | 10.7 | 8.6 | 6.4 | 4.6 | 3.6 | 2.9 | 2.5 | 2.1 | 46 |
| 4.5 | 10.7 | 14.4 | 9.6 | 7.7 | 5.8 | 4.1 | 3.2 | 2.6 | 2.2 | 1.9 | 44 |
| 4 | 9.5 | 12.8 | 8.6 | 6.8 | 5.1 | 3.7 | 2.9 | 2.3 | 2.0 | 1.7 | ↑ |
| 3.5 | 8.3 | 11.2 | 7.5 | 6.0 | 4.5 | 3.2 | 2.5 | 2.0 | 1.7 | 1.5 | ↑ |
| 3 | 7.1 | 9.6 | 6.4 | 5.1 | 3.8 | 2.7 | 2.1 | 1.7 | 1.5 | 1.3 | ↑ |
| 2.5 | 5.9 | 8.0 | 5.3 | 4.3 | 3.2 | 2.3 | 1.8 | 1.5 | 1.2 | 1.1 | ↑ |
| 2 | 4.8 | 6.4 | 4.3 | 3.4 | 2.6 | 1.8 | 1.4 | 1.2 | 1.0 | 0.9 | ↑ |
| 1.5 | 3.6 | 4.8 | 3.2 | 2.6 | 1.9 | 1.4 | 1.1 | 0.9 | 0.7 | 0.6 | ↑ |
| 1 | 2.4 | 3.2 | 2.1 | 1.7 | 1.3 | 0.9 | 0.7 | 0.6 | 0.5 | 0.4 | ↑ |
| 0.5 | 1.2 | 1.6 | 1.1 | 0.9 | 0.6 | 0.5 | 0.4 | 0.3 | 0.2 | 0.2 | 44 |
| Max. pressure MPa | | 5.8 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | |

indicates nonusable range

● Sensor model (model CLM-T, CLM-C, CLM-B) applicable hydraulic pressure should be 1.5 to 7MPa.

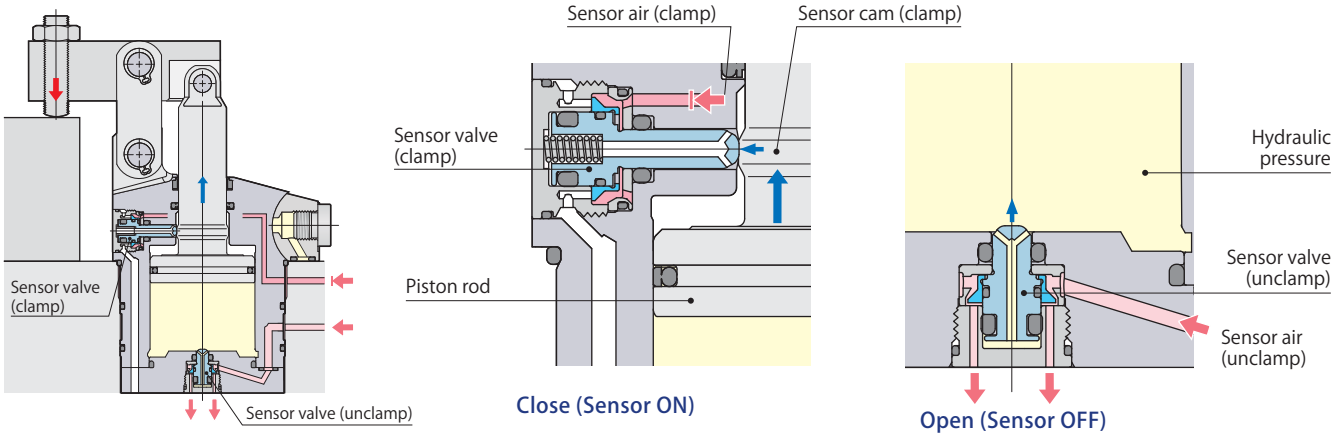
## PAL sensor function and structure

### Unclamp detection




● The sensor valve (unclamp) is pushed down by the piston rod and shuts off the sensor air flow when the piston rod reaches the unclamp end. The sensor valve (clamp) is pushed up by the hydraulic force to open for air exhaust and detects the unclamped condition.

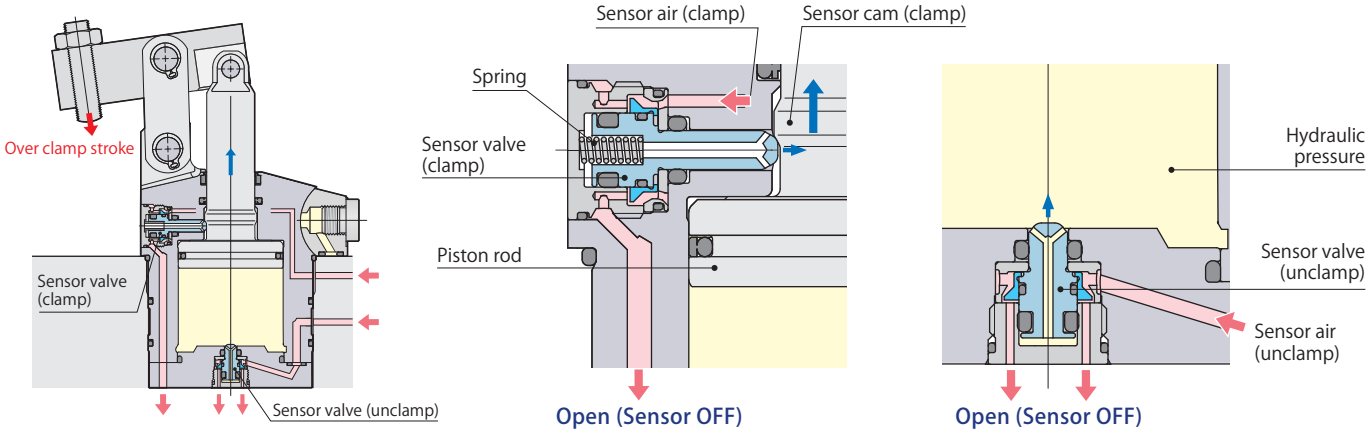
### Clamp detection




● The sensor valve (clamp) is pushed down by the sensor cam (clamp) and shuts off the sensor air flow when the piston rod reaches the clamping point. The sensor valve (unclamp) is pushed up by the hydraulic force to open for air exhaust and detects the clamped condition.

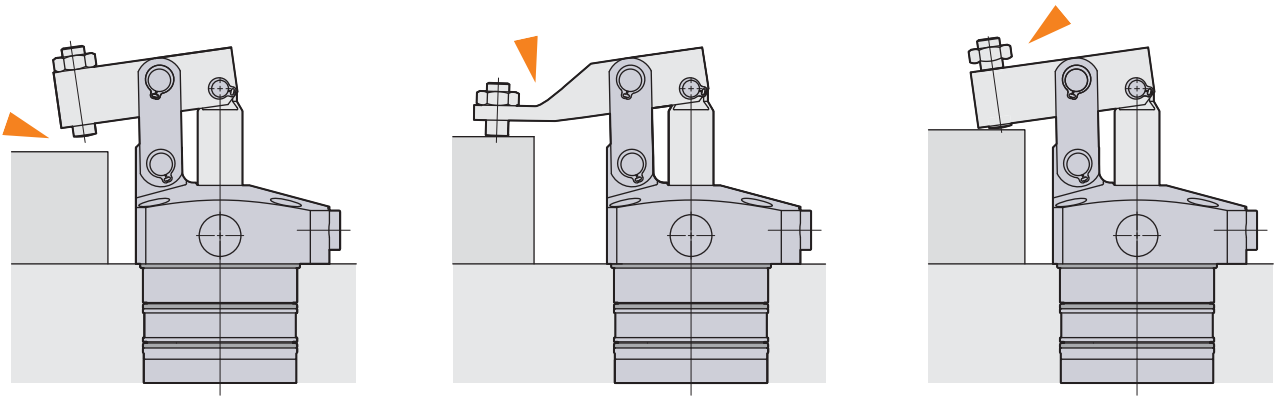
## PAL sensor function and structure

### Over clamp stroke (Incomplete clamp) detection




- The sensor cam passes the clamping point, the sensor valve (clamp) is pushed up by the spring and exhausts the sensor air. Also the sensor valve (unclamp) exhausts the air and detects the over clamp stroked (incomplete clamp) condition.

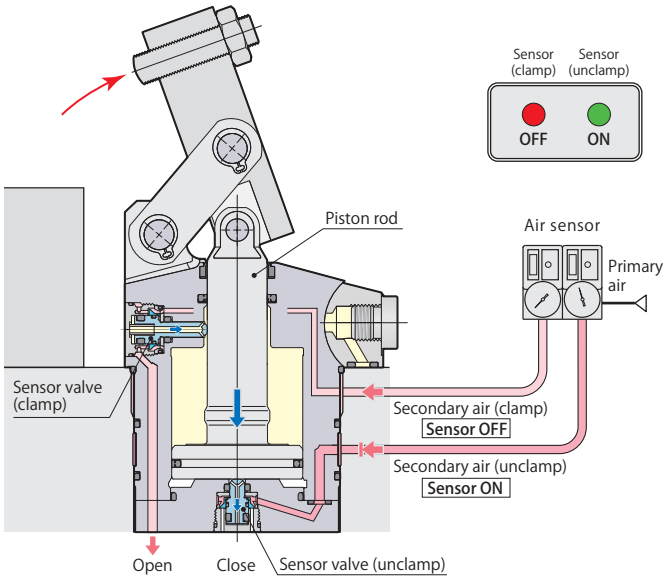
### Over clamp stroke (Incomplete clamp) detection example



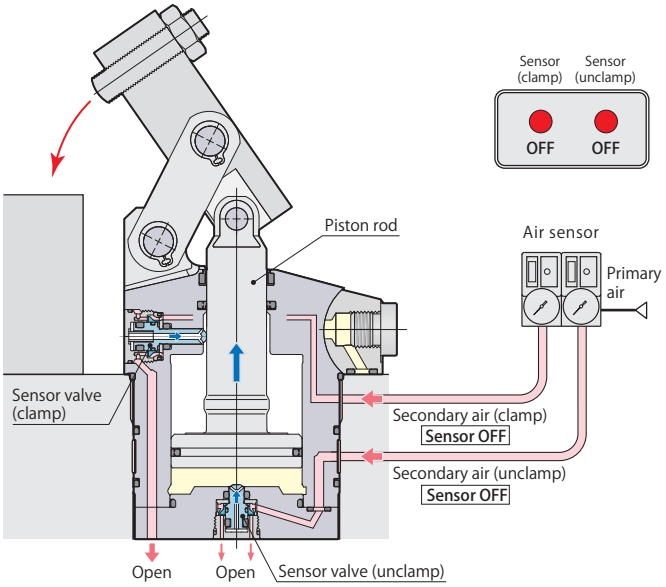
- Clamp disabled due to missetting workpiece.
- Clamp disabled due to the deflection of clamp arm.
- Clamp disabled due to the damage of piston rod or loose adjustment bolt.
- Clamp disabled due to the abrasion on the tip of clamp arm during prolonged use.

## Clamp, Unclamp, Over clamp stroke detection signal

### Unclamp detection




### In the middle of clamp stroke



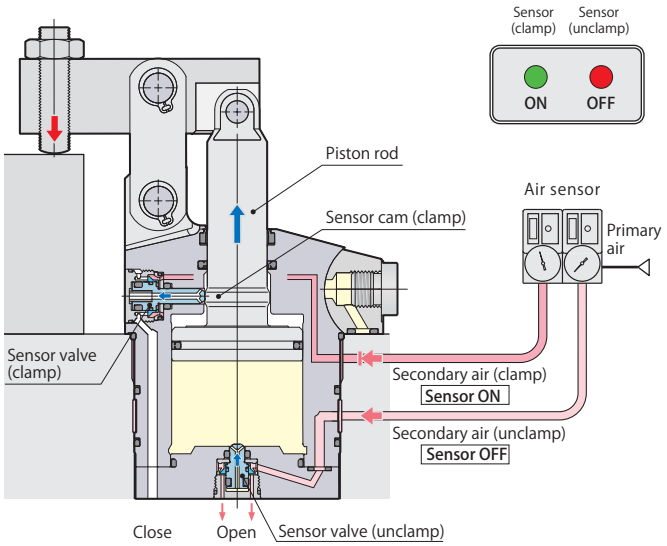

The sensor may not work correctly when the cylinder is not pressurized by hydraulic force because the piston of the clamp moves under such environment. Keep supplying hydraulic force the cylinder all the times.

| | | |
|---|---|---|
| Sensor signal (clamp) | OFF | Unclamp |
| Sensor signal (unclamp) | ON | |

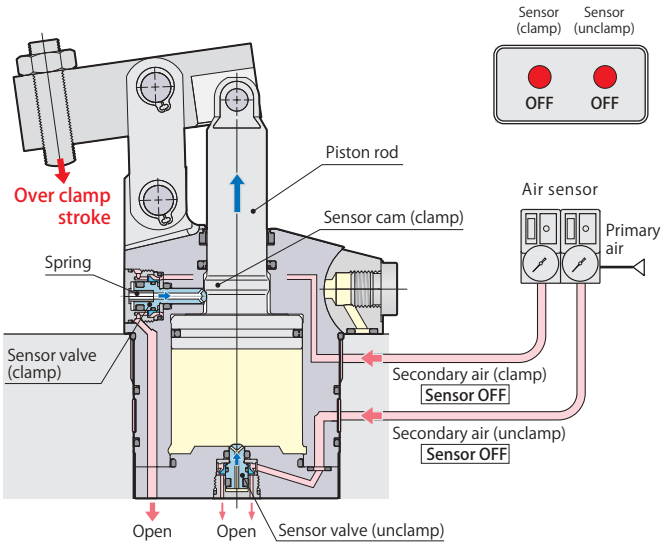
| | | |
|---|---|---|
| Sensor signal (clamp) | OFF | In the middle of clamp stroke |
| Sensor signal (unclamp) | OFF | |

More than 1.5MPa hydraulic pressure is required to operate the sensor valve. To obtain OFF signal in the middle of the valve stroke, over 1.5MPa of back pressure should be produced by using a meter-out type of flow control valve.

### Clamp detection



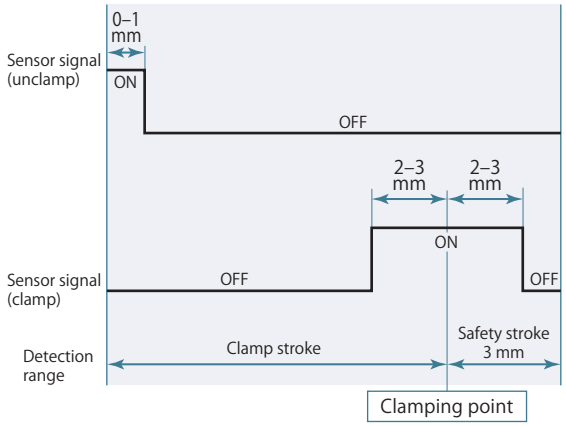

### Over clamp stroke (Incomplete clamp) detection




| | | |
|---|---|---|
| Sensor signal (clamp) | ON | Clamp |
| Sensor signal (unclamp) | OFF | |

| | | |
|---|---|---|
| Sensor signal (clamp) | OFF | Over clamp stroke (Incomplete clamp) |
| Sensor signal (unclamp) | OFF | |

## Air sensor triggering point



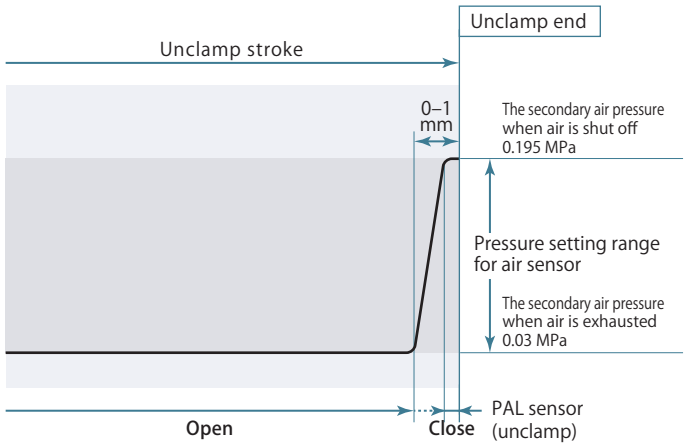

- Refer to the sensor supplier's instruction manual for the details of setting.
- Sensing performance such as detectable time and pressure differs depending on the supplier and model number of the sensor. Select the right model referring to sensor's application and characteristics.

