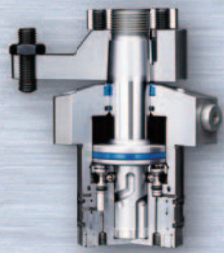
7MPa Work clamping system

CTU CTT
CLU CLT
CNA CMC CMD
CSU CST CSN CSY CSK
CEK CEA CVH
VCB VCP VHD VRG VEF WPB WPC
HCD HCS HCT X63 WRA WRB

Expansion clamp

CGC
CGT
CGU
CGE
CGY

7MPa Sensing clamp



CTM
CTN
CLM
CLN
CNB

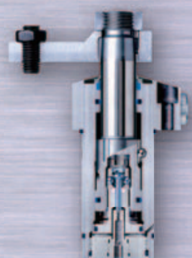
Pal system

CPC
CPH
CPY
CPK
WVP

air Work clamping system

CTX
CTY
CLX
CLY
CSS
CSX

35MPa Work clamping system



CTK CTW CTV
CLW CLV
CSW CSV
WVP
VCB VCP VHD VRG VEF WPC
HCD HCS HCT X63

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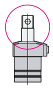
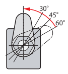
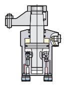
	Pin rod 	＊		—	
	Swing angle 30°, 45°, 60° 	＊		—	
	Bottom piping specifications 	＊		—	
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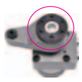
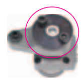
	Perfect nut 	CTH-MN	**Page →73**	—	
	Perfect release nut 	CTH-MNR	**Page →75**	—	
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＊: Contact Pascal for the details.

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Features		Standard model		Standard model	
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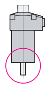
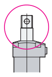
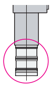
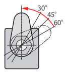
	Dual rod 	CTU-E **Page →102**	*	—	
	Pin rod 	CTU-P **Page →103**	*	CTT-P **Page →123**	—
	Air sensor 	CTU-A **Page →104**	*	—	
	Swing angle 30°, 45°, 60° 	CTU-N□ **Page →109**	*	CTT-N□ **Page →125**	—
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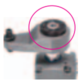
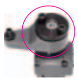
	Perfect nut 	CTH-TN **Page →129**			
	Perfect release nut 	CTH-TNR **Page →131**			
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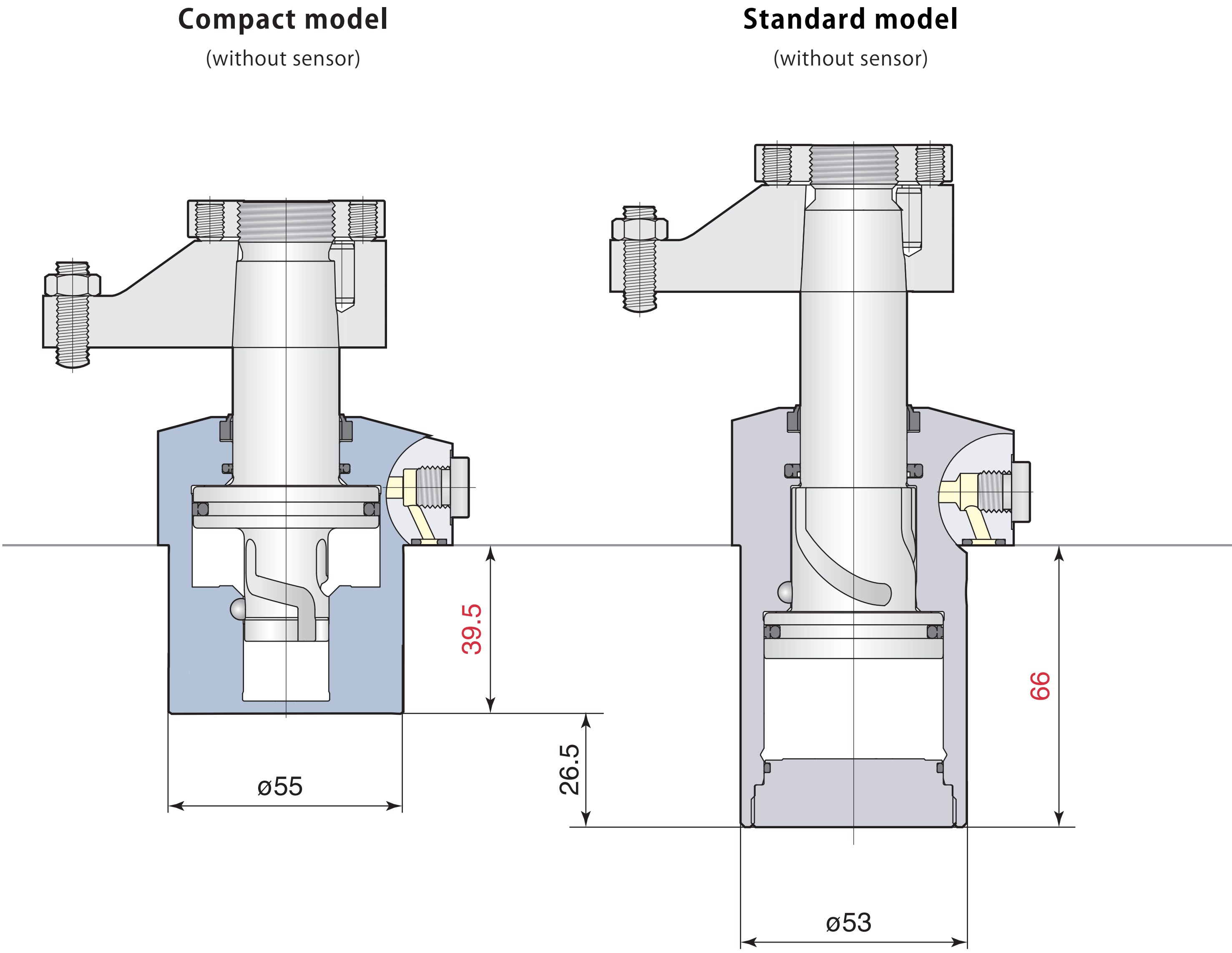
*:Contact Pascal for the details.

Super compact body

The significant downsizing is realized compared to the conventinal model.



	model CTM06-N	model CTU06
Cylinder force (at 7MPa)	7.2 kN	6.3 kN
Clamp stroke	5 mm	10 mm

Super compact body

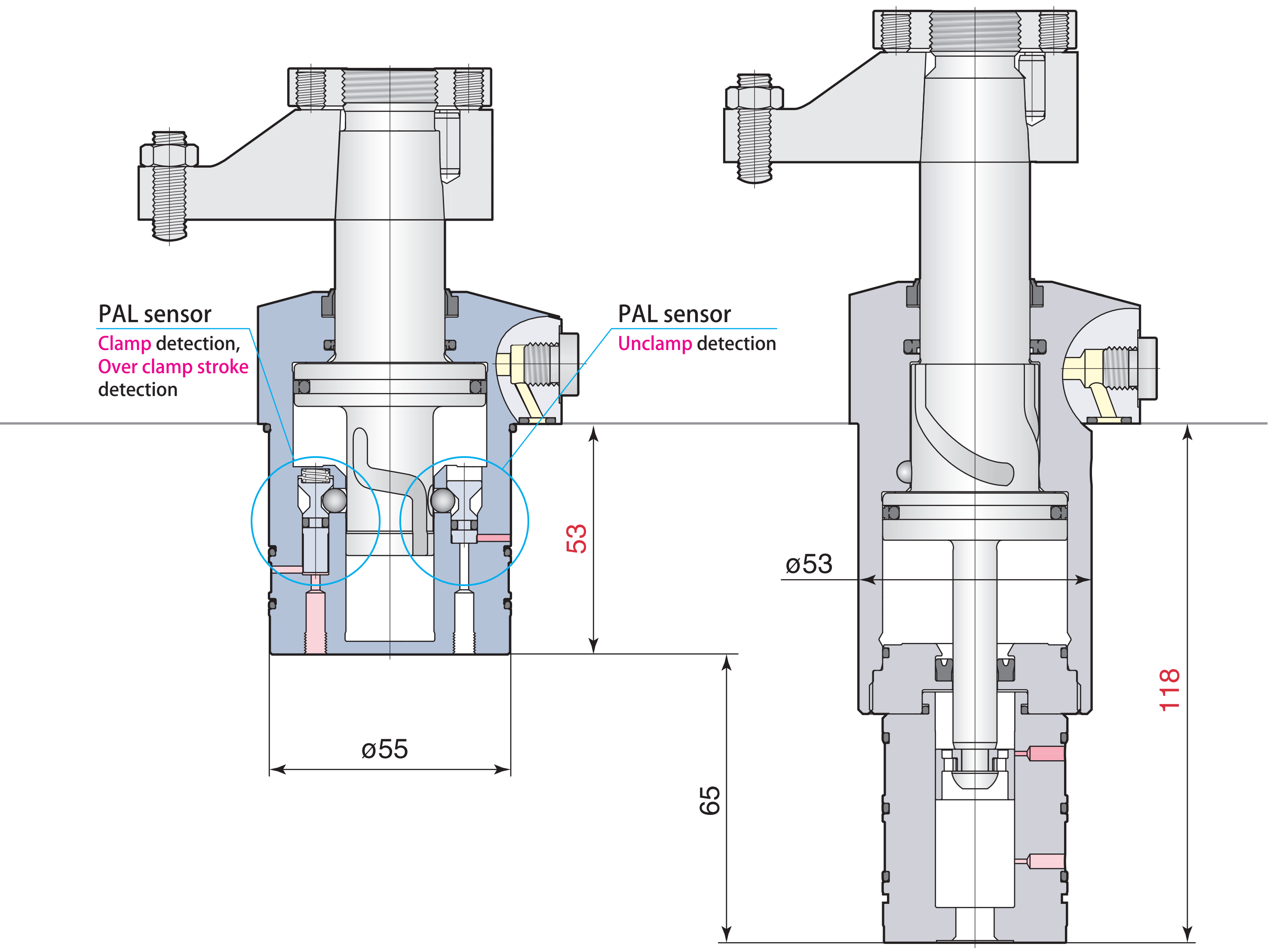
Enables a jig to be compact and simple structure with an excellent sensor function

3 point sensor model

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

Air sensor model

Clamp, Unclamp detection



model CTM06-T	model CTU06-A
7.2 kN	6.3 kN
5 mm	10 mm

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Sensing Swing clamp

Double acting 7 MPa

model CTM

3 point sensor model
model CTM06-LT

Clamp sensor model
model CTM06-LC

Unclamp sensor model
model CTM06-LB

Compact model
model CTM06-LN

Sensing Swing clamp model CTM

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

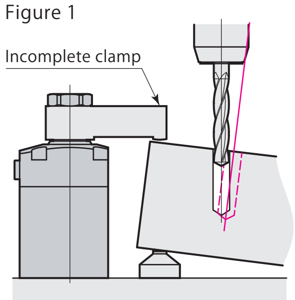
3 point sensor model

Clamp sensor model

Unclamp sensor model

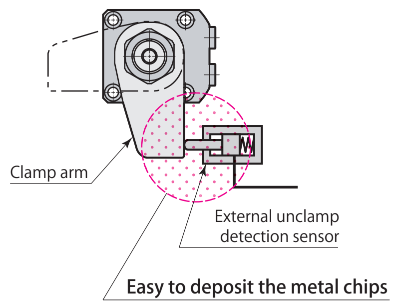
- Sensor model can prevent tool breakage and defective machining due to incomplete clamp. (Figure 1)
- Unclamp PAL sensor moves along with the piston rod and can positively detect unclamping point, thereby enabling a high-speed production line by fully synchronizing operation with workpiece lifters.
- 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



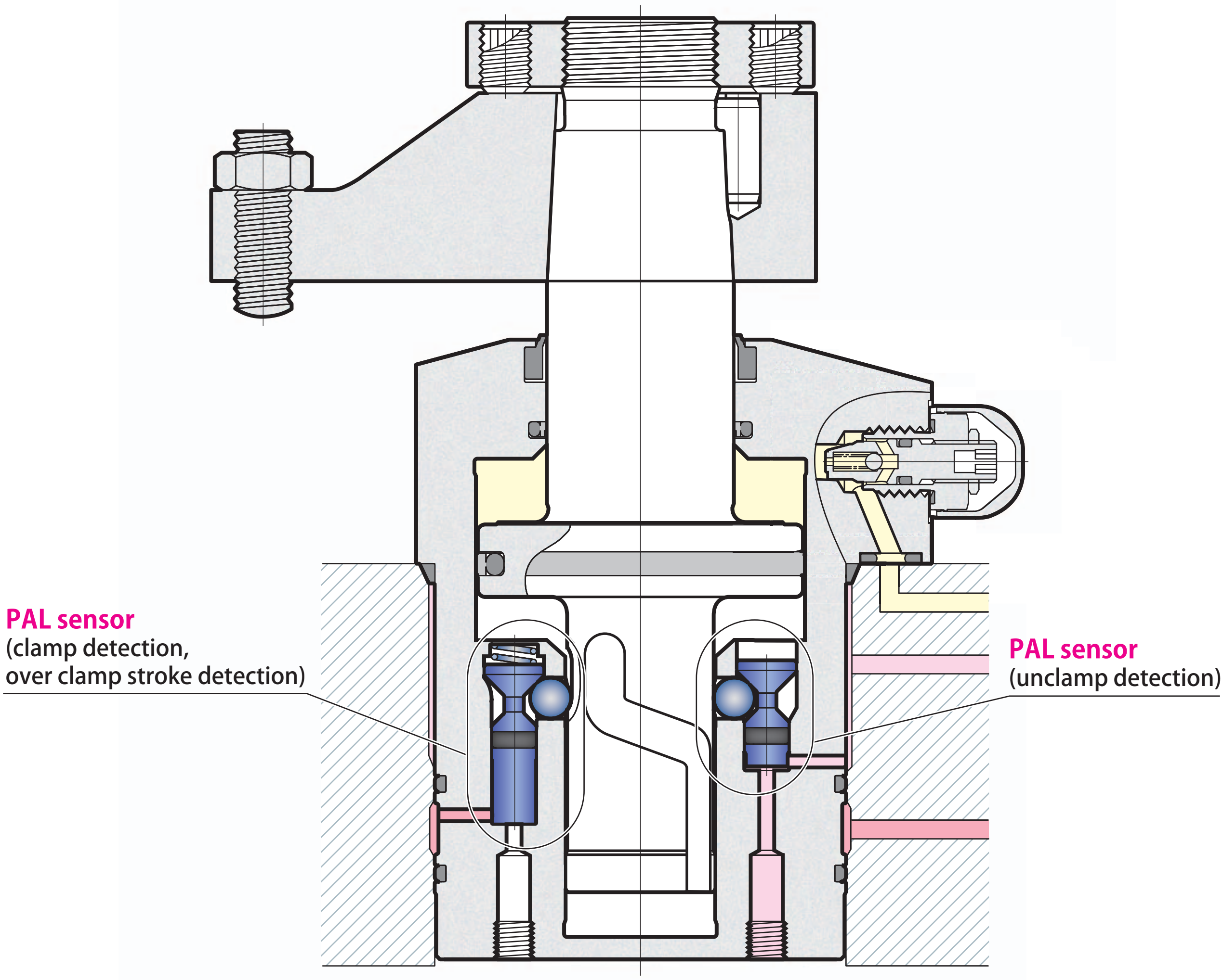
Machining failure due to incomplete clamp

Figure 2



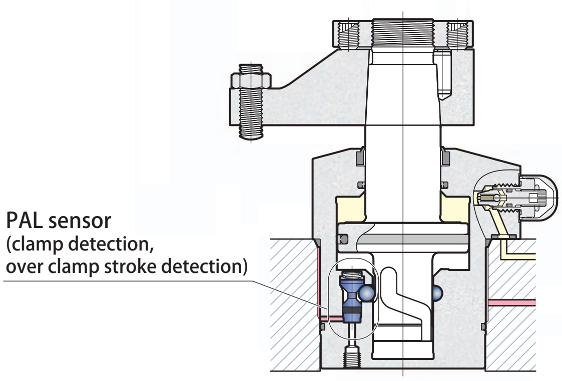
3 point sensor model

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



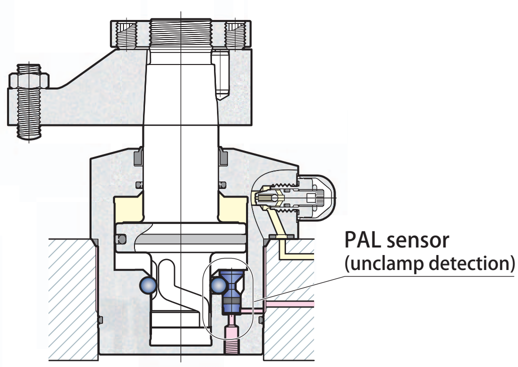
Clamp sensor model

Clamp, Over clamp stroke (Incomplete clamp) detection



Unclamp sensor model

Unclamp detection



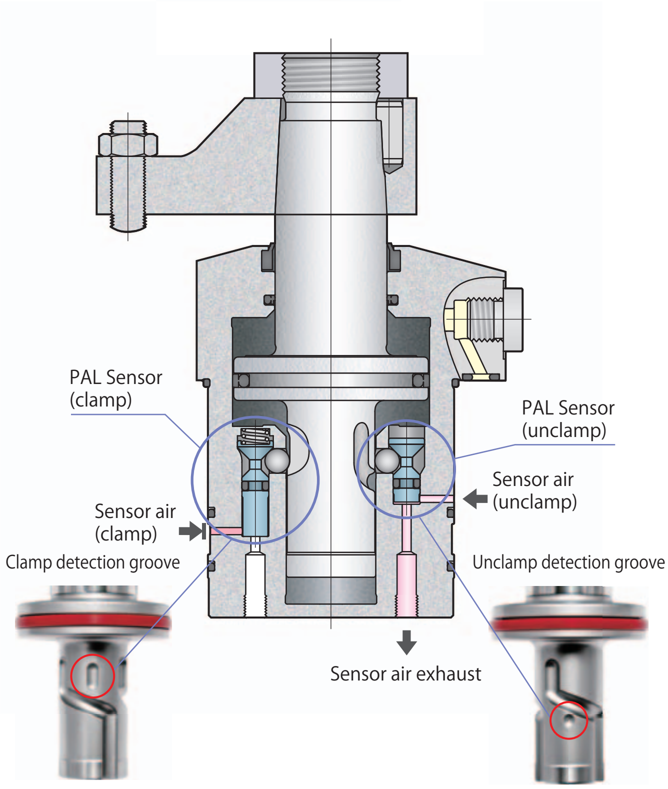
3 point sensor model T

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

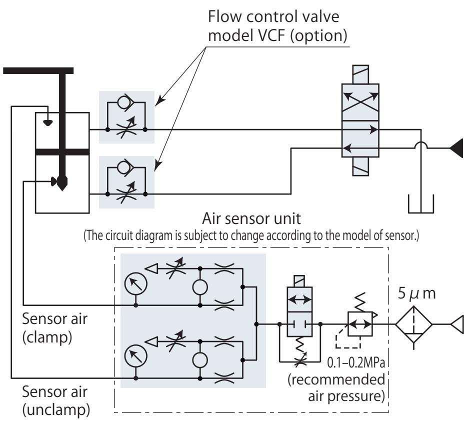
model **CTM□-□□T** PAT.

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 →18–21** for the details.



Hydraulic and pneumatic circuit diagram



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PAL sensor	page → 18
Short stroke	page → 22
Long stroke	page → 26

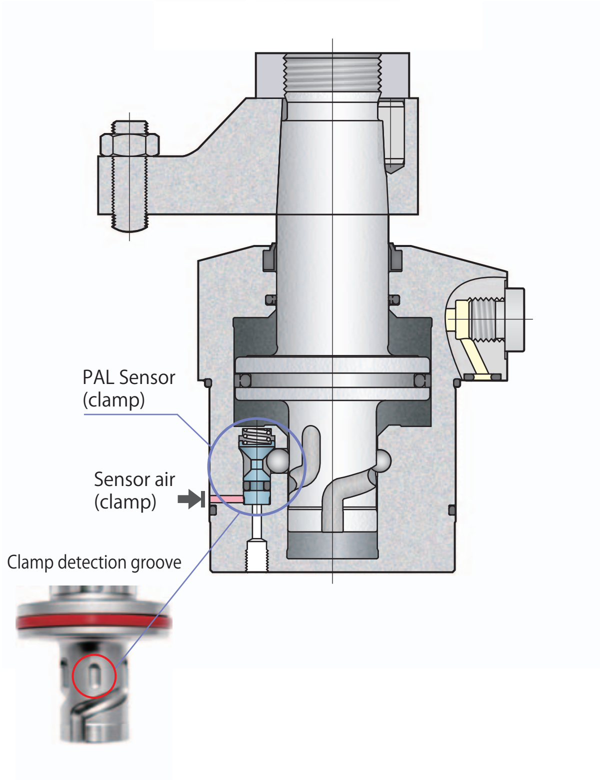
Clamp sensor model C

Clamp, Over clamp stroke (Incomplete clamp) detection

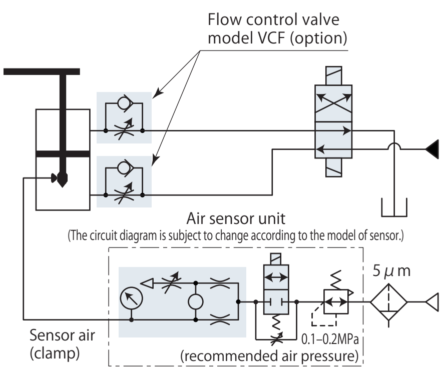
model **CTM□-□□C** PAT.

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

Refer to **pages →32–35** for the details.



Hydraulic and pneumatic circuit diagram



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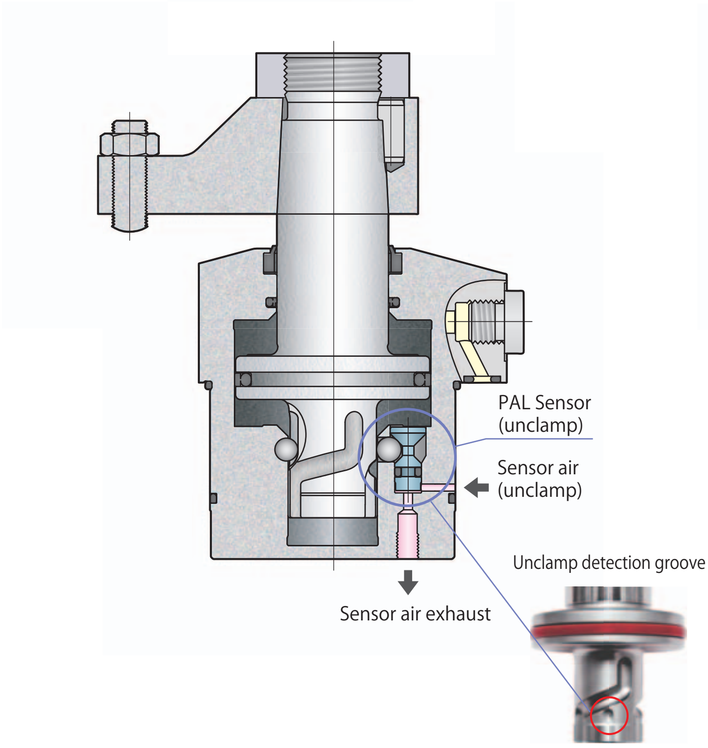
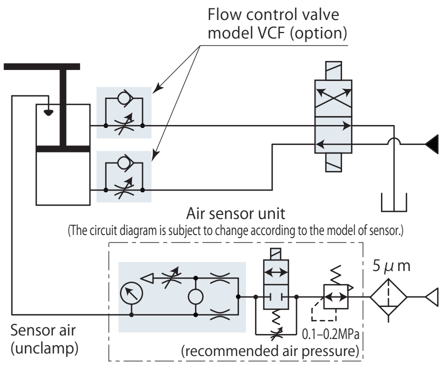
Unclamp sensor model B

model **CTM□-□□B** PAT.



Hydraulic and pneumatic circuit diagram



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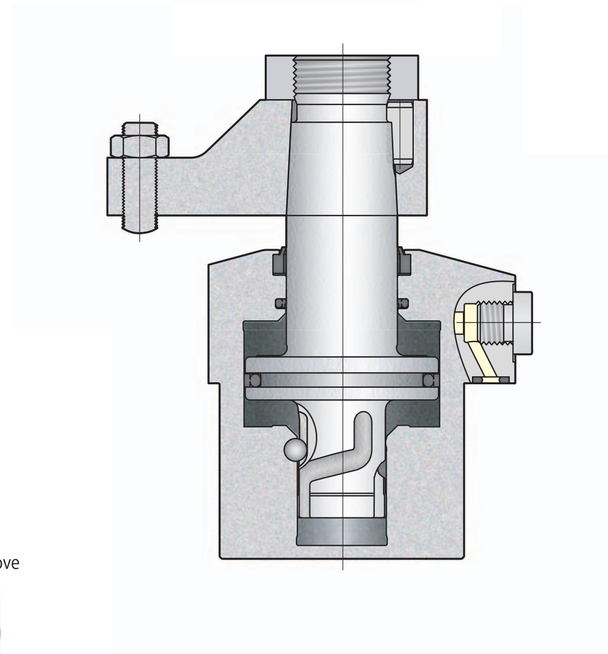
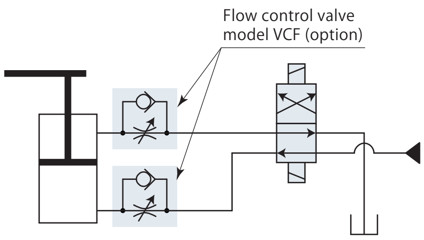
Compact model N

model **CTM□-□□N** JP PAT.

No sensors available on compact model



Hydraulic circuit diagram



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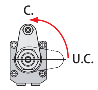
Short stroke page → 60
Long stroke page → 64

Specifications

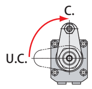
CTM – Size / Swing direction (when clamping) / Clamp stroke

Size:
- **03***1
- **04**
- **05**
- **06**
- **10**
- **16***2

Swing direction (when clamping):
- **L** : Counter-clockwise



- **R** : Clockwise



Clamp stroke:
- **(Nil)** : 5mm
- **S10** : 10mm
- **S20***3 : 20mm
- **S30***3 : 30mm

- **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

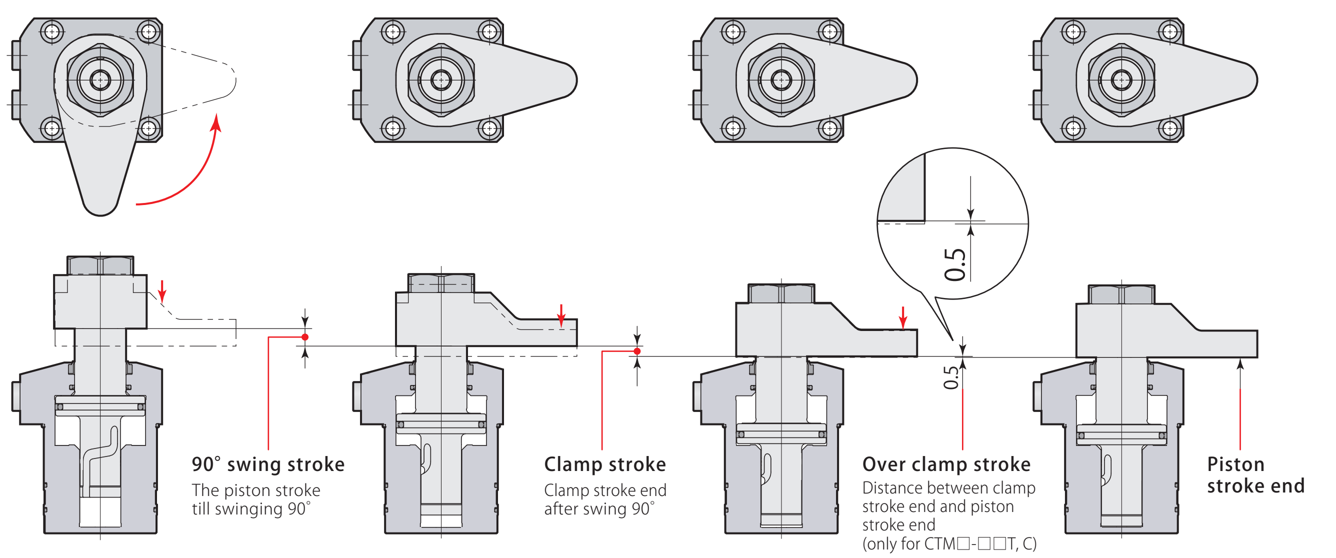
*1：For compact model only (CTM03-□□N).
*2：For long stroke only (CTM16-□S□□).
*3：CTM□-□S20T, CTM□-□S20C, CTM□-□S30T, CTM□-□S30C are made to order.
Contact Pascal for more details about swing angle 30, 45 and 60 degrees, pin rod and bottom piping.

Model	Size	CTM03			CTM04			CTM05			CTM06				CTM10				CTM16		
	Clamp stroke	5	10	20	5	10	20	5	10	20	5	10	20	30	5	10	20	30	10	20	30
Cylinder force (hydraulic pressure 7MPa)	kN	2.5			3.5			4.9			7.2				9.4				14.2		
Cylinder inner diameter	mm	26			31			37			44				51				62		
Rod diameter	mm	15			18			22			25				30				35.5		
Effective area (clamp)	cm^2	3.5			5.00			6.95			10.3				13.4				20.3		
Swing angle		90°±3°																			
Positioning pin groove position accuracy		±1°																			
Repeated clamp positioning accuracy		±0.5°																			
Full stroke	CTM□-□□T, C mm	–			12	17	27	13	18	28	14	19	29	39	15.5	20.5	30.5	40.5	22.5	32.5	42.5
	CTM□-□□B, N mm	10.5	15.5	25.5	11.5	16.5	26.5	12.5	17.5	27.5	13.5	18.5	28.5	38.5	15	20	30	40	22	32	42
90° swing stroke	mm	5.5			6.5			7.5			8.5				10				12		
Over clamp stroke (CTM□-□□T, C)	mm	–			0.5																
Mass	CTM□-□□T kg	–			0.9	0.9	1.0	1.2	1.3	1.4	1.8	1.9	2.1	2.3	2.7	2.8	3.1	3.5	4.2	4.7	5.2
	CTM□-□□C kg	–			0.8	0.8	1.0	1.1	1.2	1.4	1.6	1.7	2.0	2.3	2.4	2.6	3.0	3.4	4.1	4.6	5.1
	CTM□-□□B, N kg	0.6	0.6	0.8	0.7	0.8	1.0	1.1	1.2	1.4	1.5	1.7	2.0	2.3	2.4	2.6	3.0	3.4	4.1	4.6	5.1
Recommended tightening torque of mounting screws*	N·m	3.5			7			7			12				12				29		
Recommended tightening torque of nut	N·m	22			35			60			100				155				260		

- Pressure range：1.5–7 MPa
- 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)

*：ISO R898 class 12.9

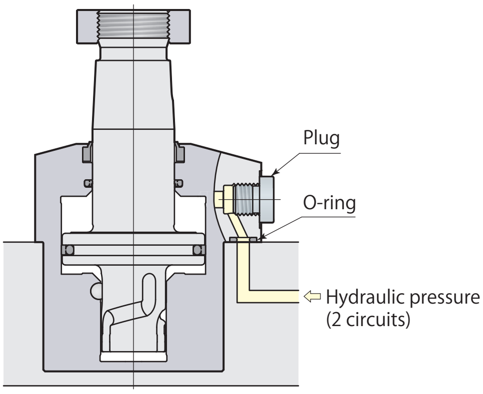
Clamping must be done within the range of clamp stroke.



Manifold piping and G port piping are available.

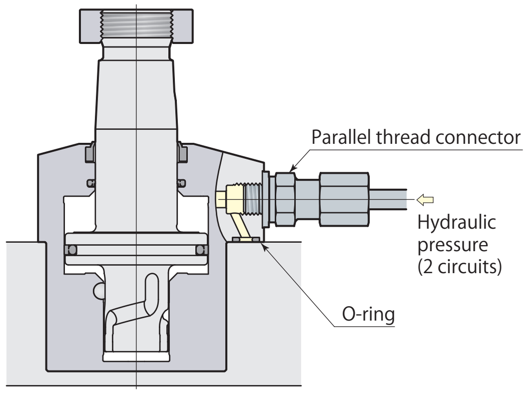
Manifold piping

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 →372** 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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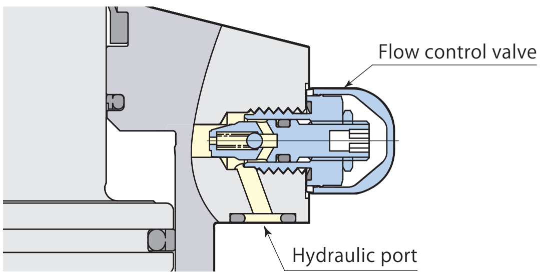

Air bleeding valve model VCE

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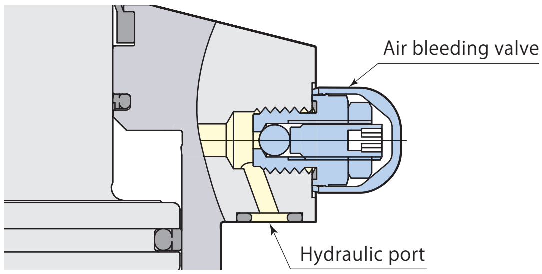
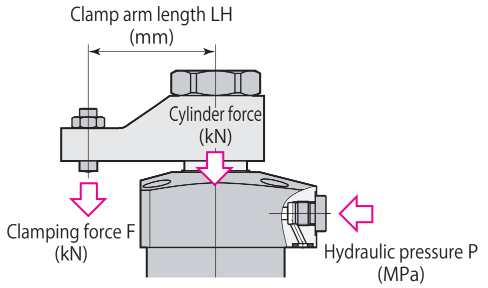


- In case of mounting flow control valve model VCF on the G port of the clamp, air bleeding valve should be installed in the piping to the clamp. (VCE Mounting details. Refer to **page →142**)

Performance table



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

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

CTM06 with clamp arm length (LH) = 50 mm at hydraulic pressure of 7 MPa, Clamping force F is calculated by
7/(0.971+0.00427×50) = 5.9 kN

Do not use the clamp in the nonusable range. It may cause damage to the cylinder and rod.

model CTM03 Clamping force F=P/(2.82+0.0153×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN Clamp arm length LH mm 30	40	50	60	70	80	100	120	Max. arm length Max. LH mm
7	2.5	2.1	2.0	2.0	1.9	1.8	1.7	Nonusable range		85
6.5	2.3	2.0	1.9	1.8	1.7	1.7	1.6			95
6	2.1	1.8	1.7	1.7	1.6	1.5	1.5	1.4		108
5.5	1.9	1.7	1.6	1.5	1.5	1.4	1.4	1.3		125
5	1.8	1.5	1.5	1.4	1.3	1.3	1.2	1.1	1.1	148
4.5	1.6	1.4	1.3	1.3	1.2	1.2	1.1	1.0	1.0	182
4	1.4	1.2	1.2	1.1	1.1	1.0	1.0	0.9	0.9	↑
3.5	1.2	1.1	1.0	1.0	0.9	0.9	0.9	0.8	0.8	↑
3	1.1	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.6	↑
2.5	0.9	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.5	↑
2	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.4	↑
1.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.3	0.3	182

model CTM04 Clamping force F=P/(2.00+0.0101×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN Clamp arm length LH mm 40	50	60	70	80	100	120	140	Max. arm length Max. LH mm
7	3.5	2.9	2.8	2.7						64
6.5	3.3	2.7	2.6	2.5	2.4					71
6	3.0	2.5	2.4	2.3	2.2		Nonusable range			79
5.5	2.8	2.3	2.2	2.1	2.0	2.0				89
5	2.5	2.1	2.0	1.9	1.8	1.8	1.7			103
4.5	2.3	1.9	1.8	1.7	1.7	1.6	1.5	1.4		121
4	2.0	1.7	1.6	1.5	1.5	1.4	1.3	1.2	1.2	148
3.5	1.8	1.5	1.4	1.3	1.3	1.2	1.2	1.1	1.0	189
3	1.5	1.2	1.2	1.2	1.1	1.1	1.0	0.9	0.9	↑
2.5	1.3	1.0	1.0	1.0	0.9	0.9	0.8	0.8	0.7	↑
2	1.0	0.8	0.8	0.8	0.7	0.7	0.7	0.6	0.6	↑
1.5	0.8	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.4	189

model CTM05 Clamping force F=P/(1.44+0.00726×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN Clamp arm length LH mm 50	60	80	100	120	140	160	180	Max. arm length Max. LH mm
7	4.9	3.9	3.7							79
6.5	4.5	3.6	3.5	3.2						87
6	4.2	3.3	3.2	3.0		Nonusable range				98
5.5	3.8	3.1	2.9	2.7	2.5					112
5	3.5	2.8	2.7	2.5	2.3	2.2				131
4.5	3.1	2.5	2.4	2.2	2.1	1.9	1.8			157
4	2.8	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.5	196
3.5	2.4	1.9	1.9	1.7	1.6	1.5	1.4	1.3	1.3	↑
3	2.1	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	↑
2.5	1.7	1.4	1.3	1.2	1.2	1.1	1.0	1.0	0.9	↑
2	1.4	1.1	1.1	1.0	0.9	0.9	0.8	0.8	0.7	↑
1.5	1.0	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	196

model CTM06 Clamping force F=P/(0.971+0.00427×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN Clamp arm length LH mm 50	60	80	100	120	140	160	180	Max. arm length Max. LH mm
7	7.2	5.9	5.7	5.3						87
6.5	6.7	5.5	5.3	5.0						96
6	6.2	5.1	4.9	4.6	4.3		Nonusable range			108
5.5	5.7	4.6	4.5	4.2	3.9	3.7				124
5	5.1	4.2	4.1	3.8	3.6	3.4	3.2			144
4.5	4.6	3.8	3.7	3.4	3.2	3.0	2.9	2.7		172
4	4.1	3.4	3.3	3.0	2.9	2.7	2.5	2.4	2.3	203
3.5	3.6	3.0	2.9	2.7	2.5	2.4	2.2	2.1	2.0	281
3	3.1	2.5	2.4	2.3	2.1	2.0	1.9	1.8	1.7	↑
2.5	2.6	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.4	↑
2	2.1	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	↑
1.5	1.5	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	281

model CTM10 Clamping force F=P/(0.749+0.00299×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN Clamp arm length LH mm 60	80	100	120	140	160	180	200	Max. arm length Max. LH mm
7	9.4	7.5	7.1							88
6.5	8.7	7.0	6.6							98
6	8.0	6.5	6.1	5.7		Nonusable range				110
5.5	7.3	5.9	5.6	5.2	5.0					125
5	6.7	5.4	5.1	4.8	4.5	4.3				144
4.5	6.0	4.8	4.6	4.3	4.1	3.9	3.7			171
4	5.3	4.3	4.0	3.8	3.6	3.4	3.3	3.1	3.0	211
3.5	4.7	3.8	3.5	3.3	3.2	3.0	2.9	2.7	2.6	273
3	4.0	3.2	3.0	2.9	2.7	2.6	2.4	2.3	2.2	↑
2.5	3.3	2.7	2.5	2.4	2.3	2.1	2.0	1.9	1.9	↑
2	2.7	2.2	2.0	1.9	1.8	1.7	1.6	1.6	1.5	↑
1.5	2.0	1.6	1.5	1.4	1.4	1.3	1.2	1.2	1.1	273

model CTM03-□S Clamping force F=P/(2.82+0.0131×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN Clamp arm length LH mm 30	40	50	60	70	80	100	120	Max. arm length Max. LH mm
7	2.5	2.2	2.1	2.0	1.9	1.9	1.8	1.7	Nonusable range	110
6.5	2.3	2.0	1.9	1.9	1.8	1.7	1.7	1.6	1.5	120
6	2.1	1.9	1.8	1.7	1.7	1.6	1.5	1.5	1.4	140
5.5	1.9	1.7	1.6	1.6	1.5	1.5	1.4	1.3	1.3	160
5	1.8	1.6	1.5	1.4	1.4	1.3	1.3	1.2	1.1	↑
4.5	1.6	1.4	1.3	1.3	1.2	1.2	1.2	1.1	1.0	↑
4	1.4	1.2	1.2	1.2	1.1	1.1	1.0	1.0	0.9	↑
3.5	1.2	1.1	1.0	1.0	1.0	0.9	0.9	0.8	0.8	↑
3	1.1	0.9	0.9	0.9	0.8	0.8	0.8	0.7	0.7	↑
2.5	0.9	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	↑
2	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	↑
1.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.3	160

model CTM04-□S Clamping force F=P/(2.00+0.00755×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN Clamp arm length LH mm 40	50	60	70	80	100	120	140	Max. arm length Max. LH mm
7	3.5	3.0	2.9	2.9	2.8					74
6.5	3.3	2.8	2.7	2.6	2.6	2.5		Nonusable range		81
6	3.0	2.6	2.5	2.4	2.4	2.3				90
5.5	2.8	2.4	2.3	2.2	2.2	2.1	2.0			101
5	2.5	2.2	2.1	2.0	2.0	1.9	1.8			116
4.5	2.3	2.0	1.9	1.8	1.8	1.7	1.6	1.5		135
4	2.0	1.7	1.7	1.6	1.6	1.5	1.5	1.4	1.3	163
3.5	1.8	1.5	1.5	1.4	1.4	1.3	1.3	1.2	1.1	↑
3	1.5	1.3	1.3	1.2	1.2	1.2	1.1	1.0	1.0	↑
2.5	1.3	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.8	↑
2	1.0	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	↑
1.5	0.8	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5	163

model CTM05-□S Clamping force F=P/(1.44+0.00543×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN Clamp arm length LH mm 50	60	80	100	120	140	160	180	Max. arm length Max. LH mm
7	4.9	4.1	4.0	3.7	3.5					105
6.5	4.5	3.8	3.7	3.5	3.3		Nonusable range			117
6	4.2	3.5	3.4	3.2	3.0	2.9				131
5.5	3.8	3.2	3.1	2.9	2.8	2.6	2.5			150
5	3.5	2.9	2.8	2.7	2.5	2.4	2.3	2.2		175
4.5	3.1	2.6	2.5	2.4	2.3	2.2	2.0	1.9	1.9	209
4	2.8	2.3	2.3	2.1	2.0	1.9	1.8	1.7	1.7	261
3.5	2.4	2.0	2.0	1.9	1.8	1.7	1.6	1.5	1.4	↑
3	2.1	1.8	1.7	1.6	1.5	1.4	1.4	1.3	1.2	↑
2.5	1.7	1.5	1.4	1.3	1.3	1.2	1.1	1.1	1.0	↑
2	1.4	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.8	↑
1.5	1.0	0.9	0.8	0.8	0.8	0.7	0.7	0.6	0.6	261

model CTM06-□S Clamping force F=P/(0.971+0.00333×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN Clamp arm length LH mm 50	60	80	100	120	140	160	180	Max. arm length Max. LH mm
7	7.2	6.2	6.0	5.7	5.4					112
6.5	6.7	5.7	5.6	5.3	5.0	4.7		Nonusable range		124
6	6.2	5.3	5.1	4.8	4.6	4.4				139
5.5	5.7	4.8	4.7	4.4	4.2	4.0	3.8			159
5	5.1	4.4	4.3	4.0	3.8	3.6	3.5	3.3	3.2	184
4.5	4.6	4.0	3.8	3.6	3.5	3.3	3.1	3.0	2.9	220
4	4.1	3.5	3.4	3.2	3.1	2.9	2.8	2.7	2.5	274
3.5	3.6	3.1	3.0	2.8	2.7	2.6	2.4	2.3	2.2	↑
3	3.1	2.6	2.6	2.4	2.3	2.2	2.1	2.0	1.9	↑
2.5	2.6	2.2	2.1	2.0	1.9	1.8	1.7	1.7	1.6	↑
2	2.1	1.8	1.7	1.6	1.5	1.5	1.4	1.3	1.3	↑
1.5	1.5	1.3	1.3	1.2	1.2	1.1	1.0	1.0	1.0	274

model CTM10-□S Clamping force F=P/(0.749+0.00238×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN Clamp arm length LH mm 60	80	100	120	140	160	180	200	Max. arm length Max. LH mm
7	9.4	7.8	7.5	7.1						111
6.5	8.7	7.3	6.9	6.6	6.3		Nonusable range			123
6	8.0	6.7	6.4	6.1	5.8					138
5.5	7.3	6.2	5.9	5.6	5.3	5.1				157
5	6.7	5.6	5.3	5.1	4.8	4.6	4.4	4.2		181
4.5	6.0	5.0	4.8	4.6	4.3	4.2	4.0	3.8	3.7	215
4	5.3	4.5	4.3	4.1	3.9	3.7	3.5	3.4	3.3	265
3.5	4.7	3.9	3.7	3.5	3.4	3.2	3.1	3.0	2.9	↑
3	4.0	3.4	3.2	3.0	2.9	2.8	2.7	2.5	2.4	↑
2.5	3.3	2.8	2.7	2.5	2.4	2.3	2.2	2.1	2.0	↑
2	2.7	2.2	2.1	2.0	1.9	1.8	1.8	1.7	1.6	↑
1.5	2.0	1.7	1.6	1.5	1.4	1.4	1.3	1.3	1.2	265

model CTM16-□S Clamping force F=P/(0.493+0.00138×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN Clamp arm length LH mm 60	80	100	120	140	160	180	200	Max. arm length Max. LH mm
7	14.2	12.2	11.6	11.1	10.6					132
6.5	13.2	11.3	10.8	10.3	9.9	9.5		Nonusable range		147
6	12.2	10.4	9.9	9.5	9.1	8.7	8.4			164
5.5	11.2	9.6	9.1	8.7	8.4	8.0	7.7	7.4		187
5	10.1	8.7	8.3	7.9	7.6	7.3	7.0	6.7	6.5	217
4.5	9.1	7.8	7.5	7.1	6.8	6.6	6.3	6.1	5.9	259
4	8.1	6.9	6.6	6.3	6.1	5.8	5.6	5.4	5.2	↑
3.5	7.1	6.1	5.8	5.5	5.3	5.1	4.9	4.7	4.6	↑
3	6.1	5.2	5.0	4.8	4.6	4.4	4.2	4.0	3.9	↑
2.5	5.1	4.3	4.1	4.0	3.8	3.6	3.5	3.4	3.3	↑
2	4.1	3.5	3.3	3.2	3.0	2.9	2.8	2.7	2.6	↑
1.5	3.0	2.6	2.5	2.4	2.3	2.2	2.1	2.0	2.0	259

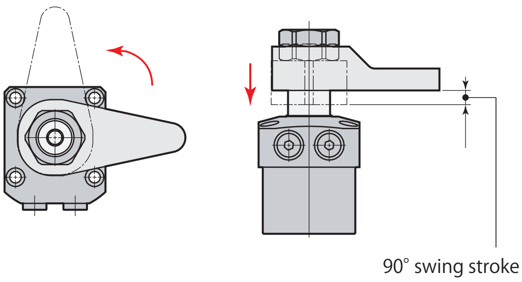
Swing speed adjustment

Swing time is restricted by the mass and length of the clamp arm (moment of inertia) since the 90° swing action impacts the cam shaft.

1.Calculate the moment of inertia according to the arm length and mass.

2.Adjust swing speed with flow control valve to ensure that 90° swing time of the clamp arm is greater than the shortest swing time in the graph shown below.

● The cam groove may be damaged in case the swing speed is set at the nonusable range in the graph.

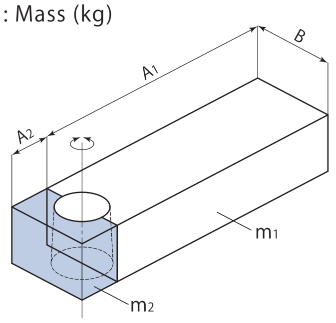


Example of calculation for moment of inertia

$$I=\frac{1}{12}m_1(4A_1^2+B^2)+\frac{1}{12}m_2(4A_2^2+B^2)$$

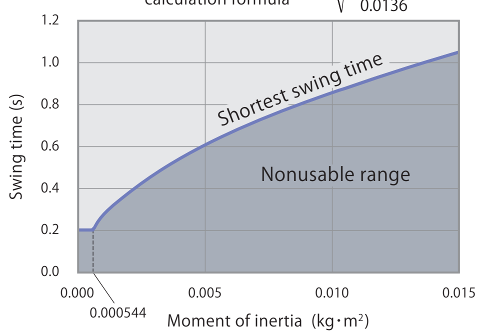
I : Moment of inertia (kg·m²)

m: Mass (kg)



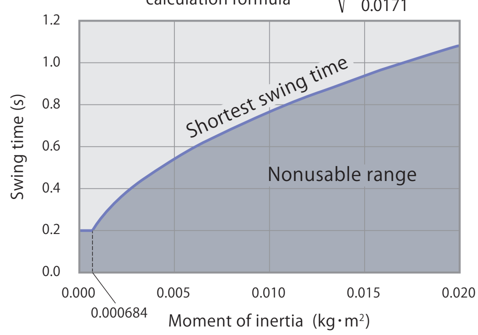
model CTM03

Shortest swing time calculation formula $t=\sqrt{\dfrac{I}{0.0136}}$



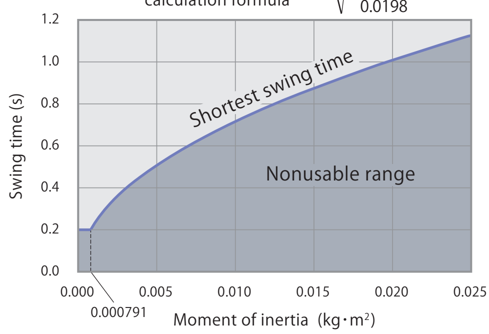
model CTM04

Shortest swing time calculation formula $t=\sqrt{\dfrac{I}{0.0171}}$



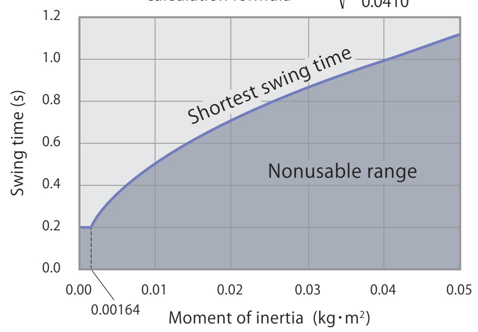
model CTM05

Shortest swing time calculation formula $t=\sqrt{\dfrac{I}{0.0198}}$



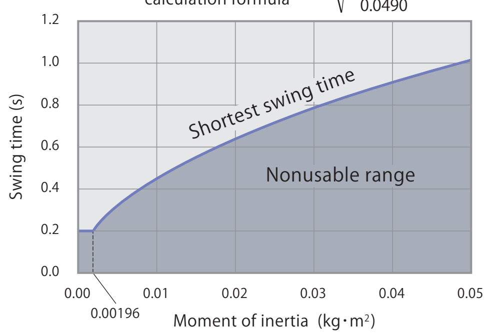
model CTM06

Shortest swing time calculation formula $t=\sqrt{\dfrac{I}{0.0410}}$



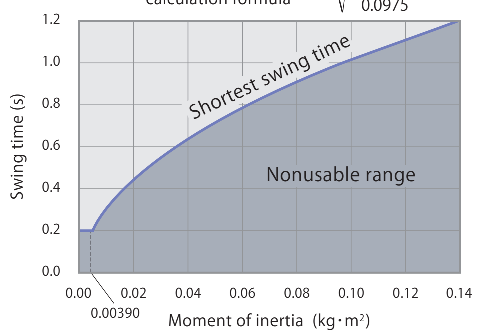
model CTM10

Shortest swing time calculation formula $t=\sqrt{\dfrac{I}{0.0490}}$



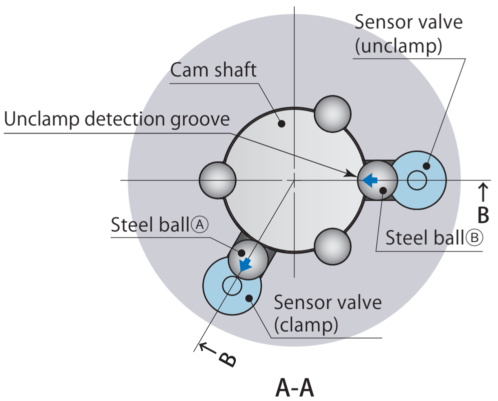
model CTM16

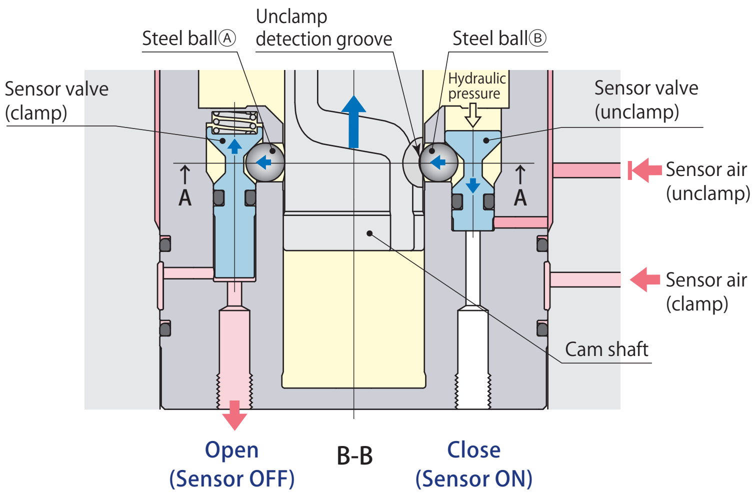
Shortest swing time calculation formula $t=\sqrt{\dfrac{I}{0.0975}}$



PAL sensor function and structure

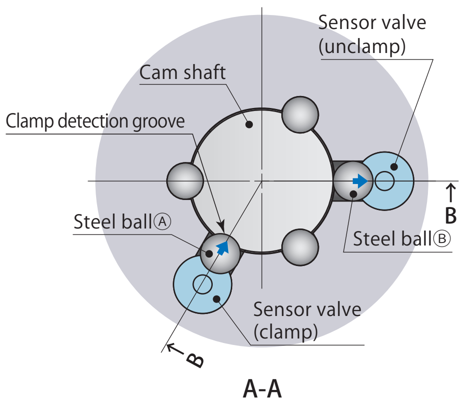
Unclamp detection

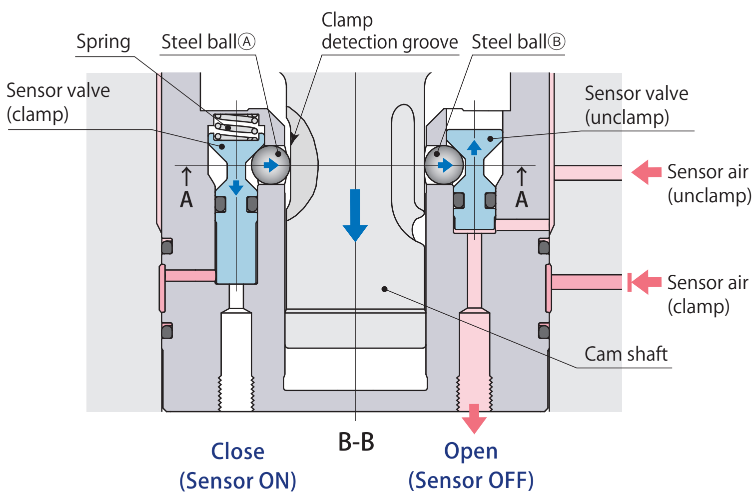




● The steel ball Ⓑ seats in the unclamp detection groove when the cam shaft reaches unclamp end, and a sensor valve (unclamp) is pushed down to shut off the sensor air by hydraulic force. The sensor valve (clamp) is pushed up by the steel ball Ⓐ to open for air exhaust and detects the unclamped condition.

Clamp detection

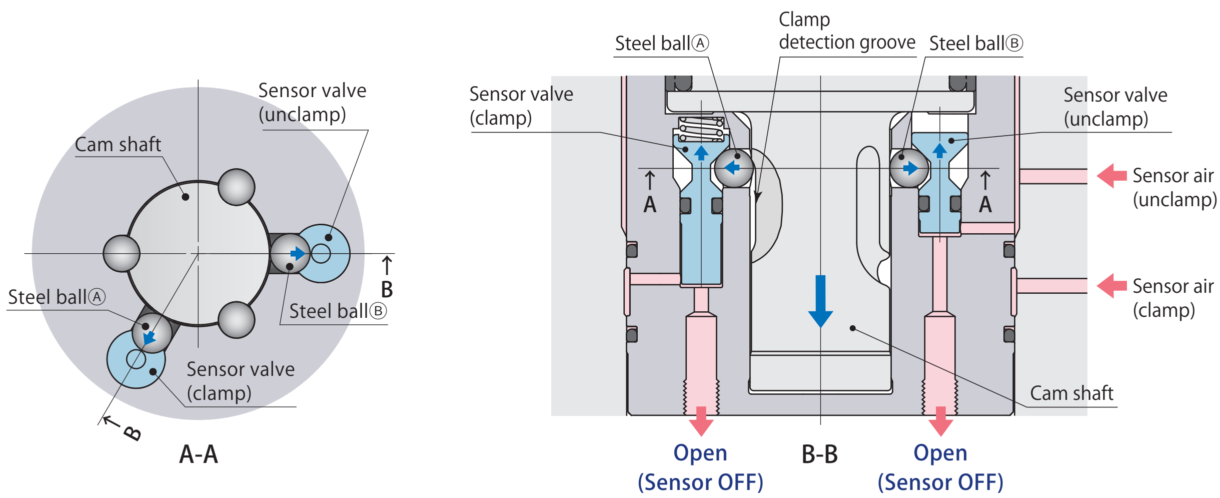




● The steel ball Ⓐ seats in the clamp detection groove when the cam shaft reaches clamping point, and a sensor valve (clamp) is pushed down to shut of the sensor air by a spring. The sensor valve (unclamp) is pushed up by the steel ball Ⓑ to open for air exhaust and detects the clamped condition.

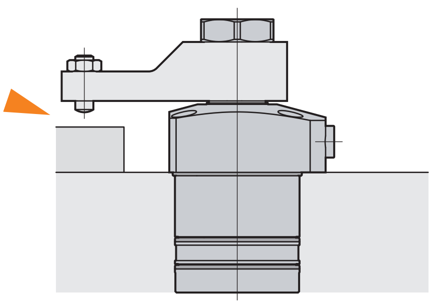
PAL sensor function and structure

Over clamp stroke (Incomplete clamp) detection

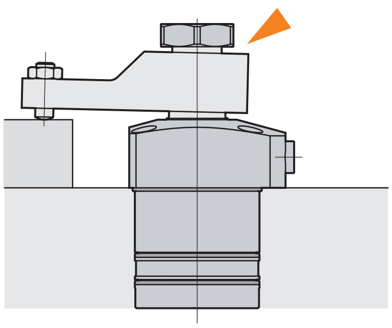


● When the cam shaft passes the clamping point, the sensor valve (clamp) is pushed up by the steel ball Ⓐ to open for air exhaust. The sensor valve (unclamp) is pushed up by the steel ball Ⓑ to open for air exhaust and detects the over clamp stroked (incomplete clamp) condition.

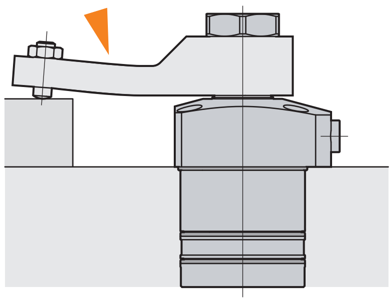
Over clamp stroke (Incomplete clamp) detection example



● Clamp disabled due to mis-setting workpiece.



● Clamp disabled due to the damage of piston rod or loose clamp arm.

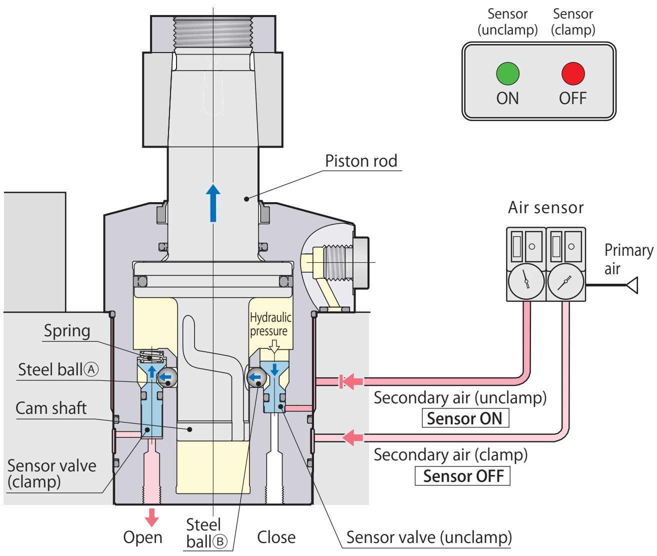


● Clamp disabled due to the deflection of clamp arm.

● Clamp disabled due to the abrasion on the tip of clamp arm during prolonged use.

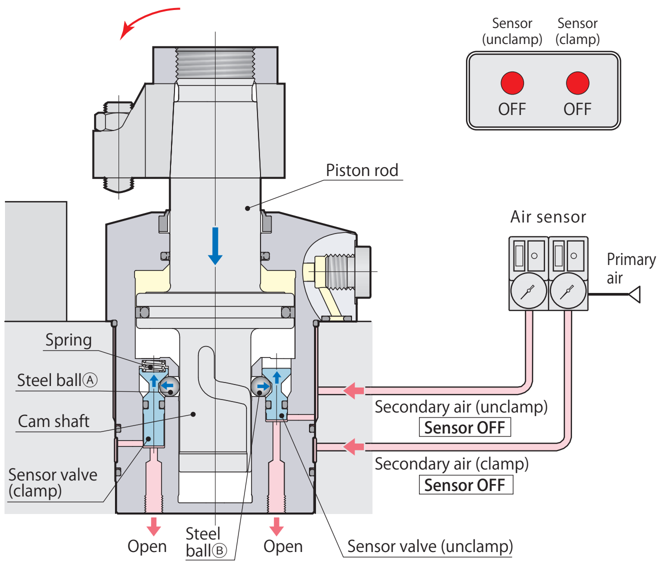
Clamp, Unclamp, Over clamp stroke detection signal

Unclamp detection



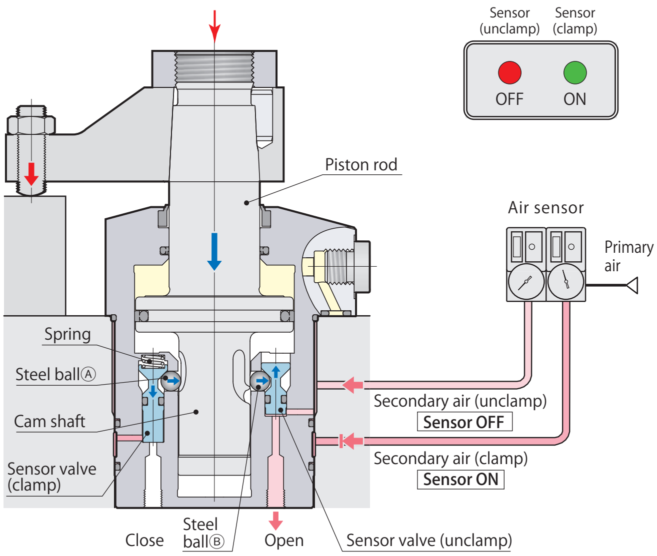
Sensor signal (unclamp)	ON	Unclamp
Sensor signal (clamp)	OFF	

In the middle of swing stroke



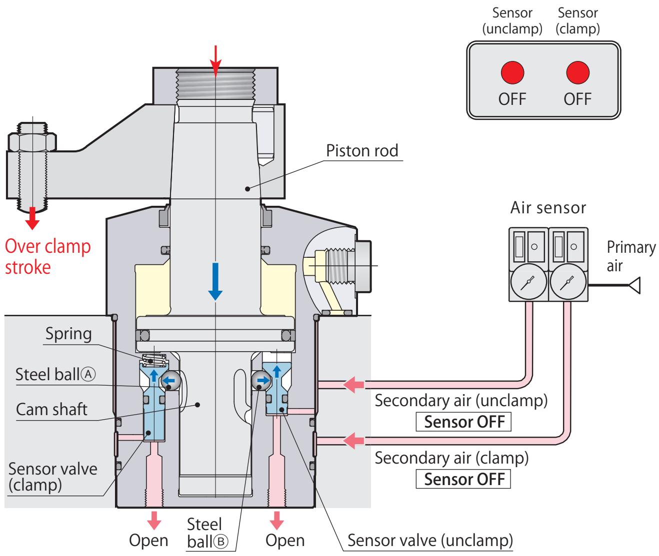
Sensor signal (unclamp)	OFF	In the middle of swing stroke
Sensor signal (clamp)	OFF	

Clamp detection



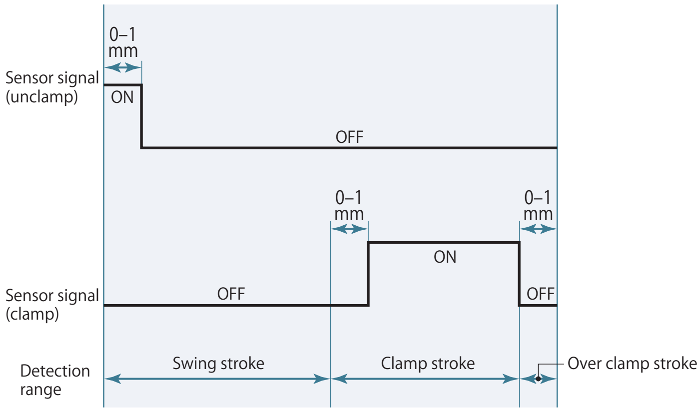
Sensor signal (unclamp)	OFF	Clamp
Sensor signal (clamp)	ON	

Over clamp stroke (Incomplete clamp) detection



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

Air sensor triggering point



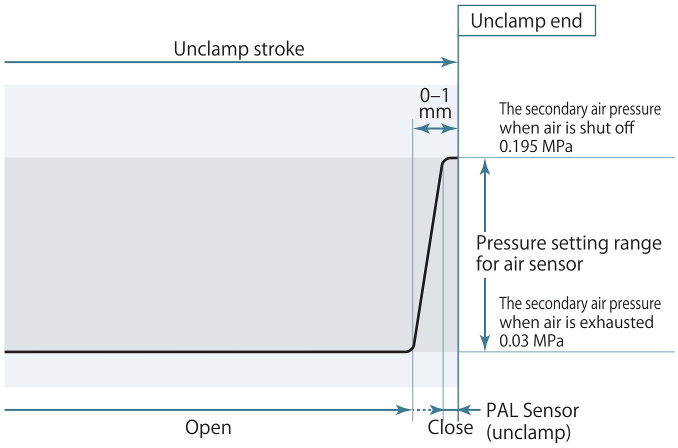
- Refer to the sensor supplier's instruction manual for the details of setting.
- Sensing performance such as detectable time and pressure differs depending on the supplier and model number of the sensor. Select the right model referring to sensor’s application and characteristics.

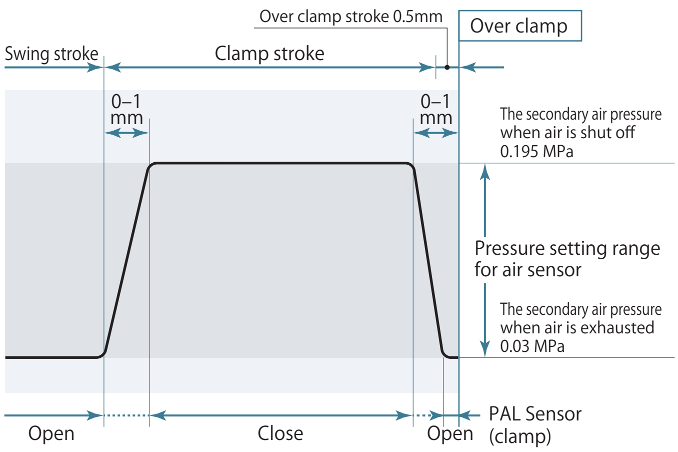
Air sensor unit recommended condition of use

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



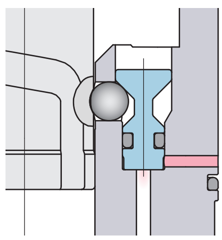


The diagram shown on the left indicates the relation between the PAL sensor, piston stroke, and secondary air pressure. (The pressure shown in the diagram is a reference based on the 0.2 MPa of primary air pressure for one piece of clamp.)

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

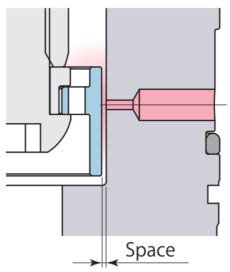
- Enhances the pressure setting range of the sensor which enables the sensor to set easily.
  (Ex. Pressure setting range 0.03–0.195 MPa in the diagram)
- Allows the use for a number of clamps by one air sensor because of better pressure holding when air is shut off.
  (Maximum number of clamps to be 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



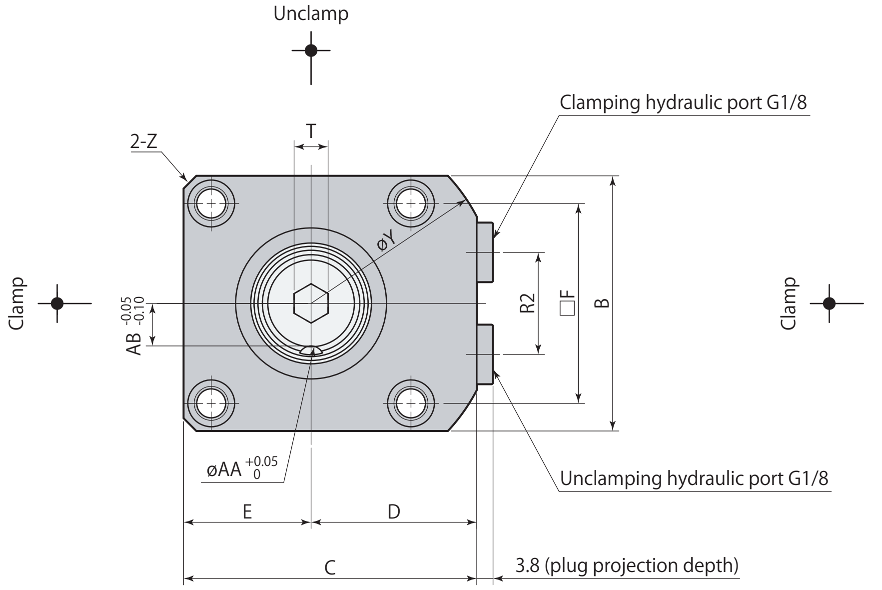
Poppet structure ensures superior sealing performance and can create large differential-pressure when the valve is opening and closing, and air leakage can be minimized.

Previous sensor valve

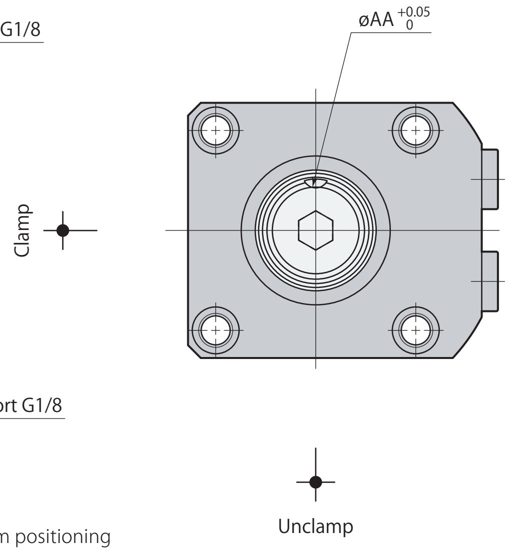


Air leaks easily due to a large space.

Dimensions

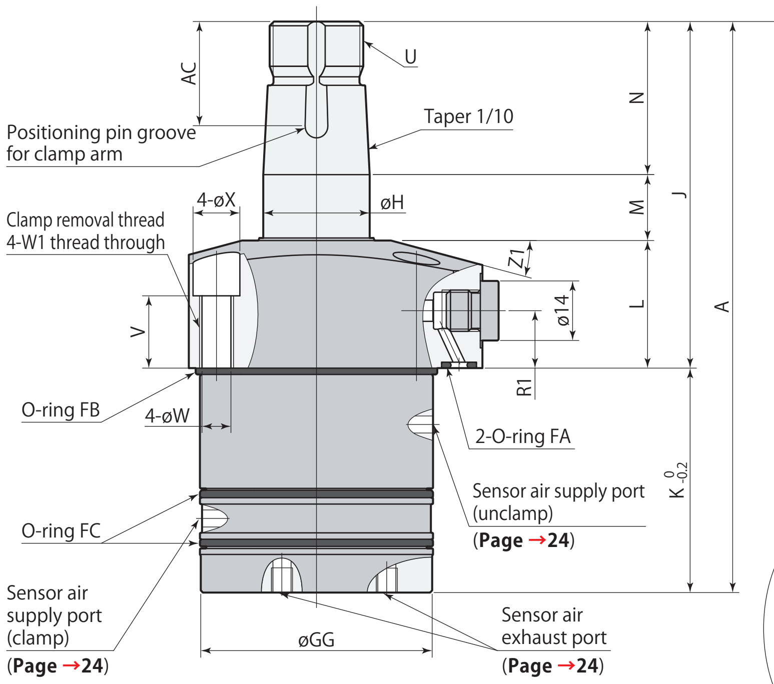


This diagram indicates the arm positioning pin groove at unclamped condition.

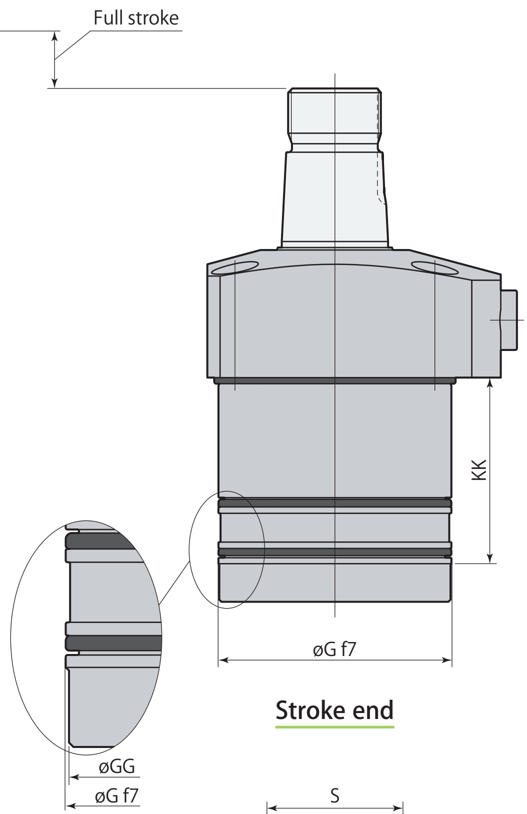


Swing direction L (counter-clockwise)

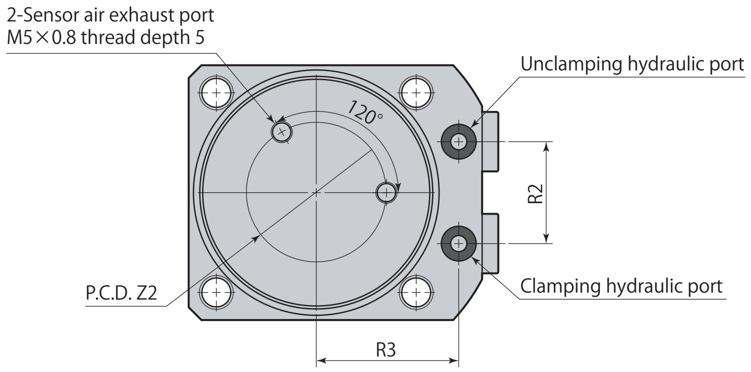
Swing direction R (clockwise)

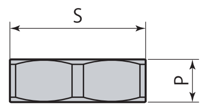


Unclamp



Stroke end





Hex nut for arm mount

- Hex nut for arm mount is included.
- Refer to **page →72** for the details of perfect nut.
- Clamp arm, positioning pin and mounting screws are not included.

mm

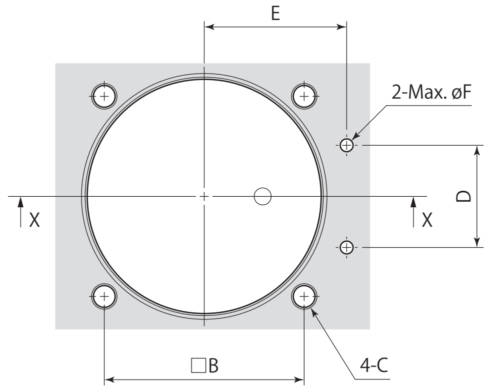
Model		CTM04-□T	CTM05-□T	CTM06-□T	CTM10-□T
Cylinder capacity (cm³)	Clamp	6.0	9.0	14.4	20.7
	Unclamp	9.1	14.0	21.3	31.7
A		113.5	120.5	134.5	146
B		45	51	60	70
C		54	61	69	81
D		31.5	35.5	39	46
E		22.5	25.5	30	35
F		34	40	47	55
øG		$40^{-0.025}_{-0.050}$	$48^{-0.025}_{-0.050}$	$55^{-0.030}_{-0.060}$	$65^{-0.030}_{-0.060}$
øGG		39.7	47.6	54.6	64.6
øH		18	22	25	30
J		65.5	74.5	81.5	88
K		48	46	53	58
KK		41.5	37.5	44	46.5
L		25	28	30	31
M		13.5	14.5	15.5	17
N		27	32	36	40
P		8	9	10	11
R1		12.5	14	13.5	14
R2		18	22	24	30
R3		26	30	33.5	39.5
S (nut width across flats)		24	30	32	41
T (hex socket)		6	8	8	10
U		M16×1.5	M20×1.5	M22×1.5	M27×1.5
V		15	17.5	17	17
øW		5.5	5.5	6.8	6.8
W1		M6×1	M6×1	M8×1.25	M8×1.25
øX		9	9	11	11
øY		73	83	88	106
Z		C3	C3	C3	C4
Z1		12°	15°	15°	15°
Z2		22	27	33	38
øAA (pin groove diameter)		4	5	6	6
AB		7	9	10	12.5
AC		18.5	21.5	24.5	27.5
Positioning pin (dowel pin)		ø4(h8)×10	ø5(h8)×12	ø6(h8)×14	ø6(h8)×16
O-ring FA (fluorocarbon hardness Hs90)		P5	P5	P5	P7
O-ring FB (fluorocarbon hardness Hs70)		38×1.5 (inner diameter×thickness)	AS568-031	AS568-034	AS568-037
O-ring FC (fluorocarbon hardness Hs70)		AS568-028	AS568-031	AS568-033	AS568-036
Taper sleeve		CTH04-MS	CTH05-MS	CTH06-MS	CTH10-MS
Flow control valve*	Meter-in	VCF01S	VCF01S	VCF01S	VCF01
	Meter-out	VCF01S-O	VCF01S-O	VCF01S-O	VCF01-O
Air bleeding valve		VCE01	VCE01	VCE01	VCE01

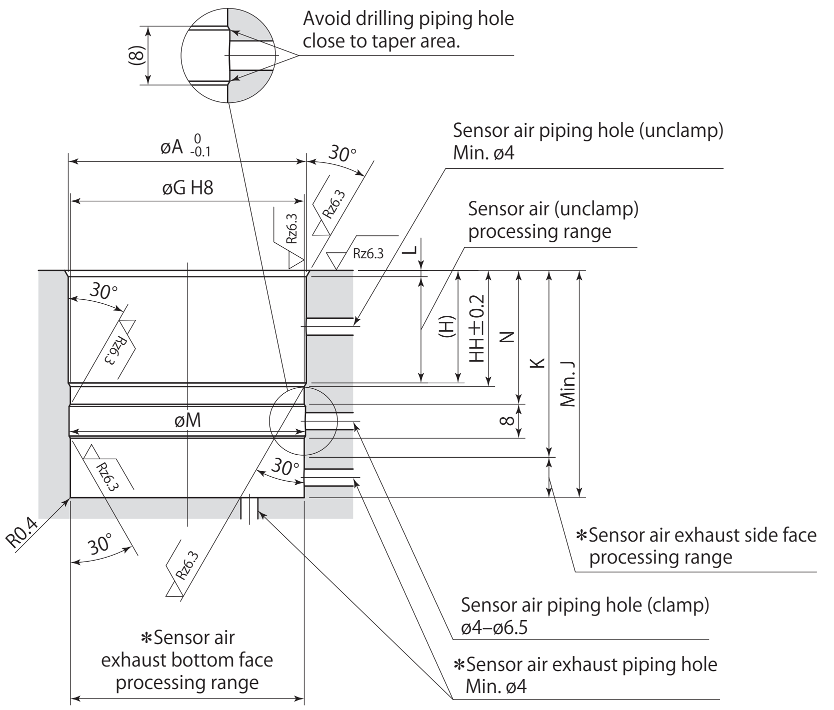
*:Select the right model of VCF according to the size of the clamp.

Refer to each page for the details of options.

● Taper sleeve **page →70** ● Flow control valve **page →140** ● Air bleeding valve **page →142**

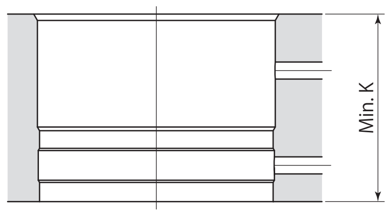
Mounting details





In blind hole X-X

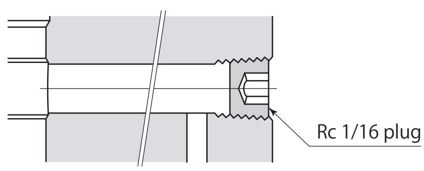
*: Sensor air exhaust piping hole must be made on either side or bottom face.



In through hole X-X

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 1/16 plug.



Mounting details

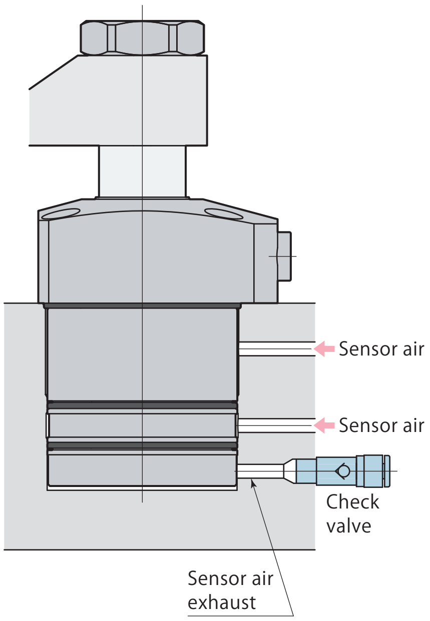
mm

Model	CTM04-□T	CTM05-□T	CTM06-□T	CTM10-□T
øA	40.8	49	56	66
B	34	40	47	55
C	M5	M5	M6	M6
D	18	22	24	30
E	26	30	33.5	39.5
øF	3	3	3	5
øG	$40^{+0.039}_{0}$	$48^{+0.039}_{0}$	$55^{+0.046}_{0}$	$65^{+0.046}_{0}$
H	24.5	20	26.5	29
HH	25.2	20.9	27.4	29.9
J	48.5	46.5	53.5	58.5
K	41.5	37.5	44	46.5
L	1.2	1.5	1.5	1.5
øM	40.6	48.6	55.6	65.6
N	29	25	31.5	34

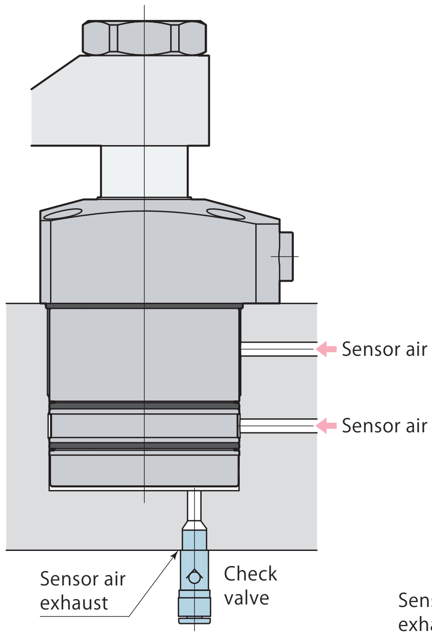
Caution for piping

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

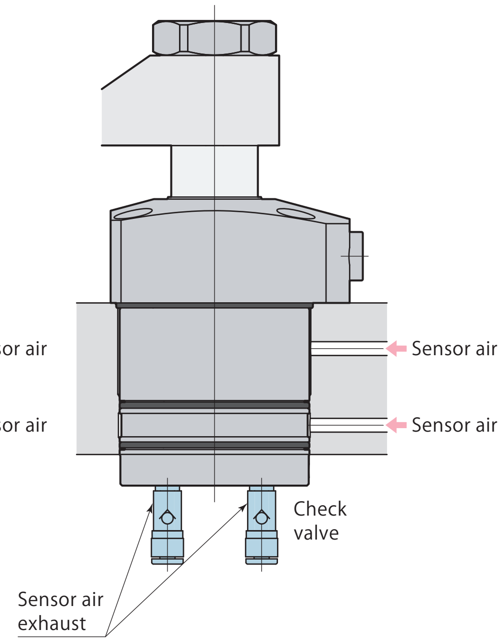
Mounting in blind hole
(Sensor air exhaust：side face)



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



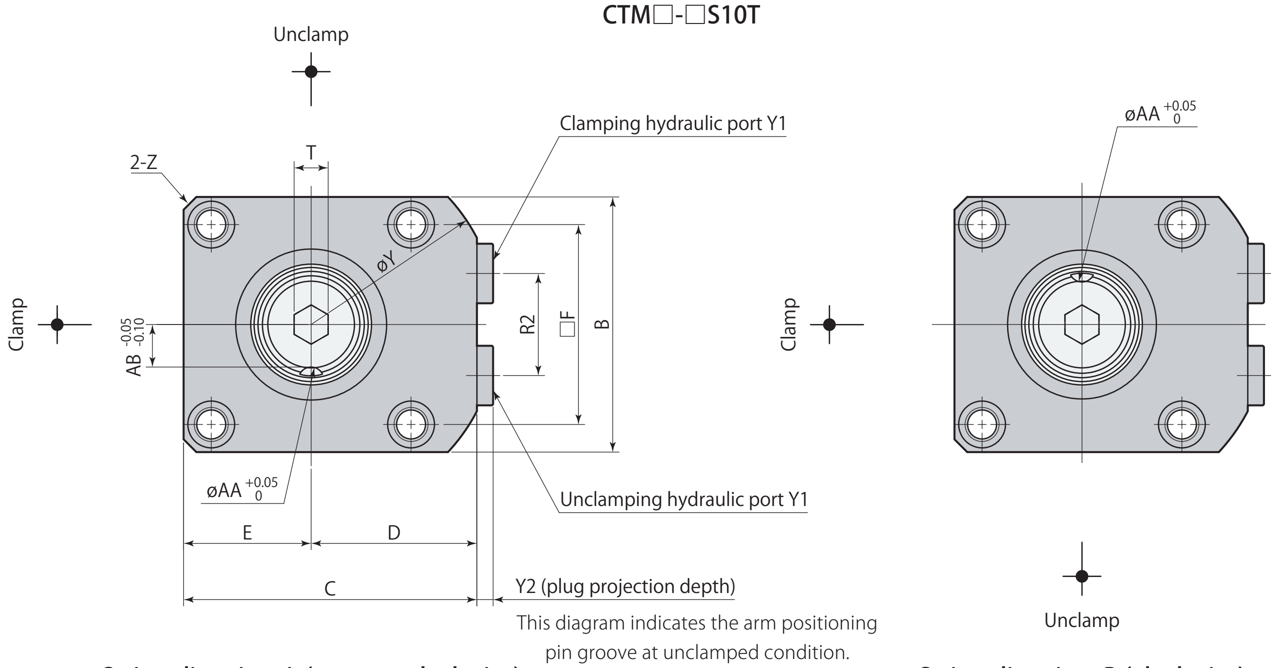
Mounting in through hole



● 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.

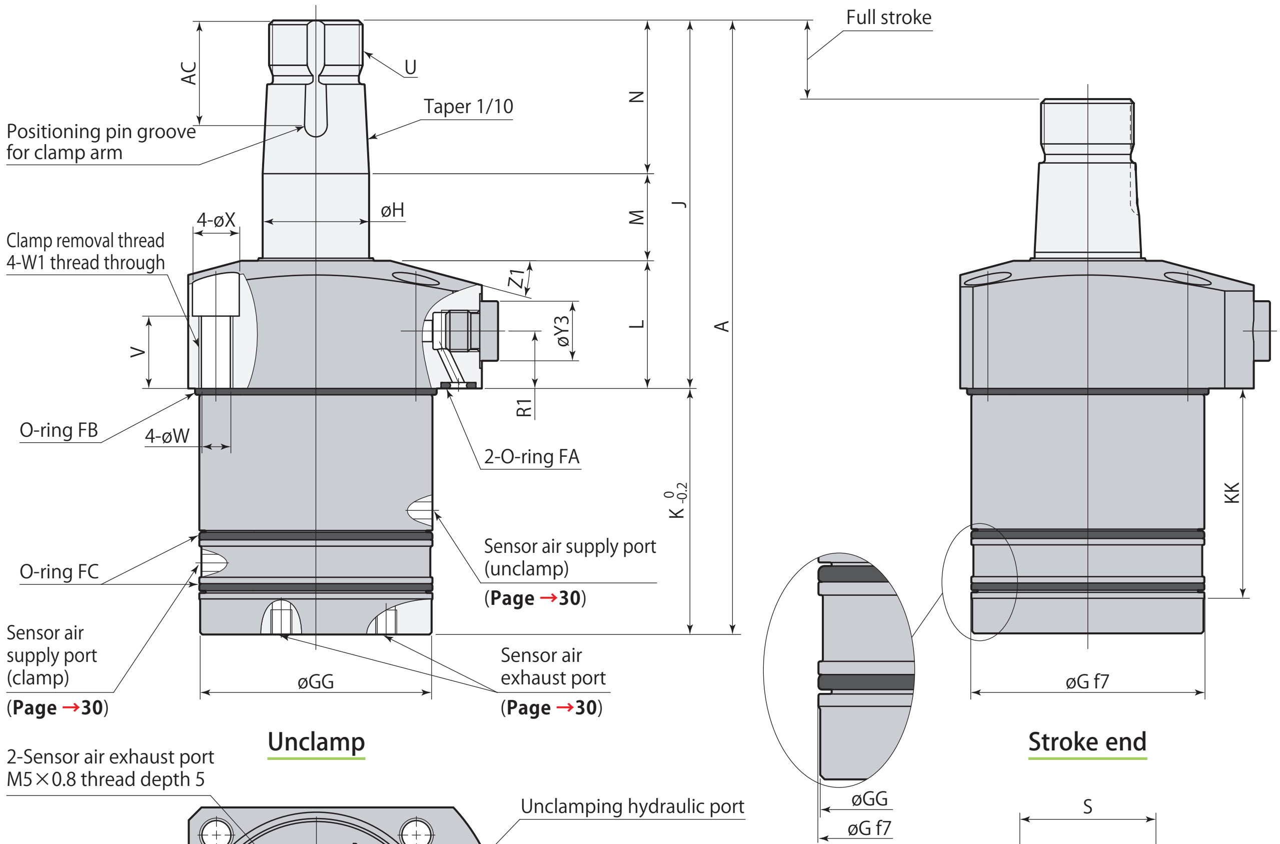
Dimensions

CTM□-□S10T



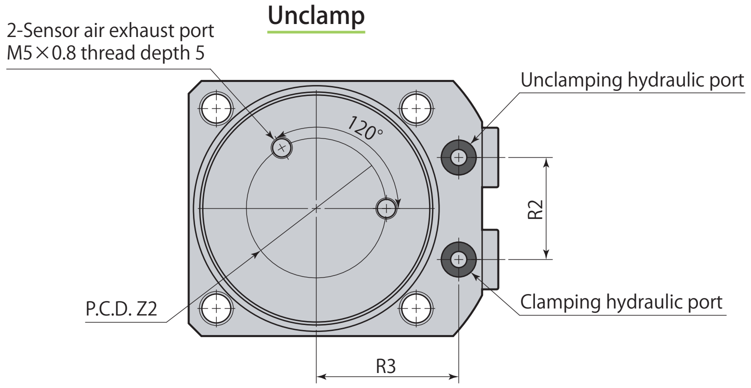
Swing direction L (counter-clockwise)

Swing direction R (clockwise)



Unclamp

Stroke end



Hex nut for arm mount

- Hex nut for arm mount is included.
- Refer to **page →72** for the details of perfect nut.
- Clamp arm, positioning pin and mounting screws are not included.

mm

Model		CTM04-□S10T	CTM05-□S10T	CTM06-□S10T	CTM10-□S10T	CTM16-□S10T
Cylinder capacity (cm³)	Clamp	8.5	12.5	19.6	27.4	45.7
	Unclamp	12.8	19.4	28.9	41.9	67.9
A		123.5	130.5	144.5	156	177
B		45	51	60	70	80
C		54	61	69	81	92
D		31.5	35.5	39	46	52
E		22.5	25.5	30	35	40
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		39.7	47.6	54.6	64.6	74.6
øH		18	22	25	30	35.5
J		70.5	79.5	86.5	93	108
K		53	51	58	63	69
KK		46.5	42.5	49	51.5	56.5
L		25	28	30	31	38
M		18.5	19.5	20.5	22	24
N		27	32	36	40	46
P		8	9	10	11	11
R1		12.5	14	13.5	14	16
R2		18	22	24	30	32
R3		26	30	33.5	39.5	45
S (nut width across flats)		24	30	32	41	46
T (hex socket)		6	8	8	10	10
U		M16×1.5	M20×1.5	M22×1.5	M27×1.5	M30×1.5
V		15	17.5	17	17	21
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	9	11	11	14
øY		73	83	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	C4	C5
Z1		12°	15°	15°	15°	15°
Z2		22	27	33	38	45
øAA (pin groove diameter)		4	5	6	6	8
AB		7	9	10	12.5	14
AC		18.5	21.5	24.5	27.5	28.5
Positioning pin (dowel pin)		ø4(h8)×10	ø5(h8)×12	ø6(h8)×14	ø6(h8)×16	ø8(h8)×16
O-ring FA (fluorocarbon hardness Hs90)		P5	P5	P5	P7	P7
O-ring FB (fluorocarbon hardness Hs70)		38×1.5 (inner diameter×thickness)	AS568-031	AS568-034	AS568-037	AS568-040
O-ring FC (fluorocarbon hardness Hs70)		AS568-028	AS568-031	AS568-033	AS568-036	AS568-039
Taper sleeve		CTH04-MS	CTH05-MS	CTH06-MS	CTH10-MS	CTH16-MS
Flow control valve*	Meter-in	VCF01S	VCF01S	VCF01S	VCF01	VCF02
	Meter-out	VCF01S-O	VCF01S-O	VCF01S-O	VCF01-O	VCF02-O
Air bleeding valve		VCE01	VCE01	VCE01	VCE01	VCE02

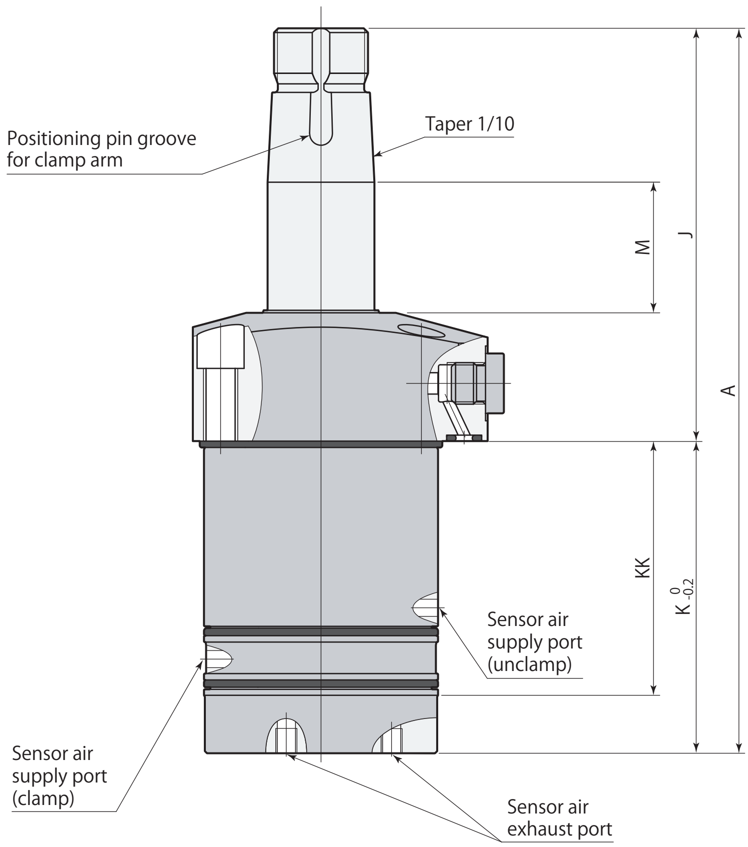
＊:Select the right model of VCF and VCE according to the size of the clamp.

Refer to each page for the details of options.

● Taper sleeve **page →70** ● Flow control valve **page →140** ● Air bleeding valve **page →142**

Dimensions

CTM□-□S20T



Unclamp

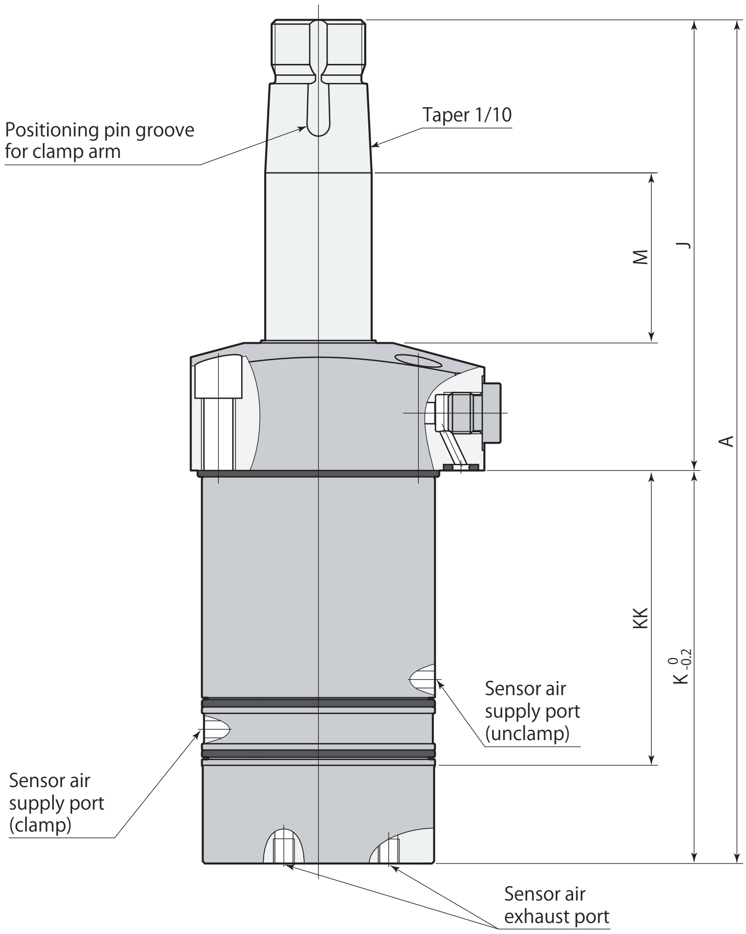
mm

Model		CTM04-□S20T	CTM05-□S20T	CTM06-□S20T	CTM10-□S20T	CTM16-□S20T
Cylinder capacity (cm^3)	Clamp	13.5	19.5	29.9	40.7	66.0
	Unclamp	20.4	30.1	44.1	62.3	98.1
A		148.5	155.5	169.5	181	205
J		80.5	89.5	96.5	103	118
K		68	66	73	78	87
KK		56.5	52.5	59	61.5	66.5
M		28.5	29.5	30.5	32	34

● Refer to **pages** →**26**, **27** for other dimensions that are not shown in the diagram.
Refer to each page for the details of options.
● Taper sleeve **page** →**70** ● Flow control valve **page** →**140** ● Air bleeding valve **page** →**142**
● This product is made to order.

Dimensions

CTM□-□S30T



Unclamp

mm

Model		CTM06-□S30T	CTM10-□S30T	CTM16-□S30T
Cylinder capacity (cm³)	Clamp	40.2	54.1	86.2
	Unclamp	59.3	82.7	128.3
A		199.5	211	235
J		106.5	113	128
K		93	98	107
KK		69	71.5	76.5
M		40.5	42	44

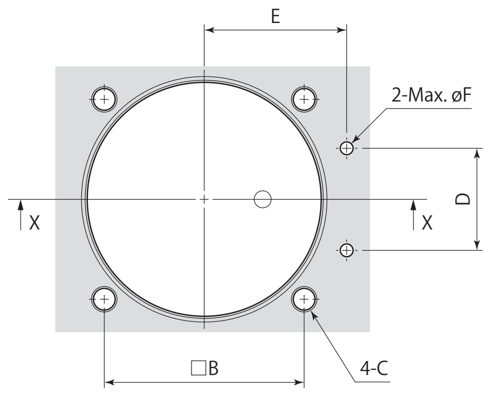
● Refer to **pages →26, 27** for other dimensions that are not shown in the diagram.

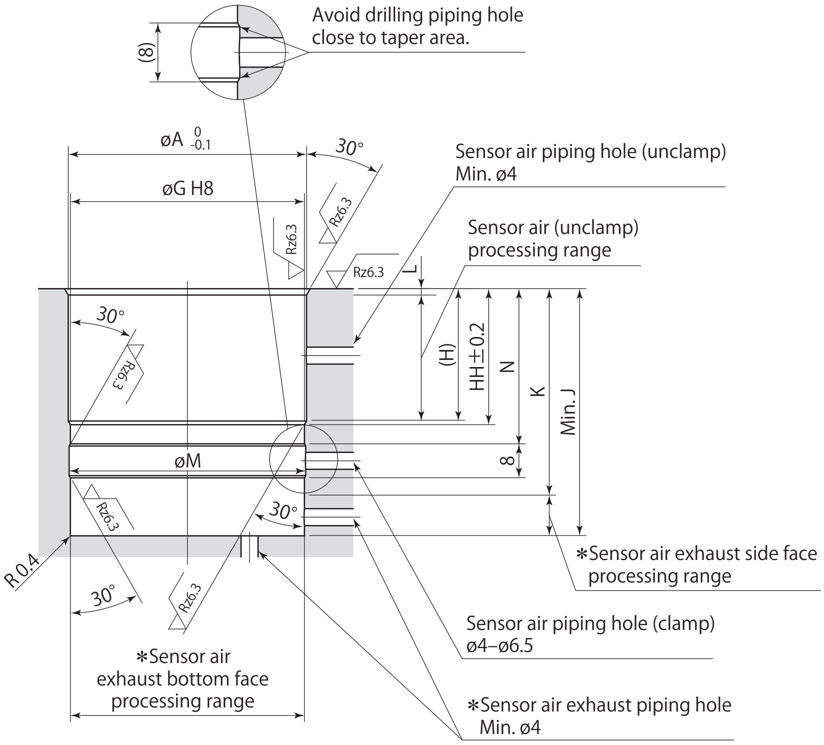
Refer to each page for the details of options.

● Taper sleeve **page →70** ● Flow control valve **page →140** ● Air bleeding valve **page →142**

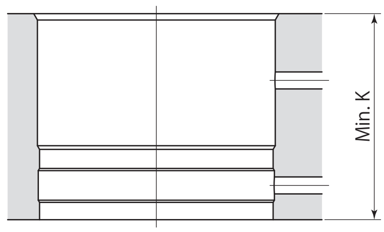
● This product is made to order.

Mounting details





In blind hole X-X

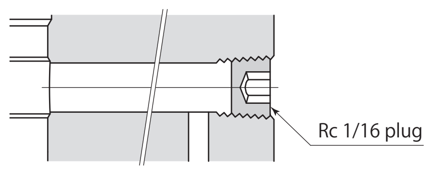


In through hole X-X

*: 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 1/16 plug.



- Refer to **page →25** for caution for piping.

Mounting details

mm

Model	CTM04-□S10T	CTM05-□S10T	CTM06-□S10T	CTM10-□S10T	CTM16-□S10T
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	29.5	25	31.5	34	39
HH	30.2	25.9	32.4	34.9	39.9
J	53.5	51.5	58.5	63.5	69.5
K	46.5	42.5	49	51.5	56.5
L	1.2	1.5	1.5	1.5	1.5
øM	40.6	48.6	55.6	65.6	75.6
N	34	30	36.5	39	44

mm

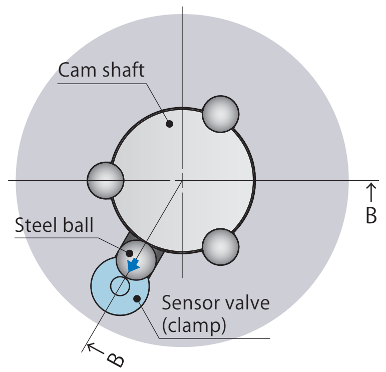
Model	CTM04-□S20T	CTM05-□S20T	CTM06-□S20T	CTM10-□S20T	CTM16-□S20T
H	39.5	35	41.5	44	49
HH	40.2	35.9	42.4	44.9	49.9
J	68.5	66.5	73.5	78.5	87.5
K	56.5	52.5	59	61.5	66.5
N	44	40	46.5	49	54

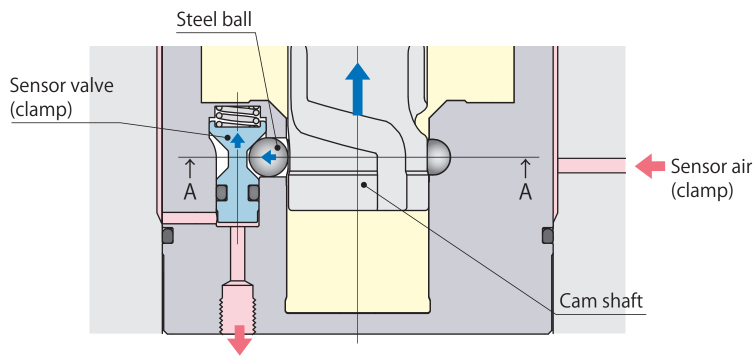
mm

Model	CTM06-□S30T	CTM10-□S30T	CTM16-□S30T
H	51.5	54	59
HH	52.4	54.9	59.9
J	93.5	98.5	107.5
K	69	71.5	76.5
N	56.5	59	64

Clamp PAL sensor function and structure

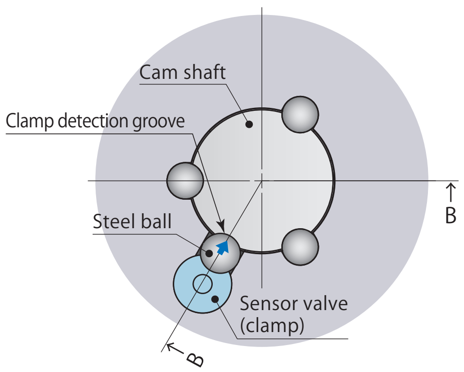
In the middle of swing stroke

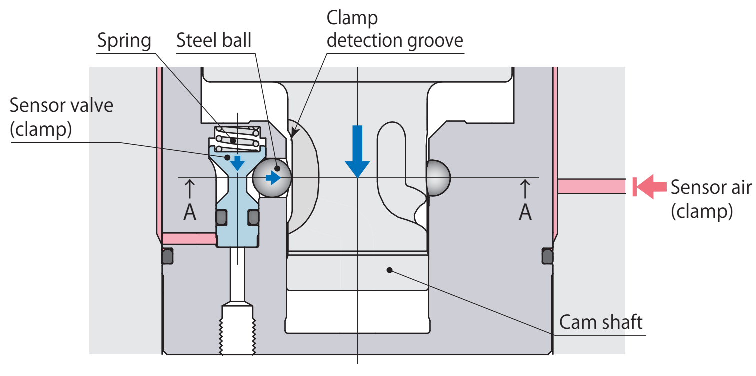




- The sensor valve (clamp) is pushed up by the steel ball to open for air exhaust while piston rod swing strokes.

Clamp detection

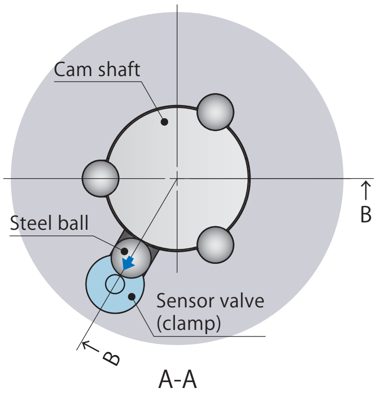


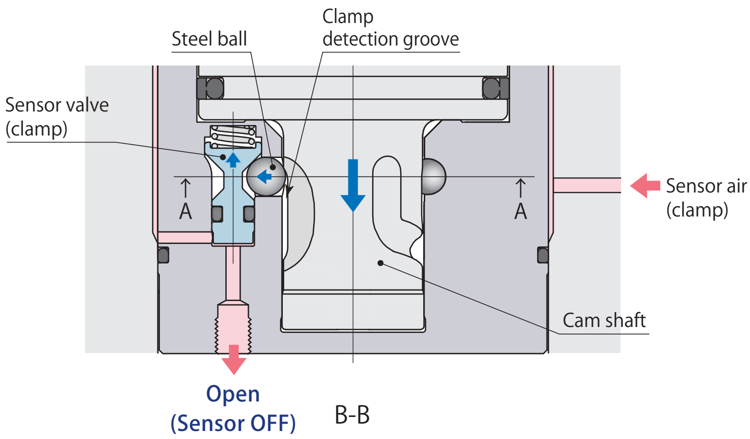


- The steel ball seats in the clamp detection groove when the cam shaft reaches clamping point, and a sensor valve (clamp) is pushed down to shut of the sensor air by a spring, and detects the clamped condition.

Clamp PAL sensor function and structure

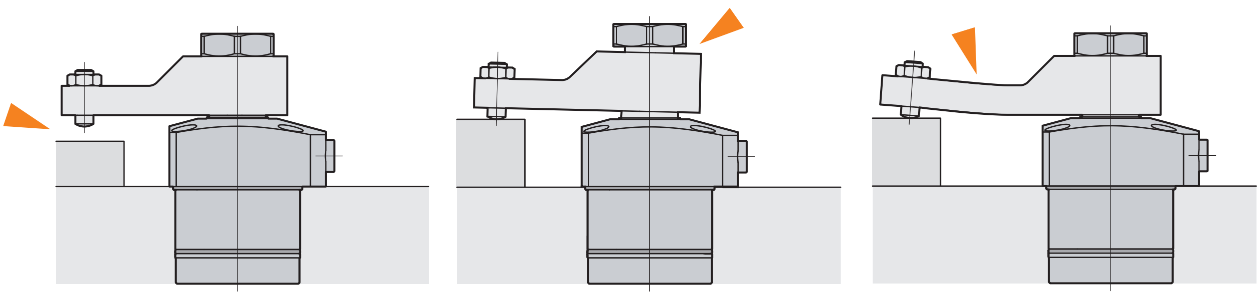
Over clamp stroke (Incomplete clamp) detection





- When the cam shaft passes the clamping point, the sensor valve (clamp) is pushed up by the steel ball to open for air exhaust, and detects the over clamp stroked condition.

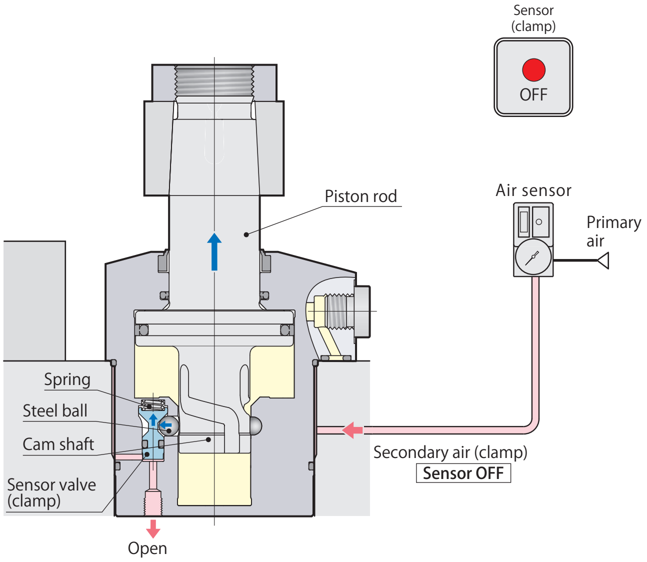
Over clamp stroke (Incomplete clamp) detection example



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

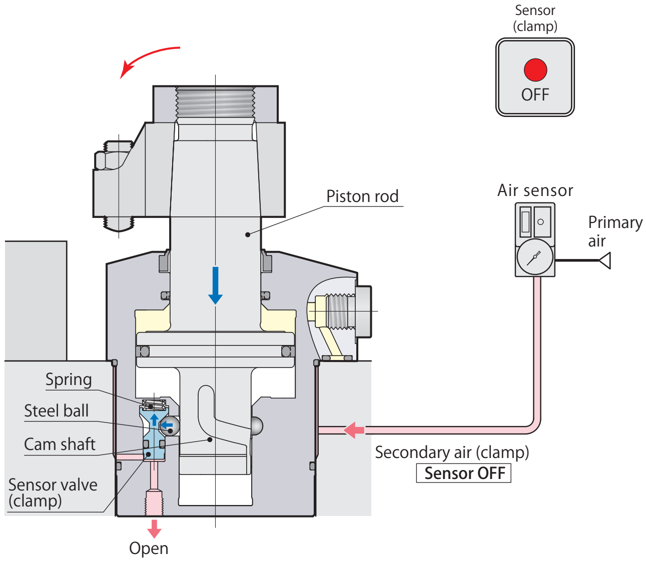
Clamp, Over clamp stroke detection signal

Unclamp



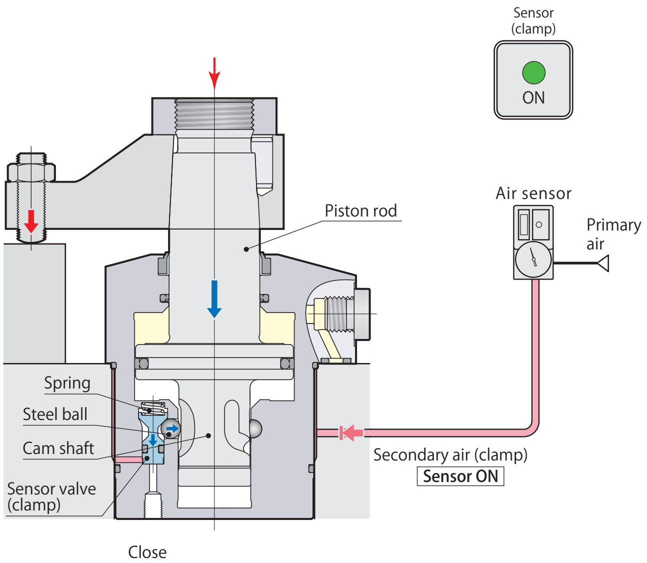
Sensor signal (clamp)	OFF	Unclamp

In the middle of swing stroke



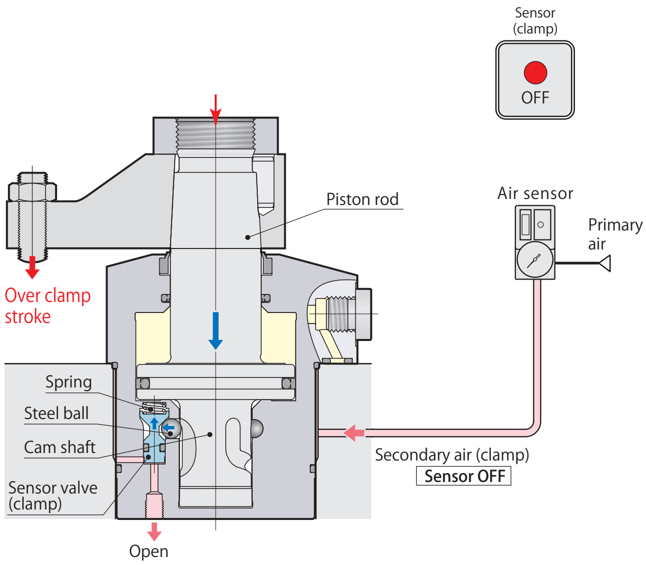
Sensor signal (clamp)	OFF	In the middle of swing stroke

Clamp detection



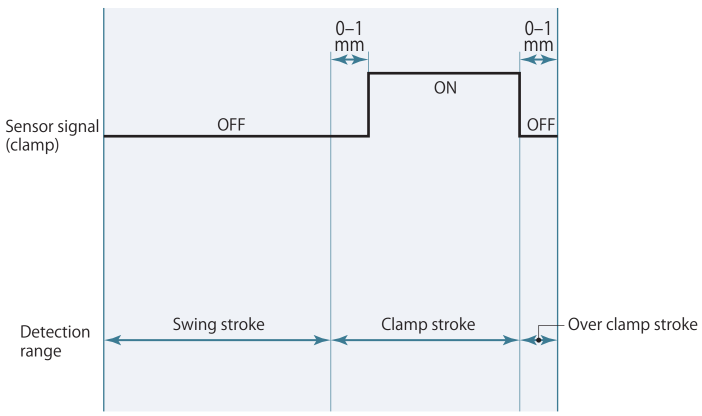
Sensor signal (clamp)	ON	Clamp

Over clamp stroke (Incomplete clamp) detection



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

Air sensor triggering point



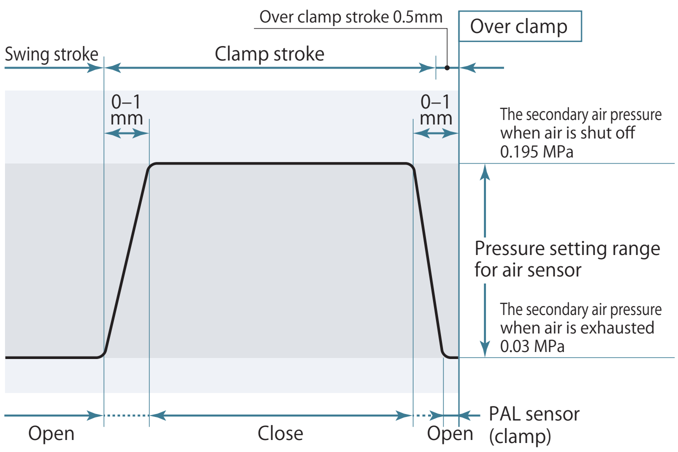
- Refer to the sensor supplier's instruction manual for the details of setting.
- Sensing performance such as detectable time and pressure differs depending on the supplier and model number of the sensor. Select the right model referring to sensor's application and characteristics.

Air sensor unit 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

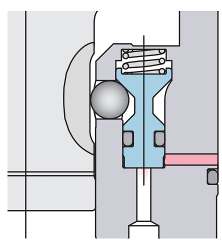


The diagram shown above indicates the relation between the PAL sensor, piston stroke, and secondary air pressure. (The pressure shown in the diagram is a reference based on the 0.2 MPa of primary air pressure for one piece of clamp.)

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

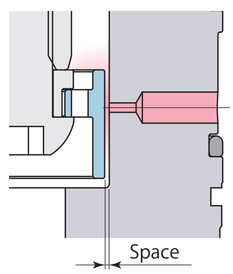
- Enhances the pressure setting range of the sensor which enables the sensor to set easily.
  (Ex. Pressure setting range 0.03–0.195 MPa in the diagram)
- Allows the use for a number of clamps by one air sensor because of better pressure holding when air is shut off. (Maximum number of clamps to be detected 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



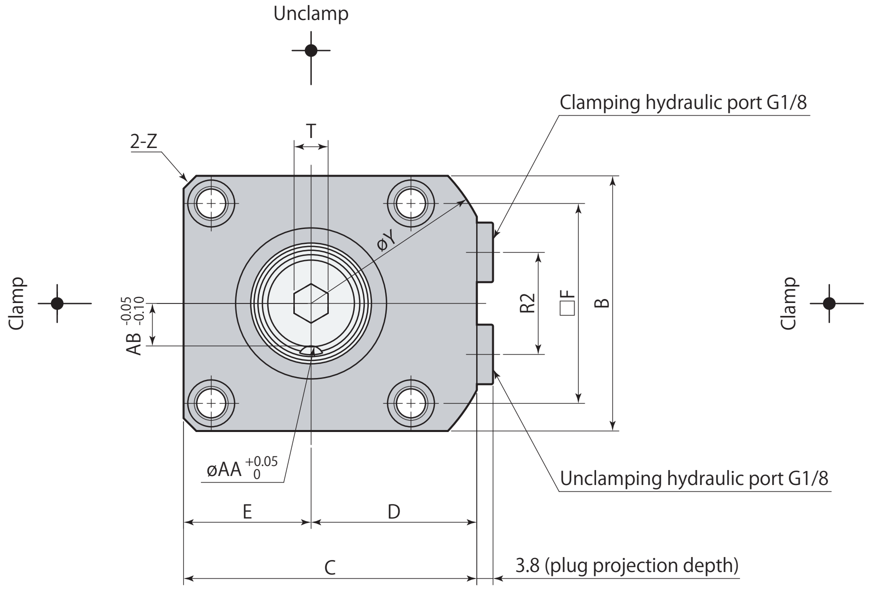
Poppet structure ensures superior sealing performance and can create large differential-pressure when the valve is opening and closing, and air leakage can be minimized.

Previous sensor valve



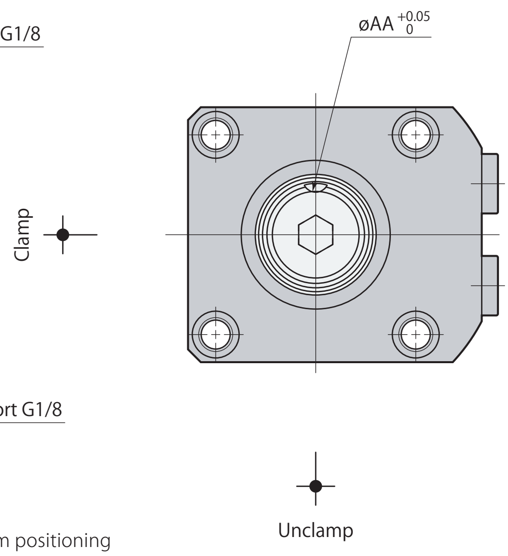
Air leaks easily due to a large space.

Dimensions

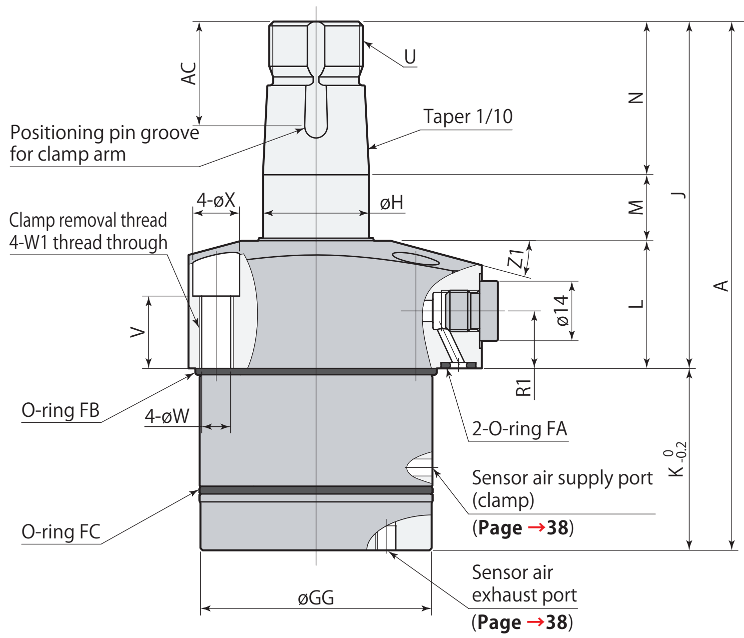


This diagram indicates the arm positioning pin groove at unclamped condition.

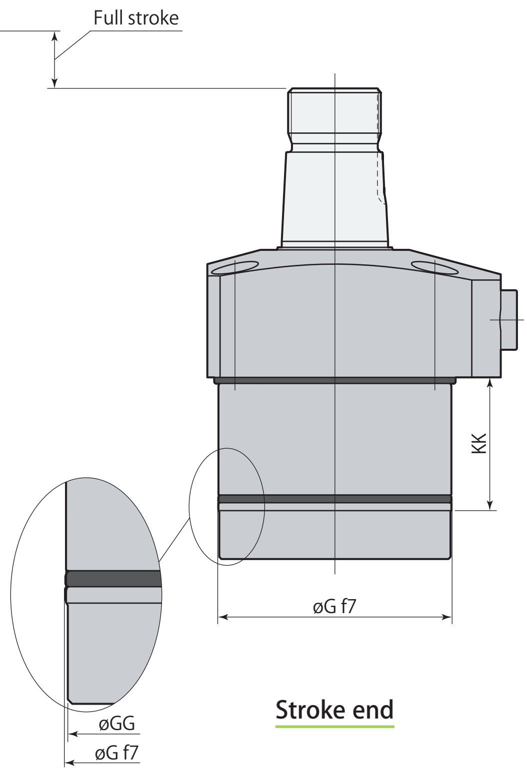
Swing direction L (counter-clockwise)



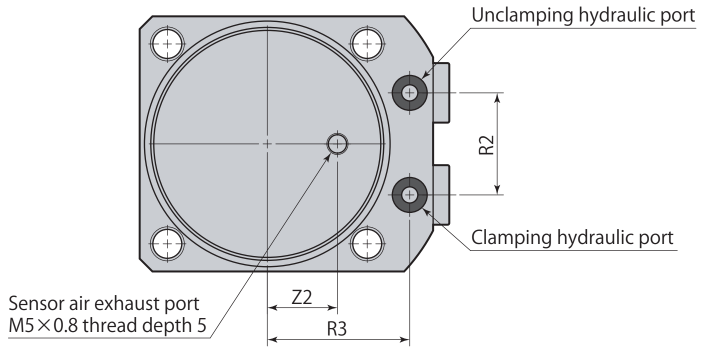
Swing direction R (clockwise)

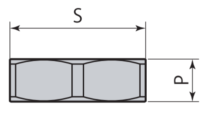


Unclamp



Stroke end





Hex nut for arm mount

- Hex nut for arm mount is included.
- Refer to **page →72** for the details of perfect nut.
- Clamp arm, positioning pin and mounting screws are not included.

mm

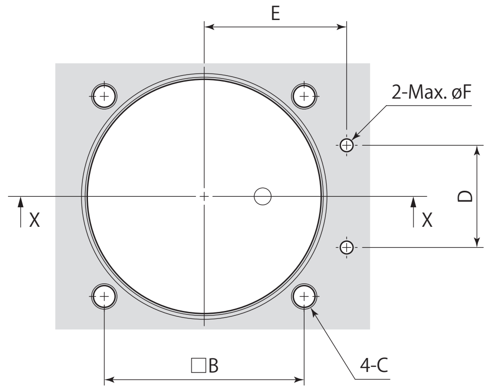
Model		CTM04-□C	CTM05-□C	CTM06-□C	CTM10-□C
Cylinder capacity (cm³)	Clamp	6.0	9.0	14.4	20.7
	Unclamp	9.1	14.0	21.3	31.7
A		103.5	110.5	124.5	136
B		45	51	60	70
C		54	61	69	81
D		31.5	35.5	39	46
E		22.5	25.5	30	35
F		34	40	47	55
øG		$40^{-0.025}_{-0.050}$	$48^{-0.025}_{-0.050}$	$55^{-0.030}_{-0.060}$	$65^{-0.030}_{-0.060}$
øGG		39.7	47.6	54.6	64.6
øH		18	22	25	30
J		65.5	74.5	81.5	88
K		38	36	43	48
KK		29.5	25	31.5	34
L		25	28	30	31
M		13.5	14.5	15.5	17
N		27	32	36	40
P		8	9	10	11
R1		12.5	14	13.5	14
R2		18	22	24	30
R3		26	30	33.5	39.5
S (nut width across flats)		24	30	32	41
T (hex socket)		6	8	8	10
U		M16×1.5	M20×1.5	M22×1.5	M27×1.5
V		15	17.5	17	17
øW		5.5	5.5	6.8	6.8
W1		M6×1	M6×1	M8×1.25	M8×1.25
øX		9	9	11	11
øY		73	83	88	106
Z		C3	C3	C3	C4
Z1		12°	15°	15°	15°
Z2		11	13.5	16.5	19
øAA (pin groove diameter)		4	5	6	6
AB		7	9	10	12.5
AC		18.5	21.5	24.5	27.5
Positioning pin (dowel pin)		ø4(h8)×10	ø5(h8)×12	ø6(h8)×14	ø6(h8)×16
O-ring FA (fluorocarbon hardness Hs90)		P5	P5	P5	P7
O-ring FB (fluorocarbon hardness Hs70)		38×1.5 (inner diameter×thickness)	AS568-031	AS568-034	AS568-037
O-ring FC (fluorocarbon hardness Hs70)		AS568-028	AS568-031	AS568-033	AS568-036
Taper sleeve		CTH04-MS	CTH05-MS	CTH06-MS	CTH10-MS
Flow control valve*	Meter-in	VCF01S	VCF01S	VCF01S	VCF01
	Meter-out	VCF01S-O	VCF01S-O	VCF01S-O	VCF01-O
Air bleeding valve		VCE01	VCE01	VCE01	VCE01

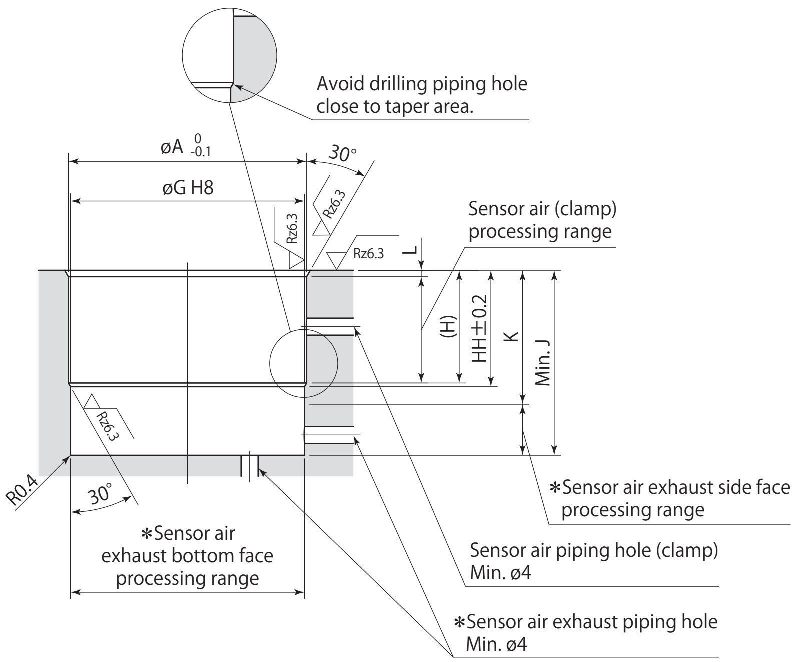
*: Select the right model of VCF according to the size of the clamp.

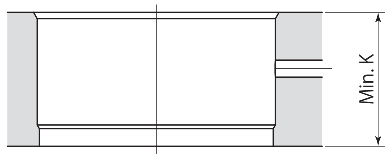
Refer to each page for the details of options.

● Taper sleeve **page →70** ● Flow control valve **page →140** ● Air bleeding valve **page →142**

Mounting details







In through hole X-X

In blind 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

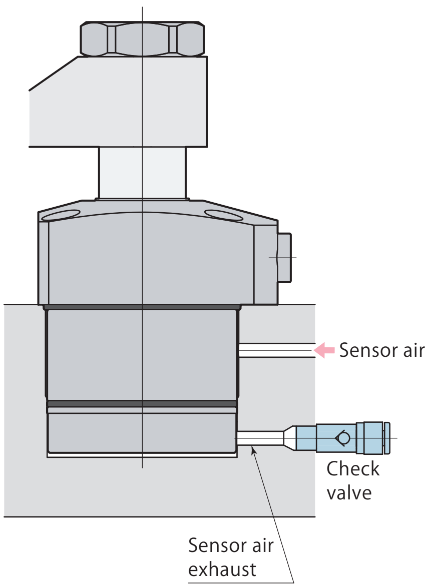
mm

Model	CTM04-□C	CTM05-□C	CTM06-□C	CTM10-□C
øA	40.8	49	56	66
B	34	40	47	55
C	M5	M5	M6	M6
D	18	22	24	30
E	26	30	33.5	39.5
øF	3	3	3	5
øG	$40^{+0.039}_{0}$	$48^{+0.039}_{0}$	$55^{+0.046}_{0}$	$65^{+0.046}_{0}$
H	24.5	20	26.5	29
HH	25.2	20.9	27.4	29.9
J	38.5	36.5	43.5	48.5
K	29.5	25	31.5	34
L	1.2	1.5	1.5	1.5

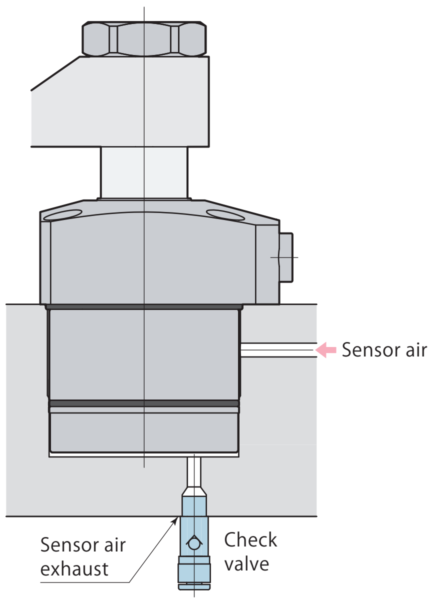
Caution for piping

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

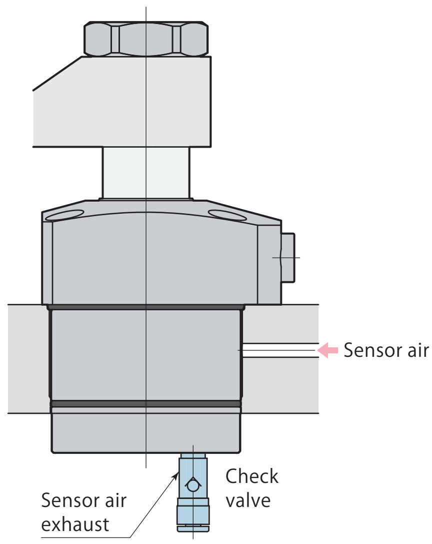
Mounting in blind hole
(Sensor air exhaust : side face)



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



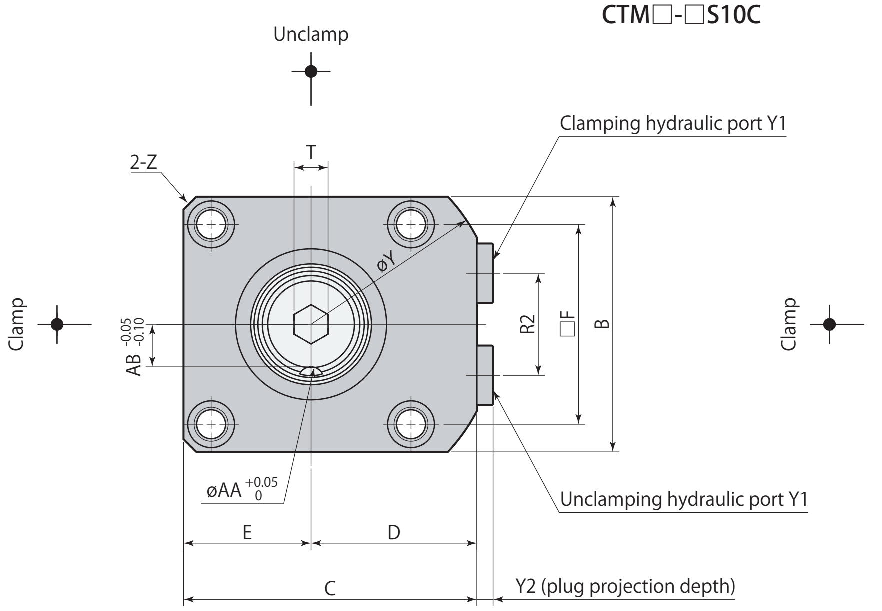
Mounting in through hole



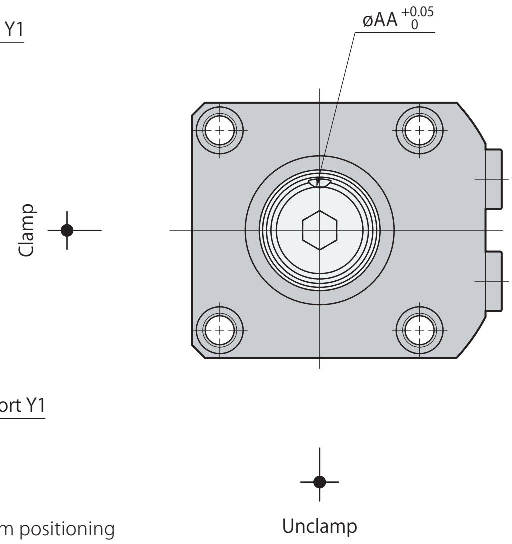
● Use a check valve with cracking pressure of 0.005 MPa or less if there is a risk of metal chips or coolant intrusion. Recommended check valve : AKH or AKB series manufactured by SMC.

Dimensions

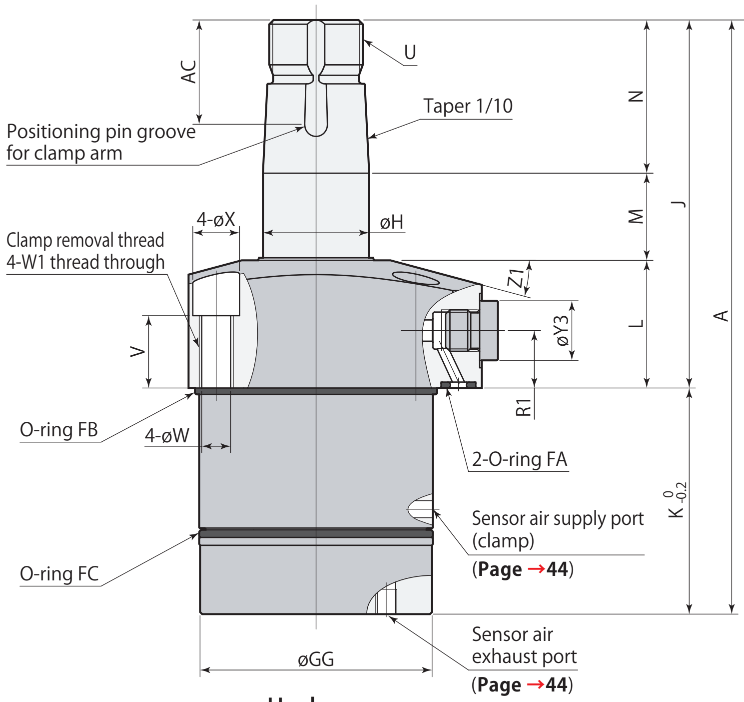
CTM□-□S10C



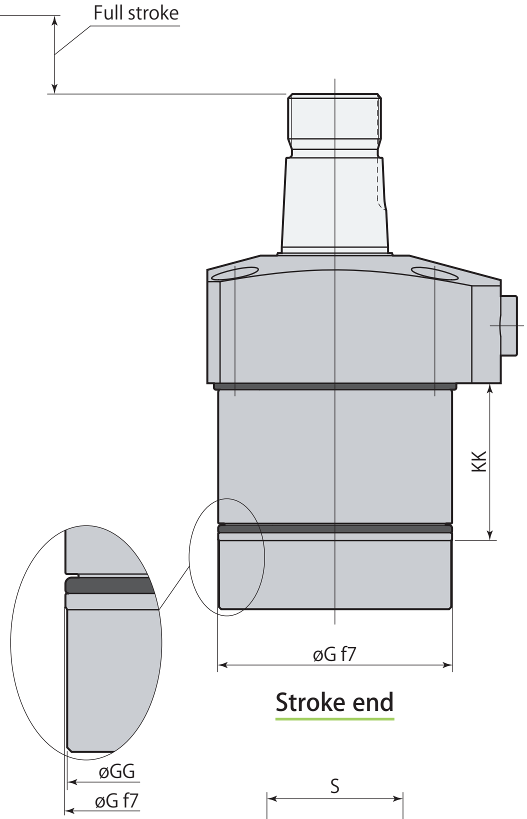
Swing direction L (counter-clockwise)



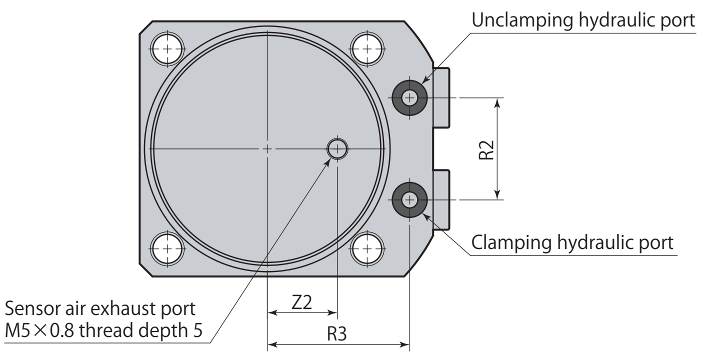
Swing direction R (clockwise)

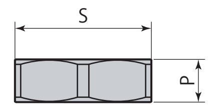


Unclamp



Stroke end





Hex nut for arm mount

- Hex nut for arm mount is included.
- Refer to **page →72** for the details of perfect nut.
- Clamp arm, positioning pin and mounting screws are not included.

mm

Model		CTM04-□S10C	CTM05-□S10C	CTM06-□S10C	CTM10-□S10C	CTM16-□S10C
Cylinder capacity (cm³)	Clamp	8.5	12.5	19.6	27.4	45.7
	Unclamp	12.8	19.4	28.9	41.9	67.9
A		118.5	125.5	139.5	151	175
B		45	51	60	70	80
C		54	61	69	81	92
D		31.5	35.5	39	46	52
E		22.5	25.5	30	35	40
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		39.7	47.6	54.6	64.6	74.6
øH		18	22	25	30	35.5
J		70.5	79.5	86.5	93	108
K		48	46	53	58	67
KK		34.5	30	36.5	39	44
L		25	28	30	31	38
M		18.5	19.5	20.5	22	24
N		27	32	36	40	46
P		8	9	10	11	11
R1		12.5	14	13.5	14	16
R2		18	22	24	30	32
R3		26	30	33.5	39.5	45
S (nut width across flats)		24	30	32	41	46
T (hex socket)		6	8	8	10	10
U		M16×1.5	M20×1.5	M22×1.5	M27×1.5	M30×1.5
V		15	17.5	17	17	21
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	9	11	11	14
øY		73	83	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	C4	C5
Z1		12°	15°	15°	15°	15°
Z2		11	13.5	16.5	19	22.5
øAA (pin groove diameter)		4	5	6	6	8
AB		7	9	10	12.5	14
AC		18.5	21.5	24.5	27.5	28.5
Positioning pin (dowel pin)		ø4(h8)×10	ø5(h8)×12	ø6(h8)×14	ø6(h8)×16	ø8(h8)×16
O-ring FA (fluorocarbon hardness Hs90)		P5	P5	P5	P7	P7
O-ring FB (fluorocarbon hardness Hs70)		38×1.5 (inner diameter×thickness)	AS568-031	AS568-034	AS568-037	AS568-040
O-ring FC (fluorocarbon hardness Hs70)		AS568-028	AS568-031	AS568-033	AS568-036	AS568-039
Taper sleeve		CTH04-MS	CTH05-MS	CTH06-MS	CTH10-MS	CTH16-MS
Flow control valve*	Meter-in	VCF01S	VCF01S	VCF01S	VCF01	VCF02
	Meter-out	VCF01S-O	VCF01S-O	VCF01S-O	VCF01-O	VCF02-O
Air bleeding valve*		VCE01	VCE01	VCE01	VCE01	VCE02

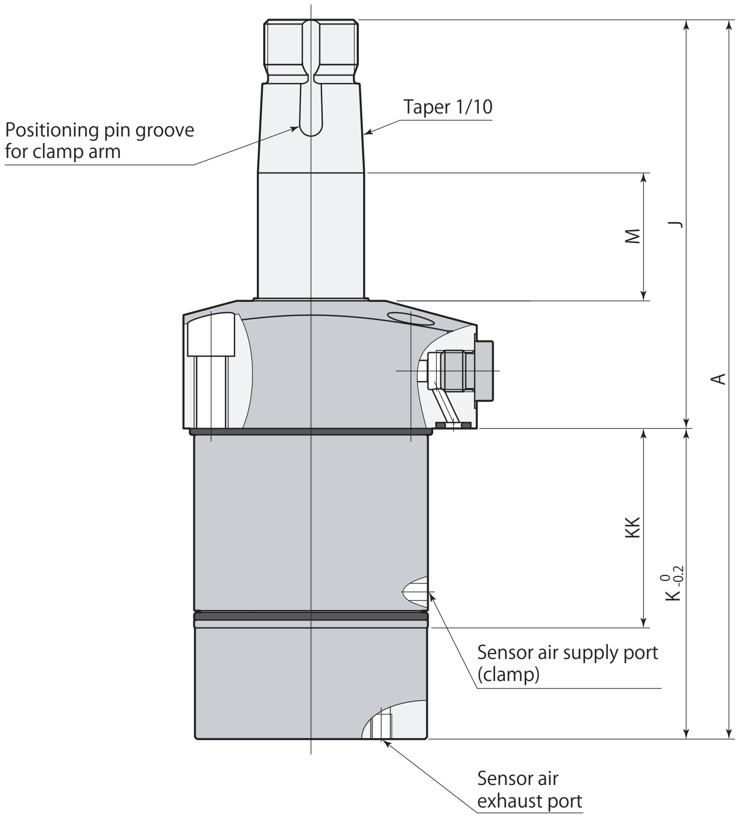
*: Select the right model of VCF and VCE according to the size of the clamp.

Refer to each page for the details of options.

● Taper sleeve **page →70** ● Flow control valve **page →140** ● Air bleeding valve **page →142**

Dimensions

CTM□-□S20C



Unclamp

mm

Model		CTM04-□S20C	CTM05-□S20C	CTM06-□S20C	CTM10-□S20C	CTM16-□S20C
Cylinder capacity (cm³)	Clamp	13.5	19.5	29.9	40.7	66.0
	Unclamp	20.4	30.1	44.1	62.3	98.1
A		148.5	155.5	169.5	181	205
J		80.5	89.5	96.5	103	118
K		68	66	73	78	87
KK		44.5	40	46.5	49	54
M		28.5	29.5	30.5	32	34

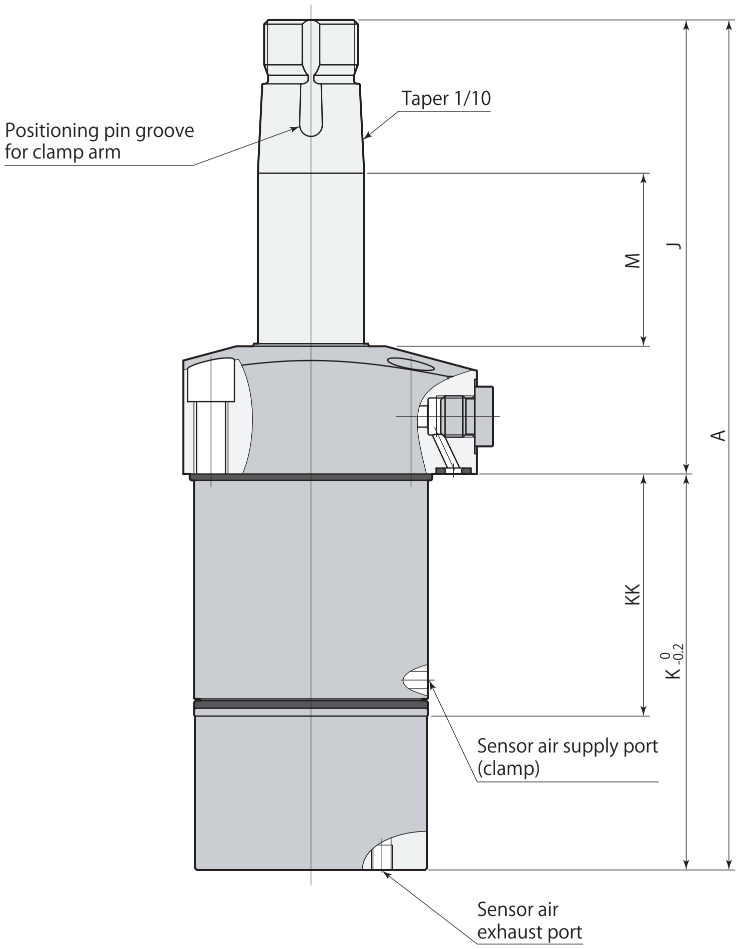
- Refer to **pages →40, 41** for other dimensions that are not shown in the diagram.

Refer to each page for the details of options.

- Taper sleeve **page →70**
- Flow control valve **page →140**
- Air bleeding valve **page →142**
- This product is made to order.

Dimensions

CTM□-□S30C



Unclamp

mm

Model		CTM06-□S30C	CTM10-□S30C	CTM16-□S30C
Cylinder capacity (cm³)	Clamp	40.2	54.1	86.2
	Unclamp	59.3	82.7	128.3
A		199.5	211	235
J		106.5	113	128
K		93	98	107
KK		56.5	59	64
M		40.5	42	44

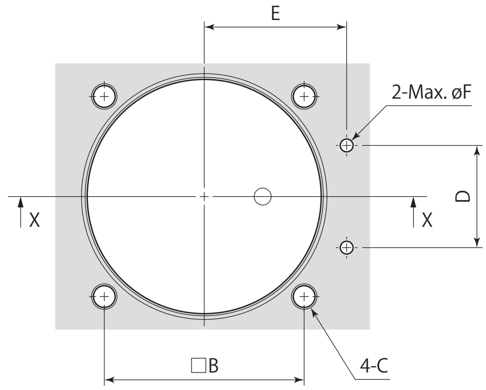
● Refer to **pages →40**, **41** for other dimensions that are not shown in the diagram.

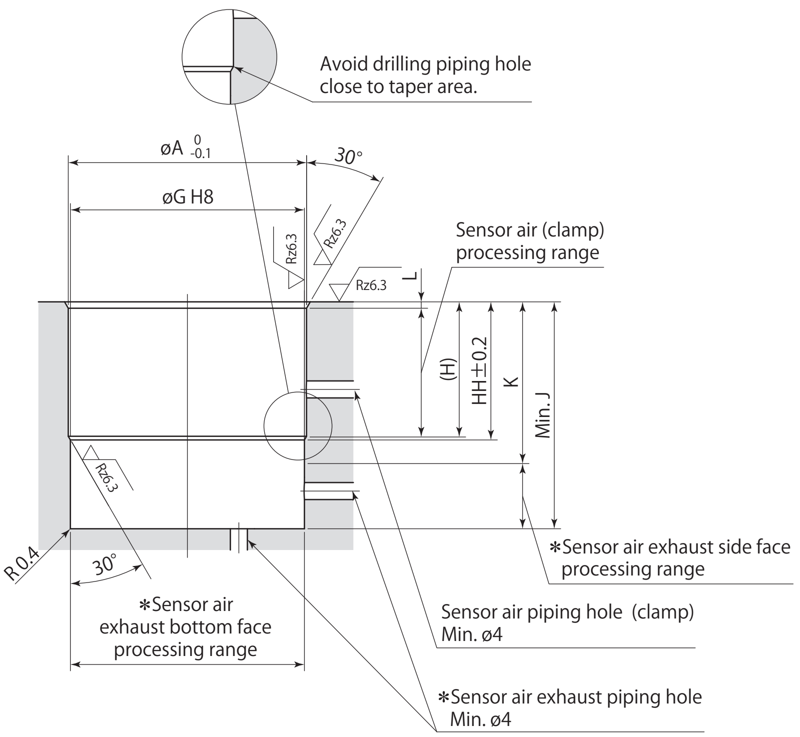
Refer to each page for the details of options.

● Taper sleeve **page →70** ● Flow control valve **page →140** ● Air bleeding valve **page →142**

● This product is made to order.

Mounting details

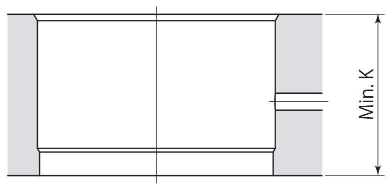




∗: Sensor air exhaust piping hole must be made on either side or bottom face.

In blind hole X-X

Rz: ISO4287(1997)



In through hole X-X

- 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.
- Refer to **page** →**39** for caution for piping.

Mounting details

mm

Model	CTM04-□S10C	CTM05-□S10C	CTM06-□S10C	CTM10-□S10C	CTM16-□S10C
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	29.5	25	31.5	34	39
HH	30.2	25.9	32.4	34.9	39.9
J	48.5	46.5	53.5	58.5	67.5
K	34.5	30	36.5	39	44
L	1.2	1.5	1.5	1.5	1.5

mm

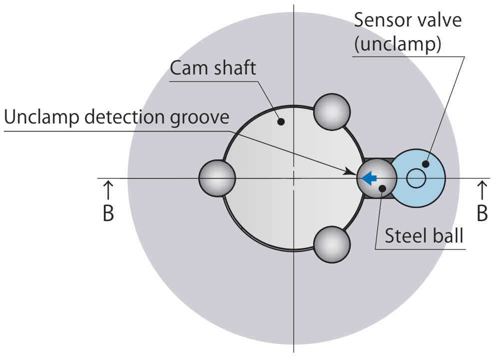
Model	CTM04-□S20C	CTM05-□S20C	CTM06-□S20C	CTM10-□S20C	CTM16-□S20C
H	39.5	35	41.5	44	49
HH	40.2	35.9	42.4	44.9	49.9
J	68.5	66.5	73.5	78.5	87.5
K	44.5	40	46.5	49	54

mm

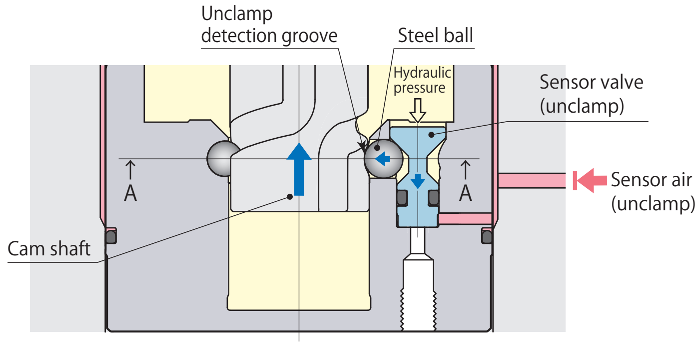
Model	CTM06-□S30C	CTM10-□S30C	CTM16-□S30C
H	51.5	54	59
HH	52.4	54.9	59.9
J	93.5	98.5	107.5
K	56.5	59	64

Unclamp PAL sensor function and structure

Unclamp detection



A-A

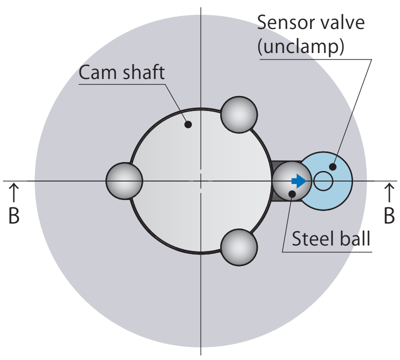


B-B

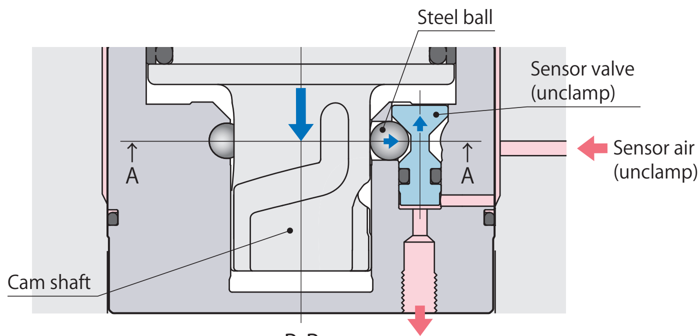
Close (Sensor ON)

● The steel ball seats in the unclamp detection groove when the cam shaft reaches unclamp end, and a sensor valve (unclamp) is pushed down to shut off the sensor air by hydraulic force, and detects the unclamped condition.

In the middle of stroke



A-A



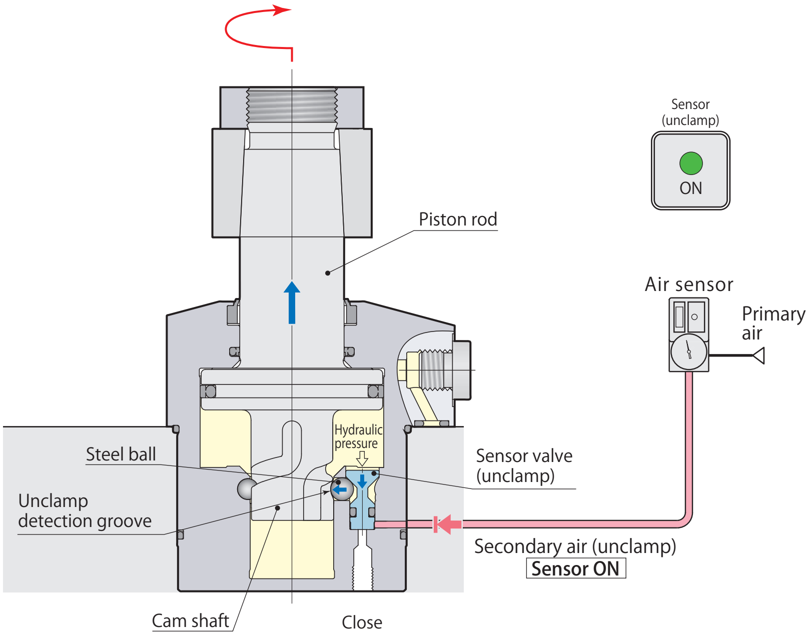
B-B

Open (Sensor OFF)

● When the cam shaft lowers, the sensor valve (unclamp) is pushed up by the steel ball to open for air exhaust.

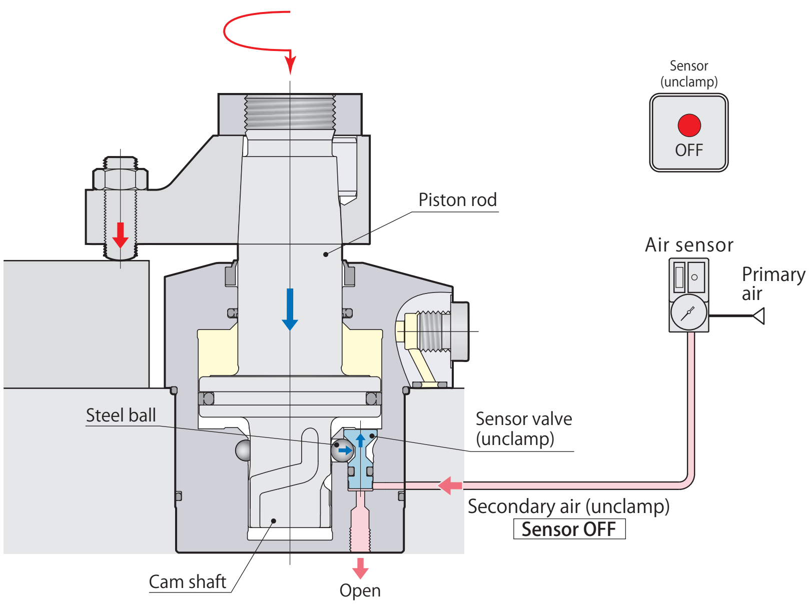
Unclamp detection signal

Unclamp detection



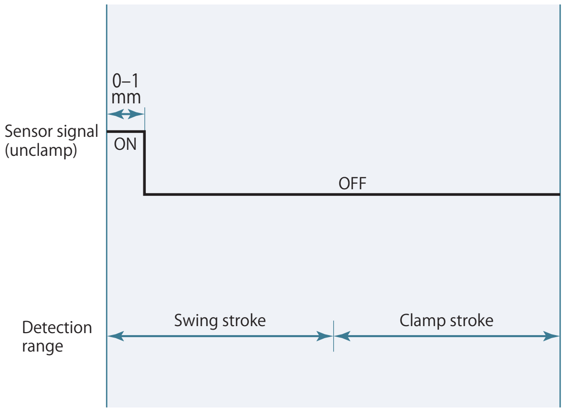
Sensor signal (unclamp)	ON	Unclamp

In the middle of stroke



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

Air sensor triggering point



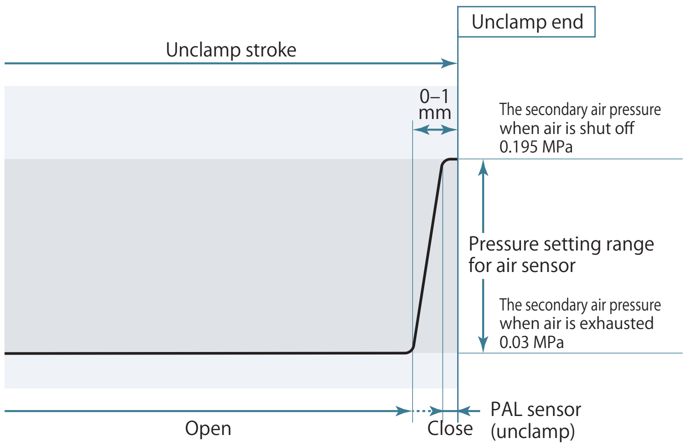
- Refer to the sensor supplier's instruction manual for the details of setting.
- Sensing performance such as detectable time and pressure differs depending on the supplier and model number of the sensor. Select the right model referring to sensor's application and characteristics.

Air sensor unit 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

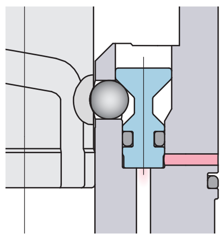


The diagram shown above indicates the relation between the PAL sensor, piston stroke, and secondary air pressure. (The pressure shown in the diagram is a reference based on the 0.2 MPa of primary air pressure for one piece of clamp.)

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

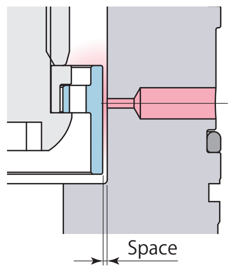
- Enhances the pressure setting range of the sensor which enables the sensor to set easily. (Ex. Pressure setting range 0.03–0.195 MPa in the diagram)
- Allows the use for a number of clamps by one air sensor because of better pressure holding when air is shut off. (Maximum number of clamps to be detected 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



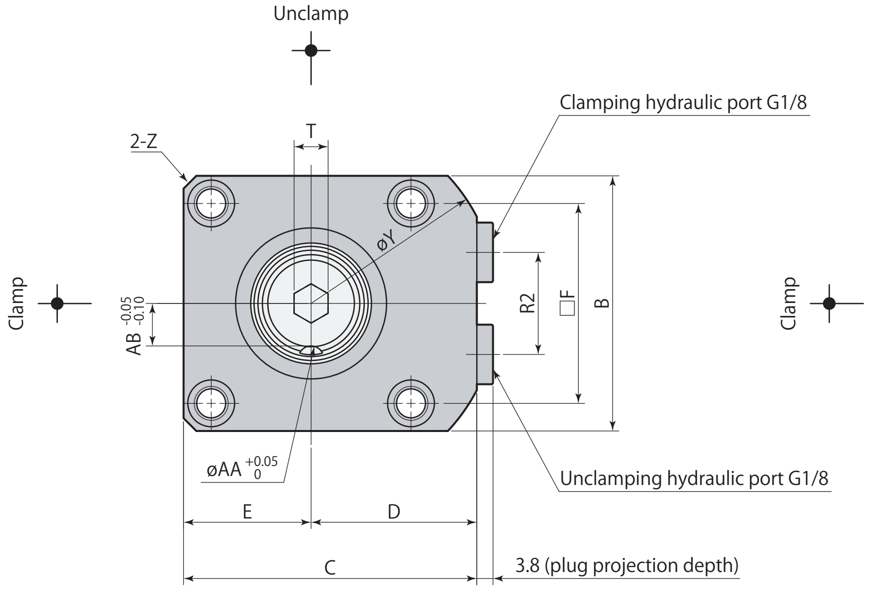
Poppet structure ensures superior sealing performance and can create large differential-pressure when the valve is opening and closing, and air leakage can be minimized.

Previous sensor valve



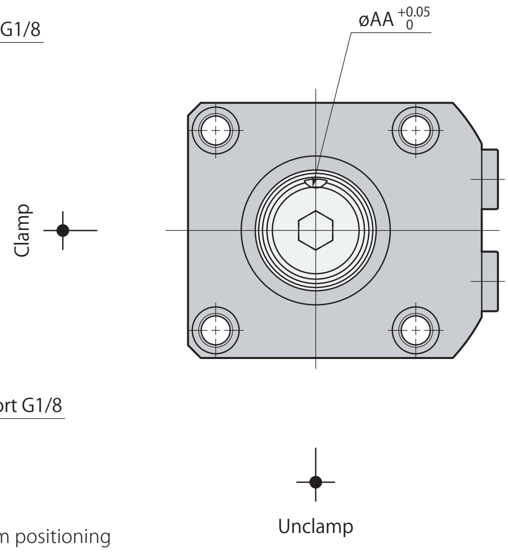
Air leaks easily due to a large space.

Dimensions

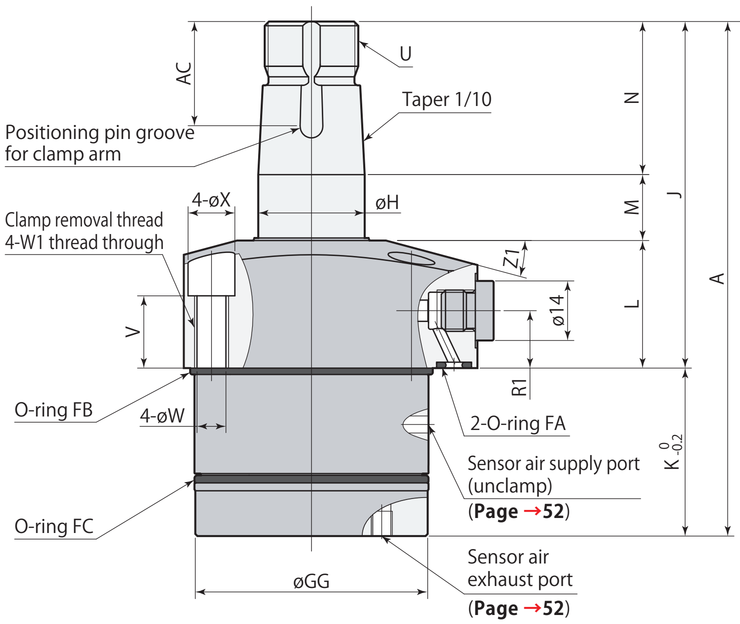


This diagram indicates the arm positioning pin groove at unclamped condition.

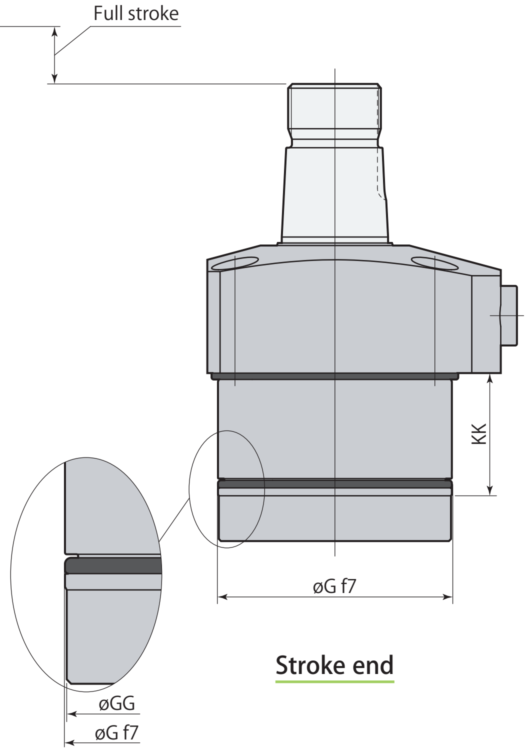
Swing direction L (counter-clockwise)



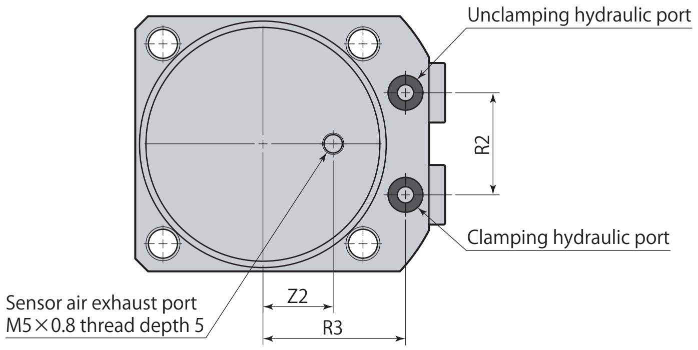
Swing direction R (clockwise)

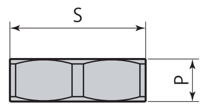


Unclamp



Stroke end





Hex nut for arm mount

- Hex nut for arm mount is included.
- Refer to **page →72** for the details of perfect nut.
- Clamp arm, positioning pin and mounting screws are not included.

mm

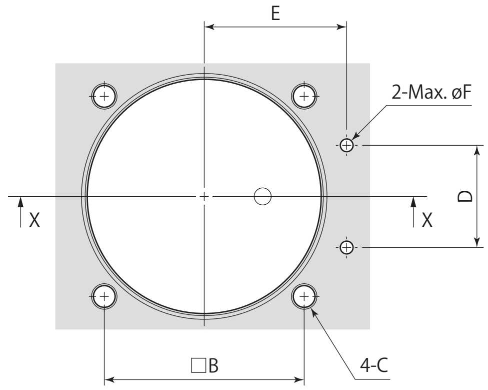
Model		CTM04-□B	CTM05-□B	CTM06-□B	CTM10-□B
Cylinder capacity (cm^3)	Clamp	5.8	8.7	13.9	20.0
	Unclamp	8.7	13.4	20.5	30.6
A		99.5	107.5	121	132.5
B		45	51	60	70
C		54	61	69	81
D		31.5	35.5	39	46
E		22.5	25.5	30	35
F		34	40	47	55
øG		$40^{-0.025}_{-0.050}$	$48^{-0.025}_{-0.050}$	$55^{-0.030}_{-0.060}$	$65^{-0.030}_{-0.060}$
øGG		39.7	47.6	54.6	64.6
øH		18	22	25	30
J		65.5	74.5	81.5	88
K		34	33	39.5	44.5
KK		26	22.5	28.5	31
L		25	28	30	31
M		13.5	14.5	15.5	17
N		27	32	36	40
P		8	9	10	11
R1		12.5	14	13.5	14
R2		18	22	24	30
R3		26	30	33.5	39.5
S (nut width across flats)		24	30	32	41
T (hex socket)		6	8	8	10
U		M16×1.5	M20×1.5	M22×1.5	M27×1.5
V		15	17.5	17	17
øW		5.5	5.5	6.8	6.8
W1		M6×1	M6×1	M8×1.25	M8×1.25
øX		9	9	11	11
øY		73	83	88	106
Z		C3	C3	C3	C4
Z1		12°	15°	15°	15°
Z2		11	13.5	16.5	19
øAA (pin groove diameter)		4	5	6	6
AB		7	9	10	12.5
AC		18.5	21.5	24.5	27.5
Positioning pin (dowel pin)		ø4(h8)×10	ø5(h8)×12	ø6(h8)×14	ø6(h8)×16
O-ring FA (fluorocarbon hardness Hs90)		P5	P5	P5	P7
O-ring FB (fluorocarbon hardness Hs70)		38×1.5 (inner diameter×thickness)	AS568-031	AS568-034	AS568-037
O-ring FC (fluorocarbon hardness Hs70)		AS568-028	AS568-031	AS568-033	AS568-036
Taper sleeve		CTH04-MS	CTH05-MS	CTH06-MS	CTH10-MS
Flow control valve*	Meter-in	VCF01S	VCF01S	VCF01S	VCF01
	Meter-out	VCF01S-O	VCF01S-O	VCF01S-O	VCF01-O
Air bleeding valve		VCE01	VCE01	VCE01	VCE01

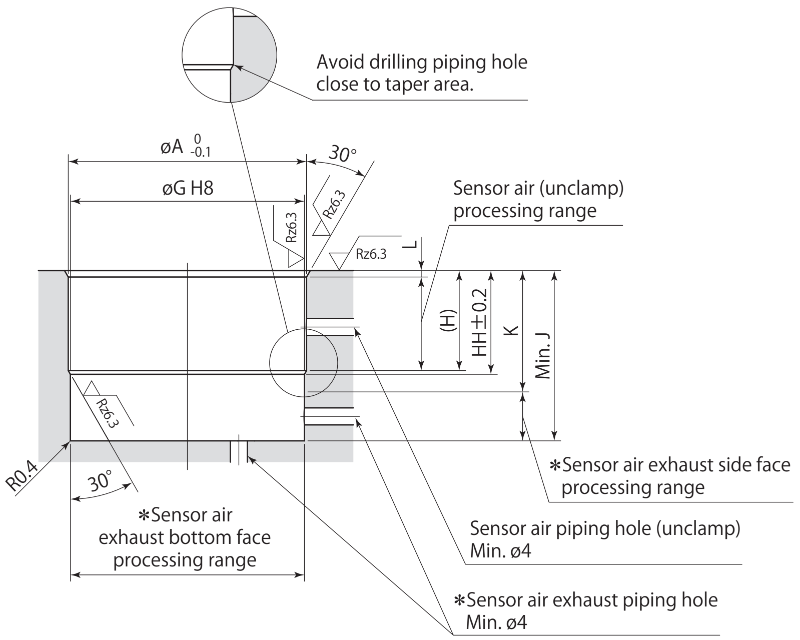
∗:Select the right model of VCF according to the size of the clamp.

Refer to each page for the details of options.

● Taper sleeve **page →70** ● Flow control valve **page →140** ● Air bleeding valve **page →142**

Mounting details

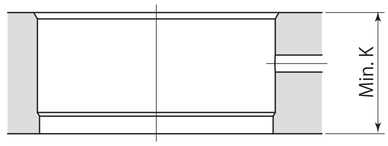




In blind hole X-X

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

Rz: ISO4287(1997)



In through hole X-X

- 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

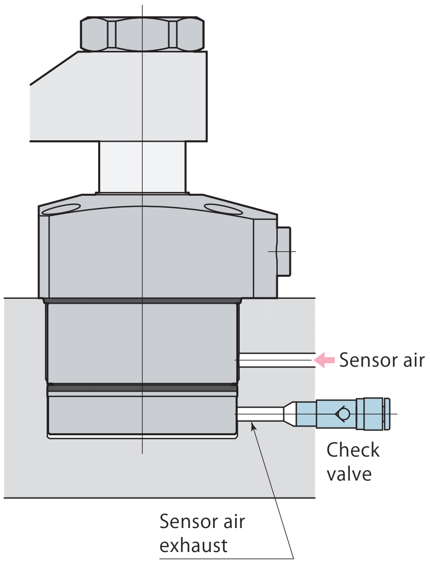
mm

Model	CTM04-□B	CTM05-□B	CTM06-□B	CTM10-□B
øA	40.8	49	56	66
B	34	40	47	55
C	M5	M5	M6	M6
D	18	22	24	30
E	26	30	33.5	39.5
øF	3	3	3	5
øG	$40^{+0.039}_{0}$	$48^{+0.039}_{0}$	$55^{+0.046}_{0}$	$65^{+0.046}_{0}$
H	21	17.5	23.5	26
HH	21.7	18.4	24.4	26.9
J	34.5	33.5	40	45
K	26	22.5	28.5	31
L	1.2	1.5	1.5	1.5

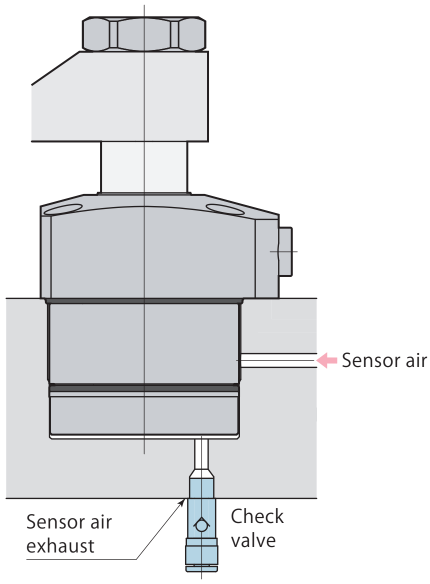
Caution for piping

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

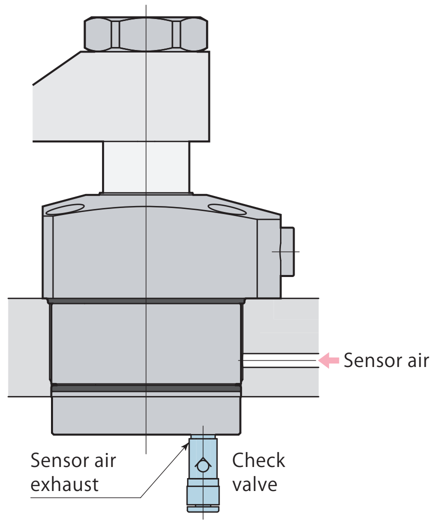
Mounting in blind hole
(Sensor air exhaust : side face)



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



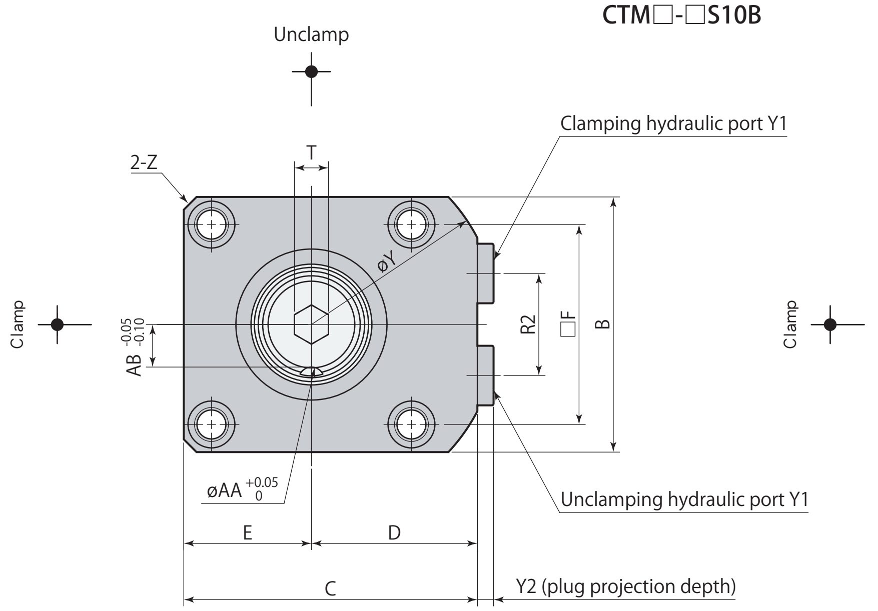
Mounting in through hole



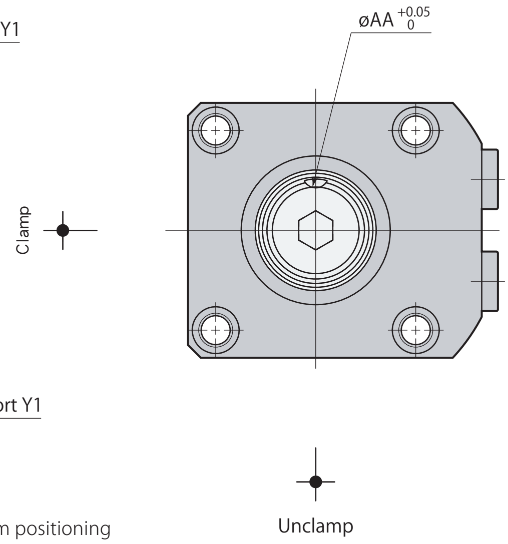
● Use a check valve with cracking pressure of 0.005 MPa or less if there is a risk of metal chips or coolant intrusion. Recommended check valve : AKH or AKB series manufactured by SMC.

Dimensions

CTM□-□S10B

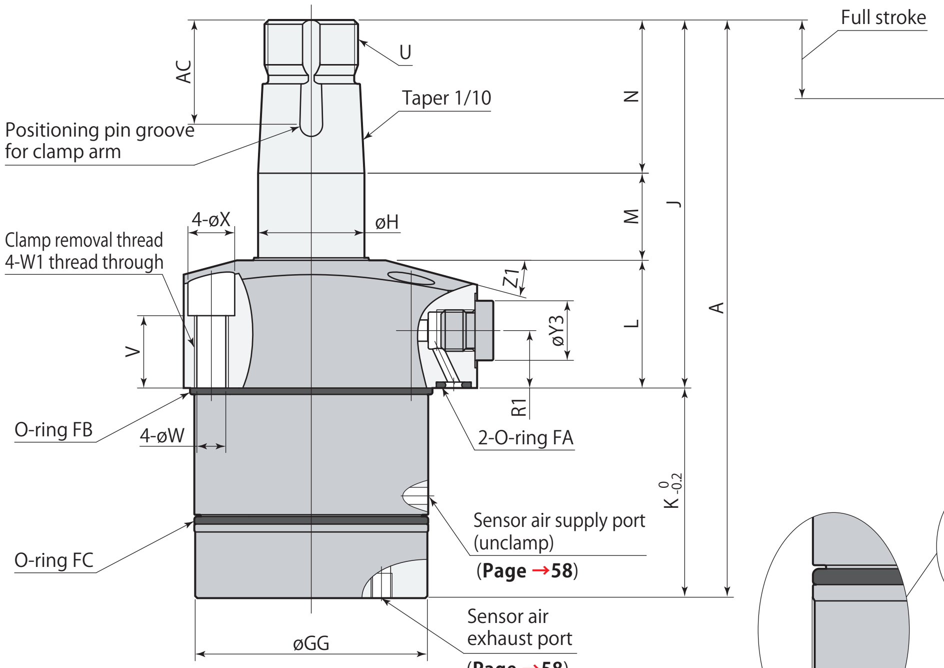


This diagram indicates the arm positioning pin groove at unclamped condition.

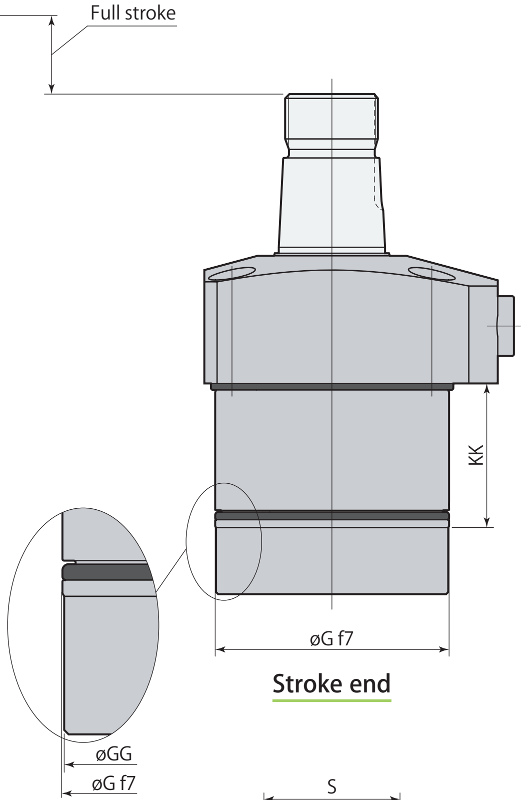


Swing direction L (counter-clockwise)

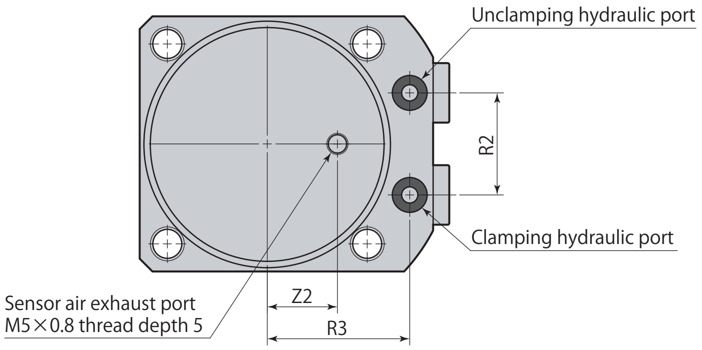
Swing direction R (clockwise)

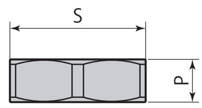


Unclamp



Stroke end





Hex nut for arm mount

- Hex nut for arm mount is included.
- Refer to **page →72** for the details of perfect nut.
- Clamp arm, positioning pin and mounting screws are not included.

CTM□-□S□B　Swing clamp　Long stroke　Unclamp sensor model　7MPa　Double acting

mm

Model		CTM04-□S10B	CTM05-□S10B	CTM06-□S10B	CTM10-□S10B	CTM16-□S10B
Cylinder capacity (cm^3)	Clamp	8.3	12.2	19.0	26.7	44.6
	Unclamp	12.5	18.8	28.1	40.9	66.4
A		114.5	122.5	136	147.5	172.5
B		45	51	60	70	80
C		54	61	69	81	92
D		31.5	35.5	39	46	52
E		22.5	25.5	30	35	40
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		39.7	47.6	54.6	64.6	74.6
øH		18	22	25	30	35.5
J		70.5	79.5	86.5	93	108
K		44	43	49.5	54.5	64.5
KK		31	27.5	33.5	36	42
L		25	28	30	31	38
M		18.5	19.5	20.5	22	24
N		27	32	36	40	46
P		8	9	10	11	11
R1		12.5	14	13.5	14	16
R2		18	22	24	30	32
R3		26	30	33.5	39.5	45
S (nut width across flats)		24	30	32	41	46
T (hex socket)		6	8	8	10	10
U		M16×1.5	M20×1.5	M22×1.5	M27×1.5	M30×1.5
V		15	17.5	17	17	21
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	9	11	11	14
øY		73	83	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	C4	C5
Z1		12°	15°	15°	15°	15°
Z2		11	13.5	16.5	19	22.5
øAA (pin groove diameter)		4	5	6	6	8
AB		7	9	10	12.5	14
AC		18.5	21.5	24.5	27.5	28.5
Positioning pin (dowel pin)		ø4(h8)×10	ø5(h8)×12	ø6(h8)×14	ø6(h8)×16	ø8(h8)×16
O-ring FA (fluorocarbon hardness Hs90)		P5	P5	P5	P7	P7
O-ring FB (fluorocarbon hardness Hs70)		38×1.5 (inner diameter×thickness)	AS568-031	AS568-034	AS568-037	AS568-040
O-ring FC (fluorocarbon hardness Hs70)		AS568-028	AS568-031	AS568-033	AS568-036	AS568-039
Taper sleeve		CTH04-MS	CTH05-MS	CTH06-MS	CTH10-MS	CTH16-MS
Flow control valve*	Meter-in	VCF01S	VCF01S	VCF01S	VCF01	VCF02
	Meter-out	VCF01S-O	VCF01S-O	VCF01S-O	VCF01-O	VCF02-O
Air bleeding valve*		VCE01	VCE01	VCE01	VCE01	VCE02

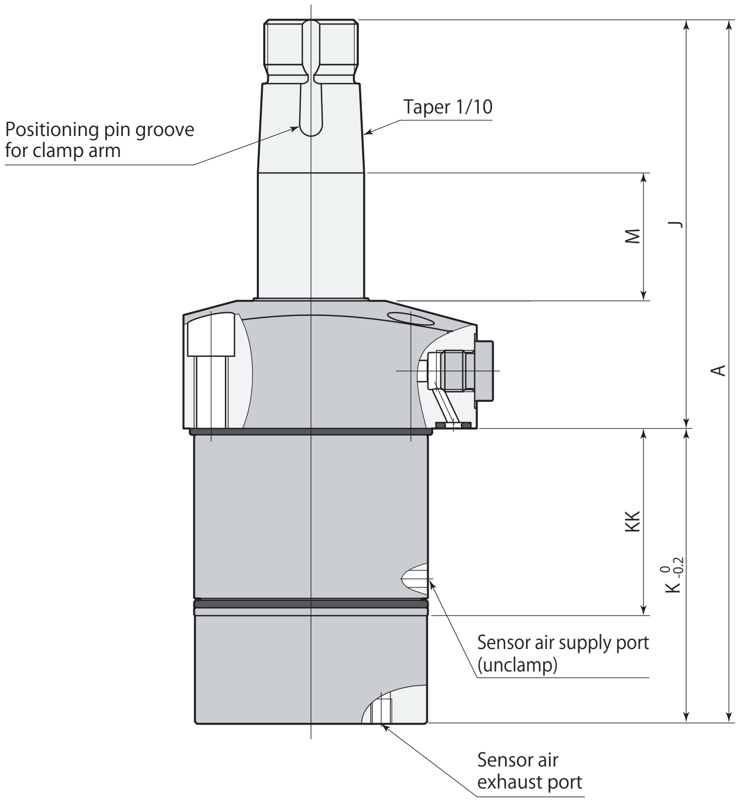
*: Select the right model of VCF and VCE according to the size of the clamp.

Refer to each page for the details of options.

● Taper sleeve **page →70**　● Flow control valve **page →140**　● Air bleeding valve **page →142**

Dimensions

CTM□-□S20B



Unclamp

mm

Model		CTM04-□S20B	CTM05-□S20B	CTM06-□S20B	CTM10-□S20B	CTM16-□S20B
Cylinder capacity (cm³)	Clamp	13.3	19.1	29.3	40.1	64.9
	Unclamp	20.0	29.6	43.3	61.3	96.6
A		144.5	152.5	166	177.5	202.5
J		80.5	89.5	96.5	103	118
K		64	63	69.5	74.5	84.5
KK		41	37.5	43.5	46	52
M		28.5	29.5	30.5	32	34

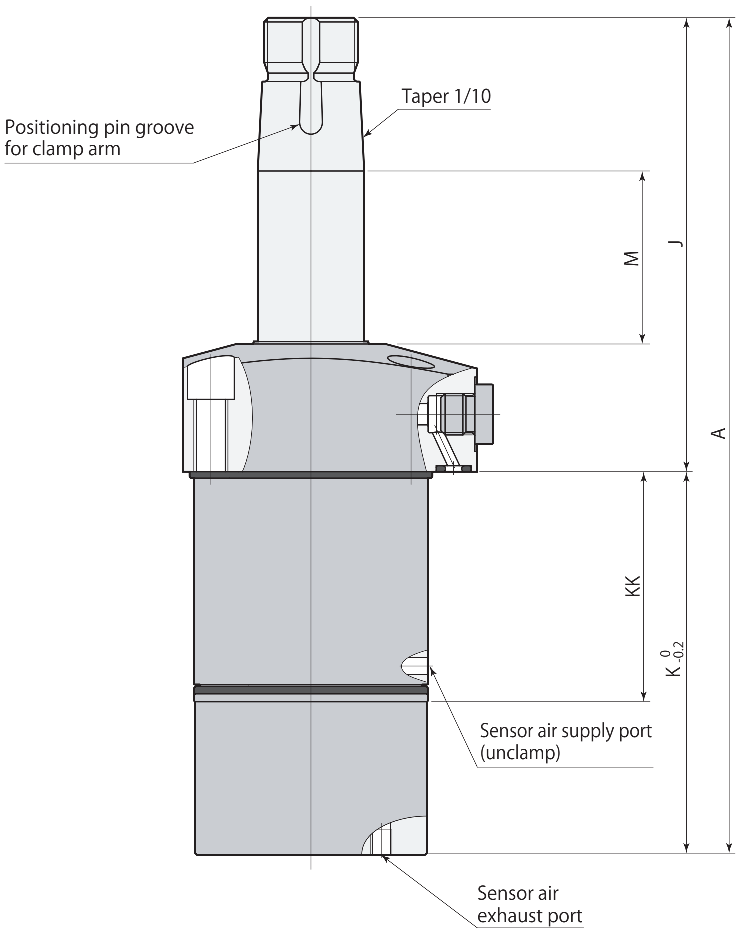
● Refer to **pages →54**, **55** for other dimensions that are not shown in the diagram.

Refer to each page for the details of options.

● Taper sleeve **page →70** ● Flow control valve **page →140** ● Air bleeding valve **page →142**

Dimensions

CTM□-□S30B



Unclamp

mm

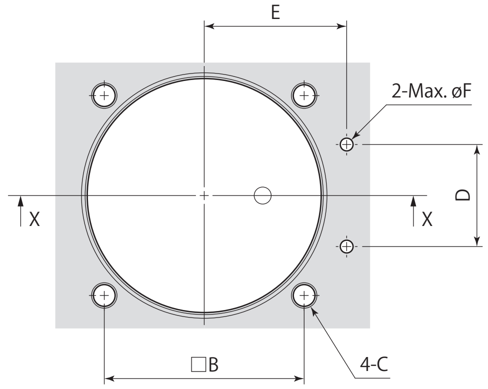
Model		CTM06-□S30B	CTM10-□S30B	CTM16-□S30B
Cylinder capacity (cm³)	Clamp	39.6	53.4	85.2
	Unclamp	58.5	81.7	126.8
A		196	207.5	232.5
J		106.5	113	128
K		89.5	94.5	104.5
KK		53.5	56	62
M		40.5	42	44

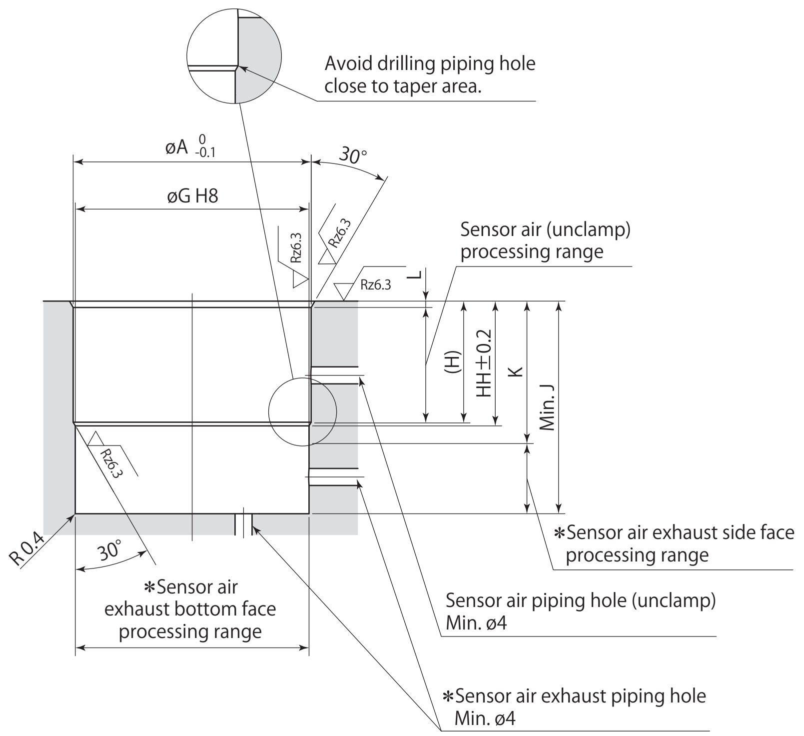
● Refer to **pages →54**, **55** for other dimensions that are not shown in the diagram.

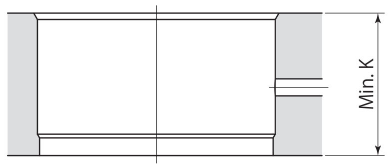
Refer to each page for the details of options.

● Taper sleeve **page →70** ● Flow control valve **page →140** ● Air bleeding valve **page →142**

Mounting details







In through hole X-X

In blind 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.
- Refer to **page →53** for caution for piping.

Mounting details

mm

Model	CTM04-□S10B	CTM05-□S10B	CTM06-□S10B	CTM10-□S10B	CTM16-□S10B
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	26	22.5	28.5	31	37
HH	26.7	23.4	29.4	31.9	37.9
J	44.5	43.5	50	55	65
K	31	27.5	33.5	36	42
L	1.2	1.5	1.5	1.5	1.5

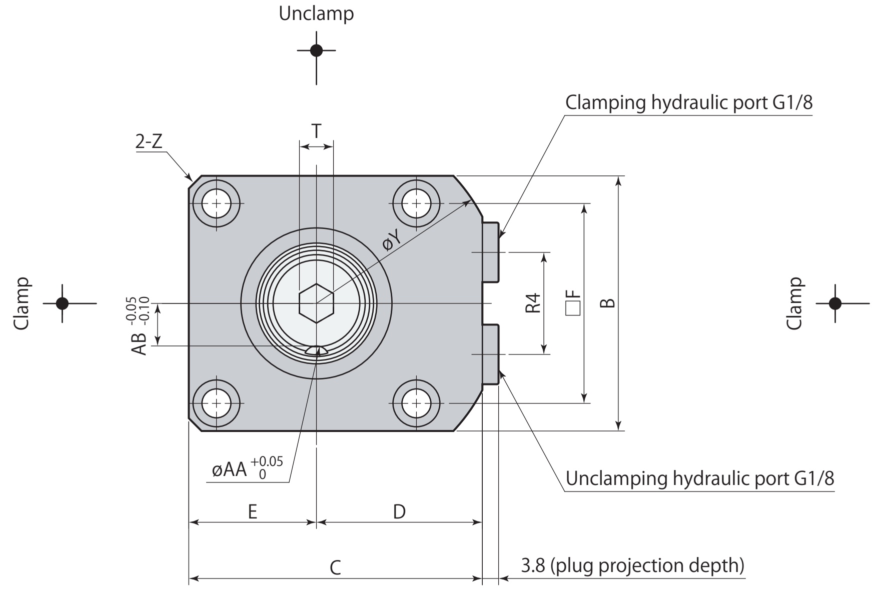
mm

Model	CTM04-□S20B	CTM05-□S20B	CTM06-□S20B	CTM10-□S20B	CTM16-□S20B
H	36	32.5	38.5	41	47
HH	36.7	33.4	39.4	41.9	47.9
J	64.5	63.5	70	75	85
K	41	37.5	43.5	46	52

mm

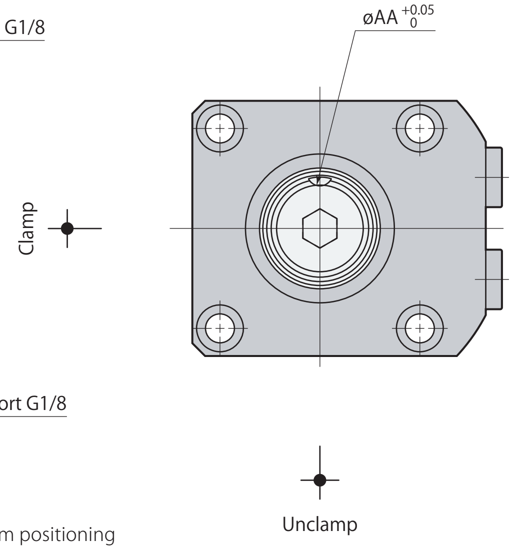
Model	CTM06-□S30B	CTM10-□S30B	CTM16-□S30B
H	48.5	51	57
HH	49.4	51.9	57.9
J	90	95	105
K	53.5	56	62

Dimensions

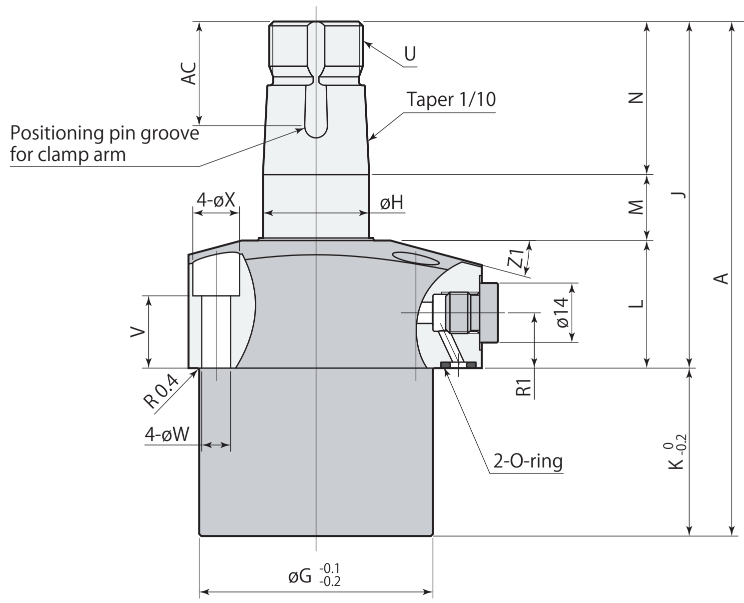


This diagram indicates the arm positioning pin groove at unclamped condition.

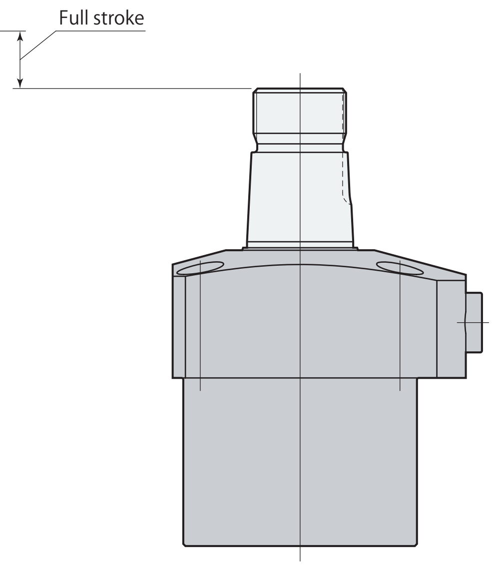
Swing direction L (counter-clockwise)



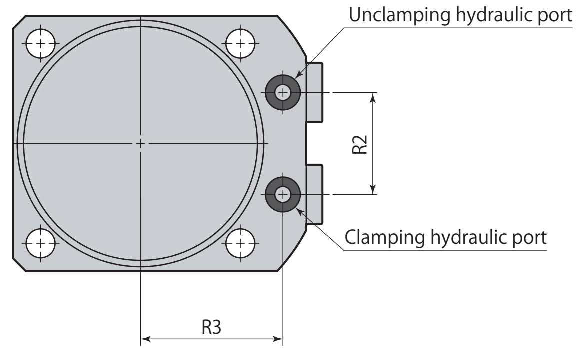
Swing direction R (clockwise)

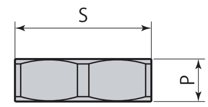


Unclamp



Stroke end





Hex nut for arm mount

- Hex nut for arm mount is included.
- Refer to **page →72** for the details of perfect nut.
- Clamp arm, positioning pin and mounting screws are not included.

mm

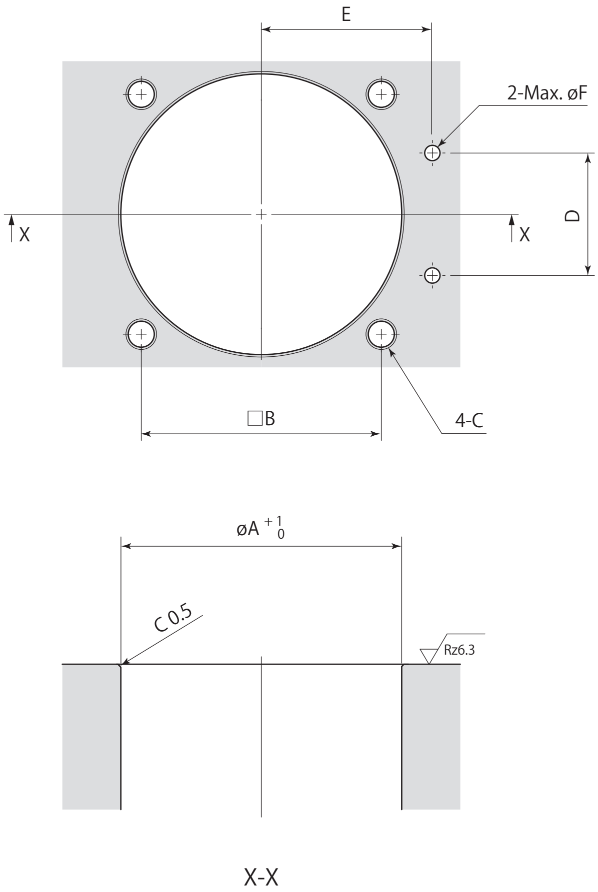
Model		CTM03-□N	CTM04-□N	CTM05-□N	CTM06-□N	CTM10-□N
Cylinder capacity (cm³)	Clamp	3.7	5.8	8.7	13.9	20.0
	Unclamp	5.6	8.7	13.4	20.5	30.6
A		92	99.5	107.5	121	132.5
B		40	45	51	60	70
C		49	54	61	69	81
D		29	31.5	35.5	39	46
E		20	22.5	25.5	30	35
F		31.4	34	40	47	55
øG		36	40	48	55	65
øH		15	18	22	25	30
J		61.5	65.5	74.5	81.5	88
K		30.5	34	33	39.5	44.5
L		25	25	28	30	31
M		12.5	13.5	14.5	15.5	17
N		24	27	32	36	40
P		7	8	9	10	11
R1		12	12.5	14	13.5	14
R2		16	18	22	24	30
R3		23.5	26	30	33.5	39.5
R4		18	18	22	24	30
S (nut width across flats)		22	24	30	32	41
T (hex socket)		5	6	8	8	10
U		M14×1.5	M16×1.5	M20×1.5	M22×1.5	M27×1.5
V		16	15	17.5	17	17
øW		4.5	5.5	5.5	6.8	6.8
øX		7.5	9	9	11	11
øY		66	73	83	88	106
Z		C2	C3	C3	C3	C4
Z1		15°	12°	15°	15°	15°
øAA (pin groove diameter)		4	4	5	6	6
AB		6	7	9	10	12.5
AC		17.5	18.5	21.5	24.5	27.5
Positioning pin (dowel pin)		ø4(h8)×10	ø4(h8)×10	ø5(h8)×12	ø6(h8)×14	ø6(h8)×16
O-ring (fluorocarbon hardness Hs90)		P5	P5	P5	P5	P7
Taper sleeve		CTH03-MS	CTH04-MS	CTH05-MS	CTH06-MS	CTH10-MS
Flow control valve*	Meter-in	VCF01S	VCF01S	VCF01S	VCF01S	VCF01
	Meter-out	VCF01S-O	VCF01S-O	VCF01S-O	VCF01S-O	VCF01-O
Air bleeding valve		VCE01	VCE01	VCE01	VCE01	VCE01

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

Refer to each page for the details of options.

● Taper sleeve **page →70** ● Flow control valve **page →140** ● Air bleeding valve **page →142**

Mounting details



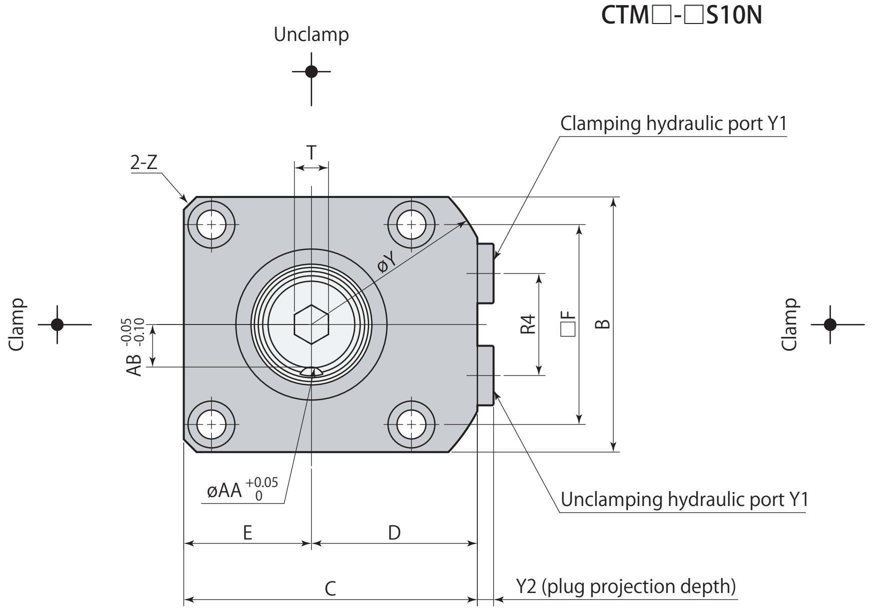
Rz: ISO4287(1997)

mm

Model	CTM03-□N	CTM04-□N	CTM05-□N	CTM06-□N	CTM10-□N
øA	36	40	48	55	65
B	31.4	34	40	47	55
C	M4	M5	M5	M6	M6
D	16	18	22	24	30
E	23.5	26	30	33.5	39.5
øF	3	3	3	3	5

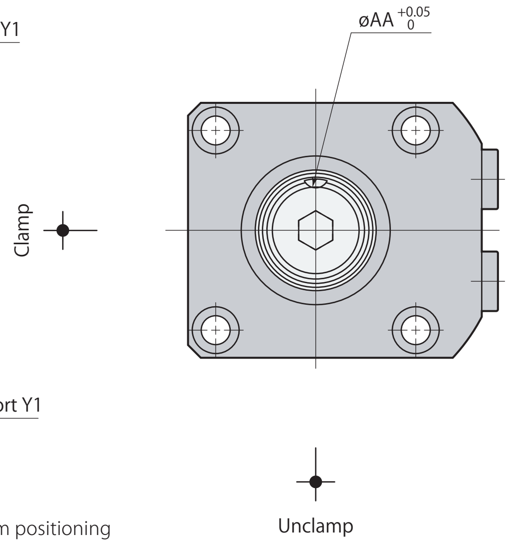
Dimensions

CTM□-□S10N

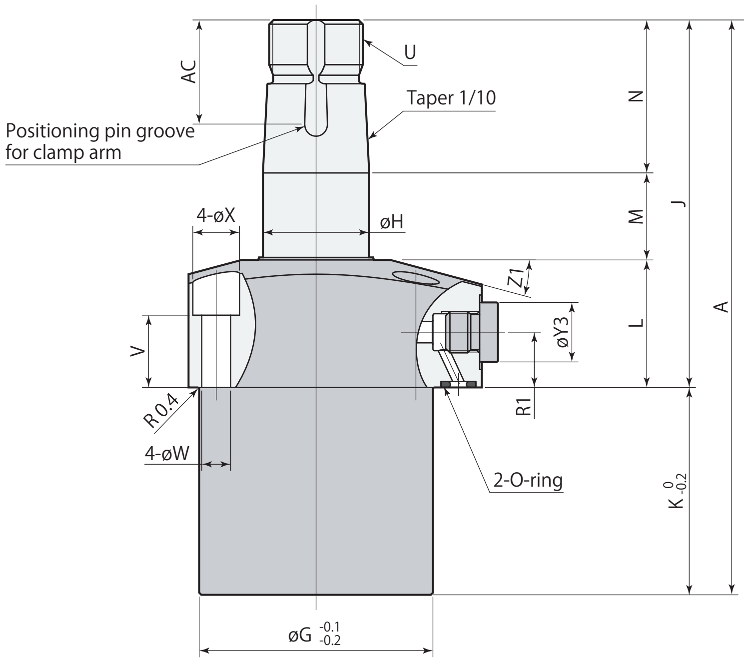


This diagram indicates the arm positioning pin groove at unclamped condition.

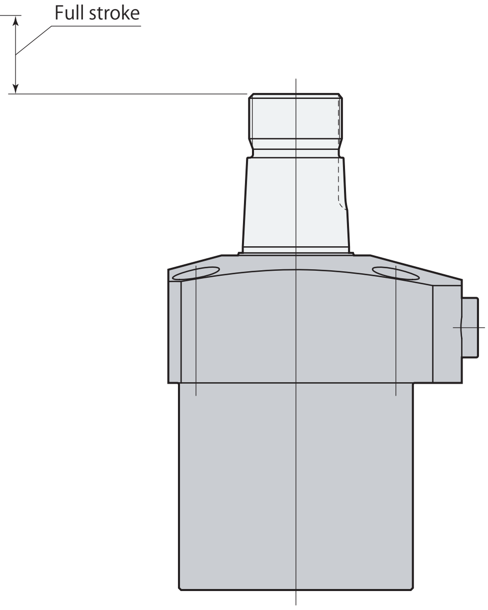
Swing direction L (counter-clockwise)



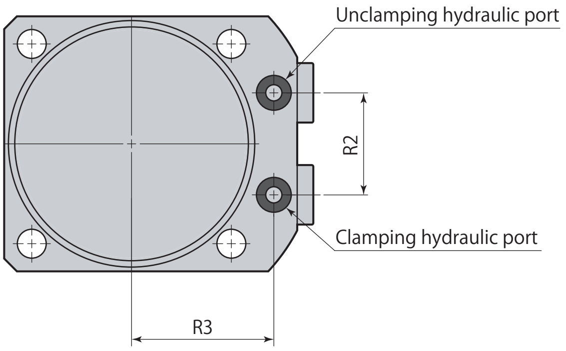
Swing direction R (clockwise)

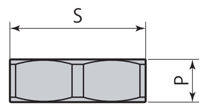


Unclamp



Stroke end





Hex nut for arm mount

- Hex nut for arm mount is included.
- Refer to **page →72** for the details of perfect nut.
- Clamp arm, positioning pin and mounting screws are not included.

mm

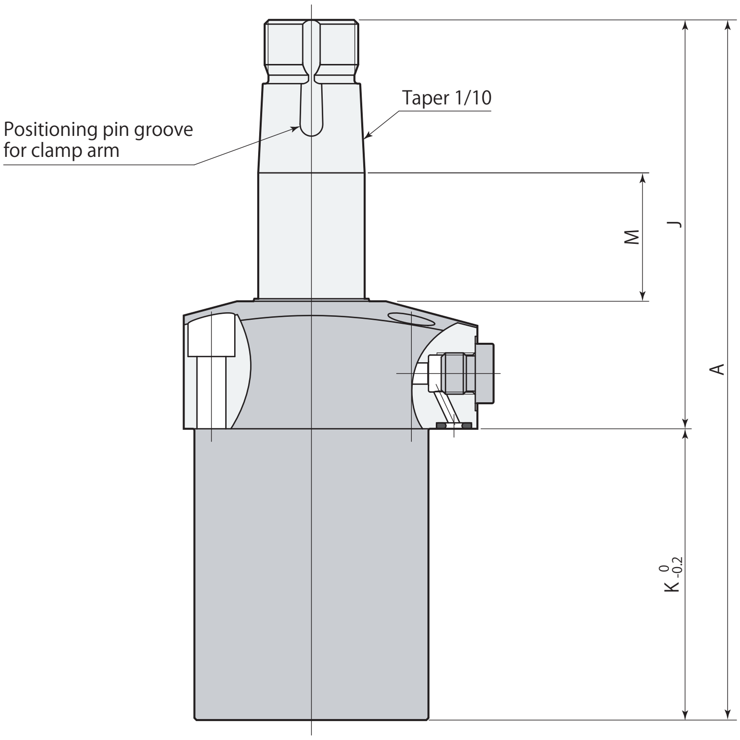
Model		CTM03-□S10N	CTM04-□S10N	CTM05-□S10N	CTM06-□S10N	CTM10-□S10N	CTM16-□S10N
Cylinder capacity (cm³)	Clamp	5.5	8.3	12.2	19.0	26.7	44.6
	Unclamp	8.2	12.5	18.8	28.1	40.9	66.4
A		107	114.5	122.5	136	147.5	172.5
B		40	45	51	60	70	80
C		49	54	61	69	81	92
D		29	31.5	35.5	39	46	52
E		20	22.5	25.5	30	35	40
F		31.4	34	40	47	55	63
øG		36	40	48	55	65	75
øH		15	18	22	25	30	35.5
J		66.5	70.5	79.5	86.5	93	108
K		40.5	44	43	49.5	54.5	64.5
L		25	25	28	30	31	38
M		17.5	18.5	19.5	20.5	22	24
N		24	27	32	36	40	46
P		7	8	9	10	11	11
R1		12	12.5	14	13.5	14	16
R2		16	18	22	24	30	32
R3		23.5	26	30	33.5	39.5	45
R4		18	18	22	24	30	32
S (nut width across flats)		22	24	30	32	41	46
T (hex socket)		5	6	8	8	10	10
U		M14×1.5	M16×1.5	M20×1.5	M22×1.5	M27×1.5	M30×1.5
V		16	15	17.5	17	17	21
øW		4.5	5.5	5.5	6.8	6.8	9
øX		7.5	9	9	11	11	14
øY		66	73	83	88	106	116
Y1		G1/8	G1/8	G1/8	G1/8	G1/8	G1/4
Y2		3.8	3.8	3.8	3.8	3.8	4.8
øY3		14	14	14	14	14	19
Z		C2	C3	C3	C3	C4	C5
Z1		15°	12°	15°	15°	15°	15°
øAA (pin groove diameter)		4	4	5	6	6	8
AB		6	7	9	10	12.5	14
AC		17.5	18.5	21.5	24.5	27.5	28.5
Positioning pin (dowel pin)		ø4(h8)×10	ø4(h8)×10	ø5(h8)×12	ø6(h8)×14	ø6(h8)×16	ø8(h8)×16
O-ring (fluorocarbon hardness Hs90)		P5	P5	P5	P5	P7	P7
Taper sleeve		CTH03-MS	CTH04-MS	CTH05-MS	CTH06-MS	CTH10-MS	CTH16-MS
Flow control valve*	Meter-in	VCF01S	VCF01S	VCF01S	VCF01S	VCF01	VCF02
	Meter-out	VCF01S-O	VCF01S-O	VCF01S-O	VCF01S-O	VCF01-O	VCF02-O
Air bleeding valve*		VCE01	VCE01	VCE01	VCE01	VCE01	VCE02

*：Select the right model of VCF and VCE according to the size of the clamp.
Refer to each page for the details of options.

● Taper sleeve **page →70** ● Flow control valve **page →140** ● Air bleeding valve **page →142**

Dimensions

CTM□-□S20N



Unclamp

mm

Model		CTM03-□S20N	CTM04-□S20N	CTM05-□S20N	CTM06-□S20N	CTM10-□S20N	CTM16-□S20N
Cylinder capacity (cm³)	Clamp	9.0	13.3	19.1	29.3	40.1	64.9
	Unclamp	13.5	20.0	29.6	43.3	61.3	96.6
A		137	144.5	152.5	166	177.5	202.5
J		76.5	80.5	89.5	96.5	103	118
K		60.5	64	63	69.5	74.5	84.5
M		27.5	28.5	29.5	30.5	32	34

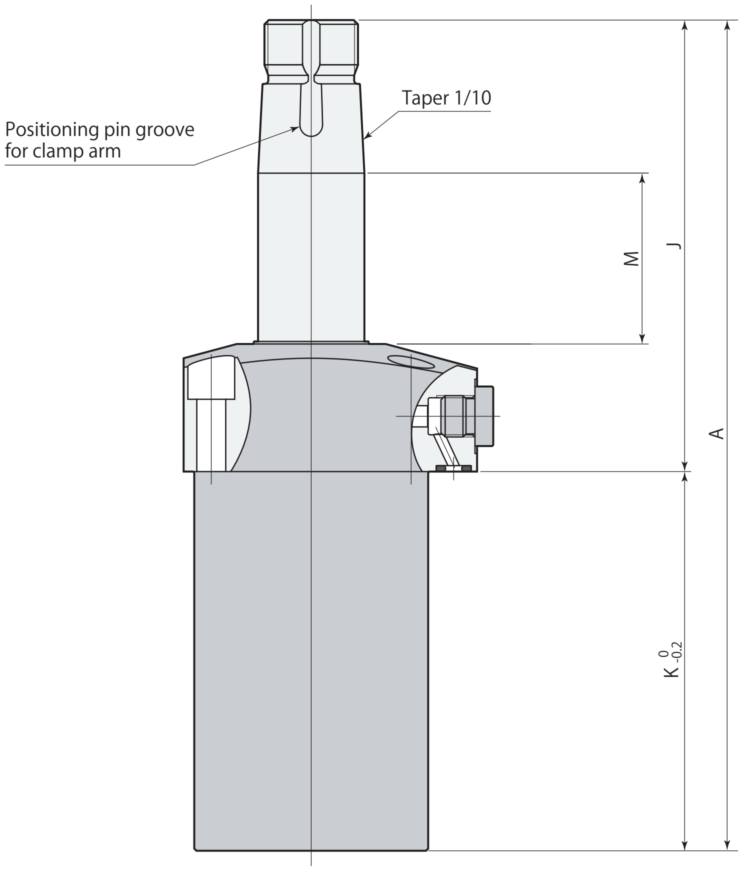
● Refer to **pages →64**, **65** for other dimensions that are not shown in the diagram.

Refer to each page for the details of options.

● Taper sleeve **page →70** ● Flow control valve **page →140** ● Air bleeding valve **page →142**

Dimensions

CTM□-□S30N



Unclamp

mm

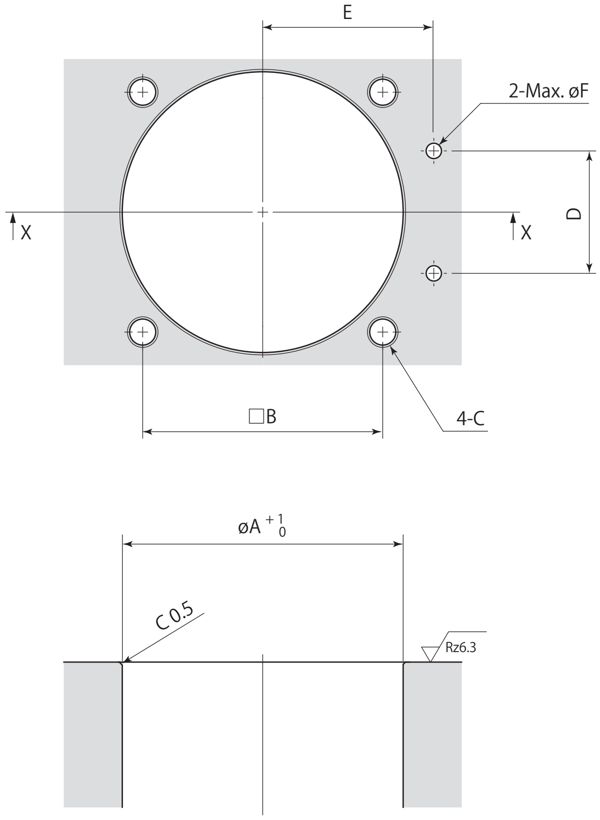
Model		CTM06-□S30N	CTM10-□S30N	CTM16-□S30N
Cylinder capacity (cm³)	Clamp	39.6	53.4	85.2
	Unclamp	58.5	81.7	126.8
A		196	207.5	232.5
J		106.5	113	128
K		89.5	94.5	104.5
M		40.5	42	44

● Refer to **pages →64, 65** for other dimensions that are not shown in the diagram.

Refer to each page for the details of options.

● Taper sleeve **page →70** ● Flow control valve **page →140** ● Air bleeding valve **page →142**

Mounting details



X-X

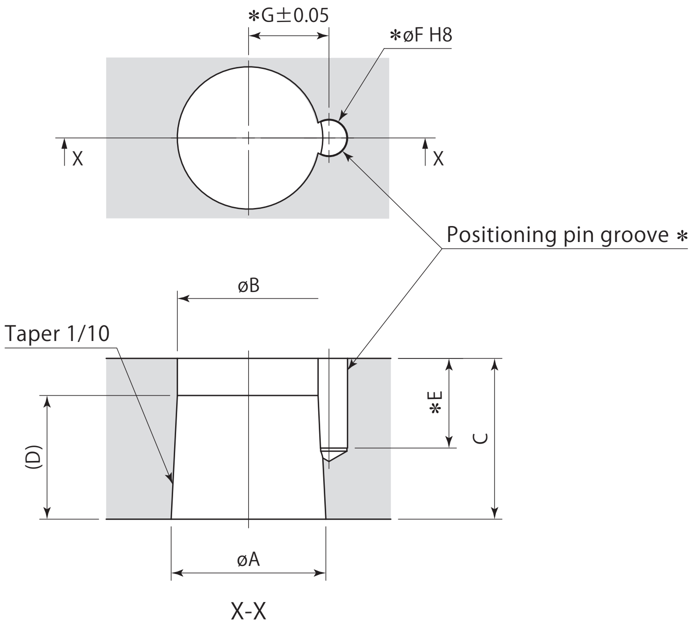
Rz: ISO4287(1997)

mm

Model	CTM03-□S□N	CTM04-□S□N	CTM05-□S□N	CTM06-□S□N	CTM10-□S□N	CTM16-□S□N
øA	36	40	48	55	65	75
B	31.4	34	40	47	55	63
C	M4	M5	M5	M6	M6	M8
D	16	18	22	24	30	32
E	23.5	26	30	33.5	39.5	45
øF	3	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.



∗ : No need to machine the pin groove (E, øF, G) unless positioning pin is used for the arm.
The positioning pin enables a clamp arm to locate on the clamp firmly and easily.

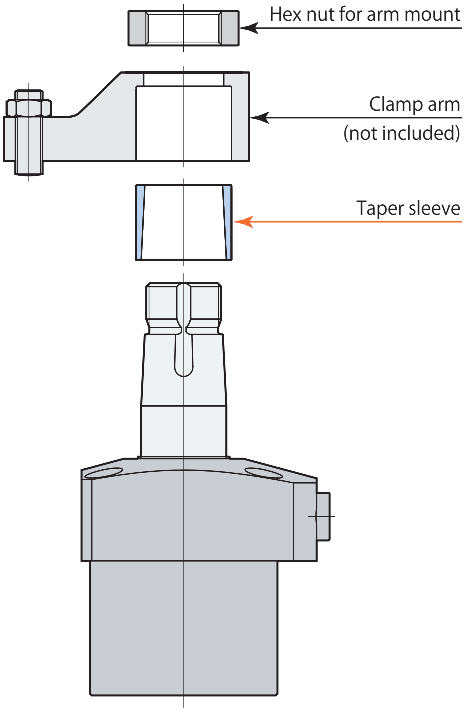
mm

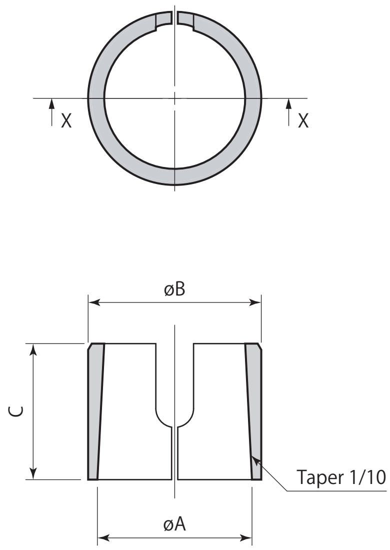
Swing clamp	CTM03	CTM04	CTM05	CTM06	CTM10	CTM16
øA	$15^{-0.016}_{-0.034}$	$18^{-0.016}_{-0.034}$	$22^{-0.020}_{-0.041}$	$25^{-0.020}_{-0.041}$	$30^{-0.020}_{-0.041}$	$35.5^{-0.025}_{-0.050}$
øB	14.1	16.5	20.5	23	28	(32)
C	17	19	23	26	29	35
D	9	15	15	20	20	–
E	10.5	10.5	12.5	14.5	16.5	17.5
øF (pin groove diameter)	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$	$8^{+0.022}_{0}$
G	8	9	11.5	13	15.5	18

Taper sleeve

Size

CTH [03 / 04 / 05 / 06 / 10 / 16] – MS : Taper sleeve





X-X

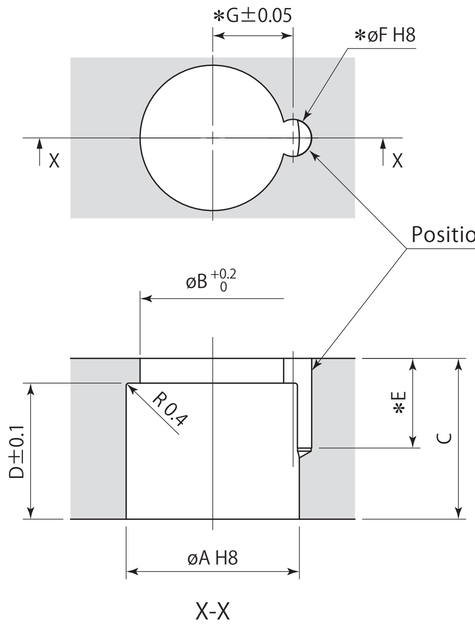
mm

Taper sleeve	CTH03-MS	CTH04-MS	CTH05-MS	CTH06-MS	CTH10-MS	CTH16-MS
Applicable swing clamp	CTM03	CTM04	CTM05	CTM06	CTM10	CTM16
øA	15	18	22	25	30	35.5
øB	17	20	25	28	34	40
C	14	16	19	22	25	31

Clamp arm mounting details

(Using taper sleeve)

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

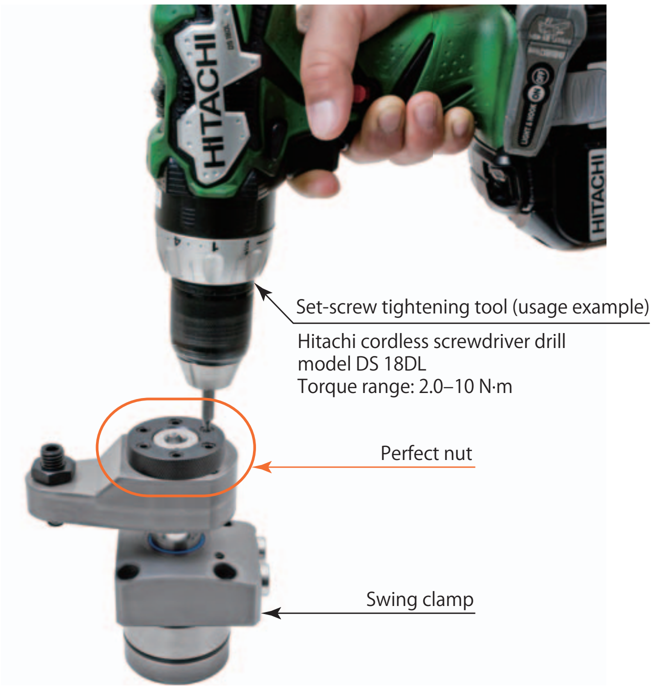


∗ : No need to machine the pin groove (E, øF, G) unless positioning pin is used for the arm.
The positioning pin enables a clamp arm to locate on the clamp firmly and easily.

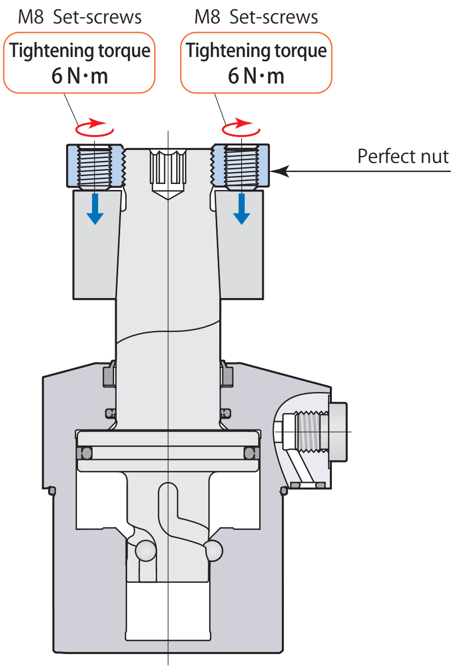
mm

Taper sleeve	CTH03-MS	CTH04-MS	CTH05-MS	CTH06-MS	CTH10-MS	CTH16-MS
Applicable swing clamp	CTM03	CTM04	CTM05	CTM06	CTM10	CTM16
øA	$17^{+0.027}_{0}$	$20^{+0.033}_{0}$	$25^{+0.033}_{0}$	$28^{+0.033}_{0}$	$34^{+0.039}_{0}$	$40^{+0.039}_{0}$
øB	15	17	21	23.5	29	33
C	17	19	23	26	29	35
D	14	16	19	22	25	31
E	10.5	10.5	12.5	14.5	16.5	17.5
øF (pin groove diameter)	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$	$8^{+0.022}_{0}$
G	8	9	11.5	13	15.5	18

Mounting arm firmly and easily.



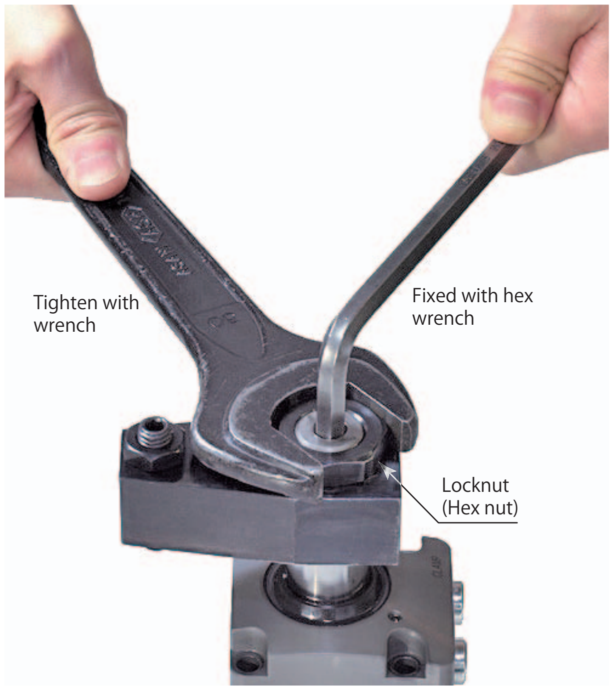
● Fastening or loosening the nut over the top of the clamp by an electric wrench helps to improve the workability on the machine table or the jig.



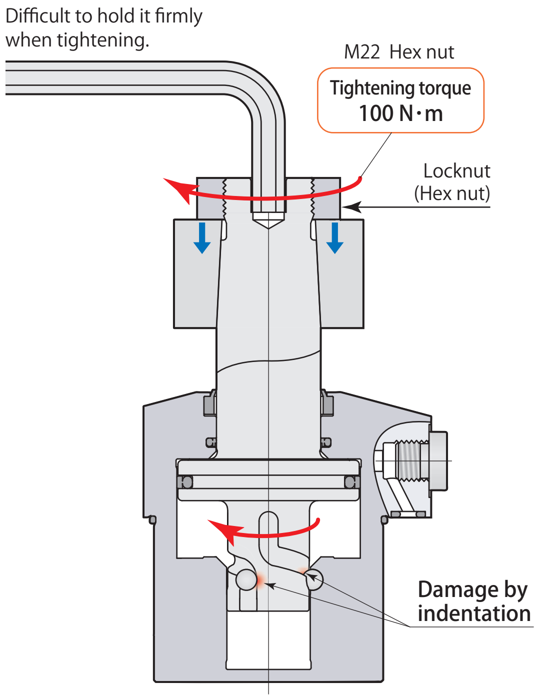
Swing clamp model CTM06

● The perfect nut needs minimum torque to tighten the set-screws and it can avoid giving the overload to the cam groove on the piston rod, which enables the arm to mount firmly and easily.

Less workability with conventional way of the mount.



● To fasten or loosen the nut using the conventional way in a limited space makes the workability lower and may cause incomplete arm mounting.



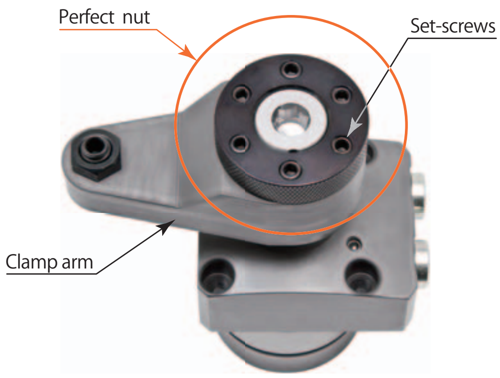
Swing clamp model CTM06

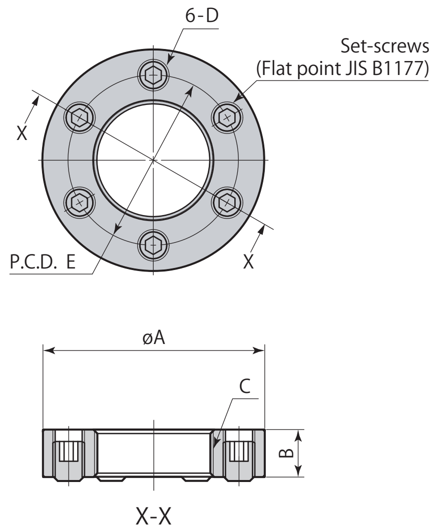
● The piston rod of the clamp must be fixed firmly to fasten the nut however it may cause damage on cam groove in case the rod is not fixed firmly.

Perfect nut

Size

CTH [04 / 05 / 06 / 10 / 16] – MN : Perfect nut



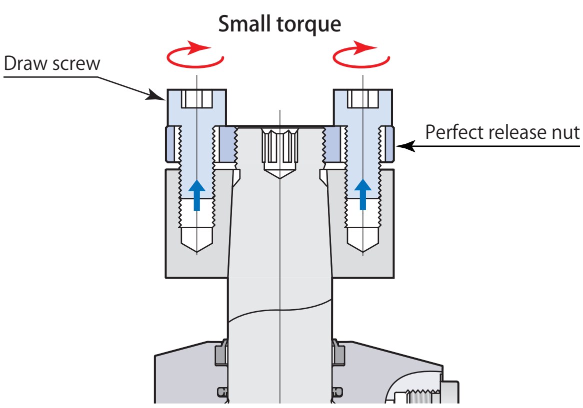


mm

Perfect nut		CTH04-MN	CTH05-MN	CTH06-MN	CTH10-MN	CTH16-MN
Applicable swing clamp		CTM04	CTM05	CTM06	CTM10	CTM16
Set-screws	Size	M6×1 length 8	M6×1 length 8	M8×1.25 length 10	M8×1.25 length 10	M8×1.25 length 10
	Recommended tightening torque	2.5 N·m	3 N·m	6 N·m	7 N·m	8 N·m
øA		32	40	48	54	56
B		8	9	10	11	11
C		M16×1.5	M20×1.5	M22×1.5	M27×1.5	M30×1.5
D		M6×1	M6×1	M8×1.25	M8×1.25	M8×1.25
E		24	30	35	41	43
Mass		0.04 kg	0.06 kg	0.12 kg	0.15 kg	0.17 kg

Dismounting arm easily.

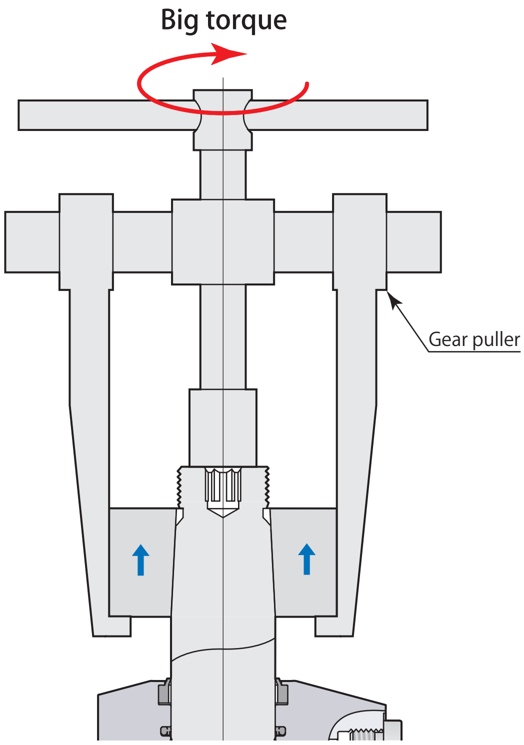
● By simply fastening the draw screw the clamp arm can be easily removed, which does not need a specialized tool such as a gear puller.



● The clamp arm can be dismounted easily and securely with a small torque.

Inferior dismounting workability using a gear puller.

● On the machine table top and the jig the working space is limited, it is difficult to pull up a clamp arm using a specialized tool such as a gear puller.



● A large torque is needed to pull the clamp arm off from the tapered area of the rod, which will be risky for a worker when the arm comes off suddenly.

Perfect release nut

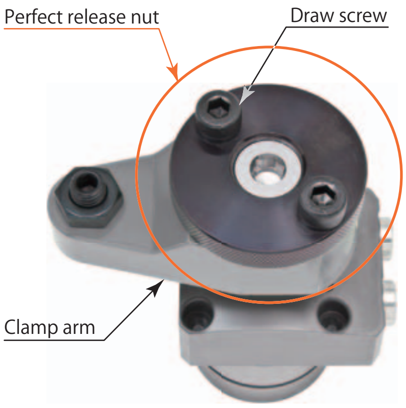
Size

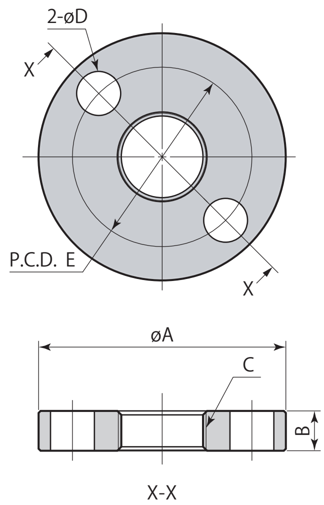
	04		
	05		
CTH	06	—	MNR : Perfect release nut
	10		
	16		

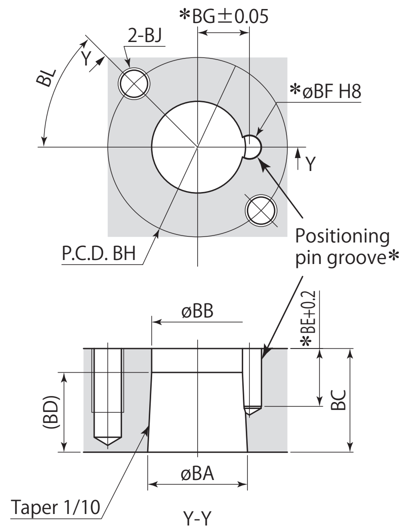
Clamp arm mounting details

(Using perfect release nut)

Drill a 1/10 taper hole into the clamp arm, and provide the tap holes for draw screws to remove the clamp arm.







*: No need to machine the pin groove (BE, øBF, BG) unless positioning pin is used for the arm.

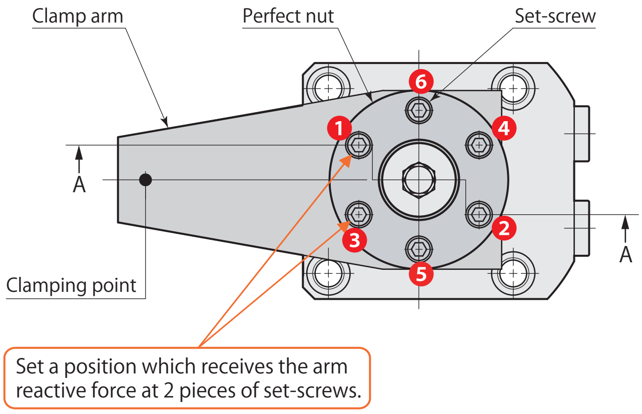
mm

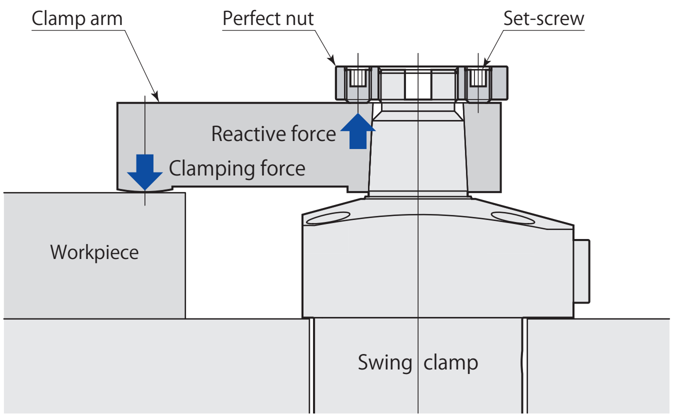
Perfect release nut	CTH04-MNR	CTH05-MNR	CTH06-MNR	CTH10-MNR	CTH16-MNR
Applicable swing clamp	CTM04	CTM05	CTM06	CTM10	CTM16
Recommended draw screw	M6×1	M8×1.25	M10×1.5	M10×1.5	M10×1.5
øA	45	54	62	68	70
B	8	9	10	11	11
C	M16×1.5	M20×1.5	M22×1.5	M27×1.5	M30×1.5
øD	6.8	9	11	11	11
E	34	39	45	51	53
Mass	0.08 kg	0.13 kg	0.20 kg	0.25 kg	0.28 kg
øBA	$18^{-0.016}_{-0.034}$	$22^{-0.020}_{-0.041}$	$25^{-0.020}_{-0.041}$	$30^{-0.020}_{-0.041}$	$35.5^{-0.025}_{-0.050}$
øBB	16.5	20.5	23	28	(32)
BC	19	23	26	29	35
BD	15	15	20	20	–
BE	10.5	12.5	14.5	16.5	17.5
øBF (pin groove diameter)	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$	$8^{+0.022}_{0}$
BG	9	11.5	13	15.5	18
BH	34	39	45	51	53
BJ	M6	M8	M10	M10	M10
BL	Standard 60° allowable range 45°–70° (within range that there is no interference with set-screws)				

● Draw screws are not included with perfect release nut.

Perfect nut (Arm mounting guide)

1. Set clamp arm and turn perfect nut as tight as it gets manually.
2. Turn back perfect nut to the position where two set-screws hold against reactive force of arm, as shown in diagram below.
3. Tighten set-screws with recommended torque in order of ❶ to ❻ in diagram below.
4. Once set-screws are tightened to ❻ , ❶ becomes loose, so retighten in sequence of ❶ to ❻ again.
5. Repeat tightening of set-screws ❶ to ❻ six times.
6. Repeat clamping and unclamping of workpiece five times (this operation allows taper section to become accustomed to use).
7. Return to unclamped condition and then retighten set-screws in order of ❶ to ❻.
   Once tightening in sequence of ❶ to ❻ is repeated three times, all set-screws will be fixed and clamp arm is completely mounted.



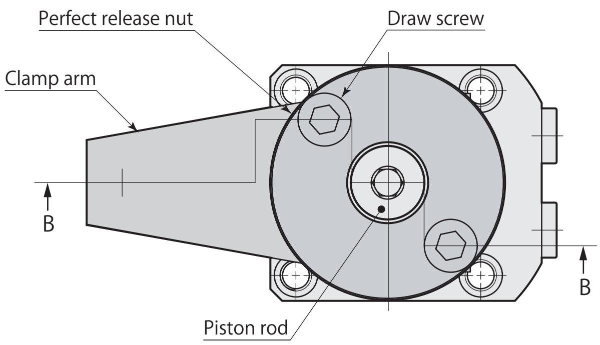


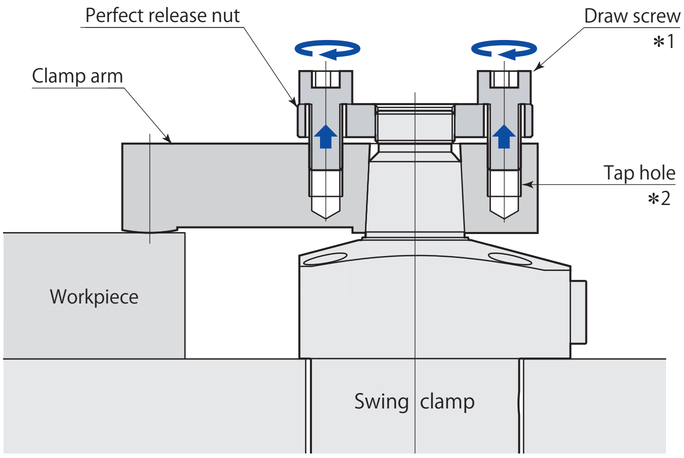
A-A

- The clamp arm may bite at the taper of the clamp rod and it will cause the demount failure if the set screw is tightened with excessive force. Be sure to use recommended torque when tightening.
- More secure tightening can be accomplished by applying some thread adhesive on set-screws.
  Recommended adhesive: LOCTITE 243 (medium strength type)

Perfect release nut (Arm dismounting guide)

1. Loosen all set-screws of perfect nut and dismount perfect nut from piston rod.
2. Mount perfect release nut and turn it until clamp arm comes into contact.
3. Turn perfect release nut back one or two more times, align the nut hole with tap hole of clamp arm and then mount the draw screws.
4. Once draw screws are tightened, clamp arm can be pulled off piston rod.





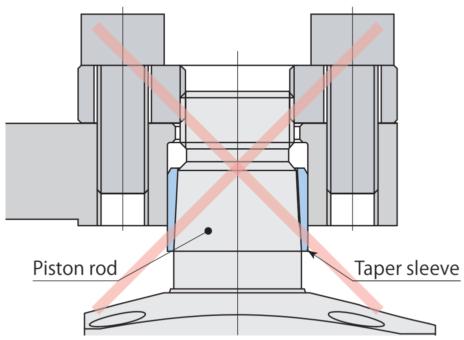
B-B

∗1:Turn draw screws as a pair, alternately turning 45° to 90° at a time to tighten them evenly.
Some movement is felt in hand as clamp arm comes off, but there is no danger involved in this procedure.

∗2:Tap holes for draw screws are needed on clamp arm in order to use perfect release nut.
Refer to clamp arm mounting details on **page →75** for details on tap holes.

Caution in use

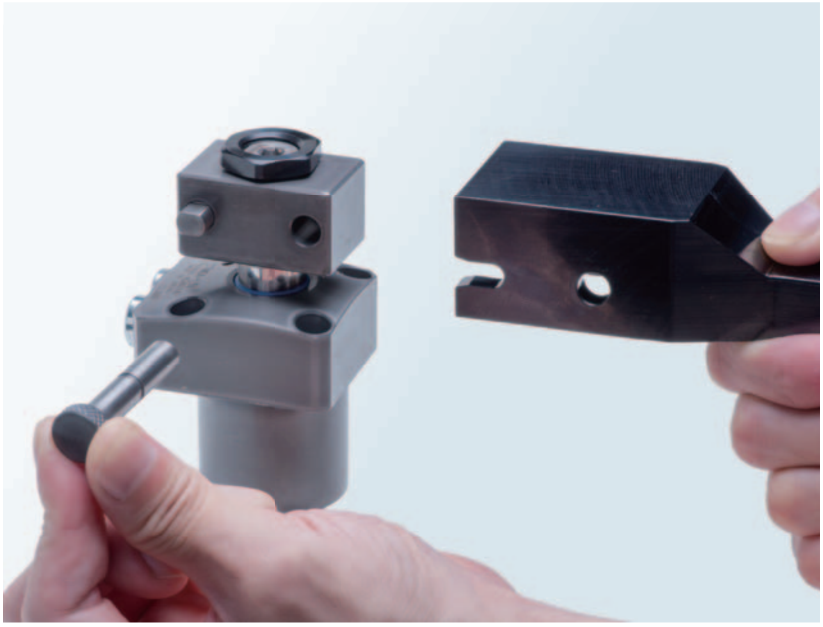
In the event that a clamp arm is used with taper sleeve, the perfect release nut cannot remove the clamp arm due to the taper sleeve remaining on the piston rod. When using a taper sleeve, please use a gear puller (or similar) to remove clamp arm.
To be able to easily remove clamp arms using the perfect release nut, drill a 1/10 taper hole into the clamp arm. (Clamp arm mounting details refer to **page →75**)



Quick arm change

● Clamp arm is replaceable quickly.

Toolless



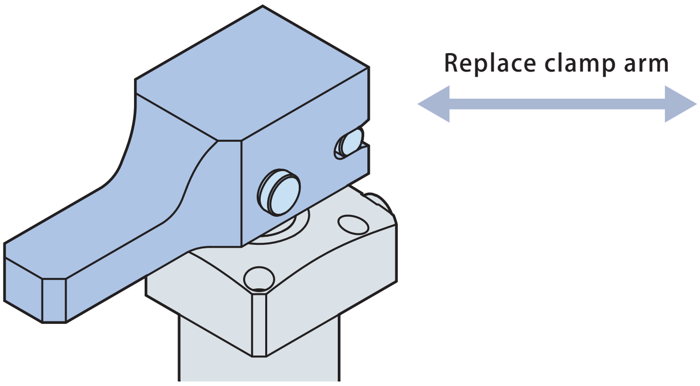
● No specific tools are required to replace,
simply place the arm and put the pin in.

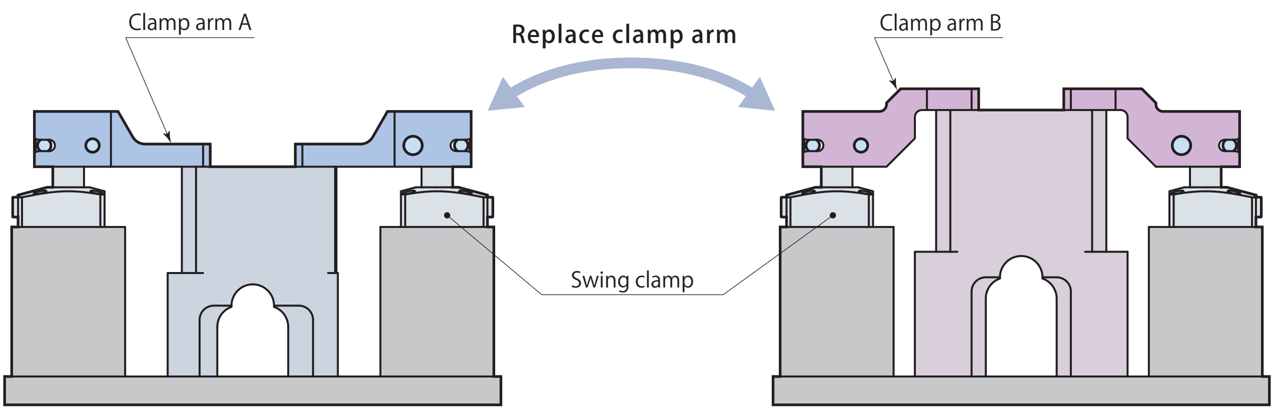
Jig cost is reduced

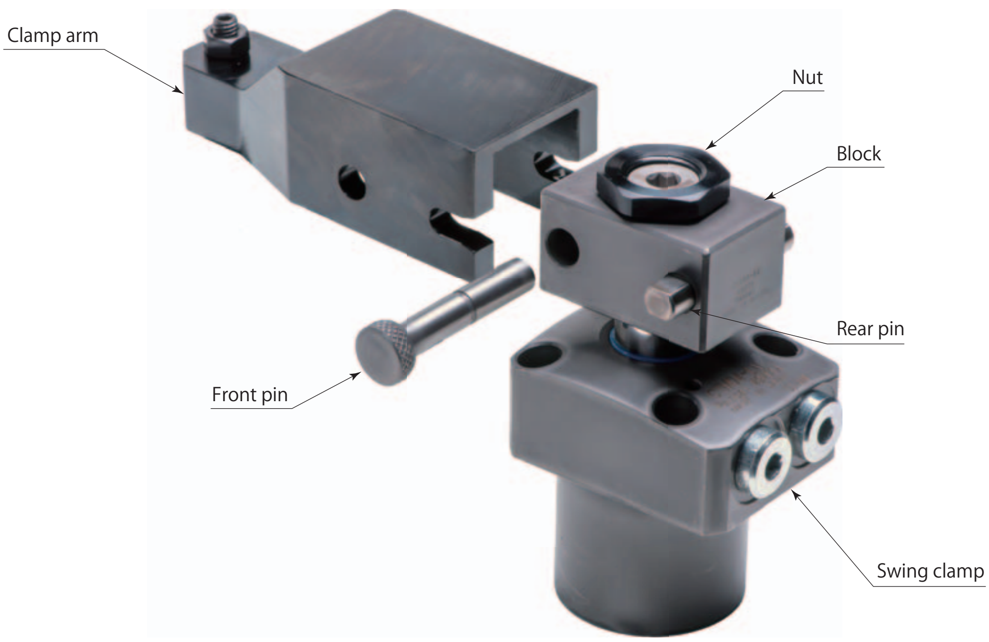
● The arm makes the clamp versatile for many kinds of the workpiece and overall Jig cost is reduced.

Productivity improved

● The introduction of the arm enable the jig to be exchanged very quick and to reduce the set-up time, which ends up the increase of productivity.





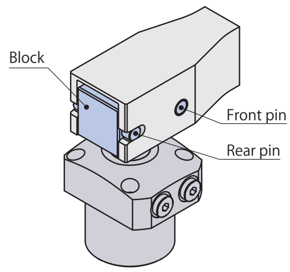


Quick arm change

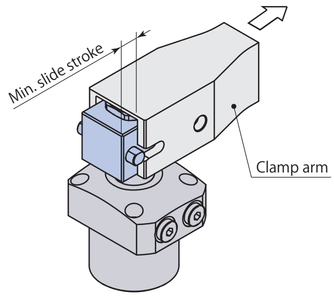
Size

CTH — 04 / 05 / 06 / 10 / 16 — **BQ** : Quick arm change

(grey box) indicates made to order.



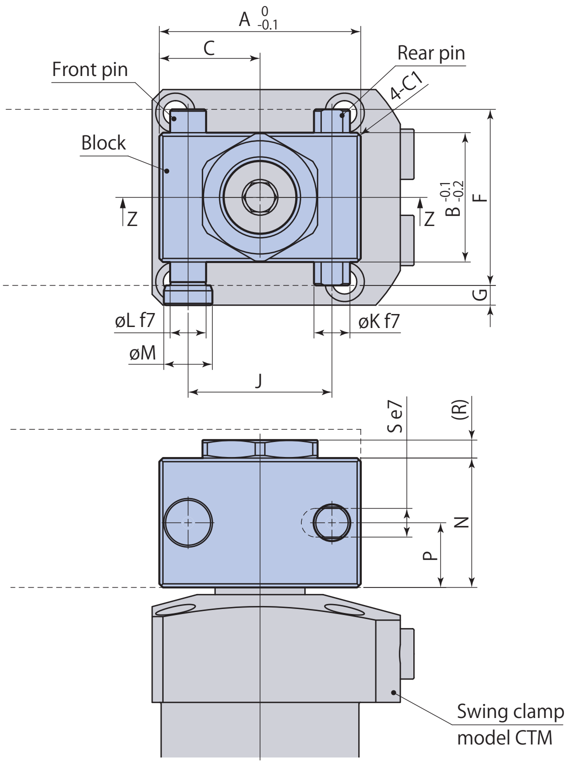
Clamp arm mounting

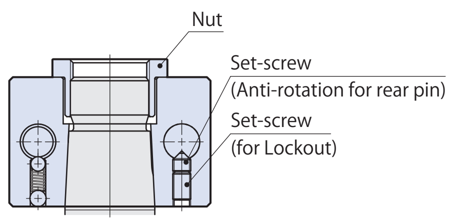


Clamp arm dismounting

Pull the pin out and slide the clamp arm to the front of the clamp so the arm can be removed.

Dimensions

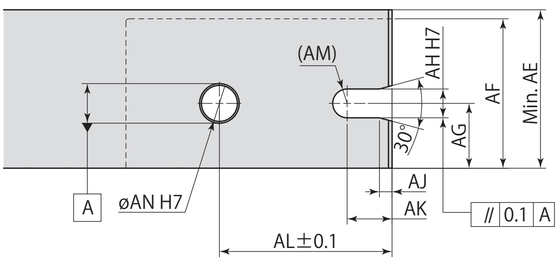


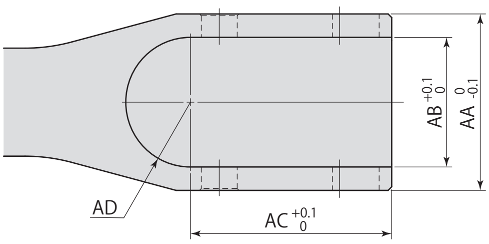


Z-Z

Clamp arm mounting details

Recommended material：S45C (HB201–269)





mm

Quick arm change	CTH04-BQ	CTH05-BQ	CTH06-BQ	CTH10-BQ	CTH16-BQ
Applicable swing clamp	CTM04	CTM05	CTM06	CTM10	CTM16
A	42	48	56	67	80
B	27	33.5	36	45.5	50.5
C	21	24	28	33.5	40
F	40	45	49	59	72
G	5.5	5.5	5.5	5.5	9
J	29	34	40	50	56
øK	$8^{-0.013}_{-0.028}$	$10^{-0.013}_{-0.028}$	$10^{-0.013}_{-0.028}$	$10^{-0.013}_{-0.028}$	$16^{-0.016}_{-0.034}$
øL	$8^{-0.013}_{-0.028}$	$10^{-0.013}_{-0.028}$	$10^{-0.013}_{-0.028}$	$10^{-0.013}_{-0.028}$	$16^{-0.016}_{-0.034}$
øM	11.5	13.5	13.5	13.5	21
N	23	30	36	36	50
P	11.5	15	18	18	25
R	5	5	5	5	7
S (width across flats)	$6^{-0.020}_{-0.032}$	$8^{-0.025}_{-0.040}$	$8^{-0.025}_{-0.040}$	$8^{-0.025}_{-0.040}$	$14^{-0.032}_{-0.050}$
Min. slide stroke	10.5	12	13	13.5	20

- Refer to **pages →12–67** for model CTM for other specifications and dimensions that are not shown in the diagram.
- Refer to performance table (**pages →14**, **15**) for the relation between hydraulic force and clamp arm length.
- A nut, block, front pin and a rear pin are included.
- Customers must arrange for the clamp arm.

mm

Quick arm change	CTH04-BQ	CTH05-BQ	CTH06-BQ	CTH10-BQ	CTH16-BQ
Applicable swing clamp	CTM04	CTM05	CTM06	CTM10	CTM16
AA	40	45	49	59	72
AB	27	33.5	36	45.5	50.5
AC	42	48	56	67	80
AD	R13.5	R16.75	R18	R22.75	R25.25
AE	32	39	44	44	62
AF	29	36	41.5	41.5	58
AG	11.5	15	18	18	25
AH	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$8^{+0.015}_{0}$	$8^{+0.015}_{0}$	$14^{+0.018}_{0}$
AJ	2.5	3	3.5	4	6
AK	9.5	10.5	11.5	12	16.5
AL	35.5	41	48	58.5	68
AM	R3	R4	R4	R4	R7
øAN	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$	$10^{+0.015}_{0}$	$10^{+0.015}_{0}$	$16^{+0.018}_{0}$

Table of contents

Swing clamp

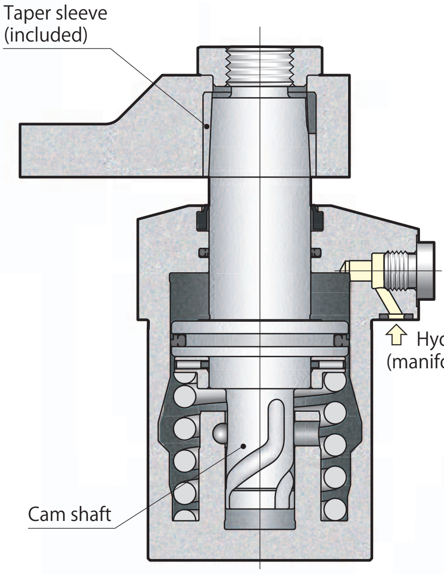
Single acting 7 MPa

model CTN

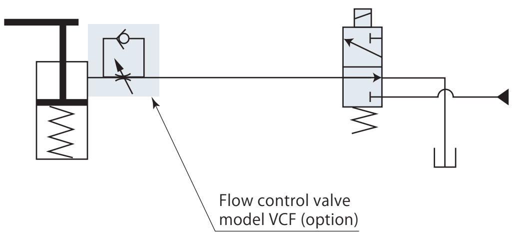
Single acting Swing clamp
model CTN06-L

Compact model

model **CTN□-□** JP PAT.



Hydraulic circuit diagram



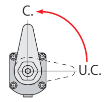
Use flow control valve for meter-in control.

Specifications page → 85
Dimensions page → 88
Mounting details page → 90

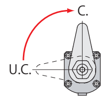
Specifications

CTN | Size: 02 / 04 / 05 / 06 / 10 / 16 | – | Swing direction (when clamping)

L : Counter-clockwise



R : Clockwise



Contact Pascal for the details of variation codes (models) that are not described in the catalog.

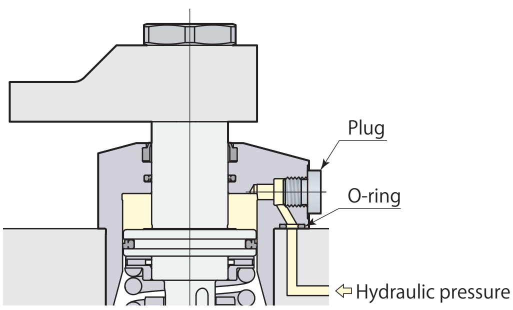
Model			CTN02	CTN04	CTN05	CTN06	CTN10	CTN16
Cylinder force (hydraulic pressure 7MPa)*1		kN	2.3	3.3	4.4	5.8	8.1	12.1
Cylinder inner diameter		mm	27	32	38	44	52	63
Rod diameter		mm	15	18	22	25	30	35.5
Effective area (clamp)		cm^2	4.0	5.5	7.5	10.3	14.2	21.3
Swing angle			90° ±3°					
Positioning pin groove position accuracy			±1°					
Repeated clamp positioning accuracy			±0.5°					
Full stroke		mm	12.5	13	14	16.5	18	21.5
90° swing stroke		mm	4.5	5	6	6.5	8	9.5
Clamp stroke		mm	8	8	8	10	10	12
Cylinder capacity (clamp)		cm^3	4.9	7.1	10.6	17.0	25.5	45.7
Return spring force	Unclamp	kN	0.35	0.42	0.59	0.82	1.03	1.54
	Clamp stroke central position	kN	0.45	0.54	0.85	1.38	1.82	2.80
	Clamp end	kN	0.50	0.60	0.95	1.63	2.13	3.29
Recommended piping inner diameter*2		mm	ø6	ø6	ø6	ø6	ø8	ø8
Mass		kg	0.6	0.8	1.2	1.7	2.5	3.8
Recommended tightening torque of mounting screws*3		N·m	3.5	7	7	12	12	29
Recommended tightening torque of nut		N·m	7.5	14	40	50	74	116

● Pressure range：2.5–7 MPa　● 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：This is value for central position of clamp stroke.
∗2：Care must be taken when numerous clamps are used or when hydraulic piping is long.　∗3：ISO R898 class 12.9

Manifold piping and G port piping are available.

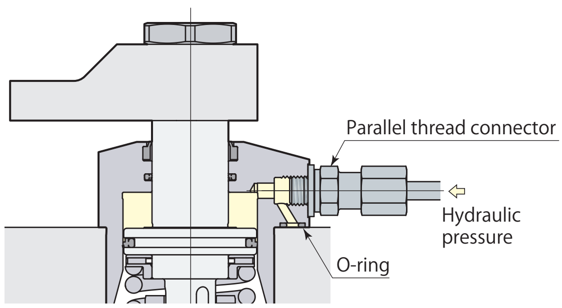
Manifold piping

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.

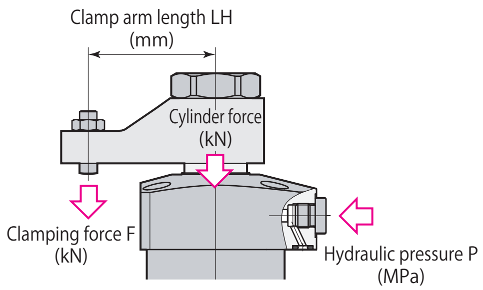


G port piping

Remove plug when choosing G port piping. (O-ring must be used.) Refer to **page →372** 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.



Performance table



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

Clamping force calculation formula
F = (P - Coefficient 1)/(Coefficient 2 + Coefficient 3 × LH)
F: Clamping force P: Hydraulic pressure LH: Clamp arm length

CTN06 with clamp arm length (LH) = 50 mm at hydraulic pressure of 7 MPa, Clamping force F is calculated by
(7-1.34)/(0.971+0.00444×50)=4.7 kN

Do not use the clamp in the nonusable range. It may cause damage to the cylinder and rod.

model CTN02 Clamping force F=(P-1.15)/(2.53+0.014×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN								Max. arm length Max. LH mm
		Clamp arm length LH mm								
		25	30	40	50	60	80	100	120	
7	2.3	2.0	2.0	1.9	1.8					53
6.5	2.1	1.9	1.8	1.7	1.7	1.6	Nonusable range			60
6	1.9	1.7	1.6	1.6	1.5	1.4				69
5.5	1.7	1.5	1.5	1.4	1.3	1.3	1.2			81
5	1.5	1.3	1.3	1.2	1.2	1.1	1.1			98
4.5	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.8	123
4	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.7	0.7	↑
3.5	0.9	0.8	0.8	0.8	0.7	0.7	0.6	0.6	0.6	↑
3	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.4	↑
2.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	123

model CTN04 Clamping force F=(P-0.986)/(1.82+0.00974×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN								Max. arm length Max. LH mm
		Clamp arm length LH mm								
		40	50	60	70	80	100	120	140	
7	3.3	2.7	2.6	2.5						68
6.5	3.0	2.5	2.4	2.3	2.2		Nonusable range			77
6	2.8	2.3	2.2	2.1	2.0	1.9				89
5.5	2.5	2.0	2.0	1.9	1.8	1.7	1.6			104
5	2.2	1.8	1.7	1.7	1.6	1.5	1.4	1.3		127
4.5	1.9	1.6	1.5	1.5	1.4	1.4	1.3	1.2	1.1	162
4	1.7	1.4	1.3	1.3	1.2	1.2	1.1	1.0	0.9	↑
3.5	1.4	1.1	1.1	1.0	1.0	1.0	0.9	0.8	0.8	↑
3	1.1	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.6	↑
2.5	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	162

model CTN05 Clamping force F=(P-1.12)/(1.33+0.00663×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN								Max. arm length Max. LH mm
		Clamp arm length LH mm								
		50	60	80	100	120	140	160	180	
7	4.4	3.5	3.4	3.2						84
6.5	4.0	3.2	3.1	2.9		Nonusable range				96
6	3.7	2.9	2.8	2.6	2.4					111
5.5	3.3	2.6	2.5	2.4	2.2	2.1				133
5	2.9	2.3	2.2	2.1	1.9	1.8	1.7	1.6		164
4.5	2.5	2.0	2.0	1.8	1.7	1.6	1.5	1.4	1.3	214
4	2.2	1.7	1.7	1.5	1.4	1.4	1.3	1.2	1.1	↑
3.5	1.8	1.4	1.4	1.3	1.2	1.1	1.1	1.0	0.9	↑
3	1.4	1.1	1.1	1.0	0.9	0.9	0.8	0.8	0.7	↑
2.5	1.0	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	214

model CTN06 Clamping force F=(P-1.34)/(0.971+0.00444×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN								Max. arm length Max. LH mm
		Clamp arm length LH mm								
		50	60	80	100	120	140	160	180	
7	5.8	4.7	4.6							69
6.5	5.3	4.3	4.2			Nonusable range				78
6	4.8	3.9	3.8	3.5						90
5.5	4.3	3.5	3.4	3.1	2.9					106
5	3.8	3.1	3.0	2.8	2.6	2.4				128
4.5	3.3	2.6	2.6	2.4	2.2	2.1	2.0	1.9		164
4	2.7	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.5	227
3.5	2.2	1.8	1.7	1.6	1.5	1.4	1.4	1.3	1.2	↑
3	1.7	1.4	1.3	1.3	1.2	1.1	1.0	1.0	0.9	↑
2.5	1.2	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.7	227

model CTN10 Clamping force F=(P-1.29)/(0.706+0.00298×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN								Max. arm length Max. LH mm
		Clamp arm length LH mm								
		60	80	100	120	140	160	180	200	
7	8.1	6.5	6.0							86
6.5	7.4	5.9	5.5							97
6	6.7	5.3	5.0	4.7		Nonusable range				112
5.5	6.0	4.8	4.5	4.2	4.0					133
5	5.3	4.2	3.9	3.7	3.5	3.3	3.1			163
4.5	4.5	3.6	3.4	3.2	3.0	2.9	2.7	2.6	2.5	212
4	3.8	3.1	2.9	2.7	2.5	2.4	2.3	2.2	2.1	↑
3.5	3.1	2.5	2.3	2.2	2.1	2.0	1.9	1.8	1.7	↑
3	2.4	1.9	1.8	1.7	1.6	1.5	1.4	1.4	1.3	↑
2.5	1.7	1.4	1.3	1.2	1.1	1.1	1.0	1.0	0.9	212

model CTN16 Clamping force F=(P-1.32)/(0.47+0.00171×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN								Max. arm length Max. LH mm
		Clamp arm length LH mm								
		60	80	100	120	140	160	180	200	
7	12.1	9.9	9.4	8.9						102
6.5	11.0	9.0	8.5	8.1		Nonusable range				116
6	10.0	8.2	7.7	7.3	6.9					134
5.5	8.9	7.3	6.9	6.5	6.2	5.9				159
5	7.8	6.4	6.1	5.7	5.5	5.2	4.9	4.7		197
4.5	6.8	5.6	5.2	5.0	4.7	4.5	4.3	4.1	3.9	256
4	5.7	4.7	4.4	4.2	4.0	3.8	3.6	3.4	3.3	↑
3.5	4.6	3.8	3.6	3.4	3.2	3.1	2.9	2.8	2.7	↑
3	3.6	2.9	2.8	2.6	2.5	2.4	2.3	2.2	2.1	↑
2.5	2.5	2.1	1.9	1.8	1.7	1.7	1.6	1.5	1.5	256

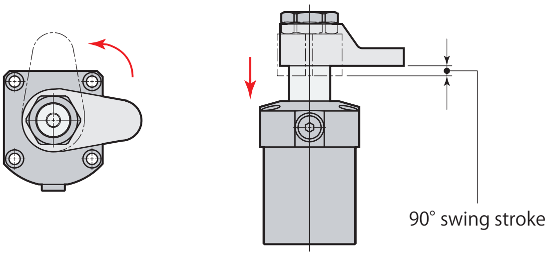
Swing speed adjustment

Swing time is restricted by the mass and length of the clamp arm (moment of inertia) since the 90° swing action impacts the cam shaft.

1.Calculate the moment of inertia according to the arm length and mass.

2.Adjust swing speed with flow control valve to ensure that 90° swing time of the clamp arm is greater than the shortest swing time in the graph shown below.

● The cam groove may be damaged in case the swing speed is set at the nonusable range in the graph.

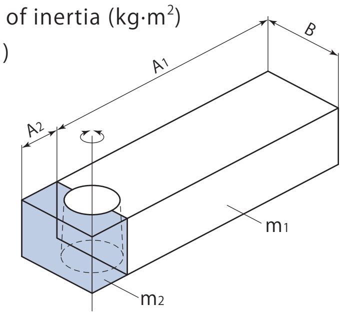


Example of calculation for moment of inertia

$$I = \frac{1}{12} m_1(4A_1^2+B^2) + \frac{1}{12} m_2(4A_2^2+B^2)$$

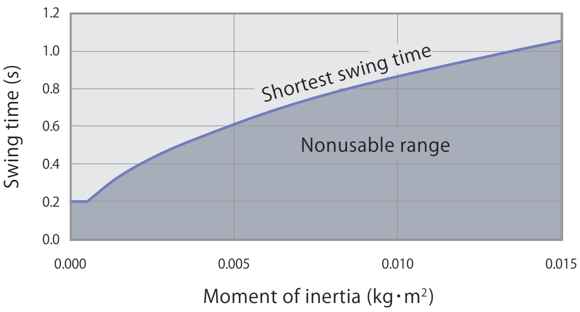
I : Moment of inertia ($kg \cdot m^2$)

m: Mass (kg)



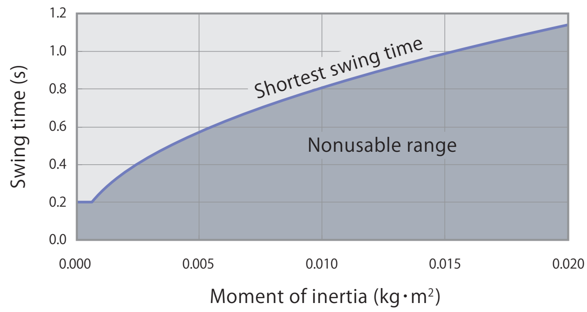
model CTN02

Shortest swing time calculation formula $t = \sqrt{\frac{I}{0.0134}}$



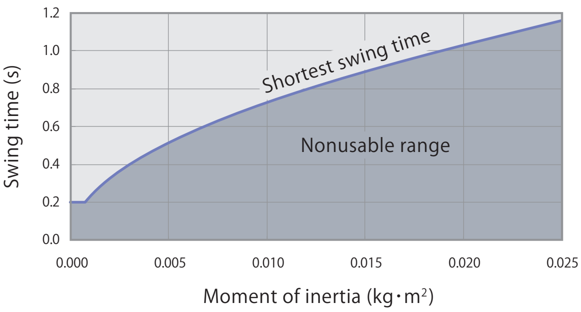
model CTN04

Shortest swing time calculation formula $t = \sqrt{\frac{I}{0.0153}}$



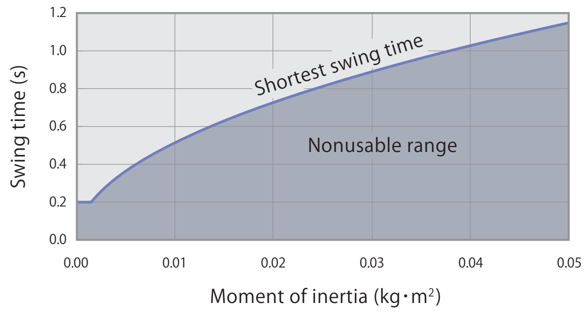
model CTN05

Shortest swing time calculation formula $t = \sqrt{\frac{I}{0.0190}}$



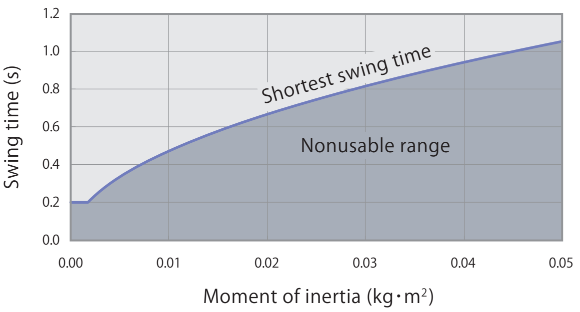
model CTN06

Shortest swing time calculation formula $t = \sqrt{\frac{I}{0.0378}}$



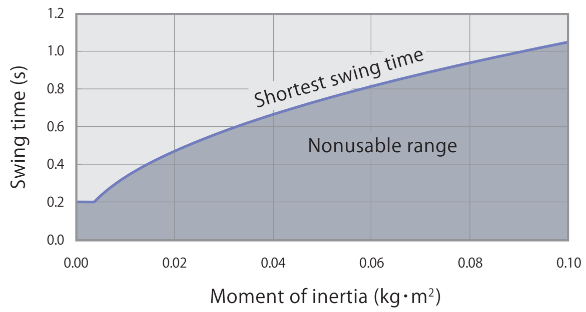
model CTN10

Shortest swing time calculation formula $t = \sqrt{\frac{I}{0.0450}}$

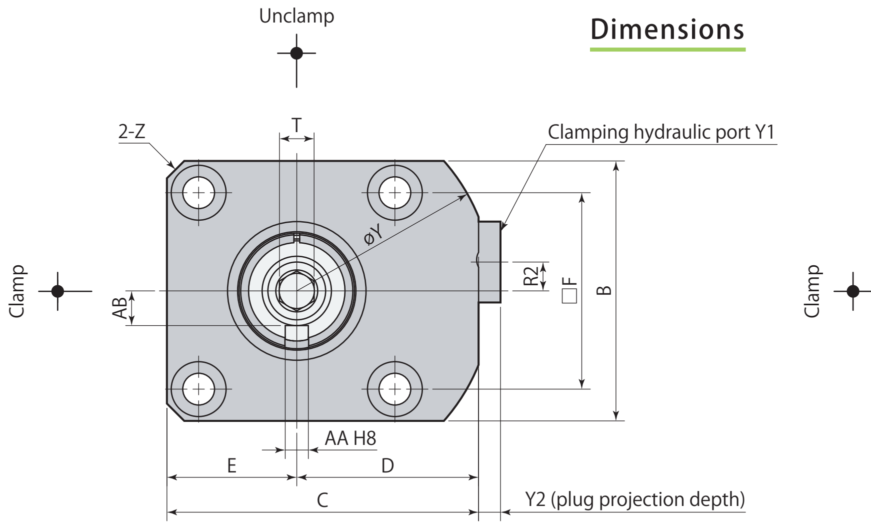


model CTN16

Shortest swing time calculation formula $t = \sqrt{\frac{I}{0.0905}}$

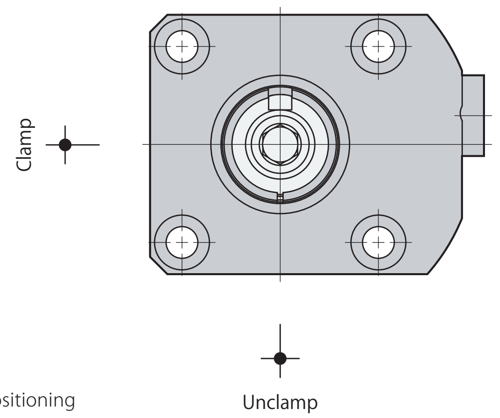


Dimensions

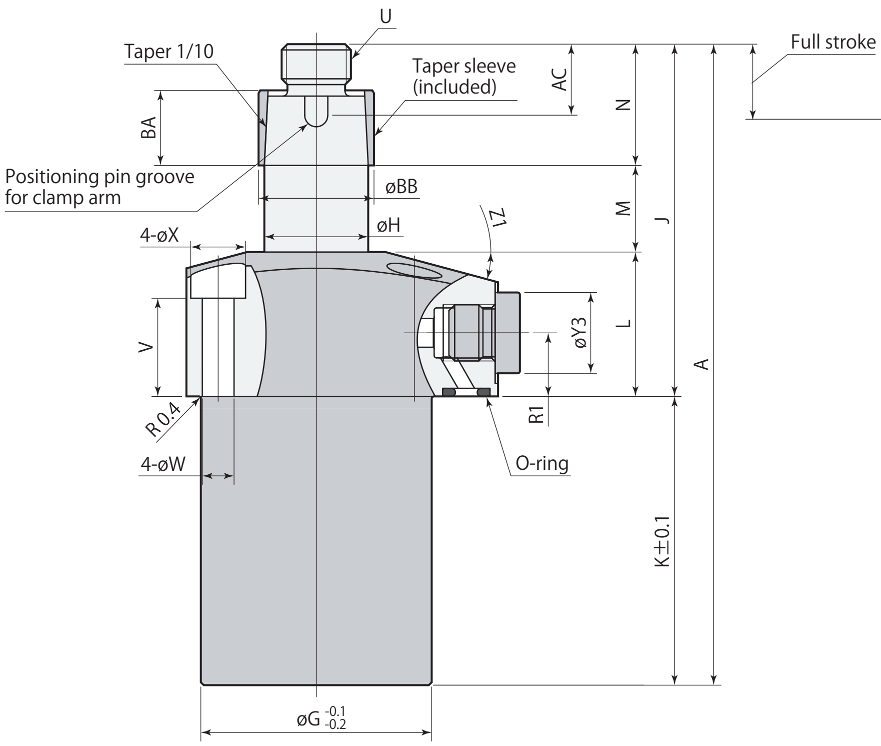


This diagram indicates the arm positioning pin groove at unclamped condition.

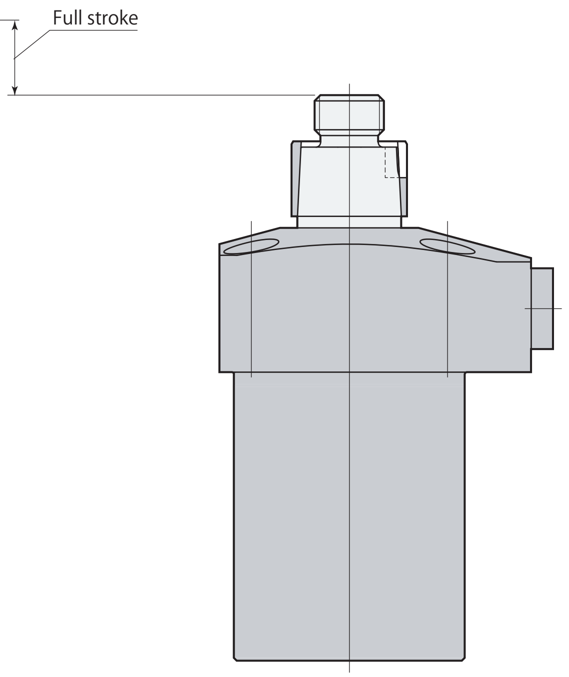
Swing direction L (counter-clockwise)



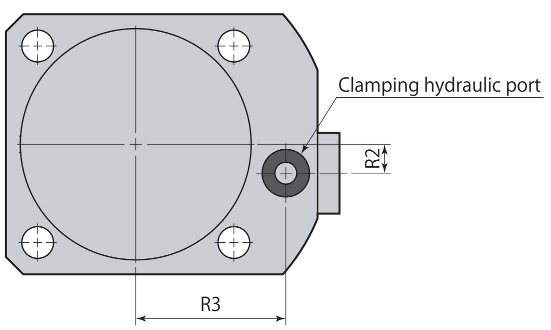
Swing direction R (clockwise)

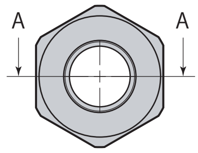


Unclamp

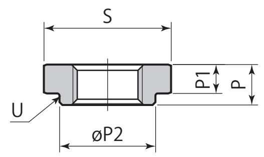


Stroke end





Hex nut for arm mount



A-A

- Hex nut for arm mount, taper sleeve are included.
- Clamp arm, positioning pin and mounting screws are not included.

mm

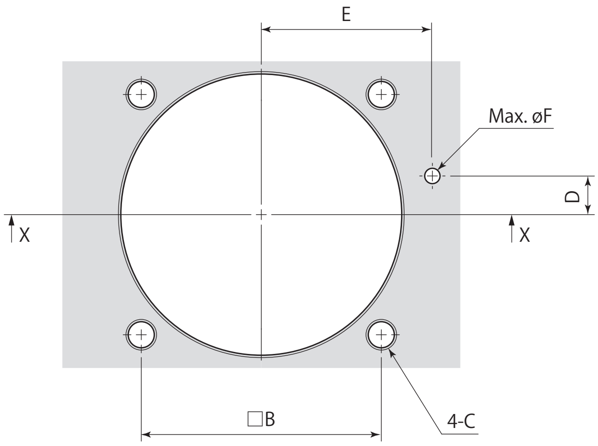
Model		CTN02-□	CTN04-□	CTN05-□	CTN06-□	CTN10-□	CTN16-□
A		103.5	111	121	137.5	145	171.5
B		40	45	51	60	70	80
C		49	54	61	69	81	92
D		29	31.5	35.5	39	46	52
E		20	22.5	25.5	30	35	40
F		31.4	34	40	47	55	63
øG		36	40	48	55	65	75
øH		15	18	22	25	30	35.5
J		55.5	61	69	78.5	82	100.5
K		48	50	52	59	63	71
L		25	25	28	28	30	37
M		14.5	15	16	18.5	20	23.5
N		16	21	25	32	32	40
P		5.8	7	9	10	10	12
P1		4	5	6	7	7	8
øP2		13.8	16.6	20.5	22.9	27.9	32.8
R1		11	11	13	12	14.5	18
R2	G port position	5	5	0	0	15	16
	Manifold port position					0	0
R3		23.5	26	30	33.5	39.5	45
S (nut width across flats)		19	22	24	30	36	41
T (hex socket)		5	6	8	8	10	10
U		M10×1	M12×1.5	M16×1.5	M18×1.5	M22×1.5	M28×1.5
V		18	17	18.5	17	18	22
øW		4.5	5.5	5.5	6.8	6.8	9
øX		7.5	9.5	9.5	11	11	14
øY		63	68	73	80	106	116
Y1		G1/8	G1/8	G1/8	G1/8	G1/4	G1/4
Y2		3.8	3.8	3.8	3.8	4.8	4.8
øY3		14	14	14	14	19	19
Z		C2	C3	C3	(ø80)	C4	C5
Z1		15°	15°	15°	15°	12°	12°
O-ring (fluorocarbon hardness Hs90)		P5	P5	P5	P5	P7	P7
AA		$3^{+0.018}_{0}$	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$
AB		5	6	8	9	11	14
AC		9.5	12.3	14.3	15.3	16.5	18.5
BA		9.5	13	15	21	21	27
øBB		17	20	25	28	34	40
Flow control valve (meter-in)*		VCF01S	VCF01S	VCF01S	VCF01S	VCF02	VCF02
Air bleeding valve*		VCE01	VCE01	VCE01	VCE01	VCE02	VCE02

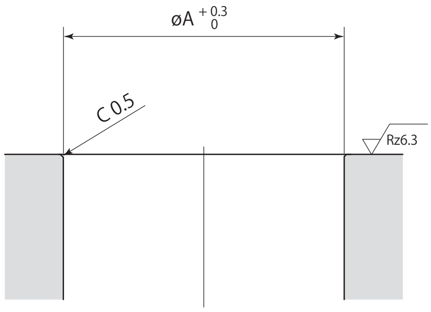
*: Select the right model of VCF and VCE according to the size of the clamp.

Refer to each page for the details of options.

● Flow control valve **page →140** ● Air bleeding valve **page →142**

Mounting details





X-X

Rz: ISO4287(1997)

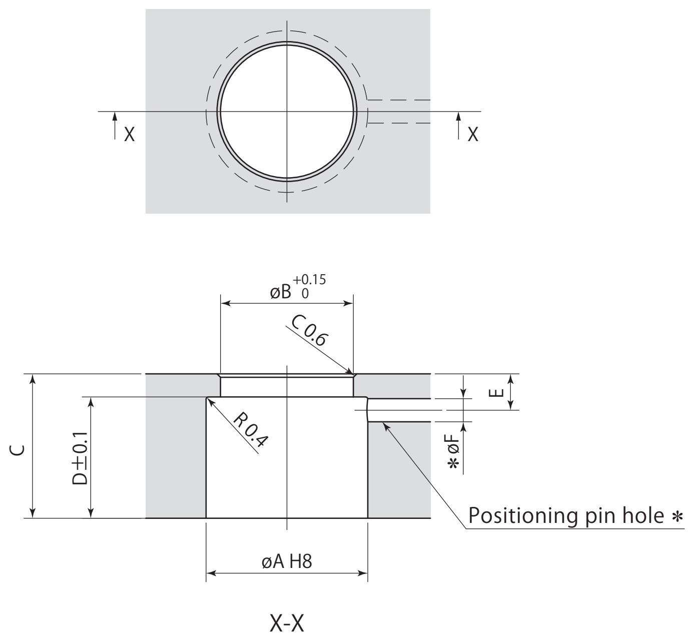
mm

Model	CTN02-□	CTN04-□	CTN05-□	CTN06-□	CTN10-□	CTN16-□
øA	36	40	48	55	65	75
B	31.4	34	40	47	55	63
C	M4	M5	M5	M6	M6	M8
D	5	5	0	0	0	0
E	23.5	26	30	33.5	39.5	45
øF	3	3	3	3	5	5

Clamp arm mounting details

(Using taper sleeve)

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



∗:No need to machine the pin hole (øF) unless positioning pin is used for the arm.
The positioning pin enables a clamp arm to locate on the clamp firmly and easily.

mm

Swing clamp	CTN02	CTN04	CTN05	CTN06	CTN10	CTN16
øA	17 $^{+0.027}_{0}$	20 $^{+0.033}_{0}$	25 $^{+0.033}_{0}$	28 $^{+0.033}_{0}$	34 $^{+0.039}_{0}$	40 $^{+0.039}_{0}$
øB	13.9	16.7	20.6	23	28	32.9
C	12	16	19	25	25	32
D	9.5	13	15	21	21	27
E	4.3	5.3	6.3	6.3	7.5	8.5
øF (pin hole diameter)	3	4	4	4	6	6

Table of contents

Swing clamp

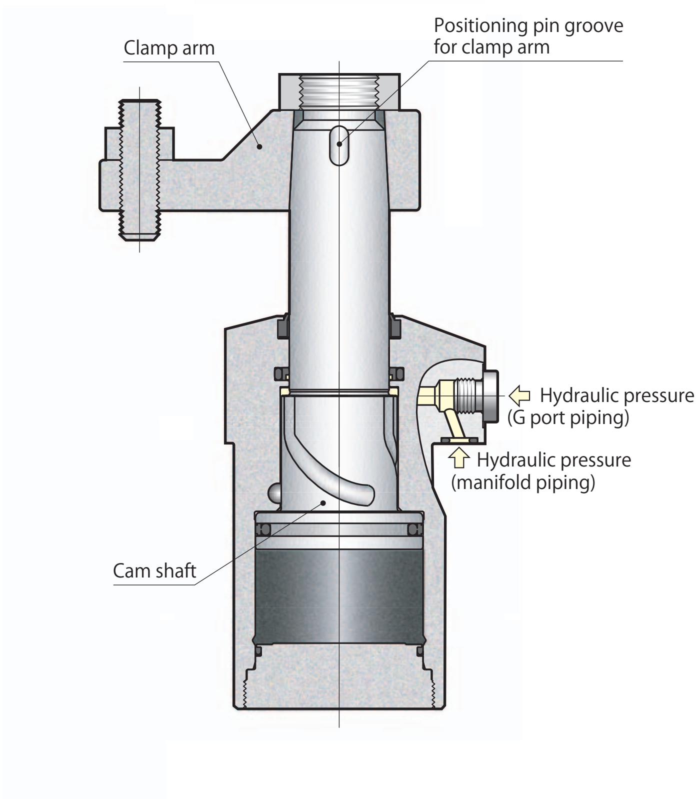
Double acting 7 MPa

model CTU

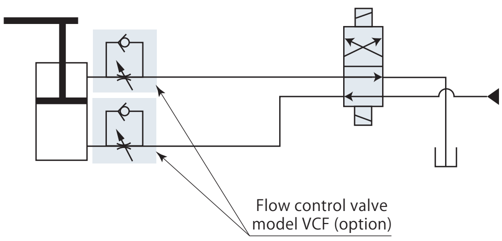
Standard model
model CTU06-L

Standard model

model **CTU□-□**



Hydraulic circuit diagram



For flow control valve, we recommend the meter-in control. If meter-out control is used, due to the area difference, it will cause back pressure and become high pressure. This can lead to malfunction of the system. Please be aware when designing the circuit.

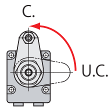
Specifications page → 95
Standard page → 98
Dual rod page → 102
Pin rod page → 103
Air sensor page → 104
Swing angle 30°, 45°, 60° page → 108
Long stroke page → 110

Specifications

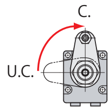
CTU – Size / Swing direction (when clamping) / Variation code*1

Size: 01, 02, 04, 06, 10, 16, 25*2

Swing direction (when clamping):
- **L** : Counter-clockwise



- **R** : Clockwise



Variation code*1:
- **(Nil)** : Standard
- **E** : Dual rod
- **P** : Pin rod
- **A** : Air sensor
- **N□** : Swing angle 30°, 45°, 60°
- **S□** : Long stroke

(shaded) indicates made to order.

*1: All varieties are not available for all sizes. Refer to each relevant page for details.
Contact Pascal for the details of variation codes (models) that are not described in the catalog.
*2: CTU25-□E, CTU25-□P and CTU25-□S30 are made to order.

Model			CTU01	CTU02	CTU04	CTU06	CTU10	CTU16	CTU25
Cylinder force (hydraulic pressure 7MPa)		kN	2.4	2.8	4.4	6.3	9.9	16.3	25.8
Cylinder inner diameter		mm	25	29	36	42	52	65	82
Rod diameter		mm	14	18	22.4	25	30	35.5	45
Effective area (clamp)		cm^2	3.4	4.1	6.2	8.9	14.2	23.3	36.9
Swing angle			90°±3°						
Positioning pin groove position accuracy			±1°						
Repeated clamp positioning accuracy			±0.5°						
Full stroke		mm	16	18	20.5	23.5	26.5	28.5	36
90°swing stroke		mm	8	10	12.5	13.5	16.5	18.5	23
Clamp stroke		mm	8	8	8	10	10	10	13
Max. swing torque*1		N·m	0.6	0.7	1.6	1.8	3.4	5.6	9.3
Cylinder capacity	Clamp	cm^3	5.4	7.3	12.8	21.0	37.5	66.4	132.9
	Unclamp	cm^3	7.9	11.9	20.9	32.6	56.3	94.6	190.1
Mass		kg	0.7	0.9	1.3	1.7	2.8	4.7	9.9
Recommended tightening torque of mounting screws*2		N·m	3.5	7	7	12	29	57	77
Recommended tightening torque of nut		N·m	12	26	51	60	86	120	180

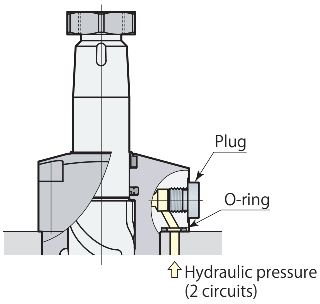
- Pressure range: 1–7 MPa
- Proof pressure: 10.5 MPa
- Operating temperature: 0–70 ℃
- Fluid used: General mineral based hydraulic oil (ISO-VG32 equivalent)
- Seals are resistant to chlorine-based cutting fluid. (not thermal resistant specification)

*1: This is the limit value for lifting arm at 1 MPa when mounted vertically. *2: ISO R898 class 12.9

Manifold piping and G port piping are available.

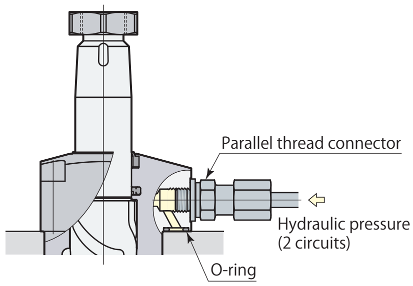
Manifold piping

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 →372** 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.



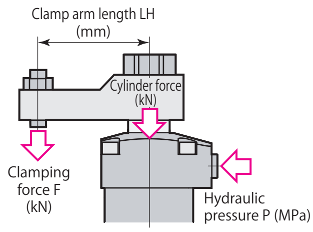
Performance table

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

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

CTU06 with clamp arm length (LH) = 60 mm
at hydraulic pressure of 7 MPa,
Clamping force F is calculated by
7/(1.12+0.00422×60)=5.1 kN

Do not use the clamp in the nonusable range.
It may cause damage to the cylinder and rod.



model CTU01　Clamping force F=P/(2.97+0.0153×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN								Max. arm length Max. LH mm
		Clamp arm length LH mm								
		30	35	40	50	60	80	100	120	
7	2.4	2.0	2.0							39
6.5	2.2	1.9	1.9	1.8						43
6	2.0	1.7	1.7	1.7	Nonusable range					48
5.5	1.9	1.6	1.6	1.5	1.5					53
5	1.7	1.5	1.4	1.4	1.3	1.3				61
4.5	1.5	1.3	1.3	1.3	1.2	1.2				70
4	1.3	1.2	1.1	1.1	1.1	1.0	1.0			83
3.5	1.2	1.0	1.0	1.0	0.9	0.9	0.8	0.8		102
3	1.0	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.6	131
2.5	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.5	↑
2	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.4	↑
1.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	↑
1	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	131

model CTU02　Clamping force F=P/(2.46+0.0116×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN								Max. arm length Max. LH mm
		Clamp arm length LH mm								
		35	40	50	60	80	100	120	140	
7	2.8	2.4	2.4	2.3	2.2	2.1				80
6.5	2.6	2.3	2.2	2.1	2.1	1.9	Nonusable range			89
6	2.4	2.1	2.1	2.0	1.9	1.8	1.7			101
5.5	2.2	1.9	1.9	1.8	1.7	1.6	1.5			115
5	2.0	1.7	1.7	1.6	1.6	1.5	1.4	1.3		135
4.5	1.8	1.6	1.5	1.5	1.4	1.3	1.2	1.2	1.1	162
4	1.6	1.4	1.4	1.3	1.3	1.2	1.1	1.0	1.0	202
3.5	1.4	1.2	1.2	1.2	1.1	1.0	1.0	0.9	0.9	↑
3	1.2	1.0	1.0	1.0	1.0	0.9	0.8	0.8	0.7	↑
2.5	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.6	0.6	↑
2	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.5	0.5	↑
1.5	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	↑
1	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	202

model CTU04　Clamping force F=P/(1.60+0.00664×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN								Max. arm length Max. LH mm
		Clamp arm length LH mm								
		40	50	60	80	100	120	140	160	
7	4.4	3.8	3.6	3.5	3.3	3.1				105
6.5	4.1	3.5	3.4	3.3	3.0	2.9	Nonusable range			117
6	3.8	3.2	3.1	3.0	2.8	2.7	2.5			133
5.5	3.4	2.9	2.8	2.8	2.6	2.4	2.3	2.2		153
5	3.1	2.7	2.6	2.5	2.3	2.2	2.1	2.0	1.9	181
4.5	2.8	2.4	2.3	2.3	2.1	2.0	1.9	1.8	1.7	220
4	2.5	2.1	2.1	2.0	1.9	1.8	1.7	1.6	1.5	↑
3.5	2.2	1.9	1.8	1.8	1.6	1.5	1.5	1.4	1.3	↑
3	1.9	1.6	1.6	1.5	1.4	1.3	1.3	1.2	1.1	↑
2.5	1.6	1.3	1.3	1.3	1.2	1.1	1.0	1.0	0.9	↑
2	1.3	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.8	↑
1.5	0.9	0.8	0.8	0.8	0.7	0.7	0.6	0.6	0.6	↑
1	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	220

model CTU06　Clamping force F=P/(1.12+0.00422×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN								Max. arm length Max. LH mm
		Clamp arm length LH mm								
		50	60	80	100	120	140	160	180	
7	6.3	5.3	5.1	4.8						96
6.5	5.8	4.9	4.7	4.5	4.2		Nonusable range			107
6	5.4	4.5	4.4	4.1	3.9	3.7				120
5.5	4.9	4.1	4.0	3.8	3.6	3.4				137
5	4.5	3.8	3.6	3.4	3.2	3.1	2.9	2.8		160
4.5	4.0	3.4	3.3	3.1	2.9	2.8	2.6	2.5	2.4	191
4	3.6	3.0	2.9	2.7	2.6	2.5	2.3	2.2	2.1	238
3.5	3.1	2.6	2.5	2.4	2.3	2.2	2.0	1.9	1.9	↑
3	2.7	2.3	2.2	2.1	1.9	1.8	1.8	1.7	1.6	↑
2.5	2.2	1.9	1.8	1.7	1.6	1.5	1.5	1.4	1.3	↑
2	1.8	1.5	1.5	1.4	1.3	1.2	1.2	1.1	1.1	↑
1.5	1.3	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.8	↑
1	0.9	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.5	238

model CTU10　Clamping force F=P/(0.706+0.00228×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN								Max. arm length Max. LH mm
		Clamp arm length LH mm								
		60	80	100	120	140	160	180	200	
7	9.9	8.3	7.9	7.5						102
6.5	9.2	7.7	7.3	7.0		Nonusable range				113
6	8.5	7.1	6.8	6.4	6.1					127
5.5	7.8	6.5	6.2	5.9	5.6	5.4				144
5	7.1	5.9	5.6	5.4	5.1	4.9	4.7			167
4.5	6.4	5.3	5.1	4.8	4.6	4.4	4.2	4.0		199
4	5.7	4.7	4.5	4.3	4.1	3.9	3.7	3.6	3.4	245
3.5	5.0	4.2	3.9	3.7	3.6	3.4	3.3	3.1	3.0	↑
3	4.2	3.6	3.4	3.2	3.1	2.9	2.8	2.7	2.6	↑
2.5	3.5	3.0	2.8	2.7	2.6	2.4	2.3	2.2	2.2	↑
2	2.8	2.4	2.3	2.1	2.0	2.0	1.9	1.8	1.7	↑
1.5	2.1	1.8	1.7	1.6	1.5	1.5	1.4	1.3	1.3	↑
1	1.4	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.9	245

model CTU16　Clamping force F=P/(0.429+0.00128×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN								Max. arm length Max. LH mm
		Clamp arm length LH mm								
		70	80	100	120	140	160	180	200	
7	16.3	13.5	13.2							99
6.5	15.2	12.5	12.2	11.7						110
6	14.0	11.6	11.3	10.8	10.3	Nonusable range				123
5.5	12.8	10.6	10.4	9.9	9.4					139
5	11.7	9.6	9.4	9.0	8.6	8.2	7.9			161
4.5	10.5	8.7	8.5	8.1	7.7	7.4	7.1	6.8		190
4	9.3	7.7	7.5	7.2	6.9	6.6	6.3	6.1	5.8	231
3.5	8.2	6.7	6.6	6.3	6.0	5.8	5.5	5.3	5.1	↑
3	7.0	5.8	5.6	5.4	5.1	4.9	4.7	4.5	4.4	↑
2.5	5.8	4.8	4.7	4.5	4.3	4.1	3.9	3.8	3.6	↑
2	4.7	3.9	3.8	3.6	3.4	3.3	3.2	3.0	2.9	↑
1.5	3.5	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.2	↑
1	2.3	1.9	1.9	1.8	1.7	1.6	1.6	1.5	1.5	231

model CTU25　Clamping force F=P/(0.271+0.000658×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN								Max. arm length Max. LH mm
		Clamp arm length LH mm								
		90	100	120	140	160	180	200	240	
7	25.8	21.2	20.8	20.0						129
6.5	24.0	19.7	19.3	18.6	17.9		Nonusable range			143
6	22.1	18.2	17.8	17.1	16.5	15.9				161
5.5	20.3	16.7	16.3	15.7	15.1	14.6	14.1			183
5	18.5	15.1	14.8	14.3	13.8	13.3	12.8	12.4		212
4.5	16.6	13.6	13.4	12.9	12.4	12.0	11.6	11.2	10.5	251
4	14.8	12.1	11.9	11.4	11.0	10.6	10.3	9.9	9.3	308
3.5	12.9	10.6	10.4	10.0	9.6	9.3	9.0	8.7	8.2	↑
3	11.1	9.1	8.9	8.6	8.3	8.0	7.7	7.5	7.0	↑
2.5	9.2	7.6	7.4	7.1	6.9	6.6	6.4	6.2	5.8	↑
2	7.4	6.1	5.9	5.7	5.5	5.3	5.1	5.0	4.7	↑
1.5	5.5	4.5	4.5	4.3	4.1	4.0	3.9	3.7	3.5	↑
1	3.7	3.0	3.0	2.9	2.8	2.7	2.6	2.5	2.3	308

● See the formula shown on **page →103** for clamping force calculation when pin rod type (CTU□-□P) is selected.

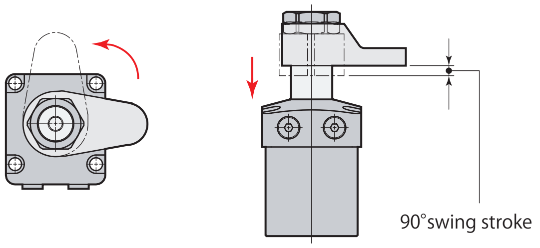
Swing speed adjustment

Swing time is restricted by the mass and length of the clamp arm (moment of inertia) since the 90° swing action impacts the cam shaft.

1.Calculate the moment of inertia according to the arm length and mass.

2.Adjust swing speed with flow control valve to ensure that 90° swing time of the clamp arm is greater than the shortest swing time in the graph shown below.

● The cam groove may be damaged in case the swing speed is set at the nonusable range in the graph.

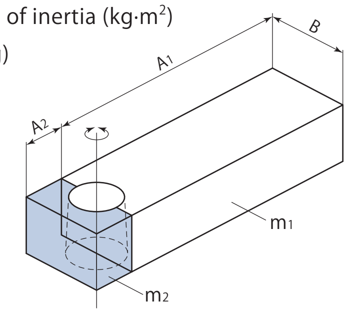


Example of calculation for moment of inertia

$$I=\frac{1}{12}m_1(4A_1^2+B^2)+\frac{1}{12}m_2(4A_2^2+B^2)$$

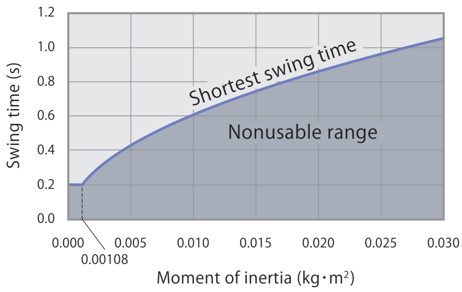
I ：Moment of inertia ($kg\cdot m^2$)

m ：Mass (kg)



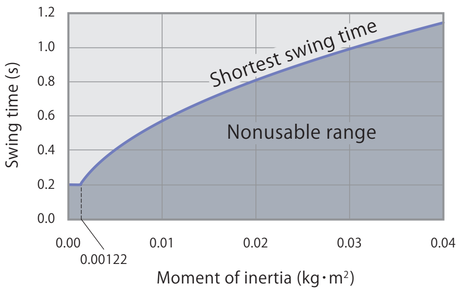
model CTU01

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.0270}}$



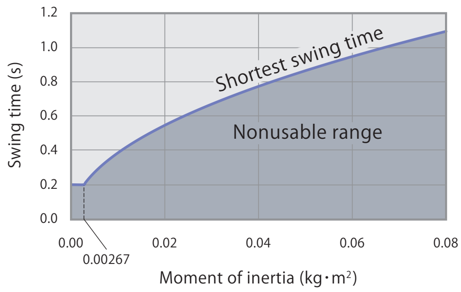
model CTU02

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.0305}}$



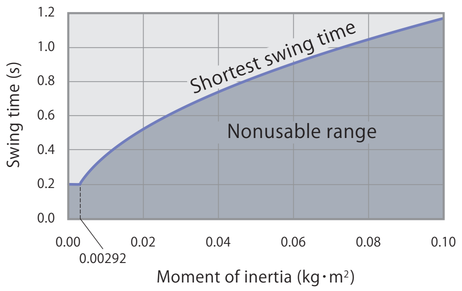
model CTU04

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.0668}}$



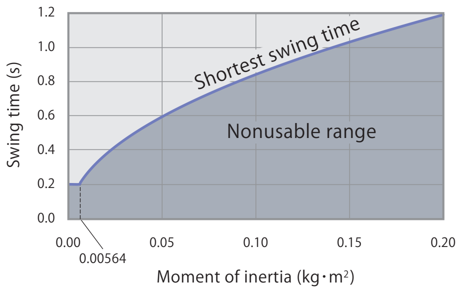
model CTU06

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.0730}}$



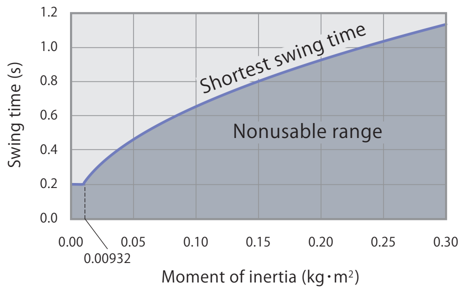
model CTU10

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.141}}$



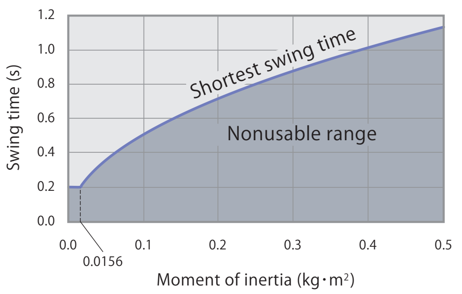
model CTU16

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.233}}$

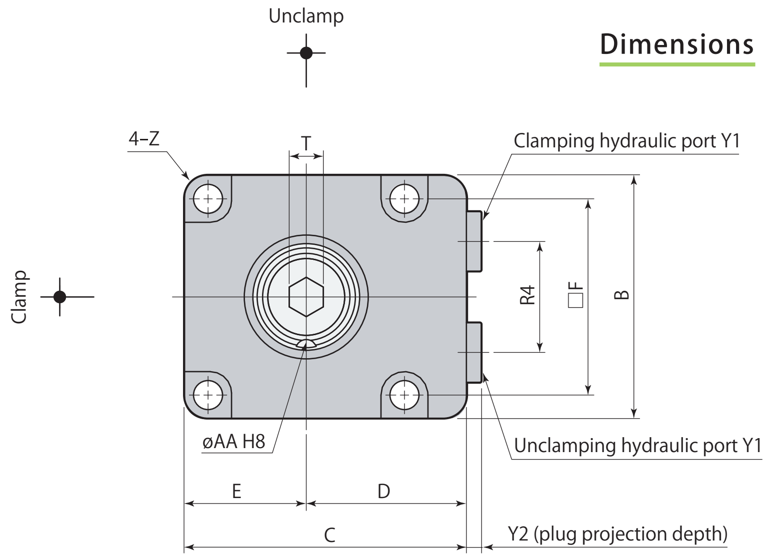


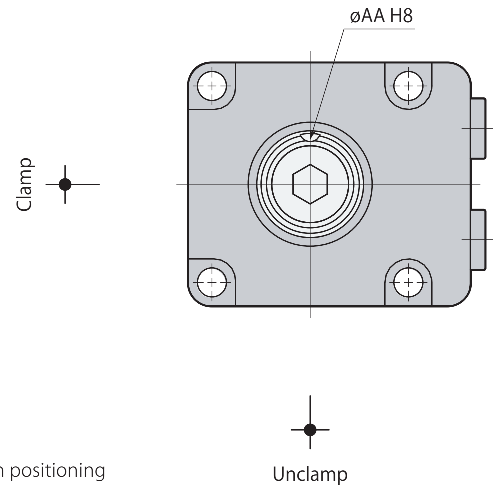
model CTU25

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.389}}$



Dimensions

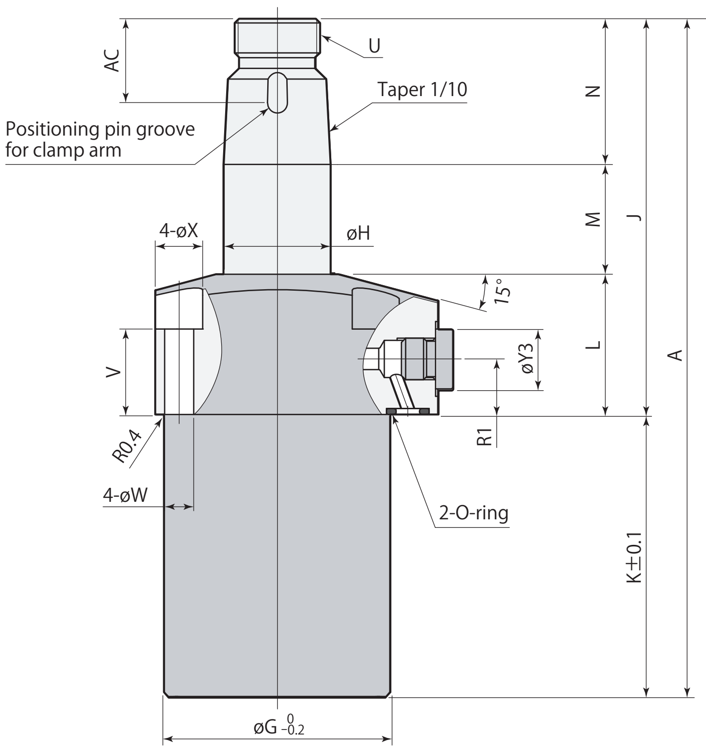


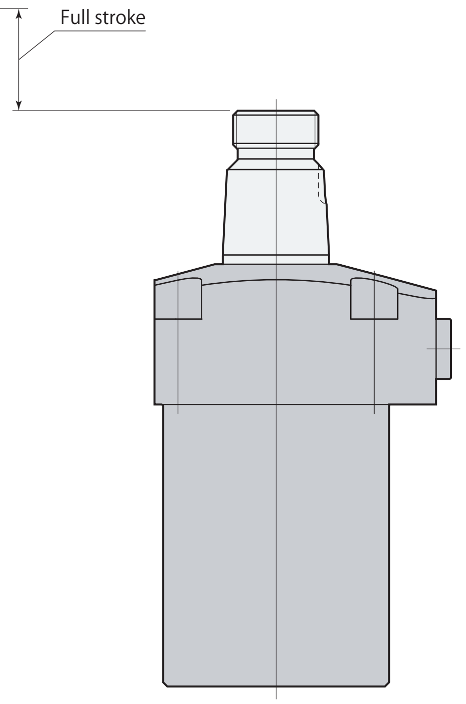


This diagram indicates the arm positioning pin groove at unclamped condition.

Swing direction L (counter-clockwise)

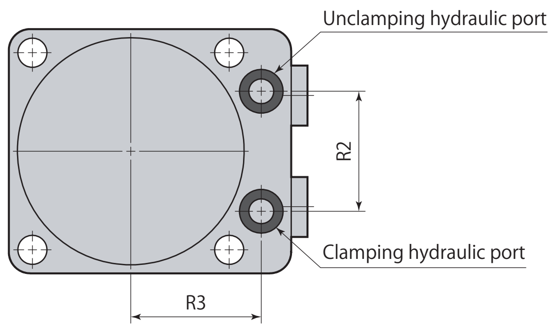
Swing direction R (clockwise)

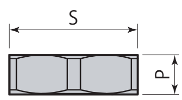




Unclamp

Stroke end





Hex nut for arm mount

- Hex nut for arm mount is included.
- Refer to **page →129** for the details of perfect nut.
- Clamp arm, positioning pin and mounting screws are not included.

mm

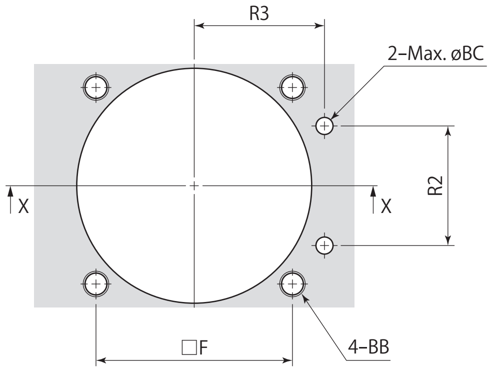
Model		CTU01-□	CTU02-□	CTU04-□	CTU06-□	CTU10-□	CTU16-□	CTU25-□
A		117	131	148.5	158.5	178.5	201.5	244
B		38	45	50	57	70	86	108
C		48	55	60	66	82	96	120
D		29	32.5	35	37.5	47	53	66
E		19	22.5	25	28.5	35	43	54
F		30.5	35	40	46	56	68	88
øG		35	39	47	53	63	78	100
øH		14	18	22.4	25	30	35.5	45
J		68.5	77	87.5	92.5	101.5	117.5	147
K		48.5	54	61	66	77	84	97
L		28.5	29	31	33	36	40.5	51.5
M		17.5	20	22.5	25.5	28.5	30	37.5
N		22.5	28	34	34	37	47	58
P		6.5	8	9	9	10	12	13
R1		12.5	12.5	12.5	12.5	14	14	21
R2		18	22	24	28	36	45	50
R3		22.5	25	28	30.5	36	42	57
R4		16.2	20	22	26	30	38	50
S (nut width across flats)		19	22	27	30	36	46	55
T (hex socket)		5	6	6	8	8	10	14
U		M12×1.5	M14×1.5	M18×1.5	M20×1.5	M24×1.5	M30×1.5	M39×1.5
V		20	19.5	20	20	19.5	20	26
øW		4.3	5.5	5.5	6.8	9	11	14
øX		8	9.5	9.5	11	14	17.5	20
Y1		G1/8	G1/8	G1/8	G1/8	G1/4	G1/4	G3/8
Y2		3.8	3.8	3.8	3.8	4.8	4.8	4.8
øY3		14	14	14	14	19	19	22
Z		R3	R3	R3	R5	R6	R7	R10
øAA (pin groove diameter)		$3^{+0.014}_{0}$	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$
AC		15.5	18.5	19.5	19.5	22.5	24.5	27.5
Positioning pin (dowel pin)		ø3(h8)×8	ø4(h8)×10	ø4(h8)×10	ø5(h8)×10	ø6(h8)×12	ø6(h8)×12	ø6(h8)×14
O-ring (fluorocarbon hardness Hs90)		P7	P7	P7	P7	P8	P8	P10
Taper sleeve		CTH01-TS	CTH02-TS	CTH04-TS	CTH06-TS	CTH10-TS	CTH16-TS	CTH25-TS
Flow control valve*	Meter-in	VCF01	VCF01	VCF01	VCF01	VCF02	VCF02	VCF03
	Meter-out	VCF01-O	VCF01-O	VCF01-O	VCF01-O	VCF02-O	VCF02-O	VCF03-O
Air bleeding valve*		VCE01	VCE01	VCE01	VCE01	VCE02	VCE02	VCE03

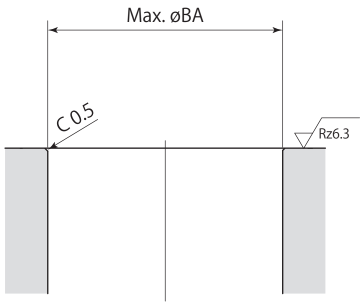
*:Select the right model of VCF and VCE according to the size of the clamp.

Refer to each page for the details of options.

● Taper sleeve **page →113** ● Flow control valve **page →140** ● Air bleeding valve **page →142**

Mounting details





X-X

Rz: ISO4287(1997)

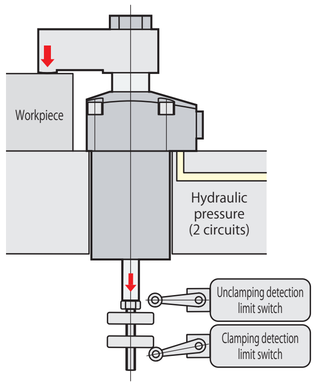
mm

Model	CTU01-□	CTU02-□	CTU04-□	CTU06-□	CTU10-□	CTU16-□	CTU25-□
F	30.5	35	40	46	56	68	88
R2	18	22	24	28	36	45	50
R3	22.5	25	28	30.5	36	42	57
øBA	36	40	48	54	64	79	101
BB	M4	M5	M5	M6	M8	M10	M12
øBC	4	4	4	4	6	6	8

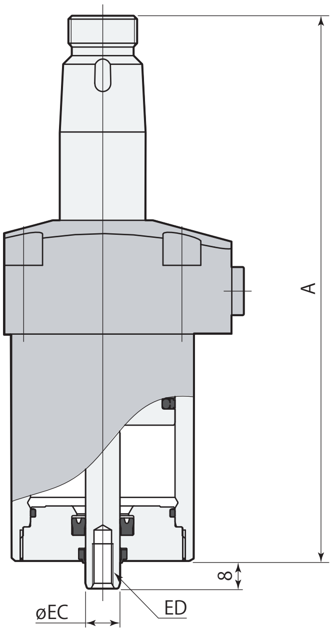
CTU — Size: 01, 02, 04, 06, 10, 16, 25 — Swing direction (when clamping): L : Counter-clockwise / R : Clockwise — E : Dual rod

(grey box) indicates made to order. (Size 25)

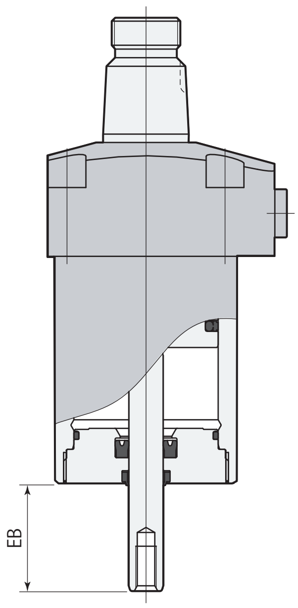
Usage example



Dimensions



Unclamp



Stroke end

- This diagram indicates a swing direction L (L stands for counter-clockwise).
- Refer to specifications (**page →95**), dimensions (**page →98**) for other specifications and dimensions that are not shown in the diagram.

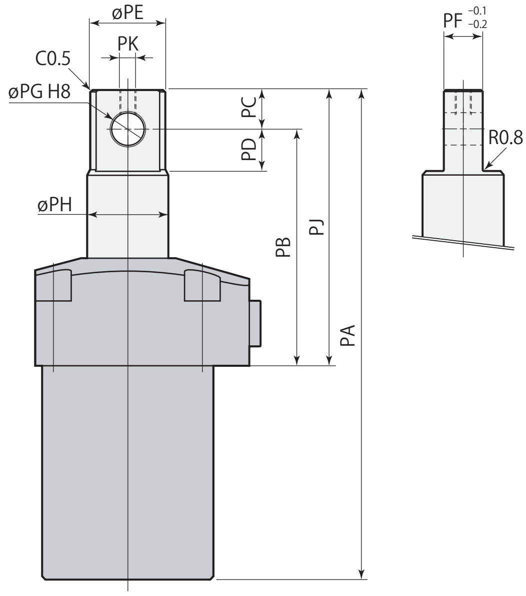
mm

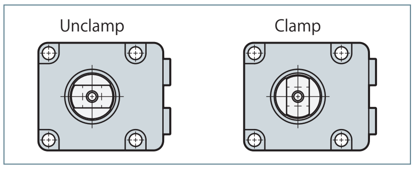
Model	CTU01-□E	CTU02-□E	CTU04-□E	CTU06-□E	CTU10-□E	CTU16-□E	CTU25-□E
Cylinder capacity (unclamp)	7.0 cm^3	11.0 cm^3	19.3 cm^3	30.7 cm^3	53.3 cm^3	91.3 cm^3	182.9 cm^3
A	117	131	148.5	158.5	178.5	201.5	244
EB	24	26	28.5	31.5	34.5	36.5	44
øEC	8	8	10	10	12	12	16
ED	M5×0.8 depth 8	M5×0.8 depth 8	M6×1 depth 11	M6×1 depth 11	M8×1.25 depth 15	M8×1.25 depth 15	M10×1.5 depth 18
Mass	0.7 kg	0.9 kg	1.3 kg	1.7 kg	2.8 kg	4.7 kg	9.9 kg

CTU – Size: 01 / 02 / 04 / 06 / 10 / 16 / 25 – Swing direction (when clamping): **L** : Counter-clockwise, **R** : Clockwise – **P** : Pin rod

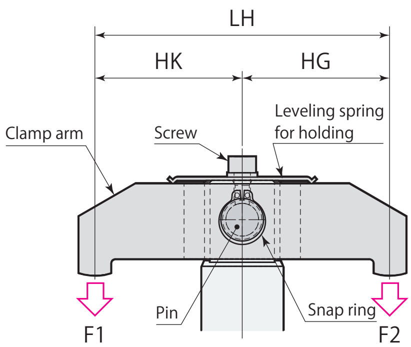
(25: indicates made to order.)

Dimensions





Usage example



Clamping performance

Clamping force calculation formula
$F1 = \frac{HG}{LH} \times n \times P$
$F2 = \frac{HK}{LH} \times n \times P$

F1, F2=Clamping force (kN),
n=Coefficient (refer to right table),
P=Hydraulic pressure (MPa),
HG, HK=Distance from center of piston to clamping point (mm), LH=(mm)

Model	Coefficient *n*
CTU01-□P	0.336
CTU02-□P	0.406
CTU04-□P	0.624
CTU06-□P	0.895
CTU10-□P	1.42
CTU16-□P	2.33
CTU25-□P	3.69

- This diagram indicates unclamped condition. Direction of pin hole will be hydraulic port side at the time of clamping.
- Clamp arm, pin and snap ring are not included. Customers must arrange for them.
- Thread at top portion of the rod is for attaching a leveling spring. Screw and leveling spring are not included.
- Refer to specifications (**page →95**), dimensions (**page →98**) for other specifications and dimensions that are not shown in the diagram.

mm

Model	CTU01-□P	CTU02-□P	CTU04-□P	CTU06-□P	CTU10-□P	CTU16-□P	CTU25-□P
PA	113	121.5	137	151	172	195	236.5
PB	56.5	59.5	66	73	81	92	115.5
PC	8	8	10	12	14	19	24
PD	9	9	11	13	15	20	25
øPE	12	16	20.4	23	28	33.5	43
PF	8	8	10	12	16	18	22
øPG	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$	$8^{+0.022}_{0}$	$10^{+0.022}_{0}$	$12^{+0.027}_{0}$	$16^{+0.027}_{0}$	$20^{+0.033}_{0}$
øPH	14	18	22.4	25	30	35.5	45
PJ	64.5	67.5	76	85	95	111	139.5
PK	M3×0.5	M3×0.5	M4×0.7	M5×0.8	M6×1	M6×1	M8×1.25
Mass	0.6 kg	0.9 kg	1.3 kg	1.8 kg	3.0 kg	4.9 kg	9.5 kg

CTU — Size: 01 / 02 / 04 / 06 / 10 / 16 / 25

Swing direction (when clamping)

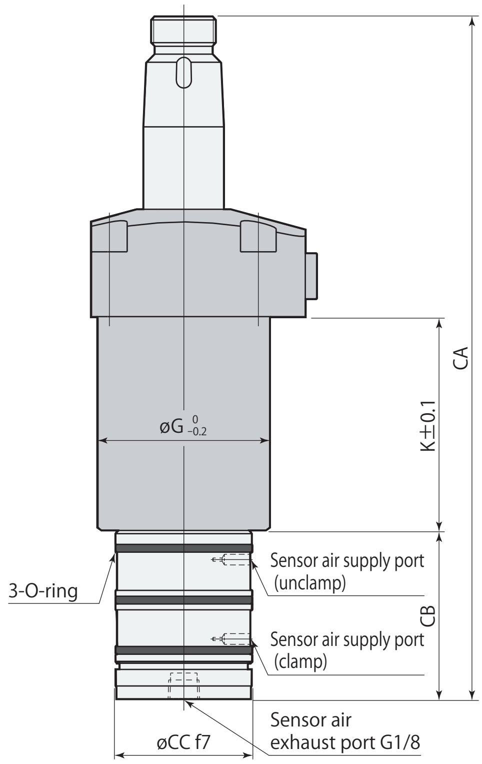
L : Counter-clockwise

R : Clockwise

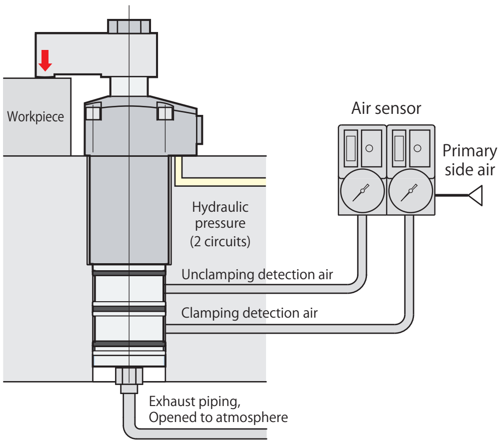
A : Air sensor

▇ indicates made to order.

Dimensions



Usage example

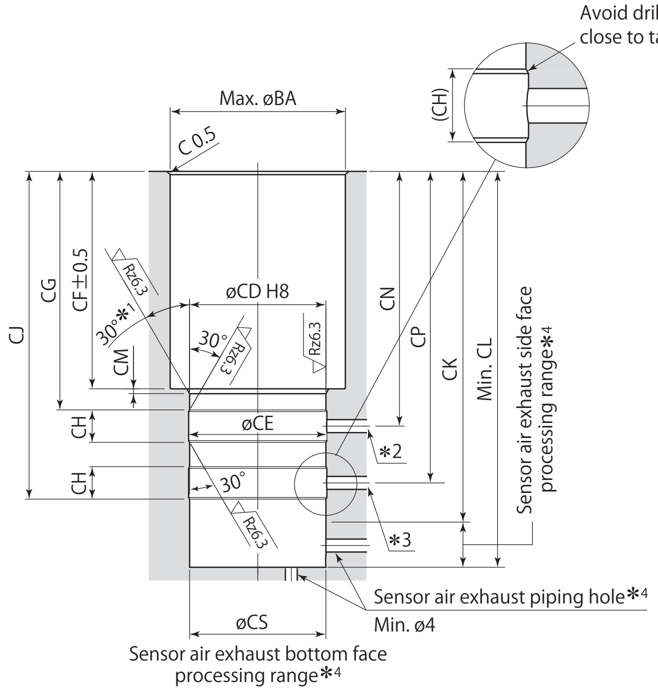


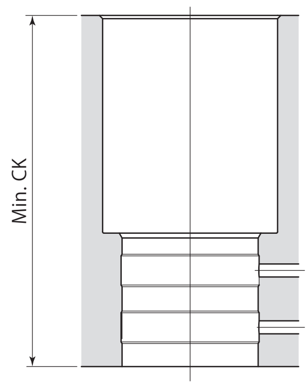
- This diagram indicates unclamped condition of swing direction L (L stands for counter-clockwise). Direction of positioning pin groove will be hydraulic port side at the time of clamping.
- Exhaust port must be opened to atmosphere.
  If sensor is embedded, prepare an exhaust piping hole.
  Furthermore, provide the piping if there is a risk of coolant or metal chips intrusion.
  Use one-touch fittings manufactured by SMC for G port piping. (See SMC catalog for the details of the fitting.)
- Refer to specifications (**page →95**), dimensions (**page →98**) for other specifications and dimensions that are not shown in the diagram.

mm

Model	CTU01-□A	CTU02-□A	CTU04-□A	CTU06-□A	CTU10-□A	CTU16-□A	CTU25-□A
Cylinder capacity (unclamp)	7.0 cm³	11.0 cm³	19.3 cm³	30.7 cm³	53.3 cm³	91.3 cm³	182.9 cm³
CA	159	175	197.5	210.5	233.5	258.5	311.5
CB	42	44	49	52	55	57	67.5
øCC	$33^{-0.025}_{-0.050}$	$38^{-0.025}_{-0.050}$	$42^{-0.025}_{-0.050}$	$42^{-0.025}_{-0.050}$	$45^{-0.025}_{-0.050}$	$45^{-0.025}_{-0.050}$	$52^{-0.030}_{-0.060}$
øG	35	39	47	53	63	78	100
K	48.5	54	61	66	77	84	97
O-ring (fluorocarbon hardness Hs70)	AS568-025	AS568-028	AS568-029	AS568-029	AS568-030	AS568-030	AS568-032
Mass	0.8 kg	1.0 kg	1.6 kg	2.0 kg	3.2 kg	5.2 kg	10.1 kg

Mounting details





In through hole

In blind hole

Rz: ISO4287(1997)

*1：15° only for CTU01-□A , CTU02-□A
*2：Sensor air piping hole (unclamp) ø4 to ø6. ø4 to ø5 only for CTU01-□A.
*3：Sensor air piping hole (clamp) ø4 to ø6. ø4 to ø5 only for CTU01-□A.
*4：Sensor air exhaust piping hole must be made on either side or bottom face.

- 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.

mm

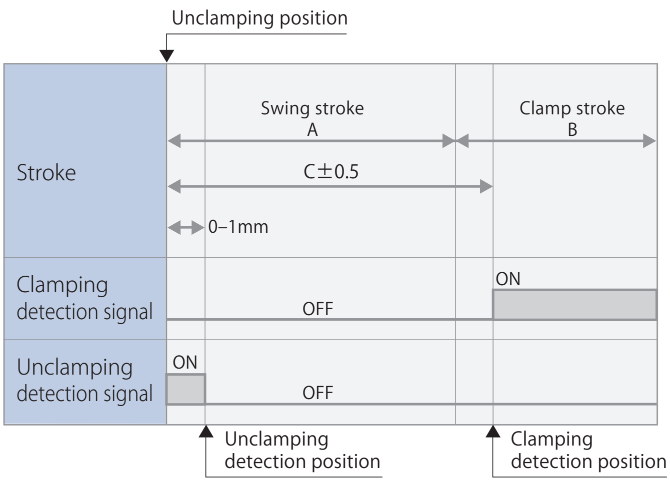
Model	CTU01-□A	CTU02-□A	CTU04-□A	CTU06-□A	CTU10-□A	CTU16-□A	CTU25-□A
øCD	$33^{+0.039}_{0}$	$38^{+0.039}_{0}$	$42^{+0.039}_{0}$	$42^{+0.039}_{0}$	$45^{+0.039}_{0}$	$45^{+0.039}_{0}$	$52^{+0.046}_{0}$
øCE	33.6	38.6	42.6	42.6	45.6	45.6	52.6
CF	49.5	55	62	67	78	85	98
CG	$56^{+0.5}_{0}$	$61.5^{+0.5}_{0}$	68.5^{+1}_{0}	73.5^{+1}_{0}	84.5^{+1}_{0}	91.5^{+1}_{0}	104.5^{+1}_{0}
CH	8	8.5	10	10	10	10	10
CJ	$77^{0}_{-0.5}$	$84.5^{0}_{-0.5}$	95.5^{0}_{-1}	101^{0}_{-1}	116.5^{0}_{-1}	123.5^{0}_{-1}	144.5^{0}_{-1}
CK	84	91.5	101.5	106.5	123.5	130.5	156
CL	94.5	102	114	122	136	145	168.5
CM	1	1	1.5	1.5	1.5	1.5	1.5
CN	60	66	73.5	78.5	89.5	96.5	109.5
CP	73	80	90.5	96	111.5	118.5	139.5
øCS	33	38	42	42	45	45	52
øBA	36	40	48	54	64	79	101

Air sensor unit

Supplier and model	ISA3-G series manufactured by SMC
	GPS2-05 series manufactured by CKD
Air supply pressure	0.2 MPa
Inner diameter of piping	ø4 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 usage shown on the left. Contact Technical service center for more details.
- 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.
- Maximum 6 pieces of clamp can be detected at 0.2MPa air pressure by means of 1 piece of sensor. In case of 0.1MPa air pressure, maximum 3 pieces of clamp are detectable.

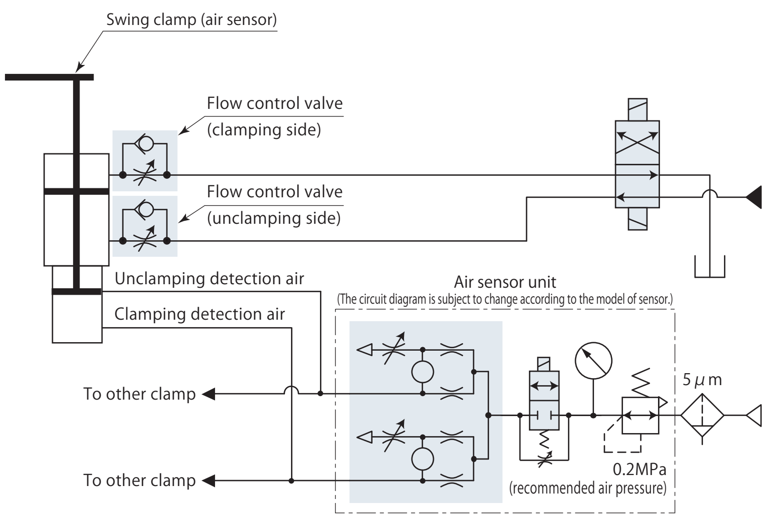
Air sensor triggering point



mm

Model	Swing stroke A	Clamp stroke B	Clamping detection position C
CTU01-□A	8	8	9
CTU02-□A	10	8	11
CTU04-□A	12.5	8	13.5
CTU06-□A	13.5	10	14.5
CTU10-□A	16.5	10	17.5
CTU16-□A	18.5	10	19.5
CTU25-□A	23	13	24

Hydraulic and pneumatic circuit diagram



CTU□-□N□ | Swing clamp Swing angle 30°, 45°, 60° | 7MPa Double acting

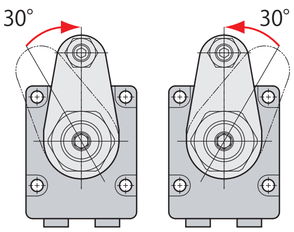
CTU – Size / Swing direction (when clamping)

Size		Swing direction (when clamping)	
01			
02		L : Counter-clockwise	N30 : Swing angle 30°
04			
06			N45 : Swing angle 45°
10		R : Clockwise	N60 : Swing angle 60°
16			
25			

Swing angle

CTU□-□N30

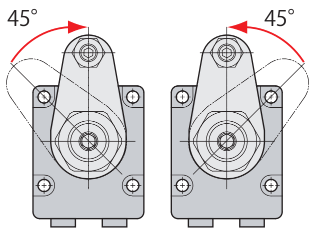
Swing angle 30°



R:Clockwise L:Counter-clockwise

CTU□-□N45

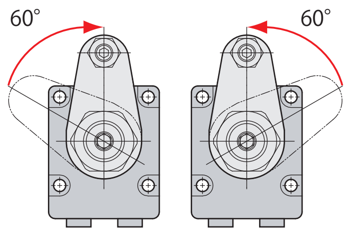
Swing angle 45°



R:Clockwise L:Counter-clockwise

CTU□-□N60

Swing angle 60°



R:Clockwise L:Counter-clockwise

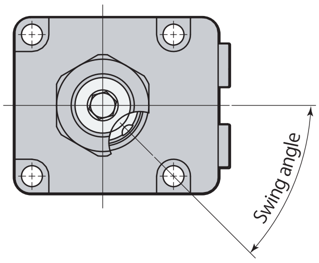
Specifications

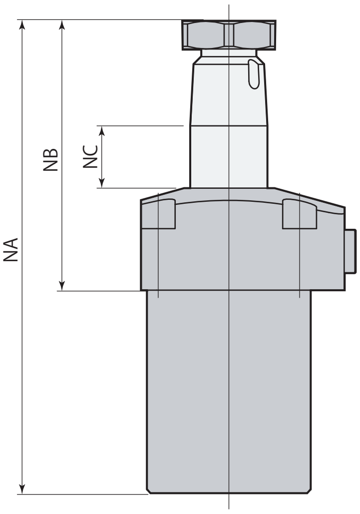
Model			CTU01-□N□			CTU02-□N□			CTU04-□N□			CTU06-□N□		
Swing angle			30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°
Full stroke		mm	11.8	12.7	13.7	13.0	14.3	15.5	14.3	15.8	17.4	16.8	18.4	20.1
Swing stroke		mm	3.8	4.7	5.7	5.0	6.3	7.5	6.3	7.8	9.4	6.8	8.4	10.1
Clamp stroke		mm	8			8			8			10		
Cylinder capacity	Clamp	cm^3	4.0	4.3	4.6	5.3	5.8	6.3	8.9	9.9	10.8	15.0	16.5	18.0
	Unclamp	cm^3	5.8	6.2	6.7	8.6	9.4	10.2	14.5	16.1	17.7	23.3	25.5	27.9

Model			CTU10-□N□			CTU16-□N□			CTU25-□N□		
Swing angle			30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°
Full stroke		mm	18.3	20.3	22.4	19.3	21.6	23.9	24.5	27.4	30.3
Swing stroke		mm	8.3	10.3	12.4	9.3	11.6	13.9	11.5	14.4	17.3
Clamp stroke		mm	10			10			13		
Cylinder capacity	Clamp	cm^3	25.9	28.8	31.7	44.8	50.2	55.6	90.4	101.0	111.6
	Unclamp	cm^3	38.8	43.1	47.5	63.9	71.5	79.2	129.4	144.6	159.8

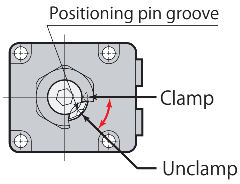
● Refer to **page →95** for the specifications of products that are not listed on this page.

Dimensions

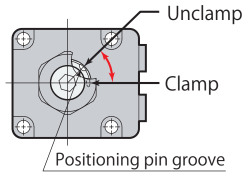




Swing direction L
(counter-clockwise)



Swing direction R
(clockwise)



- This diagram indicates unclamped condition of swing direction L (L stands for counter-clockwise).
  Direction of positioning pin groove will be hydraulic port side at the time of clamping.
- Refer to **page →98** for the dimensions of products that are not listed on this page.

mm

Model	CTU01-□N□			CTU02-□N□			CTU04-□N□			CTU06-□N□		
Swing angle	30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°
NA	112.8	113.7	114.7	126.0	127.3	128.5	142.3	143.8	145.4	151.8	153.4	155.1
NB	64.3	65.2	66.2	72.0	73.3	74.5	81.3	82.8	84.4	85.8	87.4	89.1
NC	13.3	14.2	15.2	15.0	16.3	17.5	16.3	17.8	19.4	18.8	20.4	22.1

mm

Model	CTU10-□N□			CTU16-□N□			CTU25-□N□		
Swing angle	30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°
NA	170.3	172.3	174.4	192.3	194.6	196.9	232.5	235.4	238.3
NB	93.3	95.3	97.4	108.3	110.6	112.9	135.5	138.4	141.3
NC	20.3	22.3	24.4	20.8	23.1	25.4	26.0	28.9	31.8

	Size		Swing direction (when clamping)	Clamp stroke
CTU	01, 02, 04, 06, 10, 16, 25	–	L : Counter-clockwise R : Clockwise	S16 : 16mm S20 : 20mm S25 : 25mm S30 : 30mm S50 : 50mm

▇ indicates made to order. (25)

Size, stroke and shape of flange

CTU size	01	02	04	06	10	16	25	Shape of flange
Clamp stroke mm	16			20			30	Standard **page →110**
	–		25	30	30 50		–	Round **page →111**

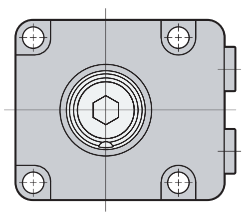
Specifications

Model			CTU01-□S16	CTU02-□S16	CTU04-□S16	CTU06-□S20	CTU10-□S20	CTU16-□S20	CTU25-□S30
Full stroke		mm	24	26	28.5	33.5	36.5	38.5	53
Clamp stroke		mm	16	16	16	20	20	20	30
Cylinder capacity	Clamp	cm^3	8.1	10.6	17.8	30.0	51.7	89.6	195.6
	Unclamp	cm^3	11.8	17.2	29.0	46.4	77.5	127.8	279.9
Mass		kg	0.8	1.1	1.6	2.1	3.4	5.5	11.7

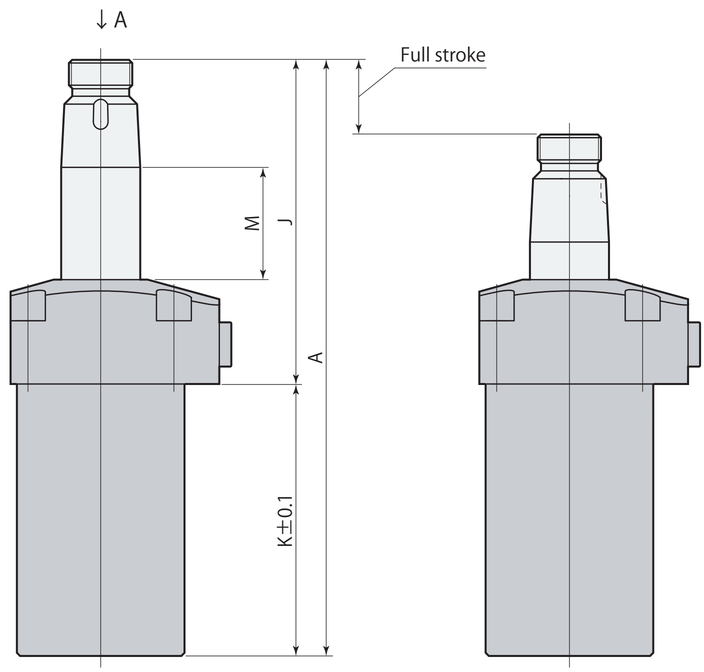
● Refer to standard (**page →95**) for the specifications of products that are not listed on this page.

Dimensions

Arrow A view



Standard



Unclamp

Stroke end

● Flange size is same as standard stroke model.
Refer to section for standard stroke model (**page →98**) for the dimensions of products that are not listed on this page.

mm

Model	CTU01-□S16	CTU02-□S16	CTU04-□S16	CTU06-□S20	CTU10-□S20	CTU16-□S20	CTU25-□S30
A	141	155	172.5	188.5	208.5	231.5	295
J	76.5	85	95.5	102.5	111.5	127.5	164
K	64.5	70	77	86	97	104	131
M	25.5	28	30.5	35.5	38.5	40	54.5

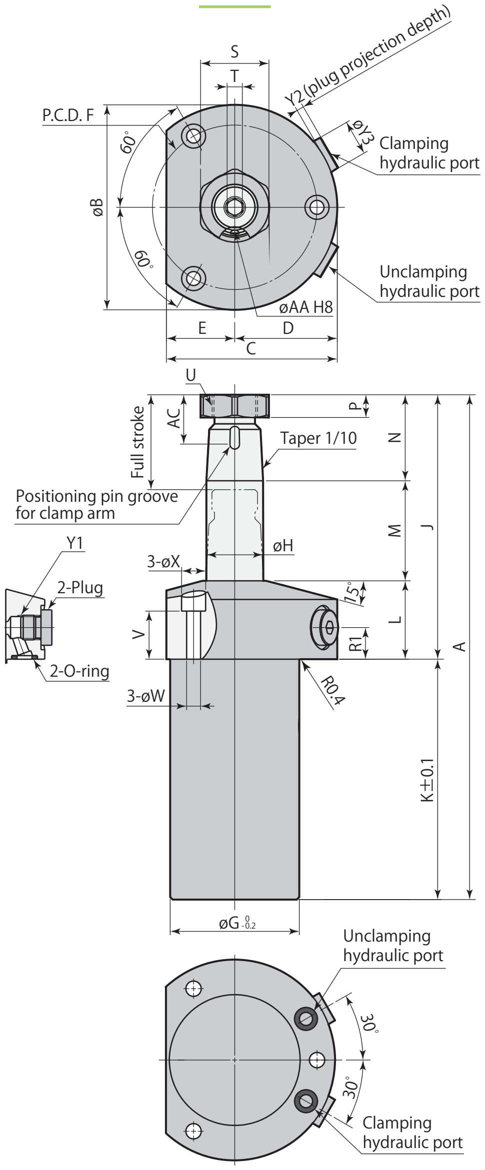
Specifications

Model			CTU04-□S25	CTU06-□S30	CTU10-□S30	CTU10-□S50	CTU16-□S30	CTU16-□S50
Full stroke		mm	37.5	43.5	46.5	66.5	48.5	68.5
Clamp stroke		mm	25	30	30	50	30	50
Cylinder capacity	Clamp	cm^3	23.4	38.9	65.9	94.2	112.9	159.5
	Unclamp	cm^3	38.2	60.3	98.8	141.2	160.9	227.3
Mass		kg	2.3	3.1	5.0	6.0	7.5	8.7

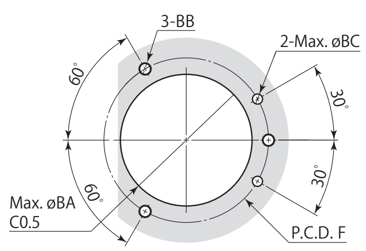
● Refer to standard (**page →95**) for the specifications of products that are not listed on this page.

Dimensions

Round



Mounting details



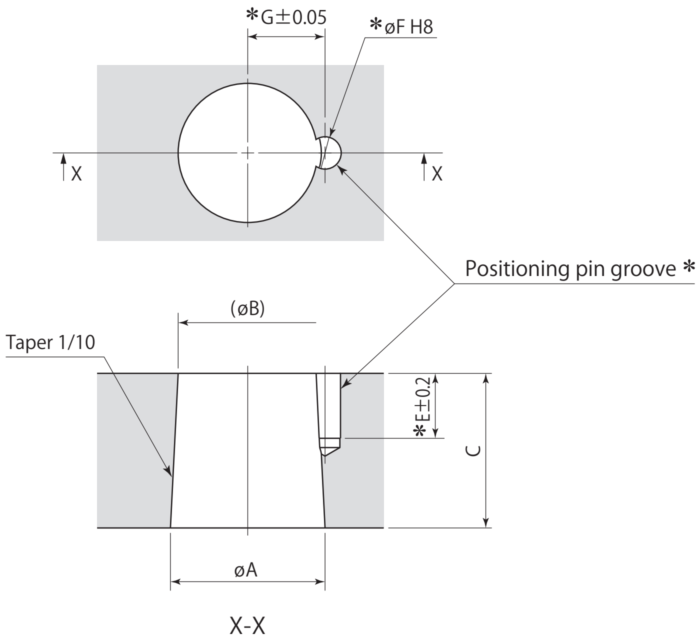
mm

Model	CTU04-□S25	CTU06-□S30	CTU10-□S30	CTU10-□S50	CTU16-□S30	CTU16-□S50
A	199.5	218.5	238.5	298.5	261.5	321.5
øB	81	89	112	112	125	125
C	67.5	75	92.5	92.5	105.5	105.5
D	40.5	44.5	56	56	62.5	62.5
E	27	30.5	36.5	36.5	43	43
F	65	73	88	88	101	101
øG	51	58	70	70	83	83
øH	22.4	25	30	30	35.5	35.5
J	104.5	112.5	121.5	141.5	137.5	157.5
K	95	106	117	157	124	164
L	31	33	36	36	40.5	40.5
M	39.5	45.5	48.5	68.5	50	70
N	34	34	37	37	47	47
P (nut thickness)	9	9	10	10	12	12
R1	12.5	12.5	14	14	14	14
S (nut width across flats)	27	30	36	36	46	46
T (hex socket)	6	8	8	8	10	10
U	M18×1.5	M20×1.5	M24×1.5	M24×1.5	M30×1.5	M30×1.5
V	19	19.5	19	19	20	20
øW	5.5	6.8	9	9	11	11
øX	9.5	11	14	14	17.5	17.5
Y1	G1/8	G1/8	G1/4	G1/4	G1/4	G1/4
Y2	2.8	2.8	3.8	3.8	3.8	3.8
øY3	14	14	19	19	19	19
O-ring*	P7	P7	P8	P8	P8	P8
øAA (pin groove diameter)	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$
AC	19.5	19.5	22.5	22.5	24.5	24.5
øBA	52	59	71	71	84	84
BB	M5	M6	M8	M8	M10	M10
øBC	4	4	6	6	6	6
Positioning pin (dowel pin)	ø4(h8)×10	ø5(h8)×10	ø6(h8)×12	ø6(h8)×12	ø6(h8)×12	ø6(h8)×12

*: Fluorocarbon hardness Hs90 ● This diagram indicates unclamped condition of swing direction L (L stands for counter-clockwise).

Clamp arm mounting details

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



*: No need to machine the pin groove (E, øF, G) unless positioning pin is used for the arm.
The positioning pin enables a clamp arm to locate on the clamp firmly and easily.

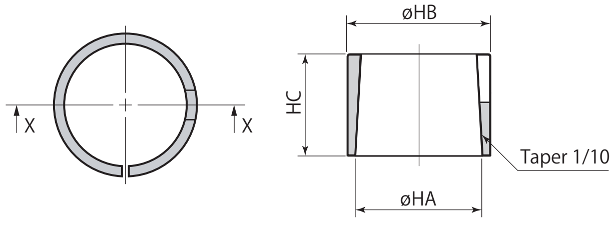
mm

Swing clamp	CTU01	CTU02	CTU04	CTU06	CTU10	CTU16	CTU25
øA	$14^{-0.016}_{-0.034}$	$18^{-0.016}_{-0.034}$	$22.4^{-0.020}_{-0.041}$	$25^{-0.020}_{-0.041}$	$30^{-0.020}_{-0.041}$	$35.5^{-0.025}_{-0.050}$	$45^{-0.025}_{-0.050}$
øB	12.4	16	19.9	22.5	27.3	32	40.5
C	16	20	25	25	27	35	45
E	9	10.5	10.5	10.5	12.5	12.5	14.5
øF (pin groove diameter)	$3^{+0.014}_{0}$	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$
G	7.55	9.1	11.1	12.6	15.1	18.1	22.6

Taper sleeve

Size

CTH [01 / 02 / 04 / 06 / 10 / 16 / 25] – TS : Taper sleeve



X-X

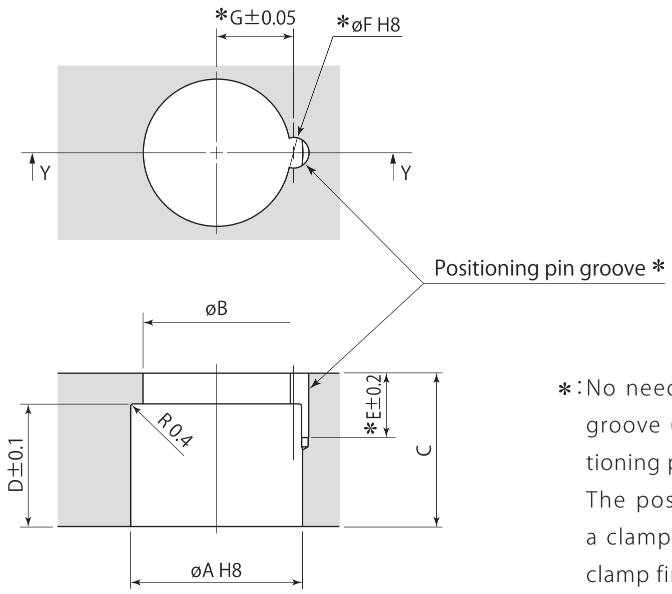
mm

Taper sleeve	CTH01-TS	CTH02-TS	CTH04-TS	CTH06-TS	CTH10-TS	CTH16-TS	CTH25-TS
Applicable swing clamp	CTU01	CTU02	CTU04	CTU06	CTU10	CTU16	CTU25
øHA	14	18	22.4	25	30	35.5	45
øHB	16	20	25	28	34	40	49
HC	13	16	21	20	22	29	38

Clamp arm mounting details

(Using taper sleeve)

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



Y-Y

*: No need to machine the pin groove (E, øF, G) unless positioning pin is used for the arm. The positioning pin enables a clamp arm to locate on the clamp firmly and easily.

mm

Taper sleeve	CTH01-TS	CTH02-TS	CTH04-TS	CTH06-TS	CTH10-TS	CTH16-TS	CTH25-TS
Applicable swing clamp	CTU01	CTU02	CTU04	CTU06	CTU10	CTU16	CTU25
øA	16 $^{+0.027}_{0}$	20 $^{+0.033}_{0}$	25 $^{+0.033}_{0}$	28 $^{+0.033}_{0}$	34 $^{+0.039}_{0}$	40 $^{+0.039}_{0}$	49 $^{+0.039}_{0}$
øB	13	17	21	24	28.5	34	42
C	16	20	25	25	27	35	45
D	13	16	21	20	22	29	38
E	9	10.5	10.5	10.5	12.5	12.5	14.5
øF (pin groove diameter)	3 $^{+0.014}_{0}$	4 $^{+0.018}_{0}$	4 $^{+0.018}_{0}$	5 $^{+0.018}_{0}$	6 $^{+0.018}_{0}$	6 $^{+0.018}_{0}$	6 $^{+0.018}_{0}$
G	7.55	9.1	11.1	12.6	15.1	18.1	22.6

Table of contents

Swing clamp

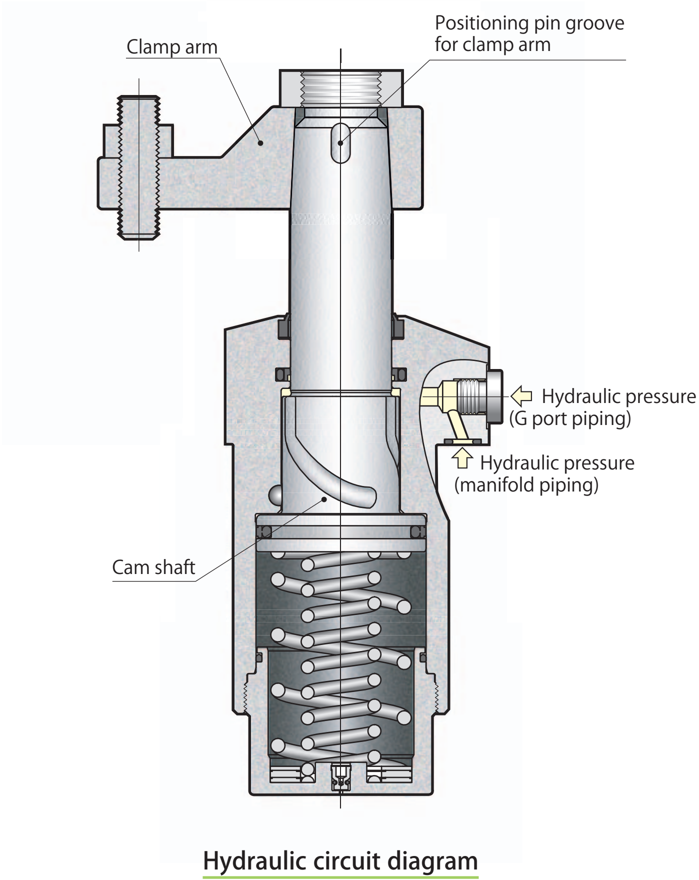
Single acting 7 MPa

model CTT

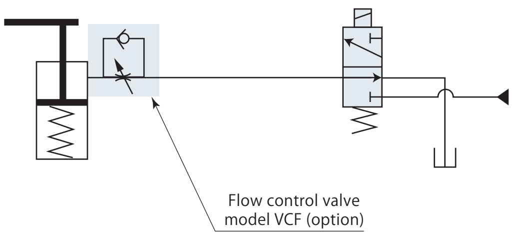
Single acting Swing clamp
model CTT06-L

Standard model

model **CTT□-□**



Hydraulic circuit diagram



Use flow control valve for meter-in control.

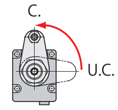
Specifications page → 117
Standard page → 120
Pin rod page → 123
Swing angle 30°, 45°, 60° page → 124

Specifications

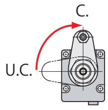
CTT – Size: 01, 02, 04, 06, 10, 16, 25

Swing direction (when clamping)

L : Counter-clockwise



R : Clockwise



Variation code*

(Nil) : Standard

P : Pin rod

N□ : Swing angle 30°, 45°, 60°

▇ indicates made to order.

∗:Contact Pascal for the details of variation codes (models) that are not described in the catalog.

Model			CTT01	CTT02	CTT04	CTT06	CTT10	CTT16	CTT25
Cylinder force (hydraulic pressure 7MPa)*1		kN	2.0	2.4	3.4	5.1	8.1	13.3	20.5
Cylinder inner diameter		mm	25	29	36	42	52	65	82
Rod diameter		mm	14	18	22.4	25	30	35.5	45
Effective area (clamp)		cm^2	3.4	4.1	6.2	8.9	14.2	23.3	36.9
Swing angle			90°±3°						
Positioning pin groove position accuracy			±1°						
Repeated clamp positioning accuracy			±0.5°						
Full stroke		mm	16	18	20.5	23.5	26.5	28.5	36
90°swing stroke		mm	8	10	12.5	13.5	16.5	18.5	23
Clamp stroke		mm	8	8	8	10	10	10	13
Max. swing torque*2		N·m	0.15	0.2	0.6	1.0	1.8	3.6	5.4
Cylinder capacity (clamp)		cm^3	5.4	7.3	12.8	21.0	37.5	66.4	132.9
Return spring force	Unclamp	kN	0.23	0.29	0.50	0.74	1.13	1.79	2.92
	Clamp stroke central position	kN	0.37	0.47	0.94	1.12	1.79	2.99	5.32
	Clamp end	kN	0.42	0.52	1.05	1.22	1.94	3.25	5.85
Recommended piping inner diameter*3		mm	ø6	ø6	ø6	ø6	ø8	ø8	ø10
Mass		kg	0.7	1.0	1.5	2.0	3.3	5.5	10.4
Recommended tightening torque of mounting screws*4		N·m	3.5	7	7	12	29	57	77
Recommended tightening torque of nut		N·m	12	26	51	60	86	120	180

- Pressure range:2.5–7 MPa
- 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:This is value for central position of clamp stroke.

∗2:This is the limit value for lifting arm with spring force (unclamp) when mounted vertically.

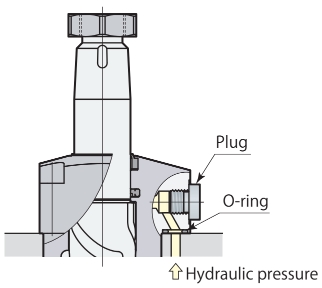
∗3:Care must be taken when numerous clamps are used or when hydraulic piping is long.

∗4:ISO R898 class 12.9

Manifold piping and G port piping are available.

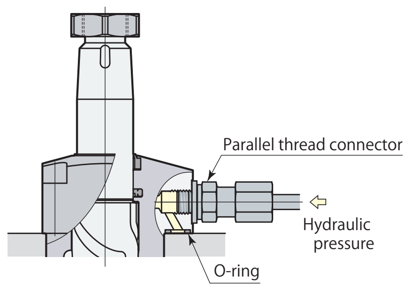
Manifold piping

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 plug when choosing G port piping. (O-ring must be used.) Refer to **page →372** 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.



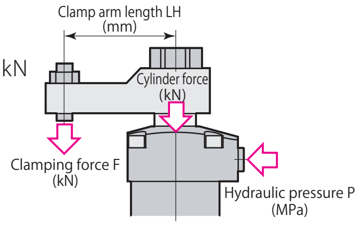
Performance table

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

Clamping force calculation formula
F = (P - Coefficient 1)/(Coefficient 2 + Coefficient 3 × LH)
F : Clamping force P : Hydraulic pressure LH : Clamp arm length

CTT06 with clamp arm length (LH) = 60 mm
at hydraulic pressure of 7 MPa,
Clamping force F is calculated by
(7-1.25)/(1.12+0.00422×60)=4.2 kN

Do not use the clamp in the nonusable range.
It may cause damage to the cylinder and rod.



model CTT01 Clamping force F=(P-1.10)/(2.97+0.0153×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN, Clamp arm length LH mm								Max. arm length Max. LH mm
		30	35	40	50	60	80	100	120	
7	2.0	1.7	1.7	1.6	Nonusable range					49
6.5	1.8	1.6	1.5	1.5	1.4					55
6	1.6	1.4	1.4	1.4	1.3	1.3				62
5.5	1.5	1.3	1.3	1.2	1.2	1.1				73
5	1.3	1.1	1.1	1.1	1.0	1.0	0.9			87
4.5	1.1	1.0	1.0	0.9	0.9	0.9	0.8	0.8		107
4	1.0	0.8	0.8	0.8	0.8	0.7	0.7	0.6	0.6	139
3.5	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.5	0.5	↑
3	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.4	0.4	↑
2.5	0.5	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	139

model CTT02 Clamping force F=(P-1.16)/(2.46+0.0116×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN, Clamp arm length LH mm								Max. arm length Max. LH mm
		35	40	50	60	80	100	120	140	
7	2.4	2.0	2.0	1.9	1.9	Nonusable range				78
6.5	2.2	1.9	1.8	1.8	1.7	1.6				89
6	2.0	1.7	1.7	1.6	1.5	1.4	1.3			104
5.5	1.8	1.5	1.5	1.4	1.4	1.3	1.2	1.1		123
5	1.6	1.3	1.3	1.3	1.2	1.1	1.1	1.0	0.9	152
4.5	1.4	1.2	1.1	1.1	1.1	1.0	0.9	0.9	0.8	↑
4	1.2	1.0	1.0	0.9	0.9	0.8	0.8	0.7	0.7	↑
3.5	1.0	0.8	0.8	0.8	0.7	0.7	0.6	0.6	0.6	↑
3	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	↑
2.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	152

model CTT04 Clamping force F=(P-1.51)/(1.60+0.00664×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN, Clamp arm length LH mm								Max. arm length Max. LH mm
		40	50	60	80	100	120	140	160	
7	3.4	2.9	2.8	2.7	2.6	2.4	Nonusable range			116
6.5	3.1	2.7	2.6	2.5	2.3	2.2	2.1			135
6	2.8	2.4	2.3	2.2	2.1	2.0	1.9	1.8	1.7	161
5.5	2.5	2.1	2.1	2.0	1.9	1.8	1.7	1.6	1.5	199
5	2.2	1.9	1.8	1.7	1.6	1.5	1.5	1.4	1.3	↑
4.5	1.9	1.6	1.5	1.5	1.4	1.3	1.2	1.2	1.1	↑
4	1.6	1.3	1.3	1.2	1.2	1.1	1.0	1.0	0.9	↑
3.5	1.2	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.7	↑
3	0.9	0.8	0.8	0.7	0.7	0.7	0.6	0.6	0.6	↑
2.5	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	199

model CTT06 Clamping force F=(P-1.25)/(1.12+0.00422×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN, Clamp arm length LH mm								Max. arm length Max. LH mm
		50	60	80	100	120	140	160	180	
7	5.1	4.3	4.2	3.9	3.7	Nonusable range				111
6.5	4.7	3.9	3.8	3.6	3.4	3.2				127
6	4.2	3.6	3.5	3.3	3.1	2.9	2.8			149
5.5	3.8	3.2	3.1	2.9	2.8	2.6	2.5	2.4	2.3	180
5	3.3	2.8	2.7	2.6	2.4	2.3	2.2	2.1	2.0	226
4.5	2.9	2.4	2.4	2.2	2.1	2.0	1.9	1.8	1.7	↑
4	2.5	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.5	↑
3.5	2.0	1.7	1.6	1.5	1.5	1.4	1.3	1.3	1.2	↑
3	1.6	1.3	1.3	1.2	1.1	1.1	1.0	1.0	0.9	↑
2.5	1.1	0.9	0.9	0.9	0.8	0.8	0.7	0.7	0.7	226

model CTT10 Clamping force F=(P-1.26)/(0.706+0.00228×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN, Clamp arm length LH mm								Max. arm length Max. LH mm
		60	80	100	120	140	160	180	200	
7	8.1	6.8	6.5	6.1	5.9	Nonusable range				135
6.5	7.4	6.2	5.9	5.6	5.3	5.1				155
6	6.7	5.6	5.3	5.1	4.8	4.6	4.4	4.2		182
5.5	6.0	5.0	4.8	4.5	4.3	4.1	4.0	3.8	3.6	221
5	5.3	4.4	4.2	4.0	3.8	3.6	3.5	3.4	3.2	↑
4.5	4.6	3.8	3.6	3.5	3.3	3.2	3.0	2.9	2.8	↑
4	3.9	3.3	3.1	2.9	2.8	2.7	2.6	2.5	2.4	↑
3.5	3.2	2.7	2.5	2.4	2.3	2.2	2.1	2.0	1.9	↑
3	2.5	2.1	2.0	1.9	1.8	1.7	1.6	1.6	1.5	↑
2.5	1.8	1.5	1.4	1.3	1.3	1.2	1.2	1.1	1.1	221

model CTT16 Clamping force F=(P-1.28)/(0.429+0.00128×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN, Clamp arm length LH mm								Max. arm length Max. LH mm
		70	80	100	120	140	160	180	200	
7	13.3	11.0	10.8	10.3	9.8	Nonusable range				132
6.5	12.2	10.1	9.8	9.4	9.0	8.6				151
6	11.0	9.1	8.9	8.5	8.1	7.8	7.4			176
5.5	9.8	8.1	7.9	7.6	7.2	6.9	6.7	6.4	6.2	212
5	8.7	7.2	7.0	6.7	6.4	6.1	5.9	5.6	5.4	264
4.5	7.5	6.2	6.1	5.8	5.5	5.3	5.1	4.9	4.7	↑
4	6.3	5.2	5.1	4.9	4.7	4.5	4.3	4.1	4.0	↑
3.5	5.2	4.3	4.2	4.0	3.8	3.7	3.5	3.4	3.2	↑
3	4.0	3.3	3.2	3.1	3.0	2.8	2.7	2.6	2.5	↑
2.5	2.8	2.4	2.3	2.2	2.1	2.0	1.9	1.9	1.8	264

model CTT25 Clamping force F=(P-1.44)/(0.271+0.000658×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN, Clamp arm length LH mm								Max. arm length Max. LH mm
		90	100	120	140	160	180	200	240	
7	20.5	16.8	16.5	15.9	15.3	14.8	14.3	Nonusable range		180
6.5	18.7	15.3	15.0	14.5	13.9	13.4	13.0	12.6		208
6	16.8	13.8	13.5	13.0	12.6	12.1	11.7	11.3	10.6	246
5.5	15.0	12.3	12.1	11.6	11.2	10.8	10.4	10.1	9.5	300
5	13.1	10.8	10.6	10.2	9.8	9.5	9.1	8.8	8.3	↑
4.5	11.3	9.3	9.1	8.7	8.4	8.1	7.9	7.6	7.1	↑
4	9.4	7.8	7.6	7.3	7.1	6.8	6.6	6.4	6.0	↑
3.5	7.6	6.2	6.1	5.9	5.7	5.5	5.3	5.1	4.8	↑
3	5.8	4.7	4.6	4.5	4.3	4.1	4.0	3.9	3.6	↑
2.5	3.9	3.2	3.1	3.0	2.9	2.8	2.7	2.6	2.5	300

● See the formula shown on **page →123** for clamping force calculation when pin rod type (CTT□-□P) is selected.

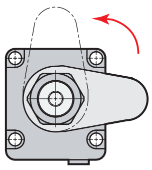
Swing speed adjustment

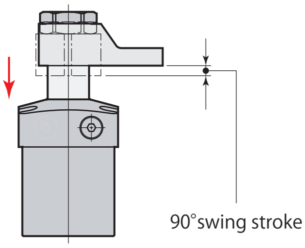
Swing time is restricted by the mass and length of the clamp arm (moment of inertia) since the 90° swing action impacts the cam shaft.

1.Calculate the moment of inertia according to the arm length and mass.

2.Adjust swing speed with flow control valve to ensure that 90° swing time of the clamp arm is greater than the shortest swing time in the graph shown below.

● The cam groove may be damaged in case the swing speed is set at the nonusable range in the graph.

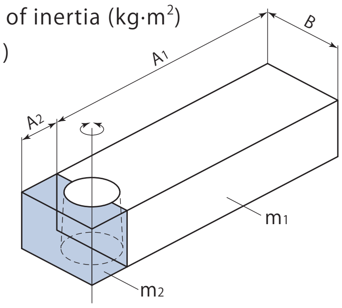




Example of calculation for moment of inertia

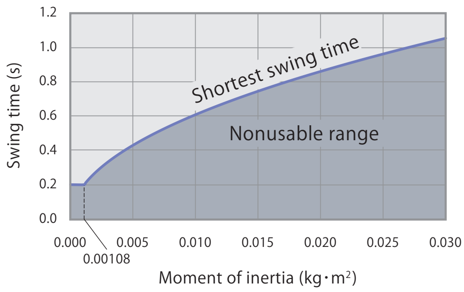
$$I=\frac{1}{12}m_1(4A_1^2+B^2)+\frac{1}{12}m_2(4A_2^2+B^2)$$

I : Moment of inertia (kg·m²)
m: Mass (kg)



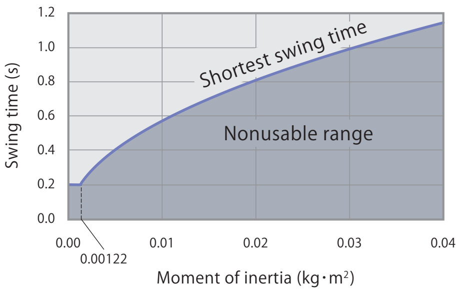
model CTT01

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.0270}}$



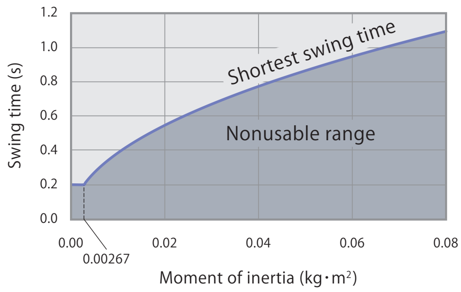
model CTT02

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.0305}}$



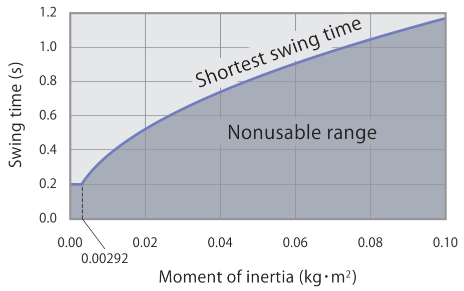
model CTT04

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.0668}}$



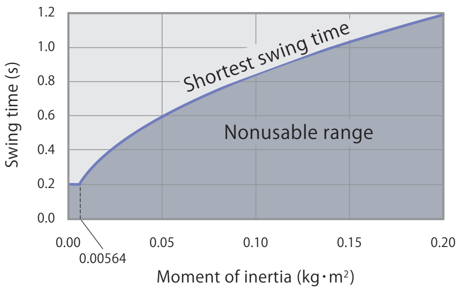
model CTT06

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.0730}}$



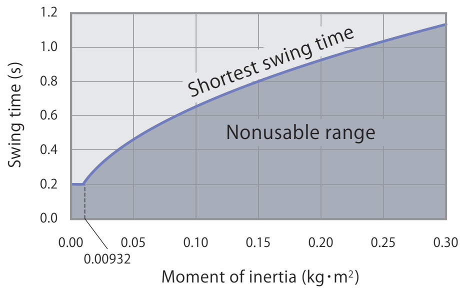
model CTT10

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.141}}$



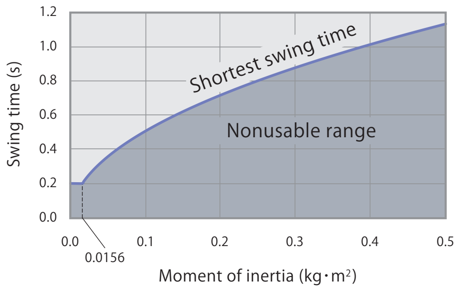
model CTT16

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.233}}$

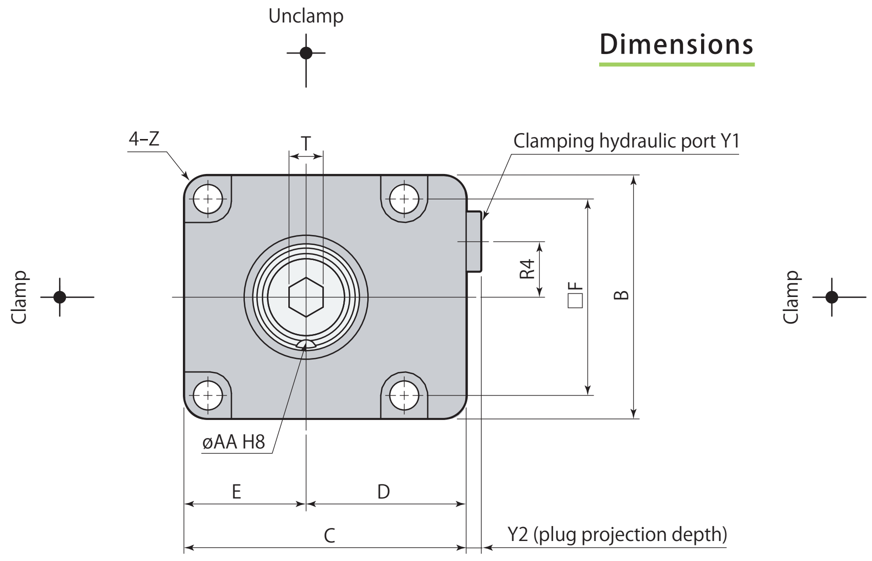


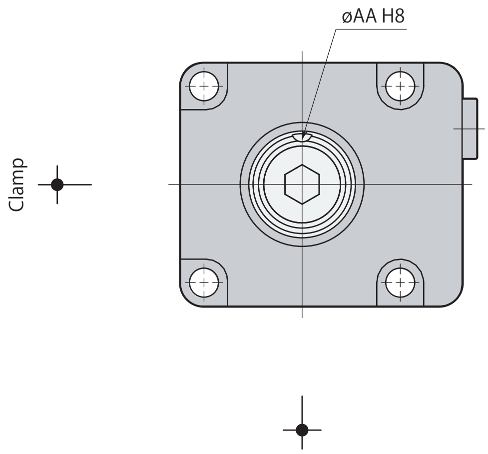
model CTT25

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.389}}$



Dimensions

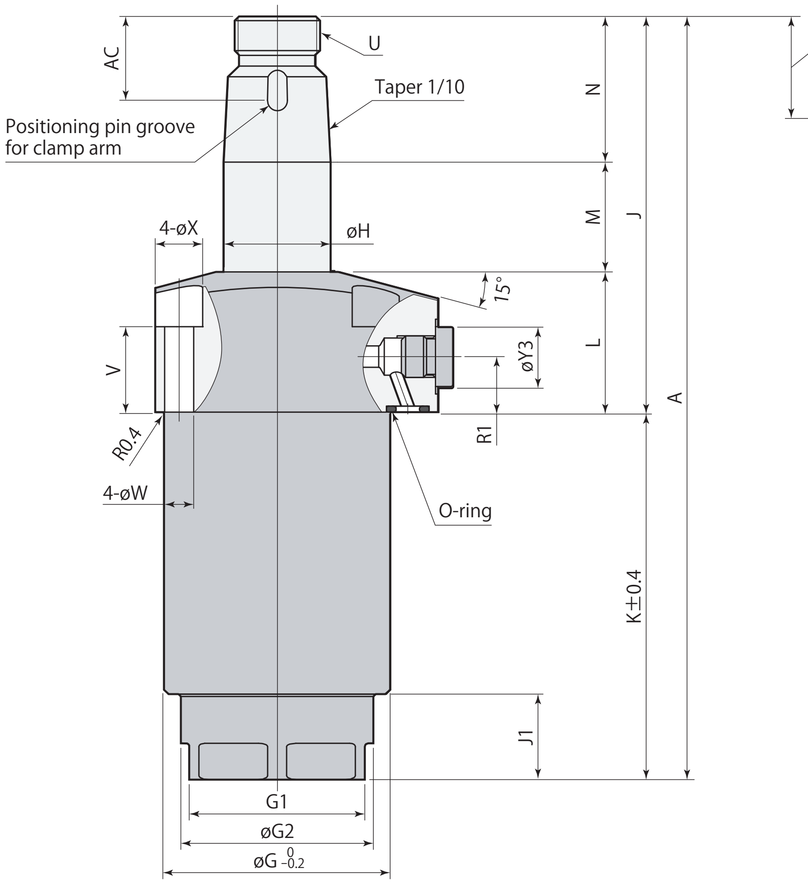


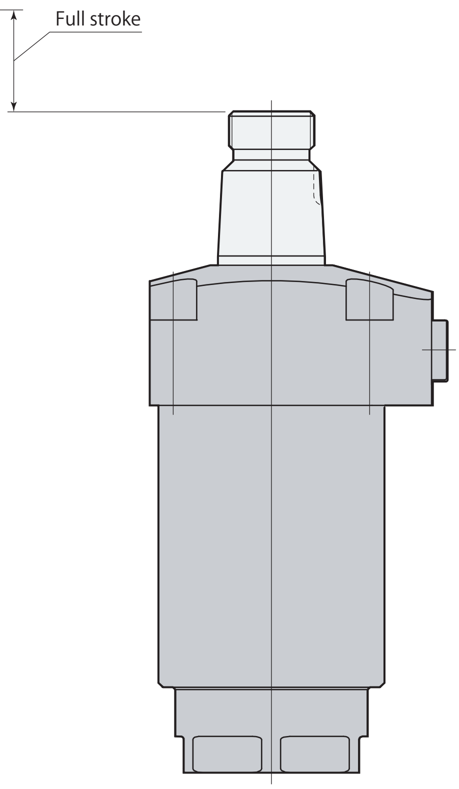


This diagram indicates the arm positioning pin groove at unclamped condition.

