Expansion clamp

Double acting 7MPa

model CGC

model CGC

Specifications

CGC — N2 [Size] E [Grip inner diameter]

Size	Grip inner diameter	: Number of grippers
1	070 073 076 079 082	: 2 Grippers
2	085 09 10	: 2 Grippers
	11 12 13	: 3 Grippers
3	12 13 14 15 16	: 3 Grippers

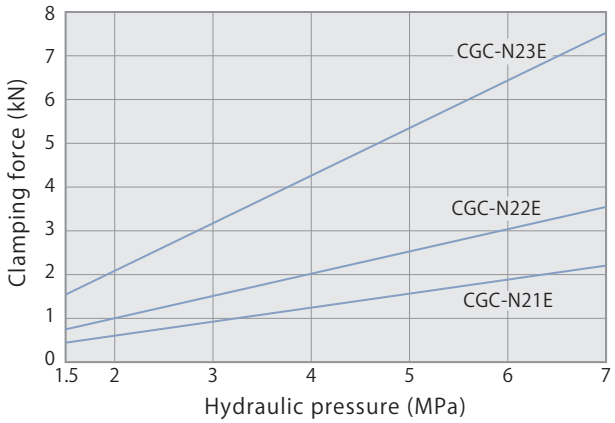
■ indicates made to order.

Model	Size	CGC-N21E*1					CGC-N22E						CGC-N23E				
	Grip inner diameter	070	073	076	079	082	085	09	10	11	12	13	12	13	14	15	16
Number of grippers		2 Grippers					2 Grippers			3 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				
	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

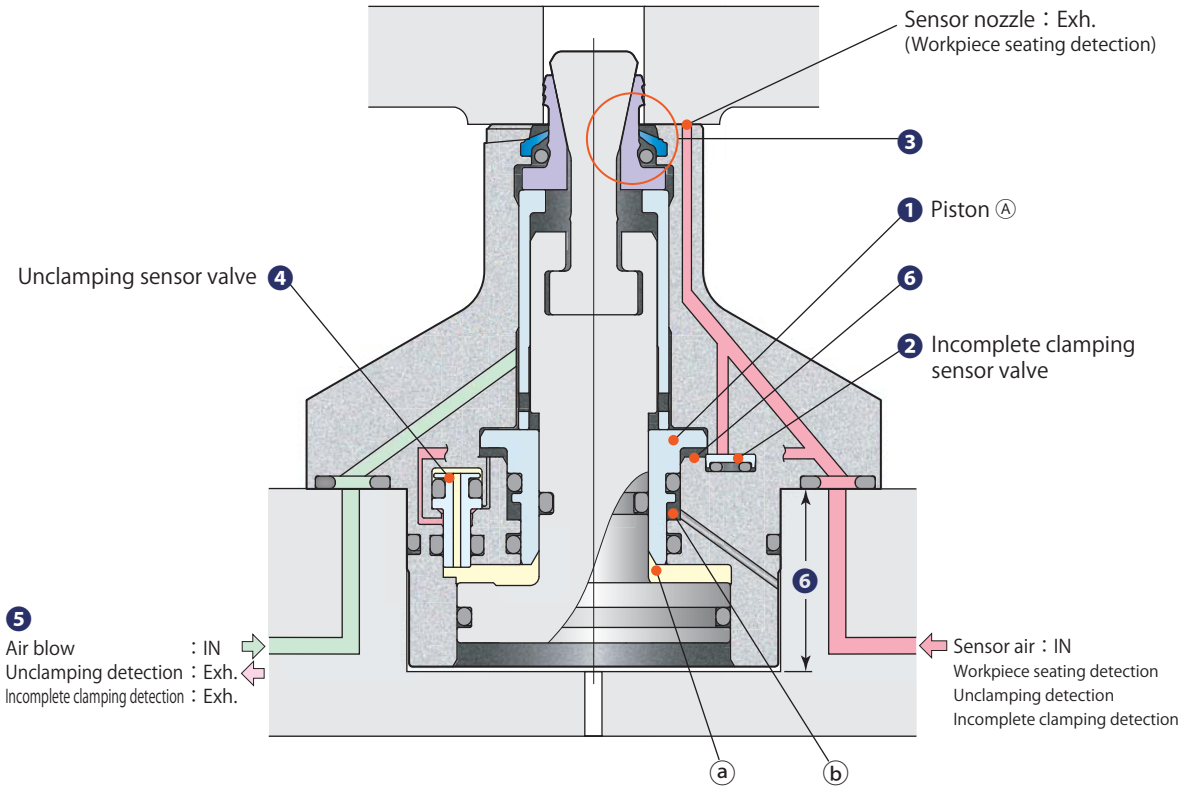
P : Hydraulic pressure (MPa)

- 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



1 Gripper 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.

2 Incomplete clamping sensor valve (PAT.)

- Incomplete clamping can be detected by an air sensor and the clamped condition can positively be confirmed. Refer to **page →21**.

3 Most 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 →24, 25**.
- 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.

4 Unclamping sensor valve (JP PAT.)

- The valve enables positive unclamping detection by movement of piston when model CGC is in unclamping action. Refer to **page →22**.

5 Using 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.

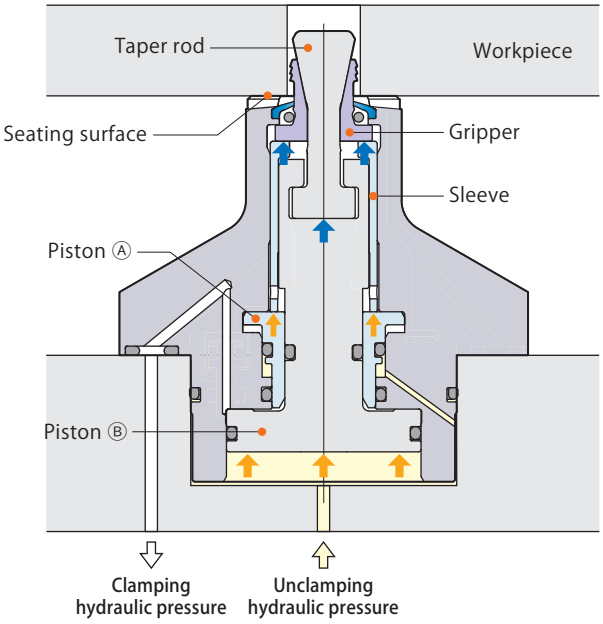
6 Stroke end detection by a piston Ⓐ (JP PAT.)

- 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.

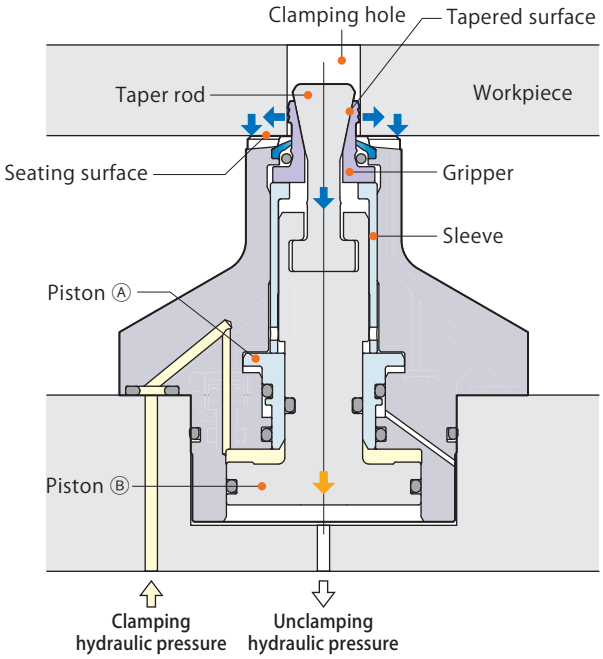


Workpiece holding

① Piston Ⓑ and taper rod lower with piston Ⓐ being held at upper stroke end position by clamping hydraulic pressure.

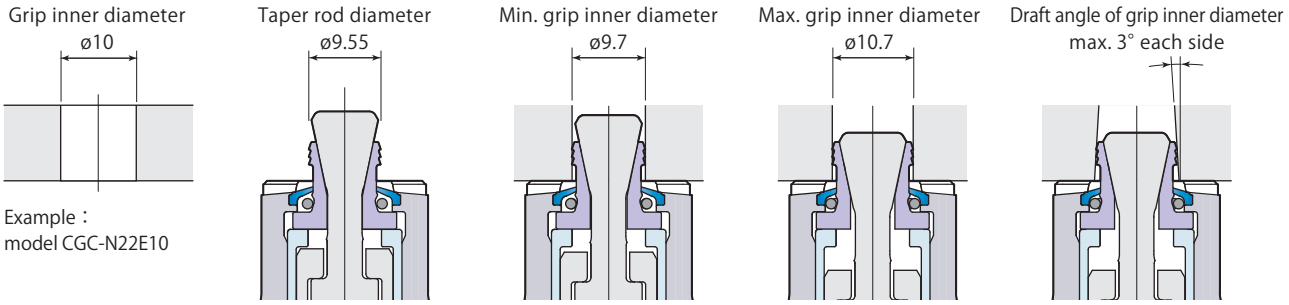
② The gripper expands horizontally along the tapered surface to grip inner face of clamping hole holding its position at upper stroke end by piston Ⓐ and sleeve.

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.



