

# air Expansion clamp

Double acting 1MPa

model **CGE**



model CGE

## Specifications

Grip inner diameter : Number of grippers

CGE — N22E **070 073 076 079 082** : 2 Grippers  
**085 09 10**

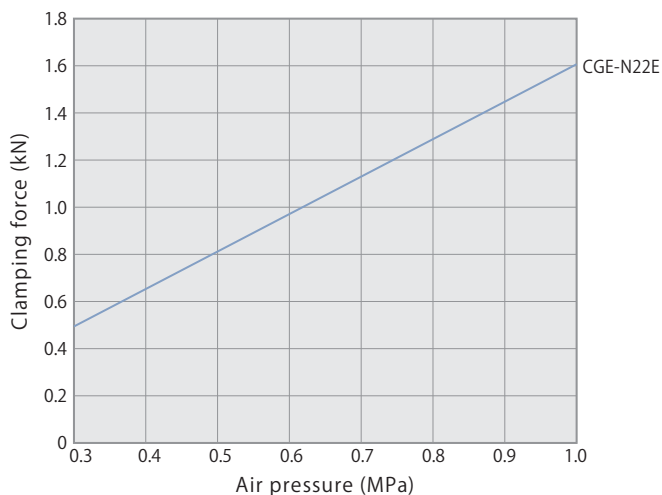
**11 12 13** : 3 Grippers ■ indicates made to order.

Model	Grip inner diameter	CGE-N22E										
		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	8.7										
	Unclamp	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 °C
- 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 $F=1.617 \times P$	kN	0.49	0.65	0.81	0.97	1.13	1.29	1.46	1.62

P: Air pressure (MPa)

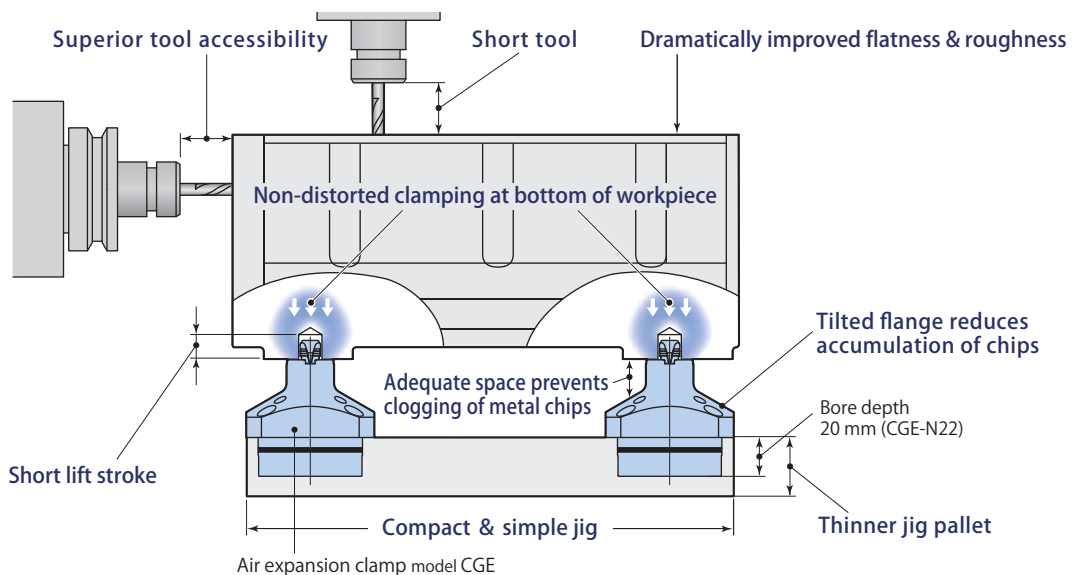
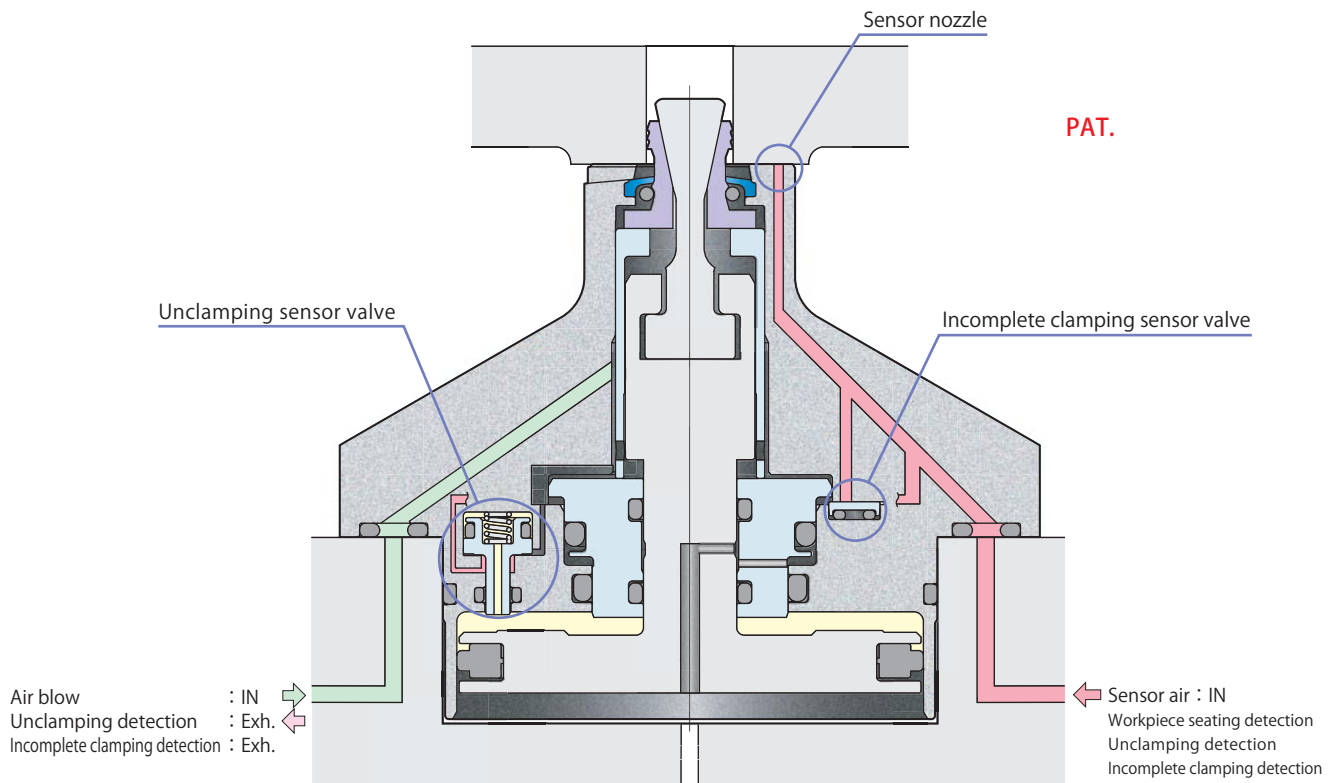
model **CGE-N22E**  
2 Grippers  
ø7.0 7.3 7.6 7.9 8.2



model **CGE-N22E**  
2 Grippers  
ø8.5 9 10



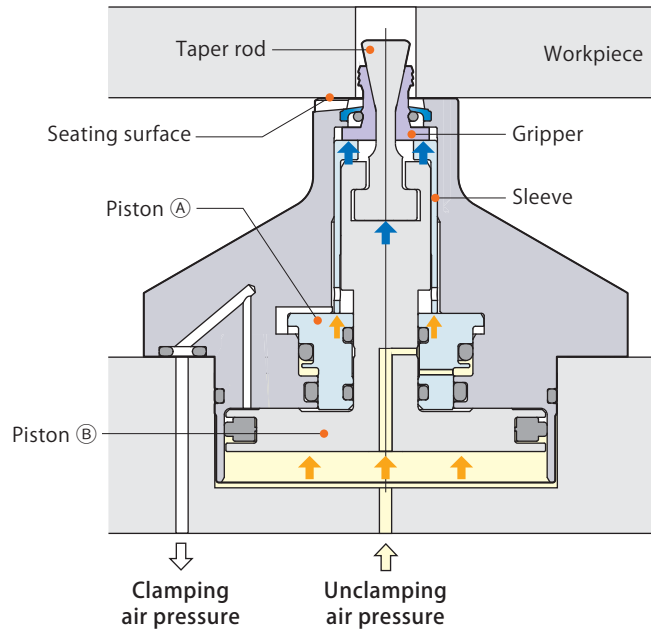
model **CGE-N22E**  
3 Grippers  
ø11 12 13



Air expansion clamp  
CGE

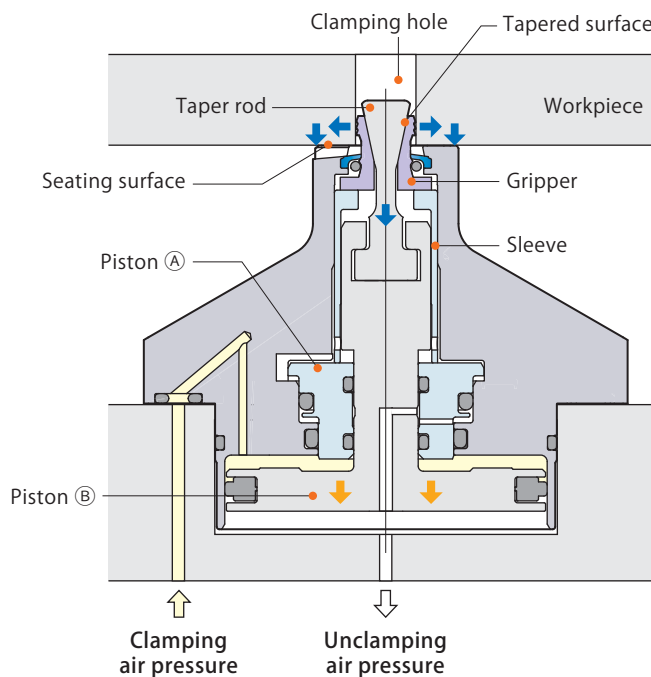
### Workpiece setting

- ① Taper rod and gripper are raised by pistons (A), (B) and sleeve. The gripper is drawn inward within the taper rod diameter.
- ② Set the workpiece onto the seating surface.



