Expansion clamp

Double acting 7MPa

model CGU

model CGU

Specifications

CGU — F2

Size

1	—	: Air blow model
2	E	: Non-constant air blow model

Grip inner diameter : Number of grippers

07	08		: 4 Gripper
09	10		: 2 Gripper
11	12	13	: 3 Gripper

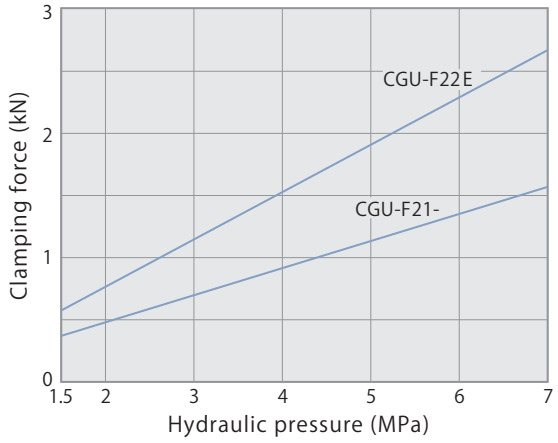
■ indicates made to order.

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				
	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

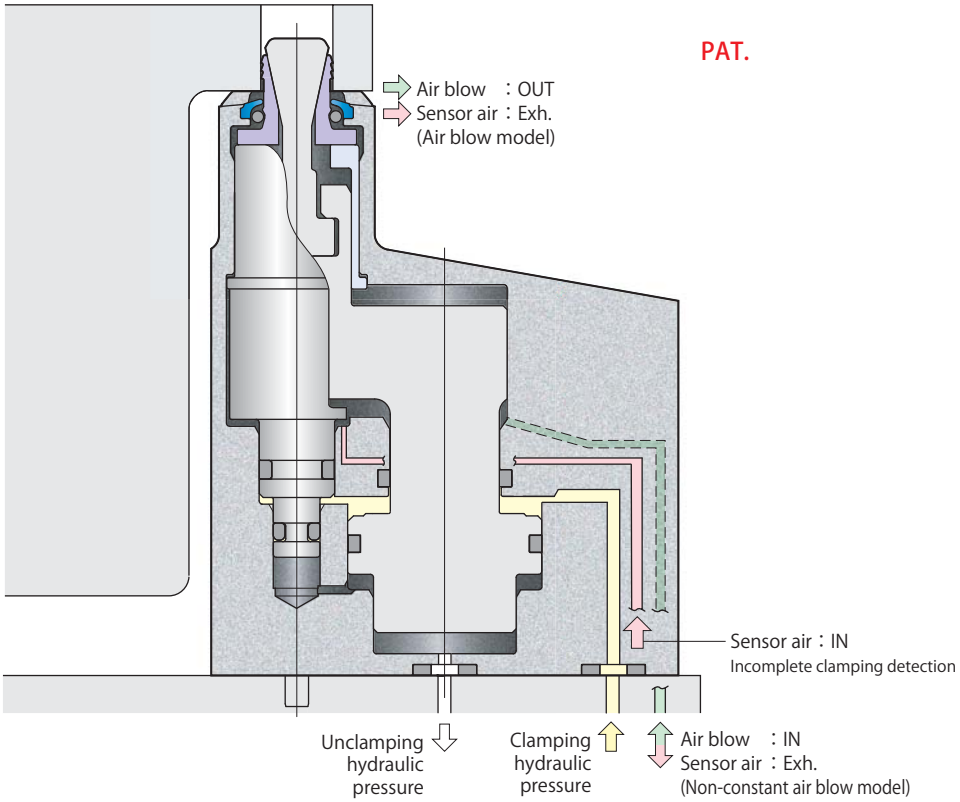
P : Hydraulic pressure (MPa)

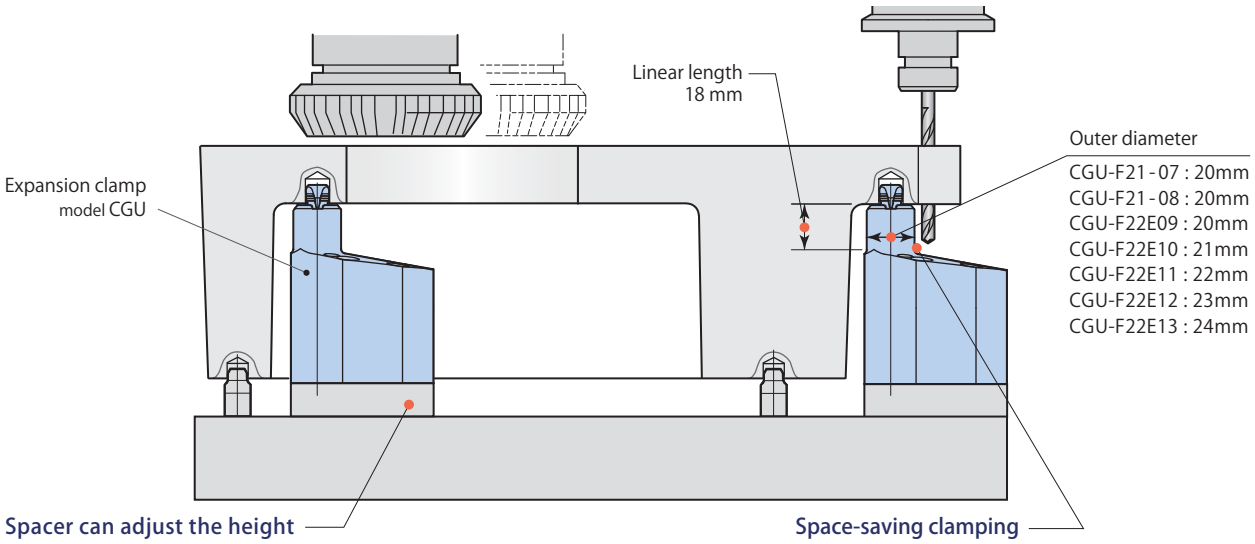
Air blow model
model **CGU-F21-**
4 Grippers
ø7 8

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

PAT.

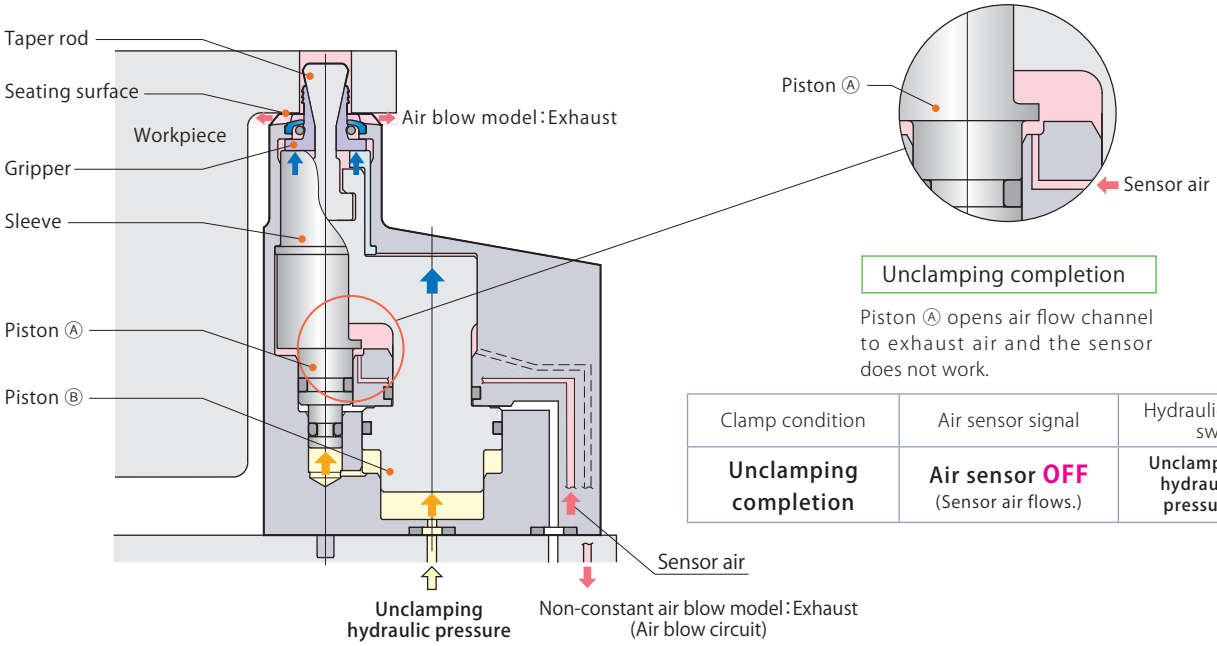




Workpiece setting (Unclamping completion)

