7MPa Work clamping system

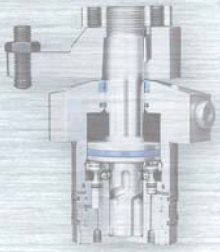
CTU CTT
CLU CLT
CNA CMC CMD
CSU CST CSN CSY CSK
CEK CEA CVH
VCB VCP VHD VRG VEF WPB WPC
HCD HCS HCT X63 WRA WRB

Refer to separate catalog for details.

Expansion clamp

CGC
CGT
CGU
CGE
CGY

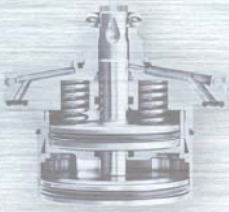
7MPa Sensing clamp



CTM
CTN
CLM
CLN
CNB

Refer to separate catalog for details.

Pal system



CPC
CPH
CPY
CPK
WVP

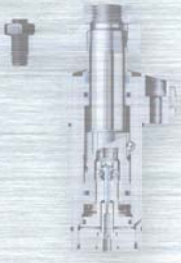
Refer to separate catalog for details.

air Work clamping system

CTX
CTY
CLX
CLY
CSS
CSX

Refer to separate catalog for details.

35MPa Work clamping system



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

Refer to separate catalog for details.

INDEX

Expansion clamp

Expansion clamp
CGC

7MPa
Double acting
Page → 14

Expansion clamp
CGT
Long neck

7MPa
Double acting
Page → 40

Expansion clamp
CGU
Eccentric

7MPa
Double acting
Page → 66

Air expansion clamp
CGE

air
Double acting
Page → 90

Air expansion clamp
CGY
Long neck

air
Double acting
Page → 114

Expansion clamp

7 MPa & air

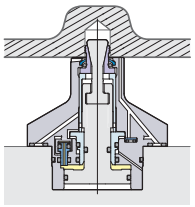
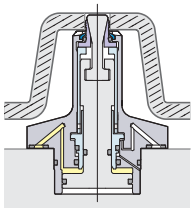
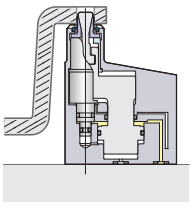
model CGY

model CGE

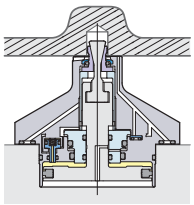
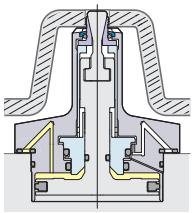
model CGU

model CGT

model CGC

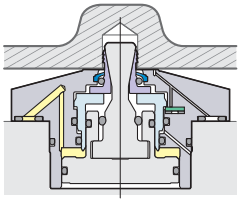
Expansion clamp	model **CGC** Page →14 	model **CGT** Page →40 	model **CGU** Page →66 
Model	7MPa Double acting Standard model 	7MPa Double acting Long neck model 	7MPa Double acting Eccentric model 
Specifications Clamping force & hydraulic pressure	**Page →15**	**Page →41**	**Page →67**
Structure Explanation of operation	**Page →16**	**Page →42**	**Page →68**
Features	**Page →18**	**Page →44**	**Page →70**
Air sensor valve function and structure	**Page →20**	**Page →46**	**Page →72**
Advantage of non-constant air blow model	**Page →24**	**Page →48**	**Page →74**
Dimensions Mounting details	**Page →26**	**Page →50**	**Page →76**
Gripper set Grip inner diameter & rod height	**Page →34**	**Page →58**	**Page →82**
System configuration example	**Page →35**	**Page →59**	**Page →83**
Hydraulic and pneumatic circuit diagram	**Page →36**	**Page →60**	**Page →84**
Operation cycle	**Page →38**	**Page →63**	**Page →87**
Caution in use	**Page →39**	**Page →64**	**Page →88**

Refer to **page →6** for the details of the expansion clamps that are not described in the catalog.

air Expansion clamp	model **CGE** **Page →90** 	model **CGY** **Page →114** 
Model	1MPa Double acting Standard model 	1MPa Double acting Long neck model 
Specifications Clamping force & air pressure	**Page →91**	**Page →115**
Structure Explanation of operation	**Page →92**	**Page →116**
Features	**Page →94**	**Page →118**
Air sensor valve function and structure	**Page →96**	**Page →120**
Advantage of non-constant air blow model	**Page →100**	**Page →122**
Dimensions Mounting details	**Page →102**	**Page →124**
Gripper set Grip inner diameter & rod height	**Page →108**	**Page →132**
System configuration example	**Page →109**	**Page →133**
Pneumatic circuit diagram	**Page →110**	**Page →134**
Operation cycle	**Page →112**	**Page →137**
Caution in use	**Page →113**	**Page →138**

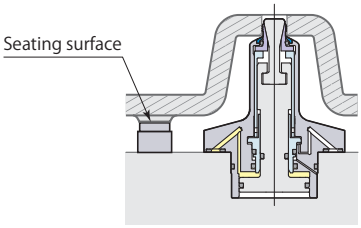
Refer to **page →6** for the details of the expansion clamps that are not described in the catalog.

model
CGS-N2
7MPa Double acting



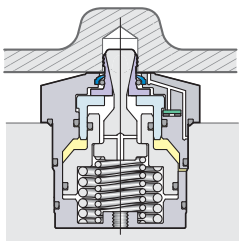
Low height model

model
CGT-R
7MPa Double acting



Seating surface is set apart from clamp
Seating-less model

model
CGS-N1
7MPa Single acting

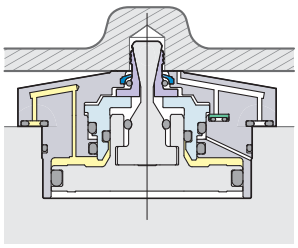


Hydraulic : Clamp
Spring : Unclamp

Contact Pascal for more details.