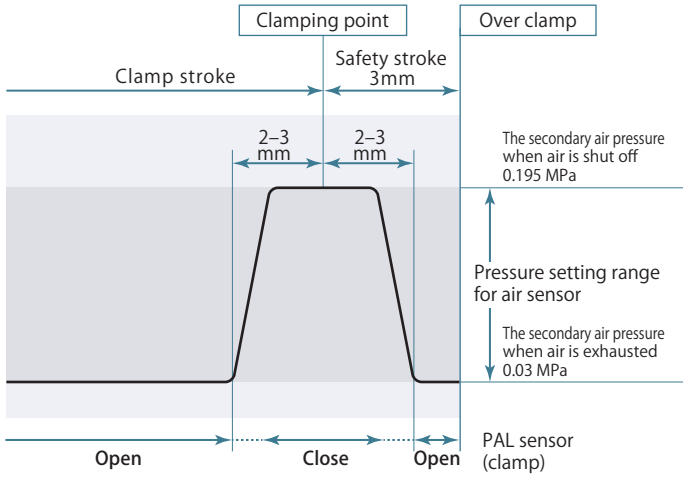
## Air sensor recommended condition of use

| | |
|---|---|
| Supplier and model | ISA3-F/G series manufactured by SMC |
| | GPS2-05, GPS3-E series manufactured by CKD |
| Air supply pressure | 0.1–0.2 MPa |
| Inner diameter of piping | ø4 mm (ISA3-F：ø2.5 mm) |
| Overall piping length | 5 m or less |

- Supply the dry and filtered air. Particulate size 5 μm or less is recommended.
- Use a solenoid valve with needle for air sensor unit and control it supplying air all the time in order to eliminate intrusion of chips or coolant.
- There is a case that air sensing cannot be successfully made as designed when it is used out of the above usage. Contact Technical service center for more details.

## Relation between sensor air pressure, PAL sensor and piston stroke



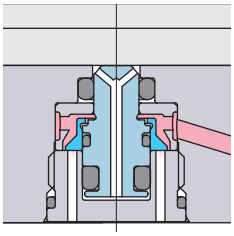




The diagram shown on the left indicates the relation between the PAL sensor, piston stroke, and secondary air pressure. (The pressure shown in the diagram is a reference based on the 0.2 MPa of primary air pressure for one piece of clamp.)

Since the new PAL sensor works with less air-leakage compared to previous sensor valve,

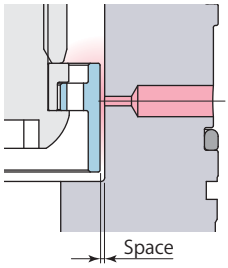
- Enhances the pressure setting range of the sensor which enables the sensor to set easily.
  (Ex. Pressure setting range 0.03–0.195 MPa in the diagram)
- Allows the use for a number of clamps by one air sensor because of better pressure holding when air is shut off.
  (Maximum number of clamps to be detected by one sensor is 10.)
- Allows to choose less air-consumed, i.e. small orifice diameter type, air sensor.
- Can create large differential-pressure when opening and closing the PAL sensor so that sensor primary pressure can be set as low as possible and reduce the consumption of air.

New PAL sensor



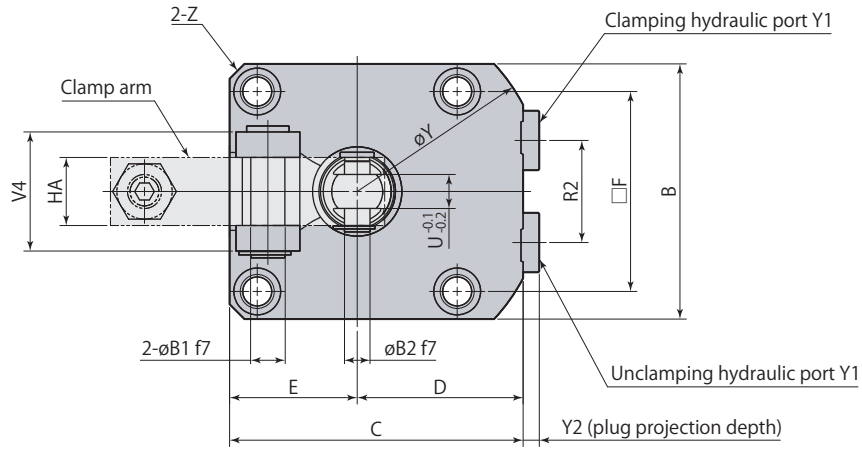
Poppet structure ensures superior sealing performance and can create large differential-pressure when the valve is opening and closing, and air leakage can be minimized.

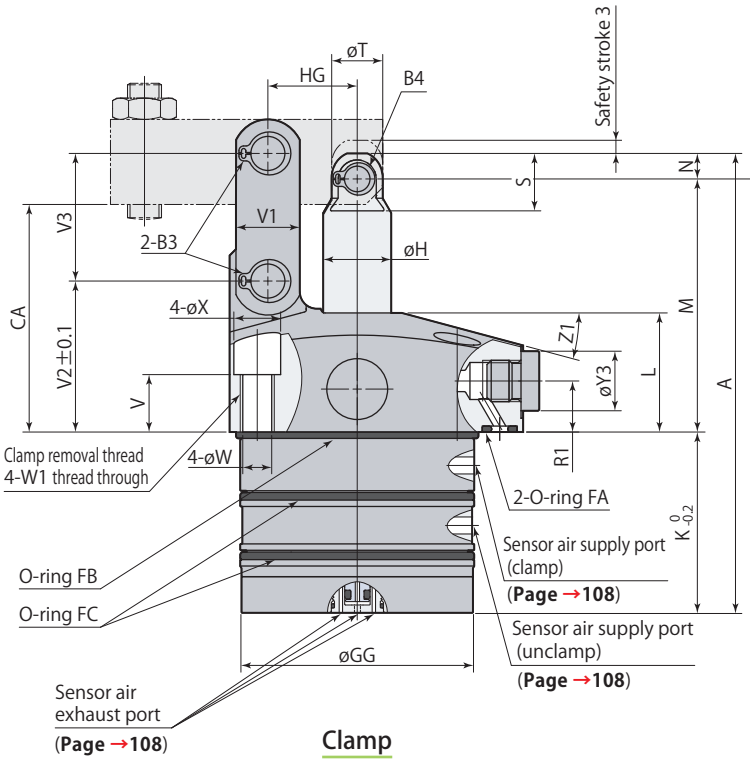
Previous sensor valve



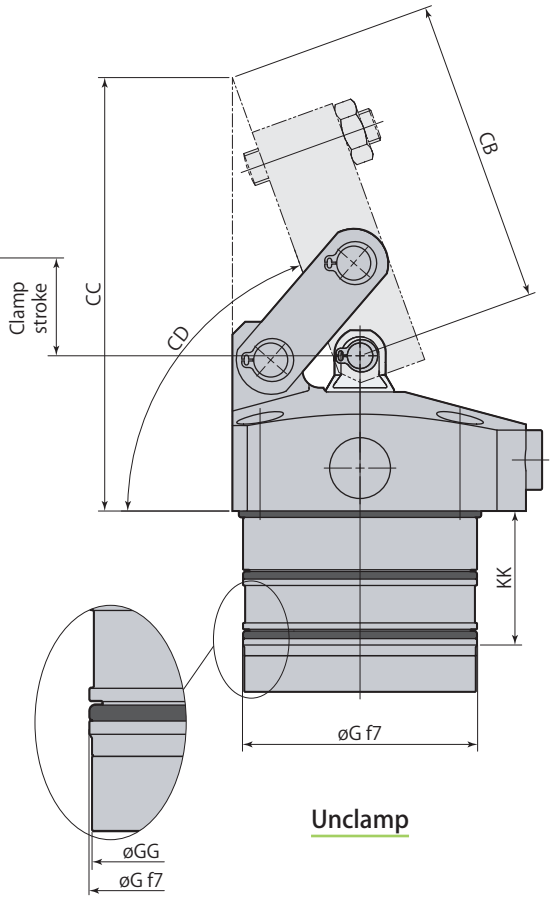

Air leaks easily due to a large space.

## Dimensions

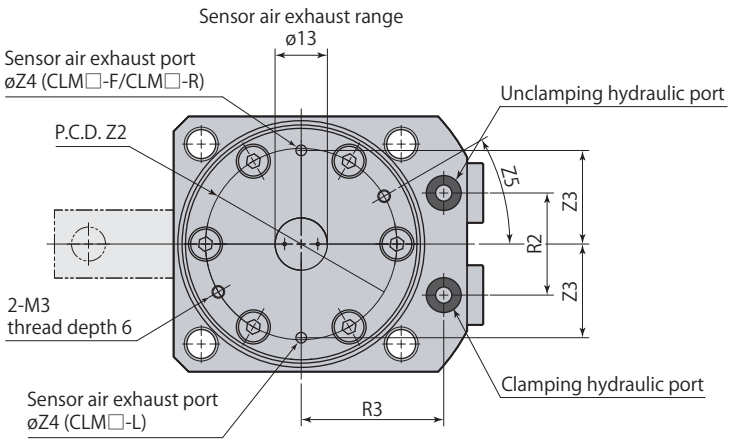



Clamp

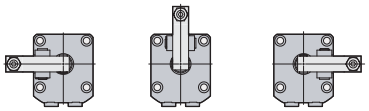



Unclamp




- This diagram represents external contour of CLM□-F. CLM□-L and CLM□-R differ only in terms of mounting direction of clamp arm and otherwise all dimensions are identical to those of CLM□-F.

L:Left side F:Front side R:Right side



- Clamp arm and mounting screws are not included.

mm

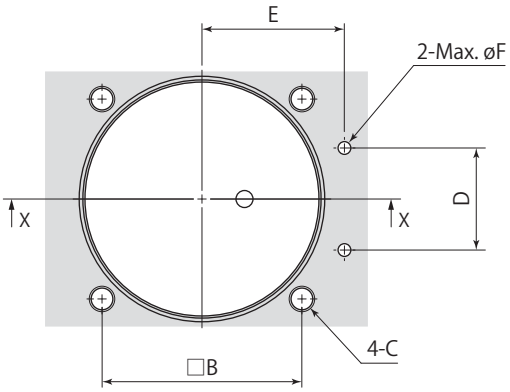
| Model | | CLM04-□T | CLM05-□T | CLM06-□T | CLM10-□T | CLM16-□T |
|---|---|---|---|---|---|---|
| A | | 96.5 | 106 | 108 | 124 | 139.5 |
| B | | 45 | 51 | 60 | 70 | 85 |
| C | | 54 | 61 | 69 | 81 | 94.5 |
| D | | 31.5 | 35.5 | 39 | 46 | 52 |
| E | | 22.5 | 25.5 | 30 | 35 | 42.5 |
| F | | 34 | 40 | 47 | 55 | 63 |
| øG | | 40 $^{-0.025}_{-0.050}$ | 48 $^{-0.025}_{-0.050}$ | 55 $^{-0.030}_{-0.060}$ | 65 $^{-0.030}_{-0.060}$ | 75 $^{-0.030}_{-0.060}$ |
| øGG | | 39.4 | 47.4 | 54.4 | 64.4 | 74.4 |
| øH | | 12 | 14 | 16 | 20 | 22 |
| K | | 41 | 43 | 42.5 | 49 | 47.5 |
| KK | | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 |
| L | | 25 | 28 | 28 | 30 | 37 |
| M | | 50 | 57 | 59.5 | 67 | 82 |
| N | | 5.5 | 6 | 6 | 8 | 10 |
| R1 | | 11 | 12 | 12 | 13 | 16 |
| R2 | | 18 | 22 | 24 | 30 | 32 |
| R3 | | 26 | 30 | 33.5 | 39.5 | 45 |
| S | | 12.5 | 13.5 | 13.5 | 17.5 | 22 |
| øT | | 11 | 12 | 12 | 15 | 19 |
| U (width across flats) | | 6 | 6 | 8 | 10 | 11 |
| V | | 15.5 | 16.5 | 13.5 | 15.5 | 17.5 |
| V1 | | 11 | 13 | 15 | 19 | 25 |
| V2 | | 30.5 | 34.5 | 35.5 | 39 | 48 |
| V3 | | 22 | 26 | 30 | 35.5 | 43.5 |
| V4 | | 21 | 21 | 28 | 37 | 40 |
| øW | | 5.5 | 5.5 | 6.8 | 6.8 | 9 |
| W1 | | M6×1 | M6×1 | M8×1.25 | M8×1.25 | M10×1.5 |
| øX | | 9.5 | 9.5 | 11 | 11 | 14 |
| øY | | 72 | 81 | 88 | 106 | 116 |
| Y1 | | G1/8 | G1/8 | G1/8 | G1/8 | G1/4 |
| Y2 | | 3.8 | 3.8 | 3.8 | 3.8 | 4.8 |
| øY3 | | 14 | 14 | 14 | 14 | 19 |
| Z | | C3 | C3 | C3.5 | C4.5 | C10 |
| Z1 | | 15° | 15° | 15° | 12° | 15° |
| Z2 | | 32 | 38 | 45 | 53.5 | 65 |
| Z3 | | 16 | 19.5 | 22 | 27.5 | 32.5 |
| Z4 | | 2.5 | 2.5 | 2.5 | 3.3 | 3.3 |
| Z5 | | 30° | 30° | 30° | 30° | 10° |
| øB1 | | 6 $^{-0.010}_{-0.022}$ | 6 $^{-0.010}_{-0.022}$ | 8 $^{-0.013}_{-0.028}$ | 10 $^{-0.013}_{-0.028}$ | 12 $^{-0.016}_{-0.034}$ |
| øB2 | | 6 $^{-0.010}_{-0.022}$ | 6 $^{-0.010}_{-0.022}$ | 6 $^{-0.010}_{-0.022}$ | 8 $^{-0.013}_{-0.028}$ | 10 $^{-0.013}_{-0.028}$ |
| B3 (snap ring)*1 | | STW-6 | STW-6 | STW-8 | STW-10 | STW-12 |
| B4 (snap ring)*1 | | STW-6 | STW-6 | STW-6 | STW-8 | STW-10 |
| CA | | 44.5 | 51 | 53.5 | 59 | 72 |
| CB | | 50.2 | 61.2 | 71.7 | 78.7 | 90.8 |
| CC | | 77.7 | 92.4 | 101.9 | 111.4 | 130.8 |
| CD | | About 70° | About 71° | About 70° | About 70° | About 69° |
| HA | | 12 | 12 | 16 | 19 | 22 |
| HG | | 16 | 18.5 | 21 | 24.5 | 30 |
| O-ring FA (fluorocarbon hardness Hs90) | | P5 | P5 | P5 | P7 | P7 |
| O-ring FB (fluorocarbon hardness Hs70) | | AS568-029 | AS568-031 | AS568-034 | AS568-037 | AS568-040 |
| O-ring FC (fluorocarbon hardness Hs70) | | AS568-028 | AS568-031 | AS568-033 | AS568-036 | AS568-039 |
| Flow control valve*2 | Meter-in | VCF01S | VCF01 | VCF01 | VCF01 | VCF02 |
| | Meter-out | VCF01S-O | VCF01-O | VCF01-O | VCF01-O | VCF02-O |
| Air bleeding valve*2 | | VCE01 | VCE01 | VCE01 | VCE01 | VCE02 |