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**

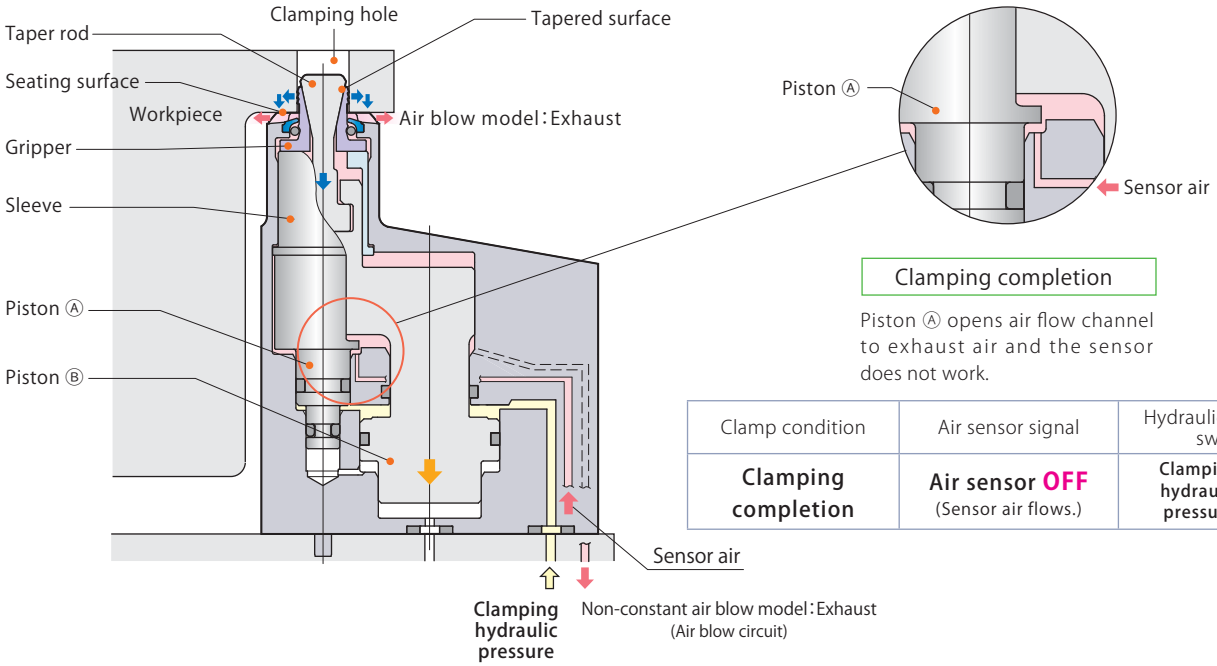
Workpiece holding (Clamping completion)

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.



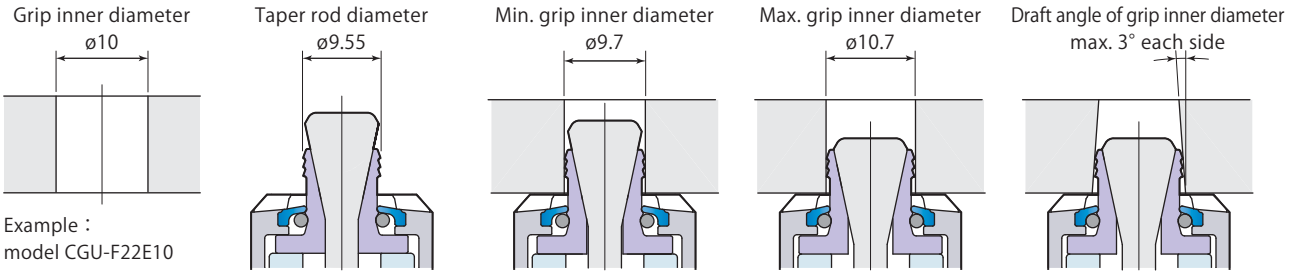
Clamping completion

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.

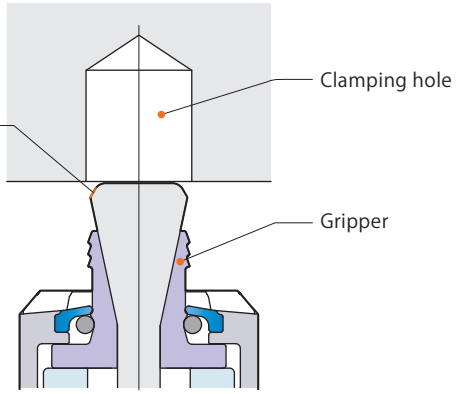


Taper rod and gripper with superior durability

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.

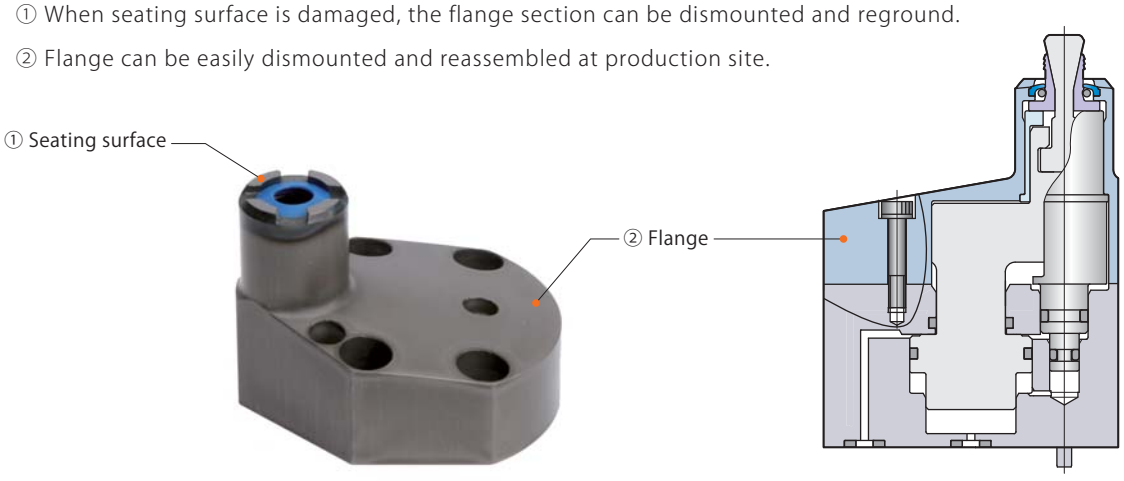
③ Tip section of taper rod has larger diameter than gripper and is well chamfered to be a better guide when setting the workpiece.



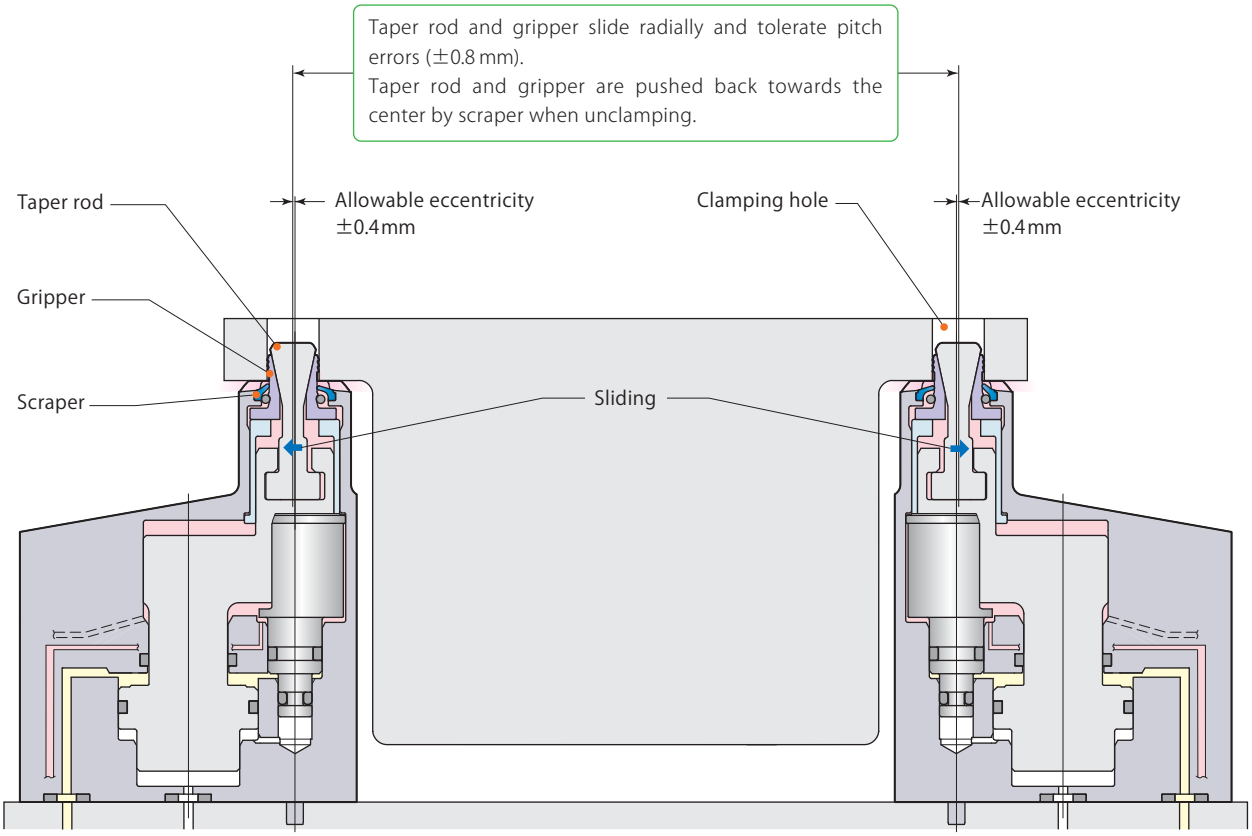
Seating surface can be reground (Max. 0.1 mm)

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.