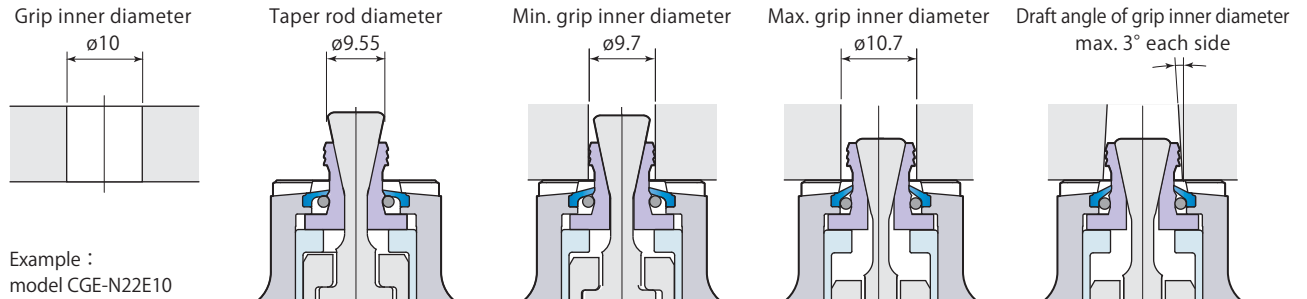
### Workpiece holding

- ① Piston (B) and taper rod lower with piston (A) 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 (A) 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

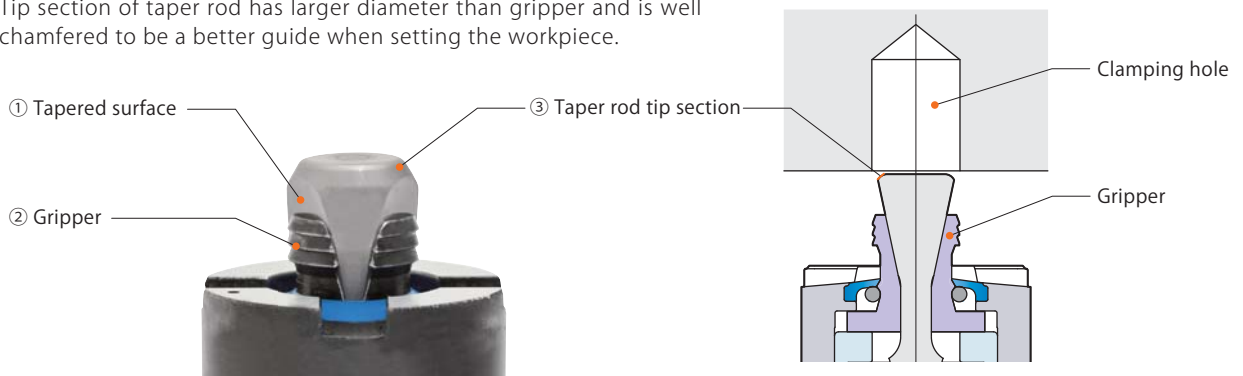
The gripper expands horizontally 1.0mm(\*), which enables the accommodation of dimensional variations in diecast bore diameters and ensures workpiece is held securely.



\* : 0.7mm stroke for CGE-N22E070, 073, 076, 079, 082

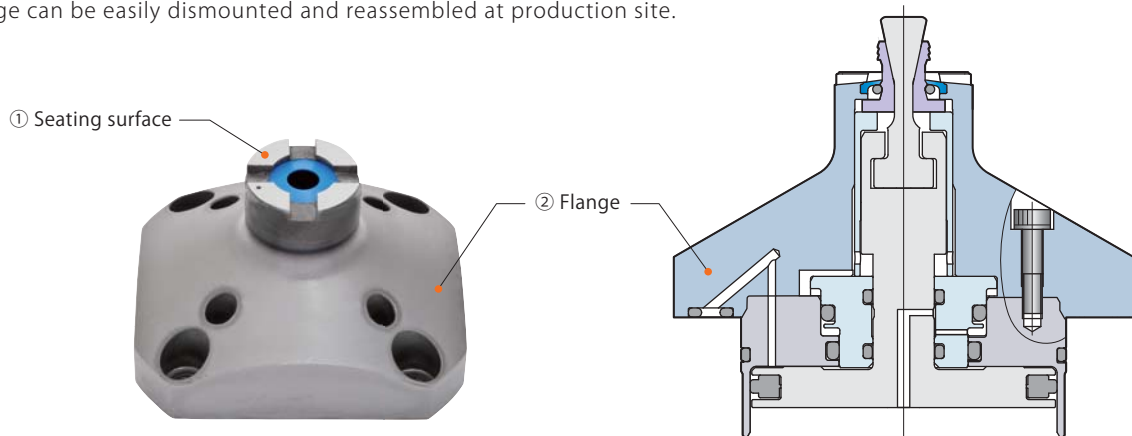
### Taper rod and gripper with superior durability

- 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.

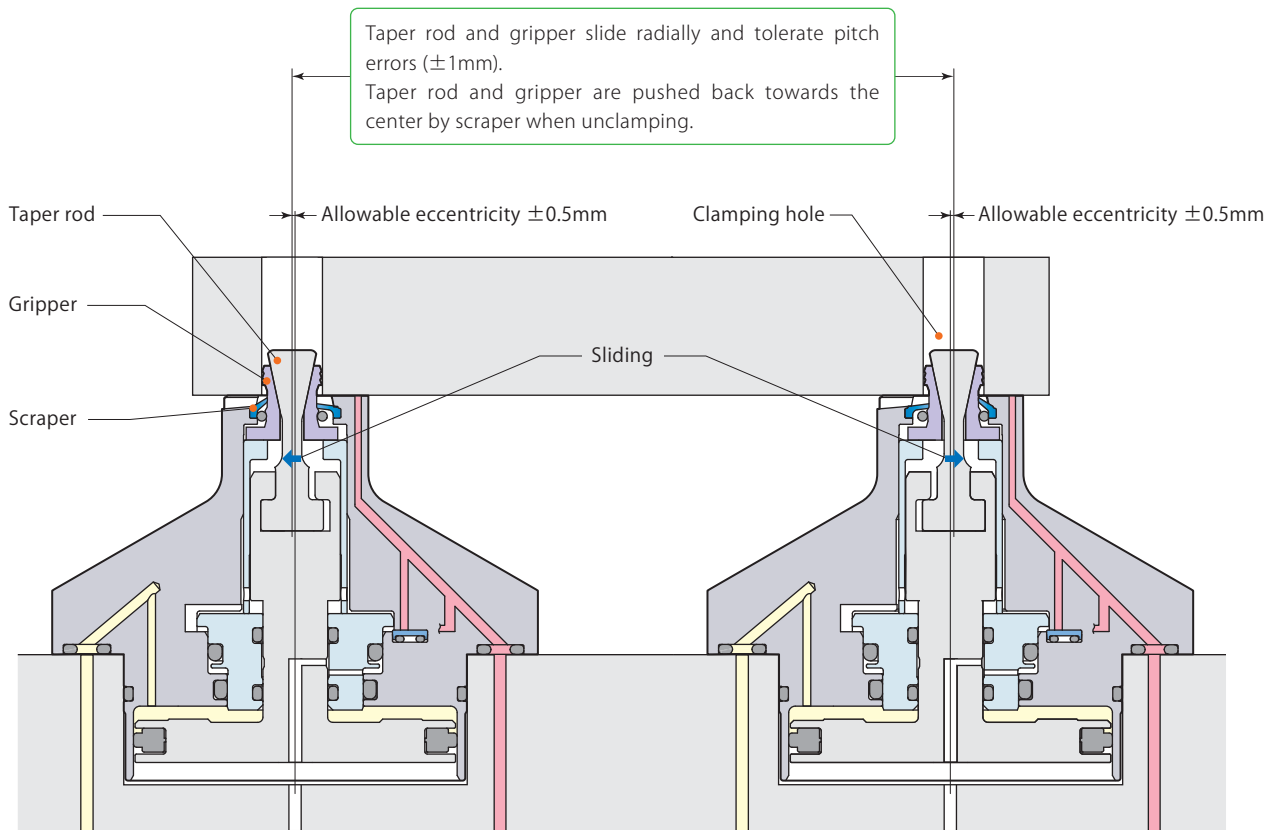


### Seating surface can be reground (Max. 0.1 mm)

- ① When seating surface is damaged, the flange section can be dismantled and reground.
- ② Flange can be easily dismantled and reassembled at production site.