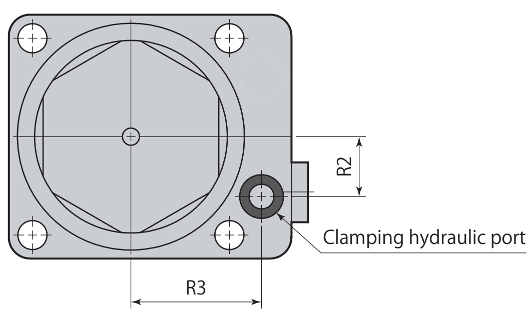
Swing direction L (counter-clockwise)

Swing direction R (clockwise)

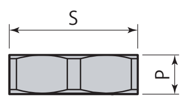




Unclamp



Stroke end



Hex nut for arm mount

- Hex nut for arm mount is included.
- Refer to **page →128** for the details of perfect nut.
- Clamp arm, positioning pin and mounting screws are not included.

mm

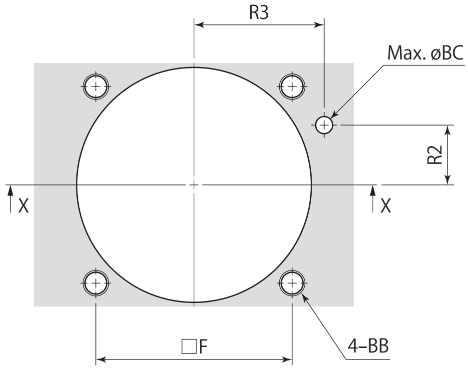
Model	CTT01-□	CTT02-□	CTT04-□	CTT06-□	CTT10-□	CTT16-□	CTT25-□
A	129	136	161.5	178.5	203.5	231.5	284
B	38	45	50	57	70	86	108
C	48	55	60	66	82	96	120
D	29	32.5	35	37.5	47	53	66
E	19	22.5	25	28.5	35	43	54
F	30.5	35	40	46	56	68	88
øG	35	39	47	53	63	78	100
G1 (width across flats)	24	30	36	41	50	60	75
øG2	26	33	40	45	55	66	85
øH	14	18	22.4	25	30	35.5	45
J	68.5	77	87.5	92.5	101.5	117.5	147
J1	12	5	13	20	25	30	40
K	60.5	59	74	86	102	114	137
L	28.5	29	31	33	36	40.5	51.5
M	17.5	20	22.5	25.5	28.5	30	37.5
N	22.5	28	34	34	37	47	58
P	6.5	8	9	9	10	12	13
R1	12.5	12.5	12.5	12.5	14	14	21
R2	9	11	12	14	18	22.5	25
R3	22.5	25	28	30.5	36	42	57
R4	8.1	10	11	13	15	19	25
S (nut width across flats)	19	22	27	30	36	46	55
T (hex socket)	5	6	6	8	8	10	14
U	M12×1.5	M14×1.5	M18×1.5	M20×1.5	M24×1.5	M30×1.5	M39×1.5
V	20	19.5	20	20	19.5	20	26
øW	4.3	5.5	5.5	6.8	9	11	14
øX	8	9.5	9.5	11	14	17.5	20
Y1	G1/8	G1/8	G1/8	G1/8	G1/4	G1/4	G3/8
Y2	3.8	3.8	3.8	3.8	4.8	4.8	4.8
øY3	14	14	14	14	19	19	22
Z	R3	R3	R3	R5	R6	R7	R10
øAA (pin groove diameter)	$3^{+0.014}_{0}$	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$
AC	15.5	18.5	19.5	19.5	22.5	24.5	27.5
Positioning pin (dowel pin)	ø3(h8)×8	ø4(h8)×10	ø4(h8)×10	ø5(h8)×10	ø6(h8)×12	ø6(h8)×12	ø6(h8)×14
O-ring (fluorocarbon hardness Hs90)	P7	P7	P7	P7	P8	P8	P10
Taper sleeve	CTH01-TS	CTH02-TS	CTH04-TS	CTH06-TS	CTH10-TS	CTH16-TS	CTH25-TS
Flow control valve (meter-in)*	VCF01	VCF01	VCF01	VCF01	VCF02	VCF02	VCF03
Air bleeding valve*	VCE01	VCE01	VCE01	VCE01	VCE02	VCE02	VCE03

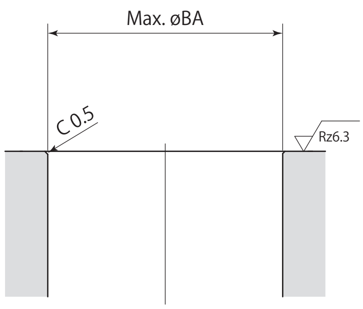
*: Select the right model of VCF and VCE according to the size of the clamp.

Refer to each page for the details of options.

● Taper sleeve **page →127** ● Flow control valve **page →140** ● Air bleeding valve **page →142**

Mounting details





X-X

Rz: ISO4287(1997)

mm

Model	CTT01-□	CTT02-□	CTT04-□	CTT06-□	CTT10-□	CTT16-□	CTT25-□
F	30.5	35	40	46	56	68	88
R2	9	11	12	14	18	22.5	25
R3	22.5	25	28	30.5	36	42	57
øBA	36	40	48	54	64	79	101
BB	M4	M5	M5	M6	M8	M10	M12
øBC	4	4	4	4	6	6	8

CTT – Size: 01 / 02 / 04 / 06 / 10 / 16 / 25

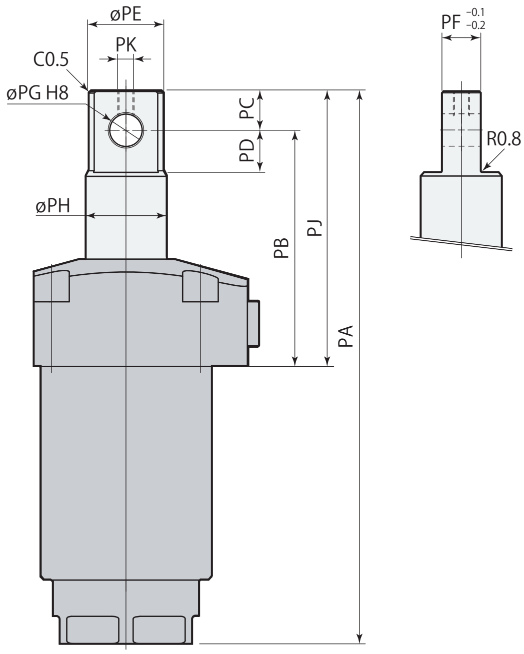
Swing direction (when clamping)

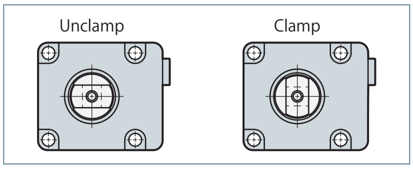
- **L** : Counter-clockwise
- **R** : Clockwise

P : Pin rod

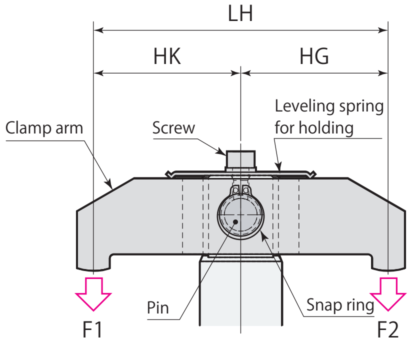
▇ indicates made to order.

Dimensions





Usage example



Clamping performance

Clamping force calculation formula
$F1 = \frac{HG}{LH} \times \frac{P-n1}{n2}$
$F2 = \frac{HK}{LH} \times \frac{P-n1}{n2}$

F1, F2=Clamping force (kN),
$n1$, $n2$=Coefficient (refer to right table),
P= Hydraulic pressure (MPa),
HG, HK=Distance from center of piston to clamping point (mm), LH=(mm)

Model	Coefficient $n1$	Coefficient $n2$
CTT01-□P	1.10	2.97
CTT02-□P	1.16	2.46
CTT04-□P	1.51	1.60
CTT06-□P	1.25	1.12
CTT10-□P	1.26	0.706
CTT16-□P	1.28	0.429
CTT25-□P	1.44	0.271

- This diagram indicates unclamped condition. Direction of pin hole will be hydraulic port side at the time of clamping.
- Clamp arm, pin and snap ring are not included. Customers must arrange for them.
- Thread at top portion of the rod is for attaching a leveling spring. Screw and leveling spring are not included.
- Refer to specifications (**page →117**), dimensions (**page →120**) for other specifications and dimensions that are not shown in the diagram.

mm

Model	CTT01-□P	CTT02-□P	CTT04-□P	CTT06-□P	CTT10-□P	CTT16-□P	CTT25-□P
PA	125	126.5	150	171	197	225	276.5
PB	56.5	59.5	66	73	81	92	115.5
PC	8	8	10	12	14	19	24
PD	9	9	11	13	15	20	25
øPE	12	16	20.4	23	28	33.5	43
PF	8	8	10	12	16	18	22
øPG	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$	$8^{+0.022}_{0}$	$10^{+0.022}_{0}$	$12^{+0.027}_{0}$	$16^{+0.027}_{0}$	$20^{+0.033}_{0}$
øPH	14	18	22.4	25	30	35.5	45
PJ	64.5	67.5	76	85	95	111	139.5
PK	M3×0.5	M3×0.5	M4×0.7	M5×0.8	M6×1	M6×1	M8×1.25
Mass	0.7 kg	0.8 kg	1.3 kg	1.8 kg	3.0 kg	4.9 kg	9.5 kg

Size

Swing direction (when clamping)

CTT — 01 / 02 / 04 / 06 / 10 / 16 / 25

L : Counter-clockwise

R : Clockwise

N30 : Swing angle 30°

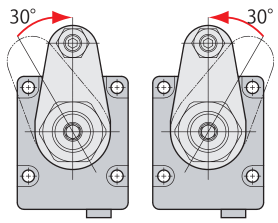
N45 : Swing angle 45°

N60 : Swing angle 60°

Swing angle

CTT□-□N30

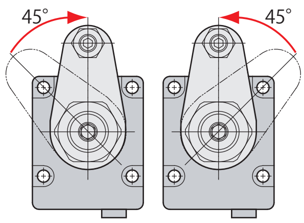
Swing angle 30°



R:Clockwise L:Counter-clockwise

CTT□-□N45

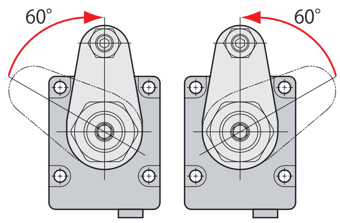
Swing angle 45°



R:Clockwise L:Counter-clockwise

CTT□-□N60

Swing angle 60°



R:Clockwise L:Counter-clockwise

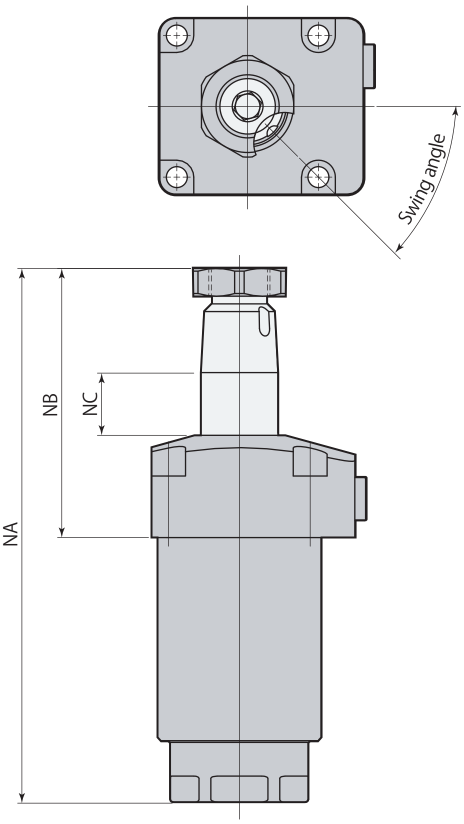
Specifications

Model		CTT01-□N□			CTT02-□N□			CTT04-□N□			CTT06-□N□		
Swing angle		30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°
Full stroke	mm	11.8	12.7	13.7	13.0	14.3	15.5	14.3	15.8	17.4	16.8	18.4	20.1
Swing stroke	mm	3.8	4.7	5.7	5.0	6.3	7.5	6.3	7.8	9.4	6.8	8.4	10.1
Clamp stroke	mm	8			8			8			10		
Cylinder capacity (clamp)	cm^3	4.0	4.3	4.6	5.3	5.8	6.3	8.9	9.9	10.8	15.0	16.5	18.0
Return spring force (unclamp)	kN	0.28	0.27	0.26	0.36	0.34	0.32	0.66	0.62	0.58	0.88	0.85	0.81

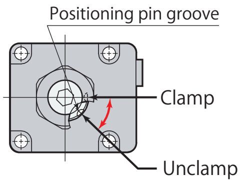
Model		CTT10-□N□			CTT16-□N□			CTT25-□N□		
Swing angle		30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°
Full stroke	mm	18.3	20.3	22.4	19.3	21.6	23.9	24.5	27.4	30.3
Swing stroke	mm	8.3	10.3	12.4	9.3	11.6	13.9	11.5	14.4	17.3
Clamp stroke	mm	10			10			13		
Cylinder capacity (clamp)	cm^3	25.9	28.8	31.7	44.8	50.2	55.6	90.4	101.0	111.6
Return spring force (unclamp)	kN	1.38	1.32	1.25	2.26	2.15	2.03	3.86	3.62	3.39

● Refer to **page →117** for the specifications of products that are not listed on this page.

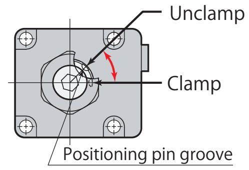
Dimensions



Swing direction L
(counter-clockwise)



Swing direction R
(clockwise)



- This diagram indicates unclamped condition of swing direction L (L stands for counter-clockwise).
  Direction of positioning pin groove will be hydraulic port side at the time of clamping.
- Refer to **page →120** for the dimensions of products that are not listed on this page.

mm

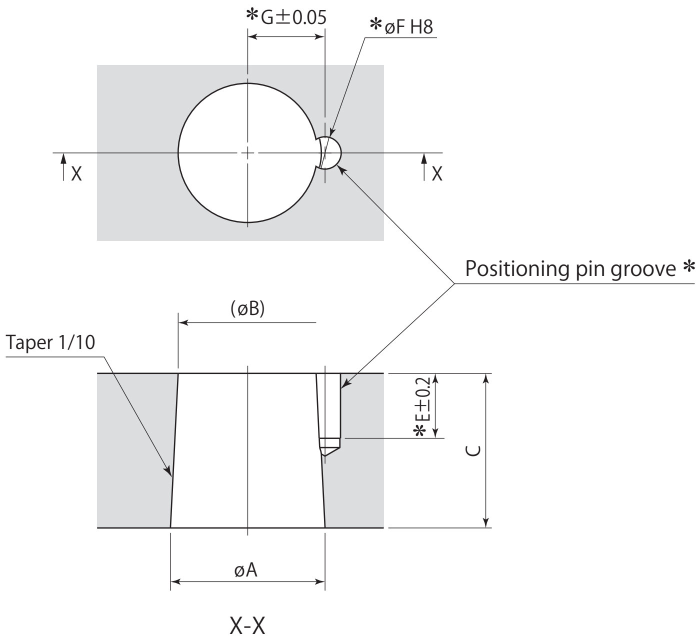
Model	CTT01-□N□			CTT02-□N□			CTT04-□N□			CTT06-□N□		
Swing angle	30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°
NA	124.8	125.7	126.7	131.0	132.3	133.5	155.3	156.8	158.4	171.8	173.4	175.1
NB	64.3	65.2	66.2	72.0	73.3	74.5	81.3	82.8	84.4	85.8	87.4	89.1
NC	13.3	14.2	15.2	15.0	16.3	17.5	16.3	17.8	19.4	18.8	20.4	22.1

mm

Model	CTT10-□N□			CTT16-□N□			CTT25-□N□		
Swing angle	30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°	30°±3°	45°±3°	60°±3°
NA	195.3	197.3	199.4	222.3	224.6	226.9	272.5	275.4	278.3
NB	93.3	95.3	97.4	108.3	110.6	112.9	135.5	138.4	141.3
NC	20.3	22.3	24.4	20.8	23.1	25.4	26.0	28.9	31.8

Clamp arm mounting details

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



*: No need to machine the pin groove (E, øF, G) unless positioning pin is used for the arm.
The positioning pin enables a clamp arm to locate on the clamp firmly and easily.

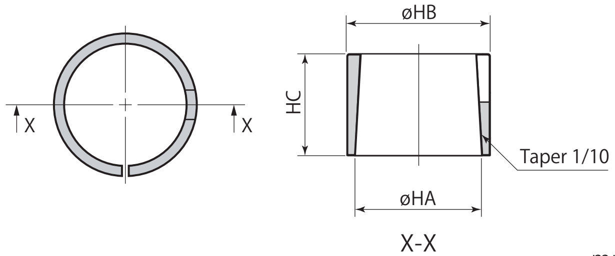
mm

Swing clamp	CTT01	CTT02	CTT04	CTT06	CTT10	CTT16	CTT25
øA	$14^{-0.016}_{-0.034}$	$18^{-0.016}_{-0.034}$	$22.4^{-0.020}_{-0.041}$	$25^{-0.020}_{-0.041}$	$30^{-0.020}_{-0.041}$	$35.5^{-0.025}_{-0.050}$	$45^{-0.025}_{-0.050}$
øB	12.4	16	19.9	22.5	27.3	32	40.5
C	16	20	25	25	27	35	45
E	9	10.5	10.5	10.5	12.5	12.5	14.5
øF (pin groove diameter)	$3^{+0.014}_{0}$	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$
G	7.55	9.1	11.1	12.6	15.1	18.1	22.6

Taper sleeve

Size

CTH [01 / 02 / 04 / 06 / 10 / 16 / 25] — TS : Taper sleeve



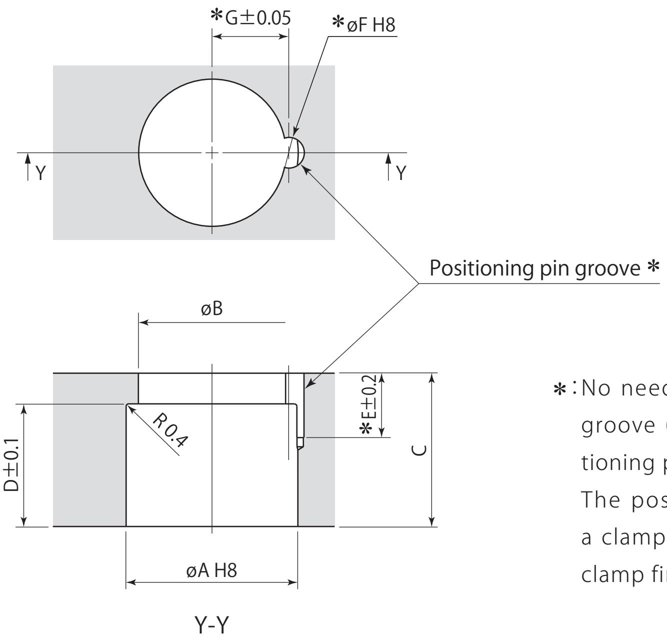
mm

Taper sleeve	CTH01-TS	CTH02-TS	CTH04-TS	CTH06-TS	CTH10-TS	CTH16-TS	CTH25-TS
Applicable swing clamp	CTT01	CTT02	CTT04	CTT06	CTT10	CTT16	CTT25
øHA	14	18	22.4	25	30	35.5	45
øHB	16	20	25	28	34	40	49
HC	13	16	21	20	22	29	38

Clamp arm mounting details

(Using taper sleeve)

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



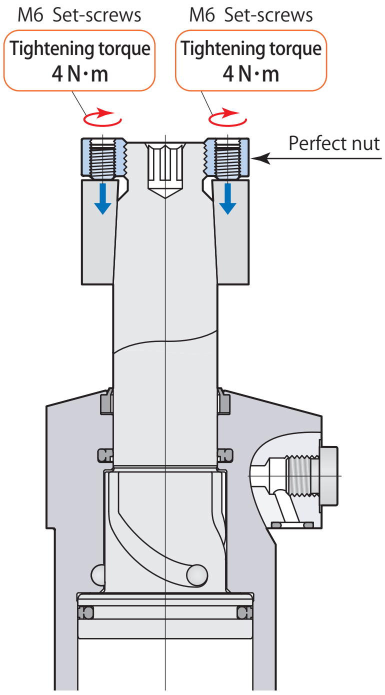
*: No need to machine the pin groove (E, øF, G) unless positioning pin is used for the arm. The positioning pin enables a clamp arm to locate on the clamp firmly and easily.

mm

Taper sleeve	CTH01-TS	CTH02-TS	CTH04-TS	CTH06-TS	CTH10-TS	CTH16-TS	CTH25-TS
Applicable swing clamp	CTT01	CTT02	CTT04	CTT06	CTT10	CTT16	CTT25
øA	$16^{+0.027}_{0}$	$20^{+0.033}_{0}$	$25^{+0.033}_{0}$	$28^{+0.033}_{0}$	$34^{+0.039}_{0}$	$40^{+0.039}_{0}$	$49^{+0.039}_{0}$
øB	13	17	21	24	28.5	34	42
C	16	20	25	25	27	35	45
D	13	16	21	20	22	29	38
E	9	10.5	10.5	10.5	12.5	12.5	14.5
øF (pin groove diameter)	$3^{+0.014}_{0}$	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$
G	7.55	9.1	11.1	12.6	15.1	18.1	22.6

Mounting arm firmly and easily.

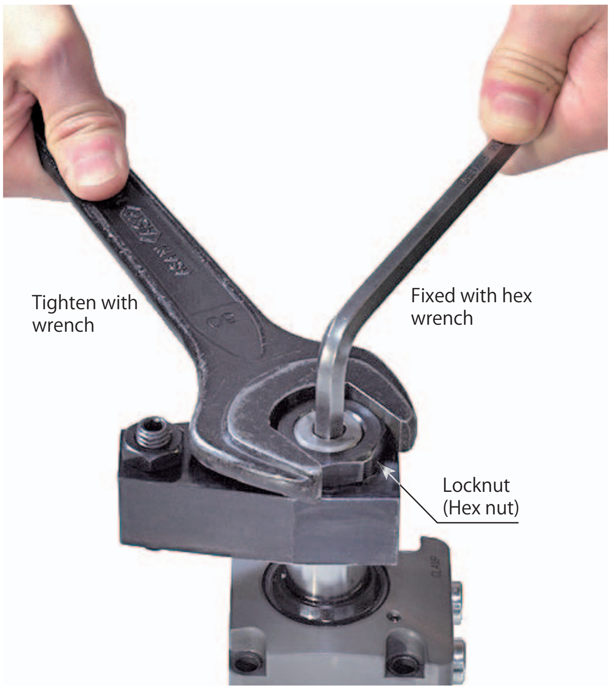
● Fastening or loosening the nut over the top of the clamp by an electric wrench helps to improve the workability on the machine table or the jig.



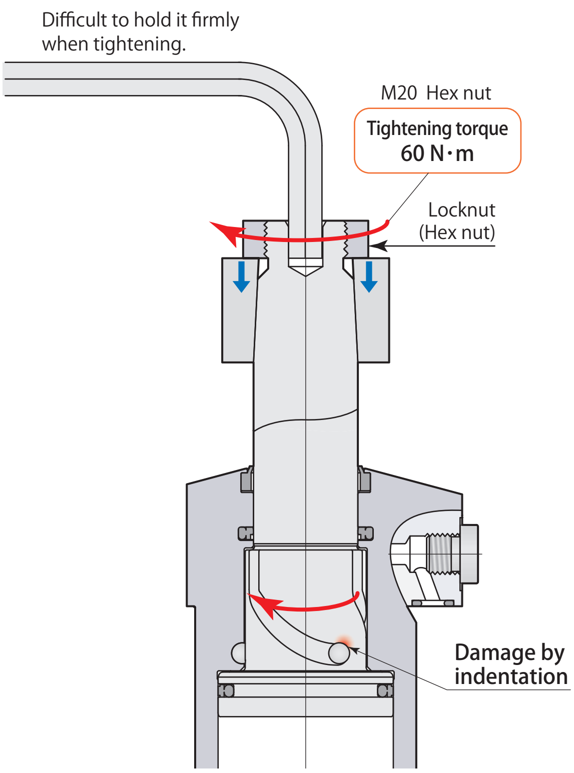
Swing clamp model CTU06

● The perfect nut needs minimum torque to tighten the set-screws and it can avoid giving the overload to the cam groove on the piston rod, which enables the arm to mount firmly and easily.

Less workability with conventional way of the mount.



● To fasten or loosen the nut using the conventional way in a limited space makes the workability lower and may cause incomplete arm mounting.



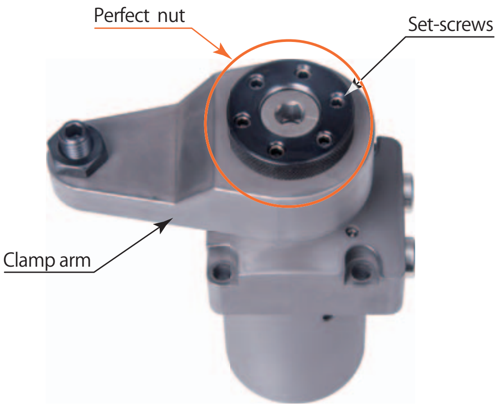
Swing clamp model CTU06

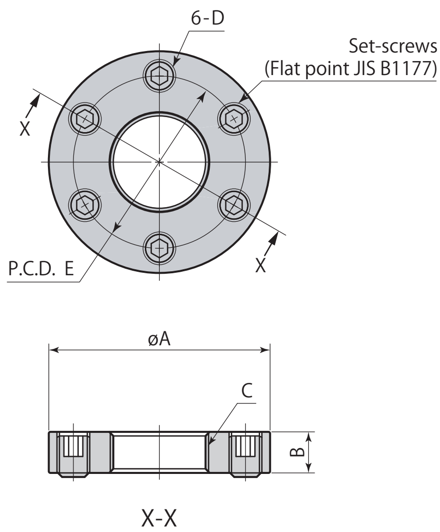
● The piston rod of the clamp must be fixed firmly to fasten the nut however it may cause damage on cam groove in case the rod is not fixed firmly.

Perfect nut

Size: 01 / 02 / 04 / 06 / 10 / 16 / 25

CTH [Size] — TN : Perfect nut



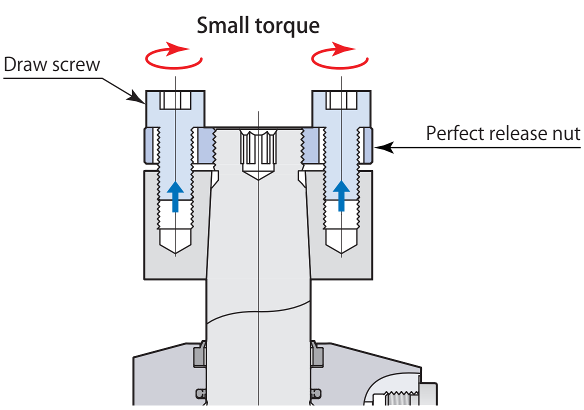


mm

Perfect nut		CTH01-TN	CTH02-TN	CTH04-TN	CTH06-TN	CTH10-TN	CTH16-TN	CTH25-TN
Applicable swing clamp		CTU01 CTT01	CTU02 CTT02	CTU04 CTT04	CTU06 CTT06	CTU10 CTT10	CTU16 CTT16	CTU25 CTT25
Set-screws	Size	M4×0.7 length 6	M5×0.8 length 8	M6×1 length 8	M6×1 length 8	M8×1.25 length 10	M8×1.25 length 10	M10×1.5 length 10
	Recommended tightening torque	1 N·m	2 N·m	3 N·m	4 N·m	6 N·m	7 N·m	10 N·m
øA		24	30	36	40	50	56	74
B		6.5	8	9	9	10	12	13
C		M12×1.5	M14×1.5	M18×1.5	M20×1.5	M24×1.5	M30×1.5	M39×1.5
D		M4×0.7	M5×0.8	M6×1	M6×1	M8×1.25	M8×1.25	M10×1.5
E		18	22	26.5	30	38	43	55
Mass		0.02 kg	0.04 kg	0.06 kg	0.07 kg	0.12 kg	0.17 kg	0.33 kg

Dismounting arm easily.

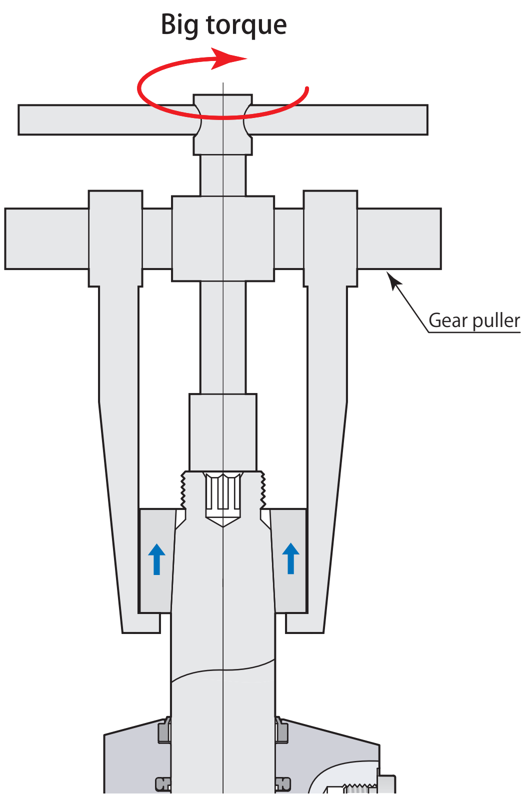
● By simply fastening the draw screw the clamp arm can be easily removed, which does not need a specialized tool such as a gear puller.



● The clamp arm can be dismounted easily and securely with a small torque.

Inferior dismounting workability using a gear puller.

● On the machine table top and the jig the working space is limited, it is difficult to pull up a clamp arm using a specialized tool such as a gear puller.

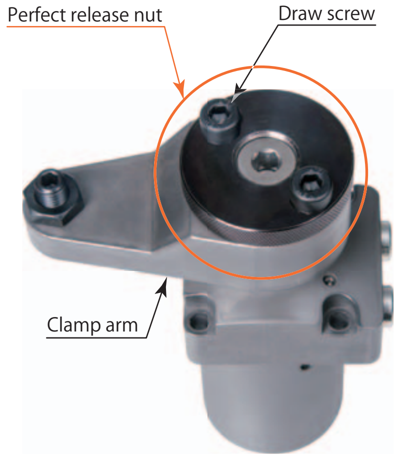


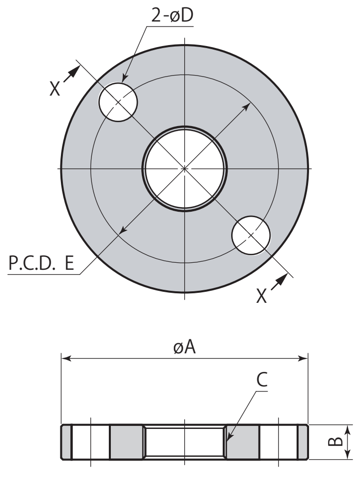
● A large torque is needed to pull the clamp arm off from the tapered area of the rod, which will be risky for a worker when the arm comes off suddenly.

Perfect release nut

Size

CTH — 01 / 02 / 04 / 06 / 10 / 16 / 25 — TNR : Perfect release nut



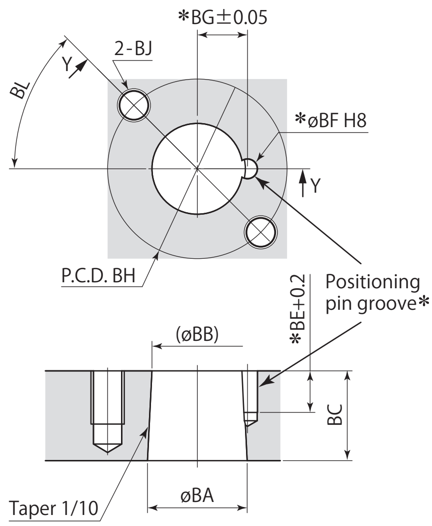


X-X

Clamp arm mounting details

(Using perfect release nut)

Drill a 1/10 taper hole into the clamp arm, and provide the tap holes for draw screws to remove the clamp arm.



Y-Y

*:No need to machine the pin groove (BE, øBF, BG) unless positioning pin is used for the arm.

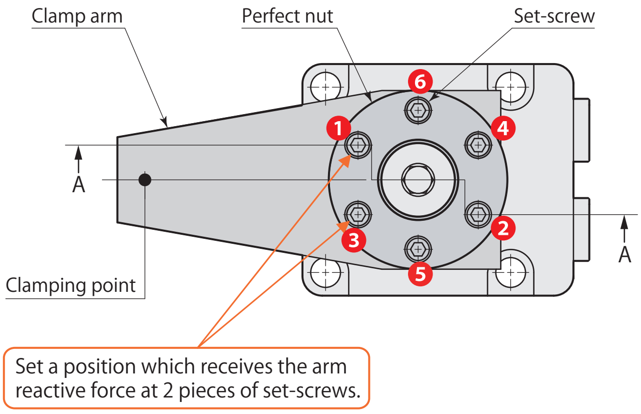
mm

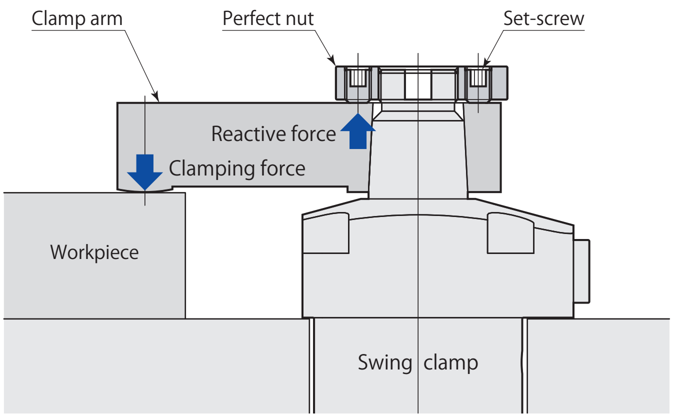
Perfect release nut	CTH01-TNR	CTH02-TNR	CTH04-TNR	CTH06-TNR	CTH10-TNR	CTH16-TNR	CTH25-TNR
Applicable swing clamp	CTU01 CTT01	CTU02 CTT02	CTU04 CTT04	CTU06 CTT06	CTU10 CTT10	CTU16 CTT16	CTU25 CTT25
Recommended draw screw	M5×0.8	M6×1	M8×1.25	M8×1.25	M10×1.5	M10×1.5	M12×1.75
øA	34	40	50	54	67	70	90
B	6.5	8	9	9	10	12	13
C	M12×1.5	M14×1.5	M18×1.5	M20×1.5	M24×1.5	M30×1.5	M39×1.5
øD	5.5	6.8	9	9	11	11	14
E	24	29	36	39	50	53	70
Mass	0.04 kg	0.07 kg	0.12 kg	0.14 kg	0.24 kg	0.30 kg	0.53 kg
øBA	$14^{-0.016}_{-0.034}$	$18^{-0.016}_{-0.034}$	$22.4^{-0.020}_{-0.041}$	$25^{-0.020}_{-0.041}$	$30^{-0.020}_{-0.041}$	$35.5^{-0.025}_{-0.050}$	$45^{-0.025}_{-0.050}$
øBB	12.4	16	19.9	22.5	27.3	32	40.5
BC	16	20	25	25	27	35	45
BE	9	10.5	10.5	10.5	12.5	12.5	14.5
øBF (pin groove diameter)	$3^{+0.014}_{0}$	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$
BG	7.55	9.1	11.1	12.6	15.1	18.1	22.6
BH	24	29	36	39	50	53	70
BJ	M5	M6	M8	M8	M10	M10	M12
BL	Standard 60° allowable range 45°–75° (within range that there is no interference with set-screws)						

● Draw screws are not included with perfect release nut.

Perfect nut (Arm mounting guide)

1. Set clamp arm and turn perfect nut as tight as it gets manually.
2. Turn back perfect nut to the position where two set-screws hold against reactive force of arm, as shown in diagram below.
3. Tighten set-screws with recommended torque in order of ❶ to ❻ in diagram below.
4. Once set-screws are tightened to ❻ , ❶ becomes loose, so retighten in sequence of ❶ to ❻ again.
5. Repeat tightening of set-screws ❶ to ❻ six times.
6. Repeat clamping and unclamping of workpiece five times (this operation allows taper section to become accustomed to use).
7. Return to unclamped condition and then retighten set-screws in order of ❶ to ❻.
   Once tightening in sequence of ❶ to ❻ is repeated three times, all set-screws will be fixed and clamp arm is completely mounted.



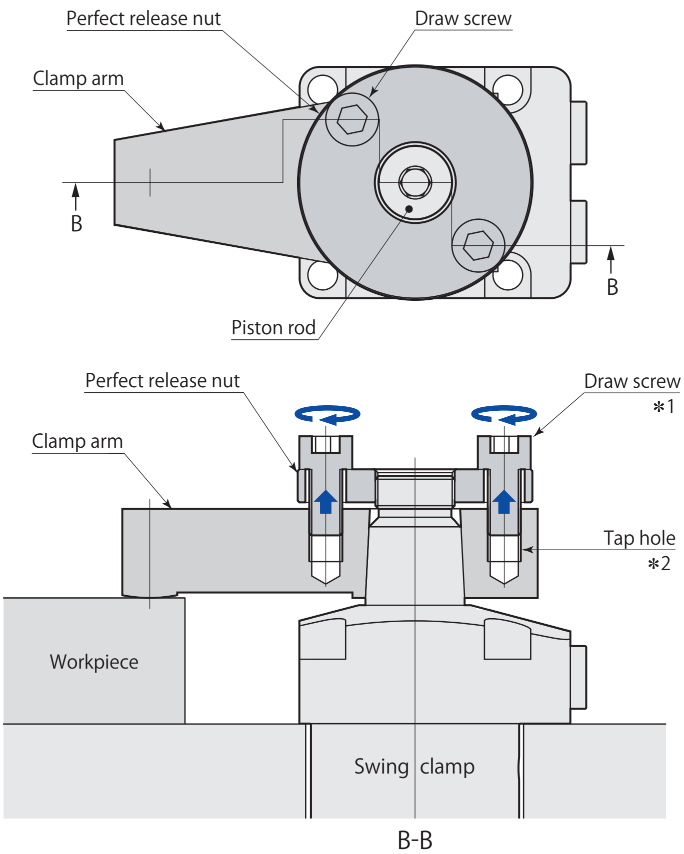


A-A

- The clamp arm may bite at the taper of the clamp rod and it will cause the demount failure if the set screw is tightened with excessive force. Be sure to use recommended torque when tightening.
- More secure tightening can be accomplished by applying some thread adhesive on set-screws.
  Recommended adhesive: LOCTITE 243 (medium strength type)

Perfect release nut (Arm dismounting guide)

1. Loosen all set-screws of perfect nut and dismount perfect nut from piston rod.
2. Mount perfect release nut and turn it until clamp arm comes into contact.
3. Turn perfect release nut back one or two more times, align the nut hole with tap hole of clamp arm and then mount the draw screws.
4. Once draw screws are tightened, clamp arm can be pulled off piston rod.

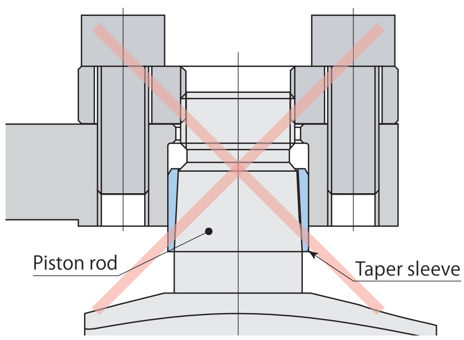


∗1：Turn draw screws as a pair, alternately turning 45° to 90° at a time to tighten them evenly.
Some movement is felt in hand as clamp arm comes off, but there is no danger involved in this procedure.

∗2：Tap holes for draw screws are needed on clamp arm in order to use perfect release nut.
Refer to clamp arm mounting details on **page →131** for details on tap holes.

Caution in use

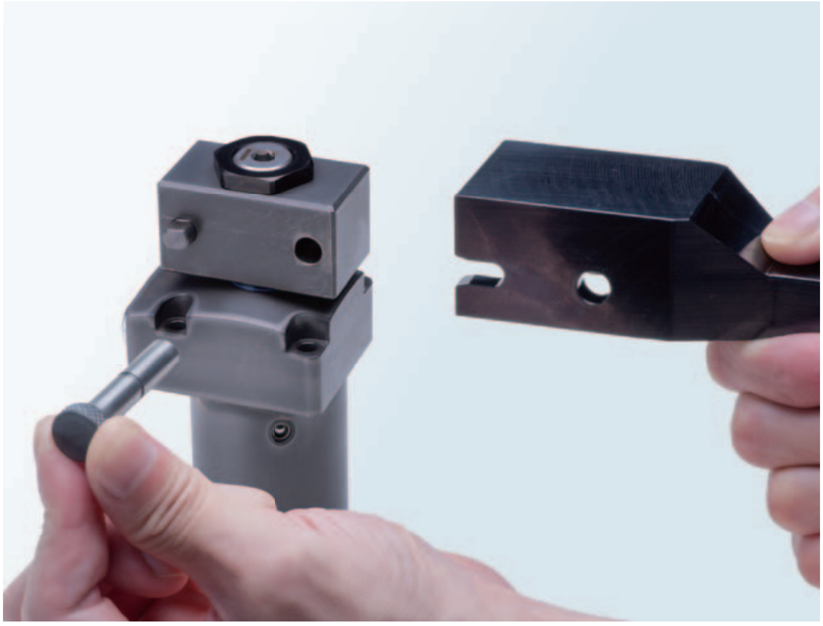
In the event that a clamp arm is used with taper sleeve, the perfect release nut cannot remove the clamp arm due to the taper sleeve remaining on the piston rod. When using a taper sleeve, please use a gear puller (or similar) to remove clamp arm.
To be able to easily remove clamp arms using the perfect release nut, drill a 1/10 taper hole into the clamp arm. (Clamp arm mounting details refer to **page →131**)



Quick arm change

● Clamp arm is replaceable quickly.

Toolless



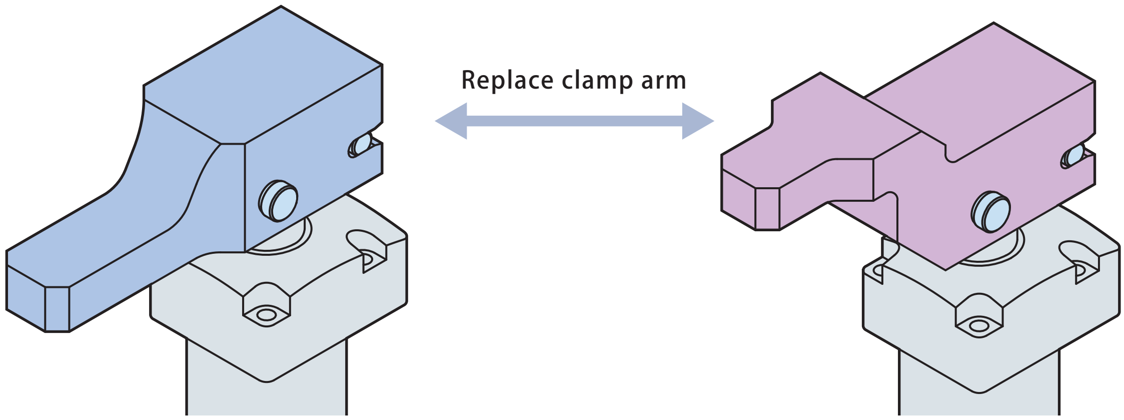
● No specific tools are required to replace, simply place the arm and put the pin in.

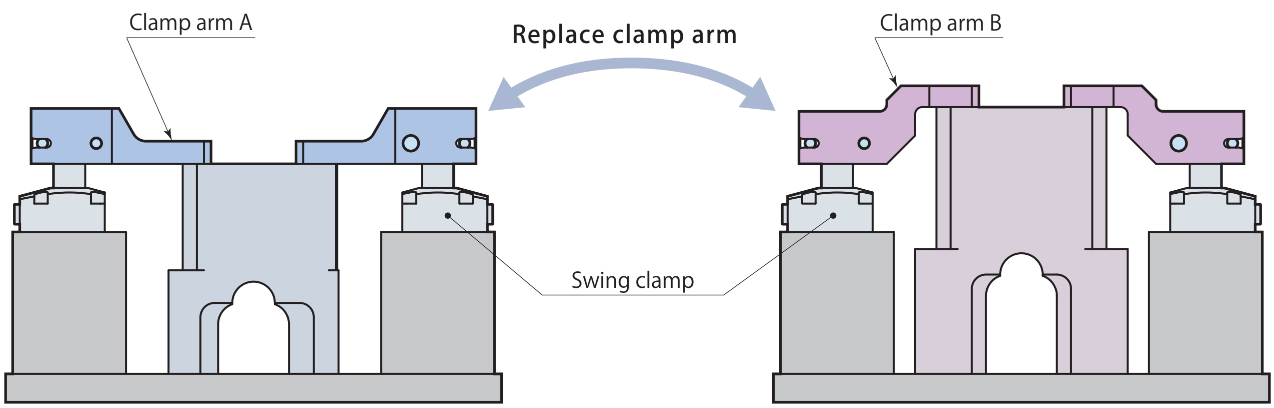
Jig cost is reduced

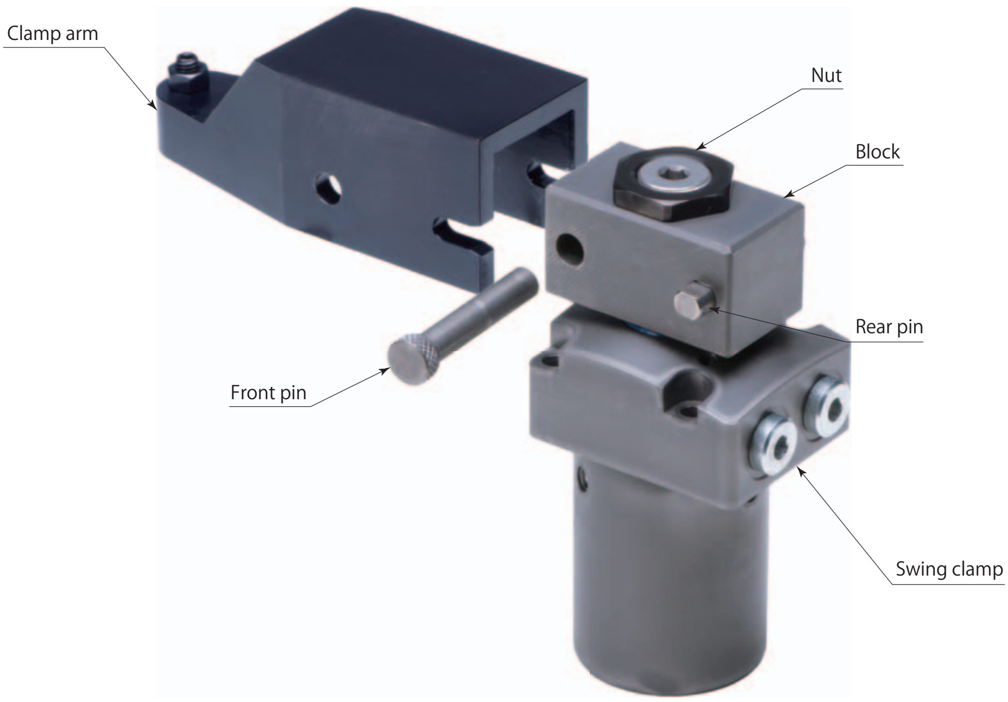
● The arm makes the clamp versatile for many kinds of the workpiece and overall Jig cost is reduced.

Productivity improved

● The introduction of the arm enable the jig to be exchanged very quick and to reduce the set-up time, which ends up the increase of productivity.





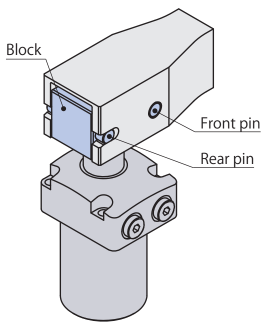


Quick arm change

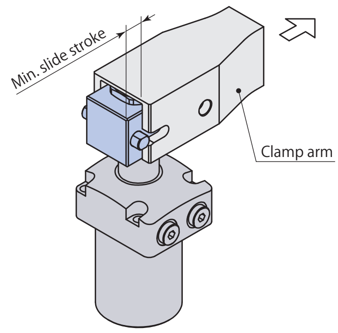
Size

CTH — 02 / 04 / 06 / 10 / 16 — **CQ** : Quick arm change

▇ indicates made to order.



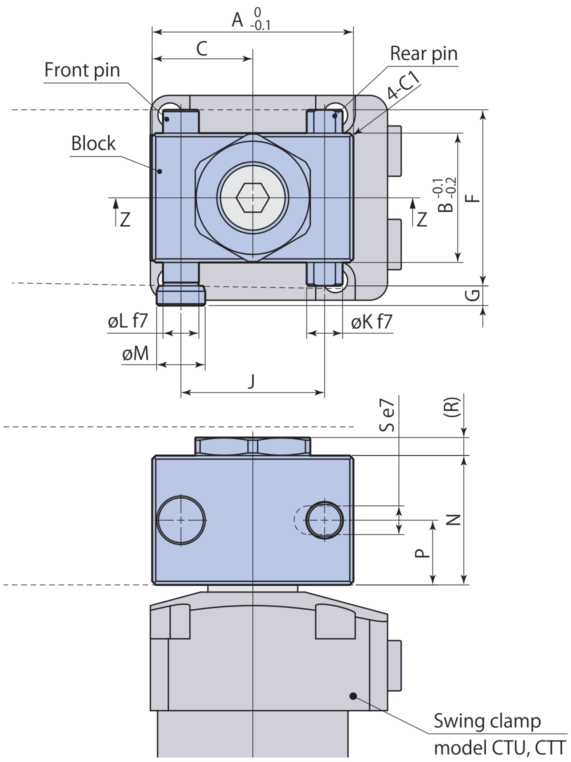
Clamp arm mounting

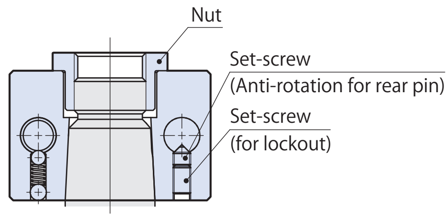


Clamp arm dismounting

Pull the pin out and slide the clamp arm to the front of the clamp so the arm can be removed.

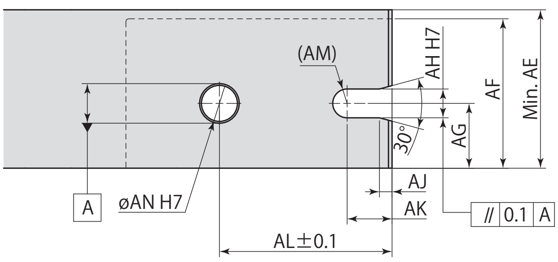
Dimensions

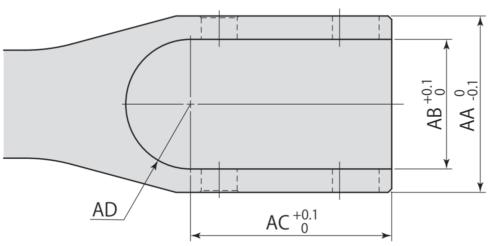




Clamp arm mounting details

Recommended material：S45C (HB201–269)





mm

Quick arm change	CTH02-CQ	CTH04-CQ	CTH06-CQ	CTH10-CQ	CTH16-CQ
Applicable swing clamp	CTU02 CTT02	CTU04 CTT04	CTU06 CTT06	CTU10 CTT10	CTU16 CTT16
A	45	54	57	66	76
B	25	30.5	33.5	40.5	51.5
C	22.5	27	28.5	33	38
F	35	42	46	55.5	70
G	5.5	5.5	5.5	7.5	9
J	32	38	38	46	56
øK	$6^{-0.011}_{-0.022}$	$8^{-0.013}_{-0.028}$	$10^{-0.013}_{-0.028}$	$12^{-0.016}_{-0.034}$	$14^{-0.016}_{-0.034}$
øL	$6^{-0.011}_{-0.022}$	$8^{-0.013}_{-0.028}$	$10^{-0.013}_{-0.028}$	$12^{-0.016}_{-0.034}$	$14^{-0.016}_{-0.034}$
øM	9.5	11.5	13.5	16	18
N	22	29	32	36	40
P	11	14.5	16	18	20
R	6	5	5	7	7
S (width across flats)	$5^{-0.020}_{-0.032}$	$6^{-0.020}_{-0.032}$	$8^{-0.025}_{-0.040}$	$10^{-0.025}_{-0.040}$	$12^{-0.032}_{-0.050}$
Min. slide stroke	9.5	12	14.5	16	17

- Refer to **pages →95–111** for model CTU, **117–125** for model CTT for other specifications and dimensions that are not shown in the diagram.
- Refer to performance table (model CTU **page →96**, model CTT **page →118**) for the relation between hydraulic force and clamp arm length.
- A nut, block, front pin and a rear pin are included.
- Customers must arrange for the clamp arm.

mm

Quick arm change	CTH02-CQ	CTH04-CQ	CTH06-CQ	CTH10-CQ	CTH16-CQ
Applicable swing clamp	CTU02 CTT02	CTU04 CTT04	CTU06 CTT06	CTU10 CTT10	CTU16 CTT16
AA	35	42	46	55.5	70
AB	25	30.5	33.5	40.5	51.5
AC	45	54	57	66	76
AD	R12.5	R15.25	R16.75	R20.25	R25.75
AE	33	39	42	48	52
AF	29	35	38	44	48
AG	11	14.5	16	18	20
AH	$5^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$	$12^{+0.018}_{0}$
AJ	2.5	3	3.5	5	5
AK	8.5	11	13	14	14
AL	38.5	46	47.5	56	66
AM	R2.5	R3	R4	R5	R6
øAN	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$	$12^{+0.018}_{0}$	$14^{+0.018}_{0}$

Mounting & dismounting of clamp arm

- Swing clamp may be damaged if excessive torque is applied to piston rod, since structure is intended for swinging using cam mechanism with lead grooves. Follow instructions shown below to prevent excessive torque from being applied on piston rod when mounting or dismounting clamp arm.

- Be sure to tighten locknut with recommended tightening torque. If the tightening torque is insufficient, clamp arm may slip during operation.

Model		CTM03	CTM04	CTM05	CTM06	CTM10	CTM16
Recommended tightening torque of locknut	N·m	22	35	60	100	155	260

Model		CTN02	CTN04	CTN05	CTN06	CTN10	CTN16
Recommended tightening torque of locknut	N·m	7.5	14	40	50	74	116

Model		CTU01 CTT01	CTU02 CTT02	CTU04 CTT04	CTU06 CTT06	CTU10 CTT10	CTU16 CTT16	CTU25 CTT25
Recommended tightening torque of locknut	N·m	12	26	51	60	86	120	180

Mounting of clamp arm

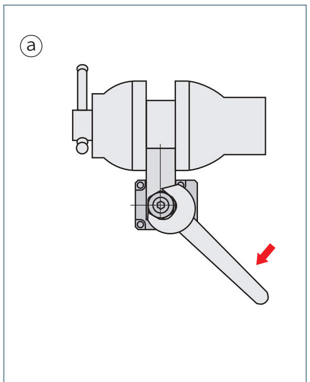
ⓐ Fix the clamp arm in a vise, then set the clamp body and clamp arm at the desired orientation, and tighten locknut with a wrench.

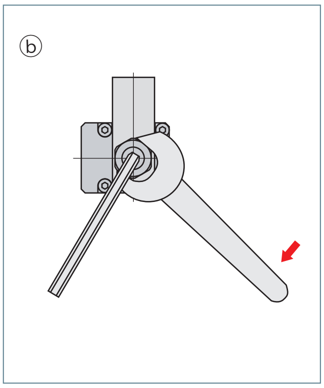
ⓑ For clamps that are mounted on jig, set clamp arm at desired orientation as shown in diagram below. Insert a hex wrench to hex socket at tip section of piston rod to hold it and tighten locknut with a wrench.

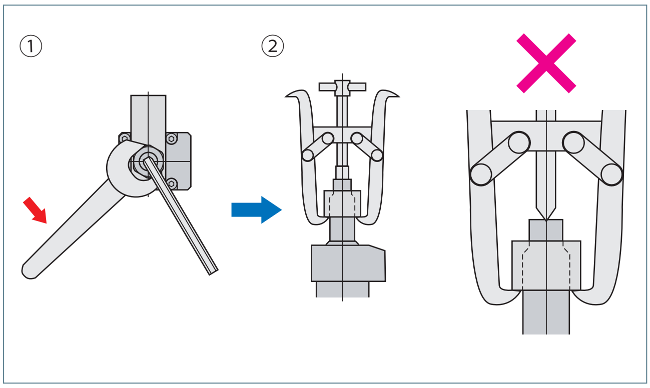
Dismounting of clamp arm

① Insert hex wrench to hex socket at tip section of piston rod to ensure that piston rod is held in place, then loosen locknut with wrench.

② After dismounting the locknut, pull out clamp arm using gear puller. A flat saddle type of gear puller should be used when removing an arm not to enlarge the hole on the tip of the piston rod. In addition, be careful not to rotate the rod when removing the arm.







Specifications

(Nil) : Meter-in

Body color：Silver

O : Meter-out

Body color：Black

VCF

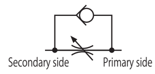
G port size

01S	: G1/8
01	: G1/8
02	: G1/4
03	: G3/8

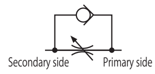
–

Control method

(Nil) : Meter-in



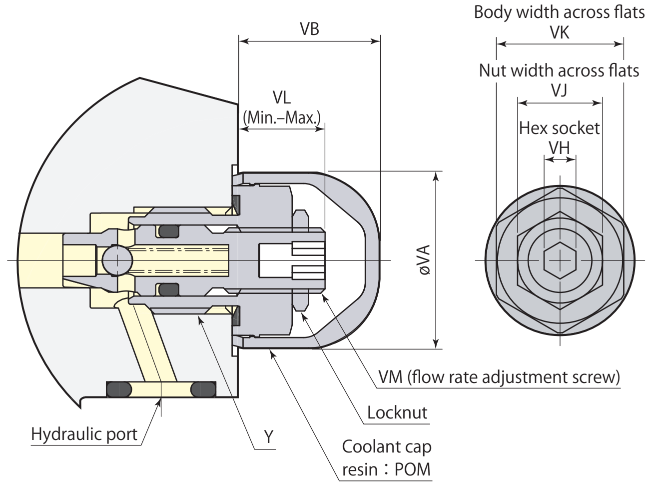
O : Meter-out



Model		Meter-in				Meter-out			
		VCF01S	VCF01	VCF02	VCF03	VCF01S-O	VCF01-O	VCF02-O	VCF03-O
G port size		G1/8	G1/8	G1/4	G3/8	G1/8	G1/8	G1/4	G3/8
Cracking pressure	MPa	0.04	0.04	0.04	0.04	0.1	0.1	0.1	0.1
Orifice area	mm^2	4.9	4.9	9.6	19.6	3.1	3.1	6.2	12.6
Recommended tightening torque	N·m	10	10	30	35	10	10	30	35
Mass	kg	0.011	0.013	0.024	0.038	0.011	0.013	0.024	0.038

- Pressure range：0.5–7 MPa
- Proof pressure：10.5 MPa
- Operating temperature：0–70 ℃
- Fluid used：General mineral based hydraulic oil (ISO-VG32 equivalent)

Dimensions



mm

Model	VCF01S VCF01S-O	VCF01 VCF01-O	VCF02 VCF02-O	VCF03 VCF03-O
Y	G1/8	G1/8	G1/4	G3/8
øVA	16	16	21	24
VB	13	13	13	14
VH	3	3	5	6
VJ	8	8	10	14
VK	12	12	17	19
VL	8–11	7–11	7.5–11.5	8.5–12.5
Adjustment screw number of turns	4 rotations	5.3 rotations	5.3 rotations	5.3 rotations
VM	M6×0.75	M6×0.75	M8×0.75	M10×0.75

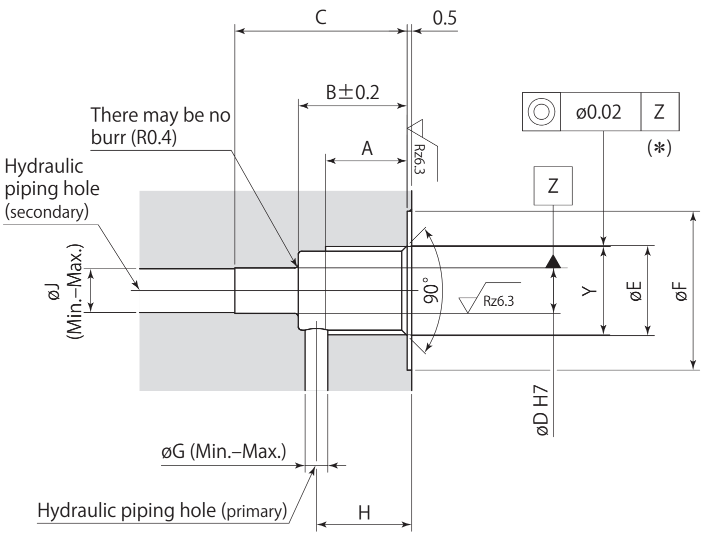
- Use a closed wrench or socket wrench for mounting and dismounting.
- Flow control valve can be mounted on hydraulic port (G port) when manifold piping.
- Adjust flow rate without hydraulic pressure. Conducting adjustments with hydraulic pressure may result in damaging seal.
- Diagram above indicates mounting for meter-in (VCF□).
- VCF is shipped with the valve fully open. Adjust the flow rate by loosening the screws after it is screwed in to close totally. Tighten the locknut after adjustment is completed.

Applicable clamp and work support

Model	VCF01S	VCF01	VCF02	VCF03
Swing clamp (double acting)	CTM03, 04, 05, 06　CTP04, 05, 06	CTM10　CTU01, 02, 04, 06	CTM16　CTU10, 16	CTU25
Swing clamp (single acting)*	CTN02, 04, 05, 06	CTT01, 02, 04, 06	CTN10, 16　CTT10, 16	CTT25
Swivel clamp (double acting)*	CTS04	CTS06	CTS10, 16	–
Link clamp (double acting)	CLM03, 04　CLP04, 05, 06	CLM05, 06, 10　CLU02, 04, 06	CLM16　CLU10, 16	CLU25
Link clamp (single acting)*	CLN04	CLN05, 06　CLT02, 04, 06	CLN10, 16　CLT10, 16	CLT25
Work lift cylinder	CNB01	CNB02, 04	–	–
Push, pull cylinder	–	CNA02, 04, 06	CNA10, 16	CNA25
Work support*	CSU　CSP-D(CSN, CSY)	–	–	–

＊：Single acting swing clamp, swivel clamp, single acting link clamp and work support are meter-in only.

Mounting details



Rz: ISO4287(1997)

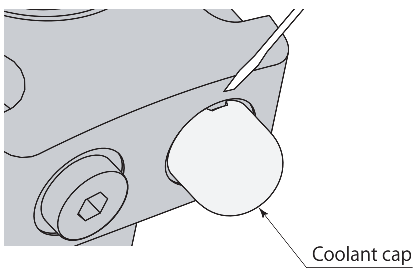
mm

Model	VCF01S VCF01S-O	VCF01 VCF01-O	VCF02 VCF02-O	VCF03 VCF03-O
A	9	9	13	13
B	11	13	18	19
C	15.5	17.5	22.5	23.5
øD	$5^{+0.012}_{0}$	$5^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$
øE	9.9	9.9	13.3	16.8
øF	17.5	17.5	21.5	24.5
øG	1.5–2	2.5–3	3.5–5	5–6
H	9–10	9.5–11.5	14.5–15.5	15–16
øJ	2.5–5	2.5–5	3.5–6	5–8
Y	G1/8	G1/8	G1/4	G3/8

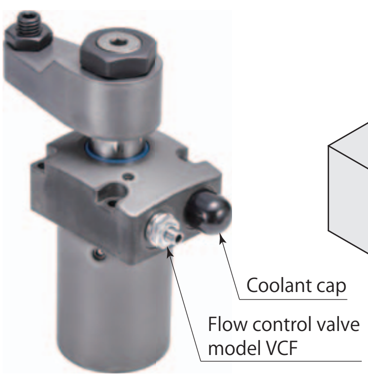
*: Concentricity is required when machining øD and Y-portion thread. Misalignment or machining defect may cause the trouble of installation and adjusting flow rate.

Mounting & dismounting of flow control valve, air bleeding valve

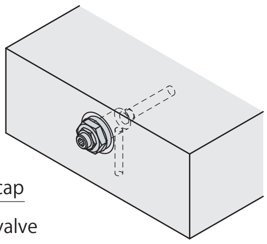
- When mounting or dismounting a flow control valve or air bleeding valve, be sure to set pressure within hydraulic circuit to 0 MPa before starting.
- When mounting a flow control valve or air bleeding valve, be sure to tighten it with the recommended tightening torque.
- When mounting a coolant cap (resin: POM), firmly press the body of cover. If it is not mounting properly, use a plastic mallet to tap it into place.
- When dismounting a coolant cap, use a sharp-pointed tool such as a precision screw driver by hooking the notched portion.



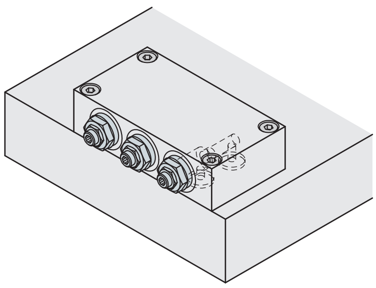
Mounting example



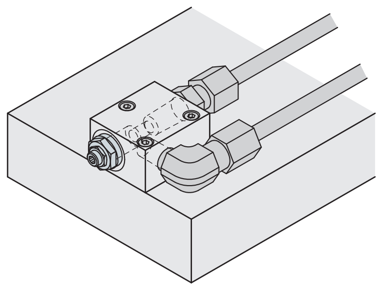
Cylinder mounting



Pallet mounting

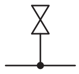


Block mounting ①



Block mounting ②

Specifications

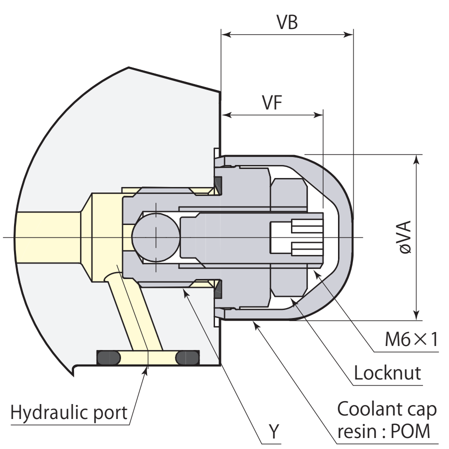


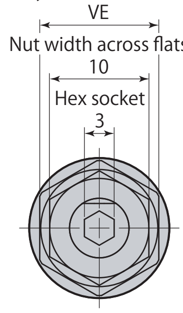
G port size

VCE
- 01 : G1/8
- 02 : G1/4
- 03 : G3/8

Model		VCE01	VCE02	VCE03
G port size		G1/8	G1/4	G3/8
Recommended tightening torque	N·m	10	30	35
Mass	kg	0.017	0.029	0.044
Pressure range	MPa	0–50		
Operating temperature	°C	0–70		
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)		

Dimensions





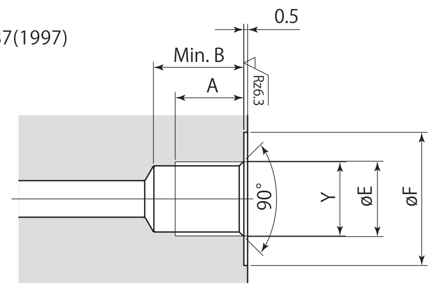
mm

Model	VCE01	VCE02	VCE03
A	9	13	13
B	10	14	14
øE	9.9	13.3	16.8
øF	17.5	21.5	24.5
Y	G1/8	G1/4	G3/8
øVA	16	21	24
VB	13	13	14
VE	12	17	19
VF	10.5	10.5	11.5

- Use a closed wrench or socket wrench for mounting and dismounting.
- Air bleeding valve can be mounted on hydraulic port (G port) when manifold piping.

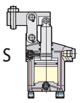
Mounting details

Rz: ISO4287(1997)

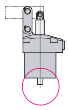
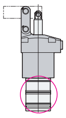


Applicable clamp and work support

Model	VCE01	VCE02	VCE03
Swing clamp (double acting)	CTM03, 04, 05, 06, 10 CTP04, 05, 06 CTU01, 02, 04, 06	CTM16 CTU10, 16	CTU25
Swing clamp (single acting)	CTN02, 04, 05, 06 CTT01, 02, 04, 06	CTN10, 16 CTT10, 16	CTT25
Swivel clamp (double acting)	CTS04, 06	CTS10, 16	–
Link clamp (double acting)	CLM03, 04, 05, 06, 10 CLP04, 05, 06 CLU02, 04, 06	CLM16 CLU10, 16	CLU25
Link clamp (single acting)	CLN04, 05, 06 CLT02, 04, 06	CLN10, 16 CLT10, 16	CLT25
Work lift cylinder	CNB01, 02, 04	–	–
Push, pull cylinder	CNA02, 04, 06	CNA10, 16	CNA25
Work support	CSU CST CSP-D(CSN, CSY, CSK)	–	–

		model CLM Page →148	model CLN Page →188
Link clamp			
Specifications		7MPa Double acting	7MPa Single acting
Features		Low profiled cylinder Built-in sensor model	Low profiled cylinder Built-in sensor model
Variations	3 point sensor model 	CLM-T **Page →162**	—
	Clamp sensor model 	CLM-C **Page →170**	—
	Unclamp sensor model 	CLM-B **Page →178**	CLN-B **Page →200**
	Compact model (without sensor) 	CLM-N **Page →182**	CLN-N **Page →204**
	Bottom piping specifications 	*	—
Option	Flow control valve 	VCF **Page →238**	
	Air bleeding valve 	VCE **Page →240**	

*:Contact Pascal for the details.

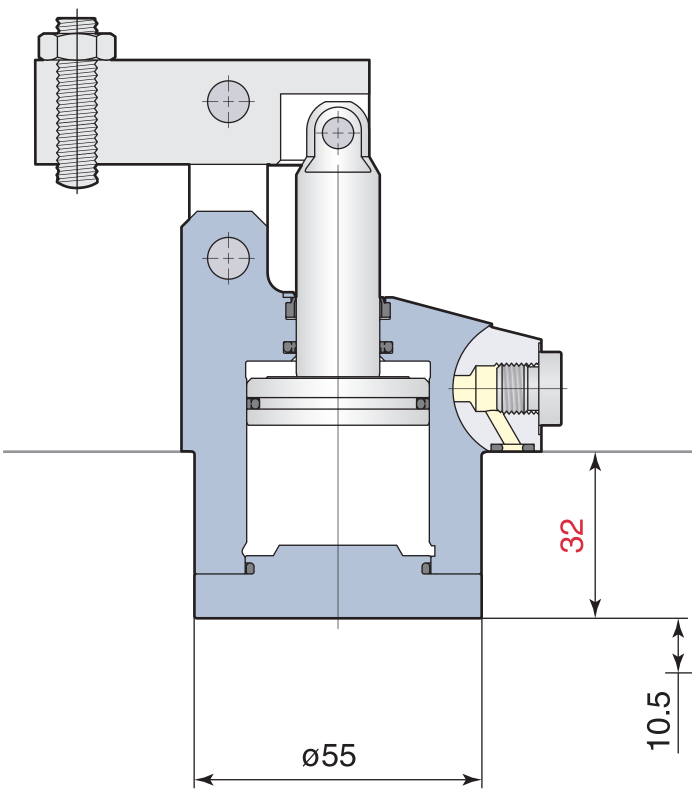
Link clamp		model **CLU** **Page →210** 	model **CLT** **Page →226** 
Specifications		7MPa Double acting	7MPa Single acting
Features		Standard model	Standard model
Variations	Standard 	CLU **Page →216**	CLT **Page →232**
	Dual rod 	CLU-E **Page →219**	—
	Air sensor 	CLU-A **Page →220**	—
Option	Flow control valve 	VCF **Page →238**	
	Air bleeding valve 	VCE **Page →240**	

Super compact body

The significant downsizing is realized compared to the conventinal model.

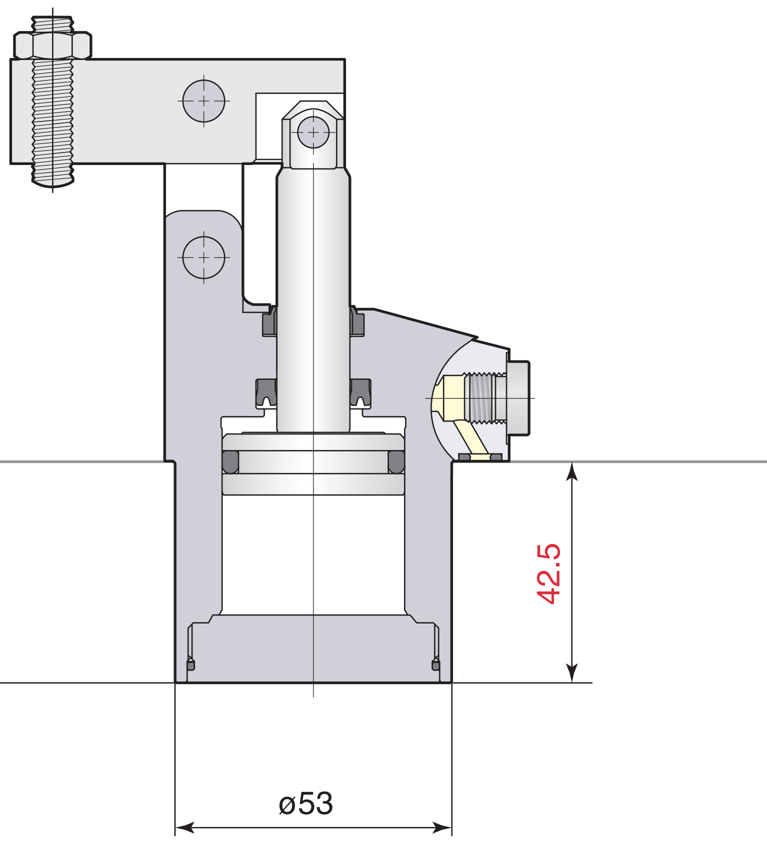
Compact model

(without sensor)



Standard model

(without sensor)



	model **CLM06-FN**	model **CLU06-F**
Cylinder force (at 7MPa)	6.7 kN	6.7 kN

Super compact body

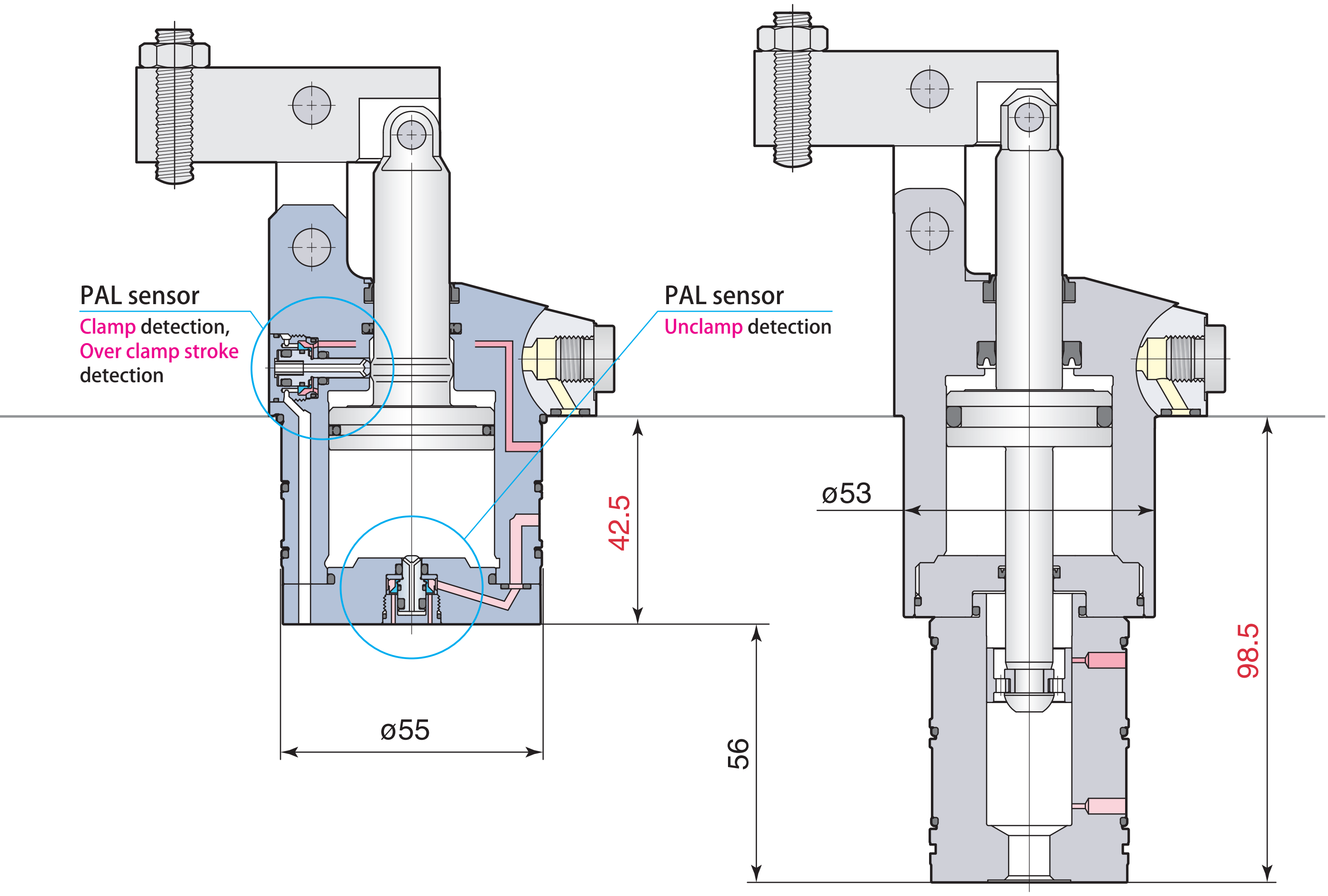
Enables a jig to be compact and simple structure with an excellent sensor function

3 point sensor model

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

Air sensor model

Clamp, Unclamp detection



model CLM06-FT	model CLU06-FA
6.7 kN	6.2 kN

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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.

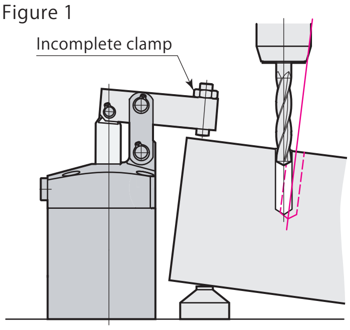
3 point sensor model

Clamp sensor model

Unclamp sensor model

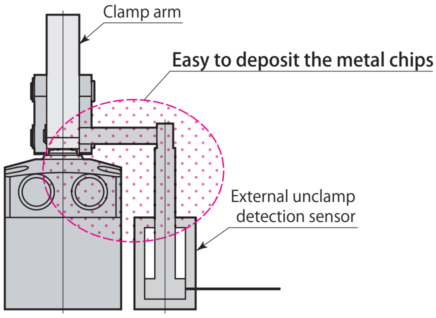
- Sensor model can prevent tool breakage and defective machining due to incomplete clamp. (Figure 1)
- Unclamp PAL sensor moves along with the piston rod and can positively detect unclamping point, thereby enabling a high-speed production line by fully synchronizing operation with workpiece lifters.
- 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



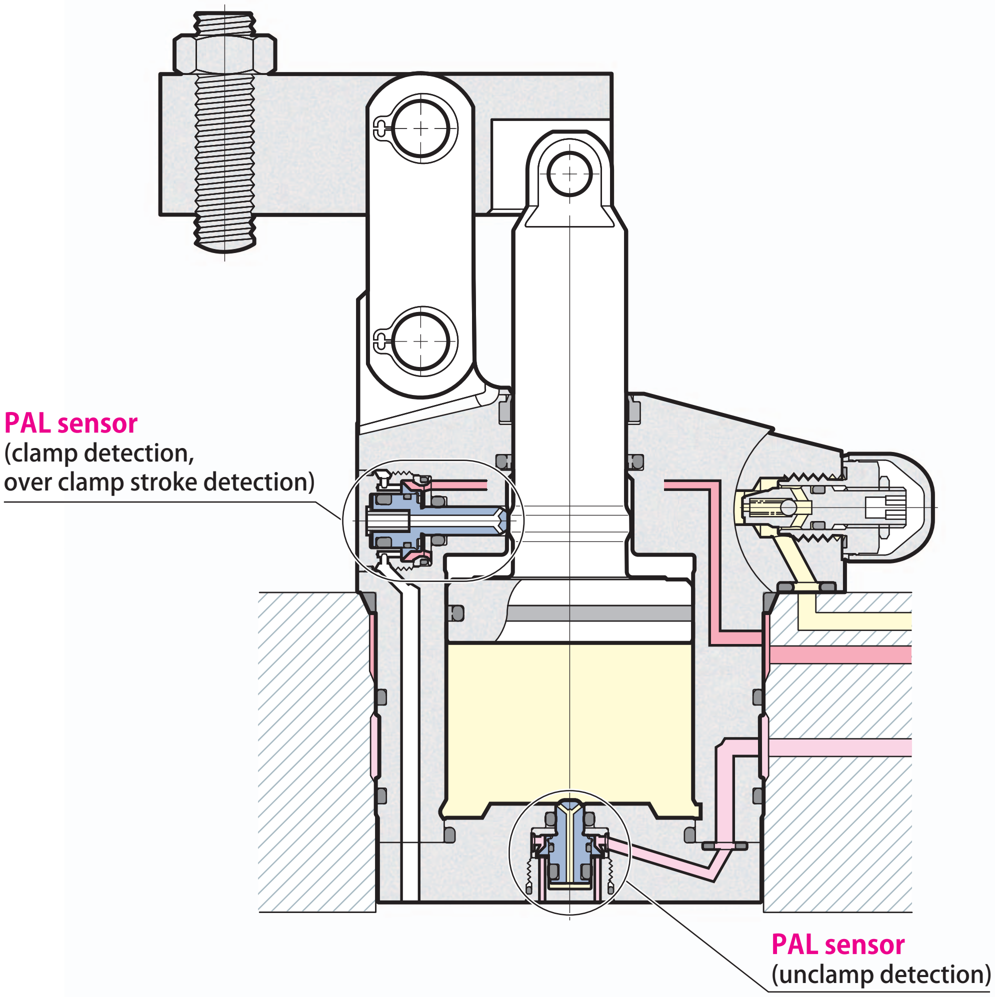
Machining failure due to incomplete clamp

Figure 2



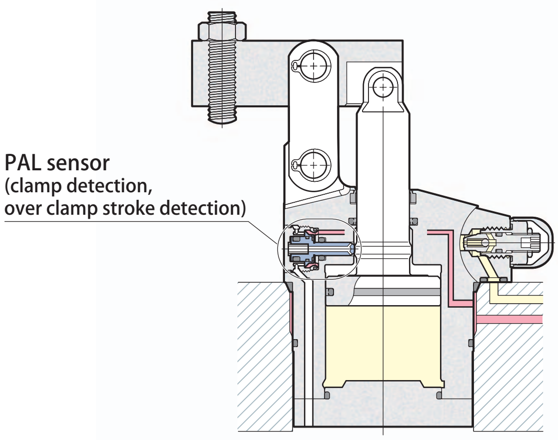
3 point sensor model

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



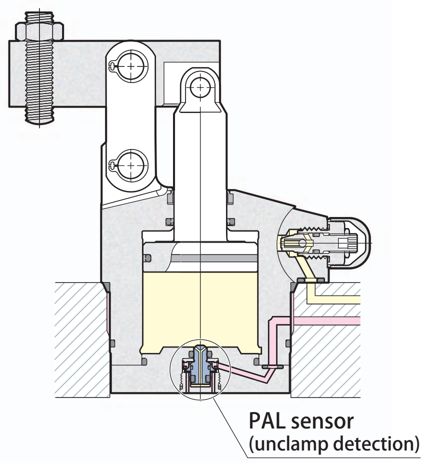
Clamp sensor model

Clamp, Over clamp stroke (Incomplete clamp) detection



Unclamp sensor model

Unclamp detection



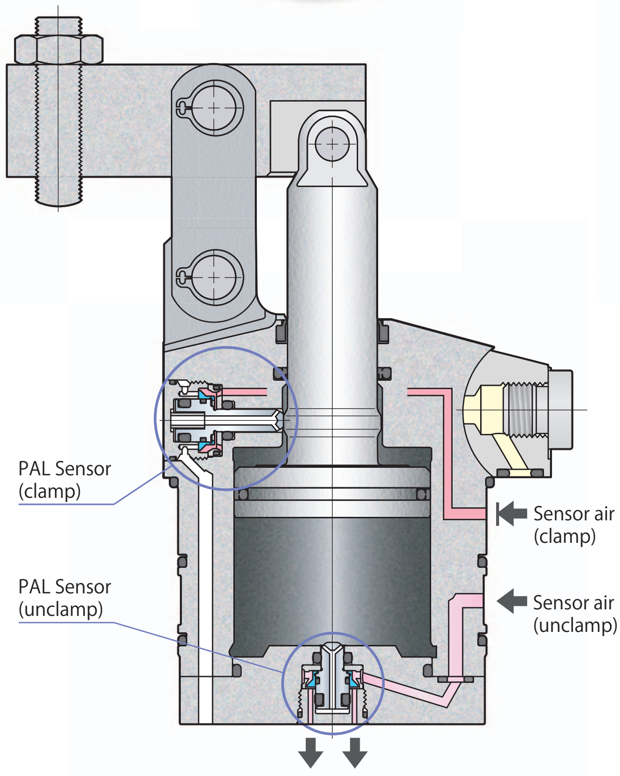
3 point sensor model T

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

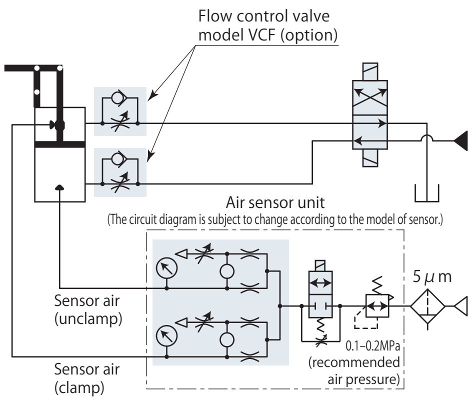
model **CLM□-□T** PAT.

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 →158–161** for the details.



Hydraulic and pneumatic circuit diagram



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PAL sensor	page → 158
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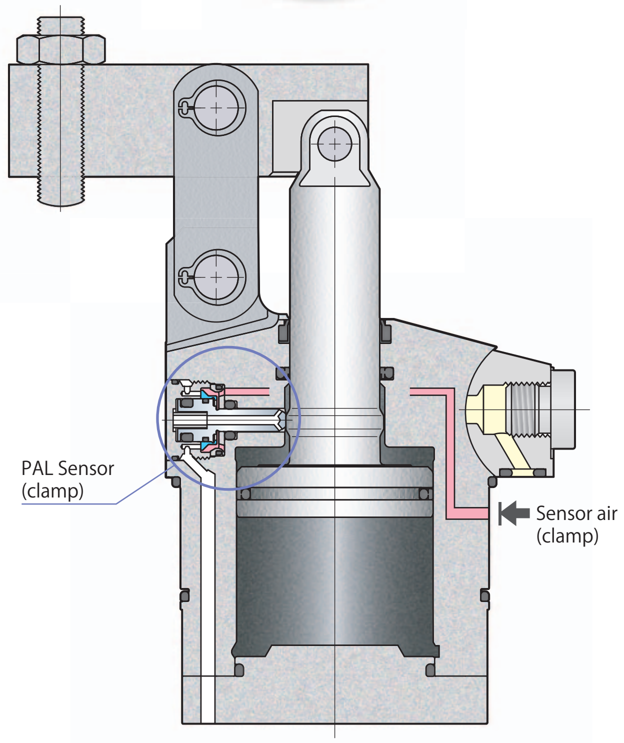
Clamp sensor model C

Clamp, Over clamp stroke (Incomplete clamp) detection

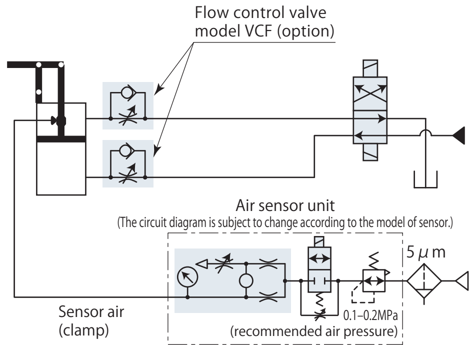
model **CLM□-□C** PAT.

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

Refer to **pages →166–169** for the details.



Hydraulic and pneumatic circuit diagram



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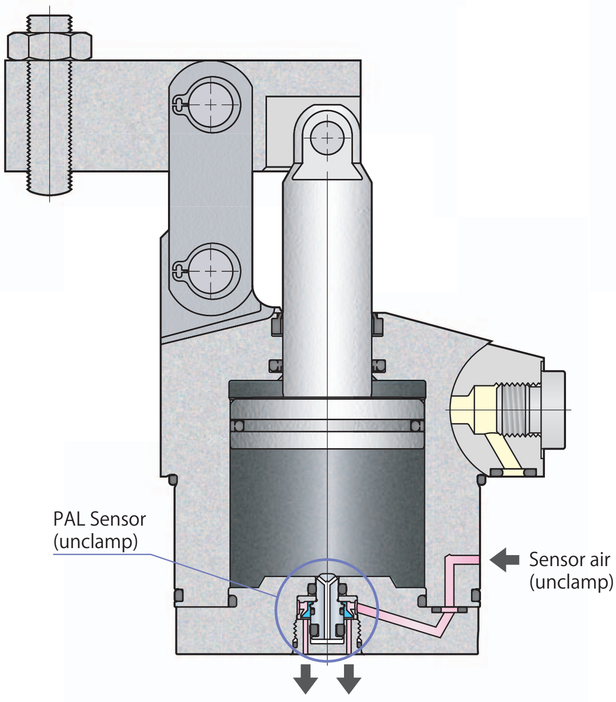
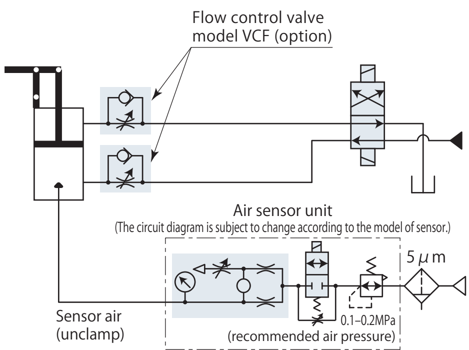
Unclamp sensor model B

model **CLM□-□B** PAT.



Hydraulic and pneumatic circuit diagram



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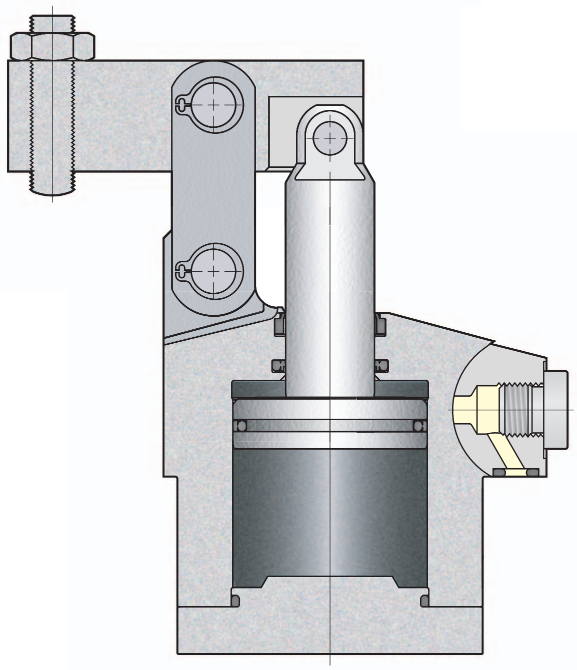
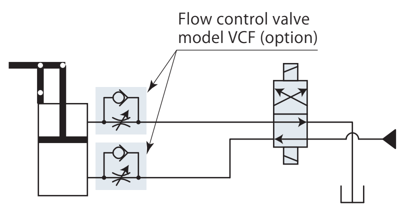
Compact model N

model **CLM□-□N**

No sensors available on compact model



Hydraulic circuit diagram



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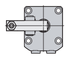
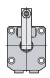
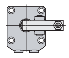
Specifications

CLM – Size – Clamp arm mounting direction – Sensor model

Size: 03* / 04 / 05 / 06 / 10 / 16

Clamp arm mounting direction:

- 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

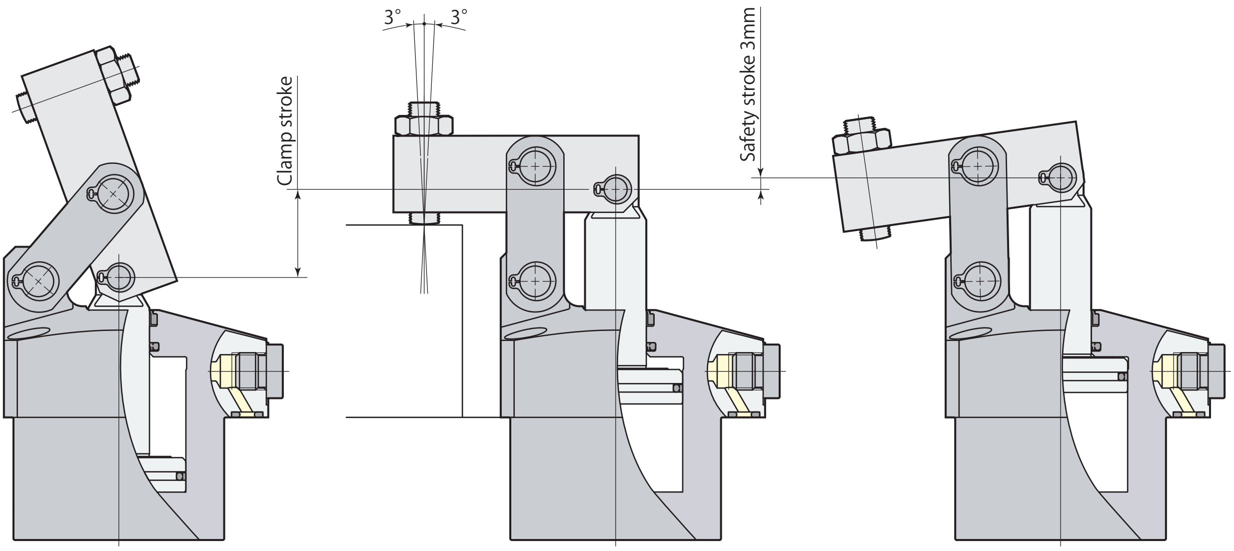
*:For compact model only (CLM03-□N).
Contact Pascal for the details of bottom piping specification.

Model			CLM03	CLM04	CLM05	CLM06	CLM10	CLM16
Cylinder force (hydraulic pressure 7MPa)		kN	3.2	3.7	5.0	6.7	11.1	16.6
Cylinder inner diameter		mm	24	26	30	35	45	55
Rod diameter		mm	10	12	14	16	20	22
Effective area (clamp)		cm^2	4.5	5.3	7.1	9.6	15.9	23.8
Full stroke		mm	18.5	20.5	23.5	26	29.5	35
Clamp stroke*1		mm	16	17.5	20.5	23	26.5	32
Safety stroke		mm	2.5	3	3	3	3	3
Max. oil flow rate		L/min	0.8	1.1	1.7	2.6	5.1	9.1
Cylinder capacity	Clamp	cm^3	8.4	10.9	16.6	25.0	46.9	83.2
	Unclamp	cm^3	6.9	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	0.5	0.6	0.9	1.2	2.0	3.0
Recommended tightening torque of mounting screws*2		N·m	3.5	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°)

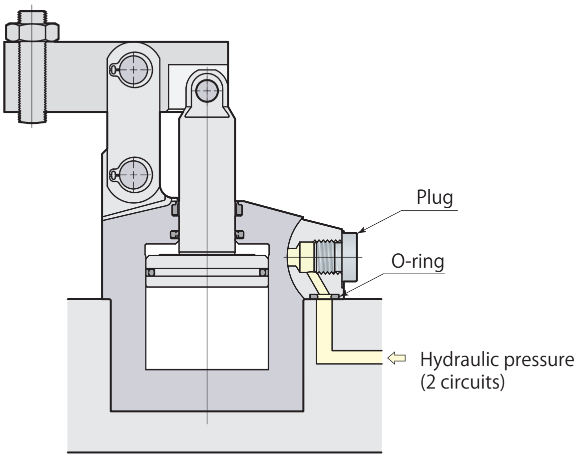


Unclamp | Clamping point | Over clamp stroke (Full stroke)

Manifold piping and G port piping are available.

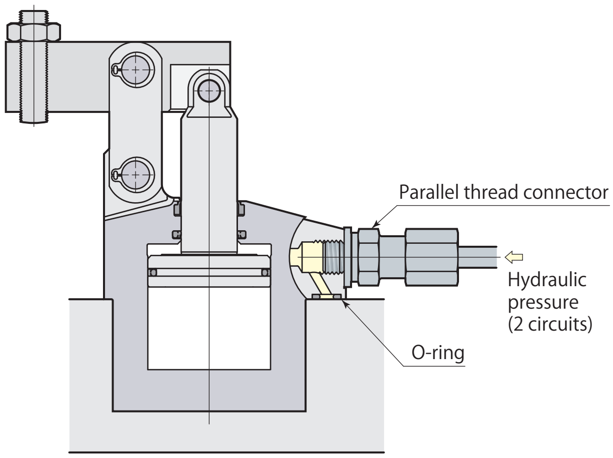
Manifold piping

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 →372** 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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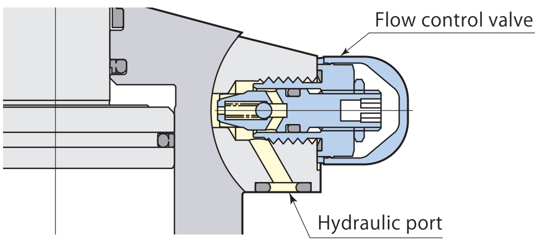

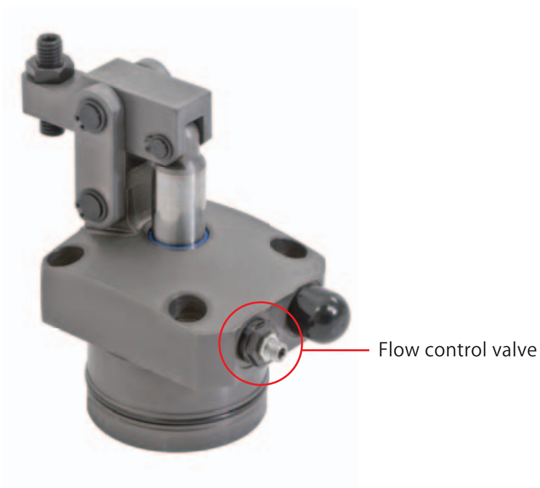

Air bleeding valve model VCE

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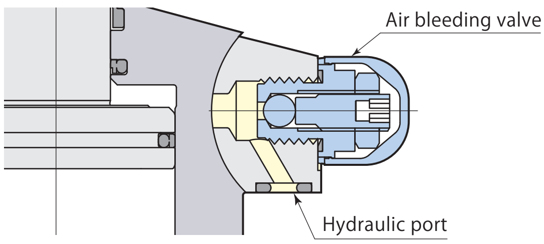
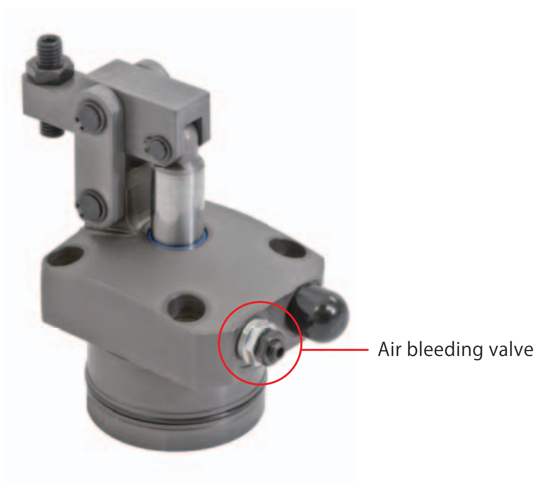
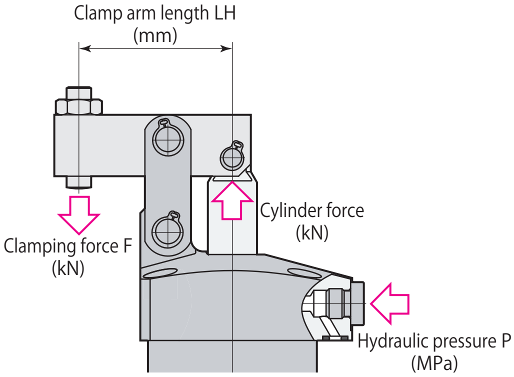




● In case of mounting flow control valve model VCF on the G port of the clamp, air bleeding valve should be installed in the piping to the clamp. (VCE Mounting details. Refer to **page →240**)

Performance diagram



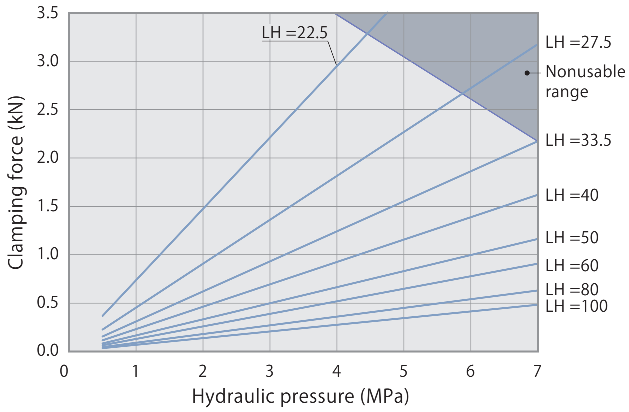
Clamping force varies depending on the clamp arm length (LH) and hydraulic pressure (P).

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

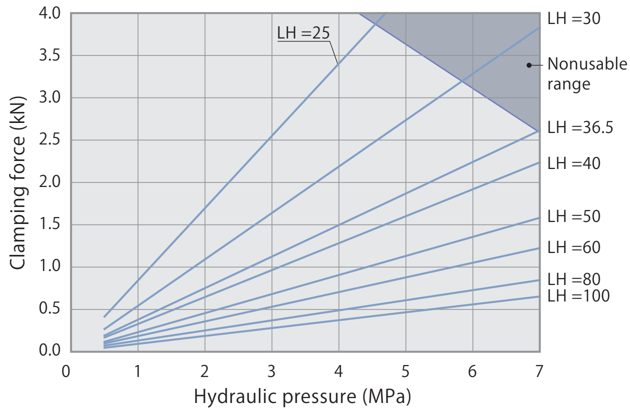
CLM06 with clamp arm length (LH) = 50 mm at hydraulic pressure of 7 MPa, Clamping force F is calculated by
18.18×7/(50-21.0)＝4.4 kN

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

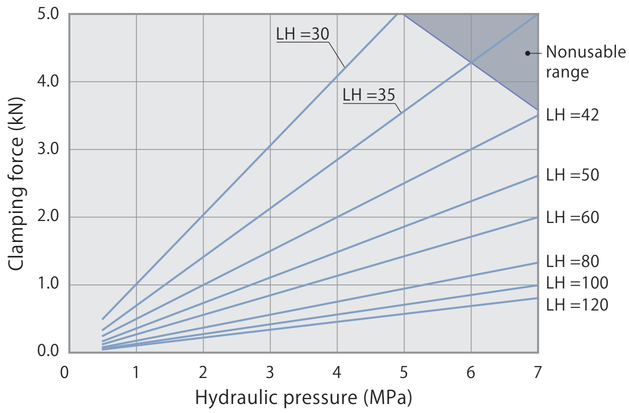
model CLM03



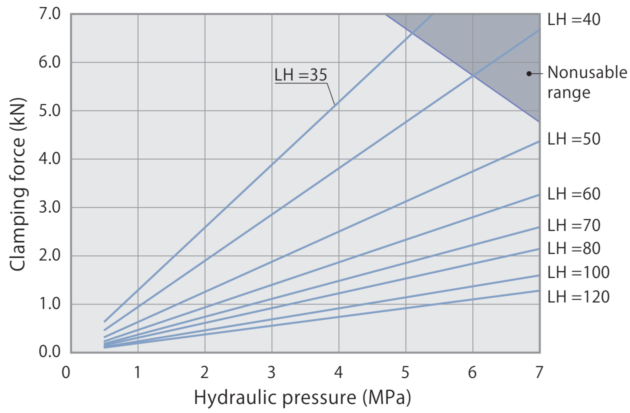
model CLM04



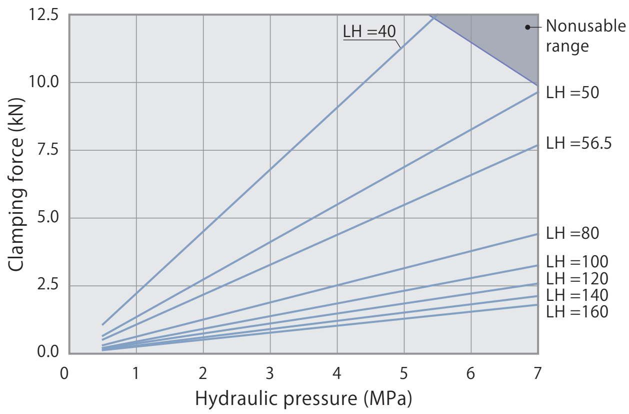
model CLM05



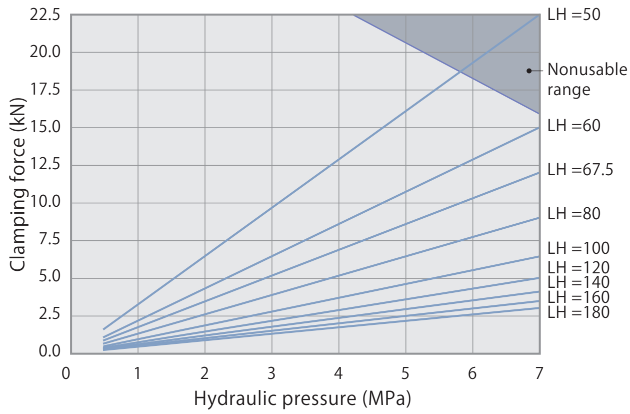
model CLM06



model CLM10



model CLM16



Performance table

model CLM03 Clamping force F=5.90×P/(LH-14.5)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN (Clamp arm length LH mm) 22.5	27.5	33.5	40	50	60	80	100	Min. arm length Min. LH mm
7	3.2				1.6	1.2	0.9	0.6	0.5	34
6.5	2.9			2.0	1.5	1.1	0.8	0.6	0.4	31
6	2.7			1.9	1.4	1.0	0.8	0.5	0.4	29
5.5	2.5		2.5	1.7	1.3	0.9	0.7	0.5	0.4	27
5	2.3		2.3	1.6	1.2	0.8	0.6	0.5	0.3	25
4.5	2.0		2.0	1.4	1.0	0.7	0.6	0.4	0.3	23
4	1.8	3.0	1.8	1.2	0.9	0.7	0.5	0.4	0.3	22
3.5	1.6	2.6	1.6	1.1	0.8	0.6	0.5	0.3	0.2	21
3	1.4	2.2	1.4	0.9	0.7	0.5	0.4	0.3	0.2	↑
2.5	1.1	1.8	1.1	0.8	0.6	0.4	0.3	0.2	0.2	↑
2	0.9	1.5	0.9	0.6	0.5	0.3	0.3	0.2	0.1	↑
1.5	0.7	1.1	0.7	0.5	0.3	0.2	0.2	0.1	0.1	↑
1	0.5	0.7	0.5	0.3	0.2	0.2	0.1	0.1	0.1	↑
0.5	0.2	0.4	0.2	0.2	0.1	0.1	0.1	0.0	0.0	21
Max. pressure MPa		4.4	5.8	7.0	7.0	7.0	7.0	7.0	7.0	

▇ indicates nonusable range

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) 25	30	36.5	40	50	60	80	100	Min. arm length Min. LH mm
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) 30	35	42	50	60	80	100	120	Min. arm length Min. LH mm
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) 35	40	50	60	70	80	100	120	Min. arm length Min. LH mm
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) 40	50	56.5	80	100	120	140	160	Min. arm length Min. LH mm
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)

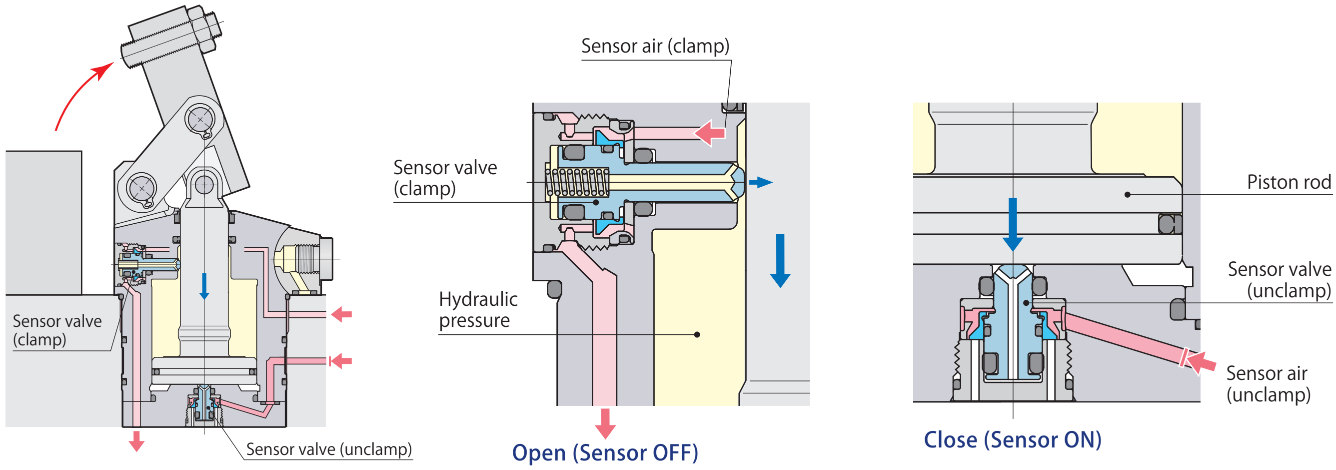
Hydraulic pressure MPa	Cylinder force kN	Clamping force kN (Clamp arm length LH mm) 50	60	67.5	80	100	120	140	160	180	Min. arm length Min. LH mm
7	16.6		15.0	12.0	9.0	6.4	5.0	4.1	3.5	3.0	59
6.5	15.4		13.9	11.1	8.3	6.0	4.6	3.8	3.2	2.8	55
6	14.3		12.8	10.3	7.7	5.5	4.3	3.5	3.0	2.6	52
5.5	13.1	17.6	11.8	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.

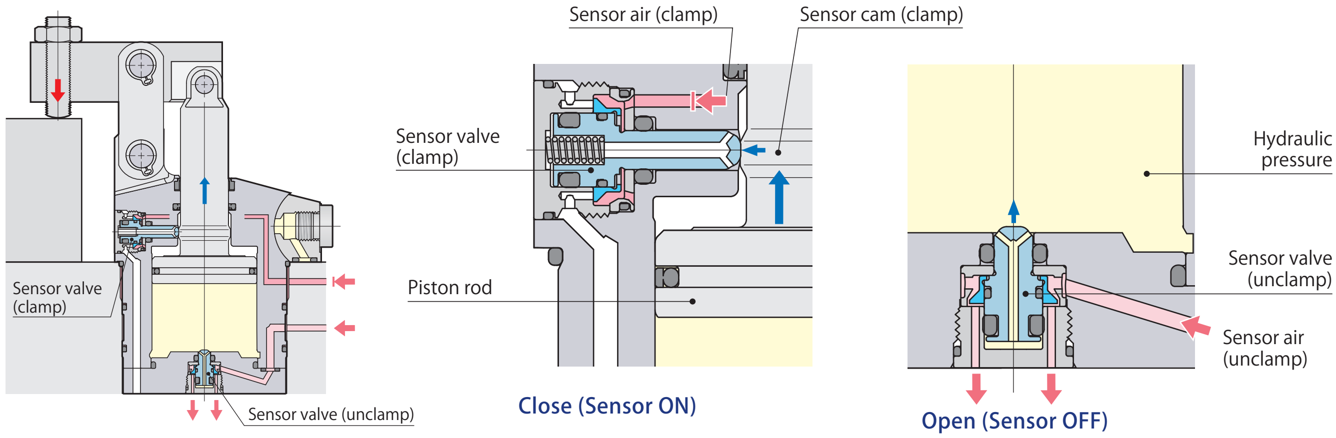
PAL sensor function and structure

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.

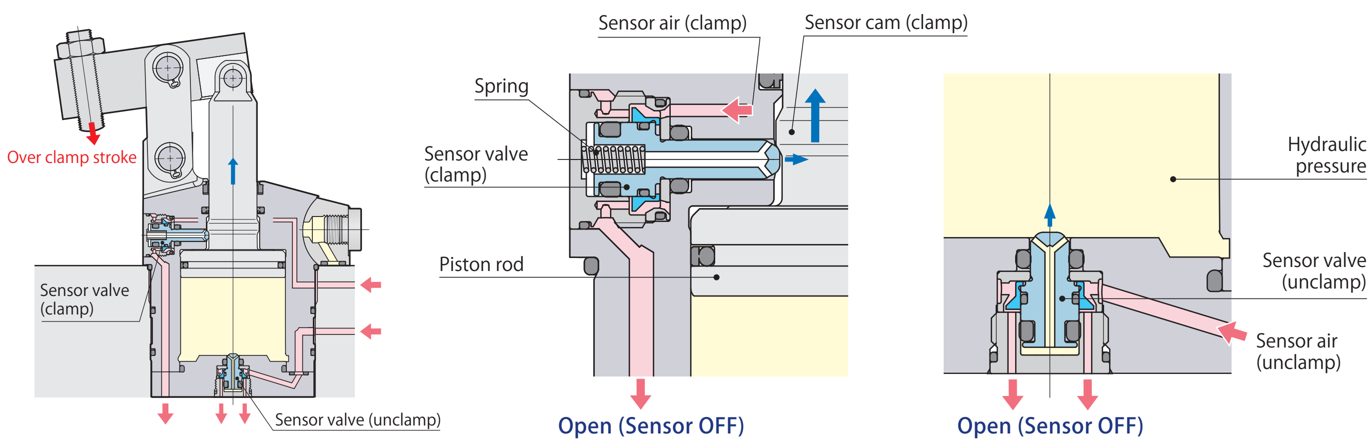
Clamp detection



● 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.

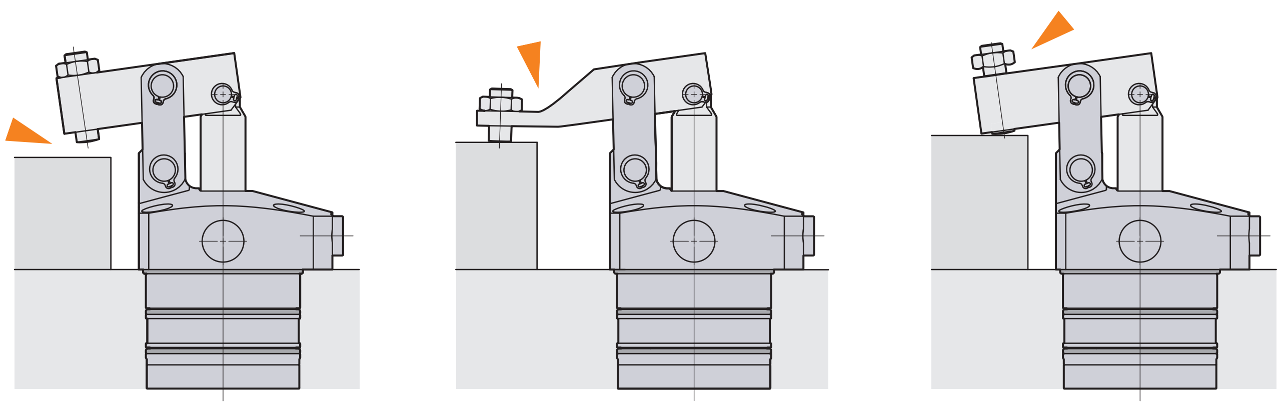
PAL sensor function and structure

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.

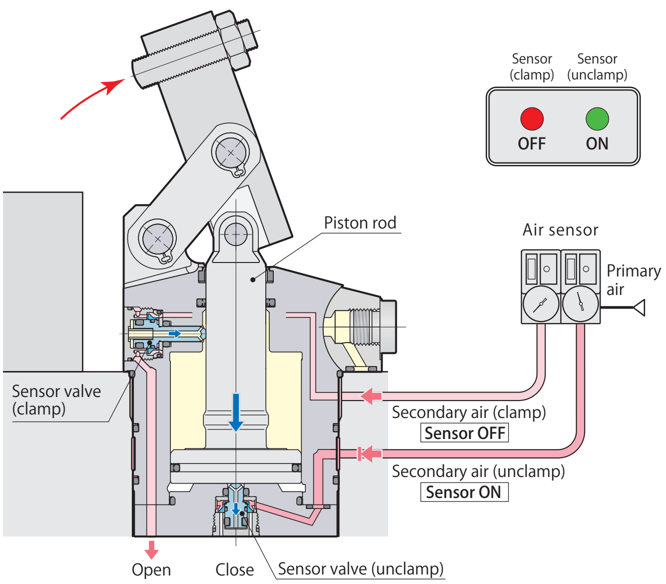
Over clamp stroke (Incomplete clamp) detection example



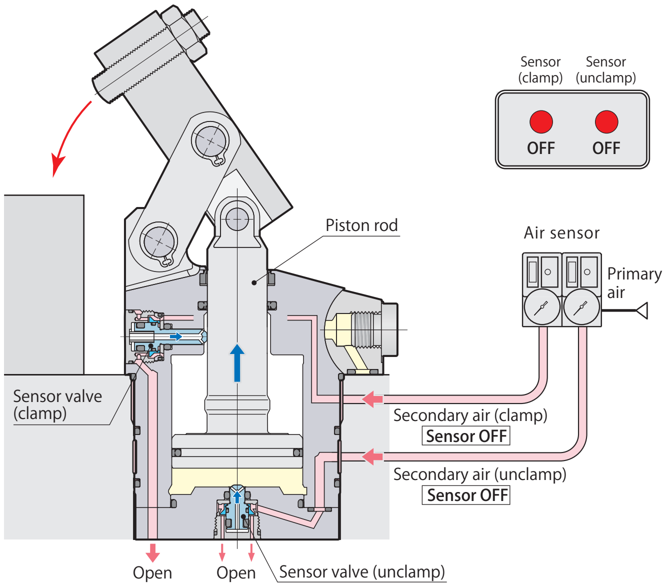
- Clamp disabled due to missetting workpiece.
- Clamp disabled due to the deflection of clamp arm.
- Clamp disabled due to the damage of piston rod or loose adjustment bolt.
- Clamp disabled due to the abrasion on the tip of clamp arm during prolonged use.

Clamp, Unclamp, Over clamp stroke detection signal

Unclamp detection



In the middle of clamp stroke



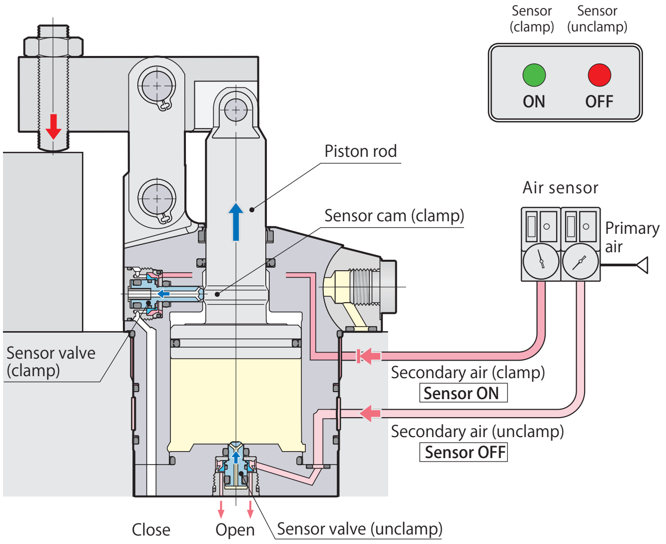
The sensor may not work correctly when the cylinder is not pressurized by hydraulic force because the piston of the clamp moves under such environment. Keep supplying hydraulic force the cylinder all the times.

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

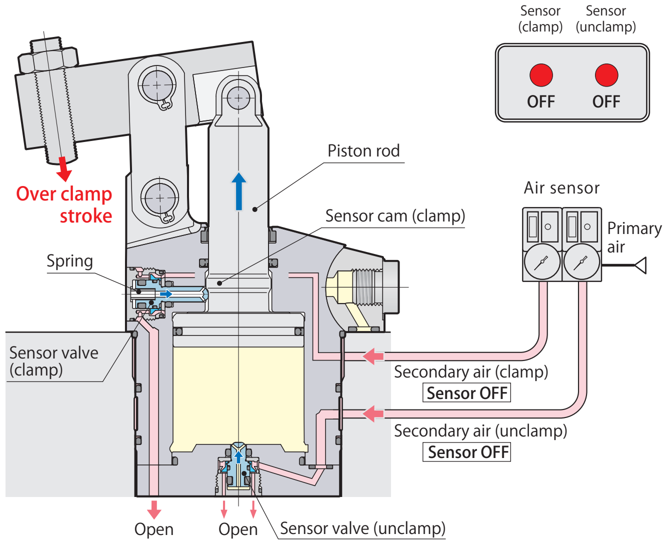
Sensor signal (clamp)	OFF	In the middle of clamp stroke
Sensor signal (unclamp)	OFF	

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



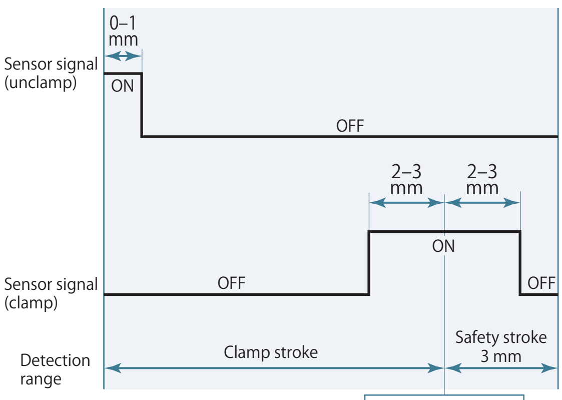
Over clamp stroke (Incomplete clamp) detection



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



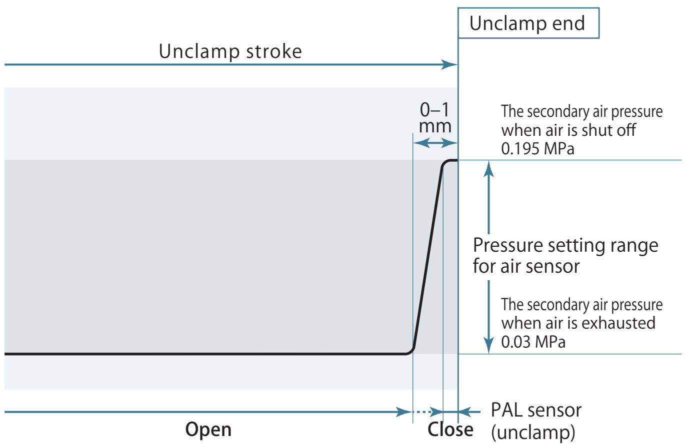
- Refer to the sensor supplier's instruction manual for the details of setting.
- Sensing performance such as detectable time and pressure differs depending on the supplier and model number of the sensor. Select the right model referring to sensor's application and characteristics.

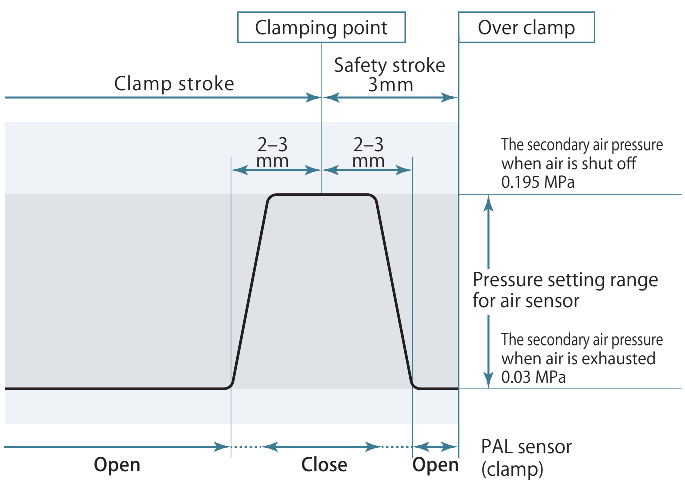
Air sensor unit recommended condition of use

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



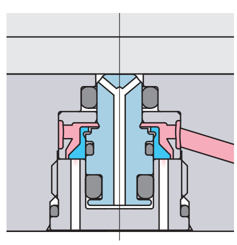


The diagram shown on the left indicates the relation between the PAL sensor, piston stroke, and secondary air pressure. (The pressure shown in the diagram is a reference based on the 0.2 MPa of primary air pressure for one piece of clamp.)

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

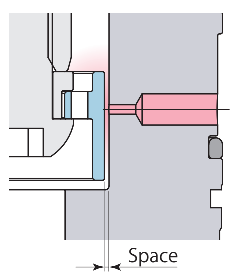
- Enhances the pressure setting range of the sensor which enables the sensor to set easily.
  (Ex. Pressure setting range 0.03–0.195 MPa in the diagram)
- Allows the use for a number of clamps by one air sensor because of better pressure holding when air is shut off.
  (Maximum number of clamps to be 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

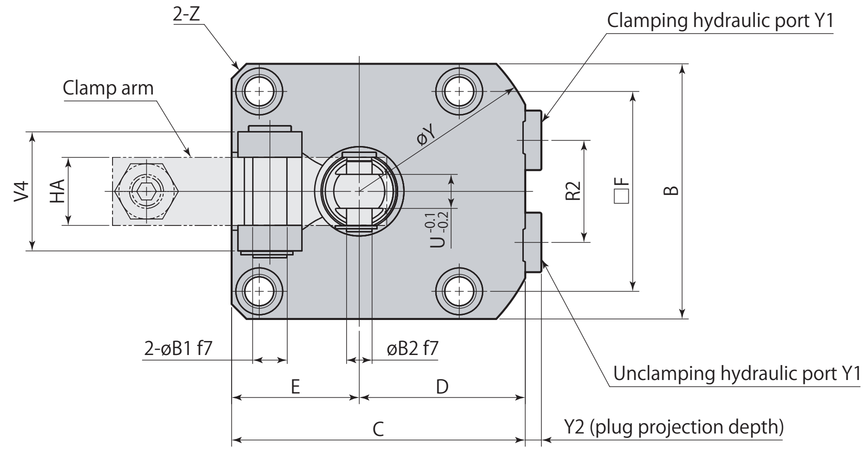


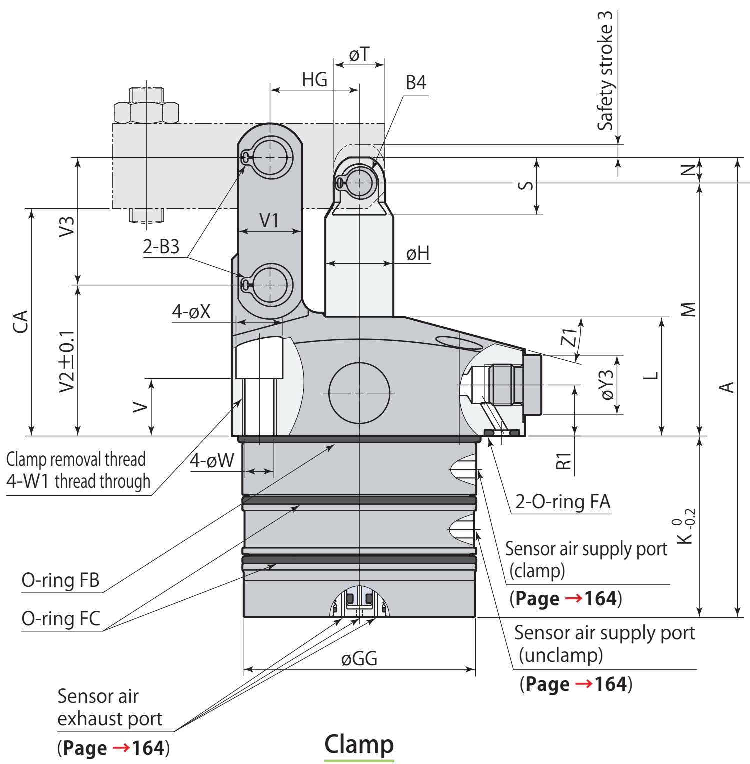
Air leaks easily due to a large space.

Sensing | Link clamp

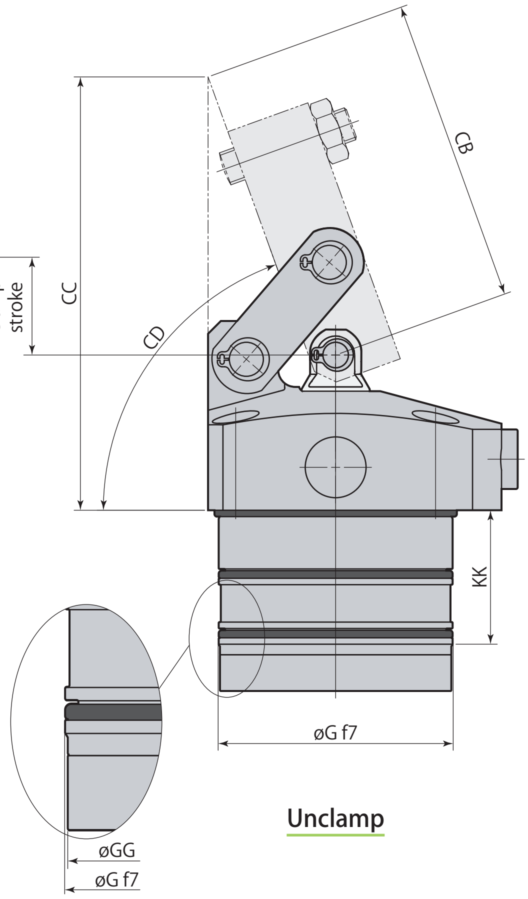
CLM-T 3 point sensor model

Dimensions

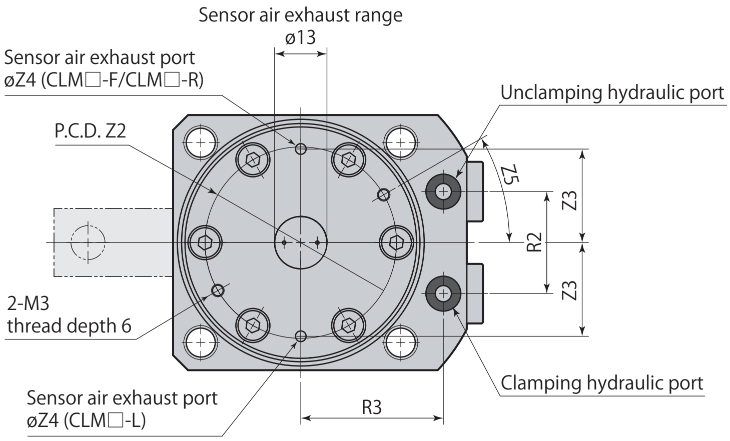




Clamp

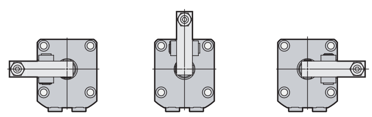


Unclamp



- 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

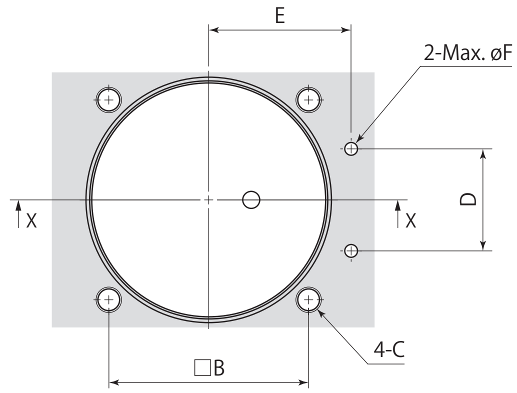
Model	CLM04-□T	CLM05-□T	CLM06-□T	CLM10-□T	CLM16-□T
A	96.5	106	108	124	139.5
B	45	51	60	70	85
C	54	61	69	81	94.5
D	31.5	35.5	39	46	52
E	22.5	25.5	30	35	42.5
F	34	40	47	55	63
øG	$40^{-0.025}_{-0.050}$	$48^{-0.025}_{-0.050}$	$55^{-0.030}_{-0.060}$	$65^{-0.030}_{-0.060}$	$75^{-0.030}_{-0.060}$
øGG	39.4	47.4	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
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

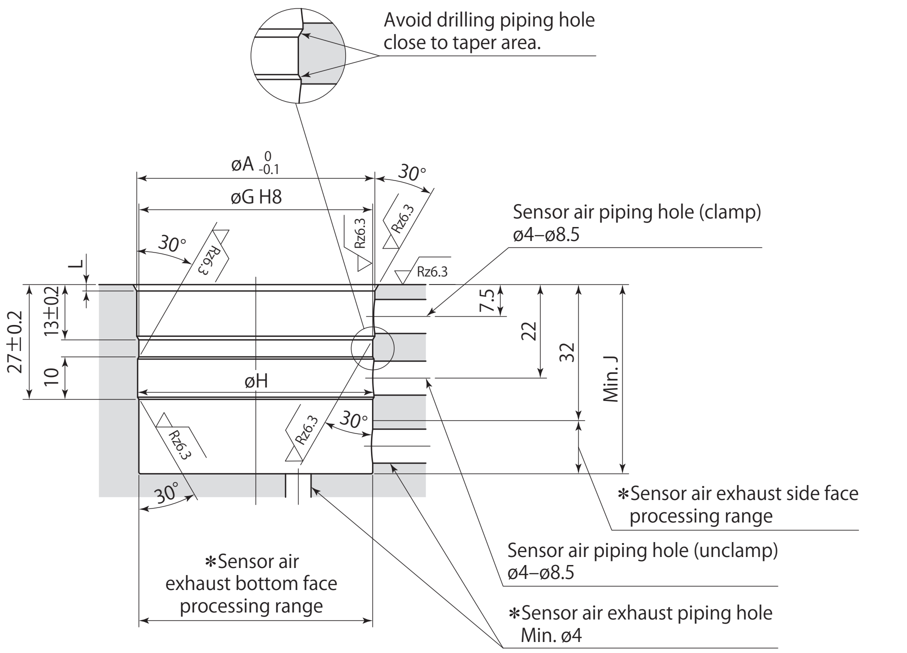
*1: Snap ring is made by Ochiai Corporation.

*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 →238** ● Air bleeding valve **page →240**

Mounting details

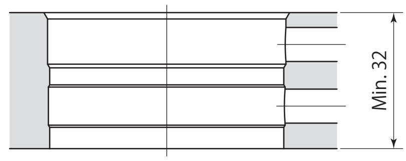




In blind hole X-X

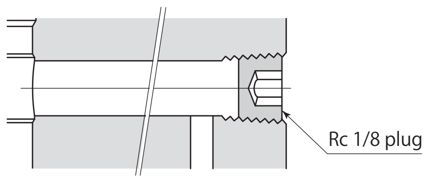
∗: Sensor air exhaust piping hole must be made on either side or bottom face.

Rz: ISO4287(1997)



In through hole X-X

- 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

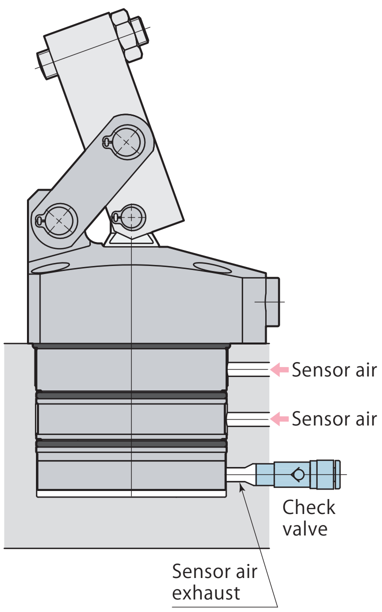
mm

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

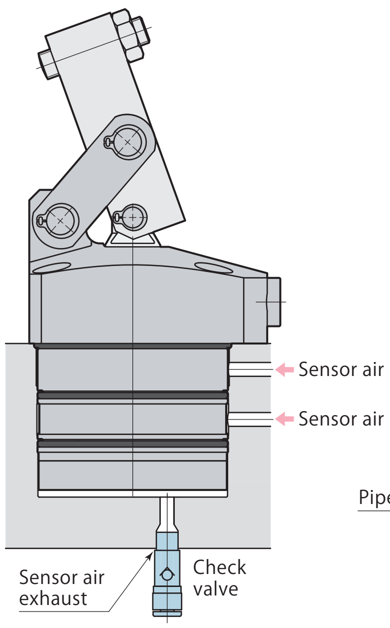
Caution for piping

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

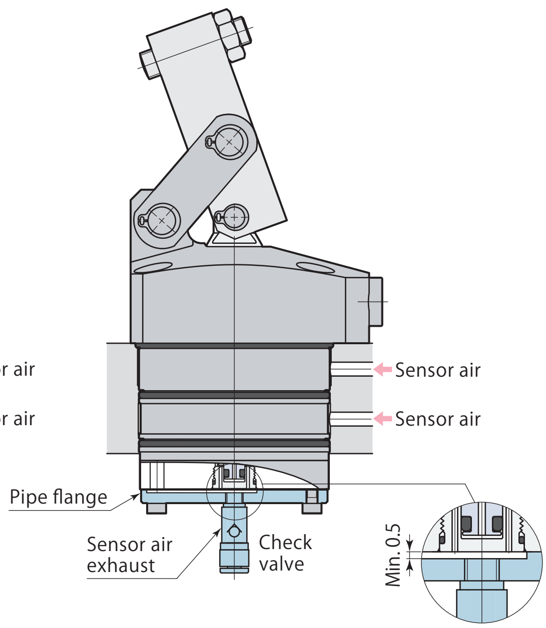
Mounting in blind hole (Sensor air exhaust：side face)



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



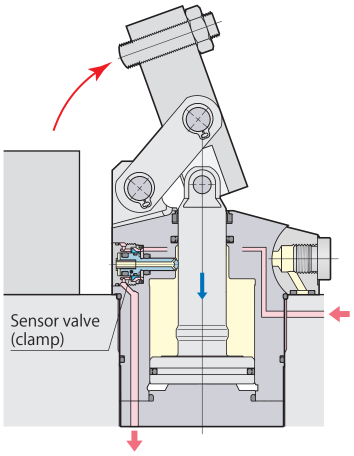
Mounting in through hole

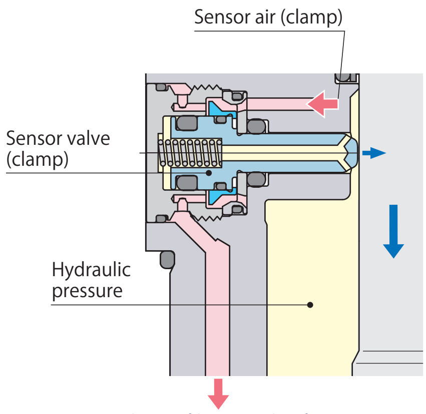


- Use a check valve with cracking pressure of 0.005 MPa or less if there is a risk of metal chips or coolant intrusion. Recommended check valve : AKH or AKB series manufactured by SMC.
- Furnish the piping by means of the pipe flange when mounting in a through hole. The flange is mountable with M3 threads 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

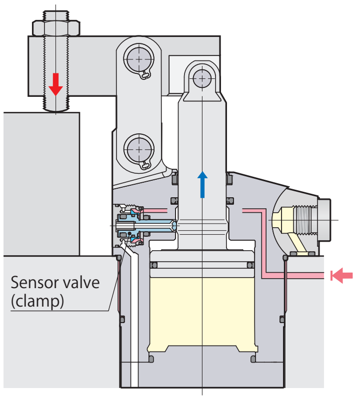


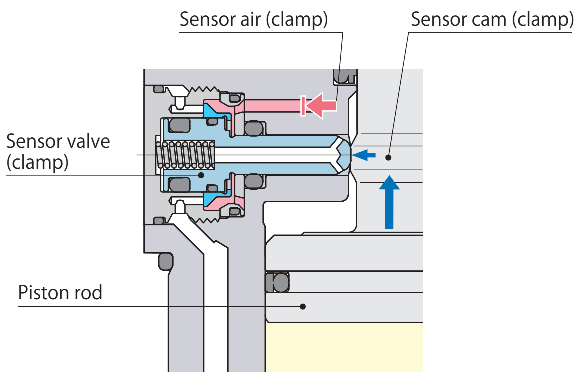


Open (Sensor OFF)

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

Clamp detection



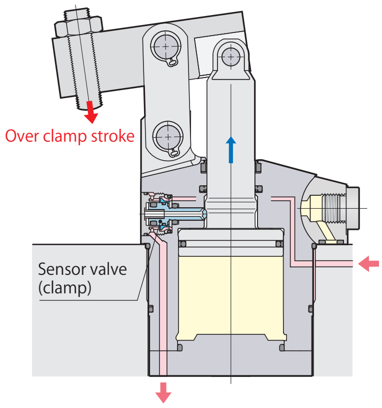


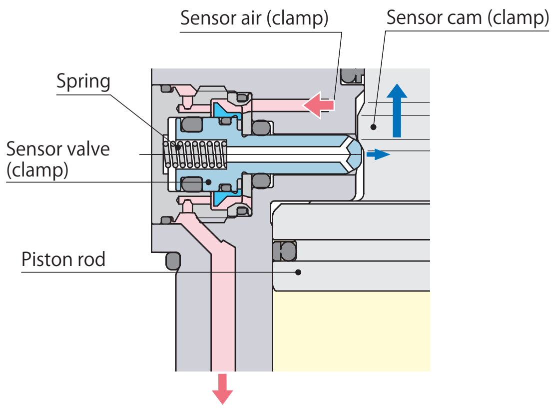
Close (Sensor ON)

● 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

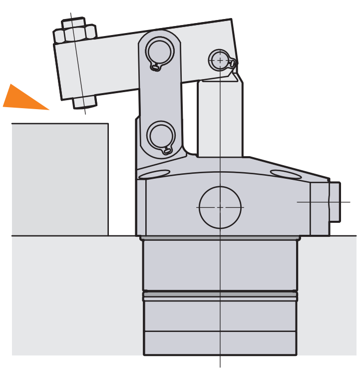
Over clamp stroke (Incomplete clamp) detection

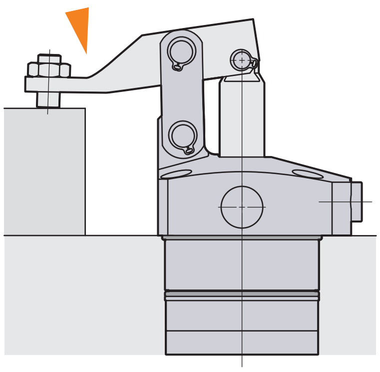


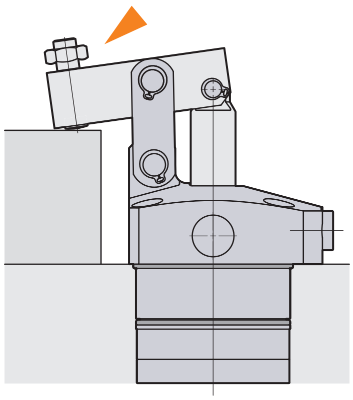


- The sensor cam passes the clamping point, the sensor valve (clamp) is pushed up by the spring and exhausts the sensor air, and detects the over clamp stroked condition.

Over clamp stroke (Incomplete clamp) detection example



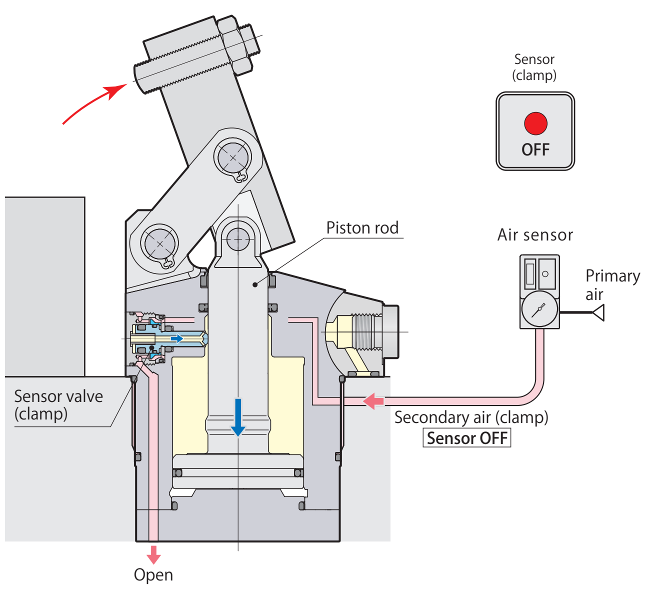




- Clamp disabled due to missetting workpiece.
- Clamp disabled due to the deflection of clamp arm.
- Clamp disabled due to the damage of piston rod or loose adjustment bolt.
- Clamp disabled due to the abrasion on the tip of clamp arm during prolonged use.

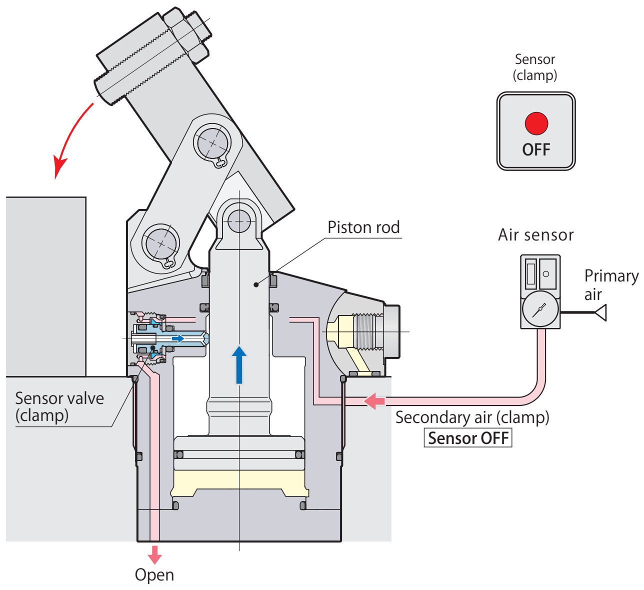
Clamp, Over clamp stroke detection signal

Unclamp



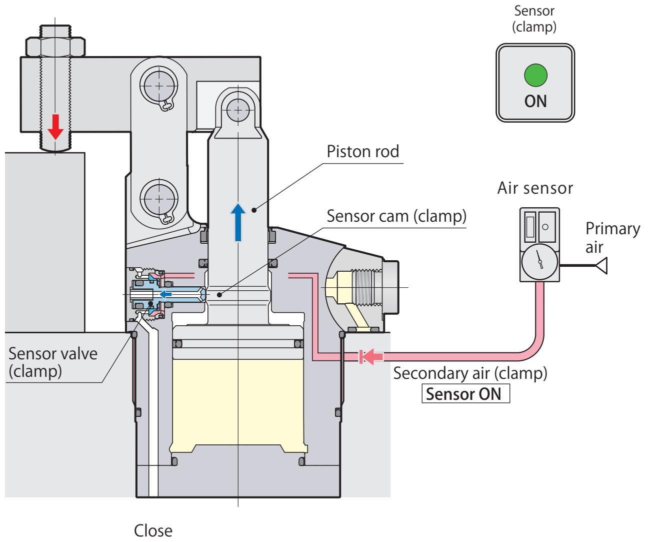
Sensor signal (clamp)	OFF	Unclamp

In the middle of clamp stroke



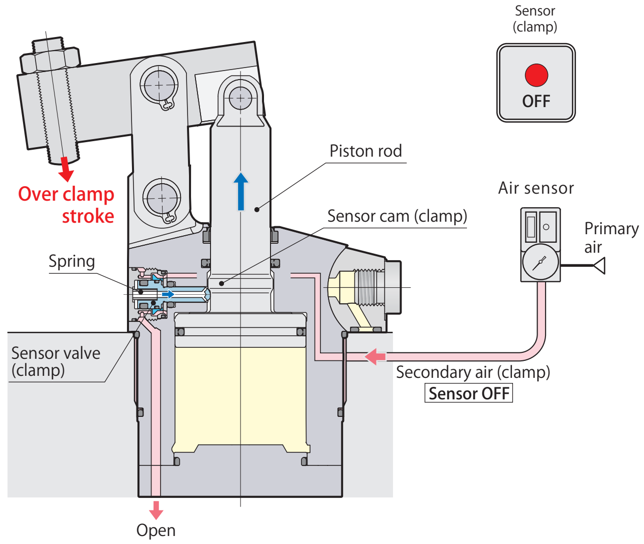
Sensor signal (clamp)	OFF	In the middle of clamp stroke

Clamp detection



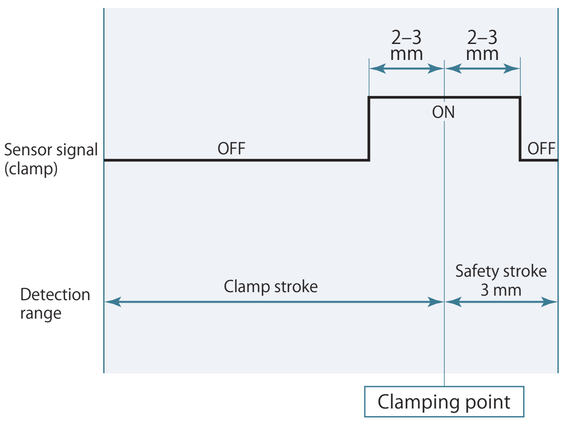
Sensor signal (clamp)	ON	Clamp

Over clamp stroke (Incomplete clamp) detection



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

Air sensor triggering point



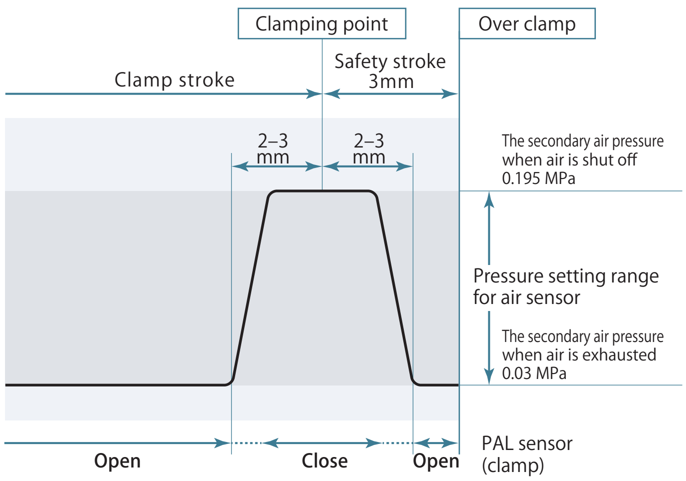
- Refer to the sensor supplier's instruction manual for the details of setting.
- Sensing performance such as detectable time and pressure differs depending on the supplier and model number of the sensor. Select the right model referring to sensor’s application and characteristics.

Air sensor unit 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

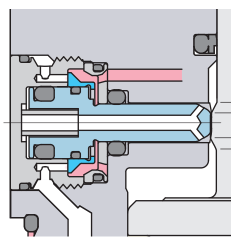


The diagram shown above indicates the relation between the PAL sensor, piston stroke, and secondary air pressure. (The pressure shown in the diagram is a reference based on the 0.2 MPa of primary air pressure for one piece of clamp.)

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

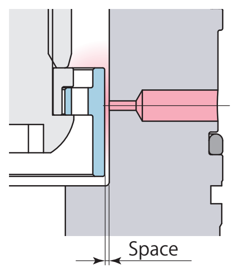
- Enhances the pressure setting range of the sensor which enables the sensor to set easily. (Ex. Pressure setting range 0.03–0.195 MPa in the diagram)
- Allows the use for a number of clamps by one air sensor because of better pressure holding when air is shut off. (Maximum number of clamps to be detected 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



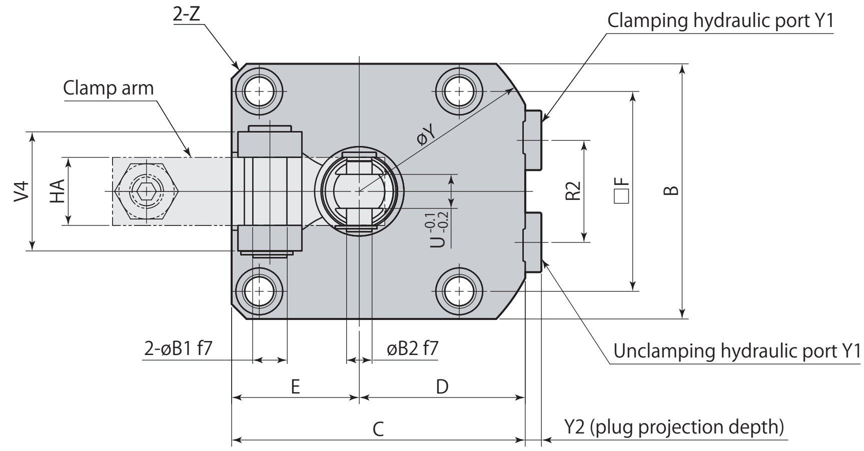
Poppet structure ensures superior sealing performance and can create large differential-pressure when the valve is opening and closing, and air leakage can be minimized.

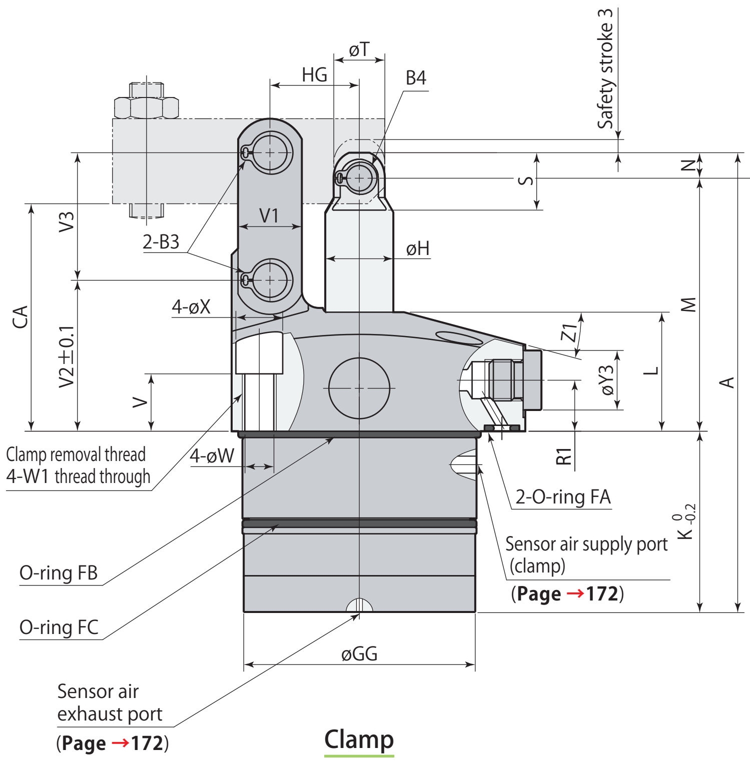
Previous sensor valve



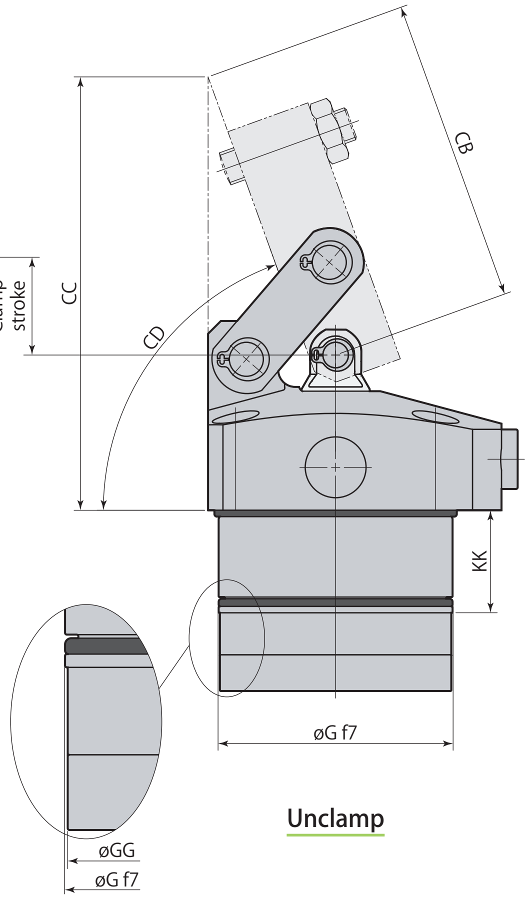
Air leaks easily due to a large space.

Dimensions

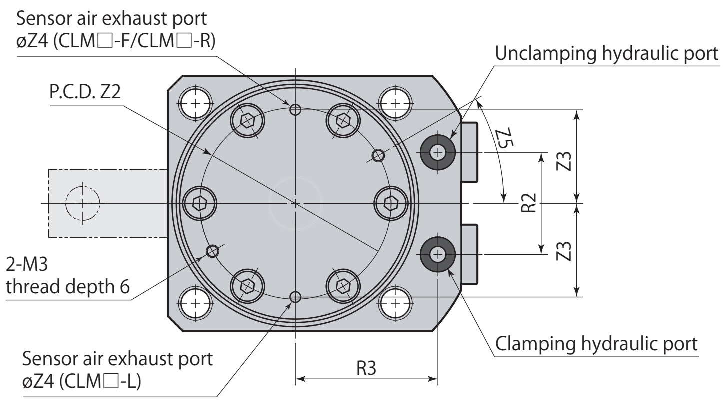




Clamp

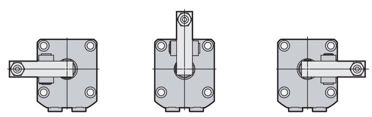


Unclamp



- 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

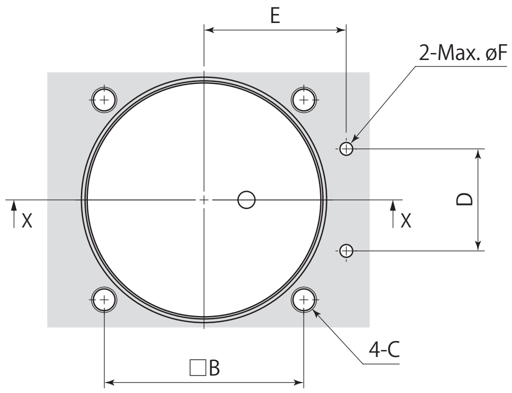
Model	CLM04-□C	CLM05-□C	CLM06-□C	CLM10-□C	CLM16-□C
A	96	106	108	124	139.5
B	45	51	60	70	85
C	54	61	69	81	94.5
D	31.5	35.5	39	46	52
E	22.5	25.5	30	35	42.5
F	34	40	47	55	63
øG	$40^{-0.025}_{-0.050}$	$48^{-0.025}_{-0.050}$	$55^{-0.030}_{-0.060}$	$65^{-0.030}_{-0.060}$	$75^{-0.030}_{-0.060}$
øGG	39.4	47.4	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
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

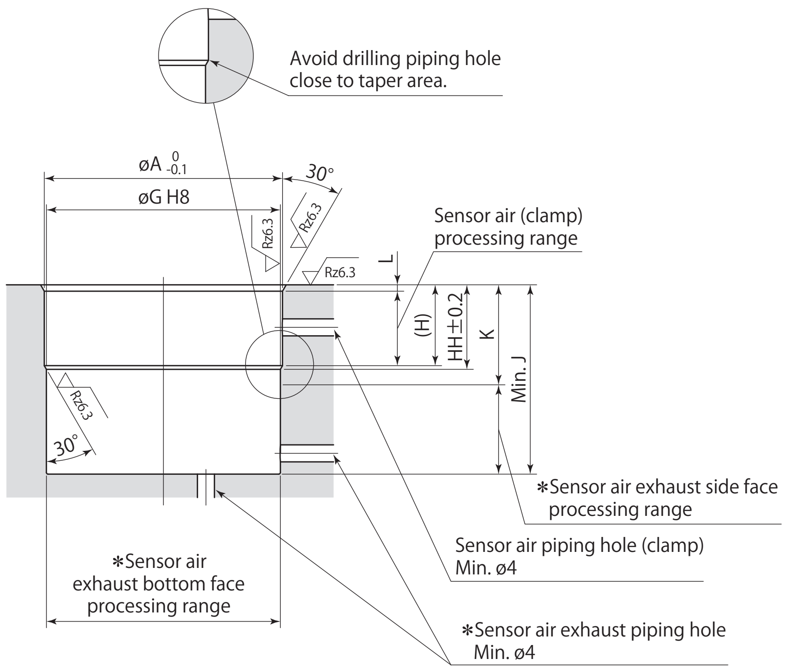
*1: Snap ring is made by Ochiai Corporation.

*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 →238** ● Air bleeding valve **page →240**

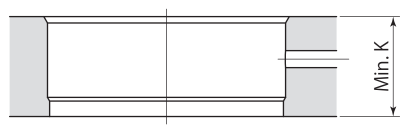
Mounting details





In blind hole X-X

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



In through hole X-X

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.

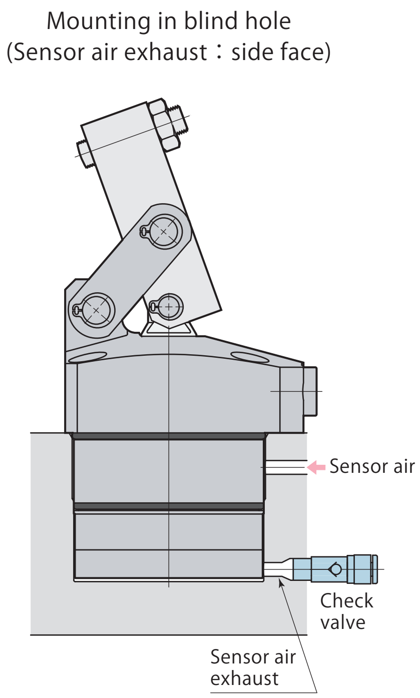
Mounting details

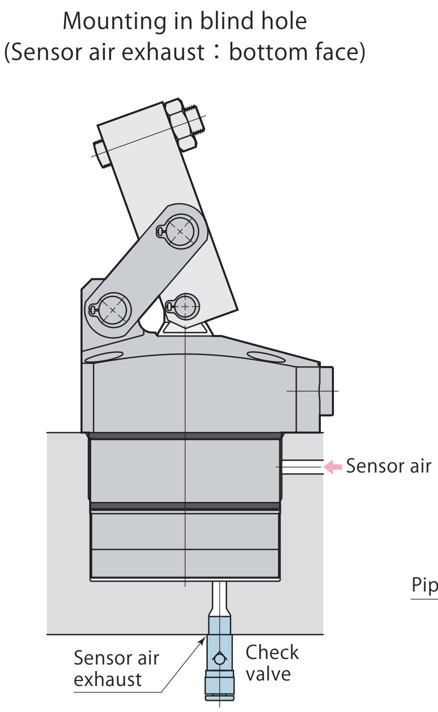
mm

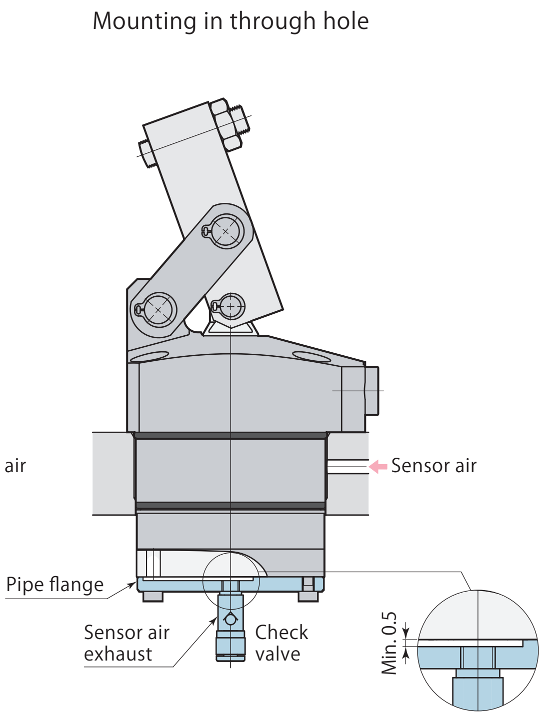
Model	CLM04-□C	CLM05-□C	CLM06-□C	CLM10-□C	CLM16-□C
øA	40.8	49	56	66	76
B	34	40	47	55	63
C	M5	M5	M6	M6	M8
D	18	22	24	30	32
E	26	30	33.5	39.5	45
øF	3	3	3	5	5
øG	$40^{+0.039}_{0}$	$48^{+0.039}_{0}$	$55^{+0.046}_{0}$	$65^{+0.046}_{0}$	$75^{+0.046}_{0}$
H	15	16.5	19	20.5	20.5
HH	15.7	17.4	19.9	21.4	21.4
J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



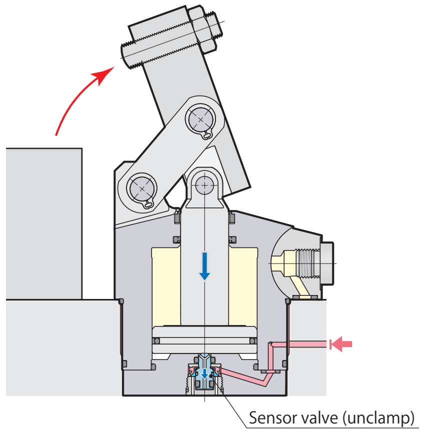


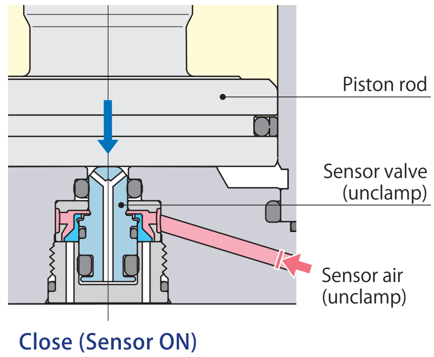


- Use a check valve with cracking pressure of 0.005 MPa or less if there is a risk of metal chips or coolant intrusion. Recommended check valve : AKH or AKB series manufactured by SMC.
- Furnish the piping by means of the pipe flange when mounting in a through hole. The flange is mountable with M3 threads 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

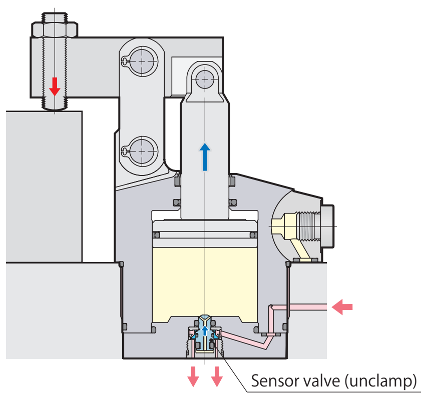
Unclamp detection

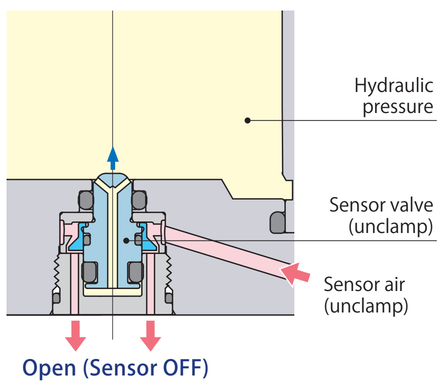




- The sensor valve (unclamp) is pushed down by the piston rod and shuts off the sensor air flow when the piston rod reaches the unclamp end, and detects the unclamped condition.

In the middle of clamp stroke

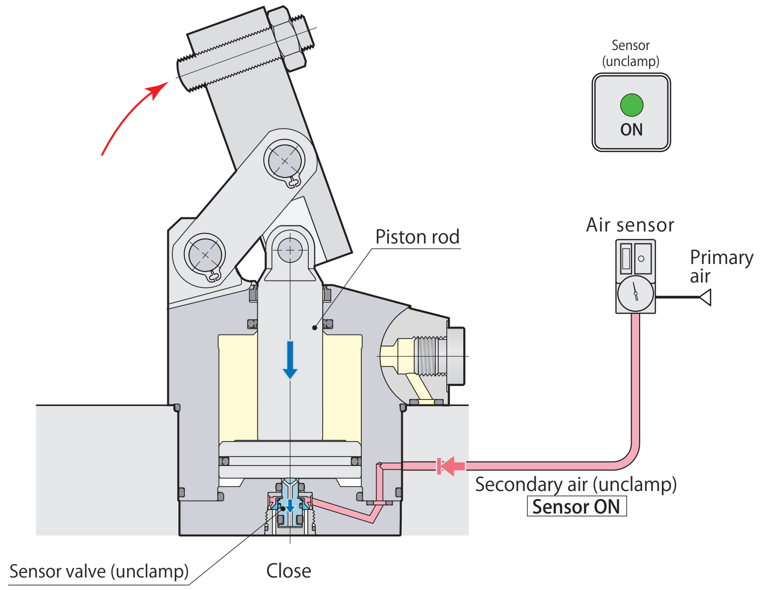




- The sensor valve (unclamp) is pushed up by the hydraulic force to open for air exhaust while piston rod strokes.

Unclamp detection signal

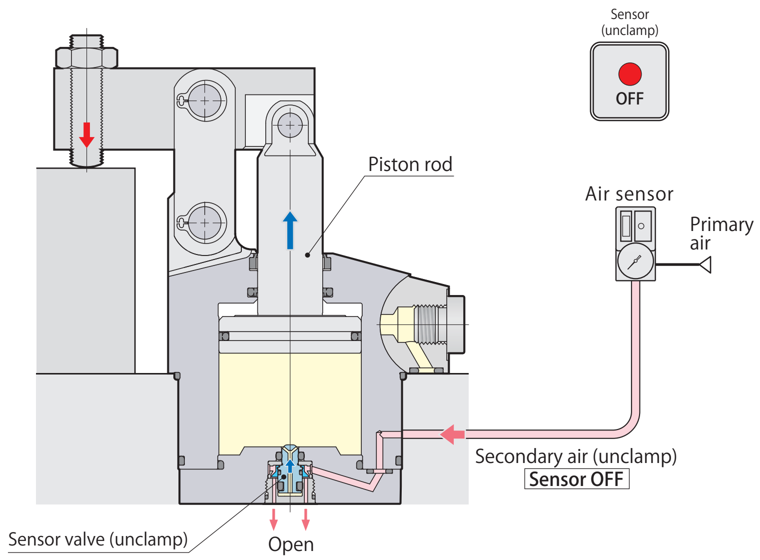
Unclamp detection



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

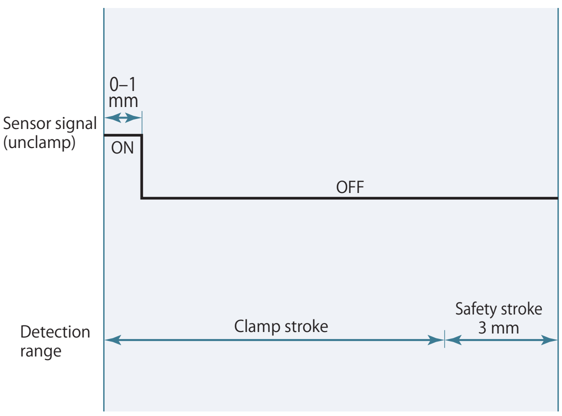
In the middle of clamp stroke



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



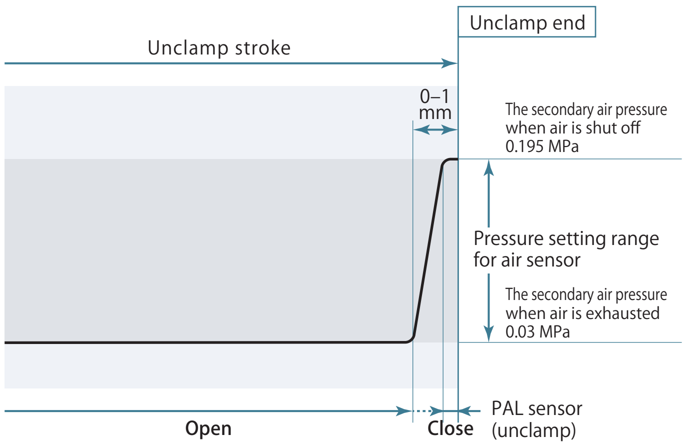
- Refer to the sensor supplier's instruction manual for the details of setting.
- Sensing performance such as detectable time and pressure differs depending on the supplier and model number of the sensor. Select the right model referring to sensor's application and characteristics.

Air sensor unit 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

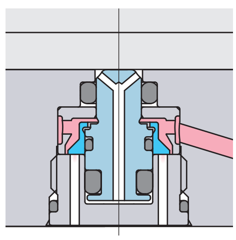


The diagram shown above indicates the relation between the PAL sensor, piston stroke, and secondary air pressure. (The pressure shown in the diagram is a reference based on the 0.2 MPa of primary air pressure for one piece of clamp.)

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

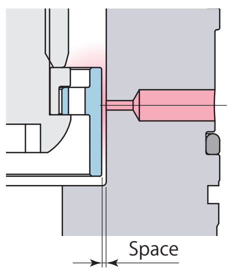
- Enhances the pressure setting range of the sensor which enables the sensor to set easily. (Ex. Pressure setting range 0.03–0.195 MPa in the diagram)
- Allows the use for a number of clamps by one air sensor because of better pressure holding when air is shut off. (Maximum number of clamps to be detected 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



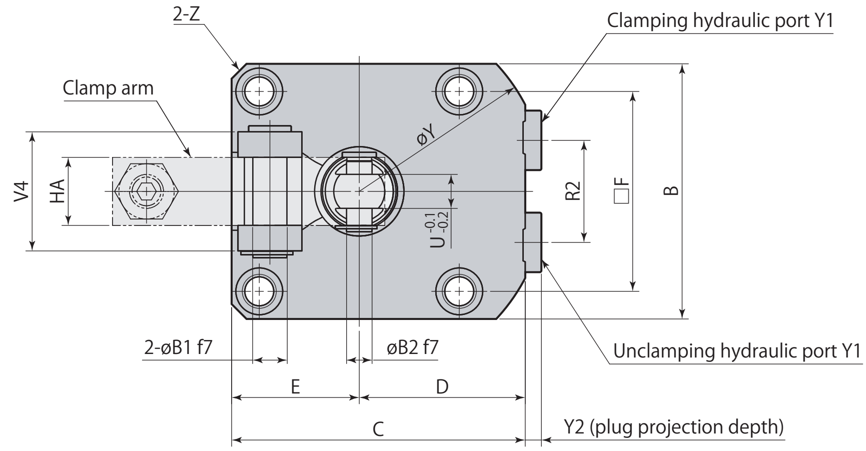
Poppet structure ensures superior sealing performance and can create large differential-pressure when the valve is opening and closing, and air leakage can be minimized.

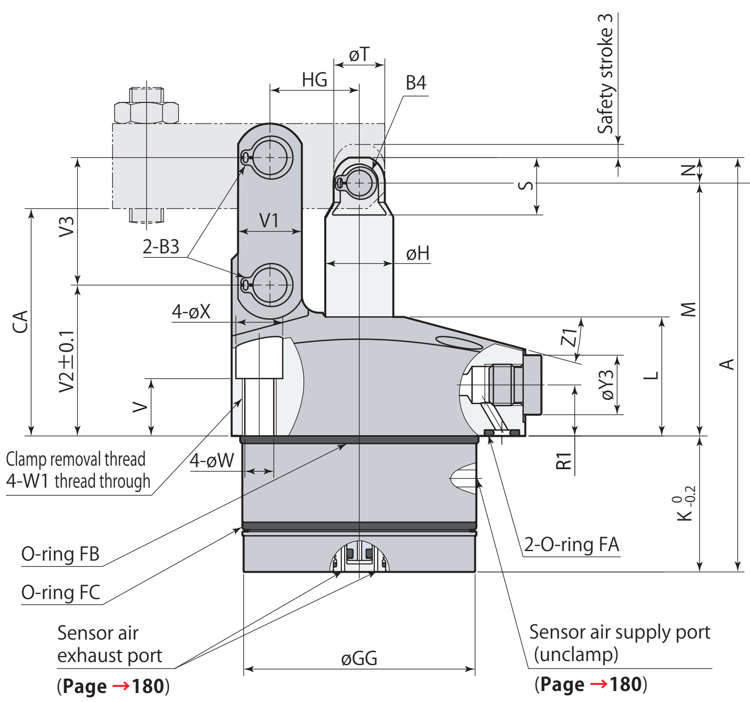
Previous sensor valve



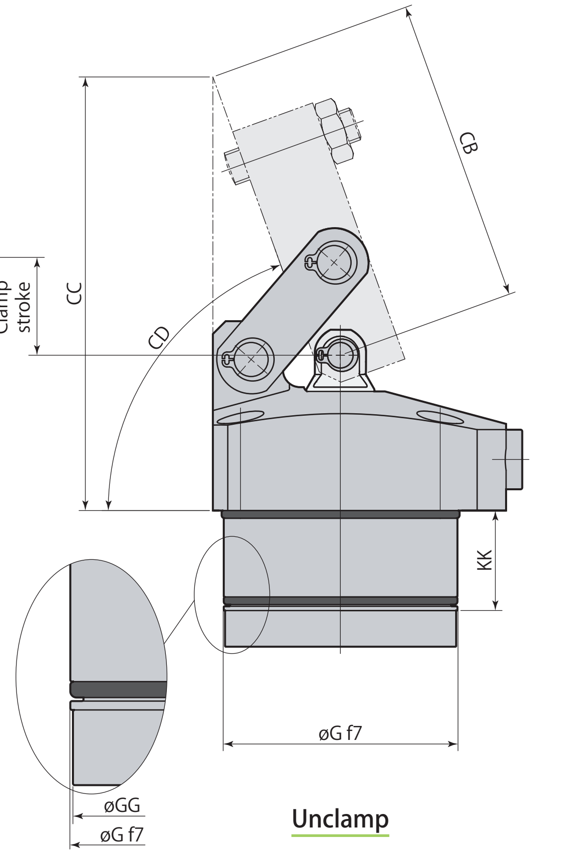
Air leaks easily due to a large space.

Dimensions

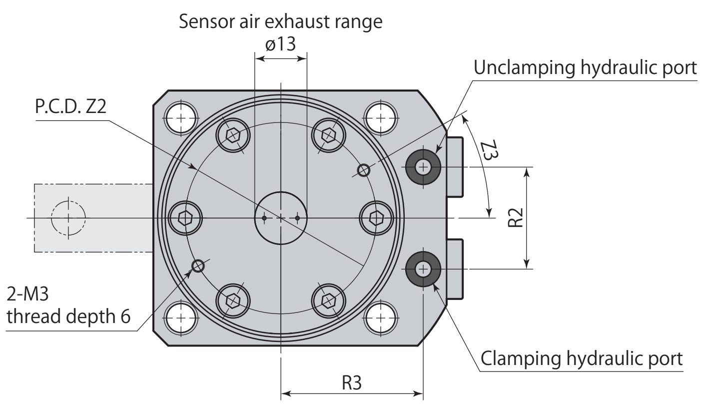




Clamp

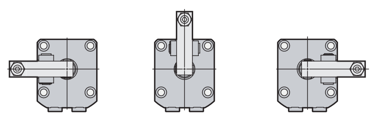


Unclamp



● 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

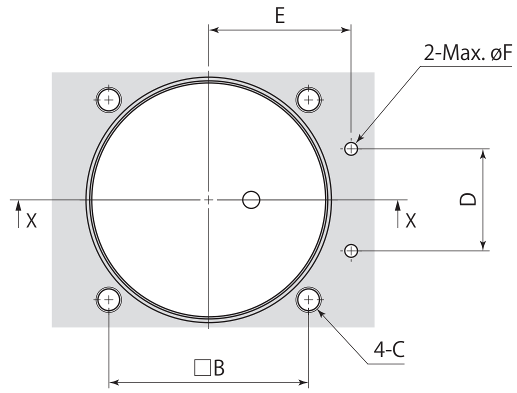
Model		CLM04-□B	CLM05-□B	CLM06-□B	CLM10-□B	CLM16-□B
A		83	92.5	97.5	113.5	132.5
B		45	51	60	70	85
C		54	61	69	81	94.5
D		31.5	35.5	39	46	52
E		22.5	25.5	30	35	42.5
F		34	40	47	55	63
øG		$40^{-0.025}_{-0.050}$	$48^{-0.025}_{-0.050}$	$55^{-0.030}_{-0.060}$	$65^{-0.030}_{-0.060}$	$75^{-0.030}_{-0.060}$
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
	Meter-out	VCF01S-O	VCF01-O	VCF01-O	VCF01-O	VCF02-O
Air bleeding valve*2		VCE01	VCE01	VCE01	VCE01	VCE02

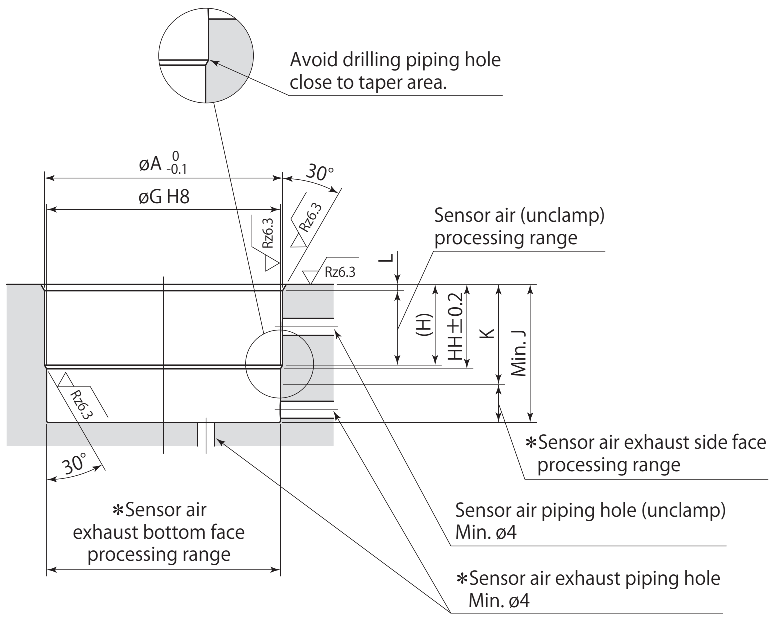
＊1：Snap ring is made by Ochiai Corporation.

＊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 →238** ● Air bleeding valve **page →240**

Mounting details

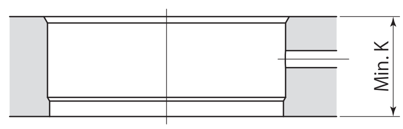




In blind hole X-X

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

Rz: ISO4287(1997)



In through hole X-X

- 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

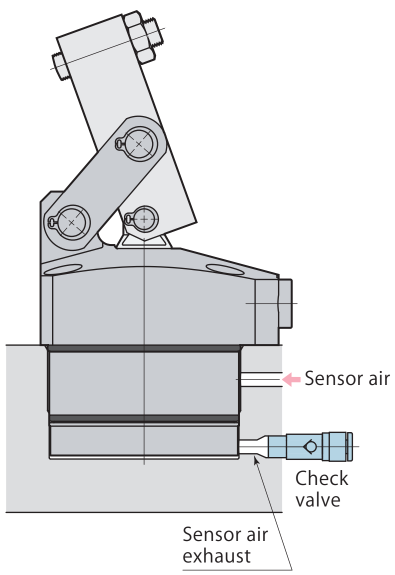
mm

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

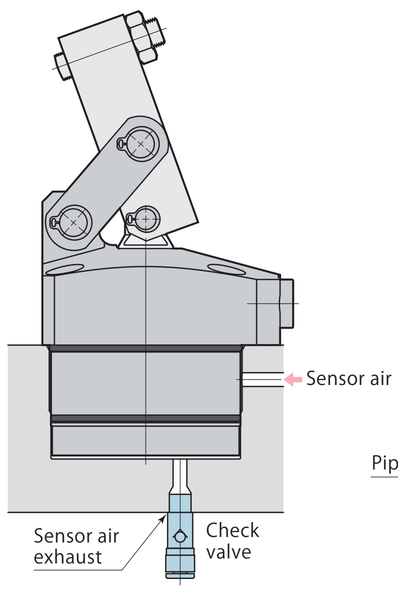
Caution for piping

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

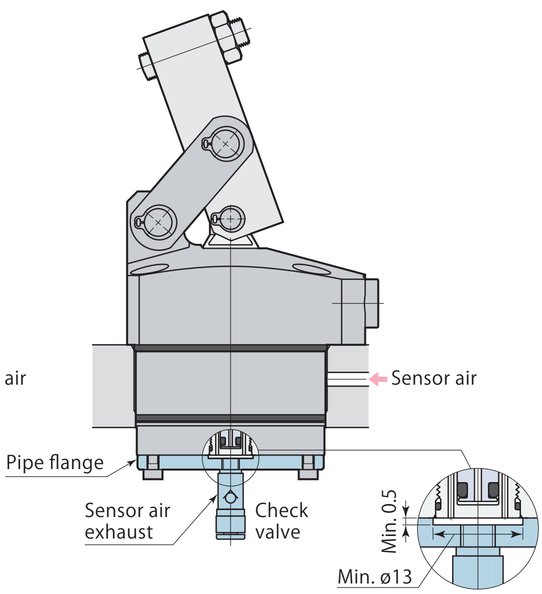
Mounting in blind hole
(Sensor air exhaust：side face)



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

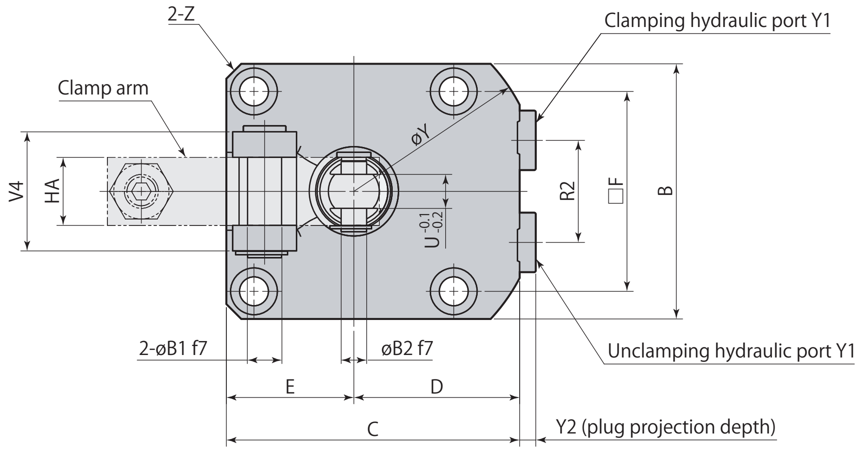


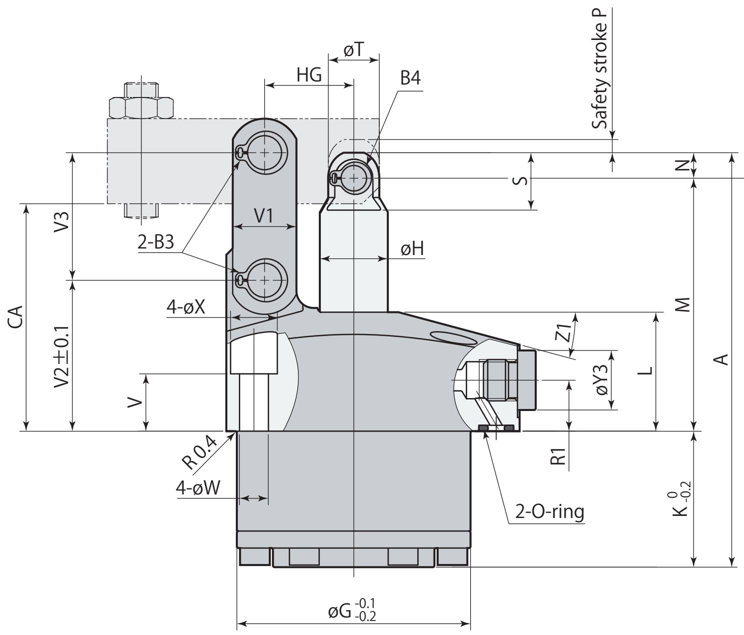
Mounting in through hole



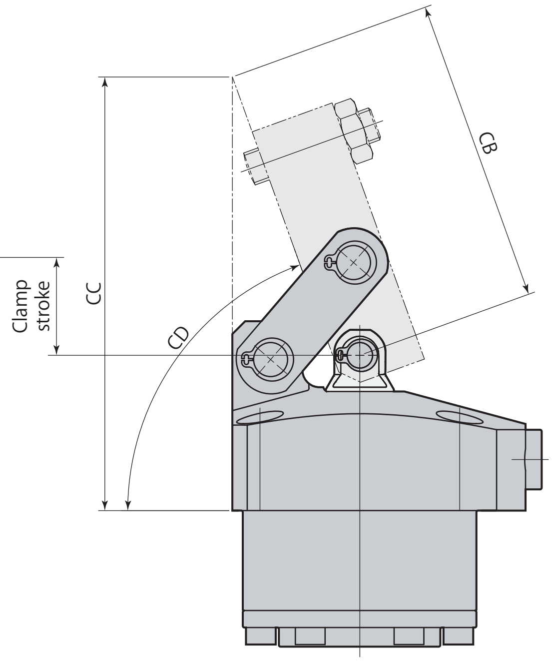
- Use a check valve with cracking pressure of 0.005 MPa or less if there is a risk of metal chips or coolant intrusion. Recommended check valve : AKH or AKB series manufactured by SMC.
- Furnish the piping by means of the pipe flange when mounting in a through hole. The flange is mountable with M3 threads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

Dimensions

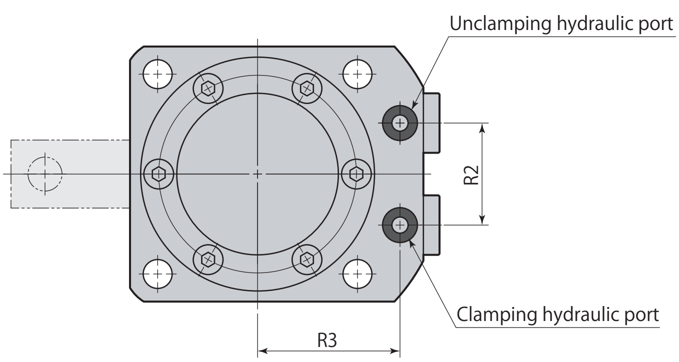




Clamp

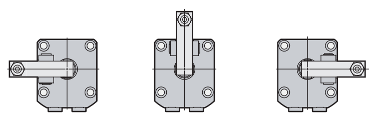


Unclamp



- 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

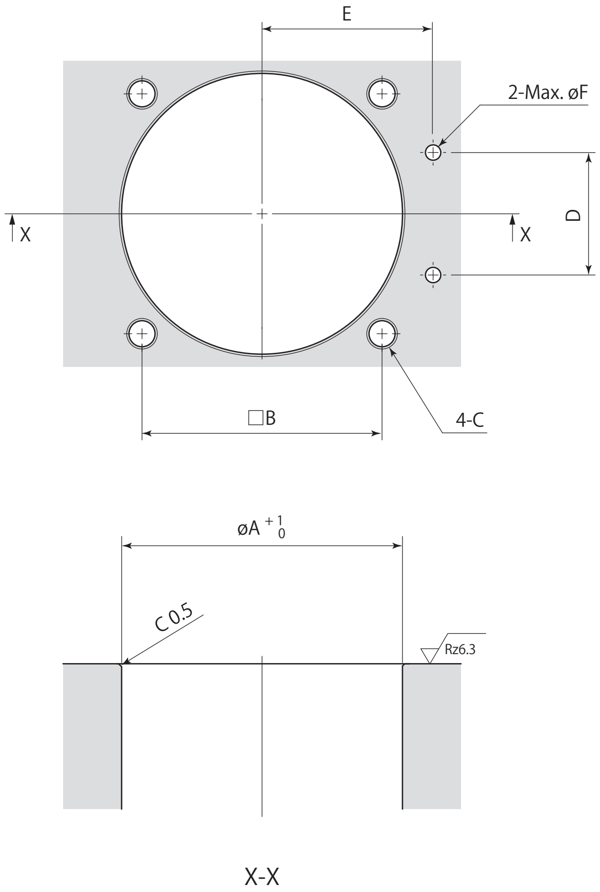
Model	CLM03-□N	CLM04-□N	CLM05-□N	CLM06-□N	CLM10-□N	CLM16-□N
A	75	83	92.5	97.5	113.5	132.5
B	40	45	51	60	70	85
C	49	54	61	69	81	94.5
D	29	31.5	35.5	39	46	52
E	20	22.5	25.5	30	35	42.5
F	31.4	34	40	47	55	63
øG	36	40	48	55	65	75
øH	10	12	14	16	20	22
K	23	27.5	29.5	32	38.5	40.5
L	25	25	28	28	30	37
M	47.5	50	57	59.5	67	82
N	4.5	5.5	6	6	8	10
P	2.5	3	3	3	3	3
R1	11	11	12	12	13	16
R2	16	18	22	24	30	32
R3	23.5	26	30	33.5	39.5	45
S	10.5	12.5	13.5	13.5	17.5	22
øT	9	11	12	12	15	19
U (width across flats)	5	6	6	8	10	11
V	15.5	15.5	16.5	13.5	15.5	17.5
V1	11	11	13	15	19	25
V2	30	30.5	34.5	35.5	39	48
V3	20	22	26	30	35.5	43.5
V4	19	21	21	28	37	40
øW	4.5	5.5	5.5	6.8	6.8	9
øX	7.5	9.5	9.5	11	11	14
øY	66	72	81	88	106	116
Y1	G1/8	G1/8	G1/8	G1/8	G1/8	G1/4
Y2	3.8	3.8	3.8	3.8	3.8	4.8
øY3	14	14	14	14	14	19
Z	C3	C3	C3	C3.5	C4.5	C10
Z1	15°	15°	15°	15°	12°	15°
øB1	$5^{-0.010}_{-0.022}$	$6^{-0.010}_{-0.022}$	$6^{-0.010}_{-0.022}$	$8^{-0.013}_{-0.028}$	$10^{-0.013}_{-0.028}$	$12^{-0.016}_{-0.034}$
øB2	$5^{-0.010}_{-0.022}$	$6^{-0.010}_{-0.022}$	$6^{-0.010}_{-0.022}$	$6^{-0.010}_{-0.022}$	$8^{-0.013}_{-0.028}$	$10^{-0.013}_{-0.028}$
B3 (snap ring)*1	STW-5	STW-6	STW-6	STW-8	STW-10	STW-12
B4 (snap ring)*1	STW-5	STW-6	STW-6	STW-6	STW-8	STW-10
CA	43	44.5	51	53.5	59	72
CB	47.2	50.2	61.2	71.7	78.7	90.8
CC	74.3	77.7	92.4	101.9	111.4	130.8
CD	About 70.4°	About 70°	About 71°	About 70°	About 70°	About 69°
HA	10	12	12	16	19	22
HG	14.5	16	18.5	21	24.5	30
O-ring (fluorocarbon hardness Hs90)	P5	P5	P5	P5	P7	P7
Flow control valve*2 Meter-in	VCF01S	VCF01S	VCF01	VCF01	VCF01	VCF02
Flow control valve*2 Meter-out	VCF01S-O	VCF01S-O	VCF01-O	VCF01-O	VCF01-O	VCF02-O
Air bleeding valve*2	VCE01	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 →238** ● Air bleeding valve **page →240**

Mounting details



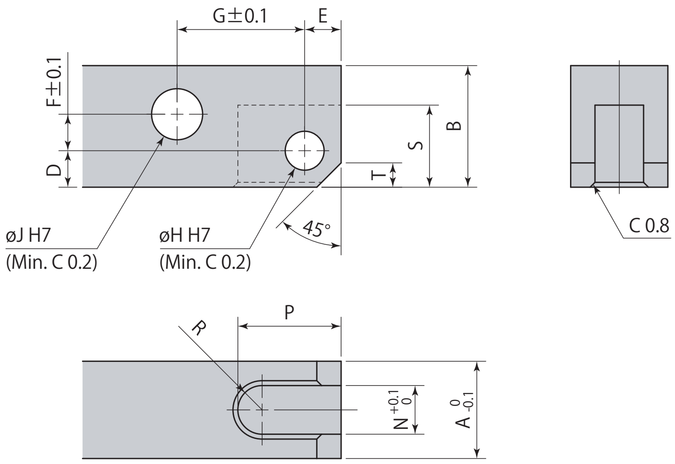
Rz: ISO4287(1997)

mm

Model	CLM03-□N	CLM04-□N	CLM05-□N	CLM06-□N	CLM10-□N	CLM16-□N
øA	36	40	48	55	65	75
B	31.4	34	40	47	55	63
C	M4	M5	M5	M6	M6	M8
D	16	18	22	24	30	32
E	23.5	26	30	33.5	39.5	45
øF	3	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)

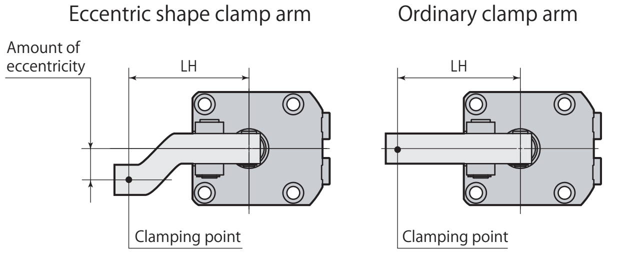
mm

Link clamp	CLM03	CLM04	CLM05	CLM06	CLM10	CLM16
A	10	12	12	16	19	22
B	12.5	14	16	20	25	32
D	4.5	5.5	6	6	8	10
E	4.5	5.5	6	6	7	10
F	2.5	2.5	3.5	6	7.5	9.5
G	14.5	16	18.5	21	24.5	30
øH	$5^{+0.012}_{0}$	$6^{+0.012}_{0}$	$6^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$
øJ	$5^{+0.012}_{0}$	$6^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$	$12^{+0.018}_{0}$
N	5	6	6	8	10	11
P	12.5	14.5	17	17	20	25.5
R	R2.5	R3	R3	R4	R5	R5.5
S	10	12	13.5	13.5	17.5	22
T	3	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.



model CLM03 (grey cells indicate nonusable range)

Hydraulic pressure MPa	Allowable eccentricity mm / Clamp arm length LH mm							
	22.5	27.5	33.5	40	50	60	80	100
7				9	17	24	39	54
6.5			6	11	19	28	44	60
6			7	13	22	31	50	↑
5.5			9	16	26	36	56	↑
5			11	19	30	41	60	↑
4.5		7	14	23	35	48	↑	↑
4		9	18	27	42	56	↑	↑
3.5		12	22	33	50	60	↑	↑
3	6	16	28	41	60	↑	↑	↑
2.5	10	22	37	52	↑	↑	↑	↑
2	15	30	49	60	↑	↑	↑	↑
1.5	24	45	60	↑	↑	↑	↑	↑
1	41	60	↑	↑	↑	↑	↑	↑
0.5	60	60	60	60	60	60	60	60

model CLM04 (grey cells indicate 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 (grey cells indicate 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 (grey cells indicate 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 (grey cells indicate 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 (grey cells indicate 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.

Table of contents

Sensing Link clamp

Single acting 7 MPa

model CLN

Unclamp sensor model
model CLN06-FB

Compact model
model CLN06-FN

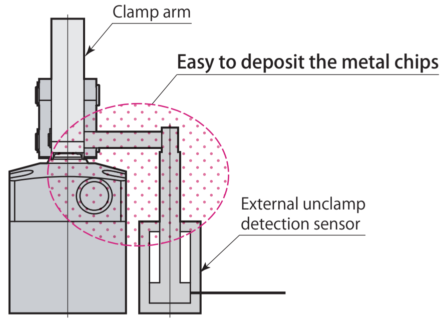
Sensing Link clamp model CLN

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

Unclamp sensor model

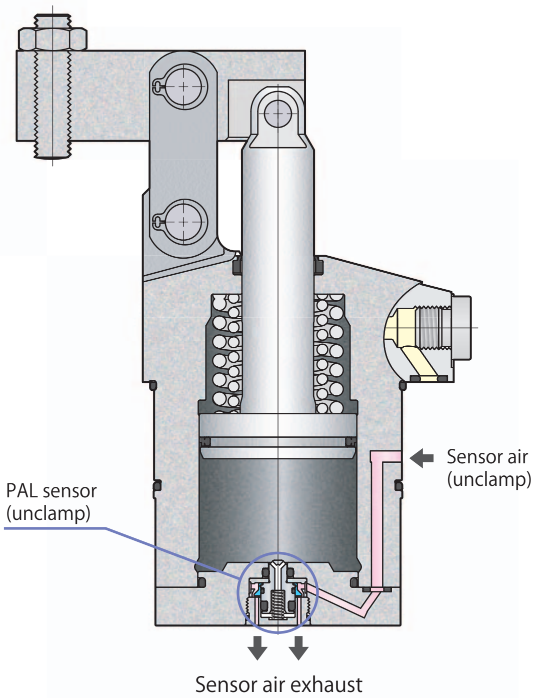
- Unclamp PAL sensor moves along with the piston rod and can positively detect unclamping point, thereby enabling a high-speed production line by fully synchronizing operation with workpiece lifters.
- Built-in sensors enable a compact and simple jig.
- Unclamp detection failure due to the metal chips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

Figure 1

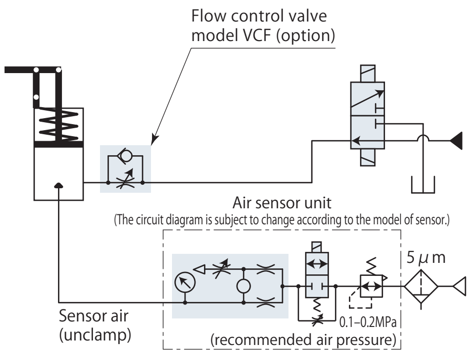


Unclamp sensor model B

model **CLN□-□B** PAT.



Hydraulic and pneumatic circuit diagram



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PAL sensor page → 197
Dimensions page → 200
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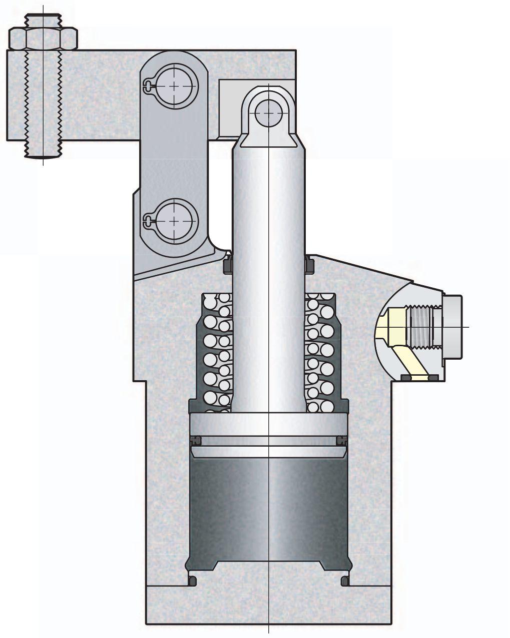
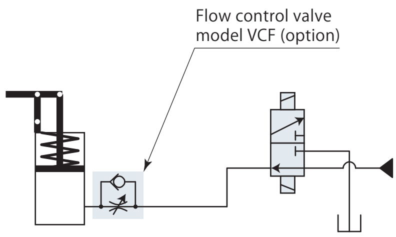
Compact model N

model **CLN□-□N**

No sensors available on compact model



Hydraulic circuit diagram



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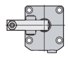
Mounting details page → 206

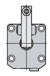
Specifications

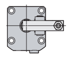
Size: 04 / 05 / 06 / 10 / 16

CLN [Size] — [Clamp arm mounting direction] [Model]

Clamp arm mounting direction

L : Left side 

F : Front side 

R : Right side 

B : Unclamp sensor model

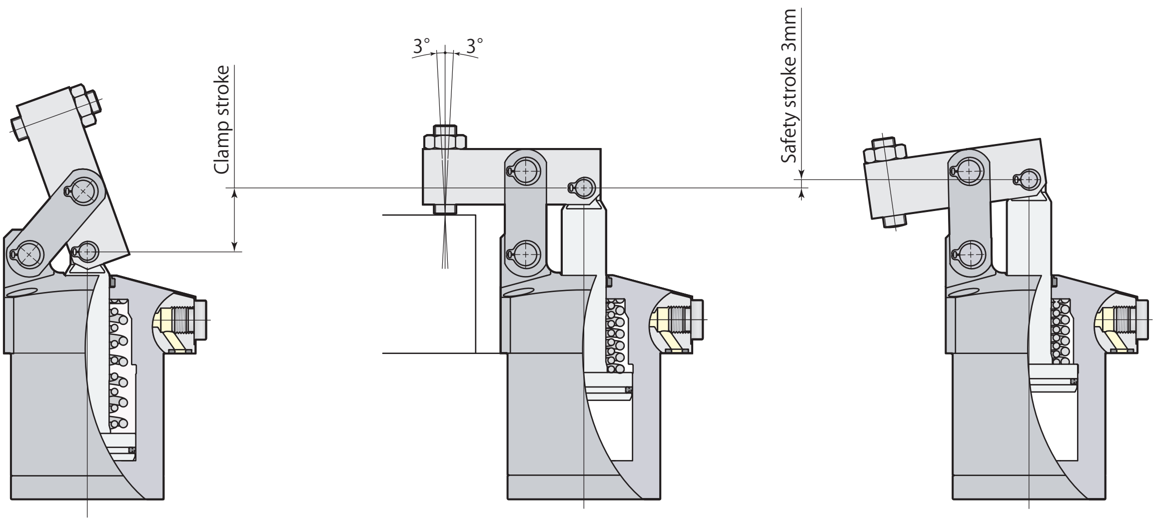
N : Compact model

Model		Unit	CLN04	CLN05	CLN06	CLN10	CLN16
Cylinder force (hydraulic pressure 7MPa)*1		kN	3.5	4.6	6.1	10.3	15.1
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*2		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		cm^3	10.9	16.6	25.0	46.9	83.2
Return spring force	Clamp	kN	0.25	0.40	0.63	0.81	1.52
	Unclamp	kN	0.13	0.19	0.33	0.44	0.84
Recommended piping inner diameter*3		mm	ø6	ø6	ø6	ø8	ø8
Max. allowable mass of clamp arm*4		kg	0.2	0.3	0.5	1.0	1.5
Mass		kg	0.7	1.1	1.4	2.3	3.8
Recommended tightening torque of mounting screws*5		N·m	7	7	12	12	29

● Pressure range：1.5–7 MPa ● 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：This is value for clamping position. ∗2：Indicates a distance from unclamping position to clamping point.
∗3：Care must be taken when numerous clamps are used or when hydraulic piping is long.
∗4：This is clamp arm mass when shape of clamp arm being described in Dimensions is retained but length only has been extended.
∗5：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)

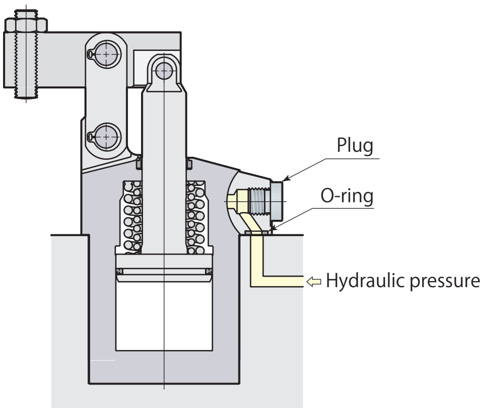
Manifold piping and G port piping are available.

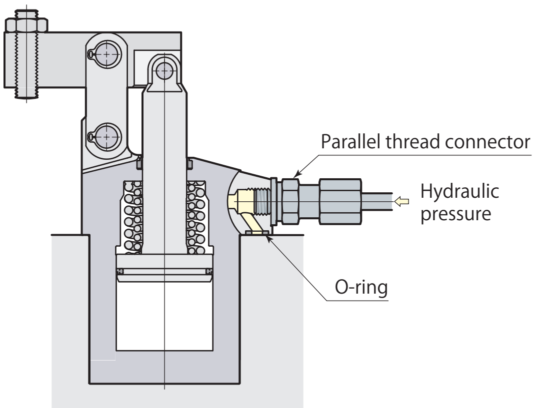
Manifold piping

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 plug when choosing G port piping. (O-ring must be used.) Refer to **page →372** 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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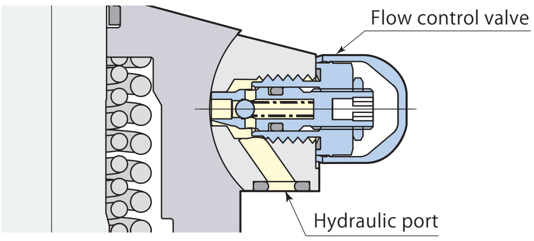

Air bleeding valve model VCE

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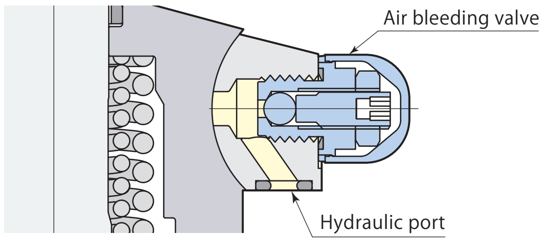
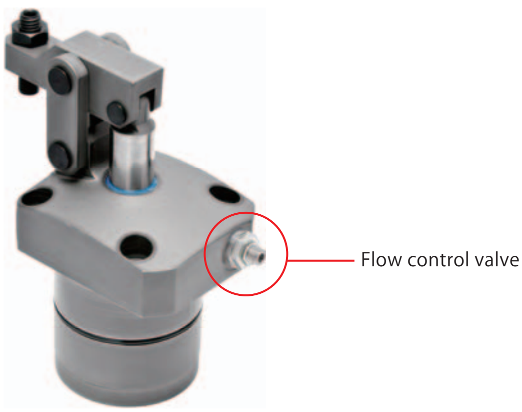
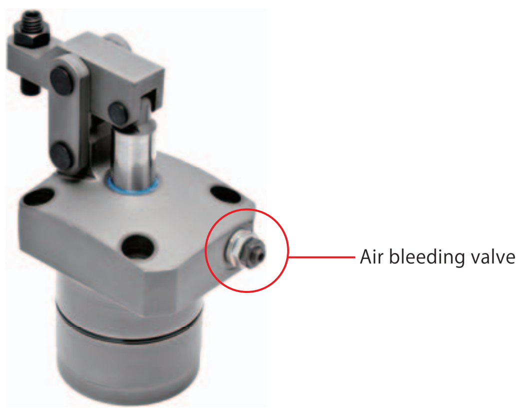
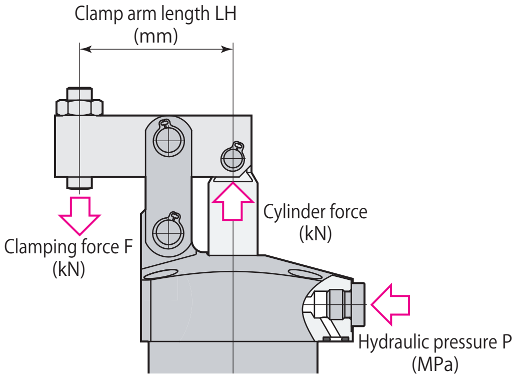






● In case of mounting flow control valve model VCF on the G port of the clamp, air bleeding valve should be installed in the piping to the clamp. (VCE Mounting details. Refer to **page →240**)

Performance diagram



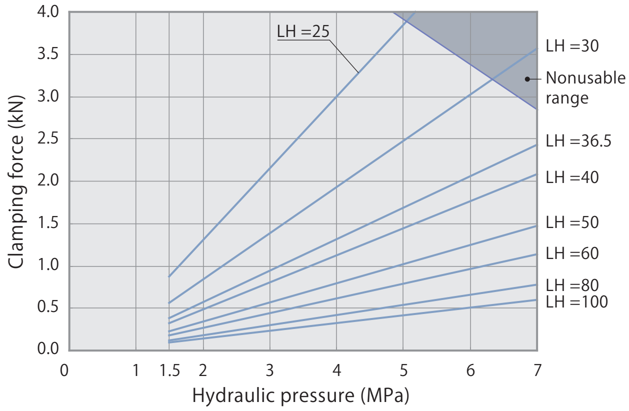
Clamping force varies depending on the clamp arm length (LH) and hydraulic pressure (P).

Clamping force calculation formula
F＝ (Coefficient 1 × P - Coefficient 2) / (LH - Coefficient 3)
F：Clamping force　P：Hydraulic pressure　LH：Clamp arm length

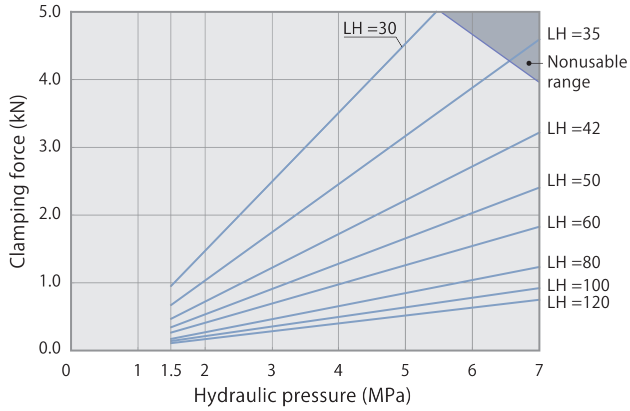
CLN06 with clamp arm length (LH) = 50 mm at hydraulic pressure of 7 MPa, Clamping force F is calculated by
(18.18×7-11.91) / (50-21.0) ＝4.0 kN

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

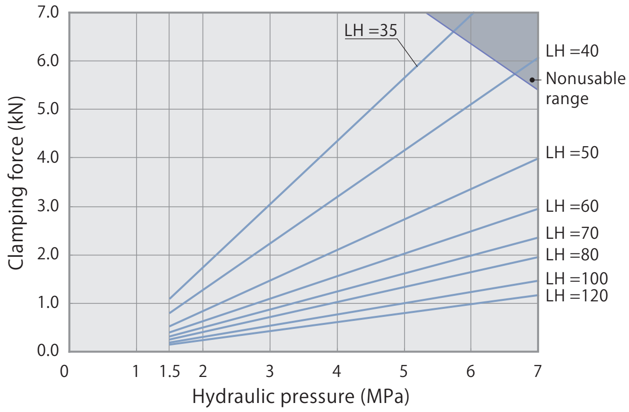
model **CLN04**



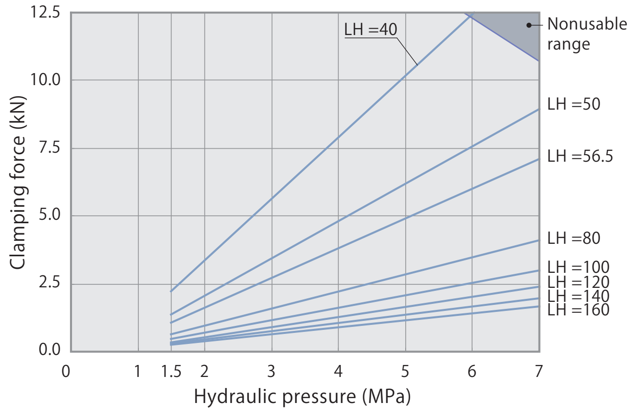
model **CLN05**



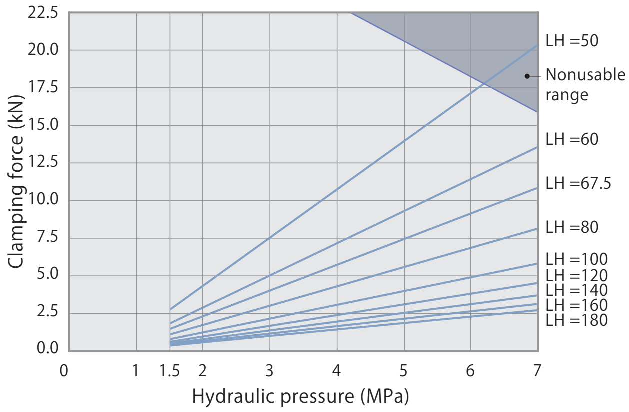
model **CLN06**



model **CLN10**



model **CLN16**



Performance table

model CLN04 Clamping force F=(7.65×P-3.63)/(LH-16.0)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN / Clamp arm length LH mm: 25	30	36.5	40	50	60	80	100	Min. arm length Min. LH mm
7	3.5			2.4	2.1	1.5	1.1	0.8	0.6	34
6.5	3.2			2.2	1.9	1.4	1.0	0.7	0.5	31
6	2.9		3.0	2.1	1.8	1.2	1.0	0.7	0.5	29
5.5	2.7		2.7	1.9	1.6	1.1	0.9	0.6	0.5	27
5	2.4	3.8	2.5	1.7	1.4	1.0	0.8	0.5	0.4	25
4.5	2.1	3.4	2.2	1.5	1.3	0.9	0.7	0.5	0.4	24
4	1.9	3.0	1.9	1.3	1.1	0.8	0.6	0.4	0.3	↑
3.5	1.6	2.6	1.7	1.1	1.0	0.7	0.5	0.4	0.3	↑
3	1.3	2.1	1.4	0.9	0.8	0.6	0.4	0.3	0.2	↑
2.5	1.1	1.7	1.1	0.8	0.6	0.5	0.4	0.2	0.2	↑
2	0.8	1.3	0.8	0.6	0.5	0.3	0.3	0.2	0.1	↑
1.5	0.5	0.9	0.6	0.4	0.3	0.2	0.2	0.1	0.1	24
Max. pressure MPa		5.0	6.3	7.0	7.0	7.0	7.0	7.0	7.0	

▒ indicates nonusable range

model CLN05 Clamping force F=(11.77×P-6.66)/(LH-18.5)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN / Clamp arm length LH mm: 30	35	42	50	60	80	100	120	Min. arm length Min. LH mm
7	4.5			3.2	2.4	1.8	1.2	0.9	0.7	38
6.5	4.2		4.2	3.0	2.2	1.7	1.1	0.9	0.7	35
6	3.8		3.9	2.7	2.0	1.5	1.0	0.8	0.6	33
5.5	3.5		3.5	2.5	1.8	1.4	0.9	0.7	0.6	31
5	3.1	4.5	3.2	2.2	1.7	1.3	0.8	0.6	0.5	29
4.5	2.8	4.0	2.8	2.0	1.5	1.1	0.8	0.6	0.5	27
4	2.4	3.5	2.4	1.7	1.3	1.0	0.7	0.5	0.4	↑
3.5	2.1	3.0	2.1	1.5	1.1	0.8	0.6	0.4	0.3	↑
3	1.7	2.5	1.7	1.2	0.9	0.7	0.5	0.4	0.3	↑
2.5	1.4	2.0	1.4	1.0	0.7	0.5	0.4	0.3	0.2	↑
2	1.0	1.5	1.0	0.7	0.5	0.4	0.3	0.2	0.2	↑
1.5	0.7	1.0	0.7	0.5	0.3	0.3	0.2	0.1	0.1	27
Max. pressure MPa		5.4	6.5	7.0	7.0	7.0	7.0	7.0	7.0	

▒ indicates nonusable range

model CLN06 Clamping force F=(18.18×P-11.91)/(LH-21.0)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN / Clamp arm length LH mm: 35	40	50	60	70	80	100	120	Min. arm length Min. LH mm
7	6.1			4.0	3.0	2.4	2.0	1.5	1.2	43
6.5	5.6		5.6	3.7	2.7	2.2	1.8	1.3	1.1	40
6	5.1		5.1	3.4	2.5	2.0	1.6	1.2	1.0	37
5.5	4.7	6.3	4.6	3.0	2.3	1.8	1.5	1.1	0.9	34
5	4.2	5.6	4.2	2.7	2.0	1.6	1.3	1.0	0.8	32
4.5	3.7	5.0	3.7	2.4	1.8	1.4	1.2	0.9	0.7	31
4	3.2	4.3	3.2	2.1	1.6	1.2	1.0	0.8	0.6	↑
3.5	2.7	3.7	2.7	1.8	1.3	1.1	0.9	0.7	0.5	↑
3	2.3	3.0	2.2	1.5	1.1	0.9	0.7	0.5	0.4	↑
2.5	1.8	2.4	1.8	1.2	0.9	0.7	0.6	0.4	0.3	↑
2	1.3	1.7	1.3	0.8	0.6	0.5	0.4	0.3	0.2	↑
1.5	0.8	1.1	0.8	0.5	0.4	0.3	0.3	0.2	0.2	31
Max. pressure MPa		5.7	6.6	7.0	7.0	7.0	7.0	7.0	7.0	

▒ indicates nonusable range

model CLN10 Clamping force F=(35.07×P-17.68)/(LH-24.5)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN / Clamp arm length LH mm: 40	50	56.5	80	100	120	140	160	Min. arm length Min. LH mm
7	10.3		8.9	7.1	4.1	3.0	2.4	2.0	1.7	46
6.5	9.5		8.2	6.6	3.8	2.8	2.2	1.8	1.6	43
6	8.7		7.6	6.0	3.5	2.6	2.0	1.7	1.4	41
5.5	7.9	11.3	6.9	5.5	3.2	2.3	1.8	1.5	1.3	38
5	7.1	10.2	6.2	4.9	2.8	2.1	1.6	1.4	1.2	36
4.5	6.3	9.0	5.5	4.4	2.5	1.9	1.5	1.2	1.0	↑
4	5.6	7.9	4.8	3.8	2.2	1.6	1.3	1.1	0.9	↑
3.5	4.8	6.8	4.1	3.3	1.9	1.4	1.1	0.9	0.8	↑
3	4.0	5.6	3.4	2.7	1.6	1.2	0.9	0.8	0.6	↑
2.5	3.2	4.5	2.7	2.2	1.3	0.9	0.7	0.6	0.5	↑
2	2.4	3.4	2.1	1.6	0.9	0.7	0.5	0.5	0.4	↑
1.5	1.6	2.2	1.4	1.1	0.6	0.5	0.4	0.3	0.3	36
Max. pressure MPa		5.9	7.0	7.0	7.0	7.0	7.0	7.0	7.0	

▒ indicates nonusable range

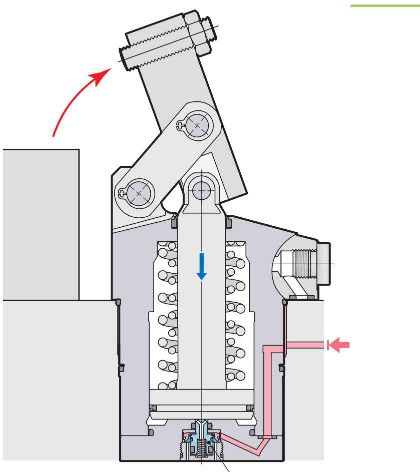
model CLN16 Clamping force F=(64.15×P-41.04)/(LH-30.0)

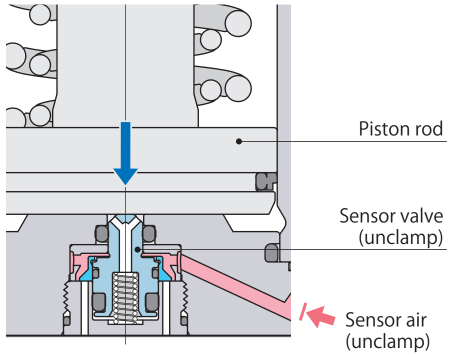
Hydraulic pressure MPa	Cylinder force kN	Clamping force kN / Clamp arm length LH mm: 50	60	67.5	80	100	120	140	160	180	Min. arm length Min. LH mm
7	15.1		13.6	10.9	8.2	5.8	4.5	3.7	3.1	2.7	54
6.5	13.9		12.5	10.0	7.5	5.4	4.2	3.4	2.9	2.5	51
6	12.7	17.2	11.5	9.2	6.9	4.9	3.8	3.1	2.6	2.3	48
5.5	11.5	15.6	10.4	8.3	6.2	4.5	3.5	2.8	2.4	2.1	45
5	10.4	14.0	9.3	7.5	5.6	4.0	3.1	2.5	2.2	1.9	43
4.5	9.2	12.4	8.3	6.6	5.0	3.5	2.8	2.3	1.9	1.7	↑
4	8.0	10.8	7.2	5.7	4.3	3.1	2.4	2.0	1.7	1.4	↑
3.5	6.8	9.2	6.1	4.9	3.7	2.6	2.0	1.7	1.4	1.2	↑
3	5.6	7.6	5.0	4.0	3.0	2.2	1.7	1.4	1.2	1.0	↑
2.5	4.4	6.0	4.0	3.2	2.4	1.7	1.3	1.1	0.9	0.8	↑
2	3.2	4.4	2.9	2.3	1.7	1.2	1.0	0.8	0.7	0.6	↑
1.5	2.0	2.8	1.8	1.5	1.1	0.8	0.6	0.5	0.4	0.4	43
Max. pressure MPa		6.4	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	

▒ indicates nonusable range

Unclamp PAL sensor function and structure

Unclamp detection

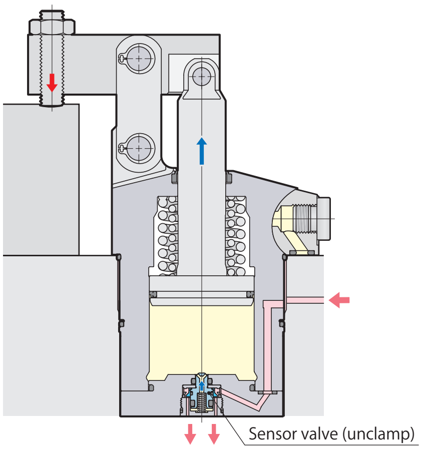


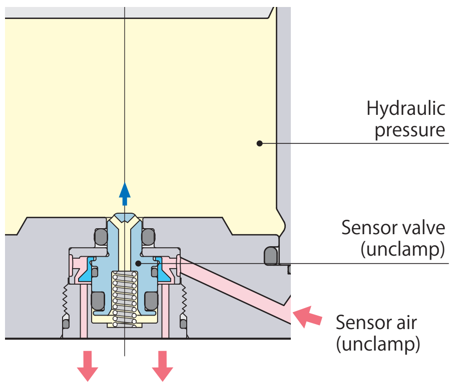


Close (Sensor ON)

● 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



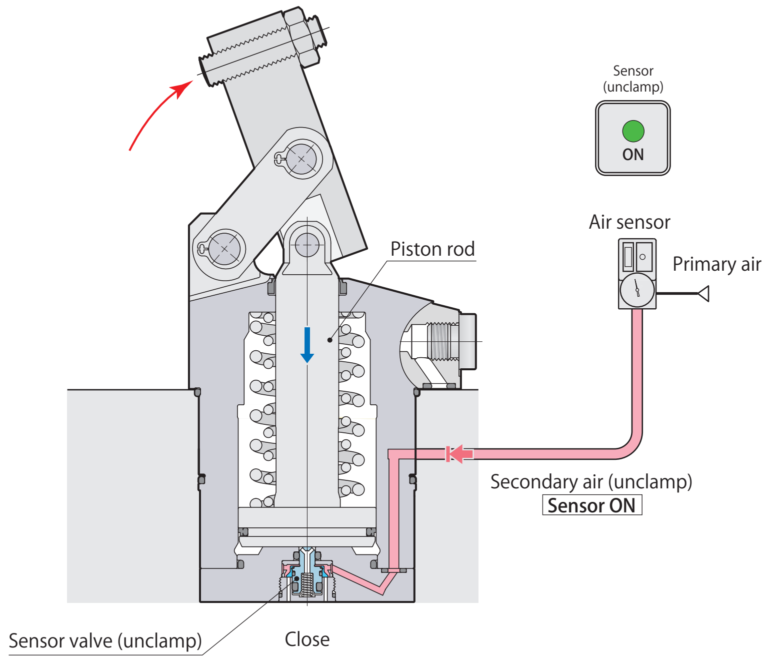


Open (Sensor OFF)

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

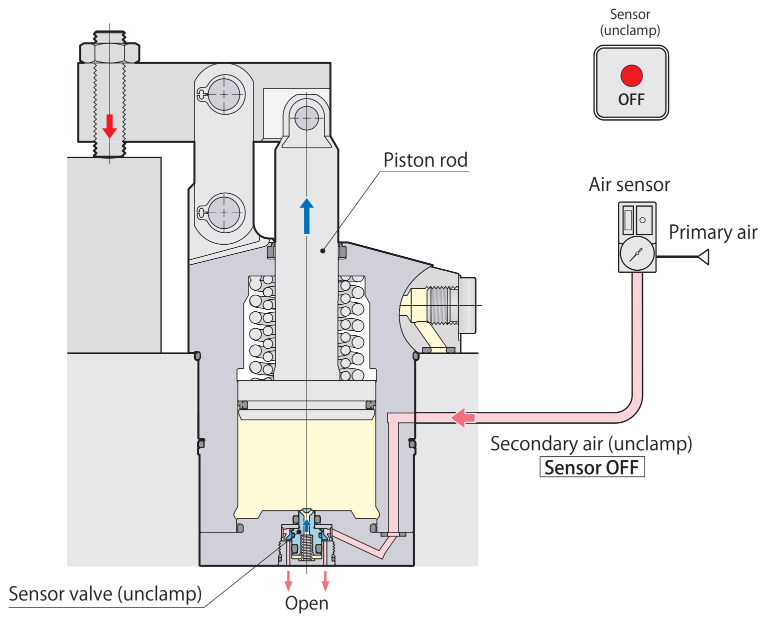
Unclamp detection signal

Unclamp detection



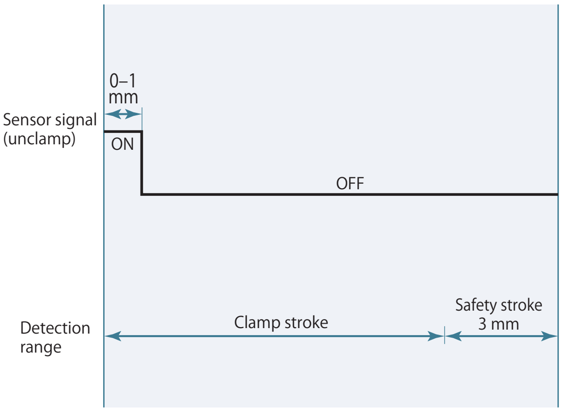
Sensor signal (unclamp)	ON	Unclamp

In the middle of clamp stroke



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

Air sensor triggering point



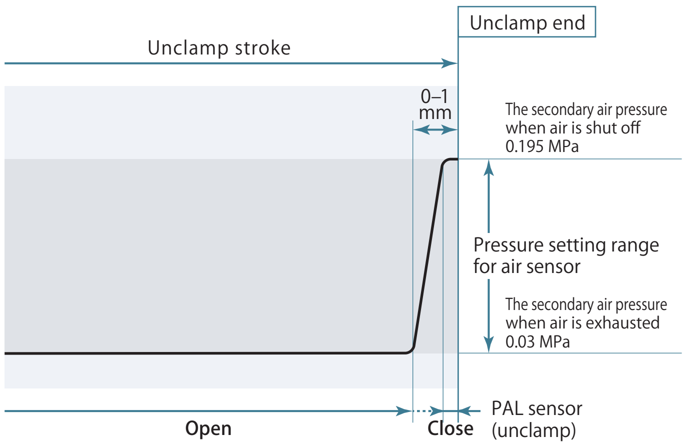
- Refer to the sensor supplier's instruction manual for the details of setting.
- Sensing performance such as detectable time and pressure differs depending on the supplier and model number of the sensor. Select the right model referring to sensor's application and characteristics.

Air sensor unit 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

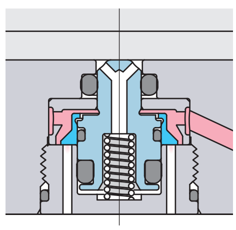


The diagram shown above indicates the relation between the PAL sensor, piston stroke, and secondary air pressure. (The pressure shown in the diagram is a reference based on the 0.2 MPa of primary air pressure for one piece of clamp.)

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

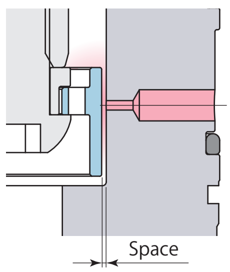
- Enhances the pressure setting range of the sensor which enables the sensor to set easily. (Ex. Pressure setting range 0.03–0.195 MPa in the diagram)
- Allows the use for a number of clamps by one air sensor because of better pressure holding when air is shut off. (Maximum number of clamps to be detected 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



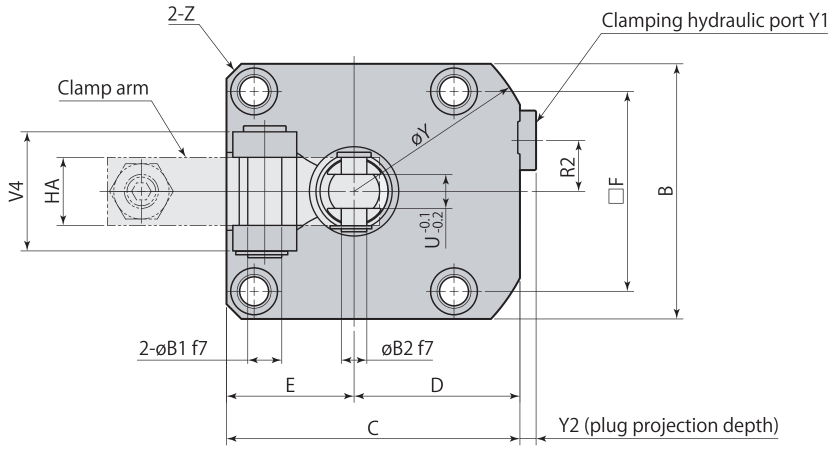
Poppet structure ensures superior sealing performance and can create large differential-pressure when the valve is opening and closing, and air leakage can be minimized.

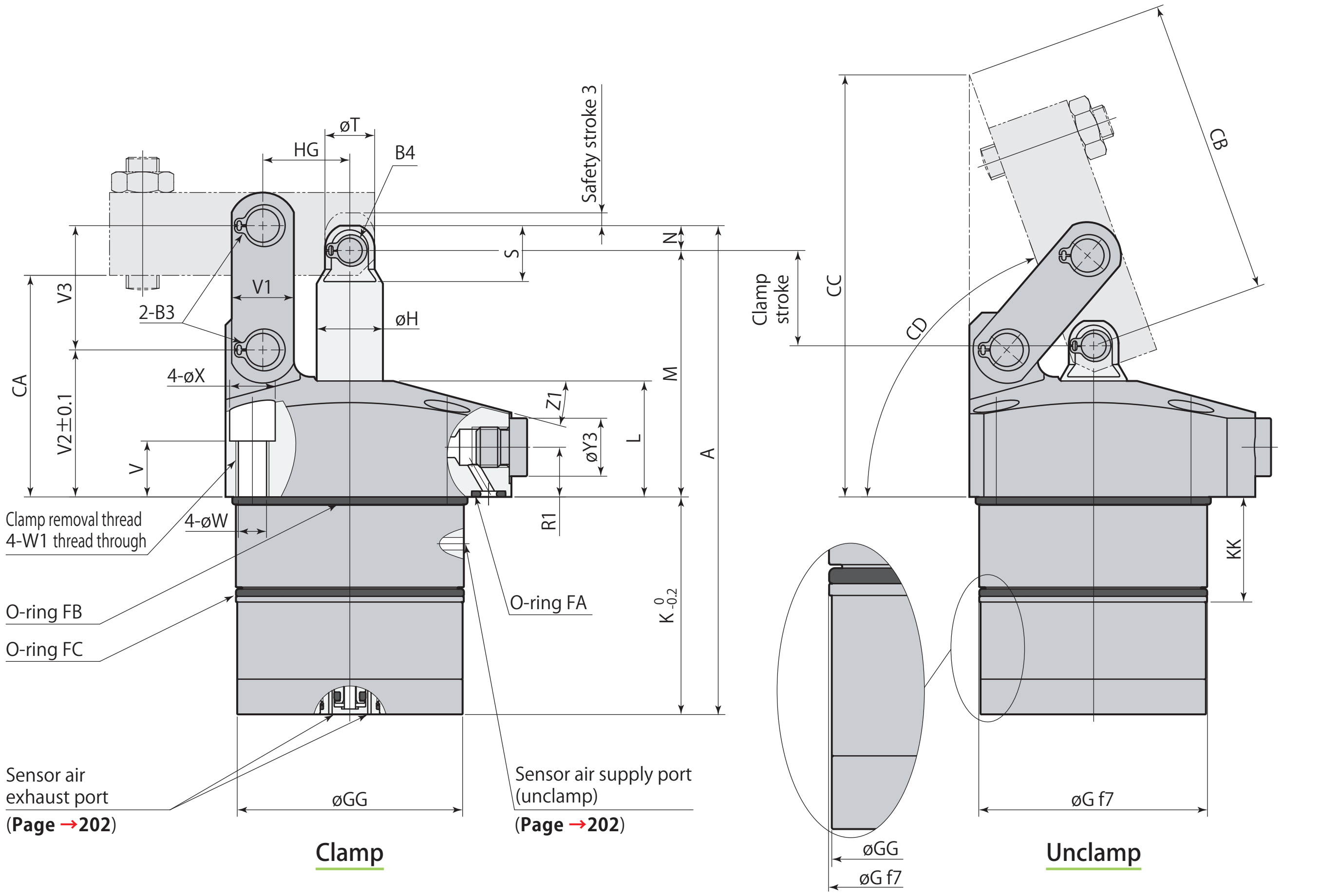
Previous sensor valve

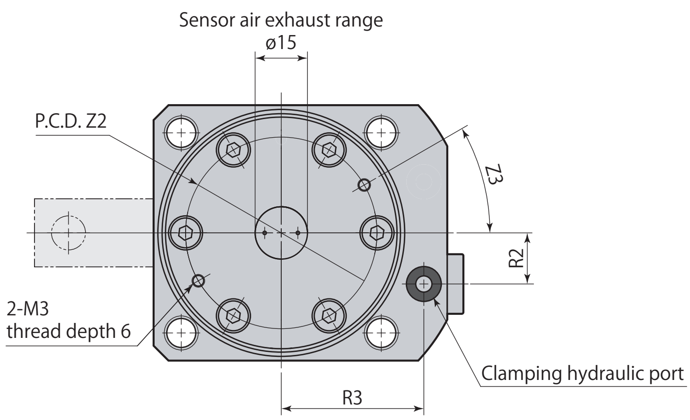


Air leaks easily due to a large space.

Dimensions

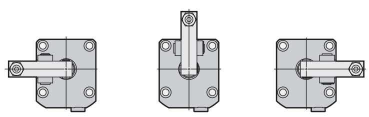






● This diagram represents external contour of CLN□-F. CLN□-L and CLN□-R differ only in terms of mounting direction of clamp arm and otherwise all dimensions are identical to those of CLN□-F.

L：Left side F：Front side R：Right side



● Clamp arm and mounting screws are not included.

mm

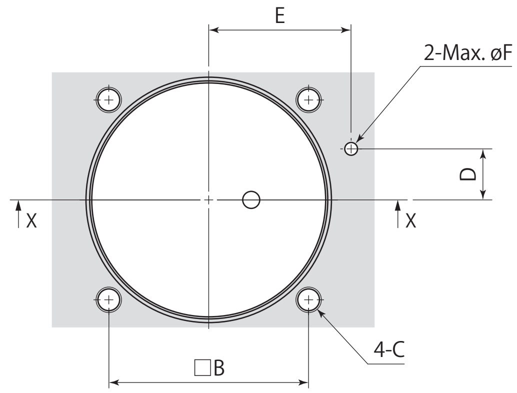
Model	CLN04-□B	CLN05-□B	CLN06-□B	CLN10-□B	CLN16-□B
A	92.5	104.5	118	132.5	158
B	45	51	60	70	85
C	54	61	69	81	94.5
D	31.5	35.5	39	46	52
E	22.5	25.5	30	35	42.5
F	34	40	47	55	63
øG	$40^{-0.025}_{-0.050}$	$48^{-0.025}_{-0.050}$	$55^{-0.030}_{-0.060}$	$65^{-0.030}_{-0.060}$	$75^{-0.030}_{-0.060}$
øGG	39.4	47.4	54.4	64.4	74.4
øH	12	14	16	20	22
K	37	41.5	52.5	57.5	66
KK	25	25	25	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	14
R2	9	11	12	15	16
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	G1/4	G1/4
Y2	3.8	3.8	3.8	4.8	4.8
øY3	14	14	14	19	19
Z	C3	C3	C3.5	C4.5	C10
Z1	15°	15°	15°	12°	15°
Z2	32	38	45	53.5	63.5
Z3	30°	30°	30°	30°	45°
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 (meter-in)*2	VCF01S	VCF01	VCF01	VCF02	VCF02
Air bleeding valve*2	VCE01	VCE01	VCE01	VCE02	VCE02

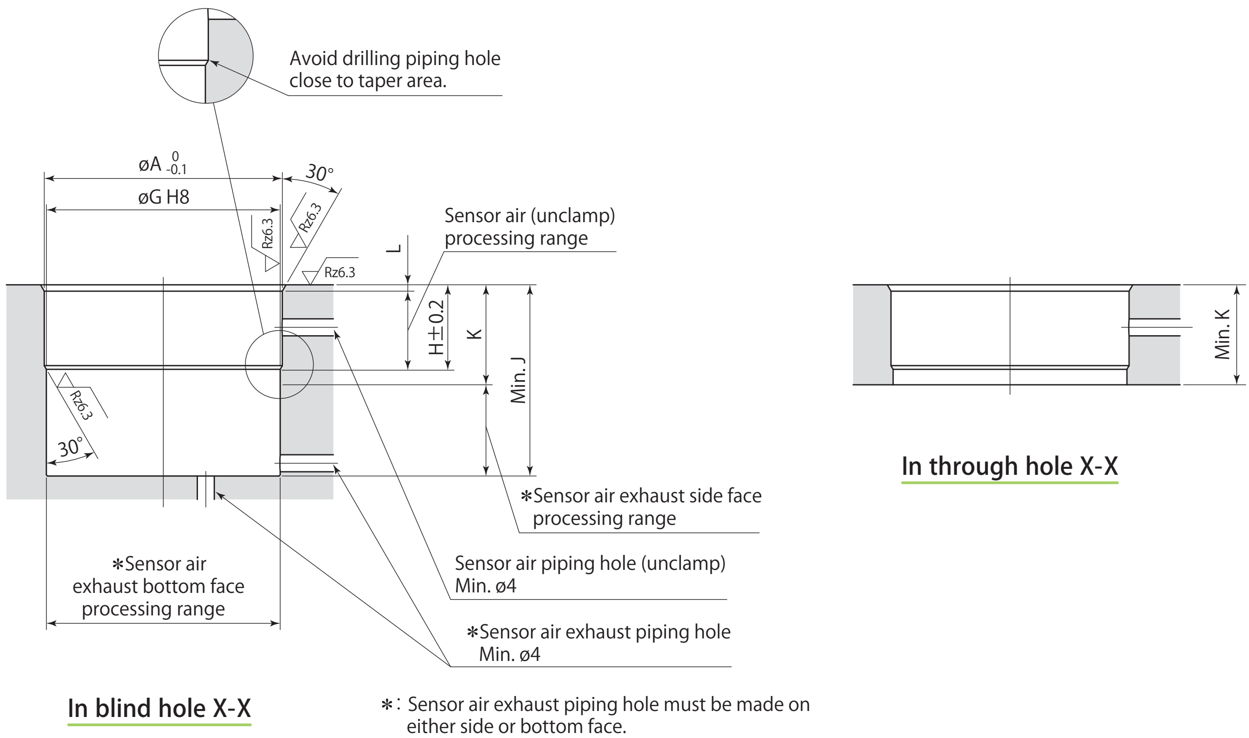
*1：Snap ring is made by Ochiai Corporation.

*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 →238** ● Air bleeding valve **page →240**

Mounting details





In blind 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.

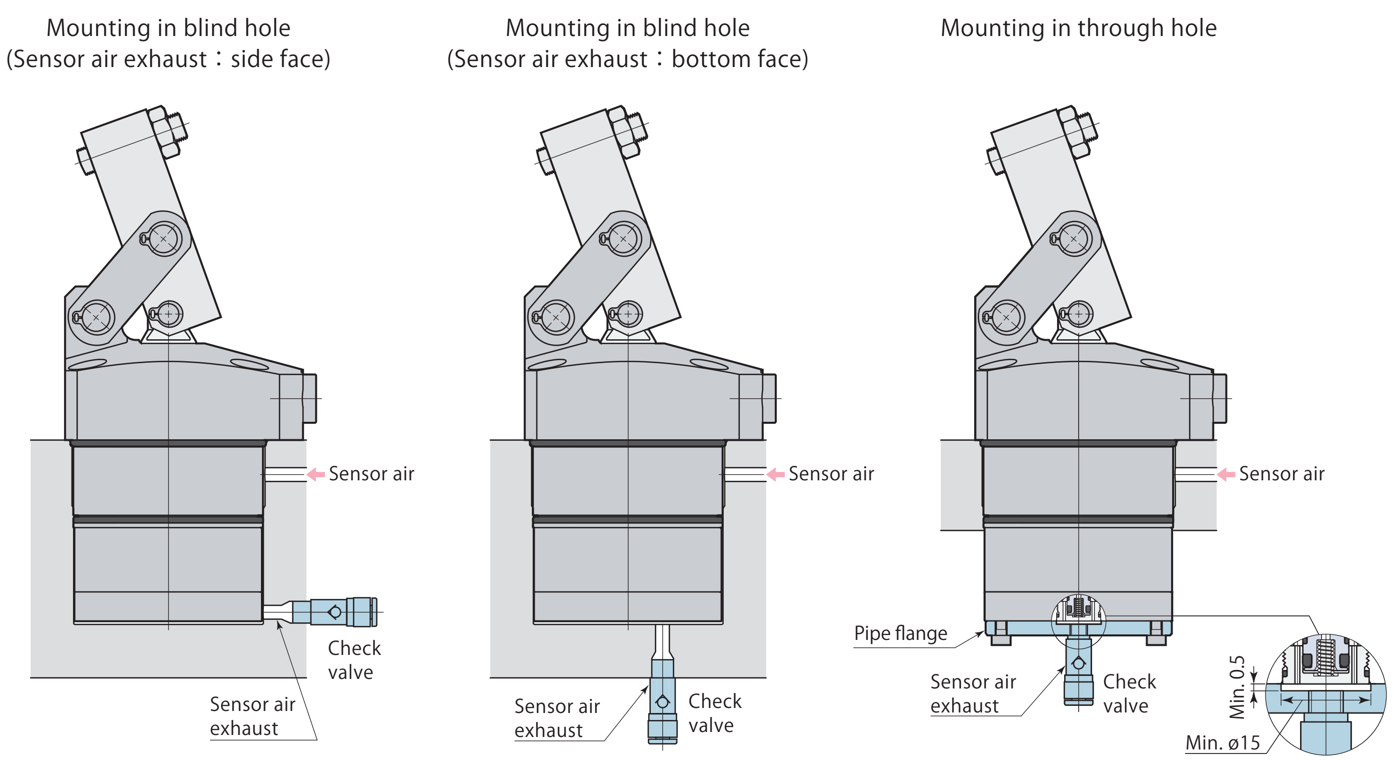
Mounting details

mm

Model	CLN04-□B	CLN05-□B	CLN06-□B	CLN10-□B	CLN16-□B
øA	40.8	49	56	66	76
B	34	40	47	55	63
C	M5	M5	M6	M6	M8
D	9	11	12	15	16
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	20.5	20.5	20.5	20.5	20.5
J	37.5	42	53	58	66.5
K	25	25	25	25	25
L	1.2	1.5	1.5	1.5	1.5

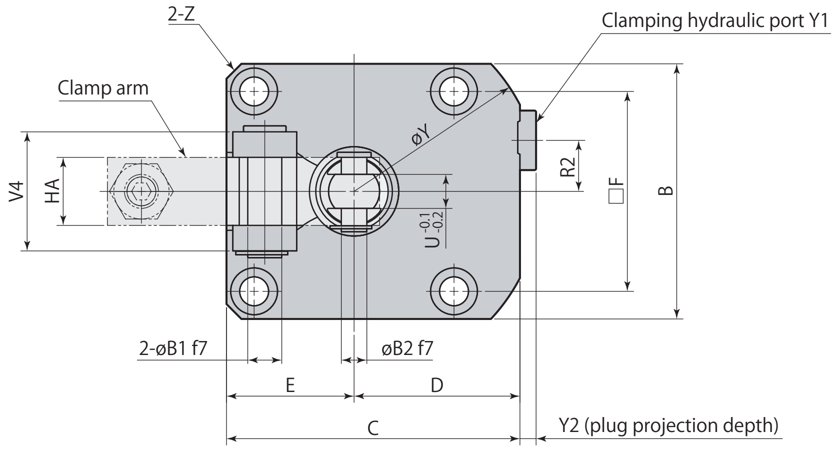
Caution for piping

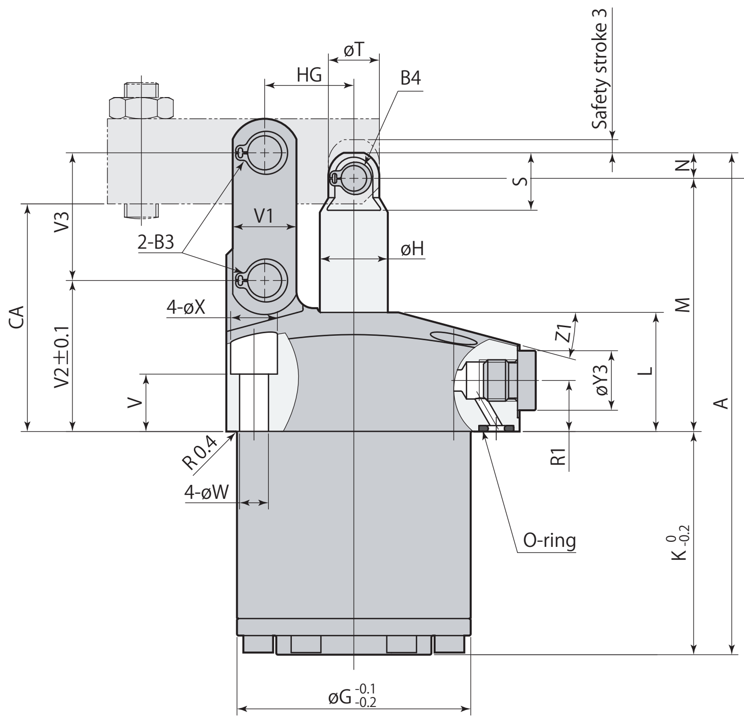
Refer to the diagram shown below for the sensor air exhaust port.



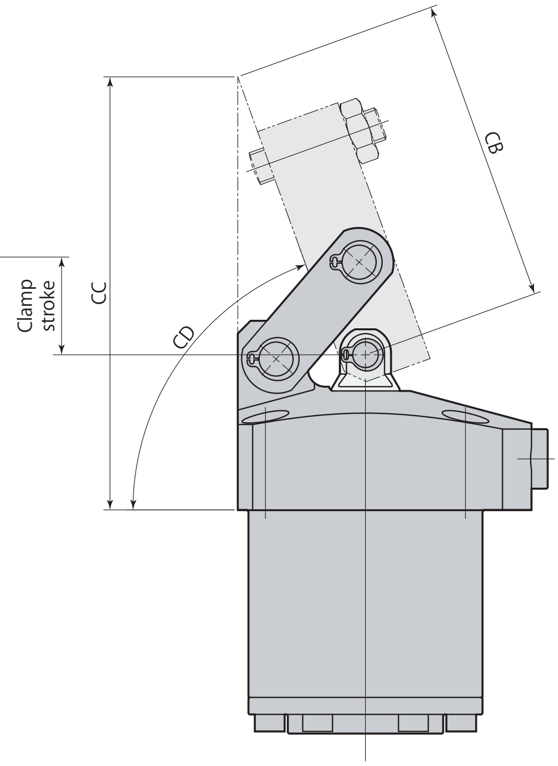
- Use a check valve with cracking pressure of 0.005 MPa or less if there is a risk of metal chips or coolant intrusion. Recommended check valve : AKH or AKB series manufactured by SMC.
- Furnish the piping by means of the pipe flange when mounting in a through hole. The flange is mountable with M3 threads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

Dimensions

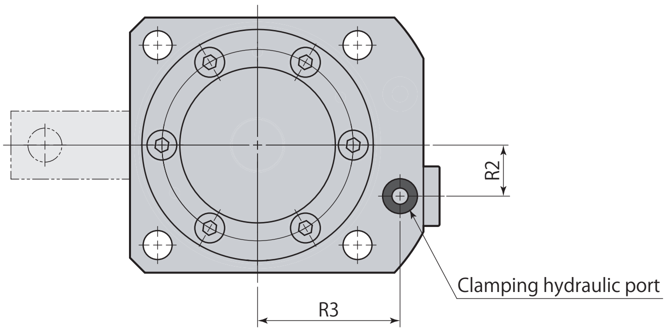




Clamp

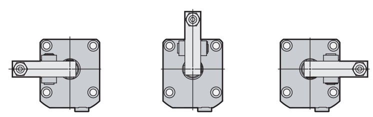


Unclamp



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

L：Left side F：Front side R：Right side



- Clamp arm and mounting screws are not included.

mm

Model	CLN04-□N	CLN05-□N	CLN06-□N	CLN10-□N	CLN16-□N
A	92.5	104.5	118	132.5	158
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	37	41.5	52.5	57.5	66
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	14
R2	9	11	12	15	16
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	G1/4	G1/4
Y2	3.8	3.8	3.8	4.8	4.8
øY3	14	14	14	19	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 (meter-in)*2	VCF01S	VCF01	VCF01	VCF02	VCF02
Air bleeding valve*2	VCE01	VCE01	VCE01	VCE02	VCE02

*1: Snap ring is made by Ochiai Corporation.

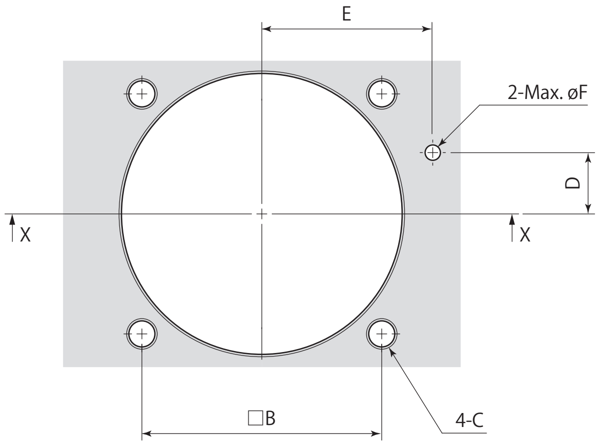
*2: Select the right model of VCF and VCE according to the size of the clamp.

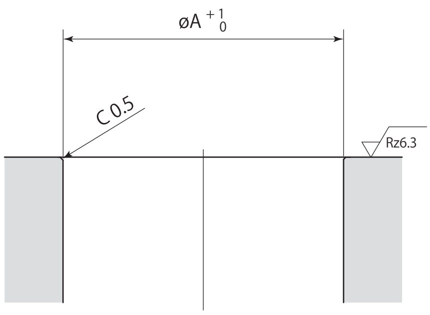
Refer to each page for the details of options. ● Flow control valve **page →238** ● Air bleeding valve **page →240**

Single acting Link clamp

CLN-N Compact model

Mounting details





X-X

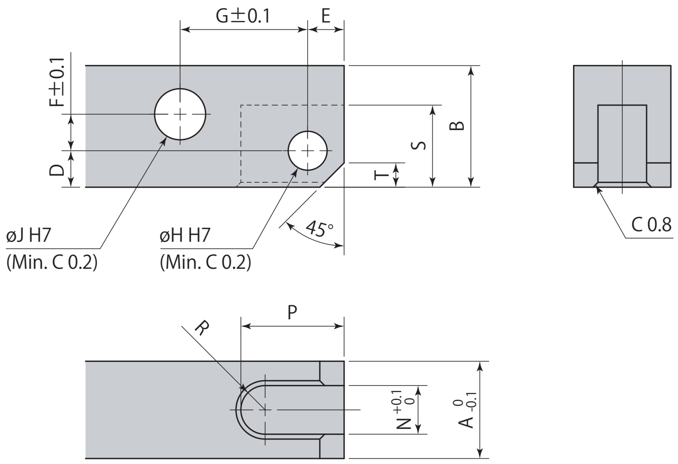
Rz: ISO4287(1997)

mm

Model	CLN04-□N	CLN05-□N	CLN06-□N	CLN10-□N	CLN16-□N
øA	40	48	55	65	75
B	34	40	47	55	63
C	M5	M5	M6	M6	M8
D	9	11	12	15	16
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)

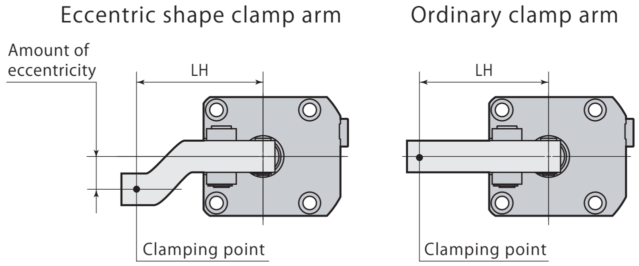
mm

Link clamp	CLN04	CLN05	CLN06	CLN10	CLN16
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 CLN, 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.



model CLN04
▭ indicates nonusable range

Hydraulic pressure MPa	Allowable eccentricity mm							
	Clamp arm length LH mm							
	25	30	36.5	40	50	60	80	100
7			14	17	26	36	54	60
6.5			16	21	32	44	60	↑
6		10	19	24	39	53	↑	↑
5.5		12	22	28	45	60	↑	↑
5	6	15	27	33	52	↑	↑	↑
4.5	8	18	32	39	60	↑	↑	↑
4	11	23	39	47	↑	↑	↑	↑
3.5	15	29	48	58	↑	↑	↑	↑
3	20	38	60	60	↑	↑	↑	↑
2.5	28	50	↑	↑	↑	↑	↑	↑
2	42	60	↑	↑	↑	↑	↑	↑
1.5	60	60	60	60	60	60	60	60

model CLN05
▭ 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	10	17	25	32
6.5		6	6	10	14	24	34	44
6		6	9	14	21	33	45	58
5.5		6	13	20	28	43	58	60
5	6	8	17	26	36	56	60	↑
4.5	6	11	21	32	45	60	↑	↑
4	7	15	26	39	54	↑	↑	↑
3.5	11	20	33	48	60	↑	↑	↑
3	15	27	43	60	↑	↑	↑	↑
2.5	23	38	58	↑	↑	↑	↑	↑
2	35	56	60	↑	↑	↑	↑	↑
1.5	60	60	60	60	60	60	60	60

model CLN06
▭ 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	9	15	17	20	24	26
6		8	14	21	28	32	41	49
5.5	8	11	20	29	38	47	60	73
5	10	15	27	39	50	62	80	80
4.5	14	22	36	51	66	80	↑	↑
4	20	30	49	68	80	↑	↑	↑
3.5	28	41	66	80	↑	↑	↑	↑
3	38	56	80	↑	↑	↑	↑	↑
2.5	53	76	↑	↑	↑	↑	↑	↑
2	78	80	↑	↑	↑	↑	↑	↑
1.5	80	80	80	80	80	80	80	80

model CLN10
▭ 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	15	23	31	39	46
6.5		9	10	22	33	44	55	65
6		10	15	31	46	59	74	88
5.5	9	15	21	42	60	79	95	95
5	9	21	29	56	79	95	↑	↑
4.5	11	29	39	74	95	↑	↑	↑
4	16	39	52	95	↑	↑	↑	↑
3.5	22	49	66	↑	↑	↑	↑	↑
3	31	64	85	↑	↑	↑	↑	↑
2.5	45	86	95	↑	↑	↑	↑	↑
2	68	95	↑	↑	↑	↑	↑	↑
1.5	95	95	95	95	95	95	95	95

model CLN16
▭ 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		13	23	35	55	68	81	94	106
6.5		16	28	41	65	89	107	110	110
6	7	20	33	47	74	102	110	↑	↑
5.5	11	25	40	55	86	110	↑	↑	↑
5	14	31	47	65	100	↑	↑	↑	↑
4.5	19	39	57	78	110	↑	↑	↑	↑
4	25	48	70	94	↑	↑	↑	↑	↑
3.5	34	62	88	110	↑	↑	↑	↑	↑
3	47	80	110	↑	↑	↑	↑	↑	↑
2.5	66	110	↑	↑	↑	↑	↑	↑	↑
2	100	↑	↑	↑	↑	↑	↑	↑	↑
1.5	110	110	110	110	110	110	110	110	110

Table of contents

Link clamp

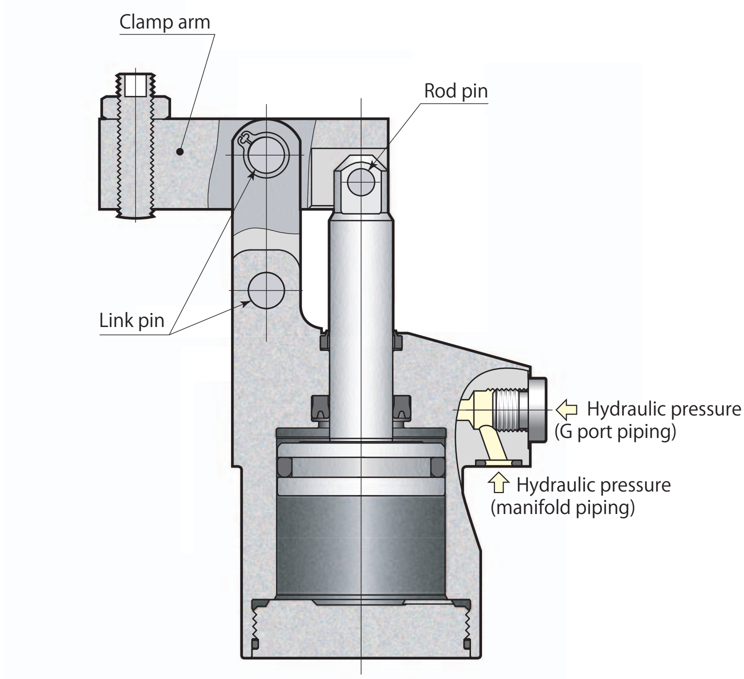
Double acting 7 MPa

model CLU

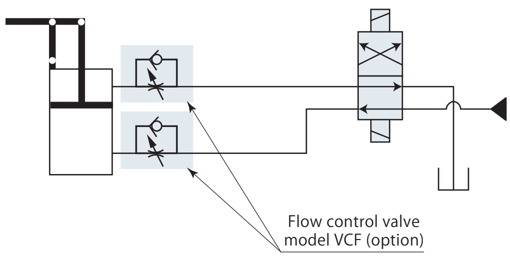
Standard model
model CLU06-F

Standard model

model **CLU□-□**



Hydraulic circuit diagram



For flow control valve, we recommend the meter-in control. If meter-out control is used, due to the area difference, it will cause back pressure and become high pressure. This can lead to malfunction of the system. Please be aware when designing the circuit.

Specifications page → 213
Standard page → 216
Dual rod page → 219
Air sensor page → 220

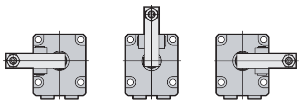
Specifications

Size | Clamp arm mounting direction | Variation code

CLU 02 / 04 / 06 / 10 / 16 / 25* –

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

L：Left side　F：Front side　R：Right side



(Nil) : Standard
E : Dual rod
A : Air sensor

＊：CLU25-LE and CLU25-RE are made to order.

■ indicates made to order.

Model			CLU02	CLU04	CLU06	CLU10	CLU16	CLU25
Cylinder force (hydraulic pressure 7MPa)		kN	3.4	5.0	6.7	10.6	17.2	26.9
Cylinder inner diameter		mm	25	30	35	44	56	70
Rod diameter		mm	12	14	14	16	22.4	28
Effective area (clamp)		cm^2	4.9	7.1	9.6	15.2	24.6	38.5
Full stroke		mm	20.5	23.5	26	29.5	36	45
Clamp stroke		mm	17.5	20.5	23	26.5	33	42
Safety stroke		mm	3	3	3	3	3	3
Max. oil flow rate		L/min	1.0	1.6	2.6	4.7	9.5	18.9
Cylinder capacity	Clamp	cm^3	10.0	16.7	25.0	44.8	88.6	173.3
	Unclamp	cm^3	7.7	13.0	21.0	38.9	74.5	145.5
Mass		kg	0.7	1.0	1.4	2.3	4.0	7.4
Recommended tightening torque of mounting screws*		N·m	7	7	12	29	57	100

● Pressure range：1–7 MPa　● 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)
＊：ISO R898 class 12.9

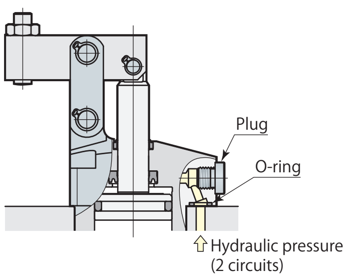
Manifold piping and G port piping are available.

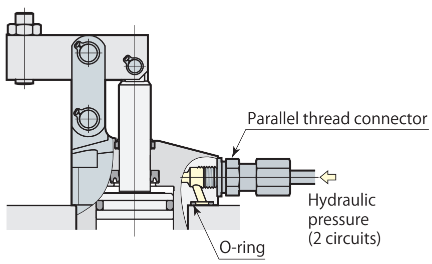
Manifold piping

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.

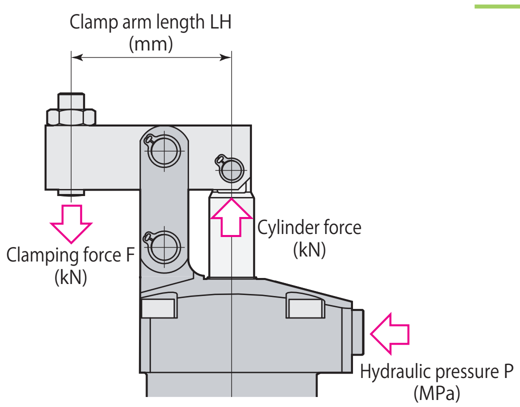
G port piping

Remove plugs when choosing G port piping. (O-ring must be used.) Refer to **page →372** 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.





Performance diagram



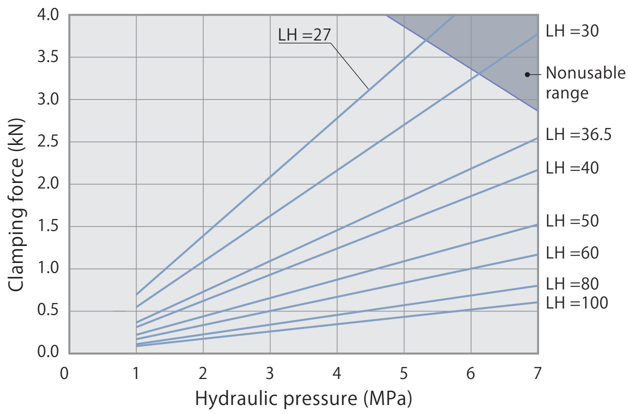
Clamping force varies depending on the clamp arm length (LH) and hydraulic pressure (P).

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

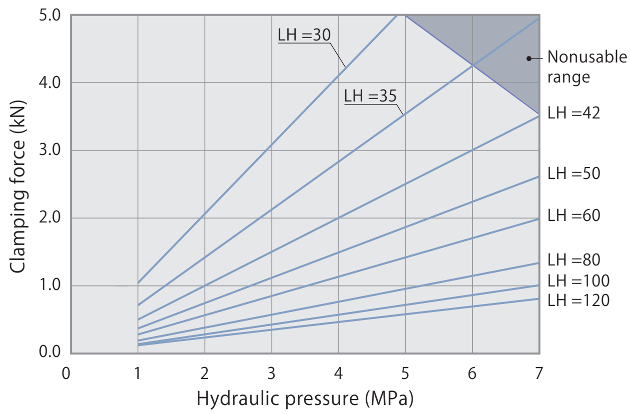
CLU06 with clamp arm length (LH) = 50 mm at hydraulic pressure of 7 MPa, Clamping force F is calculated by
18.18×7/(50-21.0) = 4.4 kN

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

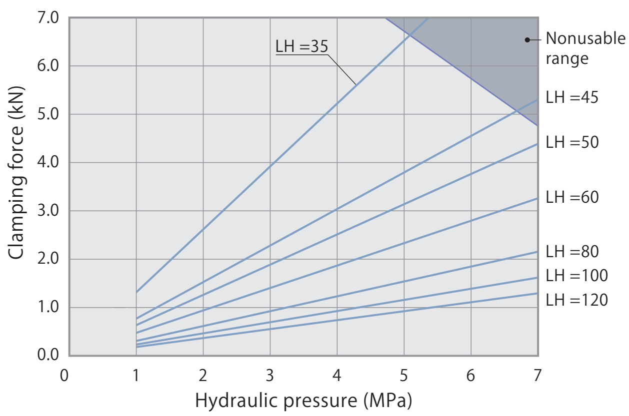
model **CLU02**



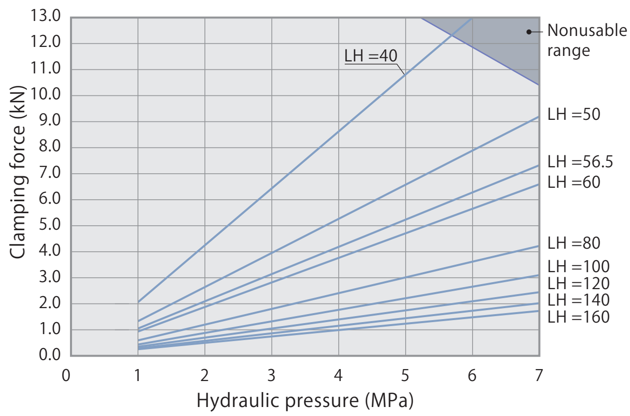
model **CLU04**



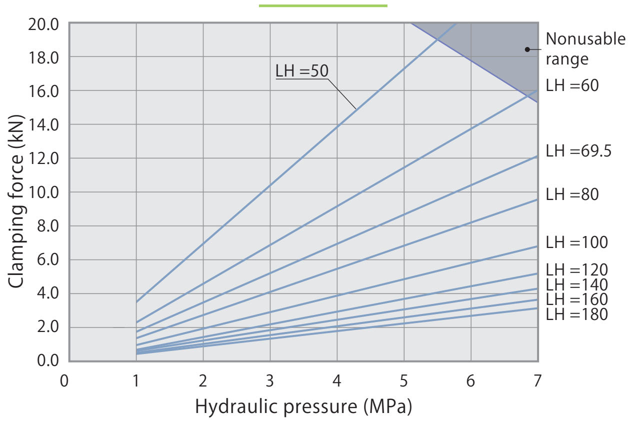
model **CLU06**



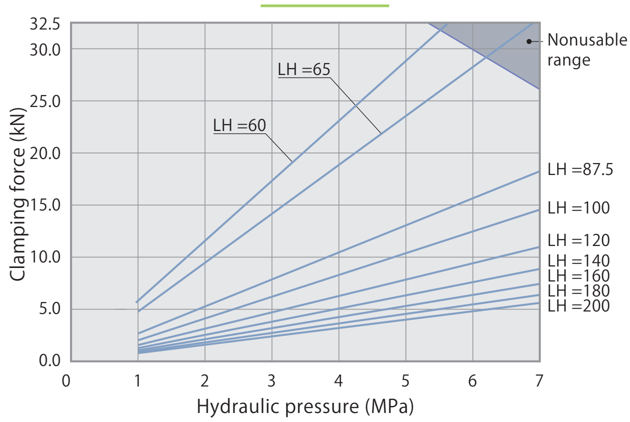
model **CLU10**



model **CLU16**



model **CLU25**



Performance table

model CLU02 Clamping force F=7.29×P/(LH-16.5)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN / Clamp arm length LH mm: 27	30	36.5	40	50	60	80	100	Min. arm length Min. LH mm
7	3.4			2.6	2.2	1.5	1.2	0.8	0.6	35
6.5	3.2			2.4	2.0	1.4	1.1	0.7	0.6	32
6	3.0		3.2	2.2	1.9	1.3	1.0	0.7	0.5	30
5.5	2.7		3.0	2.0	1.7	1.2	0.9	0.6	0.5	28
5	2.5	3.5	2.7	1.8	1.6	1.1	0.8	0.6	0.4	26
4.5	2.2	3.1	2.4	1.6	1.4	1.0	0.8	0.5	0.4	25
4	2.0	2.8	2.2	1.5	1.2	0.9	0.7	0.5	0.3	24
3.5	1.7	2.4	1.9	1.3	1.1	0.8	0.6	0.4	0.3	↑
3	1.5	2.1	1.6	1.1	0.9	0.7	0.5	0.3	0.3	↑
2.5	1.2	1.7	1.4	0.9	0.8	0.5	0.4	0.3	0.2	↑
2	1.0	1.4	1.1	0.7	0.6	0.4	0.3	0.2	0.2	↑
1.5	0.7	1.0	0.8	0.5	0.5	0.3	0.3	0.2	0.1	↑
1	0.5	0.7	0.5	0.4	0.3	0.2	0.2	0.1	0.1	24
Max. pressure	MPa	5.3	6.1	7.0	7.0	7.0	7.0	7.0	7.0	

▭ indicates nonusable range

model CLU04 Clamping force F=11.77×P/(LH-18.5)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN / Clamp arm length LH mm: 30	35	42	50	60	80	100	120	Min. arm length Min. LH mm
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	26
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	26
Max. pressure	MPa	4.9	5.9	7.0	7.0	7.0	7.0	7.0	7.0	

▭ indicates nonusable range

model CLU06 Clamping force F=18.18×P/(LH-21.0)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN / Clamp arm length LH mm: 35	45	50	60	80	100	120	Min. arm length Min. LH mm
7	6.7			4.4	3.3	2.2	1.6	1.3	48
6.5	6.3		4.9	4.1	3.0	2.0	1.5	1.2	44
6	5.8		4.5	3.8	2.8	1.8	1.4	1.1	40
5.5	5.3		4.2	3.4	2.6	1.7	1.3	1.0	37
5	4.8	6.5	3.8	3.1	2.3	1.5	1.2	0.9	35
4.5	4.3	5.8	3.4	2.8	2.1	1.4	1.0	0.8	33
4	3.9	5.2	3.0	2.5	1.9	1.2	0.9	0.7	31
3.5	3.4	4.5	2.7	2.2	1.6	1.1	0.8	0.6	30
3	2.9	3.9	2.3	1.9	1.4	0.9	0.7	0.6	↑
2.5	2.4	3.2	1.9	1.6	1.2	0.8	0.6	0.5	↑
2	1.9	2.6	1.5	1.3	0.9	0.6	0.5	0.4	↑
1.5	1.4	1.9	1.1	0.9	0.7	0.5	0.3	0.3	↑
1	1.0	1.3	0.8	0.6	0.5	0.3	0.2	0.2	30
Max. pressure	MPa	5.1	6.7	7.0	7.0	7.0	7.0	7.0	

▭ indicates nonusable range

model CLU10 Clamping force F=33.54×P/(LH-24.5)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN / Clamp arm length LH mm: 40	50	56.5	60	80	100	120	140	160	Min. arm length Min. LH mm
7	10.6		9.2	7.3	6.6	4.2	3.1	2.5	2.0	1.7	48
6.5	9.9		8.5	6.8	6.1	3.9	2.9	2.3	1.9	1.6	45
6	9.1		7.9	6.3	5.7	3.6	2.7	2.1	1.7	1.5	42
5.5	8.4	11.9	7.2	5.8	5.2	3.3	2.4	1.9	1.6	1.4	40
5	7.6	10.8	6.6	5.2	4.7	3.0	2.2	1.8	1.5	1.2	37
4.5	6.8	9.7	5.9	4.7	4.3	2.7	2.0	1.6	1.3	1.1	36
4	6.1	8.7	5.3	4.2	3.8	2.4	1.8	1.4	1.2	1.0	↑
3.5	5.3	7.6	4.6	3.7	3.3	2.1	1.6	1.2	1.0	0.9	↑
3	4.6	6.5	3.9	3.1	2.8	1.8	1.3	1.1	0.9	0.7	↑
2.5	3.8	5.4	3.3	2.6	2.4	1.5	1.1	0.9	0.7	0.6	↑
2	3.0	4.3	2.6	2.1	1.9	1.2	0.9	0.7	0.6	0.5	↑
1.5	2.3	3.2	2.0	1.6	1.4	0.9	0.7	0.5	0.4	0.4	↑
1	1.5	2.2	1.3	1.0	0.9	0.6	0.4	0.4	0.3	0.2	36
Max. pressure	MPa	5.7	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	

▭ indicates nonusable range

model CLU16 Clamping force F=67.61×P/(LH-30.5)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN / Clamp arm length LH mm: 50	60	69.5	80	100	120	140	160	180	Min. arm length Min. LH mm
7	17.2			12.1	9.6	6.8	5.3	4.3	3.7	3.2	62
6.5	16.0		14.9	11.3	8.9	6.3	4.9	4.0	3.4	2.9	58
6	14.8		13.8	10.4	8.2	5.8	4.5	3.7	3.1	2.7	54
5.5	13.6		12.6	9.5	7.5	5.4	4.2	3.4	2.9	2.5	51
5	12.3	17.3	11.5	8.7	6.8	4.9	3.8	3.1	2.6	2.3	48
4.5	11.1	15.6	10.3	7.8	6.1	4.4	3.4	2.8	2.3	2.0	45
4	9.9	13.9	9.2	6.9	5.5	3.9	3.0	2.5	2.1	1.8	44
3.5	8.6	12.1	8.0	6.1	4.8	3.4	2.6	2.2	1.8	1.6	↑
3	7.4	10.4	6.9	5.2	4.1	2.9	2.3	1.9	1.6	1.4	↑
2.5	6.2	8.7	5.7	4.3	3.4	2.4	1.9	1.5	1.3	1.1	↑
2	4.9	6.9	4.6	3.5	2.7	1.9	1.5	1.2	1.0	0.9	↑
1.5	3.7	5.2	3.4	2.6	2.0	1.5	1.1	0.9	0.8	0.7	↑
1	2.5	3.5	2.3	1.7	1.4	1.0	0.8	0.6	0.5	0.5	44
Max. pressure	MPa	5.4	6.8	7.0	7.0	7.0	7.0	7.0	7.0	7.0	

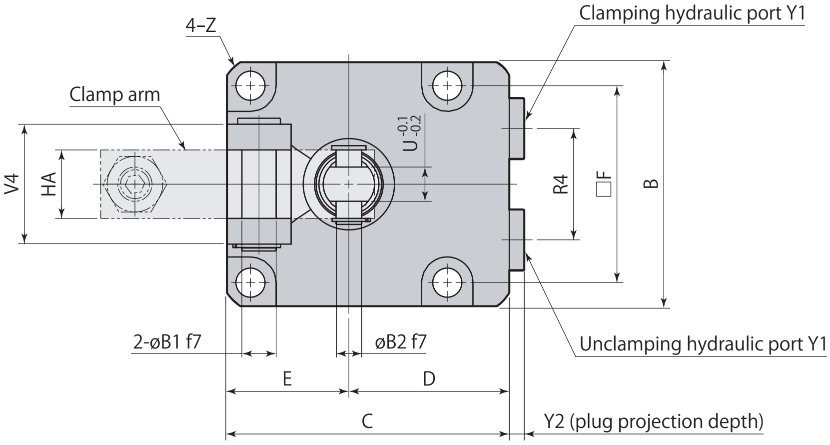
▭ indicates nonusable range

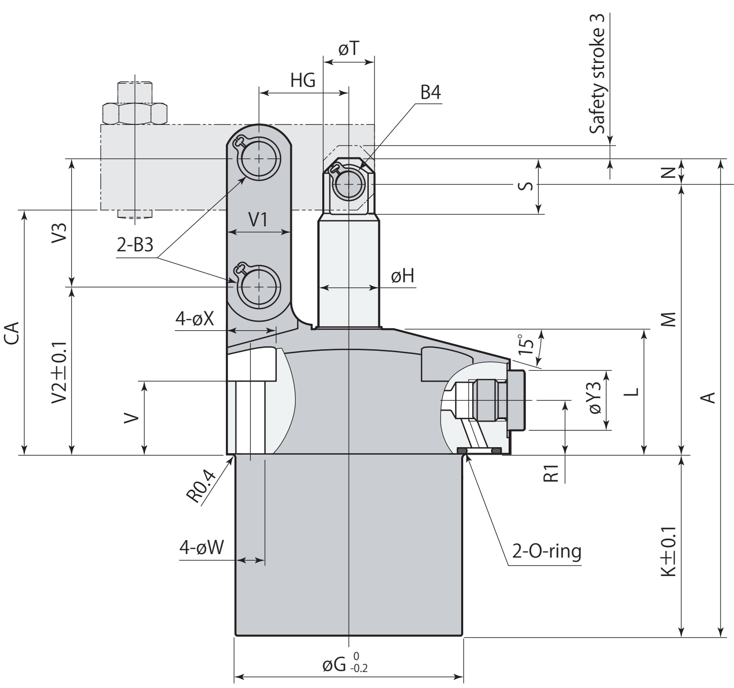
model CLU25 Clamping force F=129.87×P/(LH-37.5)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN / Clamp arm length LH mm: 60	65	87.5	100	120	140	160	180	200	Min. arm length Min. LH mm
7	26.9			18.2	14.5	11.0	8.9	7.4	6.4	5.6	73
6.5	25.0			16.9	13.5	10.2	8.2	6.9	5.9	5.2	68
6	23.1		28.3	15.6	12.5	9.4	7.6	6.4	5.5	4.8	64
5.5	21.2	31.7	26.0	14.3	11.4	8.7	7.0	5.8	5.0	4.4	60
5	19.2	28.9	23.6	13.0	10.4	7.9	6.3	5.3	4.6	4.0	57
4.5	17.3	26.0	21.3	11.7	9.4	7.1	5.7	4.8	4.1	3.6	55
4	15.4	23.1	18.9	10.4	8.3	6.3	5.1	4.2	3.6	3.2	↑
3.5	13.5	20.2	16.5	9.1	7.3	5.5	4.4	3.7	3.2	2.8	↑
3	11.6	17.3	14.2	7.8	6.2	4.7	3.8	3.2	2.7	2.4	↑
2.5	9.6	14.4	11.8	6.5	5.2	3.9	3.2	2.7	2.3	2.0	↑
2	7.7	11.5	9.4	5.2	4.2	3.1	2.5	2.1	1.8	1.6	↑
1.5	5.8	8.7	7.1	3.9	3.1	2.4	1.9	1.6	1.4	1.2	↑
1	3.9	5.8	4.7	2.6	2.1	1.6	1.3	1.1	0.9	0.8	55
Max. pressure	MPa	5.5	6.2	7.0	7.0	7.0	7.0	7.0	7.0	7.0	

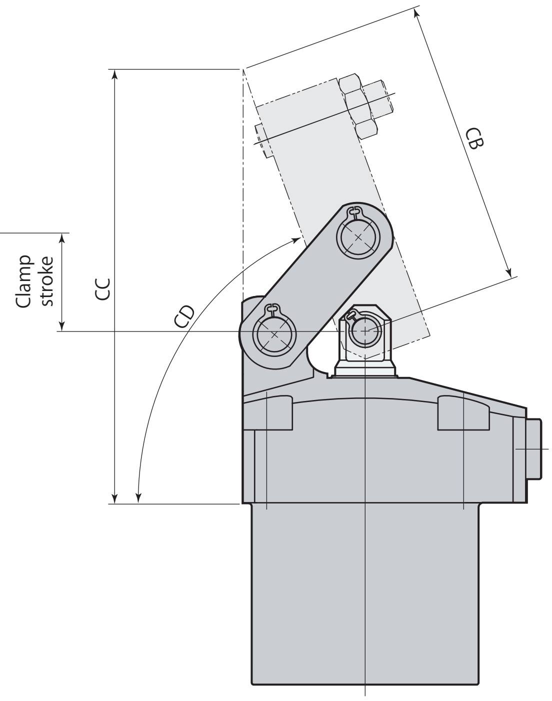
▭ indicates nonusable range

Dimensions

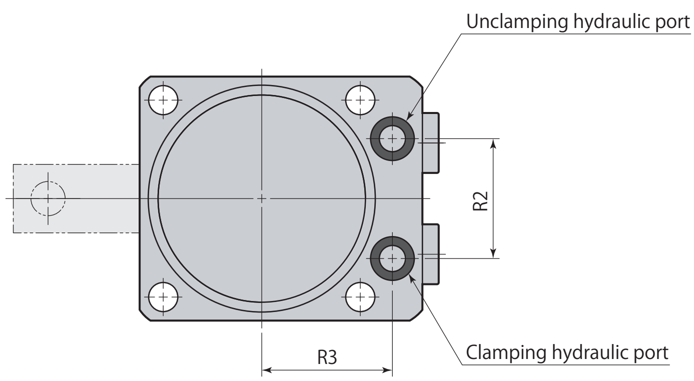




Clamp

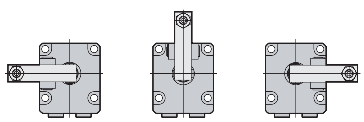


Unclamp



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

L：Left side　F：Front side　R：Right side



- Clamp arm and mounting screws are not included.

mm

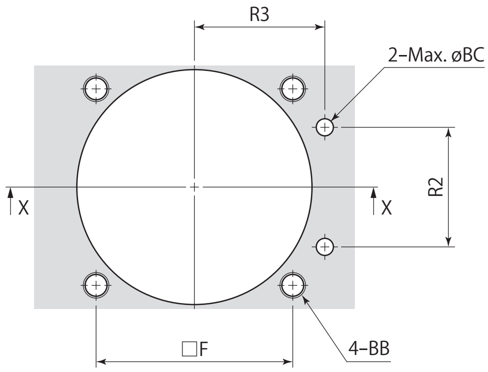
Model	CLU02-□	CLU04-□	CLU06-□	CLU10-□	CLU16-□	CLU25-□
A	93.5	104	111.5	131	155	186.5
B	45	50	57	70	86	108
C	55	60	66	82	96	120
D	32.5	35	37.5	47	53	66
E	22.5	25	28.5	35	43	54
F	35	40	46	56	68	88
øG	39	47	53	63	78	100
øH	12	14	14	16	22.4	28
K	33.5	39.5	42.5	47	55	65
L	27.5	27.7	29.3	36.3	41.5	47
M	55	58.5	63	76	89	108.5
N	5	6	6	8	11	13
R1	12.5	12.5	12.5	14	14	21
R2	22	24	28	36	45	50
R3	25	28	30.5	36	42	57
R4	20	22	26	30	38	50
S	11.5	13	13	17	21.8	27.5
øT	10	12	12	14	20	26
U (width across flats)	6	6	8	10	11	16
V	18	17	17	20	20	20
V1	11	13	15	19	25	32
V2	34	36	39	48	54.5	65
V3	24	26	30	35.5	44	53
V4	21	21	28	37	46	56
øW	5.5	5.5	6.8	9	11	14
øX	10	10	12	15	18.5	20
Y1	G1/8	G1/8	G1/8	G1/4	G1/4	G3/8
Y2	3.8	3.8	3.8	4.8	4.8	4.8
øY3	14	14	14	19	19	22
Z	C1.5	C2.5	C2.5	C3	C3.5	C5.5
øB1	$6^{-0.010}_{-0.022}$	$6^{-0.010}_{-0.022}$	$8^{-0.013}_{-0.028}$	$10^{-0.013}_{-0.028}$	$14^{-0.016}_{-0.034}$	$16^{-0.016}_{-0.034}$
øB2	$6^{-0.010}_{-0.022}$	$6^{-0.010}_{-0.022}$	$6^{-0.010}_{-0.022}$	$8^{-0.013}_{-0.028}$	$12^{-0.016}_{-0.034}$	$14^{-0.016}_{-0.034}$
B3 (snap ring)*1	STW-6	STW-6	STW-8	STW-10	STW-14	STW-16
B4 (snap ring)*1	STW-6	STW-6	STW-6	STW-8	STW-12	STW-14
CA	49.5	52.5	57	68	80	96
CB	48	59.6	67.3	78.7	98.2	133.5
CC	80.2	92.5	101.3	120.4	144.7	189.2
CD	About 69°	About 71°	About 70°	About 70°	About 69°	About 72°
HA	12	12	16	19	22	32
HG	16.5	18.5	21	24.5	30.5	37.5
O-ring (fluorocarbon hardness Hs90)	P7	P7	P7	P8	P8	P10
Flow control valve*2 Meter-in	VCF01	VCF01	VCF01	VCF02	VCF02	VCF03
Flow control valve*2 Meter-out	VCF01-O	VCF01-O	VCF01-O	VCF02-O	VCF02-O	VCF03-O
Air bleeding valve*2	VCE01	VCE01	VCE01	VCE02	VCE02	VCE03

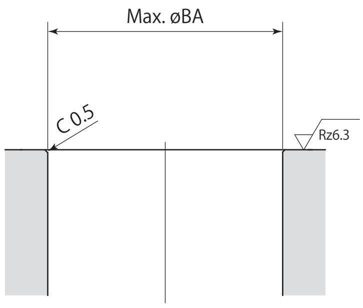
∗1：Snap ring is made by Ochiai Corporation.

∗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 →238** ● Air bleeding valve **page →240**

Mounting details





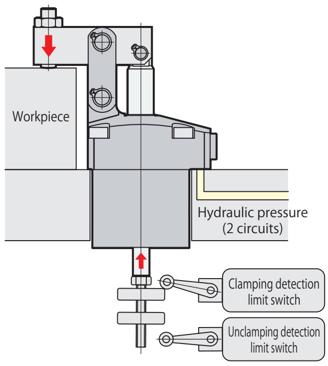
X-X

Rz: ISO4287(1997)

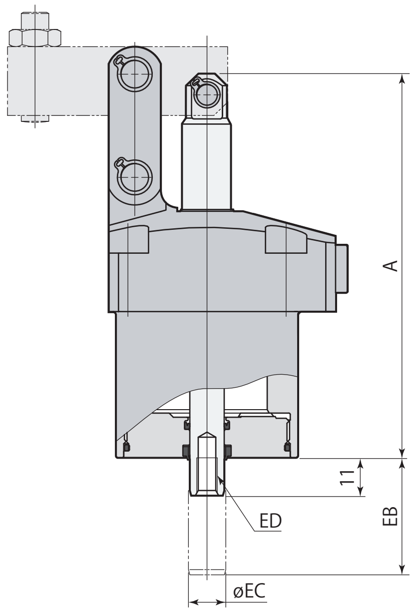
mm

Model	CLU02-□	CLU04-□	CLU06-□	CLU10-□	CLU16-□	CLU25-□
F	35	40	46	56	68	88
R2	22	24	28	36	45	50
R3	25	28	30.5	36	42	57
øBA	40	48	54	64	79	101
BB	M5	M5	M6	M8	M10	M12
øBC	4	4	4	6	6	8

Usage example



Dimensions



mm

Model	CLU02-□E	CLU04-□E	CLU06-□E	CLU10-□E	CLU16-□E	CLU25-□E
Cylinder capacity (clamp)	9.0 cm³	14.8 cm³	22.9 cm³	41.6 cm³	84.6 cm³	164.3 cm³
A	93.5	104	111.5	131	155	186.5
EB	28.5	31.5	34	37.5	44	53
øEC	8	10	10	12	12	16
ED	M5×0.8 depth 8	M6×1 depth 11	M6×1 depth 11	M8×1.25 depth 15	M8×1.25 depth 15	M10×1.5 depth 18
Mass	0.7 kg	1.0 kg	1.4 kg	2.4 kg	4.0 kg	7.4 kg

- Refer to specifications (**page →213**), dimensions (**page →216**) for other specifications and dimensions that are not shown in the diagram.
- CLU25-LE and CLU25-RE are made to order.

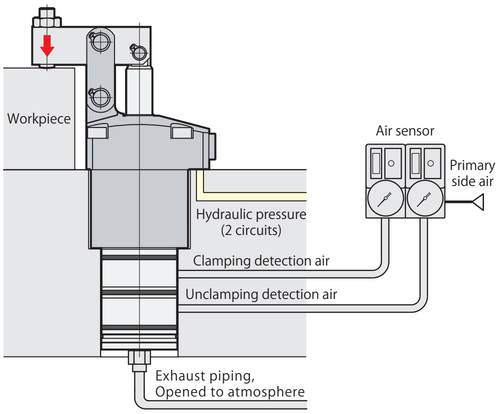
Clamping performance

Dual rod and air sensor models have smaller effective area on clamping side, which slightly reduces clamping force. Obtain clamping force by multiplying standard clamping force obtained from performance diagram (**page →214**) or performance table (**page →215**) by coefficient shown in table below.

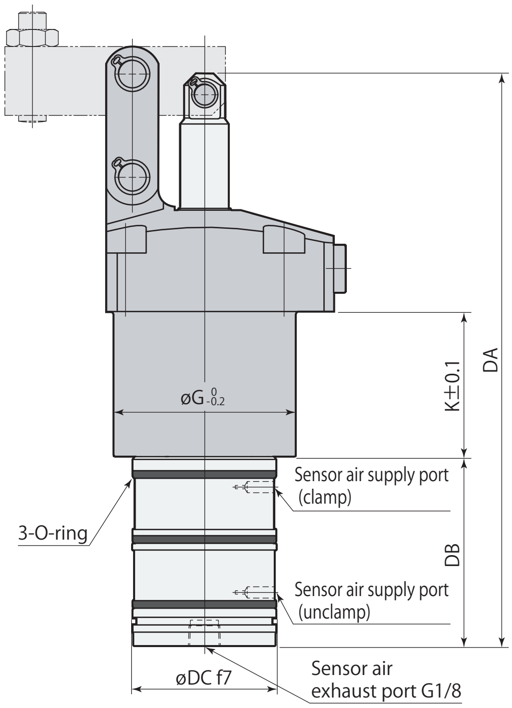
Calculation example
For models CLU10-FE or CLU10-FA, with hydraulic pressure of 7.0 MPa and clamp arm length of 60 mm:
Clamping force of standard specification CLU10-F : 6.6 kN
Clamping force of CLU10-FE or CLU10-FA : 6.6 × 0.93 = 6.1 kN

Model	CLU02-□E CLU02-□A	CLU04-□E CLU04-□A	CLU06-□E CLU06-□A	CLU10-□E CLU10-□A	CLU16-□E CLU16-□A	CLU25-□E CLU25-□A
Clamping performance coefficient	0.90	0.89	0.92	0.93	0.95	0.95

Usage example



Dimensions



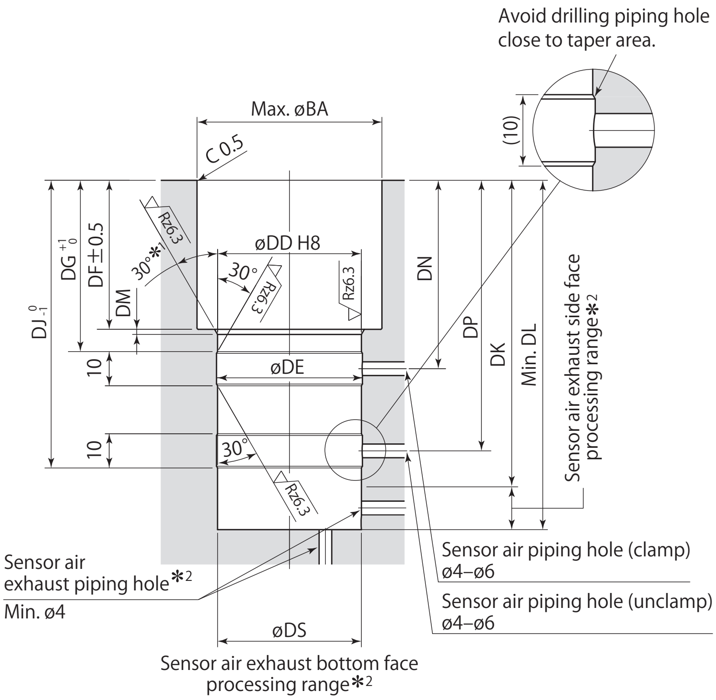
- Exhaust port must be opened to atmosphere.
  If sensor is embedded in a jig, prepare an exhaust piping hole.
  Furthermore, provide the piping if there is a risk of coolant or metal chips intrusion.
  Use one-touch fittings manufactured by SMC for G port piping. (See SMC catalog for the details of the fitting.)
- Refer to specifications (**page →213**), dimensions (**page →216**) for other specifications and dimensions that are not shown in the diagram. (Refer to **page →219** for details on clamping performance.)

mm

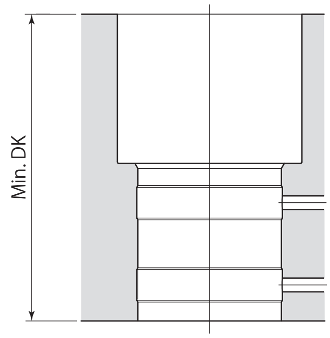
Model	CLU02-□A	CLU04-□A	CLU06-□A	CLU10-□A	CLU16-□A	CLU25-□A
Cylinder capacity (clamp)	9.0 cm³	14.8 cm³	22.9 cm³	41.6 cm³	84.6 cm³	164.3 cm³
DA	142.5	158	167.5	191	221.5	260
DB	49	54	56	60	66.5	73.5
øDC	38 $^{-0.025}_{-0.050}$	42 $^{-0.025}_{-0.050}$	42 $^{-0.025}_{-0.050}$	45 $^{-0.025}_{-0.050}$	45 $^{-0.025}_{-0.050}$	52 $^{-0.030}_{-0.060}$
øG	39	47	53	63	78	100
K	33.5	39.5	42.5	47	55	65
O-ring (fluorocarbon hardness Hs70)	AS568-028	AS568-029	AS568-029	AS568-030	AS568-030	AS568-032
Mass	0.9 kg	1.2 kg	1.6 kg	2.7 kg	4.3 kg	7.9 kg

- CLU□-□A (Air sensor) is made to order.

Mounting details



In blind hole



In through hole

Rz: ISO4287(1997)

*1: 15° only for CLU02-A

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

- 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.

mm

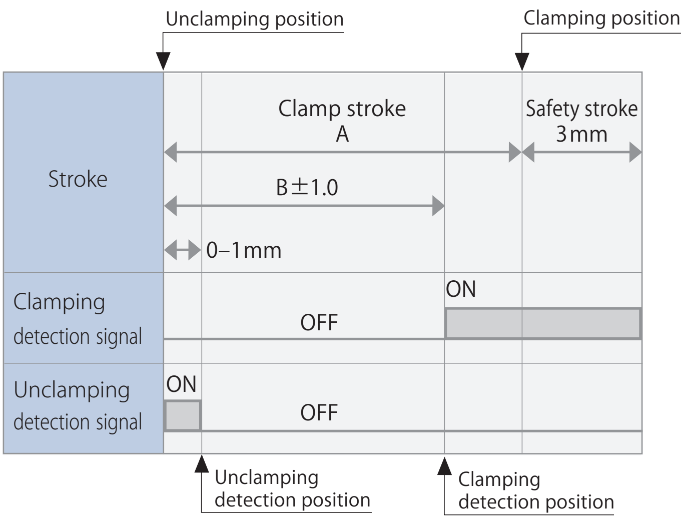
Model	CLU02-□A	CLU04-□A	CLU06-□A	CLU10-□A	CLU16-□A	CLU25-□A
øDD	38 $^{+0.039}_{0}$	42 $^{+0.039}_{0}$	42 $^{+0.039}_{0}$	45 $^{+0.039}_{0}$	45 $^{+0.039}_{0}$	52 $^{+0.046}_{0}$
øDE	38.6	42.6	42.6	45.6	45.6	52.6
DF	34.5	40.5	43.5	48	56	66
DG	41	47	50	54.5	62.5	72.5
DJ	70	79	84	92.5	107	123.5
DK	76	85	90	98.5	113	129.5
DL	86.5	97.5	102.5	111	125.5	142.5
DM	1	1.5	1.5	1.5	1.5	1.5
DN	46	52	55	59.5	67.5	77.5
DP	65	74	79	87.5	102	118.5
øDS	38	42	42	45	45	52
øBA	40	48	54	64	79	101

Air sensor unit

Supplier and model	ISA3-G series manufactured by SMC
	GPS2-05 series manufactured by CKD
Air supply pressure	0.2 MPa
Inner diameter of piping	ø4 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 usage shown on the left. Contact Technical service center for more details.
- 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.
- Maximum 6 pieces of clamp can be detected at 0.2MPa air pressure by means of 1 piece of sensor. In case of 0.1MPa air pressure, maximum 3 pieces of clamp are detectable.

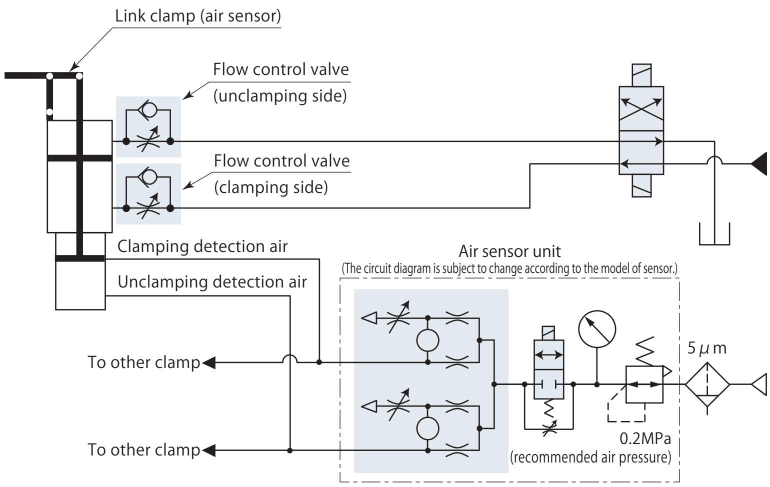
Air sensor triggering point



mm

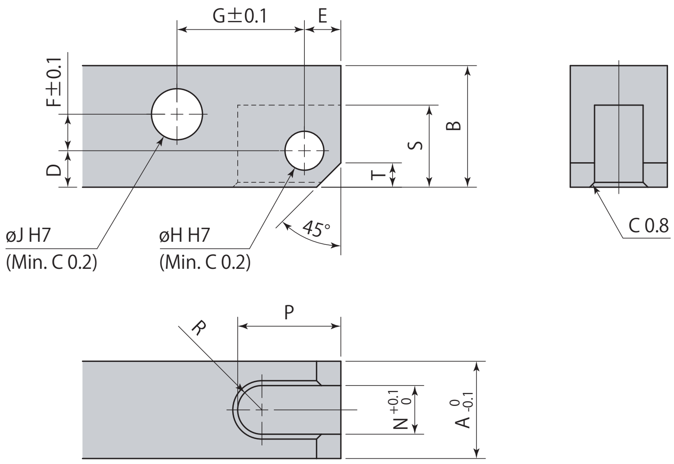
Model	Clamp stroke A	Clamping detection position B
CLU02-□A	17.5	15.5
CLU04-□A	20.5	18.5
CLU06-□A	23.0	21.0
CLU10-□A	26.5	24.5
CLU16-□A	33.0	31.0
CLU25-□A	42.0	40.0

Hydraulic and pneumatic circuit diagram



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)

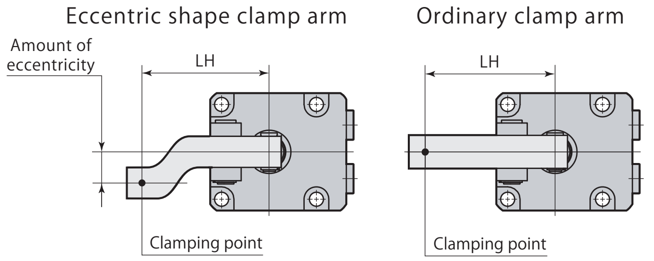
mm

Link clamp	CLU02	CLU04	CLU06	CLU10	CLU16	CLU25
A	12	12	16	19	22	32
B	14	16	20	25	31	38
D	5.5	6	6	8	9	12.5
E	5.5	6	6	7	10	13
F	3	3.5	6	7.5	9.5	9.5
G	16.5	18.5	21	24.5	30.5	37.5
øH	$6^{+0.012}_{0}$	$6^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$12^{+0.018}_{0}$	$14^{+0.018}_{0}$
øJ	$6^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$	$14^{+0.018}_{0}$	$16^{+0.018}_{0}$
N	6	6	8	10	11	16
P	14	17	17	20	26.5	36
R	R3	R3	R4	R5	R5.5	R8
S	12	13.5	13.5	17.5	22	28
T	3	4	4	5	7	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 CLU, 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.



model CLU02 ▭ indicates nonusable range

Hydraulic pressure MPa	Allowable eccentricity mm							
	Clamp arm length LH mm							
	27	30	36.5	40	50	60	80	100
7			16	20	34	47	60	60
6.5			18	23	38	52	↑	↑
6		11	21	27	43	58	↑	↑
5.5		13	24	30	48	60	↑	↑
5	10	16	28	35	55	↑	↑	↑
4.5	12	19	33	41	60	↑	↑	↑
4	15	23	39	48	↑	↑	↑	↑
3.5	20	28	47	57	↑	↑	↑	↑
3	25	35	58	60	↑	↑	↑	↑
2.5	33	45	60	↑	↑	↑	↑	↑
2	44	60	↑	↑	↑	↑	↑	↑
1.5	60	↑	↑	↑	↑	↑	↑	↑
1	60	60	60	60	60	60	60	60

model CLU04 ▭ indicates nonusable range

Hydraulic pressure MPa	Allowable eccentricity mm							
	Clamp arm length LH mm							
	30	35	42	50	60	80	100	120
7			7	13	21	36	51	60
6.5			9	15	24	41	57	↑
6			11	18	27	46	60	↑
5.5		6	13	21	32	52	↑	↑
5		8	16	25	37	60	↑	↑
4.5	6	11	20	30	43	↑	↑	↑
4	6	14	24	36	51	↑	↑	↑
3.5	9	18	30	44	60	↑	↑	↑
3	13	23	37	54	↑	↑	↑	↑
2.5	18	30	48	60	↑	↑	↑	↑
2	26	42	60	↑	↑	↑	↑	↑
1.5	39	60	↑	↑	↑	↑	↑	↑
1	60	60	60	60	60	60	60	60

model CLU06 ▭ indicates nonusable range

Hydraulic pressure MPa	Allowable eccentricity mm						
	Clamp arm length LH mm						
	35	45	50	60	80	100	120
7			8	8	8	8	8
6.5		8	8	8	8	8	8
6		12	13	15	19	23	26
5.5		18	20	24	32	41	49
5	11	24	28	35	48	62	76
4.5	15	32	37	48	68	80	80
4	19	42	49	64	80	↑	↑
3.5	24	51	65	80	↑	↑	↑
3	31	63	79	↑	↑	↑	↑
2.5	41	80	80	↑	↑	↑	↑
2	55	↑	↑	↑	↑	↑	↑
1.5	80	↑	↑	↑	↑	↑	↑
1	80	80	80	80	80	80	80

model CLU10 ▭ indicates nonusable range

Hydraulic pressure MPa	Allowable eccentricity mm								
	Clamp arm length LH mm								
	40	50	56.5	60	80	100	120	140	160
7		12	17	18	23	28	33	38	43
6.5		15	24	26	35	45	54	64	73
6		18	27	33	50	65	79	94	95
5.5	9	22	32	38	67	88	95	95	↑
5	9	27	38	45	80	95	↑	↑	↑
4.5	12	32	46	53	93	↑	↑	↑	↑
4	17	40	55	63	95	↑	↑	↑	↑
3.5	22	49	66	76	↑	↑	↑	↑	↑
3	30	61	82	93	↑	↑	↑	↑	↑
2.5	40	79	95	95	↑	↑	↑	↑	↑
2	56	95	↑	↑	↑	↑	↑	↑	↑
1.5	82	↑	↑	↑	↑	↑	↑	↑	↑
1	95	95	95	95	95	95	95	95	95

model CLU16 ▭ 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			16	26	46	66	86	107	110
6.5		11	22	34	58	81	104	110	↑
6		17	29	44	71	98	110	↑	↑
5.5		23	38	55	87	110	↑	↑	↑
5	13	31	49	68	105	↑	↑	↑	↑
4.5	19	41	62	85	110	↑	↑	↑	↑
4	27	53	78	105	↑	↑	↑	↑	↑
3.5	37	69	98	110	↑	↑	↑	↑	↑
3	51	90	110	↑	↑	↑	↑	↑	↑
2.5	71	110	↑	↑	↑	↑	↑	↑	↑
2	96	↑	↑	↑	↑	↑	↑	↑	↑
1.5	110	↑	↑	↑	↑	↑	↑	↑	↑
1	110	110	110	110	110	110	110	110	110

model CLU25 ▭ indicates nonusable range

Hydraulic pressure MPa	Allowable eccentricity mm								
	Clamp arm length LH mm								
	60	65	87.5	100	120	140	160	180	200
7			41	59	87	115	142	160	160
6.5			48	67	97	128	158	↑	↑
6		18	55	76	110	143	160	↑	↑
5.5	16	22	64	87	124	160	↑	↑	↑
5	18	28	75	100	142	↑	↑	↑	↑
4.5	24	35	88	117	160	↑	↑	↑	↑
4	31	44	104	137	↑	↑	↑	↑	↑
3.5	41	56	125	160	↑	↑	↑	↑	↑
3	53	71	153	↑	↑	↑	↑	↑	↑
2.5	71	93	160	↑	↑	↑	↑	↑	↑
2	97	125	↑	↑	↑	↑	↑	↑	↑
1.5	141	160	↑	↑	↑	↑	↑	↑	↑
1	160	160	160	160	160	160	160	160	160

Table of contents

Link clamp

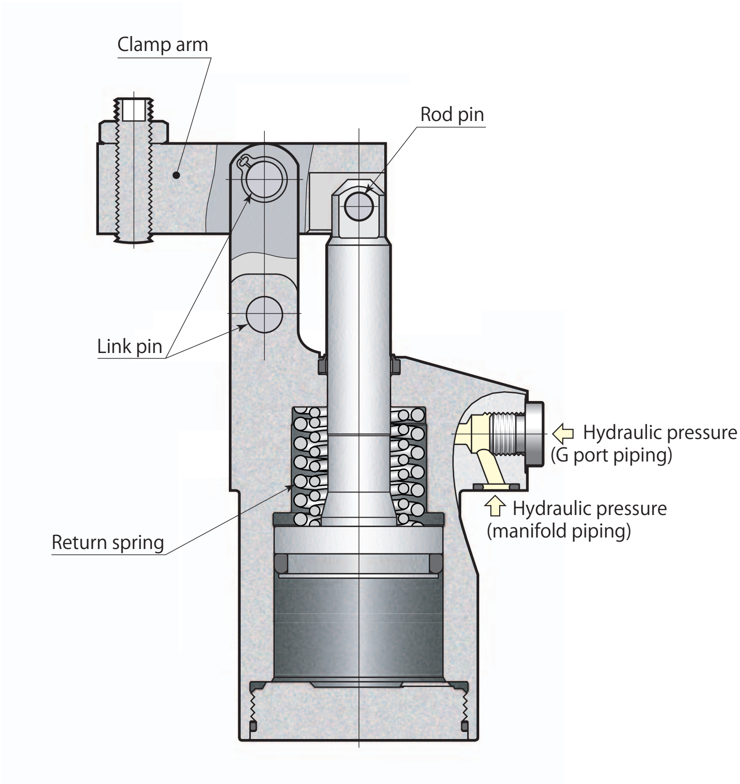
Single acting 7 MPa

model CLT

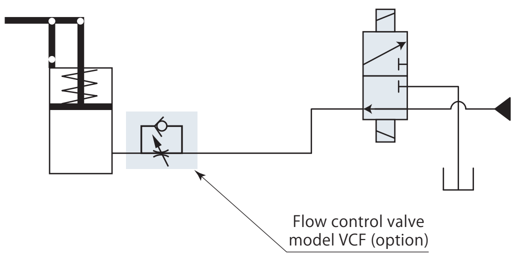
Single acting Link clamp
model CLT06-F

Standard model

model **CLT□-□**



Hydraulic circuit diagram



Use flow control valve for meter-in control.

Specifications page → 229
Standard page → 232

Specifications

Size: 02 / 04 / 06 / 10 / 16 / 25*

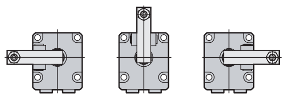
Clamp arm mounting direction

CLT [Size] – [Direction]

L : Left side

F : Front side

R : Right side



*:CLT25-L and CLT25-R are made to order.

Model			CLT02	CLT04	CLT06	CLT10	CLT16	CLT25
Cylinder force (hydraulic pressure 7MPa)*1		kN	3.2	4.5	6.1	9.8	15.7	25.4
Cylinder inner diameter		mm	25	30	35	44	56	70
Rod diameter		mm	12	14	14	16	22.4	28
Effective area (clamp)		cm^2	4.9	7.1	9.6	15.2	24.6	38.5
Full stroke		mm	20.5	23.5	26	29.5	36	45
Clamp stroke		mm	17.5	20.5	23	26.5	33	42
Safety stroke		mm	3	3	3	3	3	3
Max. oil flow rate		L/min	1.0	1.6	2.6	4.7	9.5	18.9
Cylinder capacity		cm^3	10.0	16.7	25.0	44.8	88.6	173.3
Return spring force	Clamp	kN	0.25	0.40	0.63	0.81	1.52	1.58
	Unclamp	kN	0.13	0.19	0.33	0.44	0.81	0.83
Recommended piping inner diameter*2		mm	ø6	ø6	ø6	ø8	ø8	ø10
Max. allowable mass of clamp arm*3		kg	0.2	0.3	0.5	1.0	1.5	3.0
Mass		kg	0.7	1.0	1.5	2.4	4.3	8.1
Recommended tightening torque of mounting screws*4		N·m	7	7	12	29	57	100

- Pressure range:2.5–7 MPa
- 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:This is value for clamping position.

*2:Care must be taken when numerous clamps are used or when hydraulic piping is long.

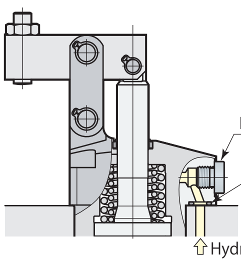
*3:This is clamp arm mass when shape of clamp arm being described in Dimensions is retained but length only has been extended.

*4:ISO R898 class 12.9

Manifold piping and G port piping are available.

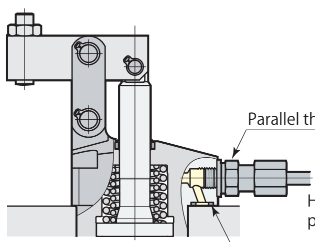
Manifold piping

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.

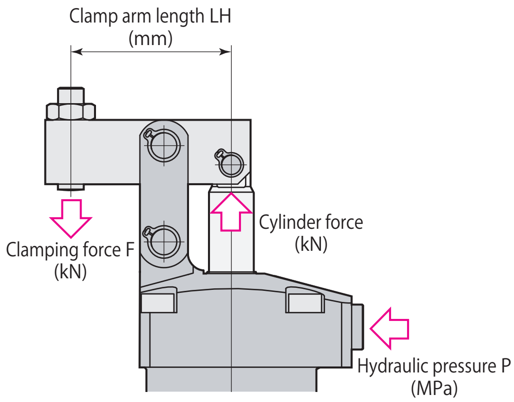


G port piping

Remove plug when choosing G port piping. (O-ring must be used.) Refer to **page →372** 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.



Performance diagram



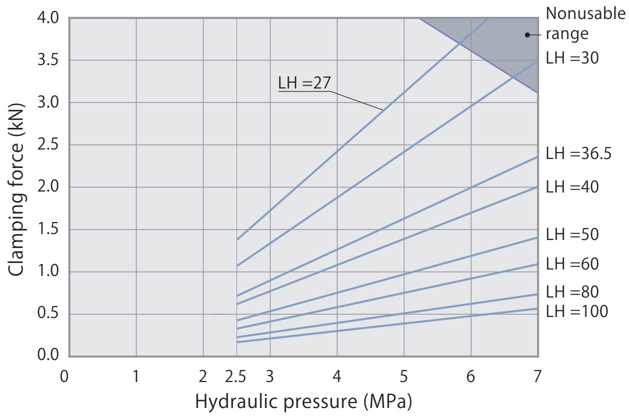
Clamping force varies depending on the clamp arm length (LH) and hydraulic pressure (P).

Clamping force calculation formula
F＝(Coefficient 1×P-Coefficient 2)/(LH-Coefficient 3)
F:Clamping force　P:Hydraulic pressure　LH:Clamp arm length

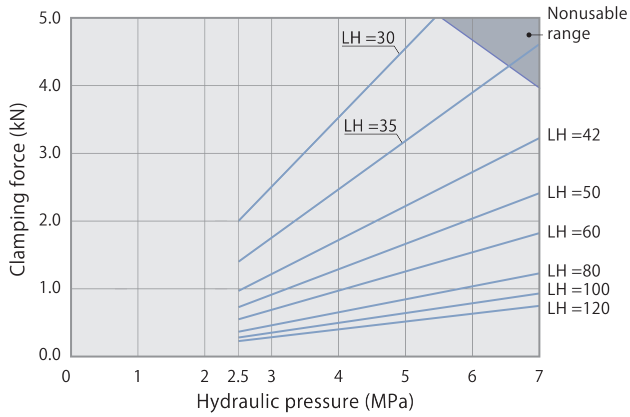
CLT06 with clamp arm length (LH) = 50 mm at hydraulic pressure of 7 MPa, Clamping force F is calculated by
(18.18×7-11.91)/(50-21.0)＝4.0 kN

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

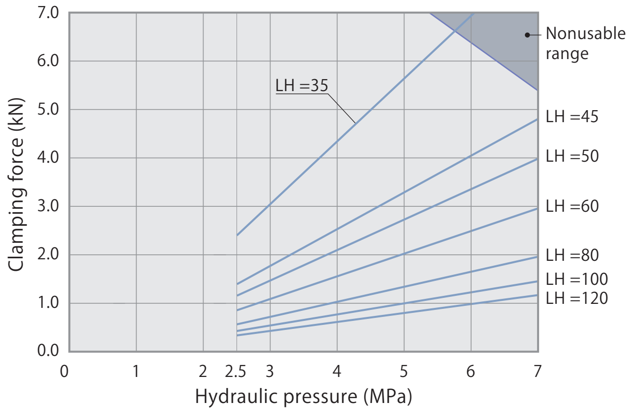
model CLT02



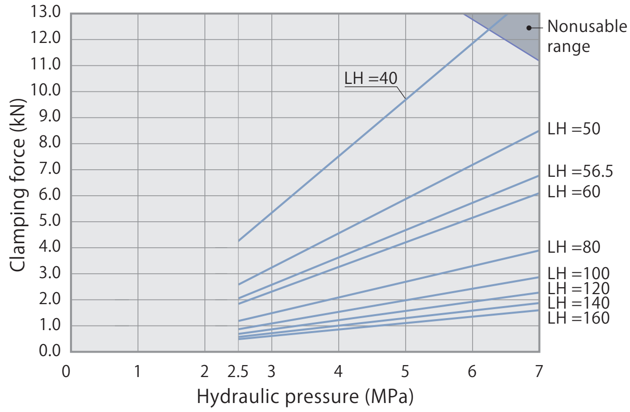
model CLT04



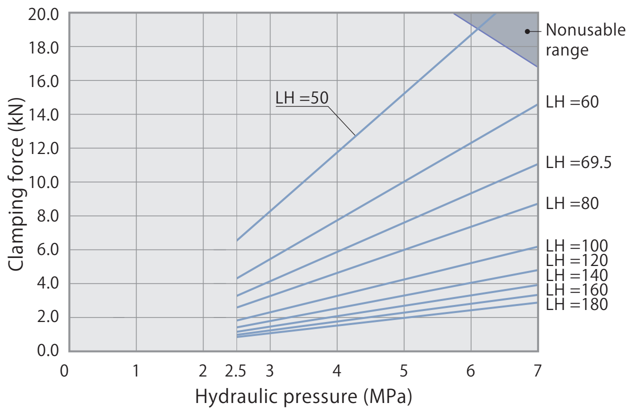
model CLT06



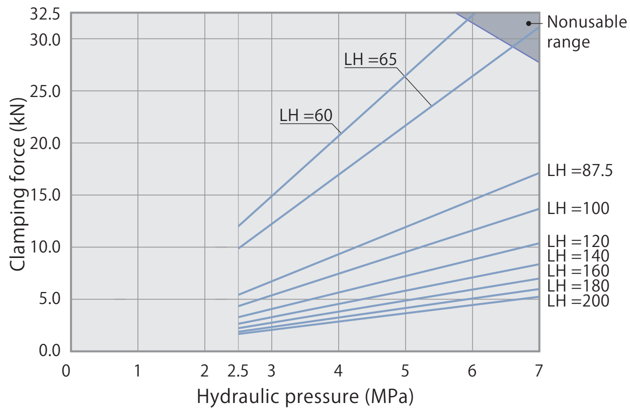
model CLT10



model CLT16



model CLT25



Performance table

model CLT02 Clamping force F=(7.29×P-3.71)/(LH-16.5)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN								Min. arm length Min. LH mm
		Clamp arm length LH mm								
		27	30	36.5	40	50	60	80	100	
7	3.2			2.4	2.0	1.4	1.1	0.7	0.6	32
6.5	2.9		3.2	2.2	1.9	1.3	1.0	0.7	0.5	30
6	2.7		3.0	2.0	1.7	1.2	0.9	0.6	0.5	28
5.5	2.4	3.5	2.7	1.8	1.5	1.1	0.8	0.6	0.4	26
5	2.2	3.1	2.4	1.6	1.4	1.0	0.8	0.5	0.4	25
4.5	2.0	2.8	2.2	1.5	1.2	0.9	0.7	0.5	0.3	24
4	1.7	2.4	1.9	1.3	1.1	0.8	0.6	0.4	0.3	↑
3.5	1.5	2.1	1.6	1.1	0.9	0.7	0.5	0.3	0.3	↑
3	1.2	1.7	1.3	0.9	0.8	0.5	0.4	0.3	0.2	↑
2.5	1.0	1.4	1.1	0.7	0.6	0.4	0.3	0.2	0.2	24
Max. pressure	MPa	5.8	6.6	7.0	7.0	7.0	7.0	7.0	7.0	

indicates nonusable range

model CLT04 Clamping force F=(11.77×P-6.66)/(LH-18.5)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN								Min. arm length Min. LH mm
		Clamp arm length LH mm								
		30	35	42	50	60	80	100	120	
7	4.5			3.2	2.4	1.8	1.2	0.9	0.7	38
6.5	4.2		4.2	3.0	2.2	1.7	1.1	0.9	0.7	35
6	3.8		3.9	2.7	2.0	1.5	1.0	0.8	0.6	33
5.5	3.5		3.5	2.5	1.8	1.4	0.9	0.7	0.6	31
5	3.1	4.5	3.2	2.2	1.7	1.3	0.8	0.6	0.5	29
4.5	2.8	4.0	2.8	2.0	1.5	1.1	0.8	0.6	0.5	27
4	2.4	3.5	2.4	1.7	1.3	1.0	0.7	0.5	0.4	26
3.5	2.1	3.0	2.1	1.5	1.1	0.8	0.6	0.4	0.3	↑
3	1.7	2.5	1.7	1.2	0.9	0.7	0.5	0.4	0.3	↑
2.5	1.4	2.0	1.4	1.0	0.7	0.5	0.4	0.3	0.2	26
Max. pressure	MPa	5.4	6.5	7.0	7.0	7.0	7.0	7.0	7.0	

indicates nonusable range

model CLT06 Clamping force F=(18.18×P-11.91)/(LH-21.0)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN							Min. arm length Min. LH mm
		Clamp arm length LH mm							
		35	45	50	60	80	100	120	
7	6.1		4.8	4.0	3.0	2.0	1.5	1.2	43
6.5	5.6		4.4	3.7	2.7	1.8	1.3	1.1	39
6	5.1		4.0	3.4	2.5	1.6	1.2	1.0	37
5.5	4.7	6.3	3.7	3.0	2.3	1.5	1.1	0.9	34
5	4.2	5.6	3.3	2.7	2.0	1.3	1.0	0.8	32
4.5	3.7	5.0	2.9	2.4	1.8	1.2	0.9	0.7	30
4	3.2	4.3	2.5	2.1	1.6	1.0	0.8	0.6	↑
3.5	2.7	3.7	2.2	1.8	1.3	0.9	0.7	0.5	↑
3	2.3	3.0	1.8	1.5	1.1	0.7	0.5	0.4	↑
2.5	1.8	2.4	1.4	1.2	0.9	0.6	0.4	0.3	30
Max. pressure	MPa	5.7	7.0	7.0	7.0	7.0	7.0	7.0	

indicates nonusable range

model CLT10 Clamping force F=(33.54×P-17.86)/(LH-24.5)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN									Min. arm length Min. LH mm
		Clamp arm length LH mm									
		40	50	56.5	60	80	100	120	140	160	
7	9.8		8.5	6.8	6.1	3.9	2.9	2.3	1.9	1.6	44
6.5	9.1		7.8	6.3	5.6	3.6	2.7	2.1	1.7	1.5	42
6	8.3	11.8	7.2	5.7	5.2	3.3	2.4	1.9	1.6	1.4	39
5.5	7.6	10.7	6.5	5.2	4.7	3.0	2.2	1.7	1.4	1.2	37
5	6.8	9.7	5.9	4.7	4.2	2.7	2.0	1.6	1.3	1.1	36
4.5	6.0	8.6	5.2	4.2	3.7	2.4	1.8	1.4	1.2	1.0	↑
4	5.3	7.5	4.6	3.6	3.3	2.1	1.5	1.2	1.0	0.9	↑
3.5	4.5	6.4	3.9	3.1	2.8	1.8	1.3	1.0	0.9	0.7	↑
3	3.8	5.3	3.2	2.6	2.3	1.5	1.1	0.9	0.7	0.6	↑
2.5	3.0	4.3	2.6	2.1	1.9	1.2	0.9	0.7	0.6	0.5	36
Max. pressure	MPa	6.2	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	

indicates nonusable range

model CLT16 Clamping force F=(67.61×P-41.72)/(LH-30.5)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN									Min. arm length Min. LH mm
		Clamp arm length LH mm									
		50	60	69.5	80	100	120	140	160	180	
7	15.7		14.6	11.1	8.7	6.2	4.8	3.9	3.3	2.9	57
6.5	14.5		13.5	10.2	8.0	5.7	4.4	3.6	3.1	2.7	53
6	13.3	18.7	12.3	9.3	7.4	5.2	4.1	3.3	2.8	2.4	50
5.5	12.0	16.9	11.2	8.5	6.7	4.8	3.7	3.0	2.5	2.2	47
5	10.8	15.2	10.0	7.6	6.0	4.3	3.3	2.7	2.3	2.0	45
4.5	9.6	13.5	8.9	6.7	5.3	3.8	2.9	2.4	2.0	1.8	44
4	8.3	11.7	7.8	5.9	4.6	3.3	2.6	2.1	1.8	1.5	↑
3.5	7.1	10.0	6.6	5.0	3.9	2.8	2.2	1.8	1.5	1.3	↑
3	5.9	8.3	5.5	4.1	3.3	2.3	1.8	1.5	1.2	1.1	↑
2.5	4.6	6.5	4.3	3.3	2.6	1.8	1.4	1.2	1.0	0.9	44
Max. pressure	MPa	6.1	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	

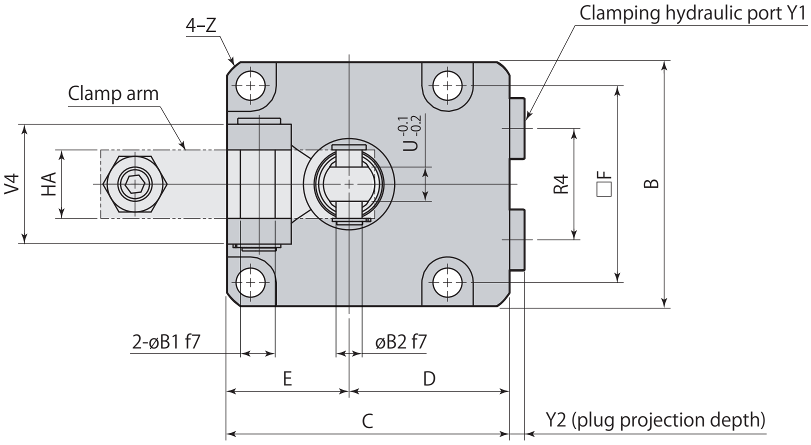
indicates nonusable range

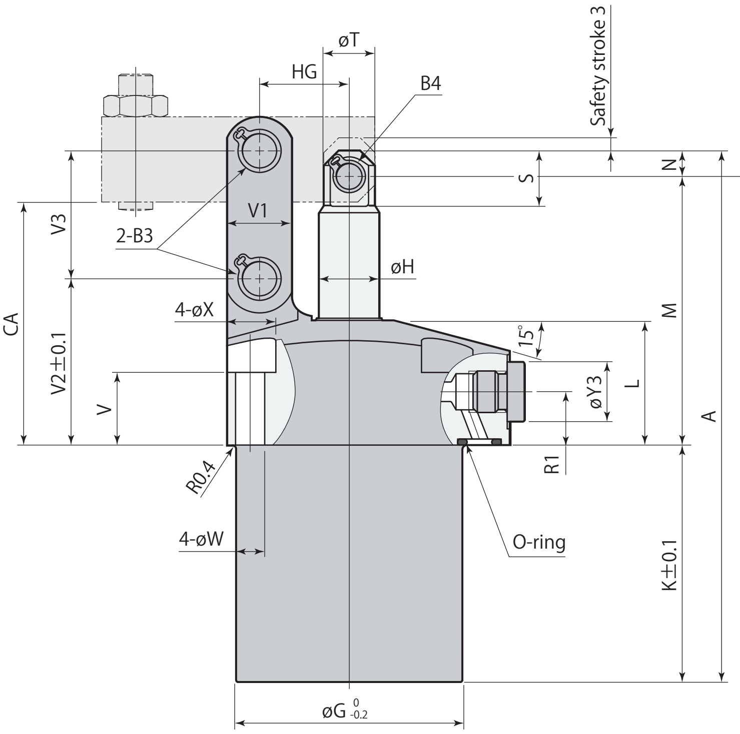
model CLT25 Clamping force F=(129.87×P-53.33)/(LH-37.5)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN									Min. arm length Min. LH mm
		Clamp arm length LH mm									
		60	65	87.5	100	120	140	160	180	200	
7	25.4			17.1	13.7	10.4	8.3	7.0	6.0	5.3	69
6.5	23.4		28.8	15.8	12.7	9.6	7.7	6.5	5.5	4.9	65
6	21.5		26.4	14.5	11.6	8.8	7.1	5.9	5.1	4.5	61
5.5	19.6	29.4	24.0	13.2	10.6	8.0	6.4	5.4	4.6	4.1	58
5	17.7	26.5	21.7	11.9	9.5	7.2	5.8	4.9	4.2	3.7	55
4.5	15.7	23.6	19.3	10.6	8.5	6.4	5.2	4.3	3.7	3.3	↑
4	13.8	20.7	17.0	9.3	7.5	5.7	4.5	3.8	3.3	2.9	↑
3.5	11.9	17.8	14.6	8.0	6.4	4.9	3.9	3.3	2.8	2.5	↑
3	10.0	14.9	12.2	6.7	5.4	4.1	3.3	2.7	2.4	2.1	↑
2.5	8.0	12.1	9.9	5.4	4.3	3.3	2.6	2.2	1.9	1.7	55
Max. pressure	MPa	5.9	6.6	7.0	7.0	7.0	7.0	7.0	7.0	7.0	

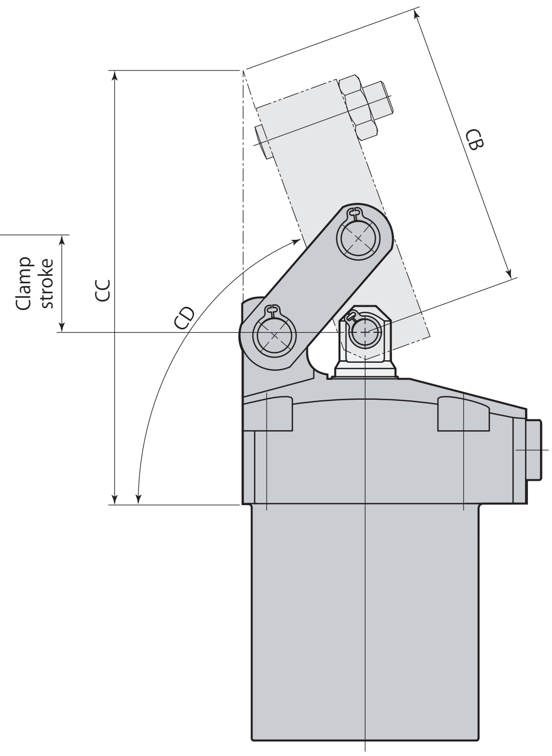
indicates nonusable range

Dimensions

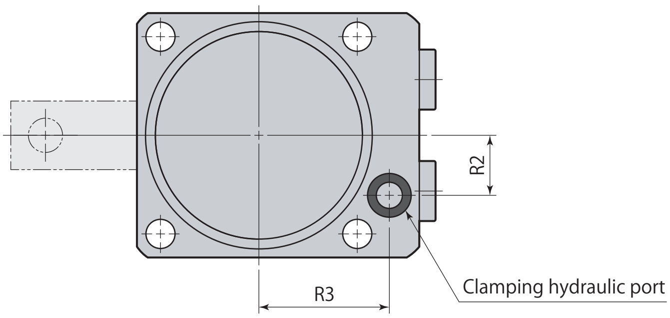




Clamp

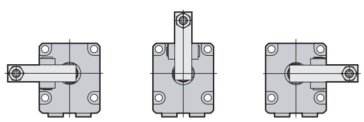


Unclamp



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

L：Left side　F：Front side　R：Right side



- Clamp arm and mounting screws are not included.

mm

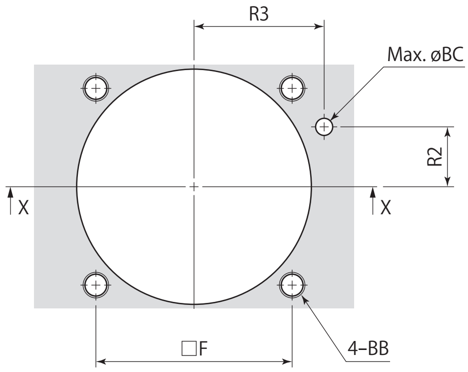
Model	CLT02-□	CLT04-□	CLT06-□	CLT10-□	CLT16-□	CLT25-□
A	97.5	110	124.5	138	169	201.5
B	45	50	57	70	86	108
C	55	60	66	82	96	120
D	32.5	35	37.5	47	53	66
E	22.5	25	28.5	35	43	54
F	35	40	46	56	68	88
øG	39	47	53	63	78	100
øH	12	14	14	16	22.4	28
K	37.5	45.5	55.5	54	69	80
L	27.5	27.7	29.3	36.3	41.5	47
M	55	58.5	63	76	89	108.5
N	5	6	6	8	11	13
R1	12.5	12.5	12.5	14	14	21
R2	11	12	14	18	22.5	25
R3	25	28	30.5	36	42	57
R4	20	22	26	30	38	50
S	11.5	13	13	17	21.8	27.5
T	10	12	12	14	20	26
U (width across flats)	6	6	8	10	11	16
V	18	17	17	20	20	20
V1	11	13	15	19	25	32
V2	34	36	39	48	54.5	65
V3	24	26	30	35.5	44	53
V4	21	21	28	37	46	56
øW	5.5	5.5	6.8	9	11	14
øX	10	10	12	15	18.5	20
Y1	G1/8	G1/8	G1/8	G1/4	G1/4	G3/8
Y2	3.8	3.8	3.8	4.8	4.8	4.8
øY3	14	14	14	19	19	22
Z	C1.5	C2.5	C2.5	C3	C3.5	C5.5
øB1	$6^{-0.010}_{-0.022}$	$6^{-0.010}_{-0.022}$	$8^{-0.013}_{-0.028}$	$10^{-0.013}_{-0.028}$	$14^{-0.016}_{-0.034}$	$16^{-0.016}_{-0.034}$
øB2	$6^{-0.010}_{-0.022}$	$6^{-0.010}_{-0.022}$	$6^{-0.010}_{-0.022}$	$8^{-0.013}_{-0.028}$	$12^{-0.016}_{-0.034}$	$14^{-0.016}_{-0.034}$
B3 (snap ring)*1	STW-6	STW-6	STW-8	STW-10	STW-14	STW-16
B4 (snap ring)*1	STW-6	STW-6	STW-6	STW-8	STW-12	STW-14
CA	49.5	52.5	57	68	80	96
CB	48	59.6	67.3	78.7	98.2	133.5
CC	80.2	92.5	101.3	120.4	144.7	189.2
CD	About 69°	About 71°	About 70°	About 70°	About 69°	About 72°
HA	12	12	16	19	22	32
HG	16.5	18.5	21	24.5	30.5	37.5
O-ring (fluorocarbon hardness Hs90)	P7	P7	P7	P8	P8	P10
Flow control valve (meter-in)*2	VCF01	VCF01	VCF01	VCF02	VCF02	VCF03
Air bleeding valve*2	VCE01	VCE01	VCE01	VCE02	VCE02	VCE03

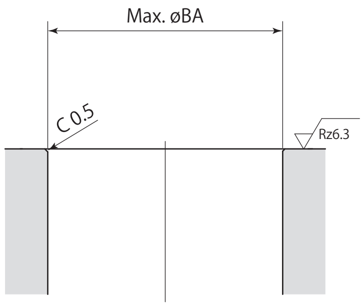
*1: Snap ring is made by Ochiai Corporation.

*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 →238** ● Air bleeding valve **page →240**

Mounting details





X-X

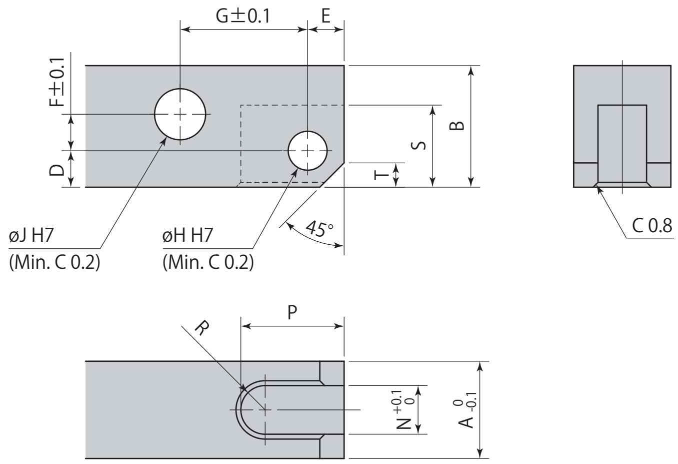
Rz: ISO4287(1997)

mm

Model	CLT02-□	CLT04-□	CLT06-□	CLT10-□	CLT16-□	CLT25-□
F	35	40	46	56	68	88
R2	11	12	14	18	22.5	25
R3	25	28	30.5	36	42	57
øBA	40	48	54	64	79	101
BB	M5	M5	M6	M8	M10	M12
øBC	4	4	4	6	6	8

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)

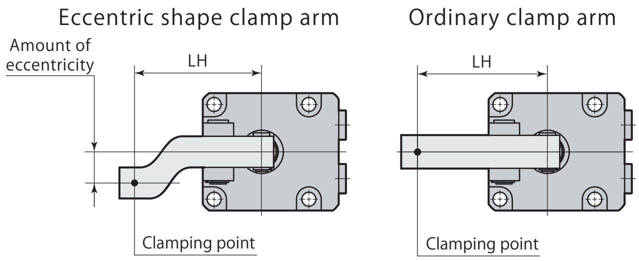
mm

Link clamp	CLT02	CLT04	CLT06	CLT10	CLT16	CLT25
A	12	12	16	19	22	32
B	14	16	20	25	31	38
D	5.5	6	6	8	9	12.5
E	5.5	6	6	7	10	13
F	3	3.5	6	7.5	9.5	9.5
G	16.5	18.5	21	24.5	30.5	37.5
øH	$6^{+0.012}_{0}$	$6^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$12^{+0.018}_{0}$	$14^{+0.018}_{0}$
øJ	$6^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$	$14^{+0.018}_{0}$	$16^{+0.018}_{0}$
N	6	6	8	10	11	16
P	14	17	17	20	26.5	36
R	R3	R3	R4	R5	R5.5	R8
S	12	13.5	13.5	17.5	22	28
T	3	4	4	5	7	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 CLT, 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.



model CLT02 (■ indicates nonusable range)

Hydraulic pressure MPa	Allowable eccentricity mm / Clamp arm length LH mm							
	27	30	36.5	40	50	60	80	100
7			18	23	38	52	60	60
6.5		11	21	27	43	58	↑	↑
6		13	24	30	48	60	↑	↑
5.5	10	16	28	35	55	↑	↑	↑
5	12	19	33	41	60	↑	↑	↑
4.5	15	23	39	48	↑	↑	↑	↑
4	20	28	47	57	↑	↑	↑	↑
3.5	25	35	58	60	↑	↑	↑	↑
3	33	45	60	↑	↑	↑	↑	↑
2.5	44	60	60	60	60	60	60	60

model CLT04 (■ indicates nonusable range)

Hydraulic pressure MPa	Allowable eccentricity mm / Clamp arm length LH mm							
	30	35	42	50	60	80	100	120
7			9	16	24	41	58	60
6.5		6	11	19	28	47	60	↑
6		6	14	22	32	53	↑	↑
5.5		8	16	26	38	60	↑	↑
5	6	11	20	31	44	↑	↑	↑
4.5	6	14	25	37	52	↑	↑	↑
4	9	18	31	45	60	↑	↑	↑
3.5	13	24	39	55	↑	↑	↑	↑
3	19	32	50	60	↑	↑	↑	↑
2.5	27	44	60	60	60	60	60	60

model CLT06 (■ indicates nonusable range)

Hydraulic pressure MPa	Allowable eccentricity mm / Clamp arm length LH mm						
	35	45	50	60	80	100	120
7		9	9	10	11	12	13
6.5		14	15	18	23	28	25
6		19	22	27	37	47	33
5.5	12	26	30	38	54	70	57
5	16	35	41	52	75	80	80
4.5	20	45	54	70	80	↑	↑
4	26	55	69	80	↑	↑	↑
3.5	33	68	80	↑	↑	↑	↑
3	44	80	↑	↑	↑	↑	↑
2.5	61	80	80	80	80	80	80

model CLT10 (■ indicates nonusable range)

Hydraulic pressure MPa	Allowable eccentricity mm / Clamp arm length LH mm								
	40	50	56.5	60	80	100	120	140	160
7		15	24	26	36	46	56	65	75
6.5		18	28	33	51	66	81	95	95
6	9	22	33	38	68	90	95	↑	↑
5.5	9	27	39	45	81	95	↑	↑	↑
5	13	33	46	53	94	↑	↑	↑	↑
4.5	17	40	55	63	95	↑	↑	↑	↑
4	23	50	67	76	↑	↑	↑	↑	↑
3.5	30	62	83	94	↑	↑	↑	↑	↑
3	41	80	95	95	↑	↑	↑	↑	↑
2.5	57	95	95	95	95	95	95	95	95

model CLT16 (■ indicates nonusable range)

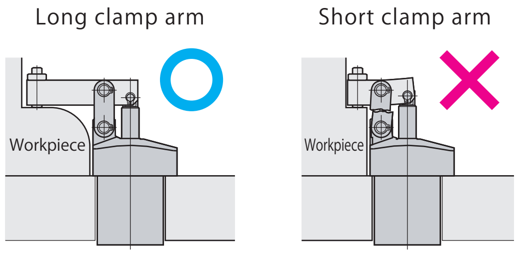
Hydraulic pressure MPa	Allowable eccentricity mm / Clamp arm length LH mm								
	50	60	69.5	80	100	120	140	160	180
7		13	24	37	61	85	110	110	110
6.5		18	32	47	75	103	↑	↑	↑
6	11	25	41	58	91	110	↑	↑	↑
5.5	14	34	52	72	110	↑	↑	↑	↑
5	21	44	66	90	↑	↑	↑	↑	↑
4.5	30	57	83	110	↑	↑	↑	↑	↑
4	41	74	105	↑	↑	↑	↑	↑	↑
3.5	56	96	110	↑	↑	↑	↑	↑	↑
3	77	110	↑	↑	↑	↑	↑	↑	↑
2.5	109	110	110	110	110	110	110	110	110

model CLT25 (■ indicates nonusable range)

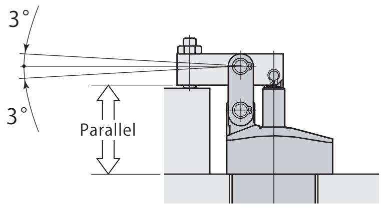
Hydraulic pressure MPa	Allowable eccentricity mm / Clamp arm length LH mm								
	60	65	87.5	100	120	140	160	180	200
7			46	65	95	125	155	160	160
6.5		17	54	74	107	140	160	↑	↑
6		21	62	85	121	158	↑	↑	↑
5.5	17	27	73	98	138	160	↑	↑	↑
5	23	34	85	113	159	↑	↑	↑	↑
4.5	30	43	101	133	160	↑	↑	↑	↑
4	39	54	121	158	↑	↑	↑	↑	↑
3.5	50	68	147	160	↑	↑	↑	↑	↑
3	67	88	160	↑	↑	↑	↑	↑	↑
2.5	91	118	160	160	160	160	160	160	160

Caution in use

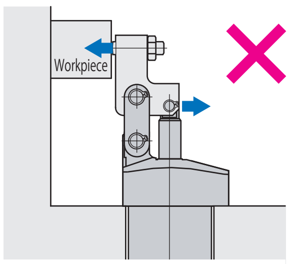
- With link clamps, force acting on link mechanism becomes larger as clamp arm becomes shorter. Exceeding maximum allowable load for link mechanism will lead to malfunction. Depending on clamp arm length, it would be necessary to lower clamping force (hydraulic pressure). Use a clamp at appropriate clamping force that is suitable for clamp arm length, referring to performance diagram and table.



- Determine height and mount clamp, ensuring that clamp arm becomes parallel to clamping surface and mounting surface when workpiece is clamped (allowable angle ±3°).



- Using a method such as that shown in the diagram on the right will apply a transverse force on the piston rod and cause the piston rod to break. Please avoid the usage that may apply a non-axial force to the piston rod.



Specifications

(Nil) : Meter-in

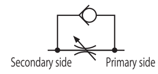
Body color : Silver

O : Meter-out

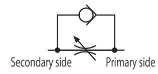
Body color : Black

VCF — G port size: 01S : G1/8, 01 : G1/8, 02 : G1/4, 03 : G3/8 — Control method:

(Nil) : Meter-in



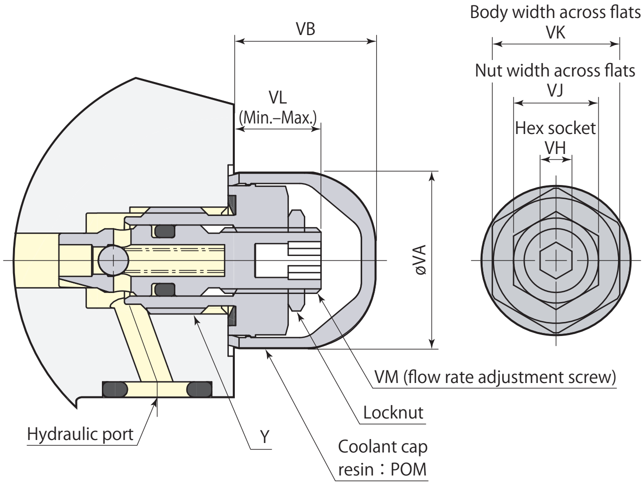
O : Meter-out



Model		Meter-in				Meter-out			
		VCF01S	VCF01	VCF02	VCF03	VCF01S-O	VCF01-O	VCF02-O	VCF03-O
G port size		G1/8	G1/8	G1/4	G3/8	G1/8	G1/8	G1/4	G3/8
Cracking pressure	MPa	0.04	0.04	0.04	0.04	0.1	0.1	0.1	0.1
Orifice area	mm^2	4.9	4.9	9.6	19.6	3.1	3.1	6.2	12.6
Recommended tightening torque	N·m	10	10	30	35	10	10	30	35
Mass	kg	0.011	0.013	0.024	0.038	0.011	0.013	0.024	0.038

- Pressure range : 0.5–7 MPa
- Proof pressure : 10.5 MPa
- Operating temperature : 0–70 ℃
- Fluid used : General mineral based hydraulic oil (ISO-VG32 equivalent)

Dimensions



mm

Model	VCF01S VCF01S-O	VCF01 VCF01-O	VCF02 VCF02-O	VCF03 VCF03-O
Y	G1/8	G1/8	G1/4	G3/8
øVA	16	16	21	24
VB	13	13	13	14
VH	3	3	5	6
VJ	8	8	10	14
VK	12	12	17	19
VL	8–11	7–11	7.5–11.5	8.5–12.5
Adjustment screw number of turns	4 rotations	5.3 rotations	5.3 rotations	5.3 rotations
VM	M6×0.75	M6×0.75	M8×0.75	M10×0.75

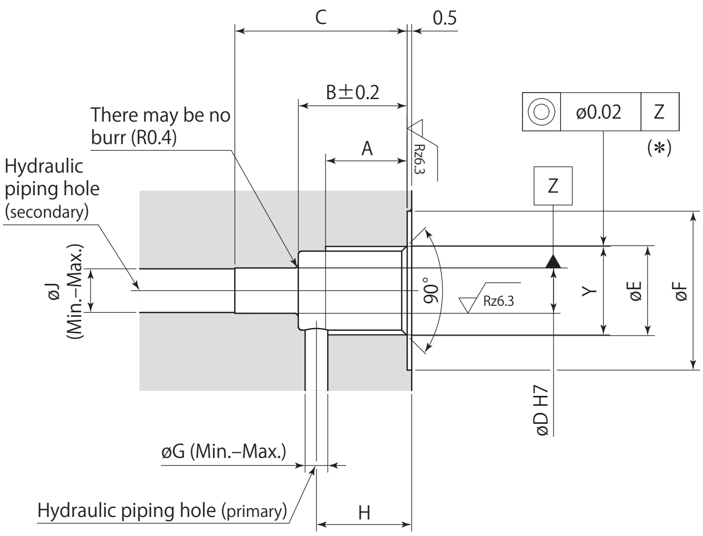
- Use a closed wrench or socket wrench for mounting and dismounting.
- Flow control valve can be mounted on hydraulic port (G port) when manifold piping.
- Adjust flow rate without hydraulic pressure. Conducting adjustments with hydraulic pressure may result in damaging seal.
- Diagram above indicates mounting for meter-in (VCF□).
- VCF is shipped with the valve fully open. Adjust the flow rate by loosening the screws after it is screwed in to close totally. Tighten the locknut after adjustment is completed.

Applicable clamp and work support

Model	VCF01S	VCF01	VCF02	VCF03
Swing clamp (double acting)	CTM03, 04, 05, 06 CTP04, 05, 06	CTM10 CTU01, 02, 04, 06	CTM16 CTU10, 16	CTU25
Swing clamp (single acting)*	CTN02, 04, 05, 06	CTT01, 02, 04, 06	CTN10, 16 CTT10, 16	CTT25
Swivel clamp (double acting)*	CTS04	CTS06	CTS10, 16	–
Link clamp (double acting)	CLM03, 04 CLP04, 05, 06	CLM05, 06, 10 CLU02, 04, 06	CLM16 CLU10, 16	CLU25
Link clamp (single acting)*	CLN04	CLN05, 06 CLT02, 04, 06	CLN10, 16 CLT10, 16	CLT25
Work lift cylinder	CNB01	CNB02, 04	–	–
Push, pull cylinder	–	CNA02, 04, 06	CNA10, 16	CNA25
Work support*	CSU CSP-D(CSN, CSY)	–	–	–

* : Single acting swing clamp, swivel clamp, single acting link clamp and work support are meter-in only.

Mounting details



Rz: ISO4287(1997)

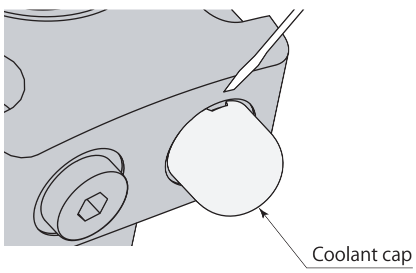
mm

Model	VCF01S VCF01S-O	VCF01 VCF01-O	VCF02 VCF02-O	VCF03 VCF03-O
A	9	9	13	13
B	11	13	18	19
C	15.5	17.5	22.5	23.5
øD	5 $^{+0.012}_{0}$	5 $^{+0.012}_{0}$	6 $^{+0.012}_{0}$	8 $^{+0.015}_{0}$
øE	9.9	9.9	13.3	16.8
øF	17.5	17.5	21.5	24.5
øG	1.5–2	2.5–3	3.5–5	5–6
H	9–10	9.5–11.5	14.5–15.5	15–16
øJ	2.5–5	2.5–5	3.5–6	5–8
Y	G1/8	G1/8	G1/4	G3/8

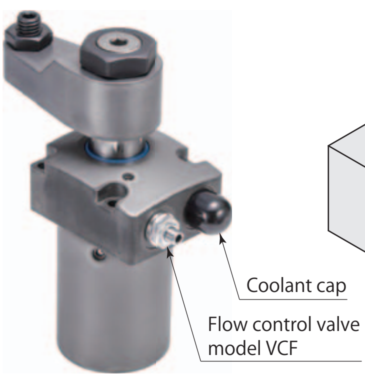
∗:Concentricity is required when machining øD and Y-portion thread. Misalignment or machining defect may cause the trouble of installation and adjusting flow rate.

Mounting & dismounting of flow control valve, air bleeding valve

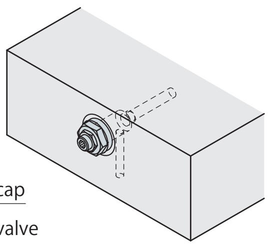
- When mounting or dismounting a flow control valve or air bleeding valve, be sure to set pressure within hydraulic circuit to 0 MPa before starting.
- When mounting a flow control valve or air bleeding valve, be sure to tighten it with the recommended tightening torque.
- When mounting a coolant cap (resin:POM), firmly press the body of cover. If it is not mounting properly, use a plastic mallet to tap it into place.
- When dismounting a coolant cap, use a sharp-pointed tool such as a precision screw driver by hooking the notched portion.



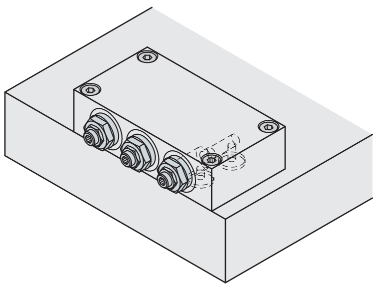
Mounting example



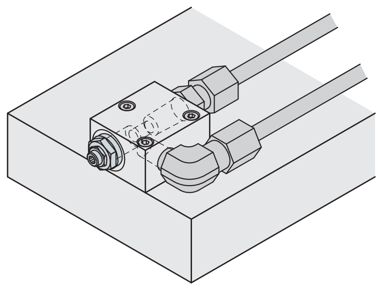
Cylinder mounting



Pallet mounting

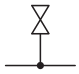


Block mounting ①



Block mounting ②

Specifications

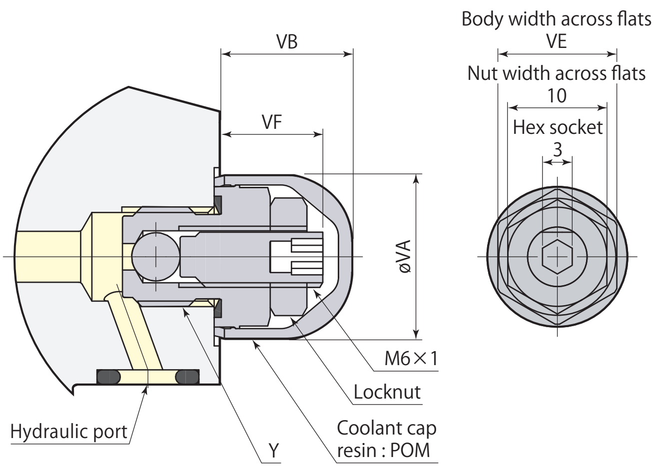


G port size

VCE
- 01 : G1/8
- 02 : G1/4
- 03 : G3/8

Model		VCE01	VCE02	VCE03
G port size		G1/8	G1/4	G3/8
Recommended tightening torque	N·m	10	30	35
Mass	kg	0.017	0.029	0.044
Pressure range	MPa	0–50		
Operating temperature	°C	0–70		
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)		

Dimensions

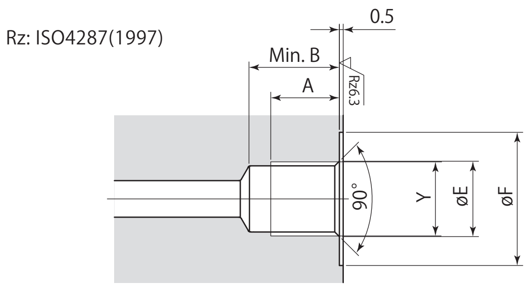


mm

Model	VCE01	VCE02	VCE03
A	9	13	13
B	10	14	14
øE	9.9	13.3	16.8
øF	17.5	21.5	24.5
Y	G1/8	G1/4	G3/8
øVA	16	21	24
VB	13	13	14
VE	12	17	19
VF	10.5	10.5	11.5

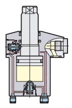
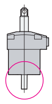
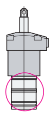
- Use a closed wrench or socket wrench for mounting and dismounting.
- Air bleeding valve can be mounted on hydraulic port (G port) when manifold piping.

Mounting details

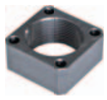
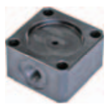


Applicable clamp and work support

Model	VCE01	VCE02	VCE03
Swing clamp (double acting)	CTM03, 04, 05, 06, 10 CTP04, 05, 06 CTU01, 02, 04, 06	CTM16 CTU10, 16	CTU25
Swing clamp (single acting)	CTN02, 04, 05, 06 CTT01, 02, 04, 06	CTN10, 16 CTT10, 16	CTT25
Swivel clamp (double acting)	CTS04, 06	CTS10, 16	–
Link clamp (double acting)	CLM03, 04, 05, 06, 10 CLP04, 05, 06 CLU02, 04, 06	CLM16 CLU10, 16	CLU25
Link clamp (single acting)	CLN04, 05, 06 CLT02, 04, 06	CLN10, 16 CLT10, 16	CLT25
Work lift cylinder	CNB01, 02, 04	–	–
Push, pull cylinder	CNA02, 04, 06	CNA10, 16	CNA25
Work support	CSU CST CSP-D(CSN, CSY, CSK)	–	–

	Clamp cylinder	Work lift cylinder model CNB Page →246  Female thread rod Pin rod	Push, pull cylinder model CNA Page →290  Female thread rod Pin rod Male thread rod
Specifications		7MPa Double acting	7MPa Double acting
Features		Low profiled cylinder Built-in sensor model	Standard model
Variations	Push, pull sensor model 	CNB-D **Page →256**	—
	Push sensor model 	CNB-U **Page →266**	—
	Pull sensor model 	CNB-B **Page →276**	—
	Compact model (without sensor) 	CNB-N **Page →284**	—
	Bottom piping specifications 	*	—
	Standard 	—	CNA **Page →294**
	Dual rod 	—	CNA-E **Page →302**
	Air sensor 	—	CNA-A **Page →304**
Option	Flow control valve 	VCF **Page →320**	
	Air bleeding valve 	VCE **Page →322**	

*:Contact Pascal for the details.

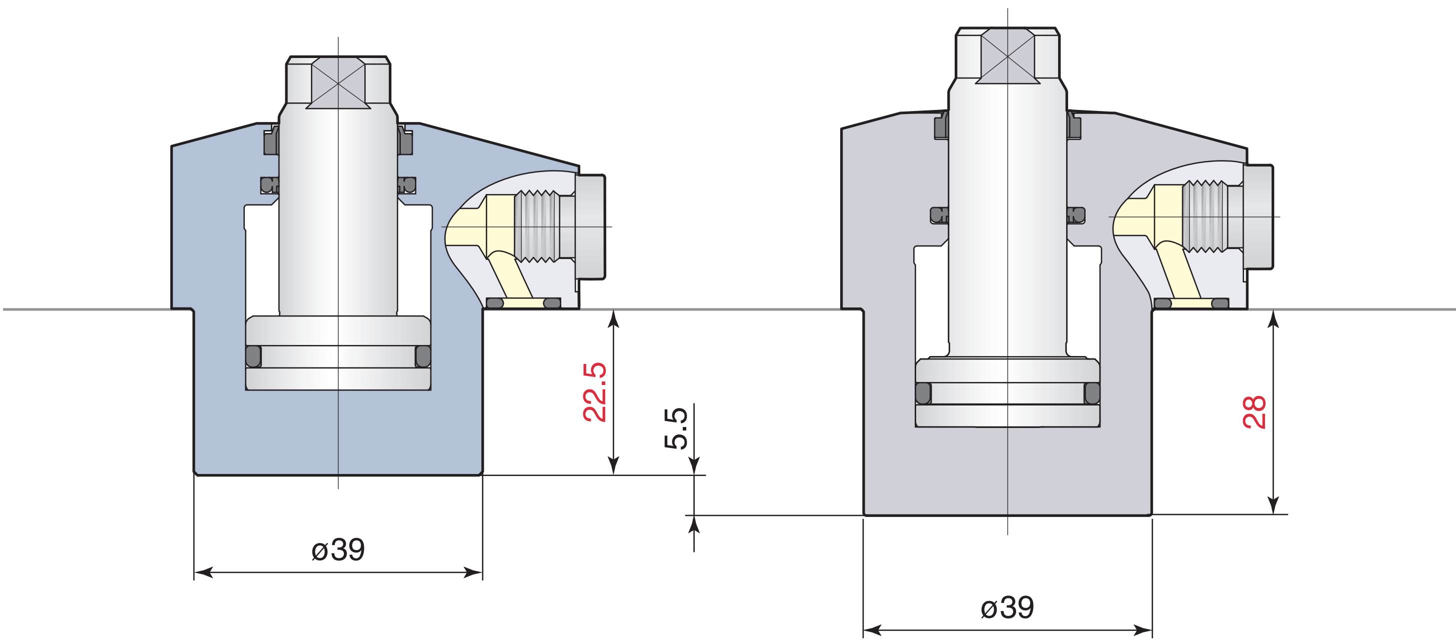
Clamp cylinder		Push cylinder model **CMC** **Page →310**   Threaded top type Round top type	Pull cylinder model **CMD** **Page →310** 
Specifications		35MPa Single acting	35MPa Single acting
Features		Threaded body	Threaded body
Option	Flange 	CSP-F **Page →318**	
	Piping block 	CMH-C **Page →319**	CMH-D **Page →319**

Super compact body

The significant downsizing is realized compared to the conventinal model.

Compact model
(without sensor)

Standard model
(without sensor)

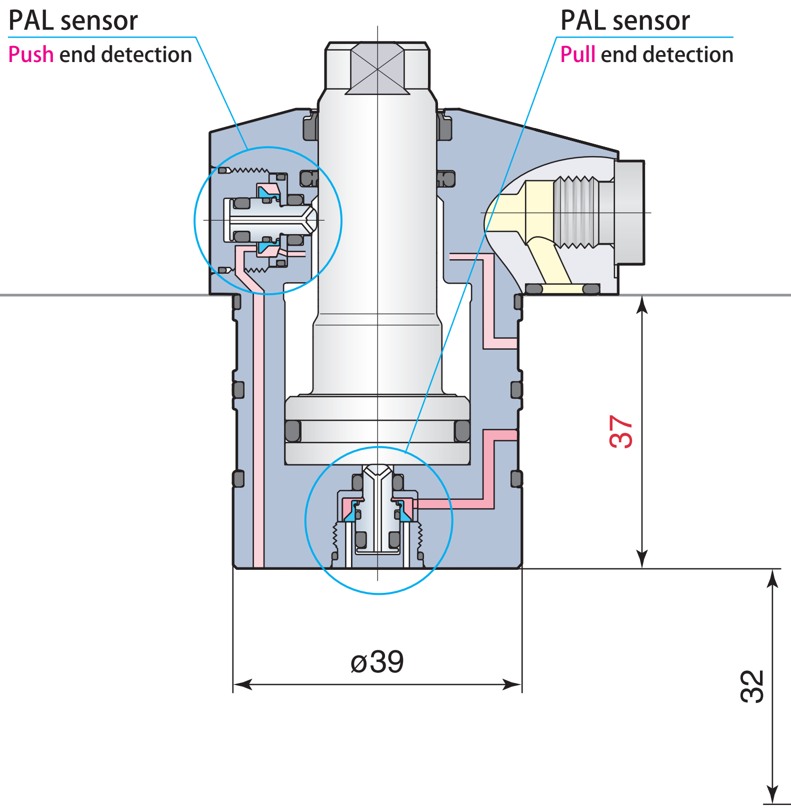


		model **CNB02-15TN**	model **CNA02-15T**
Cylinder force (at 7MPa)	Push	3.4 kN	3.4 kN
	Pull	2.0 kN	2.0 kN

Super compact body

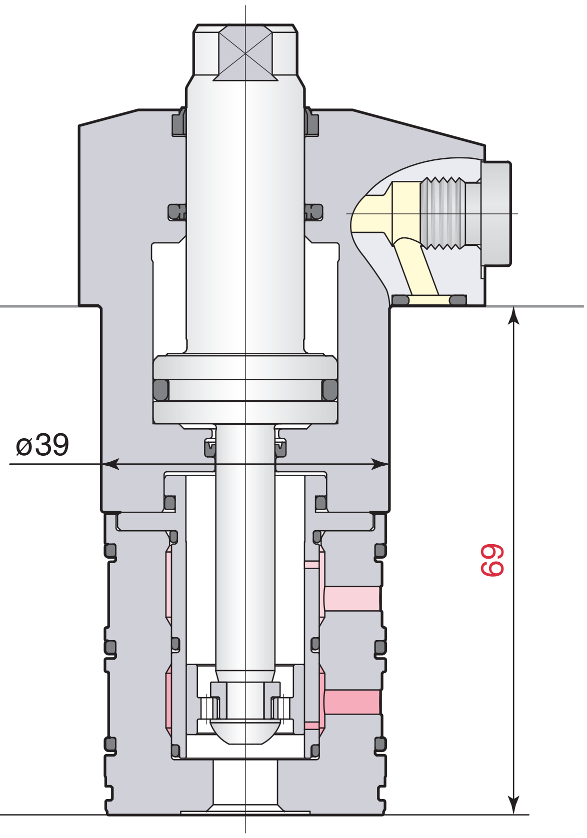
Enables a jig to be compact and simple structure with an excellent sensor function

Push, pull sensor model



Air sensor model

Push, pull detection



model CNB02-15TD	model CNA02-15TA
3.4 kN	3.1 kN
2.0 kN	2.0 kN

Table of contents

Sensing Work lift cylinder

Double acting 7 MPa

model CNB

Pull sensor model
model CNB02-15TB

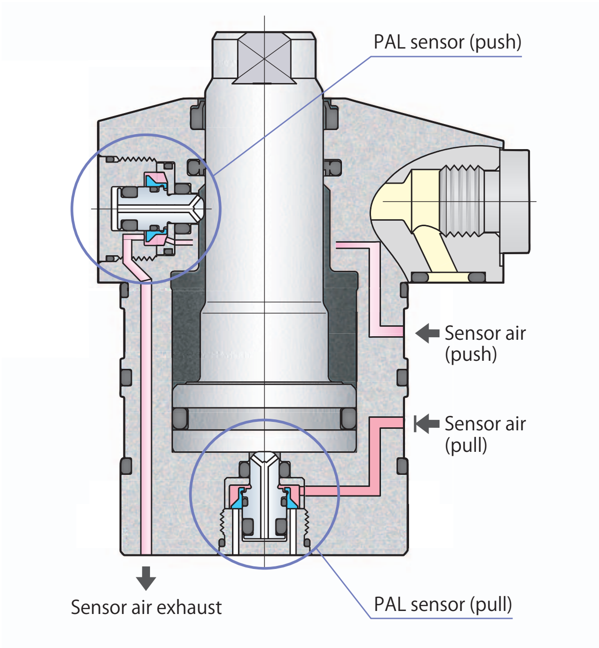
Compact model
model CNB02-15TN

Push, pull sensor model
model CNB02-15TD

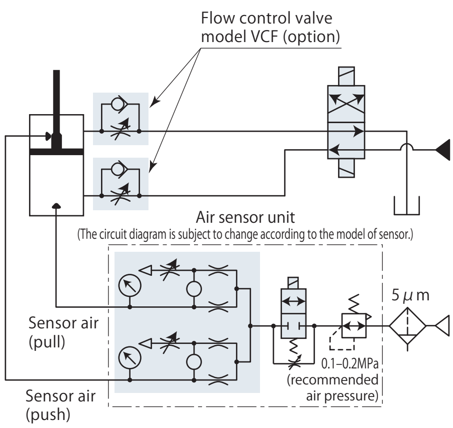
Push sensor model
model CNB02-15TU

Push, pull sensor model D

model **CNB□-□□D** PAT.



Hydraulic and pneumatic circuit diagram



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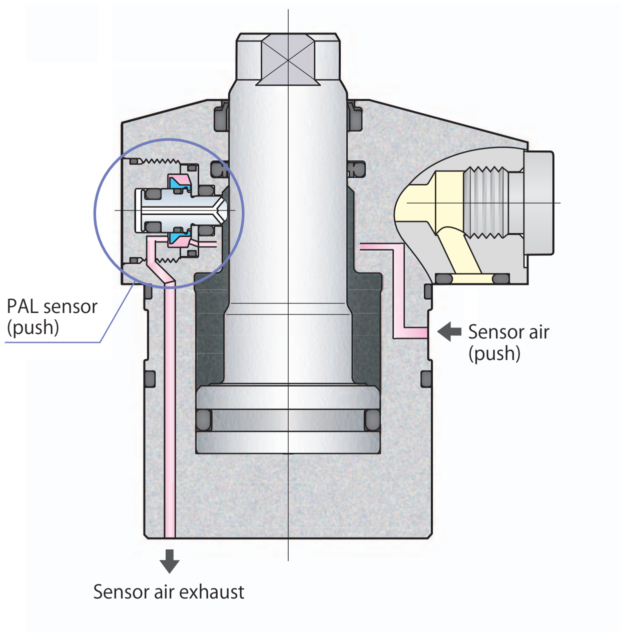
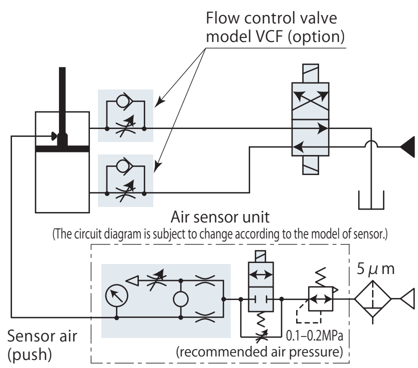
Piping page → 251
PAL sensor page → 252
Dimensions page → 256
Mounting details page → 260

Push sensor model U

model **CNB□-□□U** PAT.



Hydraulic and pneumatic circuit diagram



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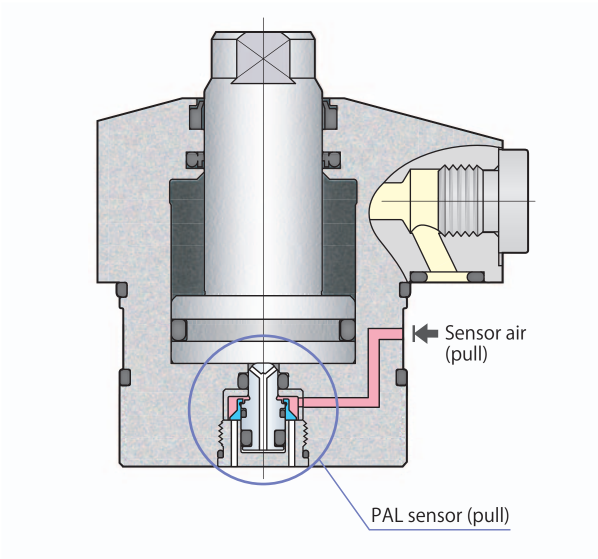
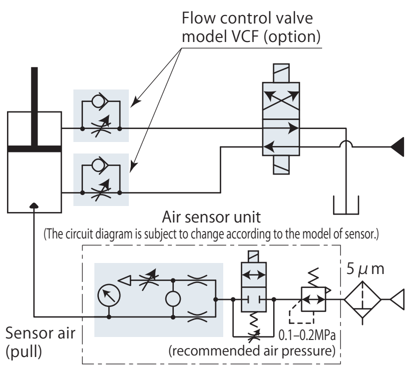
Piping page → 251
PAL sensor page → 263
Dimensions page → 266
Mounting details page → 270

Pull sensor model B

model CNB□-□□B PAT.