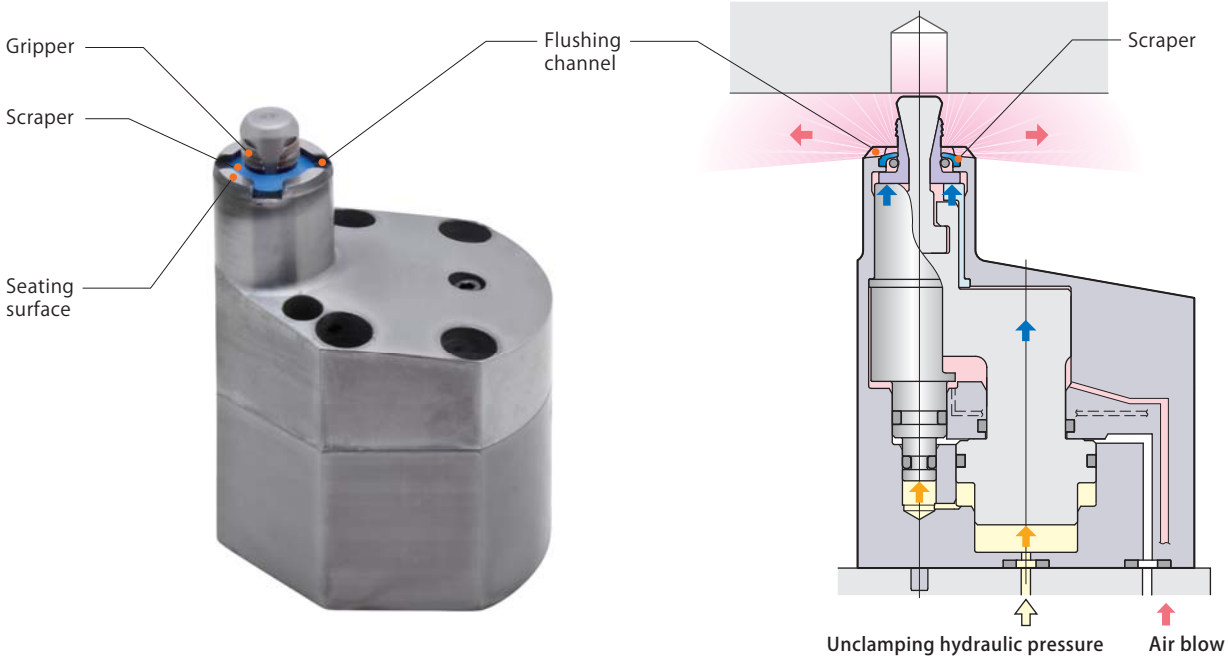
Clamping hole pitch errors can be tolerated



By the eccentric mechanism, the expansion clamp does not have a workpiece positioning function.

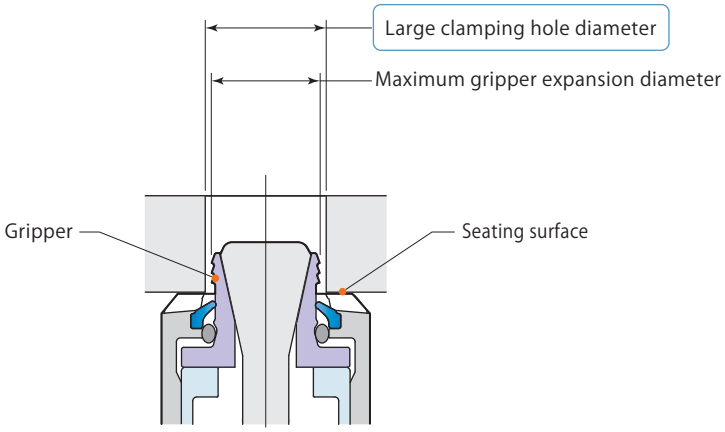
Incorporating strong air blowing circuit

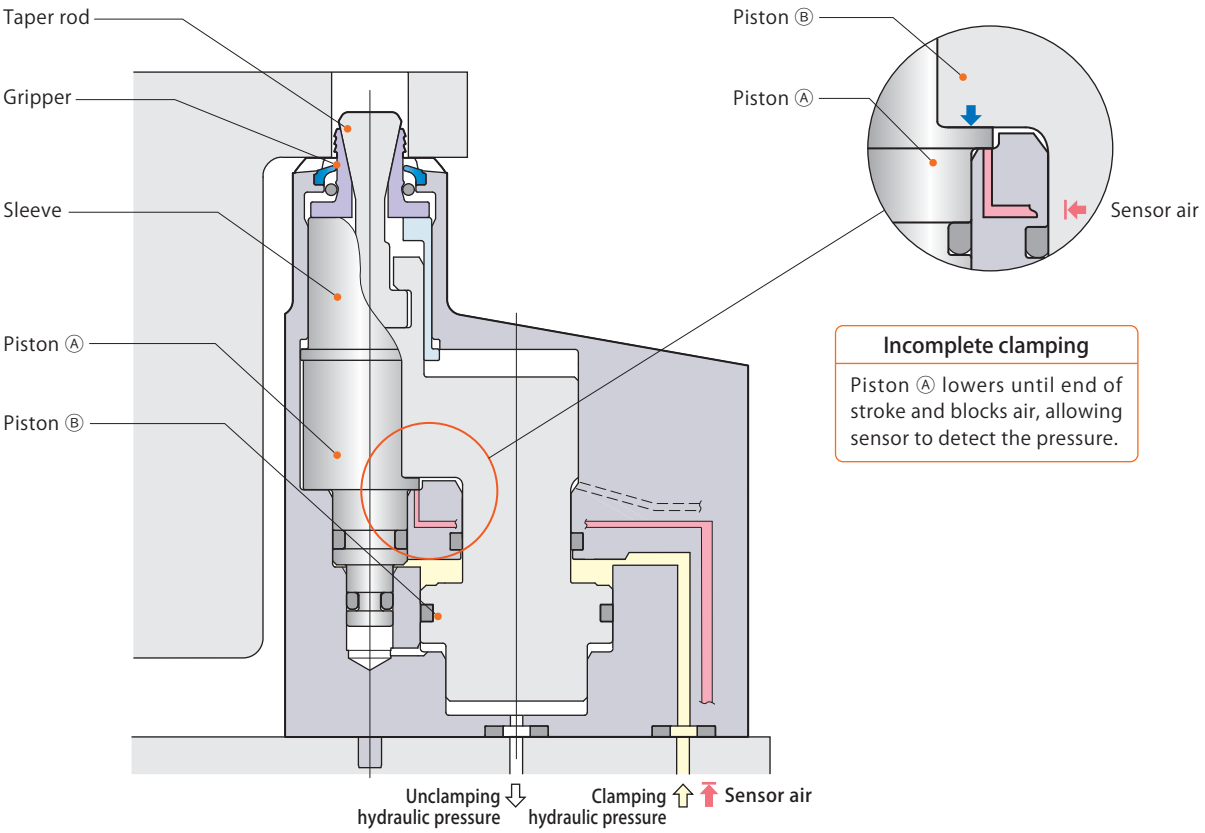
Air blow from a gap between the gripper and scraper clears off metal chips and coolant that stay on the seating surface. Flushing channel is also provided on the seating surface to remove the metal chips and coolants smoothly during workpiece setting.



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.





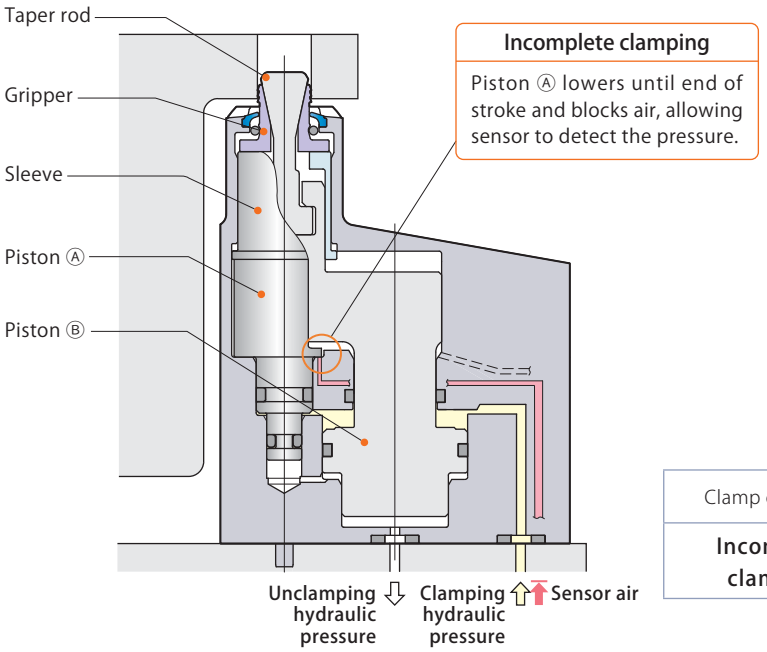
Incomplete clamping

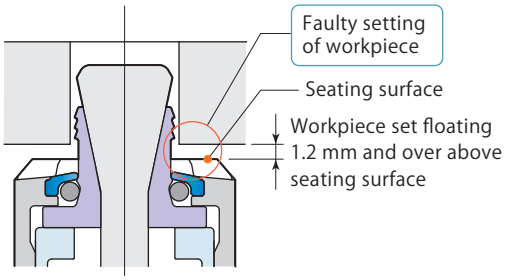
Piston Ⓐ lowers until end of stroke and blocks air, allowing sensor to detect the pressure.