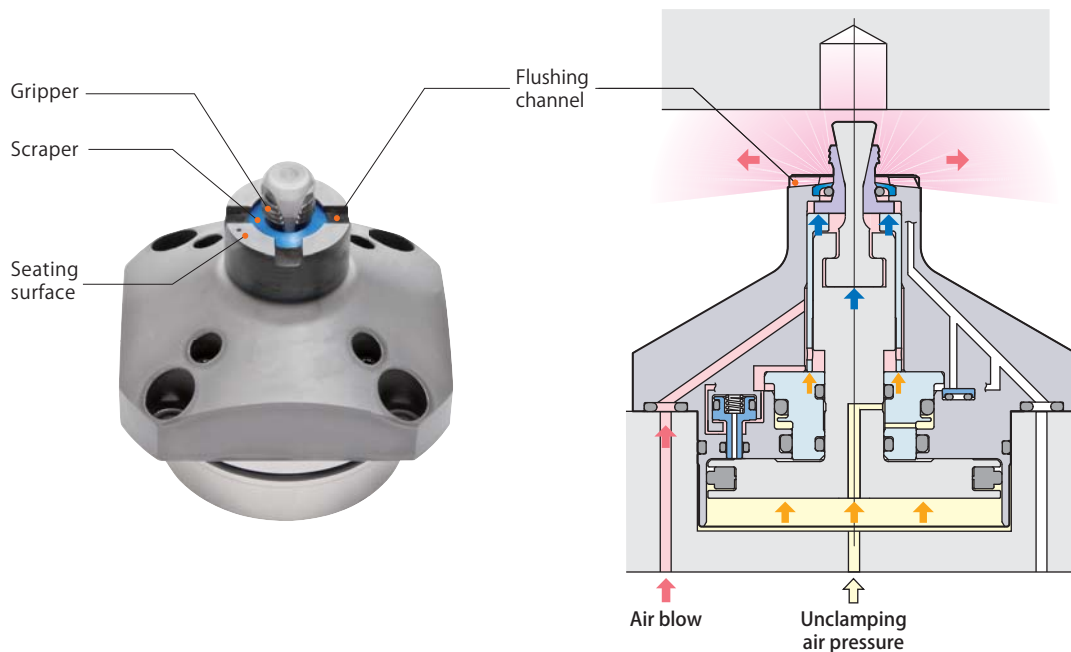
Clamping hole pitch errors can be tolerated



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.

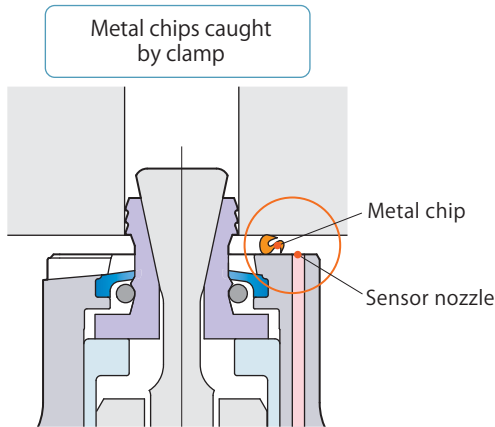


Figure 1-a

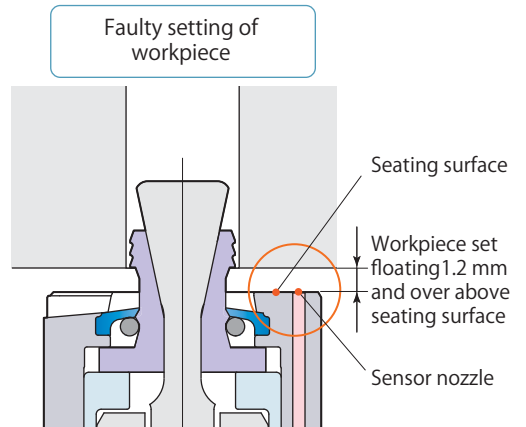
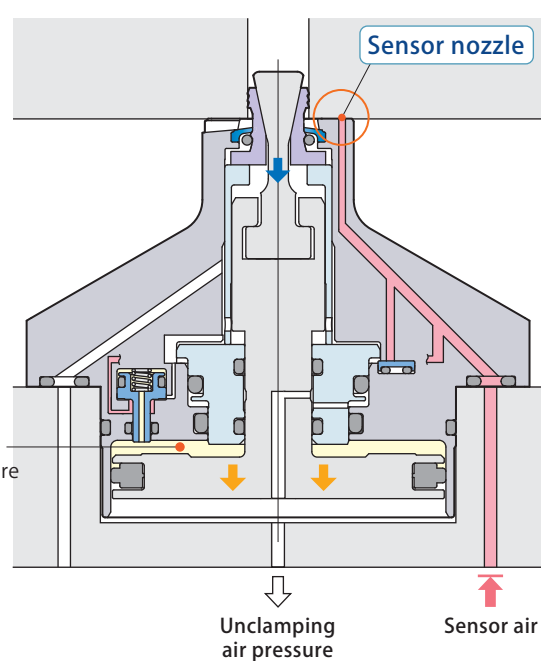
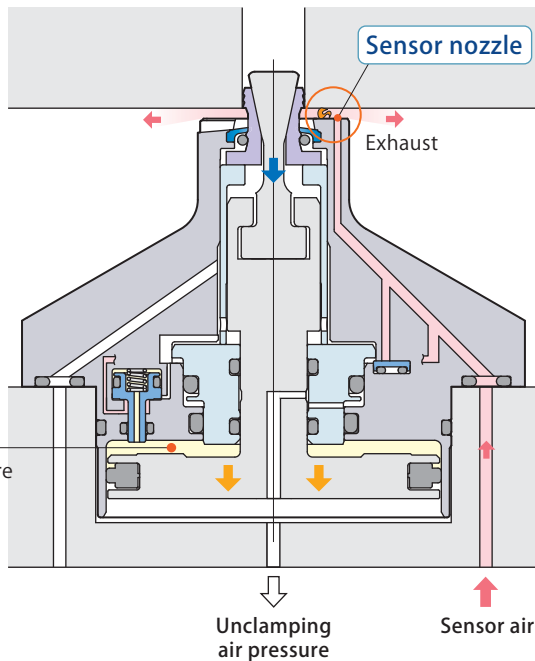


Figure 1-b

**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
<b>Faulty seating of workpiece</b>	<b>Open</b>	<b>Air sensor OFF</b> (Sensor air flows.)	<b>Clamping air pressure ON</b>

Air expansion clamp

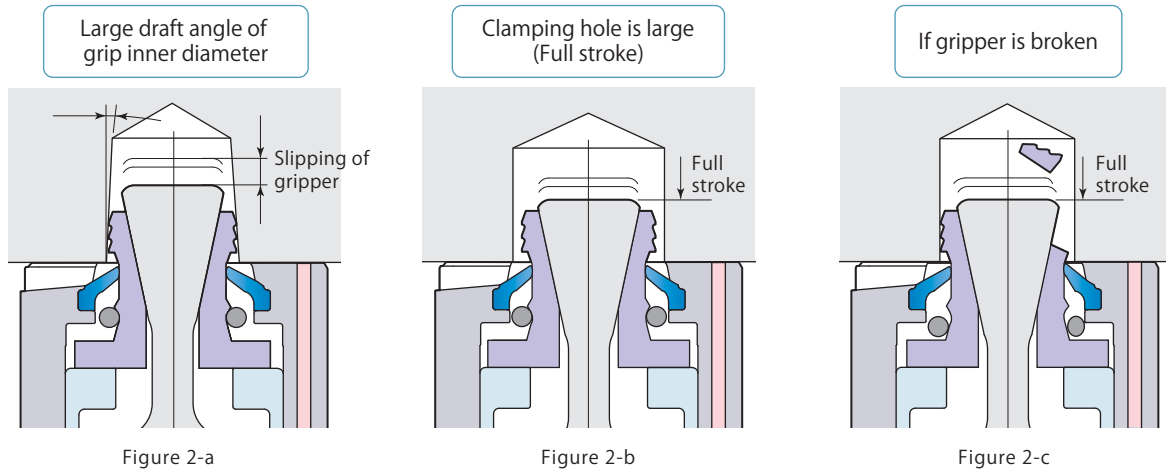
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Incomplete clamping sensor valve detects incomplete clamping

PAT. JP4297511  
US8246029  
EP2253419

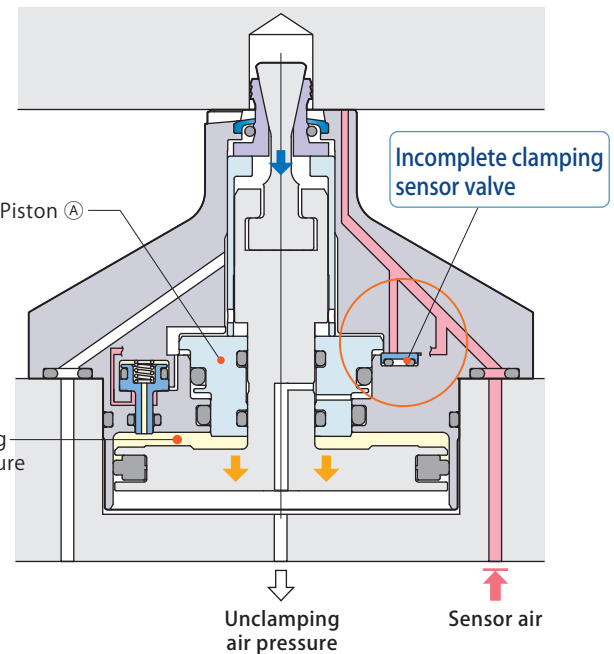
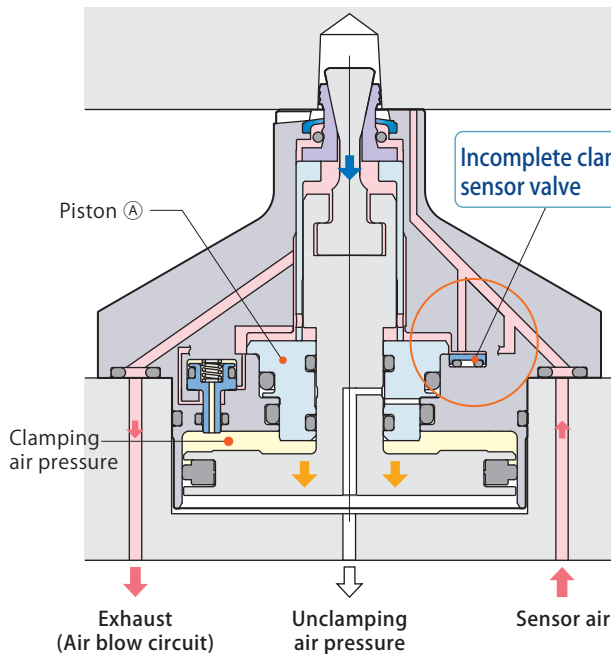
When gripper fails to grip properly due to large draft angle of grip inner diameter (Figure 2-a), incomplete clamping sensor valve is opened. Sensor air is exhausted and this detects incomplete clamping.