model
CGX

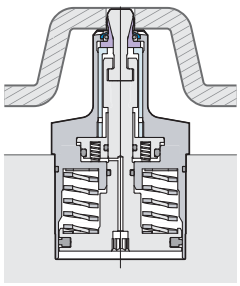
air Double acting



Low height model

model
CGY-F3

air Spring acting

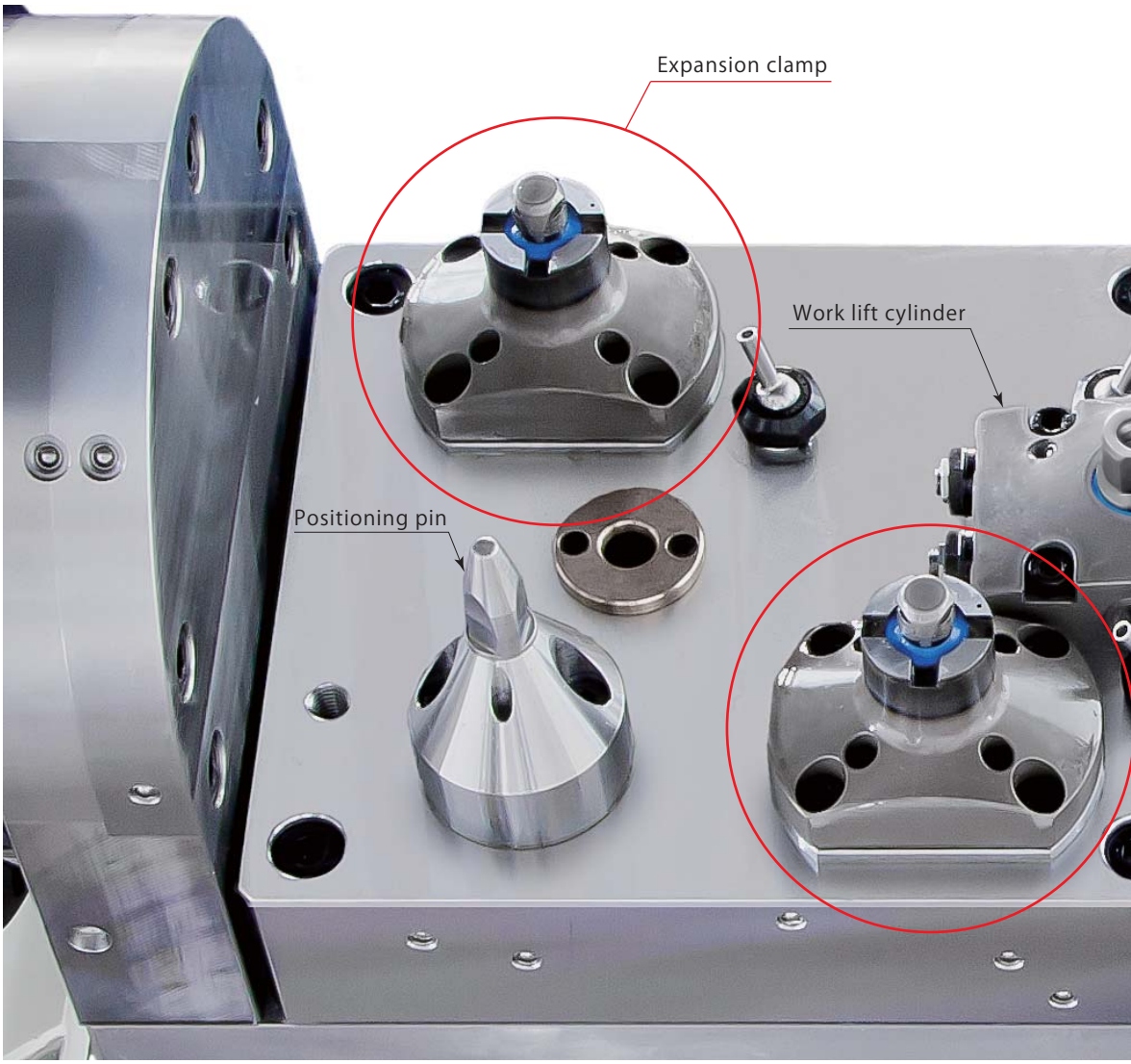


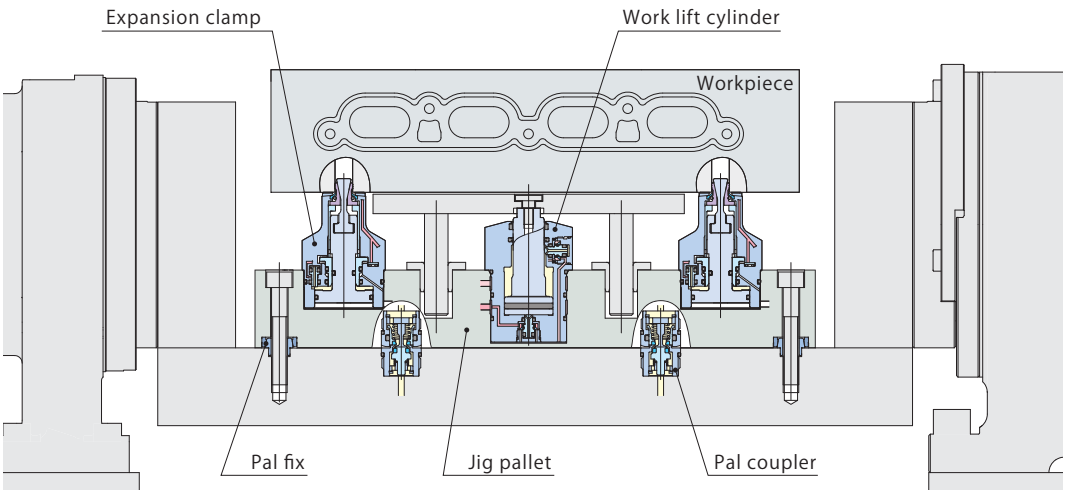
Spring : Clamp
Air : Unclamp

Contact Pascal for more details.

Pascal compact jig system

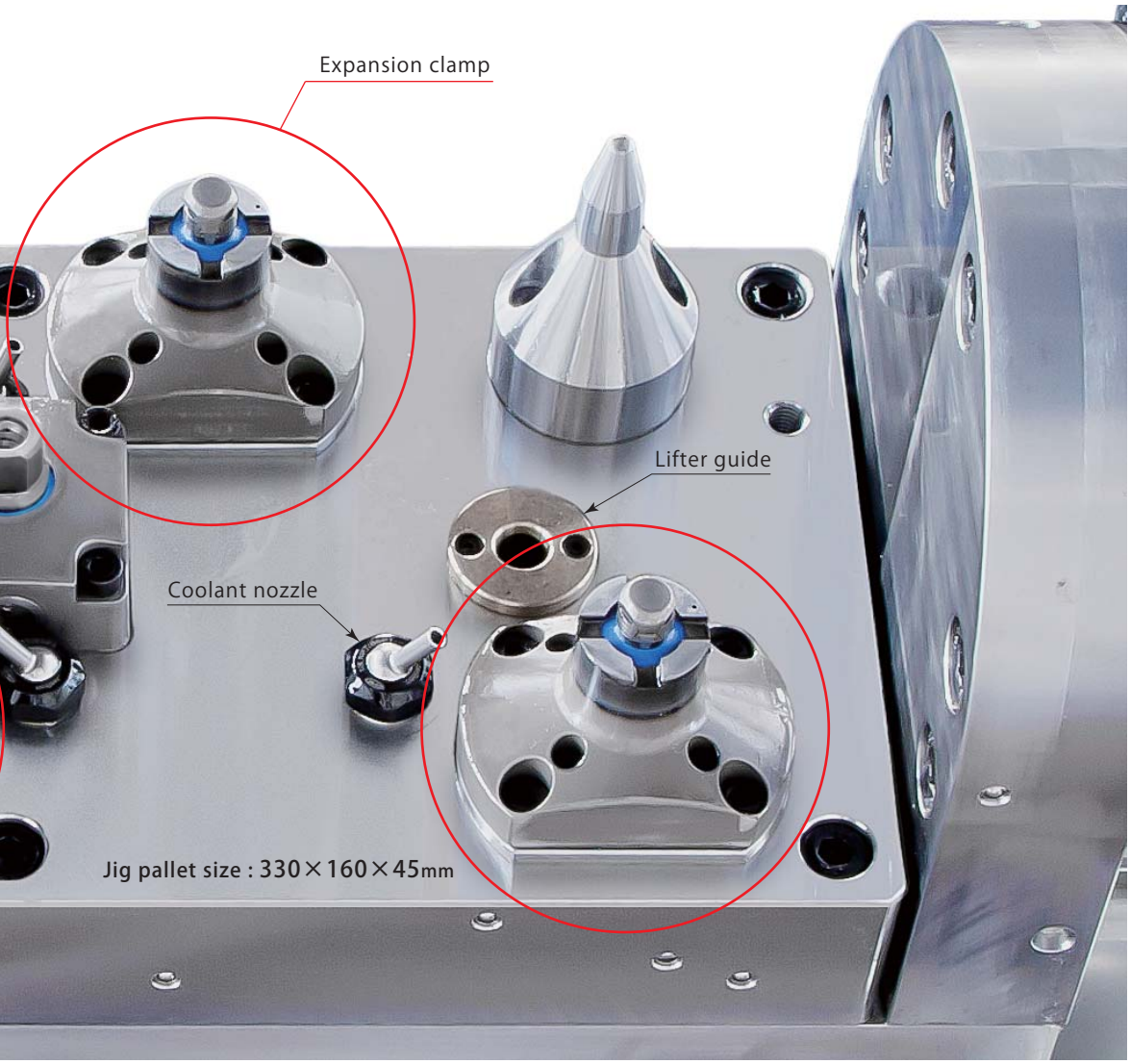
Cylinder Block & Head, Transmission case
Pascal expansion clamps are used in variety of