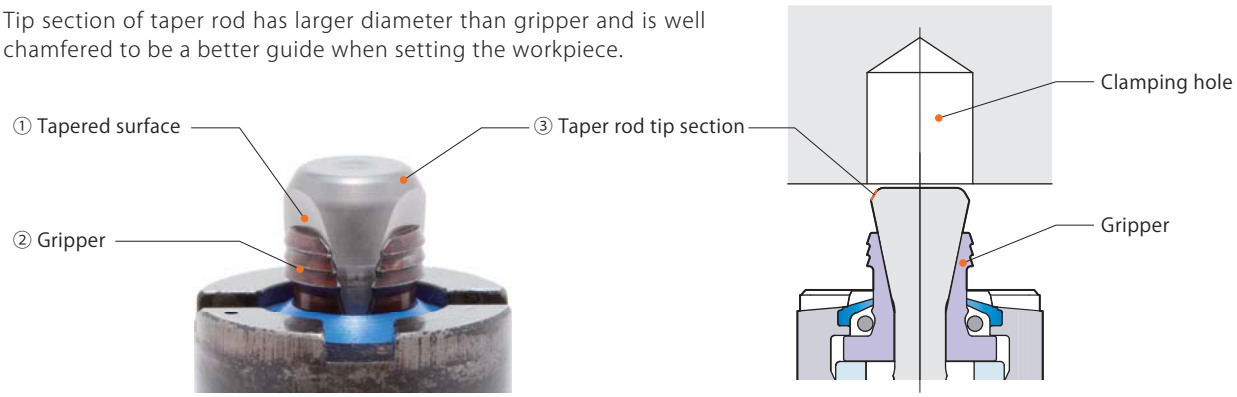
∗：0.7mm stroke for CGC-N21E070, 073, 076, 079, 082

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.

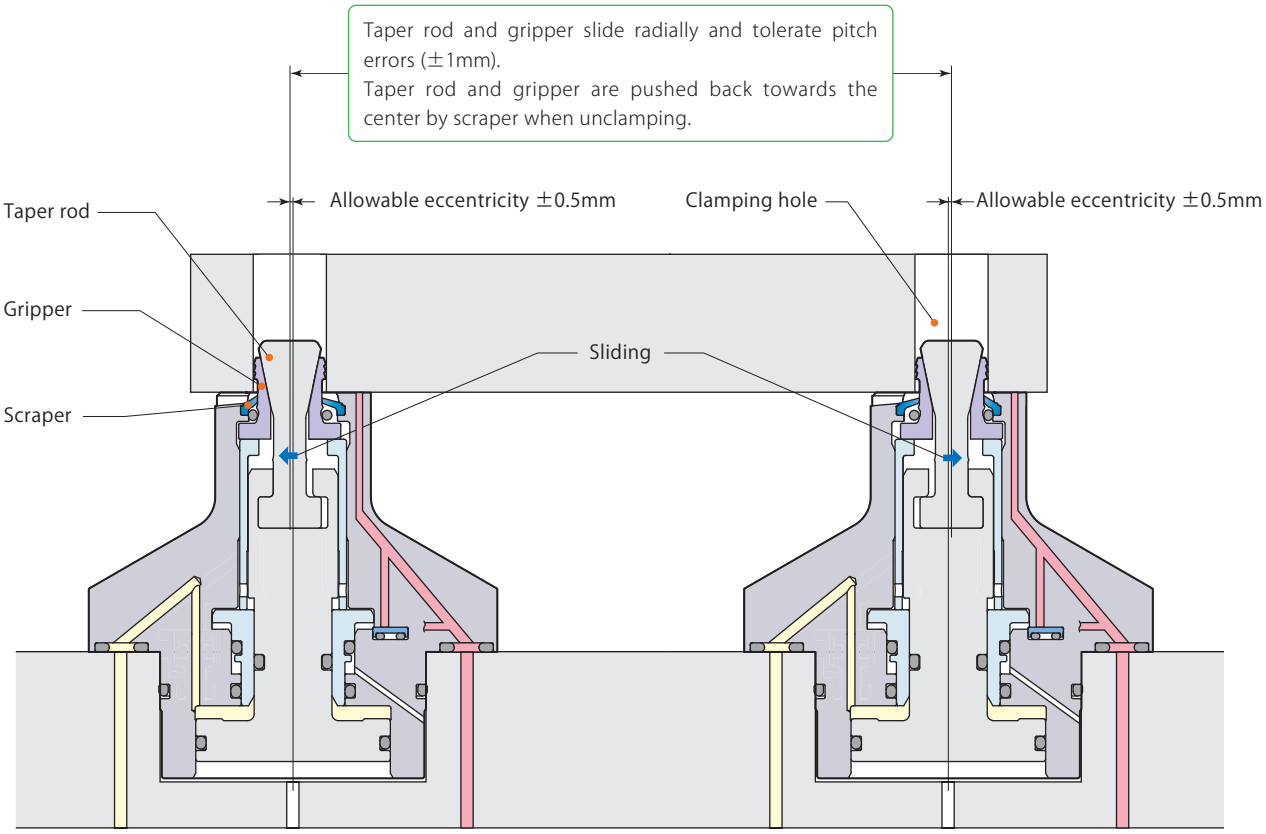


Seating surface can be reground (Max.0.1 mm)

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.

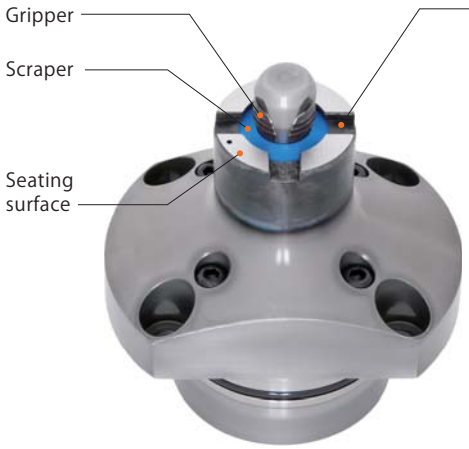
Clamping hole pitch errors can be tolerated

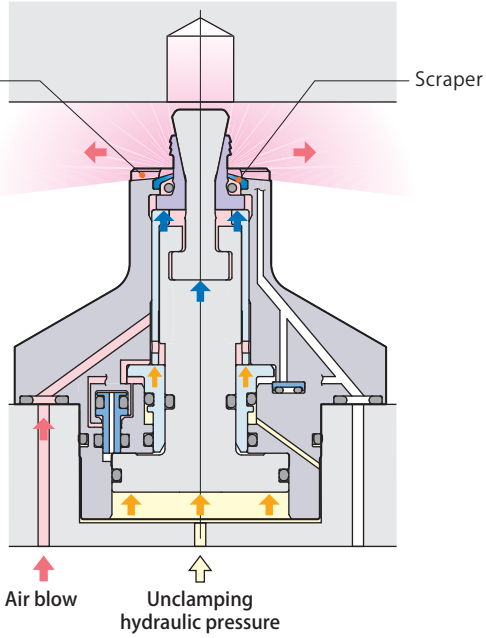


By the eccentric mechanism, the expansion clamp does not have a workpiece positioning function.

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.

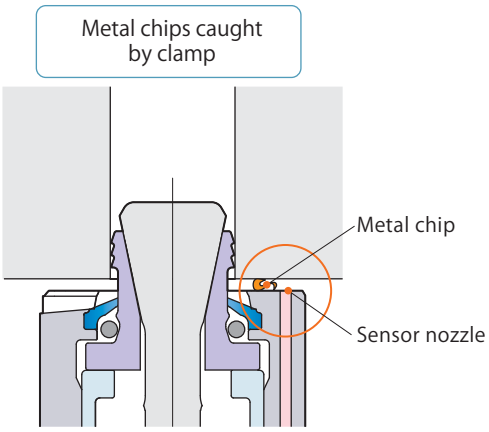


Figure 1-a

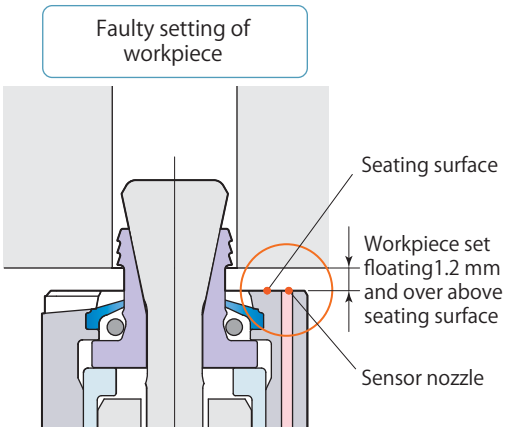
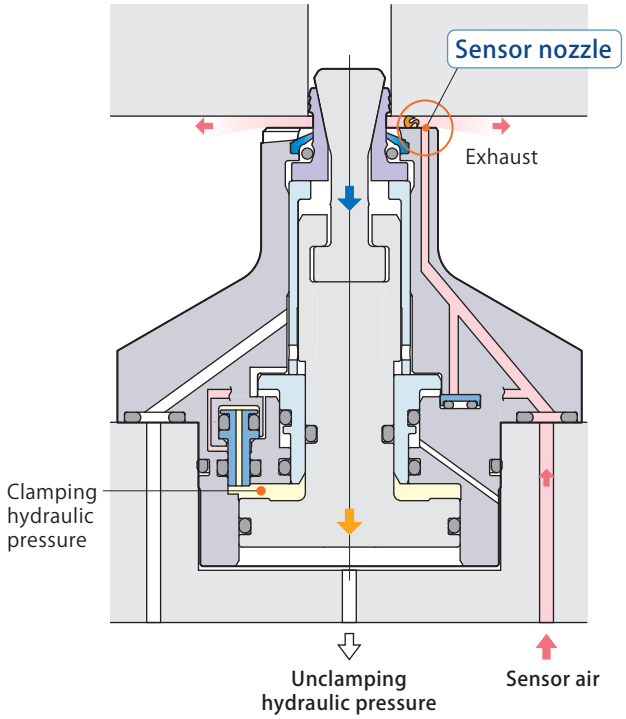