Hydraulic and pneumatic circuit diagram



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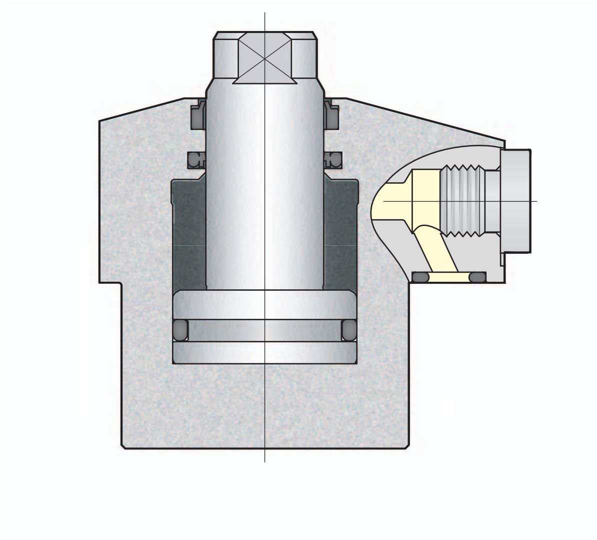
Piping	page → 251
PAL sensor	page → 273
Dimensions	page → 276
Mounting details	page → 280

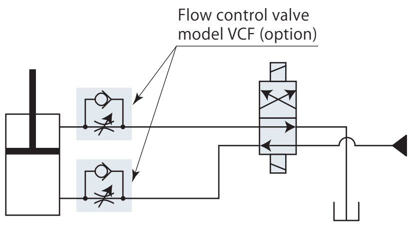
Compact model N

model CNB□-□□N

No sensors available on compact model



Hydraulic circuit diagram



Specifications	page → 250
Piping	page → 251
Dimensions	page → 284
Mounting details	page → 288

Specifications

CNB	Size	–	Stroke	Rod tip section shapes	
	01		10	T : Female thread rod	D : Push, pull sensor model
	02		15	P : Pin rod	U : Push sensor model
	04		20		B : Pull sensor model
			25		N : Compact model
			30		
			35		
			40		
			45		
			50		

(Strokes 25, 35, 45 shaded) indicates made to order. Inquire for details about bottom piping specifications.

Rod tip section shapes

T : Female thread rod

P : Pin rod

Model			CNB01	CNB02	CNB04
Cylinder force (hydraulic pressure 7MPa)	Push	kN	2.7	3.4	4.9
	Pull	kN	1.6	2.0	3.2
Cylinder force calculation formula*1	Push		F=0.38×P	F=0.49×P	F=0.71×P
	Pull		F=0.23×P	F=0.29×P	F=0.45×P
Cylinder inner diameter		mm	22	25	30
Rod diameter		mm	14	16	18
Effective area	Push	cm^2	3.8	4.9	7.1
	Pull	cm^2	2.3	2.9	4.5
Max. oil flow rate		L/min	0.8	1.0	1.6
Recommended tightening torque of mounting screws*2		N·m	3.5	7	7

- Pressure range: 1.5–7 MPa (model CNB-D, CNB-U, CNB-B), 0.5–7 MPa (model CNB-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: F=Cylinder force (kN), P=Hydraulic pressure (MPa)　　∗2: ISO R898 class 12.9

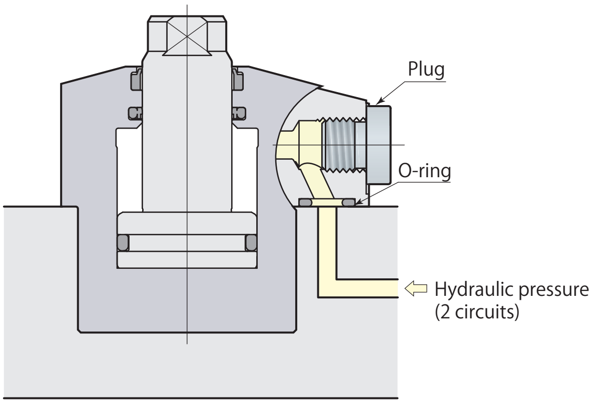
Manifold piping and G port piping are available.

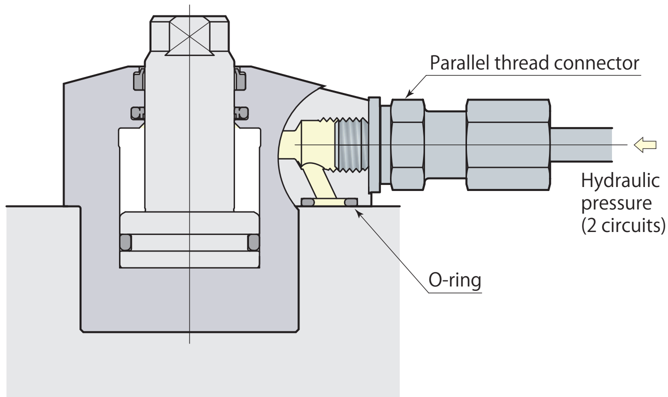
Manifold piping

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 cylinder.

G port piping

Remove plugs when choosing G port piping. (O-ring must be used.) Refer to **page →372** 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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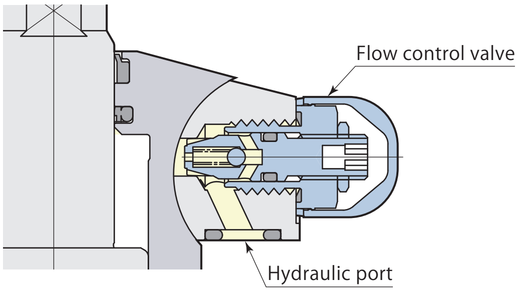

Air bleeding valve model VCE

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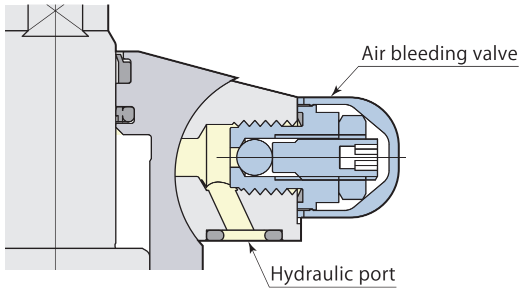
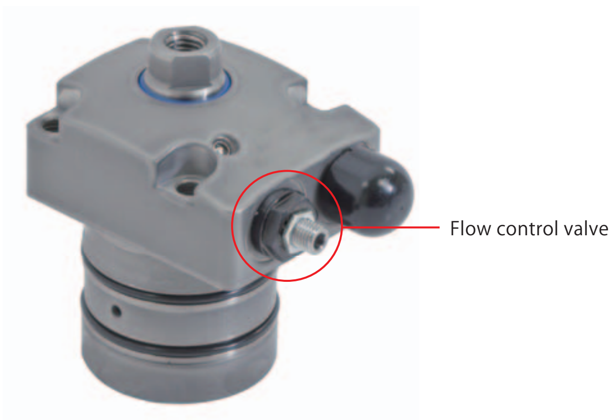
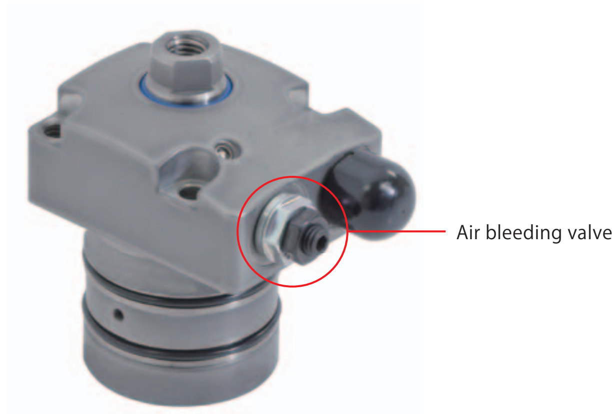


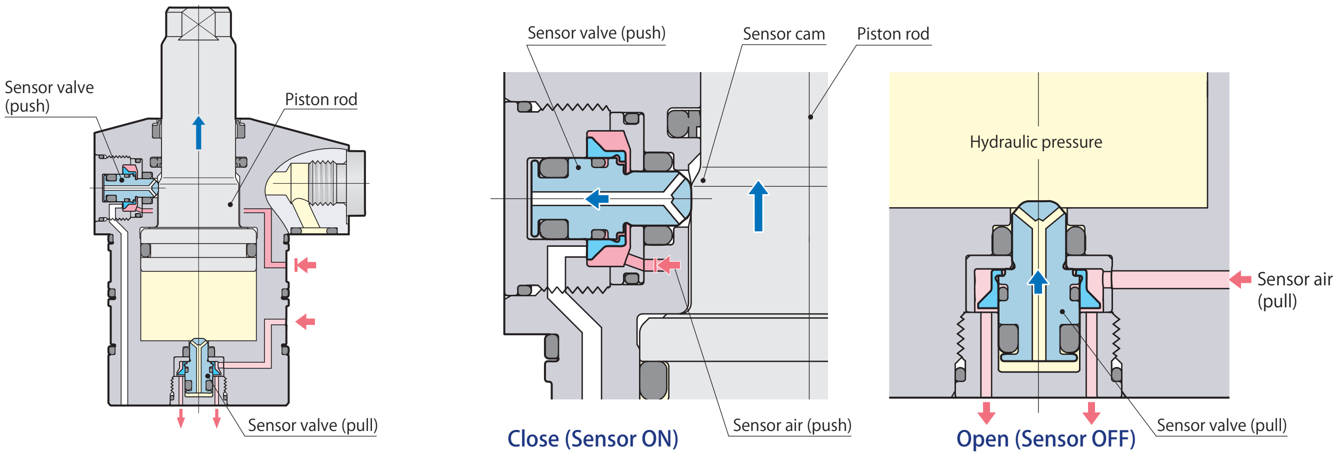




- In case of mounting flow control valve model VCF on the G port of the cylinder, air bleeding valve should be installed in the piping to the cylinder. (VCE Mounting details. Refer to **page →322**)

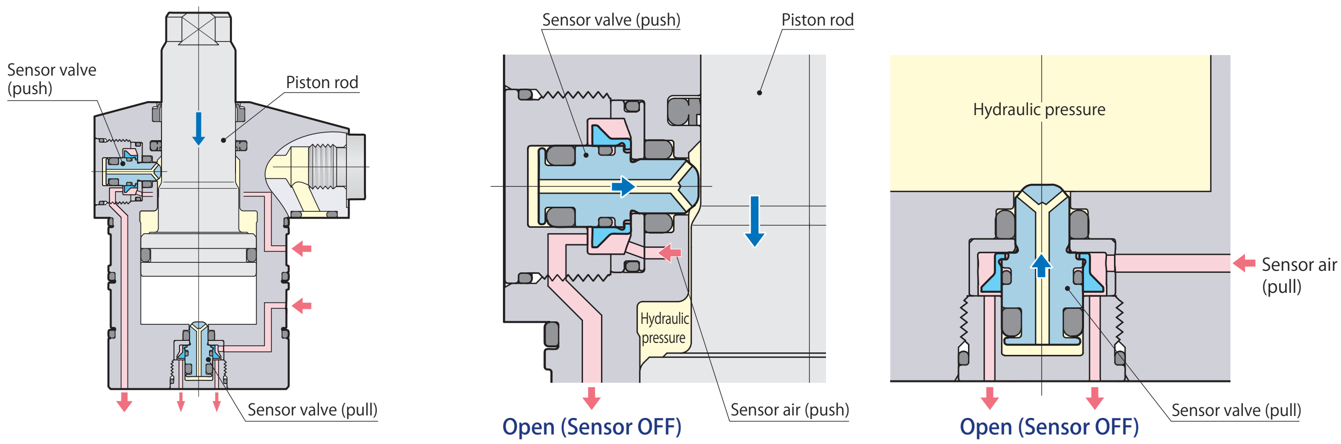
PAL sensor function and structure

Push end detection



● The sensor valve (push) is pushed down by the sensor cam and shuts off the sensor air flow when the piston rod reaches the push end position. The sensor valve (pull) is pushed up by the hydraulic force to open for air exhaust and detects the push end position.

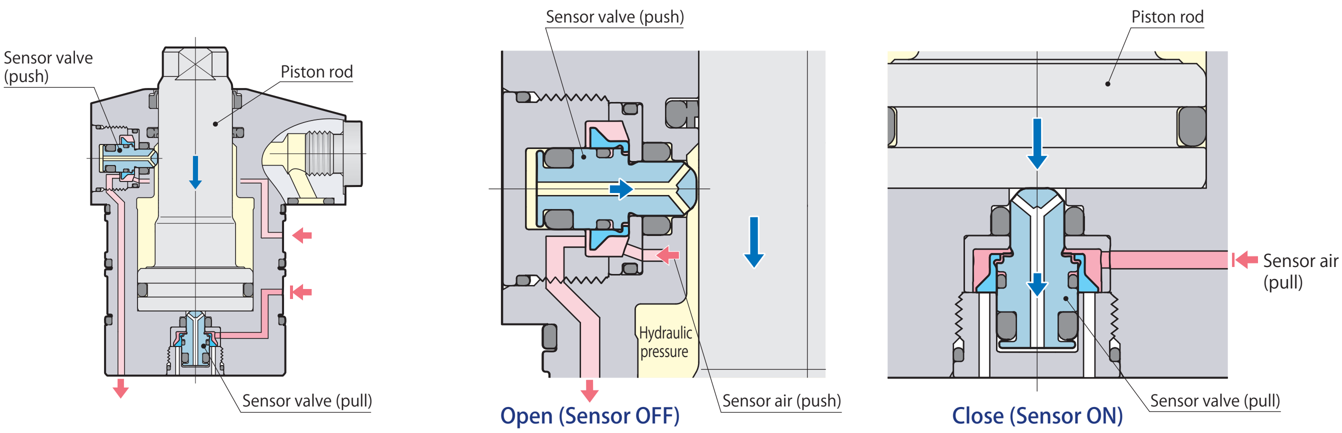
In the middle of stroke



● The sensor valve (push) is pushed up by the hydraulic force while piston rod strokes and exhausts the sensor air. The sensor valve (pull) is pushed up by the hydraulic force and exhausts the sensor air.

PAL sensor function and structure

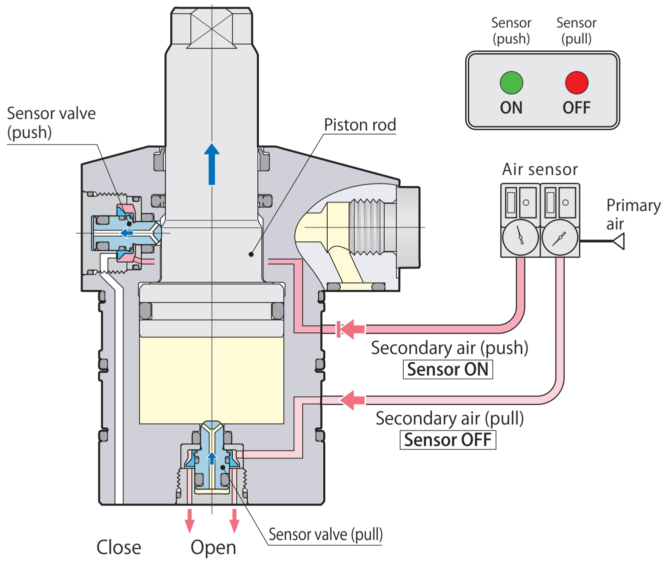
Pull end detection



- The sensor valve (pull) is pushed down by the piston rod and shuts off the sensor air flow when the piston rod reaches the pull end position. The sensor valve (push) is pushed up by the hydraulic force to open for air exhaust and detects the pull end position.

Push end, Pull end detection signal

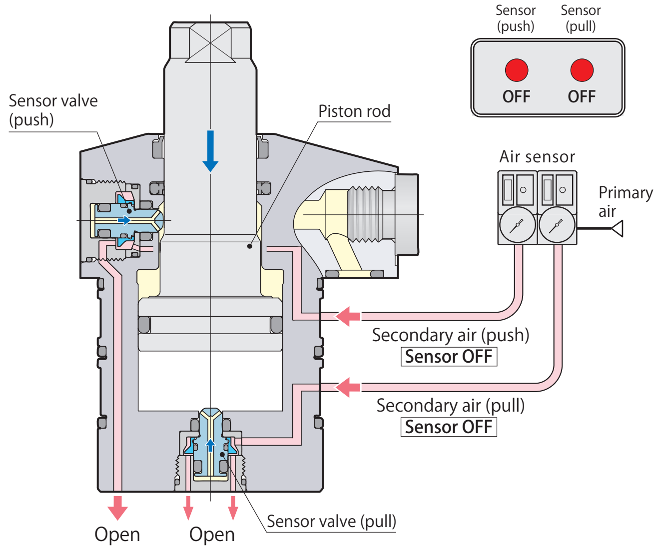
Push end detection



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 (push)	ON	Push end
Sensor signal (pull)	OFF	

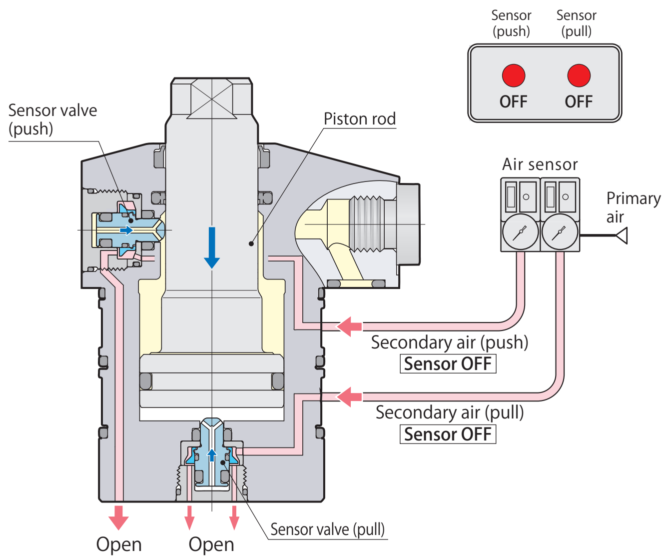
In the middle of stroke



Sensor signal (push)	OFF	In the middle of stroke
Sensor signal (pull)	OFF	

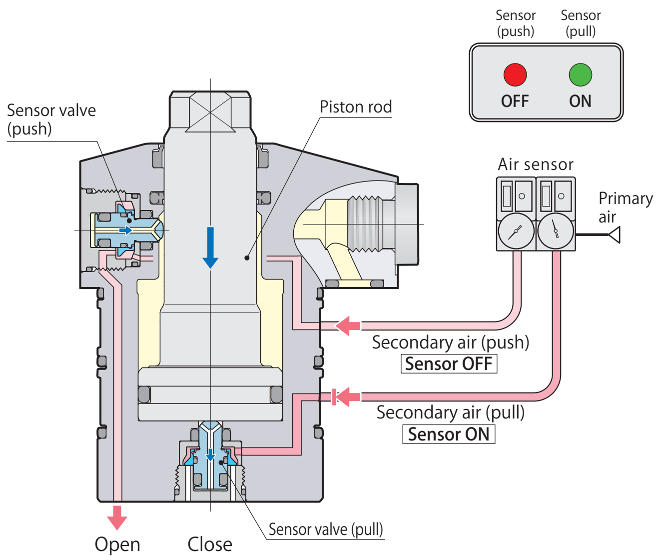
More than 1.5MPa hydraulic pressure is required to operate the sensor valve. To obtain OFF signal in the middle of the valve stroke, over 1.5MPa of back pressure should be produced by using a meter-out type of flow control valve.

In the middle of stroke



Sensor signal (push)	OFF	In the middle of stroke
Sensor signal (pull)	OFF	

Pull end detection

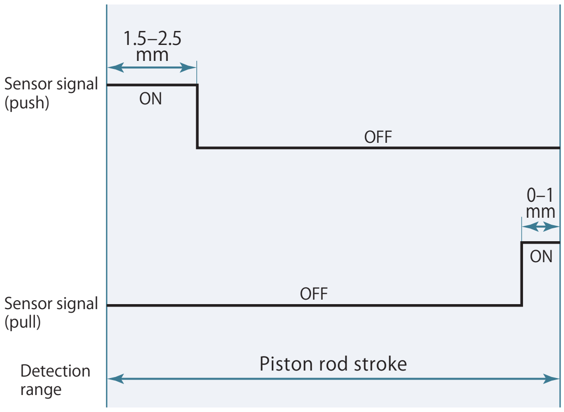


The sensor may not work correctly when the cylinder is not pressurized by hydraulic force because the piston of the clamp moves under such environment. Keep supplying hydraulic force the cylinder all the times.

Sensor signal (push)	OFF	Pull end
Sensor signal (pull)	ON	

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



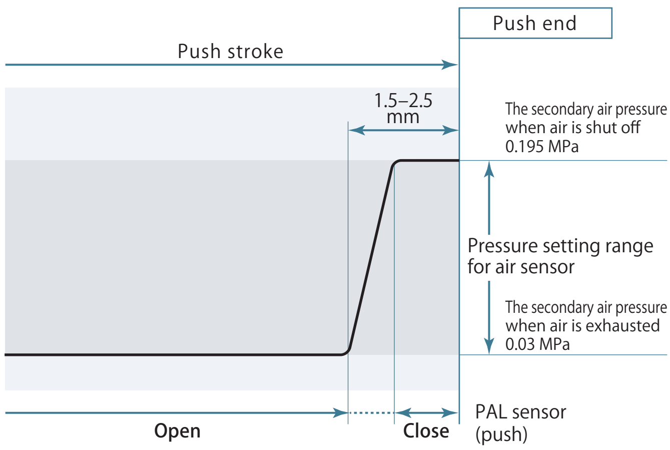
- Refer to the sensor supplier's instruction manual for the details of setting.
- Sensing performance such as detectable time and pressure differs depending on the supplier and model number of the sensor. Select the right model referring to sensor's application and characteristics.

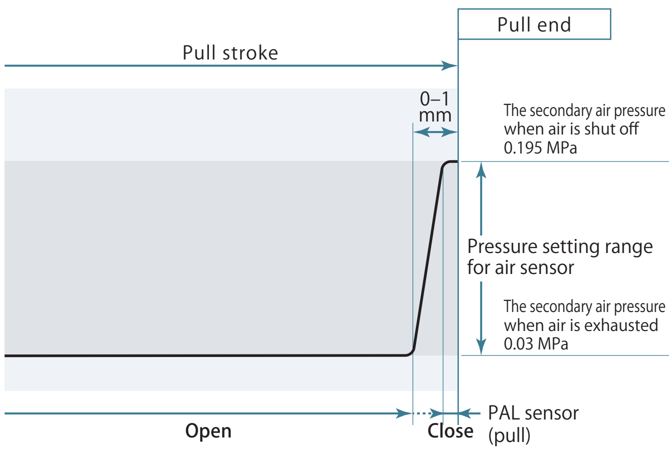
Air sensor unit recommended condition of use

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



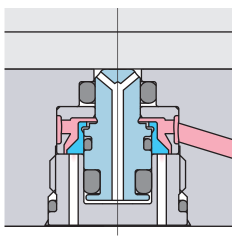


The diagram shown on the left indicates the relation between the PAL sensor, piston stroke, and secondary air pressure. (The pressure shown in the diagram is a reference based on the 0.2 MPa of primary air pressure for one piece of cylinder.)

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

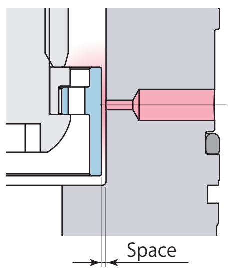
- Enhances the pressure setting range of the sensor which enables the sensor to set easily.
  (Ex. Pressure setting range 0.03–0.195 MPa in the diagram)
- Allows the use for a number of cylinders by one air sensor because of better pressure holding when air is shut off. (Maximum number of cylinders to 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.

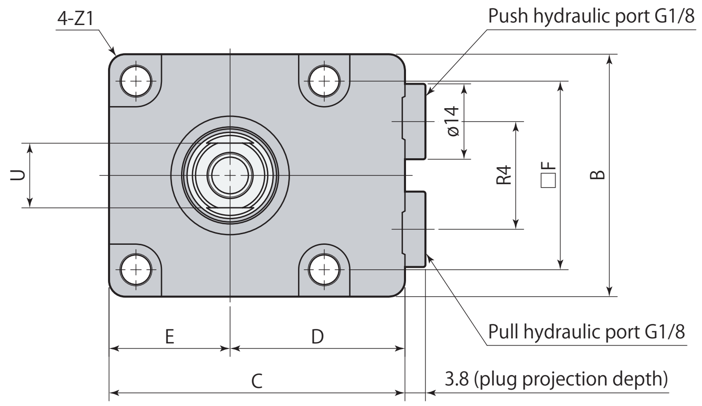
Previous sensor valve

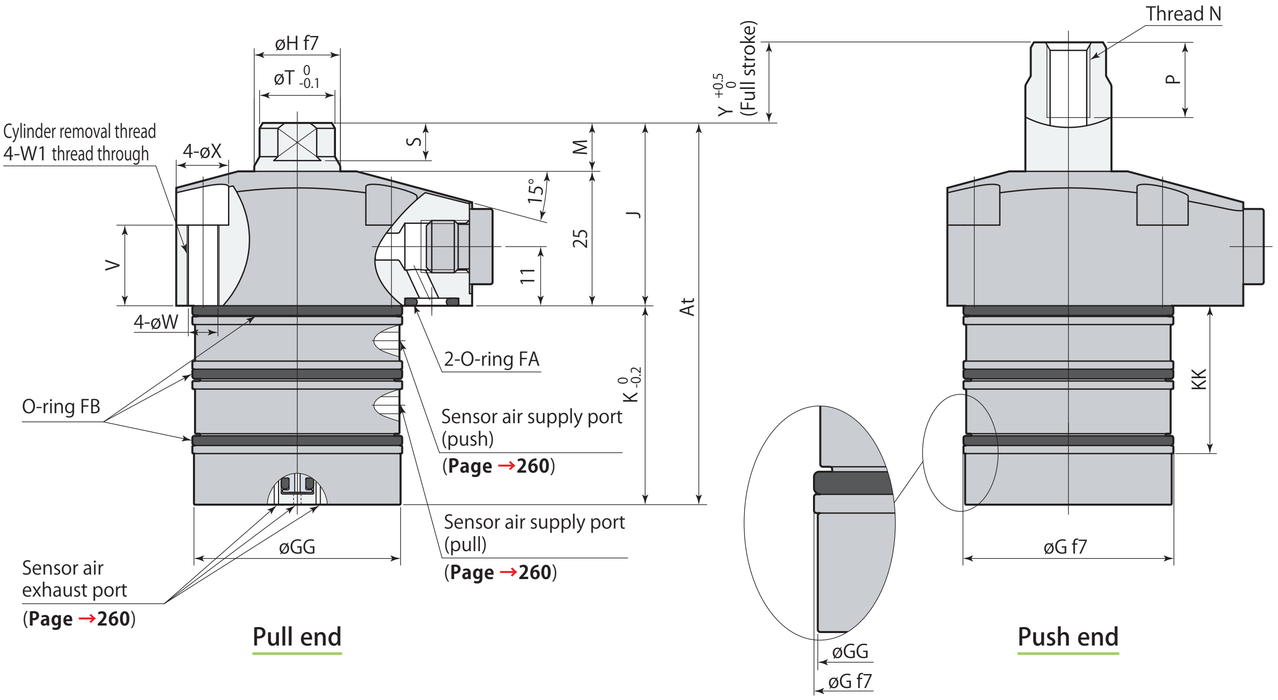


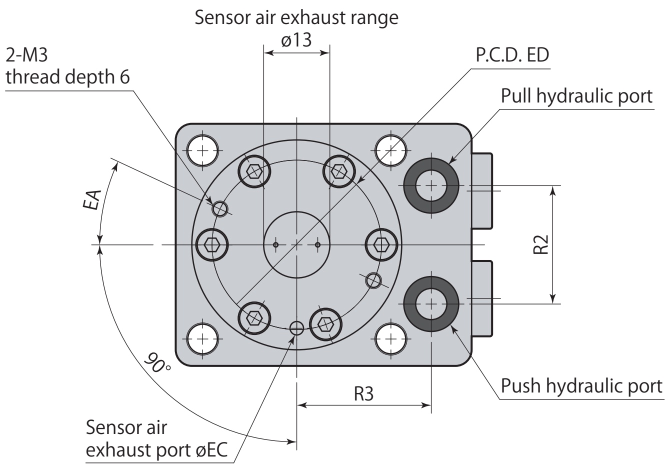
Air leaks easily due to a large space.

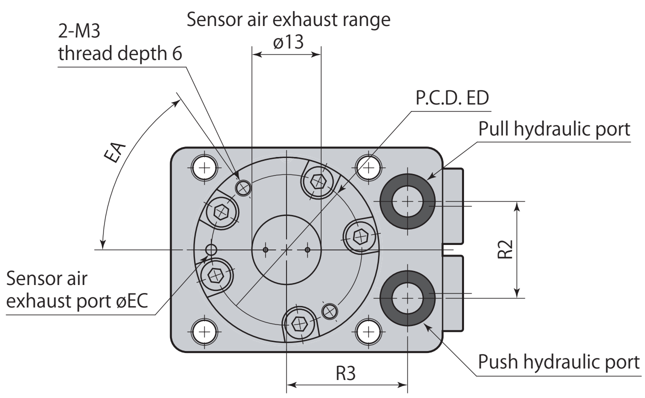
Dimensions

(Female thread rod)









CNB01-□TD

● Mounting screws are not included.

mm

Model		CNB01-□TD		CNB02-□TD		CNB04-□TD		
Y (stroke)		10, 15, 20, 25, 30, 35, 40, 45, 50						
Cylinder capacity (cm^3)	Push	0.38×Y		0.49×Y		0.71×Y		
	Pull	0.23×Y		0.29×Y		0.45×Y		
At		Y=10	Y=15–50	Y=10	Y=15–50	Y=10	Y=15–50	
		70	Y+55	71	Y+56	73.5	Y+58.5	
B		38		45		50		
C		50.5		55		60		
D		29		32.5		35		
E		21.5		22.5		25		
F		30.5		35		40		
øG		$35^{-0.025}_{-0.050}$		$39^{-0.025}_{-0.050}$		$47^{-0.025}_{-0.050}$		
øGG		34.4		38.4		46.4		
øH		$14^{-0.016}_{-0.034}$		$16^{-0.016}_{-0.034}$		$18^{-0.016}_{-0.034}$		
J		33		34		35		
K		Y=10	Y=15–50	Y=10	Y=15–50	Y=10	Y=15–50	
		37	Y+22	37	Y+22	38.5	Y+23.5	
KK		Y=10, 15	Y=20–50	Y=10, 15	Y=20–50	Y=10, 15	Y=20	Y=25–50
		27.5	32.5	27.5	32.5	29	34	32.5
M		8		9		10		
N		M6×1		M8×1.25		M8×1.25		
P		11		14		14		
R2		18		22		24		
R3		22.5		25		28		
R4		16.2		20		22		
S (width across flats height)		6		7		8		
øT		12		14		16		
U (width across flats)		10		12		14		
V		17		15		15		
øW		4.5		5.5		5.5		
W1		M5×0.8		M6×1		M6×1		
øX		8		9.5		9.5		
Z1		R3		R3		R5		
EA		55°		25°		20°		
øEC		2		2.5		3.3		
ED		28		31.5		38		
O-ring FA (fluorocarbon hardness Hs90)		P7		P7		P7		
O-ring FB (fluorocarbon hardness Hs70)		AS568-026		AS568-028		AS568-030		
Flow control valve*	Meter-in	VCF01S		VCF01		VCF01		
	Meter-out	VCF01S-O		VCF01-O		VCF01-O		
Air bleeding valve		VCE01		VCE01		VCE01		

*:Select the right model of VCF according to the size of the cylinder.

Refer to each page for the details of options. ● Flow control valve **page →320** ● Air bleeding valve **page →322**

● CNB□-□TD (Push, pull sensor model, Female thread rod) stroke 25, 35, 45 mm are made to order.

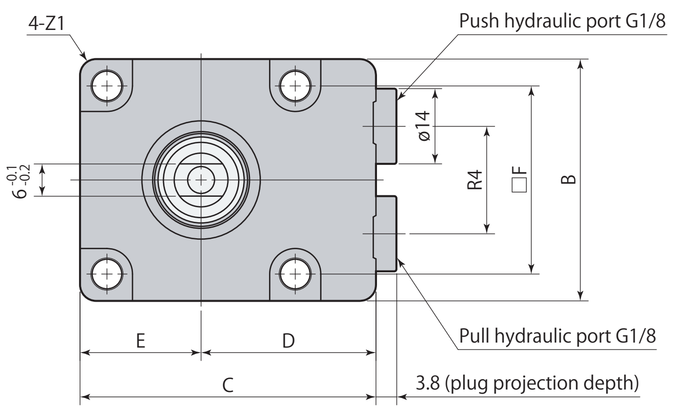
Mass

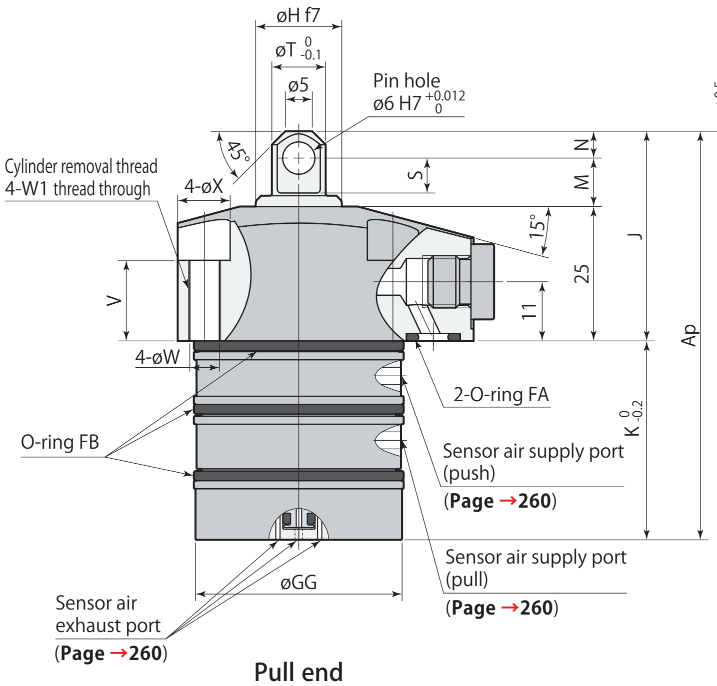
kg

Stroke	10	15	20	25	30	35	40	45	50
CNB01-□TD	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.8
CNB02-□TD	0.7	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0
CNB04-□TD	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.3

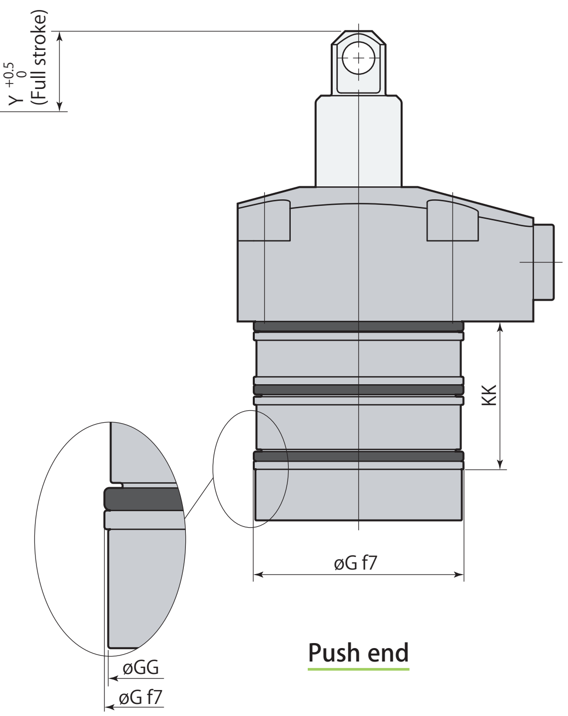
Dimensions

(Pin rod)

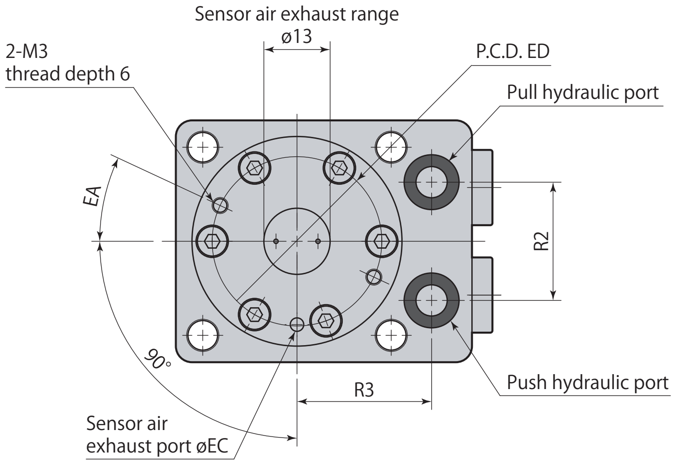


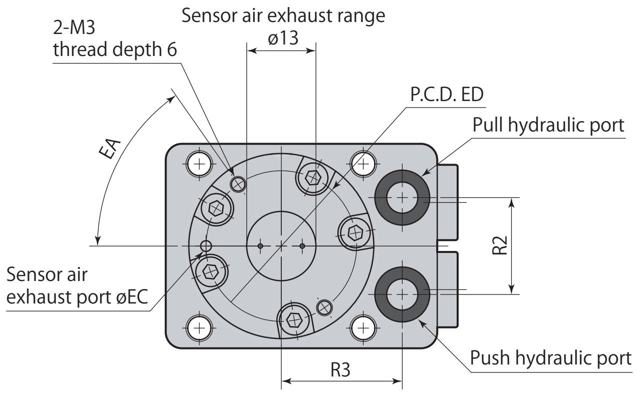


Pull end



Push end





CNB01-□PD

- Mounting screws are not included.
- Recommended material for pin: SCM435-H (HB269–331)

mm

Model		CNB01-□PD		CNB02-□PD		CNB04-□PD		
Y (stroke)		10, 15, 20, 25, 30, 35, 40, 45, 50						
Cylinder capacity (cm³)	Push	0.38×Y		0.49×Y		0.71×Y		
	Pull	0.23×Y		0.29×Y		0.45×Y		
Ap		Y=10	Y=15–50	Y=10	Y=15–50	Y=10	Y=15–50	
		76	Y+61	76	Y+61	79	Y+64	
B		38		45		50		
C		50.5		55		60		
D		29		32.5		35		
E		21.5		22.5		25		
F		30.5		35		40		
øG		$35^{-0.025}_{-0.050}$		$39^{-0.025}_{-0.050}$		$47^{-0.025}_{-0.050}$		
øGG		34.4		38.4		46.4		
øH		$14^{-0.016}_{-0.034}$		$16^{-0.016}_{-0.034}$		$18^{-0.016}_{-0.034}$		
J		39		39		40.5		
K		Y=10	Y=15–50	Y=10	Y=15–50	Y=10	Y=15–50	
		37	Y+22	37	Y+22	38.5	Y+23.5	
KK		Y=10, 15	Y=20–50	Y=10, 15	Y=20–50	Y=10, 15	Y=20	Y=25–50
		27.5	32.5	27.5	32.5	29	34	32.5
M		9		9		9.5		
N		5		5		6		
R2		18		22		24		
R3		22.5		25		28		
R4		16.2		20		22		
S		6.5		6.5		7		
øT		10		10		12		
V		17		15		15		
øW		4.5		5.5		5.5		
W1		M5×0.8		M6×1		M6×1		
øX		8		9.5		9.5		
Z1		R3		R3		R5		
EA		55°		25°		20°		
øEC		2		2.5		3.3		
ED		28		31.5		38		
O-ring FA (fluorocarbon hardness Hs90)		P7		P7		P7		
O-ring FB (fluorocarbon hardness Hs70)		AS568-026		AS568-028		AS568-030		
Flow control valve*	Meter-in	VCF01S		VCF01		VCF01		
	Meter-out	VCF01S-O		VCF01-O		VCF01-O		
Air bleeding valve		VCE01		VCE01		VCE01		

*: Select the right model of VCF according to the size of the cylinder.

Refer to each page for the details of options. ● Flow control valve **page →320** ● Air bleeding valve **page →322**

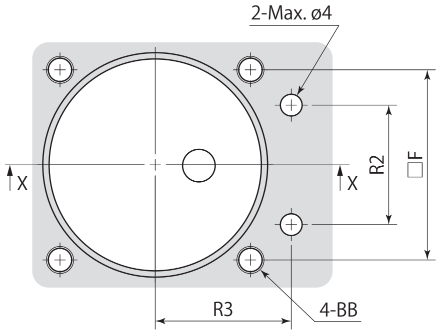
● CNB□-□PD (Push, pull sensor model, Pin rod) are made to order.

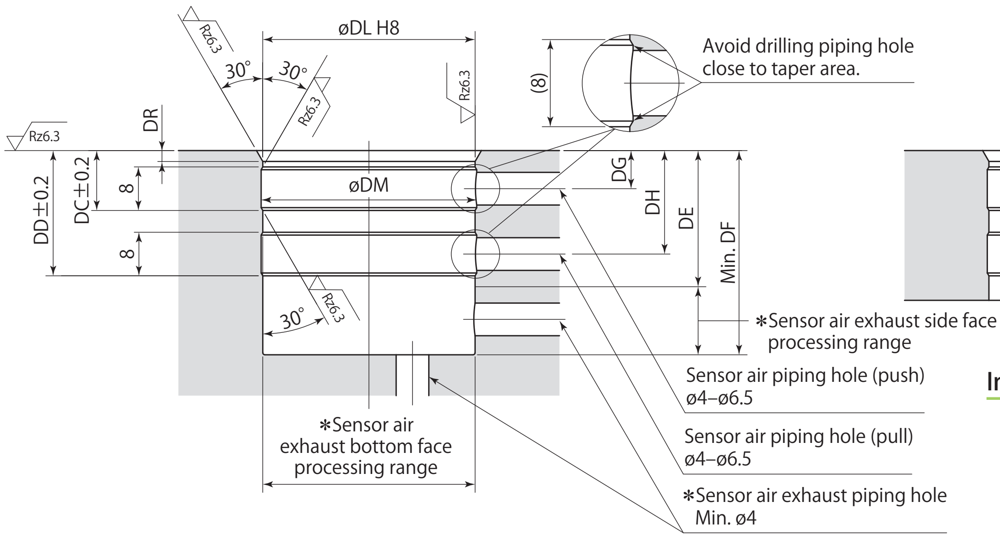
Mass

kg

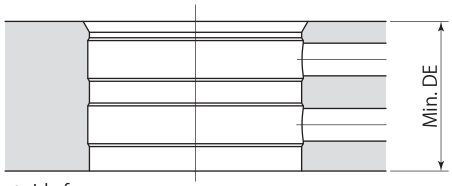
Stroke	10	15	20	25	30	35	40	45	50
CNB01-□PD	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.8
CNB02-□PD	0.7	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0
CNB04-□PD	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.3

Mounting details





In blind hole X-X

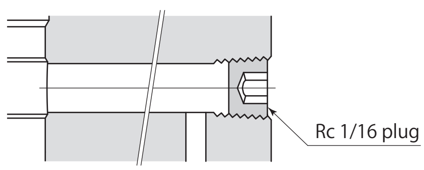


In through hole X-X

*: 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 1/16 plug.



mm

Model	CNB01-□TD CNB01-□PD								
Stroke	10	15	20	25	30	35	40	45	50
DC	11	11	16	16	16	16	16	16	16
DD	23	23	28	28	28	28	28	28	28
DE	27.5	27.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5
DF	37.5	37.5	42.5	47.5	52.5	57.5	62.5	67.5	72.5
DG	7	7	12	12	12	12	12	12	12
DH	19	19	24	24	24	24	24	24	24
øDL	$35^{+0.039}_{0}$								
øDM	35.6								
DR	2	2	1	1	1	1	1	1	1
BB	M4								
F	30.5								
R2	18								
R3	22.5								

mm

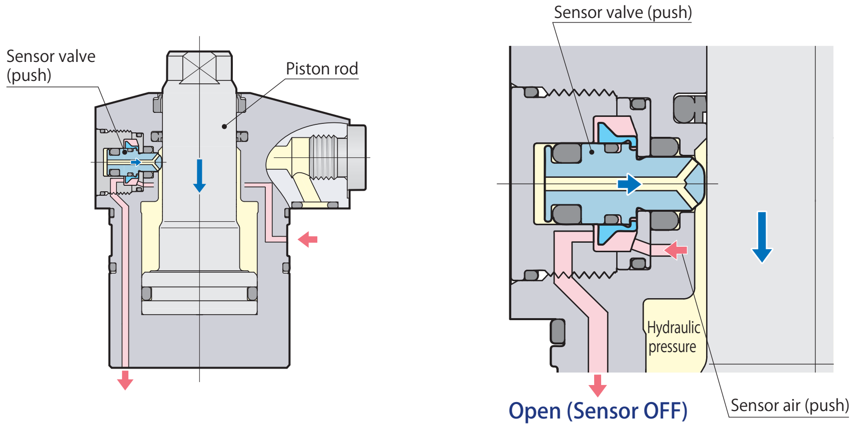
Model	CNB02-□TD CNB02-□PD								
Stroke	10	15	20	25	30	35	40	45	50
DC	11	11	16	16	16	16	16	16	16
DD	23	23	28	28	28	28	28	28	28
DE	27.5	27.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5
DF	37.5	37.5	42.5	47.5	52.5	57.5	62.5	67.5	72.5
DG	7	7	12	12	12	12	12	12	12
DH	19	19	24	24	24	24	24	24	24
øDL	$39^{+0.039}_{0}$								
øDM	39.6								
DR	2	2	1	1	1	1	1	1	1
BB	M5								
F	35								
R2	22								
R3	25								

mm

Model	CNB04-□TD CNB04-□PD								
Stroke	10	15	20	25	30	35	40	45	50
DC	11	11	16	16	16	16	16	16	16
DD	23	23	28	28	28	28	28	28	28
DE	27.5	27.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5
DF	39	39	44	49	54	59	64	69	74
DG	7	7	12	12	12	12	12	12	12
DH	19	19	24	24	24	24	24	24	24
øDL	$47^{+0.039}_{0}$								
øDM	47.6								
DR	2	2	1	1	1	1	1	1	1
BB	M5								
F	40								
R2	24								
R3	28								

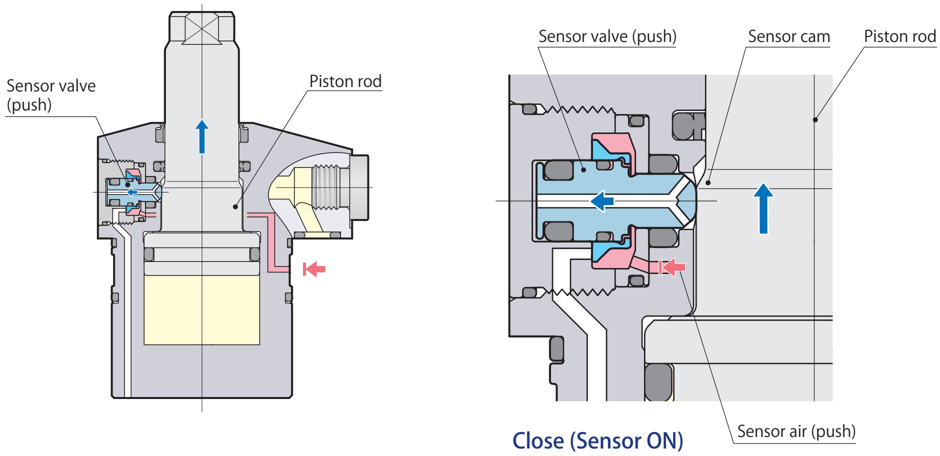
Push PAL sensor function and structure

In the middle of stroke



● The sensor valve (push) is pushed up by the hydraulic force and exhausts the sensor air while piston rod strokes.

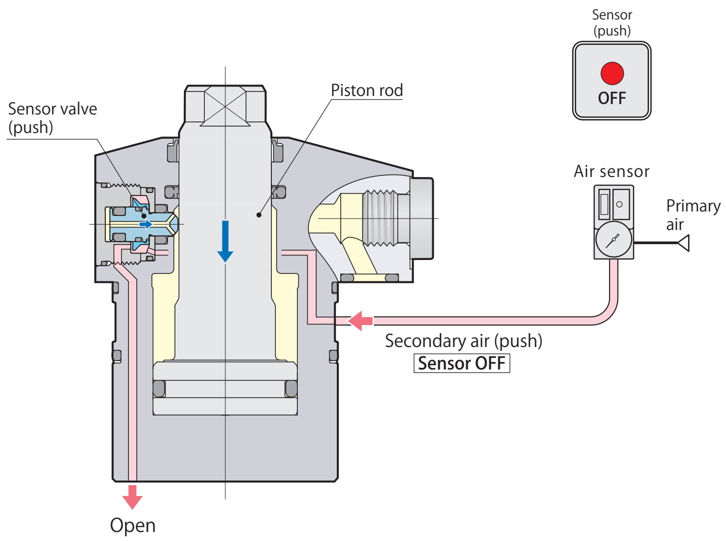
Push end detection



● The sensor valve (push) is pushed down by the sensor cam and shuts off the sensor air flow when the piston rod reaches the push end position, and detects the push end position.

Push end detection signal

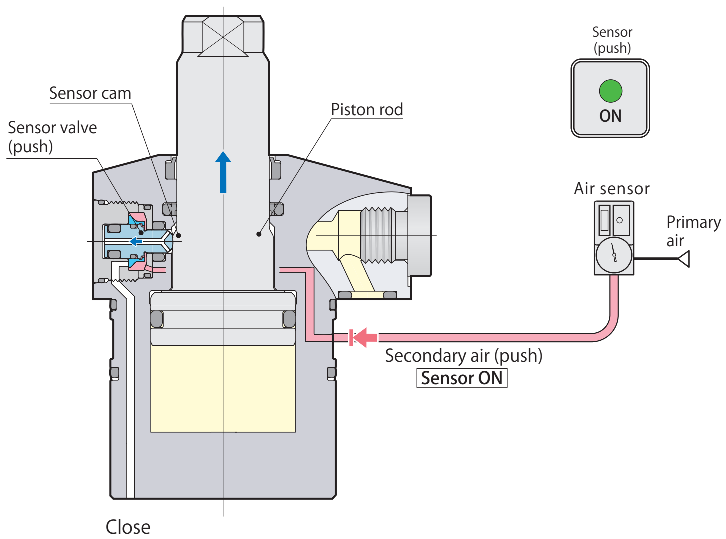
In the middle of stroke



Sensor signal (push)	OFF	Pull end, in the middle of 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.

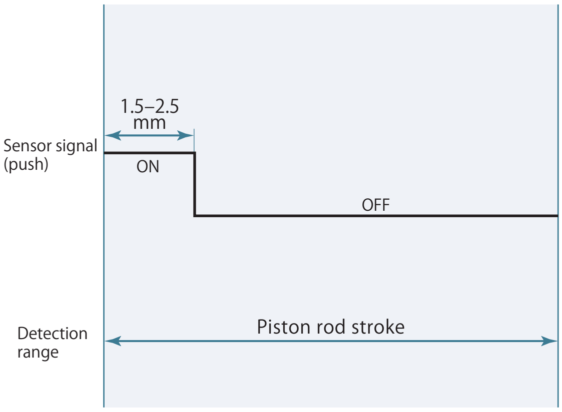
Push end detection



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 (push)	ON	Push end

Air sensor triggering point



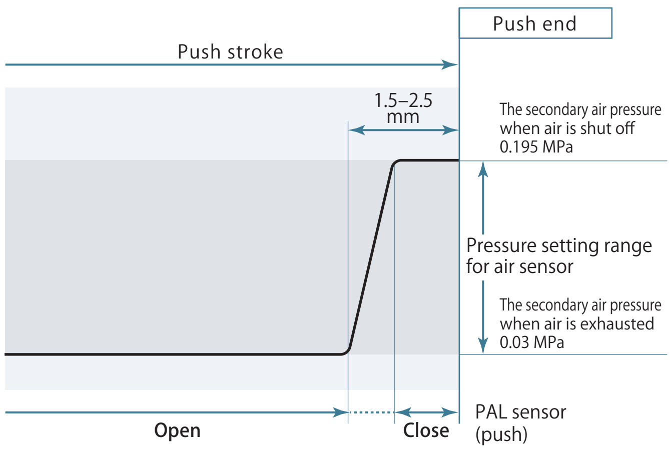
- Refer to the sensor supplier's instruction manual for the details of setting.
- Sensing performance such as detectable time and pressure differs depending on the supplier and model number of the sensor. Select the right model referring to sensor’s application and characteristics.

Air sensor unit 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

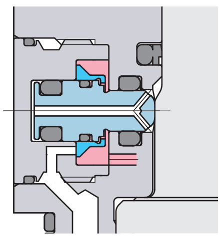


The diagram shown above indicates the relation between the PAL sensor, piston stroke, and secondary air pressure. (The pressure shown in the diagram is a reference based on the 0.2 MPa of primary air pressure for one piece of cylinder.)

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

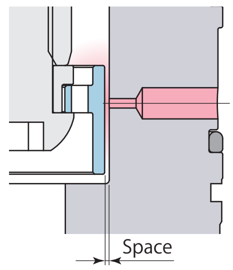
- Enhances the pressure setting range of the sensor which enables the sensor to set easily.
  (Ex. Pressure setting range 0.03–0.195 MPa in the diagram)
- Allows the use for a number of cylinders by one air sensor because of better pressure holding when air is shut off. (Maximum number of cylinders to 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.

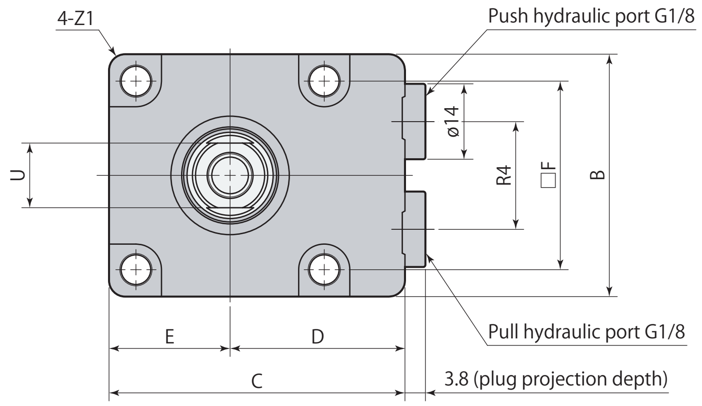
Previous sensor valve

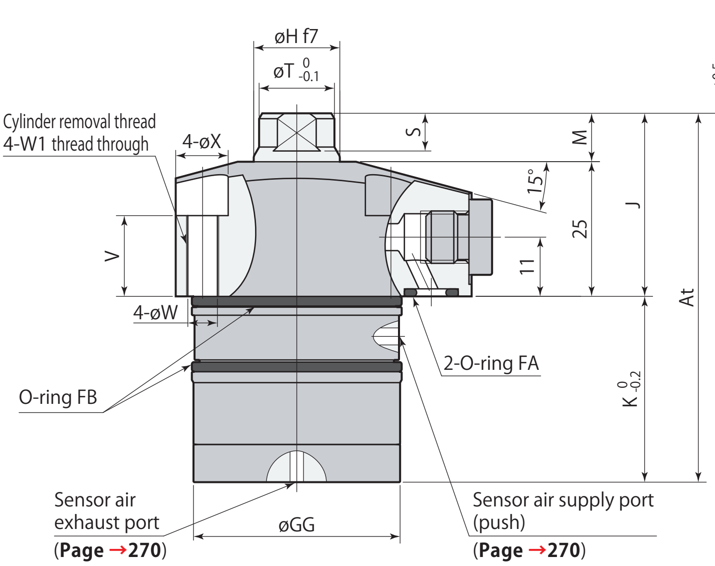


Air leaks easily due to a large space.

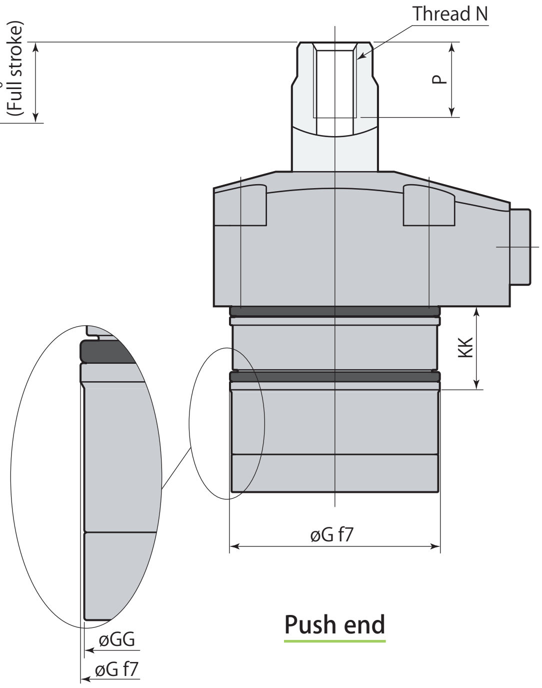
Dimensions

(Female thread rod)

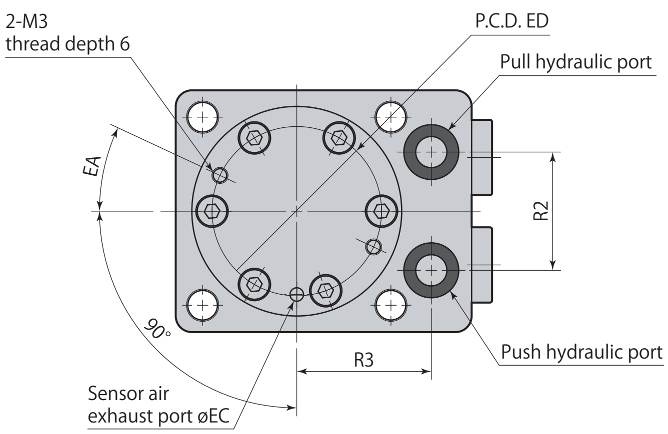


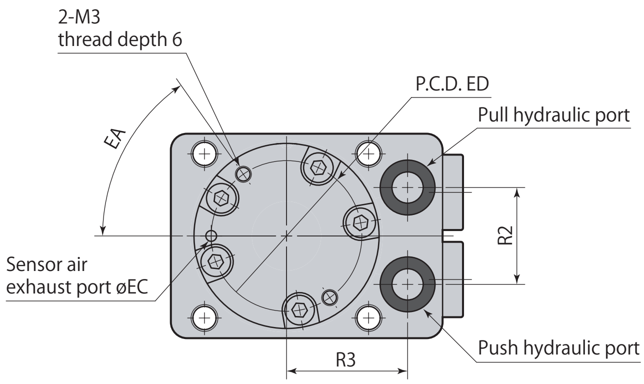


Pull end



Push end





CNB01-□TU

● Mounting screws are not included.

mm

Model		CNB01-□TU	CNB02-□TU	CNB04-□TU
Y (stroke)		10, 15, 20, 25, 30, 35, 40, 45, 50		
Cylinder capacity (cm^3)	Push	0.38×Y	0.49×Y	0.71×Y
	Pull	0.23×Y	0.29×Y	0.45×Y
At		Y+51.5	Y+53.5	Y+57.5
B		38	45	50
C		50.5	55	60
D		29	32.5	35
E		21.5	22.5	25
F		30.5	35	40
øG		$35^{-0.025}_{-0.050}$	$39^{-0.025}_{-0.050}$	$47^{-0.025}_{-0.050}$
øGG		34.4	38.4	46.4
øH		$14^{-0.016}_{-0.034}$	$16^{-0.016}_{-0.034}$	$18^{-0.016}_{-0.034}$
J		33	34	35
K		Y+18.5	Y+19.5	Y+22.5
KK	Y=10, 15	15.5	15.5	15.5
	Y=20–50	20.5	20.5	20.5
M		8	9	10
N		M6×1	M8×1.25	M8×1.25
P		11	14	14
R2		18	22	24
R3		22.5	25	28
R4		16.2	20	22
S (width across flats height)		6	7	8
øT		12	14	16
U (width across flats)		10	12	14
V		17	15	15
øW		4.5	5.5	5.5
W1		M5×0.8	M6×1	M6×1
øX		8	9.5	9.5
Z1		R3	R3	R5
EA		55°	25°	20°
øEC		2	2.5	3.3
ED		28	31.5	38
O-ring FA (fluorocarbon hardness Hs90)		P7	P7	P7
O-ring FB (fluorocarbon hardness Hs70)		AS568-026	AS568-028	AS568-030
Flow control valve*	Meter-in	VCF01S	VCF01	VCF01
	Meter-out	VCF01S-O	VCF01-O	VCF01-O
Air bleeding valve		VCE01	VCE01	VCE01

*: Select the right model of VCF according to the size of the cylinder.

Refer to each page for the details of options. ● Flow control valve **page →320** ● Air bleeding valve **page →322**

● CNB□-□TU (Push sensor model, Female thread rod) stroke 25, 35, 45 mm are made to order.

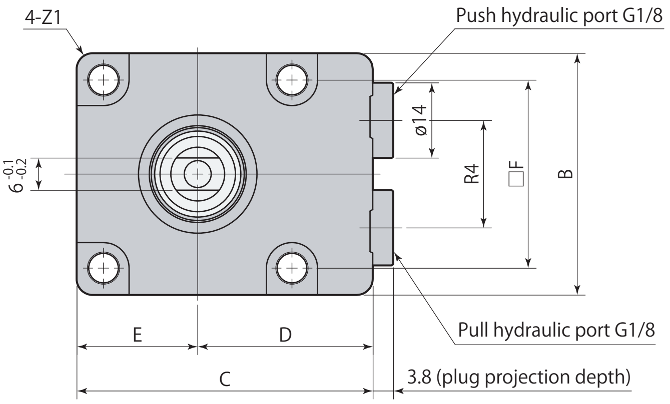
Mass

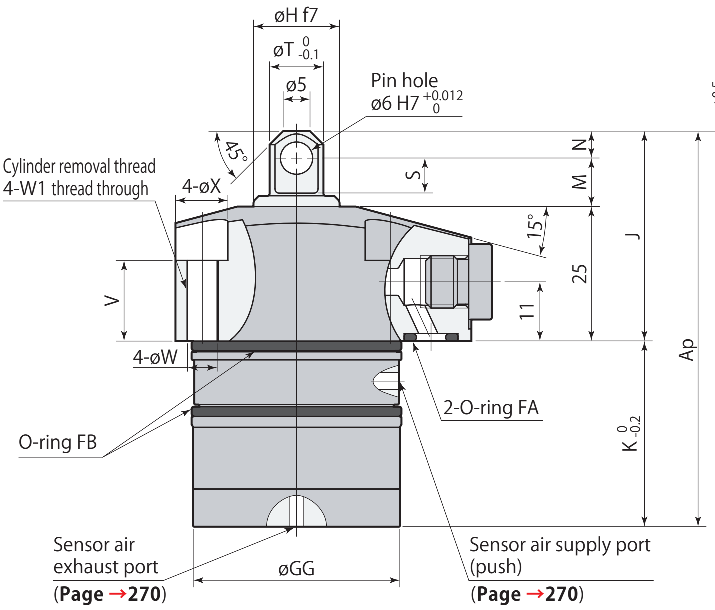
kg

Stroke	10	15	20	25	30	35	40	45	50
CNB01-□TU	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7
CNB02-□TU	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9
CNB04-□TU	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.3

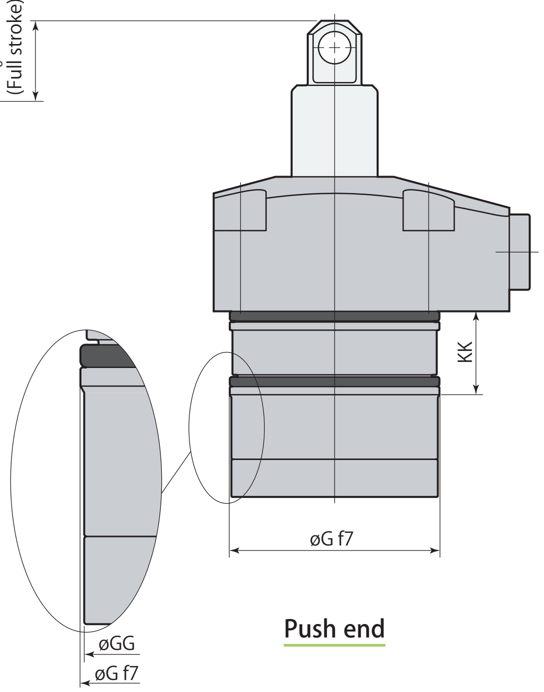
Dimensions

(Pin rod)

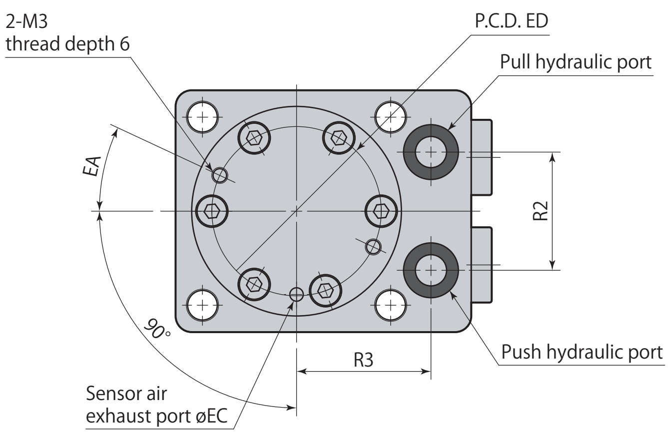


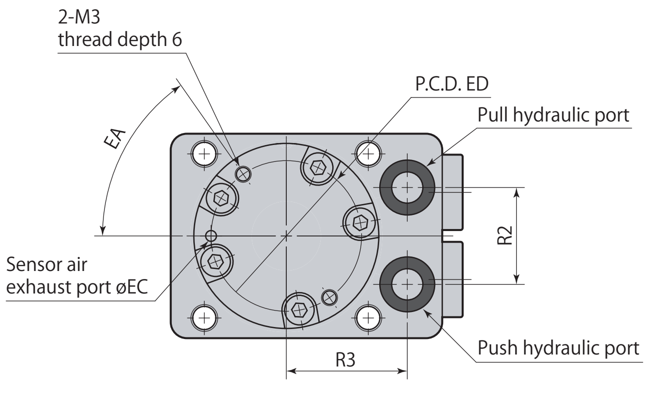


Pull end



Push end





CNB01-□PU

- Mounting screws are not included.
- Recommended material for pin：SCM435-H (HB269–331)

mm

Model		CNB01-☐PU		CNB02-☐PU		CNB04-☐PU	
Y (stroke)		10, 15, 20, 25, 30, 35, 40, 45, 50					
Cylinder capacity (cm^3)	Push	0.38×Y		0.49×Y		0.71×Y	
	Pull	0.23×Y		0.29×Y		0.45×Y	
Ap		Y+57.5		Y+58.5		Y+63	
B		38		45		50	
C		50.5		55		60	
D		29		32.5		35	
E		21.5		22.5		25	
F		30.5		35		40	
øG		$35^{-0.025}_{-0.050}$		$39^{-0.025}_{-0.050}$		$47^{-0.025}_{-0.050}$	
øGG		34.4		38.4		46.4	
øH		$14^{-0.016}_{-0.034}$		$16^{-0.016}_{-0.034}$		$18^{-0.016}_{-0.034}$	
J		39		39		40.5	
K		Y+18.5		Y+19.5		Y+22.5	
KK		Y=10, 15	Y=20–50	Y=10, 15	Y=20–50	Y=10, 15	Y=20–50
		15.5	20.5	15.5	20.5	15.5	20.5
M		9		9		9.5	
N		5		5		6	
R2		18		22		24	
R3		22.5		25		28	
R4		16.2		20		22	
S		6.5		6.5		7	
øT		10		10		12	
V		17		15		15	
øW		4.5		5.5		5.5	
W1		M5×0.8		M6×1		M6×1	
øX		8		9.5		9.5	
Z1		R3		R3		R5	
EA		55°		25°		20°	
øEC		2		2.5		3.3	
ED		28		31.5		38	
O-ring FA (fluorocarbon hardness Hs90)		P7		P7		P7	
O-ring FB (fluorocarbon hardness Hs70)		AS568-026		AS568-028		AS568-030	
Flow control valve*	Meter-in	VCF01S		VCF01		VCF01	
	Meter-out	VCF01S-O		VCF01-O		VCF01-O	
Air bleeding valve		VCE01		VCE01		VCE01	

∗:Select the right model of VCF according to the size of the cylinder.

Refer to each page for the details of options. ● Flow control valve **page →320** ● Air bleeding valve **page →322**

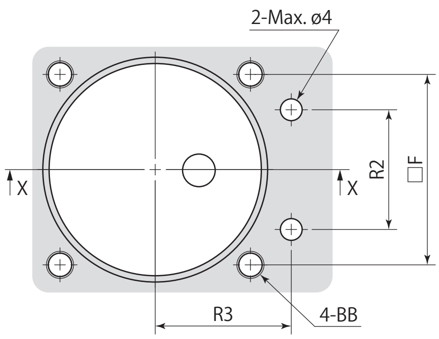
● CNB☐-☐PU (Push sensor model, Pin rod) are made to order.

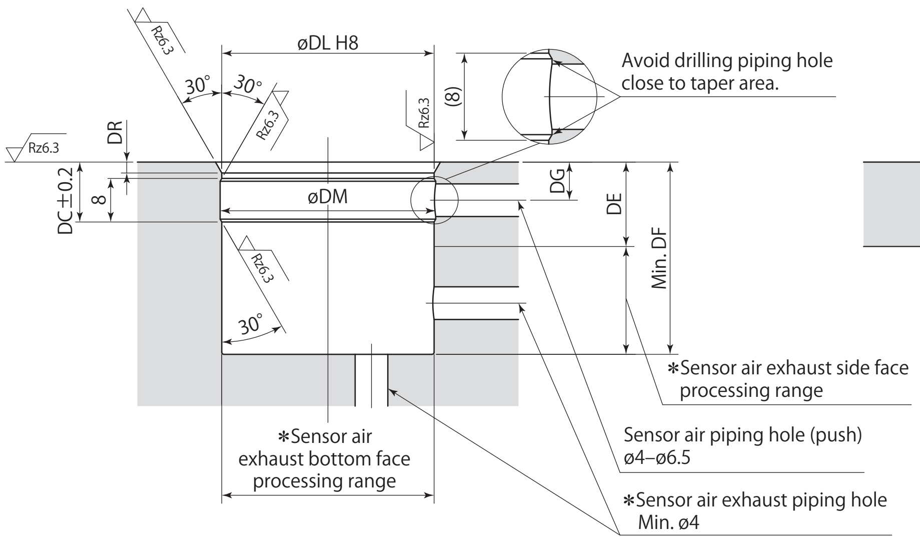
Mass

kg

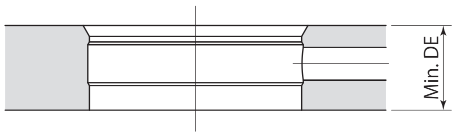
Stroke	10	15	20	25	30	35	40	45	50
CNB01-☐PU	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7
CNB02-☐PU	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9
CNB04-☐PU	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.3

Mounting details





In blind hole X-X

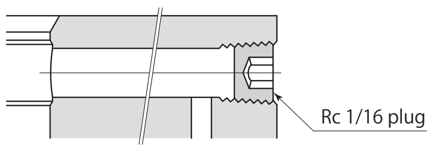


In through hole X-X

∗: 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 1/16 plug.



mm

Model	CNB01-□TU CNB01-□PU								
Stroke	10	15	20	25	30	35	40	45	50
DC	11	11	16	16	16	16	16	16	16
DE	15.5	15.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5
DF	29	34	39	44	49	54	59	64	69
DG	7	7	12	12	12	12	12	12	12
øDL	$35^{+0.039}_{0}$								
øDM	35.6								
DR	2	2	1	1	1	1	1	1	1
BB	M4								
F	30.5								
R2	18								
R3	22.5								

mm

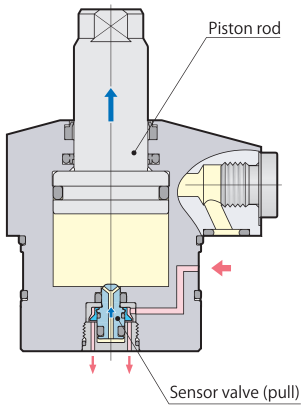
Model	CNB02-□TU CNB02-□PU								
Stroke	10	15	20	25	30	35	40	45	50
DC	11	11	16	16	16	16	16	16	16
DE	15.5	15.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5
DF	30	35	40	45	50	55	60	65	70
DG	7	7	12	12	12	12	12	12	12
øDL	$39^{+0.039}_{0}$								
øDM	39.6								
DR	2	2	1	1	1	1	1	1	1
BB	M5								
F	35								
R2	22								
R3	25								

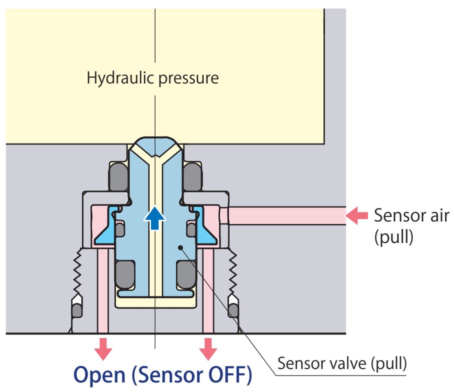
mm

Model	CNB04-□TU CNB04-□PU								
Stroke	10	15	20	25	30	35	40	45	50
DC	11	11	16	16	16	16	16	16	16
DE	15.5	15.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5
DF	33	38	43	48	53	58	63	68	73
DG	7	7	12	12	12	12	12	12	12
øDL	$47^{+0.039}_{0}$								
øDM	47.6								
DR	2	2	1	1	1	1	1	1	1
BB	M5								
F	40								
R2	24								
R3	28								

Pull PAL sensor function and structure

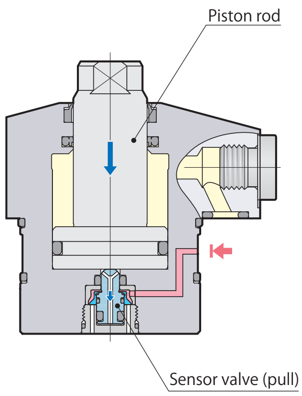
In the middle of stroke

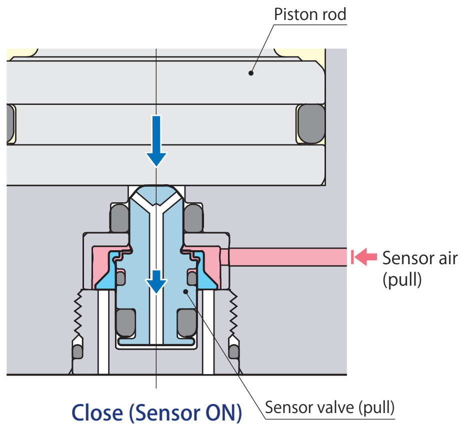




- The sensor valve (pull) is pushed up by the hydraulic force and exhausts the sensor air while piston rod strokes.

Pull end detection

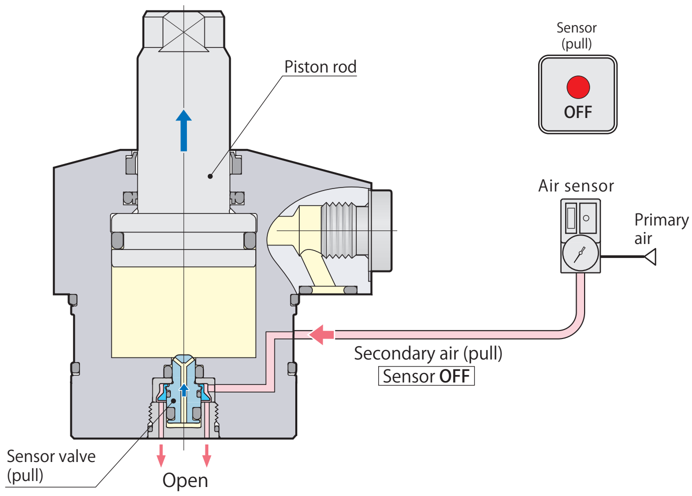




- The sensor valve (pull) is pushed down by the piston rod and shuts off the sensor air flow when the piston rod reaches the pull end position, and detects the pull end position.

Pull end detection signal

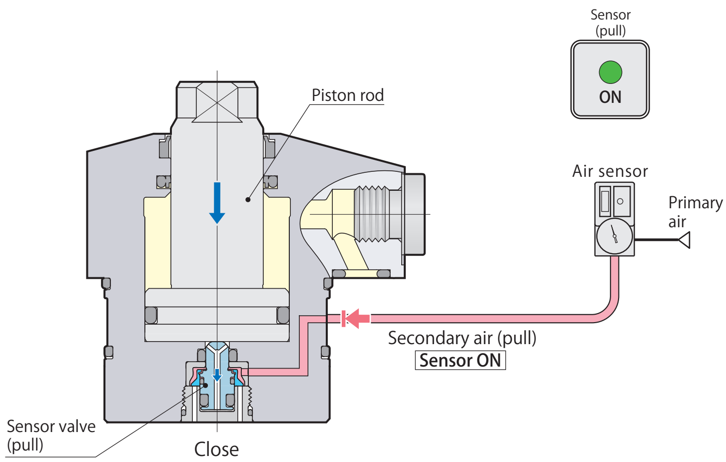
In the middle of stroke



Sensor signal (pull)	OFF	Push end, in the middle of 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.

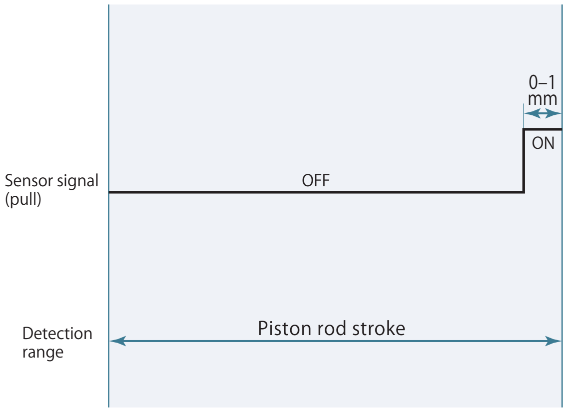
Pull end detection



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 (pull)	ON	Pull end

Air sensor triggering point



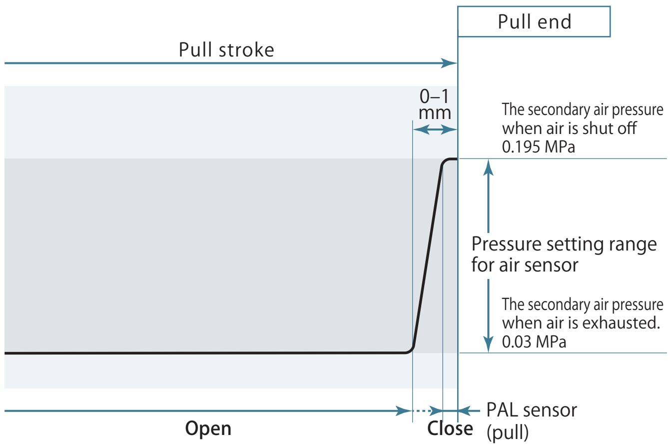
- Refer to the sensor supplier's instruction manual for the details of setting.
- Sensing performance such as detectable time and pressure differs depending on the supplier and model number of the sensor. Select the right model referring to sensor's application and characteristics.

Air sensor unit 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

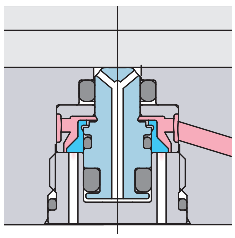


The diagram shown above indicates the relation between the PAL sensor, piston stroke, and secondary air pressure. (The pressure shown in the diagram is a reference based on the 0.2 MPa of primary air pressure for one piece of cylinder.)

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

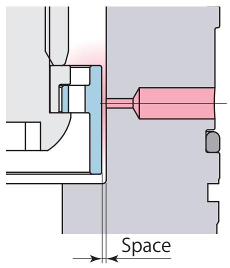
- Enhances the pressure setting range of the sensor which enables the sensor to set easily.
  (Ex. Pressure setting range 0.03–0.195 MPa in the diagram)
- Allows the use for a number of cylinders by one air sensor because of better pressure holding when air is shut off. (Maximum number of cylinders to 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.

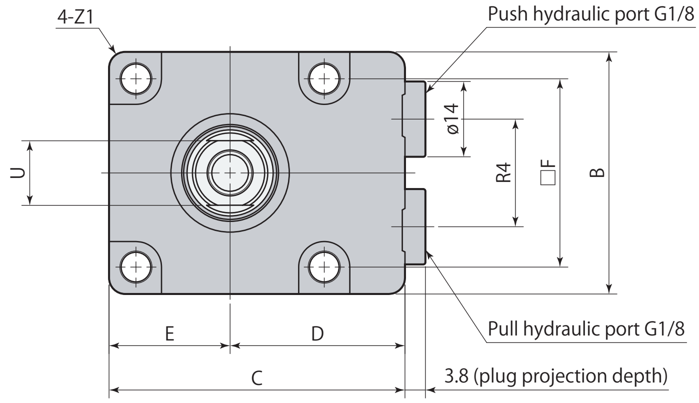
Previous sensor valve

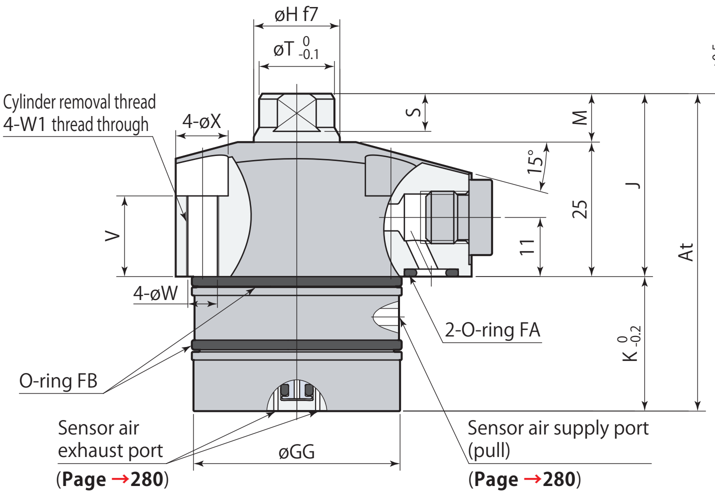


Air leaks easily due to a large space.

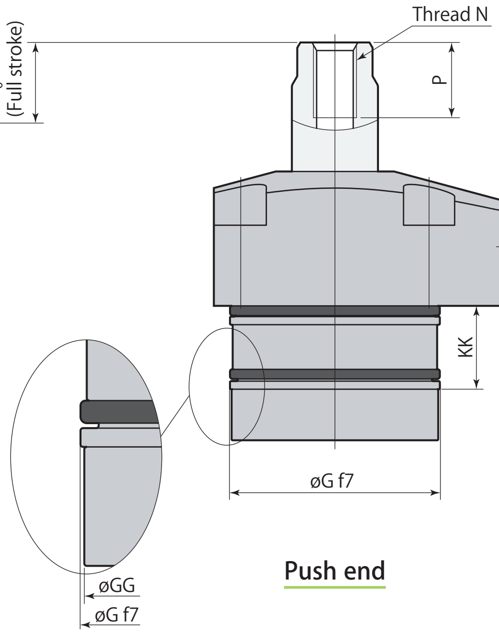
Dimensions

(Female thread rod)

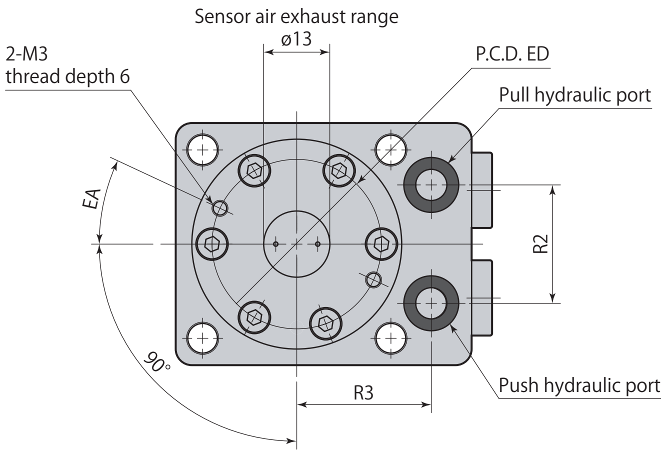


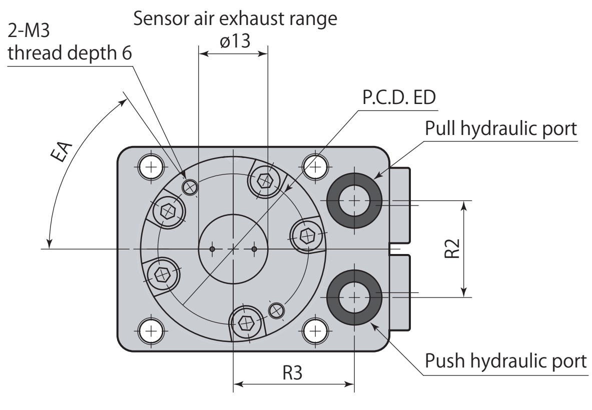


Pull end



Push end





CNB01-□TB

● Mounting screws are not included.

mm

Model		CNB01-□TB		CNB02-□TB		CNB04-□TB	
Y (stroke)		10, 15, 20, 25, 30, 35, 40, 45, 50					
Cylinder capacity (cm³)	Push	0.38×Y		0.49×Y		0.71×Y	
	Pull	0.23×Y		0.29×Y		0.45×Y	
At		Y=10	Y=15–50	Y=10	Y=15–50	Y=10	Y=15–50
		58	Y+43	59	Y+44	61.5	Y+46.5
B		38		45		50	
C		48		55		60	
D		29		32.5		35	
E		19		22.5		25	
F		30.5		35		40	
øG		$35^{-0.025}_{-0.050}$		$39^{-0.025}_{-0.050}$		$47^{-0.025}_{-0.050}$	
øGG		34.4		38.4		46.4	
øH		$14^{-0.016}_{-0.034}$		$16^{-0.016}_{-0.034}$		$18^{-0.016}_{-0.034}$	
J		33		34		35	
K		Y=10	Y=15–50	Y=10	Y=15–50	Y=10	Y=15–50
		25	Y+10	25	Y+10	26.5	Y+11.5
KK		Y=10, 15	Y=20–50	Y=10, 15	Y=20–50	Y=10, 15	Y=20–50
		15.5	20.5	15.5	20.5	15.5	20.5
M		8		9		10	
N		M6×1		M8×1.25		M8×1.25	
P		11		14		14	
R2		18		22		24	
R3		22.5		25		28	
R4		16.2		20		22	
S (width across flats height)		6		7		8	
øT		12		14		16	
U (width across flats)		10		12		14	
V		17		15		15	
øW		4.5		5.5		5.5	
W1		M5×0.8		M6×1		M6×1	
øX		8		9.5		9.5	
Z1		R3		R3		R5	
EA		55°		25°		20°	
ED		28		31.5		38	
O-ring FA (fluorocarbon hardness Hs90)		P7		P7		P7	
O-ring FB (fluorocarbon hardness Hs70)		AS568-026		AS568-028		AS568-030	
Flow control valve*	Meter-in	VCF01S		VCF01		VCF01	
	Meter-out	VCF01S-O		VCF01-O		VCF01-O	
Air bleeding valve		VCE01		VCE01		VCE01	

*:Select the right model of VCF according to the size of the cylinder.

Refer to each page for the details of options. ● Flow control valve **page →320** ● Air bleeding valve **page →322**

● CNB□-□TB (Pull sensor model, Female thread rod) stroke 25, 35, 45 mm are made to order.

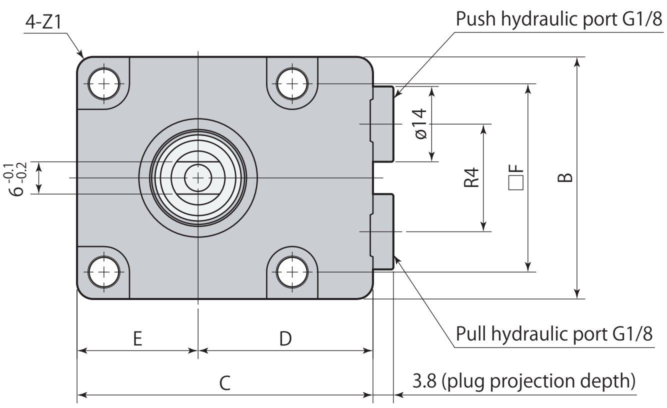
Mass

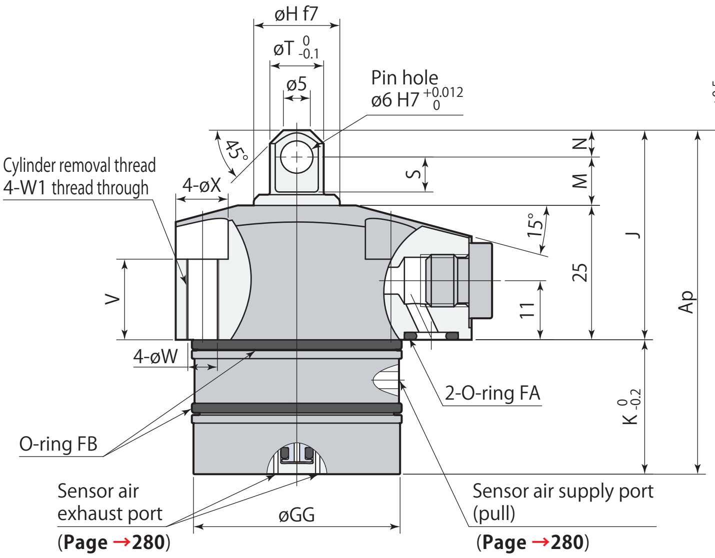
kg

Stroke	10	15	20	25	30	35	40	45	50
CNB01-□TB	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6
CNB02-□TB	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8
CNB04-□TB	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1

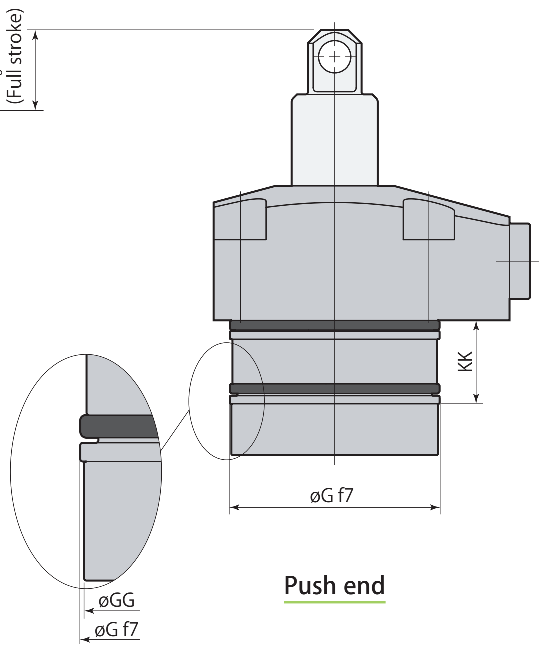
Dimensions

(Pin rod)

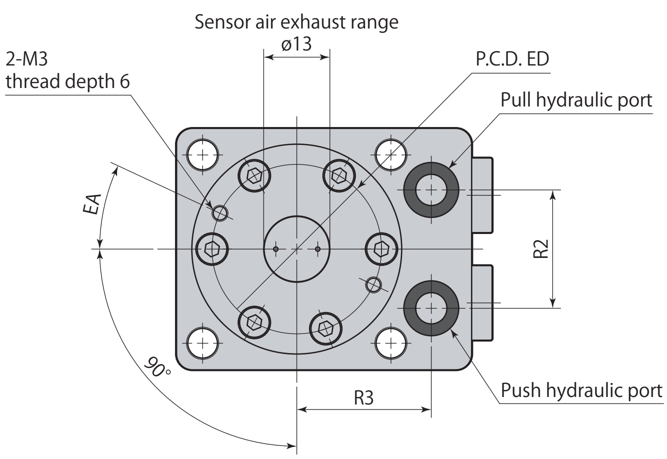


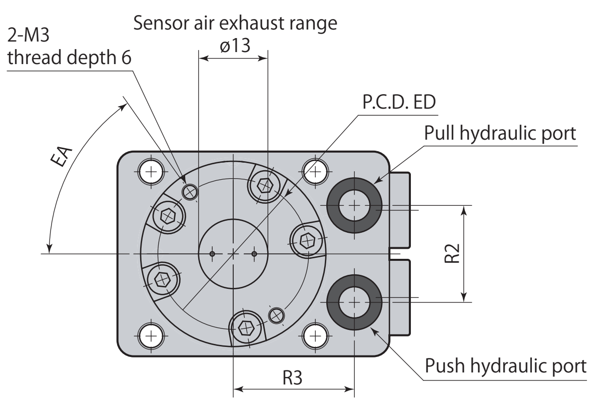


Pull end



Push end





CNB01-□PB

- Mounting screws are not included.
- Recommended material for pin：SCM435-H (HB269–331)

mm

Model		CNB01-□PB		CNB02-□PB		CNB04-□PB	
Y (stroke)		10, 15, 20, 25, 30, 35, 40, 45, 50					
Cylinder capacity (cm^3)	Push	0.38×Y		0.49×Y		0.71×Y	
	Pull	0.23×Y		0.29×Y		0.45×Y	
Ap		Y=10	Y=15–50	Y=10	Y=15–50	Y=10	Y=15–50
		64	Y+49	64	Y+49	67	Y+52
B		38		45		50	
C		48		55		60	
D		29		32.5		35	
E		19		22.5		25	
F		30.5		35		40	
øG		$35^{-0.025}_{-0.050}$		$39^{-0.025}_{-0.050}$		$47^{-0.025}_{-0.050}$	
øGG		34.4		38.4		46.4	
øH		$14^{-0.016}_{-0.034}$		$16^{-0.016}_{-0.034}$		$18^{-0.016}_{-0.034}$	
J		39		39		40.5	
K		Y=10	Y=15–50	Y=10	Y=15–50	Y=10	Y=15–50
		25	Y+10	25	Y+10	26.5	Y+11.5
KK		Y=10, 15	Y=20–50	Y=10, 15	Y=20–50	Y=10, 15	Y=20–50
		15.5	20.5	15.5	20.5	15.5	20.5
M		9		9		9.5	
N		5		5		6	
R2		18		22		24	
R3		22.5		25		28	
R4		16.2		20		22	
S		6.5		6.5		7	
øT		10		10		12	
V		17		15		15	
øW		4.5		5.5		5.5	
W1		M5×0.8		M6×1		M6×1	
øX		8		9.5		9.5	
Z1		R3		R3		R5	
EA		55°		25°		20°	
ED		28		31.5		38	
O-ring FA (fluorocarbon hardness Hs90)		P7		P7		P7	
O-ring FB (fluorocarbon hardness Hs70)		AS568-026		AS568-028		AS568-030	
Flow control valve*	Meter-in	VCF01S		VCF01		VCF01	
	Meter-out	VCF01S-O		VCF01-O		VCF01-O	
Air bleeding valve		VCE01		VCE01		VCE01	

*: Select the right model of VCF according to the size of the cylinder.

Refer to each page for the details of options. ● Flow control valve **page →320** ● Air bleeding valve **page →322**

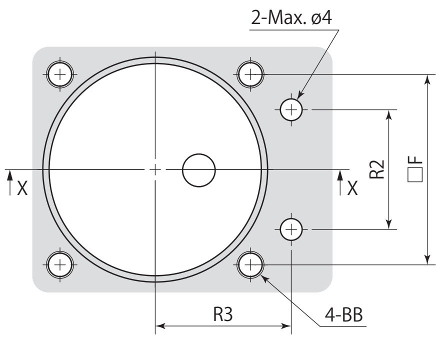
● CNB□-□PB (Pull sensor model, Pin rod) are made to order.

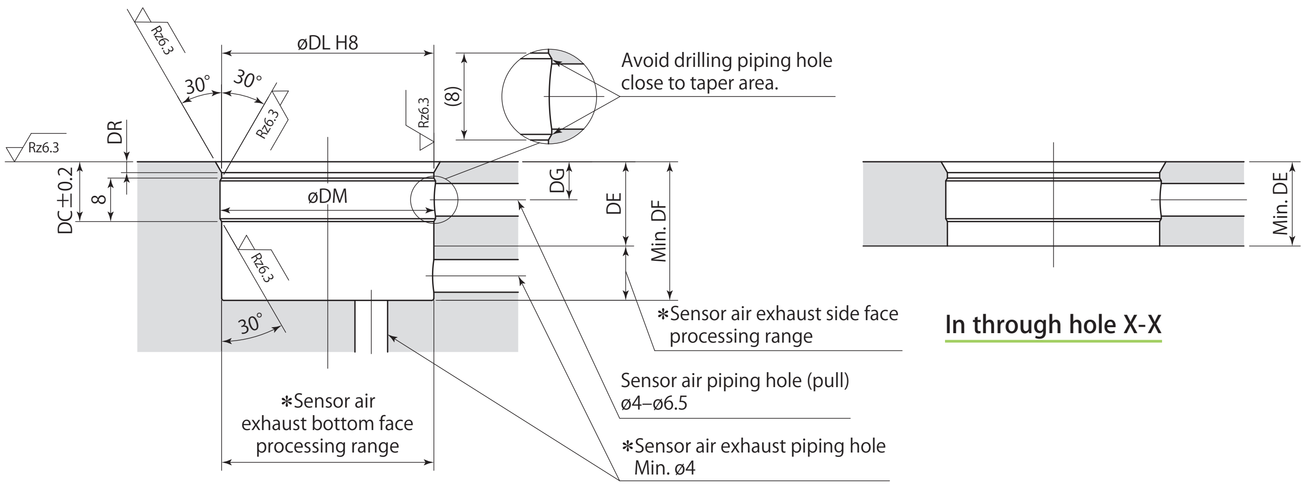
Mass

kg

Stroke	10	15	20	25	30	35	40	45	50
CNB01-□PB	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6
CNB02-□PB	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8
CNB04-□PB	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1

Mounting details





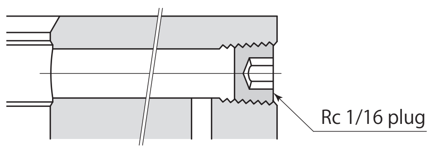
In through hole X-X

In blind 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 1/16 plug.



mm

Model	CNB01-□TB CNB01-□PB								
Stroke	10	15	20	25	30	35	40	45	50
DC	11	11	16	16	16	16	16	16	16
DE	15.5	15.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5
DF	25.5	25.5	30.5	35.5	40.5	45.5	50.5	55.5	60.5
DG	7	7	12	12	12	12	12	12	12
øDL	$35\ ^{+0.039}_{0}$								
øDM	35.6								
DR	2	2	1	1	1	1	1	1	1
BB	M4								
F	30.5								
R2	18								
R3	22.5								

mm

Model	CNB02-□TB CNB02-□PB								
Stroke	10	15	20	25	30	35	40	45	50
DC	11	11	16	16	16	16	16	16	16
DE	15.5	15.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5
DF	25.5	25.5	30.5	35.5	40.5	45.5	50.5	55.5	60.5
DG	7	7	12	12	12	12	12	12	12
øDL	$39\ ^{+0.039}_{0}$								
øDM	39.6								
DR	2	2	1	1	1	1	1	1	1
BB	M5								
F	35								
R2	22								
R3	25								

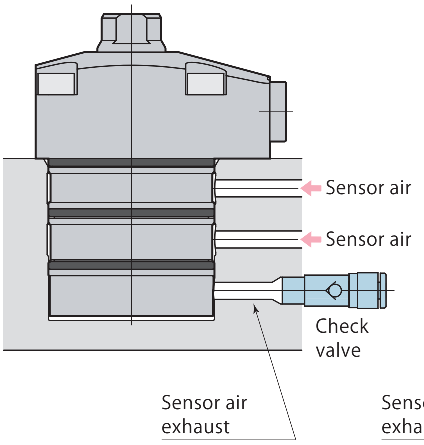
mm

Model	CNB04-□TB CNB04-□PB								
Stroke	10	15	20	25	30	35	40	45	50
DC	11	11	16	16	16	16	16	16	16
DE	15.5	15.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5
DF	27	27	32	37	42	47	52	57	62
DG	7	7	12	12	12	12	12	12	12
øDL	$47\ ^{+0.039}_{0}$								
øDM	47.6								
DR	2	2	1	1	1	1	1	1	1
BB	M5								
F	40								
R2	24								
R3	28								

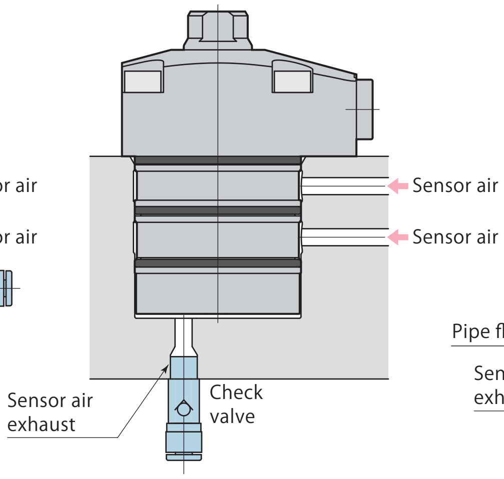
Caution for piping

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

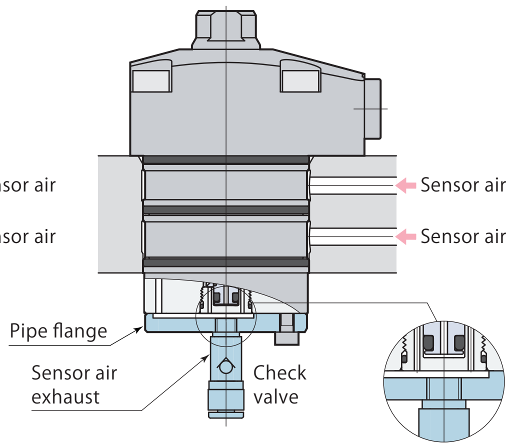
Mounting in blind hole
(Sensor air exhaust：side face)



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



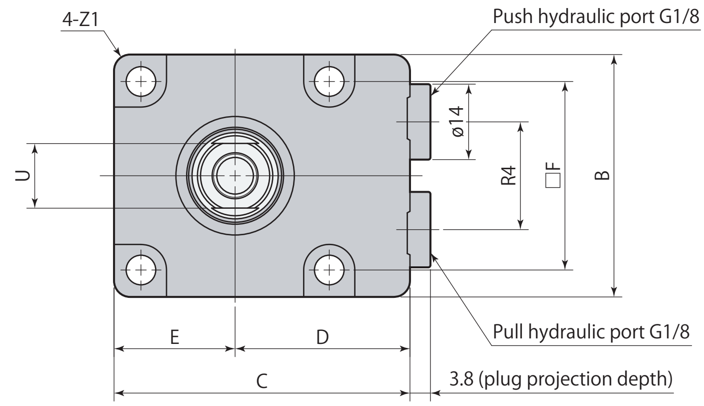
Mounting in through hole

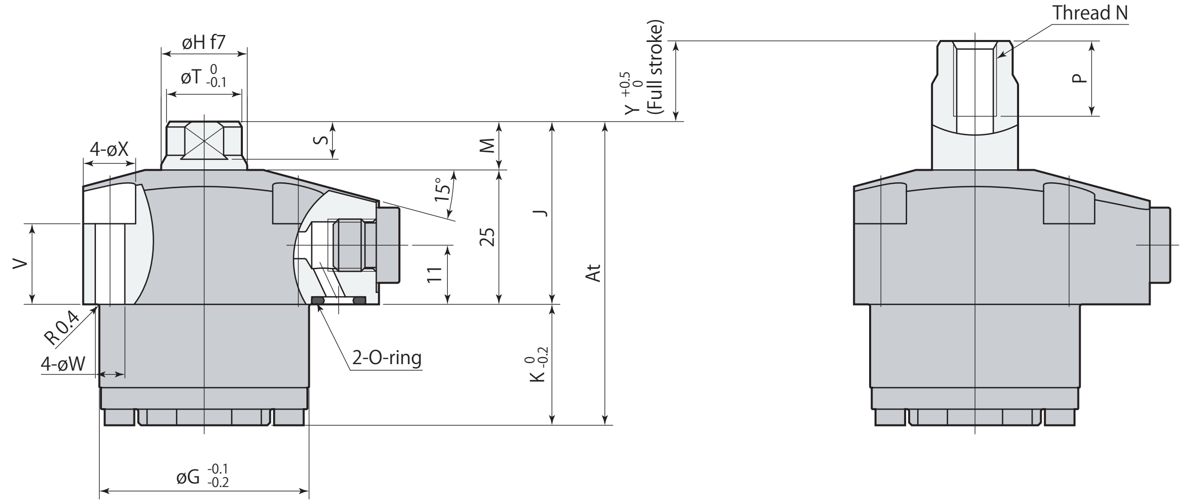


- Use a check valve with cracking pressure of 0.005 MPa or less if there is a risk of metal chips or coolant intrusion. Recommended check valve：AKH or AKB series manufactured by SMC.
- Furnish the piping by means of the pipe flange when mounting in a through hole. The flange is mountable with M3 threads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

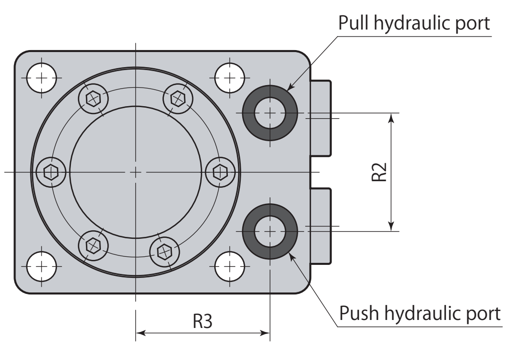
Dimensions

(Female thread rod)





Pull end **Push end**



● Mounting screws are not included.

mm

Model		CNB01-☐TN	CNB02-☐TN	CNB04-☐TN
Y (stroke)		10, 15, 20, 25, 30, 35, 40, 45, 50		
Cylinder capacity (cm^3)	Push	0.38×Y	0.49×Y	0.71×Y
	Pull	0.23×Y	0.29×Y	0.45×Y
At		Y+39.5	Y+41.5	Y+45.5
B		38	45	50
C		48	55	60
D		29	32.5	35
E		19	22.5	25
F		30.5	35	40
øG		35	39	47
øH		$14^{-0.016}_{-0.034}$	$16^{-0.016}_{-0.034}$	$18^{-0.016}_{-0.034}$
J		33	34	35
K		Y+6.5	Y+7.5	Y+10.5
M		8	9	10
N		M6×1	M8×1.25	M8×1.25
P		11	14	14
R2		18	22	24
R3		22.5	25	28
R4		16.2	20	22
S (width across flats height)		6	7	8
øT		12	14	16
U (width across flats)		10	12	14
V		17	15	15
øW		4.5	5.5	5.5
øX		8	9.5	9.5
Z1		R3	R3	R5
O-ring (fluorocarbon hardness Hs90)		P7	P7	P7
Flow control valve*	Meter-in	VCF01S	VCF01	VCF01
	Meter-out	VCF01S-O	VCF01-O	VCF01-O
Air bleeding valve		VCE01	VCE01	VCE01

*: Select the right model of VCF according to the size of the cylinder.

Refer to each page for the details of options. ● Flow control valve **page →320** ● Air bleeding valve **page →322**

● CNB☐-☐TN (Compact model, Female thread rod) stroke 25, 35, 45 mm are made to order.

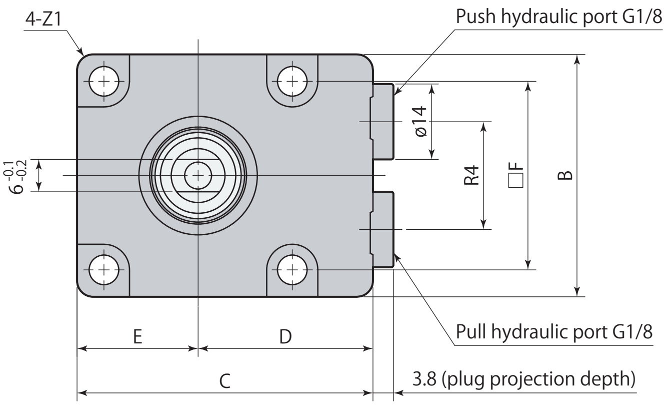
Mass

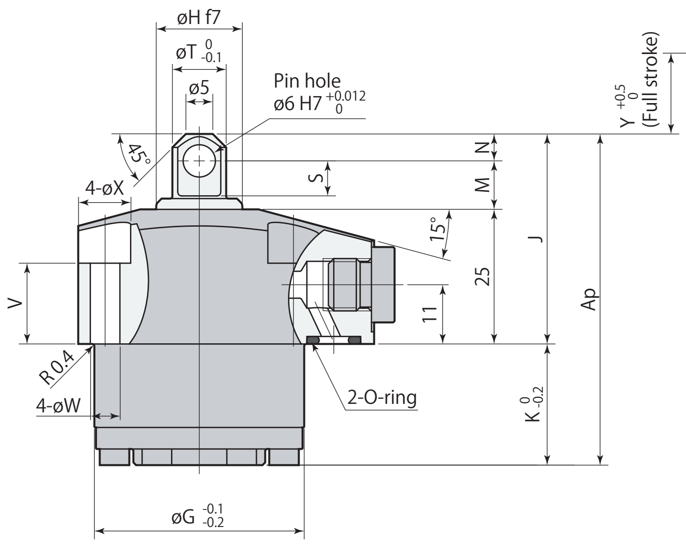
kg

Stroke	10	15	20	25	30	35	40	45	50
CNB01-☐TN	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6
CNB02-☐TN	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8
CNB04-☐TN	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1

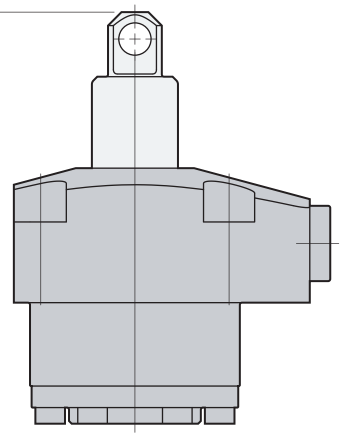
Dimensions

(Pin rod)

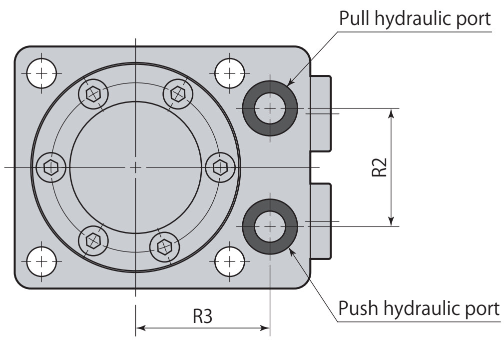




Pull end



Push end



- Mounting screws are not included.
- Recommended material for pin：SCM435-H (HB269–331)

mm

Model		CNB01-□PN	CNB02-□PN	CNB04-□PN
Y (stroke)		10, 15, 20, 25, 30, 35, 40, 45, 50		
Cylinder capacity (cm^3)	Push	0.38×Y	0.49×Y	0.71×Y
	Pull	0.23×Y	0.29×Y	0.45×Y
Ap		Y+45.5	Y+46.5	Y+51
B		38	45	50
C		48	55	60
D		29	32.5	35
E		19	22.5	25
F		30.5	35	40
øG		35	39	47
øH		$14^{-0.016}_{-0.034}$	$16^{-0.016}_{-0.034}$	$18^{-0.016}_{-0.034}$
J		39	39	40.5
K		Y+6.5	Y+7.5	Y+10.5
M		9	9	9.5
N		5	5	6
R2		18	22	24
R3		22.5	25	28
R4		16.2	20	22
S		6.5	6.5	7
øT		10	10	12
V		17	15	15
øW		4.5	5.5	5.5
øX		8	9.5	9.5
Z1		R3	R3	R5
O-ring (fluorocarbon hardness Hs90)		P7	P7	P7
Flow control valve*	Meter-in	VCF01S	VCF01	VCF01
	Meter-out	VCF01S-O	VCF01-O	VCF01-O
Air bleeding valve		VCE01	VCE01	VCE01

*: Select the right model of VCF according to the size of the cylinder.

Refer to each page for the details of options. ● Flow control valve **page →320** ● Air bleeding valve **page →322**

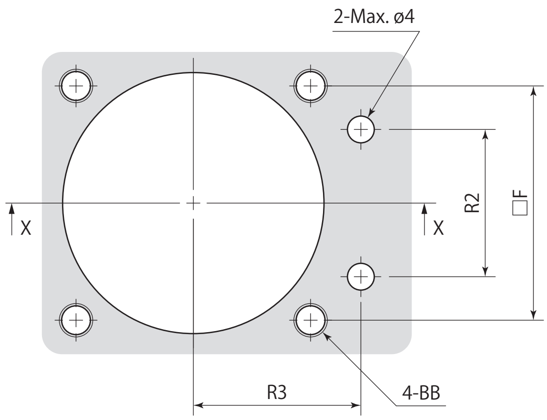
● CNB□-□PN (Compact model, Pin rod) are made to order.

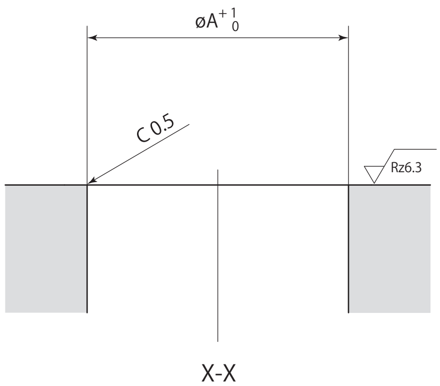
Mass

kg

Stroke	10	15	20	25	30	35	40	45	50
CNB01-□PN	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6
CNB02-□PN	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8
CNB04-□PN	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1

Mounting details





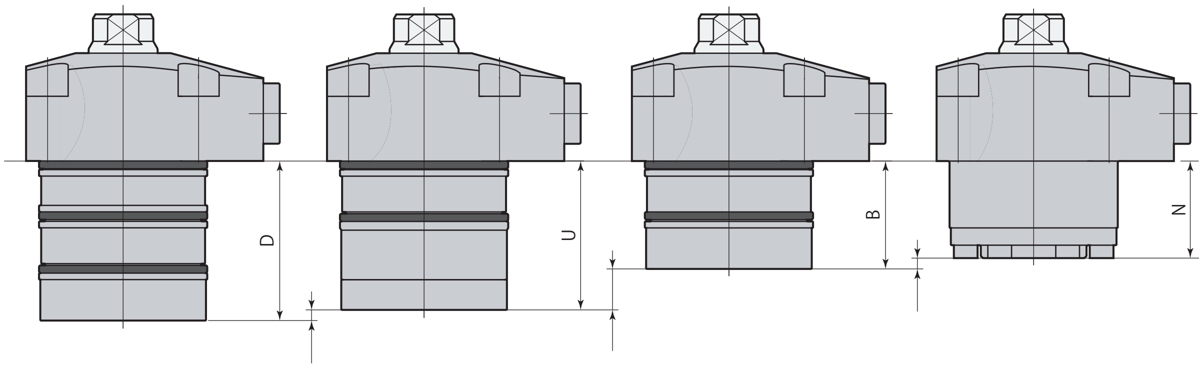
Rz: ISO4287(1997)

mm

Model	CNB01-□TN / CNB01-□PN	CNB02-□TN / CNB02-□PN	CNB04-□TN / CNB04-□PN
øA	35	39	47
F	30.5	35	40
R2	18	22	24
R3	22.5	25	28
BB	M4	M5	M5

Comparison dimensional

model CNB□-□□D	model CNB□-□□U	model CNB□-□□B	model CNB□-□□N
Push, pull sensor model D	Push sensor model U	Pull sensor model B	Compact model N



mm

Model	CNB01-□		CNB02-□		CNB04-□	
Y (stroke)	10, 15, 20, 25, 30, 35, 40, 45, 50					
D	Y=10	Y=15–50	Y=10	Y=15–50	Y=10	Y=15–50
	37	Y+22	37	Y+22	38.5	Y+23.5
U	Y+18.5		Y+19.5		Y+22.5	
B	Y=10	Y=15–50	Y=10	Y=15–50	Y=10	Y=15–50
	25	Y+10	25	Y+10	26.5	Y+11.5
N	Y+6.5		Y+7.5		Y+10.5	

Table of contents

Push, pull cylinder

Double acting 7 MPa

model CNA

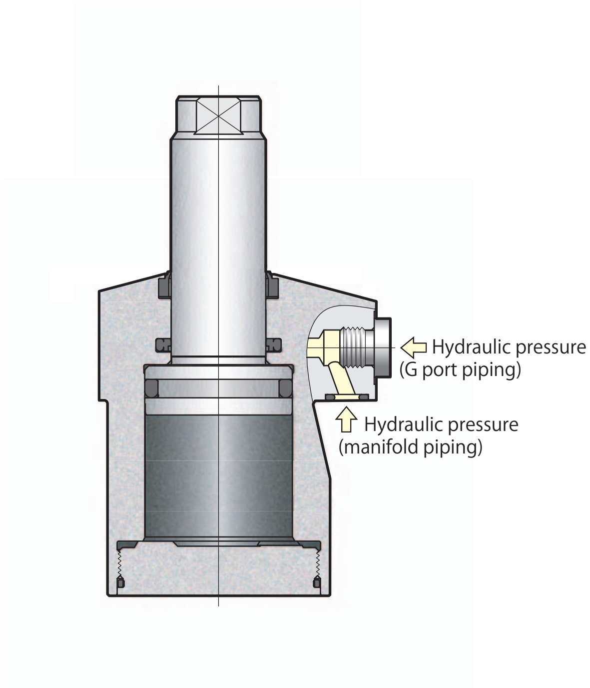
Female thread rod
model CNA06-30T

Pin rod
model CNA06-30P

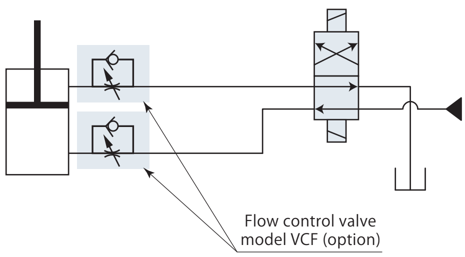
Male thread rod
model CNA06-30M

Standard model

model **CNA□-□□**



Hydraulic circuit diagram



For flow control valve, we recommend the meter-in control. If meter-out control is used, due to the area difference, it will cause back pressure and become high pressure. This can lead to malfunction of the system. Please be aware when designing the circuit.

Specifications **page → 293**
Piping **page → 293**
Standard **page → 294**
Dual rod **page → 302**
Air sensor **page → 304**

Specifications

CNA – Size – Stroke – Rod tip section shapes – Variation code

Size	Stroke									
02	10	15	20	30	40	50	(60)	(70)		
04	10	15	20	30	40	50	60	70		
06	10	15	20	30	40	50	60	70	(80)	(90)
10	10		20	30	40	50	60	70	80	(90)	(100)
16	10		20	30	40	50	60	70	80	(90)	(100)
25			20	30	40	50	60	70	80	90	(100)	(110)

Rod tip section shapes

- T : Female thread rod
- P : Pin rod
- M : Male thread rod

Variation code

- (Nil) : Standard
- E : Dual rod
- A1 : Air sensor Detection 1mm before push end
- A3 : Air sensor Detection 3mm before push end
- A5 : Air sensor Detection 5mm before push end

■ indicates made to order. Dual rod, air sensor model for the stroke with ( ) are unavailable.

Model			CNA02	CNA04	CNA06	CNA10	CNA16	CNA25
Cylinder force (hydraulic pressure 7MPa)	Push	kN	3.4	4.9	6.7	10.6	17.2	26.9
	Pull	kN	2.0	3.2	4.0	7.2	12.3	20.0
Cylinder force calculation formula*1	Push		F=0.49×P	F=0.71×P	F=0.96×P	F=1.52×P	F=2.46×P	F=3.85×P
	Pull		F=0.29×P	F=0.45×P	F=0.57×P	F=1.03×P	F=1.76×P	F=2.86×P
Cylinder inner diameter		mm	25	30	35	44	56	70
Rod diameter		mm	16	18	22.4	25	30	35.5
Effective area	Push	cm^2	4.9	7.1	9.6	15.2	24.6	38.5
	Pull	cm^2	2.9	4.5	5.7	10.3	17.6	28.6
Max. oil flow rate		L/min	1.0	1.6	2.1	5.0	8.4	10.5
Recommended tightening torque of mounting screws*2		N·m	7	7	12	29	57	77

● Pressure range：1–7 MPa ● 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：F=Cylinder force (kN), P=Hydraulic pressure (MPa) *2：ISO R898 class 12.9

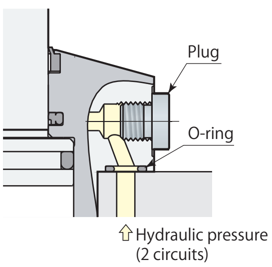
Manifold piping and G port piping are available.

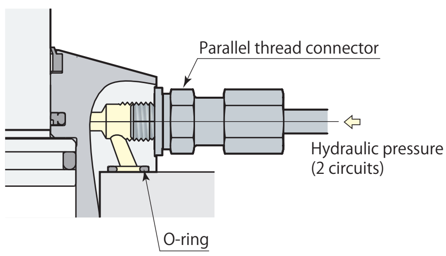
Manifold piping

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 cylinder.

G port piping

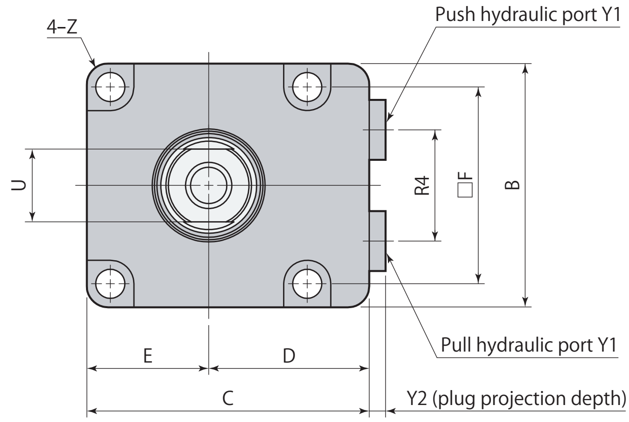
Remove plugs when choosing G port piping. (O-ring must be used.) Refer to **page →372** for details on G port piping flareless fitting. The flow control valve and the air bleeding valve should be installed in the middle of oil path.

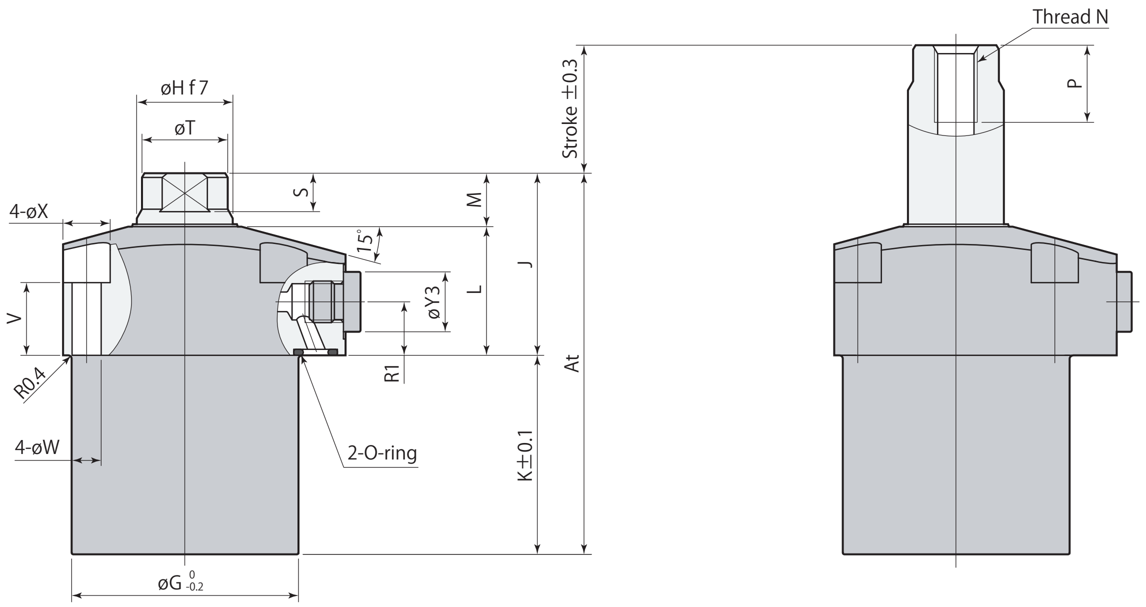




Dimensions

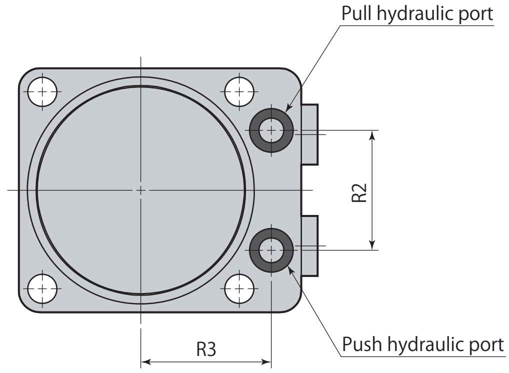
(Female thread rod)





Pull end

Push end



- Mounting screws are not included.
- Refer to **pages →302–307** for specifications of dual rod and air sensor models.

mm

Model		CNA02-□T	CNA04-□T	CNA06-□T	CNA10-□T	CNA16-□T	CNA25-□T
B		45	50	57	70	86	108
C		55	60	66	82	96	120
D		32.5	35	37.5	47	53	66
E		22.5	25	28.5	35	43	54
F		35	40	46	56	68	88
øG		39	47	53	63	78	100
øH		$16^{-0.016}_{-0.034}$	$18^{-0.016}_{-0.034}$	$22.4^{-0.020}_{-0.041}$	$25^{-0.020}_{-0.041}$	$30^{-0.020}_{-0.041}$	$35.5^{-0.025}_{-0.050}$
J		38	39.5	42.5	51	57	65.5
L		27.5	28	30	37.5	41.5	48.5
M		10.5	11.5	12.5	13.5	15.5	17
N		M8×1.25	M8×1.25	M10×1.5	M12×1.75	M16×2	M20×2.5
P		14	14	18	21	27	33
R1		12.5	12.5	12.5	14	14	21
R2		22	24	28	36	45	50
R3		25	28	30.5	36	42	57
R4		20	22	26	30	38	50
S (width across flats height)		7	8	9	10	12	14
øT		14±0.2	16±0.2	20±0.2	23±0.2	28±0.2	33.5±0.3
U (width across flats)		12	14	17	19	24	30
V		18	17	17	20	20	20
øW		5.5	5.5	6.8	9	11	14
øX		9.5	9.5	11	14	17.5	20
Y1		G1/8	G1/8	G1/8	G1/4	G1/4	G3/8
Y2		3.8	3.8	3.8	4.8	4.8	4.8
øY3		14	14	14	19	19	22
Z		R3	R5	R5	R6	R7	R10
O-ring (fluorocarbon hardness Hs90)		P7	P7	P7	P8	P8	P10
Flow control valve*	Meter-in	VCF01	VCF01	VCF01	VCF02	VCF02	VCF03
	Meter-out	VCF01-O	VCF01-O	VCF01-O	VCF02-O	VCF02-O	VCF03-O
Air bleeding valve*		VCE01	VCE01	VCE01	VCE02	VCE02	VCE03

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

Refer to each page for the details of options. ● Flow control valve **page →320** ● Air bleeding valve **page →322**

● CNA□-□T (Female thread rod) size 02, 04, 16, 25 or more than 60 mm stroke are made to order.

CNA02-Stroke			10	15	20	30	40	50	60	70
Cylinder capacity	Push	cm^3	4.9	7.4	9.8	14.7	19.6	24.5	29.4	34.3
	Pull	cm^3	2.9	4.3	5.8	8.7	11.6	14.5	17.4	20.3
At		mm	66		81		101		121	
K		mm	28		43		63		83	
Mass		kg	0.7		0.8		1.0	0.9	1.1	

● Stroke 10, 20, 40, and 60 use spacers.

CNA04-Stroke			10	15	20	30	40	50	60	70
Cylinder capacity	Push	cm^3	7.1	10.6	14.1	21.2	28.3	35.3	42.4	49.5
	Pull	cm^3	4.5	6.8	9.0	13.6	18.1	22.6	27.1	31.7
At		mm	70.5		85.5		105.5		125.5	
K		mm	31		46		66		86	
Mass		kg	0.9		1.1		1.3		1.5	

● Stroke 10, 20, 40, and 60 use spacers.

CNA06-Stroke			10	15	20	30	40	50	60	70	80	90
Cylinder capacity	Push	cm^3	9.6	14.4	19.2	28.9	38.5	48.1	57.7	67.3	77.0	86.6
	Pull	cm^3	5.7	8.5	11.4	17.0	22.7	28.4	34.1	39.8	45.4	51.1
At		mm	74		89		109		129		149	
K		mm	31.5		46.5		66.5		86.5		106.5	
Mass		kg	1.2		1.4		1.7		1.9		2.2	

● Stroke 10, 20, 40, 60 and 80 use spacers.

CNA10-Stroke			10	20	30	40	50	60	70	80	90	100
Cylinder capacity	Push	cm^3	15.2	30.4	45.6	60.8	76.0	91.2	106.4	121.6	136.8	152.1
	Pull	cm^3	10.3	20.6	30.9	41.2	51.5	61.8	72.1	82.4	92.7	103.0
At		mm	88.5		108.5		128.5		148.5		168.5	
K		mm	37.5		57.5		77.5		97.5		117.5	
Mass		kg	2.1		2.4		2.7		3.1		3.4	

● Stroke 10, 30, 50, 70 and 90 use spacers.

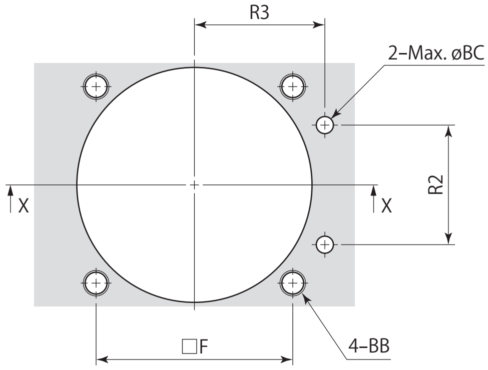
CNA16-Stroke			10	20	30	40	50	60	70	80	90	100
Cylinder capacity	Push	cm^3	24.6	49.3	73.9	98.5	123.2	147.8	172.4	197.0	221.7	246.3
	Pull	cm^3	17.6	35.1	52.7	70.2	87.8	105.4	122.9	140.5	158.1	175.6
At		mm	96		116		136		156		176	
K		mm	39		59		79		99		119	
Mass		kg	3.3		3.8		4.3		4.7		5.2	

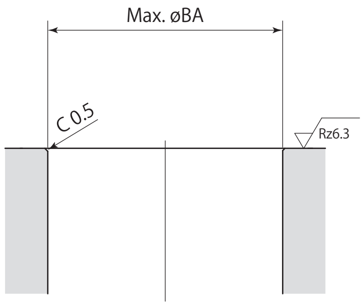
● Stroke 10, 30, 50, 70 and 90 use spacers.

CNA25-Stroke			20	30	40	50	60	70	80	90	100	110
Cylinder capacity	Push	cm^3	77.0	115.5	153.9	192.4	230.9	269.4	307.9	346.4	384.8	423.3
	Pull	cm^3	57.2	85.8	114.3	142.9	171.5	200.1	228.7	257.3	285.9	314.5
At		mm	115.5		135.5		155.5		175.5		195.5	
K		mm	50		70		90		110		130	
Mass		kg	6.3		7.1		7.8		8.6		9.4	

● Stroke 20, 40, 60, 80 and 100 use spacers.

Mounting details





X-X

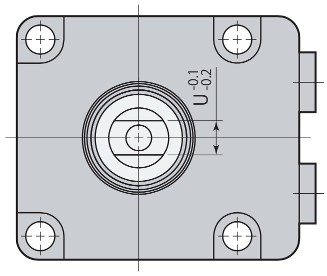
Rz: ISO4287(1997)

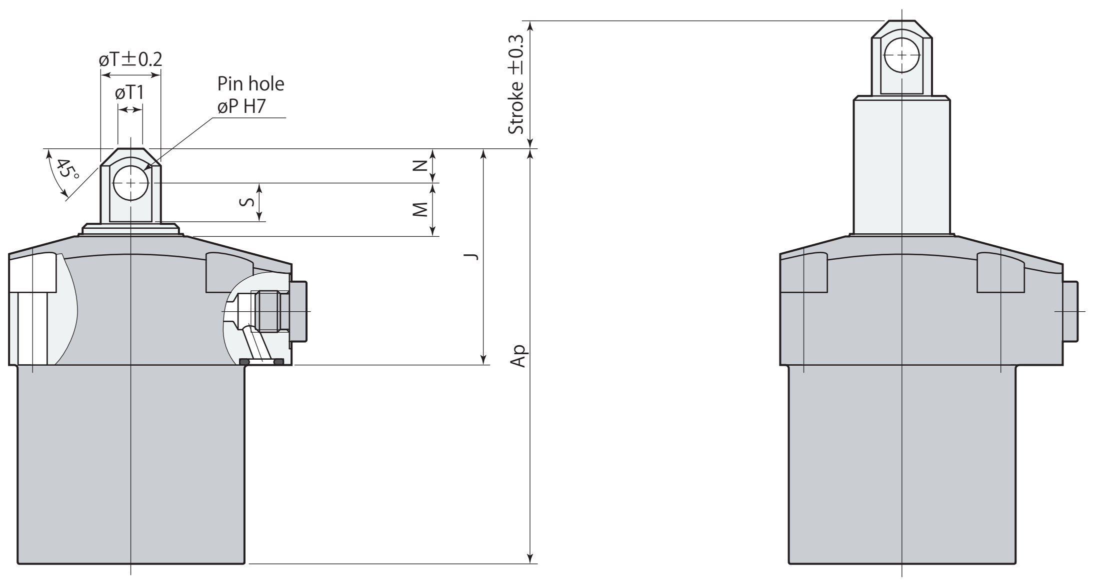
mm

Model	CNA02-☐T	CNA04-☐T	CNA06-☐T	CNA10-☐T	CNA16-☐T	CNA25-☐T
F	35	40	46	56	68	88
R2	22	24	28	36	45	50
R3	25	28	30.5	36	42	57
øBA	40	48	54	64	79	101
BB	M5	M5	M6	M8	M10	M12
øBC	4	4	4	6	6	8

Dimensions

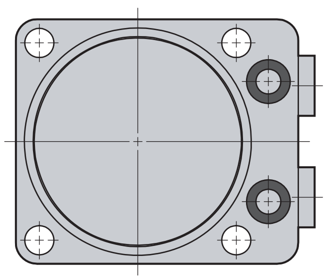
(Pin rod)





Pull end

Push end



- Mounting screws are not included.
- Recommended material for pin：SCM435-H (HB269–331)
- Refer to **pages** →**294**–**297** for specifications and dimensions that are not shown in the diagram.
- Refer to **pages** →**302**–**307** for specifications of dual rod and air sensor models.

mm

Model	CNA02-□P	CNA04-□P	CNA06-□P	CNA10-□P	CNA16-□P	CNA25-□P
J	42.5	44.5	50.5	60	67	79.5
M	10	10.5	12.5	13.5	14.5	18
N	5	6	8	9	11	13
øP	$6^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$	$12^{+0.018}_{0}$	$14^{+0.018}_{0}$
S	6.5	7	9	10	10.8	14.5
øT	10	12	14	16	20	26
øT1	5	5	6	8	10	14
U	6	6	8	11	14	16

● CNA□-□P (Pin rod) is made to order.

CNA02-Stroke		10	15	20	30	40	50	60	70
Ap	mm	70.5		85.5		105.5		125.5	
Mass	kg	0.7		0.8		1.0	0.9	1.1	

CNA04-Stroke		10	15	20	30	40	50	60	70
Ap	mm	75.5		90.5		110.5		130.5	
Mass	kg	0.9		1.1		1.3		1.5	

CNA06-Stroke		10	15	20	30	40	50	60	70	80	90
Ap	mm	82		97		117		137		157	
Mass	kg	1.2		1.4		1.7		1.9		2.2	

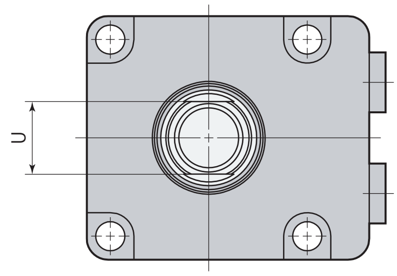
CNA10-Stroke		10	20	30	40	50	60	70	80	90	100
Ap	mm	97.5		117.5		137.5		157.5		177.5	
Mass	kg	2.1		2.4		2.7		3.1		3.4	

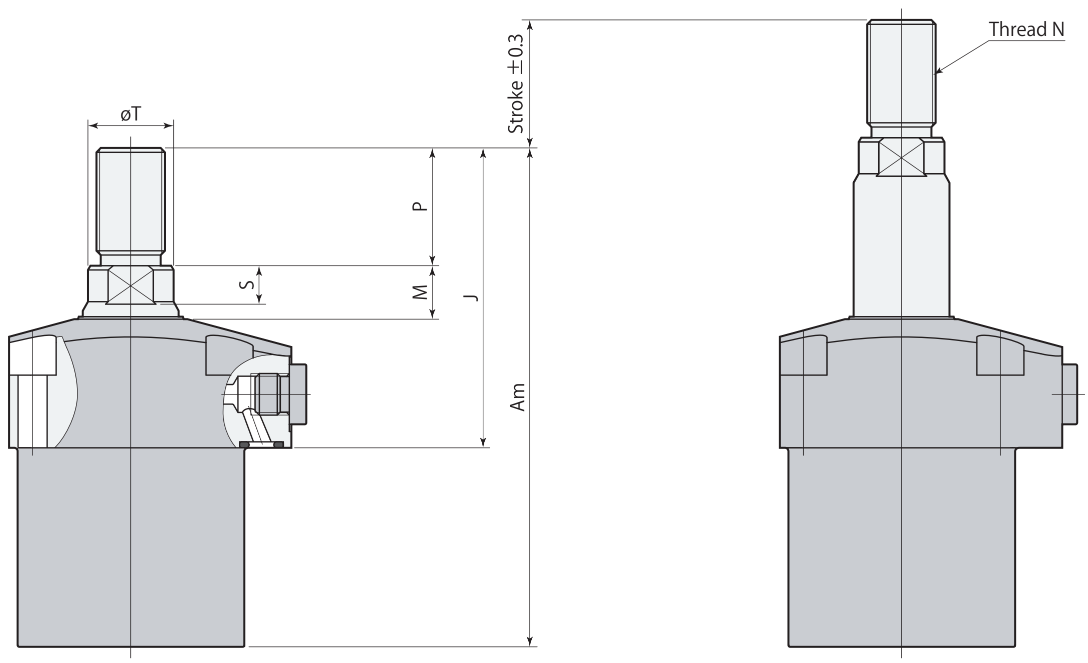
CNA16-Stroke		10	20	30	40	50	60	70	80	90	100
Ap	mm	106		126		146		166		186	
Mass	kg	3.3		3.8		4.3		4.7		5.2	

CNA25-Stroke		20	30	40	50	60	70	80	90	100	110
Ap	mm	129.5		149.5		169.5		189.5		209.5	
Mass	kg	6.3		7.1		7.9		8.6		9.5	9.4

Dimensions

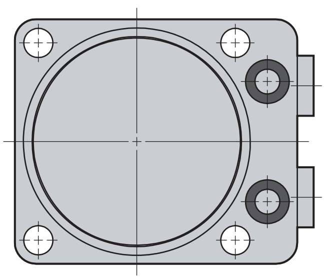
(Male thread rod)





Pull end

Push end



- Mounting screws are not included.
- Refer to **pages →294–297** for specifications and dimensions that are not shown in the diagram.
- Refer to **pages →302–307** for specifications of dual rod and air sensor models.

mm

Model	CNA02-□M	CNA04-□M	CNA06-□M	CNA10-□M	CNA16-□M	CNA25-□M
J	58	64.5	70	81	92	110.5
M	10.5	11.5	12.5	13.5	15.5	17
N	M12×1.25	M14×1.5	M16×1.5	M20×1.5	M24×1.5	M30×1.5
P	20	25	27.5	30	35	45
S (width across flats height)	7	8	9	10	12	14
øT	14±0.2	16±0.2	20±0.2	23±0.2	28±0.2	33.5±0.3
U (width across flats)	12	14	17	19	24	30

● CNA□-□M (Male thread rod) is made to order.

CNA02-Stroke		10	15	20	30	40	50	60	70
Am	mm	86		101		121		141	
Mass	kg	0.7		0.8		1.0		1.1	

CNA04-Stroke		10	15	20	30	40	50	60	70
Am	mm	95.5		110.5		130.5		150.5	
Mass	kg	1.0		1.1		1.3		1.5	

CNA06-Stroke		10	15	20	30	40	50	60	70	80	90
Am	mm	101.5		116.5		136.5		156.5		176.5	
Mass	kg	1.3		1.5		1.7		2.0		2.3	

CNA10-Stroke		10	20	30	40	50	60	70	80	90	100
Am	mm	118.5		138.5		158.5		178.5		198.5	
Mass	kg	2.2		2.5		2.8		3.2		3.5	

CNA16-Stroke		10	20	30	40	50	60	70	80	90	100
Am	mm	131		151		171		191		211	
Mass	kg	3.5		4.0		4.4		4.9		5.4	

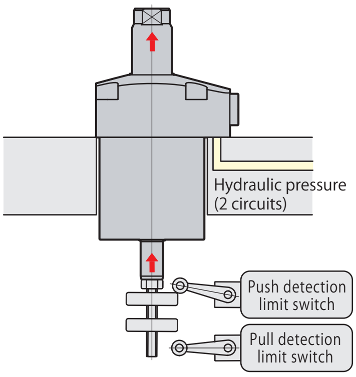
CNA25-Stroke		20	30	40	50	60	70	80	90	100	110
Am	mm	160.5		180.5		200.5		220.5		240.5	
Mass	kg	6.6		7.4		8.2		9.0		9.7	

Specifications

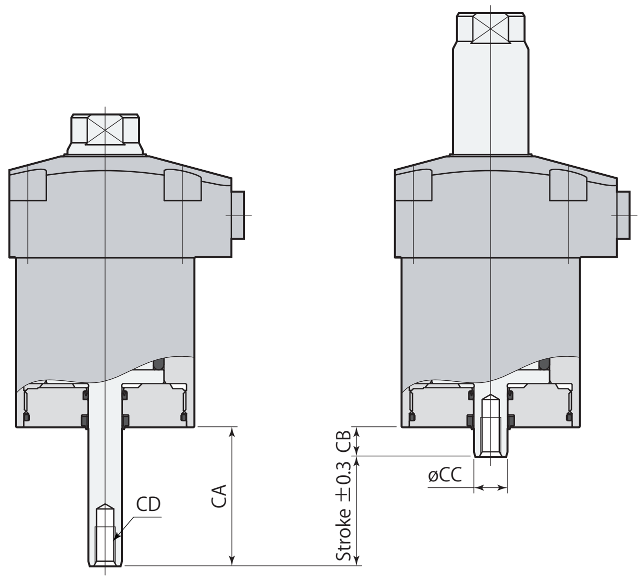
Model			CNA02-□□E	CNA04-□□E	CNA06-□□E	CNA10-□□E	CNA16-□□E	CNA25-□□E
Cylinder force (hydraulic pressure 7MPa)	Push	kN	3.1	4.4	6.2	9.9	16.4	25.5
	Pull	kN	2.0	3.2	4.0	7.2	12.3	20.0
Cylinder inner diameter		mm	25	30	35	44	56	70
Rod diameter		mm	16	18	22.4	25	30	35.5
Sensor rod diameter		mm	8	10	10	12	12	16
Effective area	Push	cm^2	4.4	6.3	8.8	14.1	23.5	36.5
	Pull	cm^2	2.9	4.5	5.7	10.3	17.6	28.6

● CNA□-□□E (Dual rod) is made to order.

Usage example



Dimensions



Pull end

Push end

● This diagram depicts shape of female thread rod.

● Mounting screws are not included.

● Refer to specifications (**page →293**), dimensions (**pages →294–301**) for specifications and dimensions that are not shown in the diagram.

CNA02-Stroke			10	15	20	30	40	50
Cylinder capacity	Push	cm^3	4.4	6.6	8.8	13.2	17.6	22.0
	Pull	cm^3	2.9	4.3	5.8	8.7	11.6	14.5
CA		mm	23	23	38	38	58	58
CB		mm	13	8	18	8	18	8
øCC		mm	8					
CD		mm	M5×0.8 depth 8					
Mass	TE : Female thread rod	kg	0.7	0.7	0.8	0.8	0.9	0.9
	PE : Pin rod	kg	0.7	0.7	0.8	0.8	0.9	0.9
	ME : Male thread rod	kg	0.7	0.7	0.8	0.8	1.0	1.0

● Stroke 10, 20, and 40 use spacers.

CNA04-Stroke			10	15	20	30	40	50	60	70
Cylinder capacity	Push	cm^3	6.3	9.4	12.6	18.8	25.1	31.4	37.7	44.0
	Pull	cm^3	4.5	6.8	9.0	13.6	18.1	22.6	27.1	31.7
	CA	mm	23	23	38	38	58	58	78	78
	CB	mm	13	8	18	8	18	8	18	8
	øCC	mm	10							
	CD	mm	M6×1 depth 11							
Mass	TE : Female thread rod	kg	0.9		1.1		1.3		1.5	
	PE : Pin rod	kg	0.9		1.1		1.3		1.5	
	ME : Male thread rod	kg	0.9		1.1		1.3		1.5	

● Stroke 10, 20, 40, and 60 use spacers.

CNA06-Stroke			10	15	20	30	40	50	60	70
Cylinder capacity	Push	cm^3	8.8	13.3	17.7	26.5	35.3	44.2	53.0	61.9
	Pull	cm^3	5.7	8.5	11.4	17.0	22.7	28.4	34.1	39.8
	CA	mm	23	23	38	38	58	58	78	78
	CB	mm	13	8	18	8	18	8	18	8
	øCC	mm	10							
	CD	mm	M6×1 depth 11							
Mass	TE : Female thread rod	kg	1.2	1.2	1.4	1.4	1.7	1.7	1.9	1.9
	PE : Pin rod	kg	1.2	1.2	1.4	1.4	1.7	1.7	1.9	1.9
	ME : Male thread rod	kg	1.3	1.3	1.5	1.4	1.7	1.7	2.0	2.0

● Stroke 10, 20, 40, and 60 use spacers.

CNA10-Stroke			10	20	30	40	50	60	70	80
Cylinder capacity	Push	cm^3	14.1	28.1	42.2	56.3	70.4	84.4	98.5	112.6
	Pull	cm^3	10.3	20.6	30.9	41.2	51.5	61.8	72.1	82.4
	CA	mm	28	28	48	48	68	68	88	88
	CB	mm	18	8	18	8	18	8	18	8
	øCC	mm	12							
	CD	mm	M8×1.25 depth 15							
Mass	TE : Female thread rod	kg	2.2	2.1	2.5	2.5	2.8	2.8	3.2	3.1
	PE : Pin rod	kg	2.2	2.1	2.5	2.5	2.8	2.8	3.2	3.1
	ME : Male thread rod	kg	2.2	2.2	2.6	2.5	2.9	2.9	3.2	3.2

● Stroke 10, 30, 50 and 70 use spacers.

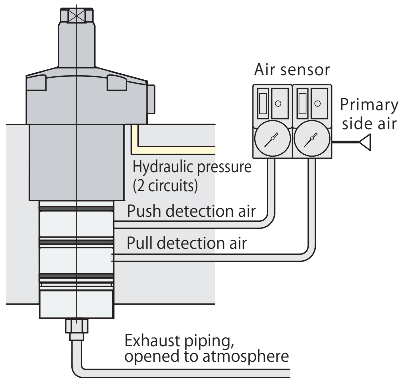
CNA16-Stroke			10	20	30	40	50	60	70	80
Cylinder capacity	Push	cm^3	23.5	47.0	70.5	94.0	117.5	141.0	164.5	188.0
	Pull	cm^3	17.6	35.1	52.7	70.2	87.8	105.4	122.9	140.5
	CA	mm	28	28	48	48	68	68	88	88
	CB	mm	18	8	18	8	18	8	18	8
	øCC	mm	12							
	CD	mm	M8×1.25 depth 15							
Mass	TE : Female thread rod	kg	3.4	3.3	3.9	3.8	4.3	4.3	4.8	4.8
	PE : Pin rod	kg	3.4	3.3	3.9	3.8	4.4	4.3	4.9	4.8
	ME : Male thread rod	kg	3.5	3.4	3.9	3.9	4.4	4.4	4.9	4.9

● Stroke 10, 30, 50 and 70 use spacers.

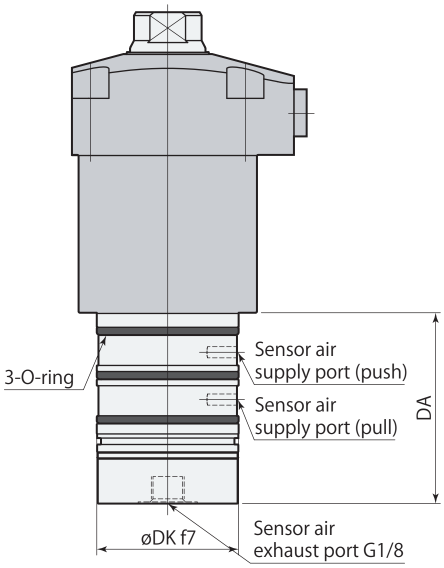
CNA25-Stroke			20	30	40	50	60	70	80	90
Cylinder capacity	Push	cm^3	72.9	109.4	145.9	182.4	218.8	255.3	291.8	328.3
	Pull	cm^3	57.2	85.8	114.3	142.9	171.5	200.1	228.7	257.3
	CA	mm	38	38	58	58	78	78	98	98
	CB	mm	18	8	18	8	18	8	18	8
	øCC	mm	16							
	CD	mm	M10×1.5 depth 18							
Mass	TE : Female thread rod	kg	6.3	6.2	7.2	7.0	7.9	7.8	8.7	8.7
	PE : Pin rod	kg	6.4	6.3	7.2	7.1	8.0	7.9	8.8	8.7
	ME : Male thread rod	kg	6.6	6.6	7.4	7.4	8.3	8.2	9.1	9.0

● Stroke 20, 40, 60, and 80 use spacers.

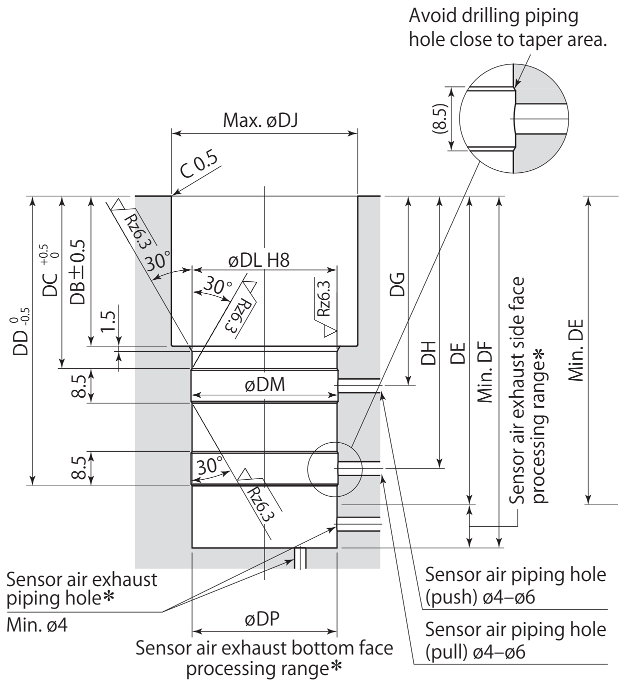
Usage example



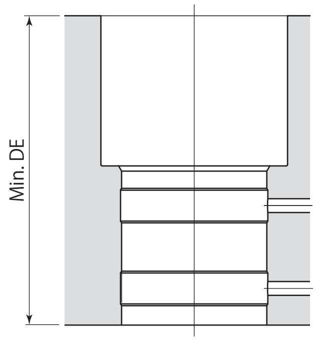
Dimensions



Mounting details



In blind hole



In through hole

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

Rz: ISO4287(1997)

- This diagram depicts shape of female thread rod.
- Exhaust port must be opened to atmosphere. If sensor is embedded in a jig, prepare an exhaust piping hole. Furthermore, provide the piping if there is a risk of coolant or metal chips intrusion.
  Use one-touch fittings manufactured by SMC for G port piping. (See SMC catalog for the details of the fitting.)
- 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.
- Refer to specifications (**page →302**), dimensions (**pages →294–301**) for specifications and dimensions that are not shown in the diagram.
- CNA□-□□A (Air sensor) is made to order.

CNA02-Stroke			10	15	20	30	40	50
	DA	mm	41		56		76	
	DB	mm	29		44		64	
	DC	mm	35.5		50.5		70.5	
	DD	mm	58		73		93	
	DE	mm	64.5		79.5		99.5	
	DF	mm	73		103		143	
	DG	mm	40		55		75	
	DH	mm	53.5		68.5		88.5	
	øDJ	mm	40					
	øDK	mm	$38^{-0.025}_{-0.050}$					
	øDL	mm	$38^{+0.039}_{0}$					
	øDM	mm	38.6					
	øDP	mm	38					
	O-ring		AS568-028 (fluorocarbon hardness Hs70)					
Mass	TA :Female thread rod	kg	0.8		1.0		1.2	
Mass	PA :Pin rod	kg	0.8		1.0		1.2	
Mass	MA :Male thread rod	kg	0.9		1.0		1.2	

CNA04-Stroke			10	15	20	30	40	50	60	70
	DA	mm	43.5		56.5		76.5		96.5	
	DB	mm	32		47		67		87	
	DC	mm	38.5		53.5		73.5		93.5	
	DD	mm	61		76		96		116	
	DE	mm	67.5		82.5		102.5		122.5	
	DF	mm	78.5		106.5		146.5		186.5	
	DG	mm	43		58		78		98	
	DH	mm	56.5		71.5		91.5		111.5	
	øDJ	mm	48							
	øDK	mm	$42^{-0.025}_{-0.050}$							
	øDL	mm	$42^{+0.039}_{0}$							
	øDM	mm	42.6							
	øDP	mm	42							
	O-ring		AS568-029 (fluorocarbon hardness Hs70)							
Mass	TA :Female thread rod	kg	1.1	1.1	1.4	1.3	1.6	1.6	1.9	1.9
Mass	PA :Pin rod	kg	1.1	1.1	1.4	1.3	1.6	1.6	1.9	1.9
Mass	MA :Male thread rod	kg	1.2	1.2	1.4	1.4	1.7	1.6	1.9	1.9

CNA06-Stroke			10	15	20	30	40	50	60	70
	DA	mm	43.5		56.5		76.5		96.5	
	DB	mm	32.5		47.5		67.5		87.5	
	DC	mm	39		54		74		94	
	DD	mm	61.5		76.5		96.5		116.5	
	DE	mm	68		83		103		123	
	DF	mm	79		107		147		187	
	DG	mm	43.5		58.5		78.5		98.5	
	DH	mm	57		72		92		112	
	øDJ	mm	54							
	øDK	mm	$42^{-0.025}_{-0.050}$							
	øDL	mm	$42^{+0.039}_{0}$							
	øDM	mm	42.6							
	øDP	mm	42							
	O-ring		AS568-029 (fluorocarbon hardness Hs70)							
Mass	TA :Female thread rod	kg	1.4	1.3	1.6	1.6	1.9	1.9	2.2	2.2
Mass	PA :Pin rod	kg	1.4	1.3	1.6	1.6	1.9	1.9	2.2	2.2
Mass	MA :Male thread rod	kg	1.4	1.4	1.7	1.6	2.0	2.0	2.3	2.3

CNA10-Stroke			10	20	30	40	50	60	70	80
DA		mm	47.5		67.5		87.5		107.5	
DB		mm	38.5		58.5		78.5		98.5	
DC		mm	45		65		85		105	
DD		mm	67.5		87.5		107.5		127.5	
DE		mm	74		94		114		134	
DF		mm	89		129		169		209	
DG		mm	49.5		69.5		89.5		109.5	
DH		mm	63		83		103		123	
øDJ		mm	64							
øDK		mm	$45^{-0.025}_{-0.050}$							
øDL		mm	$45^{+0.039}_{0}$							
øDM		mm	45.6							
øDP		mm	45							
O-ring			AS568-030 (fluorocarbon hardness Hs70)							
Mass	TA :Female thread rod	kg	2.6	2.5	3.0	2.9	3.4	3.3	3.8	3.7
	PA :Pin rod	kg	2.6	2.5	3.0	2.9	3.4	3.3	3.8	3.7
	MA :Male thread rod	kg	2.6	2.6	3.1	3.0	3.5	3.4	3.9	3.8

CNA16-Stroke			10	20	30	40	50	60	70	80
DA		mm	47.5		67.5		87.5		107.5	
DB		mm	40		60		80		100	
DC		mm	46.5		66.5		86.5		106.5	
DD		mm	69		89		109		129	
DE		mm	75.5		95.5		115.5		135.5	
DF		mm	90.5		130.5		170.5		210.5	
DG		mm	51		71		91		111	
DH		mm	64.5		84.5		104.5		124.5	
øDJ		mm	79							
øDK		mm	$45^{-0.025}_{-0.050}$							
øDL		mm	$45^{+0.039}_{0}$							
øDM		mm	45.6							
øDP		mm	45							
O-ring			AS568-030 (fluorocarbon hardness Hs70)							
Mass	TA :Female thread rod	kg	4.0	3.9	4.5	4.4	5.1	5.0	5.6	5.5
	PA :Pin rod	kg	4.0	3.9	4.5	4.5	5.1	5.0	5.6	5.6
	MA :Male thread rod	kg	4.1	4.1	4.7	4.6	5.2	5.2	5.8	5.7

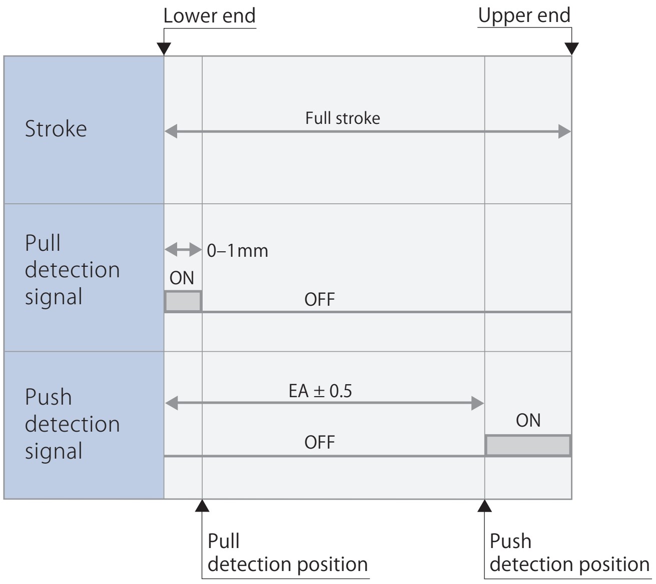
CNA25-Stroke			20	30	40	50	60	70	80	90
DA		mm	58.5		78.5		98.5		118.5	
DB		mm	51		71		91		111	
DC		mm	57.5		77.5		97.5		117.5	
DD		mm	80		100		120		140	
DE		mm	86.5		106.5		126.5		146.5	
DF		mm	112.5		152.5		192.5		232.5	
DG		mm	62		82		102		122	
DH		mm	75.5		95.5		115.5		135.5	
øDJ		mm	101							
øDK		mm	$52^{-0.030}_{-0.060}$							
øDL		mm	$52^{+0.039}_{0}$							
øDM		mm	52.6							
øDP		mm	52							
O-ring			AS568-032 (fluorocarbon hardness Hs70)							
Mass	TA :Female thread rod	kg	6.6	6.5	7.5	7.4	8.3	8.3	9.2	9.1
	PA :Pin rod	kg	6.6	6.5	7.5	7.4	8.4	8.3	9.3	9.2
	MA :Male thread rod	kg	6.9	6.8	7.8	7.7	8.7	8.6	9.6	9.5

Air sensor unit

Supplier and model	ISA3-G series manufactured by SMC
	GPS2-05 series manufactured by CKD
Air supply pressure	0.2 MPa
Inner diameter of piping	ø4 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 usage shown on the left. Contact Technical service center for more details.
- 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.
- Maximum 6 pieces of cylinder can be detected at 0.2MPa air pressure by means of 1 piece of sensor. In case of 0.1MPa air pressure, maximum 3 pieces of cylinder are detectable.

Air sensor triggering point



mm

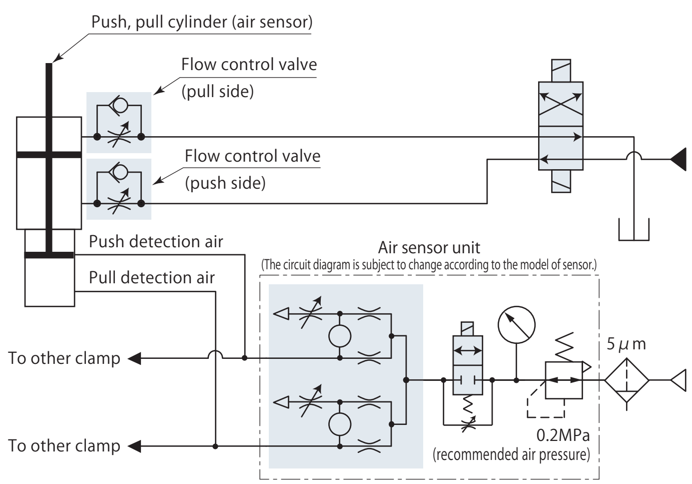
CNA02-Stroke		10	15	20	30	40	50
Push detection position	EA(A1)	9	14	19	29	39	49
	EA(A3)	7	12	17	27	37	47
	EA(A5)	5	10	15	25	35	45

CNA04 CNA06-Stroke		10	15	20	30	40	50	60	70
Push detection position	EA(A1)	9	14	19	29	39	49	59	69
	EA(A3)	7	12	17	27	37	47	57	67
	EA(A5)	5	10	15	25	35	45	55	65

CNA10 CNA16-Stroke		10	20	30	40	50	60	70	80
Push detection position	EA(A1)	9	19	29	39	49	59	69	79
	EA(A3)	7	17	27	37	47	57	67	77
	EA(A5)	5	15	25	35	45	55	65	75

CNA25-Stroke		20	30	40	50	60	70	80	90
Push detection position	EA(A1)	19	29	39	49	59	69	79	89
	EA(A3)	17	27	37	47	57	67	77	87
	EA(A5)	15	25	35	45	55	65	75	85

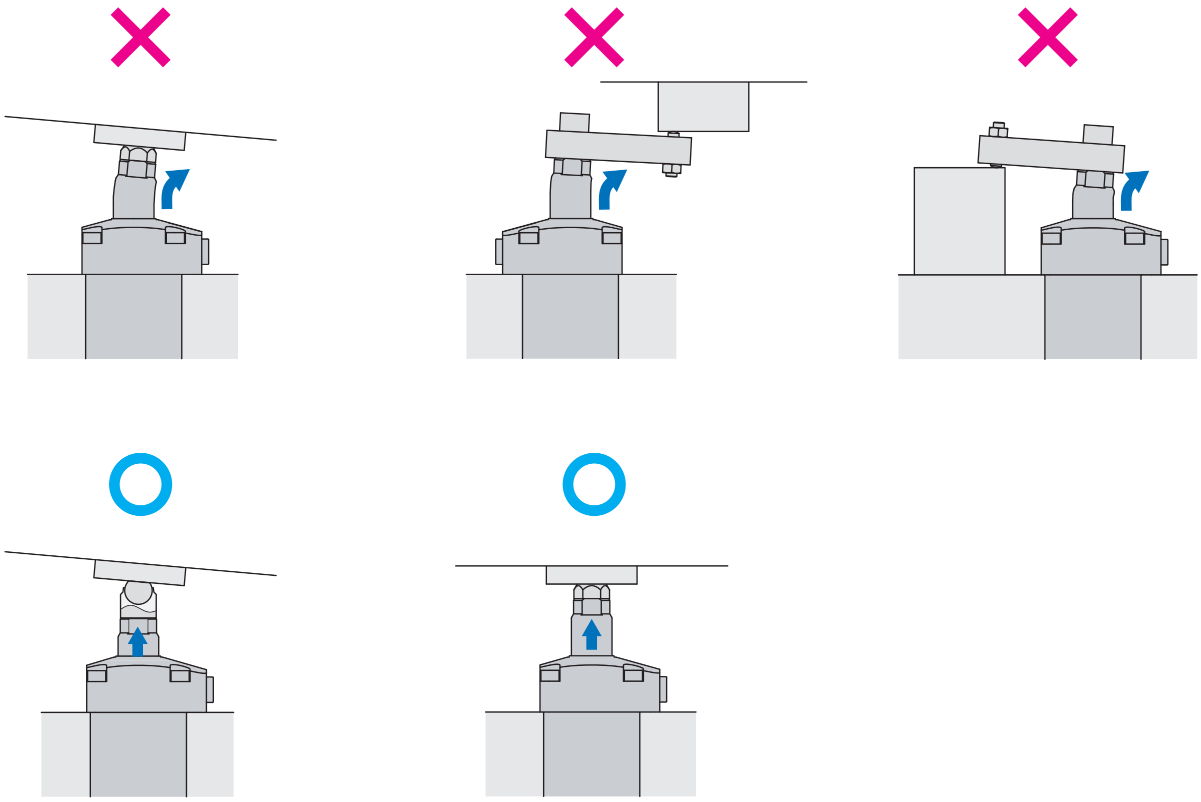
Hydraulic and pneumatic circuit diagram



Caution in use

Please avoid the usage that may apply eccentric load and non-axial force to the piston rod.
This may break the piston rod.

Female thread rod and male thread rod CNA□-□T, □M



Pin rod CNA□-□P

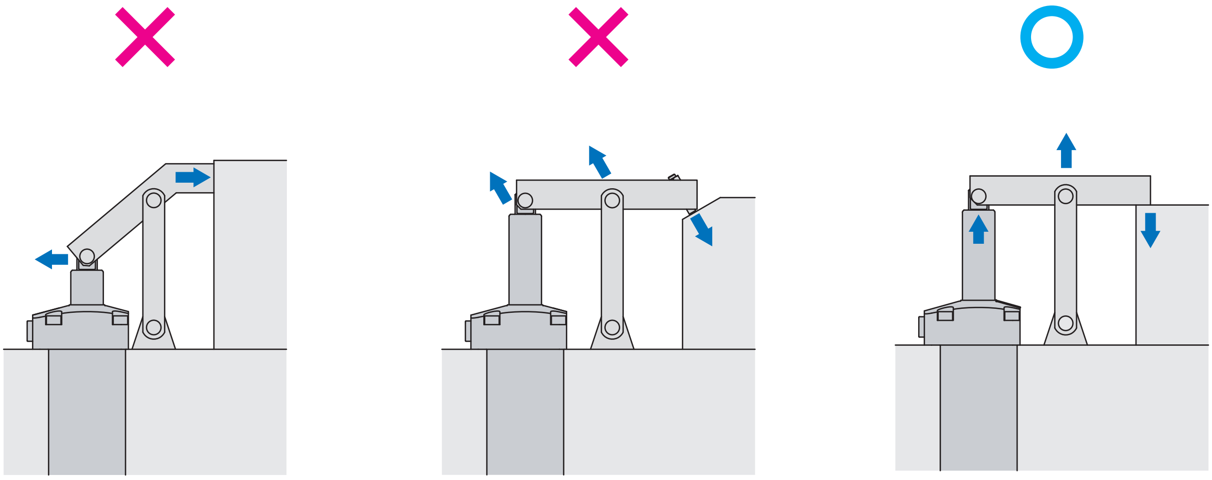


Table of contents

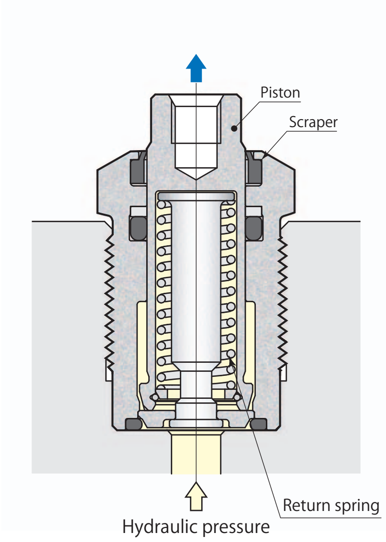
Clamp cylinder

Single acting 35 MPa

model **CMC** model **CMD**

Push cylinder
model CMC

Pull cylinder
model CMD



- This is a push-type cylinder with threaded body.
- Air vent hole was eliminated to solve problems of coolant intrusion.
- Scraper is placed for moving parts to prevent adhesion of foreign substance.

Specifications

Model		CMC01			CMC03			CMC04				CMC06			
Stroke	mm	5	10	15	5	10	15	5	10	15	20	5	10	15	20
Cylinder force*1 kN	Hydraulic pressure 3.5MPa	0.2			0.4			0.5				0.8			
	Hydraulic pressure 7MPa	0.3			0.8			1.0				1.7			
	Hydraulic pressure 25MPa	1.2			2.8			3.8				6.3			
	Hydraulic pressure 35MPa	1.7			3.9			5.3				8.8			
Cylinder force calculation formula*2		F=0.050×P-0.016			F=0.113×P-0.035			F=0.154×P-0.049				F=0.255×P-0.081			
Rod diameter	mm	8			12			14				18			
Effective area	cm^2	0.50			1.13			1.54				2.55			
Max. oil flow rate	L/min	0.15			0.34			0.46				0.76			
Cylinder capacity	cm^3	0.3	0.5	0.8	0.6	1.1	1.7	0.8	1.5	2.3	3.1	1.3	2.5	3.8	5.1
Return spring force*3	N	13–19			28–42			38–59				62–100			
Mass	kg	0.05	0.06	0.08	0.07	0.10	0.13	0.09	0.12	0.15	0.20	0.16	0.21	0.26	0.32
Recommended tightening torque of body	N·m	10			30			40				60			
Pressure range	MPa	1–35													
Proof pressure	MPa	52.5													
Operating temperature	℃	0–70													
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)													

*1: This is value for central position of stroke.
*2: F=Cylinder force (kN), P= Hydraulic pressure (MPa)
*3: Figures are for "lower end to upper end" of piston action.

Model designation

CMC □ – □ □ □

Size	Stroke
01	5, 10, 15
03	5, 10, 15
04	5, 10, 15, 20
06	5, 10, 15, 20
10	5, 10, 15, 25
20	10, 15, 20, 32
25	12, 20, 32
40	16, 25, 40
60	16, 25, 40

Rod tip section shapes

- (Nil) : Threaded top type (standard)
- R*1 : Round top type

Scraper, seal material

- (Nil) : NBR (standard)
- V*2 : Fluorocarbon (except model CMC10, 20, 40 and 60)

*1：CMC04/06/10/20/25/40/60 are made to order.

*2：Fluorocarbon has been adopted as a measure for the use of chlorine-based cutting fluid and also for thermal resistance (max. 150℃) specifications.

(grey box) indicates made to order.

Specifications

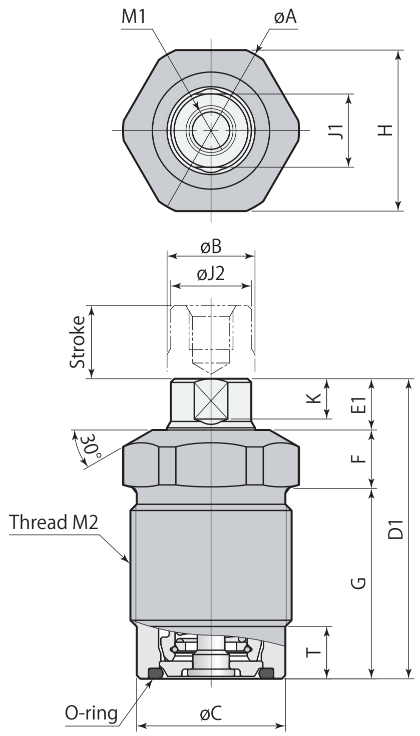
Model		CMC10				CMC20				CMC25			CMC40			CMC60		
Stroke	mm	5	10	15	25	10	15	20	32	12	20	32	16	25	40	16	25	40
Cylinder force*1 kN	Hydraulic pressure 3.5MPa	1.3				2.6				3.1			5.1			7.5		
	Hydraulic pressure 7MPa	2.6				5.4				6.6			10.6			15.8		
	Hydraulic pressure 25MPa	9.7				19.8				24.4			39.3			58.6		
	Hydraulic pressure 35MPa	13.7				27.9				34.3			55.2			82.4		
Cylinder force calculation formula*2		F=0.394×P-0.129				F=0.804×P-0.255				F=0.990×P-0.323			F=1.590×P-0.485			F=2.376×P-0.790		
Rod diameter	mm	22.4				32				35.5			45			55		
Effective area	cm^2	3.94				8.04				9.90			15.90			23.76		
Max. oil flow rate	L/min	1.18				2.41				2.97			4.77			7.13		
Cylinder capacity	cm^3	2.0	3.9	5.9	9.9	8.0	12.0	16.0	20.1	11.9	19.8	31.7	25.4	39.8	63.6	38.0	59.4	95.0
Return spring force*3	N	97–160				200–310				240–405			370–600			570–1010		
Mass	kg	0.24	0.30	0.35	0.60	0.63	0.78	0.91	1.38	0.81	1.02	1.36	1.45	1.8	2.46	2.59	3.23	4.3
Recommended tightening torque of body	N·m	110				270				360			620			1160		
Pressure range	MPa	1–35																
Proof pressure	MPa	52.5																
Operating temperature	℃	0–70																
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)																

*1：This is value for central position of stroke.

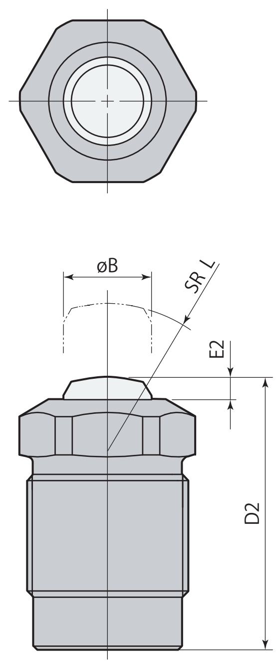
*2：F=Cylinder force (kN), P= Hydraulic pressure (MPa)

*3：Figures are for "lower end to upper end" of piston action.

Dimensions



Threaded top type



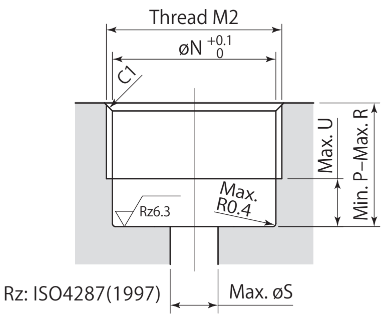
Round top type

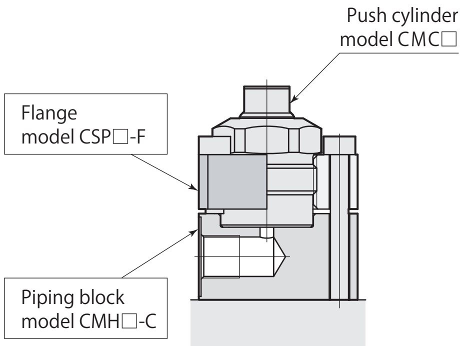
mm

Model	CMC01			CMC03			CMC04				CMC06			
Stroke	5	10	15	5	10	15	5	10	15	20	5	10	15	20
øA	15.5			24			26				33			
øB	8			12			14				18			
øC	14.3			20.3			23.3				28.3			
D1	31	41	50	31	41	51.5	36	47	58	68	40.5	51.5	62.5	72.5
D2	27	37	46	27	37	47.5	31	42	53	63	34	45	56	66
E1	5.5			7			8.5				10			
E2	1.5			3			3.5				3.5			
F	6			8			9				10.5			
G	19.5	29.5	38.5	16	26	36.5	18.5	29.5	40.5	50.5	20	31	42	52
H (hex width across flats)	14			22			24				30			
J1 (width across flats)	7			10			12				14			
øJ2	7.5			11			13				17			
K (width across flats height)	4.5			5.5			6.5				7.5			
L	16			20			25				32			
M1	M5×0.8 depth 8			M6×1 depth 6			M6×1 depth 11				M8×1.25 depth 13			
M2	M16×1.5			M22×1.5			M25×1.5				M30×1.5			
øN	14.5			20.5			23.5				28.5			
P	12			13			14				15			
R	19	29	38	15.5	25.5	36	18	29	40	50	19.5	30.5	41.5	51.5
øS	5			8			10				14			
T	7			7			7				7			
U	6			6			6				6			
O-ring (hardness Hs90)	AS568-012			AS568-015			AS568-016				AS568-019			

Dimensions

Mounting details

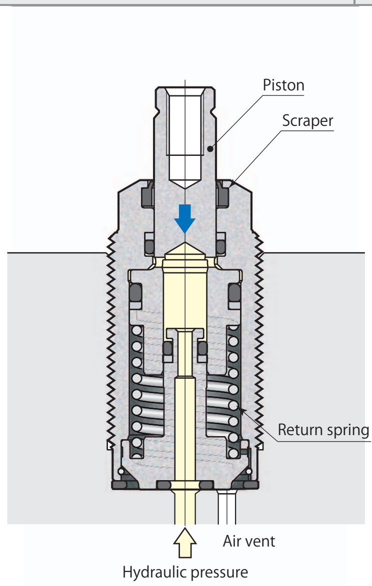




- Hardness at top of round type piston is HRC54.
- When mounting an attachment, be sure to hold the width across flats at the tip section by a spanner, etc., to prevent the piston from rotating before tightening the screw. Do not attempt to tighten it with a hydraulic-powered resistance against rotation.
- Flange and piping block (left diagram) are available as options. Refer to **pages →318**, **319** for details.
- Please avoid the usage that may apply eccentric load and non-axial force to the piston. This may break the piston.
- When assembling or installing, during the first operation after changing the oil, air is trapped in the piping and increases the flow rate. Perform complete air bleeding and use at a flow rate within tolerance.

mm

Model	CMC10				CMC20				CMC25			CMC40			CMC60		
Stroke	5	10	15	25	10	15	20	32	12	20	32	16	25	40	16	25	40
øA	40				50				55			66			80		
øB	22.4				32				35.5			45			55		
øC	34.3				46				52.6			62.6			77.6		
D1	44.5	54.5	66.5	87.5	67.5	80.5	92	118.5	67	81.5	104.5	79	94	122	89	107	138
D2	36.5	46.5	58.5	79.5	57	70	81.5	108	56	70.5	93.5	65	80	108	76	94	125
E1	12				16				17.5			21.5			20		
E2	4				5.5				6.5			7.5			7		
F	12.5				14				15			17			15		
G	20	30	42	63	37.5	50.5	62	88.5	34.5	49	72	40.5	55.5	83.5	54	72	101
H (hex width across flats)	36				46				50			60			75		
J1 (width across flats)	19				27				30			36			41		
øJ2	21.4				30				32.5			43			52		
K (width across flats height)	9.5				12.5				13.5			15.5			17		
L	40				50				60			70			80		
M1	M8×1.25 depth 13				M12×1.75 depth 18				M12×1.75 depth 18			M16×2.0 depth 18			M20×2.5 depth 22		
M2	M36×1.5				M48×1.5				M55×2.0			M65×2.0			M80×2.0		
øN	34.5				46.5				53			63			78		
P	17				20				24			27			29		
R	19.5	29.5	41.5	62.5	37	50	61.5	88	33.5	48	71	40	55	83	53.5	71.5	100.5
øS	19				26				34			44			56		
T	7				7				10			10			10		
U	6				6				9			9			9		
O-ring (hardness Hs90)	AS568-022				AS568-126				AS568-129			AS568-135			AS568-143		



- Suitable for small or irregular-shaped workpiece.
- This is a pull-type cylinder with threaded body.

Specifications

	Size		Stroke		
CMD	02	–	05	10	
	04		05	10	
	06		10	20	
	10		10	20	
	20		10	20	
	40		10	20	
	50		15	25	
	80		15	25	

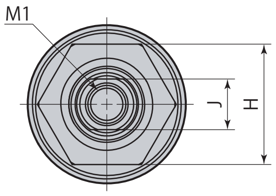
■ indicates made to order. (Sizes 20, 40, 50, 80)

Model		CMD02		CMD04		CMD06		CMD10		CMD20		CMD40		CMD50		CMD80	
Stroke	mm	5	10	5	10	10	20	10	20	10	20	10	20	15	25	15	25
Cylinder force*1 kN	Hydraulic pressure 3.5MPa	0.3		0.4		0.7		1.2		2.0		3.5		4.6		7.0	
	Hydraulic pressure 7MPa	0.5		0.9		1.5		2.5		4.3		7.4		9.9		14.9	
	Hydraulic pressure 25MPa	2.1		3.4		5.6		9.3		15.8		27.3		37.0		55.4	
	Hydraulic pressure 35MPa	2.9		4.7		7.9		13.0		22.2		38.4		52.1		77.9	
Cylinder force calculation formula*2		F=0.084×P-0.043		F=0.137×P-0.060		F=0.229×P-0.093		F=0.376×P-0.147		F=0.640×P-0.219		F=1.107×P-0.377		F=1.505×P-0.620		F=2.250×P-0.835	
Cylinder inner diameter	mm	16		18		22		28		36		46		54		65	
Rod diameter	mm	10		10		12		16		20		25		30		35.5	
Effective area	cm^2	0.84		1.37		2.29		3.76		6.40		11.07		15.05		22.50	
Max. oil flow rate	L/min	0.25		0.41		0.69		1.13		1.92		3.32		4.51		6.75	
Cylinder capacity	cm^3	0.5	0.9	0.7	1.4	2.3	4.6	3.8	7.5	6.4	12.8	11.1	22.2	22.6	37.6	33.8	56.3
Return spring force*3	N	30–56		43–77		65–120		100–193		170–267		283–470		400–840		560–1110	
Mass	kg	0.10	0.12	0.12	0.15	0.23	0.30	0.35	0.46	0.69	0.89	1.1	1.4	1.9	2.2	2.7	3.2
Recommended tightening torque of body	N·m	8		9		10		14		30		40		200		300	

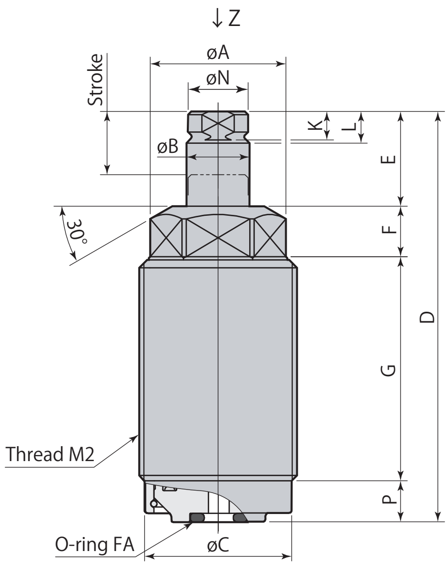
- Pressure range：1.5–35 MPa
- Proof pressure：52.5 MPa
- Operating temperature：0–70 ℃
- Fluid used：General mineral based hydraulic oil (ISO-VG32 equivalent)
- Seals are resistant to chlorine-based cutting fluid. (not thermal resistant specification)

∗1：This is value for central position of stroke.
∗2：F=Cylinder force (kN), P= Hydraulic pressure (MPa)
∗3：Figures are for “upper end to lower end” of piston action.

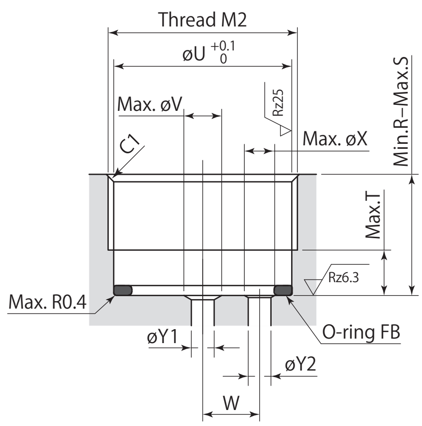
Dimensions



Arrow Z view



Mounting details



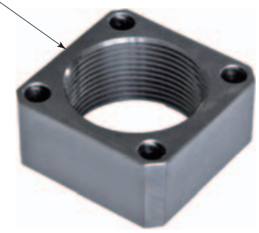
Rz: ISO4287(1997)

mm

Model	CMD02		CMD04		CMD06		CMD10		CMD20		CMD40		CMD50		CMD80	
Stroke	5	10	5	10	10	20	10	20	10	20	10	20	15	25	15	25
øA	19		21.5		27		33		45		55		67		77	
øB	10		10		12		16		20		25		30		35.5	
øC	20.3		23.3		28.3		34.3		46.3		56.3		67.6		77.6	
D	51	65	51	65	69	96	73	101	80	109	88	116	108	136	119	145
E	10	15	10	15	16	26	17	27	19	29	20.5	30.5	27.5	37.5	28.5	38.5
F	7.5		8		9.5		11.5		13.5		16.5		22.5		24.5	
G	27	36	26.5	35.5	35.5	52.5	35.5	53.5	35.5	54.5	38	56	45	63	53	69
H (hex width across flats)	17		19		24		30		41		50		60		70	
J (width across flats)	8		8		10		14		17		22		27		30	
K (width across flats height)	4.5		4.5		5.5		6.5		8.5		10		12		13	
L	5		5		6		7		9		10.5		12.5		13.5	
M1	M6×1 depth 11		M6×1 depth 11		M8×1.25 depth 18		M10×1.5 depth 20		M12×1.75 depth 22		M16×2 depth 27		M18×2.5 depth 31		M22×2.5 depth 33	
M2	M22×1.5		M25×1.5		M30×1.5		M36×1.5		M48×1.5		M58×1.5		M70×2.0		M80×2.0	
øN	9.5		9.5		11.5		15.5		19.5		24.5		29.5		35	
P	6.5		6.5		8		9		12		13		13		13	
R	13		14		15		17		20		20		25		25	
S	32.5	41.5	32	41	42.5	59.5	43.5	61.5	46.5	65.5	50	68	57	75	65	81
T	5.5		5.5		7		8		11		12		12		12	
øU	20.5		23.5		28.5		34.5		46.5		56.5		68		78	
øV	5		5		5		5		7		7		8		8	
W	7		7.5		9.5		12		15		18		19–21		19.5–26.5	
øX	4		4		4		4		4		4		8		8	
øY1 (hydraulic port)	3		3		3		4		6		6		6		6	
øY2 (air vent)	3		3		3		3		3		3		6		6	
O-ring FA (hardness Hs90)	P6		P6		P6		P6		P8		P8		P9		P9	
O-ring FB (hardness Hs90)	AS568-017		AS568-019		AS568-022		AS568-026		AS568-031		AS568-034		AS568-144		AS568-150	

- Install O-ring FB at the bottom of the hole. The O-ring FB is packed pull cylinder.
- When mounting an attachment, be sure to hold the width across flats at the tip section by a spanner, etc., to prevent the piston from rotating before tightening the screw. Do not attempt to tighten it with a hydraulic-powered resistance against rotation.
- Flange and piping block are available as options. Refer to **pages →318, 319** for details.
- Please avoid the usage that may apply eccentric load and non-axial force to the piston. This may break the piston.
- Air vent must be opened to atmosphere. Provide the piping if there is a risk of coolant or metal chips intrusion.

Flange

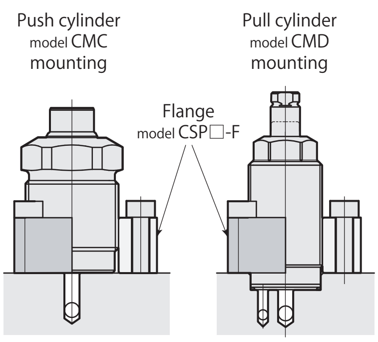


Size

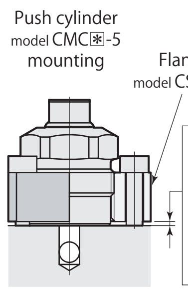
CSP 016 / 022 / 025 / 030 / 036 / 048 / 055 / 058 / 065 / 070 / 080 – F : Flange

■ indicates made to order. (070, 080)

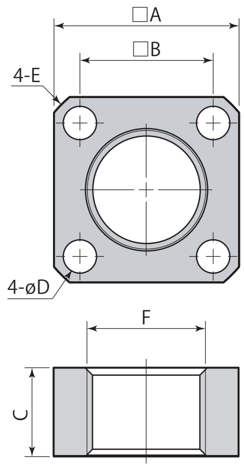
Model	CSP016-F	CSP022-F	CSP025-F	CSP030-F	CSP036-F	CSP048-F	CSP055-F	CSP058-F	CSP065-F	CSP070-F	CSP080-F
Push cylinder	CMC01	CMC03	CMC04	CMC06	CMC10	CMC20	CMC25		CMC40		CMC60
Pull cylinder		CMD02	CMD04	CMD06	CMD10	CMD20		CMD40		CMD50	CMD80



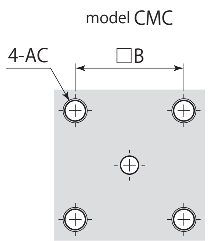
①Mount a flange with screws. ②Screw the cylinder in the flange.

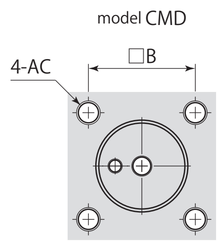


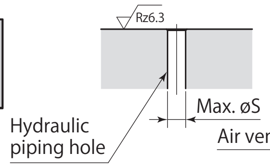
*: When using the flange with model CMC03-5, CMC04-5, CMC06-5 or CMC10-5.
①Mount model CMC onto the flange.
②Tighten the mounting screws.
(providing a clearance between the flange and the mounting surface)

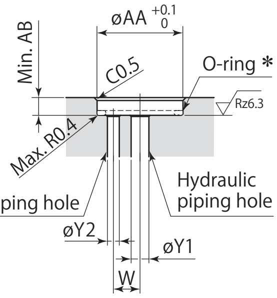


Mounting details









Rz: ISO4287(1997)

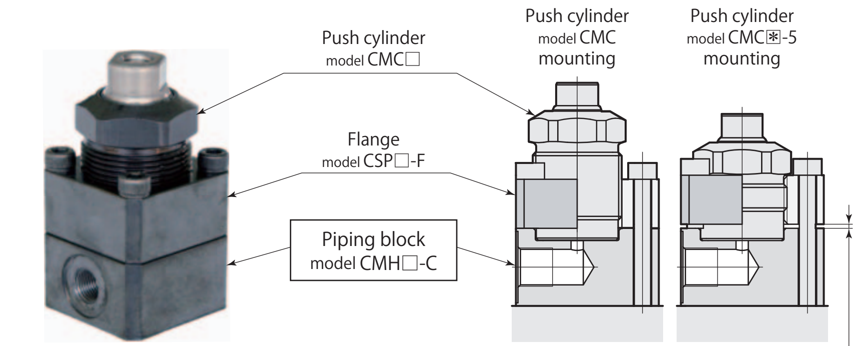
*: Install O-ring in the same way even when a flange is used for mounting. The O-ring is included in the package of the pull cylinder.

mm

Model	CSP016-F	CSP022-F	CSP025-F	CSP030-F	CSP036-F	CSP048-F	CSP055-F	CSP058-F	CSP065-F	CSP070-F	CSP080-F
A	25	30	35	40	50	65	70	70	80	85	90
B	18	23	26	31	40	48	54	54	62	65	72
C	12	12	14	16	16	20	24	20	25	25	25
øD	4.5	4.5	5.5	5.5	6.8	11	11	11	14	14	14
E	C2	C2	C3	C3	C3	C5	C5	C5	C5	C5	C5
F	M16×1.5	M22×1.5	M25×1.5	M30×1.5	M36×1.5	M48×1.5	M55×2.0	M58×1.5	M65×2.0	M70×2.0	M80×2.0
øS	5	8	10	14	19	26	34	–	44	–	56
W	–	7	7.5	9.5	12	15	–	18	–	19–21	19.5–26.5
øY1	–	3	3	3	4	6	–	6	–	6	6
øY2	–	3	3	3	3	3	–	3	–	6	6
øAA	–	20.5	23.5	28.5	34.5	46.5	–	56.5	–	68	78
AB	–	3	3	3	3	3	–	4	–	4	4
AC	M4	M4	M5	M5	M6	M10	M10	M10	M12	M12	M12
Mass	0.04 kg	0.05 kg	0.08 kg	0.11 kg	0.18 kg	0.33 kg	0.43 kg	0.31 kg	0.52 kg	0.58 kg	0.53 kg

- Mounting screws are not included.
- Refer to dimension of individual products for dimensions that are not listed in the diagram.

Piping block



CMH [Size] – C : Piping block

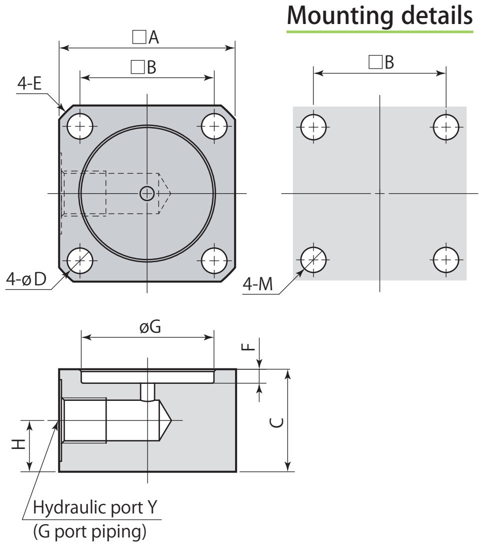
Size	
016	: CMC01
022	: CMC03
025	: CMC04
030	: CMC06
036	: CMC10
048	: CMC20
055	: CMC25
065	: CMC40
080	: CMC60

■ indicates made to order.

①Mount a piping block and a flange with screws.
②Screw the cylinder model CMC in the flange.

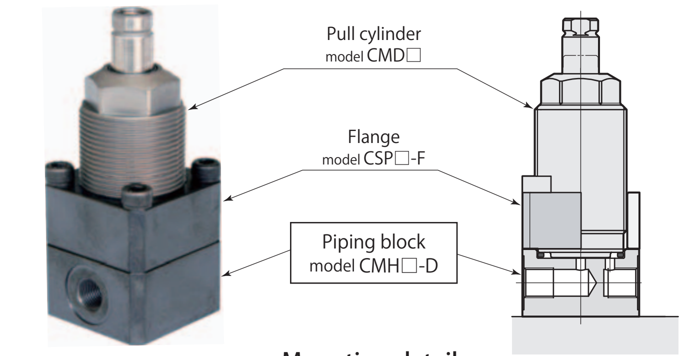
＊:When using the flange with model CMC03-5, CMC04-5, CMC06-5 or CMC10-5.
①Mount model CMC onto the flange. ②Tighten the mounting screws.
(providing a clearance between the flange and the piping block)

Mounting details



mm

Model	CMH016-C	CMH022-C	CMH025-C	CMH030-C	CMH036-C	CMH048-C	CMH055-C	CMH065-C	CMH080-C
A	25	30	35	40	50	65	70	80	90
B	18	23	26	31	40	48	54	62	72
C	19	19	19	22	22	25	25	25	28
øD	4.5	4.5	5.5	5.5	6.8	11	11	14	14
E	C2	C2	C3	C3	C3	C5	C5	C5	C5
F	1.5	3	3	3	3	4	4	4	4
øG	14.5	20.5	23.5	28.5	34.5	46.5	53	63	78
H	9.5	9.5	9.5	11	11	12.5	12.5	12.5	14
M	M4	M4	M5	M5	M6	M10	M10	M12	M12
Y	G1/8	G1/8	G1/8	G1/8	G1/8	G1/4	G1/4	G1/4	G1/4
Mass	0.07 kg	0.11 kg	0.15 kg	0.23 kg	0.38 kg	0.67 kg	0.79 kg	1.01 kg	1.47 kg



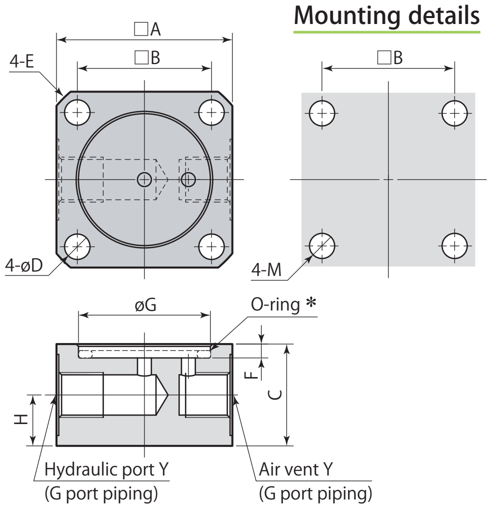
CMH [Size] – D : Piping block

Size	
022	: CMD02
025	: CMD04
030	: CMD06
036	: CMD10
048	: CMD20
058	: CMD40
070	: CMD50
080	: CMD80

①Mount a piping block and a flange with screws.
②Screw the cylinder model CMD in the flange.

■ indicates made to order.

Mounting details



＊:Install O-ring in the same way even when a piping block is used for mounting. The O-ring is included in the package of the pull cylinder.

mm

Model	CMH022-D	CMH025-D	CMH030-D	CMH036-D	CMH048-D	CMH058-D	CMH070-D	CMH080-D
A	30	35	40	50	65	70	85	90
B	23	26	31	40	48	54	65	72
C	19	19	22	22	25	25	28	28
øD	4.5	5.5	5.5	6.8	11	11	14	14
E	C2	C3	C3	C3	C5	C5	C5	C5
F	3	3	3	3	4	4	4	4
øG	20.5	23.5	28.5	34.5	46.5	56.5	68	78
H	9.5	9.5	11	11	12.5	12.5	14	14
M	M4	M5	M5	M6	M10	M10	M12	M12
Y	G1/8	G1/8	G1/8	G1/8	G1/4	G1/4	G1/4	G1/4
Mass	0.1 kg	0.14 kg	0.23 kg	0.37 kg	0.65 kg	0.76 kg	1.28 kg	1.44 kg

Specifications

(Nil) : Meter-in

Body color : Silver

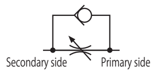
O : Meter-out

Body color : Black

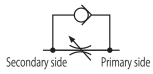
VCF –

G port size
- 01S : G1/8
- 01 : G1/8
- 02 : G1/4
- 03 : G3/8

Control method
- (Nil) : Meter-in



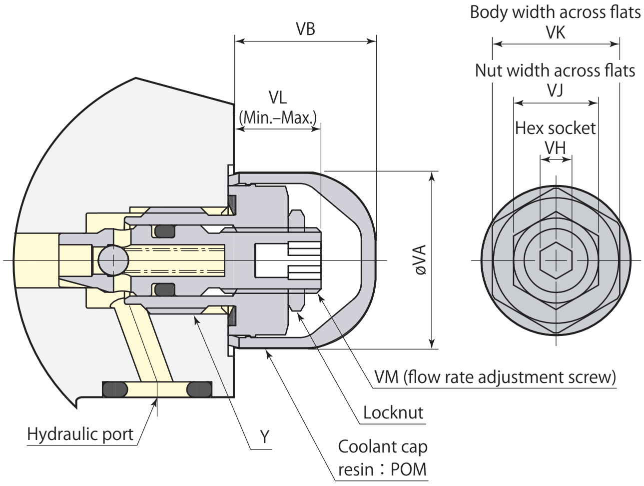
- O : Meter-out



Model		Meter-in				Meter-out			
		VCF01S	VCF01	VCF02	VCF03	VCF01S-O	VCF01-O	VCF02-O	VCF03-O
G port size		G1/8	G1/8	G1/4	G3/8	G1/8	G1/8	G1/4	G3/8
Cracking pressure	MPa	0.04	0.04	0.04	0.04	0.1	0.1	0.1	0.1
Orifice area	mm^2	4.9	4.9	9.6	19.6	3.1	3.1	6.2	12.6
Recommended tightening torque	N·m	10	10	30	35	10	10	30	35
Mass	kg	0.011	0.013	0.024	0.038	0.011	0.013	0.024	0.038

- Pressure range : 0.5–7 MPa
- Proof pressure : 10.5 MPa
- Operating temperature : 0–70 ℃
- Fluid used : General mineral based hydraulic oil (ISO-VG32 equivalent)

Dimensions



mm

Model	VCF01S VCF01S-O	VCF01 VCF01-O	VCF02 VCF02-O	VCF03 VCF03-O
Y	G1/8	G1/8	G1/4	G3/8
øVA	16	16	21	24
VB	13	13	13	14
VH	3	3	5	6
VJ	8	8	10	14
VK	12	12	17	19
VL	8–11	7–11	7.5–11.5	8.5–12.5
Adjustment screw number of turns	4 rotations	5.3 rotations	5.3 rotations	5.3 rotations
VM	M6×0.75	M6×0.75	M8×0.75	M10×0.75

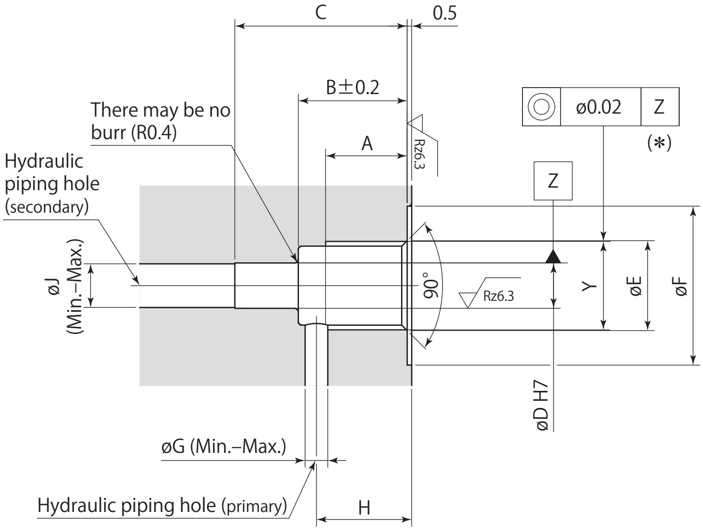
- Use a closed wrench or socket wrench for mounting and dismounting.
- Flow control valve can be mounted on hydraulic port (G port) when manifold piping.
- Adjust flow rate without hydraulic pressure. Conducting adjustments with hydraulic pressure may result in damaging seal.
- Diagram above indicates mounting for meter-in (VCF□).
- VCF is shipped with the valve fully open. Adjust the flow rate by loosening the screws after it is screwed in to close totally. Tighten the locknut after adjustment is completed.

Applicable clamp and work support

Model	VCF01S	VCF01	VCF02	VCF03
Swing clamp (double acting)	CTM03, 04, 05, 06 CTP04, 05, 06	CTM10 CTU01, 02, 04, 06	CTM16 CTU10, 16	CTU25
Swing clamp (single acting)*	CTN02, 04, 05, 06	CTT01, 02, 04, 06	CTN10, 16 CTT10, 16	CTT25
Swivel clamp (double acting)*	CTS04	CTS06	CTS10, 16	–
Link clamp (double acting)	CLM03, 04 CLP04, 05, 06	CLM05, 06, 10 CLU02, 04, 06	CLM16 CLU10, 16	CLU25
Link clamp (single acting)*	CLN04	CLN05, 06 CLT02, 04, 06	CLN10, 16 CLT10, 16	CLT25
Work lift cylinder	CNB01	CNB02, 04	–	–
Push, pull cylinder	–	CNA02, 04, 06	CNA10, 16	CNA25
Work support*	CSU CSP-D(CSN, CSY)	–	–	–

* : Single acting swing clamp, swivel clamp, single acting link clamp and work support are meter-in only.

Mounting details



Rz: ISO4287(1997)

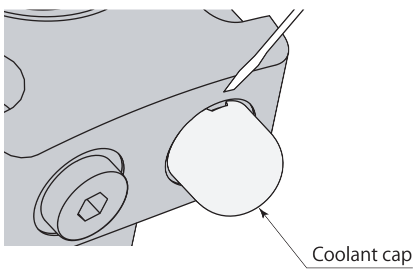
mm

Model	VCF01S VCF01S-O	VCF01 VCF01-O	VCF02 VCF02-O	VCF03 VCF03-O
A	9	9	13	13
B	11	13	18	19
C	15.5	17.5	22.5	23.5
øD	$5^{+0.012}_{0}$	$5^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$
øE	9.9	9.9	13.3	16.8
øF	17.5	17.5	21.5	24.5
øG	1.5–2	2.5–3	3.5–5	5–6
H	9–10	9.5–11.5	14.5–15.5	15–16
øJ	2.5–5	2.5–5	3.5–6	5–8
Y	G1/8	G1/8	G1/4	G3/8

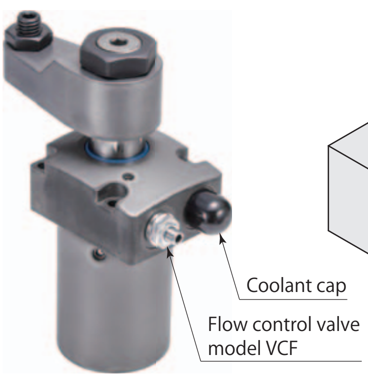
*: Concentricity is required when machining øD and Y-portion thread. Misalignment or machining defect may cause the trouble of installation and adjusting flow rate.

Mounting & dismounting of flow control valve, air bleeding valve

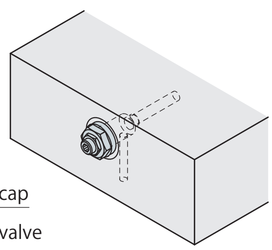
- When mounting or dismounting a flow control valve or air bleeding valve, be sure to set pressure within hydraulic circuit to 0 MPa before starting.
- When mounting a flow control valve or air bleeding valve, be sure to tighten it with the recommended tightening torque.
- When mounting a coolant cap (resin: POM), firmly press the body of cover. If it is not mounting properly, use a plastic mallet to tap it into place.
- When dismounting a coolant cap, use a sharp-pointed tool such as a precision screw driver by hooking the notched portion.



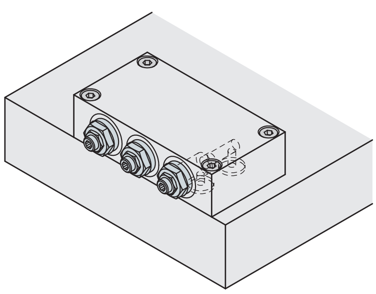
Mounting example



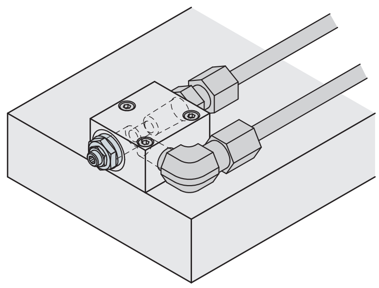
Cylinder mounting



Pallet mounting



Block mounting ①



Block mounting ②

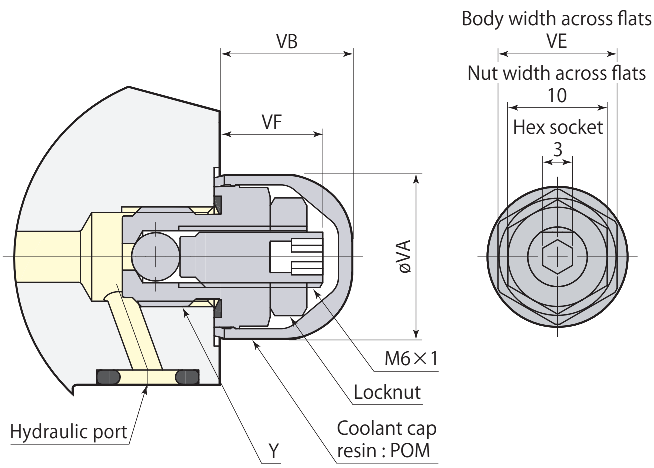
Specifications

G port size

VCE 01 : G1/8
VCE 02 : G1/4
VCE 03 : G3/8

Model		VCE01	VCE02	VCE03
G port size		G1/8	G1/4	G3/8
Recommended tightening torque	N·m	10	30	35
Mass	kg	0.017	0.029	0.044
Pressure range	MPa	0–50		
Operating temperature	°C	0–70		
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)		

Dimensions



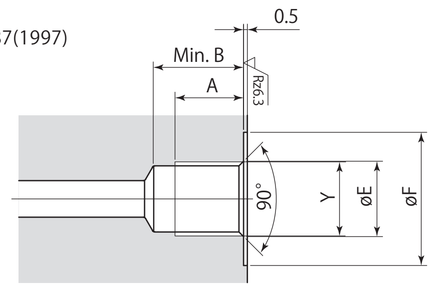
mm

Model	VCE01	VCE02	VCE03
A	9	13	13
B	10	14	14
øE	9.9	13.3	16.8
øF	17.5	21.5	24.5
Y	G1/8	G1/4	G3/8
øVA	16	21	24
VB	13	13	14
VE	12	17	19
VF	10.5	10.5	11.5

- Use a closed wrench or socket wrench for mounting and dismounting.
- Air bleeding valve can be mounted on hydraulic port (G port) when manifold piping.

Mounting details

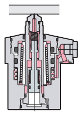
Rz: ISO4287(1997)



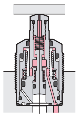
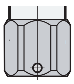
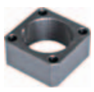
Applicable clamp and work support

Model	VCE01	VCE02	VCE03
Swing clamp (double acting)	CTM03, 04, 05, 06, 10 CTP04, 05, 06 CTU01, 02, 04, 06	CTM16 CTU10, 16	CTU25
Swing clamp (single acting)	CTN02, 04, 05, 06 CTT01, 02, 04, 06	CTN10, 16 CTT10, 16	CTT25
Swivel clamp (double acting)	CTS04, 06	CTS10, 16	–
Link clamp (double acting)	CLM03, 04, 05, 06, 10 CLP04, 05, 06 CLU02, 04, 06	CLM16 CLU10, 16	CLU25
Link clamp (single acting)	CLN04, 05, 06 CLT02, 04, 06	CLN10, 16 CLT10, 16	CLT25
Work lift cylinder	CNB01, 02, 04	–	–
Push, pull cylinder	CNA02, 04, 06	CNA10, 16	CNA25
Work support	CSU CST CSP-D(CSN, CSY, CSK)	–	–

Work support

		model **CSU** Page →326	model **CSU-H** Page →326	model **CST** Page →326
				
Specifications		7MPa Hydraulic lift		7MPa Spring lift
Features		Flange mount type Standard model	Flange mount type Support force enhanced model	Flange mount type Standard model
Variations	Standard (without sensor)	CSU **Page →334**	CSU-H **Page →334**	CST **Page →340**
Variations	Air sensor 	CSU-B **Page →336**	—	—
Option	Flow control valve 	VCF **Page →368**		—
Option	Air bleeding valve 	VCE **Page →370**		

Refer to **page →361** for the details of the work supports that are not described in the catalog.

Work support		model **CSN** **Page →326** 	model **CSY** **Page →326** 	model **CSK** **Page →326** 
Specifications		7MPa Hydraulic lift		7MPa Spring lift
Features		Threaded body Standard model	Threaded body Support force enhanced model	Threaded body Standard model
Variations	Standard (without sensor)	CSN **Page →350**	CSY **Page →352**	CSK **Page →358**
	Air sensor 	CSN-B **Page →354**	CSY-B **Page →354**	—
Option	Chip cover 	CSP-A **Page →362**		
	Piping cap 	CSP-C **Page →362**		
	Piping block 	CSP-D **Page →364**		
	Flange 	CSP-F **Page →366**		
	Flow control valve 	VCF **Page →368** (Using piping block CSP-D)		—
	Air bleeding valve 	VCE **Page →370** (Using piping block CSP-D)		

Refer to **page →361** for the details of the work supports that are not described in the catalog.

Table of contents

Refer to **page →361** for the details of the work supports that are not described in the catalog.

Work support

7 MPa

Hydraulic lift,
support force enhanced model
model CSU-H10-L

Hydraulic lift,
standard model
model CSU10-L

Spring lift
model CST10-L





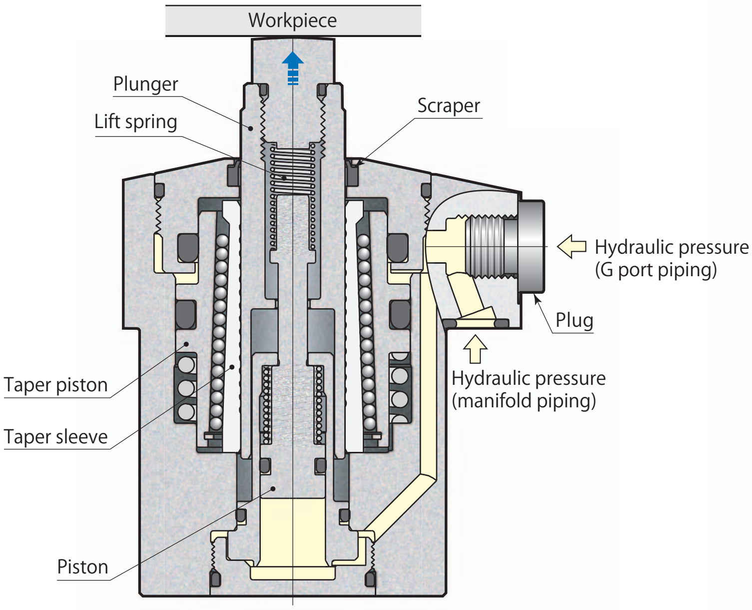
Hydraulic lift,
support force enhanced model
model CSY03-L

Hydraulic lift,
standard model
model CSN03-L

Spring lift
model CSK03-L

Hydraulic lift

Standard model **CSU□-□□**
Support force enhanced model **CSU-H□-□**



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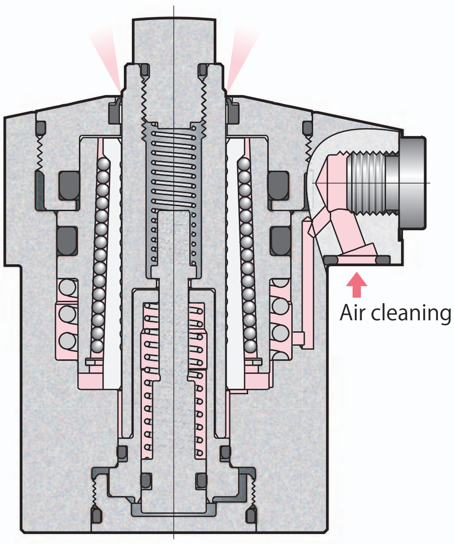
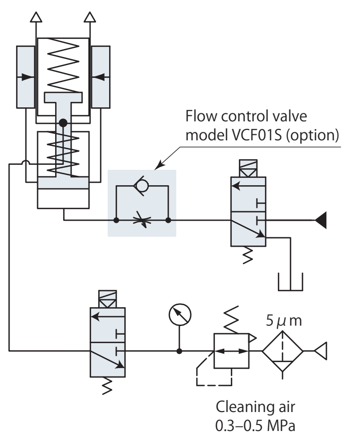


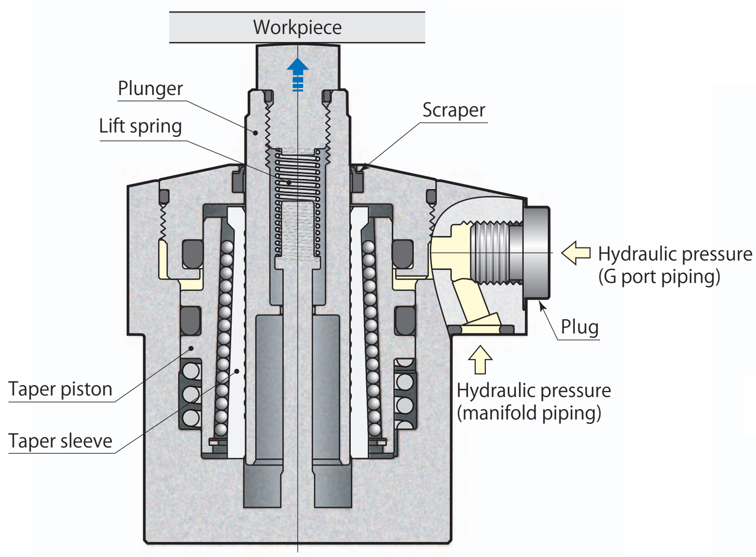
Unlock

Hydraulic and pneumatic circuit diagram



Spring lift

model **CST□-□**



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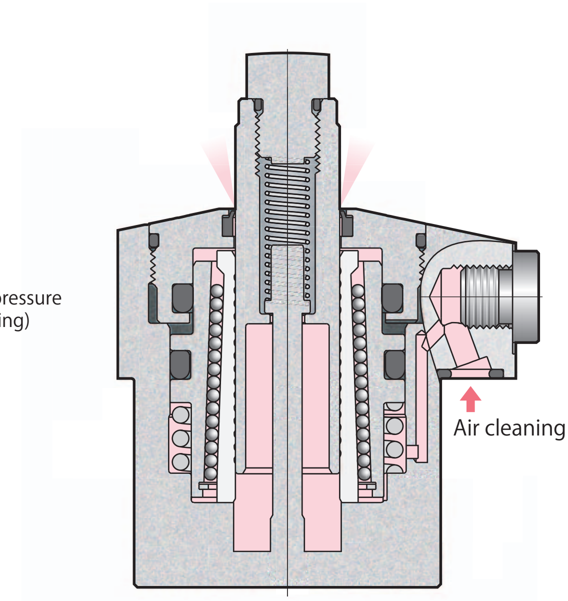
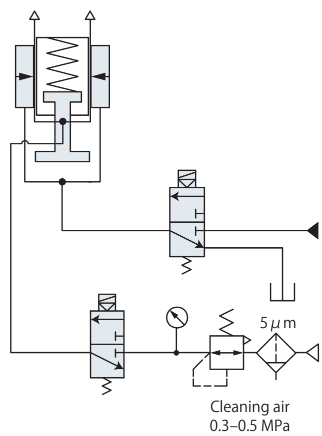


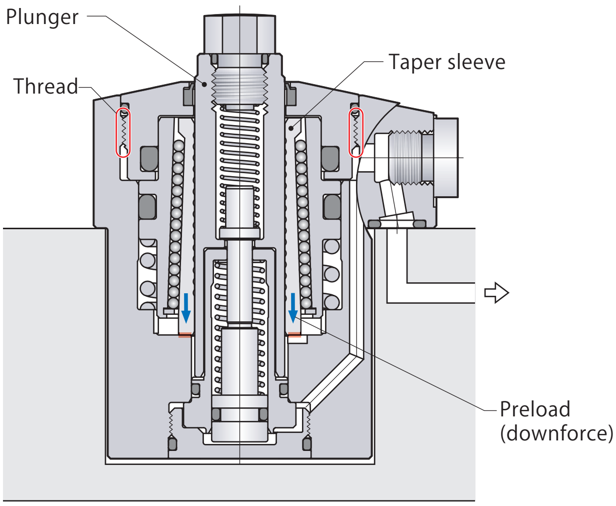
Unlock

Hydraulic and pneumatic circuit diagram



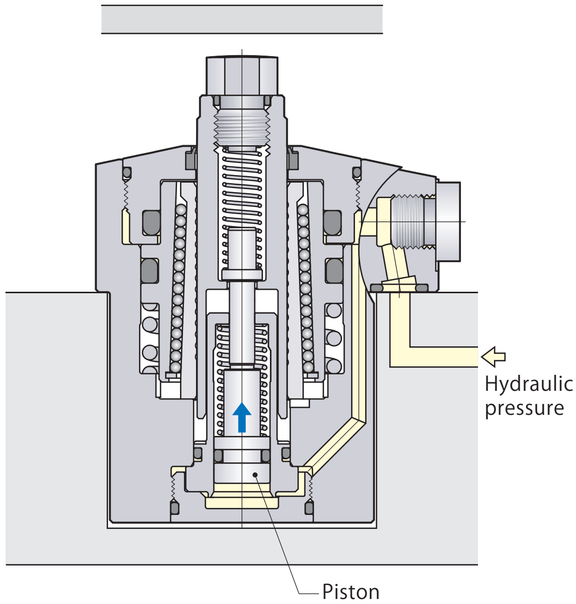
Hydraulic lift (model CSU)

Plunger is locked after it stroked by the structure containing sequencetial movement, which enables a workpiece to hold securely.



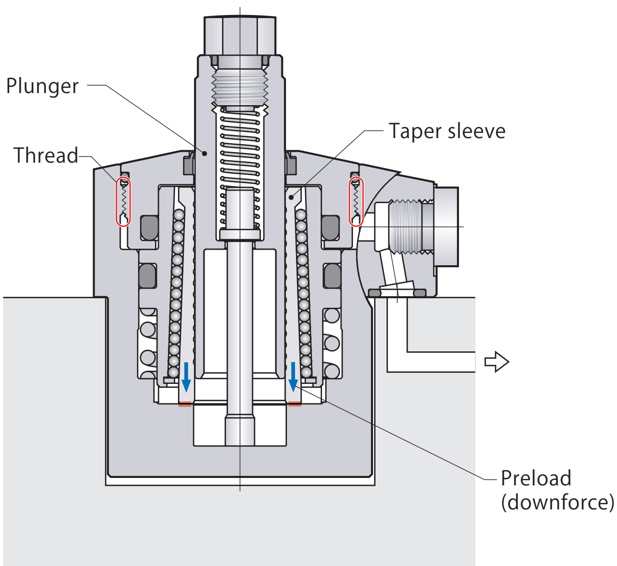
● The taper sleeve is preloaded by the thread and is kept the position lower.

①The piston moves upward



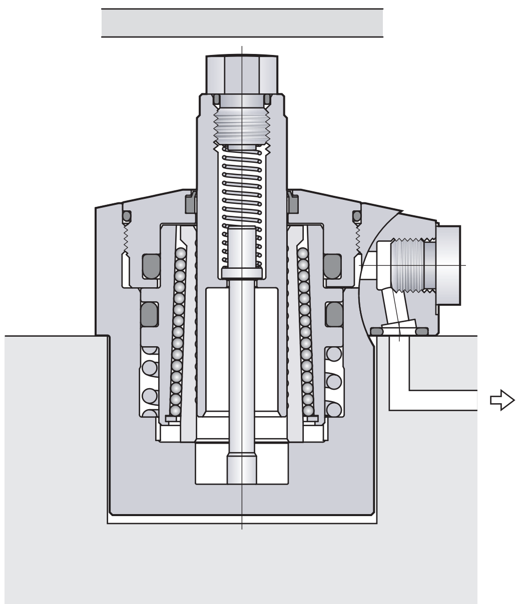
● Piston moves upward by the hydraulic force.

Spring lift (model CST)



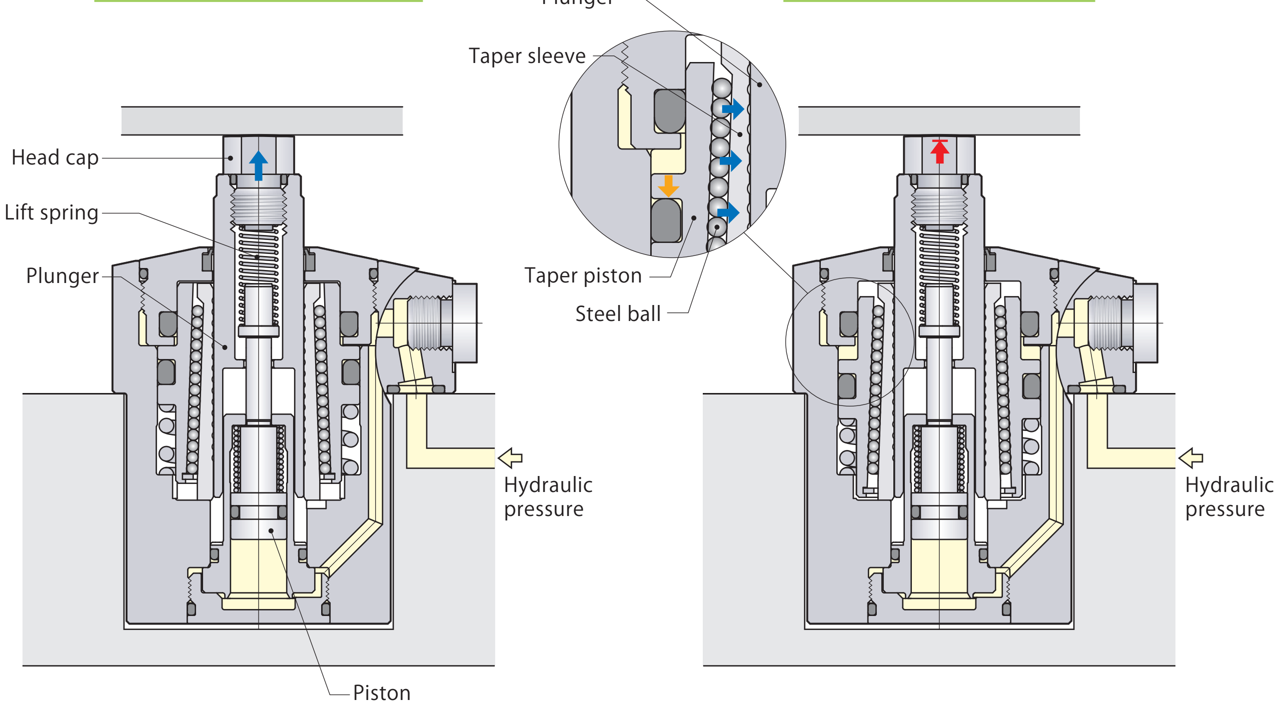
● The taper sleeve is preloaded by the thread and is kept the position lower.

①Before the workpiece approaches



②Contact with the workpiece

③Supporting the workpiece

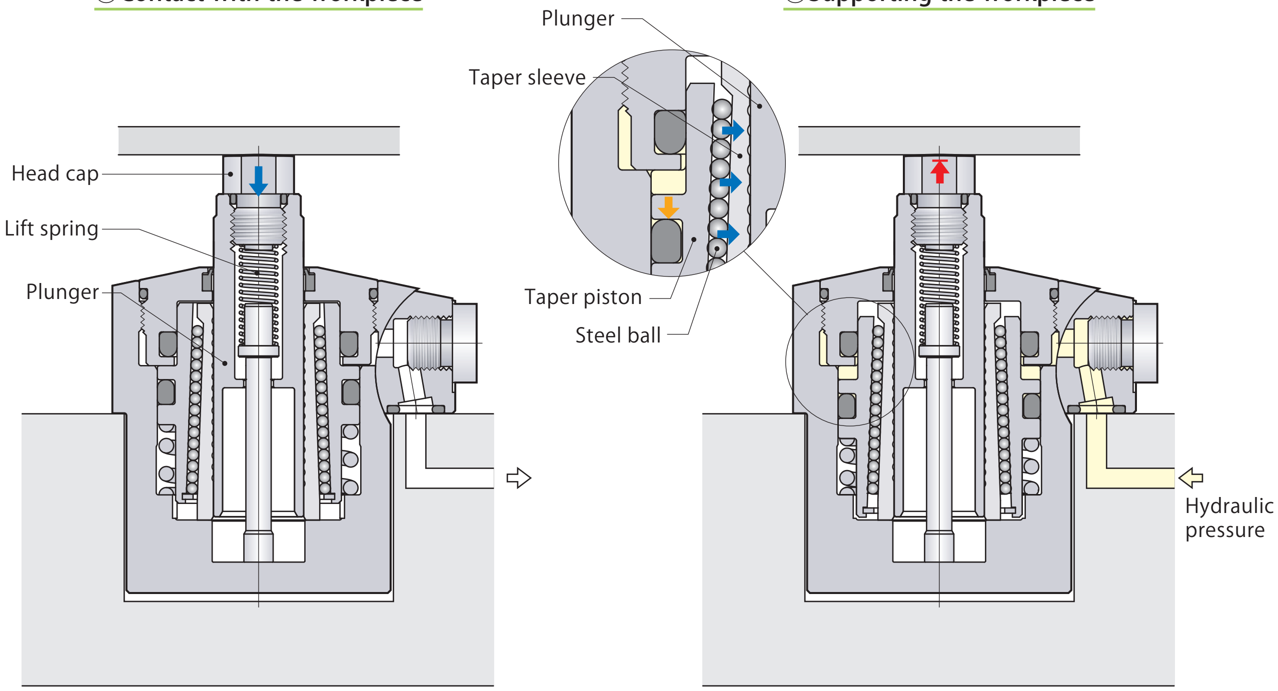


● The plunger with a head cap strokes upward by the lift spring to contact the workpiece. The plunger puts a load on the workpiece since the piston continues to move upward to the end of its stroke.

● After piston stroking, the taper piston moves down by the hydraulic force to depress the taper sleeve by means of the steel balls. Then the taper sleeve locks the plunger firmly.

②Contact with the workpiece

③Supporting the workpiece



● The workpiece touches head cap then depresses the plunger until it reaches to the seating surface. The lift spring puts a load onto the workpiece.

● The taper piston is pushed down by the hydraulic force to depress the taper sleeve by means of the steel balls. Then the taper sleeve locks the plunger firmly.

Specifications

Size: 04, 06, 10, 16, 25

Lift spring force:
- L : Standard
- H : Strong

CSU : Hydraulic lift, standard

CSU-H : Hydraulic lift, support force enhanced

CST : Spring lift

(Nil) : Standard

B : Air sensor

(grey box) indicates made to order.

Air sensor is not applicable for CSU-H (support force enhanced model) and CST.

Model				CSU□04 / CST04	CSU□06 / CST06	CSU□10 / CST10	CSU□16 / CST16	CSU□25 / CST25
Support force (hydraulic pressure 7MPa)*1		Standard	kN	5	7	10	16	25
		Support force enhanced	kN	7	10	14	23	36
Cylinder capacity		CSU	cm^3	1.2	1.8	2.6	3.9	5.7
		CST	cm^3	0.7	0.9	1.2	2.1	3.3
Lift spring force*2	L：Standard	Standard	N	3.0–4.1	4.3–8.1	5.3–10.8	5.5–10.8	6.9–13.2
		Support force enhanced	N	4.5–6.0	5.0–11.0	8.0–17.0	9.0–17.0	11.0–20.0
	H：Strong	Standard	N	4.8–7.5	6.6–11.1	7.8–13.3	11.2–19.8	13.5–22.4
		Support force enhanced	N	6.0–9.5	8.0–14.0	11.0–20.0	11.0–21.0	20.0–25.0
Plunger stroke			mm	8	12	12	16	16
Max. allowable mass of head cap			kg	0.15	0.2	0.2	0.3	0.3
Mass		CSU	kg	0.6	1.0	1.2	2.0	3.3
		CST	kg	0.5	0.9	1.1	1.8	3.1
Recommended tightening torque of mounting screws*3			N·m	7	7	7	12	29

- Pressure range：2.5–7 MPa
- 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)

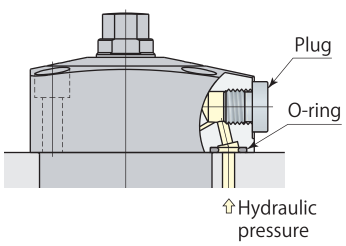
*1：When work support and clamp are used facing each other, work support and clamp must be selected in such a way that the support force is 1.5 times the applied load (clamping force + machining force).

*2：Figures are for "upper end to lower end" of plunger action. *3：ISO R898 class 12.9

Manifold piping and G port piping are available.

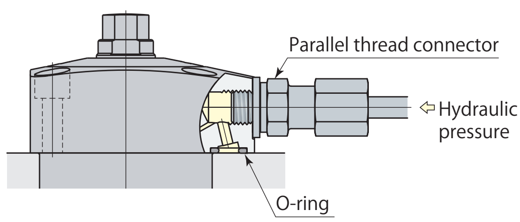
Manifold piping

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.

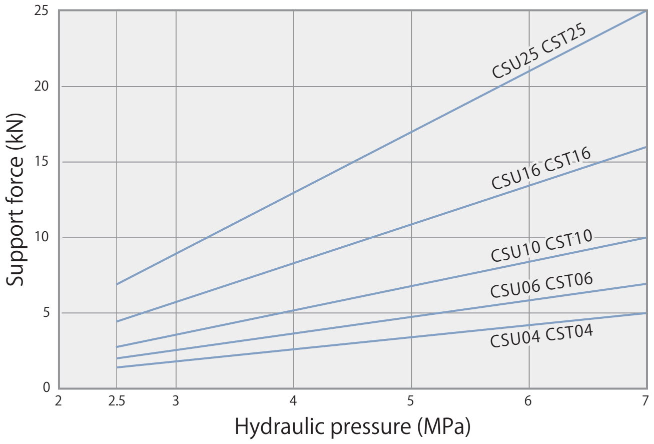


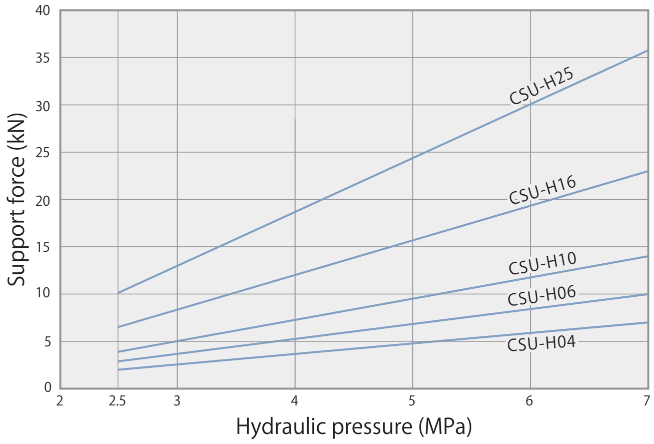
G port piping

Remove plugs when choosing G port piping. (O-ring must be used.) Refer to **page →372** 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.



Hydraulic pressure & support force

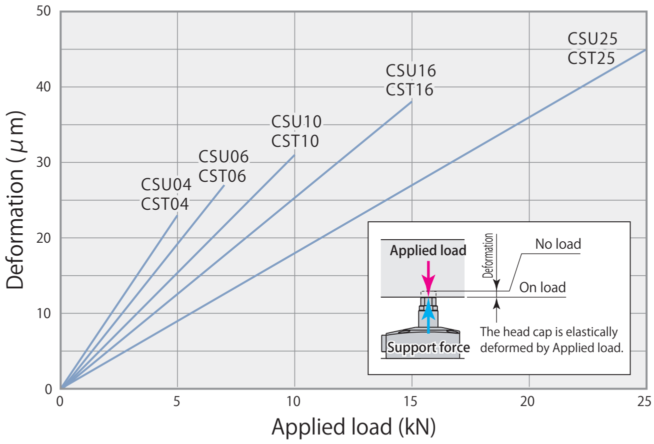


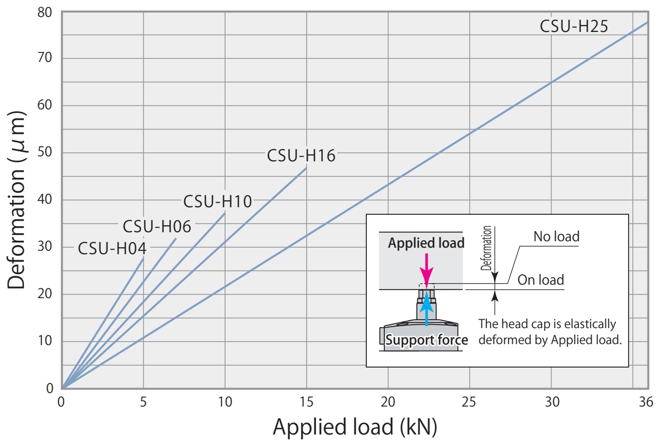


Hydraulic pressure MPa	Support force kN				
	CSU04 CST04	CSU06 CST06	CSU10 CST10	CSU16 CST16	CSU25 CST25
2.5	1.4	2.0	2.8	4.5	7.0
3.0	1.8	2.6	3.6	5.8	9.0
3.5	2.2	3.1	4.4	7.1	11.0
4.0	2.6	3.7	5.2	8.3	13.0
4.5	3.0	4.2	6.0	9.6	15.0
5.0	3.4	4.8	6.8	10.9	17.0
5.5	3.8	5.3	7.6	12.2	19.0
6.0	4.2	5.9	8.4	13.4	21.0
6.5	4.6	6.4	9.2	14.7	23.0
7.0	5.0	7.0	10.0	16.0	25.0

Hydraulic pressure MPa	Support force kN				
	CSU-H04	CSU-H06	CSU-H10	CSU-H16	CSU-H25
2.5	2.0	2.9	3.9	6.5	10.1
3.0	2.6	3.7	5.0	8.3	13.0
3.5	3.1	4.5	6.1	10.2	15.9
4.0	3.7	5.3	7.3	12.0	18.7
4.5	4.2	6.1	8.4	13.8	21.6
5.0	4.8	6.9	9.5	15.7	24.5
5.5	5.3	7.6	10.6	17.5	27.4
6.0	5.9	8.4	11.7	19.3	30.2
6.5	6.4	9.2	12.9	21.2	33.1
7.0	7.0	10.0	14.0	23.0	36.0

Applied load & deformation





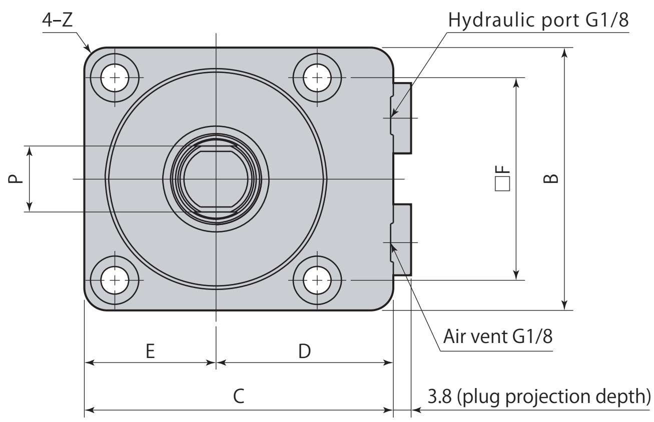
Applied load kN	Deformation μm				
	CSU04 CST04	CSU06 CST06	CSU10 CST10	CSU16 CST16	CSU25 CST25
0	0	0	0	0	0
5	23	19	16	13	9
7		27	22	18	13
10			31	26	18
15		Nonusable range		38	27
20					36
25					45

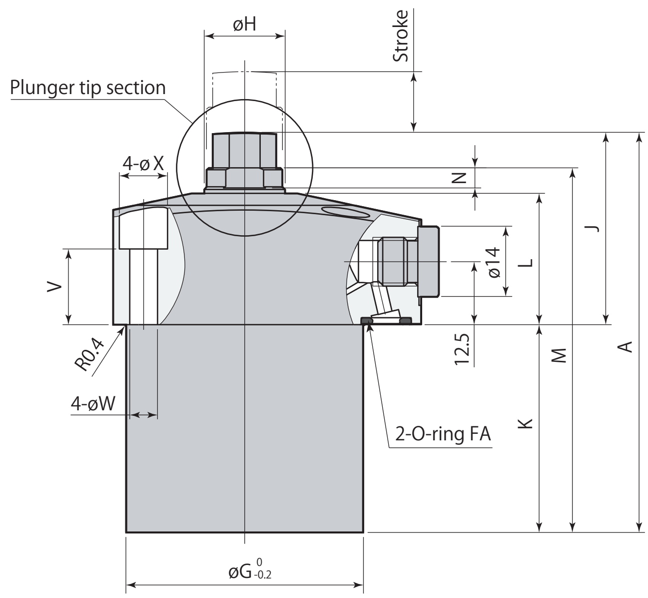
Held with hydraulic pressure of 7 MPa.

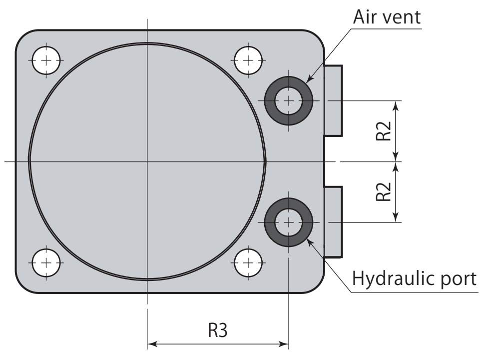
Applied load kN	Deformation μm				
	CSU-H04	CSU-H06	CSU-H10	CSU-H16	CSU-H25
0	0	0	0	0	0
5	27.6	22.8	18.6	15.6	10.8
7		31.9	26	21.8	15.1
10			37.2	31.2	21.6
15				46.8	32.4
20		Nonusable range			43.2
25					54
36					77.8

Held with hydraulic pressure of 7 MPa.

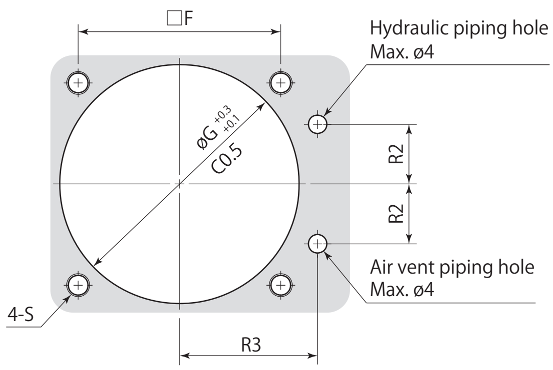
Dimensions



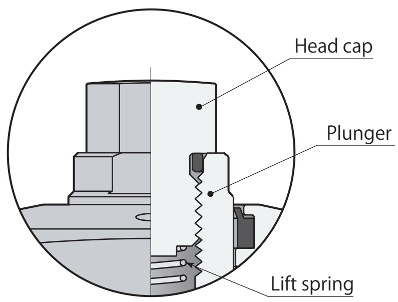




Mounting details

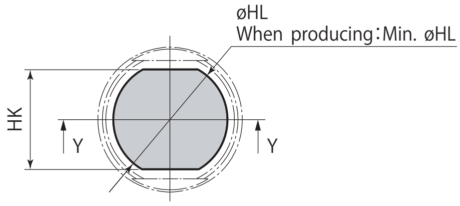


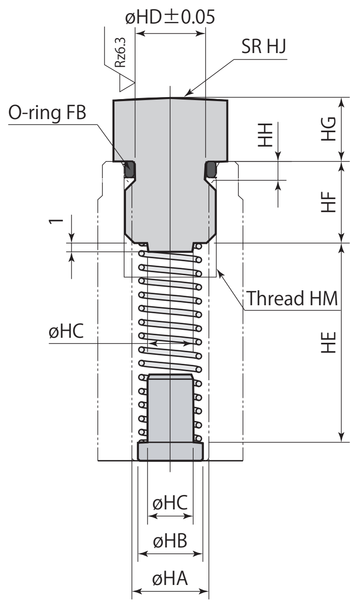
Plunger tip section details



Head cap details

Hardness：HRC52





Y-Y

mm

Model	CSU□04-□	CSU□06-□	CSU□10-□	CSU□16-□	CSU□25-□
A	68	79	82	102	122
B	45	52	56	65	78
C	55	61	65	73	85
D	32.5	35	37	40.5	46
E	22.5	26	28	32.5	39
F	34	40	44	52	62
øG	40	47	52	60	72
øH	15	16	20	22	25
J	38	38	40	45	46
K	30	41	42	57	76
L	26	26	28	30	30
M	61	72	75	93	113
N (width across flats height)	4	4	4.5	5	6
P (width across flats)	13	13	17	19	22
R2	10	12	13	15	18
R3	25.5	28	30	33.5	39
S	M5	M5	M5	M6	M8
V	15	15	16.5	15.9	12
W	5.5	5.5	5.5	6.8	9
X	9.5	9.5	9.5	11	14
Z	R3	R5	R5	R6	R7
O-ring FA (fluorocarbon hardness Hs90)	P7	P7	P7	P7	P7
Flow control valve (meter-in)	VCF01S	VCF01S	VCF01S	VCF01S	VCF01S
Air bleeding valve	VCE01	VCE01	VCE01	VCE01	VCE01

- The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).
- Always attach head cap (lift spring cannot be retained).
- Mounting screws are not included.

Head cap details

mm

Model	CSU□04-□	CSU□06-□	CSU□10-□	CSU□16-□	CSU□25-□
øHA	8.5	8.5	10.3	10.3	14
øHB	7.2	7.2	9.2	9.2	11.2
øHC	5	5	6	6	7.5
øHD	7.8	7.8	9.2	9.2	13.5
HE	17.6	22	22.5	32.5	39
HF	9	9	11	11	15
HG	7	7	7	9	9
HH	1.9	1.9	2.3	2.3	3.5
HJ	70	70	90	110	140
HK	11	11	14	14	18
øHL	12.6	12.6	16.5	16.5	21.5
Min. øHL	12.5	12.5	16.5	16.5	21.5
HM (recommended tightening torque)	M10×1.5 depth 11 (30 N·m)	M10×1.5 depth 11 (30 N·m)	M12×1.75 depth 13 (50 N·m)	M12×1.75 depth 13 (50 N·m)	M16×2 depth 20 (80 N·m)
O-ring FB (fluorocarbon hardness Hs70)	S8	S8	P9	P9	AS568-014

- When fabricating head cap, ensure that O-ring slot, spring spot facing and guide are made by referring to head cap details. Be sure to always use included O-ring.
- When fabricating a lift spring, determine dimensions by referring to head cap details. Furthermore, rustproofing must be implemented (however, there is no guarantee for operation).
- This diagram indicates a situation where head cap has been fitted into plunger with no pressure applied.

Air sensor unit

Supplier and model	ISA3-G series manufactured by SMC
	GPS2-05, GPS3-E series manufactured by CKD
Air supply pressure	0.1 MPa
Inner diameter of piping	ø4 mm
Overall piping length	5 m or less

- Air supply to air sensor unit should be provided to the air vent port. Supplied air should be dried and filtered with particulate size 5 μm or less.
- 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.
- 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.
- When performing workpiece contact detection for multiple workpieces (in parallel fittings) using one air sensor, consider detection range of air sensor before determining the number of workpiece contacts to be detected.
- Setting air pressure that exceeds air pressure range results in leaking of air from scraper and accurate detection will not be possible.
- If the lowering operation slows down due to air pressure, stop air supply during lowering operation.

Workpiece contact force

Workpiece contact force (lift spring + air pressure lift) is exerted onto workpiece during workpiece setting. Lift spring force varies according to the stroke used. Use following formula to obtain lift spring force:

Lift spring force calculation formula $Ps = P1-(P1-P2) \times D2/D1$

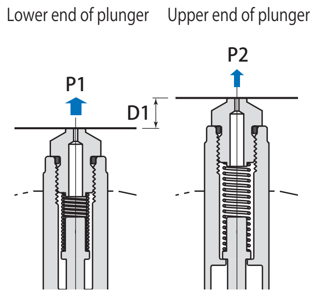
Example: model CSU06-LB using stroke of 5 mm:
Lift spring force = 8.1-(8.1-4.3)×5/12 = 6.5 (N)

Workpiece contact force varies according to the air pressure used. Use following formula to obtain workpiece contact force:

Workpiece contact force calculation formula $P = Ps + \eta \times Pa$

Example: model CSU06-LB using stroke of 5 mm and air pressure of 0.05 MPa,
Workpiece contact force = 6.5+200×0.05 = 16.5 (N)

P1 : Lift spring force at lower end (N)
P2 : Lift spring force at upper end (N)
D1: Full stroke (mm)
D2: Used stroke (mm)
Ps : Lift spring force (N)
η : Push up coefficient (refer to table below)
Pa : Air pressure (MPa)
P : Workpiece contact force (N)

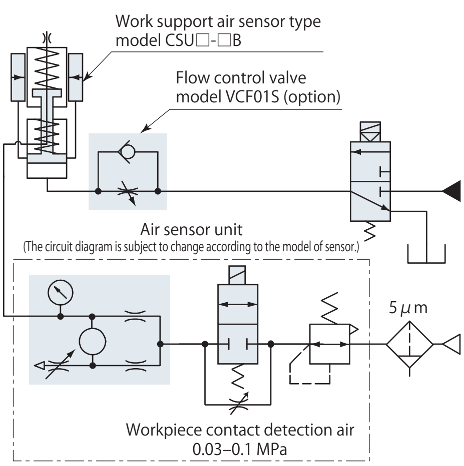


The workpiece contact force varies depending on sliding resistance of scraper. Use calculated figures only as reference.

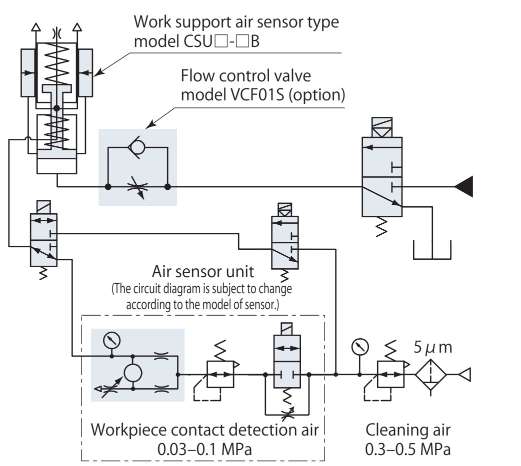
Model		CSU04-□B	CSU06-□B	CSU10-□B
Lift spring force N	L:Standard	3.0–4.1	4.3–8.1	5.3–10.8
	H:Strong	4.8–7.5	6.6–11.1	7.8–13.3
Air pressure range MPa		0.03–0.1		
Plunger stroke mm		8	12	12
Push up coefficient η		180	200	310

Lift spring force is shown as spring force for "upper end to lower end" of plunger action.

Air sensor & hydraulic circuit diagram

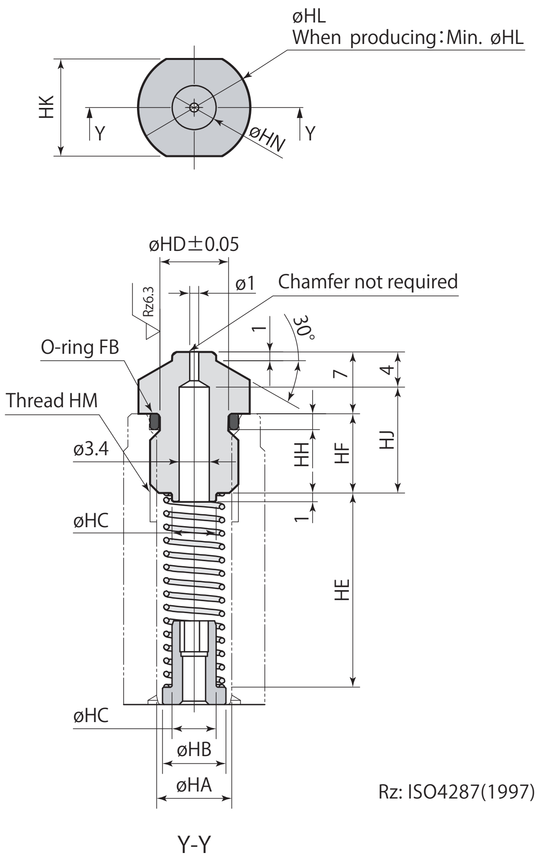


Air sensor & air cleaning & hydraulic circuit diagram



Air sensor head cap details

Hardness：HRC52



- Workpiece contact detection is not possible merely by replacing head cap of standard work support.
- There is no air sensor available for model CSU16 or CSU25.
- This diagram indicates a situation where head cap has been fitted into plunger with no pressure applied.

mm

Model	CSU04-□B	CSU06-□B	CSU10-□B
øHA	8.5	8.5	10.3
øHB	7.2	7.2	9.2
øHC	5	5	6
øHD	7.8	7.8	9.2
HE	17.6	22	22.5
HF	9	9	11
HH	1.9	1.9	2.3
HJ	12	12	14
HK (width across flats)	11	11	14
øHL	12.6	12.6	16.5
Min. øHL	12.5	12.5	16.5
HM (recommended tightening torque)	M10×1.5 depth 11 (30 N·m)	M10×1.5 depth 11 (30 N·m)	M12×1.75 depth 13 (50 N·m)
øHN	5	5	8
O-ring FB (fluorocarbon hardness Hs70)	S8	S8	P9

- CSU□-□B (Air sensor) is made to order.

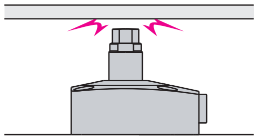
Caution in use

- The lift spring in the plunger may push the workpiece upward if it is light weight and seating detection cannot be complete. Review the weight of workpiece or lift spring force and make it appropriate to seat the workpiece perfectly and acutate the work support.

- Set the plunger lifting time to 0.5 seconds or longer by adjusting the flow control valve with check valve (meter-in). Reasonable plunger ascending speed can prevent the parts from breakage also curbs plunger contact false.
  Use a flow control valve with cracking pressure of 0.05MPa or less, in order to shorten plunger descending speed.
  (Cracking pressure of optional flow control valve model VCF01S is 0.04 MPa.)

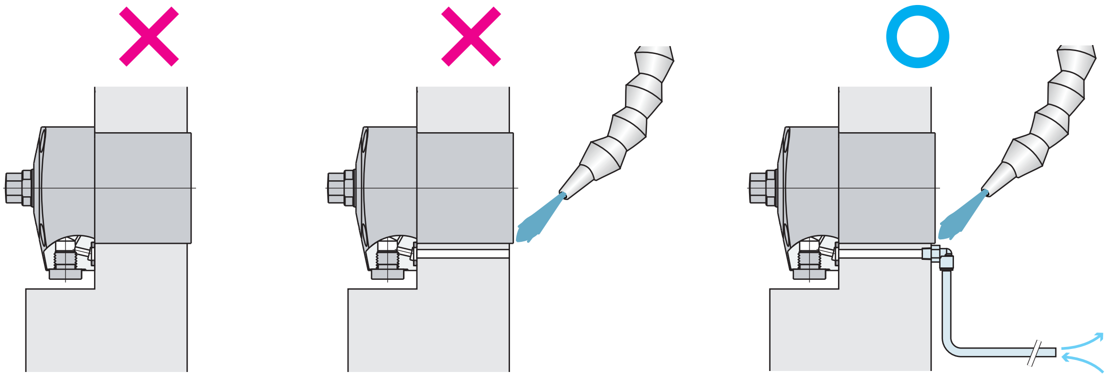
  If the plunger ascends to reach a workpiece too fast, it rebounds after hitting the workpiece and will create a small clearance between the two. The clearance may cause a supporting fault of the workpiece.

Rebound and clearance



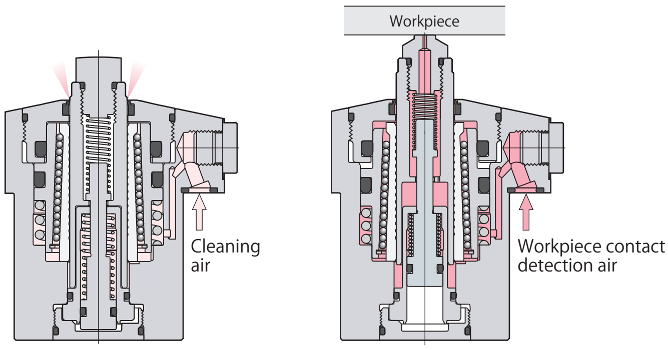
- Avoid following usages. These may cause sleeve deformation that could lead to malfunction of plunger or decreased support force.
  - ×Applying eccentric load on plunger.
  - ×Applying load that exceeds rated support force.
  - ×Rotating plunger when locked.

- Air vent must be opened to atmosphere. Any blockage on the vent results in malfunction. Provide the piping if there is a risk of coolant or metal chips intrusion. Allowing intrusion of cutting fluid may cause rusting and other problems.



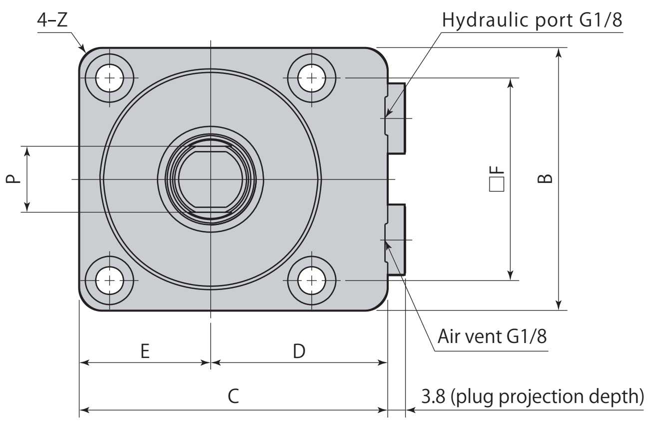
Air vent is blocked　　Cutting fluid intrusion from air vent　　Piping to metal chips or coolant free area

- Air (oil free) must be fed through a 5 μm filter that is connected to an air vent port for air cleaning or workpiece contact detection (air sensor).
  Perform air cleaning only when replacing workpiece. Plunger will rise during air cleaning.

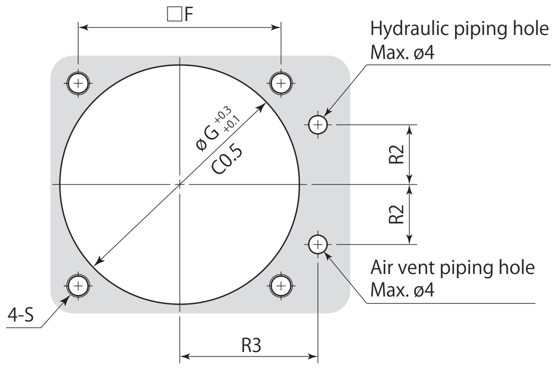


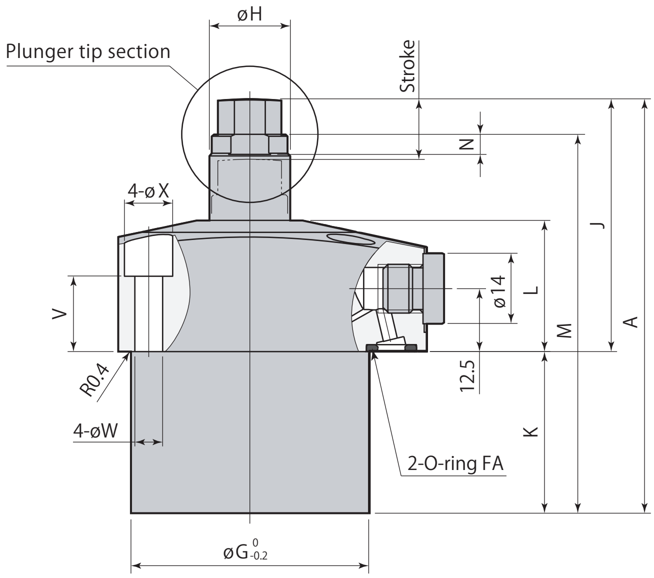
Work support
CSU Hydraulic lift

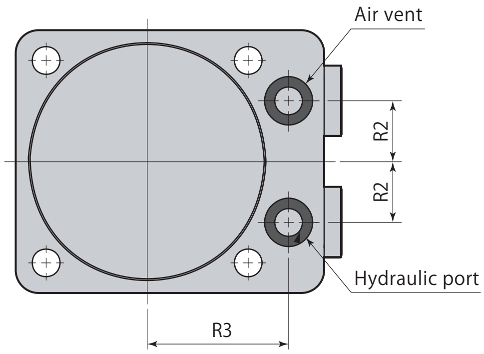
Dimensions



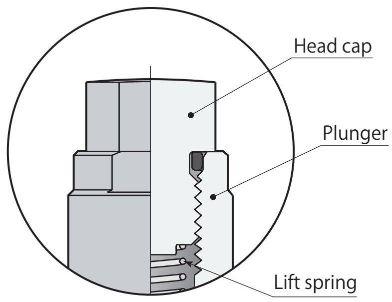
Mounting details





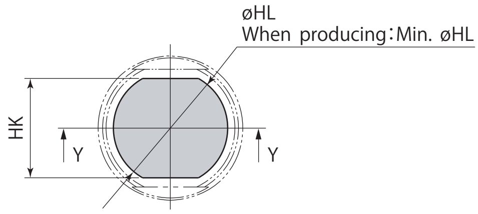


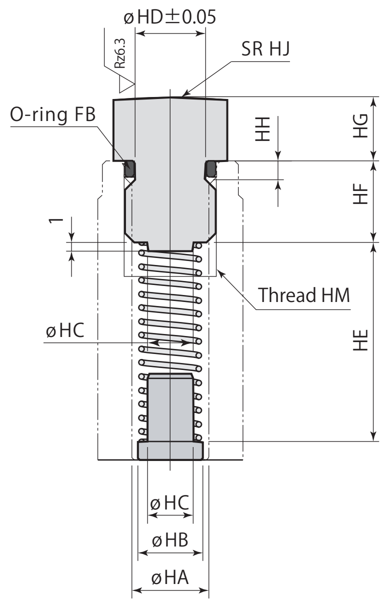
Plunger tip section details



Head cap details

Hardness：HRC52





Y-Y

mm

Model	CST04-□	CST06-□	CST10-□	CST16-□	CST25-□
A	67	82	85	108	129
B	45	52	56	65	78
C	55	61	65	73	85
D	32.5	35	37	40.5	46
E	22.5	26	28	32.5	39
F	34	40	44	52	62
øG	40	47	52	60	72
øH	15	16	20	22	25
J	46	50	52	61	62
K	21	32	33	47	67
L	26	26	28	30	30
M	60	75	78	99	120
N (width across flats height)	4	4	4.5	5	6
P (width across flats)	13	13	17	19	22
R2	10	12	13	15	18
R3	25.5	28	30	33.5	39
S	M5	M5	M5	M6	M8
V	15	15	16.5	15.9	12
W	5.5	5.5	5.5	6.8	9
X	9.5	9.5	9.5	11	14
Z	R3	R5	R5	R6	R7
O-ring FA (fluorocarbon hardness Hs90)	P7	P7	P7	P7	P7
Air bleeding valve	VCE01	VCE01	VCE01	VCE01	VCE01

- The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).
- Always attach head cap (lift spring cannot be retained).
- Mounting screws are not included.

Head cap details

mm

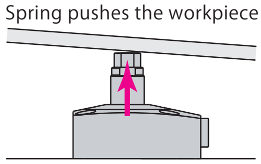
Model	CST04-□	CST06-□	CST10-□	CST16-□	CST25-□
øHA	8.5	8.5	10.3	10.3	14
øHB	7.2	7.2	9.2	9.2	11.2
øHC	5	5	6	6	7.5
øHD	7.8	7.8	9.2	9.2	13.5
HE	17.6	22	22.5	32.5	39
HF	9	9	11	11	15
HG	7	7	7	9	9
HH	1.9	1.9	2.3	2.3	3.5
HJ	70	70	90	110	140
HK	11	11	14	14	18
øHL	12.6	12.6	16.5	16.5	21.5
Min. øHL	12.5	12.5	16.5	16.5	21.5
HM (recommended tightening torque)	M10×1.5 depth 11 (30 N·m)	M10×1.5 depth 11 (30 N·m)	M12×1.75 depth 13 (50 N·m)	M12×1.75 depth 13 (50 N·m)	M16×2 depth 20 (80 N·m)
O-ring FB (fluorocarbon hardness Hs70)	S8	S8	P9	P9	AS568-014

- When fabricating head cap, ensure that O-ring slot, spring spot facing and guide are made by referring to head cap details. Be sure to always use included O-ring.
- When fabricating a lift spring, determine dimensions by referring to head cap details. Furthermore, rustproofing must be implemented (however, there is no guarantee for operation).
- This diagram indicates a situation where head cap has been fitted into plunger with no pressure applied.

Work support
CST Spring lift

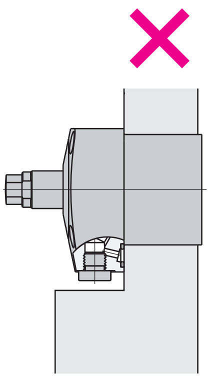
Caution in use

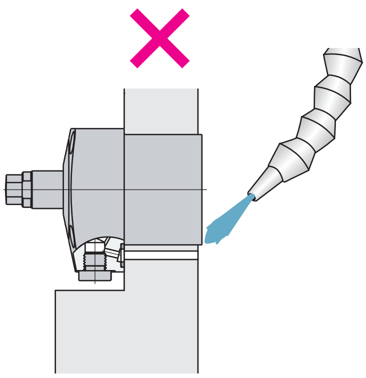
- If the workpiece is light weight, the plunger cannot be pressed down by the weight of workpiece and seating detection cannot be complete. Review the weight of workpiece or lift spring force to make the work-piece seat perfectly, and lock the work support.

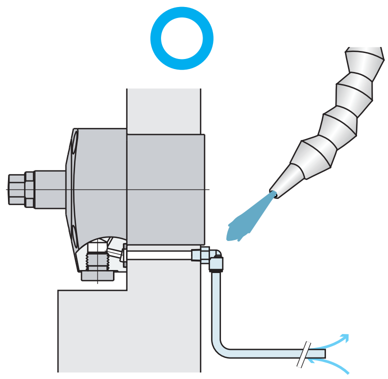


- Avoid following usages. These may cause sleeve deformation that could lead to malfunction of plunger or decreased support force.
  - ✕ Applying eccentric load on plunger.
  - ✕ Applying load that exceeds rated support force.
  - ✕ Rotating plunger when locked.

- Air vent must be opened to atmosphere. Any blockage on the vent results in malfunction. Provide the piping if there is a risk of coolant or metal chips intrusion. Allowing intrusion of cutting fluid may cause rusting and other problems.


Air vent is blocked

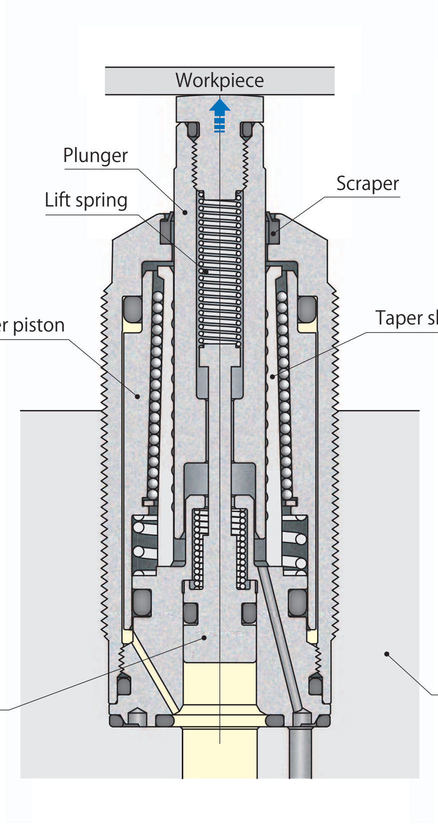

Cutting fluid intrusion from air vent


Piping to metal chips or coolant free area

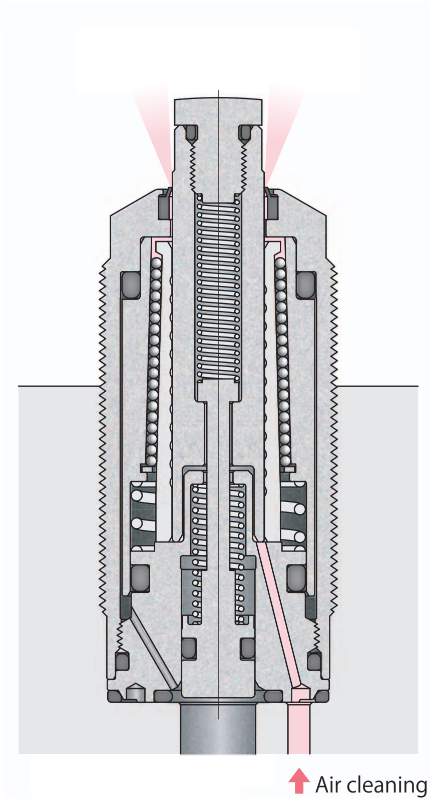
- Air (oil free) must be fed through a 5 μm filter that is connected to an air vent port for air cleaning. Perform air cleaning only when replacing workpiece.

Hydraulic lift

Standard model **CSN□-□□**
Support force enhanced model **CSY□-□□**

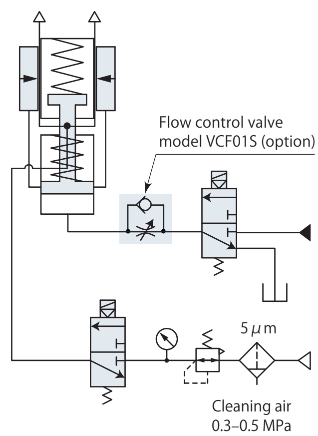


Lock



Unlock

Hydraulic and pneumatic circuit diagram



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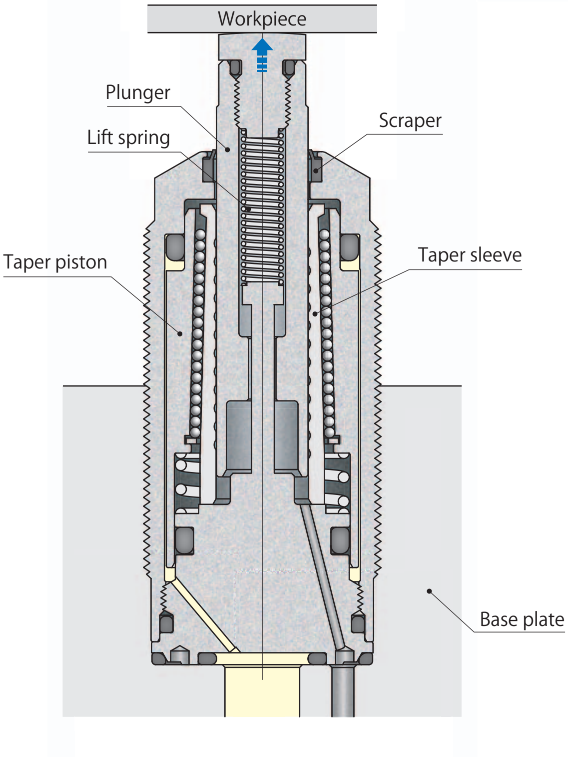
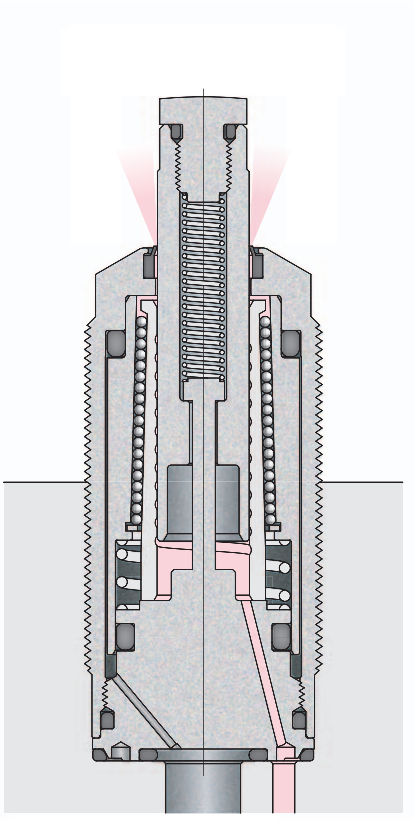
Hydraulic pressure & support force page → 349
Applied load & deformation page → 349
Dimensions pages → 350, 352
Mounting details pages → 350, 352
Air sensor page → 354

Spring lift

model **CSK□-□**



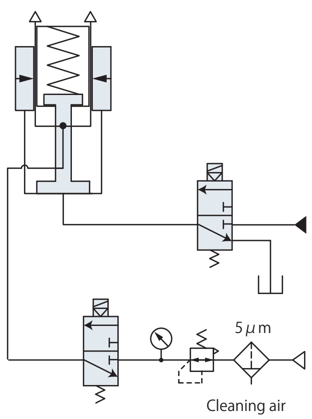
Lock



Unlock

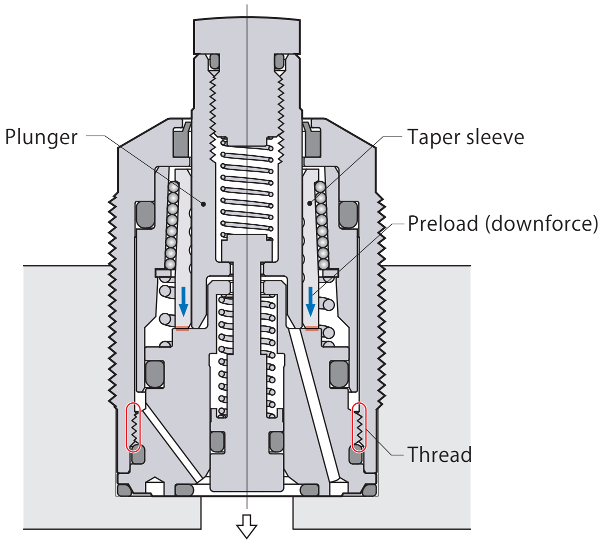
Specifications page → 348
Hydraulic pressure & support force page → 349
Applied load & deformation page → 349
Dimensions page → 358
Mounting details page → 358

Hydraulic and pneumatic circuit diagram



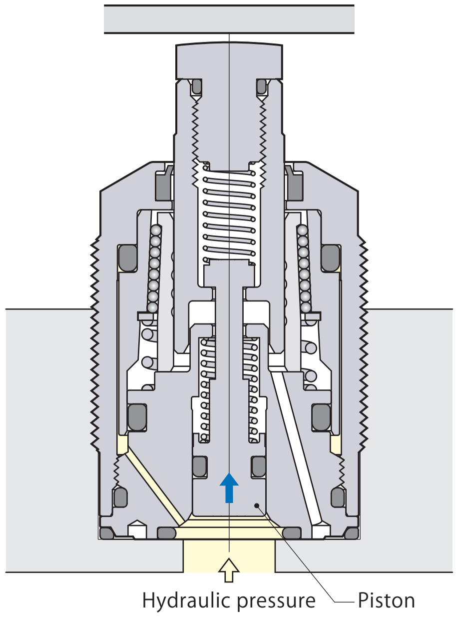
Hydraulic lift (model CSN, CSY)

Plunger is locked after it stroked by the structure containing sequencetial movement, which enables a workpiece to hold securely.



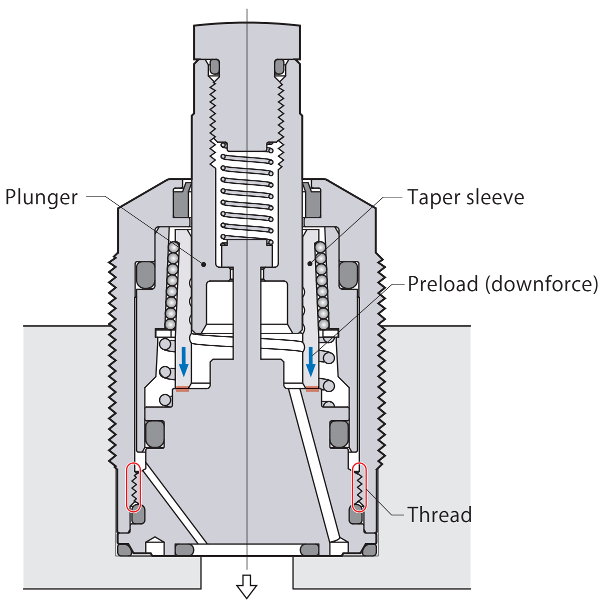
● The taper sleeve is preloaded by the thread and is kept the position lower.

①The piston moves upward



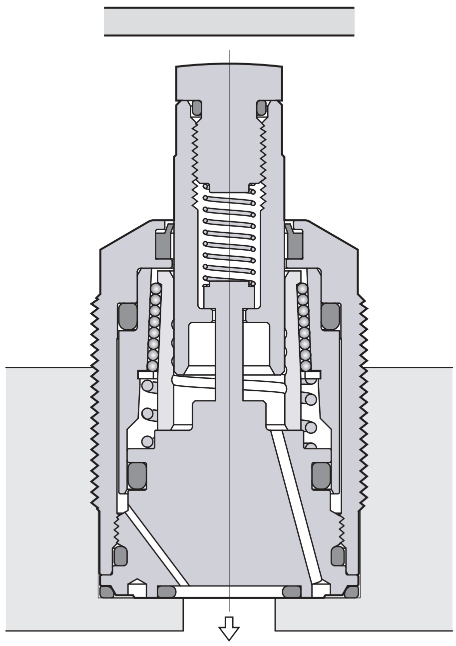
● Piston moves upward by the hydraulic force.

Spring lift (model CSK)

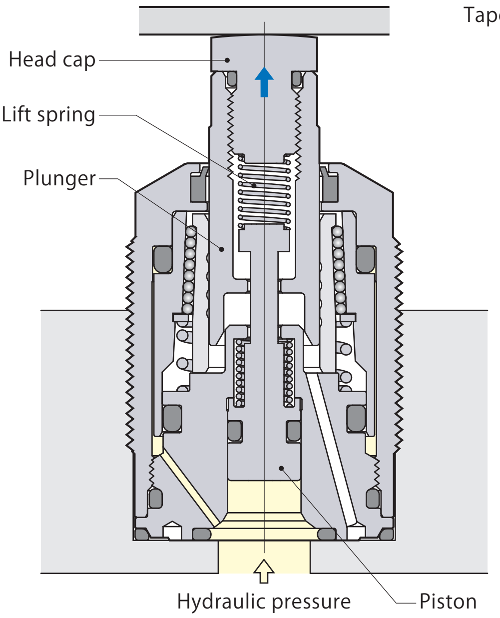


● The taper sleeve is preloaded by the thread and is kept the position lower.

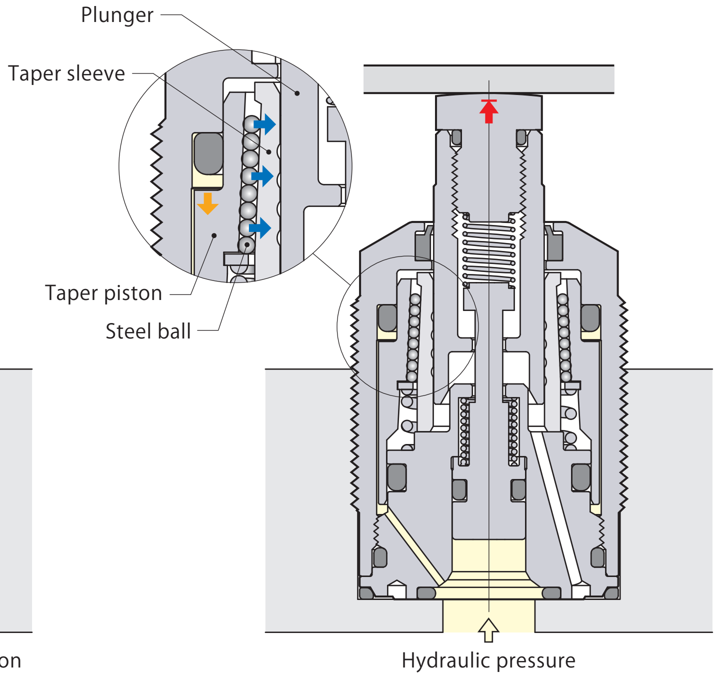
①Before the workpiece approaches



②Contact with the workpiece

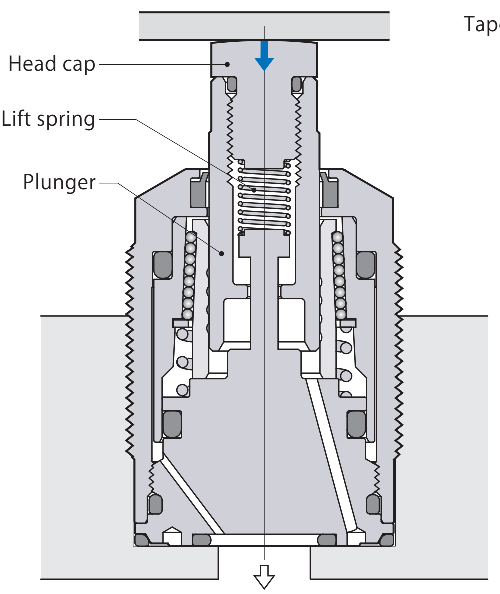


③Supporting the workpiece

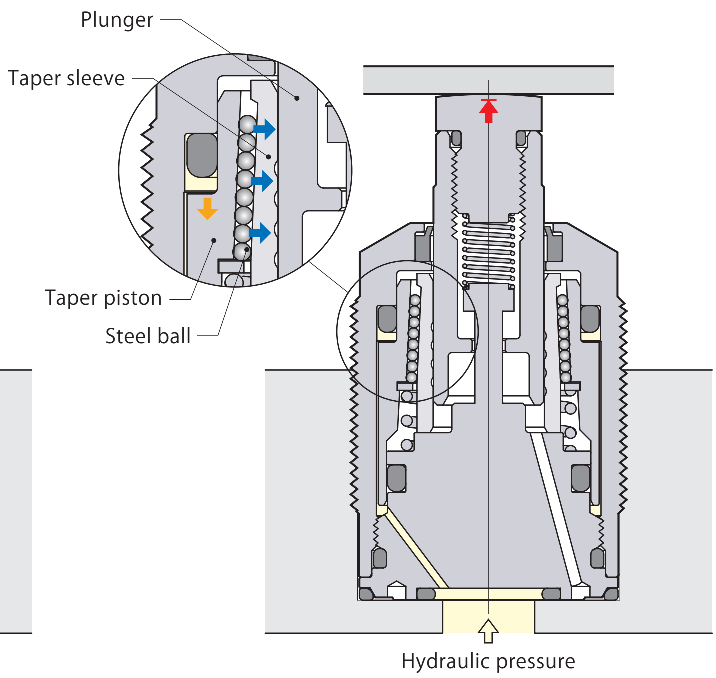


- The plunger with a head cap strokes upward by the lift spring to contact the workpiece. The plunger puts a load on the workpiece since the piston continues to move upward to the end of its stroke.
- After piston stroking, the taper piston moves down by the hydraulic force to depress the taper sleeve by means of the steel balls. Then the taper sleeve locks the plunger firmly.

②Contact with the workpiece



③Supporting the workpiece



- The workpiece touches head cap then depresses the plunger until it reaches to the seating surface. The lift spring puts a load onto the workpiece.
- The taper piston is pushed down by the hydraulic force to depress the taper sleeve by means of the steel balls. Then the taper sleeve locks the plunger firmly.

Specifications

Size | Lift spring force

CSN : Hydraulic lift, standard

CSY : Hydraulic lift, support force enhanced

CSK : Spring lift

00 / **01** / **03** / **04** / **06** – **L** : Standard / **H** : Strong | **(Nil)** : Standard / **B** : Air sensor

Air sensor is not applicable for model CSK.

Model				CSN00-□ / CSY00-□ / CSK00-□	CSN01-□ / CSY01-□ / CSK01-□	CSN03-□ / CSY03-□ / CSK03-□	CSN04-□ / CSY04-□ / CSK04-□	CSN06-□ / CSY06-□ / CSK06-□
Support force (hydraulic pressure 7MPa)*1		CSN, CSK	kN	2.5	1	3	4	7
		CSY	kN	3	1.2	4	5.5	10
Cylinder capacity		CSN, CSY	cm^3	0.6	0.4	0.8	1.2	2.0
		CSK	cm^3	0.3	0.1	0.7	0.7	1.2
Lift spring force*2	L:Standard	CSN, CSK	N	2–4			3–6	
		CSY	N	2–4	2–4	4–6	5–8	
	H:Strong	CSN, CSK	N	3–6			5–8	
		CSY	N	3–6	3–6	5–8	6–11	8–14
Plunger stroke			mm	6.5	6	8	8	10
Max. allowable mass of head cap			kg	0.05			0.1	
Mass			kg	0.2	0.2	0.3	0.4	0.7
Recommended tightening torque of body			N·m	35–45	40–50	40–50	45–55	55–65

● Pressure range : 2.5–7 MPa ● Proof pressure : 10.5 MPa ● Operating temperature : 0–70 ℃

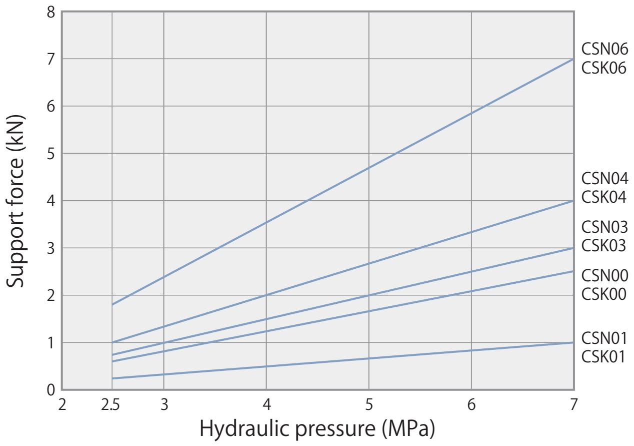
● Fluid used : General mineral based hydraulic oil (ISO-VG32 equivalent)

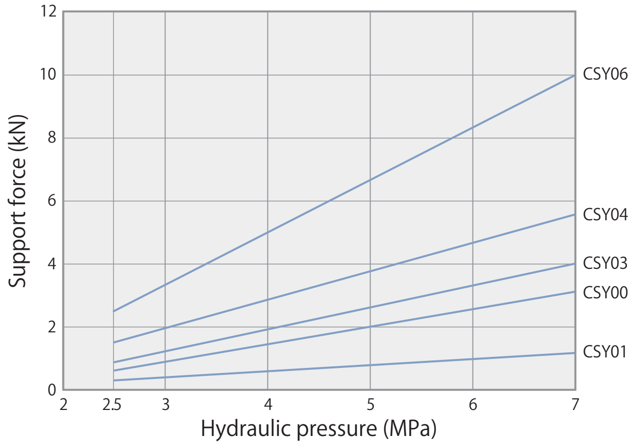
● Seals are resistant to chlorine-based cutting fluid. (not thermal resistant specification)

*1 : When work support and clamp are used facing each other, work support and clamp must be selected in such a way that the support force is 1.5 times the applied load (clamping force + machining force).

*2 : Figures are for "upper end to lower end" of plunger action.

Hydraulic pressure & support force

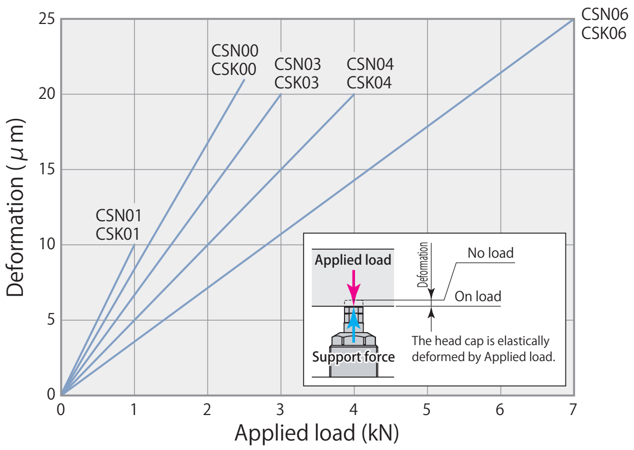


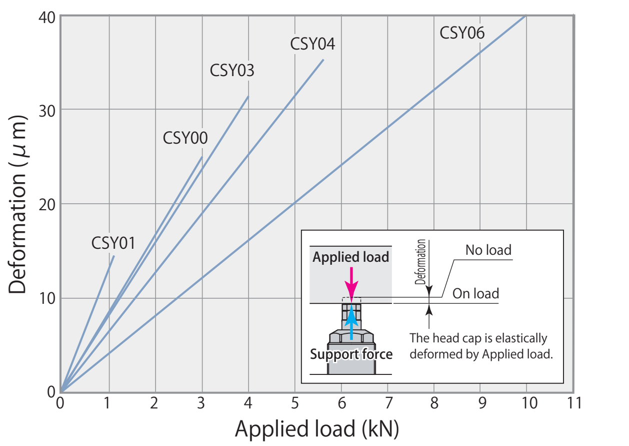


Hydraulic pressure MPa	CSN, CSK support force kN				
	CS□00	CS□01	CS□03	CS□04	CS□06
2.5	0.6	0.3	0.8	1.0	1.8
3.0	0.8	0.3	1.0	1.3	2.3
3.5	1.0	0.4	1.3	1.7	3.0
4.0	1.2	0.5	1.5	2.0	3.5
4.5	1.4	0.6	1.8	2.3	4.1
5.0	1.7	0.7	2.0	2.7	4.7
5.5	1.9	0.8	2.3	3.0	5.3
6.0	2.1	0.8	2.5	3.3	5.9
6.5	2.3	0.9	2.8	3.6	6.4
7.0	2.5	1.0	3.0	4.0	7.0

Hydraulic pressure MPa	CSY support force kN				
	CSY00	CSY01	CSY03	CSY04	CSY06
2.5	0.8	0.3	1.0	1.4	2.5
3.0	1.0	0.4	1.3	1.8	3.3
3.5	1.3	0.5	1.7	2.3	4.2
4.0	1.5	0.6	2.0	2.8	5.0
4.5	1.8	0.7	2.3	3.2	5.8
5.0	2.0	0.8	2.7	3.7	6.7
5.5	2.3	0.9	3.0	4.1	7.5
6.0	2.5	1.0	3.3	4.6	8.3
6.5	2.8	1.1	3.7	5.0	9.2
7.0	3.0	1.2	4.0	5.5	10.0

Applied load & deformation





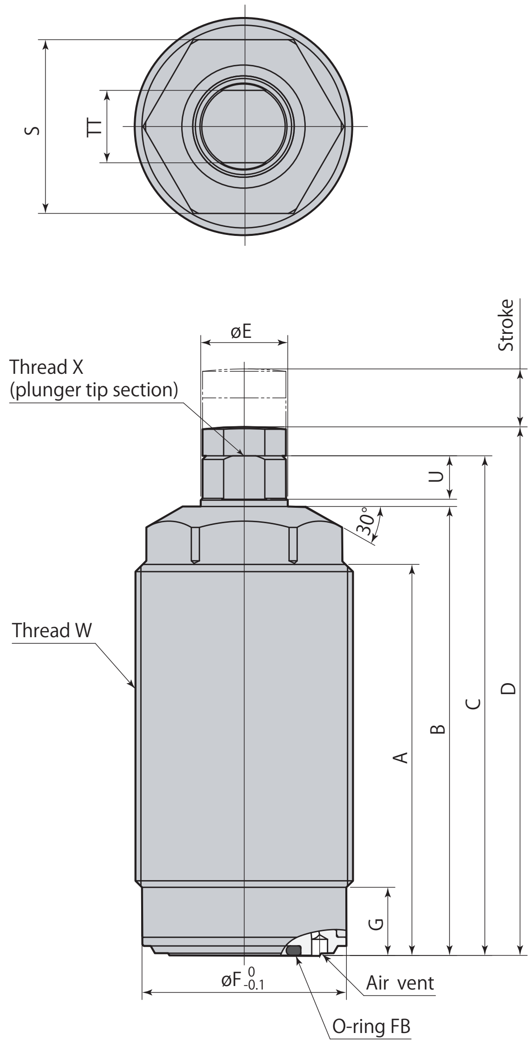
Applied load kN	CSN, CSK deformation μm				
	CS□00	CS□01	CS□03	CS□04	CS□06
0	0	0	0	0	0
1	8.4	10	6.7	5	3.6
2	16.8		13.3	10	7.1
3			20	15	10.7
4				20	14.3
5		Nonusable range			17.9
6					21.4
7					25

Held with hydraulic pressure of 7 MPa.

Applied load kN	CSY deformation μm				
	CSY00	CSY01	CSY03	CSY04	CSY06
0	0	0	0	0	0
1	8	12	8	6	4
2	17		16	13	8
3	25		24	19	12
4			32	26	16
5				32	20
6					24
7		Nonusable range			28
8					32
9					36
10					40

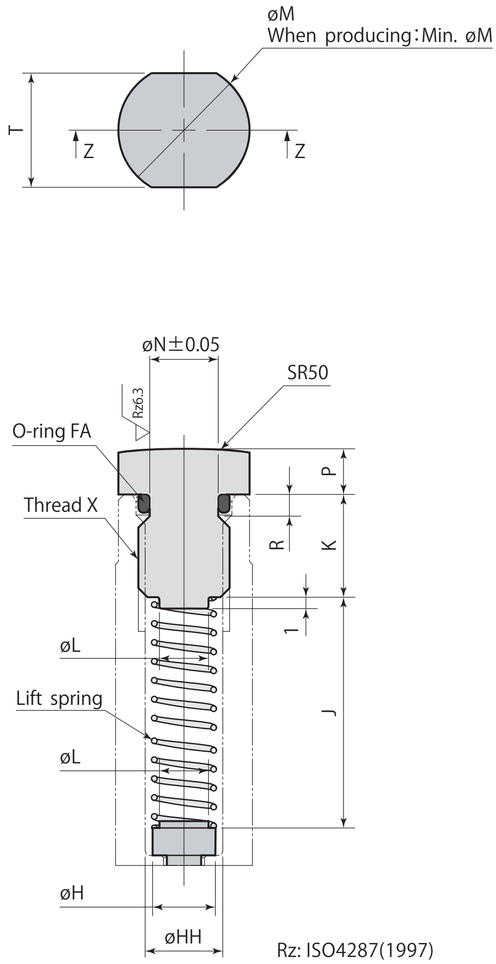
Held with hydraulic pressure of 7 MPa.

Dimensions



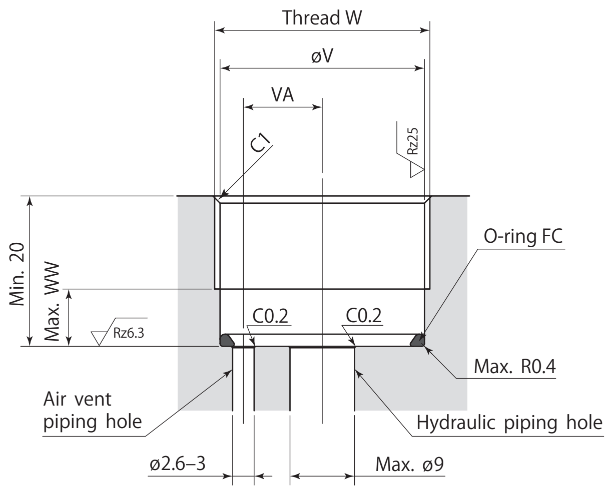
Head cap details

Hardness：HRC52



Z-Z

Mounting details



Rz: ISO4287(1997)

- When fixing the hexagon part of body with a vise, etc., make sure the tightening force is 2.5 kN or less.
- Always attach head cap (lift spring cannot be retained). When fabricating head cap, ensure that O-ring slot, spring spot facing and guide are made by referring to head cap details. Be sure to always use O-ring.
- When fabricating a lift spring, determine dimensions by referring to head cap details. Furthermore, rustproofing must be implemented (however, there is no guarantee for operation).
- Install O-ring FC at the bottom of the hole. The O-ring FC is packed with a work support.
- This diagram indicates a situation where head cap has been fitted into plunger with no pressure applied.

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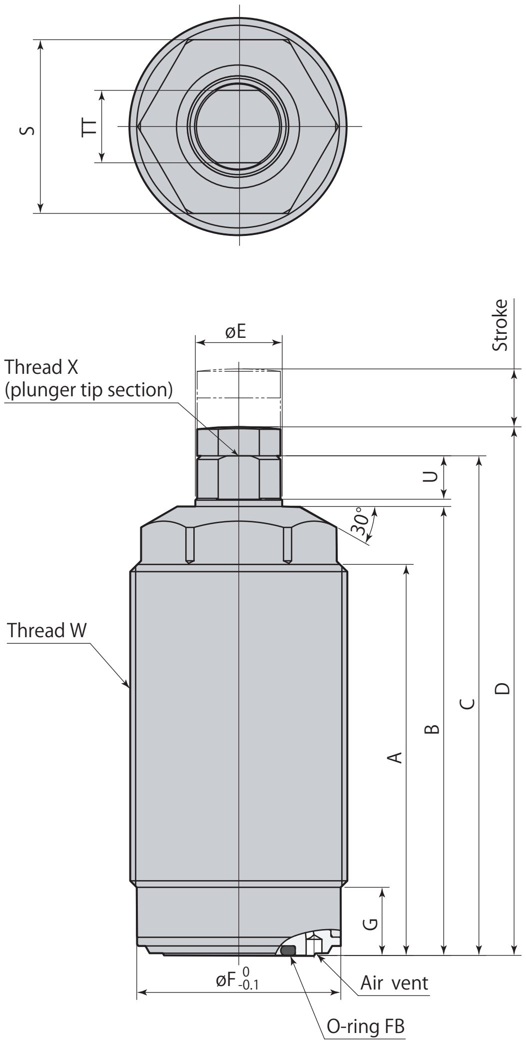
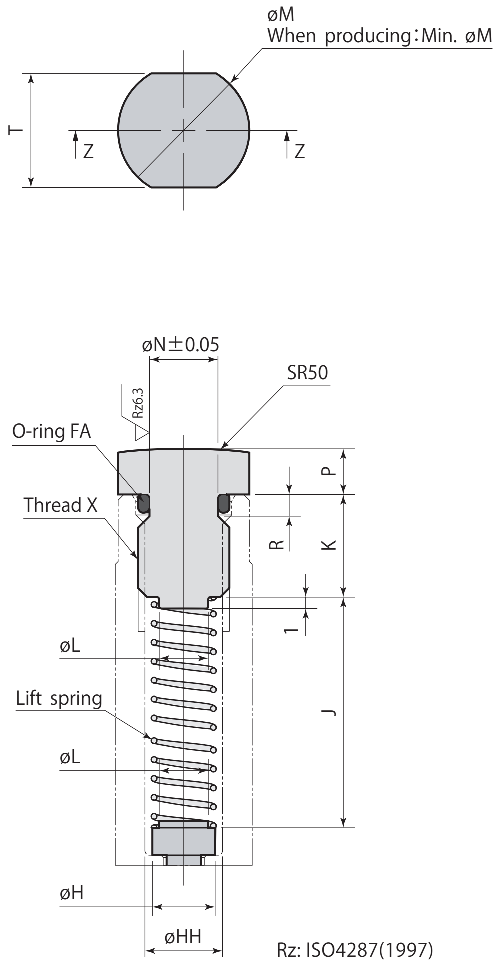
Model	CSN00-□	CSN01-□	CSN03-□	CSN04-□	CSN06-□
A	49	33	54	48	60
B	57	41	62	58	71
C	63	48	69	65	78
D	66	52	73	69	82
øE	10	12	12	15	16
øF	24.3	28.2	28.2	34.2	43.2
G	8.4	9.4	9.4	9.4	9.4
øH	4.5	5.5	5.5	7.2	7.2
øHH	5.1	6.8	6.8	8.5	8.5
J	20.6	11.2	23.2	24.1	32.5
K	7.5	9	9	9	9
øL	3.5	4.3	4.3	5	5
øM	9.5	11.5	11.5	12.5	12.5
Min. øM	8.5	10	10	12.5	12.5
øN	4.5	6	6	7.8	7.8
P	3	4	4	4	4
R	1.5	1.9	1.9	1.9	1.9
S	22	24	24	30	36
T (width across flats)	8	10	10	11	11
TT (plunger width across flats)	8	10	10	13	13
U	5	6	6	6	6
øV	24.5	28.5	28.5	34.5	43.5
VA	9	11	11	13	16
W	M26×1.5	M30×1.5	M30×1.5	M36×1.5	M45×1.5
WW	8	9	9	9	9
X (recommended tightening torque)	M6×1 depth 9 (10 N·m)	M8×1.25 depth 12 (20 N·m)	M8×1.25 depth 12 (20 N·m)	M10×1.5 depth 11 (30 N·m)	M10×1.5 depth 11 (30 N·m)
O-ring FA (fluorocarbon hardness Hs70)	S5	S6	S6	S8	S8
O-ring FB (fluorocarbon hardness Hs90)	AS568-013	AS568-014	AS568-014	AS568-014	AS568-015
O-ring FC (fluorocarbon hardness Hs90)	AS568-020	AS568-022	AS568-022	AS568-026	AS568-030

Dimensions



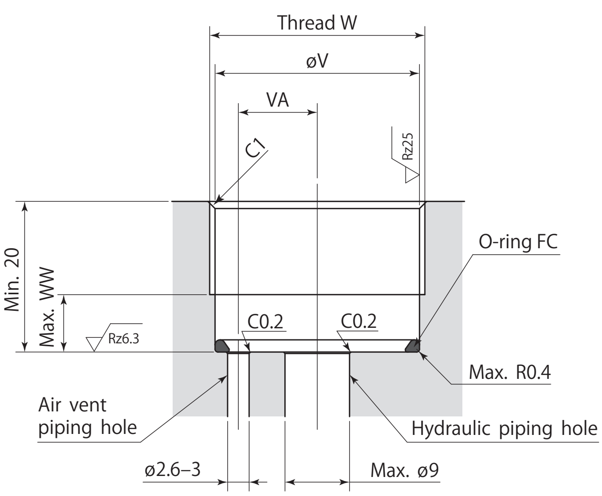
Head cap details

Hardness：HRC52



Z-Z

Mounting details



Rz: ISO4287(1997)

- When fixing the hexagon part of body with a vise, etc., make sure the tightening force is 2.5 kN or less.
- Always attach head cap (lift spring cannot be retained). When fabricating head cap, ensure that O-ring slot, spring spot facing and guide are made by referring to head cap details. Be sure to always use O-ring.
- When fabricating a lift spring, determine dimensions by referring to head cap details. Furthermore, rustproofing must be implemented (however, there is no guarantee for operation).
- Install O-ring FC at the bottom of the hole. The O-ring FC is packed with a work support.
- This diagram indicates a situation where head cap has been fitted into plunger with no pressure applied.

mm

Model	CSY00-□	CSY01-□	CSY03-□	CSY04-□	CSY06-□
A	49	33	54	48	60
B	57	41	62	58	71
C	63	48	69	65	78
D	66	52	73	69	82
øE	10	12	12	15	16
øF	24.3	28.2	28.2	34.2	43.2
G	8.4	9.4	9.4	9.4	9.4
øH	4.5	5.5	5.5	7.2	7.2
øHH	5.1	6.8	6.8	8.5	8.5
J	20.6	11.2	23.2	24.1	32.5
K	7.5	9	9	9	9
øL	3.5	4.3	4.3	5	5
øM	9.5	11.5	11.5	12.5	12.5
Min. øM	8.5	10	10	12.5	12.5
øN	4.5	6	6	7.8	7.8
P	3	4	4	4	4
R	1.5	1.9	1.9	1.9	1.9
S	22	24	24	30	36
T (width across flats)	8	10	10	11	11
TT (plunger width across flats)	8	10	10	13	13
U	5	6	6	6	6
øV	24.5	28.5	28.5	34.5	43.5
VA	9	11	11	13	16
W	M26×1.5	M30×1.5	M30×1.5	M36×1.5	M45×1.5
WW	8	9	9	9	9
X (recommended tightening torque)	M6×1 depth 9 (10 N·m)	M8×1.25 depth 12 (20 N·m)	M8×1.25 depth 12 (20 N·m)	M10×1.5 depth 11 (30 N·m)	M10×1.5 depth 11 (30 N·m)
O-ring FA (fluorocarbon hardness Hs70)	S5	S6	S6	S8	S8
O-ring FB (fluorocarbon hardness Hs90)	AS568-013	AS568-014	AS568-014	AS568-014	AS568-015
O-ring FC (fluorocarbon hardness Hs90)	AS568-020	AS568-022	AS568-022	AS568-026	AS568-030

Air sensor unit

Supplier and model	ISA3-G series manufactured by SMC
	GPS2-05, GPS3-E series manufactured by CKD
Air supply pressure	0.1 MPa
Inner diameter of piping	ø4 mm
Overall piping length	5 m or less

- Air supply to air sensor unit should be provided to the air vent port. Supplied air should be dried and filtered with particulate size 5 μm or less.
- 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.
- 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.
- When performing workpiece contact detection for multiple workpieces (in parallel fittings) using one air sensor, consider detection range of air sensor before determining the number of workpiece contacts to be detected.
- Setting air pressure that exceeds air pressure range results in leaking of air from scraper and accurate detection will not be possible.
- If the lowering operation slows down due to air pressure, stop air supply during lowering operation.

Workpiece contact force

Workpiece contact force (lift spring + air pressure lift) is exerted onto workpiece during workpiece setting. Lift spring force varies according to the stroke used. Use following formula to obtain lift spring force:

Lift spring force calculation formula $Ps = P1 - (P1 - P2) \times D2/D1$

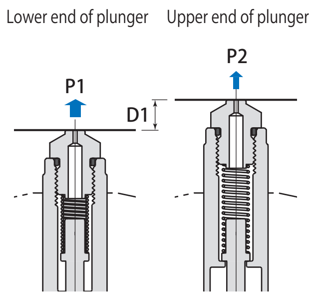
Example: model CSN03-LB using stroke of 5 mm:
Lift spring force = 4-(4-2)×5/8 = 2.75 (N)

Workpiece contact force varies according to the air pressure used. Use following formula to obtain workpiece contact force:

Workpiece contact force calculation formula $P = Ps + \eta \times Pa$

Example: model CSN03-LB using stroke of 5 mm and air pressure of 0.05 MPa,
Workpiece contact force = 2.75+110×0.05 = 8.25 (N)

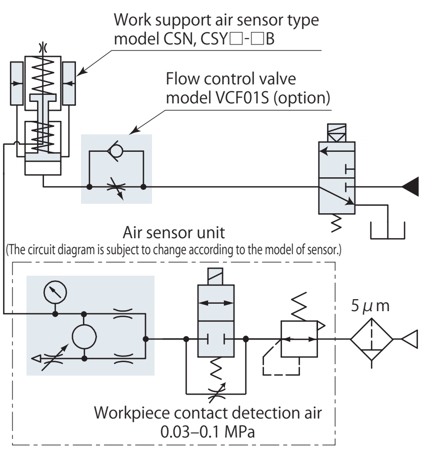
P1 : Lift spring force at lower end (N)
P2 : Lift spring force at upper end (N)
D1: Full stroke (mm)
D2: Used stroke (mm)
Ps : Lift spring force (N)
η : Push up coefficient (refer to table below)
Pa : Air pressure (MPa)
P : Workpiece contact force (N)



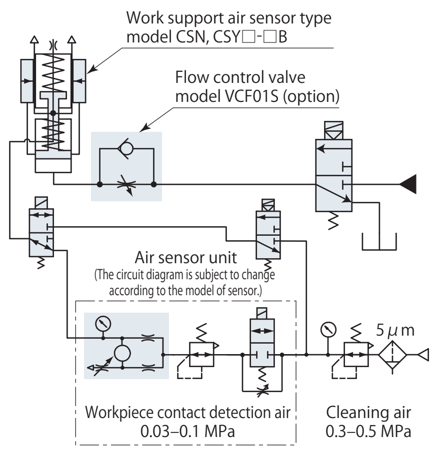
The workpiece contact force varies depending on sliding resistance of scraper. Use calculated figures only as reference.
Refer to **page →348** for specification list for details on lift spring force.

Model		CSN00-□B	CSN01-□B	CSN03-□B	CSN04-□B	CSN06-□B
		CSY00-□B	CSY01-□B	CSY03-□B	CSY04-□B	CSY06-□B
Air pressure range	MPa	0.03–0.1				
Plunger stroke	mm	6.5	6	8	8	10
Push up coefficient η		80	110		180	200

Air sensor & hydraulic circuit diagram

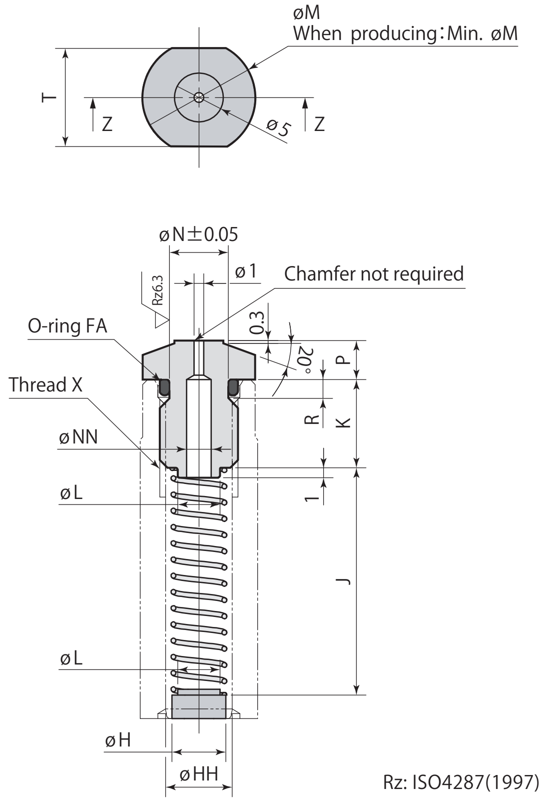


Air sensor & air cleaning & hydraulic circuit diagram



Air sensor head cap details

Hardness：HRC52



Z-Z

- Workpiece contact detection is not possible merely by replacing head cap of standard work support.
- This diagram indicates a situation where head cap has been fitted into plunger with no pressure applied.

mm

Model	CSN00-□B CSY00-□B	CSN01-□B CSY01-□B	CSN03-□B CSY03-□B	CSN04-□B CSY04-□B	CSN06-□B CSY06-□B
øH	4.5	5.5		7.2	
øHH	5.1	6.8		8.5	
J	20.6	11.2	23.2	24.1	32.5
K	7.5	9		9	
øL	3.5	4.3		5	
øM	9.5	11.5		12.5	
Min. øM	8.5	10		12.5	
øN	4.5	6		7.8	
øNN	2.5	2.5		3.4	
P	3	4		4	
R	1.5	1.9		1.9	
T (width across flats)	8	10		11	
X (recommended tightening torque)	M6×1 depth 9 (10 N·m)	M8×1.25 depth 12 (20 N·m)		M10×1.5 depth 11 (30 N·m)	
O-ring FA (fluorocarbon hardness Hs70)	S5	S6		S8	

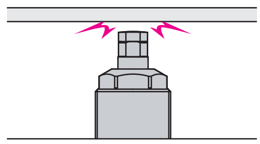
Caution in use

- The lift spring in the plunger may push the workpiece upward if it is light weight and seating detection cannot be complete. Review the weight of workpiece or lift spring force and make it appropriate to seat the workpiece perfectly and acutate the work support.

- Set the plunger lifting time to 0.5 seconds or longer by adjusting the flow control valve with check valve (meter-in). Reasonable plunger ascending speed can prevent the parts from breakage also curbs plunger contact false.
Use a flow control valve with cracking pressure of 0.05MPa or less, in order to shorten plunger descending speed.
(Cracking pressure of optional flow control valve model VCF01S is 0.04 MPa.)

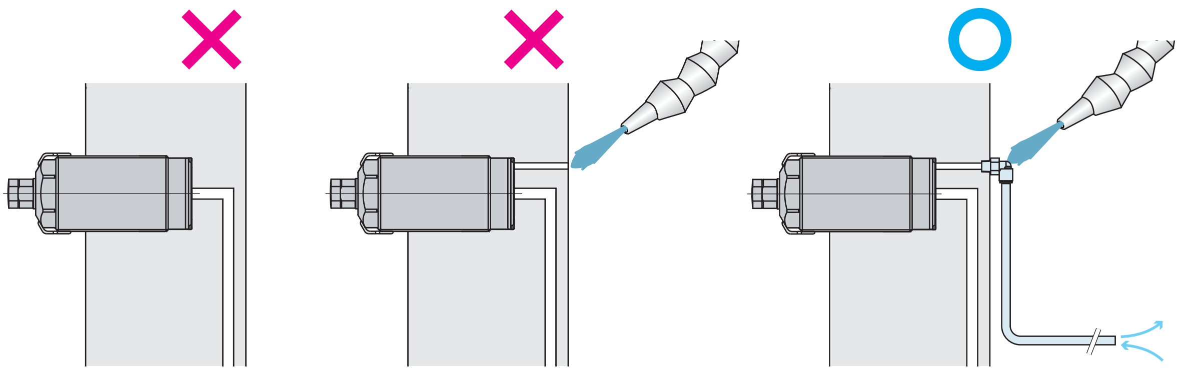
If the plunger ascends to reach a workpiece too fast, it rebounds after hitting the workpiece and will create a small clearance between the two. The clearance may cause a supporting fault of the workpiece.

Rebound and clearance



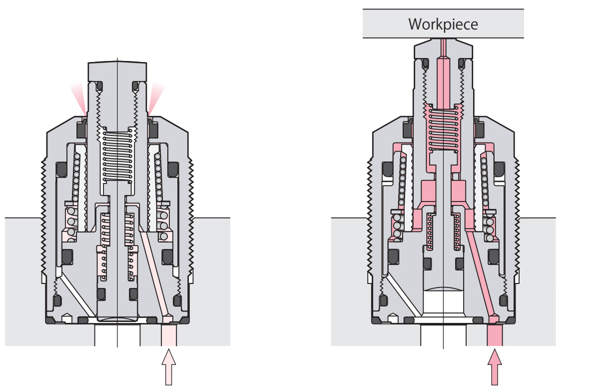
- Avoid following usages. These may cause sleeve deformation that could lead to malfunction of plunger or decreased support force.
  - ×Applying eccentric load on plunger.
  - ×Applying load that exceeds rated support force.
  - ×Rotating plunger when locked.

- Air vent must be opened to atmosphere. Any blockage on the vent results in malfunction. Provide the piping if there is a risk of coolant or metal chips intrusion. Allowing intrusion of cutting fluid may cause rusting and other problems.

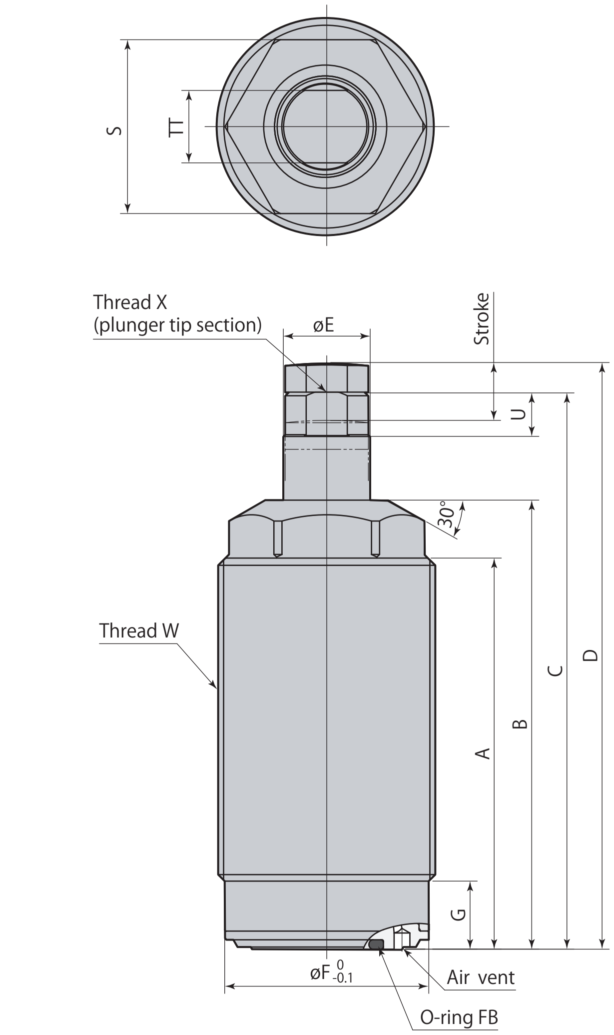


Air vent is blocked | Cutting fluid intrusion from air vent | Piping to metal chips or coolant free area

- Air (oil free) must be fed through a 5μm filter that is connected to an air vent port for air cleaning or workpiece contact detection (air sensor).
Perform air cleaning only when replacing workpiece. Plunger will rise during air cleaning.

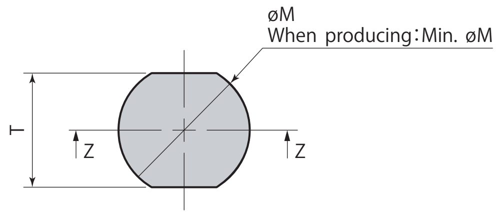


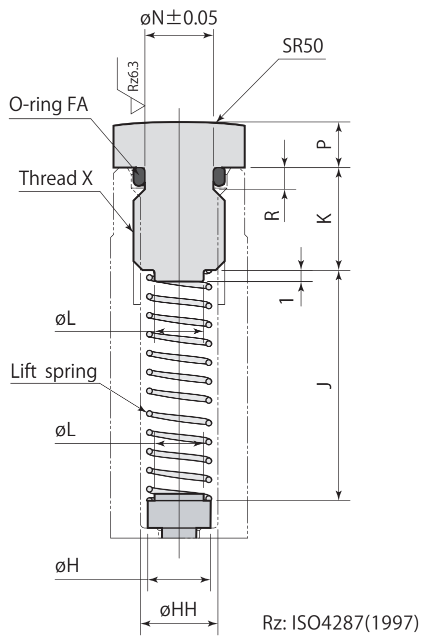
Dimensions



Head cap details

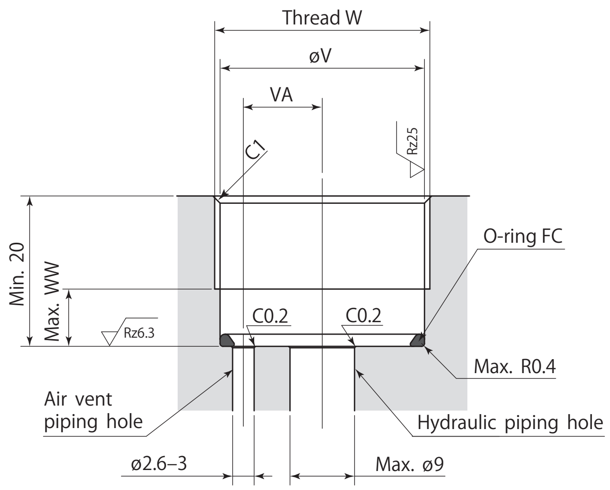
Hardness：HRC52





Z-Z

Mounting details



Rz: ISO4287(1997)

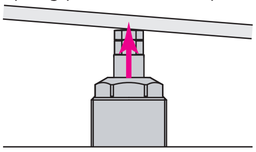
- When fixing the hexagon part of body with a vise, etc., make sure the tightening force is 2.5 kN or less.
- Always attach head cap (lift spring cannot be retained). When fabricating head cap, ensure that O-ring slot, spring spot facing and guide are made by referring to head cap details. Be sure to always use O-ring.
- When fabricating a lift spring, determine dimensions by referring to head cap details. Furthermore, rustproofing must be implemented (however, there is no guarantee for operation).
- Install O-ring FC at the bottom of the hole. The O-ring FC is packed with a work support.
- This diagram indicates a situation where head cap has been fitted into plunger with no pressure applied.

mm

Model	CSK00-□	CSK01-□	CSK03-□	CSK04-□	CSK06-□
A	49	33	54	48	60
B	57	41	62	58	71
C	69.5	54	77	73	88
D	72.5	58	81	77	92
øE	10	12	12	15	16
øF	24.3	28.2	28.2	34.2	43.2
G	8.4	9.4	9.4	9.4	9.4
øH	4.5	5.5	5.5	7.2	7.2
øHH	5.1	6.8	6.8	8.5	8.5
J	20.6	11.2	23.2	24.1	32.5
K	7.5	9	9	9	9
øL	3.5	4.3	4.3	5	5
øM	9.5	11.5	11.5	12.5	12.5
Min. øM	8.5	10	10	12.5	12.5
øN	4.5	6	6	7.8	7.8
P	3	4	4	4	4
R	1.5	1.9	1.9	1.9	1.9
S	22	24	24	30	36
T (width across flats)	8	10	10	11	11
TT (plunger width across flats)	8	10	10	13	13
U	5	6	6	6	6
øV	24.5	28.5	28.5	34.5	43.5
VA	9	11	11	13	16
W	M26×1.5	M30×1.5	M30×1.5	M36×1.5	M45×1.5
WW	8	9	9	9	9
X (recommended tightening torque)	M6×1 depth 9 (10 N·m)	M8×1.25 depth 12 (20 N·m)	M8×1.25 depth 12 (20 N·m)	M10×1.5 depth 11 (30 N·m)	M10×1.5 depth 11 (30 N·m)
O-ring FA (fluorocarbon hardness Hs70)	S5	S6	S6	S8	S8
O-ring FB (fluorocarbon hardness Hs90)	AS568-013	AS568-014	AS568-014	AS568-014	AS568-015
O-ring FC (fluorocarbon hardness Hs90)	AS568-020	AS568-022	AS568-022	AS568-026	AS568-030

Caution in use

● If the workpiece is light weight, the plunger cannot be pressed down by the weight of workpiece and seating detection cannot be complete. Review the weight of workpiece or lift spring force to make the workpiece seat perfectly, and lock the work support.



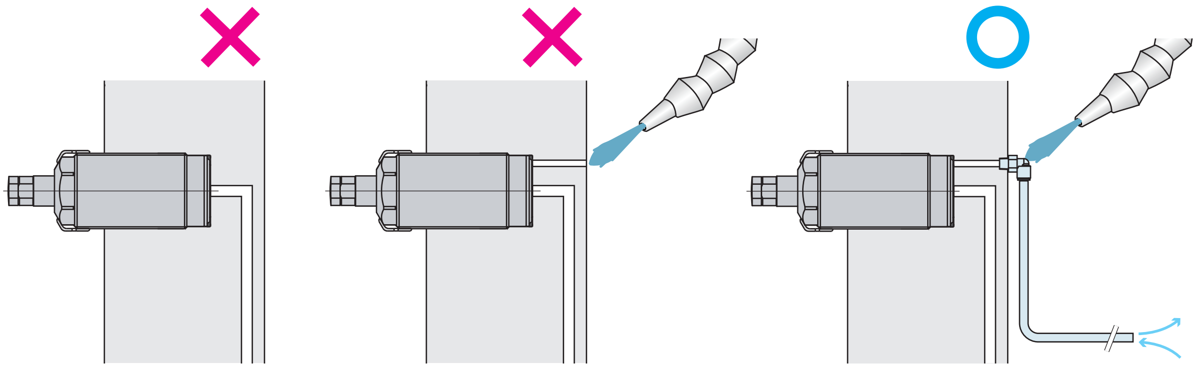
● Avoid following usages. These may cause sleeve deformation that could lead to malfunction of plunger or decreased support force.

× Applying eccentric load on plunger.

× Applying load that exceeds rated support force.

× Rotating plunger when locked.

● Air vent must be opened to atmosphere. Any blockage on the vent results in malfunction. Provide the piping if there is a risk of coolant or metal chips intrusion. Allowing intrusion of cutting fluid may cause rusting and other problems.



● Air (oil free) must be fed through a 5 μm filter that is connected to an air vent port for air cleaning. Perform air cleaning only when replacing workpiece.

7MPa Hydraulic lift (flange)

model **CSU**

Plunger operation: Hydraulic lift
Mounting: Upper flange
Lock mechanism: Taper sleeve
Air sensor: Capable

Support force
5, 7, 10, 16, 25 kN

Page →328

7MPa Support force enhanced (flange)

model **CSU-H**

Plunger operation: Hydraulic lift
Mounting: Upper flange
Lock mechanism: Taper sleeve
Air sensor: Incapable

Support force
7, 10, 14, 23, 36 kN

Page →328

7MPa Spring lift (flange)

model **CST**

Plunger operation: Spring lift
Mounting: Upper flange
Lock mechanism: Taper sleeve
Air sensor: Incapable

Support force
5, 7, 10, 16, 25 kN

Page →329

7MPa Hollow type

model **CST-C**

Plunger operation: Customers range
Mounting: Upper flange
Lock mechanism: Taper sleeve
Air sensor: Incapable

Support force
4, 5.6, 8, 12.8, 20 kN

Refer to separate materials for details.

7MPa Support force enhanced (thread)

model **CSY**

Plunger operation: Hydraulic lift
Mounting: Threaded body
Lock mechanism: Taper sleeve
Air sensor: Capable

Support force
1.2, 3, 4, 5.5, 10 kN

Page →344

7MPa Long stroke

model **CSY-S**

Plunger operation: Hydraulic lift
Mounting: Threaded body
Lock mechanism: Taper sleeve
Air sensor: Capable

Support force
3, 4, 5.5, 10 kN

Refer to separate materials for details.

7MPa Hydraulic lift (thread)

model **CSN**

Plunger operation: Hydraulic lift
Mounting: Threaded body
Lock mechanism: Taper sleeve
Air sensor: Capable

Support force
1, 2.5, 3, 4, 7 kN

Page →344

7MPa Double acting

model **CSN-D**

Plunger operation: Double acting
Mounting: Threaded body
Lock mechanism: Taper sleeve
Air sensor: Capable

Support force
1, 3, 4, 7 kN

Refer to separate materials for details.

7MPa Spring lift (thread)

model **CSK**

Plunger operation: Spring lift
Mounting: Threaded body
Lock mechanism: Taper sleeve
Air sensor: Incapable

Support force
1, 2.5, 3, 4, 7 kN

Page →345

7MPa Straight sleeve

model **CSM**

Plunger operation: Hydraulic lift
Mounting: Threaded body
Lock mechanism: Straight sleeve
Air sensor: Contact us

Support force
2, 3, 4, 6 kN

Refer to separate materials for details.

Air 1MPa Air lift

model **CSS**

Plunger operation: Air lift
Mounting: Threaded body
Lock mechanism: Taper sleeve
Air sensor: Incapable

Support force
0.8, 1.3, 1.9, 3.5, 5.0 kN

Page →796

Air 1MPa Spring lift

model **CSX**

Plunger operation: Spring lift
Mounting: Threaded body
Lock mechanism: Taper sleeve
Air sensor: Incapable

Support force
0.8, 1.3, 1.9, 3.5, 5.0 kN

Page →797

35MPa Hydraulic lift

model **CSW**

Plunger operation: Hydraulic lift
Mounting: Threaded body
Lock mechanism: Straight sleeve
Air sensor: Incapable

Support force
7.1, 11.1, 17.8, 26.7 kN

Page →928

35MPa Double acting

model **CSW-D**

Plunger operation: Double acting
Mounting: Threaded body
Lock mechanism: Straight sleeve
Air sensor: Capable

Support force
7.1, 11.1, 17.8, 26.7 kN

Page →934

35MPa Spring lift

model **CSV**

Plunger operation: Spring lift
Mounting: Threaded body
Lock mechanism: Straight sleeve
Air sensor: Incapable

Support force
7.1, 11.1, 17.8, 26.7 kN

Page →940

Specifications

CSP

Size

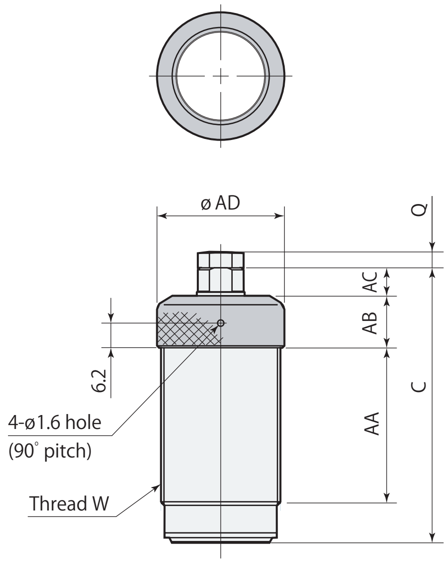
- **00** : CS □ 00
- **(Nil)** : CS □ 01, 03
- **02** : CS □ 04
- **06** : CS □ 06

–

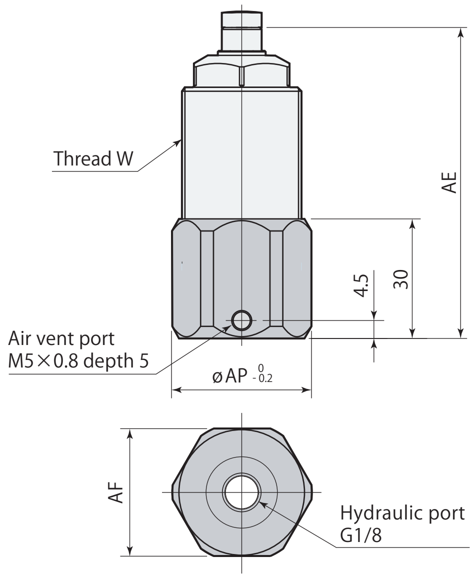
- **A** : Chip cover*
- **C** : Piping cap

*: To be used as a protection cover for hexagonal part of upper part against accumulation of metal chips.

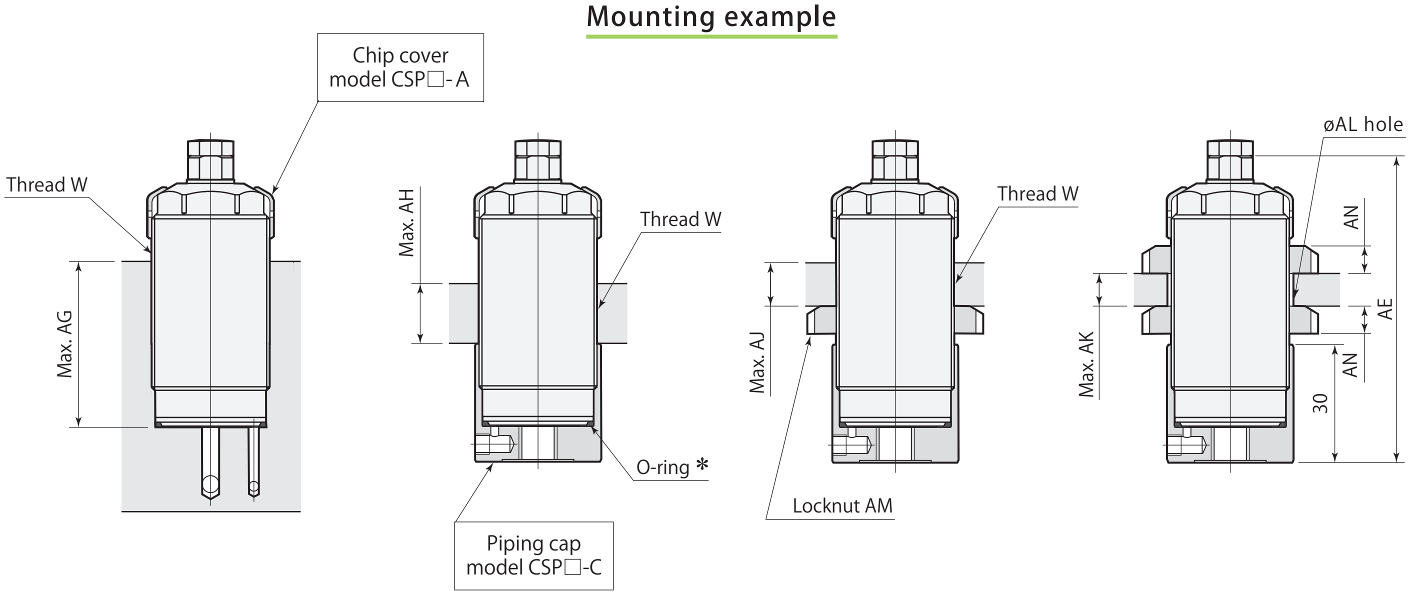
Chip cover



Piping cap



Mounting example



*: Install O-ring in the same way even when a piping cap is used for mounting. The O-ring is included in the package of the work support.

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Chip cover	CSP00-A	CSP-A		CSP02-A	CSP06-A
Work support	CS□00-□	CS□01-□	CS□03-□	CS□04-□	CS□06-□
C*	63	48	69	65	78
Q	3	4	4	4	4
W	M26×1.5	M30×1.5	M30×1.5	M36×1.5	M45×1.5
AA	33.7	16.7	37.7	31.7	42.4
AB	13	13	13	15	16
AC	7	8	8	8	9.3
øAD	28	32	32	38	47

∗:Stroke length to be added on C dimension when mounting on model CSK.

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Piping cap	CSP00-C	CSP-C		CSP02-C	CSP06-C
Work support	CS□00-□	CS□01-□	CS□03-□	CS□04-□	CS□06-□
W	M26×1.5	M30×1.5	M30×1.5	M36×1.5	M45×1.5
AE*	72	57	78	74	87
AF (width across flats)	29	32	32	41	50
øAP	32	35	35	45	54

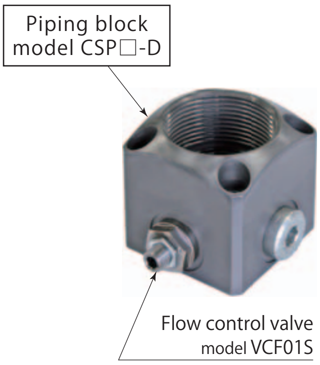
∗:Stroke length to be added on AE dimension when mounting on model CSK.

mm

Chip cover	CSP00-A	CSP-A		CSP02-A	CSP06-A
Piping cap	CSP00-C	CSP-C		CSP02-C	CSP06-C
Work support	CS□00-□	CS□01-□	CS□03-□	CS□04-□	CS□06-□
W	M26×1.5	M30×1.5	M30×1.5	M36×1.5	M45×1.5
AE*	72	57	78	74	87
AG	48	32	53	47	58
AH	26	11	31	25	36
AJ	–	–	24	–	26
AK	–	–	17	–	16
øAL	–	–	30.5	–	45.5
AM	–	–	AN06	–	AN09
AN	–	–	7	–	10

∗:Stroke length to be added on AE dimension when mounting on model CSK.

- The dimensions of AG, AH, AJ and AK are reduced by 6 mm when chip cover is used.
- Locknut AM is not included.



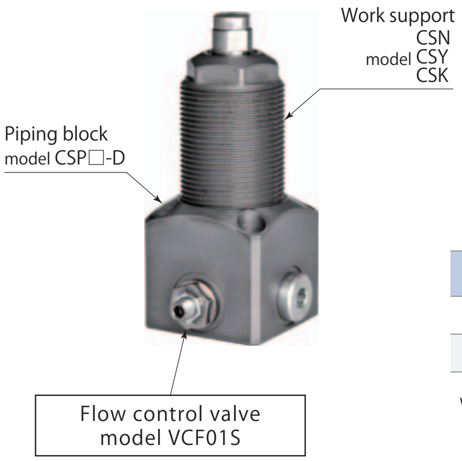
Piping block

Size

CSP –
- **00** : CS □ 00
- **(Nil)** : CS □ 01, 03
- **04** : CS □ 04
- **06** : CS □ 06

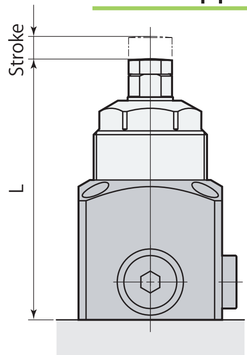
– **D** : Piping block

Plunger lifting operation time can be individually adjusted for work support model CSN & CSY, by using optional piping block model CSP-D and flow control valve model VCF01S.

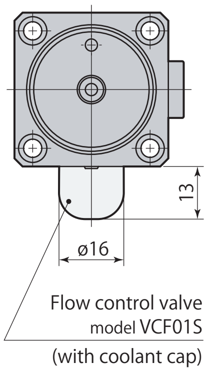


Refer to **page →368** for details.

Work support mounting dimensions



Flow control valve
mounting dimensions

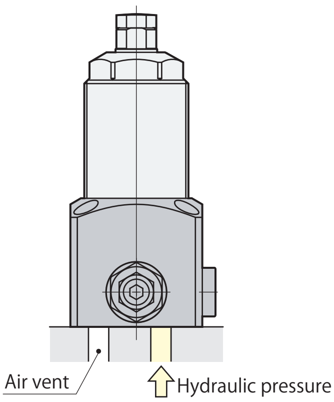


mm

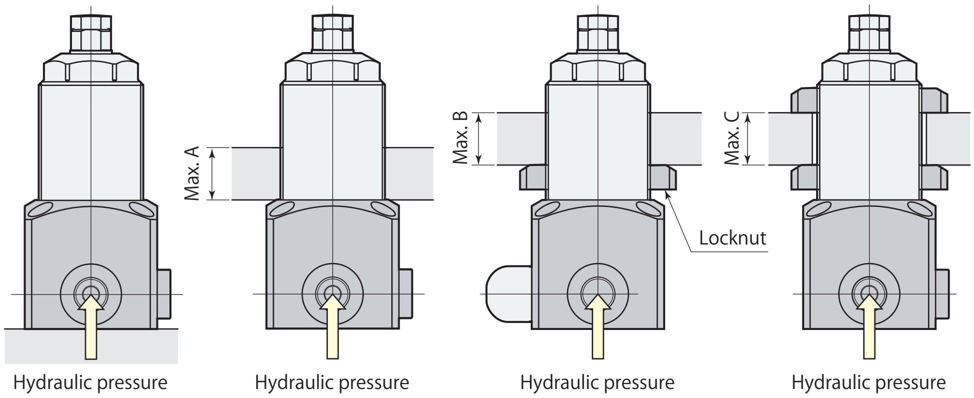
Model	CSP00-D	CSP-D		CSP04-D	CSP06-D
L*	83	69	90	86	99
Stroke	6.5	6	8	8	10
Work support models	CSN00 CSY00 CSK00	CSN01 CSY01 CSK01	CSN03 CSY03 CSK03	CSN04 CSY04 CSK04	CSN06 CSY06 CSK06

*: For model CSK, stroke length shall be added on L.

Manifold piping example



G port piping mounting example

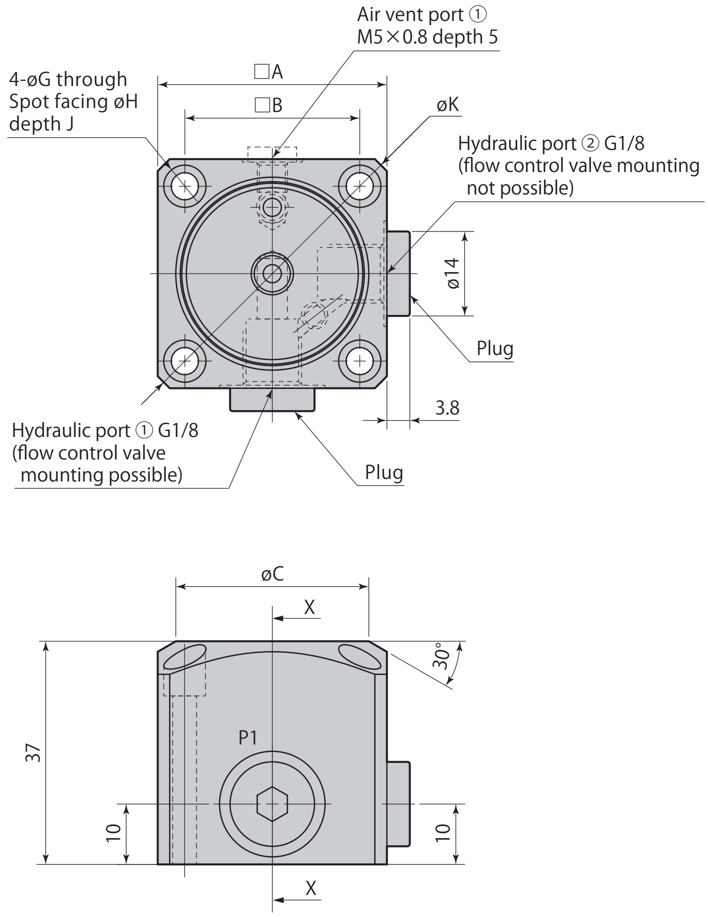


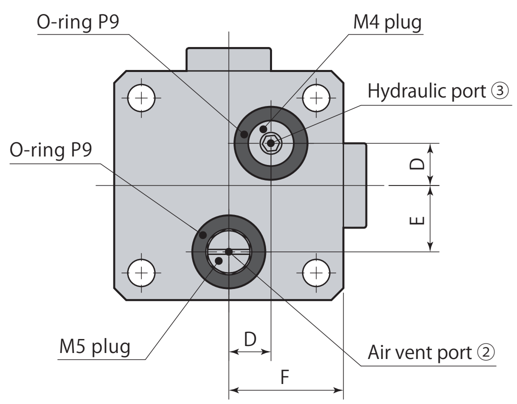
mm

Model	CSP00-D	CSP-D		CSP04-D	CSP06-D
Max. A	27	12	32	26	37
Max. B	–	–	25	–	27
Max. C	–	–	18	–	17
Work support models	CSN00 CSY00 CSK00	CSN01 CSY01 CSK01	CSN03 CSY03 CSK03	CSN04 CSY04 CSK04	CSN06 CSY06 CSK06

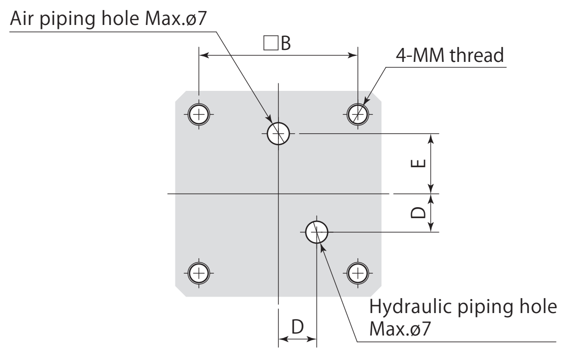
- Locknut is not included.
- Refer to **pages →350** for model CSN, **352** for model CSY, **358** for model CSK and **362**, **365** for the dimensions of products that are not listed on this page.

Dimensions

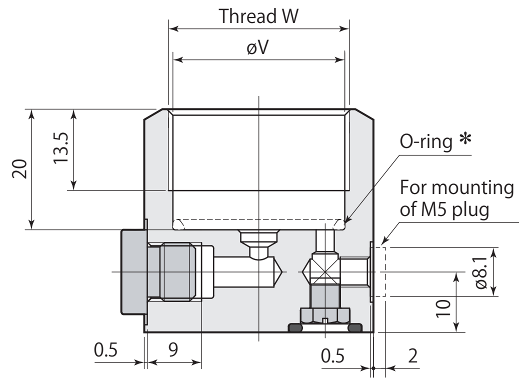




Mounting details



When using for manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).



X-X

∗:Install O-ring in the same way even when a piping block is used for mounting. The O-ring is included in the package of the work support.

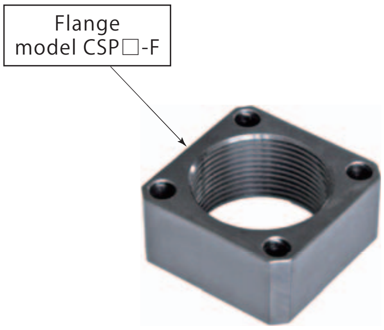
mm

Model	CSP00-D	CSP-D	CSP04-D	CSP06-D
A	36	38	45	55
B	27	29	34	44
øC	29	32	38	50
D	7	7	9	10
E	9	11	13	16
F	18	19	22.5	27.5
øG	4.5	4.5	5.5	5.5
øH	8	8	9	9
J	9	9	12	12
øK	48	50	60	75
MM	M4×0.7	M4×0.7	M5×0.8	M5×0.8
øV	24.5	28.5	34.5	43.5
W	M26×1.5	M30×1.5	M36×1.5	M45×1.5
Mass	0.26 kg	0.28 kg	0.38 kg	0.58 kg
Body tightening torque	35–45 N・m	40–50 N・m	45–55 N・m	55–65 N・m

- Material of O-ring is fluorocarbon (with hardness Hs90).
- Mounting screws are not included.
- Provide the piping if there is a risk of coolant or metal chips intrusion from air vent.
- Remove the plug of fitting port to be used when mounting.
- In case of manifold piping, shift M5 plug from air vent port ② on the bottom face to the air vent port ① on side face.
- No flow control valve can be mounted to hydraulic port ②.

Piping block
CSP

Flange

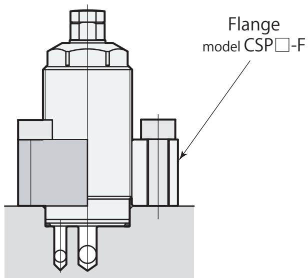


Use a mounting flange when installing with screws.

Size

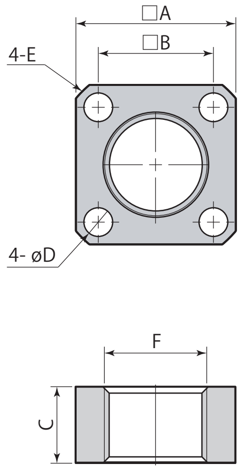
CSP — **026** : CS □ 00 / **030** : CS □ 01, 03 / **036** : CS □ 04 / **045** : CS □ 06 — **F** : Flange

Work support
model **CSN, CSY, CSK**
mounting

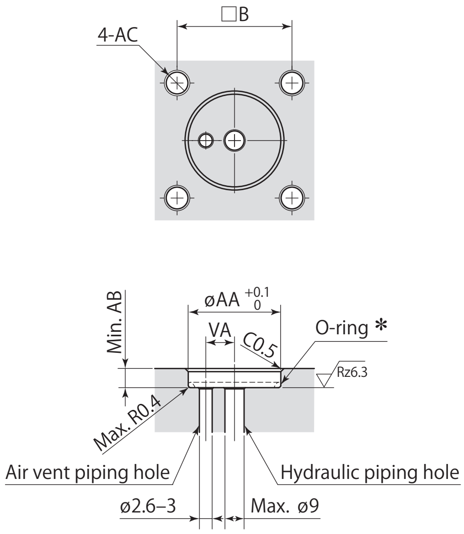


①Mount a flange with screws.
②Screw the work support in the flange.

Dimensions



Mounting details



Rz: ISO4287(1997)

∗ : Install O-ring in the same way even when a flange is used for mounting. The O-ring is included in the package of the work support.

- Mounting screws are not included.
- Refer to **pages →350** for model CSN, **352** for model CSY, **358** for model CSK for the dimensions of products that are not listed on this page.

mm

Model	CSP026-F	CSP030-F	CSP036-F	CSP045-F
A	35	40	50	55
B	26	31	40	42
C	17	16	16	18
øD	5.5	5.5	6.8	9
E	C3	C3	C3	C4
F	M26×1.5	M30×1.5	M36×1.5	M45×1.5
øAA	24.5	28.5	34.5	43.5
AB	3	3	3	3
AC	M5	M5	M6	M8
VA	9	11	13	16
Mass	0.09 kg	0.11 kg	0.18 kg	0.18 kg

Specifications

(Nil) : Meter-in

Body color : Silver

O : Meter-out

Body color : Black

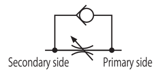
VCF [G port size] – [Control method]

G port size

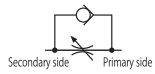
01S	: G1/8
01	: G1/8
02	: G1/4
03	: G3/8

Control method

(Nil) : Meter-in



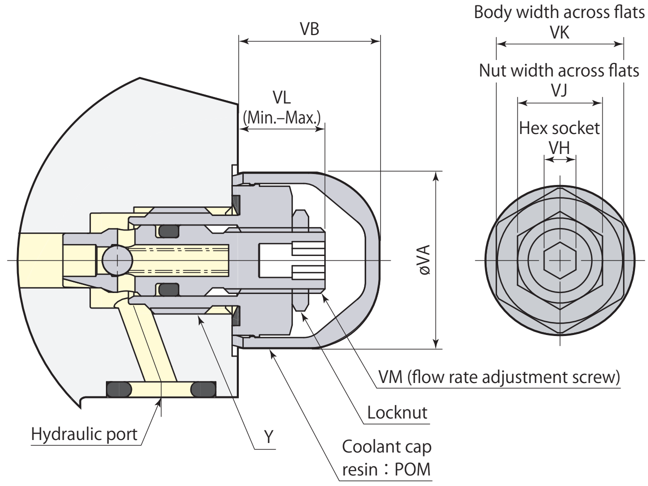
O : Meter-out



Model		Meter-in				Meter-out			
		VCF01S	VCF01	VCF02	VCF03	VCF01S-O	VCF01-O	VCF02-O	VCF03-O
G port size		G1/8	G1/8	G1/4	G3/8	G1/8	G1/8	G1/4	G3/8
Cracking pressure	MPa	0.04	0.04	0.04	0.04	0.1	0.1	0.1	0.1
Orifice area	mm^2	4.9	4.9	9.6	19.6	3.1	3.1	6.2	12.6
Recommended tightening torque	N·m	10	10	30	35	10	10	30	35
Mass	kg	0.011	0.013	0.024	0.038	0.011	0.013	0.024	0.038

- Pressure range : 0.5–7 MPa
- Proof pressure : 10.5 MPa
- Operating temperature : 0–70 ℃
- Fluid used : General mineral based hydraulic oil (ISO-VG32 equivalent)

Dimensions



mm

Model	VCF01S VCF01S-O	VCF01 VCF01-O	VCF02 VCF02-O	VCF03 VCF03-O
Y	G1/8	G1/8	G1/4	G3/8
øVA	16	16	21	24
VB	13	13	13	14
VH	3	3	5	6
VJ	8	8	10	14
VK	12	12	17	19
VL	8–11	7–11	7.5–11.5	8.5–12.5
Adjustment screw number of turns	4 rotations	5.3 rotations	5.3 rotations	5.3 rotations
VM	M6×0.75	M6×0.75	M8×0.75	M10×0.75

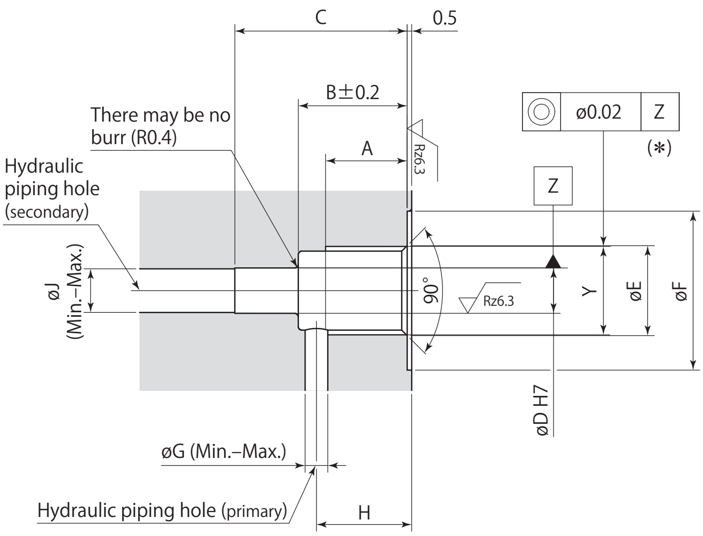
- Use a closed wrench or socket wrench for mounting and dismounting.
- Flow control valve can be mounted on hydraulic port (G port) when manifold piping.
- Adjust flow rate without hydraulic pressure. Conducting adjustments with hydraulic pressure may result in damaging seal.
- Diagram above indicates mounting for meter-in (VCF□).
- VCF is shipped with the valve fully open. Adjust the flow rate by loosening the screws after it is screwed in to close totally. Tighten the locknut after adjustment is completed.

Applicable clamp and work support

Model	VCF01S	VCF01	VCF02	VCF03
Swing clamp (double acting)	CTM03, 04, 05, 06 CTP04, 05, 06	CTM10 CTU01, 02, 04, 06	CTM16 CTU10, 16	CTU25
Swing clamp (single acting)*	CTN02, 04, 05, 06	CTT01, 02, 04, 06	CTN10, 16 CTT10, 16	CTT25
Swivel clamp (double acting)*	CTS04	CTS06	CTS10, 16	–
Link clamp (double acting)	CLM03, 04 CLP04, 05, 06	CLM05, 06, 10 CLU02, 04, 06	CLM16 CLU10, 16	CLU25
Link clamp (single acting)*	CLN04	CLN05, 06 CLT02, 04, 06	CLN10, 16 CLT10, 16	CLT25
Work lift cylinder	CNB01	CNB02, 04	–	–
Push, pull cylinder	–	CNA02, 04, 06	CNA10, 16	CNA25
Work support*	CSU CSP-D(CSN, CSY)	–	–	–

＊: Single acting swing clamp, swivel clamp, single acting link clamp and work support are meter-in only.

Mounting details



Rz: ISO4287(1997)

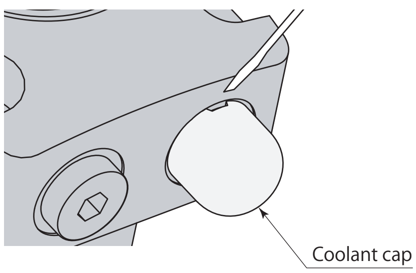
mm

Model	VCF01S VCF01S-O	VCF01 VCF01-O	VCF02 VCF02-O	VCF03 VCF03-O
A	9	9	13	13
B	11	13	18	19
C	15.5	17.5	22.5	23.5
øD	$5^{+0.012}_{0}$	$5^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$
øE	9.9	9.9	13.3	16.8
øF	17.5	17.5	21.5	24.5
øG	1.5–2	2.5–3	3.5–5	5–6
H	9–10	9.5–11.5	14.5–15.5	15–16
øJ	2.5–5	2.5–5	3.5–6	5–8
Y	G1/8	G1/8	G1/4	G3/8

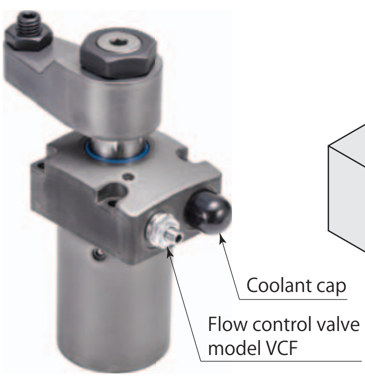
*:Concentricity is required when machining øD and Y-portion thread. Misalignment or machining defect may cause the trouble of installation and adjusting flow rate.

Mounting & dismounting of flow control valve, air bleeding valve

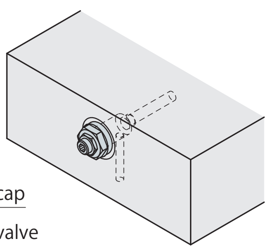
- When mounting or dismounting a flow control valve or air bleeding valve, be sure to set pressure within hydraulic circuit to 0 MPa before starting.
- When mounting a flow control valve or air bleeding valve, be sure to tighten it with the recommended tightening torque.
- When mounting a coolant cap (resin:POM), firmly press the body of cover. If it is not mounting properly, use a plastic mallet to tap it into place.
- When dismounting a coolant cap, use a sharp-pointed tool such as a precision screw driver by hooking the notched portion.



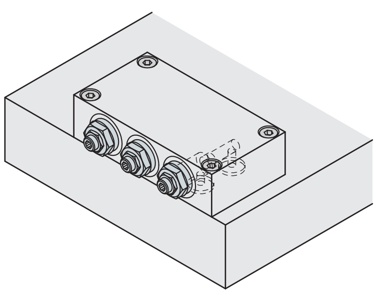
Mounting example



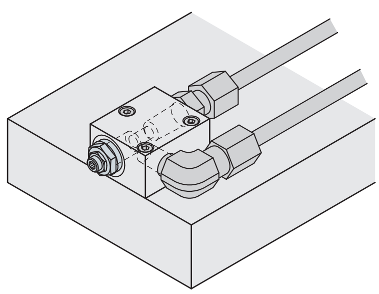
Cylinder mounting



Pallet mounting



Block mounting ①



Block mounting ②

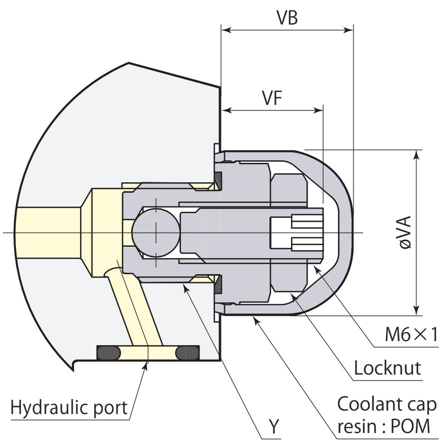
Specifications

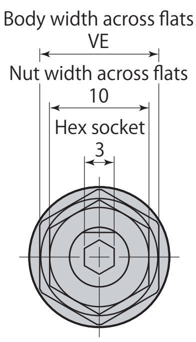
G port size

VCE
- 01 : G1/8
- 02 : G1/4
- 03 : G3/8

Model		VCE01	VCE02	VCE03
G port size		G1/8	G1/4	G3/8
Recommended tightening torque	N·m	10	30	35
Mass	kg	0.017	0.029	0.044
Pressure range	MPa	0–50		
Operating temperature	°C	0–70		
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)		

Dimensions





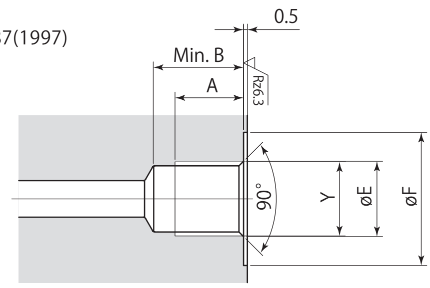
mm

Model	VCE01	VCE02	VCE03
A	9	13	13
B	10	14	14
øE	9.9	13.3	16.8
øF	17.5	21.5	24.5
Y	G1/8	G1/4	G3/8
øVA	16	21	24
VB	13	13	14
VE	12	17	19
VF	10.5	10.5	11.5

- Use a closed wrench or socket wrench for mounting and dismounting.
- Air bleeding valve can be mounted on hydraulic port (G port) when manifold piping.

Mounting details

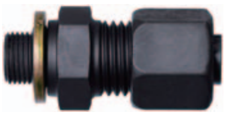
Rz: ISO4287(1997)

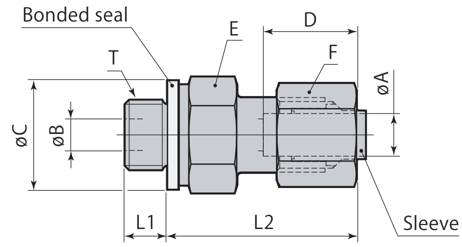


Applicable clamp and work support

Model	VCE01	VCE02	VCE03
Swing clamp (double acting)	CTM03, 04, 05, 06, 10 CTP04, 05, 06 CTU01, 02, 04, 06	CTM16 CTU10, 16	CTU25
Swing clamp (single acting)	CTN02, 04, 05, 06 CTT01, 02, 04, 06	CTN10, 16 CTT10, 16	CTT25
Swivel clamp (double acting)	CTS04, 06	CTS10, 16	–
Link clamp (double acting)	CLM03, 04, 05, 06, 10 CLP04, 05, 06 CLU02, 04, 06	CLM16 CLU10, 16	CLU25
Link clamp (single acting)	CLN04, 05, 06 CLT02, 04, 06	CLN10, 16 CLT10, 16	CLT25
Work lift cylinder	CNB01, 02, 04	–	–
Push, pull cylinder	CNA02, 04, 06	CNA10, 16	CNA25
Work support	CSU CST CSP-D(CSN, CSY, CSK)	–	–

Parallel thread connector

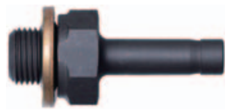




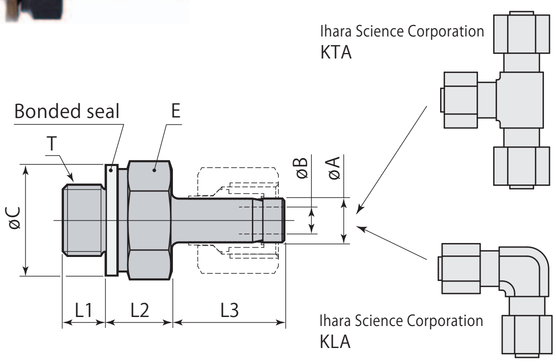
mm

Model	Applicable pipe outer diameter øA	T	øB	øC	D	Width across flats E	Width across flats F	L1	L2
8FKCO06010	6	G1/8	4	17	17.5	14	14	6	32.5
8FKCO08010	8		4	17	17.5	17	17	6	32.5
8FKCO08020	8	G1/4	6	20.5	17.5	19	17	10	33.5
8FKCO10020	10		6	20.5	18.5	19	19	10	34.5
8FKCO10030	10	G3/8	8	24	18.5	22	19	10	35.5
8FKCO12030	12		8	24	18.5	22	22	10	35.5

Parallel thread adaptor



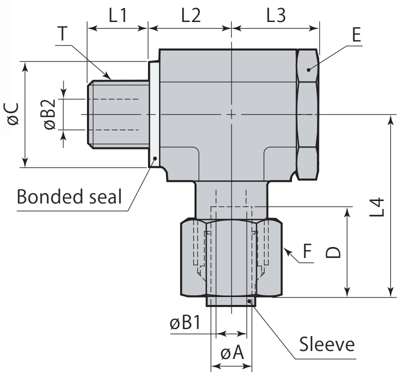
Use NE bite type tube fitting from Ihara Science Corporation on opposite side.



mm

Model	Applicable pipe outer diameter øA	T	øB	øC	Width across flats E	L1	L2	L3
8FKHB06010	6	G1/8	3	17	14	6	9	21
8FKHB08020	8	G1/4	5	20.5	19	10	10	21
8FKHB10020	10		6	20.5	19	10	10	22
8FKHB10030	10	G3/8	6	24	22	10	11	22
8FKHB12030	12		8	24	22	10	11.5	22.5

Stud elbow

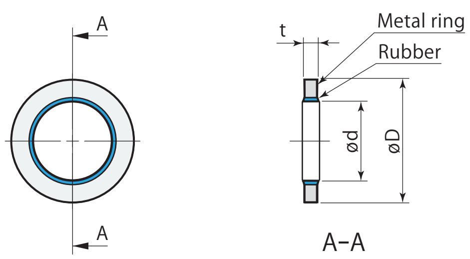


mm

Model	Applicable pipe outer diameter øA	T	øB1	øB2	øC	D	Width across flats E	Width across flats F	L1	L2	L3	L4
8FKMB06010	6	G1/8	4	4	17	17.5	17	14	8	13	14	33.5
8FKMB08020	8	G1/4	6	7	20.5	17.5	22	17	12	16	17	35.5
8FKMB10020	10		8	7	20.5	18.5	22	19	12	16	17	36.5
8FKMB12030	12	G3/8	10	9	24	18.5	27	22	12	19	22	40.5

Bonded seal (spare parts)

Standard material is NBR for rubber and SPCC (cold roll steel) for metal ring.
A bonded seal is usually supplied with a fitting however Pascal sells it alone as a service part.

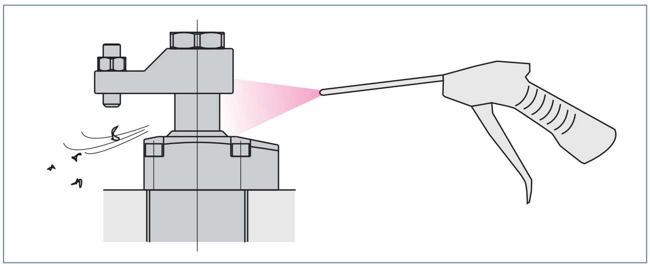


mm

Model	Applicable thread	ød	øD	t
8FKP-C-010	G1/8	9.9	17	2
8FKP-C-020	G1/4	13.3	20.5	2
8FKP-C-030	G3/8	16.8	24	2

- Use a bonded seal to seal flange surface where a fitting will be fitted (do not use O-ring type G thread fitting).
- Use the sleeve KKO from Ihara Science Corporation for the sleeve of fitting.

Caution in use of equipment



1. Clamp and work supports have been developed for the purpose of clamping workpiece for machine tools.
   Do not use them for other purposes.

2. Always protect them with a cover to ensure sliding surfaces are not exposed to weld slags when using them as jig for welding.

3. Clean sliding surfaces and top part of clamp body with air blowing periodically to ensure smooth operations.

Caution for hydraulic piping

1. Most problems that occur with hydraulic equipment are caused by foreign substances such as metal chips and dust that enter into hydraulic circuits. Refer to "Piping Hydraulic & Pneumatic Equipment-Practical Notes" provided with the product for mounting and hydraulic piping of the product.

2. After performing hydraulic piping, always be sure to bleed out air in the hydraulic circuit. Insufficient bleeding can lead to malfunction.

3. When using multiple clamps, operating speeds and timings vary due to variance in pipe resistance and internal resistance of clamps. Adjust operating speeds and timings using flow control valve.

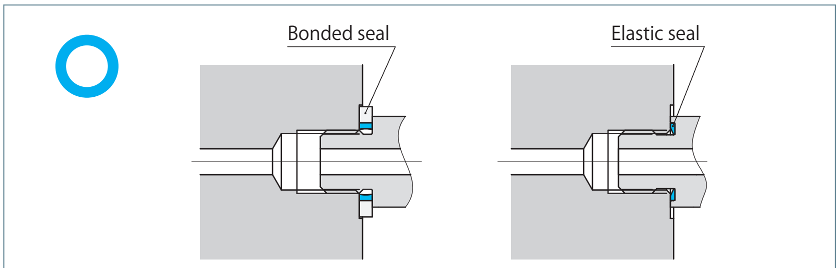
G port sealing method

1. "Sealing method for flange surfaces" has been adopted as standard means for this product. Use fittings and connectors of bonded seal or elastic body seal. Do not use fittings of "Sealing method for tapered surfaces" (O-ring seal method).

2. Seal tapes and liquid packing are not necessary. Seal fittings are included with packing.

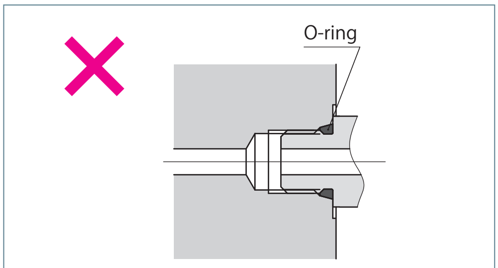
3. When mounting, clean metal chips and dust off surfaces that will come into contact with packing.

Sealing method for flange surfaces



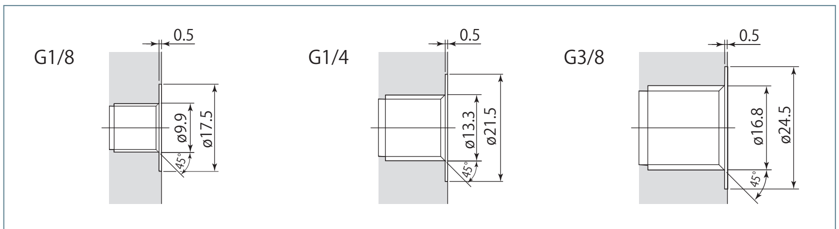
Use bonded seal or elastic seal for flat surfaces.

Sealing method for tapered surfaces



Seal tapered surface with an O-ring.

G port details



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Work positioning cylinder

Double acting 7 MPa

model CEK

X & Y axes positioning model CEK-A

θ axis positioning model CEK-B

X & Y axes positioning

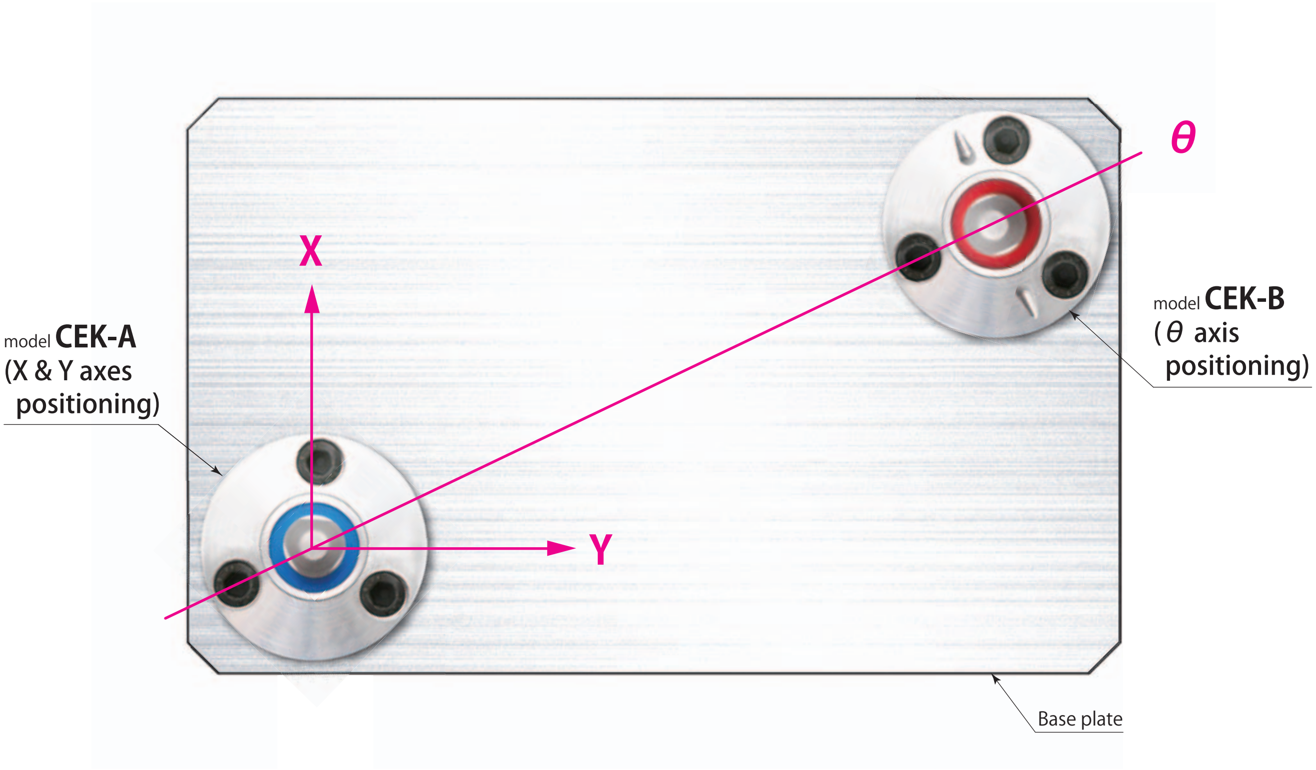
model **CEK-A□** JP PAT.

θ axis positioning

model **CEK-B□** JP PAT.

Enables high accuracy positioning of the workpiece and maintains machining accuracy under between operations.

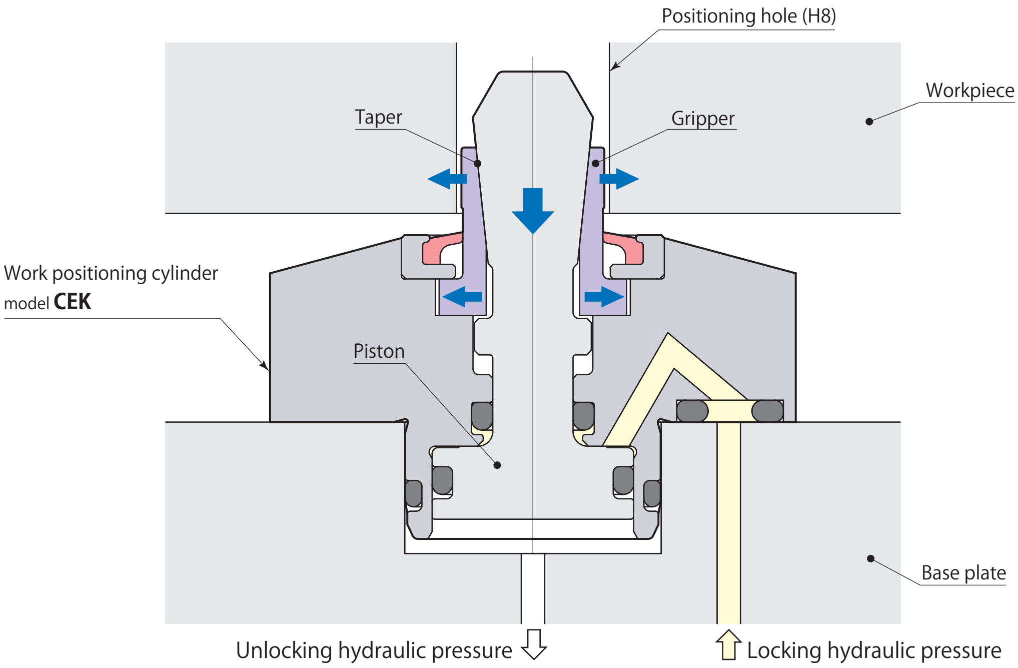
Repeatability : within 5 μm



XY axes and θ axis constraint allow high accuracy positioning.

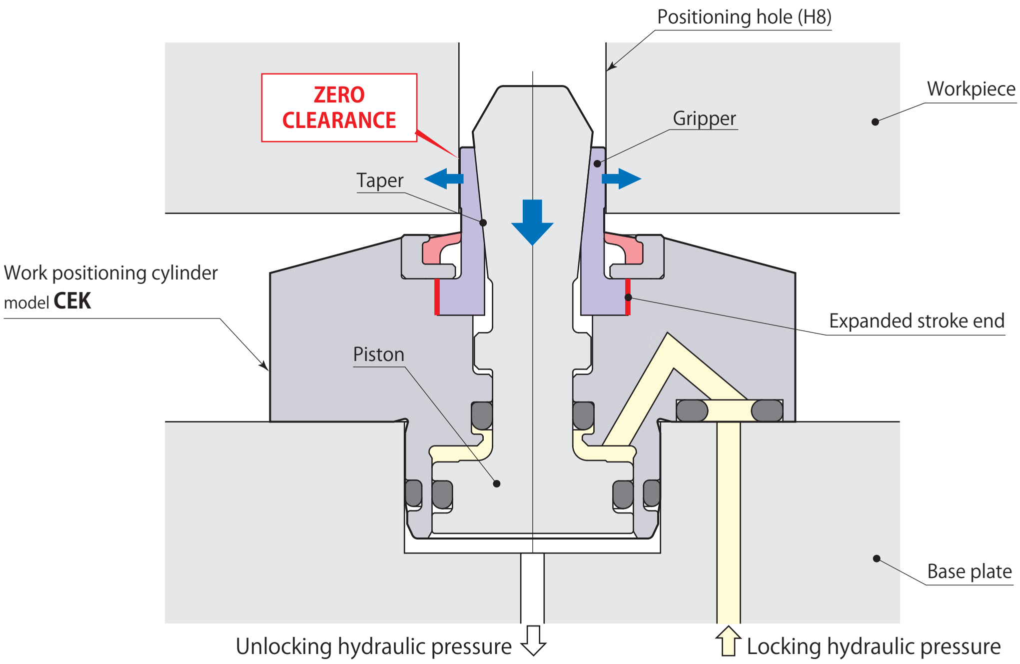
Specifications page → 380
Dimensions page → 382
Mounting details page → 384

Gripper expansion



A piston lowers by locking hydraulic pressure then a gripper expands horizontally along the taper face of the piston.

Workpiece positioning



The gripper deforms elastically in radial direction when it comes to the stroke end and the clearance between hole and the gripper is infilled by the deformation, which ensures accurate positioning.

Work positioning cylinder
CEK

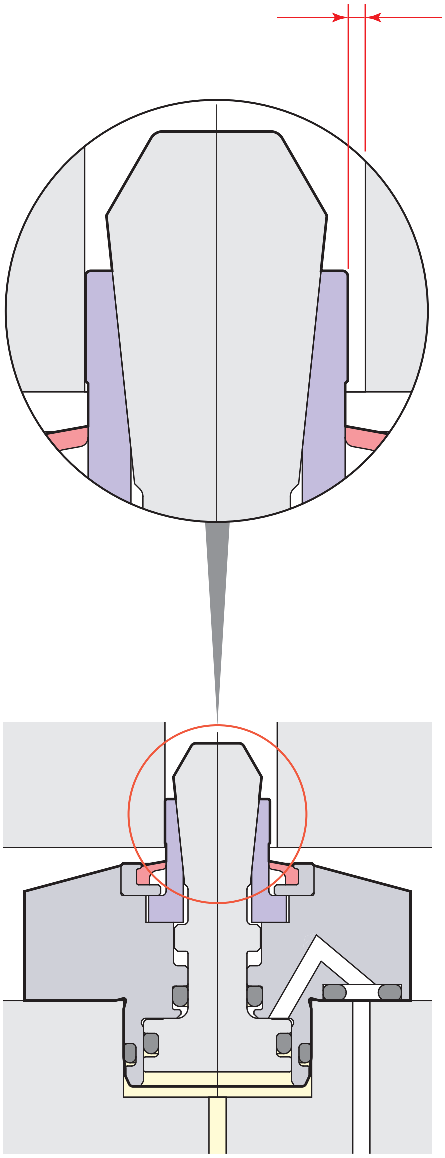
Enables workpiece change smooth

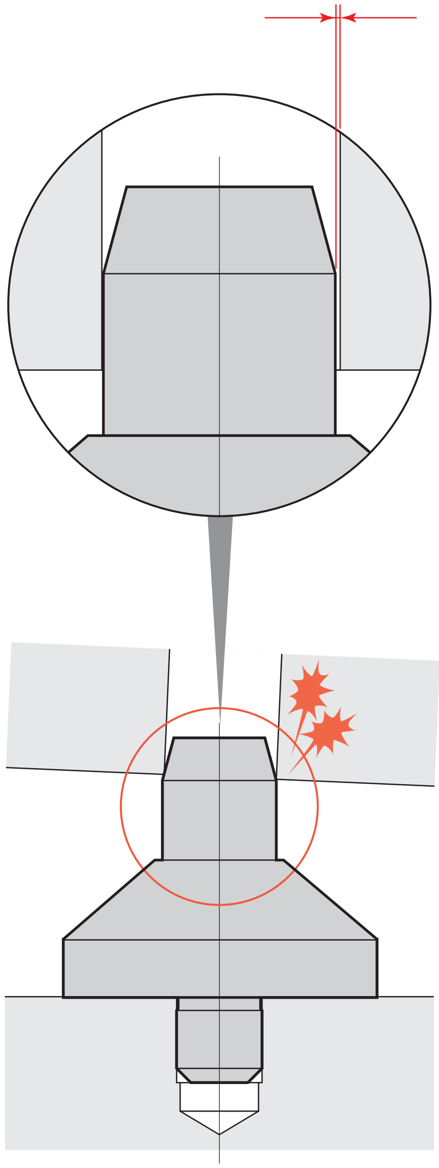
Clearance：0.2mm

Enough clearance to make the change quick and easy

Clearance：0.01–0.03mm

Difficult to change due to very small clearance





Work positioning cylinder

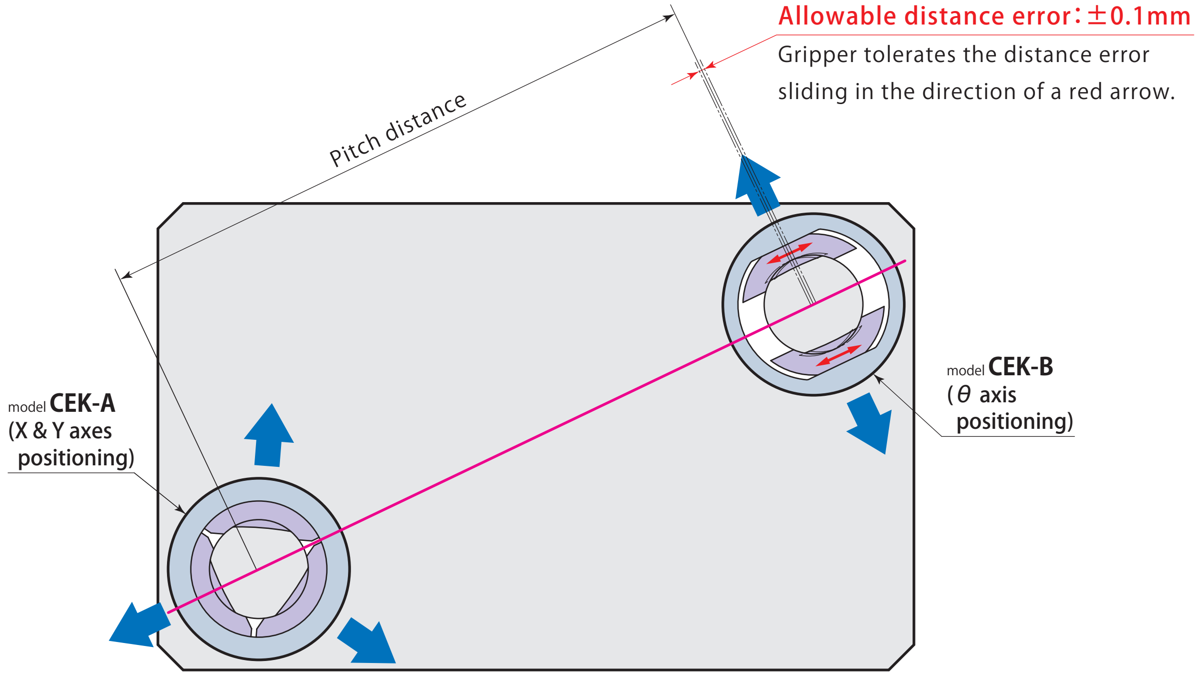
Model CEK has long expansion stroke to make an enough clearance (0.2mm) to change the workpiece easily and quickly.