When clamping hole exceeds tolerance value (Figure 2-b), or when gripper is broken (Figure 2-c), incomplete clamping is detected as well.



**Incomplete clamping**  
Incomplete clamping sensor valve is opened by piston ①, 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
<b>Incomplete clamping</b>	<b>Open</b>	<b>Air sensor OFF</b> (Sensor air flows.)	<b>Clamping air pressure ON</b>

Air expansion clamp

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## Unclamping sensor valve detects unclamping operation is complete

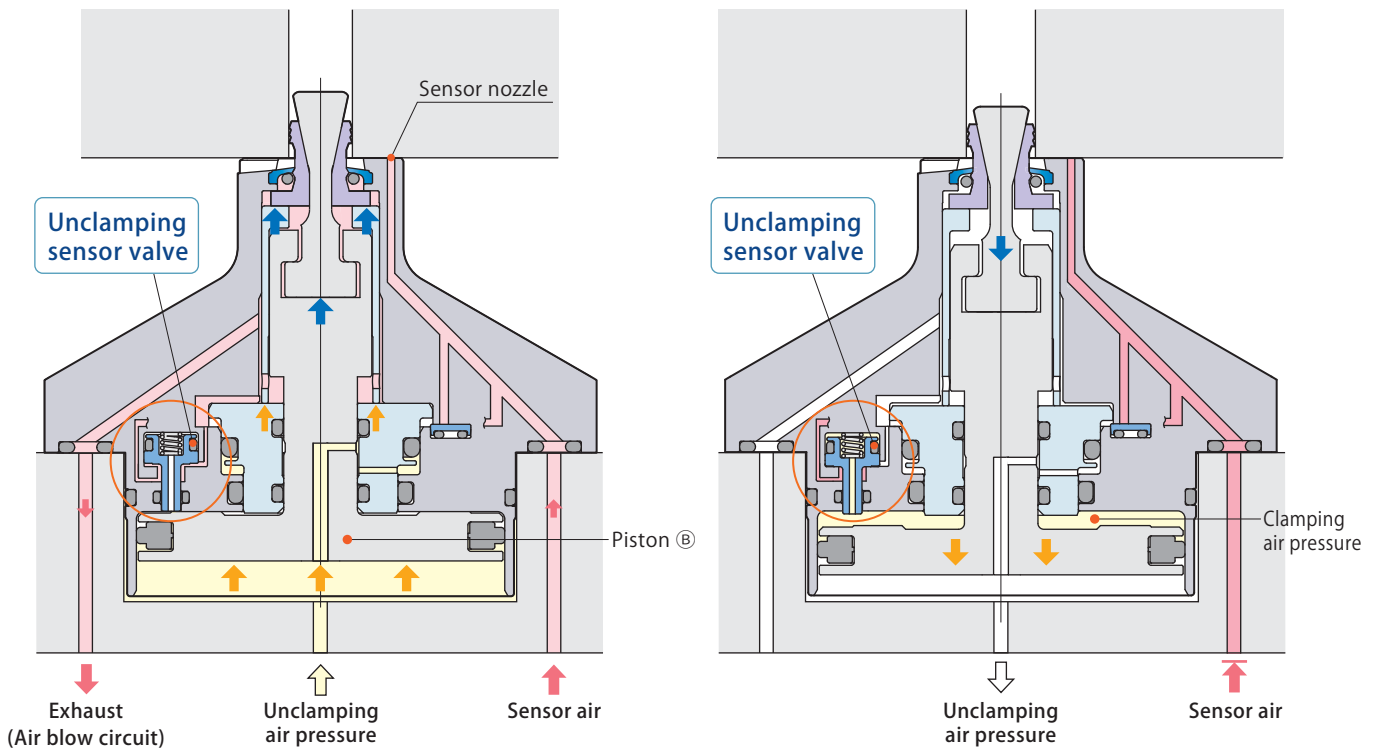
Unclamping sensor valve enables sensor to detect unclamping completion. The valve opens to exhaust sensor air even when the workpiece blocks the sensor nozzle.

### Unclamping completion

Unclamping sensor valve is opened by piston ② and sensor air is exhausted. Air sensor is not triggered and this detects unclamping completion.

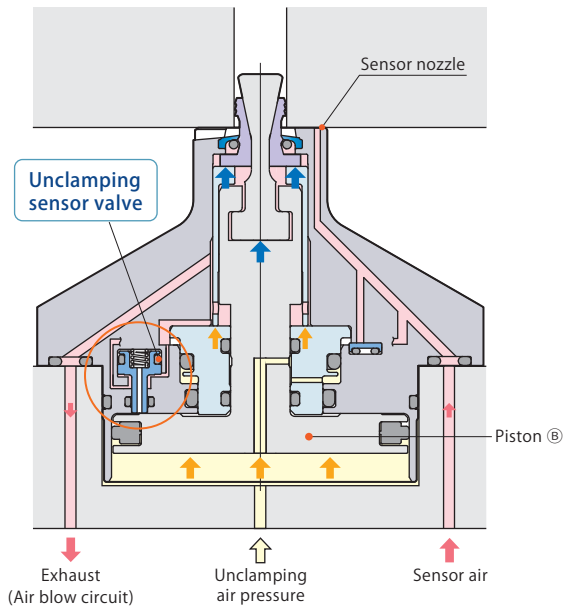
### Clamping completion

Unclamping sensor valve is closed by clamping air pressure. Air sensor detects normal clamping completion.

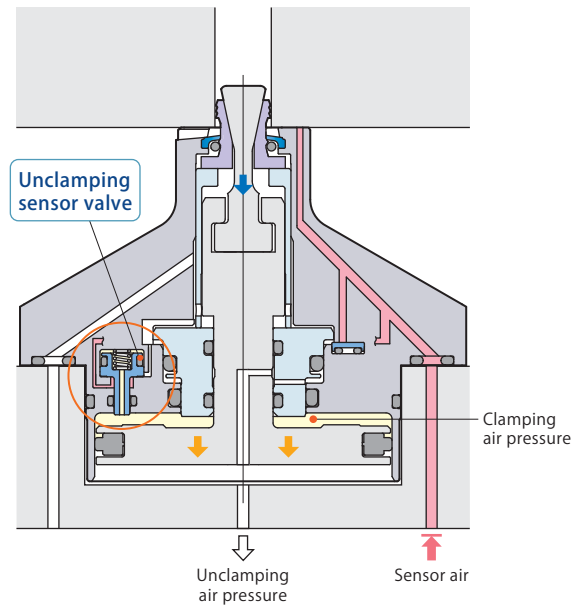


Clamp condition	Unclamping sensor valve	Air sensor signal	Air pressure switch
<b>Unclamping completion</b>	<b>Open</b>	<b>Air sensor OFF</b> (Sensor air flows.)	<b>Unclamping air pressure ON</b>
<b>Clamping completion</b>	<b>Close</b>	<b>Air sensor ON</b> (Sensor air does not flow.)	<b>Clamping air pressure ON</b>

Unclamping completion

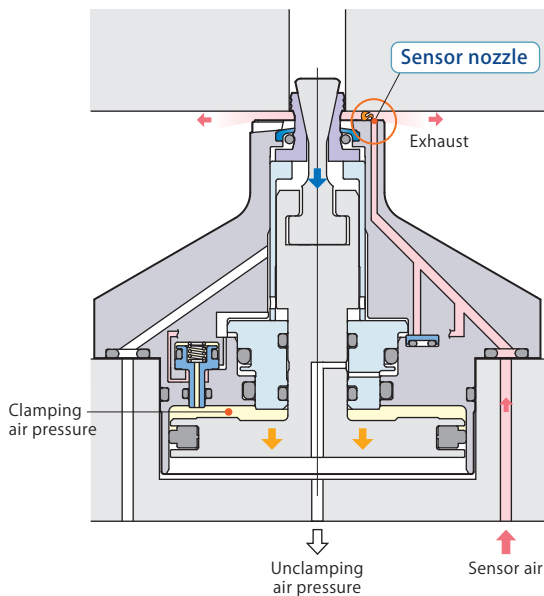


Clamping completion

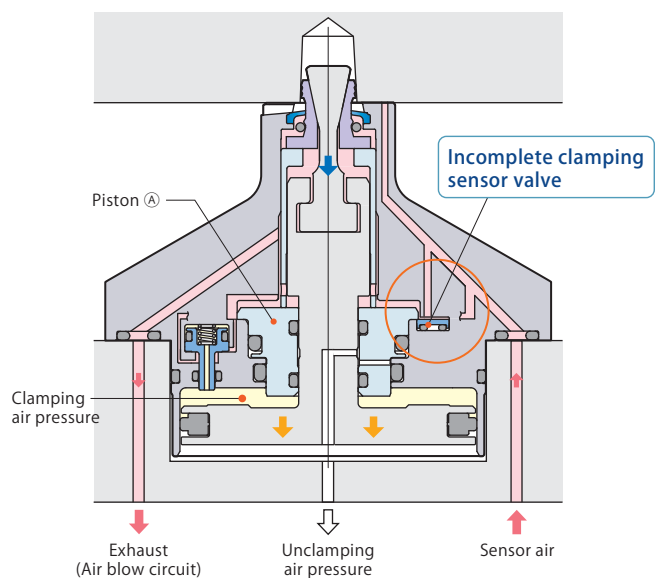


Clamp condition	Sensor nozzle	Incomplete clamping sensor valve	Unclamping sensor valve	Air sensor signal	Air pressure switch
<b>Unclamping completion</b>	Close	Close	Open	<b>Air sensor OFF</b> (Sensor air flows.)	Unclamping air pressure <b>ON</b>
<b>Clamping completion</b>	Close	Close	Close	<b>Air sensor ON</b> (Sensor air does not flow.)	Clamping air pressure <b>ON</b>