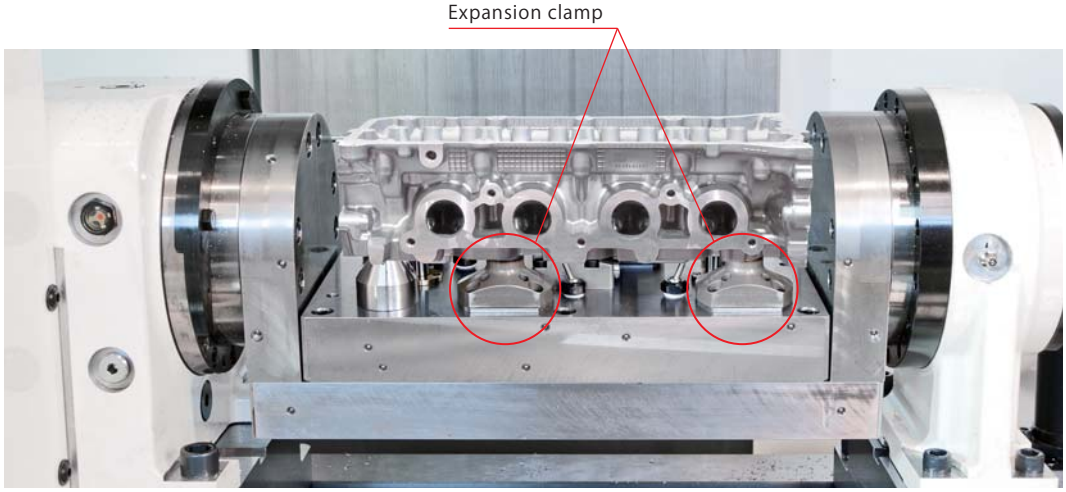




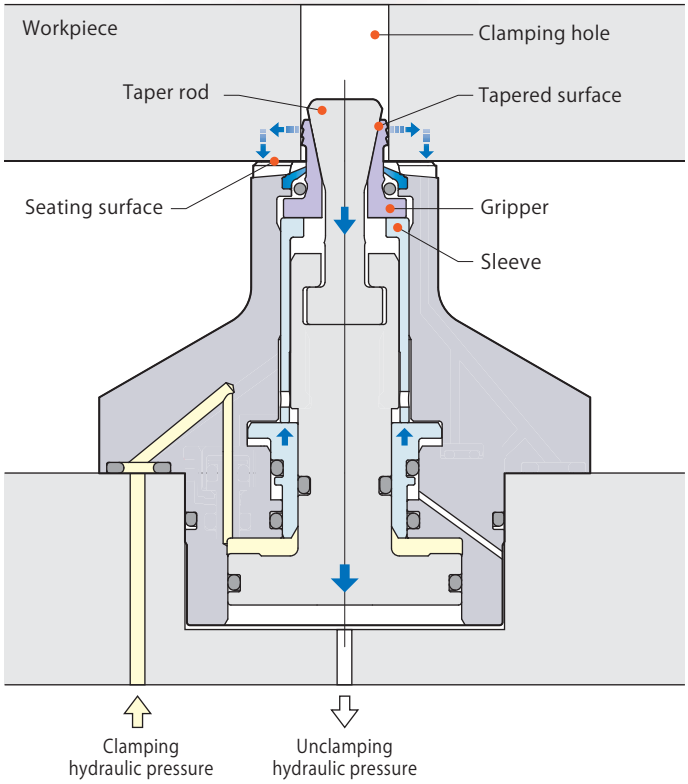
with the Expansion clamp

& housing, Valve body, knuckle, carrier, and ABS…
automobile parts machining processes all over the world.



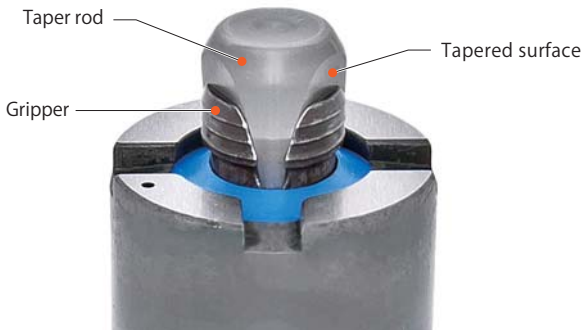


Expansion clamp model CGC



The holding force of expansion clamp is transmitted to a gripper by the tapered surface.
As the taper rod lowers, the gripper expands horizontally first along the tapered surface to grip the inner face of clamping hole then pulls a workpiece down to the seating surface.