Positioning pin

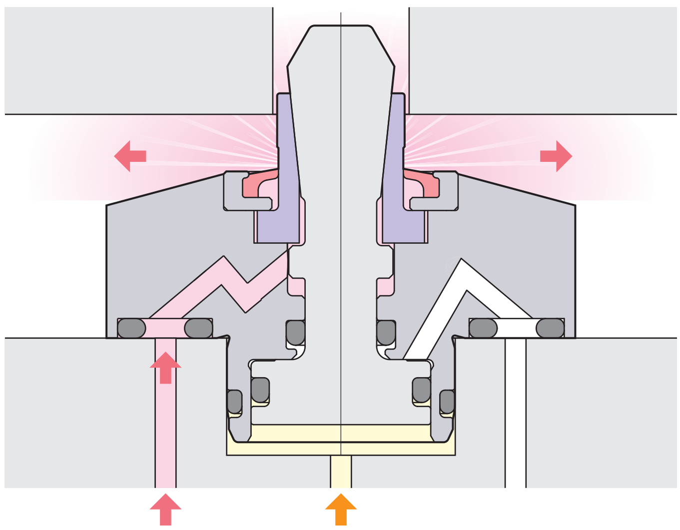
A positioning pin requires very small clearance to achieve accurate positioning, which makes it difficult to engage or disengage the pin.

Do not have an impact on gripper and piston since it employs many parts and has less strength than positioning pin.

Positioning hole pitch error can be tolerated



Incorporating strong air blow circuit



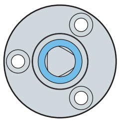
Air blows out from the gap between rod, gripper and scraper to protect the positioning hole from the intrusion of chips and coolant.

Specifications

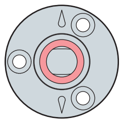
Type | Size | Positioning hole diameter

CEK –

A : X & Y axes positioning



B : θ axis positioning



Size		Positioning hole diameter
01	–	08, 09, 10, 11, 12
02	–	13, 14, 15, 16
03	–	17, 18, 19, 20

Model			CEK-A01-Positioning hole diameter CEK-B01-Positioning hole diameter	CEK-A02-Positioning hole diameter CEK-B02-Positioning hole diameter	CEK-A03-Positioning hole diameter CEK-B03-Positioning hole diameter
Positioning hole diameter		mm	8–12	13–16	17–20
Radial expansion force	Hydraulic pressure 2.5MPa	kN	1.21	1.78	2.52
	Hydraulic pressure 5MPa	kN	2.43	3.56	5.03
	Hydraulic pressure 7MPa	kN	3.40	4.99	7.05
Full stroke		mm	1.35	1.35	1.4
Cylinder capacity	Lock	cm^3	0.17	0.25	0.37
	Unlock	cm^3	0.20	0.32	0.47
Allowable distance error*1		mm	±0.1		
Repeatability		μm	5		
Recommended air blow pressure		MPa	0.3–0.4		
Mass		kg	0.10	0.14	0.21
Recommended tightening torque of mounting screws*2		N·m	3.6	3.6	7.2

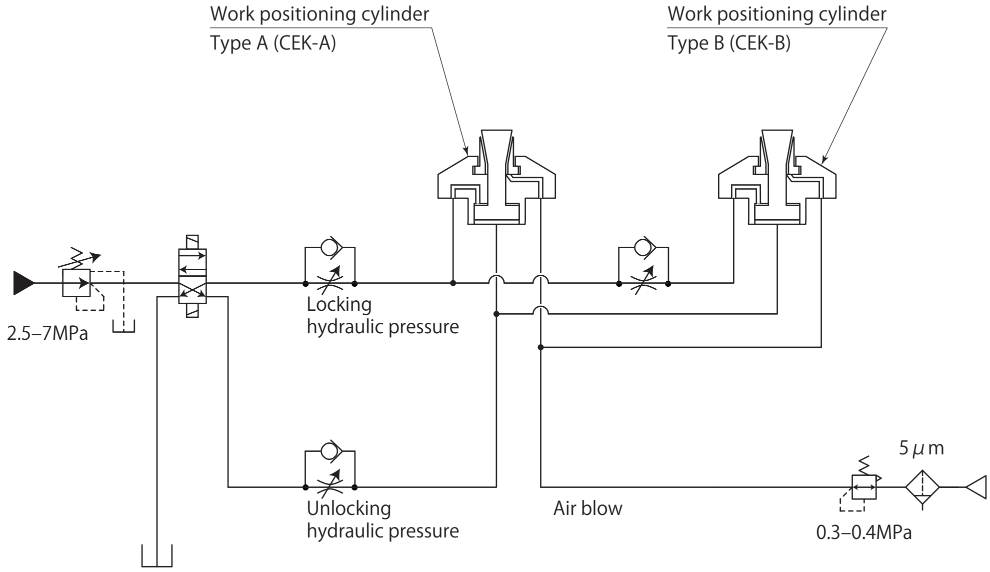
● Pressure range : 2.5–7 MPa ● Proof pressure : 10.5 MPa ● Operating temperature : 0–70 ℃

● Fluid used : General mineral based hydraulic oil (ISO-VG32 equivalent)

∗1 : This is value when CEK-A and CEK-B are used in combination. The value is achievable only when CEK-A and CEK-B are used together.

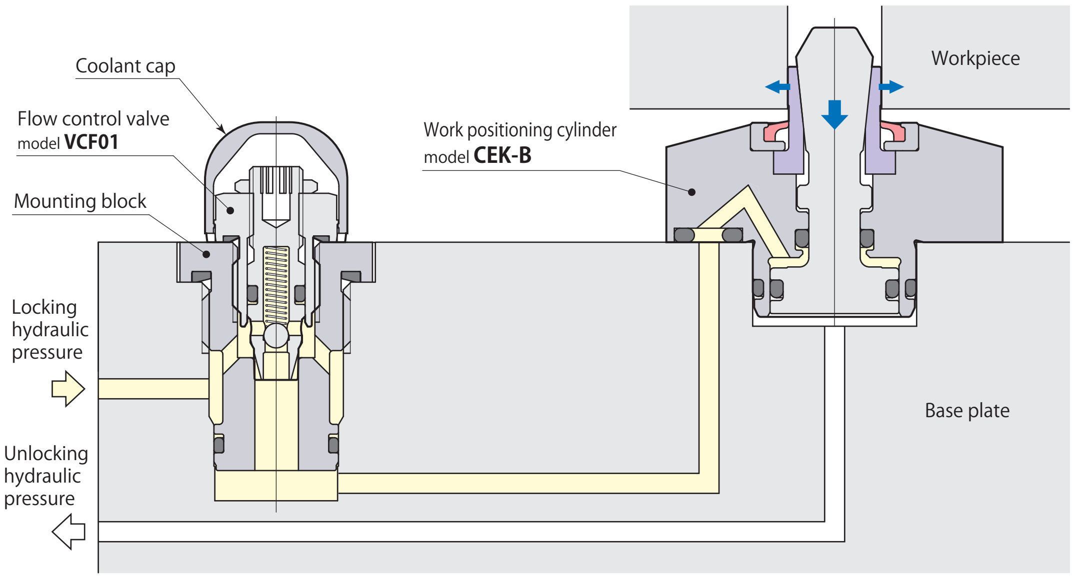
∗2 : ISO R898 class 12.9

Hydraulic and pneumatic circuit diagram



For stable positioning accuracy, the circuit should be built to have Type A actuate first.

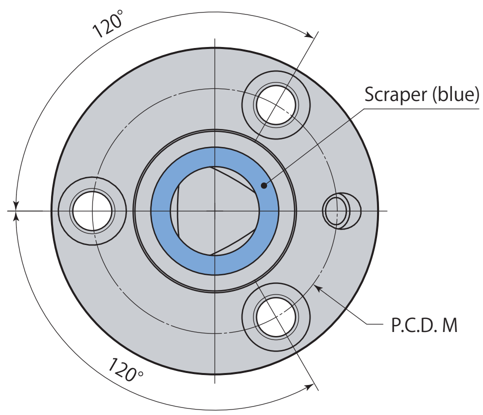
Flow control valve mounting example



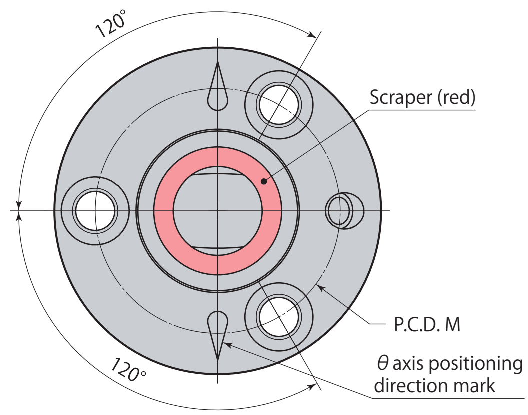
Refer to **page →368** for details on flow control valve model VCF.

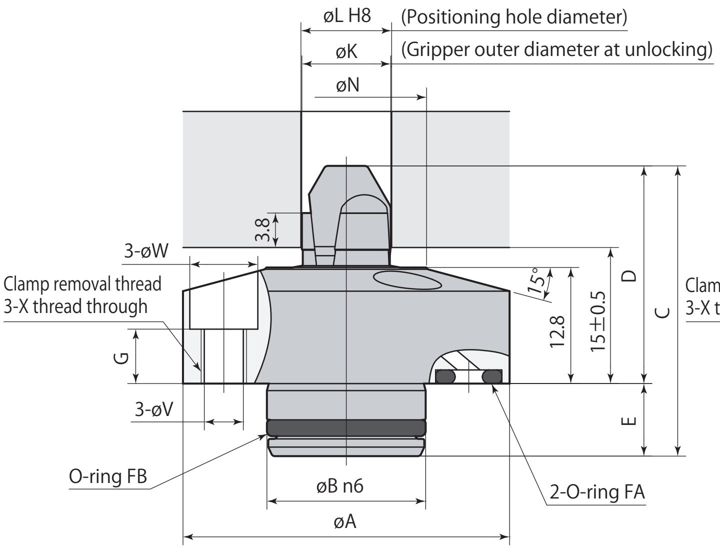
Dimensions

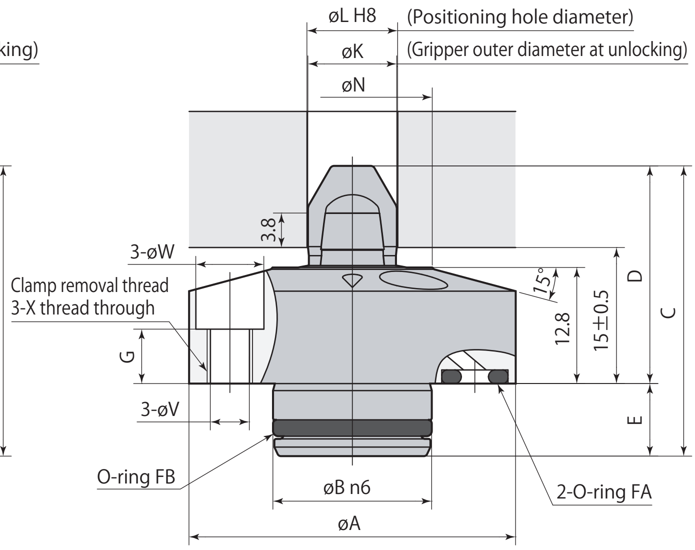
CEK-A

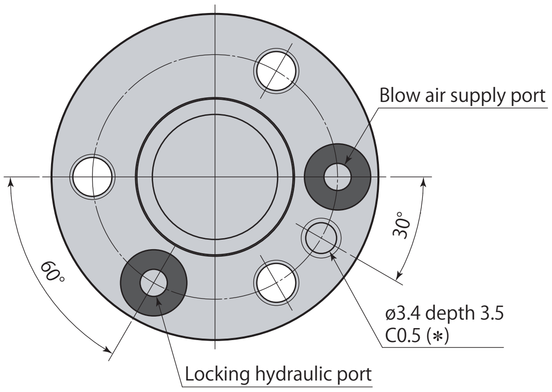


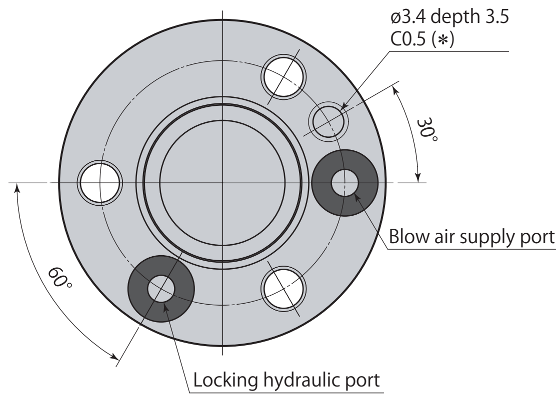
CEK-B











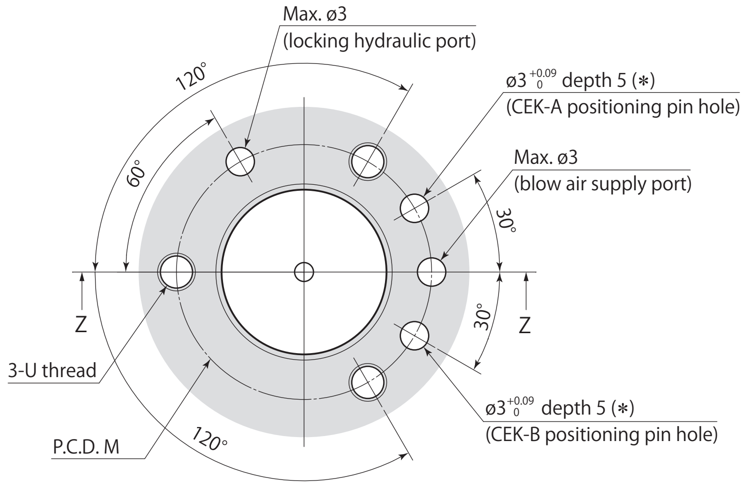
*:Positioning pin is used to prevent positioning mistake (recommended positioning pin : Spring pin ø3×8).

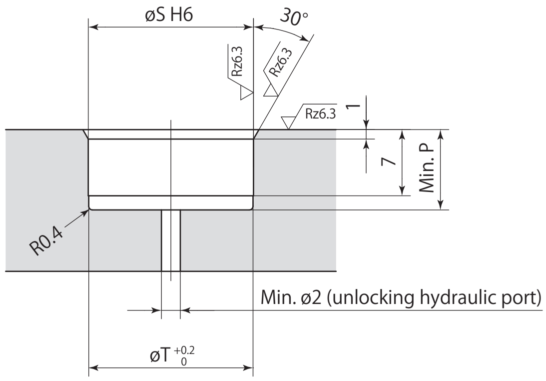
mm

Model	CEK-A01-Positioning hole diameter CEK-B01-Positioning hole diameter					CEK-A02-Positioning hole diameter CEK-B02-Positioning hole diameter				CEK-A03-Positioning hole diameter CEK-B03-Positioning hole diameter			
Positioning hole diameter	8	9	10	11	12	13	14	15	16	17	18	19	20
øA	36					40				47			
øB	$17.5^{+0.023}_{+0.012}$					$21^{+0.028}_{+0.015}$				$26^{+0.028}_{+0.015}$			
C	32					35				38			
D	24					25				26			
E	8					10				12			
G	6					6				5			
øK	7.8	8.8	9.8	10.8	11.8	12.8	13.8	14.8	15.8	16.8	17.8	18.8	19.8
øL	$8^{+0.022}_{0}$	$9^{+0.022}_{0}$	$10^{+0.022}_{0}$	$11^{+0.027}_{0}$	$12^{+0.027}_{0}$	$13^{+0.027}_{0}$	$14^{+0.027}_{0}$	$15^{+0.027}_{0}$	$16^{+0.027}_{0}$	$17^{+0.027}_{0}$	$18^{+0.027}_{0}$	$19^{+0.033}_{0}$	$20^{+0.033}_{0}$
M	27					31				36			
øN	18					22				25.6			
øV	4.3					4.3				5.5			
øW	7.5					7.5				9			
X	M5×0.8					M5×0.8				M6×1			
O-ring FA (fluorocarbon hardness Hs90)	P4					P4				P4			
O-ring FB (fluorocarbon hardness Hs90)	S15					S18				AS568-020			

- The diagram indicates unlocked condition.
- Mounting screws, positioning pin are not included.
- Use øA for positioning measurement after mounting.

Mounting details





Z-Z

Rz: ISO4287(1997)

∗:Positioning pin is used to prevent positioning mistake (recommended positioning pin : Spring pin ø3×8).

mm

Model	CEK-A01-Positioning hole diameter CEK-B01-Positioning hole diameter	CEK-A02-Positioning hole diameter CEK-B02-Positioning hole diameter	CEK-A03-Positioning hole diameter CEK-B03-Positioning hole diameter
M	27	31	36
P	8.5	10.5	12.5
øS	17.5 $^{+0.011}_{0}$	21 $^{+0.013}_{0}$	26 $^{+0.013}_{0}$
øT	17.3	20.8	25.8
U	M4	M4	M5

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air Work sensor

model CEA

model CEA08-5   model CEA08-35

Specifications

Size Stroke

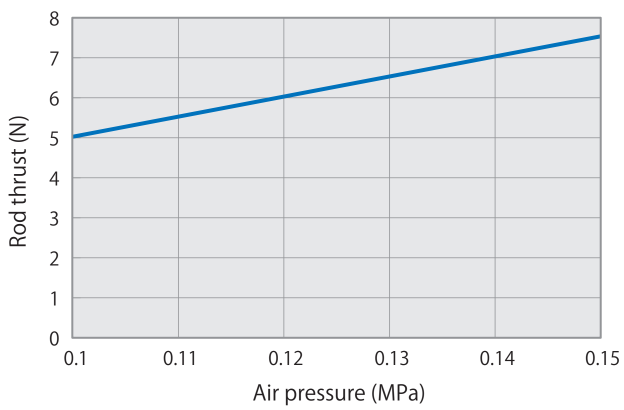
CEA 08 — 5 / 35

Model		CEA08-5	CEA08-35
Stroke	mm	5	35
Rod diameter	mm	8	
Air pressure range	MPa	0.10–0.15	
Recommended sensor model		ISA3-G series manufactured by SMC GPS2-05, GPS3-E series manufactured by CKD	
Operating temperature	℃	0–70	
Mass	g	45	65
Recommended tightening torque of mounting screws*1	N･m	3.6	

● Fluid used：Air*2 ● Oil supply：Not required

*1：ISO R898 class 12.9 *2：Supply the dry and filtered air. Particulate size 5 μm or less is recommended.

Rod theory thrust

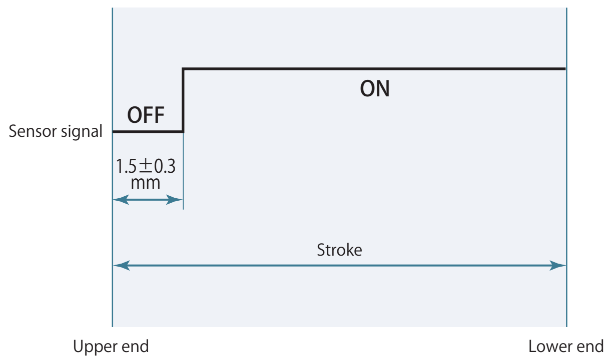


● The table indicates the theory thrust at air sensor ON.

● The force goes lower when air sensor OFF.

● Minimum 1.5 times of theory thrust force should be loaded to push the rod down.

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.

● 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.

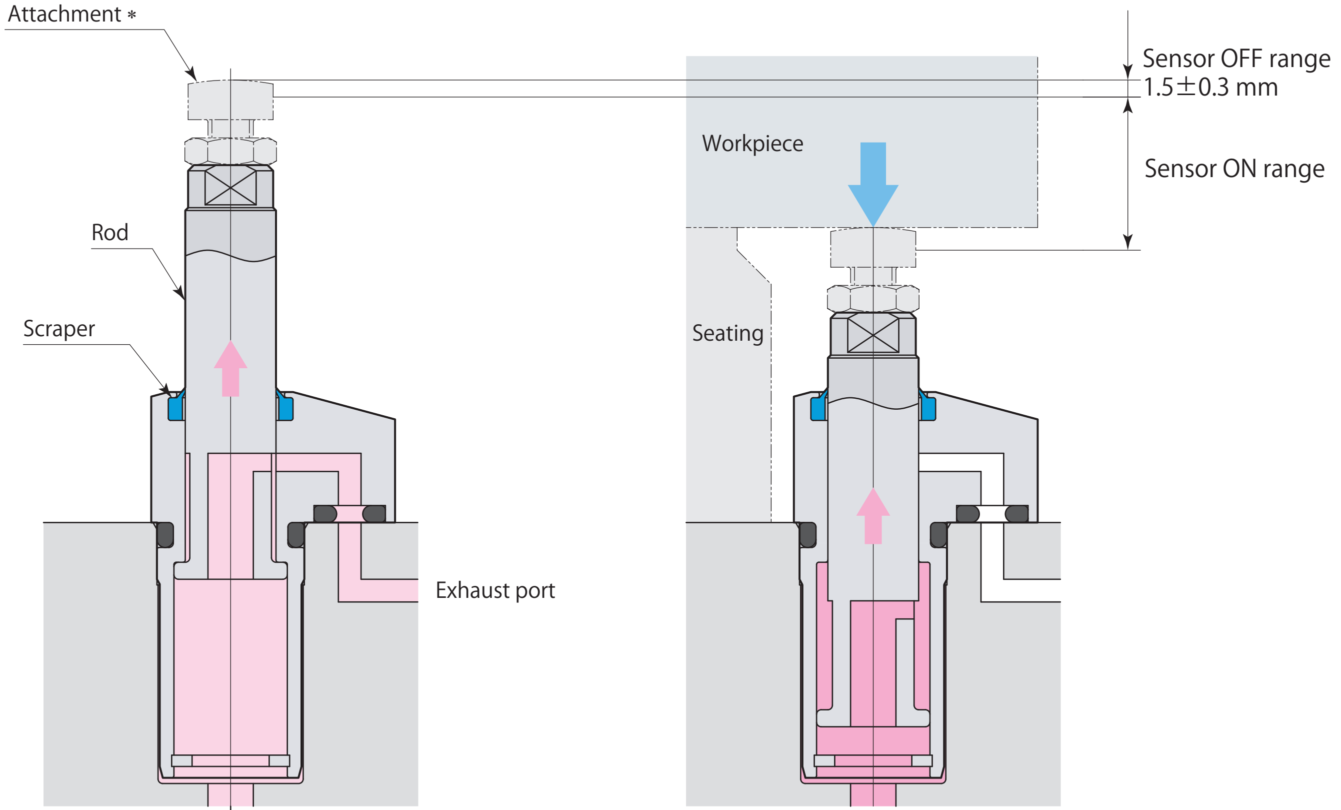
Sensor OFF

The rod goes up by means of air from the sensor.

Air sensor opens to exhaust air when the rod goes up to the air sensor OFF range.

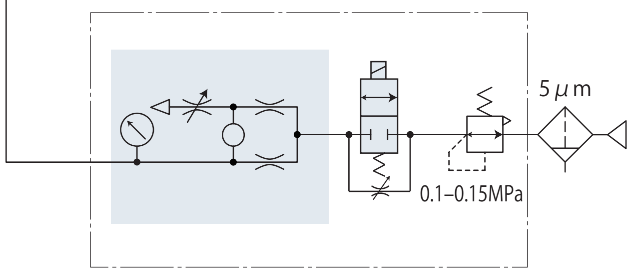
Sensor ON

The rod goes down to sensor ON range by the top load like a workpiece and blocks the sensing air then air sensor can detect the load.



Air sensor unit

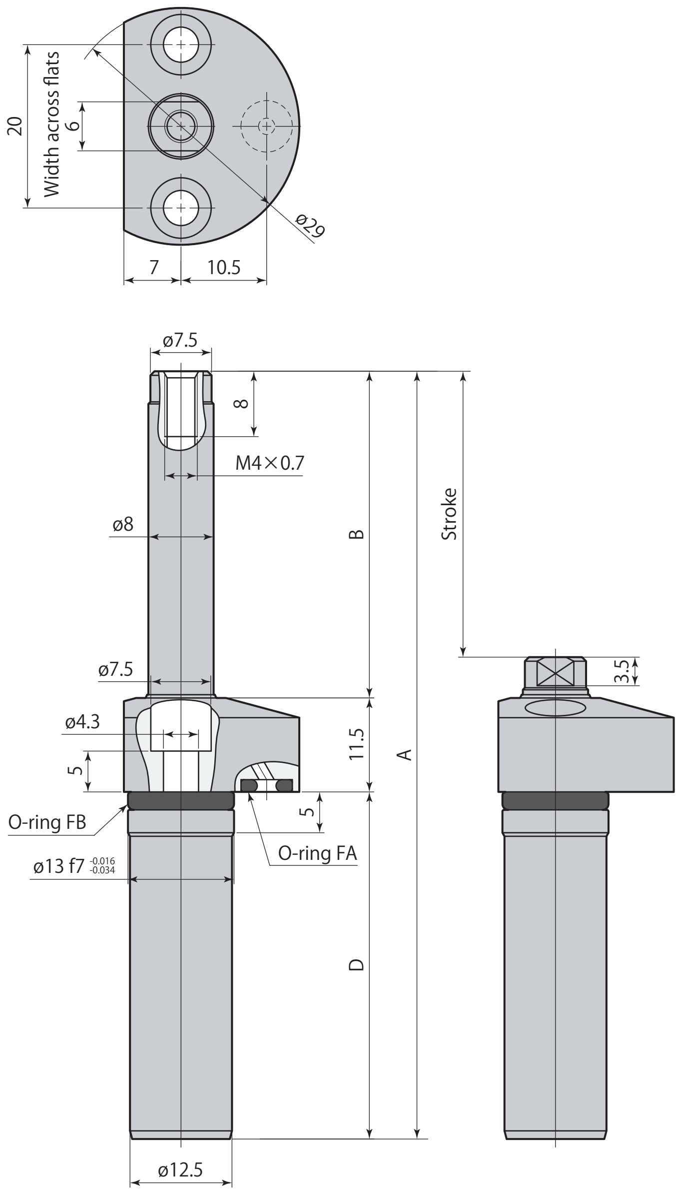
(The circuit diagram is subject to change according to the model of sensor.)



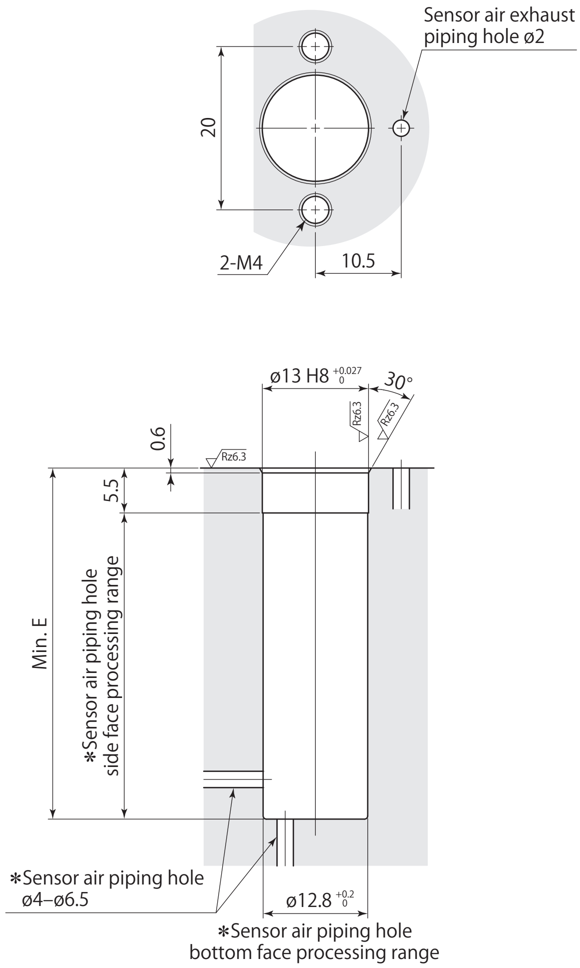
*: Attachment is not included. The attachment should be less than 10g when manufacturing by the user.

- Do not apply side load (thrust force) to the rod.
- Exhaust port must be opened to atmosphere. Also the port should be protected from chips or coolant oil.
- The slight air leakage from scraper may be seen but it causes no problem on product performance.

Dimensions



Mounting details



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

mm

Model	CEA08-5	CEA08-35
Stroke	5	35
A	34	94
B	10	40
D	12.5	42.5
E	13	43
O-ring FA (fluorocarbon hardness Hs90)	P3	
O-ring FB (fluorocarbon hardness Hs90)	AS568-012	

● Mounting screws are not included

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Centering vise

model CVH

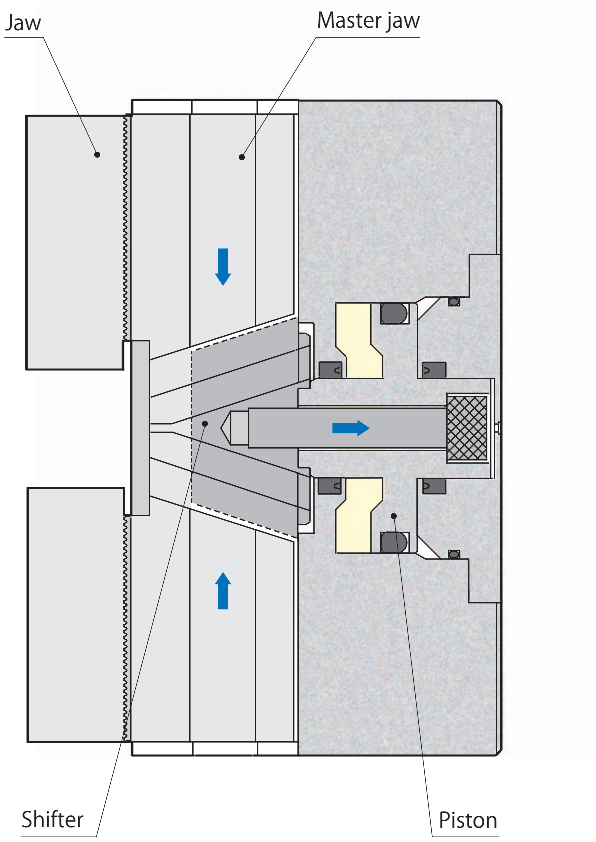
model CVH08

model CVH06

model CVH04

model **CVH□□**

Best suited for milling after lathe turning



Specifications	page → 395
Standard	page → 396
Long stroke	page → 398
Option	page → 400

Specifications

Size / Piping method

CVH 04 / 06 / 08 — G : Manifold piping / S : Rc thread piping — (Nil) : Standard / J : Long stroke

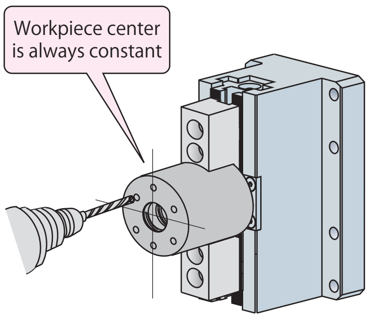
J indicates made to order.

Refer to page →398 for long stroke.

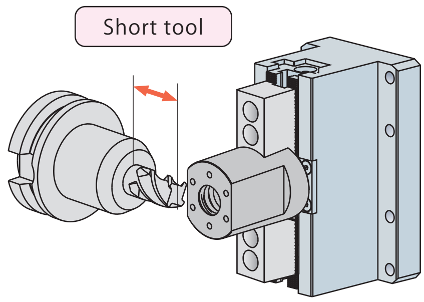
Model			CVH04 (4 inch)	CVH06 (6 inch)	CVH08 (8 inch)
Clamping force (hydraulic pressure 7MPa)		kN	10	20	30
Jaw stroke (diameter)		mm	5.6	5.8	6.0
Max. grip outer diameter		mm	100	145	190
Max. grip inner diameter		mm	125	170	220
Cylinder capacity	Grip outer diameter	cm^3	11.6	23.7	34.6
	Grip inner diameter	cm^3	11.6	23.7	34.6
Mass		kg	4.6	8.3	15.3
Recommended tightening torque of mounting screws*		N･m	12	29	57
Recommended tightening torque of jaw mounting screws*		N･m	29	57	77
Recommended positioning pin			ø6 (m6) × 18	ø8 (m6) × 24	ø10 (m6) × 30

- Pressure range：1–7 MPa
- Proof pressure：10.5 MPa
- Operating temperature：0–70 ℃
- Fluid used：General mineral based hydraulic oil (ISO-VG32 equivalent)

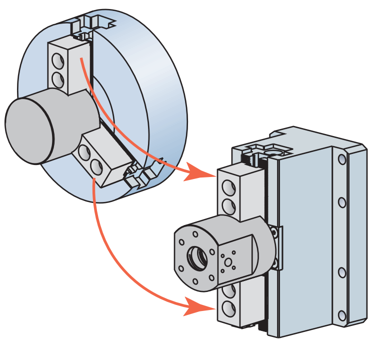
＊：ISO R898 class 12.9



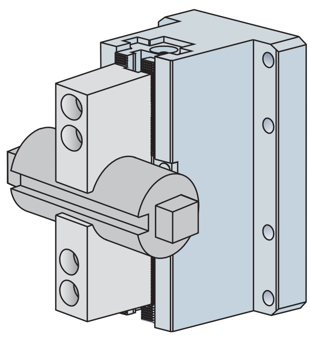
- Since both jaws stroke with centering vise, center datum processing is possible even when external shape of workpiece is variable.



- Centering vise minimizes tool interference and facilitates stable cutting process with comfortable tool length.

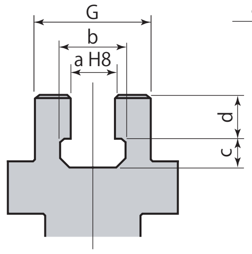


- Soft jaw used for lathe turning process can be mounted on centering vise, thereby eliminating fabrication of soft jaw at machining center.

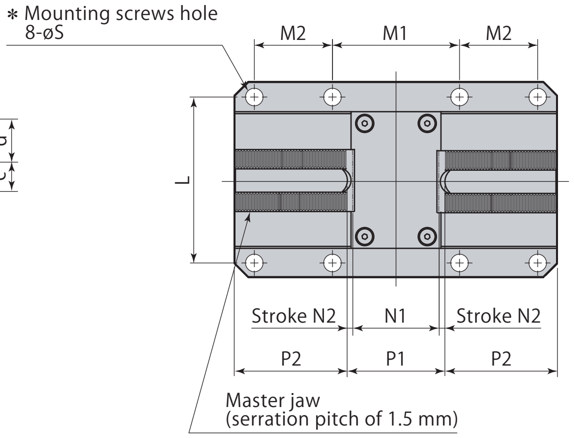


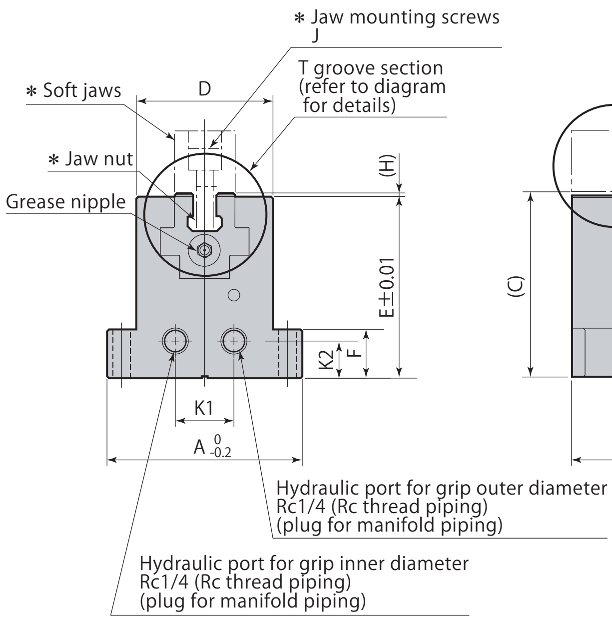
- One chuck machining for diverse shapes of workpiece using self-cut soft jaw.

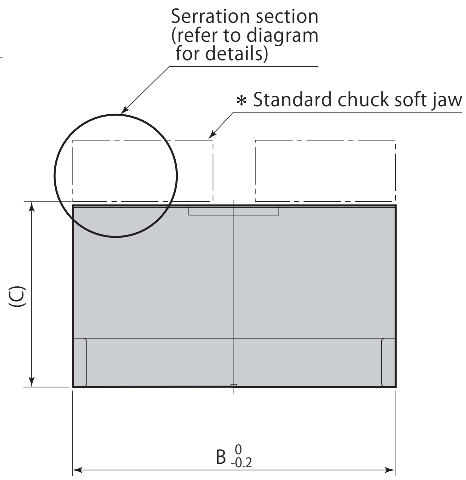
Dimensions

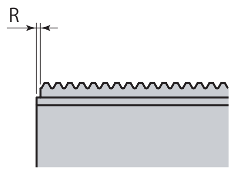


T groove section details

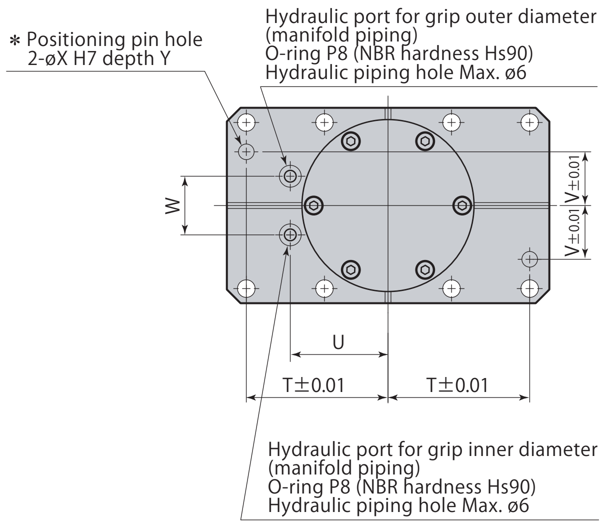








Serration section details



∗: Soft jaws, jaw nuts, mounting screws and positioning pins are not included.

mm

Model	CVH04□	CVH06□	CVH08□
A	90	100	125
B	120	165	210
C	84.85	94.85	109.85
D	60	70	85
E	83	93	108
F	20	25	30
G	27	31	35
H	1.85	1.85	1.85
J	M8	M10	M12
K1	30	30	35
K2	17	19	19
L	75	85	105
M1	45	65	60
M2	30	40	60
N1	38.6	44.2	64.9
N2	2.8	2.9	3
P1	44.2	50	70.9
P2	37.5	57	69
R	0.4	0.5	0.55
øS	6.8	9	11
T	52.5	72.5	90
U	42.5	50	75
V	27.5	27.5	35
W	30	30	35
øX	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$
Y	9	12	15
a	$10^{+0.022}_{0}$	$12^{+0.027}_{0}$	$14^{+0.027}_{0}$
b	15.5	18.5	21.5
c	6	8	10
d	10	12	13

- The diagram shown on the left indicates the jaw strokes out when gripping inner diameter.
- The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

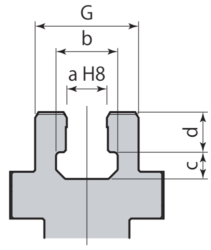
Specifications

Model			CVH04□-J (4 inch)	CVH06□-J (6 inch)	CVH08□-J (8 inch)
Clamping force	Outer diameter (hydraulic pressure 7MPa)	kN	10	20	30
	Inner diameter (hydraulic pressure 5MPa)	kN	9	17	25
Jaw stroke (diameter)		mm	12.1	13	13
Max. grip outer diameter		mm	100	145	190
Max. grip inner diameter		mm	125	170	220
Cylinder capacity	Grip outer diameter	cm^3	24.7	52.5	74.2
	Grip inner diameter	cm^3	29.5	62.3	88.4
Mass		kg	5.8	10	17.9
Recommended tightening torque of mounting screws*		N･m	12	29	57
Recommended tightening torque of jaw mounting screws*		N･m	29	57	77
Recommended positioning pin			ø6 (m6) ×18	ø8 (m6) ×24	ø10 (m6) ×30

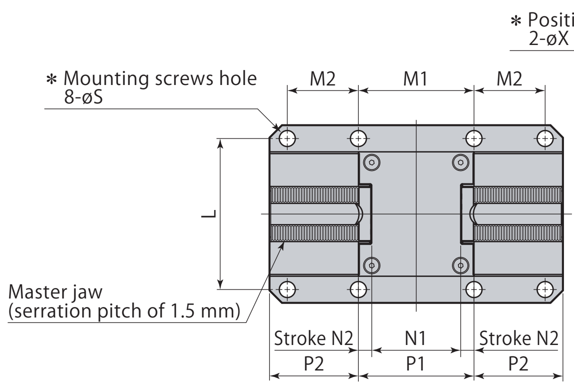
- Pressure range：1–7 MPa (grip outer diameter), 1–5 MPa (grip inner diameter)
- Proof pressure：10.5 MPa (grip outer diameter), 7.5 MPa (grip inner diameter)
- Operating temperature：0–70 ℃
- Fluid used：General mineral based hydraulic oil (ISO-VG32 equivalent)

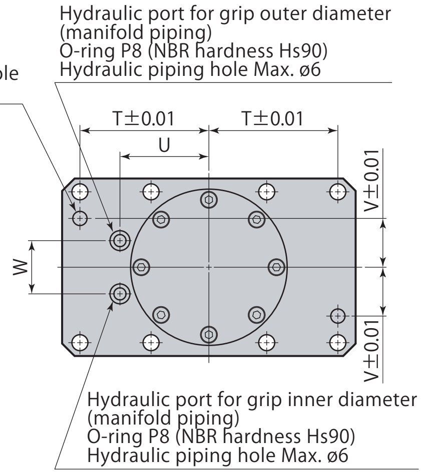
＊：ISO R898 class 12.9

Dimensions

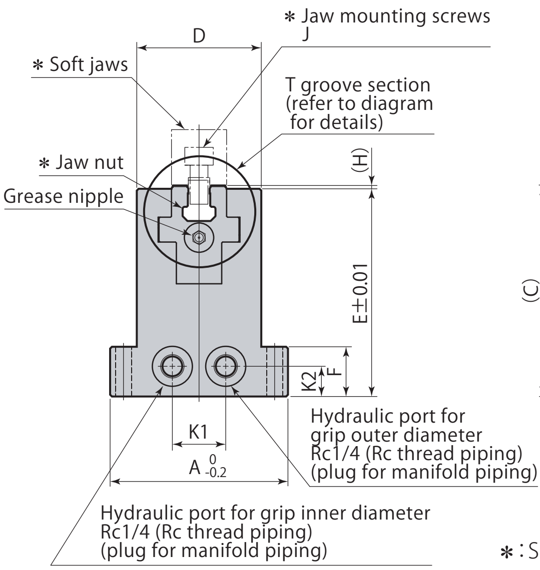


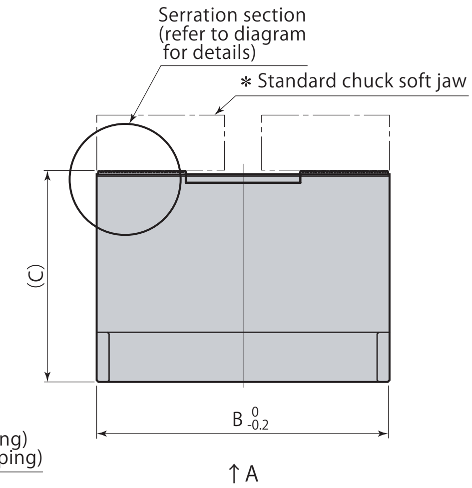
T groove section details

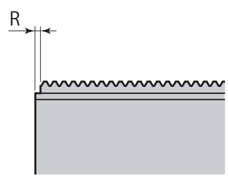




Arrow A view







Serration section details

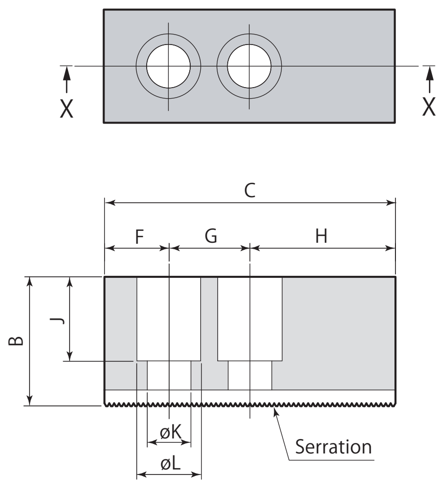
＊：Soft jaws, jaw nuts, mounting screws and positioning pins are not included.

mm

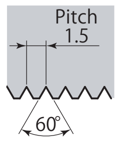
Model	CVH04□-J	CVH06□-J	CVH08□-J
A	90	100	125
B	130	165	210
C	100.85	118.85	133.85
D	60	70	85
E	99	117	132
F	20	28	30
G	27	31	35
H	1.85	1.85	1.85
J	M8	M10	M12
K1	30	30	35
K2	17	17	19
L	75	85	105
M1	45	65	60
M2	30	40	60
N1	41.9	51.4	63.7
N2	6.05	6.5	6.5
P1	54	64.4	76.7
P2	37.5	49.5	66
R	0.5	0.8	0.6
øS	6.8	9	11
T	52.5	72.5	90
U	42.5	50	75
V	27.5	27.5	35
W	30	30	35
øX	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$
Y	9	12	15
a	$10^{+0.022}_{0}$	$12^{+0.027}_{0}$	$14^{+0.027}_{0}$
b	15.5	18.5	21.5
c	6	8	10
d	10	12	13

- The diagram shown on the left indicates the jaw strokes out when gripping inner diameter.
- The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

Jaw (option)

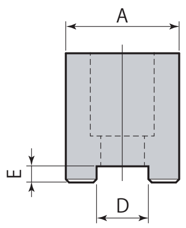


X-X

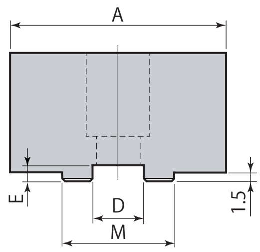


Serration section details

Material：S50C



Standard jaw & tall jaw



Wide jaw

- Jaw (soft jaw) is supplied in sets of two. Specify number of sets when ordering. (Example：CVJ06-N×1 set)

mm

Model	Soft jaw shape	A	B	C	D	E	F	G	H	J	øK	øL	M
CVJ04-N	Standard jaw	23	25							16			–
CVJ04-H	Tall jaw	23	48	55	10	4	13	14	28	39	8.5	13.5	–
CVJ04-W	Wide jaw	60	25							16			23

- CVJ04 mounting screw size：M8×22L (not included)

mm

Model	Soft jaw shape	A	B	C	D	E	F	G	H	J	øK	øL	M
CVJ06-N	Standard jaw	31	32							20			–
CVJ06-H	Tall jaw	31	66	72	12	5	15	20	37	54	11	17	–
CVJ06-W	Wide jaw	70	32							20			31

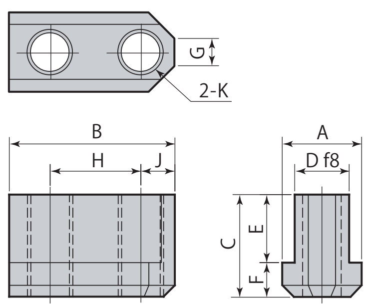
- CVJ06 mounting screw size：M10×30L (not included)

mm

Model	Soft jaw shape	A	B	C	D	E	F	G	H	J	øK	øL	M
CVJ08-N	Standard jaw	35	38							23			–
CVJ08-H	Tall jaw	35	76	95	14	5	24	25	46	61	13	19	–
CVJ08-W	Wide jaw	85	38							23			35

- CVJ08 mounting screw size：M12×35L (not included)

Jaw nut (option)



- Jaw nut is supplied in sets of two. Specify number of sets when ordering. (Example：CVJ06-T×1 set)

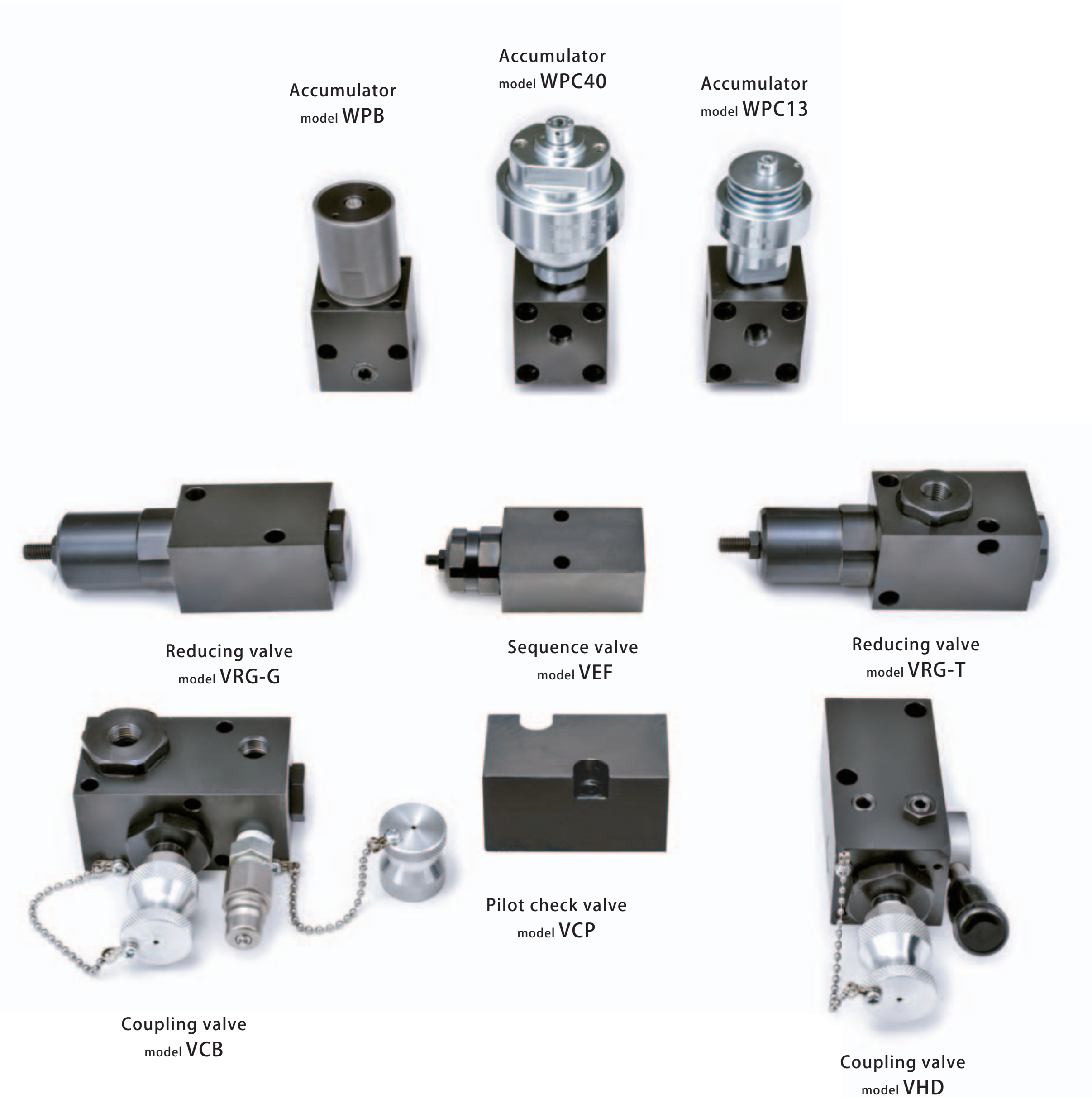
mm

Model	A	B	C	D	E	F	G	H	J	K
CVJ04-T	14.5	26	18	10	12.5	5.5	5	14	6	M8×1.25
CVJ06-T	17	36.5	22.5	12	15	7.5	8	20	7.5	M10×1.5
CVJ08-T	20	48	25.5	14	16	9.5	8	25	11	M12×1.75

Table of contents

Control system

7 MPa



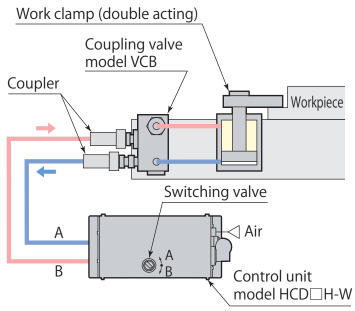
Double acting clamp is controlled and operated with control unit model **HCD□H-W** and coupling valve model **VCB**.

Control unit model **HCD□H-W**
Page→428

Coupling valve model **VCB**
Pages→412, 413

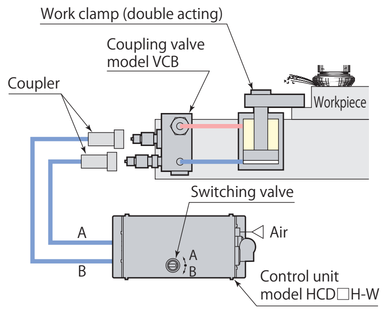
Control unit (HCD□H-W) converts air pressure to hydraulic pressure by actuation of air driven Pascal pump. Once circuit pressure is attained to the set pressure, it stops pumping then keeps the hydraulic pressure.
Coupling valve (VCB) is placed between a control unit and double acting clamps, and it allows to disconnect the control unit from the valve by means of hydraulic coupler. Built-in check valve in coupling valve can positively seal the pressure.

Clamping operation



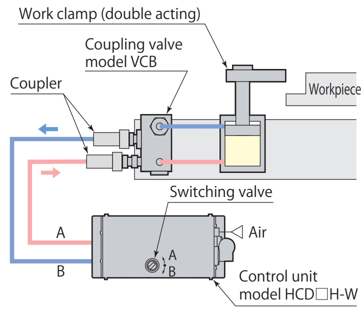
After coupler is connected, workpiece is clamped by aligning switching valve of control unit to B hydraulic port (clamping circuit).

Hydraulic pressure source disengagement (during processing)

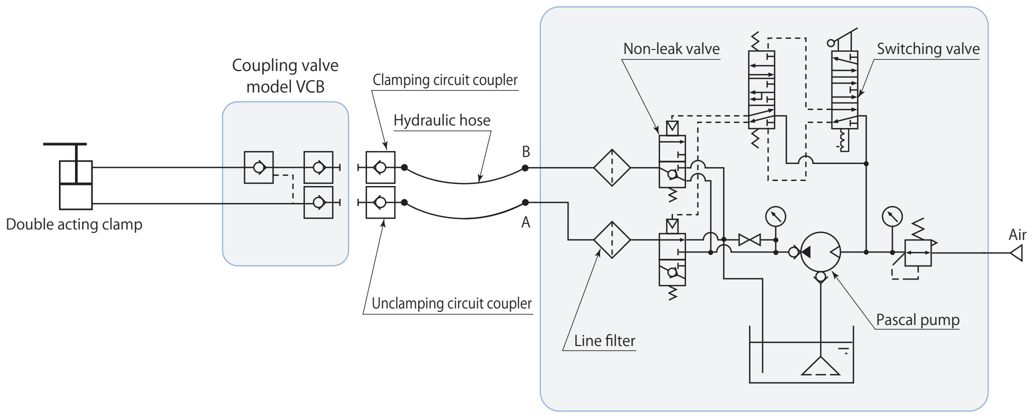


Coupler is released by aligning switching valve of control unit to center position after workpiece clamping is completed.

Unclamping operation

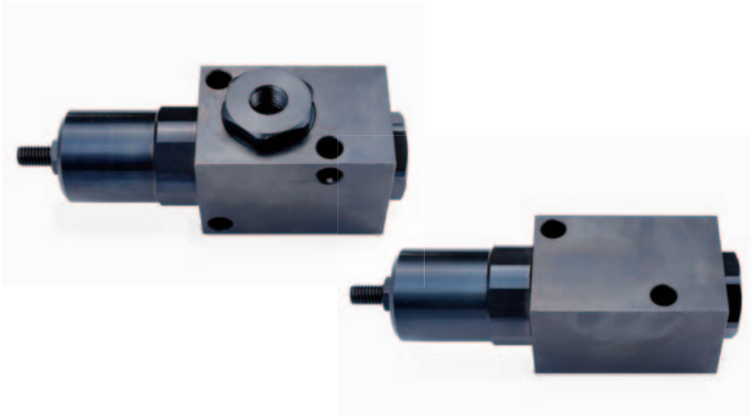


After coupler is connected, workpiece is taken out by unclamping, which is made possible by aligning switching valve of control unit to A hydraulic port (unclamping circuit).



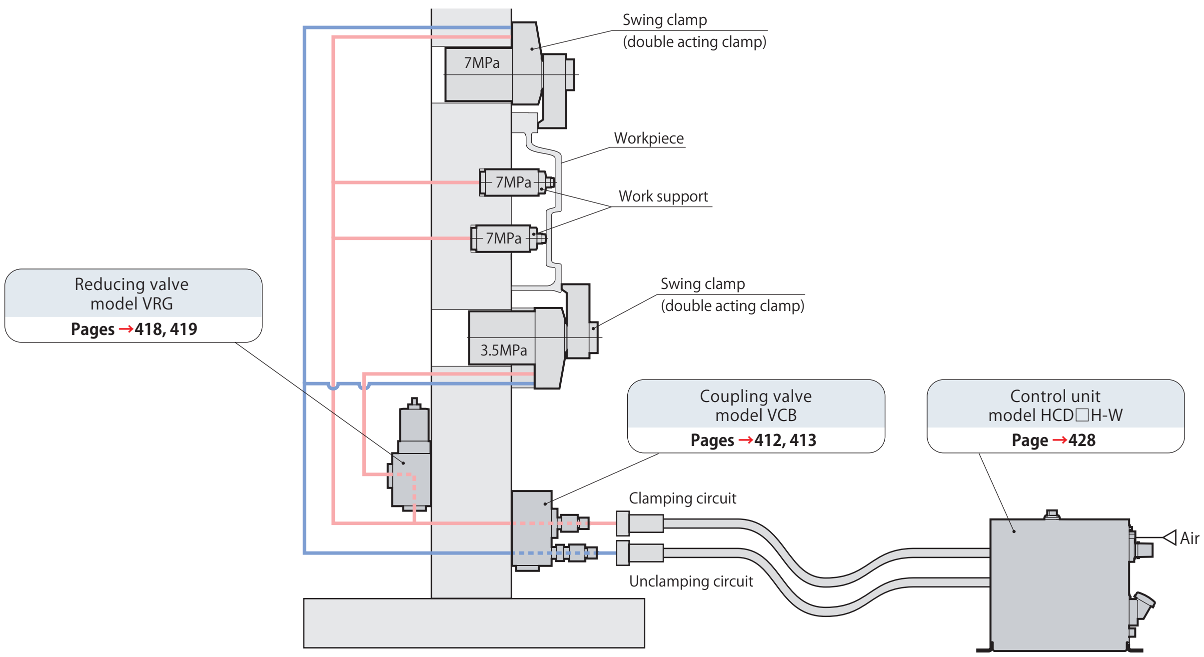
Control unit model HCD□H-W

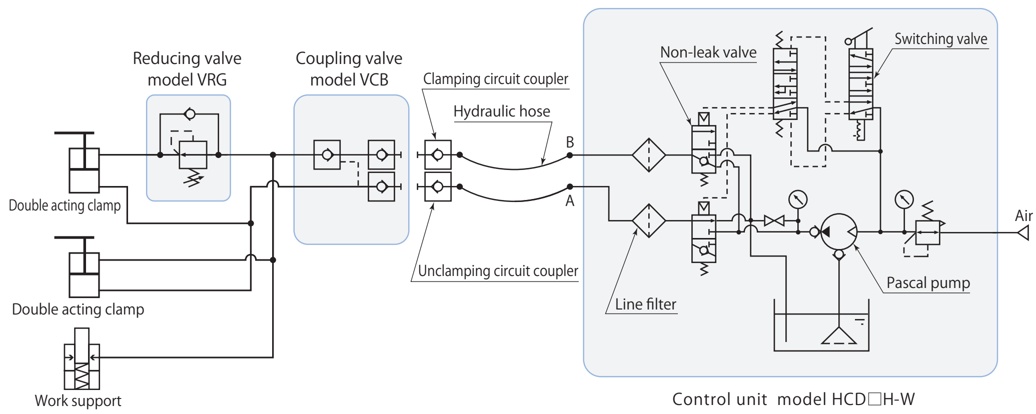
Since Pascal pump does not raise oil temperature like electrical pumps, it does not trigger pressure drop (reduction in clamping force) after clamping due to difference between ambient temperature and oil temperature. Fluctuation of pressure due to changes in ambient temperature, however, does occur. (This fluctuation presents minimal problems with ordinary cutting processes. Inquire for details.)

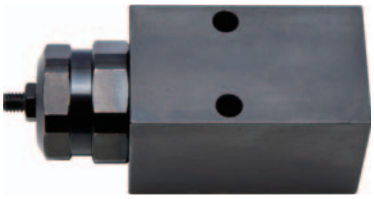


Reducing valve model **VRG**
Pages →418, 419

Internal hydraulic pressure of circuit can be partially reduced.
(Example) For work support 7 MPa (primary pressure)
pressure of work clamp is reduced to 3.5 MPa.

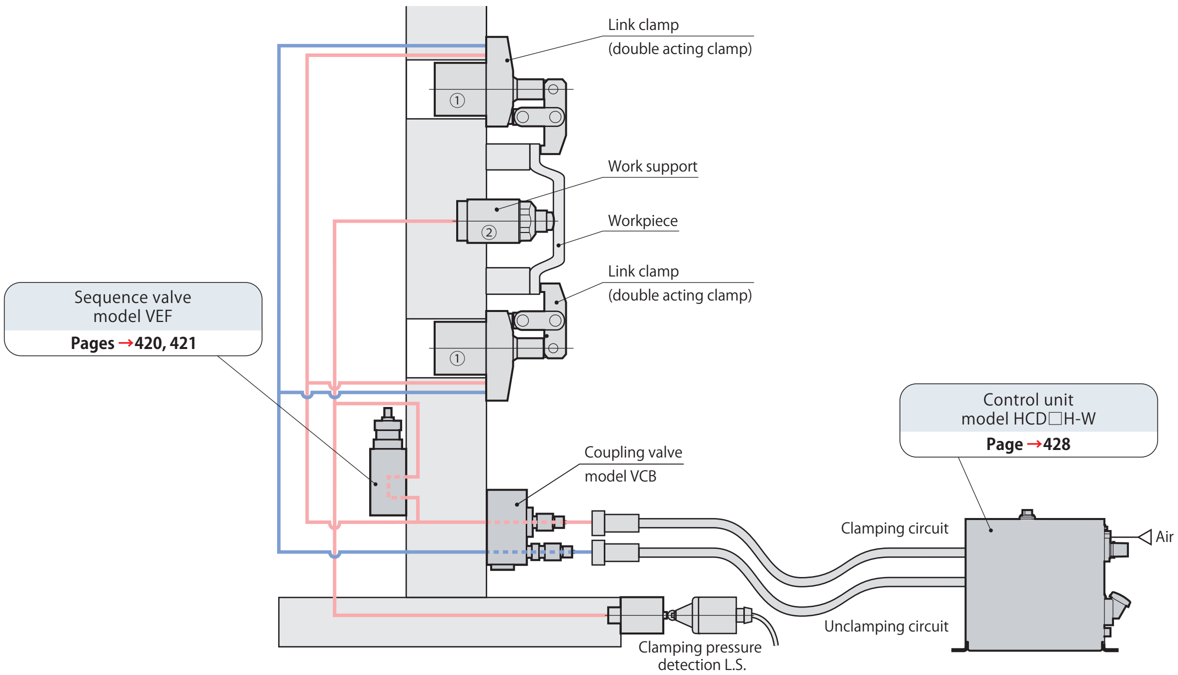


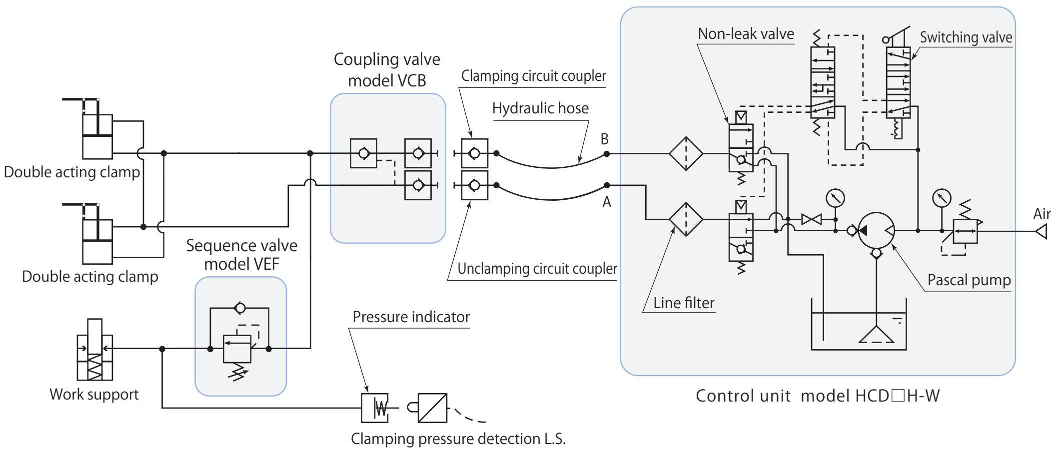




Sequence valve model **VEF**
Pages →420, 421

Clamps are sequentially operated through same circuit.
(Example) ① After clamping operation of work clamp
② Work support operation locked.



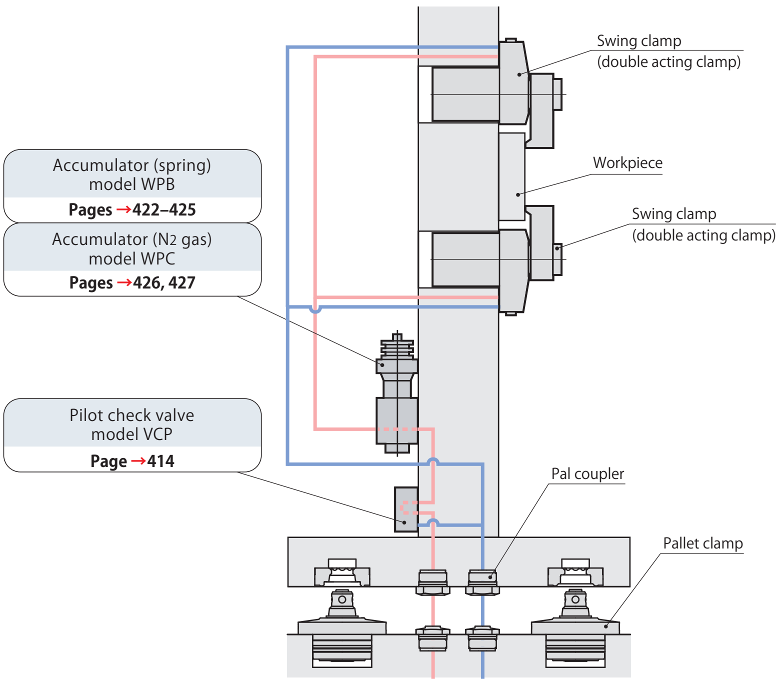


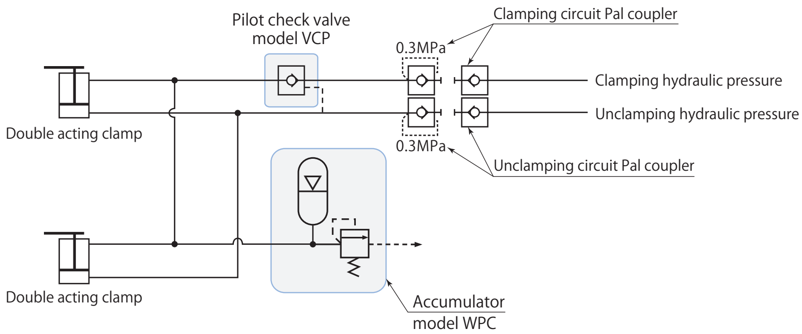
Pilot check valve model **VCP**
Page →414

Accumulator model **WPB, WPC**
Pages →422–427

It ensures the clamp circuit pressure positively retained even when hydraulic unit provides zero pressure or pressure line is cut off, which can prevent the workpiece fall or accident due to the clamp loose.

After hydraulic pressure source has been disengaged, circuit pressure fluctuation due to temperature changes is suppressed.





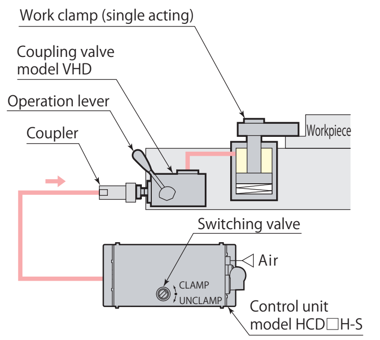
Single acting clamp is controlled and operated with control unit model **HCD☐H-S** and coupling valve model **VHD**.

Control unit model **HCD☐H-S**
Page →429

Coupling valve model **VHD**
Pages →416, 417

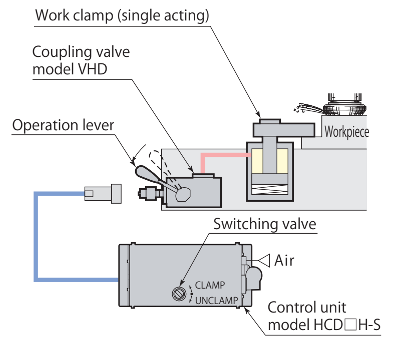
Control unit (HCD☐H-S) converts air pressure to hydraulic pressure by actuation of air driven Pascal pump. Once circuit pressure is attained to the set pressure, it stops pumping then keeps the hydraulic pressure.
Coupling valve (VHD) is placed between a control unit and single acting clamps, and it allows to disconnect the control unit from the valve by means of hydraulic coupler. Built-in check valve in coupling valve can positively seal the pressure.

Clamping operation



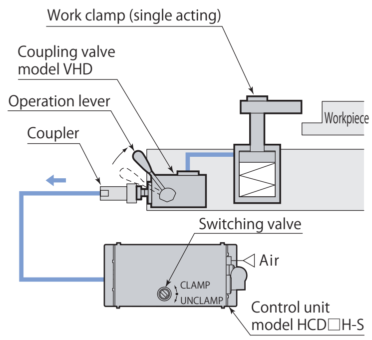
After coupler is connected, workpiece is clamped by aligning switching valve of control unit to clamping circuit.

Hydraulic pressure source disengagement (during processing)

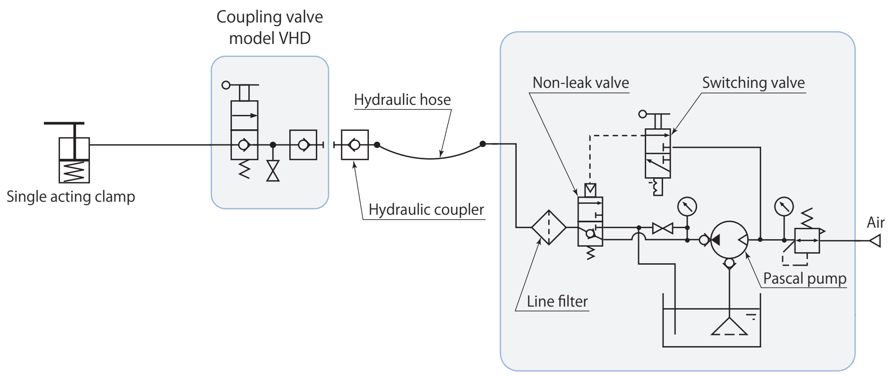


Coupler is released by positioning operation lever of coupling valve to clamping side and aligning switching valve of control unit with unclamping.

Unclamping operation



Workpiece is taken out after coupler is connected, by positioning operation lever of coupling valve to unclamping side, to unclamp.



Control unit model HCD☐H-S

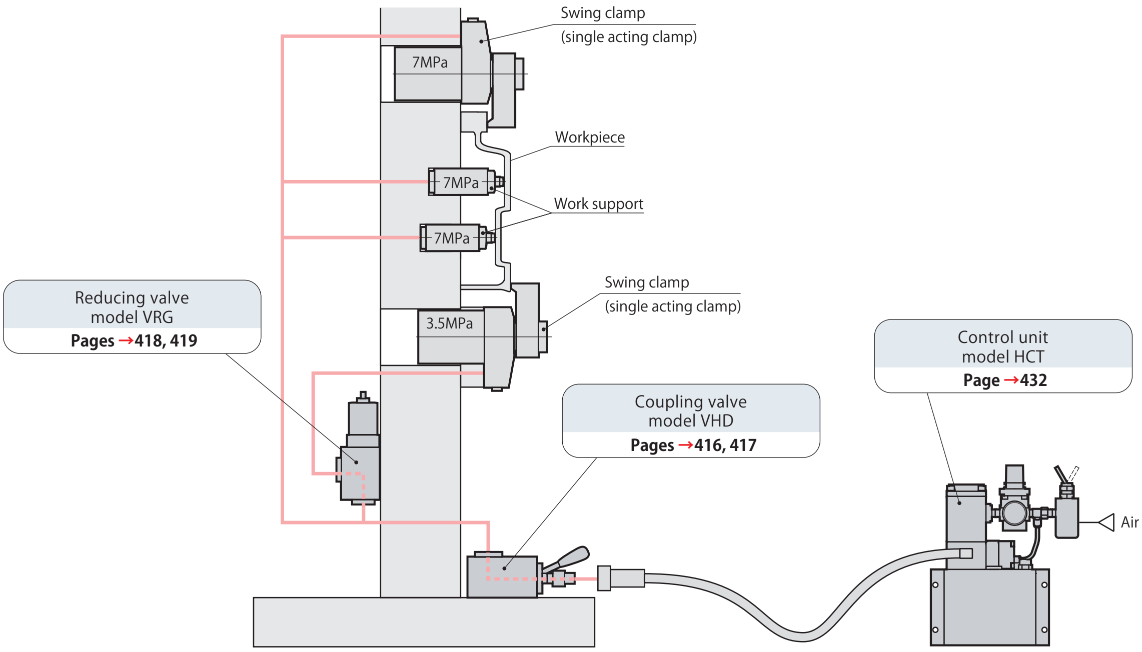
Since Pascal pump does not raise oil temperature like electrical pumps, it does not trigger pressure drop (reduction in clamping force) after clamping due to difference between ambient temperature and oil temperature. Fluctuation of pressure due to changes in ambient temperature, however, does occur. (This fluctuation presents minimal problems with ordinary cutting processes. Inquire for details.)

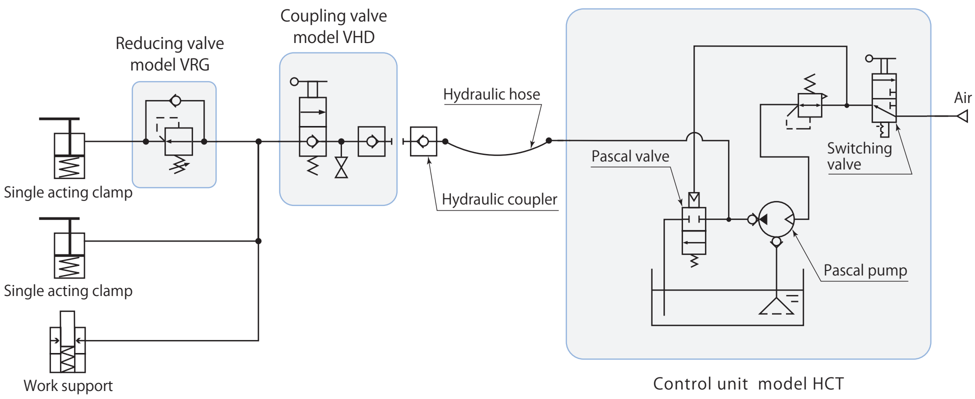
Control unit model **HCT-□**
Page→432

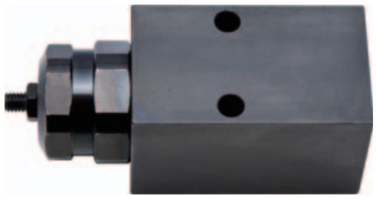
Compact hydraulic control unit for air drive and manual operations. Control unit (HCT-□) converts air pressure to hydraulic pressure by actuation of air driven Pascal pump. Once circuit pressure is attained to the set pressure, it stops pumping then keeps the hydraulic pressure.

Reducing valve model **VRG**
Pages→418, 419

Internal hydraulic pressure of circuit can be partially reduced.
(Example) For work support 7 MPa (primary pressure)
pressure of work clamp is reduced to 3.5 MPa.

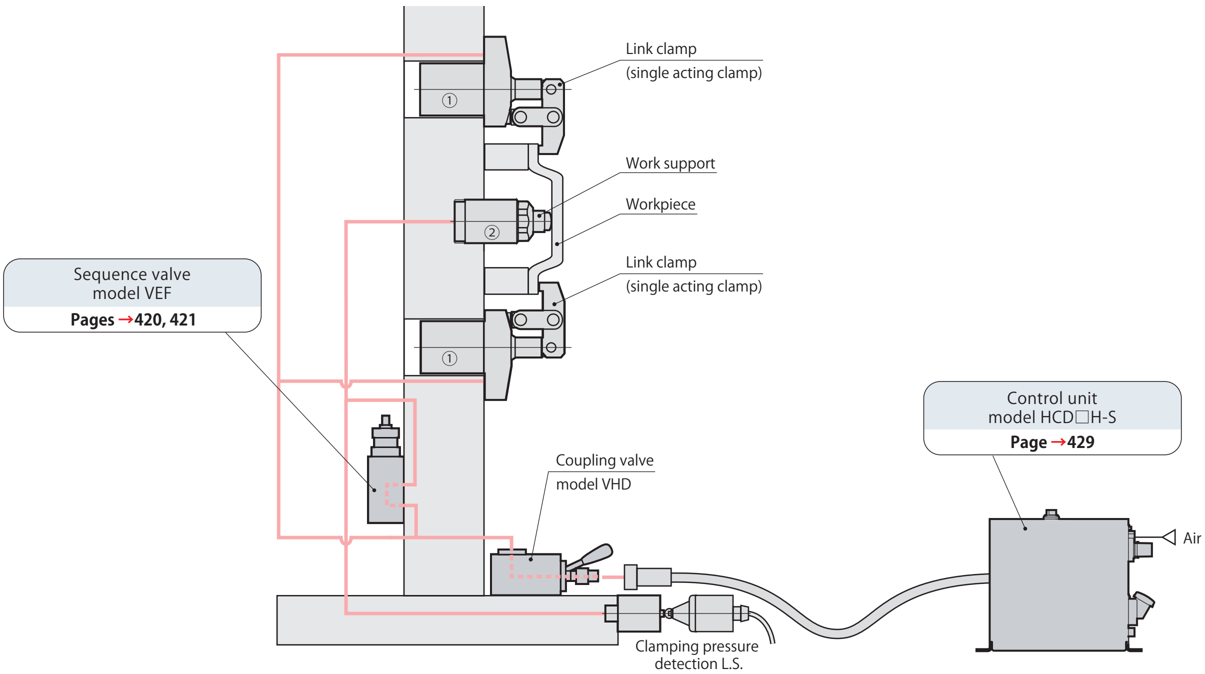


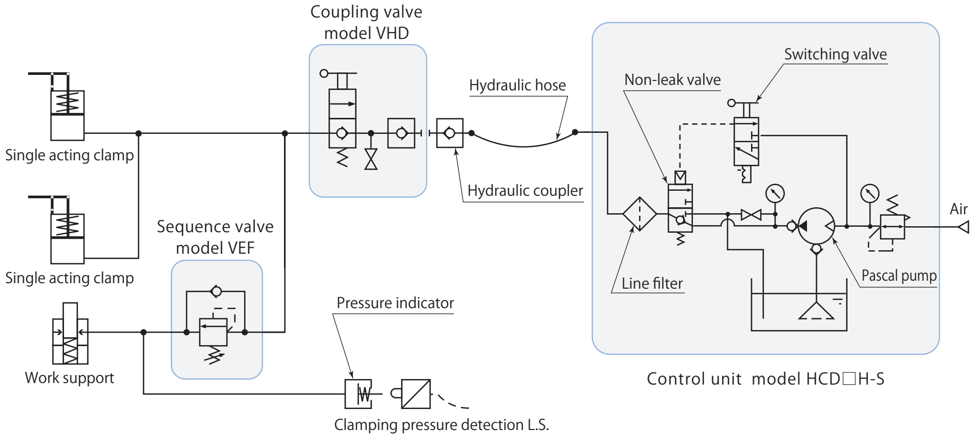




Sequence valve **model VEF**
Pages→420, 421

Clamps are sequentially operated through same circuit.
(Example) ① After clamping operation of work clamp
② Work support operation locked.

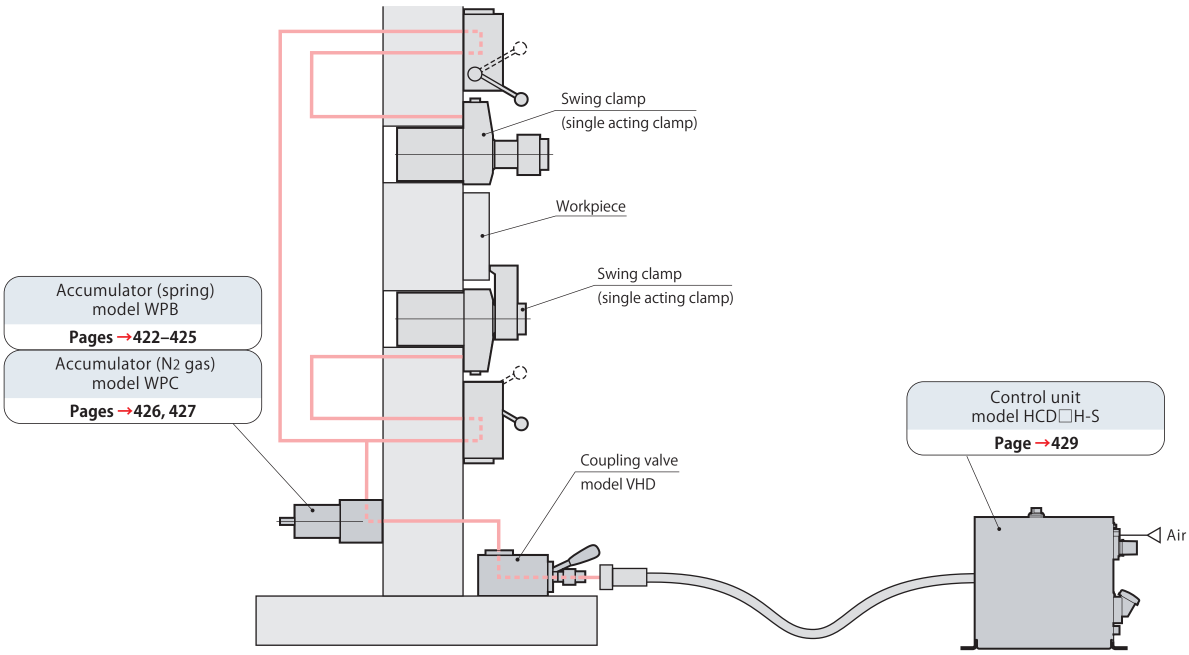


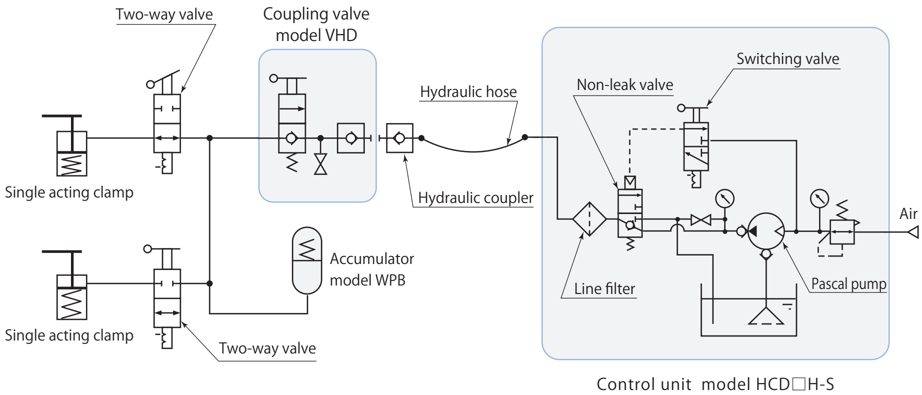


Accumulator **model WPB, WPC**

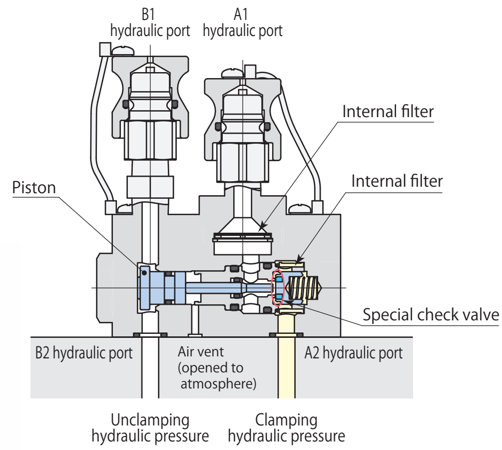
Pages →422–427

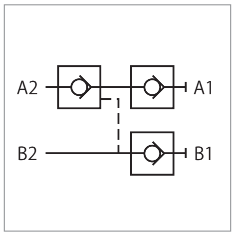
After hydraulic pressure source has been disengaged, circuit pressure fluctuation due to temperature changes is suppressed.





Coupling valve model **VCB**





This is a non-leak valve, with which coupling of double acting clamp can be performed easily and clamping circuit pressure can be retained over a long period of time after disengagement of hydraulic pressure source.

Specifications

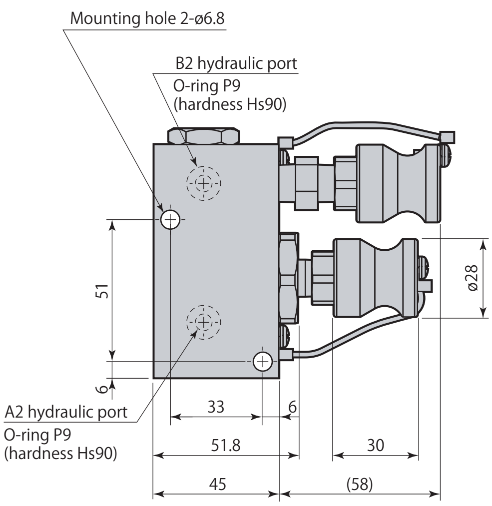
Model		VCB-LGB	VCB-LGS	VCB-LT
Mounting, piping methods		Manifold, GB mounting	Manifold, GS mounting	Piping mounting
Pressure range	MPa	2–7		
Proof pressure	MPa	10.5		
Min. pilot pressure (open valve)	MPa	0.3 ＋ 0.23 × secondary side pressure		
Orifice area	mm^2	14.2		
Operating temperature	℃	0–70		
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)		
Mass	kg	1.4		

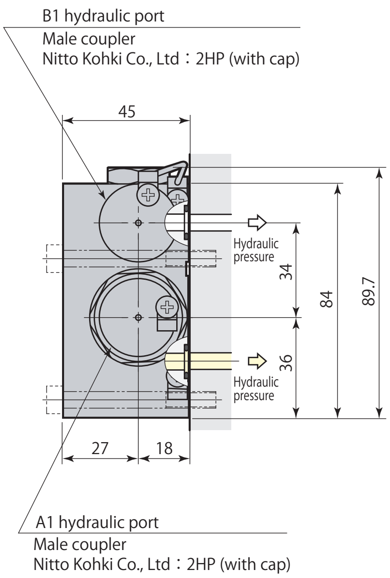
● There is also a type that adopts fluorocarbon for seal sections where cutting fluid is applied, as a measure for the use of chlorine-based cutting fluid (this is not thermal resistant specification. Model designation VCB-□□-V).

Dimensions

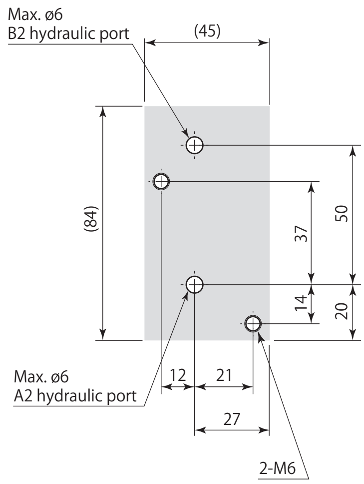
VCB-LGB Manifold, GB mounting

∗With internal filter (A1 & A2 hydraulic ports)





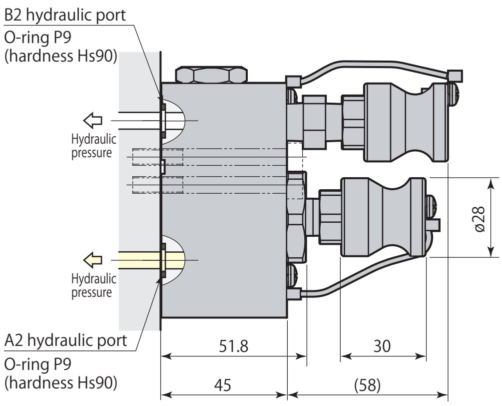
Mounting details

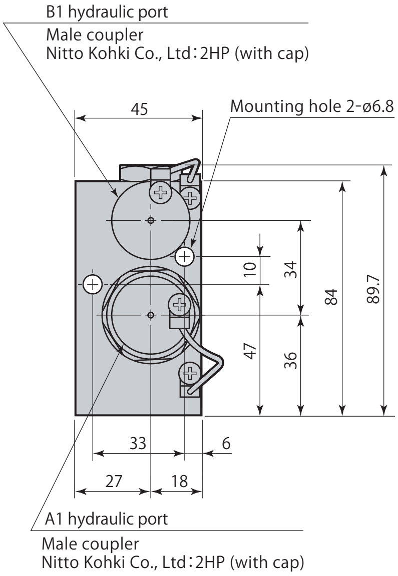


For manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

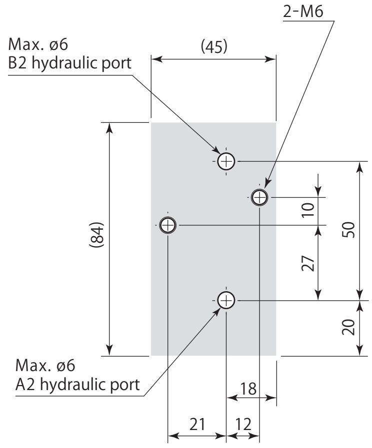
Dimensions

VCB-LGS Manifold, GS mounting ∗With internal filter (A1 & A2 hydraulic ports)



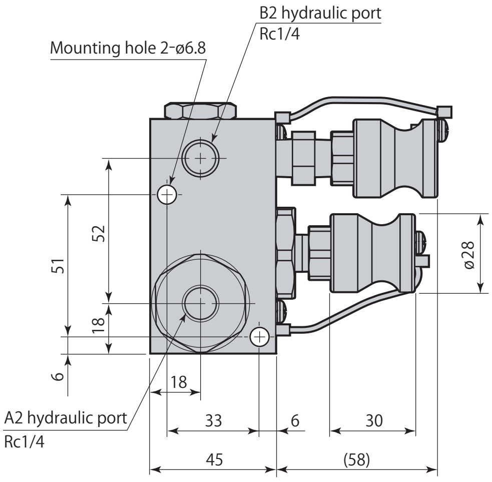


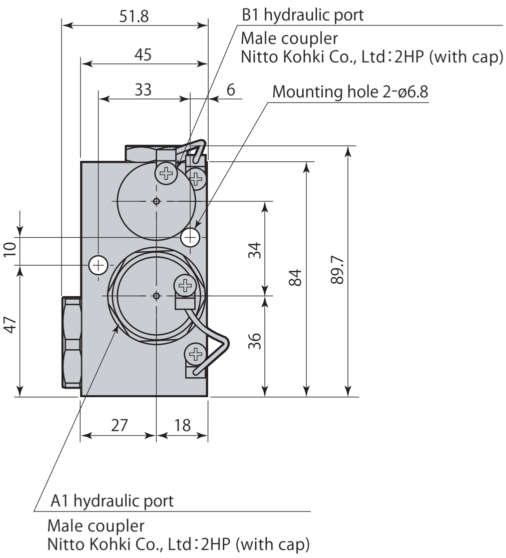
Mounting details



For manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

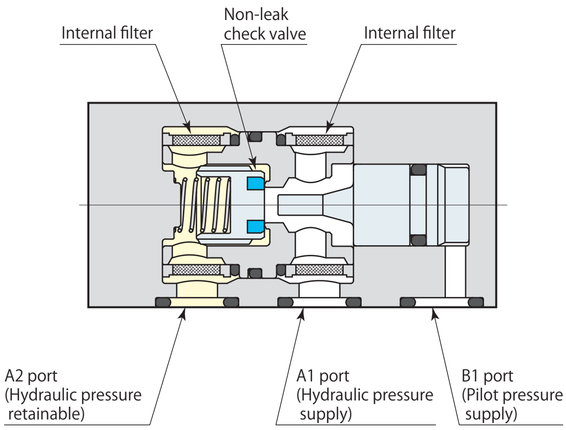
VCB-LT Piping mounting ∗With internal filter (A1 & A2 hydraulic ports)

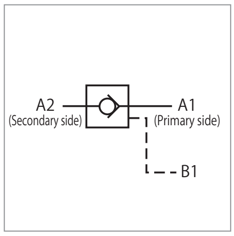




● Female coupler (Nitto Kohki Co., Ltd：2HS) and mounting screws are not included.

Pilot check valve model VCP





This is a non-leak pilot check valve, with which clamping circuit pressure can be retained over a long period of time after disengagement of hydraulic pressure source.

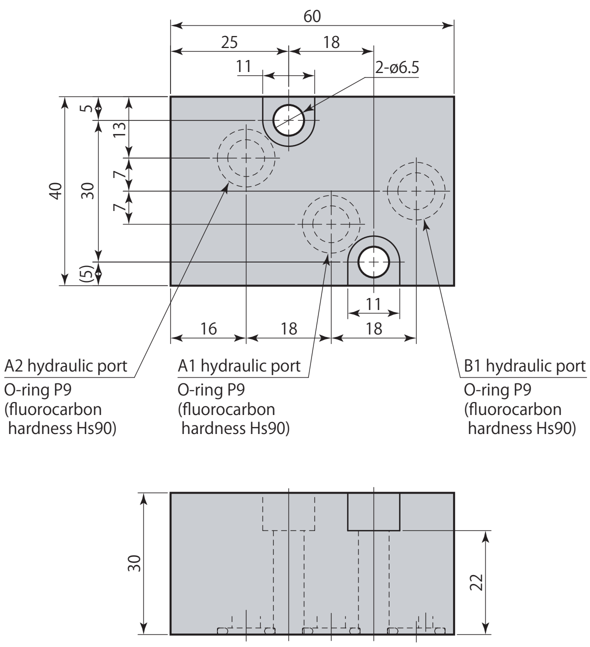
Specifications

Model		VCP-LG
Mounting, piping methods		Manifold mounting
Pressure range	MPa	1–7
Proof pressure	MPa	10.5
Cracking pressure	MPa	0.019
Min. pilot pressure (open valve)	MPa	0.01 + 0.24 × A2 hydraulic port (secondary side) pressure
Orifice area	mm^2	14.2
Operating temperature	℃	0–70
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)
Mass	kg	0.5

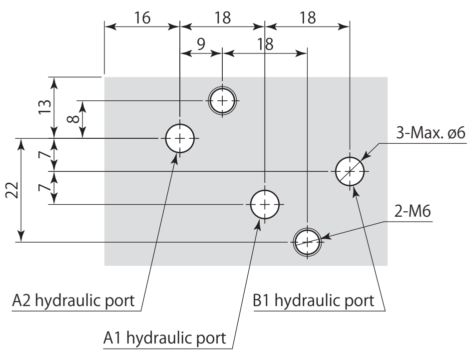
● Fluorocarbon has been adopted for seal sections where cutting fluid is applied, as a measure for the use of chlorine-based cutting fluid (this is not thermal resistant specification).

Dimensions

VCP-LG Manifold mounting ∗With internal filter (A1 & A2 hydraulic ports)



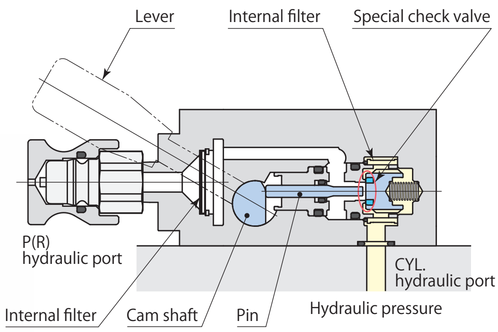
Mounting details



For manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

● Mounting screws are not included.
● This valve cannot be used in the circuit which pressure is applied to both of A1 and B1 port.

Coupling valve **model VHD**



This is a non-leak valve, with which coupling of single acting clamp can be performed easily and clamping circuit pressure can be retained over a long period of time after disengagement of hydraulic pressure source.

Specifications

VHD-L – Mounting, piping methods – Lever action – Lever mounting – Option

Mounting, piping methods
- **GB** : Manifold, GB mounting
- **GS** : Manifold, GS mounting
- **T** : Piping

Lever action
- **(Nil)** : Clamping position keeping type
- **D** : Detent type

Lever mounting
- **(Nil)** : Standard
- **K** : Opposite side

Option
- **(Nil)** : NBR
- **V***: Fluorocarbon

▇ indicates made to order.

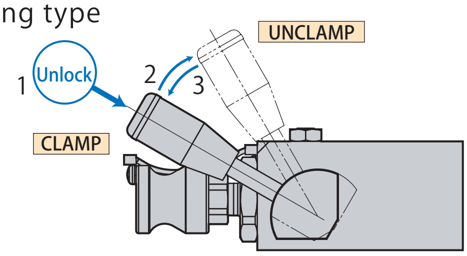
*: Fluorocarbon has been adopted for seal sections where cutting fluid is applied, as a measure for the use of chlorine-based cutting fluid (this is not thermal resistant specification).

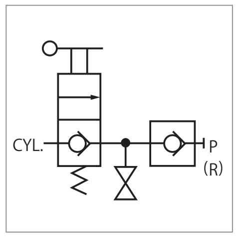
Model		VHD-LGB	VHD-LGS	VHD-LT
Pressure range	MPa	2–7		
Proof pressure	MPa	10.5		
Cracking pressure	MPa	0.017		
Orifice area	mm^2	21.0		
Operating temperature	℃	0–70		
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)		
Mass	kg	1.4		

Lever operation

VHD-L□-□□ Clamping position keeping type

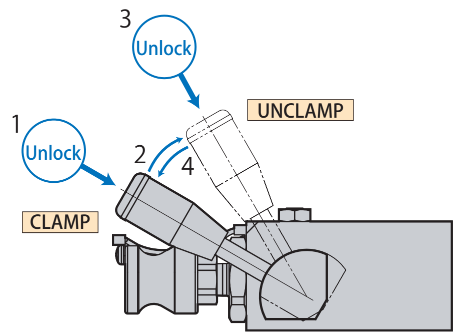
From the clamping position
1. Push the lever lock is released.
2. Unclamp causing the lever.
3. Return to the clamping position when you take your hand off the lever.

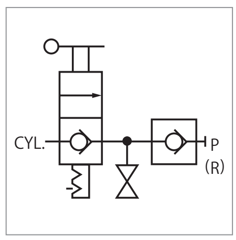




VHD-L□-D□□ Detent type

From the clamping position
1. Push the lever lock is released.
2. Unclamp and lock causing the lever.
3. When the clamp, push the lever to unlock.
4. Clamp and lock the lever back.





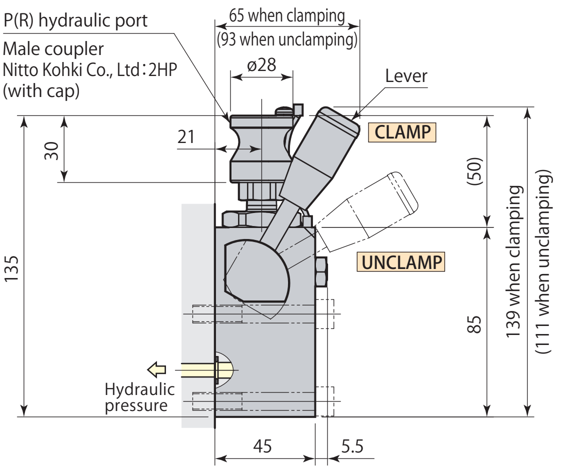
Coupling valve

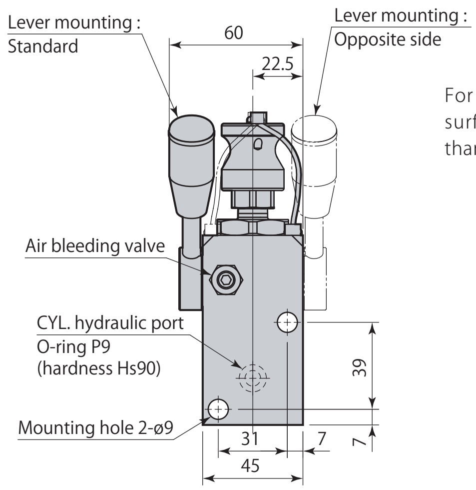
VHD

Dimensions

VHD-LGB-□□□ Manifold, GB mounting

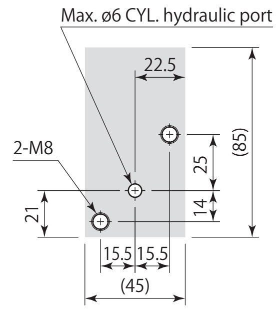
∗With internal filter (P & CYL. hydraulic ports)





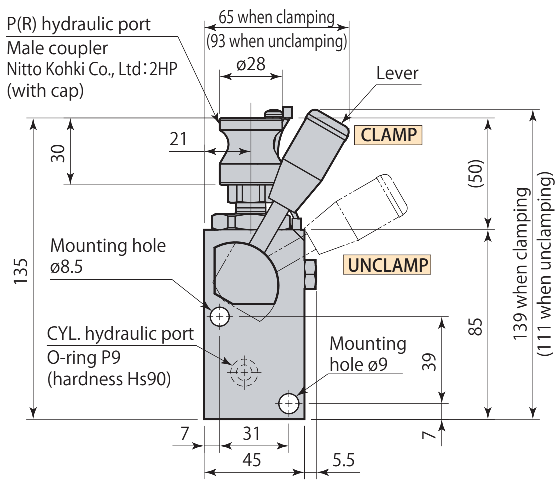
Mounting details

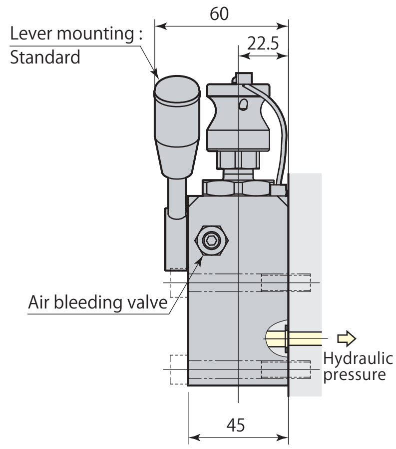
For manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).



VHD-LGS-□□ Manifold, GS mounting

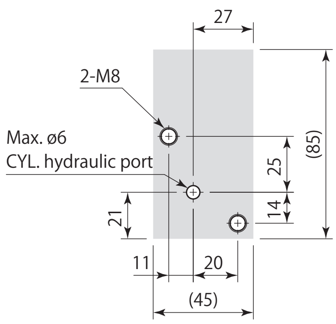
∗With internal filter (P & CYL. hydraulic ports)
Opposite side lever not available





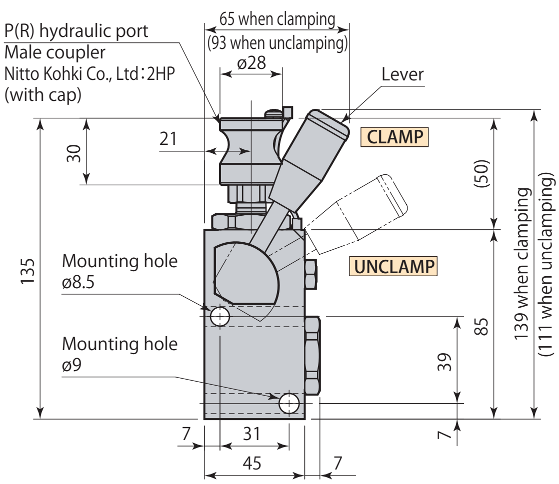
Mounting details

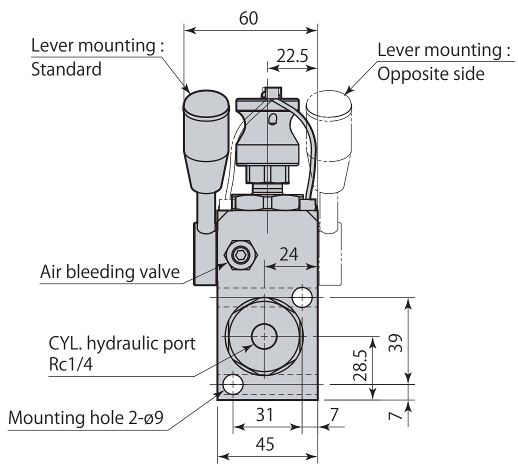
For manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).



VHD-LT-□□□ Piping mounting

∗With internal filter (P & CYL. hydraulic ports)



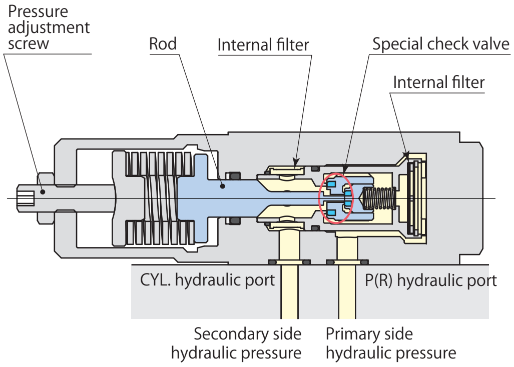


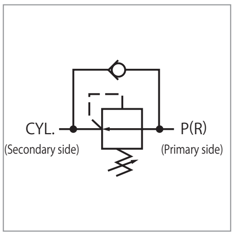
● Female coupler (Nitto Kohki Co., Ltd：2HS) and mounting screws are not included.

Coupling valve

VHD

Reducing valve model **VRG**





Internal hydraulic pressure of circuit can be partially reduced.
This is a non-leak type that requires no drain.

Specifications

Model		VRG-LG	VRG-LT	VRG-LS
Mounting, piping methods		Manifold mounting	Piping mounting	VHD linking
Primary side hydraulic pressure range	MPa	2–7		
Secondary side hydraulic pressure range	MPa	1–6		
Allowable min. differential pressure*	MPa	1		
Proof pressure	MPa	10.5		
Pressure change per revolution	MPa/rev	0.5		
Orifice area	mm^2	28.1		
Operating temperature	℃	0–70		
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)		
Mass	kg	0.9	1.0	1.0

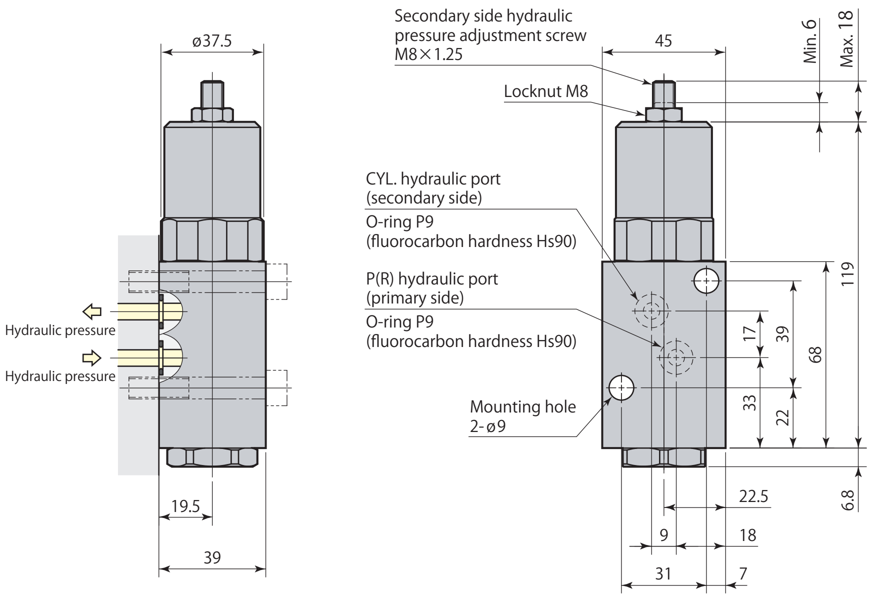
- Fluorocarbon has been adopted for seal sections where cutting fluid is applied, as a measure for the use of chlorine-based cutting fluid (this is not thermal resistant specification).
- Avoid overpressure to CYL. hydraulic port of the valve if there is a risk of back pressure in secondary circuit.

*:The setting should be performed so that the differential pressure between primary side hydraulic pressure and secondary side hydraulic pressure may exceed 1 MPa. (Example:If primary side hydraulic pressure is 5 MPa, secondary side hydraulic pressure should be from 1 to 4 MPa.)

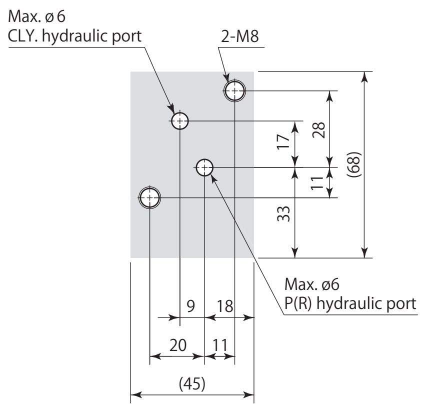
▇ indicates made to order.

Dimensions

VRG-LG Manifold mounting ∗With internal filter (P & CYL. hydraulic ports)



Mounting details

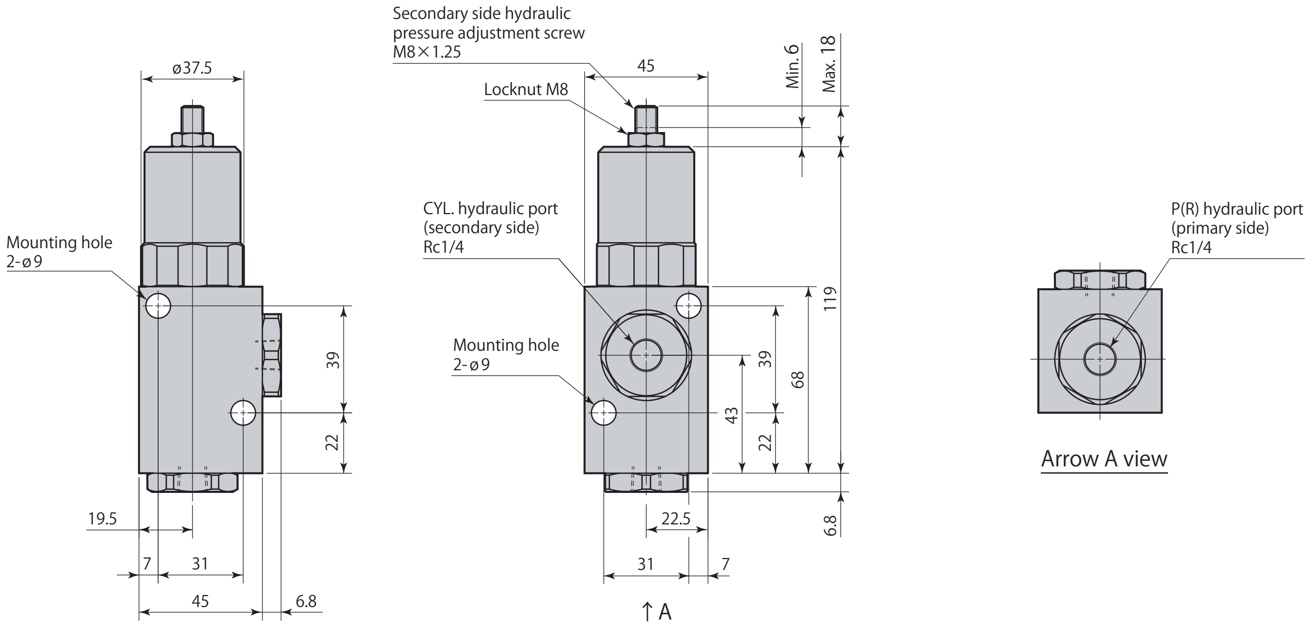


For manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

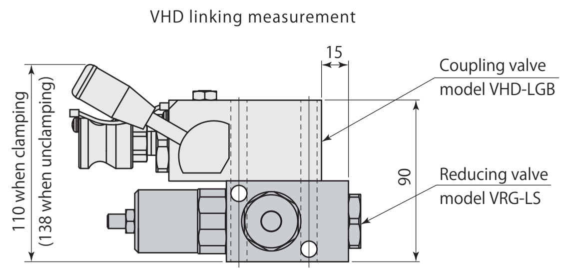
Reducing valve
VRG

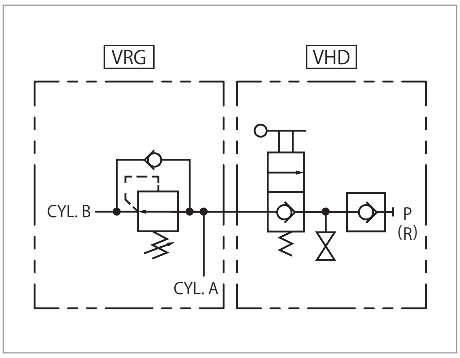
Dimensions

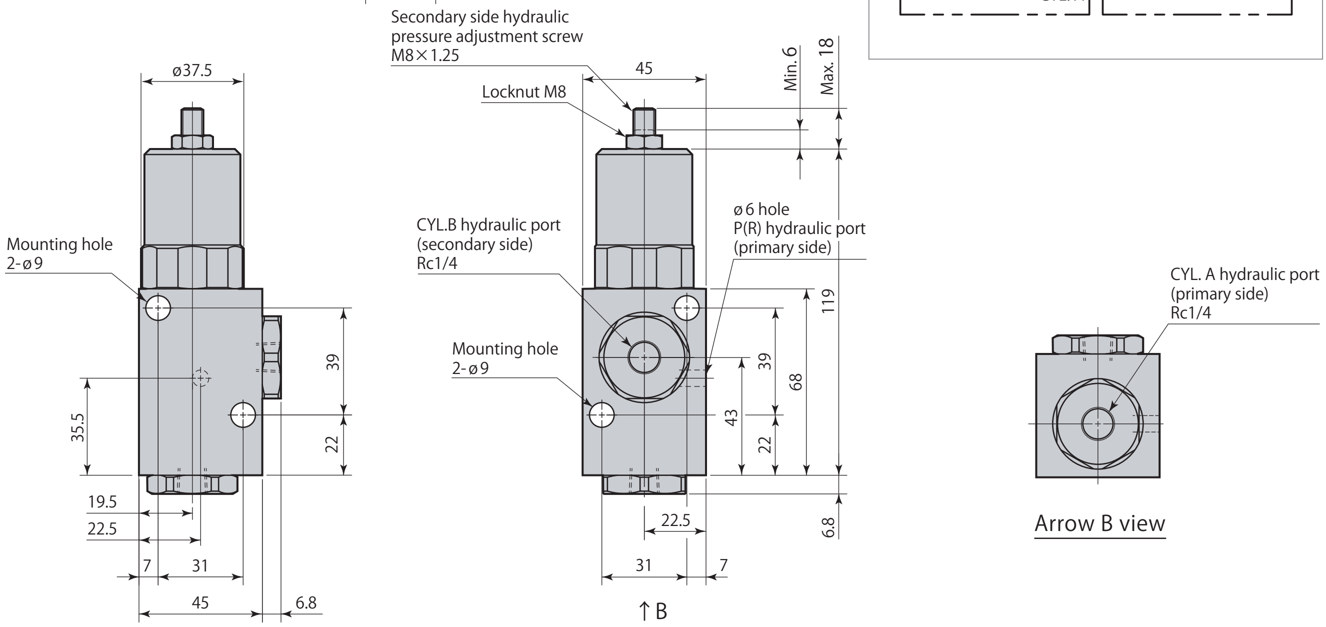
VRG-LT Piping mounting ∗With internal filter (P & CYL. hydraulic ports)



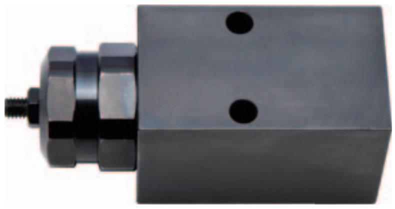
VRG-LS VHD linking ∗With internal filter (P & CYL. hydraulic ports)



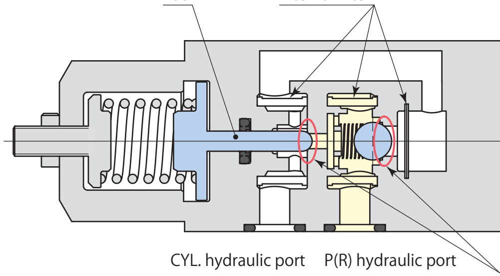


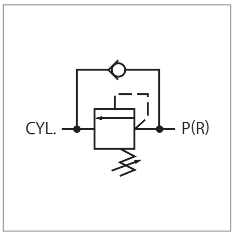


- Structure is such that when pressure on secondary side (low pressure side) drops due to temperature change or oil leak, flow channel to primary side (high pressure side) is opened to replenish oil until pressure reaches set pressure.
- Pressure is not supplemented when primary side is separated from hydraulic pressure source.
- Mounting screws are not included.



Sequence valve model **VEF**





Clamps are sequentially operated through same circuit.

Specifications

Model		VEF-LG	VEF-LT
Mounting, piping methods		Manifold mounting	Piping mounting
Pressure range	MPa	2–30	
Allowable min. differential pressure*	MPa	1	
Set hydraulic pressure range	MPa	1–6	
Proof pressure	MPa	37.5	
Cracking pressure	MPa	0.01	
Pressure change per revolution	MPa/rev	1	
Orifice area	mm^2	P → CYL. 7.1　CYL. → R 28.3	
Operating temperature	℃	0–70	
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)	
Mass	kg	0.8	1.0

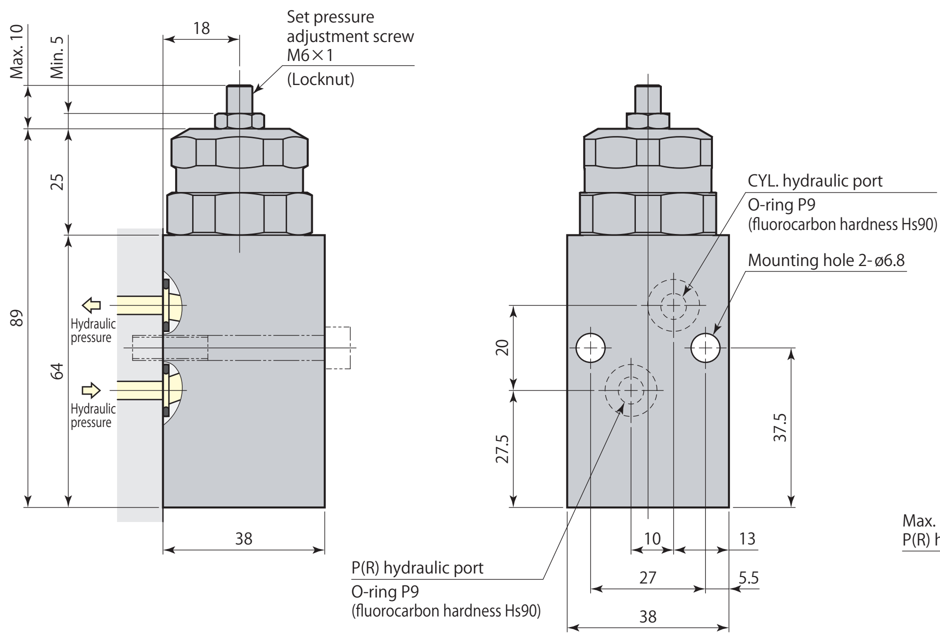
● Fluorocarbon has been adopted for seal sections where cutting fluid is applied, as a measure for the use of chlorine-based cutting fluid (this is not thermal resistant specification).

＊: The setting should be performed so that the differential pressure between working pressure and set hydraulic pressure may exceed 1 MPa. (Example: If working pressure is 5 MPa, set hydraulic pressure should be from 1 to 4 MPa.)

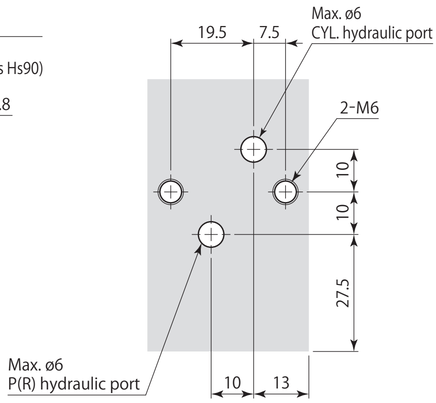
Dimensions

VEF-LG　Manifold mounting

＊With internal filter (P & CYL. hydraulic ports)



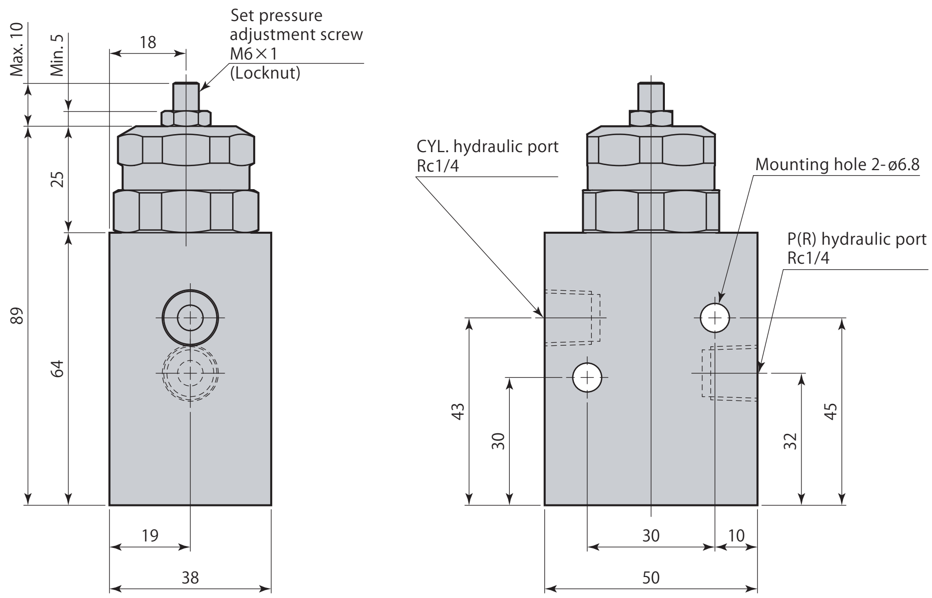
Mounting details



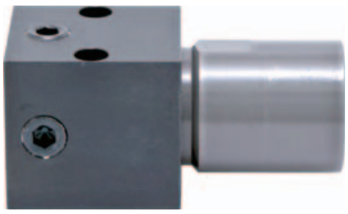
For manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

Dimensions

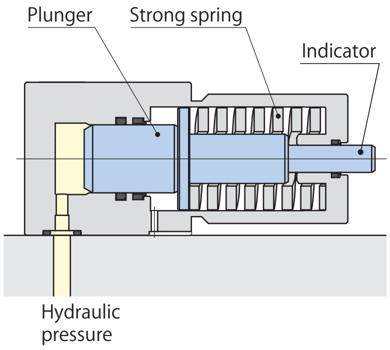
VEF-LT Piping mounting ∗With internal filter (P & CYL. hydraulic ports)

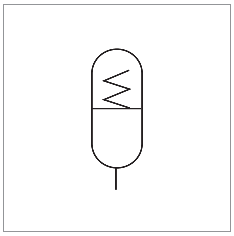


- The sequence valve may open by lower pressure than the set value when a large volume of oil flow is applied. It is due to the surge pressure caused by an oil hammer phenomenon. Use VEF with a flow control valve installing at primary side to adjust the flow rate.
- The sequence effect may not be achievable due to a back pressure in case the hydraulic circuit would be built by meter-out control or would generate pipe resistance.
- Mounting screws are not included.



Accumulator model **WPB**





Spring pressure type accumulator.
Pressure fluctuation that occurs due to temperature change after disengaging hydraulic pressure source is suppressed.

Specifications

WPB [2 / 3 / 4 / 5 / 6 / 7] – [Oil discharge, absorption amount] [Mounting method] – [Scraper, seal material]

Oil discharge, absorption amount
- **1** : 3.3 cm^3
- **2** : 6.6 cm^3
- **3** : 13 cm^3

Mounting method
- **GB** : Manifold, GB mounting
- **GS** : Manifold, GS mounting
- **T** : Piping

Scraper, seal material
- **(Nil)** : NBR (standard)
- **V*** : Fluorocarbon

*:Fluorocarbon has been adopted for seal sections where cutting fluid is applied, as a measure for the use of chlorine-based cutting fluid (this is not thermal resistant specification).

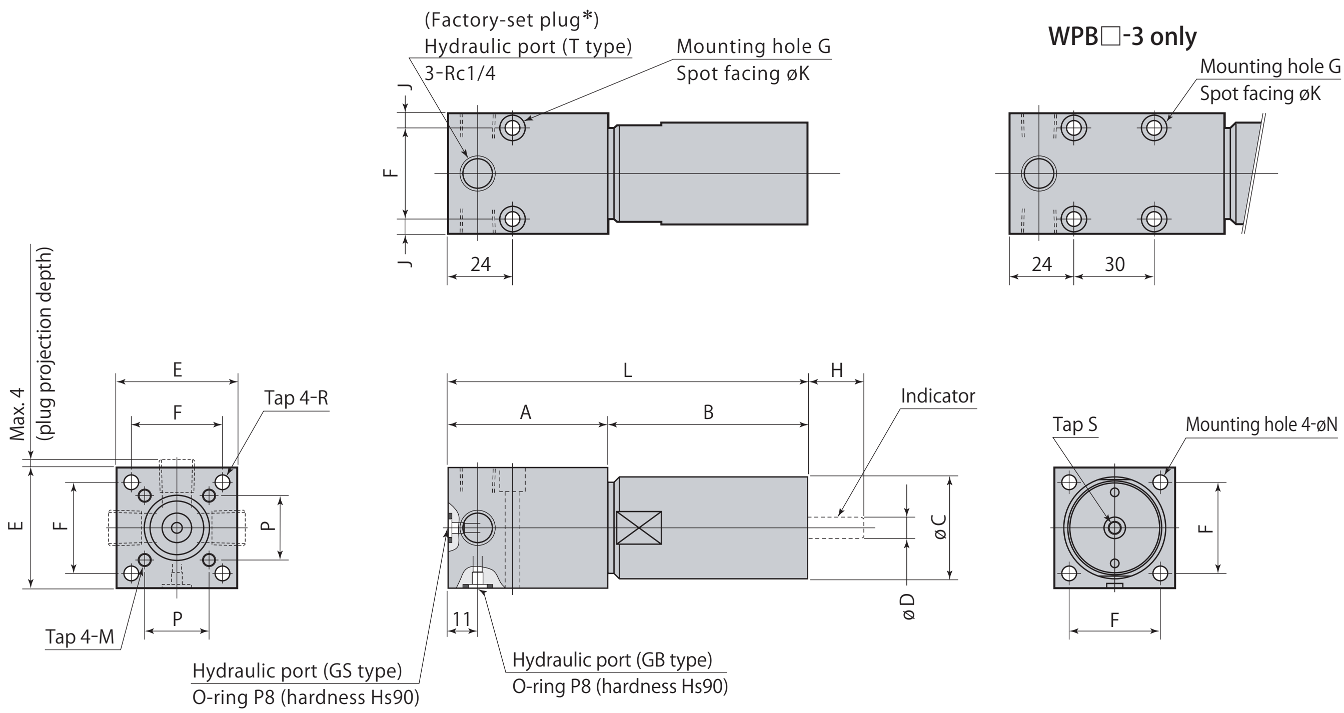
Model		WPB2-1	WPB2-2	WPB2-3	WPB3-1	WPB3-2	WPB3-3	WPB4-1	WPB4-2	WPB4-3
Hydraulic pressure	MPa	Refer to **page →425** for characteristic line diagram.								
Oil capacity	cm^3	3.3	6.6	13.0	3.3	6.6	13.0	3.3	6.6	13.0
Pressure fluctuation per 1cm^3	MPa	0.55	0.38	0.19	0.50	0.33	0.17	0.43	0.29	0.14
Mass	kg	0.9	1.2	1.8	0.9	1.2	1.8	0.9	1.2	1.8

Model		WPB5-1	WPB5-2	WPB5-3	WPB6-1	WPB6-2	WPB6-3	WPB7-1	WPB7-2	WPB7-3
Hydraulic pressure	MPa	Refer to **page →425** for characteristic line diagram.								
Oil capacity	cm^3	3.3	6.6	13.0	3.3	6.6	13.0	3.3	6.6	13.0
Pressure fluctuation per 1cm^3	MPa	0.41	0.27	0.16	0.90	0.61	0.36	0.84	0.59	0.34
Mass	kg	1.3	1.7	2.4	1.3	1.7	2.4	1.3	1.7	2.4

● Proof pressure:7 MPa (WPB2, 3, 4) , 15 MPa (WPB5, 6, 7) ● Operating temperature:0–70℃
● Fluid used:General mineral based hydraulic oil (ISO-VG32 or equivalent)

Dimensions

WPB□-□□-□ ∗No internal filter



mm

Model		A	B	øC	øD	E	F	G	Max. H	J	øK	L	M	øN	P	R	S
WPB 2 3 4	-1	49	46	38	8	45	34	2-ø5.5	10.5	5.5	9.5 depth 9	95	M5×0.8 depth 10	5.5	24	–	M5×0.8 depth 9
	-2	59.5	74.5					2-ø5.5	21			134					
	-3	80	151					4-ø5.5	41.5			231					
WPB 5 6 7	-1	49	70	42.7	10	50	38	2-ø6.8	10.5	6	11 depth 11	119	–	6.8	–	M8×1.25 depth 16	M6×1 depth 11
	-2	59.5	105					2-ø6.8	21			164.5					
	-3	80	186					4-ø6.8	41.5			266					

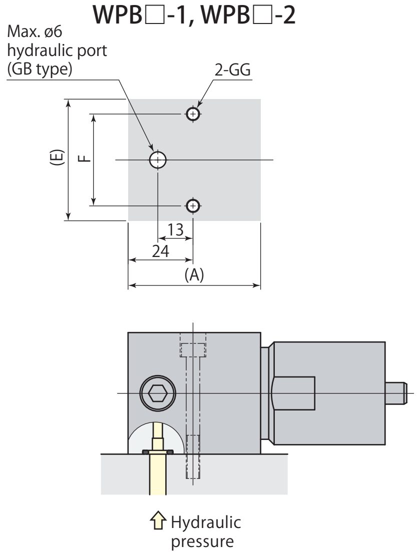
∗: Included plug T type: 2 pieces, GB & GS type: 3 pieces.

● Mounting screws are not included.

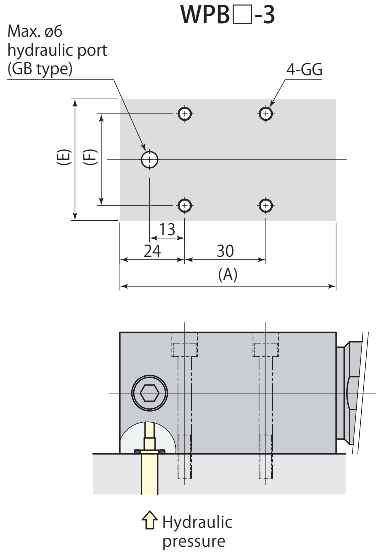
Mounting details

Manifold, GB mounting / Piping mounting

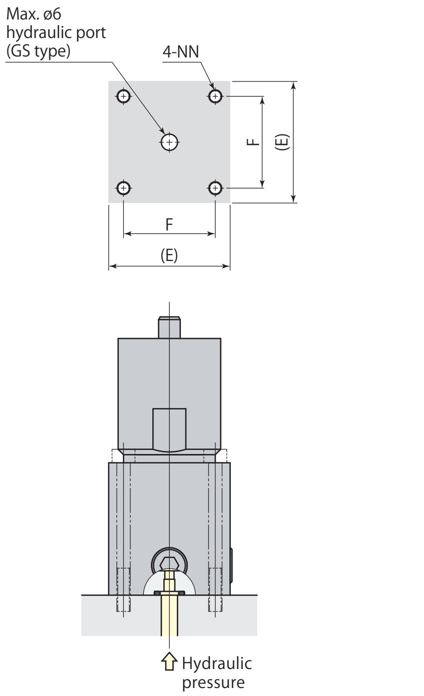
WPB□-1, WPB□-2



WPB□-3

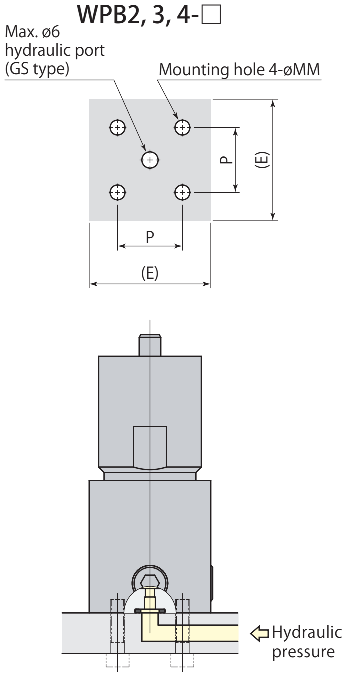


Manifold, GS mounting ① / Piping mounting ①

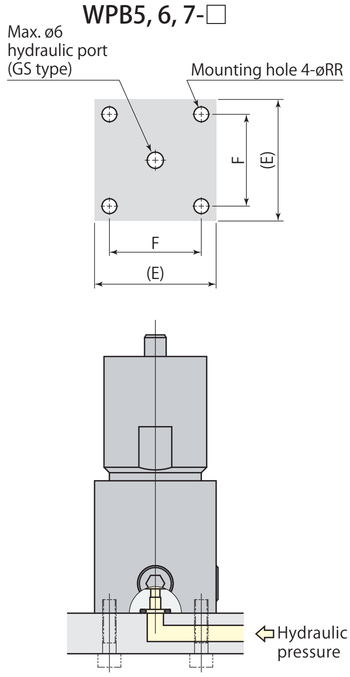


Manifold, GS mounting ② / Piping mounting ②

WPB2, 3, 4-□



WPB5, 6, 7-□

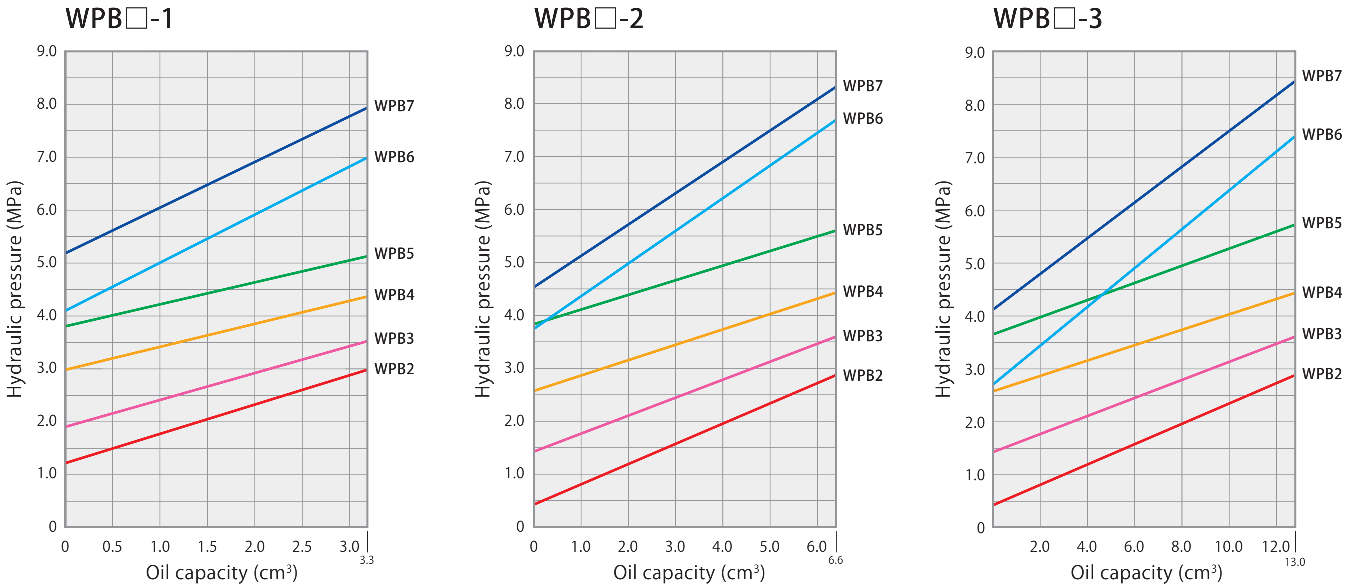


When manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

mm

Model		A	E	F	GG	øMM	NN	P	øRR
WPB 2 3 4	-1	49	45	34	M5	5.5	M5	24	–
	-2	59.5							
	-3	80							
WPB 5 6 7	-1	49	50	38	M6	–	M6	–	9
	-2	59.5							
	-3	80							

Characteristic line diagram



This characteristic line diagram represents theoretical values.

Model selection example

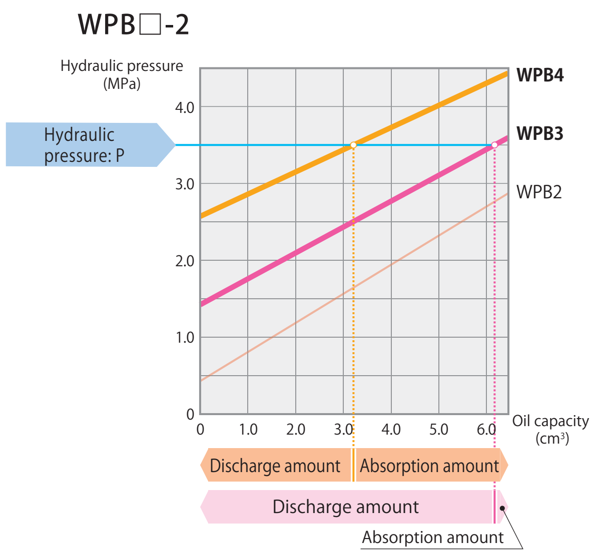
Condition (estimated temperature drop：20℃)

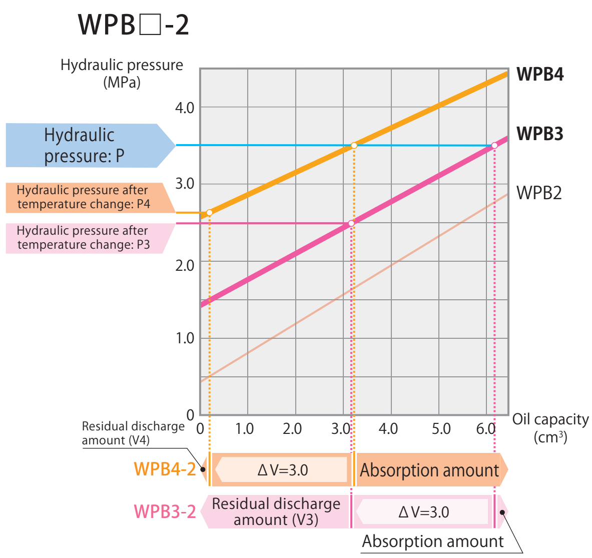
Working clamp	CLU06×4 pieces	Piping	Inner diameter ø6×0.6m×4 pieces
Hydraulic pressure：P	3.5 MPa	Valve & hydraulic pressure equipment	VCB：1 piece, VRG：2 pieces

Selection procedure

1. Calculation of circuit capacity
   Clamping capacity：$\underset{\text{Pressure bearing area}}{9.6}\times\underset{\text{Stroke}}{2.6}\times\underset{\text{Qty}}{4}=100\ cm^3$
   Piping capacity：$0.283\times60\times4=68\ cm^3$
   Valve & hydraulic equipment capacity：$8\times3=24\ cm^3$
   (Perform calculation with capacity of 8 cm^3 for each of valves and hydraulic equipment in hydraulic circuit, when using Pascal product.)
   Circuit capacity：$100+68+24=192\ cm^3$
2. Selection of oil capacity
   Select the equipment having oil capacity capable of keeping volumetric change.
   Volumetric change is obtained by using formula shown below.
   $\Delta V=V\times\Delta T\times\alpha$ ΔV：Volumetric change (cm^3) V：Circuit capacity (cm^3)
   ΔT：Temperature change (℃) α：Thermal expansion coefficient (7.8×10^{-4})
   $\Delta V=192\times20\times7.8\times10^{-4}=3.0\ cm^3$
   Here, WPB□-2 is selected as an example (∗1).
3. Selection of WPB hydlaulic pressure
   Select the pressure whose oil discharge amount (∗2) under hydraulic pressure satisfies ΔV calculated in step 2. Read off characteristic line diagram.
   If the hydraulic pressure is 3.5 MPa, select WPB3-2 or WPB4-2.
4. Verification of hydraulic pressure and residual discharge amount (∗2) after temperature change
   Select the one whose hydraulic pressure drop after temperature change is low and residual discharge amount (∗2) satisfies the marginal oil amount (∗3). Read off characteristic line diagram.
   The hydraulic pressure after temperature change drops to 2.5 MPa with WPB3-2 (P3) and to 2.6 MPa with WPB4-2 (P4).
   The residual discharge amount (∗2) becomes 3.3 cm^3 with WPB3-2 (V3) and 0.3 cm^3 with WPB4-2 (V4).
   In this case, select WPB3-2□ with the marginal amount retained.
5. Select piping method.

∗1：WPB□-1 and WPB□-3 are also selectable. Likewise, select appropriate one in consideration of steps 3 and 4.
∗2：For when the temperature decreases. If the temperature increases, check the absorption amount.
∗3：Allow adequate margin for residual discharge amount after temperature change, as there may be margin of error with spring force of internal spring. Marginal oil amount：WPB□-1：About 0.5 cm^3, WPB□-2：About 1.0 cm^3, WPB□-3：About 1.5 cm^3

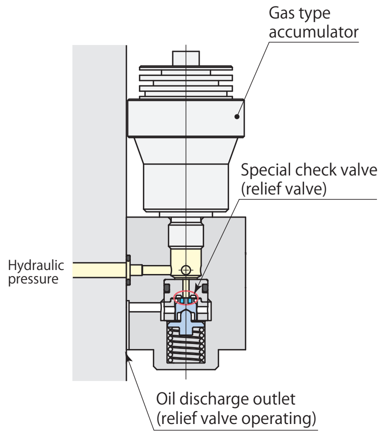


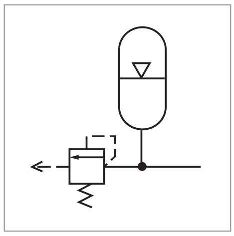


Accumulator

WPB Spring

Accumulator model **WPC**





N2 pressure type accumulator.
Equipped with a relief valve for preventing breakdown of device in case of problems with circuit pressure (high pressure).

Specifications

Model		WPC13L-G Gas pressure*	WPC13L-T Gas pressure*	WPC40L-G Gas pressure*	WPC40L-T Gas pressure*
Mounting, piping methods		Manifold mounting	Piping mounting	Manifold mounting	Piping mounting
Pressure range	MPa	Refer to **page →427** for characteristic line diagram.			
Gas capacity	cm^3	13		40	
Oil capacity	cm^3	10		30	
Mass	kg	1.1		1.6	

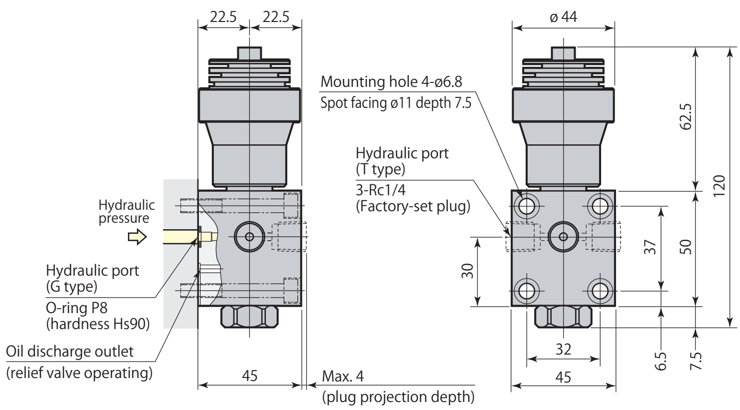
- Proof pressure：10.5 MPa
- Operating temperature：0–60°C
- Fluid used：General mineral based hydraulic oil (ISO-VG32 equivalent)
- There is also a type that adopts fluorocarbon for seal sections where cutting fluid is applied, as a measure for the use of chlorine-based cutting fluid (this is not thermal resistant specification. Model designation WPC□L-□□-V).

＊：Initially filled gas pressure can be set in range of 1 MPa to 6 MPa with 0.5 MPa increment. Specify gas pressure when ordering.
Example：WPC13L-T3.0 (gas pressure 3 MPa)

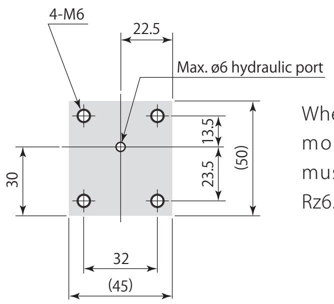
Dimensions

WPC13L-□□

＊No internal filter



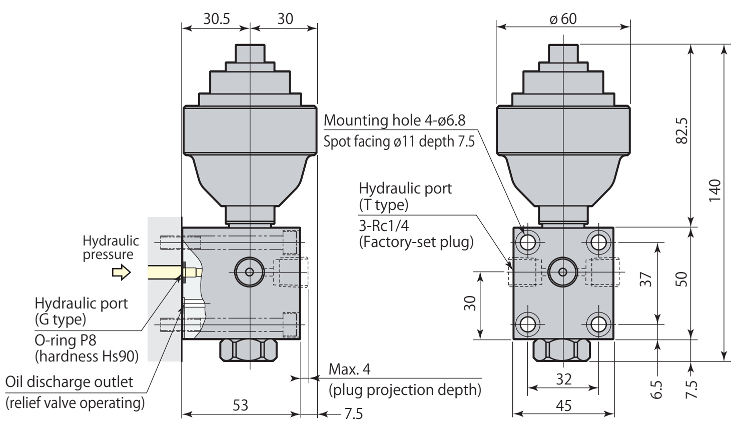
Mounting details



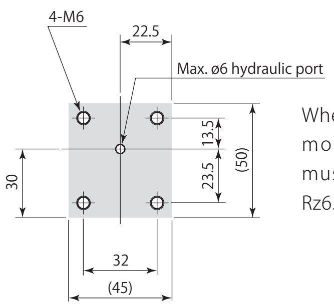
When manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

WPC40L-□□

＊No internal filter



Mounting details

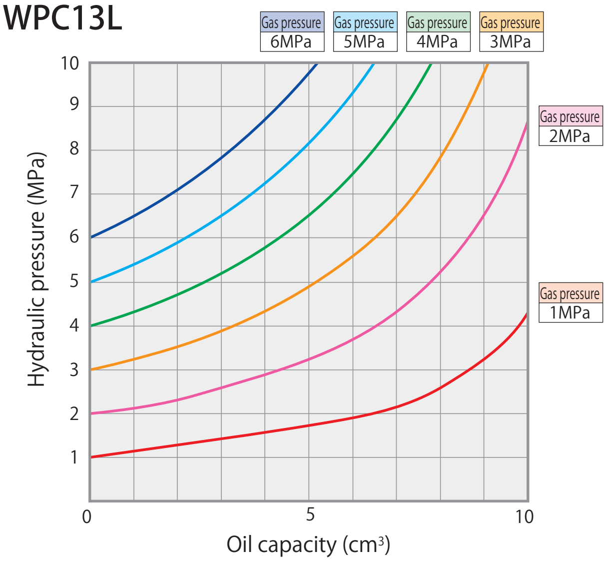


When manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

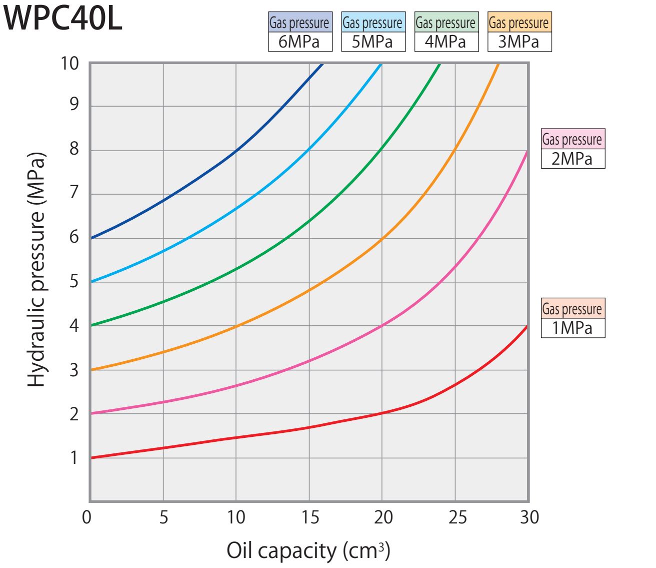
- Mounting screws are not included.

Characteristic line diagram

WPC13L



WPC40L



This characteristic line diagram represents theoretical values.

Model selection example

Condition (estimated temperature drop：20℃)

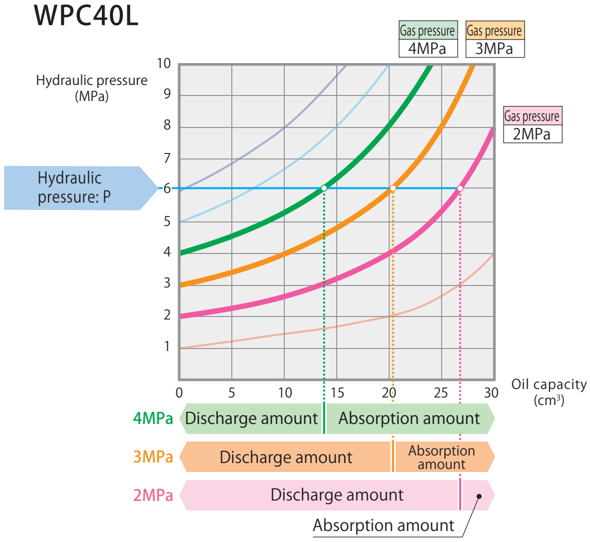
Working clamp	CTU06×8 pieces	Piping	Inner diameter ø6×0.8 m×8 pieces
Hydraulic pressure：P	6 MPa	Valve & hydraulic pressure equipment	VCB：1 piece, VRG：2 pieces

Selection procedure

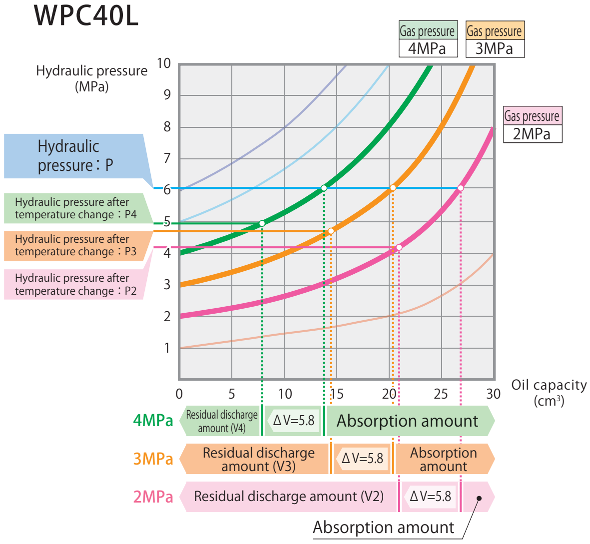
1. Calculation of circuit capacity
   Clamping capacity：$\underbrace{8.9}_{\text{Pressure bearing area}}\times\underbrace{2.35}_{\text{Stroke}}\times\underbrace{8}_{\text{Qty}}= 167\ \text{cm}^3$
   Piping capacity：$0.283\times80\times8=181\ \text{cm}^3$
   Valve & hydraulic equipment capacity：$8\times3=24\ \text{cm}^3$
   (Perform calculation with capacity of 8 cm³ for each of valves and hydraulic equipment in hydraulic circuit, when using Pascal product.)
   Circuit capacity：$167+181+24=372\ \text{cm}^3$
2. Selection of oil capacity
   Select the equipment having oil capacity capable of keeping volumetric change.
   Volumetric change is obtained by using formula shown below.
   $\Delta V=V\times\Delta T\times\alpha$ ΔV：Volumetric change (cm³) V：Circuit capacity (cm³)
   ΔT：Temperature change (℃) α：Thermal expansion coefficient (7.8×10^{-4})
   $\Delta V= 372\times20\times7.8\times10^{-4}=5.8\ \text{cm}^3$
   Here, WPC40L is selected as an example (∗1).
3. Selection of gas pressure
   Select the pressure whose oil discharge amount (∗2) under hydraulic pressure satisfies ΔV calculated in step 2. Read off characteristic line diagram.
   If the hydraulic pressure of the clamping circuit is 6 MPa, select gas pressure 2 MPa, 3 MPa, or 4 MPa.
4. Verification of hydraulic pressure and residual discharge amount (∗2) after temperature change
   Select the one whose hydraulic pressure drop after temperature change is low and residual discharge amount (∗2) satisfies the marginal oil amount (∗3). Read off characteristic line diagram.
   The hydraulic pressure after temperature change drops to 4.2 MPa with 2 MPa gas pressure (P2), to 4.7 MPa with 3 MPa gas pressure (P3), and to 4.9 MPa with 4 MPa gas pressure (P4), respectively.
   The residual discharge amount (∗2) is 20.9 cm³ for 2 MPa gas pressure (V2), 14.2 cm³ for 3 MPa (V3), and 7.5 cm³ for 4 MPa (V4), respectively.
   Here, select WPC40L-□4 whose pressure drop is low.
5. Select piping method.

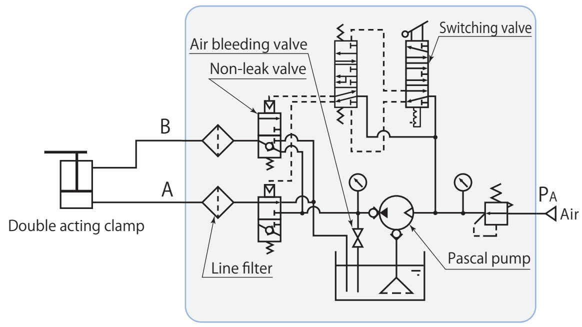
∗1：WPC13L is also available. Likewise, select appropriate one in consideration of steps 3 and 4.
∗2：For when the temperature decreases. If the temperature increases, check the absorption amount.
∗3：Allow adequate margin for residual discharge amount after temperature change, as there may be margin of error with gas filling pressure. Marginal oil amount : About 2.0 cm³

WPC40L



WPC40L





Control unit model **HCD□H-W**

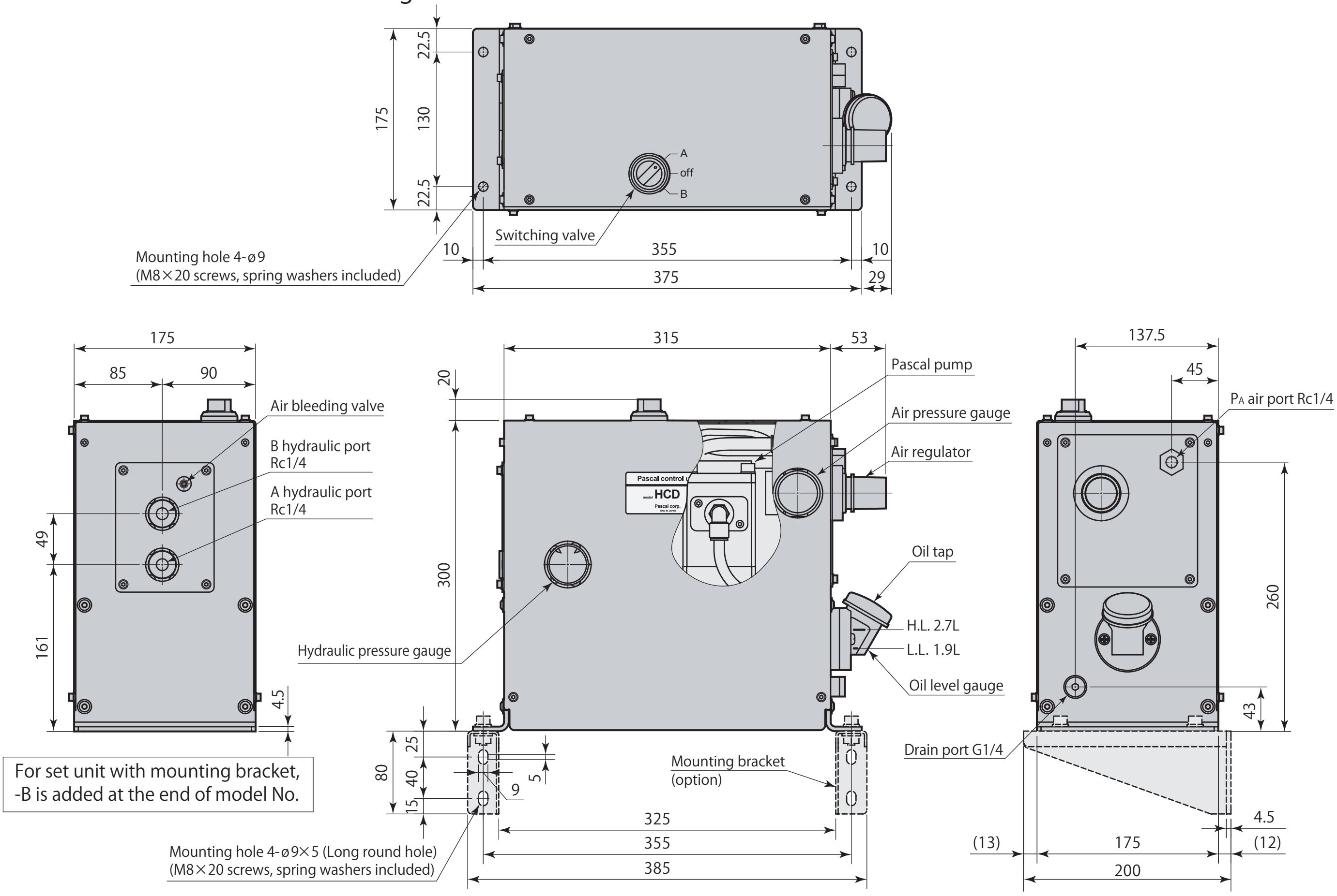
This is a hydraulic control unit that is air driven and manually operated, combining non-leak valve with non-leak feature (zero oil leaks), which is essential for hydraulic clamps, and Pascal pump. Since two hydraulic circuits can be operated and controlled alternatingly, it is best suited hydraulic pressure source for double acting clamps.
Pascal pump stops pumping once circuit pressure has been attained and retains the pressure. Furthermore, since there is hardly any temperature fluctuation of working fluid, there is no need for any auxiliary pressure equipment.

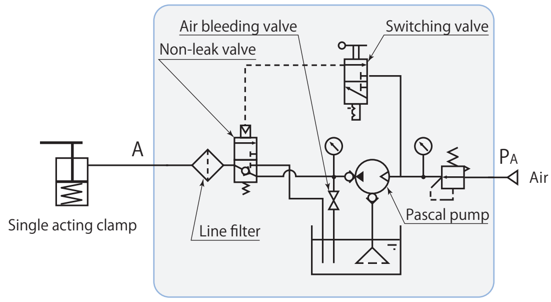
Model		HCD4H-W	HCD5H-W
Pascal pump		X6312U-C	X6316S-C
Discharge oil pressure*1	MPa	3.6–10.8	2.25–6.75
Set air pressure	MPa	0.2–0.5	
Unloaded oil discharge amount	L/min	Refer to **page →433** for performance diagram.	
Tank capacity*2	L	H.L. 2.7 L.L. 1.9	
Operating temperature	°C	5–60	
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)	
Mass	kg	23	

∗1 : Ask for consultation on specifications that exceed discharge oil pressure range.
∗2 : Oil level in the tank should be always between H.L. and L.L. of the gauge.

Dimensions

HCD□H-W Double acting circuit control unit





Control unit model **HCD□H-S**

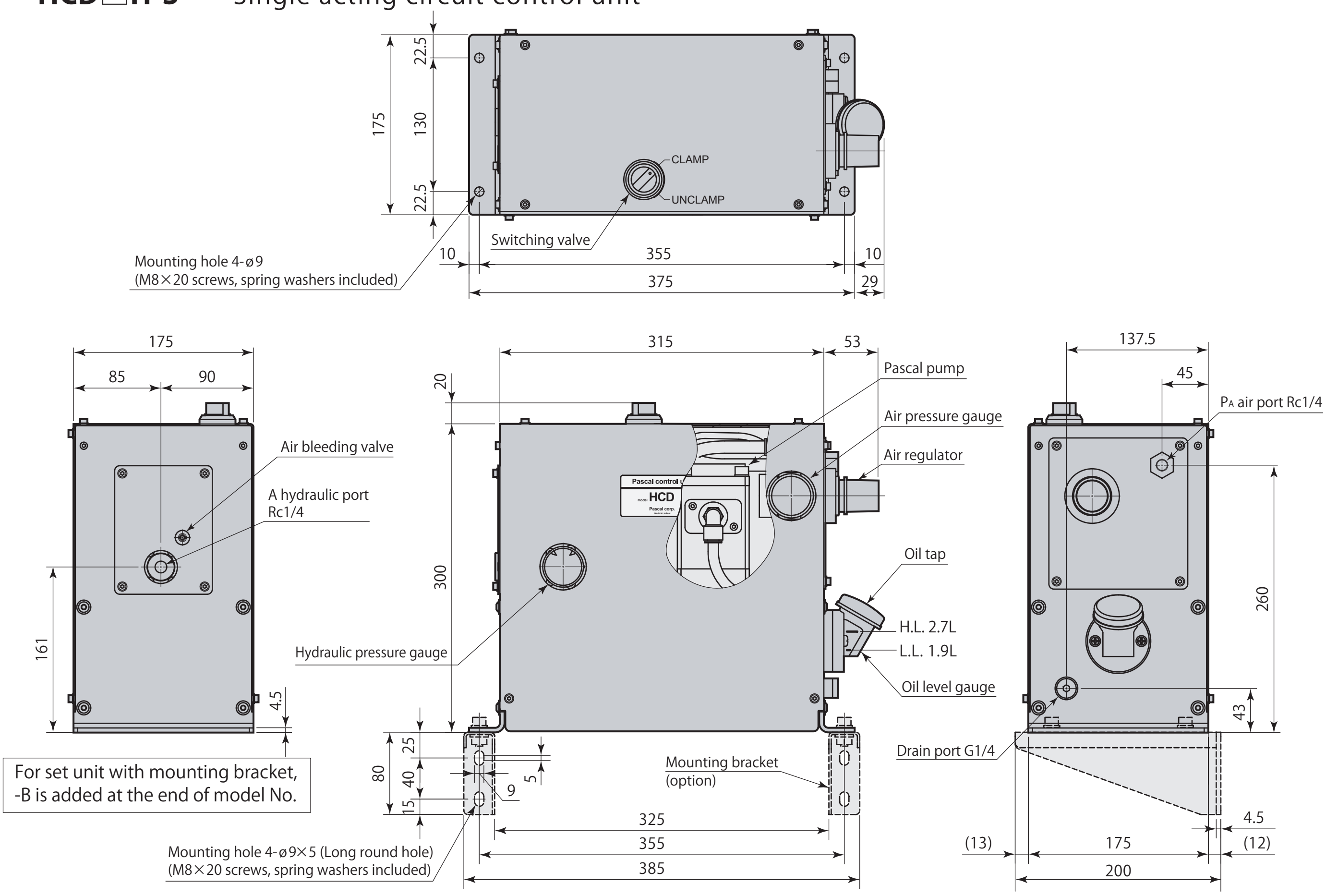
This is a hydraulic control unit that is air driven and manually operated, combining non-leak valve with non-leak feature (zero oil leaks), which is essential for hydraulic clamps, and Pascal pump.
Pascal pump stops pumping once circuit pressure has been attained and retains the pressure. Furthermore, since there is hardly any temperature fluctuation of working fluid, there is no need for any auxiliary pressure equipment.

Model		HCD4H-S	HCD5H-S
Pascal pump		X6312U-C	X6316S-C
Discharge oil pressure*1	MPa	3.6–10.8	2.25–6.75
Set air pressure	MPa	0.2–0.5	
Unloaded oil discharge amount	L/min	Refer to page →433 for performance diagram.	
Tank capacity*2	L	H.L. 2.7 L.L. 1.9	
Operating temperature	°C	5–60	
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)	
Mass	kg	21	

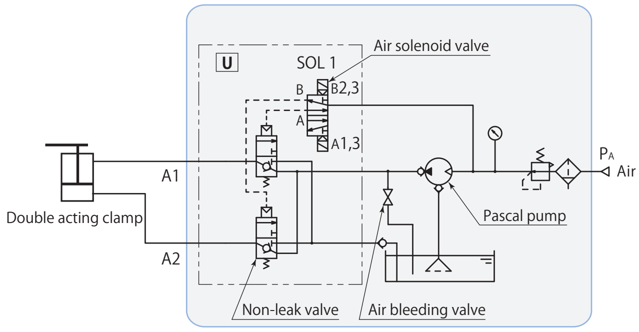
∗1: Ask for consultation on specifications that exceed discharge oil pressure range.
∗2: Oil level in the tank should be always between H.L. and L.L. of the gauge.

Dimensions

HCD□H-S Single acting circuit control unit



Control unit model **HCSD-H□U**



This is a hydraulic control unit that is air driven and solenoidal operated, combining non-leak valve with non-leak feature (zero oil leaks), which is essential for hydraulic clamps, and Pascal pump. Since two hydraulic circuits can be operated and controlled alternatingly, it is best suited hydraulic pressure source for double acting clamps.

Pascal pump stops pumping once circuit pressure has been attained and retains the pressure. Furthermore, since there is hardly any temperature fluctuation of working fluid, there is no need for any auxiliary pressure equipment.

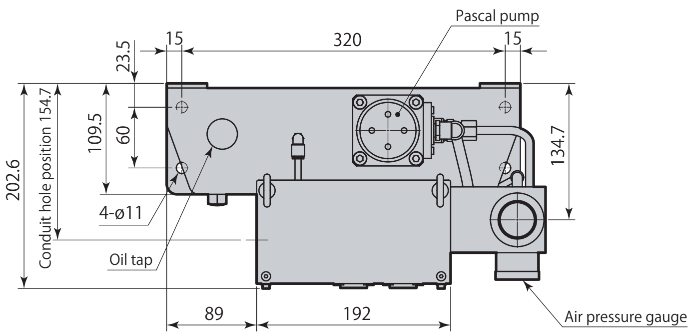
HCSD-H□U is made to order.

Model		HCSD-H4U	HCSD-H5U
Pascal pump		X6312U-D	X6316U-D
Control voltage*1		DC24V	
Discharge oil pressure*2	MPa	3.6–10.8	2.25–6.75
Set air pressure	MPa	0.2–0.5	
Unloaded oil discharge amount	L/min	Refer to **page →433** for performance diagram.	
Tank capacity*3	L	H.L. 3.5 L.L. 1.5	
Operating temperature	°C	0–50	
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)	
Mass	kg	20	

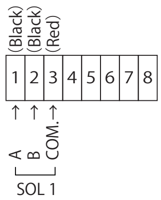
∗1：Ask us if the control voltage is different.
∗2：Ask for consultation on specifications that exceed discharge oil pressure range.
∗3：Oil level in the tank should be always between H.L. and L.L. of the gauge.

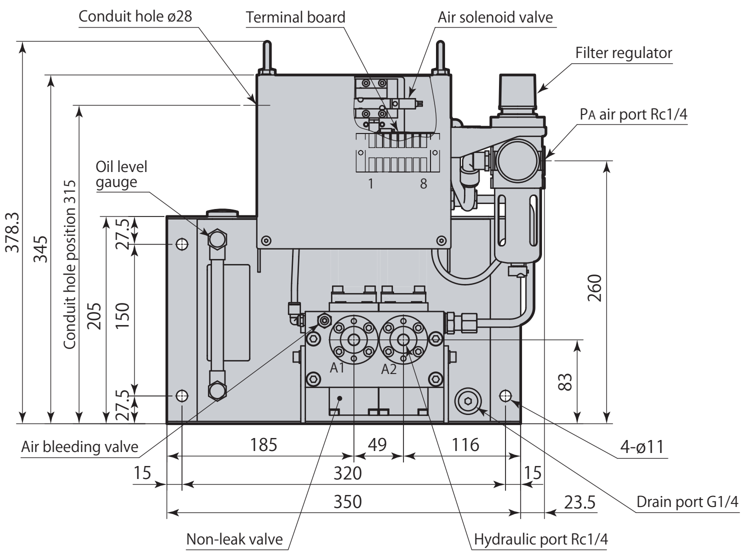
Dimensions

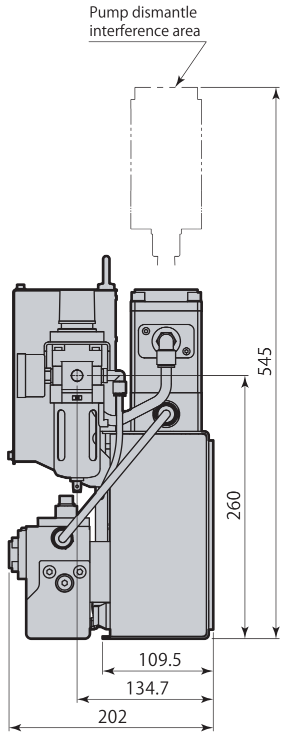
HCSD-H□U Double acting circuit control unit



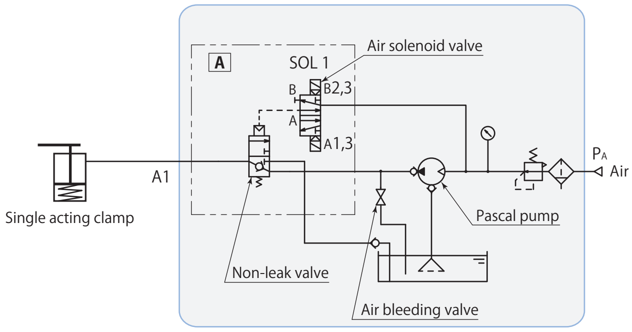
Wiring Diagram







Control unit **model HCSD-H□A**



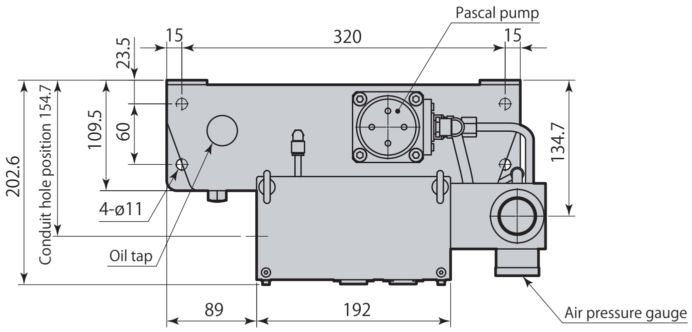
This is a hydraulic control unit that is air driven and solenoidal operated, combining non-leak valve with non-leak feature (zero oil leaks), which is essential for hydraulic clamps, and Pascal pump.
Pascal pump stops pumping once circuit pressure has been attained and retains the pressure. Furthermore, since there is hardly any temperature fluctuation of working fluid, there is no need for any auxiliary pressure equipment.
HCSD-H□A is made to order.

Model		HCSD-H4A	HCSD-H5A
Pascal pump		X6312U-D	X6316U-D
Control voltage*1		DC24V	
Discharge oil pressure*2	MPa	3.6–10.8	2.25–6.75
Set air pressure	MPa	0.2–0.5	
Unloaded oil discharge amount	L/min	Refer to **page →433** for performance diagram.	
Tank capacity*3	L	H.L. 3.5 L.L. 1.5	
Operating temperature	°C	0–50	
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)	
Mass	kg	17	

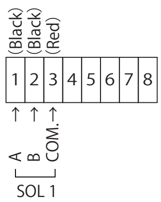
∗1: Ask us if the control voltage is different.
∗2: Ask for consultation on specifications that exceed discharge oil pressure range.
∗3: Oil level in the tank should be always between H.L. and L.L. of the gauge.

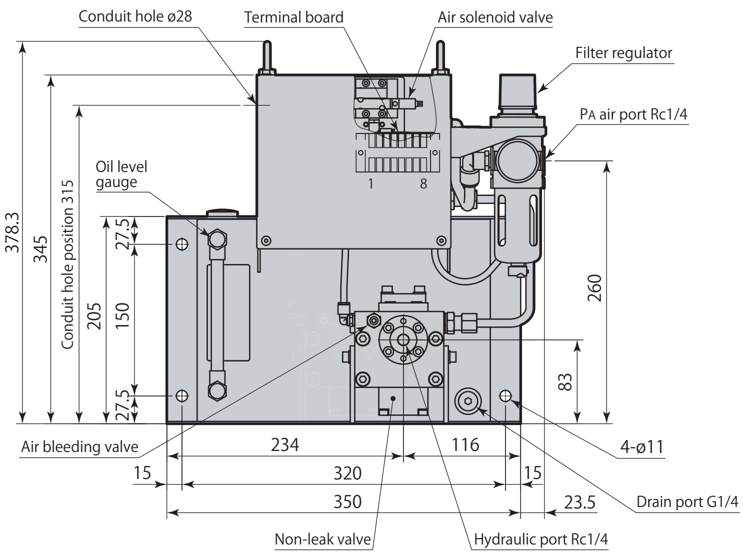
Dimensions

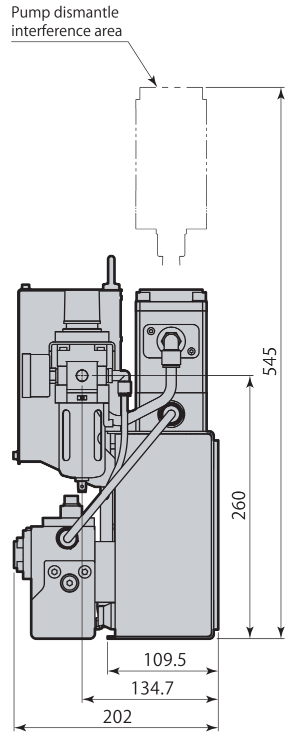
HCSD-H□A Single acting circuit control unit



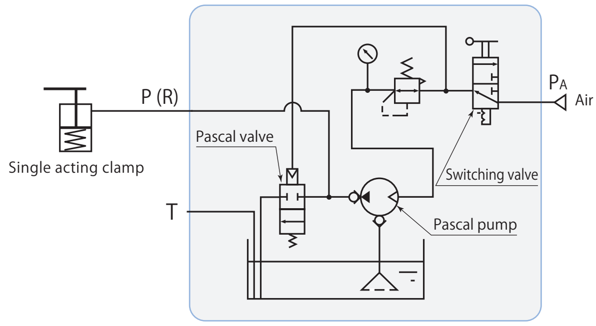
Wiring Diagram







Control unit model **HCT-□**



Compact hydraulic control unit for air drive and manual operations. Pascal pump stops pumping once circuit pressure has been attained and retains the pressure. Furthermore, since there is hardly any temperature fluctuation of working fluid, there is no need for any auxiliary pressure equipment.

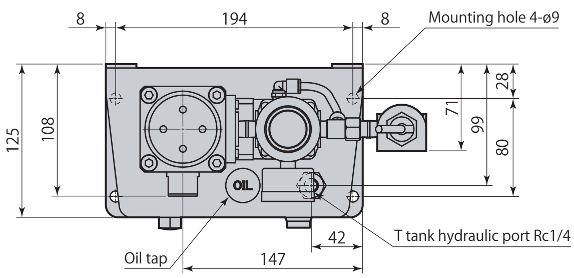
Model		HCT-4	HCT-5
Pascal pump		X6312-HCK-C	X6316-HCK-C
Discharge oil pressure*1	MPa	3.6–10.8	2.25–6.75
Set air pressure	MPa	0.2–0.5	
Unloaded oil discharge amount	L/min	Refer to **page →433** for performance diagram.	
Tank capacity*2	L	H.L. 1.5　L.L. 0.6	
Operating temperature	°C	5–60	
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)	
Mass	kg	8.3	

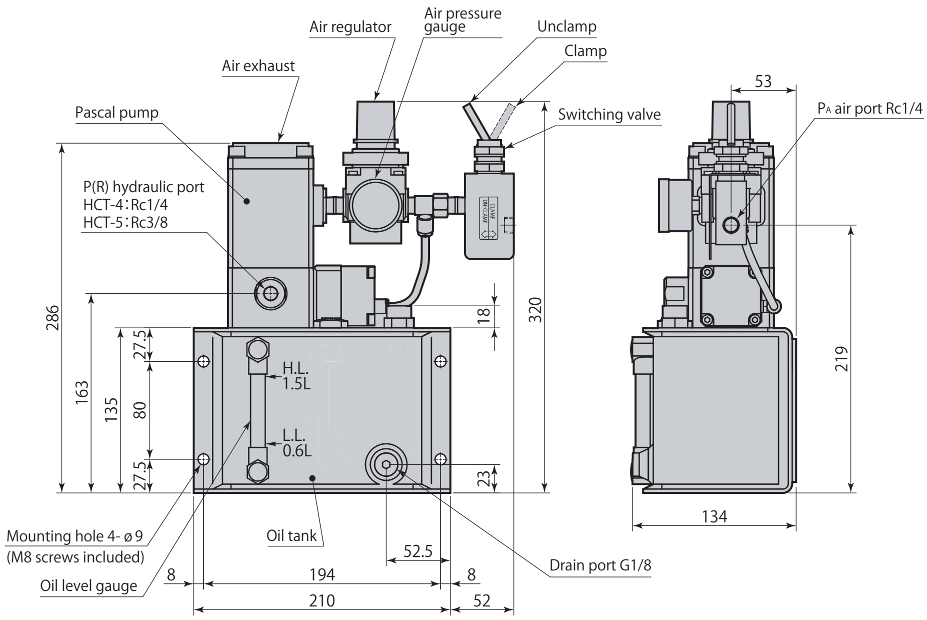
*1: Ask for consultation on specifications that exceed discharge oil pressure range.

*2: Oil level in the tank should be always between H.L. and L.L. of the gauge.

Dimensions

HCT-□　Single acting circuit control unit





Control unit
HCT Manual operated

Pascal pump model **X63**

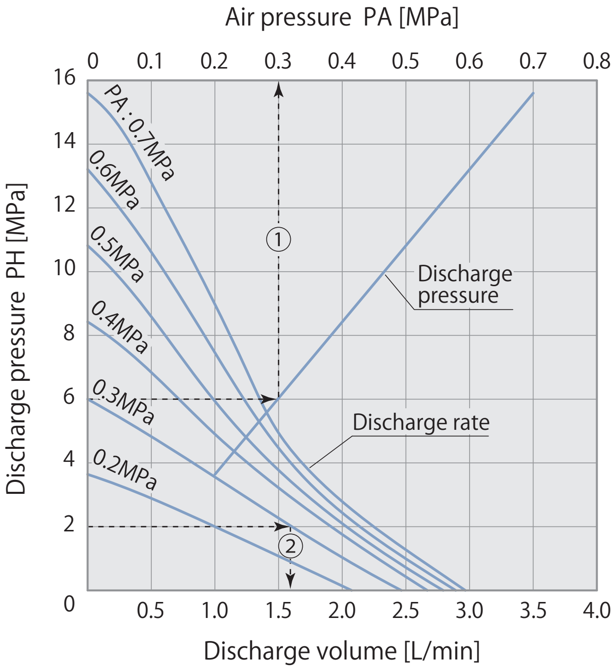
- Air-driven, compact, high performance hydraulic pump.
- Pascal pump is a compact but reliable hydraulic pump, which converts a compressed air force into high-pressure hydraulic power.
- Secure and high speed reciprocation of air and hydraulic piston generates a repetitive suction and discharge of air and oil. As the hydraulic pressure becomes close to the designated level, the reciprocation becomes slower. At the designated hydraulic pressure, the driving air force and hydraulic force become balanced to maintain the pressure.
- At the balanced condition, there is no air consumption so that there is no power loss or temperature rise compared to an electric pump. In the event of an air supply failure, the hydraulic pressure can be kept by the built-in check valve on the discharge side.
- If there is a decrease in the downstream holding pressure, the pump immediately reacts to start reciprocating to recover the pressure loss.

Model	X6312	X6316
Control unit models	HCD4H-W HCD4H-S HCSD-H4U HCSD-H4A HCT-4	HCD5H-W HCD5H-S HCSD-H5U HCSD-H5A HCT-5
Boosting ratio	24	15
Mass	2.6 kg	

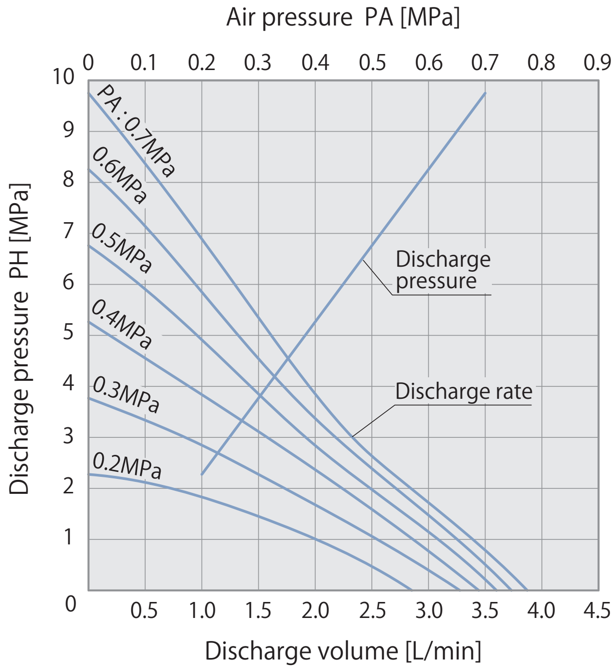
Air pressure range	:0.2–0.7 MPa
Air consumption	:0.4 Nm³/min
Operating noise	:78±1 db (A)
Operating temperature	:0–70 ℃ (No frozen)

Performance diagram [Measured with operating oil ISO-VG32 at 20℃]

X6312 PH = 24 (PA-0.05)



X6316 PH = 15 (PA-0.05)



1. How to read the discharge pressure (PH)* [ex:X6312]

*:PH is the pump discharge pressure when cylinders are clamped and the circuit pressure is built up.

When 6 MPa is required for PH, the desired air pressure (PA) should be 0.3 MPa by following the chain line ①.

2. How to read the discharge volume [ex:X6312]

When 0.3 MPa air pressure (PA) is supplied, with discharge pressure at 2 MPa, the discharge volume should be 1.6 L/min by following the chain line ②. (Pump discharge pressure while cylinders are in action may vary according to the circuit structure.)

Table of contents

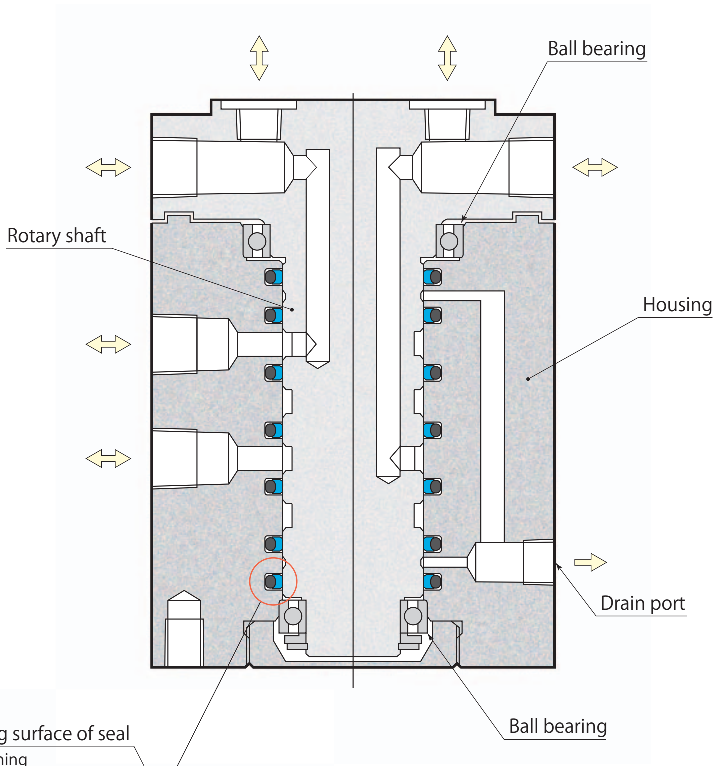
Rotary joint

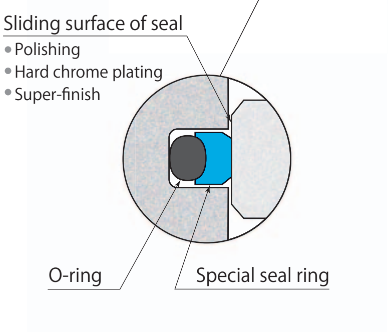
Single rotary standard 25MPa

model **WRA□**

Rotary joints are best suited for supplying hydraulic pressure and air to rotary table of machining center on which use of secured hydraulic hoses or fixed piping is difficult.

Four types are available with 2 to 8 circuits, and each circuit can be used independently.

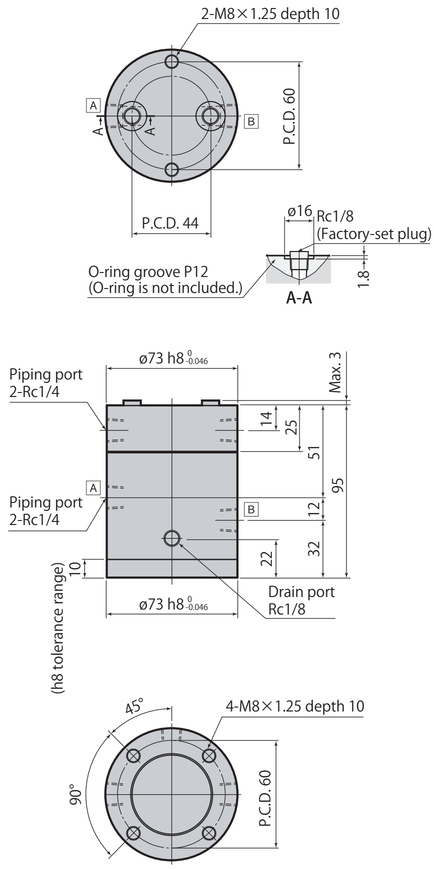




Sliding surface is polished, hard chrome plated and then super-finished to offer superior seal performance and durability.

2 circuits

WRA2



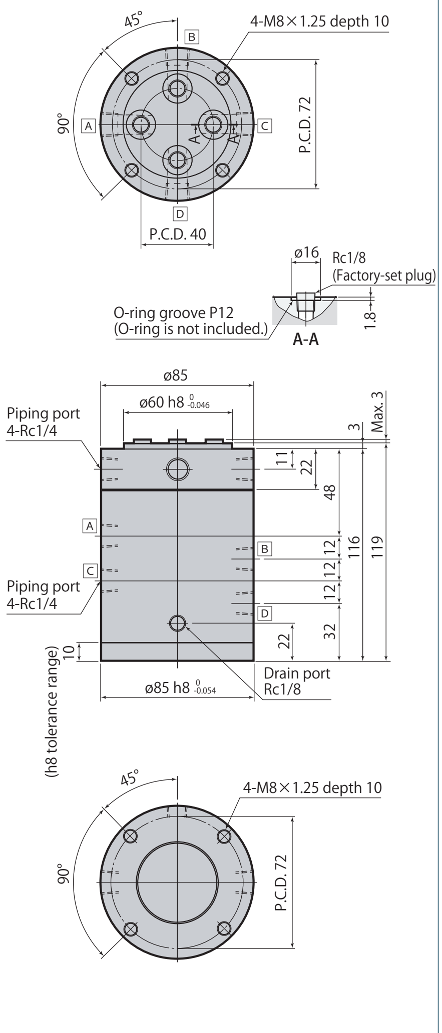
Each piping port is marked with code A or B.

Specifications

Model		WRA2	WRA4	WRA6	WRA8
Number of circuits		2 circuits	4 circuits	6 circuits	8 circuits
Orifice area	mm^2	20.4			
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent) or air			
Max. pressure	MPa	25			
Allowable rotations		Varies depending on fluid pressure (refer to **page →444** for details on allowable rotations.)			
Operating temperature	°C	0–70			
Piping port size		Rc1/4 (body upper surface is Rc1/8)			
Mass	kg	3.0	5.0	8.9	12.9

4 circuits

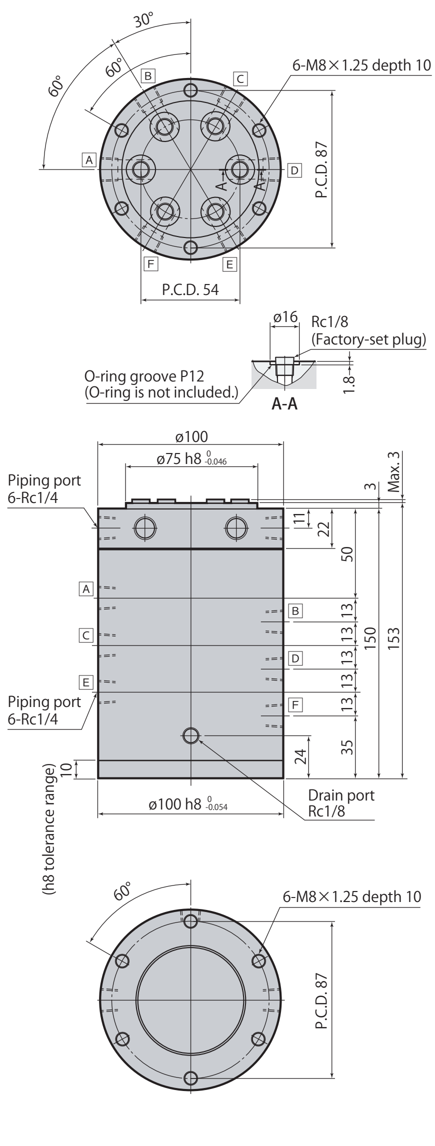
WRA4



Each piping port is marked with code A through D.

6 circuits

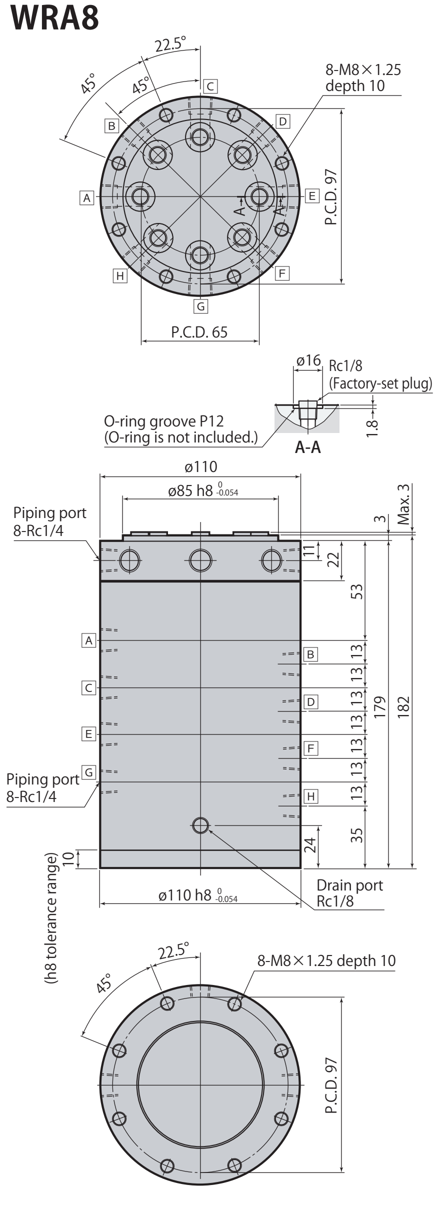
WRA6



Each piping port is marked with code A through F.

8 circuits

WRA8



Each piping port is marked with code A through H.

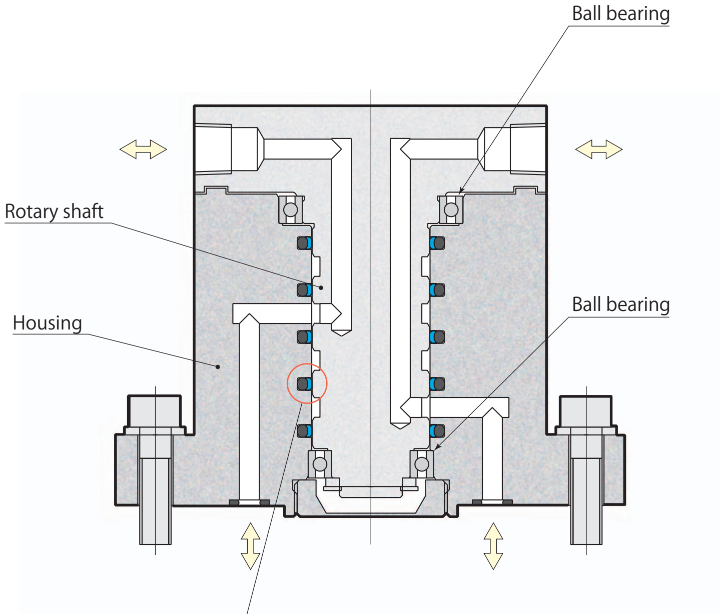
● Mounting screws are not included.

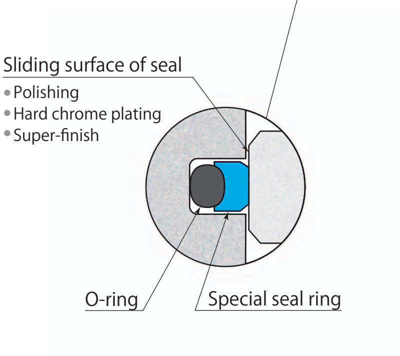
Single rotary with flange 25MPa

model **WRA□F**

Single rotary with flange is a compact type rotary joint with mounting section of the body shaped in the form of flange to keep the overall height low. Four types are available with 2 to 8 circuits, and each circuit can be used independently.

Fluid should be supplied from flange side of the body with manifold piping.

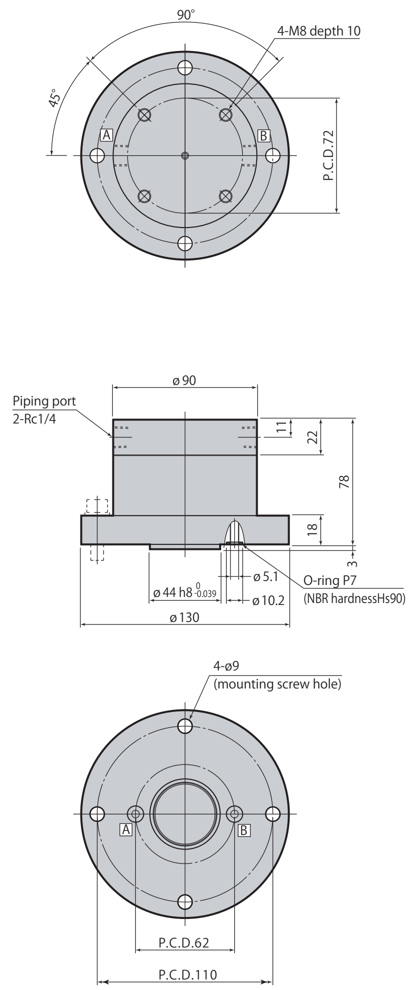




Sliding surface is polished, hard chrome plated and then super-finished to offer superior seal performance and durability.

2 circuits

WRA2F



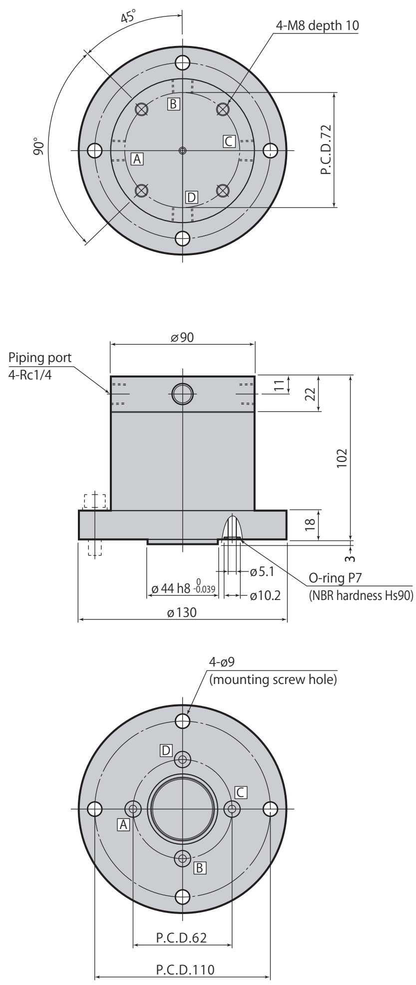
Each piping port is marked with code A or B.
The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

Specifications

Model	WRA2F	WRA4F	WRA6F	WRA8F
Number of circuits	2 circuits	4 circuits	6 circuits	8 circuits
Orifice area mm^2	20.4			
Fluid used	General mineral based hydraulic oil (ISO-VG32 equivalent) or air			
Max. pressure MPa	25			
Allowable rotations	Varies depending on fluid pressure (refer to **page →444** for details on allowable rotations.)			
Operating temperature °C	0–70			
Piping port size	Rc1/4 (body lower surface is manifold piping)			
Mass kg	4.9	6.1	10.9	14.9

4 circuits

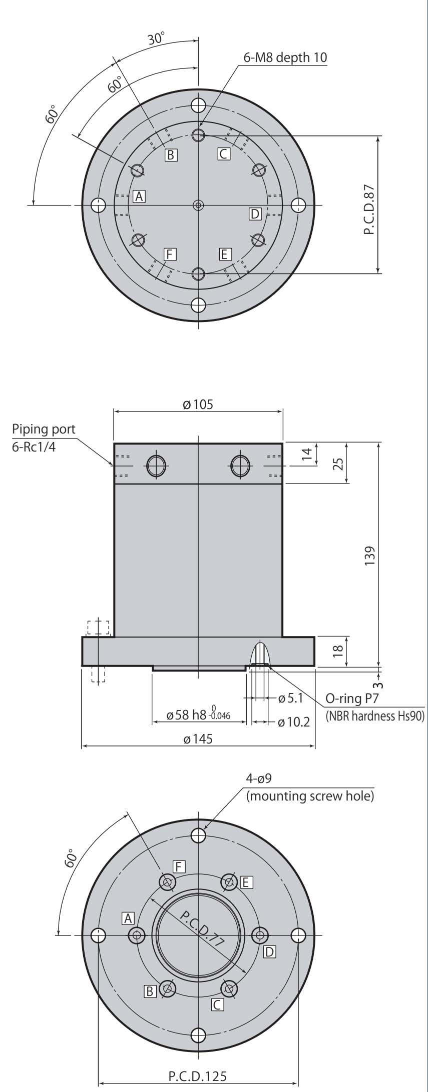
WRA4F



Each piping port is marked with code A through D. The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

6 circuits

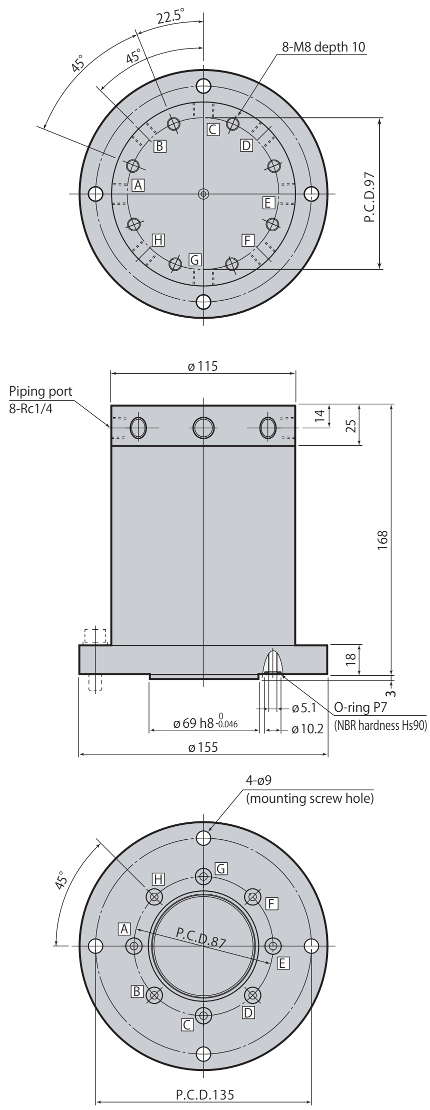
WRA6F



Each piping port is marked with code A through F. The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

8 circuits

WRA8F



Each piping port is marked with code A through H. The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

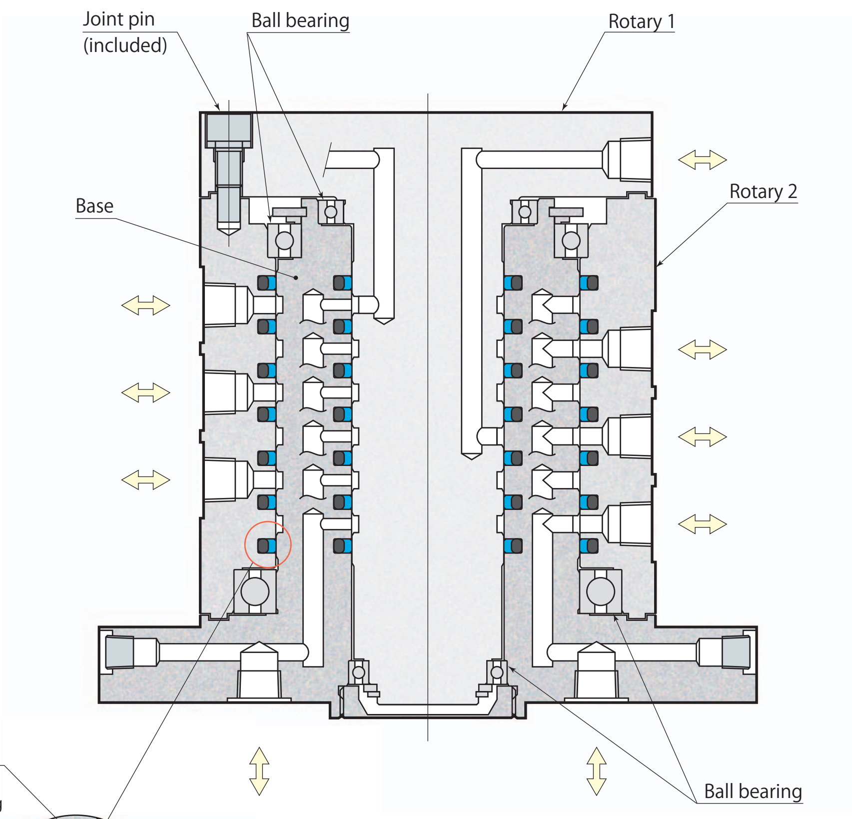
● Mounting screws are not included.

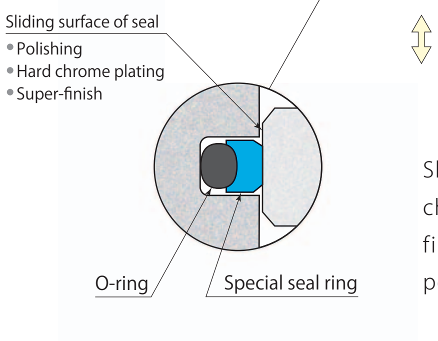
Double rotary with flange 25MPa

model **WRA□□**

Double rotary type combines two rotaries on same axis to keep the overall height lower still. Two types are available with 12 or 16 circuits, and each circuit can be used independently.

Rotary 1 and Rotary 2 rotate independently but they can be synchronized by using a joint pin (included).





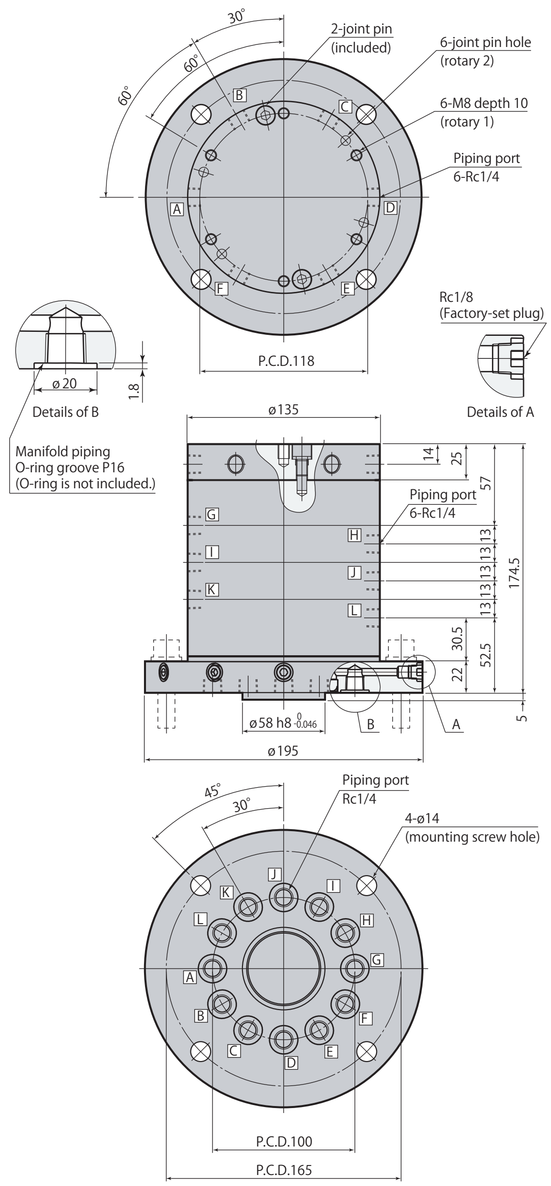
Sliding surface is polished, hard chrome plated and then super-finished to offer superior seal performance and durability.

Specifications

Model	WRA66	WRA88
Number of circuits	12 circuits	16 circuits
Orifice area mm²	A–F port：8.6 G–L port：20.4	A–H port：8.6 I–P port：20.4
Fluid used	General mineral based hydraulic oil (ISO-VG32 equivalent) or air	
Max. pressure MPa	25	
Allowable rotations	Varies depending on fluid pressure (refer to **page →444** for details on allowable rotations.)	
Operating temperature °C	0–70	
Piping port size	Rc1/4	
Mass kg	22	30

12 circuits

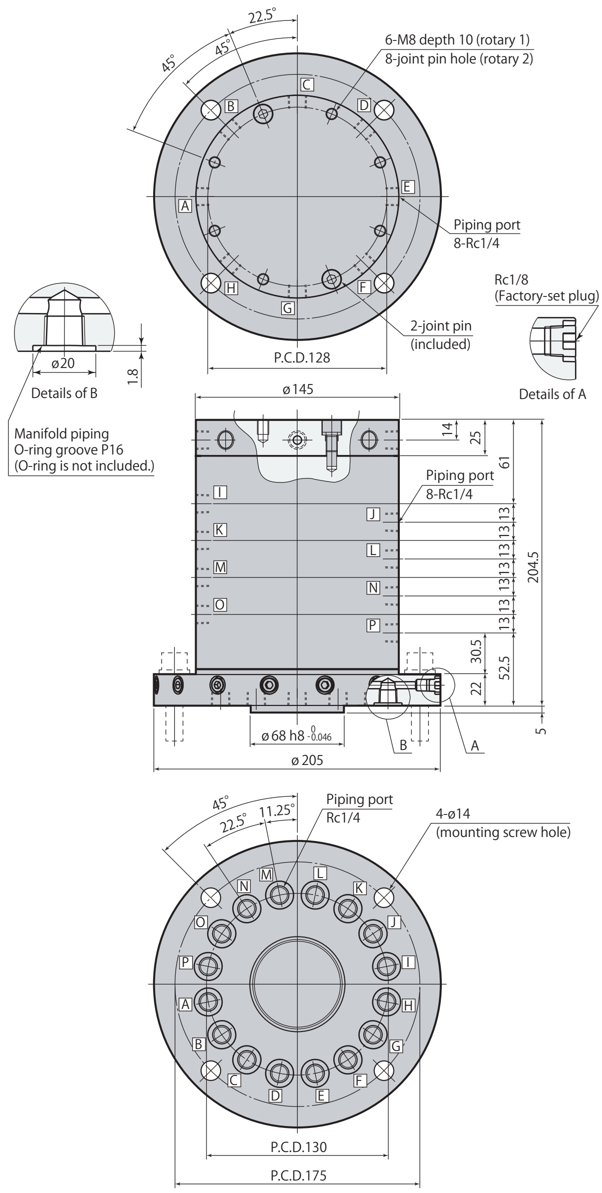
WRA66



Each piping port is marked with code A through L.

16 circuits

WRA88



Each piping port is marked with code A through P.

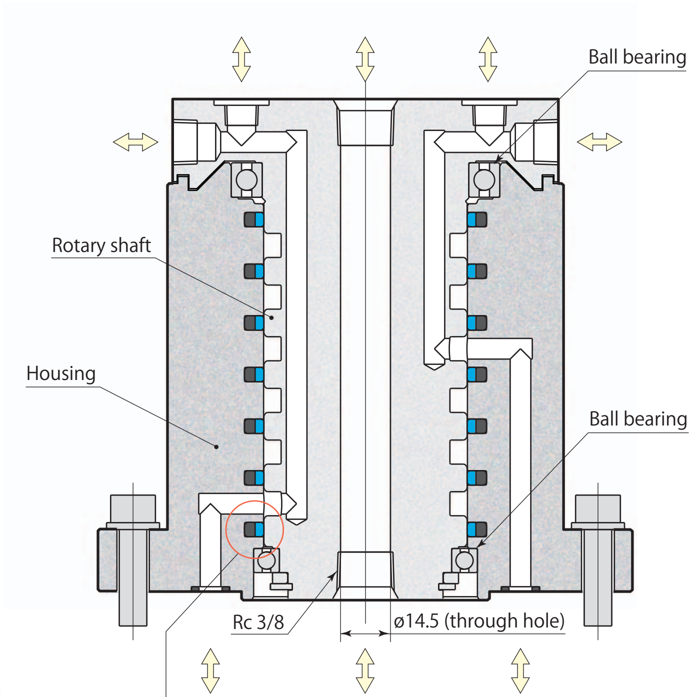
● Mounting screws are not included.

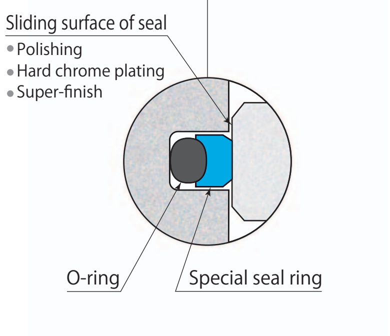
Single rotary with flange 7MPa

model **WRB□**

Rotary joint model WRB was developed for low pressure applications. Aluminum is adopted as body material to reduce the weight. This is a center through type, which the through bore of rotary shaft can be used for coolant piping.

Single rotary with flange is a compact type rotary joint with mounting section of the body shaped in the form of flange to keep the overall height low. Four types are available with 2 to 8 circuits, and each circuit can be used independently. Fluid should be supplied from flange side of the body with manifold piping.

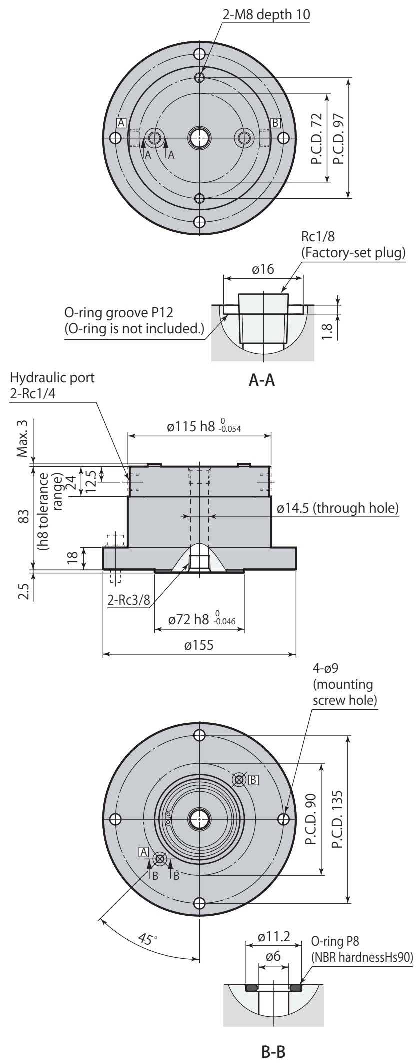




Sliding surface is polished, hard chrome plated and then super-finished to offer superior seal performance and durability.

2 circuits

WRB2



Each piping port is marked with code A or B.
The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

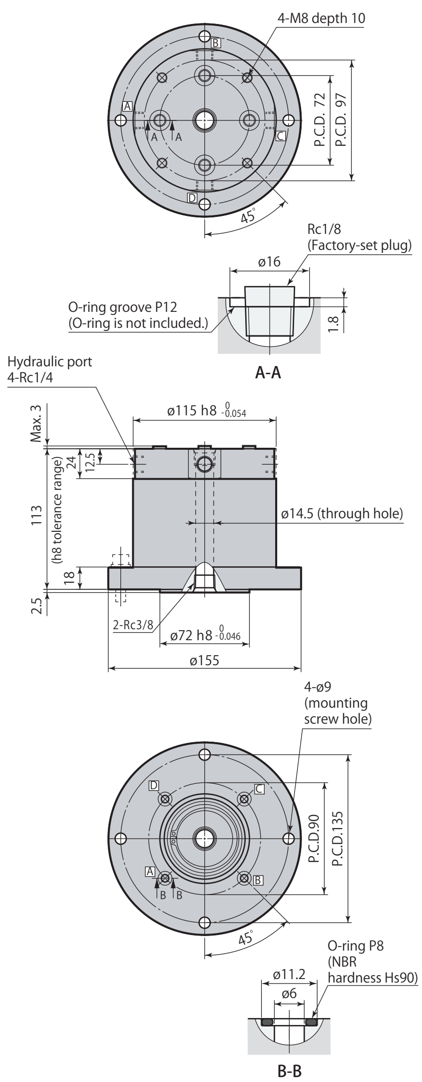
Specifications

Model	WRB2	WRB4	WRB6	WRB8
Number of circuits	2 circuits + 1 circuit*	4 circuits + 1 circuit*	6 circuits + 1 circuit*	8 circuits + 1 circuit*
Orifice area mm^2	28.3			
Fluid used	General mineral based hydraulic oil (ISO-VG32 equivalent) or air (center through circuit: coolant)			
Max. pressure MPa	7			
Allowable rotations	Varies depending on fluid pressure (refer to **page →444** for details on allowable rotations.)			
Operating temperature °C	0–70			
Piping port size	Body lower surface is manifold piping, upper surface is Rc1/8, side surface is Rc1/4, center through is Rc3/8			
Mass kg	4.5	5.5	6.5	7.5

*: +1 circuit indicates a center through circuit (coolant).

4 circuits

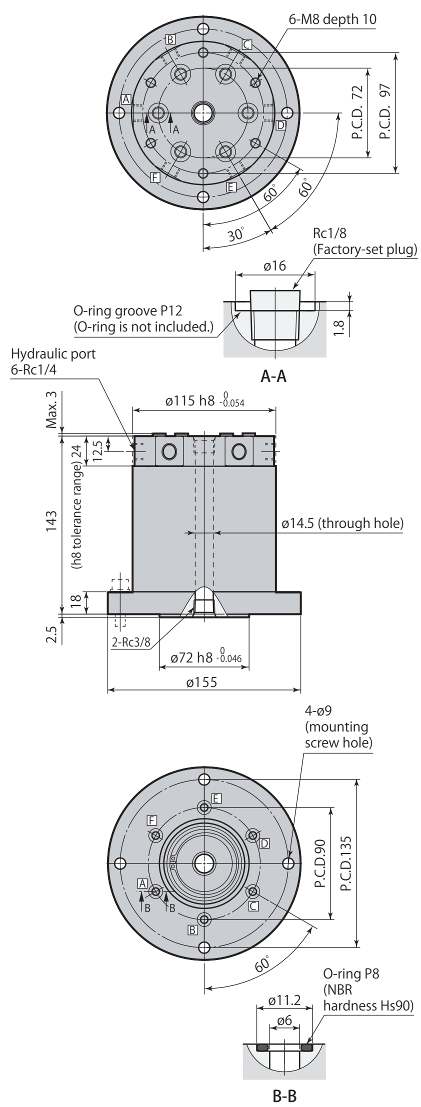
WRB4



Each piping port is marked with code A through D. The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

6 circuits

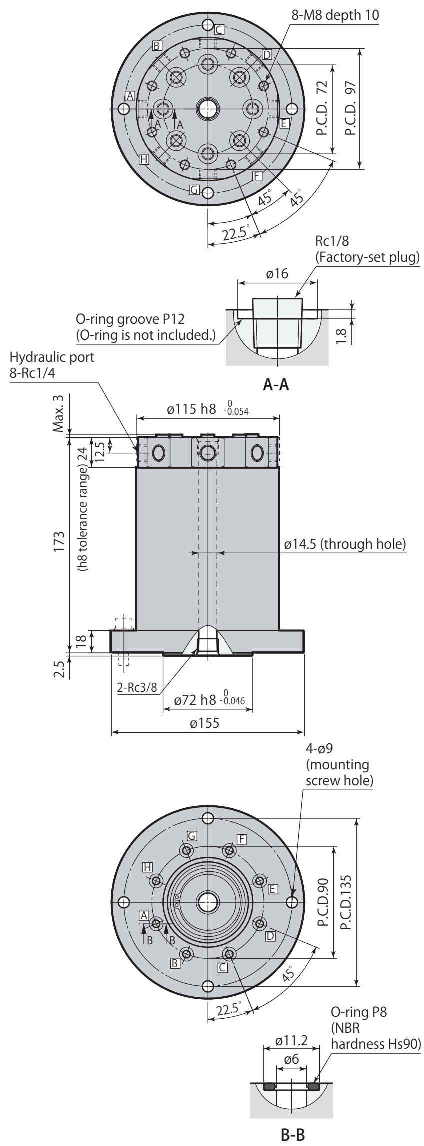
WRB6



Each piping port is marked with code A through F. The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

8 circuits

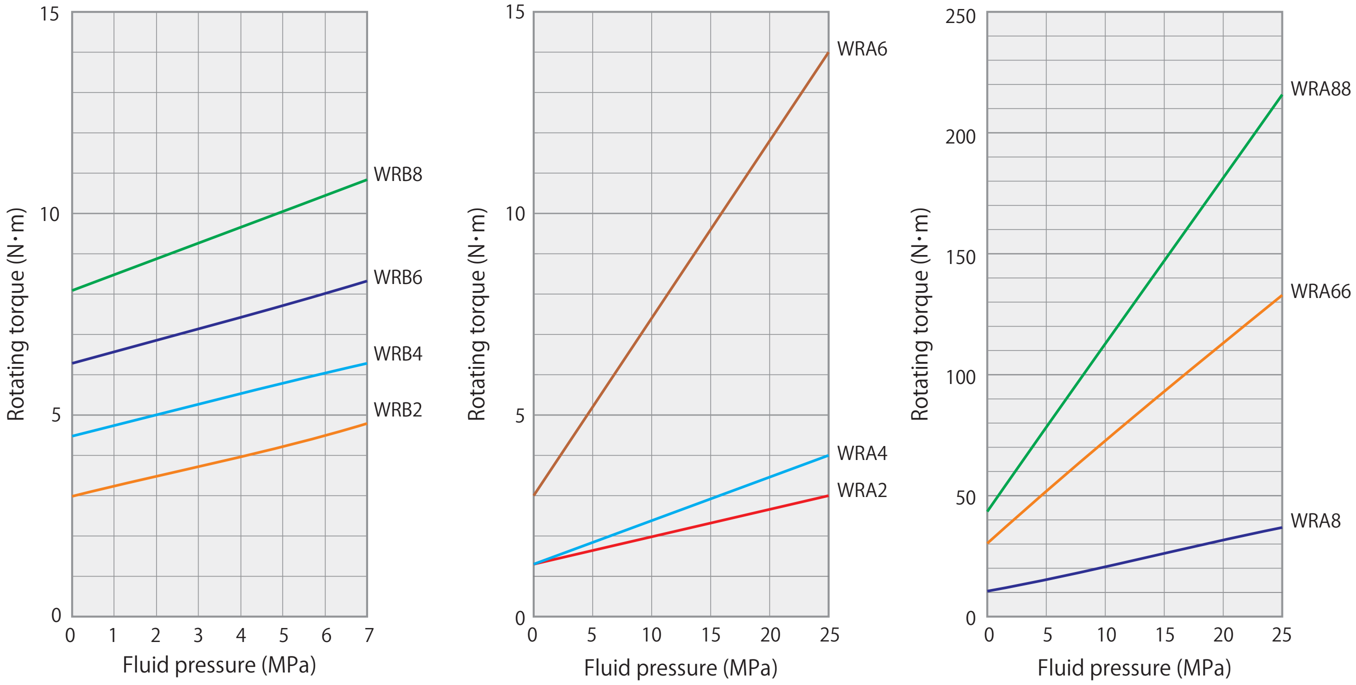
WRB8



Each piping port is marked with code A through H. The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

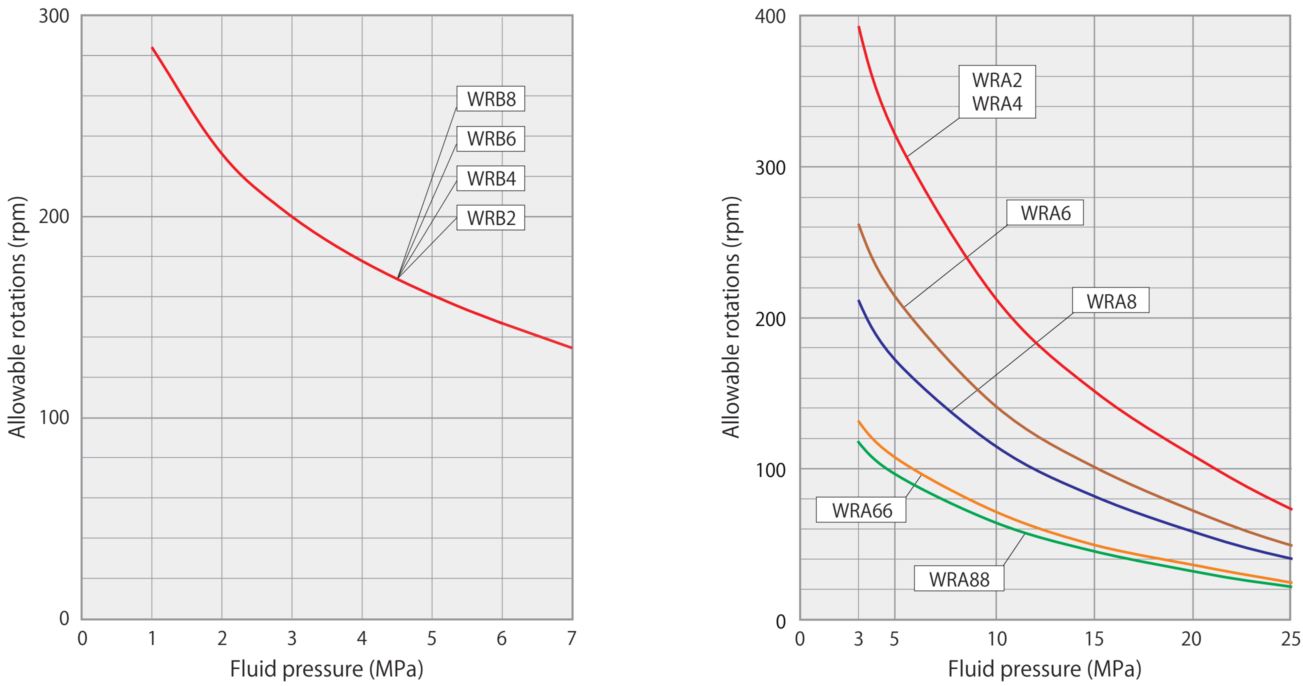
● Mounting screws are not included.

Rotating torque (reference)



1. Diagram above depicts torque (sliding resistance of packing) for stable rotation.
2. Starting torque may become twice as much as torque during stable rotation.
3. There is variance of torque with each product.
4. Rotating torque values indicated above are reference values.

Allowable rotations



1. Diagram above depicts allowable rotation when proper lubrication oil film has been formed.
2. Simultaneous use of maximum values is not possible, since used fluid pressure, rotating speed and operating temperature mutually affect each other.

Caution in use

1. Fluid applied is limited to general mineral based hydraulic oil or air. Contact us concerning other fluid.

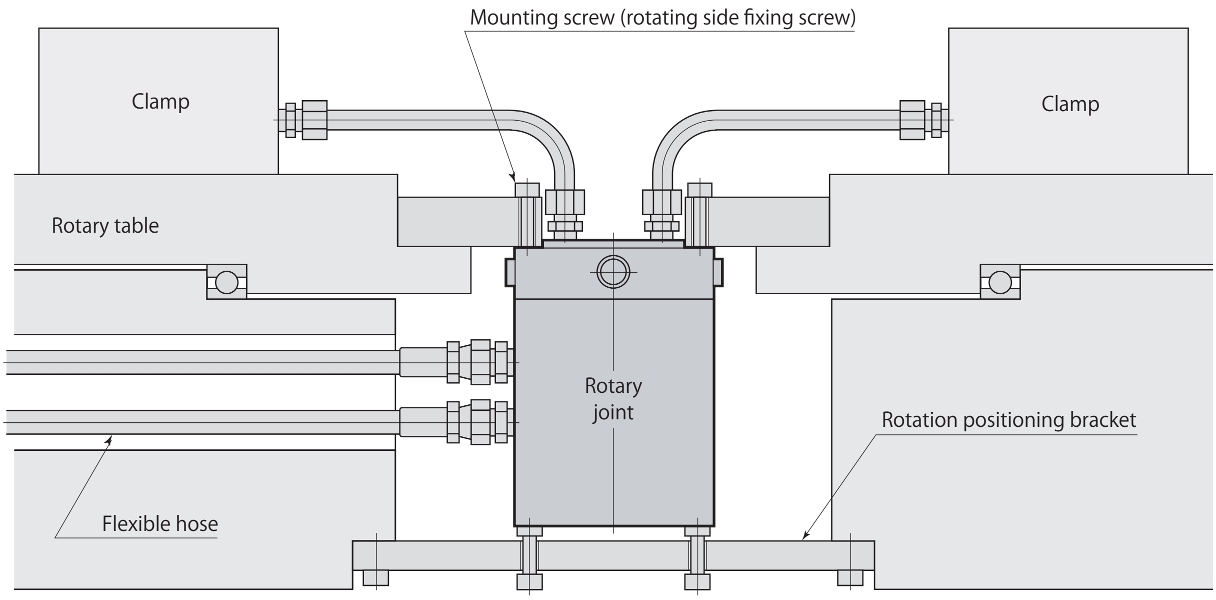
2. When applying hydraulic oil to rotary joint, oil film leakage to adjacent circuits is inevitable. When the oil and air circuits are being allocated in one rotary joint, be sure to allocate a circuit between them as a drain circuit. (If the air circuit can tolerate the oil leakage, drain circuit is not mandatory.)

3. Non-stop operation should be avoided, as heat from packing's sliding resistance is generated.

4. At installation, fixate the rotating side. For the stationary side, only the rotational restraint should be provided to avoid an eccentric overload. (Refer to diagram below.)

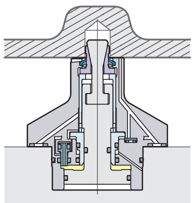
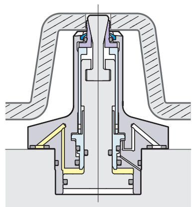
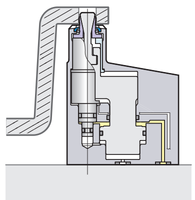
5. Flexible hose must be used for piping when installation. Do not use the steel tube.

6. When using mineral hydraulic oil, drain port should have an independent piping to return the oil directly to tank.

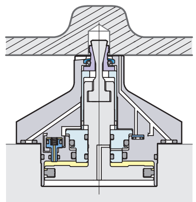
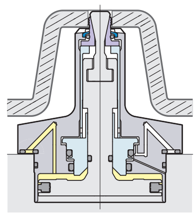


Expansion clamp

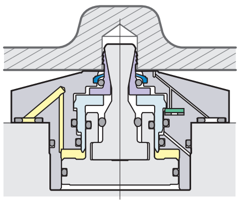
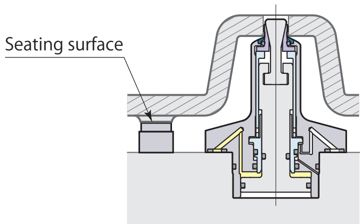
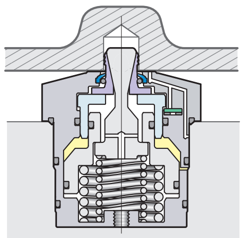
7 MPa & air

Expansion clamp	model **CGC** Page →458 	model **CGT** Page →484 	model **CGU** Page →510 
Model	7MPa Double acting Standard model 	7MPa Double acting Long neck model 	7MPa Double acting Eccentric model 
Specifications Clamping force & hydraulic pressure	**Page →459**	**Page →485**	**Page →511**
Structure Explanation of operation	**Page →460**	**Page →486**	**Page →512**
Features	**Page →462**	**Page →488**	**Page →514**
Air sensor valve function and structure	**Page →464**	**Page →490**	**Page →516**
Advantage of non-constant air blow model	**Page →468**	**Page →492**	**Page →518**
Dimensions Mounting details	**Page →470**	**Page →494**	**Page →520**
Gripper set Grip inner diameter & rod height	**Page →478**	**Page →502**	**Page →526**
System configuration example	**Page →479**	**Page →503**	**Page →527**
Hydraulic and pneumatic circuit diagram	**Page →480**	**Page →504**	**Page →528**
Operation cycle	**Page →482**	**Page →507**	**Page →531**
Caution in use	**Page →483**	**Page →508**	**Page →532**

Refer to **page →450** for the details of the expansion clamps that are not described in the catalog.

air **Expansion clamp**	model **CGE** **Page →534** 	model **CGY** **Page →558** 
Model	1MPa Double acting Standard model 	1MPa Double acting Long neck model 
Specifications Clamping force & air pressure	**Page →535**	**Page →559**
Structure Explanation of operation	**Page →536**	**Page →560**
Features	**Page →538**	**Page →562**
Air sensor valve function and structure	**Page →540**	**Page →564**
Advantage of non-constant air blow model	**Page →544**	**Page →566**
Dimensions Mounting details	**Page →546**	**Page →568**
Gripper set Grip inner diameter & rod height	**Page →552**	**Page →576**
System configuration example	**Page →553**	**Page →577**
Pneumatic circuit diagram	**Page →554**	**Page →578**
Operation cycle	**Page →556**	**Page →581**
Caution in use	**Page →557**	**Page →582**

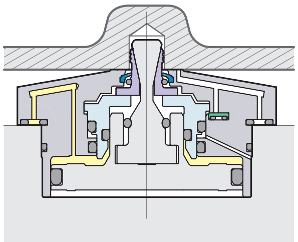
Refer to **page →450** for the details of the expansion clamps that are not described in the catalog.

model **CGS-N2**	model **CGT-R**	model **CGS-N1**
7MPa Double acting	7MPa Double acting	7MPa Single acting
		
		
Low height model	Seating surface is set apart from clamp Seating-less model	Hydraulic : Clamp Spring : Unclamp

Contact Pascal for more details.

model
CGX

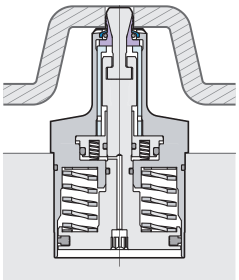
air Double acting



Low height model

model
CGY-F3

air Spring acting

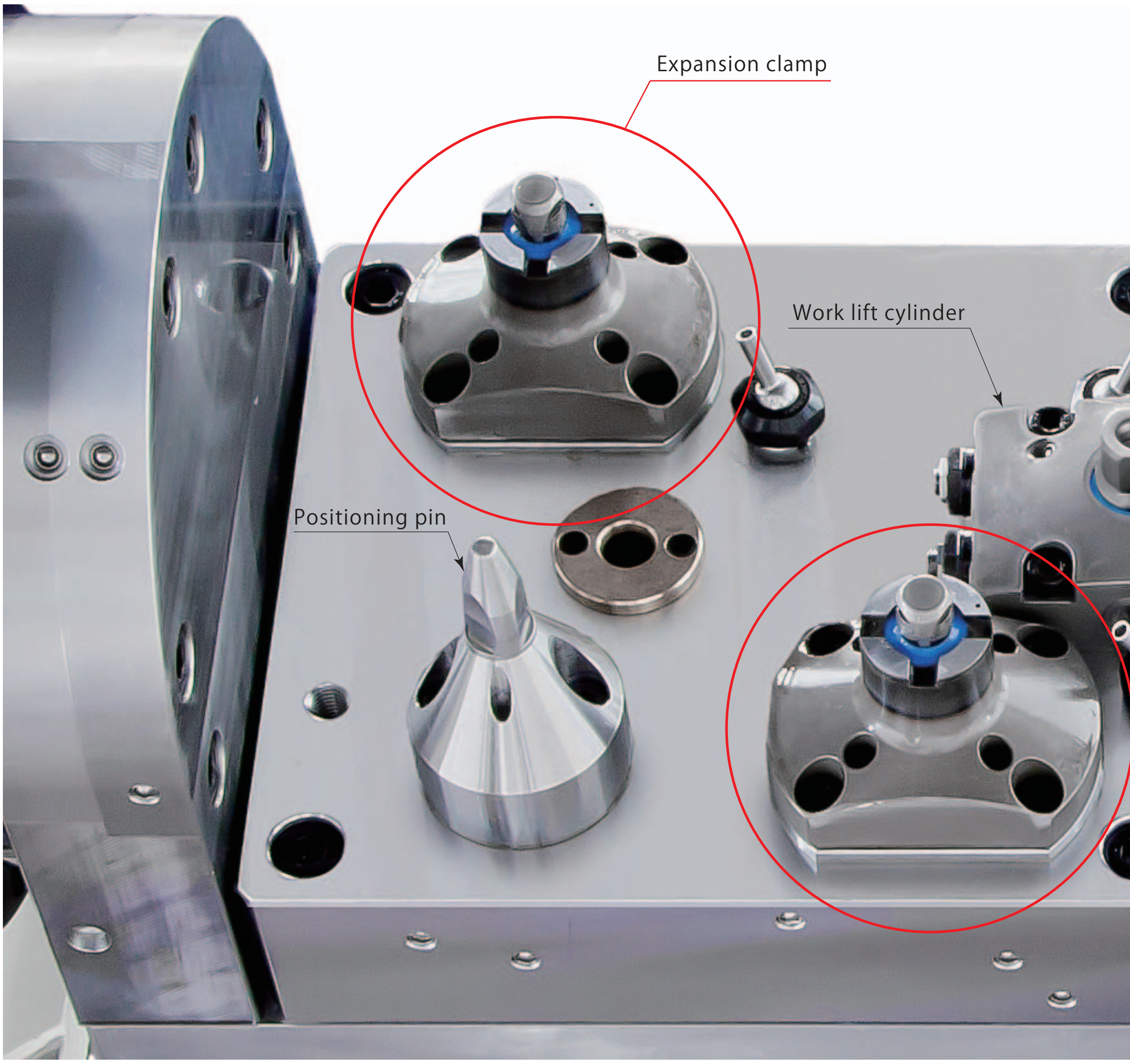


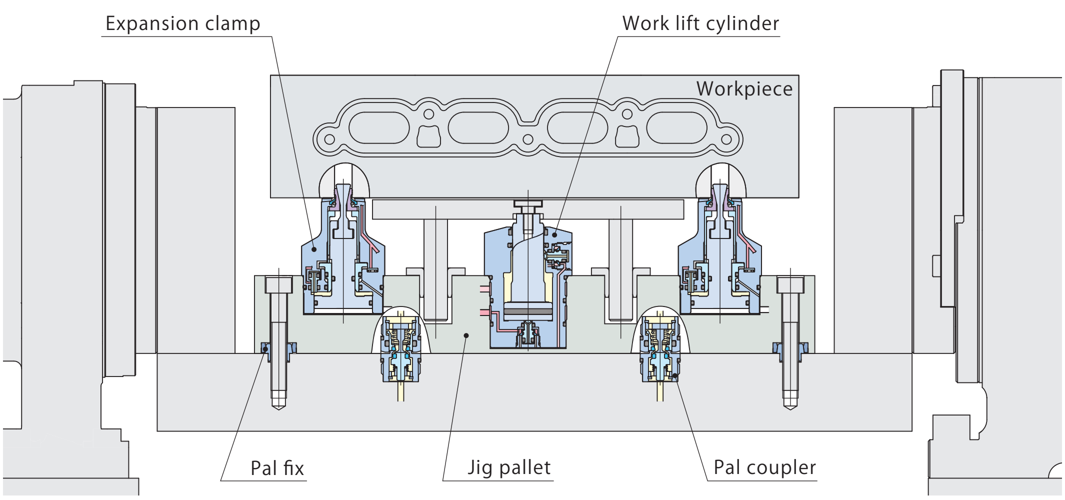
Spring : Clamp
Air : Unclamp

Contact Pascal for more details.

Pascal compact jig system

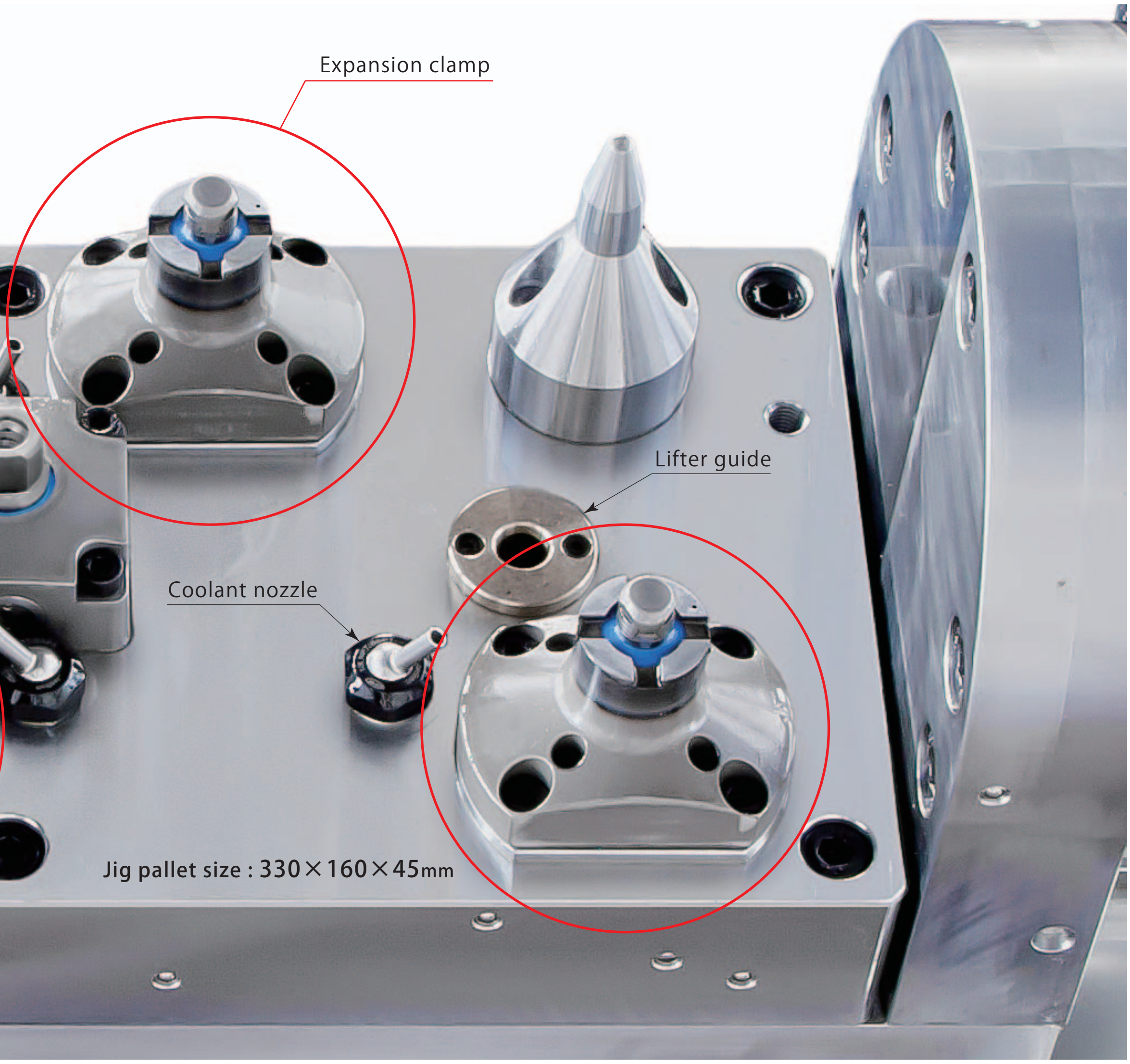
Cylinder Block & Head, Transmission case
Pascal expansion clamps are used in variety of

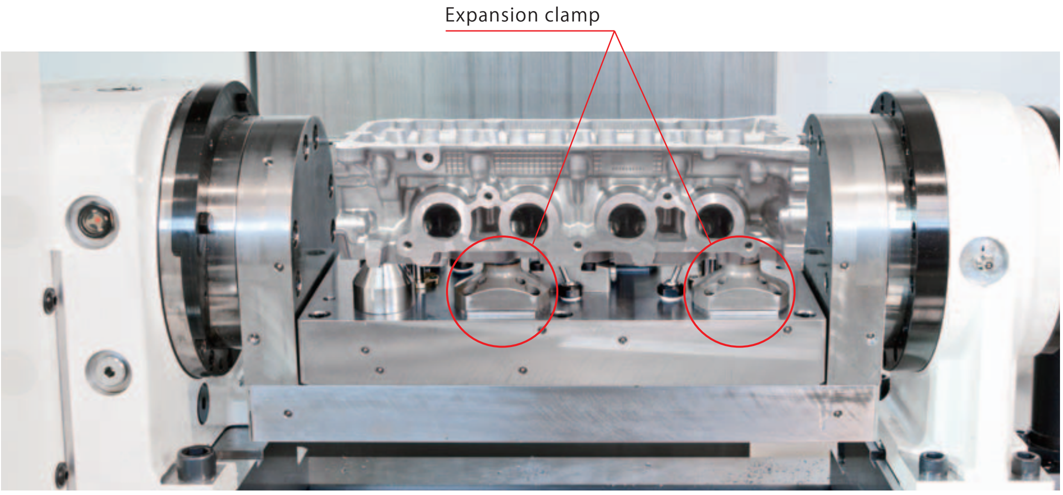


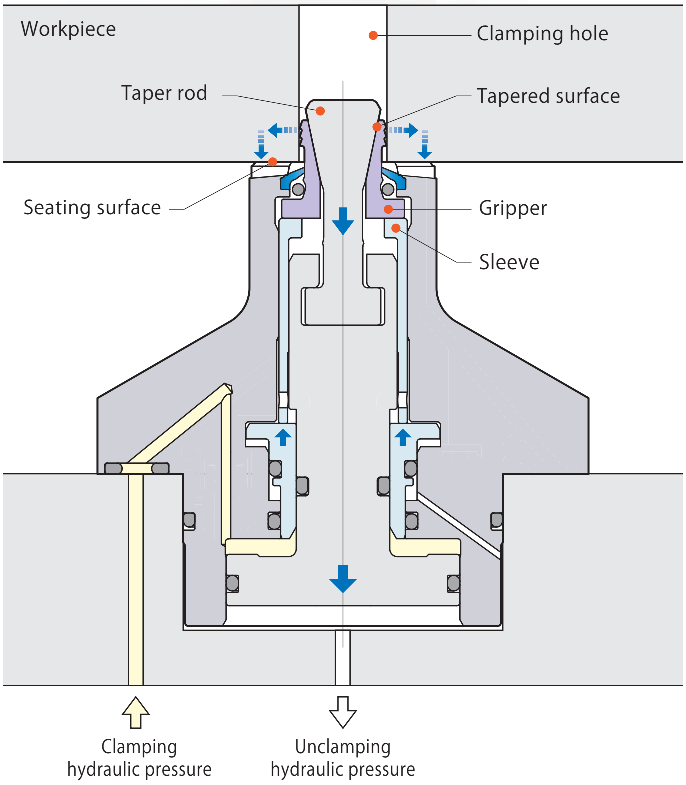


with the Expansion clamp

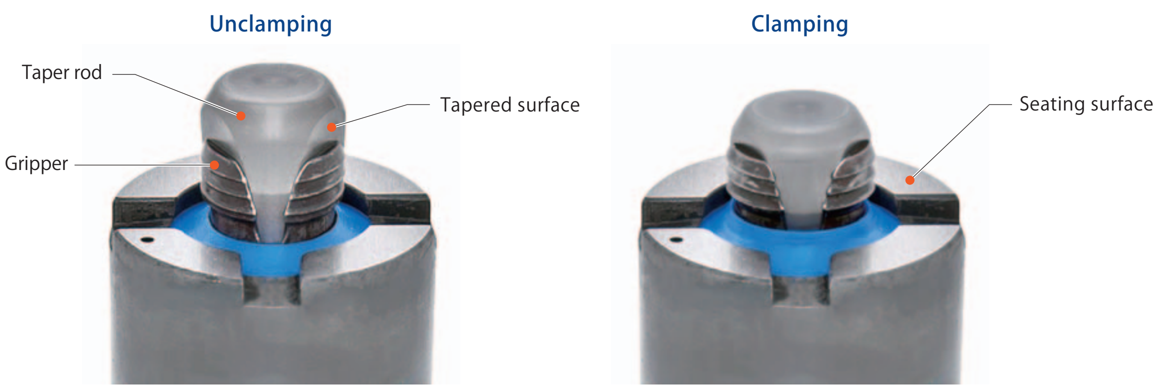
& housing, Valve body, knuckle, carrier, and ABS…
automobile parts machining processes all over the world.





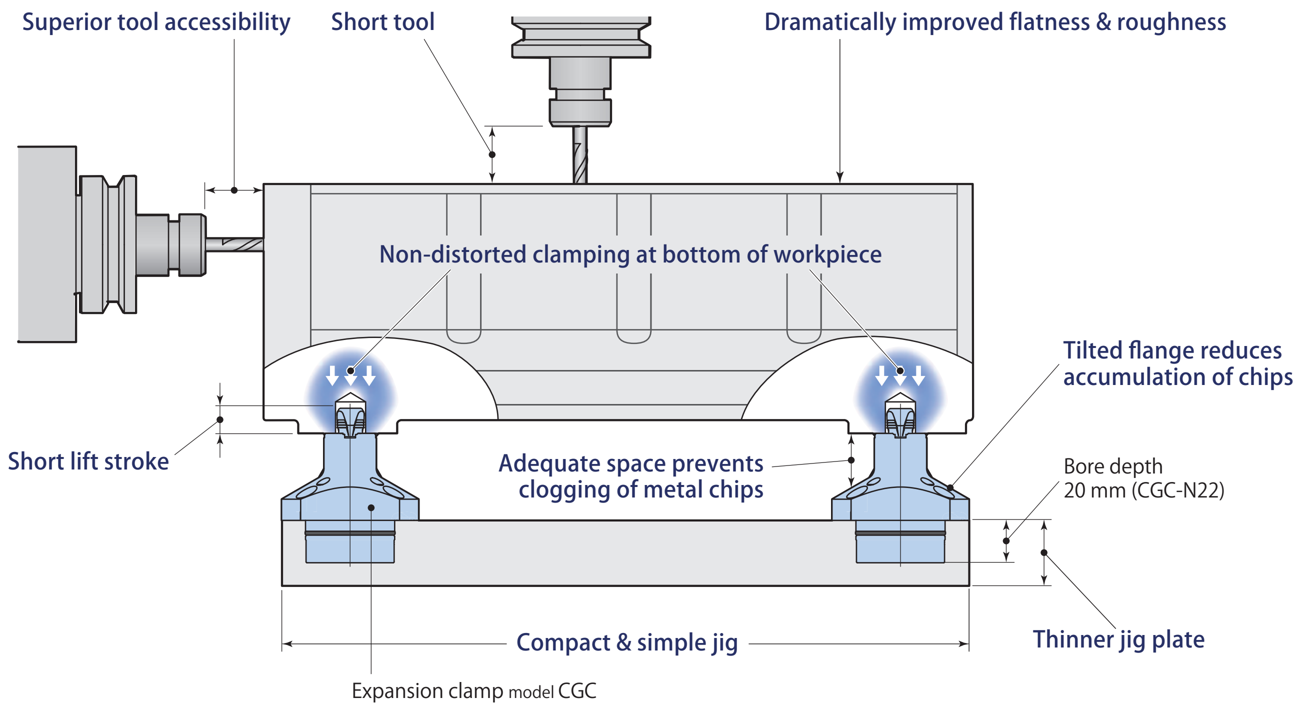


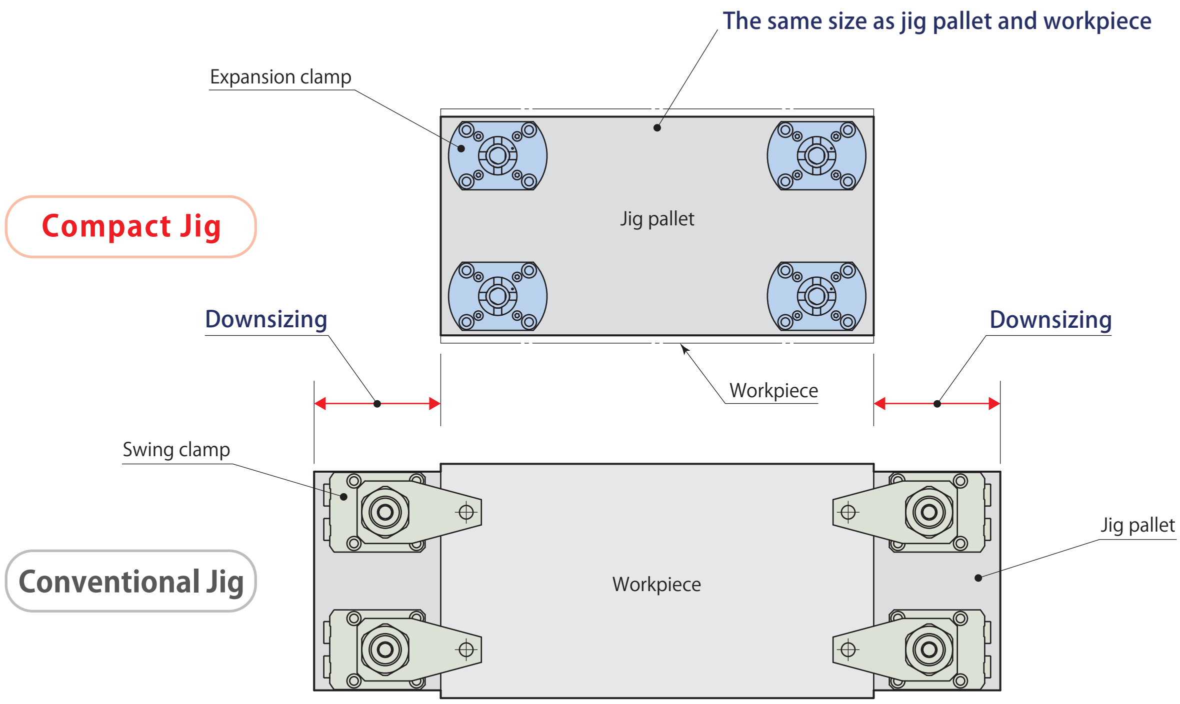
The holding force of expansion clamp is transmitted to a gripper by the tapered surface. As the taper rod lowers, the gripper expands horizontally first along the tapered surface to grip the inner face of clamping hole then pulls a workpiece down to the seating surface.



Compact jig system

The development of the expansion clamp has allowed compact and reliable jigs to be realized.
The compact jig enables the size of machine and workpiece loading system to be minimized and compresses the machining line.
This can significantly help save on the investment for facilities.

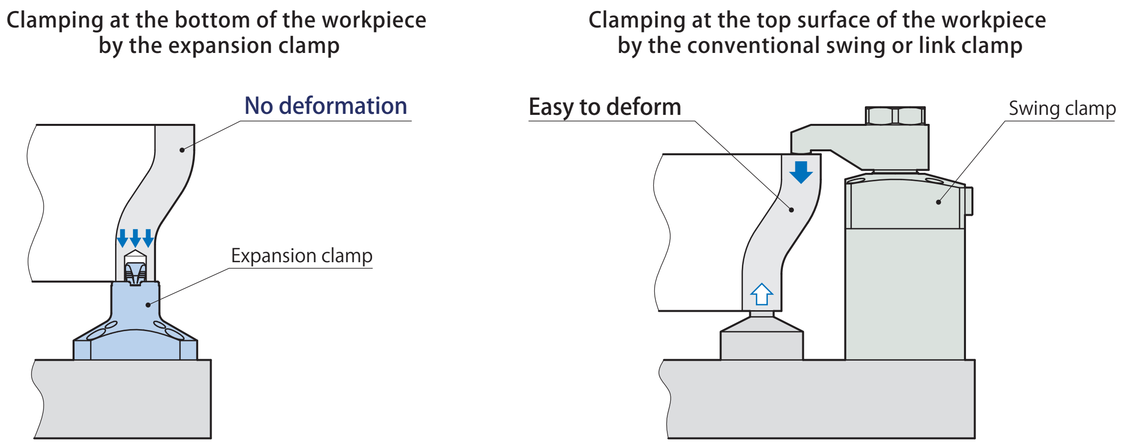




Features of expansion clamp

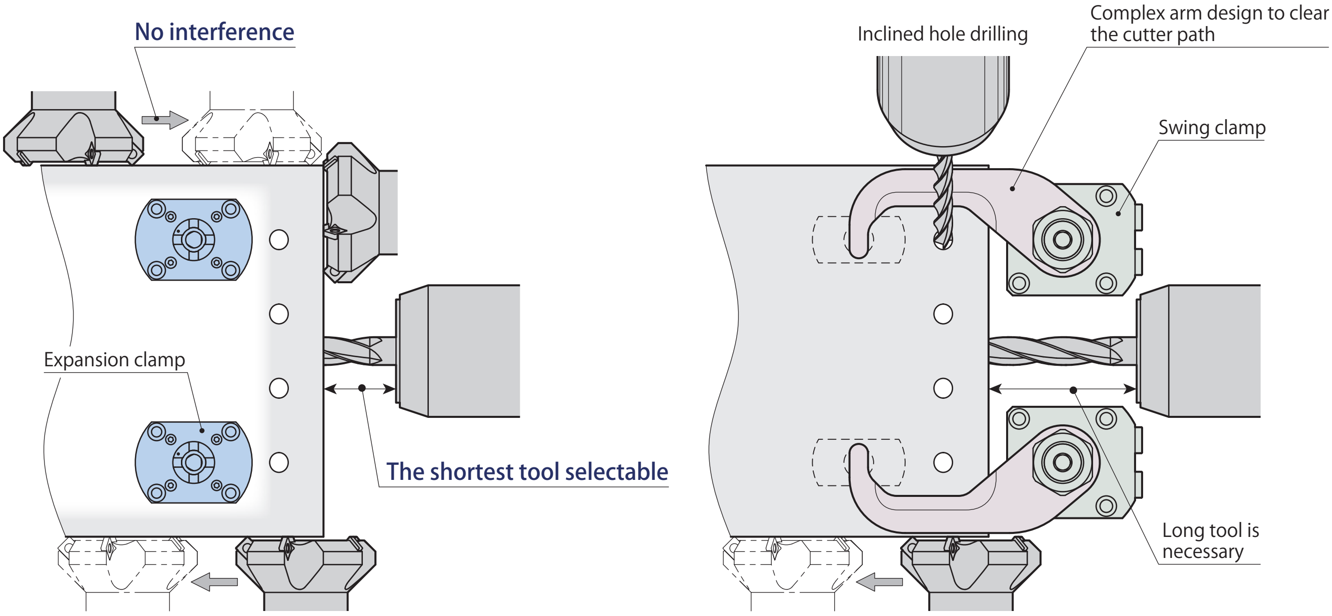
Non-distorted clamping at bottom of workpiece

The expansion clamp grasps the bottom of the workpiece without any deformation and has a superior gripping force that allows improved machining accuracy and efficiency.



Superior tool accessibility

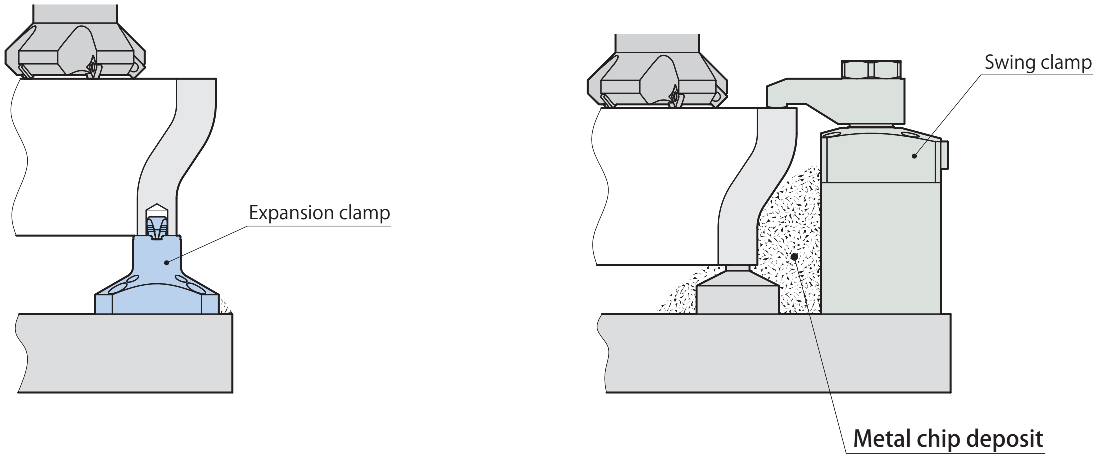
Any interferences between the tool and a clamp body or an arm are eliminated by using the expansion clamp, which enables machining from all directions and results in a highly efficient machining process.



Features of expansion clamp

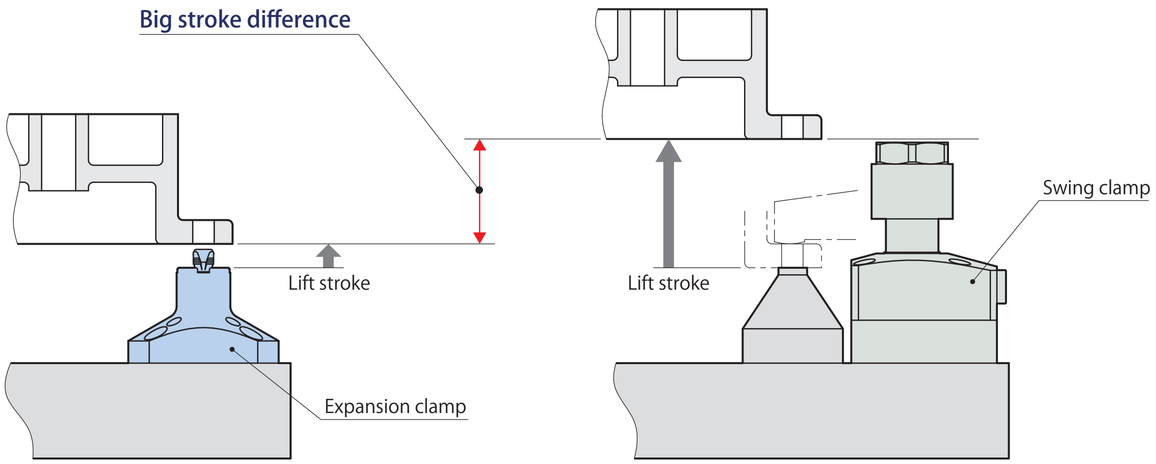
Eliminate the troubles caused by metal chip

The expansion clamp can eliminate the troubles caused by metal chip deposits or debris contamination by clamping at the bottom of the workpiece.



High-speed workpiece transport

Low profile gripper design allows lift stroke of workpiece loading system to be shortened, thereby enabling high-speed transport and system operation.



Expansion clamp

Double acting 7MPa

model CGC

model CGC

Specifications

Size / Grip inner diameter / : Number of grippers

CGC − N2 [1] E [070] [073] [076] [079] [082] : 2 Grippers

CGC − N2 [2] E [085] [09] [10] : 2 Grippers; [11] [12] [13] : 3 Grippers

CGC − N2 [3] E [12] [13] [14] [15] [16] : 3 Grippers

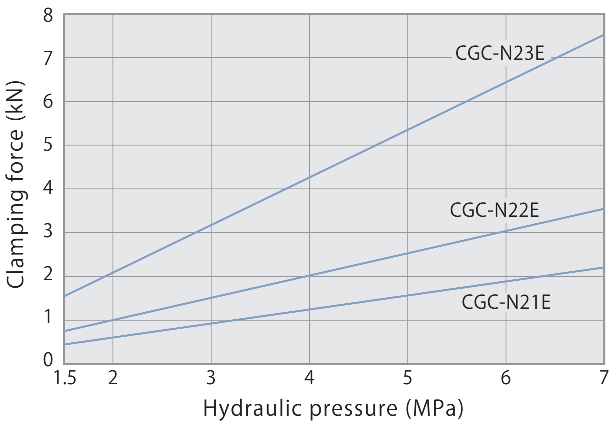
(grey box) indicates made to order.

Model: Size		CGC-N21E*1					CGC-N22E						CGC-N23E				
Model: Grip inner diameter		070	073	076	079	082	085	09	10	11	12	13	12	13	14	15	16
Number of grippers		2 Grippers								3 Grippers							
Clamping force (hydraulic pressure 7MPa)	kN	1.92*2	2.24				3.04*2	3.54					7.50				
Radial expansion force (hydraulic pressure 7MPa)	kN	6.7*2	7.8				9.5*2	11.1					23.4				
Taper rod stroke	mm	4.8															
Clamp stroke	mm	1.2															
Cylinder capacity: Clamp	cm³	1.7					2.7						5.8				
Cylinder capacity: Unclamp	cm³	2.3					3.5						7.2				
Allowable eccentricity*3	mm	±0.5															
Recommended air blow pressure	MPa	0.3															
Recommended sensor air pressure	MPa	0.2															
Mass	kg	0.38					0.50						0.83				
Recommended tightening torque of mounting screws*4	N·m	3.5					7						12				
Workpiece material		Aluminum, steel and others (HRC30 or below) Cast iron also usable depending on conditions															
Allowable min. grip inner diameter	mm	6.7	7.0	7.3	7.6	7.9	8.2	8.7	9.7	10.7	11.7	12.7	11.7	12.7	13.7	14.7	15.7
Allowable max. grip inner diameter	mm	7.4	7.7	8.0	8.3	8.6	9.2	9.7	10.7	11.7	12.7	13.7	12.7	13.7	14.7	15.7	16.7
Grip inner diameter tapering angle (Draft angle)		3° or below															
Grip inner diameter circularity		0.1 or below															

- Pressure range: 1.5–7 MPa (CGC-N21E070, CGC-N22E085: 1.5–6 MPa)
- Proof pressure: 10.5 MPa (CGC-N21E070, CGC-N22E085: 9 MPa)
- Operating temperature: 0–70 ℃
- Fluid used: General mineral based hydraulic oil (ISO-VG32 equivalent)
- Please inquire if above terms are not applied.

*1: CGC-N21E070, 073, 076, 079, 082 are not built-in unclamping sensor valve. *2: Capacity values for hydraulic pressure of 6 MPa are shown.
*3: By the eccentric mechanism, the expansion clamp does not have a workpiece positioning function. *4: ISO R898 class 12.9

Clamping force & hydraulic pressure



Hydraulic pressure	MPa	1.5	2	3	4	5	6	7
CGC-N21E Clamping force F=0.320×P	kN	0.48	0.64	0.96	1.28	1.60	1.92	2.24
CGC-N22E Clamping force F=0.506×P	kN	0.76	1.01	1.52	2.02	2.53	3.04	3.54
CGC-N23E Clamping force F=1.072×P	kN	1.61	2.14	3.22	4.29	5.36	6.43	7.50

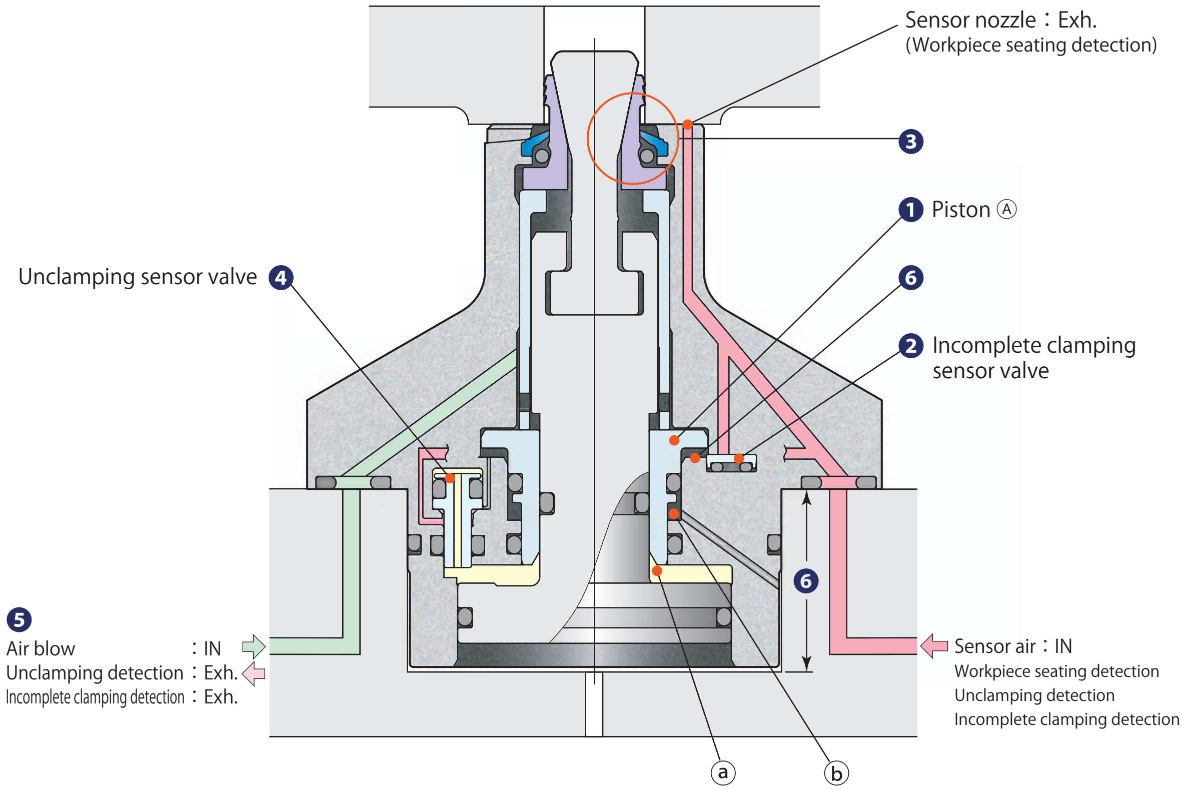
P: Hydraulic pressure (MPa)

- CGC-N21E070, CGC-N22E085 applicable hydraulic pressure should be 1.5 to 6 MPa.

model **CGC-N21E**
2 Grippers
ø7.0 7.3 7.6 7.9 8.2

model **CGC-N22E**
2 Grippers 3 Grippers
ø8.5 9 10 ø11 12 13

model **CGC-N23E**
3 Grippers
ø12 13 14 15 16



❶Gripper support mechanism (PAT.)

- The gripping force can be maintained by the hydraulic power (Cylinder ⓐ) so that the gripper can firmly catch the workpiece without slipping. When unclamping, the hydraulic power (Cylinder ⓑ) support the gripper.

❷Incomplete clamping sensor valve (PAT.)

- Incomplete clamping can be detected by an air sensor and the clamped condition can positively be confirmed. Refer to **page →465**.

❸Most effective scraping structure to prevent the clamp from metal chips (PAT.)

- No chips can intrude because the scraper fits around the gripper and the rod without space. Refer to **pages →468, 469**.
- Model CGC does not need air-blow during cutting process and it prevents work environment from air contamination by air-blow mist also lessens air consumption.
- The durability of scraper has been improved because it deforms radially and evenly along with the stroke of the gripper.

❹Unclamping sensor valve (JP PAT.)

- The valve enables positive unclamping detection by movement of piston when model CGC is in unclamping action. Refer to **page →466**.

❺Using one circuit for air blow and sensor exhaust (JP PAT.)

- Sharing exhaust circuit of the unclamping sensor valve and the incomplete clamping sensor valve with an air blow circuit allows to reduce the number of the circuits and thereby enables the circuit design to be easy.

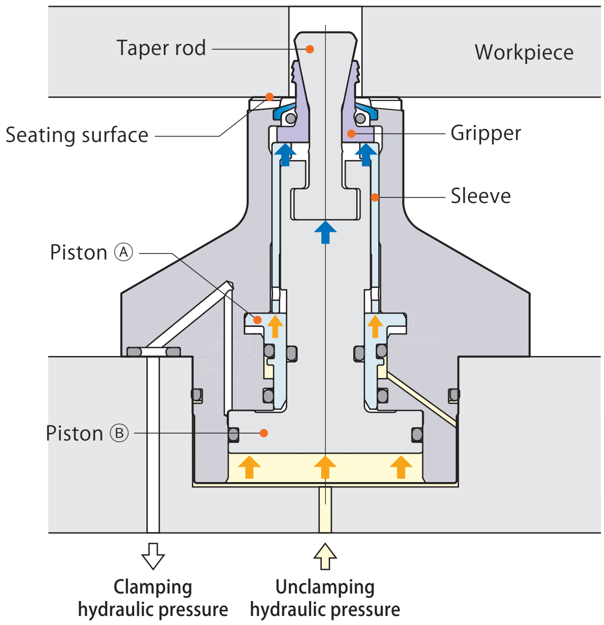
❻Stroke end detection by a piston Ⓐ (JP PAT.)

- The gripper does not impair the scraper because it expands horizontally first then strokes down for clamping.
- No tolerance is required on depth of the bore when machining it because the piston ends its stroke by an internal part, not at the bottom of the bore.

Workpiece setting

① Taper rod and gripper are raised by pistons Ⓐ, Ⓑ and sleeve. The gripper is drawn inward within the taper rod diameter.

② Set the workpiece onto the seating surface.

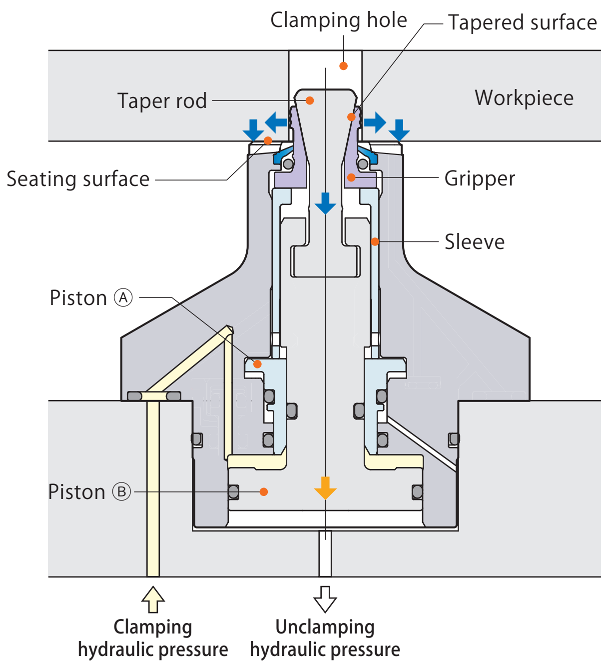


Workpiece holding

① Piston Ⓑ and taper rod lower with piston Ⓐ being held at upper stroke end position by clamping hydraulic pressure.

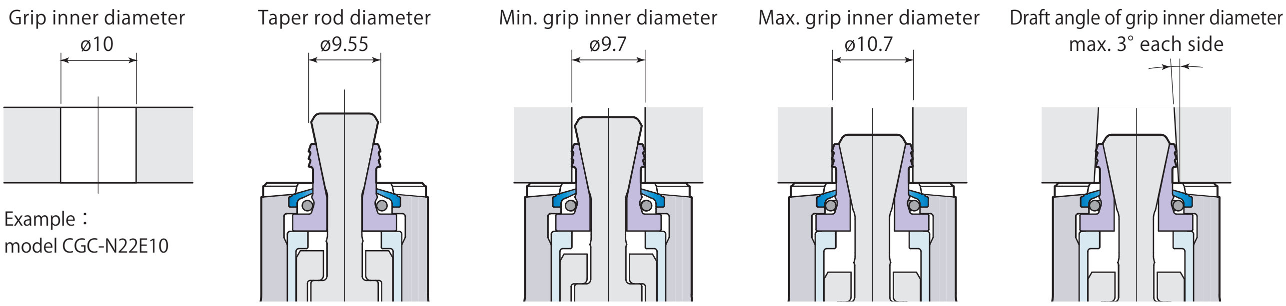
② The gripper expands horizontally along the tapered surface to grip inner face of clamping hole holding its position at upper stroke end by piston Ⓐ and sleeve.

③ The gripper securely grips the inner face of clamping hole and pulls the workpiece down firmly onto the seating surface.



Large gripper expansion stroke

The gripper expands horizontally 1.0mm(∗), which enables the accommodation of dimensional variations in diecast bore diameters and ensures workpiece is held securely.



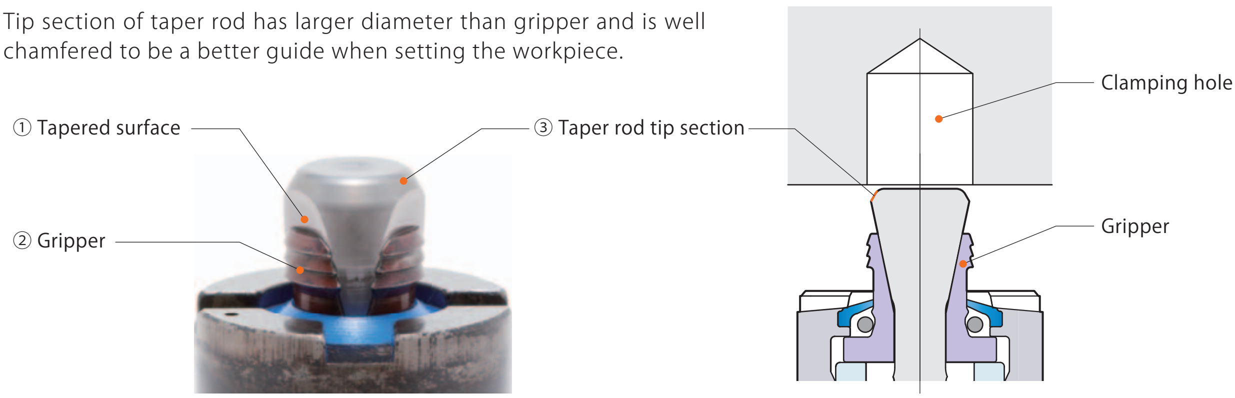
∗：0.7mm stroke for CGC-N21E070, 073, 076, 079, 082

Taper rod and gripper with superior durability

① The holding force of expansion clamp is transmitted from tapered surface to gripper, making it possible for the gripper to hold onto inner face of clamping hole and hold the workpiece on the seating surface for secure workpiece clamping.

② Special steel with superior abrasion resistance is used for gripper to improve durability.

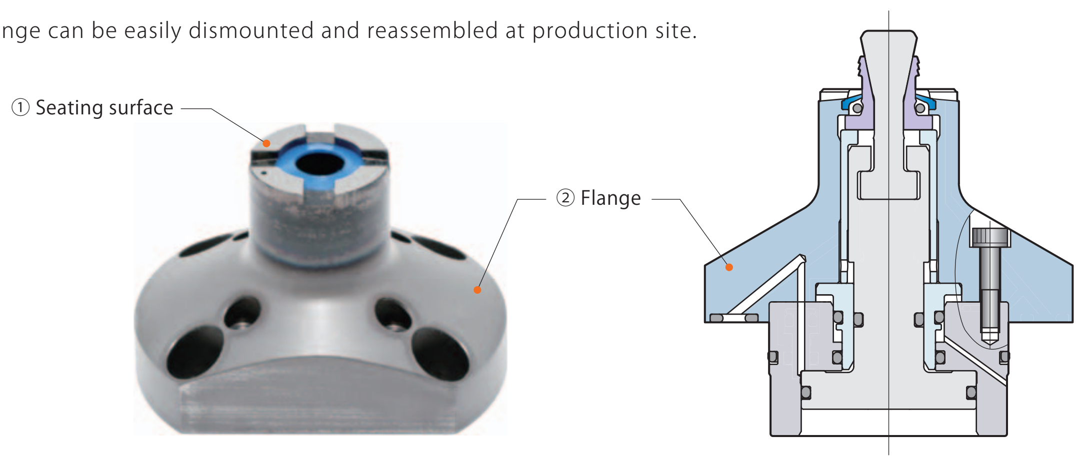
③ Tip section of taper rod has larger diameter than gripper and is well chamfered to be a better guide when setting the workpiece.



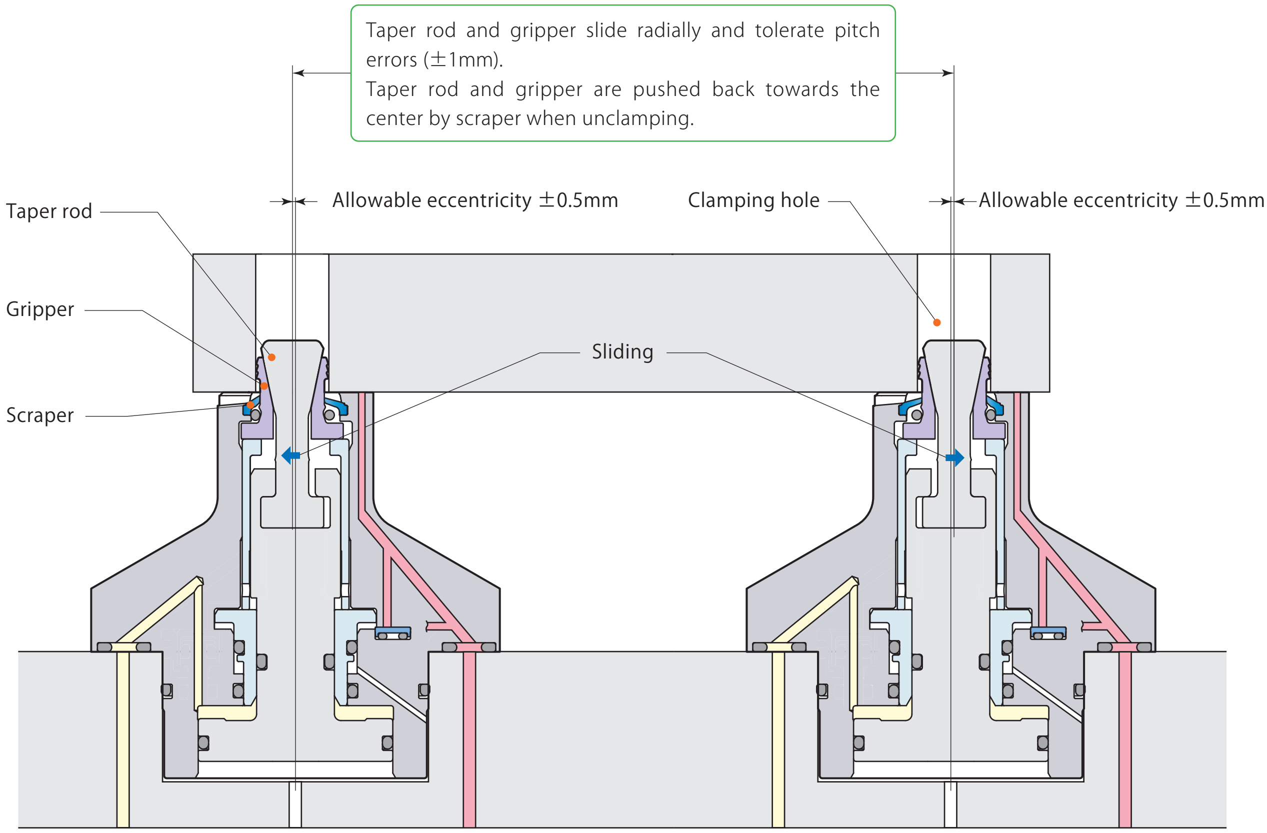
Seating surface can be reground (Max.0.1 mm)

① When seating surface is damaged, the flange section can be dismounted and reground.

② Flange can be easily dismounted and reassembled at production site.



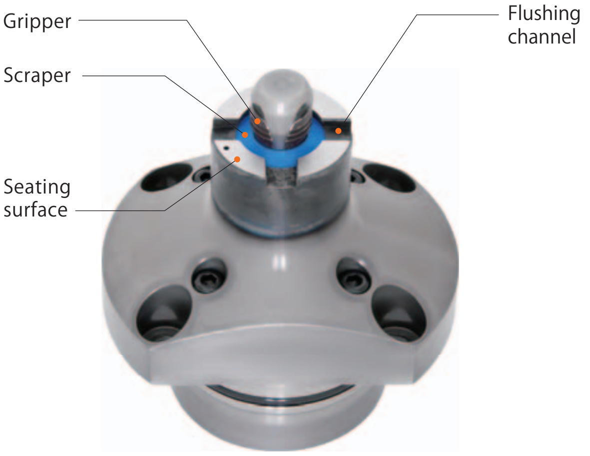
Clamping hole pitch errors can be tolerated

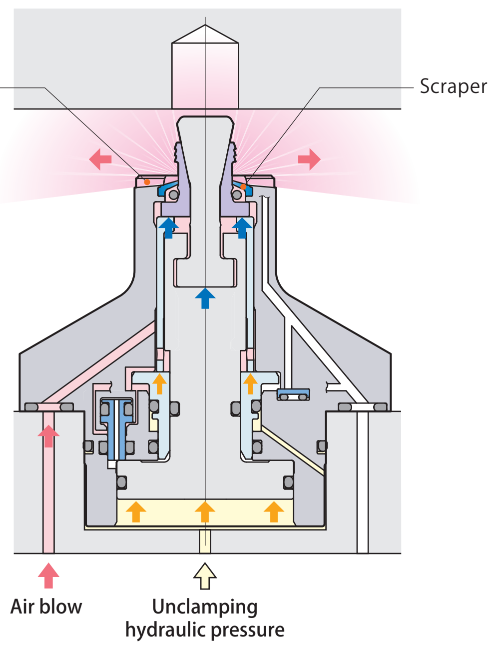


By the eccentric mechanism, the expansion clamp does not have a workpiece positioning function.

Incorporating strong air blowing circuit

Air blow from a gap between the gripper and scraper clears off metal chips and coolant that stay on the seating surface. Flushing channel is also provided on the seating surface to remove the metal chips and coolants smoothly during workpiece setting.





Sensor nozzle detects faulty seating of workpiece

If clamping operation is made when metal chips are under the workpiece (Figure 1-a), or when the workpiece is set 1.2mm and over above the seating surface due to its distortion, the workpiece cannot sit fully on the surface and air is exhausted from the sensor nozzle. Incomplete workpiece seating is detected.

Metal chips caught by clamp

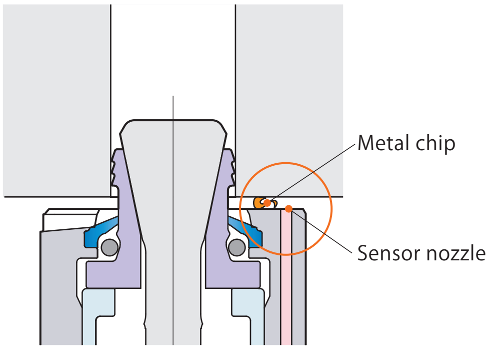


Figure 1-a

Faulty setting of workpiece

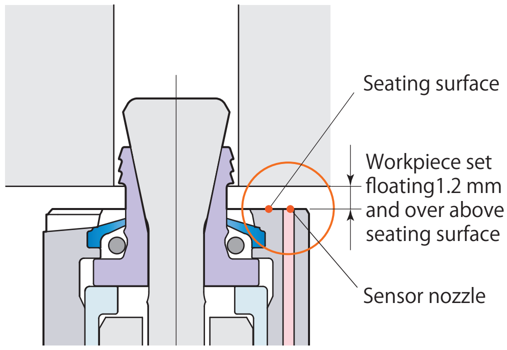
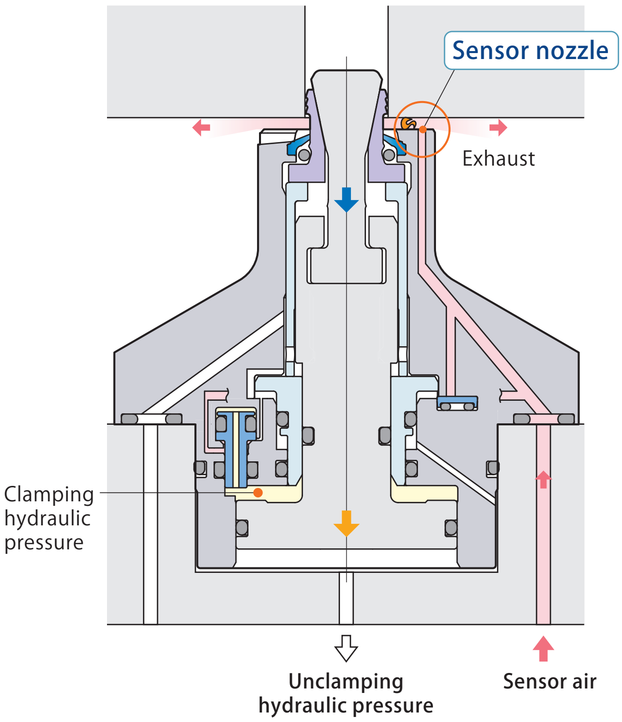


Figure 1-b

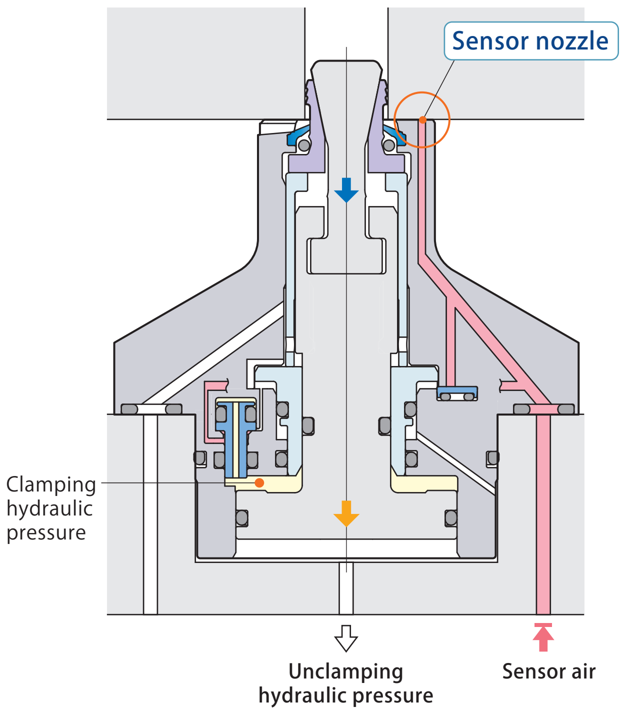
Faulty seating of workpiece

Sensor air is exhausted from sensor nozzle. Air sensor is not triggered and faulty seating of workpiece is detected.



Seating completion of workpiece

Sensor nozzle is blocked by the workpiece. Air sensor detects the seating completion of workpiece.



Clamp condition	Sensor nozzle	Air sensor signal	Hydraulic pressure switch
Faulty seating of workpiece	Open	Air sensor OFF (Sensor air flows.)	Clamping hydraulic pressure ON

Incomplete clamping sensor valve detects incomplete clamping

PAT. JP4297511
US8246029
EP2253419

When gripper fails to grip properly due to large draft angle of grip inner diameter (Figure 2-a), incomplete clamping sensor valve is opened. Sensor air is exhausted and this detects incomplete clamping.
When clamping hole exceeds tolerance value (Figure 2-b), or when gripper is broken (Figure 2-c), incomplete clamping is detected as well.

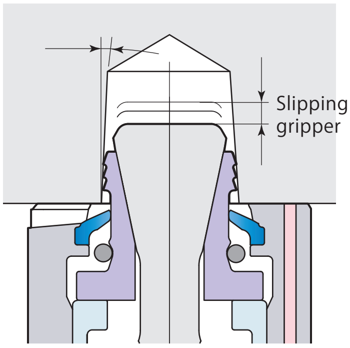


Figure 2-a

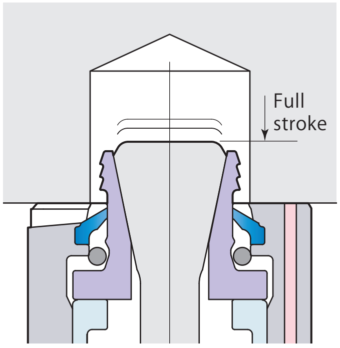


Figure 2-b

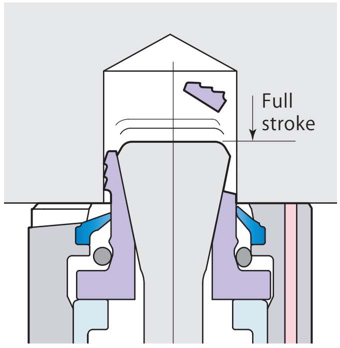
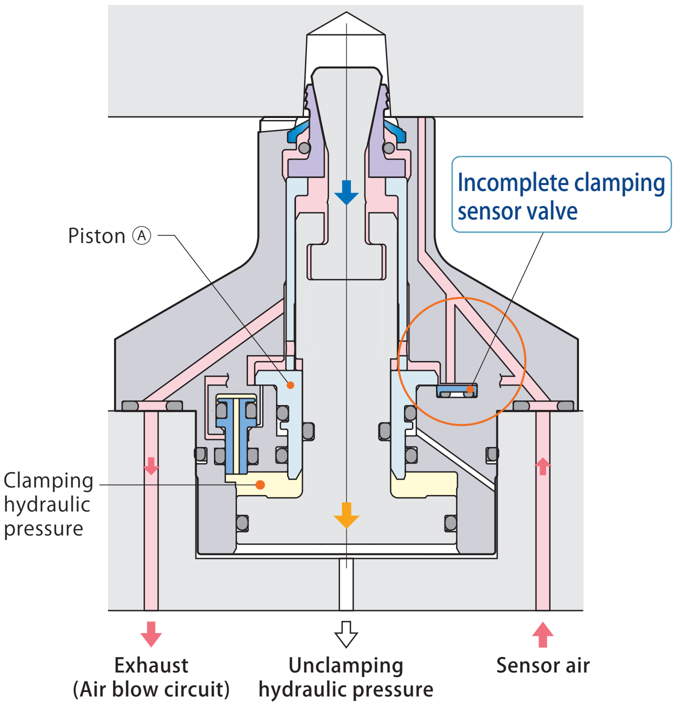


Figure 2-c

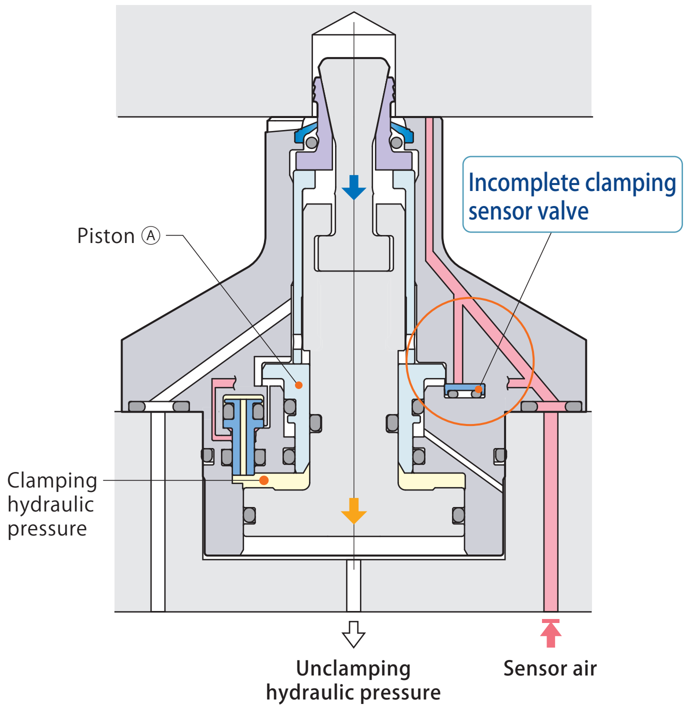
Incomplete clamping

Incomplete clamping sensor valve is opened by piston Ⓐ, sensor air is exhausted. Air sensor is not triggered and this detects incomplete clamping.



Clamping completion

Incomplete clamping sensor valve remains closed. Air sensor detects normal clamping completion.



Clamp condition	Incomplete clamping sensor valve	Air sensor signal	Hydraulic pressure switch
Incomplete clamping	Open	Air sensor OFF (Sensor air flows.)	Clamping hydraulic pressure ON

Unclamping sensor valve detects unclamping operation is complete

Unclamping sensor valve enables sensor to detect unclamping completion. The valve opens to exhaust sensor air even when the workpiece blocks the sensor nozzle.

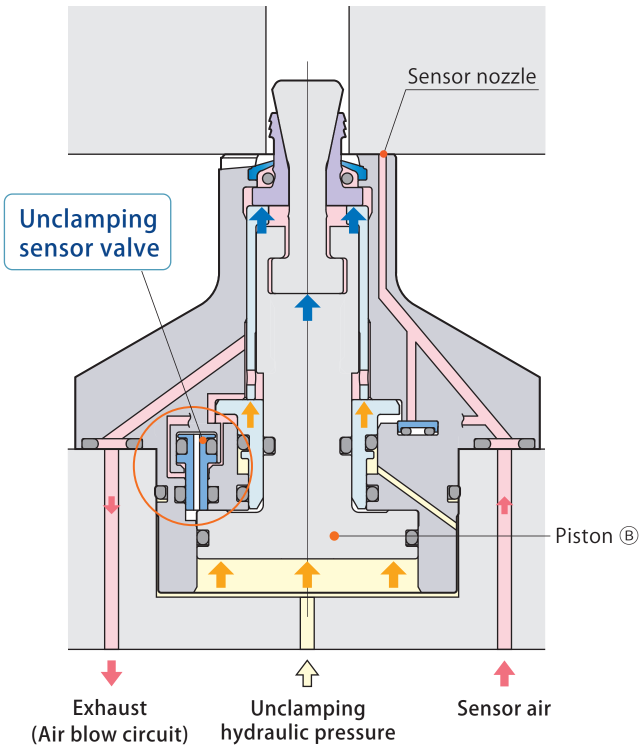
Unclamping sensor valve will not equipped with the following models.
CGC-N21E070 / 073 / 076 / 079 / 082

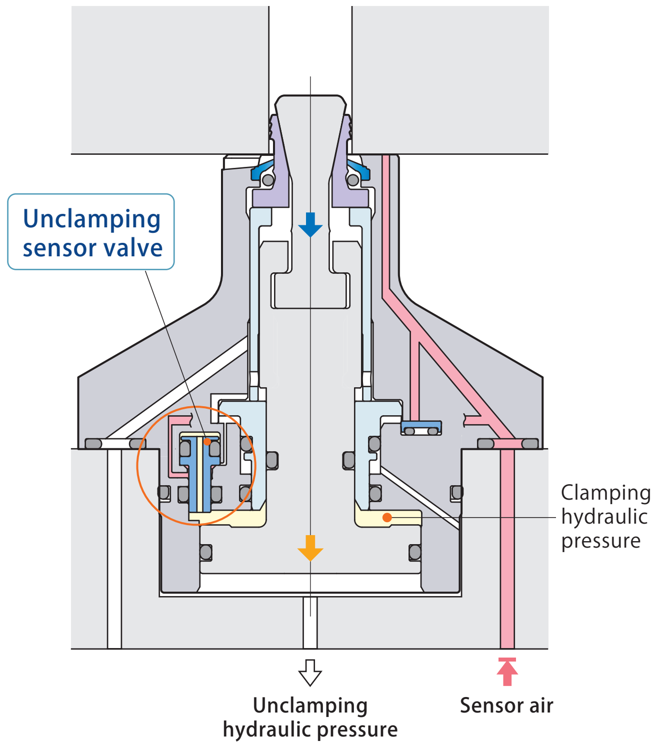
Unclamping completion

Unclamping sensor valve is opened by piston Ⓑ and sensor air is exhausted. Air sensor is not triggered and this detects unclamping completion.

Clamping completion

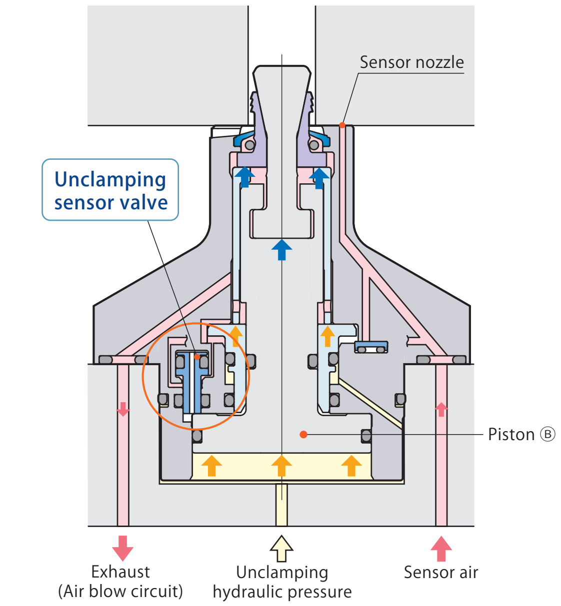
Unclamping sensor valve is closed by clamping hydraulic pressure. Air sensor detects normal clamping completion.



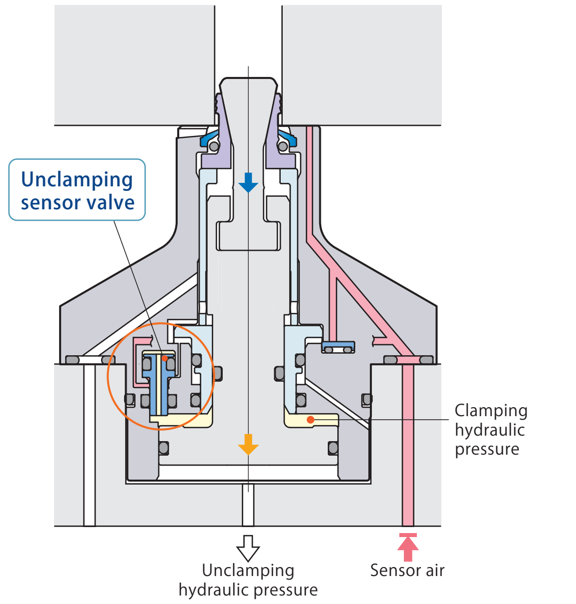


Clamp condition	Unclamping sensor valve	Air sensor signal	Hydraulic pressure switch
Unclamping completion	Open	Air sensor OFF (Sensor air flows.)	Unclamping hydraulic pressure ON
Clamping completion	Close	Air sensor ON (Sensor air does not flow.)	Clamping hydraulic pressure ON

Unclamping completion

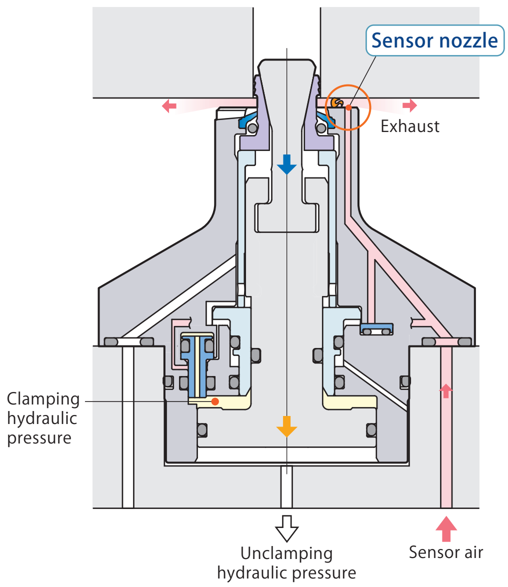


Clamping completion

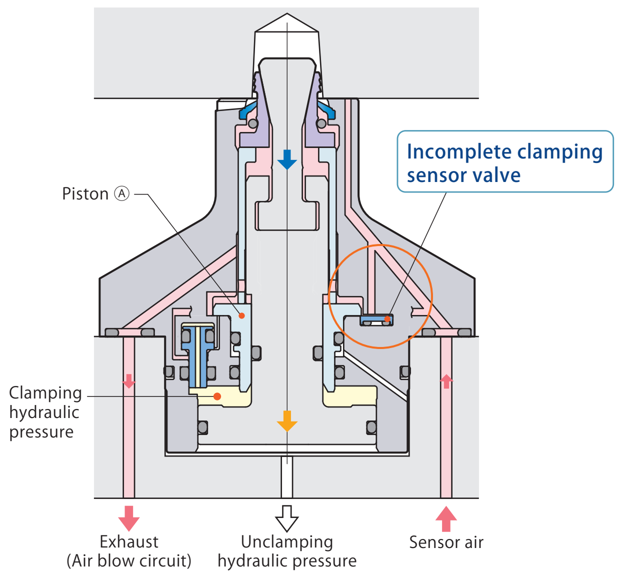


Clamp condition	Sensor nozzle	Incomplete clamping sensor valve	Unclamping sensor valve	Air sensor signal	Hydraulic pressure switch
Unclamping completion	Close	Close	Open	Air sensor OFF (Sensor air flows.)	Unclamping hydraulic pressure ON
Clamping completion	Close	Close	Close	Air sensor ON (Sensor air does not flow.)	Clamping hydraulic pressure ON

Faulty seating of workpiece



Incomplete clamping

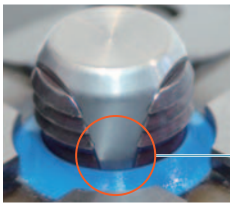


Clamp condition	Sensor nozzle	Incomplete clamping sensor valve	Unclamping sensor valve	Air sensor signal	Hydraulic pressure switch
Faulty seating of workpiece	Open	Close	Close	Air sensor OFF (Sensor air flows.)	Clamping hydraulic pressure ON
Incomplete clamping	Close	Open	Close	Air sensor OFF (Sensor air flows.)	Clamping hydraulic pressure ON

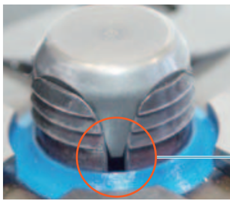
Non-constant air blow model considerably reduces air consumption

PAT. JP5674191
US8800982
EP2543468

The newly developed non-constant air blow model has no open space between a scraper, a gripper and a rod thereby no air blow during machining is required to prevent chips intrusion.
The air blow model (See picture on the right), which requires constant air blow during machining, used to consume constantly 50 L/min (0.3MPa) of air for 12mm of grip inner diameter, however, the new model requires air blow only when the clamp is in clamp and unclamp action, and when workpiece replacement.
This enables significant reduction of air consumption, which helps promote energy conservation.



2 Grippers, 3 Grippers
Non-constant air blow model
Open space where metal chips can intrude is removed during clamping.



4 Grippers (Old model)
Air blow model
Open space where metal chips can intrude is created during clamping.

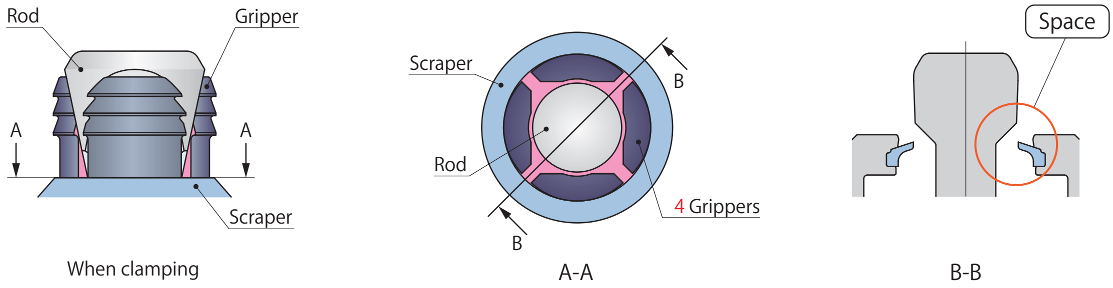
Non-constant air blow model

Number of grippers	Grip inner diameter	Clamping force	Model
2 Grippers	ø 7.0	1.92 kN (Hydraulic pressure 6MPa)	CGC-N21E Grip inner diameter
	ø 7.3 7.6 7.9 8.2	2.24 kN (Hydraulic pressure 7MPa)	
	ø 8.5	3.04 kN (Hydraulic pressure 6MPa)	CGC-N22E Grip inner diameter
	ø 9 10	3.54 kN (Hydraulic pressure 7MPa)	

Number of grippers	Grip inner diameter	Clamping force	Model
3 Grippers	ø 11 12 13	3.54 kN (Hydraulic pressure 7MPa)	CGC-N22E Grip inner diameter
	ø 12 13 14 15 16	7.50 kN (Hydraulic pressure 7MPa)	CGC-N23E Grip inner diameter

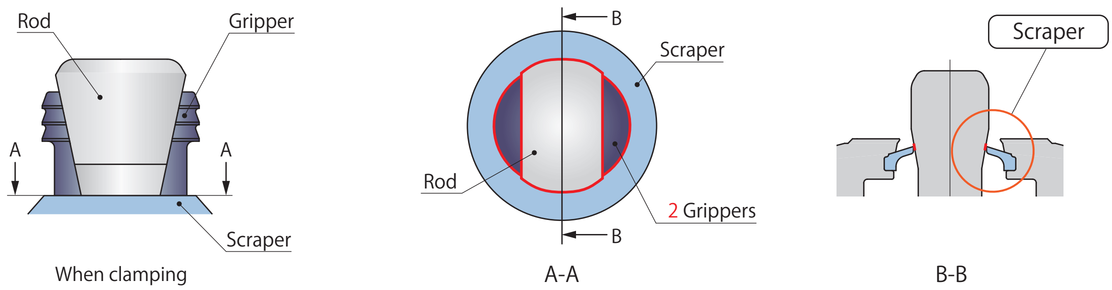
ø12, ø13 has been available in two different models of the clamping force.

Space where metal chips can intrude is created (Old model)



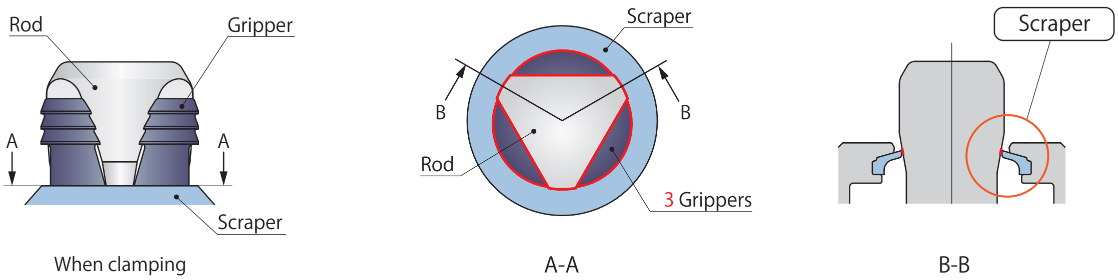
Because of space between scraper, gripper and the rod, air blow must always be performed to prevent intrusion of chips.

Secure chip protection



Pages →470–473

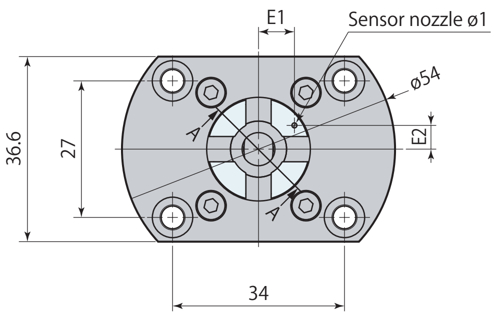
Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.

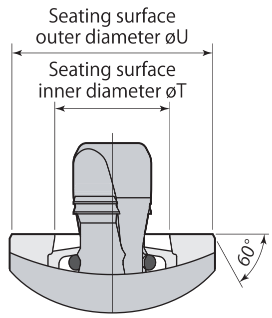


Pages →474–477

Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.

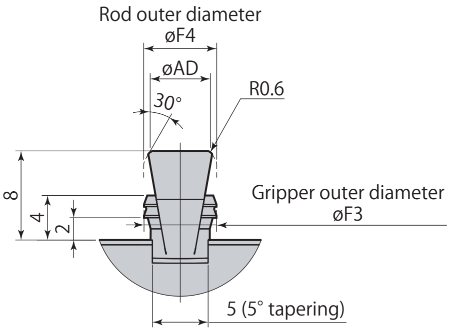
Dimensions

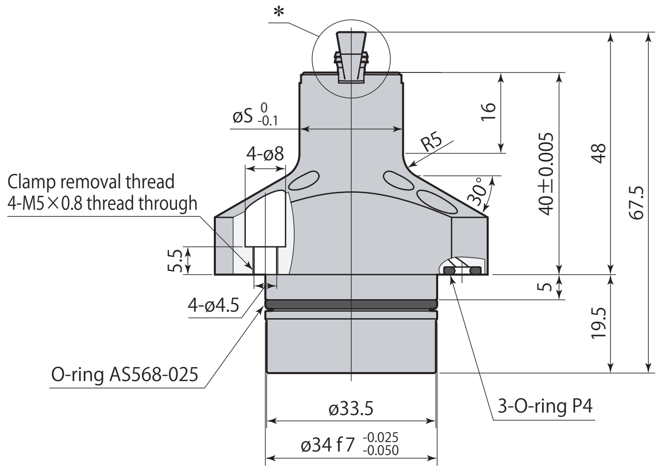




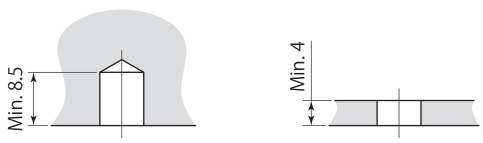
A-A

∗Details

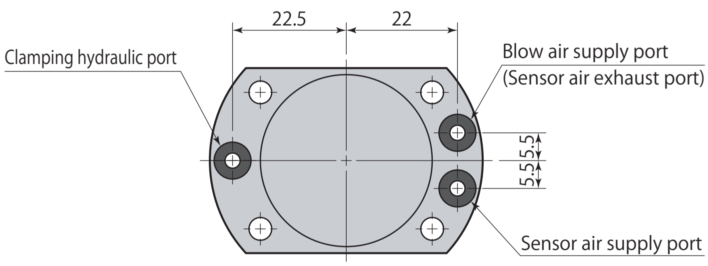




Grip inner diameter usage requirements



Blind hole　　Through hole



- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

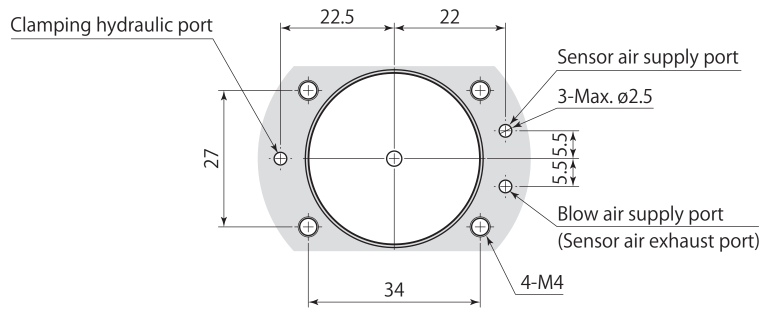
mm

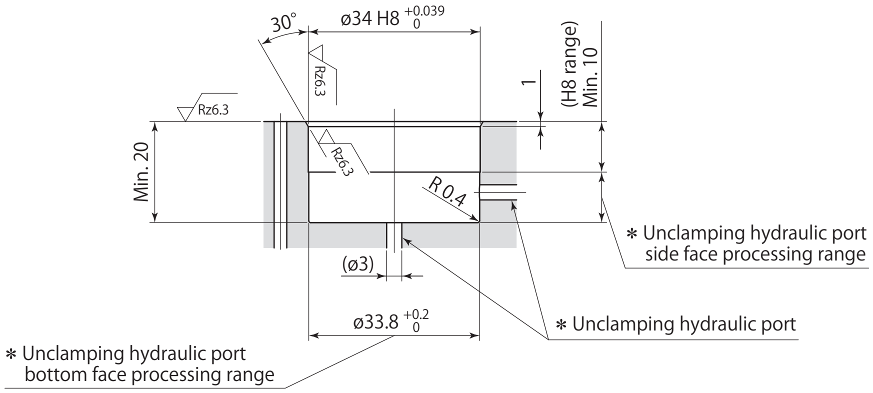
Model	CGC-N21E□				
	070	073	076	079	082
E1	7.1	7.1	7.3	7.5	7.6
E2	4.7	4.7	4.7	4.7	4.7
øF3	6.5	6.8	7.1	7.4	7.7
øF4	6.55	6.85	7.15	7.45	7.75
øS	20.5	20.6	20.9	21.2	21.5
øT	10.6	10.9	11.2	11.5	11.8
øU	20	20.1	20.4	20.7	21
øAD	5.4	5.7	6	6.3	6.6

- CGC-N21E070, 073, 076, 079, 082 are made to order.

Expansion clamp
Non-constant air blow model
CGC

Mounting details





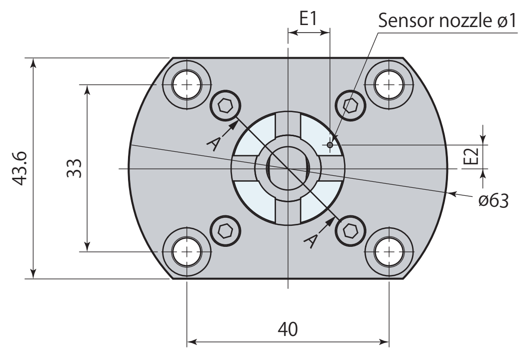
Rz: ISO4287(1997)

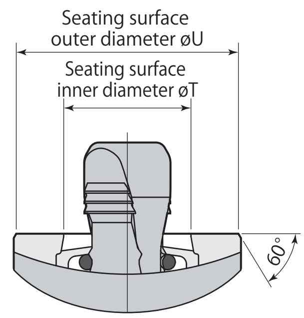
∗: Unclamping hydraulic port must be made on either side or bottom face.

- 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.

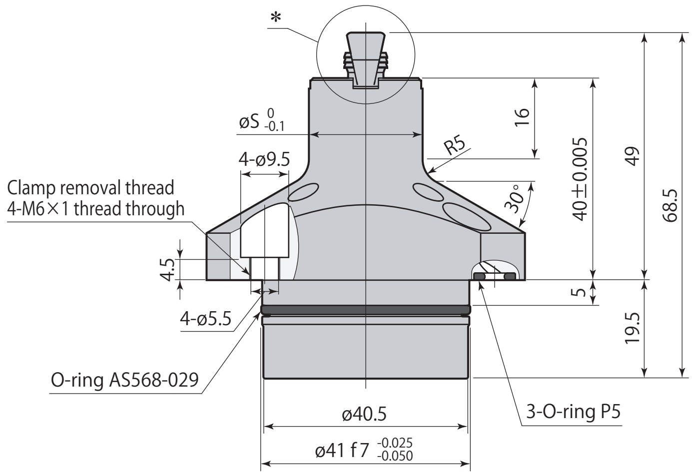
- The 30° taper machining must be provided to avoid the damage of the O-ring.

Dimensions

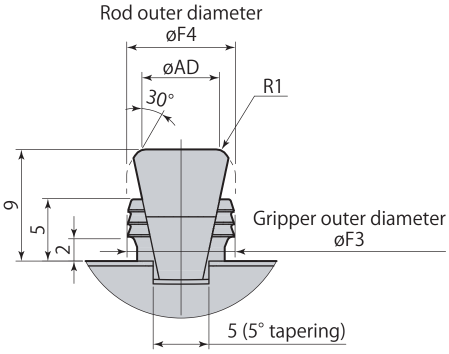




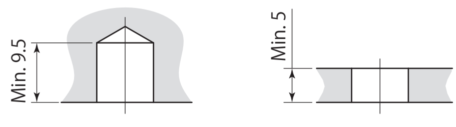
A-A



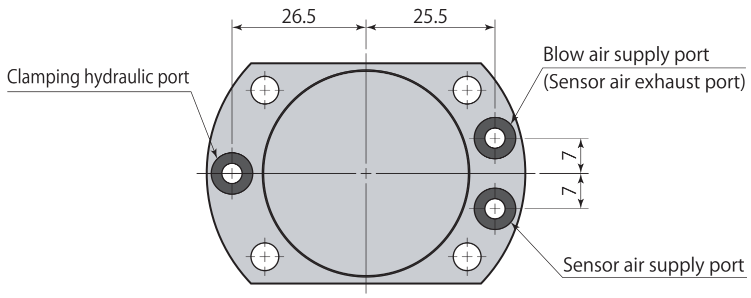
*Details



Grip inner diameter usage requirements



Blind hole   Through hole



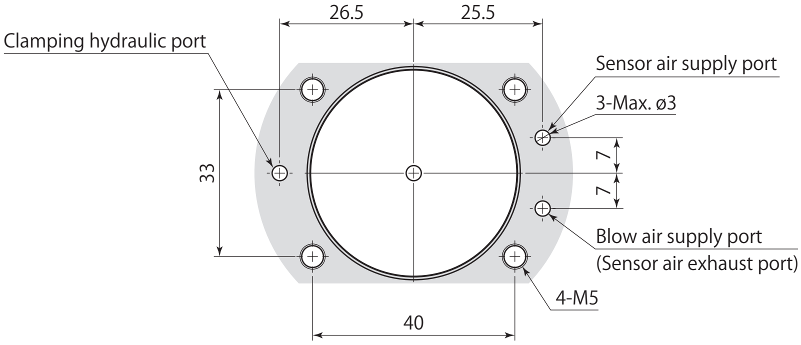
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

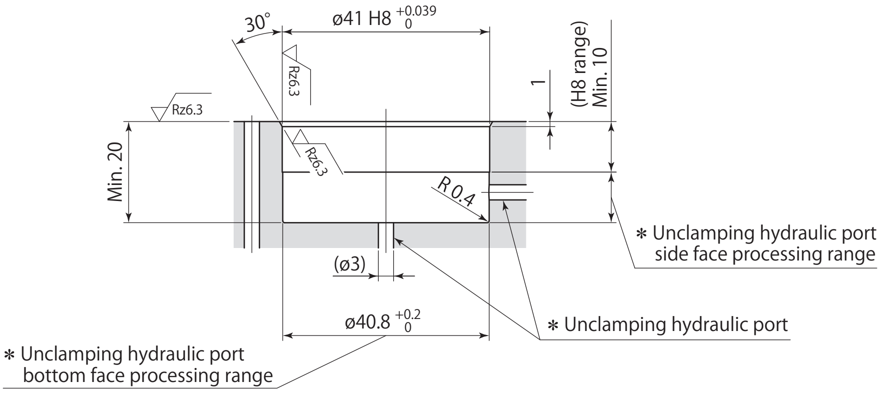
mm

Model	CGC-N22E□		
	085	09	10
E1	8.3	8.3	8.9
E2	4.6	4.6	4.6
øF3	8	8.5	9.5
øF4	8.05	8.55	9.55
øS	22.5	22.5	23.5
øT	12.1	12.6	13.6
øU	22	22	23
øAD	6.3	6.8	7.8

- CGC-N22E085 is made to order.

Mounting details



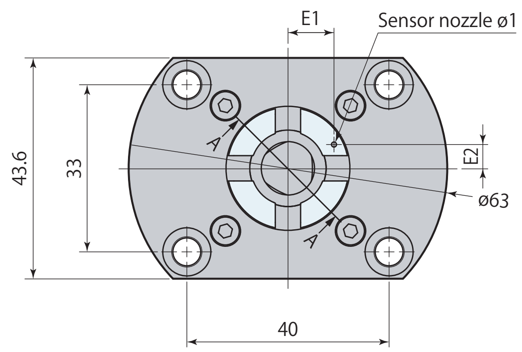


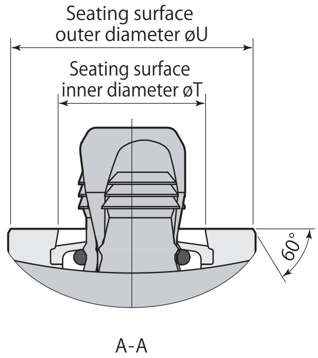
Rz: ISO4287(1997)

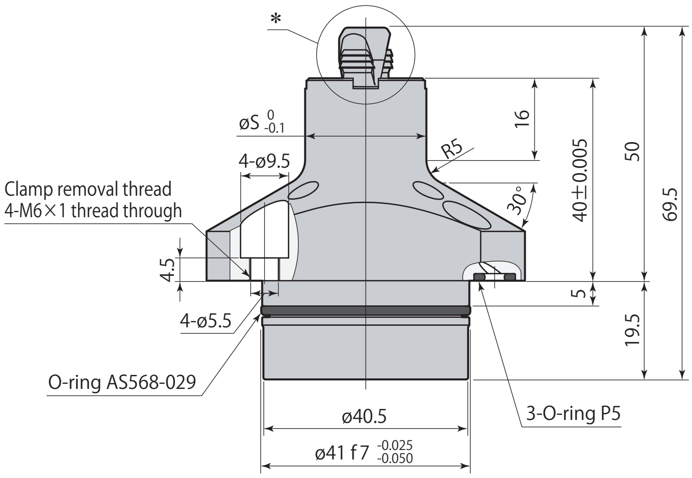
∗: Unclamping hydraulic port must be made on either side or bottom face.

- 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.

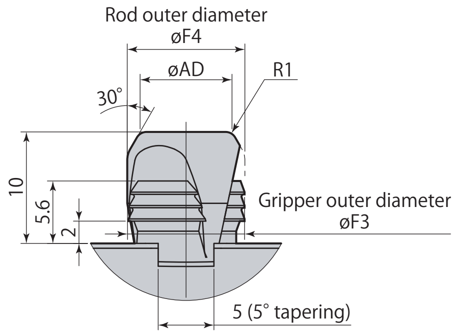
Dimensions





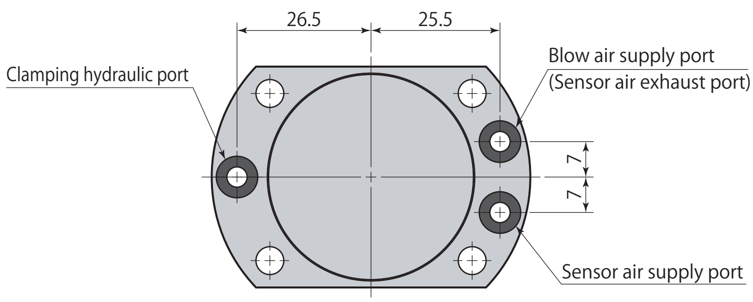


*Details



Grip inner diameter usage requirements

Blind hole   Through hole

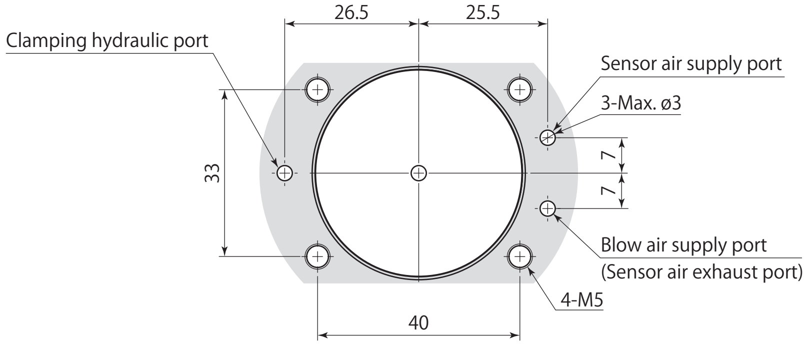


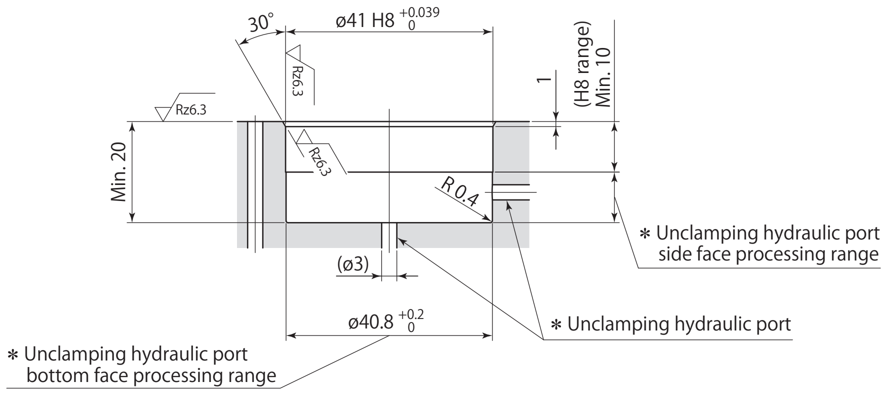
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

mm

Model	CGC-N22E□		
	11	12	13
E1	9.4	9.9	10.4
E2	4.7	4.8	4.9
øF3	10.5	11.5	12.5
øF4	10.55	11.55	12.55
øS	24.5	25.5	26.5
øT	14.6	15.6	16.6
øU	24	25	26
øAD	8.2	9.2	10.2

Mounting details



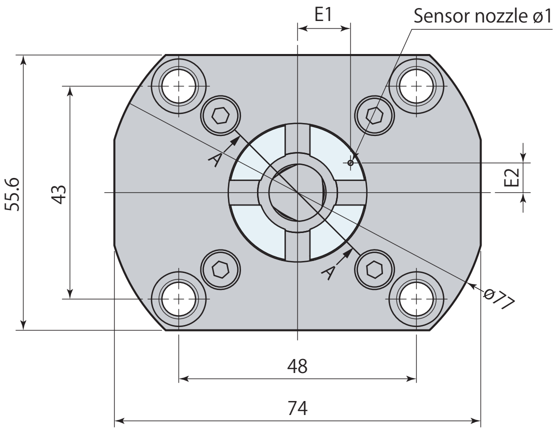


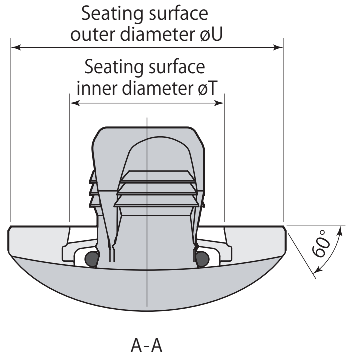
Rz: ISO4287(1997)

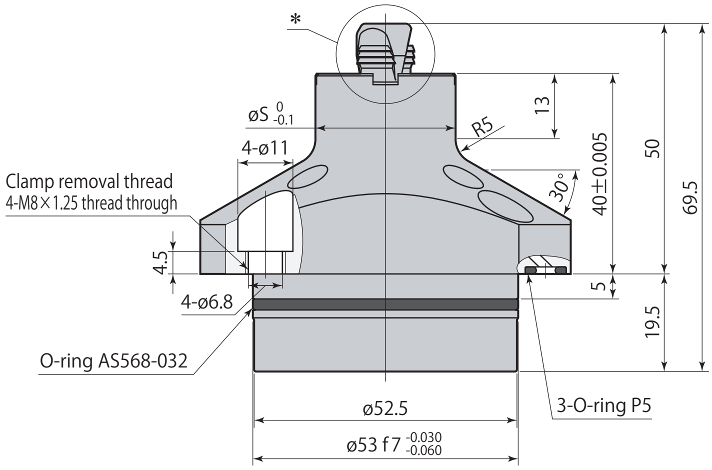
*: Unclamping hydraulic port must be made on either side or bottom face.

- 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.

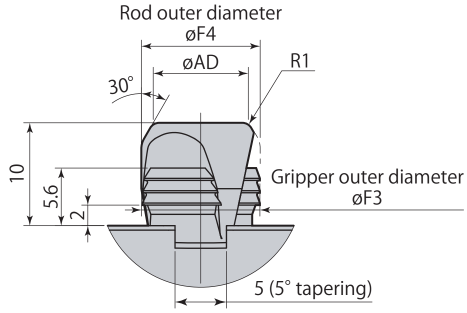
Dimensions

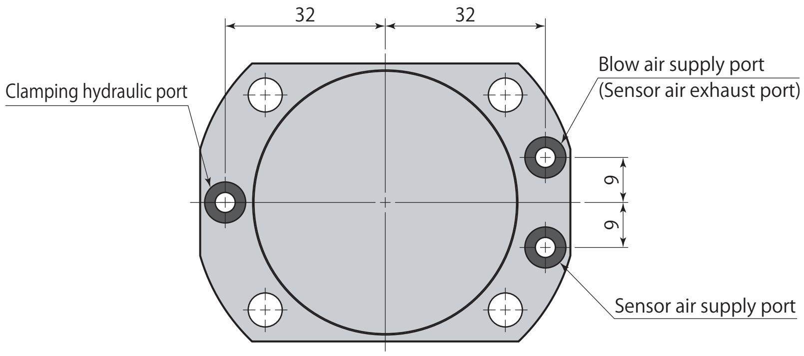






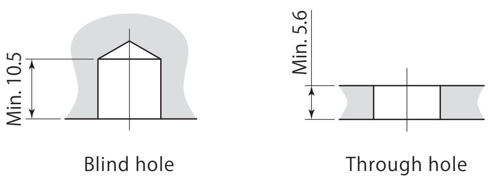
*Details





- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

Grip inner diameter usage requirements

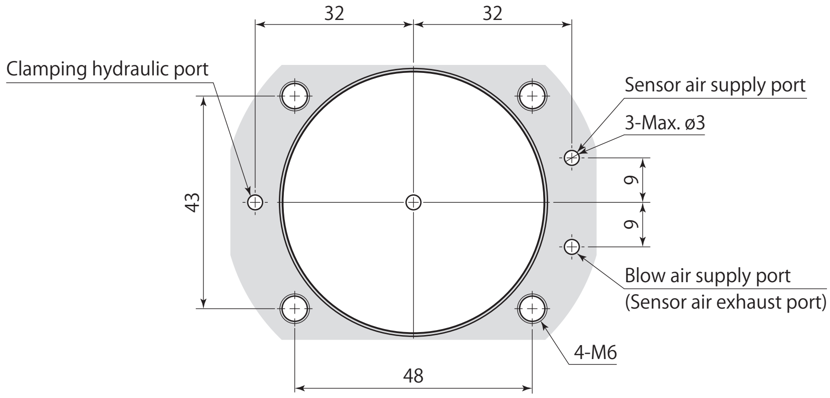


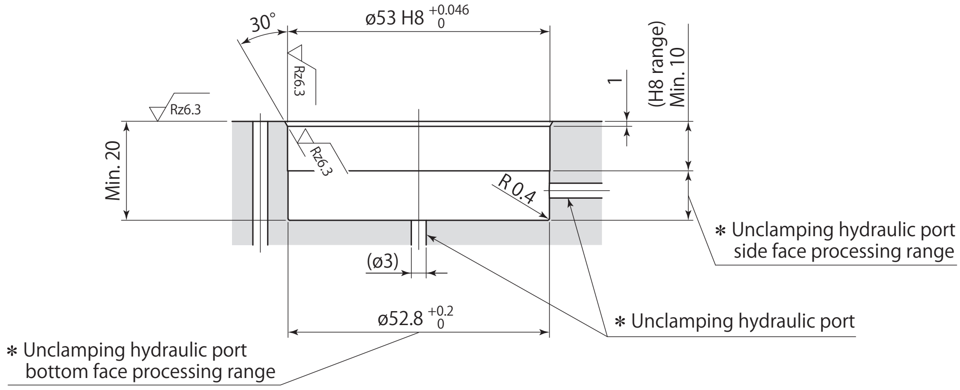
mm

Model	CGC-N23E□				
	12	13	14	15	16
E1	10.7	10.7	10.7	11	11.5
E2	6	6	6	6	6.1
øF3	11.5	12.5	13.5	14.5	15.5
øF4	11.55	12.55	13.55	14.55	15.55
øS	28	28	28	28.5	29.5
øT	15.6	16.6	17.6	18.6	19.6
øU	27.5	27.5	27.5	28	29
øAD	9.2	10.2	11.2	12.2	13.2

- CGC-N23E12, 13, 14, 15, 16 are made to order.

Mounting details



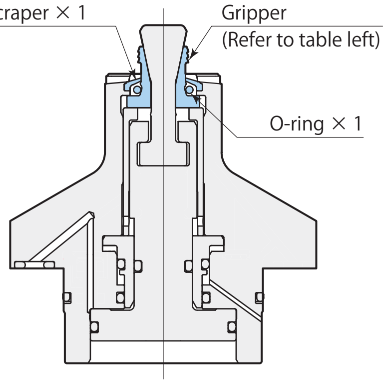


Rz: ISO4287(1997)

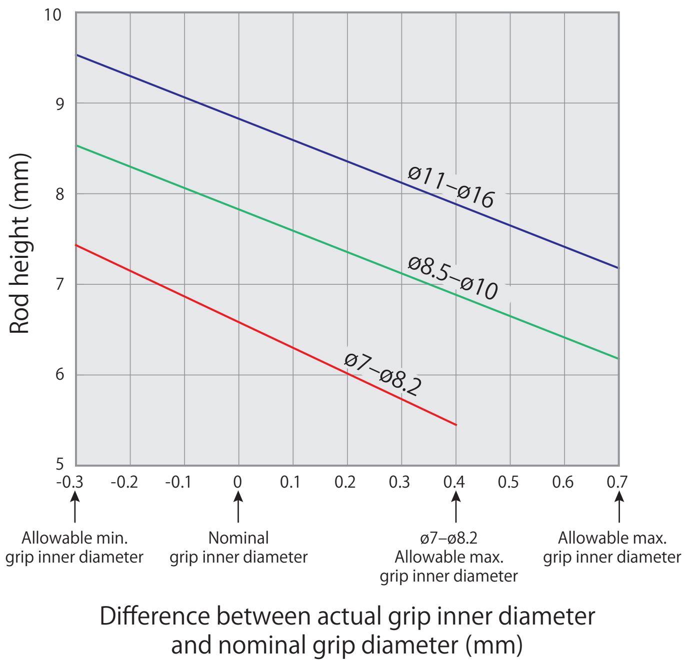
∗: Unclamping hydraulic port must be made on either side or bottom face.

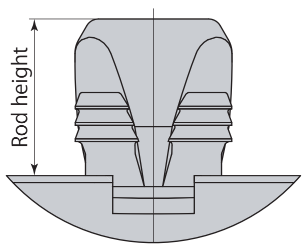
- Apply an appropriate amount of grease to the chamfer and the bore when mounting. Excessive grease may be a blockage in the air passage, causing malfunction of the sensor.
- The 30° taper machining must be provided to avoid the damage of the O-ring.

Gripper set replacement

Number of grippers	Gripper set model	Clamp model	Set description
2 Grippers	CGC-N21EJ070	CGC-N21E070	 It is recommended that grippers, scraper and O-ring be replaced after about 200,000 operations. Replace grippers in sets and not just an individual gripper. (Refer to the table on the left for the gripper set model.)
	CGC-N21EJ073	CGC-N21E073	
	CGC-N21EJ076	CGC-N21E076	
	CGC-N21EJ079	CGC-N21E079	
	CGC-N21EJ082	CGC-N21E082	
	CGC-N22EJ085	CGC-N22E085	
	CGC-N22EJ09	CGC-N22E09	
	CGC-N22EJ10	CGC-N22E10	
3 Grippers	CGC-N22EJ11	CGC-N22E11	
	CGC-N22EJ12	CGC-N22E12	
	CGC-N22EJ13	CGC-N22E13	
	CGC-N23EJ12	CGC-N23E12	
	CGC-N23EJ13	CGC-N23E13	
	CGC-N23EJ14	CGC-N23E14	
	CGC-N23EJ15	CGC-N23E15	
	CGC-N23EJ16	CGC-N23E16	

Grip inner diameter & rod height when clamping





Rod height calculation formula

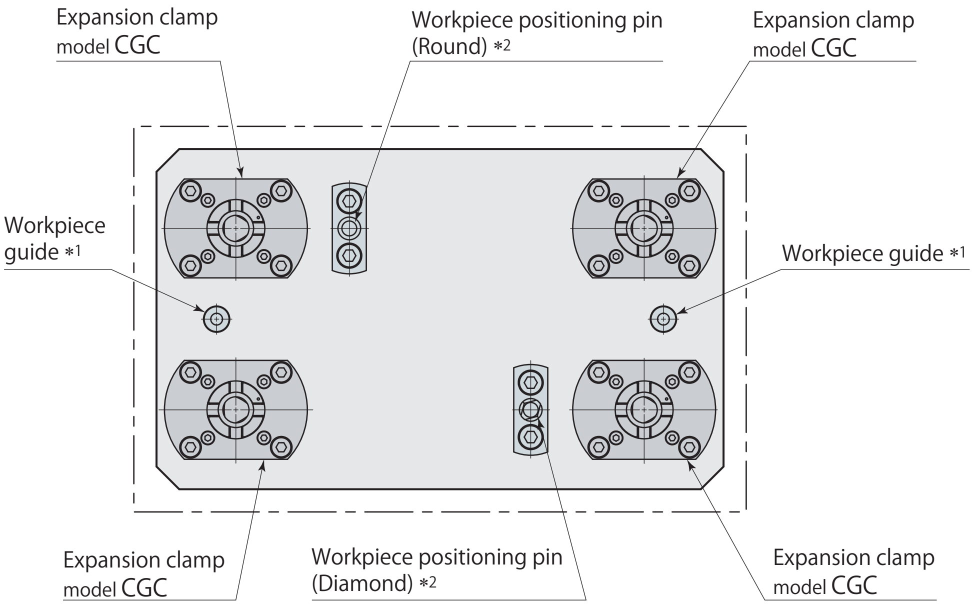
ø7 – ø8.2 : 6.58-2.84 × Actual grip inner diameter and nominal grip diameter difference

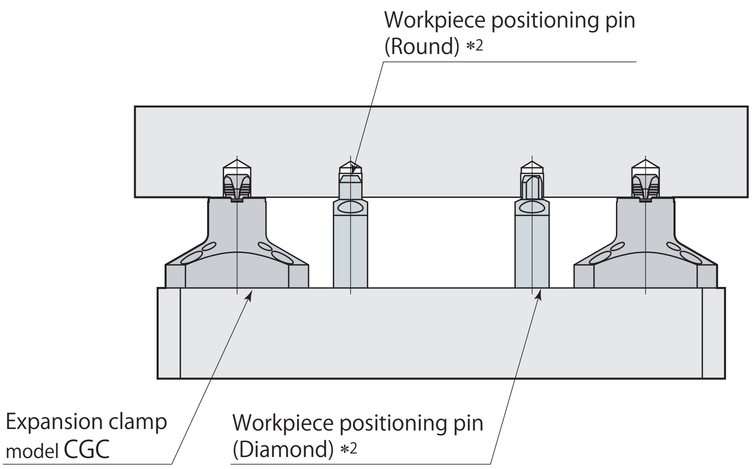
ø8.5 – ø10 : 7.82-2.35 × Actual grip inner diameter and nominal grip diameter difference

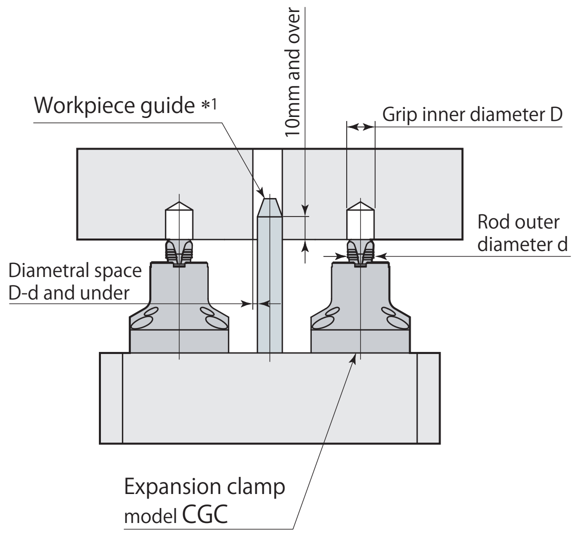
ø11 – ø16 : 8.82-2.35 × Actual grip inner diameter and nominal grip diameter difference

Example : When CGC-N22E10 (Nominal grip diameter : ø10) is clamping ø9.8 hole
Rod height = 7.82 - 2.35 × (-0.2) = 8.29 mm

System configuration example



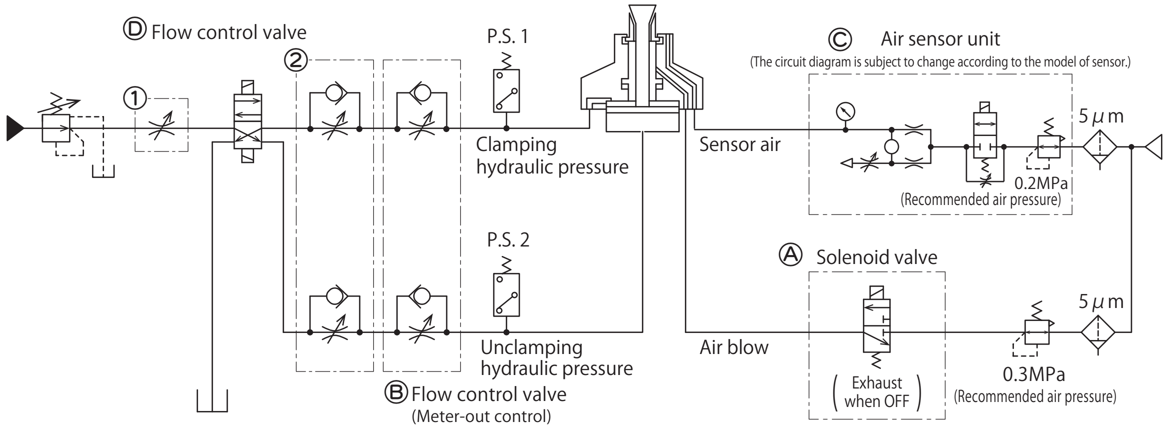




*1: When using automatic or robotic conveyers, prevent damage to clamp caused from impact by setting workpiece guides. Using the above guide as reference, accurately position the holes when using workpiece guides.

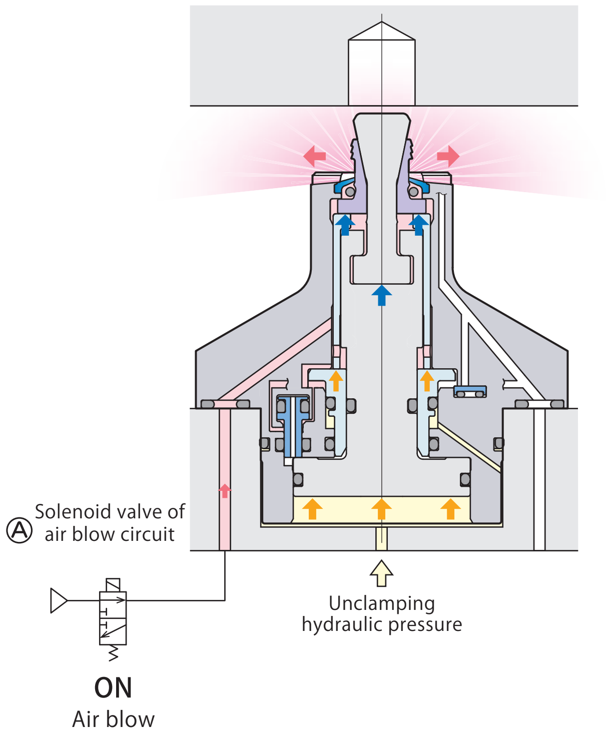
*2: **The expansion clamp does not have a workpiece positioning function.**
Install workpiece positioning pins (or similar).

Hydraulic and pneumatic circuit diagram

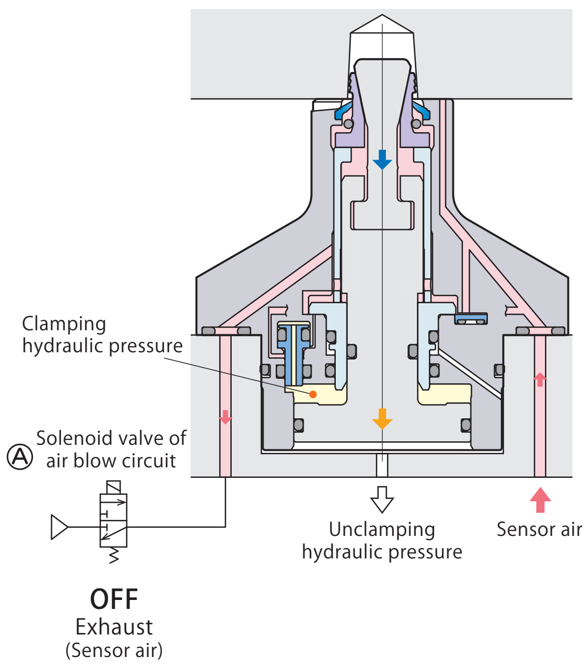


- Air blow will not be necessary during cutting process. Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping to remove metal chips and debris.
- The solenoid valve Ⓐ must be closed when checking the operation of the clamp with the air sensor. Also 3 port type of solenoid valve must be used in the circuit. If 2 port type of the valve is used, sensing air cannot be exhausted and misclamp detection function is disabled.

Air blowing



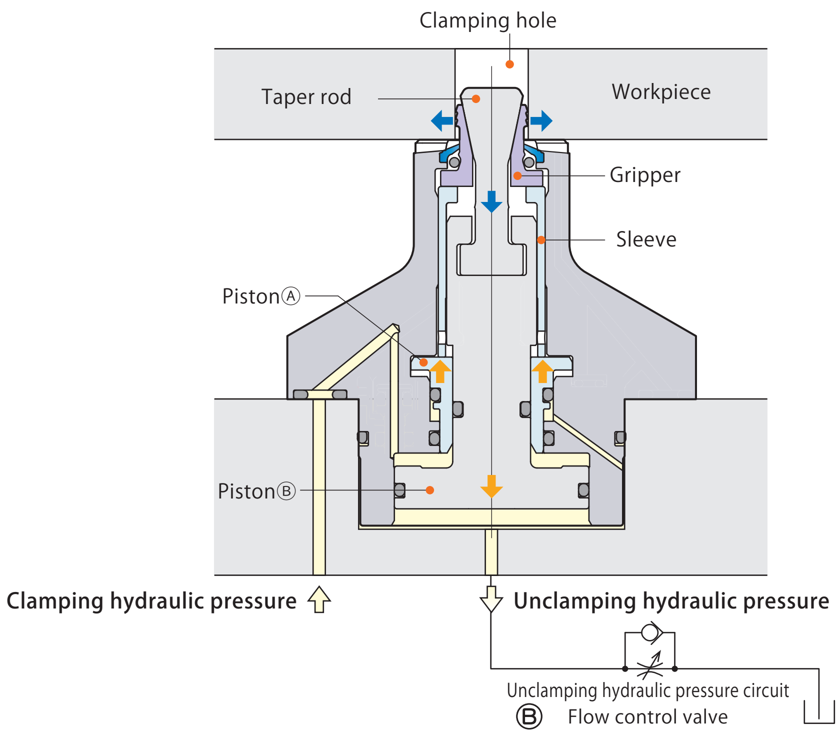
Incomplete clamping



- Operation speed must be adjusted by a meter-out type flow control valve Ⓑ being provided in the unclamping circuit. By the adjustment, oil flow in unclamping circuit is squeezed and back pressure is generated. The back pressure acts on the piston Ⓐ of the clamp and makes the gripper expand first then the taper rod strokes down to clamp. If meter-in type flow control valve is installed in the circuit, it dumps the oil rapidly and makes the gripper move very quick which causes incomplete clamping.

- Adjust oil flow when clamping to have the taper rod full stroke in 0.3 sec or over.
  Excessive oil flow to the clamp gives impact load and may cause breakage of the parts.

- Provide additional flow control valve Ⓓ to the place of either ① or ② in the circuit diagram to adjust oil flow when a large discharge volume pump is used for the hydraulic circuit. The flow control valve Ⓑ alone may not be good enough to adjust the speed of clamp operation.



Air sensor unit Ⓒ 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	0.2 MPa
Inner diameter of piping	ø4 mm (ISA3-F：ø2.5 mm)
Overall piping length	5 m or less

- 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 made successfully as designed when it is used out of the usage shown on the left. Contact Technical service center for more details.

Operation cycle

The clamp should be controlled with the cycle in the diagram shown below to detect the operation status exactly.

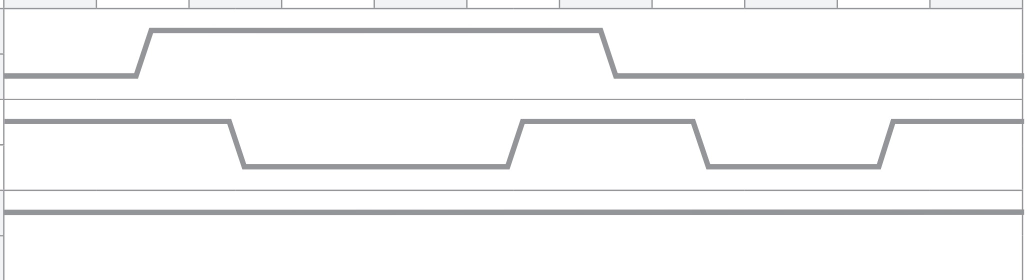
Case of model CGC-N21E□

State			Workpiece loading	Clamping	Air blow OFF	Clamping completion*1	(Machining)	Air blow ON	Unclamping	Unclamping completion*2	Workpiece unloading
*4	Workpiece clamp	Clamp									
		Unclamp									
	Air blow	ON									
		OFF									
	Sensor air	ON									
		OFF									
*5	Clamping hydraulic pressure P.S. 1		OFF	ON					OFF		
	Unclamping hydraulic pressure P.S. 2		ON	OFF					ON		
	Air sensor				ON or OFF*3						

*1 : Clamping completion : P.S. 1=ON P.S. 2=OFF Air sensor=ON
*2 : Unclamping completion : P.S. 1=OFF P.S. 2=ON
*3 : ON : Complete clamping OFF : Incomplete clamping
*4 : Solenoid valve control *5 : Hydraulic pressure switch, Air sensor signal

Case of model CGC-N22E□, CGC-N23E□

State			Workpiece loading	Clamping	Air blow OFF	Clamping completion*1	(Machining)	Air blow ON	Unclamping	Air blow OFF	Unclamping completion*2	Air blow ON	Workpiece unloading
*4	Workpiece clamp	Clamp											
		Unclamp											
	Air blow	ON											
		OFF											
	Sensor air	ON											
		OFF											
*5	Clamping hydraulic pressure P.S. 1		OFF	ON					OFF				
	Unclamping hydraulic pressure P.S. 2		ON	OFF					ON				
	Air sensor				ON or OFF*3					OFF			



*1 : Clamping completion : P.S. 1=ON P.S. 2=OFF Air sensor=ON
*2 : Unclamping completion : P.S. 1=OFF P.S. 2=ON Air sensor=OFF
*3 : ON : Complete clamping OFF : Incomplete clamping
*4 : Solenoid valve control *5 : Hydraulic pressure switch, Air sensor signal

Caution in use

- Be sure to make inner diameter of air blow circuit 4 mm and over except for clamp mounting surface.

- Set the workpiece in such a way that the clamping hole of workpiece is perpendicular to seating surface. Clamping in tilted condition results in uneven contact of gripper with hole, which leads to concentration of load that may cause damage.

- Verify that there are no metal chips or debris on seating surface of clamping hole and clamp body before setting workpiece. Allowing intrusion of metal chips results in insecure clamping, which can lead to low grade of machining accuracy.

- Flaring (Biting) of gripper into workpiece varies depending on workpiece material or thermal processing conditions. With regards to conditions of workpiece and clamping hole, refer to **page →459**. Secure clamping is not possible when workpiece or clamping hole that does not satisfy these conditions is used.

- If clamping hole serves as taper hole (cast draft hole with gradient), then perform test clamping using applicable workpiece beforehand to verify that there are no problems with operations.

- Deformation may occur if the thickness of clamping hole section of workpiece is extremely thin. Use applicable workpiece to perform test clamping beforehand to verify that there are no deformations in thin portion.

- Supply the dry and filtered air. Particulate size 5 μm or less is recommended.

- Measure seating surface flatness with hydraulic pressure applied on clamping side, or by applying hydraulic pressure on neither clamping nor unclamping side.

- Set detection range of air sensor to 0.05 mm and under from seating surface. Insert a feeler gauge between workpiece and seating surface to create detection distance in order to perform setting accurately. Refer to instruction manual of air sensor for details on setting methods.

- Perform unclamping completion detection, clamping completion detection and incomplete clamping detection with combination actions of pressure switch and sensor shown in table below. (Refer to hydraulic and pneumatic circuit diagram on **page →480** for details.)

Case of model CGC-N21E□

Applications	Pressure switch 1 (P.S. 1)	Pressure switch 2 (P.S. 2)	Air sensor
Unclamping completion detection	OFF	ON	—
Clamping completion detection	ON	OFF	ON
Incomplete clamping detection	ON	OFF	OFF

Case of model CGC-N22E□, CGC-N23E□

Applications	Pressure switch 1 (P.S. 1)	Pressure switch 2 (P.S. 2)	Air sensor
Unclamping completion detection	OFF	ON	OFF
Clamping completion detection	ON	OFF	ON
Incomplete clamping detection	ON	OFF	OFF

Expansion clamp

Double acting 7MPa

model CGT

model CGT

Specifications

Size / Grip inner diameter / : Number of grippers

CGT — F2

- 1 — : Air blow model — 055 058 061 064 067 070A : 2 Grippers
- 1 E : Non-constant air blow model — 070 073 076 079 082 : 2 Grippers
- 2 E : Non-constant air blow model — 085 09 10 : 2 Grippers; 11 12 13 : 3 Grippers

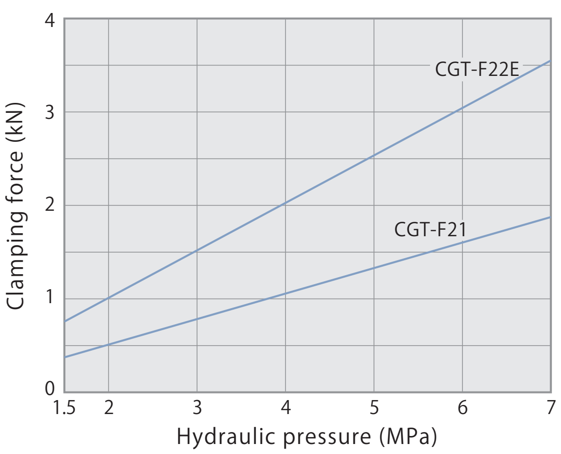
■ indicates made to order. (055, 058, 061, 064, 067, 070A, 070, 073, 076, 079, 082, 085, 13)

Model	Size		CGT-F21-						CGT-F21E					CGT-F22E					
	Grip inner diameter		055	058	061	064	067	070A	070	073	076	079	082	085	09	10	11	12	13
Number of grippers			2 Grippers														3 Grippers		
Clamping force (hydraulic pressure 7MPa)		kN	1.35[*1]						1.89					3.04[*2]	3.54				
Radial expansion force (hydraulic pressure 7MPa)		kN	4.21[*1]						6.58					9.5[*2]	11.1				
Taper rod stroke		mm	4.0						4.8										
Clamp stroke		mm	1.2																
Cylinder capacity	Clamp	cm^3	1.2						1.5					2.7					
	Unclamp	cm^3	1.6						2.0					3.5					
Allowable eccentricity[*3]		mm	±0.3						±0.4										
Recommended air blow pressure		MPa	0.3																
Recommended sensor air pressure		MPa	0.2																
Mass		kg	0.27						0.29					0.43					
Recommended tightening torque of mounting screws[*4]		N·m	3.5											7					
Workpiece material			Aluminum, steel and others (HRC30 or below) Cast iron also usable depending on conditions																
Allowable min. grip inner diameter		mm	5.2	5.5	5.8	6.1	6.4	6.7	6.7	7.0	7.3	7.6	7.9	8.2	8.7	9.7	10.7	11.7	12.7
Allowable max. grip inner diameter		mm	5.8	6.1	6.4	6.7	7.0	7.3	7.4	7.7	8.0	8.3	8.6	9.2	9.7	10.7	11.7	12.7	13.7
Grip inner diameter tapering angle (Draft angle)			3° or below																
Grip inner diameter circularity			0.1 or below																

- Pressure range: 1.5–7 MPa (CGT-F21-055, 058, 061, 064, 067, 070A: 1.5–5 MPa, CGT-F22E085: 1.5–6 MPa)
- Proof pressure: 10.5 MPa (CGT-F21-055, 058, 061, 064, 067, 070A: 7.5 MPa, CGT-F22E085: 9 MPa)
- Operating temperature: 0–70 ℃
- Fluid used: General mineral based hydraulic oil (ISO-VG32 equivalent)
- Please inquire if above terms are not applied.

∗1: Capacity values for hydraulic pressure of 5 MPa are shown. ∗2: Capacity values for hydraulic pressure of 6 MPa are shown.
∗3: By the eccentric mechanism, the expansion clamp does not have a workpiece positioning function. ∗4: ISO R898 class 12.9

Clamping force & hydraulic pressure



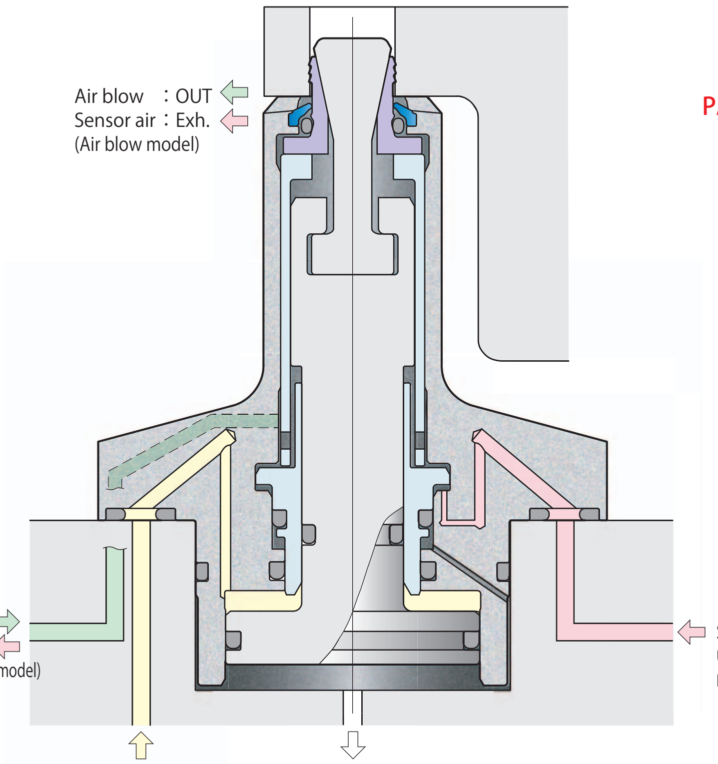
Hydraulic pressure	MPa	1.5	2	3	4	5	6	7
CGT-F21 Clamping force F=0.270×P	kN	0.41	0.54	0.81	1.08	1.35	1.62	1.89
CGT-F22E Clamping force F=0.506×P	kN	0.76	1.01	1.52	2.02	2.53	3.04	3.54

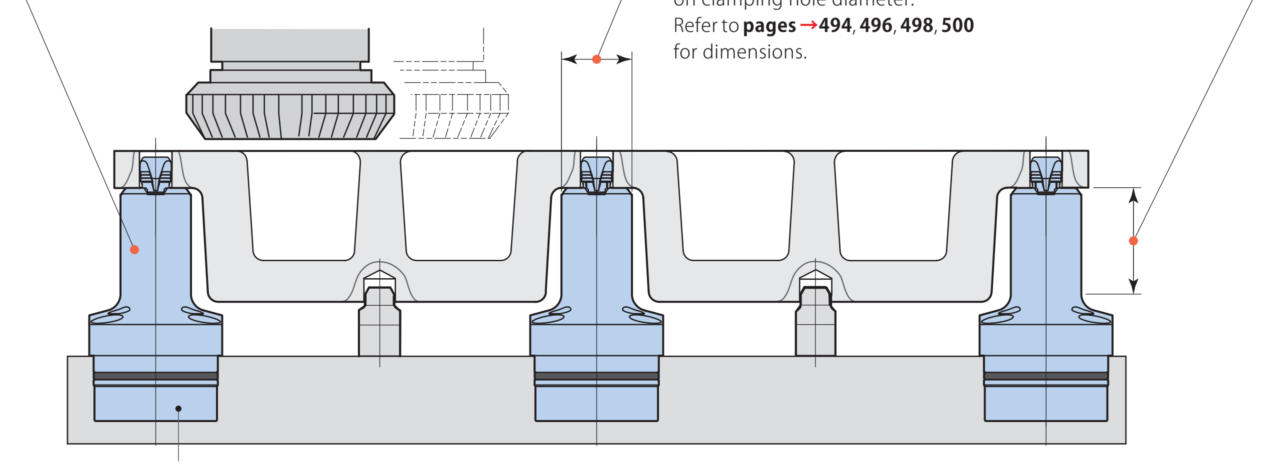
P: Hydraulic pressure (MPa)

- CGT-F21-055, 058, 061, 064, 067, 070A applicable hydraulic pressure should be 1.5 to 5 MPa.
  CGT-F22E085 applicable hydraulic pressure should be 1.5 to 6 MPa.

Air blow model	Non-constant air blow model	Non-constant air blow model
model **CGT-F21-**	model **CGT-F21E**	model **CGT-F22E**
2 Grippers	2 Grippers	2 Grippers / 3 Grippers
ø5.5 5.8 6.1 6.4 6.7 7.0	ø7.0 7.3 7.6 7.9 8.2	ø8.5 9 10 / ø11 12 13





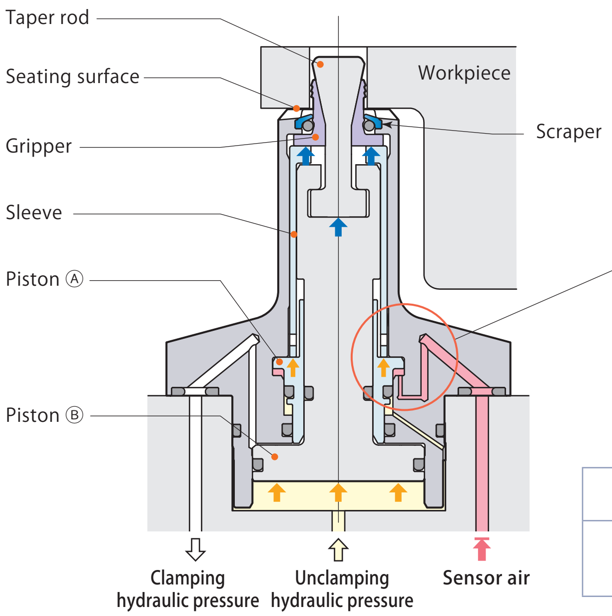


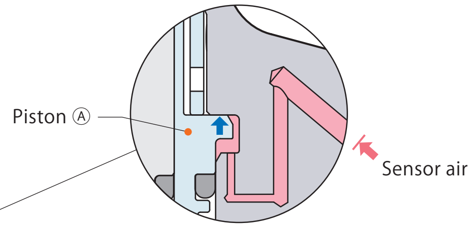
Workpiece setting (Unclamping completion)

① Pistons Ⓐ & Ⓑ, as well as taper rod and gripper are raised by unclamping hydraulic pressure.

② Workpiece unclamping is completed by the sensor air, clamping and unclamping hydraulic pressure.

③ Set the workpiece onto the seating surface.





Unclamping completion

Piston Ⓐ blocks air flow channel to shut air and triggers sensor.

Clamp condition	Air sensor signal	Hydraulic pressure switch
Unclamping completion	Air sensor ON (Sensor air does not flow.)	Unclamping hydraulic pressure ON

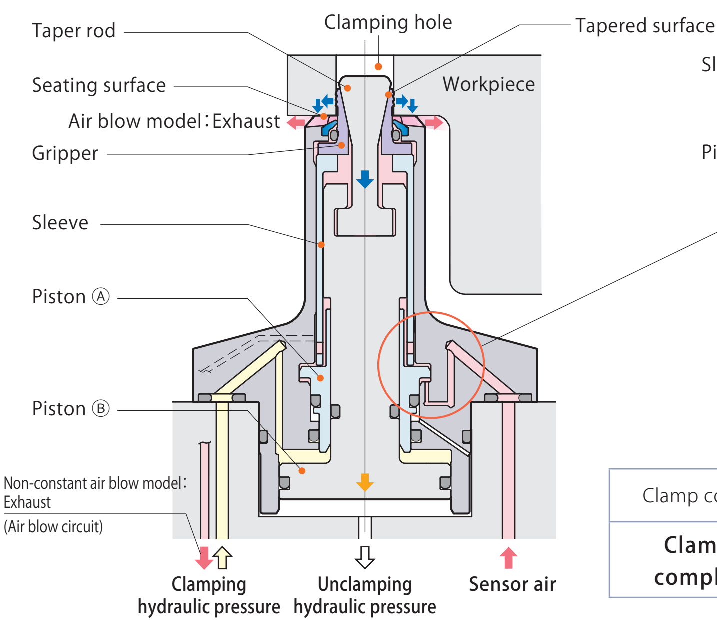
Workpiece holding (Clamping completion)

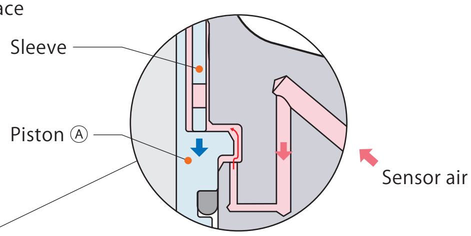
① Piston Ⓑ and taper rod are lowered by clamping hydraulic pressure after releasing unclamping hydraulic pressure.

② The gripper expands horizontally along the tapered surface to grip inner face of clamping hole.

③ The gripper securely grips the inner face of clamping hole and pulls the workpiece down firmly onto the seating surface.

④ Workpiece holding is completed by the sensor air, clamping and unclamping hydraulic pressure.





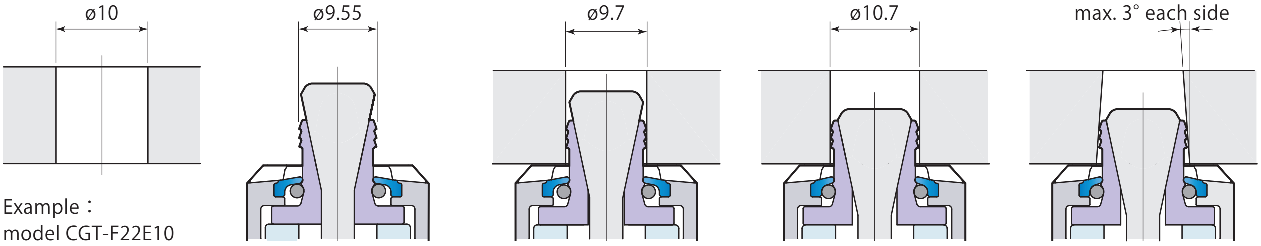
Clamping completion

Sleeve pushes down piston Ⓐ, air flows and sensor is not triggered.

Clamp condition	Air sensor signal	Hydraulic pressure switch
Clamping completion	Air sensor OFF (Sensor air flows.)	Clamping hydraulic pressure ON

Large gripper expansion stroke

The gripper expands horizontally 1.0mm(∗), which enables the accommodation of dimensional variations in diecast bore diameters and ensures workpiece is held securely.



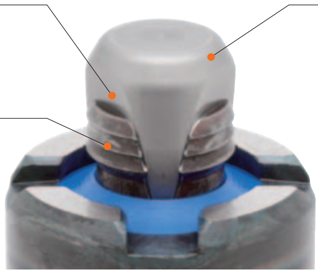
∗:0.6mm stroke for CGT-F21-055, 058, 061, 064, 067, 070A. 0.7mm stroke for CGT-F21E070, 073, 076, 079, 082.

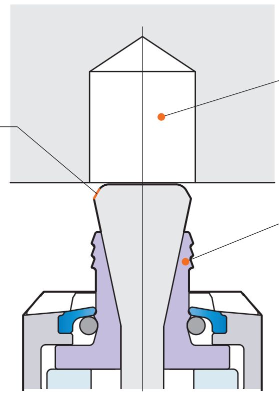
Taper rod and gripper with superior durability

① The holding force of expansion clamp is transmitted from tapered surface to gripper, making it possible for the gripper to hold onto inner face of clamping hole and hold the workpiece on the seating surface for secure workpiece clamping.

② Special steel with superior abrasion resistance is used for gripper to improve durability.

③ Tip section of taper rod has larger diameter than gripper and is well chamfered to be a better guide when setting the workpiece.

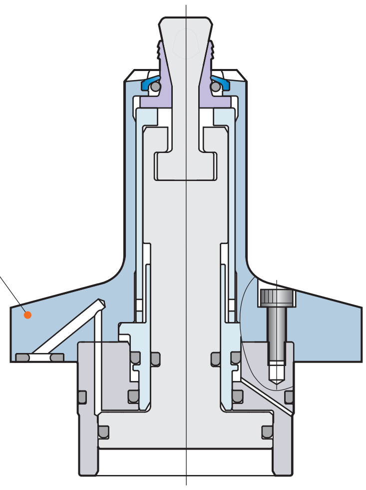




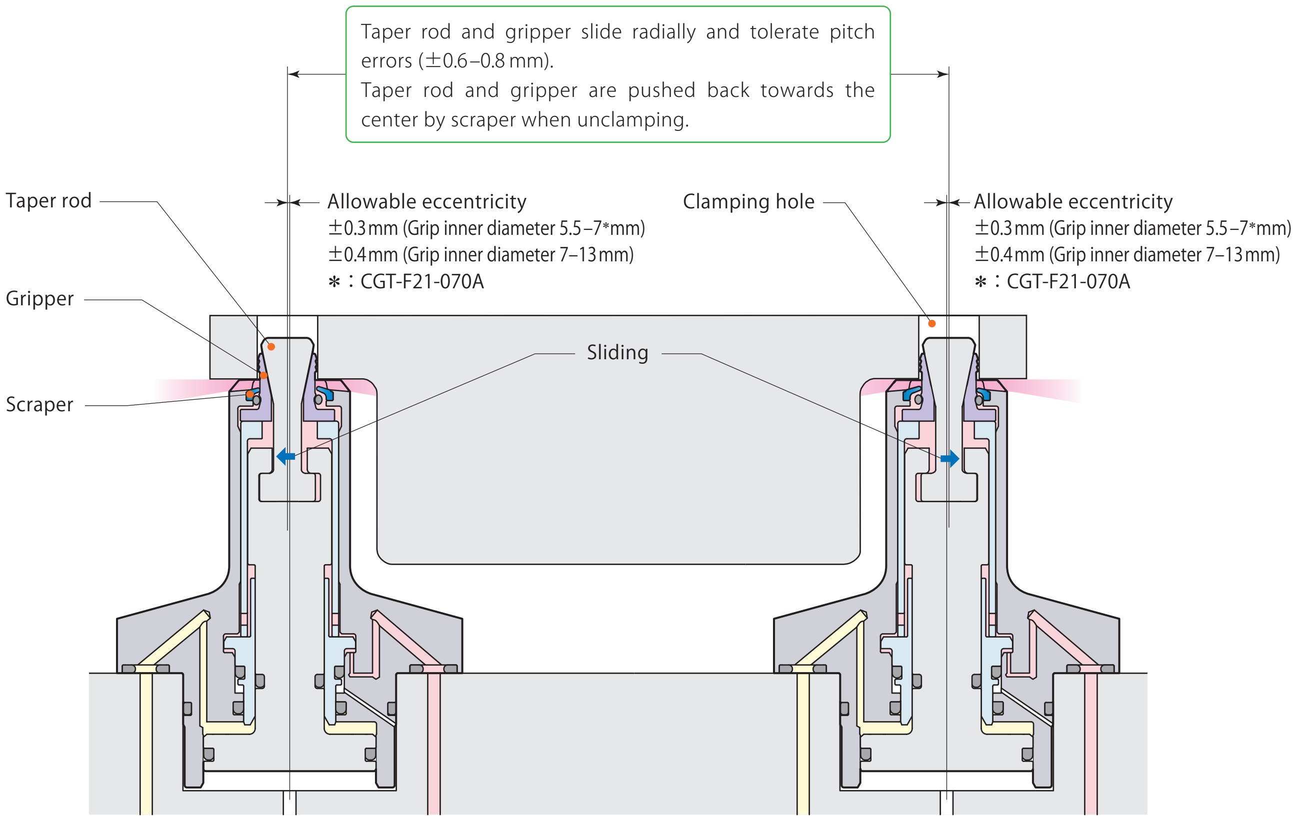
Seating surface can be reground (Max. 0.1 mm)

① When seating surface is damaged, the flange section can be dismounted and reground.

② Flange can be easily dismounted and reassembled at production site.



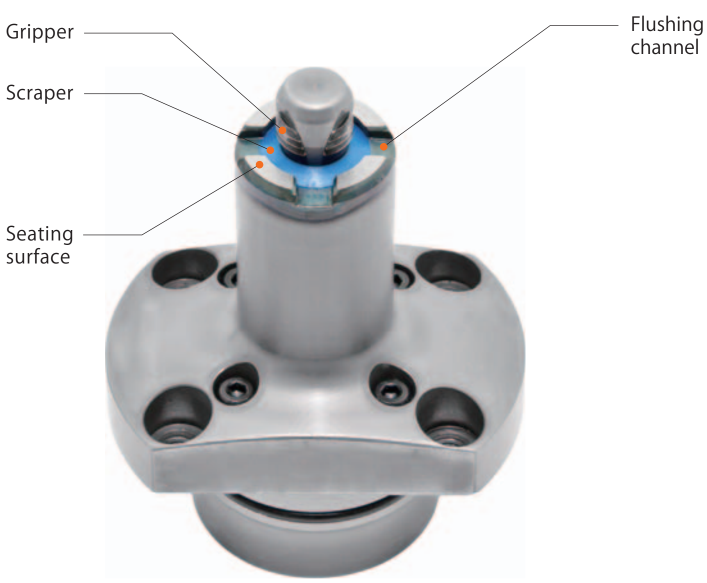
Clamping hole pitch errors can be tolerated

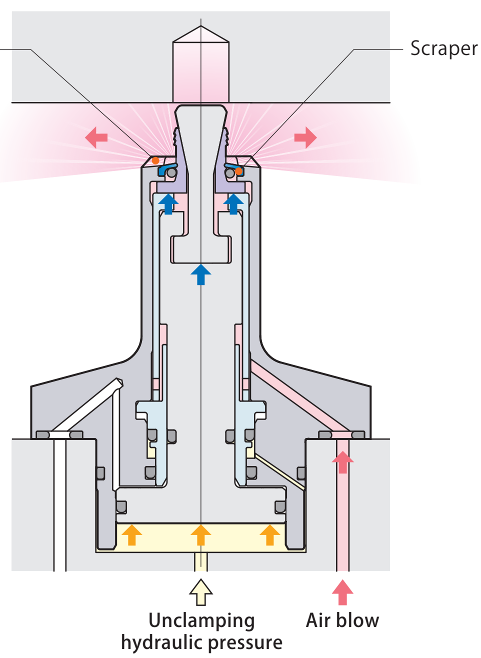


By the eccentric mechanism, the expansion clamp does not have a workpiece positioning function.

Incorporating strong air blowing circuit

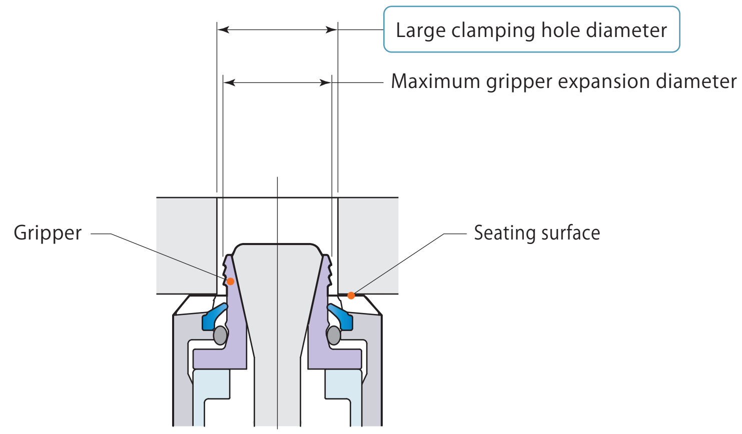
Air blow from a gap between the gripper and scraper clears off metal chips and coolant that stay on the seating surface. Flushing channel is also provided on the seating surface to remove the metal chips and coolants smoothly during workpiece setting.