Figure 1-b

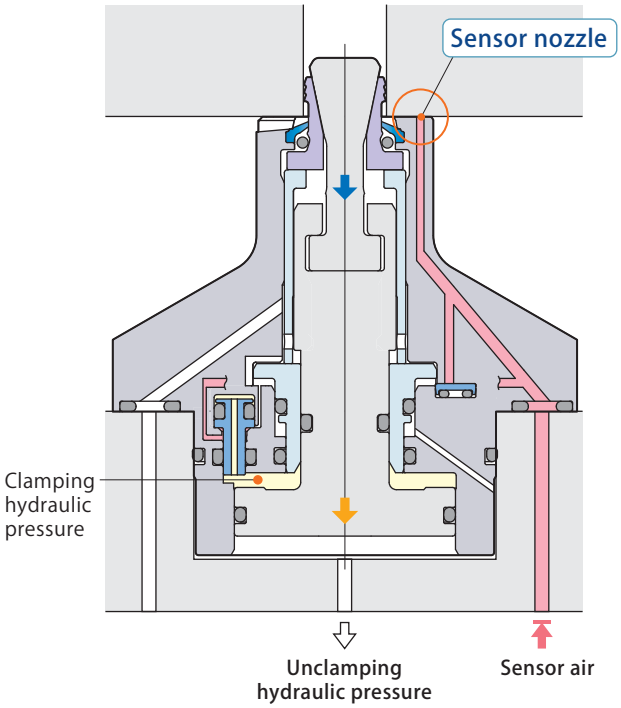
Faulty seating of workpiece

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	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.

Large draft angle of grip inner diameter

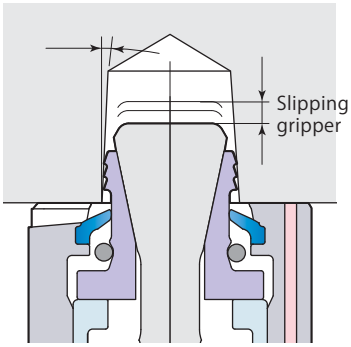


Figure 2-a

Clamping hole is large (Full stroke)

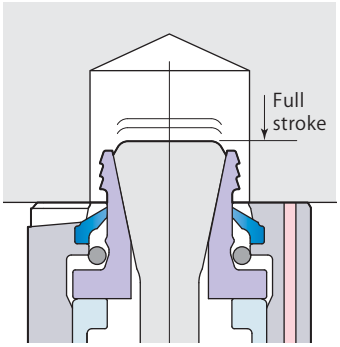


Figure 2-b

If gripper is broken

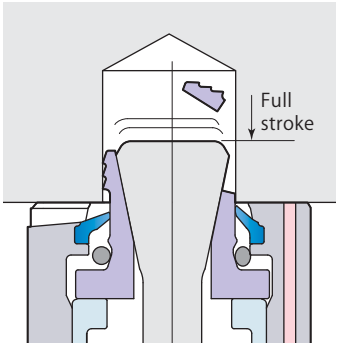
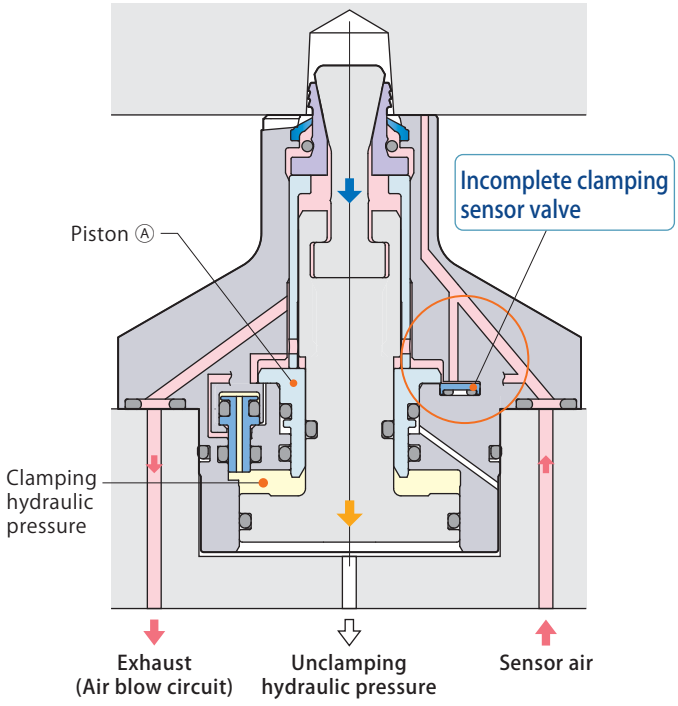


Figure 2-c

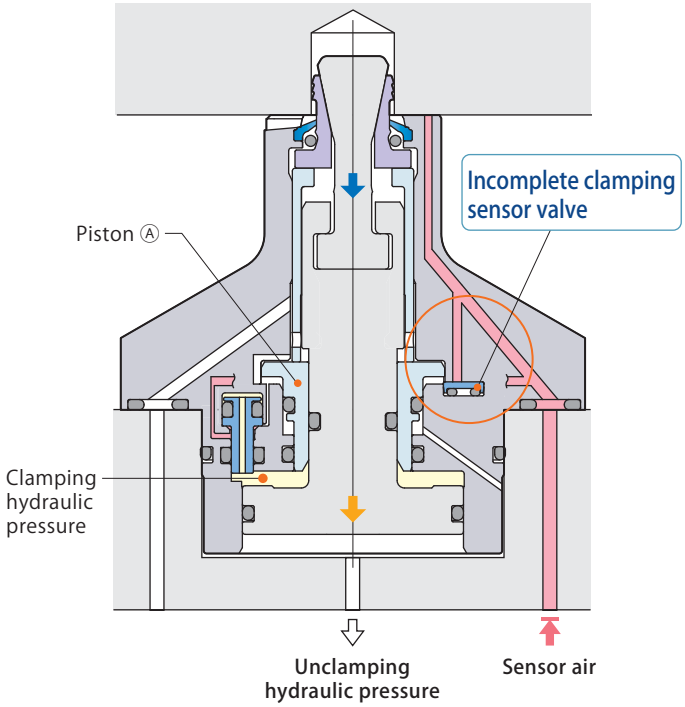
Incomplete clamping

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	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.