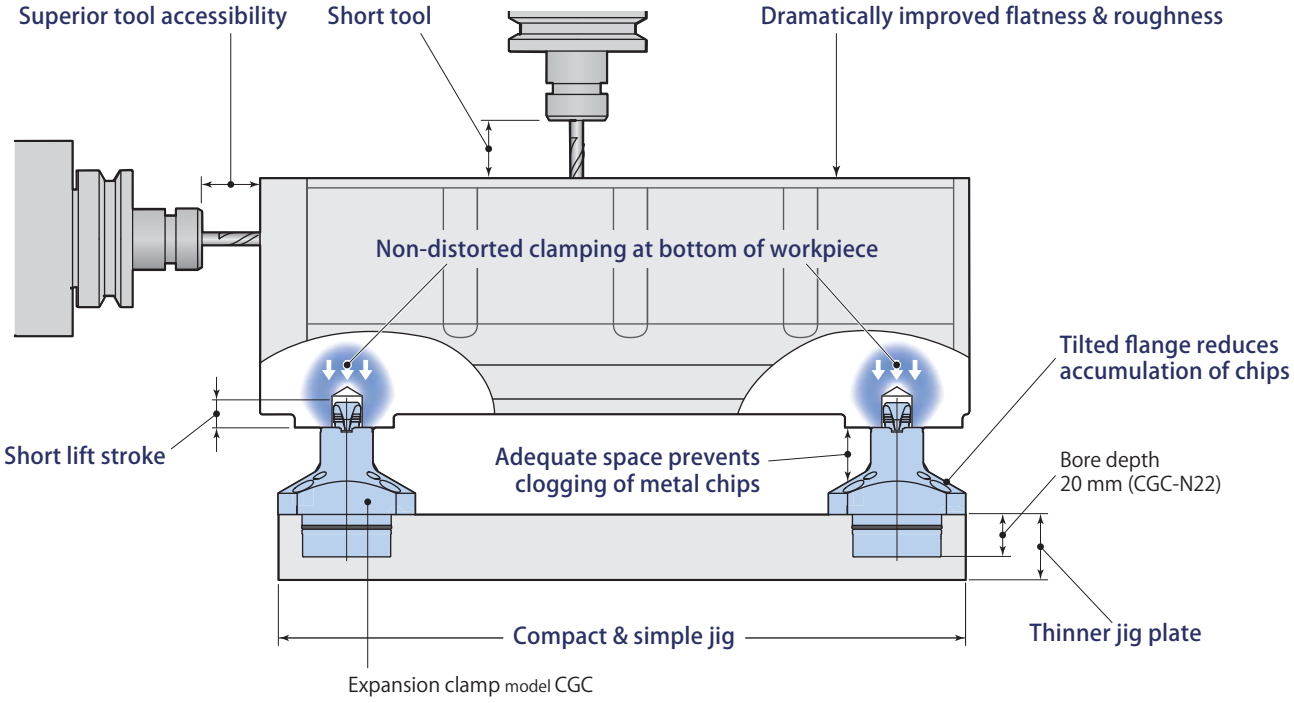
Unclamping

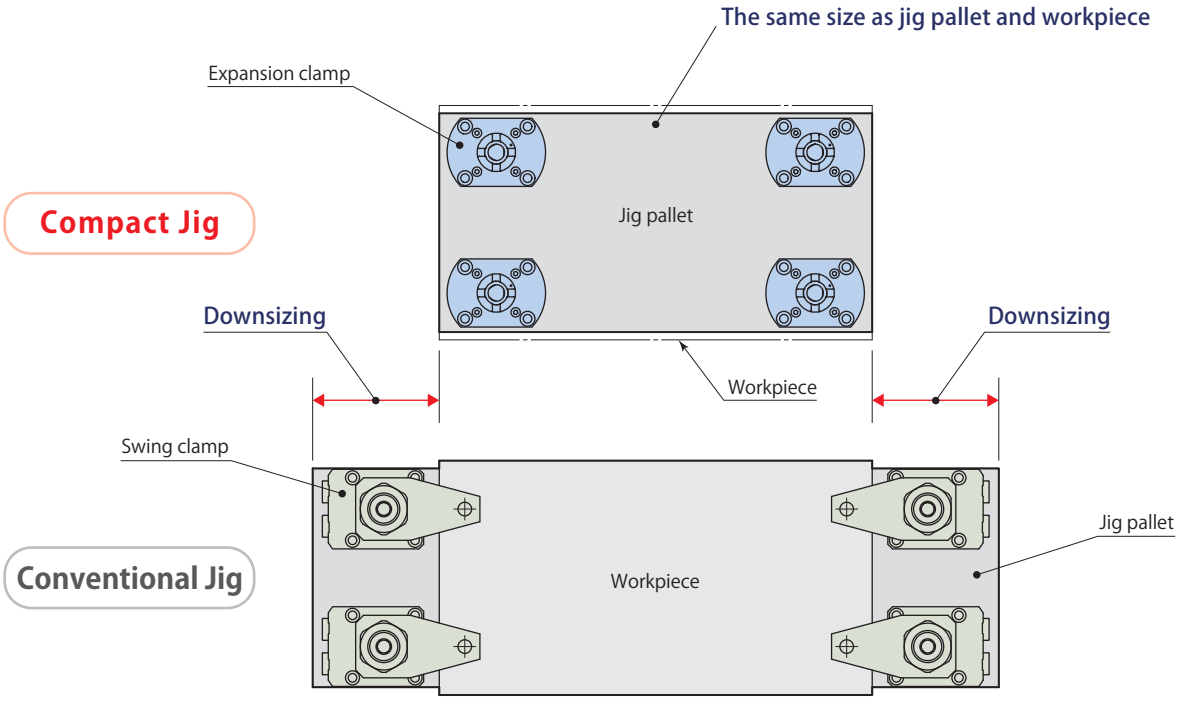


Clamping

Compact jig system

The development of the expansion clamp has allowed compact and reliable jigs to be realized.
The compact jig enables the size of machine and workpiece loading system to be minimized and compresses the machining line.
This can significantly help save on the investment for facilities.



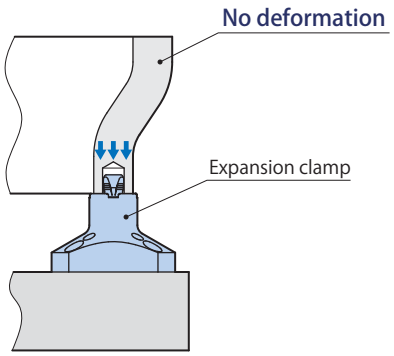


Features of expansion clamp

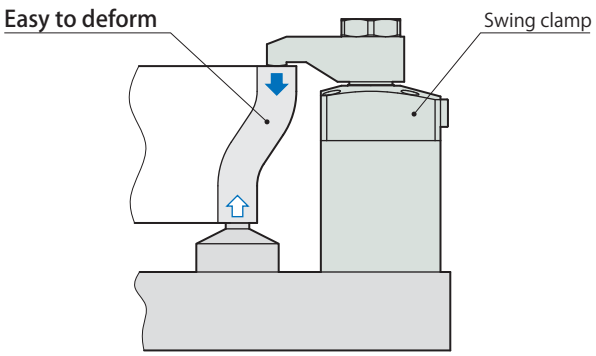
Non-distorted clamping at bottom of workpiece

The expansion clamp grasps the bottom of the workpiece without any deformation and has a superior gripping force that allows improved machining accuracy and efficiency.