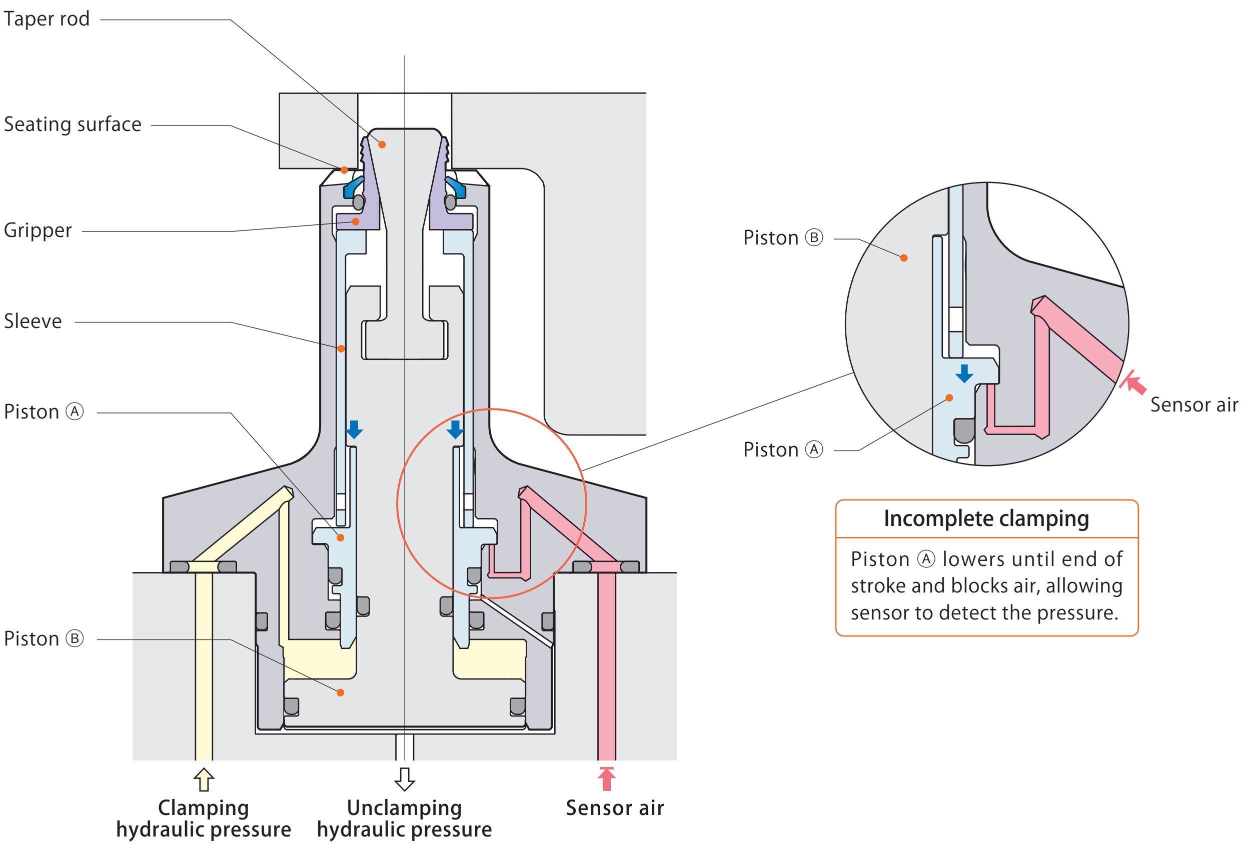




Detects clamping hole diameter that is too large

When the inner diameter of clamping hole exceeds tolerance value, then gripper will fail to gain grip on workpiece even when extended to maximum reach. Piston Ⓐ lowers until end of stroke as it is pushed down by piston Ⓑ and blocks sensor air, which triggers air sensor and detects incomplete clamping.

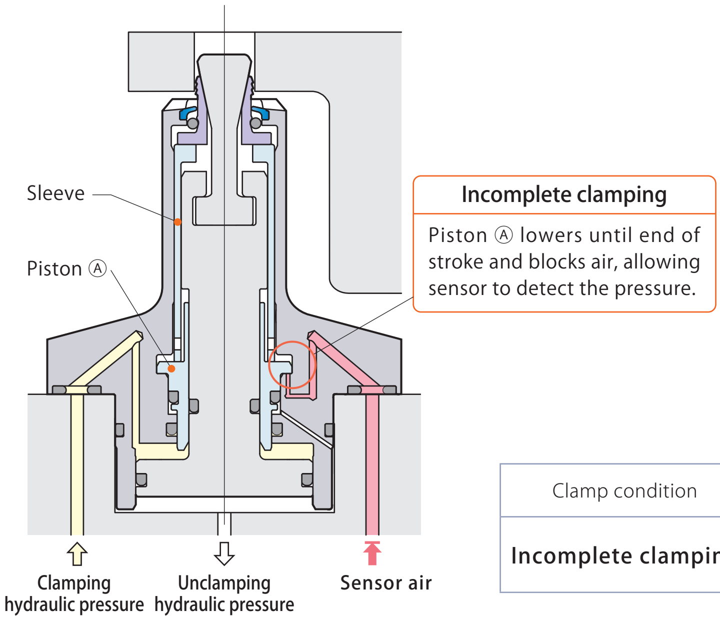


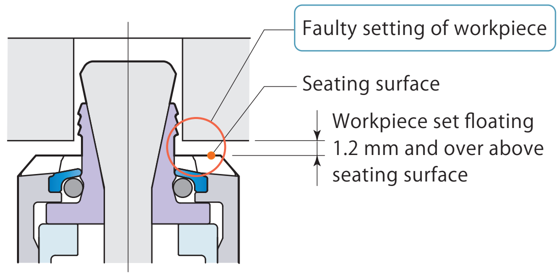


Clamp condition	Air sensor signal	Hydraulic pressure switch
Incomplete clamping	**Air sensor ON** (Sensor air does not flow.)	**Clamping hydraulic pressure ON**

Detects deformation of workpiece and floating of workpiece

When workpiece has significant deformation or when it is set poorly with gap of 1.2 mm above seating surface, then even when the gripper lowers until end of stroke, the workpiece is not held on seating surface. At this time, piston Ⓐ lowers until end of stroke as it is pushed down by sleeve and blocks sensor air, which triggers air sensor and detects incomplete clamping.

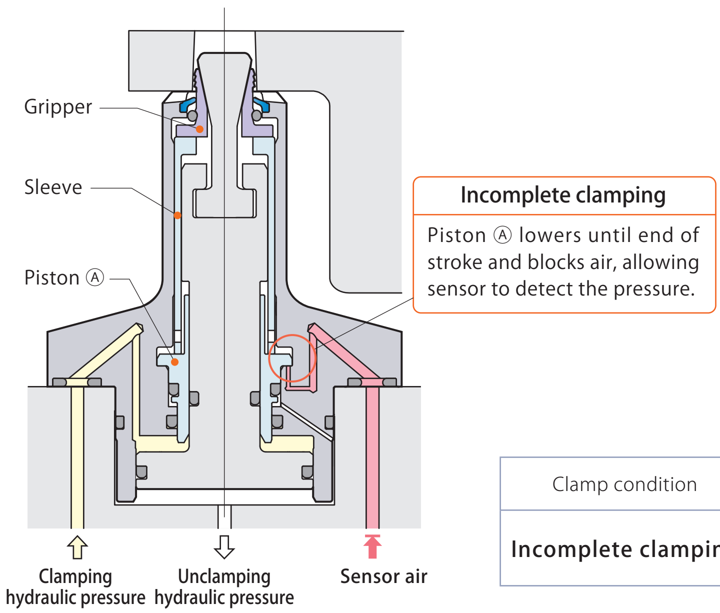


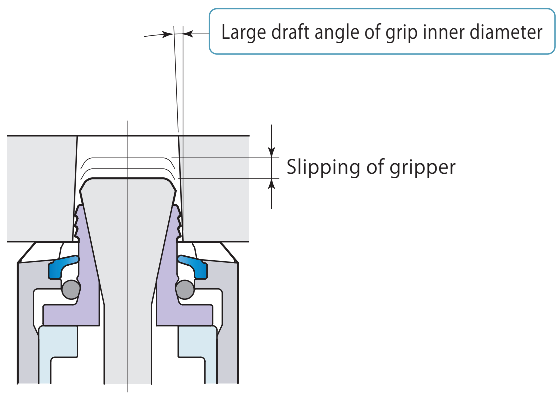


Clamp condition	Air sensor signal	Hydraulic pressure switch
Incomplete clamping	Air sensor ON (Sensor air does not flow.)	Clamping hydraulic pressure ON

Detects incomplete gripping

When the inner diameter of clamping hole is slightly larger than allowable value, or when the draft angle of grip inner diameter is large and results in incomplete gripping by the gripper, piston Ⓐ lowers until end of stroke as sleeve pushes it down and sensor air is blocked, which triggers air sensor and detects incomplete clamping.





Clamp condition	Air sensor signal	Hydraulic pressure switch
Incomplete clamping	Air sensor ON (Sensor air does not flow.)	Clamping hydraulic pressure ON

With the development of the non-constant air blow expansion clamp, air consumption will be significantly decreased.
The traditional model ordinarily requires 50L/min (0.3MPa) flow rate (when grip inner diameter is ø12). The new model can reduce

Air blow model

Number of grippers	Grip inner diameter	Clamping force	Model
2 Grippers	ø 5.5 5.8 6.1 6.4 6.7 7.0	1.35 kN (Hydraulic pressure 5 MPa)	CGT-F21- Grip inner diameter

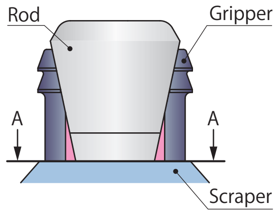
Non-constant air blow model

Number of grippers	Grip inner diameter	Clamping force	Model
2 Grippers	ø 7.0 7.3 7.6 7.9 8.2	1.89 kN (Hydraulic pressure 7 MPa)	CGT-F21E Grip inner diameter
	ø 8.5	3.04 kN (Hydraulic pressure 6 MPa)	CGT-F22E Grip inner diameter
	ø 9 10	3.54 kN (Hydraulic pressure 7 MPa)	

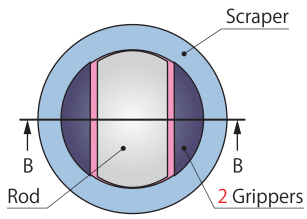
Number of grippers	Grip inner diameter	Clamping force	Model
3 Grippers	ø 11 12 13	3.54 kN (Hydraulic pressure 7 MPa)	CGT-F22E Grip inner diameter

air consumption and help promote energy conservation. However air blow at time of workpiece replacement is a must.

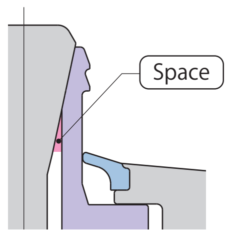
Space where metal chips can intrude is created



When clamping



A-A

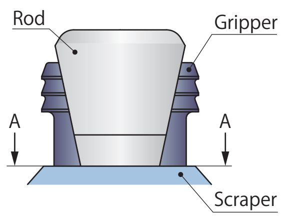


B-B

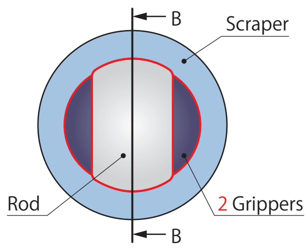
Pages →494, 495

Because of space between scraper, gripper and the rod, air blow must always be performed to prevent intrusion of chips.

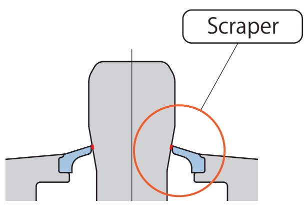
Secure chip protection



When clamping



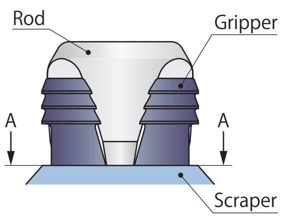
A-A



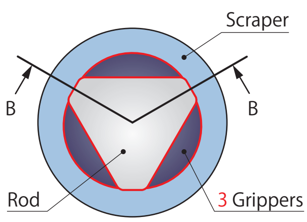
B-B

Pages →496–499

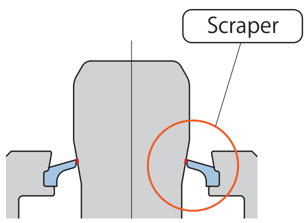
Because of space between scraper, gripper and the rod, air blow must always be performed to prevent intrusion of chips.



When clamping



A-A

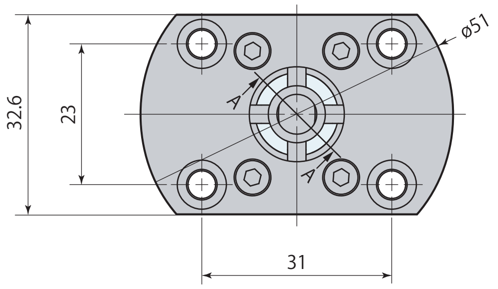


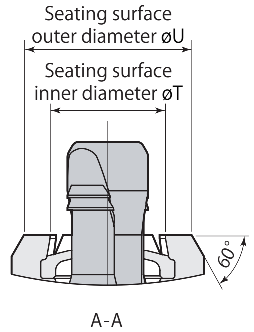
B-B

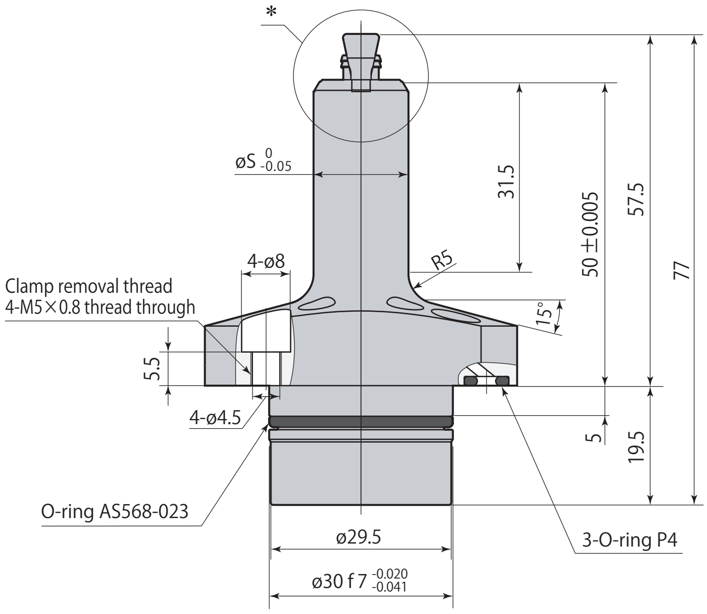
Pages →500, 501

Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.

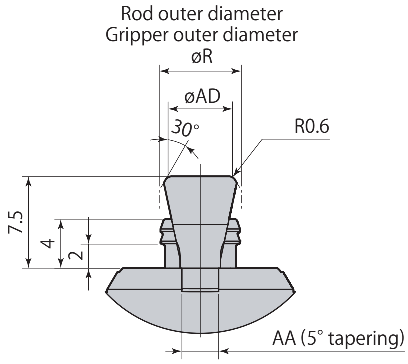
Dimensions



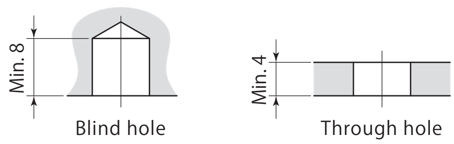


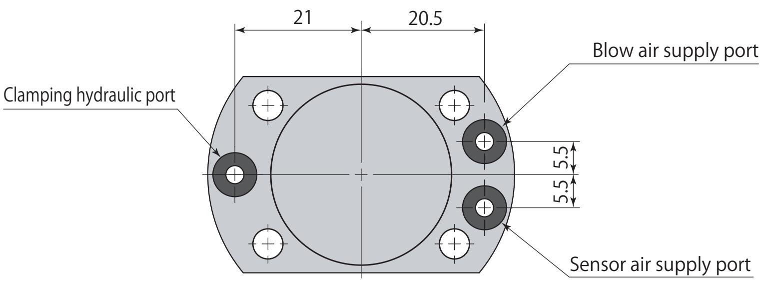


*Details



Grip inner diameter usage requirements





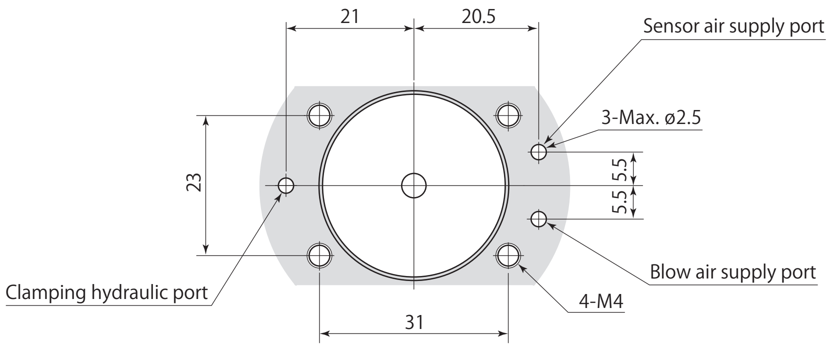
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

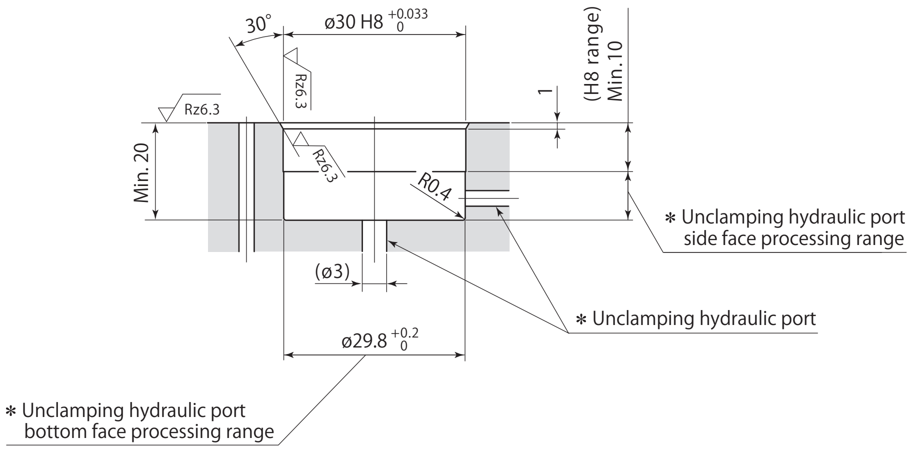
mm

Model	CGT- F21-□					
	055	058	061	064	067	070A
øR	5	5.3	5.6	5.9	6.2	6.5
øS	15	15	15	15	15	15.5
øT	7.8	8.1	8.4	8.7	9	9.3
øU	11	11.6	12.2	12.8	13	13.5
AA	2.5	2.5	3	3	3	3
øAD	3.8	4.1	4.4	4.7	5.0	5.3

- CGT-F21-055,058,061,064,067,070A are made to order.

Mounting details



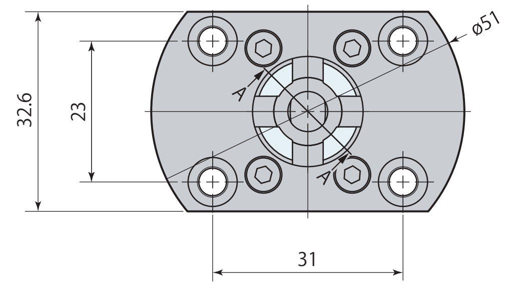


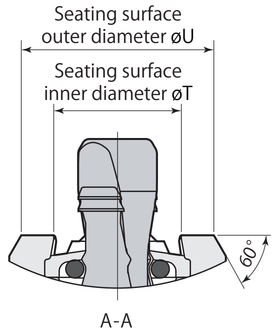
Rz: ISO4287(1997)

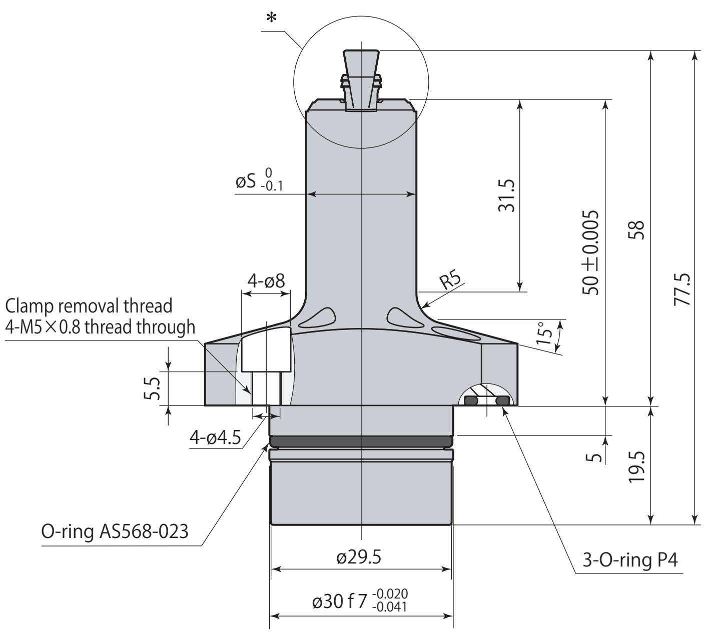
∗: Unclamping hydraulic port must be made on either side or bottom face.

- 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.

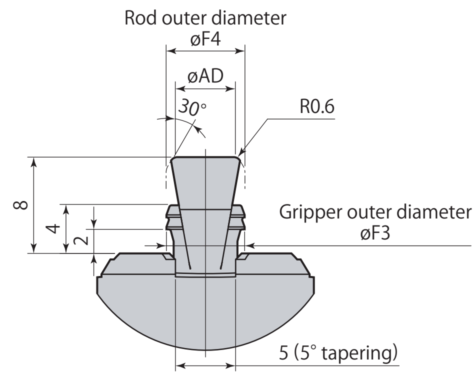
Dimensions



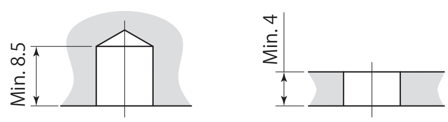




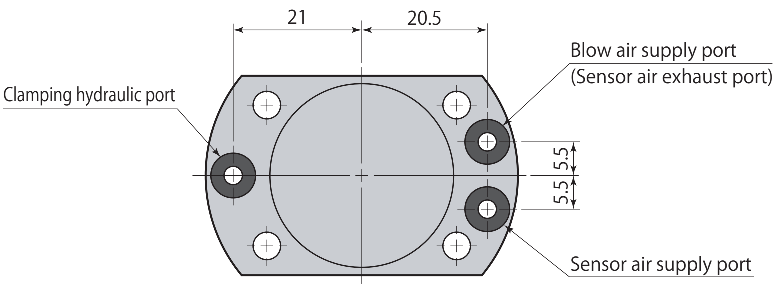
*Details



Grip inner diameter usage requirements



Blind hole Through hole



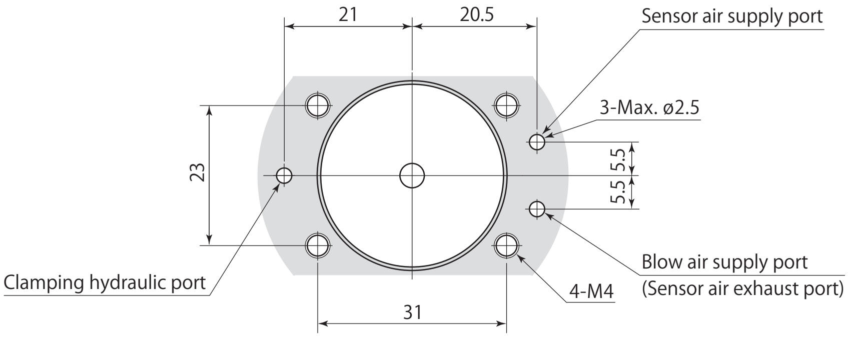
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

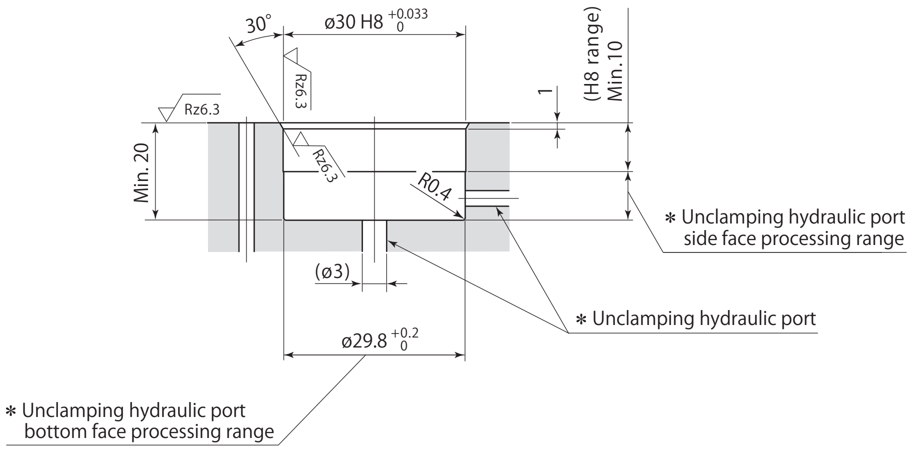
mm

Model	CGT-F21E□				
	070	073	076	079	082
øF3	6.5	6.8	7.1	7.4	7.7
øF4	6.55	6.85	7.15	7.45	7.75
øS	18	18.3	18.6	18.8	18.8
øT	10.6	10.9	11.2	11.5	11.8
øU	16	16.3	16.6	16.9	17.2
øAD	5.4	5.7	6	6.3	6.6

- CGT-F21E070,073,076,079,082 are made to order.

Mounting details





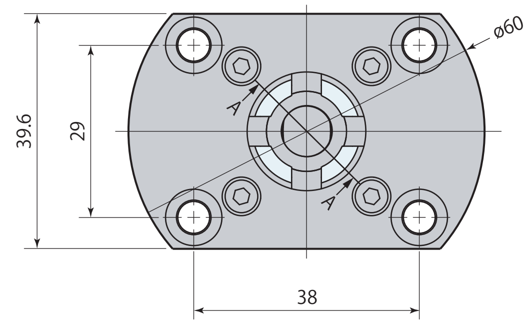
Rz: ISO4287(1997)

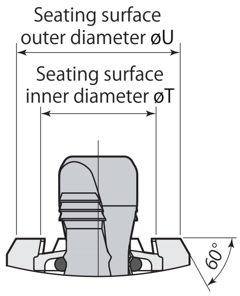
∗ : Unclamping hydraulic port must be made on either side or bottom face.

- 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.

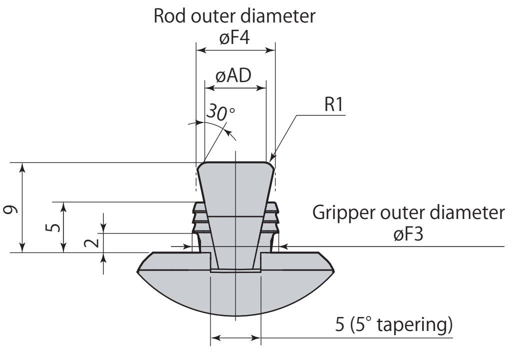
Dimensions

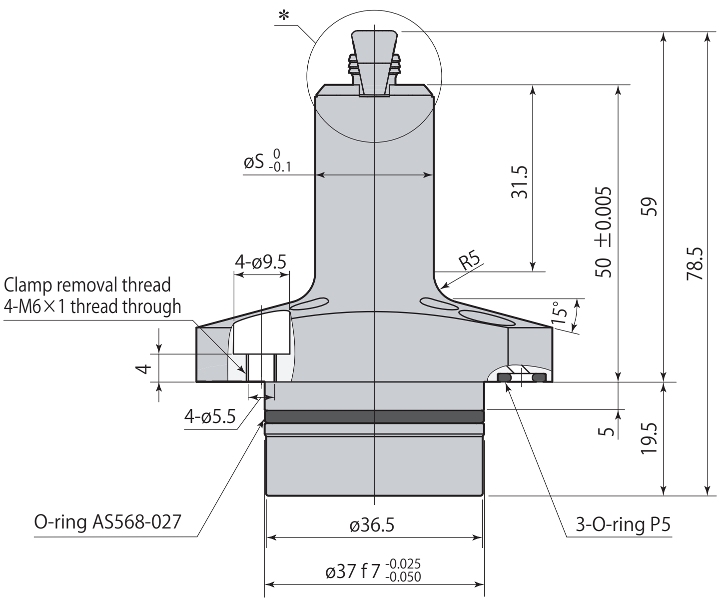




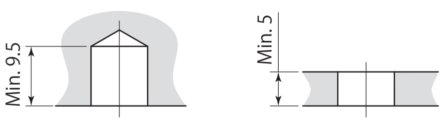
A-A

∗Details

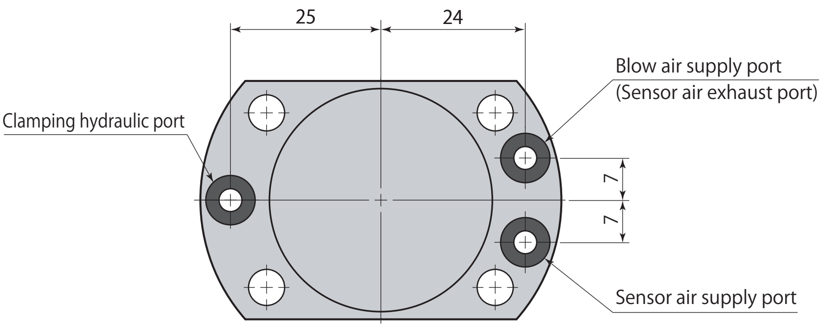




Grip inner diameter usage requirements



Blind hole Through hole



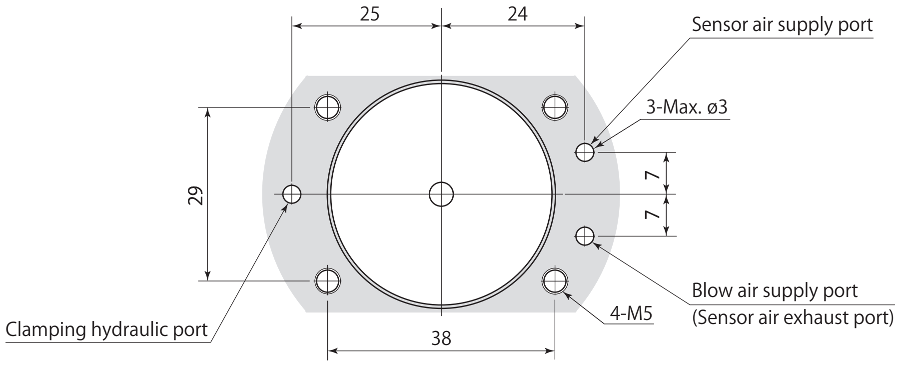
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

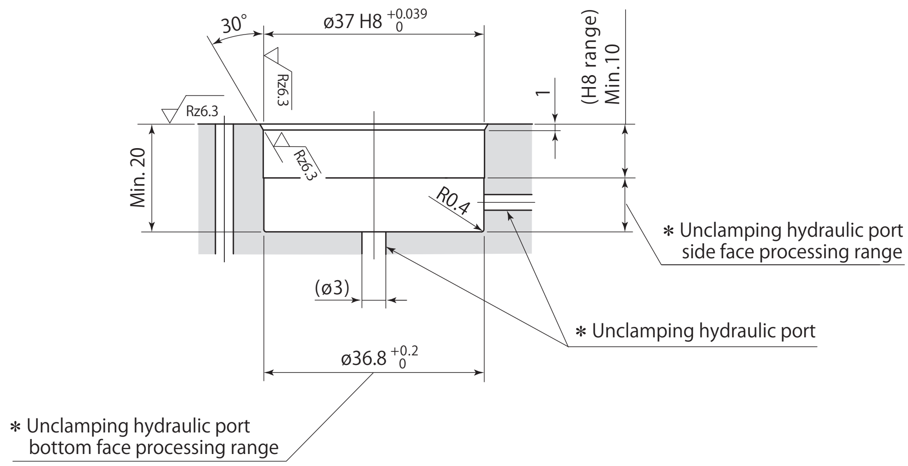
mm

Model	CGT-F22E□		
	085	09	10
øF3	8	8.5	9.5
øF4	8.05	8.55	9.55
øS	19.5	20	21
øT	12.1	12.6	13.6
øU	17.5	18	19
øAD	6.3	6.8	7.8

- CGT-F22E085 is made to order.

Mounting details



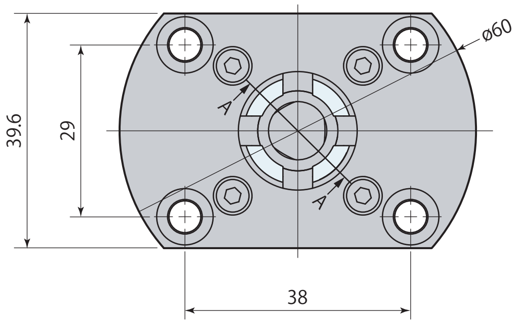


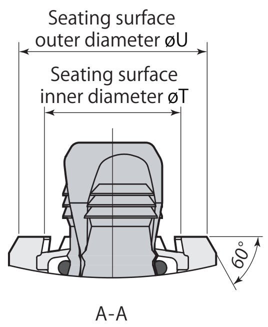
Rz: ISO4287(1997)

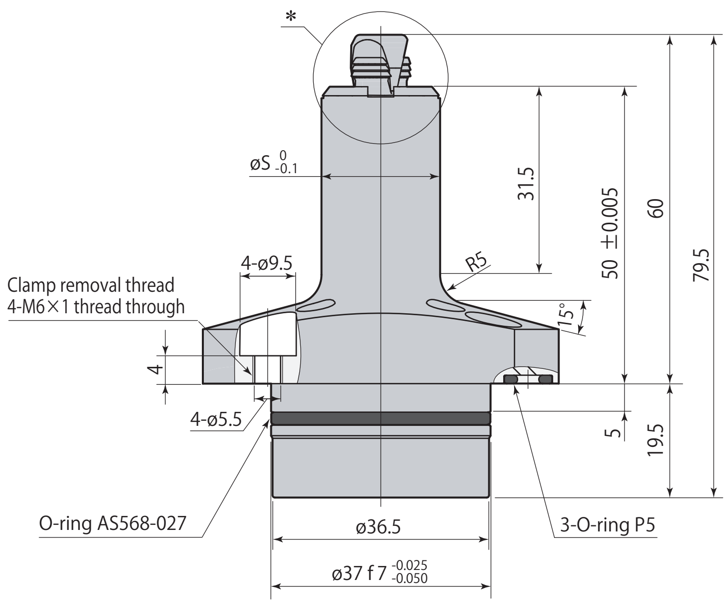
∗: Unclamping hydraulic port must be made on either side or bottom face.

- 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.

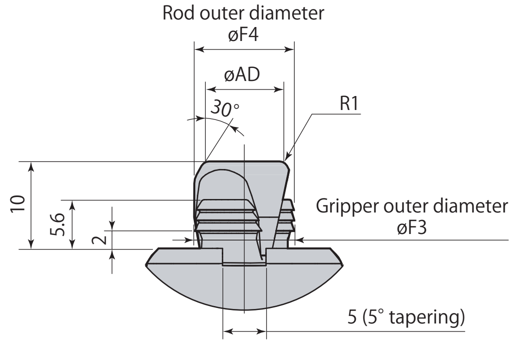
Dimensions



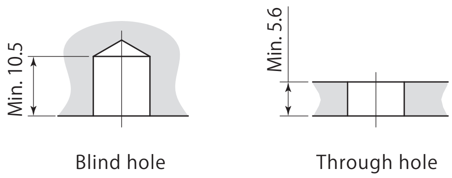


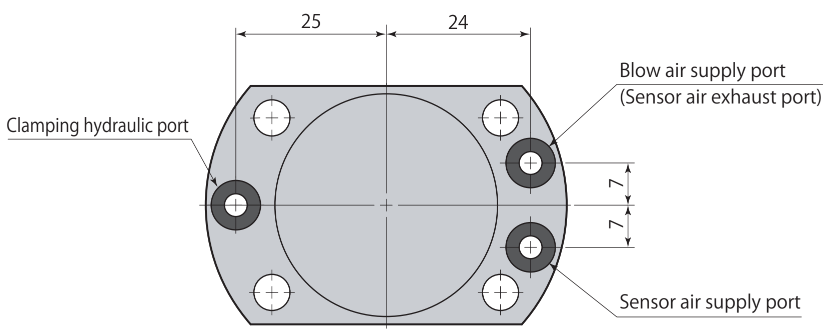


*Details



Grip inner diameter usage requirements





mm

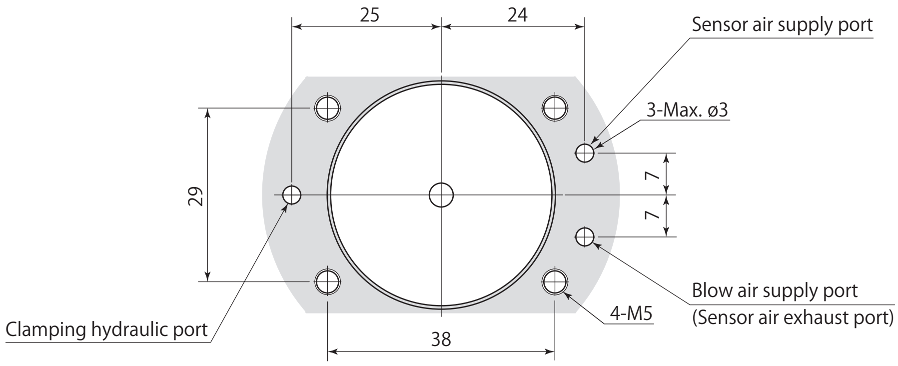
Model	CGT-F22E□		
	11	12	13
øF3	10.5	11.5	12.5
øF4	10.55	11.55	12.55
øS	22	23	24
øT	14.6	15.6	16.6
øU	20	21	22
øAD	8.2	9.2	10.2

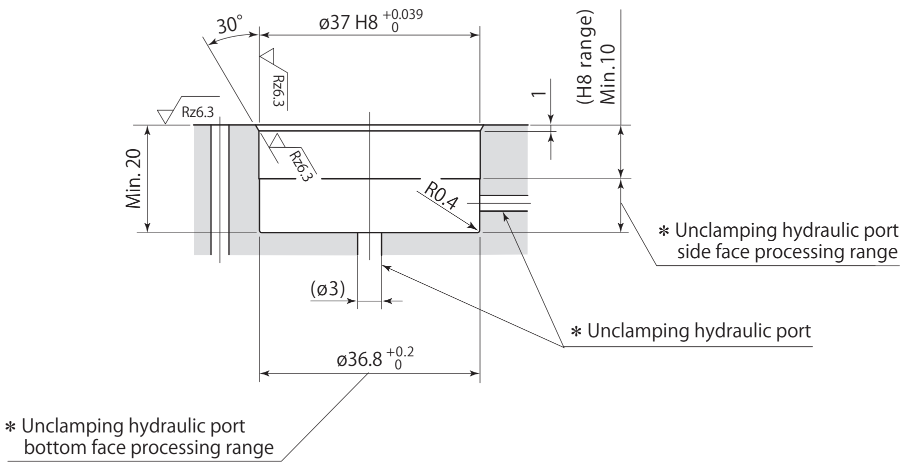
- CGT-F22E13 is made to order.

- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

Expansion clamp Non-constant air blow model
CGT Long neck

Mounting details





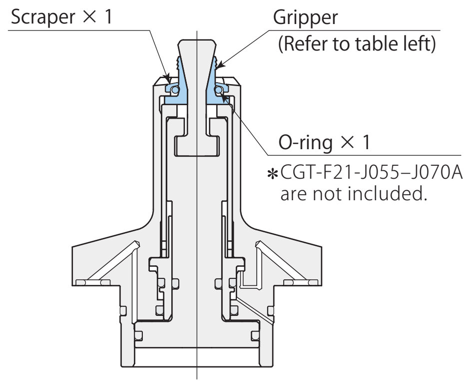
Rz: ISO4287(1997)

∗ : Unclamping hydraulic port must be made on either side or bottom face.

- 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.

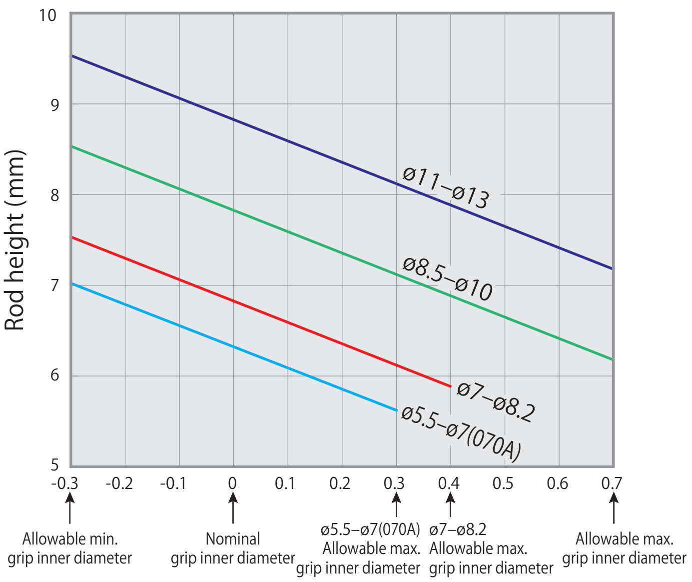
Gripper set replacement

Number of grippers	Gripper set model	Clamp model	Set description
2 Grippers	CGT-F21-J055	CGT-F21-055	
	CGT-F21-J058	CGT-F21-058	
	CGT-F21-J061	CGT-F21-061	
	CGT-F21-J064	CGT-F21-064	
	CGT-F21-J067	CGT-F21-067	
	CGT-F21-J070A	CGT-F21-070A	
	CGT-F21EJ070	CGT-F21E070	
	CGT-F21EJ073	CGT-F21E073	
	CGT-F21EJ076	CGT-F21E076	
	CGT-F21EJ079	CGT-F21E079	
	CGT-F21EJ082	CGT-F21E082	
	CGT-F22EJ085	CGT-F22E085	
	CGT-F22EJ09	CGT-F22E09	
	CGT-F22EJ10	CGT-F22E10	
3 Grippers	CGT-F22EJ11	CGT-F22E11	
	CGT-F22EJ12	CGT-F22E12	
	CGT-F22EJ13	CGT-F22E13	

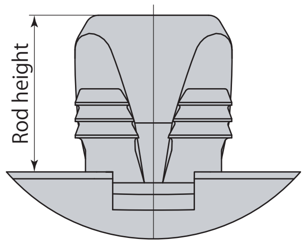


It is recommended that grippers, scraper and O-ring be replaced after about 200,000 operations. Replace grippers in sets and not just an individual gripper. (Refer to the table on the left for the gripper set model.)

Grip inner diameter & rod height when clamping



Difference between actual grip inner diameter and nominal grip diameter (mm)

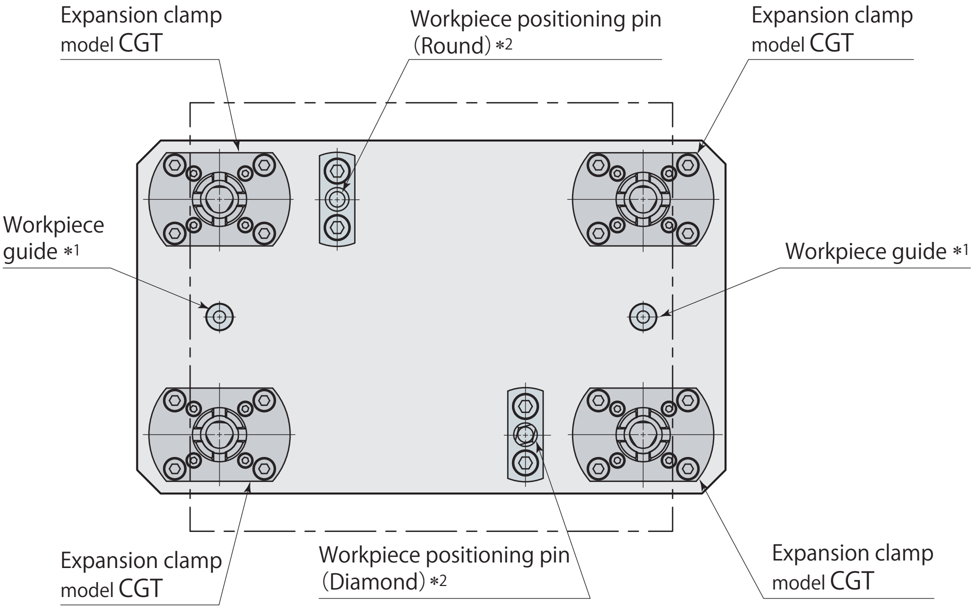


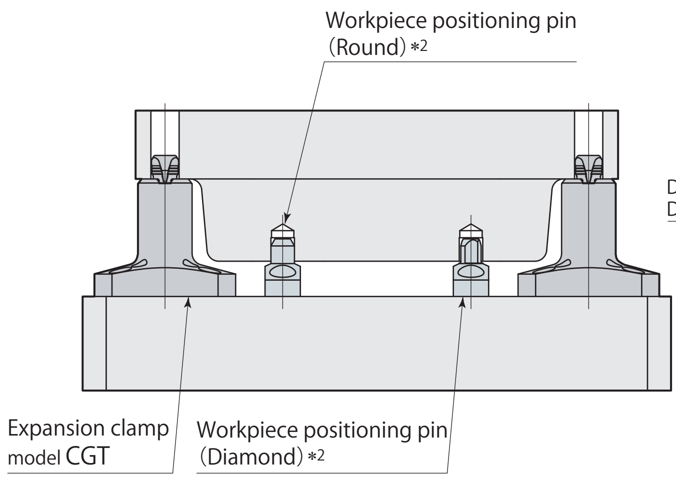
Rod height calculation formula
ø5.5– ø7* : 6.32-2.35 × Actual grip inner diameter and nominal grip diameter difference
ø7 – ø8.2 : 6.58-2.84 × Actual grip inner diameter and nominal grip diameter difference
ø8.5– ø10 : 7.82-2.35 × Actual grip inner diameter and nominal grip diameter difference
ø11 – ø13 : 8.82-2.35 × Actual grip inner diameter and nominal grip diameter difference

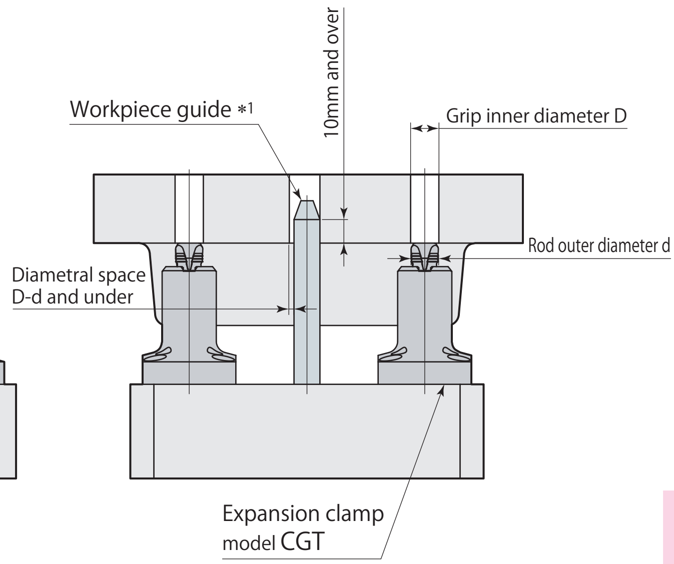
∗: CGT-F21-070A

Example: When CGT-F22E10 (Nominal grip diameter : ø10) is clamping ø9.8 hole
Rod height = 7.82 - 2.35 × (-0.2) = 8.29mm

System configuration example



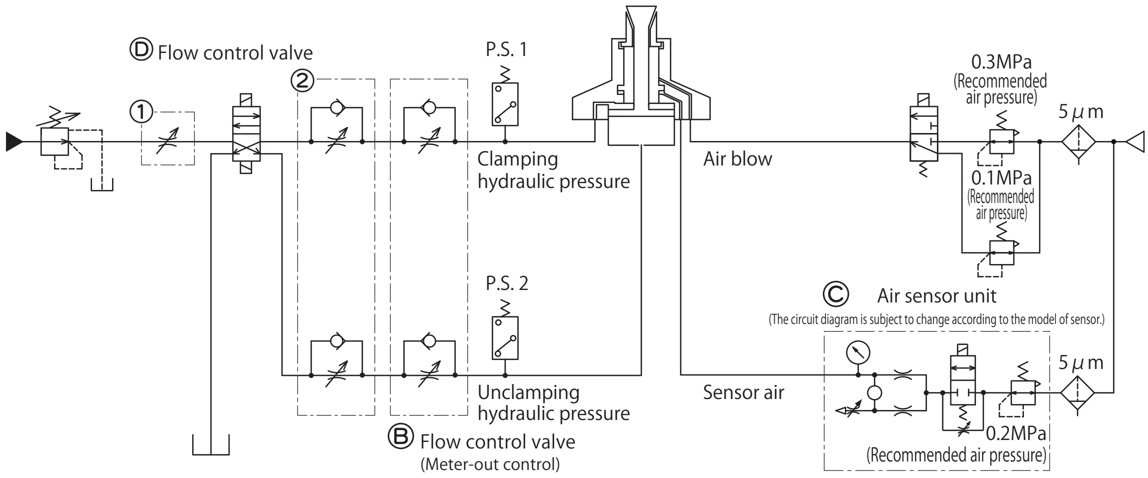




∗1: When using automatic or robotic conveyers, prevent damage to clamp caused from impact by setting workpiece guides. Using the above guide as reference, accurately position the holes when using workpiece guides.

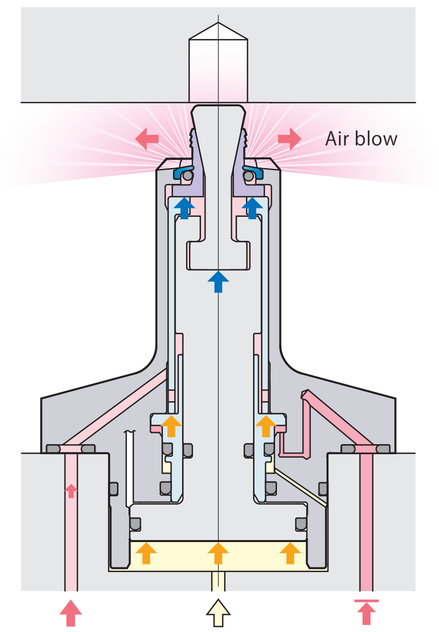
∗2: **The expansion clamp does not have a workpiece positioning function.**
Install workpiece positioning pins (or similar).

Air blow model hydraulic and pneumatic circuit diagram

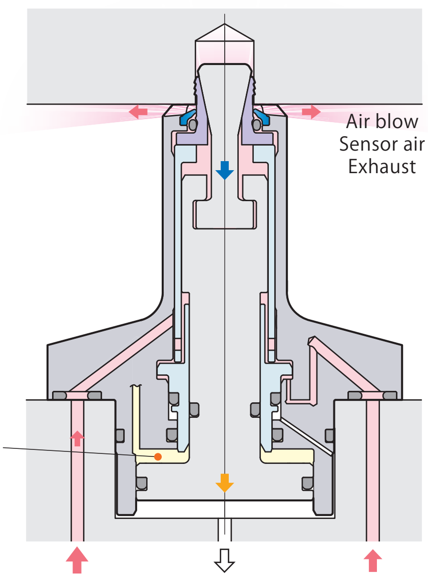


- Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping. During cutting, if chips adhere to the gripper such as when going through the clamping hole, continue air blowing during processing as well.
- Air blow pressure must be set to 0.1MPa when checking the operation of the clamp with the air sensor.

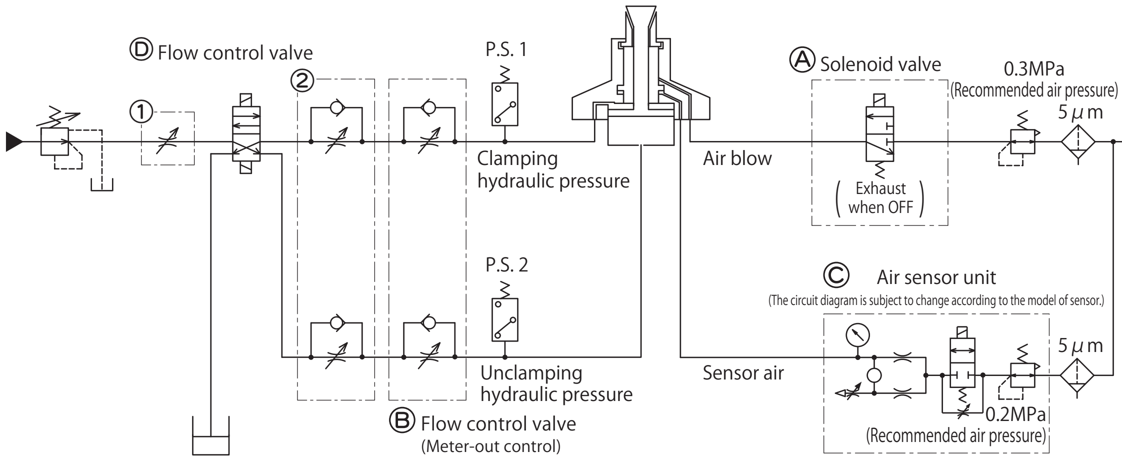
Air blowing



Clamping

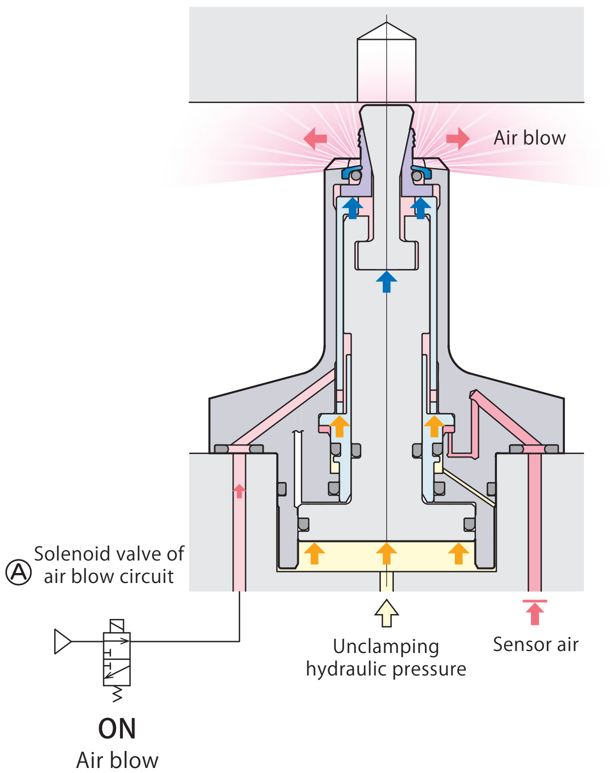


Non-constant air blow model hydraulic and pneumatic circuit diagram

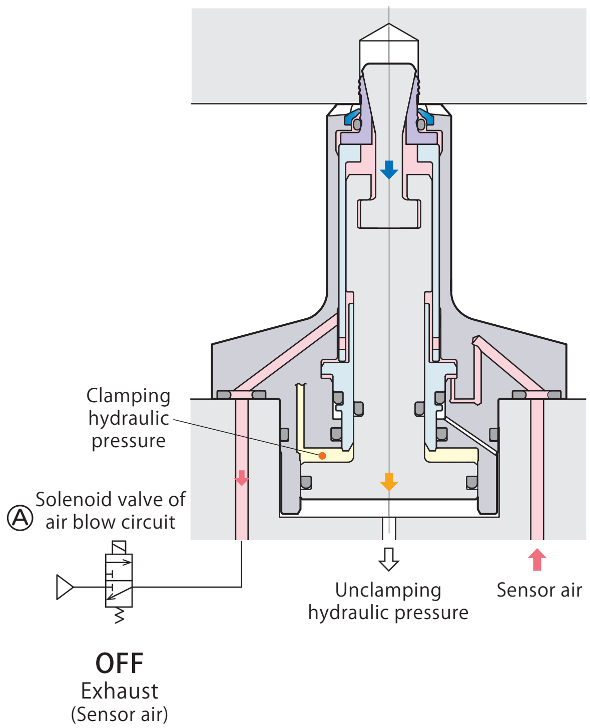


- Air blow will not be necessary during cutting process. Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping to remove metal chips and debris.
- The solenoid valve Ⓐ must be closed when checking the operation of the clamp with the air sensor. Also 3 port type of solenoid valve must be used in the circuit. If 2 port type of the valve is used, sensing air cannot be exhausted and clamp detection function is disabled.

Air blowing



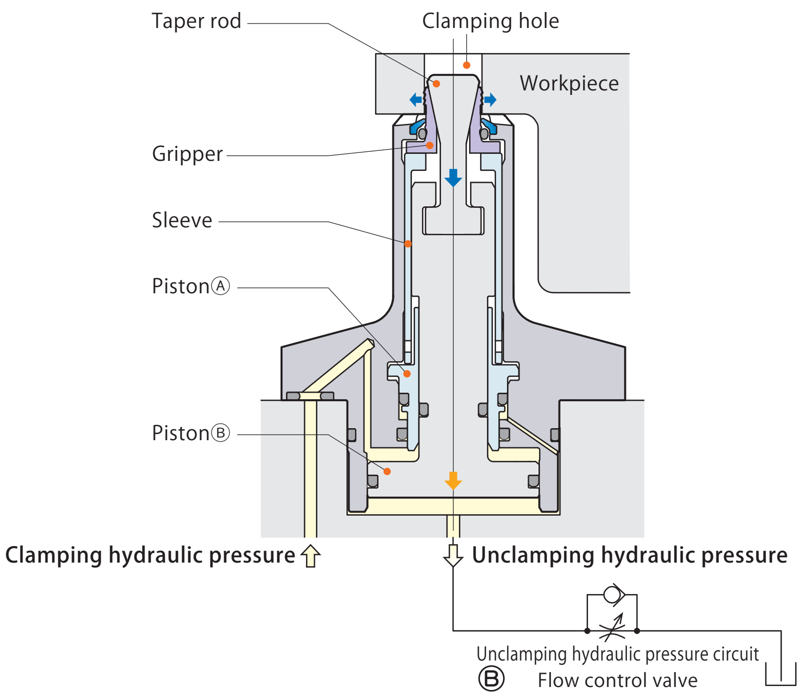
Clamping



- Operation speed must be adjusted by a meter-out type flow control valve Ⓑ being provided in the unclamping circuit. By the adjustment, oil flow in unclamping circuit is squeezed and back pressure is generated. The back pressure acts on the piston Ⓐ of the clamp and makes the gripper expand first then the taper rod strokes down to clamp. If meter-in type flow control valve is installed in the circuit, it dumps the oil rapidly and makes the gripper move very quick which causes incomplete clamping.

- Adjust oil flow when clamping to have the taper rod full stroke in 0.3 sec or over.
  Excessive oil flow to the clamp gives impact load and may cause breakage of the parts.

- Provide additional flow control valve Ⓓ to the place of either ① or ② in the circuit diagram to adjust oil flow when a large discharge volume pump is used for the hydraulic circuit. The flow control valve Ⓑ alone may not be good enough to adjust the speed of clamp operation.



Air sensor unit Ⓒ 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	0.2 MPa
Inner diameter of piping	ø4 mm (ISA3-F：ø2.5 mm)
Overall piping length	5 m or less

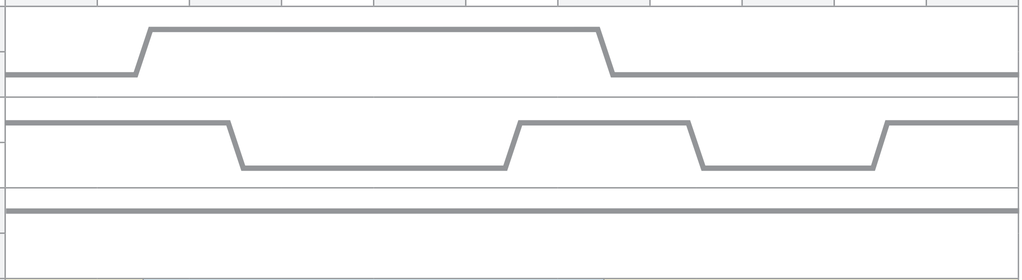
- Use a solenoid valve with needle for air sensor unit Ⓒ and control it supplying air all the time in order to eliminate intrusion of chips or coolant.

- There is a case that air sensing cannot be made successfully as designed when it is used out of the usage shown on the left. Contact Technical service center for more details.

Operation cycle

The clamp should be controlled with the cycle in the diagram shown below to detect the operation status exactly.

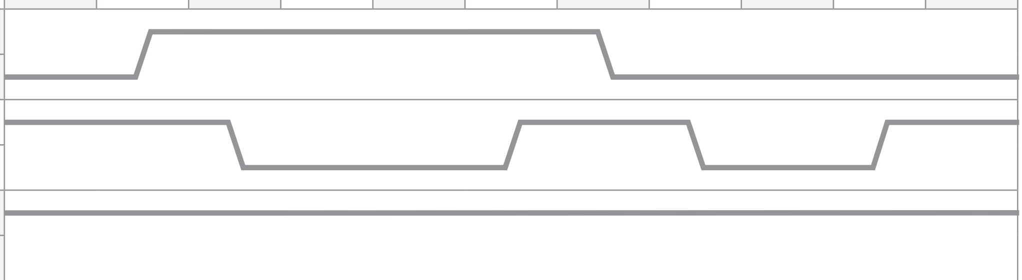
Case of air blow model



		State	Workpiece loading	Clamping	Air blow switching	Clamping completion*1	(Machining)	Air blow switching	Unclamping	Air blow switching	Unclamping completion*2	Air blow switching	Workpiece unloading
*4	Workpiece clamp	Clamp / Unclamp											
	Air blow	0.3MPa / 0.1MPa											
	Sensor air	ON / OFF											
*5	Clamping hydraulic pressure P.S. 1		OFF				ON				OFF		
	Unclamping hydraulic pressure P.S. 2		ON				OFF				ON		
	Air sensor						OFF or ON*3				ON		

*1 : Clamping completion : P.S. 1=ON P.S. 2=OFF Air sensor=OFF
*2 : Unclamping completion : P.S. 1=OFF P.S. 2=ON Air sensor=ON
*3 : OFF : Complete clamping ON : Incomplete clamping
*4 : Solenoid valve control *5 : Hydraulic pressure switch, Air sensor signal

Case of non-constant air blow model



		State	Workpiece loading	Clamping	Air blow OFF	Clamping completion*1	(Machining)	Air blow ON	Unclamping	Air blow OFF	Unclamping completion*2	Air blow ON	Workpiece unloading
*4	Workpiece clamp	Clamp / Unclamp											
	Air blow	ON / OFF											
	Sensor air	ON / OFF											
*5	Clamping hydraulic pressure P.S. 1		OFF				ON				OFF		
	Unclamping hydraulic pressure P.S. 2		ON				OFF				ON		
	Air sensor						OFF or ON*3				ON		

*1 : Clamping completion : P.S. 1=ON P.S. 2=OFF Air sensor=OFF
*2 : Unclamping completion : P.S. 1=OFF P.S. 2=ON Air sensor=ON
*3 : OFF : Complete clamping ON : Incomplete clamping
*4 : Solenoid valve control *5 : Hydraulic pressure switch, Air sensor signal

Caution in use

● Be sure to make inner diameter of air blow circuit 4 mm and over except for clamp mounting surface.

● Set the workpiece in such a way that the clamping hole of workpiece is perpendicular to seating surface. Clamping in tilted condition results in uneven contact of gripper with hole, which leads to concentration of load that may cause damage.

● Verify that there are no metal chips or debris on seating surface of clamping hole and clamp body before setting workpiece. Allowing intrusion of metal chips results in insecure clamping, which can lead to low grade of machining accuracy.

● Flaring (Biting) of gripper into workpiece varies depending on workpiece material or thermal processing conditions. With regards to conditions of workpiece and clamping hole, refer to **page →485**. Secure clamping is not possible when workpiece or clamping hole that does not satisfy these conditions is used.

● If clamping hole serves as taper hole (cast draft hole with gradient), then perform test clamping using applicable workpiece beforehand to verify that there are no problems with operations.

● Deformation may occur if the thickness of clamping hole section of workpiece is extremely thin. Use applicable workpiece to perform test clamping beforehand to verify that there are no deformations in thin portion.

● Supply the dry and filtered air. Particulate size 5 μm or less is recommended.

● Measure seating surface flatness with hydraulic pressure applied on clamping side, or by applying hydraulic pressure on neither clamping nor unclamping side.

● Perform unclamping completion detection, clamping completion detection and incomplete clamping detection with combination actions of pressure switch and sensor shown in table below. (Refer to hydraulic and pneumatic circuit diagram on **pages →504**, **505** for details.)

Applications	Pressure switch 1 (P.S. 1)	Pressure switch 2 (P.S. 2)	Air sensor
Unclamping completion detection	OFF	ON	ON
Clamping completion detection	ON	OFF	OFF
Incomplete clamping detection	ON	OFF	ON

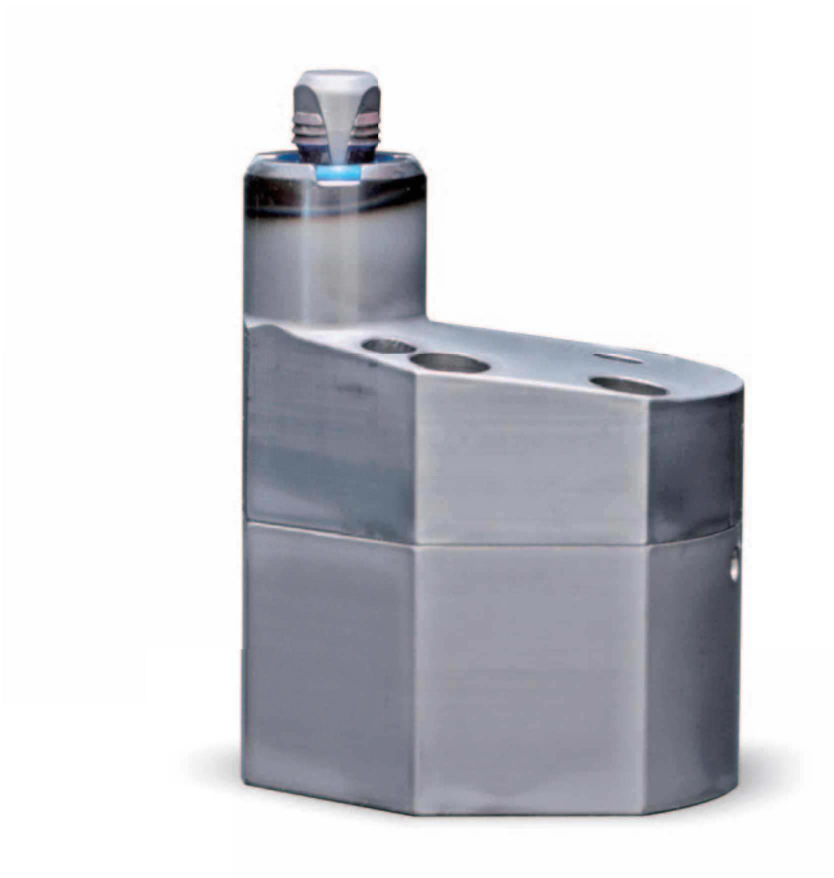
Expansion clamp

CGT Long neck

Expansion clamp

Double acting 7MPa

model CGU



model CGU

Specifications

Size / Grip inner diameter : Number of grippers

CGU − F2

- 1 − : Air blow model — 07 08 : 4 Gripper
- 2 E : Non-constant air blow model — 09 10 : 2 Gripper; 11 12 13 : 3 Gripper

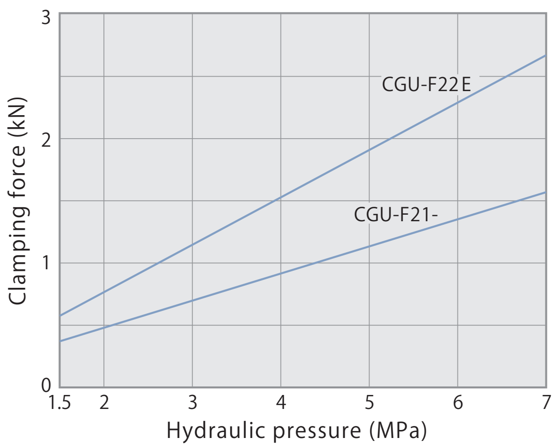
■ indicates made to order.

Model	Size	CGU-F21-		CGU-F22E				
	Grip inner diameter	07	08	09	10	11	12	13
Number of grippers		4 Grippers		2 Grippers		3 Grippers		
Clamping force (hydraulic pressure 7MPa)	kN	1.57		2.76				
Radial expansion force (hydraulic pressure 7MPa)	kN	5.34		9.30				
Taper rod stroke	mm	4.8						
Clamp stroke	mm	1.2						
Cylinder capacity Clamp	cm^3	1.5		2.6				
Cylinder capacity Unclamp	cm^3	2.3		3.5				
Allowable eccentricity*1	mm	±0.4						
Recommended air blow pressure	MPa	0.3						
Recommended sensor air pressure	MPa	0.2						
Mass	kg	0.88						
Recommended tightening torque of mounting screws*2	N・m	7						
Workpiece material		Aluminum, steel and others (HRC30 or below) Cast iron also usable depending on conditions						
Allowable min. grip inner diameter	mm	6.7	7.7	8.7	9.7	10.7	11.7	12.7
Allowable max. grip inner diameter	mm	7.7	8.7	9.7	10.7	11.7	12.7	13.7
Grip inner diameter tapering angle (Draft angle)		3° below						
Grip inner diameter circularity		0.1 below						

- Pressure range：1.5–7 MPa ● Proof pressure：10.5 MPa ● Operating temperature：0–70 ℃
- Fluid used：General mineral based hydraulic oil (ISO-VG32 equivalent)
- Please inquire if above terms are not applied.

＊1：By the eccentric mechanism, the expansion clamp does not have a workpiece positioning function. ＊2：ISO R898 class 12.9

Clamping force & hydraulic pressure



Hydraulic pressure MPa	1.5	2	3	4	5	6	7
CGU-F21- Clamping force F=0.224×P kN	0.34	0.45	0.67	0.90	1.12	1.34	1.57
CGU-F22E Clamping force F=0.394×P kN	0.59	0.79	1.18	1.58	1.97	2.36	2.76

P：Hydraulic pressure (MPa)

Air blow model

model **CGU-F21-**

4 Grippers

ø7 8

Non-constant air blow model

model **CGU-F22E**

2 Grippers

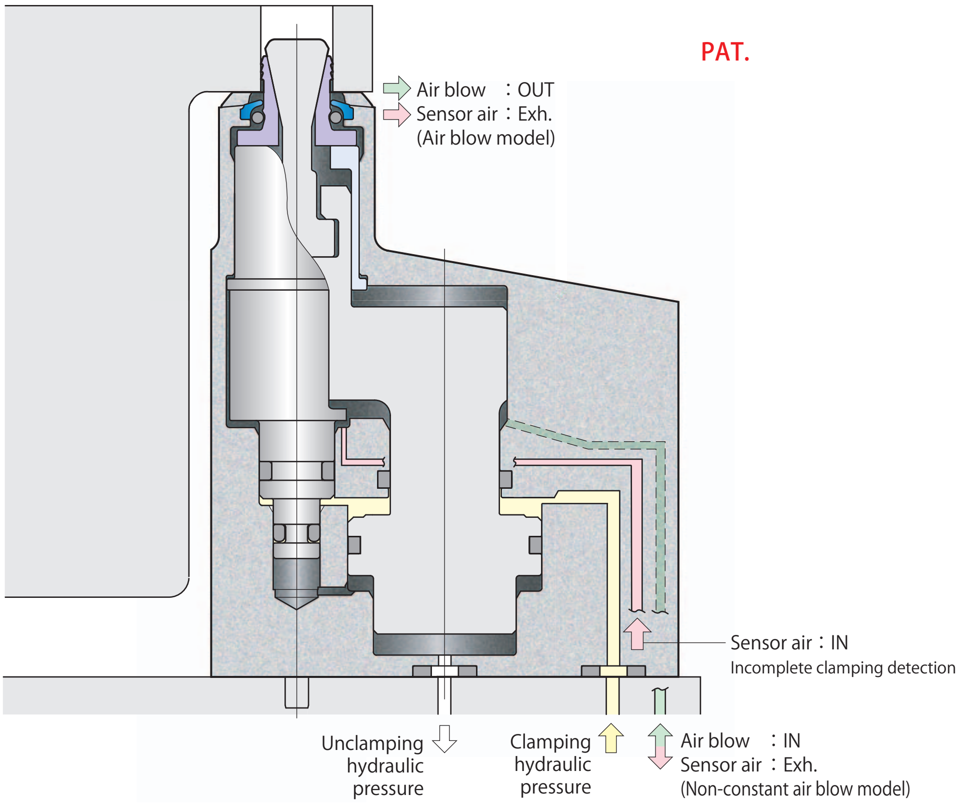
ø9 10

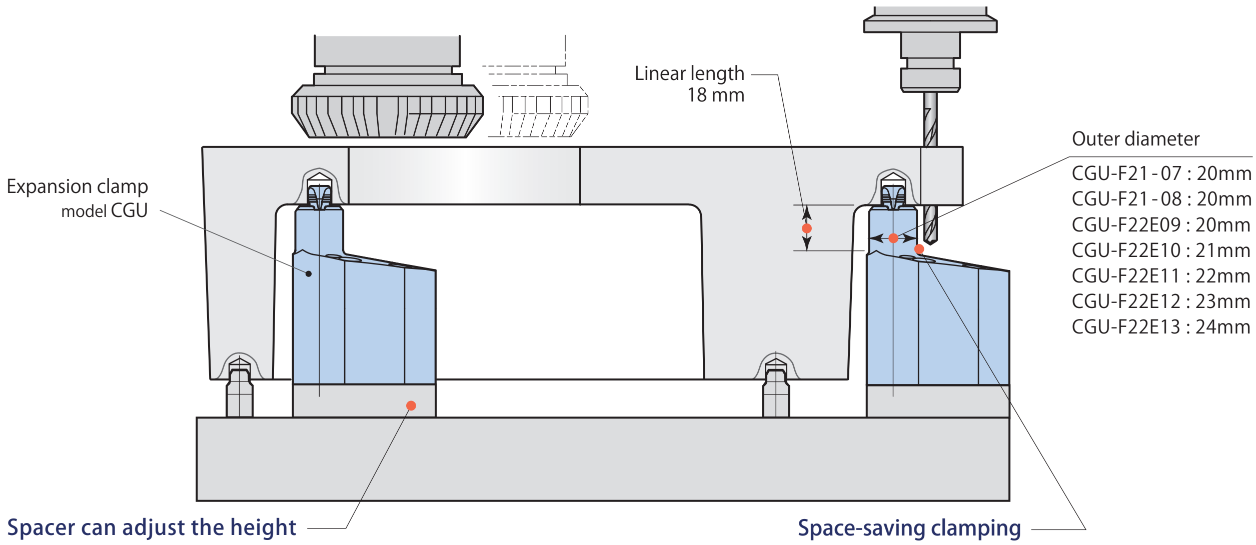
Non-constant air blow model

model **CGU-F22E**

3 Grippers

ø11 12 13

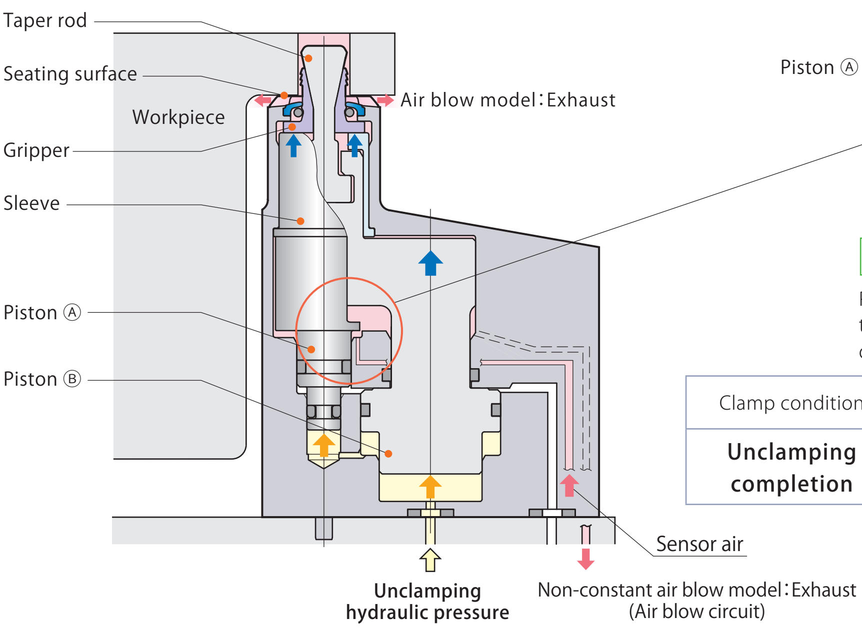


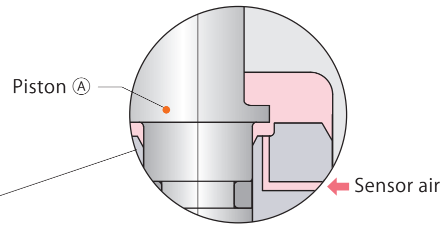


Workpiece setting (Unclamping completion)

① Taper rod and gripper are raised by pistons Ⓐ, Ⓑ and sleeve.

② Set the workpiece onto the seating surface.





Unclamping completion

Piston Ⓐ opens air flow channel to exhaust air and the sensor does not work.

Clamp condition	Air sensor signal	Hydraulic pressure switch
Unclamping completion	**Air sensor OFF** (Sensor air flows.)	**Unclamping hydraulic pressure** **ON**

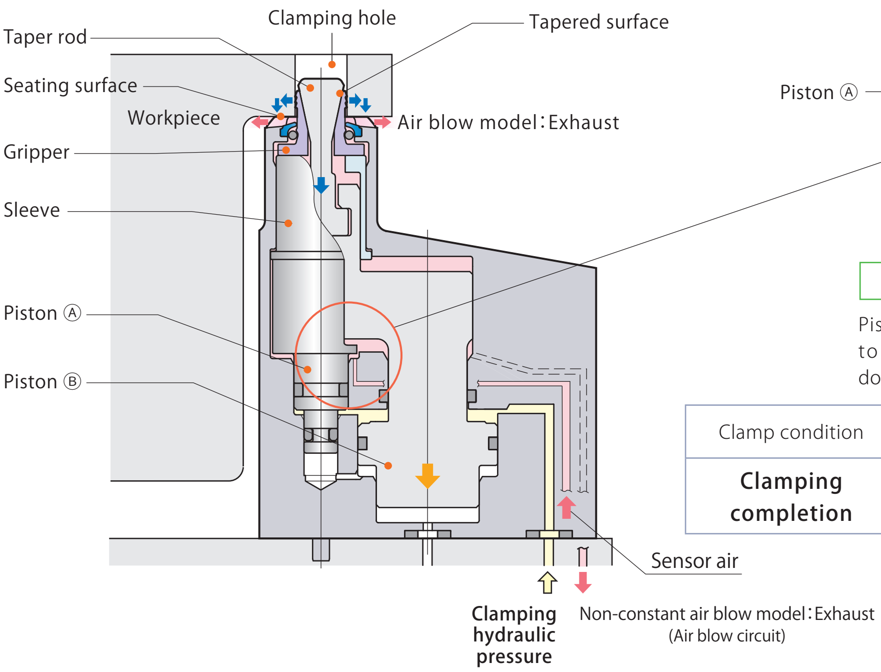
Workpiece holding (Clamping completion)

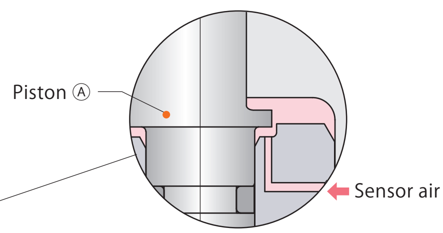
① Piston Ⓑ and taper rod lower with piston Ⓐ being held at upper stroke end position by clamping hydraulic pressure.

② The gripper expands horizontally along the tapered surface to grip inner face of clamping hole holding its position at upper stroke end by piston Ⓐ and sleeve.

③ The gripper securely grips the inner face of clamping hole and pulls the workpiece down firmly onto the seating surface.

④ Workpiece holding is completed by the sensor air, clamping and unclamping hydraulic pressure.





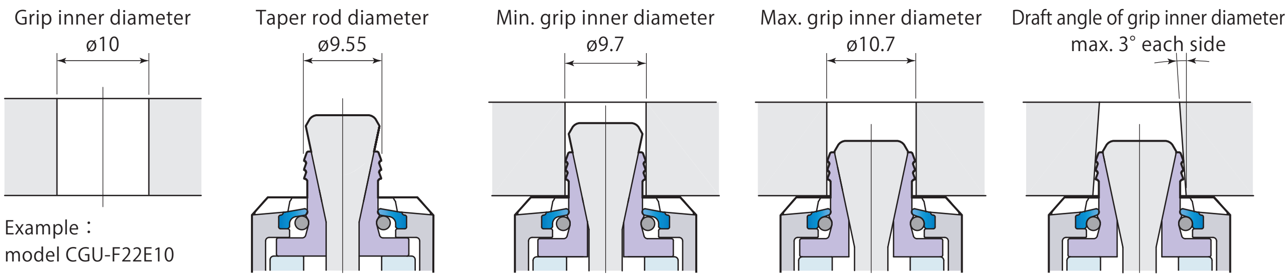
Clamping completion

Piston Ⓐ opens air flow channel to exhaust air and the sensor does not work.

Clamp condition	Air sensor signal	Hydraulic pressure switch
Clamping completion	**Air sensor OFF** (Sensor air flows.)	**Clamping hydraulic pressure** **ON**

Large gripper expansion stroke

The gripper expands horizontally 1.0mm, which enables the accommodation of dimensional variations in diecast bore diameters and ensures workpiece is held securely.

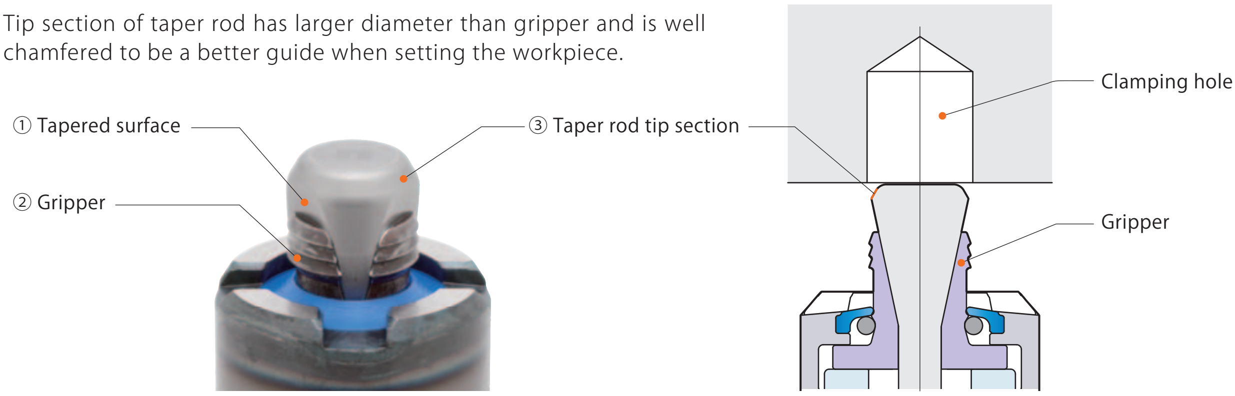


Taper rod and gripper with superior durability

① The holding force of expansion clamp is transmitted from tapered surface to gripper, making it possible for the gripper to hold onto inner face of clamping hole and hold the workpiece on the seating surface for secure workpiece clamping.

② Special steel with superior abrasion resistance is used for gripper to improve durability.

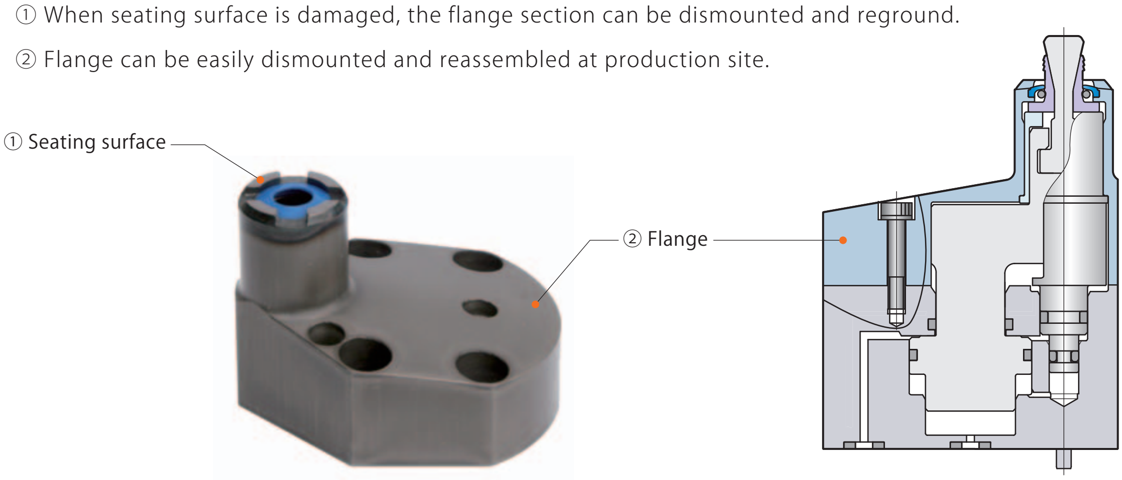
③ Tip section of taper rod has larger diameter than gripper and is well chamfered to be a better guide when setting the workpiece.



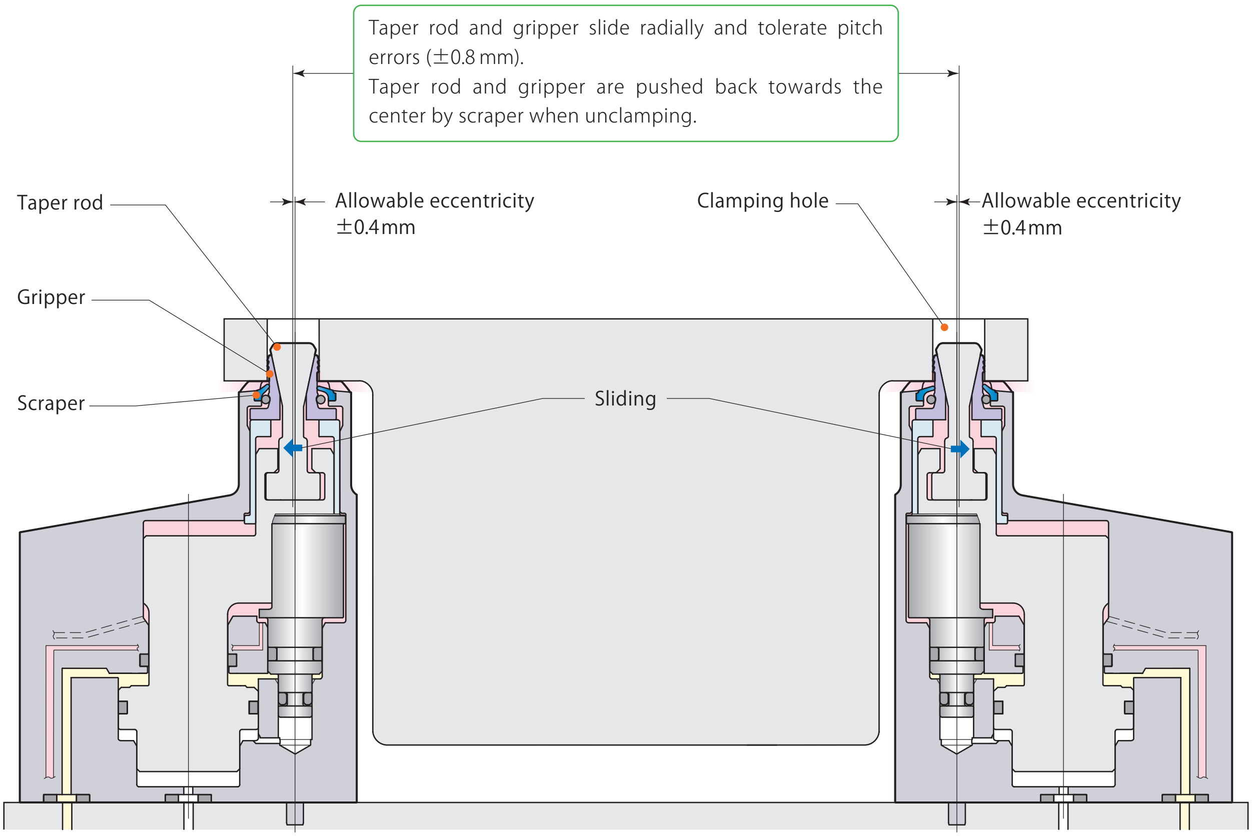
Seating surface can be reground (Max. 0.1 mm)

① When seating surface is damaged, the flange section can be dismounted and reground.

② Flange can be easily dismounted and reassembled at production site.



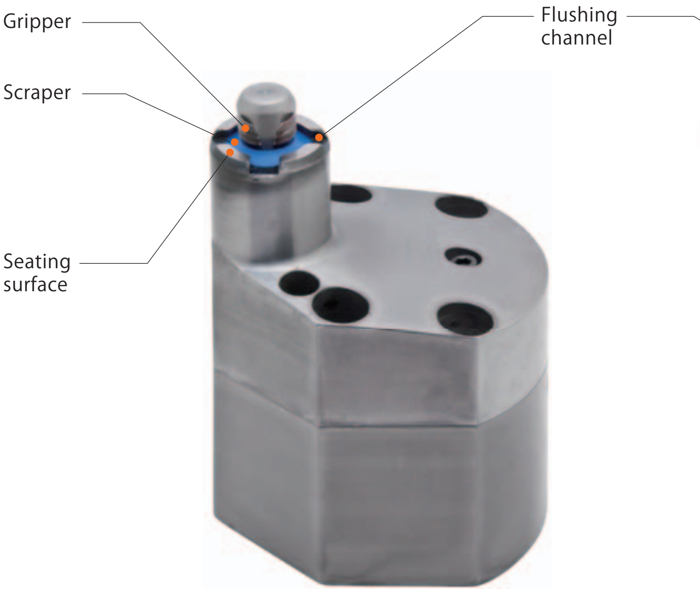
Clamping hole pitch errors can be tolerated

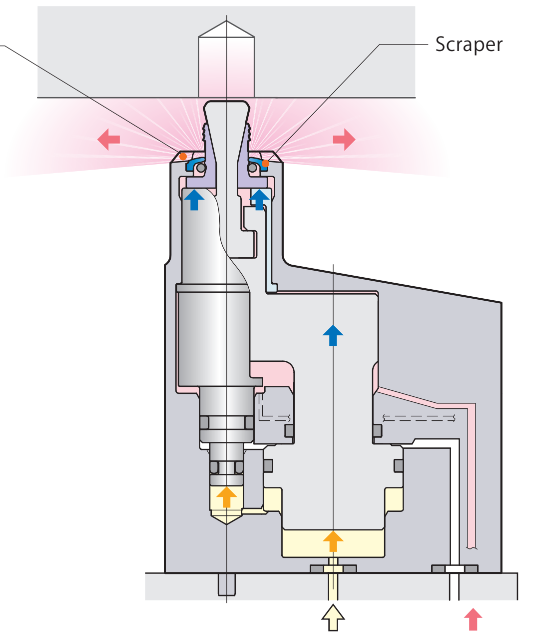


By the eccentric mechanism, the expansion clamp does not have a workpiece positioning function.

Incorporating strong air blowing circuit

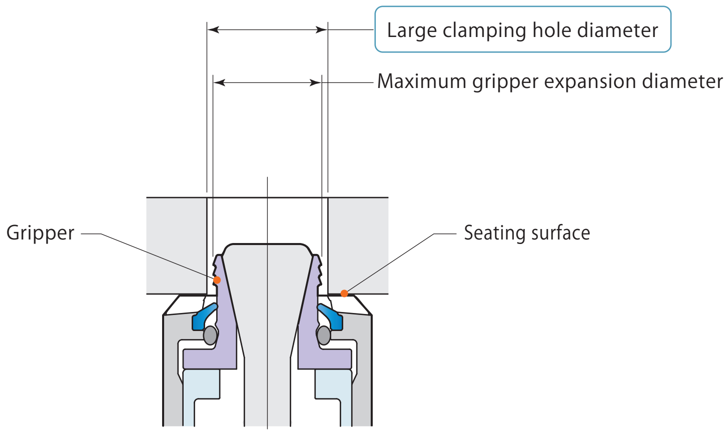
Air blow from a gap between the gripper and scraper clears off metal chips and coolant that stay on the seating surface. Flushing channel is also provided on the seating surface to remove the metal chips and coolants smoothly during workpiece setting.

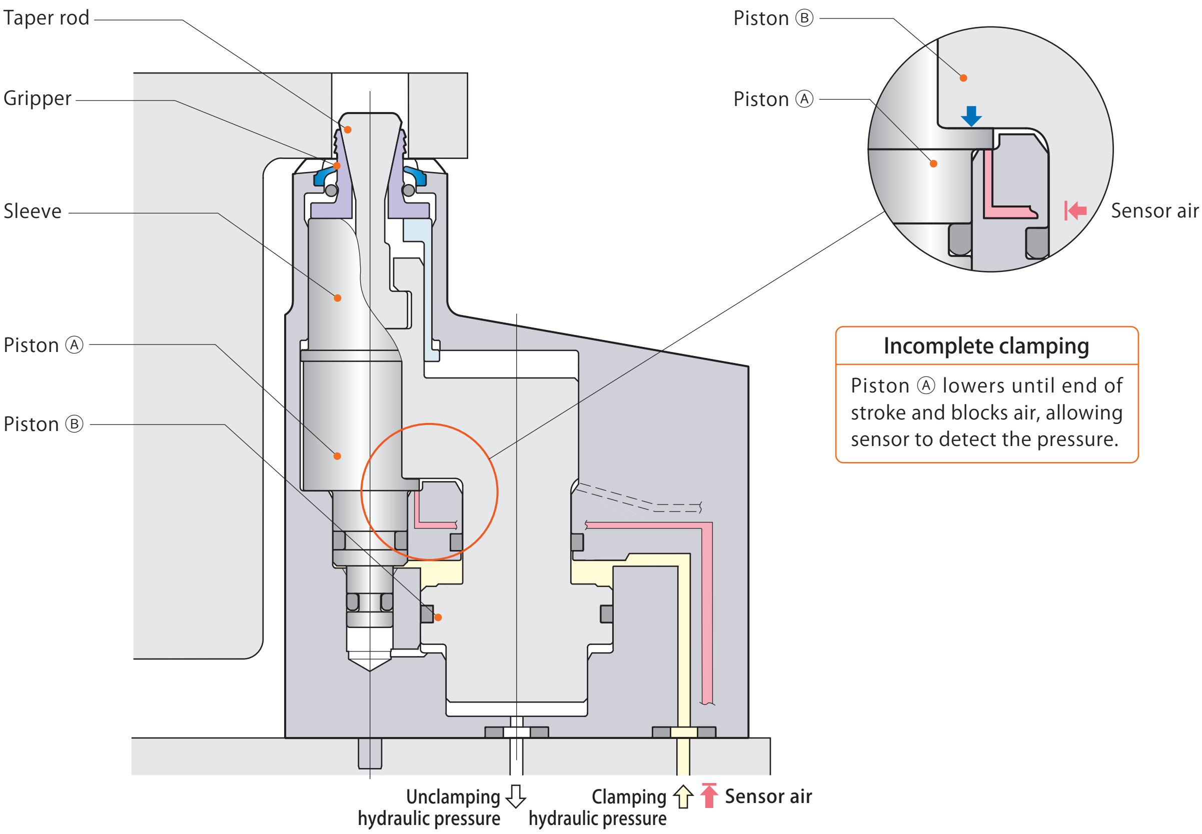




Detects clamping hole diameter that is too large

When the inner diameter of clamping hole exceeds tolerance value, then gripper will fail to gain grip on workpiece even when extended to maximum reach. Piston Ⓐ lowers until end of stroke as it is pushed down by piston Ⓑ and blocks sensor air, which triggers air sensor and detects incomplete clamping.

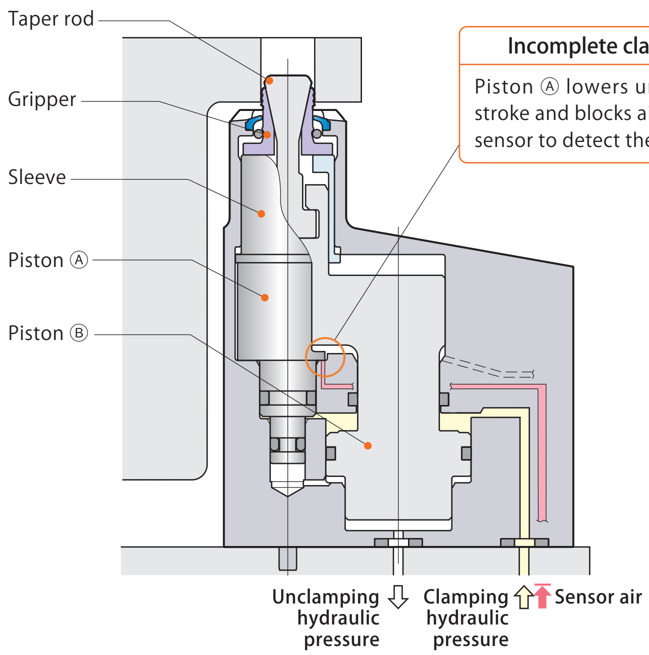


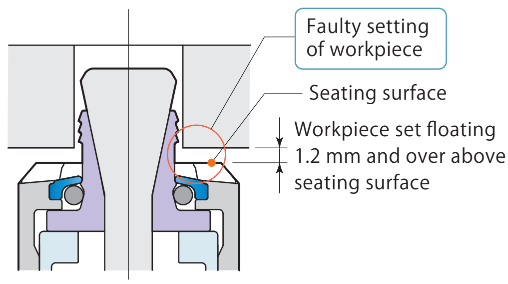


Clamp condition	Air sensor signal	Hydraulic pressure switch
Incomplete clamping	Air sensor ON (Sensor air does not flow.)	Clamping hydraulic pressure ON

Detects deformation of workpiece and floating of workpiece

When workpiece has significant deformation or when it is set poorly with gap of 1.2 mm above seating surface, then even when the gripper lowers until end of stroke, the workpiece is not held on seating surface. At this time, piston Ⓐ lowers until end of stroke as it is pushed down by sleeve and blocks sensor air, which triggers air sensor and detects incomplete clamping.

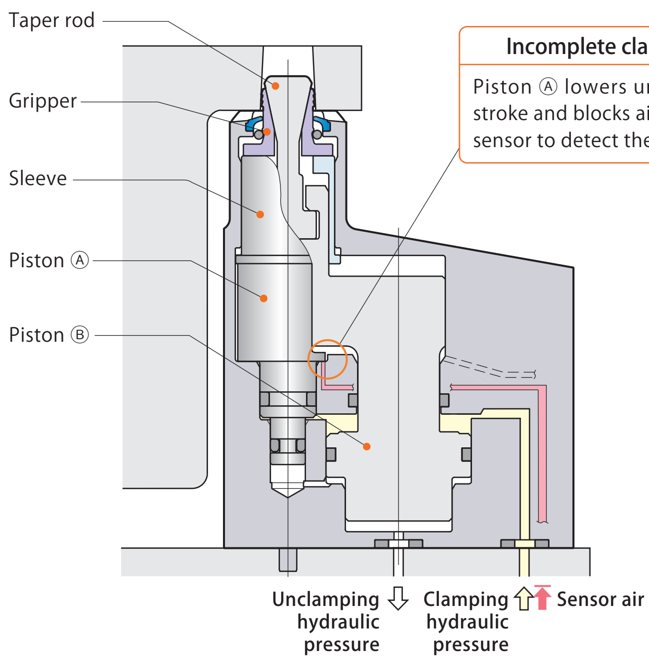


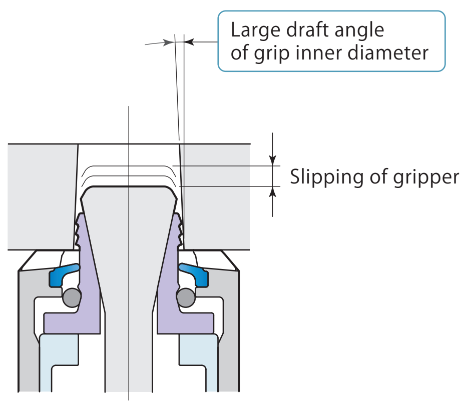


Clamp condition	Air sensor signal	Hydraulic pressure switch
Incomplete clamping	Air sensor ON (Sensor air does not flow.)	Clamping hydraulic pressure ON

Detects incomplete gripping

When the inner diameter of clamping hole is slightly larger than allowable value, or when the draft angle of grip inner diameter is large and results in incomplete gripping by the gripper, piston Ⓐ lowers until end of stroke as sleeve pushes it down and sensor air is blocked, which triggers air sensor and detects incomplete clamping.





Clamp condition	Air sensor signal	Hydraulic pressure switch
Incomplete clamping	Air sensor ON (Sensor air does not flow.)	Clamping hydraulic pressure ON

With the development of the non-constant air blow expansion clamp, air consumption will be significantly decreased.
The traditional model ordinarily requires 50L/min (0.3MPa) flow rate (when grip inner diameter is ø12). The new model can reduce

Air blow model

Number of grippers	Grip inner diameter	Clamping force	Model
4 Grippers	ø 7 8	1.57 kN (Hydraulic pressure 7 MPa)	CGU-F21-[Grip inner diameter]

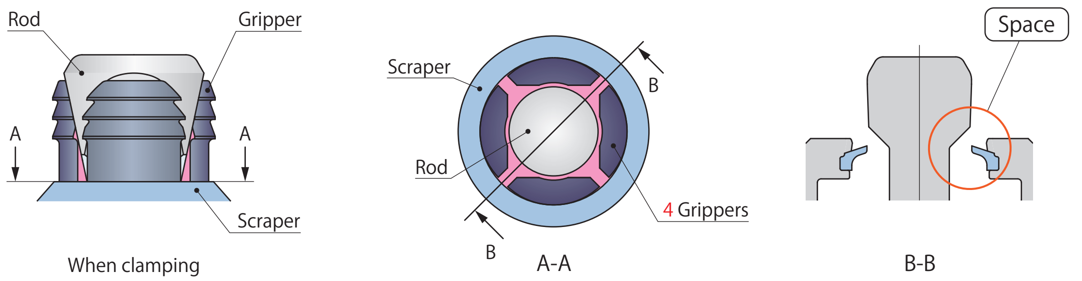
Non-constant air blow model

Number of grippers	Grip inner diameter	Clamping force	Model
2 Grippers	ø 9 10	2.76 kN (Hydraulic pressure 7 MPa)	CGU-F22E[Grip inner diameter]

Number of grippers	Grip inner diameter	Clamping force	Model
3 Grippers	ø 11 12 13	2.76 kN (Hydraulic pressure 7 MPa)	CGU-F22E[Grip inner diameter]

air consumption and help promote energy conservation. However air blow at time of workpiece replacement is a must.

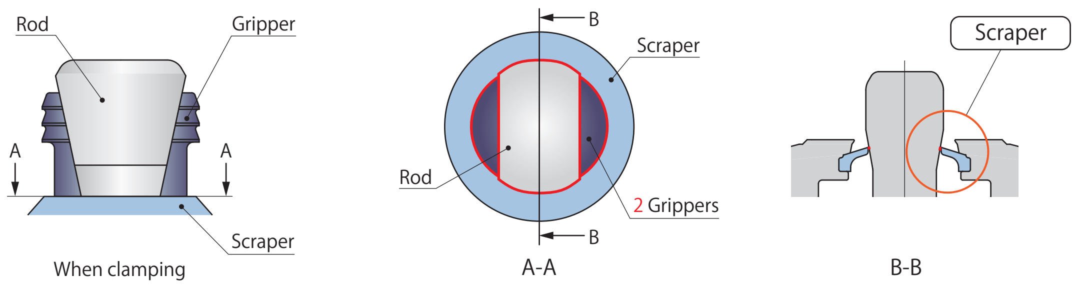
Space where metal chips can intrude is created



Pages → 520, 521

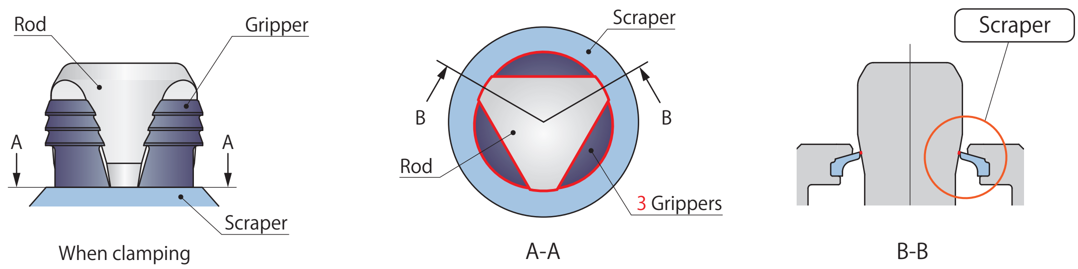
Because of space between scraper, gripper and the rod, air blow must always be performed to prevent intrusion of chips.

Secure chip protection



Pages → 522, 523

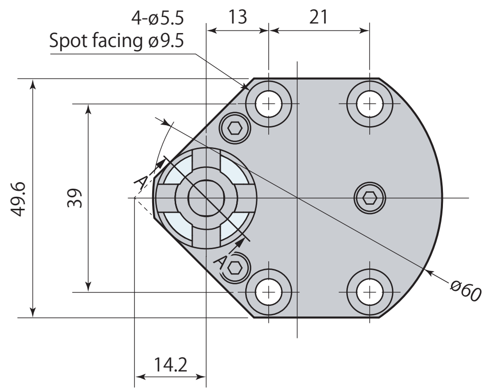
Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.

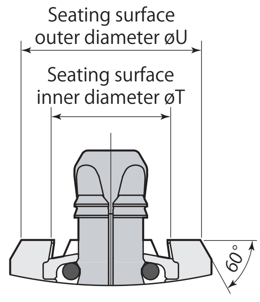


Pages → 524, 525

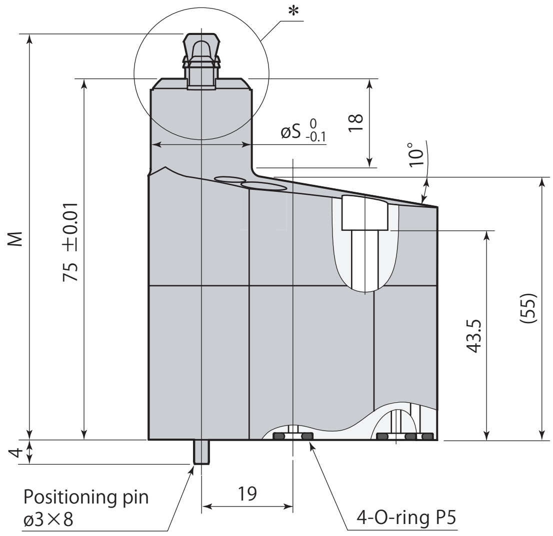
Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.

Dimensions

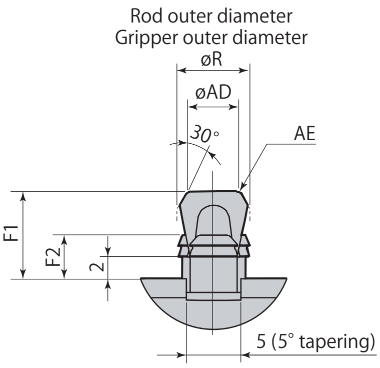




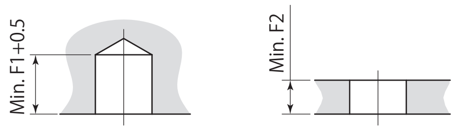
A-A



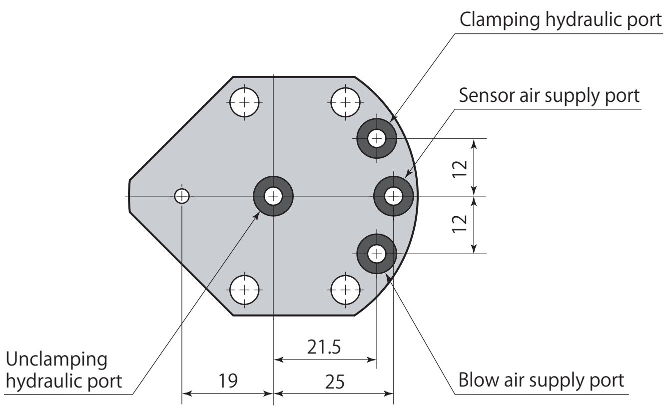
*Details



Grip inner diameter usage requirements



Blind hole Through hole



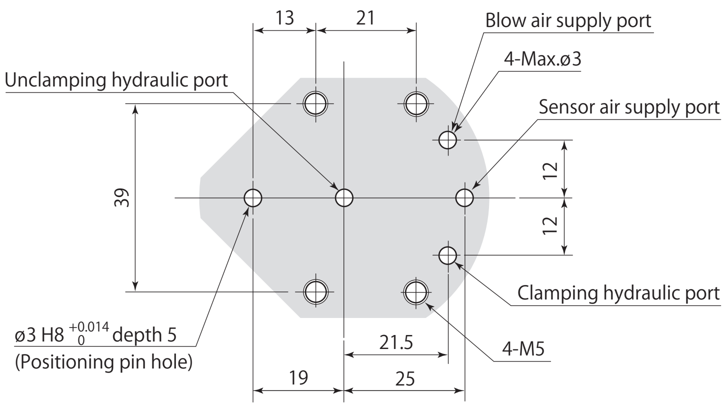
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

mm

Model	CGU-F21-□	
	07	08
F1	8	9
F2	4	5
M	83	84
øR	6.5	7.5
øS	20	20
øT	10.6	11.6
øU	18	18
øAD	4.8	5.8
AE	R0.6	R1

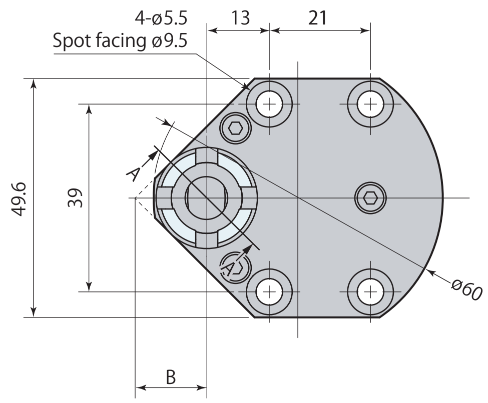
- CGU-F21-07, 08 are made to order.

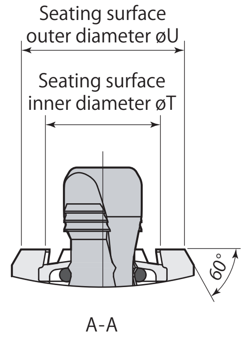
Mounting details

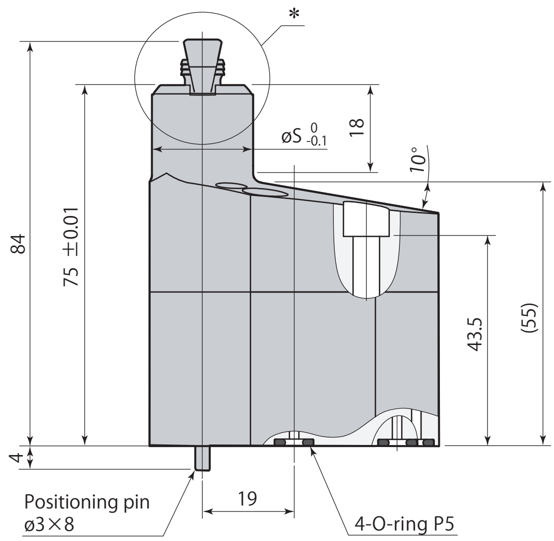


- The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

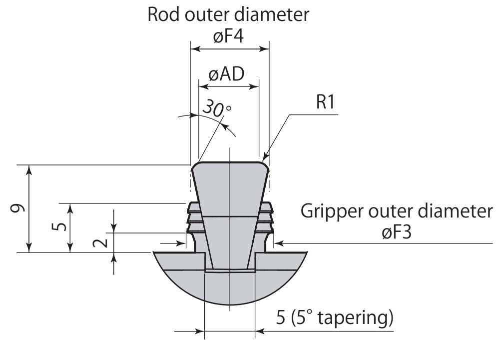
Dimensions



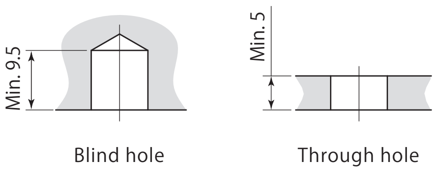


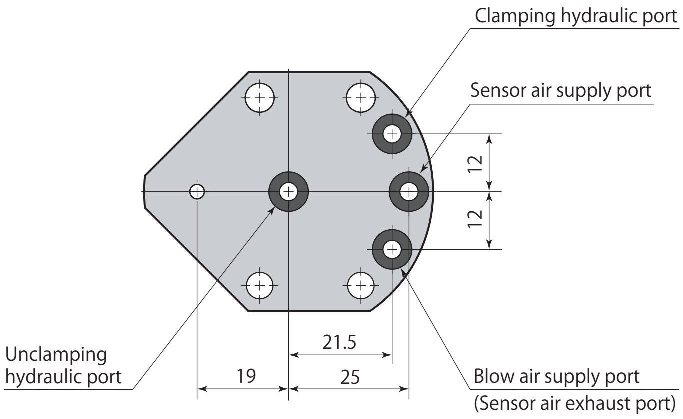


*Details



Grip inner diameter usage requirements





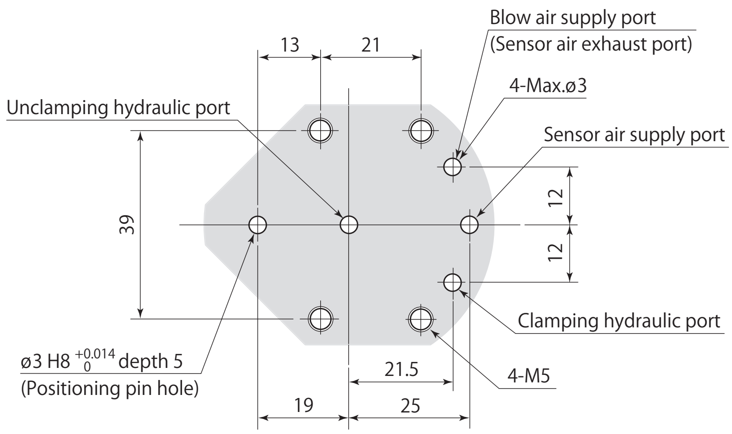
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

mm

Model	CGU-F22E□	
	09	10
B	14.2	14.9
øF3	8.5	9.5
øF4	8.55	9.55
øS	20	21
øT	12.6	13.6
øU	18	19
øAD	6.8	7.8

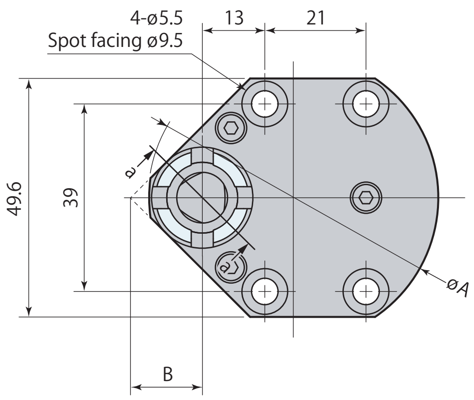
- CGU-F22E09, 10 are made to order.

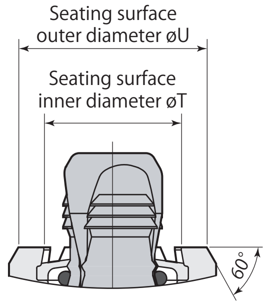
Mounting details



● The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

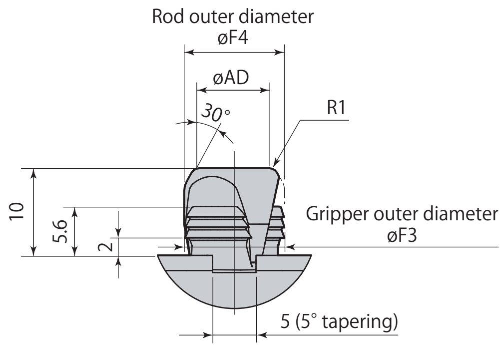
Dimensions

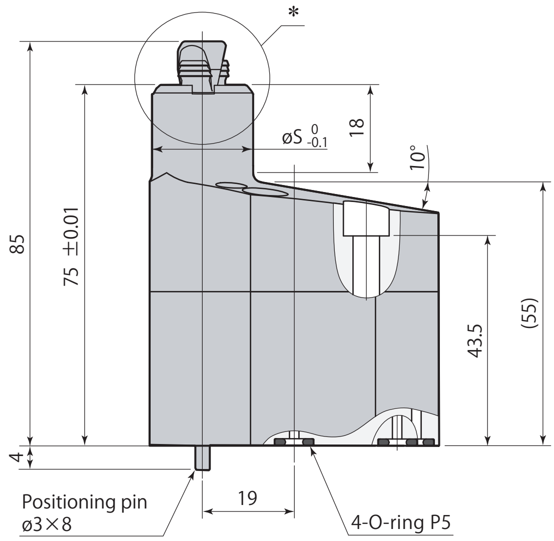




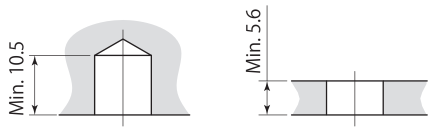
a-a

＊Details

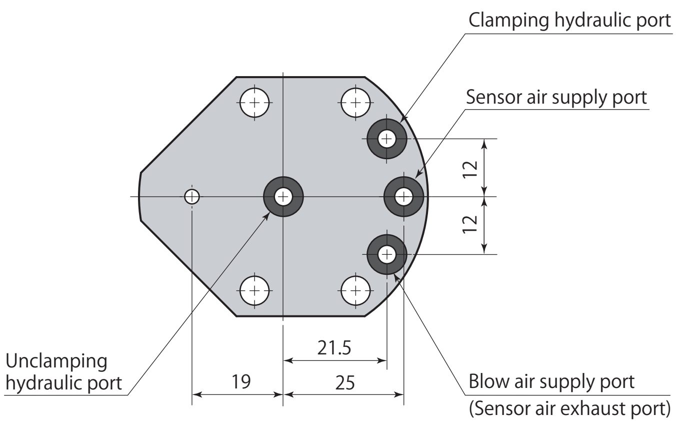




Grip inner diameter usage requirements



Blind hole Through hole



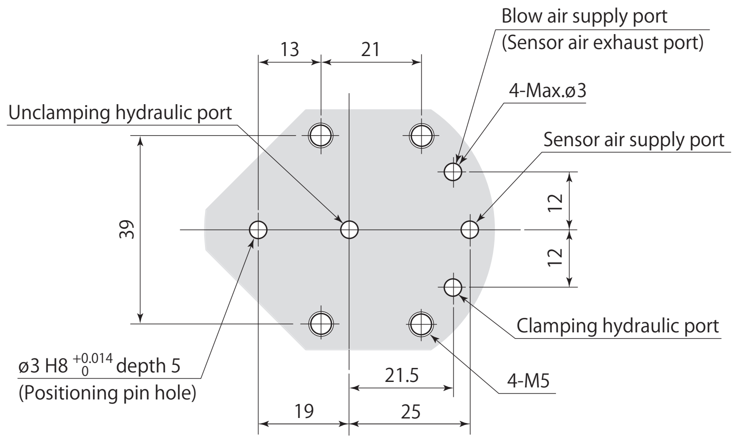
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

mm

Model	CGU-F22E□		
	11	12	13
øA	60	62	62
B	15.6	16.3	17
øF3	10.5	11.5	12.5
øF4	10.55	11.55	12.55
øS	22	23	24
øT	14.6	15.6	16.6
øU	20	21	22
øAD	8.2	9.2	10.2

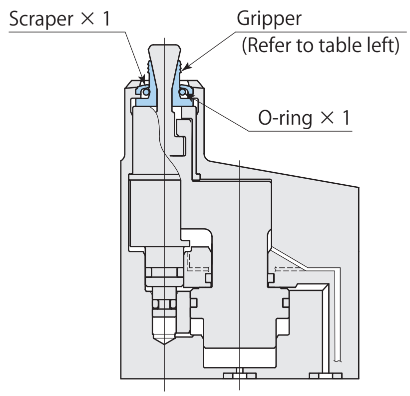
- CGU-F22E11, 12, 13 are made to order.

Mounting details

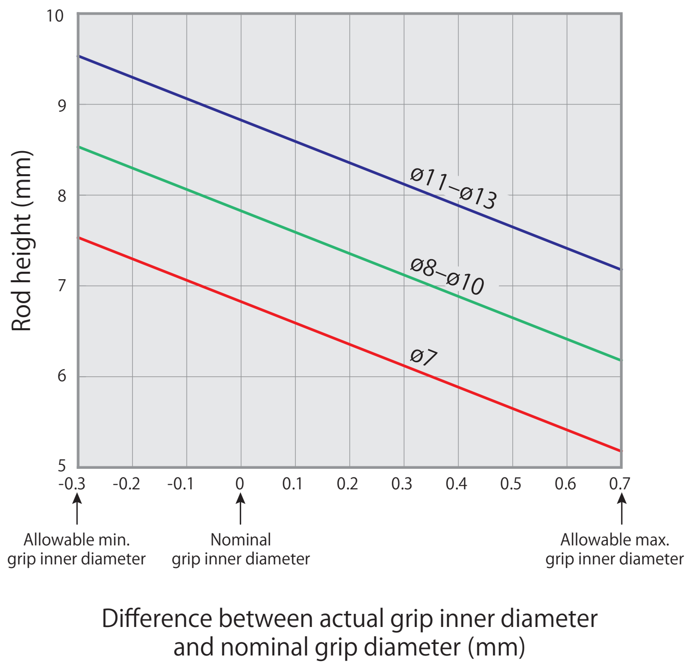


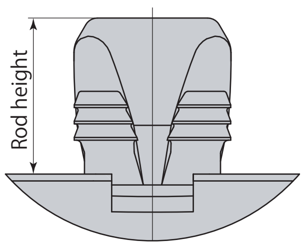
● The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

Gripper set replacement

Number of grippers	Gripper set model	Clamp model	Set description
4 Grippers	CGU-F21-J07	CGU-F21-07	 It is recommended that grippers, scraper and O-ring be replaced after about 200,000 operations. Replace grippers in sets and not just an individual gripper. (Refer to the table on the left for the gripper set model.)
	CGU-F21-J08	CGU-F21-08	
2 Grippers	CGU-F22EJ09	CGU-F22E09	
	CGU-F22EJ10	CGU-F22E10	
3 Grippers	CGU-F22EJ11	CGU-F22E11	
	CGU-F22EJ12	CGU-F22E12	
	CGU-F22EJ13	CGU-F22E13	

Grip inner diameter & rod height when clamping

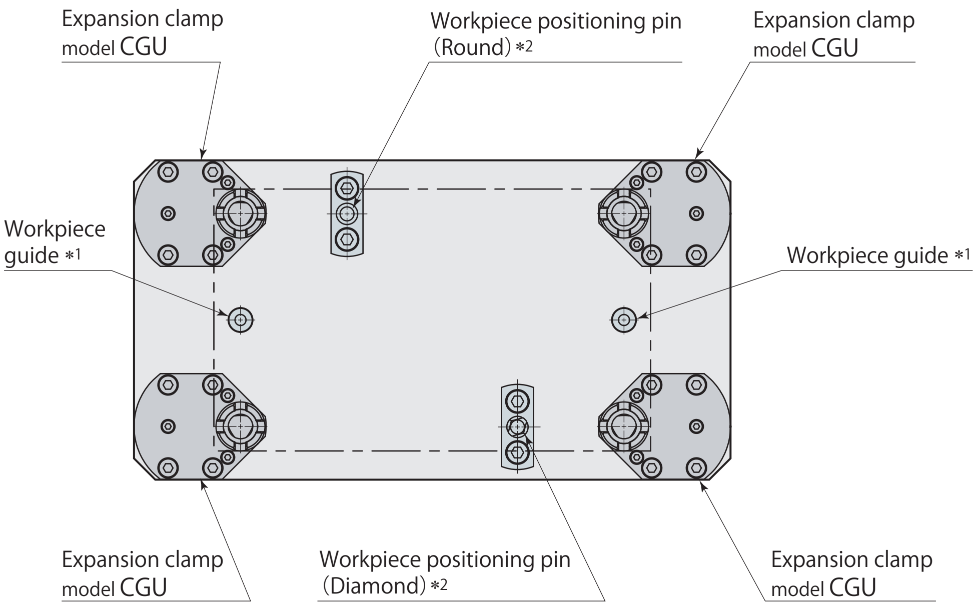


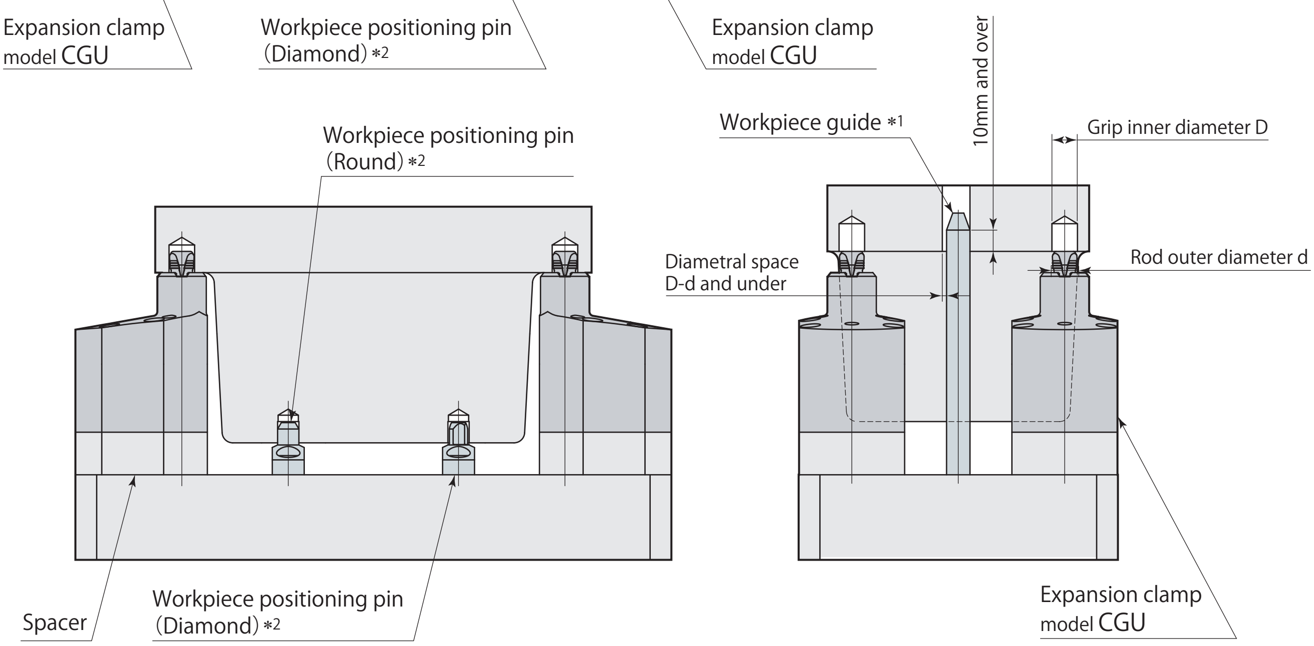


Rod height calculation formula	
ø7	: 6.82-2.35 × Actual grip inner diameter and nominal grip diameter difference
ø8 – ø10	: 7.82-2.35 × Actual grip inner diameter and nominal grip diameter difference
ø11 – ø13	: 8.82-2.35 × Actual grip inner diameter and nominal grip diameter difference

Example: When CGU-F22E10 (Nominal grip diameter : ø10) is clamping ø9.8 hole
Rod height = 7.82 - 2.35 × (-0.2) = 8.29mm

System configuration example

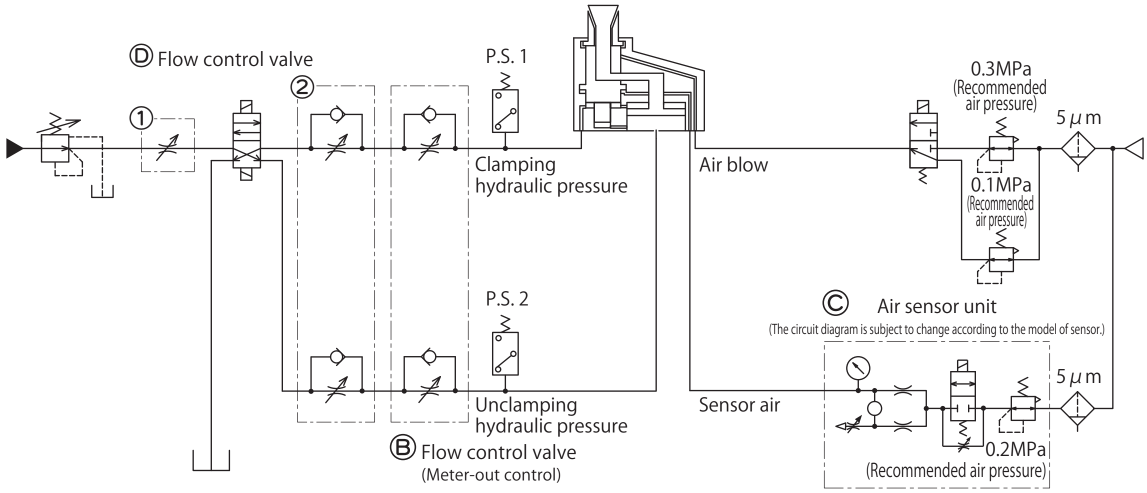




*1: When using automatic or robotic conveyers, prevent damage to clamp caused from impact by setting workpiece guides. Using the above guide as reference, accurately position the holes when using workpiece guides.

*2: **The expansion clamp does not have a workpiece positioning function.**
Install workpiece positioning pins (or similar).

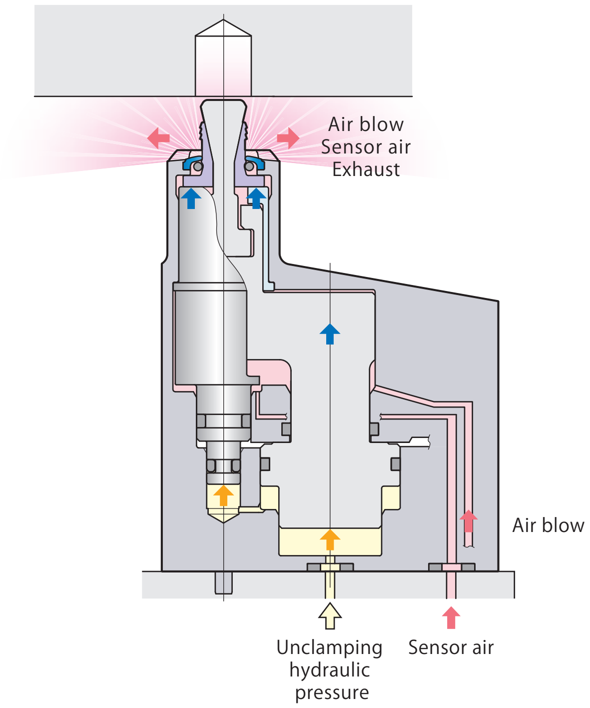
Air blow model hydraulic and pneumatic circuit diagram



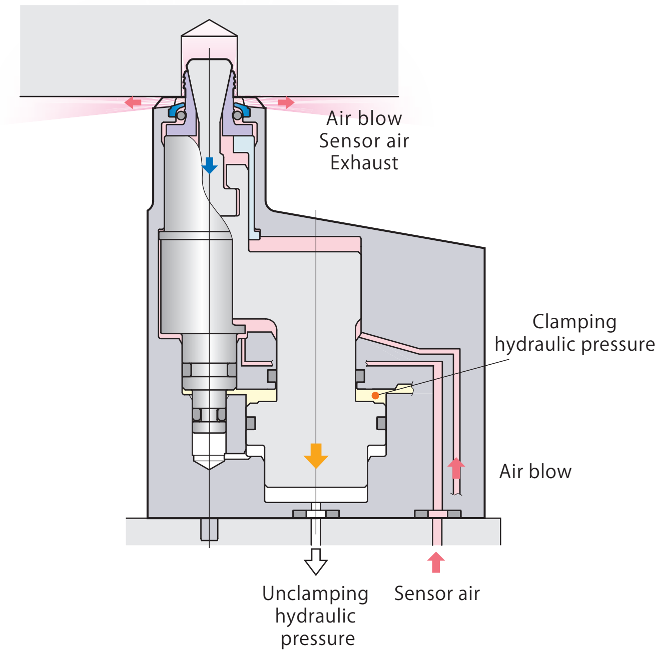
- Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping. During cutting, if chips adhere to the gripper such as when going through the clamping hole, continue air blowing during processing as well.

- Air blow pressure must be set to 0.1MPa when checking the operation of the clamp with the air sensor.

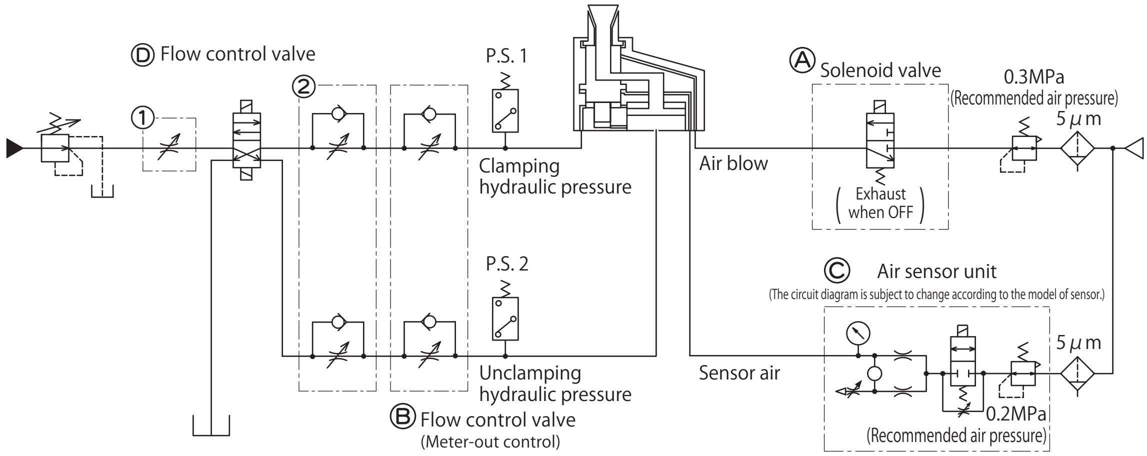
Air blowing



Clamping

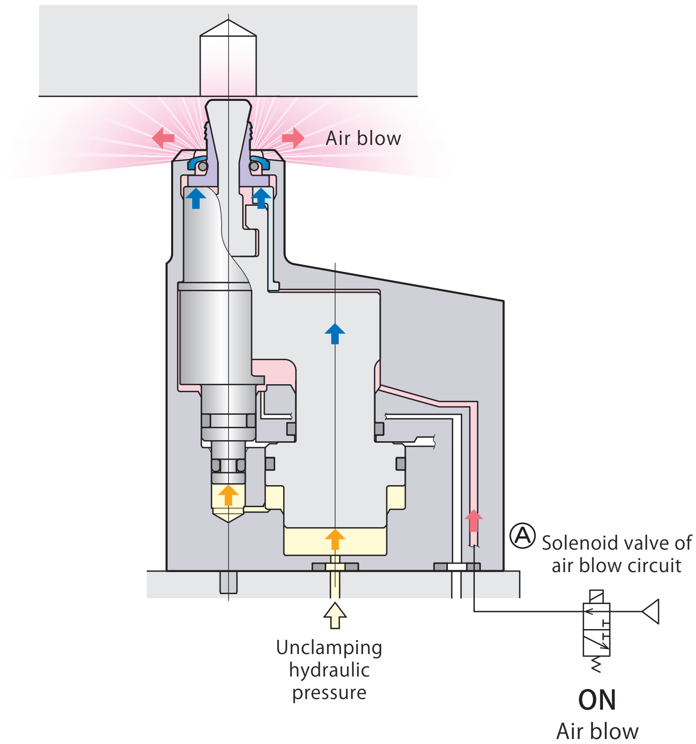


Non-constant air blow model hydraulic and pneumatic circuit diagram

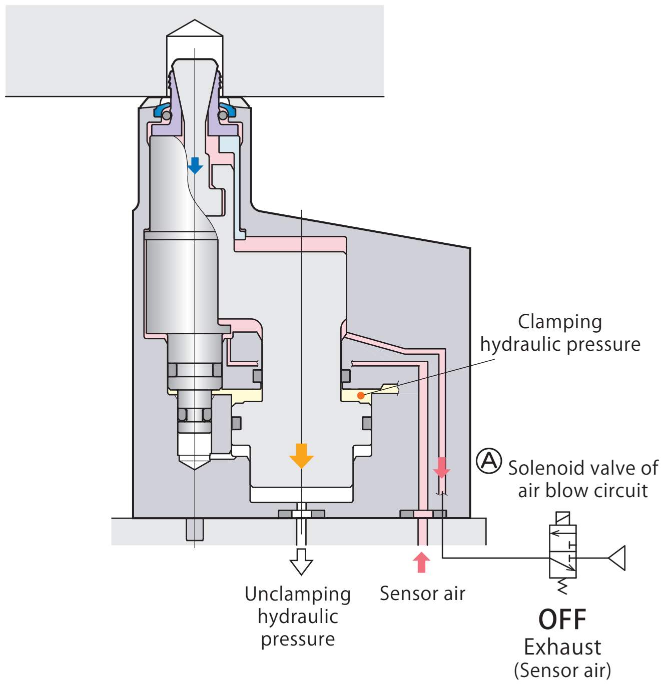


- Air blow will not be necessary during cutting process. Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping to remove metal chips and debris.
- The solenoid valve Ⓐ must be closed when checking the operation of the clamp with the air sensor. Also 3 port type of solenoid valve must be used in the circuit. If 2 port type of the valve is used, sensing air cannot be exhausted and clamp detection function is disabled.

Air blowing



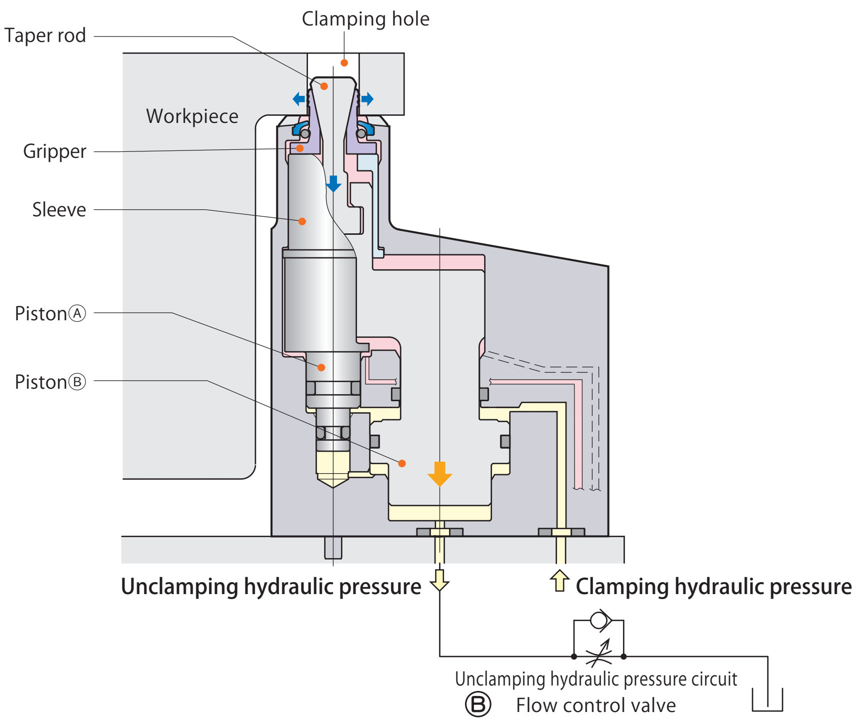
Clamping



- Operation speed must be adjusted by a meter-out type flow control valve Ⓑ being provided in the unclamping circuit. By the adjustment, oil flow in unclamping circuit is squeezed and back pressure is generated. The back pressure acts on the piston Ⓐ of the clamp and makes the gripper expand first then the taper rod strokes down to clamp. If meter-in type flow control valve is installed in the circuit, it dumps the oil rapidly and makes the gripper move very quick which causes incomplete clamping.

- Adjust oil flow when clamping to have the taper rod full stroke in 0.3 sec or over.
  Excessive oil flow to the clamp gives impact load and may cause breakage of the parts.

- Provide additional flow control valve Ⓓ to the place of either ① or ② in the circuit diagram to adjust oil flow when a large discharge volume pump is used for the hydraulic circuit. The flow control valve Ⓑ alone may not be good enough to adjust the speed of clamp operation.



Air sensor unit Ⓒ 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	0.2 MPa
Inner diameter of piping	ø4 mm (ISA3-F：ø2.5 mm)
Overall piping length	5 m or less

- 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.

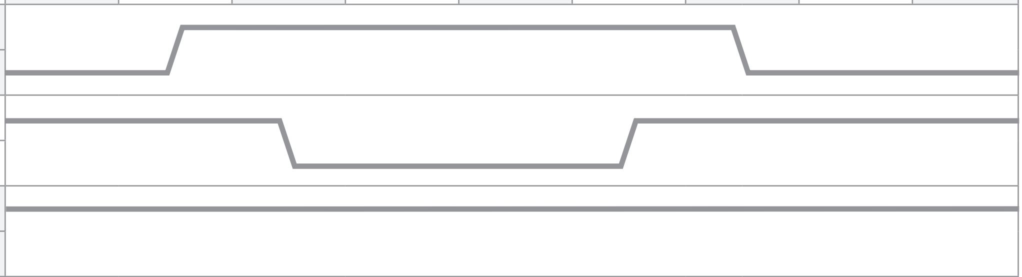
- There is a case that air sensing cannot be made successfully as designed when it is used out of the usage shown on the left. Contact Technical service center for more details.

Operation cycle

The clamp should be controlled with the cycle in the diagram shown below to detect the operation status exactly.

Case of air blow model

State			Workpiece loading	Clamping	Air blow switching	Clamping completion*1	(Machining)	Air blow switching	Unclamping	Unclamping completion*2	Workpiece unloading
∗4	Workpiece clamp	Clamp									
		Unclamp									
	Air blow	0.3MPa									
		0.1MPa									
	Sensor air	ON									
		OFF									
∗5	Clamping hydraulic pressure P.S. 1		OFF				ON			OFF	
	Unclamping hydraulic pressure P.S. 2		ON				OFF			ON	
	Air sensor						OFF or ON*3				



∗1 : Clamping completion : P.S. 1＝ON P.S. 2＝OFF Air sensor＝OFF
∗2 : Unclamping completion : P.S. 1＝OFF P.S. 2＝ON
∗3 : OFF : Complete clamping ON : Incomplete clamping
∗4 : Solenoid valve control ∗5 : Hydraulic pressure switch, Air sensor signal

Case of non-constant air blow model

State			Workpiece loading	Clamping	Air blow OFF	Clamping completion*1	(Machining)	Air blow ON	Unclamping	Unclamping completion*2	Workpiece unloading
∗4	Workpiece clamp	Clamp									
		Unclamp									
	Air blow	ON									
		OFF									
	Sensor air	ON									
		OFF									
∗5	Clamping hydraulic pressure P.S. 1		OFF				ON			OFF	
	Unclamping hydraulic pressure P.S. 2		ON				OFF			ON	
	Air sensor						OFF or ON*3				

∗1 : Clamping completion : P.S. 1＝ON P.S. 2＝OFF Air sensor＝OFF
∗2 : Unclamping completion : P.S. 1＝OFF P.S. 2＝ON
∗3 : OFF : Complete clamping ON : Incomplete clamping
∗4 : Solenoid valve control ∗5 : Hydraulic pressure switch, Air sensor signal

Caution in use

- Be sure to make inner diameter of air blow circuit 4 mm and over except for clamp mounting surface.

- Set the workpiece in such a way that the clamping hole of workpiece is perpendicular to seating surface. Clamping in tilted condition results in uneven contact of gripper with hole, which leads to concentration of load that may cause damage.

- Verify that there are no metal chips or debris on seating surface of clamping hole and clamp body before setting workpiece. Allowing intrusion of metal chips results in insecure clamping, which can lead to low grade of machining accuracy.

- Flaring (Biting) of gripper into workpiece varies depending on workpiece material or thermal processing conditions. With regards to conditions of workpiece and clamping hole, refer to **page** →**511** Secure clamping is not possible when workpiece or clamping hole that does not satisfy these conditions is used.

- If clamping hole serves as taper hole (cast draft hole with gradient), then perform test clamping using applicable workpiece beforehand to verify that there are no problems with operations.

- Deformation may occur if the thickness of clamping hole section of workpiece is extremely thin. Use applicable workpiece to perform test clamping beforehand to verify that there are no deformations in thin portion.

- Supply the dry and filtered air. Particulate size 5 μm or less is recommended.

- Measure seating surface flatness with hydraulic pressure applied on clamping side, or by applying hydraulic pressure on neither clamping nor unclamping side.

- Perform unclamping completion detection, clamping completion detection and incomplete clamping detection with combination actions of pressure switch and sensor shown in table below. (Refer to hydraulic and pneumatic circuit diagram on **page** →**528**, **529** for details.)

Applications	Pressure switch 1 (P.S. 1)	Pressure switch 2 (P.S. 2)	Air sensor
Unclamping completion detection	OFF	ON	—
Clamping completion detection	ON	OFF	OFF
Incomplete clamping detection	ON	OFF	ON

air Expansion clamp

Double acting 1MPa

model CGE

model CGE

Specifications

Grip inner diameter : Number of grippers

CGE — N22E

070 073 076 079 082 085 09 10 : 2 Grippers

11 12 13 : 3 Grippers

▇ indicates made to order.

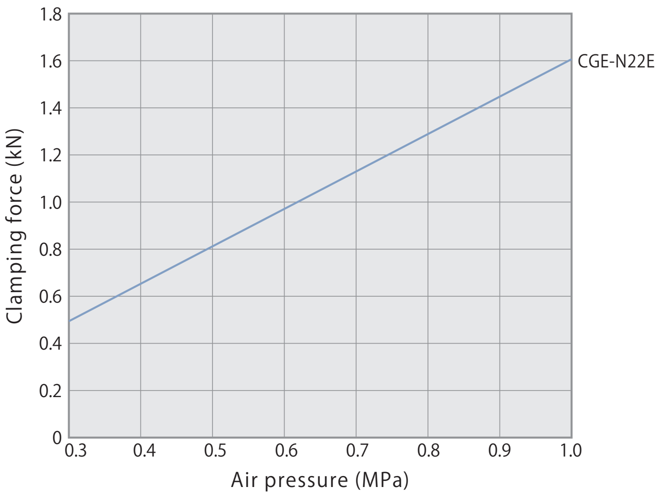
Model		CGE-N22E										
	Grip inner diameter	070	073	076	079	082	085	09	10	11	12	13
Number of grippers		2 Grippers								3 Grippers		
Clamping force (air pressure 0.5MPa)	kN	0.81										
Radial expansion force (air pressure 0.5MPa)	kN	2.81					2.52					
Taper rod stroke	mm	4.8										
Clamp stroke	mm	1.2										
Cylinder capacity: Clamp	cm^3	8.7										
Cylinder capacity: Unclamp	cm^3	9.7										
Allowable eccentricity*1	mm	±0.5										
Recommended air blow pressure	MPa	0.3										
Recommended sensor air pressure	MPa	0.2										
Mass	kg	0.74					0.75					
Recommended tightening torque of mounting screws*2	N･m	7										
Workpiece material		Aluminum, steel and others (HRC25 or below). Cast iron are not usable.										
Allowable min. grip inner diameter	mm	6.7	7.0	7.3	7.6	7.9	8.2	8.7	9.7	10.7	11.7	12.7
Allowable max. grip inner diameter	mm	7.4	7.7	8.0	8.3	8.6	9.2	9.7	10.7	11.7	12.7	13.7
Grip inner diameter tapering angle (Draft angle)		3° or below										
Grip inner diameter circularity		0.1 or below										

● Pressure range：0.3–1 MPa ● Proof pressure：1.5 MPa ● Operating temperature：0–70 ℃ ● Fluid used：Air

● Please inquire if above terms are not applied.

∗1：By the eccentric mechanism, the expansion clamp does not have a workpiece positioning function. ∗2：ISO R898 class 12.9

Clamping force & air pressure



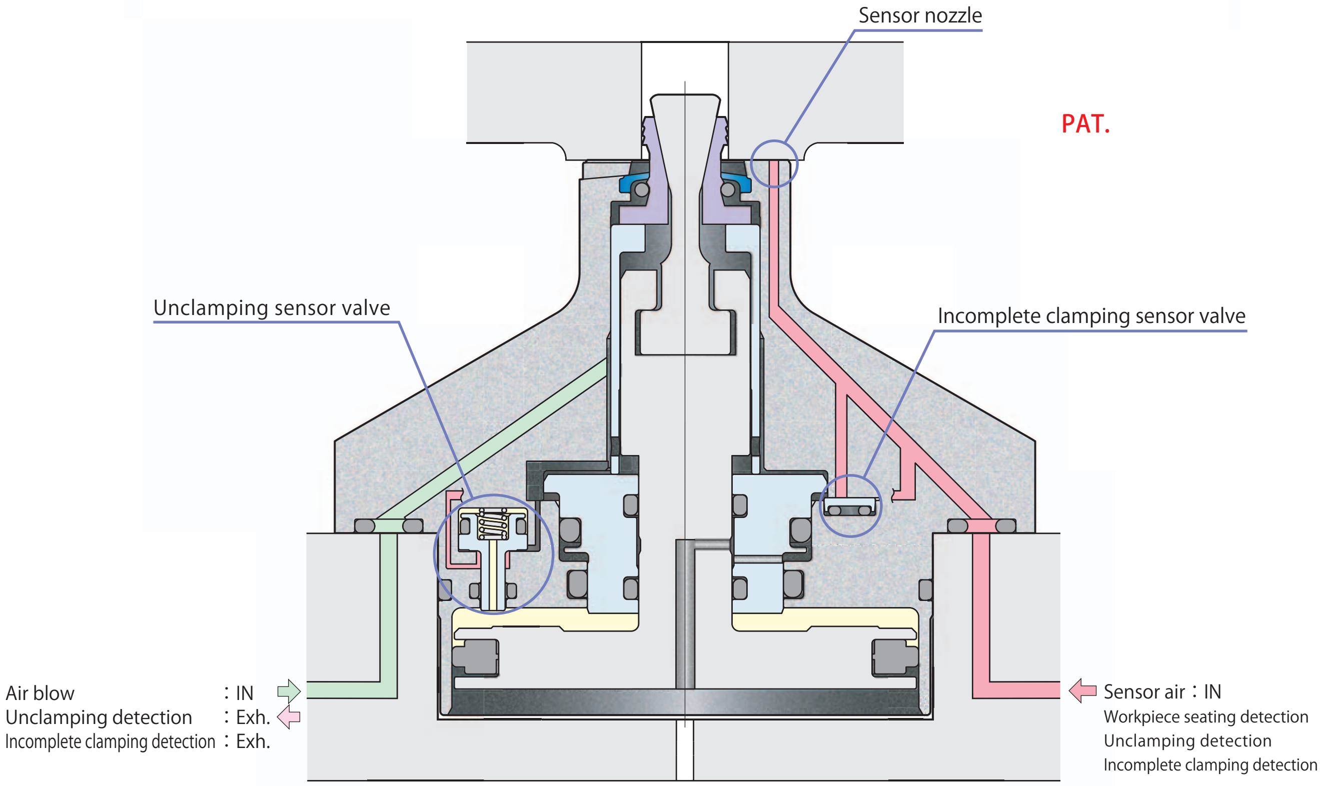
Air pressure	MPa	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Clamping force F=1.617×P	kN	0.49	0.65	0.81	0.97	1.13	1.29	1.46	1.62

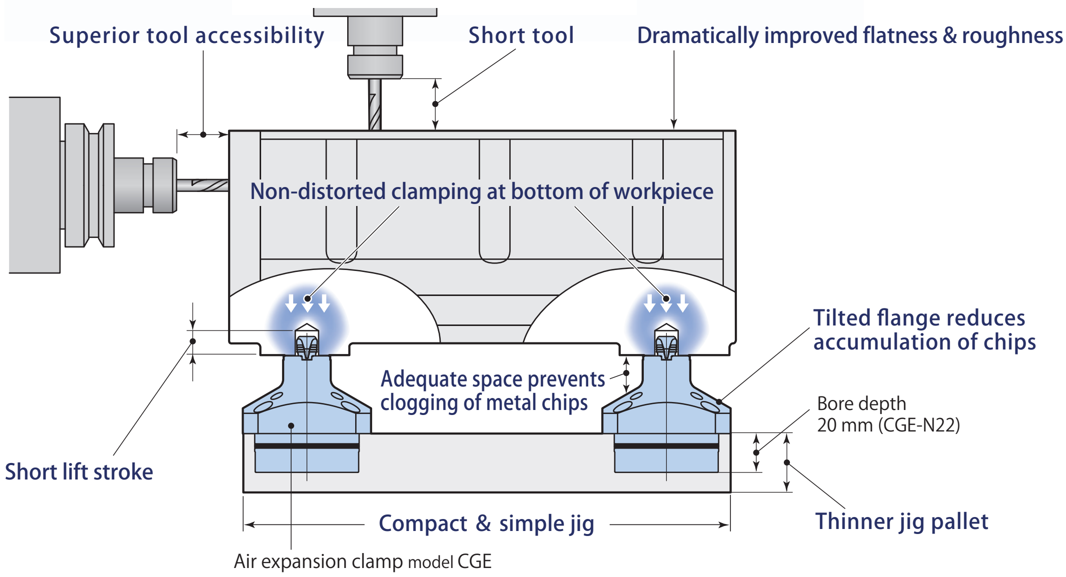
P：Air pressure (MPa)

model **CGE-N22E**
2 Grippers
ø7.0 7.3 7.6 7.9 8.2

model **CGE-N22E**
2 Grippers
ø8.5 9 10

model **CGE-N22E**
3 Grippers
ø11 12 13

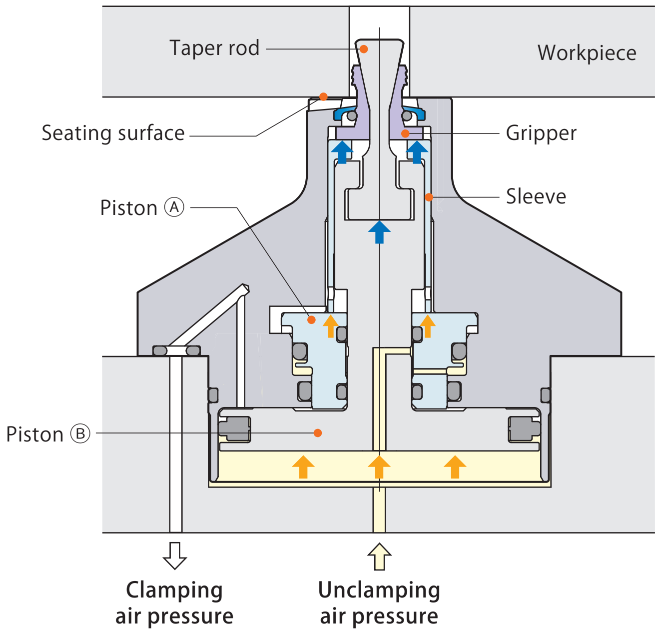




Workpiece setting

① Taper rod and gripper are raised by pistons Ⓐ, Ⓑ and sleeve. The gripper is drawn inward within the taper rod diameter.

② Set the workpiece onto the seating surface.

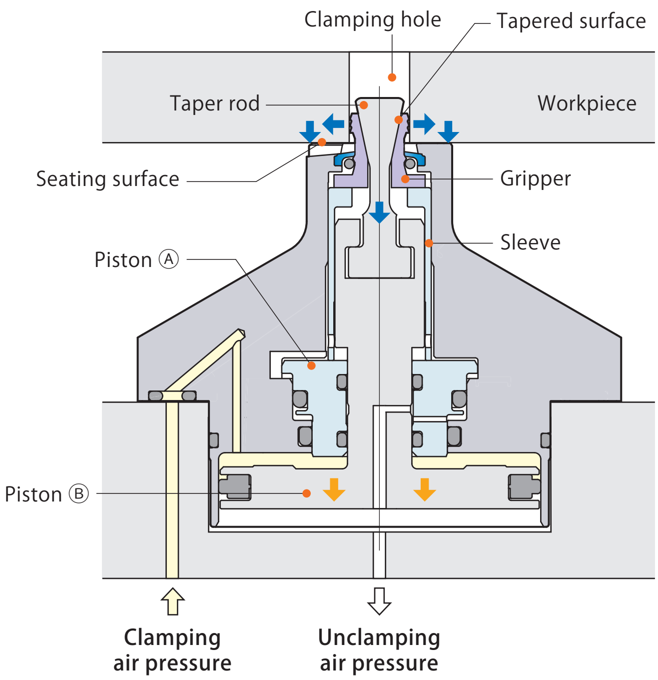


Workpiece holding

① Piston Ⓑ and taper rod lower with piston Ⓐ being held at upper stroke end position by clamping air pressure.

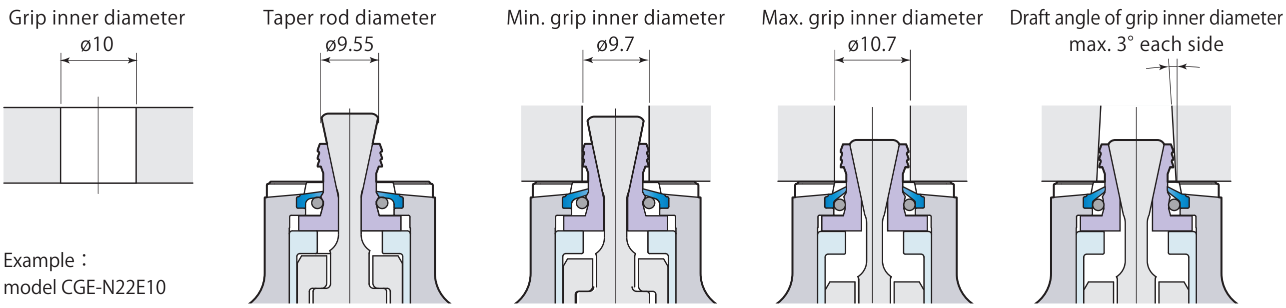
② The gripper expands horizontally along the tapered surface to grip inner face of clamping hole holding its position at upper stroke end by piston Ⓐ and sleeve.

③ The gripper securely grips the inner face of clamping hole and pulls the workpiece down firmly onto the seating surface.



Large gripper expansion stroke

The gripper expands horizontally 1.0mm(∗), which enables the accommodation of dimensional variations in diecast bore diameters and ensures workpiece is held securely.



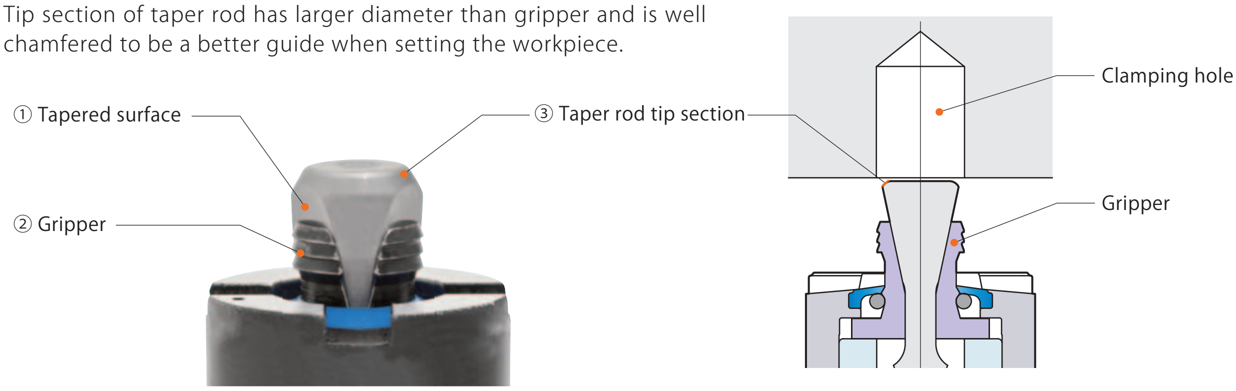
∗：0.7mm stroke for CGE-N22E070, 073, 076, 079, 082

Taper rod and gripper with superior durability

① The holding force of expansion clamp is transmitted from tapered surface to gripper, making it possible for the gripper to hold onto inner face of clamping hole and hold the workpiece on the seating surface for secure workpiece clamping.

② Special steel with superior abrasion resistance is used for gripper to improve durability.

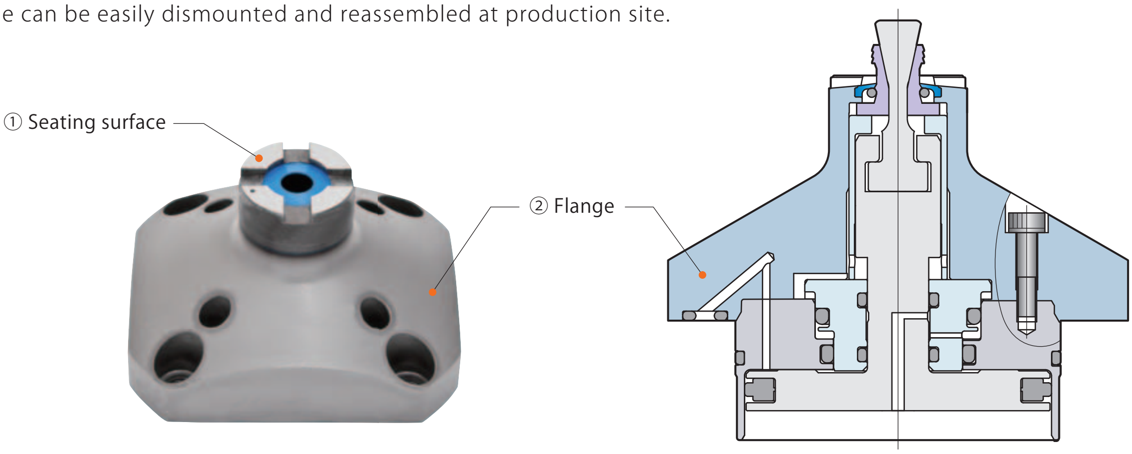
③ Tip section of taper rod has larger diameter than gripper and is well chamfered to be a better guide when setting the workpiece.



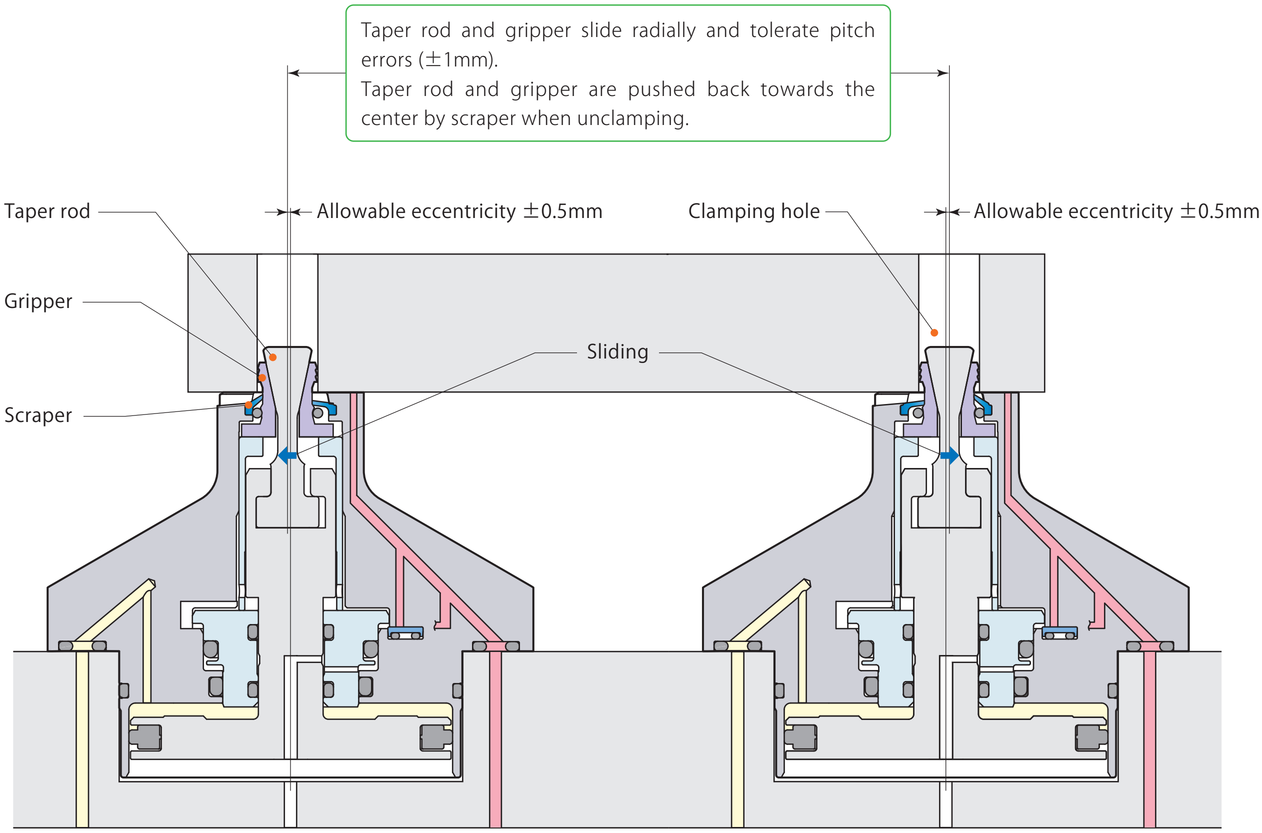
Seating surface can be reground (Max. 0.1 mm)

① When seating surface is damaged, the flange section can be dismounted and reground.

② Flange can be easily dismounted and reassembled at production site.



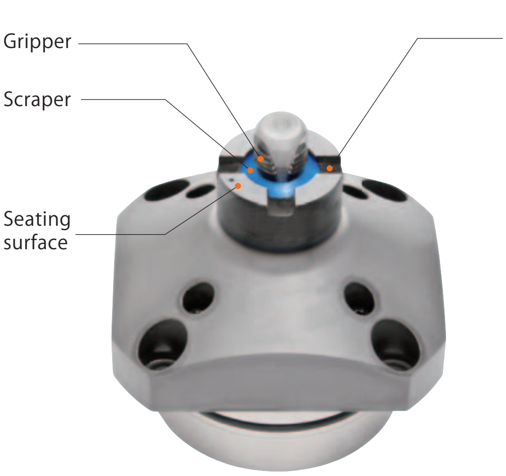
Clamping hole pitch errors can be tolerated

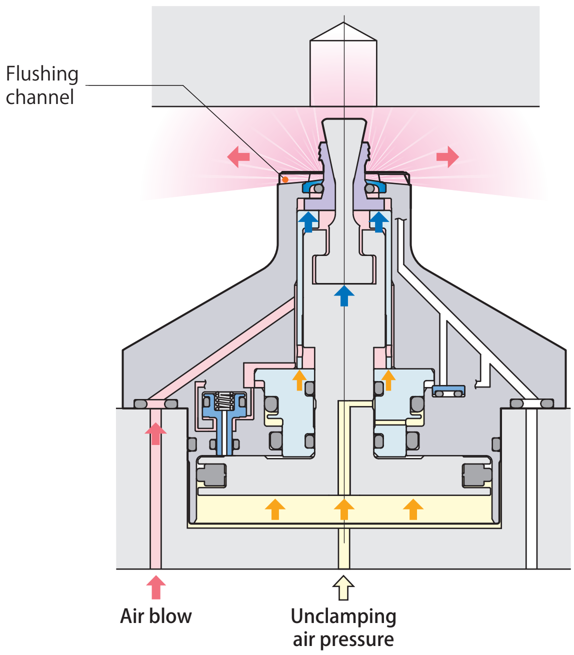


By the eccentric mechanism, the expansion clamp does not have a workpiece positioning function.

Incorporating strong air blowing circuit

Air blow from a gap between the gripper and scraper clears off metal chips and coolant that stay on the seating surface. Flushing channel is also provided on the seating surface to remove the metal chips and coolants smoothly during workpiece setting.





Sensor nozzle detects faulty seating of workpiece

If clamping operation is made when metal chips are under the workpiece (Figure 1-a), or when the workpiece is set 1.2mm and over above the seating surface due to its distortion (Figure 1-b), the workpiece cannot sit fully on the surface and air is exhausted from the sensor nozzle. Incomplete workpiece seating is detected.

Metal chips caught by clamp

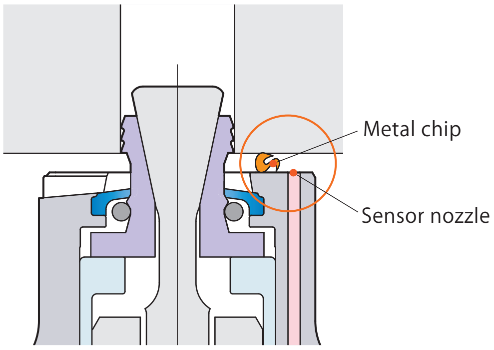


Figure 1-a

Faulty setting of workpiece

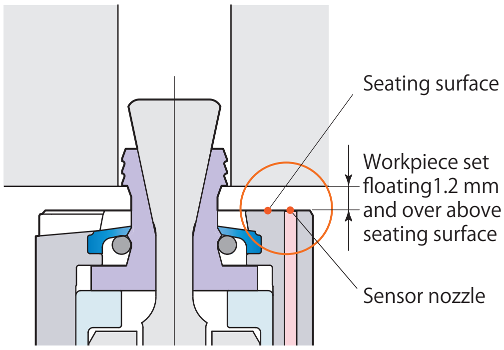
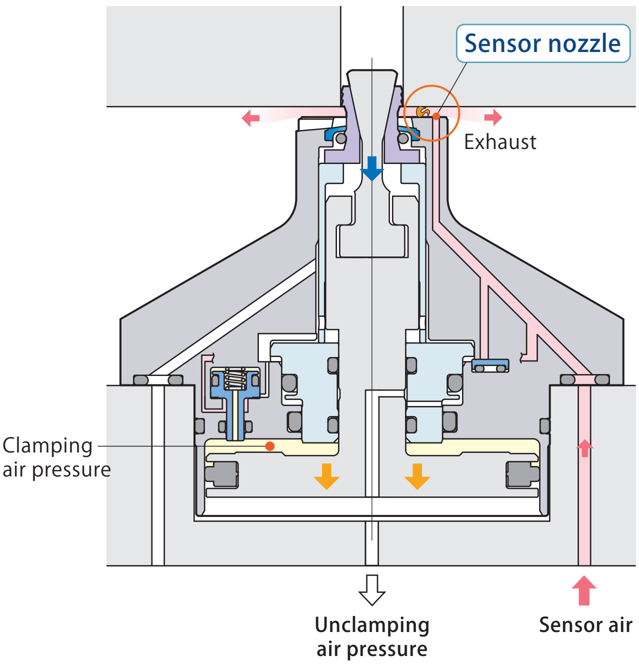


Figure 1-b

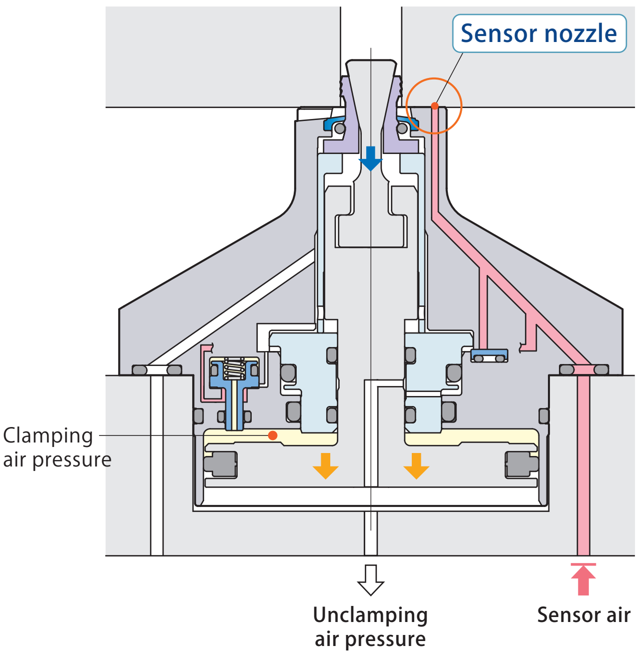
Faulty seating of workpiece

Sensor air is exhausted from sensor nozzle. Air sensor is not triggered and faulty seating of workpiece is detected.



Seating completion of workpiece

Sensor nozzle is blocked by the workpiece. Air sensor detects the seating completion of workpiece.



Clamp condition	Sensor nozzle	Air sensor signal	Air pressure switch
Faulty seating of workpiece	Open	Air sensor OFF (Sensor air flows.)	Clamping air pressure ON

Incomplete clamping sensor valve detects incomplete clamping

PAT. JP4297511
US8246029
EP2253419

When gripper fails to grip properly due to large draft angle of grip inner diameter (Figure 2-a), incomplete clamping sensor valve is opened. Sensor air is exhausted and this detects incomplete clamping.
When clamping hole exceeds tolerance value (Figure 2-b), or when gripper is broken (Figure 2-c), incomplete clamping is detected as well.

Large draft angle of grip inner diameter

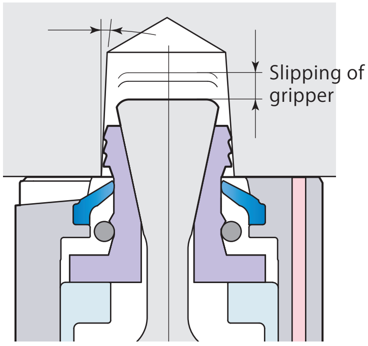


Figure 2-a

Clamping hole is large (Full stroke)

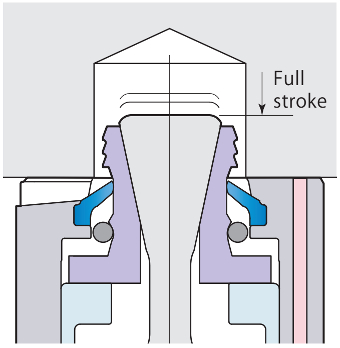


Figure 2-b

If gripper is broken

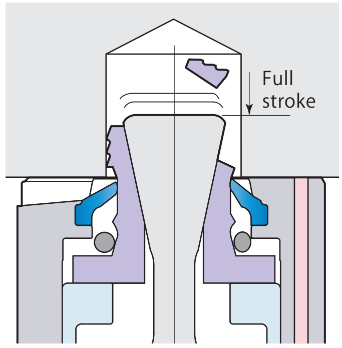
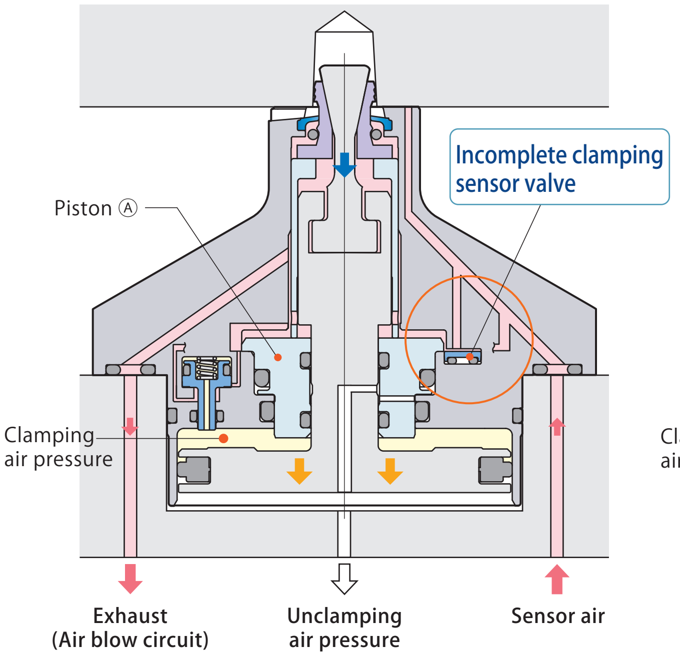


Figure 2-c

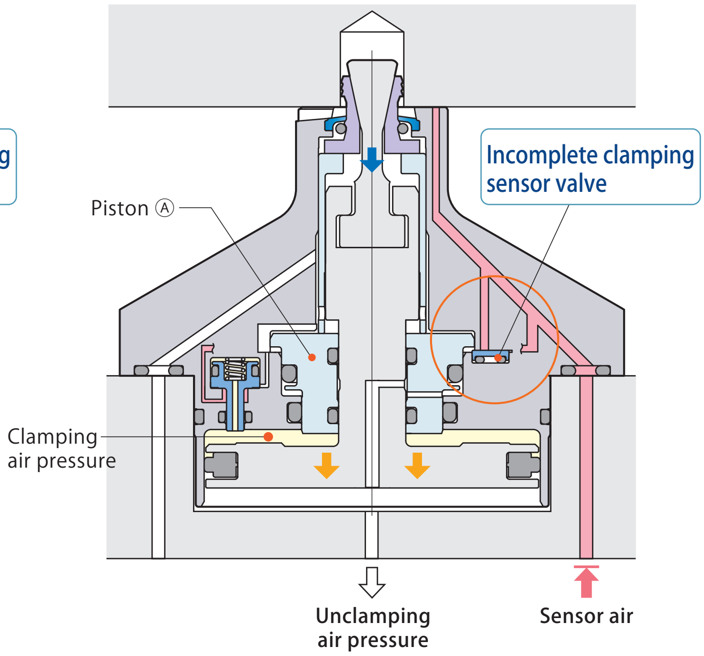
Incomplete clamping

Incomplete clamping sensor valve is opened by piston Ⓐ, sensor air is exhausted. Air sensor is not triggered and this detects incomplete clamping.



Clamping completion

Incomplete clamping sensor valve remains closed. Air sensor detects normal clamping completion.



Clamp condition	Incomplete clamping sensor valve	Air sensor signal	Air pressure switch
Incomplete clamping	Open	Air sensor OFF (Sensor air flows.)	Clamping air pressure ON

Unclamping sensor valve detects unclamping operation is complete

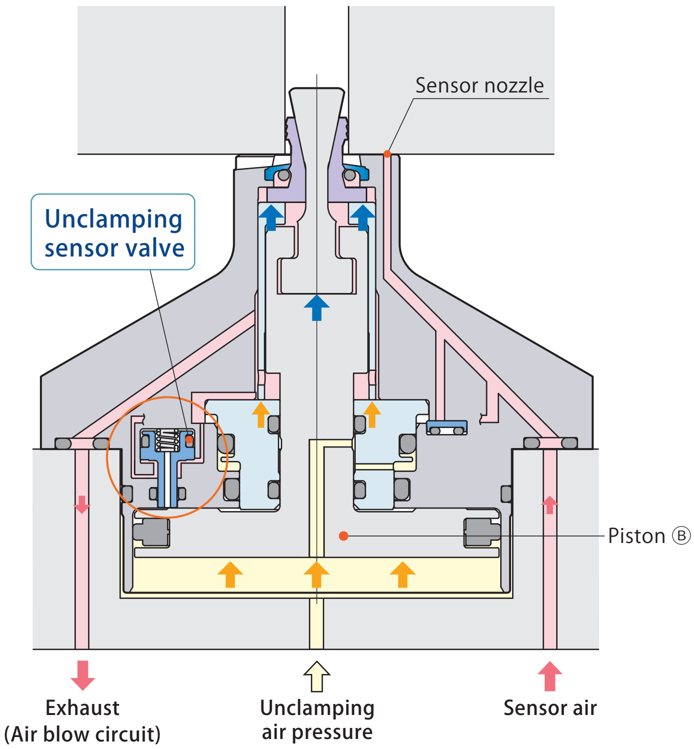
Unclamping sensor valve enables sensor to detect unclamping completion. The valve opens to exhaust sensor air even when the workpiece blocks the sensor nozzle.

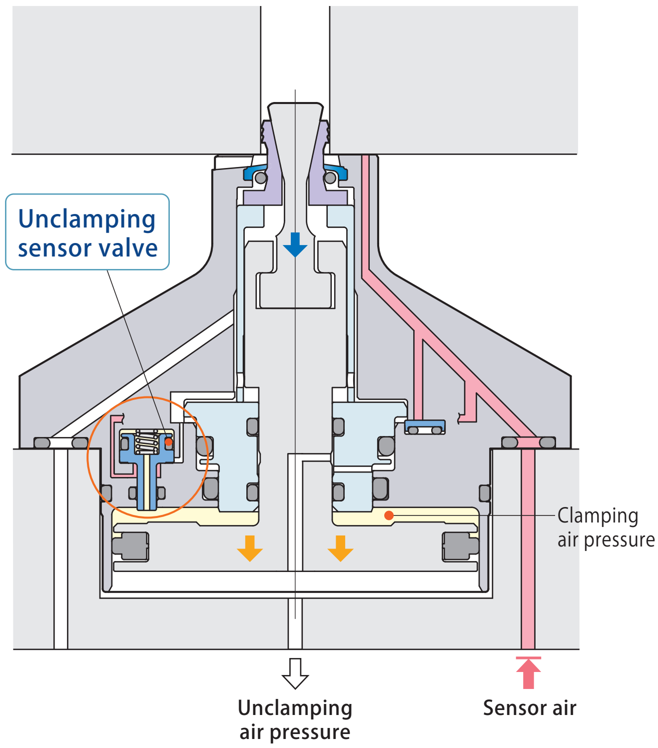
Unclamping completion

Unclamping sensor valve is opened by piston Ⓑ and sensor air is exhausted. Air sensor is not triggered and this detects unclamping completion.

Clamping completion

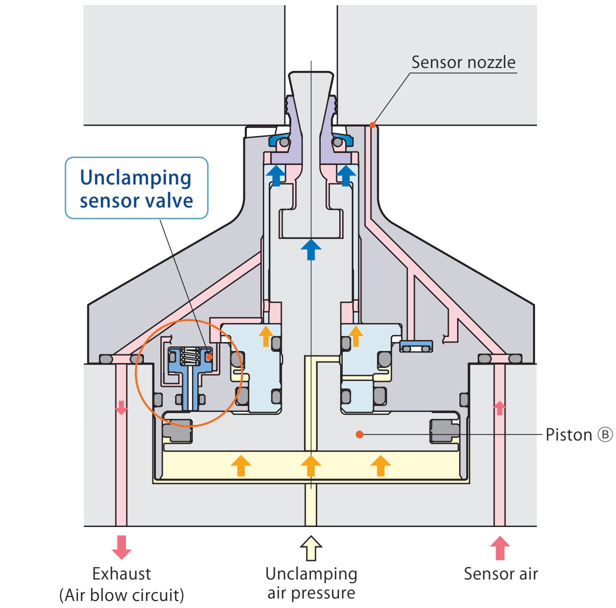
Unclamping sensor valve is closed by clamping air pressure. Air sensor detects normal clamping completion.



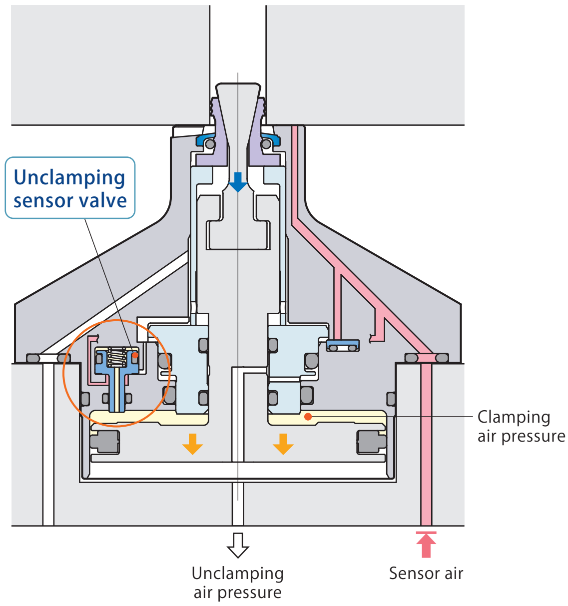


Clamp condition	Unclamping sensor valve	Air sensor signal	Air pressure switch
Unclamping completion	Open	Air sensor OFF (Sensor air flows.)	Unclamping air pressure ON
Clamping completion	Close	Air sensor ON (Sensor air does not flow.)	Clamping air pressure ON

Unclamping completion

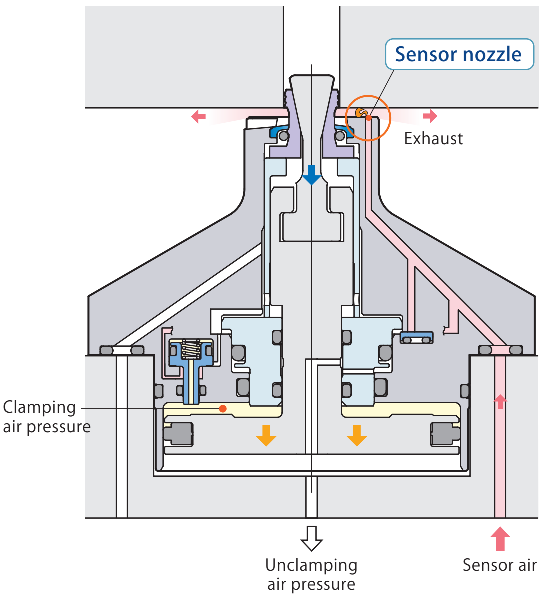


Clamping completion

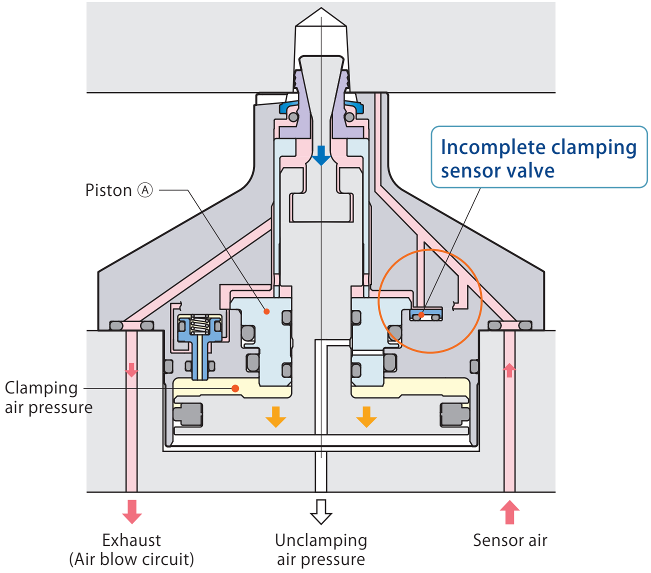


Clamp condition	Sensor nozzle	Incomplete clamping sensor valve	Unclamping sensor valve	Air sensor signal	Air pressure switch
Unclamping completion	Close	Close	Open	Air sensor OFF (Sensor air flows.)	Unclamping air pressure ON
Clamping completion	Close	Close	Close	Air sensor ON (Sensor air does not flow.)	Clamping air pressure ON

Faulty seating of workpiece



Incomplete clamping

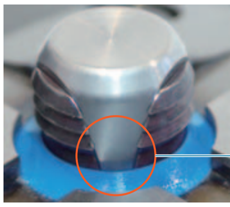


Clamp condition	Sensor nozzle	Incomplete clamping sensor valve	Unclamping sensor valve	Air sensor signal	Air pressure switch
Faulty seating of workpiece	Open	Close	Close	Air sensor OFF (Sensor air flows.)	Clamping air pressure ON
Incomplete clamping	Close	Open	Close	Air sensor OFF (Sensor air flows.)	Clamping air pressure ON

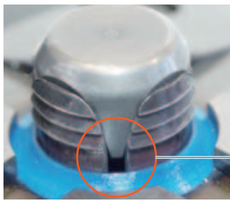
Non-constant air blow model considerably reduces air consumption

PAT. JP5674191
US8800982
EP2543468

The newly developed non-constant air blow model has no open space between a scraper, a gripper and a rod thereby no air blow during machining is required to prevent chips intrusion.
The air blow model (See picture on the right), which requires constant air blow during machining, used to consume constantly 50 L/min (0.3MPa) of air for 12mm of grip inner diameter, however, the new model requires air blow only when the clamp is in clamp and unclamp action, and when workpiece replacement.
This enables significant reduction of air consumption, which helps promote energy conservation.



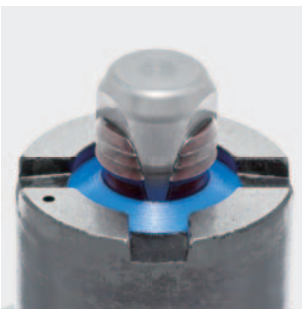
2 Grippers, 3 Grippers
Non-constant air blow model
Open space where metal chips can intrude is removed during clamping.



4 Grippers (Old model)
Air blow model
Open space where metal chips can intrude is created during clamping.

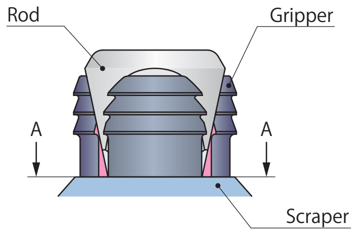
Non-constant air blow model

Number of grippers	Grip inner diameter	Clamping force	Model
2 Grippers	ø 7.0 7.3 7.6 7.9 8.2 ø 8.5 9 10	0.81 kN (Air pressure 0.5MPa)	CGE-N22E Grip inner diameter

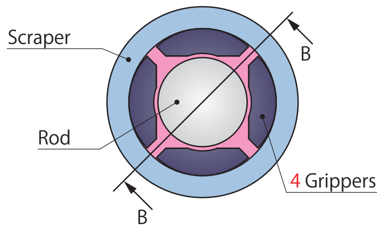


Number of grippers	Grip inner diameter	Clamping force	Model
3 Grippers	ø 11 12 13	0.81 kN (Air pressure 0.5MPa)	CGE-N22E Grip inner diameter

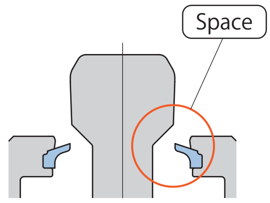
Space where metal chips can intrude is created (Old model)



When clamping



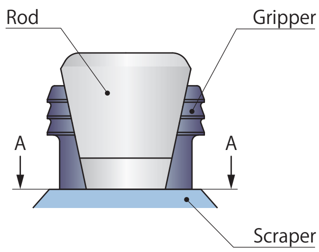
A-A



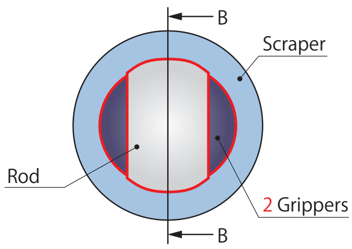
B-B

Because of space between scraper, gripper and the rod, air blow must always be performed to prevent intrusion of chips.

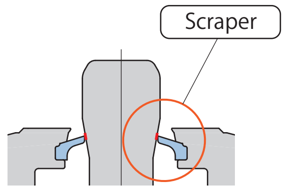
Secure chip protection



When clamping



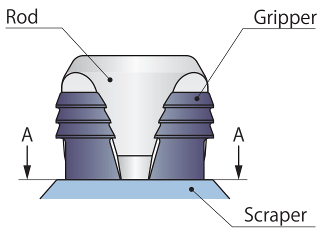
A-A



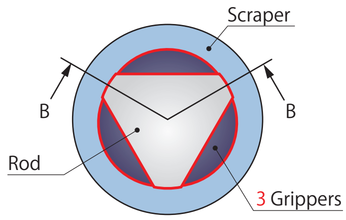
B-B

Pages→546–549

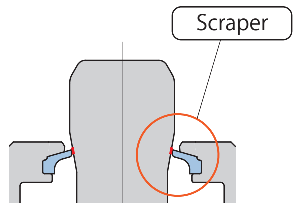
Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.



When clamping



A-A

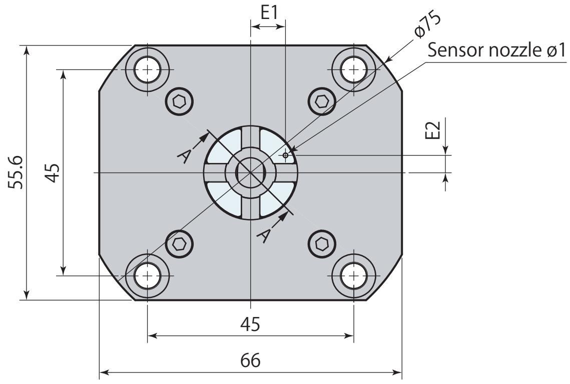


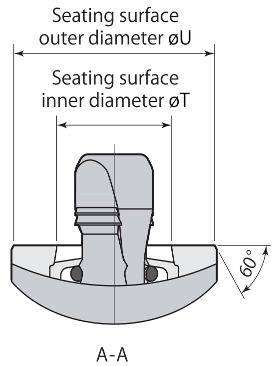
B-B

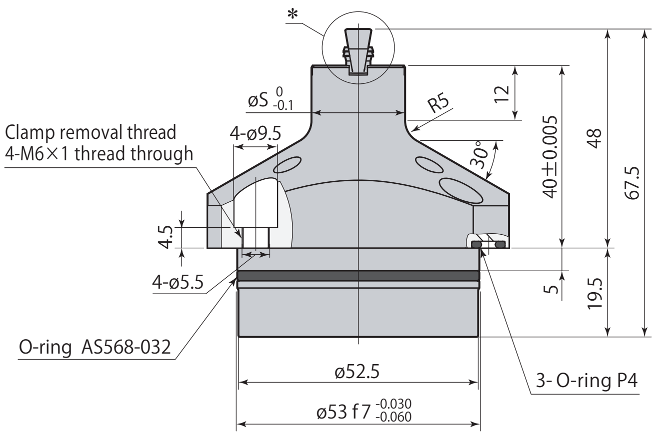
Pages→550, 551

Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.

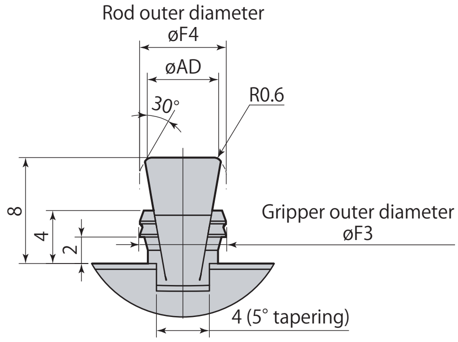
Dimensions





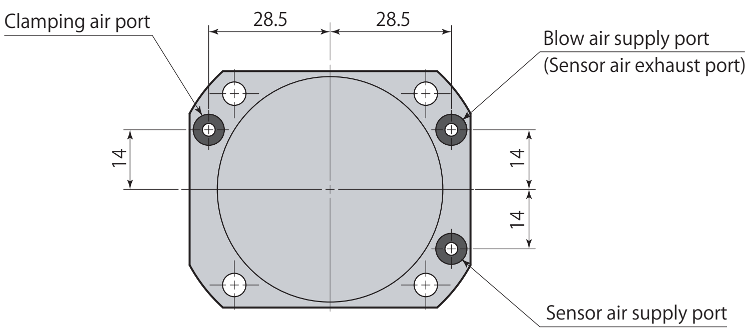


✻Details



Grip inner diameter usage requirements

Blind hole　　Through hole



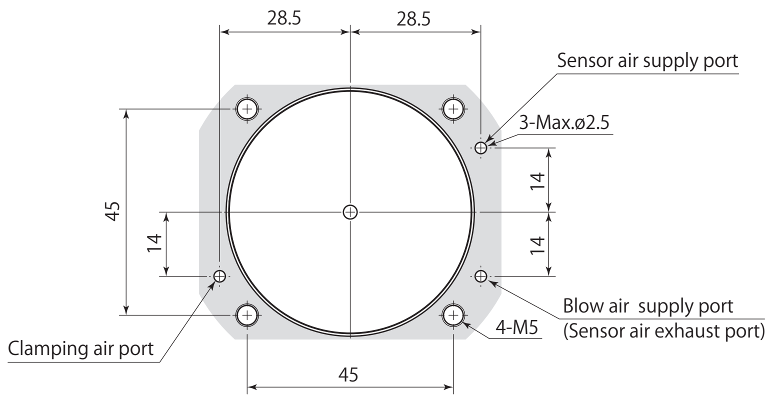
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

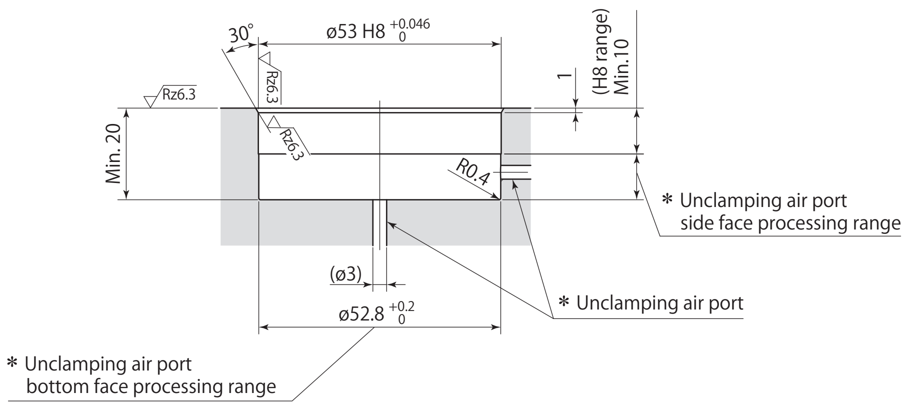
mm

Model	CGE-N22E□				
	070	073	076	079	082
E1	7.6	7.7	7.8	7.9	8.1
E2	3.8	3.8	3.8	3.9	4
øF3	6.5	6.8	7.1	7.4	7.7
øF4	6.55	6.85	7.15	7.45	7.75
øS	20.5	20.6	20.9	21.2	21.5
øT	10.6	10.9	11.2	11.5	11.8
øU	20	20.1	20.4	20.7	21
øAD	5.4	5.7	6	6.3	6.6

- CGE-N22E070, 073, 076, 079, 082 are made to order.

Mounting details



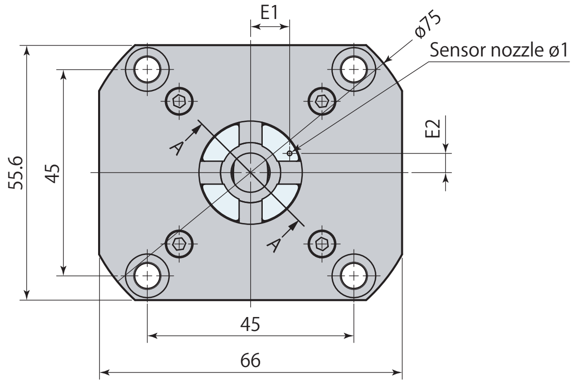


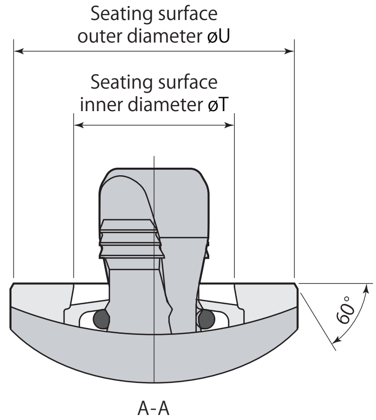
Rz: ISO4287(1997)

*: Unclamping air port must be made on either side or bottom face.

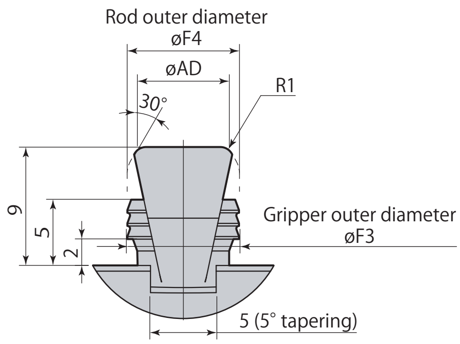
- Apply an appropriate amount of grease to the chamfer and the bore when mounting. Excessive grease may be a blockage in the air passage, causing malfunction of the sensor.
- The 30° taper machining must be provided to avoid the damage of the O-ring.

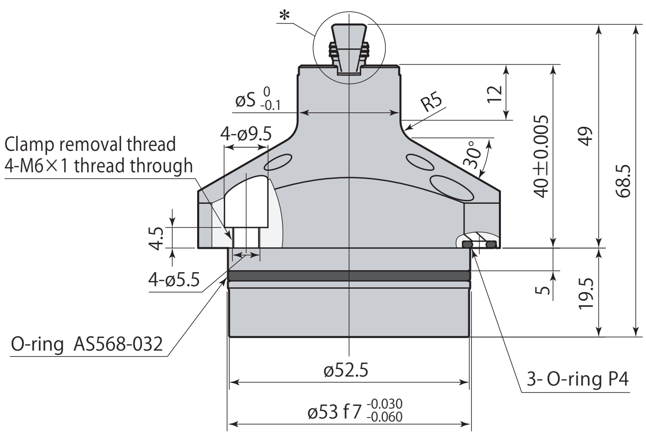
Dimensions



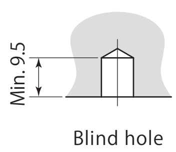


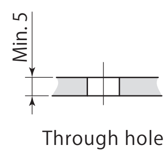
∗Details

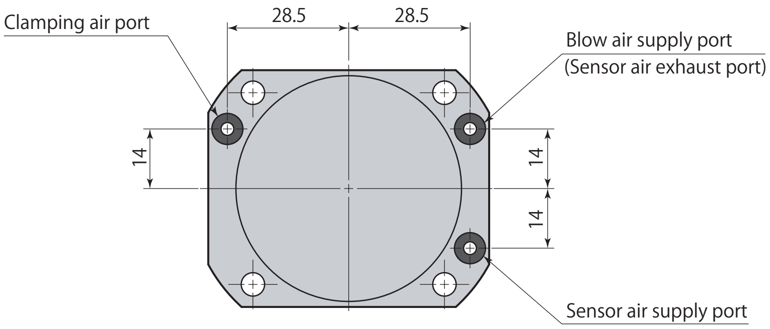




Grip inner diameter usage requirements







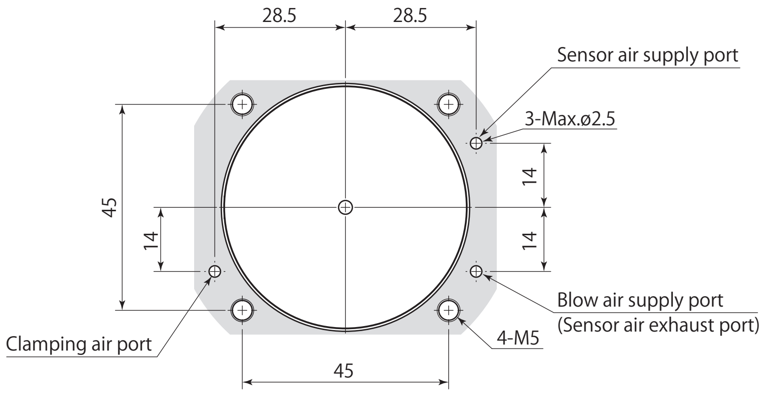
mm

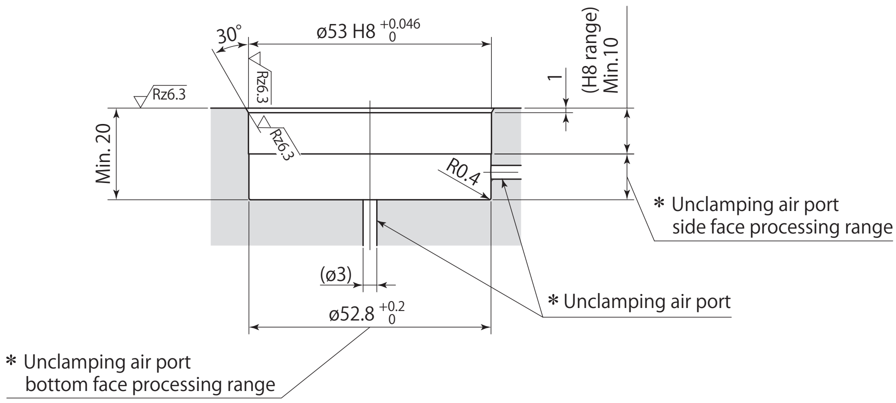
Model	CGE-N22E□		
	085	09	10
E1	8.5	8.5	9
E2	4.2	4.2	4.4
øF3	8	8.5	9.5
øF4	8.05	8.55	9.55
øS	22.5	22.5	23.5
øT	12.1	12.6	13.6
øU	22	22	23
øAD	6.3	6.8	7.8

- CGE-N22E085, 09, 10 are made to order.

- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

Mounting details



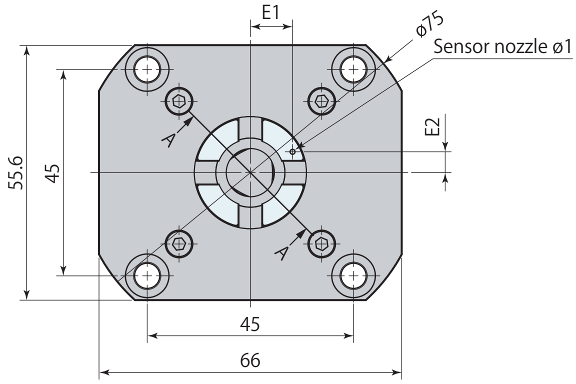


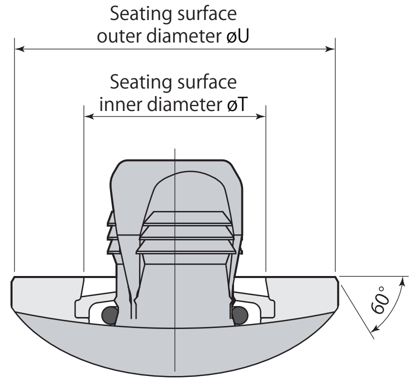
Rz: ISO4287(1997)

*: Unclamping air port must be made on either side or bottom face.

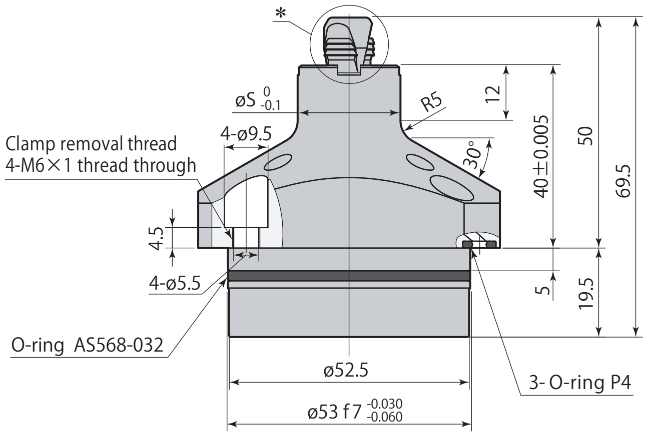
- Apply an appropriate amount of grease to the chamfer and the bore when mounting. Excessive grease may be a blockage in the air passage, causing malfunction of the sensor.
- The 30° taper machining must be provided to avoid the damage of the O-ring.

Dimensions

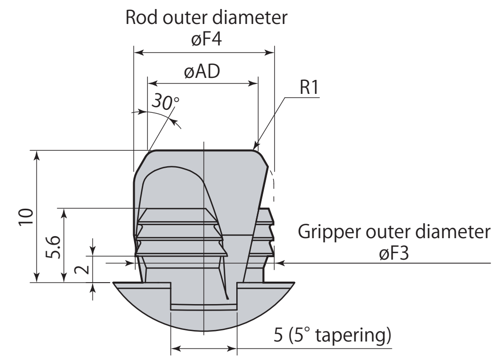




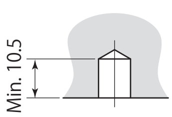
A-A



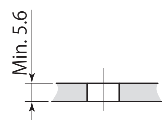
*Details



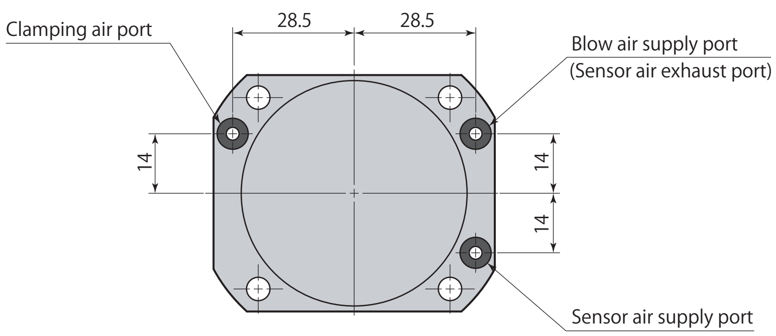
Grip inner diameter usage requirements



Blind hole



Through hole



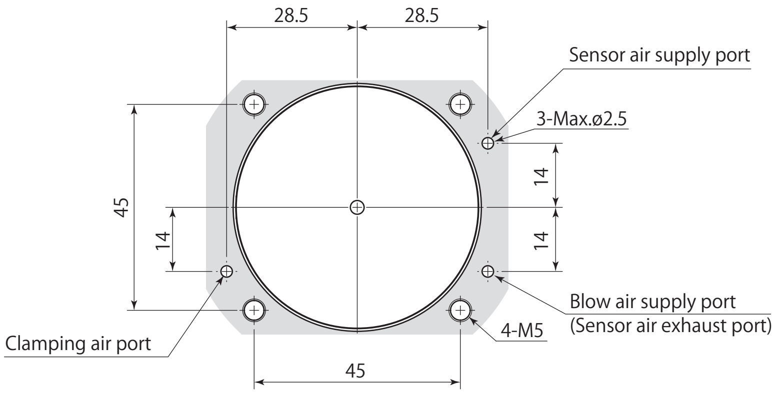
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

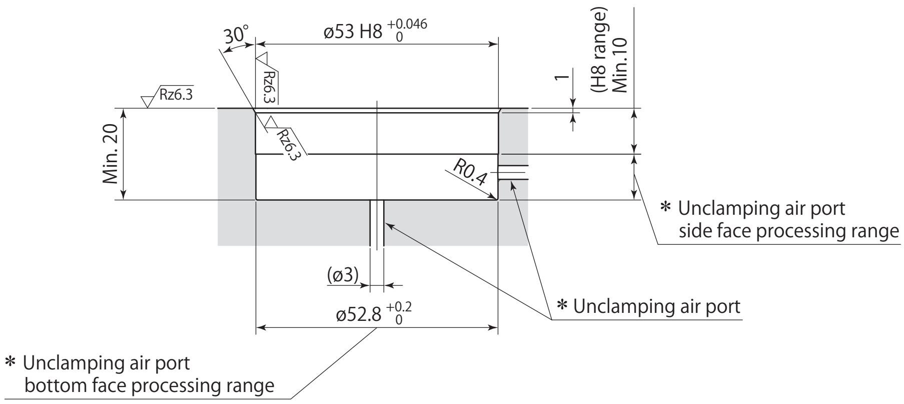
mm

Model	CGE-N22E□		
	11	12	13
E1	9.4	9.9	10.3
E2	4.6	4.8	5.1
øF3	10.5	11.5	12.5
øF4	10.55	11.55	12.55
øS	24.5	25.5	26.5
øT	14.6	15.6	16.6
øU	24	25	26
øAD	8.2	9.2	10.2

- CGE-N22E11, 12, 13 are made to order.

Mounting details



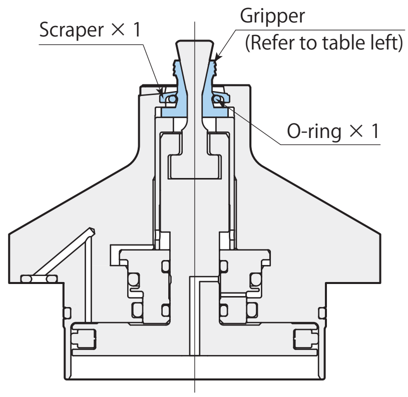


Rz: ISO4287(1997)

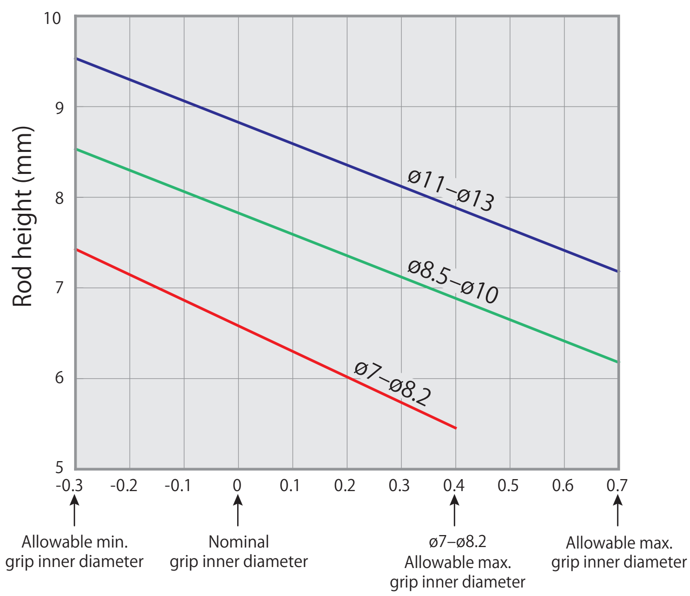
*: Unclamping air port must be made on either side or bottom face.

- 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.

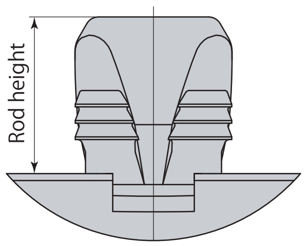
Gripper set replacement

Number of grippers	Gripper set model	Clamp model	Set description
2 Grippers	CGE-N22EJ070	CGE-N22E070	 It is recommended that grippers, scraper and O-ring be replaced after about 200,000 operations. Replace grippers in sets and not just an individual gripper. (Refer to the table on the left for the gripper set model.)
	CGE-N22EJ073	CGE-N22E073	
	CGE-N22EJ076	CGE-N22E076	
	CGE-N22EJ079	CGE-N22E079	
	CGE-N22EJ082	CGE-N22E082	
	CGE-N22EJ085	CGE-N22E085	
	CGE-N22EJ09	CGE-N22E09	
	CGE-N22EJ10	CGE-N22E10	
3 Grippers	CGE-N22EJ11	CGE-N22E11	
	CGE-N22EJ12	CGE-N22E12	
	CGE-N22EJ13	CGE-N22E13	

Grip inner diameter & rod height when clamping



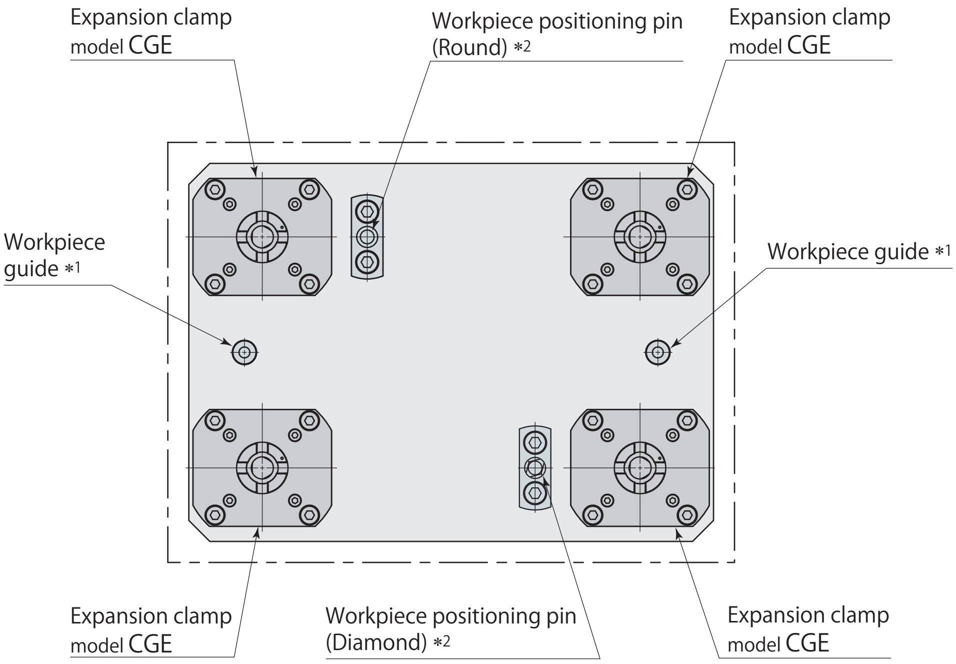
Difference between actual grip inner diameter and nominal grip diameter (mm)

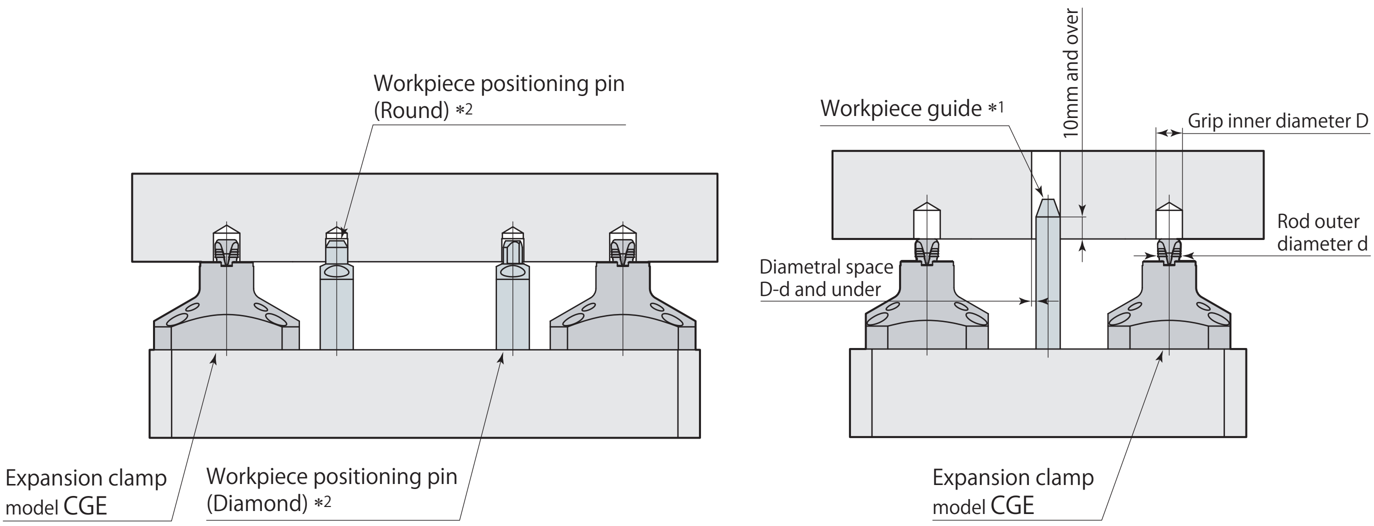


Rod height calculation formula
ø7 – ø8.2 : 6.58-2.84× Actual grip inner diameter and nominal grip diameter difference
ø8.5 – ø10 : 7.82-2.35× Actual grip inner diameter and nominal grip diameter difference
ø11 – ø13 : 8.82-2.35× Actual grip inner diameter and nominal grip diameter difference

Example : When CGE-N22E10 (Nominal grip diameter : ø10) is clamping ø9.8 hole
Rod height = 7.82 - 2.35×(-0.2) = 8.29mm

System configuration example

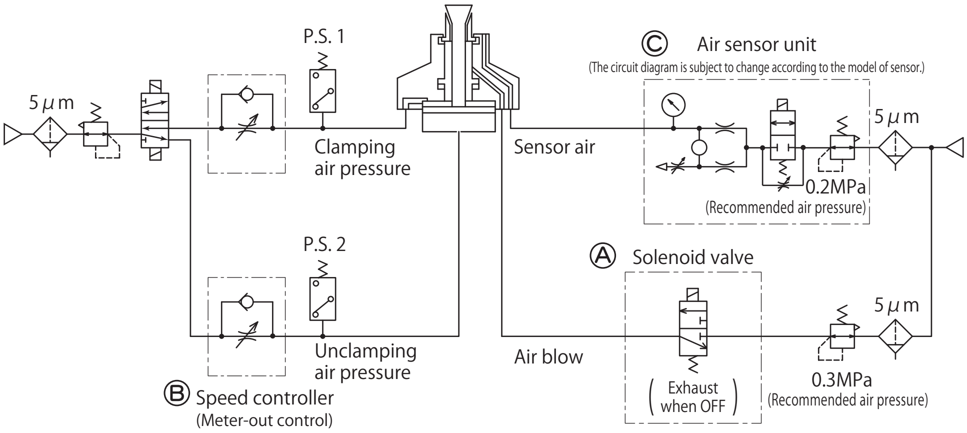




∗1: When using automatic or robotic conveyers, prevent damage to clamp caused from impact by setting workpiece guides. Using the above guide as reference, accurately position the holes when using workpiece guides.

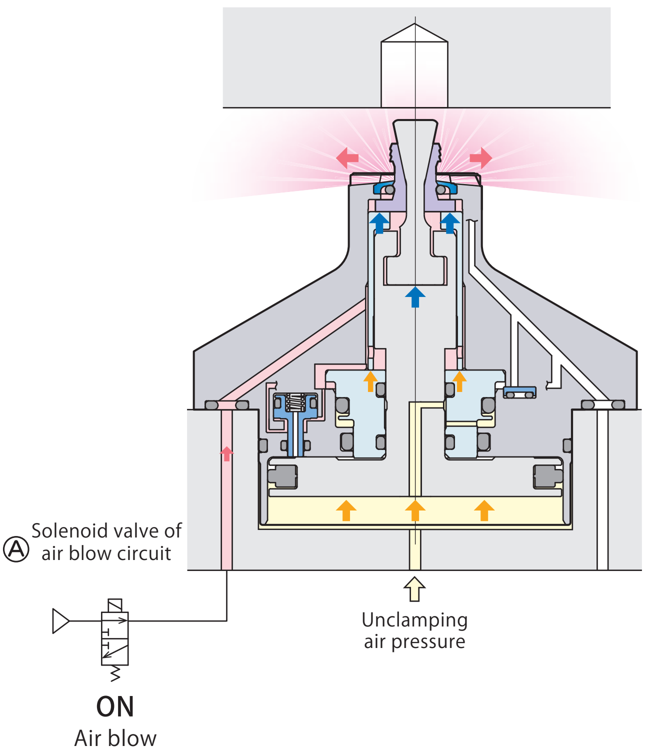
∗2: **The expansion clamp does not have a workpiece positioning function.**
Install workpiece positioning pins (or similar).

Pneumatic circuit diagram

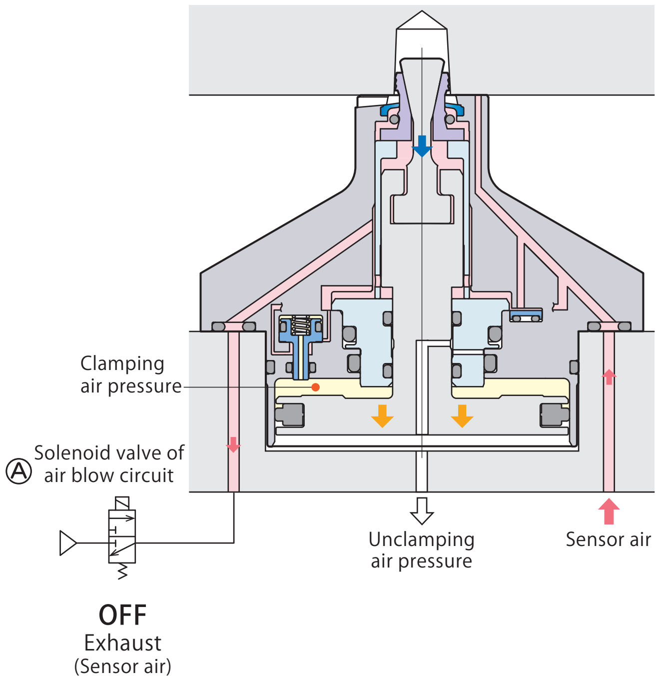


- Air blow will not be necessary during cutting process. Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping to remove metal chips and debris.
- The solenoid valve Ⓐ must be closed when checking the operation of the clamp with the air sensor. Also 3 port type of solenoid valve must be used in the circuit. If 2 port type of the valve is used, sensing air cannot be exhausted and misclamp detection function is disabled.

Air blowing

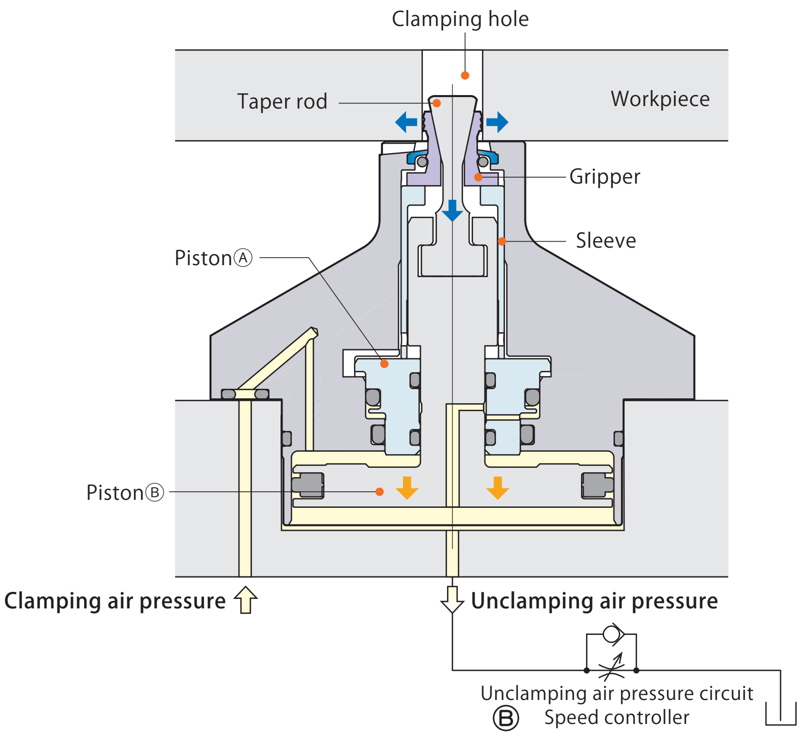


Incomplete clamping



- Operation speed must be adjusted by a meter-out type speed controller Ⓑ being provided in the unclamping circuit. By the adjustment, air flow in unclamping circuit is squeezed and back pressure is generated. The back pressure acts on the piston Ⓐ of the clamp and makes the gripper expand first then the taper rod strokes down to clamp. If meter-in type speed controller is installed in the circuit, it dumps the air rapidly and makes the gripper move very quick which causes incomplete clamping.

- Adjust air flow when clamping to have the taper rod full stroke in 0.3 sec or over.
Excessive air flow to the clamp gives impact load and may cause breakage of the parts.



Air sensor unit Ⓒ 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	0.2 MPa
Inner diameter of piping	ø4 mm (ISA3-F：ø2.5 mm)
Overall piping length	5 m or less

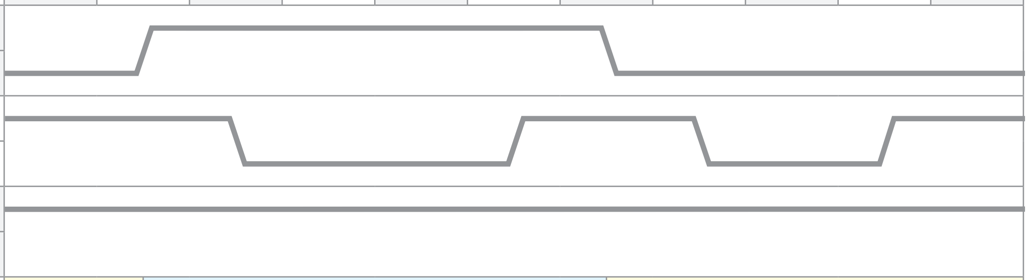
- Use a solenoid valve with needle for air sensor unit Ⓒ and control it supplying air all the time in order to eliminate intrusion of chips or coolant.

- There is a case that air sensing cannot be made successfully as designed when it is used out of the usage shown on the left. Contact Technical service center for more details.

Operation cycle

The clamp should be controlled with the cycle in the diagram shown below to detect the operation status exactly.

State			Workpiece loading	Clamping	Air blow OFF	Clamping completion*1	(Machining)	Air blow ON	Unclamping	Air blow OFF	Unclamping completion*2	Air blow ON	Workpiece unloading
*4	Workpiece clamp	Clamp											
		Unclamp											
	Air blow	ON											
		OFF											
	Sensor air	ON											
		OFF											
*5	Clamping air pressure P.S. 1		OFF	ON						OFF			
	Unclamping air pressure P.S. 2		ON	OFF						ON			
	Air sensor				ON or OFF*3						OFF		



*1 : Clamping completion : P.S. 1=ON P.S. 2=OFF Air sensor=ON
*2 : Unclamping completion : P.S. 1=OFF P.S. 2=ON Air sensor=OFF
*3 : ON : Complete clamping OFF : Incomplete clamping
*4 : Solenoid valve control *5 : Air pressure switch, Air sensor signal

Caution in use

- Be sure to make inner diameter of air blow circuit 4 mm and over except for clamp mounting surface.

- Set the workpiece in such a way that the clamping hole of workpiece is perpendicular to seating surface. Clamping in tilted condition results in uneven contact of gripper with hole, which leads to concentration of load that may cause damage.

- Verify that there are no metal chips or debris on seating surface of clamping hole and clamp body before setting workpiece. Allowing intrusion of metal chips results in insecure clamping, which can lead to low grade of machining accuracy.

- Flaring (Biting) of gripper into workpiece varies depending on workpiece material or thermal processing conditions. With regards to conditions of workpiece and clamping hole, refer to **page →535**. Secure clamping is not possible when workpiece or clamping hole that does not satisfy these conditions is used.

- If clamping hole serves as taper hole (cast draft hole with gradient), then perform test clamping using applicable workpiece beforehand to verify that there are no problems with operations.

- Deformation may occur if the thickness of clamping hole section of workpiece is extremely thin. Use applicable workpiece to perform test clamping beforehand to verify that there are no deformations in thin portion.

- Supply the dry and filtered air. Particulate size 5 μm or less is recommended.

- Measure seating surface flatness with air pressure applied on clamping side, or by applying air pressure on neither clamping nor unclamping side.

- Set detection range of air sensor to 0.05 mm and under from seating surface. Insert a feeler gauge between workpiece and seating surface to create detection distance in order to perform setting accurately. Refer to instruction manual of air sensor for details on setting methods.

- Perform unclamping completion detection, clamping completion detection and incomplete clamping detection with combination actions of pressure switch and sensor shown in table below. (Refer to the pneumatic circuit diagram on **page →554** for details.)

Applications	Pressure switch 1 (P.S. 1)	Pressure switch 2 (P.S. 2)	Air sensor
Unclamping completion detection	OFF	ON	OFF
Clamping completion detection	ON	OFF	ON
Incomplete clamping detection	ON	OFF	OFF

air Expansion clamp

Double acting 1MPa

model CGY

Specifications

CGY — F22

Grip inner diameter : Number of grippers

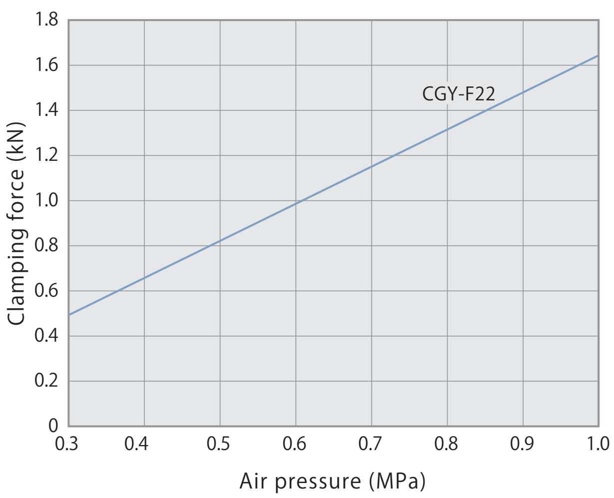
	Grip inner diameter	Number of grippers
— : Air blow model	055 058 061 064 067 070A	: 2 Grippers
E : Non-constant air blow model	070 073 076 079 082	: 2 Grippers
	085 09 10	: 2 Grippers
	11 12 13	: 3 Grippers

■ indicates made to order.

Model		Size	CGY-F22-						CGY-F22E											
		Grip inner diameter	055	058	061	064	067	070A	070	073	076	079	082	085	09	10	11	12	13
Number of grippers			2 Grippers														3 Grippers		
Clamping force (air pressure 0.5MPa)		kN	0.81																
Radial expansion force (air pressure 0.5MPa)		kN	2.52						2.81					2.52					
Taper rod stroke		mm	4.0						4.8										
Clamp stroke		mm	1.2																
Cylinder capacity	Clamp	cm^3	7.2						8.7										
	Unclamp	cm^3	8.1						9.7										
Allowable eccentricity*1		mm	±0.3						±0.4										
Recommended air blow pressure		MPa	0.3																
Recommended sensor air pressure		MPa	0.2																
Mass		kg	0.61						0.65					0.67			0.68		
Recommended tightening torque of mounting screws*2		N·m	7																
Workpiece material			Aluminum, steel and others (HRC25 or below). Cast iron are not usable.																
Allowable min. grip inner diameter		mm	5.2	5.5	5.8	6.1	6.4	6.7	6.7	7.0	7.3	7.6	7.9	8.2	8.7	9.7	10.7	11.7	12.7
Allowable max. grip inner diameter		mm	5.8	6.1	6.4	6.7	7.0	7.3	7.4	7.7	8.0	8.3	8.6	9.2	9.7	10.7	11.7	12.7	13.7
Grip inner diameter tapering angle (Draft angle)			3° or below																
Grip inner diameter circularity			0.1 or below																

● Pressure range：0.3–1 MPa (CGY-F22-055, 058, 061, 064, 067, 070A：0.3–0.8 MPa)
● Proof pressure：1.5 MPa (CGY-F22-055, 058, 061, 064, 067, 070A：1.2 MPa) ● Operating temperature：0–70 ℃ ● Fluid used：air
● Please inquire if above terms are not applied.
∗1：By the eccentric mechanism, the expansion clamp does not have a workpiece positioning function. ∗2：ISO R898 class 12.9

Clamping force & air pressure



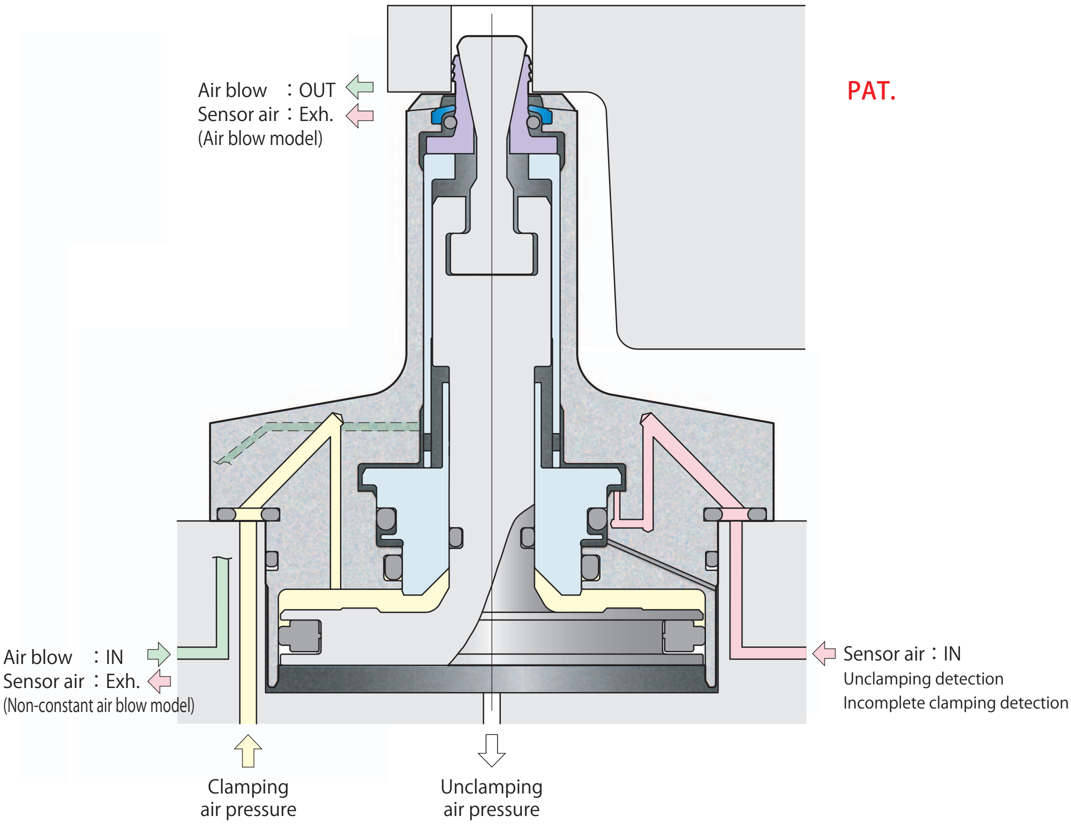
Air pressure	MPa	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Clamping force F=1.617×P	kN	0.49	0.65	0.81	0.97	1.13	1.29	1.46	1.62

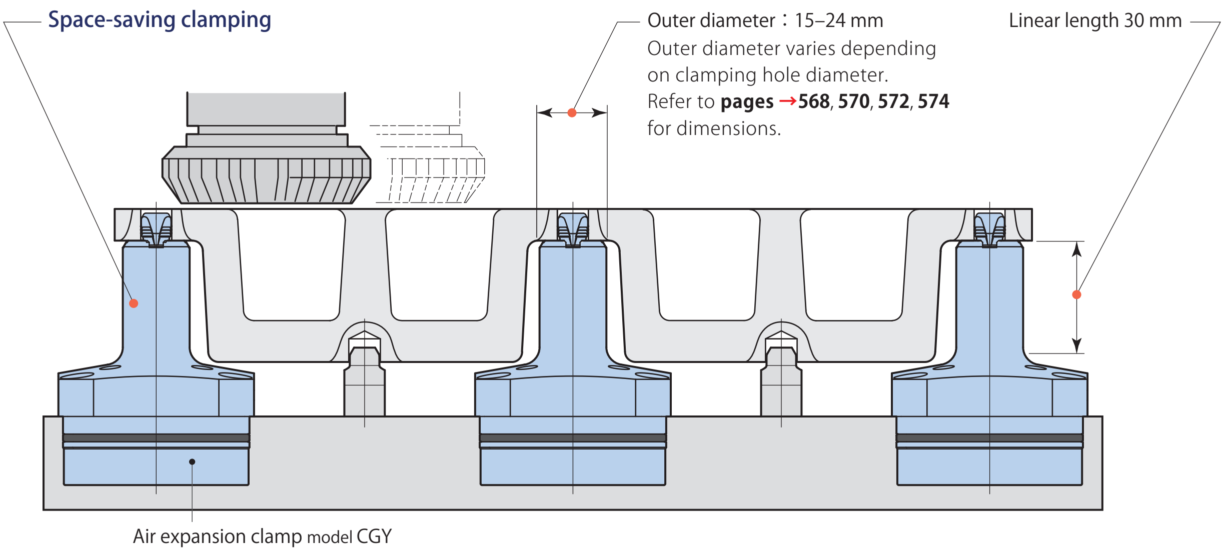
P：Air pressure (MPa)

● CGY-F22-055, 058, 061, 064, 067, 070A applicable air pressure should be 0.3 to 0.8 MPa.

Air blow model	Non-constant air blow model	Non-constant air blow model	
model **CGY-F22-**	model **CGY-F22E**	model **CGY-F22E**	
2 Grippers	2 Grippers	2 Grippers	3 Grippers
ø5.5 5.8 6.1 6.4 6.7 7.0	ø7.0 7.3 7.6 7.9 8.2	ø8.5 9 10	ø11 12 13





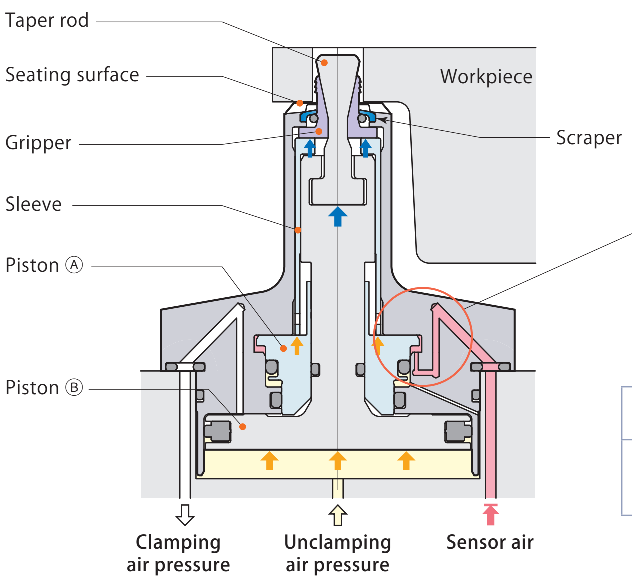


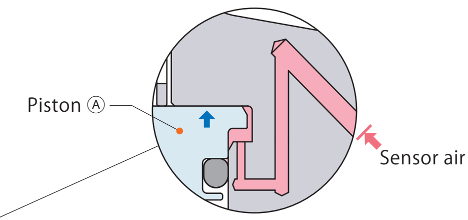
Workpiece setting (Unclamping completion)

① Pistons Ⓐ & Ⓑ, as well as taper rod and gripper are raised by unclamping air pressure.

② Workpiece unclamping is completed by the sensor air, clamping and unclamping air pressure.

③ Set the workpiece onto the seating surface.





Unclamping completion

Piston Ⓐ blocks air flow channel to shut air and triggers sensor.

Clamp condition	Air sensor signal	Air pressure switch
Unclamping completion	Air sensor ON (Sensor air does not flow.)	Unclamping air pressure ON

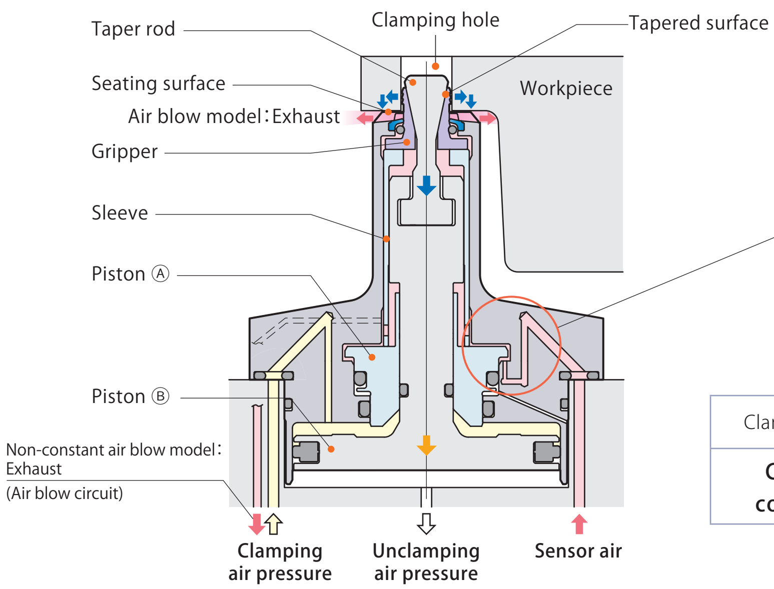
Workpiece holding (Clamping completion)

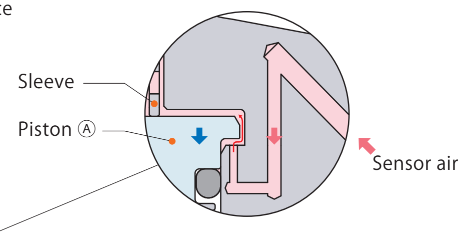
① Piston Ⓑ and taper rod are lowered by clamping air pressure after releasing unclamping air pressure.

② The gripper expands horizontally along the tapered surface to grip inner face of clamping hole.

③ The gripper securely grips the inner face of clamping hole and pulls the workpiece down firmly onto the seating surface.

④ Workpiece holding is completed by the sensor air, clamping and unclamping air pressure.





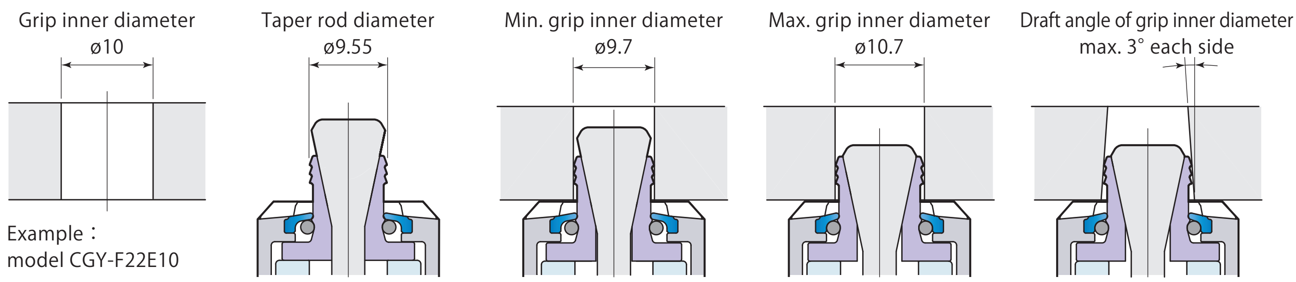
Clamping completion

Sleeve pushes down piston Ⓐ, air flows and sensor is not triggered.

Clamp condition	Air sensor signal	Air pressure switch
Clamping completion	Air sensor OFF (Sensor air flows.)	Clamping air pressure ON

Large gripper expansion stroke

The gripper expands horizontally 1.0mm(∗), which enables the accommodation of dimensional variations in diecast bore diameters and ensures workpiece is held securely.



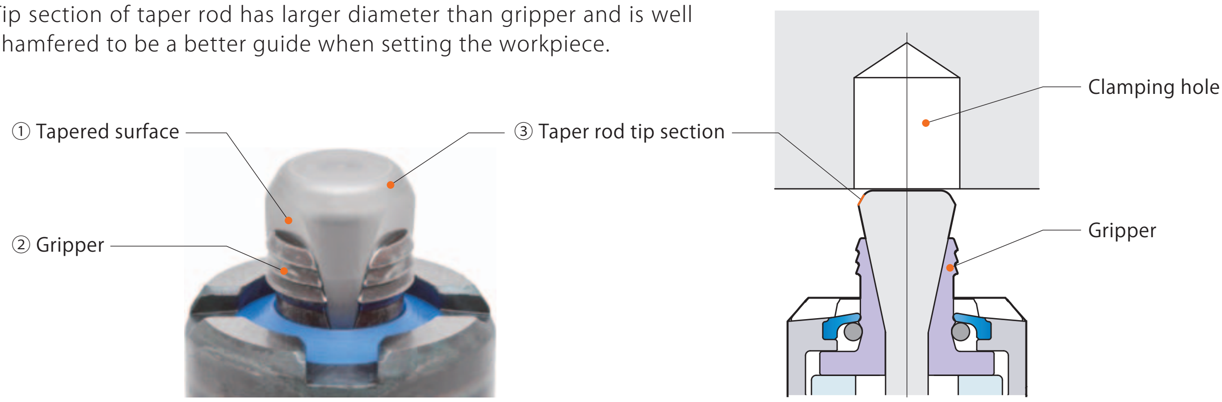
∗：0.6mm stroke for CGY-F22-055, 058, 061, 064, 067, 070A. 0.7mm stroke for CGY-F22E070, 073, 076, 079, 082.

Taper rod and gripper with superior durability

① The holding force of expansion clamp is transmitted from tapered surface to gripper, making it possible for the gripper to hold onto inner face of clamping hole and hold the workpiece on the seating surface for secure workpiece clamping.

② Special steel with superior abrasion resistance is used for gripper to improve durability.

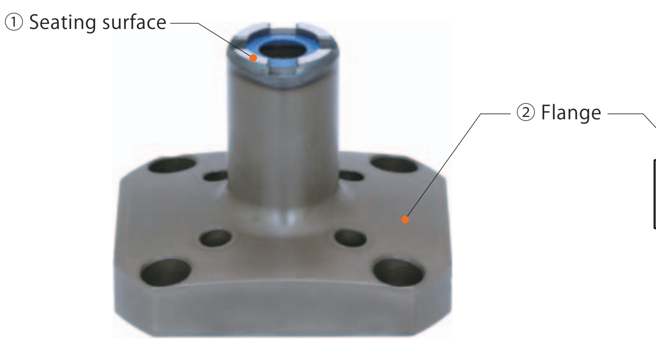
③ Tip section of taper rod has larger diameter than gripper and is well chamfered to be a better guide when setting the workpiece.

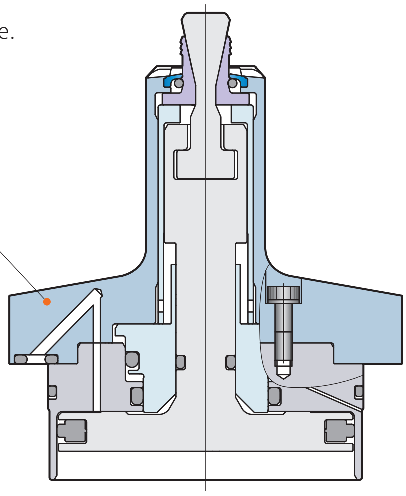


Seating surface can be reground (Max. 0.1 mm)

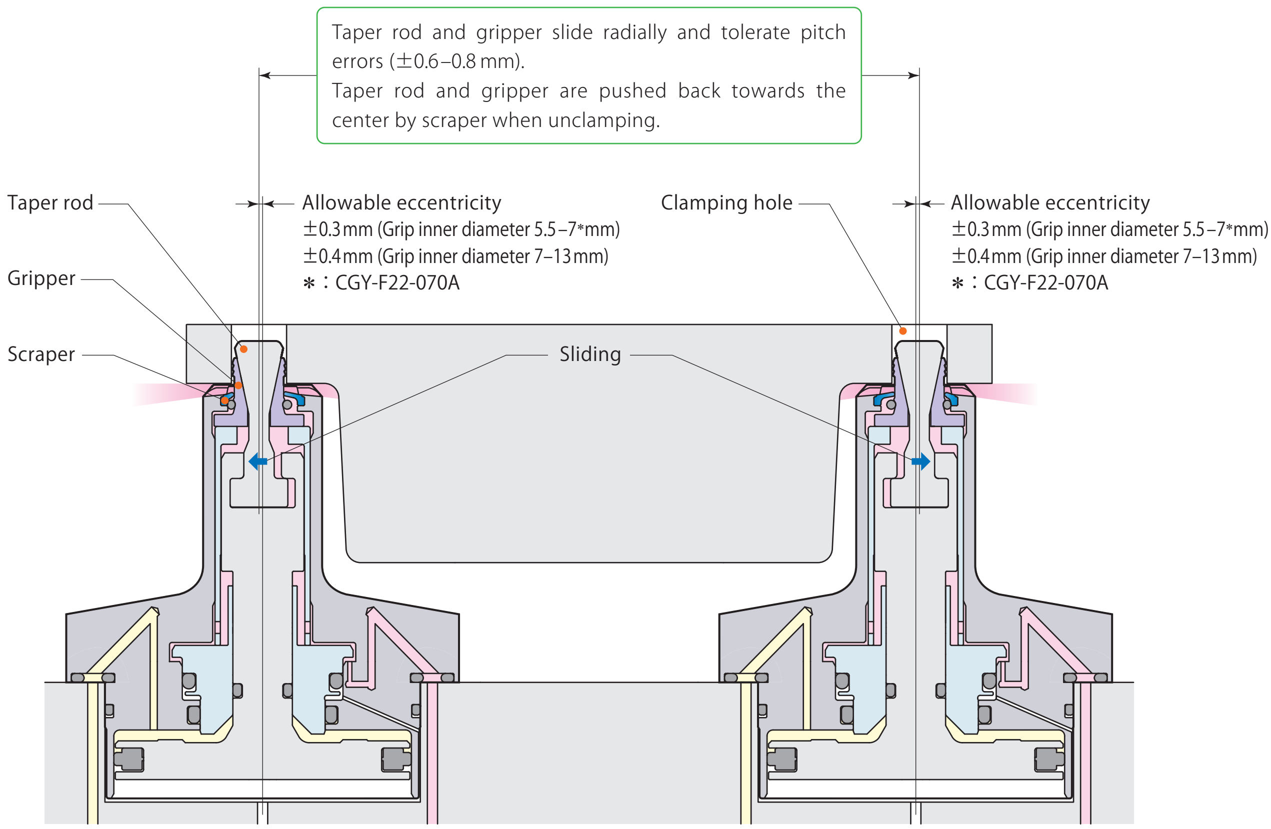
① When seating surface is damaged, the flange section can be dismounted and reground.

② Flange can be easily dismounted and reassembled at production site.





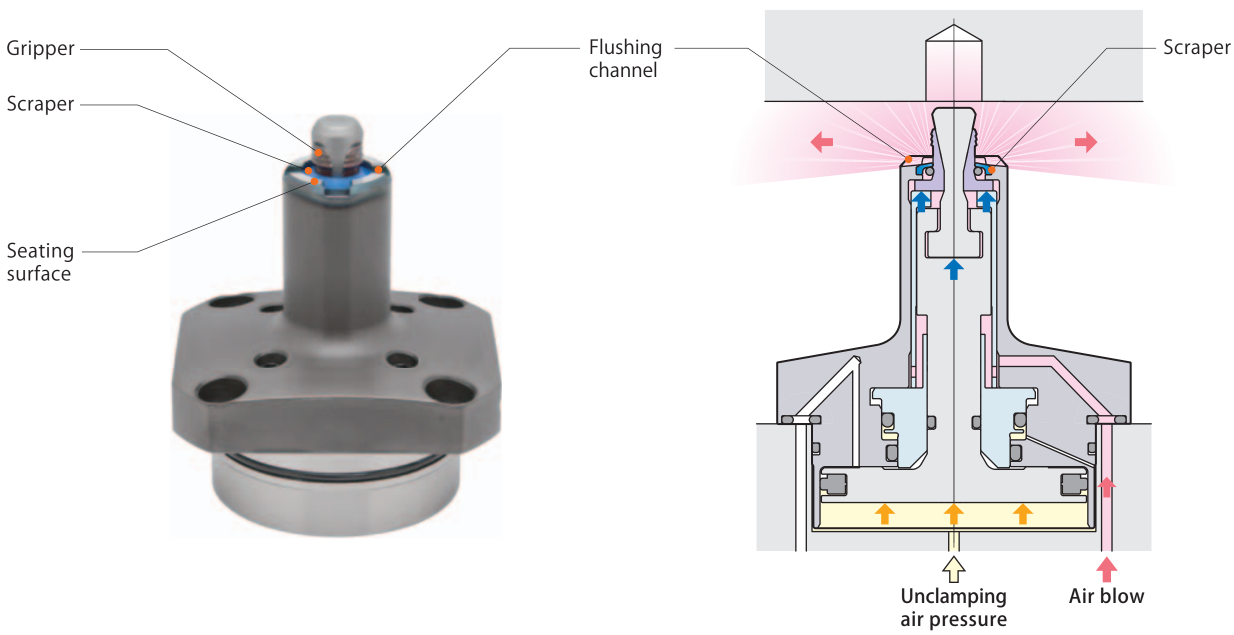
Clamping hole pitch errors can be tolerated



By the eccentric mechanism, the expansion clamp does not have a workpiece positioning function.

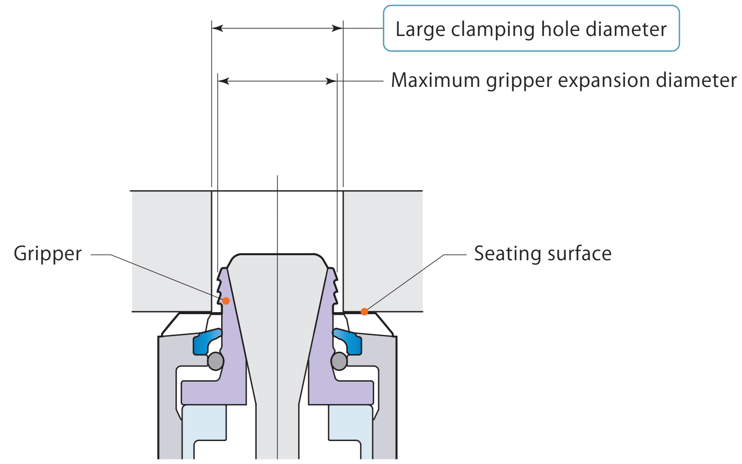
Incorporating strong air blowing circuit

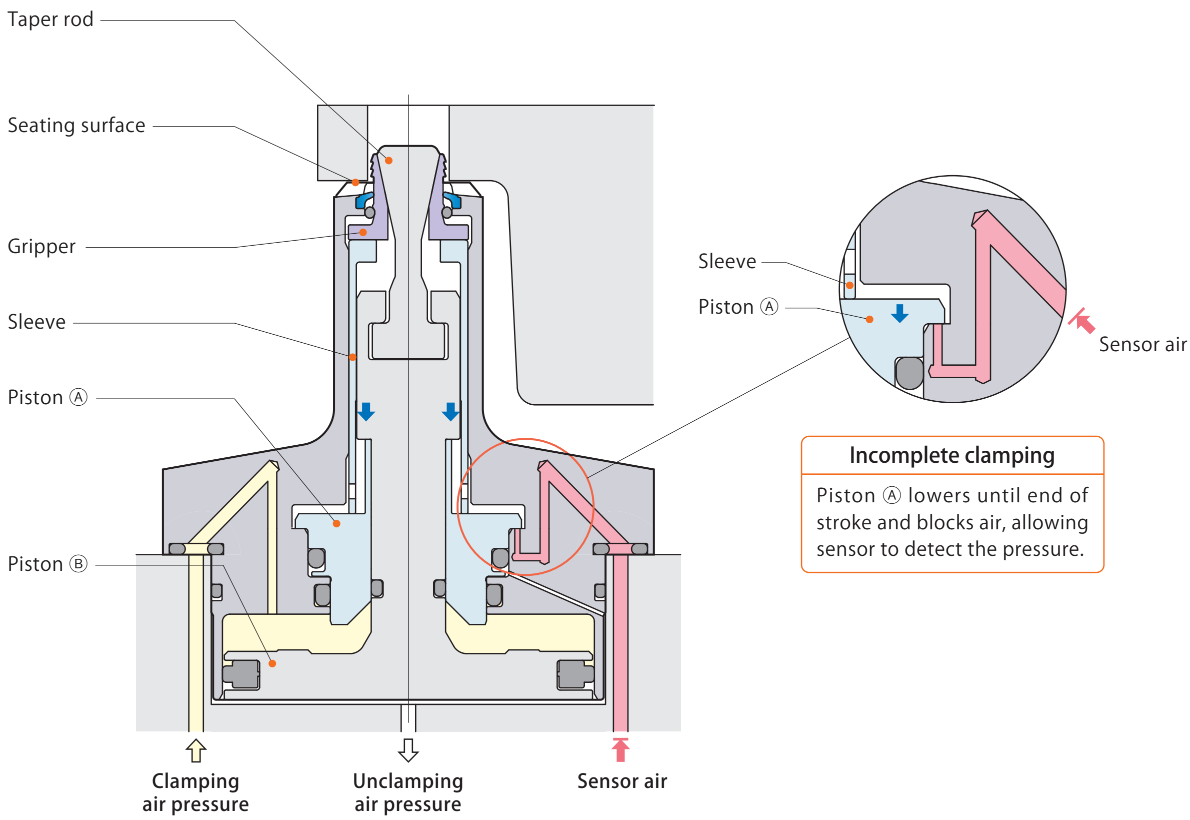
Air blow from a gap between the gripper and scraper clears off metal chips and coolant that stay on the seating surface. Flushing channel is also provided on the seating surface to remove the metal chips and coolants smoothly during workpiece setting.



Detects clamping hole diameter that is too large

When the inner diameter of clamping hole exceeds tolerance value, then gripper will fail to gain grip on workpiece even when extended to maximum reach. Piston Ⓐ lowers until end of stroke as it is pushed down by piston Ⓑ and blocks sensor air, which triggers air sensor and detects incomplete clamping.

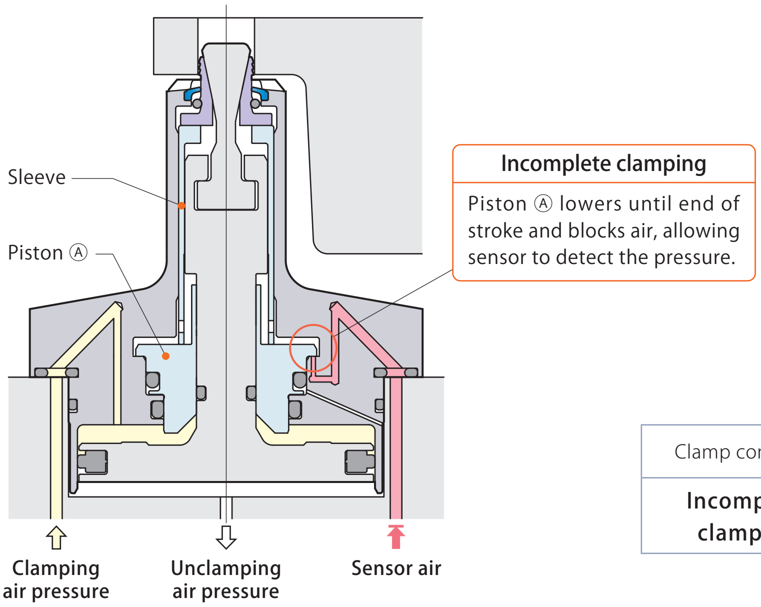


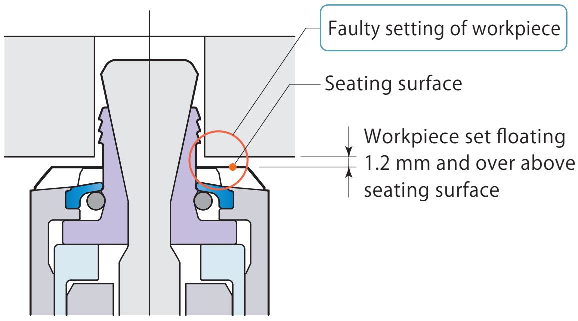


Clamp condition	Air sensor signal	Air pressure switch
Incomplete clamping	Air sensor ON (Sensor air does not flow.)	Clamping air pressure ON

Detects deformation of workpiece and floating of workpiece

When workpiece has significant deformation or when it is set poorly with gap of 1.2 mm above seating surface, then even when the gripper lowers until end of stroke, the workpiece is not held on seating surface. At this time, piston Ⓐ lowers until end of stroke as it is pushed down by sleeve and blocks sensor air, which triggers air sensor and detects incomplete clamping.

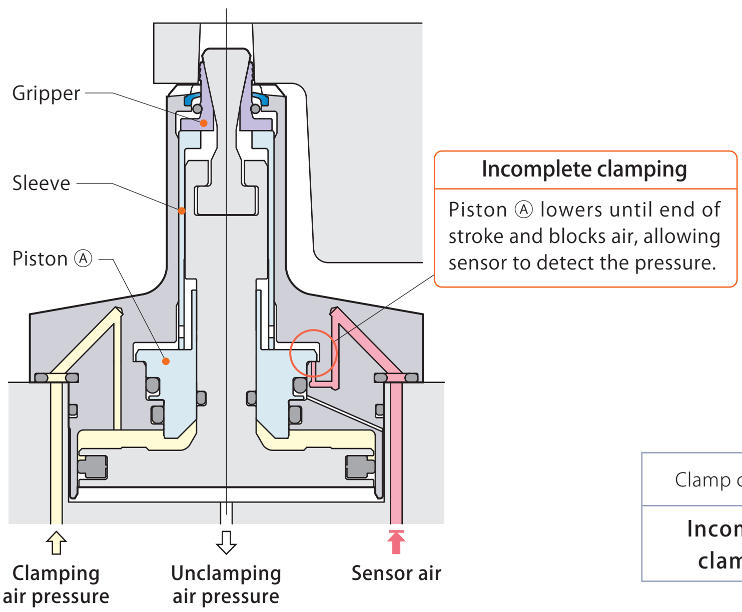


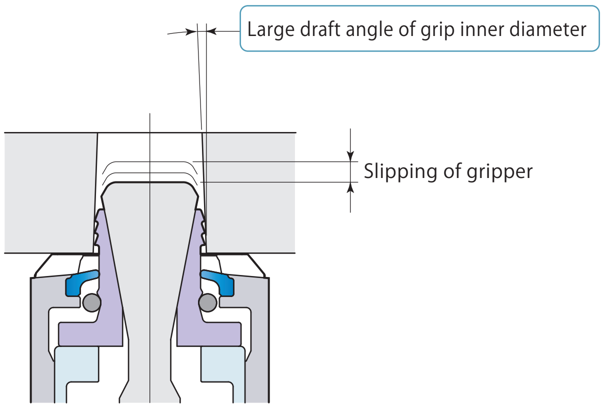


Clamp condition	Air sensor signal	Air pressure switch
Incomplete clamping	Air sensor ON (Sensor air does not flow.)	Clamping air pressure ON

Detects incomplete gripping

When the inner diameter of clamping hole is slightly larger than allowable value, or when the draft angle of grip inner diameter is large and results in incomplete gripping by the gripper, piston Ⓐ lowers until end of stroke as sleeve pushes it down and sensor air is blocked, which triggers air sensor and detects incomplete clamping.





Clamp condition	Air sensor signal	Air pressure switch
Incomplete clamping	Air sensor ON (Sensor air does not flow.)	Clamping air pressure ON

With the development of the non-constant air blow expansion clamp, air consumption will be significantly decreased.
The traditional model ordinarily requires 50L/min (0.3MPa) flow rate (when grip inner diameter is ø12). The new model can reduce

Air blow model

Number of grippers	Grip inner diameter	Clamping force	Model
2 Grippers	ø 5.5 5.8 6.1 6.4 6.7 7.0	0.81 kN (Air pressure 0.5MPa)	CGY-F22-Grip inner diameter

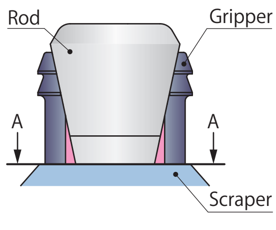
Non-constant air blow model

Number of grippers	Grip inner diameter	Clamping force	Model
2 Grippers	ø 7.0 7.3 7.6 7.9 8.2	0.81 kN (Air pressure 0.5MPa)	CGY-F22E Grip inner diameter
	ø 8.5 9 10	0.81 kN (Air pressure 0.5MPa)	CGY-F22E Grip inner diameter

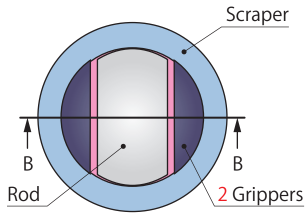
Number of grippers	Grip inner diameter	Clamping force	Model
3 Grippers	ø 11 12 13	0.81 kN (Air pressure 0.5MPa)	CGY-F22E Grip inner diameter

air consumption and help promote energy conservation. However air blow at time of workpiece replacement is a must.

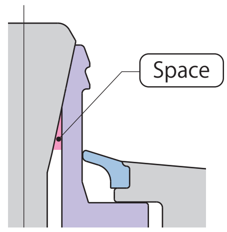
Space where metal chips can intrude is created



When clamping



A-A

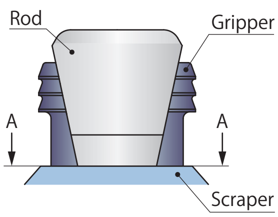


B-B

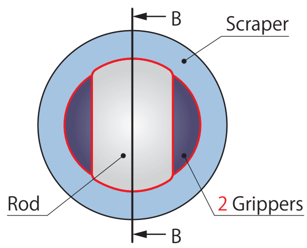
Pages→568, 569

Because of space between scraper, gripper and the rod, air blow must always be performed to prevent intrusion of chips.

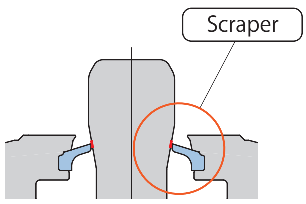
Secure chip protection



When clamping



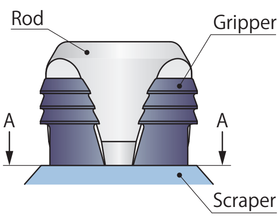
A-A



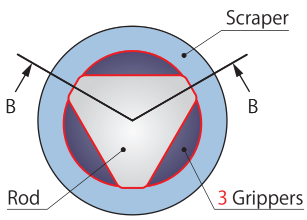
B-B

Pages→570–573

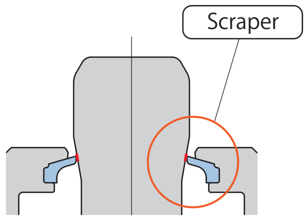
Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.



When clamping



A-A

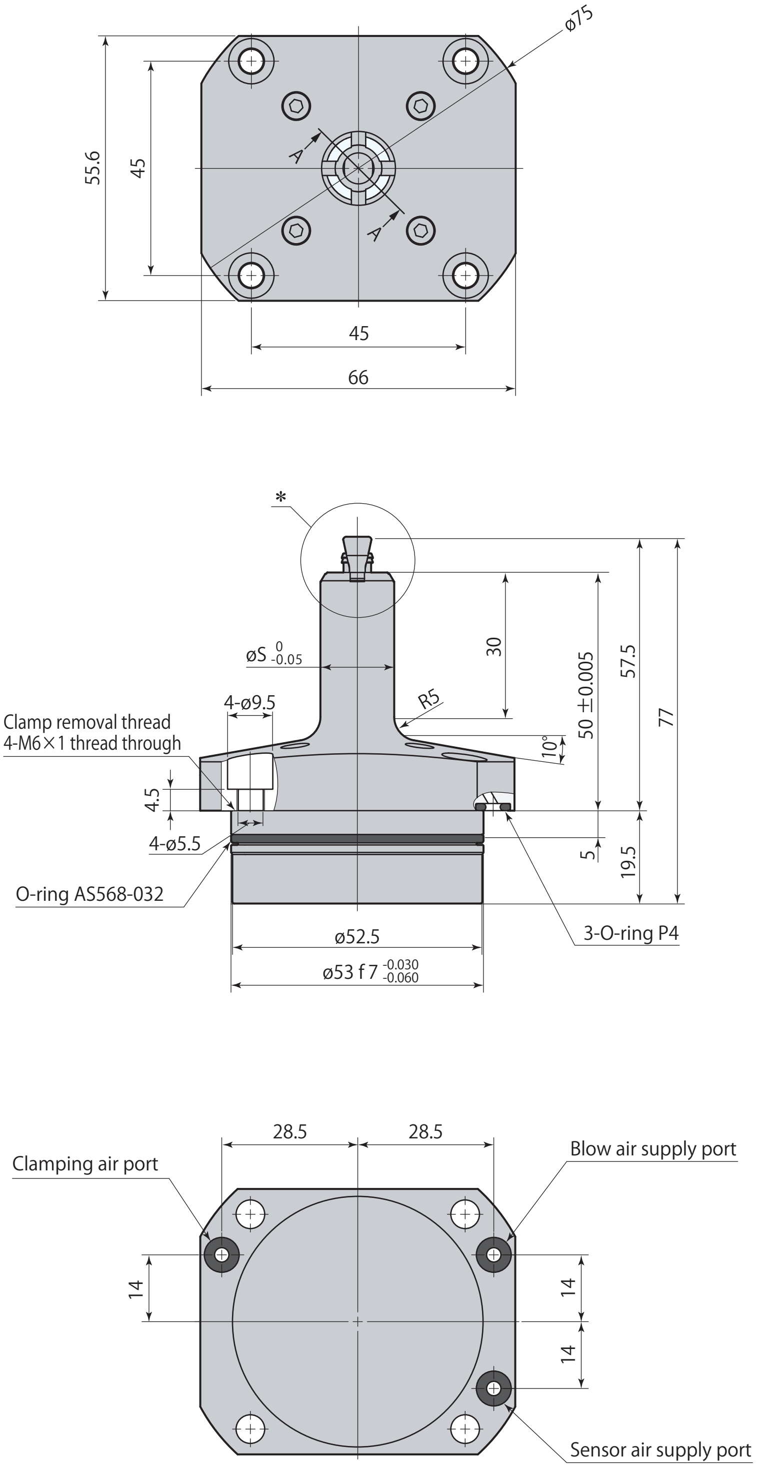


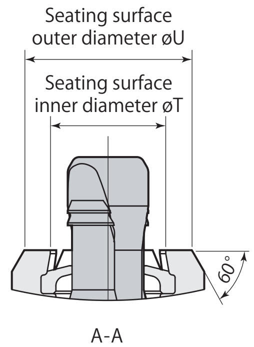
B-B

Pages→574, 575

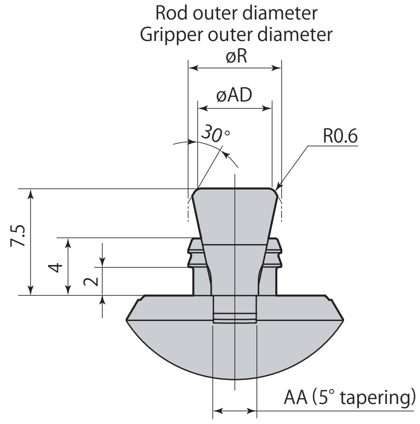
Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.

Dimensions

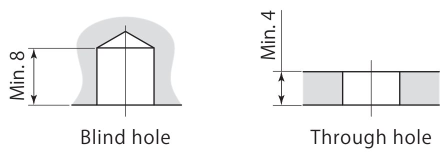




*Details



Grip inner diameter usage requirements



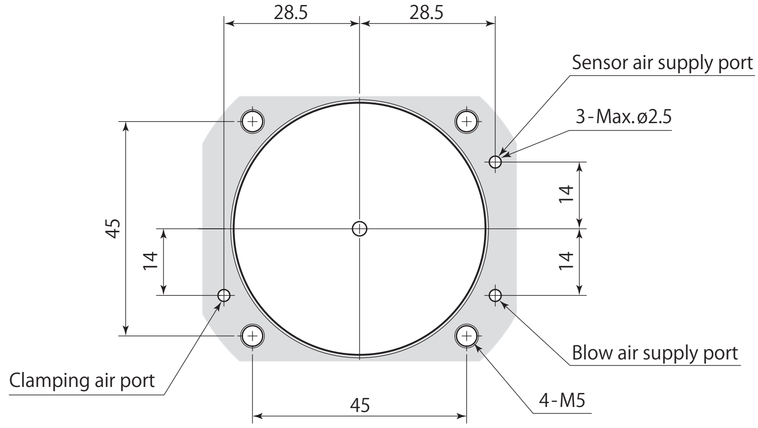
mm

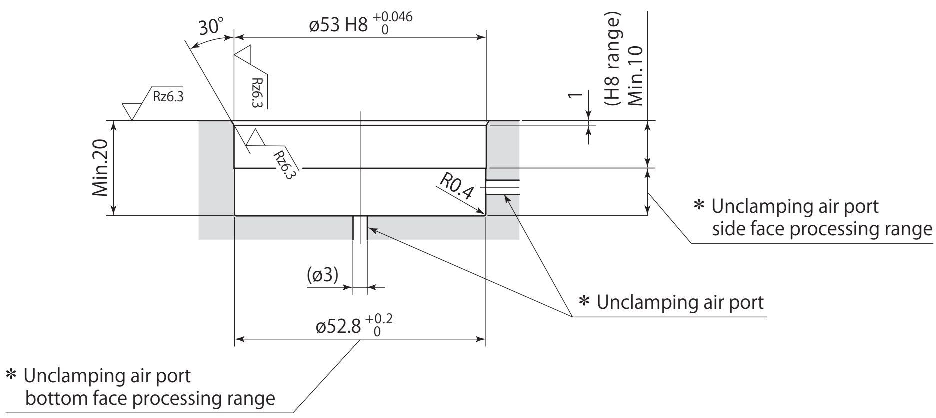
Model	CGY-F22-□					
	055	058	061	064	067	070A
øR	5	5.3	5.6	5.9	6.2	6.5
øS	15	15	15	15	15	15.5
øT	7.8	8.1	8.4	8.7	9	9.3
U	11	11.6	12.2	12.8	13	13.5
AA	2.5	2.5	3	3	3	3
øAD	3.8	4.1	4.4	4.7	5.0	5.3

● CGY-F22-055,058,061,064,067,070A are made to order.

● Mounting screws are not included.
● Material used for O-ring is fluorocarbon (Hardness Hs90).
● Seating surface hardness is HRC55.
● The above diagram indicates unclamped condition.

Mounting details



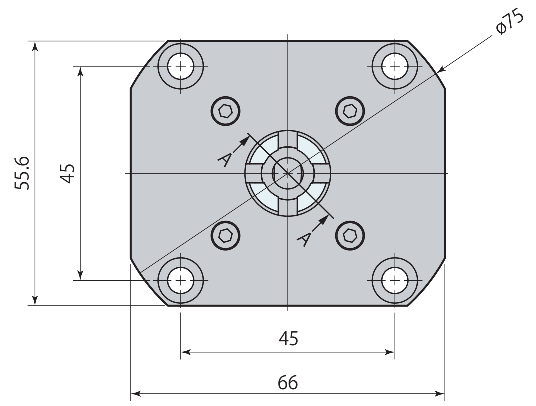


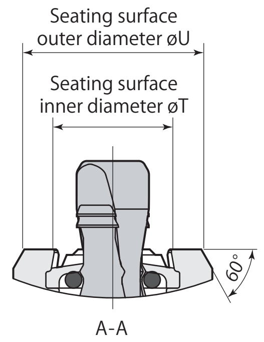
Rz: ISO4287(1997)

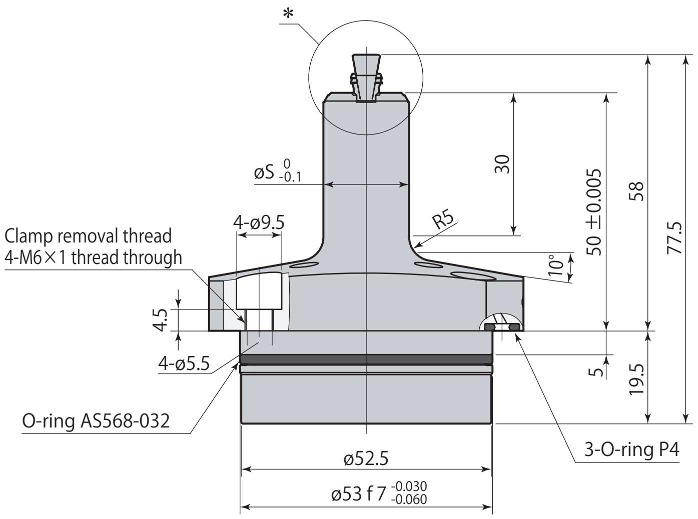
*: Unclamping air port must be made on either side or bottom face.

- 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.

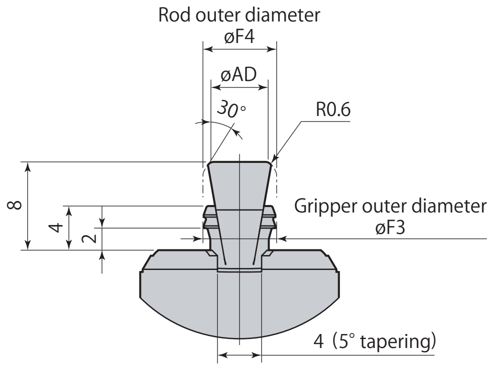
Dimensions

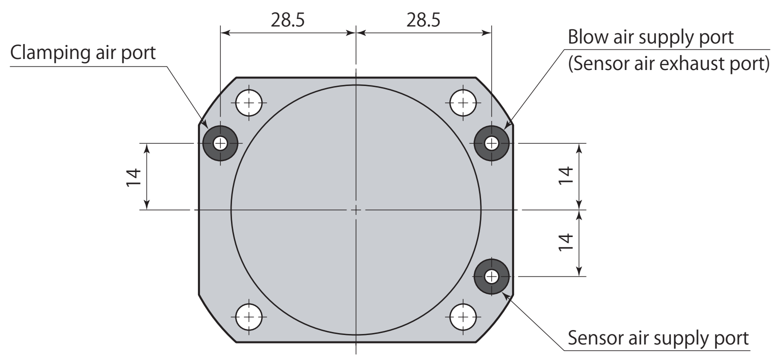




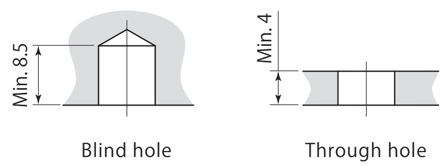


*Details





Grip inner diameter usage requirements



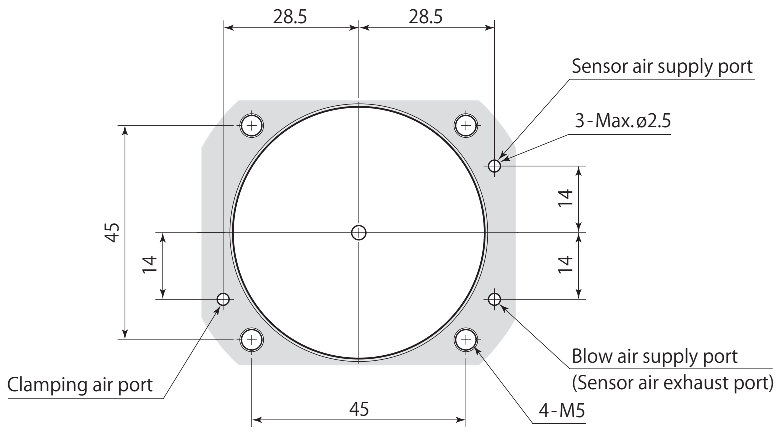
mm

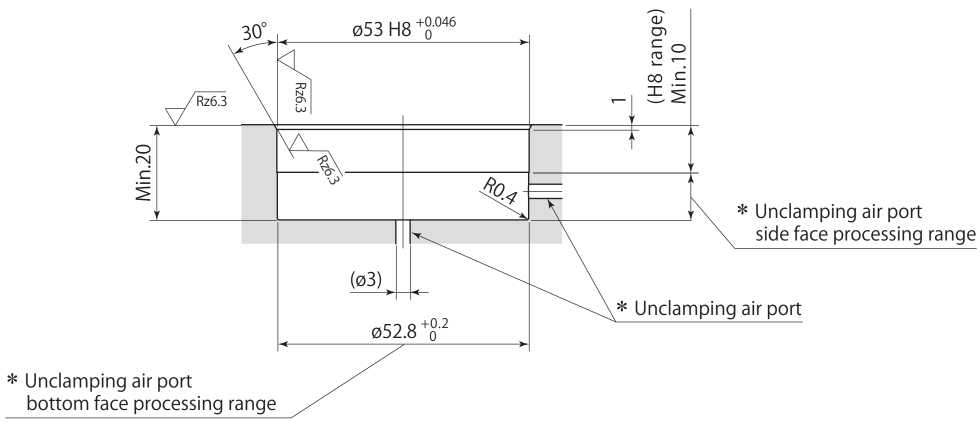
Model	CGY-F22E□				
	070	073	076	079	082
øF3	6.5	6.8	7.1	7.4	7.7
øF4	6.55	6.85	7.15	7.45	7.75
øS	18	18.3	18.6	18.8	18.8
øT	10.6	10.9	11.2	11.5	11.8
øU	16	16.3	16.6	16.9	17.2
øAD	5.4	5.7	6	6.3	6.6

- CGY-F22E070,073,076,079,082 are made to order.

- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

Mounting details





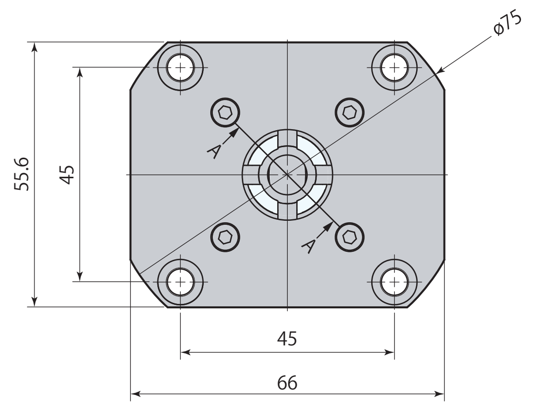
Rz: ISO4287(1997)

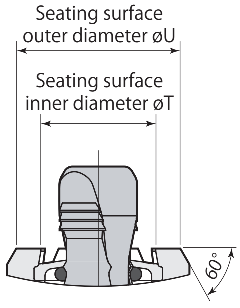
*: Unclamping air port must be made on either side or bottom face.

- 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.

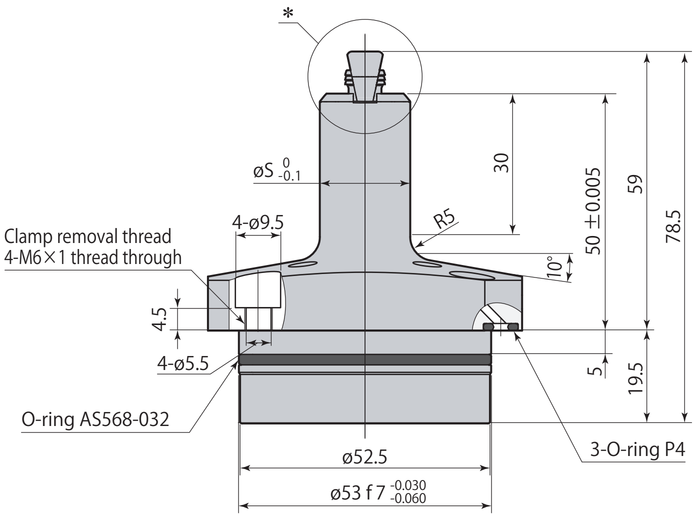
- The 30° taper machining must be provided to avoid the damage of the O-ring.

Dimensions

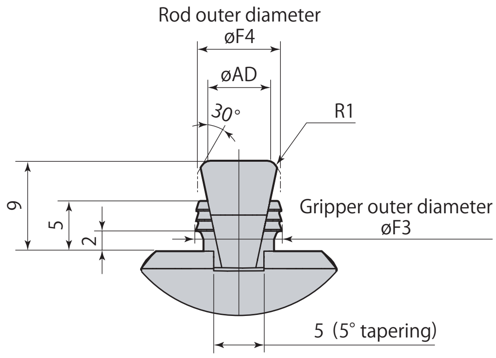




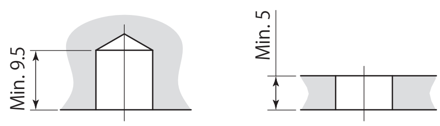
A-A



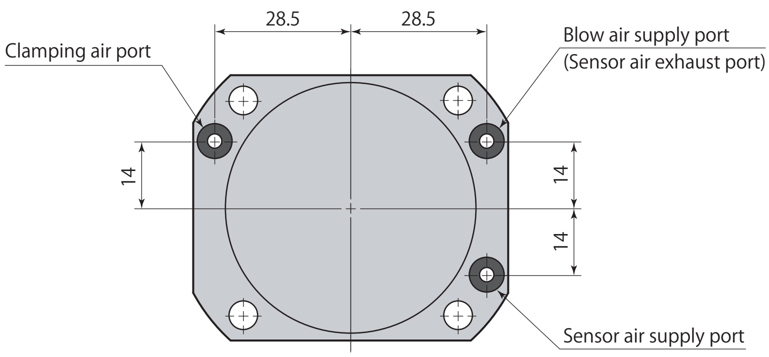
*Details



Grip inner diameter usage requirements



Blind hole   Through hole



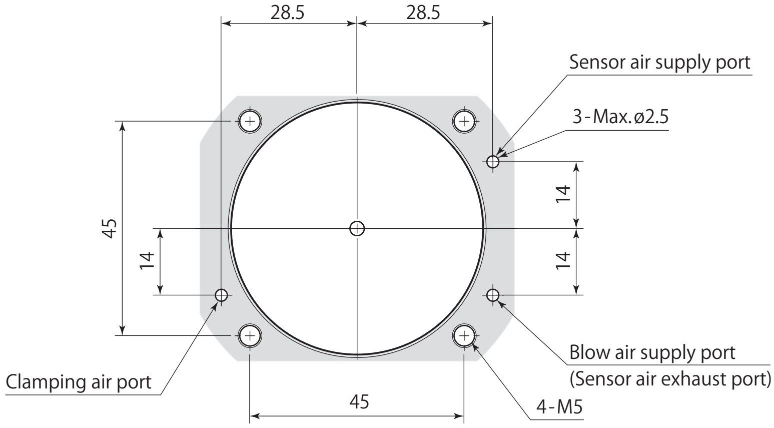
mm

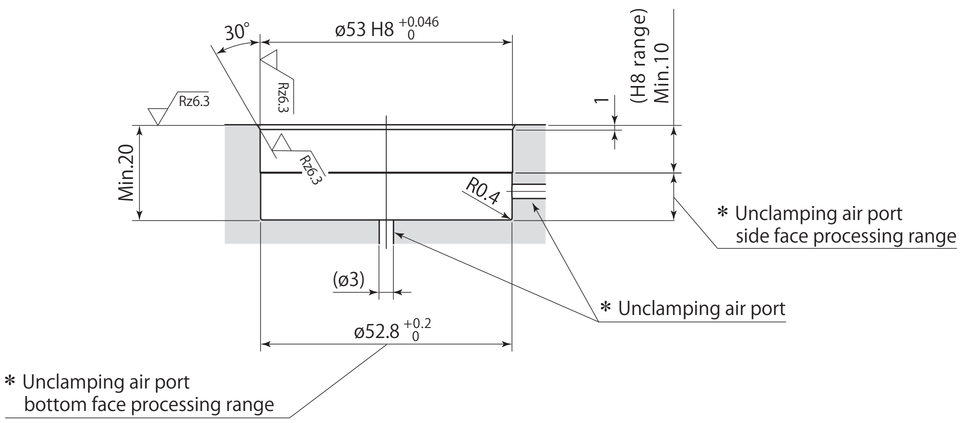
Model	CGY-F22E□		
	085	09	10
øF3	8	8.5	9.5
øF4	8.05	8.55	9.55
øS	19.5	20	21
øT	12.1	12.6	13.6
øU	17.5	18	19
øAD	6.3	6.8	7.8

- CGY-F22E085 is made to order.

- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

Mounting details



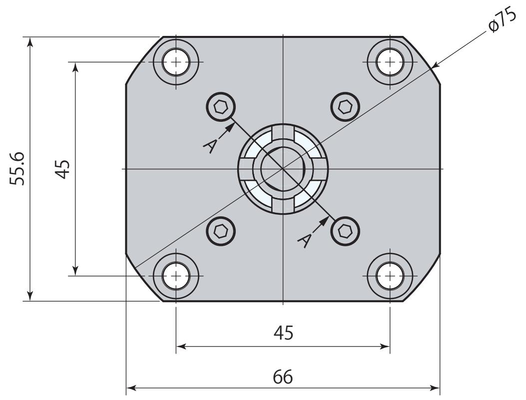


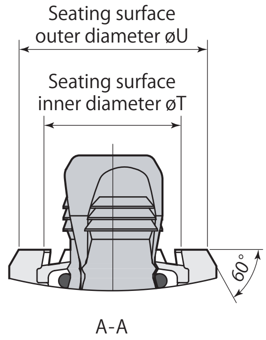
Rz: ISO4287(1997)

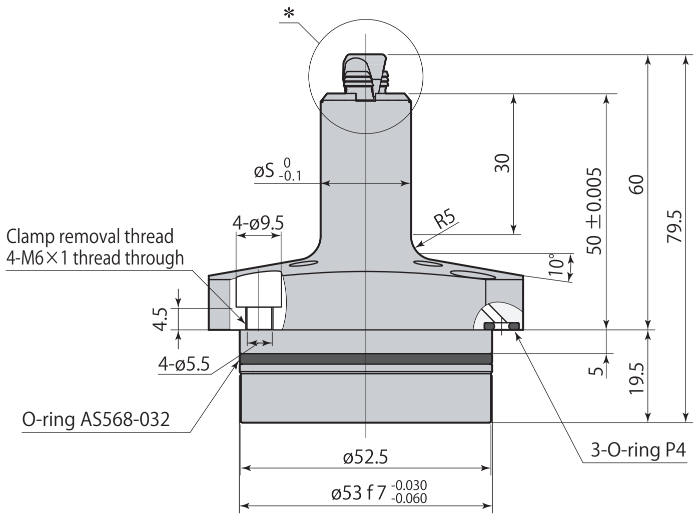
＊: Unclamping air port must be made on either side or bottom face.

- 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.

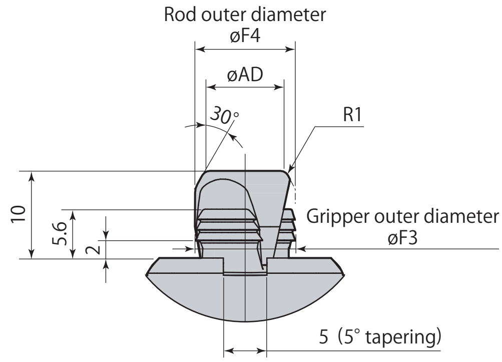
Dimensions



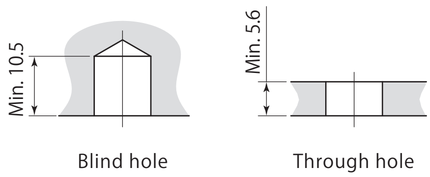


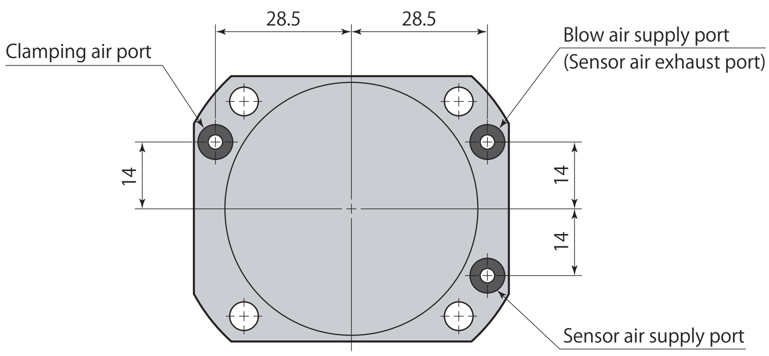


*Details



Grip inner diameter usage requirements





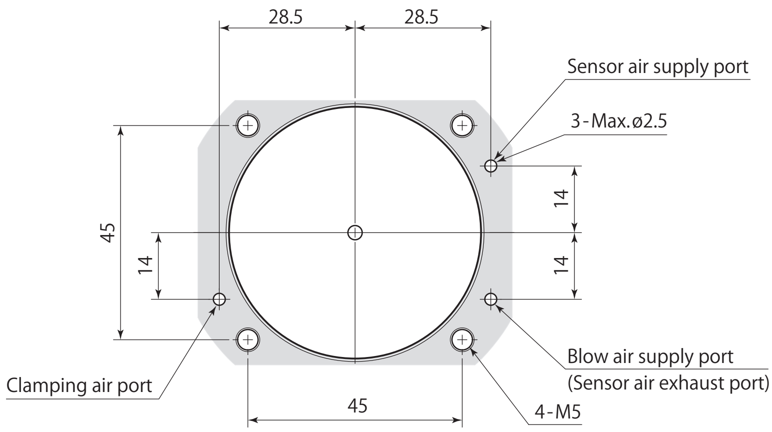
mm

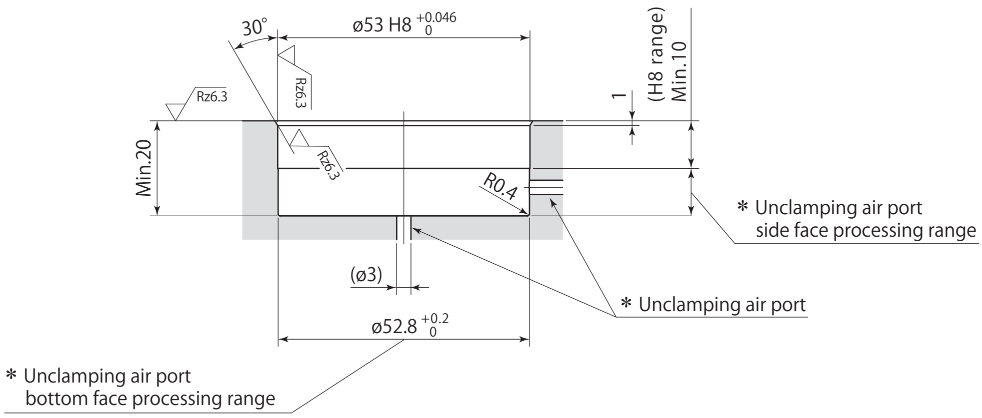
Model	CGY-F22E□		
	11	12	13
øF3	10.5	11.5	12.5
øF4	10.55	11.55	12.55
øS	22	23	24
øT	14.6	15.6	16.6
øU	20	21	22
øAD	8.2	9.2	10.2

- CGY-F22E11, 12, 13 are made to order.

- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

Mounting details





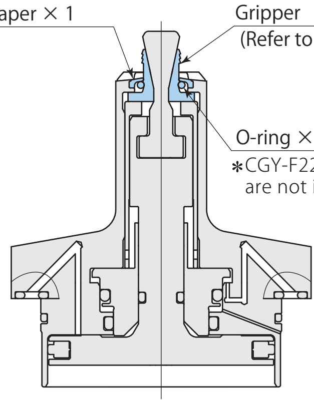
Rz: ISO4287(1997)

*: Unclamping air port must be made on either side or bottom face.

- 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.

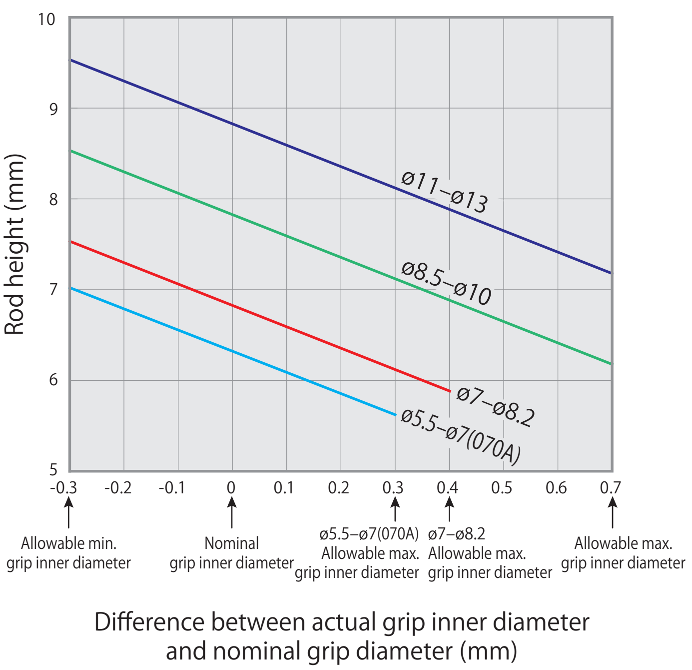
Gripper set replacement

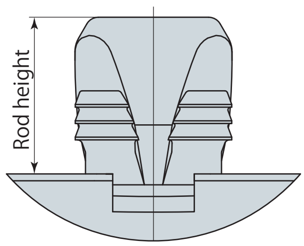
Number of grippers	Gripper set model	Clamp model	Set description
2 Grippers	CGY-F22-J055	CGY-F22-055	
	CGY-F22-J058	CGY-F22-058	
	CGY-F22-J061	CGY-F22-061	
	CGY-F22-J064	CGY-F22-064	
	CGY-F22-J067	CGY-F22-067	
	CGY-F22-J070A	CGY-F22-070A	
	CGY-F22EJ070	CGY-F22E070	
	CGY-F22EJ073	CGY-F22E073	
	CGY-F22EJ076	CGY-F22E076	
	CGY-F22EJ079	CGY-F22E079	
	CGY-F22EJ082	CGY-F22E082	
	CGY-F22EJ085	CGY-F22E085	
	CGY-F22EJ09	CGY-F22E09	
	CGY-F22EJ10	CGY-F22E10	
3 Grippers	CGY-F22EJ11	CGY-F22E11	
	CGY-F22EJ12	CGY-F22E12	
	CGY-F22EJ13	CGY-F22E13	



It is recommended that grippers, scraper and O-ring be replaced after about 200,000 operations. Replace grippers in sets and not just an individual gripper. (Refer to the table on the left for the gripper set model.)

Grip inner diameter & rod height when clamping



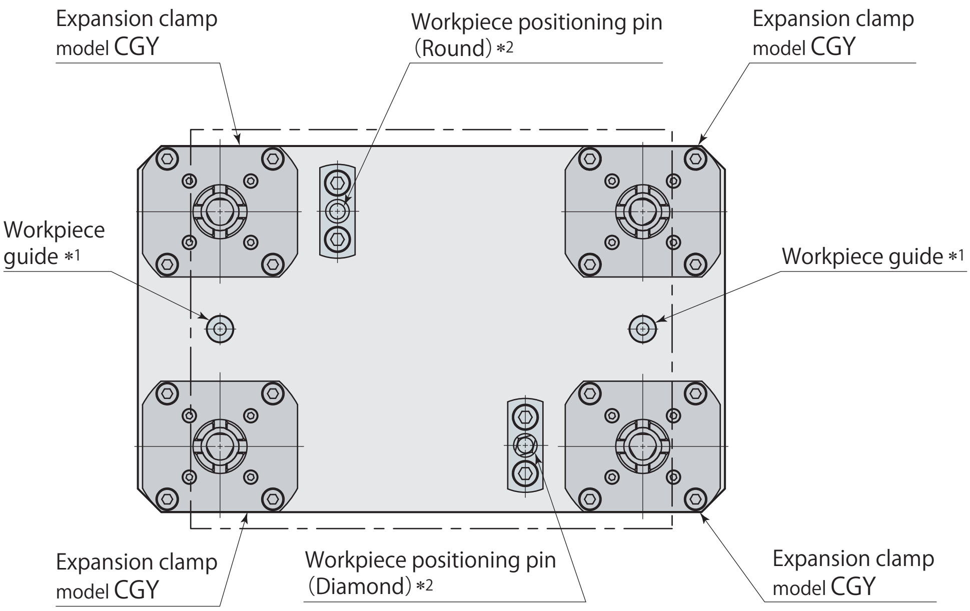


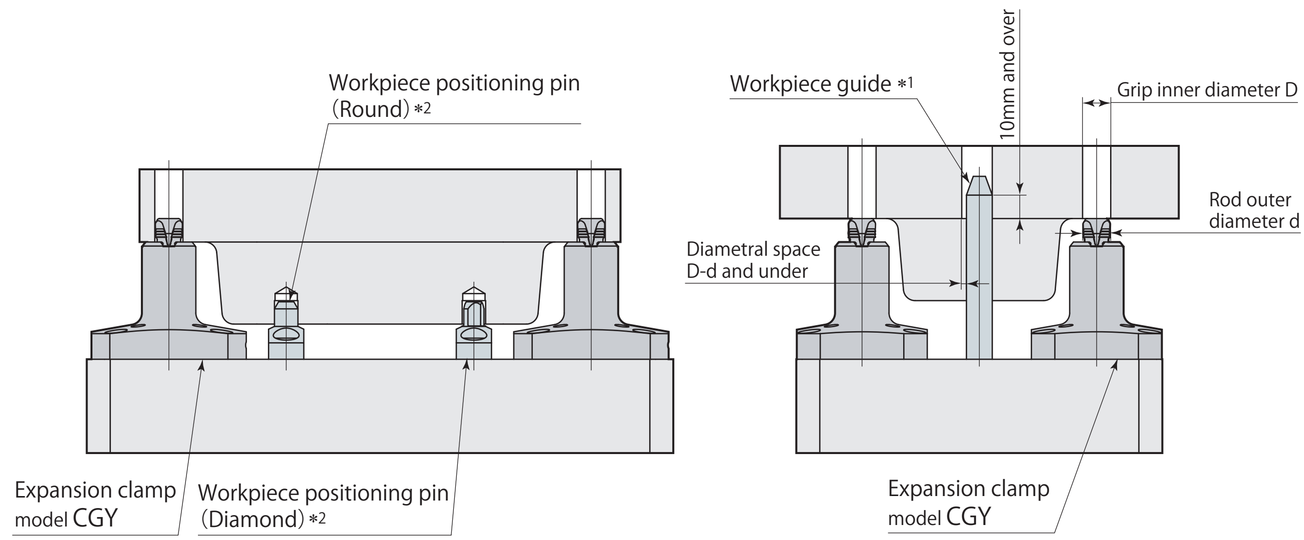
Rod height calculation formula	
ø5.5– ø7* : 6.32-2.35×	Actual grip inner diameter and nominal grip diameter difference
ø7 – ø8.2 : 6.58-2.84×	Actual grip inner diameter and nominal grip diameter difference
ø8.5– ø10 : 7.82-2.35×	Actual grip inner diameter and nominal grip diameter difference
ø11 – ø13 : 8.82-2.35×	Actual grip inner diameter and nominal grip diameter difference

∗: CGY-F22-070A

Example: When CGY-F22E10 (Nominal grip diameter : ø10) is clamping ø9.8 hole
Rod height = 7.82 - 2.35×(-0.2) = 8.29mm

System configuration example

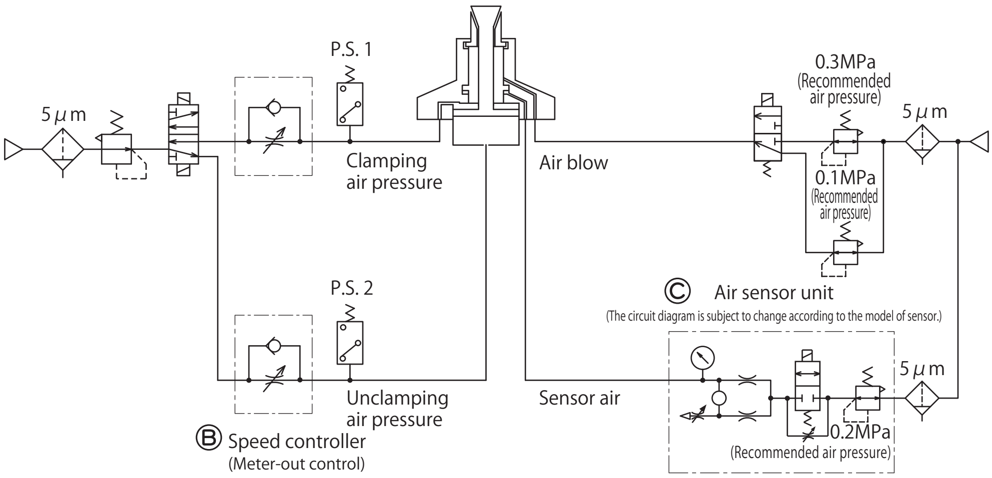




*1: When using automatic or robotic conveyers, prevent damage to clamp caused from impact by setting workpiece guides. Using the above guide as reference, accurately position the holes when using workpiece guides.

*2: **The expansion clamp does not have a workpiece positioning function.**
Install workpiece positioning pins (or similar).

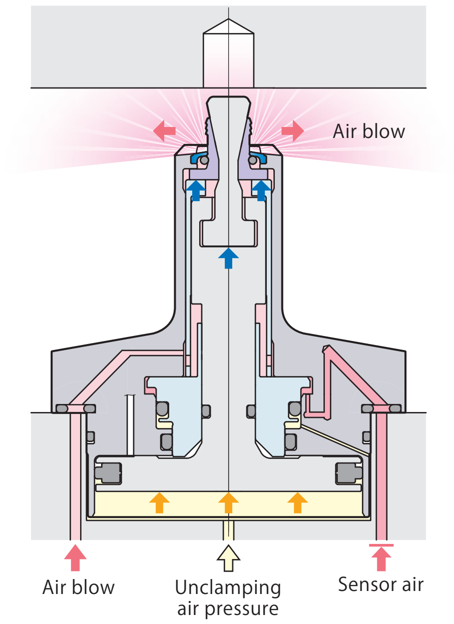
Air blow model pneumatic circuit diagram



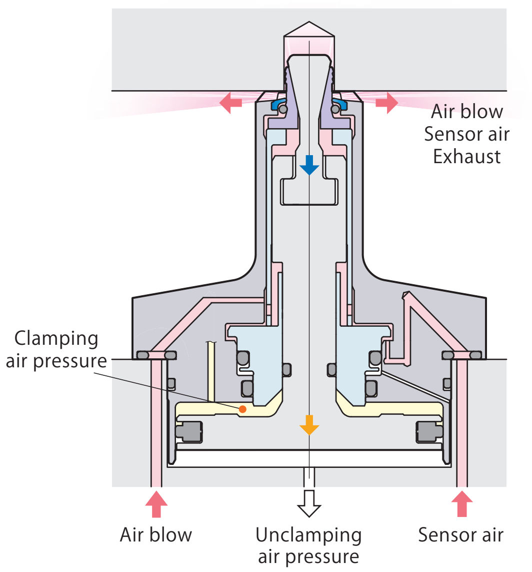
● Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping. During cutting, if chips adhere to the gripper such as when going through the clamping hole, continue air blowing during processing as well.

● Air blow pressure must be set to 0.1MPa when checking the operation of the clamp with the air sensor.

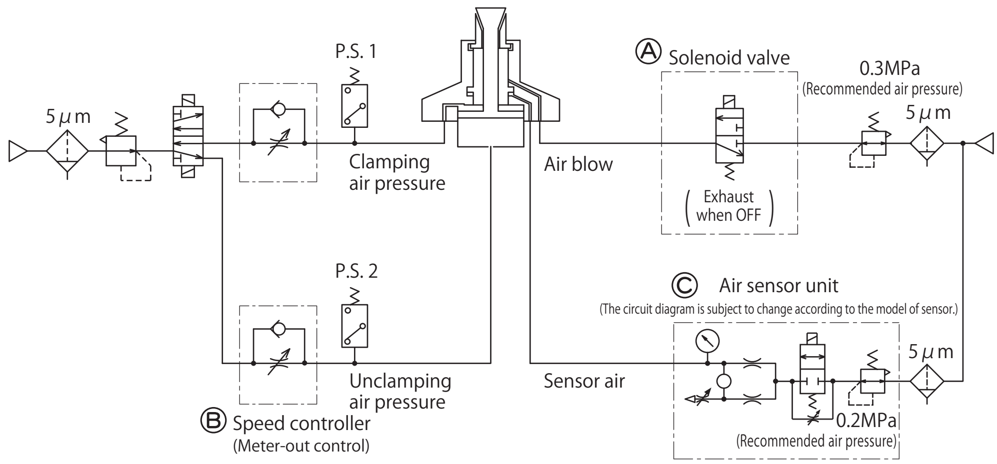
Air blowing



Clamping



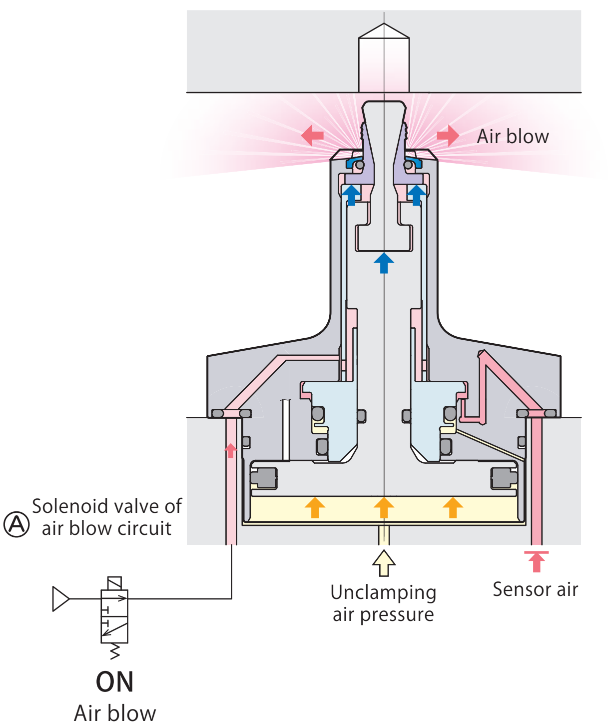
Non-constant air blow model pneumatic circuit diagram



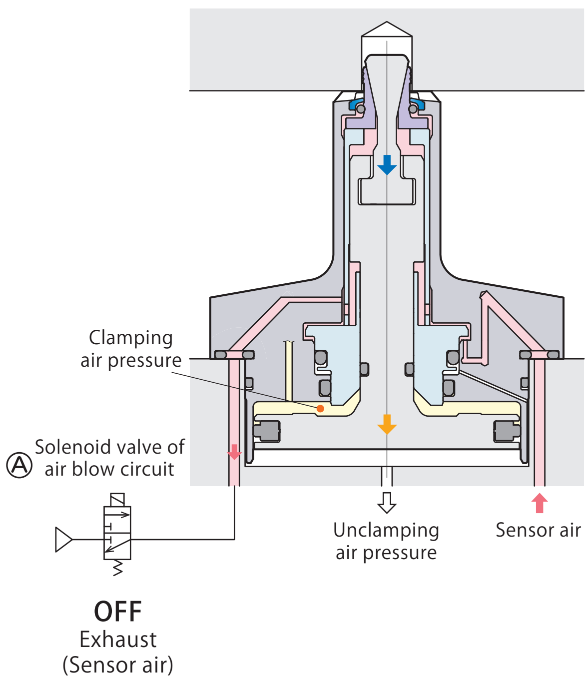
● Air blow will not be necessary during cutting process. Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping to remove metal chips and debris.

● The solenoid valve Ⓐ must be closed when checking the operation of the clamp with the air sensor. Also 3 port type of solenoid valve must be used in the circuit. If 2 port type of the valve is used, sensing air cannot be exhausted and clamp detection function is disabled.

Air blowing

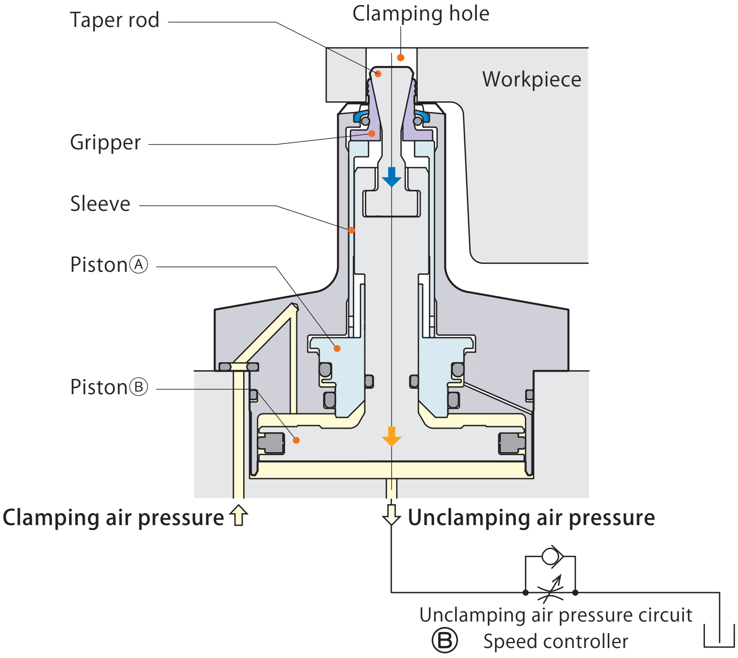


Clamping



- Operation speed must be adjusted by a meter-out type speed controller Ⓑ being provided in the unclamping circuit. By the adjustment, air flow in unclamping circuit is squeezed and back pressure is generated. The back pressure acts on the piston Ⓐ of the clamp and makes the gripper expand first then the taper rod strokes down to clamp. If meter-in type speed controller is installed in the circuit, it dumps the air rapidly and makes the gripper move very quick which causes incomplete clamping.

- Adjust air flow when clamping to have the taper rod full stroke in 0.3 sec or over.
  Excessive air flow to the clamp gives impact load and may cause breakage of the parts.



Air sensor unit Ⓒ 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	0.2 MPa
Inner diameter of piping	ø4 mm (ISA3-F：ø2.5 mm)
Overall piping length	5 m or less

- 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.

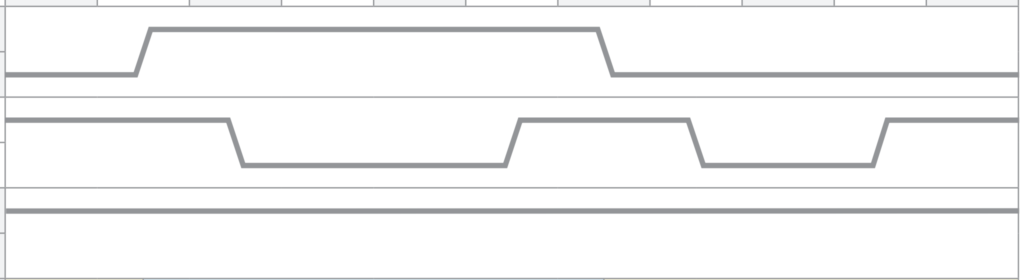
- There is a case that air sensing cannot be made successfully as designed when it is used out of the usage shown on the left. Contact Technical service center for more details.

Operation cycle

The clamp should be controlled with the cycle in the diagram shown below to detect the operation status exactly.

Case of air blow model

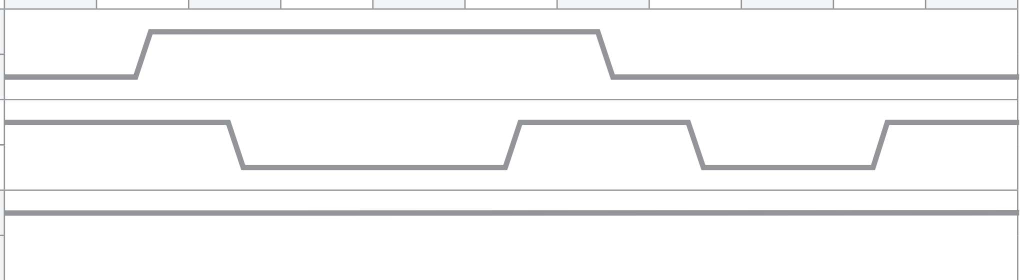
State			Workpiece loading	Clamping	Air blow switching	Clamping completion*1	(Machining)	Air blow switching	Unclamping	Air blow switching	Unclamping completion*2	Air blow switching	Workpiece unloading
*4	Workpiece clamp	Clamp											
		Unclamp											
	Air blow	0.3MPa											
		0.1MPa											
	Sensor air	ON											
		OFF											
*5	Clamping air pressure P.S. 1		OFF	ON					OFF				
	Unclamping air pressure P.S. 2		ON	OFF					ON				
	Air sensor				OFF or ON*3					ON			



*1 : Clamping completion : P.S. 1=ON P.S. 2=OFF Air sensor=OFF
*2 : Unclamping completion : P.S. 1=OFF P.S. 2=ON Air sensor=ON
*3 : OFF : Complete clamping ON : Incomplete clamping
*4 : Solenoid valve control *5 : Air pressure switch, Air sensor signal

Case of non-constant air blow model

State			Workpiece loading	Clamping	Air blow OFF	Clamping completion*1	(Machining)	Air blow ON	Unclamping	Air blow OFF	Unclamping completion*2	Air blow ON	Workpiece unloading
*4	Workpiece clamp	Clamp											
		Unclamp											
	Air blow	ON											
		OFF											
	Sensor air	ON											
		OFF											
*5	Clamping air pressure P.S. 1		OFF	ON					OFF				
	Unclamping air pressure P.S. 2		ON	OFF					ON				
	Air sensor				OFF or ON*3					ON			



*1 : Clamping completion : P.S. 1=ON P.S. 2=OFF Air sensor=OFF
*2 : Unclamping completion : P.S. 1=OFF P.S. 2=ON Air sensor=ON
*3 : OFF : Complete clamping ON : Incomplete clamping
*4 : Solenoid valve control *5 : Air pressure switch, Air sensor signal

Caution in use

- Be sure to make inner diameter of air blow circuit 4 mm and over except for clamp mounting surface.

- Set the workpiece in such a way that the clamping hole of workpiece is perpendicular to seating surface. Clamping in tilted condition results in uneven contact of gripper with hole, which leads to concentration of load that may cause damage.

- Verify that there are no metal chips or debris on seating surface of clamping hole and clamp body before setting workpiece. Allowing intrusion of metal chips results in insecure clamping, which can lead to low grade of machining accuracy.

- Flaring (Biting) of gripper into workpiece varies depending on workpiece material or thermal processing conditions. With regards to conditions of workpiece and clamping hole, refer to **page →559**. Secure clamping is not possible when workpiece or clamping hole that does not satisfy these conditions is used.

- If clamping hole serves as taper hole (cast draft hole with gradient), then perform test clamping using applicable workpiece beforehand to verify that there are no problems with operations.

- Deformation may occur if the thickness of clamping hole section of workpiece is extremely thin. Use applicable workpiece to perform test clamping beforehand to verify that there are no deformations in thin portion.

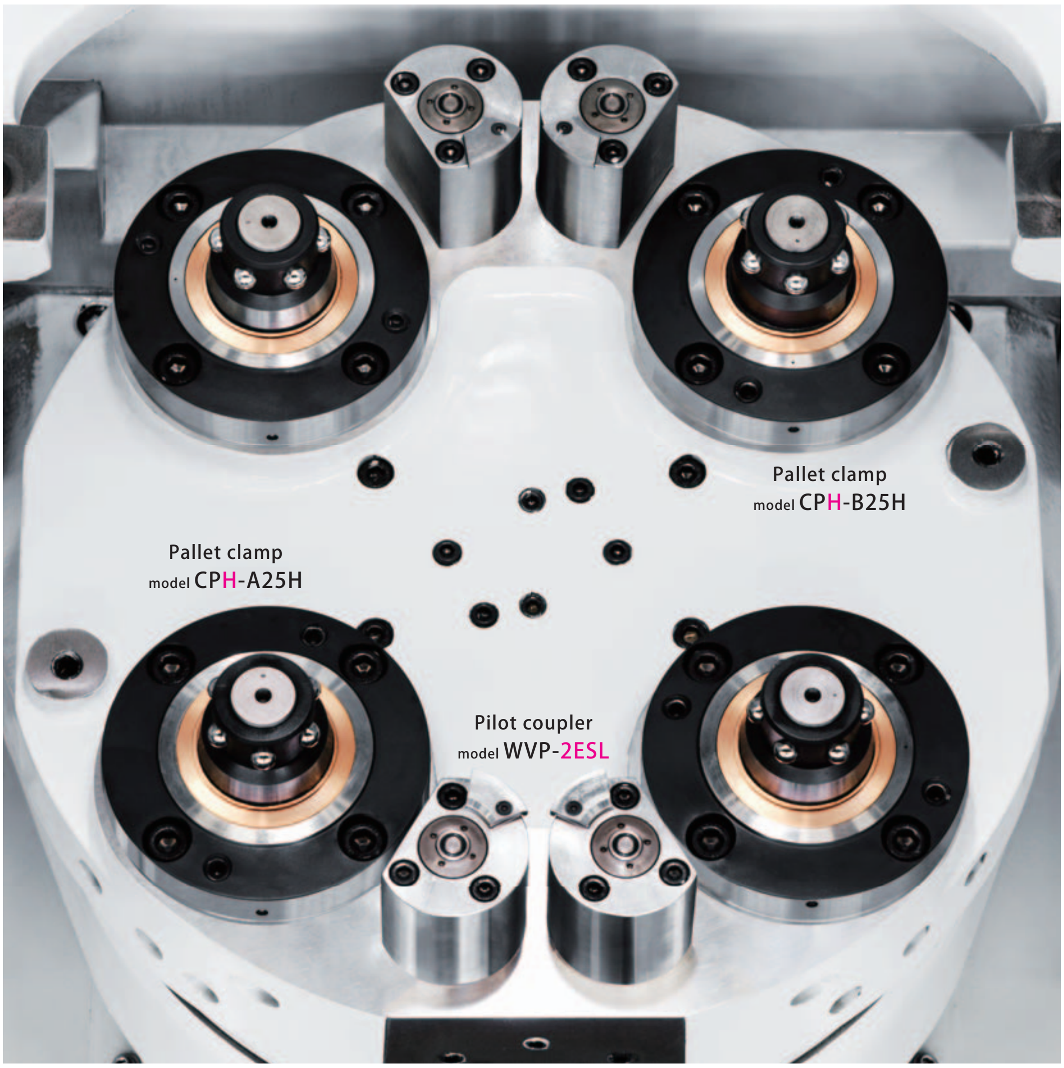
- Supply the dry and filtered air. Particulate size 5 μm or less is recommended.

- Measure seating surface flatness with air pressure applied on clamping side, or by applying air pressure on neither clamping nor unclamping side.

- Perform unclamping completion detection, clamping completion detection and incomplete clamping detection with combination actions of pressure switch and sensor shown in table below. (Refer to the pneumatic circuit diagram on **page →578**, **579** for details.)

Applications	Pressure switch 1 (P.S. 1)	Pressure switch 2 (P.S. 2)	Air sensor
Unclamping completion detection	OFF	ON	ON
Clamping completion detection	ON	OFF	OFF
Incomplete clamping detection	ON	OFF	ON

Pal system



Pallet clamp
model CPH-B25H
Pallet clamp
model CPH-A25H
Pilot coupler
model WVP-2ESL

Standard Pal system

Pal system that changes pallet by reducing hydraulic (air) clamp circuit pressure to zero

Pal coupler fitting stroke 1 mm

Pal coupler socket
(blow air & coolant)
Orifice ø6 & metal seal

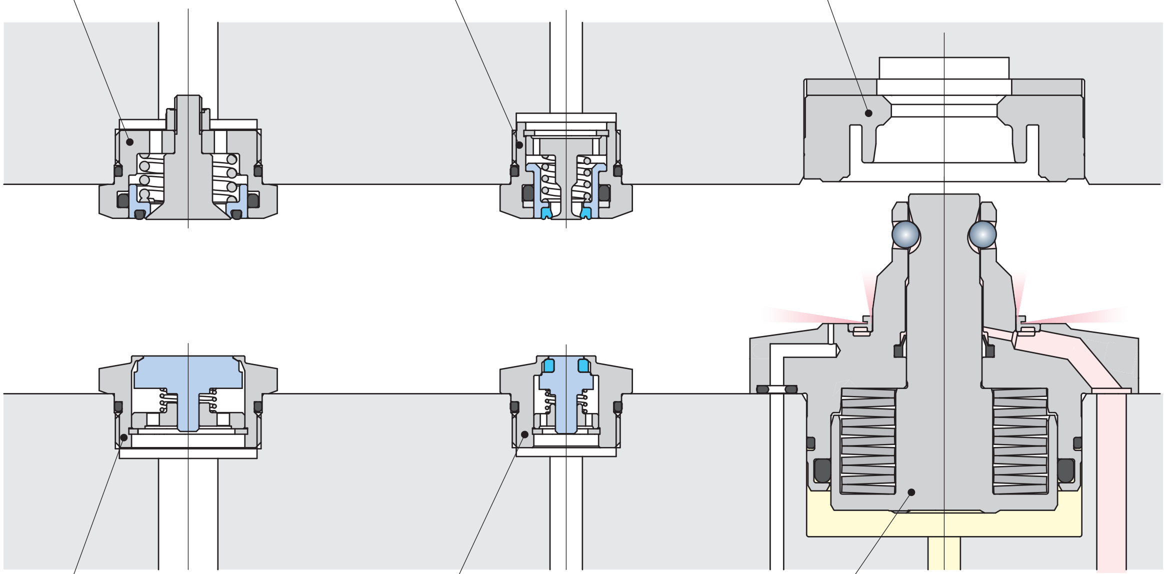
Page →663

Pal coupler socket
(clamping hydraulics & air)
Orifice ø4 & soft seal

Page →662

Locate ring

Page →610



Pal coupler plug
(blow air & coolant)
Orifice ø6 & metal seal

Page →663

Pal coupler plug
(clamping hydraulics & air)
Orifice ø4 & soft seal

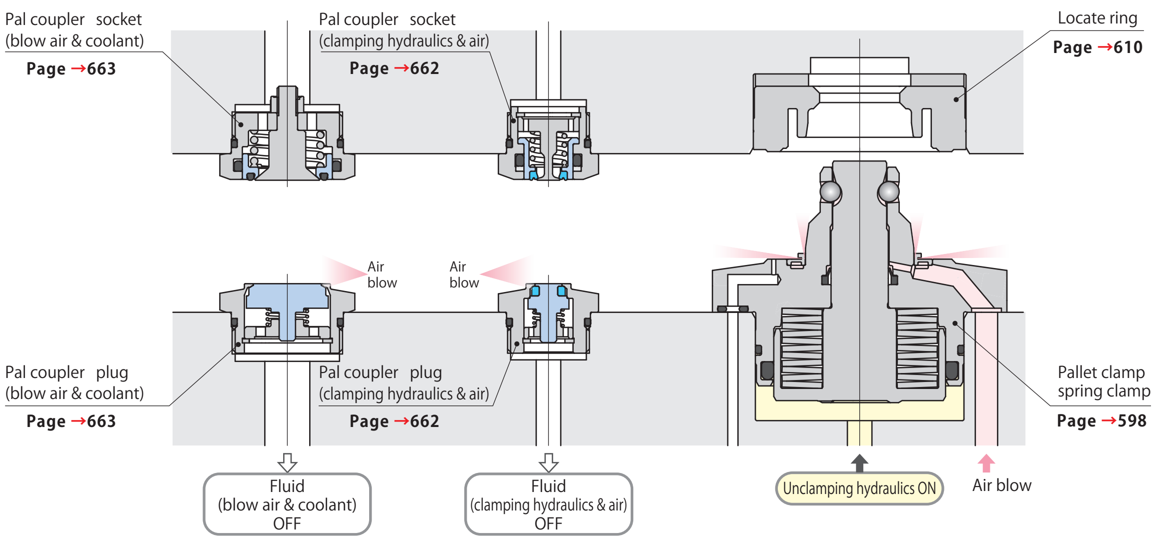
Page →662

Pallet clamp
(spring clamp)

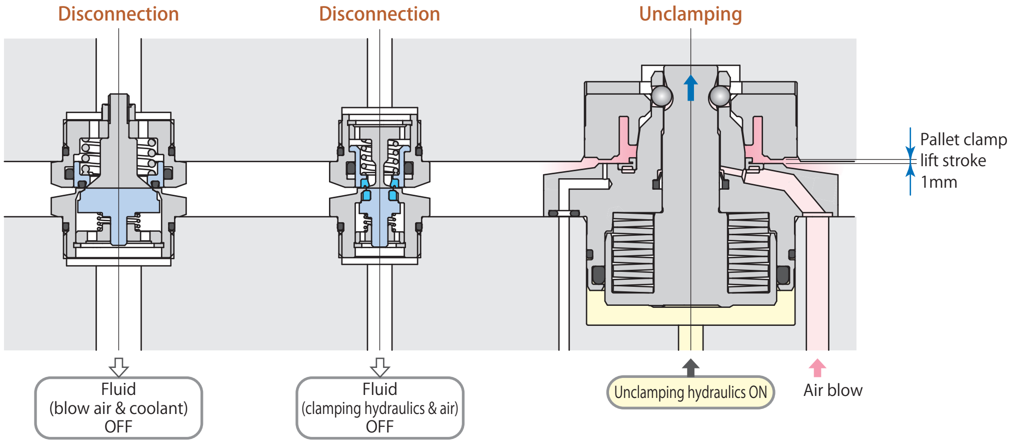
Page →598

Select one of either spring clamp (model CPC), hydraulic clamp (model CPH) or air clamp (model CPY) .

Pallet change

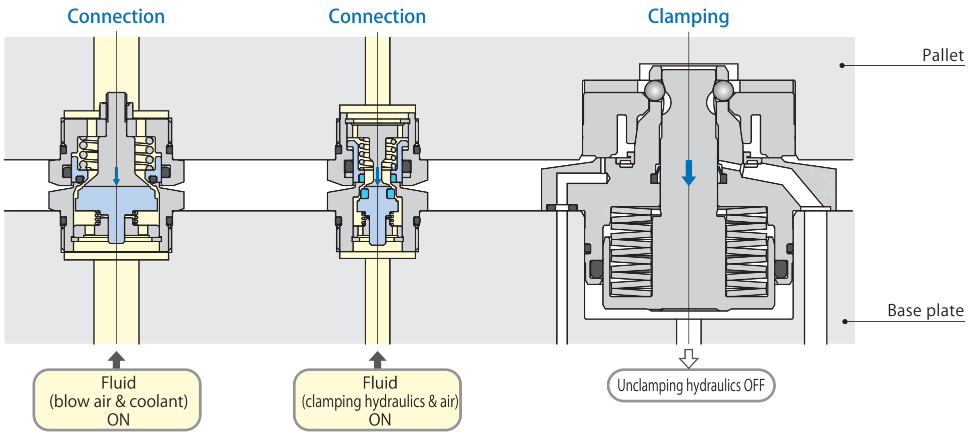


Pallet unclamped and coupler disconnected



When unclamping pallet, coupler disconnects due to lift stroke of pallet clamp.

Pallet clamped and coupler connected

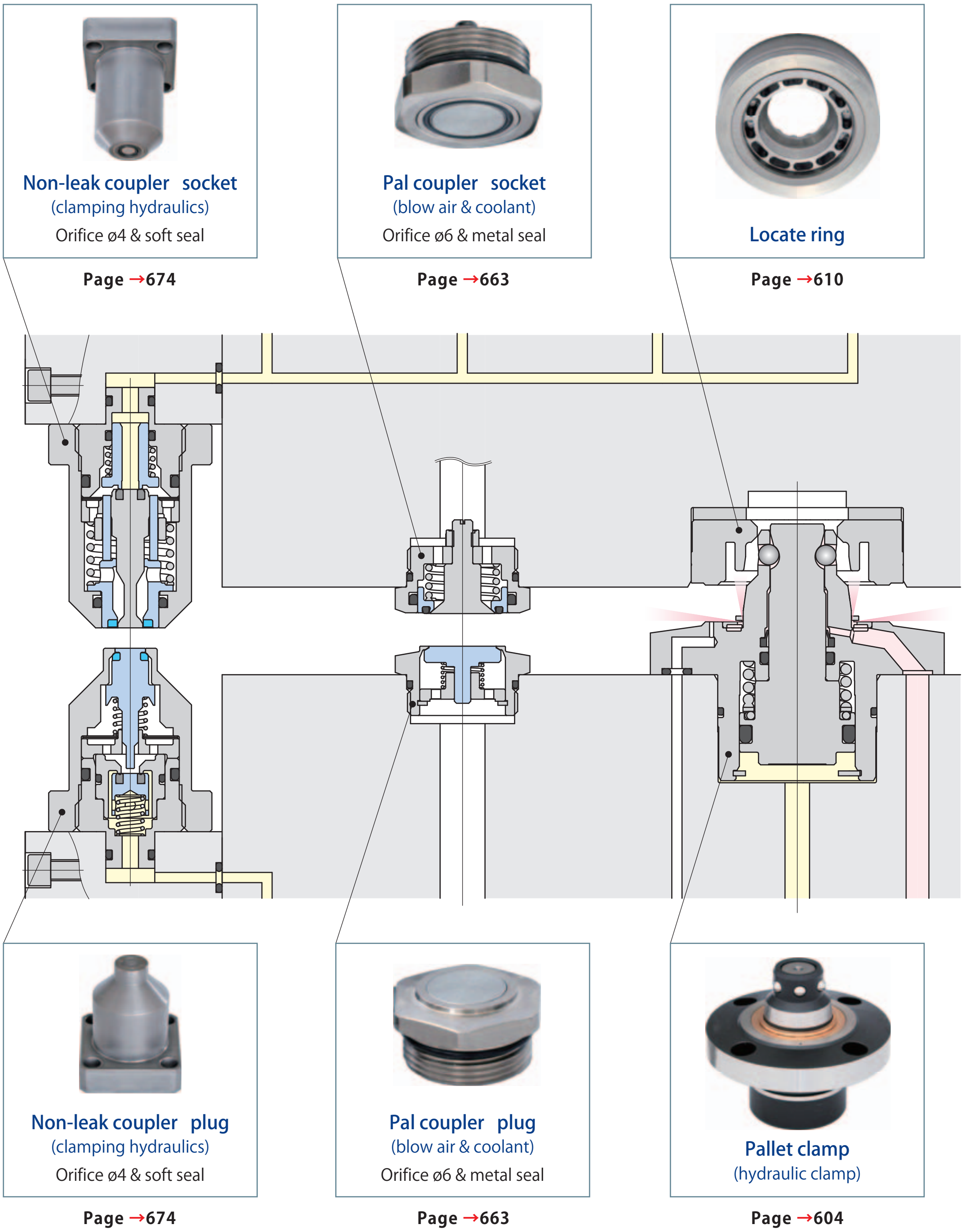


When clamping pallet, coupler connects due to clamp stroke of pallet clamp.

Pallet changer Pal system

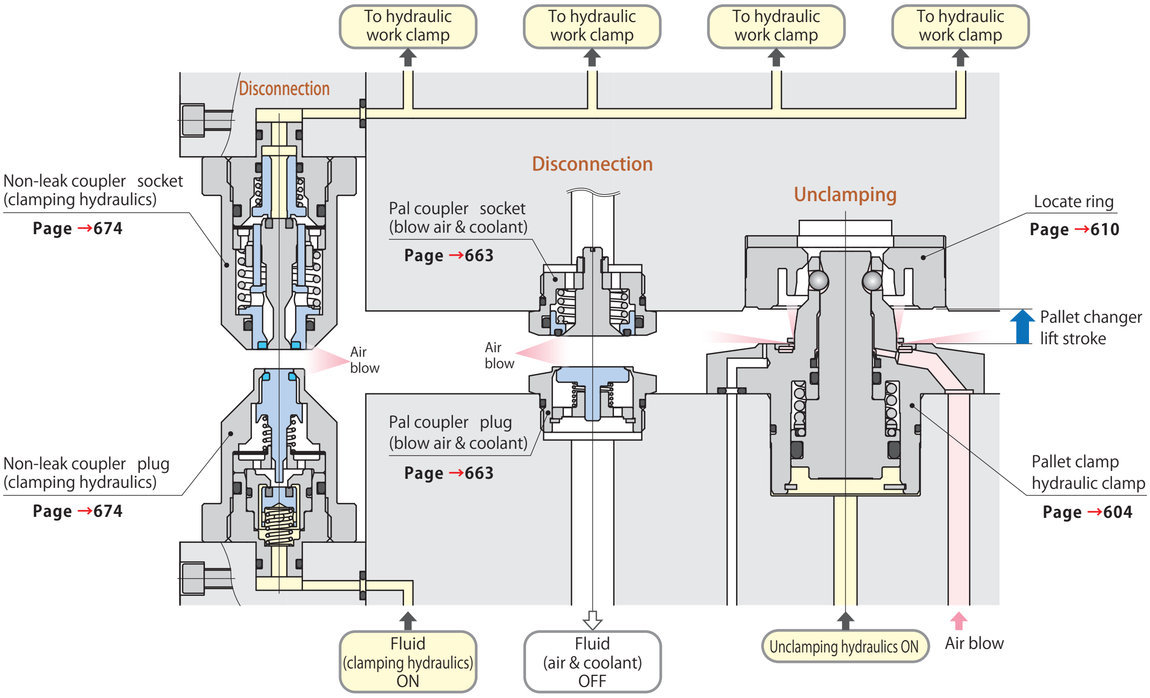
Pal system capable of changing pallets while maintaining hydraulic clamp in clamp condition

Non-leak coupler fitting stroke 4 mm



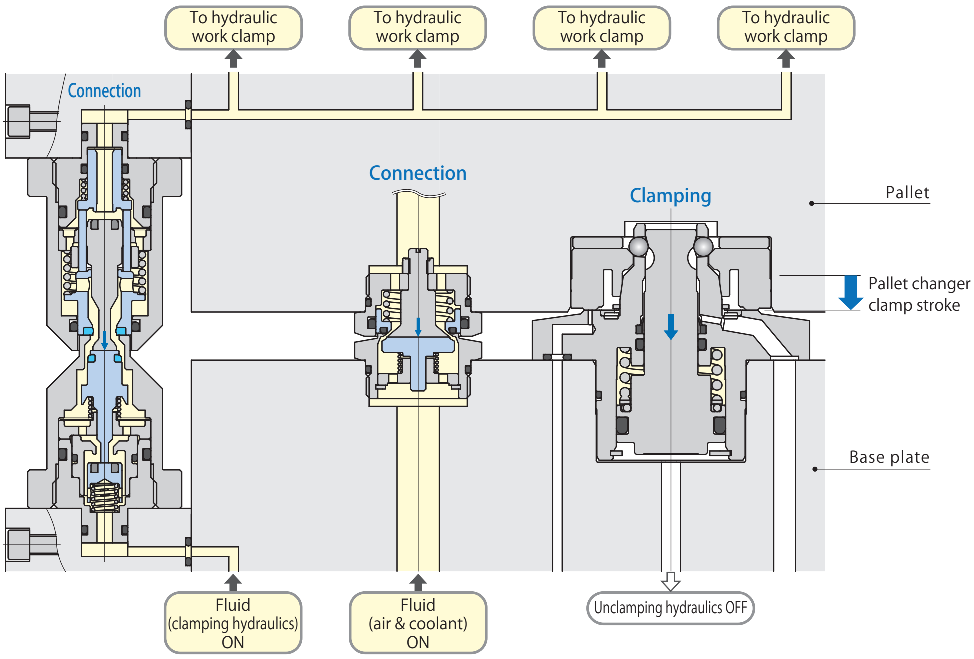
Select one of either spring clamp (model CPC), hydraulic clamp (model CPH) or air clamp (model CPY) .

Pallet unclamped and coupler disconnected



When unclamping pallet, coupler disconnects due to lift stroke of pallet changer, with hydraulics sustained.

Pallet clamped and coupler connected



When clamping pallet, coupler connects due to clamp stroke of pallet changer, with hydraulics sustained.

Table of contents

Pallet clamp

7 MPa

Locate ring
Pallet lower surface mounting
model CPS-ED

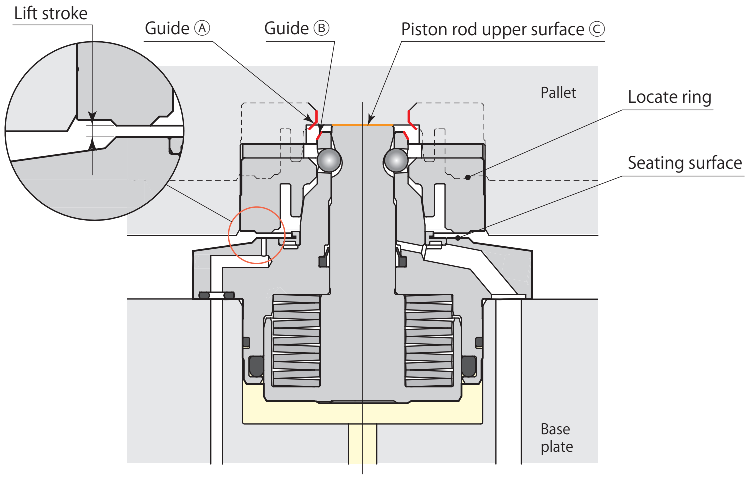
Locate ring
Pallet upper surface mounting
model CPS-ET

Spring clamp
model CPC-A

Hydraulic clamp
model CPH-A

Pallet setting

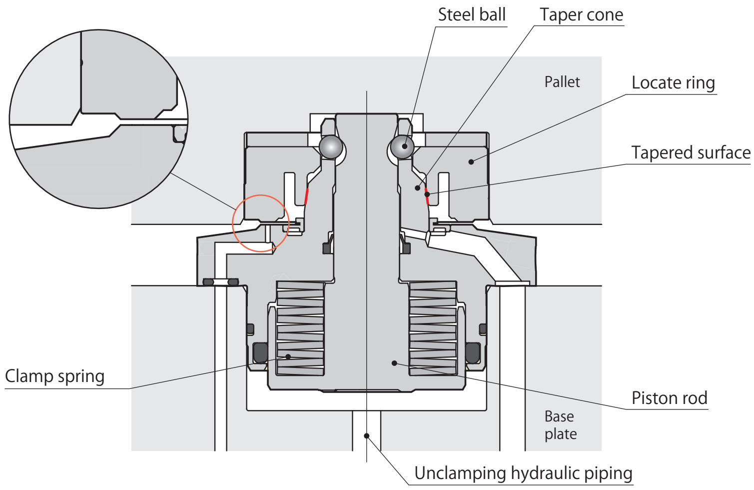
- Bring the pallet above the base plate. After positioning, lower the pallet. Pallet descends along guides Ⓐ & Ⓑ and stops after coming into contact with piston rod upper surface Ⓒ, making pallet setting easy. Furthermore, since locate ring does not come into contact with seating surface of pallet clamp, damages on seating surface can be prevented during pallet exchanges.



XY axes positioning

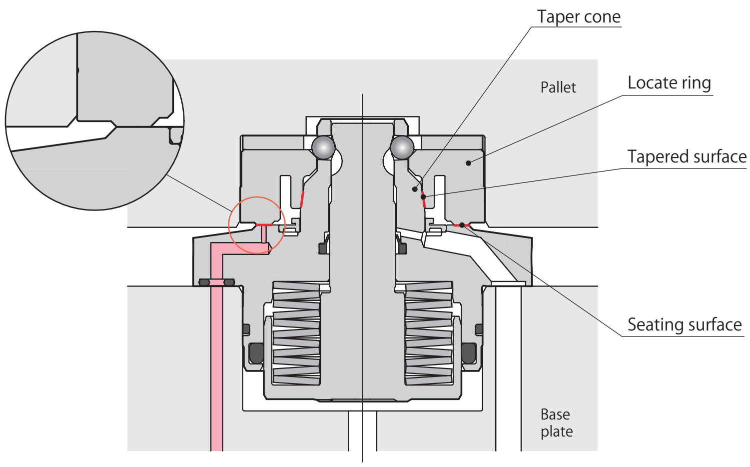
- When the unclamping hydraulic pressure is released, piston rod goes down by spring force* and radially extends the steel balls, pulling down the locate ring. The locate ring and taper cone at pallet clamp come into contact.

＊: For only model CPC. The piston rod in CPH goes down by the hydraulic force, the piston rod in CPY goes down by air force.



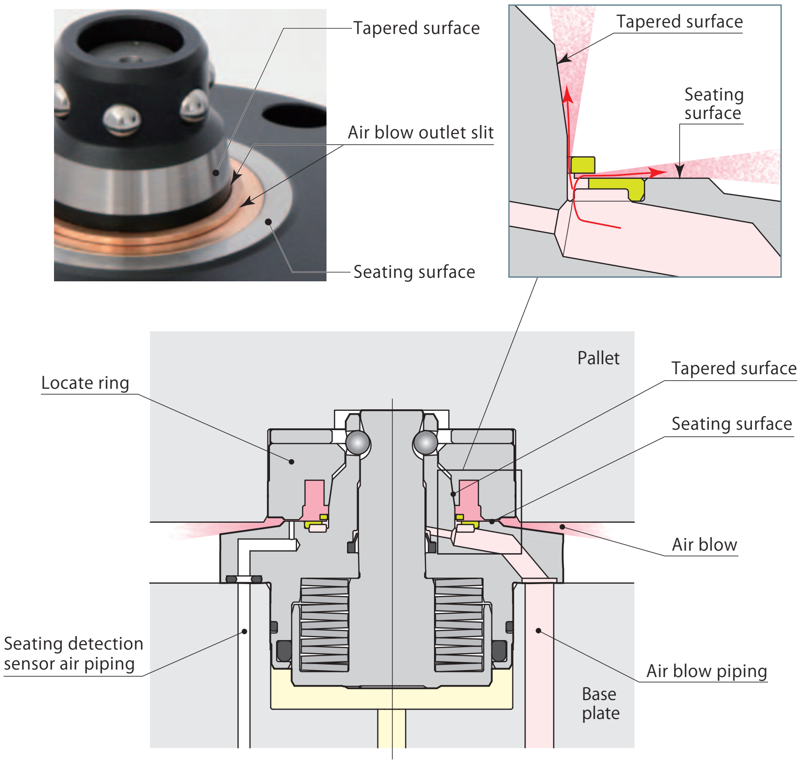
XYZ axes positioning (clamping is completed)

- The locate ring that is attached to tapered surface of taper cone is expanded and deformed in radial direction to firmly position X axis and Y axis.
Locate ring is attached to seating surface and positions Z axis. The positioning of X, Y and Z axes by tapered surface and seating surface completes the XYZ positioning (dual surface positioning).



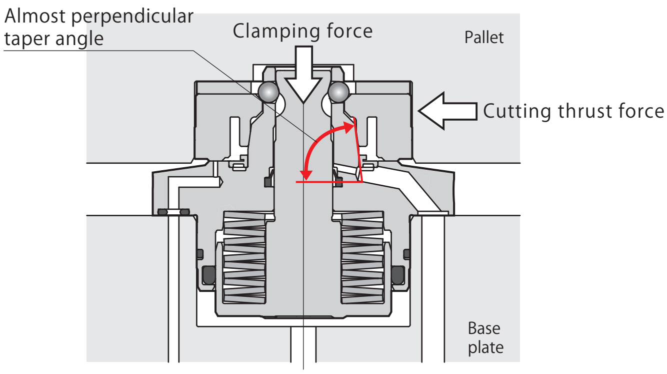
High repeatability and retention of accuracy

- Air blows out of wide slits laid out over circumference to tapered surface and seating surface directly for ensuring prevention of foreign substances.
- Since seating detection function is provided, it is possible to prevent operation with incomplete clamping due to insertion of metal chips.
- Rust proofing has been implemented to locate ring in order to prevent rusting while pallet is in storage or on standby.
- All machined parts related to dual surface positioning are made using a high-precision grinding machine in a temperature control room to improve the accuracy of the parts.



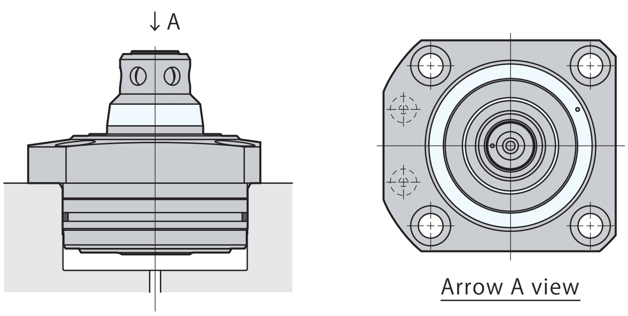
Taper angle that withstands large cutting thrust force

- Pallet clamp has tapered surface angle that is close to perpendicular, which allows for stable clamping with minimal impact from thrust exerted during cutting process. This is particularly effective in inhibiting chatter when cutting process at higher locations on the pallet, which improves processing conditions for high-speed cutting and heavy duty cutting.



Rectangular flange (made to order)

- A rectangular flange, created by cutting out mounting flange portion of pallet clamp body, is available (made to order). Inquire for details.



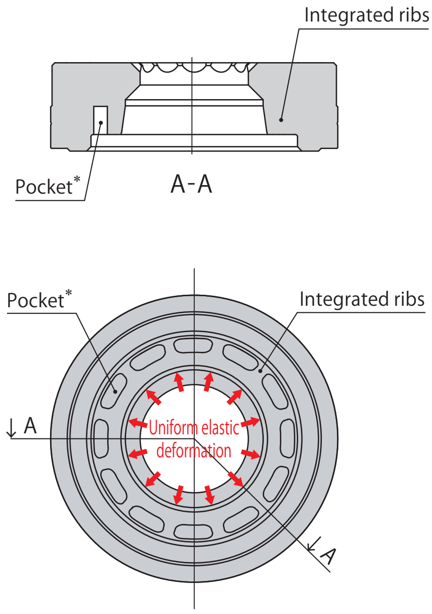
Arrow A view

Solid tapering method with superior durability and repeatability

- Solid tapering type locate ring has no sliding portion for its positioning structure. Advantageous in terms of durability as well as in keeping the initial repeatability for a long time.
- When positioning X & Y axes, the taper portion evenly and elastically deforms outwards to offer highly accurate positioning. Furthermore, the taper portion has no slits, eliminating accuracy issues relating to positioning due to intrusion of metal chips into slits.
- Elastic deformation of taper portion is conducted evenly due to the integrated ribs that are evenly distributed in the radial direction providing high clamping rigidity.

∗: No pockets are provided with the model CPS-E25 and CPS-E40 because elastic deformation is easily obtainable at tapered part due to its body size.

Solid tapering type
model CPS-E

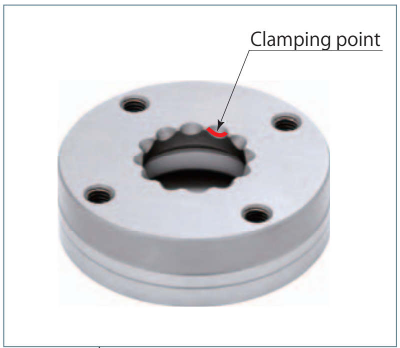


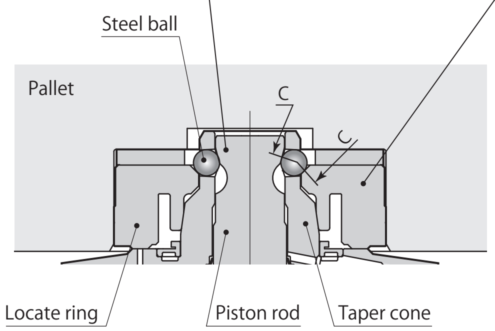
Specialized design reduces surface contact pressure and prevents deterioration of clamping force

- Pallet clamp enhances output of clamp piston and firmly secures pallet. Steel ball contacting portions, where high surface pressure is exerted, have been designed in a special form that prevents indentation marking, which can deteriorate the clamping force, thereby making it possible to firmly fix pallets over long periods of time.

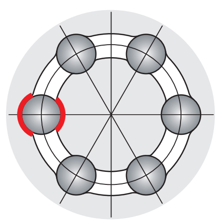
Special shape of piston rod
(steel ball contacting portions)

Special shape of locate ring
(steel ball contacting portions)



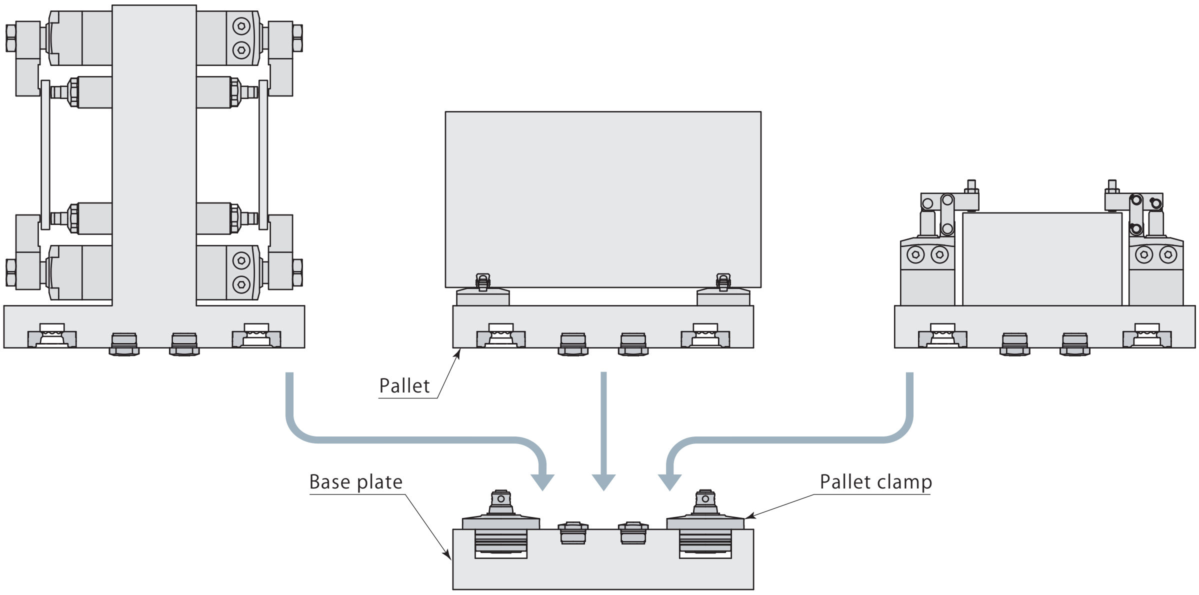


C-C



Contact portions to steel balls are line contacts, with lower surface pressure, thus initial clamping force is sustained for a long time.

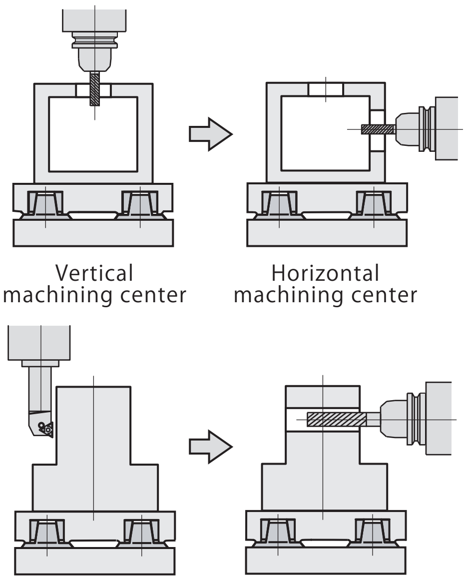
Exchanges of jigs and workpieces are easy with Pal system



Offline setup promoted

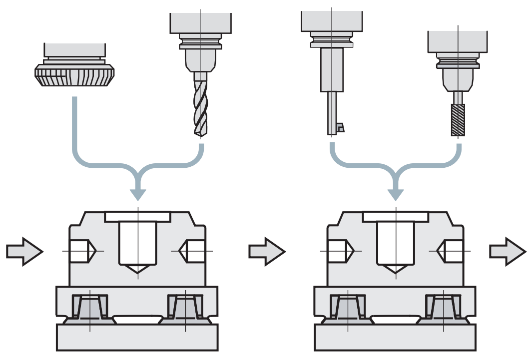
- Implementation of Pal system makes it possible to perform setting of workpiece on jigs of machine table accurately and significantly reduces setup time that was previously necessary for alignment.

Multifaceted machining with high accuracy is easy



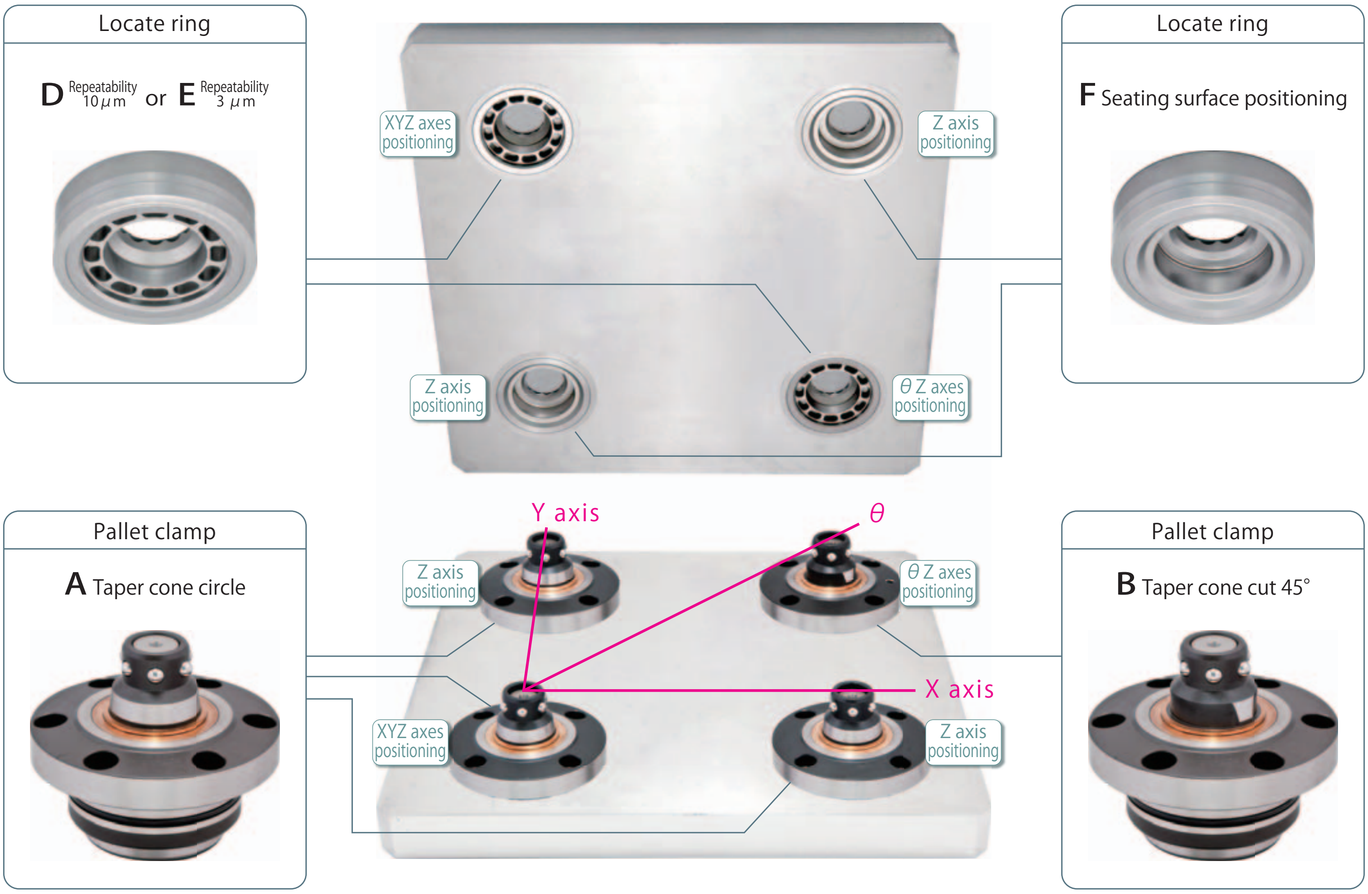
- Since workpieces do not have to be dismounted from pallets, continuous operations through multiple machines are possible. Highly accurate, multifaceted machining is possible with the Pal system.

Process division is easy (pallet transfer method)

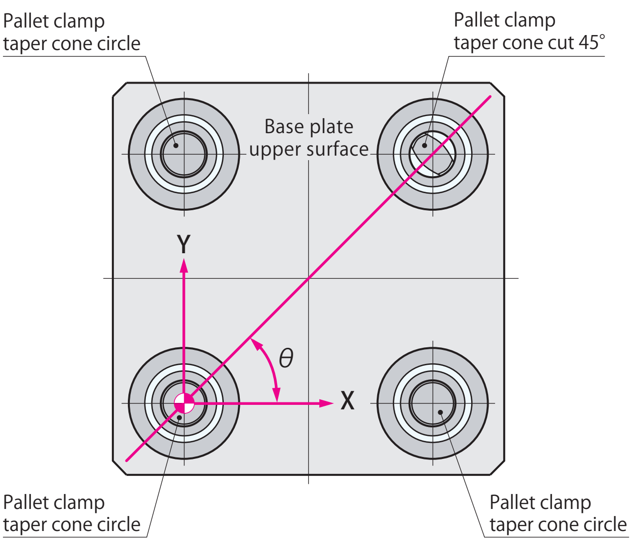


- Highly accurate positioning of Pal system makes it possible to distribute processes. This advantage allows a flexible allocation of machining process, which needs a very high accuracy. This flexibility makes it easier to unify tact time among all machines, leading to even distribution of load among machines to raise productivity.
- With pallet transfer method, mixed production of workpieces can be done easily.
- Workpieces are fixed onto the pallet before transferring, thus clamp time is short and problems relating to clamping can be mitigated at each machine.

Pallet clamp configuration pattern 1

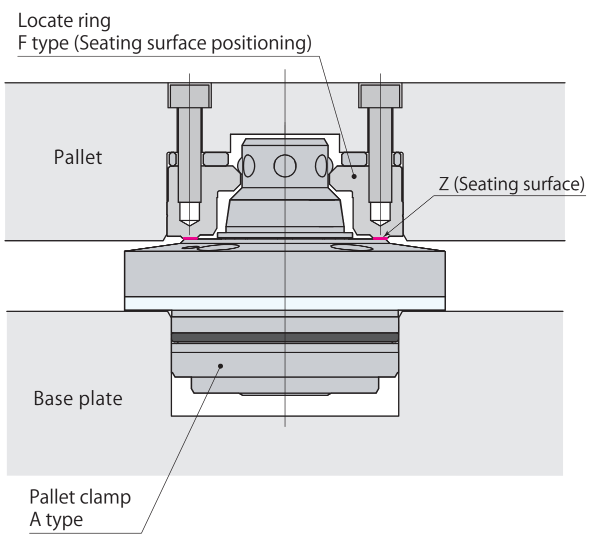


θ X Y axes positioning by tapered surface



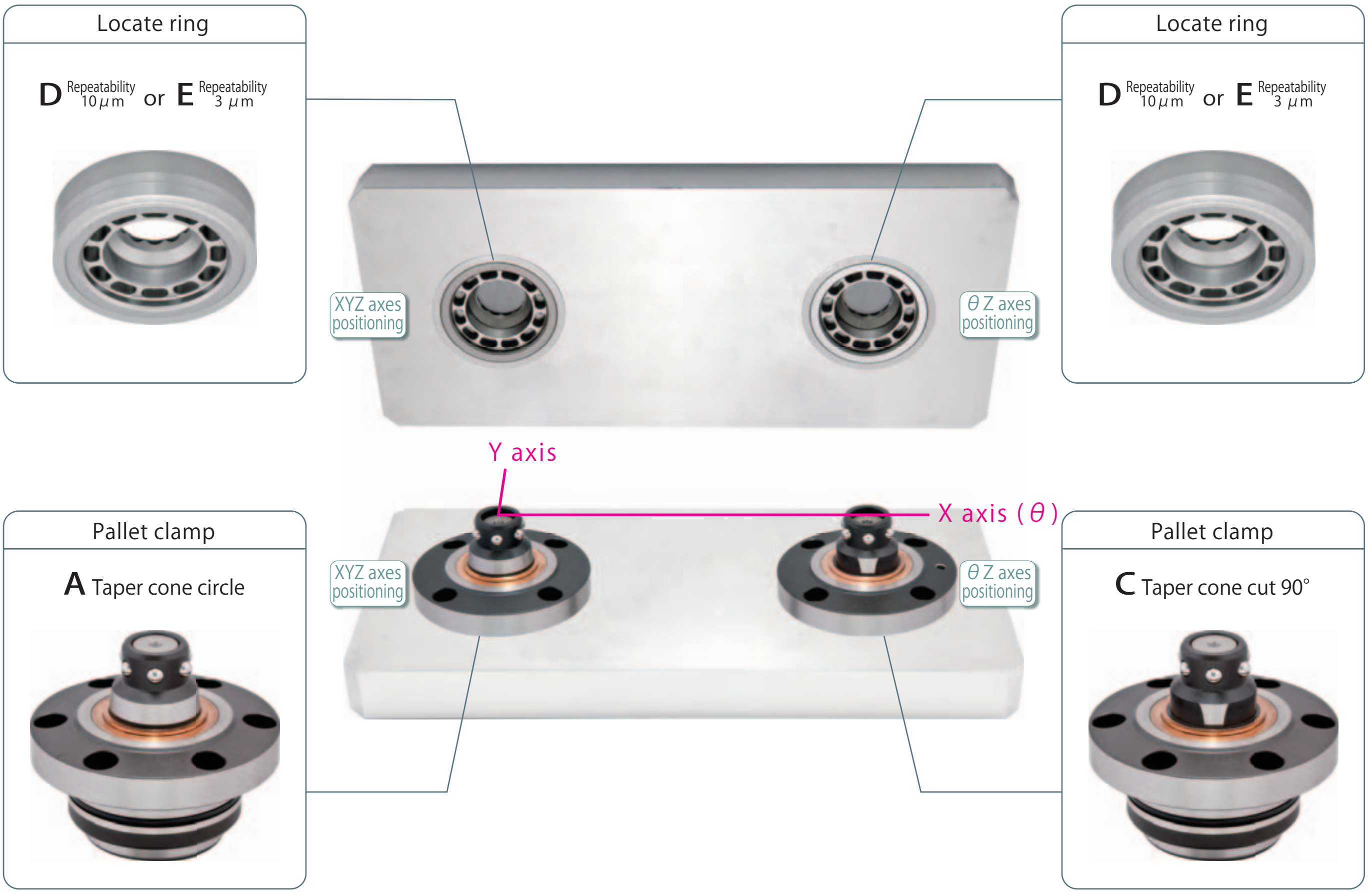
The pitch error between XYZ axes positioning pallet clamp and θZ axes positioning pallet clamp is tolerated by cut type taper cone even under thermal change conditions.

Z axis positioning by seating surface

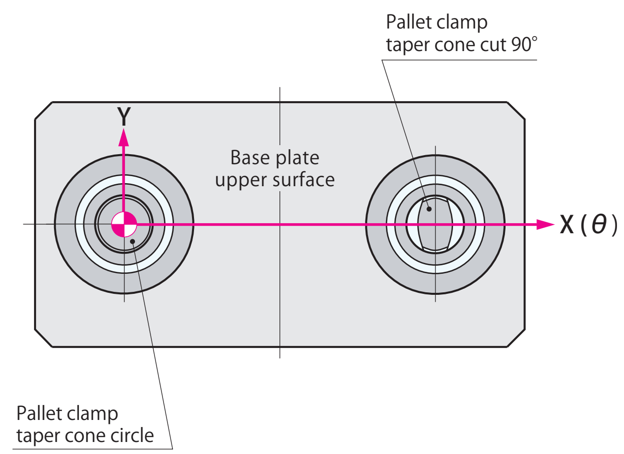


Since Z axis is positioned by 4 points of seating surface with no effect from pitch error, surface accuracy of pallet is sustained at high levels.

Pallet clamp configuration pattern 2

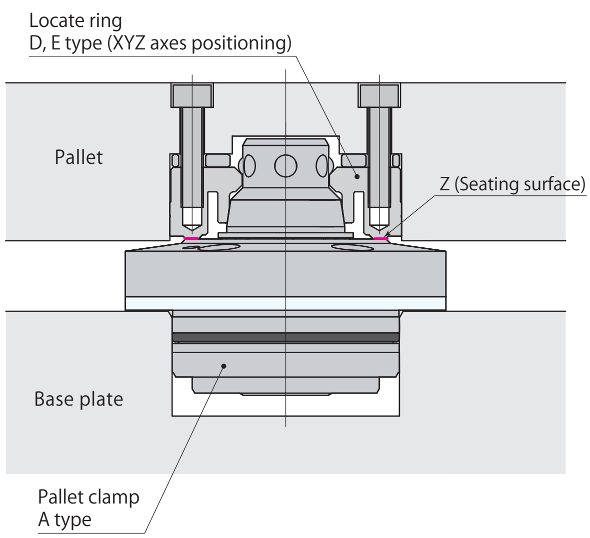


θX Y axes positioning by tapered surface



The pitch error between XYZ axes positioning pallet clamp and θZ axes positioning pallet clamp is tolerated by cut type taper cone even under thermal change conditions.

Z axis positioning by seating surface

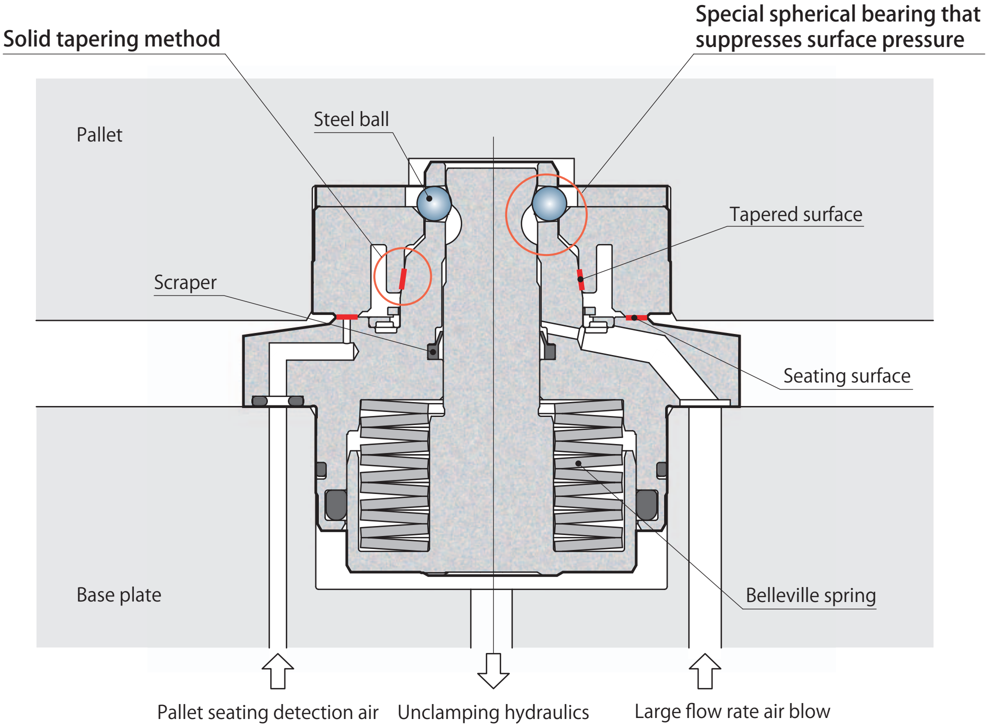


Since Z axis is positioned by 2 points of seating surface with no effect from pitch error, surface accuracy of pallet is sustained at high levels.

Spring clamp

model **CPC-□□H** PAT.

Highly rigid pallet clamp and repeatability of 3 μm with dual surface contact
The mechanical clamp with high output, long-life belleville spring



Specifications	page → 599
Dimensions	page → 600
Mounting details	page → 602
Locate ring	page → 610

Specifications

CPC – Type – Size H

Type:
- **A** : Taper cone circle
- **B** : Taper cone cut 45°
- **C** : Taper cone cut 90°
- **S** : Shim

Size: 03, 06, 10, 16, 25, 40

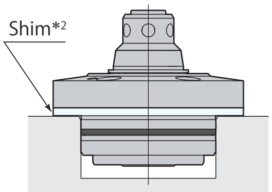
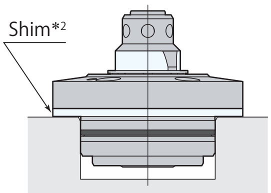
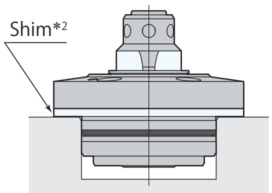
- Be sure to specify models and serial numbers when placing repeat orders. (Models and serial numbers are laser marked on clamps; For shim, same models and serial numbers as clamps may be specified.)

■ indicates made to order. (40)

Model			CPC-□03H	CPC-□06H	CPC-□10H	CPC-□16H	CPC-□25H	CPC-□40H
Clamping force*1		kN	4.0	6.0	10.0	16.0	25.0	40.0
Cylinder capacity (unclamp)*1		cm^3	4.0	6.1	14.1	28.7	49.6	77.9
Full stroke		mm	4.4	4.4	5.0	6.5	7.0	7.5
Clamp stroke		mm	2.4	2.4	3.0	4.0	4.5	5.0
Safety stroke		mm	2.0	2.0	2.0	2.5	2.5	2.5
Lift stroke*2		mm	1					
Max. allowable eccentricity for pallet setting		mm	±1.0	±1.5	±2.0	±2.5	±3.5	±4.0
Lift force*1*3	Hydraulic pressure 3.5MPa	kN	0.4	0.4	1.5	3.2	4.6	4.6
	Hydraulic pressure 5MPa	kN	1.8	2.5	5.7	9.8	15.3	20.1
	Hydraulic pressure 7MPa	kN	3.6	5.2	11.4	18.7	29.4	40.9
Lift force calculation (P:Unclamping hydraulic pressure MPa)*1*3			0.91×P-2.73	1.39×P-4.46	2.83×P-8.42	4.42×P-12.25	7.09×P-20.18	10.39×P-31.80
Max. allowable load (including a pallet)*4	Horizontal mounting	kN	3.0	8.0	15.0	25.0	35.0	50.0
	Vertical mounting	kN	0.5	1.5	2.5	4.0	5.0	7.5
Mass*1		kg	0.5	0.7	1.6	3.0	5.6	9.6
Recommended tightening torque of mounting screws*5		N·m	7	7	12	29	57	100

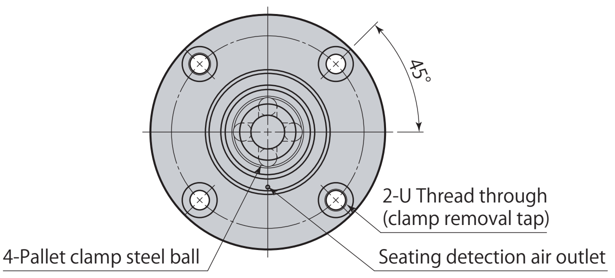
- Pressure range:3.5–7 MPa
- Proof pressure:10.5 MPa
- Operating temperature:0–70 ℃
- Fluid used:General mineral based hydraulic oil (ISO-VG32 equivalent)
- Recommended air blow pressure:0.3–0.5 MPa

*1:The figure indicates one piece of clamp. *2:This is the amount for lifting pallet when unclamping.
*3:Set the hydraulic pressure so that the lift force is equal to or greater than the max. allowable load.
*4:This is maximum allowable load of pallet, regardless of how many clamps are used. *5:ISO R898 class 12.9

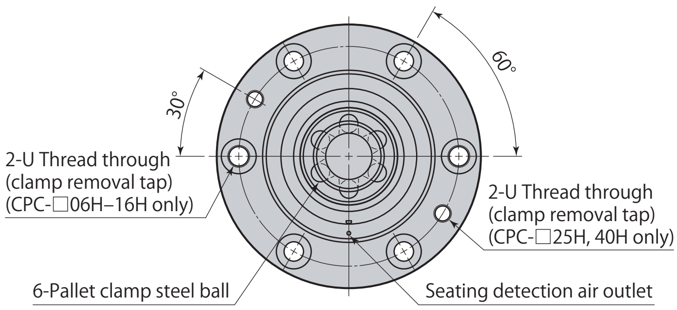
Pallet clamp type	A Taper cone circle	B*3 Taper cone cut 45°	C*3 Taper cone cut 90°
Spring clamp model **CPC***1	 model CPC-A□H	 model CPC-B□H	 model CPC-C□H

*1:Spring clamp model CPC and hydraulic clamp model CPH (**page →604**) cannot be used together.
*2:Shim of pallet clamp can be used when heights of mounted clamps vary. (option)
*3:Taper cone cut can be selected from B type or C type.