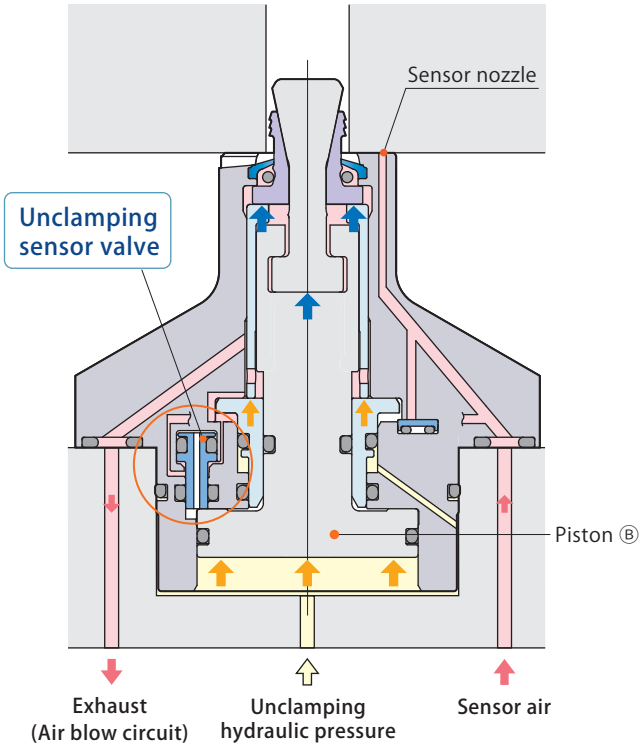
CGC-N21E070 / 073 / 076 / 079 / 082

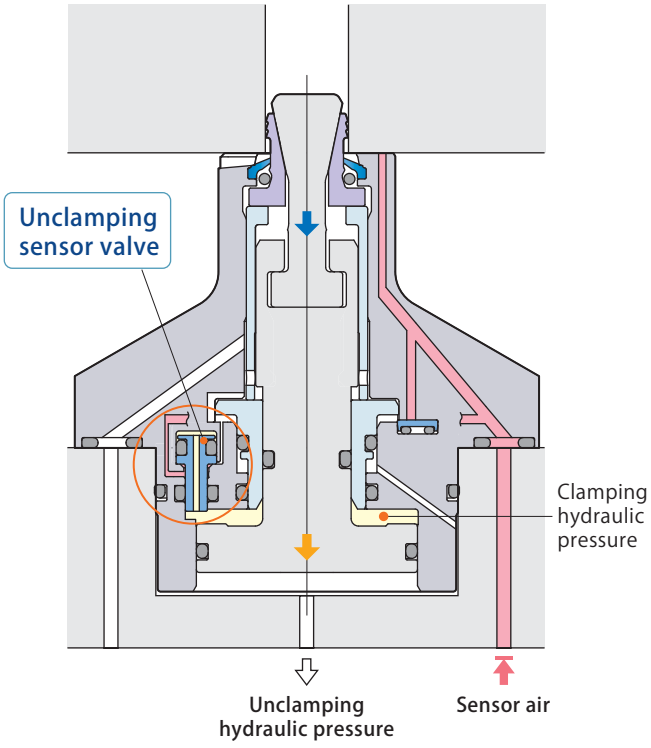
Unclamping completion

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

Clamping completion

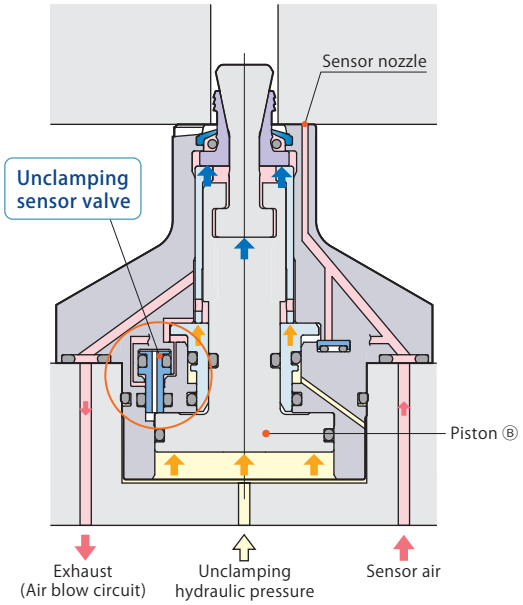
Unclamping sensor valve is closed by clamping hydraulic pressure. Air sensor detects normal clamping completion.



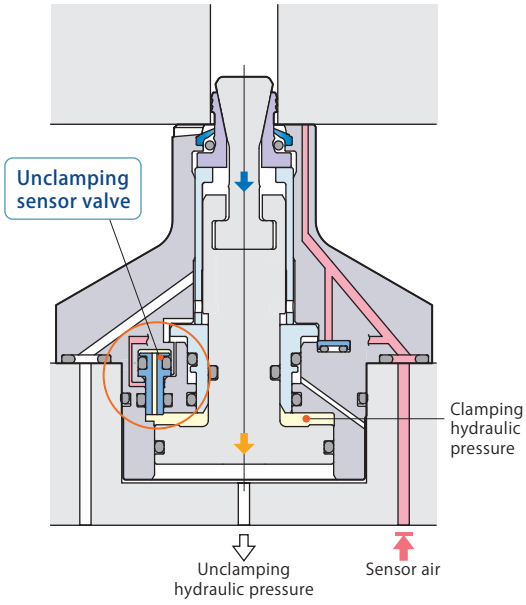


Clamp condition	Unclamping sensor valve	Air sensor signal	Hydraulic pressure switch
Unclamping completion	Open	Air sensor OFF (Sensor air flows.)	Unclamping hydraulic pressure ON
Clamping completion	Close	Air sensor ON (Sensor air does not flow.)	Clamping hydraulic pressure ON

Unclamping completion

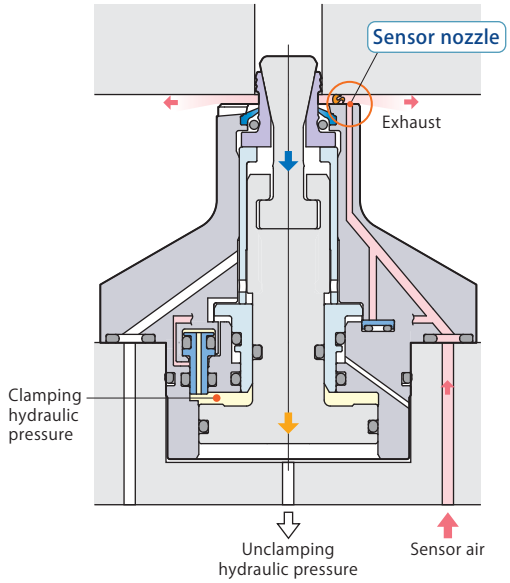


Clamping completion

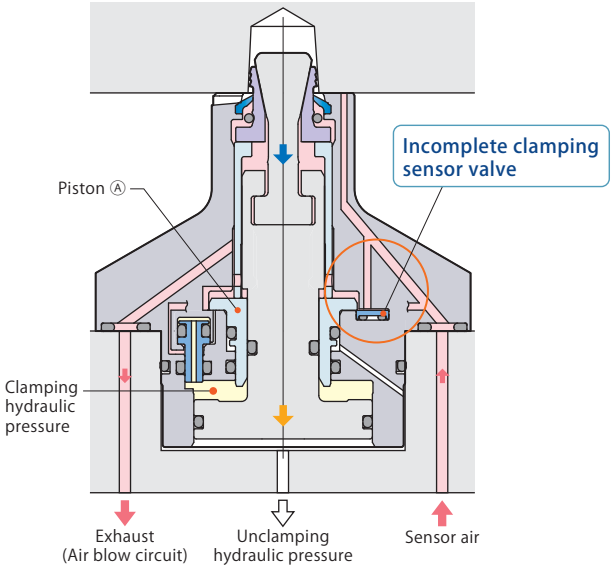


Clamp condition	Sensor nozzle	Incomplete clamping sensor valve	Unclamping sensor valve	Air sensor signal	Hydraulic pressure switch
Unclamping completion	Close	Close	Open	Air sensor OFF (Sensor air flows.)	Unclamping hydraulic pressure ON
Clamping completion	Close	Close	Close	Air sensor ON (Sensor air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

Faulty seating of workpiece



Incomplete clamping

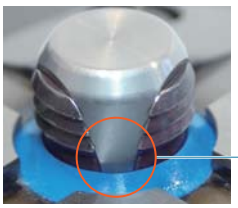


Clamp condition	Sensor nozzle	Incomplete clamping sensor valve	Unclamping sensor valve	Air sensor signal	Hydraulic pressure switch
Faulty seating of workpiece	Open	Close	Close	Air sensor OFF (Sensor air flows.)	Clamping hydraulic pressure ON
Incomplete clamping	Close	Open	Close	Air sensor OFF (Sensor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

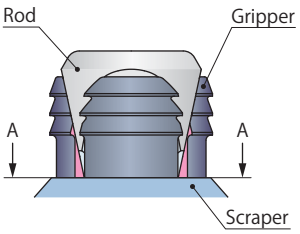
Non-constant air blow model

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)	

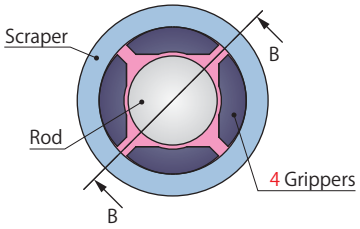
Number of grippers	Grip inner diameter	Clamping force	Model
3 Grippers	ø 11 12 13	3.54 kN (Hydraulic pressure 7MPa)	CGC-N22E Grip inner diameter
	ø 12 13 14 15 16	7.50 kN (Hydraulic pressure 7MPa)	CGC-N23E Grip inner diameter

ø12, ø13 has been available in two different models of the clamping force.

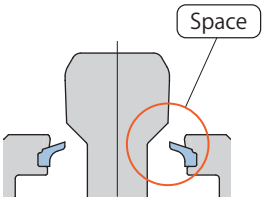
Space where metal chips can intrude is created (Old model)



When clamping



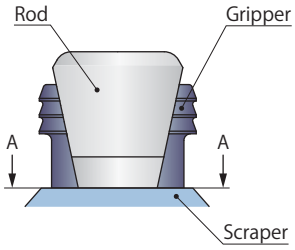
A-A



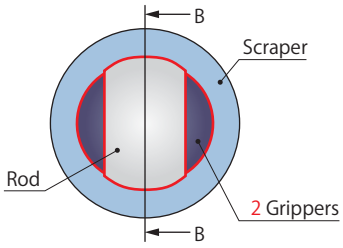
B-B

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

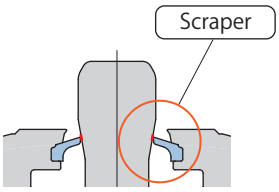
Secure chip protection



When clamping



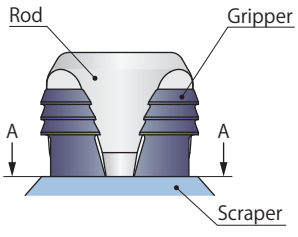
A-A



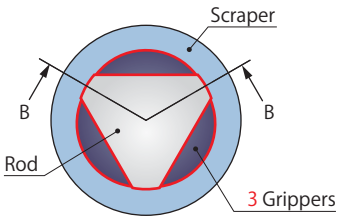
B-B

Pages →26–29

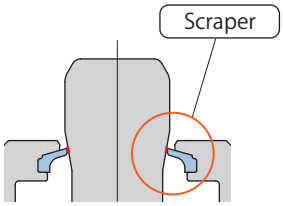
Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.