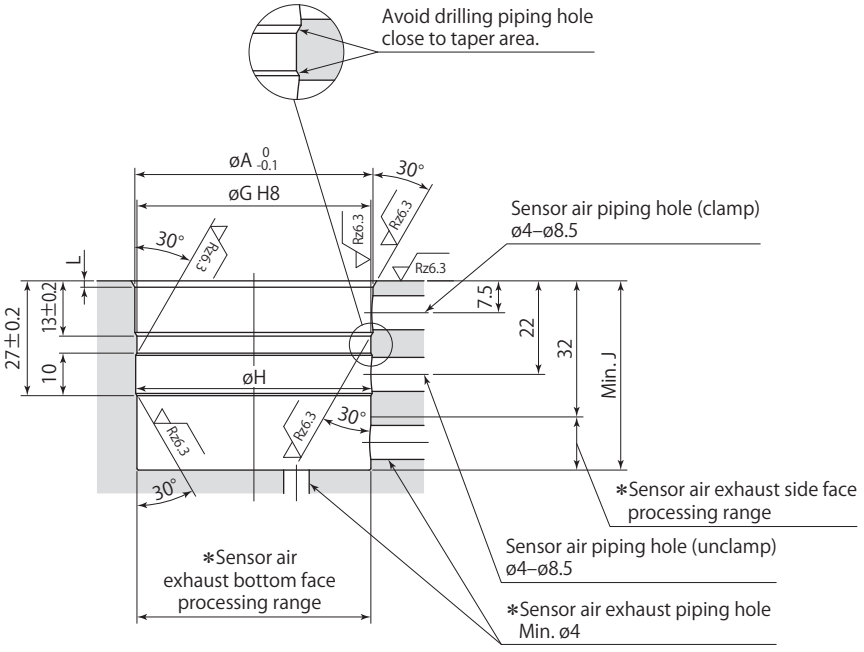
∗1：Snap ring is made by Ochiai Corporation.

∗2：Select the right model of VCF and VCE according to the size of the clamp.

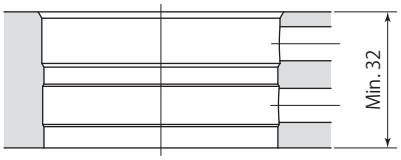
Refer to each page for the details of options. ● Flow control valve **page →154** ● Air bleeding valve **page →156**

## Mounting details




In blind hole X-X

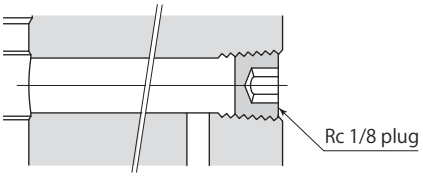



In through hole X-X

*: Sensor air exhaust piping hole must be made on either side or bottom face.

Rz: ISO4287(1997)

- Apply an appropriate amount of grease to the chamfer and the bore when mounting. Excessive grease may be a blockage in the air passage, causing malfunction of the sensor.
- The 30° taper machining must be provided to avoid the damage of the O-ring. Ensure that there are no interference on taper area when drilling the hole for sensor air.
- The sensor air piping hole can be used for a pilot hole of Rc 1/8 plug.



## Mounting details

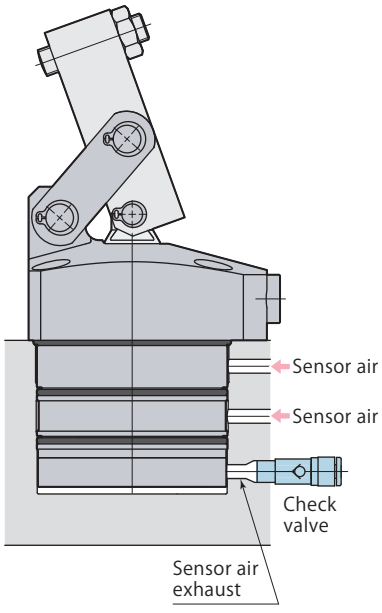
mm

| Model | CLM04-□T | CLM05-□T | CLM06-□T | CLM10-□T | CLM16-□T |
|---|---|---|---|---|---|
| øA | 40.8 | 49 | 56 | 66 | 76 |
| B | 34 | 40 | 47 | 55 | 63 |
| C | M5 | M5 | M6 | M6 | M8 |
| D | 18 | 22 | 24 | 30 | 32 |
| E | 26 | 30 | 33.5 | 39.5 | 45 |
| øF | 3 | 3 | 3 | 5 | 5 |
| øG | 40 $^{+0.039}_{0}$ | 48 $^{+0.039}_{0}$ | 55 $^{+0.046}_{0}$ | 65 $^{+0.046}_{0}$ | 75 $^{+0.046}_{0}$ |
| øH | 40.6 | 48.6 | 55.6 | 65.6 | 75.6 |
| J | 41.5 | 43.5 | 43 | 49.5 | 48 |
| L | 1.2 | 1.5 | 1.5 | 1.5 | 1.5 |

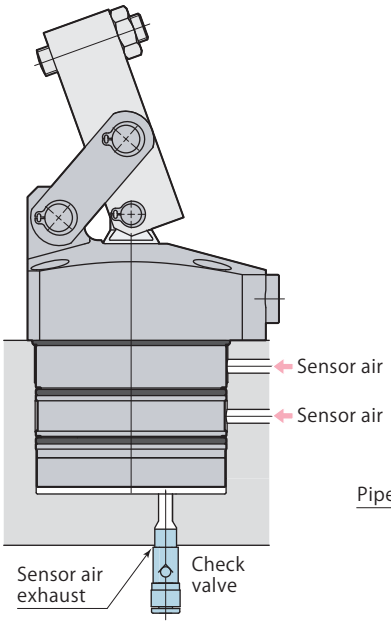
## Caution for piping

Refer to the diagram shown below for the sensor air exhaust port.

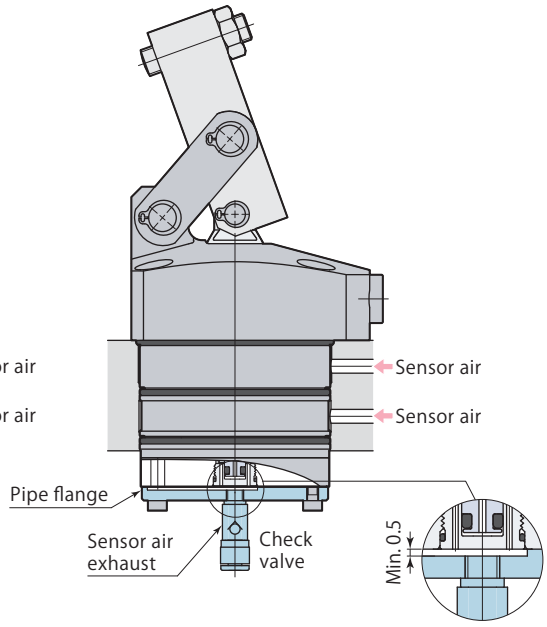
Mounting in blind hole
(Sensor air exhaust：side face)




Mounting in blind hole
(Sensor air exhaust：bottom face)



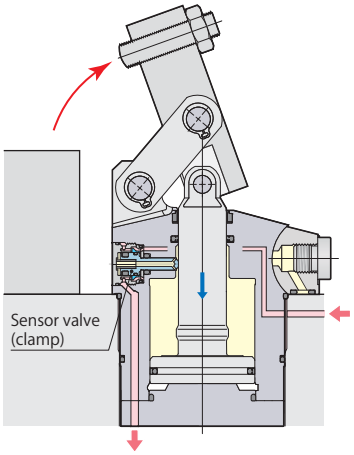

Mounting in through hole

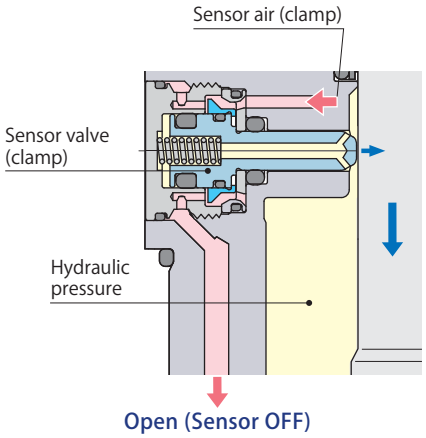



- Use a check valve with cracking pressure of 0.005 MPa or less if there is a risk of metal chips or coolant intrusion. Recommended check valve : AKH or AKB series manufactured by SMC.
- Furnish the piping by means of the pipe flange when mounting in a through hole. The flange is mountable with M3 threads at the bottom of the clamp. Be sure to provide an opening not to cover the exhaust port. See the sketch shown above.

## Clamp PAL sensor function and structure

### In the middle of clamp stroke

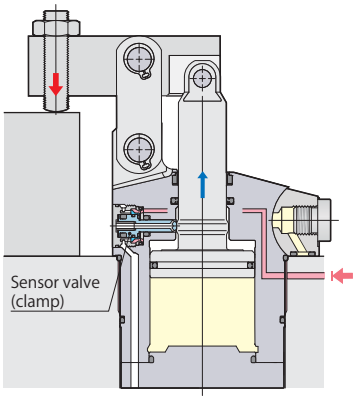


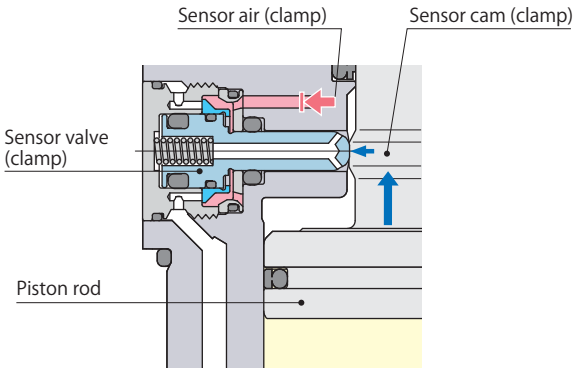




Open (Sensor OFF)

- The sensor valve (clamp) is pushed up by the hydraulic force to open for air exhaust while piston rod strokes.

### Clamp detection



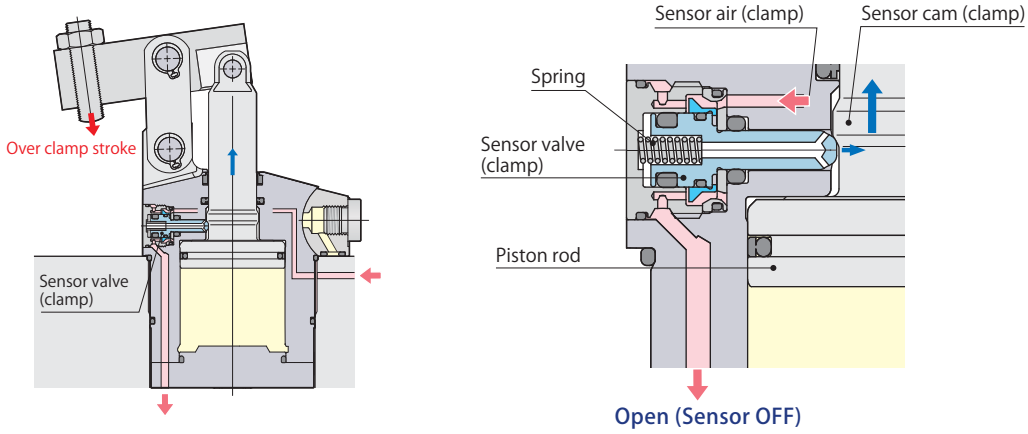




Close (Sensor ON)

- The sensor valve (clamp) is pushed down by the sensor cam (clamp) and shuts off the sensor air flow when the piston rod reaches the clamping point, and detects the clamped condition.

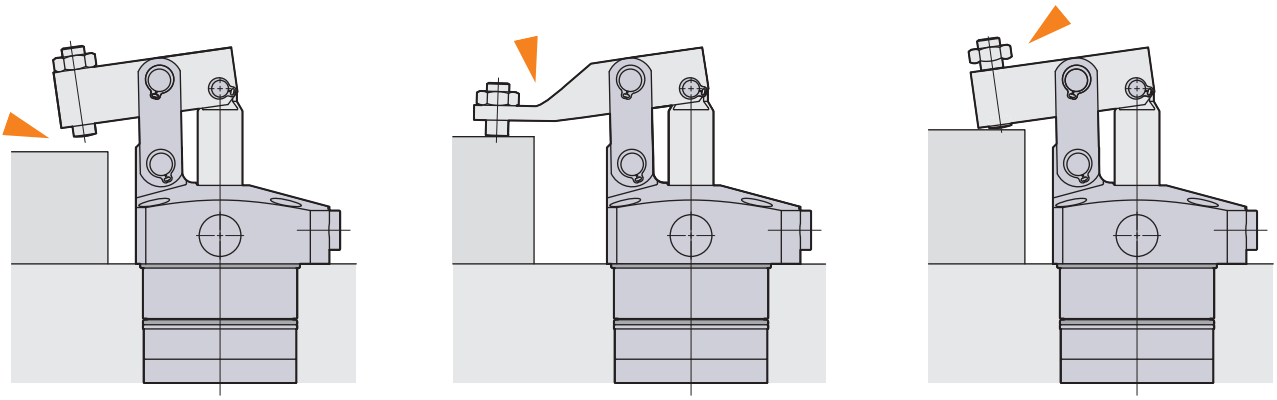
## Clamp PAL sensor function and structure

### Over clamp stroke (Incomplete clamp) detection




- The sensor cam passes the clamping point, the sensor valve (clamp) is pushed up by the spring and exhausts the sensor air, and detects the over clamp stroked condition.

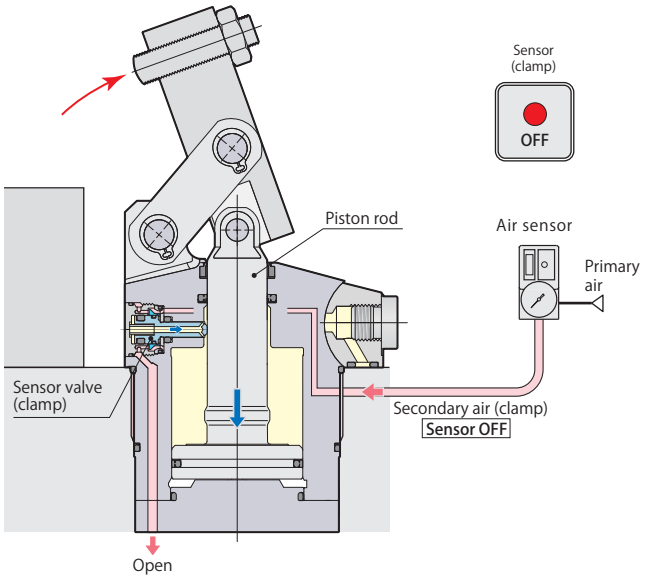
### Over clamp stroke (Incomplete clamp) detection example



- Clamp disabled due to missetting workpiece.
- Clamp disabled due to the deflection of clamp arm.
- Clamp disabled due to the damage of piston rod or loose adjustment bolt.
- Clamp disabled due to the abrasion on the tip of clamp arm during prolonged use.