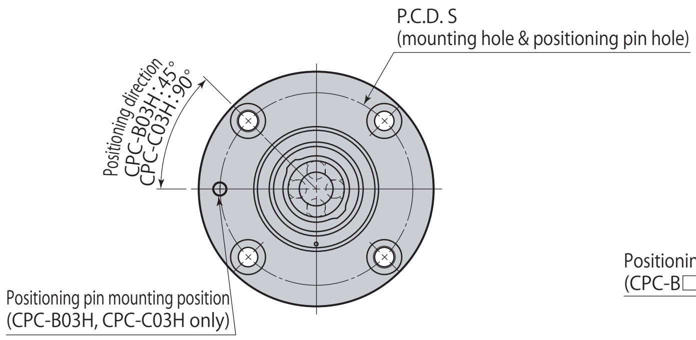
Dimensions



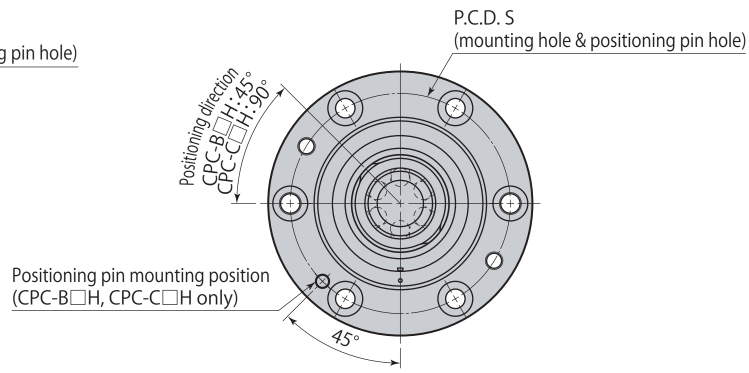
CPC-A03H



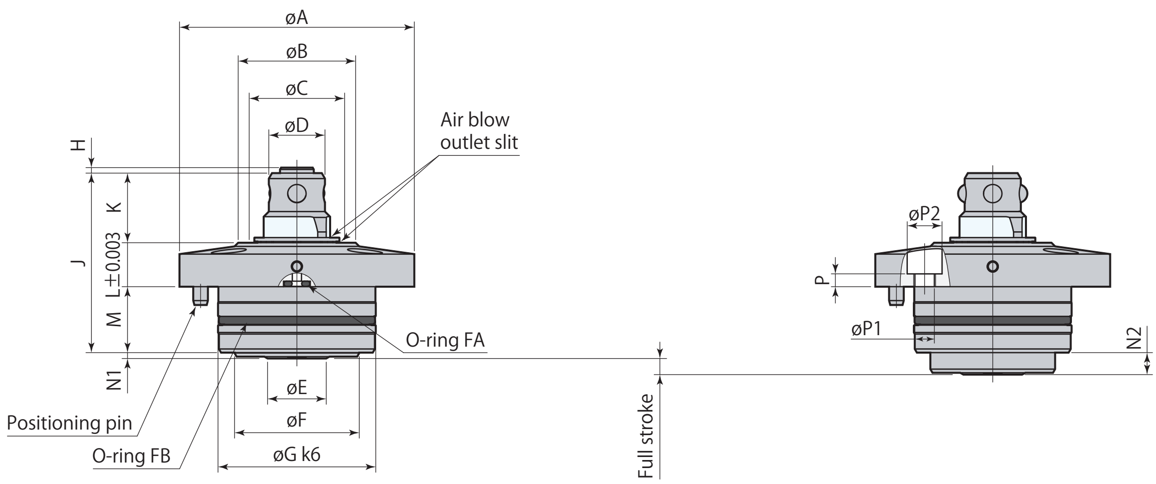
CPC-A06–40H



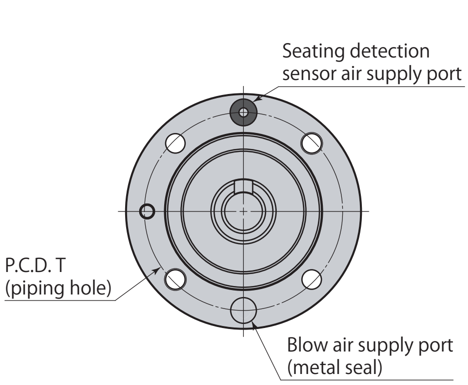
CPC- B/C 03H



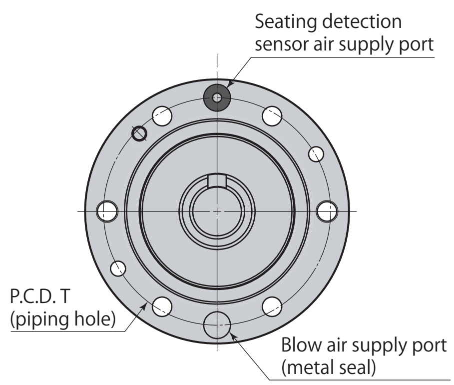
CPC- B/C 06–40H



Unclamp **Stroke end**



CPC-□03H



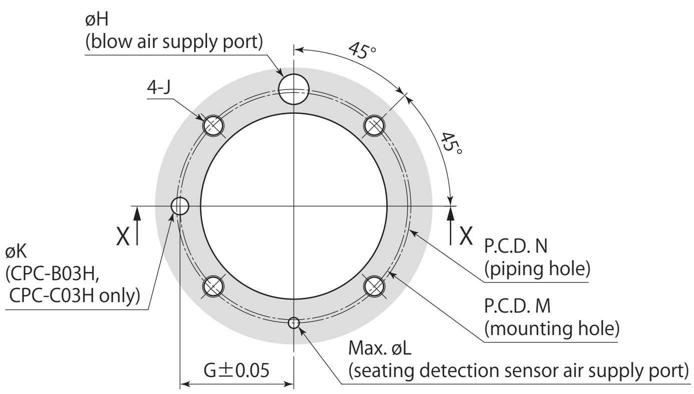
CPC-□06–40H

mm

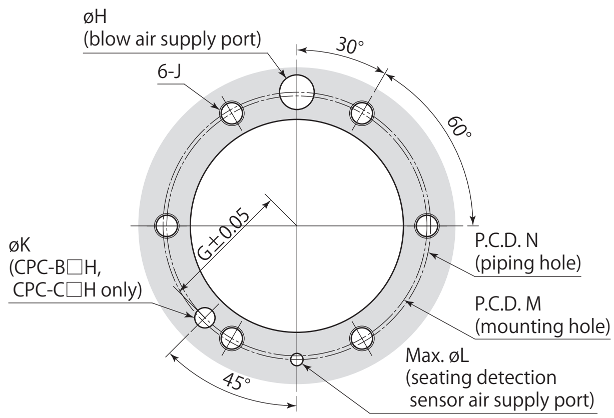
Model	CPC-□03H	CPC-□06H	CPC-□10H	CPC-□16H	CPC-□25H	CPC-□40H
øA	64	72	100	120	150	175
øB	32	45	48	66	78	94
øC	26	37	40	56	66	78
øD	15.3	19.3	23	29.4	37.3	46
øE	16	19	29	35	45	56
øF	34	42	60	75	95	115
øG	$43^{+0.018}_{+0.002}$	$51^{+0.021}_{+0.002}$	$74^{+0.021}_{+0.002}$	$89^{+0.025}_{+0.003}$	$110^{+0.025}_{+0.003}$	$130^{+0.028}_{+0.003}$
H	1.5	1.5	1.3	1.3	1.3	1.3
J	50.6	57.6	68	85.5	107	129.5
K	19	22.5	26	34	41	48
L	12	13	15	18	22	28
M	18	18	24	27	32	35
N1	1.6	4.1	3	6.5	12	18.5
N2	6	8.5	8	13	19	26
P	3.5	5	4	5	5	7
P1	5.3	5.3	6.8	9	11	14
P2	9.5	9.5	11	14	17.5	20
S	52.5	60	86	104	130	152
T	54	62	86	104	130	152
U	M6×1	M6×1	M8×1.25	M10×1.5	M10×1.5	M12×1.75
O-ring FA (hardness Hs90)	P4	P4	P4	P6	P8	P10
O-ring FB (hardness Hs90)	AS568-029	AS568-032	AS568-147	AS568-152	AS568-155	AS568-158

- Be sure to match up phase of pallet clamp steel balls and locate ring steel ball grooves.
- Positioning direction is the direction in which tapered surface has not been cut.
- Use øA, which has been ground at the same time as tapered surface, for positioning measurement after mounting.
- Mounting screws are not included.
- Pal coupler (**pages →662–667**) recommended when using couplers in a set.
- ▭ dimensions are different from former pallet clamp (model CPC-□□F).

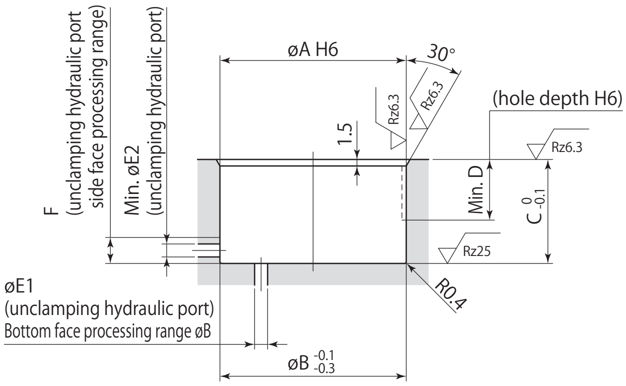
Mounting details



CPC-□03H



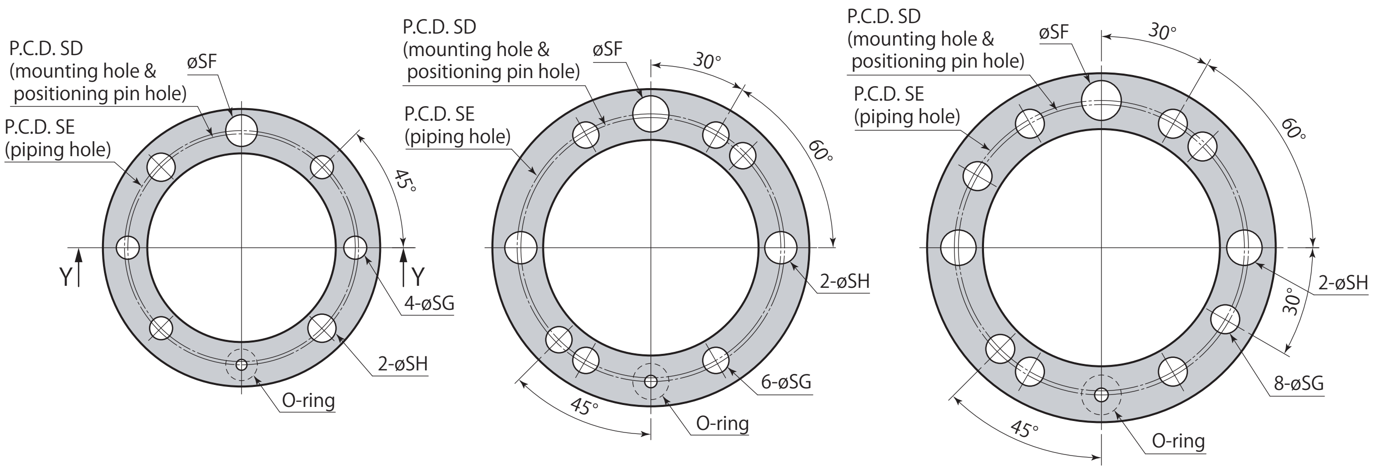
CPC-□06–40H



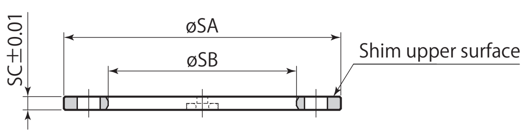
X-X

Rz: ISO4287(1997)

Shim (option)



CPC-S03H CPC-S06–16H CPC-S25/40H



Y-Y

mm

Model	CPC-□03H	CPC-□06H	CPC-□10H	CPC-□16H	CPC-□25H	CPC-□40H
øA	$43^{+0.016}_{0}$	$51^{+0.019}_{0}$	$74^{+0.019}_{0}$	$89^{+0.022}_{0}$	$110^{+0.022}_{0}$	$130^{+0.025}_{0}$
øB	43	51	74	89	110	130
øE1	3–12	3–15	3–25	3–31	4–39	4–50
øE2	3	3	3	3	4	4
F	6	8.5	8	13	19	26
G	26.25	30	43	52	65	76
øH	4.5–7	4.5–7	5.5–8	6–9	7–11	7–13
J	M5	M5	M6	M8	M10	M12
øL	2.5	2.5	2.5	4	6	8
M	52.5	60	86	104	130	152
N	54	62	86	104	130	152
Not using shim (standard specifications)						
C	24	26.5	32	40	51	61
D	14	14	15	15	16	16
øK	$4.1^{+0.1}_{0}$ depth 6	$4.1^{+0.1}_{0}$ depth 6	$4.1^{+0.1}_{0}$ depth 6	$6.1^{+0.1}_{0}$ depth 6	$6.1^{+0.1}_{0}$ depth 6	$6.1^{+0.1}_{0}$ depth 6
Using shim (shim specifications)						
C	21	23.5	29	37	47	57
D	11	11	12	12	12	12
øK	$4.1^{+0.1}_{0}$ depth 4	$4.1^{+0.1}_{0}$ depth 4	$4.1^{+0.1}_{0}$ depth 4	$6.1^{+0.1}_{0}$ depth 4	$6.1^{+0.1}_{0}$ depth 4	$6.1^{+0.1}_{0}$ depth 4

- Process with shim specification dimensions when shim is attached. Processing with standard specification dimensions will result in clamp damage during full stroke.
- Process either bottom or side surface of unclamping hydraulic port.
- Be sure to match up phase of pallet clamp steel balls and locate ring steel ball grooves.
- ▭ dimensions are different from former pallet clamp (model CPC-□□F).

mm

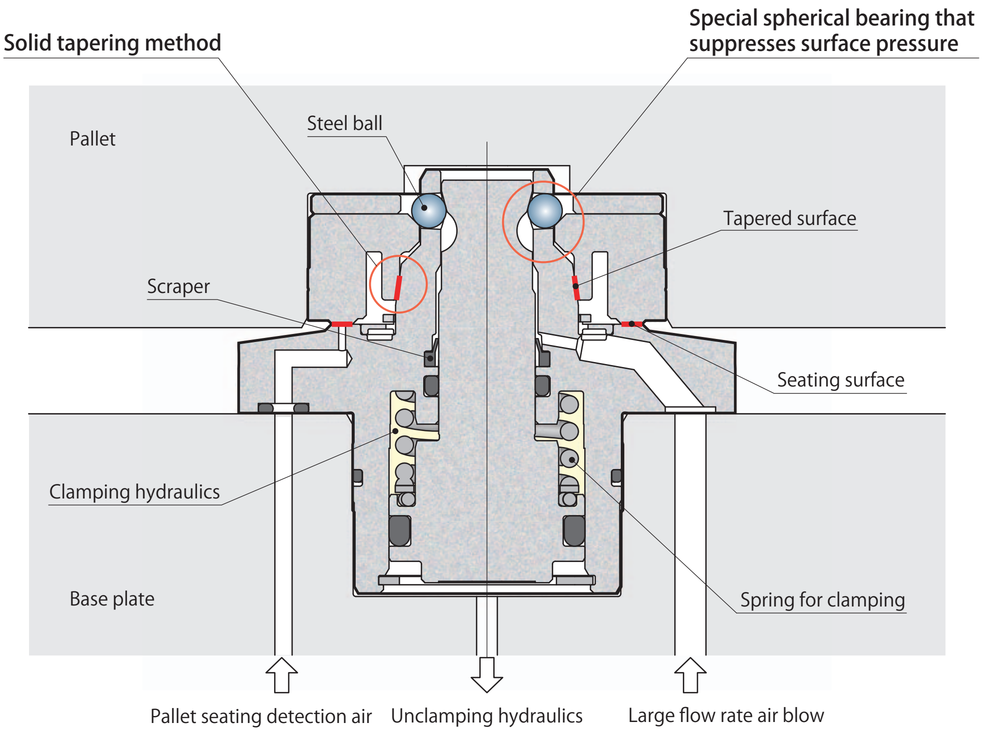
Shim	CPC-S03H	CPC-S06H	CPC-S10H	CPC-S16H	CPC-S25H	CPC-S40H
øSA	64	72	100	120	150	175
øSB	43.5	51.5	75	90	111	131
SC	3.05	3.05	3.05	3.05	4.05	4.05
SD	52.5	60	86	104	130	152
SE	54	62	86	104	130	152
øSF	7.3	7.3	8.2	9.2	11.2	13.2
øSG	5.3	5.3	6.3	9	11	14
øSH	6.5	6.5	9	11	11	14
O-ring (hardness Hs90)	P4	P4	P4	P6	P8	P10
Mass	0.04 kg	0.04 kg	0.07 kg	0.10 kg	0.22 kg	0.28 kg

- This diagram indicates dimensions at shipping.
- Adjust thickness of shim by grinding to ensure flatness of pallet.
- Grind shim upper surface (surface without O-ring) to adjust shim.
- ▭ dimensions are different from former pallet clamp (model CPC-□□F).

Hydraulic clamp

model **CPH-□□H** PAT.

Highly rigid pallet clamp and repeatability of 3 μm with dual surface contact
Compact and reliable hydraulic clamp



Specifications page → 605
Dimensions page → 606
Mounting details page → 608
Locate ring page → 610

Specifications

CPH – [Type] [Size] H

Type:
- **A** : Taper cone circle
- **B** : Taper cone cut 45°
- **C** : Taper cone cut 90°
- **S** : Shim

Size: 03, 06, 10, 16, 25, 40

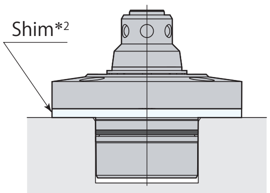
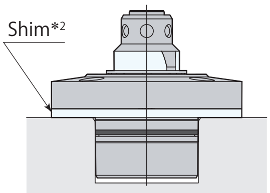
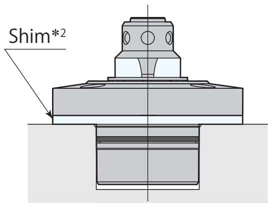
- Be sure to specify models and serial numbers when placing repeat orders. (Models and serial numbers are laser marked on clamps; For shim, same models and serial numbers as clamps may be specified.)

■ indicates made to order. (40)

Model			CPH-□03H	CPH-□06H	CPH-□10H	CPH-□16H	CPH-□25H	CPH-□40H
Clamping force*1	Hydraulic pressure 0MPa*2	kN	0.3	0.3	0.4	0.5	0.6	0.8
	Hydraulic pressure 5MPa	kN	2.9	4.4	7.3	11.6	18.0	28.8
	Hydraulic pressure 7MPa	kN	4.0	6.0	10.0	16.0	25.0	40.0
Clamping force calculation (P：Hydraulic pressure MPa)*1			0.52×P+0.3	0.81×P+0.3	1.37×P+0.4	2.21×P+0.5	3.48×P+0.6	5.60×P+0.8
Cylinder capacity*1	Unclamp	cm^3	1.7	2.8	4.8	9.9	16.0	27.2
	Clamp	cm^3	1.3	2.1	3.8	7.8	12.6	21.4
Full stroke		mm	4.4	4.4	5.0	6.5	7.0	7.5
Clamp stroke		mm	2.4	2.4	3.0	4.0	4.5	5.0
Safety stroke		mm	2.0	2.0	2.0	2.5	2.5	2.5
Lift stroke*3		mm	1					
Max. allowable eccentricity for pallet setting		mm	±1.0	±1.5	±2.0	±2.5	±3.5	±4.0
Lift force*1*4	Hydraulic pressure 3.5MPa	kN	1.1	1.9	3.0	4.9	7.5	12.0
	Hydraulic pressure 5MPa	kN	1.7	2.9	4.4	7.2	11.0	17.5
	Hydraulic pressure 7MPa	kN	2.4	4.2	6.4	10.2	15.5	24.8
Lift force calculation (P：Unclamping hydraulic pressure MPa)*1*4			0.38×P-0.24	0.63×P-0.28	0.96×P-0.37	1.52×P-0.41	2.29×P-0.50	3.63×P-0.67
Max. allowable load (including a pallet)*5	Horizontal mounting	kN	3.0	8.0	15.0	25.0	35.0	50.0
	Vertical mounting	kN	0.5	1.5	2.5	4.0	5.0	7.5
Mass*1		kg	0.3	0.6	0.8	1.6	2.7	4.9
Recommended tightening torque of mounting screws*6		N・m	7	7	12	29	57	100

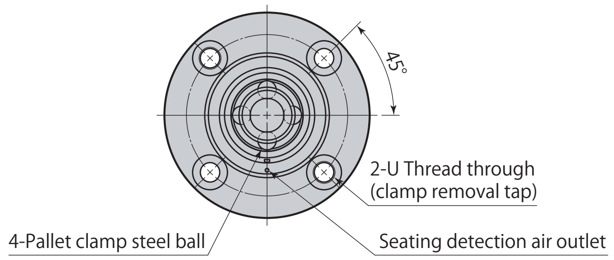
- Pressure range：5–7 MPa (model CPS-E), 2–7 MPa (model CPS-D, CPS-F)
- Proof pressure：10.5 MPa
- Operating temperature：0–70℃
- Fluid used：General mineral based hydraulic oil (ISO-VG32 equivalent)
- Recommended air blow pressure：0.3–0.5 MPa

∗1：The figure indicates one piece of clamp. ∗2：The value indicates the force generated by the spring.
∗3：This is the amount for lifting pallet when unclamping.
∗4：Set the hydraulic pressure so that the lift force is equal to or greater than the max allowable load.
∗5：This is maximum allowable load of pallet, regardless of how many clamps are used. ∗6：ISO R898 class 12.9

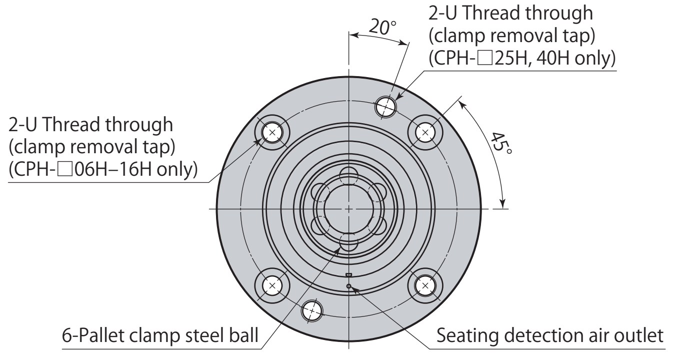
Pallet clamp type	A Taper cone circle	B*3 Taper cone cut 45°	C*3 Taper cone cut 90°
Hydraulic clamp model **CPH***1	 model CPH-A□H	 model CPH-B□H	 model CPH-C□H

∗1：Hydraulic clamp model CPH and spring clamp model CPC (**page →598**) cannot be used together.
∗2：Shim of pallet clamp can be used when heights of mounted clamps vary. (option)
∗3：Taper cone cut can be selected from B type or C type.

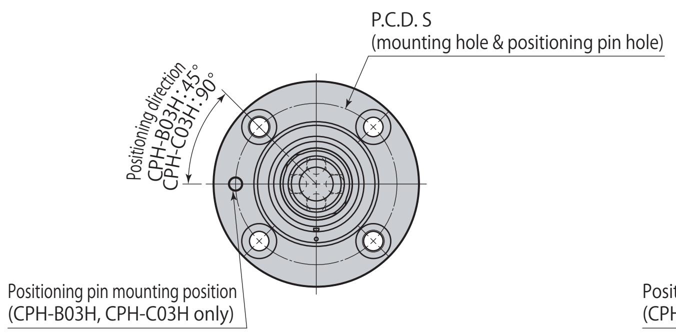
Dimensions



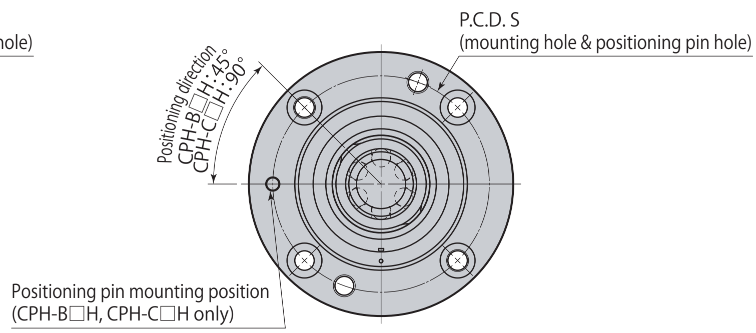
CPH-A03H



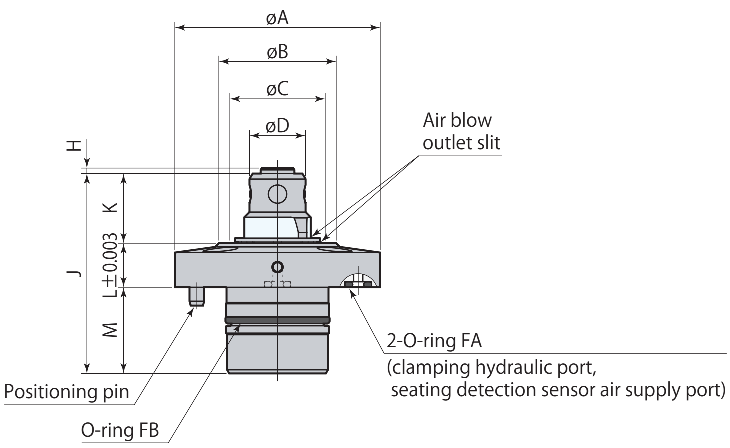
CPH-A06–40H



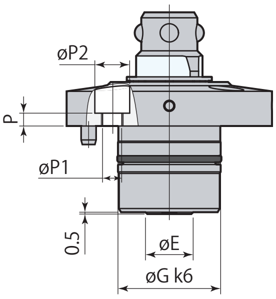
CPH-$\genfrac{}{}{0pt}{}{B}{C}$03H



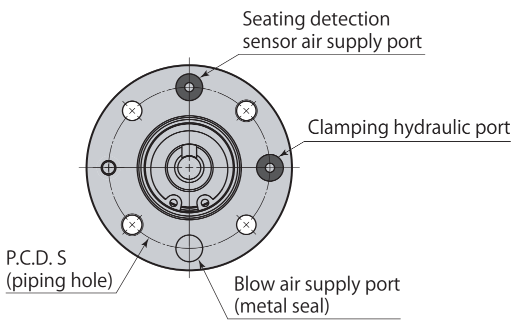
CPH-$\genfrac{}{}{0pt}{}{B}{C}$06–40H



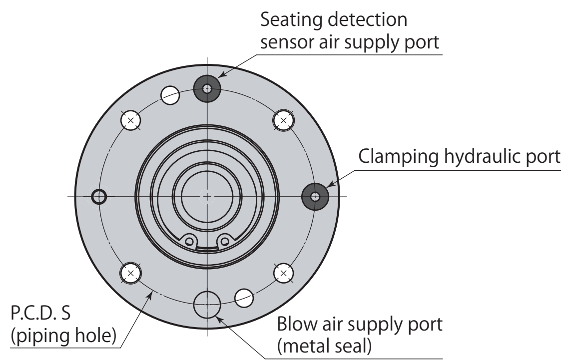
Unclamp



Stroke end



CPH-□03H



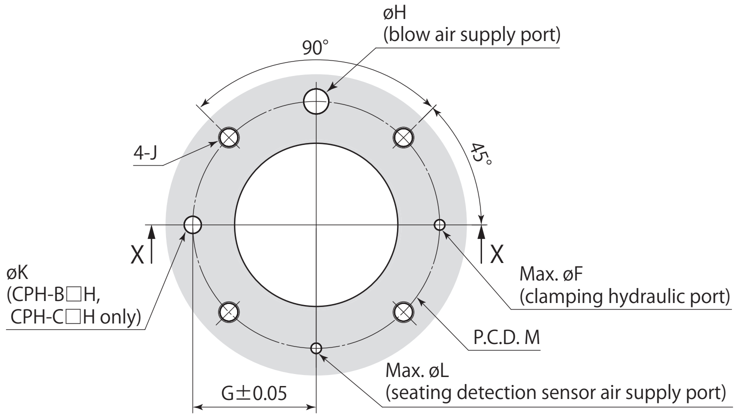
CPH-□06–40H

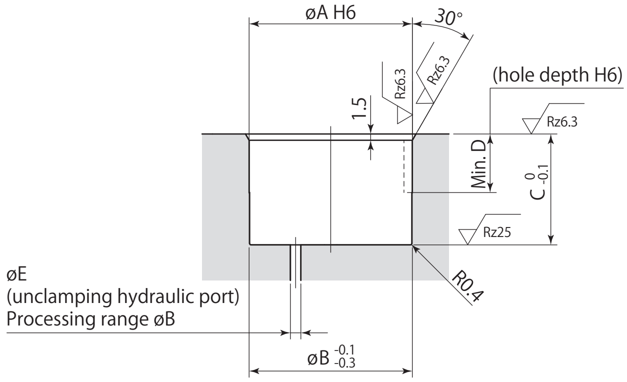
mm

Model	CPH-□03H	CPH-□06H	CPH-□10H	CPH-□16H	CPH-□25H	CPH-□40H
øA	56	72	76	100	120	145
øB	32	45	48	66	78	94
øC	26	37	40	56	66	78
øD	15.3	19.3	23	29.4	37.3	46
øE	13	19	21	28	38	48
øG	$28^{+0.015}_{+0.002}$	$39^{+0.018}_{+0.002}$	$45^{+0.018}_{+0.002}$	$54^{+0.021}_{+0.002}$	$65^{+0.021}_{+0.002}$	$80^{+0.021}_{+0.002}$
H	1.5	1.5	1.3	1.3	1.3	1.3
J	54.5	61.5	67.5	79.5	93.5	109.5
K	19	22.5	26	34	41	48
L	12	13	15	18	22	28
M	23.5	26	26.5	27.5	30.5	33.5
P	3.5	5	6	6	7	9
øP1	5.3	5.3	6.8	9	11	14
øP2	9.5	9.5	11	14	17.5	20
S	44	59	62	84	100	122
U	M6×1	M6×1	M8×1.25	M10×1.5	M10×1.5	M12×1.75
O-ring FA (hardness Hs90)	P4	P4	P4	P6	P8	P10
O-ring FB (hardness Hs90)	AS568-022	AS568-028	AS568-030	AS568-135	AS568-141	AS568-150

- Be sure to match up phase of pallet clamp steel balls and locate ring steel ball grooves.
- Positioning direction is the direction in which tapered surface has not been cut.
- Use øA, which has been ground at the same time as tapered surface, for positioning measurement after mounting.
- Mounting screws are not included.
- Pal coupler (**pages →662–667**) recommended when using couplers in a set.
- ▭ dimensions are different from former pallet clamp (model CPH-□□F).

Mounting details

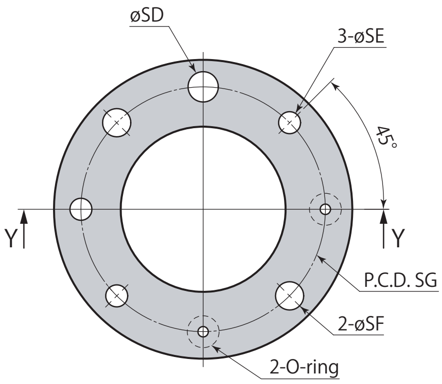




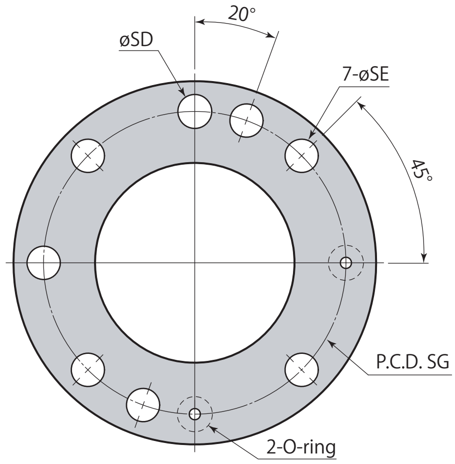
X-X

Rz: ISO4287(1997)

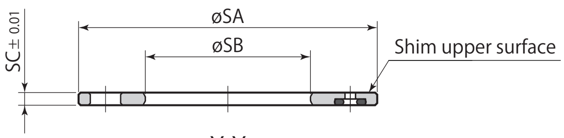
Shim (option)



CPH-S03–16H



CPH-S25/40H



Y-Y

mm

Model	CPH-□03H	CPH-□06H	CPH-□10H	CPH-□16H	CPH-□25H	CPH-□40H
øA	$28^{+0.013}_{0}$	$39^{+0.016}_{0}$	$45^{+0.016}_{0}$	$54^{+0.019}_{0}$	$65^{+0.019}_{0}$	$80^{+0.019}_{0}$
øB	28	39	45	54	65	80
øE	3–8	3–14	3–16	3–23	4–31	4–41
øF	2.5	2.5	2.5	4	6	8
G	22	29.5	31	42	50	61
øH	4.5–7	4.5–7	5.5–8	6–9	7–11	7–13
J	M5	M5	M6	M8	M10	M12
øL	2.5	2.5	2.5	4	6	8
M	44	59	62	84	100	122
Not using shim (standard specifications)						
C	24	26.5	27	28	31	34
D	14	14	14	15	16	16
øK	$4.1^{+0.1}_{0}$ depth 6	$4.1^{+0.1}_{0}$ depth 6	$4.1^{+0.1}_{0}$ depth 6	$6.1^{+0.1}_{0}$ depth 6	$6.1^{+0.1}_{0}$ depth 6	$6.1^{+0.1}_{0}$ depth 6
Using shim (shim specifications)						
C	21	23.5	24	25	27	30
D	11	11	11	12	12	12
øK	$4.1^{+0.1}_{0}$ depth 4	$4.1^{+0.1}_{0}$ depth 4	$4.1^{+0.1}_{0}$ depth 4	$6.1^{+0.1}_{0}$ depth 4	$6.1^{+0.1}_{0}$ depth 4	$6.1^{+0.1}_{0}$ depth 4

- Process with shim specification dimensions when shim is attached. Processing with standard specification dimensions will result in clamp damage during full stroke.
- Be sure to match up phase of pallet clamp steel balls and locate ring steel ball grooves.
- ▭ dimensions are different from former pallet clamp (model CPH-□□F).

mm

Shim	CPH-S03H	CPH-S06H	CPH-S10H	CPH-S16H	CPH-S25H	CPH-S40H
øSA	56	72	76	100	120	145
øSB	28.8	39.8	46	55	66	81
SC	3.05	3.05	3.05	3.05	4.05	4.05
øSD	7.3	7.3	8.2	9.2	11.2	13.2
øSE	5.3	5.3	6.3	9	11	14
øSF	6.8	6.8	9	11	–	–
SG	44	59	62	84	100	122
O-ring (hardness Hs90)	P4	P4	P4	P6	P8	P10
Mass	0.04 kg	0.06 kg	0.06 kg	0.12 kg	0.22 kg	0.32 kg

- This diagram indicates dimensions at shipping.
- Adjust thickness of shim by grinding to ensure flatness of pallet.
- Grind shim upper surface (surface without O-ring) to adjust shim.
- ▭ dimensions are different from former pallet clamp (model CPH-□□F).

Specifications

CPS － [Type] [Size] [Mounting method]

Type
- **D** : Repeatability 10 μm*1
- **E** : Repeatability 3 μm
- **F** : Seating surface positioning (Z axis positioning)
- **S** : Shim
- **P** : Protective plate*2

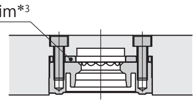
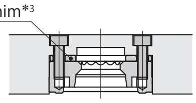
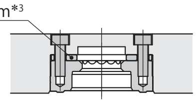
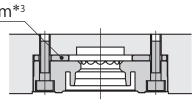
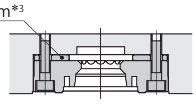
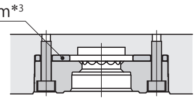
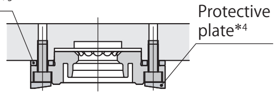
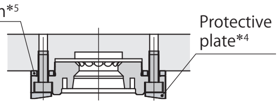
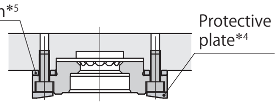
Size
- 03
- 06
- 10
- 16
- 25
- 40

Mounting method
- **T** : Pallet upper surface mounting
- **D** : Pallet lower surface mounting
- **F** : Flange mounting

● Be sure to specify models and serial numbers when placing repeat orders. (Models and serial numbers are laser marked on clamps; For shim, same models and serial numbers as clamps may be specified.)

▇ indicates made to order.

∗1：model CPS-D (repeatability 10 μm) is limited to sizes of 03, 06, 10, and 16.
∗2：The protective plate is only flange mounting type.

Locate ring	D*1 Repeatability 10 μm	E*1 Repeatability 3 μm	F*2 Seating surface positioning (Z axis positioning)
T Pallet upper surface mounting	model CPS-D□T 	model CPS-E□T 	model CPS-F□T 
D Pallet lower surface mounting	model CPS-D□D 	model CPS-E□D 	model CPS-F□D 
F Flange mounting	model CPS-D□F 	model CPS-E□F 	model CPS-F□F 

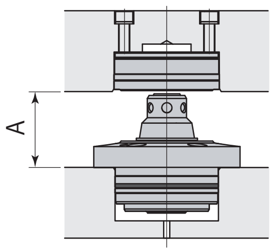
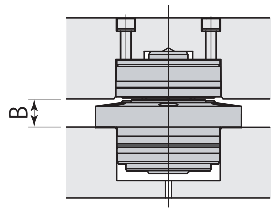
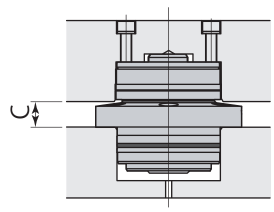
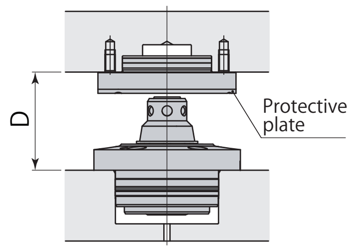
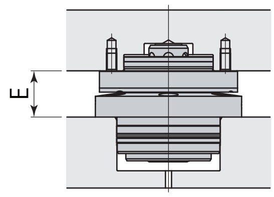
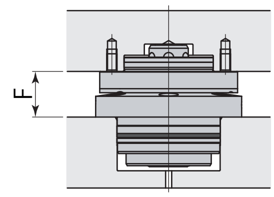
∗1：model CPS-D (repeatability 10 μm) and model CPS-E (repeatability 3 μm) of locate ring cannot be used together.
∗2：model CPS-F (seating surface positioning) needs the positioning of XY axes.
∗3：It is recommended to use a shim (option) to adjust mounting hole depth for the locate rings for pallet upper surface mounting and lower surface mounting. Grind shim to adjust thickness.
∗4：Protective plate (flange mounting only) can be used to prevent damage of seating surface, when pallet must be placed on the floor, etc. (option)
∗5：Shim of locate ring of flange mounting can be used when heights of mounted locate rings vary. (option)

Mass

kg

Locate ring		D Repeatability 10 μm				E Repeatability 3 μm						F Seating surface positioning (Z axis positioning)					
T Pallet upper surface mounting	Model	CPS-D03T	CPS-D06T	CPS-D10T	CPS-D16T	CPS-E03T	CPS-E06T	CPS-E10T	CPS-E16T	CPS-E25T	CPS-E40T	CPS-F03T	CPS-F06T	CPS-F10T	CPS-F16T	CPS-F25T	CPS-F40T
	Mass	0.1	0.2	0.3	0.7	0.1	0.2	0.3	0.7	1.2	2	0.1	0.2	0.3	0.7	1.1	1.8
D Pallet lower surface mounting	Model	CPS-D03D	CPS-D06D	CPS-D10D	CPS-D16D	CPS-E03D	CPS-E06D	CPS-E10D	CPS-E16D	CPS-E25D	CPS-E40D	CPS-F03D	CPS-F06D	CPS-F10D	CPS-F16D	CPS-F25D	CPS- F40D
	Mass	0.2	0.3	0.5	1.2	0.2	0.3	0.5	1.2	2	3.1	0.2	0.3	0.5	1.1	1.9	3
F Flange mounting	Model	CPS-D03F	CPS-D06F	CPS-D10F	CPS-D16F	CPS-E03F	CPS-E06F	CPS-E10F	CPS-E16F	CPS-E25F	CPS-E40F	CPS-F03F	CPS-F06F	CPS-F10F	CPS-F16F	CPS-F25F	CPS- F40F
	Mass	0.1	0.2	0.3	0.8	0.1	0.2	0.3	0.8	1.5	2.5	0.1	0.2	0.4	0.8	1.5	2.4

Height of pallet from base plate

Locate ring mounting method	Pallet changing	Pallet setting (Unclamp)	Clamp
T Pallet upper surface mounting **D** Pallet lower surface mounting			
F Flange mounting			

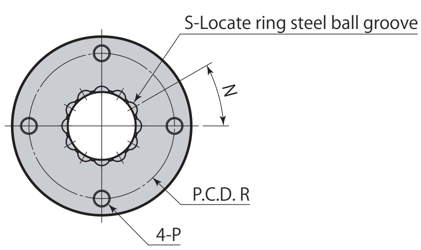
mm

Spring clamp / Hydraulic clamp		CPC / CPH -□03H	CPC / CPH -□06H	CPC / CPH -□10H	CPC / CPH -□16H	CPC / CPH -□25H	CPC / CPH -□40H
T Pallet upper surface mounting / **D** Pallet lower surface mounting	A	Min. 33	Min. 38	Min. 44	Min. 55	Min. 66	Min. 79
	B	12.5	13.5	15.5	18.5	22.5	28.5
	C	11.5	12.5	14.5	17.5	21.5	27.5
F Flange mounting	D	Min. 43	Min. 48	Min. 56	Min. 71	Min. 86	Min. 104
	E	22	23.5	27.5	33.5	41	52
	F	21	22.5	26.5	32.5	40	51

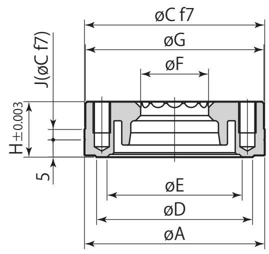
- Pallet lift capacity for dimension A or D or more is needed to change pallet.
- The height from base plate to pallet varies when using shim for pallet clamp or locate ring (flange mounting).

Former type pallet clamps (model CPC-□□F, CPH-□□F) have different lift stroke, air blow (air outlet, sealing method, connecting pipe diameter), locate ring mounting dimensions. Please bear this in mind when placing repeat orders.
Inquire separately regarding former type pallet clamps.

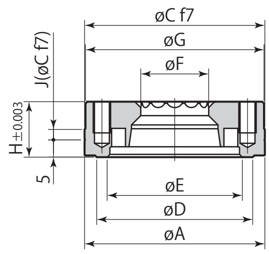
Dimensions



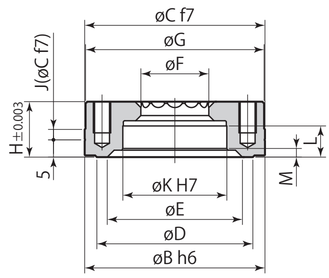
CPS-D03–16T Locate ring (D type)



CPS-E03–40T Locate ring (E type)



CPS-F03–40T Locate ring (F type)



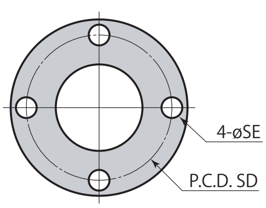
mm

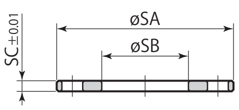
Model	CPS-□03T	CPS-□06T	CPS-□10T	CPS-□16T	CPS-□25T	CPS-□40T
øA	40 $^{+0.005}_{-0.011}$	52 $^{+0.006}_{-0.013}$	60 $^{+0.006}_{-0.013}$	80 $^{+0.006}_{-0.013}$	95 $^{+0.007}_{-0.015}$	115 $^{+0.007}_{-0.015}$
øB	40 $^{0}_{-0.016}$	52 $^{0}_{-0.019}$	60 $^{0}_{-0.019}$	80 $^{0}_{-0.019}$	95 $^{0}_{-0.022}$	115 $^{0}_{-0.022}$
øC	40 $^{-0.025}_{-0.050}$	52 $^{-0.030}_{-0.060}$	60 $^{-0.030}_{-0.060}$	80 $^{-0.030}_{-0.060}$	95 $^{-0.036}_{-0.071}$	115 $^{-0.036}_{-0.071}$
øD	32	45	48	66	78	94
øE	28	39	42	58	68	80
øF	15.6	19.6	23.3	29.7	37.6	46.3
øG	39.5	51.5	59.5	79.5	94.5	114.5
H	13	16	20	25	30	35
J	3	3	3	3	3	4
øK	22 $^{+0.021}_{0}$	30 $^{+0.021}_{0}$	32 $^{+0.025}_{0}$	45 $^{+0.025}_{0}$	55 $^{+0.030}_{0}$	65 $^{+0.030}_{0}$
L	7	9	11	14	16	19
M	2	2.5	2.5	3	4	5
N*	45°	30°	30°	30°	30°	30°
P	M5×0.8 depth 6	M5×0.8 depth 9	M6×1 depth 11	M8×1.25 depth 15	M10×1.5 depth 18	M12×1.75 depth 21
R	31	42	48	64	75	90
S	8	12	12	12	12	12

*: Be sure to match up phase of locate ring steel ball grooves and pallet clamp steel balls.

● Mounting screws are not included.

Shim (option)





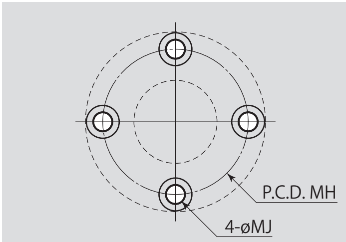
mm

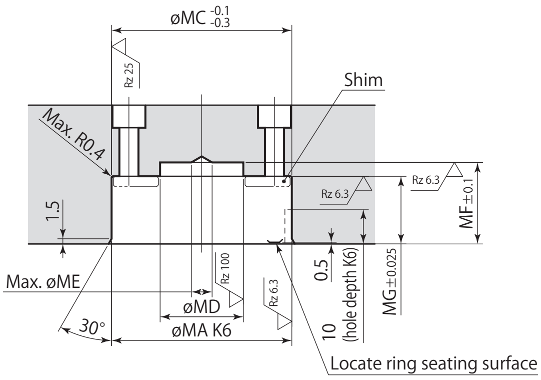
Shim	CPS-S03T	CPS-S06T	CPS-S10T	CPS-S16T	CPS-S25T	CPS-S40T
øSA	39	51	59	79	94	114
øSB	21	25	33	46	56	67
SC	2.05	3.05	3.05	3.05	4.05	4.05
SD	31	42	48	64	75	90
øSE	6	6	7	9	11	14
Mass	0.01 kg	0.03 kg	0.04 kg	0.07 kg	0.13 kg	0.14 kg

● This diagram indicates dimensions at shipping.

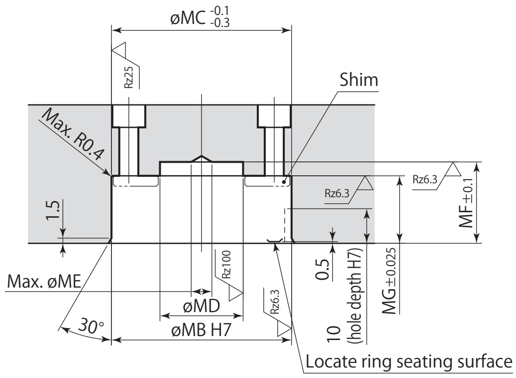
● Adjust thickness of shim by grinding to ensure flatness of pallet.

Mounting details





CPS-D03–16T, CPS-E03–40T



CPS-F03–40T

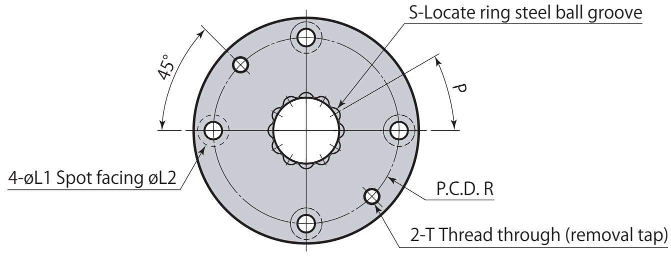
Rz: ISO4287(1997)

mm

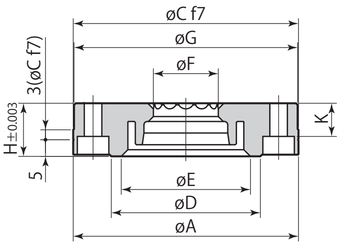
Model	CPS-□03T	CPS-□06T	CPS-□10T	CPS-□16T	CPS-□25T	CPS-□40T
øMA	40 $^{+0.003}_{-0.013}$	52 $^{+0.004}_{-0.015}$	60 $^{+0.004}_{-0.015}$	80 $^{+0.004}_{-0.015}$	95 $^{+0.004}_{-0.018}$	115 $^{+0.004}_{-0.018}$
øMB	40 $^{+0.025}_{0}$	52 $^{+0.030}_{0}$	60 $^{+0.030}_{0}$	80 $^{+0.030}_{0}$	95 $^{+0.035}_{0}$	115 $^{+0.035}_{0}$
øMC	40	52	60	80	95	115
øMD	20	24	28	36	50	60
øME	6	6	8	10	12	15
MF	20	23.5	26.8	34.8	41.8	48.8
MG	15.5	19.5	23.5	28.5	34.5	39.5
MH	31	42	48	64	75	90
øMJ	5.5	5.5	6.6	9	11	13.5

- Be sure to match up phase of locate ring steel ball grooves and pallet clamp steel balls.
- ▭ dimensions are different from former pallet clamp (model CPC-□□F, CPH-□□F).

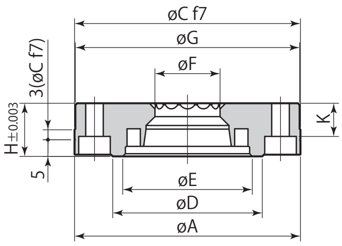
Dimensions



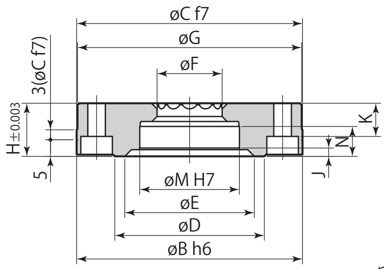
CPS-D03–16D Locate ring (D type)



CPS-E03–40D Locate ring (E type)



CPS-F03–40D Locate ring (F type)



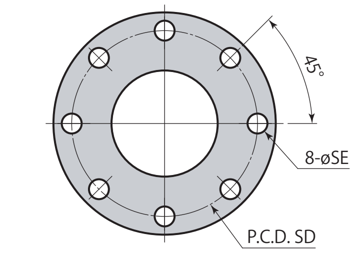
mm

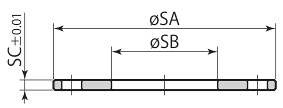
Model	CPS-□03D	CPS-□06D	CPS-□10D	CPS-□16D	CPS-□25D	CPS-□40D
øA	$55^{+0.006}_{-0.013}$	$68^{+0.006}_{-0.013}$	$75^{+0.006}_{-0.013}$	$100^{+0.007}_{-0.015}$	$120^{+0.007}_{-0.015}$	$140^{+0.007}_{-0.018}$
øB	$55^{0}_{-0.019}$	$68^{0}_{-0.019}$	$75^{0}_{-0.019}$	$100^{0}_{-0.022}$	$120^{0}_{-0.022}$	$140^{0}_{-0.025}$
øC	$55^{-0.030}_{-0.060}$	$68^{-0.030}_{-0.060}$	$75^{-0.030}_{-0.060}$	$100^{-0.036}_{-0.071}$	$120^{-0.036}_{-0.071}$	$140^{-0.043}_{-0.083}$
øD	32	45	48	66	78	94
øE	28	39	42	58	68	80
øF	15.6	19.6	23.3	29.7	37.6	46.3
øG	54.5	67.5	74.5	99.5	119.5	139.5
H	13	16	20	25	30	35
J	2	2.5	2.5	3	4	5
K	7	10	13	16	19	22
øL1	5.3	5.3	6.8	9	11	14
øL2	9.5	9.5	11	14	17.5	20
øM	$22^{+0.021}_{0}$	$30^{+0.021}_{0}$	$32^{+0.025}_{0}$	$45^{+0.025}_{0}$	$55^{+0.030}_{0}$	$65^{+0.030}_{0}$
N	7	9	11	14	16	19
P*	45°	30°	30°	30°	30°	30°
R	43	56	61	82	98	116
S	8	12	12	12	12	12
T	M5×0.8	M5×0.8	M6×1	M8×1.25	M10×1.5	M12×1.75

*:Be sure to match up phase of locate ring steel ball grooves and pallet clamp steel balls.

● Mounting screws are not included.

Shim (option)





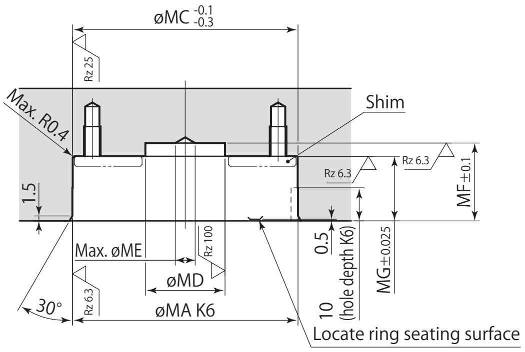
mm

Shim	CPS-S03D	CPS-S06D	CPS-S10D	CPS-S16D	CPS-S25D	CPS-S40D
øSA	54	67	74	99	119	139
øSB	24	32	39	55	65	77
SC	2.05	3.05	3.05	3.05	4.05	4.05
SD	43	56	61	82	98	116
øSE	6	6	7	9	11	14
Mass	0.06 kg	0.06 kg	0.07 kg	0.11 kg	0.22 kg	0.31 kg

● This diagram indicates dimensions at shipping.

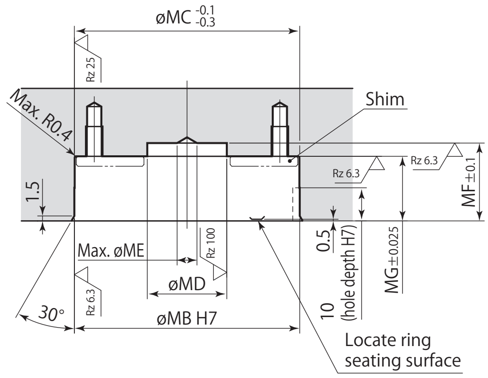
● Adjust thickness of shim by grinding to ensure flatness of pallet.

Mounting details

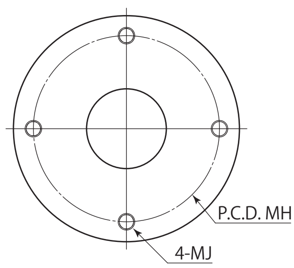


CPS-D03–16D, CPS-E03–40D

Rz: ISO4287(1997)



CPS-F03–40D

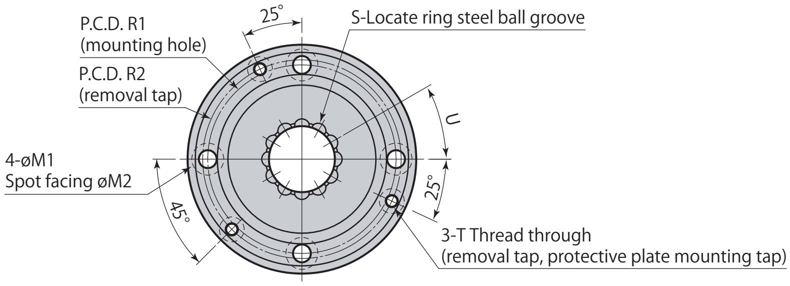


mm

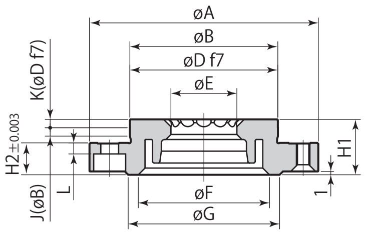
Model	CPS-□03D	CPS-□06D	CPS-□10D	CPS-□16D	CPS-□25D	CPS-□40D
øMA	$55^{+0.004}_{-0.015}$	$68^{+0.004}_{-0.015}$	$75^{+0.004}_{-0.015}$	$100^{+0.004}_{-0.018}$	$120^{+0.004}_{-0.018}$	$140^{+0.004}_{-0.021}$
øMB	$55^{+0.030}_{0}$	$68^{+0.030}_{0}$	$75^{+0.030}_{0}$	$100^{+0.035}_{0}$	$120^{+0.035}_{0}$	$140^{+0.035}_{0}$
øMC	55	68	75	100	120	140
øMD	20	24	28	36	50	60
øME	6	6	8	10	12	15
MF	20	23.5	26.8	34.8	41.8	48.8
MG	15.5	19.5	23.5	28.5	34.5	39.5
MH	43	56	61	82	98	116
MJ	M5	M5	M6	M8	M10	M12

- Be sure to match up phase of locate ring steel ball grooves and pallet clamp steel balls.
- ▭ dimensions are different from former pallet clamp (model CPC-□□F, CPH-□□F).

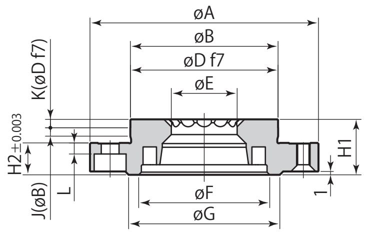
Dimensions



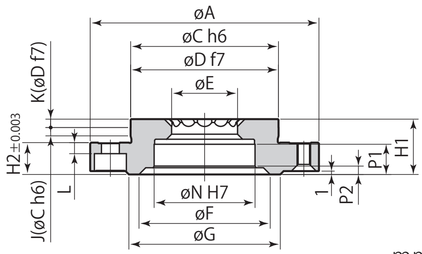
CPS-D03–16F Locate ring (D type)



CPS-E03–40F Locate ring (E type)



CPS-F03–40F Locate ring (F type)



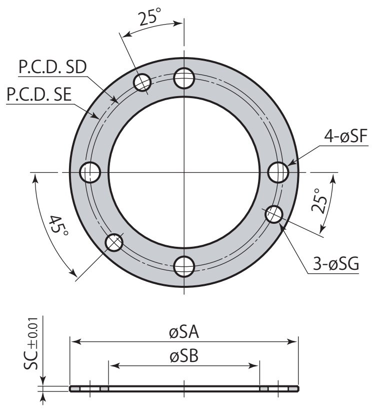
mm

Model	CPS-□03F	CPS-□06F	CPS-□10F	CPS-□16F	CPS-□25F	CPS-□40F
øA	55	68	75	100	120	140
øB	$31^{+0.005}_{-0.011}$	$44^{+0.005}_{-0.011}$	$47^{+0.005}_{-0.011}$	$66^{+0.006}_{-0.013}$	$80^{+0.006}_{-0.013}$	$95^{+0.007}_{-0.015}$
øC	$31^{0}_{-0.016}$	$44^{0}_{-0.016}$	$47^{0}_{-0.016}$	$66^{0}_{-0.019}$	$80^{0}_{-0.019}$	$95^{0}_{-0.022}$
øD	$31^{-0.025}_{-0.050}$	$44^{-0.025}_{-0.050}$	$47^{-0.025}_{-0.050}$	$66^{-0.030}_{-0.060}$	$80^{-0.030}_{-0.060}$	$95^{-0.036}_{-0.071}$
øE	15.6	19.6	23.3	29.7	37.6	46.3
øF	28	39	42	58	68	80
øG	32	45	48	66	78	94
H1	15.5	16.5	20	25	30	35
H2	9	9.5	11.5	14.5	18	23
J	2.4	2.5	3.2	4.7	4.2	4.2
K	2.1	2.5	2.8	3.3	3.8	3.8
L	2.8	3.3	4.2	5.2	6.5	9.5
øM1	5.3	5.3	6.8	9	11	14
øM2	9.5	9.5	11	14	17.5	20
øN	$22^{+0.021}_{0}$	$30^{+0.021}_{0}$	$32^{+0.025}_{0}$	$45^{+0.025}_{0}$	$55^{+0.030}_{0}$	$65^{+0.030}_{0}$
P1	7	9	11	14	16	19
P2	2	2.5	2.5	3	4	5
R1	43	56	61	82	98	116
R2	46	59	64	88	106	124
S	8	12	12	12	12	12
T	M4×0.7	M4×0.7	M5×0.8	M5×0.8	M6×1	M6×1
U*	45°	30°	30°	30°	30°	30°

*: Be sure to match up phase of locate ring steel ball grooves and pallet clamp steel balls.

● Mounting screws are not included.

Shim (option)



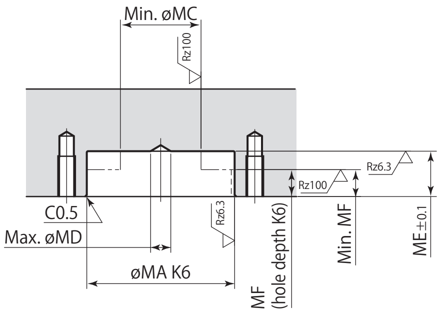
mm

Shim	CPS-S03F	CPS-S06F	CPS-S10F	CPS-S16F	CPS-S25F	CPS-S40F
øSA	55	68	75	100	120	140
øSB	32	45	48	67	81	96
SC	1.55	1.55	2.05	3.05	3.05	3.05
SD	43	56	61	82	98	116
SE	46	59	64	88	106	124
øSF	6	6	7	9	11	14
øSG	5	5	6	6	7	7
Mass	0.02 kg	0.02 kg	0.04 kg	0.09 kg	0.13 kg	0.17 kg

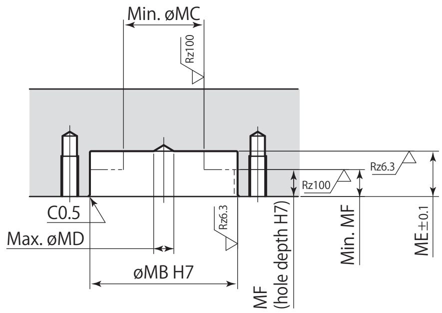
● This diagram indicates dimensions at shipping.

● Adjust thickness of shim by grinding to ensure flatness of pallet.

Mounting details

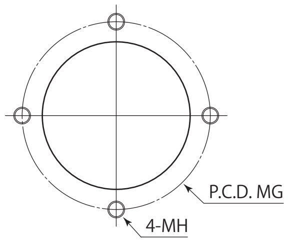


CPS-D03–16F, CPS-E03–40F



CPS-F03–40F

Rz: ISO4287(1997)

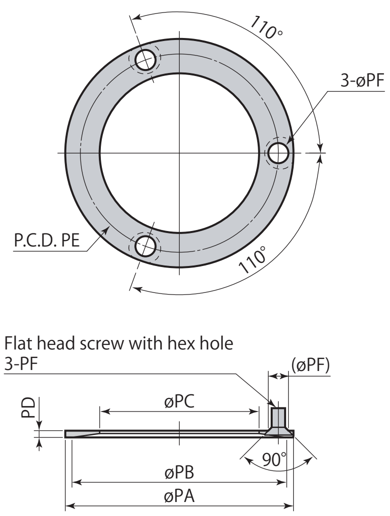


mm

Model	CPS-□03F	CPS-□06F	CPS-□10F	CPS-□16F	CPS-□25F	CPS-□40F
øMA	$31^{+0.003}_{-0.013}$	$44^{+0.003}_{-0.013}$	$47^{+0.003}_{-0.013}$	$66^{+0.004}_{-0.015}$	$80^{+0.004}_{-0.015}$	$95^{+0.004}_{-0.018}$
øMB	$31^{+0.025}_{0}$	$44^{+0.025}_{0}$	$47^{+0.025}_{0}$	$66^{+0.030}_{0}$	$80^{+0.030}_{0}$	$95^{+0.035}_{0}$
øMC	20	24	28	36	50	60
øMD	6	6	8	10	12	15
MG	43	56	61	82	98	116
MH	M5	M5	M6	M8	M10	M12
Not using shim (standard specifications)						
ME	10.5	13.5	14.8	19.8	23.3	25.3
MF	7.5	8	9.5	11.5	13	13
Using shim (shim specifications)						
ME	9	12	12.8	16.8	20.3	22.3
MF	6.5	6.5	7.5	8.5	10	10

- Be sure to match up phase of locate ring steel ball grooves and pallet clamp steel balls.
- ▭ dimensions are different from former pallet clamp (model CPC-□□F, CPH-□□F).

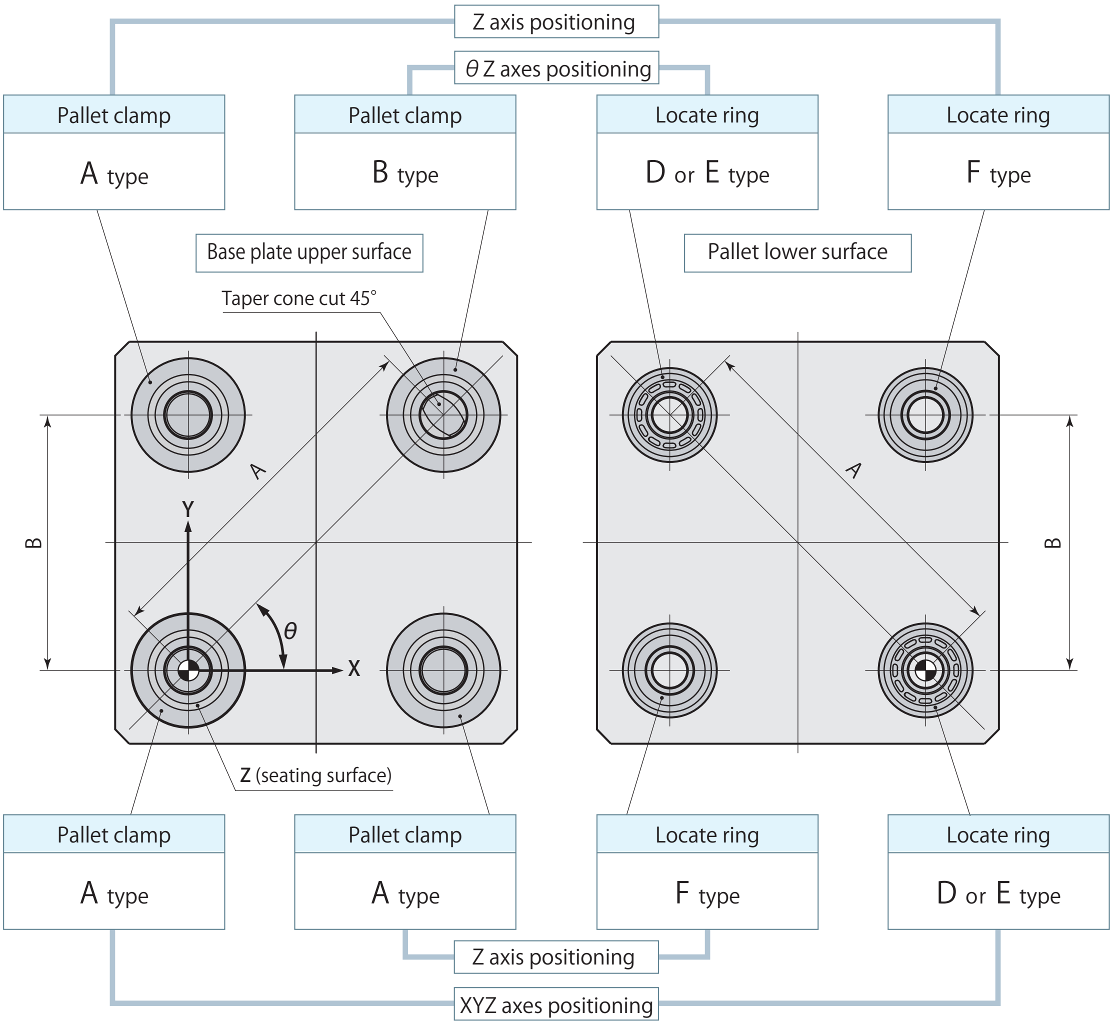
Protective plate (option)



mm

Protective plate	CPS-P03F	CPS-P06F	CPS-P10F	CPS-P16F	CPS-P25F	CPS-P40F
øPA	55	68	75	100	120	140
øPB	51	64	68	94	114	132
øPC	34.5	47.5	50.5	68.5	80.5	96.5
PD	2	2	2	2.5	3	3
PE	46	59	64	88	106	124
øPF	6	6	8	8	9	9
Mass	0.02 kg	0.02 kg	0.03 kg	0.06 kg	0.1 kg	0.13 kg

Pitch tolerance of Pal system



mm

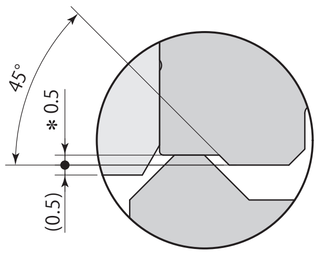
Model (Size)	03	06	10	16	25	40
Pitch tolerance of A dimensions		±0.01		±0.02	±0.03	
Pitch tolerance of B dimensions		±0.03		±0.04	±0.05	

Method for positioning pallet changer setup table

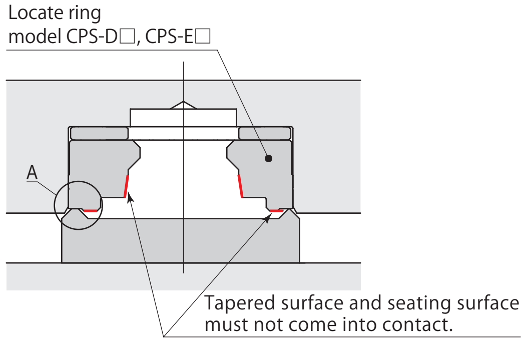
Internal hole of model CPS-F (Seating surface positioning) can be used for positioning of setup table for pallet change with pallet changer. In order to sustain accuracy, do not allow surfaces other than those of pallet clamp model CPC or model CPH to come into contact with tapered surface or seating surface.

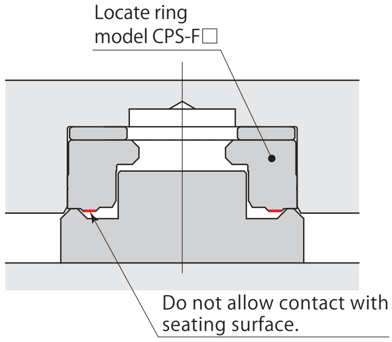
Locate ring XYZ axes and θ Z axes positioning

Locate ring Z axis positioning



Details of A

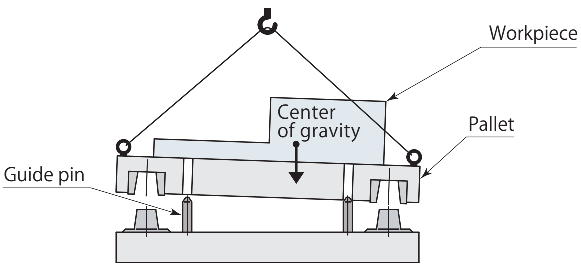


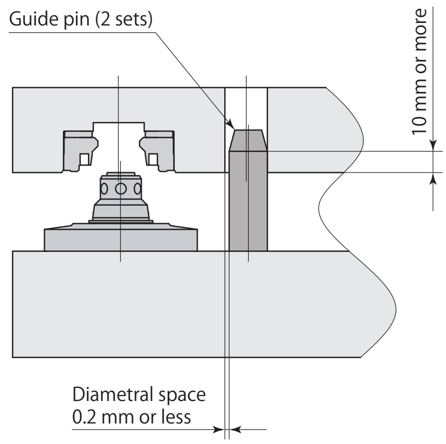


∗: 1mm for CPS-□□F (Locate ring for flange mounting)

Pallet change

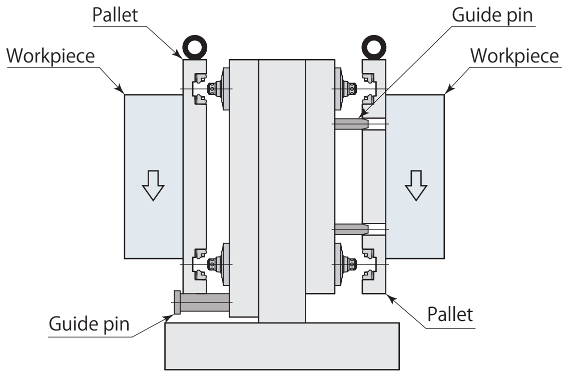
- When pallet changing, the pallet should be mounted or dismounted observing the figures shown in "Max. allowable eccentricity for pallet setting". (Refer to **page →599** (model CPC), **page →605** (model CPH) for max. allowable eccentricity for pallet setting.)
- Ensure that pallet does not lean to the side when pallet mounting or dismounting. When dismounting pallet in particular, pulling while in a tilted condition can damage pallet clamp and locate ring. A guide pin is recommended to prevent the pallet from leaning.

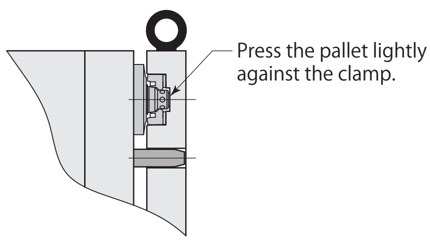




For vertical mounting of pallet

- A guide pin must be installed when mounting pallet vertically.
- Ensure spacing is set in order to ensure that mounted guide pin does not affect positioning.
- Ensure the pallet is closely contact with the base when it is clamped. Clamping with a space may cause the damage of both of clamp and locate ring.
  (Refer to **page →611** for the height of pallet from base plate when pallet setting.)





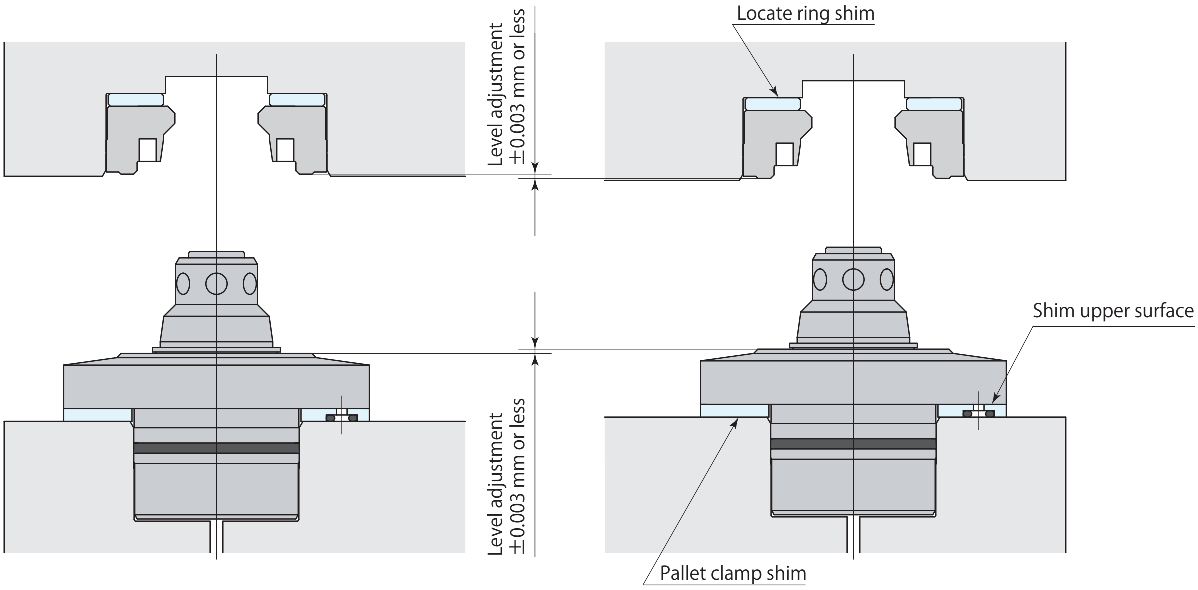
Level adjustment

Level adjustment of pallet clamp seating surface

- If level adjustment of pallet clamp seating surface is required, use pallet clamp shim (option). The level can be adjusted by grinding the shim.
- Grind shim upper surface (surface without O-ring).
- The measurement on the seating surface should be performed under the pallet clamped condition without locate rings. (Recommended adjustment figure : ±0.003mm)

Level adjustment of locate ring seating surface

- If level adjustment of locate ring seating surface is required, use locate ring shim (option). The level can be adjusted by grinding the shim. (Recommended adjustment figure : ±0.003mm)

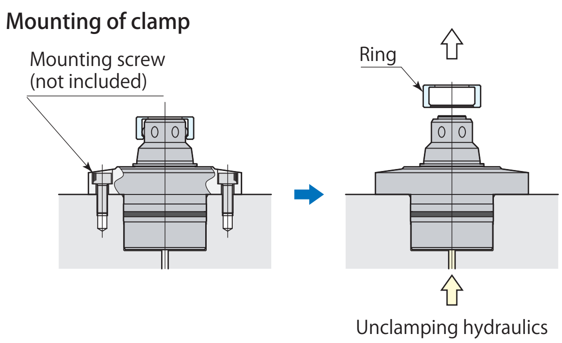


Mounting & dismounting of clamp

Mounting of clamp

①The ring has been mounted on the clamp to avoid taking it apart during the shipment. Remove it after mounting the clamp on the base plate, supplying the hydraulic pressure for unclamping.

②The ring is an important part for dismounting the clamp. Store if for future maintenance.



Dismounting of clamp

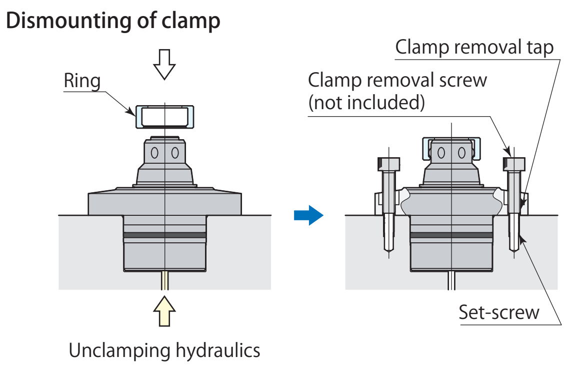
①Mount the ring before dismounting the clamp from the base plate. Supply hydraulic pressure for unclamping to mount it.

②Drain oil in the circuit and remove the mounting screws.

③Mount the set-screws on the mounting tap to protect the threads and clamp mounting surface.

④Mount the clamp removal screw on the clamp removal tap and dismount the clamp.

⑤Retain the clamp upright condition when dismounting it.



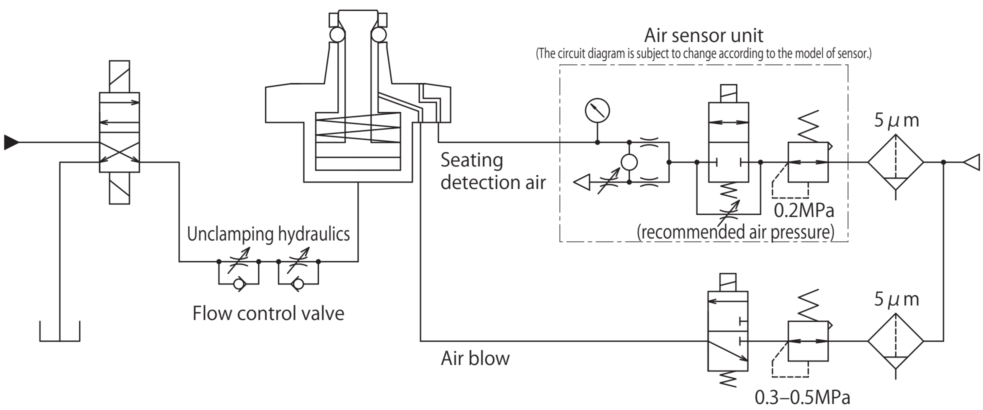
Air sensor unit recommended condition of use

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

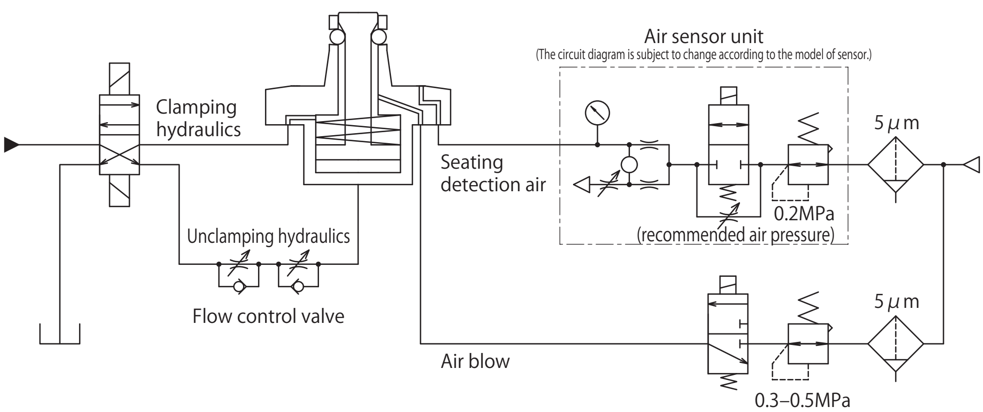
- Supply the dry and filtered air. Particulate size 5 μm or less is recommended.
- Use a solenoid valve with needle for air sensor unit and control it supplying air all the time in order to eliminate intrusion of chips or coolant.
- There is a case that air sensing cannot be made successfully as designed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

Hydraulic and pneumatic circuit diagram

Spring clamp model CPC



Hydraulic clamp model CPH



- Be sure to make inner diameter of air blow circuit 8 mm or more except for clamp mounting surface.
- Adjust full stroking time to be more than 1 second by a flow control valve to avoid impact at the time of clamp or unclamp action.

Table of contents

air Pallet clamp

Dual cylinder model Double acting 0.5 MPa

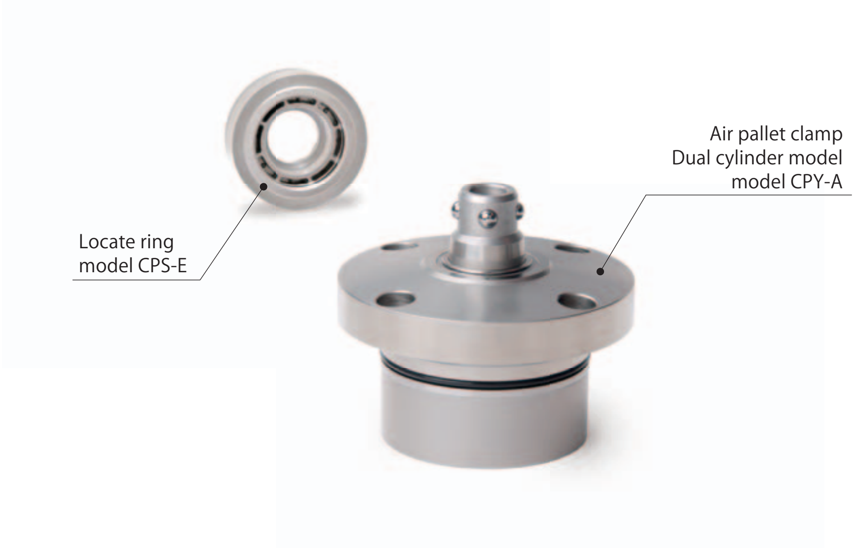
model CPY

Locate ring
Flange mounting
model CPS-EF

Air pallet clamp Dual cylinder model
model CPY-A

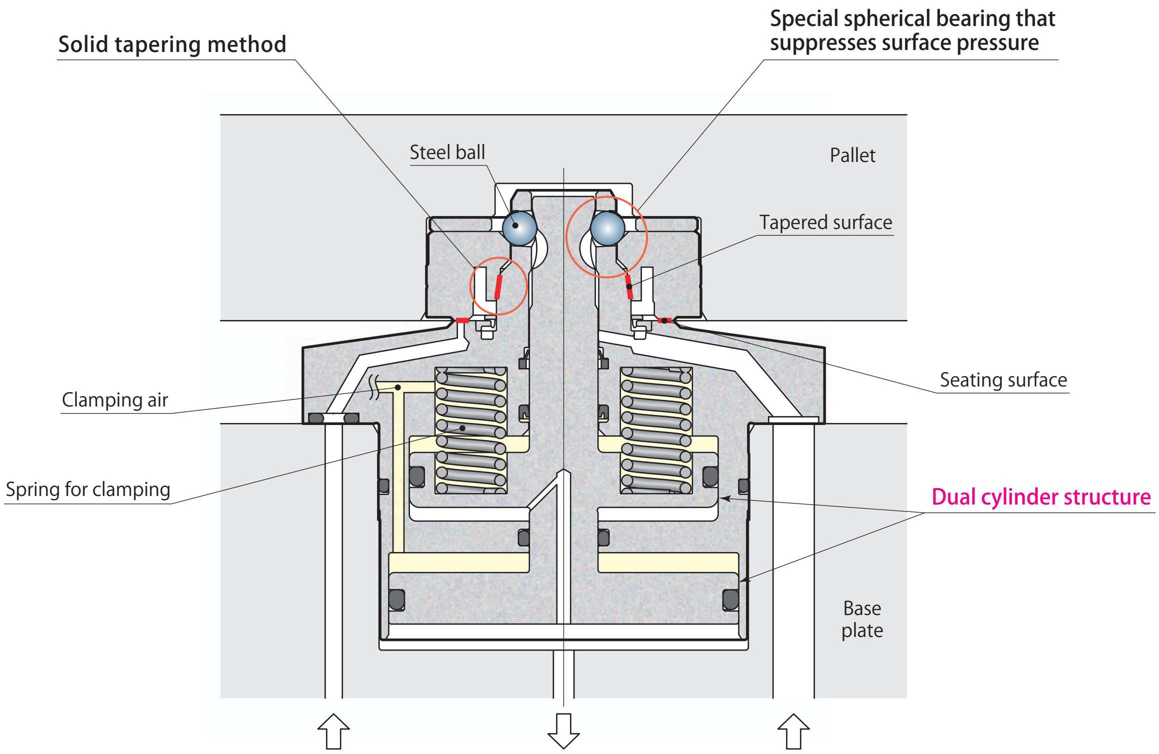
Dual cylinder model

model **CPY-□□H** PAT.



Highly rigid pallet clamp and repeatability of 3 μm with dual surface contact

Compact downsized compared with the conventional model thanks to dual cylinder structure



Specifications	page → 625
Dimensions	page → 626
Mounting details	page → 628
Locate ring	page → 630

Specifications

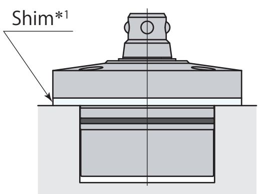
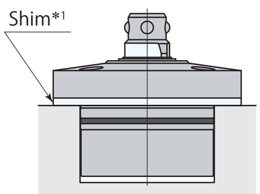
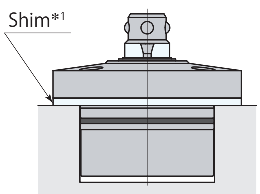
	Type	Size	
CPY –	A : Taper cone circle	02	H
	B : Taper cone cut 45°	03	
	C : Taper cone cut 90°	04	
	S : Shim	06	
		10	

(grey box) indicates made to order.

Model			CPY-□02H	CPY-□03H	CPY-□04H	CPY-□06H	CPY-□10H
Air pressure range		MPa	0.4–0.5 (model CPS-L)		0.4–0.5 (model CPS-E)		
			0.25–0.5 (model CPS-D, CPS-F)				
Clamping force*1	Air pressure 0MPa*2	kN	0.1	0.3	0.8	1.2	1.8
	Air pressure 0.25MPa	kN	0.9	1.5	2.4	3.7	5.8
	Air pressure 0.3MPa	kN	1.0	1.8	2.7	4.2	6.6
	Air pressure 0.4MPa	kN	1.3	2.3	3.4	5.2	8.2
	Air pressure 0.5MPa	kN	1.7	2.7	4.0	6.1	9.8
Clamping force calculation (P:Air pressure MPa)*1			3.10×P+0.1	4.88×P+0.3	6.38×P+0.8	9.88×P+1.2	16.0×P+1.8
Cylinder capacity*1	Clamp	cm^3	7.3	11.6	15.3	23.8	43.7
	Unclamp	cm^3	7.7	11.9	15.6	24.4	44.7
Full stroke		mm	4.4	4.4	4.4	4.4	5.0
Max. allowable eccentricity for pallet setting		mm	±1.0	±1.0	±1.0	±1.5	±2.0
Lift stroke*3		mm	1				
Lift force*1*4	Air pressure 0.25MPa	kN	0.3	0.4	0.2	0.5	0.8
	Air pressure 0.3MPa	kN	0.4	0.6	0.4	0.7	1.3
	Air pressure 0.4MPa	kN	0.6	0.8	0.7	1.3	2.2
	Air pressure 0.5MPa	kN	0.8	1.1	1.1	1.9	3.1
Lift force calculation (P:Unclamping air pressure MPa)*1*4			1.74×P-0.10	2.71×P-0.25	3.55×P-0.68	5.56×P-0.92	8.94×P-1.39
Max. allowable load (including a pallet)*5	Horizontal mounting	kN	2.0	2.5	3.0	8.0	15.0
	Vertical mounting	kN	0.3	0.4	0.5	1.5	2.5
Mass*1		kg	0.4	0.6	0.8	1.3	2.3
Recommended tightening torque of mounting screws*6		N·m	3.5	3.5	7	7	7

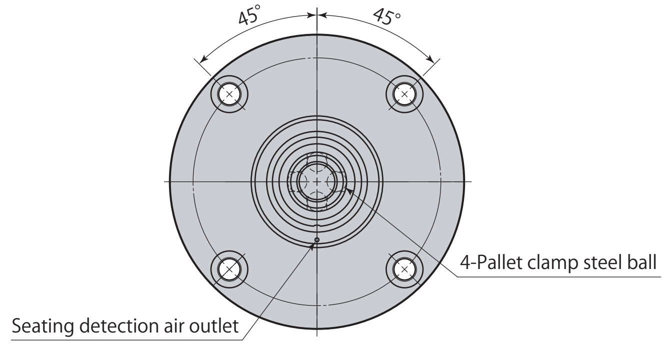
● Proof pressure: 0.75 MPa ● Operating temperature: 0–70 ℃ ● Fluid used: Air*7 ● Oil supply: Not required
● Recommended air blow pressure: 0.3–0.5 MPa

∗1: The figure indicates one piece of clamp. ∗2: The value indicates the force generated by the spring.
∗3: This is the amount for lifting pallet when unclamping.
∗4: Set the air pressure for unclamping so that the lift force is equal to or greater than the max. allowable load.
The max. allowable load can be calculated by the formula of lift force×quantity of CPY×0.8.
∗5: This is maximum allowable load of pallet, regardless of how many clamps are used.
∗6: ISO R898 class 12.9 ∗7: Supply the dry and filtered air. Particulate size 5 μm or less is recommended.

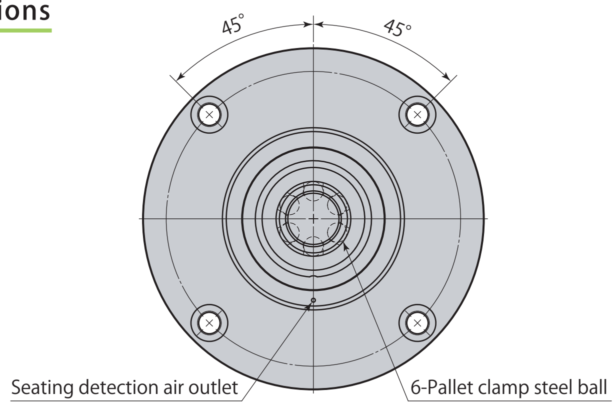
Pallet clamp type	A Taper cone circle	B*2 Taper cone cut 45°	C*2 Taper cone cut 90°
Air clamp model **CPY**	 model CPY-A□H	 model CPY-B□H	 model CPY-C□H

∗1: Shim of pallet clamp can be used when heights of mounted clamps vary. (option)
∗2: Taper cone cut can be selected from B type or C type.

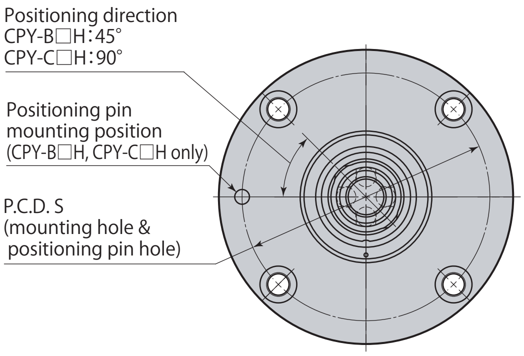
Dimensions



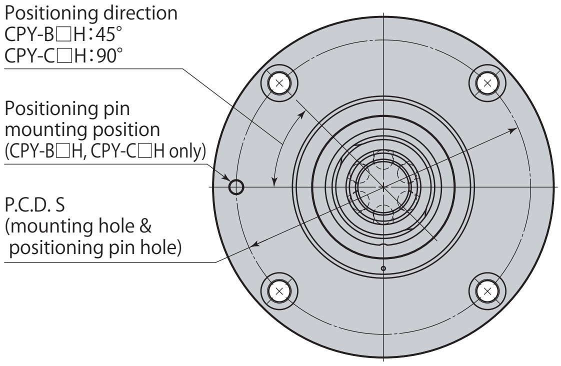
CPY-A02–04H



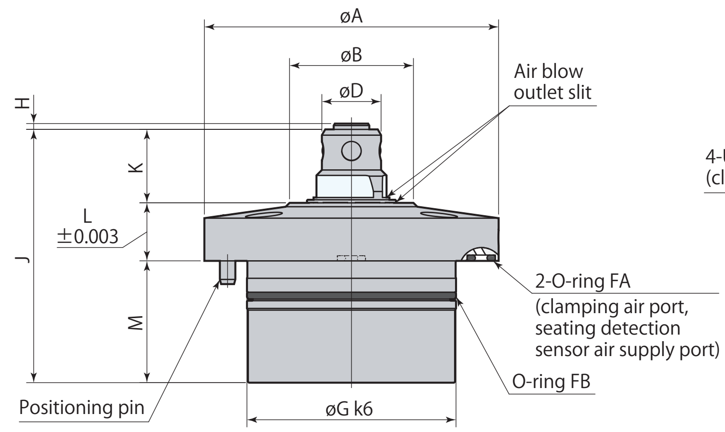
CPY-A06/10H



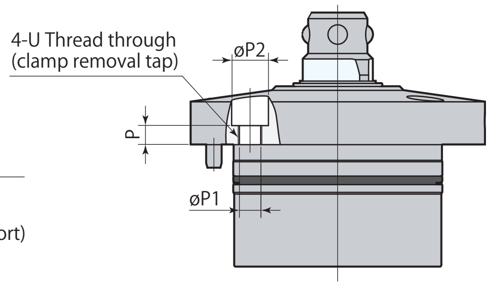
CPY-$^{B}_{C}$02–04H



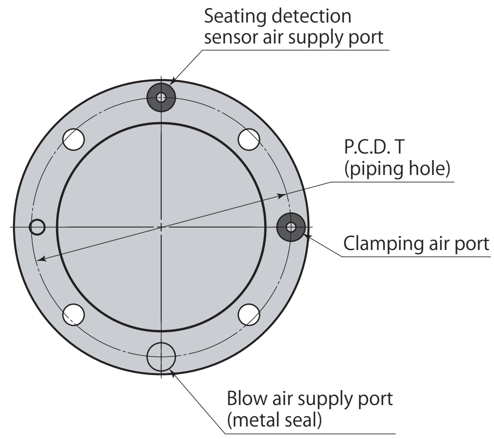
CPY-$^{B}_{C}$06/10H



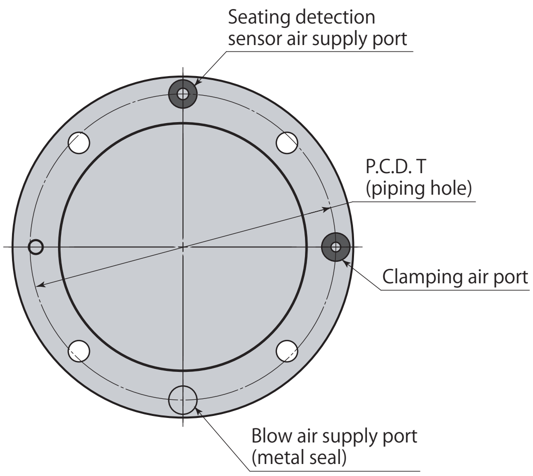
Unclamp



Stroke end



CPY-□02–04H



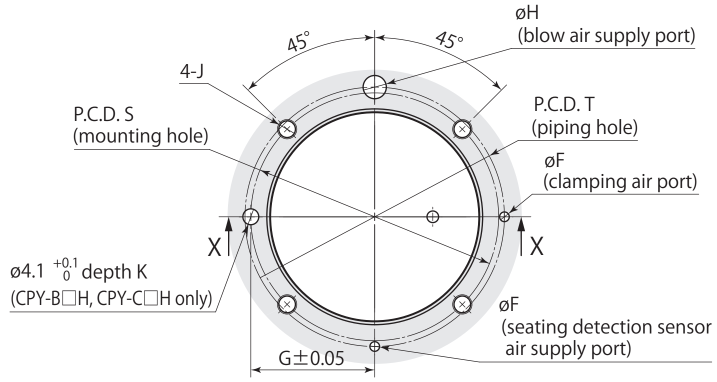
CPY-□06/10H

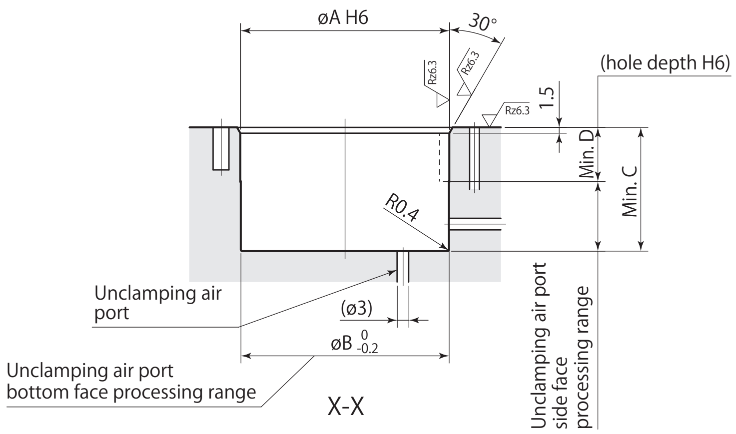
mm

Model	CPY-□02H	CPY-□03H	CPY-□04H	CPY-□06H	CPY-□10H
øA	59	68	76	88	106
øB	32	32	32	45	48
øD	15.3	15.3	15.3	19.3	23
øG	$39^{+0.018}_{+0.002}$	$48^{+0.018}_{+0.002}$	$54^{+0.021}_{+0.002}$	$66^{+0.021}_{+0.002}$	$84^{+0.025}_{+0.003}$
H	1.5	1.5	1.5	1.5	1.3
J	61.5	61.5	65.5	72	83.5
K	19	19	19	22.5	26
L	12	12	15	18	22
M	30.5	30.5	31.5	31.5	35.5
P	4	3.5	5	8	11
øP1	4.3	4.3	5.5	5.5	5.5
øP2	8	8	9.5	9.5	9.5
S	49	58	64	76	94
T	50	59	67	79	96
U	M5×0.8	M5×0.8	M6×1	M6×1	M6×1
O-ring FA (fluorocarbon hardness Hs90)	P4	P4	P4	P4	P5
O-ring FB (fluorocarbon hardness Hs90)	AS568-028	AS568-031	AS568-033	AS568-036	AS568-151

- Be sure to match up phase of pallet clamp steel balls and locate ring steel ball grooves.
- Positioning direction is the direction in which tapered surface has not been cut.
- Use øA, which has been ground at the same time as tapered surface, for positioning measurement after mounting.
- Mounting screws are not included.
- Pal coupler (**pages →662–667**) recommended when using couplers in a set.
- Blow air supply port is metal seal. Air bubbles may come out from the mounting surface due to the air blow, however it is not abnormal.

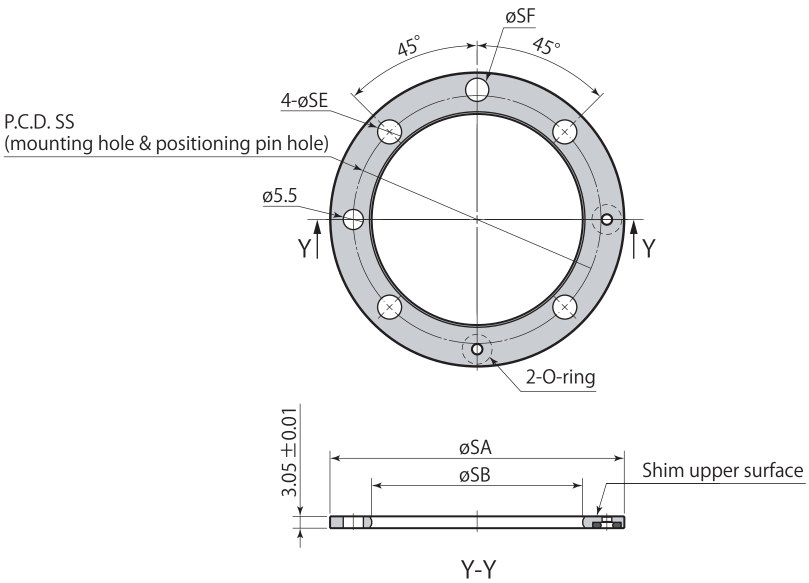
Mounting details





Rz: ISO4287(1997)

Shim (option)



mm

Model	CPY-□02H	CPY-□03H	CPY-□04H	CPY-□06H	CPY-□10H
øA	$39^{+0.016}_{0}$	$48^{+0.016}_{0}$	$54^{+0.019}_{0}$	$66^{+0.019}_{0}$	$84^{+0.022}_{0}$
øB	39	48	54	66	84
øF	2.5	2.5	2.5	2.5	3
G	24.5	29	32	38	47
øH	4.5–6	4.5–6	4.5–6	4.5–6	5.5–7
J	M4	M4	M5	M5	M5
S	49	58	64	76	94
T	50	59	67	79	96
Not using shim (standard specifications)					
C	31	31	32	32	36
D	14	14	14	14	15
K	7	7	7	7	7
Using shim (shim specifications)					
C	28	28	29	29	33
D	11	11	11	11	12
K	4	4	4	4	4

- Process with shim specification dimensions when shim is attached.
- Process either bottom or side surface of unclamping air port.
- Be sure to match up phase of pallet clamp steel balls and locate ring steel ball grooves.

mm

Shim	CPY-S02H	CPY-S03H	CPY-S04H	CPY-S06H	CPY-S10H
øSA	59	68	76	88	106
øSB	39.5	48.5	54.5	66.5	84.5
øSE	5.5	5.5	6.5	6.5	6.5
øSF	6	6	6	6	7
SS	49	58	64	76	94
O-ring (fluorocarbon hardness Hs90)	P4	P4	P4	P4	P5
Mass	0.03kg	0.04kg	0.05kg	0.06kg	0.07kg

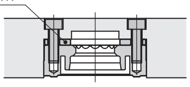
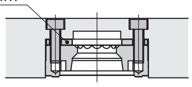
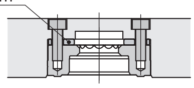
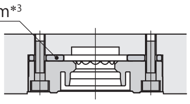
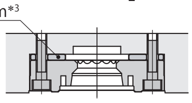
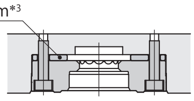
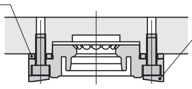
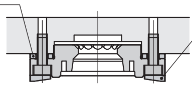
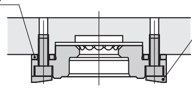
- This diagram indicates dimensions at shipping.
- Adjust thickness of shim by grinding to ensure flatness of pallet.
- Grind shim upper surface (surface without O-ring) to adjust shim.

Specifications

	Type	Size	Mounting method
CPS –	**D** : Repeatability 10μm		
	E : Repeatability 3μm	**03**	**T** : Pallet upper surface mounting
	L : Repeatability 3μm*1	**06**	**D** : Pallet lower surface mounting
	F : Seating surface positioning (Z axis positioning)	**10**	**F** : Flange mounting
	S : Shim		
	P : Protective plate*2		

■ indicates made to order.

*1: model CPS-L (repeatability 3μm) is available for size 03 only. (Exclusive use for CPY-□02H, CPY-□03H)
*2: The protective plate is only flange mounting type.

Locate ring	D*1 Repeatability 10μm	E or L*1 Repeatability 3μm	F*2 Seating surface positioning (Z axis positioning)
T Pallet upper surface mounting	model CPS-D□T  	model CPS-$^{E}_{L}$□T  	model CPS-F□T 
D Pallet lower surface mounting	model CPS-D□D  	model CPS-$^{E}_{L}$□D  	model CPS-F□D 
F Flange mounting	model CPS-D□F  	model CPS-$^{E}_{L}$□F  	model CPS-F□F 

*1: model CPS-D (repeatability 10μm) cannot be used together with model CPS-E or CPS-L (repeatability 3μm).
*2: model CPS-F (seating surface positioning) needs the positioning of XY axes.
*3: It is recommended to use a shim (option) to adjust mounting hole depth for the locate rings for pallet upper surface mounting and lower surface mounting. Grind shim to adjust thickness.
*4: Protective plate (flange mounting only) can be used to prevent damage of seating surface, when pallet must be placed on the floor, etc. (option)
*5: Shim of locate ring of flange mounting can be used when heights of mounted locate rings vary. (option)

Locate ring model correspondence

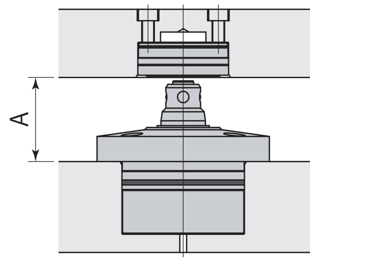
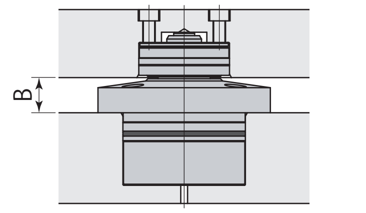
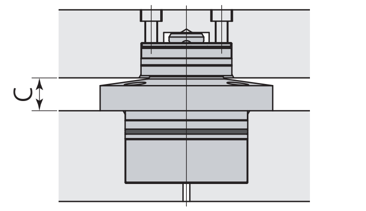
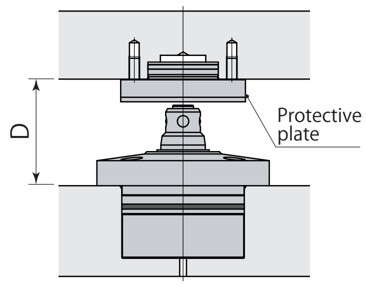
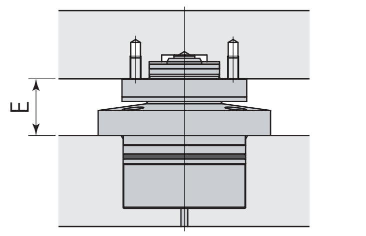
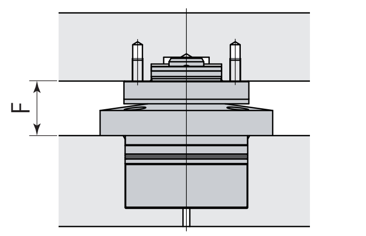
Pallet clamp		CPY-□02H	CPY-□03H	CPY-□04H	CPY-□06H	CPY-□10H
Repeatability	3μm	CPS-L03□		CPS-E03□	CPS-E06□	CPS-E10□
	10μm	CPS-D03□			CPS-D06□	CPS-D10□
Seating surface positioning (Z axis positioning)		CPS-F03□			CPS-F06□	CPS-F10□

Mass

kg

Locate ring		D Repeatability 10 μm			E or L Repeatability 3 μm				F Seating surface positioning (Z axis positioning)		
T Pallet upper surface mounting	Model	CPS-D03T	CPS-D06T	CPS-D10T	CPS-L03T	CPS-E03T	CPS-E06T	CPS-E10T	CPS-F03T	CPS-F06T	CPS-F10T
	Mass	0.1	0.2	0.3	0.1	0.1	0.2	0.3	0.1	0.2	0.3
D Pallet lower surface mounting	Model	CPS-D03D	CPS-D06D	CPS-D10D	CPS-L03D	CPS-E03D	CPS-E06D	CPS-E10D	CPS-F03D	CPS-F06D	CPS-F10D
	Mass	0.2	0.3	0.5	0.2	0.2	0.3	0.5	0.2	0.3	0.5
F Flange mounting	Model	CPS-D03F	CPS-D06F	CPS-D10F	CPS-L03F	CPS-E03F	CPS-E06F	CPS-E10F	CPS-F03F	CPS-F06F	CPS-F10F
	Mass	0.1	0.2	0.3	0.1	0.1	0.2	0.3	0.1	0.2	0.4

Height of pallet from base plate

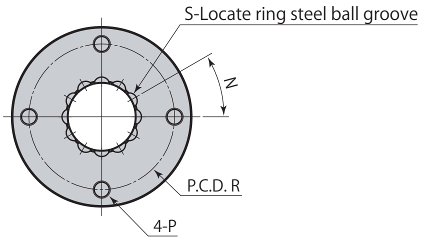
Locate ring mounting method	Pallet changing	Pallet setting (Unclamp)	Clamp
T Pallet upper surface mounting D Pallet lower surface mounting			
F Flange mounting			

mm

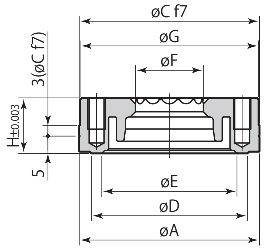
Pallet clamp		CPY-□02H	CPY-□03H	CPY-□04H	CPY-□06H	CPY-□10H
T Pallet upper surface mounting D Pallet lower surface mounting	A	Min. 33	Min. 33	Min. 36	Min. 43	Min. 51
	B	12.5	12.5	15.5	18.5	22.5
	C	11.5	11.5	14.5	17.5	21.5
F Flange mounting	D	Min. 43	Min. 43	Min. 46	Min. 53	Min. 63
	E	22	22	25	28.5	34.5
	F	21	21	24	27.5	33.5

- Pallet lift capacity for dimension A or D or more is needed to change pallet.
- The height from base plate to pallet varies when using shim for pallet clamp or locate ring (flange mounting).

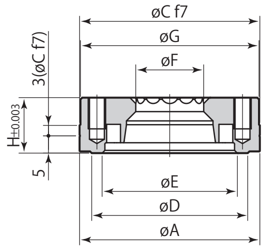
Dimensions



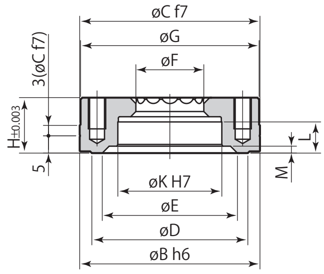
CPS-D03–10T Locate ring (D type)



CPS-E03–10T Locate ring (E type)
CPS-L03T Locate ring (L type)



CPS-F03–10T Locate ring (F type)



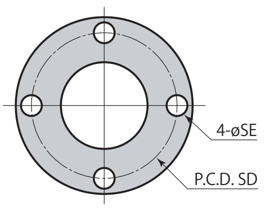
mm

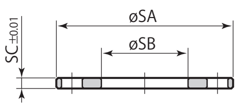
Model	CPS-□03T	CPS-□06T	CPS-□10T
øA	$40^{+0.005}_{-0.011}$	$52^{+0.006}_{-0.013}$	$60^{+0.006}_{-0.013}$
øB	$40^{\ 0}_{-0.016}$	$52^{\ 0}_{-0.019}$	$60^{\ 0}_{-0.019}$
øC	$40^{-0.025}_{-0.050}$	$52^{-0.030}_{-0.060}$	$60^{-0.030}_{-0.060}$
øD	32	45	48
øE	28	39	42
øF	15.6	19.6	23.3
øG	39.5	51.5	59.5
H	13	16	20
øK	$22^{+0.021}_{\ 0}$	$30^{+0.021}_{\ 0}$	$32^{+0.025}_{\ 0}$
L	7	9	11
M	2	2.5	2.5
N*	45°	30°	30°
P	M5×0.8 depth 6	M5×0.8 depth 9	M6×1 depth 11
R	31	42	48
S	8	12	12

*: Be sure to match up phase of locate ring steel ball grooves and pallet clamp steel balls.

● Mounting screws are not included.

Shim (option)





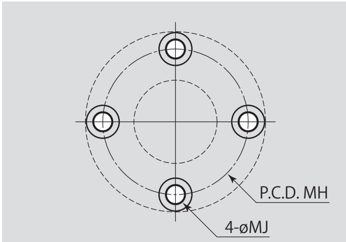
mm

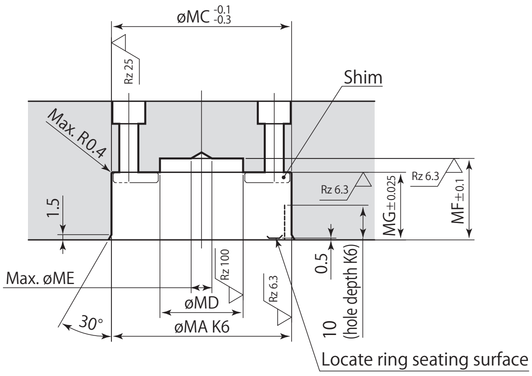
Shim	CPS-S03T	CPS-S06T	CPS-S10T
øSA	39	51	59
øSB	21	25	33
SC	2.05	3.05	3.05
SD	31	42	48
øSE	6	6	7
Mass	0.01 kg	0.03 kg	0.04 kg

● This diagram indicates dimensions at shipping.

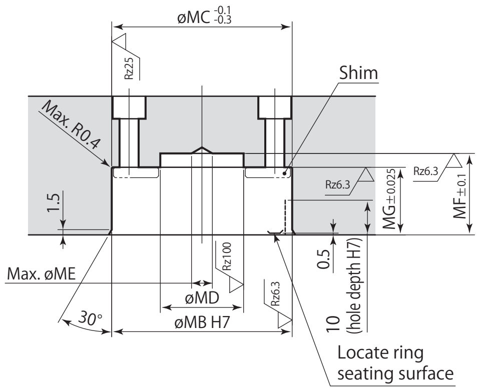
● Adjust thickness of shim by grinding to ensure flatness of pallet.

Mounting details





CPS-D03–10T, CPS-E03–10T, CPS-L03T



CPS-F03–10T

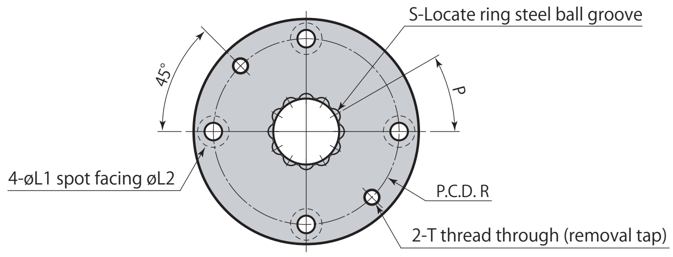
Rz: ISO4287(1997)

mm

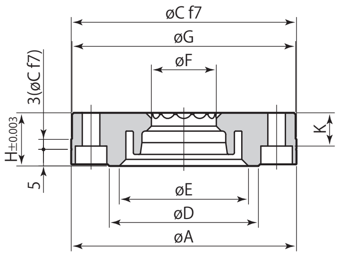
Model	CPS-□03T	CPS-□06T	CPS-□10T
øMA	$40^{+0.003}_{-0.013}$	$52^{+0.004}_{-0.015}$	$60^{+0.004}_{-0.015}$
øMB	$40^{+0.025}_{0}$	$52^{+0.030}_{0}$	$60^{+0.030}_{0}$
øMC	40	52	60
øMD	20	24	28
øME	6	6	8
MF	20	23.5	26.8
MG	15.5	19.5	23.5
MH	31	42	48
øMJ	5.5	5.5	6.6

● Be sure to match up phase of locate ring steel ball grooves and pallet clamp steel balls.

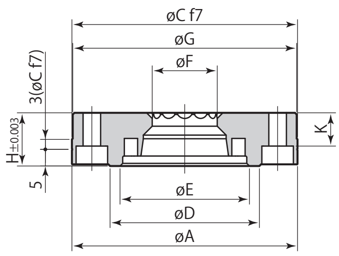
Dimensions



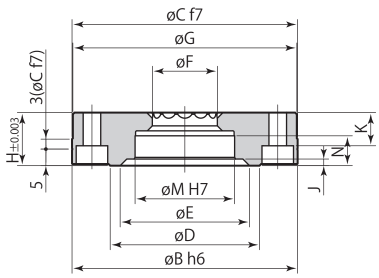
CPS-D03–10D Locate ring (D type)



CPS-E03–10D Locate ring (E type)
CPS-L03D Locate ring (L type)



CPS-F03–10D Locate ring (F type)



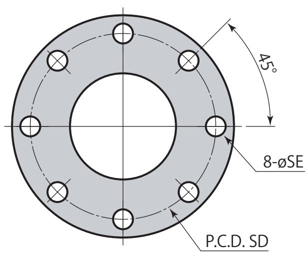
mm

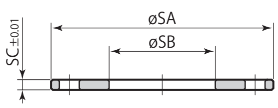
Model	CPS-□03D	CPS-□06D	CPS-□10D
øA	$55^{+0.006}_{-0.013}$	$68^{+0.006}_{-0.013}$	$75^{+0.006}_{-0.013}$
øB	$55^{\ 0}_{-0.019}$	$68^{\ 0}_{-0.019}$	$75^{\ 0}_{-0.019}$
øC	$55^{-0.030}_{-0.060}$	$68^{-0.030}_{-0.060}$	$75^{-0.030}_{-0.060}$
øD	32	45	48
øE	28	39	42
øF	15.6	19.6	23.3
øG	54.5	67.5	74.5
H	13	16	20
J	2	2.5	2.5
K	7	10	13
øL1	5.3	5.3	6.8
øL2	9.5	9.5	11
øM	$22^{+0.021}_{\ 0}$	$30^{+0.021}_{\ 0}$	$32^{+0.025}_{\ 0}$
N	7	9	11
P*	45°	30°	30°
R	43	56	61
S	8	12	12
T	M5×0.8	M5×0.8	M6×1

*: Be sure to match up phase of locate ring steel ball grooves and pallet clamp steel balls.

● Mounting screws are not included.

Shim (option)





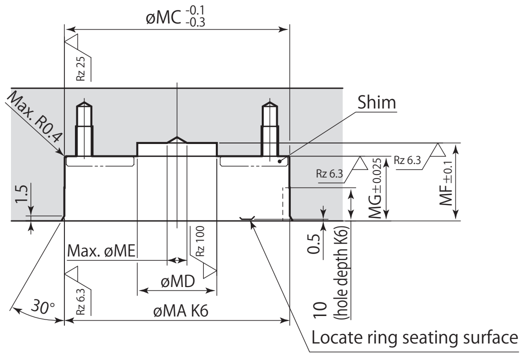
mm

Shim	CPS-S03D	CPS-S06D	CPS-S10D
øSA	54	67	74
øSB	24	32	39
SC	2.05	3.05	3.05
SD	43	56	61
øSE	6	6	7
Mass	0.06 kg	0.06 kg	0.07 kg

● This diagram indicates dimensions at shipping.

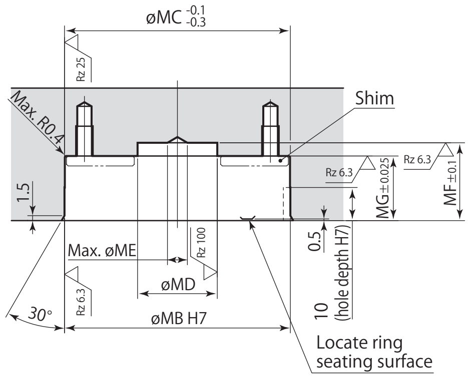
● Adjust thickness of shim by grinding to ensure flatness of pallet.

Mounting details

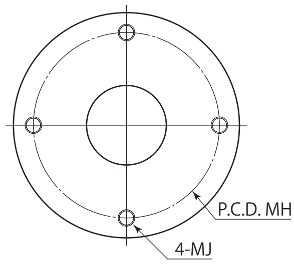


CPS-D03–10D, CPS-E03–10D, CPS-L03D

Rz: ISO4287(1997)



CPS-F03–10D

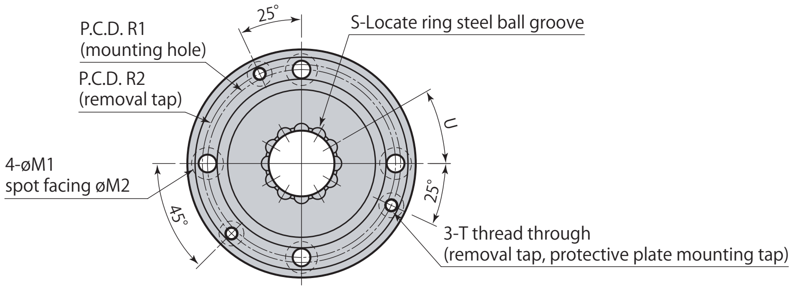


mm

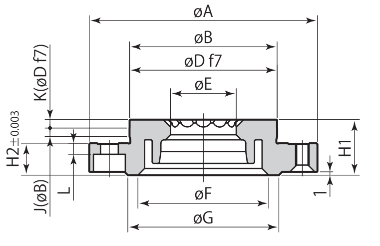
Model	CPS-□03D	CPS-□06D	CPS-□10D
øMA	55 $^{+0.004}_{-0.015}$	68 $^{+0.004}_{-0.015}$	75 $^{+0.004}_{-0.015}$
øMB	55 $^{+0.025}_{0}$	68 $^{+0.030}_{0}$	75 $^{+0.030}_{0}$
øMC	55	68	75
øMD	20	24	28
øME	6	6	8
MF	20	23.5	26.8
MG	15.5	19.5	23.5
MH	43	56	61
MJ	M5	M5	M6

● Be sure to match up phase of locate ring steel ball grooves and pallet clamp steel balls.

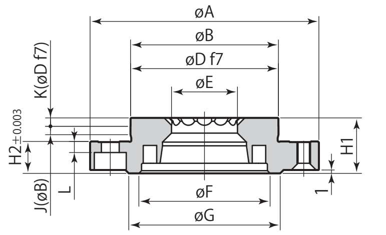
Dimensions



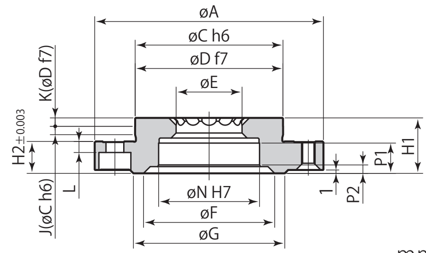
CPS-D03–10F Locate ring (D type)



CPS-E03–10F Locate ring (E type)
CPS-L03F Locate ring (L type)



CPS-F03–10F Locate ring (F type)



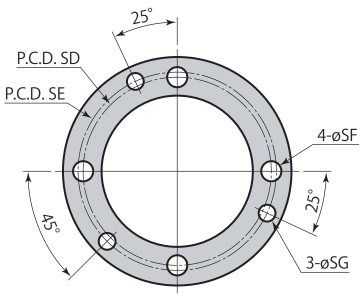
mm

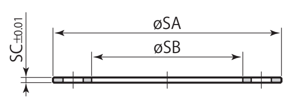
Model	CPS-□03F	CPS-□06F	CPS-□10F
øA	55	68	75
øB	$31^{+0.005}_{-0.011}$	$44^{+0.005}_{-0.011}$	$47^{+0.005}_{-0.011}$
øC	$31^{0}_{-0.016}$	$44^{0}_{-0.016}$	$47^{0}_{-0.016}$
øD	$31^{-0.025}_{-0.050}$	$44^{-0.025}_{-0.050}$	$47^{-0.025}_{-0.050}$
øE	15.6	19.6	23.3
øF	28	39	42
øG	32	45	48
H1	15.5	16.5	20
H2	9	9.5	11.5
J	2.4	2.5	3.2
K	2.1	2.5	2.8
L	2.8	3.3	4.2
øM1	5.3	5.3	6.8
øM2	9.5	9.5	11
øN	$22^{+0.021}_{0}$	$30^{+0.021}_{0}$	$32^{+0.025}_{0}$
P1	7	9	11
P2	2	2.5	2.5
R1	43	56	61
R2	46	59	64
S	8	12	12
T	M4×0.7	M4×0.7	M5×0.8
U*	45°	30°	30°

*: Be sure to match up phase of locate ring steel ball grooves and pallet clamp steel balls.

● Mounting screws are not included.

Shim (option)





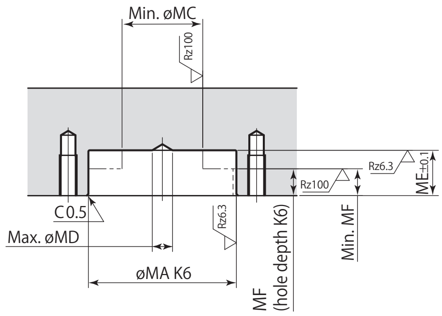
mm

Shim	CPS-S03F	CPS-S06F	CPS-S10F
øSA	55	68	75
øSB	32	45	48
SC	1.55	1.55	2.05
SD	43	56	61
SE	46	59	64
øSF	6	6	7
øSG	5	5	6
Mass	0.02 kg	0.02 kg	0.04 kg

● This diagram indicates dimensions at shipping.

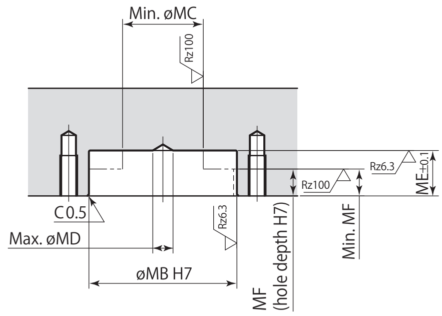
● Adjust thickness of shim by grinding to ensure flatness of pallet.

Mounting details

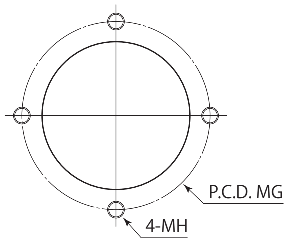


CPS-D03–10F, CPS-E03–10F, CPS-L03F

Rz: ISO4287(1997)



CPS-F03–10F

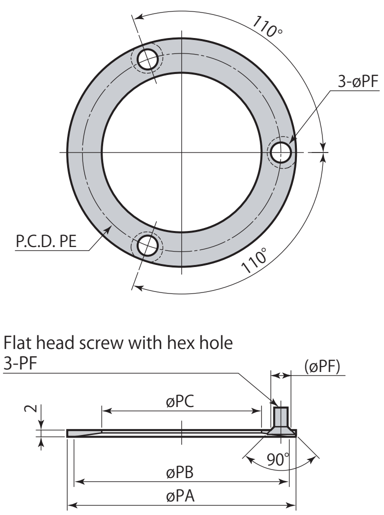


mm

Model	CPS-□03F	CPS-□06F	CPS-□10F
øMA	31 $^{+0.003}_{-0.013}$	44 $^{+0.003}_{-0.013}$	47 $^{+0.003}_{-0.013}$
øMB	31 $^{+0.025}_{0}$	44 $^{+0.025}_{0}$	47 $^{+0.025}_{0}$
øMC	20	24	28
øMD	6	6	8
MG	43	56	61
MH	M5	M5	M6
Not using shim (standard specifications)			
ME	10.5	13.5	14.8
MF	7.5	8	9.5
Using shim (shim specifications)			
ME	9	12	12.8
MF	6.5	6.5	7.5

● Be sure to match up phase of locate ring steel ball grooves and pallet clamp steel balls.

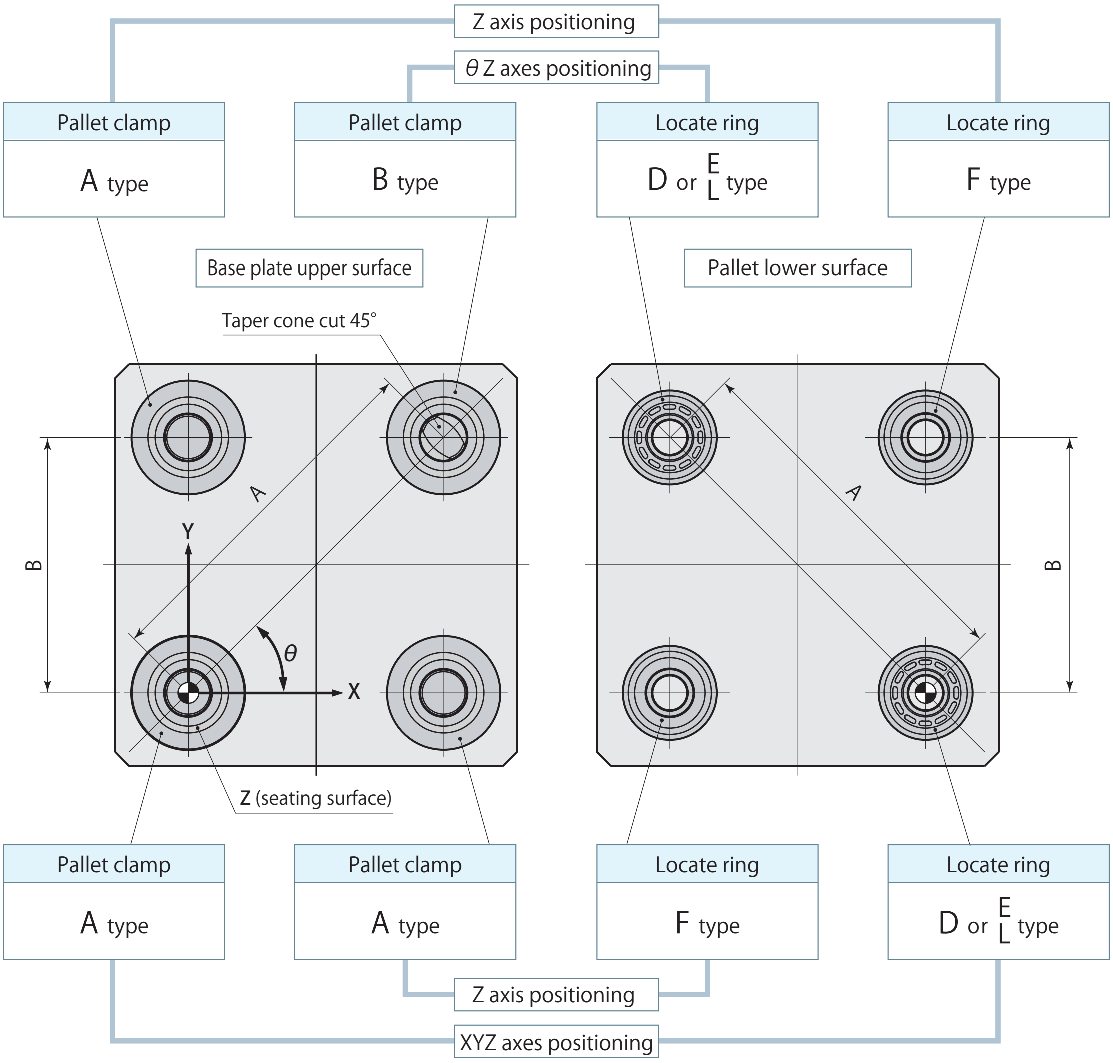
Protective plate (option)



mm

Protective plate	CPS-P03F	CPS-P06F	CPS-P10F
øPA	55	68	75
øPB	51	64	68
øPC	34.5	47.5	50.5
PE	46	59	64
øPF	6	6	8
Mass	0.02 kg	0.02 kg	0.03 kg

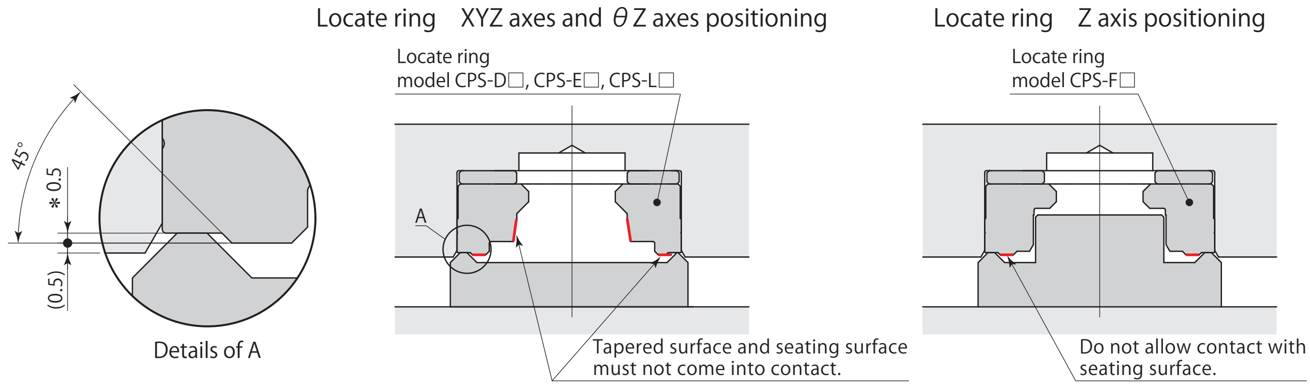
Pitch tolerance of Pal system



Pitch tolerance of A dimensions	±0.01 mm
Pitch tolerance of B dimensions	±0.03 mm

Method for positioning pallet changer setup table

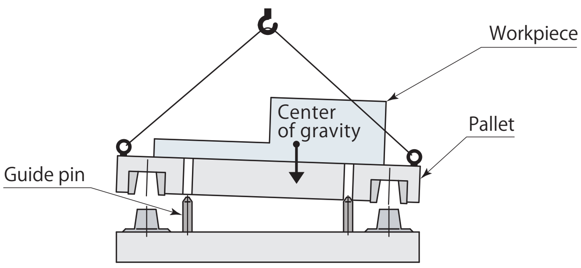
Internal hole of model CPS-F (Seating surface positioning) can be used for positioning of setup table for pallet change with pallet changer. In order to sustain accuracy, do not allow surfaces other than those of pallet clamp model CPY to come into contact with tapered surface or seating surface.

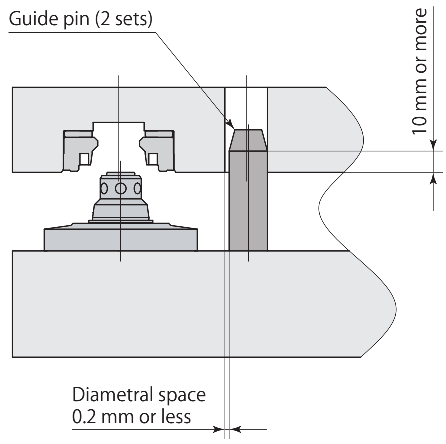


＊: 1mm for CPS-□□F (Locate ring for flange mounting)

Pallet change

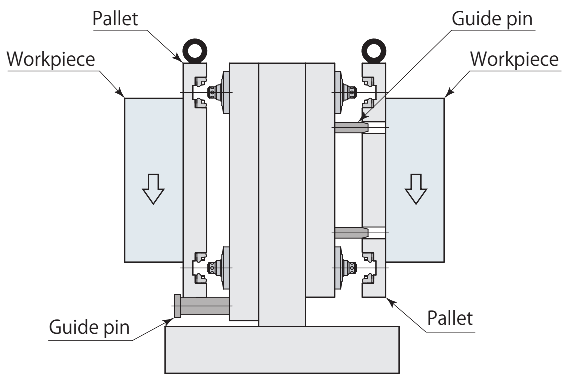
- When pallet changing, the pallet should be mounted or dismounted observing the figures shown in "Max. allowable eccentricity for pallet setting". (Refer to **page →625** for max. allowable eccentricity for pallet setting.)
- Ensure that pallet does not lean to the side when pallet mounting or dismounting. When dismounting pallet in particular, pulling while in a tilted condition can damage pallet clamp and locate ring. A guide pin is recommended to prevent the pallet from leaning.

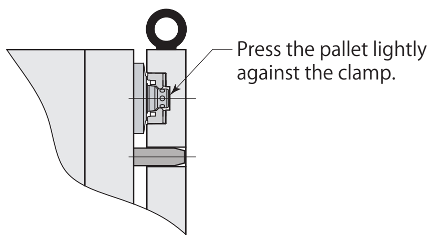




For vertical mounting of pallet

- A guide pin must be installed when mounting pallet vertically.
- Ensure spacing is set in order to ensure that mounted guide pin does not affect positioning.
- Ensure the pallet is closely contact with the base when it is clamped. Clamping with a space may cause the damage of both of clamp and locate ring.
(Refer to **page →631** for the height of pallet from base plate when pallet setting.)





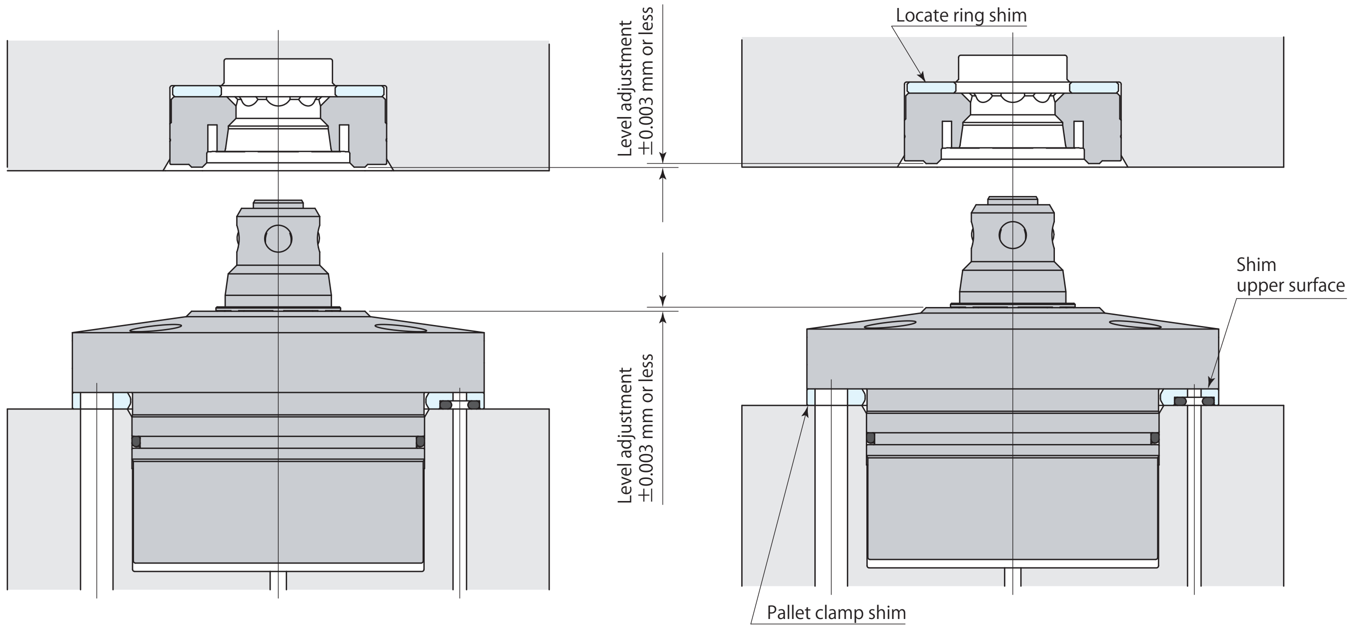
Level adjustment

Level adjustment of pallet clamp seating surface

- If level adjustment of pallet clamp seating surface is required, use pallet clamp shim (option). The level can be adjusted by grinding the shim.
- Grind shim upper surface (surface without O-ring).
- The measurement on the seating surface should be performed under the pallet clamped condition without locate rings. (Recommended adjustment figure : ±0.003mm)

Level adjustment of locate ring seating surface

- If level adjustment of locate ring seating surface is required, use locate ring shim (option). The level can be adjusted by grinding the shim. (Recommended adjustment figure : ±0.003mm)



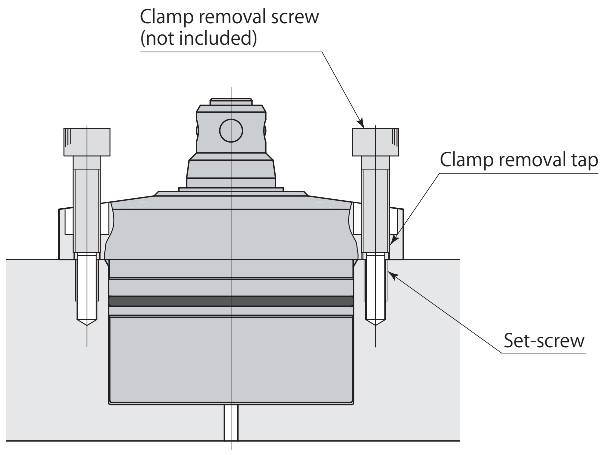
Dismounting of clamp

Dismounting of clamp

①Mount the set-screws on the mounting tap to protect the threads and clamp mounting surface.

②Mount the clamp removal screw on the clamp removal tap and dismount the clamp.

③Retain the clamp upright condition when dismounting it.

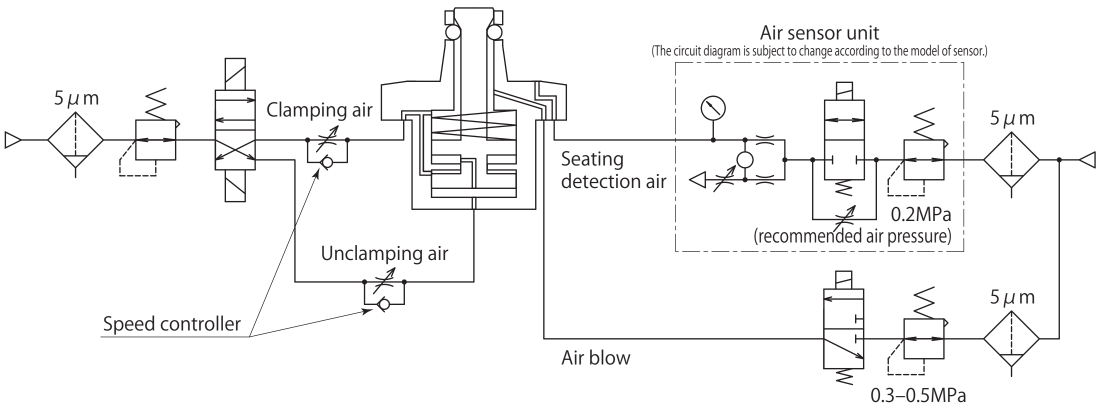


Air sensor unit recommended condition of use

Supplier and model	ISA3-F/G series manufactured by SMC
	GPS2-05, GPS3-E series manufactured by CKD
Air supply pressure	0.2 MPa
Inner diameter of piping	ø4 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 made successfully as designed when it is used out of the usage shown on the left. Contact Technical service center for more details.
- 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.
- Clamp state observation or operating check by the air sensor should be made while air blow is OFF.

Pneumatic circuit diagram



- Be sure to make inner diameter of air blow circuit 8 mm or more except for clamp mounting surface.
- Adjust full stroking time to be more than 1 second by a speed controller to avoid impact at the time of clamp or unclamp action.

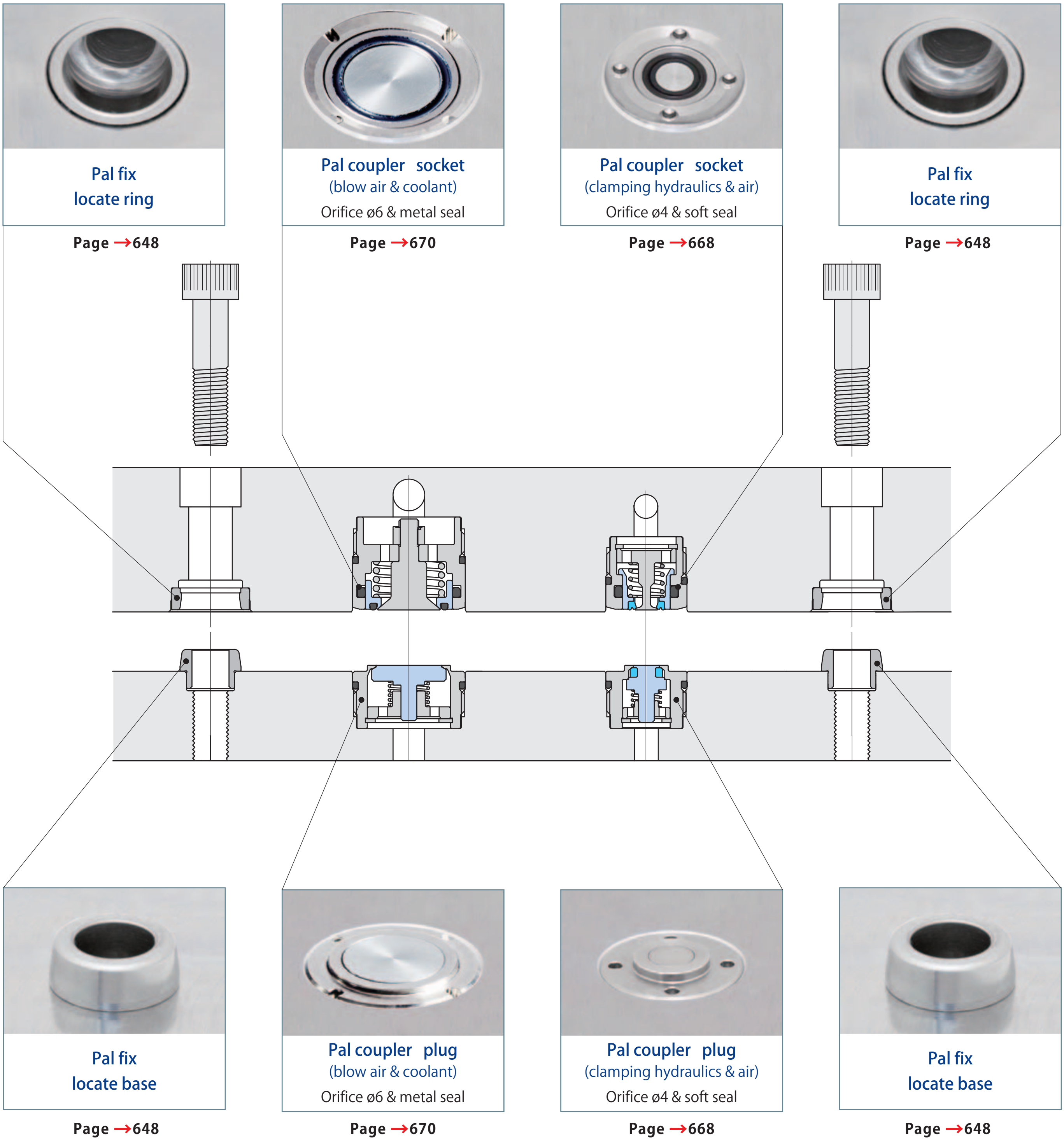
Table of contents

Pal fix

Manual clamp

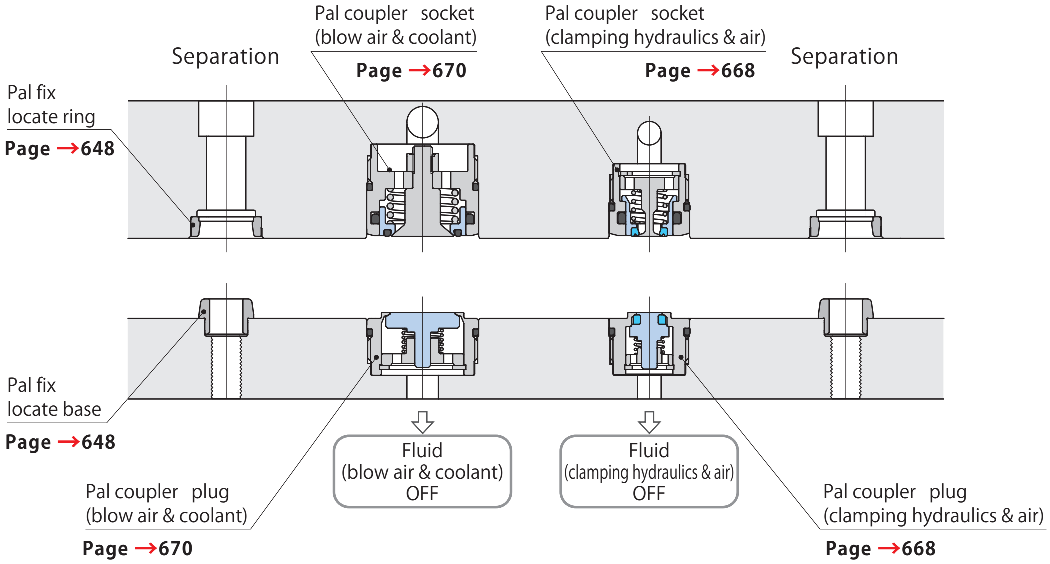
model CPK

Super-compact locating device makes you utilize a working space to the full.

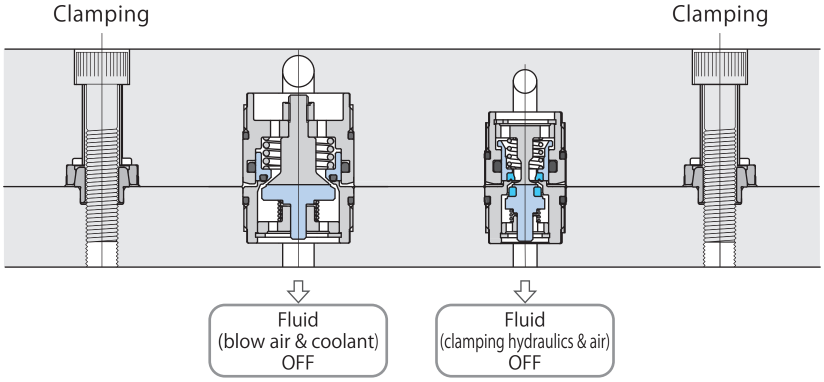


It is a taper cone model with dual surface contact to position high-accuracy.

Pallet change and coupler disconnected

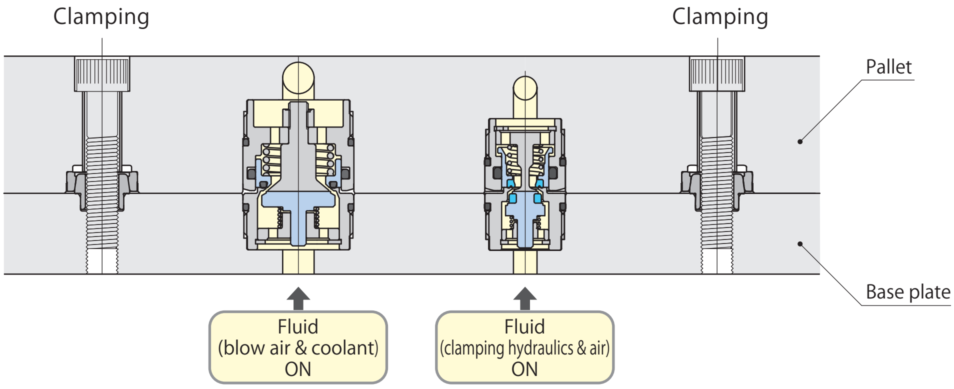


Pallet clamped and coupler connected



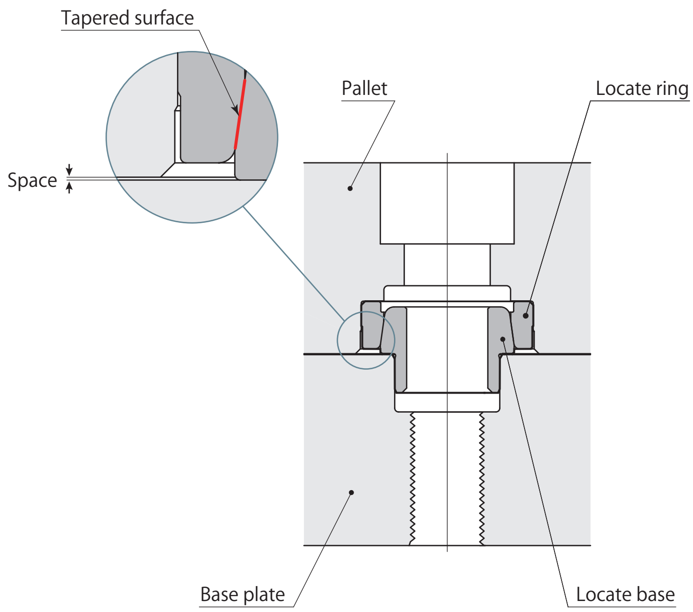
Precise positioning can be made by simply tightening the screws, and couplers can be connected at the same time.

Pallet clamped and circuit pressurized



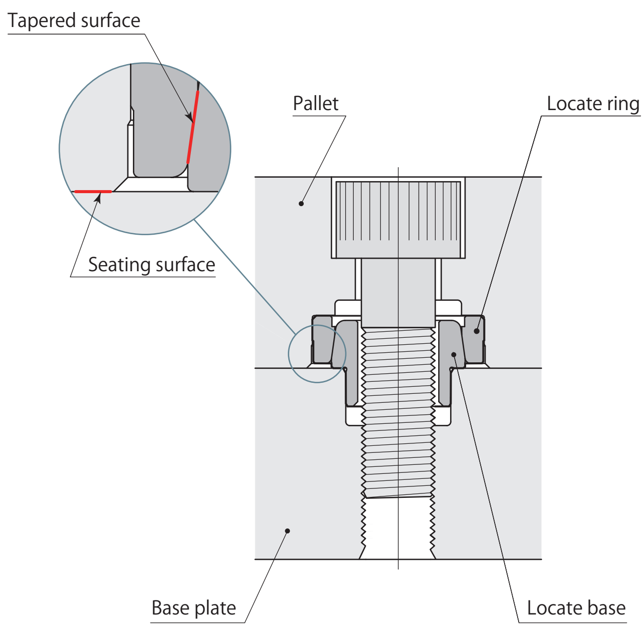
Pallet setting

- Bring pallet above the base plate. Lower it slowly after positioning.
  Pallet is centered along the tapered surface of the locate base.



XYZ positioning (dual surface positioning)

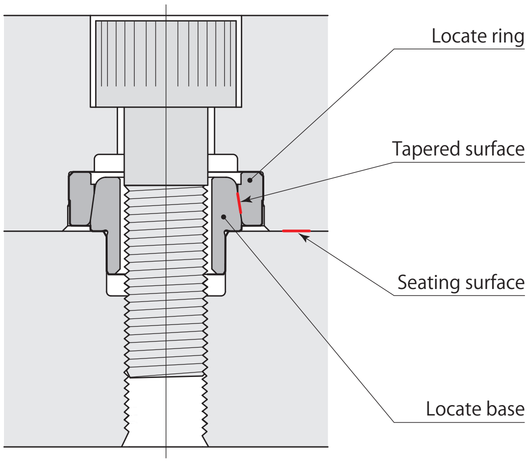
- Tapered surface of locate ring is expanded and deformed in radial direction by the locate base to firmly position X axis and Y axis.
  Pallet is attached to seating surface of base plate and positions Z axis. The positioning of X, Y and Z axes by tapered surface and seating surface completes the XYZ positioning (dual surface positioning).



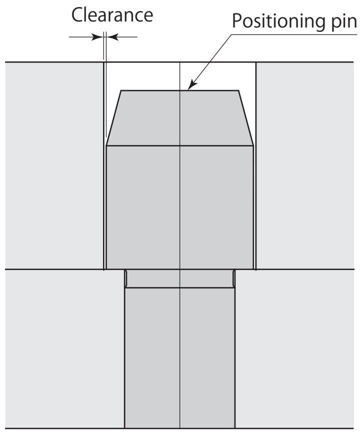
Realizing high-accuracy positioning

● In the case of ordinary positioning pin, it is common knowledge that the clearance is provided between the pin and the hole to allow the dimensional tolerance between the two pins, and to facilitate the positioning operation, however there is a risk of impairing the positioning repeatability depending on the volume of clearance so that the positioning re-adjustment must be done when re-setting the objects.
Pal fix can exert 3 μm of repeatability and requires no re-adjustment after setting the objects.

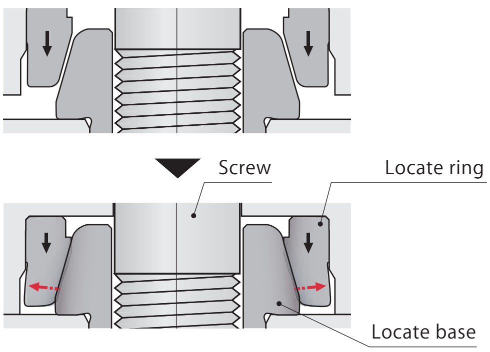
Pal fix



Positioning pin



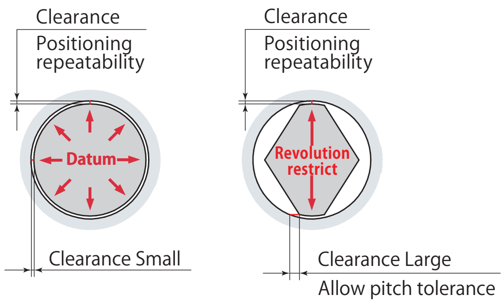
Taper cone makes attaching / detaching easy



By means of elastic deformation

Positioning repeatability : Within 3 μm
Pitch tolerance allowance : ±0.02mm

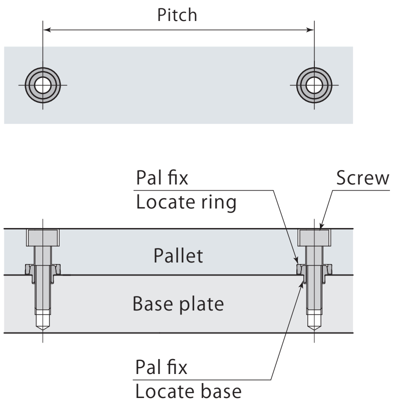
Round **Diamond**

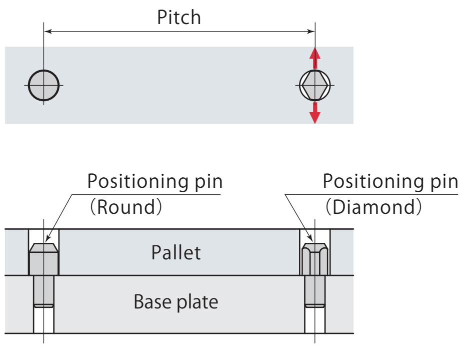


The positioning repeatability spoils when providing a large clearance.
A small clearance impairs the operability.

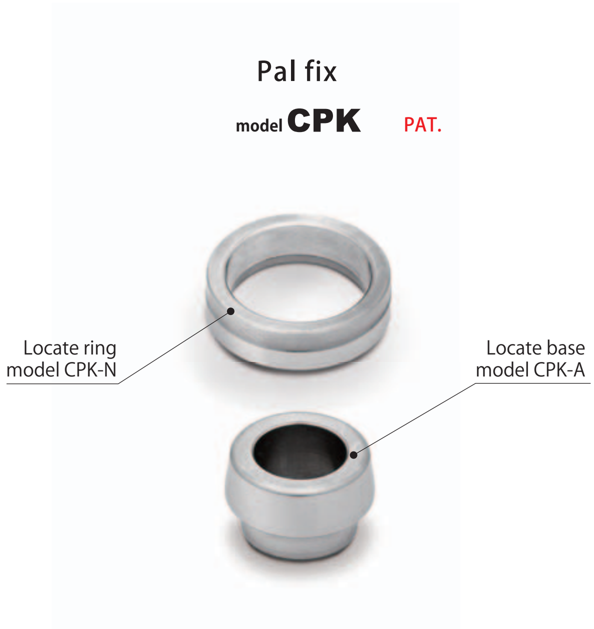
The diamond pin must be mounted perpendicularly toward round pin in addition to keeping the pitch accuracy between the two.

Pal fix only keeps pitch accuracy.



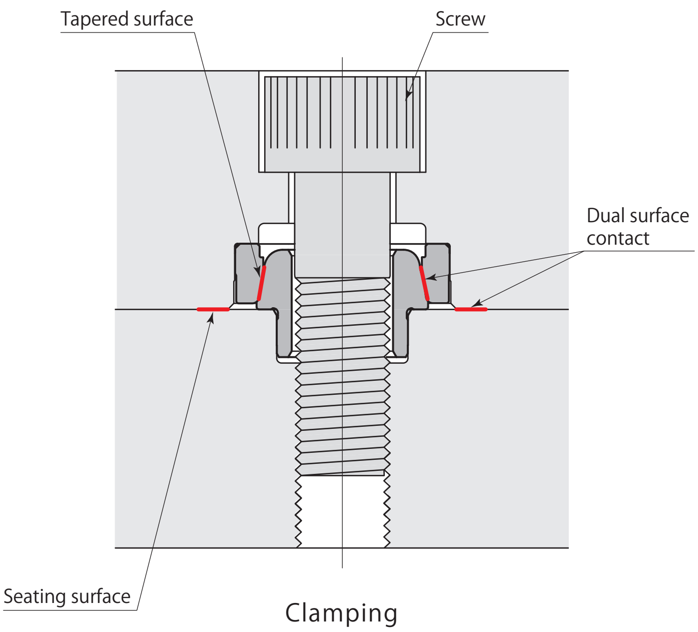


Combination of round and diamond pin

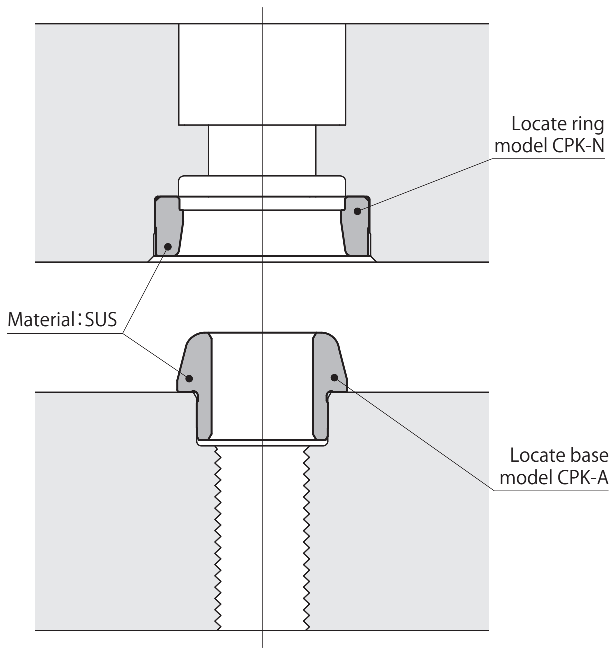


The dual surface contact taper cone combines high precision machining (repeatability: 3 μm*) and makes attaching or detaching easy.

*: Repeatability dependent on mounting orientation and mass (weight)



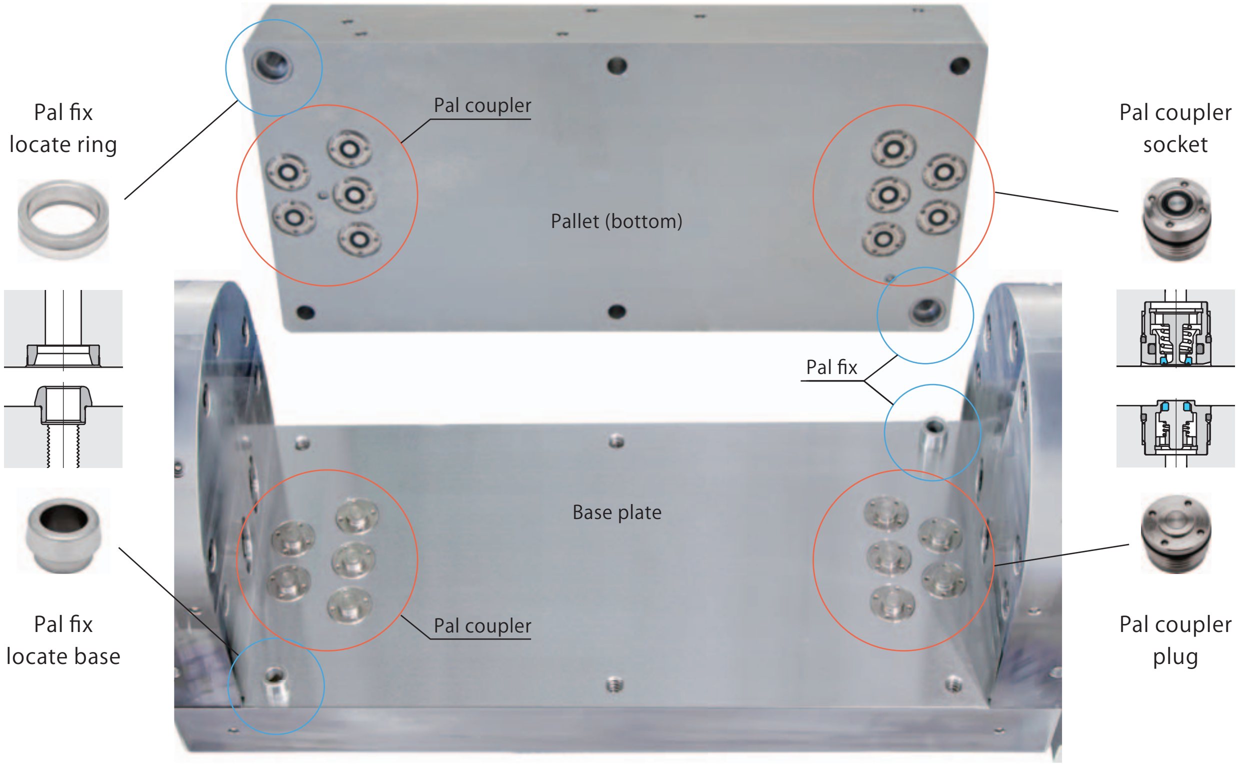
Clamping

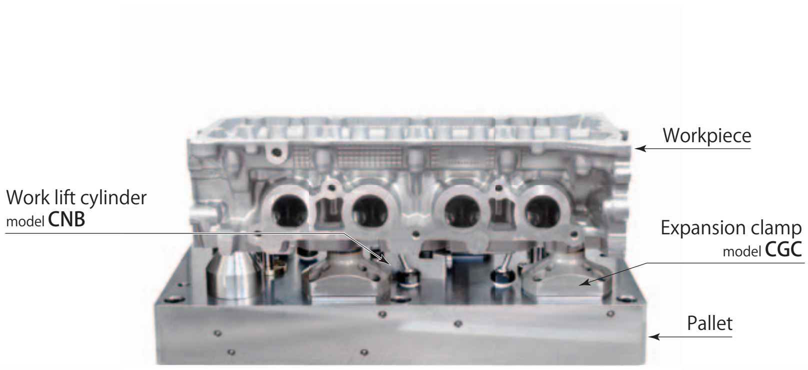


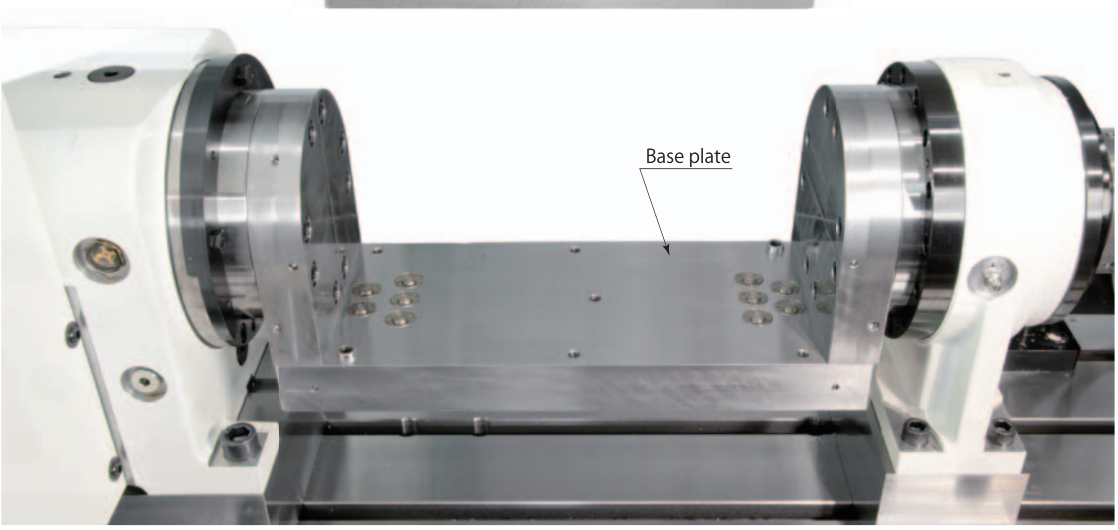
Separation

Specifications page → 651
Dimensions page → 652
Mounting details page → 653
Option page → 655

Usage example



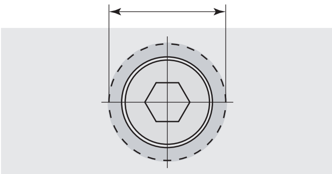




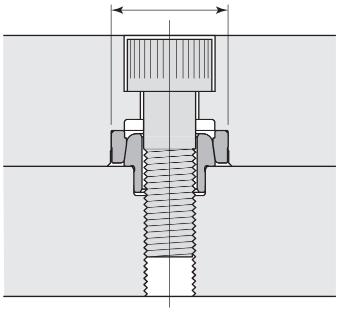
Compacting

Pal fix

Space (small)

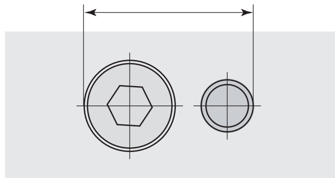


Space (small)

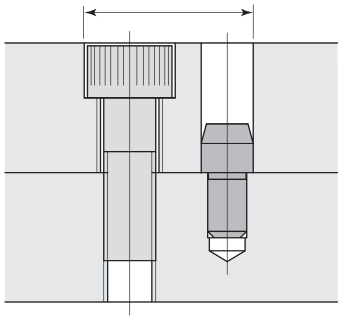


Positioning pin

Space (big)

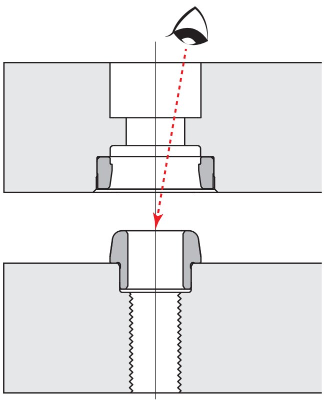


Space (big)

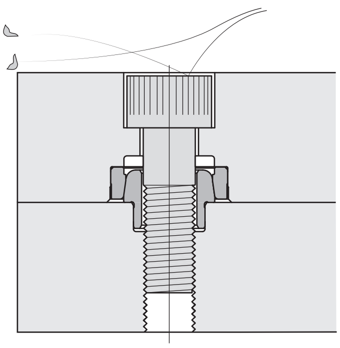


Easy attaching and detaching

Pal fix

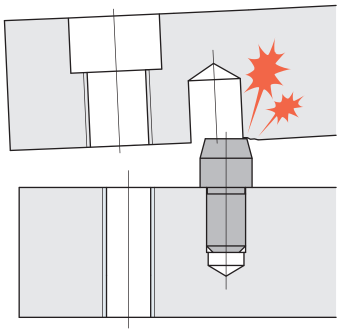


● Visual attaching and detaching.

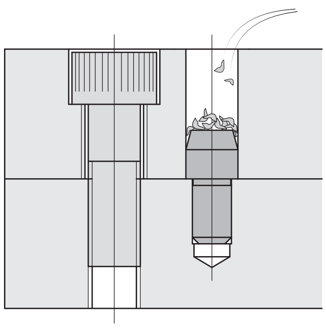


● Prevents intrusion of chips and foreign substances.

Positioning pin



● With no visual, it is difficult to detach and attach. Seating surface will also be damaged.



● Chips accumulate and are trapped, becoming difficult to remove.

Specifications

Size

CPK – A : Locate base / N : Locate ring – 06 / 08 / 10 / 12 / 16

Model				CPK-□06	CPK-□08	CPK-□10	CPK-□12	CPK-□16
Max. allowable load*1	Repeatability 3 μm	Horizontal mounting	kN	0.85	1.0	1.2	1.5	2.0
		Vertical mounting	kN	0.17	0.2	0.25	0.3	0.4
	Repeatability 5 μm	Horizontal mounting	kN	2.5	3.0	3.7	4.5	6.0
		Vertical mounting	kN	0.5	0.6	0.75	0.9	1.2
Min. clamping force*2			kN	7.5	9.0	12.5	15.5	21.5
Max. allowable eccentricity for pallet changing			mm	±0.5	±0.5	±0.5	±0.5	±1.0
Mass	Locate base		g	3.0	5.0	7.0	10.0	21.0
	Locate ring		g	3.0	4.0	7.0	11.0	22.0

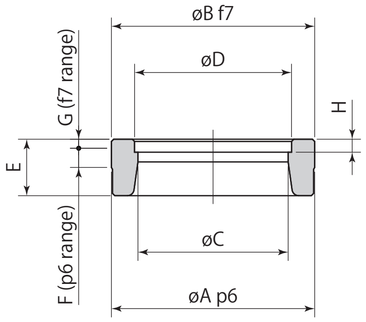
∗1：This is maximum allowable load of pallet, regardless of how many Pal fix are used.

∗2：Indicates necessary force to position one pair of locate base and locate ring.

Scale 1:1

Dimensions

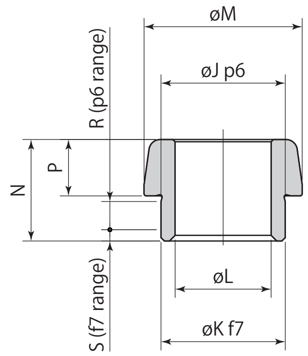
Locate ring



mm

Model	CPK-N06	CPK-N08	CPK-N10	CPK-N12	CPK-N16
øA	$15^{+0.029}_{+0.018}$	$18^{+0.029}_{+0.018}$	$22^{+0.035}_{+0.022}$	$25^{+0.035}_{+0.022}$	$32^{+0.042}_{+0.026}$
øB	$15^{-0.016}_{-0.034}$	$18^{-0.016}_{-0.034}$	$22^{-0.020}_{-0.041}$	$25^{-0.020}_{-0.041}$	$32^{-0.025}_{-0.050}$
øC	10.9	13.3	16.1	18.4	24
øD	11.4	13.9	16.9	19.4	25.2
E	4.5	5	6	7	9
F	1.7	1.7	1.7	1.7	2
G	0.8	0.8	1	1.3	2
H	1.15	1.15	1.15	1.15	1.35

Locate base

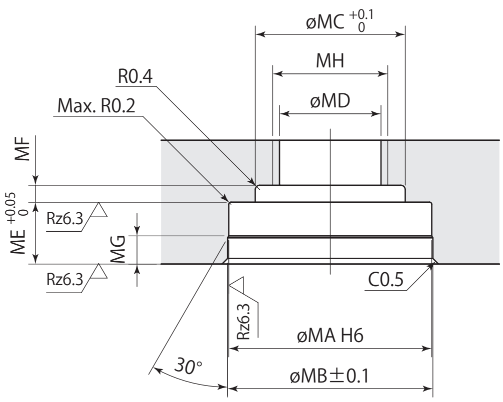


mm

Model	CPK-A06	CPK-A08	CPK-A10	CPK-A12	CPK-A16
øJ	$9^{+0.024}_{+0.015}$	$11^{+0.029}_{+0.018}$	$14^{+0.029}_{+0.018}$	$16^{+0.029}_{+0.018}$	$21^{+0.035}_{+0.022}$
øK	$9^{-0.013}_{-0.028}$	$11^{-0.016}_{-0.034}$	$14^{-0.016}_{-0.034}$	$16^{-0.016}_{-0.034}$	$21^{-0.020}_{-0.041}$
øL	6.5	8.5	11	13	17
øM	11.5	14	17	19.5	25.5
N	8.5	9	10	11.5	13.5
P	4.5	5	6	7	9
R	2.5	2.5	2.5	3	3
S	1	1	1	1	1

Mounting details

Locate ring
mounting details



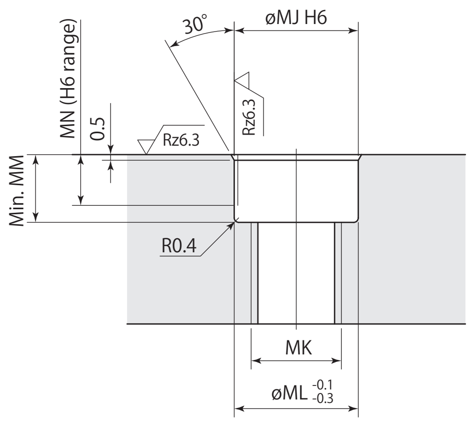
Rz: ISO4287(1997)

mm

Model	CPK-N06	CPK-N08	CPK-N10	CPK-N12	CPK-N16
øMA	15 $^{+0.011}_{0}$	18 $^{+0.011}_{0}$	22 $^{+0.013}_{0}$	25 $^{+0.013}_{0}$	32 $^{+0.016}_{0}$
øMB	15.2	18.2	22.2	25.2	32.2
øMC	11.6	14.2	17.5	20.0	25.8
øMD	6.8	9	11	14	18
ME	5	5.5	6.5	7.5	9.5
MF	1.5	1.5	2	2	2
MG	2	2.5	3.5	4	5
MH*	M8	M10	M12	M16	M20

＊: Thread MH is provided to mount model CPK-N.
Refer to **page** →**655** for mounting method.
● Refer to **page** →**654** for mounting pitch tolerance.

Locate base
mounting details



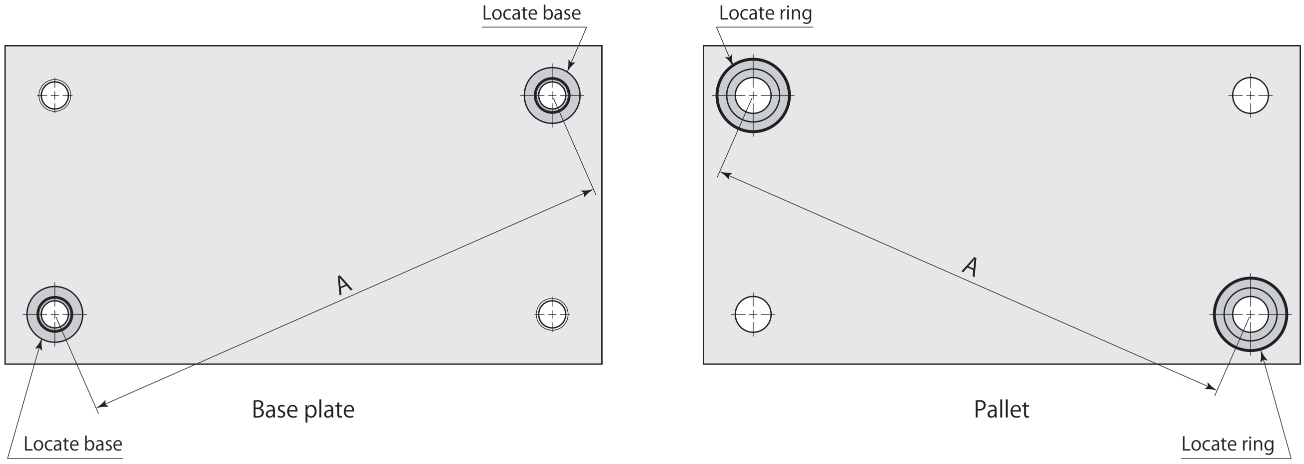
Rz: ISO4287(1997)

mm

Model	CPK-A06	CPK-A08	CPK-A10	CPK-A12	CPK-A16
øMJ	9 $^{+0.009}_{0}$	11 $^{+0.011}_{0}$	14 $^{+0.011}_{0}$	16 $^{+0.011}_{0}$	21 $^{+0.013}_{0}$
MK	M6	M8	M10	M12	M16
øML	9	11	14	16	21
MM	5.5	6	6	7	7
MN	4.5	4.5	4.5	5	5

● Refer to **page** →**654** for mounting pitch tolerance.

Mounting pitch tolerance



Pitch tolerance of A dimension	±0.02 mm

Tightening turn for screws

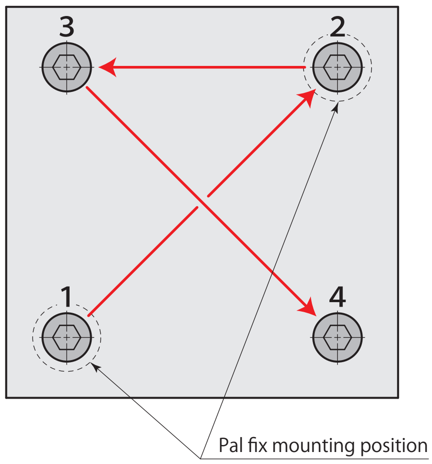
① Tighten the screw up by hand until the seating surface of screw holding to other.

② Tighten the screws tentatively in order as shown in the diagram on the right with a minimum force. (**page →651**)

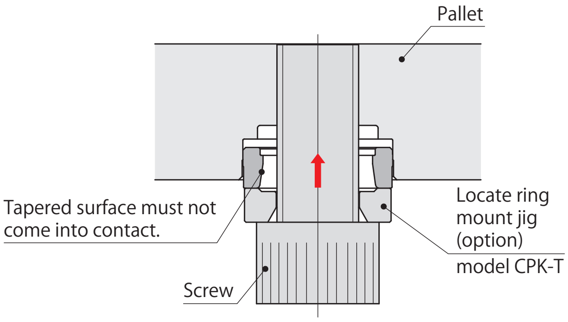
③ Tighten all of the screws again in order shown in the diagram.

● Make sure to tighten all screws evenly. Make sure not to give extra force only one or two screws on the same side. (e.c. : 1 and 3 on the right drawing.)

Tightening turn for screws

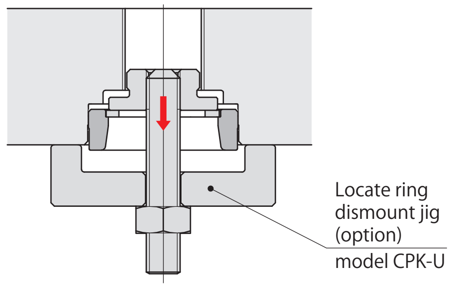


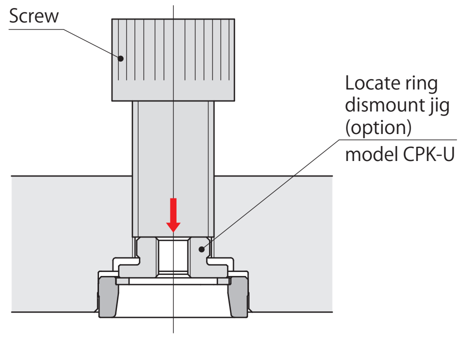
Mounting of locate ring



● Press a locate ring in the hole keeping it upright.

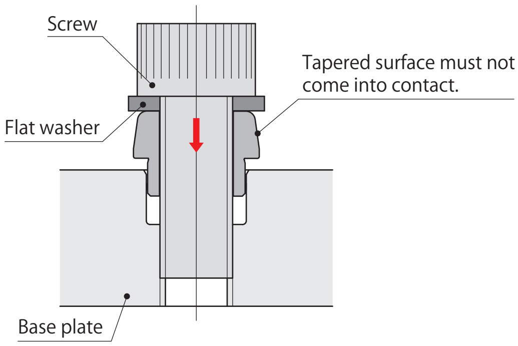
Dismounting of locate ring





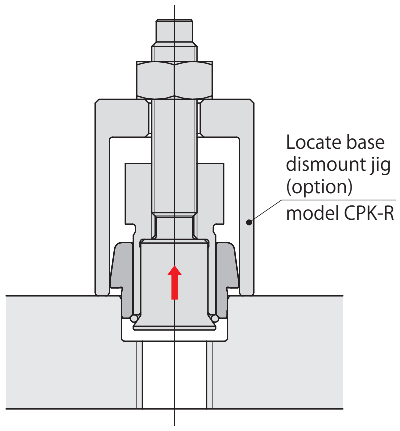
● The ring can be removed by a screw.

Mounting of locate base



● Press a locate base in the hole keeping it upright.
Be sure to use a flat washer to protect the locate base from damage.

Dismounting of locate base

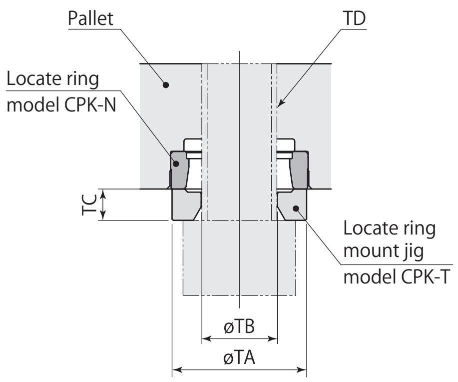


● Ask Pascal in the use of dismount jig of locate ring and locate base.

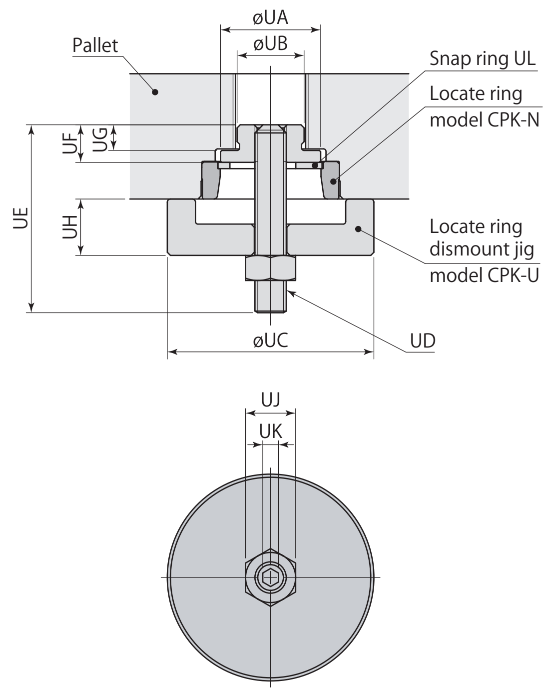
Size

CPK – T : Locate ring mount jig / U : Locate ring dismount jig – 06 / 08 / 10 / 12 / 16

Locate ring mount jig



Locate ring dismount jig



mm

Locate ring mount jig	CPK-T06	CPK-T08	CPK-T10	CPK-T12	CPK-T16
Locate ring dismount jig	CPK-U06	CPK-U08	CPK-U10	CPK-U12	CPK-U16
øTA	14.5	17.5	21.5	24.5	31.5
øTB	8.2	10.2	12.2	16.2	20.2
TC	4	4	5	5	6
TD	M8	M10	M12	M16	M20
øUA	10.8	13.2	16	18.3	23.9
øUB	6.5	8.7	10.7	13.7	17.7
øUC	25	27	33	35	43
UD	M4×0.7	M4×0.7	M5×0.8	M5×0.8	M6×1.0
UE	25	25	30	30	40
UF	5.5	5.5	6	6.5	9
UG	4.1	4.1	4.1	4.6	7.1
UH	8	8	9	9.5	11.5
UJ (nut width across flats)	7	7	8	8	10
UK (hex socket)	2	2	2.5	2.5	3
UL*	RTW-11	RTW-13	RTW-16	RTW-18	RTW-24
Locate ring	CPK-N06	CPK-N08	CPK-N10	CPK-N12	CPK-N16

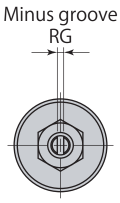
∗: Snap ring is made by Ochiai Corporation.

Size

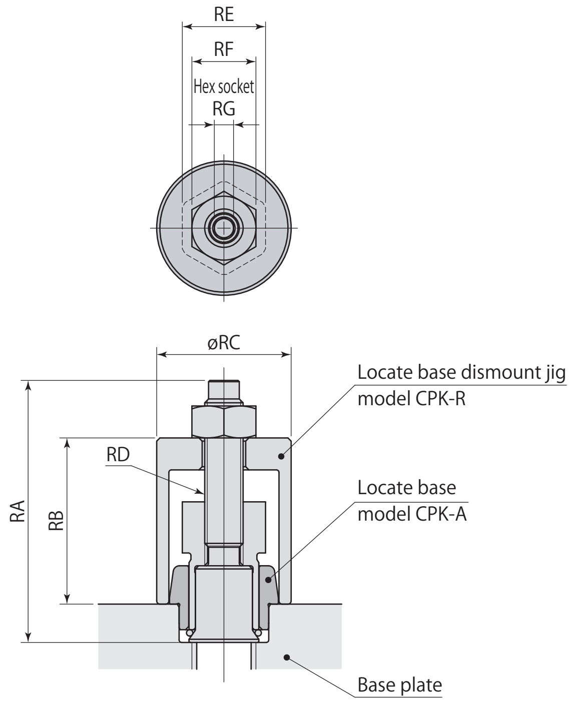
CPK – R : Locate base dismount jig

Size
06
08
10
12
16

Locate base dismount jig



CPK-R06 only

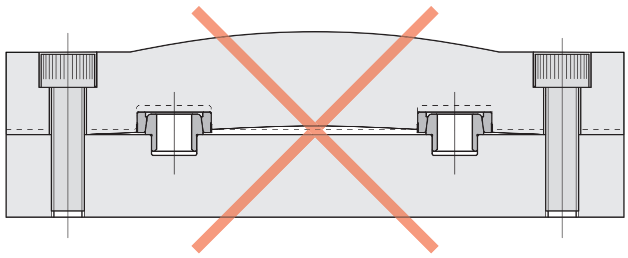


mm

Locate base dismount jig	CPK-R06	CPK-R08	CPK-R10	CPK-R12	CPK-R16
RA	33	36.5	41	43.5	55.5
RB	20.5	22.5	26	27.5	37
øRC	14.5	17	21	24	31
RD	M4×0.7	M5×0.8	M6×1.0	M6×1.0	M8×1.25
RE (hex width across flats)	10	10	13	17	22
RF (nut width across flats)	7	8	10	10	13
RG	1	2.5	3	3	4
Locate base	CPK-A06	CPK-A08	CPK-A10	CPK-A12	CPK-A16

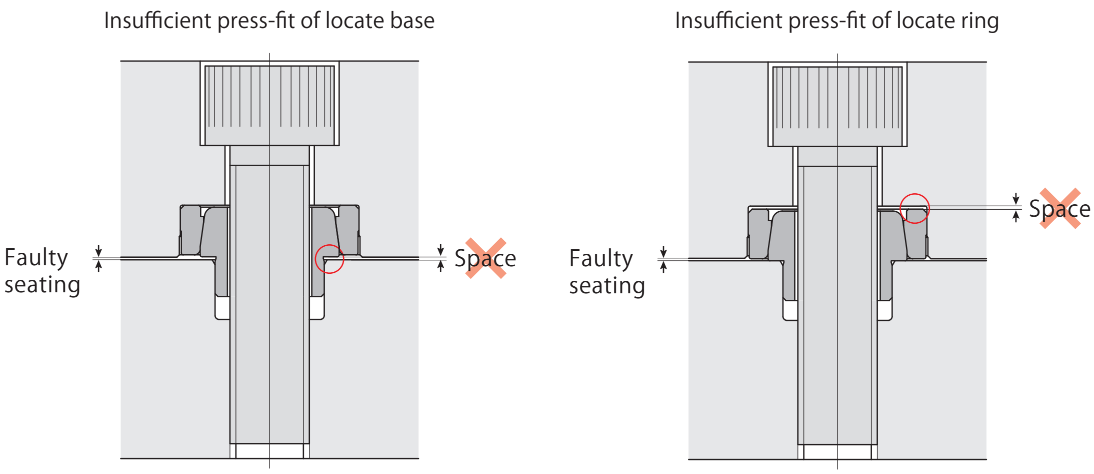
Clamping

- Put the screws through Pal fix and tighten it.
  Failure of the instruction may cause impair the repeatability.



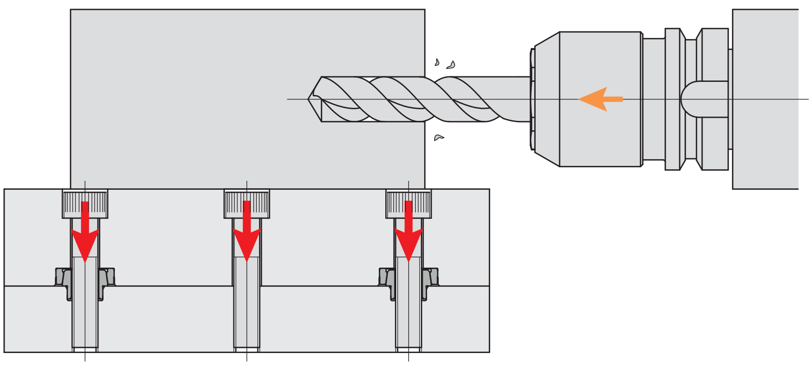
Mounting

- Make sure if locate base, locate ring are securely pressed into the end of the mounting hole.
  Insufficient press-fit may cause mis-seating and excessive deformation, which results in breakage.



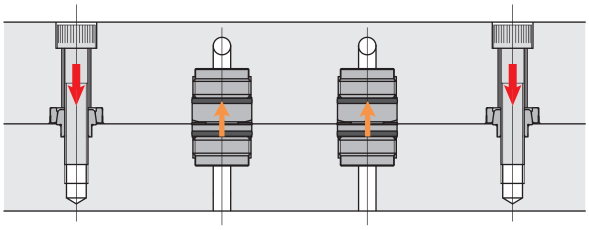
Defining fastening power

- Define the fastening power based on the load from the side.
  There is a risk of damage when the load is applied to Pal fix.



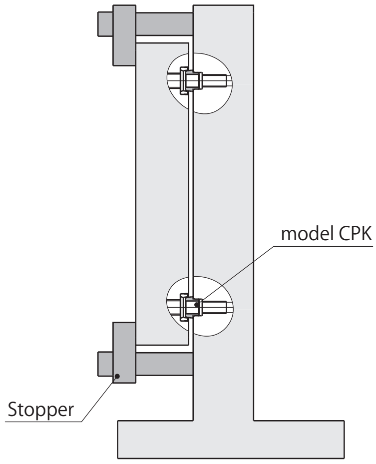
Reactive force of coupler

● Reactive force is generated when Pal couplers are used. The fastening power should be determined considering the reactive force of the coupler.



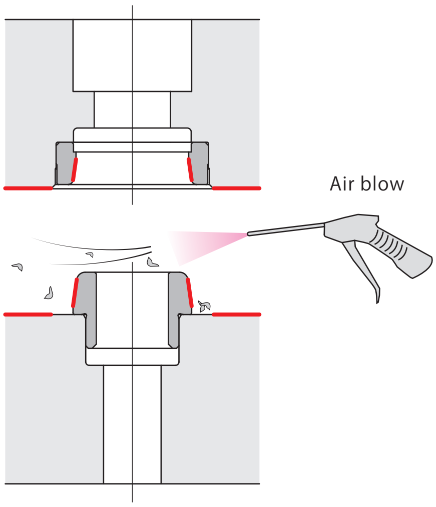
Fall protection

● The mechanical stopper must be provided to avoid pallet falling when changing the pallet.



Cleaning

● Keep the seating and tapered surface clean.



Max. allowable eccentricity

● Keep allowable eccentricity when loading or unloading the pallet.
(Refer to **page →651** for max. allowable eccentricity.)

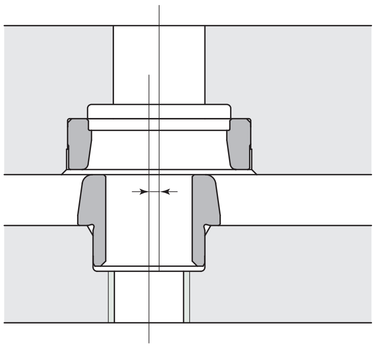


Table of contents

Refer to **page →685** for the details of the couplers that are not described in the catalog.

Coupler

model WVP

Pal coupler Hydraulic pressure 25MPa & air
model WVP-2BSH model WVP-2BPH

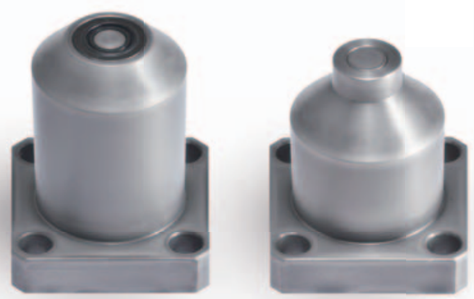
Pal coupler Blow air & coolant
model WVP-3DSN model WVP-3DPN

Pal coupler Hydraulic pressure 7MPa & air
model WVP-2FSL model WVP-2FPL

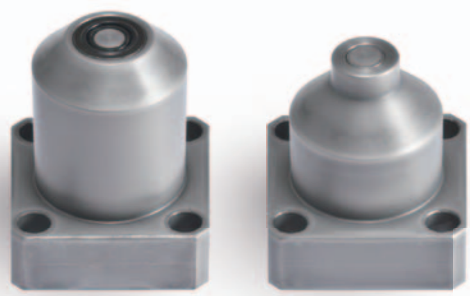
Pal coupler Blow air & coolant
model WVP-3GSN model WVP-3GPN

Pal coupler Air
model WVP-1FSN model WVP-1FPN

Pilot coupler Hydraulic pressure 7MPa
model WVP-2ESL model WVP-2EPL



Non-leak coupler Hydraulic pressure 7MPa
(Plug hydraulic pressure source)
model WVP-2HSL model WVP-2HPL



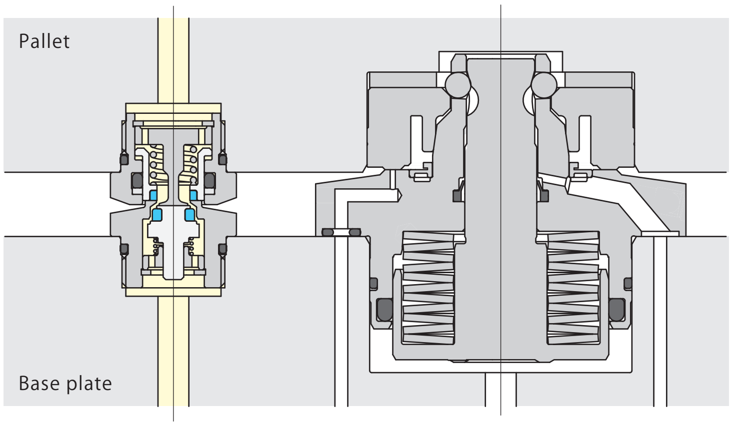
Non-leak coupler Hydraulic pressure 7MPa
(Socket hydraulic pressure source)
model WVP-2SSL model WVP-2SPL

Hydraulic and air coupler with zero hydraulic oil leak with special seal at tip section

Pal coupler socket
Hydraulic pressure 25 MPa & air
model **WVP-2BSH**

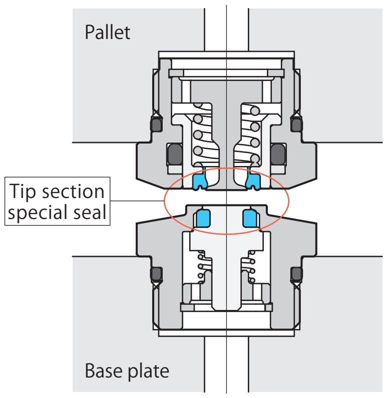
Pal coupler plug
Hydraulic pressure 25 MPa & air
model **WVP-2BPH-□□**

- Special soft seal at tip section enables plug (WVP-2BPH) to be pressurized under disconnected state. Socket (WVP-2BSH) can retain residual pressure of up to 0.3 MPa.
- Special seal installed on the tip of coupler socket and coupler plug can minimize the intrusion of air and spill of working fluid during connection and disconnection, furthermore, it prevents corruption of coolant by being miscible with spilled working fluid and air contamination of clamp circuit.
- Disconnection and connection of coupler is performed by lift stroke of pallet clamp and there is no need for connecting mechanism or stopper. No reactive force is generated when pallet is set, since coupler is not connected. (Refer to **page →587**)
- The couplers are selectable according to the size of pallet clamp and no spacer block is required.
- Height of coupler is maintained low in order to reduce thickness of pallet.
- The parts in the coupler are corrosion prevented (plating or stainless) and oil and air can be applied as a fluid.

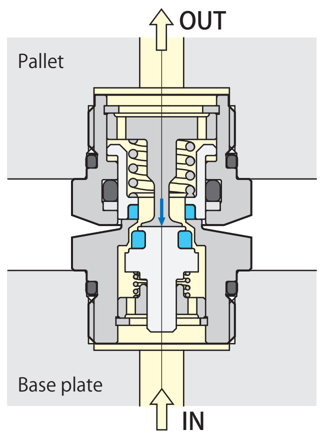


Coupling at same time with pallet clamp

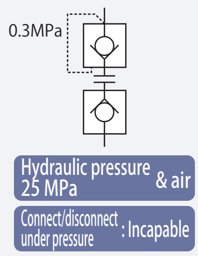
Disconnected



Connected



Specifications

Pressure range	0–25 MPa	Circuit symbol 
Proof pressure	37.5 MPa	
Orifice area	10.2 mm²	
Fluid used	General mineral based hydraulic oil (ISO-VG32 equivalent) & air	
Allowable eccentricity	±0.5 mm	
Allowable inclination	0.3° or less	
Reactive force*	113 N per 1 MPa fluid pressure	
	Max. spring force for no pressure 40 N	
Operating temperature	0–70 ℃	

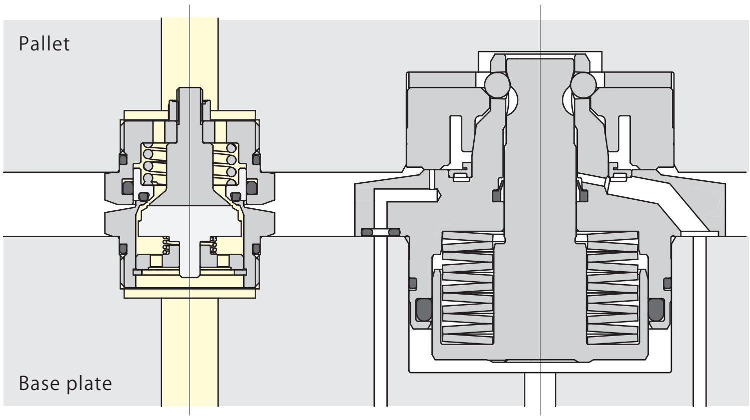
＊: Reactive force (N) = Fluid pressure (MPa) ×113+40

- Refer to **pages →664, 665** for details.

Air & coolant coupler with large orifice area and capability to accommodate large flow rates.

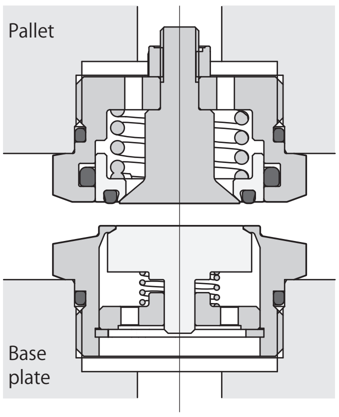
Pal coupler socket
Blow air & coolant
model **WVP-3DSN**

Pal coupler plug
Blow air & coolant
model **WVP-3DPN-☐☐**

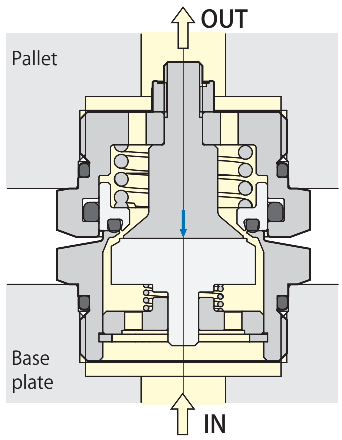


Coupling at same time with pallet clamp

Disconnected

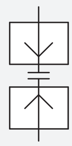


Connected



- Height of coupler is maintained low in order to reduce thickness of pallet.
- Disconnection and connection of coupler is performed by lift stroke of pallet clamp and there is no need for connecting mechanism or stopper. No reactive force is generated when pallet is set, since coupler is not connected. (Refer to **page →587**)
- The couplers are selectable according to the size of pallet clamp and no spacer block is required.
- Large orifice area allows to supply large volume of coolant or blow air.

Specifications

Pressure range	0–1 MPa	Circuit symbol
Proof pressure	1.5 MPa	
Orifice area	29.0 mm²	
Fluid used	Air & coolant	Air & coolant
Allowable eccentricity	±0.5 mm	Connect/disconnect under pressure : Incapable
Allowable inclination	0.3° or less	
Reactive force*	380 N per 1 MPa fluid pressure	
	Max. spring force for no pressure 60 N	
Operating temperature	0–70 ℃	

＊: Reactive force (N) = Fluid pressure (MPa) ×380+60

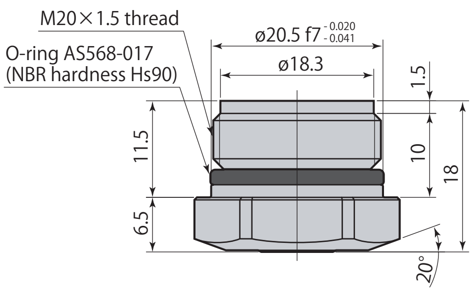
- Refer to **pages →666, 667** for details.

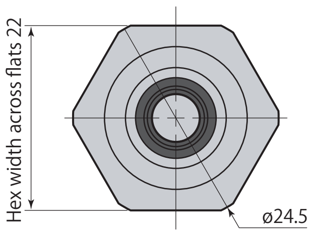
Dimensions

WVP-2BSH

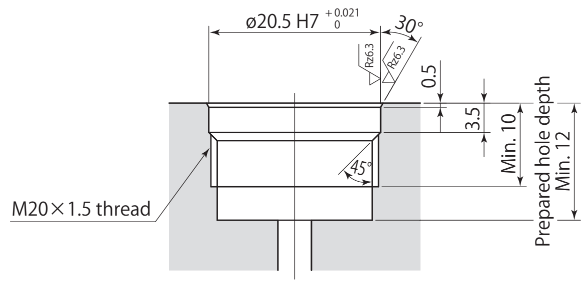
Hydraulic pressure 25 MPa & air socket

Recommended tightening torque：25 N･m



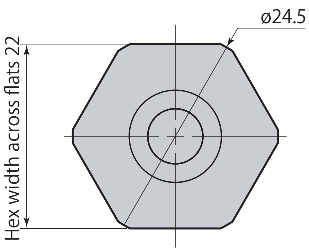


Mounting details

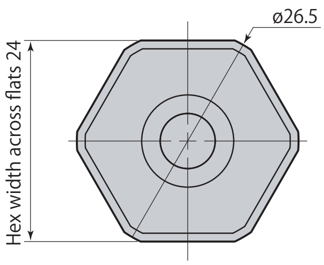


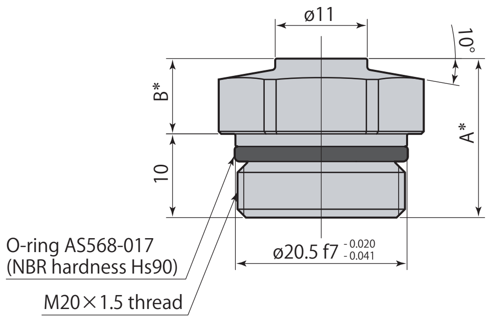
Rz: ISO4287(1997)

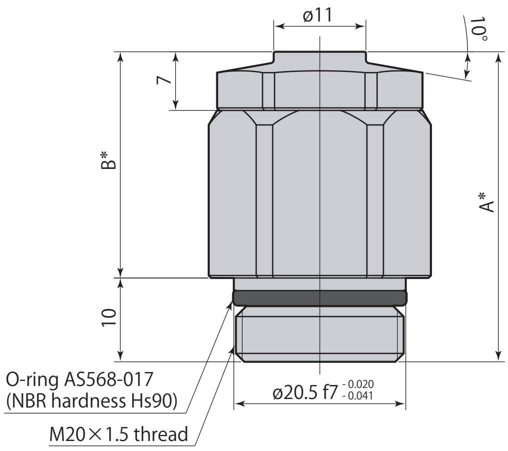
- Stop supplying fluid during disconnection and connection operations. Disconnecting or connecting coupler while fluid is flowing results in the leakage.
- Coupler has no built in filter. Ensure that foreign substances on connecting surfaces are removed by blowing air before connecting to prevent intrusion of foreign substances into piping.
- Make sure air bleeding in the hydraulic circuit is perfectly done when installation.



WVP-2BPH-10A, 16F, 25F, 40F
WVP-2BPH-16S, 25S, 40S only







＊：Dimension varies according to the size and model no of the coupler.

WVP-2BPH-□□ Hydraulic pressure 25 MPa & air plug Recommended tightening torque：25 N･m

mm

Coupler		WVP-2BSH									
	Plug	WVP-2BPH-03T	WVP-2BPH-06T	WVP-2BPH-10T		WVP-2BPH-16T		WVP-2BPH-25T		WVP-2BPH-40T	
A		16	17	19		22		26		32	
B		6	7	9		12		16		22	
H (distance to pallets)		11.5	12.5	14.5		17.5		21.5		27.5	
Coupler mass	Socket	38 g									
	Plug	34 g	37 g	42 g		49 g		58 g		73 g	
Applicable pallet clamp / locate ring											
Pallet clamp	CPC-, CPH-	□03H	□06H	□10H	–	□16H	–	□25H	–	□40H	–
Air pallet clamp	CPY-	□02H, □03H	–	–	□04H	–	□06H	–	□10H	–	□06H
Locate ring	CPS-	□03T, D	□06T, D	□10T, D	□03T, D	□16T, D	□06T, D	□25T, D	□10T, D	□40T, D	□06F
Locate ring shim		S03T, D	S06T, D	S10T, D	S03T, D	S16T, D	S06T, D	S25T, D	S10T, D	S40T, D	–

mm

Coupler	Socket	WVP-2BSH							
	Plug	WVP-2BPH-03F	WVP-2BPH-06F		WVP-2BPH-10F	WVP-2BPH-10A	WVP-2BPH-16F	WVP-2BPH-25F	WVP-2BPH-40F
A		25.5	27		31	38	37	44.5	55.5
B		15.5	17		21	28	27	34.5	45.5
H (distance to pallets)		21	22.5		26.5	33.5	32.5	40	51
Coupler mass	Socket	38 g							
	Plug	57 g	61 g		71 g	95 g	92 g	114 g	147 g
Applicable pallet clamp / locate ring									
Pallet clamp	CPC-, CPH-	□03H	□06H	□03H	□10H	–	□16H	□25H	□40H
Air pallet clamp	CPY-	□02H, □03H	–	□02H, □03H	–	□10H	–	–	–
Locate ring	CPS-	□03F	□06F	□03F	□10F	□10F	□16F	□25F	□40F
Locate ring shim		–	–	S03F	–	–	–	–	–

mm

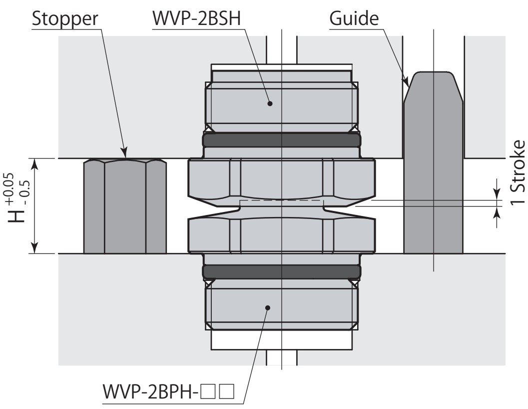
Coupler	Socket	WVP-2BSH								
	Plug	WVP-2BPH-03B	WVP-2BPH-06S		WVP-2BPH-06B	WVP-2BPH-10S	WVP-2BPH-16S		WVP-2BPH-25S	WVP-2BPH-40S
A		30	28.5		33.5	33	40		47.5	58.5
B		20	18.5		23.5	23	30		37.5	48.5
H (distance to pallets)		25.5	24		29	28.5	35.5		43	54
Coupler mass	Socket	38 g								
	Plug	68 g	65 g		77 g	75 g	101 g		123 g	156 g
Applicable pallet clamp / locate ring										
Pallet clamp	CPC-, CPH-	–	□06H	–	–	□10H	□16H	–	□25H	□40H
Air pallet clamp	CPY-	□04H	–	□04H	□06H	–	–	□10H	–	–
Locate ring	CPS-	□03F	□06F	□03F	□06F	□10F	□16F	□10F	□25F	□40F
Locate ring shim		S03F	S06F	–	S06F	S10F	S16F	S10F	S25F	S40F

(gray) indicates made to order.

Caution in use

- The distance between the base and the pallet varies when the pallet clamp is mounted with the shim (model CPC-S, CPH-S, CPY-S). Install the Pal coupler to have the dimension $H^{+0.05}_{-0.5}$ set as shown in the above table when it is connected.
- Former pallet clamp (model CPC-□□F, CPH-□□F) cannot be used in combination with the couplers, as lift stroke is different.
- Ask Pascal in case it is used in combination with Pal coupling model CPM.
- Provide the stopper and the guide as shown in the diagram to protect coupler from damage unless it is used in combination with pallet clamp. Do not use a coupler as a guide or stopper when connecting. It may cause the damage. Install the stopper to have the dimension $H^{+0.05}_{-0.5}$ set as shown in the above table (See diagram on the right). Observe allowable eccentricity and inclination value when installing the guide. (Refer to **page →662** for details on allowable eccentricity and inclination value.)

Mounting sample without pallet clamp

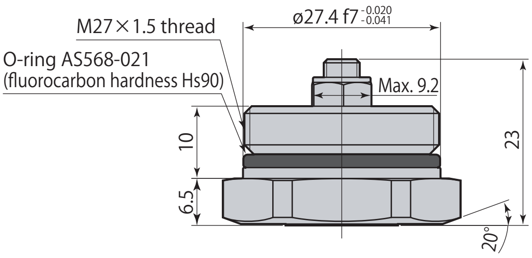


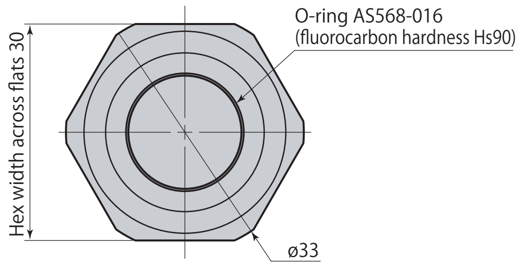
Dimensions

WVP-3DSN

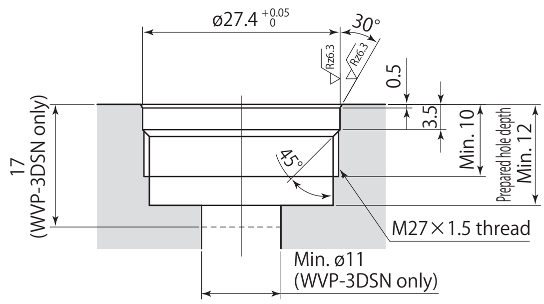
Blow air & coolant socket

Recommended tightening torque：30 N･m



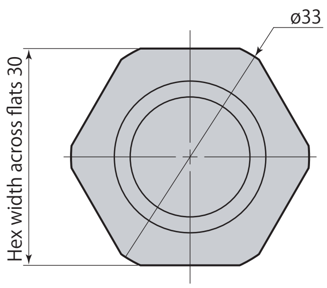


Mounting details

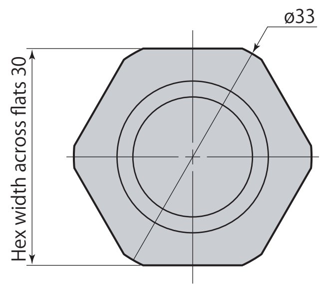


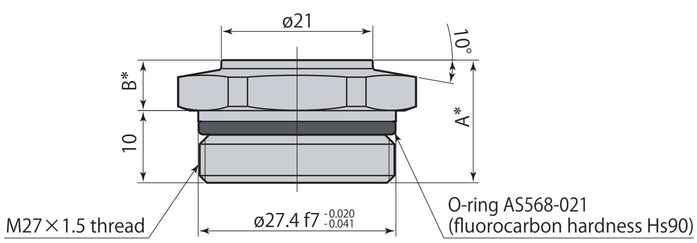
Rz: ISO4287(1997)

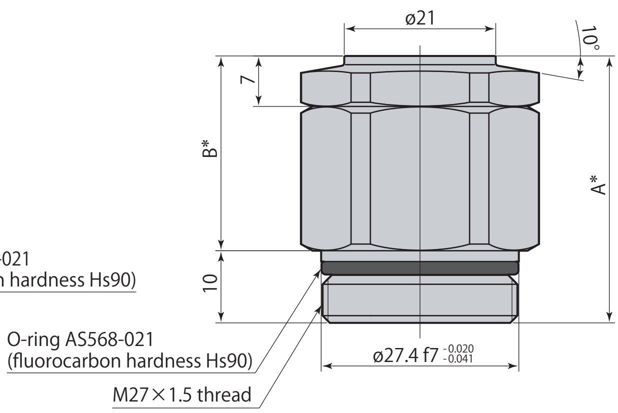
- Fluid leaks from the tip of coupler when supplying it under disconnected state.
- Stop supplying fluid during disconnection and connection operations. Disconnecting or connecting coupler while fluid is flowing results in the leakage.
- Coupler has no built in filter. Ensure that foreign substances on connecting surfaces are removed by blowing air before connecting to prevent intrusion of foreign substances into piping.



WVP-3DPN-10A, 16F, 25F, 40F
WVP-3DPN-16S, 25S, 40S only







＊：Dimension varies according to the size and model no of the coupler.

WVP-3DPN-□□ Blow air & coolant plug Recommended tightening torque：30 N･m

mm

Coupler		WVP-3DSN					
	Socket	WVP-3DSN					
	Plug	WVP-3DPN-03T	WVP-3DPN-06T	WVP-3DPN-10T	WVP-3DPN-16T	WVP-3DPN-25T	WVP-3DPN-40T
A		16	17	19	22	26	32
B		6	7	9	12	16	22
H (distance to pallets)		11.5	12.5	14.5	17.5	21.5	27.5
Coupler mass	Socket	70 g					
	Plug	57 g	60 g	67 g	77 g	90 g	111 g

Applicable pallet clamp / locate ring

		WVP-3DPN-03T	WVP-3DPN-06T	WVP-3DPN-10T		WVP-3DPN-16T		WVP-3DPN-25T		WVP-3DPN-40T	
Pallet clamp	CPC-, CPH-	□03H	□06H	□10H	–	□16H	–	□25H	–	□40H	–
Air pallet clamp	CPY-	□02H, □03H	–	–	□04H	–	□06H	–	□10H	–	□06H
Locate ring	CPS-	□03T, D	□06T, D	□10T, D	□03T, D	□16T, D	□06T, D	□25T, D	□10T, D	□40T, D	□06F
Locate ring shim	CPS-	S03T, D	S06T, D	S10T, D	S03T, D	S16T, D	S06T, D	S25T, D	S10T, D	S40T, D	–

mm

Coupler		WVP-3DSN						
	Socket	WVP-3DSN						
	Plug	WVP-3DPN-03F	WVP-3DPN-06F	WVP-3DPN-10F	WVP-3DPN-10A	WVP-3DPN-16F	WVP-3DPN-25F	WVP-3DPN-40F
A		25.5	27	31	38	37	44.5	55.5
B		15.5	17	21	28	27	34.5	45.5
H (distance to pallets)		21	22.5	26.5	33.5	32.5	40	51
Coupler mass	Socket	70 g						
	Plug	89 g	94 g	108 g	132 g	128 g	157 g	197 g

Applicable pallet clamp / locate ring

		WVP-3DPN-03F	WVP-3DPN-06F		WVP-3DPN-10F	WVP-3DPN-10A	WVP-3DPN-16F	WVP-3DPN-25F	WVP-3DPN-40F
Pallet clamp	CPC-, CPH-	□03H	□06H	□03H	□10H	–	□16H	□25H	□40H
Air pallet clamp	CPY-	□02H, □03H	–	□02H, □03H	–	□10H	–	–	–
Locate ring	CPS-	□03F	□06F	□03F	□10F	□10F	□16F	□25F	□40F
Locate ring shim	CPS-	–	–	S03F	–	–	–	–	–

mm

Coupler		WVP-3DSN						
	Socket	WVP-3DSN						
	Plug	WVP-3DPN-03B	WVP-3DPN-06S	WVP-3DPN-06B	WVP-3DPN-10S	WVP-3DPN-16S	WVP-3DPN-25S	WVP-3DPN-40S
A		30	28.5	33.5	33	40	47.5	58.5
B		20	18.5	23.5	23	30	37.5	48.5
H (distance to pallets)		25.5	24	29	28.5	35.5	43	54
Coupler mass	Socket	70 g						
	Plug	104 g	99 g	116 g	114 g	139 g	168 g	208 g

Applicable pallet clamp / locate ring

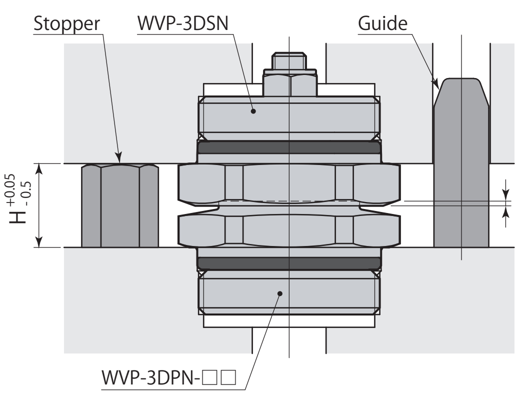
		WVP-3DPN-03B	WVP-3DPN-06S		WVP-3DPN-06B	WVP-3DPN-10S	WVP-3DPN-16S		WVP-3DPN-25S	WVP-3DPN-40S
Pallet clamp	CPC-, CPH-	–	□06H	–	–	□10H	□16H	–	□25H	□40H
Air pallet clamp	CPY-	□04H	–	□04H	□06H	–	–	□10H	–	–
Locate ring	CPS-	□03F	□06F	□03F	□06F	□10F	□16F	□10F	□25F	□40F
Locate ring shim	CPS-	S03F	S06F	–	S06F	S10F	S16F	S10F	S25F	S40F

(grey) indicates made to order.

Caution in use

- The distance between the base and the pallet varies when the pallet clamp is mounted with the shim (model CPC-S, CPH-S, CPY-S). Install the Pal coupler to have the dimension $H^{+0.05}_{-0.5}$ set as shown in the above table when it is connected.
- Former pallet clamp (model CPC-□□F, CPH-□□F) cannot be used in combination with the couplers, as lift stroke is different.
- Ask Pascal in case it is used in combination with Pal coupling model CPM.
- Provide the stopper and the guide as shown in the diagram to protect coupler from damage unless it is used in combination with pallet clamp. Do not use a coupler as a guide or stopper when connecting. It may cause the damage. Install the stopper to have the dimension $H^{+0.05}_{-0.5}$ set as shown in the above table (See diagram on the right). Observe allowable eccentricity and inclination value when installing the guide. (Refer to **page →663** for details on allowable eccentricity and inclination value.)

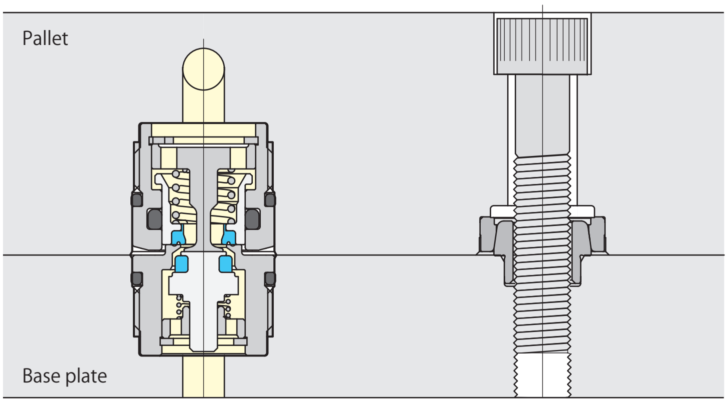
Mounting sample without pallet clamp

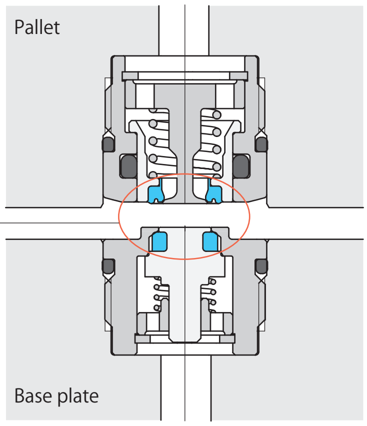


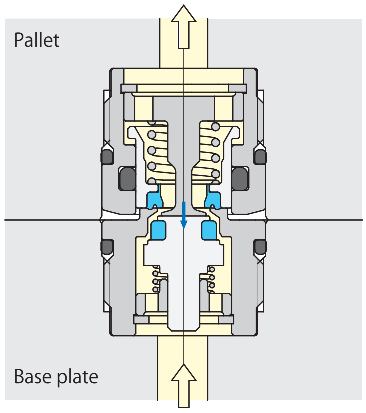
Hydraulic and air coupler with zero hydraulic oil leak with special seal at tip section

Pal coupler socket
Hydraulic pressure 7 MPa & air
model **WVP-2FSL**

Pal coupler plug
Hydraulic pressure 7 MPa & air
model **WVP-2FPL**

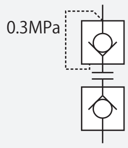






- Special soft seal at tip section enables plug (WVP-2FPL) to be pressurized under disconnected state. Socket (WVP-2FSL) can retain residual pressure of up to 0.3 MPa.
- Special seal installed on the tip of coupler socket and coupler plug can minimize the intrusion of air and spill of working fluid during connection and disconnection, furthermore, it prevents corruption of coolant by being miscible with spilled working fluid and air contamination of clamp circuit.
- Height of coupler is maintained low in order to reduce thickness of pallet.
- This model is designed to use on flat mating faces with no protrusion from mount face.
- The parts in the coupler are corrosion prevented (plating or stainless) and oil and air can be applied as a fluid.

Specifications

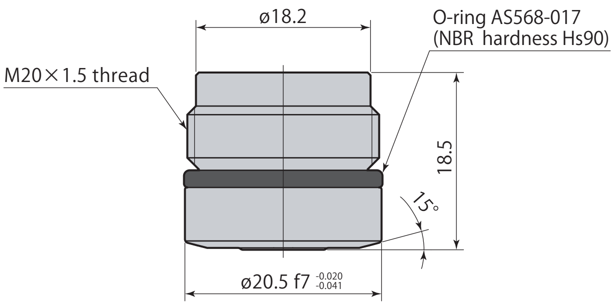
Pressure range	0–7 MPa	Circuit symbol  Hydraulic pressure 7 MPa & air; Connect/disconnect under pressure : Incapable
Proof pressure	10.5 MPa	
Orifice area	10.2 mm²	
Fluid used	General mineral based hydraulic oil (ISO-VG32 equivalent) & air	
Allowable eccentricity	±0.5 mm	
Allowable inclination	0.3° or less	
Reactive force*	113 N per 1 MPa fluid pressure	
	Max. spring force for no pressure 40 N	
Operating temperature	0–70 ℃	
Mass	WVP-2FSL : 31 g WVP-2FPL : 29 g	

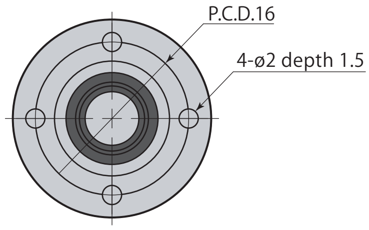
*: Reactive force (N) = Fluid pressure (MPa) ×113+40

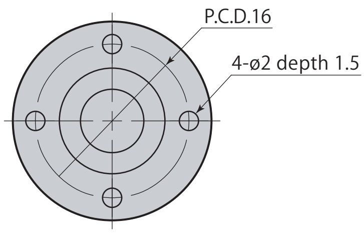
Dimensions

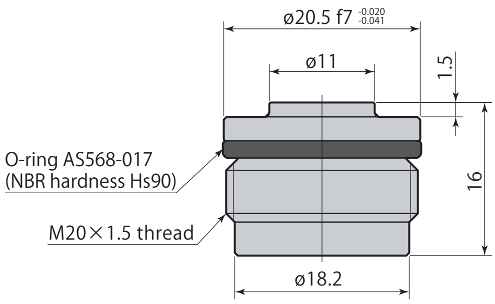
WVP-2FSL

Hydraulic pressure 7 MPa & air socket
Recommended tightening torque：15 N･m







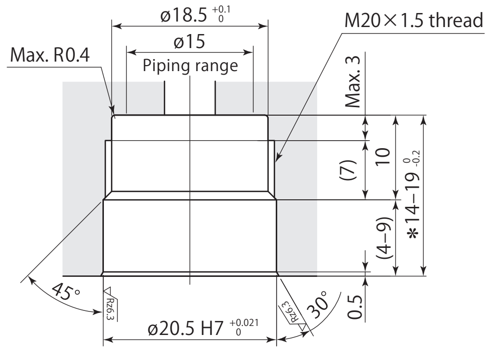


WVP-2FPL

Hydraulic pressure 7 MPa & air plug
Recommended tightening torque：15 N･m

Mounting details

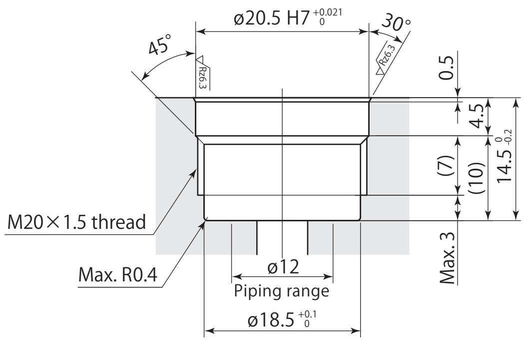
WVP-2FSL



*：When using Pal fix as a set, be sure to set depth to $19^{\ 0}_{-0.2}$.
Refer to **pages →648–659** for details on Pal fix.

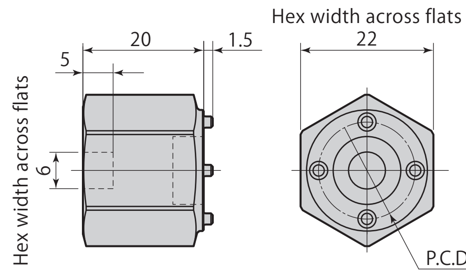
Mounting details

WVP-2FPL



Rz: ISO4287(1997)

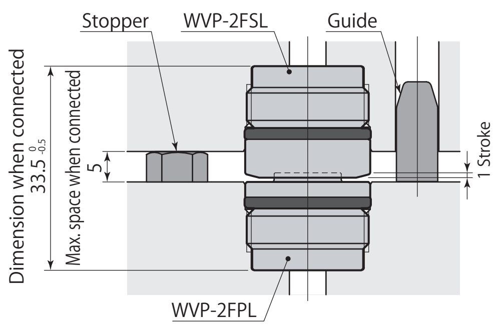
Mounting tool (option) model **WVP-2FJ**



Caution in use

- Stop supplying fluid during disconnection and connection operations. Disconnecting or connecting coupler while fluid is flowing results in the leakage.
- Coupler has no built in filter. Ensure that foreign substances on connecting surfaces are removed by blowing air before connecting to prevent intrusion of foreign substances into piping.
- Make sure air bleeding in the hydraulic circuit is perfectly done when installation.
- Provide the stopper and the guide as shown in the diagram to protect coupler from damage unless it is used in combination with Pal fix. Do not use a coupler as a guide or stopper when connecting. It may cause the damage. Install the stopper to have the dimension $33.5^{\ 0}_{-0.5}$ (See diagram on the right). Observe allowable eccentricity and inclination value when installing the guide. (Refer to **page →668** for details on allowable eccentricity and inclination value.)

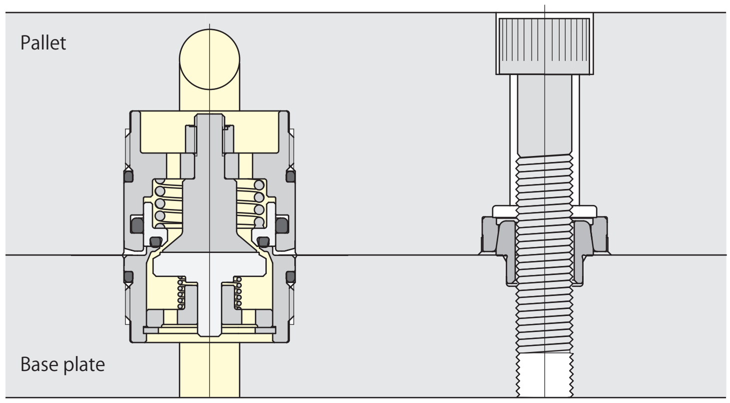
Mounting sample without Pal fix



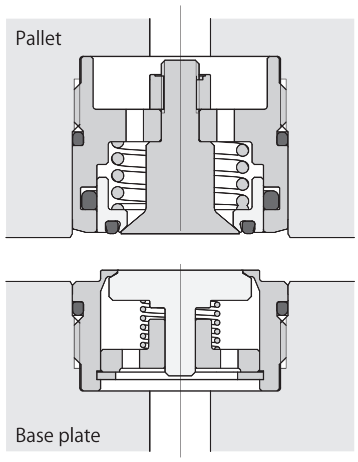
Air & coolant coupler with large orifice area and capability to accommodate large flow rates.

Pal coupler socket
Blow air & coolant
model **WVP-3GSN**

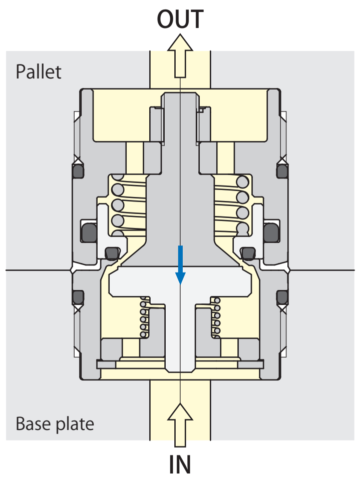
Pal coupler plug
Blow air & coolant
model **WVP-3GPN**



Disconnected



Connected



- Large orifice area allows to supply large volume of coolant or blow air.
- Height of coupler is maintained low in order to reduce thickness of pallet.
- This model is designed to use on flat mating faces with no protrusion from mount face.

Specifications

Pressure range	0–1 MPa	Circuit symbol  Air & coolant; Connect/disconnect under pressure : Incapable
Proof pressure	1.5 MPa	
Orifice area	29.0 mm²	
Fluid used	Air & coolant	
Allowable eccentricity	±0.5 mm	
Allowable inclination	0.3° or less	
Reactive force*	380 N per 1 MPa fluid pressure	
	Max. spring force for no pressure 60 N	
Operating temperature	0–70 ℃	
Mass	WVP-3GSN：77 g　WVP-3GPN：48 g	

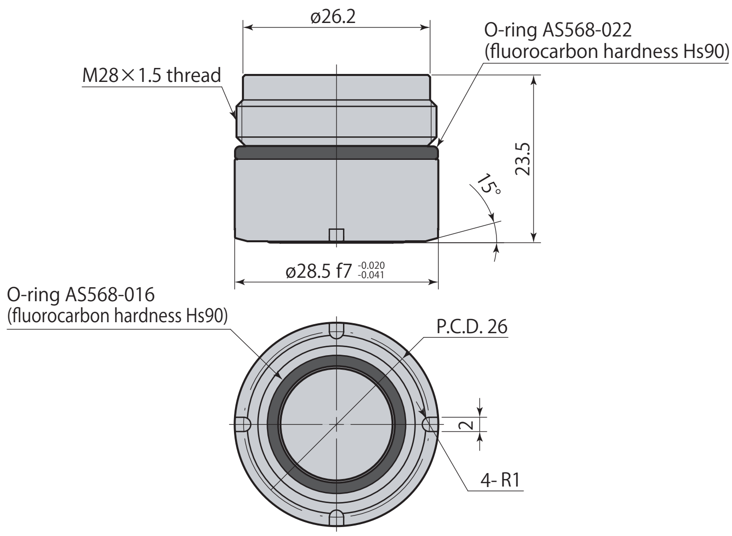
＊:Reactive force (N) = Fluid pressure (MPa) ×380+60

Dimensions

WVP-3GSN

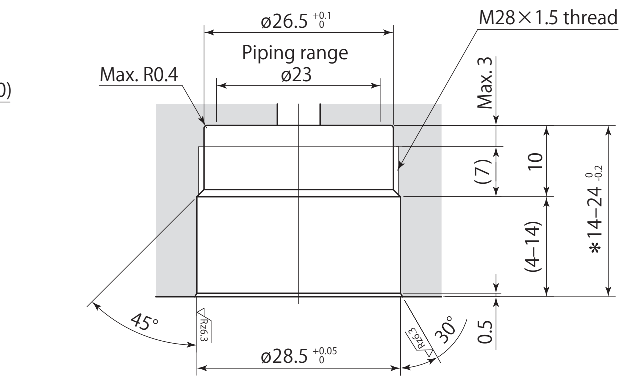
Blow air & coolant socket

Recommended tightening torque：30 N･m



Mounting details

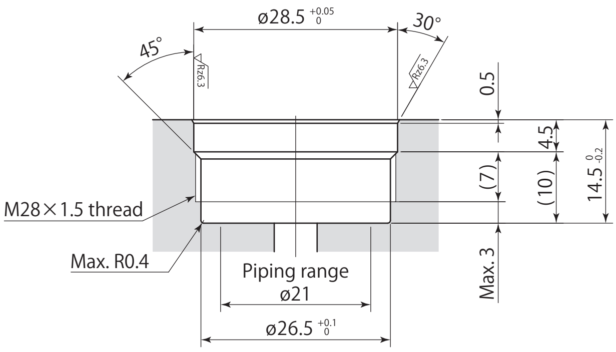
WVP-3GSN



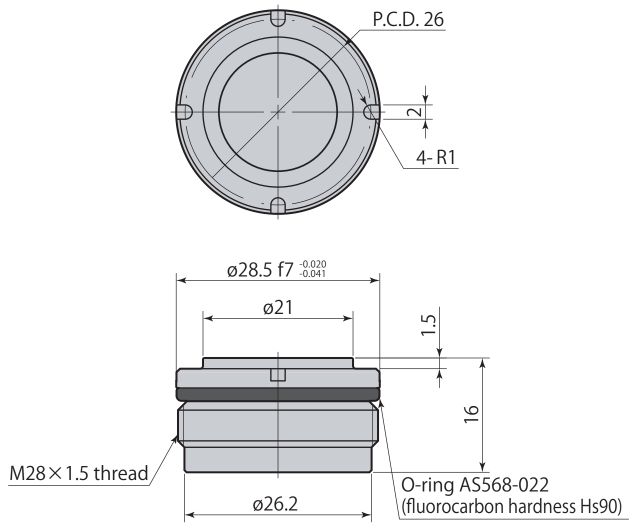
＊:When using Pal fix as a set, be sure to set depth to $24^{\ 0}_{-0.2}$.
Refer to **pages →648–659** for details on Pal fix.

Mounting details

WVP-3GPN



Rz: ISO4287(1997)

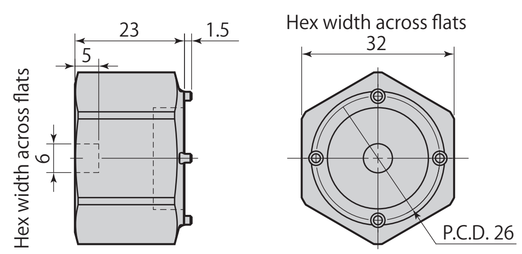


WVP-3GPN

Blow air & coolant plug

Recommended tightening torque：30 N･m

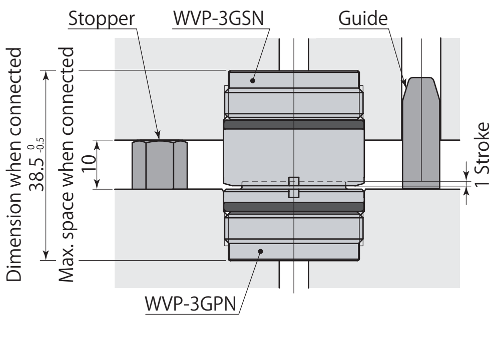
Mounting tool (option) model **WVP-3GJ**



Caution in use

- Fluid leaks from the tip of coupler when supplying it under disconnected state.
- Stop supplying fluid during disconnection and connection operations. Disconnecting or connecting coupler while fluid is flowing results in the leakage.
- Coupler has no built in filter. Ensure that foreign substances on connecting surfaces are removed by blowing air before connecting to prevent intrusion of foreign substances into piping.
- Provide the stopper and the guide as shown in the diagram to protect coupler from damage unless it is used in combination with Pal fix. Do not use a coupler as a guide or stopper when connecting. It may cause the damage. Install the stopper to have the dimension $38.5^{\ 0}_{-0.5}$ (See diagram on the right). Observe allowable eccentricity and inclination value when installing the guide. (Refer to **page →670** for details on allowable eccentricity and inclination value.)

Mounting sample without Pal fix



Downsized air coupler but maintaining same flow rate with existing models.

Pal coupler socket

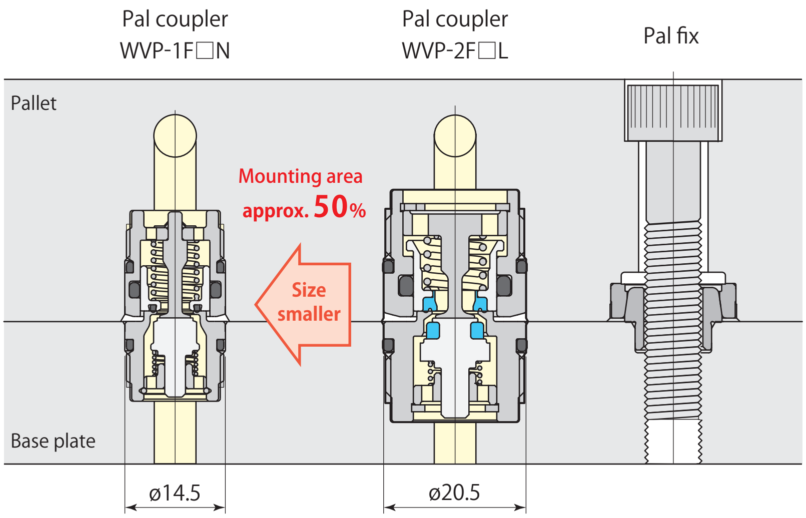
Air

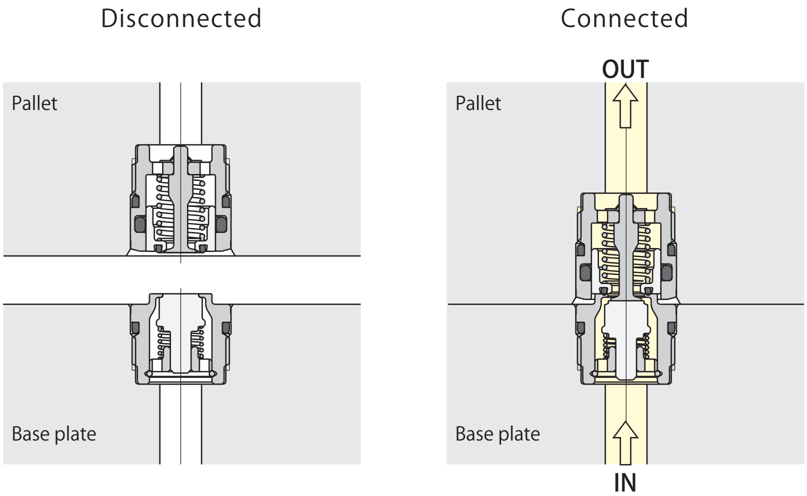
model **WVP-1FSN**

Pal coupler plug

Air

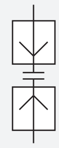
model **WVP-1FPN**





- This model is designed to use on flat mating faces with no protrusion from mount face.
- The parts in the coupler are corrosion prevented (stainless).

Specifications

Pressure range	0–1 MPa	Circuit symbol  Air; Connect/disconnect under pressure : Incapable
Proof pressure	1.5 MPa	
Orifice area	8 mm²	
Fluid used	Air	
Allowable eccentricity	±0.4 mm	
Allowable inclination	0.3° or less	
Reactive force*	79 N per 1 MPa fluid pressure	
	Max. spring force for no pressure 24 N	
Operating temperature	0–70 ℃	
Mass	WVP-1FSN：12.5 g WVP-1FPN：10.5 g	

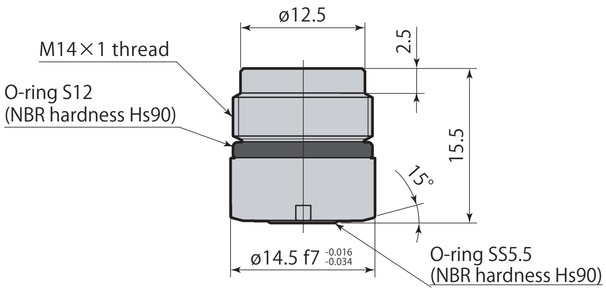
*：Reactive force (N) = Fluid pressure (MPa) ×79+24

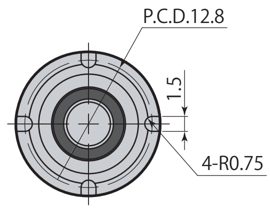
Dimensions

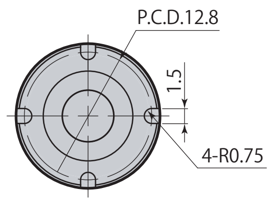
WVP-1FSN

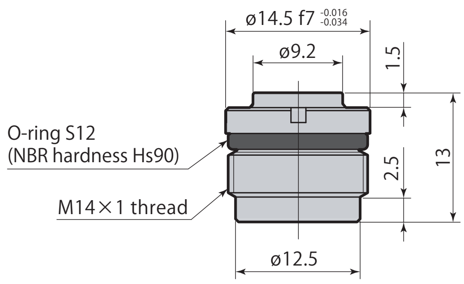
Air socket

Recommended tightening torque：5 N・m









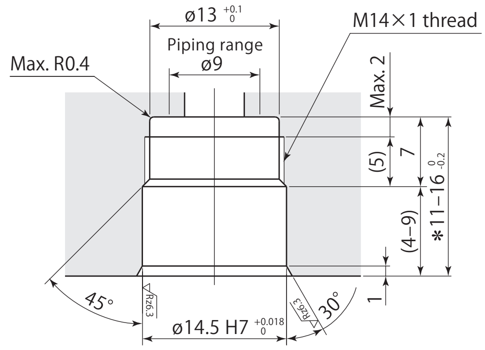
WVP-1FPN

Air plug

Recommended tightening torque：5 N・m

Mounting details

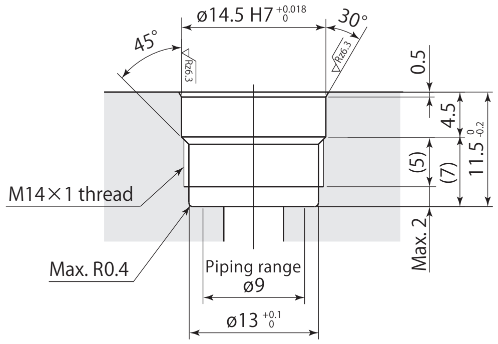
WVP-1FSN



∗：When using Pal fix as a set, be sure to set depth to $16^{0}_{-0.2}$.
Refer to **pages →648–659** for details on Pal fix.

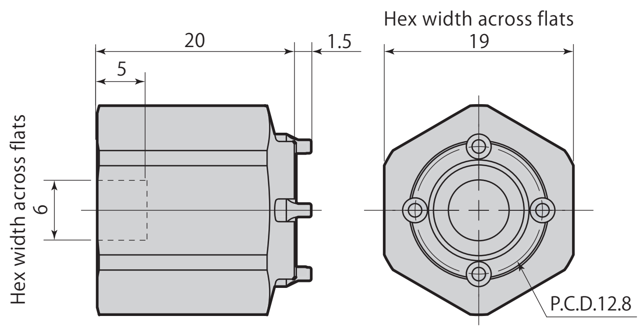
Mounting details

WVP-1FPN



Rz: ISO4287(1997)

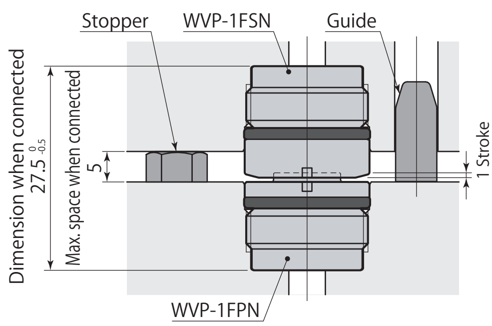
Mounting tool (option) model **WVP-1FJ**



Caution in use

- Stop supplying fluid during disconnection and connection operations. Disconnecting or connecting coupler while fluid is flowing results in the leakage.
- Coupler has no built in filter. Ensure that foreign substances on connecting surfaces are removed by blowing air before connecting to prevent intrusion of foreign substances into piping.
- Provide the stopper and the guide as shown in the diagram to protect coupler from damage unless it is used in combination with Pal fix. Do not use a coupler as a guide or stopper when connecting. It may cause the damage. Install the stopper to have the dimension $27.5^{0}_{-0.5}$ (See diagram on the right). Observe allowable eccentricity and inclination value when installing the guide. (Refer to **page →672** for details on allowable eccentricity and inclination value.)

Mounting sample without Pal fix



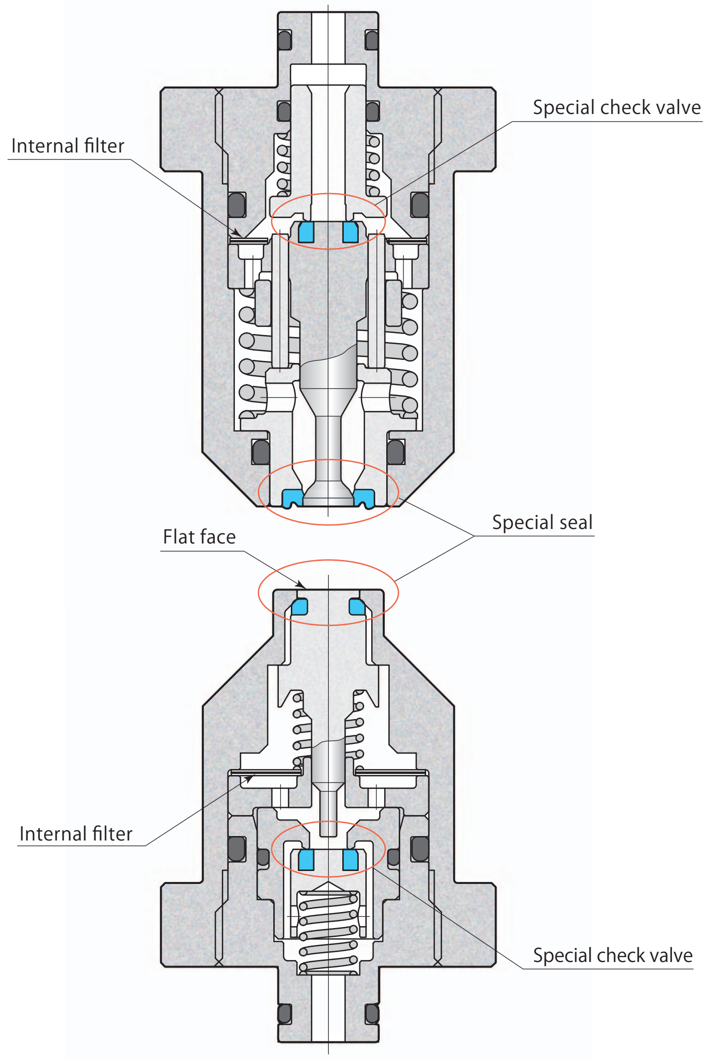
Special seal mechanism ensures leak of operating oil is zero for connecting and disconnecting

7 MPa Non-leak coupler socket

model **WVP-2HSL**

7 MPa Non-leak coupler plug

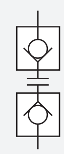
model **WVP-2HPL**



Spill amount (liquid drip amount per connection or disconnection) 0.01 mL or less

- Special seal installed on the tip of coupler socket and coupler plug can minimize the intrusion of air and spill of working fluid during connection and disconnection, furthermore, it prevents corruption of coolant by being miscible with spilled working fluid and air contamination of clamp circuit.
- Model WVP-2H incorporates filter and protects internal check valves and clamps from foreign substances.
- Connection and disconnection, which had been difficult to perform with conventional couplers while hydraulic pressure is applied, can be performed smoothly.
- Pressure in the circuit is retained for a long time after disconnection of coupler.

Specifications

Pressure range	1–7 MPa	Circuit symbol  Plug hydraulic pressure source 7MPa; Connect/disconnect under pressure : Capable
Proof pressure	10.5 MPa	
Orifice area	12.5 mm²	
Fluid used	General mineral based hydraulic oil (ISO-VG32 equivalent)	
Allowable eccentricity	±0.4 mm	
Allowable inclination	0.2° or less	
Reactive force*	154 N per 1 MPa fluid pressure	
	Max. spring force for no pressure 157 N	
Operating temperature	0–70 ℃	
Mass	WVP-2HSL : 270 g	WVP-2HPL, 2HDL : 230 g

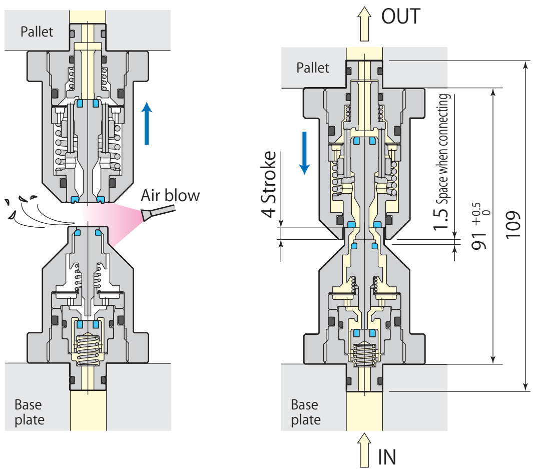
∗:Reactive force (N) = Fluid pressure (MPa) ×154+157

- Supply operating oil from plug.
- Mixed use with model WVP-2S□L is not possible.

Non-leak coupler fixed

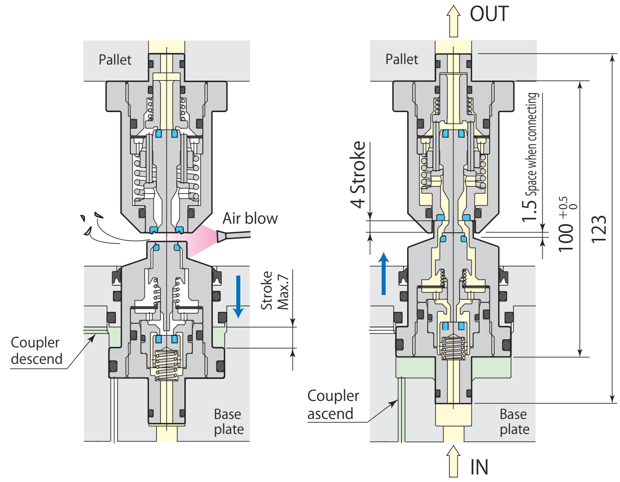
Coupler lower section hydraulic pressure supply

Disconnected / Connected



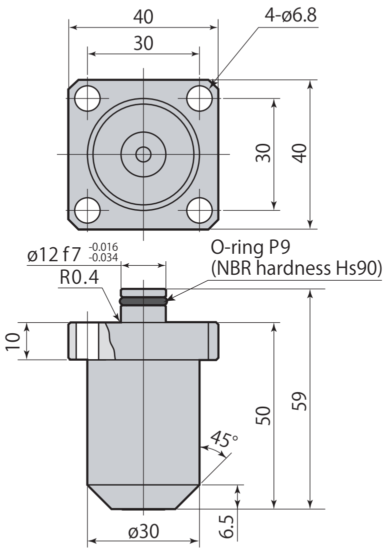
Non-leak coupler float

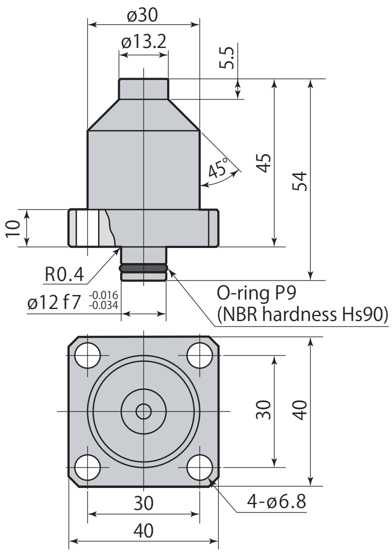
Disconnected / Connected



Dimensions

WVP-2HSL socket (fixed)

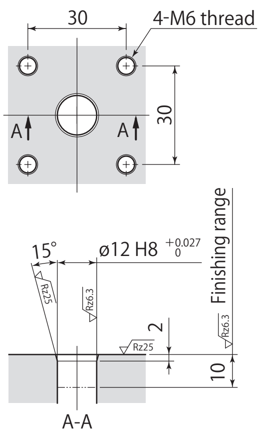




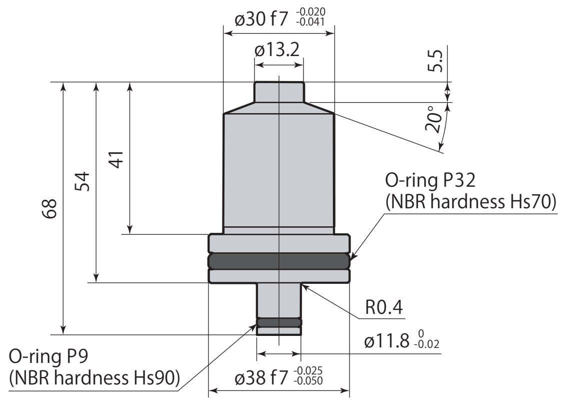
WVP-2HPL plug (fixed)

Mounting details

WVP-2HSL
WVP-2HPL

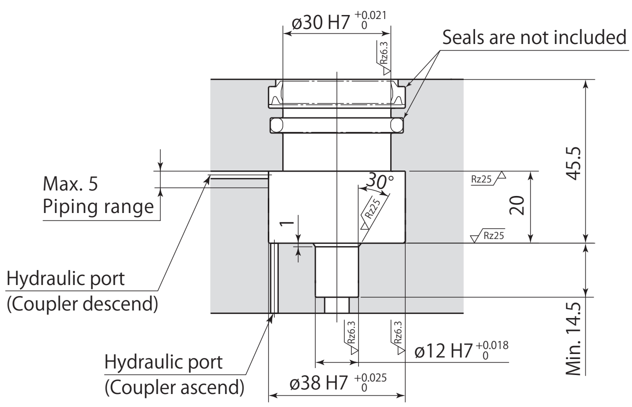


WVP-2HDL plug (floating)



Mounting details

WVP-2HDL

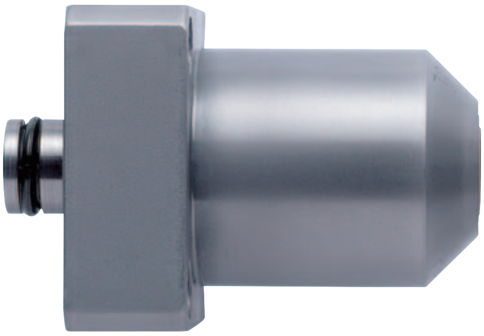


● Mounting screws are not included.

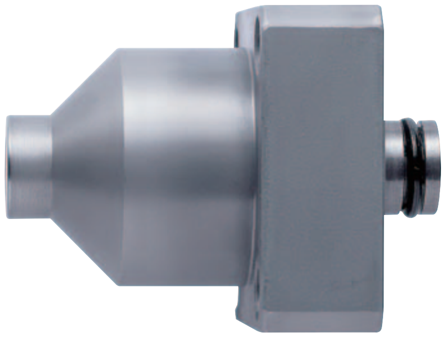
Rz: ISO4287(1997)

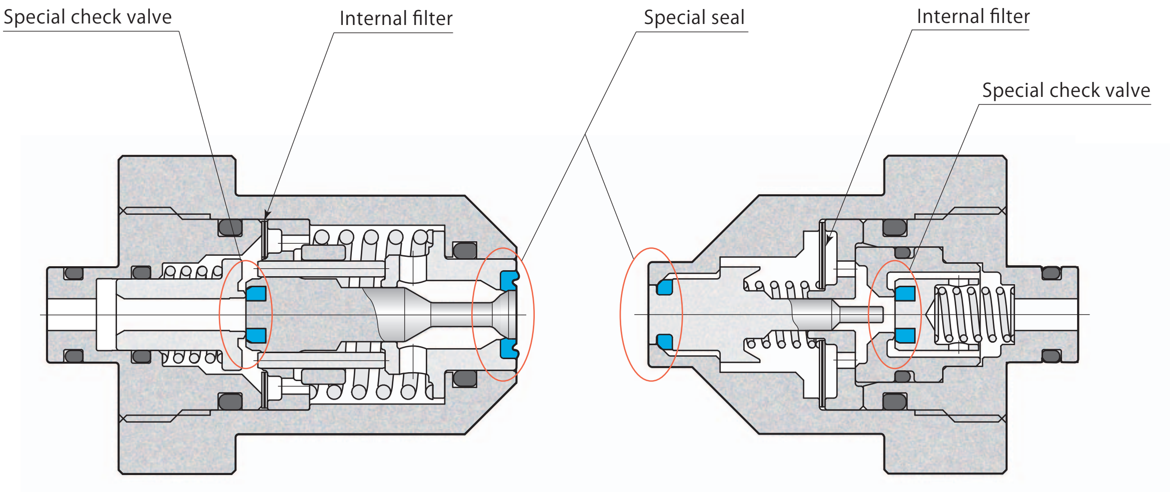
Special seal mechanism ensures leak of operating oil is zero for connecting and disconnecting

7 MPa Non-leak coupler socket
model **WVP-2SSL**



7 MPa Non-leak coupler plug
model **WVP-2SPL**

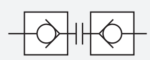




Spill amount (liquid drip amount per connection or disconnection) 0.01 mL or less

Specifications

- Special seal installed on the tip of coupler socket and coupler plug can minimize the intrusion of air and spill of working fluid during connection and disconnection, furthermore, it prevents corruption of coolant by being miscible with spilled working fluid and air contamination of clamp circuit.
- Model WVP-2S incorporates filter and protects internal check valves and clamps from foreign substances.
- Connection and disconnection, which had been difficult to perform with conventional couplers while hydraulic pressure is applied, can be performed smoothly.
- Pressure in the circuit is retained for a long time after disconnection of coupler.
- Jig pallet fabrication cost is kept low by using an economically priced plug for coupler of pallet.

Pressure range	1–7 MPa	Circuit symbol  Socket hydraulic pressure source 7MPa Connect/disconnect under pressure: Capable
Proof pressure	10.5 MPa	
Orifice area	12.5 mm²	
Fluid used	General mineral based hydraulic oil (ISO-VG32 equivalent)	
Allowable eccentricity	±0.4 mm	
Allowable inclination	0.2° or less	
Reactive force*	154 N per 1 MPa fluid pressure	
	Max. spring force for no pressure 162 N	
Operating temperature	0–70 ℃	
Mass	WVP-2SSL : 300 g WVP-2SPL : 260 g	

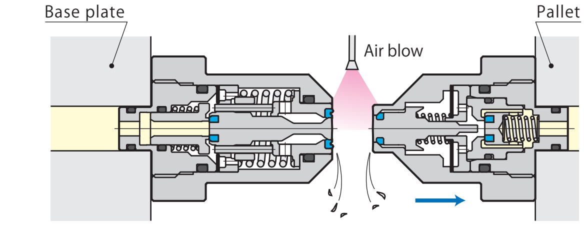
*: Reactive force (N) = Fluid pressure (MPa) ×154+162

- Supply operating oil from socket.
- Mixed use with model WVP-2H□L is not possible.

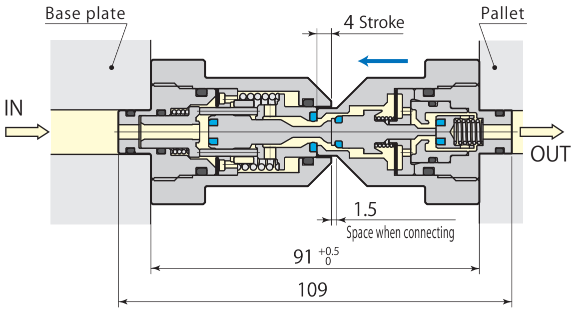
Non-leak coupler fixed

Horizontal mounting of coupler

Disconnected



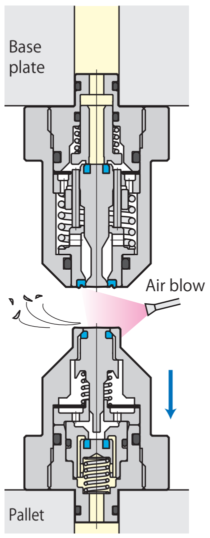
Connected



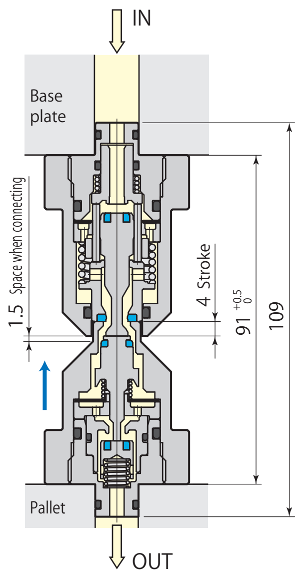
Non-leak coupler fixed

Coupler upper section hydraulic pressure supply

Disconnected



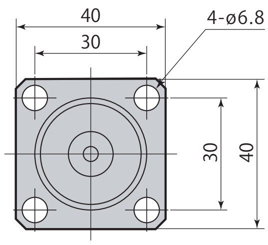
Connected

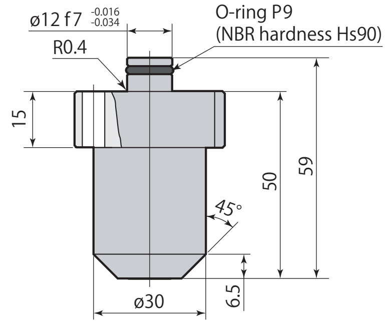


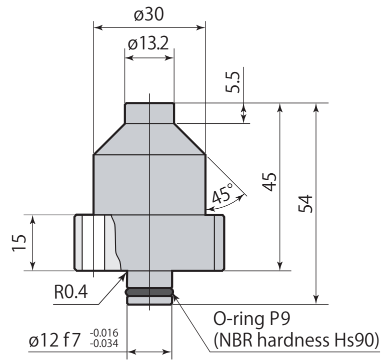
● Perform installation with plug below so metal chips are less likely to adhere and air blowing can be performed properly.

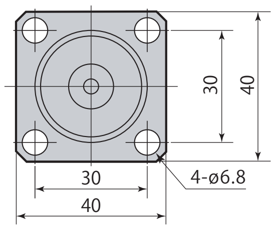
Dimensions

WVP-2SSL socket (fixed)







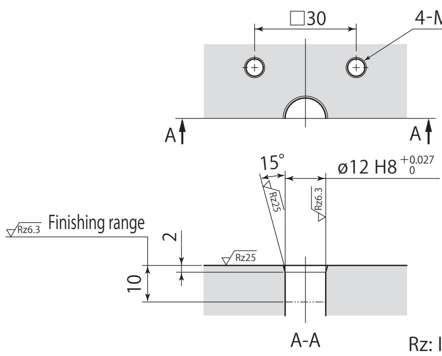


WVP-2SPL plug (fixed)

● Mounting screws are not included.

Mounting details

WVP-2SSL, WVP-2SPL

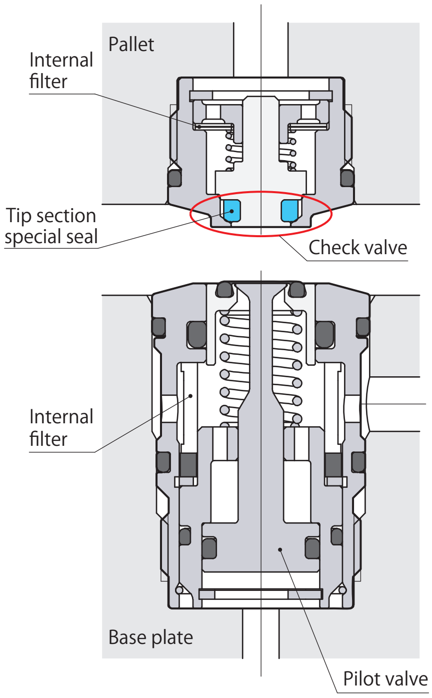


Rz: ISO4287(1997)

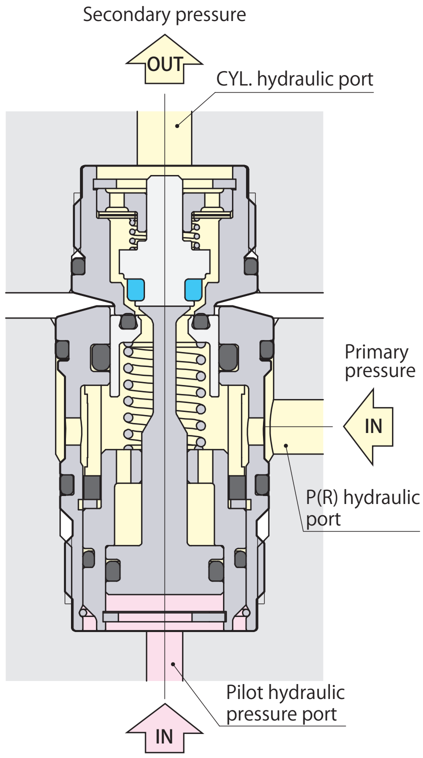
Compact coupler that has less reactive force when connecting by means of a pilot check valve

7 MPa Pilot coupler plug
model **WVP-2EPL**

7 MPa Pilot coupler socket
model **WVP-2ESL**

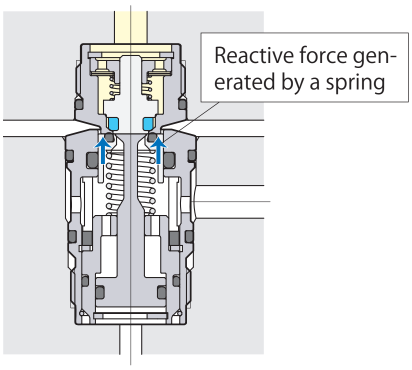


Disconnected



Connected
(Pressure)

- A pilot check mechanism enables the reactive force when connecting to lower.

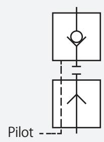


- Unique seal on the tip of coupler ensures a long-term retaining the circuit pressure even after disconnection.
- Filter is fitted inside coupler to prevent intrusion of metal chips and debris into hydraulic circuit.

Specifications

Pressure range	1–7 MPa
Proof pressure	10.5 MPa
Orifice area	10.2 mm²
Fluid used	General mineral based hydraulic oil (ISO-VG32 equivalent)
Allowable eccentricity	±0.5 mm
Allowable inclination	0.3° or less
Reactive force	Spring force when connected 28 N
	Reactive force when pressurized 113 × P*1＋ 36 N
Pilot pressure	0.4 × P*2＋ 0.1 MPa or more
Operating temperature	0–70 ℃
Mass	WVP-2EPL：29 g　WVP-2ESL：82 g

Circuit symbol



OIL　7MPa
Secondary pressure retainable

∗1：P = Primary side hydraulic pressure (MPa)
∗2：P = Secondary side hydraulic pressure (MPa)

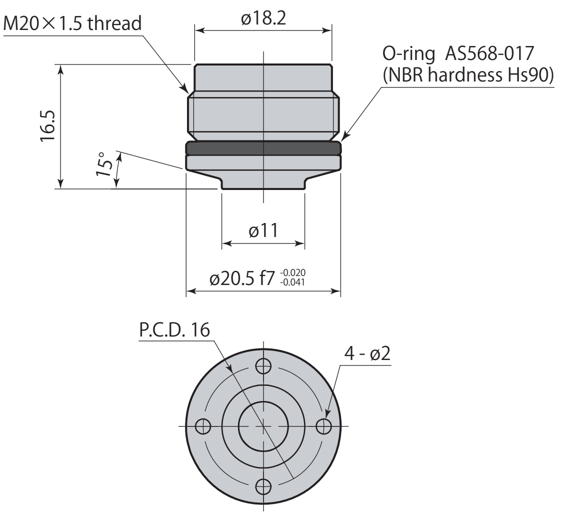
Pilot coupler

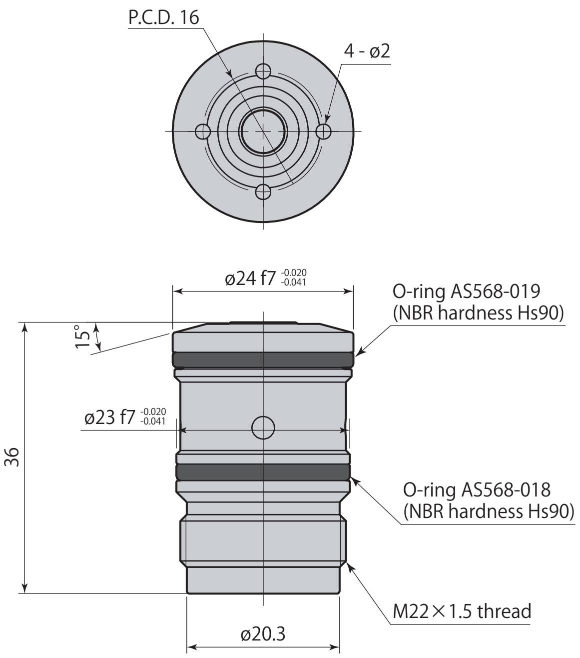
WVP Oil

Dimensions

WVP-2EPL

Hydraulic pressure 7MPa plug
Recommended tightening torque：15 N･m



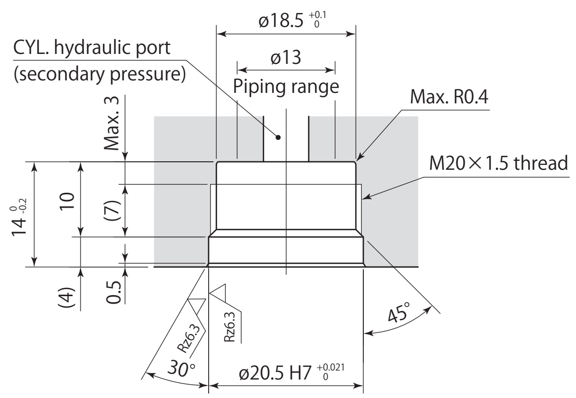


WVP-2ESL

Hydraulic pressure 7MPa socket
Recommended tightening torque：15 N･m

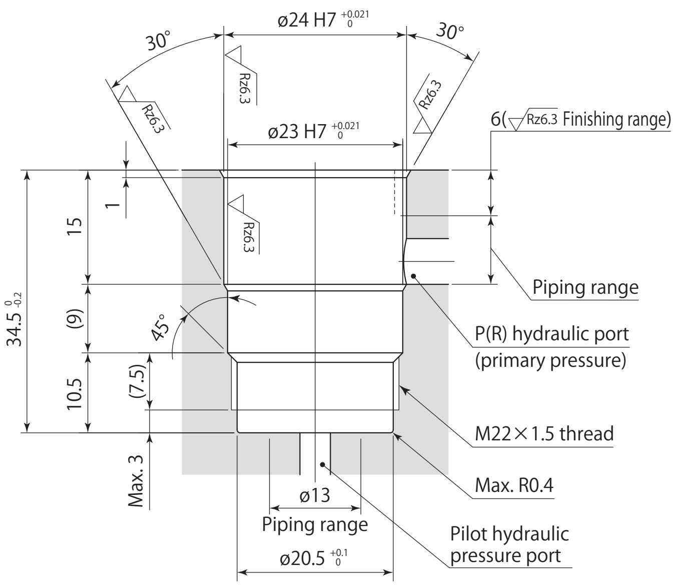
Mounting details

WVP-2EPL



Mounting details

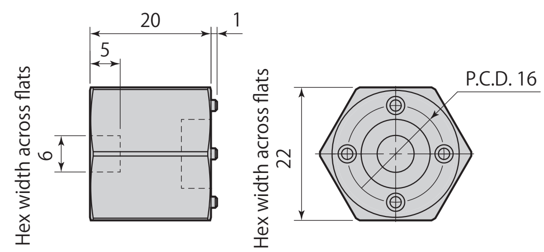
WVP-2ESL



Rz: ISO4287(1997)

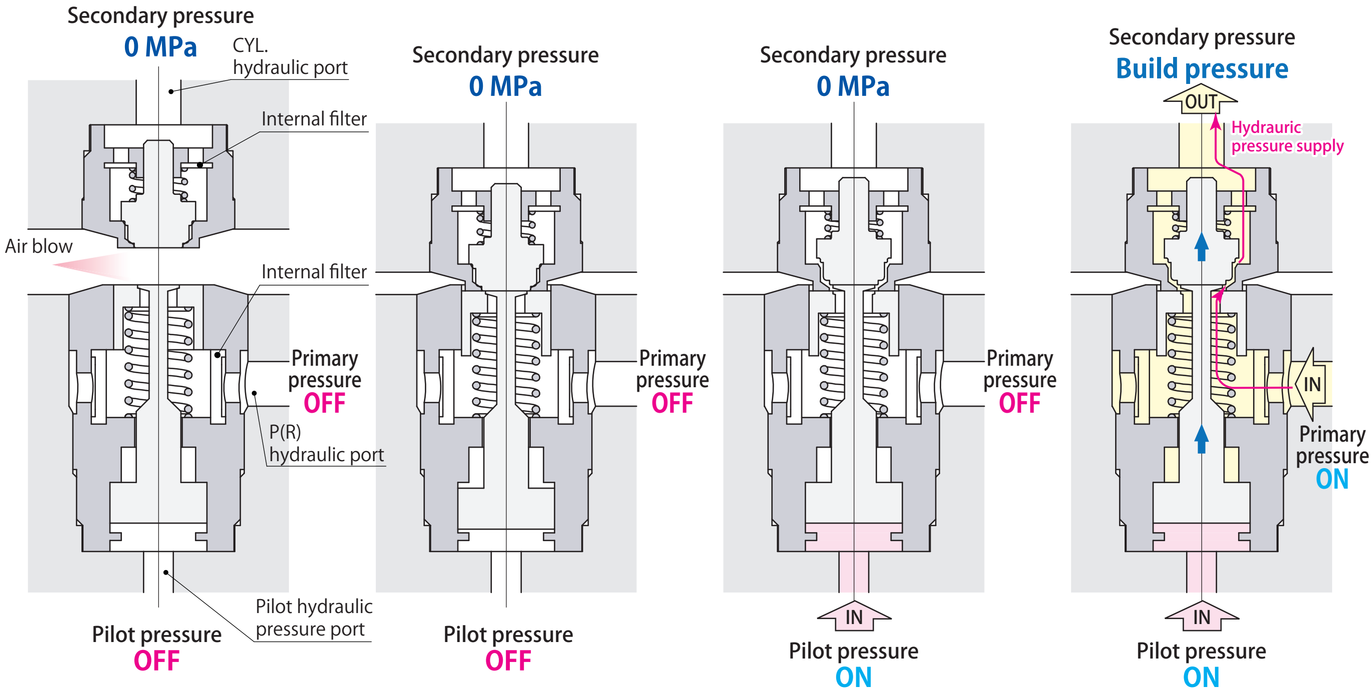
- Do not supply pressure to P port (primary) and pilot port under disconnected state or during connecting and disconnecting action.
- No check valve provided in a socket. Do not supply pressure when coupler disconnected state.
- Make sure air bleeding in the hydraulic circuit is perfectly done when installation.
- Reactive force generates when primary pressure is supplied. Locking device which exerts bigger force than reactive force should be mounted after couplers are connected.

Mounting tool (option) model **WVP-2EJ**



Clamp pressure holding action

①Disconnected state ②Connecting ③Build pressure-1 ④Build pressure-2



Do not supply primary and pilot pressure when coupler disconnected state.

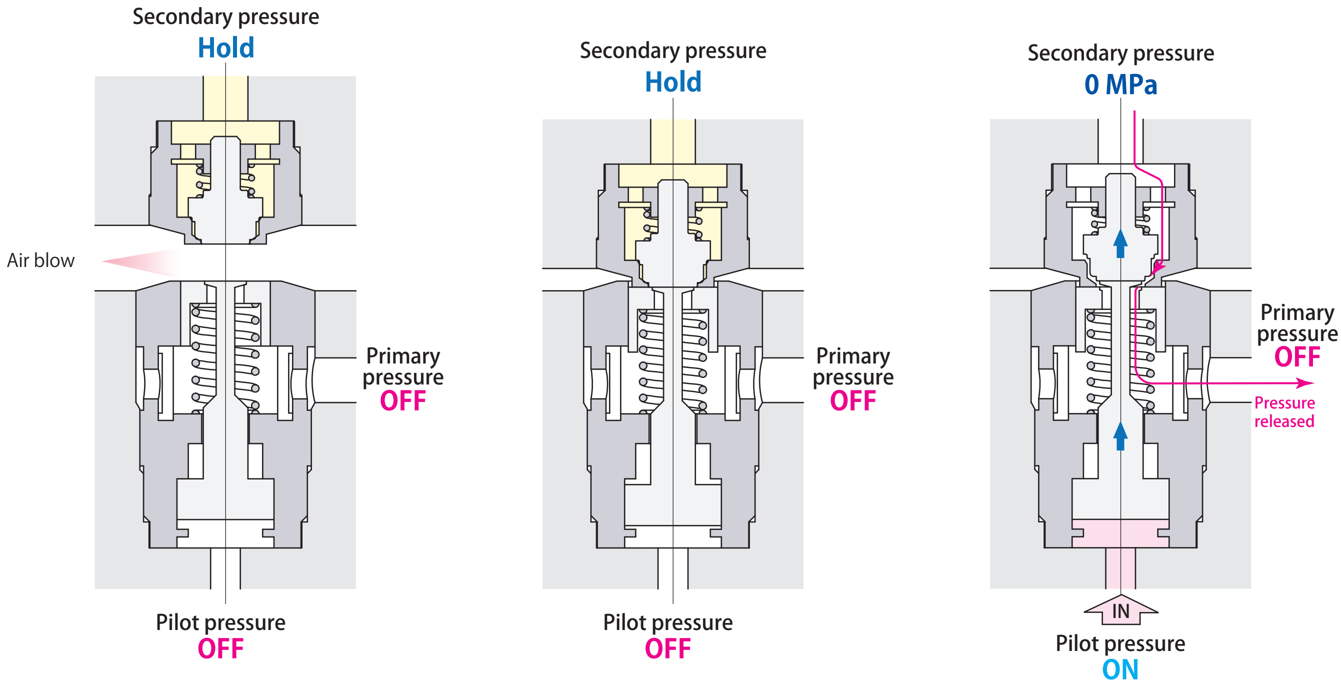
Connect the couplers.

Supply pilot pressure to open the check valve.

Supply primary pressure after pilot pressure is supplied.

Clamp pressure release action

①Disconnected state ②Connecting ③Clamp pressure release action-1



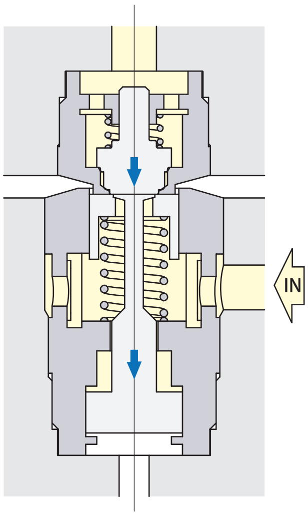
Do not supply primary and pilot pressure when coupler disconnected state.

Connect the couplers.

Supply pilot pressure after connection and release the clamp pressure.

⑤Pressure holding action-1

Secondary pressure
Hold



IN

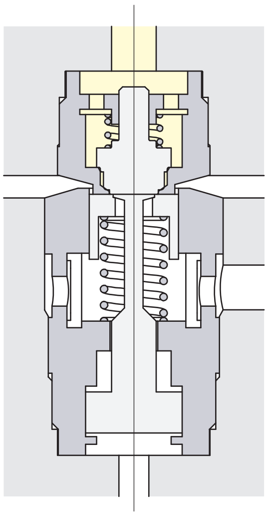
Primary pressure
ON

Pilot pressure
OFF

Stop supplying pilot pressure after secondary pressure is built up.

⑥Pressure holding action-2

Secondary pressure
Hold



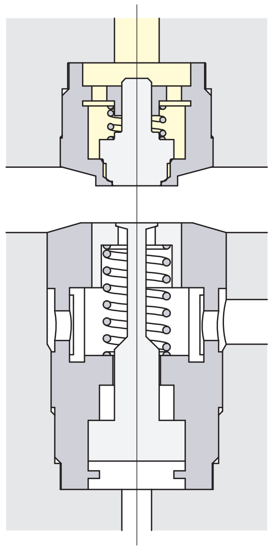
Primary pressure
OFF

Pilot pressure
OFF

Stop supplying primary pressure after pilot pressure is supplied.

⑦Coupler disconnecting action

Secondary pressure
Hold



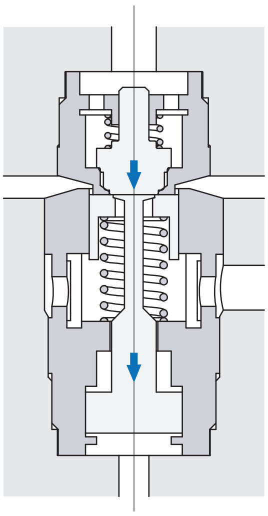
Primary pressure
OFF

Pilot pressure
OFF

Clamp pressure is kept even after coupler is disconnected.

④Clamp pressure release action-2

Secondary pressure
0 MPa



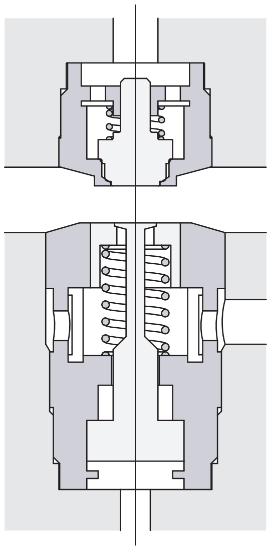
Primary pressure
OFF

Pilot pressure
OFF

Stop supplying pilot pressure after clamp pressure is released.

⑤Coupler disconnecting action

Secondary pressure
0 MPa



Primary pressure
OFF

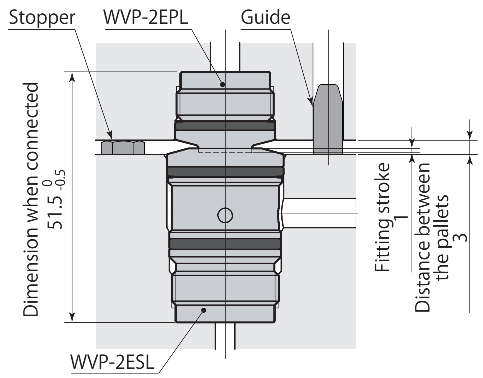
Pilot pressure
OFF

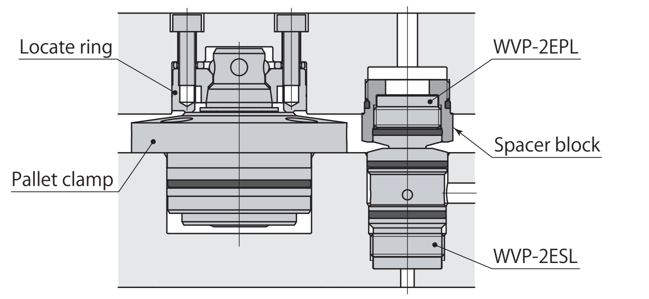
Disconnect couplers.

Caution in use

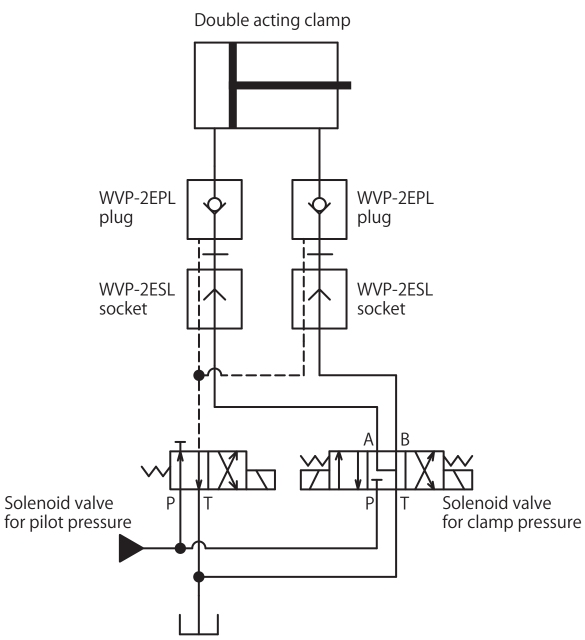
- Install the stopper to have the dimension $51.5^{\ 0}_{-0.5}$(See diagram on the below).
  Observe allowable eccentricity and inclination value when installing the guide (Refer to **page →678**).

- Prepare a spacer block (by customer) separately when coupler is used with a pallet clamp.



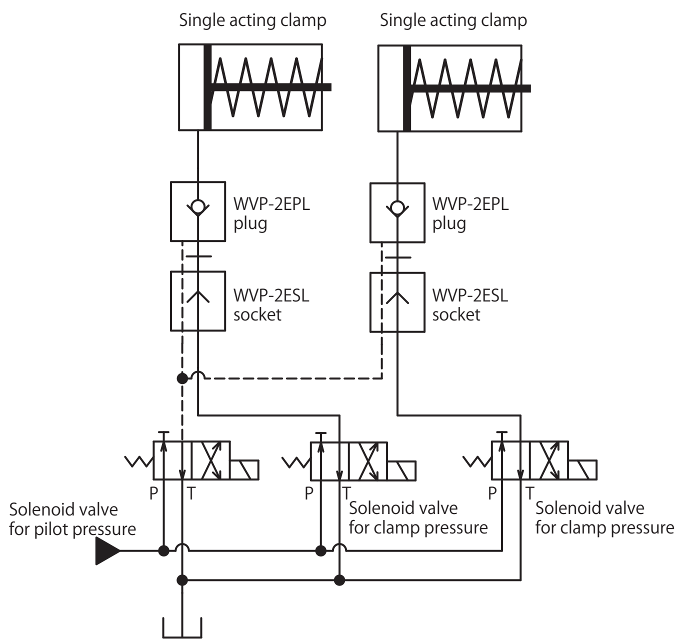


Hydraulic circuit diagram for double acting clamp



- 3 position, center tank-port solenoid valve should be used for clamp pressure circuit to avoid back pressure. A solenoid valve which switches to Tank port connection except supplying pressure to the circuit should be used.

Hydraulic circuit diagram for single acting clamp



- A solenoid valve which switches to Tank port connection except supplying pressure to the circuit should be used to avoid back pressure.

Caution in use

- Perform complete air bleeding of the circuit when using couplers under pressure type. Insufficient air bleeding may cause the oil spill when connecting or circuit pressure drop.
- Do not connect the couplers with metal chips or coolant on the tip of it. Perform air blow to clean it off if there is a risk of adherence.
- Provide complete flushing to the oil pass of the manifold block to avoid contamination of the burrs or debris in the circuit. Failure of this instruction may cause damage of seals and result in the oil leakage because all models of coupler does not have preventive filters to protect contamination from oil supply side.
- Set coupling force to be same or more than reactive force of each model. Reactive force remains active until coupler has been totally disconnected.
- Provide the guide pin separately because coupler does not contain a guide or stopper block.
- Do not mount the couplers on the place where coolant oil builds up.

Reactive force calculation example

Piping specification

Hydraulic pressure	Two double acting clamp circuits (5 MPa each) Coupler models : WVP-2BPH×2, WVP-2BSH×2
Air	One seating detection circuit (0.3 MPa) Coupler models : WVP-3DPN, WVP-3DSN

Reactive force against clamping

Clamping circuit

Spring force 40 (N) + Hydraulic pressure 5 (MPa) ×113 = 605 (N)

Unclamping circuit

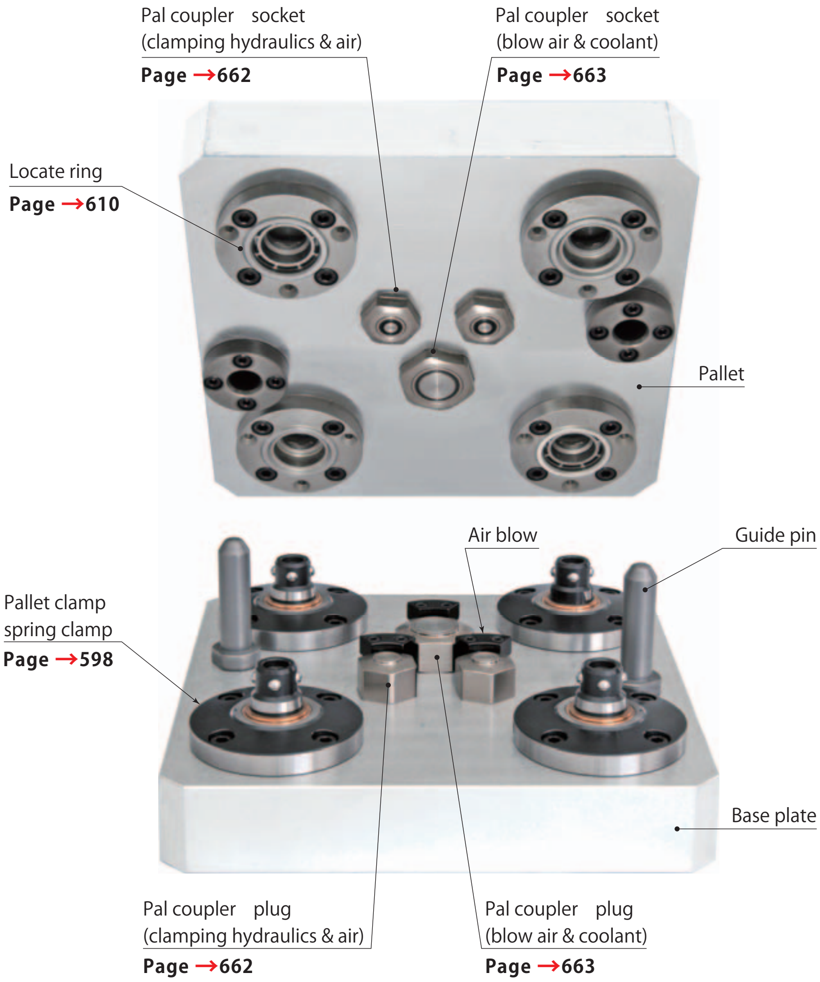
Spring force 40 (N)

Air circuit

Spring force 60 (N) + Air pressure 0.3 (MPa) ×380 = 174 (N)

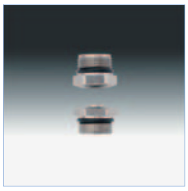
Total reactive force

Hydraulic coupler 605 (N) + 40 (N) + Air coupler 174 (N) = 819 (N)



Standard Pal system configuration example

25MPa Pal coupler



Fluid used: Oil, air
Orifice: 10.2 mm²
Built in filter: Not included
Connect/disconnect under pressure: Incapable

Socket model **WVP-2BSH**
Plug model **WVP-2BPH**

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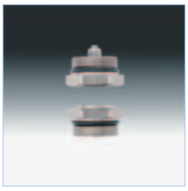
1MPa Pal coupler

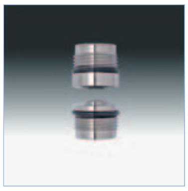


Fluid used: Air, coolant
Orifice: 29.0 mm²
Built in filter: Not included
Connect/disconnect under pressure: Incapable

Socket model **WVP-3DSN**
Plug model **WVP-3DPN**

Page →663

7MPa Pal coupler

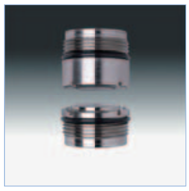


Fluid used: Oil, air
Orifice: 10.2 mm²
Built in filter: Not included
Connect/disconnect under pressure: Incapable

Socket model **WVP-2FSL**
Plug model **WVP-2FPL**

Page →668

1MPa Pal coupler



Fluid used: Air, coolant
Orifice: 29.0 mm²
Built in filter: Not included
Connect/disconnect under pressure: Incapable

Socket model **WVP-3GSN**
Plug model **WVP-3GPN**

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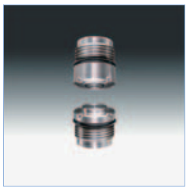
1MPa Pal coupler



Fluid used: Air
Orifice: 8 mm²
Built in filter: Not included
Connect/disconnect under pressure: Incapable

Socket model **WVP-1FSN**
Plug model **WVP-1FPN**

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7MPa Non-leak coupler

Plug hydraulic pressure source

Fluid used: Oil
Orifice: 12.5 mm²
Built in filter: Included
Connect/disconnect under pressure: Capable

Socket (fixed) model **WVP-2HSL**
Plug (fixed) model **WVP-2HPL**
Plug (floating) model **WVP-2HDL**

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7MPa Non-leak coupler

Socket hydraulic pressure source

Fluid used: Oil
Orifice: 12.5 mm²
Built in filter: Included
Connect/disconnect under pressure: Capable

Socket model **WVP-2SSL**
Plug model **WVP-2SPL**

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7MPa Pilot coupler

Fluid used: Oil
Orifice: 10.2 mm²
Built in filter: Included
Connect/disconnect under pressure: Incapable*

*: Secondary pressure retainable

Socket model **WVP-2ESL**
Plug model **WVP-2EPL**

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35MPa Non-leak coupler

Plug hydraulic pressure source

Fluid used: Oil
Orifice: 12.5 mm²
Built in filter: Included
Connect/disconnect under pressure: Capable

Socket (fixed) model **WVP-2HSH**
Plug (fixed) model **WVP-2HPH**
Plug (floating) model **WVP-2HDH**

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35MPa Non-leak coupler

Socket hydraulic pressure source

Fluid used: Oil
Orifice: 12.5 mm²
Built in filter: Included
Connect/disconnect under pressure: Capable

Socket model **WVP-2SSH**
Plug model **WVP-2SPH**

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1MPa Air coupler

Fluid used: Air
Orifice: 16.7 mm²
Built in filter: Included
Connect/disconnect under pressure: Incapable

Socket model **WVP-2WSN**
Plug model **WVP-2WPN**

Request a catalog seperately.

1MPa Coolant coupler

Fluid used: Coolant
Orifice: 54.5 mm²
Built in filter: Not included
Connect/disconnect under pressure: Incapable

Socket model **WVP-4KSN**
Plug model **WVP-4KPN**

Request a catalog seperately.

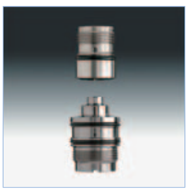
7MPa Compact coupler

Fluid used: Oil, air
Orifice: 12.5 mm²
Built in filter: Included
Connect/disconnect under pressure: Incapable

Socket (fixed) model **WVP-2CSL**
Socket (embeded) model **WVP-2CFL**
Plug (fixed) model **WVP-2CPL**

Request a catalog seperately.

7MPa Pal coupler

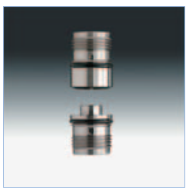


Fluid used: Oil, air
Orifice: 12.6 mm²
Built in filter: Not included
Connect/disconnect under pressure: Incapable

Socket model **WVP-2MSH**
Plug model **WVP-2MDL**

Request a catalog seperately.

25MPa Mini coupler



Fluid used: Oil, air
Orifice: 12.6 mm²
Built in filter: Not included
Connect/disconnect under pressure: Incapable

Socket model **WVP-2MSH**
Plug model **WVP-2MPH**

Request a catalog seperately.

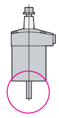
air Swing clamp		model **CTX-T** Page →688 	model **CTX** Page →708 	model **CTY** Page →724 
Specifications		air Double acting	air Double acting	air Double acting
Features		Built-in sensor model	Standard model	Dual cylinder model
Variations	3 point sensor model 	CTX-T **Page →700**	—	—
	Standard (without sensor) 	—	CTX **Page →716**	CTY **Page →732**
	Dual rod 	—	CTX-E **Page →719**	—
Option	Taper sleeve 	CTH-XS **Pages →706, 722, 736**		
	Speed controller 	VCL **Page →740**		

Table of contents

Sensing air Swing clamp

Double acting 1 MPa

model CTX-T

3 point sensor model
model CTX50-LT

Sensing air Swing clamp model CTX-T

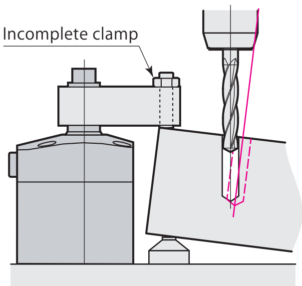
The extremely small sensing clamp can detect the loading miss and setting miss of a workpiece firmly.

3 point sensor model

Cylinder force is increased 1.1 to 1.3 times of the force of CTX standard model

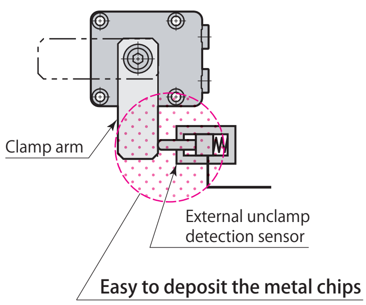
- Sensor model can prevent tool breakage and defective machining due to incomplete clamp. (Figure 1)
- Unclamp PAL sensor moves along with the piston rod and can positively detect unclamping point, thereby enabling a high-speed production line by fully synchronizing operation with workpiece lifters.
- 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



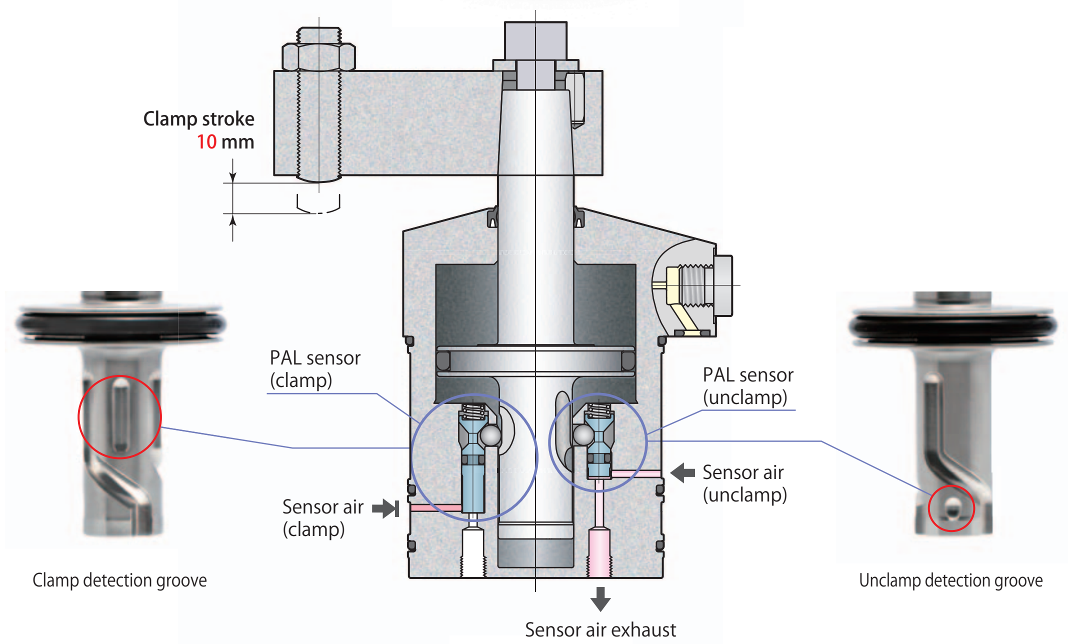
3 point sensor model T

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

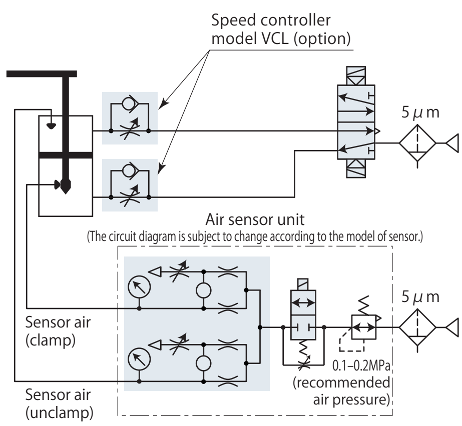
model **CTX□-□T** PAT.

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 →696–699** for the details.



Pneumatic circuit diagram



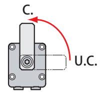
Specifications page → 692
Piping page → 693
PAL sensor page → 696
Dimensions page → 700
Mounting details page → 702

Specifications

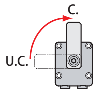
CTX – Size: 32 / 40 / 50 / 63

Swing direction (when clamping)

L : Counter-clockwise



R : Clockwise



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

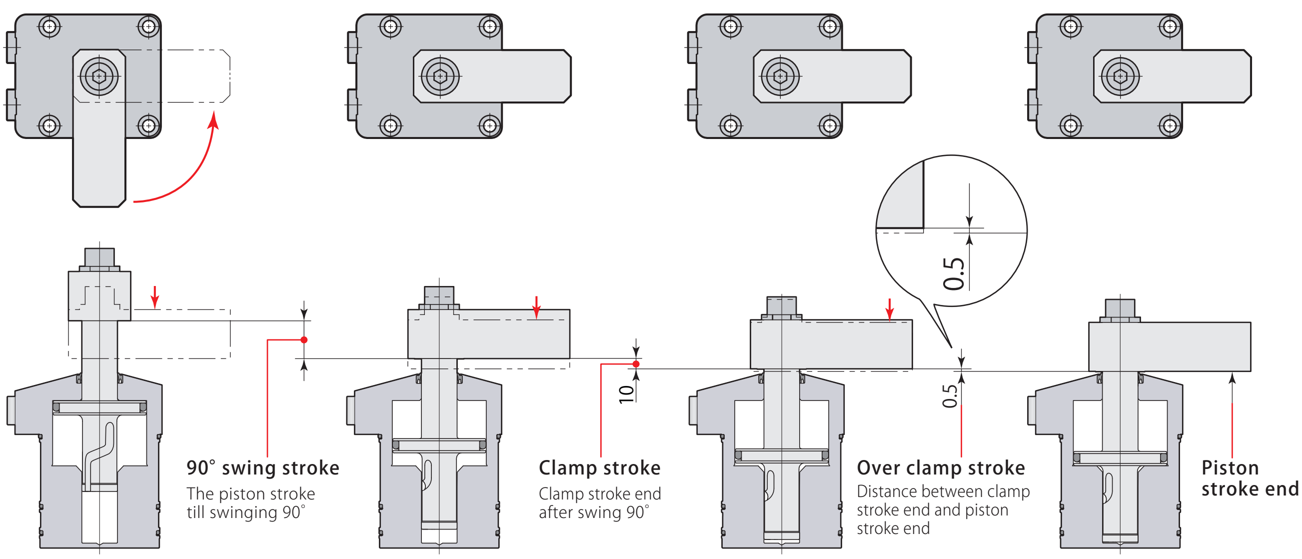
Model			CTX32-□T	CTX40-□T	CTX50-□T	CTX63-□T
Cylinder force (air pressure 0.5MPa)		N	400	590	900	1410
Cylinder inner diameter		mm	35	42	52	65
Rod diameter		mm	14	16	20	25
Effective area		mm^2	808	1184	1810	2827
Swing angle			90°±3°			
Positioning pin groove position accuracy			±1°			
Repeated clamp positioning accuracy			±0.5°			
Full stroke		mm	21	22.5	25.5	29
90° swing stroke		mm	10.5	12	15	18.5
Clamp stroke		mm	10	10	10	10
Over clamp stroke		mm	0.5	0.5	0.5	0.5
Cylinder capacity	Clamp	cm^3	17.0	26.6	46.1	82.0
	Unclamp	cm^3	20.2	31.2	54.2	96.2
Mass		kg	0.45	0.62	1.05	1.72
Recommended tightening torque of mounting screws*1		N·m	4.0	4.0	5.9	5.9
Recommended tightening torque of cap screw*2		N·m	25	25	50	53

● Pressure range：0.2–1 MPa ● Proof pressure：1.5 MPa ● Operating temperature：0–70 ℃ ● Fluid used：Air*3
● Oil supply：Not required ● Seals are resistant to chlorine-based cutting fluid. (not thermal resistant specification)

*1：ISO R898 class 12.9 *2：Arm mounting screw

*3：Supply the dry and filtered air. Particulate size 5 μm or less is recommended.

Clamping must be done within the range of clamp stroke.



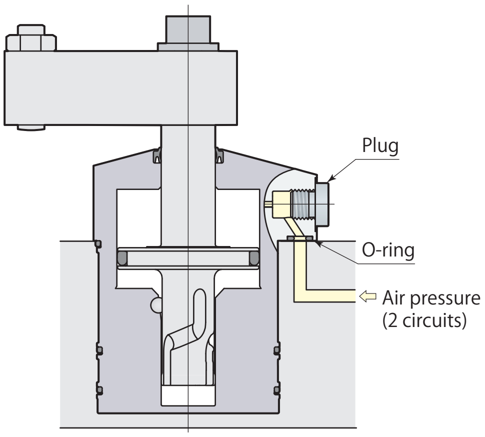
Manifold piping and G port piping are available.

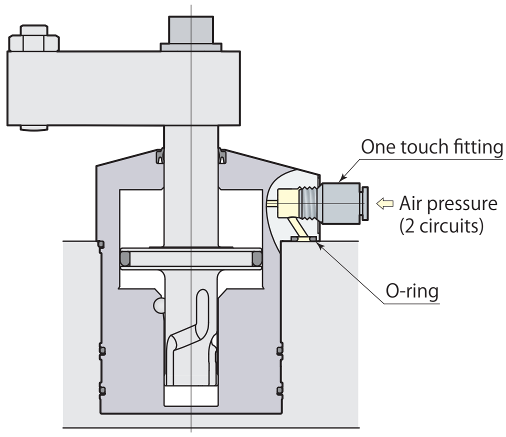
Manifold piping

When choosing manifold piping, a speed controller model VCL is mountable on the G ports of the clamp.

G port piping

When choosing G port piping, remove plugs. (O-ring must be used.) The one touch fitting or the speed controller with one touch fitting should be mounted when choosing G port piping.





Speed controller model VCL

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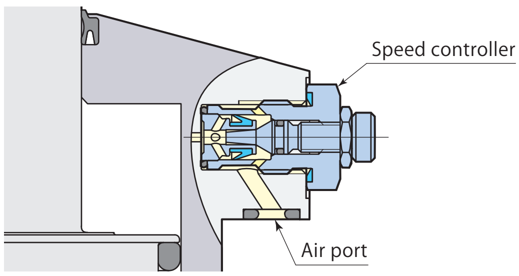
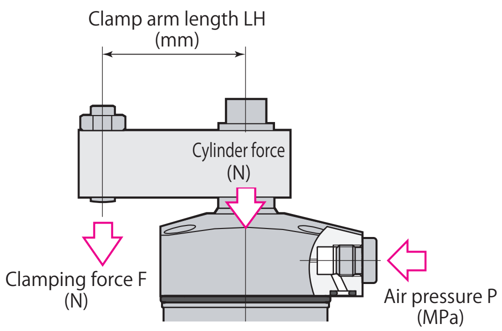


Performance table



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

Clamping force calculation formula
F＝P × 1000/(Coefficient 1＋Coefficient 2 × LH)
F：Clamping force P：Air pressure LH：Clamp arm length

CTX50-T with clamp arm length (LH) 60 mm at air pressure of 1.0 MPa, Clamping force F is calculated by
1.0×1000/(0.553+0.00152×60)=1550 N

Do not use the clamp in the nonusable range. It may cause damage to the cylinder and rod.

model CTX32-□T Clamping force F=P×1000/(1.24+0.00424×LH)

Air pressure MPa	Cylinder force N	Clamping force N, Clamp arm length LH mm: 35	50	70	90	100	120	Max. arm length Max. LH mm
1.0	810	720	690	650	Nonusable range			77
0.9	730	650	620	590				88
0.8	650	580	550	520	490	480		104
0.7	560	500	480	460	430	420	400	125
0.6	480	430	410	390	370	360	340	159
0.5	400	360	340	330	310	300	290	190
0.4	320	290	280	260	250	240	230	↑
0.3	240	220	210	200	190	180	170	↑
0.2	160	140	140	130	120	120	110	190

model CTX40-□T Clamping force F=P×1000/(0.844+0.00275×LH)

Air pressure MPa	Cylinder force N	Clamping force N, Clamp arm length LH mm: 50	70	90	110	130	150	Max. arm length Max. LH mm
1.0	1180	1020	960					80
0.9	1070	920	870	820	Nonusable range			92
0.8	950	820	770	730				108
0.7	830	710	680	640	610	580		130
0.6	710	610	580	550	520	500	480	164
0.5	590	510	480	460	440	420	400	196
0.4	470	410	390	370	350	330	320	↑
0.3	360	310	290	270	260	250	240	↑
0.2	240	200	190	180	170	170	160	196

model CTX50-□T Clamping force F=P×1000/(0.553+0.00152×LH)

Air pressure MPa	Cylinder force N	Clamping force N, Clamp arm length LH mm: 60	80	100	120	140	160	Max. arm length Max. LH mm
1.0	1810	1550	1480	1420	Nonusable range			104
0.9	1630	1400	1330	1280	1220			120
0.8	1450	1240	1190	1130	1090	1040		142
0.7	1270	1090	1040	990	950	910	880	172
0.6	1080	930	890	850	820	780	750	219
0.5	900	780	740	710	680	650	630	260
0.4	720	620	590	570	540	520	500	↑
0.3	540	470	440	430	410	390	380	↑
0.2	360	310	300	280	270	260	250	260

model CTX63-□T Clamping force F=P×1000/(0.354+0.000835×LH)

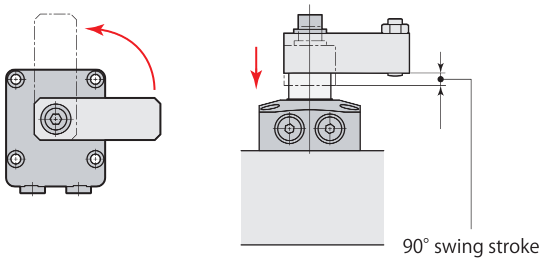
Air pressure MPa	Cylinder force N	Clamping force N, Clamp arm length LH mm: 75	90	110	130	150	170	Max. arm length Max. LH mm
1.0	2820	2400	2330	2240	2160	Nonusable range		134
0.9	2540	2160	2100	2020	1950	1880		155
0.8	2260	1920	1860	1790	1730	1670	1610	184
0.7	1980	1680	1630	1570	1510	1460	1410	225
0.6	1690	1440	1400	1350	1300	1250	1210	290
0.5	1410	1200	1170	1120	1080	1040	1010	330
0.4	1130	960	930	900	860	830	810	↑
0.3	850	720	700	670	650	630	600	↑
0.2	560	480	470	450	430	420	400	330

Swing speed adjustment

Swing time is restricted by the mass and length of the clamp arm (moment of inertia) since the 90° swing action impacts the cam shaft.

1. Calculate the moment of inertia according to the arm length and mass.
2. Adjust swing speed with speed controller to ensure that 90° swing time of the clamp arm is greater than the shortest swing time in the graph shown below.

● The cam groove may be damaged in case the swing speed is set at the nonusable range in the graph.

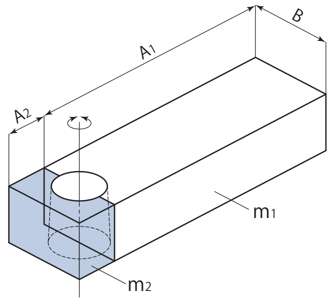


Example of calculation for moment of inertia

$$I=\frac{1}{12}m_1(4A_1^2+B^2)+\frac{1}{12}m_2(4A_2^2+B^2)$$

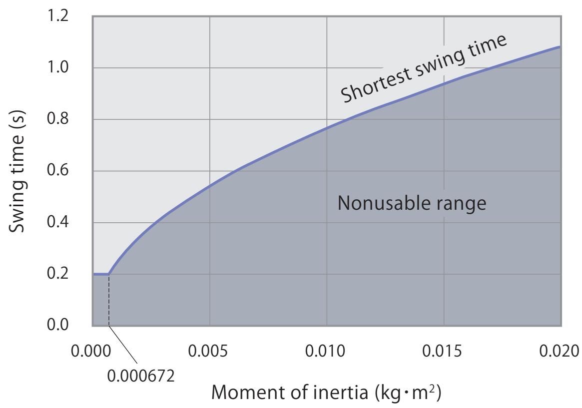
I : Moment of inertia ($kg \cdot m^2$)

m: Mass (kg)



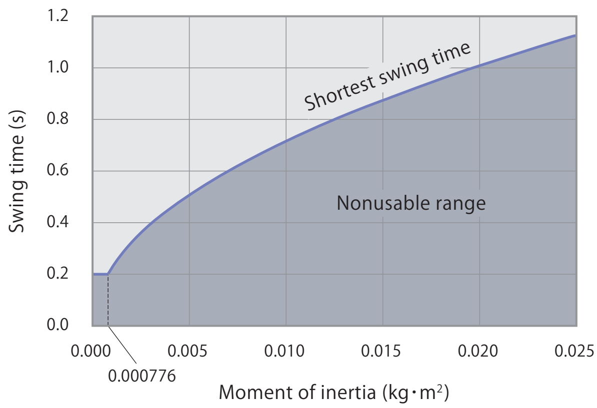
model CTX32-□T

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.0168}}$



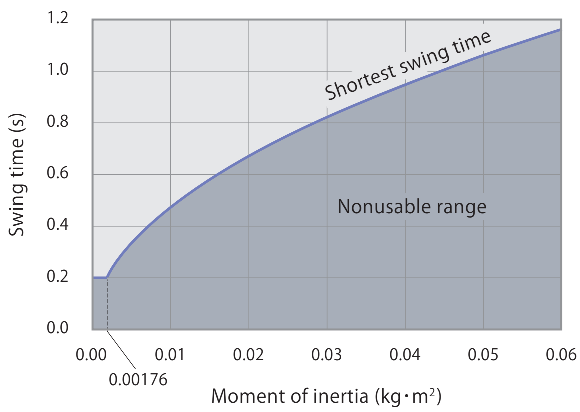
model CTX40-□T

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.0194}}$



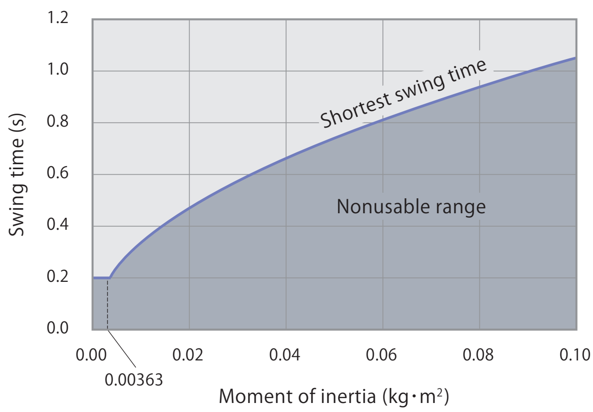
model CTX50-□T

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.0440}}$



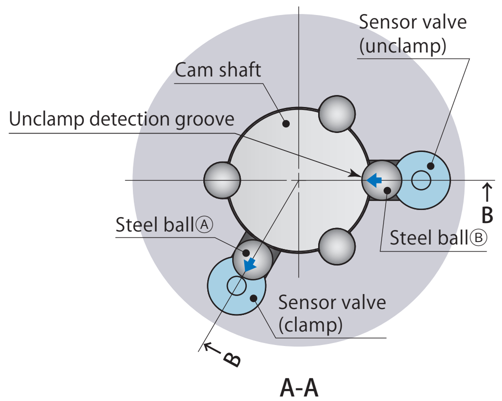
model CTX63-□T

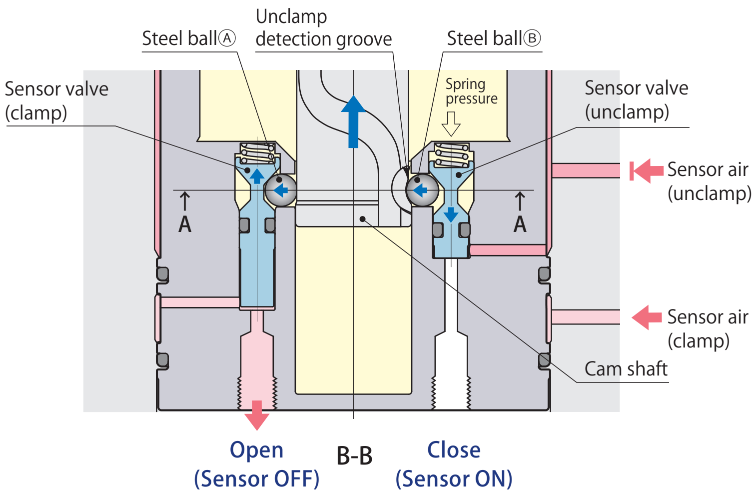
Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.0908}}$



PAL sensor function and structure

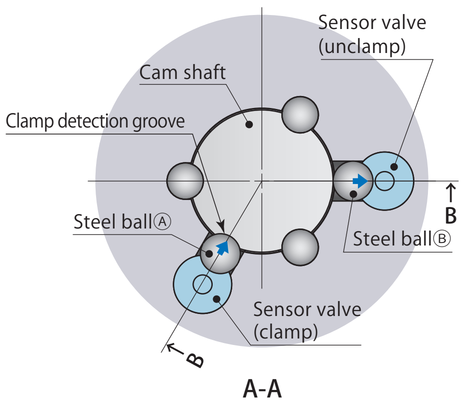
Unclamp detection

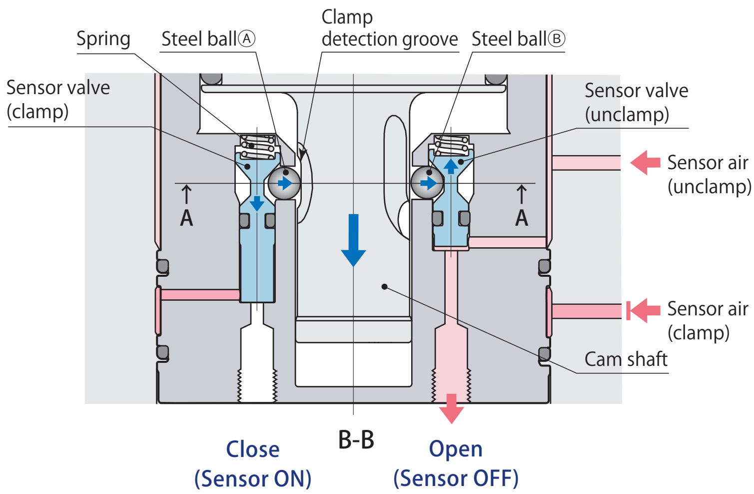




- The steel ball Ⓑ seats in the unclamp detection groove when the cam shaft reaches unclamp end, and a sensor valve (unclamp) is pushed down to shut off the sensor air by spring pressure. The sensor valve (clamp) is pushed up by the steel ball Ⓐ to open for air exhaust and detects the unclamped condition.

Clamp detection

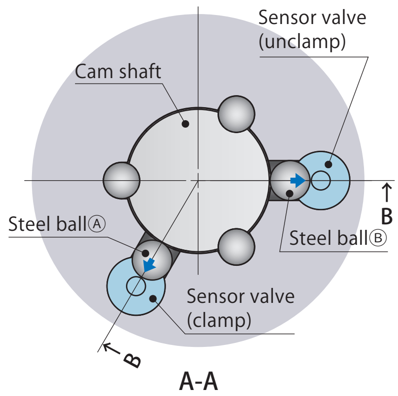


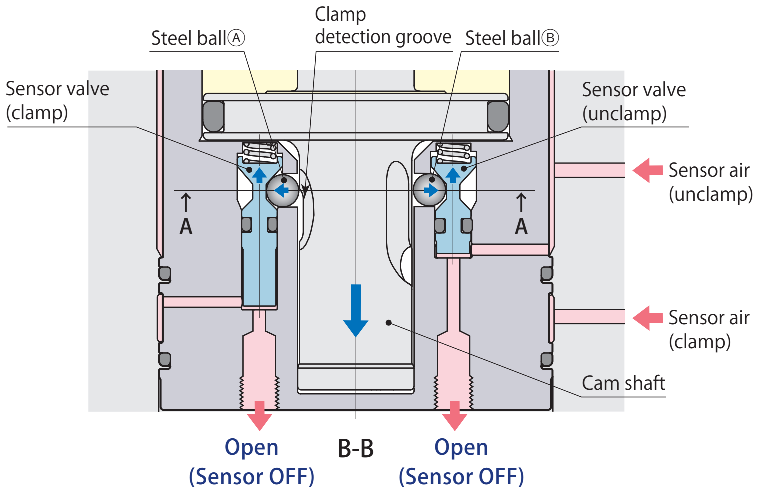


- The steel ball Ⓐ seats in the clamp detection groove when the cam shaft reaches clamping point, and a sensor valve (clamp) is pushed down to shut of the sensor air by a spring. The sensor valve (unclamp) is pushed up by the steel ball Ⓑ to open for air exhaust and detects the clamped condition.

PAL sensor function and structure

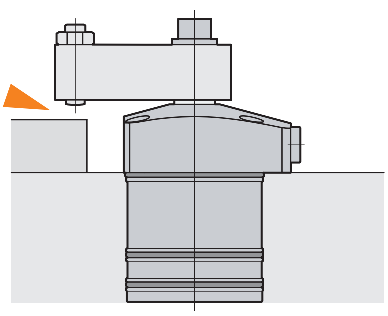
Over clamp stroke (Incomplete clamp) detection



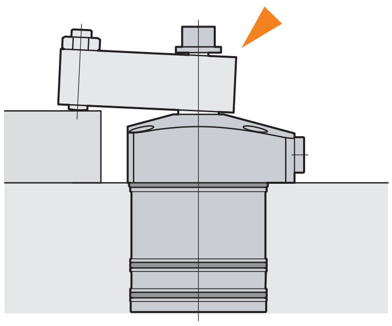


- When the cam shaft passes the clamping point, the sensor valve (clamp) is pushed up by the steel ball Ⓐ to open for air exhaust. The sensor valve (unclamp) is pushed up by the steel ball Ⓑ to open for air exhaust and detects the over clamp stroked (incomplete clamp) condition.

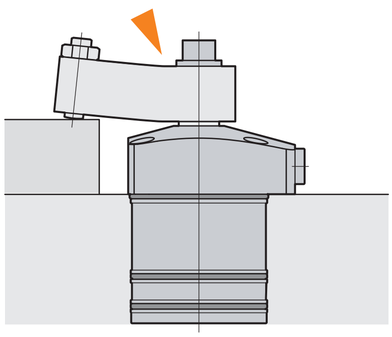
Over clamp stroke (Incomplete clamp) detection example



- Clamp disabled due to mis-setting workpiece.



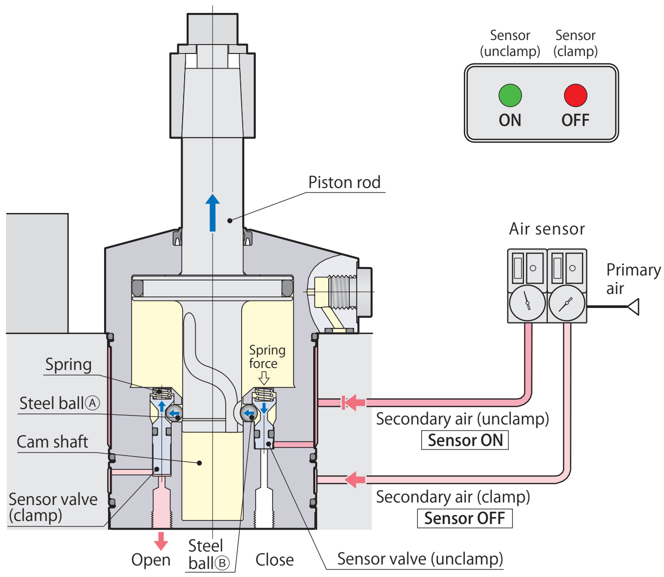
- Clamp disabled due to the damage of piston rod or loose clamp arm.



- Clamp disabled due to the deflection of clamp arm.
- Clamp disabled due to the abrasion on the tip of clamp arm during prolonged use.

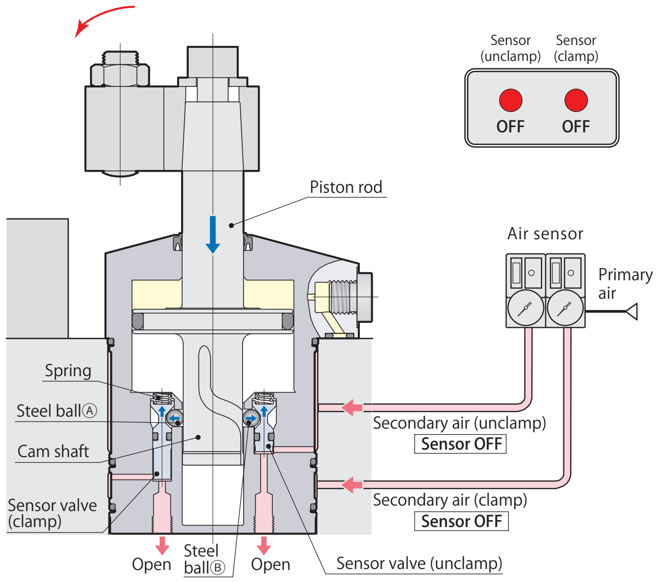
Clamp, Unclamp, Over clamp stroke detection signal

Unclamp detection



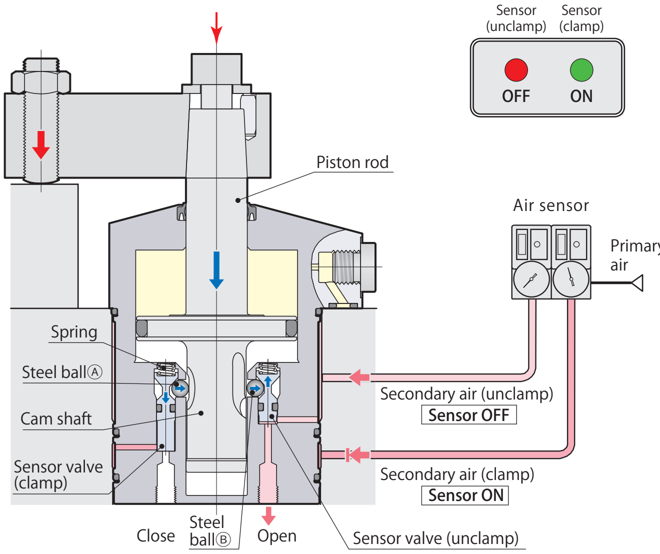
Sensor signal (unclamp)	ON	Unclamp
Sensor signal (clamp)	OFF	

In the middle of swing stroke



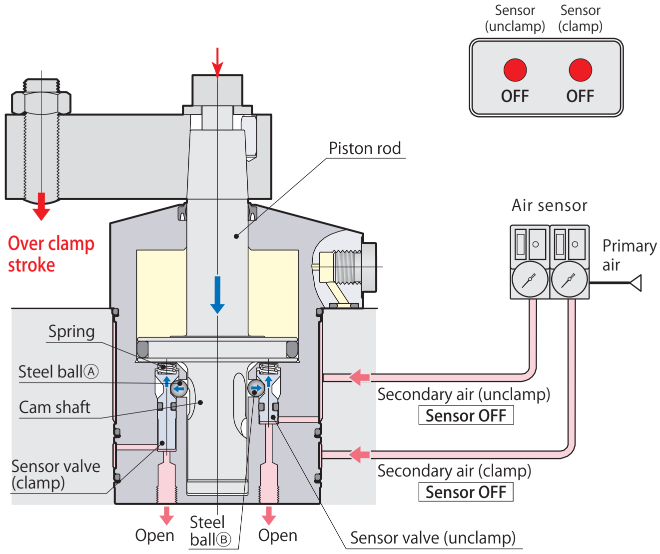
Sensor signal (unclamp)	OFF	In the middle of swing stroke
Sensor signal (clamp)	OFF	

Clamp detection



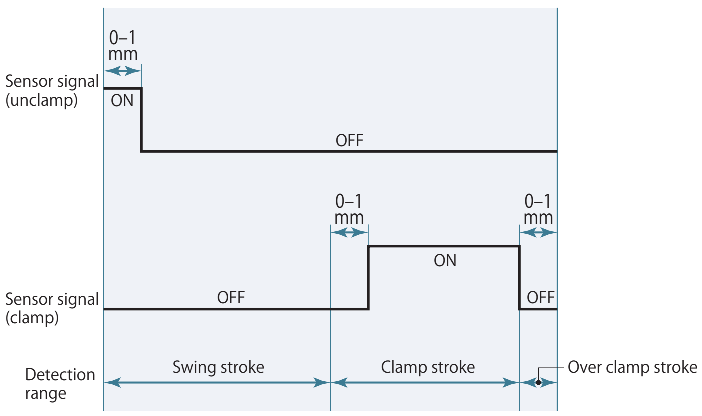
Sensor signal (unclamp)	OFF	Clamp
Sensor signal (clamp)	ON	

Over clamp stroke (Incomplete clamp) detection



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

Air sensor triggering point



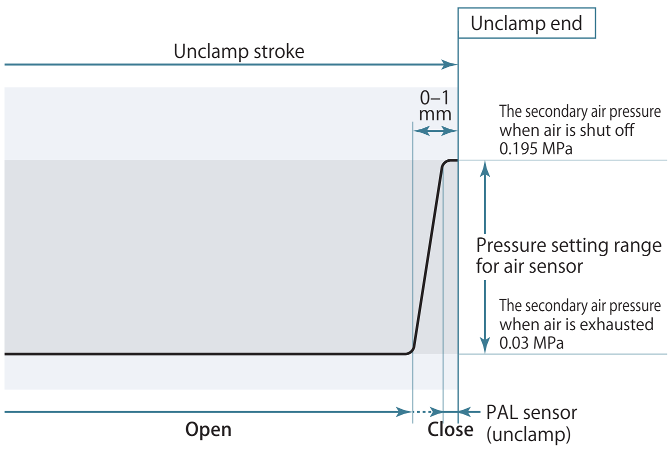
- Refer to the sensor supplier's instruction manual for the details of setting.
- Sensing performance such as detectable time and pressure differs depending on the supplier and model number of the sensor. Select the right model referring to sensor's application and characteristics.

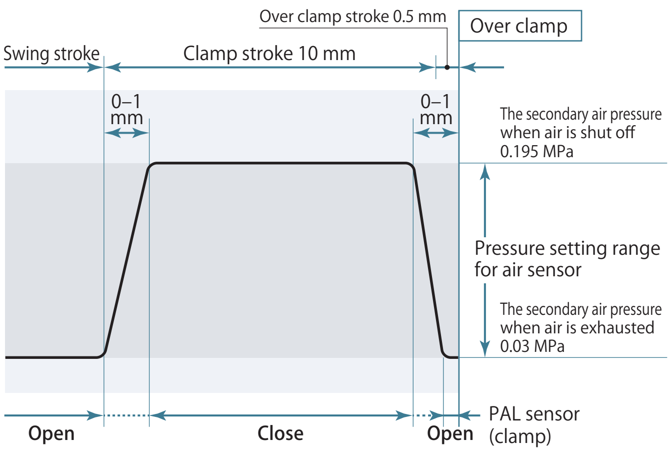
Air sensor unit recommended condition of use

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



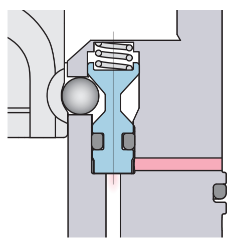


The diagram shown on the left indicates the relation between the PAL sensor, piston stroke, and secondary air pressure. (The pressure shown in the diagram is a reference based on the 0.2 MPa of primary air pressure for one piece of clamp.)

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

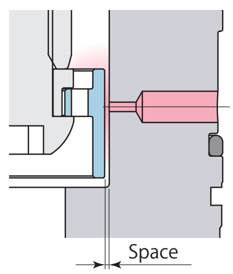
- Enhances the pressure setting range of the sensor which enables the sensor to set easily.
  (Ex. Pressure setting range 0.03–0.195 MPa in the diagram)
- Allows the use for a number of clamps by one air sensor because of better pressure holding when air is shut off. (Maximum number of clamps to be detected 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



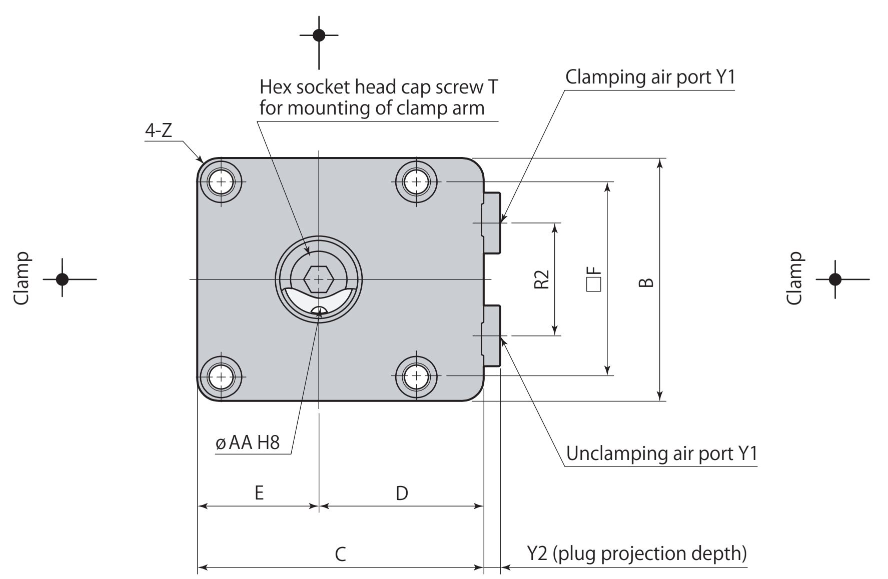
Poppet structure ensures superior sealing performance and can create large differential-pressure when the valve is opening and closing, and air leakage can be minimized.

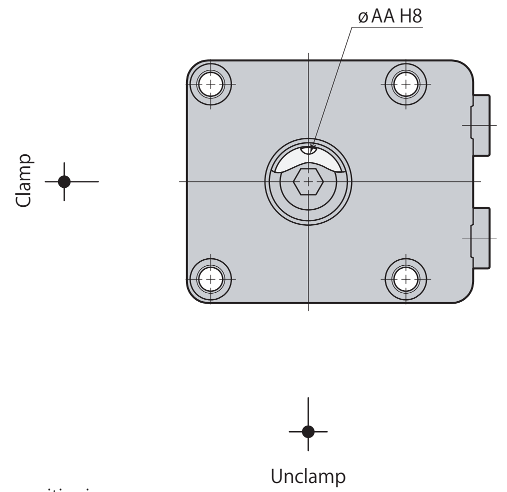
Previous sensor valve



Air leaks easily due to a large space.

Dimensions

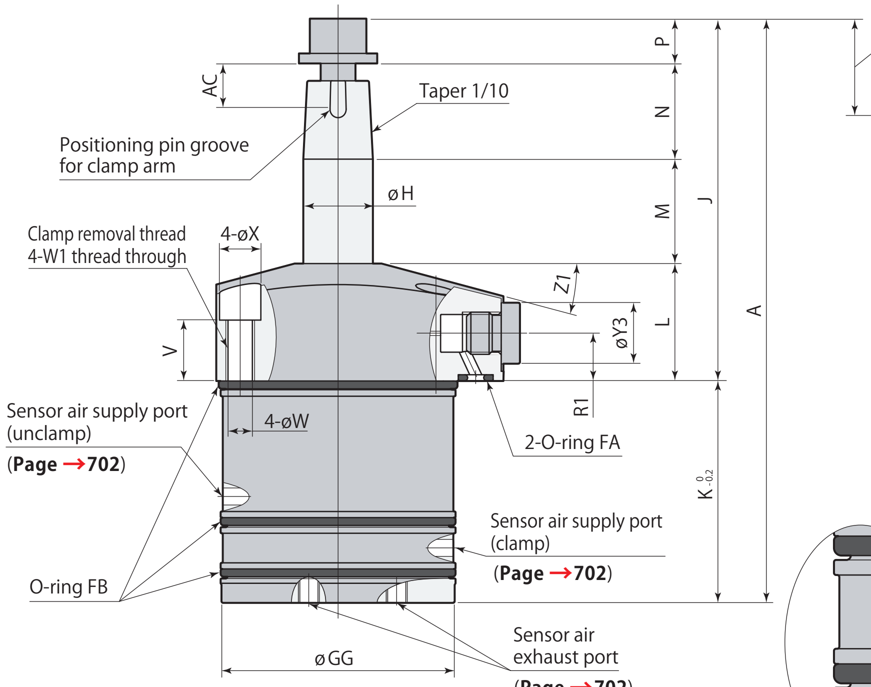




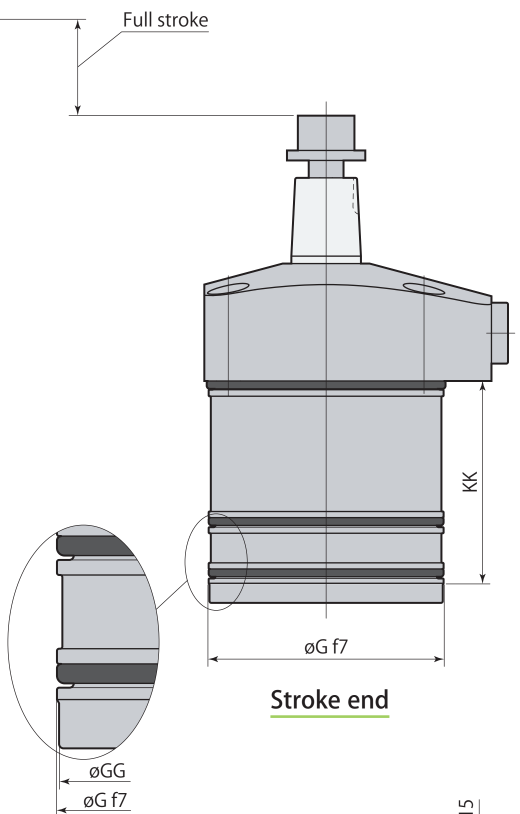
This diagram indicates the arm positioning pin groove at unclamped condition.

Swing direction L (counter-clockwise)

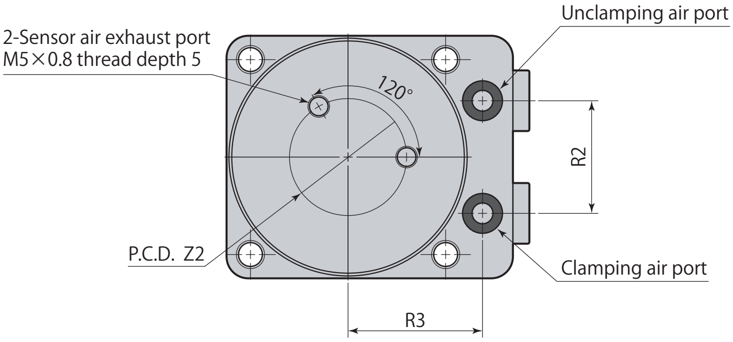
Swing direction R (clockwise)

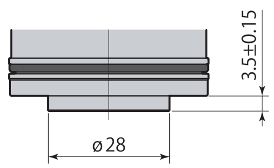


Unclamp



Stroke end





CTX32-□T only

- Clamp arm, positioning pin and mounting screws are not included.

mm

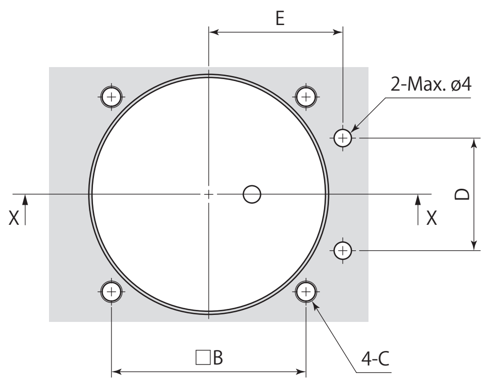
Model		CTX32-□T	CTX40-□T	CTX50-□T	CTX63-□T
A		127.3	134.3	159.2	181.7
B		50	56	66	78
C		60	66	80	91
D		35	38	47	52
E		25	28	33	39
F		39	45	53	65
øG		$46^{-0.025}_{-0.050}$	$54^{-0.030}_{-0.060}$	$64^{-0.030}_{-0.060}$	$77^{-0.030}_{-0.060}$
øGG		45.6	53.6	63.6	76.6
øH		14	16	20	25
J		78.8	83.3	100.2	110.7
K		48.5	51	59	71
KK		44.5	46.5	49.5	57.5
L		27	27	32	32
M		22.5	24	28	31.5
N (arm thickness)		19	22	27	32
P		10.3	10.3	13.2	15.2
R1		11	11	12.5	12.5
R2		20	26	30	40
R3		28	31	36	41
T		M8×1.25 length 16	M8×1.25 length 16	M10×1.5 length 20	M12×1.75 length 25
V		14	14	17	16
øW		5.5	5.5	6.8	6.8
W1		M6×1	M6×1	M8×1.25	M8×1.25
øX		9.5	9.5	11	11
Y1		G1/8	G1/8	G1/4	G1/4
Y2		3.8	3.8	4.8	4.8
øY3		14	14	19	19
Z		R5	R5	R6	R6
Z1		15°	15°	14°	13°
Z2		20	27	34	42
øAA (pin groove diameter)		$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$5^{+0.018}_{0}$
AC		10.5	10.5	12.5	12.5
Positioning pin (dowel pin)		ø4(h8)×10	ø4(h8)×10	ø5(h8)×12	ø5(h8)×12
O-ring FA (fluorocarbon hardness Hs90)		P6	P6	P6	P6
O-ring FB (fluorocarbon hardness Hs70)		AS568-030	AS568-033	AS568-036	AS568-040
Taper sleeve		CTH32-XS	CTH40-XS	CTH50-XS	CTH63-XS
Speed controller*	Meter-in	VCL01-I	VCL01-I	VCL02-I	VCL02-I
	Meter-out	VCL01-O	VCL01-O	VCL02-O	VCL02-O

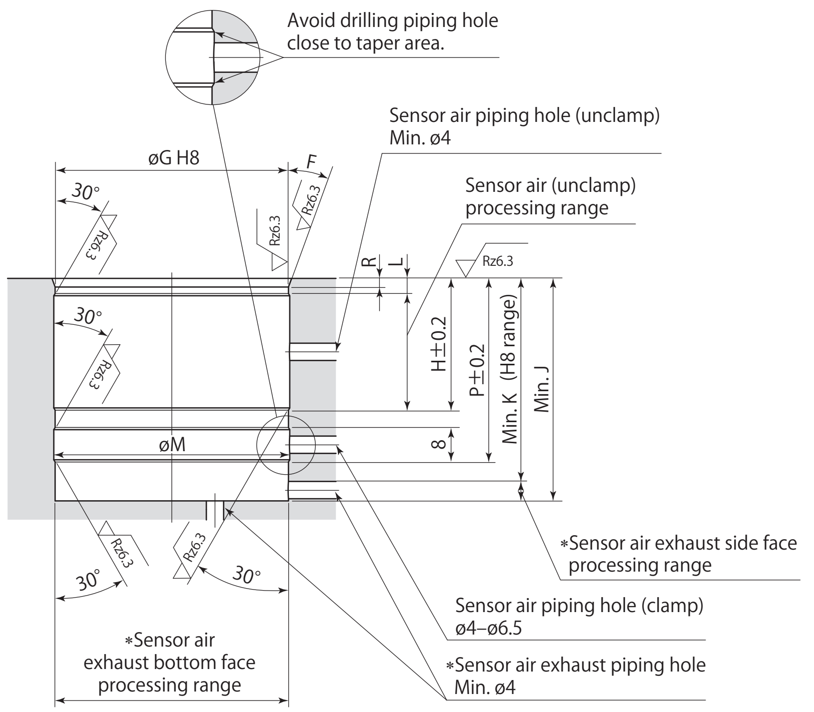
*: Select the right model of VCL according to the size of the clamp.

Refer to each page for the details of options.

● Taper sleeve **page →706** ● Speed controller **page →740**

Mounting details

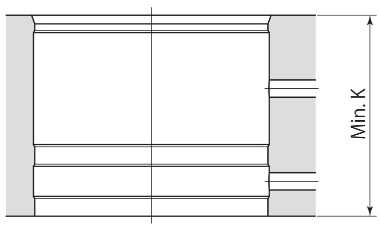




In blind hole X-X

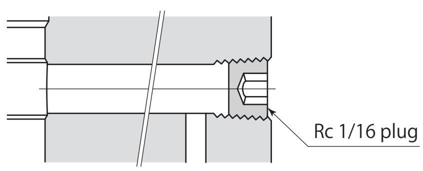
*: Sensor air exhaust piping hole must be made on either side or bottom face.

Rz: ISO4287(1997)



In through hole X-X

- 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.
- No sensor air piping hole (unclamp) is needed unless unclamp sensor is used. Contact Pascal for the details.
- The sensor air piping hole can be used for a pilot hole of Rc 1/16 plug.



Mounting details

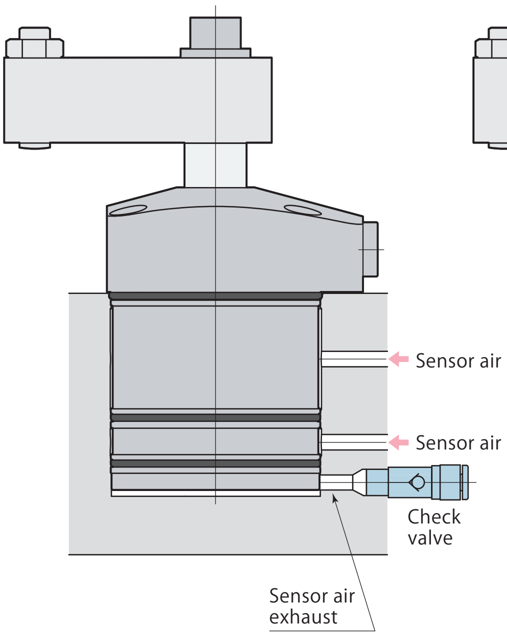
mm

Model	CTX32-□T	CTX40-□T	CTX50-□T	CTX63-□T
B	39	45	53	65
C	M5	M5	M6	M6
D	20	26	30	40
E	28	31	36	41
F	20°	20°	20°	30°
øG	$46^{+0.039}_{0}$	$54^{+0.046}_{0}$	$64^{+0.046}_{0}$	$77^{+0.046}_{0}$
H	28.5	30.5	33.5	41.5
J	52.5	51.5	59.5	71.5
K	44.5	46.5	49.5	57.5
L	3.5	3.5	3.5	8±0.2
øM	46.6	54.6	64.6	77.6
P	40.5	42.5	45.5	53.5
R	2	2	2	1

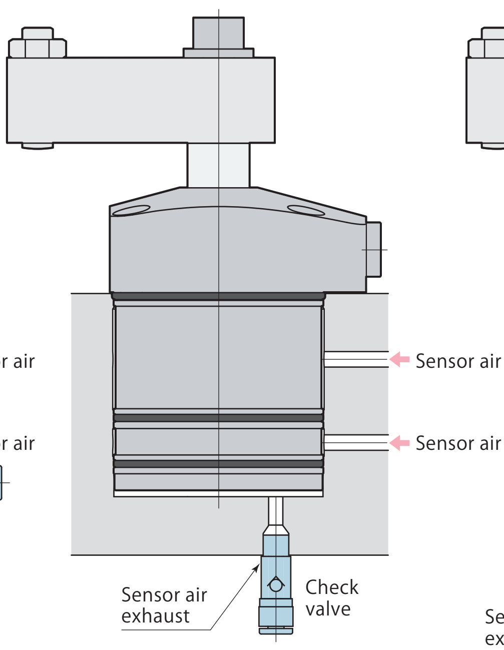
Caution for piping

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

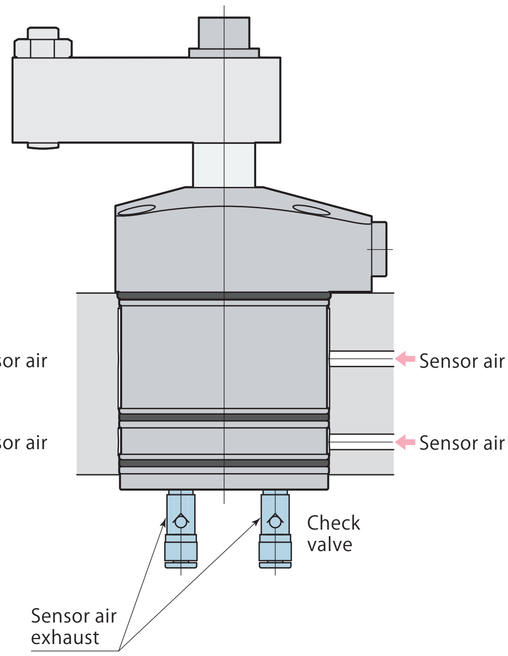
Mounting in blind hole
(Sensor air exhaust : side face)



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



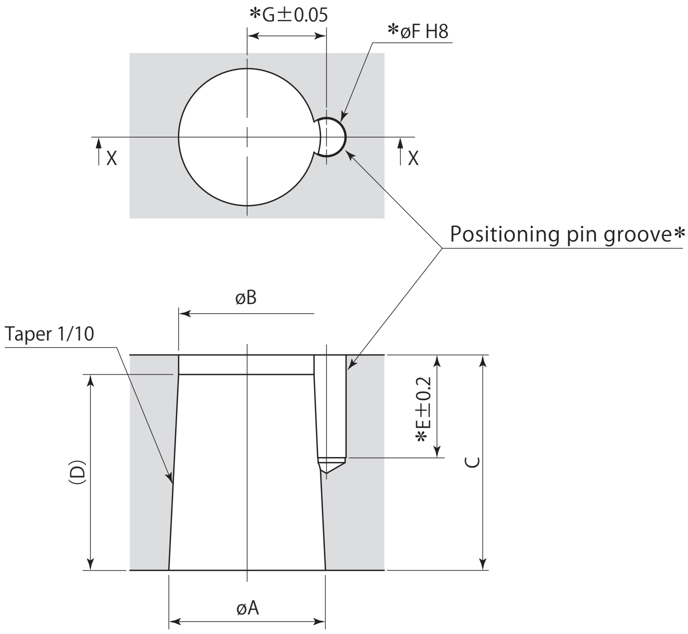
Mounting in through hole



- 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.

Clamp arm mounting details

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



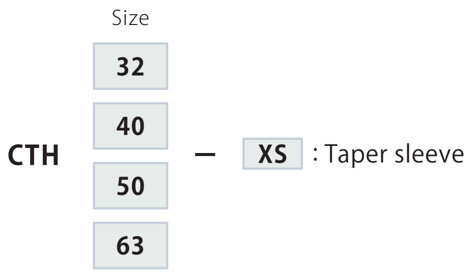
X-X

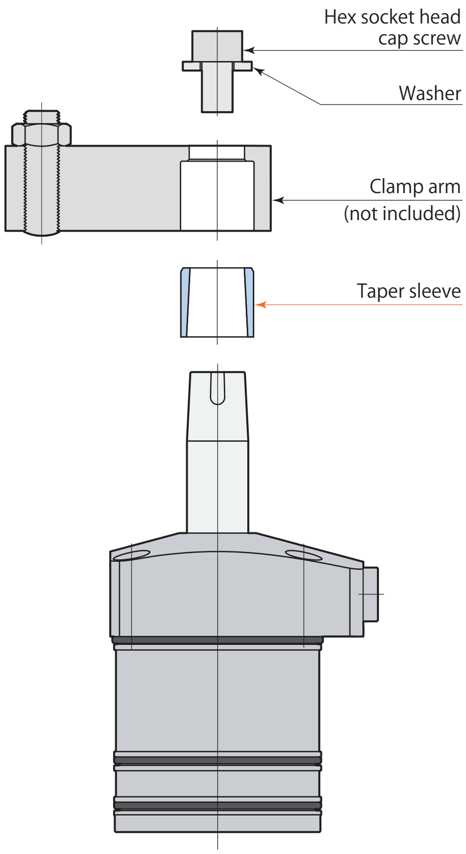
*: No need to machine the pin groove (E, øF, G) unless positioning pin is used for the arm.
The positioning pin enables a clamp arm to locate on the clamp firmly and easily.

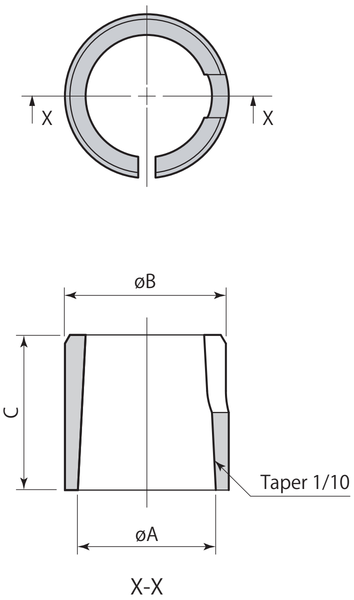
mm

Swing clamp	CTX32-□T	CTX40-□T	CTX50-□T	CTX63-□T
øA	$14^{-0.016}_{-0.034}$	$16^{-0.016}_{-0.034}$	$20^{-0.020}_{-0.041}$	$25^{-0.020}_{-0.041}$
øB	12.6	14	17.8	22.4
C	19	22	27	32
D	14	20	22	26
E	10.5	10.5	12.5	12.5
øF (pin groove diameter)	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$5^{+0.018}_{0}$
G	7.1	8.1	10.1	12.6

Taper sleeve







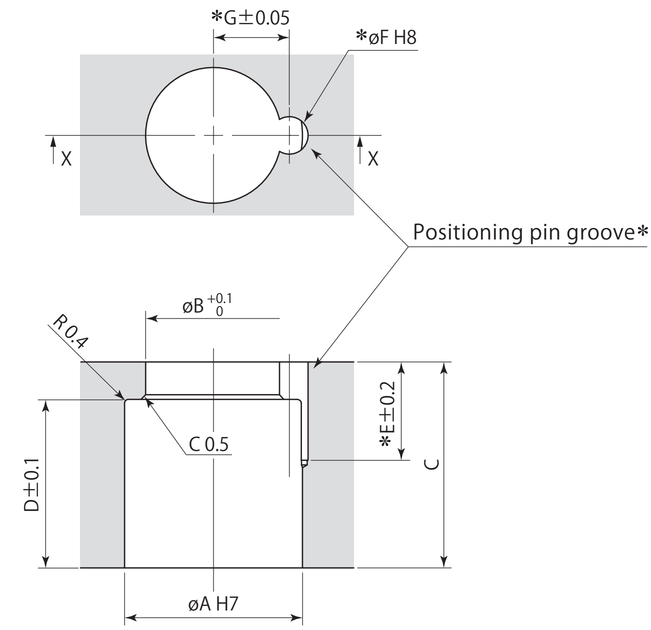
mm

Taper sleeve	CTH32-XS	CTH40-XS	CTH50-XS	CTH63-XS
Applicable swing clamp	CTX32-□T	CTX40-□T	CTX50-□T	CTX63-□T
øA	14	16	20	25
øB	17	19	24	29
C	14	18	22	26

Clamp arm mounting details

(Using taper sleeve)

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



X-X

*：No need to machine the pin groove (E, øF, G) unless positioning pin is used for the arm.
The positioning pin enables a clamp arm to locate on the clamp firmly and easily.

mm

Taper sleeve	CTH32-XS	CTH40-XS	CTH50-XS	CTH63-XS
Applicable swing clamp	CTX32-□T	CTX40-□T	CTX50-□T	CTX63-□T
øA	$17^{+0.018}_{0}$	$19^{+0.021}_{0}$	$24^{+0.021}_{0}$	$29^{+0.021}_{0}$
øB	13	14.5	18.5	23
C	19	22	27	32
D	14	18	22	26
E	10.5	10.5	12.5	12.5
øF (pin groove diameter)	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$5^{+0.018}_{0}$
G	7.1	8.1	10.1	12.6

Table of contents

air Swing clamp

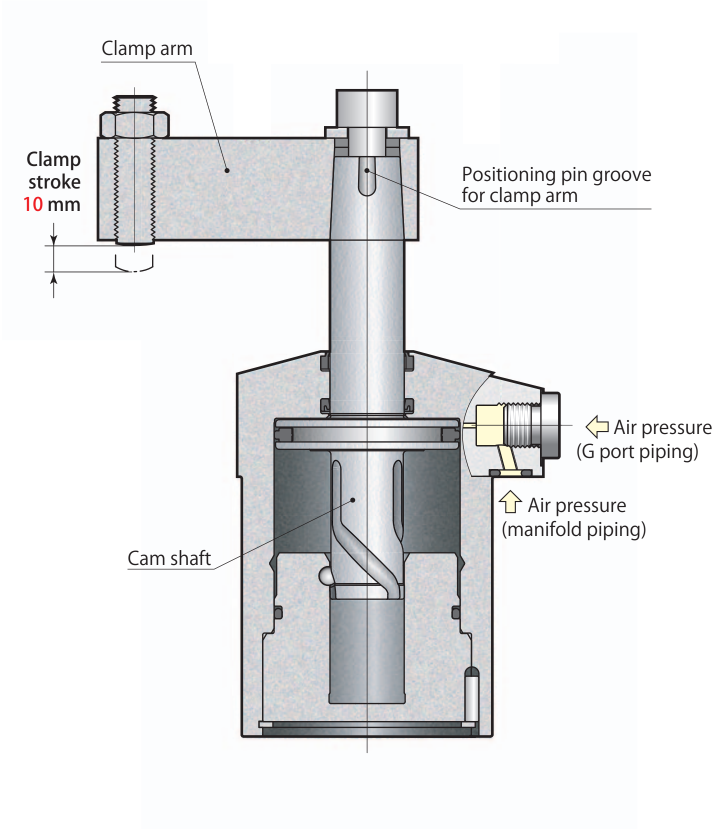
Double acting 1 MPa

model CTX

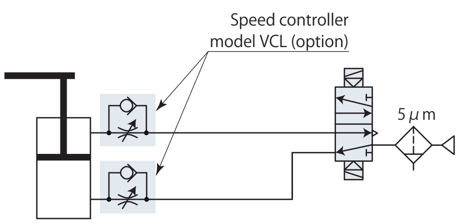
Standard model
model CTX40-L

Standard model

model **CTX□-□**



Pneumatic circuit diagram



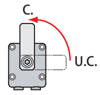
Specifications page → 712
Piping page → 713
Standard page → 716
Dual rod page → 719

Specifications

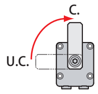
CTX — Size: 32 / 40 / 50 / 63 —

Swing direction (when clamping)

L : Counter-clockwise



R : Clockwise



(Nil) : Standard

E : Dual rod

Model			CTX32	CTX40	CTX50	CTX63
Cylinder force (air pressure 0.5MPa)		N	330	530	820	1310
Cylinder inner diameter		mm	32	40	50	63
Rod diameter		mm	14	16	20	25
Effective area (clamp)		mm^2	650	1056	1649	2626
Swing angle			90°±3°			
Positioning pin groove position accuracy			±1°			
Repeated clamp positioning accuracy			±0.5°			
Full stroke		mm	20.5	22	25	28.5
90° swing stroke		mm	10.5	12	15	18.5
Clamp stroke		mm	10	10	10	10
Max. swing torque*1		N·m	0.10	0.20	0.40	0.75
Cylinder capacity	Clamp	cm^3	13.3	23.2	41.2	74.9
	Unclamp	cm^3	16.5	27.6	49.1	88.8
Mass		kg	0.45	0.62	1.02	1.68
Recommended tightening torque of mounting screws*2		N·m	4.0	4.0	5.9	5.9
Recommended tightening torque of cap screw*3		N·m	25	25	50	53

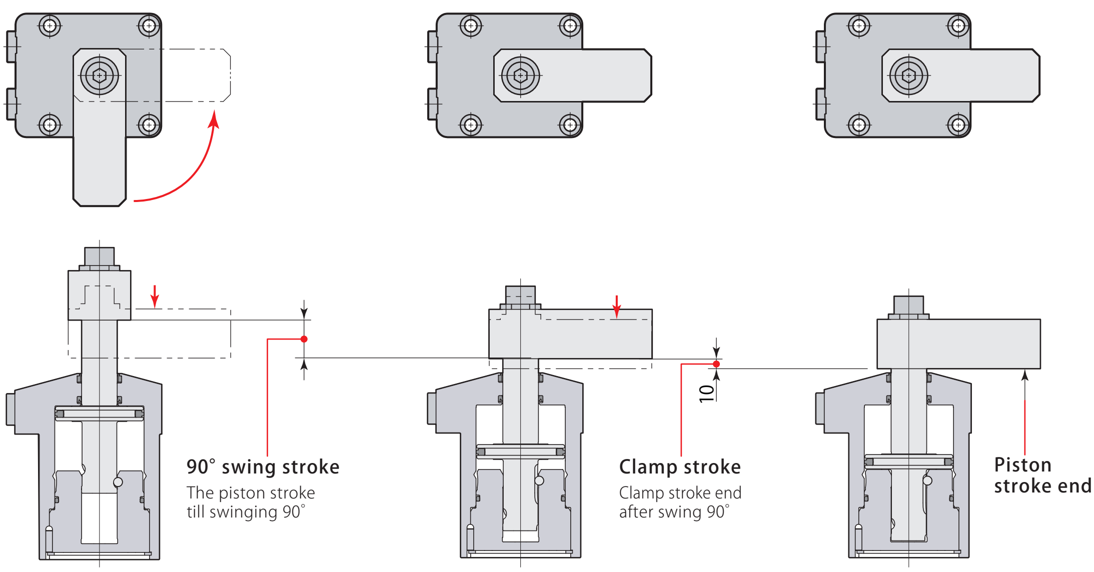
● Pressure range：0.1–1 MPa　● Proof pressure：1.5 MPa　● Operating temperature：0–70 ℃　● Fluid used：Air*4

● Oil supply：Not required　● Seals are resistant to chlorine-based cutting fluid (not thermal resistant specification).

∗1：This is the limit value for lifting arm at 0.1 MPa when mounted vertically.　∗2：ISO R898 class 12.9

∗3：Arm mounting screw　∗4：Supply the dry and filtered air. Particulate size 5 μm or less is recommended.

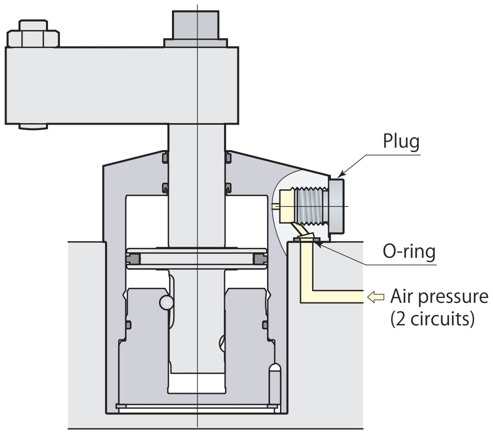
Clamping must be done within the range of clamp stroke.



Manifold piping and G port piping are available.

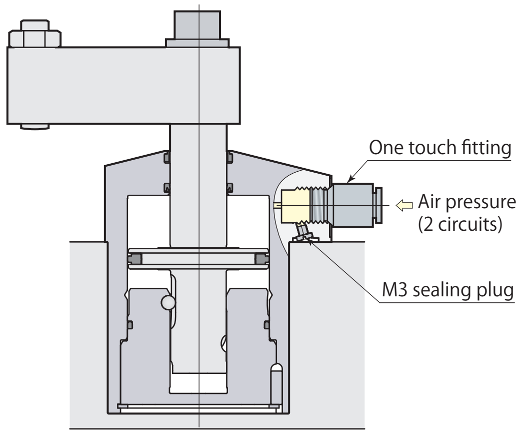
Manifold piping

When choosing manifold piping, a speed controller model VCL is mountable on the G ports of the clamp.



G port piping

When choosing G port piping, remove plugs and mount M3 sealing plugs that are included. (M3 sealing plugs are not mounted at the time of factory shipment.)
The one touch fitting or the speed controller with one touch fitting should be mounted when choosing G port piping.



Speed controller model VCL

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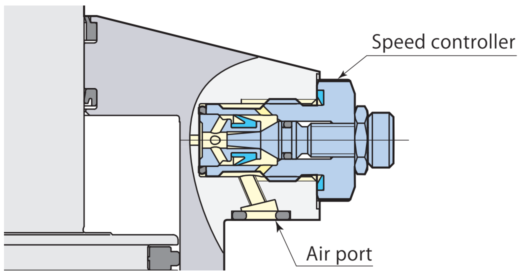
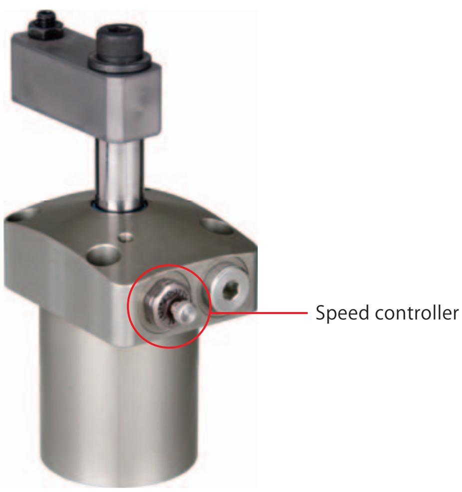
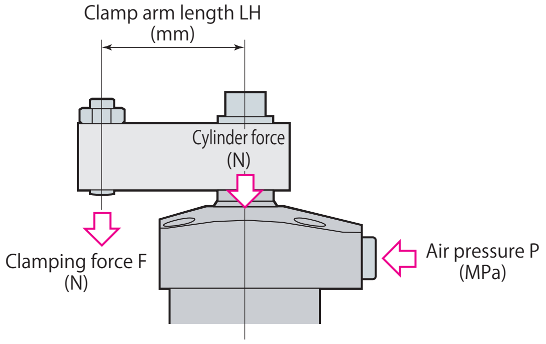




Performance table



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

Clamping force calculation formula
F＝P × 1000/(Coefficient 1＋Coefficient 2 × LH)
F：Clamping force　P：Air pressure　LH：Clamp arm length

CTX50 with clamp arm length (LH) 60 mm at air pressure of 1.0 MPa,
Clamping force F is calculated by
1.0×1000/(0.606+0.00169×60)=1410 N

Do not use the clamp in the nonusable range. It may cause damage to the cylinder and rod.

model CTX32　Clamping force　F=P×1000/(1.53+0.00527×LH)

Air pressure MPa	Cylinder force N	Clamping force N — Clamp arm length LH mm: 35	50	70	90	100	120	Max. arm length Max. LH mm
1.0	650	580	560	530	Nonusable range			89
0.9	590	520	500	470	450	440		103
0.8	520	470	450	420	400	390	370	122
0.7	460	410	390	370	350	340	320	148
0.6	390	350	330	320	300	290	280	190
0.5	330	290	280	260	250	240	230	↑
0.4	260	230	220	210	200	190	180	↑
0.3	200	170	170	160	150	150	140	↑
0.2	130	120	110	110	100	100	90	↑
0.1	70	60	60	50	50	50	50	190

model CTX40　Clamping force　F=P×1000/(0.947+0.00302×LH)

Air pressure MPa	Cylinder force N	Clamping force N — Clamp arm length LH mm: 50	70	90	110	130	150	Max. arm length Max. LH mm
1.0	1060	910	860	820				92
0.9	950	820	780	740	Nonusable range			107
0.8	840	730	690	660	630			126
0.7	740	640	600	570	550	520	500	153
0.6	630	550	520	490	470	450	430	196
0.5	530	460	430	410	390	370	360	↑
0.4	420	360	350	330	310	300	290	↑
0.3	320	270	260	250	230	220	210	↑
0.2	210	180	170	160	160	150	140	↑
0.1	110	90	90	80	80	70	70	196

model CTX50　Clamping force　F=P×1000/(0.606+0.00169×LH)

Air pressure MPa	Cylinder force N	Clamping force N — Clamp arm length LH mm: 60	80	100	120	140	160	Max. arm length Max. LH mm
1.0	1650	1410	1350	1290		Nonusable range		119
0.9	1480	1270	1210	1160	1110			138
0.8	1320	1130	1080	1030	990	950	910	163
0.7	1150	990	940	900	870	830	800	201
0.6	990	850	810	770	740	710	680	260
0.5	820	710	670	650	620	590	570	↑
0.4	660	570	540	520	490	470	460	↑
0.3	490	420	400	390	370	360	340	↑
0.2	330	280	270	260	250	240	230	↑
0.1	160	140	130	130	120	120	110	260

model CTX63　Clamping force　F=P×1000/(0.381+0.00090×LH)

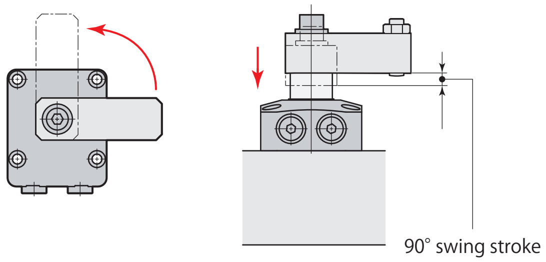
Air pressure MPa	Cylinder force N	Clamping force N — Clamp arm length LH mm: 75	90	110	130	150	170	Max. arm length Max. LH mm
1.0	2630	2230	2160	2080	2010	Nonusable range		148
0.9	2360	2010	1950	1880	1810	1740	1690	172
0.8	2100	1780	1730	1670	1610	1550	1500	205
0.7	1840	1560	1520	1460	1410	1360	1310	253
0.6	1580	1340	1300	1250	1200	1160	1120	330
0.5	1310	1110	1080	1040	1000	970	940	↑
0.4	1050	890	870	830	800	780	750	↑
0.3	790	670	650	630	600	580	560	↑
0.2	530	450	430	420	400	390	370	↑
0.1	260	220	220	210	200	190	190	330

Swing speed adjustment

Swing time is restricted by the mass and length of the clamp arm (moment of inertia) since the 90° swing action impacts the cam shaft.

1. Calculate the moment of inertia according to the arm length and mass.
2. Adjust swing speed with speed controller to ensure that 90° swing time of the clamp arm is greater than the shortest swing time in the graph shown below.

● The cam groove may be damaged in case the swing speed is set at the nonusable range in the graph.

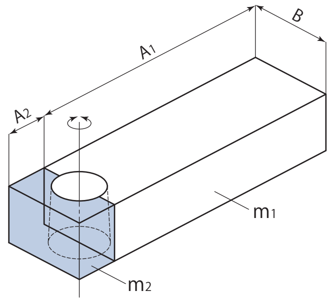


Example of calculation for moment of inertia

$$I=\frac{1}{12}m_1(4A_1^2+B^2)+\frac{1}{12}m_2(4A_2^2+B^2)$$

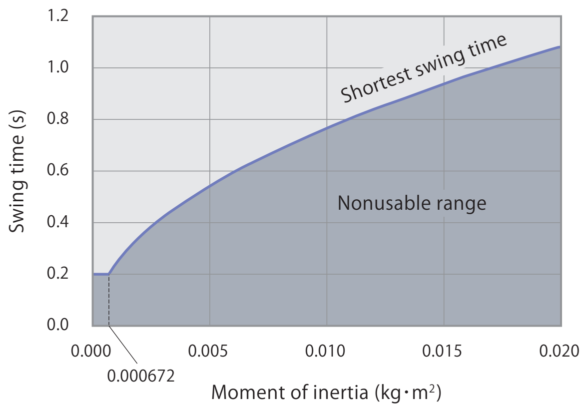
I : Moment of inertia ($kg \cdot m^2$)

m: Mass (kg)



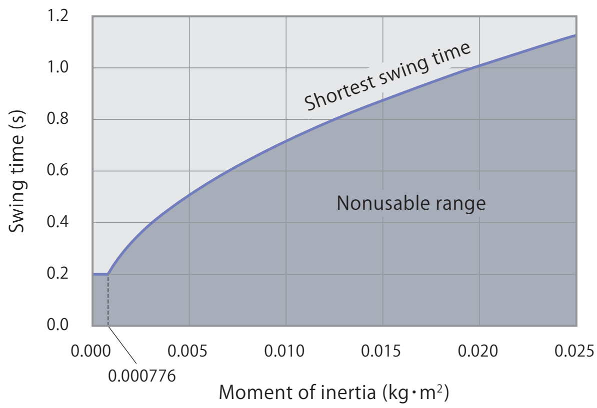
model CTX32

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.0168}}$



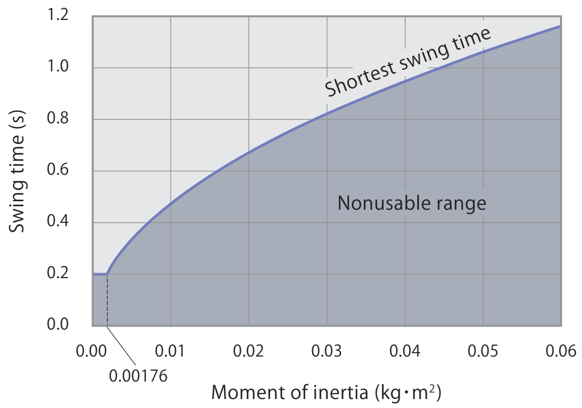
model CTX40

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.0194}}$



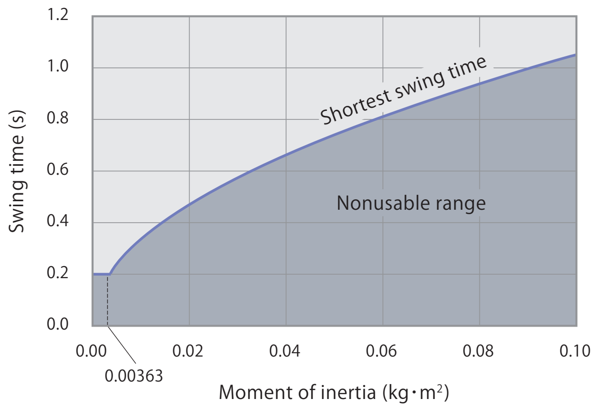
model CTX50

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.0440}}$

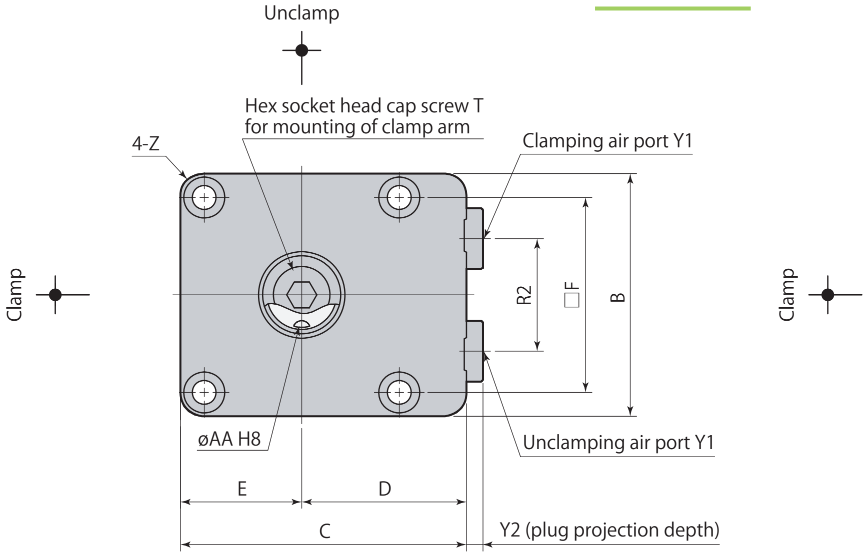


model CTX63

Shortest swing time calculation formula $t=\sqrt{\frac{I}{0.0908}}$

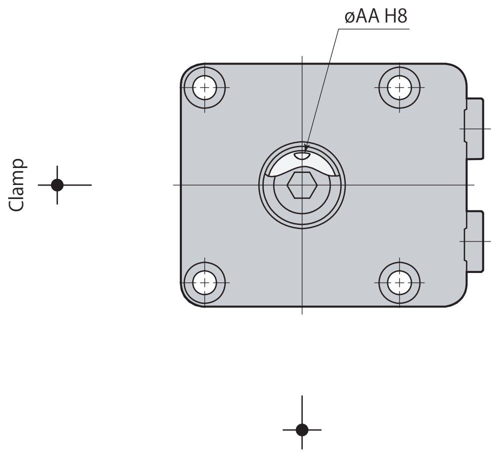


Dimensions

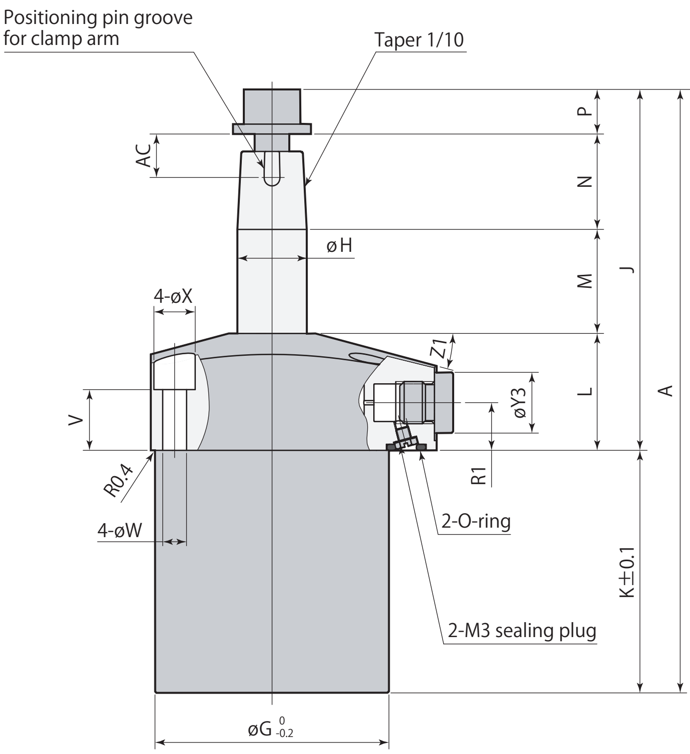


This diagram indicates the arm positioning pin groove at unclamped condition.