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.

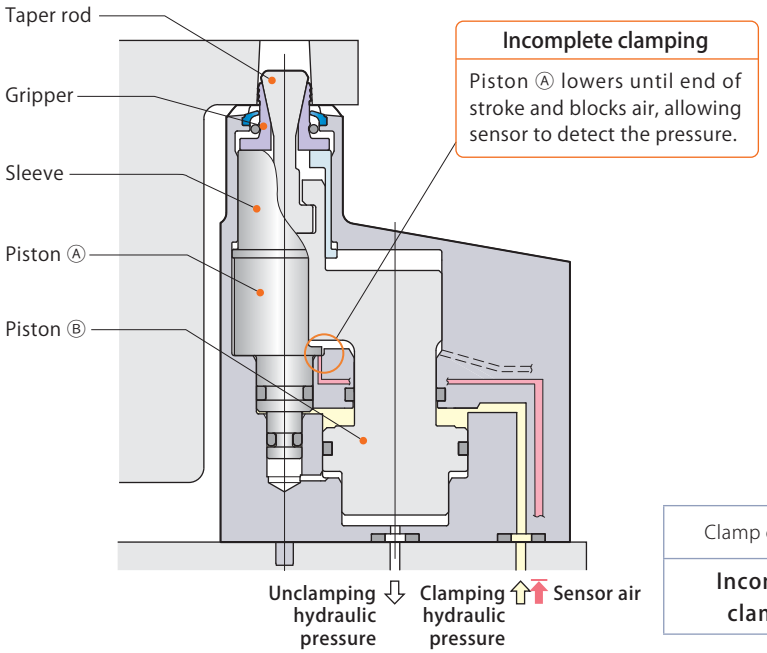


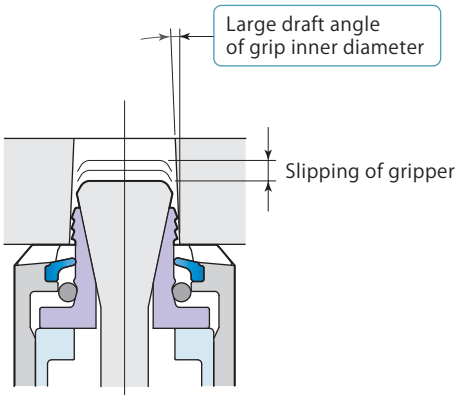


Clamp condition	Air sensor signal	Hydraulic pressure switch
Incomplete clamping	**Air sensor ON** (Sensor air does not flow.)	**Clamping hydraulic pressure** **ON**

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

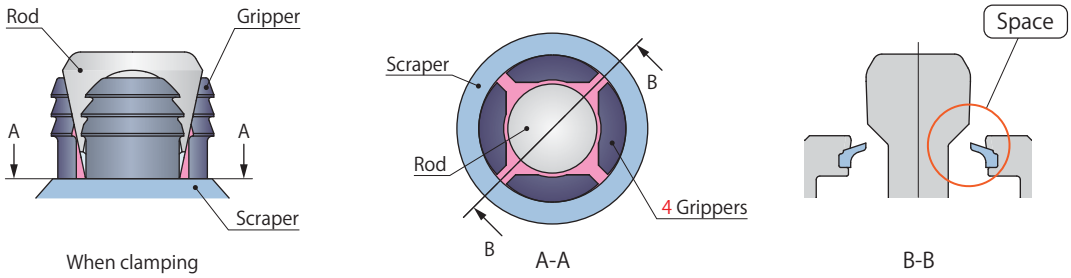
Non-constant air blow model

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.

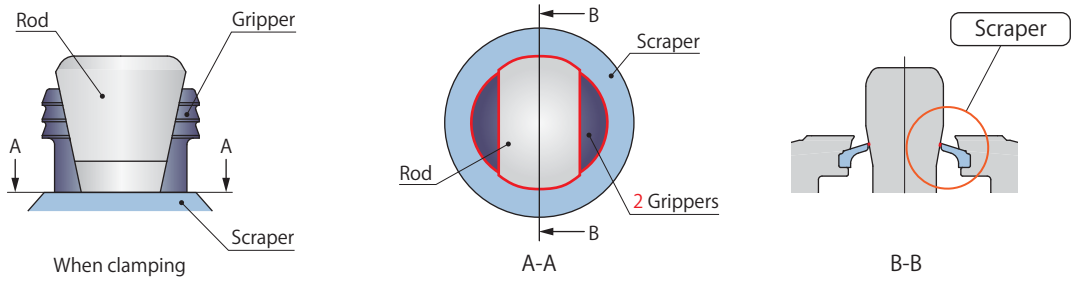
Space where metal chips can intrude is created



Pages →76, 77

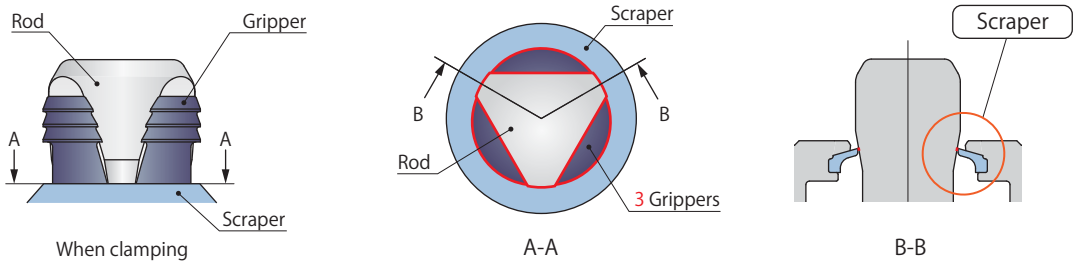
Because of space between scraper, gripper and the rod, air blow must always be performed to prevent intrusion of chips.

Secure chip protection



Pages →78, 79

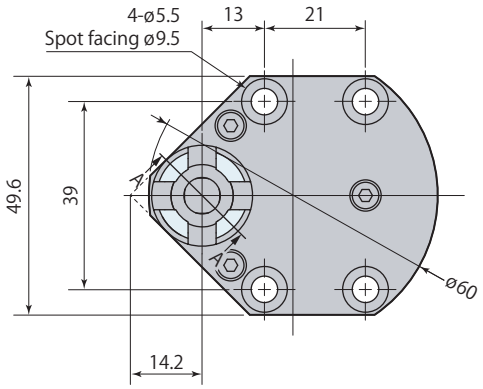
Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.

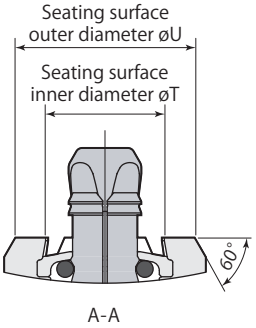


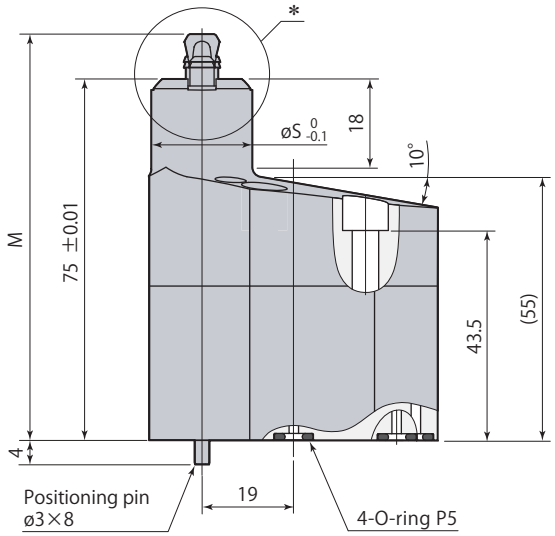
Pages →80, 81

Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.