Faulty seating of workpiece



Incomplete clamping



Clamp condition	Sensor nozzle	Incomplete clamping sensor valve	Unclamping sensor valve	Air sensor signal	Air pressure switch
<b>Faulty seating of workpiece</b>	Open	Close	Close	<b>Air sensor OFF</b> (Sensor air flows.)	Clamping air pressure <b>ON</b>
<b>Incomplete clamping</b>	Close	Open	Close	<b>Air sensor OFF</b> (Sensor air flows.)	Clamping air pressure <b>ON</b>

Air expansion clamp

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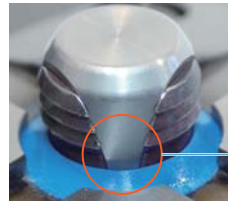
Non-constant air blow model considerably reduces air consumption

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**

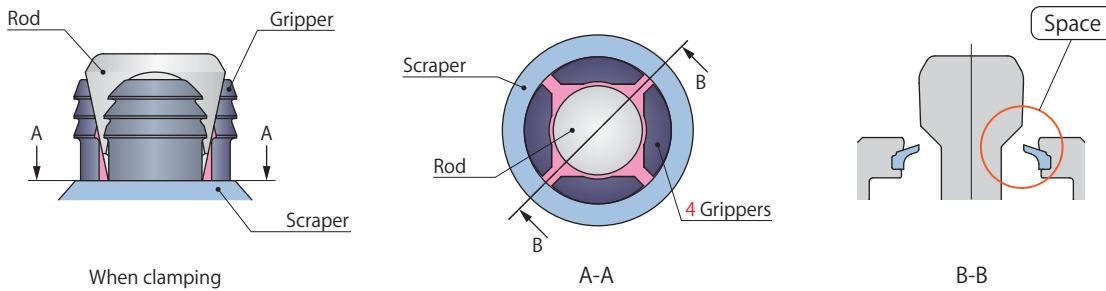


Number of grippers	Grip inner diameter	Clamping force	Model
2 Grippers	ø 7.0 7.3 7.6 7.9 8.2	0.81 kN (Air pressure 0.5MPa)	CGE-N22E <small>Grip inner diameter</small>
	ø 8.5 9 10		



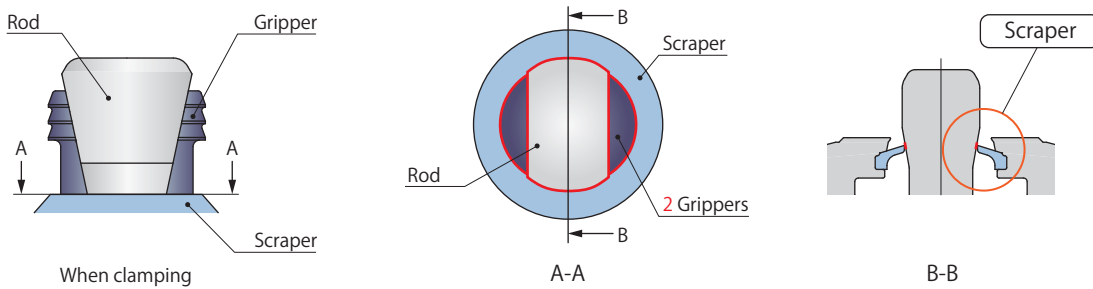
Number of grippers	Grip inner diameter	Clamping force	Model
3 Grippers	ø 11 12 13	0.81 kN (Air pressure 0.5MPa)	CGE-N22E <small>Grip inner diameter</small>

Space where metal chips can intrude is created (Old model)



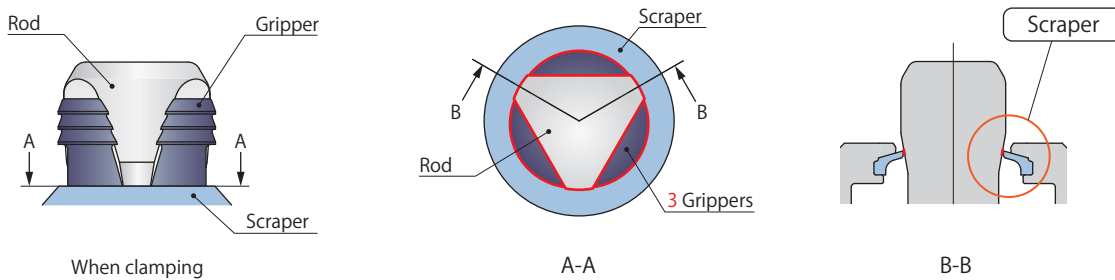
Because of space between scraper, gripper and the rod, air blow must always be performed to prevent intrusion of chips.

Secure chip protection



Pages → 102-105

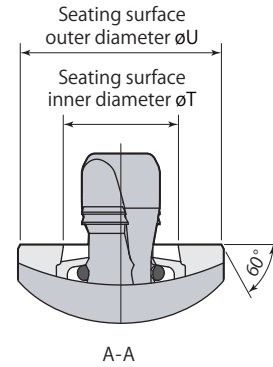
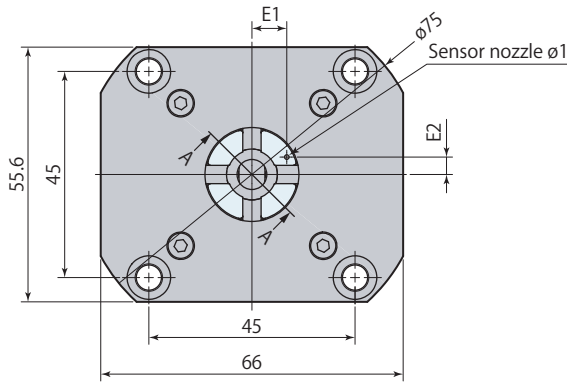
Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.



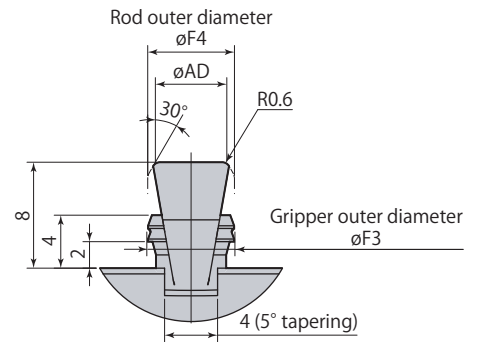
Pages → 106, 107

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

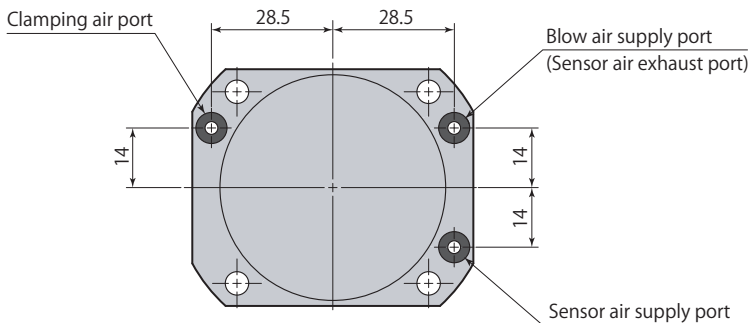
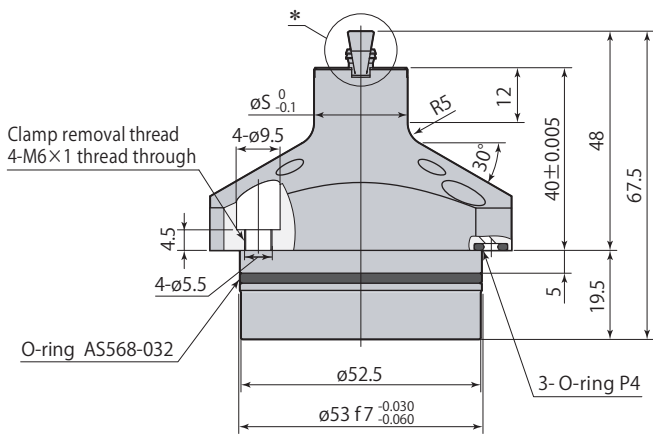
Dimensions



**\*Details**



Grip inner diameter usage requirements



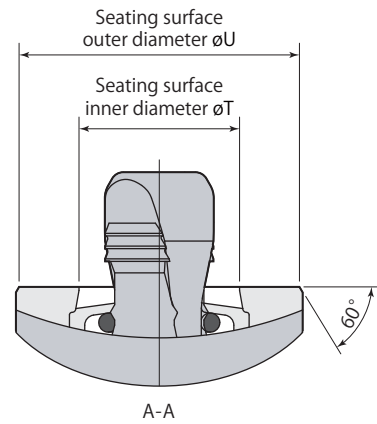
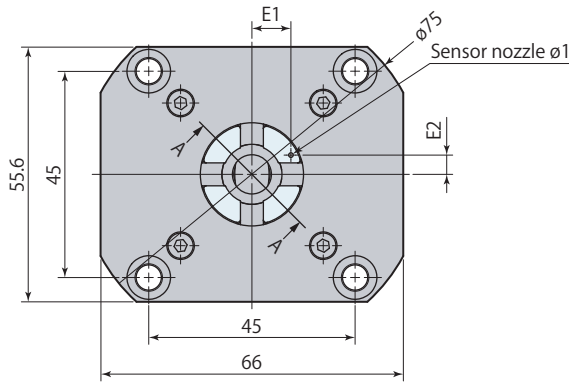
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

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
$\phi F3$	6.5	6.8	7.1	7.4	7.7
$\phi F4$	6.55	6.85	7.15	7.45	7.75
$\phi S$	20.5	20.6	20.9	21.2	21.5
$\phi T$	10.6	10.9	11.2	11.5	11.8
$\phi U$	20	20.1	20.4	20.7	21
$\phi AD$	5.4	5.7	6	6.3	6.6

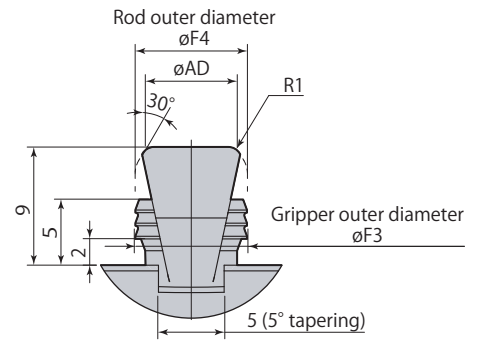
● CGE-N22E070, 073, 076, 079, 082 are made to order.