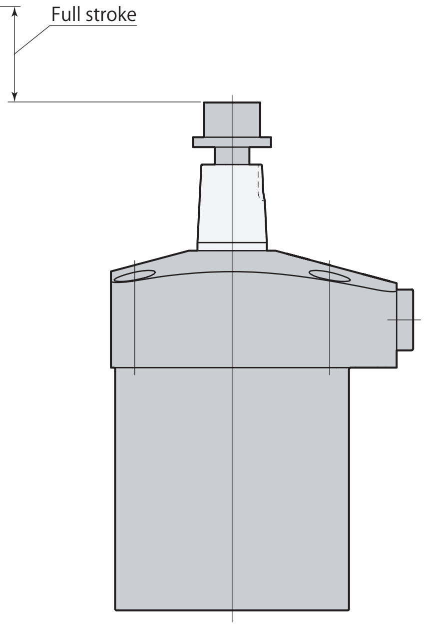
Swing direction L (counter-clockwise)



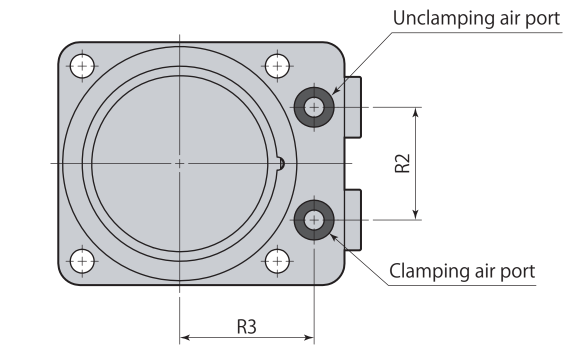
Swing direction R (clockwise)



Unclamp



Stroke end



- Clamp arm, positioning pin and mounting screws are not included.
- Install M3 sealing plug when choosing G port piping. The M3 sealing plug is packed with a swing clamp.

mm

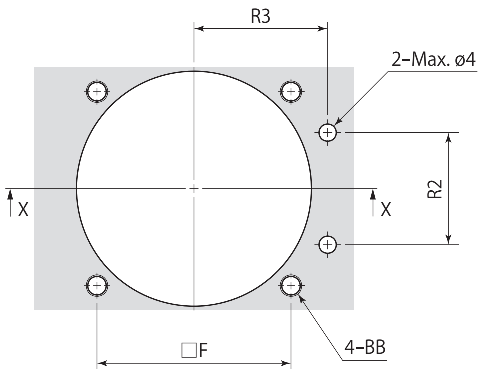
Model		CTX32-□	CTX40-□	CTX50-□	CTX63-□
A		129.8	139.3	160.7	187.2
B		50	56	66	78
C		60	66	80	91
D		35	38	47	52
E		25	28	33	39
F		39	45	53	65
øG		46	54	64	77
øH		14	16	20	25
J		78.8	83.3	100.2	110.7
K		51	56	60.5	76.5
L		27	27	32	32
M		22.5	24	28	31.5
N (arm thickness)		19	22	27	32
P		10.3	10.3	13.2	15.2
R1		11	11	12.5	12.5
R2		20	26	30	40
R3		28	31	36	41
T		M8×1.25 length 16	M8×1.25 length 16	M10×1.5 length 20	M12×1.75 length 25
V		14	14	17	16
øW		5.5	5.5	6.8	6.8
øX		9.5	9.5	11	11
Y1		G1/8	G1/8	G1/4	G1/4
Y2		3.8	3.8	4.8	4.8
øY3		14	14	19	19
Z		R5	R5	R6	R6
Z1		15°	15°	14°	13°
øAA (pin groove diameter)		$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$5^{+0.018}_{0}$
AC		10.5	10.5	12.5	12.5
Positioning pin (dowel pin)		ø4(h8)×10	ø4(h8)×10	ø5(h8)×12	ø5(h8)×12
O-ring (fluorocarbon hardness Hs90)		P6	P6	P6	P6
Taper sleeve		CTH32-XS	CTH40-XS	CTH50-XS	CTH63-XS
Speed controller*	Meter-in	VCL01-I	VCL01-I	VCL02-I	VCL02-I
	Meter-out	VCL01-O	VCL01-O	VCL02-O	VCL02-O

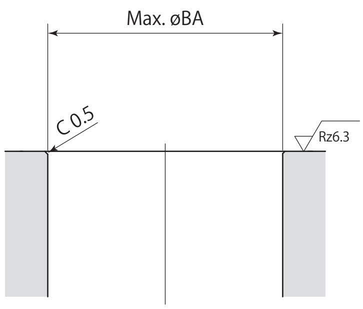
*:Select the right model of VCL according to the size of the clamp.

Refer to each page for the details of options.

● Taper sleeve **page →722**　● Speed controller **page →740**

Mounting details





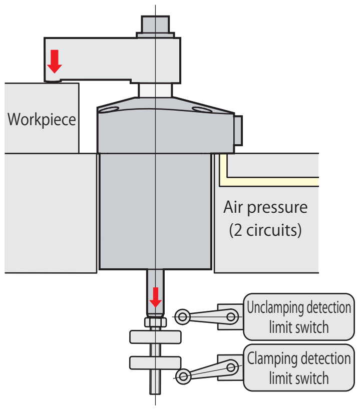
X-X

Rz: ISO4287(1997)

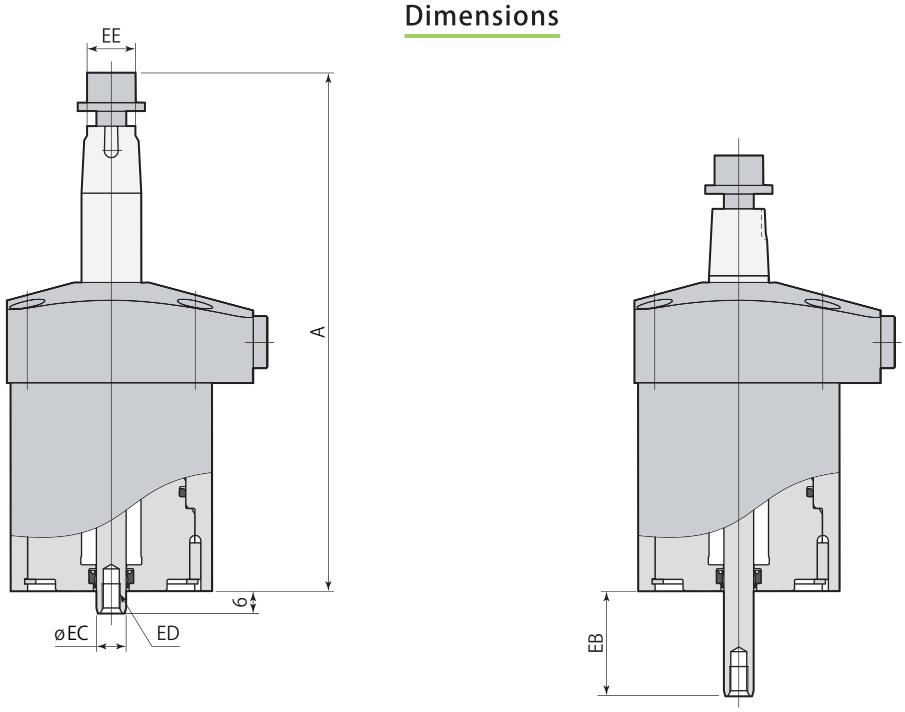
mm

Model	CTX32-□	CTX40-□	CTX50-□	CTX63-□
F	39	45	53	65
R2	20	26	30	40
R3	28	31	36	41
øBA	46.5	54.5	64.5	77.5
BB	M5	M5	M6	M6

Usage example



Dimensions



Unclamp

Stroke end

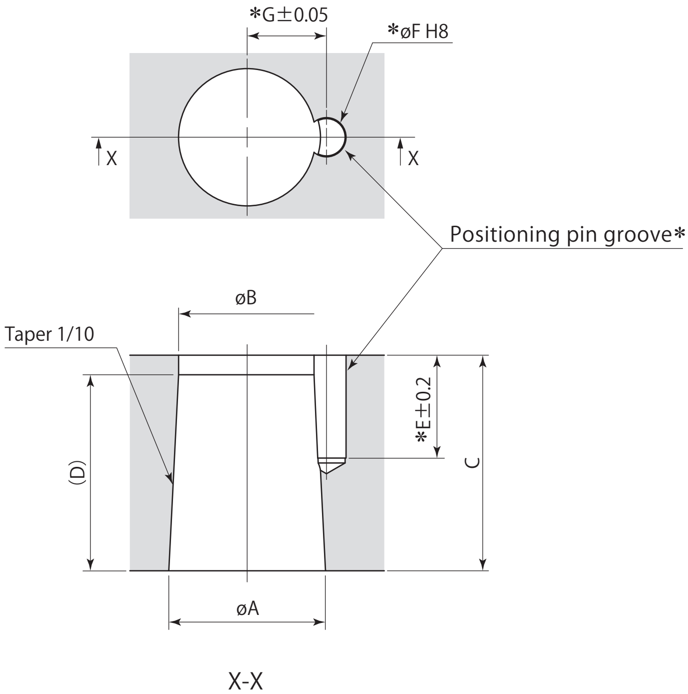
mm

Model	CTX32-□E	CTX40-□E	CTX50-□E	CTX63-□E
Cylinder capacity (unclamp)	15.5 cm^3	26.5 cm^3	47.1 cm^3	86.6 cm^3
A	129.8	139.3	160.7	187.2
EB	26.5	28	31	34.5
øEC	8	8	10	10
ED	M5×0.8 depth 8	M5×0.8 depth 8	M6×1 depth 11	M6×1 depth 11
EE (width across flats)	11 $^{0}_{-0.2}$	13 $^{0}_{-0.2}$	14 $^{0}_{-0.2}$	19 $^{0}_{-0.2}$
Mass	0.47 kg	0.63 kg	1.04 kg	1.70 kg

- This diagram indicates a swing direction L (L stands for counter-clockwise).
- Refer to specifications (**page →712**), dimensions (**page →716**) for specifications and dimensions that are not shown in the diagram.

Clamp arm mounting details

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



*: No need to machine the pin groove (E, øF, G) unless positioning pin is used for the arm.
The positioning pin enables a clamp arm to locate on the clamp firmly and easily.

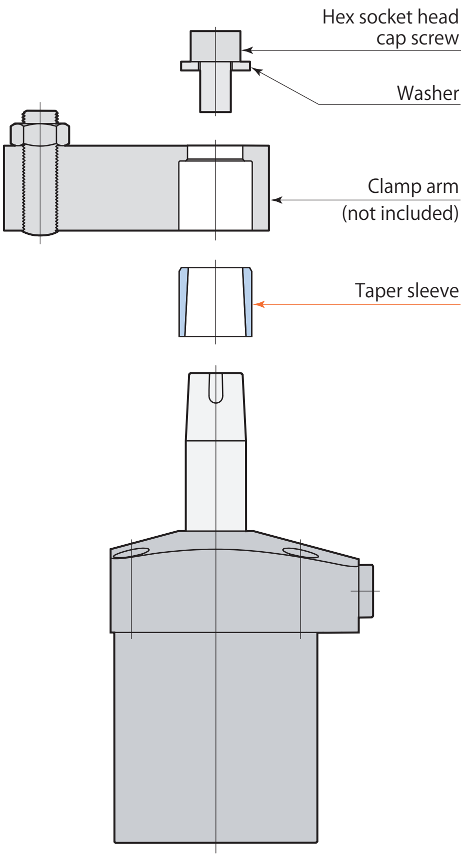
mm

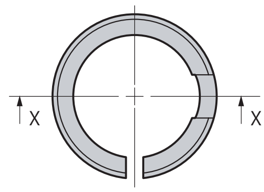
Swing clamp	CTX32	CTX40	CTX50	CTX63
øA	$14^{-0.016}_{-0.034}$	$16^{-0.016}_{-0.034}$	$20^{-0.020}_{-0.041}$	$25^{-0.020}_{-0.041}$
øB	12.6	14	17.8	22.4
C	19	22	27	32
D	14	20	22	26
E	10.5	10.5	12.5	12.5
øF (pin groove diameter)	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$5^{+0.018}_{0}$
G	7.1	8.1	10.1	12.6

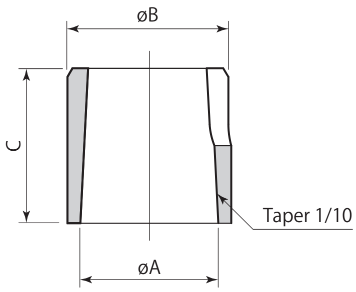
Taper sleeve

Size

CTH	32 / 40 / 50 / 63	–	XS : Taper sleeve







X-X

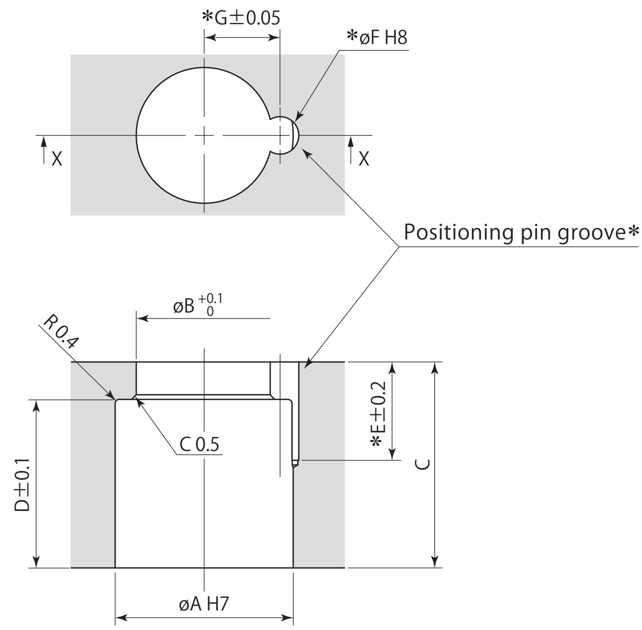
mm

Taper sleeve	CTH32-XS	CTH40-XS	CTH50-XS	CTH63-XS
Applicable swing clamp	CTX32	CTX40	CTX50	CTX63
øA	14	16	20	25
øB	17	19	24	29
C	14	18	22	26

Clamp arm mounting details

(Using taper sleeve)

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



X-X

*: No need to machine the pin groove (E, øF, G) unless positioning pin is used for the arm.
The positioning pin enables a clamp arm to locate on the clamp firmly and easily.

mm

Taper sleeve	CTH32-XS	CTH40-XS	CTH50-XS	CTH63-XS
Applicable swing clamp	CTX32	CTX40	CTX50	CTX63
øA	$17^{+0.018}_{0}$	$19^{+0.021}_{0}$	$24^{+0.021}_{0}$	$29^{+0.021}_{0}$
øB	13	14.5	18.5	23
C	19	22	27	32
D	14	18	22	26
E	10.5	10.5	12.5	12.5
øF (pin groove diameter)	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$5^{+0.018}_{0}$
G	7.1	8.1	10.1	12.6

Table of contents

air Swing clamp

Dual cylinder model Double acting 0.5 MPa

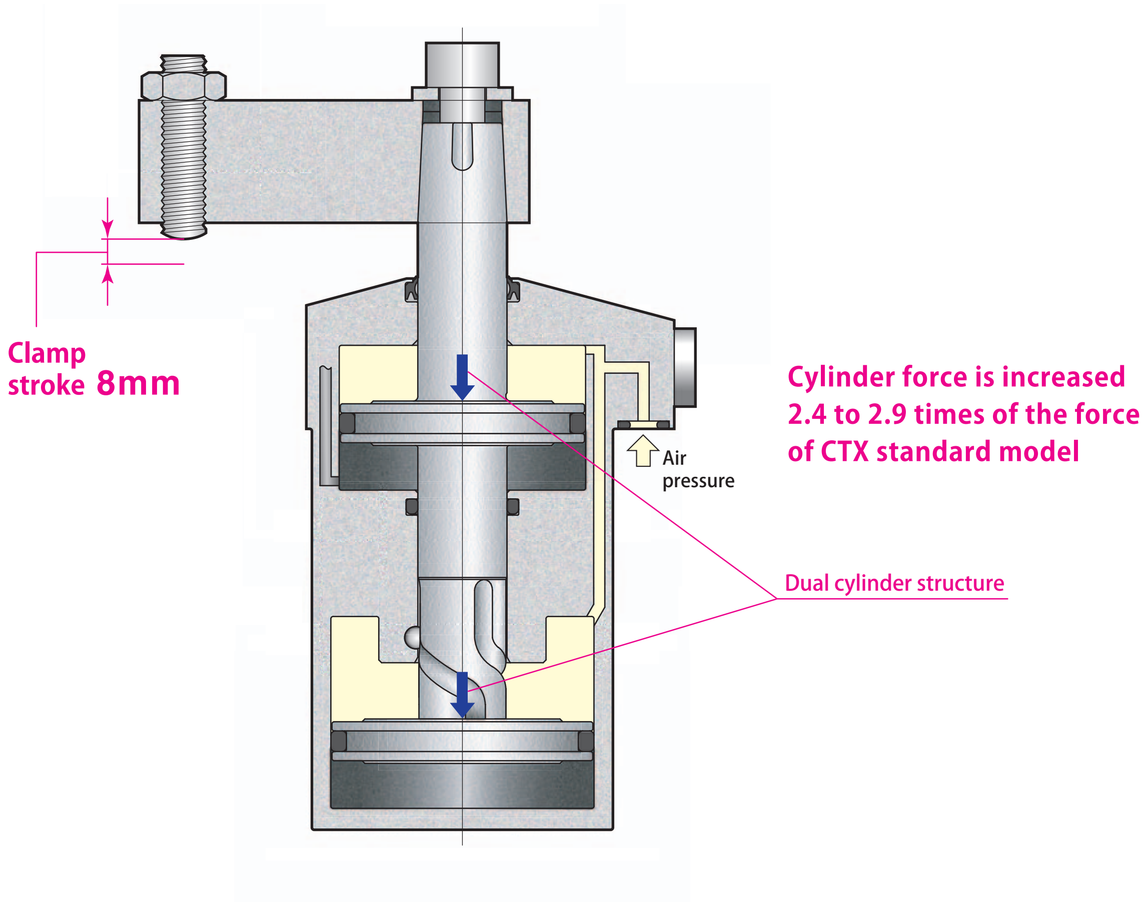
model CTY

Dual cylinder model
model CTY40-L

Dual cylinder model

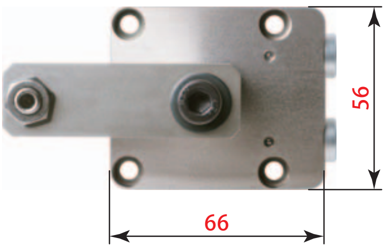
model **CTY□-□** JP PAT.

Dual cylinder structure enables cylinder force 2.4 to 2.9 times than that of single cylinder's.



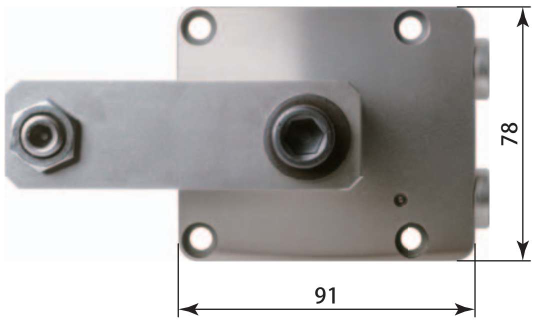
Comparison with the current model

Air swing clamp **Dual cylinder model** **CTY40**		Air swing clamp **Standard model** **CTX63**
Clamp stroke：**8mm** Cylinder force：**1430N** (Air pressure 0.5MPa)	**Clamp stroke** **Cylinder force** **Equality**	Clamp stroke：**10mm** Cylinder force：**1310N** (Air pressure 0.5MPa)

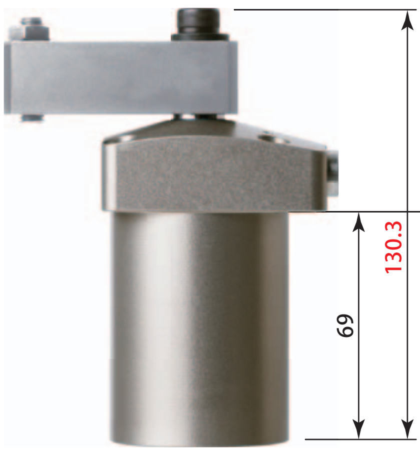


Flange area
approx. **52%**

2 size smaller

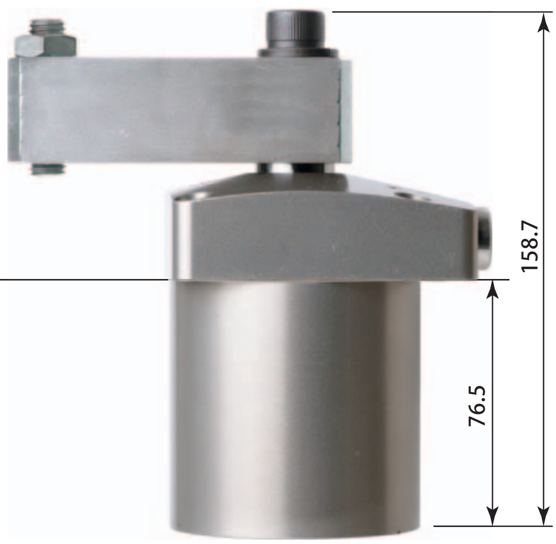


Less space



Height
approx. **82%**

Size smaller



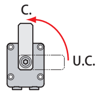
Stroke end　　　　Stroke end

Specifications

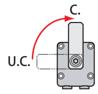
CTY — Size: 25 / 32 / 40 / 50 / 63

Swing direction (when clamping)

L : Counter-clockwise



R : Clockwise



Model			CTY25	CTY32	CTY40	CTY50	CTY63
Cylinder force (air pressure 0.5MPa)		N	650	950	1430	2110	3090
Rod diameter		mm	12	14	16	20	25
Effective area (clamp)		mm^2	1290	1905	2853	4214	6179
Swing angle			90° ±3°				
Positioning pin groove position accuracy			±1°				
Repeated clamp positioning accuracy			±0.5°				
Full stroke		mm	16	17	18	21	24.5
90° swing stroke		mm	8	9	10	13	16.5
Clamp stroke		mm	8	8	8	8	8
Cylinder capacity	Clamp	cm^3	20.6	32.4	51.4	88.5	151.4
	Unclamp	cm^3	22.4	35.0	55.0	95.1	163.4
Mass		kg	0.4	0.49	0.67	1.10	1.70
Recommended tightening torque of mounting screws*1		N·m	4.0	4.0	4.0	5.9	5.9
Recommended tightening torque of cap screw*2		N·m	11	25	25	50	53

● Pressure range：0.1–0.5 MPa ● Proof pressure：0.75 MPa ● Operating temperature：0–70 ℃ ● Fluid used：Air*3

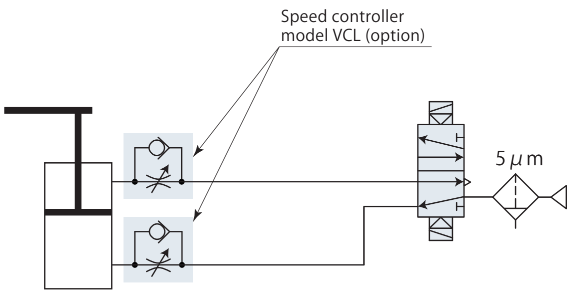
● Oil supply：Not required ● Seals are resistant to chlorine-based cutting fluid. (not thermal resistant specification)

*1：ISO R898 class 12.9

*2：Arm mounting screw

*3：Supply the dry and filtered air. Particulate size 5 μm or less is recommended.

Pneumatic circuit diagram



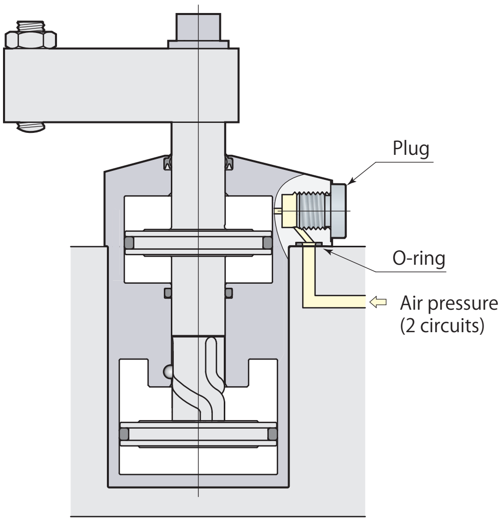
Manifold piping and G port piping are available.

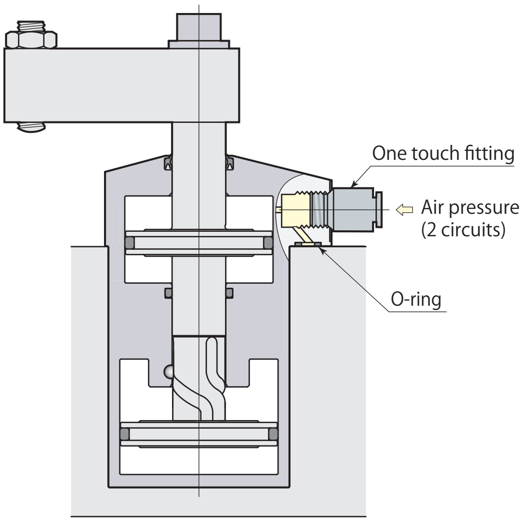
Manifold piping

When choosing manifold piping, a speed controller model VCL is mountable on the G ports of the clamp.

G port piping

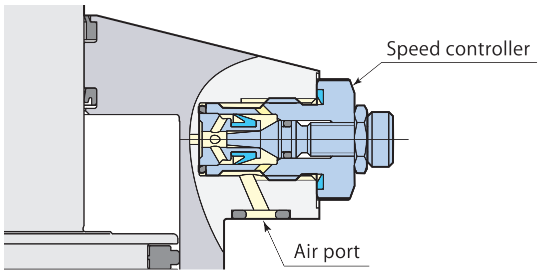
When choosing G port piping, remove plugs. (O-ring must be used.) The one touch fitting or the speed controller with one touch fitting should be mounted when choosing G port piping.



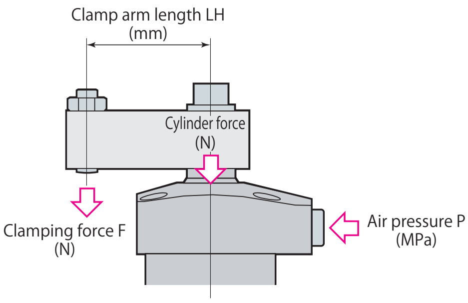


Speed controller model VCL

Page →740



Performance table



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

Clamping force calculation formula
F＝P × 1000/(Coefficient 1＋Coefficient 2 × LH)
F：Clamping force P：Air pressure LH：Clamp arm length

CTY50 with clamp arm length (LH) 60 mm at air pressure of 0.5 MPa, Clamping force F is calculated by
0.5×1000/(0.237+0.00105×60)＝1670 N

Do not use the clamp in the nonusable range. It may cause damage to the cylinder and rod.

model CTY25 Clamping force F=P×1000/(0.775+0.00432×LH)

Air pressure MPa	Cylinder force N	Clamping force N / Clamp arm length LH mm						Max. arm length Max. LH mm
		30	40	50	65	80	100	
0.5	650	550	530	500	470	Nonusable range		70
0.4	520	440	420	400	380	360		98
0.3	390	330	320	300	280	270	250	163
0.2	260	220	210	200	190	180	170	↑
0.1	130	110	110	100	90	90	80	163

model CTY32 Clamping force F=P×1000/(0.525+0.00283×LH)

Air pressure MPa	Cylinder force N	Clamping force N / Clamp arm length LH mm						Max. arm length Max. LH mm
		35	50	70	90	100	120	
0.5	950	800	750	690	Nonusable range			77
0.4	760	640	600	550	510	500		109
0.3	570	480	450	410	380	370	350	182
0.2	380	320	300	280	260	250	230	190
0.1	190	160	150	140	130	120	120	190

model CTY40 Clamping force F=P×1000/(0.350+0.00180×LH)

Air pressure MPa	Cylinder force N	Clamping force N / Clamp arm length LH mm						Max. arm length Max. LH mm
		50	70	90	110	130	150	
0.5	1430	1140	1050	Nonusable range				75
0.4	1140	910	840	780				105
0.3	860	680	630	590	550	510	480	174
0.2	570	450	420	390	360	340	320	196
0.1	290	230	210	200	180	170	160	196

model CTY50 Clamping force F=P×1000/(0.237+0.00105×LH)

Air pressure MPa	Cylinder force N	Clamping force N / Clamp arm length LH mm						Max. arm length Max. LH mm
		60	80	100	120	140	160	
0.5	2110	1670	1560	1460	Nonusable range			105
0.4	1690	1330	1250	1170	1100	1040		151
0.3	1270	1000	930	880	830	780	740	260
0.2	840	670	620	580	550	520	490	↑
0.1	420	330	310	290	280	260	250	260

model CTY63 Clamping force F=P×1000/(0.162+0.00062×LH)

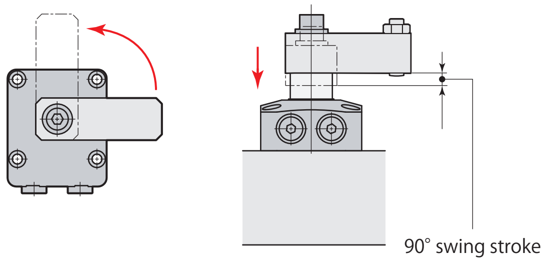
Air pressure MPa	Cylinder force N	Clamping force N / Clamp arm length LH mm						Max. arm length Max. LH mm
		75	90	110	130	150	170	
0.5	3090	2400	2300	2170	2060	1960	Nonusable range	152
0.4	2470	1920	1840	1740	1650	1570	1500	224
0.3	1850	1440	1380	1300	1240	1180	1120	330
0.2	1230	960	920	870	820	780	750	↑
0.1	620	480	460	430	410	390	370	330

Swing speed adjustment

Swing time is restricted by the mass and length of the clamp arm (moment of inertia) since the 90° swing action impacts the cam shaft.

1. Calculate the moment of inertia according to the arm length and mass.
2. Adjust swing speed with speed controller to ensure that 90° swing time of the clamp arm is greater than the shortest swing time in the graph shown below.

● The cam groove may be damaged in case the swing speed is set at the nonusable range in the graph.

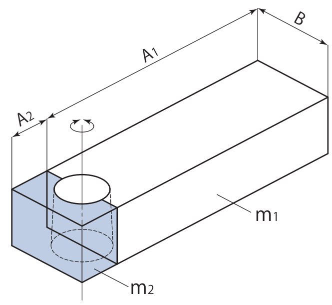


Example of calculation for moment of inertia

$$I = \frac{1}{12} m_1(4A_1^2+B^2) + \frac{1}{12} m_2(4A_2^2+B^2)$$

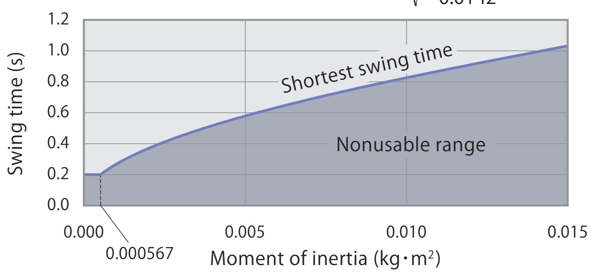
I : Moment of inertia ($kg \cdot m^2$)

m: Mass (kg)



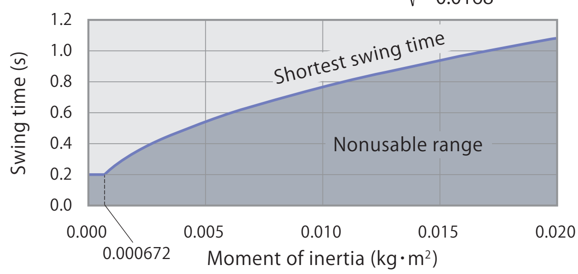
model CTY25

Shortest swing time calculation formula $t = \sqrt{\frac{I}{0.0142}}$



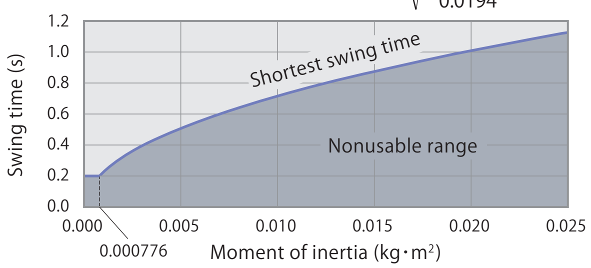
model CTY32

Shortest swing time calculation formula $t = \sqrt{\frac{I}{0.0168}}$



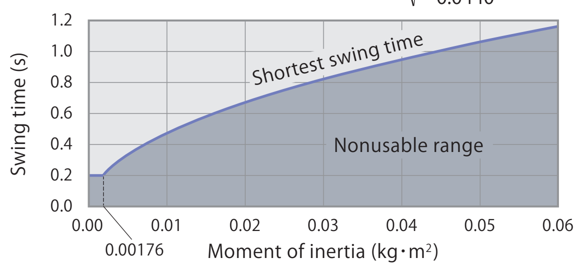
model CTY40

Shortest swing time calculation formula $t = \sqrt{\frac{I}{0.0194}}$



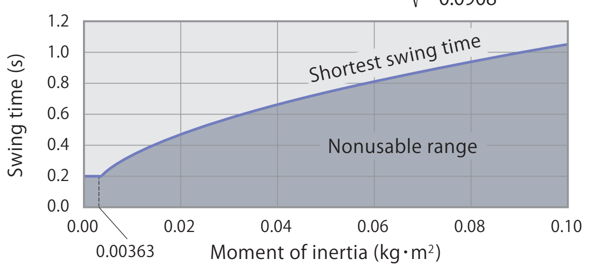
model CTY50

Shortest swing time calculation formula $t = \sqrt{\frac{I}{0.0440}}$

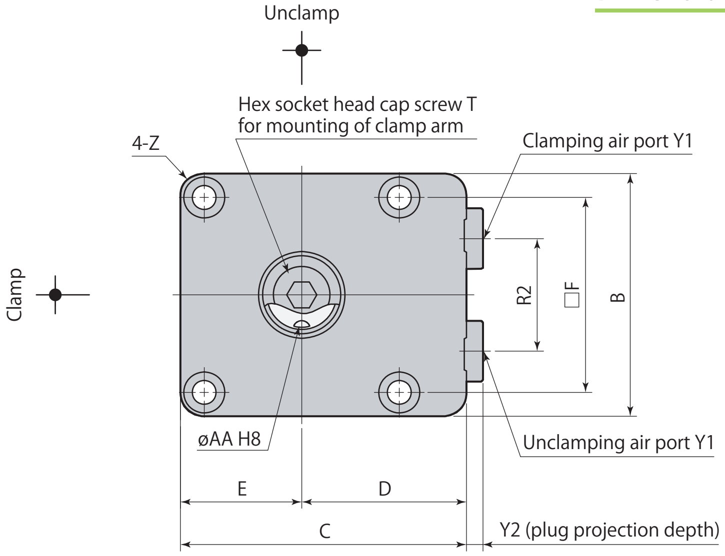


model CTY63

Shortest swing time calculation formula $t = \sqrt{\frac{I}{0.0908}}$

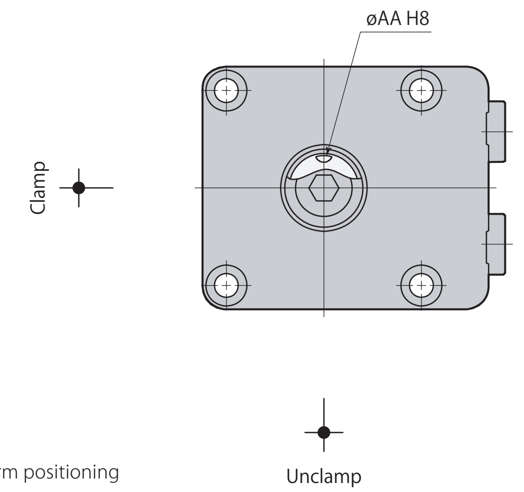


Dimensions

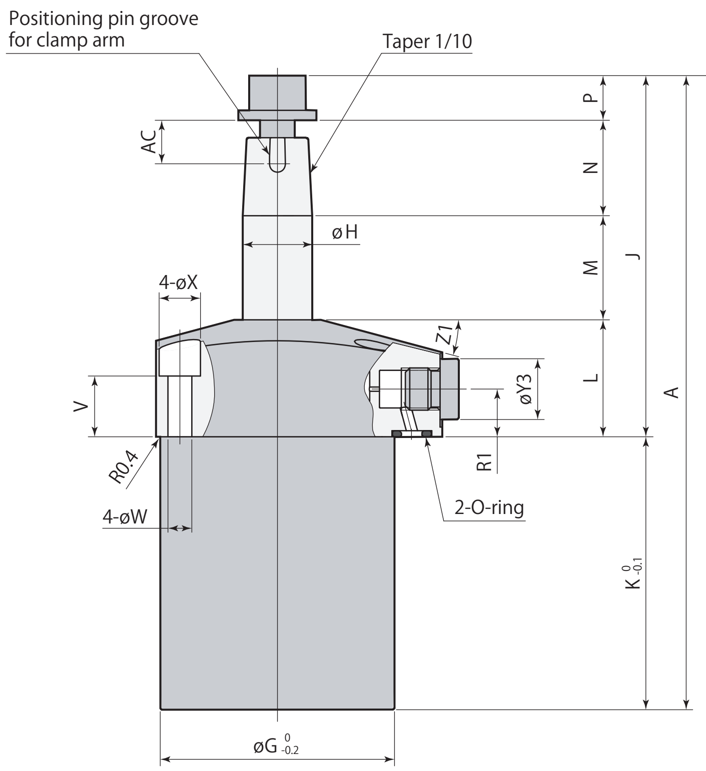


This diagram indicates the arm positioning pin groove at unclamped condition.

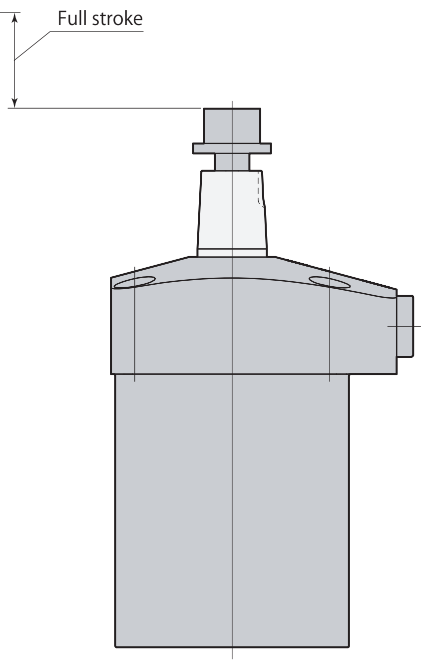
Swing direction L (counter-clockwise)



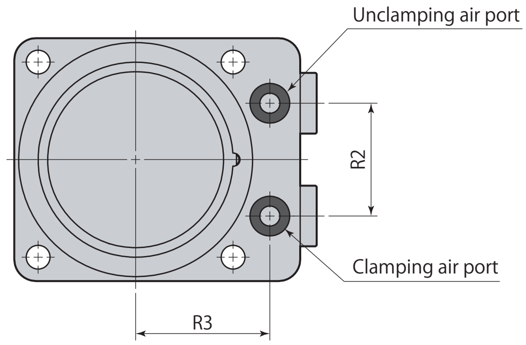
Swing direction R (clockwise)



Unclamp



Stroke end



● Clamp arm, positioning pin and mounting screws are not included.

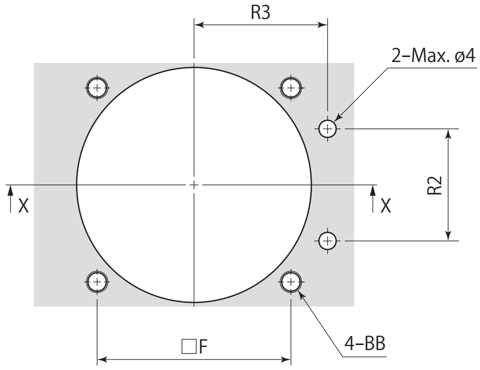
mm

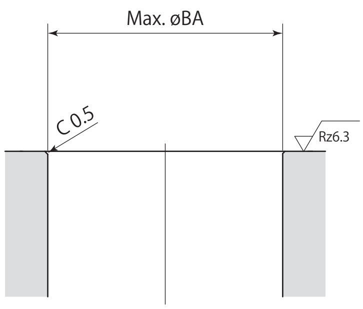
Model		CTY25-□	CTY32-□	CTY40-□	CTY50-□	CTY63-□
A		131.8	141.3	148.3	171.7	195.7
B		45	50	56	66	78
C		54	60	66	80	91
D		31.5	35	38	47	52
E		22.5	25	28	33	39
F		34	39	45	53	65
øG		39	46	54	64	77
øH		12	14	16	20	25
J		69.3	75.3	79.3	95.2	105.7
K		62.5	66	69	76.5	90
L		27	27	27	32	32
M		18	19	20	23	26.5
N (arm thickness)		16	19	22	27	32
P		8.3	10.3	10.3	13.2	15.2
R1		11	11	11	12.5	12.5
R2		18	20	26	30	40
R3		26	28	31	36	41
T		M6×1 length 20	M8×1.25 length 16	M8×1.25 length 16	M10×1.5 length 20	M12×1.75 length 25
V		14	14	14	17	16
øW		5.5	5.5	5.5	6.8	6.8
øX		9.5	9.5	9.5	11	11
Y1		G1/8	G1/8	G1/8	G1/4	G1/4
Y2		3.8	3.8	3.8	4.8	4.8
øY3		14	14	14	19	19
Z		R5	R5	R5	R6	R6
Z1		15°	15°	15°	14°	13°
øAA (pin groove diameter)		$3^{+0.014}_{0}$	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$5^{+0.018}_{0}$
AC		10.5	10.5	10.5	12.5	12.5
Positioning pin (dowel pin)		ø3(h8)×10	ø4(h8)×10	ø4(h8)×10	ø5(h8)×12	ø5(h8)×12
O-ring (fluorocarbon hardness Hs90)		P6	P6	P6	P6	P6
Taper sleeve		CTH25-XS	CTH32-XS	CTH40-XS	CTH50-XS	CTH63-XS
Speed controller*	Meter-in	VCL01-I	VCL01-I	VCL01-I	VCL02-I	VCL02-I
	Meter-out	VCL01-O	VCL01-O	VCL01-O	VCL02-O	VCL02-O

*:Select the right model of VCL according to the size of the clamp.
Refer to each page for the details of options.

● Taper sleeve **page →736** ● Speed controller **page →740**

Mounting details





X-X

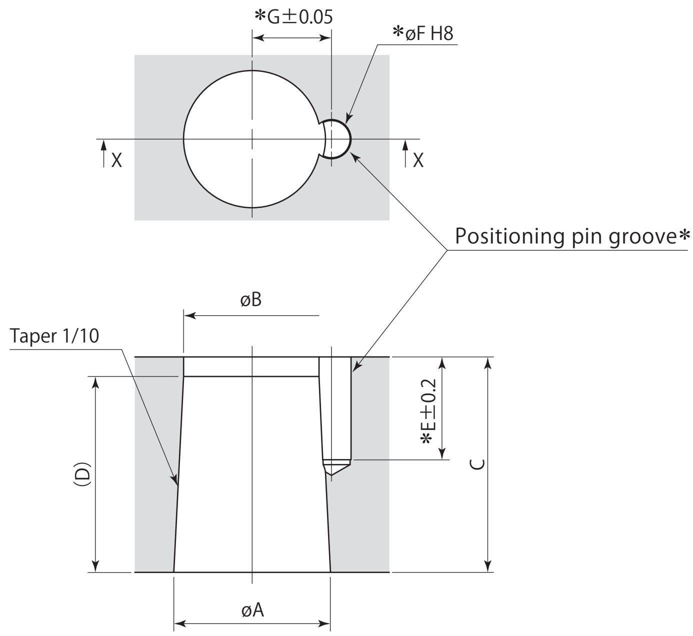
Rz: ISO4287(1997)

mm

Model	CTY25-□	CTY32-□	CTY40-□	CTY50-□	CTY63-□
F	34	39	45	53	65
R2	18	20	26	30	40
R3	26	28	31	36	41
øBA	39.5	46.5	54.5	64.5	77.5
BB	M5	M5	M5	M6	M6

Clamp arm mounting details

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



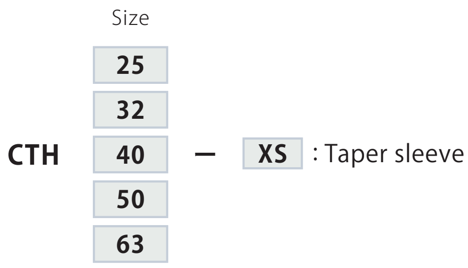
X-X

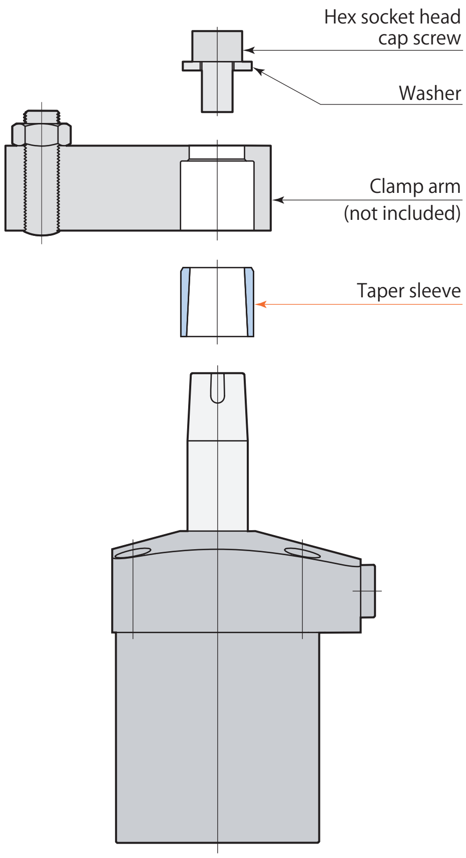
*: No need to machine the pin groove (E, øF, G) unless positioning pin is used for the arm.
The positioning pin enables a clamp arm to locate on the clamp firmly and easily.

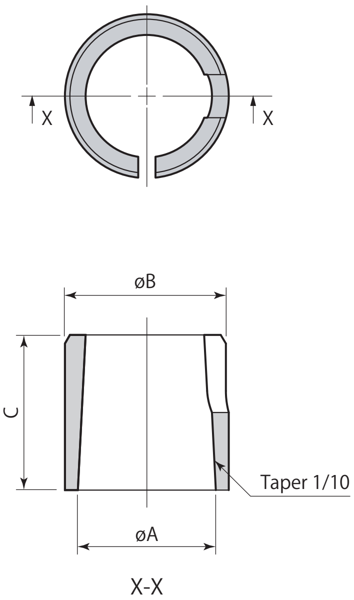
mm

Swing clamp	CTY25-□	CTY32-□	CTY40-□	CTY50-□	CTY63-□
øA	$12^{-0.016}_{-0.034}$	$14^{-0.016}_{-0.034}$	$16^{-0.016}_{-0.034}$	$20^{-0.020}_{-0.041}$	$25^{-0.020}_{-0.041}$
øB	10.5	12.6	14	17.8	22.4
C	16	19	22	27	32
D	15	14	20	22	26
E	10.5	10.5	10.5	12.5	12.5
øF (pin groove diameter)	$3^{+0.014}_{0}$	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$5^{+0.018}_{0}$
G	6.1	7.1	8.1	10.1	12.6

Taper sleeve







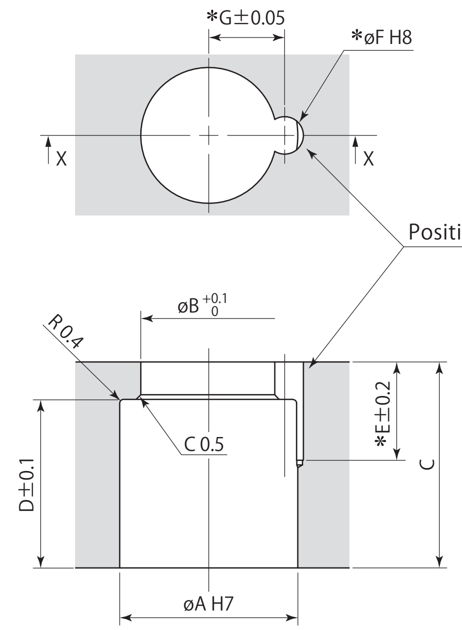
mm

Taper sleeve	CTH25-XS	CTH32-XS	CTH40-XS	CTH50-XS	CTH63-XS
Applicable swing clamp	CTY25-□	CTY32-□	CTY40-□	CTY50-□	CTY63-□
øA	12	14	16	20	25
øB	14.5	17	19	24	29
C	10	14	18	22	26

Clamp arm mounting details

(Using taper sleeve)

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



X-X

*：No need to machine the pin groove (E, øF, G) unless positioning pin is used for the arm.
The positioning pin enables a clamp arm to locate on the clamp firmly and easily.

mm

Taper sleeve	CTH25-XS	CTH32-XS	CTH40-XS	CTH50-XS	CTH63-XS
Applicable swing clamp	CTY25-□	CTY32-□	CTY40-□	CTY50-□	CTY63-□
øA	$14.5^{+0.018}_{0}$	$17^{+0.018}_{0}$	$19^{+0.021}_{0}$	$24^{+0.021}_{0}$	$29^{+0.021}_{0}$
øB	10.5	13	14.5	18.5	23
C	16	19	22	27	32
D	10	14	18	22	26
E	10.5	10.5	10.5	12.5	12.5
øF (pin groove diameter)	$3^{+0.014}_{0}$	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$5^{+0.018}_{0}$
G	6.1	7.1	8.1	10.1	12.6

Mounting & dismounting of clamp arm

- Swing clamp may be damaged if excessive torque is applied, since structure is intended for swinging using cam mechanism with lead grooves. Follow instructions shown below to prevent excessive torque from being applied on piston rod when mounting or dismounting clamp arm.

- Be sure to tighten the hex socket head cap screw with recommended tightening torque. If the tightening torque is insufficient, clamp arm may slip during operation.

Model		CTY25	CTX32 CTY32	CTX40 CTY40	CTX50 CTY50	CTX63 CTY63
Recommended tightening torque of cap screw	N･m	11	25	25	50	53

Mounting of clamp arm

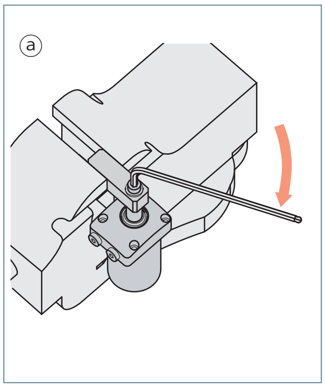
ⓐ Fix the clamp arm in a vise, then set the clamp body and clamp arm at the desired orientation, and tighten the hex socket head cap screw with a hex wrench.

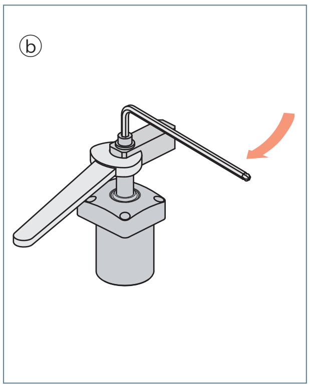
ⓑ For clamps that are mounted on jig, set clamp arm at desired orientation, and hold it with a wrench not to rotate piston rod, and then tighten screw on the piston rod with a hex wrench.

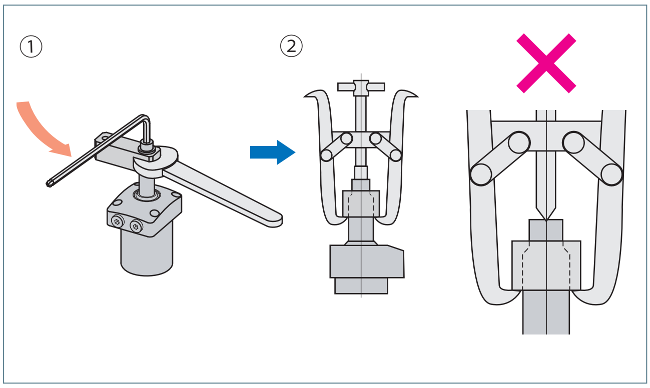
Dismounting of clamp arm

① Hold the clamp arm with a wrench not to rotate piston rod, and then loosen screw on the piston rod with a hex wrench.

② After dismounting hex socket head cap screw, pull out clamp arm using gear puller. A flat saddle type of gear puller should be used when removing an arm not to enlarge the hole on the tip of the piston rod. In addition, be careful not to rotate the rod when removing the arm.







Specifications

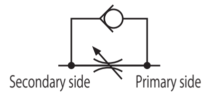
I : Meter-in

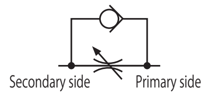
Locknut color : Silver

O : Meter-out

Locknut color : Black

	G port size		Control method
VCL	01 : G1/8 02 : G1/4	–	I : Meter-in O : Meter-out

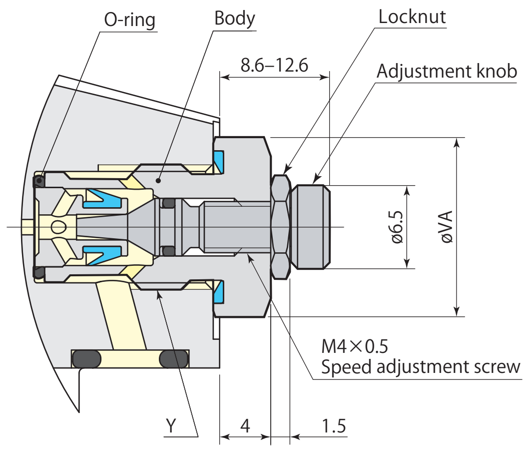


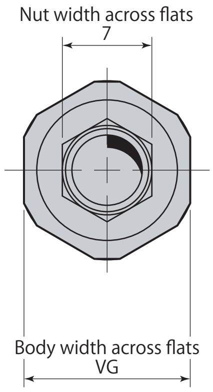


Model	VCL01-I	VCL01-O	VCL02-I	VCL02-O
G port size	G1/8		G1/4	
Orifice area mm²	2.8		6.2	
Recommended tightening torque N･m	7		15	
Mass kg	0.01		0.02	

● Pressure range : 0.1–1.0 MPa ● Proof pressure : 1.5 MPa ● Operating temperature : 0–70 ℃ ● Fluid used : Air*

* : Supply the dry and filtered air. Particulate size 5 μm or less is recommended.





mm

Model	VCL01	VCL02
Y	G1/8	G1/4
øVA	14	19
VG	13	17
Adjustment screw number of turns	8 rotations	
O-ring*1	6.0×1.0*2	8.0×1.0*2

*1 : Fluorocarbon hardness Hs90
*2 : Inner diameter × Thickness

● Use a closed wrench or socket wrench for mounting and dismounting.

● Speed controller can be mounted on air port (G port) when using manifold piping.

● This diagram depicts mounted condition for meter-out (VCL□-O).

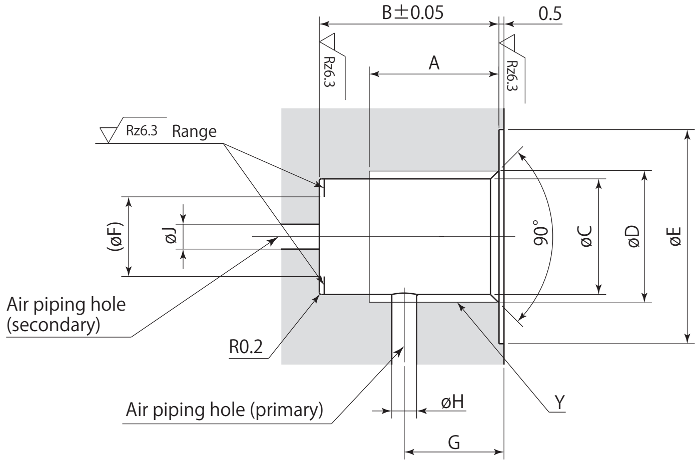
● VCL is shipped with the valve fully open. Adjust the flow rate by loosening the screw after it is tighted up to close the valve. Tighten the locknut after adjustment is completed.

Applicable clamp

Model	VCL01	VCL02
Air swing clamp	CTX32, CTX40 CTY25, CTY32, CTY40	CTX50, CTX63 CTY50, CTY63
Air link clamp	CLX32, CLX40 CLY32, CLY40*	CLX50, CLX63 CLY50, CLY63*

* : Air link clamp boost model CLY are meter-out only.

Mounting details



mm

Model	VCL01	VCL02
A	9	13
B	14	18
øC	$8.7^{+0.1}_{0}$	$11.6^{+0.1}_{0}$
øD	9.9	13.3
øE	17.5	21.5
øF	6	8
G	8–11	9–12.5
øH	2	3
øJ	2	3
Y	G1/8	G1/4

Rz: ISO4287(1997)

Mounting & dismounting of speed controller

- When mounting or dismounting a speed controller, be sure to set pressure within air circuit to 0 MPa before starting.
- When mounting a speed controller, be sure to tighten it with the recommended tightening torque.

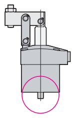
air **Link clamp**	model **CLX-T** **Page →744** 	model **CLX** **Page →762** 	model **CLY** **Page →776** 
Specifications	air Double acting	air Double acting	air Double acting
Features	Built-in sensor model	Standard model	Boost model
Variations: 3 point sensor model 	CLX-T **Page →756**	—	—
Variations: Standard (without sensor) 	—	CLX **Page →770**	CLY **Page →784**
Variations: Dual rod 	—	CLX-E **Page →773**	—
Option: Speed controller 	VCL **Page →790**		

Table of contents

Sensing air Link clamp

Double acting 1 MPa

model CLX-T

3 point sensor model
model CLX50-FT

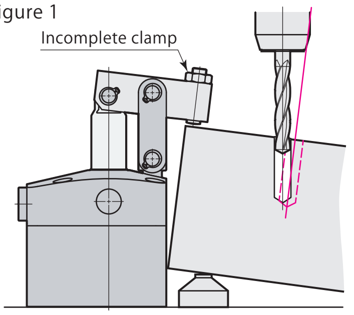
Sensing air Link clamp model CLX-T

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

3 point sensor model

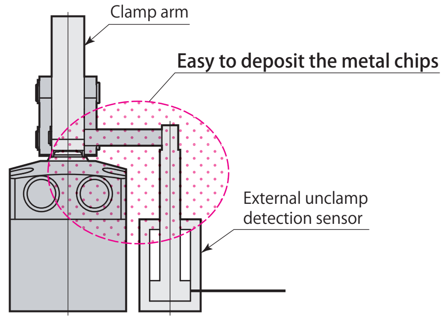
- Sensor model can prevent tool breakage and defective machining due to incomplete clamp. (Figure 1)
- Unclamp PAL sensor moves along with the piston rod and can positively detect unclamping point, thereby enabling a high-speed production line by fully synchronizing operation with workpiece lifters.
- 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



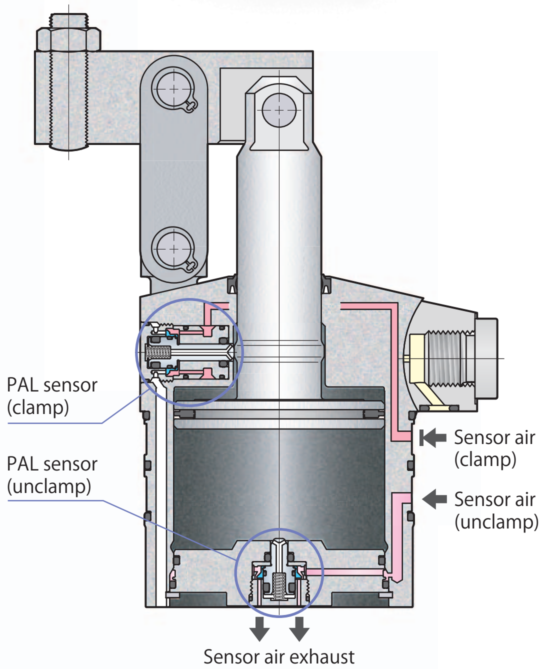
3 point sensor model T

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

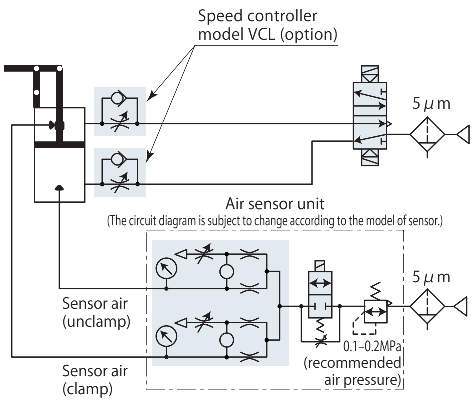
model **CLX□-□T** PAT.

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 →752–755** for the details.



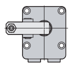
Pneumatic circuit diagram

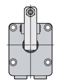


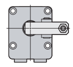
Specifications page → 748
Piping page → 749
PAL sensor page → 752
Dimensions page → 756
Mounting details page → 758

Specifications

CLX — Size: 32 / 40 / 50 / 63 — Clamp arm mounting direction:

L : Left side 

F : Front side 

R : Right side 

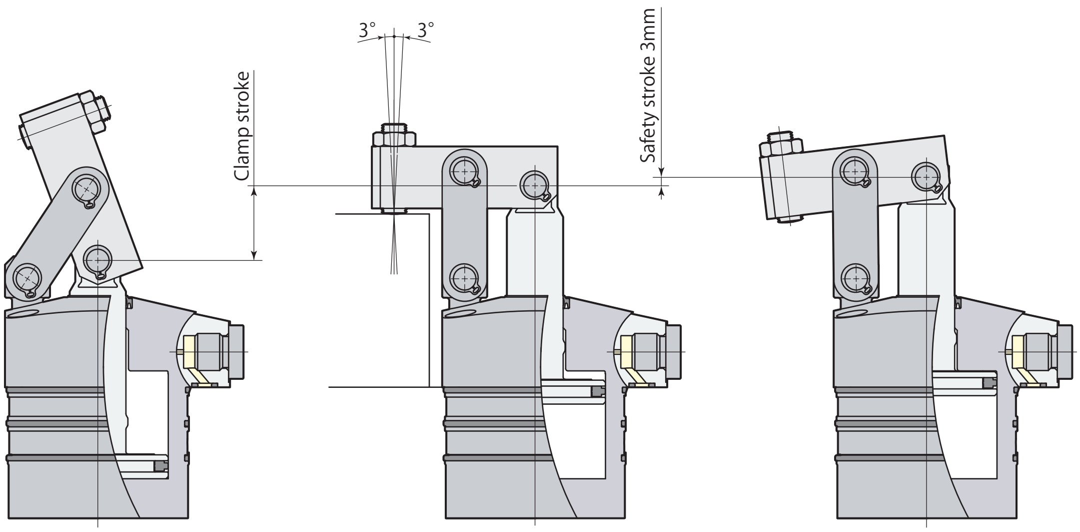
T : 3 point sensor model
Clamp, Unclamp, Over clamp stroke (Incomplete clamp) detection

Model			CLX32-□T	CLX40-□T	CLX50-□T	CLX63-□T
Cylinder force (air pressure 0.5MPa)		N	400	630	980	1560
Cylinder inner diameter		mm	32	40	50	63
Rod diameter		mm	14	16	20	25
Effective area (clamp)		mm^2	804	1257	1963	3117
Full stroke		mm	24	26	29.5	34.5
Clamp stroke*1		mm	21	23	26.5	31.5
Safety stroke		mm	3	3	3	3
Cylinder capacity	Clamp	cm^3	19.3	32.7	57.9	107.5
	Unclamp	cm^3	15.6	27.4	48.7	90.6
Mass		kg	0.44	0.59	0.99	1.54
Recommended tightening torque of mounting screws*2		N·m	4.0	4.0	5.9	5.9

● Pressure range：0.1–1 MPa ● Proof pressure：1.5 MPa ● Operating temperature：0–70 ℃ ● Fluid used：Air*3
● Oil supply：Not required ● 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 ∗3：Supply the dry and filtered air. Particulate size 5 μm or less is recommended.

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)

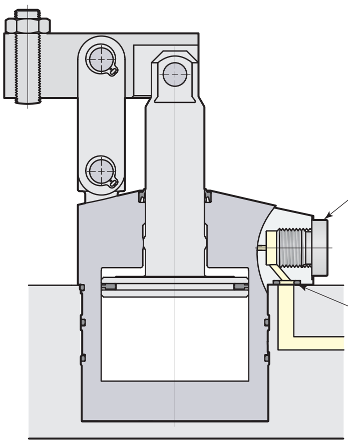
Manifold piping and G port piping are available.

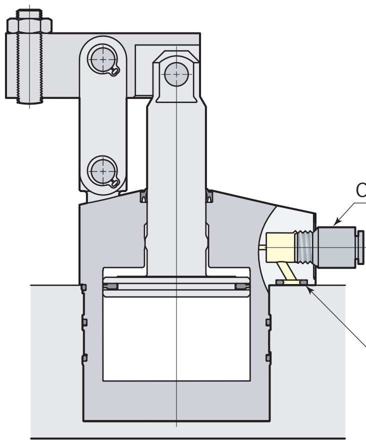
Manifold piping

When choosing manifold piping, a speed controller model VCL is mountable on the G ports of the clamp.

G port piping

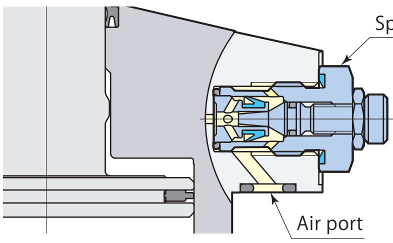
When choosing G port piping, remove plugs. (O-ring must be used.) The one touch fitting or the speed controller with one touch fitting should be mounted when choosing G port piping.



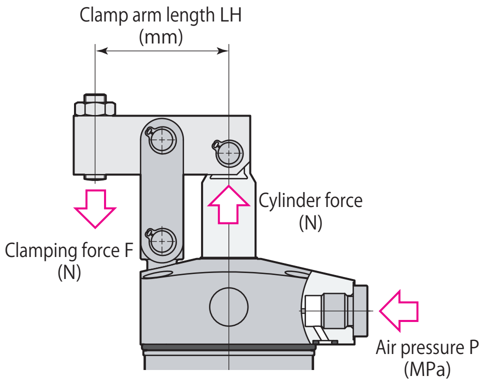


Speed controller model VCL

Page →790



Performance diagram



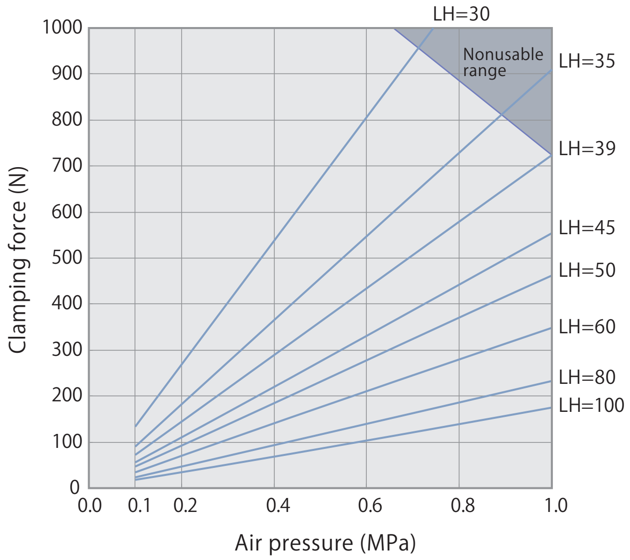
Clamping force varies depending on the clamp arm length (LH) and air pressure (P).

Clamping force calculation formula
F = Coefficient 1 × P × 1000/ (LH - Coefficient 2)
F : Clamping force P : Air pressure LH : Clamp arm length

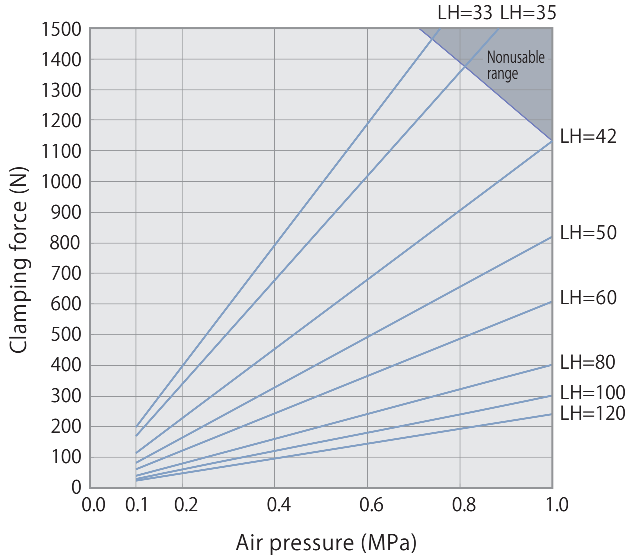
CLX50-T with clamp arm length (LH) 50 mm at air pressure of 0.5 MPa, Clamping force F is calculated by
44.18×0.5×1000/(50-25.0)=880 N

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

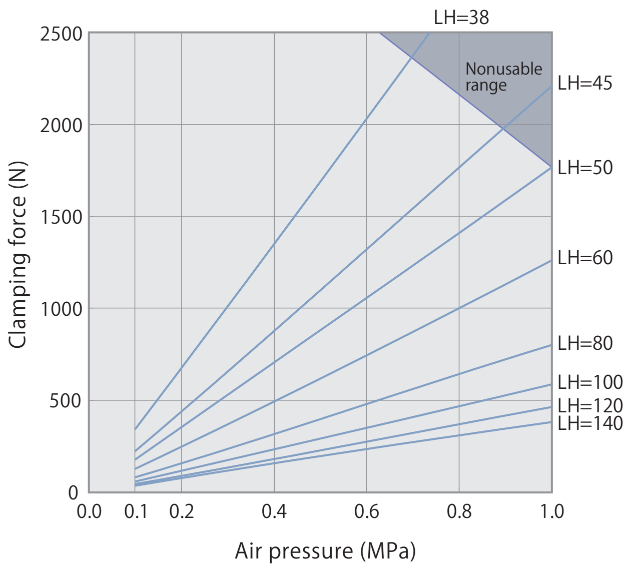
model CLX32-□T



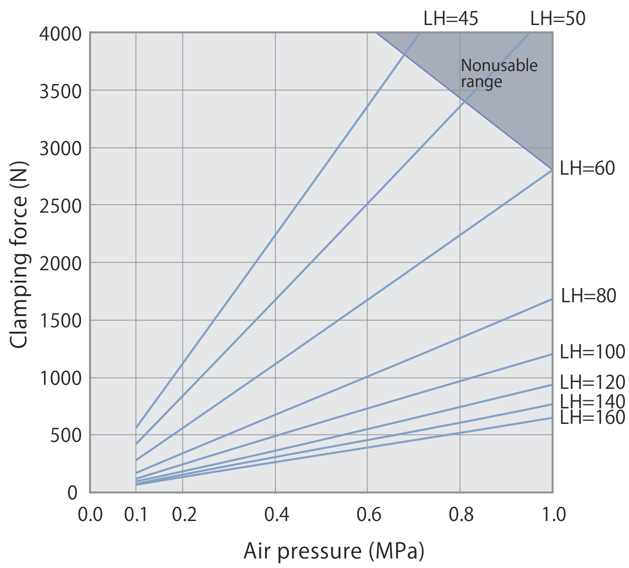
model CLX40-□T



model CLX50-□T



model CLX63-□T



Performance table

model CLX32-□T Clamping force F=14.11×P×1000/(LH-19.5)

Air pressure MPa	Cylinder force N	Clamping force N / Clamp arm length LH mm: 30	35	39	45	50	60	80	100	Min. arm length Min. LH mm
1.0	800			720	550	460	350	230	180	39
0.9	720			650	500	420	310	210	160	36
0.8	640		730	580	440	370	280	190	140	33
0.7	560	940	640	510	390	320	240	160	120	30
0.6	480	810	550	430	330	280	210	140	110	28
0.5	400	670	460	360	280	230	170	120	90	26
0.4	320	540	360	290	220	190	140	90	70	↑
0.3	240	400	270	220	170	140	100	70	50	↑
0.2	160	270	180	140	110	90	70	50	40	↑
0.1	80	130	90	70	60	50	30	20	20	26

▒ indicates nonusable range

model CLX40-□T Clamping force F=23.75×P×1000/(LH-21.0)

Air pressure MPa	Cylinder force N	Clamping force N / Clamp arm length LH mm: 33	35	42	50	60	80	100	120	Min. arm length Min. LH mm
1.0	1260			1130	820	610	400	300	240	42
0.9	1130			1020	740	550	360	270	220	38
0.8	1010		1360	900	660	490	320	240	190	35
0.7	880	1390	1190	790	570	430	280	210	170	32
0.6	750	1190	1020	680	490	370	240	180	140	30
0.5	630	990	850	570	410	300	200	150	120	29
0.4	500	790	680	450	330	240	160	120	100	↑
0.3	380	590	510	340	250	180	120	90	70	↑
0.2	250	400	340	230	160	120	80	60	50	↑
0.1	130	200	170	110	80	60	40	30	20	29

▒ indicates nonusable range

model CLX50-□T Clamping force F=44.18×P×1000/(LH-25.0)

Air pressure MPa	Cylinder force N	Clamping force N / Clamp arm length LH mm: 38	45	50	60	80	100	120	140	Min. arm length Min. LH mm
1.0	1960			1770	1260	800	590	470	380	50
0.9	1770			1590	1140	720	530	420	350	46
0.8	1570		1770	1410	1010	640	470	370	310	42
0.7	1370		1550	1240	880	560	410	330	270	39
0.6	1180	2040	1330	1060	760	480	350	280	230	36
0.5	980	1700	1100	880	630	400	290	230	190	34
0.4	790	1360	880	710	500	320	240	190	150	↑
0.3	590	1020	660	530	380	240	180	140	120	↑
0.2	390	680	440	350	250	160	120	90	80	↑
0.1	200	340	220	180	130	80	60	50	40	34

▒ indicates nonusable range

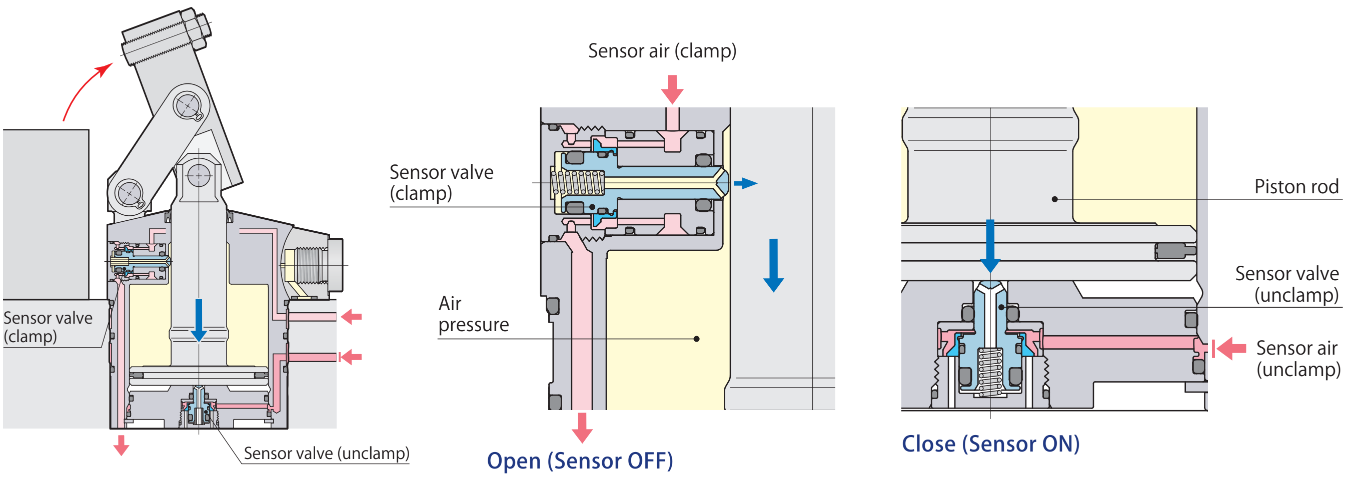
model CLX63-□T Clamping force F=84.16×P×1000/(LH-30.0)

Air pressure MPa	Cylinder force N	Clamping force N / Clamp arm length LH mm: 45	50	60	80	100	120	140	160	Min. arm length Min. LH mm
1.0	3120			2810	1680	1200	940	770	650	60
0.9	2810			2520	1510	1080	840	690	580	55
0.8	2490		3370	2240	1350	960	750	610	520	50
0.7	2180		2950	1960	1180	840	650	540	450	46
0.6	1870	3370	2520	1680	1010	720	560	460	390	43
0.5	1560	2810	2100	1400	840	600	470	380	320	40
0.4	1250	2240	1680	1120	670	480	370	310	260	↑
0.3	940	1680	1260	840	500	360	280	230	190	↑
0.2	620	1120	840	560	340	240	190	150	130	↑
0.1	310	560	420	280	170	120	90	80	60	40

▒ indicates nonusable range

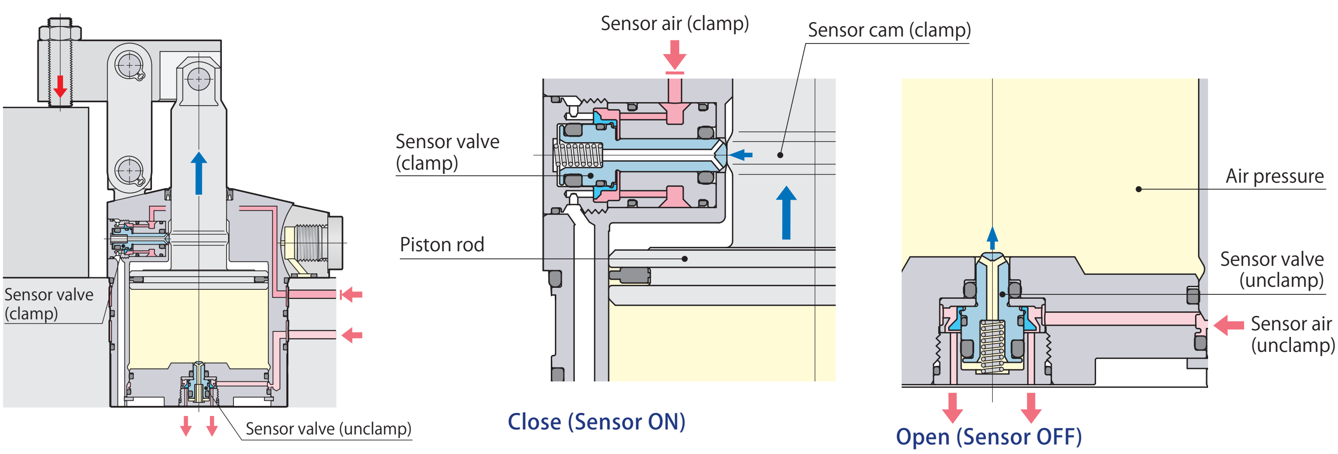
PAL sensor function and structure

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 air pressure to open for air exhaust and detects the unclamped condition.

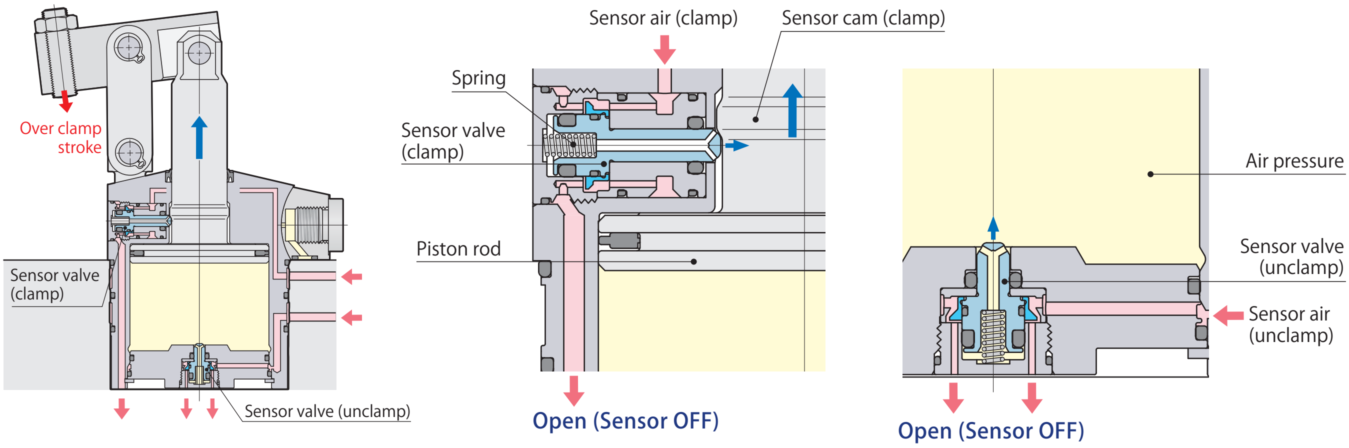
Clamp detection



● 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 air pressure to open for air exhaust and detects the clamped condition.

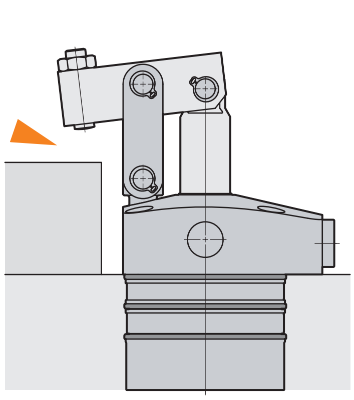
PAL sensor function and structure

Over clamp stroke (Incomplete clamp) detection

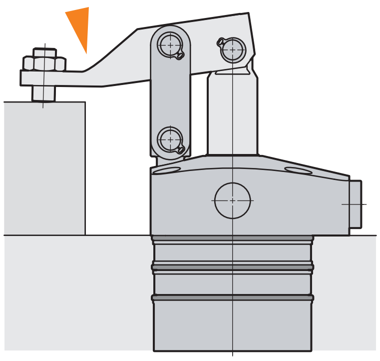


- The sensor cam passes the clamping point, the sensor valve (clamp) is pushed up by the spring and exhausts the sensor air. Also the sensor valve (unclamp) exhausts the air and detects the over clamp stroked (incomplete clamp) condition.

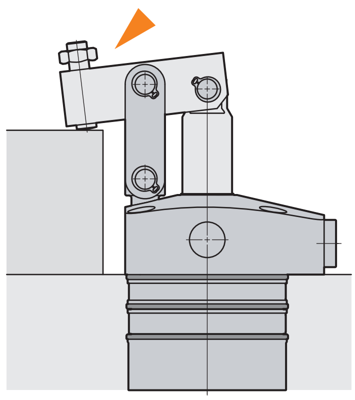
Over clamp stroke (Incomplete clamp) detection example



- Clamp disabled due to missetting workpiece.



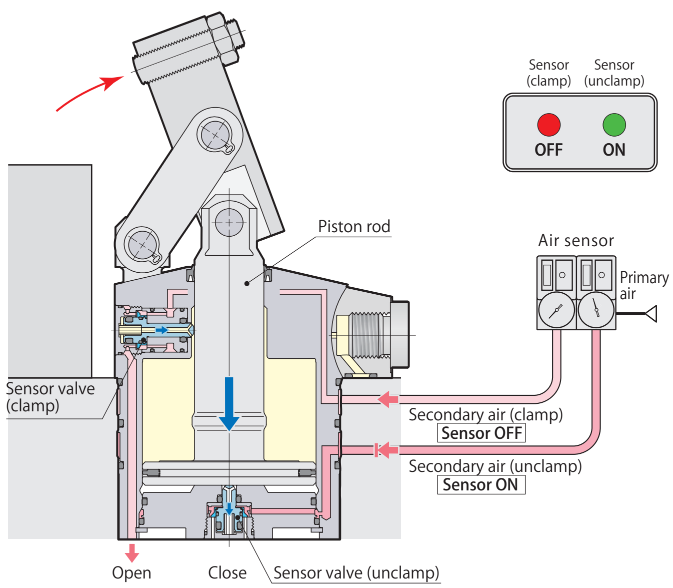
- Clamp disabled due to the deflection of clamp arm.



- 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.

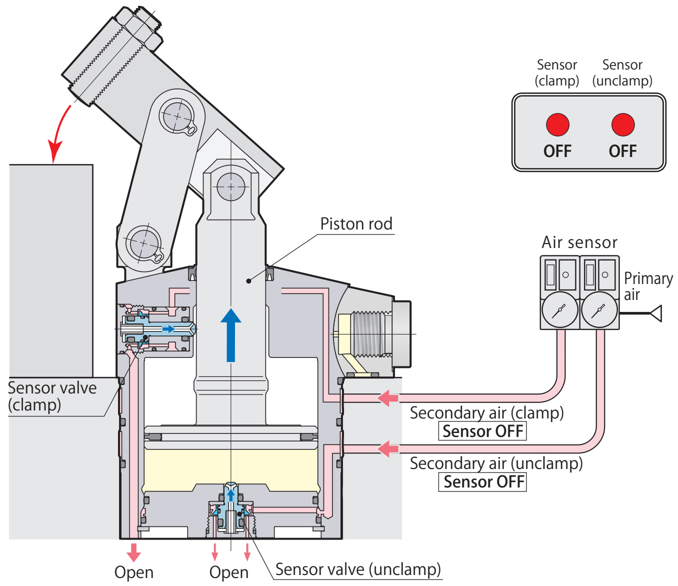
Clamp, Unclamp, Over clamp stroke detection signal

Unclamp detection



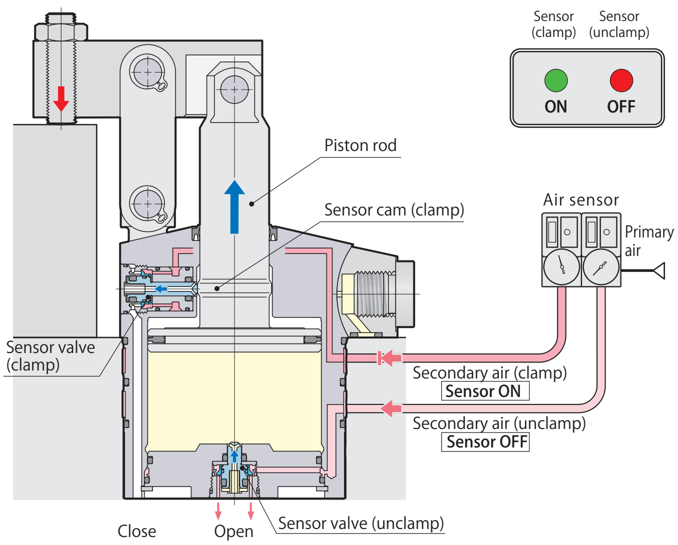
Sensor signal (clamp)	OFF	Unclamp
Sensor signal (unclamp)	ON	

In the middle of clamp stroke



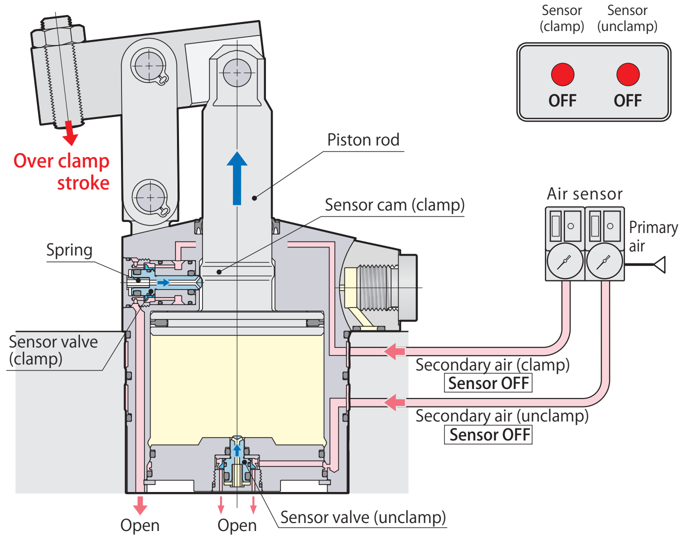
Sensor signal (clamp)	OFF	In the middle of clamp stroke
Sensor signal (unclamp)	OFF	

Clamp detection



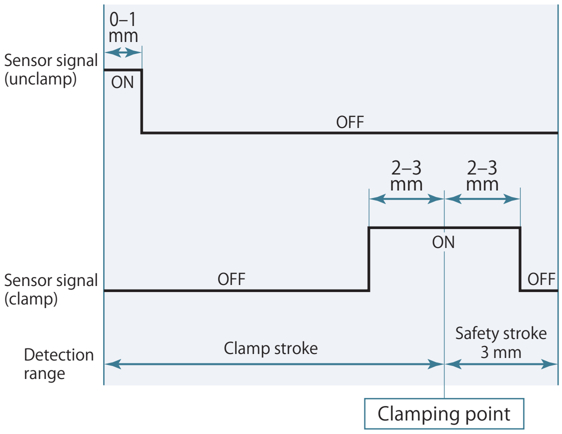
Sensor signal (clamp)	ON	Clamp
Sensor signal (unclamp)	OFF	

Over clamp stroke (Incomplete clamp) detection



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

Air sensor triggering point



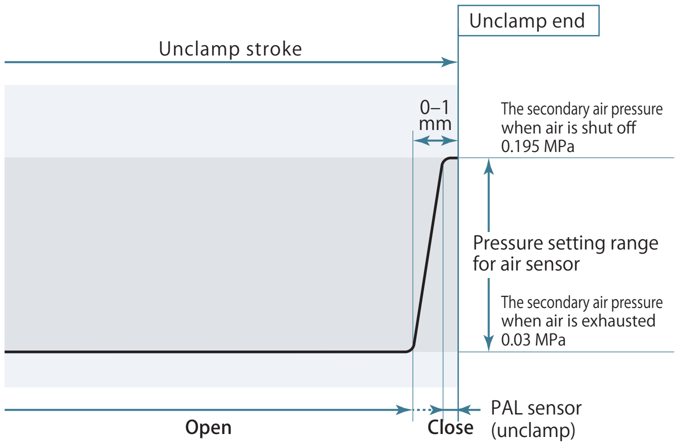
- Refer to the sensor supplier's instruction manual for the details of setting.
- Sensing performance such as detectable time and pressure differs depending on the supplier and model number of the sensor. Select the right model referring to sensor’s application and characteristics.

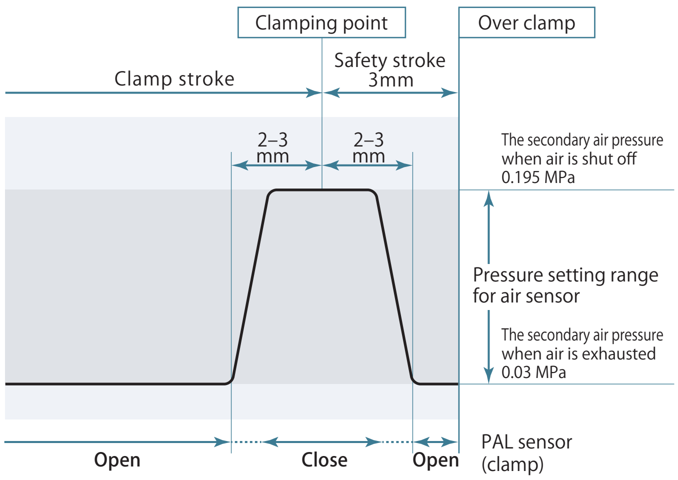
Air sensor unit recommended condition of use

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



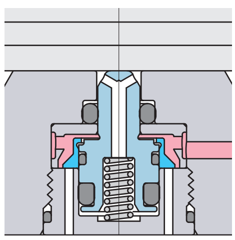


The diagram shown on the left indicates the relation between the PAL sensor, piston stroke, and secondary air pressure. (The pressure shown in the diagram is a reference based on the 0.2 MPa of primary air pressure for one piece of clamp.)

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

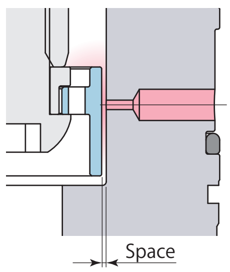
- Enhances the pressure setting range of the sensor which enables the sensor to set easily.
  (Ex. Pressure setting range 0.03–0.195 MPa in the diagram)
- Allows the use for a number of clamps by one air sensor because of better pressure holding when air is shut off. (Maximum number of clamps to be detected 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



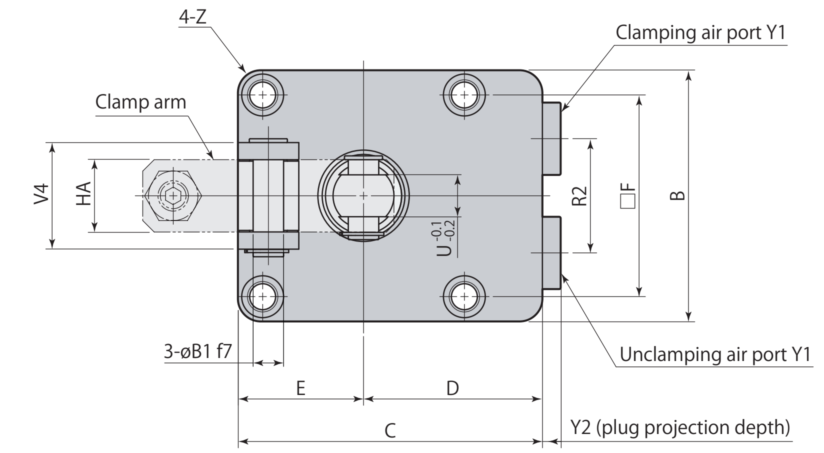
Poppet structure ensures superior sealing performance and can create large differential-pressure when the valve is opening and closing, and air leakage can be minimized.

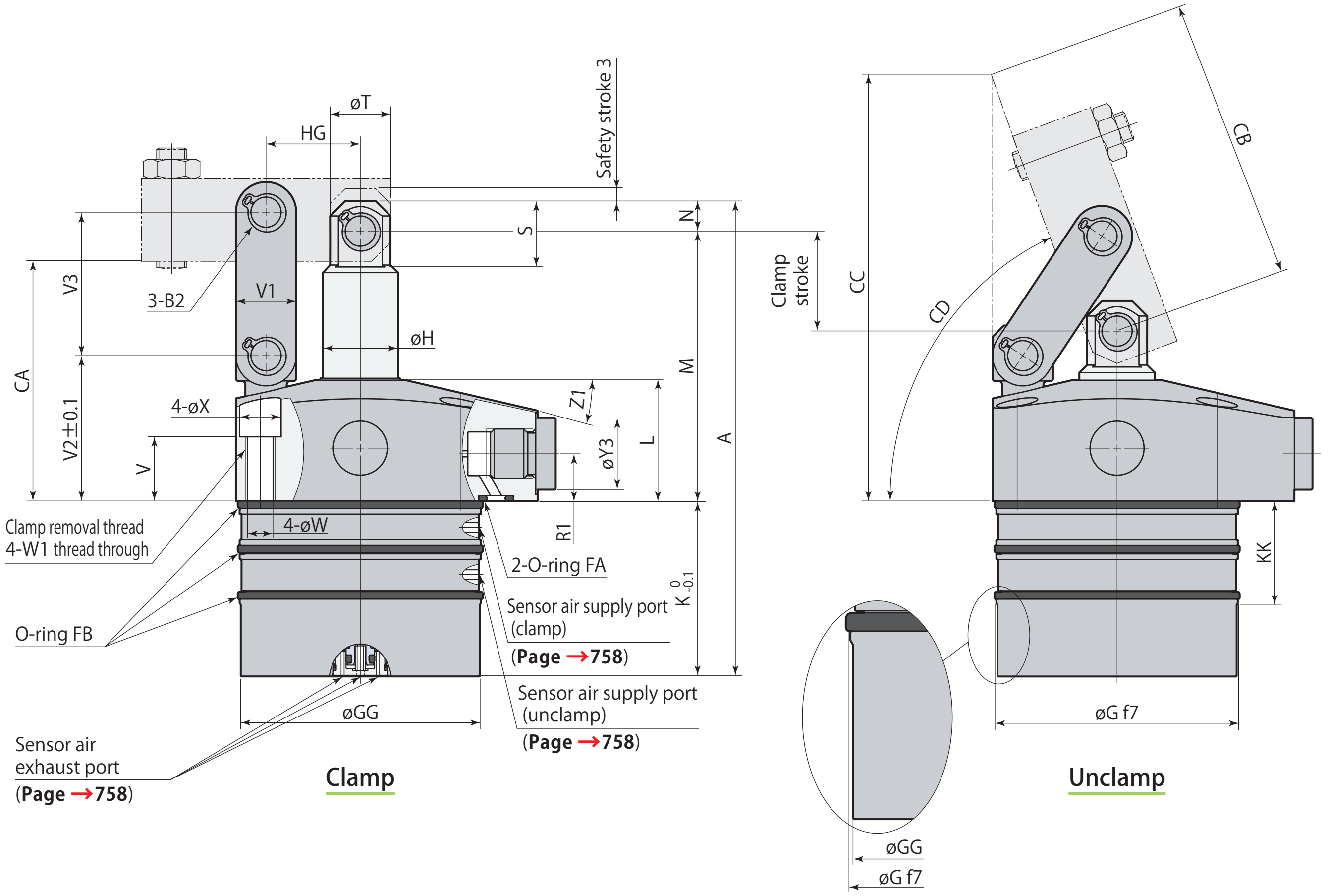
Previous sensor valve



Air leaks easily due to a large space.

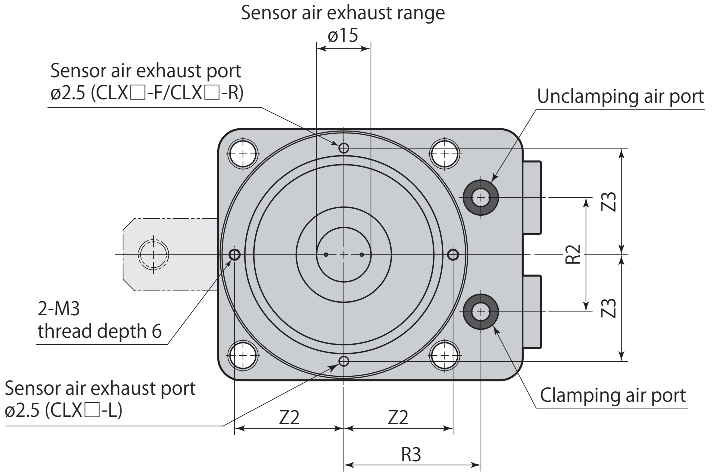
Dimensions





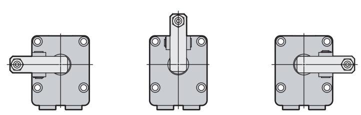
Clamp

Unclamp



- This diagram represents external contour of CLX□-FT, CLX□-LT and CLX□-RT differ only in terms of mounting direction of clamp arm and otherwise all dimensions are identical to those of CLX□-FT.

L：Left side　F：Front side　R：Right side



- Clamp arm and mounting screws are not included.

mm

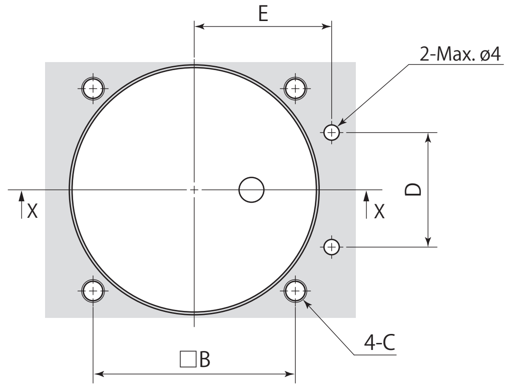
Model	CLX32-□T	CLX40-□T	CLX50-□T	CLX63-□T
A	101.5	110	126	144.5
B	50	56	66	78
C	60	66	80	91
D	35	38	47	52
E	25	28	33	39
F	39	45	53	65
øG	$46^{-0.025}_{-0.050}$	$54^{-0.030}_{-0.060}$	$64^{-0.030}_{-0.060}$	$77^{-0.030}_{-0.060}$
øGG	45.4	53.4	63.4	76.4
øH	14	16	20	25
K	39.5	43	46.5	56
KK	27	27	27	29
L	27	27	32	32
M	57	61	71.5	78.5
N	5	6	8	10
R1	11	11	12.5	12.5
R2	20	26	30	40
R3	28	31	36	41
S	11.5	14	17.5	21.5
øT	11	12	16	21
U (width across flats)	7	8	11	13
V	14	14	17	17
V1	10	12	16	18
V2	31.5	33	38.5	39.5
V3	28.5	32	38	44
V4	20	25	28	34
øW	5.5	5.5	6.8	6.8
W1	M6	M6	M8	M8
øX	9.5	9.5	11	11
Y1	G1/8	G1/8	G1/4	G1/4
Y2	3.8	3.8	4.8	4.8
øY3	14	14	19	19
Z	R5	R5	R6	R6
Z1	15°	15°	13°	13°
Z2	19.5	23.5	28.7	35.3
Z3	19.2	23.2	28	34.7
øB1	$5^{-0.010}_{-0.022}$	$6^{-0.010}_{-0.022}$	$8^{-0.013}_{-0.028}$	$10^{-0.013}_{-0.028}$
B2 (snap ring)*1	STW-5	STW-6	STW-8	STW-10
CA	52	55	63.5	69.5
CB	59.1	72.5	73.3	82.4
CC	89.7	105.2	110.9	120.2
CD	About 70°	About 72°	About 70°	About 68°
HA	14	16	19	22
HG	19.5	21	25	30
O-ring FA (fluorocarbon hardness Hs90)	P6	P6	P6	P6
O-ring FB (fluorocarbon hardness Hs70)	AS568-030	AS568-033	AS568-036	AS568-040
Speed controller*2 Meter-in	VCL01-I	VCL01-I	VCL02-I	VCL02-I
Speed controller*2 Meter-out	VCL01-O	VCL01-O	VCL02-O	VCL02-O

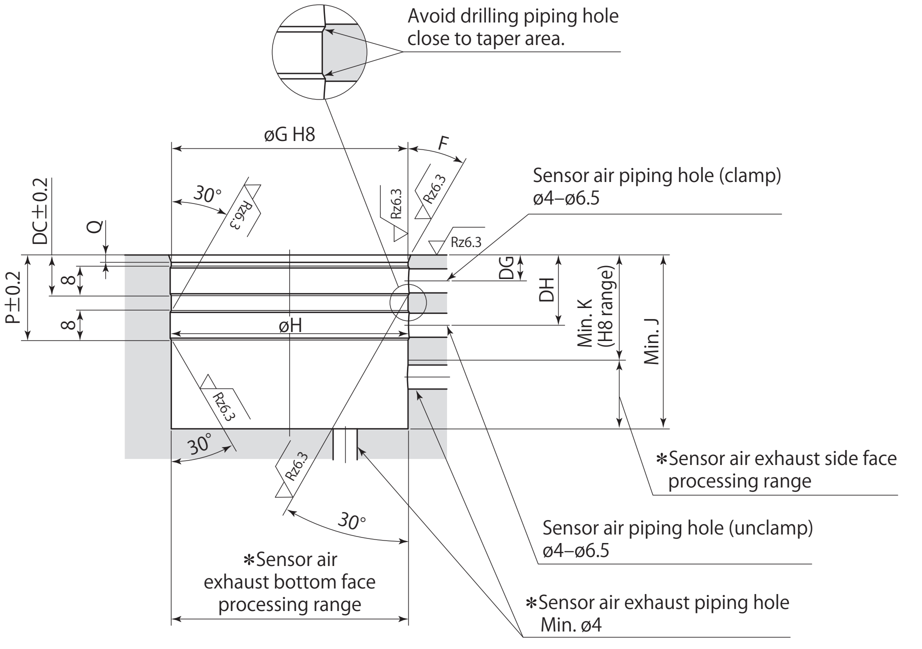
*1：Snap ring is made by Ochiai Corporation.

*2：Select the right model of VCL according to the size of the clamp.

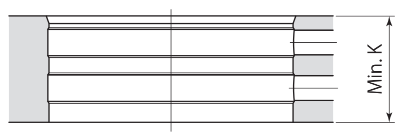
● Refer to **page →790** for the details of speed controller.

Mounting details





In blind hole X-X

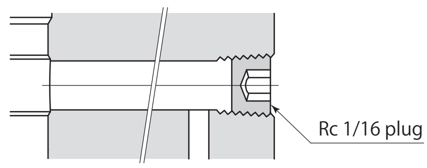


In through hole X-X

∗: 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.
- No sensor air piping hole (unclamp) is needed unless unclamp sensor is used. Contact Pascal for the details.
- The sensor air piping hole can be used for a pilot hole of Rc 1/16 plug.



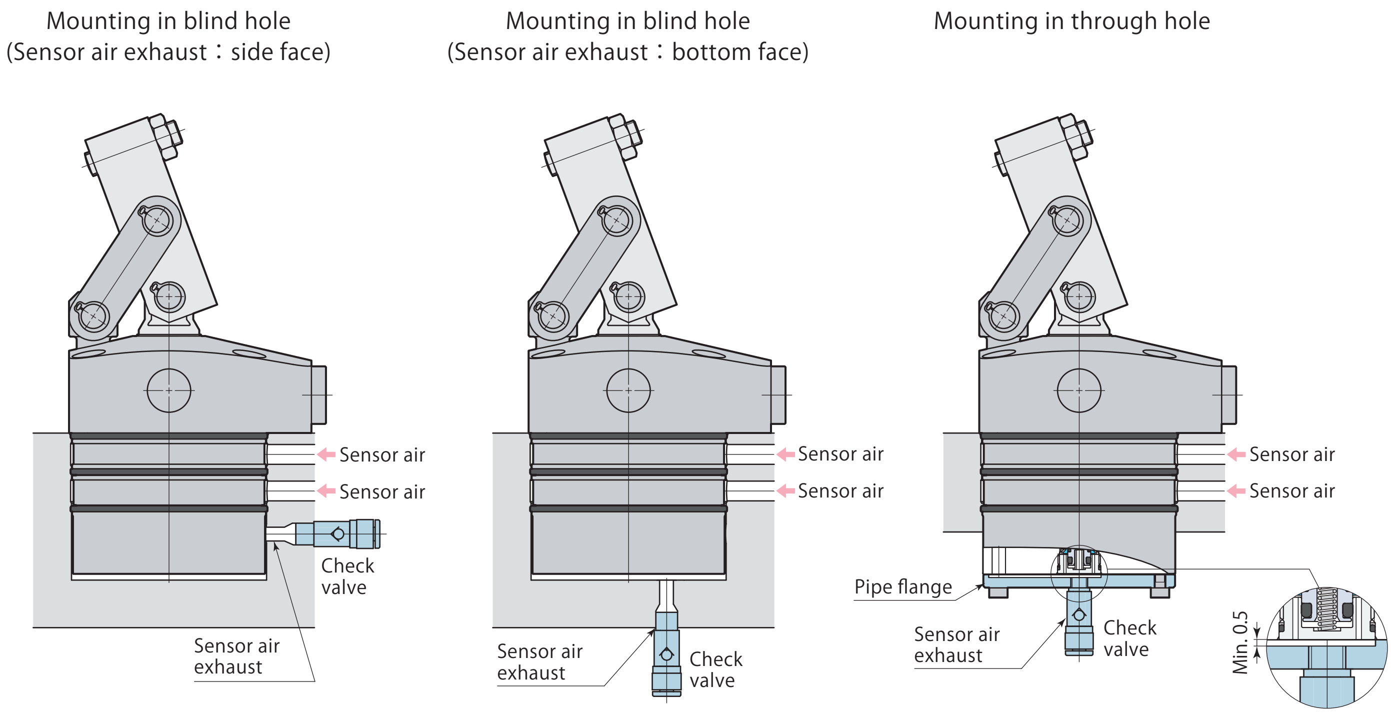
Mounting details

mm

Model	CLX32-□T	CLX40-□T	CLX50-□T	CLX63-□T
B	39	45	53	65
C	M5	M5	M6	M6
D	20	26	30	40
E	28	31	36	41
F	20°	20°	20°	30°
øG	$46^{+0.039}_{0}$	$54^{+0.046}_{0}$	$64^{+0.046}_{0}$	$77^{+0.046}_{0}$
øH	46.6	54.6	64.6	77.6
J	40	43.5	47	56.5
K	28	28	28	30
P	23	23	23	25
Q	2	2	2	1
DC	11	11	11	13
DG	7	7	7	9
DH	19	19	19	21

Caution for piping

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

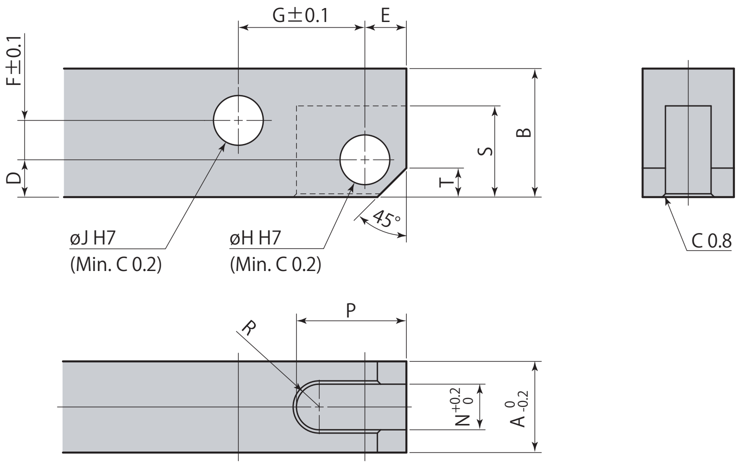


● Use a check valve with cracking pressure of 0.005 MPa or less if there is a risk of metal chips or coolant intrusion. Recommended check valve : AKH or AKB series manufactured by SMC.

● 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 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

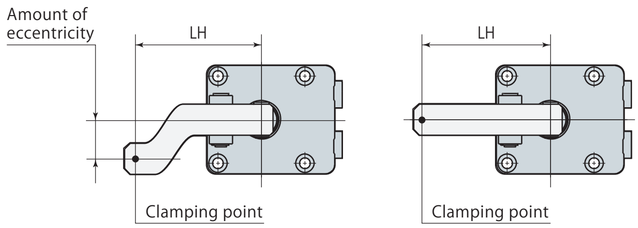
Link clamp	CLX32-□T	CLX40-□T	CLX50-□T	CLX63-□T
A	14	16	19	22
B	16	19	22	25
D	5	6	8	9
E	5	6	8	10
F	3	4	5	5
G	19.5	21	25	30
øH	$5^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$
øJ	$5^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$
N	7	8	11	13
P	16	20	22	27
R	R3.5	R4	R5.5	R6.5
S	12	15	18	22
T	3	4	5	6

● 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 CLX-T, 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 CLX32-□T　▭ indicates nonusable range

Air pressure MPa	Allowable eccentricity mm							
	Clamp arm length LH mm							
	30	35	39	45	50	60	80	100
1.0					7	12	24	35
0.9				8	11	18	32	47
0.8			7	12	17	26	44	60
0.7		7	12	18	24	35	58	↑
0.6	5	12	18	26	34	48	60	↑
0.5	9	19	26	38	47	60	↑	↑
0.4	16	29	39	54	60	↑	↑	↑
0.3	28	46	60	60	↑	↑	↑	↑
0.2	51	60	↑	↑	↑	↑	↑	↑
0.1	60	60	60	60	60	60	60	60

model CLX40-□T　▭ indicates nonusable range

Air pressure MPa	Allowable eccentricity mm							
	Clamp arm length LH mm							
	33	35	42	50	60	80	100	120
1.0				6	13	26	39	53
0.9			5	11	20	36	53	70
0.8			9	17	28	49	70	80
0.7	3	6	15	25	39	65	80	↑
0.6	7	11	23	36	53	80	↑	↑
0.5	14	18	33	51	73	↑	↑	↑
0.4	23	29	50	73	80	↑	↑	↑
0.3	38	47	77	80	↑	↑	↑	↑
0.2	67	80	80	↑	↑	↑	↑	↑
0.1	80	80	80	80	80	80	80	80

model CLX50-□T　▭ indicates nonusable range

Air pressure MPa	Allowable eccentricity mm							
	Clamp arm length LH mm							
	38	45	50	60	80	100	120	140
1.0				10	24	37	51	65
0.9			7	16	33	50	67	85
0.8		7	12	23	44	66	87	100
0.7		12	19	33	59	86	100	↑
0.6	8	20	28	45	79	100	↑	↑
0.5	14	30	41	63	100	↑	↑	↑
0.4	24	45	60	90	↑	↑	↑	↑
0.3	41	70	92	100	↑	↑	↑	↑
0.2	74	100	100	↑	↑	↑	↑	↑
0.1	100	100	100	100	100	100	100	100

model CLX63-□T　▭ indicates nonusable range

Air pressure MPa	Allowable eccentricity mm							
	Clamp arm length LH mm							
	45	50	60	80	100	120	140	160
1.0			4	19	33	48	62	76
0.9			9	27	45	63	81	99
0.8		5	16	38	60	83	105	120
0.7		10	24	52	80	108	120	↑
0.6	9	18	35	71	106	120	↑	↑
0.5	17	28	51	97	120	↑	↑	↑
0.4	29	44	75	120	↑	↑	↑	↑
0.3	48	70	114	↑	↑	↑	↑	↑
0.2	87	120	120	↑	↑	↑	↑	↑
0.1	120	120	120	120	120	120	120	120

Table of contents

air Link clamp

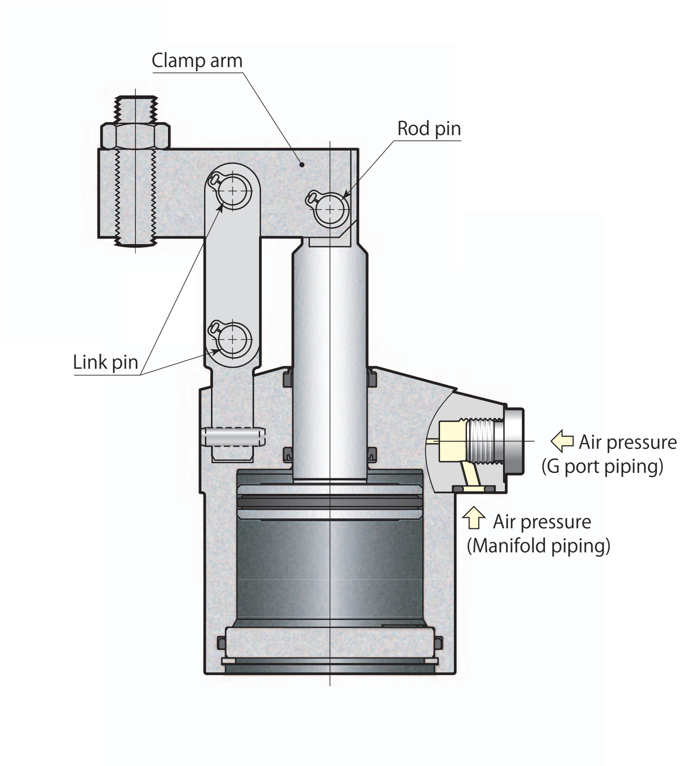
Double acting 1 MPa

model CLX

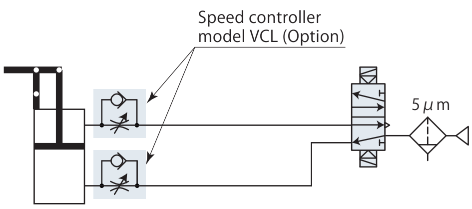
Standard model
model CLX40-F

Standard model

model CLX□-□



Pneumatic circuit diagram

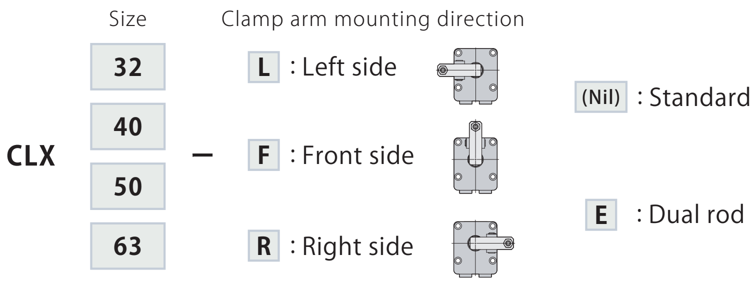


Specifications	page → 766
Piping	page → 767
Standard	page → 770
Dual rod	page → 773

Air link clamp

CLX

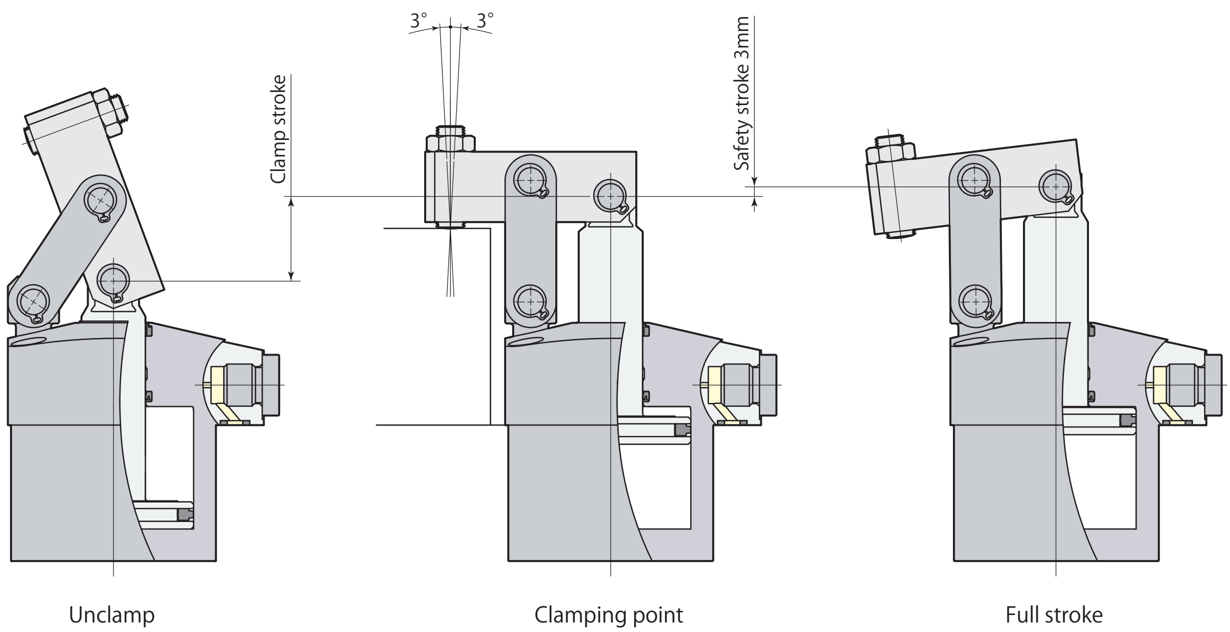
Specifications



Model			CLX32	CLX40	CLX50	CLX63
Cylinder force (air pressure 0.5MPa)		N	400	630	980	1560
Cylinder inner diameter		mm	32	40	50	63
Rod diameter		mm	14	16	20	25
Effective area (clamp)		mm^2	804	1257	1963	3117
Full stroke		mm	24	26	29.5	34.5
Clamp stroke		mm	21	23	26.5	31.5
Safety stroke		mm	3	3	3	3
Cylinder capacity	Clamp	cm^3	19.3	32.7	57.9	107.5
	Unclamp	cm^3	15.6	27.4	48.7	90.6
Mass		kg	0.39	0.54	0.92	1.44
Recommended tightening torque of mounting screws*1		N·m	4.0	4.0	5.9	5.9

● Pressure range : 0.1–1 MPa ● Proof pressure : 1.5 MPa ● Operating temperature : 0–70 ℃ ● Fluid used : Air*2
● Oil supply : Not required ● Seals are resistant to chlorine-based cutting fluid. (not thermal resistant specification)
*1 : ISO R898 class 12.9 *2 : Supply the dry and filtered air. Particulate size 5 μm or less is recommended.

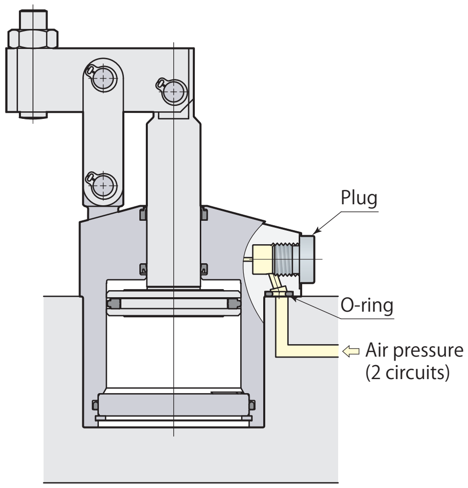
When clamping the workpiece, the clamp arm should be situated like the sketch as shown below. (Clamping point)
Please avoid any non-axial force such as the bending moment toward the piston rod. (Allowable angle ±3°)



Manifold piping and G port piping are available.

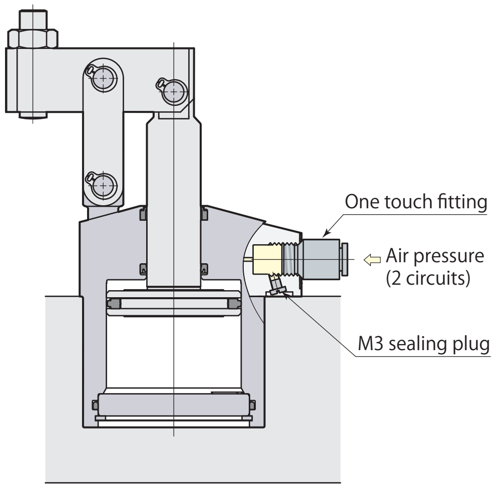
Manifold piping

When choosing manifold piping, a speed controller model VCL is mountable on the G ports of the clamp.



G port piping

When choosing G port piping, remove plugs and mount M3 sealing plugs that are included. (M3 sealing plugs are not mounted at the time of factory shipment.)
The one touch fitting or the speed controller with one touch fitting should be mounted when choosing G port piping.



Speed controller model VCL

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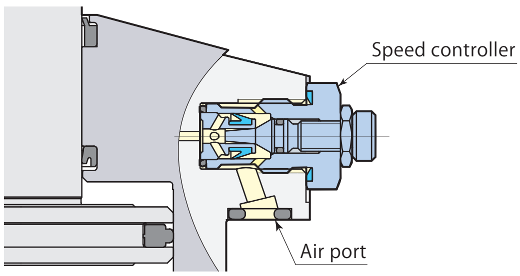
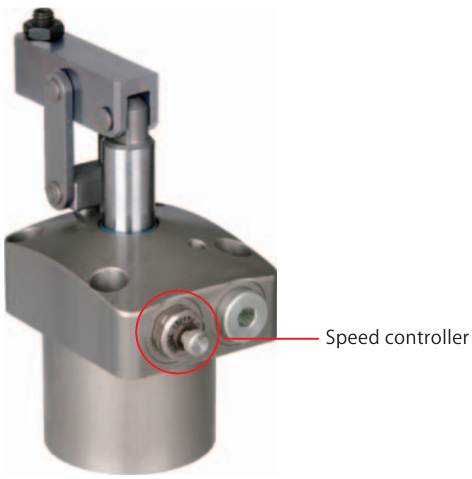
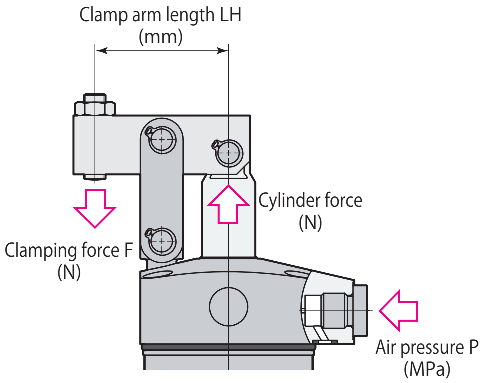




Performance diagram



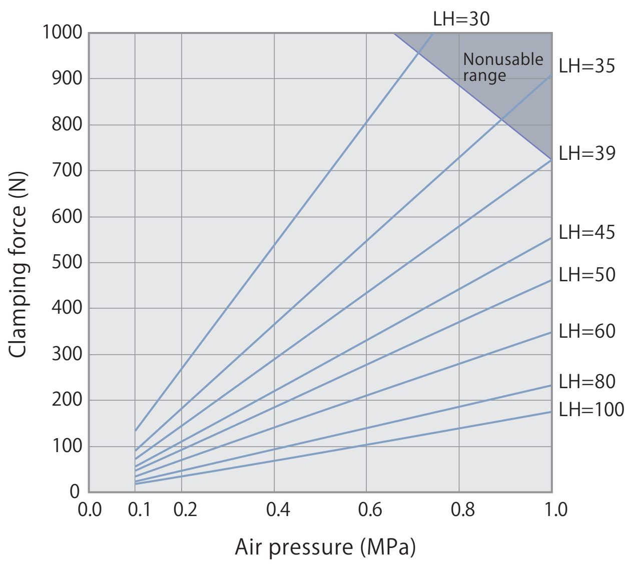
Clamping force varies depending on the clamp arm length (LH) and air pressure (P).

Clamping force calculation formula
F＝Coefficient 1 × P × 1000/ (LH - Coefficient 2)
F：Clamping force　P：Air pressure　LH：Clamp arm length

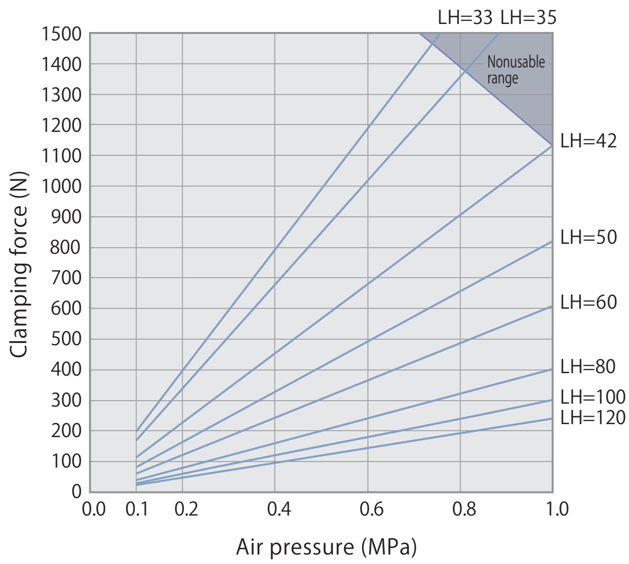
CLX50 with clamp arm length (LH) 50 mm at air pressure of 0.5 MPa,
Clamping force F is calculated by
44.18×0.5×1000/(50-25.0)=880 N

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

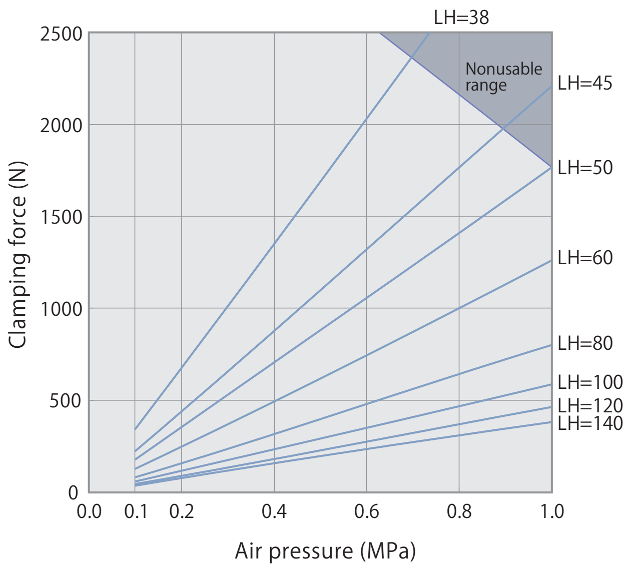
model CLX32



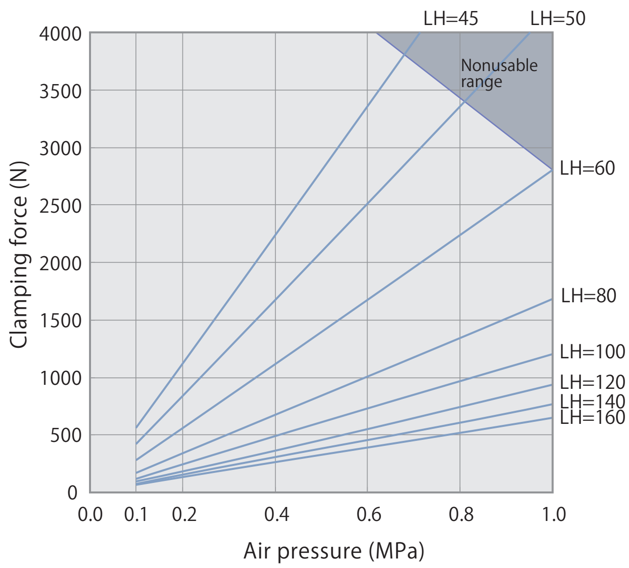
model CLX40



model CLX50



model CLX63



Performance table

model CLX32 Clamping force F=14.11×P×1000/(LH-19.5)

Air pressure MPa	Cylinder force N	Clamping force N								Min. arm length Min. LH mm
		Clamp arm length LH mm								
		30	35	39	45	50	60	80	100	
1.0	800			720	550	460	350	230	180	39
0.9	720			650	500	420	310	210	160	36
0.8	640		730	580	440	370	280	190	140	33
0.7	560	940	640	510	390	320	240	160	120	30
0.6	480	810	550	430	330	280	210	140	110	28
0.5	400	670	460	360	280	230	170	120	90	26
0.4	320	540	360	290	220	190	140	90	70	↑
0.3	240	400	270	220	170	140	100	70	50	↑
0.2	160	270	180	140	110	90	70	50	40	↑
0.1	80	130	90	70	60	50	30	20	20	26

▭ indicates nonusable range

model CLX40 Clamping force F=23.75×P×1000/(LH-21.0)

Air pressure MPa	Cylinder force N	Clamping force N								Min. arm length Min. LH mm
		Clamp arm length LH mm								
		33	35	42	50	60	80	100	120	
1.0	1260			1130	820	610	400	300	240	42
0.9	1130			1020	740	550	360	270	220	38
0.8	1010		1360	900	660	490	320	240	190	35
0.7	880	1390	1190	790	570	430	280	210	170	32
0.6	750	1190	1020	680	490	370	240	180	140	30
0.5	630	990	850	570	410	300	200	150	120	29
0.4	500	790	680	450	330	240	160	120	100	↑
0.3	380	590	510	340	250	180	120	90	70	↑
0.2	250	400	340	230	160	120	80	60	50	↑
0.1	130	200	170	110	80	60	40	30	20	29

▭ indicates nonusable range

model CLX50 Clamping force F=44.18×P×1000/(LH-25.0)

Air pressure MPa	Cylinder force N	Clamping force N								Min. arm length Min. LH mm
		Clamp arm length LH mm								
		38	45	50	60	80	100	120	140	
1.0	1960			1770	1260	800	590	470	380	50
0.9	1770			1590	1140	720	530	420	350	46
0.8	1570		1770	1410	1010	640	470	370	310	42
0.7	1370		1550	1240	880	560	410	330	270	39
0.6	1180	2040	1330	1060	760	480	350	280	230	36
0.5	980	1700	1100	880	630	400	290	230	190	34
0.4	790	1360	880	710	500	320	240	190	150	↑
0.3	590	1020	660	530	380	240	180	140	120	↑
0.2	390	680	440	350	250	160	120	90	80	↑
0.1	200	340	220	180	130	80	60	50	40	34

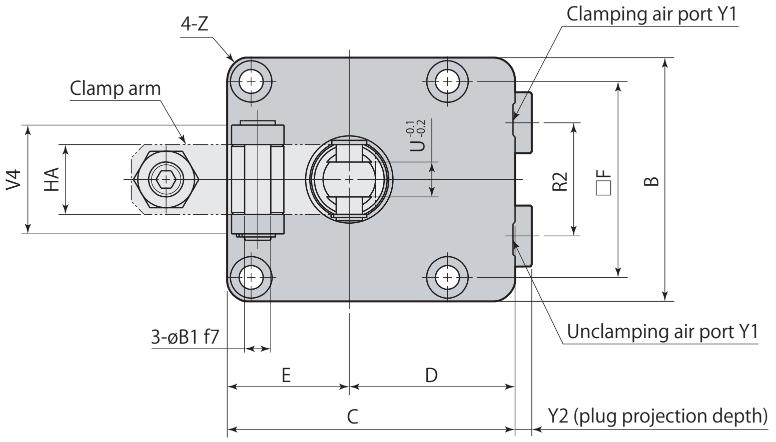
▭ indicates nonusable range

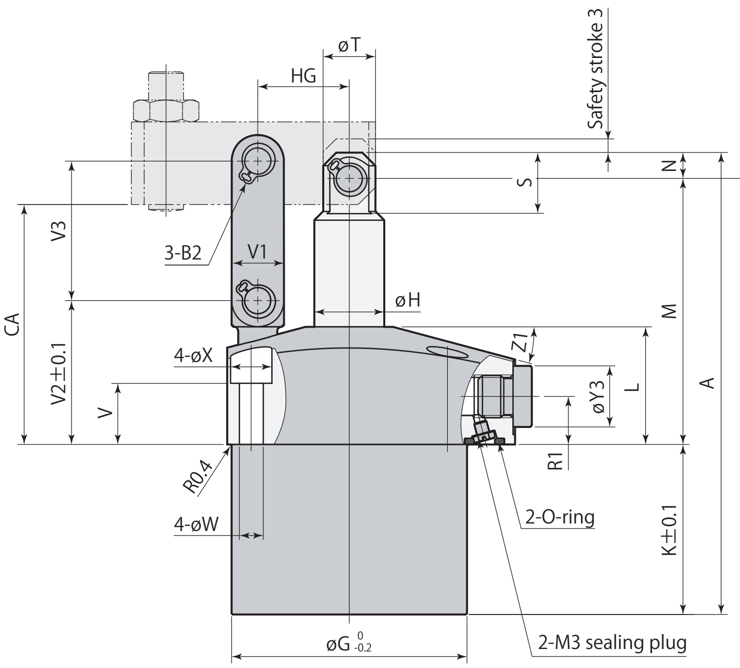
model CLX63 Clamping force F=84.16×P×1000/(LH-30.0)

Air pressure MPa	Cylinder force N	Clamping force N								Min. arm length Min. LH mm
		Clamp arm length LH mm								
		45	50	60	80	100	120	140	160	
1.0	3120			2810	1680	1200	940	770	650	60
0.9	2810			2520	1510	1080	840	690	580	55
0.8	2490		3370	2240	1350	960	750	610	520	50
0.7	2180		2950	1960	1180	840	650	540	450	46
0.6	1870	3370	2520	1680	1010	720	560	460	390	43
0.5	1560	2810	2100	1400	840	600	470	380	320	40
0.4	1250	2240	1680	1120	670	480	370	310	260	↑
0.3	940	1680	1260	840	500	360	280	230	190	↑
0.2	620	1120	840	560	340	240	190	150	130	↑
0.1	310	560	420	280	170	120	90	80	60	40

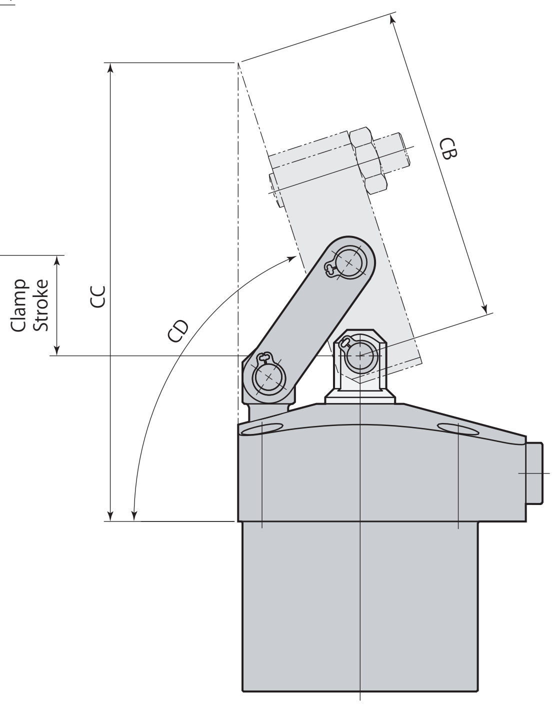
▭ indicates nonusable range

Dimensions

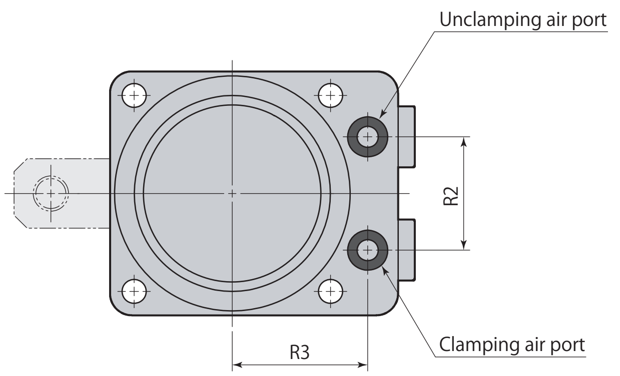




Clamp

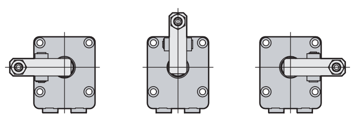


Unclamp



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

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



- Clamp arm and mounting screws are not included.
- Install M3 sealing plug when choosing G port piping. The M3 sealing plug is packed with a link clamp.

mm

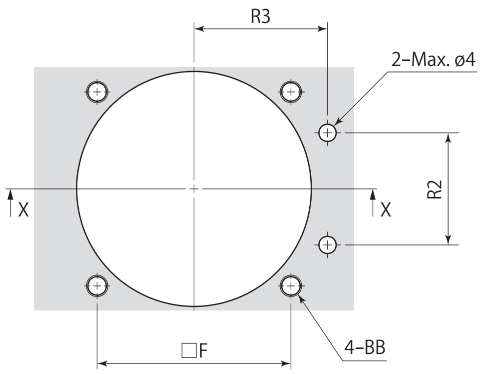
Model		CLX32-□	CLX40-□	CLX50-□	CLX63-□
A		97	106	122	141.5
B		50	56	66	78
C		60	66	80	91
D		35	38	47	52
E		25	28	33	39
F		39	45	53	65
øG		46	54	64	77
øH		14	16	20	25
K		35	39	42.5	53
L		27	27	32	32
M		57	61	71.5	78.5
N		5	6	8	10
R1		11	11	12.5	12.5
R2		20	26	30	40
R3		28	31	36	41
S		11.5	14	17.5	21.5
øT		11	12	16	21
U (width across flats)		7	8	11	13
V		14	14	17	17
V1		10	12	16	18
V2		31.5	33	38.5	39.5
V3		28.5	32	38	44
V4		20	25	28	34
øW		5.5	5.5	6.8	6.8
øX		9.5	9.5	11	11
Y1		G1/8	G1/8	G1/4	G1/4
Y2		3.8	3.8	4.8	4.8
øY3		14	14	19	19
Z		R5	R5	R6	R6
Z1		15°	15°	13°	13°
B1		$5^{-0.010}_{-0.022}$	$6^{-0.010}_{-0.022}$	$8^{-0.013}_{-0.028}$	$10^{-0.013}_{-0.028}$
B2 (snap ring)*1		STW-5	STW-6	STW-8	STW-10
CA		52	55	63.5	69.5
CB		59	72.5	73.3	82.4
CC		89.7	105.2	110.9	120.2
CD		About 70°	About 72°	About 70°	About 68°
HA		14	16	19	22
HG		19.5	21	25	30
O-ring (fluorocarbon hardness Hs90)		P6	P6	P6	P6
Speed controller*2	Meter-in	VCL01-I	VCL01-I	VCL02-I	VCL02-I
	Meter-out	VCL01-O	VCL01-O	VCL02-O	VCL02-O

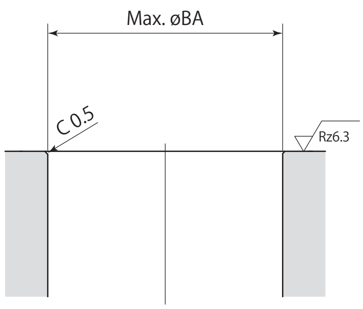
*1 : Snap ring is made by Ochiai Corporation.

*2 : Select the right model of VCL according to the size of the clamp.

● Refer to **page →790** for the details of speed controller.

Mounting details





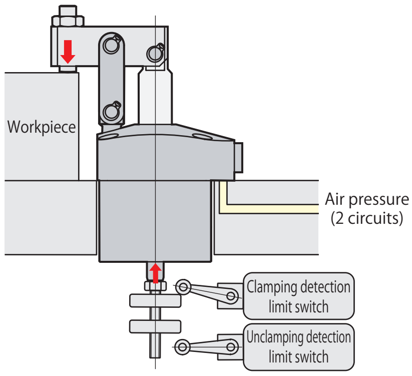
X-X

Rz: ISO4287(1997)

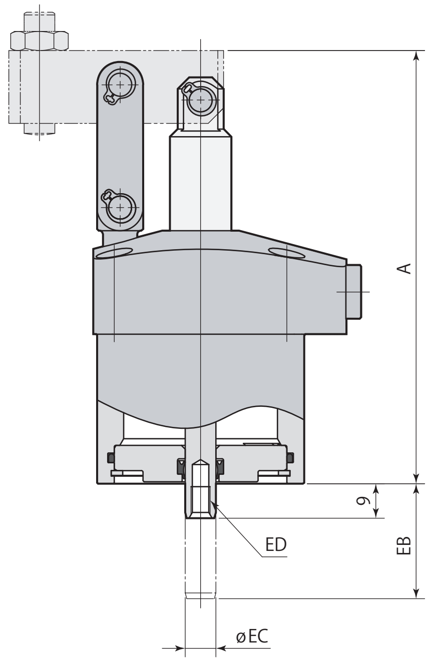
mm

Model	CLX32-□	CLX40-□	CLX50-□	CLX63-□
F	39	45	53	65
R2	20	26	30	40
R3	28	31	36	41
øBA	46.5	54.5	64.5	77.5
BB	M5	M5	M6	M6

Usage example



Dimensions



mm

Model	CLX32-□E	CLX40-□E	CLX50-□E	CLX63-□E
Effective area (clamp)	754 mm²	1206 mm²	1885 mm²	3039 mm²
Cylinder capacity (clamp)	18.1 cm³	31.4 cm³	55.6 cm³	104.8 cm³
A	103	113	128	147.5
EB	30	32	35.5	40.5
øEC	8	8	10	10
ED	M5×0.8 depth 8	M5×0.8 depth 8	M6×1 depth 11	M6×1 depth 11
Mass	0.41 kg	0.56 kg	0.95 kg	1.47 kg

● Refer to specifications (**page →766**), dimensions (**page →770**) for specifications and dimensions of products that are not listed on this page.

Clamping performance

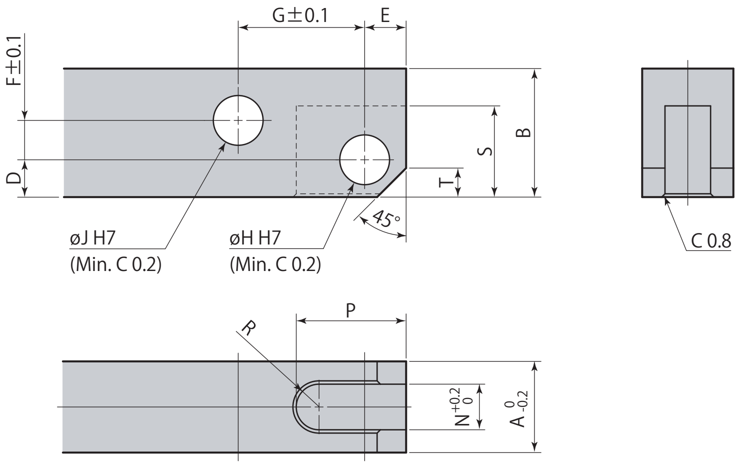
Dual rod models have smaller effective area on clamping side, which slightly reduces clamping force.
Obtain clamping force by multiplying standard clamping force obtained from performance diagram (**page →768**) or performance table (**page →769**) by coefficient shown in table below.

Calculation example
For models CLX50-FE, with air pressure of 0.5 MPa and clamp arm length of 60 mm :
Clamping force of standard specification CLX50-F : 630 N
Clamping force of CLX50-FE : 630×0.96 = 604.8 N

Model	CLX32-□E	CLX40-□E	CLX50-□E	CLX63-□E
Clamping performance coefficient	0.94	0.96	0.96	0.97

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

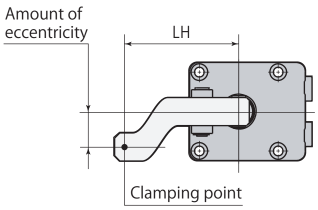
Link clamp	CLX32	CLX40	CLX50	CLX63
A	14	16	19	22
B	16	19	22	25
D	5	6	8	9
E	5	6	8	10
F	3	4	5	5
G	19.5	21	25	30
øH	$5^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$
øJ	$5^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$
N	7	8	11	13
P	16	20	22	27
R	R3.5	R4	R5.5	R6.5
S	12	15	18	22
T	3	4	5	6

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

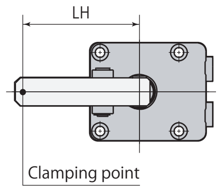
Clamp arm allowable eccentricity

An eccentric shape clamp arm, as shown in diagram on right can be used with link clamp model CLX, 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 CLX32 (shaded cells indicate nonusable range)

Air pressure MPa	Allowable eccentricity mm / Clamp arm length LH mm							
	30	35	39	45	50	60	80	100
1.0					7	12	24	35
0.9				8	11	18	32	47
0.8			7	12	17	26	44	60
0.7		7	12	18	24	35	58	↑
0.6	5	12	18	26	34	48	60	↑
0.5	9	19	26	38	47	60	↑	↑
0.4	16	29	39	54	60	↑	↑	↑
0.3	28	46	60	60	↑	↑	↑	↑
0.2	51	60	↑	↑	↑	↑	↑	↑
0.1	60	60	60	60	60	60	60	60

model CLX40 (shaded cells indicate nonusable range)

Air pressure MPa	Allowable eccentricity mm / Clamp arm length LH mm							
	33	35	42	50	60	80	100	120
1.0				6	13	26	39	53
0.9			5	11	20	36	53	70
0.8			9	17	28	49	70	80
0.7	3	6	15	25	39	65	80	↑
0.6	7	11	23	36	53	80	↑	↑
0.5	14	18	33	51	73	↑	↑	↑
0.4	23	29	50	73	80	↑	↑	↑
0.3	38	47	77	80	↑	↑	↑	↑
0.2	67	80	80	↑	↑	↑	↑	↑
0.1	80	80	80	80	80	80	80	80

model CLX50 (shaded cells indicate nonusable range)

Air pressure MPa	Allowable eccentricity mm / Clamp arm length LH mm							
	38	45	50	60	80	100	120	140
1.0				10	24	37	51	65
0.9			7	16	33	50	67	85
0.8		7	12	23	44	66	87	100
0.7		12	19	33	59	86	100	↑
0.6	8	20	28	45	79	100	↑	↑
0.5	14	30	41	63	100	↑	↑	↑
0.4	24	45	60	90	↑	↑	↑	↑
0.3	41	70	92	100	↑	↑	↑	↑
0.2	74	100	100	↑	↑	↑	↑	↑
0.1	100	100	100	100	100	100	100	100

model CLX63 (shaded cells indicate nonusable range)

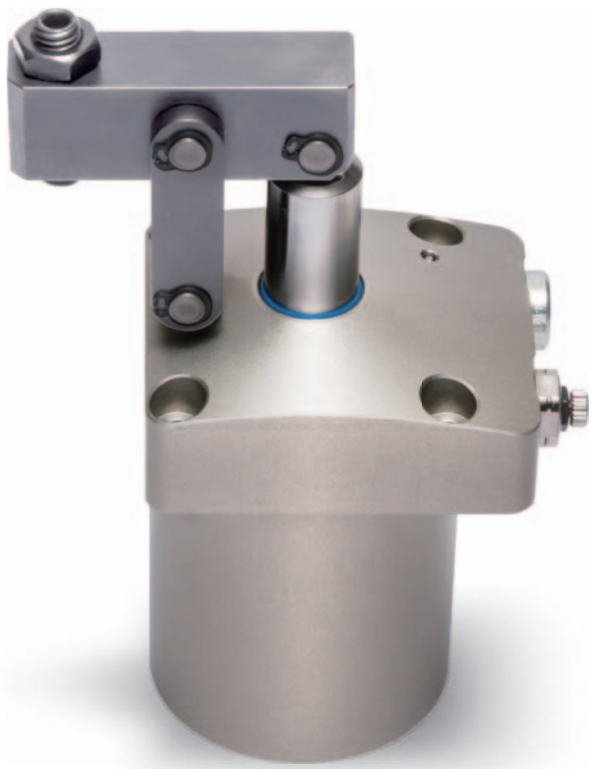
Air pressure MPa	Allowable eccentricity mm / Clamp arm length LH mm							
	45	50	60	80	100	120	140	160
1.0			4	19	33	48	62	76
0.9			9	27	45	63	81	99
0.8		5	16	38	60	83	105	120
0.7		10	24	52	80	108	120	↑
0.6	9	18	35	71	106	120	↑	↑
0.5	17	28	51	97	120	↑	↑	↑
0.4	29	44	75	120	↑	↑	↑	↑
0.3	48	70	114	↑	↑	↑	↑	↑
0.2	87	120	120	↑	↑	↑	↑	↑
0.1	120	120	120	120	120	120	120	120

Table of contents

air Link clamp

Boost model Double acting 0.5 MPa

model CLY



Air link clamp boost model
model CLY40-F

Boost model

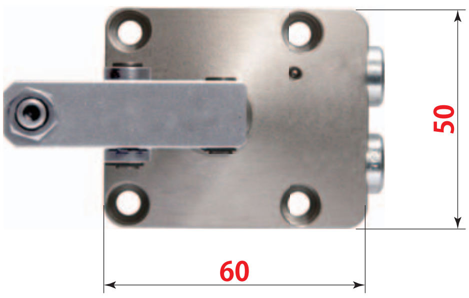
model **CLY□-□** JP PAT.

New boosting mechanism makes cylinder force 2.5 times larger.

Air link clamp boost model
CLY32
Cylinder force：**1070 N**
(Air pressure 0.5MPa)

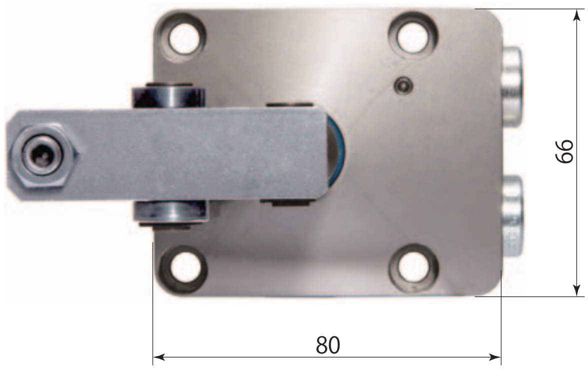
Less space

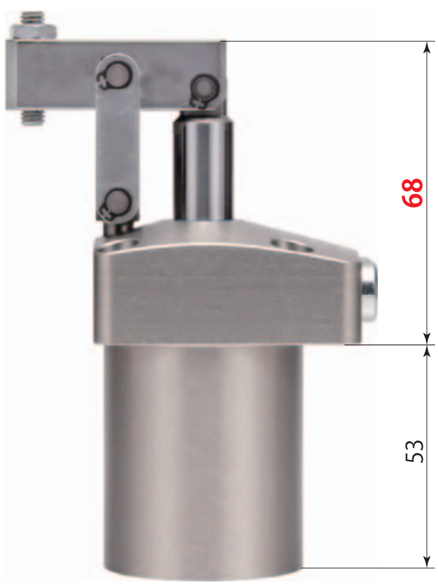
Air link clamp
CLX50
Cylinder force：**982 N**
(Air pressure 0.5MPa)



Flange area
approx. **57**%

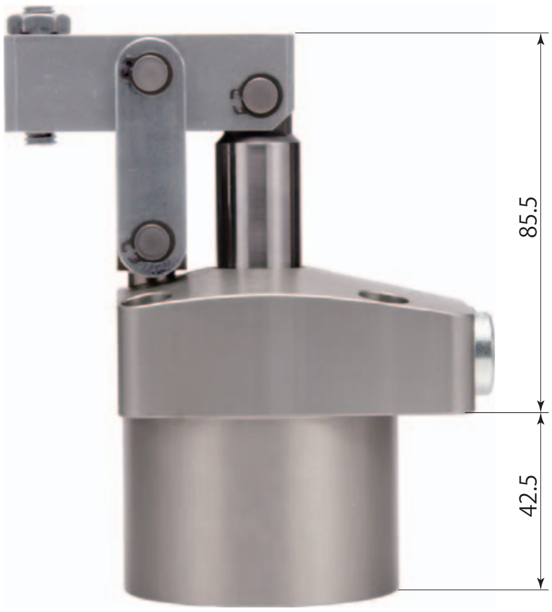
2 size smaller





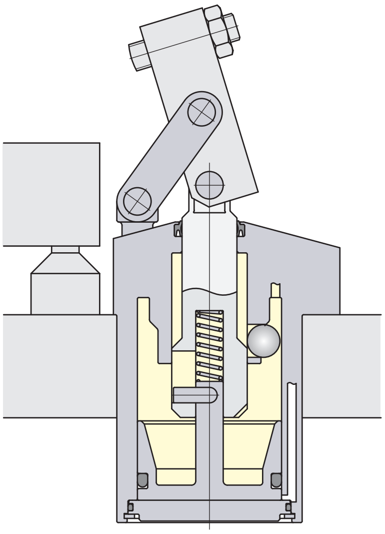
Height from mounting surface
approx. **80**%

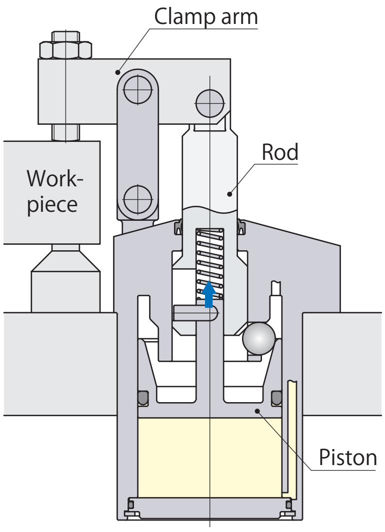
2 size smaller

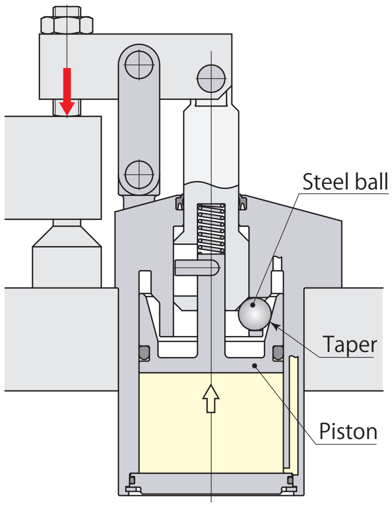


Clamp

① Unclamp ⇨ ② Clamping position ⇨ ③ Clamping force boosted





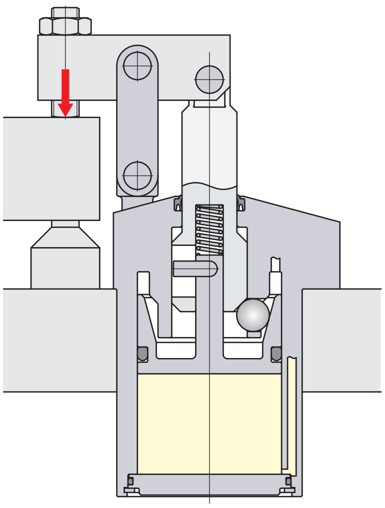


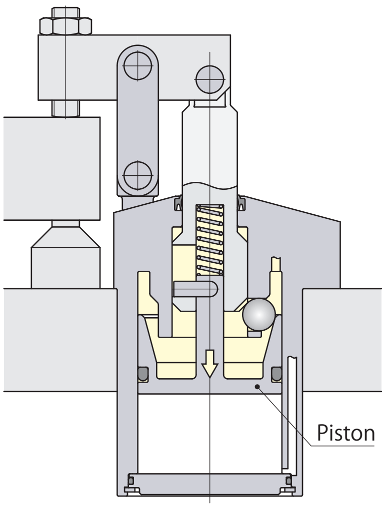
- The rod and piston go up at the same time until a clamp arm contacts to workpiece.
  Designing the circuit to generate the back pressure on unclamp chamber of the cylinder ensures smoother operation.

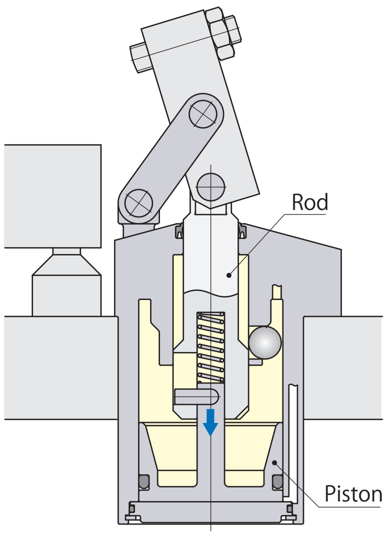
- Only a piston goes up, the clamping force is boosted up by the taper and steel balls.

Unclamp

① Clamping force boosted ⇨ ② Taper-lock released ⇨ ③ Unclamp







- Only a piston goes down, Taper-lock is released firmly.

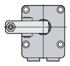
- The rod and piston go down at the same time.
  The rod may go down too far if no air pressure remains in the unclamping side. Keep supplying air as much as possible when the clamp is in unclamped condition.

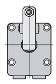
Specifications

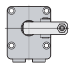
Size: 32 / 40 / 50 / 63

CLY [Size] – [Clamp arm mounting direction]

Clamp arm mounting direction

L : Left side 

F : Front side 

R : Right side 

(grey box) indicates made to order.

Model			CLY32	CLY40	CLY50	CLY63
Cylinder force (air pressure 0.5MPa)		N	1070	1600	2400	3590
Boost range angle*1			±3.5°			
Cylinder inner diameter		mm	36	44	54	66
Rod diameter		mm	14	16	20	25
Effective area (clamp)		cm^2	10.2	15.2	22.9	34.2
Rod clamp stroke*2		mm	21.0	23.0	26.5	31.5
Safety stroke		mm	1.5	1.6	1.9	2.3
Cylinder capacity	Clamp	cm^3	32.6	53.5	93.9	165.2
	Unclamp	cm^3	29.1	48.6	84.9	148.6
Mass		kg	0.53	0.75	1.28	2.12
Recommended tightening torque of mounting screws*3		N・m	4.0	4.0	5.9	5.9

● Pressure range：0.1–0.5 MPa ● Proof pressure：0.75 MPa ● Operating temperature：0–70 ℃

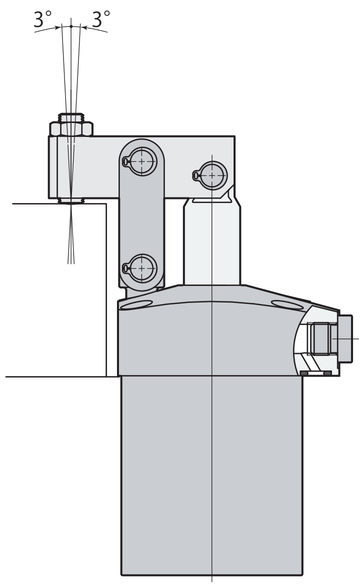
● Fluid used：Air*4 ● Oil supply：Not required

● Seals are resistant to chlorine-based cutting fluid. (not thermal resistant specification)

∗1：Cylinder cannot exert the rated value in case the angle is out of range.

∗2：Indicates a distance from unclamping position to clamping point. ∗3：ISO R898 class 12.9

∗4：Supply the dry and filtered air. Particulate size 5 μm or less is recommended.



Clamping point

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

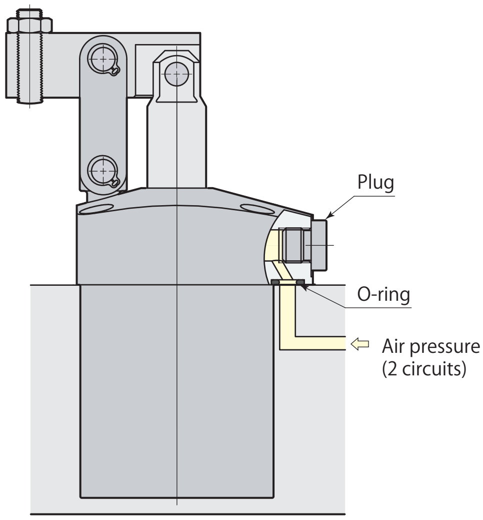
Manifold piping and G port piping are available.

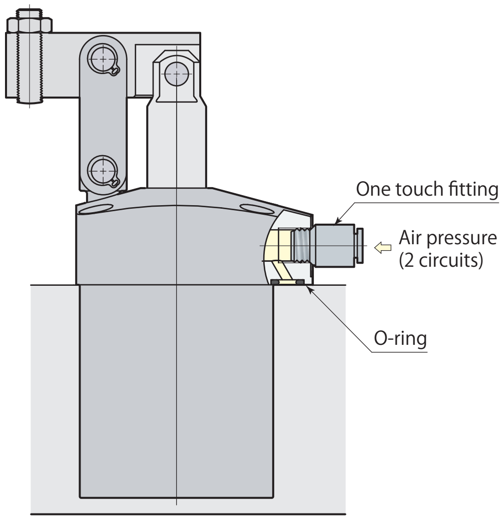
Manifold piping

When choosing manifold piping, a speed controller model VCL is mountable on the G ports of the clamp.

G port piping

When choosing G port piping, remove plugs. (O-ring must be used.) The one touch fitting or the speed controller with one touch fitting should be mounted when choosing G port piping.





Speed controller model VCL-O

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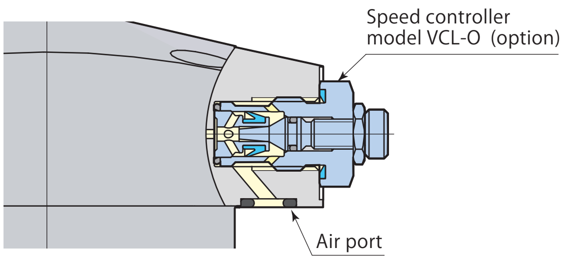
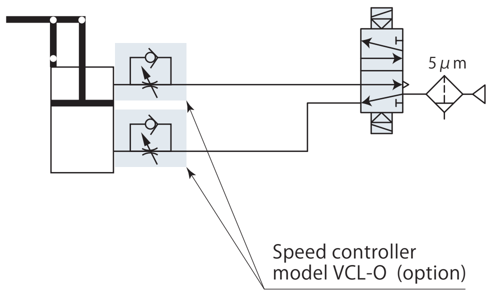
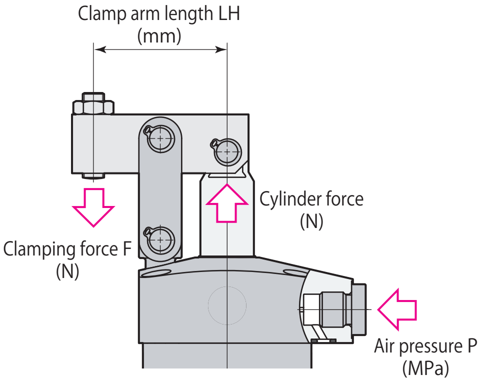


Pneumatic circuit diagram



The meter-out control is recommended for speed controller.

Performance diagram



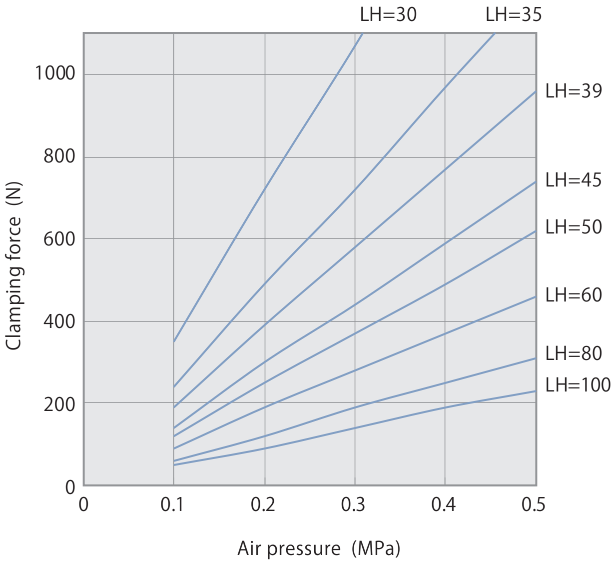
Clamping force varies depending on the clamp arm length (LH) and air pressure (P).

Clamping force calculation formula
F = Coefficient 1 × P × 1000/ (LH - Coefficient 2)
F: Clamping force P: Air pressure LH: Clamp arm length

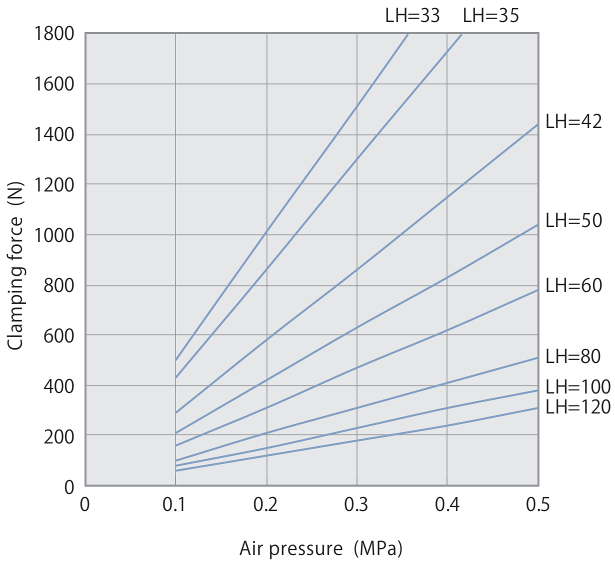
CLY50 with clamp arm length (LH) 50 mm at air pressure of 0.5 MPa, Clamping force F is calculated by
108.23×0.5×1000/(50-25.0)=2160 N

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

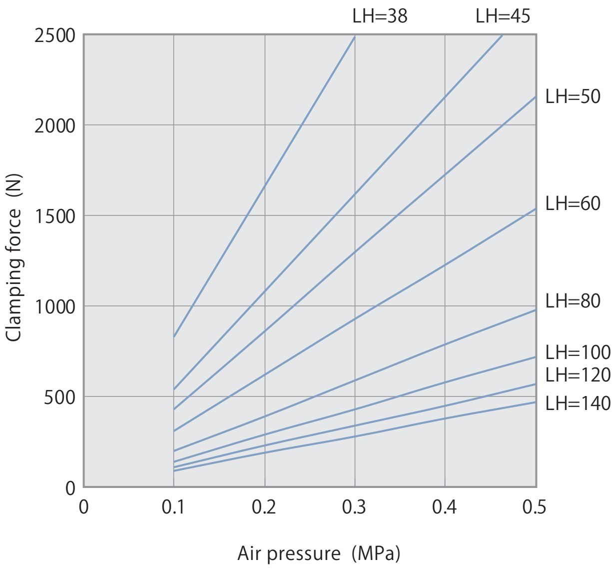
model CLY32



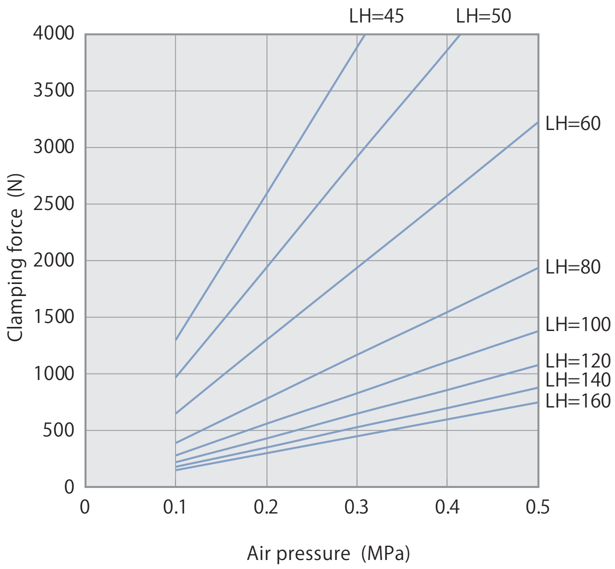
model CLY40



model CLY50



model CLY63



Performance table

model CLY32 Clamping force $F=37.52\times P\times 1000/(LH-19.5)$

Air pressure MPa	Cylinder force N	Clamping force N (Clamp arm length LH mm)								Min. arm length Min. LH mm
		30	35	39	45	50	60	80	100	
0.5	1070			960	740	620	460	310	230	39
0.4	860		970	770	590	490	370	250	190	33
0.3	640	1070	720	580	440	370	280	190	140	28
0.2	430	720	490	390	300	250	190	120	90	26
0.1	210	350	240	190	140	120	90	60	50	26

▨ indicates nonusable range

model CLY40 Clamping force $F=60.36\times P\times 1000/(LH-21.0)$

Air pressure MPa	Cylinder force N	Clamping force N (Clamp arm length LH mm)								Min. arm length Min. LH mm
		33	35	42	50	60	80	100	120	
0.5	1600			1440	1040	780	510	380	310	42
0.4	1280		1730	1150	830	620	410	310	240	35
0.3	960	1510	1300	860	630	470	310	230	180	30
0.2	640	1010	860	580	420	310	210	150	120	29
0.1	320	500	430	290	210	160	100	80	60	29

▨ indicates nonusable range

model CLY50 Clamping force $F=108.23\times P\times 1000/(LH-25.0)$

Air pressure MPa	Cylinder force N	Clamping force N (Clamp arm length LH mm)								Min. arm length Min. LH mm
		38	45	50	60	80	100	120	140	
0.5	2400			2160	1540	980	720	570	470	50
0.4	1920		2160	1730	1230	790	580	450	380	42
0.3	1440	2490	1620	1300	930	590	430	340	280	36
0.2	960	1660	1080	860	620	390	290	230	190	34
0.1	480	830	540	430	310	200	140	110	90	34

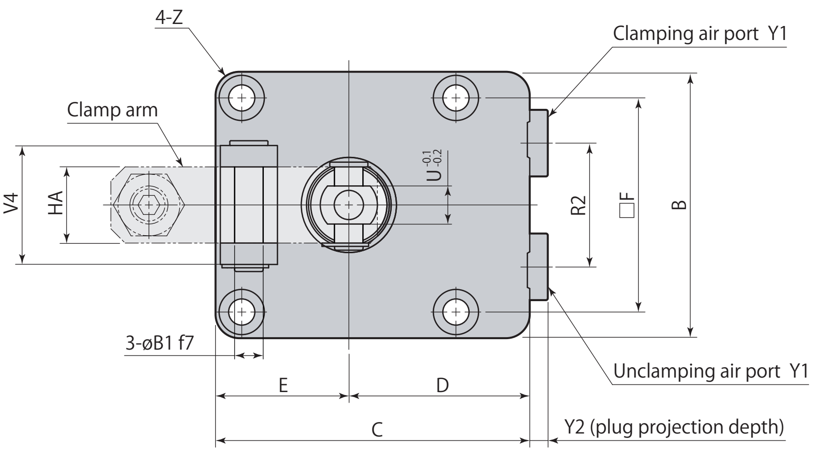
▨ indicates nonusable range

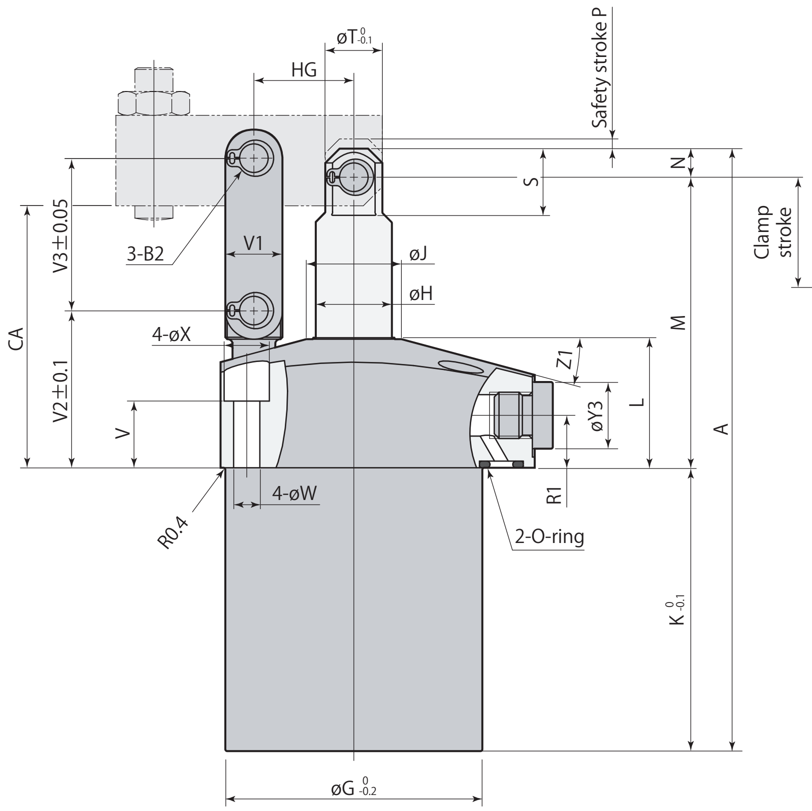
model CLY63 Clamping force $F=193.97\times P\times 1000/(LH-30.0)$

Air pressure MPa	Cylinder force N	Clamping force N (Clamp arm length LH mm)								Min. arm length Min. LH mm
		45	50	60	80	100	120	140	160	
0.5	3590			3230	1940	1380	1080	880	750	60
0.4	2870		3870	2580	1550	1110	860	700	600	50
0.3	2160	3890	2920	1940	1170	830	650	530	450	43
0.2	1440	2590	1940	1300	780	560	430	350	300	40
0.1	720	1300	970	650	390	280	220	180	150	40

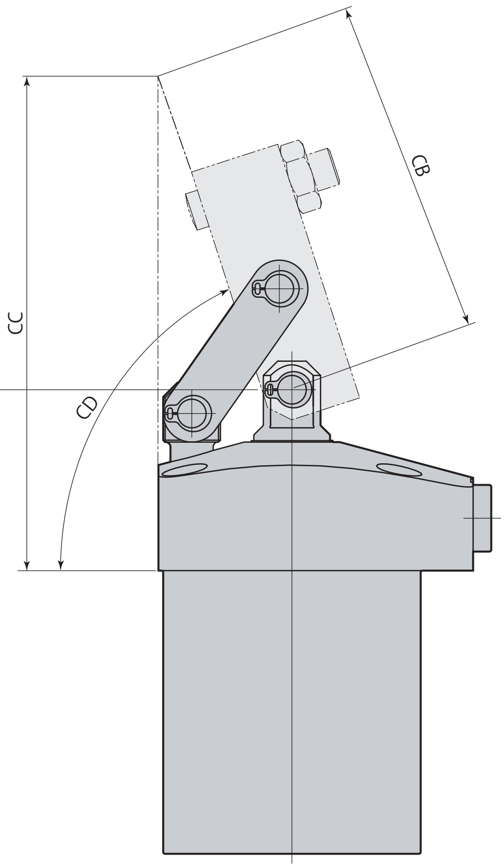
▨ indicates nonusable range

Dimensions

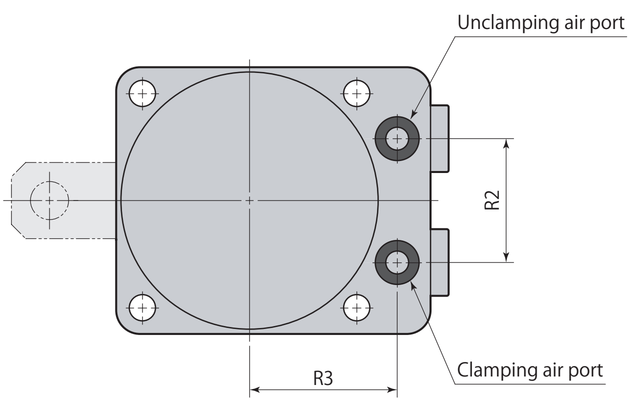




Clamp

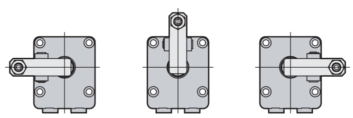


Unclamp



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

L：Left side F：Front sideR：Right side



- Clamp arm and mounting screws are not included.

mm

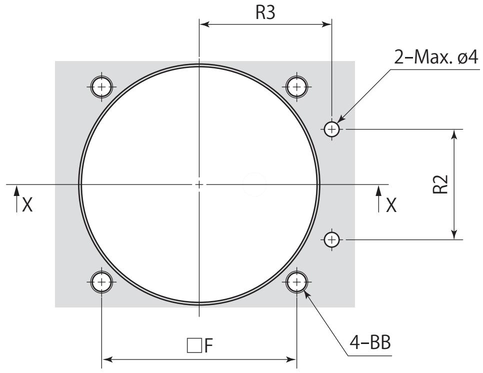
Model	CLY32-□	CLY40-□	CLY50-□	CLY63-□
A	115	126.5	146.5	173
B	50	56	66	78
C	60	66	80	91
D	35	38	47	52
E	25	28	33	39
F	39	45	53	65
øG	46	54	64	77
øH	14	16	20	25
øJ	18	20	24	30
K	53	59.5	67	84.5
L	27	27	32	32
M	57	61	71.5	78.5
N	5	6	8	10
P	1.5	1.6	1.9	2.3
R1	11	11	12.5	12.5
R2	20	26	30	40
R3	28	31	36	41
S	11.5	14	17.5	21.5
øT	11	12	16	21
U (width across flats)	7	8	11	13
V	14	14	17	17
V1	10	12	16	18
V2	31.5	33	38.5	39.5
V3	28.5	32	38	44
V4	20	25	28	34
øW	5.5	5.5	6.8	6.8
øX	9.5	9.5	11	11
Y1	G1/8	G1/8	G1/4	G1/4
Y2	3.8	3.8	4.8	4.8
øY3	14	14	19	19
Z	R5	R5	R6	R6
Z1	15°	15°	13°	13°
øB1	$5^{-0.010}_{-0.022}$	$6^{-0.010}_{-0.022}$	$8^{-0.013}_{-0.028}$	$10^{-0.013}_{-0.028}$
B2 (snap ring)*1	STW-5	STW-6	STW-8	STW-10
CA	52	55	63.5	69.5
CB	59.1	72.5	73.3	82.4
CC	89.7	105.2	110.9	120.2
CD	About 70°	About 72°	About 70°	About 68°
HA	14	16	19	22
HG	19.5	21	25	30
O-ring (fluorocarbon hardness Hs90)	P6	P6	P6	P6
Speed controller (Meter-out)*2	VCL01-O	VCL01-O	VCL02-O	VCL02-O

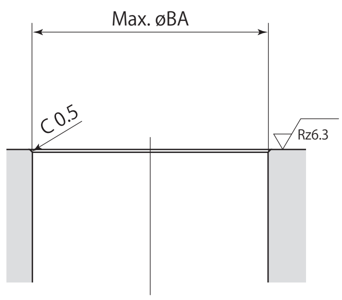
*1: Snap ring is made by Ochiai Corporation.

*2: Select the right model of VCL according to the size of the clamp.

● Refer to **page →790** for the details of speed controller.

Mounting details





X-X

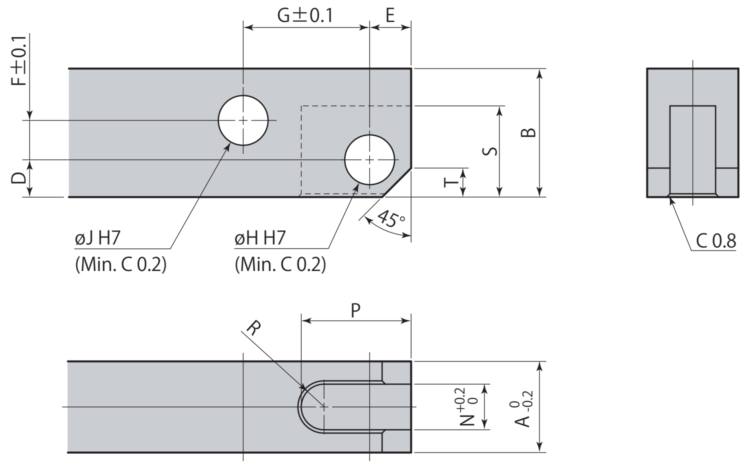
Rz: ISO4287(1997)

mm

Model	CLY32-□	CLY40-□	CLY50-□	CLY63-□
F	39	45	53	65
R2	20	26	30	40
R3	28	31	36	41
øBA	46.5	54.5	64.5	77.5
BB	M5	M5	M6	M6

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

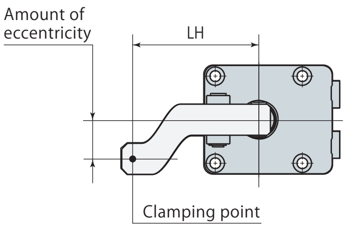
Link clamp	CLY32-□	CLY40-□	CLY50-□	CLY63-□
A	14	16	19	22
B	16	19	22	25
D	5	6	8	9
E	5	6	8	10
F	3	4	5	5
G	19.5	21	25	30
øH	$5^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$
øJ	$5^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$
N	7	8	11	13
P	16	20	22	27
R	R3.5	R4	R5.5	R6.5
S	12	15	18	22
T	3	4	5	6

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

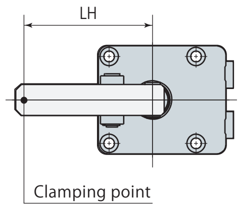
Clamp arm allowable eccentricity

An eccentric shape clamp arm, as shown in diagram on right can be used with link clamp model CLY, 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 CLY32 (shaded cells indicate nonusable range)

Air pressure MPa	Allowable eccentricity mm							
	Clamp arm length LH mm							
	30	35	39	45	50	60	80	100
0.5					3	7	15	24
0.4			1	4	7	13	24	36
0.3		2	6	11	15	23	40	56
0.2	3	10	15	23	30	43	60	60
0.1	19	33	39	45	50	60	60	60

model CLY40 (shaded cells indicate nonusable range)

Air pressure MPa	Allowable eccentricity mm							
	Clamp arm length LH mm							
	33	35	42	50	60	80	100	120
0.5					3	11	19	27
0.4				3	8	19	30	41
0.3			3	10	17	33	49	64
0.2	2	5	13	23	36	61	80	80
0.1	19	24	42	50	60	80	80	80

model CLY50 (shaded cells indicate nonusable range)

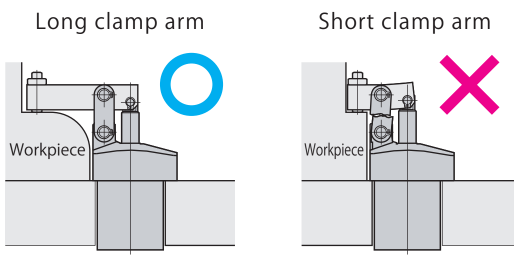
Air pressure MPa	Allowable eccentricity mm							
	Clamp arm length LH mm							
	38	45	50	60	80	100	120	140
0.5				6	18	29	41	53
0.4		1	5	13	28	44	59	75
0.3		8	13	24	46	68	90	100
0.2	8	20	29	47	80	100	100	↑
0.1	33	45	50	60	80	100	100	100

model CLY63 (shaded cells indicate nonusable range)

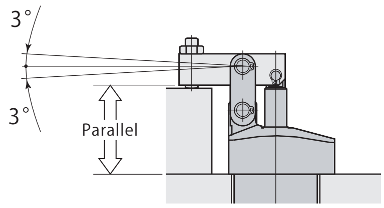
Air pressure MPa	Allowable eccentricity mm							
	Clamp arm length LH mm							
	45	50	60	80	100	120	140	160
0.5				12	24	36	48	60
0.4			6	22	38	54	70	86
0.3		5	16	39	61	84	106	120
0.2	9	18	36	71	100	120	120	↑
0.1	39	50	60	80	100	120	120	120

Caution in use

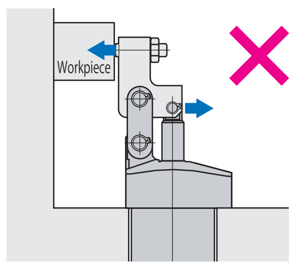
- With link clamps, force acting on link mechanism becomes larger as clamp arm becomes shorter. Exceeding maximum allowable load for link mechanism will lead to malfunction. Depending on clamp arm length, it would be necessary to lower clamping force (air pressure). Use a clamp at appropriate clamping force that is suitable for clamp arm length, referring to performance diagram and table.



- Determine height and mount clamp, ensuring that clamp arm becomes parallel to clamping surface and mounting surface when workpiece is clamped (allowable angle ±3°).



- Using a method such as that shown in the diagram on the right will apply a transverse force on the piston rod and cause the piston rod to break. Please avoid the usage that may apply a non-axial force to the piston rod.



Specifications

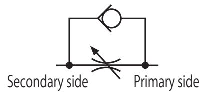
I : Meter-in

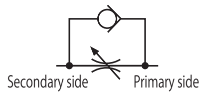
Locknut color : Silver

O : Meter-out

Locknut color : Black

VCL	G port size	–	Control method
	01 : G1/8		I : Meter-in
	02 : G1/4		O : Meter-out

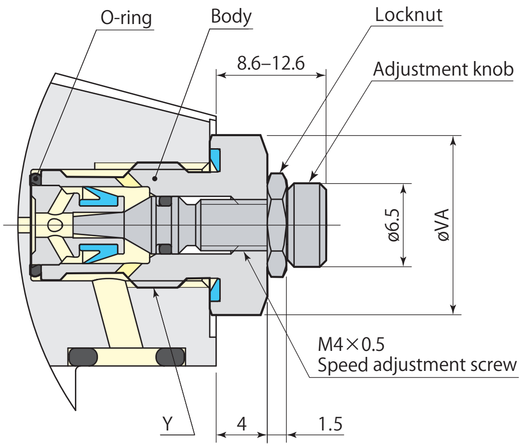


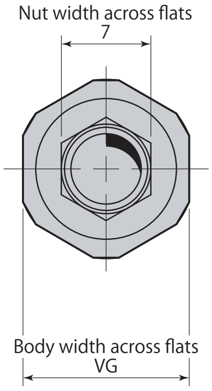


Model		VCL01-I	VCL01-O	VCL02-I	VCL02-O
G port size		G1/8		G1/4	
Orifice area	mm^2	2.8		6.2	
Recommended tightening torque	N·m	7		15	
Mass	kg	0.01		0.02	

● Pressure range : 0.1–1.0 MPa ● Proof pressure : 1.5 MPa ● Operating temperature : 0–70 ℃ ● Fluid used : Air*

* : Supply the dry and filtered air. Particulate size 5 μm or less is recommended.





mm

Model	VCL01	VCL02
Y	G1/8	G1/4
øVA	14	19
VG	13	17
Adjustment screw number of turns	8 rotations	
O-ring*1	6.0×1.0*2	8.0×1.0*2

*1 : Fluorocarbon hardness Hs90

*2 : Inner diameter × Thickness

● Use a closed wrench or socket wrench for mounting and dismounting.

● Speed controller can be mounted on air port (G port) when using manifold piping.

● This diagram depicts mounted condition for meter-out (VCL□-O).

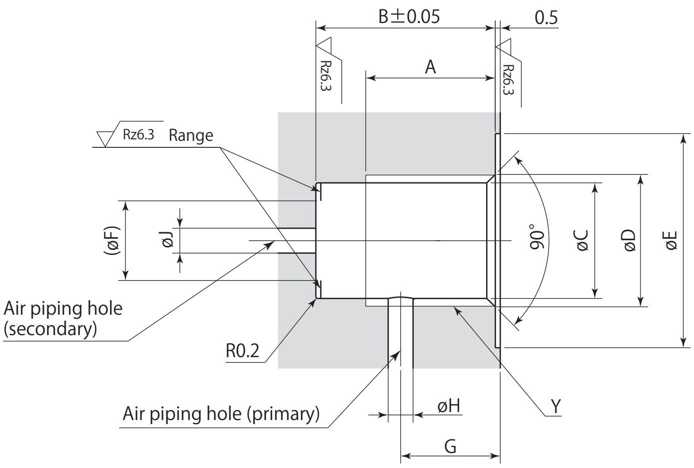
● VCL is shipped with the valve fully open. Adjust the flow rate by loosening the screw after it is tighted up to close the valve. Tighten the locknut after adjustment is completed.

Applicable clamp

Model	VCL01	VCL02
Air swing clamp	CTX32, CTX40 CTY32, CTY40	CTX50, CTX63 CTY50, CTY63
Air link clamp	CLX32, CLX40 CLY32, CLY40*	CLX50, CLX63 CLY50, CLY63*

* : Air link clamp boost model CLY are meter-out only.

Mounting details



mm

Model	VCL01	VCL02
A	9	13
B	14	18
øC	8.7 $^{+0.1}_{0}$	11.6 $^{+0.1}_{0}$
øD	9.9	13.3
øE	17.5	21.5
øF	6	8
G	8–11	9–12.5
øH	2	3
øJ	2	3
Y	G1/8	G1/4

Rz: ISO4287(1997)

Mounting & dismounting of speed controller

- When mounting or dismounting a speed controller, be sure to set pressure within air circuit to 0 MPa before starting.
- When mounting a speed controller, be sure to tighten it with the recommended tightening torque.

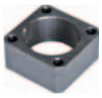
air Work support		model **CSS** **Page →794** 	model **CSX** **Page →794** 
Specifications		air Air lift	air Spring lift
Features		Threaded body Standard model	Threaded body Standard model
Option	Piping cap 	CSP-C **Page →810**	
	Flange 	CSP-F **Page →811**	
	Piping block 	CSP-P **Page →812**	

Table of contents

air Work support

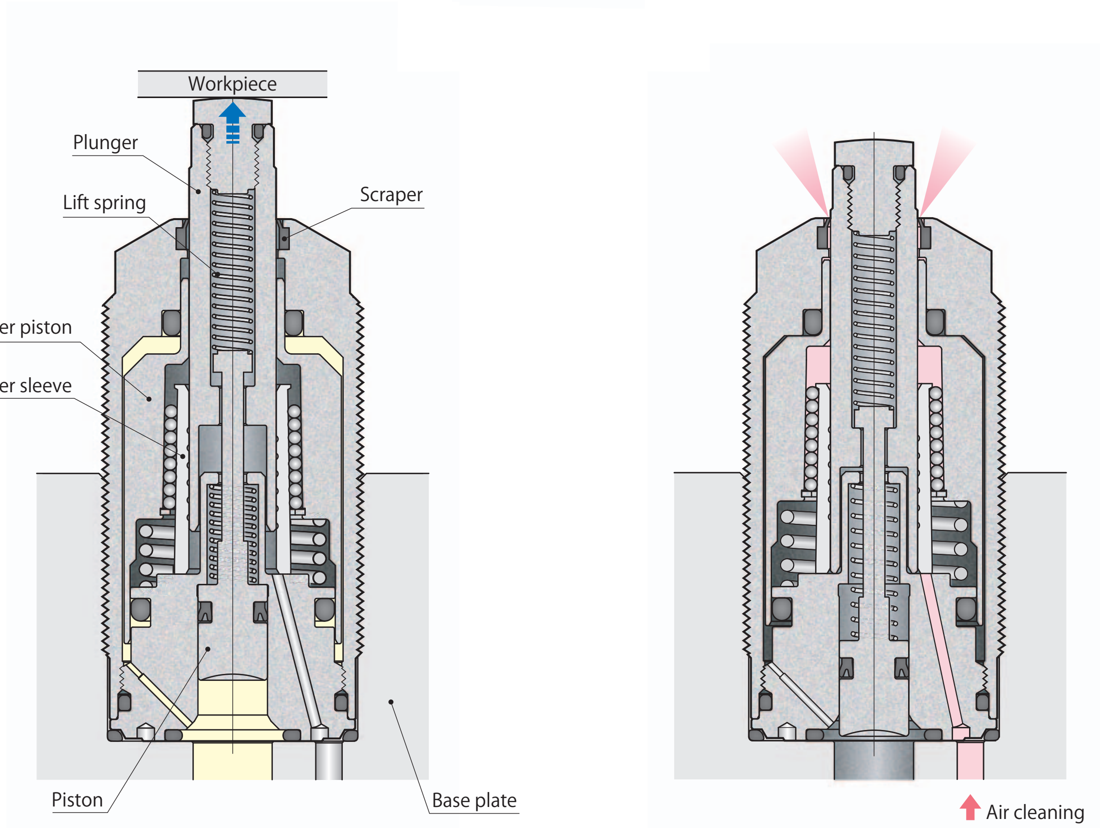
1 MPa

Air lift
model CSS04-L

Spring lift
model CSX04-L

Air lift

model CSS□-□

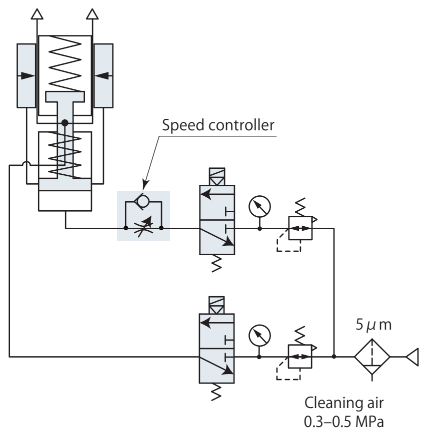


Lock

Unlock

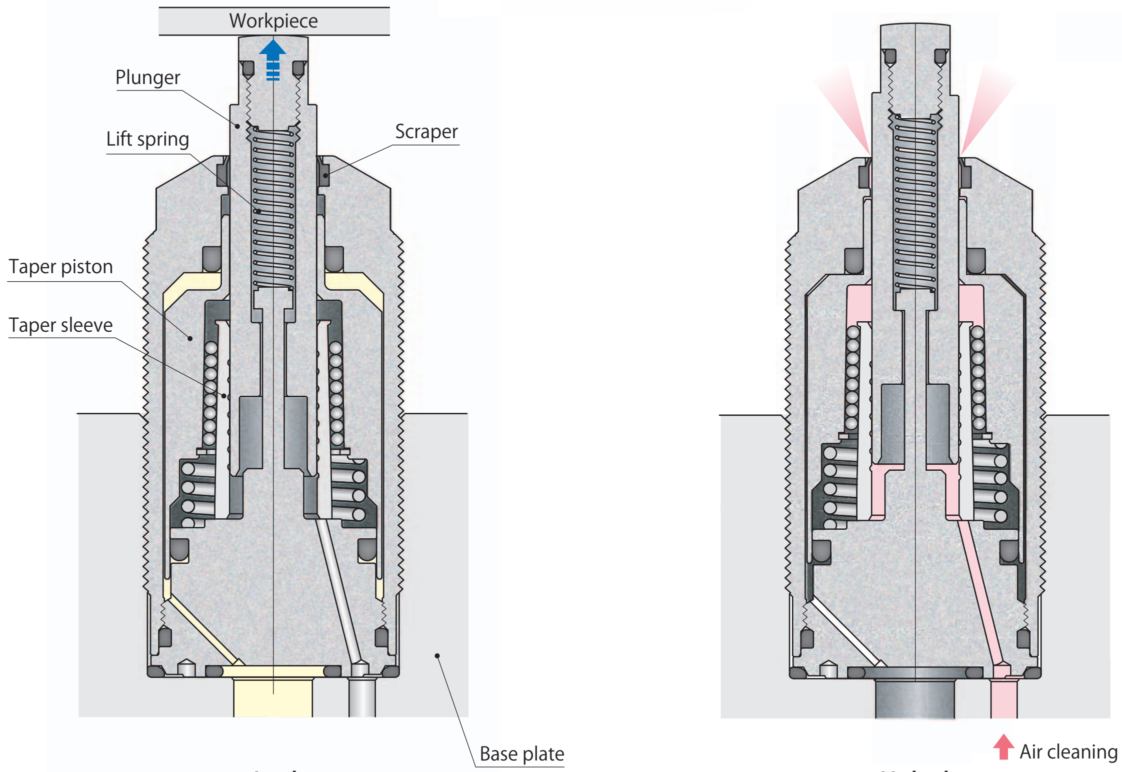
Specifications page → 800
Air pressure & support force page → 801
Applied load & deformation page → 801
Dimensions page → 802
Mounting details page → 804

Pneumatic circuit diagram



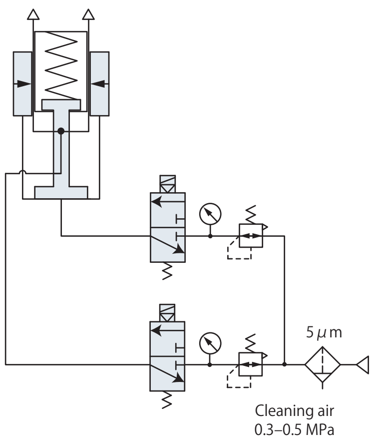
Spring lift

model **CSX□-□**



Lock **Unlock**

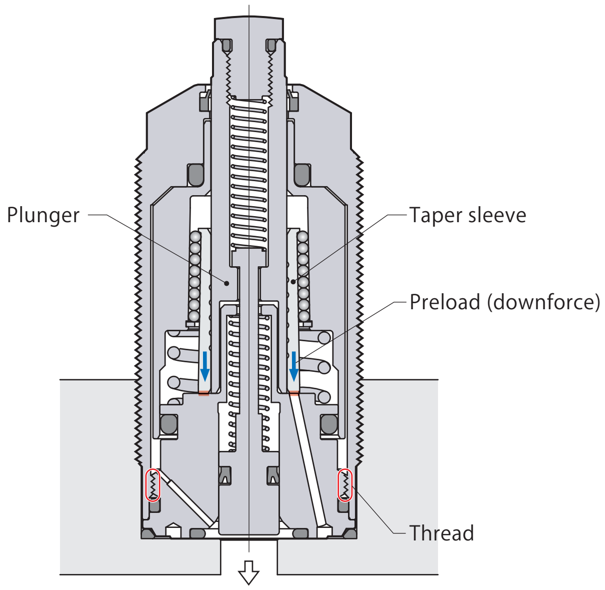
Pneumatic circuit diagram



Specifications	page → 800
Air pressure & support force	page → 801
Applied load & deformation	page → 801
Dimensions	page → 806
Mounting details	page → 808

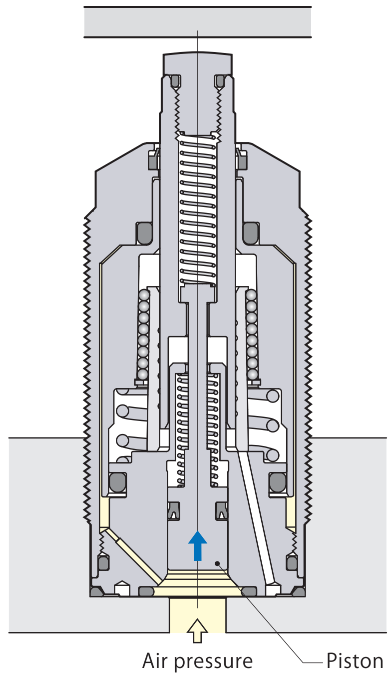
Air lift (model CSS)

Plunger is locked after it stroked by the structure containing sequencetial movement, which enables a workpiece to hold securely.



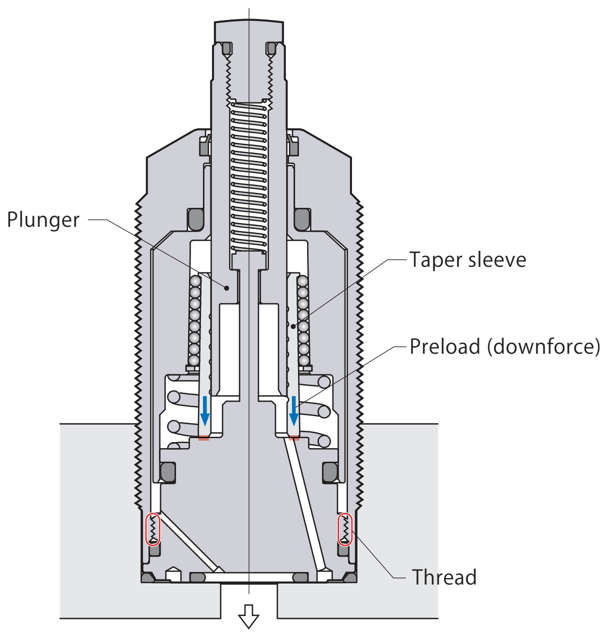
● The taper sleeve is preloaded by the thread and is kept the position lower.

①The piston moves upward



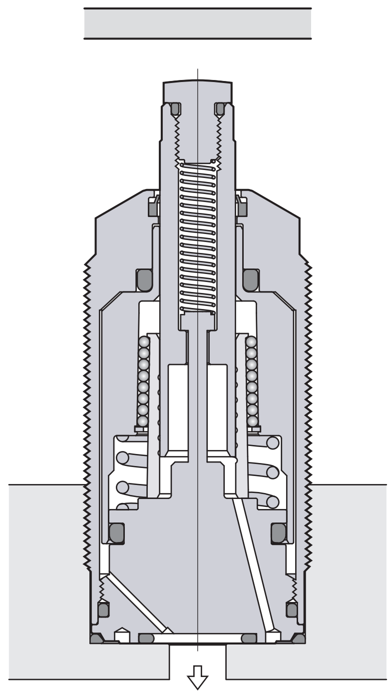
● Piston moves upward by the air force.

Spring lift (model CSX)

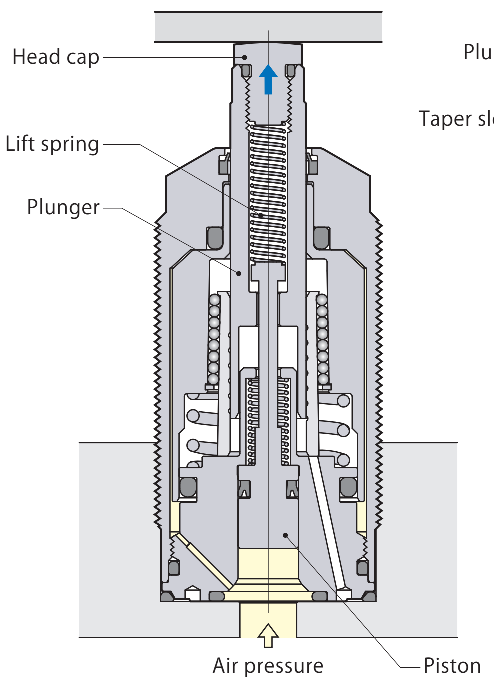


● The taper sleeve is preloaded by the thread and is kept the position lower.

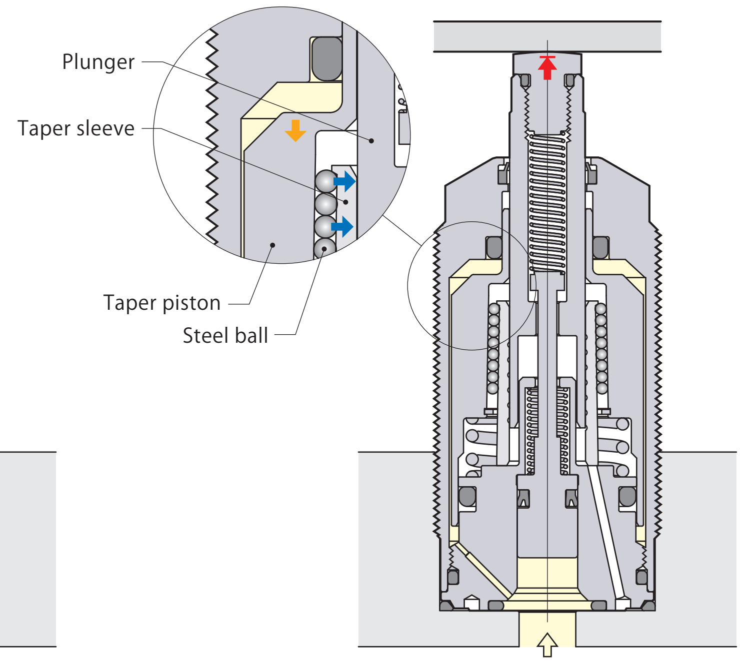
①Before the workpiece approaches



②Contact with the workpiece

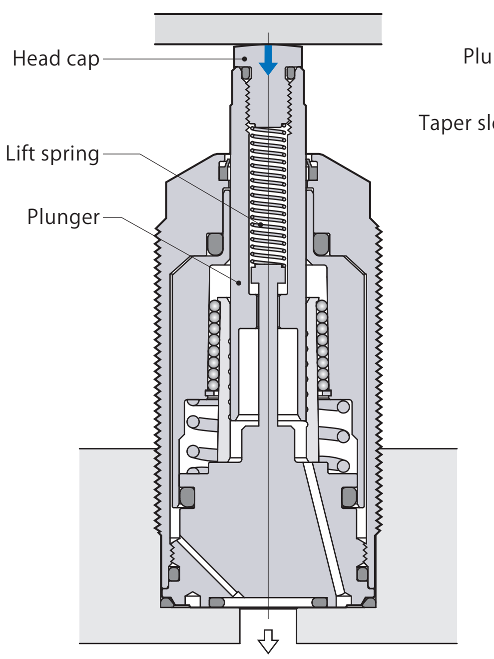


③Supporting the workpiece

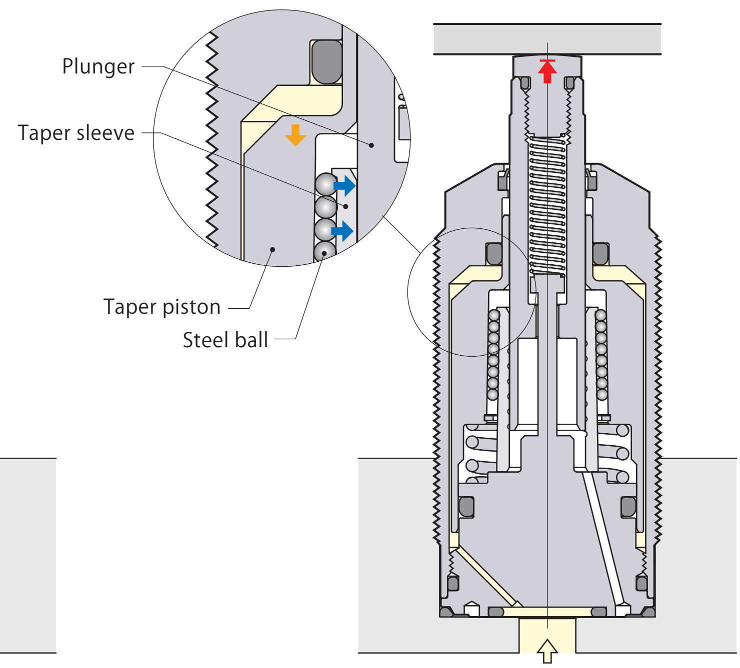


- The plunger with a head cap strokes upward by the lift spring to contact the workpiece. The plunger puts a load on the workpiece since the piston continues to move upward to the end of its stroke.
- After piston stroking, the taper piston moves down by the air force to depress the taper sleeve by means of the steel balls. Then the taper sleeve locks the plunger firmly.

②Contact with the workpiece



③Supporting the workpiece



- The workpiece touches head cap then depresses the plunger until it reaches to the seating surface. The lift spring puts a load onto the workpiece.
- The taper piston is pushed down by the air force to depress the taper sleeve by means of the steel balls. Then the taper sleeve locks the plunger firmly.

Specifications

	Size		Lift spring force
CSS : Air lift	005	–	**L** : Standard
CSX : Spring lift	00		**H** : Strong
	01		
	02		
	04		
	05		

Model			CSS005 / CSX005	CSS00 / CSX00	CSS01 / CSX01	CSS02 / CSX02	CSS04 / CSX04	CSS05 / CSX05
Support force*1	Air pressure 1MPa	kN	0.5	0.8	1.3	1.9	3.5	5.0
	Air pressure 0.5MPa	kN	0.19	0.3	0.5	0.7	1.3	1.9
Cylinder capacity	CSS	cm^3	0.7	1.1	1.7	2.6	4.2	6.2
	CSX	cm^3	0.5	0.8	1.3	2.2	3.6	4.6
Lift spring force*2	L:Standard	N	1–2	1–2	1–2	1–2	2–4	4–7
	H:Strong	N	2–3	2–3	2–3	2–3	3–6	6–11
Plunger stroke		mm	6.5	6.5	6.5	8	8	8
Max. allowable mass of head cap		kg	0.05					
Mass		kg	0.1	0.2	0.3	0.4	0.8	1.1
Recommended tightening torque of body		N·m	20–25	35–45	40–50	45–55	55–65	80–90

● Air pressure range: 0.4–1 MPa ● Proof pressure: 1.5 MPa ● Operating temperature: 0–70 ℃ ● Fluid used: Air*3

● Oil supply: Not required ● Seals are resistant to chlorine-based cutting fluid. (not thermal resistant specification)

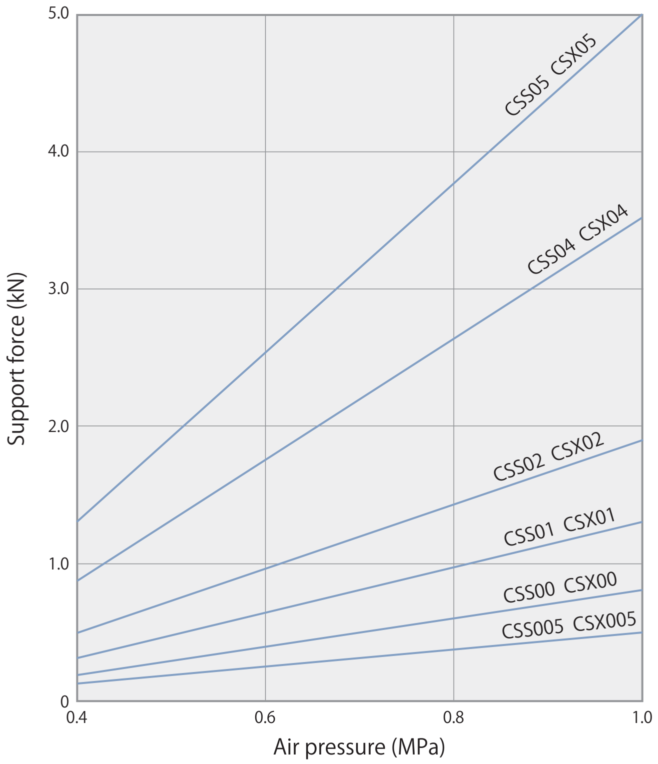
● Air sensor operation is unavailable.

*1: When work support and clamp are used facing each other, work support and clamp must be selected in such a way that the support force is 1.5 times the applied load (clamping force + machining force).

*2: Figures are for "upper end to lower end" of plunger action.

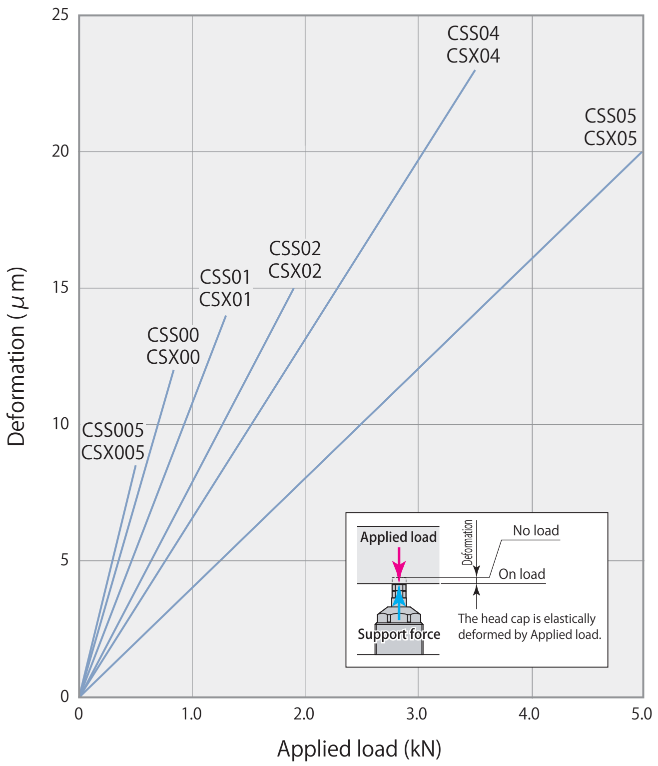
*3: Supply the dry and filtered air. Particulate size 5 μm or less is recommended.

Air pressure & support force



Air pressure MPa	Support force kN					
	CSS005	CSS00	CSS01	CSS02	CSS04	CSS05
	CSX005	CSX00	CSX01	CSX02	CSX04	CSX05
0.4	0.13	0.2	0.3	0.5	0.9	1.3
0.5	0.19	0.3	0.5	0.7	1.3	1.9
0.6	0.25	0.4	0.7	1.0	1.7	2.5
0.7	0.31	0.5	0.8	1.2	2.2	3.1
0.8	0.38	0.6	1.0	1.4	2.6	3.8
0.9	0.44	0.7	1.1	1.7	3.1	4.4
1.0	0.5	0.8	1.3	1.9	3.5	5.0

Applied load & deformation

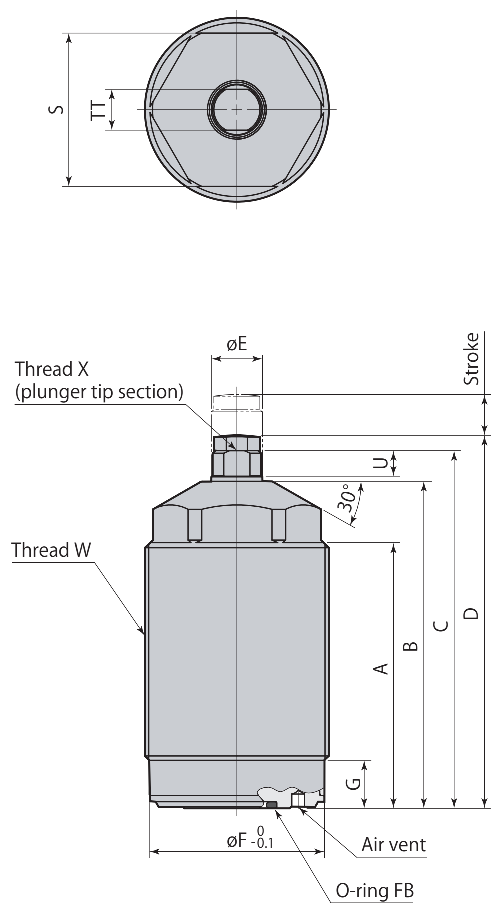


Applied load kN	Deformation μm					
	CSS005	CSS00	CSS01	CSS02	CSS04	CSS05
	CSX005	CSX00	CSX01	CSX02	CSX04	CSX05
0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	8.5	7.5	5.4	3.9	3.3	2.0
1.0			10.8	7.9	6.6	4.0
1.5				11.8	9.9	6.0
2.0					13.1	8.0
2.5					16.4	10.0
3.0		Nonusable range			19.7	12.0
3.5					23.0	14.0
4.0						16.0
4.5						18.0
5.0						20.0

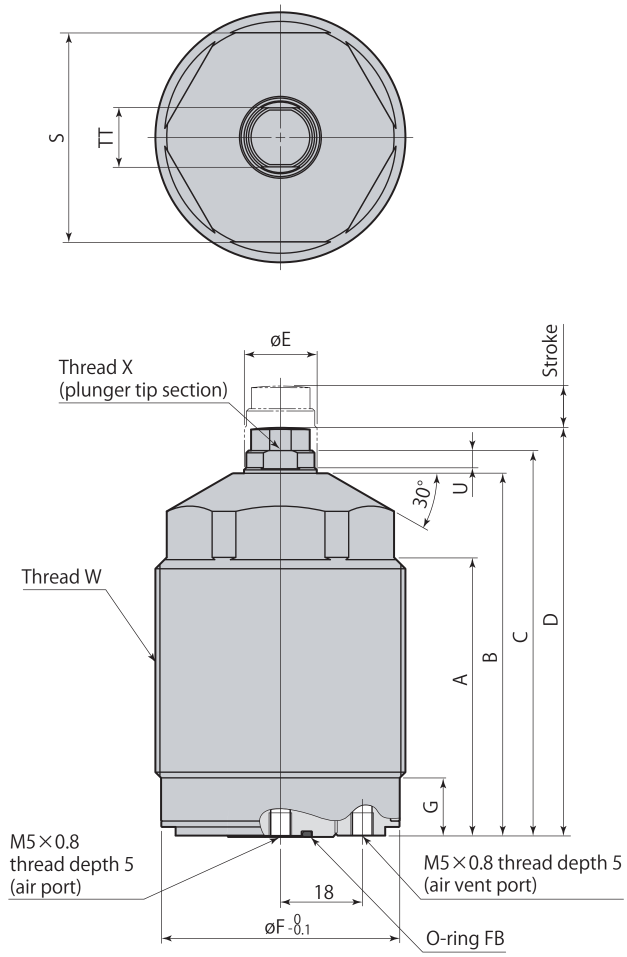
Held with air pressure of 1 MPa.

Dimensions

CSS005, CSS00, CSS01, CSS02, CSS04



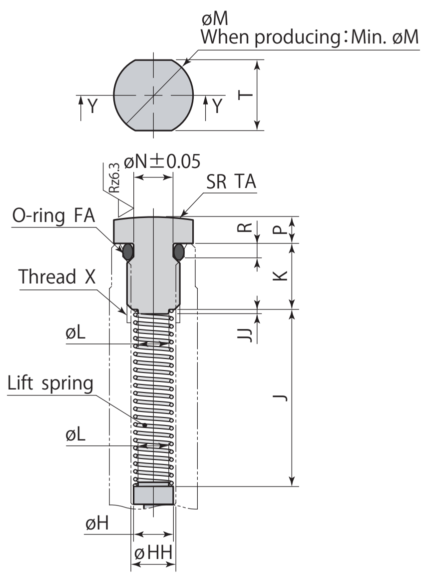
CSS05



Head cap details

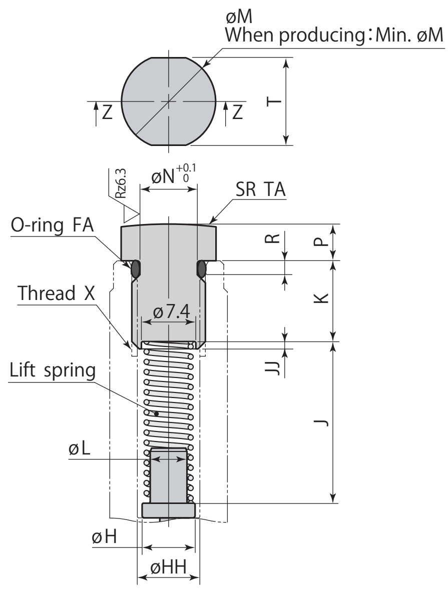
Hardness：HRC52

CSS005, CSS00, CSS01, CSS02, CSS04



Y-Y

CSS05



Z-Z

Rz: ISO4287(1997)

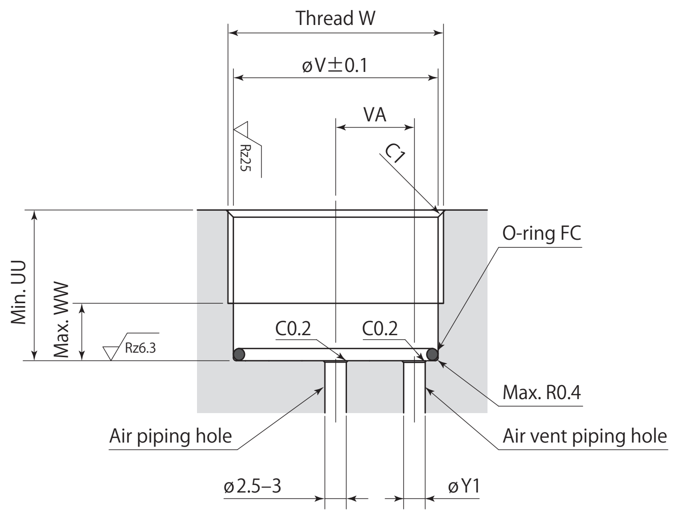
mm

Model	CSS005-□	CSS00-□	CSS01-□	CSS02-□	CSS04-□	CSS05-□
A	39	44	51	52	61	61
B	47	53	60	64	76	80
C	51.5	59	66	70	83	85
D	54	62	69	73	87	90
øE	8	10	10	10	12	16
øF	20.3	24.3	28.3	34.3	43.3	52.5
G	8.4	9.4	9.4	9.4	9.4	13
øH	3.8	4.5	4.5	4.5	5.5	7.2
øHH	4.3	5.1	5.1	5.1	6.8	8.5
J	15.5	20.5	20.5	20	20.1	22
JJ	0.5	0.5	0.5	0.5	1	1
K	7	7.5	7.5	7.5	9	11
øL	2.8	3.5	3.5	3.5	4.3	5
øM	8	9	9	9	11.5	12.9
Min. øM	7.5	8.5	8.5	8.5	10	12.5
øN	4	4.5	4.5	4.5	6	7.8
P	2.5	3	3	3	4	5
R	1.0	1.5	1.5	1.5	1.9	1.9
S (hex width across flats)	19	22	24	30	36	46
T (width across flats)	7	8	8	8	10	12
TA	30	30	30	30	50	55
TT (plunger width across flats)	7	8	8	8	10	13
U	3.5	5	5	5	6	4
W	M22×1.5	M26×1.5	M30×1.5	M36×1.5	M45×1.5	M55×2
X (recommended tightening torque)	M5×0.8 depth 8 (6 N·m)	M6×1 depth 9 (10 N·m)	M6×1 depth 9 (10 N·m)	M6×1 depth 9 (10 N·m)	M8×1.25 depth 12 (20 N·m)	M10×1.5 depth 13 (30 N·m)
O-ring FA (fluorocarbon hardness Hs70)	SS4.5 (4.0×1.0)*	S5	S5	S5	S6	S8
O-ring FB (fluorocarbon hardness Hs90)	AS568-011	AS568-013	AS568-014	AS568-014	AS568-015	AS568-013

* : Inner diameter × Thickness

- When fixing the hexagon part of body with a vise, etc., make sure the tightening force is 2.5 kN or less.
- Always attach head cap (lift spring cannot be retained). When fabricating head cap, ensure that O-ring slot, spring spot facing and guide are made by referring to head cap details. Be sure to always use O-ring.
- When fabricating a lift spring, determine dimensions by referring to head cap details. Furthermore, rustproofing must be implemented (however, there is no guarantee for operation).
- A pipe fitting (M5) is mountable at the bottom of the body. (CSS05 only) Refer to the diagram shown in **page →802** for details.
- This diagram indicates a situation where head cap has been fitted into plunger with no pressure applied.

Mounting details



Rz: ISO4287(1997)

mm

Model	CSS005-□	CSS00-□	CSS01-□	CSS02-□	CSS04-□	CSS05-□
UU	19	20	20	20	20	27
øV	20.5	24.5	28.5	34.5	43.5	53
VA	7	9	11	13	15	21
W	M22×1.5	M26×1.5	M30×1.5	M36×1.5	M45×1.5	M55×2
WW	8	9	9	9	9	12
øY1	2	2.5–3	2.5–3	2.5–3	2.5–3	2.5–3
O-ring FC (fluorocarbon hardness Hs90)	AS568-017	AS568-020	AS568-022	AS568-026	AS568-030	AS568-134

● Install O-ring FC at the bottom of the hole. The O-ring FC is packed with a work support.

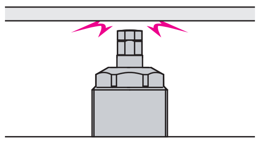
Caution in use

- The lift spring in the plunger may push the workpiece upward if it is light weight and seating detection cannot be complete. Review the weight of workpiece or lift spring force and make it appropriate to seat the workpiece perfectly and acutate the work support.

- Set the plunger lifting time to 0.5 seconds or longer by adjusting the speed controller (meter-in). Reasonable plunger ascending speed can prevent the parts from breakage also curbs plunger contact false.

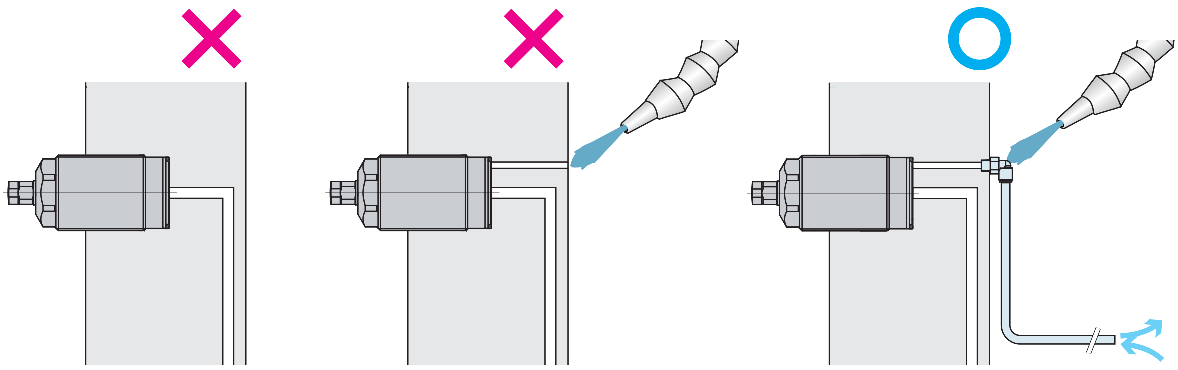
If the plunger ascends to reach a workpiece too fast, it rebounds after hitting the workpiece and will create a small clearance between the two. The clearance may cause a supporting fault of the workpiece.

Rebound and clearance



- Avoid following usages. These may cause sleeve deformation that could lead to malfunction of plunger or decreased support force.
  - ✕ Applying eccentric load on plunger.
  - ✕ Applying load that exceeds rated support force.
  - ✕ Rotating plunger when locked.

- Air vent must be opened to atmosphere. Any blockage on the vent results in malfunction. Provide the piping if there is a risk of coolant or metal chips intrusion. Allowing intrusion of cutting fluid may cause rusting and other problems.

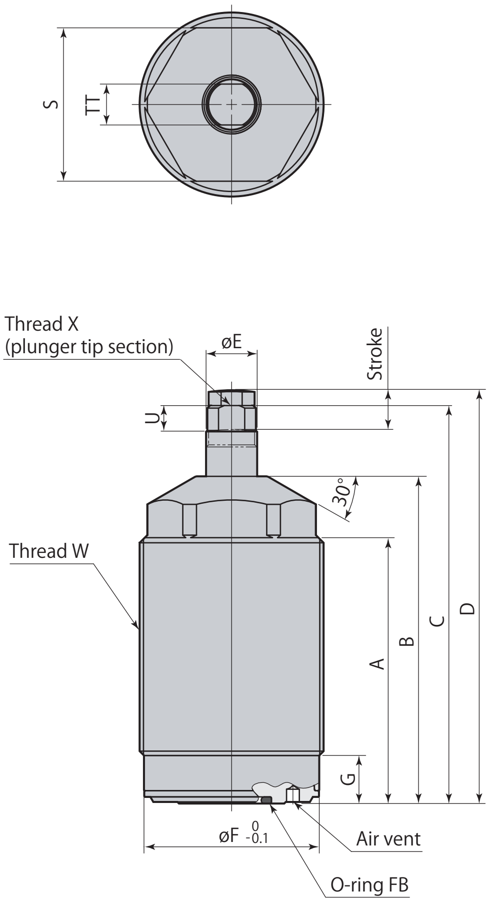


Air vent is blocked | Cutting fluid intrusion from air vent | Piping to metal chips or coolant free area

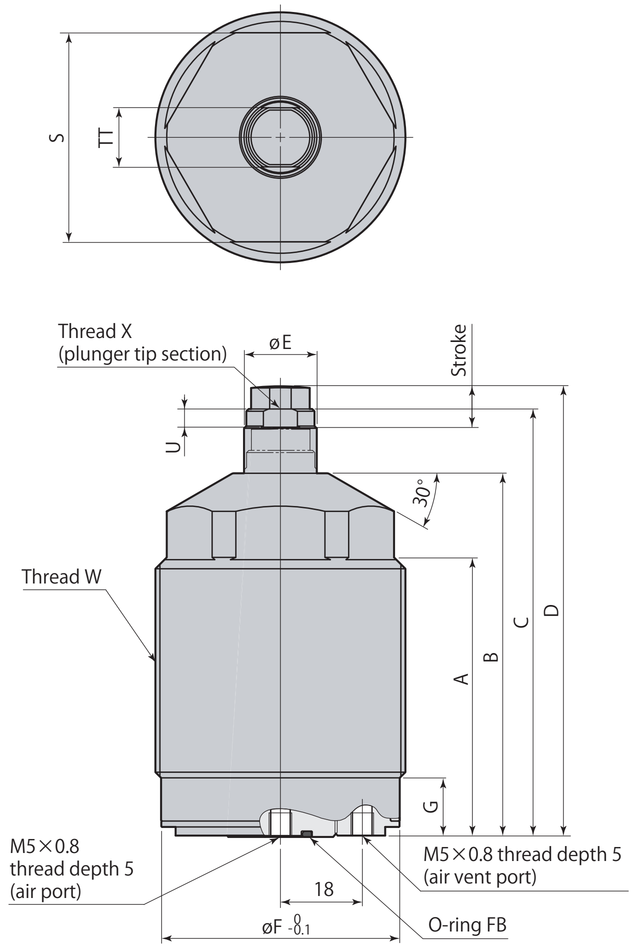
- Air (oil free) must be fed through a 5 μm filter that is connected to an air vent port for air cleaning. Perform air cleaning only when replacing workpiece. Plunger will rise during air cleaning.

Dimensions

CSX005, CSX00, CSX01, CSX02, CSX04



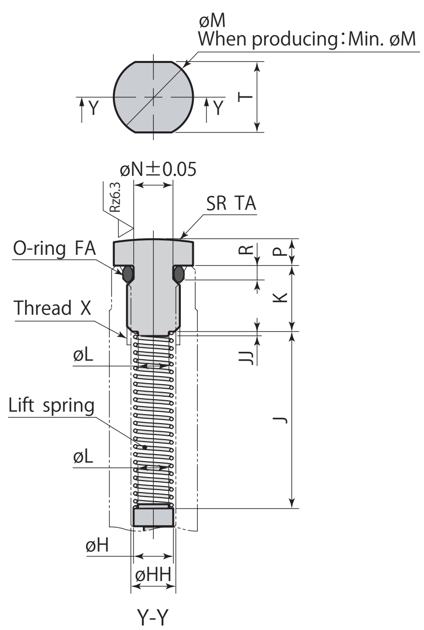
CSX05



Head cap details

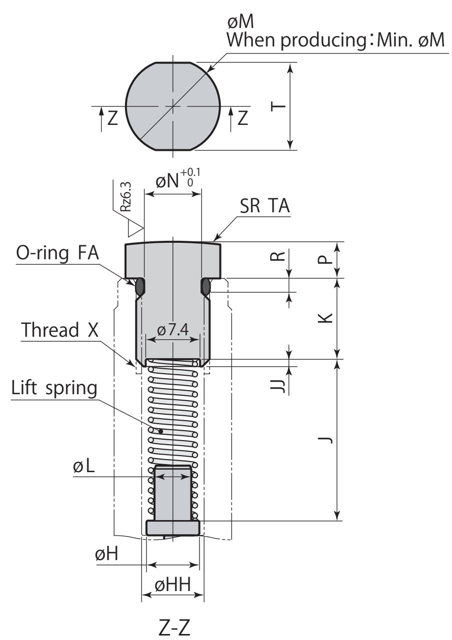
Hardness：HRC52

CSX005, CSX00, CSX01, CSX02, CSX04



Rz: ISO4287(1997)

CSX05



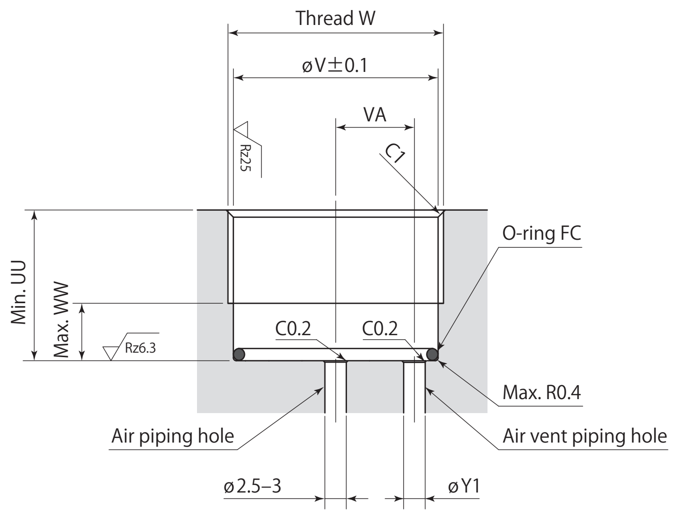
mm

Model	CSX005-□	CSX00-□	CSX01-□	CSX02-□	CSX04-□	CSX05-□
A	39	44	51	52	61	61
B	47	53	60	64	76	80
C	58	65.5	72.5	78	91	93
D	60.5	68.5	75.5	81	95	98
øE	8	10	10	10	12	16
øF	20.3	24.3	28.3	34.3	43.3	52.5
G	8.4	9.4	9.4	9.4	9.4	13
øH	3.8	4.5	4.5	4.5	5.5	7.2
øHH	4.3	5.1	5.1	5.1	6.8	8.5
J	15.5	20.5	20.5	20	20.1	22
JJ	0.5	0.5	0.5	0.5	1	1
K	7	7.5	7.5	7.5	9	11
øL	2.8	3.5	3.5	3.5	4.3	5
øM	8	9	9	9	11.5	12.9
Min. øM	7.5	8.5	8.5	8.5	10	12.5
øN	4	4.5	4.5	4.5	6	7.8
P	2.5	3	3	3	4	5
R	1.0	1.5	1.5	1.5	1.9	1.9
S (hex width across flats)	19	22	24	30	36	46
T (width across flats)	7	8	8	8	10	12
TA	30	30	30	30	50	55
TT (plunger width across flats)	7	8	8	8	10	13
U	3.5	5	5	5	6	4
W	M22×1.5	M26×1.5	M30×1.5	M36×1.5	M45×1.5	M55×2
X (recommended tightening torque)	M5×0.8 depth 8 (6 N·m)	M6×1 depth 9 (10 N·m)	M6×1 depth 9 (10 N·m)	M6×1 depth 9 (10 N·m)	M8×1.25 depth 12 (20 N·m)	M10×1.5 depth 13 (30 N·m)
O-ring FA (fluorocarbon hardness Hs70)	SS4.5 (4.0×1.0)*	S5	S5	S5	S6	S8
O-ring FB (fluorocarbon hardness Hs90)	AS568-011	AS568-013	AS568-014	AS568-014	AS568-015	AS568-013

*：Inner diameter × Thickness

- When fixing the hexagon part of body with a vise, etc., make sure the tightening force is 2.5 kN or less.
- Always attach head cap (lift spring cannot be retained). When fabricating head cap, ensure that O-ring slot, spring spot facing and guide are made by referring to head cap details. Be sure to always use O-ring.
- When fabricating a lift spring, determine dimensions by referring to head cap details. Furthermore, rustproofing must be implemented (however, there is no guarantee for operation).
- A pipe fitting (M5) is mountable at the bottom of the body. (CSX05 only) Refer to the diagram shown in **page →806** for details.
- This diagram indicates a situation where head cap has been fitted into plunger with no pressure applied.

Mounting details



Rz: ISO4287(1997)

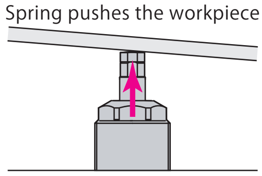
mm

Model	CSX005-□	CSX00-□	CSX01-□	CSX02-□	CSX04-□	CSX05-□
UU	19	20	20	20	20	27
øV	20.5	24.5	28.5	34.5	43.5	53
VA	7	9	11	13	15	21
W	M22×1.5	M26×1.5	M30×1.5	M36×1.5	M45×1.5	M55×2
WW	8	9	9	9	9	12
øY1	2	2.5–3	2.5–3	2.5–3	2.5–3	2.5–3
O-ring FC (fluorocarbon hardness Hs90)	AS568-017	AS568-020	AS568-022	AS568-026	AS568-030	AS568-134

● Install O-ring FC at the bottom of the hole. The O-ring FC is packed with a work support.

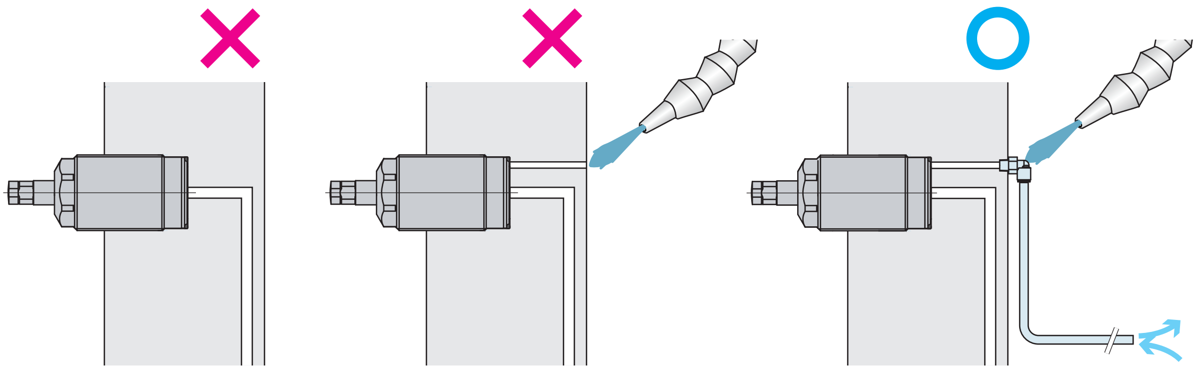
Caution in use

- If the workpiece is light weight, the plunger cannot be pressed down by the weight of workpiece and seating detection cannot be complete. Review the weight of workpiece or lift spring force to make the work-piece seat perfectly, and lock the work support.



- Avoid following usages. These may cause sleeve deformation that could lead to malfunction of plunger or decreased support force.
  - ✕ Applying eccentric load on plunger.
  - ✕ Applying load that exceeds rated support force.
  - ✕ Rotating plunger when locked.

- Air vent must be opened to atmosphere. Any blockage on the vent results in malfunction. Provide the piping if there is a risk of coolant or metal chips intrusion. Allowing intrusion of cutting fluid may cause rusting and other problems.



- Air (oil free) must be fed through a 5 μm filter that is connected to an air vent port for air cleaning. Perform air cleaning only when replacing workpiece.

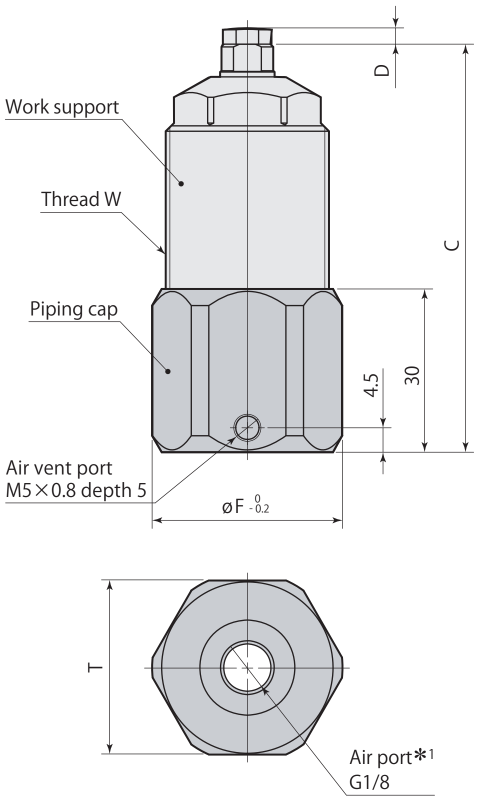
Piping cap

Size

	005	: CSS005, CSX005			
	00	: CSS00, CSX00			
CSP	(Nil)	: CSS01, CSX01	–	C	: Piping cap
	02	: CSS02, CSX02			
	06	: CSS04, CSX04			

Work support	CSS005 CSX005	CSS00 CSX00	CSS01 CSX01	CSS02 CSX02	CSS04 CSX04	CSS05 CSX05
Piping cap	CSP005-C	CSP00-C	CSP-C	CSP02-C	CSP06-C	(*)

*:Connect model CSS05 and model CSX05 directly as a port is available on body. (For details about thread size and connecting position, please refer to **page** →**802** for model CSS, **page** →**806** for model CSX.)



mm

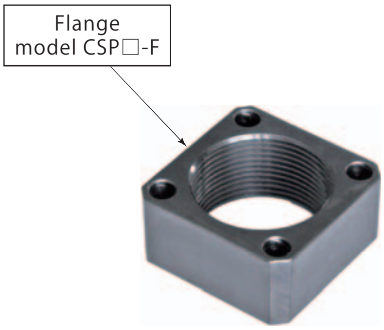
Model	CSP005-C	CSP00-C	CSP-C	CSP02-C	CSP06-C
C*2	61.5	68	75	79	92
D	2.5	3	3	3	4
øF	32	32	35	45	54
T (width across flats)	29	29	32	41	50
W	M22×1.5	M26×1.5	M30×1.5	M36×1.5	M45×1.5

*1:Use one-touch fittings manufactured by SMC for G port piping. (See SMC catalog for the details of the fitting.)

*2:Stroke length to be added on C dimension when mounting on model CSX.

Install O-ring in the same way even when a piping cap is used for mounting.
The O-ring is included in the package of the work support.

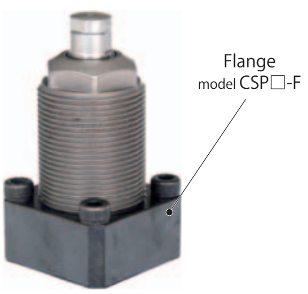
Flange



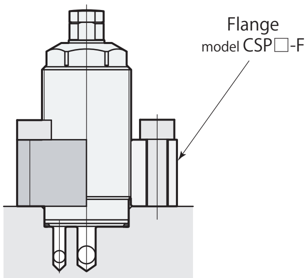
Use a mounting flange when installing with screws.

CSP [Size] – F : Flange

Size
- **022** : CSS005, CSX005
- **026** : CSS00, CSX00
- **030** : CSS01, CSX01
- **036** : CSS02, CSX02
- **045** : CSS04, CSX04
- **055** : CSS05, CSX05

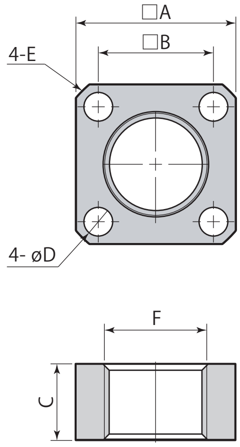


Work support model **CSS, CSX** mounting

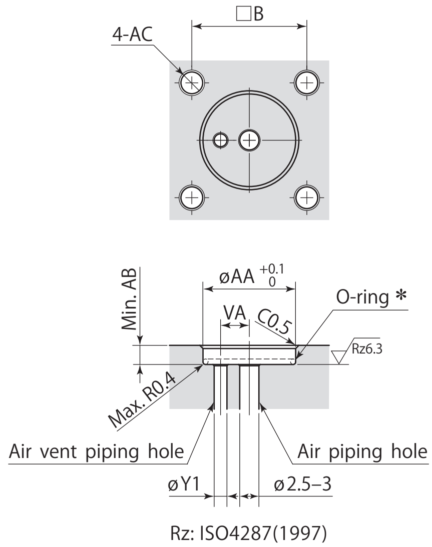


①Mount a flange with screws.
②Screw the work support in the flange.

Dimensions



Mounting details



∗ : Install O-ring in the same way even when a flange is used for mounting. The O-ring is included in the package of the work support.

- Mounting screws are not included.
- Refer to **pages** →**802** for model CSS, **806** for model CSX for the dimensions of products that are not listed on this page.

mm

Model	CSP022-F	CSP026-F	CSP030-F	CSP036-F	CSP045-F	CSP055-F
A	30	35	40	50	55	70
B	23	26	31	40	42	54
C	12	17	16	16	18	24
øD	4.5	5.5	5.5	6.8	9	11
E	C2	C3	C3	C3	C4	C5
F	M22×1.5	M26×1.5	M30×1.5	M36×1.5	M45×1.5	M55×2.0
øY1	2	2.5–3	2.5–3	2.5–3	2.5–3	2.5–3
øAA	20.5	24.5	28.5	34.5	43.5	53
AB	3	3	3	3	3	3
AC	M4	M5	M5	M6	M8	M10
VA	7	9	11	13	15	21
Mass	0.05 kg	0.09 kg	0.11 kg	0.18 kg	0.18 kg	0.43 kg

Piping block

CSP – Size – P

Size

022 : CSS005, CSX005

026 : CSS00, CSX00

030 : CSS01, CSX01

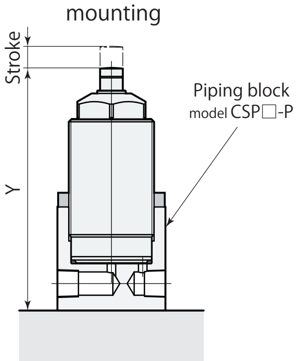
036 : CSS02, CSX02

045 : CSS04, CSX04

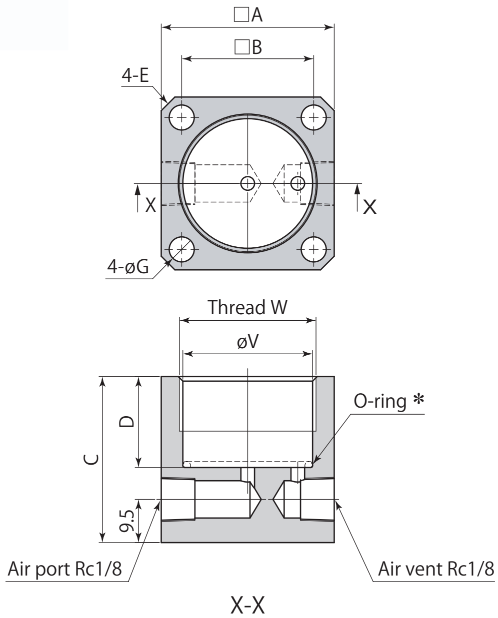
055 : CSS05, CSX05

P : Piping block

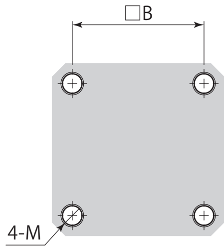
Work support
model **CSS, CSX**
mounting



Dimensions



Mounting details



∗ : Install O-ring in the same way even when a piping block is used for mounting. The O-ring is included in the package of the work support.

- Mounting screws are not included.
- Provide the piping if there is a risk of coolant or metal chips intrusion from air vent.
- Refer to **pages →802** for model CSS, **806** for model CSX for the dimensions of products that are not listed on this page.

mm

Model	CSP022-P	CSP026-P	CSP030-P	CSP036-P	CSP045-P	CSP055-P
A	28	35	38	45	55	70
B	21	26	29	35	42	54
C	35.5	36.5	36.5	36.5	36.5	43.5
D	19	20	20	20	20	27
E	C2	C3	C3	C3	C4	C5
øG	4.5	5.5	5.5	6.8	9	11
M	M4	M5	M5	M6	M8	M10
øV	20.5	24.5	28.5	34.5	43.5	53
W	M22×1.5	M26×1.5	M30×1.5	M36×1.5	M45×1.5	M55×2
Y∗	70.5	78.5	85.5	89.5	103.5	106.5
Stroke	6.5	6.5	6.5	8	8	8
Mass	0.14 kg	0.23 kg	0.27 kg	0.37 kg	0.53 kg	1.03 kg

∗ : Stroke length to be added on Y dimension when mounting on model CSX.

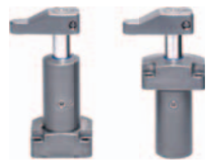
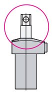
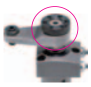
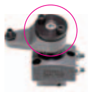
	Swing clamp	model **CTK** **Page →816**  Upper flange Cartridge Lower flange		model **CTW/CTV** **Page →864**  Lower flange Upper flange	
	Specifications	35MPa Double acting		35MPa Double acting	35MPa Single acting
	Features	Wide varieties of designs Built-in sensor model		Clamp arm, lateral bolting type	
	Clamp stroke	Standard	Long stroke	Standard	
Variations	Standard (without sensor) 	CTK **Page →824**	CTK-J **Page →842**	CTW **Page →870**	CTV **Page →884**
	Clamp sensor model 	CTK-C **Page →850**	—	—	
	Unclamp sensor model 	CTK-B **Page →850**	—	—	
	Pin rod 	CTK-P **Page →836**	—	—	
	Swing angle 30°, 45°, 60°	CTK-30/45/60 **Page →838**	CTK-J30/45/60 **Page →843**	CTW-N **Page →878**	CTV-N **Page →892**
Option	Taper sleeve 	CTH-KS **Page →854**		—	
	Perfect nut 	CTH-KN **Page →855**		—	
	Perfect release nut 	CTH-KNR **Page →855**		—	
	Clamp arm	—		CTH-W/CTH-VB **Page →894**	
	Flow control valve 	VCH **Page →860**		—	
	Air bleeding valve 	VCE **Page →862**		—	

Table of contents

Swing clamp

Double acting 35MPa

model CTK

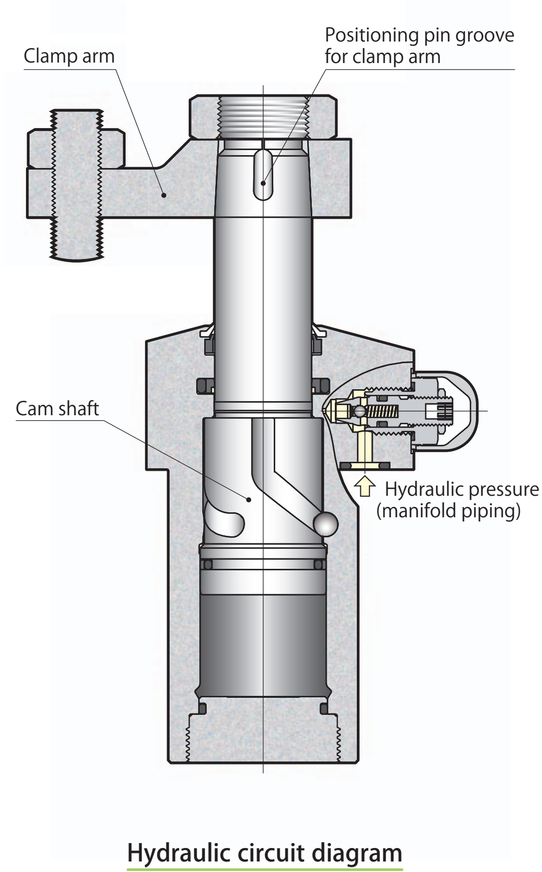
Lower flange
model CTK04B-L

Cartridge
model CTK04N-L

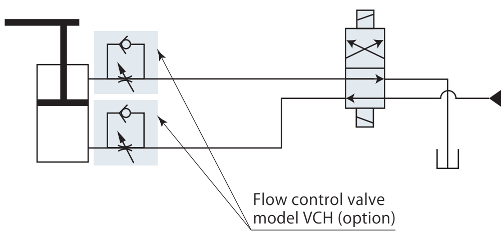
Upper flange
model CTK04U-L

Upper flange

model **CTK□U-□**



Hydraulic circuit diagram



For flow control valve, we recommend the meter-in control. If meter-out control is used, due to the area difference, it will cause back pressure and become high pressure. This can lead to malfunction of the system. Please be aware when designing the circuit.

Specifications page → 819
Upper flange page → 824
Lower flange page → 828
Cartridge page → 832
Pin rod page → 836
Swing angle 30°, 45°, 60° page → 838
Long stroke page → 842

Specifications

CTK

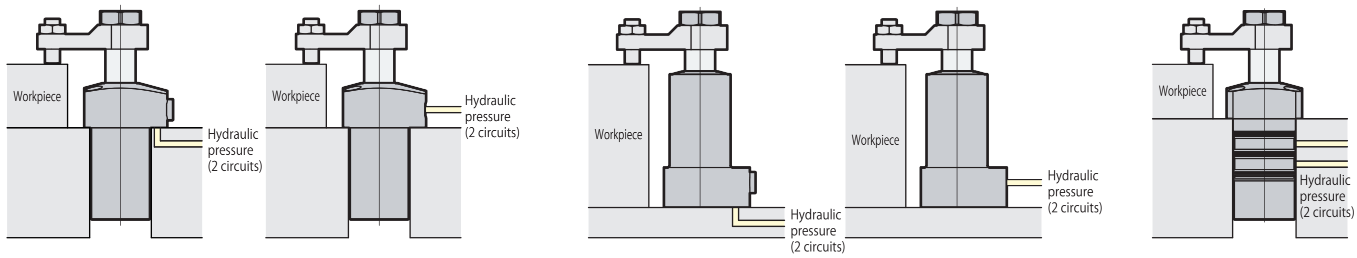
Size	Mounting and piping types		Swing direction (when clamping), swing angle
02	U : Upper flange	–	L : Counter-clockwise, swing angle 90°
04	B : Lower flange		L30 : Counter-clockwise, swing angle 30°
06	N : Cartridge		L45 : Counter-clockwise, swing angle 45°
10			L60 : Counter-clockwise, swing angle 60°
16			R : Clockwise, swing angle 90°
			R30 : Clockwise, swing angle 30°
			R45 : Clockwise, swing angle 45°
			R60 : Clockwise, swing angle 60°
			C : Straight, swing angle 0°

▇ indicates made to order.

Refer to **pages** →**836** and **837** for details of pin rod (CTK□□-□P).
Refer to **pages** →**842** and **843** for details of long stroke of upper flange (CTK□U-□J).
Refer to **pages** →**844** to **853** for details of sensor model (CTK□U-□C, CTK□U-□B).

Mounting and piping types

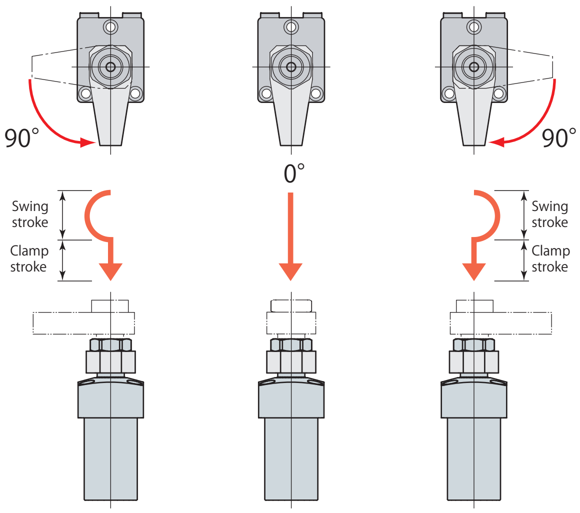
CTK□U-□ Upper flange, manifold piping
CTK□U-□ Upper flange, G port piping
CTK□B-□ Lower flange, manifold piping
CTK□B-□ Lower flange, G port piping
CTK□N-□ Cartridge



Refer to **page** →**821** for details of piping methods.
Only manifold piping is available for model CTK02.

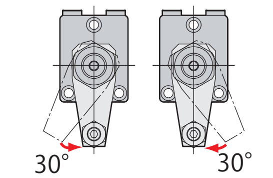
Swing direction (when clamping)

CTK□□-L Counter-clockwise Swing angle 90°
CTK□□-C Straight Swing angle 0°
CTK□□-R Clockwise Swing angle 90°



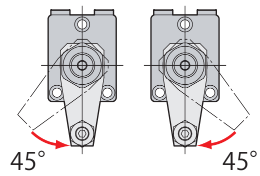
Swing angle

CTK□□-L30/R30
Swing angle 30°



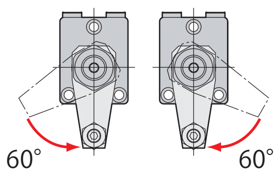
L:Counter-clockwise R:Clockwise

CTK□□-L45/R45
Swing angle 45°



L:Counter-clockwise R:Clockwise

CTK□□-L60/R60
Swing angle 60°



L:Counter-clockwise R:Clockwise

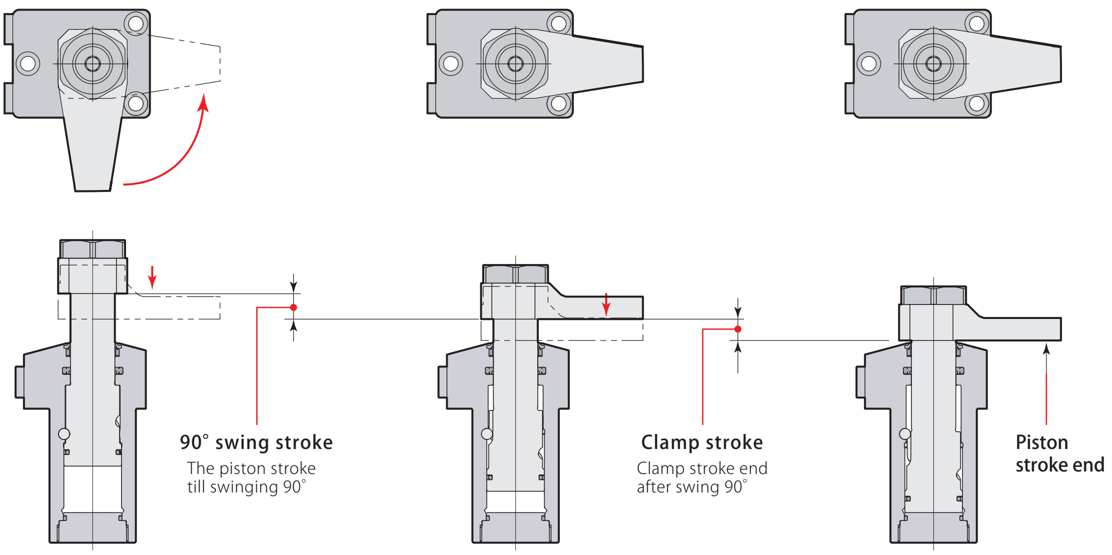
Refer to **pages** →**838** to **840**, and **843** for details.

Specifications

Model			CTK02	CTK04	CTK06	CTK10	CTK16
Cylinder force (hydraulic pressure 35MPa)		kN	3.1	5.1	7.6	14.6	20.3
Cylinder inner diameter		mm	16	21	26	34	42
Rod diameter		mm	12	16	20	25	32
Effective area (clamp)		cm^2	0.88	1.45	2.17	4.17	5.81
Swing angle	CTK□□-L, R		90°±3°				
	CTK□□-C		0°				
Positioning pin groove position accuracy			±1°				
Repeated clamp positioning accuracy			±0.5°				
Full stroke		mm	15	17	21	25.5	28.5
90° swing stroke (CTK□□-L, R)		mm	7	9	11	13.5	16.5
Clamp stroke (CTK□□-L, R)		mm	8	8	10	12	12
Cylinder capacity	Clamp	cm^3	1.3	2.5	4.6	10.6	16.6
	Unclamp	cm^3	3.0	5.9	11.1	23.2	39.5
Mass		kg	0.4	0.7	1.1	2.0	3.3
Recommended tightening torque of mounting screws*		N·m	7	7	12	29	57
Recommended tightening torque of nut		N·m	11	26	51	75	130

● Pressure range：5–35 MPa ● Proof pressure：52.5 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)
● There is no overload protection mechanism.
*：ISO R898 class 12.9

Clamping must be done within the range of clamp stroke.



Manifold piping and G port piping are available.

Two piping methods are available for model CTK□U-□ (upper flange) and model CTK□B-□ (lower flange), manifold piping and G port piping.

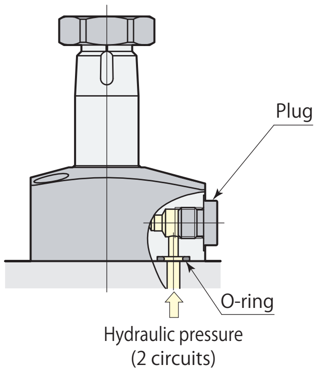
Manifold piping

When choosing manifold piping, a flow control valve (model VCH) and an air bleeding valve (model VCE) are mountable on the G ports of the clamp.
Only manifold piping is available for model CTK02.

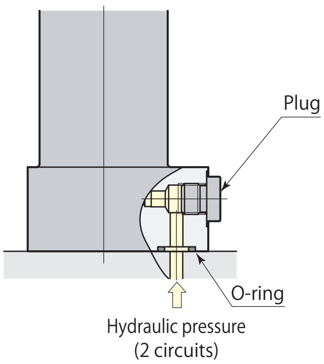
G port piping

Remove plugs when choosing G port piping for model CTK□U-□ (upper flange). (O-ring must be used.)
Remove plugs and O-ring, and mount sealing plug that is included, when choosing G port piping for model CTK□B-□ (lower flange). (Sealing plug is not mounted with shipment.)
The flow control valve and the air bleeding valve should be installed in the middle of oil path.

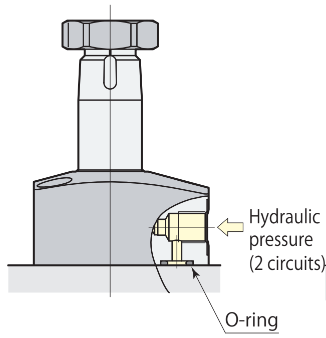
Upper flange
manifold piping



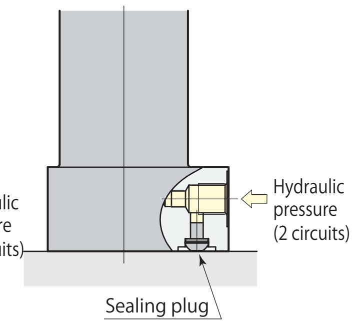
Lower flange
manifold piping



Upper flange
G port piping

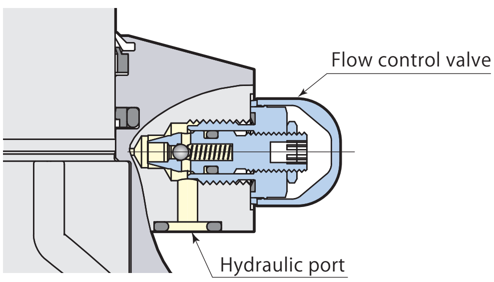


Lower flange
G port piping



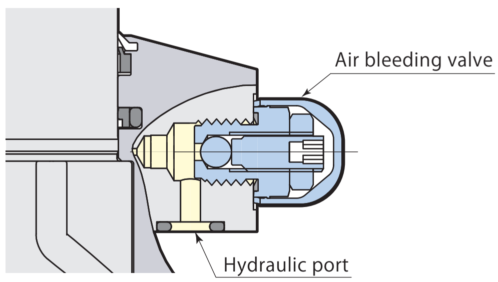
Flow control valve model VCH

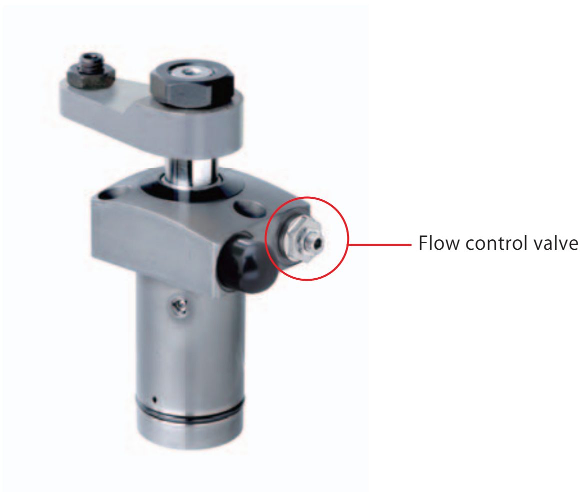
Page →860



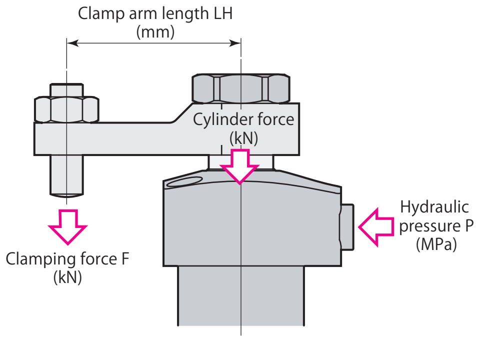
Air bleeding valve model VCE

Page →862





Performance table



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

Clamping force calculation formula

F = P/(Coefficient 1 + Coefficient 2 × LH)

F: Clamping force P: Hydraulic pressure LH: Clamp arm length

CTK06 with clamp arm length (LH) = 80 mm at hydraulic pressure of 20 MPa, Clamping force F is calculated by

20/(4.61+0.0185×80)=3.3 kN

Do not use the clamp in the nonusable range. It may cause damage to the cylinder and rod.

model CTK02   Clamping force F=P/(11.4+0.0625×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN										Max. arm length Max. LH mm
		Clamp arm length LH mm										
		20	25	30	35	40	45	50	60	70	80	
35	3.1	2.8	2.7									27
30	2.6	2.4	2.3	2.3					Nonusable range			32
25	2.2	2.0	1.9	1.9	1.8	1.8						41
20	1.8	1.6	1.5	1.5	1.5	1.4	1.4	1.4				54
15	1.3	1.2	1.2	1.1	1.1	1.1	1.1	1.0	1.0	1.0	0.9	82
10	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.6	0.6	↑
5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	82

model CTK04   Clamping force F=P/(6.88+0.0324×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN										Max. arm length Max. LH mm
		Clamp arm length LH mm										
		25	30	40	50	60	70	80	90	100	120	
35	5.1	4.6	4.5	4.3								40
30	4.4	3.9	3.8	3.7					Nonusable range			49
25	3.6	3.3	3.2	3.1	2.9	2.8						62
20	2.9	2.6	2.5	2.4	2.4	2.3	2.2	2.1				84
15	2.2	2.0	1.9	1.8	1.8	1.7	1.6	1.6	1.5	1.5	1.4	131
10	1.5	1.3	1.3	1.2	1.2	1.1	1.1	1.1	1.0	1.0	0.9	↑
5	0.7	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	131

model CTK06   Clamping force F=P/(4.61+0.0185×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN										Max. arm length Max. LH mm
		Clamp arm length LH mm										
		30	40	50	60	70	80	100	120	140	160	
35	7.6	6.8	6.5	6.3								54
30	6.5	5.8	5.6	5.4	5.2				Nonusable range			66
25	5.4	4.8	4.7	4.5	4.4	4.2	4.1					84
20	4.3	3.9	3.7	3.6	3.5	3.4	3.3	3.1				116
15	3.3	2.9	2.8	2.7	2.6	2.5	2.5	2.3	2.2	2.1	2.0	185
10	2.2	1.9	1.9	1.8	1.7	1.7	1.6	1.5	1.5	1.4	1.3	↑
5	1.1	1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.7	185

model CTK10   Clamping force F=P/(2.40+0.00776×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN										Max. arm length Max. LH mm
		Clamp arm length LH mm										
		35	40	50	60	70	80	100	120	140	160	
35	14.6	13.1	12.9	12.6								52
30	12.5	11.2	11.1	10.8	10.5				Nonusable range			63
25	10.4	9.4	9.2	9.0	8.7	8.5						79
20	8.3	7.5	7.4	7.2	7.0	6.8	6.6	6.3				107
15	6.3	5.6	5.5	5.4	5.2	5.1	5.0	4.7	4.5	4.3	4.1	164
10	4.2	3.7	3.7	3.6	3.5	3.4	3.3	3.1	3.0	2.9	2.7	↑
5	2.1	1.9	1.8	1.8	1.7	1.7	1.7	1.6	1.5	1.4	1.4	164

model CTK16   Clamping force F=P/(1.72+0.00479×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN										Max. arm length Max. LH mm
		Clamp arm length LH mm										
		40	50	60	70	80	100	120	140	160	180	
35	20.3	18.3	17.9	17.4	17.0	16.6						83
30	17.4	15.7	15.3	14.9	14.6	14.3	13.6		Nonusable range			101
25	14.5	13.1	12.8	12.5	12.2	11.9	11.4	10.9				131
20	11.6	10.5	10.2	10.0	9.7	9.5	9.1	8.7	8.4	8.0	7.7	182
15	8.7	7.8	7.7	7.5	7.3	7.1	6.8	6.5	6.3	6.0	5.8	297
10	5.8	5.2	5.1	5.0	4.9	4.8	4.5	4.4	4.2	4.0	3.9	↑
5	2.9	2.6	2.6	2.5	2.4	2.4	2.3	2.2	2.1	2.0	1.9	297

● See the formula shown on **page →836** for clamping force calculation when pin rod type (CTK□□-□P) is selected.

Swing speed adjustment

Swing time is restricted by the mass and length of the clamp arm (moment of inertia) since the 90° swing action impacts the cam shaft.

1. Calculate the moment of inertia according to the arm length and mass.
2. Adjust swing speed with flow control valve to ensure that 90° swing time of the clamp arm is greater than the shortest swing time in the graph shown below.

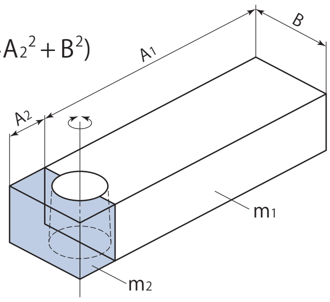
● The cam groove may be damaged in case the swing speed is set at the nonusable range in the graph.

Example of calculation for moment of inertia

$$I=\frac{1}{12}m_1(4A_1^2+B^2)+\frac{1}{12}m_2(4A_2^2+B^2)$$

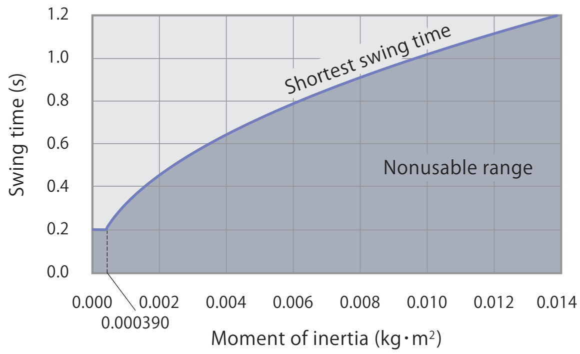
I : Moment of inertia (kg·m²)

m : Mass (kg)



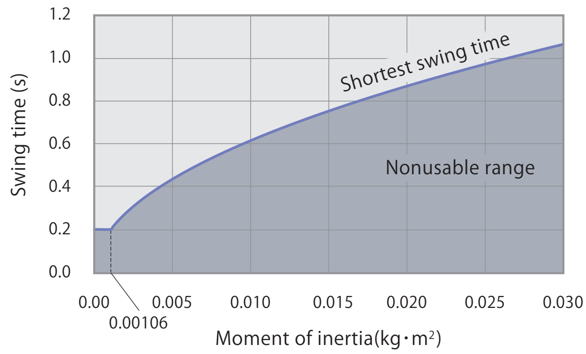
model CTK02

Shortest swing time calculation formula $t=\sqrt{\dfrac{I}{0.00965}}$



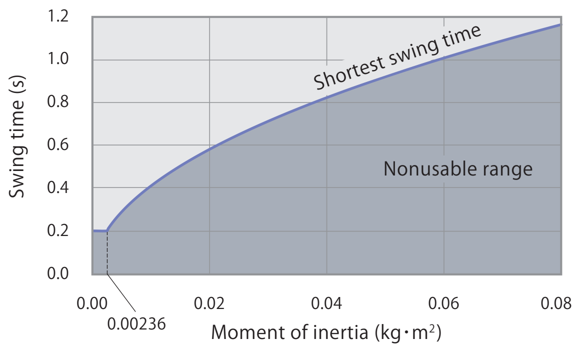
model CTK04

Shortest swing time calculation formula $t=\sqrt{\dfrac{I}{0.0265}}$



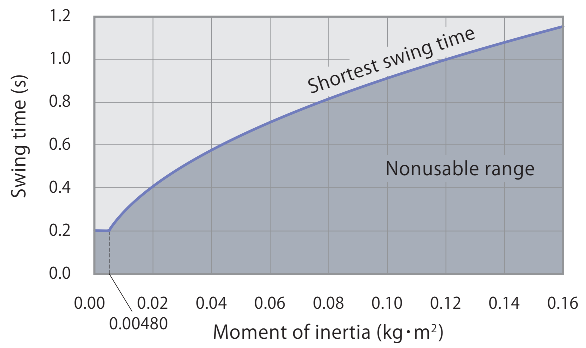
model CTK06

Shortest swing time calculation formula $t=\sqrt{\dfrac{I}{0.0590}}$



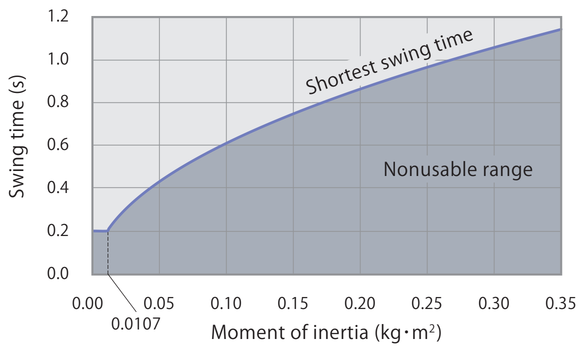
model CTK10

Shortest swing time calculation formula $t=\sqrt{\dfrac{I}{0.120}}$

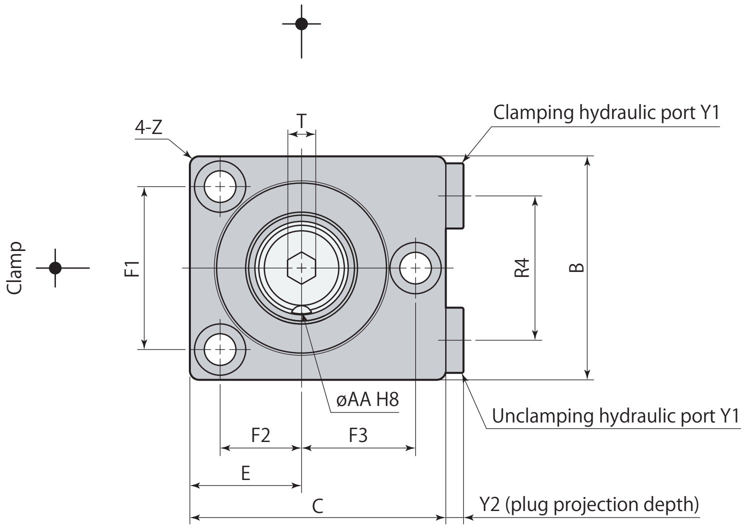


model CTK16

Shortest swing time calculation formula $t=\sqrt{\dfrac{I}{0.268}}$

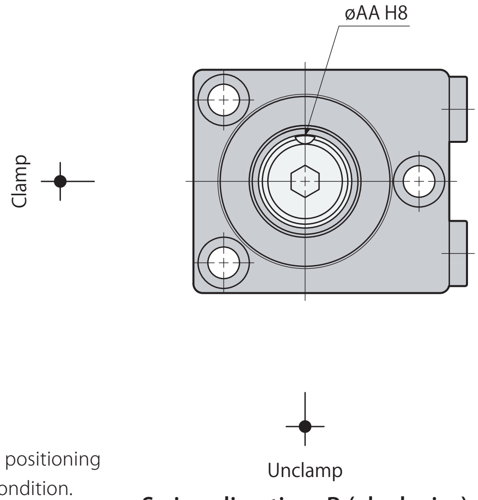


Dimensions

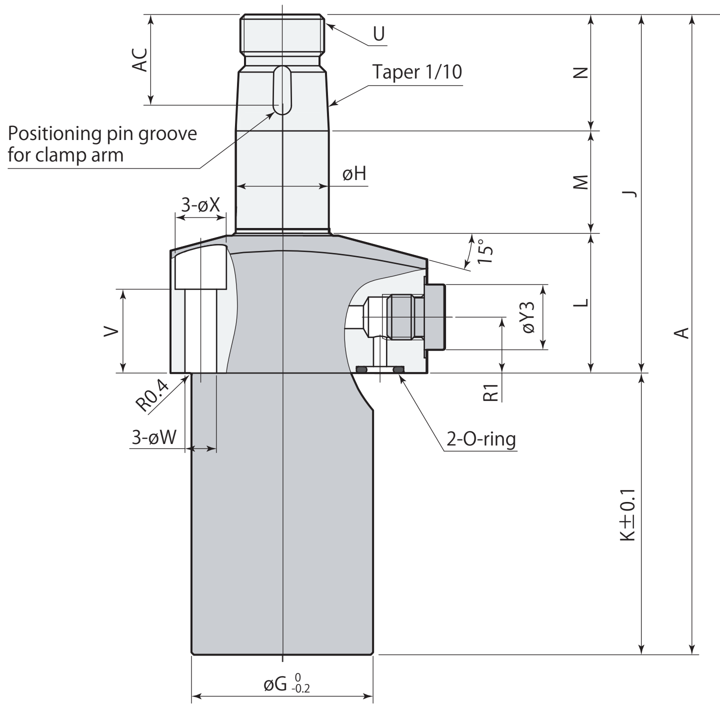


This diagram indicates the arm positioning pin groove at unclamped condition.

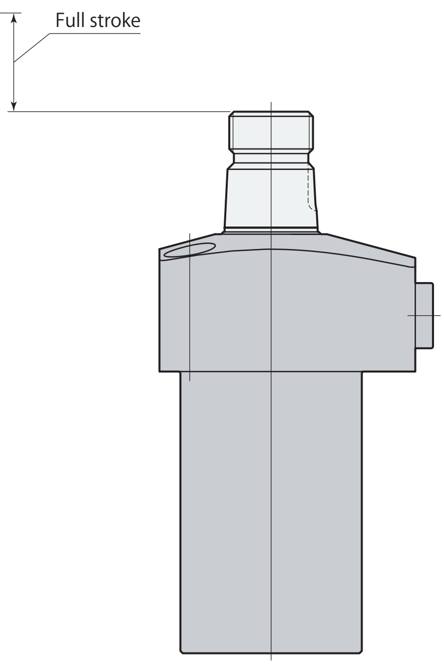
Swing direction L (counter-clockwise)



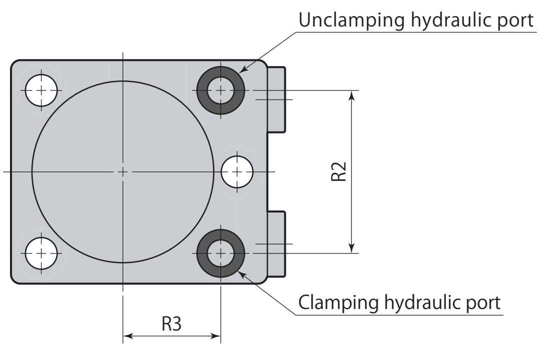
Swing direction R (clockwise)

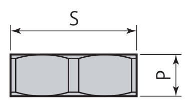


Unclamp



Stroke end





Hex nut for arm mount

- Hex nut for arm mount is included.
- Refer to **page →855** for the details of perfect nut.
- Clamp arm, positioning pin and mounting screws are not included.

mm

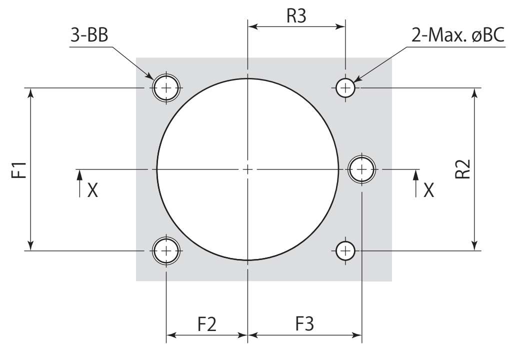
Model	CTK02U-□	CTK04U-□	CTK06U-□	CTK10U-□	CTK16U-□
A	103	118	137.5	165	191.5
B	37	43	48	60	74
C	42	50	55	70	85
E	18.5	21.5	24	30	37
F1	26	32	35	44	54
F2	13	16	17.5	22	27
F3	18	22.5	24.5	32	38
øG	27	33	39	48	58
øH	12	16	20	25	32
J	55.5	64	77	89.5	103
K	47.5	54	60.5	75.5	88.5
L	21	24	30	34	37.5
M	16	18	22	26.5	29.5
N	18.5	22	25	29	36
P	6.5	8	9	10	11
R1	–	9.5	12	12.5	14
R2	22	30	35	44	56
R3	17	18.5	21	30	33
R4	–	26	31	40	50
S (nut width across flats)	17	22	27	30	36
T (hex socket)	4	5	6	10	12
U	M10×0.75	M14×1.5	M18×1.5	M22×1.5	M28×1.5
V	11	12	18	18	18
øW	5.5	5.5	6.8	9	11
øX	9.5	9.5	11	14	17.5
Y1*1	–	G1/8	G1/8	G1/8	G1/4
Y2	–	3.8	3.8	3.8	4.8
øY3	–	14	14	14	19
Z	R2	R2	R2	R3	R3
øAA (pin groove diameter)	$2.5^{+0.014}_{0}$	$3^{+0.014}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$6^{+0.018}_{0}$
AC	13	16.5	19.5	22.5	23.5
Positioning pin (dowel pin)	ø2.5(h8)×6	ø3(h8)×8	ø4(h8)×10	ø5(h8)×12	ø6(h8)×12
O-ring (fluorocarbon hardness Hs90)	P5	P7	P7	P7	P8
Taper sleeve	CTH02-KS	CTH04-KS	CTH06-KS	CTH10-KS	CTH16-KS
Flow control valve (meter-in)*2	–	VCH01	VCH01	VCH01	VCH02
Air bleeding valve*2	–	VCE01	VCE01	VCE01	VCE02

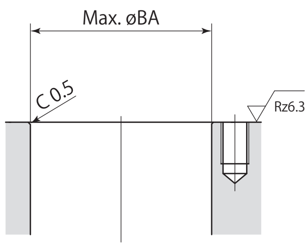
∗1：There is no piping port on model CTK02 (Manifold piping connection only).
∗2：Select the right model of VCH and VCE according to the size of the clamp.
Refer to each page for the details of options.

● Taper sleeve **page →854** ● Flow control valve **page →860** ● Air bleeding valve **page →862**

● CTK□U-C (Straight, swing angle 0°) is made to order.

Mounting details





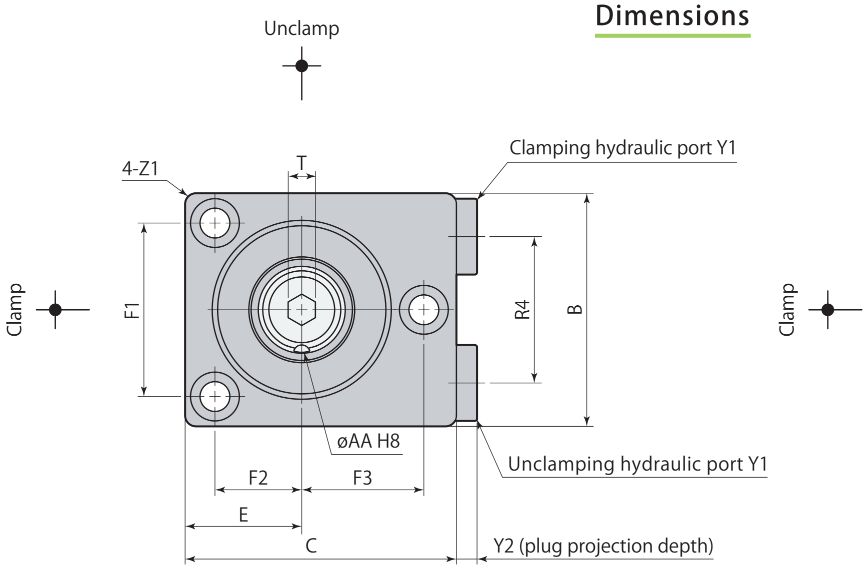
X-X

Rz: ISO4287(1997)

mm

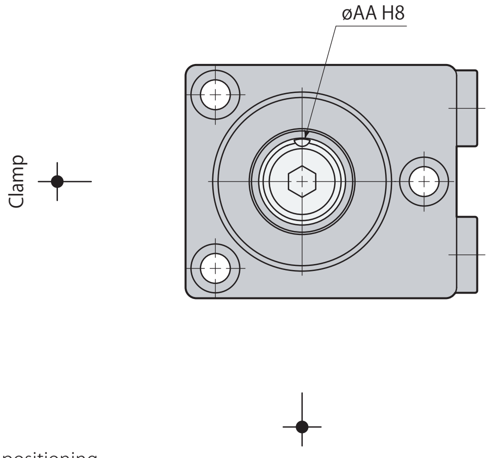
Model	CTK02U-□	CTK04U-□	CTK06U-□	CTK10U-□	CTK16U-□
F1	26	32	35	44	54
F2	13	16	17.5	22	27
F3	18	22.5	24.5	32	38
R2	22	30	35	44	56
R3	17	18.5	21	30	33
øBA	28	34	40	49	59
BB	M5	M5	M6	M8	M10
øBC	3	5	5	5	6

Dimensions

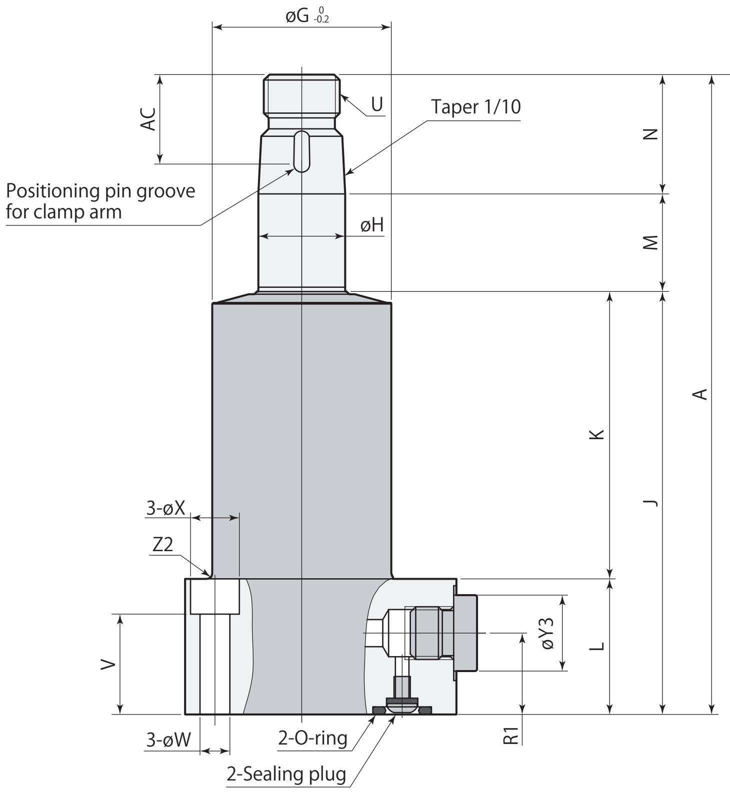


This diagram indicates the arm positioning pin groove at unclamped condition.

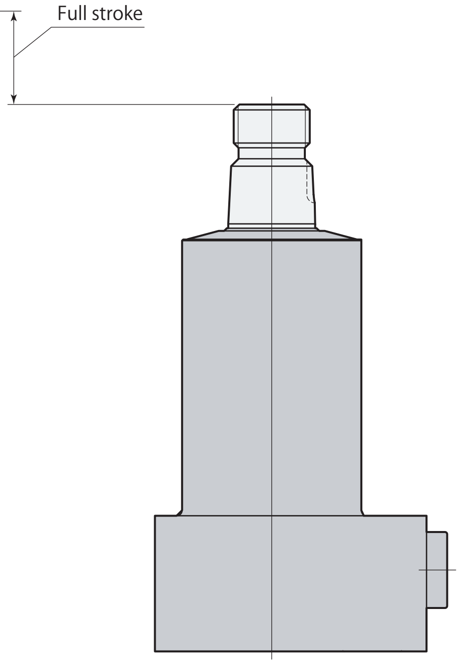
Swing direction L (counter-clockwise)



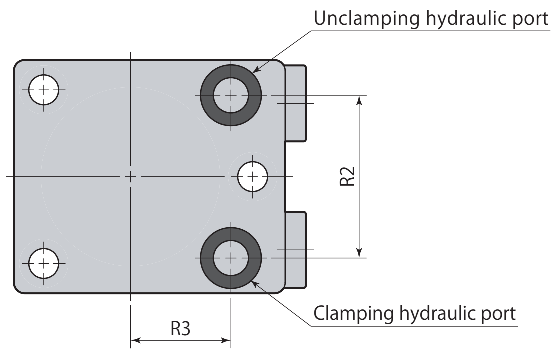
Swing direction R (clockwise)

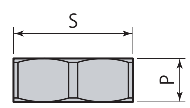


Unclamp



Stroke end





Hex nut for arm mount

- Hex nut for arm mount is included.
- Refer to **page** →**855** for the details of perfect nut.
- Clamp arm, positioning pin and mounting screws are not included.

mm

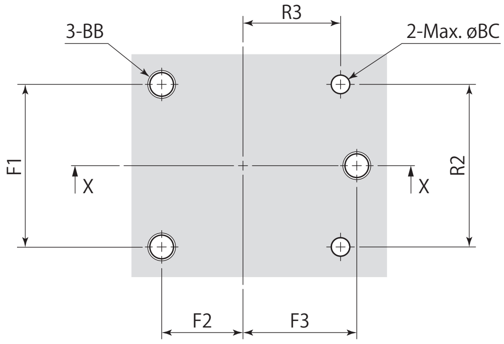
Model	CTK02B-□	CTK04B-□	CTK06B-□	CTK10B-□	CTK16B-□
A	103	118	137.5	165	191.5
B	38	43	52	63	77
C	43	50	57	70	86.5
E	18.5	21.5	24	30	37
F1	27	32	39	47	57
F2	13	16	17.5	22	27
F3	19	22.5	26.5	32	39.5
øG	27.5	33	40.5	49	60
øH	12	16	20	25	32
J	68.5	78	90.5	109.5	126
K	50.5	53	64	82.5	93
L	18	25	26.5	27	33
M	16	18	22	26.5	29.5
N	18.5	22	25	29	36
P	6.5	8	9	10	11
R1	–	15	16.5	17	22
R2	22	30	35	44	56
R3	18	18.5	23	30	34.5
R4	–	27	32	40	50
S (nut width across flats)	17	22	27	30	36
T (hex socket)	4	5	6	10	12
U	M10×0.75	M14×1.5	M18×1.5	M22×1.5	M28×1.5
V	12	18.5	18.5	16	20
øW	5.5	5.5	6.8	9	11
øX	9	9	11	14	17.5
Y1*1	–	G1/8	G1/8	G1/8	G1/4
Y2	–	3.8	3.8	3.8	4.8
øY3	–	14	14	14	19
Z1	R2	R2	R2	R3	R3
Z2	R1	R1	R1	R1	R2
øAA (pin groove diameter)	$2.5^{+0.014}_{0}$	$3^{+0.014}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$6^{+0.018}_{0}$
AC	13	16.5	19.5	22.5	23.5
Positioning pin (dowel pin)	ø2.5(h8)×6	ø3(h8)×8	ø4(h8)×10	ø5(h8)×12	ø6(h8)×12
O-ring (fluorocarbon hardness Hs90)	P5	P8	P9	P9	P9
Taper sleeve	CTH02-KS	CTH04-KS	CTH06-KS	CTH10-KS	CTH16-KS
Flow control valve (meter-in)*2	–	VCH01	VCH01	VCH01	VCH02
Air bleeding valve*2	–	VCE01	VCE01	VCE01	VCE02

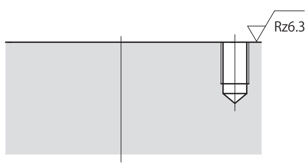
∗1：There is no piping port on model CTK02 (Manifold piping connection only).
∗2：Select the right model of VCH and VCE according to the size of the clamp.
Refer to each page for the details of options.

● Taper sleeve **page →854** ● Flow control valve **page →860** ● Air bleeding valve **page →862**

● CTK□B-C (Straight, swing angle 0°) is made to order.

Mounting details





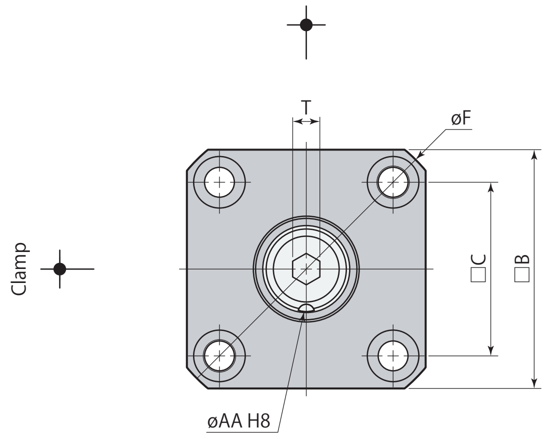
X-X

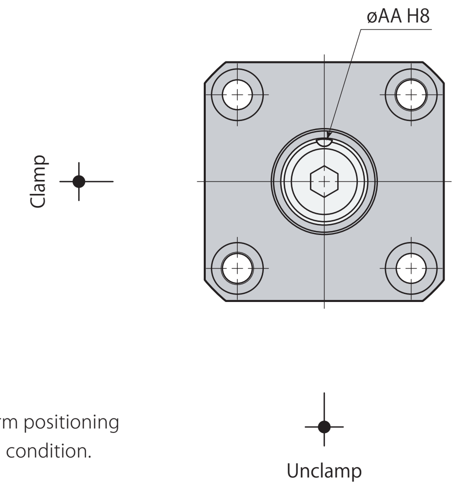
Rz: ISO4287(1997)

mm

Model	CTK02B-□	CTK04B-□	CTK06B-□	CTK10B-□	CTK16B-□
F1	27	32	39	47	57
F2	13	16	17.5	22	27
F3	19	22.5	26.5	32	39.5
R2	22	30	35	44	56
R3	18	18.5	23	30	34.5
BB	M5	M5	M6	M8	M10
øBC	3	6	7	7	7

Dimensions

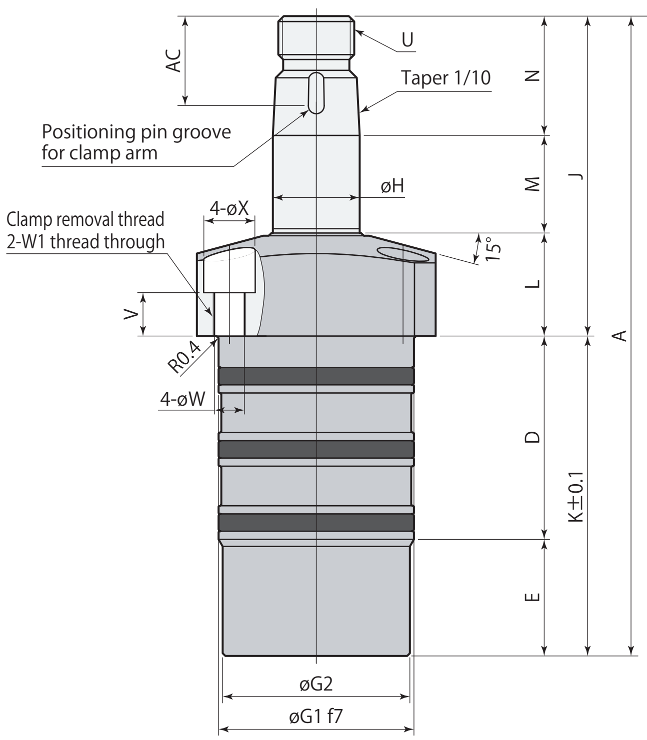


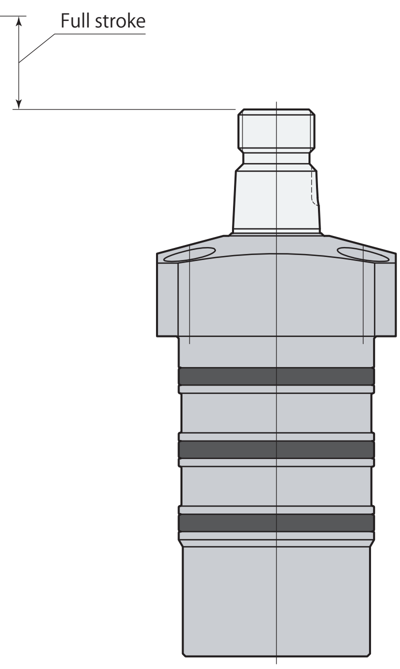


This diagram indicates the arm positioning pin groove at unclamped condition.

Swing direction L (counter-clockwise)

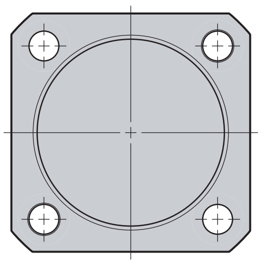
Swing direction R (clockwise)

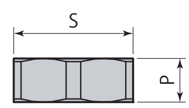




Unclamp

Stroke end





Hex nut for arm mount

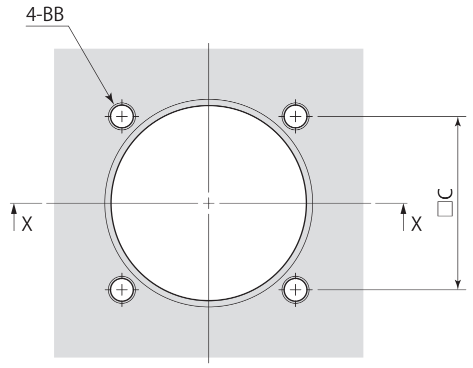
- Hex nut for arm mount is included.
- Refer to **page →855** for the details of perfect nut.
- Clamp arm, positioning pin and mounting screws are not included.

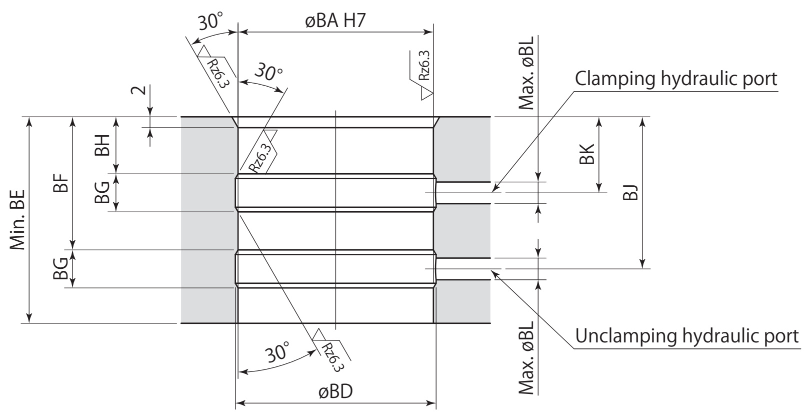
mm

Model	CTK02N-□	CTK04N-□	CTK06N-□	CTK10N-□	CTK16N-□
A	103	118	137.5	165	191.5
B	39	44	50	62	75
C	28	32	37	46	55
D	34.5	37.5	39.5	49.5	54.5
E	17	21.5	27	33	42.5
øF	51	57	66	82	98
øG1	$30^{-0.020}_{-0.041}$	$36^{-0.025}_{-0.050}$	$42^{-0.025}_{-0.050}$	$51^{-0.030}_{-0.060}$	$61^{-0.030}_{-0.060}$
øG2	29	34.5	40.5	49.5	59.5
H	12	16	20	25	32
J	51.5	59	71	82.5	94.5
K	51.5	59	66.5	82.5	97
L	17	19	24	27	29
M	16	18	22	26.5	29.5
N	18.5	22	25	29	36
P	6.5	8	9	10	11
S (nut width across flats)	17	22	27	30	36
T (hex socket)	4	5	6	10	12
U	M10×0.75	M14×1.5	M18×1.5	M22×1.5	M28×1.5
V	6	8	11.5	10	9.5
øW	5.5	5.5	6.8	9	11
W1	M6×1.0	M6×1.0	M8×1.25	M10×1.5	M12×1.75
øX	9.5	9.5	11	14	17.5
øAA (pin groove diameter)	$2.5^{+0.014}_{0}$	$3^{+0.014}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$6^{+0.018}_{0}$
AC	13	16.5	19.5	22.5	23.5
Positioning pin (dowel pin)	ø2.5(h8)×6	ø3(h8)×8	ø4(h8)×10	ø5(h8)×12	ø6(h8)×12
Taper sleeve	CTH02-KS	CTH04-KS	CTH06-KS	CTH10-KS	CTH16-KS

- Refer to **page** →**854** for the details of taper sleeve.
- When removing clamp from mounting hole, use removal tap hole. (Refer to **page** →**858** for caution in use.)
- CTK□N-□ (Cartridge) is made to order.

Mounting details





X-X

Rz: ISO4287(1997)

mm

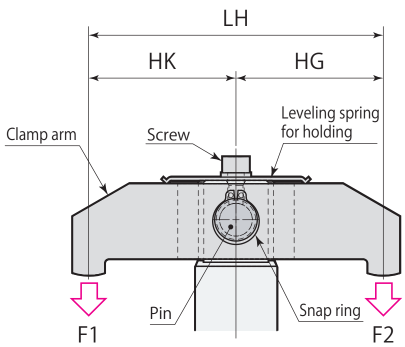
Model	CTK02N-□	CTK04N-□	CTK06N-□	CTK10N-□	CTK16N-□
C	28	32	37	46	55
øBA	$30^{+0.021}_{0}$	$36^{+0.025}_{0}$	$42^{+0.025}_{0}$	$51^{+0.030}_{0}$	$61^{+0.030}_{0}$
BB	M5	M5	M6	M8	M10
øBD	31	37	43	52	62
BE	35	38	40	50	55
BF	22.5	24.5	26.5	33.5	38.5
BG	6	7	7	10	10
BH	10	10.5	13	16.5	21.5
BJ	25.5±0.5	28±0.5	30±0.5	38.5±1	43.5±1
BK	13±0.5	14±0.5	16.5±0.5	21.5±1	26.5±1
øBL	3	4	4	6	6

Specifications

Size	Mounting and piping types	Swing direction (when clamping)	
CTK 02 / 04 / 06 / 10 / 16	U : Upper flange B : Lower flange N : Cartridge	– L : Counter-clockwise R : Clockwise	P : Pin rod

▒ indicates made to order.

Usage example



Clamping performance

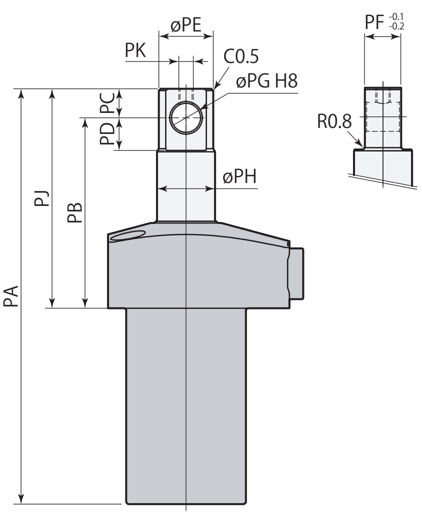
Clamping force calculation formula
$F1 = \frac{HG}{LH} \times n \times P$
$F2 = \frac{HK}{LH} \times n \times P$

F1, F2=Clamping force (kN),
n=Coefficient (refer to right table),
P=Hydraulic pressure (MPa),
HG, HK=Distance from center of piston to clamping point (mm), LH=(mm)

Model	Coefficient n
CTK02□-□P	0.088
CTK04□-□P	0.145
CTK06□-□P	0.217
CTK10□-□P	0.417
CTK16□-□P	0.581

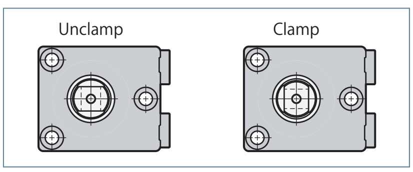
- Clamp arm, pin and snap ring are not included. Customers must arrange for them.
- Thread at top portion of the rod is for attaching a leveling spring. Screw and leveling spring are not included.

Upper flange, pin rod



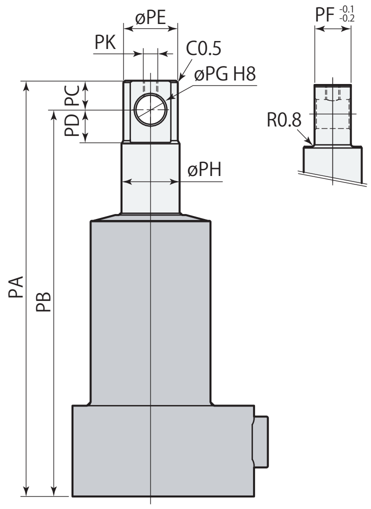
mm

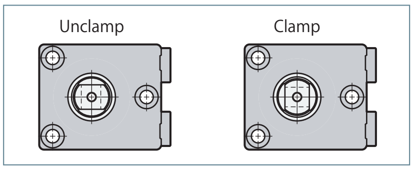
Model	CTK02U-□P	CTK04U-□P	CTK06U-□P	CTK10U-□P	CTK16U-□P
PA	99	114.5	135	166.5	190
PB	45.5	52.5	64.5	77	85.5
PC	6	8	10	14	16
PD	7	9	11	15	17
øPE	11	15	19	24	30
PF	7.5	10	12	18	20
øPG	$6^{+0.018}_{0}$	$8^{+0.022}_{0}$	$10^{+0.022}_{0}$	$14^{+0.027}_{0}$	$16^{+0.027}_{0}$
øPH	12	16	20	25	32
PJ	51.5	60.5	74.5	91	101.5
PK	M3×0.5	M4×0.7	M5×0.8	M6×1.0	M8×1.25
Mass	0.4 kg	0.7 kg	1.1 kg	1.9 kg	3.3 kg



- This diagram indicates unclamped condition. Direction of pin hole will be hydraulic port side at the time of clamping.
- Refer to specifications (**page →820**), dimensions (**page →824**) for specifications and dimensions of products that are not listed on this diagram.

Lower flange, pin rod



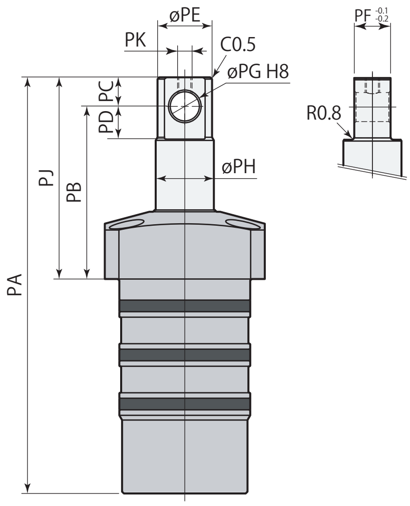


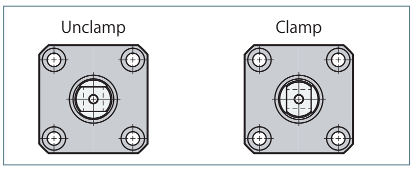
mm

Model	CTK02B-□P	CTK04B-□P	CTK06B-□P	CTK10B-□P	CTK16B-□P
PA	99	114.5	135	166.5	190
PB	93	106.5	125	152.5	174
PC	6	8	10	14	16
PD	7	9	11	15	17
øPE	11	15	19	24	30
PF	7.5	10	12	18	20
øPG	$6^{+0.018}_{0}$	$8^{+0.022}_{0}$	$10^{+0.022}_{0}$	$14^{+0.027}_{0}$	$16^{+0.027}_{0}$
øPH	12	16	20	25	32
PK	M3×0.5	M4×0.7	M5×0.8	M6×1.0	M8×1.25
Mass	0.4 kg	0.7 kg	1.1 kg	1.9 kg	3.3 kg

- This diagram indicates unclamped condition. Direction of pin hole will be hydraulic port side at the time of clamping.
- Refer to specifications (**page →820**), dimensions (**page →828**) for specifications and dimensions of products that are not listed on this diagram.

Cartridge, pin rod





mm

Model	CTK02N-□P	CTK04N-□P	CTK06N-□P	CTK10N-□P	CTK16N-□P
PA	99	114.5	135	166.5	190
PB	41.5	47.5	58.5	70	77
PC	6	8	10	14	16
PD	7	9	11	15	17
øPE	11	15	19	24	30
PF	7.5	10	12	18	20
øPG	$6^{+0.018}_{0}$	$8^{+0.022}_{0}$	$10^{+0.022}_{0}$	$14^{+0.027}_{0}$	$16^{+0.027}_{0}$
øPH	12	16	20	25	32
PJ	47.5	55.5	68.5	84	93
PK	M3×0.5	M4×0.7	M5×0.8	M6×1.0	M8×1.25
Mass	0.4 kg	0.7 kg	1.1 kg	1.9 kg	3.3 kg

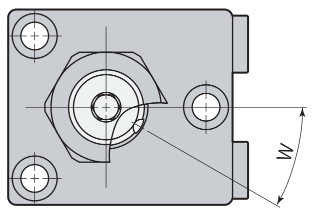
- Refer to specifications (**page →820**), dimensions (**page →832**) for specifications and dimensions of products that are not listed on this diagram.

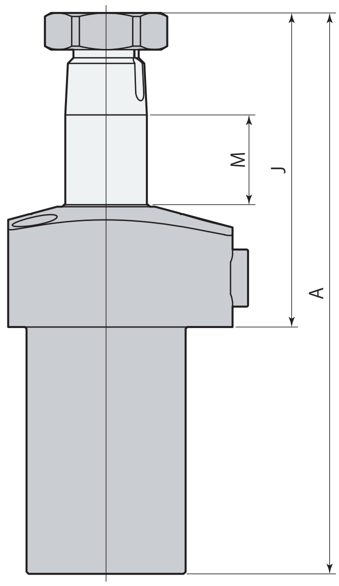
Specifications

	Size	Mounting and piping types		Swing direction (when clamping), swing angle
CTK	02	U : Upper flange	–	L30 : Counter-clockwise, swing angle 30°
	04			L45 : Counter-clockwise, swing angle 45°
	06			L60 : Counter-clockwise, swing angle 60°
	10			R30 : Clockwise, swing angle 30°
	16			R45 : Clockwise, swing angle 45°
				R60 : Clockwise, swing angle 60°

■ indicates made to order.

Upper flange, swing angle 30˚, 45˚, 60˚





mm

Model		CTK02U-□30	CTK04U-□30	CTK06U-□30	CTK10U-□30	CTK16U-□30
W (swing angle)		30°±5°				
Full stroke		11.5	12.5	15.5	18.8	20.3
Swing stroke		3.5	4.5	5.5	6.8	8.3
Clamp stroke		8	8	10	12	12
Cylinder capacity	Clamp	1.0 cm³	1.8 cm³	3.4 cm³	7.8 cm³	11.8 cm³
	Unclamp	2.3 cm³	4.3 cm³	8.2 cm³	17.0 cm³	28.1 cm³
A		99.5	113.5	132	158.3	183.3
J		52	59.5	71.5	82.8	94.8
M		12.5	13.5	16.5	19.8	21.3

mm

Model		CTK02U-□45	CTK04U-□45	CTK06U-□45	CTK10U-□45	CTK16U-□45
W (swing angle)		45°±5°				
Full stroke		12.4	13.6	16.9	20.4	22.3
Swing stroke		4.4	5.6	6.9	8.4	10.3
Clamp stroke		8	8	10	12	12
Cylinder capacity	Clamp	1.1 cm³	2.0 cm³	3.7 cm³	8.5 cm³	13.0 cm³
	Unclamp	2.5 cm³	4.7 cm³	9.0 cm³	18.6 cm³	30.9 cm³
A		100.4	114.6	133.4	159.9	185.3
J		52.9	60.6	72.9	84.4	96.8
M		13.4	14.6	17.9	21.4	23.3

mm

Model		CTK02U-□60	CTK04U-□60	CTK06U-□60	CTK10U-□60	CTK16U-□60
W (swing angle)		60°±5°				
Full stroke		13.3	14.8	18.3	22.1	24.4
Swing stroke		5.3	6.8	8.3	10.1	12.4
Clamp stroke		8	8	10	12	12
Cylinder capacity	Clamp	1.2 cm³	2.1 cm³	4.0 cm³	9.2 cm³	14.2 cm³
	Unclamp	2.7 cm³	5.1 cm³	9.7 cm³	20.1 cm³	33.8 cm³
A		101.3	115.8	134.8	161.6	187.4
J		53.8	61.8	74.3	86.1	98.9
M		14.3	15.8	19.3	23.1	25.4

● This diagram indicates unclamped condition.

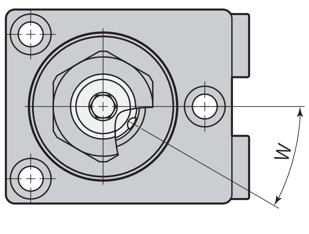
● Refer to specifications (**page →820**), dimensions (**page →824**) for specifications and dimensions of products that are not listed on this diagram.

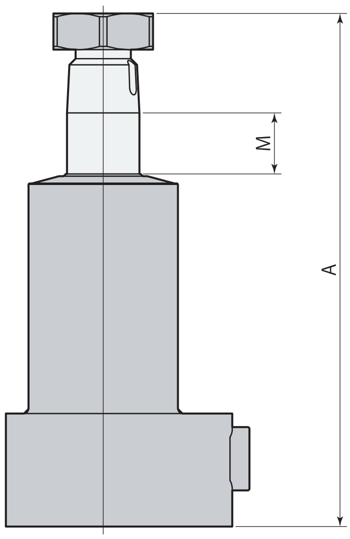
Specifications

	Size	Mounting and piping types		Swing direction (when clamping), swing angle
CTK	02 04 06 10 16	B : Lower flange	–	L30 : Counter-clockwise, swing angle 30° L45 : Counter-clockwise, swing angle 45° L60 : Counter-clockwise, swing angle 60° R30 : Clockwise, swing angle 30° R45 : Clockwise, swing angle 45° R60 : Clockwise, swing angle 60°

(grey box) indicates made to order.

Lower flange, swing angle 30˚, 45˚, 60˚





mm

Model		CTK02B-□30	CTK04B-□30	CTK06B-□30	CTK10B-□30	CTK16B-□30
W (swing angle)		30°±5°				
Full stroke		11.5	12.5	15.5	18.8	20.3
Swing stroke		3.5	4.5	5.5	6.8	8.3
Clamp stroke		8	8	10	12	12
Cylinder capacity	Clamp	1.0 cm³	1.8 cm³	3.4 cm³	7.8 cm³	11.8 cm³
	Unclamp	2.3 cm³	4.3 cm³	8.2 cm³	17.0 cm³	28.1 cm³
A		99.5	113.5	132	158.3	183.3
M		12.5	13.5	16.5	19.8	21.3

mm

Model		CTK02B-□45	CTK04B-□45	CTK06B-□45	CTK10B-□45	CTK16B-□45
W (swing angle)		45°±5°				
Full stroke		12.4	13.6	16.9	20.4	22.3
Swing stroke		4.4	5.6	6.9	8.4	10.3
Clamp stroke		8	8	10	12	12
Cylinder capacity	Clamp	1.1 cm³	2.0 cm³	3.7 cm³	8.5 cm³	13.0 cm³
	Unclamp	2.5 cm³	4.7 cm³	9.0 cm³	18.6 cm³	30.9 cm³
A		100.4	114.6	133.4	159.9	185.3
M		13.4	14.6	17.9	21.4	23.3

mm

Model		CTK02B-□60	CTK04B-□60	CTK06B-□60	CTK10B-□60	CTK16B-□60
W (swing angle)		60°±5°				
Full stroke		13.3	14.8	18.3	22.1	24.4
Swing stroke		5.3	6.8	8.3	10.1	12.4
Clamp stroke		8	8	10	12	12
Cylinder capacity	Clamp	1.2 cm³	2.1 cm³	4.0 cm³	9.2 cm³	14.2 cm³
	Unclamp	2.7 cm³	5.1 cm³	9.7 cm³	20.1 cm³	33.8 cm³
A		101.3	115.8	134.8	161.6	187.4
M		14.3	15.8	19.3	23.1	25.4

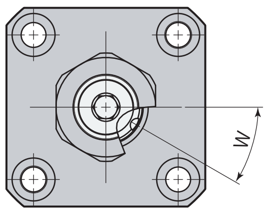
- This diagram indicates unclamped condition.
- Refer to specifications (**page →820**), dimensions (**page →828**) for specifications and dimensions of products that are not listed on this diagram.

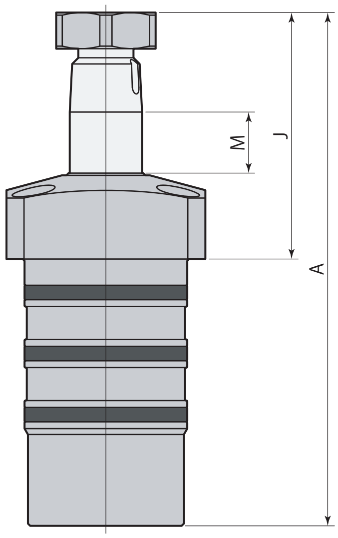
Specifications

	Size		Mounting and piping types		Swing direction (when clamping), swing angle
CTK	02 / 04 / 06 / 10 / 16		N : Cartridge	–	L30 : Counter-clockwise, swing angle 30°
					L45 : Counter-clockwise, swing angle 45°
					L60 : Counter-clockwise, swing angle 60°
					R30 : Clockwise, swing angle 30°
					R45 : Clockwise, swing angle 45°
					R60 : Clockwise, swing angle 60°

■ indicates made to order.

Cartridge, swing angle 30˚, 45˚, 60˚





mm

Model		CTK02N-□30	CTK04N-□30	CTK06N-□30	CTK10N-□30	CTK16N-□30
W (swing angle)		30°±5°				
Full stroke		11.5	12.5	15.5	18.8	20.3
Swing stroke		3.5	4.5	5.5	6.8	8.3
Clamp stroke		8	8	10	12	12
Cylinder capacity	Clamp	1.0 cm^3	1.8 cm^3	3.4 cm^3	7.8 cm^3	11.8 cm^3
	Unclamp	2.3 cm^3	4.3 cm^3	8.2 cm^3	17.0 cm^3	28.1 cm^3
A		99.5	113.5	132	158.3	183.3
J		48	54.5	65.5	75.8	86.3
M		12.5	13.5	16.5	19.8	21.3

mm

Model		CTK02N-□45	CTK04N-□45	CTK06N-□45	CTK10N-□45	CTK16N-□45
W (swing angle)		45°±5°				
Full stroke		12.4	13.6	16.9	20.4	22.3
Swing stroke		4.4	5.6	6.9	8.4	10.3
Clamp stroke		8	8	10	12	12
Cylinder capacity	Clamp	1.1 cm^3	2.0 cm^3	3.7 cm^3	8.5 cm^3	13.0 cm^3
	Unclamp	2.5 cm^3	4.7 cm^3	9.0 cm^3	18.6 cm^3	30.9 cm^3
A		100.4	114.6	133.4	159.9	185.3
J		48.9	55.6	66.9	77.4	88.3
M		13.4	14.6	17.9	21.4	23.3

mm

Model		CTK02N-□60	CTK04N-□60	CTK06N-□60	CTK10N-□60	CTK16N-□60
W (swing angle)		60°±5°				
Full stroke		13.3	14.8	18.3	22.1	24.4
Swing stroke		5.3	6.8	8.3	10.1	12.4
Clamp stroke		8	8	10	12	12
Cylinder capacity	Clamp	1.2 cm^3	2.1 cm^3	4.0 cm^3	9.2 cm^3	14.2 cm^3
	Unclamp	2.7 cm^3	5.1 cm^3	9.7 cm^3	20.1 cm^3	33.8 cm^3
A		101.3	115.8	134.8	161.6	187.4
J		49.8	56.8	68.3	79.1	90.4
M		14.3	15.8	19.3	23.1	25.4

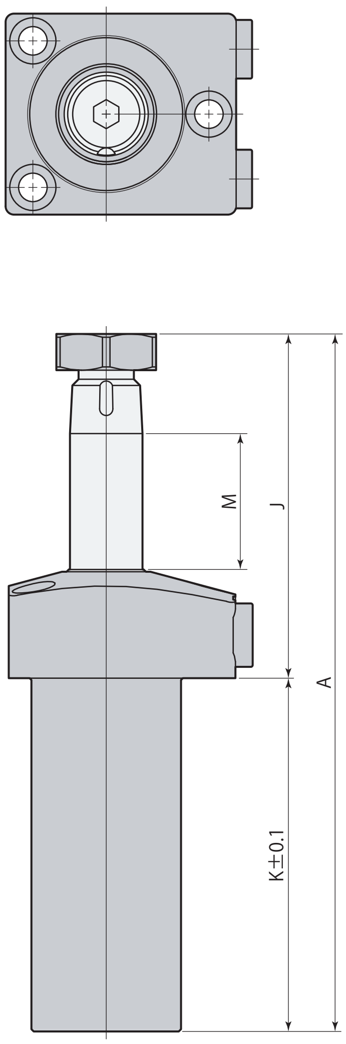
- This diagram indicates unclamped condition.
- Refer to specifications (**page →820**), dimensions (**page →832**) for specifications and dimensions of products that are not listed on this diagram.

Specifications

Size		Mounting and piping types		Swing direction (when clamping), clamp stroke
CTK	02 / 04 / 06 / 10 / 16	U : Upper flange	–	LJ : Counter-clockwise, long stroke RJ : Clockwise, long stroke CJ : Straight, long stroke

▇ indicates made to order.

Upper flange, long stroke



mm

Model		CTK02U-□J	CTK04U-□J	CTK06U-□J	CTK10U-□J	CTK16U-□J
Swing angle	CTK□U-LJ, RJ	90°±3°				
	CTK□U-CJ	0°				
Full stroke		27	29	36	43.5	46.5
Swing stroke (CTK□U-LJ, RJ)		7	9	11	13.5	16.5
Clamp stroke (CTK□U-LJ, RJ)		20	20	25	30	30
Cylinder capacity	Clamp	2.4 cm³	4.2 cm³	7.8 cm³	18.1 cm³	27.0 cm³
	Unclamp	5.4 cm³	10.0 cm³	19.1 cm³	39.5 cm³	64.4 cm³
A		139	154	182.5	219	245.5
J		67.5	76	92	107.5	121
K		71.5	78	90.5	111.5	124.5
M		28	30	37	44.5	47.5
Mass		0.5 kg	0.9 kg	1.4 kg	2.4 kg	4.1 kg

● This diagram indicates unclamped condition.

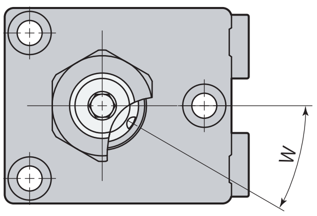
● Refer to specifications (**page →820**), dimensions (**page →824**) for specifications and dimensions of products that are not listed on this diagram.

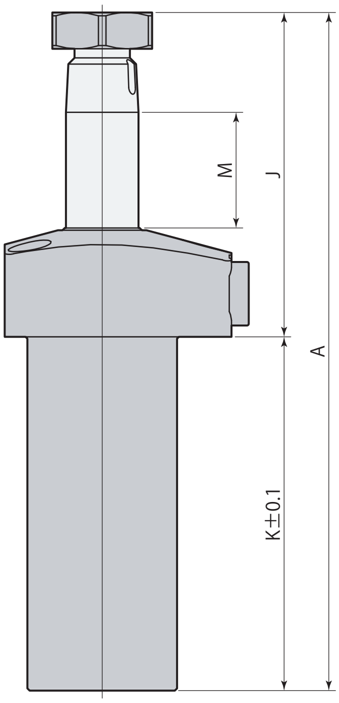
Specifications

	Size	Mounting and piping types		Swing direction (when clamping), clamp stroke, swing angle
CTK	02 04 06 10 16	U : Upper flange	–	LJ30 : Counter-clockwise, long stroke, swing angle 30° LJ45 : Counter-clockwise, long stroke, swing angle 45° LJ60 : Counter-clockwise, long stroke, swing angle 60° RJ30 : Clockwise, long stroke, swing angle 30° RJ45 : Clockwise, long stroke, swing angle 45° RJ60 : Clockwise, long stroke, swing angle 60°

▇ indicates made to order.

Upper flange, long stroke, swing angle 30˚, 45˚, 60˚





mm

Model		CTK02U-□J30	CTK04U-□J30	CTK06U-□J30	CTK10U-□J30	CTK16U-□J30
W (swing angle)		30°±5°				
Full stroke		23.5	24.5	30.5	36.8	38.3
Swing stroke		3.5	4.5	5.5	6.8	8.3
Clamp stroke		20	20	25	30	30
Cylinder capacity	Clamp	2.1 cm^3	3.6 cm^3	6.6 cm^3	15.3 cm^3	22.3 cm^3
	Unclamp	4.7 cm^3	8.5 cm^3	16.2 cm^3	33.4 cm^3	53.1 cm^3
A		135.5	149.5	177	212.3	237.3
J		64	71.5	86.5	100.8	112.8
K		71.5	78	90.5	111.5	124.5
M		24.5	25.5	31.5	37.8	39.3

mm

Model		CTK02U-□J45	CTK04U-□J45	CTK06U-□J45	CTK10U-□J45	CTK16U-□J45
W (swing angle)		45°±5°				
Full stroke		24.4	25.6	31.9	38.4	40.3
Swing stroke		4.4	5.6	6.9	8.4	10.3
Clamp stroke		20	20	25	30	30
Cylinder capacity	Clamp	2.1 cm^3	3.7 cm^3	6.9 cm^3	16.0 cm^3	23.4 cm^3
	Unclamp	4.9 cm^3	8.9 cm^3	16.9 cm^3	34.9 cm^3	55.8 cm^3
A		136.4	150.6	178.4	213.9	239.3
J		64.9	72.6	87.9	102.4	114.8
K		71.5	78	90.5	111.5	124.5
M		25.4	26.6	32.9	39.4	41.3

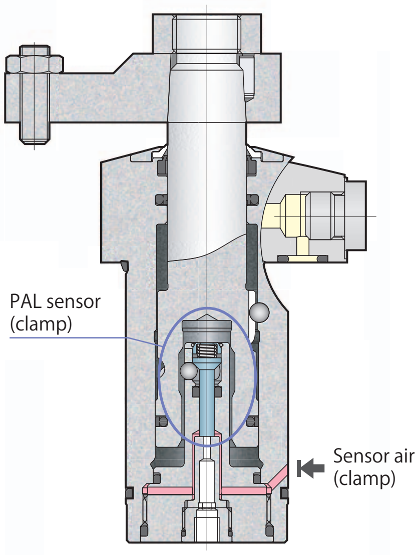
mm

Model		CTK02U-□J60	CTK04U-□J60	CTK06U-□J60	CTK10U-□J60	CTK16U-□J60
W (swing angle)		60°±5°				
Full stroke		25.3	26.8	33.3	40.1	42.4
Swing stroke		5.3	6.8	8.3	10.1	12.4
Clamp stroke		20	20	25	30	30
Cylinder capacity	Clamp	2.2 cm^3	3.9 cm^3	7.2 cm^3	16.7 cm^3	24.6 cm^3
	Unclamp	5.1 cm^3	9.3 cm^3	17.7 cm^3	36.4 cm^3	58.7 cm^3
A		137.3	151.8	179.8	215.6	241.4
J		65.8	73.8	89.3	104.1	116.9
K		71.5	78	90.5	111.5	124.5
M		26.3	27.8	34.3	41.1	43.4

- This diagram indicates unclamped condition.
- Refer to specifications (**page →820**), dimensions (**page →824**) for specifications and dimensions of products that are not listed on this diagram.

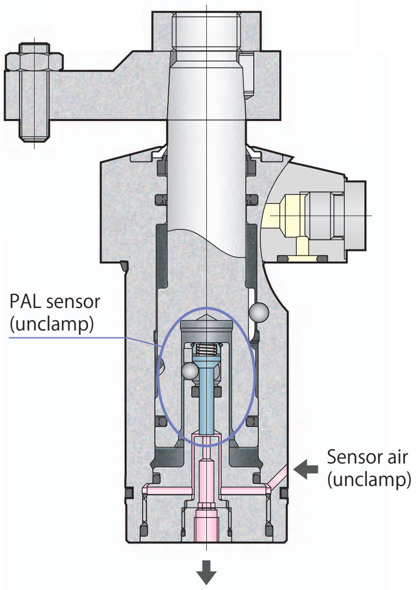
Clamp sensor model C

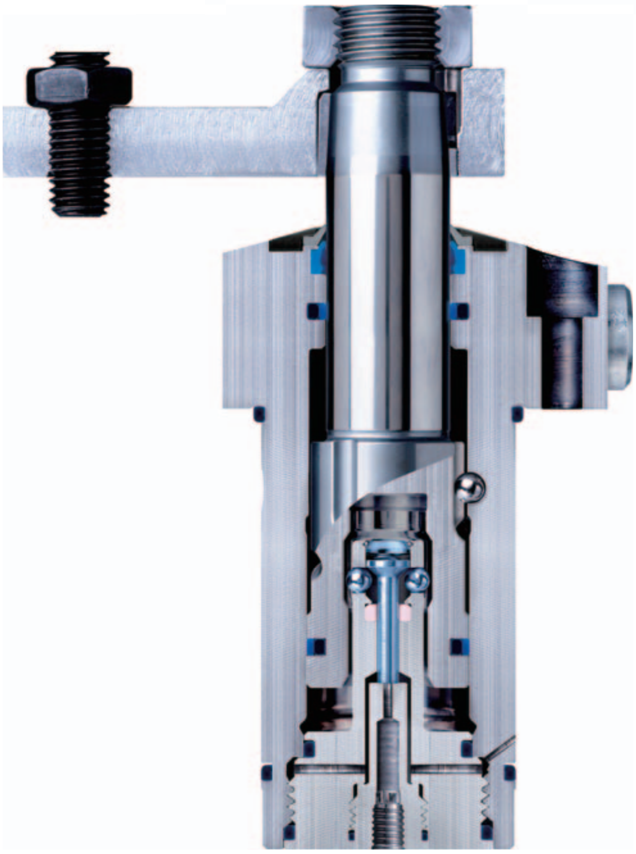
model **CTK□U-□C**



Unclamp sensor model B

model **CTK□U-□B**





model **CTK04U-□C**

Specifications	page → 845
Sensor	page → 846
Dimensions	page → 850
Mounting details	page → 852

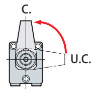
Specifications

Size: **04**, **06**, **10**, **16**

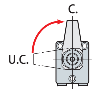
CTK [Size] **U** : Upper flange – [Swing direction (when clamping)] [Sensor model]

Swing direction (when clamping)

L : Counter-clockwise



R : Clockwise



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

B : Unclamp sensor model

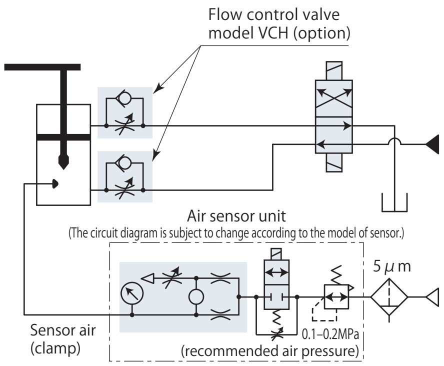
Model			CTK04U-□□	CTK06U-□□	CTK10U-□□	CTK16U-□□
Cylinder force (hydraulic pressure 35MPa)		kN	5.1	7.6	14.6	20.3
Cylinder inner diameter		mm	21	26	34	42
Rod diameter		mm	16	20	25	32
Effective area (clamp)		cm^2	1.45	2.17	4.17	5.81
Swing angle			90°±3°			
Positioning pin groove position accuracy			±1°			
Repeated clamp positioning accuracy			±0.5°			
Full stroke	CTK□U-□C	mm	17.5	21.5	26	29
	CTK□U-□B	mm	17	21	25.5	28.5
90° swing stroke		mm	9	11	13.5	16.5
Clamp stroke		mm	8	10	12	12
Over clamp stroke (CTK□U-□C)		mm	0.5	0.5	0.5	0.5
Cylinder capacity (CTK□U-□C)	Clamp	cm^3	2.5	4.7	10.8	16.9
	Unclamp	cm^3	6.1	11.4	23.6	40.2
Cylinder capacity (CTK□U-□B)	Clamp	cm^3	2.5	4.6	10.6	16.6
	Unclamp	cm^3	5.9	11.1	23.2	39.5
Mass		kg	0.7	1.1	2.0	3.4
Recommended tightening torque of mounting screws*		N･m	7	12	29	57
Recommended tightening torque of nut		N･m	26	51	75	130

- Pressure range：5–35 MPa
- Proof pressure：52.5 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)
- There is no overload protection mechanism.
- Refer to Performance table (**page →822**), Swing speed adjustment (**page →823**).

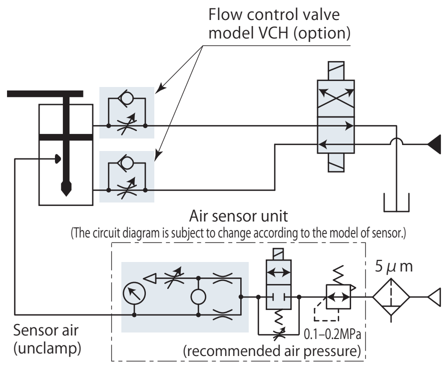
∗：ISO R898 class 12.9

Hydraulic and pneumatic circuit diagram

model **CTK□U-□C**

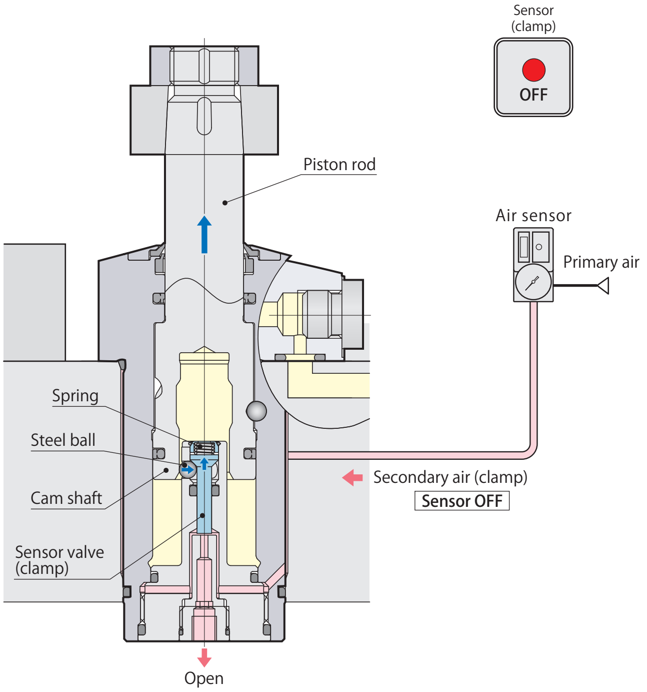


model **CTK□U-□B**



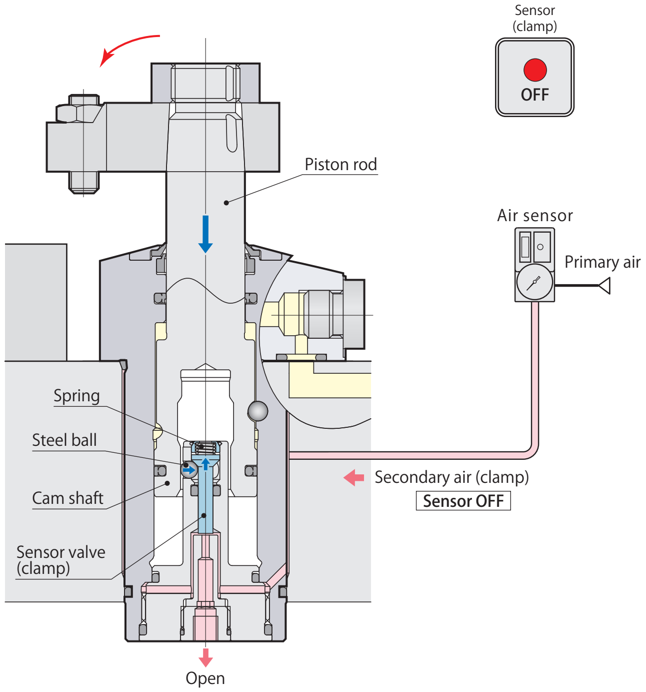
Clamp, Over clamp stroke detection signal

Unclamp



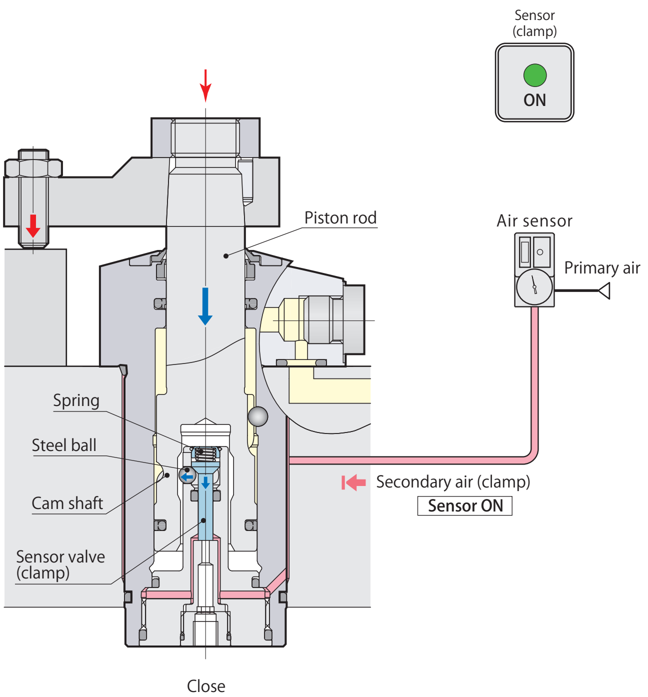
Sensor signal (clamp)	OFF	Unclamp

In the middle of swing stroke



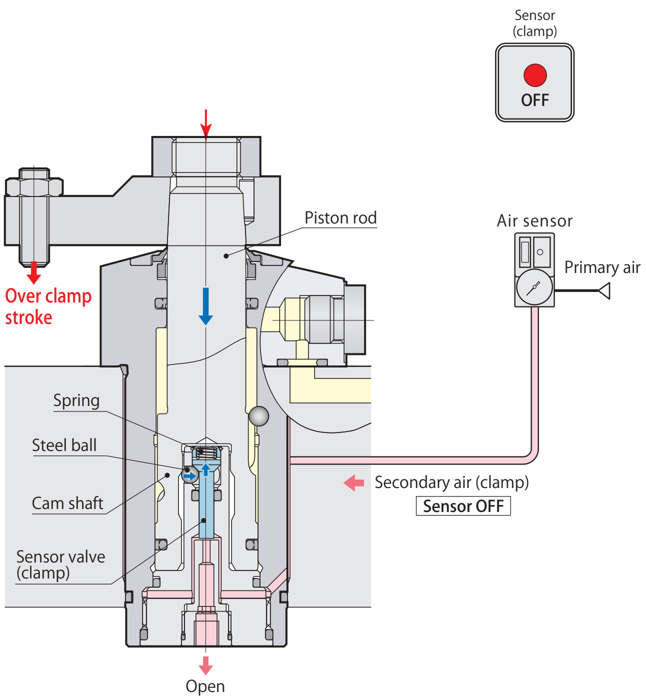
Sensor signal (clamp)	OFF	In the middle of swing stroke

Clamp detection



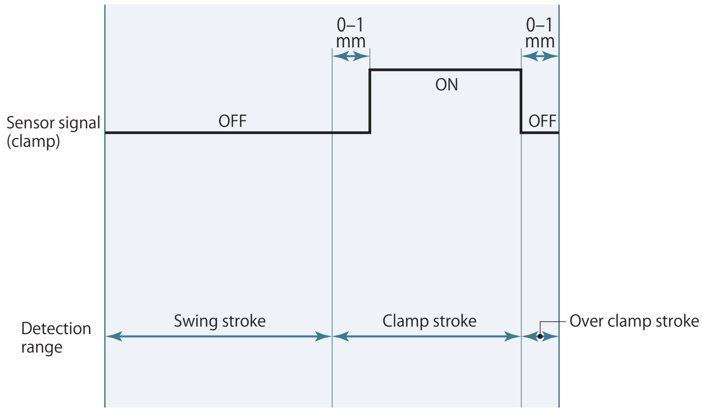
Sensor signal (clamp)	ON	Clamp

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.

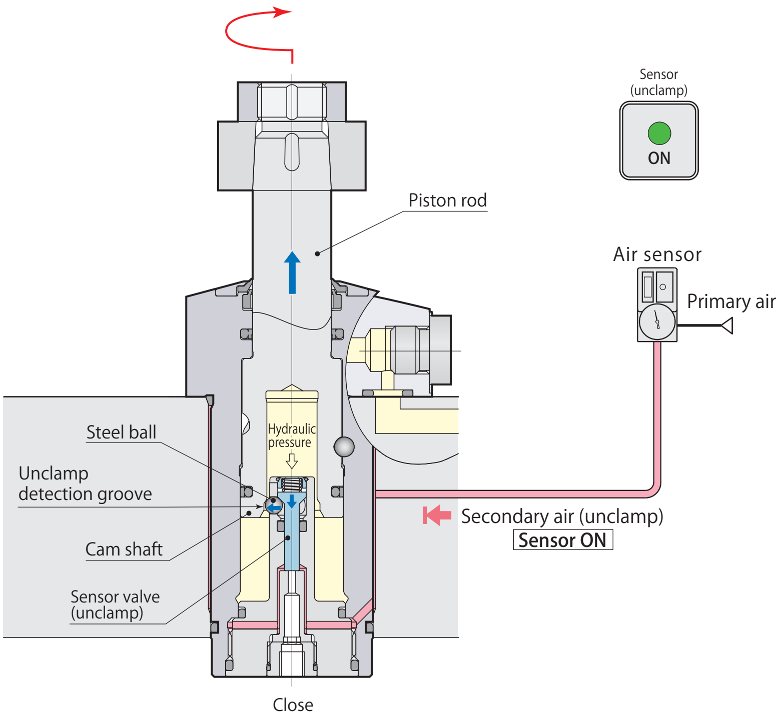
Air sensor unit recommended condition of use

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.

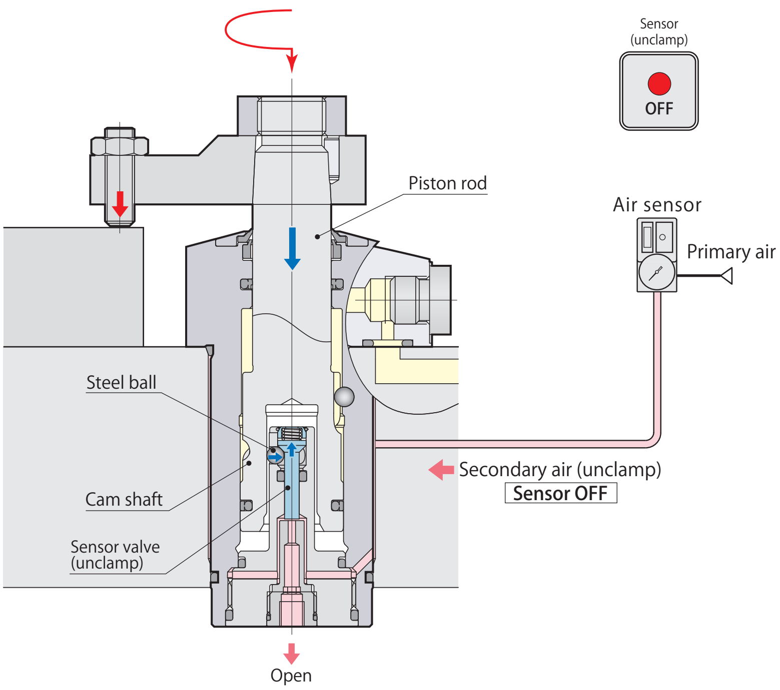
Unclamp detection signal

Unclamp detection



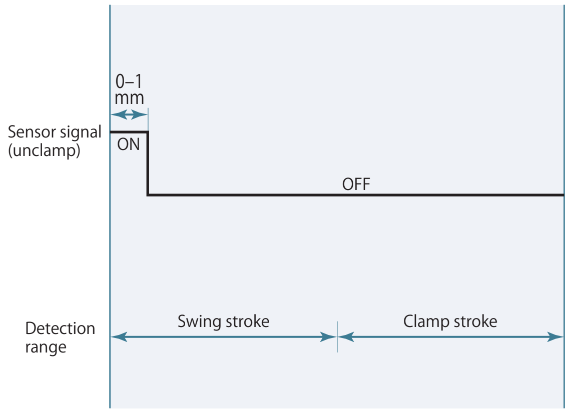
Sensor signal (unclamp)	ON	Unclamp

In the middle of stroke



Sensor signal (unclamp)	OFF	Clamp, In the middle of stroke

Air sensor triggering point



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Air sensor unit recommended condition of use

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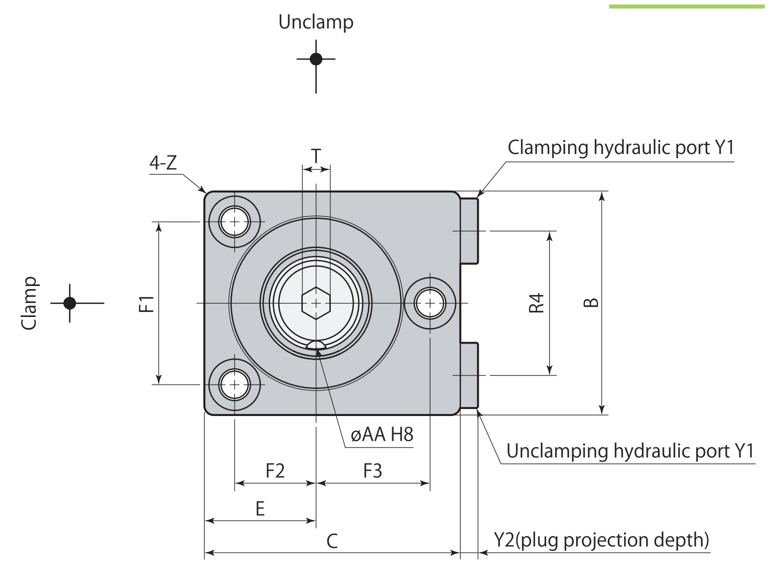
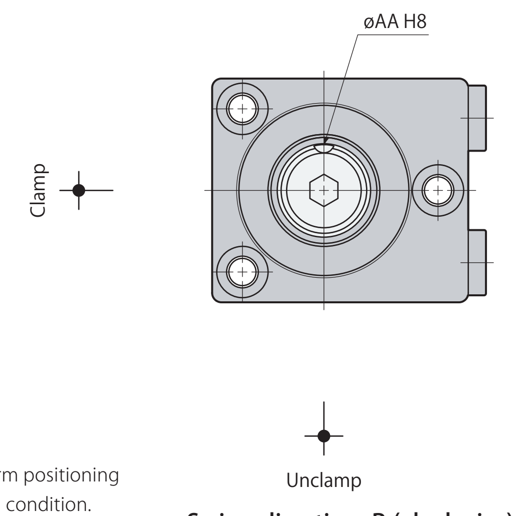
- Use a solenoid valve with needle for air sensor unit and control it supplying air all the time in order to eliminate intrusion of chips or coolant.
- There is a case that air sensing cannot be successfully made as designed when it is used out of the above usage. Contact Technical service center for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

Dimensions

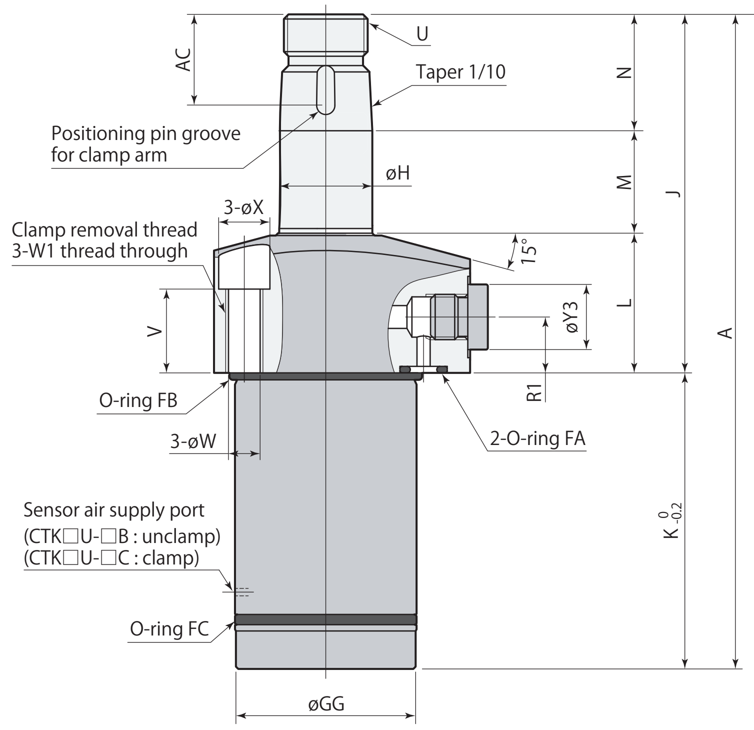


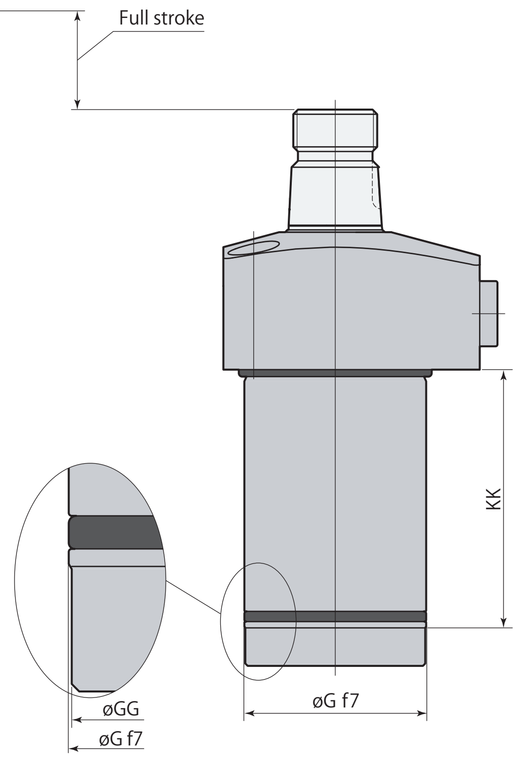


This diagram indicates the arm positioning pin groove at unclamped condition.

Swing direction L (counter-clockwise)

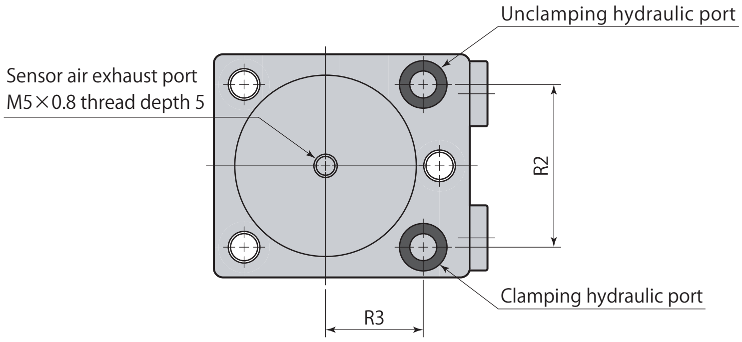
Swing direction R (clockwise)

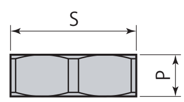




Unclamp

Stroke end





Hex nut for arm mount

- Hex nut for arm mount is included.
- Clamp arm, positioning pin and mounting screws are not included.
- Remove plugs when choosing G port piping. O-ring must be used.

mm

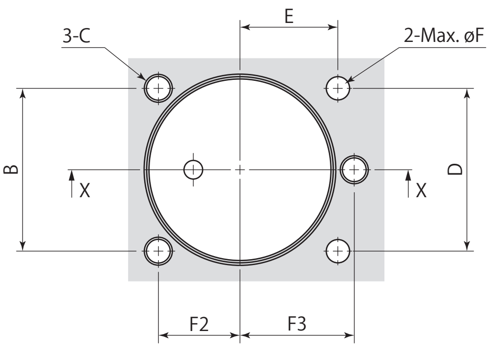
Model	CTK04U-□□	CTK06U-□□	CTK10U-□□	CTK16U-□□
A	121	140.5	168	194.5
B	43	48	60	74
C	50	55	70	85
E	21.5	24	30	37
F1	32	35	44	54
F2	16	17.5	22	27
F3	22.5	24.5	32	38
øG	$33^{-0.025}_{-0.050}$	$39^{-0.025}_{-0.050}$	$48^{-0.025}_{-0.050}$	$58^{-0.030}_{-0.060}$
øGG	32.6	38.6	47.6	57.6
øH	16	20	25	32
J	64	77	89.5	100
K	57	63.5	78.5	91.5
KK	49	55	69	78
L	24	30	34	37.5
M	18	22	26.5	29.5
N	22	25	29	36
P	8	9	10	11
R1	9.5	12	12.5	14
R2	30	35	44	56
R3	18.5	21	30	33
R4	26	31	40	50
S (nut width across flats)	22	27	30	36
T (hex socket)	5	6	10	12
U	M14×1.5	M18×1.5	M22×1.5	M28×1.5
V	12	18	18	18
øW	5.5	6.8	9	11
W1	M6×1	M8×1.25	M10×1.5	M12×1.75
øX	9.5	11	14	17.5
Y1	G1/8	G1/8	G1/8	G1/4
Y2	3.8	3.8	3.8	4.8
øY3	14	14	14	19
Z	R2	R2	R3	R3
øAA (pin groove diameter)	$3^{+0.014}_{0}$	$4^{+0.018}_{0}$	$5^{+0.018}_{0}$	$6^{+0.018}_{0}$
AC	16.5	19.5	22.5	23.5
Positioning pin (dowel pin)	ø3(h8)×8	ø4(h8)×10	ø5(h8)×12	ø6(h8)×12
O-ring FA (fluorocarbon hardness Hs90)	P7	P7	P7	P8
O-ring FB (fluorocarbon hardness Hs70)	AS568-026	AS568-029	AS568-031	AS568-035
O-ring FC (fluorocarbon hardness Hs70)	AS568-025	AS568-028	AS568-031	AS568-034
Taper sleeve	CTH04-KS	CTH06-KS	CTH10-KS	CTH16-KS
Flow control valve (meter-in)*	VCH01	VCH01	VCH01	VCH02
Air bleeding valve*	VCE01	VCE01	VCE01	VCE02

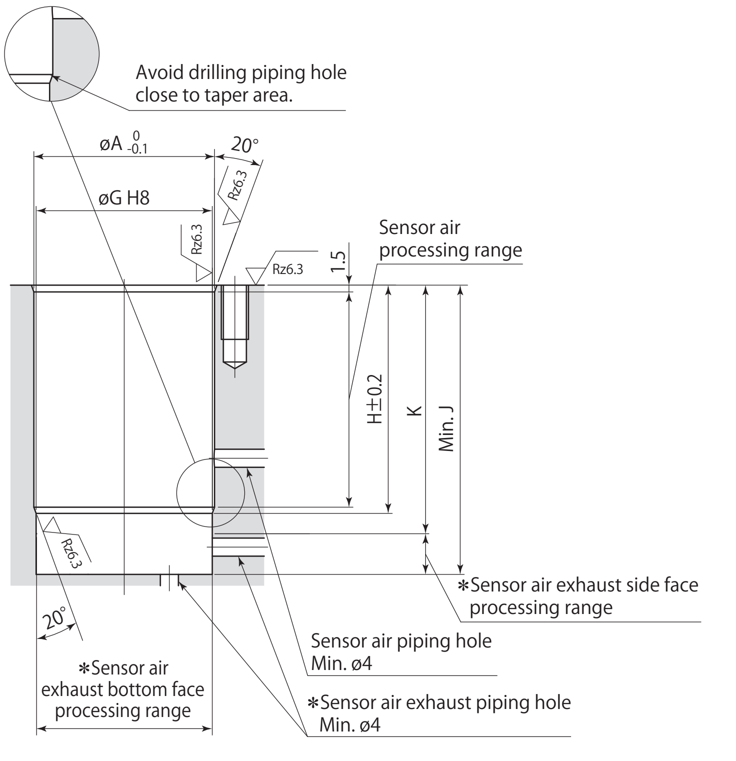
*:Select the right model of VCH and VCE according to the size of the clamp.

Refer to each page for the details of options.

● Taper sleeve **page →854**　● Flow control valve **page →860**　● Air bleeding valve **page →862**

Mounting details

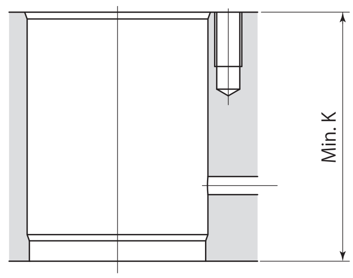




In blind hole X-X

Rz: ISO4287(1997)

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



In through hole X-X

- 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 20° 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

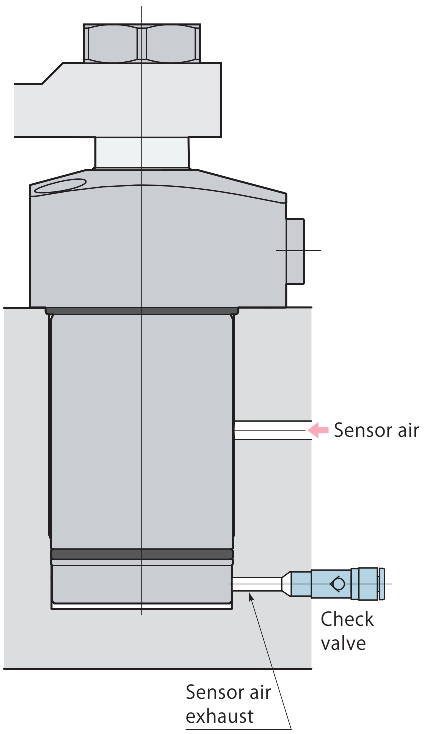
mm

Model	CTK04U-□□	CTK06U-□□	CTK10U-□□	CTK16U-□□
øA	34	40	49	59
B	32	35	44	54
C	M5	M6	M8	M10
D	30	35	44	56
E	18.5	21	30	33
øF	5	5	5	6
F2	16	17.5	22	27
F3	22.5	24.5	32	38
øG	$33^{+0.039}_{0}$	$39^{+0.039}_{0}$	$48^{+0.039}_{0}$	$58^{+0.046}_{0}$
H	44.5	50.5	64.5	73.5
J	57.5	64	79	92
K	49	55	69	78

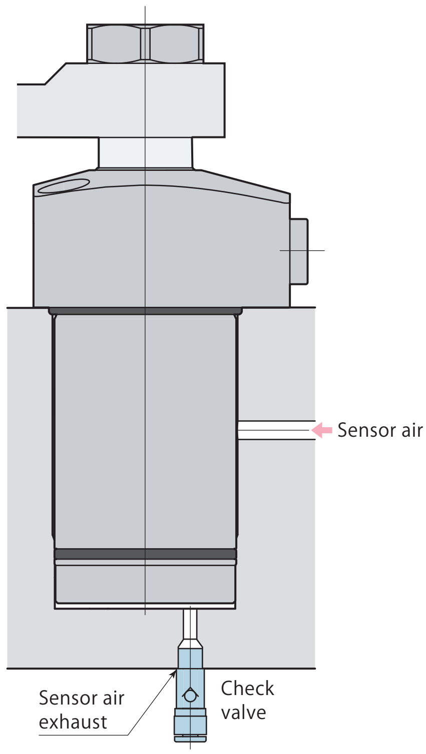
Caution for piping

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

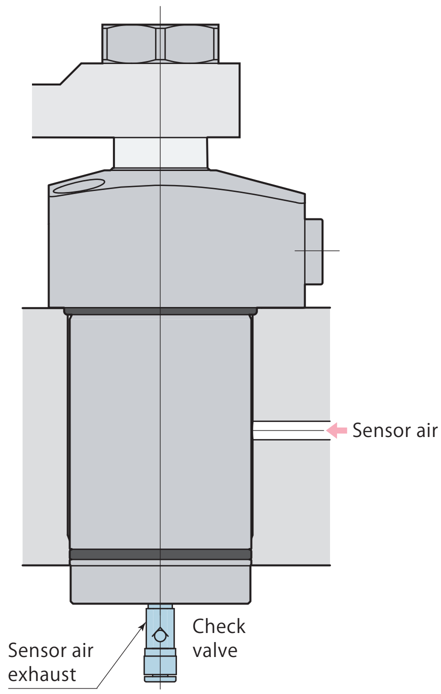
Mounting in blind hole
(Sensor air exhaust：side face)



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



Mounting in through hole



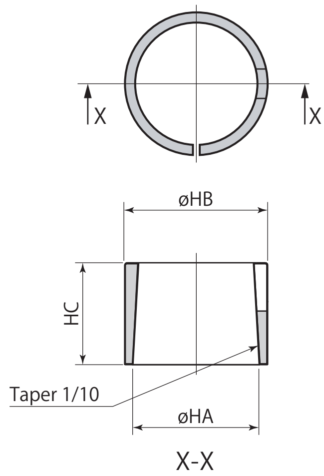
- Use a check valve with cracking pressure of 0.005 MPa or less if there is a risk of metal chips or coolant intrusion.
  Recommended check valve：AKH or AKB series manufactured by SMC.

Specifications

Size		Option code	
CTH	02 / 04 / 06 / 10 / 16	— KS	: Taper sleeve
		KN	: Perfect nut
		KNR	: Perfect release nut

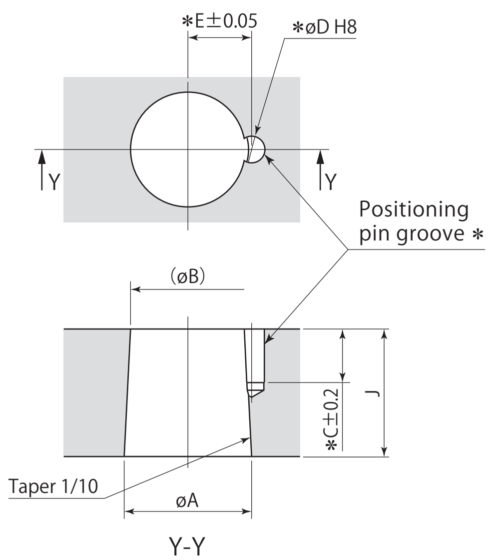
Taper sleeve and perfect release nut can not be combined.
▇ indicates made to order.

Taper sleeve

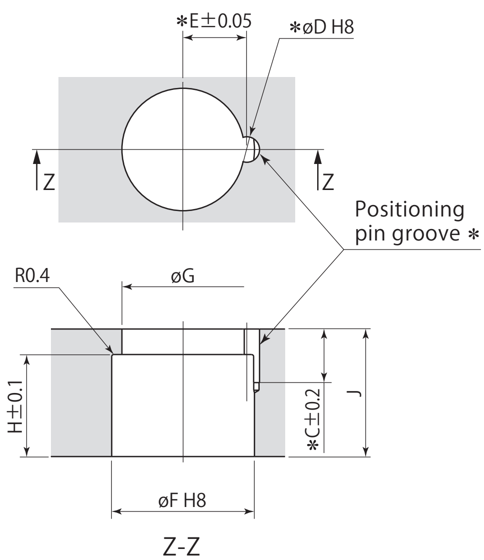


Clamp arm mounting details

Not using taper sleeve



Using taper sleeve

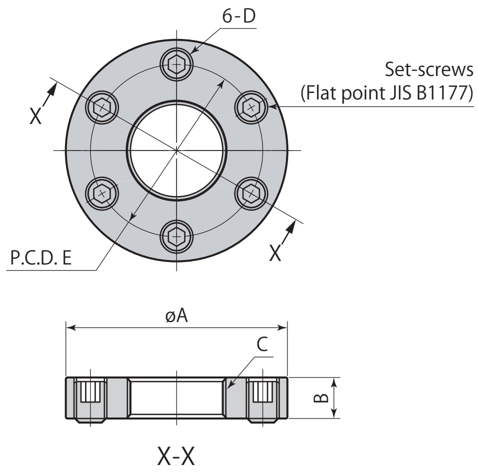


*: No need to machine the pin groove (C, øD, E) unless positioning pin is used for the arm.
The positioning pin enables a clamp arm to locate on the clamp firmly and easily.

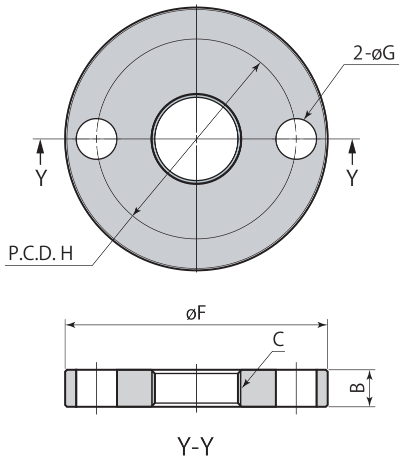
mm

Taper sleeve	CTH02-KS	CTH04-KS	CTH06-KS	CTH10-KS	CTH16-KS
Applicable swing clamp	CTK02	CTK04	CTK06	CTK10	CTK16
øHA	12	16	20	25	32
øHB	14	18	22	28	36
HC	9.5	11	13	16	22
øA	12 $^{-0.016}_{-0.034}$	16 $^{-0.016}_{-0.034}$	20 $^{-0.020}_{-0.041}$	25 $^{-0.020}_{-0.041}$	32 $^{-0.025}_{-0.050}$
øB	10.8	14.6	18.4	23.1	29.5
C	6.5	8.5	10.5	12.5	12.5
øD (pin groove diameter)	2.5 $^{+0.014}_{0}$	3 $^{+0.014}_{0}$	4 $^{+0.018}_{0}$	5 $^{+0.018}_{0}$	6 $^{+0.018}_{0}$
E	6.05	8.1	10.1	12.6	16.1
øF	14 $^{+0.027}_{0}$	18 $^{+0.027}_{0}$	22 $^{+0.033}_{0}$	28 $^{+0.033}_{0}$	36 $^{+0.039}_{0}$
øG	11.5	15	19	23.5	30
H	9.5	11	13	16	22
J	12	14	16	19	25

Perfect nut



Perfect release nut



Perfect nut and perfect release nut are not included with swing clamp. Place an order by specifying following models.

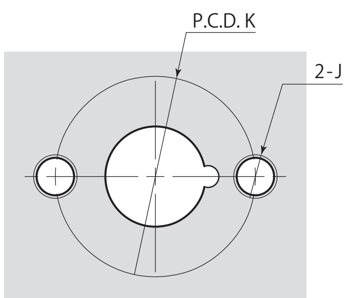
mm

Perfect nut		CTH02-KN	CTH04-KN	CTH06-KN	CTH10-KN	CTH16-KN
Perfect release nut		CTH02-KNR	CTH04-KNR	CTH06-KNR	CTH10-KNR	CTH16-KNR
Applicable swing clamp		CTK02	CTK04	CTK06	CTK10	CTK16
Set-screw	Size	M4×0.7 length 6	M5×0.8 length 8	M6×1 length 8	M8×1.25 length 8	M8×1.25 length 8
	Recommended tightening torque	0.8 N·m	2 N·m	3 N·m	6 N·m	7 N·m
Recommended draw screw		M5×0.8	M6×1	M8×1.25	M10×1.5	M10×1.5
øA		23	30	36	48	55
B		6.5	8	9	10	11
C		M10×0.75	M14×1.5	M18×1.5	M22×1.5	M28×1.5
D		M4×0.7	M5×0.8	M6×1	M8×1.25	M8×1.25
E		17	22	26.5	35	42
øF		33	40	50	62	70
øG		5.5	6.8	9	11	11
H		23	29	36	45	52
Mass	Perfect nut	0.02 kg	0.04 kg	0.06 kg	0.12 kg	0.16 kg
	Perfect release nut	0.04 kg	0.07 kg	0.12 kg	0.21 kg	0.28 kg

● Draw screws are not included with perfect release nut.

Clamp arm details

(Using perfect release nut)



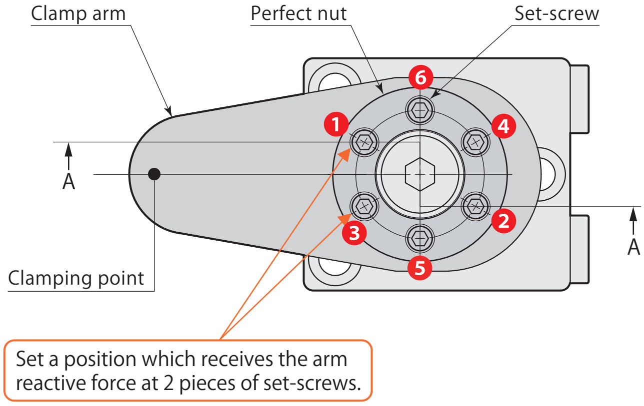
mm

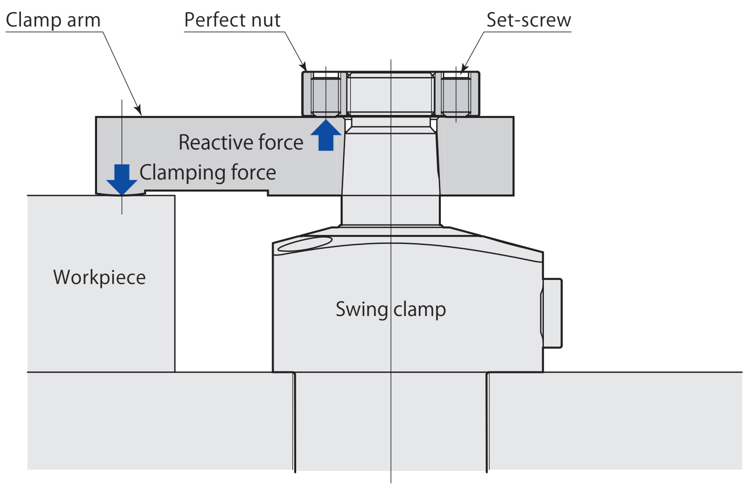
Applicable swing clamp	CTK02	CTK04	CTK06	CTK10	CTK16
J	M5	M6	M8	M10	M10
K	23	29	36	45	52

● For the finished dimensions of clamp arm in those portions other than the perfect release nut using part, refer to **page →854**.

Perfect nut (Arm mounting guide)

1. Set clamp arm and turn perfect nut as tight as it gets manually.
2. Turn back perfect nut to the position where two set-screws hold against reactive force of arm, as shown in diagram below.
3. Tighten set-screws with recommended torque in order of ❶ to ❻ in diagram below.
4. Once set-screws are tightened to ❻ , ❶ becomes loose, so retighten in sequence of ❶ to ❻ again.
5. Repeat tightening of set-screws ❶ to ❻ six times.
6. Repeat clamping and unclamping of workpiece five times (this operation allows taper section to become accustomed to use).
7. Return to unclamped condition and then retighten set-screws in order of ❶ to ❻.
   Once tightening in sequence of ❶ to ❻ is repeated three times, all set-screws will be fixed and clamp arm is completely mounted.



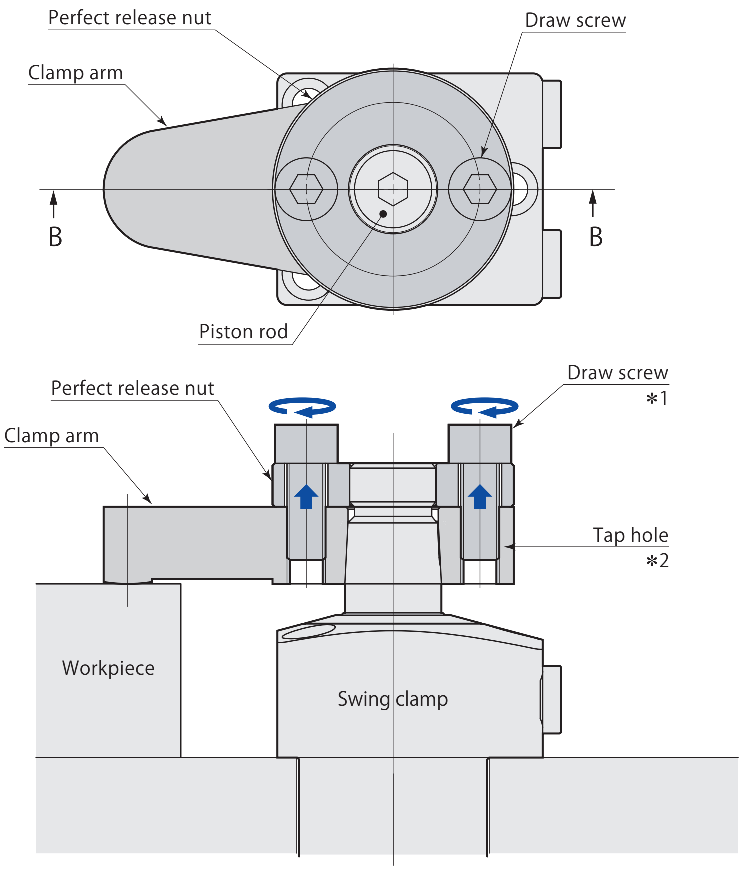


A-A

- The clamp arm may bite at the taper of the clamp rod and it will cause the demount failure if the set screw is tightened with excessive force. Be sure to use recommended torque when tightening.
- More secure tightening can be accomplished by applying some thread adhesive on set-screws.
  Recommended adhesive: LOCTITE 243 (medium strength type)

Perfect release nut (Arm dismounting guide)

1. Loosen all set-screws of perfect nut and dismount perfect nut from piston rod.
2. Mount perfect release nut and turn it until clamp arm comes into contact.
3. Turn perfect release nut back one or two more times, align the nut hole with tap hole of clamp arm and then mount the draw screws.
4. Once draw screws are tightened, clamp arm can be pulled off piston rod.



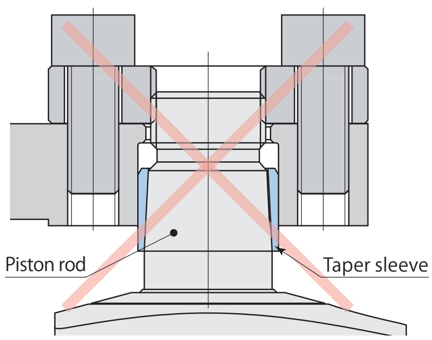
B-B

∗1：Turn draw screws as a pair, alternately turning 45° to 90° at a time to tighten them evenly.
Some movement is felt in hand as clamp arm comes off, but there is no danger involved in this procedure.

∗2：Tap holes for draw screws are needed on clamp arm in order to use perfect release nut.
Refer to clamp arm details on **page →855** for details on tap holes.

Caution in use

In the event that a clamp arm is used with taper sleeve, the perfect release nut cannot remove the clamp arm due to the taper sleeve remaining on the piston rod. (When using a taper sleeve, please use a gear puller (or similar) to remove clamp arm.)
To be able to easily remove clamp arms using the perfect release nut, drill a 1/10 taper hole into the clamp arm. (Clamp arm mounting details refer to **page →854**)



Mounting & dismounting of clamp arm

- Swing clamp may be damaged if excessive torque is applied to piston rod, since structure is intended for swinging using cam mechanism with lead grooves. Follow instructions shown below to prevent excessive torque from being applied on piston rod when mounting or dismounting clamp arm.
- Be sure to tighten the locknut with recommended tightening torque. If the tightening torque is insufficient, clamp arm may slip during operation.

Model		CTK02	CTK04	CTK06	CTK10	CTK16
Recommended tightening torque of locknut	N·m	11	26	51	75	130

Mounting of clamp arm

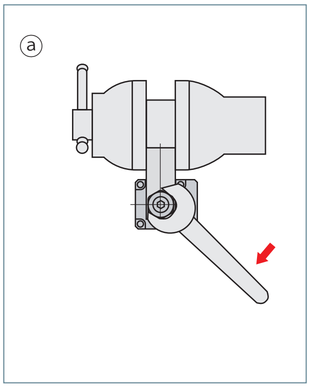
ⓐ Fix the clamp arm in a vise, then set the clamp body and clamp arm at the desired orientation, and tighten locknut with a wrench.