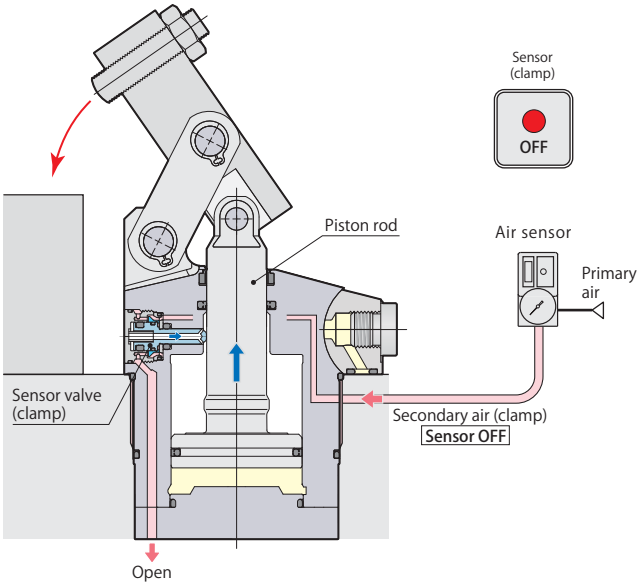
## Clamp, Over clamp stroke detection signal

### Unclamp



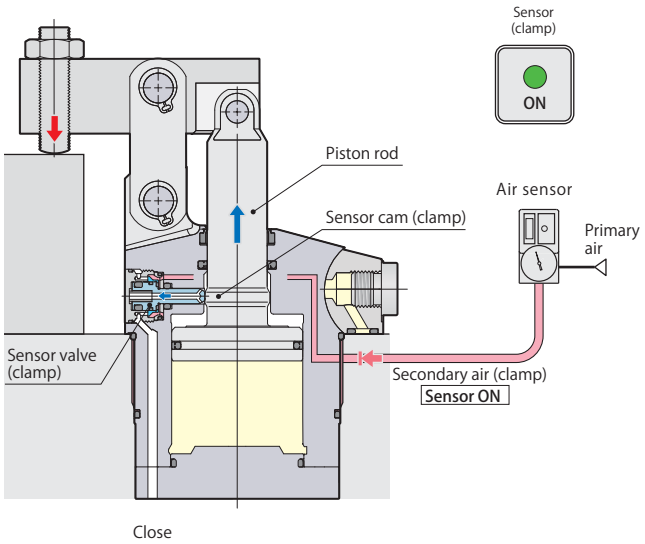

| Sensor signal (clamp) | OFF | Unclamp |
|---|---|---|

### In the middle of clamp stroke



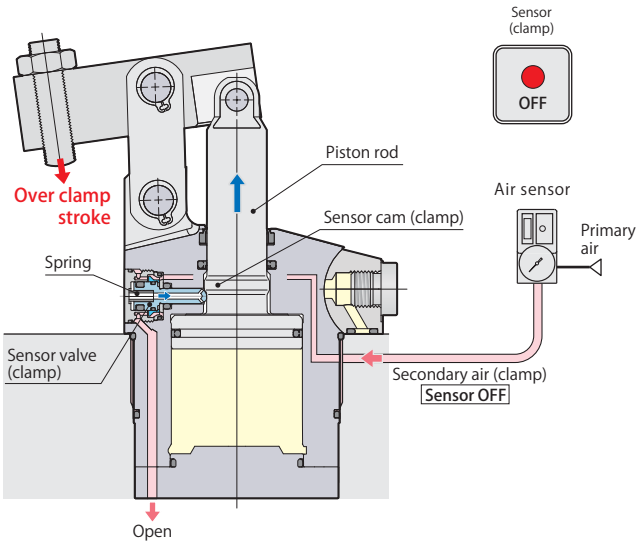

| Sensor signal (clamp) | OFF | In the middle of clamp stroke |
|---|---|---|

### Clamp detection



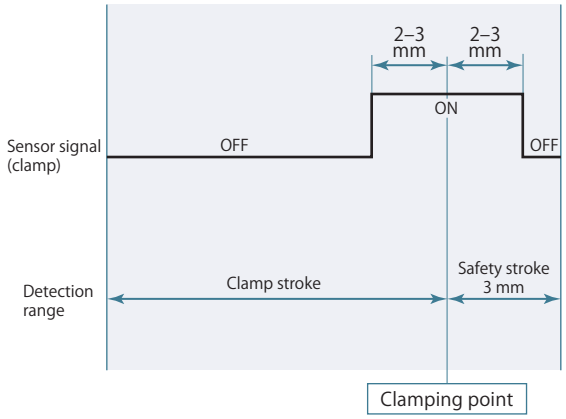

| Sensor signal (clamp) | ON | Clamp |
|---|---|---|

### Over clamp stroke (Incomplete clamp) detection




| Sensor signal (clamp) | OFF | Over clamp stroke (Incomplete clamp) |
|---|---|---|

## Air sensor triggering point



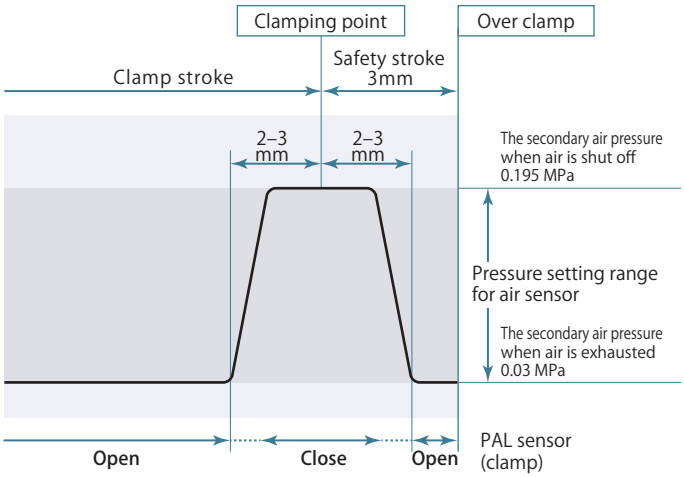

- Refer to the sensor supplier's instruction manual for the details of setting.
- Sensing performance such as detectable time and pressure differs depending on the supplier and model number of the sensor. Select the right model referring to sensor's application and characteristics.

## Air sensor recommended condition of use

| | |
|---|---|
| Supplier and model | ISA3-F/G series manufactured by SMC |
| | GPS2-05, GPS3-E series manufactured by CKD |
| Air supply pressure | 0.1–0.2 MPa |
| Inner diameter of piping | ø4 mm (ISA3-F：ø2.5 mm) |
| Overall piping length | 5 m or less |

- Supply the dry and filtered air. Particulate size 5 μm or less is recommended.
- Use a solenoid valve with needle for air sensor unit and control it supplying air all the time in order to eliminate intrusion of chips or coolant.
- There is a case that air sensing cannot be successfully made as designed when it is used out of the above usage. Contact Technical service center for more details.

## Relation between sensor air pressure, PAL sensor and piston stroke

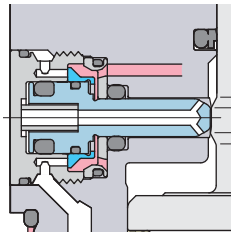



The diagram shown above indicates the relation between the PAL sensor, piston stroke, and secondary air pressure. (The pressure shown in the diagram is a reference based on the 0.2 MPa of primary air pressure for one piece of clamp.)

Since the new PAL sensor works with less air-leakage compared to previous sensor valve,

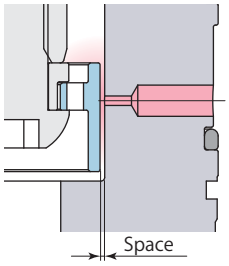
- Enhances the pressure setting range of the sensor which enables the sensor to set easily.
  (Ex. Pressure setting range 0.03–0.195 MPa in the diagram)
- Allows the use for a number of clamps by one air sensor because of better pressure holding when air is shut off. (Maximum number of clamps to be detected by one sensor is 10.)
- Allows to choose less air-consumed, i.e. small orifice diameter type, air sensor.
- Can create large differential-pressure when opening and closing the PAL sensor so that sensor primary pressure can be set as low as possible and reduce the consumption of air.

New PAL sensor



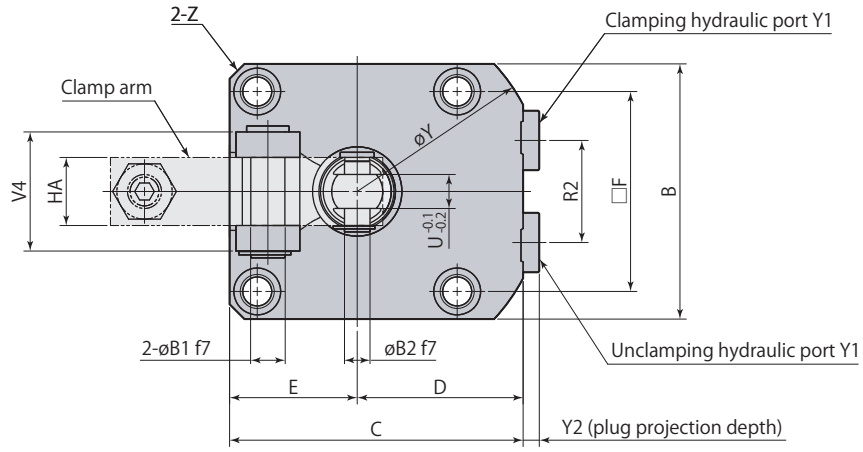
Poppet structure ensures superior sealing performance and can create large differential-pressure when the valve is opening and closing, and air leakage can be minimized.

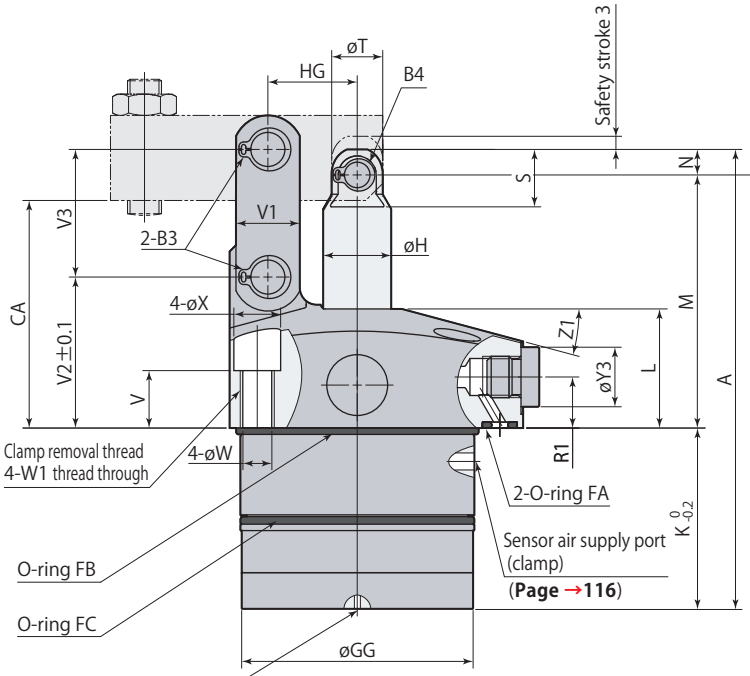
Previous sensor valve



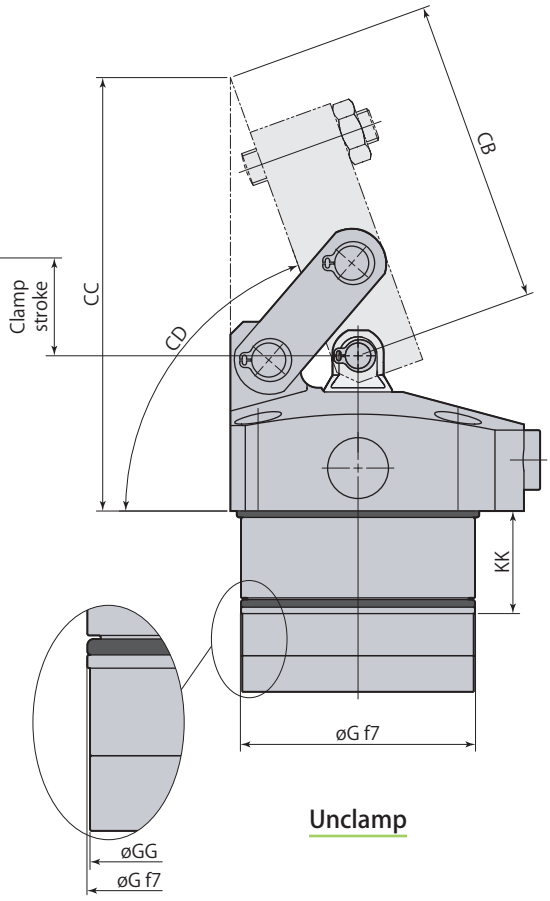

Air leaks easily due to a large space.

## Dimensions

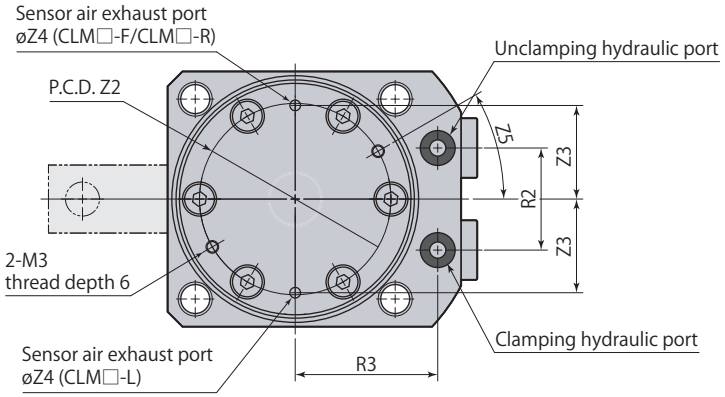



Clamp

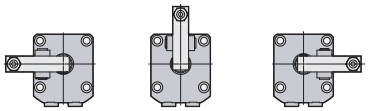



Unclamp




- This diagram represents external contour of CLM□-F. CLM□-L and CLM□-R differ only in terms of mounting direction of clamp arm and otherwise all dimensions are identical to those of CLM□-F.