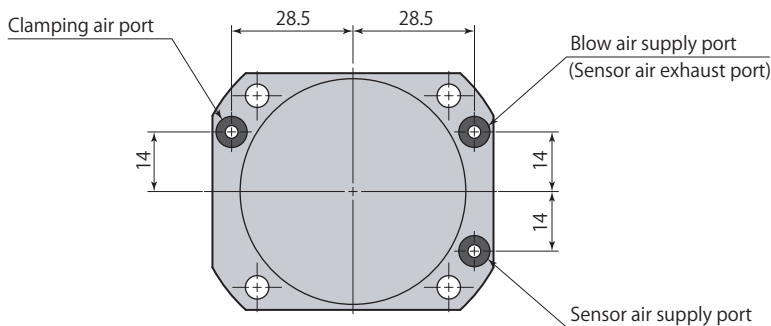
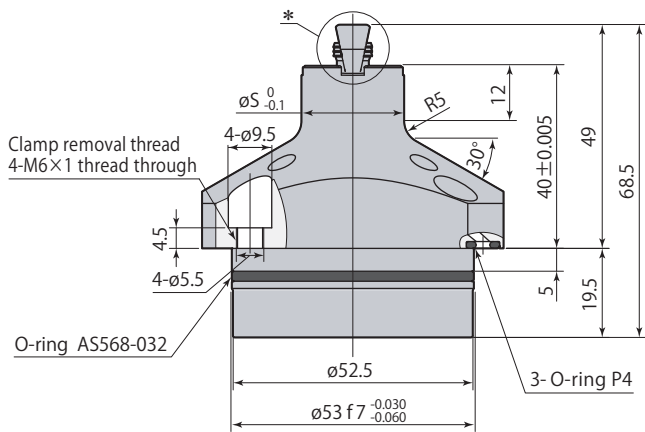
Dimensions



\*Details



Grip inner diameter usage requirements

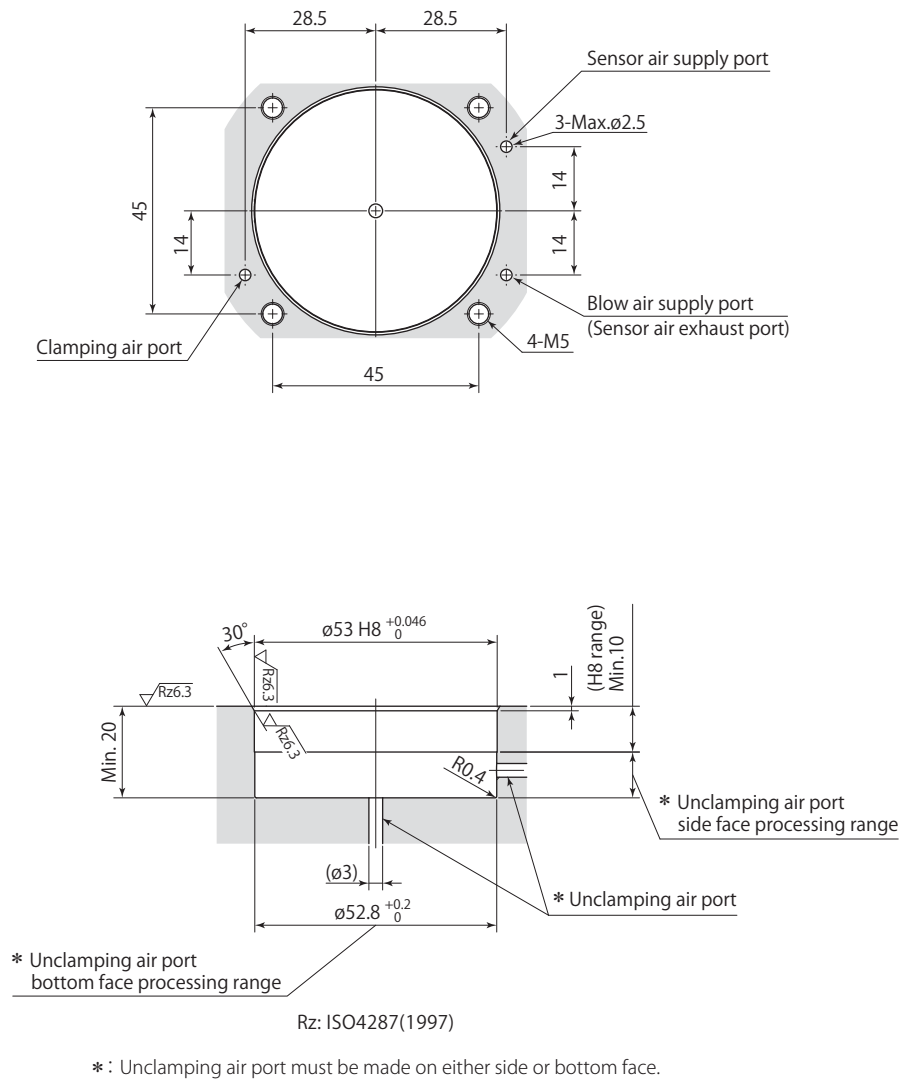


- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

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.

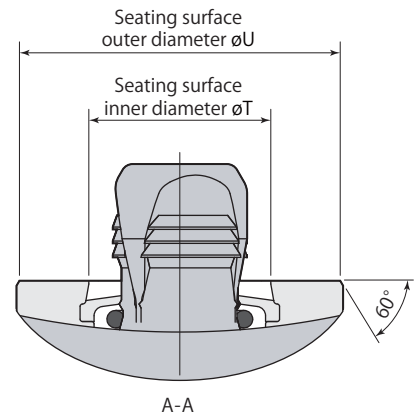
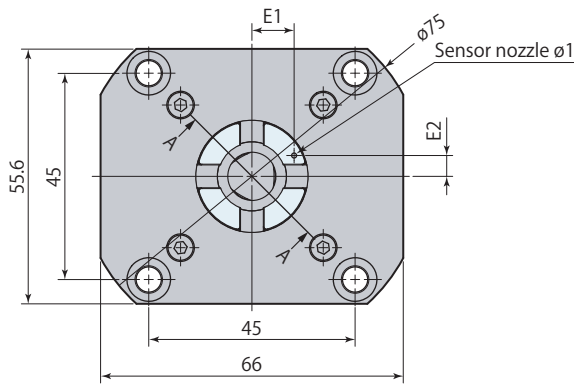
## Mounting details



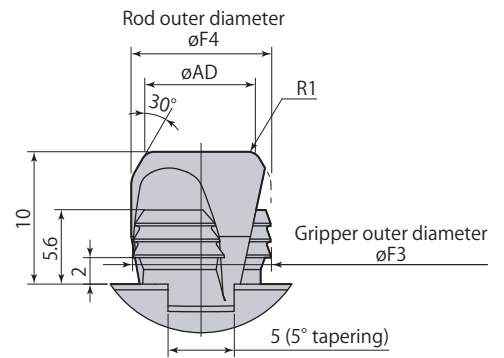
- Apply an appropriate amount of grease to the chamfer and the bore when mounting. Excessive grease may be a blockage in the air passage, causing malfunction of the sensor.
- The 30° taper machining must be provided to avoid the damage of the O-ring.



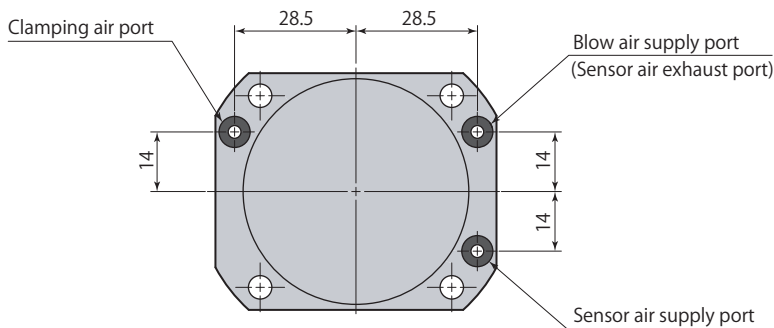
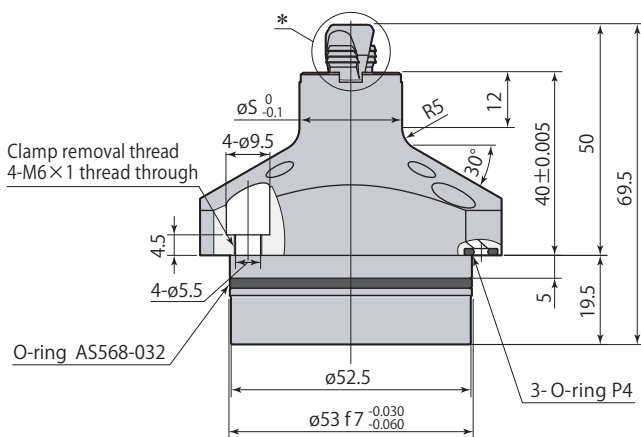
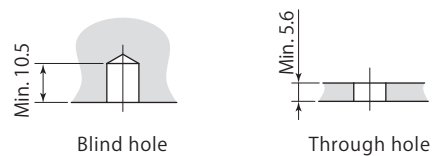
Dimensions