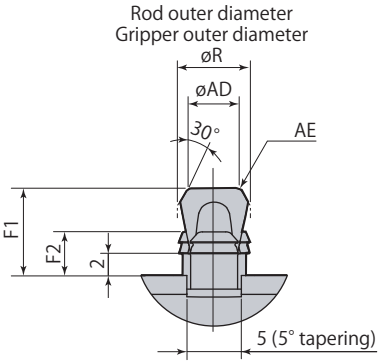
Dimensions



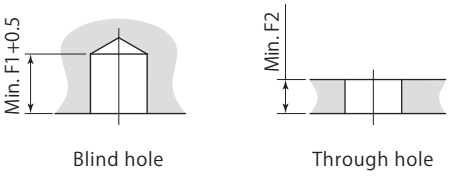


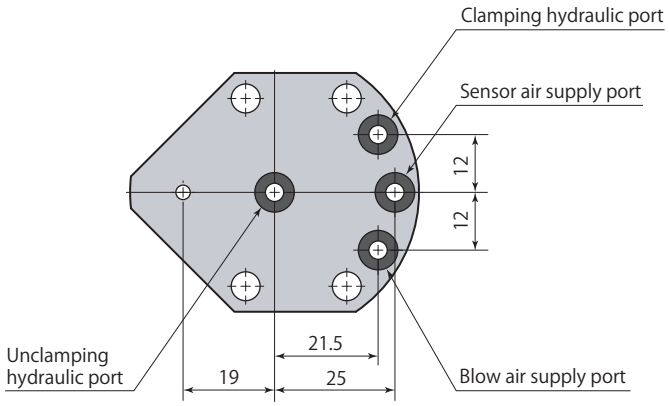


*Details



Grip inner diameter usage requirements



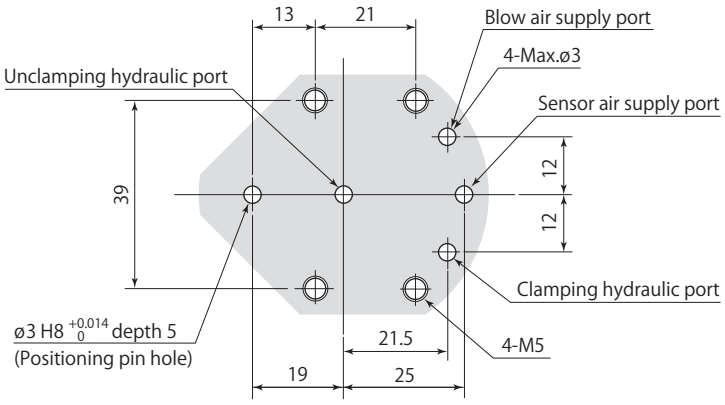


mm

Model	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

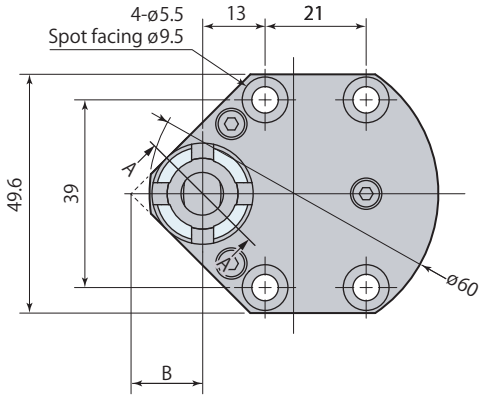
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.
- CGU-F21-07, 08 are made to order.

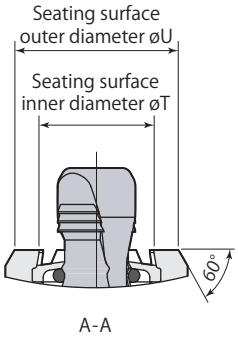
Mounting details

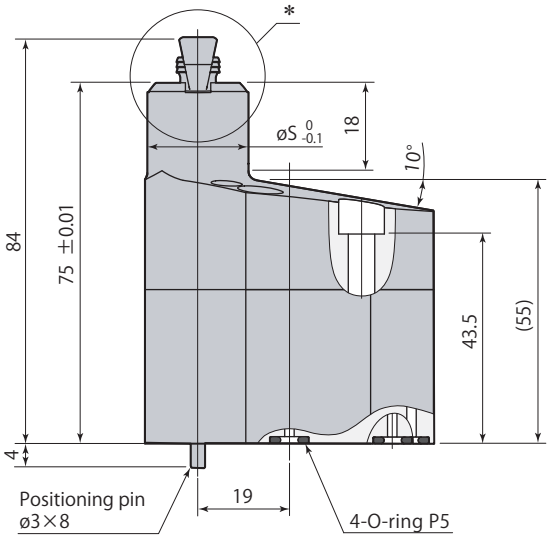


● The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

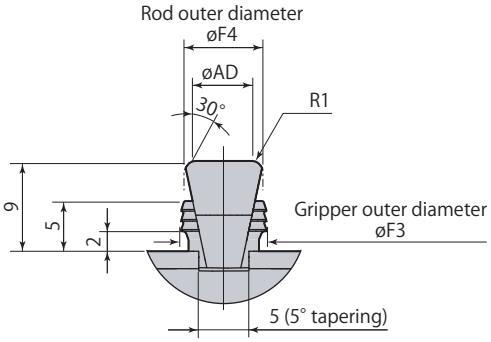
Dimensions



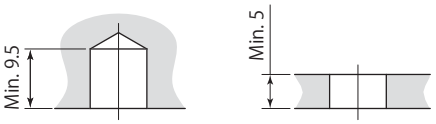


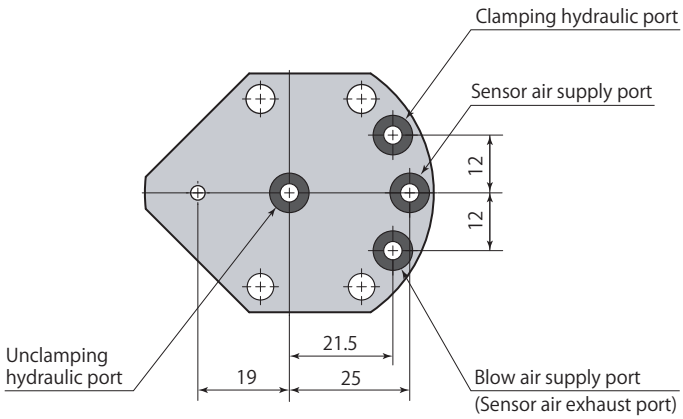


∗Details



Grip inner diameter usage requirements





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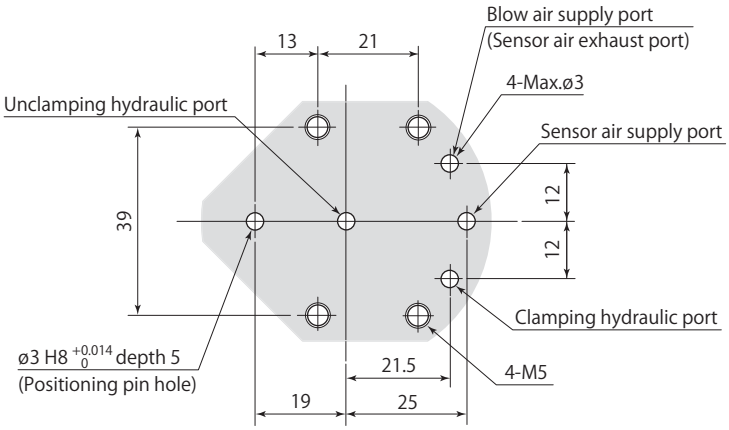
Model	CGU-F22E□	
	09	10
B	14.2	14.9
øF3	8.5	9.5
øF4	8.55	9.55
øS	20	21
øT	12.6	13.6
øU	18	19
øAD	6.8	7.8

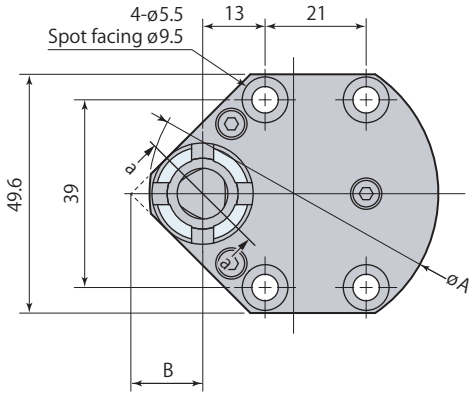
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.
- CGU-F22E09, 10 are made to order.