Clamping at the bottom of the workpiece by the expansion clamp

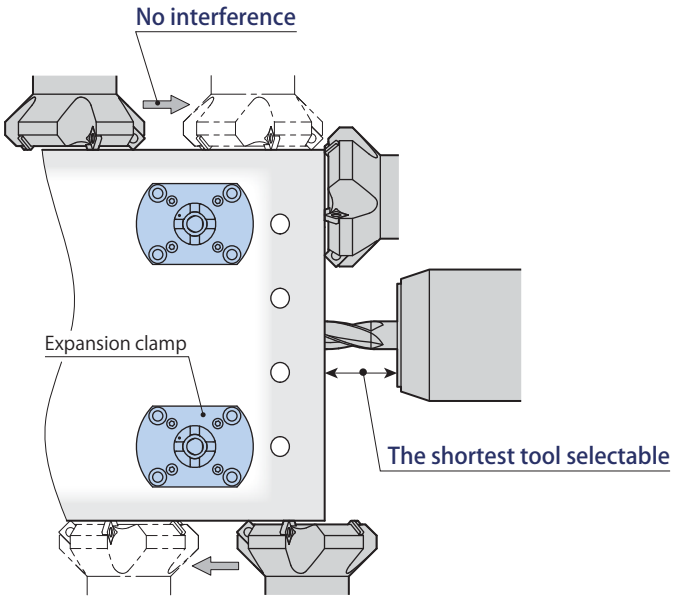


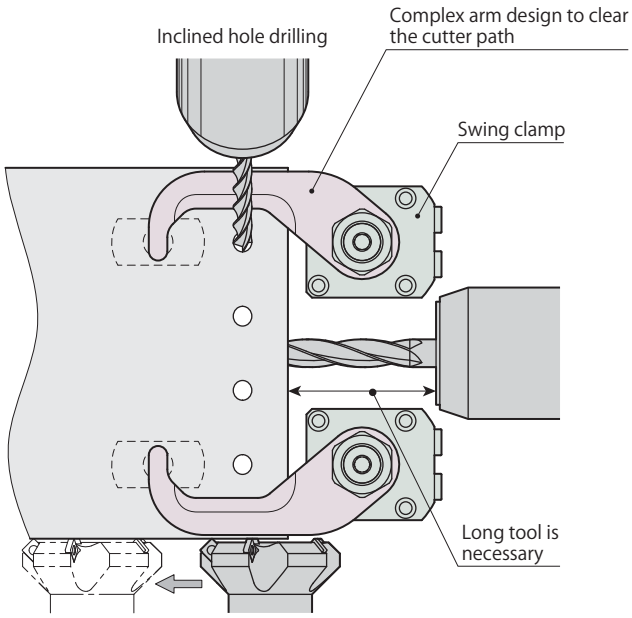
Clamping at the top surface of the workpiece by the conventional swing or link clamp



Superior tool accessibility

Any interferences between the tool and a clamp body or an arm are eliminated by using the expansion clamp, which enables machining from all directions and results in a highly efficient machining process.

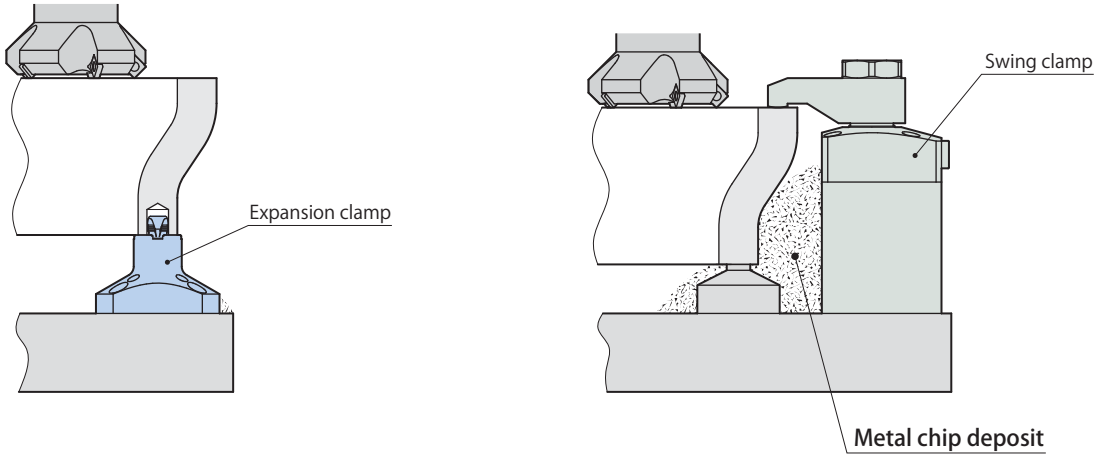




Features of expansion clamp

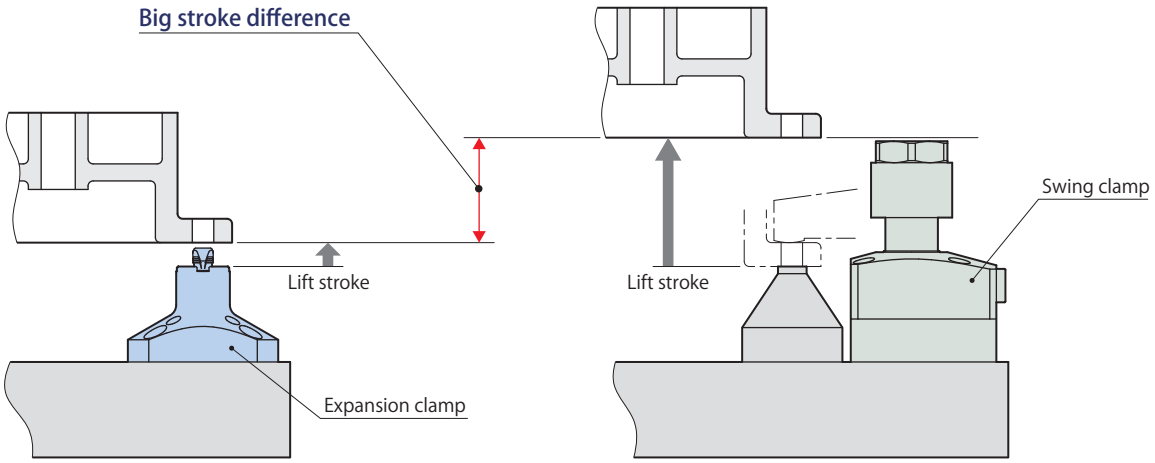
Eliminate the troubles caused by metal chip

The expansion clamp can eliminate the troubles caused by metal chip deposits or debris contamination by clamping at the bottom of the workpiece.



High-speed workpiece transport

Low profile gripper design allows lift stroke of workpiece loading system to be shortened, thereby enabling high-speed transport and system operation.



Expansion clamp

Double acting 7MPa

model CGC

model CGC

Specifications

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

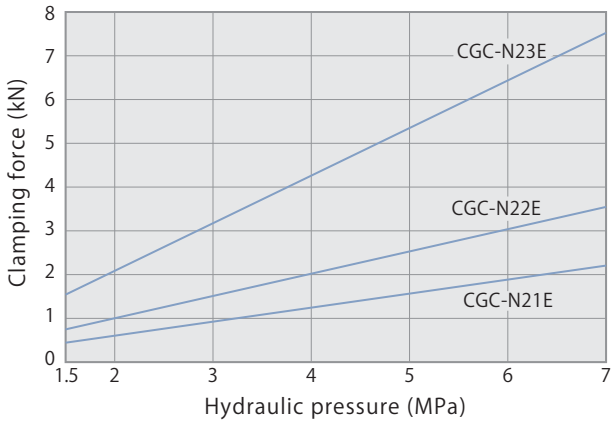
■ indicates made to order.