\*Details



Grip inner diameter usage requirements

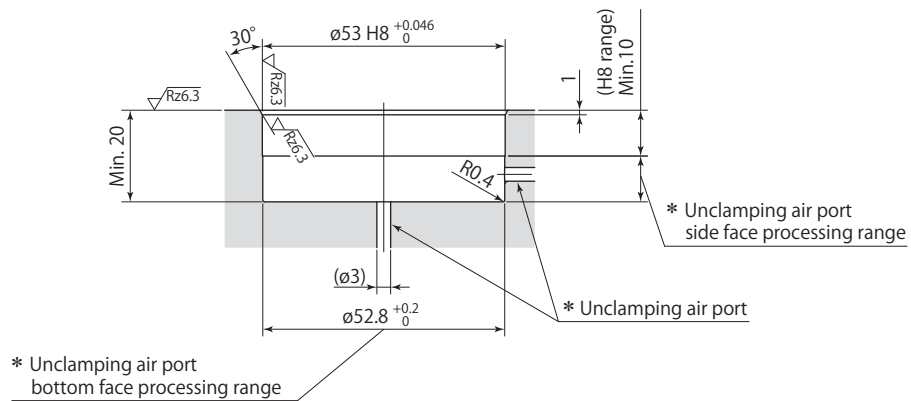
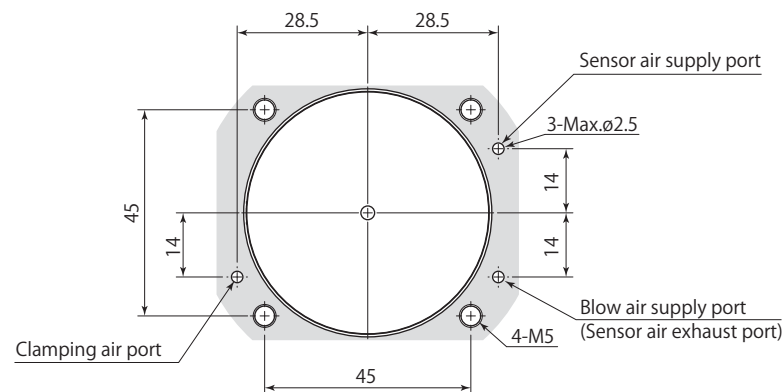


- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

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

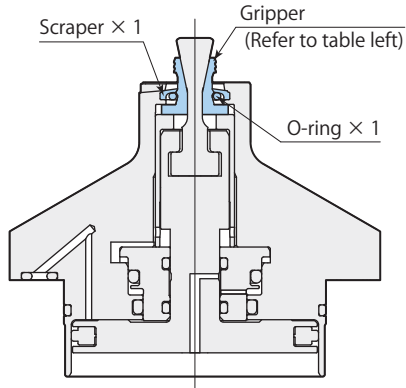


Rz: ISO4287(1997)

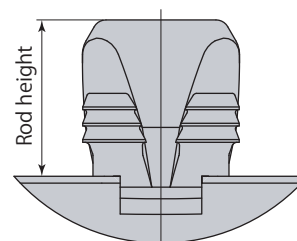
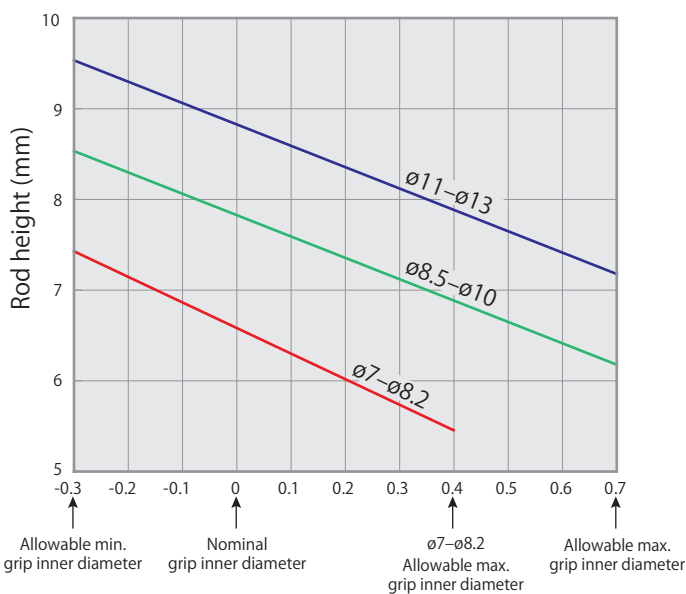
\* : Unclamping air port must be made on either side or bottom face.

- 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	 <p>Scrapers × 1 Gripper (Refer to table left) O-ring × 1</p>
	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	<p>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.)</p>
	CGE-N22EJ12	CGE-N22E12	
	CGE-N22EJ13	CGE-N22E13	

Grip inner diameter & rod height when clamping



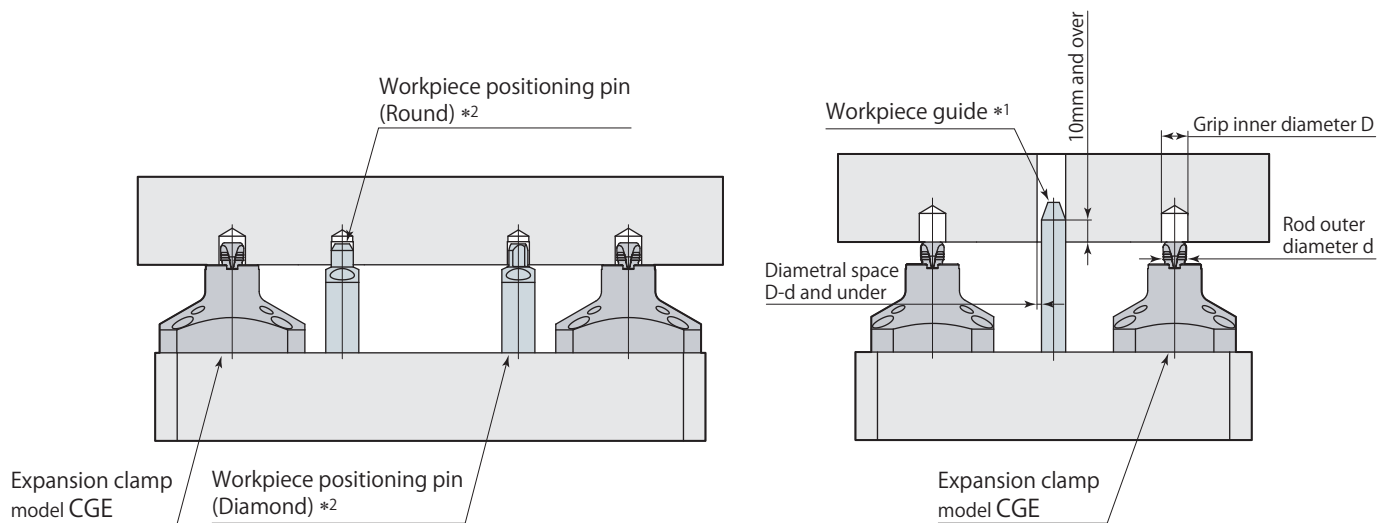
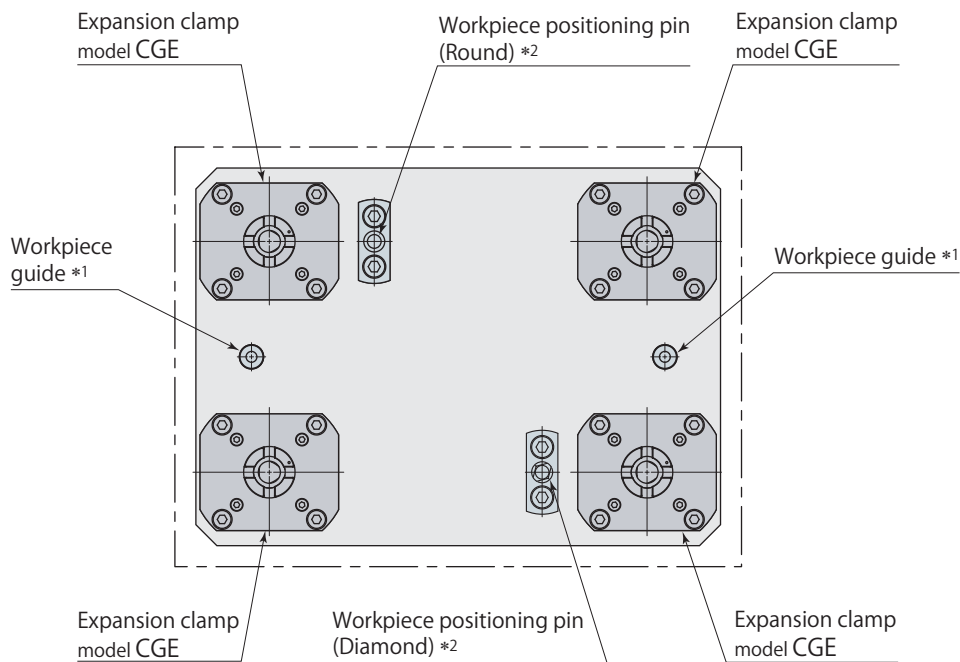
**Rod height calculation formula**

- $\phi 7 - \phi 8.2 : 6.58 - 2.84 \times$  Actual grip inner diameter and nominal grip diameter difference
- $\phi 8.5 - \phi 10 : 7.82 - 2.35 \times$  Actual grip inner diameter and nominal grip diameter difference
- $\phi 11 - \phi 13 : 8.82 - 2.35 \times$  Actual grip inner diameter and nominal grip diameter difference

Example: When CGE-N22E10 (Nominal grip diameter :  $\phi 10$ ) is clamping  $\phi 9.8$  hole  
 Rod height =  $7.82 - 2.35 \times (-0.2) = 8.29\text{mm}$