When clamping



A-A

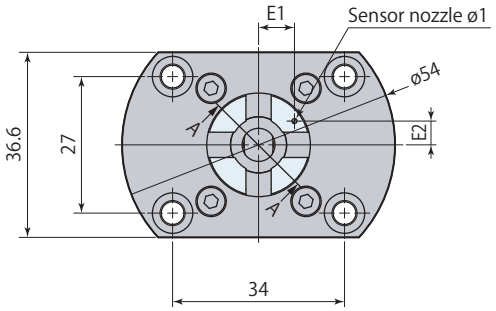


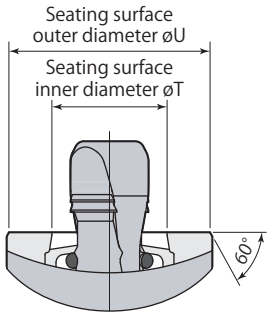
B-B

Pages →30–33

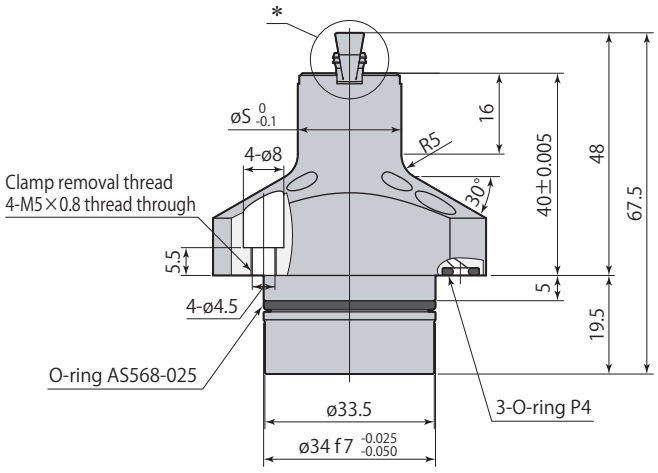
Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.

Dimensions

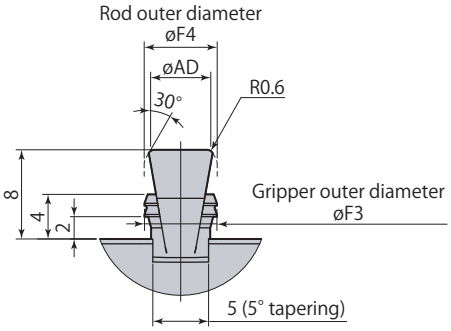




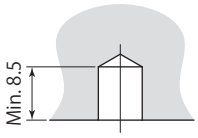
A-A



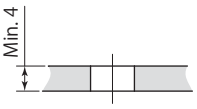
∗Details



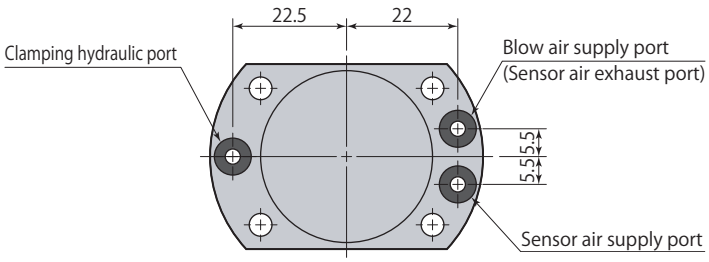
Grip inner diameter usage requirements



Blind hole



Through hole



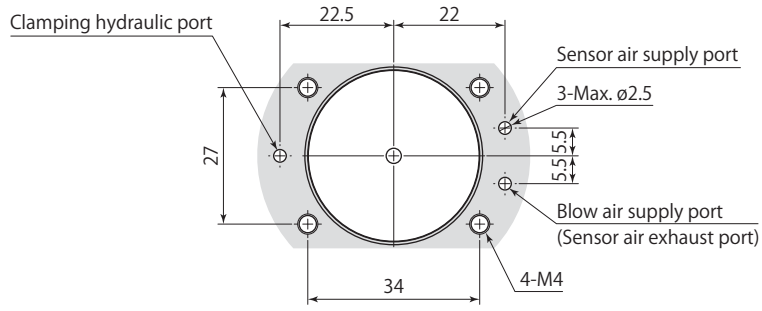
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

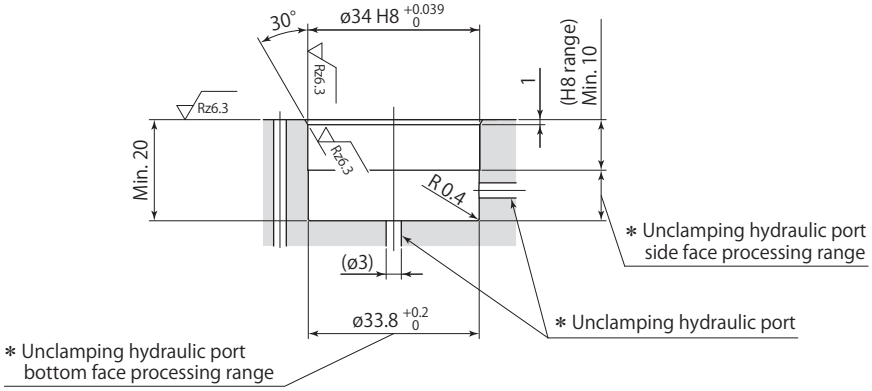
mm

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.

Mounting details



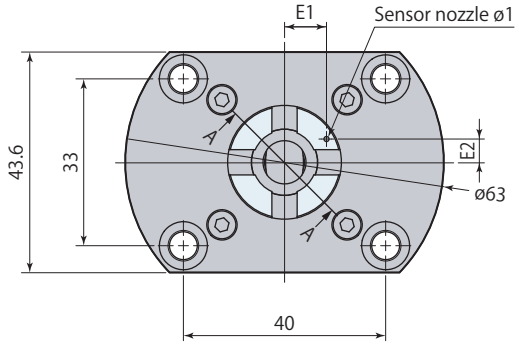


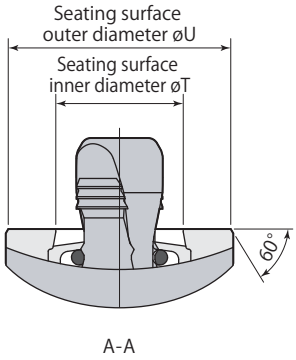
Rz: ISO4287(1997)

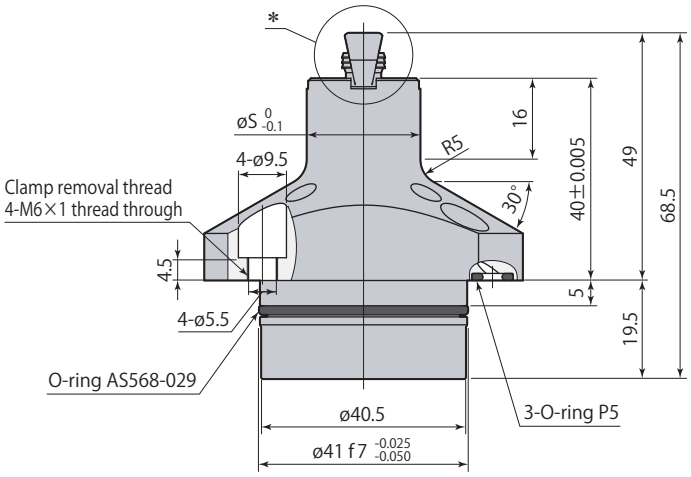
*: Unclamping hydraulic port must be made on either side or bottom face.

- 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.

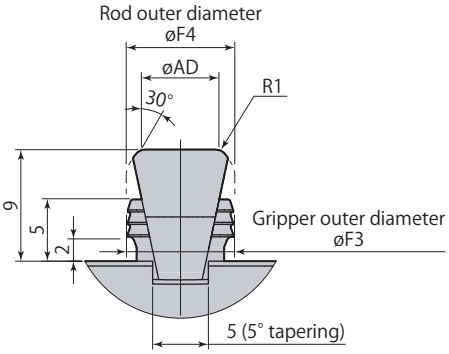
Dimensions



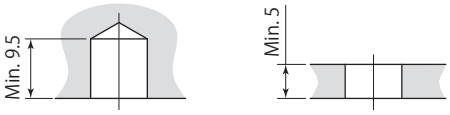


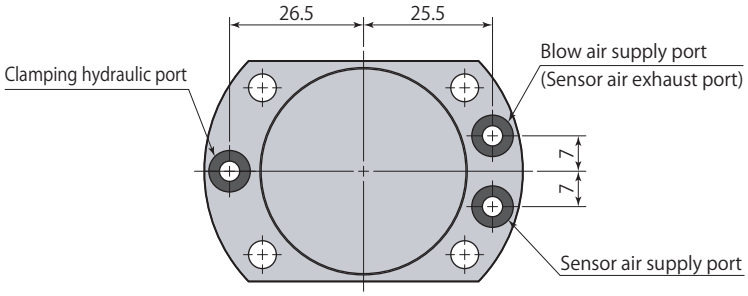


∗Details



Grip inner diameter usage requirements





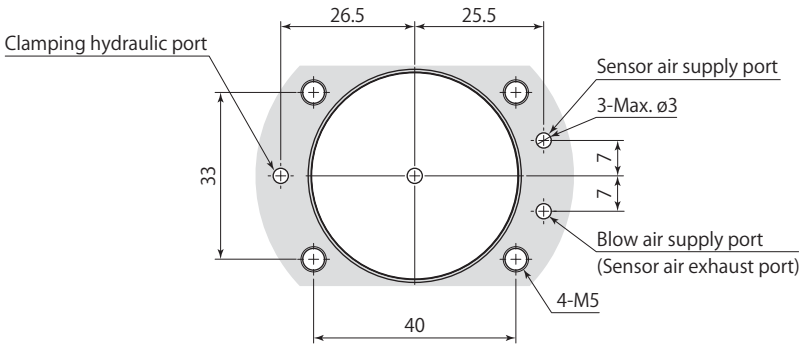
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