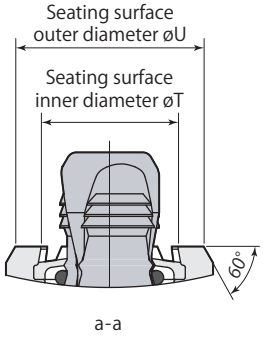
Mounting details

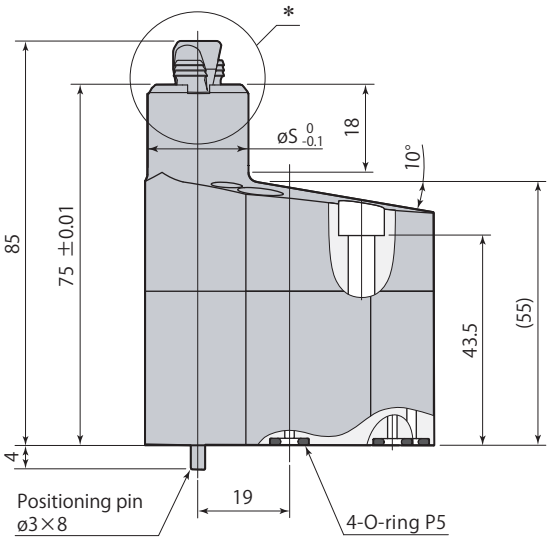


● The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

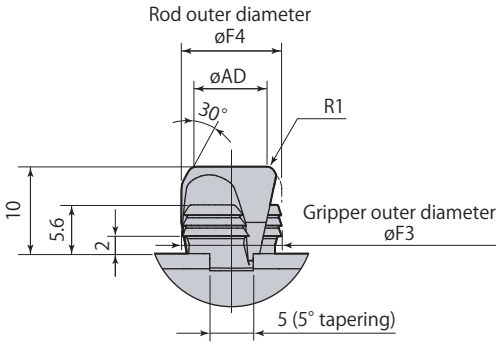
Dimensions



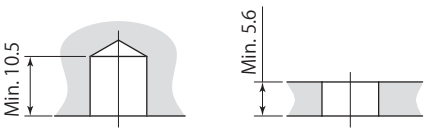


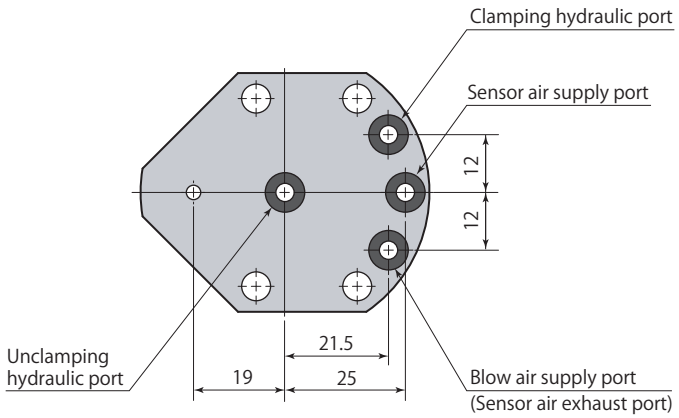


*Details



Grip inner diameter usage requirements





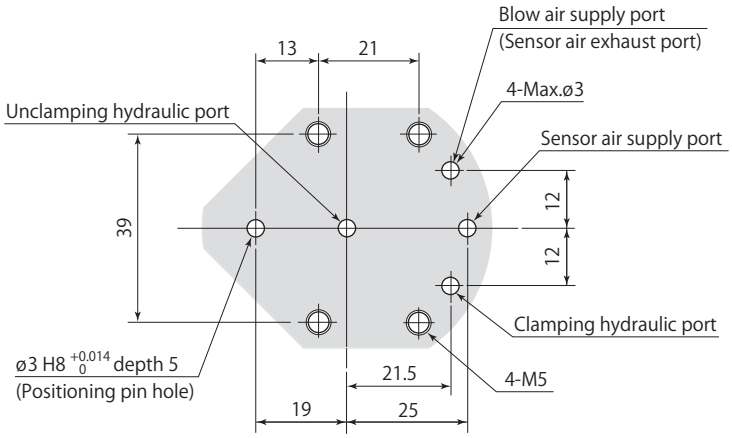
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

mm

Model	CGU-F22E□		
	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

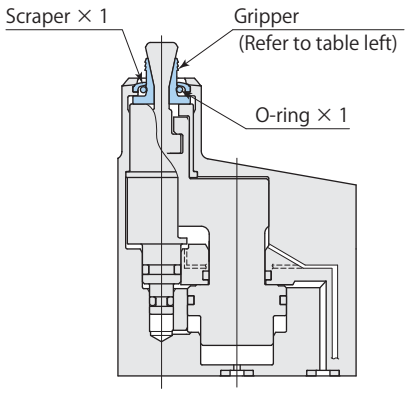
- CGU-F22E11, 12, 13 are made to order.

Mounting details



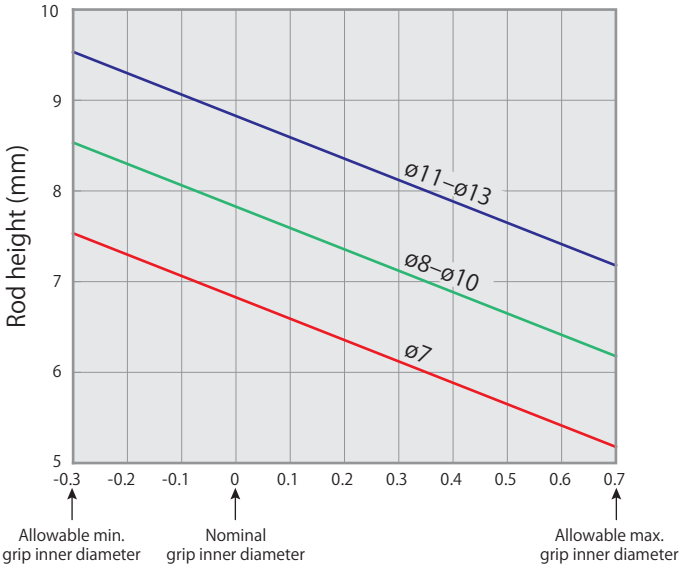
● The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

Gripper set replacement

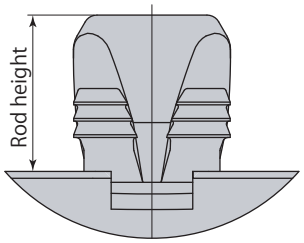
Number of grippers	Gripper set model	Clamp model	Set description
4 Grippers	CGU-F21-J07	CGU-F21-07	
	CGU-F21-J08	CGU-F21-08	
2 Grippers	CGU-F22EJ09	CGU-F22E09	
	CGU-F22EJ10	CGU-F22E10	
3 Grippers	CGU-F22EJ11	CGU-F22E11	
	CGU-F22EJ12	CGU-F22E12	
	CGU-F22EJ13	CGU-F22E13	

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



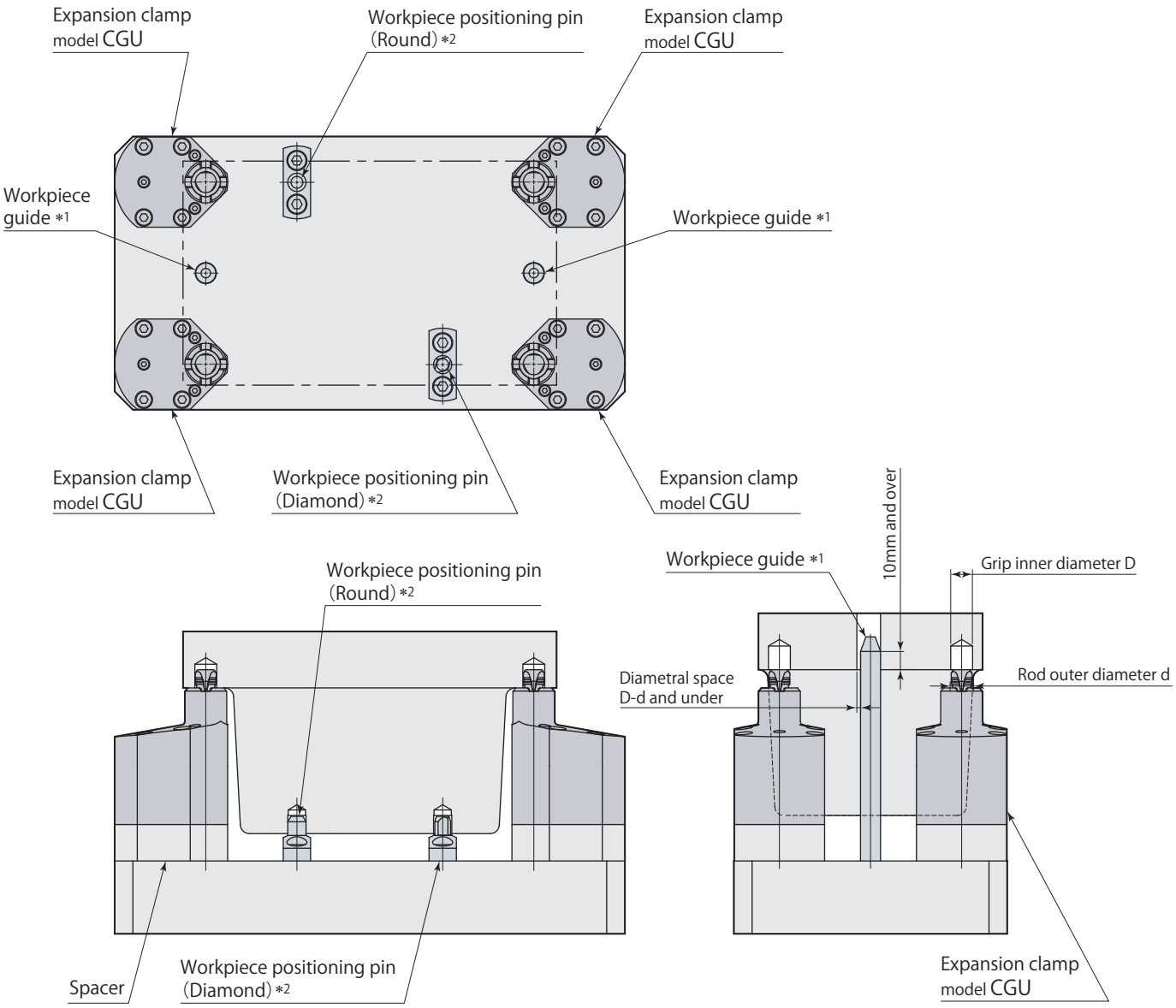
Difference between actual grip inner diameter and nominal grip diameter (mm)