L:Left side F:Front side R:Right side



- Clamp arm and mounting screws are not included.

mm

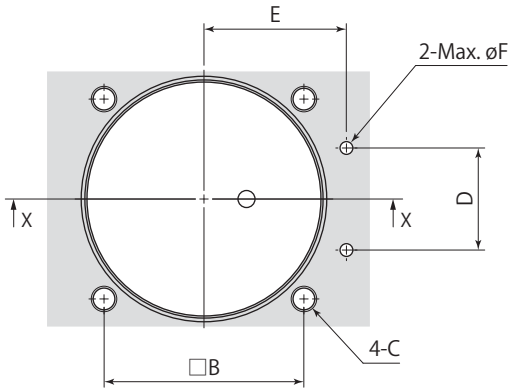
| Model | | CLM04-□C | CLM05-□C | CLM06-□C | CLM10-□C | CLM16-□C |
|---|---|---|---|---|---|---|
| A | | 96 | 106 | 108 | 124 | 139.5 |
| B | | 45 | 51 | 60 | 70 | 85 |
| C | | 54 | 61 | 69 | 81 | 94.5 |
| D | | 31.5 | 35.5 | 39 | 46 | 52 |
| E | | 22.5 | 25.5 | 30 | 35 | 42.5 |
| F | | 34 | 40 | 47 | 55 | 63 |
| øG | | 40 $^{-0.025}_{-0.050}$ | 48 $^{-0.025}_{-0.050}$ | 55 $^{-0.030}_{-0.060}$ | 65 $^{-0.030}_{-0.060}$ | 75 $^{-0.030}_{-0.060}$ |
| øGG | | 39.4 | 47.4 | 54.4 | 64.4 | 74.4 |
| øH | | 12 | 14 | 16 | 20 | 22 |
| K | | 40.5 | 43 | 42.5 | 49 | 47.5 |
| KK | | 19.5 | 21 | 23.5 | 25 | 25 |
| L | | 25 | 28 | 28 | 30 | 37 |
| M | | 50 | 57 | 59.5 | 67 | 82 |
| N | | 5.5 | 6 | 6 | 8 | 10 |
| R1 | | 11 | 12 | 12 | 13 | 16 |
| R2 | | 18 | 22 | 24 | 30 | 32 |
| R3 | | 26 | 30 | 33.5 | 39.5 | 45 |
| S | | 12.5 | 13.5 | 13.5 | 17.5 | 22 |
| øT | | 11 | 12 | 12 | 15 | 19 |
| U (width across flats) | | 6 | 6 | 8 | 10 | 11 |
| V | | 15.5 | 16.5 | 13.5 | 15.5 | 17.5 |
| V1 | | 11 | 13 | 15 | 19 | 25 |
| V2 | | 30.5 | 34.5 | 35.5 | 39 | 48 |
| V3 | | 22 | 26 | 30 | 35.5 | 43.5 |
| V4 | | 21 | 21 | 28 | 37 | 40 |
| øW | | 5.5 | 5.5 | 6.8 | 6.8 | 9 |
| W1 | | M6×1 | M6×1 | M8×1.25 | M8×1.25 | M10×1.5 |
| øX | | 9.5 | 9.5 | 11 | 11 | 14 |
| øY | | 72 | 81 | 88 | 106 | 116 |
| Y1 | | G1/8 | G1/8 | G1/8 | G1/8 | G1/4 |
| Y2 | | 3.8 | 3.8 | 3.8 | 3.8 | 4.8 |
| øY3 | | 14 | 14 | 14 | 14 | 19 |
| Z | | C3 | C3 | C3.5 | C4.5 | C10 |
| Z1 | | 15° | 15° | 15° | 12° | 15° |
| Z2 | | 32 | 38 | 45 | 53.5 | 65 |
| Z3 | | 16 | 19.5 | 22 | 27.5 | 32.5 |
| Z4 | | 2.5 | 2.5 | 2.5 | 3.3 | 3.3 |
| Z5 | | 30° | 30° | 30° | 30° | 10° |
| øB1 | | 6 $^{-0.010}_{-0.022}$ | 6 $^{-0.010}_{-0.022}$ | 8 $^{-0.013}_{-0.028}$ | 10 $^{-0.013}_{-0.028}$ | 12 $^{-0.016}_{-0.034}$ |
| øB2 | | 6 $^{-0.010}_{-0.022}$ | 6 $^{-0.010}_{-0.022}$ | 6 $^{-0.010}_{-0.022}$ | 8 $^{-0.013}_{-0.028}$ | 10 $^{-0.013}_{-0.028}$ |
| B3 (snap ring)*1 | | STW-6 | STW-6 | STW-8 | STW-10 | STW-12 |
| B4 (snap ring)*1 | | STW-6 | STW-6 | STW-6 | STW-8 | STW-10 |
| CA | | 44.5 | 51 | 53.5 | 59 | 72 |
| CB | | 50.2 | 61.2 | 71.7 | 78.7 | 90.8 |
| CC | | 77.7 | 92.4 | 101.9 | 111.4 | 130.8 |
| CD | | About 70° | About 71° | About 70° | About 70° | About 69° |
| HA | | 12 | 12 | 16 | 19 | 22 |
| HG | | 16 | 18.5 | 21 | 24.5 | 30 |
| O-ring FA (fluorocarbon hardness Hs90) | | P5 | P5 | P5 | P7 | P7 |
| O-ring FB (fluorocarbon hardness Hs70) | | AS568-029 | AS568-031 | AS568-034 | AS568-037 | AS568-040 |
| O-ring FC (fluorocarbon hardness Hs70) | | AS568-028 | AS568-031 | AS568-033 | AS568-036 | AS568-039 |
| Flow control valve*2 | Meter-in | VCF01S | VCF01 | VCF01 | VCF01 | VCF02 |
| | Meter-out | VCF01S-O | VCF01-O | VCF01-O | VCF01-O | VCF02-O |
| Air bleeding valve*2 | | VCE01 | VCE01 | VCE01 | VCE01 | VCE02 |

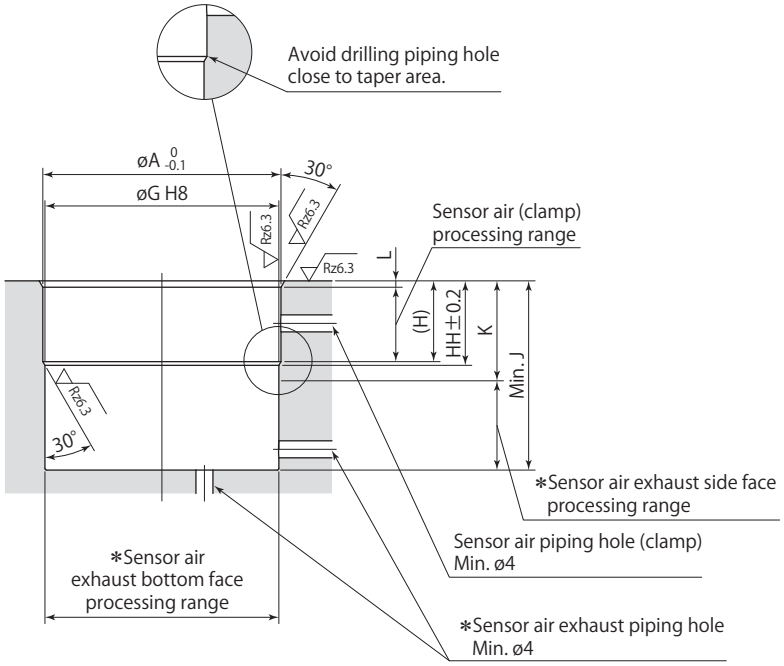
∗1：Snap ring is made by Ochiai Corporation.

∗2：Select the right model of VCF and VCE according to the size of the clamp.

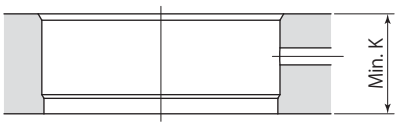
Refer to each page for the details of options. ● Flow control valve **page →154** ● Air bleeding valve **page →156**

## Mounting details




In blind hole X-X




In through hole X-X

*: Sensor air exhaust piping hole must be made on either side or bottom face.

Rz: ISO4287(1997)

- Apply an appropriate amount of grease to the chamfer and the bore when mounting. Excessive grease may be a blockage in the air passage, causing malfunction of the sensor.
- The 30° taper machining must be provided to avoid the damage of the O-ring. Ensure that there are no interference on taper area when drilling the hole for sensor air.

## Mounting details

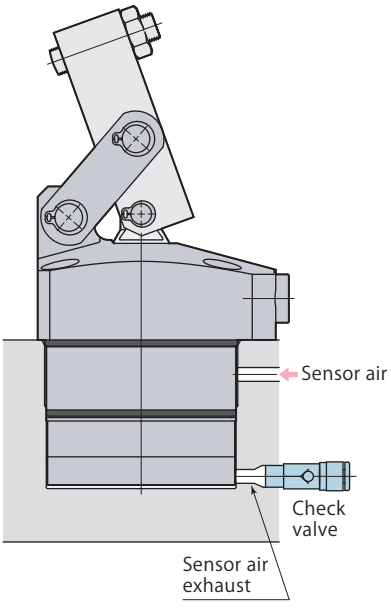
mm

| Model | CLM04-□C | CLM05-□C | CLM06-□C | CLM10-□C | CLM16-□C |
|---|---|---|---|---|---|
| øA | 40.8 | 49 | 56 | 66 | 76 |
| B | 34 | 40 | 47 | 55 | 63 |
| C | M5 | M5 | M6 | M6 | M8 |
| D | 18 | 22 | 24 | 30 | 32 |
| E | 26 | 30 | 33.5 | 39.5 | 45 |
| øF | 3 | 3 | 3 | 5 | 5 |
| øG | $40^{+0.039}_{0}$ | $48^{+0.039}_{0}$ | $55^{+0.046}_{0}$ | $65^{+0.046}_{0}$ | $75^{+0.046}_{0}$ |
| H | 15 | 16.5 | 19 | 20.5 | 20.5 |
| HH | 15.7 | 17.4 | 19.9 | 21.4 | 21.4 |
| J | 41 | 43.5 | 43 | 49.5 | 48 |
| K | 19.5 | 21 | 23.5 | 25 | 25 |
| L | 1.2 | 1.5 | 1.5 | 1.5 | 1.5 |

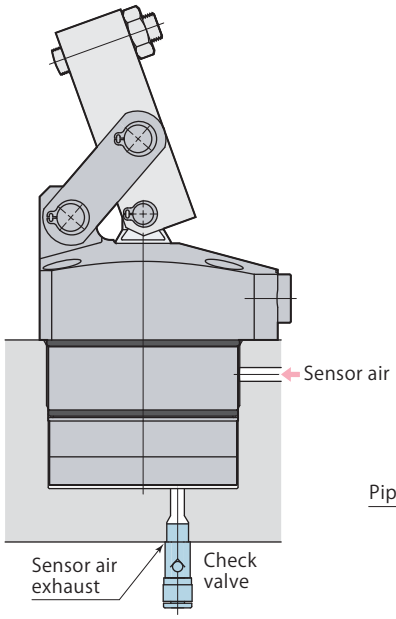
## Caution for piping

Refer to the diagram shown below for the sensor air exhaust port.

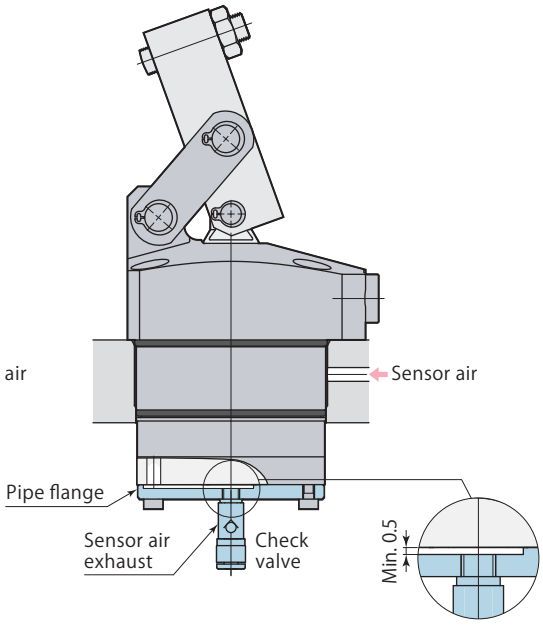
Mounting in blind hole
(Sensor air exhaust：side face)




Mounting in blind hole
(Sensor air exhaust：bottom face)



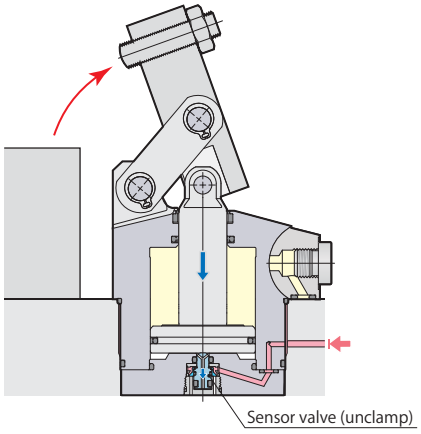

Mounting in through hole

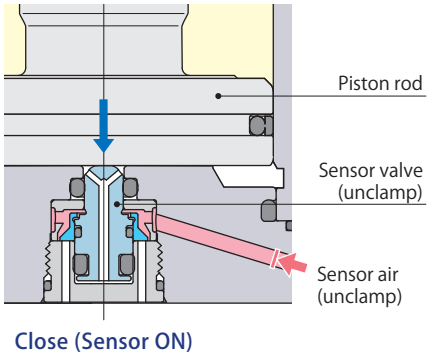



- Use a check valve with cracking pressure of 0.005 MPa or less if there is a risk of metal chips or coolant intrusion. Recommended check valve : AKH or AKB series manufactured by SMC.
- Furnish the piping by means of the pipe flange when mounting in a through hole. The flange is mountable with M3 threads at the bottom of the clamp. Be sure to provide an opening not to cover the exhaust port. See the sketch shown above.

## Unclamp PAL sensor function and structure

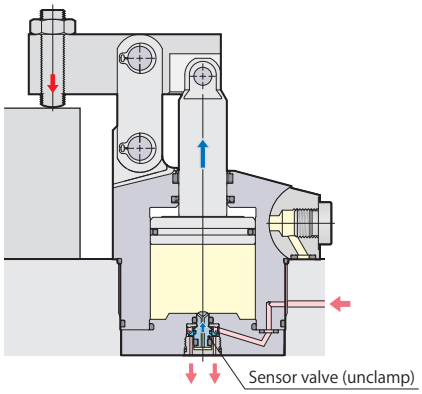
### Unclamp detection

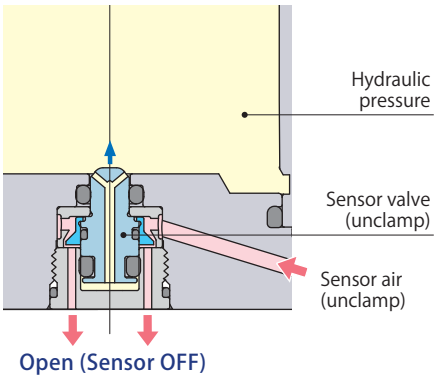



- The sensor valve (unclamp) is pushed down by the piston rod and shuts off the sensor air flow when the piston rod reaches the unclamp end, and detects the unclamped condition.

### In the middle of clamp stroke

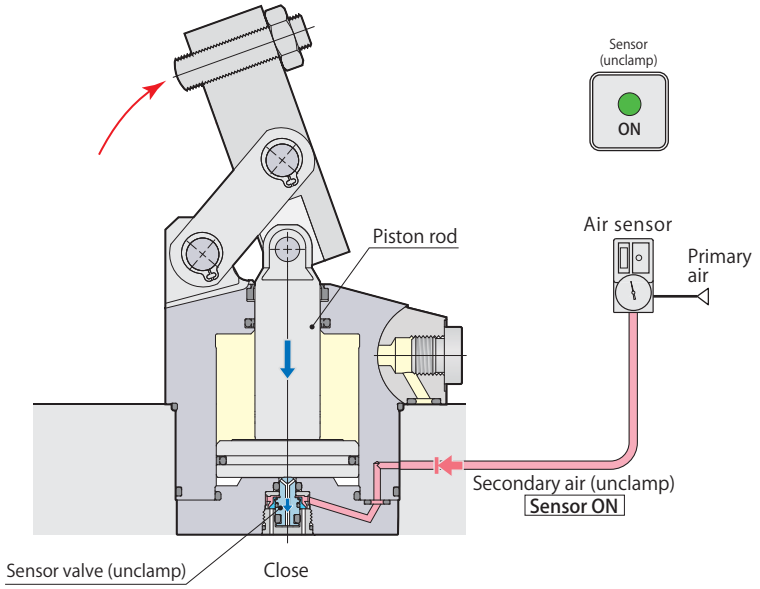



- The sensor valve (unclamp) is pushed up by the hydraulic force to open for air exhaust while piston rod strokes.