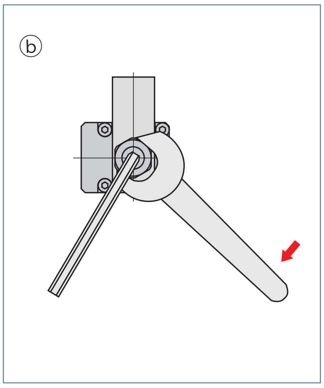
ⓑ For clamps that are mounted on jig, set clamp arm at desired orientation as shown in diagram below. Insert a hex wrench to hex socket at tip section of piston rod to hold it and tighten locknut with a wrench.

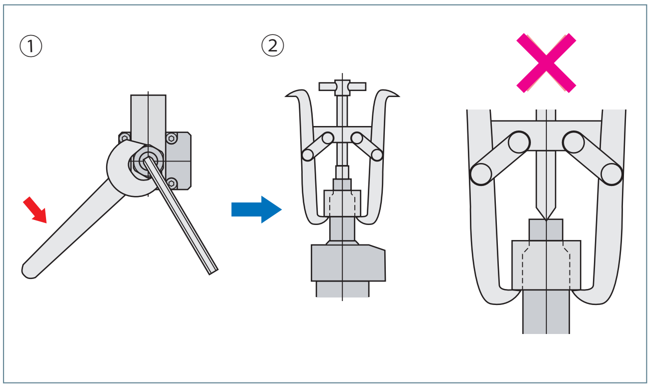
Dismounting of clamp arm

① Insert hex wrench to hex socket at tip section of piston rod to ensure that piston rod is held in place, then loosen locknut with wrench.

② After dismounting the locknut, pull out clamp arm using gear puller. A flat saddle type of gear puller should be used when removing an arm not to enlarge the hole on the tip of the piston rod. In addition, be careful not to rotate the rod when removing the arm.

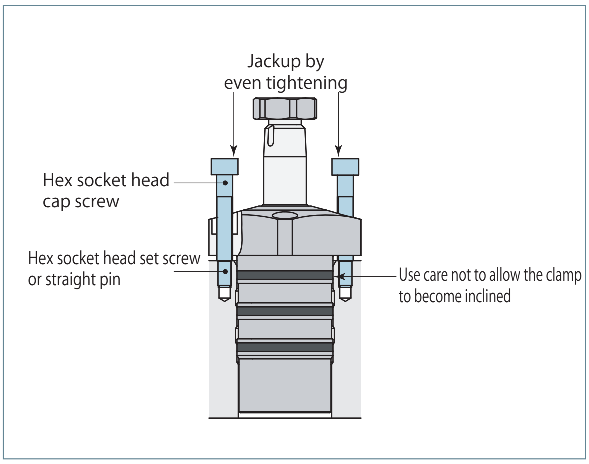






Dismounting of model CTK□N (Cartrige)

1. Check that the hydraulic pressure is set at zero (0).
2. Remove mounting screws.
3. For protection of the mounting surfaces, install the hex socket head set screw or straight pin.
4. Using removal tap hole in the clamp, lift the clamp up with two screws for proper dismounting. In this step, use care not to allow the clamp to become inclined.



Specifications

Body color：Silver

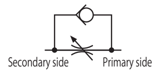
VCH

G port size

01	：G1/8
02	：G1/4

Control method

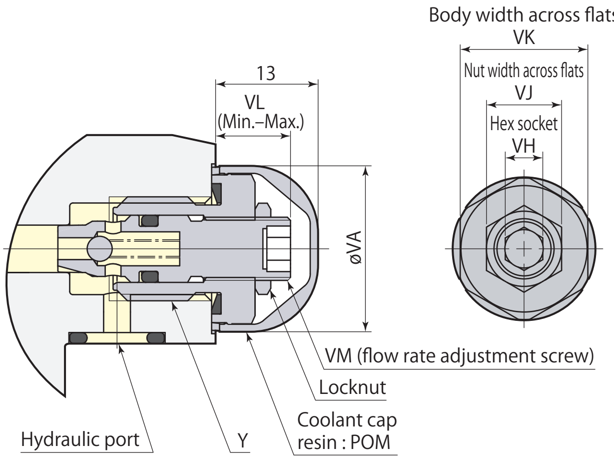
(Nil) ：Meter-in



Model		VCH01	VCH02
G port size		G1/8	G1/4
Cracking pressure	MPa	0.04	
Orifice area	mm^2	3.1	6.2
Recommended tightening torque	N·m	10	30
Mass	kg	0.06	0.07

● Pressure range：1–50 MPa ● Operating temperature：0–70 ℃
● Fluid used：General mineral based hydraulic oil (ISO-VG32 equivalent)

Dimensions



mm

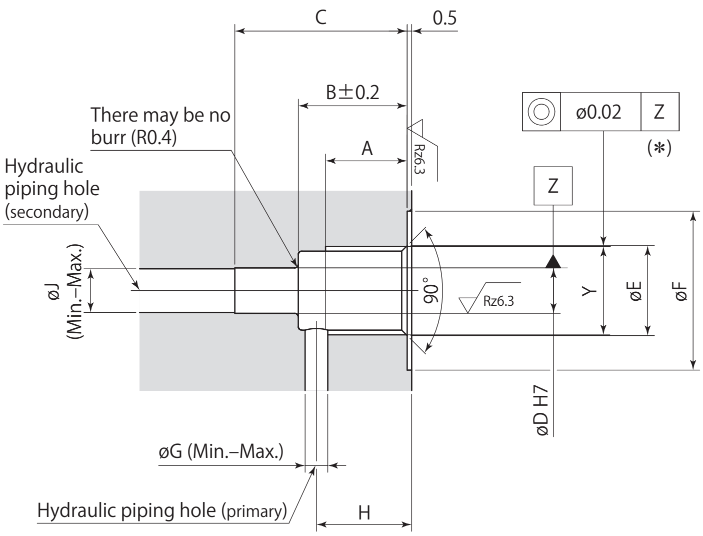
Model	VCH01	VCH02
Y	G1/8	G1/4
øVA	16	21
VH	3	5
VJ	8	10
VK	12	17
VL	7–11	7.5–11.5
Adjustment screw number of turns	5.3 rotations	5.3 rotations
VM	M6×0.75	M8×0.75

● Use a closed wrench or socket wrench for mounting and dismounting.
● Flow control valve can be mounted on hydraulic port (G port) when manifold piping.
● Adjust flow rate without hydraulic pressure. Conducting adjustments with hydraulic pressure may result in damaging seal.
● VCH is shipped with the valve fully open. Adjust the flow rate by loosening the screws after it is screwed in to close totally. Tighten the locknut after adjustment is completed.

Applicable clamp

Model	VCH01	VCH02
Swing clamp (double acting)	CTK04U, 06U, 10U CTK04B, 06B, 10B	CTK16U CTK16B
Link clamp (double acting)	CLW04-N, 06-N, 10-N	CLW16-N, 25-N
Link clamp (single acting)	CLV06-N, 10-N	CLV16-N, 25-N

Mounting details



Rz: ISO4287(1997)

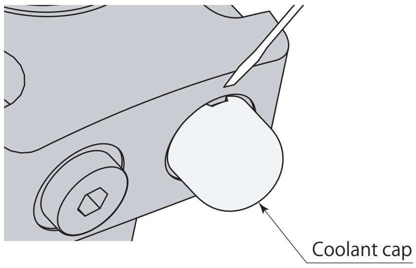
mm

Model	VCH01	VCH02
A	9	13
B	13	18
C	17.5	22.5
øD	$5^{+0.012}_{0}$	$6^{+0.012}_{0}$
øE	9.9	13.3
øF	17.5	21.5
øG	2.5–3	3.5–5
H	9.5–11.5	14.5–15.5
øJ	2.5–5	3.5–6
Y	G1/8	G1/4

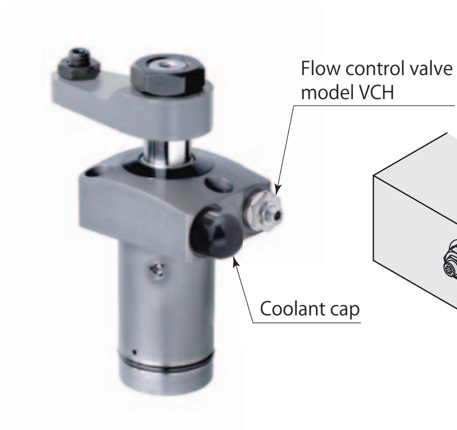
*: Concentricity is required when machining øD and Y-portion thread. Misalignment or machining defect may cause the trouble of installation and adjusting flow rate.

Mounting & dismounting of flow control valve, air bleeding valve

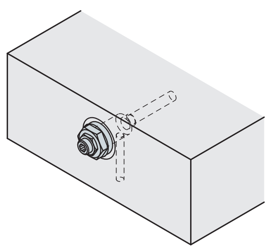
- When mounting or dismounting a flow control valve or air bleeding valve, be sure to set pressure within hydraulic circuit to 0 MPa before starting.
- When mounting a flow control valve or air bleeding valve, be sure to tighten it with the recommended tightening torque.
- When mounting a coolant cap (resin: POM), firmly press the body of cover. If it is not mounting properly, use a plastic mallet to tap it into place.
- When dismounting a coolant cap, use a sharp-pointed tool such as a precision screw driver by hooking the notched portion.



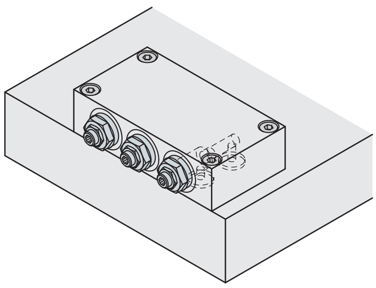
Mounting example



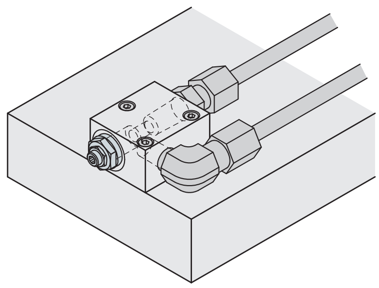
Cylinder mounting



Pallet mounting



Block mounting ①



Block mounting ②

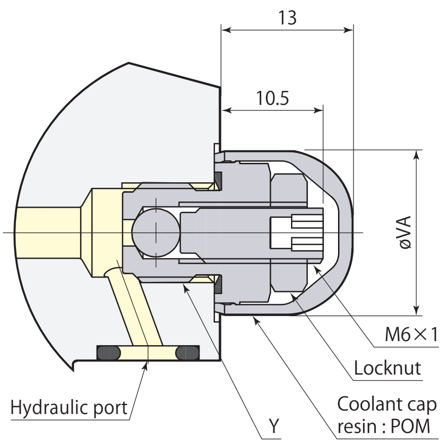
Specifications

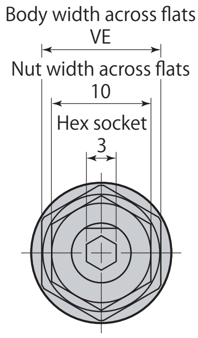
G port size

VCE **01** : G1/8
VCE **02** : G1/4

Model		VCE01	VCE02
G port size		G1/8	G1/4
Recommended tightening torque	N·m	10	30
Mass	kg	0.017	0.029
Pressure range	MPa	0–50	
Operating temperature	°C	0–70	
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)	

Dimensions



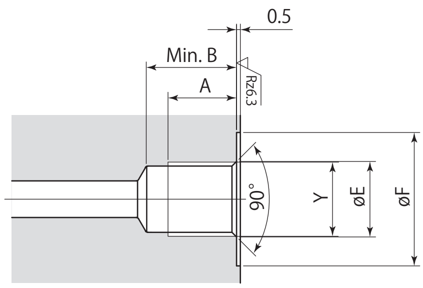


mm

Model	VCE01	VCE02
A	9	13
B	10	14
øE	9.9	13.3
øF	17.5	21.5
Y	G1/8	G1/4
øVA	16	21
VE	12	17

- Use a closed wrench or socket wrench for mounting and dismounting.
- Air bleeding valve can be mounted on hydraulic port (G port) when manifold piping.

Mounting details



Rz: ISO4287(1997)

Applicable clamp and work support

Model	VCE01	VCE02
Swing clamp (double acting)	CTK04U, 06U, 10U CTK04B, 06B, 10B CTW06, 10	CTK16U CTK16B CTW16, 25
Swing clamp (single acting)	CTV06, 10	CTV16, 25
Link clamp (double acting)	CLW04, 06, 10	CLW16, 25
Link clamp (single acting)	CLV06, 10	CLV16, 25
Work support	CSP-M-N (CSW, CSV)	–

Table of contents

Swing clamp

35MPa

Double acting

model **CTW**

Single acting

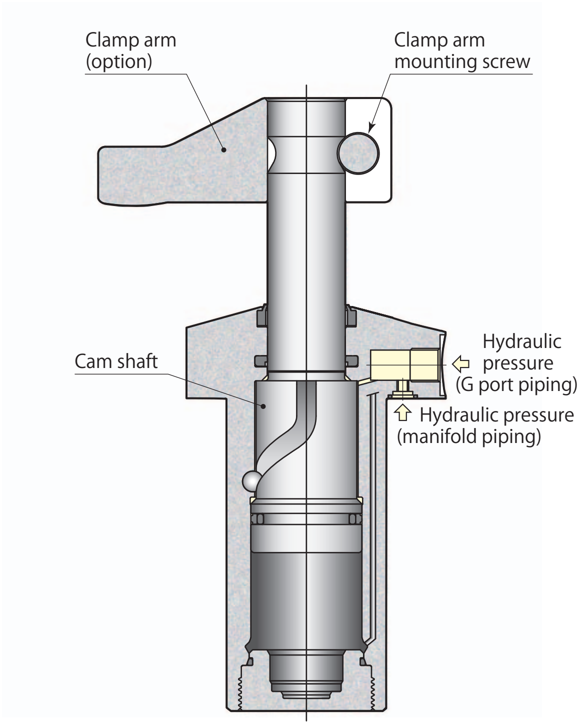
model **CTV**

Double acting
Lower flange
model CTW06B-L

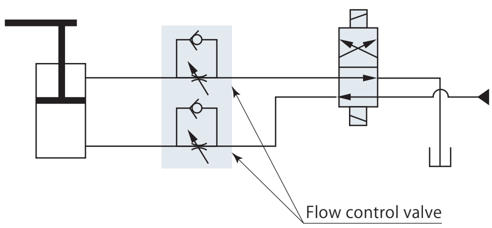
Single acting
Upper flange
model CTV06U-L

Upper flange

model **CTW□U-□**



Hydraulic circuit diagram



For flow control valve, we recommend the meter-in control. If meter-out control is used, due to the area difference, it will cause back pressure and become high pressure. This can lead to malfunction of the system. Please be aware when designing the circuit.

Flow control valve model VCH can not be mounted.

Specifications **page** → 867
Upper flange **page** → 870
Lower flange **page** → 874
Swing angle 30°, 45°, 60° **page** → 878

Specifications

CTW

Size:
- 06
- 10
- 16
- 25

Mounting and piping types:
- U : Upper flange
- B : Lower flange

–

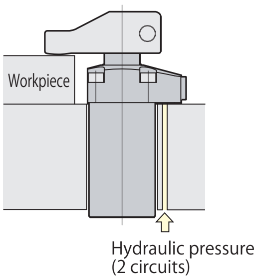
Swing direction (when clamping), swing angle:
- L : Counter-clockwise, swing angle 90°
- LN30 : Counter-clockwise, swing angle 30°
- LN45 : Counter-clockwise, swing angle 45°
- LN60 : Counter-clockwise, swing angle 60°
- R : Clockwise, swing angle 90°
- RN30 : Clockwise, swing angle 30°
- RN45 : Clockwise, swing angle 45°
- RN60 : Clockwise, swing angle 60°
- C : Straight, swing angle 0°

▇ indicates made to order.

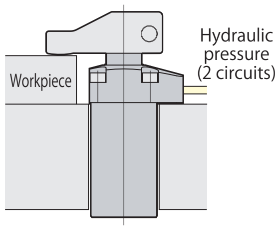
Mounting and piping types

CTW□U-□

Upper flange
manifold piping

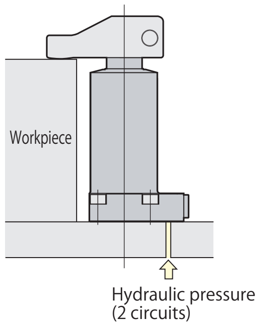


Upper flange
G port piping

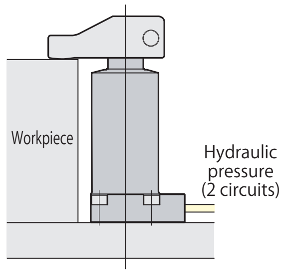


CTW□B-□

Lower flange
manifold piping



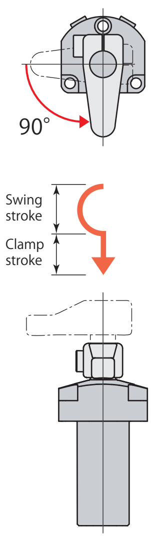
Lower flange
G port piping



Swing direction (when clamping)

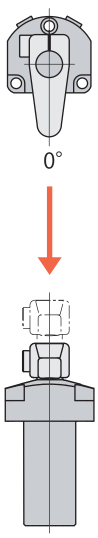
CTW□□-L

Counter-clockwise
Swing angle 90°



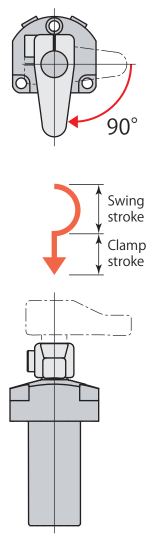
CTW□□-C

Straight
Swing angle 0°



CTW□□-R

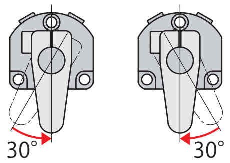
Clockwise
Swing angle 90°



Swing angle

CTW□□- LN30 / RN30

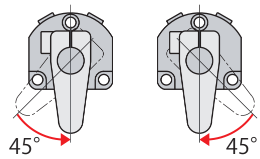
Swing angle 30°



L : Counter-clockwise　R : Clockwise

CTW□□- LN45 / RN45

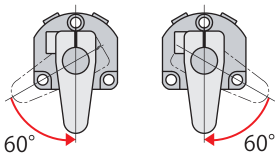
Swing angle 45°



L : Counter-clockwise　R : Clockwise

CTW□□- LN60 / RN60

Swing angle 60°



L : Counter-clockwise　R : Clockwise

Refer to **pages →878** and **879** for details.

Specifications

Model			CTW06	CTW10	CTW16	CTW25
Cylinder force (hydraulic pressure 35MPa)		kN	6.3	14.3	19.2	26.3
Clamping force*1	Hydraulic pressure 35MPa	kN	5.4	12.4	16.6	22.9
	Hydraulic pressure 25MPa	kN	3.9	8.8	11.9	16.3
	Hydraulic pressure 15MPa	kN	2.3	5.3	7.1	9.8
Standard clamp arm length		mm	40	50	57	65
Cylinder inner diameter		mm	22	32	40	44.5
Rod diameter		mm	16	22.4	30	32
Effective area (clamp)		cm^2	1.79	4.10	5.50	7.51
Swing angle	CTW□□-L, R		90°±3°			
	CTW□□-C		0°			
Repeated clamp positioning accuracy			±0.5°			
Full stroke		mm	22	28	32	40
90° swing stroke (CTW□□-L, R)		mm	12	15	18	24
Clamp stroke (CTW□□-L, R)		mm	10	13	14	16
Max. swing torque*2		N·m	0.35	0.97	1.51	2.10
Max. oil flow rate	Clamp	L/min	0.43	1.23	1.48	2.70
	Unclamp	L/min	0.91	2.41	3.39	5.60
Cylinder capacity	Clamp	cm^3	3.9	11.5	17.6	30.0
	Unclamp	cm^3	8.4	22.5	40.2	62.2
Recommended tightening torque of mounting screws*3		N·m	12	29	29	29

- Pressure range：3.5–35 MPa　● Proof pressure：52.5 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：Clamping force at time standard clamp arm is mounted (refer to section on W1, W2 series on **page →894**).
Clamping force varies depending on clamp arm length. Refer to performance table (**page →869**) for details.

∗2：This is the limit value for lifting arm at 3.5 MPa when mounted vertically.

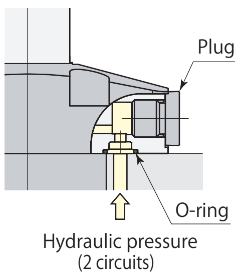
∗3：ISO R898 class 12.9

Manifold piping and G port piping are available.

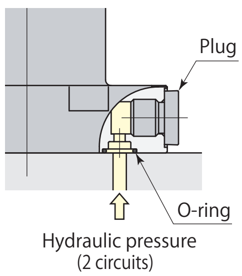
Manifold piping

Remove sealing plugs when using manifold piping. An air bleeding valve (model VCE) is mountable on the G port of the clamp.

Upper flange



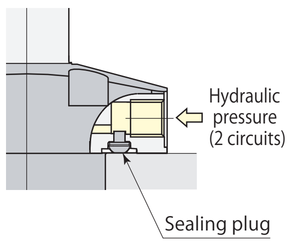
Lower flange



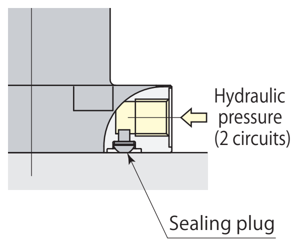
G port piping

Remove plugs and O-ring when choosing G port piping. The flow control valve and the air bleeding valve should be installed in the middle of oil path.

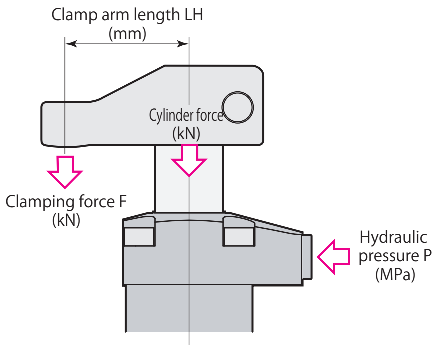
Upper flange



Lower flange



Performance table



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

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

CTW10 with clamp arm length (LH) = 60 mm at hydraulic pressure of 20 MPa, Clamping force F is calculated by
20/(2.44+0.00773×60)=6.9 kN

Do not use the clamp in the nonusable range. It may cause damage to the cylinder and rod.

model CTW06 Clamping force F=P/(5.58+0.0224×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN (Clamp arm length LH mm) 40	60	80	100	120	Max. arm length Max. LH mm
35	6.3	5.4					42
30	5.4	4.6		Nonusable range			51
25	4.5	3.9	3.6				64
20	3.6	3.1	2.9	2.7			85
15	2.7	2.3	2.2	2.0	1.9	1.8	127
10	1.8	1.5	1.4	1.4	1.3	1.2	200
5	0.9	0.8	0.7	0.7	0.6	0.6	↑
3.5	0.6	0.5	0.5	0.5	0.4	0.4	200

model CTW10 Clamping force F=P/(2.44+0.00773×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN (Clamp arm length LH mm) 50	60	80	100	120	Max. arm length Max. LH mm
35	14.3	12.4					52
30	12.3	10.6	10.3		Nonusable range		62
25	10.2	8.8	8.6				77
20	8.2	7.1	6.9	6.5	6.2		103
15	6.1	5.3	5.2	4.9	4.7	4.5	154
10	4.1	3.5	3.4	3.3	3.1	3.0	240
5	2.0	1.8	1.7	1.6	1.6	1.5	↑
3.5	1.4	1.2	1.2	1.1	1.1	1.0	240

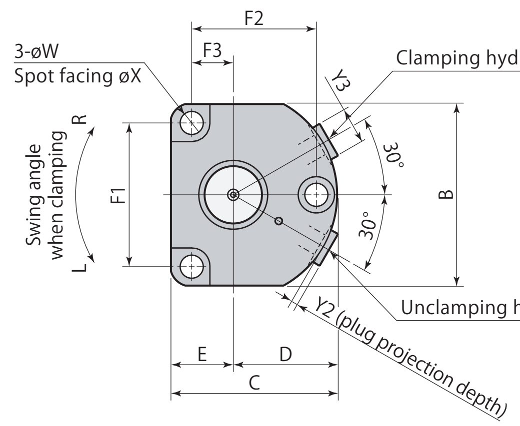
model CTW16 Clamping force F=P/(1.82+0.00506×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN (Clamp arm length LH mm) 57	80	100	120	140	Max. arm length Max. LH mm
35	19.2	16.6					57
30	16.5	14.2		Nonusable range			62
25	13.7	11.9					77
20	11.0	9.5	9.0	8.6			102
15	8.2	7.1	6.7	6.4	6.2	5.9	150
10	5.5	4.7	4.5	4.3	4.1	4.0	255
5	2.7	2.4	2.2	2.1	2.1	2.0	↑
3.5	1.9	1.7	1.6	1.5	1.4	1.4	255

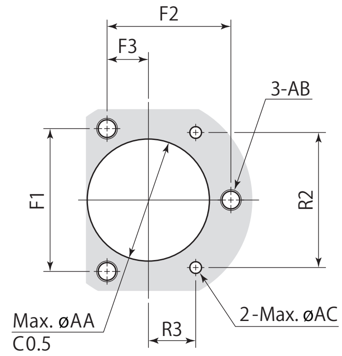
model CTW25 Clamping force F=P/(1.33+0.00310×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN (Clamp arm length LH mm) 65	80	100	120	140	160	Max. arm length Max. LH mm
35	26.3	22.9						65
30	22.6	19.6			Nonusable range			72
25	18.8	16.3	15.8					90
20	15.0	13.1	12.7	12.2				119
15	11.3	9.8	9.5	9.1	8.8	8.5	8.2	174
10	7.5	6.5	6.3	6.1	5.9	5.7	5.5	270
5	3.8	3.3	3.2	3.0	2.9	2.8	2.7	↑
3.5	2.6	2.3	2.2	2.1	2.1	2.0	1.9	270

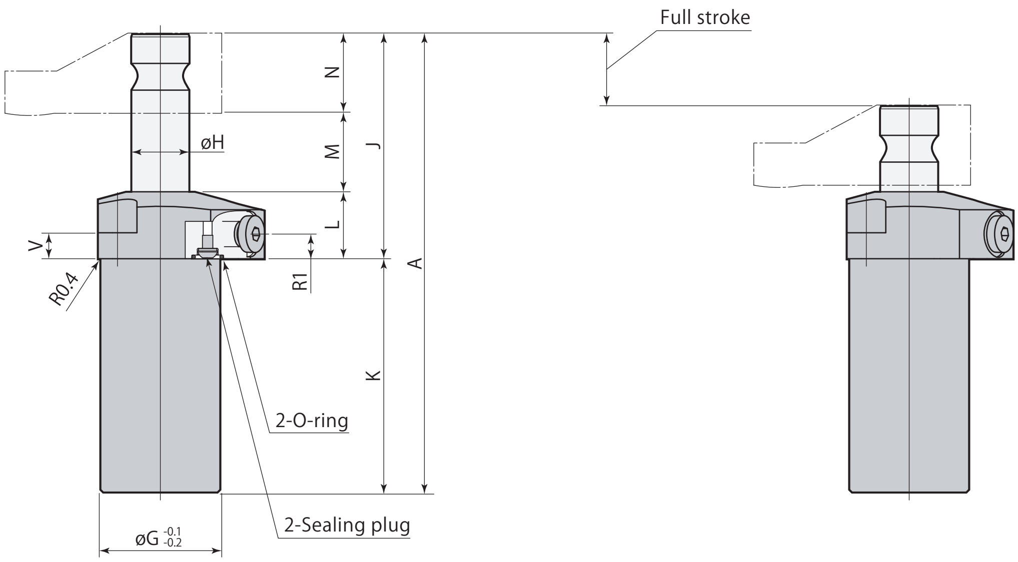
Dimensions



Mounting details

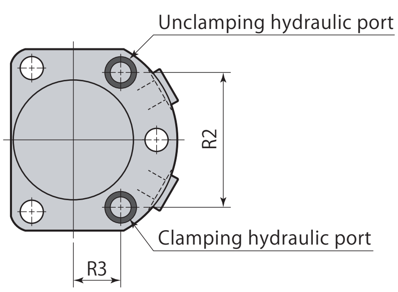


The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997) for manifold piping.



Unclamp

Stroke end



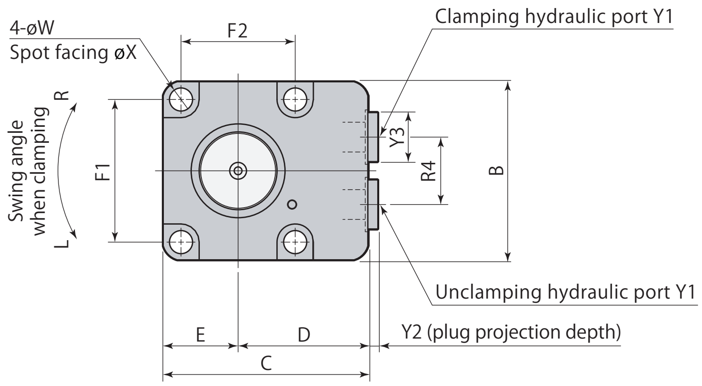
mm

Model	CTW06U-□	CTW10U-□
A	137	176.5
B	56	70
C	50.5	64
D	32.5	40
E	18	24
F1	43.3	55
F2	37.5	47.6
F3	12.5	15.9
øG	33	46
øH	16	22.4
J	71	86.5
K	66	90
L	26	26
M	24	30.5
N	21	30
R1	9.5	9.5
R2	41	52
R3	14.3	18.2
V	13	10
øW	7	8.9
øX	11	14
Y1	G1/8	G1/8
Y2	2.8	2.8
Y3	14	14
O-ring (fluorocarbon hardness Hs90)	P9	P9
øAA	34	47
AB	M6	M8
øAC	7	7
Mass	0.7 kg	1.6 kg
Air bleeding valve	VCE01	VCE01

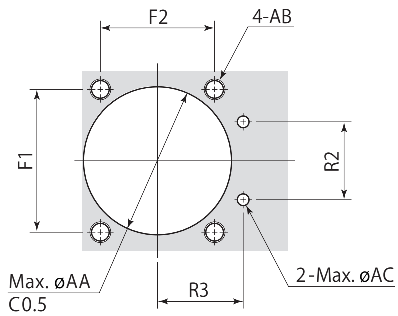
Refer to each page for the details of options.

- Clamp arm **page →894**
- Air bleeding valve **page →862**
- Clamp arm and mounting screws are not included.
- CTW□U-C (Straight, swing angle 0°) is made to order.

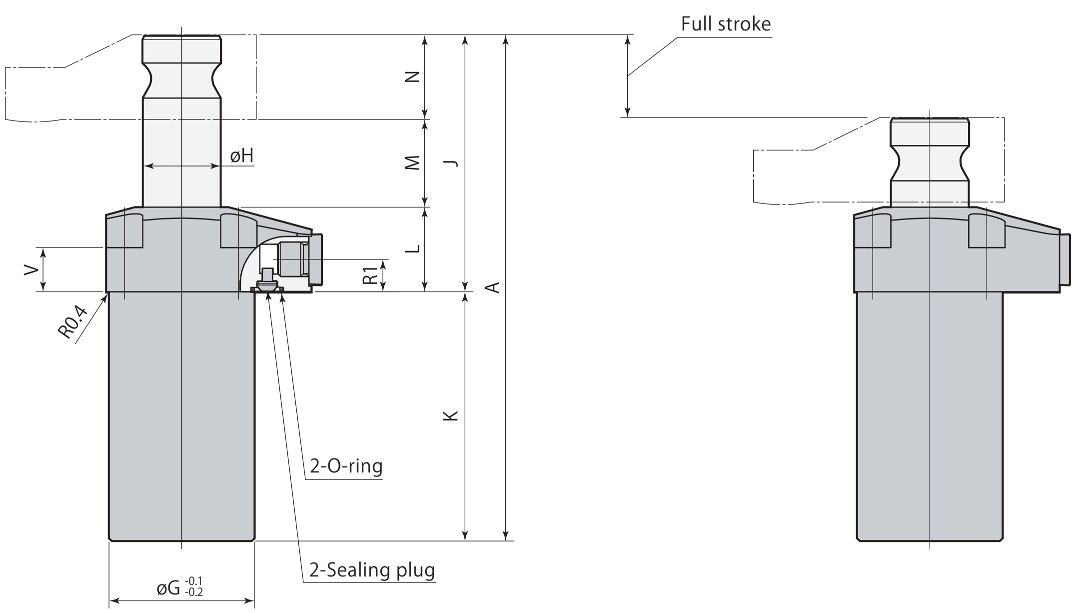
Dimensions



Mounting details

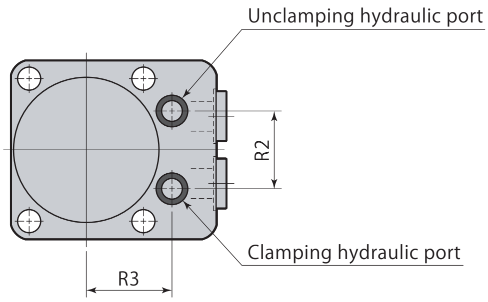


The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997) for manifold piping.



Unclamp

Stroke end



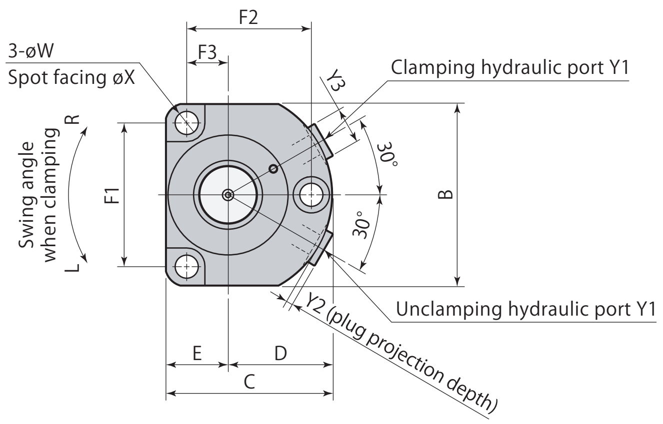
mm

Model	CTW16U-□	CTW25U-□
A	195	226
B	69	69
C	79	87.5
D	50	53
E	29	34.5
F1	55	55
F2	44	55
øG	56	61.5
øH	30	32
J	99	110
K	96	116
L	32	32.5
M	35	42.5
N	32	35
R1	12.5	12.5
R2	30	30
R3	33	36
R4	26	26
V	17	17
øW	8.9	8.9
øX	14	14
Y1	G1/4	G1/4
Y2	4.3	4.3
Y3	19	19
O-ring (fluorocarbon hardness Hs90)	P9	P9
øAA	57	62.5
AB	M8	M8
øAC	7	7
Mass	2.6 kg	3.4 kg
Air bleeding valve	VCE02	VCE02

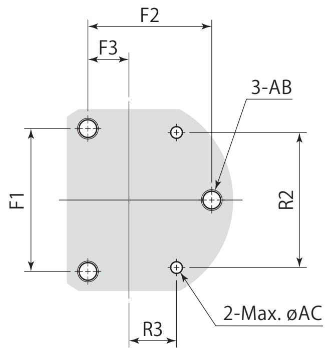
Refer to each page for the details of options.

- Clamp arm **page →894** ● Air bleeding valve **page →862**
- Clamp arm and mounting screws are not included.
- CTW□U-C (Straight, swing angle 0°) is made to order.

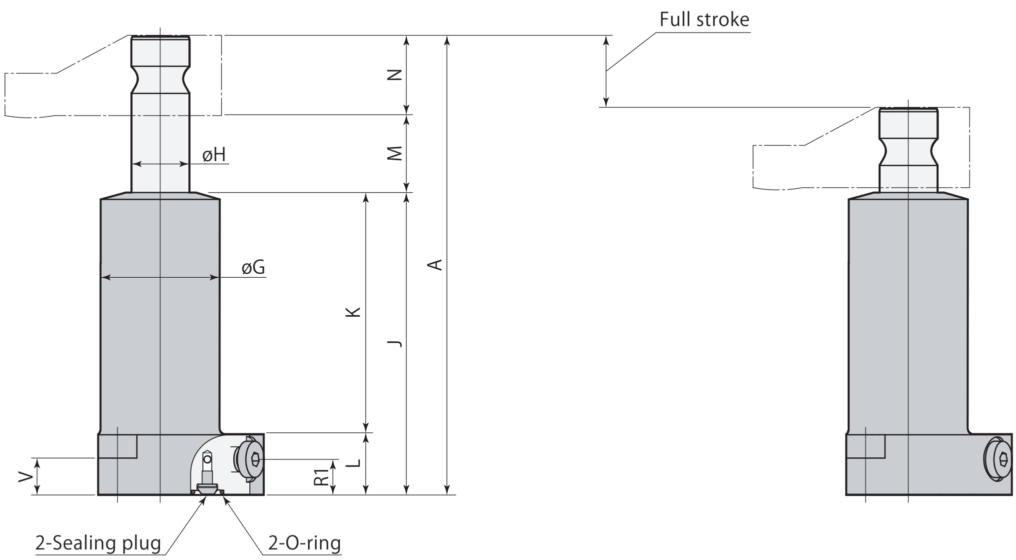
Dimensions



Mounting details

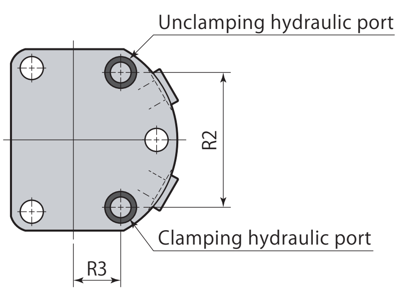


The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997) for manifold piping.



Unclamp

Stroke end



mm

Model	CTW06B-□	CTW10B-□
A	137	176.5
B	56	70
C	50.5	64
D	32.5	40
E	18	24
F1	43.3	55
F2	37.5	47.6
F3	12.5	15.9
øG	35	46
øH	16	22.4
J	92	116
K	69	93
L	23	23
M	24	30.5
N	21	30
R1	13.5	13.5
R2	41	52
R3	14.3	18.2
V	16	14
øW	7	8.9
øX	11	14
Y1	G1/8	G1/8
Y2	2.8	2.8
Y3	14	14
O-ring (fluorocarbon hardness Hs90)	P9	P9
AB	M6	M8
øAC	7	7
Mass	0.8 kg	1.6 kg
Air bleeding valve	VCE01	VCE01

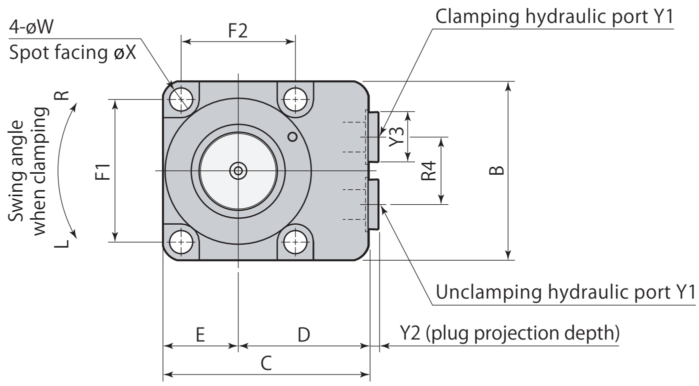
Refer to each page for the details of options.

● Clamp arm **page →894** ● Air bleeding valve **page →862**

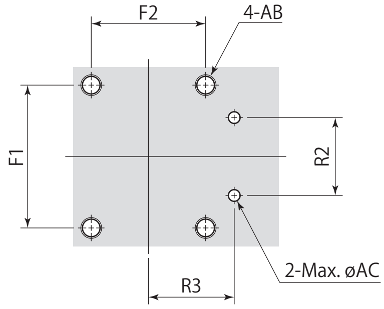
● Clamp arm and mounting screws are not included.

● CTW□B-C (Straight, swing angle 0°) is made to order.

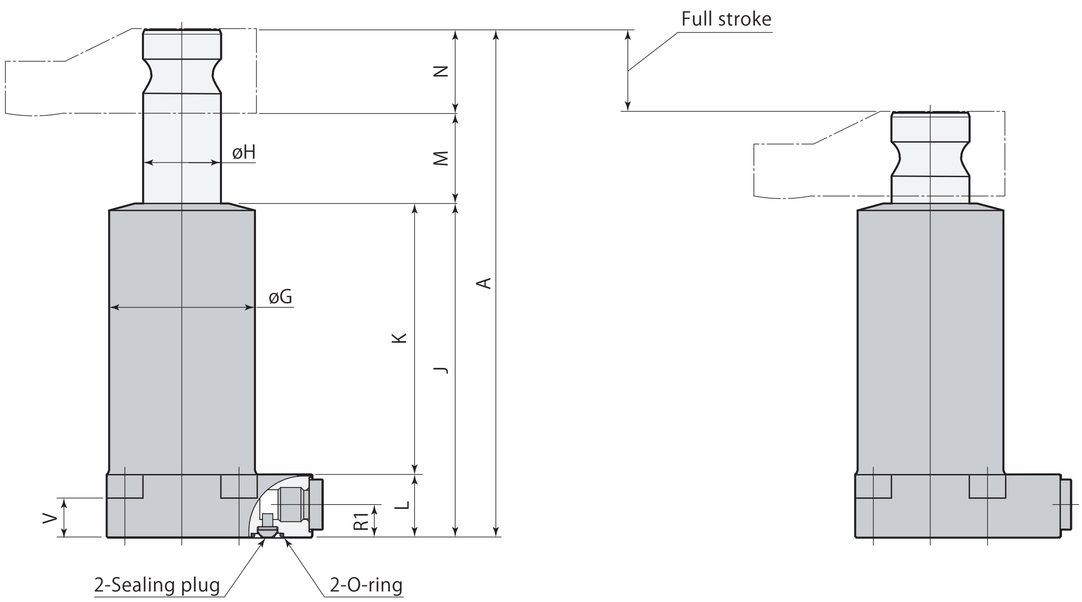
Dimensions



Mounting details

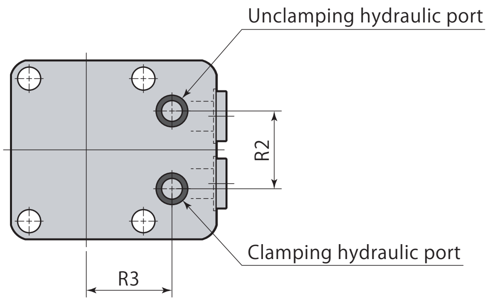


The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997) for manifold piping.



Unclamp

Stroke end



mm

Model	CTW16B-□	CTW25B-□
A	195	226
B	69	69
C	79	87.5
D	50	53
E	29	34.5
F1	55	55
F2	44	55
øG	56	61.5
øH	30	32
J	128	148.5
K	104	124.5
L	24	24
M	35	42.5
N	32	35
R1	12.5	12.5
R2	30	30
R3	33	36
R4	26	26
V	15	15
øW	8.9	8.9
øX	14	14
Y1	G1/4	G1/4
Y2	4.3	4.3
Y3	19	19
O-ring (fluorocarbon hardness Hs90)	P9	P9
AB	M8	M8
øAC	7	7
Mass	2.6 kg	3.3 kg
Air bleeding valve	VCE02	VCE02

Refer to each page for the details of options.

● Clamp arm **page →894** ● Air bleeding valve **page →862**

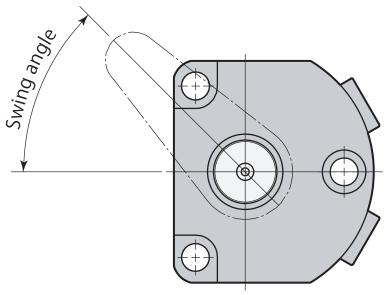
● Clamp arm and mounting screws are not included.

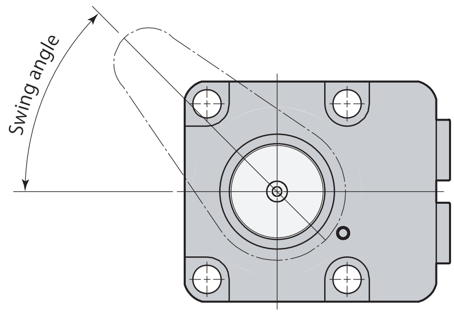
● CTW□B-C (Straight, swing angle 0°) is made to order.

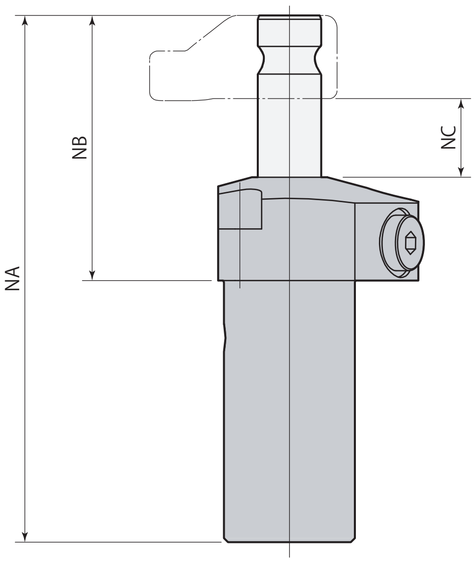
Dimensions

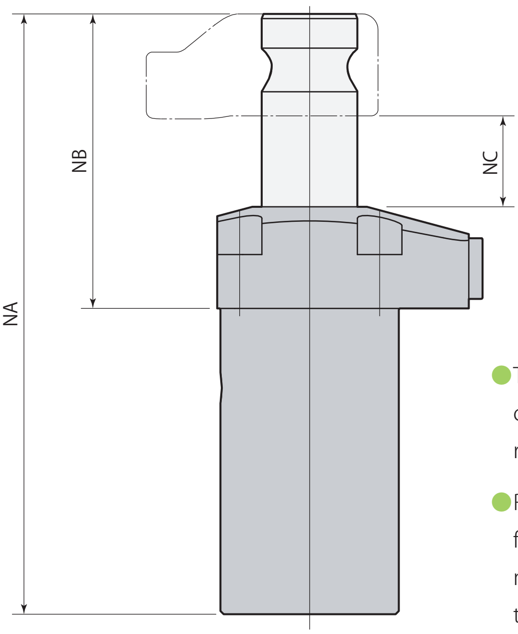
CTW 06, 10 U-□
N30, N45, N60

CTW 16, 25 U-□
N30, N45, N60









- This diagram indicates unclamped condition of swing direction L (counter-clockwise).
- Refer to **pages** →**870** to **873** for other specifications and dimensions that are not shown in the diagram.
- This product is made to order.

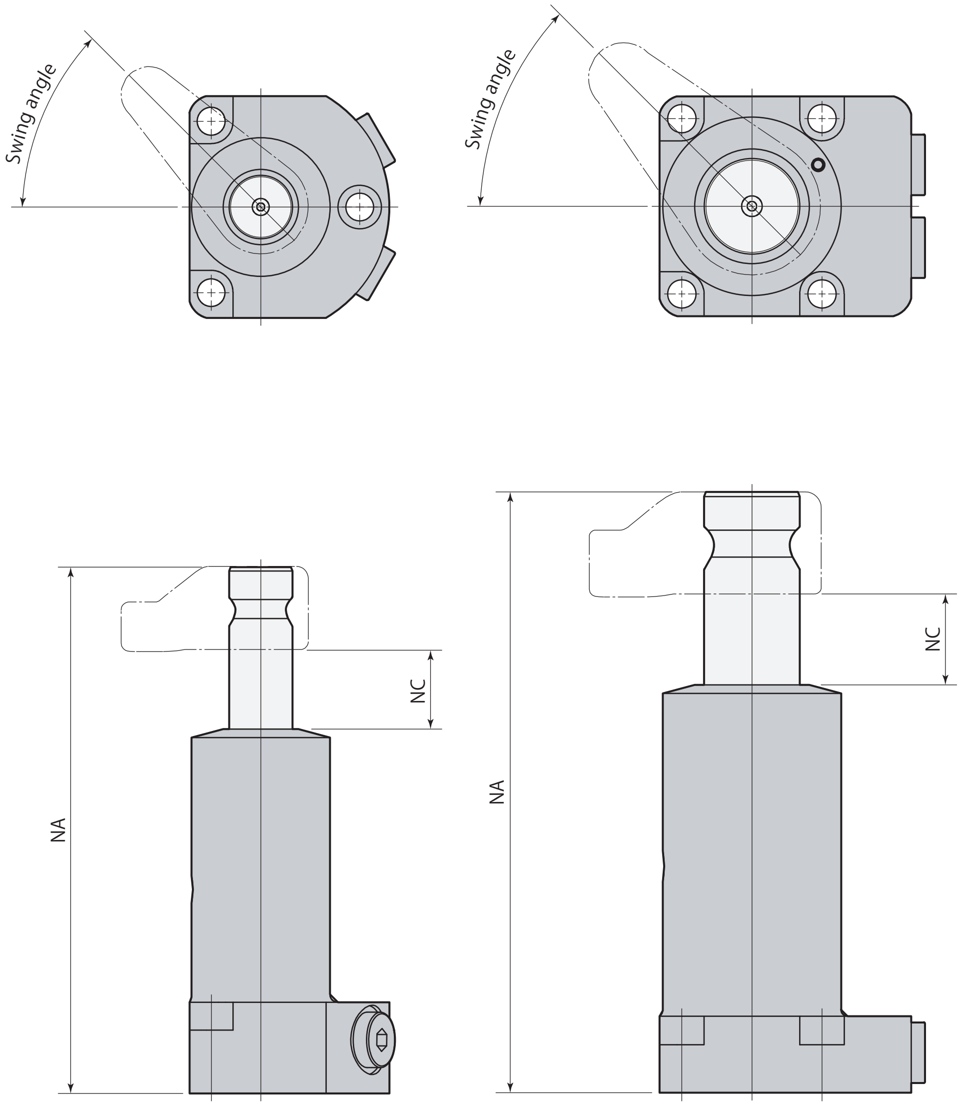
mm

Model		CTW06U-□N□			CTW10U-□N□			CTW16U-□N□			CTW25U-□N□		
Swing angle		30°±5°	45°±5°	60°±5°	30°±5°	45°±5°	60°±5°	30°±5°	45°±5°	60°±5°	30°±5°	45°±5°	60°±5°
Full stroke		16.5	17.9	19.3	20.7	22.5	24.3	23.3	25.5	27.6	28.0	31.0	34.0
Swing stroke		6.5	7.9	9.3	7.7	9.5	11.3	9.3	11.5	13.6	12.0	15.0	18.0
Clamp stroke		10			13			14			16		
Cylinder capacity (cm^3)	Clamp	3.0	3.2	3.5	8.5	9.2	10.0	12.8	14.0	15.2	21.0	23.3	25.5
	Unclamp	6.3	6.8	7.3	16.6	18.1	19.5	29.3	32.0	34.7	43.5	48.2	52.9
NA		131.5	132.9	134.3	169.2	171.0	172.8	186.3	188.5	190.6	214.0	217.0	220.0
NB		65.5	66.9	68.3	79.2	81.0	82.8	90.3	92.5	94.6	98.0	101.0	104.0
NC		18.5	19.9	21.3	23.2	25.0	26.8	26.3	28.5	30.6	30.5	33.5	36.5

Dimensions

CTW06, 10 B-□
N30, N45, N60

CTW16, 25 B-□
N30, N45, N60



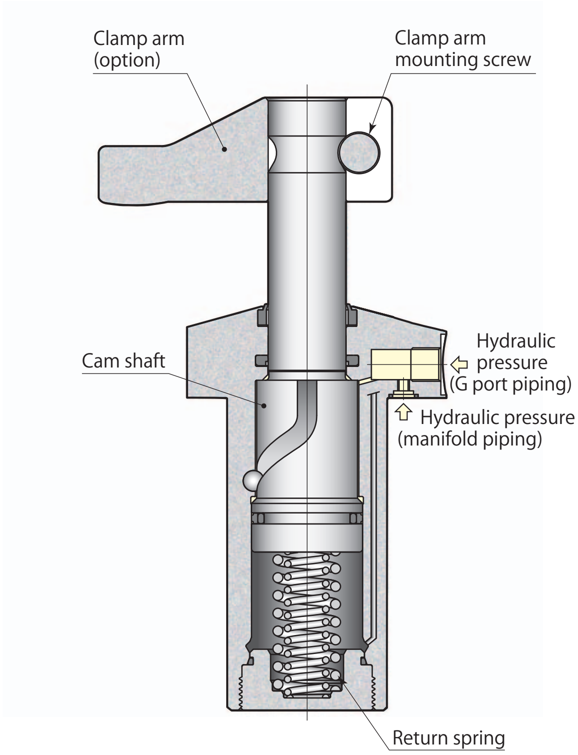
- This diagram indicates unclamped condition of swing direction L (counter-clockwise).
- Refer to **pages** →**874** to **877** for other specifications and dimensions that are not shown in the diagram.
- This product is made to order.

mm

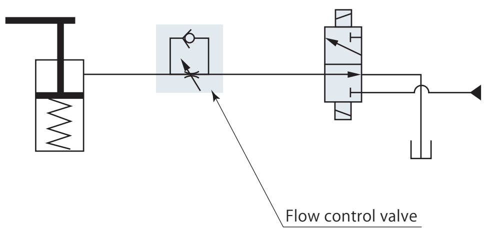
Model		CTW06B-□N□			CTW10B-□N□			CTW16B-□N□			CTW25B-□N□		
Swing angle		30°±5°	45°±5°	60°±5°	30°±5°	45°±5°	60°±5°	30°±5°	45°±5°	60°±5°	30°±5°	45°±5°	60°±5°
Full stroke		16.5	17.9	19.3	20.7	22.5	24.3	23.3	25.5	27.6	28.0	31.0	34.0
Swing stroke		6.5	7.9	9.3	7.7	9.5	11.3	9.3	11.5	13.6	12.0	15.0	18.0
Clamp stroke		10			13			14			16		
Cylinder capacity (cm^3)	Clamp	3.0	3.2	3.5	8.5	9.2	10.0	12.8	14.0	15.2	21.0	23.3	25.5
	Unclamp	6.3	6.8	7.3	16.6	18.1	19.5	29.3	32.0	34.73	43.5	48.2	52.9
NA		131.5	132.9	134.3	169.2	171.0	172.8	186.3	188.5	190.6	214.0	217.0	220.0
NC		18.5	19.9	21.3	23.2	25.0	26.8	26.3	28.5	30.6	30.5	33.5	36.5

Upper flange

model **CTV□U-□**



Hydraulic circuit diagram



Use flow control valve for meter-in control.
Flow control valve model VCH can not be mounted.

Specifications	page → 882
Upper flange	page → 884
Lower flange	page → 888
Swing angle 30°, 45°, 60°	page → 892

Specifications

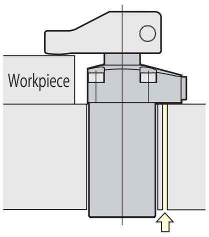
Size	Mounting and piping types		Swing direction (when clamping), swing angle
CTV 06	U : Upper flange	–	L : Counter-clockwise, swing angle 90°
10	B : Lower flange		LN30 : Counter-clockwise, swing angle 30°
16			LN45 : Counter-clockwise, swing angle 45°
25			LN60 : Counter-clockwise, swing angle 60°
			R : Clockwise, swing angle 90°
			RN30 : Clockwise, swing angle 30°
			RN45 : Clockwise, swing angle 45°
			RN60 : Clockwise, swing angle 60°
			C : Straight, swing angle 0°

▇ indicates made to order.

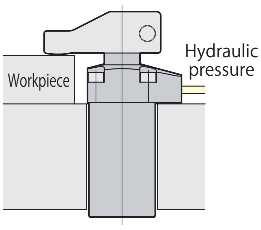
Mounting and piping types

CTV□U-□

Upper flange
manifold piping

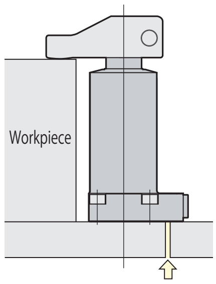


Upper flange
G port piping

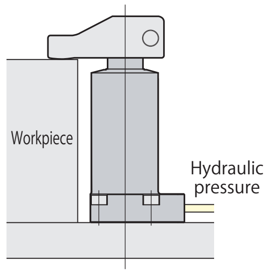


CTV□B-□

Lower flange
manifold piping



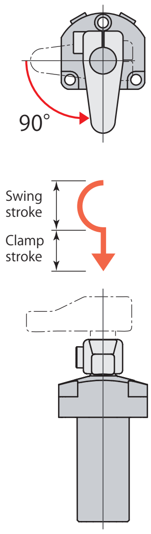
Lower flange
G port piping



Swing direction (when clamping)

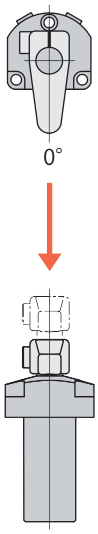
CTV□□-L

Counter-clockwise
Swing angle 90°



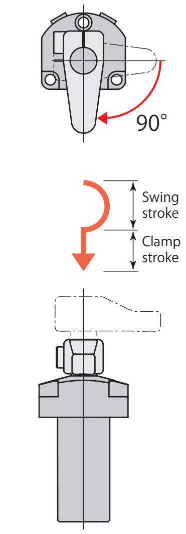
CTV□□-C

Straight
Swing angle 0°



CTV□□-R

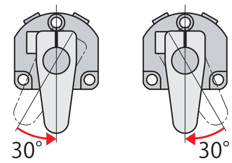
Clockwise
Swing angle 90°



Swing angle

CTV□□- LN30 RN30

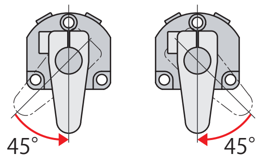
Swing angle 30°



L : Counter-clockwise R : Clockwise

CTV□□- LN45 RN45

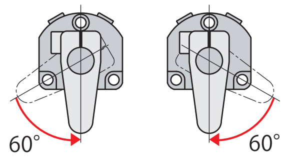
Swing angle 45°



L : Counter-clockwise R : Clockwise

CTV□□- LN60 RN60

Swing angle 60°



L : Counter-clockwise R : Clockwise

Refer to **pages →892** and **893** for details.

Specifications

Model			CTV06	CTV10	CTV16	CTV25
Cylinder force (hydraulic pressure 35MPa)*1		kN	6.0	13.7	18.4	25.1
Clamping force*1*2	Hydraulic pressure 35MPa	kN	5.2	11.8	15.9	21.8
	Hydraulic pressure 25MPa	kN	3.6	8.3	11.1	15.3
	Hydraulic pressure 15MPa	kN	2.1	4.7	6.4	8.8
Standard clamp arm length		mm	40	50	57	65
Cylinder inner diameter		mm	22	32	40	44.5
Rod diameter		mm	16	22.4	30	32
Effective area (clamp)		cm^2	1.79	4.10	5.50	7.51
Swing angle	CTV□□-L, R		90°±3°			
	CTV□□-C		0°			
Repeated clamp positioning accuracy			±0.5°			
Full stroke		mm	22	28	32	40
90° swing stroke (CTV□□-L, R)		mm	12	15	18	24
Clamp stroke (CTV□□-L, R)		mm	10	13	14	16
Max. swing torque*3		N·m	0.35	0.97	1.51	2.10
Max. oil flow rate		L/min	0.43	1.23	1.48	2.70
Cylinder capacity		cm^3	3.9	11.5	17.6	30.0
Recommended tightening torque of mounting screws*4		N·m	12	29	29	29

- Pressure range：3.5–35 MPa
- Proof pressure：52.5 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：This is value for central position of clamp stroke.

∗2：Clamping force at time standard clamp arm is mounted (refer to section on W1, W2 series on **page →894**).
Clamping force varies depending on clamp arm length. Refer to performance table (**page →883**) for details.

∗3：This is the limit value for lifting arm at 3.5 MPa when mounted vertically.

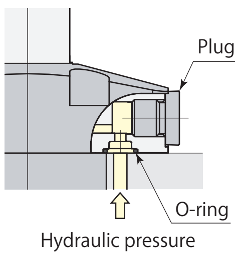
∗4：ISO R898 class 12.9

Manifold piping and G port piping are available.

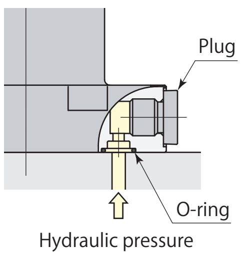
Manifold piping

Remove sealing plug when using manifold piping. An air bleeding valve (model VCE) is mountable on the G port of the clamp.

Upper flange



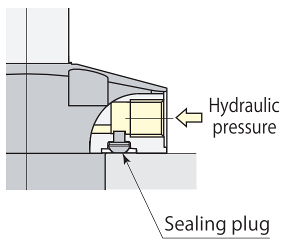
Lower flange



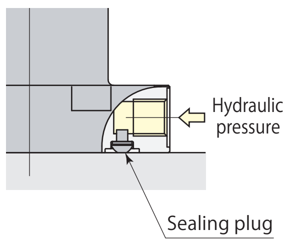
G port piping

Remove plug and O-ring when choosing G port piping. The flow control valve and the air bleeding valve should be installed in the middle of oil path.

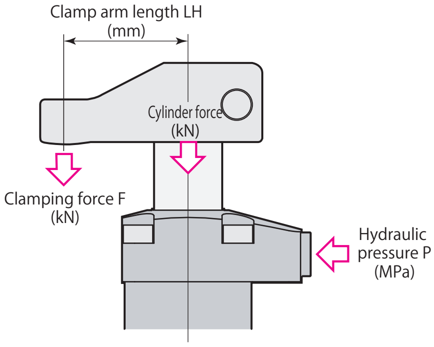
Upper flange



Lower flange



Performance table



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

Clamping force calculation formula
F = (P - Coefficient 1)/(Coefficient 2 + Coefficient 3 × LH)
F : Clamping force　P : Hydraulic pressure　LH : Clamp arm length

CTV10 with clamp arm length (LH) = 60 mm at hydraulic pressure of 20 MPa, Clamping force F is calculated by
(20-1.65)/(2.44+0.00773×60)=6.3 kN

Do not use the clamp in the nonusable range. It may cause damage to the cylinder and rod.

model CTV06　Clamping force　F=(P-1.43)/(5.58+0.0224×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN					Max. arm length Max. LH mm
		Clamp arm length LH mm					
		40	60	80	100	120	
35	6.0	5.2					44
30	5.1	4.4					54
25	4.2	3.6	3.4		Nonusable range		68
20	3.3	2.9	2.7	2.5			93
15	2.4	2.1	2.0	1.8	1.7	1.6	148
10	1.5	1.3	1.2	1.2	1.1	1.0	200
5	0.6	0.6	0.5	0.5	0.5	0.4	↑
3.5	0.4	0.3	0.3	0.3	0.3	0.3	200

model CTV10　Clamping force　F=(P-1.65)/(2.44+0.00773×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN					Max. arm length Max. LH mm
		Clamp arm length LH mm					
		50	60	80	100	120	
35	13.7	11.8					55
30	11.6	10.0	9.8		Nonusable range		66
25	9.6	8.3	8.0	7.6			84
20	7.5	6.5	6.3	6.0	5.7		115
15	5.5	4.7	4.6	4.4	4.2	4.0	184
10	3.4	3.0	2.9	2.7	2.6	2.5	240
5	1.4	1.2	1.2	1.1	1.0	1.0	↑
3.5	0.8	0.7	0.6	0.6	0.6	0.5	240

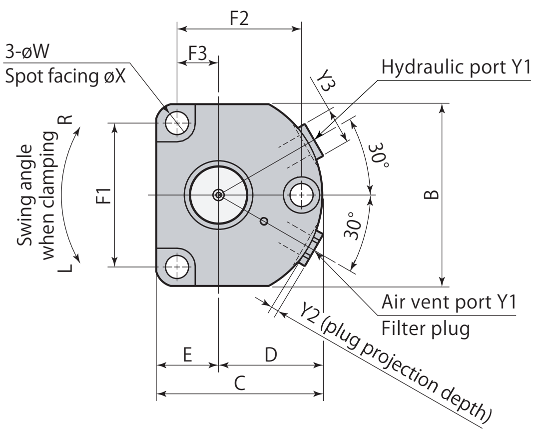
model CTV16　Clamping force　F=(P-1.55)/(1.82+0.00506×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN					Max. arm length Max. LH mm
		Clamp arm length LH mm					
		57	80	100	120	140	
35	18.4	15.9					57
30	15.6	13.5					66
25	12.9	11.1	10.5		Nonusable range		83
20	10.1	8.8	8.3	7.9			113
15	7.4	6.4	6.0	5.8	5.5	5.3	175
10	4.6	4.0	3.8	3.6	3.5	3.3	255
5	1.9	1.6	1.6	1.5	1.4	1.4	↑
3.5	1.1	0.9	0.9	0.8	0.8	0.8	255

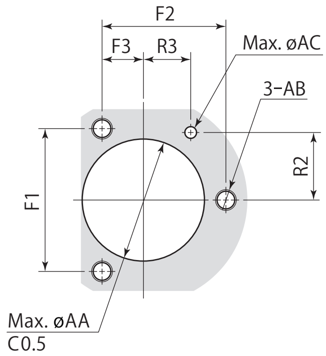
model CTV25　Clamping force　F=(P-1.59)/(1.33+0.00310×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN						Max. arm length Max. LH mm
		Clamp arm length LH mm						
		65	80	100	120	140	160	
35	25.1	21.8						65
30	21.4	18.6						77
25	17.6	15.3	14.8		Nonusable range			97
20	13.8	12.0	11.7	11.2	10.8			131
15	10.1	8.8	8.5	8.2	7.9	7.6	7.3	203
10	6.3	5.5	5.3	5.1	4.9	4.8	4.6	270
5	2.6	2.2	2.2	2.1	2.0	1.9	1.9	↑
3.5	1.4	1.2	1.2	1.2	1.1	1.1	1.0	270

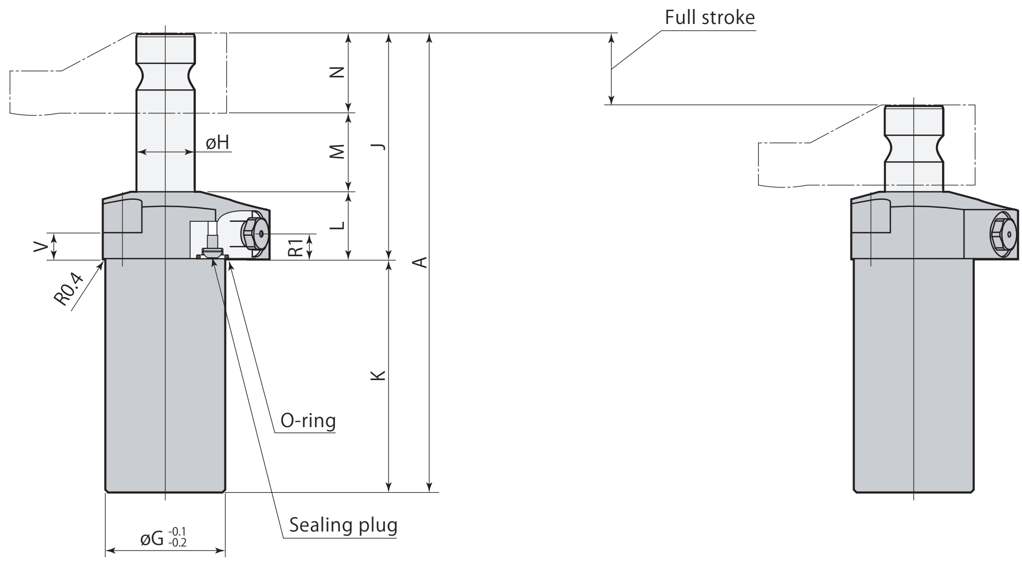
Dimensions



Mounting details

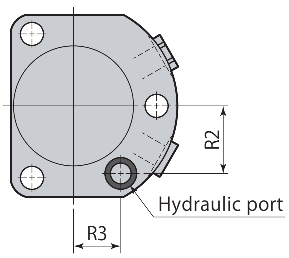


The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997) for manifold piping.



Unclamp

Stroke end



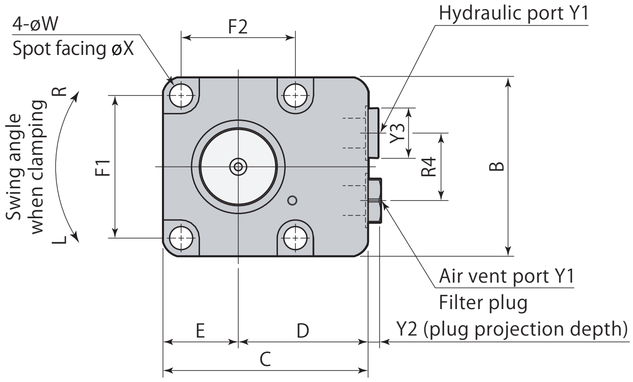
mm

Model	CTV06U-□	CTV10U-□
A	137	176.5
B	56	70
C	50.5	64
D	32.5	40
E	18	24
F1	43.3	55
F2	37.5	47.5
F3	12.5	15.9
øG	33	46
øH	16	22.4
J	71	86.5
K	66	90
L	26	26
M	24	30.5
N	21	30
R1	9.5	9.5
R2	20.5	26
R3	14.3	18.2
V	13	10
øW	7	8.9
øX	11	14
Y1	G1/8	G1/8
Y2	2.8	2.8
Y3	14	14
O-ring (fluorocarbon hardness Hs90)	P9	P9
øAA	34	47
AB	M6	M8
øAC	7	7
Mass	0.8 kg	1.6 kg
Air bleeding valve	VCE01	VCE01

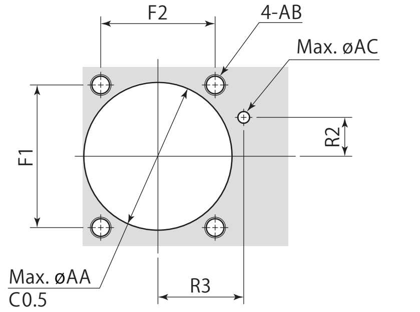
Refer to each page for the details of options.

- Clamp arm **page →894** ● Air bleeding valve **page →862**
- Clamp arm and mounting screws are not included.
- Air vent must be opened to atmosphere. Provide the piping if there is a risk of coolant or metal chips intrusion.
- CTV□U-C (Straight, swing angle 0°) is made to order.

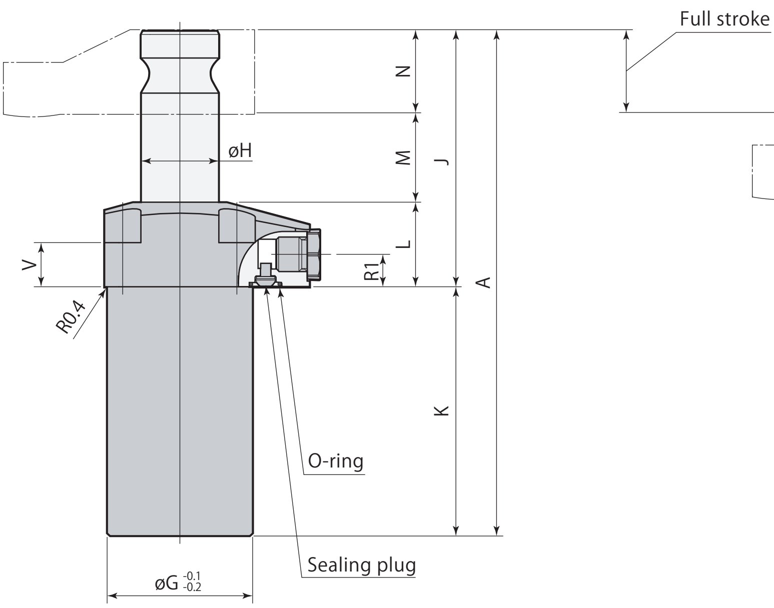
Dimensions



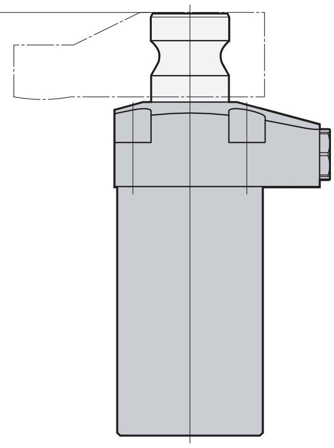
Mounting details



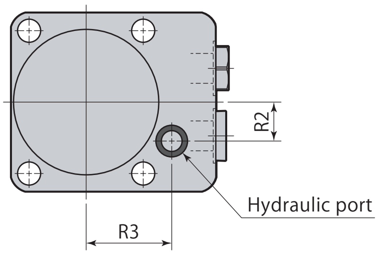
The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997) for manifold piping.



Unclamp



Stroke end



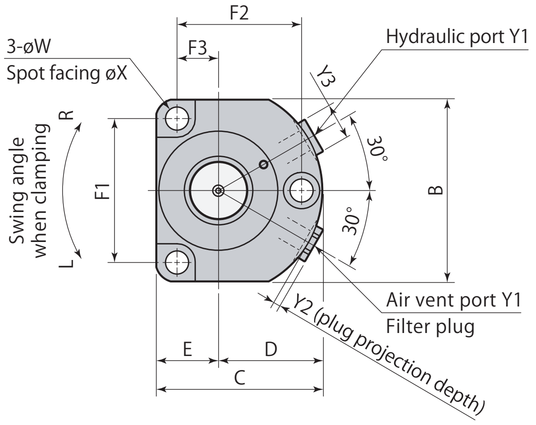
mm

Model	CTV16U-□	CTV25U-□
A	195	226
B	69	69
C	79	87.5
D	50	53
E	29	34.5
F1	55	55
F2	44	55
øG	56	61.5
øH	30	32
J	99	110
K	96	116
L	32	32.5
M	35	42.5
N	32	35
R1	12.5	12.5
R2	15	15
R3	33	36
R4	26	26
V	17	17
øW	8.9	8.9
øX	14	14
Y1	G1/4	G1/4
Y2	4.3	4.3
Y3	19	19
O-ring (fluorocarbon hardness Hs90)	P9	P9
øAA	57	62.5
AB	M8	M8
øAC	7	7
Mass	2.6 kg	3.4 kg
Air bleeding valve	VCE02	VCE02

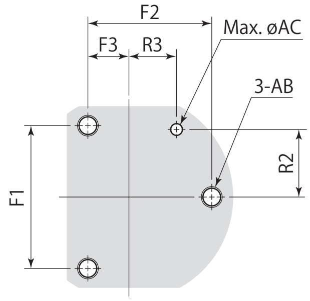
Refer to each page for the details of options.

- Clamp arm **page →894** Air bleeding valve **page →862**
- Clamp arm and mounting screws are not included.
- Air vent must be opened to atmosphere. Provide the piping if there is a risk of coolant or metal chips intrusion.
- CTV□U-C (Straight, swing angle 0°) is made to order.

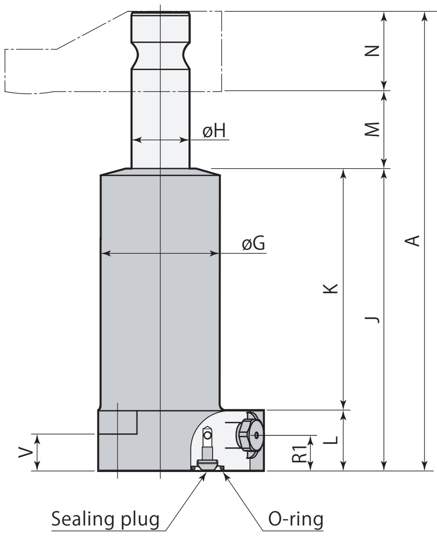
Dimensions

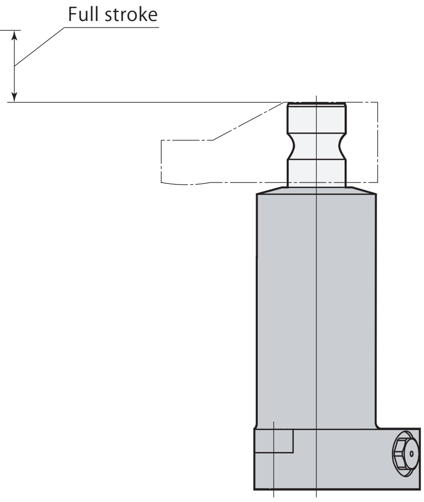


Mounting details



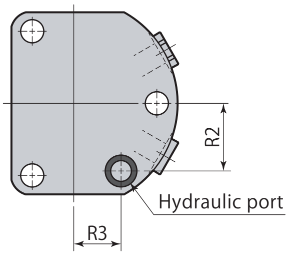
The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997) for manifold piping.





Unclamp

Stroke end



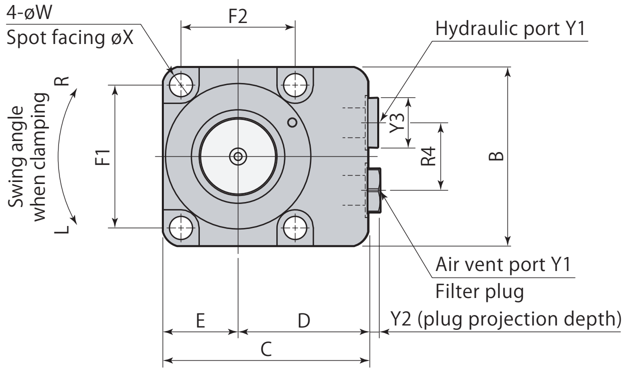
mm

Model	CTV06B-□	CTV10B-□
A	137	176.5
B	56	70
C	50.5	64
D	32.5	40
E	18	24
F1	43.3	55
F2	37.5	47.6
F3	12.5	15.9
øG	35	46
øH	16	22.4
J	92	116
K	69	93
L	23	23
M	24	30.5
N	21	30
R1	13.5	13.5
R2	20.5	26
R3	14.3	18.2
V	16	14
øW	7	8.9
øX	11	14
Y1	G1/8	G1/8
Y2	2.8	2.8
Y3	14	14
O-ring (fluorocarbon hardness Hs90)	P9	P9
AB	M6	M8
øAC	7	7
Mass	0.8 kg	1.7 kg
Air bleeding valve	VCE01	VCE01

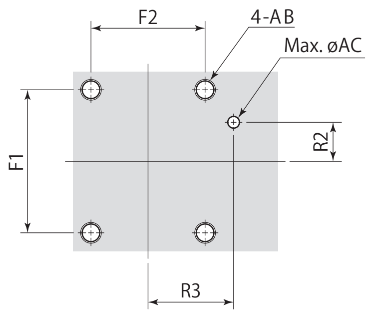
Refer to each page for the details of options.

- Clamp arm **page** →**894**
- Air bleeding valve **page** →**862**
- Clamp arm and mounting screws are not included.
- Air vent must be opened to atmosphere. Provide the piping if there is a risk of coolant or metal chips intrusion.
- CTV□B-C (Straight, swing angle 0°) is made to order.

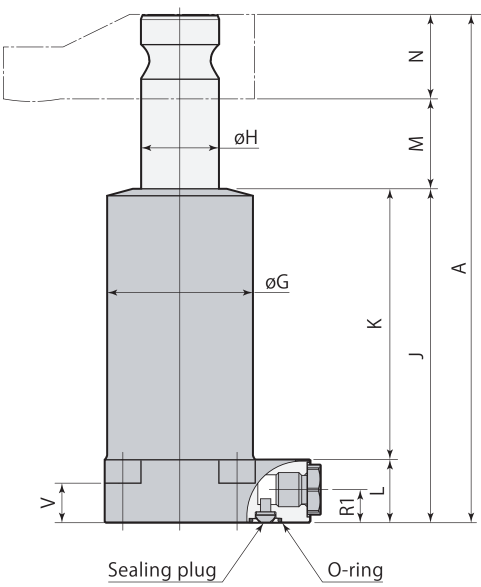
Dimensions



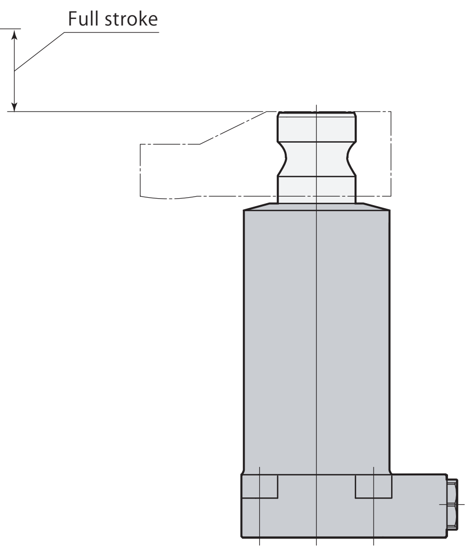
Mounting details



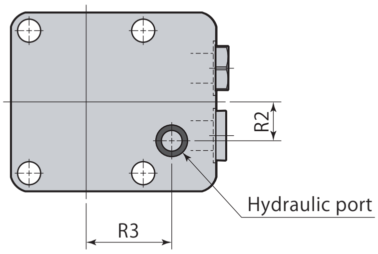
The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997) for manifold piping.



Unclamp



Stroke end



mm

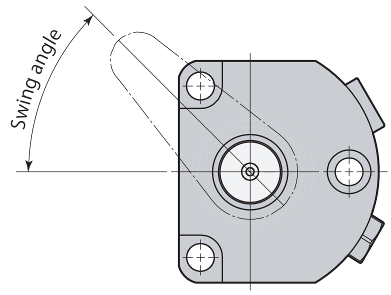
Model	CTV16B-☐	CTV25B-☐
A	195	226
B	69	69
C	79	87.5
D	50	53
E	29	34.5
F1	55	55
F2	44	55
øG	56	61.5
øH	30	32
J	128	148.5
K	104	124.5
L	24	24
M	35	42.5
N	32	35
R1	12.5	12.5
R2	15	15
R3	33	36
R4	26	26
V	15	15
øW	8.9	8.9
øX	14	14
Y1	G1/4	G1/4
Y2	4.3	4.3
Y3	19	19
O-ring (fluorocarbon hardness Hs90)	P9	P9
AB	M8	M8
øAC	7	7
Mass	2.7 kg	3.5 kg
Air bleeding valve	VCE02	VCE02

Refer to each page for the details of options.

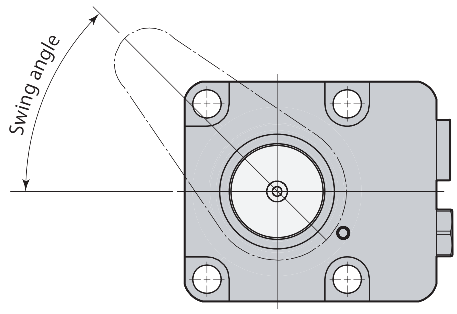
- Clamp arm **page →894** Air bleeding valve **page →862**
- Clamp arm and mounting screws are not included.
- Air vent must be opened to atmosphere. Provide the piping if there is a risk of coolant or metal chips intrusion.
- CTV☐B-C (Straight, swing angle 0°) is made to order.

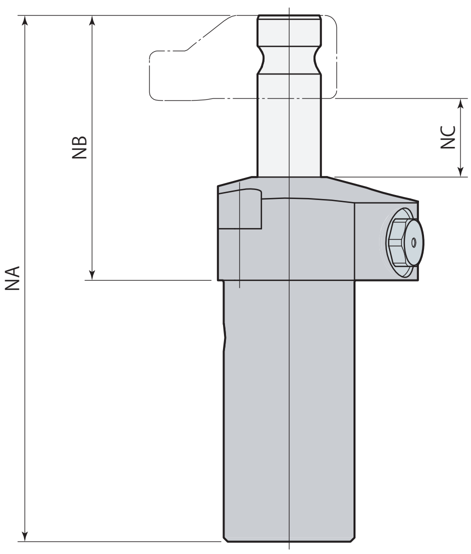
Dimensions

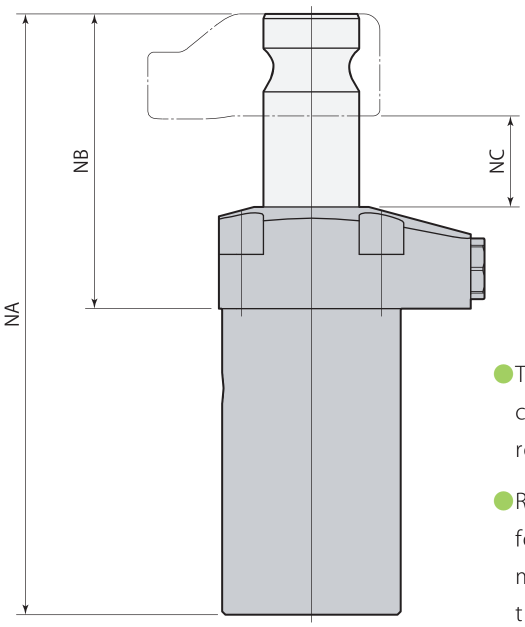
CTV06, 10 U-□
N30, N45, N60



CTV16, 25 U-□
N30, N45, N60







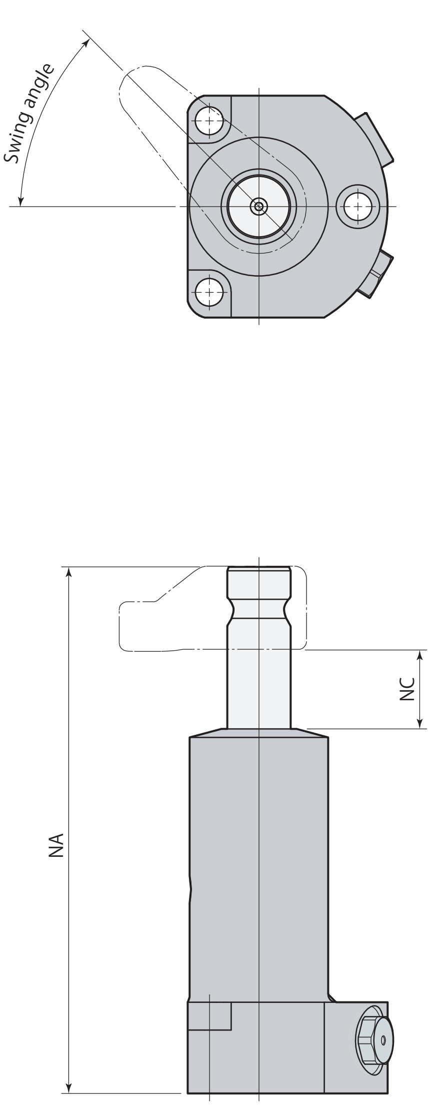
- This diagram indicates unclamped condition of swing direction L (counter-clockwise).
- Refer to **pages** →**884** to **887** for other specifications and dimensions that are not shown in the diagram.
- This product is made to order.

mm

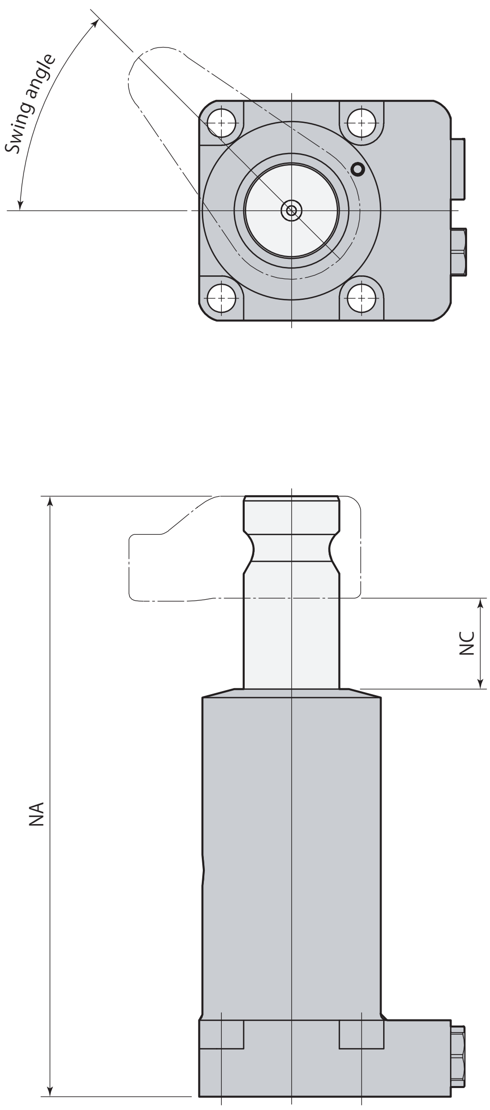
Model	CTV06U-□N□			CTV10U-□N□			CTV16U-□N□			CTV25U-□N□		
Swing angle	30°±5°	45°±5°	60°±5°	30°±5°	45°±5°	60°±5°	30°±5°	45°±5°	60°±5°	30°±5°	45°±5°	60°±5°
Full stroke	16.5	17.9	19.3	20.7	22.5	24.3	23.3	25.5	27.6	28.0	31.0	34.0
Swing stroke	6.5	7.9	9.3	7.7	9.5	11.3	9.3	11.5	13.6	12.0	15.0	18.0
Clamp stroke	10			13			14			16		
Cylinder capacity (cm^3)	3.0	3.2	3.5	8.5	9.2	10.0	12.8	14.0	15.2	21.0	23.3	25.5
NA	131.5	132.9	134.3	169.2	171.0	172.8	186.3	188.5	190.6	214.0	217.0	220.0
NB	65.5	66.9	68.3	79.2	81.0	82.8	90.3	92.5	94.6	98.0	101.0	104.0
NC	18.5	19.9	21.3	23.2	25.0	26.8	26.3	28.5	30.6	30.5	33.5	36.5

Dimensions

CTV06, 10 B-□
N30, N45, N60



CTV16, 25 B-□
N30, N45, N60

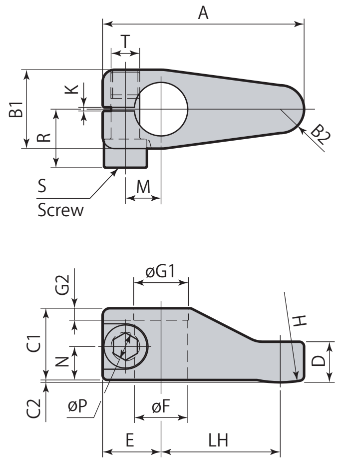


- This diagram indicates unclamped condition of swing direction L (counter-clockwise).
- Refer to **pages →888** to **891** for other specifications and dimensions that are not shown in the diagram.
- This product is made to order.

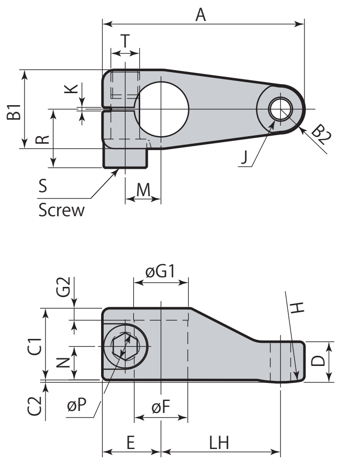
mm

Model	CTV06B-□N□			CTV10B-□N□			CTV16B-□N□			CTV25B-□N□		
Swing angle	30°±5°	45°±5°	60°±5°	30°±5°	45°±5°	60°±5°	30°±5°	45°±5°	60°±5°	30°±5°	45°±5°	60°±5°
Full stroke	16.5	17.9	19.3	20.7	22.5	24.3	23.3	25.5	27.6	28.0	31.0	34.0
Swing stroke	6.5	7.9	9.3	7.7	9.5	11.3	9.3	11.5	13.6	12.0	15.0	18.0
Clamp stroke	10			13			14			16		
Cylinder capacity (cm^3)	3.0	3.2	3.5	8.5	9.2	10.0	12.8	14.0	15.2	21.0	23.3	25.5
NA	131.5	132.9	134.3	169.2	171.0	172.8	186.3	188.5	190.6	214.0	217.0	220.0
NC	18.5	19.9	21.3	23.2	25.0	26.8	26.3	28.5	30.6	30.5	33.5	36.5

W1 Clamp arm



W2 Clamp arm

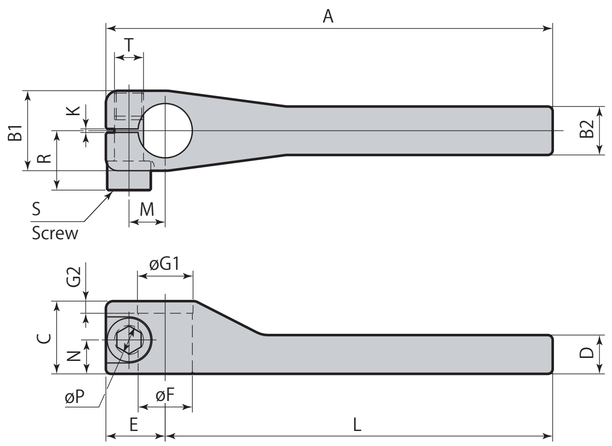


Material : SCM440 (Refining HB285–344)

mm

Clamp arm	CTH06-W□	CTH10-W□	CTH16-W□	CTH25-W□
A	64.5	84.5	98	113
B1	24	33	43	49
B2	7	10	11	15
C1	21	30	32	35
C2	0.5	1	1	1.5
D	12.5	17	21	21.5
E	17.5	24.5	30	33
øF	$16^{+0.003}_{-0.015}$	$22.4^{+0.004}_{-0.017}$	$30^{+0.004}_{-0.017}$	$32^{+0.005}_{-0.020}$
øG1	–	23	–	33
G2	–	5	–	6
H	50	50	60	75
J	M8×1.25	M10×1.5	M10×1.5	M12×1.75
K	2	2	2	2
LH	40	50	57	65
M	10.5±0.1	15±0.1	19±0.1	20.5±0.1
N	10	14	15	16
øP	$8^{+0.015}_{0}$	$12^{+0.018}_{0}$	$14^{+0.018}_{0}$	$16^{+0.018}_{0}$
R	16.5	24.5	29.5	34.5
S (screw)	CTH06-VB	CTH10-VB	CTH16-VB	CTH25-VB
T	M8×1.0	M12×1.5	M14×1.5	M16×1.5
Mass	0.13 kg	0.33 kg	0.52 kg	0.78 kg
Swing clamp	CTW06 CTV06	CTW10 CTV10	CTW16 CTV16	CTW25 CTV25

WL Clamp arm

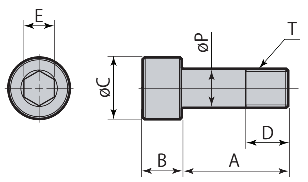


Material : SCM440 (Refining HB285–344)

mm

Clamp arm	CTH06-WL	CTH10-WL	CTH16-WL	CTH25-WL
A	152.5	184.5	200	213
B1	24	33	43	49
B2	14	20	22	30
C	21	30	32	35
D	12	16	20	20
E	17.5	24.5	30	33
øF	$16^{+0.003}_{-0.015}$	$22.4^{+0.004}_{-0.017}$	$30^{+0.004}_{-0.017}$	$32^{+0.005}_{-0.020}$
øG1	–	23	–	33
G2	–	5	–	6
K	2	2	2	2
L	135	160	170	180
M	10.5±0.1	15±0.1	19±0.1	20.5±0.1
N	10	14	15	16
øP	$8^{+0.015}_{0}$	$12^{+0.018}_{0}$	$14^{+0.018}_{0}$	$16^{+0.018}_{0}$
R	16.5	24.5	29.5	34.5
S (screw)	CTH06-VB	CTH10-VB	CTH16-VB	CTH25-VB
T	M8×1.0	M12×1.5	M14×1.5	M16×1.5
Mass	0.24 kg	0.58 kg	0.87 kg	1.25 kg
Swing clamp	CTW06 CTV06	CTW10 CTV10	CTW16 CTV16	CTW25 CTV25

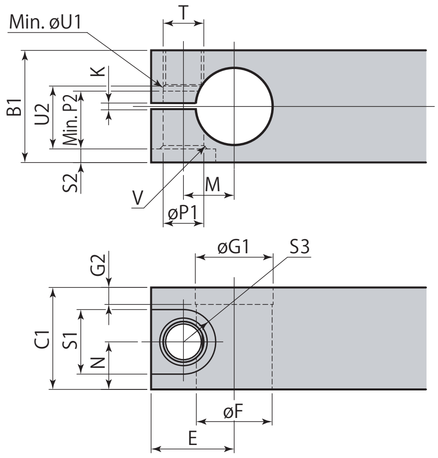
Screw



mm

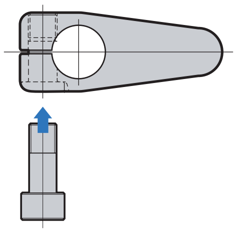
Screw	CTH06-VB	CTH10-VB	CTH16-VB	CTH25-VB
A	20	28	35	41
B	8	12	14	16
øC	13	18	21	24
D	9	11	13	15
E	6	10	12	14
øP	$8^{-0.01}_{-0.05}$	$12^{-0.01}_{-0.05}$	$14^{-0.01}_{-0.05}$	$16^{-0.01}_{-0.05}$
T	M8×1.0	M12×1.5	M14×1.5	M16×1.5
Swing clamp	CTW06 CTV06	CTW10 CTV10	CTW16 CTV16	CTW25 CTV25

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



mm

Swing clamp	CTW06 CTV06	CTW10 CTV10	CTW16 CTV16	CTW25 CTV25
B1	24	33	43	49
C1	21	30	32	35
E	17.5	24.5	30	33
øF	$16^{+0.003}_{-0.015}$	$22.4^{+0.004}_{-0.017}$	$30^{+0.004}_{-0.017}$	$32^{+0.005}_{-0.020}$
øG1	–	23	–	33
G2	–	5	–	6
K	2	2	2	2
M	10.5±0.1	15±0.1	19±0.1	20.5±0.1
N	10	14	15	16
øP1	$8^{+0.015}_{0}$	$12^{+0.018}_{0}$	$14^{+0.018}_{0}$	$16^{+0.018}_{0}$
P2	11	17	22	26
S1	14	19	22	25
S2	3.5	4	6	6
S3	7	9.5	11	12.5
T	M8×1.0	M12×1.5	M14×1.5	M16×1.5
øU1	7.9	11.9	13.9	15.9
U2	12.5	18.5	23.5	27.5
V	C1	C1	C1.5	C1.5



● Install mounting screws for arm from direction shown in left diagram viewed from top. Installation from the opposite direction can cause loosened screws and resultant broken rod.

Caution in use

Mounting & dismounting of clamp arm

Swing clamp may be damaged if excessive torque is applied to piston rod, since structure is intended for swinging using cam mechanism with lead grooves.
Loosen screw (CTH□-VB) before mounting or dismounting clamp arm, or adjusting position of clamp arm, to prevent excessive rotating torque from being applied on piston rod.
Refer to table below for screw tightening torque.

Swing clamp	Thread size	Tightening torque
CTW06, CTV06	M 8	30 N･m
CTW10, CTV10	M12	100 N･m
CTW16, CTV16	M14	150 N･m
CTW25, CTV25	M16	240 N･m

Swing speed adjustment

Too fast swinging speed of clamp arm can cause malfunction. Adjust speed using flow control valve with check valve to set the swing time equal to or higher than the shortest swing time shown in the table below. Clamp stroke (perpendicular descend) time is not included in 90° swing time.

Swing clamp	Shortest swing time	Max. flow rate	
		Clamping side	Unclamping side
CTW06, CTV06	0.3 s	0.43 L/min	0.91 L/min*
CTW10, CTV10	0.3 s	1.23 L/min	2.41 L/min*
CTW16, CTV16	0.4 s	1.48 L/min	3.39 L/min*
CTW25, CTV25	0.4 s	2.70 L/min	5.60 L/min*

*: Only for the double-acting model CTW

Moment of inertia for clamp arm

Too large moment of inertia for clamp arm can also cause malfunction. When fabricating the clamp arm, determine a proper shape which provides moment of inertia smaller than the maximum moment of inertia shown in the table below.

Swing clamp	Max. moment of inertia
CTW06, CTV06	1.6×10^{-3} kg･m²
CTW10, CTV10	5.1×10^{-3} kg･m²
CTW16, CTV16	8.5×10^{-3} kg･m²
CTW25, CTV25	1.4×10^{-2} kg･m²

Moment of inertia for option clamp arm (reference)

Clamp arm models		Moment of inertia
Standard type	CTH06-W1, CTH06-W2	6.1×10^{-5} kg･m²
	CTH10-W1, CTH10-W2	2.6×10^{-4} kg･m²
	CTH16-W1, CTH16-W2	5.5×10^{-4} kg･m²
	CTH25-W1, CTH25-W2	1.14×10^{-3} kg･m²
Long type	CTH06-WL	1.1×10^{-3} kg･m²
	CTH10-WL	3.5×10^{-3} kg･m²
	CTH16-WL	5.8×10^{-3} kg･m²
	CTH25-WL	9.5×10^{-3} kg･m²

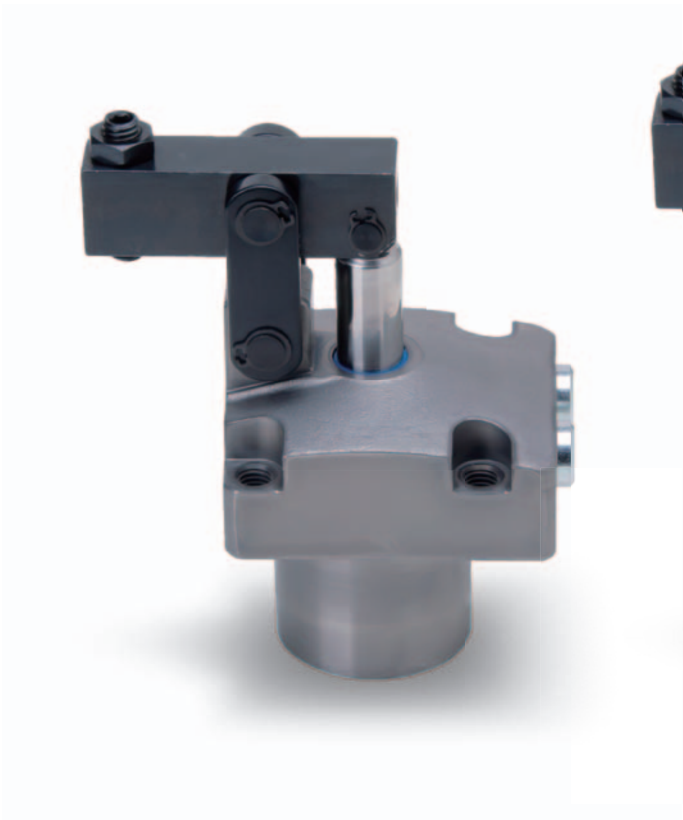
		model **CLW** **Page →898**	model **CLV** **Page →898**
	Link clamp		
	Specifications	35MPa Double acting	35MPa Single acting
	Features	Low profiled cylinder Built-in sensor model	Low profiled cylinder Built-in sensor model
Variations	Compact model (without sensor) 	CLW-N **Page →904**	CLV-N **Page →914**
Option	Flow control valve 	VCH **Page →920**	
	Air bleeding valve 	VCE **Page →922**	

Table of contents

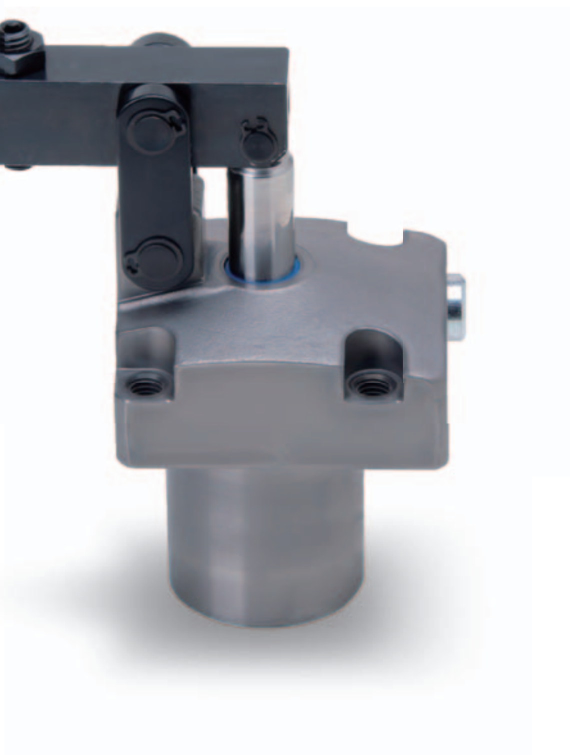
Link clamp

35MPa

Double acting	Single acting
model **CLW**	model **CLV**



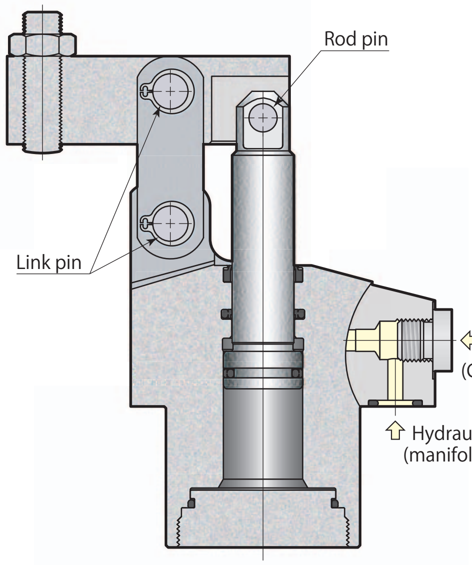
Double acting
model CLW06-FN



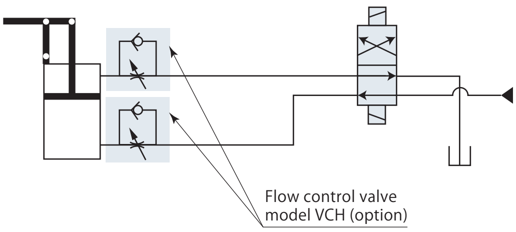
Single acting
model CLV06-FN

Compact model

model **CLW□-□N**



Hydraulic circuit diagram



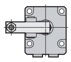
For flow control valve, we recommend the meter-in control. If meter-out control is used, due to the area difference, it will cause back pressure and become high pressure. This can lead to malfunction of the system. Please be aware when designing the circuit.

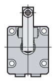
Specifications page → **901**
Dimentions page → **904**
Mounting details page → **906**

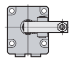
Specifications

Size / Clamp arm mounting direction

CLW — 04 / 06 / 10 / 16 / 25 —

L : Left side 

F : Front side 

R : Right side 

N : Compact model

Model			CLW04	CLW06	CLW10	CLW16	CLW25
Cylinder force (hydraulic pressure 35MPa)		kN	5.4	8.9	13.3	21.6	35.6
Cylinder inner diameter		mm	14	18	22	28	36
Rod diameter		mm	12	14	18	22.4	28
Effective area (clamp)		cm^2	1.5	2.5	3.8	6.2	10.2
Full stroke		mm	23.5	26	29.5	36	45
Clamp stroke*1		mm	20.5	23	26.5	33	42
Safety stroke		mm	3	3	3	3	3
Max. oil flow rate		L/min	0.38	0.69	1.18	2.39	5.08
Cylinder capacity	Clamp	cm^3	3.6	6.6	11.2	22.2	45.8
	Unclamp	cm^3	1.0	2.6	3.7	8.0	18.1
Mass		kg	0.9	1.3	1.9	3.5	5.7
Recommended tightening torque of mounting screws*2		N·m	7	12	29	57	100

- Pressure range：1–35 MPa (model CLW04：3–35 MPa)
- Proof pressure：52.5 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)

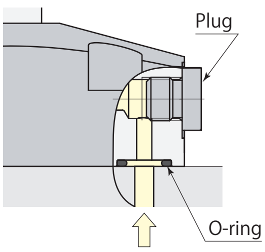
∗1：Indicates a distance from unclamping position to clamping point.

∗2：ISO R898 class 12.9

Manifold piping and G port piping are available.

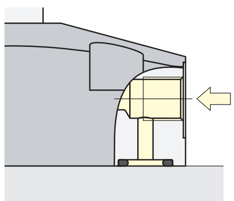
Manifold piping

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

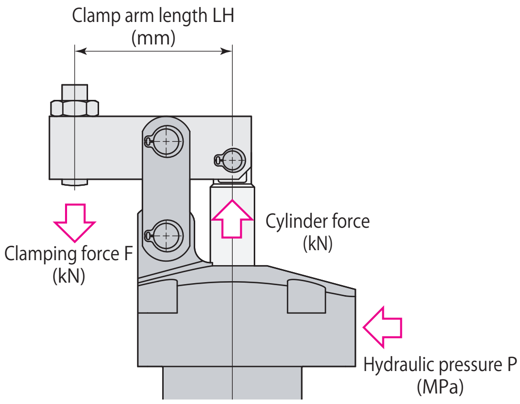


G port piping

Remove plugs when choosing G port piping. (O-ring must be used.) The flow control valve and the air bleeding valve should be installed in the middle of oil path.



Performance diagram



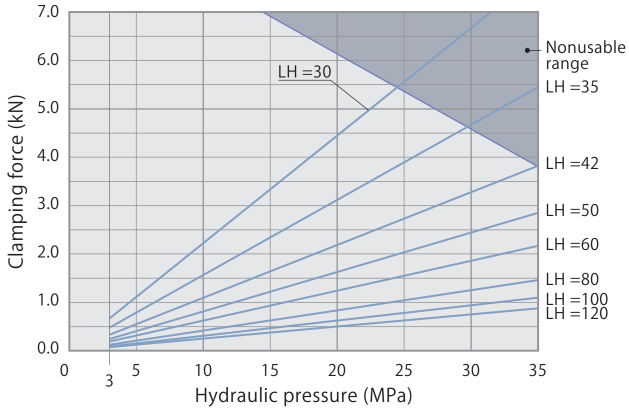
Clamping force varies depending on the clamp arm length (LH) and hydraulic pressure (P).

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

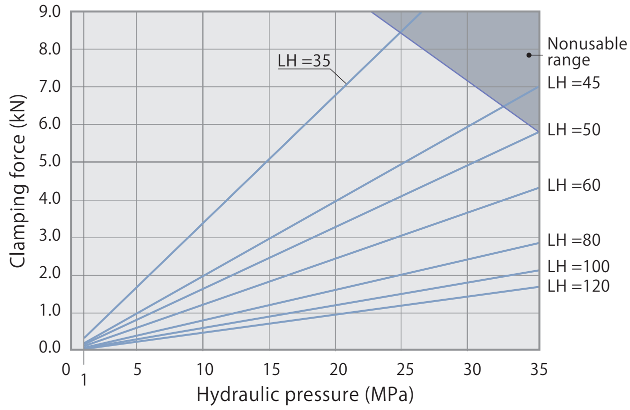
CLW10 with clamp arm length (LH) = 50 mm at hydraulic pressure of 25 MPa, Clamping force F is calculated by
8.38×25/(50-24.5)＝8.2 kN

Do not use the clamp in the nonusable range. It may cause damage to the cylinder and rod.

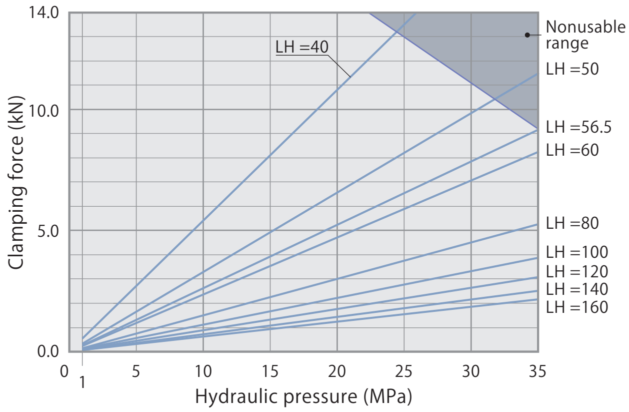
model **CLW04**



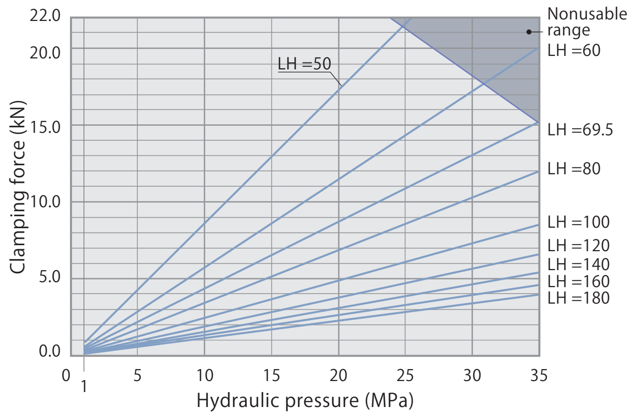
model **CLW06**



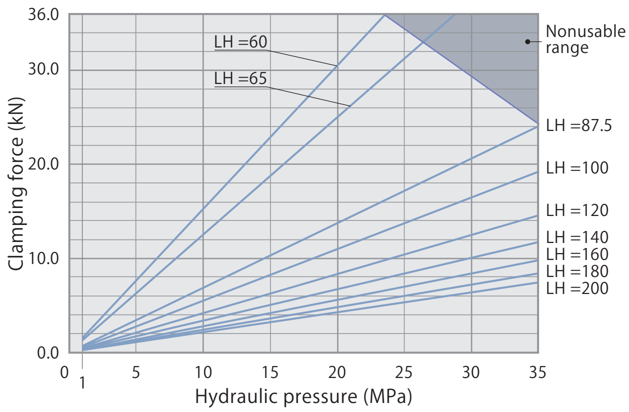
model **CLW10**



model **CLW16**



model **CLW25**



Performance table

model CLW04 Clamping force F=2.56×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	
35	5.4			3.8	2.8	2.2	1.5	1.1	0.9	42
30	4.6			3.3	2.4	1.9	1.2	0.9	0.8	35.3
25	3.9		3.9	2.7	2.0	1.5	1.0	0.8	0.6	30.5
20	3.1	4.5	3.1	2.2	1.6	1.2	0.8	0.6	0.5	30
15	2.3	3.3	2.3	1.6	1.2	0.9	0.6	0.5	0.4	↑
10	1.5	2.2	1.6	1.1	0.8	0.6	0.4	0.3	0.3	↑
5	0.8	1.1	0.8	0.5	0.4	0.3	0.2	0.2	0.1	↑
3	0.5	0.7	0.5	0.3	0.2	0.2	0.1	0.1	0.1	30
Max. pressure MPa		24.4	29.7	35	35	35	35	35	35	

indicates nonusable range

model CLW06 Clamping force F=4.81×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	45	50	60	80	100	120	
35	8.9			5.8	4.3	2.9	2.1	1.7	50
30	7.6		6.0	5.0	3.7	2.4	1.8	1.5	41.5
25	6.4		5.0	4.1	3.1	2.0	1.5	1.2	35.5
20	5.1	6.9	4.0	3.3	2.5	1.6	1.2	1.0	35
15	3.8	5.2	3.0	2.5	1.9	1.2	0.9	0.7	↑
10	2.5	3.4	2.0	1.7	1.2	0.8	0.6	0.5	↑
5	1.3	1.7	1.0	0.8	0.6	0.4	0.3	0.2	↑
1	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	35
Max. pressure MPa		24.6	32.3	35	35	35	35	35	

indicates nonusable range

model CLW10 Clamping force F=8.38×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	60	80	100	120	140	160	
35	13.3			9.2	8.3	5.3	3.9	3.1	2.5	2.2	56.5
30	11.4		9.9	7.9	7.1	4.5	3.3	2.6	2.2	1.9	47
25	9.5		8.2	6.5	5.9	3.8	2.8	2.2	1.8	1.5	40.5
20	7.6	10.8	6.6	5.2	4.7	3.0	2.2	1.8	1.5	1.2	40
15	5.7	8.1	4.9	3.9	3.5	2.3	1.7	1.3	1.1	0.9	↑
10	3.8	5.4	3.3	2.6	2.4	1.5	1.1	0.9	0.7	0.6	↑
5	1.9	2.7	1.6	1.3	1.2	0.8	0.6	0.4	0.4	0.3	↑
1	0.4	0.5	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	40
Max. pressure MPa		24.4	31.7	35	35	35	35	35	35	35	

indicates nonusable range

model CLW16 Clamping force F=16.90×P/(LH-30.5)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN / Clamp arm length LH mm									Min. arm length Min. LH mm
		50	60	69.5	80	100	120	140	160	180	
35	21.6			15.2	11.9	8.5	6.6	5.4	4.6	4.0	69.5
30	18.5		17.2	13.0	10.2	7.3	5.7	4.6	3.9	3.4	58.5
25	15.4		14.3	10.8	8.5	6.1	4.7	3.9	3.3	2.8	50.5
20	12.3	17.3	11.5	8.7	6.8	4.9	3.8	3.1	2.6	2.3	50
15	9.2	13.0	8.6	6.5	5.1	3.6	2.8	2.3	2.0	1.7	↑
10	6.2	8.7	5.7	4.3	3.4	2.4	1.9	1.5	1.3	1.1	↑
5	3.1	4.3	2.9	2.2	1.7	1.2	0.9	0.8	0.7	0.6	↑
1	0.6	0.9	0.6	0.4	0.3	0.2	0.2	0.2	0.1	0.1	50
Max. pressure MPa		24.8	30.9	35	35	35	35	35	35	35	

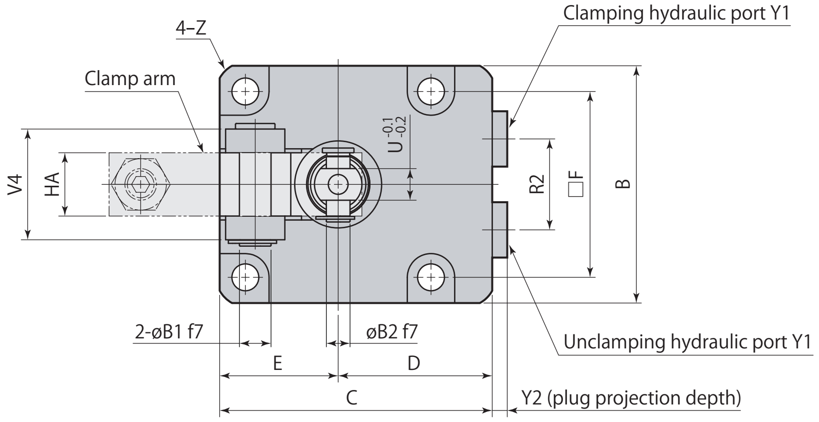
indicates nonusable range

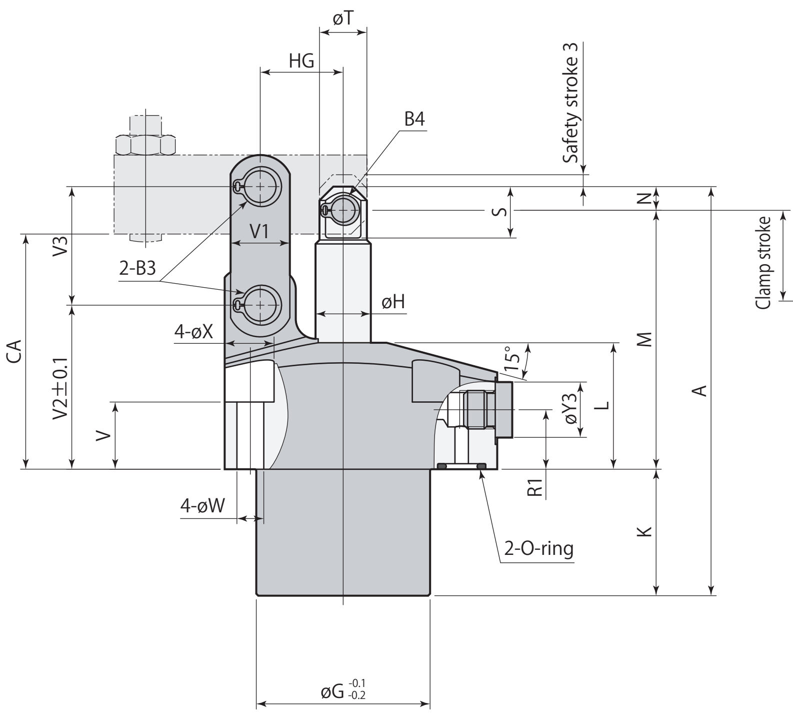
model CLW25 Clamping force F=34.35×P/(LH-37.5)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN / Clamp arm length LH mm									Min. arm length Min. LH mm
		60	65	87.5	100	120	140	160	180	200	
35	35.6			24.0	19.2	14.6	11.7	9.8	8.4	7.4	87.5
30	30.5			20.6	16.5	12.5	10.1	8.4	7.2	6.3	73
25	25.5		31.2	17.2	13.7	10.4	8.4	7.0	6.0	5.3	62.5
20	20.4	30.5	25.0	13.7	11.0	8.3	6.7	5.6	4.8	4.2	60
15	15.3	22.9	18.7	10.3	8.2	6.2	5.0	4.2	3.6	3.2	↑
10	10.2	15.3	12.5	6.9	5.5	4.2	3.4	2.8	2.4	2.1	↑
5	5.1	7.6	6.2	3.4	2.7	2.1	1.7	1.4	1.2	1.1	↑
1	1.0	1.5	1.2	0.7	0.5	0.4	0.3	0.3	0.2	0.2	60
Max. pressure MPa		23.5	26.3	35	35	35	35	35	35	35	

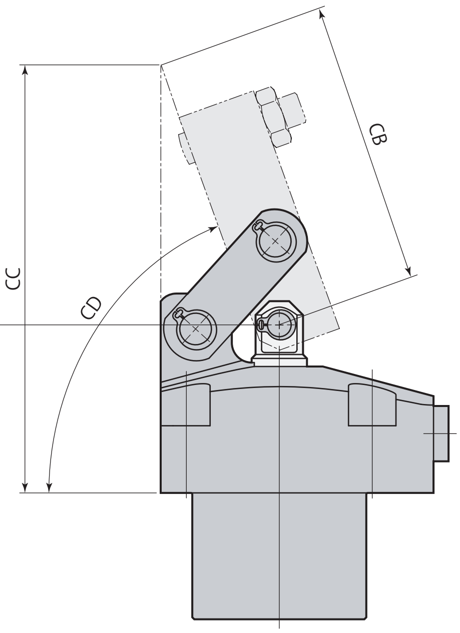
indicates nonusable range

Dimensions

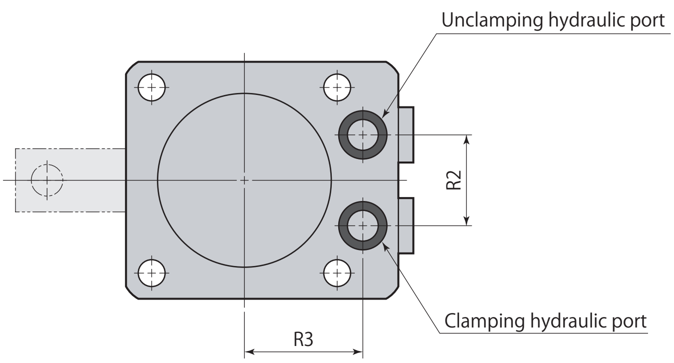




Clamp

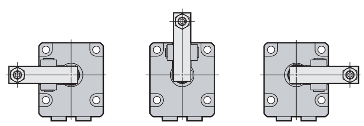


Unclamp



- This diagram represents external contour of CLW□-FN. CLW□-LN and CLW□-RN differ only in terms of mounting direction of clamp arm and otherwise all dimensions are identical to those of CLW□-FN.

L：Left side F：Front side R：Right side



- Clamp arm and mounting screws are not included.

mm

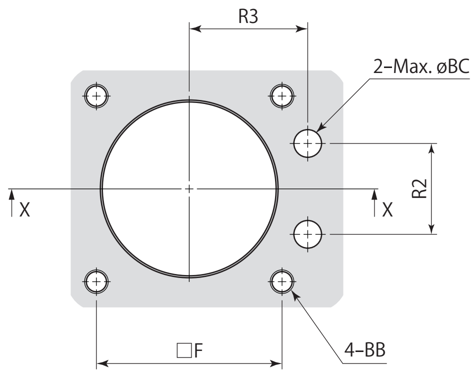
Model	CLW04-□N	CLW06-□N	CLW10-□N	CLW16-□N	CLW25-□N
A	96	103.5	116.5	143.5	171.5
B	50	60	70	86	108
C	60	69	77	96	110
D	35	39	42	53	56
E	25	30	35	43	54
F	40	47	54	65	85
øG	35	44	48	58	66
øH	12	14	18	22.4	28
K	31.5	32	35.5	43.5	50
L	27.7	32	33.5	41	47
M	58.5	65.5	73	89	108.5
N	6	6	8	11	13
R1	12.5	15	15	17	21
R2	22	23	26	30	40
R3	27.5	30	33	40	43
S	13	13	17	21.8	27.5
øT	10	12	15	20	26
U (width across flats)	6	8	10	11	16
V	17	17	17	20	21
V1	13	15	19	25	32
V2	36	41.5	45	54.5	65
V3	26	30	35.5	44	53
V4	21	28	37	46	56
øW	5.5	6.8	9	11	14
øX	10	12	15	18.5	20.5
Y1	G1/8	G1/8	G1/8	G1/4	G1/4
Y2	3.8	3.8	3.8	4.8	4.8
Y3	14	14	14	19	19
Z	C2.5	C2.5	C3	C3.5	C5.5
øB1	$6^{-0.010}_{-0.022}$	$8^{-0.013}_{-0.028}$	$10^{-0.013}_{-0.028}$	$14^{-0.016}_{-0.034}$	$16^{-0.016}_{-0.034}$
øB2	$6^{-0.010}_{-0.022}$	$6^{-0.010}_{-0.022}$	$8^{-0.013}_{-0.028}$	$12^{-0.016}_{-0.034}$	$14^{-0.016}_{-0.034}$
B3 (snap ring)*1	STW-6	STW-8	STW-10	STW-14	STW-16
B4 (snap ring)*1	STW-6	STW-6	STW-8	STW-12	STW-14
CA	52.5	59.5	65	80	96
CB	59.6	71.7	78.7	98.2	133.5
CC	92.5	107.9	117.4	144.7	189.2
CD	About 71°	About 70°	About 70°	About 69°	About 72°
HA	12	16	19	22	32
HG	18.5	21	24.5	30.5	37.5
O-ring (fluorocarbon hardness Hs90)	P9	P9	P9	P9	P9
Flow control valve (meter-in)*2	VCH01	VCH01	VCH01	VCH02	VCH02
Air bleeding valve*2	VCE01	VCE01	VCE01	VCE02	VCE02

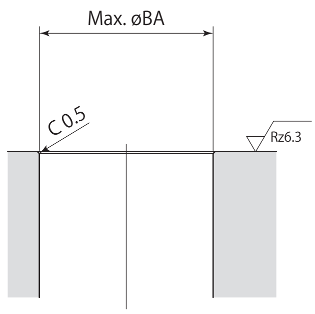
∗1：Snap ring is made by Ochiai Corporation.

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

Refer to each page for the details of options. ● Flow control valve **page →920** ● Air bleeding valve **page →922**

Mounting details





X-X

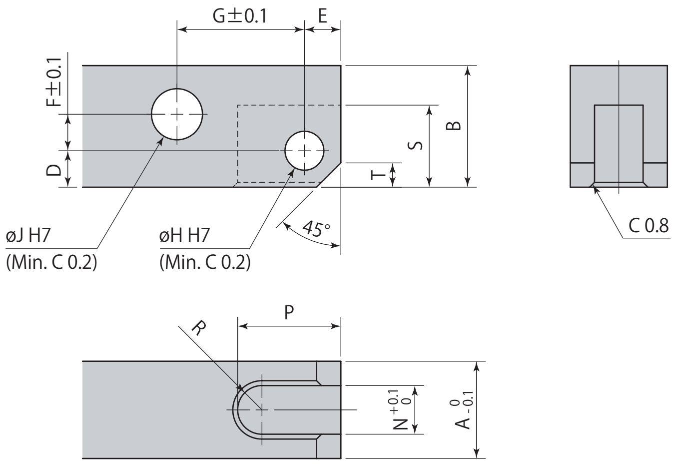
Rz: ISO4287(1997)

mm

Model	CLW04-□N	CLW06-□N	CLW10-□N	CLW16-□N	CLW25-□N
F	40	47	54	65	85
R2	22	23	26	30	40
R3	27.5	30	33	40	43
øBA	36	47	52	62	72
BB	M5	M6	M8	M10	M12
øBC	7	7	7	7	7

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

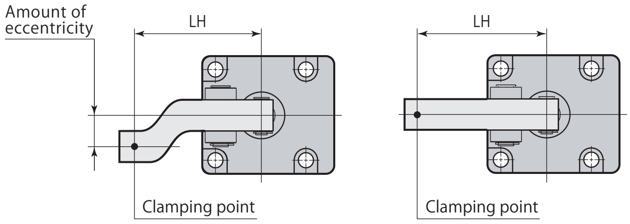
Link clamp	CLW04-□N	CLW06-□N	CLW10-□N	CLW16-□N	CLW25-□N
A	12	16	19	22	32
B	16	20	25	31	38
D	6	6	8	9	12.5
E	6	6	7	10	13
F	3.5	6	7.5	9.5	9.5
G	18.5	21	24.5	30.5	37.5
øH	$6^{+0.012}_{0}$	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$12^{+0.018}_{0}$	$14^{+0.018}_{0}$
øJ	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$	$14^{+0.018}_{0}$	$16^{+0.018}_{0}$
N	6	8	10	11	16
P	17	17	20	26.5	36
R	R3	R4	R5	R5.5	R8
S	13.5	13.5	17.5	22	28
T	4	4	5	7	8

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

Allowable eccentricity of clamp arm

An eccentric shape clamp arm, as shown in diagram on right can be used with link clamp model CLW, 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 CLW04 (shaded cells indicate nonusable range)

Hydraulic pressure MPa	Allowable eccentricity mm / Clamp arm length LH mm: 30	35	42	50	60	70	80	100	120
35					7	11	16	24	33
30				9	15	22	28	41	53
25			6	18	27	36	45	60	60
20		6	18	27	39	52	60	↑	↑
15	8	17	29	42	59	60	↑	↑	↑
10	19	32	51	60	60	↑	↑	↑	↑
5	52	60	60	60	60	60	60	60	60

model CLW06 (shaded cells indicate nonusable range)

Hydraulic pressure MPa	Allowable eccentricity mm / Clamp arm length LH mm: 35	45	50	60	70	80	90	100	120
35			8	8	8	8	8	8	8
30		8	8	8	8	8	8	8	8
25		8	8	8	8	8	8	8	8
20	10	20	23	28	33	38	44	49	60
15	19	43	50	65	80	80	80	80	80
10	37	74	80	80	↑	↑	↑	↑	↑
5	80	80	80	80	80	80	80	80	80

model CLW10 (shaded cells indicate nonusable range)

Hydraulic pressure MPa	Allowable eccentricity mm / Clamp arm length LH mm: 40	50	56.5	60	80	100	120	140	160
35			9	9	9	9	9	9	9
30		9	11	11	12	13	14	15	16
25		16	25	30	42	54	66	78	90
20	9	27	38	45	80	95	95	95	95
15	19	44	60	69	95	↑	↑	↑	↑
10	40	79	95	95	↑	↑	↑	↑	↑
5	95	95	95	95	95	95	95	95	95

model CLW16 (shaded cells indicate nonusable range)

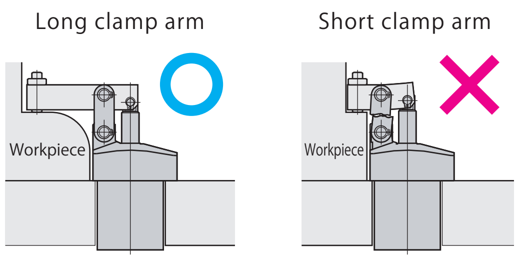
Hydraulic pressure MPa	Allowable eccentricity mm / Clamp arm length LH mm: 50	60	69.5	80	100	120	140	160	180
35			11	11	13	24	34	45	56
30		11	11	16	32	48	65	81	96
25		12	23	35	59	83	107	110	110
20	11	29	46	64	99	110	110	↑	↑
15	30	57	83	110	110	↑	↑	↑	↑
10	67	110	110	↑	↑	↑	↑	↑	↑
5	110	110	110	110	110	110	110	110	110

model CLW25 (shaded cells indicate nonusable range)

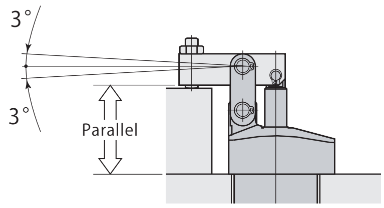
Hydraulic pressure MPa	Allowable eccentricity mm / Clamp arm length LH mm: 60	65	87.5	100	120	140	160	180	200
35			21	27	30	34	37	41	44
30			31	46	70	83	97	110	123
25		16	46	65	95	125	154	160	160
20	16	25	68	92	131	160	160	↑	↑
15	32	45	105	139	160	↑	↑	↑	↑
10	65	86	160	160	↑	↑	↑	↑	↑
5	160	160	160	160	160	160	160	160	160

Caution in use

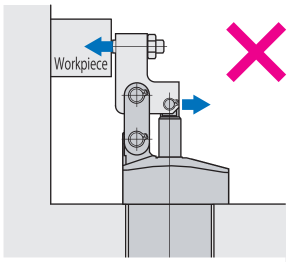
- With link clamps, force acting on link mechanism becomes larger as clamp arm becomes shorter. Exceeding maximum allowable load for link mechanism will lead to malfunction. Depending on clamp arm length, it would be necessary to lower clamping force (hydraulic pressure). Use a clamp at appropriate clamping force that is suitable for clamp arm length, referring to performance diagram and table.



- Determine height and mount clamp, ensuring that clamp arm becomes parallel to clamping surface and mounting surface when workpiece is clamped (allowable angle ±3°).

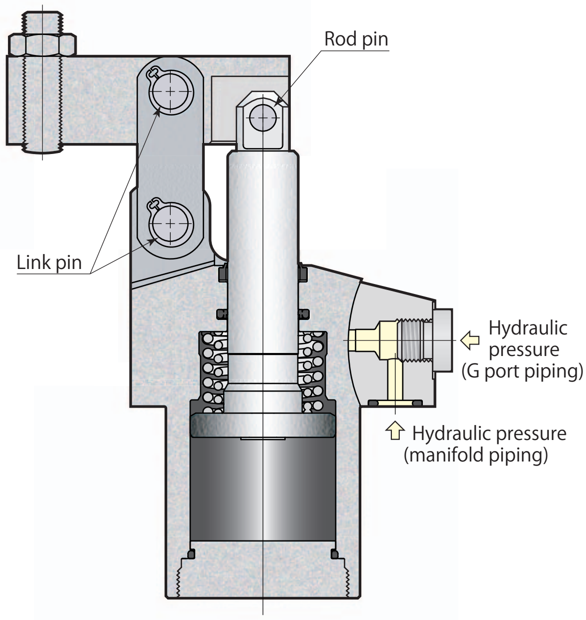


- Using a method such as that shown in the diagram on the right will apply a transverse force on the piston rod and cause the piston rod to break. Please avoid the usage that may apply a non-axial force to the piston rod.

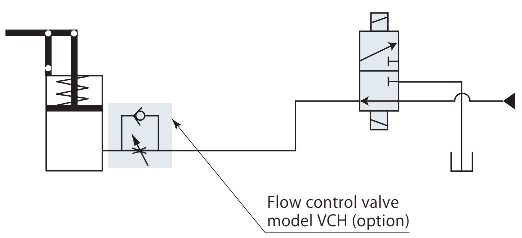


Compact model

model **CLV□-□N**



Hydraulic circuit diagram

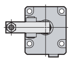
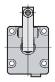
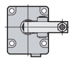


Use flow control valve for meter-in control.

Specifications page → **911**
Dimentions page → **914**
Mounting details page → **916**

Specifications

Size — Clamp arm mounting direction

CLV **06** / **10** / **16** / **25** – **L** : Left side  **F** : Front side  **R** : Right side  **N** : Compact model

Model			CLV06	CLV10	CLV16	CLV25
Cylinder force (hydraulic pressure 35MPa)*1		kN	6.8	10.5	16.7	24.0
Rod diameter		mm	16	20	25	30
Effective area (clamp)		cm^2	2.0	3.1	4.9	7.1
Full stroke		mm	26	29.5	36	45
Clamp stroke*2		mm	23	26.5	33	42
Safety stroke		mm	3	3	3	3
Max. oil flow rate		L/min	0.54	1.00	1.93	3.55
Cylinder capacity		cm^3	5.2	9.3	17.7	31.8
Return spring force	Clamp	kN	0.26	0.45	0.52	0.75
	Unclamp	kN	0.12	0.19	0.30	0.40
Recommended piping inner diameter*3		mm	ø4	ø4	ø6	ø6
Max. allowable mass of clamp arm*4		kg	0.4	0.7	1.2	2.3
Mass		kg	1.4	2.0	3.6	5.9
Recommended tightening torque of mounting screws*5		N·m	12	29	57	100

● Pressure range：3.5–35 MPa ● Proof pressure：52.5 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：This is value for clamping position. ∗2：Indicates a distance from unclamping position to clamping point.

∗3：Care must be taken when numerous clamps are used or when hydraulic piping is long.

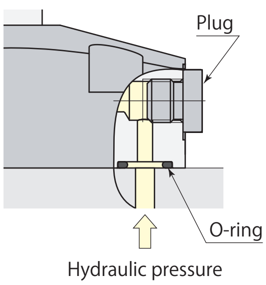
∗4：This is clamp arm mass when shape of clamp arm being described in Dimensions is retained but length only has been extended.

∗5：ISO R898 class 12.9

Manifold piping and G port piping are available.

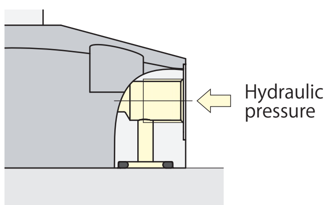
Manifold piping

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

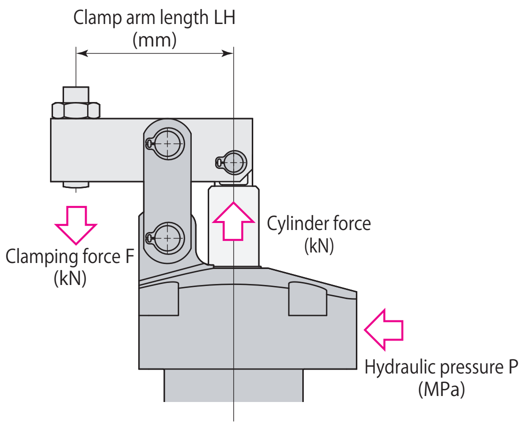


G port piping

Remove plug when choosing G port piping. (O-ring must be used.) The flow control valve and the air bleeding valve should be installed in the middle of oil path.



Performance diagram



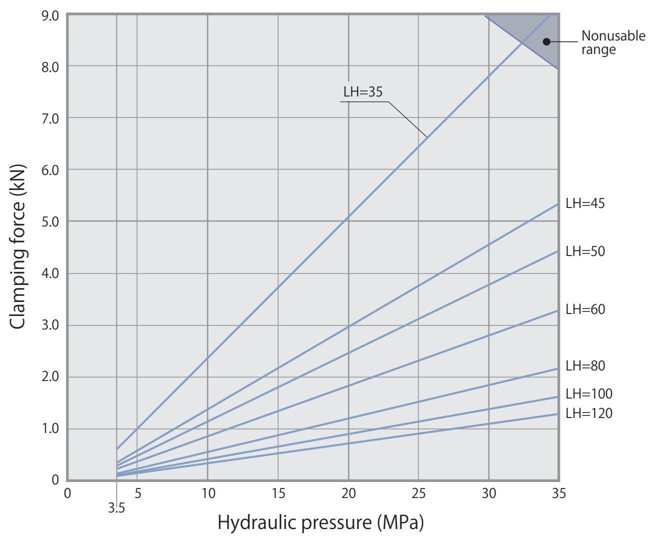
Clamping force varies depending on the clamp arm length (LH) and hydraulic pressure (P).

Clamping force calculation formula
F＝(Coefficient 1 × P - Coefficient 2)/(LH - Coefficient 3)
F：Clamping force P：Hydraulic pressure LH：Clamp arm length

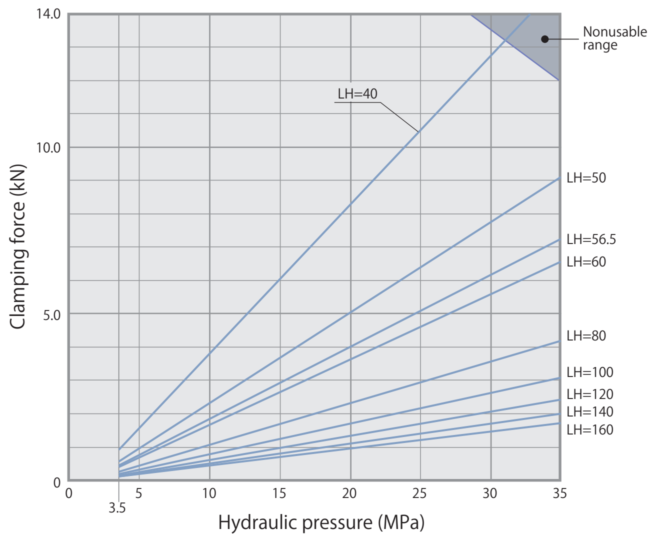
CLV10 with clamp arm length (LH) = 50 mm at hydraulic pressure of 35 MPa, Clamping force F is calculated by
(6.93×35-9.92)/(50-24.5)＝9.1 kN

Do not use the clamp in the nonusable range. It may cause damage to the cylinder and rod.

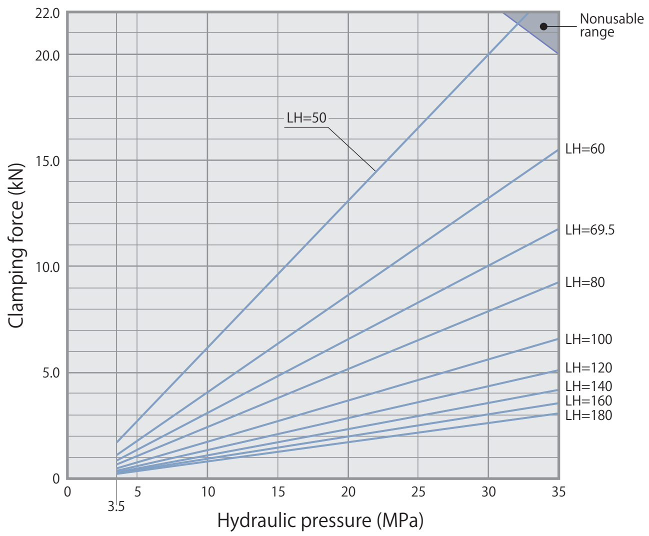
model CLV06



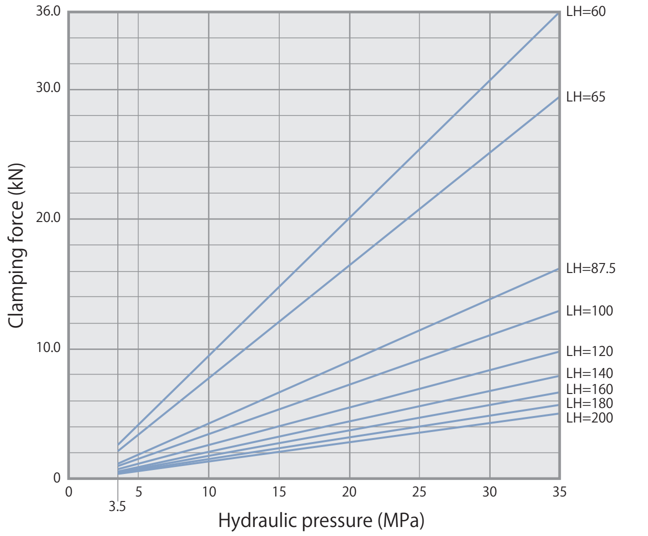
model CLV10



model CLV16



model CLV25



Performance table

model CLV06 Clamping force F=(3.80×P-4.91)/(LH-21.0)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN Clamp arm length LH mm							Min. arm length Min. LH mm
		35	45	50	60	80	100	120	
35	6.8		5.3	4.4	3.3	2.2	1.6	1.3	37.5
30	5.8	7.8	4.5	3.8	2.8	1.8	1.4	1.1	35
25	4.8	6.4	3.8	3.1	2.3	1.5	1.1	0.9	↑
20	3.8	5.1	3.0	2.5	1.8	1.2	0.9	0.7	↑
15	2.8	3.7	2.2	1.8	1.3	0.9	0.7	0.5	↑
10	1.8	2.4	1.4	1.1	0.8	0.6	0.4	0.3	↑
5	0.7	1.0	0.6	0.5	0.4	0.2	0.2	0.1	↑
3.5	0.4	0.6	0.3	0.3	0.2	0.1	0.1	0.1	35
Max. pressure MPa		32.4	35	35	35	35	35	35	

▇ indicates nonusable range

model CLV10 Clamping force F=(6.93×P-9.92)/(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	60	80	100	120	140	160	
35	10.5		9.1	7.3	6.6	4.2	3.1	2.4	2.0	1.7	44
30	9.0	12.8	7.8	6.2	5.6	3.6	2.6	2.1	1.7	1.5	40
25	7.4	10.5	6.4	5.1	4.6	2.9	2.2	1.7	1.4	1.2	↑
20	5.8	8.3	5.0	4.0	3.6	2.3	1.7	1.3	1.1	0.9	↑
15	4.3	6.1	3.7	2.9	2.6	1.7	1.2	1.0	0.8	0.7	↑
10	2.7	3.8	2.3	1.9	1.7	1.1	0.8	0.6	0.5	0.4	↑
5	1.1	1.6	1.0	0.8	0.7	0.4	0.3	0.3	0.2	0.2	↑
3.5	0.6	0.9	0.6	0.4	0.4	0.3	0.2	0.2	0.1	0.1	40
Max. pressure MPa		31.0	35	35	35	35	35	35	35	35	

▇ indicates nonusable range

model CLV16 Clamping force F=(13.47×P-14.27)/(LH-30.5)

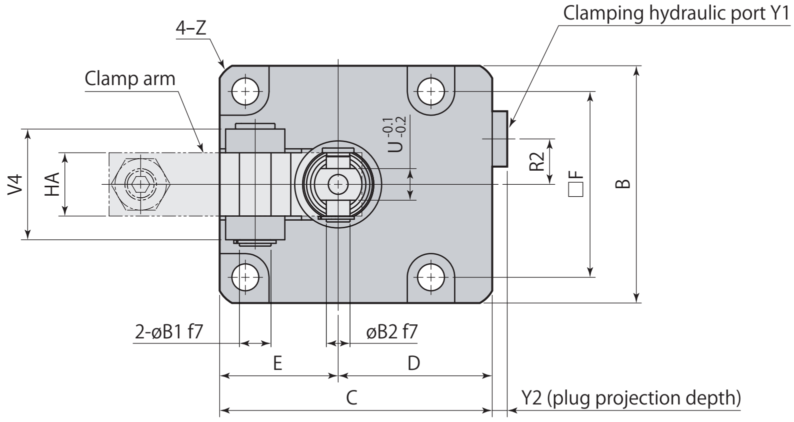
Hydraulic pressure MPa	Cylinder force kN	Clamping force kN Clamp arm length LH mm									Min. arm length Min. LH mm
		50	60	69.5	80	100	120	140	160	180	
35	16.7		15.5	11.7	9.2	6.6	5.1	4.2	3.5	3.1	53.5
30	14.2	20.0	13.2	10.0	7.9	5.6	4.4	3.6	3.0	2.6	50
25	11.8	16.5	10.9	8.3	6.5	4.6	3.6	2.9	2.5	2.2	↑
20	9.3	13.1	8.6	6.5	5.2	3.7	2.9	2.3	2.0	1.7	↑
15	6.8	9.6	6.4	4.8	3.8	2.7	2.1	1.7	1.5	1.3	↑
10	4.4	6.2	4.1	3.1	2.4	1.7	1.3	1.1	0.9	0.8	↑
5	1.9	2.7	1.8	1.4	1.1	0.8	0.6	0.5	0.4	0.4	↑
3.5	1.2	1.7	1.1	0.8	0.7	0.5	0.4	0.3	0.3	0.2	50
Max. pressure MPa		32.1	35	35	35	35	35	35	35	35	

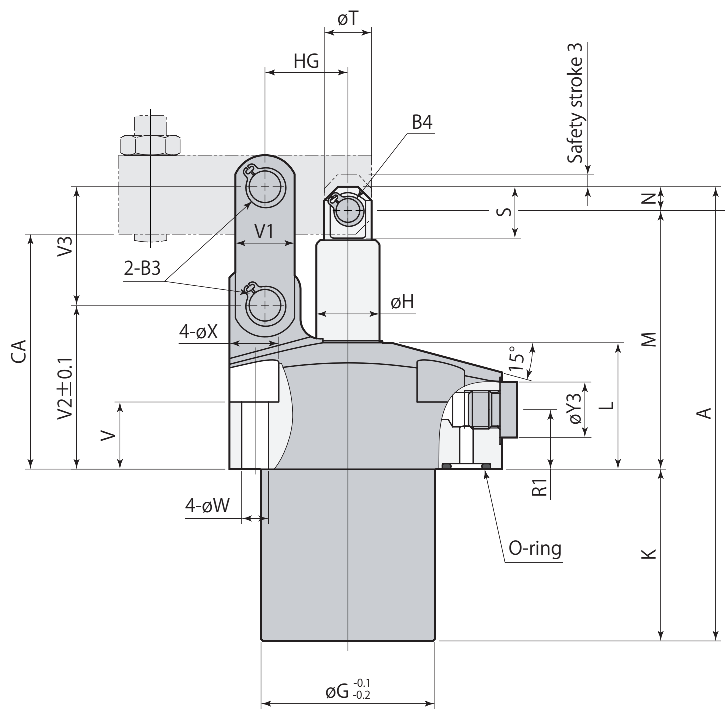
▇ indicates nonusable range

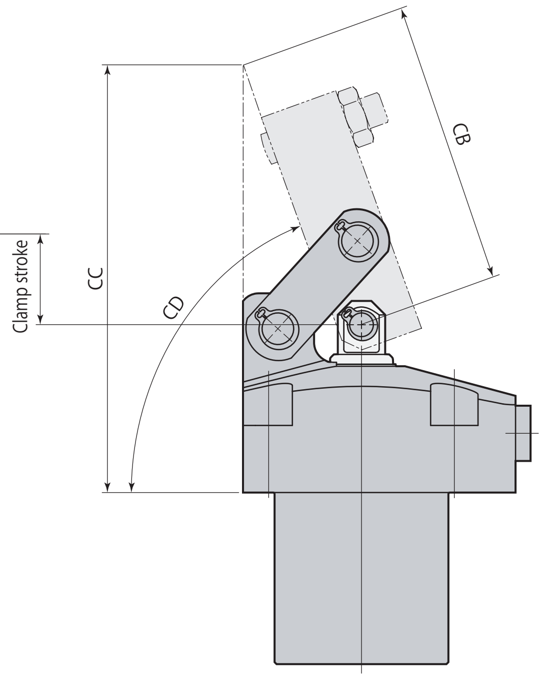
model CLV25 Clamping force F=(23.86×P-25.31)/(LH-37.5)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN Clamp arm length LH mm									Min. arm length Min. LH mm
		60	65	87.5	100	120	140	160	180	200	
35	24.0	36.0	29.4	16.2	13.0	9.8	7.9	6.6	5.7	5.0	60
30	20.5	30.7	25.1	13.8	11.0	8.4	6.7	5.6	4.8	4.2	↑
25	16.9	25.4	20.8	11.4	9.1	6.9	5.6	4.7	4.0	3.5	↑
20	13.4	20.1	16.4	9.0	7.2	5.5	4.4	3.7	3.2	2.8	↑
15	9.9	14.8	12.1	6.7	5.3	4.0	3.2	2.7	2.3	2.0	↑
10	6.3	9.5	7.8	4.3	3.4	2.6	2.1	1.7	1.5	1.3	↑
5	2.8	4.2	3.4	1.9	1.5	1.1	0.9	0.8	0.7	0.6	↑
3.5	1.7	2.6	2.1	1.2	0.9	0.7	0.6	0.5	0.4	0.4	60
Max. pressure MPa		35	35	35	35	35	35	35	35	35	

Dimensions

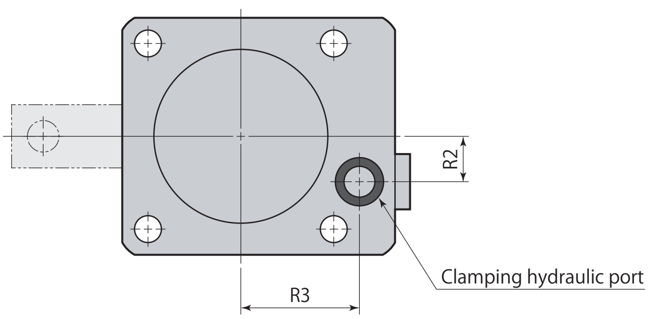






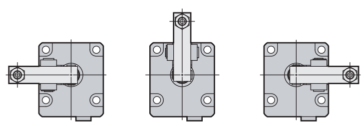
Clamp

Unclamp



● This diagram represents external contour of CLV□-FN. CLV□-LN and CLV□-RN differ only in terms of mounting direction of clamp arm and otherwise all dimensions are identical to those of CLV□-FN.

L：Left side F：Front side R：Right side



● Clamp arm and mounting screws are not included.

mm

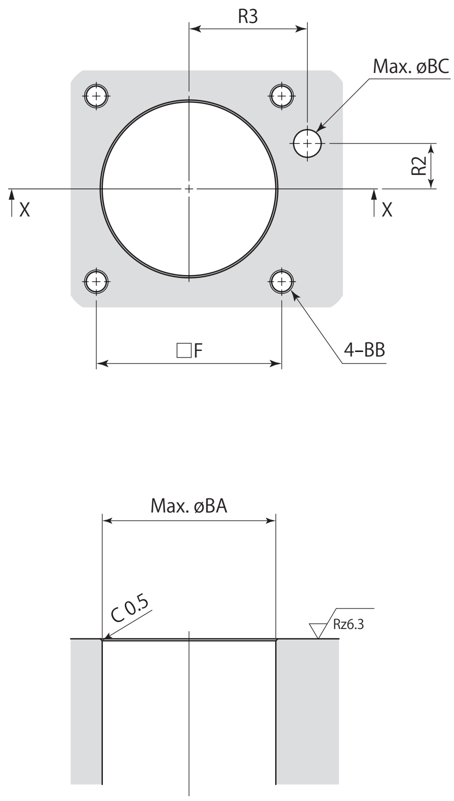
Model	CLV06-□N	CLV10-□N	CLV16-□N	CLV25-□N
A	115	134	160	190.5
B	60	70	86	108
C	69	77	96	110
D	39	42	53	56
E	30	35	43	54
F	47	54	65	85
øG	44	48	58	66
øH	16	20	25	30
K	43.5	53	60	69
L	32	33.5	41	47
M	65.5	73	89	108.5
N	6	8	11	13
R1	15	15	17	21
R2	11.5	13	15	20
R3	30	33	40	43
S	13	17	21.8	27.5
øT	12	15	20	26
U (width across flats)	8	10	11	16
V	17	17	20	21
V1	15	19	25	32
V2	41.5	45	54.5	65
V3	30	35.5	44	53
V4	28	37	46	56
øW	6.8	9	11	14
øX	12	15	18.5	20.5
Y1	G1/8	G1/8	G1/4	G1/4
Y2	3.8	3.8	4.8	4.8
Y3	14	14	19	19
Z	C2.5	C3	C3.5	C5.5
øB1	$8^{-0.013}_{-0.028}$	$10^{-0.013}_{-0.028}$	$14^{-0.016}_{-0.034}$	$16^{-0.016}_{-0.034}$
øB2	$6^{-0.010}_{-0.022}$	$8^{-0.013}_{-0.028}$	$12^{-0.016}_{-0.034}$	$14^{-0.016}_{-0.034}$
B3 (snap ring)*1	STW-8	STW-10	STW-14	STW-16
B4 (snap ring)*1	STW-6	STW-8	STW-12	STW-14
CA	59.5	65	80	96
CB	71.7	78.7	98.2	133.5
CC	107.9	117.4	144.7	189.2
CD	About 70°	About 70°	About 69°	About 72°
HA	16	19	22	32
HG	21	24.5	30.5	37.5
O-ring (fluorocarbon hardness Hs90)	P9	P9	P9	P9
Flow control valve (meter-in)*2	VCH01	VCH01	VCH02	VCH02
Air bleeding valve*2	VCE01	VCE01	VCE02	VCE02

∗1：Snap ring is made by Ochiai Corporation.

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

Refer to each page for the details of options. ● Flow control valve **page →920** ● Air bleeding valve **page →922**

Mounting details



X-X

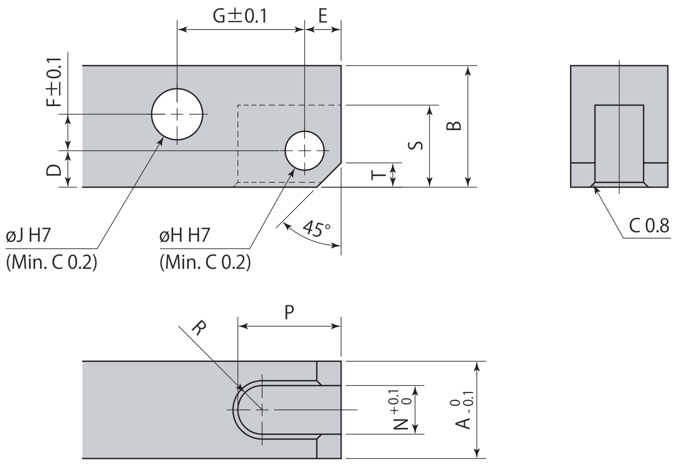
Rz: ISO4287(1997)

mm

Model	CLV06-□N	CLV10-□N	CLV16-□N	CLV25-□N
F	47	54	65	85
R2	11.5	13	15	20
R3	30	33	40	43
øBA	47	52	62	72
BB	M6	M8	M10	M12
øBC	7	7	7	7

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

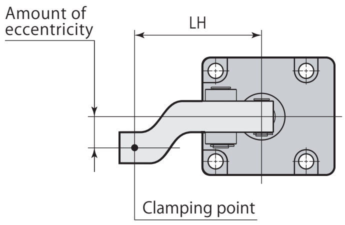
Link clamp	CLV06-□N	CLV10-□N	CLV16-□N	CLV25-□N
A	16	19	22	32
B	20	25	31	38
D	6	8	9	12.5
E	6	7	10	13
F	6	7.5	9.5	9.5
G	21	24.5	30.5	37.5
øH	$6^{+0.012}_{0}$	$8^{+0.015}_{0}$	$12^{+0.018}_{0}$	$14^{+0.018}_{0}$
øJ	$8^{+0.015}_{0}$	$10^{+0.015}_{0}$	$14^{+0.018}_{0}$	$16^{+0.018}_{0}$
N	8	10	11	16
P	17	20	26.5	36
R	R4	R5	R5.5	R8
S	13.5	17.5	22	28
T	4	5	7	8

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

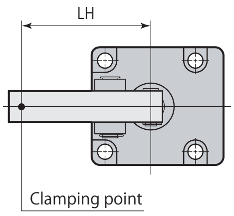
Allowable eccentricity of clamp arm

An eccentric shape clamp arm, as shown in diagram on right can be used with link clamp model CLV, 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 CLV06 (gray cell indicates nonusable range)

Hydraulic pressure MPa	Allowable eccentricity mm								
	Clamp arm length LH mm								
	35	45	50	60	70	80	90	100	120
35		8	8	8	8	8	8	8	8
30	8	12	13	15	17	19	21	23	26
25	12	25	28	36	43	50	57	65	79
20	19	44	52	67	80	80	80	80	80
15	33	67	80	80	↑	↑	↑	↑	↑
10	62	80	↑	↑	↑	↑	↑	↑	↑
5	80	80	80	80	80	80	80	80	80

model CLV10 (gray cell indicates nonusable range)

Hydraulic pressure MPa	Allowable eccentricity mm								
	Clamp arm length LH mm								
	40	50	56.5	60	80	100	120	140	160
35		12	18	19	24	30	35	41	46
30	9	19	28	34	53	69	85	95	95
25	10	28	40	47	83	95	95	↑	↑
20	18	42	58	67	95	↑	↑	↑	↑
15	33	67	89	95	↑	↑	↑	↑	↑
10	66	95	95	↑	↑	↑	↑	↑	↑
5	95	95	95	95	95	95	95	95	95

model CLV16 (gray cell indicates nonusable range)

Hydraulic pressure MPa	Allowable eccentricity mm								
	Clamp arm length LH mm								
	50	60	69.5	80	100	120	140	160	180
35		11	16	27	47	67	87	108	110
30	11	17	30	45	72	100	110	110	↑
25	14	33	51	71	110	110	↑	↑	↑
20	29	56	82	110	↑	↑	↑	↑	↑
15	56	97	110	↑	↑	↑	↑	↑	↑
10	110	110	↑	↑	↑	↑	↑	↑	↑
5	110	110	110	110	110	110	110	110	110

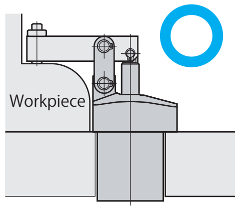
model CLV25

Hydraulic pressure MPa	Allowable eccentricity mm								
	Clamp arm length LH mm								
	60	65	87.5	100	120	140	160	180	200
35	16	16	52	72	104	136	160	160	160
30	16	24	68	92	130	160	↑	↑	↑
25	25	37	91	121	160	↑	↑	↑	↑
20	41	56	126	160	↑	↑	↑	↑	↑
15	68	90	160	↑	↑	↑	↑	↑	↑
10	126	160	↑	↑	↑	↑	↑	↑	↑
5	160	160	160	160	160	160	160	160	160

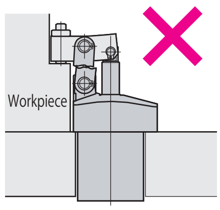
Caution in use

- With link clamps, force acting on link mechanism becomes larger as clamp arm becomes shorter. Exceeding maximum allowable load for link mechanism will lead to malfunction. Depending on clamp arm length, it would be necessary to lower clamping force (hydraulic pressure). Use a clamp at appropriate clamping force that is suitable for clamp arm length, referring to performance diagram and table.

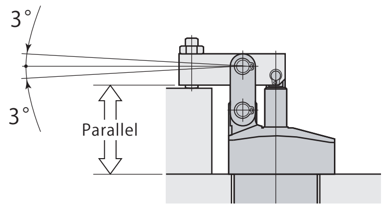
Long clamp arm



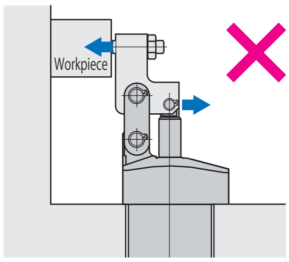
Short clamp arm



- Determine height and mount clamp, ensuring that clamp arm becomes parallel to clamping surface and mounting surface when workpiece is clamped (allowable angle ±3°).



- Using a method such as that shown in the diagram on the right will apply a transverse force on the piston rod and cause the piston rod to break. Please avoid the usage that may apply a non-axial force to the piston rod.



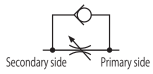
Specifications

Body color：Silver

VCH

G port size
01：G1/8
02：G1/4

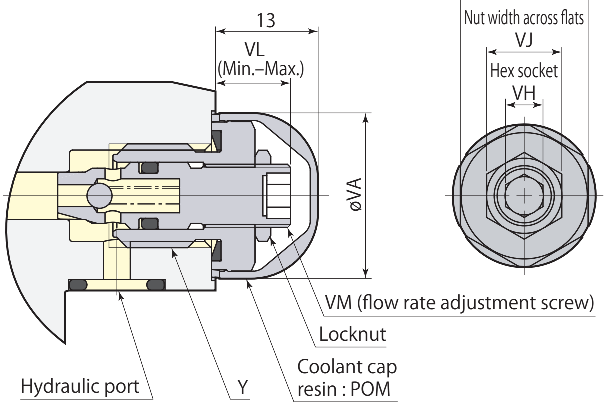
Control method
(Nil)：Meter-in



Model		VCH01	VCH02
G port size		G1/8	G1/4
Cracking pressure	MPa	0.04	
Orifice area	mm^2	3.1	6.2
Recommended tightening torque	N·m	10	30
Mass	kg	0.06	0.07

- Pressure range：1–50 MPa
- Operating temperature：0–70 ℃
- Fluid used：General mineral based hydraulic oil (ISO-VG32 equivalent)

Dimensions



mm

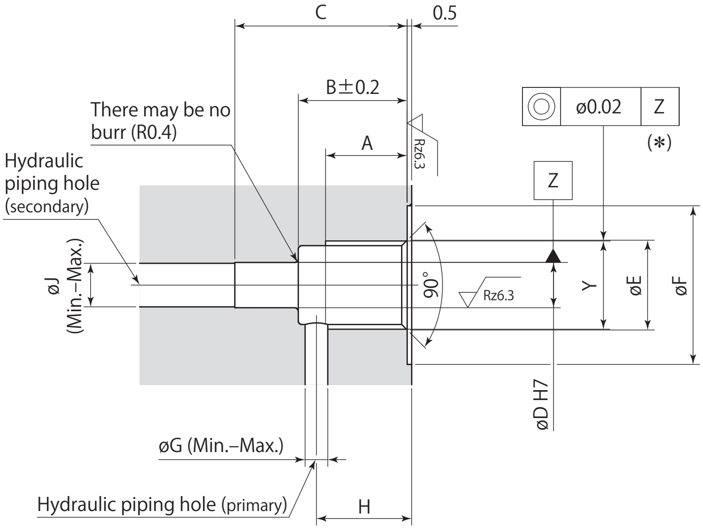
Model	VCH01	VCH02
Y	G1/8	G1/4
øVA	16	21
VH	3	5
VJ	8	10
VK	12	17
VL	7–11	7.5–11.5
Adjustment screw number of turns	5.3 rotations	5.3 rotations
VM	M6×0.75	M8×0.75

- Use a closed wrench or socket wrench for mounting and dismounting.
- Flow control valve can be mounted on hydraulic port (G port) when manifold piping.
- Adjust flow rate without hydraulic pressure. Conducting adjustments with hydraulic pressure may result in damaging seal.
- VCH is shipped with the valve fully open. Adjust the flow rate by loosening the screws after it is screwed in to close totally. Tighten the locknut after adjustment is completed.

Applicable clamp

Model	VCH01	VCH02
Swing clamp (double acting)	CTK04U, 06U, 10U CTK04B, 06B, 10B	CTK16U CTK16B
Link clamp (double acting)	CLW04-N, 06-N, 10-N	CLW16-N, 25-N
Link clamp (single acting)	CLV06-N, 10-N	CLV16-N, 25-N

Mounting details



Rz: ISO4287(1997)

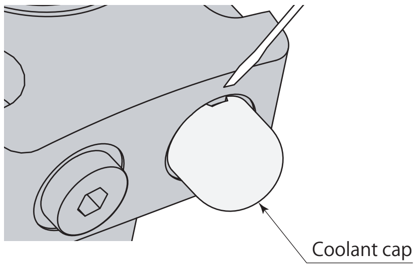
mm

Model	VCH01	VCH02
A	9	13
B	13	18
C	17.5	22.5
øD	$5^{+0.012}_{0}$	$6^{+0.012}_{0}$
øE	9.9	13.3
øF	17.5	21.5
øG	2.5–3	3.5–5
H	9.5–11.5	14.5–15.5
øJ	2.5–5	3.5–6
Y	G1/8	G1/4

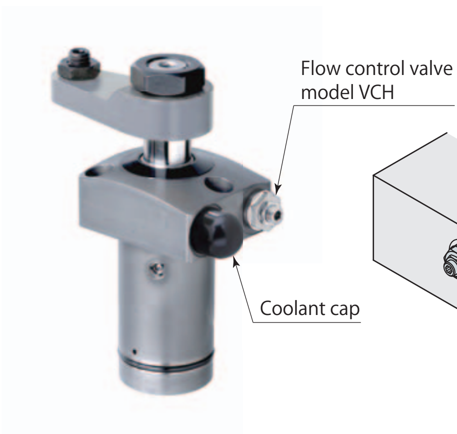
*: Concentricity is required when machining øD and Y-portion thread. Misalignment or machining defect may cause the trouble of installation and adjusting flow rate.

Mounting & dismounting of flow control valve, air bleeding valve

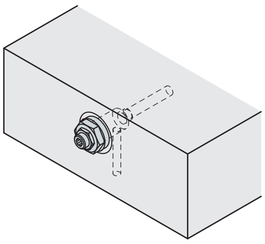
- When mounting or dismounting a flow control valve or air bleeding valve, be sure to set pressure within hydraulic circuit to 0 MPa before starting.
- When mounting a flow control valve or air bleeding valve, be sure to tighten it with the recommended tightening torque.
- When mounting a coolant cap (resin：POM), firmly press the body of cover. If it is not mounting properly, use a plastic mallet to tap it into place.
- When dismounting a coolant cap, use a sharp-pointed tool such as a precision screw driver by hooking the notched portion.



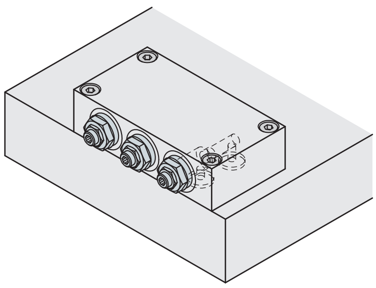
Mounting example



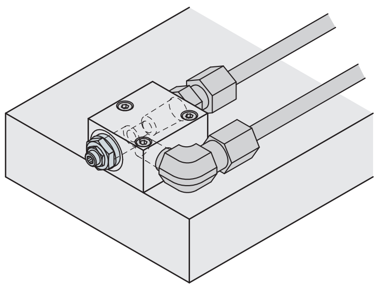
Cylinder mounting



Pallet mounting

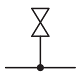


Block mounting ①



Block mounting ②

Specifications

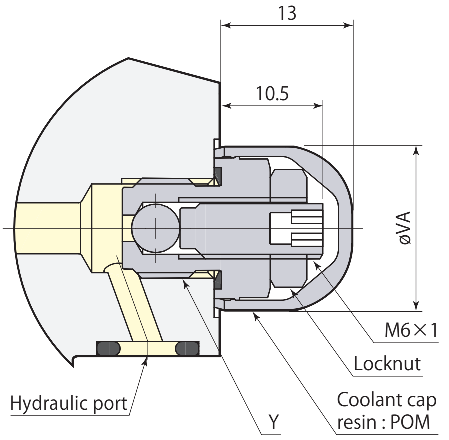


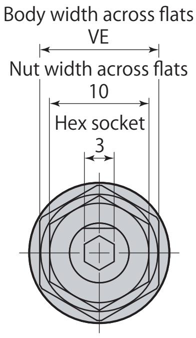
G port size

VCE
- 01 : G1/8
- 02 : G1/4

Model		VCE01	VCE02
G port size		G1/8	G1/4
Recommended tightening torque	N·m	10	30
Mass	kg	0.017	0.029
Pressure range	MPa	0–50	
Operating temperature	°C	0–70	
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)	

Dimensions



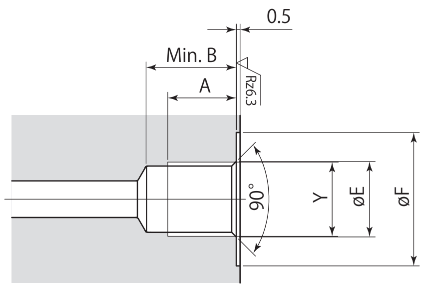


mm

Model	VCE01	VCE02
A	9	13
B	10	14
øE	9.9	13.3
øF	17.5	21.5
Y	G1/8	G1/4
øVA	16	21
VE	12	17

- Use a closed wrench or socket wrench for mounting and dismounting.
- Air bleeding valve can be mounted on hydraulic port (G port) when manifold piping.

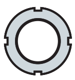
Mounting details



Rz: ISO4287(1997)

Applicable clamp and work support

Model	VCE01	VCE02
Swing clamp (double acting)	CTK04U, 06U, 10U CTK04B, 06B, 10B CTW06, 10	CTK16U CTK16B CTW16, 25
Swing clamp (single acting)	CTV06, 10	CTV16, 25
Link clamp (double acting)	CLW04, 06, 10	CLW16, 25
Link clamp (single acting)	CLV06, 10	CLV16, 25
Work support	CSP-M-N (CSW, CSV)	–

Work support			model **CSW** Page →926 		model **CSV** Page →926 
Specifications			35MPa Hydraulic lift		35MPa Spring lift
Features			Threaded body Standard model	Threaded body Long stroke	Threaded body Standard model
Variations	Standard		CSW **Page →930**	CSW06M-D **Page →930**	CSV **Page →942**
	Double acting ＊		CSW-D **Page →936**	CSW-D06M-D **Page →936**	—
Option	Flange		CSP-N **Page →946**		
	Piping cap		CSP-Q **Page →948**		
	Locknut		CSP-L **Page →948**		
	Chip cover		CSP-J **Page →948**		

＊:Flange ＆ piping cap (option) can not be mounted on double acting work support.

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Work support

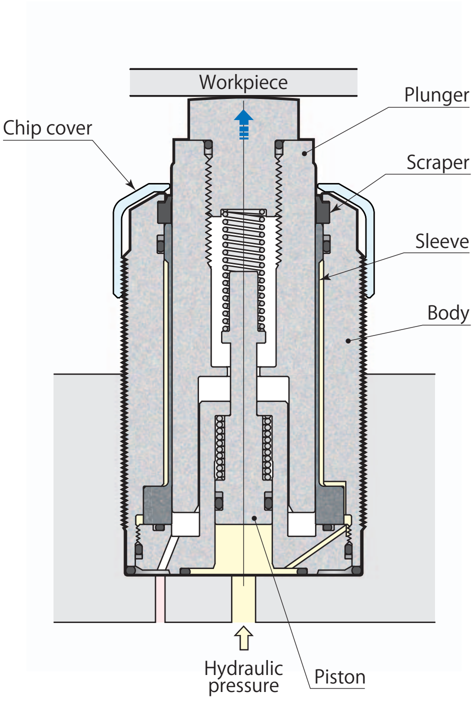
35MPa

Hydraulic lift
model **CSW**

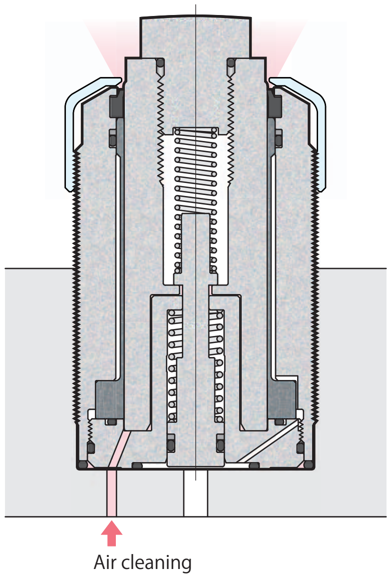
Spring lift
model **CSV**

Hydraulic lift

model **CSW□M-□**

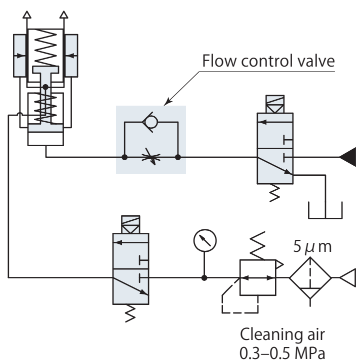


Lock



Unlock

Hydraulic and pneumatic circuit diagram



Specifications

Size: 06 / 10 / 16 / 25

Plunger stroke

CSW [06 / 10 / 16 / 25] M – [L / D]

L : Standard stroke

D : Long stroke (only for CSW06)

Model		CSW06M-L 8 mm stroke	CSW06M-D 15 mm stroke	CSW10M-L	CSW16M-L	CSW25M-L
Support force (hydraulic pressure 35MPa)*1	kN	7.1		11.1	17.8	26.7
Cylinder capacity	cm^3	1.5	2.0	2.9	5.5	5.7
Lift spring force*2	N	6–11	4–11	10–16	16–29	25–45
Plunger stroke	mm	8	15	10	10	13
Max. allowable mass of head cap	kg	0.1		0.1	0.2	0.2
Mass	kg	0.29	0.33	0.43	1.03	1.89
Recommended tightening torque of body	N·m	35	35	60	130	250

● Pressure range：10–35 MPa ● Proof pressure：52.5 MPa ● Max. allowable back pressure：0.05 MPa

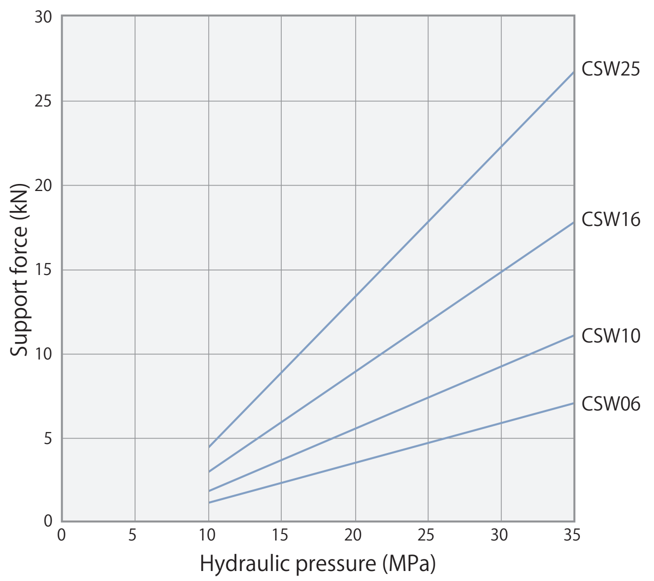
● Operating temperature：0–70℃ ● Fluid used：General mineral based hydraulic oil (ISO-VG32 equivalent)

● Seals are resistant to chlorine-based cutting fluid. (not thermal resistant specification)

∗1：When work support and clamp are used facing each other, work support and clamp must be selected in such a way that the support force is 1.5 times the applied load (clamping force + machining force).

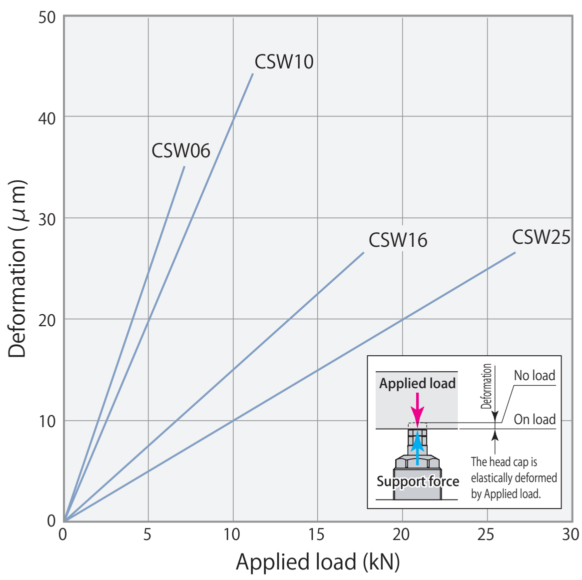
∗2：Figures are for "upper end to lower end" of plunger action.

Hydraulic pressure & support force



Hydraulic pressure MPa	Support force kN			
	CSW06	CSW10	CSW16	CSW25
10	1.2	1.9	3.0	4.5
15	2.3	3.7	6.0	8.9
20	3.5	5.6	8.9	13.4
25	4.7	7.4	11.9	17.8
30	5.9	9.3	14.8	22.3
35	7.1	11.1	17.8	26.7

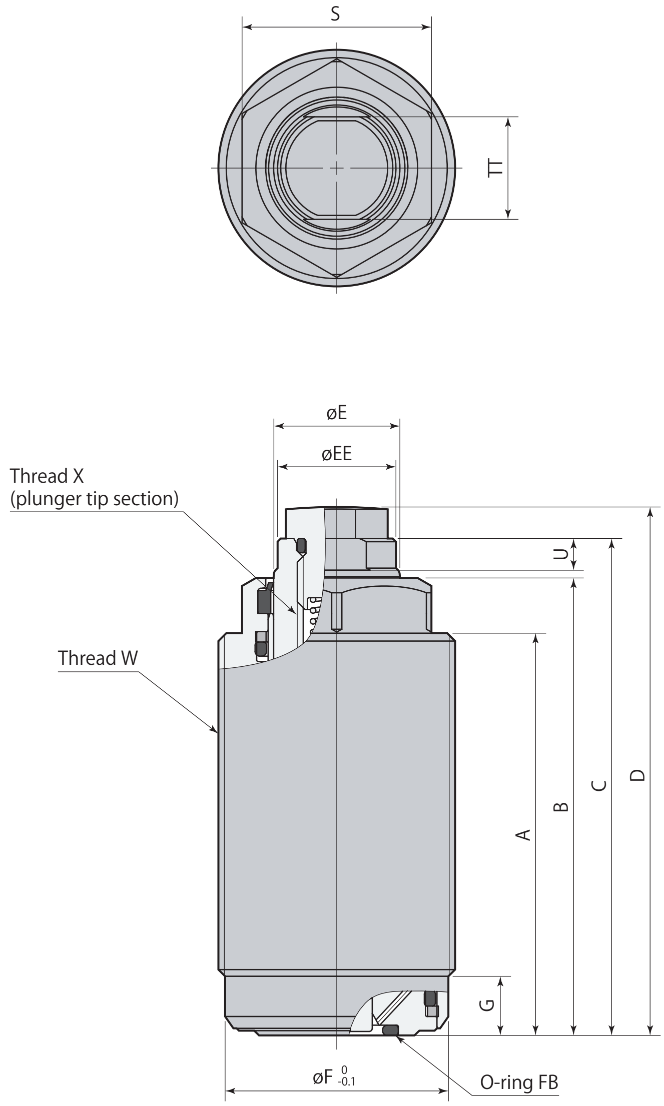
Applied load & deformation



Applied load kN	Deformation μm			
	CSW06	CSW10	CSW16	CSW25
0	0	0	0	0
5	25	20	7.5	5
10		40	15	10
15			22.5	15
20		Nonusable range		20
25				25
30				

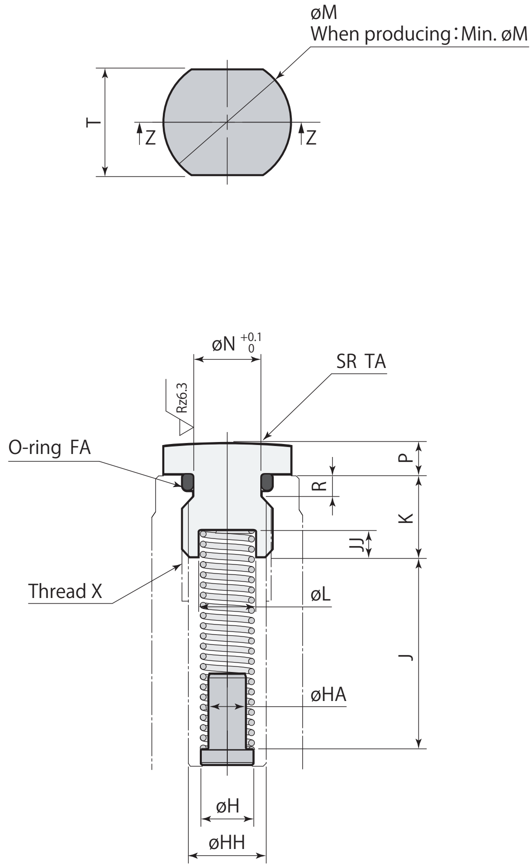
Held with hydraulic pressure of 35 MPa.

Dimensions



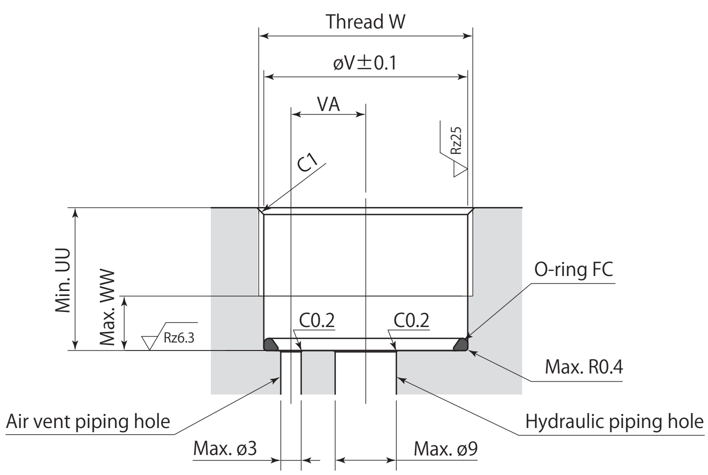
Head cap details

Hardness：HRC52



Z-Z

Mounting details



Rz: ISO4287(1997)

- When fixing the hexagon part of body with a vise, etc., make sure the tightening force is 2.5 kN or less.
- Always attach head cap (lift spring cannot be retained). When fabricating head cap, ensure that O-ring slot, spring spot facing and guide are made by referring to head cap details. Be sure to always use O-ring.
- When fabricating a lift spring, determine dimensions by referring to head cap details. Furthermore, rustproofing must be implemented (however, there is no guarantee for operation).
- Install O-ring FC at the bottom of the hole. The O-ring FC is packed with a work support.
- This diagram indicates a situation where head cap has been fitted into plunger with no pressure applied.

mm

Model	CSW06M-L	CSW06M-D	CSW10M-L	CSW16M-L	CSW25M-L
A	51	58	58	59.5	68.5
B	58	65	67	71.8	82
C	63	70	73	78	89
D	67	74	77	84	96
øE	16	16	20	30	40
øEE	15	15	19	29	39
øF	28.3	28.3	33.2	48.2	63.2
G	7.5	7.5	7.5	7.5	8
øH	7	7	7	8.5	10
øHA	5	5	5	6	7.5
øHH	8.5	8.5	10.3	14	14
J	20.5	21.3	25.5	25	32.5
JJ	1.5	1.5	3.5	1.5	1.5
K	9	9	11	12	11
øL	7.4	7.4	7.6	9.2	11.2
øM	12.9	12.9	16.9	23	30
Min. øM	12.5	12.5	16	21	21
øN	7.8	7.8	8.9	13.3	13.3
P	4	4	4	6	7
R	1.9	1.9	3	2.4	2.4
S	24	24	30	41	55
T (width across flats)	12	12	14	19	24
TA	70	70	90	110	140
TT (plunger width across flats)	13	13	17	24	32
U	4	4	5	5	5.7
UU	15.5	15.5	15.5	15.5	20
øV	28.5	28.5	33.5	48.5	63.5
VA	11	11	12	18	23.5
W	M30×1.5	M30×1.5	M35×1.5	M50×1.5	M65×1.5
WW	6.5	6.5	6.5	6.5	7
X (recommended tightening torque)	M10×1.5 depth 13 (30 N・m)	M10×1.5 depth 13 (30 N・m)	M12×1.75 depth 16 (50 N・m)	M16×2 depth 20 (100 N・m)	M16×2 depth 20 (100 N・m)
O-ring FA (fluorocarbon hardness Hs70)	S8	S8	P9	AS568-014	AS568-014
O-ring FB (fluorocarbon hardness Hs90)	AS568-014	AS568-014	AS568-015	AS568-019	AS568-022
O-ring FC (fluorocarbon hardness Hs90)	AS568-022	AS568-022	AS568-025	S45	AS568-036

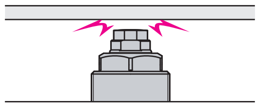
Caution in use

- The lift spring in the plunger may push the workpiece upward if it is light weight and seating detection cannot be complete. Review the weight of workpiece or lift spring force and make it appropriate to seat the workpiece perfectly and acutate the work support.

- Set the plunger lifting time to 0.2 seconds or longer by adjusting the flow control valve with check valve (meter-in). Reasonable plunger ascending speed can prevent the parts from breakage also curbs plunger contact false.
  Use a flow control valve with cracking pressure of 0.05MPa or less, in order to shorten plunger descending speed.

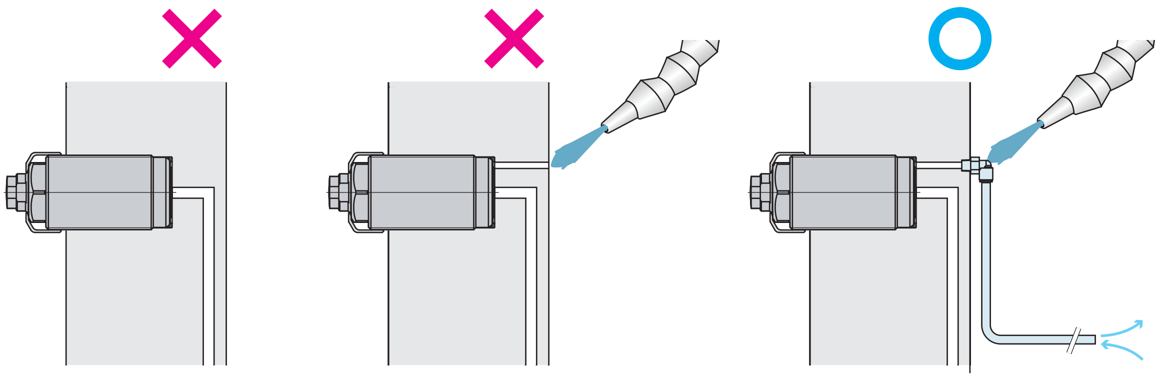
  If the plunger ascends to reach a workpiece too fast, it rebounds after hitting the workpice and will create a small clearance between the two. The clearance may cause a supporting fault of the workpiece.

Rebound and clearance



- Avoid following usages. These may cause sleeve deformation that could lead to malfunction of plunger or decreased support force.
  - ×Applying eccentric load on plunger.
  - ×Applying load that exceeds rated support force.
  - ×Rotating plunger when locked.

- Air vent must be opened to atmosphere. Any blockage on the vent results in malfunction. Provide the piping if there is a risk of coolant or metal chips intrusion. Allowing intrusion of cutting fluid may cause rusting and other problems.

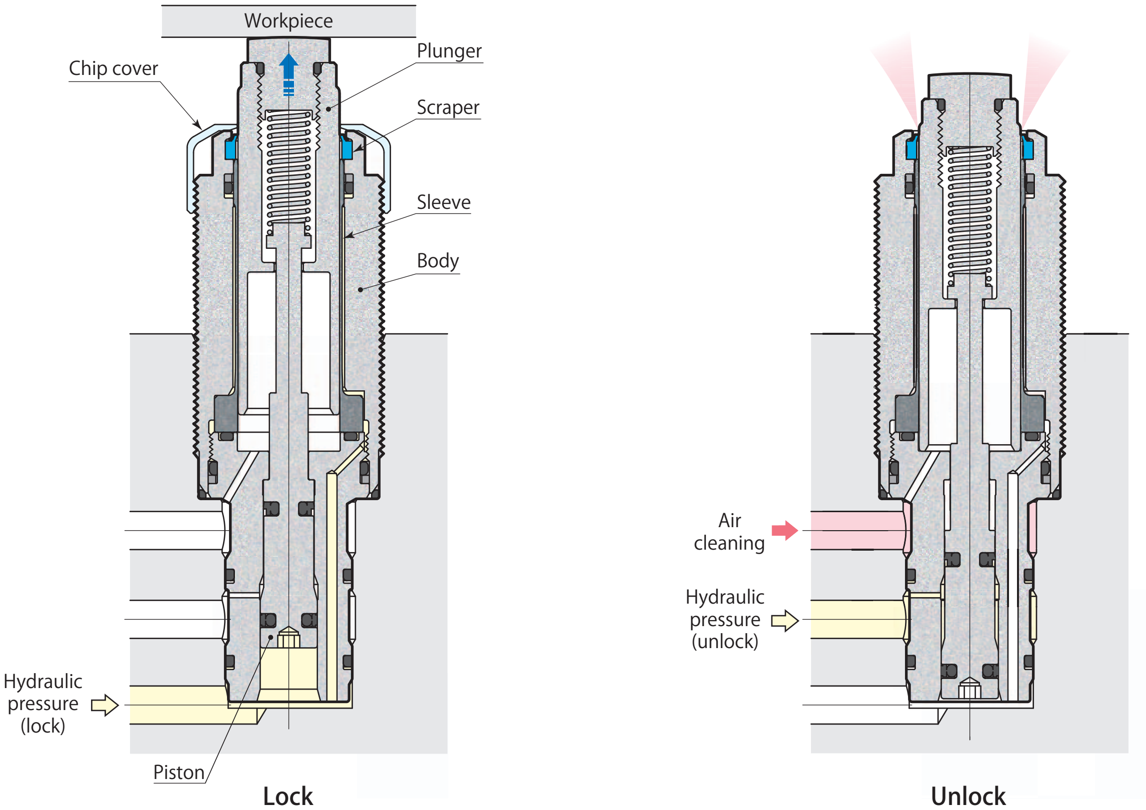


Air vent is blocked　　Cutting fluid intrusion from air vent　　Piping to metal chips or coolant free area

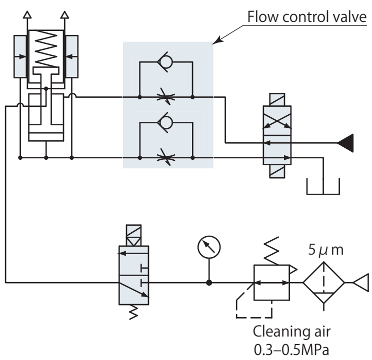
- Air (oil free) must be fed through a 5μm filter that is connected to an air vent port for air cleaning.
  Perform air cleaning only when replacing workpiece. Plunger will rise during air cleaning.

Double acting

model **CSW-D□M-□**



Hydraulic and pneumatic circuit diagram



Specifications	page → 935
Hydraulic pressure & support force	page → 935
Applied load & deformation	page → 935
Dimensions	page → 936
Mounting details	page → 936

Specifications

CSW－D [Size: 06 / 10 / 16 / 25] M－ [Plunger stroke]

L : Standard stroke

D : Long stroke (only for CSW-D06)

(grey box) indicates made to order.

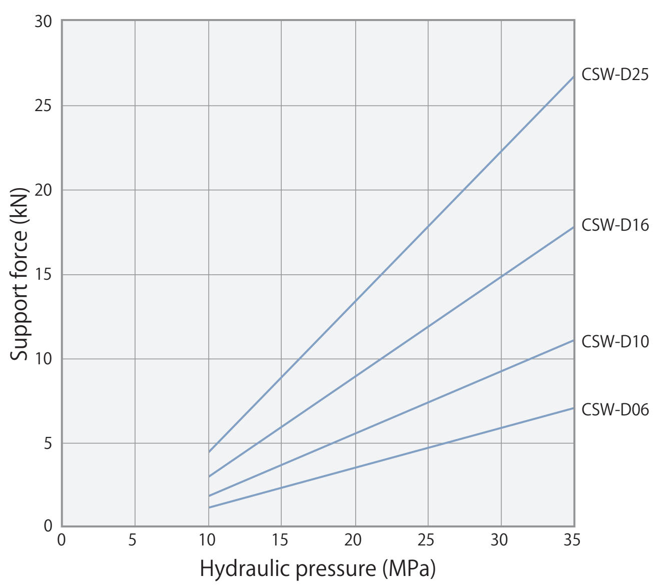
Model		CSW-D06M-L 8 mm stroke	CSW-D06M-D 15 mm stroke	CSW-D10M-L	CSW-D16M-L	CSW-D25M-L
Support force (hydraulic pressure 35MPa)*1	kN	7.1		11.1	17.8	26.7
Cylinder capacity	cm^3	1.5	2.0	2.9	5.5	5.7
Lift spring force*2	N	6–11	4–11	10–16	16–29	25–45
Plunger stroke	mm	8	15	10	10	13
Max. allowable mass of head cap	kg	0.1		0.1	0.2	0.2
Mass	kg	0.30	0.34	0.47	1.00	2.01
Recommended tightening torque of body	N·m	35	35	60	130	250

- Pressure range：10–35 MPa
- Proof pressure：52.5 MPa
- Max. allowable back pressure：0.05 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：When work support and clamp are used facing each other, work support and clamp must be selected in such a way that the support force is 1.5 times the applied load (clamping force + machining force).

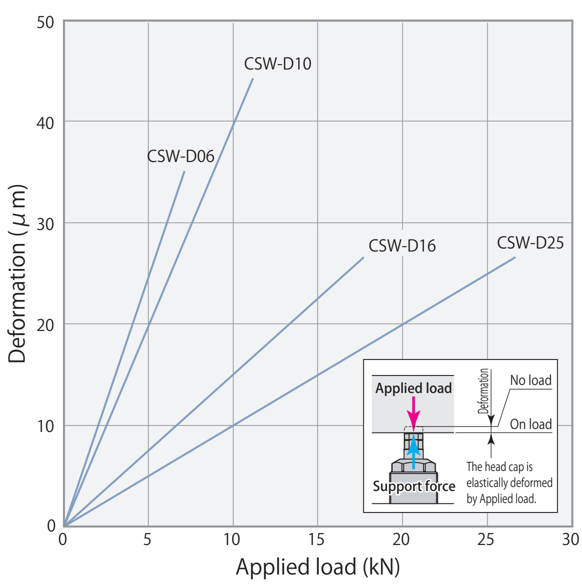
∗2：Figures are for “upper end to lower end” of plunger action.

Hydraulic pressure & support force



Hydraulic pressure MPa	Support force kN			
	CSW-D06	CSW-D10	CSW-D16	CSW-D25
10	1.2	1.9	3.0	4.5
15	2.3	3.7	6.0	8.9
20	3.5	5.6	8.9	13.4
25	4.7	7.4	11.9	17.8
30	5.9	9.3	14.8	22.3
35	7.1	11.1	17.8	26.7

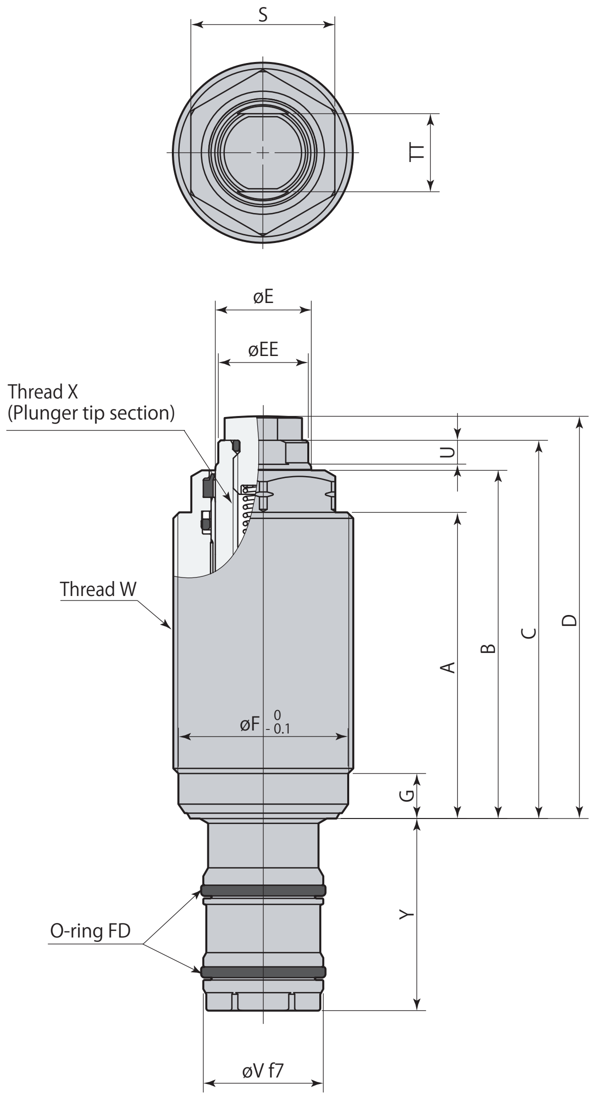
Applied load & deformation



Applied load kN	Deformation μm			
	CSW-D06	CSW-D10	CSW-D16	CSW-D25
0	0	0	0	0
5	25	20	7.5	5
10		40	15	10
15			22.5	15
20		Nonusable range		20
25				25
30				

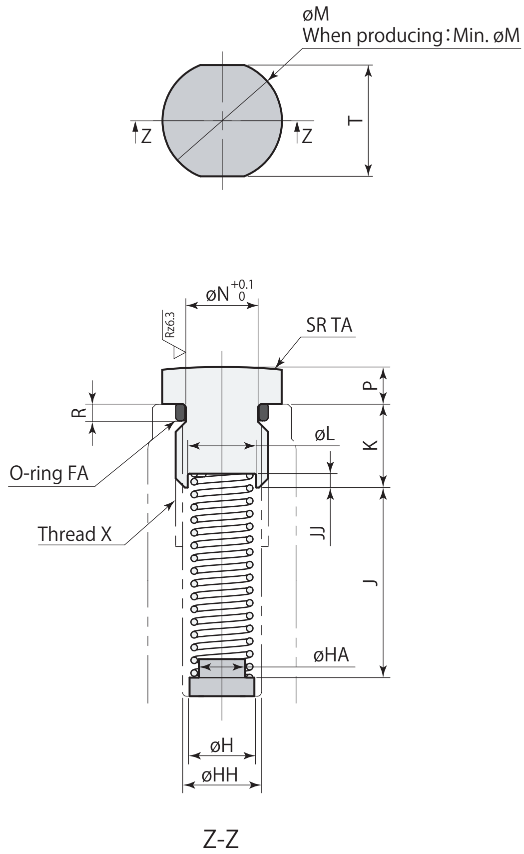
Held with hydraulic pressure of 35 MPa.

Dimensions

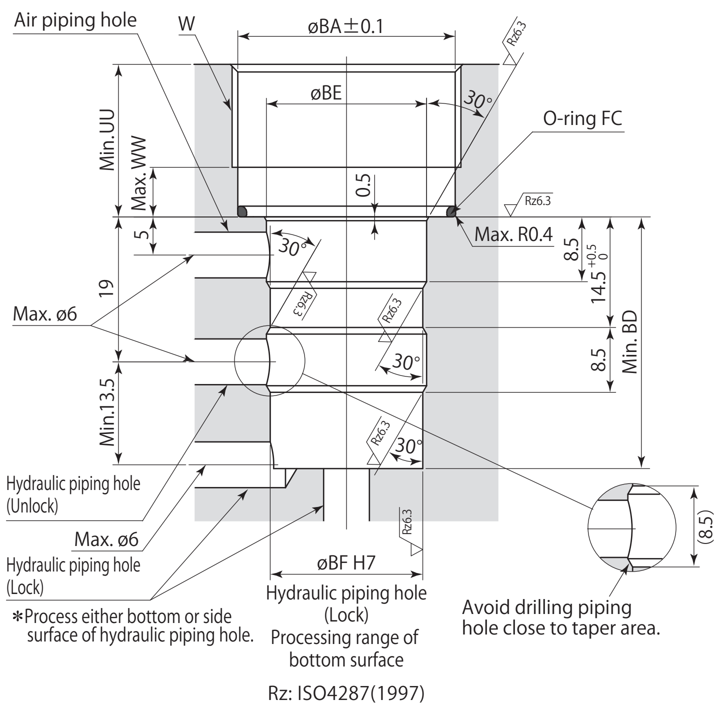


Head cap details

Hardness：HRC52



Mounting details



- When fixing the hexagon part of body with a vise, etc., make sure the tightening force is 2.5 kN or less.
- Always attach head cap (lift spring cannot be retained). When fabricating head cap, ensure that O-ring slot, spring spot facing and guide are made by referring to head cap details. Be sure to always use O-ring.
- When fabricating a lift spring, determine dimensions by referring to head cap details. Furthermore, rustproofing must be implemented (however, there is no guarantee for operation).
- Install O-ring FC at the bottom of the hole. The O-ring FC is packed with a work support.
- This diagram indicates a situation where head cap has been fitted into plunger with no pressure applied.

mm

Model	CSW-D06M-L	CSW-D06M-D	CSW-D10M-L	CSW-D16M-L	CSW-D25M-L
A	51	58	58	59.5	68.5
B	58	65	67	71.8	82
C	63	70	73	78	89
D	67	74	77	84	96
øE	16	16	20	30	40
øEE	15	15	19	29	39
øF	28.3	28.3	33.2	48.2	63.2
G	7.5	7.5	7.5	7.5	8
øH	7	7	7	8.5	10
øHA	5	5	5	6	7.5
øHH	8.5	8.5	10.3	14	14
J	20.5	21.3	25.5	25	32.5
JJ	1.5	1.5	3.5	1.5	1.5
K	9	9	11	12	11
øL	7.4	7.4	7.6	9.2	11.2
øM	12.9	12.9	16.9	23	30
Min. øM	12.5	12.5	16	21	21
øN	7.8	7.8	8.9	13.3	13.3
P	4	4	4	6	7
R	1.9	1.9	3	2.4	2.4
S	24	24	30	41	55
T (width across flats)	12	12	14	19	24
TA	70	70	90	110	140
TT (plunger width across flats)	13	13	17	24	32
U	4	4	5	5	5.7
UU	15.5	15.5	15.5	15.5	20
øV	$20^{-0.020}_{-0.041}$	$20^{-0.020}_{-0.041}$	$22^{-0.020}_{-0.041}$	$27^{-0.020}_{-0.041}$	$30^{-0.020}_{-0.041}$
W	M30×1.5	M30×1.5	M35×1.5	M50×1.5	M65×1.5
WW	6.5	6.5	6.5	6.5	7
X (recommended tightening torque)	M10×1.5 depth 13 (30 N·m)	M10×1.5 depth 13 (30 N·m)	M12×1.75 depth 16 (50 N·m)	M16×2 depth 20 (100 N·m)	M16×2 depth 20 (100 N·m)
Y	32	33	34	35	38
O-ring FA (fluorocarbon hardness Hs70)	S8	S8	P9	AS568-014	AS568-014
O-ring FC (fluorocarbon hardness Hs90)	AS568-022	AS568-022	AS568-025	S45	AS568-036
O-ring FD (Urethane hardness Hs90)	AS568-017	AS568-017	AS568-018	AS568-021	AS568-023
BA	28.5	28.5	33.5	48.5	63.5
BD	33	34	35	36	39
BE	21	21	23	28	31
BF	$20^{+0.021}_{0}$	$20^{+0.021}_{0}$	$22^{+0.021}_{0}$	$27^{+0.021}_{0}$	$30^{+0.021}_{0}$

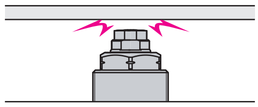
Caution in use

- The lift spring in the plunger may push the workpiece upward if it is light weight and seating detection cannot be complete. Review the weight of workpiece or lift spring force and make it appropriate to seat the workpiece perfectly and acutate the work support.

- Set the plunger lifting time to 0.2 seconds or longer by adjusting the flow control valve with check valve (meter-in). Reasonable plunger ascending speed can prevent the parts from breakage also curbs plunger contact false.
Use a flow control valve with cracking pressure of 0.05MPa or less, in order to shorten plunger descending speed.

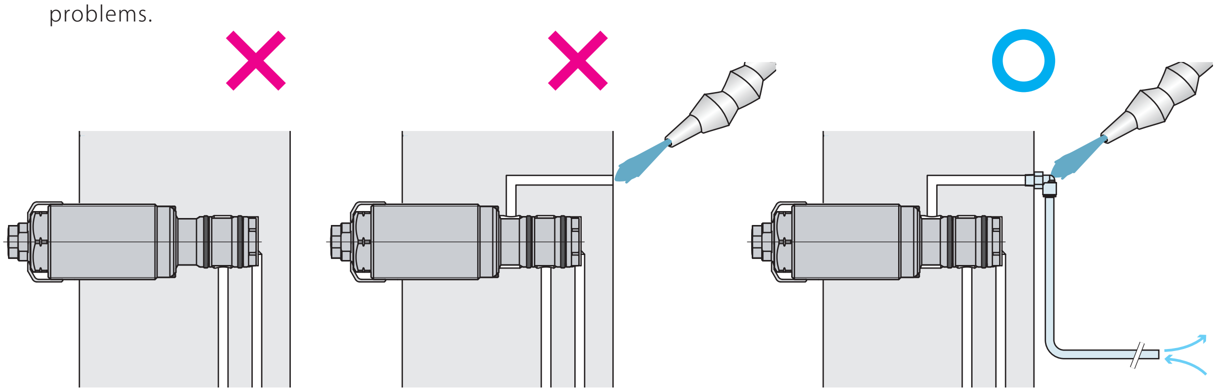
If the plunger ascends to reach a workpiece too fast, it rebounds after hitting the workpice and will create a small clearance between the two. The clearance may cause a supporting fault of the workpiece.

Rebound and clearance



- Avoid following usages. These may cause sleeve deformation that could lead to malfunction of plunger or decreased support force.
  - ✕ Applying eccentric load on plunger.
  - ✕ Applying load that exceeds rated support force.
  - ✕ Rotating plunger when locked.

- Air vent must be opened to atmosphere. Any blockage on the vent results in malfunction. Provide the piping if there is a risk of coolant or metal chips intrusion. Allowing intrusion of cutting fluid may cause rusting and other problems.

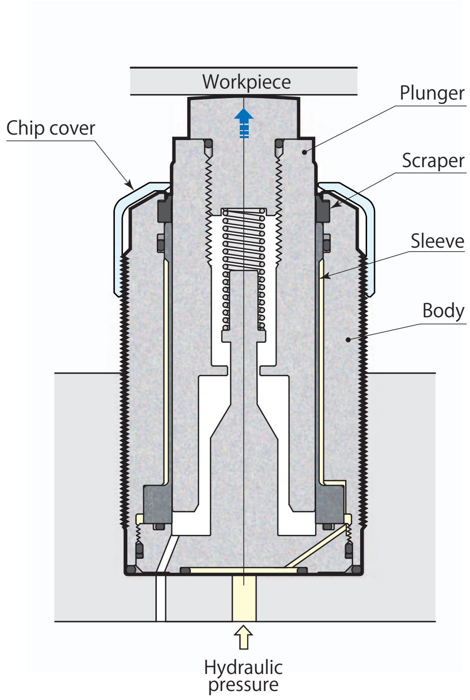


Air vent is blocked — Cutting fluid intrusion from air vent — Piping to metal chips or coolant free area

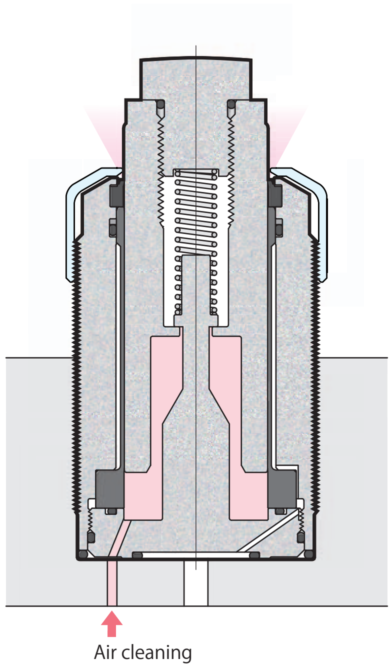
- Air (oil free) must be fed through a 5 μm filter that is connected to an air vent port for air cleaning.
Perform air cleaning only when replacing workpiece. Plunger will rise during air cleaning.

Spring lift

model **CSV□M-L**

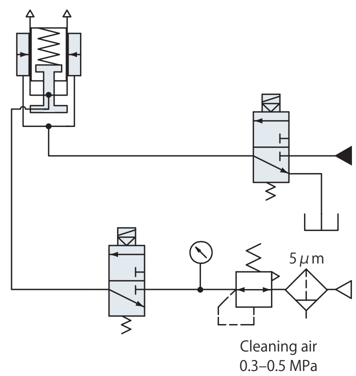


Lock



Unlock

Hydraulic and pneumatic circuit diagram



Specifications page → 941
Hydraulic pressure & support force page → 941
Applied load & deformation page → 941
Dimensions page → 942
Mounting details page → 942

Specifications

Size: 06 / 10 / 16 / 25 — Plunger stroke

CSV [06 | 10 | 16 | 25] M − L : Standard stroke

Model		CSV06M-L	CSV10M-L	CSV16M-L	CSV25M-L
Support force (hydraulic pressure 35MPa)*1	kN	7.1	11.1	17.8	26.7
Cylinder capacity	cm^3	1.5	2.9	5.5	5.7
Lift spring force*2	N	6–11	10–16	16–29	25–45
Plunger stroke	mm	8	10	10	13
Max. allowable mass of head cap	kg	0.1	0.1	0.2	0.2
Mass	kg	0.28	0.42	1.02	1.90
Recommended tightening torque of body	N·m	35	60	130	250

● Pressure range：10–35 MPa　● Proof pressure：52.5 MPa　● Operating temperature：0–70℃

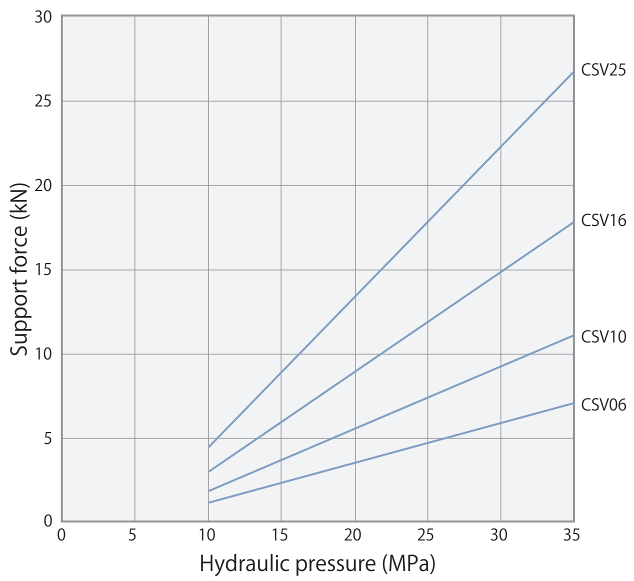
● Fluid used：General mineral based hydraulic oil (ISO-VG32 equivalent)

● Seals are resistant to chlorine-based cutting fluid. (not thermal resistant specification)

∗1：When work support and clamp are used facing each other, work support and clamp must be selected in such a way that the support force is 1.5 times the applied load (clamping force + machining force).

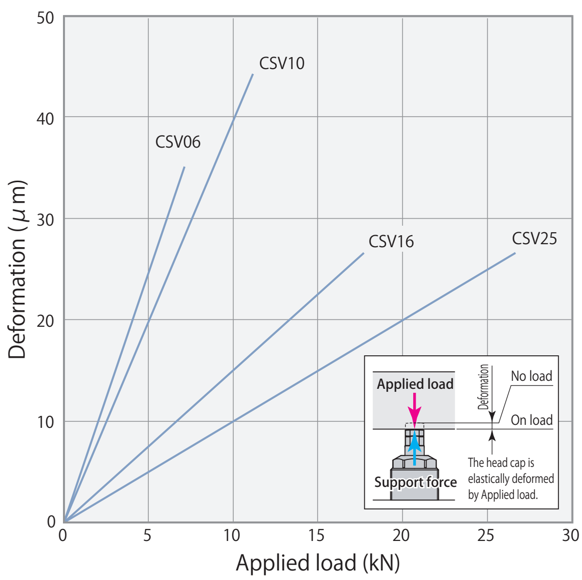
∗2：Figures are for “upper end to lower end” of plunger action.

Hydraulic pressure & support force



Hydraulic pressure MPa	Support force kN			
	CSV06	CSV10	CSV16	CSV25
10	1.2	1.9	3.0	4.5
15	2.3	3.7	6.0	8.9
20	3.5	5.6	8.9	13.4
25	4.7	7.4	11.9	17.8
30	5.9	9.3	14.8	22.3
35	7.1	11.1	17.8	26.7

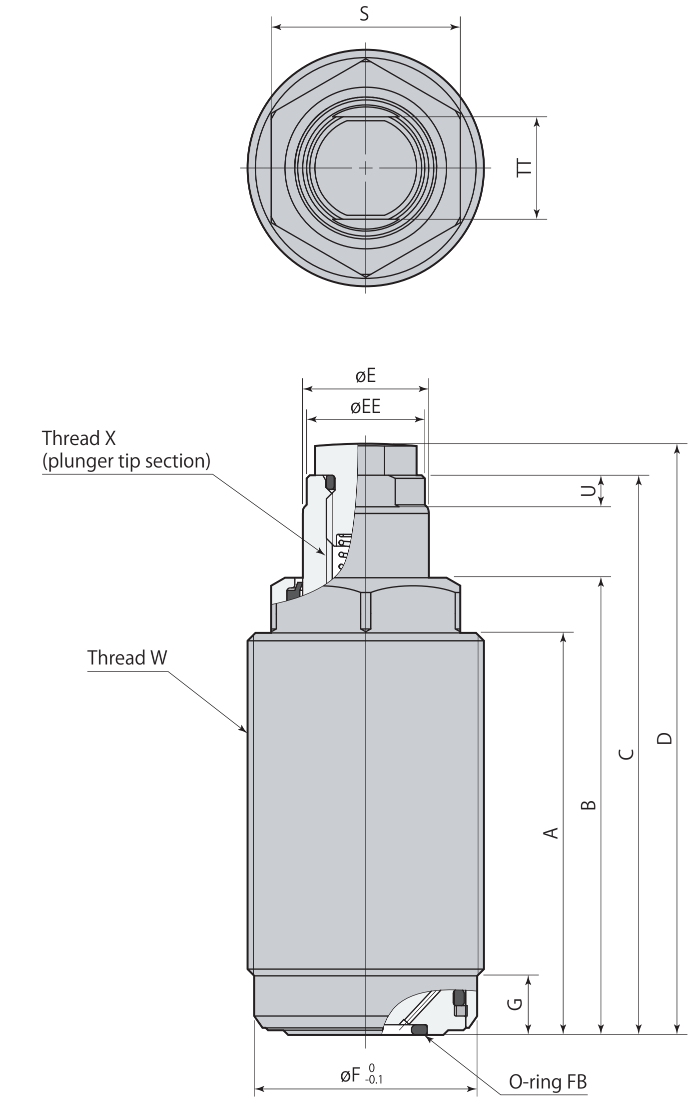
Applied load & deformation



Applied load kN	Deformation μm			
	CSV06	CSV10	CSV16	CSV25
0	0	0	0	0
5	25	20	7.5	5
10		40	15	10
15			22.5	15
20		Nonusable range		20
25				25
30				

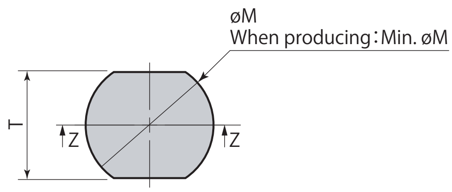
Held with hydraulic pressure of 35 MPa.

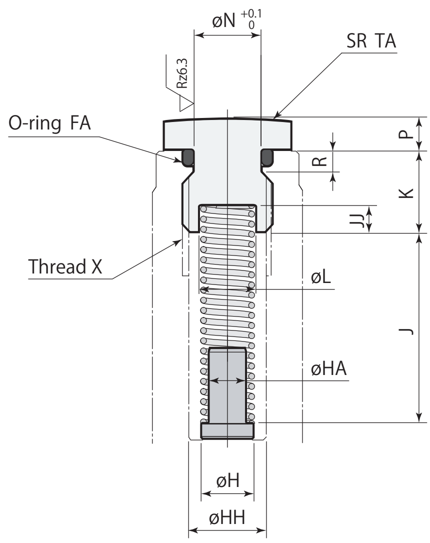
Dimensions



Head cap details

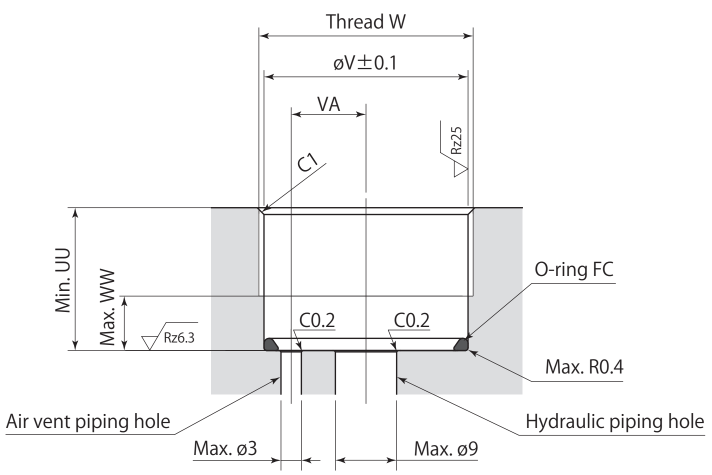
Hardness：HRC52





Z-Z

Mounting details



Rz: ISO4287(1997)

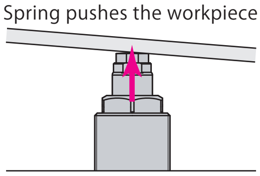
- When fixing the hexagon part of body with a vise, etc., make sure the tightening force is 2.5 kN or less.
- Always attach head cap (lift spring cannot be retained). When fabricating head cap, ensure that O-ring slot, spring spot facing and guide are made by referring to head cap details. Be sure to always use O-ring.
- When fabricating a lift spring, determine dimensions by referring to head cap details. Furthermore, rustproofing must be implemented (however, there is no guarantee for operation).
- Install O-ring FC at the bottom of the hole. The O-ring FC is packed with a work support.
- This diagram indicates a situation where head cap has been fitted into plunger with no pressure applied.

mm

Model	CSV06M-L	CSV10M-L	CSV16M-L	CSV25M-L
A	51	58	59.5	68.5
B	58	67	71.8	82
C	71	83	88	102
D	75	87	94	109
øE	16	20	30	40
øEE	15	19	29	39
øF	28.3	33.2	48.2	63.2
G	7.5	7.5	7.5	8
øH	7	7	8.5	10
øHA	5	5	6	7.5
øHH	8.5	10.3	14	14
J	20.5	25.5	25	32.5
JJ	1.5	3.5	1.5	1.5
K	9	11	12	11
øL	7.4	7.6	9.2	11.2
øM	12.9	16.9	23	30
Min. øM	12.5	16	21	21
øN	7.8	8.9	13.3	13.3
P	4	4	6	7
R	1.9	3	2.4	2.4
S	24	30	41	55
T (width across flats)	12	14	19	24
TA	70	90	110	140
TT (plunger width across flats)	13	17	24	32
U	4	5	5	5.7
UU	15.5	15.5	15.5	20
øV	28.5	33.5	48.5	63.5
VA	11	12	18	23.5
W	M30×1.5	M35×1.5	M50×1.5	M65×1.5
WW	6.5	6.5	6.5	7
X (recommended tightening torque)	M10×1.5 depth 13 (30 N·m)	M12×1.75 depth 16 (50 N·m)	M16×2 depth 20 (100 N·m)	M16×2 depth 20 (100 N·m)
O-ring FA (fluorocarbon hardness Hs70)	S8	P9	AS568-014	AS568-014
O-ring FB (fluorocarbon hardness Hs90)	AS568-014	AS568-015	AS568-019	AS568-022
O-ring FC (fluorocarbon hardness Hs90)	AS568-022	AS568-025	S45	AS568-036

Caution in use

● If the workpiece is light weight, the plunger cannot be pressed down by the weight of workpiece and seating detection cannot be complete. Review the weight of workpiece or lift spring force to make the workpiece seat perfectly, and lock the work support.



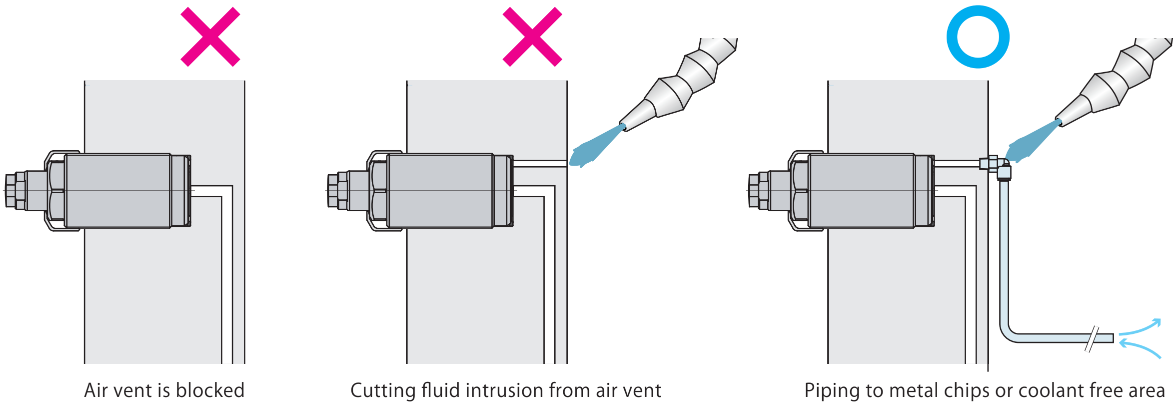
● Avoid following usages. These may cause sleeve deformation that could lead to malfunction of plunger or decreased support force.

×Applying eccentric load on plunger.

×Applying load that exceeds rated support force.

×Rotating plunger when locked.

● Air vent must be opened to atmosphere. Any blockage on the vent results in malfunction. Provide the piping if there is a risk of coolant or metal chips intrusion. Allowing intrusion of cutting fluid may cause rusting and other problems.

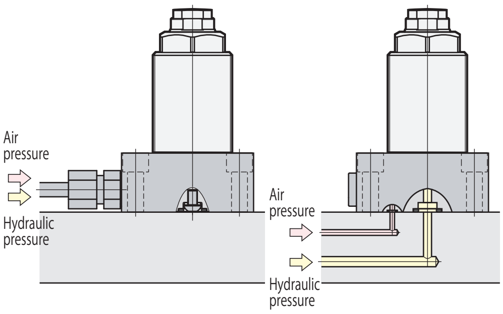


● Air (oil free) must be fed through a 5 μm filter that is connected to an air vent port for air cleaning.
Perform air cleaning only when replacing workpiece.

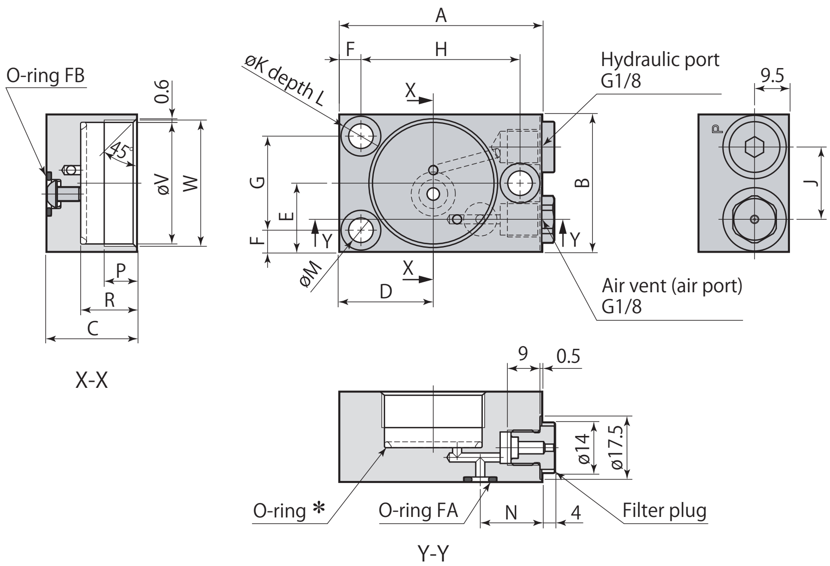
Specifications

Size		Option code		
CSP 06	M —	N	: Flange	page →946
CSP 10	M —	Q	: Piping cap	page →948
CSP 16	M —	L	: Locknut	page →948
CSP 25	M —	J	: Chip cover	page →948

Flange

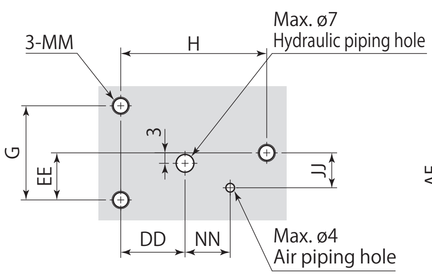


Flange is available for G port piping and manifold piping.



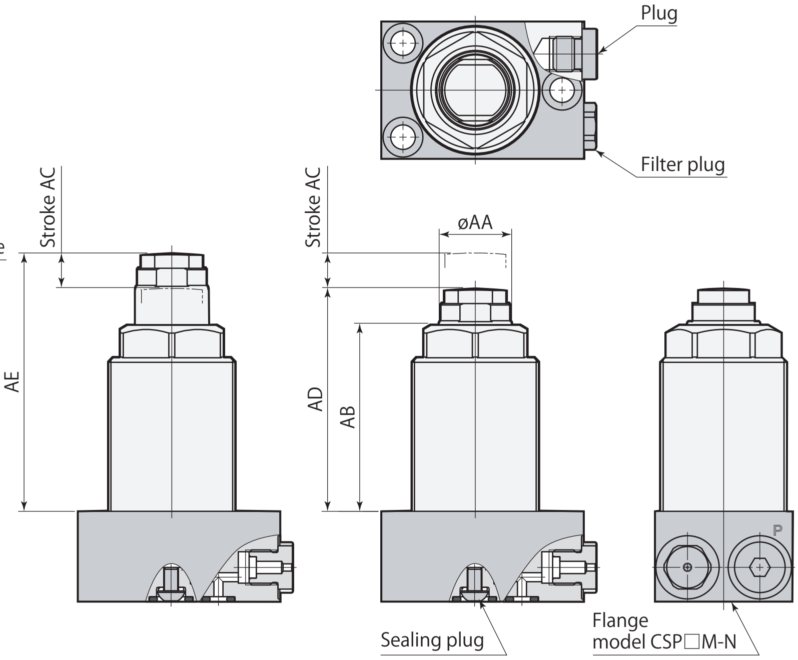
*: Install O-ring in the same way even when a flange is used for mounting. The O-ring is included in the package of the work support.

Mounting details



The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997) for manifold piping.

Work support mounting dimensions

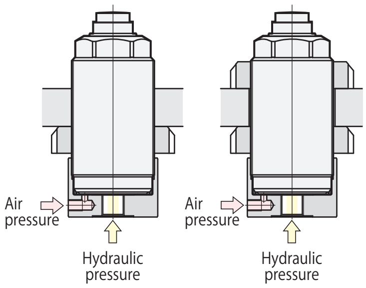


mm

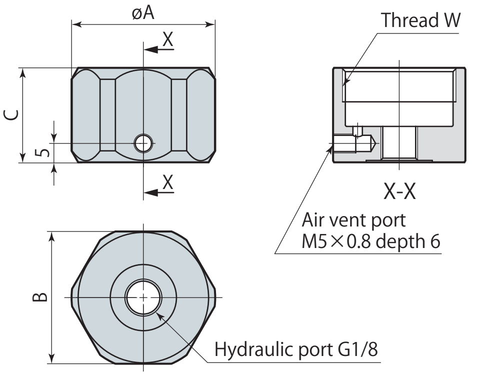
Flange	CSP06M-N		CSP10M-N	CSP16M-N	CSP25M-N
Work support	CSW06M-L CSV06M-L	CSW06M-D	CSW10M-L CSV10M-L	CSW16M-L CSV16M-L	CSW25M-L CSV25M-L
A	49	49	56	66.5	83.5
B	38	38	38	60	75
C	25	25	25	25	30
D	21	21	26	29	36
E	19	19	19	30	37.5
F	5	5	6	6	8
G	28	28	26	48	59
H	37.5	37.5	44	54.5	68
J	20	20	20	24	30
K	9.5	9.5	11	11	14
L	6.5	6.5	8	8	11
M	5.5	5.5	6.8	6.8	8.5
N	16	16	17	22	25
P	9	9	9	9	12
R	15.5	15.5	15.5	15.5	20
øV	28.5	28.5	33.5	48.5	63.5
W	M30×1.5	M30×1.5	M35×1.5	M50×1.5	M65×1.5
O-ring FA (fluorocarbon hardness Hs70)	P6	P6	P6	P6	P6
O-ring FB (fluorocarbon hardness Hs90)	P9	P9	P9	P9	P9
øAA	16	16	20	30	40
AB	42.5	49.5	51.5	56.3	62
AC	8	15	10	10	13
AD	51.5	58.5	61.5	68.5	76
AE	59.5	–	71.5	78.5	89
DD	16	16	20	23	28
EE	14	14	13	24	29.5
JJ	10	10	10	12	15
MM	M5	M5	M6	M6	M8
NN	12	12	13	15.5	22.5

- Remove the plug of fitting port to be used when mounting.
- Mounting screws are not included.
- If the air vent is directly subjected to the coolant, extend the piping to a location that is not subjected to the coolant and make the air vent open to atmosphere.

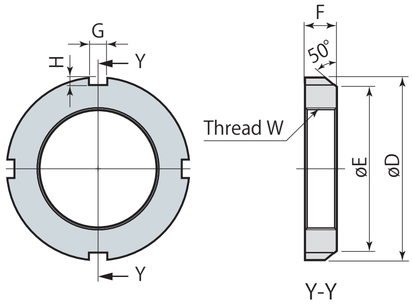
Piping cap, locknut



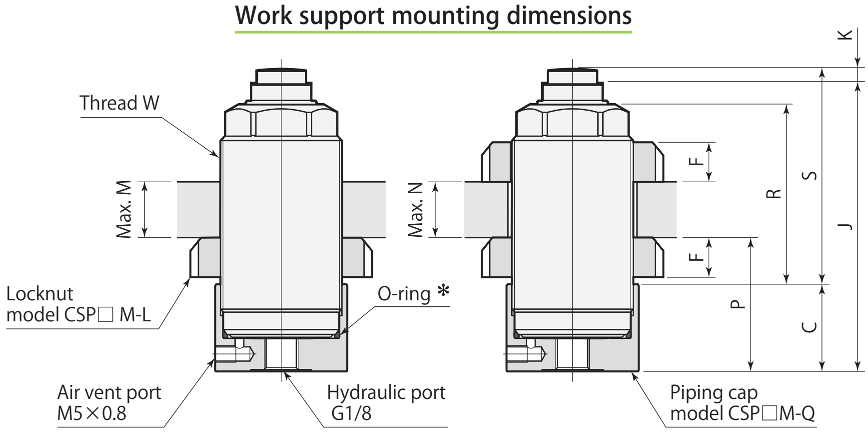
Piping cap



Locknut

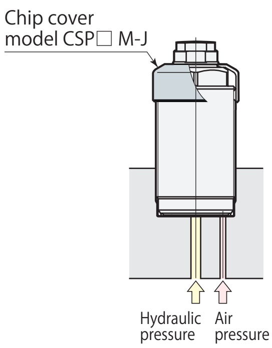


Work support mounting dimensions

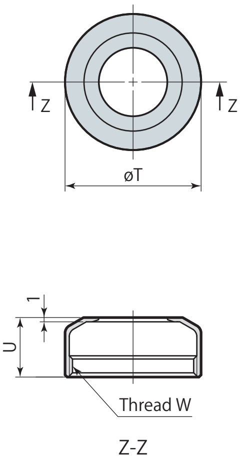


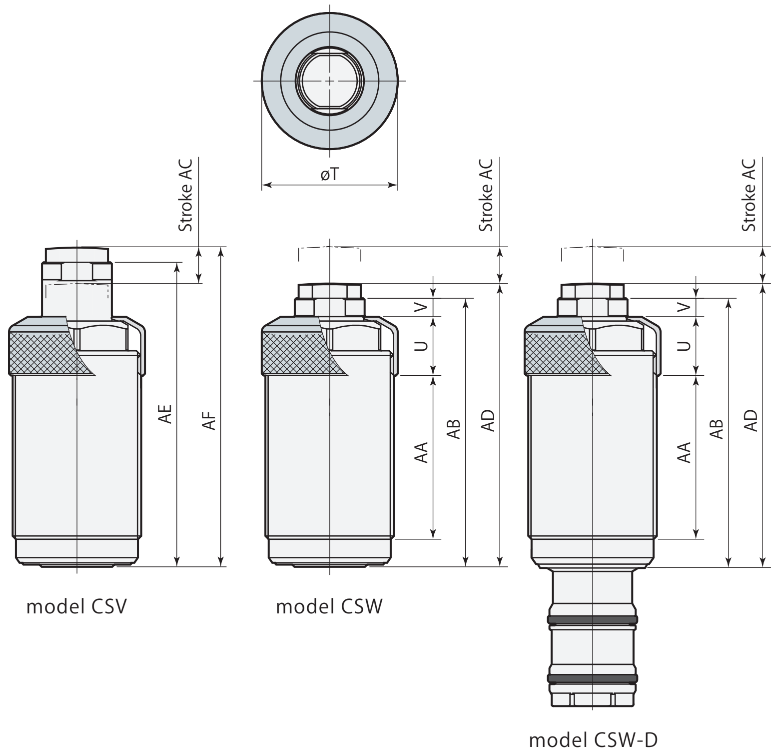
∗: Install O-ring in the same way even when a piping cap is used for mounting.
The O-ring is included in the package of the work support.

Chip cover



Work support mounting dimensions





mm

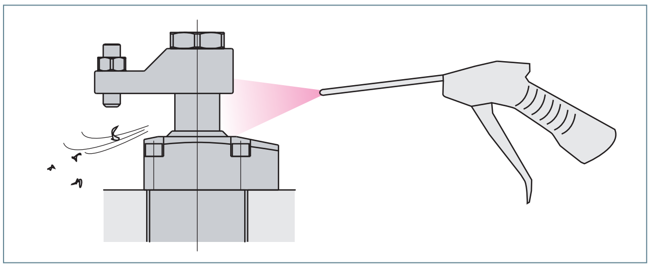
Piping cap	CSP06M-Q		CSP10M-Q	CSP16M-Q	CSP25M-Q
Locknut	CSP06M-L		CSP10M-L	CSP16M-L	CSP25M-L
Work support	CSW06M-L CSV06M-L	CSW06M-D	CSW10M-L CSV10M-L	CSW16M-L CSV16M-L	CSW25M-L CSV25M-L
øA	38	38	41	60	76
B	35	35	38	55	70
C	25	25	25	25	28.5
øD	45	45	52	70	85
øE	38	38	44	61	79
F	7	7	8	11	12
G	5	5	5	6	7
H	2	2	2	2.5	3
J*	72.5	79.5	82.5	87.5	98.5
K	4	4	4	6	7
M	26.5	33.5	32.5	30.9	35
N	19.5	26.5	24.5	19.9	23
P	33	33	34	37	41.5
R	42.5	49.5	51.5	56.3	63
S*	51.5	58.5	61.5	68.5	77
W	M30×1.5	M30×1.5	M35×1.5	M50×1.5	M65×1.5

∗:Stroke length to be added on J and S dimension when mounting on model CSV.

mm

Chip cover	CSP06M-J		CSP10M-J	CSP16M-J	CSP25M-J
Work support	CSW06M-L CSW-D06M-L CSV06M-L	CSW06M-D CSW-D06M-D	CSW10M-L CSW-D10M-L CSV10M-L	CSW16M-L CSW-D16M-L CSV16M-L	CSW25M-L CSW-D25M-L CSV25M-L
øT	32	32	37	52	68
U	14	14	16	20	21
V	4	4	5	5.2	6
W	M30×1.5	M30×1.5	M35×1.5	M50×1.5	M65×1.5
AA	37.5	44.5	44.5	45.3	54
AB	63	70	73	78	89
AC	8	15	10	10	13
AD	67	74	77	84	96
AE	71	–	83	88	102
AF	75	–	87	94	109

Caution in use of equipment



1. Clamp and work supports have been developed for the purpose of clamping workpiece for machine tools.
   Do not use them for other purposes.

2. Always protect them with a cover to ensure sliding surfaces are not exposed to weld slags when using them as jig for welding.

3. Clean sliding surfaces and top part of clamp body with air blowing periodically to ensure smooth operations.

Caution for hydraulic piping

1. Most problems that occur with hydraulic equipment are caused by foreign substances such as metal chips and dust that enter into hydraulic circuits. Refer to "Piping Hydraulic & Pneumatic Equipment-Practical Notes" provided with the product for mounting and hydraulic piping of the product.

2. After performing hydraulic piping, always be sure to bleed out air in the hydraulic circuit. Insufficient bleeding can lead to malfunction.

3. When using multiple clamps, operating speeds and timings vary due to variance in pipe resistance and internal resistance of clamps. Adjust operating speeds and timings using flow control valve.

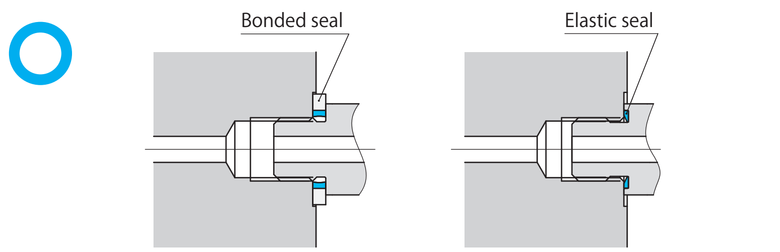
G port sealing method

1. "Sealing method for flange surfaces" has been adopted as standard means for this product. Use fittings and connectors of bonded seal or elastic body seal. Do not use fittings of "Sealing method for tapered surfaces" (O-ring seal method).

2. Seal tapes and liquid packing are not necessary. Seal fittings are included with packing.

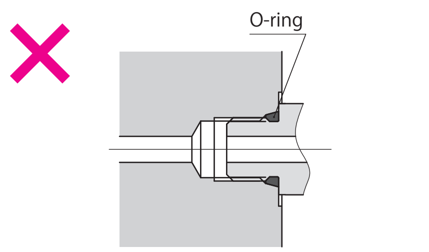
3. When mounting, clean metal chips and dust off surfaces that will come into contact with packing.

Sealing method for flange surfaces



Use bonded seal or elastic seal for flat surfaces.

Sealing method for tapered surfaces



Seal tapered surface with an O-ring.

G port details

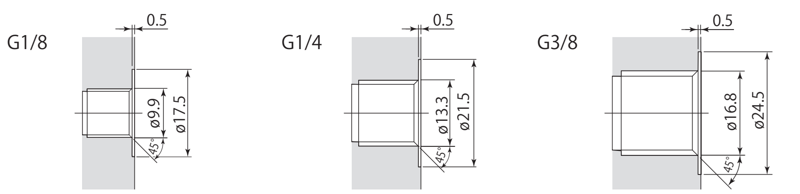


Table of contents

Non-leak coupler

35MPa

model WVP

model WVP-2HPH

model WVP-2HSH

model WVP-2SPH

model WVP-2SSH

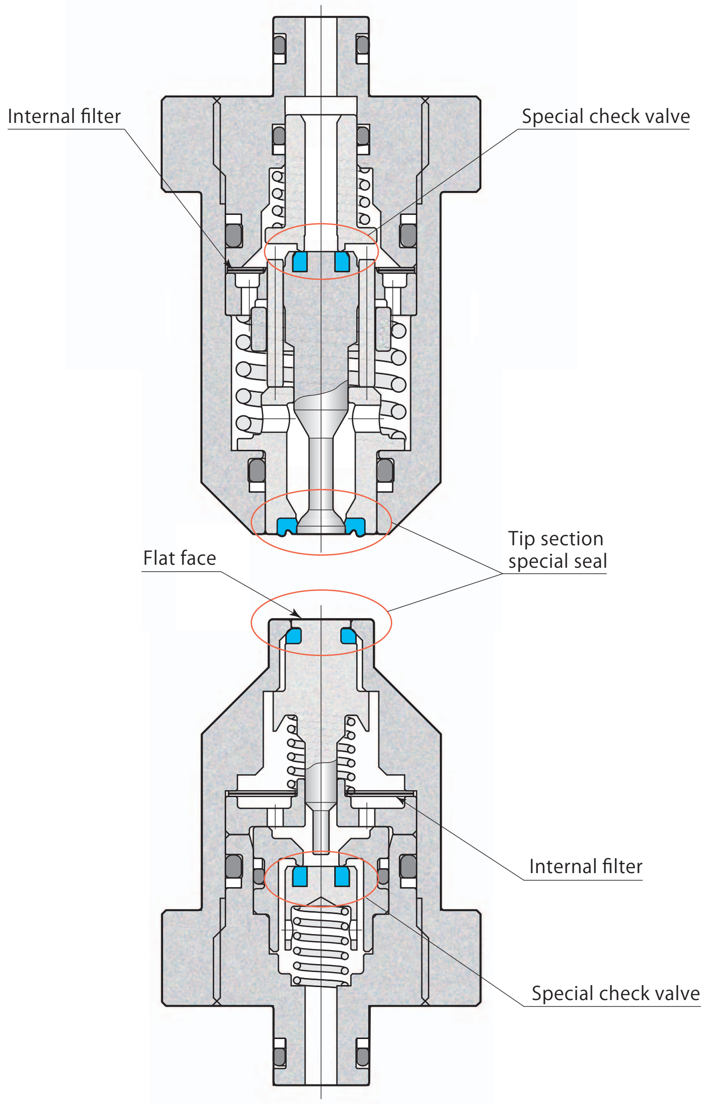
Special seal mechanism ensures leak of operating oil is zero for connecting and disconnecting

35 MPa Non-leak coupler socket

model **WVP-2HSH**

35 MPa Non-leak coupler plug

model **WVP-2HPH**



Spill amount (liquid drip amount per connection or disconnection) 0.01 mL or less

- Special seal installed on the tip of coupler socket and coupler plug can minimize the intrusion of air and spill of working fluid during connection and disconnection, furthermore, it prevents corruption of coolant by being miscible with spilled working fluid and air contamination of clamp circuit.
- Model WVP-2H incorporates filter and protects internal check valves and clamps from foreign substances.
- Connection and disconnection, which had been difficult to perform with conventional couplers while hydraulic pressure is applied, can be performed smoothly.
- Pressure in the circuit is retained for a long time after disconnection of coupler.

Specifications

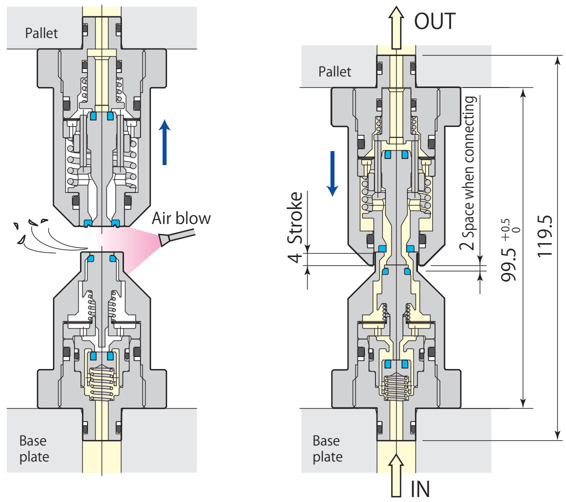
Pressure range	7–35 MPa	Circuit symbol 
Proof pressure	52.5 MPa	
Orifice area	12.5 mm²	
Fluid used	General mineral based hydraulic oil (ISO-VG32 equivalent)	
Allowable eccentricity	±0.4 mm	Plug hydraulic pressure source 35MPa
Allowable inclination	0.2° or less	Connect/disconnect under pressure : Capable
Reactive force*	154 N per 1 MPa fluid pressure	
	Max. spring force for no pressure 157 N	
Operating temperature	0–70 ℃	
Mass	WVP-2HSH : 310g WVP-2HPH : 260g WVP-2HDH : 230g	

＊: Reactive force (N) = Fluid pressure (MPa) ×154+157

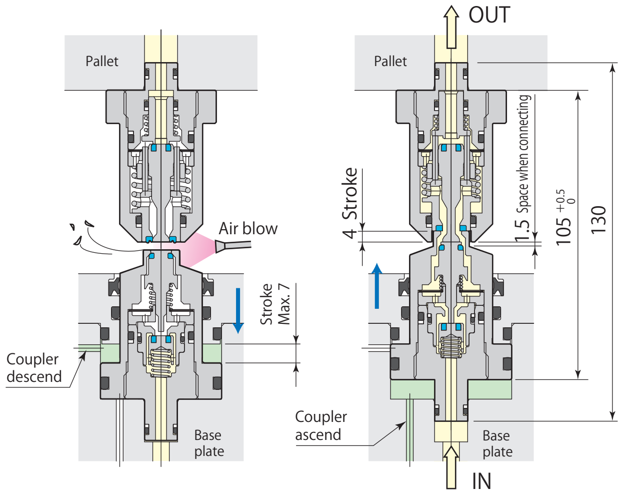
- Supply operating oil from plug.
- Mixed use with model WVP-2S□H is not possible.

Non-leak coupler fixed

Coupler lower section hydraulic pressure supply

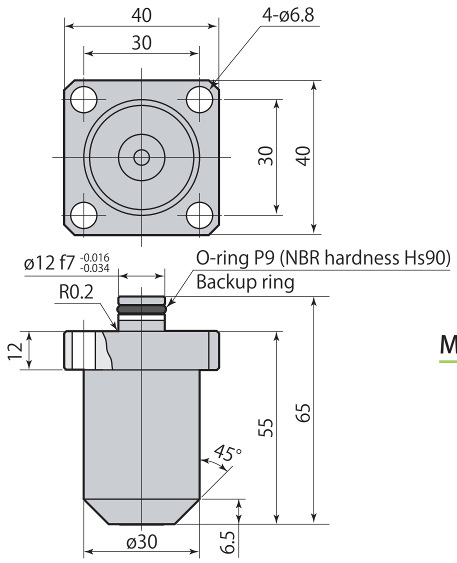


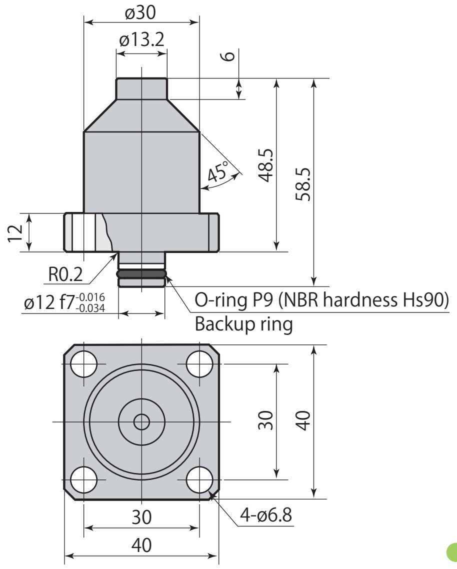
Non-leak coupler float



Dimensions

WVP-2HSH socket (fixed)

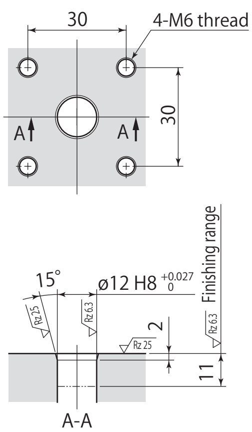




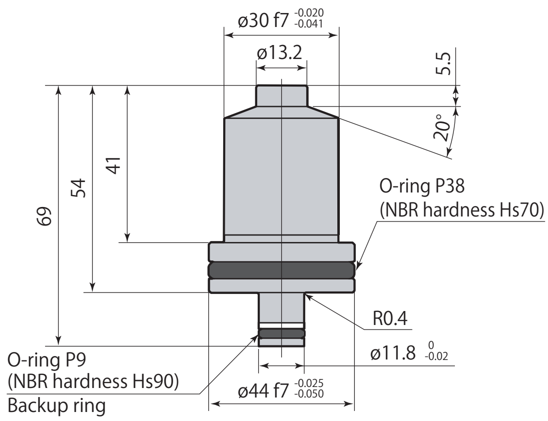
WVP-2HPH plug (fixed)

Mounting details

WVP-2HSH
WVP-2HPH

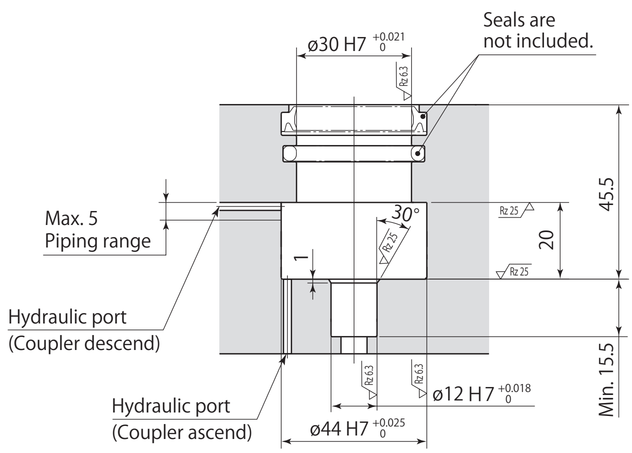


WVP-2HDH plug (floating)



Mounting details

WVP-2HDH



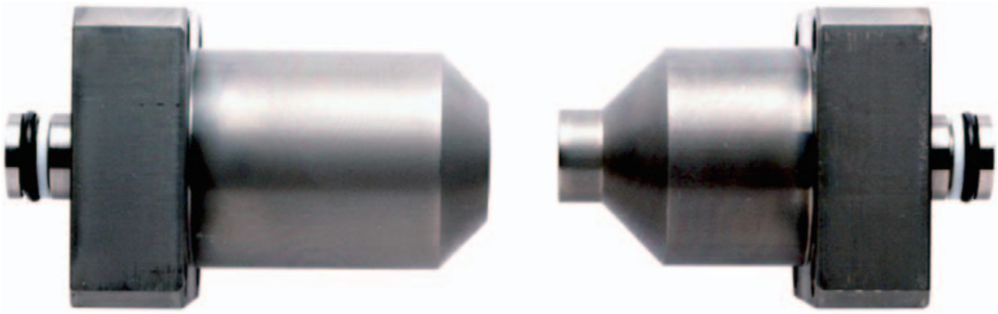
● Mounting screws are not included.

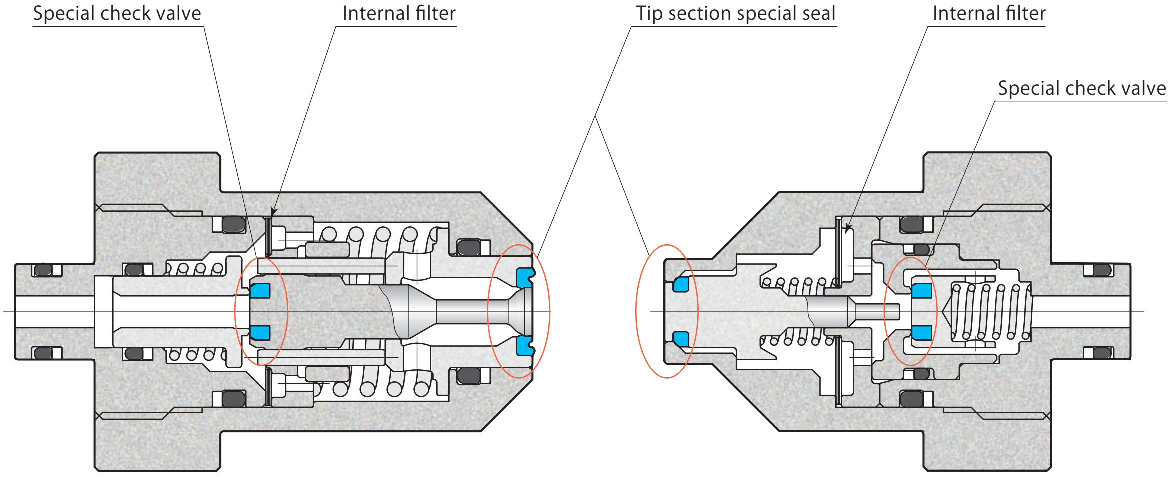
Rz: ISO4287(1997)

Special seal mechanism ensures leak of operating oil is zero for connecting and disconnecting

35 MPa Non-leak coupler socket
model **WVP-2SSH**

35 MPa Non-leak coupler plug
model **WVP-2SPH**

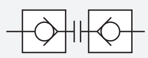




Spill amount (liquid drip amount per connection or disconnection) 0.01 mL or less

- Special seal installed on the tip of coupler socket and coupler plug can minimize the intrusion of air and spill of working fluid during connection and disconnection, furthermore, it prevents corruption of coolant by being miscible with spilled working fluid and air contamination of clamp circuit.
- Model WVP-2S incorporates filter and protects internal check valves and clamps from foreign substances.
- Connection and disconnection, which had been difficult to perform with conventional couplers while hydraulic pressure is applied, can be performed smoothly.
- Pressure in the circuit is retained for a long time after disconnection of coupler.
- Jig pallet fabrication cost is kept low by using an economically priced plug for coupler of pallet.

Specifications

Pressure range	7–35 MPa	Circuit symbol
Proof pressure	52.5 MPa	
Orifice area	12.5 mm^2	
Fluid used	General mineral based hydraulic oil (ISO-VG32 equivalent)	Socket hydraulic pressure source 35MPa
Allowable eccentricity	±0.4 mm	Connect/disconnect under pressure : Capable
Allowable inclination	0.2° or less	
Reactive force*	154 N per 1 MPa fluid pressure	
	Max. spring force for no pressure 162 N	
Operating temperature	0–70 ℃	
Mass	WVP-2SSH : 330g　WVP-2SPH : 270g	

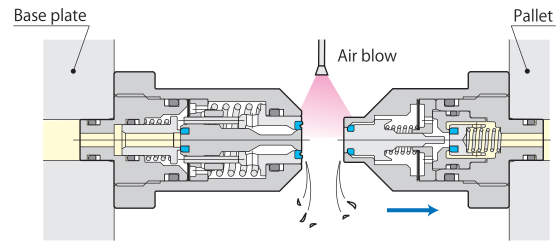
＊: Reactive force (N) = Fluid pressure (MPa) ×154+162

- Supply operating oil from socket.
- Mixed use with model WVP-2H□H is not possible.

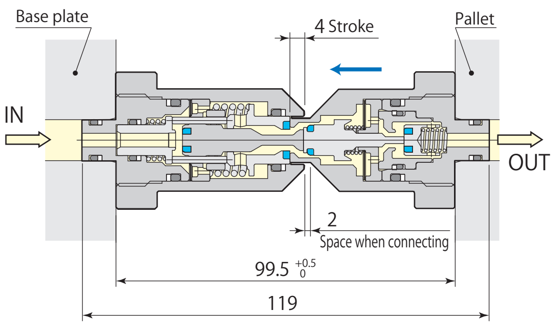
Non-leak coupler fixed

Horizontal mounting of coupler

Disconnected condition



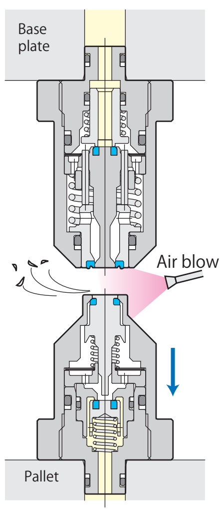
Connected condition



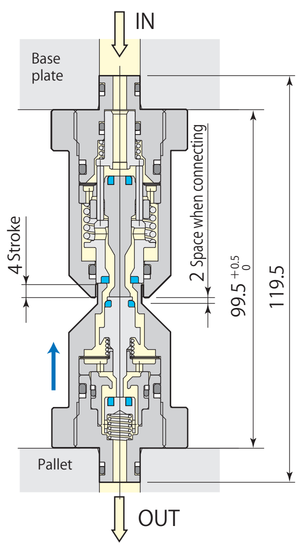
Non-leak coupler fixed

Coupler upper section hydraulic pressure supply

Disconnected condition



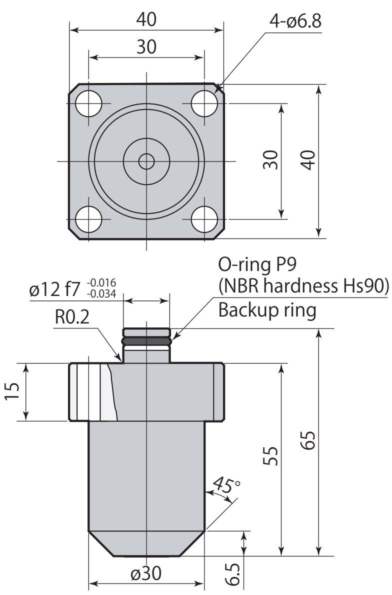
Connected condition

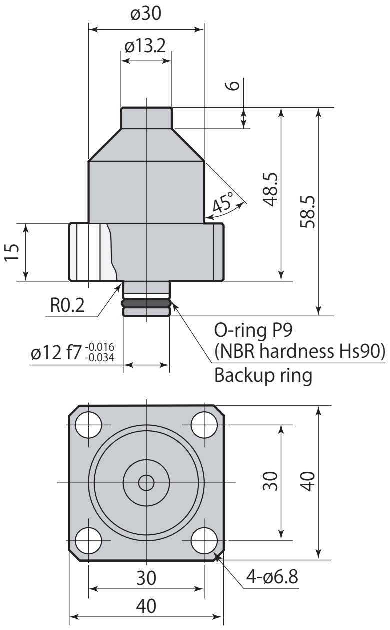


- Perform installation with plug below so metal chips are less likely to adhere and air blowing can be performed properly.

Dimensions

WVP-2SSH socket (fixed)



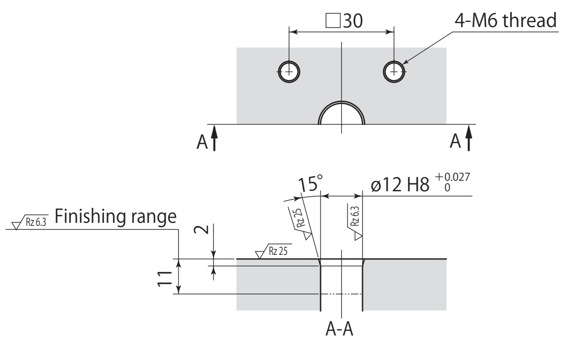


WVP-2SPH plug (fixed)

- Mounting screws are not included.

Mounting details

WVP-2SSH, WVP-2SPH



Rz: ISO4287(1997)

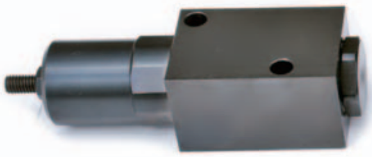
Table of contents

Control system

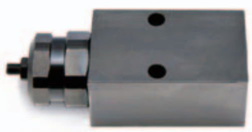
30MPa

Accumulator
model WPC40

Accumulator
model WPC13

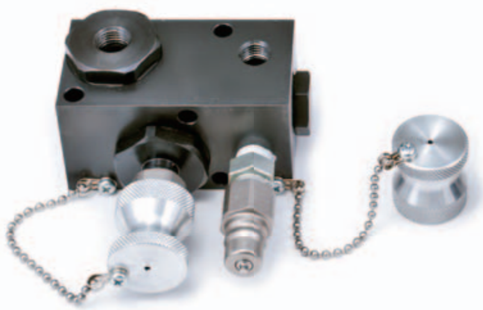


Reducing valve
model VRG-G



Sequence valve
model VEF

Reducing valve
model VRG-T



Coupling valve
model VCB

Pilot check valve
model VCP

Coupling valve
model VHD

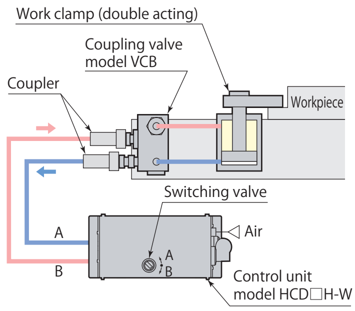
Double acting clamp is controlled and operated with control unit model **HCD□H-W** and coupling valve model **VCB**.

Control unit model **HCD□H-W**
Page →980

Coupling valve model **VCB**
Pages →968, 969

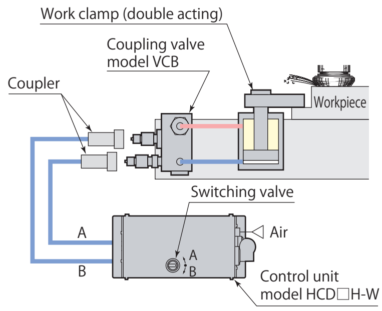
Control unit (HCD□H-W) converts air pressure to hydraulic pressure by actuation of air driven Pascal pump. Once circuit pressure is attained to the set pressure, it stops pumping then keeps the hydraulic pressure.
Coupling valve (VCB) is placed between a control unit and double acting clamps, and it allows to disconnect the control unit from the valve by means of hydraulic coupler. Built-in check valve in coupling valve can positively seal the pressure.

Clamping operation



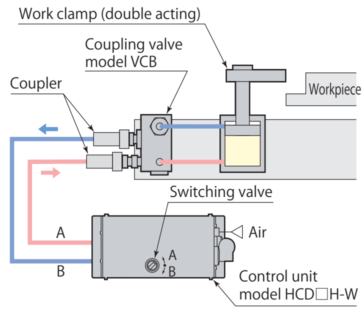
After coupler is connected, workpiece is clamped by aligning switching valve of control unit to B hydraulic port (clamping circuit).

Hydraulic pressure source disengagement (during processing)

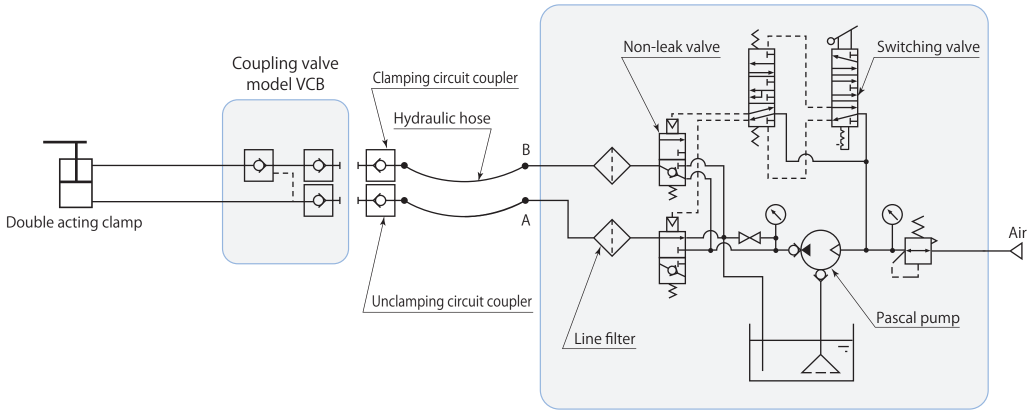


Coupler is released by aligning switching valve of control unit to center position after workpiece clamping is completed.

Unclamping operation

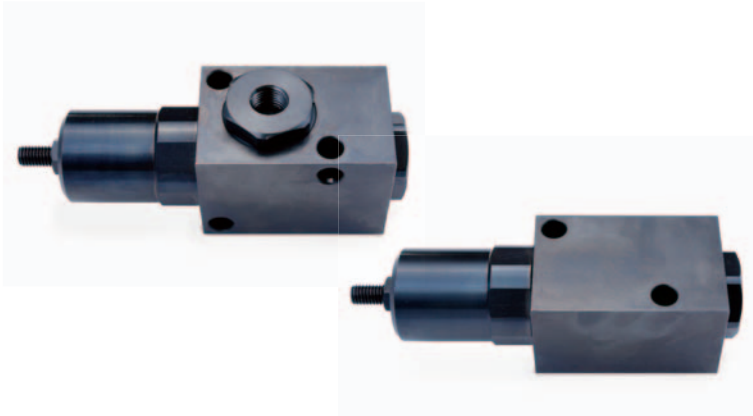


After coupler is connected, workpiece is taken out by unclamping, which is made possible by aligning switching valve of control unit to A hydraulic port (unclamping circuit).



Control unit model HCD□H-W

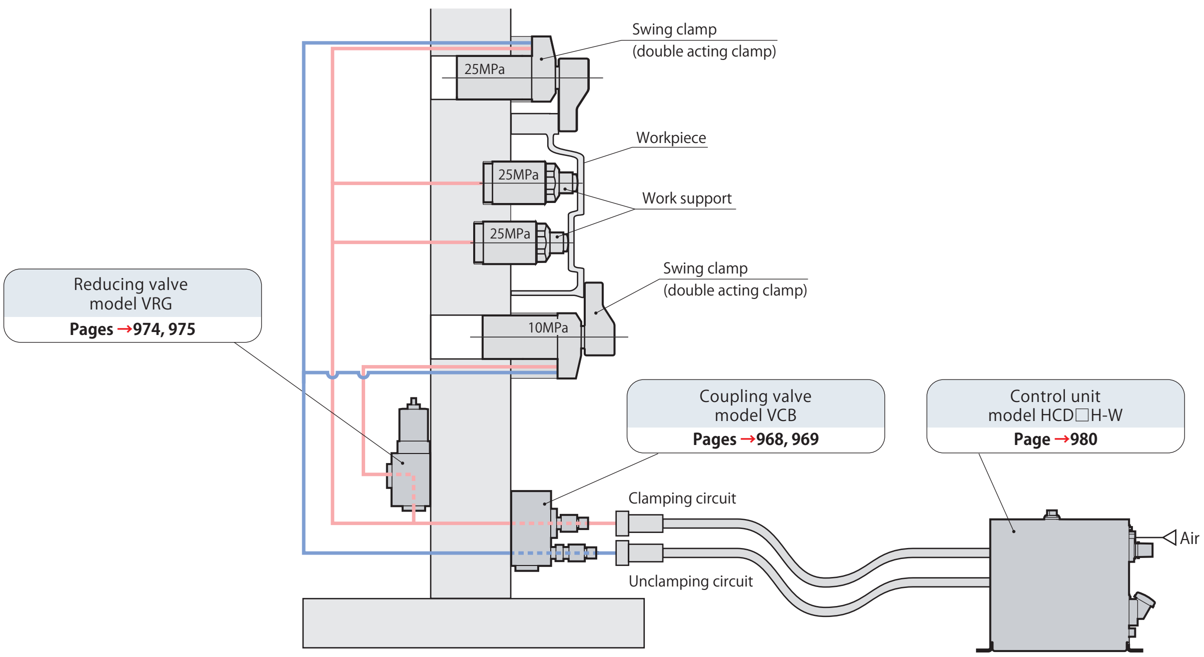
Since Pascal pump does not raise oil temperature like electrical pumps, it does not trigger pressure drop (reduction in clamping force) after clamping due to difference between ambient temperature and oil temperature. Fluctuation of pressure due to changes in ambient temperature, however, does occur. (This fluctuation presents minimal problems with ordinary cutting processes. Inquire for details.)

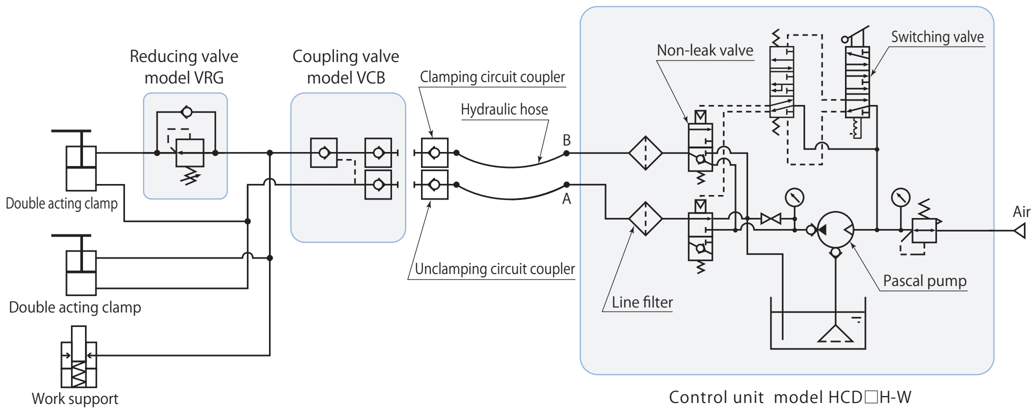


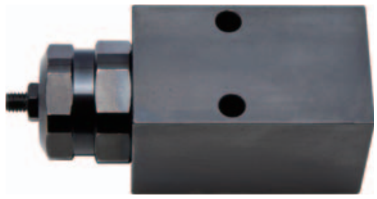
Reducing valve model **VRG**

Pages →974, 975

Internal hydraulic pressure of circuit can be partially reduced.
(Example) For work support 25 MPa (primary pressure)
pressure of work clamp is reduced to 10 MPa.



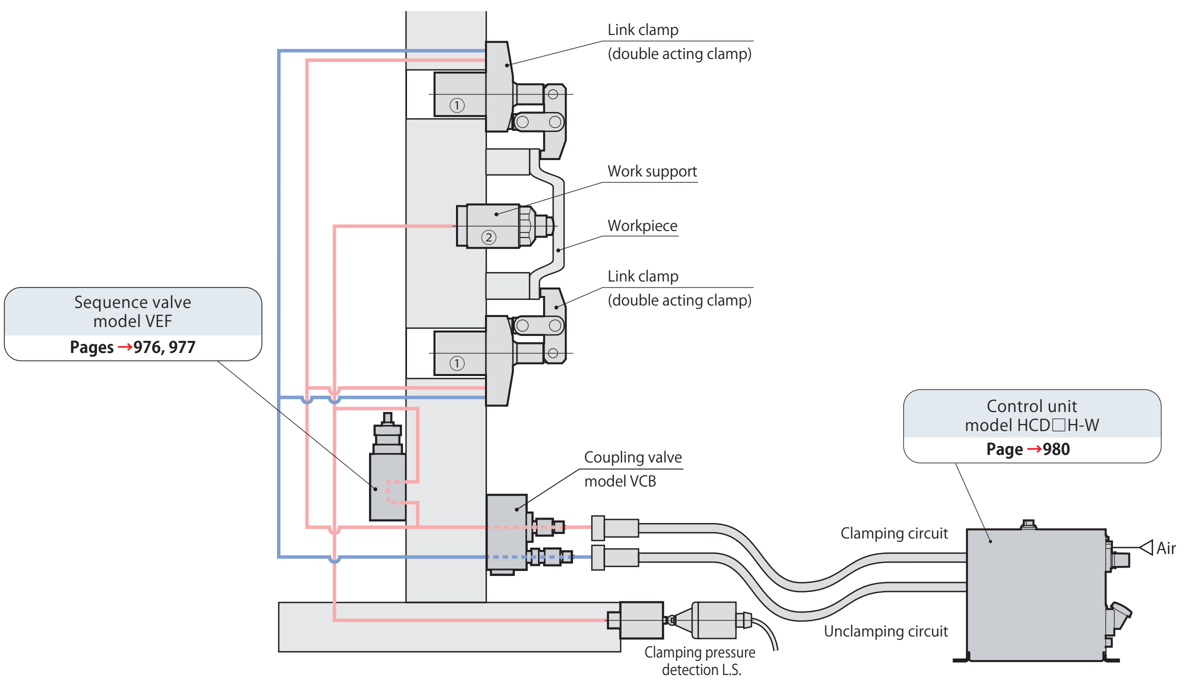


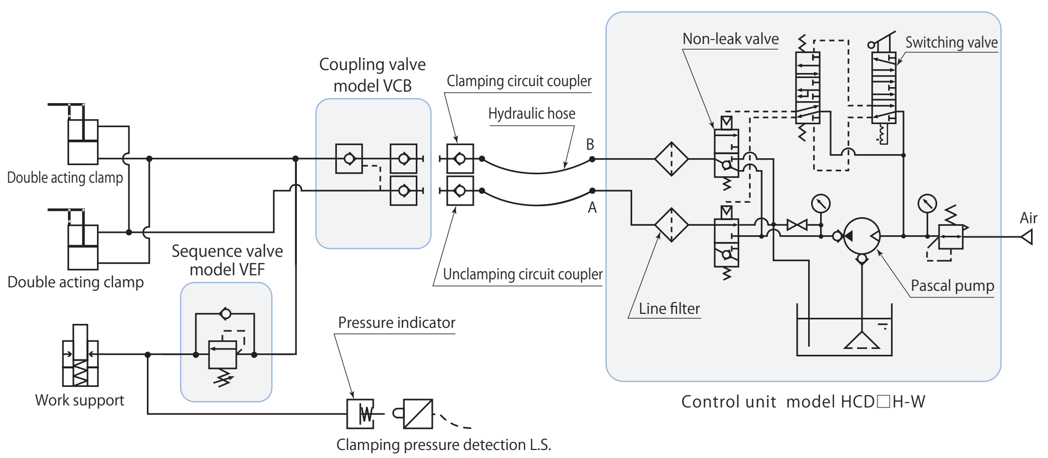


Sequence valve **model VEF**

Pages →976, 977

Clamps are sequentially operated through same circuit.
(Example) ① After clamping operation of work clamp
② Work support operation locked.



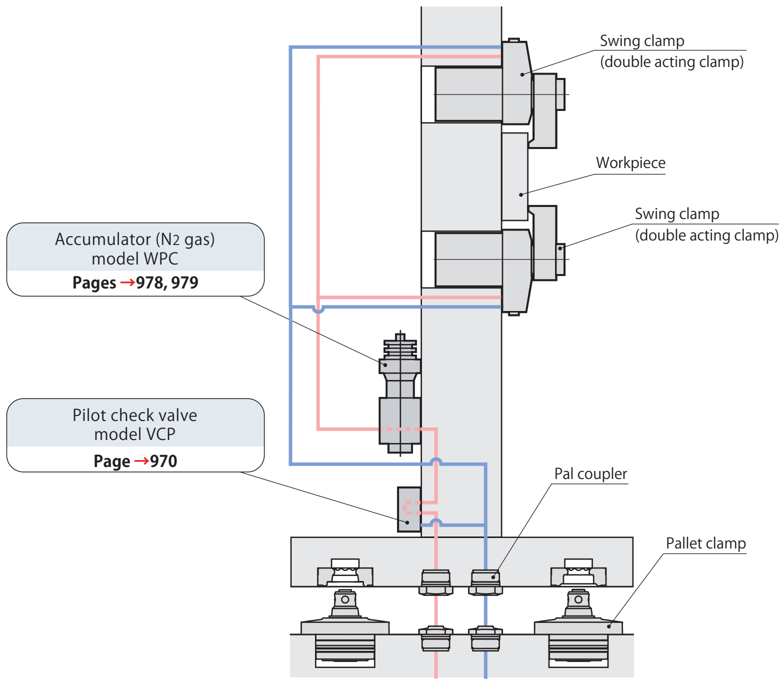


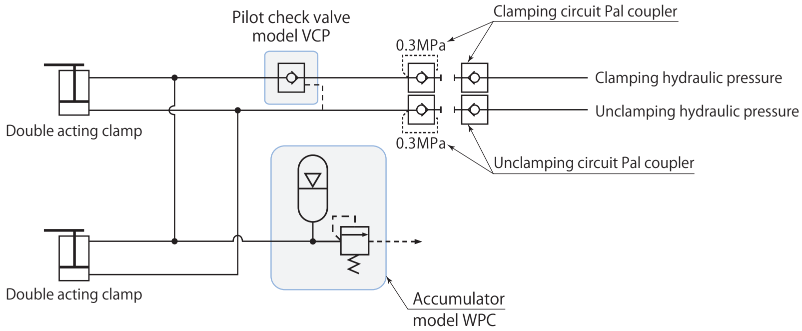
Pilot check valve **model VCP**
Page→970

Accumulator **model WPC**
Pages→978, 979

It ensures the clamp circuit pressure positively retained even when hydraulic unit provides zero pressure or pressure line is cut off, which can prevent the workpiece fall or accident due to the clamp loose.

After hydraulic pressure source has been disengaged, circuit pressure fluctuation due to temperature changes is suppressed.

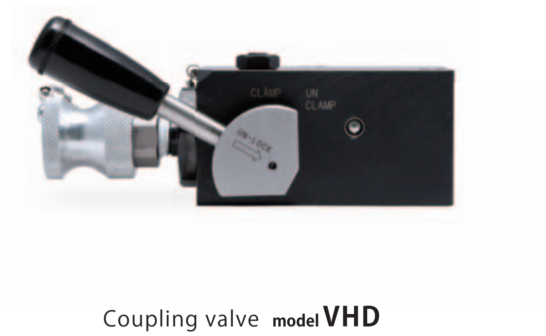




Control system

Single acting clamp is controlled and operated with control unit model **HCD□H-S** and coupling valve model **VHD**.

Control unit model **HCD□H-S**
Page →981

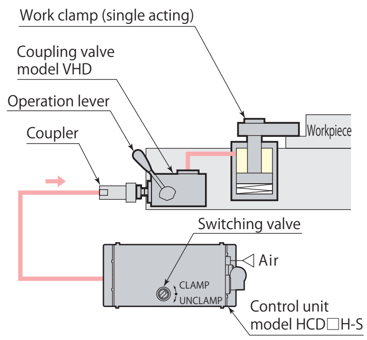


Coupling valve model **VHD**
Pages →972, 973

Control unit (HCD□H-S) converts air pressure to hydraulic pressure by actuation of air driven Pascal pump. Once circuit pressure is attained to the set pressure, it stops pumping then keeps the hydraulic pressure.

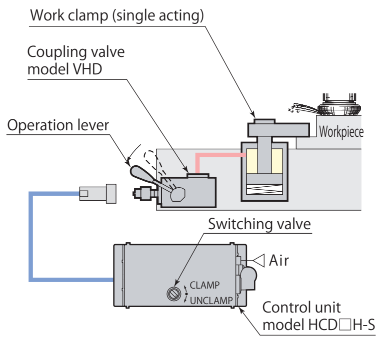
Coupling valve (VHD) is placed between a control unit and single acting clamps, and it allows to disconnect the control unit from the valve by means of hydraulic coupler. Built-in check valve in coupling valve can positively seal the pressure.

Clamping operation



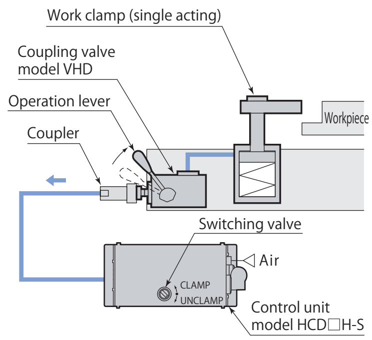
After coupler is connected, workpiece is clamped by aligning switching valve of control unit to clamping circuit.

Hydraulic pressure source disengagement (during processing)

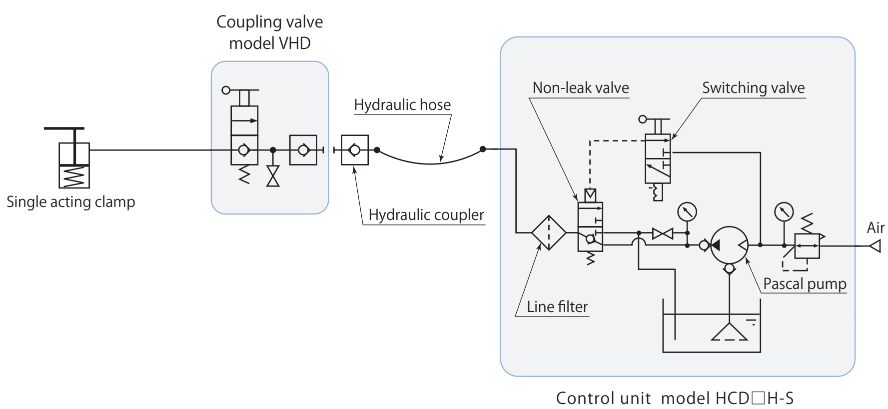


Coupler is released by positioning operation lever of coupling valve to clamping side and aligning switching valve of control unit with unclamping.

Unclamping operation



Workpiece is taken out after coupler is connected, by positioning operation lever of coupling valve to unclamping side, to unclamp.



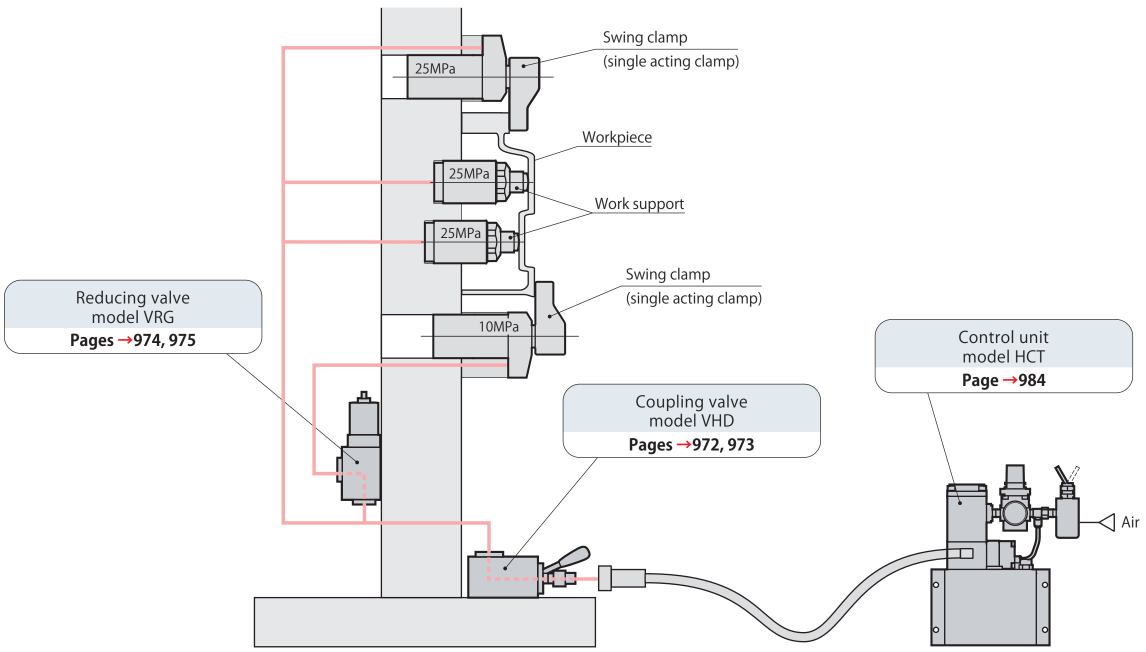
Since Pascal pump does not raise oil temperature like electrical pumps, it does not trigger pressure drop (reduction in clamping force) after clamping due to difference between ambient temperature and oil temperature. Fluctuation of pressure due to changes in ambient temperature, however, does occur. (This fluctuation presents minimal problems with ordinary cutting processes. Inquire for details.)

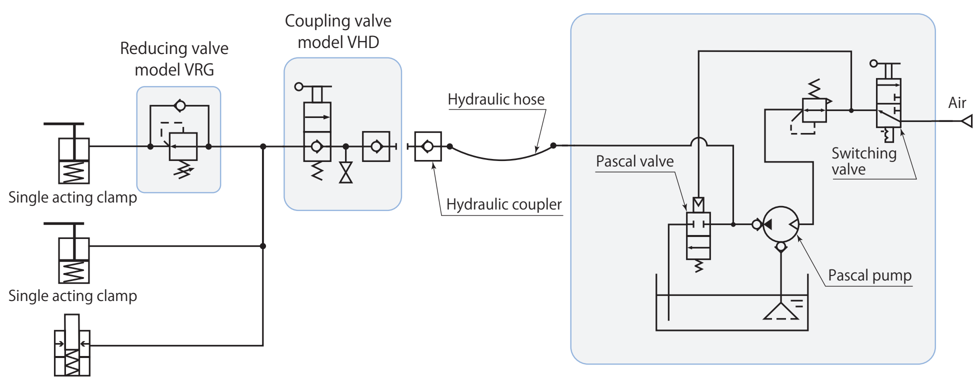
Control unit model **HCT-□**
Page→984

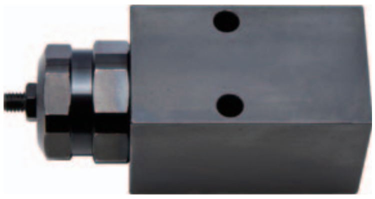
Reducing valve model **VRG**
Pages→974, 975

Compact hydraulic control unit for air drive and manual operations. Control unit (HCT-□) converts air pressure to hydraulic pressure by actuation of air driven Pascal pump. Once circuit pressure is attained to the set pressure, it stops pumping then keeps the hydraulic pressure.

Internal hydraulic pressure of circuit can be partially reduced.
(Example) For work support 25 MPa (primary pressure)
pressure of work clamp is reduced to 10 MPa.

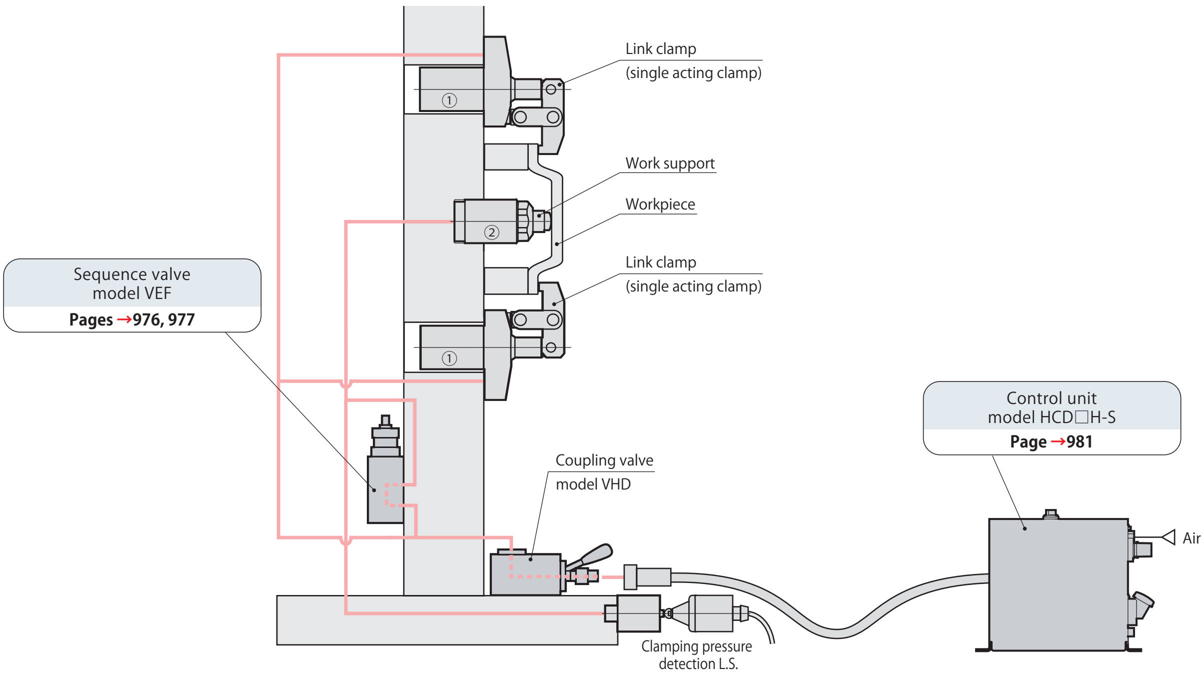


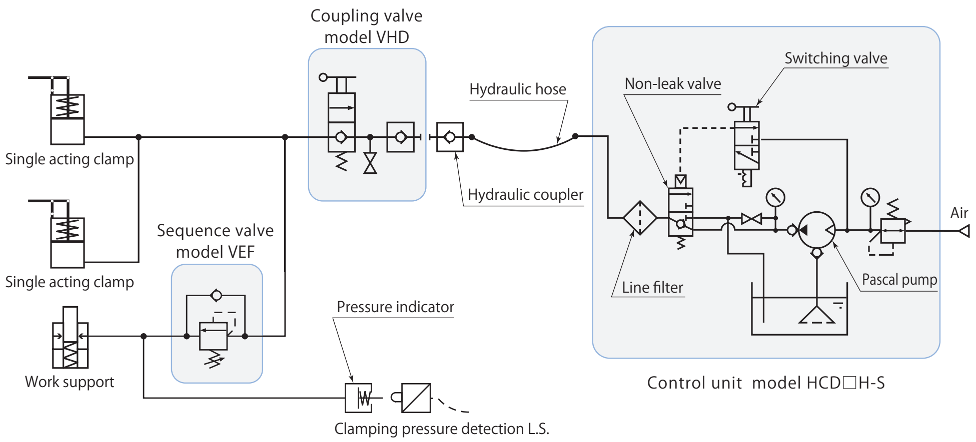




Sequence valve model **VEF**
Pages →976, 977

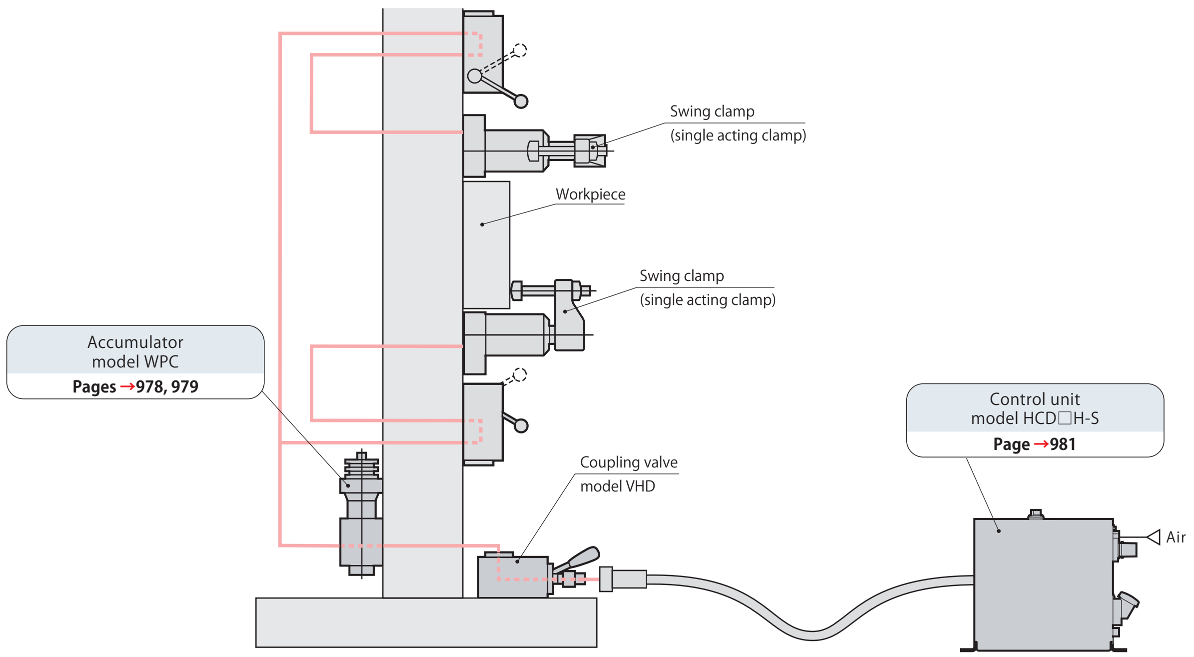
Clamps are sequentially operated through same circuit.
(Example) ① After clamping operation of work clamp
② Work support operation locked.

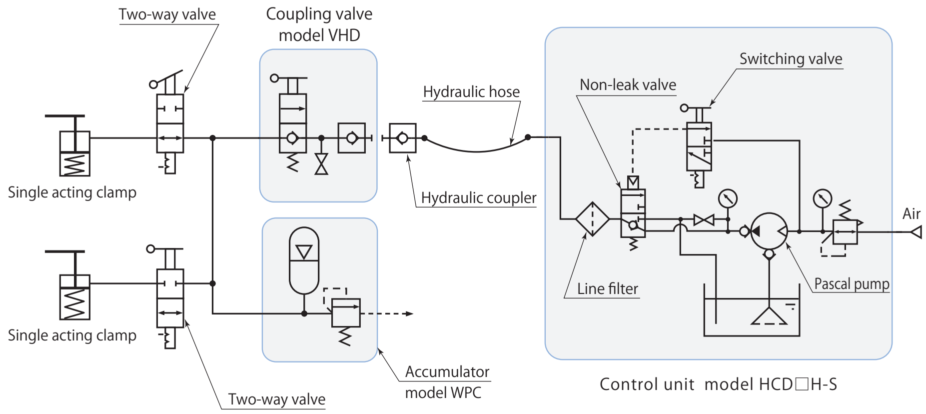




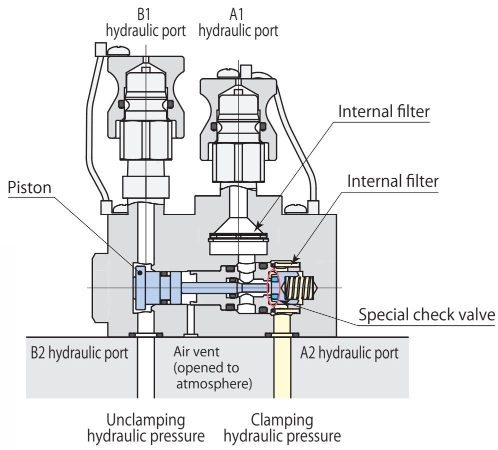
Accumulator model **WPC**
Pages →978, 979

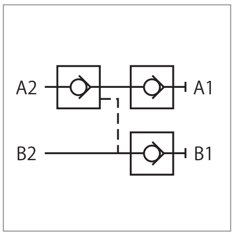
After hydraulic pressure source has been disengaged, circuit pressure fluctuation due to temperature changes is suppressed.





Coupling valve model VCB





This is a non-leak valve, with which coupling of double acting clamp can be performed easily and clamping circuit pressure can be retained over a long period of time after disengagement of hydraulic pressure source.

Specifications

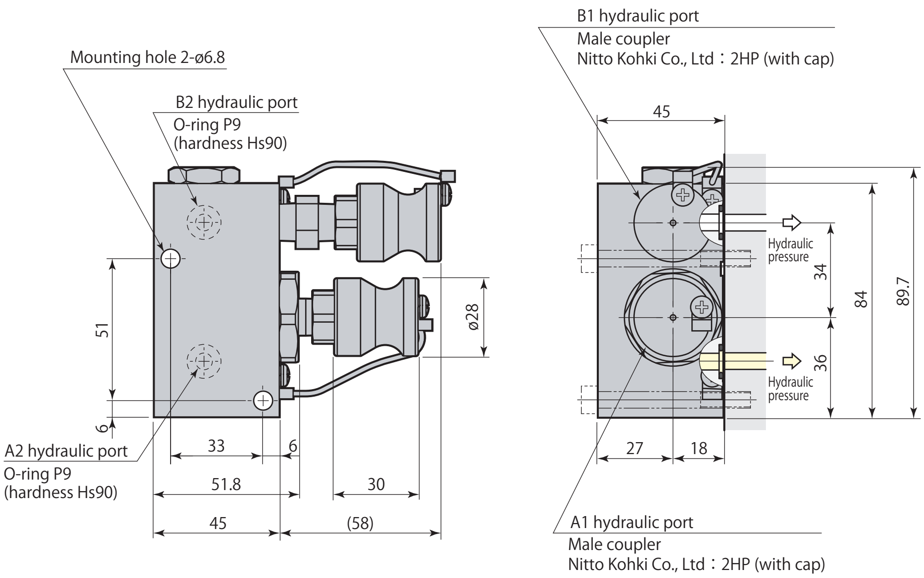
Model		VCB-HGB	VCB-HGS	VCB-HT
Mounting, piping methods		Manifold, GB mounting	Manifold, GS mounting	Piping mounting
Pressure range	MPa	7–30		
Proof pressure	MPa	37.5		
Min. pilot pressure (open valve)	MPa	0.3 ＋ 0.23 × secondary side pressure		
Orifice area	mm^2	14.2		
Operating temperature	℃	0–70		
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)		
Mass	kg	1.4		

● There is also a type that adopts fluorocarbon for seal sections where cutting fluid is applied, as a measure for the use of chlorine-based cutting fluid (this is not thermal resistant specification. Model designation VCB-□□-V).

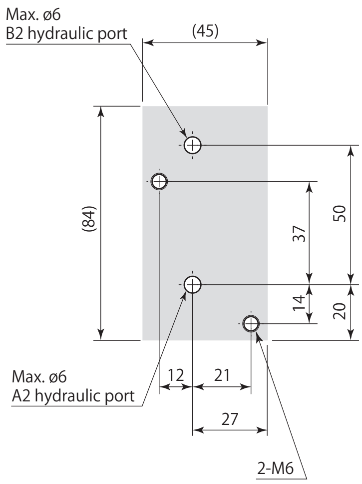
Dimensions

VCB-HGB Manifold, GB mounting

＊With internal filter (A1 & A2 hydraulic ports)



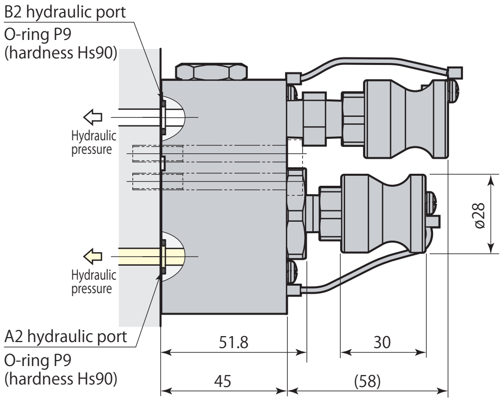
Mounting details

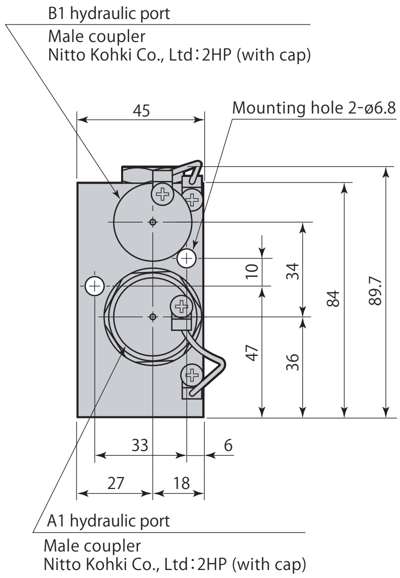


For manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

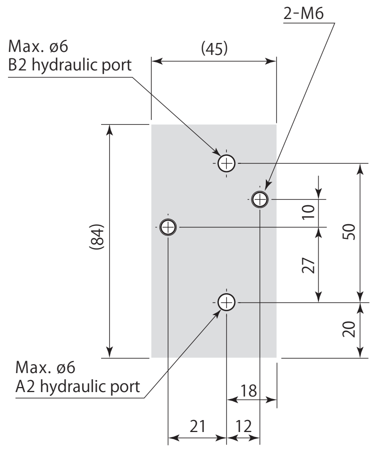
Dimensions

VCB-HGS Manifold, GS mounting ∗With internal filter (A1 & A2 hydraulic ports)



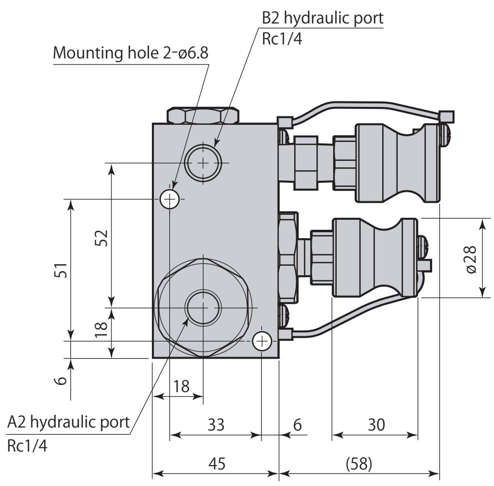


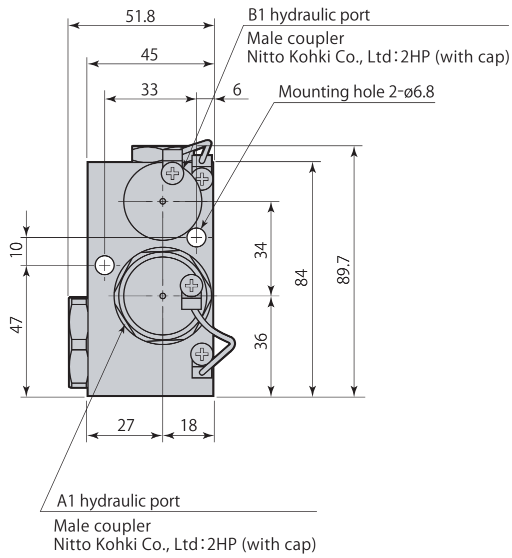
Mounting details



For manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

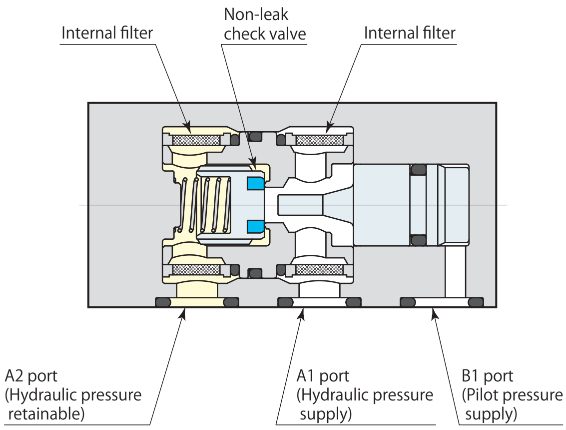
VCB-HT Piping mounting ∗With internal filter (A1 & A2 hydraulic ports)

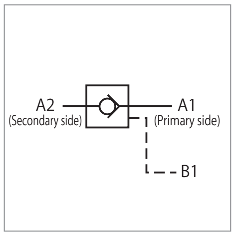




● Female coupler (Nitto Kohki Co., Ltd：2HS) and mounting screws are not included.

Pilot check valve model VCP





This is a non-leak pilot check valve, with which clamping circuit pressure can be retained over a long period of time after disengagement of hydraulic pressure source.

Specifications

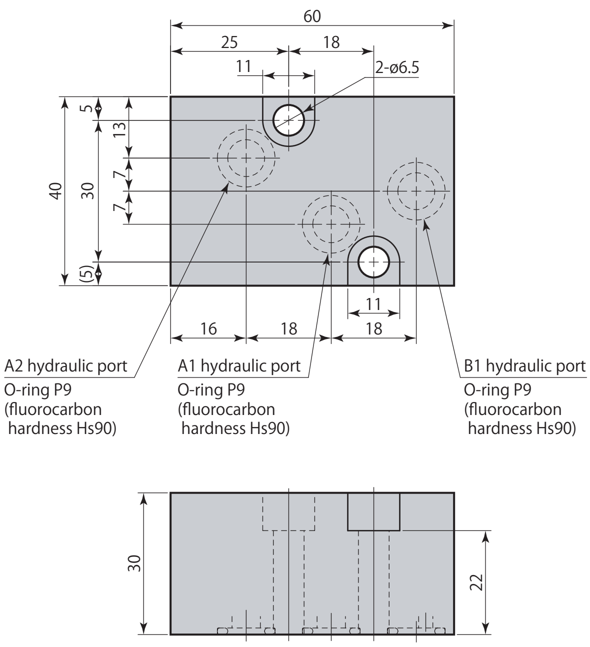
Model		VCP-HG
Mounting, piping methods		Manifold mounting
Pressure range	MPa	7–30
Proof pressure	MPa	37.5
Cracking pressure	MPa	0.019
Min. pilot pressure (open valve)	MPa	0.01 + 0.24 × A2 hydraulic port (secondary side) pressure
Orifice area	mm^2	14.2
Operating temperature	℃	0–70
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)
Mass	kg	0.5

- Fluorocarbon has been adopted for seal sections where cutting fluid is applied, as a measure for the use of chlorine-based cutting fluid (this is not thermal resistant specification).

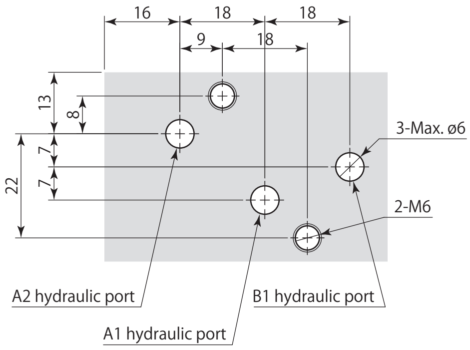
Dimensions

VCP-HG Manifold mounting

*With internal filter (A1 & A2 hydraulic ports)

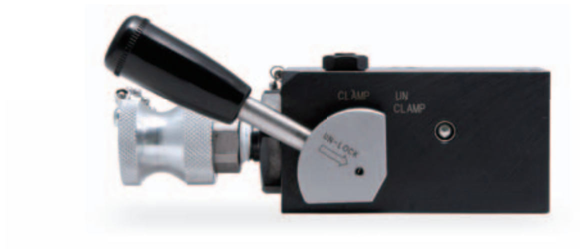


Mounting details

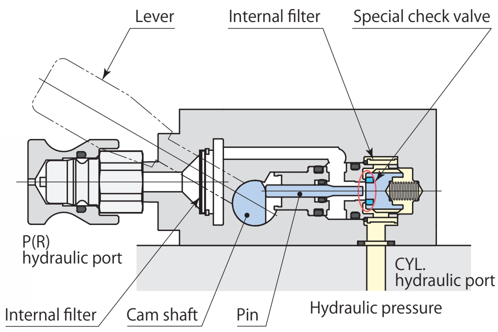


For manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

- Mounting screws are not included.
- This valve cannot be used in the circuit which pressure is applied to both of A1 and B1 port.



Coupling valve model **VHD**



This is a non-leak valve, with which coupling of single acting clamp can be performed easily and clamping circuit pressure can be retained over a long period of time after disengagement of hydraulic pressure source.

Specifications

VHD-H –

Mounting, piping methods
- **GB** : Manifold, GB mounting
- **GS** : Manifold, GS mounting
- **T** : Piping

Lever action
- (Nil) : Clamping position keeping type
- **D** : Detent type

Lever mounting
- (Nil) : Standard
- **K** : Opposite side

Option
- (Nil) : NBR
- **V*** : Fluorocarbon

(grey box) indicates made to order.

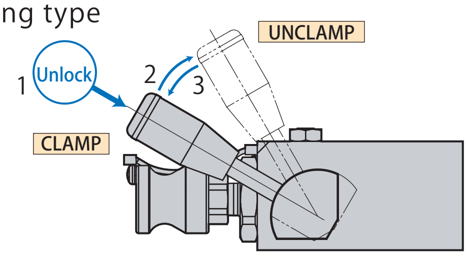
*: Fluorocarbon has been adopted for seal sections where cutting fluid is applied, as a measure for the use of chlorine-based cutting fluid (this is not thermal resistant specification).

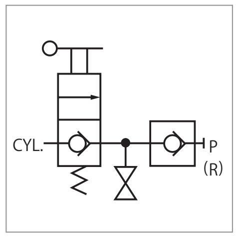
Model		VHD-HGB	VHD-HGS	VHD-HT
Pressure range	MPa	7–30		
Proof pressure	MPa	37.5		
Cracking pressure	MPa	0.017		
Orifice area	mm^2	21.0		
Operating temperature	℃	0–70		
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)		
Mass	kg	1.4		

Lever operation

VHD-H□-□□ Clamping position keeping type

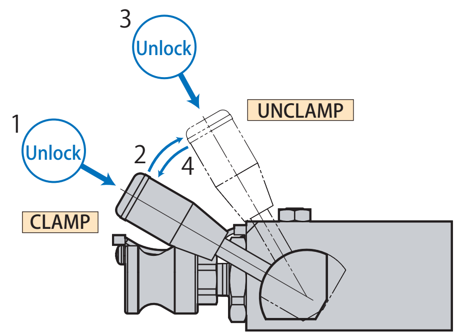
From the clamping position
1. Push the lever lock is released.
2. Unclamp causing the lever.
3. Return to the clamping position when you take your hand off the lever.

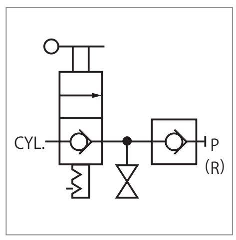




VHD-H□-D□□ Detent type

From the clamping position
1. Push the lever lock is released.
2. Unclamp and lock causing the lever.
3. When the clamp, push the lever to unlock.
4. Clamp and lock the lever back.

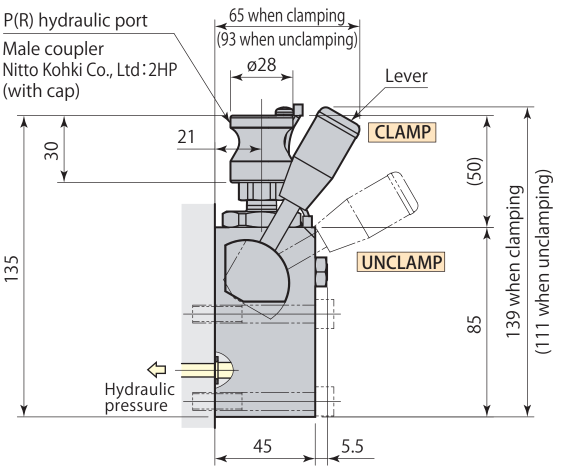


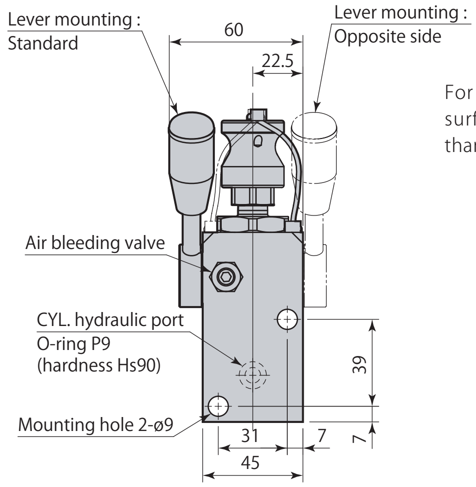


Dimensions

VHD-HGB-□□□ Manifold, GB mounting

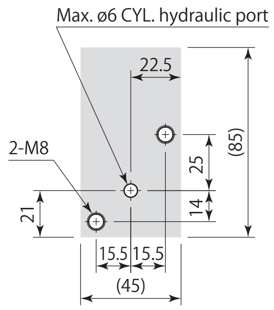
∗With internal filter (P & CYL. hydraulic ports)





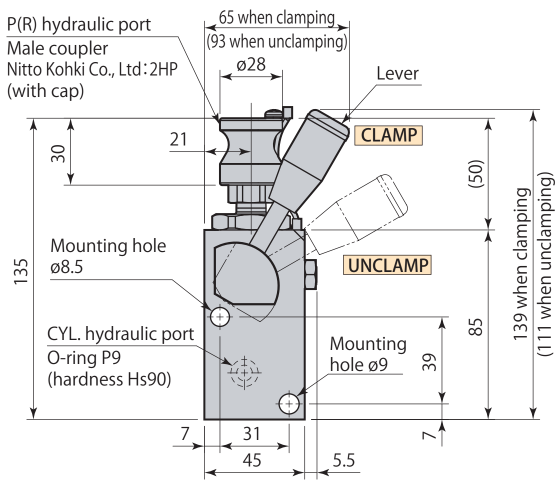
Mounting details

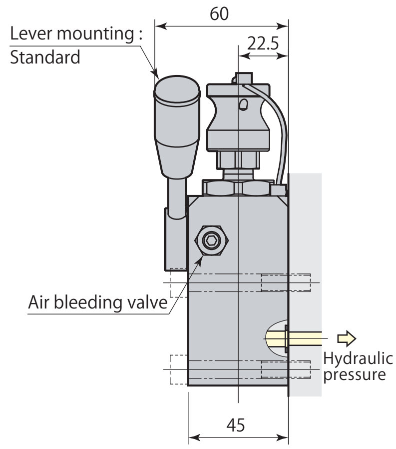
For manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).



VHD-HGS-□□ Manifold, GS mounting

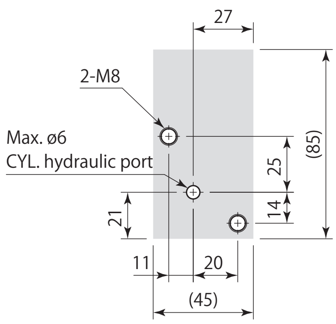
∗With internal filter (P & CYL. hydraulic ports)
Opposite side lever not available





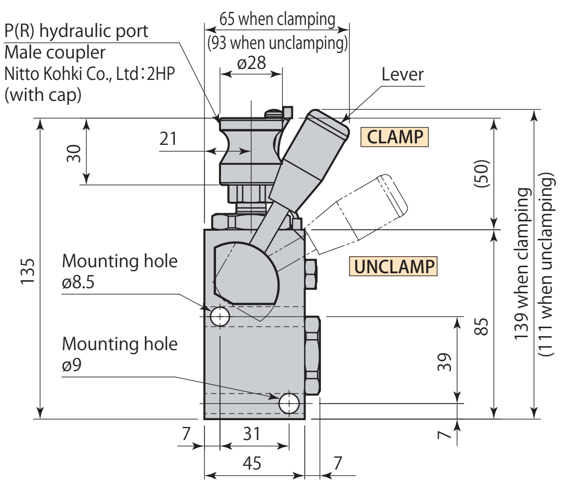
Mounting details

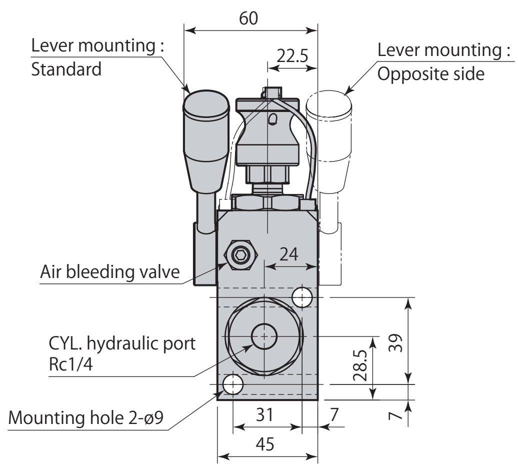
For manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).



VHD-HT-□□□ Piping mounting

∗With internal filter (P & CYL. hydraulic ports)

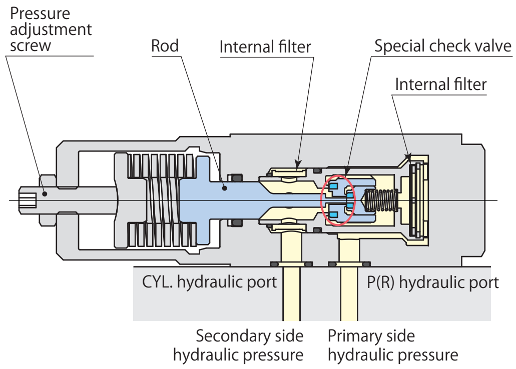


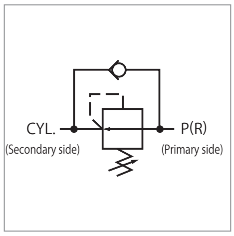


● Female coupler (Nitto Kohki Co., Ltd：2HS) and mounting screws are not included.

VRG-□□ | Reducing valve | 30MPa

Reducing valve model **VRG**





Internal hydraulic pressure of circuit can be partially reduced.
This is a non-leak type that requires no drain.

Specifications

Model		VRG-MG	VRG-MT	VRG-MS	VRG-HG	VRG-HT	VRG-HS
Mounting, piping methods		Manifold	Piping	VHD linking	Manifold	Piping	VHD linking
Primary side hydraulic pressure range	MPa	7–30			10–30		
Secondary side hydraulic pressure range	MPa	1–20			7–27		
Allowable min. differential pressure*	MPa	3					
Proof pressure	MPa	37.5					
Pressure change per revolution	MPa/rev	3.9			6.2		
Orifice area	mm^2	28.1					
Operating temperature	℃	0–70					
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)					
Mass	kg	1.0 (0.9 only for manifold type)					

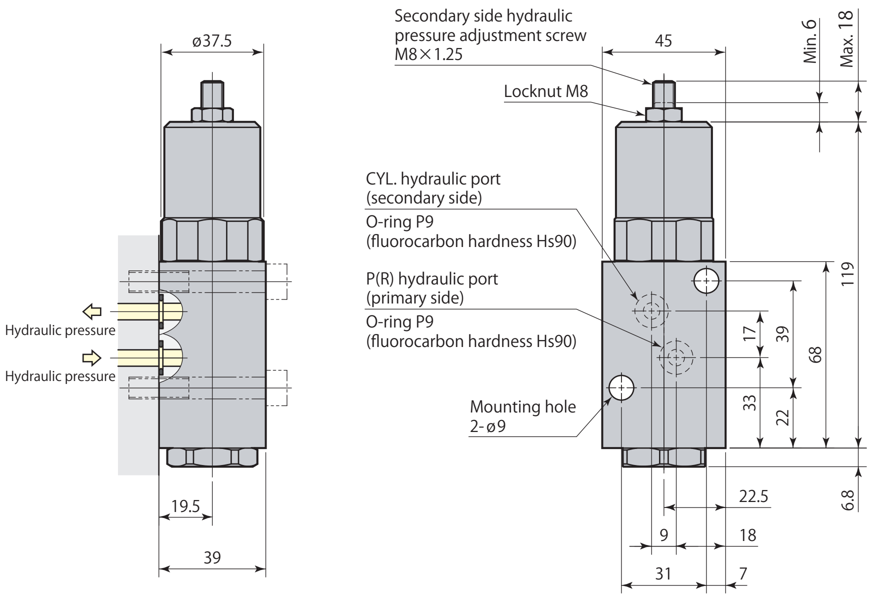
- Fluorocarbon has been adopted for seal sections where cutting fluid is applied, as a measure for the use of chlorine-based cutting fluid (this is not thermal resistant specification).
- Avoid overpressure to CYL. hydraulic port of the valve if there is a risk of back pressure in secondary circuit.

＊: The setting should be performed so that the differential pressure between primary side hydraulic pressure and secondary side hydraulic pressure may exceed 3 MPa. (Example: When VRG-H, if primary side hydraulic pressure is 25 MPa, secondary side hydraulic pressure should be from 7 to 22 MPa.)

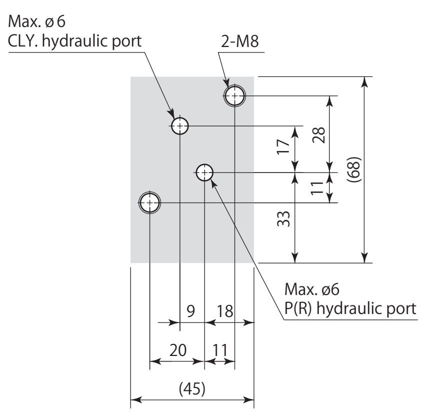
(grey) indicates made to order.

Dimensions

VRG-□G Manifold mounting ＊With internal filter (P & CYL. hydraulic ports)



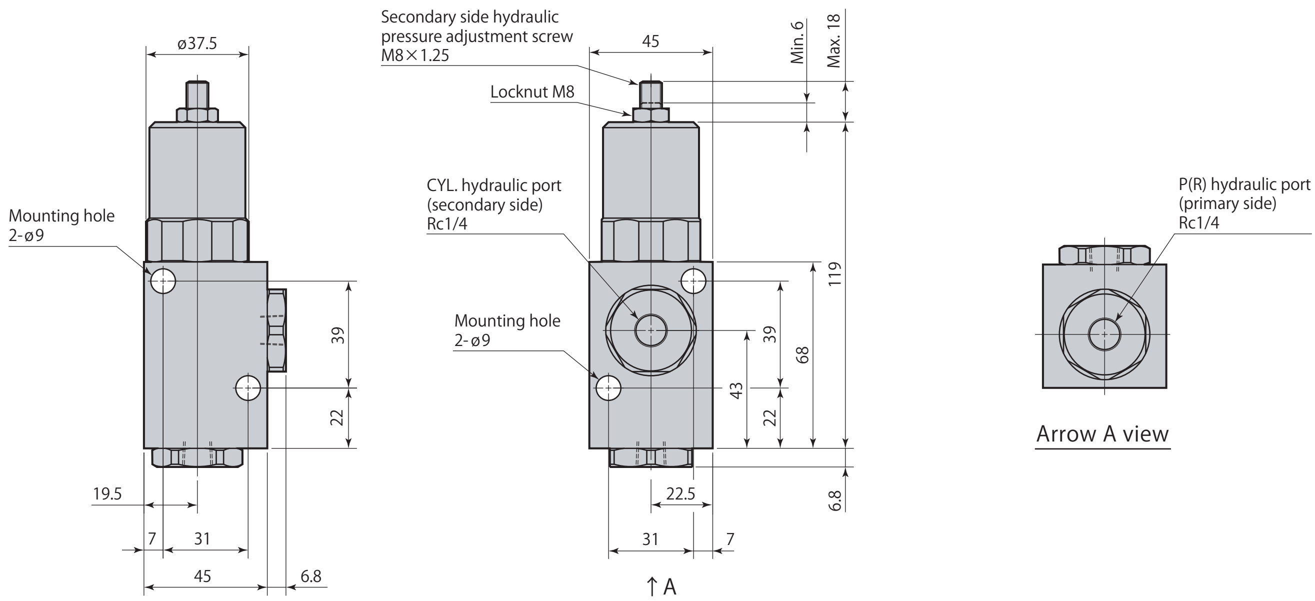
Mounting details



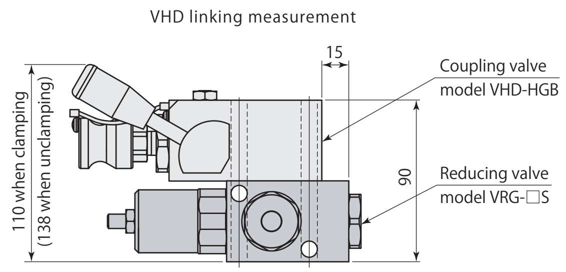
For manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

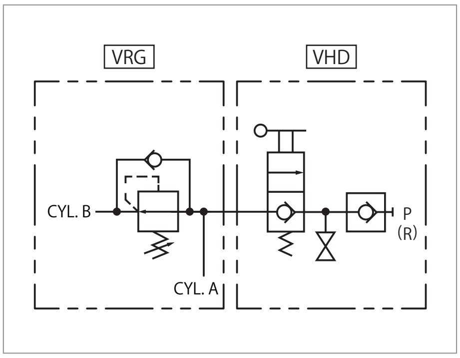
Dimensions

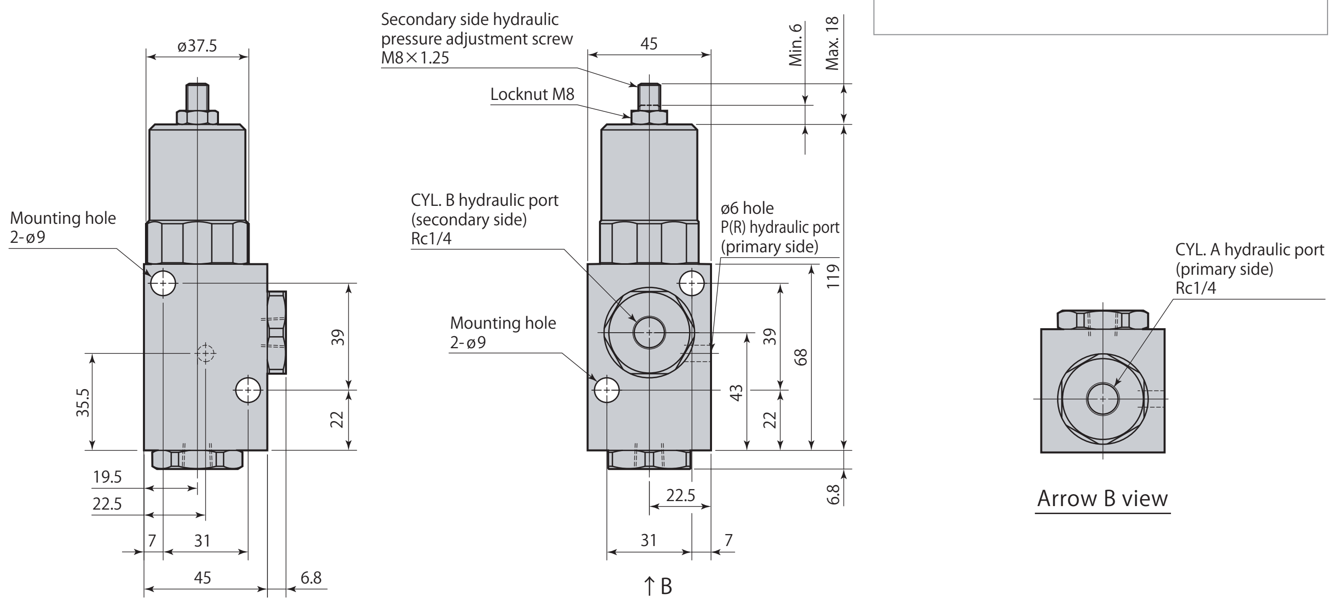
VRG-□T Piping mounting ∗With internal filter (P & CYL. hydraulic ports)



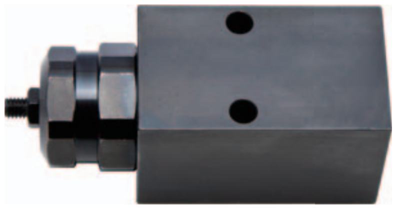
VRG-□S VHD linking ∗With internal filter (P & CYL. hydraulic ports)



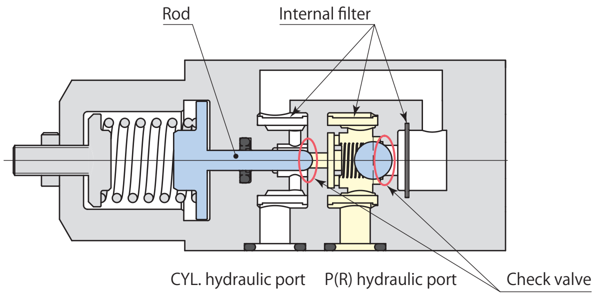


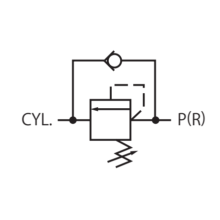


- Structure is such that when pressure on secondary side (low pressure side) drops due to temperature change or oil leak, flow channel to primary side (high pressure side) is opened to replenish oil until pressure reaches set pressure.
- Pressure is not supplemented when primary side is separated from hydraulic pressure source.
- Mounting screws are not included.



Sequence valve model **VEF**





Clamps are sequentially operated through same circuit.

Specifications

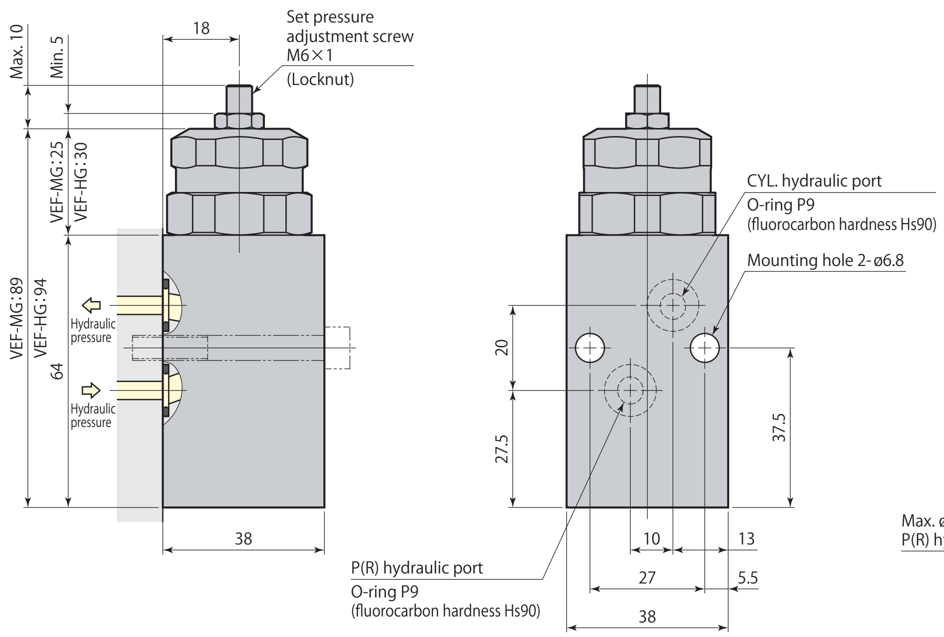
Model		VEF-MG	VEF-MT	VEF-HG	VEF-HT
Mounting, piping methods		Manifold mounting	Piping mounting	Manifold mounting	Piping mounting
Pressure range	MPa	2–30			
Allowable min. differential pressure*	MPa	1			
Set hydraulic pressure range	MPa	6–11		11–20	
Proof pressure	MPa	37.5			
Cracking pressure	MPa	0.01			
Pressure change per revolution	MPa/rev	1		1.4	
Orifice area	mm^2	P → CYL. 7.1 CYL. → R 28.3			
Operating temperature	℃	0–70			
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)			
Mass	kg	G：0.8 T：1.0			

● Fluorocarbon has been adopted for seal sections where cutting fluid is applied, as a measure for the use of chlorine-based cutting fluid (this is not thermal resistant specification).

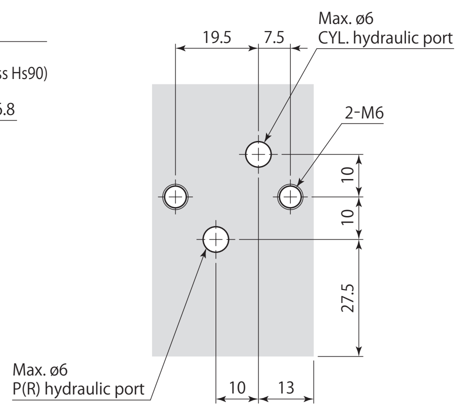
∗:The setting should be performed so that the differential pressure between working pressure and set hydraulic pressure may exceed 1 MPa. (Example：When VEF-H, if working pressure is 15 MPa, set hydraulic pressure should be from 11 to 14 MPa.)

Dimensions

VEF-□G Manifold mounting ∗With internal filter (P & CYL. hydraulic ports)



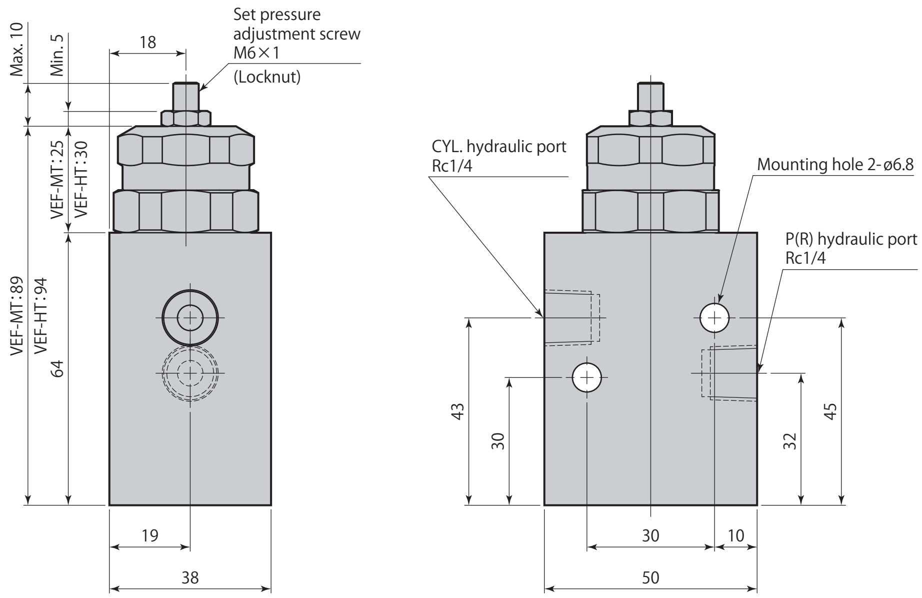
Mounting details



For manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

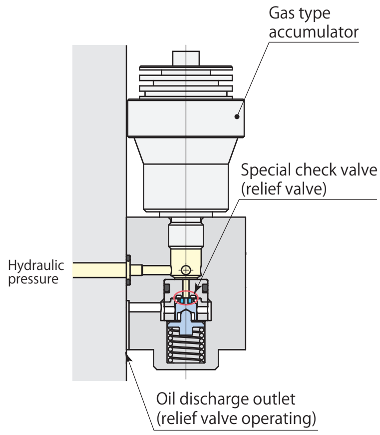
Dimensions

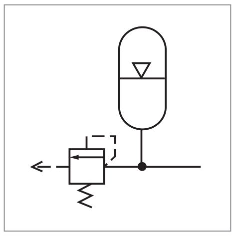
VEF-□T Piping mounting ∗With internal filter (P & CYL. hydraulic ports)



- The sequence valve may open by lower pressure than the set value when a large volume of oil flow is applied. It is due to the surge pressure caused by an oil hammer phenomenon. Use VEF with a flow control valve installing at primary side to adjust the flow rate.
- The sequence effect may not be achievable due to a back pressure in case the hydraulic circuit would be built by meter-out control or would generate pipe resistance.
- Mounting screws are not included.

Accumulator model **WPC**





N_2 pressure type accumulator.
Equipped with a relief valve for preventing breakdown of device in case of problems with circuit pressure (high pressure).

Specifications

Model	WPC13H-G Gas pressure*	WPC13H-T Gas pressure*	WPC40H-G Gas pressure*	WPC40H-T Gas pressure*
Mounting, piping methods	Manifold mounting	Piping mounting	Manifold mounting	Piping mounting
Pressure range MPa	Refer to **page →979** for characteristic line diagram.			
Gas capacity cm^3	13		40	
Oil capacity cm^3	10		30	
Mass kg	1.1		1.6	

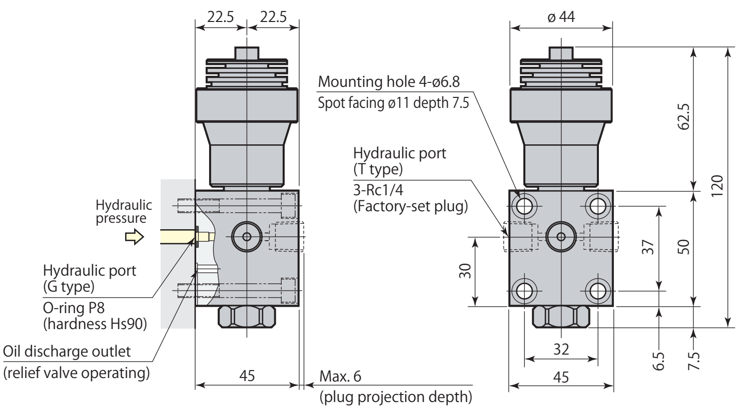
- Proof pressure：37.5 MPa
- Operating temperature：0–60°C
- Fluid used：General mineral based hydraulic oil (ISO-VG32 equivalent)
- There is also a type that adopts fluorocarbon for seal sections where cutting fluid is applied, as a measure for the use of chlorine-based cutting fluid (this is not thermal resistant specification. Model designation WPC□H-□□-V).

＊：Initially filled gas pressure can be set in range of 7 MPa to 25 MPa with 1 MPa increment. Specify gas pressure when ordering.
Example：WPC13H-T10 (gas pressure 10 MPa)

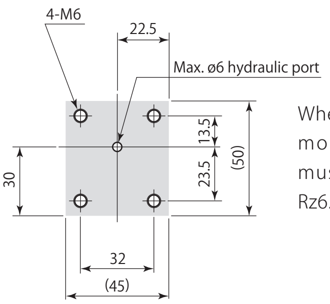
Dimensions

WPC13H-□□

＊No internal filter



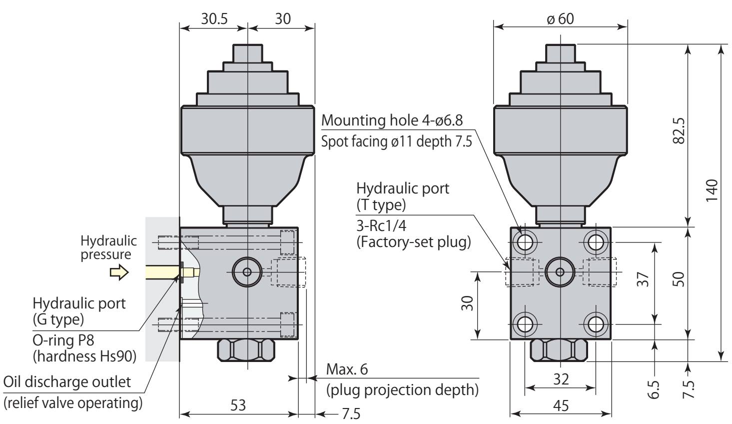
Mounting details



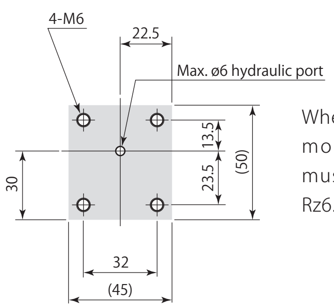
When manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

WPC40H-□□

＊No internal filter



Mounting details

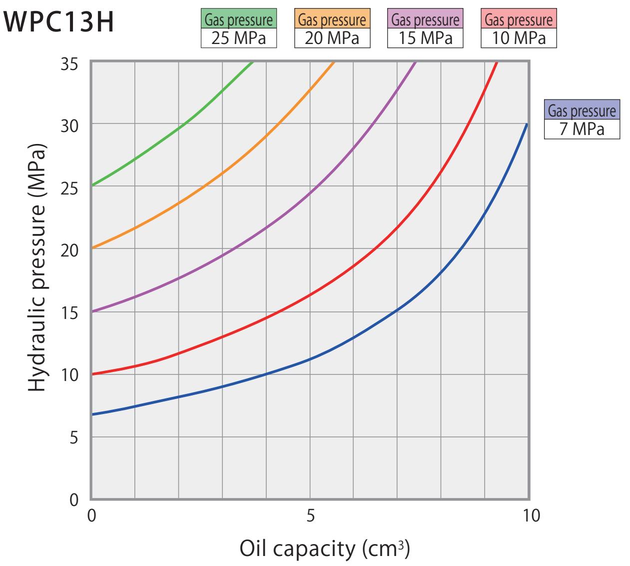


When manifold piping, the mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

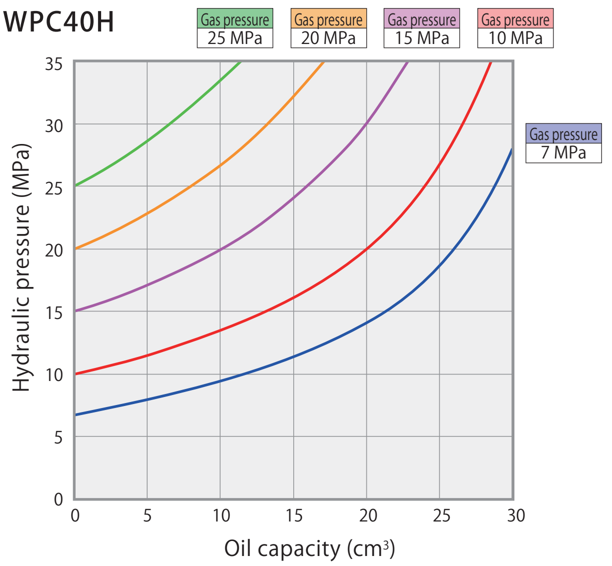
- Mounting screws are not included.

Characteristic line diagram

WPC13H



WPC40H



This characteristic line diagram represents theoretical values.

Model selection example

Condition (estimated temperature drop：20℃)

Working clamp	CLW16×8 pieces	Piping	Inner diameter ø6×0.5 m×8 pieces
Hydraulic pressure：P	25 MPa	Valve & hydraulic pressure equipment	VCB：1 piece, VRG：2 pieces

Selection procedure

1. Calculation of circuit capacity

   Clamping capacity：$\underset{\text{Pressure bearing area}}{6.16} \times \underset{\text{Stroke}}{3.3} \times \underset{\text{Qty}}{8} = 163\ cm^3$

   Piping capacity：$0.283 \times 50 \times 8 = 113\ cm^3$

   Valve & hydraulic equipment capacity：$8 \times 3 = 24\ cm^3$

   (Perform calculation with capacity of 8 cm^3 for each of valves and hydraulic equipment in hydraulic circuit, when using Pascal product.)

   Circuit capacity：$163 + 113 + 24 = 300\ cm^3$

2. Selection of oil capacity

   Select the equipment having oil capacity capable of keeping volumetric change.
   Volumetric change is obtained by using formula shown below.

   $\Delta V = V \times \Delta T \times \alpha$ ΔV：Volumetric change (cm^3) V：Circuit capacity (cm^3)
   ΔT：Temperature change (℃) α：Thermal expansion coefficient (7.8×10^{-4})

   $\Delta V = 300 \times 20 \times 7.8 \times 10^{-4} = 4.7\ cm^3$

   Here, WPC40H is selected as an example (∗1).

3. Selection of gas pressure

   Select the pressure whose oil discharge amount (∗2) under hydraulic pressure satisfies ΔV calculated in step 2. Read off characteristic line diagram.
   If the hydraulic pressure of the clamping circuit is 25 MPa, select gas pressure 10 MPa, 15 MPa, or 20 MPa.

4. Verification of hydraulic pressure and residual discharge amount (∗2) after temperature change

   Select the one whose hydraulic pressure drop after temperature change is low and residual discharge amount (∗2) satisfies the marginal oil amount (∗3). Read off characteristic line diagram.
   The hydraulic pressure after temperature change drops to 19.3 MPa with 10 MPa gas pressure (P10), to 21 MPa with 15 MPa gas pressure (P15), and to 22 MPa with 20 MPa gas pressure (P20), respectively.
   The residual oil discharge amount (∗2) is 19.3 cm^3 for 10 MPa gas pressure (V10), 11.3 cm^3 for 15 MPa (V15), and 3.3 cm^3 for 20 MPa (V20), respectively.
   Here, select WPC40H-□20 whose pressure drop is low.

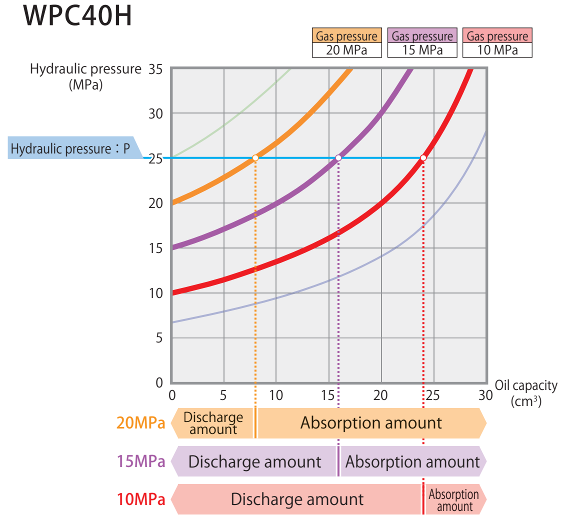
5. Select piping method.

∗1：WPC13H is also available. Likewise, select appropriate one in consideration of steps 3 and 4.

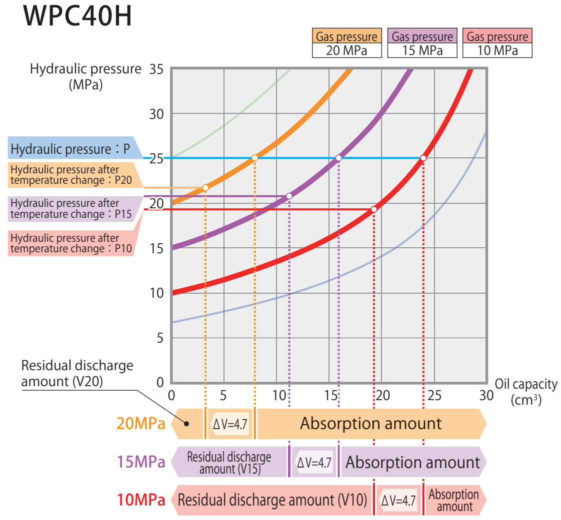
∗2：For when the temperature decreases. If the temperature increases, check the absorption amount.

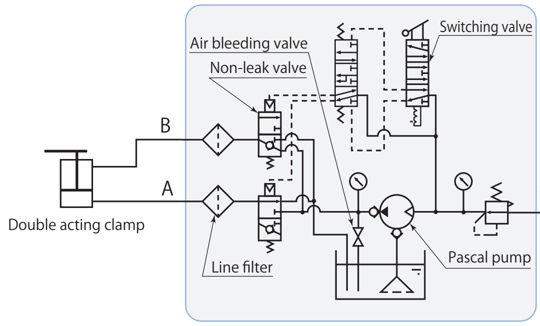
∗3：Allow adequate margin for residual discharge amount after temperature change, as there may be margin of error with gas filling pressure. Marginal oil amount : About 2.0 cm^3

WPC40H



WPC40H





Control unit model **HCD□H-W**

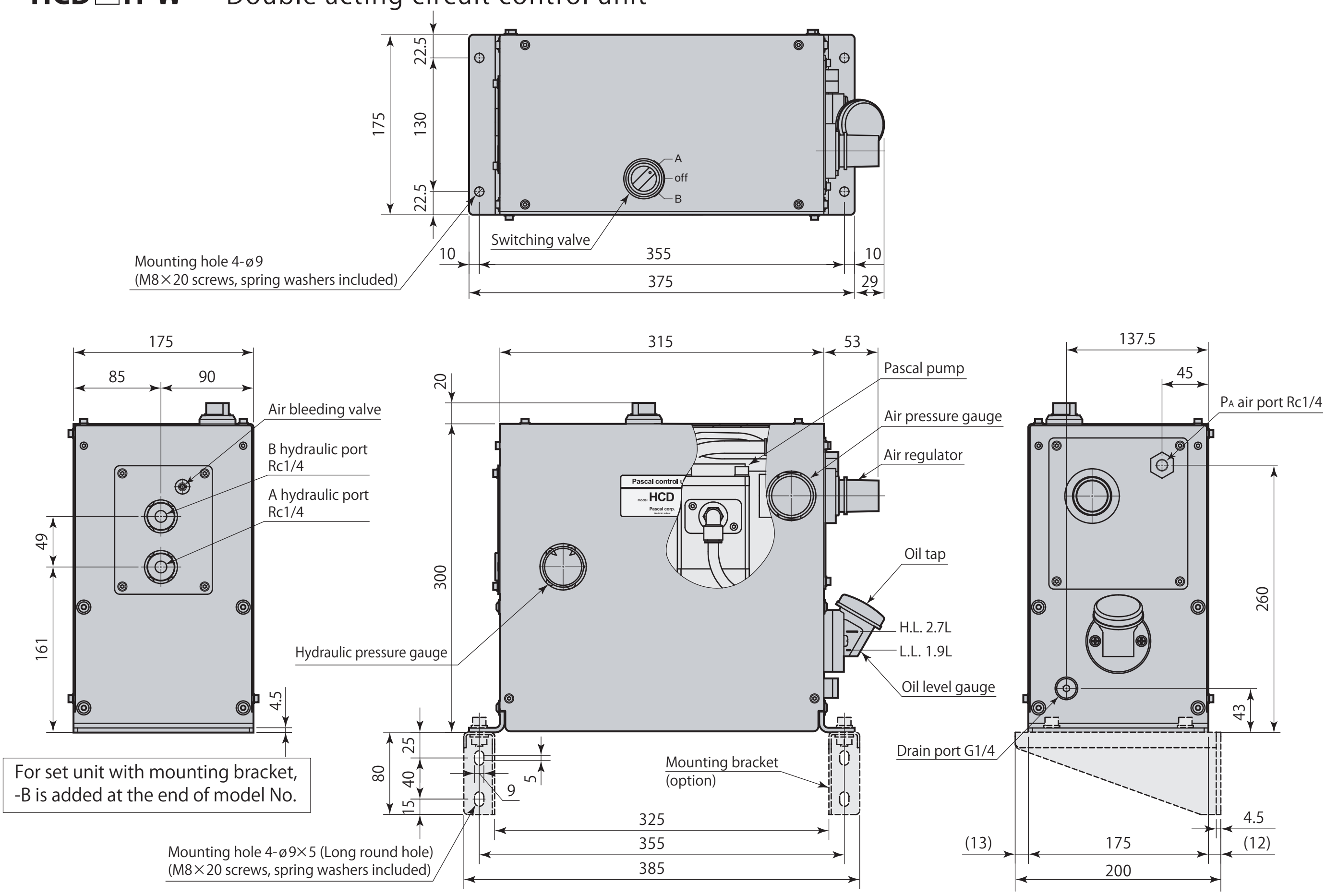
This is a hydraulic control unit that is air driven and manually operated, combining non-leak valve with non-leak feature (zero oil leaks), which is essential for hydraulic clamps, and Pascal pump. Since two hydraulic circuits can be operated and controlled alternatingly, it is best suited hydraulic pressure source for double acting clamps.
Pascal pump stops pumping once circuit pressure has been attained and retains the pressure. Furthermore, since there is hardly any temperature fluctuation of working fluid, there is no need for any auxiliary pressure equipment.

Model		HCD2H-W	HCD3H-W
Pascal pump		X6308U-C	X6310U-C
Discharge oil pressure*1	MPa	8.7–26.1	5.55–16.65
Set air pressure	MPa	0.2–0.5	
Unloaded oil discharge amount	L/min	Refer to page →985 for performance diagram.	
Tank capacity*2	L	H.L. 2.7 L.L. 1.9	
Operating temperature	°C	5–60	
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)	
Mass	kg	23	

∗1：Ask for consultation on specifications that exceed discharge oil pressure range.
∗2：Oil level in the tank should be always between H.L. and L.L. of the gauge.

Dimensions

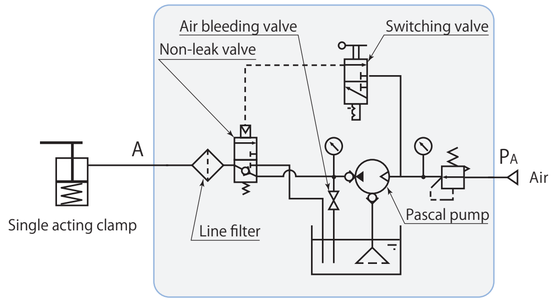
HCD□H-W Double acting circuit control unit



For set unit with mounting bracket, -B is added at the end of model No.

Control unit model **HCD□H-S**

This is a hydraulic control unit that is air driven and manually operated, combining non-leak valve with non-leak feature (zero oil leaks), which is essential for hydraulic clamps, and Pascal pump.
Pascal pump stops pumping once circuit pressure has been attained and retains the pressure. Furthermore, since there is hardly any temperature fluctuation of working fluid, there is no need for any auxiliary pressure equipment.

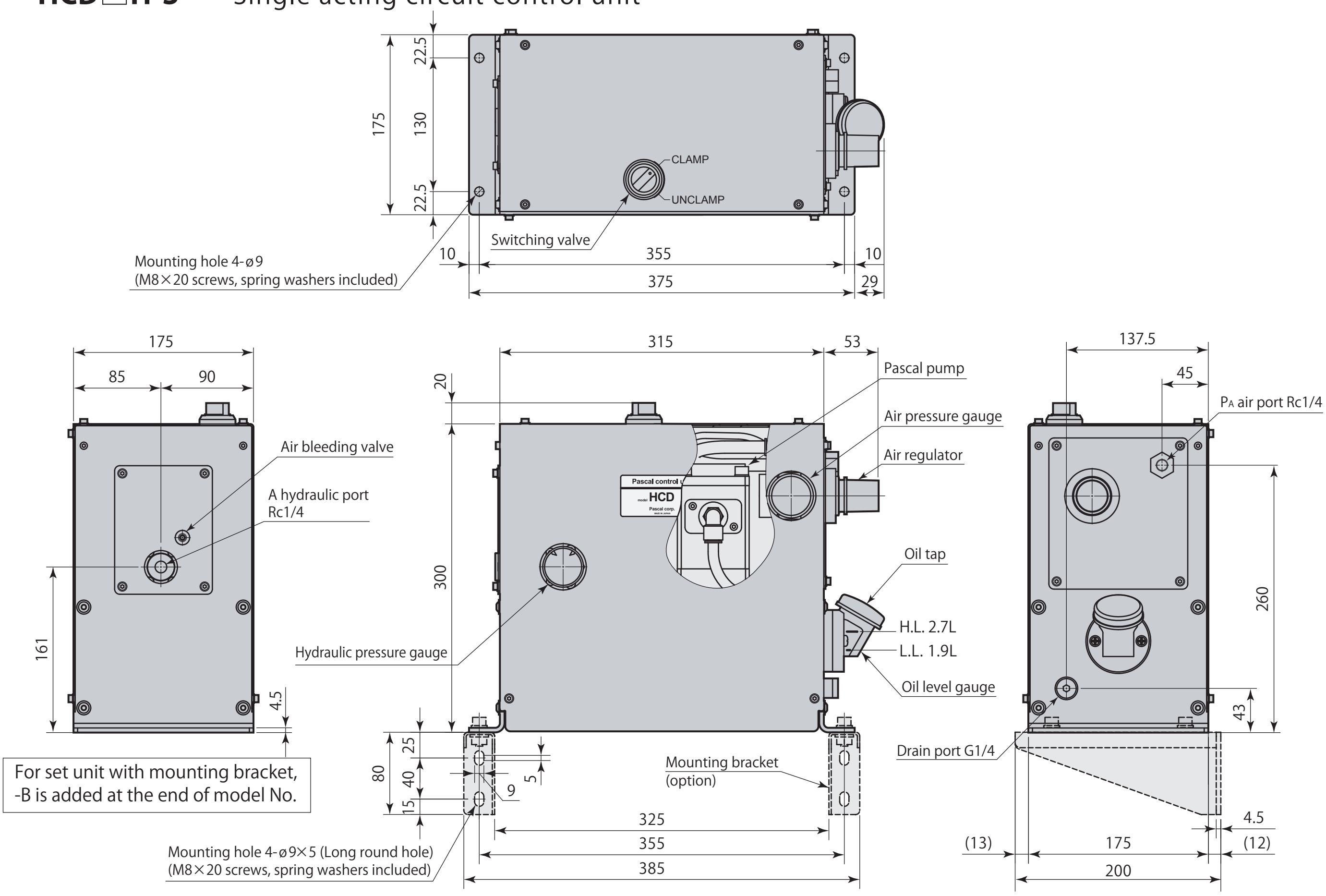


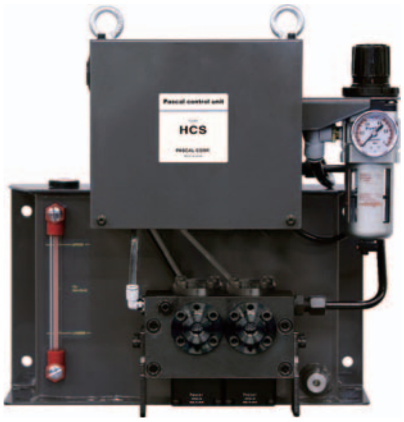
Model		HCD2H-S	HCD3H-S
Pascal pump		X6308U-C	X6310U-C
Discharge oil pressure*1	MPa	8.7–26.1	5.55–16.65
Set air pressure	MPa	0.2–0.5	
Unloaded oil discharge amount	L/min	Refer to **page** →**985** for performance diagram.	
Tank capacity*2	L	H.L. 2.7 L.L. 1.9	
Operating temperature	°C	5–60	
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)	
Mass	kg	21	

∗1: Ask for consultation on specifications that exceed discharge oil pressure range.
∗2: Oil level in the tank should be always between H.L. and L.L. of the gauge.

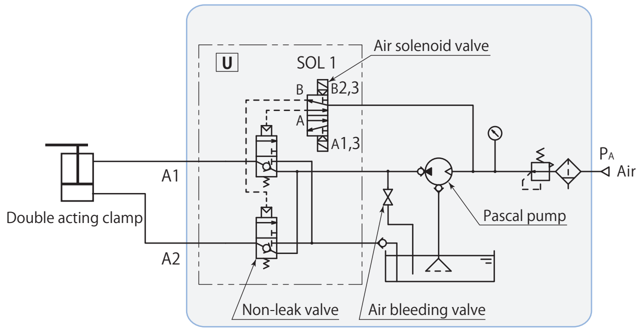
Dimensions

HCD□H-S Single acting circuit control unit





Control unit model **HCSD-H□U**



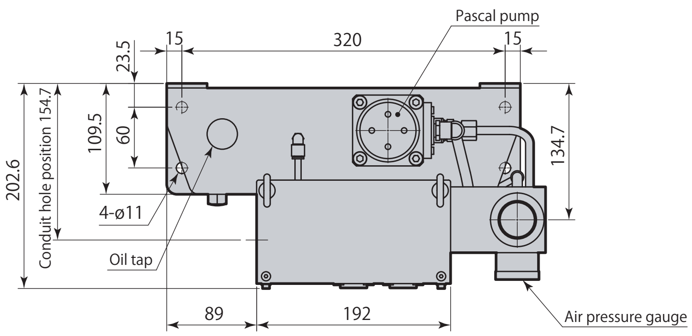
This is a hydraulic control unit that is air driven and solenoidal operated, combining non-leak valve with non-leak feature (zero oil leaks), which is essential for hydraulic clamps, and Pascal pump. Since two hydraulic circuits can be operated and controlled alternatingly, it is best suited hydraulic pressure source for double acting clamps.
Pascal pump stops pumping once circuit pressure has been attained and retains the pressure. Furthermore, since there is hardly any temperature fluctuation of working fluid, there is no need for any auxiliary pressure equipment.
HCSD-H□U is made to order.

Model		HCSD-H2U	HCSD-H3U
Pascal pump		X6308U-D	X6310U-D
Control voltage*1		DC24V	
Discharge oil pressure*2	MPa	8.7–26.1	5.55–16.65
Set air pressure	MPa	0.2–0.5	
Unloaded oil discharge amount	L/min	Refer to **page →985** for performance diagram.	
Tank capacity*3	L	H.L. 3.5 L.L. 1.5	
Operating temperature	°C	0–50	
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)	
Mass	kg	20	

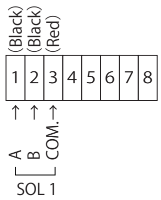
∗1: Ask us if the control voltage is different.
∗2: Ask for consultation on specifications that exceed discharge oil pressure range.
∗3: Oil level in the tank should be always between H.L. and L.L. of the gauge.

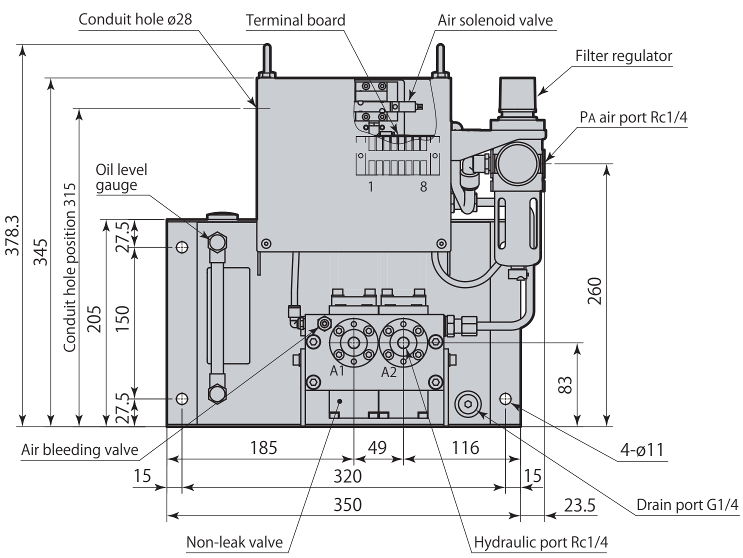
Dimensions

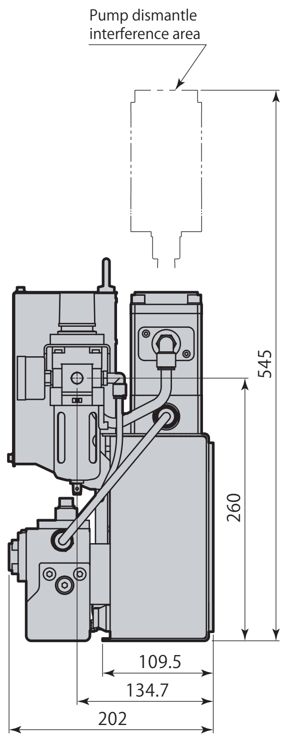
HCSD-H□U Double acting circuit control unit

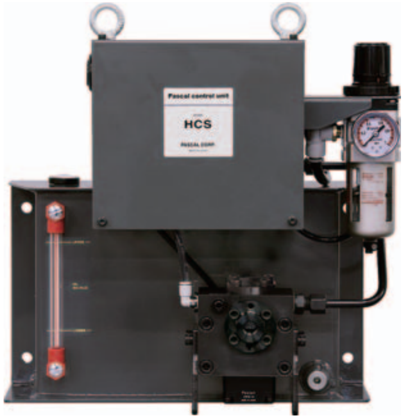


Wiring Diagram







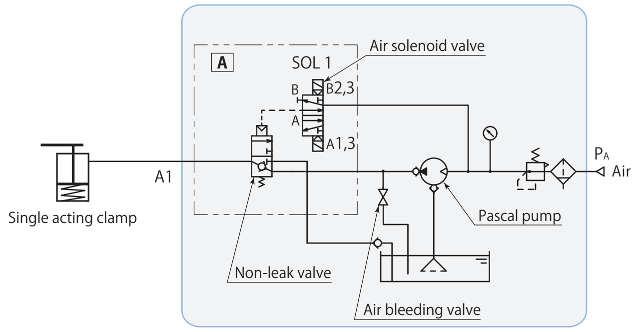


Control unit model **HCSD-H□A**

This is a hydraulic control unit that is air driven and solenoidal operated, combining non-leak valve with non-leak feature (zero oil leaks), which is essential for hydraulic clamps, and Pascal pump.

Pascal pump stops pumping once circuit pressure has been attained and retains the pressure. Furthermore, since there is hardly any temperature fluctuation of working fluid, there is no need for any auxiliary pressure equipment.

HCSD-H□A is made to order.

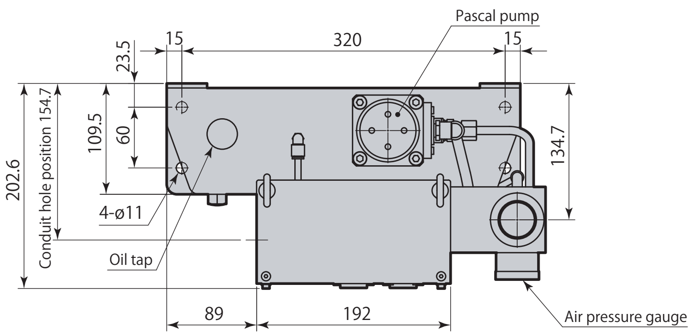


Model	HCSD-H2A	HCSD-H3A
Pascal pump	X6308U-D	X6310U-D
Control voltage*1	DC24V	
Discharge oil pressure*2 MPa	8.7–26.1	5.55–16.65
Set air pressure MPa	0.2–0.5	
Unloaded oil discharge amount L/min	Refer to **page →985** for performance diagram.	
Tank capacity*3 L	H.L. 3.5 L.L. 1.5	
Operating temperature °C	0–50	
Fluid used	General mineral based hydraulic oil (ISO-VG32 equivalent)	
Mass kg	17	

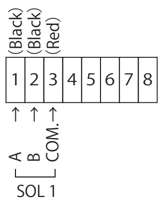
∗1：Ask us if the control voltage is different.
∗2：Ask for consultation on specifications that exceed discharge oil pressure range.
∗3：Oil level in the tank should be always between H.L. and L.L. of the gauge.

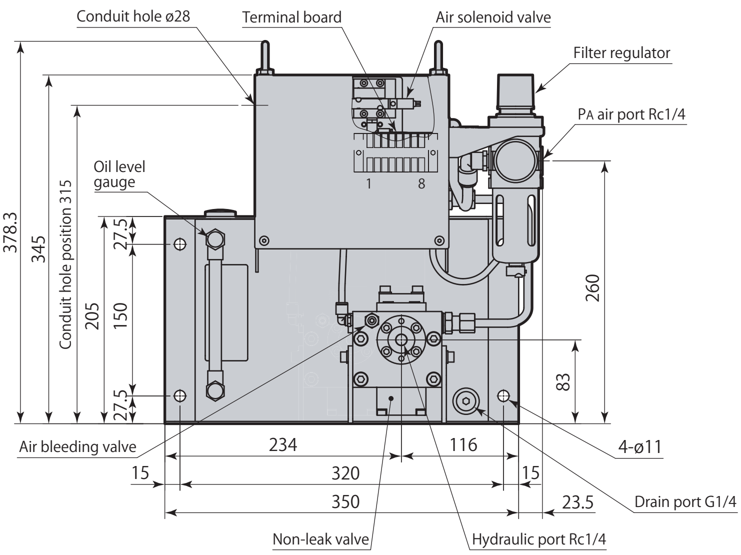
Dimensions

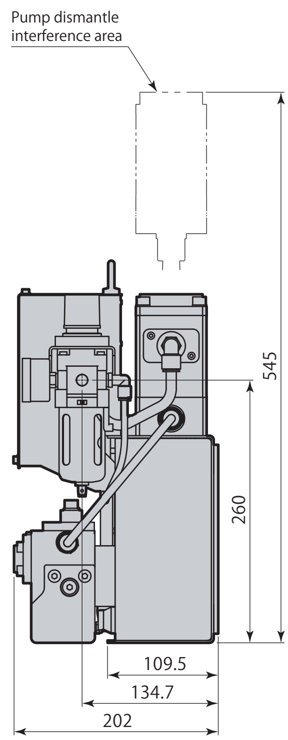
HCSD-H□A Single acting circuit control unit



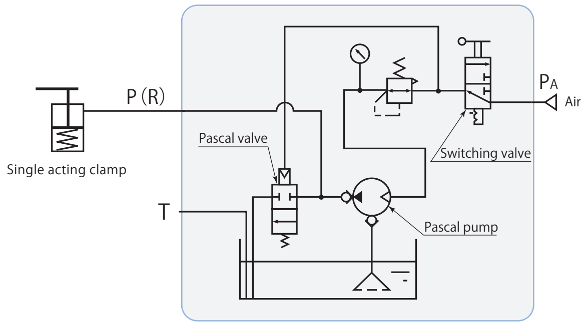
Wiring Diagram







Control unit model **HCT-□**



Compact hydraulic control unit for air drive and manual operations. Pascal pump stops pumping once circuit pressure has been attained and retains the pressure. Furthermore, since there is hardly any temperature fluctuation of working fluid, there is no need for any auxiliary pressure equipment.

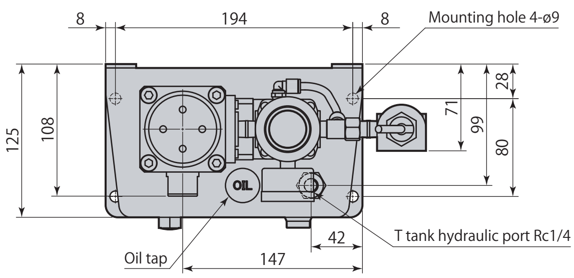
Model		HCT-2	HCT-3
Pascal pump		X6308-HCK-C	X6310-HCK-C
Discharge oil pressure*1	MPa	8.7–26.1	5.55–16.65
Set air pressure	MPa	0.2–0.5	
Unloaded oil discharge amount	L/min	Refer to page →985 for performance diagram.	
Tank capacity*2	L	H.L. 1.5 L.L. 0.6	
Operating temperature	°C	5–60	
Fluid used		General mineral based hydraulic oil (ISO-VG32 equivalent)	
Mass	kg	8.3	

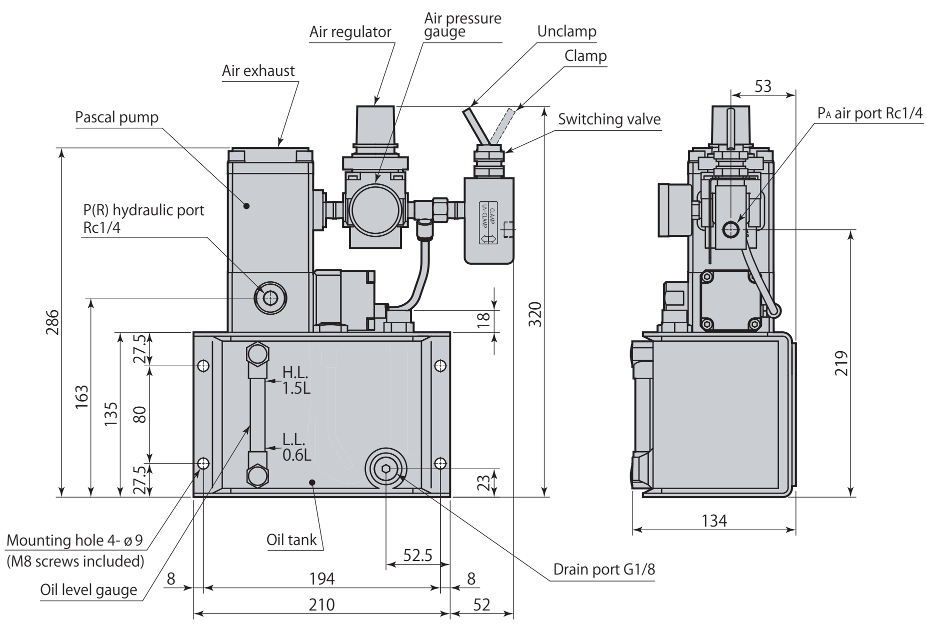
*1: Ask for consultation on specifications that exceed discharge oil pressure range.

*2: Oil level in the tank should be always between H.L. and L.L. of the gauge.

Dimensions

HCT-□ Single acting circuit control unit





Pascal pump model **X63**

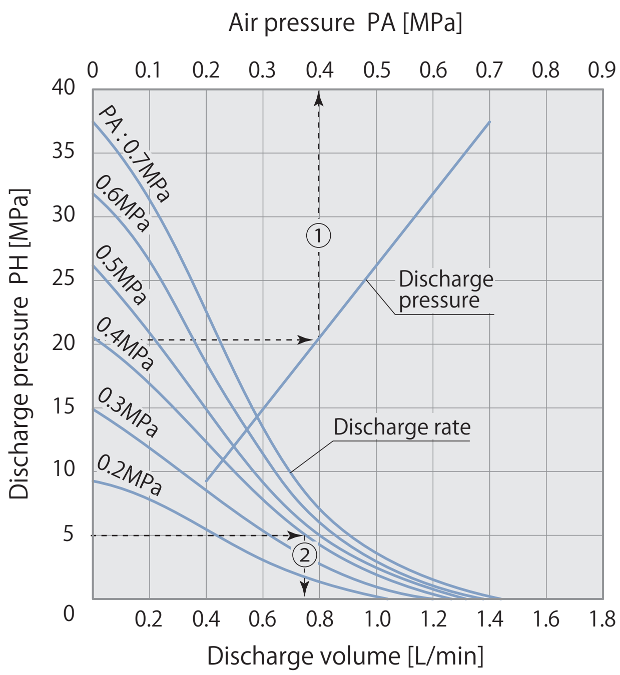
- Air-driven, compact, high performance hydraulic pump.
- Pascal pump is a compact but reliable hydraulic pump, which converts a compressed air force into high-pressure hydraulic power.
- Secure and high speed reciprocation of air and hydraulic piston generates a repetitive suction and discharge of air and oil. As the hydraulic pressure becomes close to the designated level, the reciprocation becomes slower. At the designated hydraulic pressure, the driving air force and hydraulic force become balanced to maintain the pressure.
- At the balanced condition, there is no air consumption so that there is no power loss or temperature rise compared to an electric pump. In the event of an air supply failure, the hydraulic pressure can be kept by the built-in check valve on the discharge side.
- If there is a decrease in the downstream holding pressure, the pump immediately reacts to start reciprocating to recover the pressure loss.

Model	X6308		X6310	
Control unit models	HCD2H-W HCSD-H2U HCT-2	HCD2H-S HCSD-H2A	HCD3H-W HCSD-H3U HCT-3	HCD3H-S HCSD-H3A
Boosting ratio	58		37	
Mass	2.6 kg			

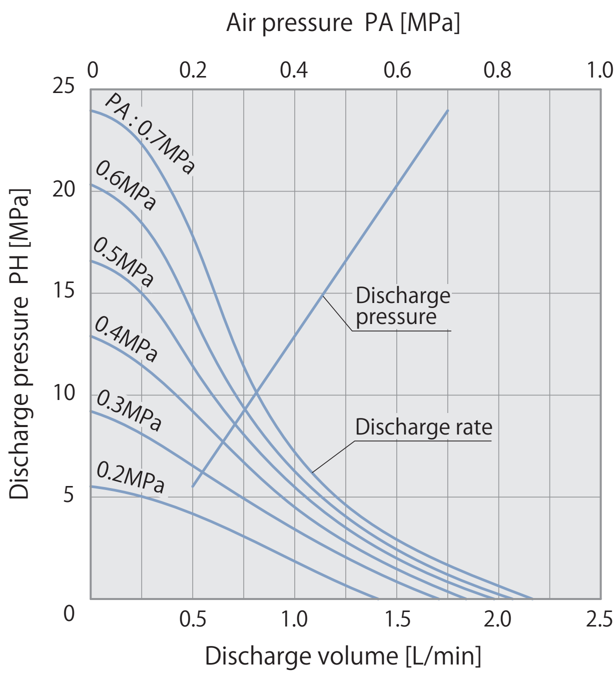
Air pressure range	:0.2–0.7 MPa
Air consumption	:0.4 Nm³/min
Operating noise	:78±1 db (A)
Operating temperature	:0–70 ℃ (No frozen)

Performance diagram [Measured with operating oil ISO-VG32 at 20℃]

X6308 PH = 58 (PA-0.05)



X6310 PH = 37 (PA-0.05)



1. How to read the discharge pressure (PH)* [ex:X6308]

*:PH is the pump discharge pressure when cylinders are clamped and the circuit pressure is built up.

When 20 MPa is required for PH, the desired air pressure (PA) should be 0.4 MPa by following the chain line ①.

2. How to read the discharge volume [ex:X6308]

When 0.4 MPa air pressure (PA) is supplied, with discharge pressure at 5 MPa, the discharge volume should be 0.75 L/min by following the chain line ②. (Pump discharge pressure while cylinders are in action may vary according to the circuit structure.)

Work clamp & work support 7 MPa 35 MPa

● Swing clamp

Old model	New model	End date
CTE	**CTT**	September 2003
CTG	**CTU**	September 2003
CTF	**CTU**	April 2000
CTD	**CTW/CTK**	October 2003
CTC	**CTV**	August 2003
CTB	**CTW**	October 1998

● Link clamp

Old model	New model	End date
CLR	**CLT**	April 2004
CLG	**CLU**	February 2004
CLC	**CLT**	January 2001
CLD	**CLU**	February 2000
CLW	**CLW-N**	June 2019
CLV	**CLV-N**	June 2019
CLB	**CLW**	January 2000

● Work support

Old model	New model	End date
CSH	**CSU**	June 2009
CSG	**CST**	June 2009
CSD	**CSV**	August 2003
CSE	**Production discontinued**	August 2003
CSF	**CSW**	August 2003

Work positioning cylinder

● Work positioning cylinder

Old model	New model	End date
CGK	**CEK**	November 2013

Pallet clamp

● Pallet clamp

Old model	New model	End date
CPC-□□F	**CPC-□□H**	December 2010
CPH-□□F	**CPH-□□H**	December 2010

● Locate ring

Old model	New model	End date
CPS-A□□	**CPS-E□□**	March 2005
CPS-B□□	**CPS-F□□**	March 2005

Hydraulic control system 7 MPa 30 MPa

● Coupling valve

Old model	New model	End date
VHC	**VHD**	December 2010

● Reducing valve

Old model	New model	End date
VRD	**VRG**	October 2008

● Sequence valve

Old model	New model	End date
VED	**VEF**	January 2014

● Control unit

Old model	New model	End date
HCD□	**HCD□H**	November 2015
HCK	**HCT**	November 2011

● Pascal pump

Old model	New model	End date
HPX	**X63**	July 2013

Work clamp & work support Air

● Air swing clamp

Old model	New model	End date
CTL	**CTX**	June 2009

● Air link clamp

Old model	New model	End date
CLL	**CLX**	June 2009

● Air work support

Old model	New model	End date
CSR	**CSS**	June 2009

Ask for more details about compatibility with old model.