Rod height calculation formula		
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

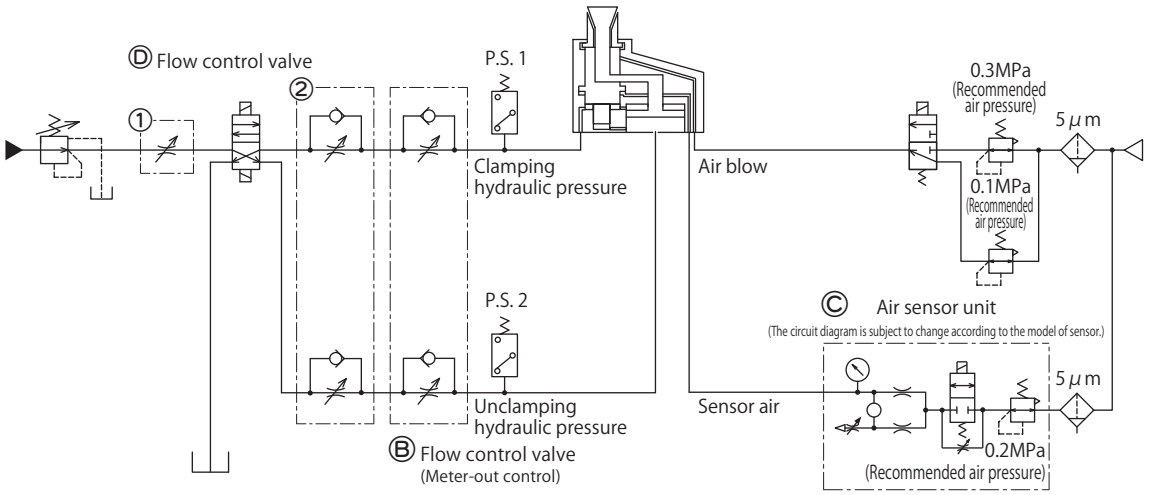
System configuration example



*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.

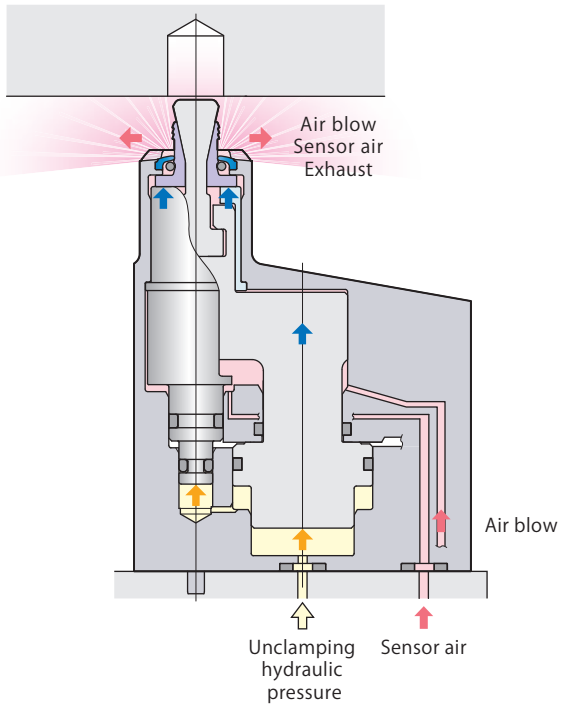
*2: **The expansion clamp does not have a workpiece positioning function.**
Install workpiece positioning pins (or similar).

Air blow model hydraulic and pneumatic circuit diagram

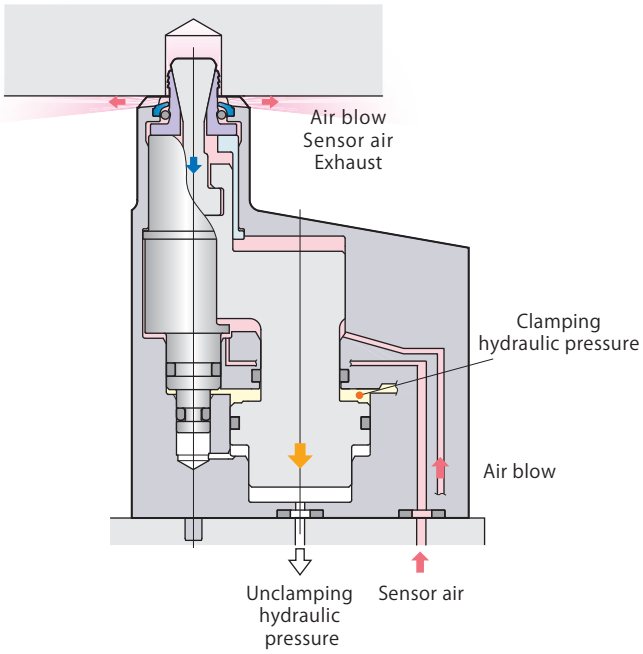


- Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping. During cutting, if chips adhere to the gripper such as when going through the clamping hole, continue air blowing during processing as well.
- Air blow pressure must be set to 0.1MPa when checking the operation of the clamp with the air sensor.

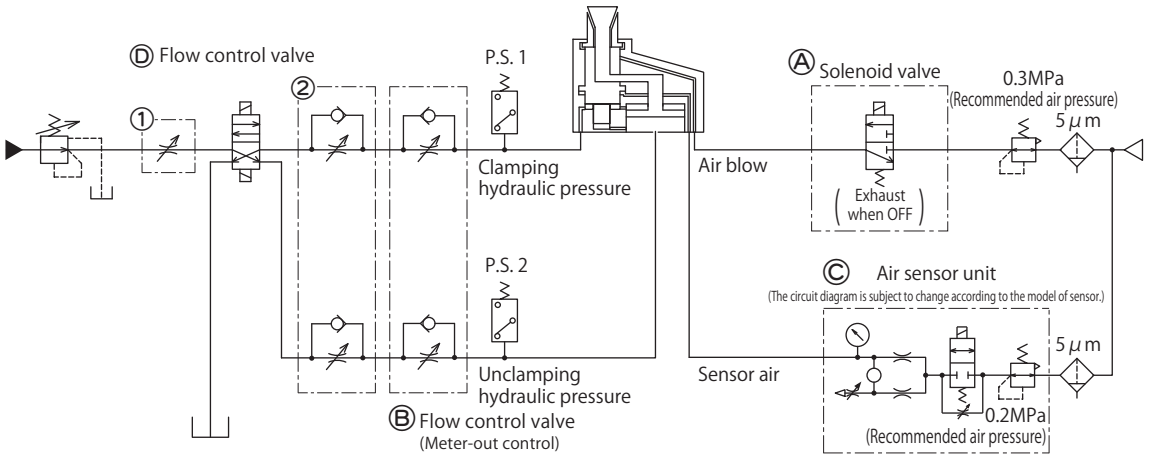
Air blowing



Clamping

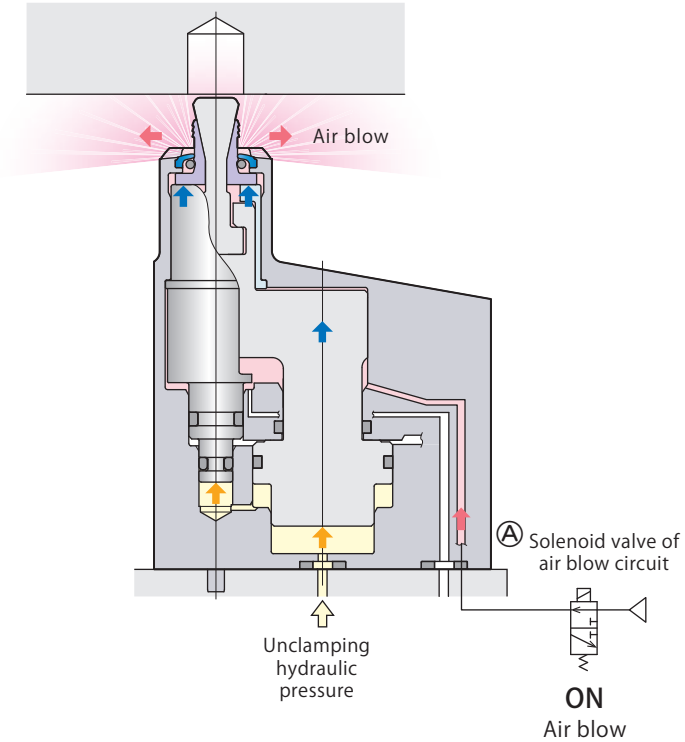


Non-constant air blow model hydraulic and pneumatic circuit diagram

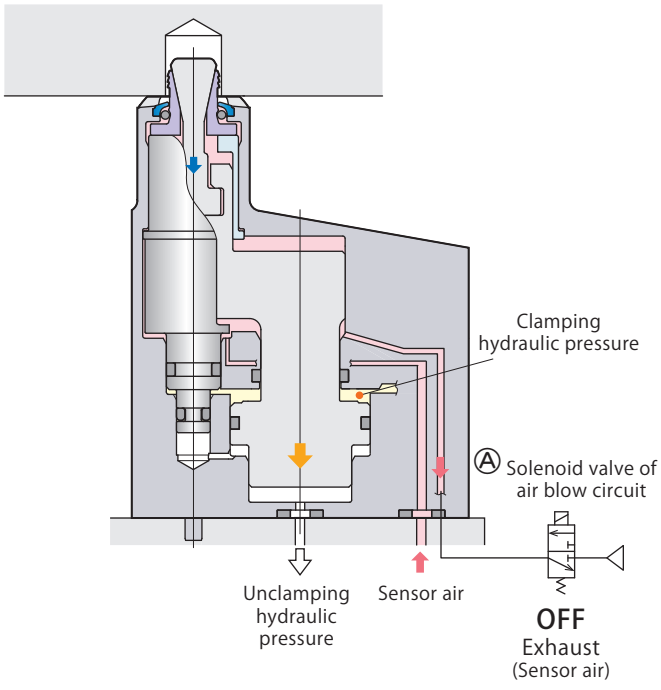


- Air blow will not be necessary during cutting process. Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping to remove metal chips and debris.
- The solenoid valve Ⓐ must be closed when checking the operation of the clamp with the air sensor. Also 3 port type of 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