## Unclamp detection signal

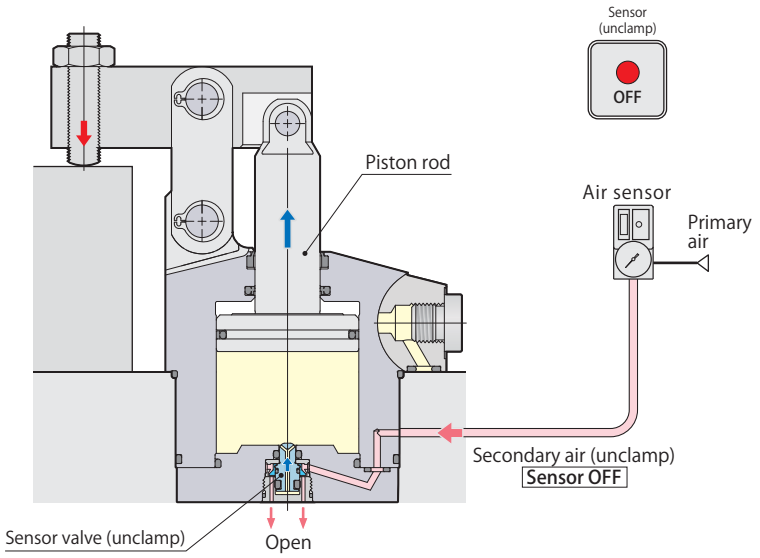
### Unclamp detection




The sensor may not work correctly when the cylinder is not pressurized by hydraulic force because the piston of the clamp moves under such environment. Keep supplying hydraulic force the cylinder all the times.

| Sensor signal (unclamp) | ON | Unclamp |
|---|---|---|

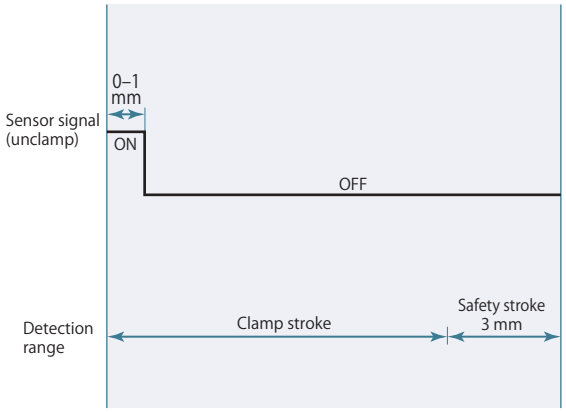
### In the middle of clamp stroke




| Sensor signal (unclamp) | OFF | Clamp, in the middle of clamp stroke |
|---|---|---|

More than 1.5MPa hydraulic pressure is required to operate the sensor valve. To obtain OFF signal in the middle of the valve stroke, over 1.5MPa of back pressure should be produced by using a meter-out type of flow control valve.

## Air sensor triggering point



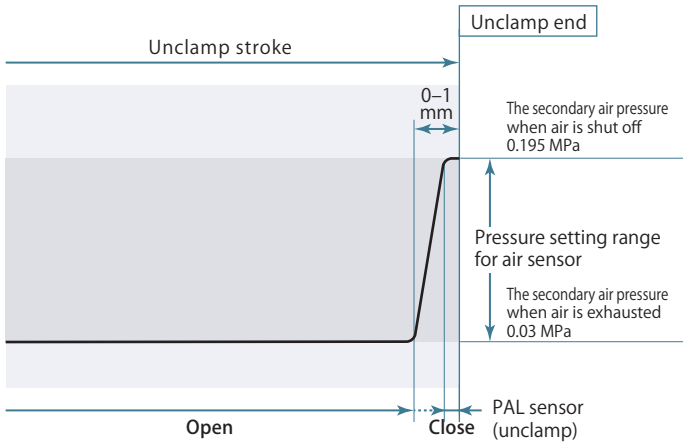

- Refer to the sensor supplier's instruction manual for the details of setting.
- Sensing performance such as detectable time and pressure differs depending on the supplier and model number of the sensor. Select the right model referring to sensor's application and characteristics.

## Air sensor recommended condition of use

| | |
|---|---|
| Supplier and model | ISA3-F/G series manufactured by SMC |
| | GPS2-05, GPS3-E series manufactured by CKD |
| Air supply pressure | 0.1–0.2 MPa |
| Inner diameter of piping | ø4 mm (ISA3-F：ø2.5 mm) |
| Overall piping length | 5 m or less |

- Supply the dry and filtered air. Particulate size 5 μm or less is recommended.
- Use a solenoid valve with needle for air sensor unit and control it supplying air all the time in order to eliminate intrusion of chips or coolant.
- There is a case that air sensing cannot be successfully made as designed when it is used out of the above usage. Contact Technical service center for more details.

## Relation between sensor air pressure, PAL sensor and piston stroke

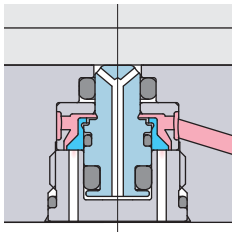



The diagram shown above indicates the relation between the PAL sensor, piston stroke, and secondary air pressure. (The pressure shown in the diagram is a reference based on the 0.2 MPa of primary air pressure for one piece of clamp.)

Since the new PAL sensor works with less air-leakage compared to previous sensor valve,

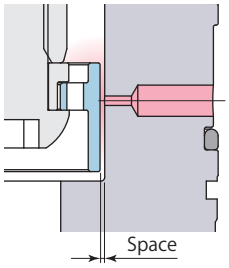
- Enhances the pressure setting range of the sensor which enables the sensor to set easily. (Ex. Pressure setting range 0.03–0.195 MPa in the diagram)
- Allows the use for a number of clamps by one air sensor because of better pressure holding when air is shut off. (Maximum number of clamps to be detected by one sensor is 10.)
- Allows to choose less air-consumed, i.e. small orifice diameter type, air sensor.
- Can create large differential-pressure when opening and closing the PAL sensor so that sensor primary pressure can be set as low as possible and reduce the consumption of air.

New PAL sensor



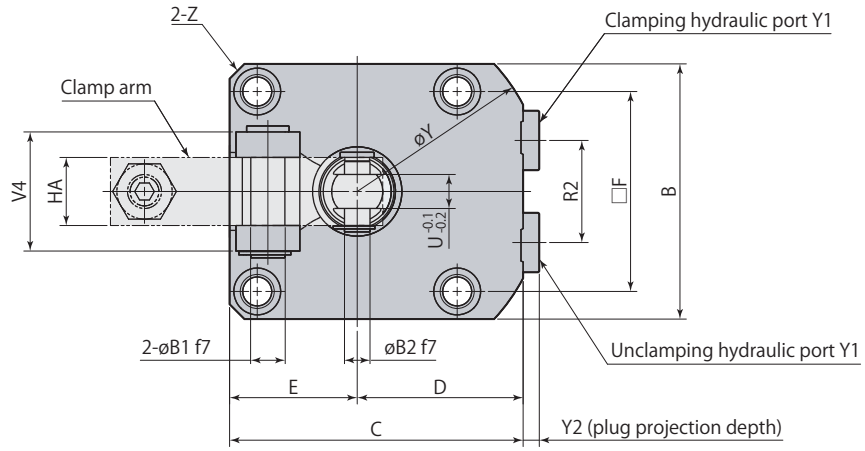
Poppet structure ensures superior sealing performance and can create large differential-pressure when the valve is opening and closing, and air leakage can be minimized.

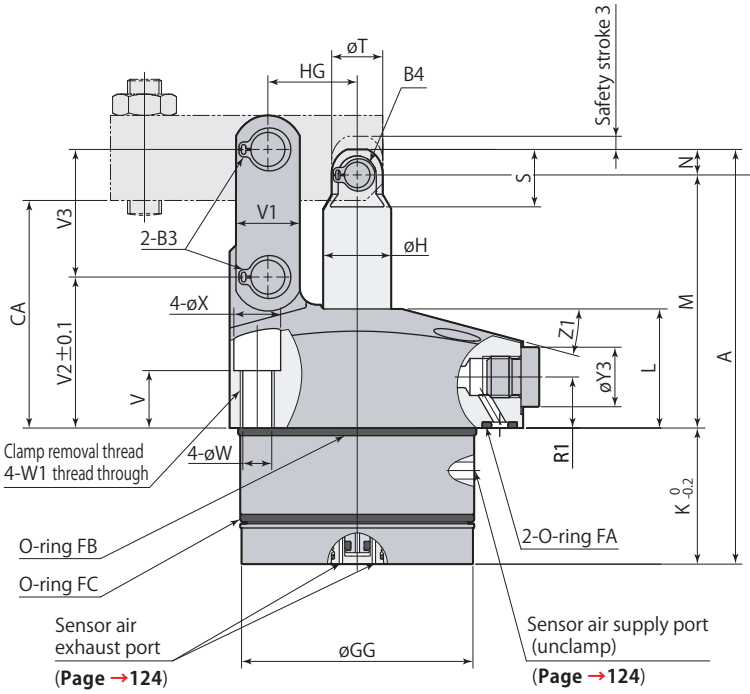
Previous sensor valve



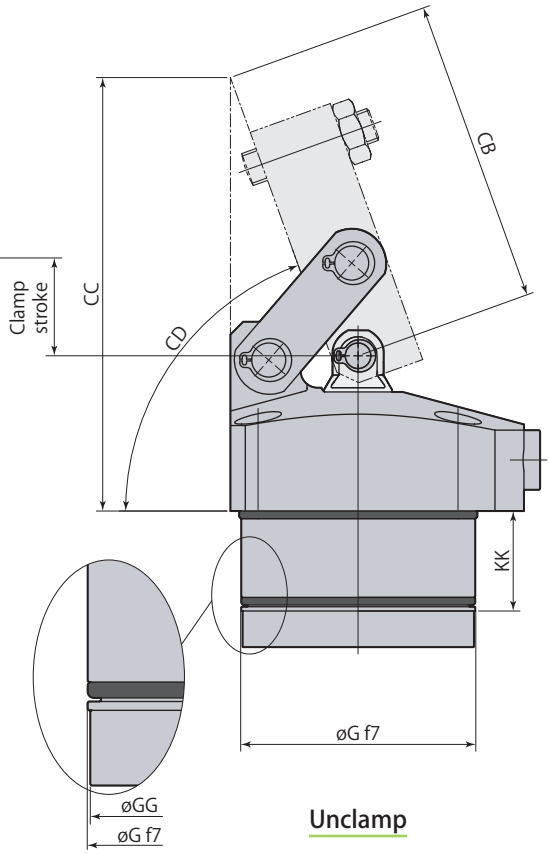

Air leaks easily due to a large space.

## Dimensions

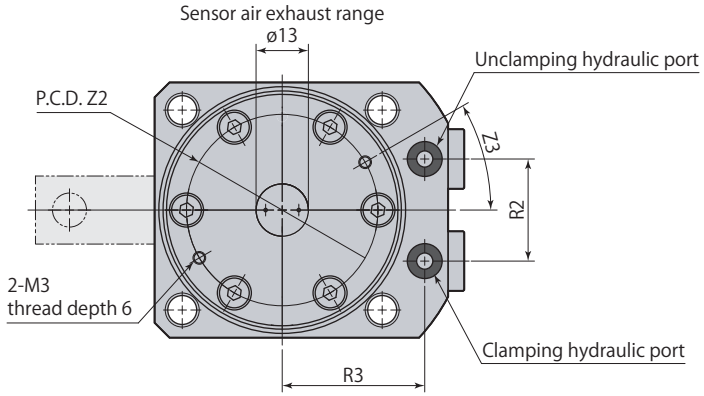



Clamp

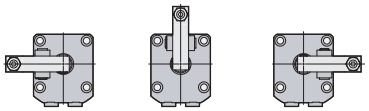



Unclamp




- This diagram represents external contour of CLM□-F. CLM□-L and CLM□-R differ only in terms of mounting direction of clamp arm and otherwise all dimensions are identical to those of CLM□-F.

L : Left side F : Front side R : Right side



- Clamp arm and mounting screws are not included.

mm

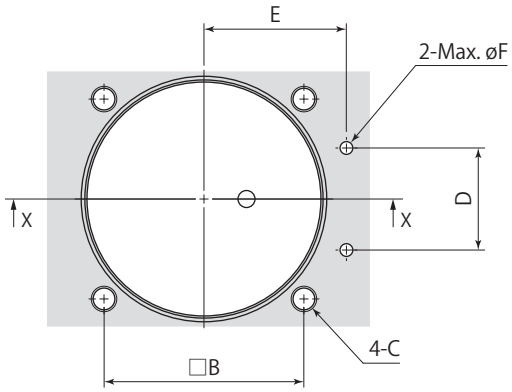
| Model | CLM04-□B | CLM05-□B | CLM06-□B | CLM10-□B | CLM16-□B |
|---|---|---|---|---|---|
| A | 83 | 92.5 | 97.5 | 113.5 | 132.5 |
| B | 45 | 51 | 60 | 70 | 85 |
| C | 54 | 61 | 69 | 81 | 94.5 |
| D | 31.5 | 35.5 | 39 | 46 | 52 |
| E | 22.5 | 25.5 | 30 | 35 | 42.5 |
| F | 34 | 40 | 47 | 55 | 63 |
| øG | $40^{-0.025}_{-0.050}$ | $48^{-0.025}_{-0.050}$ | $55^{-0.030}_{-0.060}$ | $65^{-0.030}_{-0.060}$ | $75^{-0.030}_{-0.060}$ |
| øGG | 39.4 | 47.4 | 54.4 | 64.4 | 74.4 |
| øH | 12 | 14 | 16 | 20 | 22 |
| K | 27.5 | 29.5 | 32 | 38.5 | 40.5 |
| KK | 19.5 | 21 | 23.5 | 25 | 25 |
| L | 25 | 28 | 28 | 30 | 37 |
| M | 50 | 57 | 59.5 | 67 | 82 |
| N | 5.5 | 6 | 6 | 8 | 10 |
| R1 | 11 | 12 | 12 | 13 | 16 |
| R2 | 18 | 22 | 24 | 30 | 32 |
| R3 | 26 | 30 | 33.5 | 39.5 | 45 |
| S | 12.5 | 13.5 | 13.5 | 17.5 | 22 |
| øT | 11 | 12 | 12 | 15 | 19 |
| U (width across flats) | 6 | 6 | 8 | 10 | 11 |
| V | 15.5 | 16.5 | 13.5 | 15.5 | 17.5 |
| V1 | 11 | 13 | 15 | 19 | 25 |
| V2 | 30.5 | 34.5 | 35.5 | 39 | 48 |
| V3 | 22 | 26 | 30 | 35.5 | 43.5 |
| V4 | 21 | 21 | 28 | 37 | 40 |
| øW | 5.5 | 5.5 | 6.8 | 6.8 | 9 |
| W1 | M6×1 | M6×1 | M8×1.25 | M8×1.25 | M10×1.5 |
| øX | 9.5 | 9.5 | 11 | 11 | 14 |
| øY | 72 | 81 | 88 | 106 | 116 |
| Y1 | G1/8 | G1/8 | G1/8 | G1/8 | G1/4 |
| Y2 | 3.8 | 3.8 | 3.8 | 3.8 | 4.8 |
| øY3 | 14 | 14 | 14 | 14 | 19 |
| Z | C3 | C3 | C3.5 | C4.5 | C10 |
| Z1 | 15° | 15° | 15° | 12° | 15° |
| Z2 | 32 | 38 | 45 | 53.5 | 65 |
| Z3 | 30° | 30° | 30° | 30° | 10° |
| øB1 | $6^{-0.010}_{-0.022}$ | $6^{-0.010}_{-0.022}$ | $8^{-0.013}_{-0.028}$ | $10^{-0.013}_{-0.028}$ | $12^{-0.016}_{-0.034}$ |
| øB2 | $6^{-0.010}_{-0.022}$ | $6^{-0.010}_{-0.022}$ | $6^{-0.010}_{-0.022}$ | $8^{-0.013}_{-0.028}$ | $10^{-0.013}_{-0.028}$ |
| B3 (snap ring)*1 | STW-6 | STW-6 | STW-8 | STW-10 | STW-12 |
| B4 (snap ring)*1 | STW-6 | STW-6 | STW-6 | STW-8 | STW-10 |
| CA | 44.5 | 51 | 53.5 | 59 | 72 |
| CB | 50.2 | 61.2 | 71.7 | 78.7 | 90.8 |
| CC | 77.7 | 92.4 | 101.9 | 111.4 | 130.8 |
| CD | About 70° | About 71° | About 70° | About 70° | About 69° |
| HA | 12 | 12 | 16 | 19 | 22 |
| HG | 16 | 18.5 | 21 | 24.5 | 30 |
| O-ring FA (fluorocarbon hardness Hs90) | P5 | P5 | P5 | P7 | P7 |
| O-ring FB (fluorocarbon hardness Hs70) | AS568-029 | AS568-031 | AS568-034 | AS568-037 | AS568-040 |
| O-ring FC (fluorocarbon hardness Hs70) | AS568-028 | AS568-031 | AS568-033 | AS568-036 | AS568-039 |
| Flow control valve*2 Meter-in | VCF01S | VCF01 | VCF01 | VCF01 | VCF02 |
| Flow control valve*2 Meter-out | VCF01S-O | VCF01-O | VCF01-O | VCF01-O | VCF02-O |
| Air bleeding valve*2 | VCE01 | VCE01 | VCE01 | VCE01 | VCE02 |