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

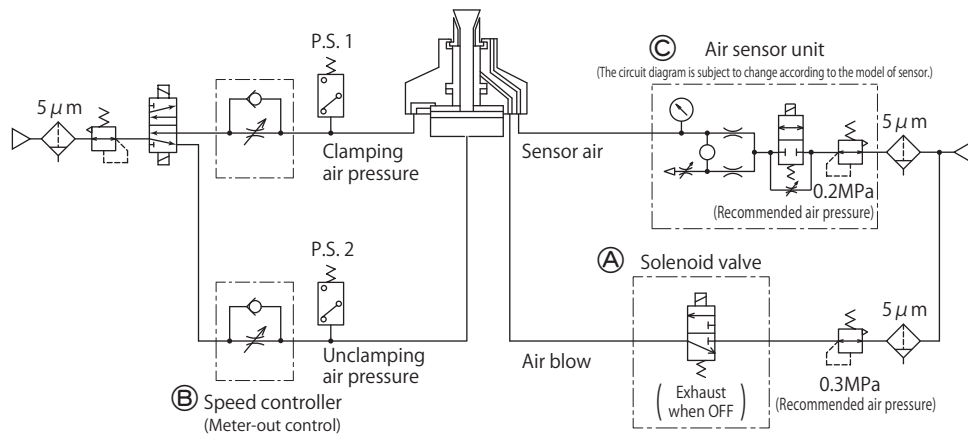
### System configuration example



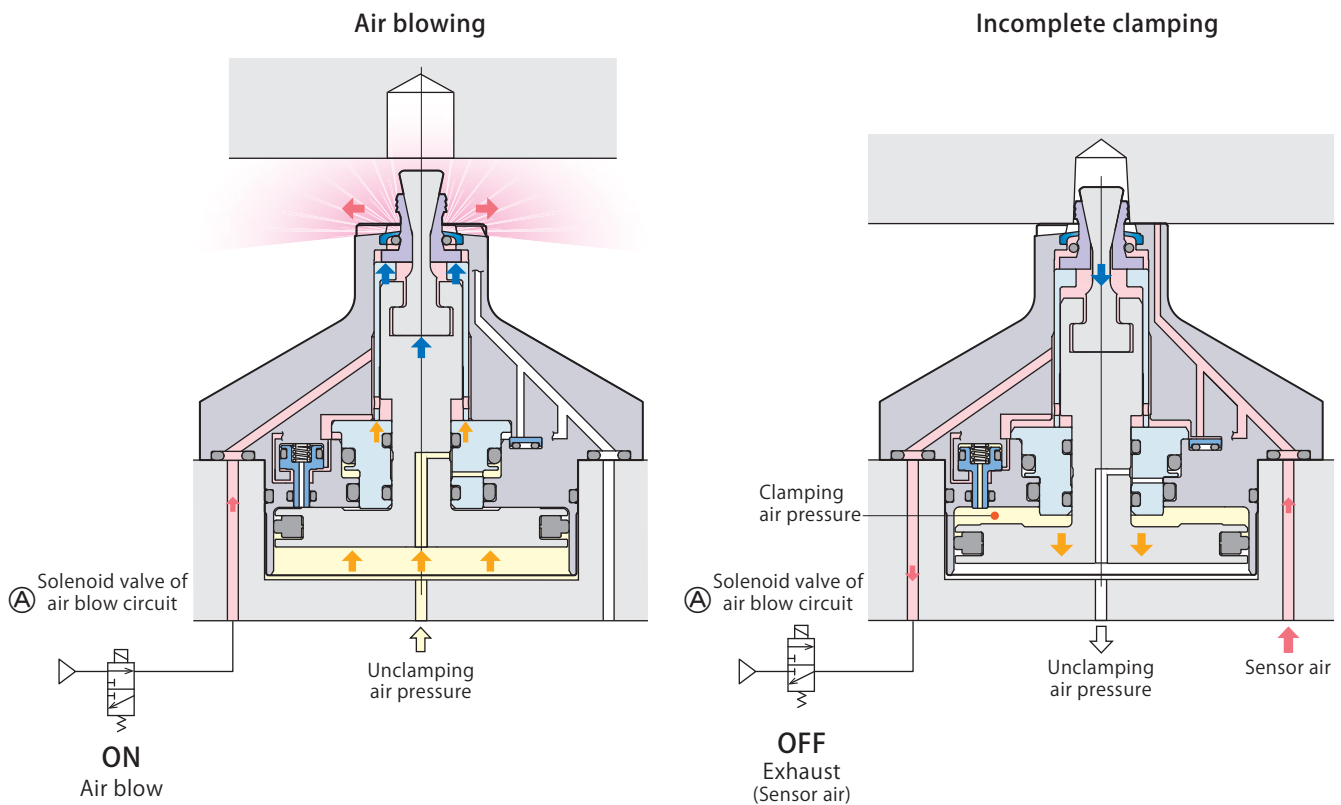
\*1: When using automatic or robotic conveyers, prevent damage to clamp caused from impact by setting workpiece guides. Using the above guide as reference, accurately position the holes when using workpiece guides.

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

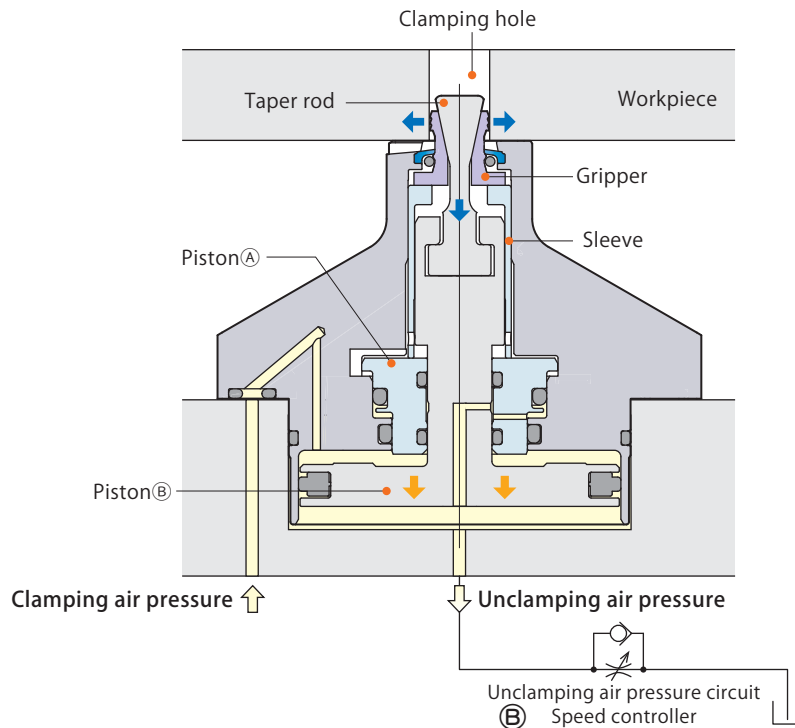
### Pneumatic circuit diagram



- 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 (A) 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.



- Operation speed must be adjusted by a meter-out type speed controller ② 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 ① 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.



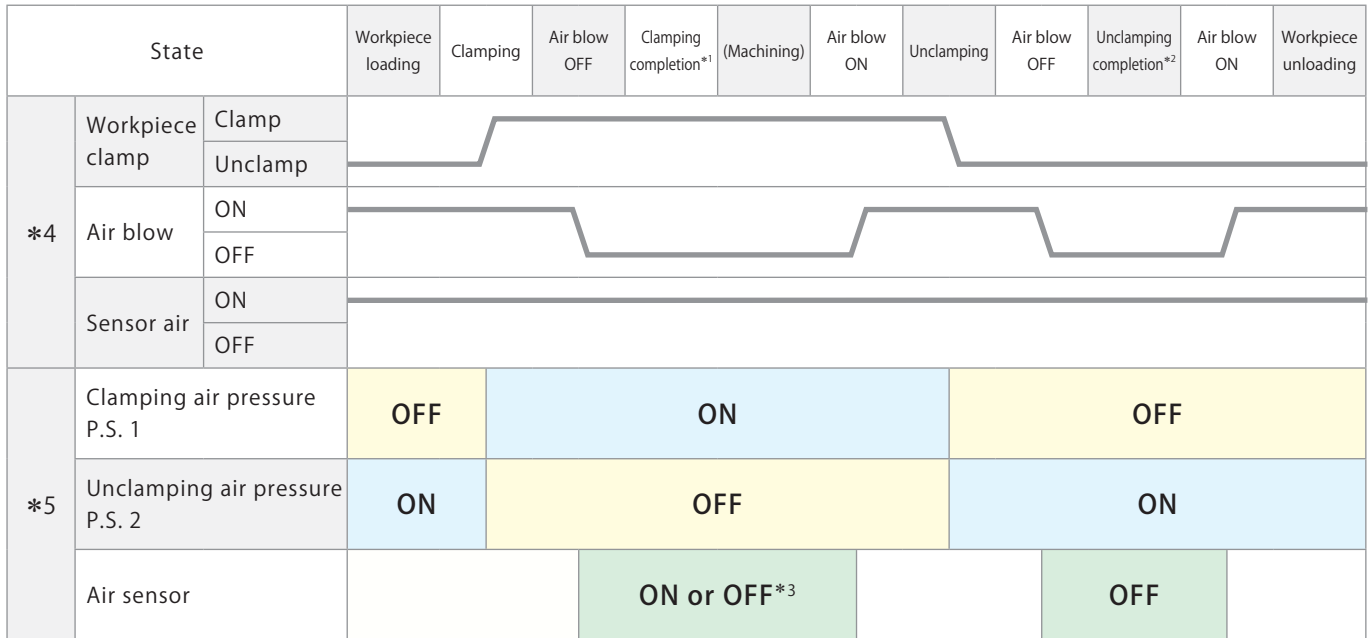
### Air sensor unit ③ recommended condition of use

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 ③ 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.



- \*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 →91**. 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 →110** 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