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

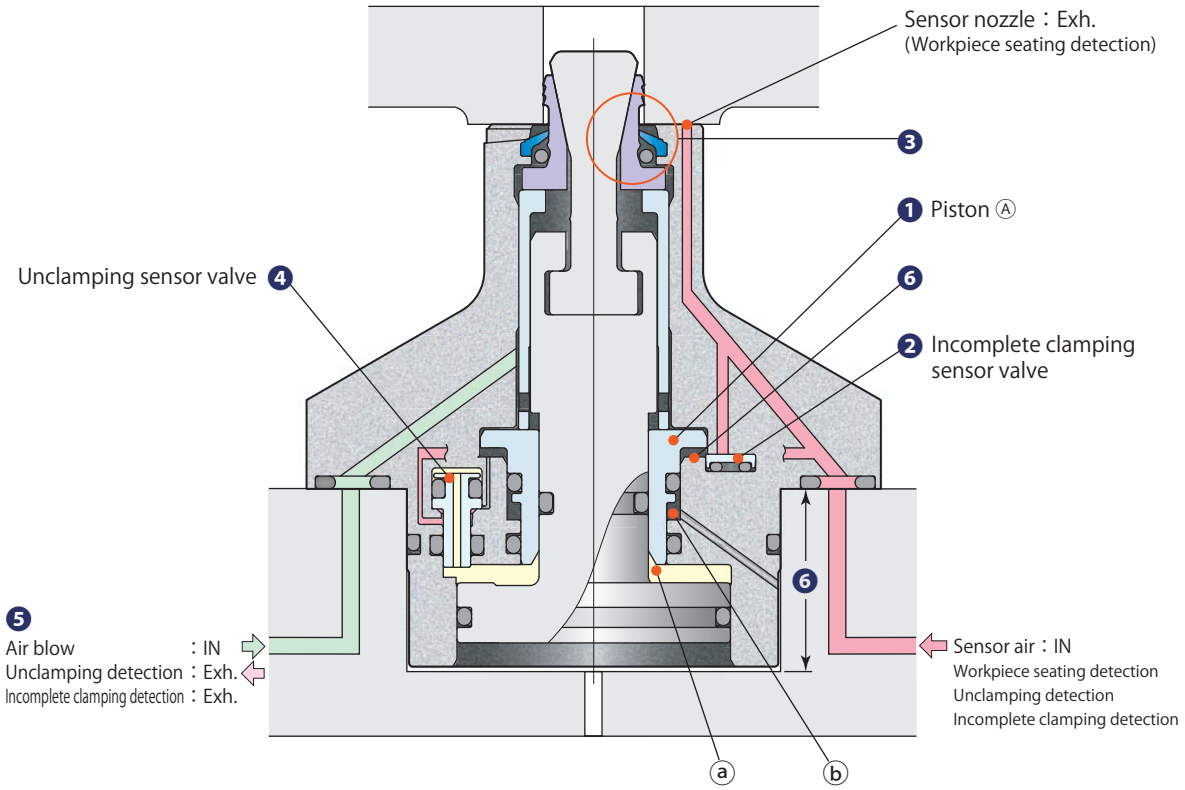
P : Hydraulic pressure (MPa)

- 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.

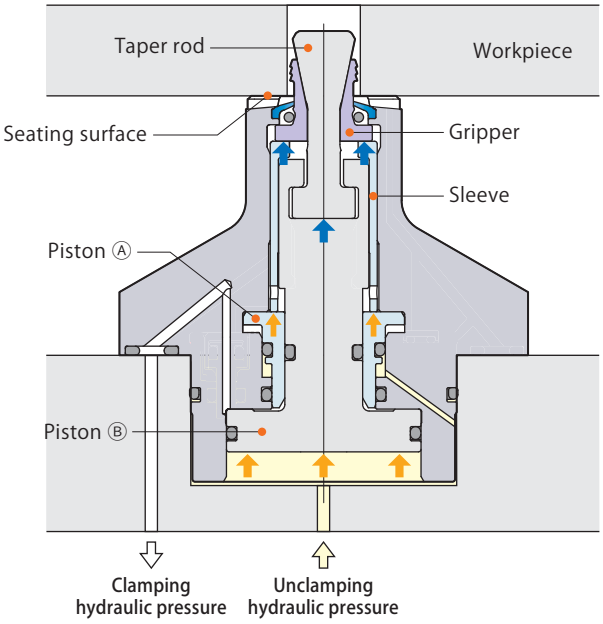
6 Stroke end detection by a piston Ⓐ (JP PAT.)

- 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.

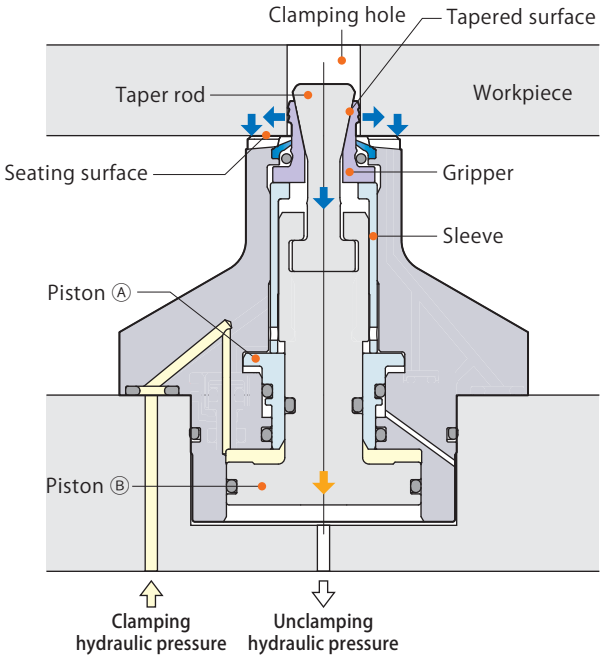


Workpiece holding

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

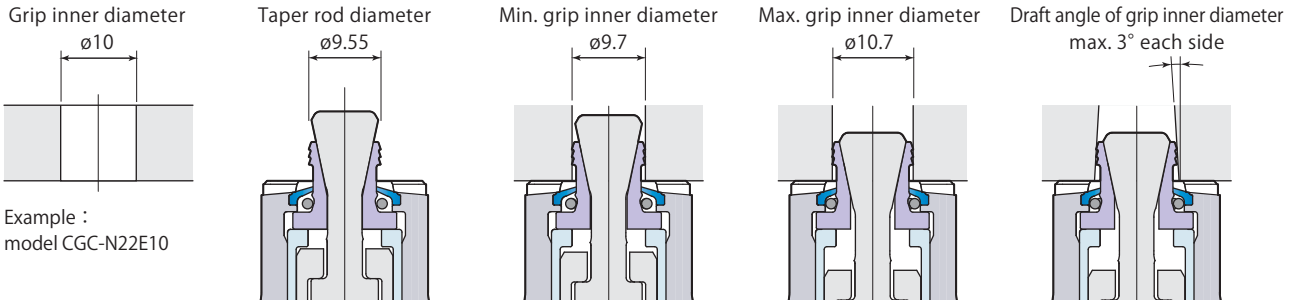
② The gripper expands horizontally along the tapered surface to grip inner face of clamping hole holding its position at upper stroke end by piston Ⓐ and sleeve.

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.