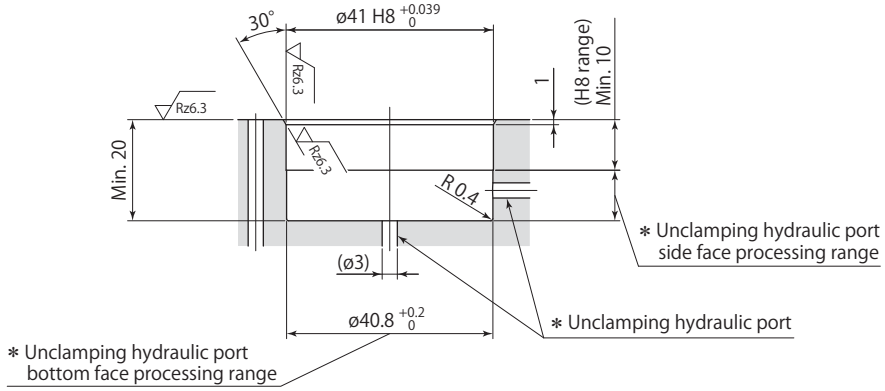
mm

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



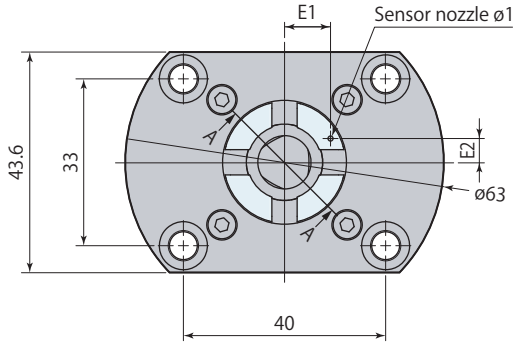


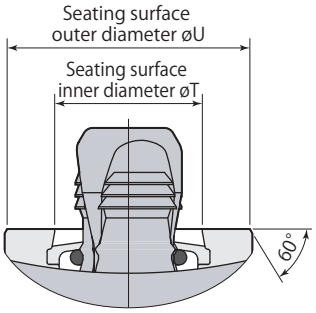
Rz: ISO4287(1997)

∗: Unclamping hydraulic port must be made on either side or bottom face.

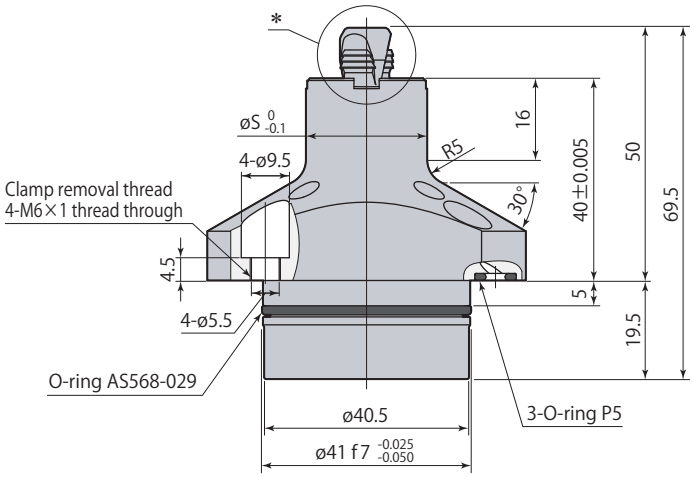
- Apply an appropriate amount of grease to the chamfer and the bore when mounting.
  Excessive grease may be a blockage in the air passage, causing malfunction of the sensor.
- The 30° taper machining must be provided to avoid the damage of the O-ring.

Dimensions

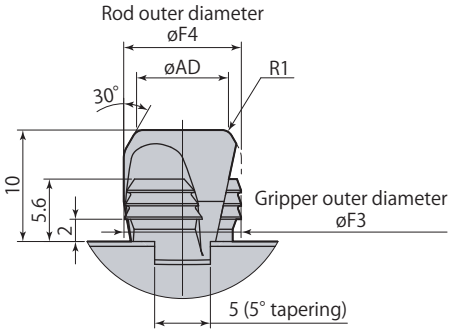




A-A

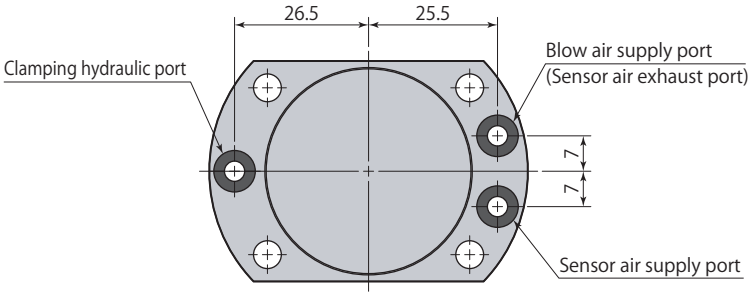


∗Details



Grip inner diameter usage requirements

Blind hole　　Through hole

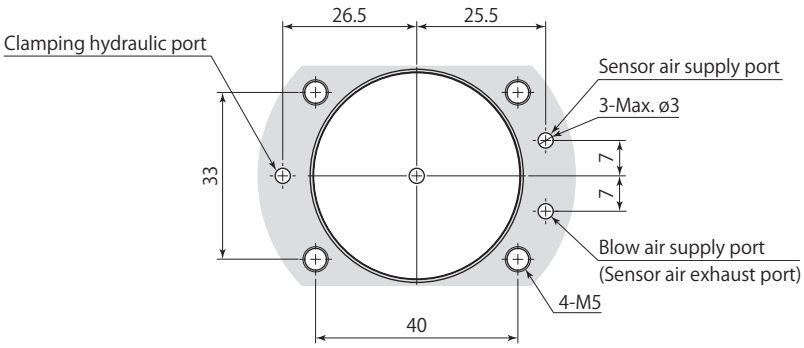


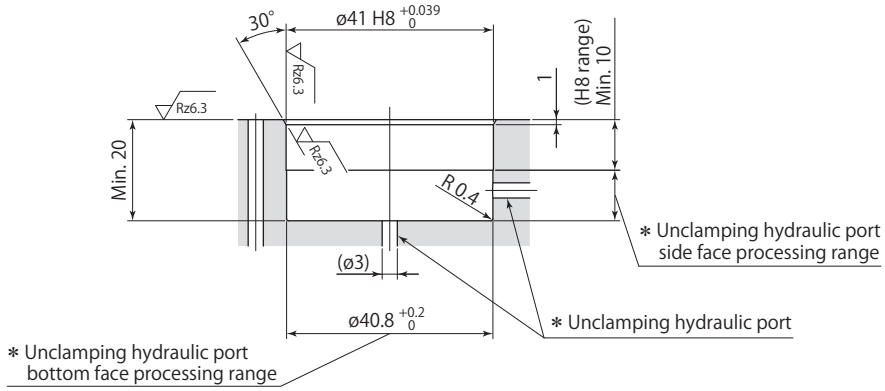
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

mm

Model	CGC-N22E□		
	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



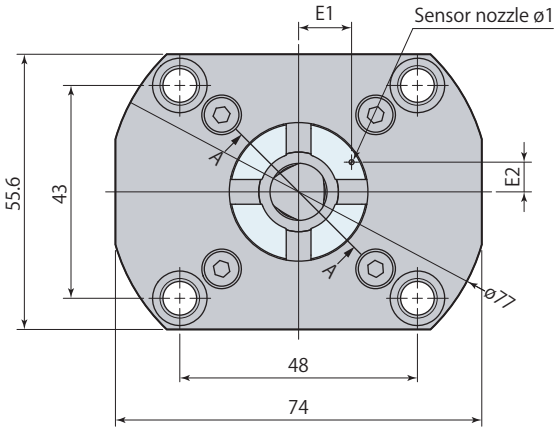


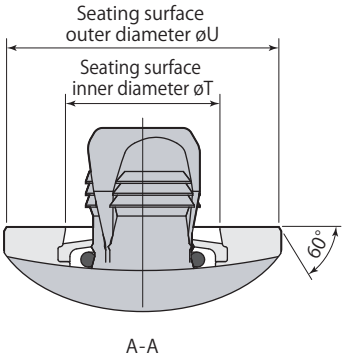
Rz: ISO4287(1997)

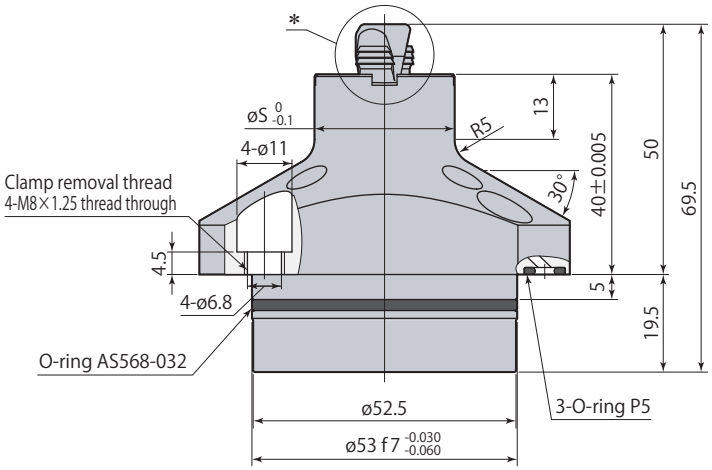
∗: Unclamping hydraulic port must be made on either side or bottom face.