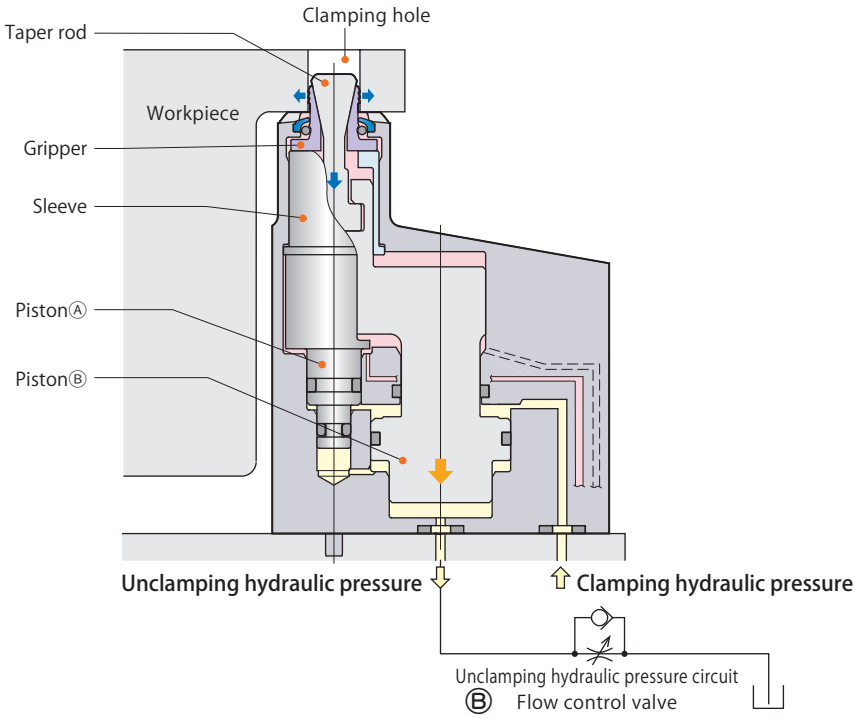
Clamping



- 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

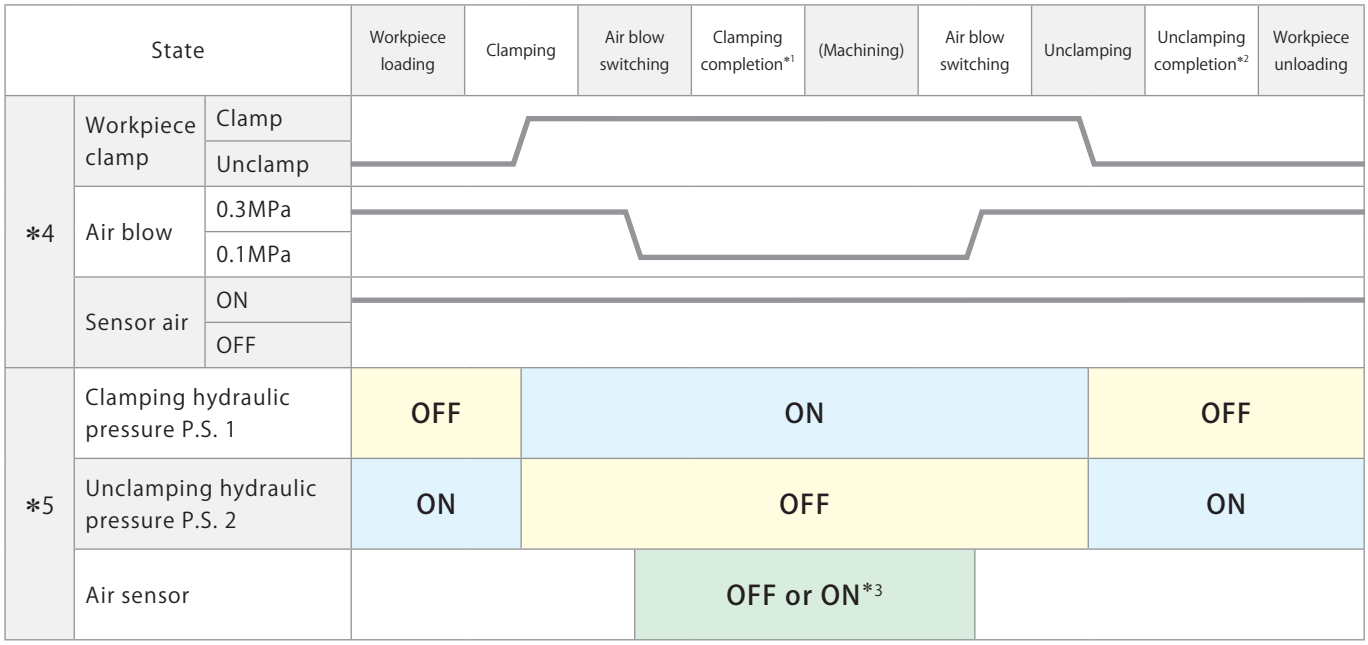
- Use a solenoid valve with needle for air sensor unit Ⓒ and control it supplying air all the time in order to eliminate intrusion of chips or coolant.

- 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

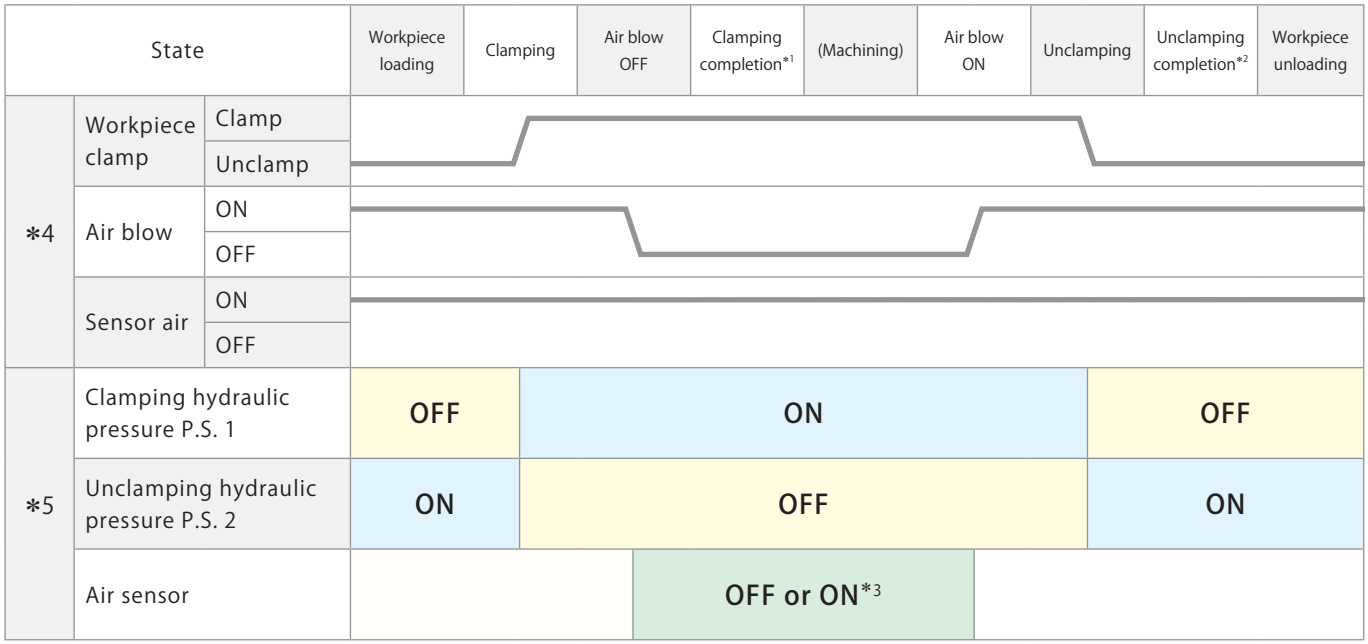
The clamp should be controlled with the cycle in the diagram shown below to detect the operation status exactly.

Case of air blow model



∗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



∗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 →67** 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 →84**, **85** 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