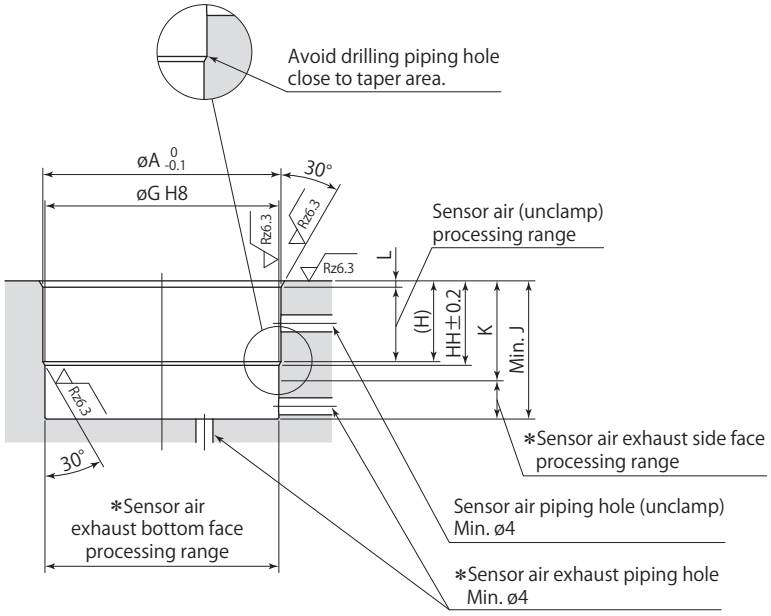
*1: Snap ring is made by Ochiai Corporation.

*2: Select the right model of VCF and VCE according to the size of the clamp.

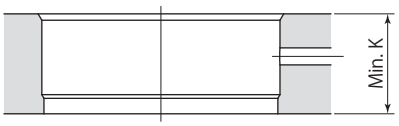
Refer to each page for the details of options. ● Flow control valve **page →154** ● Air bleeding valve **page →156**

## Mounting details




In blind hole X-X




In through hole X-X

*: Sensor air exhaust piping hole must be made on either side or bottom face.

Rz: ISO4287(1997)

- Apply an appropriate amount of grease to the chamfer and the bore when mounting. Excessive grease may be a blockage in the air passage, causing malfunction of the sensor.
- The 30° taper machining must be provided to avoid the damage of the O-ring. Ensure that there are no interference on taper area when drilling the hole for sensor air.

## Mounting details

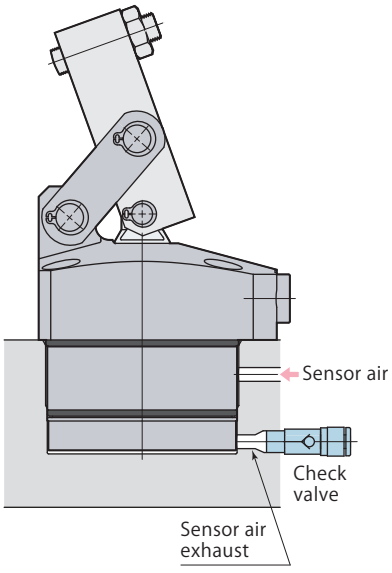
mm

| Model | CLM04-□B | CLM05-□B | CLM06-□B | CLM10-□B | CLM16-□B |
|---|---|---|---|---|---|
| øA | 40.8 | 49 | 56 | 66 | 76 |
| B | 34 | 40 | 47 | 55 | 63 |
| C | M5 | M5 | M6 | M6 | M8 |
| D | 18 | 22 | 24 | 30 | 32 |
| E | 26 | 30 | 33.5 | 39.5 | 45 |
| øF | 3 | 3 | 3 | 5 | 5 |
| øG | 40 $^{+0.039}_{0}$ | 48 $^{+0.039}_{0}$ | 55 $^{+0.046}_{0}$ | 65 $^{+0.046}_{0}$ | 75 $^{+0.046}_{0}$ |
| H | 15 | 16.5 | 19 | 20.5 | 20.5 |
| HH | 15.7 | 17.4 | 19.9 | 21.4 | 21.4 |
| J | 28 | 30 | 32.5 | 39 | 41 |
| K | 19.5 | 21 | 23.5 | 25 | 25 |
| L | 1.2 | 1.5 | 1.5 | 1.5 | 1.5 |

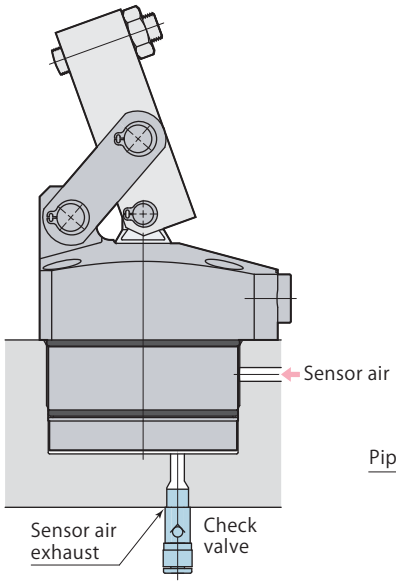
## Caution for piping

Refer to the diagram shown below for the sensor air exhaust port.

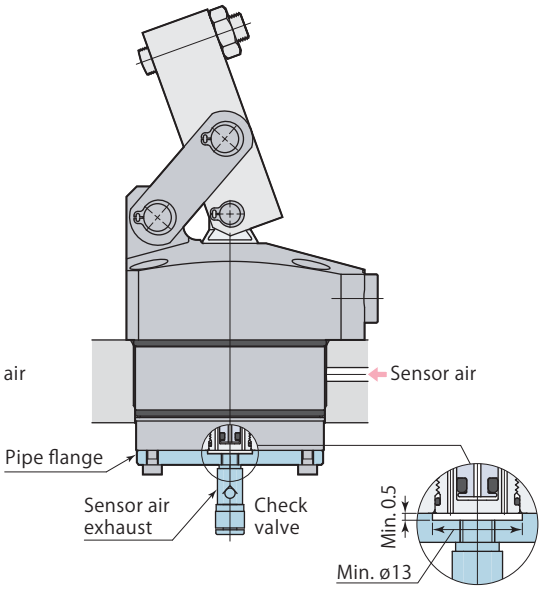
Mounting in blind hole
(Sensor air exhaust：side face)




Mounting in blind hole
(Sensor air exhaust：bottom face)

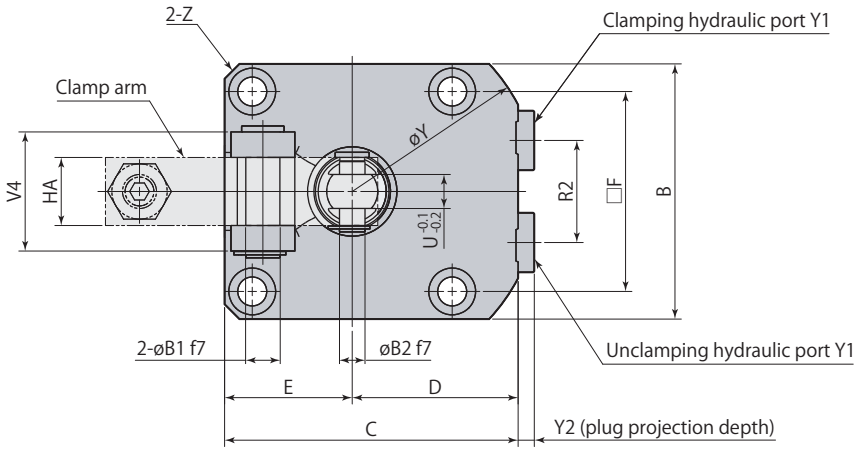


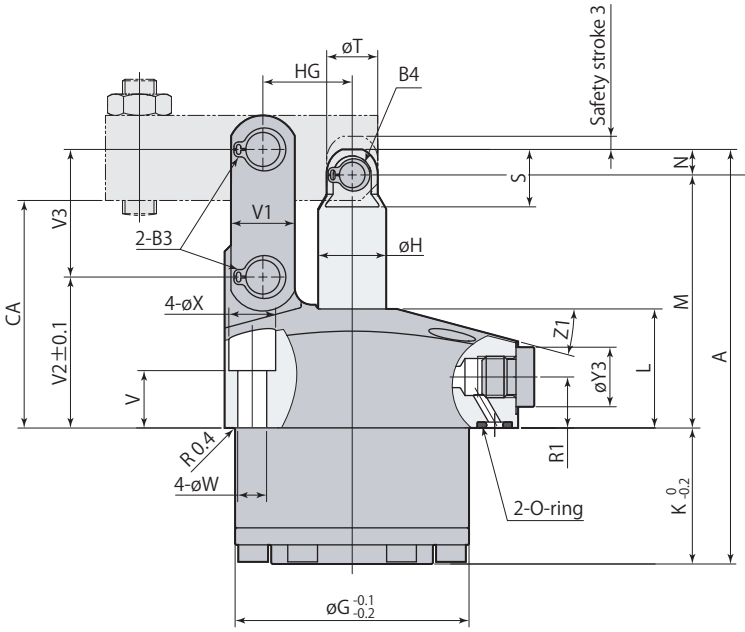

Mounting in through hole



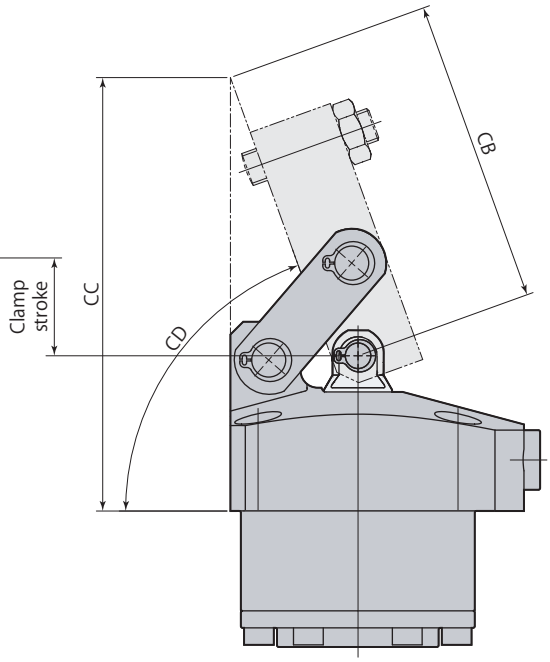

- Use a check valve with cracking pressure of 0.005 MPa or less if there is a risk of metal chips or coolant intrusion. Recommended check valve : AKH or AKB series manufactured by SMC.
- Furnish the piping by means of the pipe flange when mounting in a through hole. The flange is mountable with M3 threads at the bottom of the clamp. Be sure to provide an opening not to cover the exhaust port. See the sketch shown above.

## Dimensions

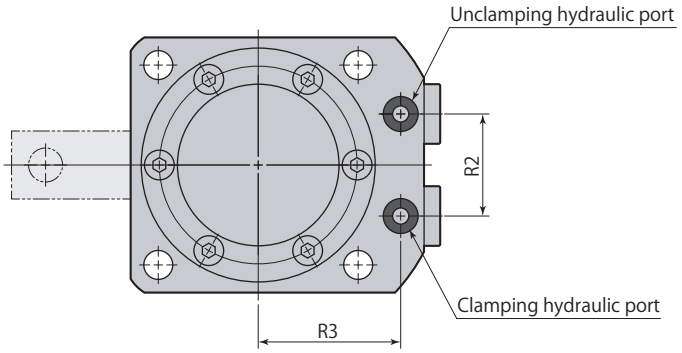



Clamp

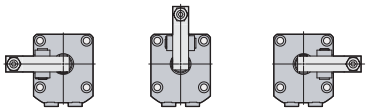



Unclamp




- This diagram represents external contour of CLM□-F. CLM□-L and CLM□-R differ only in terms of mounting direction of clamp arm and otherwise all dimensions are identical to those of CLM□-F.