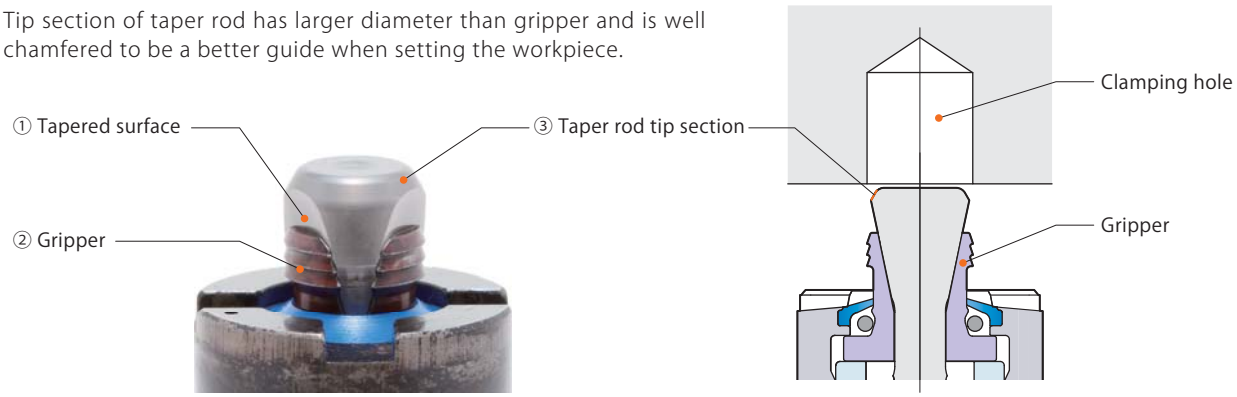
∗：0.7mm stroke for CGC-N21E070, 073, 076, 079, 082

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.

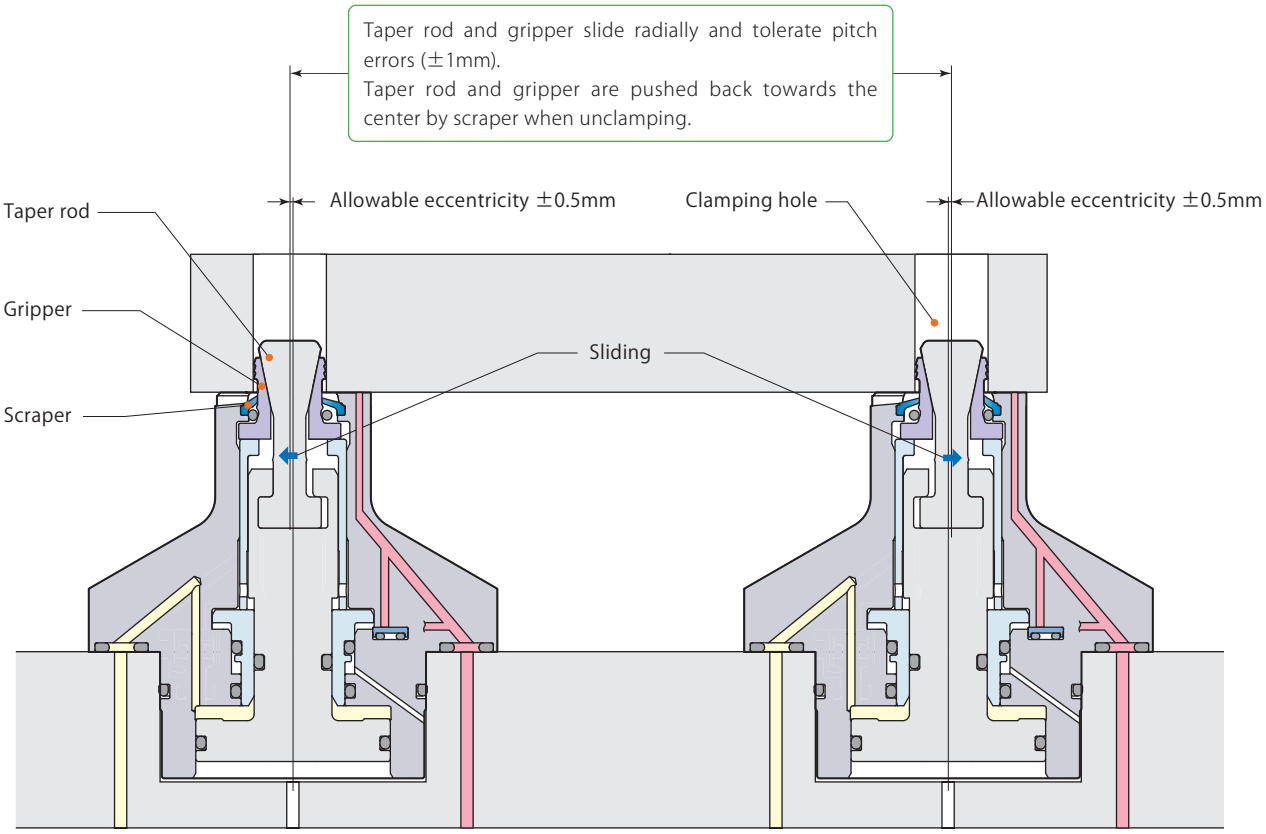


Seating surface can be reground (Max.0.1 mm)

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.

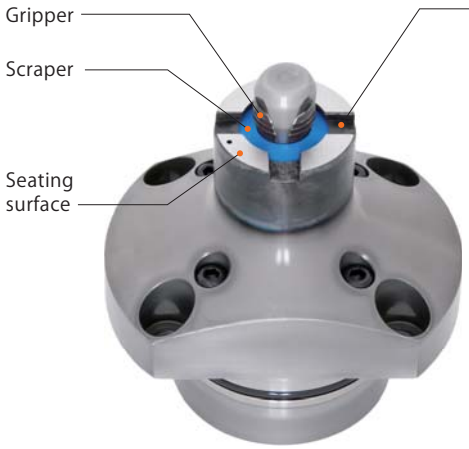
Clamping hole pitch errors can be tolerated

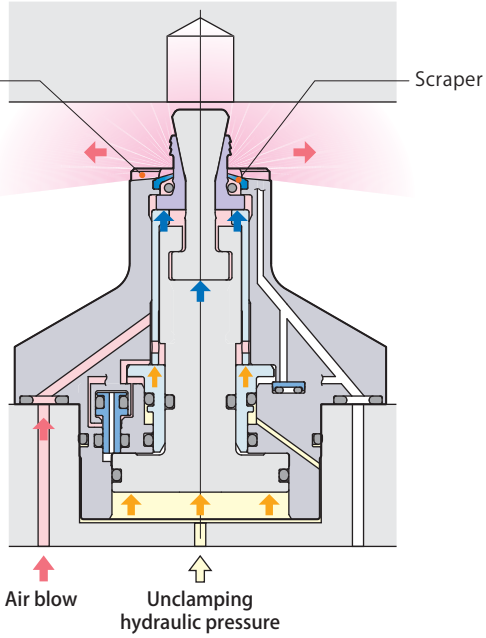


By the eccentric mechanism, the expansion clamp does not have a workpiece positioning function.

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.