- 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.

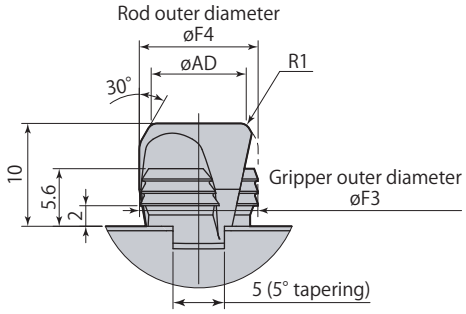
Dimensions



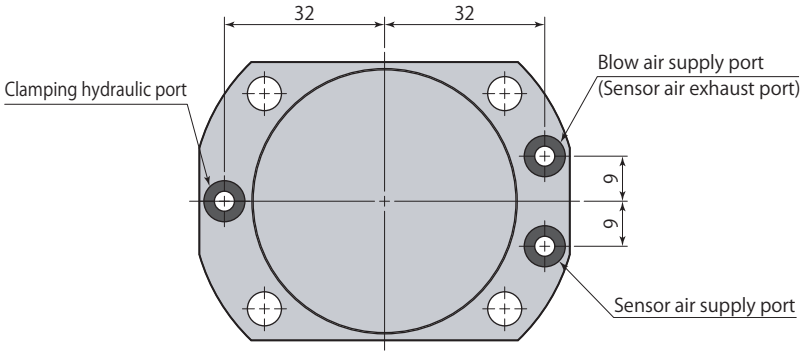




∗Details



Grip inner diameter usage requirements

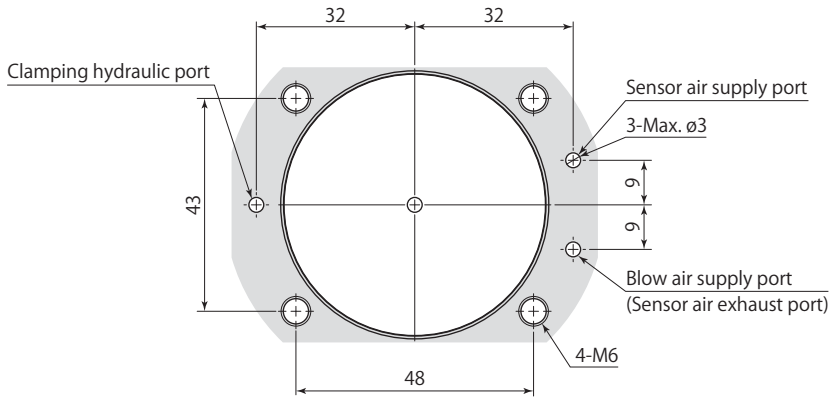


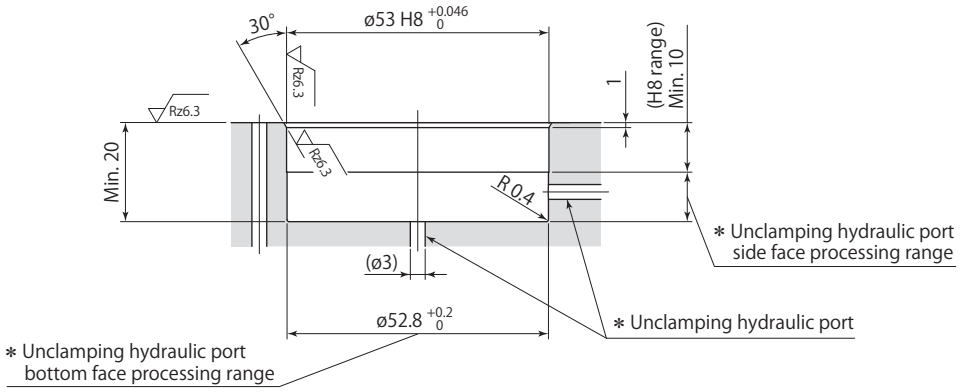
mm

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

- 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.
- CGC-N23E12, 13, 14, 15, 16 are made to order.

Mounting details



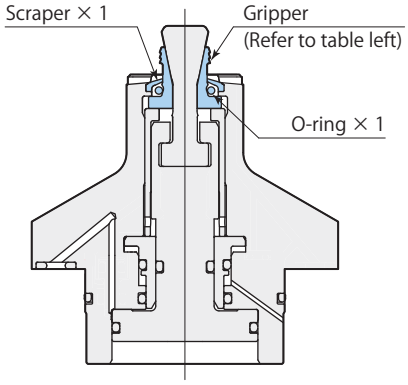


Rz: ISO4287(1997)

∗: Unclamping hydraulic port must be made on either side or bottom face.

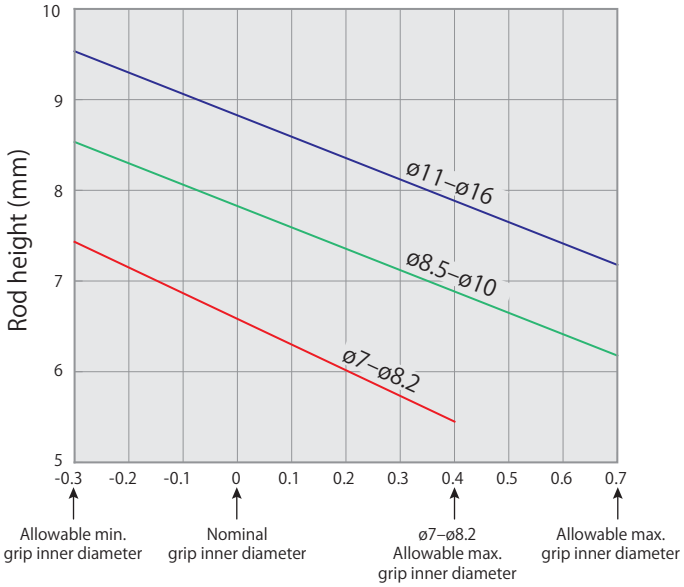
- Apply an appropriate amount of grease to the chamfer and the bore when mounting.
  Excessive grease may be a blockage in the air passage, causing malfunction of the sensor.
- The 30° taper machining must be provided to avoid the damage of the O-ring.

Gripper set replacement

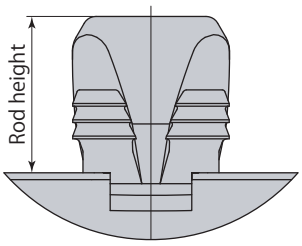
Number of grippers	Gripper set model	Clamp model	Set description
2 Grippers	CGC-N21EJ070	CGC-N21E070	
	CGC-N21EJ073	CGC-N21E073	
	CGC-N21EJ076	CGC-N21E076	
	CGC-N21EJ079	CGC-N21E079	
	CGC-N21EJ082	CGC-N21E082	
	CGC-N22EJ085	CGC-N22E085	
	CGC-N22EJ09	CGC-N22E09	
	CGC-N22EJ10	CGC-N22E10	
3 Grippers	CGC-N22EJ11	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	

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



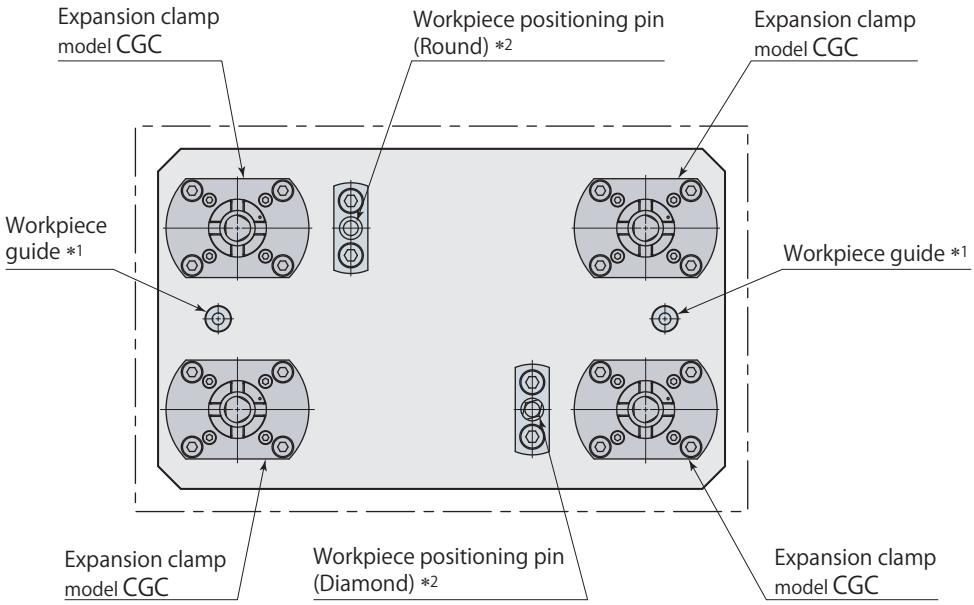
Difference between actual grip inner diameter and nominal grip diameter (mm)