L：Left side F：Front side R：Right side



- Clamp arm and mounting screws are not included.

mm

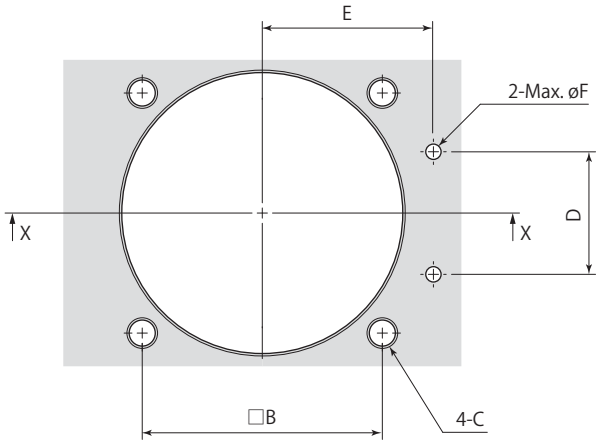
| Model | | CLM04-□N | CLM05-□N | CLM06-□N | CLM10-□N | CLM16-□N |
|---|---|---|---|---|---|---|
| A | | 83 | 92.5 | 97.5 | 113.5 | 132.5 |
| B | | 45 | 51 | 60 | 70 | 85 |
| C | | 54 | 61 | 69 | 81 | 94.5 |
| D | | 31.5 | 35.5 | 39 | 46 | 52 |
| E | | 22.5 | 25.5 | 30 | 35 | 42.5 |
| F | | 34 | 40 | 47 | 55 | 63 |
| øG | | 40 | 48 | 55 | 65 | 75 |
| øH | | 12 | 14 | 16 | 20 | 22 |
| K | | 27.5 | 29.5 | 32 | 38.5 | 40.5 |
| L | | 25 | 28 | 28 | 30 | 37 |
| M | | 50 | 57 | 59.5 | 67 | 82 |
| N | | 5.5 | 6 | 6 | 8 | 10 |
| R1 | | 11 | 12 | 12 | 13 | 16 |
| R2 | | 18 | 22 | 24 | 30 | 32 |
| R3 | | 26 | 30 | 33.5 | 39.5 | 45 |
| S | | 12.5 | 13.5 | 13.5 | 17.5 | 22 |
| øT | | 11 | 12 | 12 | 15 | 19 |
| U (width across flats) | | 6 | 6 | 8 | 10 | 11 |
| V | | 15.5 | 16.5 | 13.5 | 15.5 | 17.5 |
| V1 | | 11 | 13 | 15 | 19 | 25 |
| V2 | | 30.5 | 34.5 | 35.5 | 39 | 48 |
| V3 | | 22 | 26 | 30 | 35.5 | 43.5 |
| V4 | | 21 | 21 | 28 | 37 | 40 |
| øW | | 5.5 | 5.5 | 6.8 | 6.8 | 9 |
| øX | | 9.5 | 9.5 | 11 | 11 | 14 |
| øY | | 72 | 81 | 88 | 106 | 116 |
| Y1 | | G1/8 | G1/8 | G1/8 | G1/8 | G1/4 |
| Y2 | | 3.8 | 3.8 | 3.8 | 3.8 | 4.8 |
| øY3 | | 14 | 14 | 14 | 14 | 19 |
| Z | | C3 | C3 | C3.5 | C4.5 | C10 |
| Z1 | | 15° | 15° | 15° | 12° | 15° |
| øB1 | | $6^{-0.010}_{-0.022}$ | $6^{-0.010}_{-0.022}$ | $8^{-0.013}_{-0.028}$ | $10^{-0.013}_{-0.028}$ | $12^{-0.016}_{-0.034}$ |
| øB2 | | $6^{-0.010}_{-0.022}$ | $6^{-0.010}_{-0.022}$ | $6^{-0.010}_{-0.022}$ | $8^{-0.013}_{-0.028}$ | $10^{-0.013}_{-0.028}$ |
| B3 (snap ring)*1 | | STW-6 | STW-6 | STW-8 | STW-10 | STW-12 |
| B4 (snap ring)*1 | | STW-6 | STW-6 | STW-6 | STW-8 | STW-10 |
| CA | | 44.5 | 51 | 53.5 | 59 | 72 |
| CB | | 50.2 | 61.2 | 71.7 | 78.7 | 90.8 |
| CC | | 77.7 | 92.4 | 101.9 | 111.4 | 130.8 |
| CD | | About 70° | About 71° | About 70° | About 70° | About 69° |
| HA | | 12 | 12 | 16 | 19 | 22 |
| HG | | 16 | 18.5 | 21 | 24.5 | 30 |
| O-ring (fluorocarbon hardness Hs90) | | P5 | P5 | P5 | P7 | P7 |
| Flow control valve*2 | Meter-in | VCF01S | VCF01 | VCF01 | VCF01 | VCF02 |
| | Meter-out | VCF01S-O | VCF01-O | VCF01-O | VCF01-O | VCF02-O |
| Air bleeding valve*2 | | VCE01 | VCE01 | VCE01 | VCE01 | VCE02 |

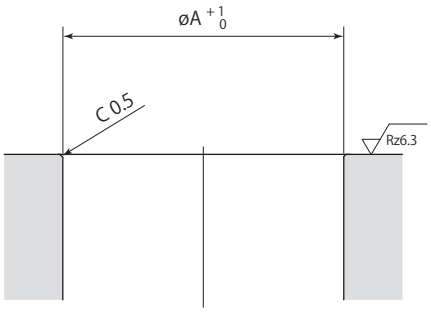
*1: Snap ring is made by Ochiai Corporation.

*2: Select the right model of VCF and VCE according to the size of the clamp.

Refer to each page for the details of options. ● Flow control valve **page →154** ● Air bleeding valve **page →156**

## Mounting details




X-X

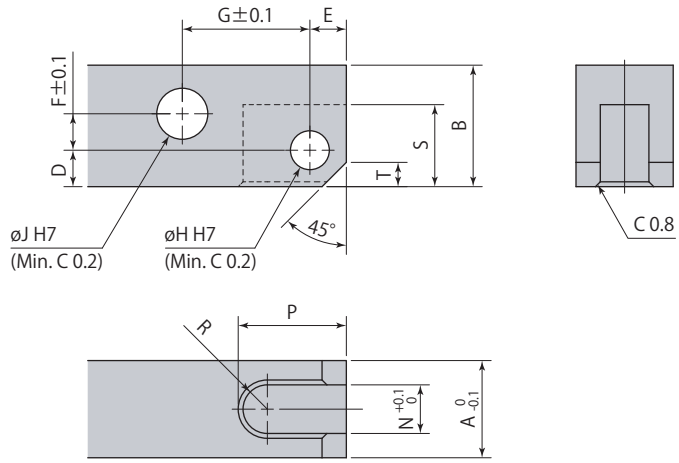
Rz: ISO4287(1997)

mm

| Model | CLM04-□N | CLM05-□N | CLM06-□N | CLM10-□N | CLM16-□N |
|---|---|---|---|---|---|
| øA | 40 | 48 | 55 | 65 | 75 |
| B | 34 | 40 | 47 | 55 | 63 |
| C | M5 | M5 | M6 | M6 | M8 |
| D | 18 | 22 | 24 | 30 | 32 |
| E | 26 | 30 | 33.5 | 39.5 | 45 |
| øF | 3 | 3 | 3 | 5 | 5 |

## Clamp arm mounting details

Clamp arm is not included. Manufacture a clamp arm with the dimensions shown in the table below.




Recommended material：S45C (HB167–229)

mm

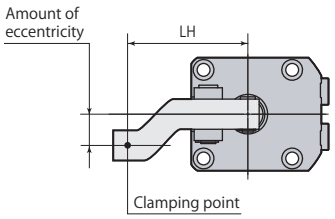
| Link clamp | CLM04 | CLM05 | CLM06 | CLM10 | CLM16 |
|---|---|---|---|---|---|
| A | 12 | 12 | 16 | 19 | 22 |
| B | 14 | 16 | 20 | 25 | 32 |
| D | 5.5 | 6 | 6 | 8 | 10 |
| E | 5.5 | 6 | 6 | 7 | 10 |
| F | 2.5 | 3.5 | 6 | 7.5 | 9.5 |
| G | 16 | 18.5 | 21 | 24.5 | 30 |
| øH | $6^{+0.012}_{0}$ | $6^{+0.012}_{0}$ | $6^{+0.012}_{0}$ | $8^{+0.015}_{0}$ | $10^{+0.015}_{0}$ |
| øJ | $6^{+0.012}_{0}$ | $6^{+0.012}_{0}$ | $8^{+0.015}_{0}$ | $10^{+0.015}_{0}$ | $12^{+0.018}_{0}$ |
| N | 6 | 6 | 8 | 10 | 11 |
| P | 14.5 | 17 | 17 | 20 | 25.5 |
| R | R3 | R3 | R4 | R5 | R5.5 |
| S | 12 | 13.5 | 13.5 | 17.5 | 22 |
| T | 3 | 4 | 4 | 5 | 8 |

● When mounting the clamp arm, use included pins and snap rings.

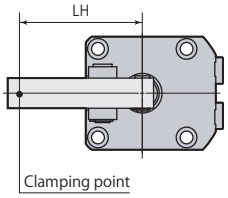
## Clamp arm allowable eccentricity

An eccentric shape clamp arm, as shown in diagram on right can be used with link clamp model CLM, if it is not possible to set clamping point at tip section of clamp arm in alignment with center line of piston rod and clamp arm.
Amount of eccentricity, however, must be within allowable eccentricity shown below.
Using a clamp arm that exceeds allowable eccentricity results in significant eccentric load on link mechanism and piston rod, leading to malfunction.

Eccentric shape clamp arm




Ordinary clamp arm




**model CLM04** (shaded) indicates nonusable range

| Hydraulic pressure MPa | Allowable eccentricity mm, Clamp arm length LH mm | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 25 | 30 | 36.5 | 40 | 50 | 60 | 80 | 100 |
| 7 | | | 6 | 8 | 15 | 21 | 33 | 46 |
| 6.5 | | | 8 | 10 | 18 | 25 | 39 | 53 |
| 6 | | | 10 | 13 | 21 | 29 | 45 | 60 |
| 5.5 | | 6 | 12 | 16 | 25 | 34 | 53 | ↑ |
| 5 | | 8 | 15 | 19 | 30 | 41 | 60 | ↑ |
| 4.5 | 6 | 11 | 19 | 23 | 36 | 48 | ↑ | ↑ |
| 4 | 7 | 14 | 23 | 29 | 43 | 58 | ↑ | ↑ |
| 3.5 | 9 | 18 | 29 | 35 | 53 | 60 | ↑ | ↑ |
| 3 | 13 | 23 | 37 | 44 | 60 | ↑ | ↑ | ↑ |
| 2.5 | 17 | 30 | 48 | 57 | ↑ | ↑ | ↑ | ↑ |
| 2 | 24 | 41 | 60 | 60 | ↑ | ↑ | ↑ | ↑ |
| 1.5 | 36 | 60 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| 1 | 60 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| 0.5 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |

**model CLM05** (shaded) indicates nonusable range

| Hydraulic pressure MPa | Allowable eccentricity mm, Clamp arm length LH mm | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 30 | 35 | 42 | 50 | 60 | 80 | 100 | 120 |
| 7 | | | 6 | 6 | 6 | 10 | 16 | 21 |
| 6.5 | | | 6 | 6 | 8 | 16 | 24 | 30 |
| 6 | | | 6 | 10 | 14 | 23 | 32 | 42 |
| 5.5 | | 6 | 6 | 14 | 20 | 32 | 44 | 56 |
| 5 | | 6 | 12 | 19 | 26 | 42 | 58 | 60 |
| 4.5 | 6 | 8 | 16 | 25 | 35 | 55 | 60 | ↑ |
| 4 | 6 | 11 | 20 | 30 | 44 | 60 | ↑ | ↑ |
| 3.5 | 6 | 14 | 25 | 38 | 53 | ↑ | ↑ | ↑ |
| 3 | 10 | 19 | 32 | 46 | 60 | ↑ | ↑ | ↑ |
| 2.5 | 15 | 26 | 41 | 58 | ↑ | ↑ | ↑ | ↑ |
| 2 | 22 | 36 | 56 | 60 | ↑ | ↑ | ↑ | ↑ |
| 1.5 | 33 | 52 | 60 | ↑ | ↑ | ↑ | ↑ | ↑ |
| 1 | 56 | 60 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| 0.5 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |

**model CLM06** (shaded) indicates nonusable range

| Hydraulic pressure MPa | Allowable eccentricity mm, Clamp arm length LH mm | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 35 | 40 | 50 | 60 | 70 | 80 | 100 | 120 |
| 7 | | | 8 | 8 | 8 | 8 | 8 | 8 |
| 6.5 | | | 8 | 8 | 8 | 8 | 8 | 8 |
| 6 | | | 8 | 12 | 14 | 16 | 18 | 20 |
| 5.5 | | 6 | 12 | 20 | 25 | 28 | 34 | 42 |
| 5 | 6 | 10 | 18 | 27 | 36 | 42 | 54 | 65 |
| 4.5 | 9 | 14 | 26 | 36 | 48 | 58 | 75 | 80 |
| 4 | 13 | 20 | 35 | 48 | 64 | 78 | 80 | ↑ |
| 3.5 | 19 | 28 | 46 | 66 | 80 | 80 | ↑ | ↑ |
| 3 | 26 | 40 | 65 | 80 | ↑ | ↑ | ↑ | ↑ |
| 2.5 | 34 | 52 | 80 | ↑ | ↑ | ↑ | ↑ | ↑ |
| 2 | 47 | 68 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| 1.5 | 68 | 80 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| 1 | 80 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| 0.5 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |

**model CLM10** (shaded) indicates nonusable range

| Hydraulic pressure MPa | Allowable eccentricity mm, Clamp arm length LH mm | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 40 | 50 | 56.5 | 80 | 100 | 120 | 140 | 160 |
| 7 | | 9 | 9 | 9 | 14 | 16 | 18 | 19 |
| 6.5 | | 9 | 9 | 15 | 22 | 30 | 38 | 45 |
| 6 | | 9 | 9 | 22 | 32 | 44 | 55 | 65 |
| 5.5 | | 9 | 15 | 32 | 45 | 60 | 75 | 88 |
| 5 | 9 | 15 | 20 | 42 | 60 | 80 | 95 | 95 |
| 4.5 | 9 | 22 | 30 | 56 | 80 | 95 | ↑ | ↑ |
| 4 | 11 | 30 | 40 | 75 | 95 | ↑ | ↑ | ↑ |
| 3.5 | 16 | 38 | 52 | 95 | ↑ | ↑ | ↑ | ↑ |
| 3 | 22 | 48 | 66 | ↑ | ↑ | ↑ | ↑ | ↑ |
| 2.5 | 30 | 64 | 85 | ↑ | ↑ | ↑ | ↑ | ↑ |
| 2 | 44 | 85 | 95 | ↑ | ↑ | ↑ | ↑ | ↑ |
| 1.5 | 66 | 95 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| 1 | 95 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| 0.5 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |

**model CLM16** (shaded) indicates nonusable range

| Hydraulic pressure MPa | Allowable eccentricity mm, Clamp arm length LH mm | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 50 | 60 | 69.5 | 80 | 100 | 120 | 140 | 160 | 180 |
| 7 | | 11 | 18 | 28 | 37 | 45 | 53 | 61 | 68 |
| 6.5 | | 12 | 22 | 33 | 51 | 63 | 74 | 86 | 97 |
| 6 | | 15 | 26 | 39 | 63 | 81 | 97 | 110 | 110 |
| 5.5 | 11 | 19 | 31 | 45 | 72 | 98 | 110 | ↑ | ↑ |
| 5 | 11 | 24 | 38 | 53 | 82 | 110 | ↑ | ↑ | ↑ |
| 4.5 | 13 | 29 | 45 | 62 | 96 | ↑ | ↑ | ↑ | ↑ |
| 4 | 17 | 36 | 54 | 74 | 110 | ↑ | ↑ | ↑ | ↑ |
| 3.5 | 23 | 45 | 66 | 89 | ↑ | ↑ | ↑ | ↑ | ↑ |
| 3 | 31 | 57 | 82 | 110 | ↑ | ↑ | ↑ | ↑ | ↑ |
| 2.5 | 43 | 74 | 104 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| 2 | 60 | 100 | 110 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| 1.5 | 88 | 110 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| 1 | 110 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| 0.5 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |

● Sensor model (model CLM-T, CLM-C, CLM-B) applicable hydraulic pressure should be 1.5 to 7MPa.