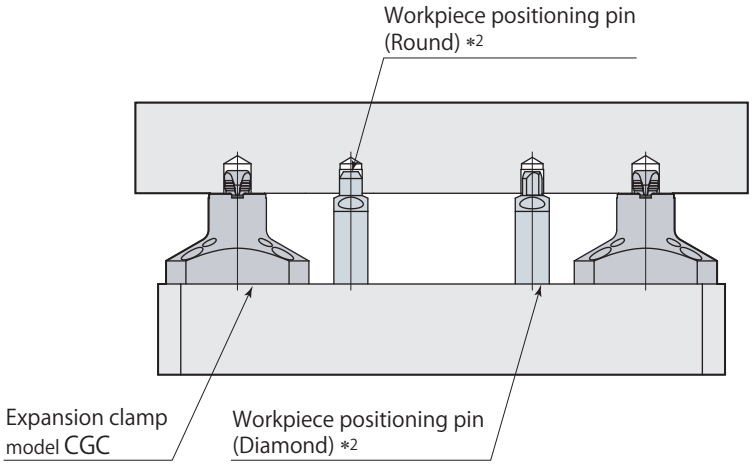


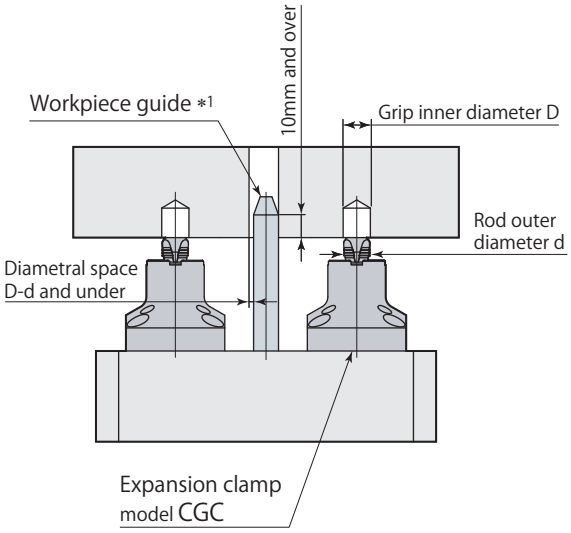
Rod height calculation formula	
ø7 – ø8.2	6.58-2.84× Actual grip inner diameter and nominal grip diameter difference
ø8.5– ø10	7.82-2.35× Actual grip inner diameter and nominal grip diameter difference
ø11 – ø16	8.82-2.35× Actual grip inner diameter and nominal grip diameter difference

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



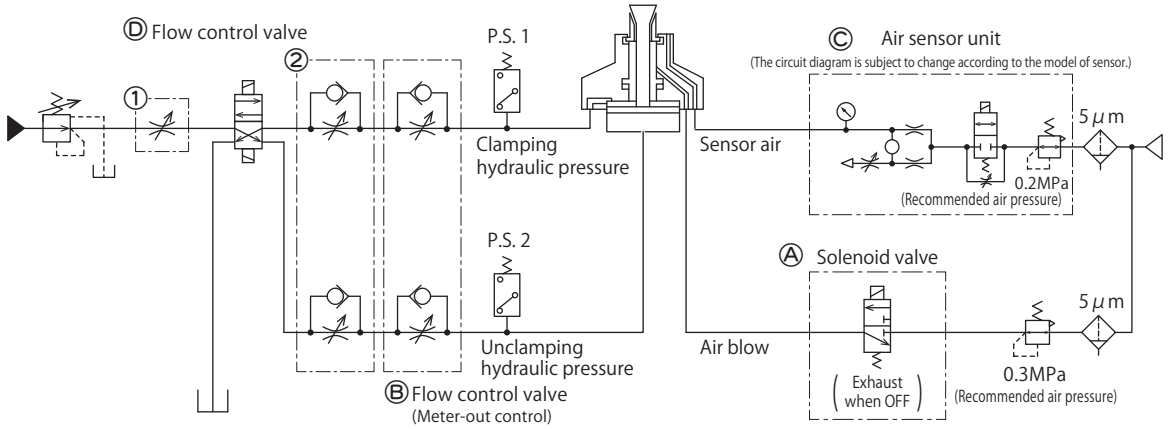




*1: When using automatic or robotic conveyers, prevent damage to clamp caused from impact by setting workpiece guides. Using the above guide as reference, accurately position the holes when using workpiece guides.

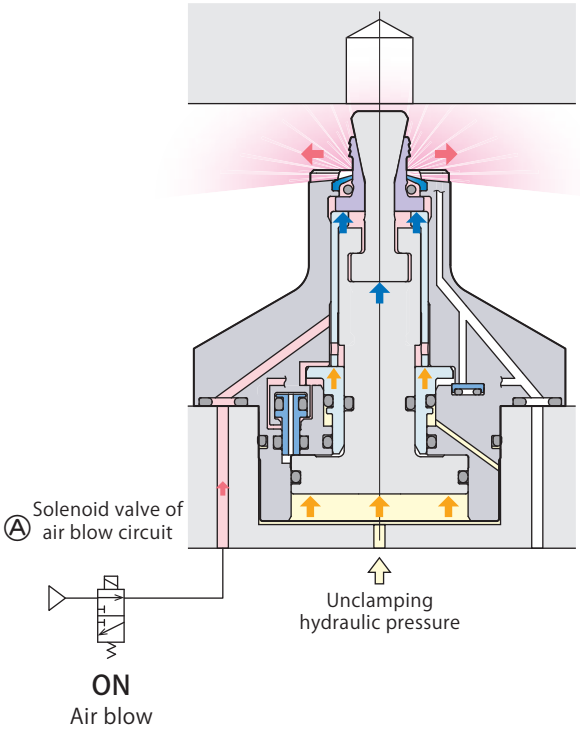
*2: **The expansion clamp does not have a workpiece positioning function.**
Install workpiece positioning pins (or similar).

Hydraulic and pneumatic circuit diagram

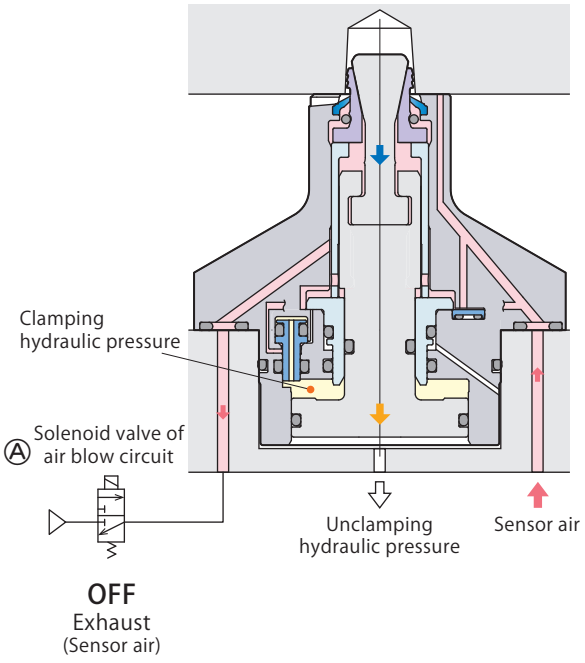


- Air blow will not be necessary during cutting process. Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping to remove metal chips and debris.
- The solenoid valve Ⓐ must be closed when checking the operation of the clamp with the air sensor. Also 3 port type of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



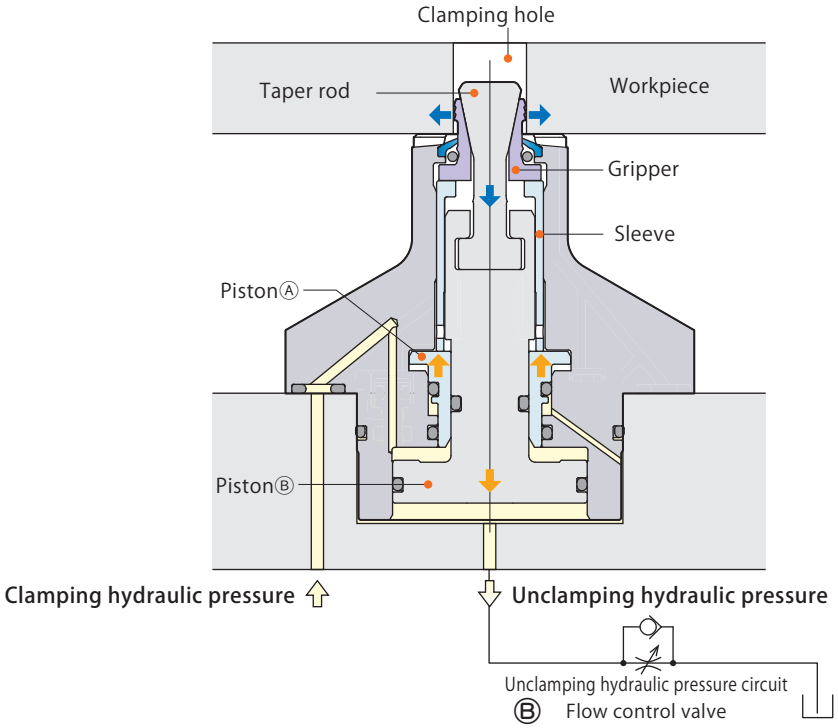
Incomplete clamping



- 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 →15**. 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 →36** 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