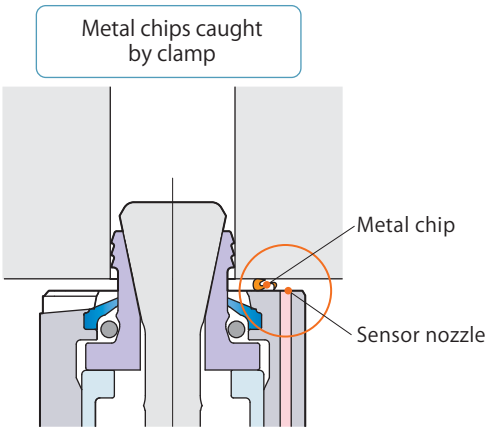


Figure 1-a

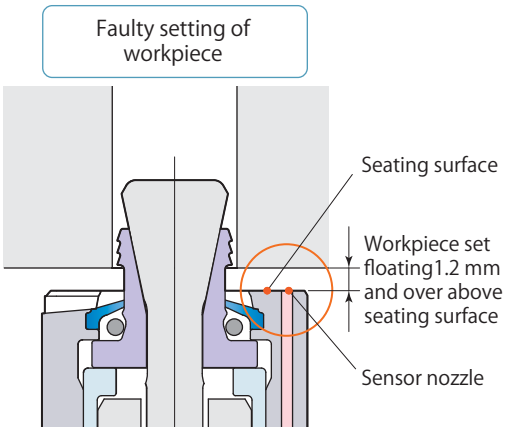
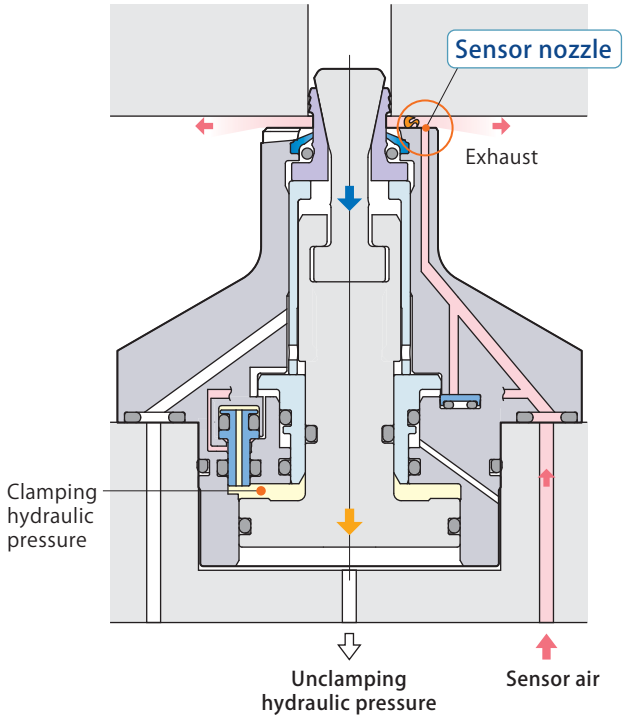


Figure 1-b

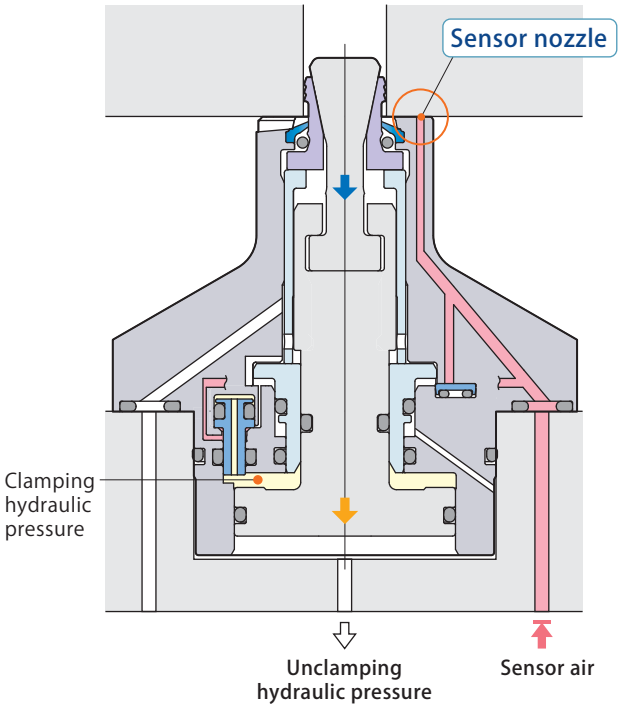
Faulty seating of workpiece

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

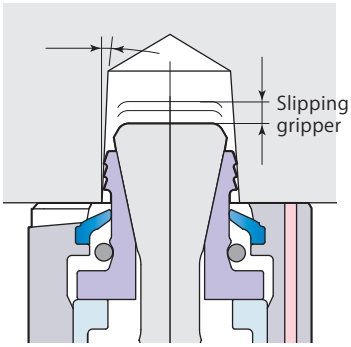


Figure 2-a

Clamping hole is large (Full stroke)

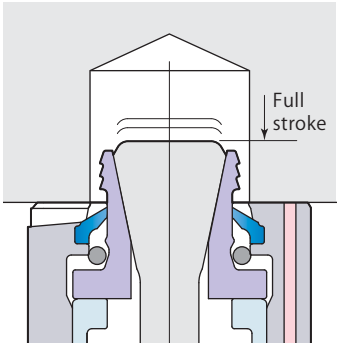


Figure 2-b

If gripper is broken

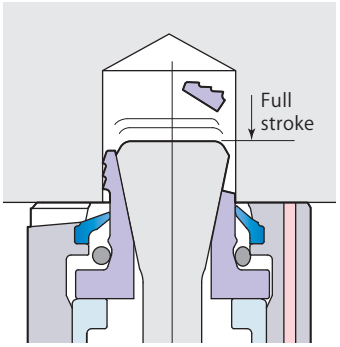
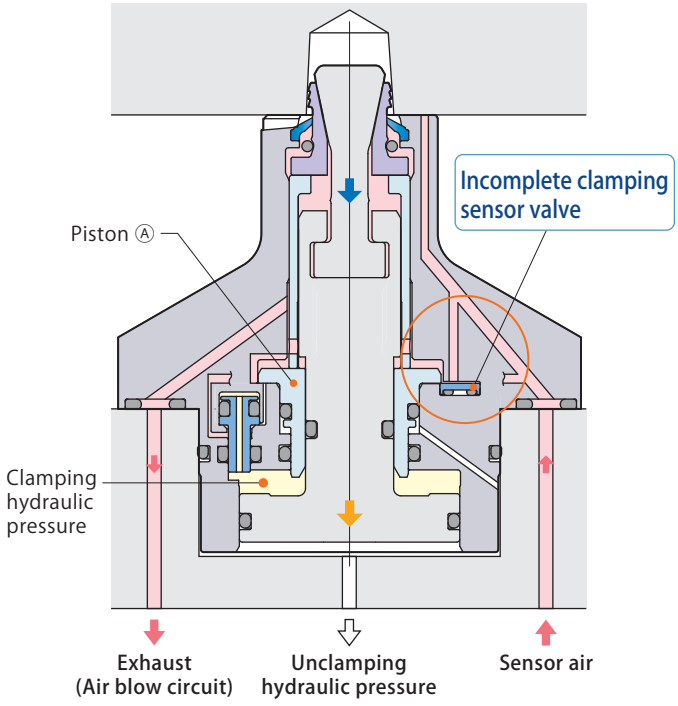


Figure 2-c

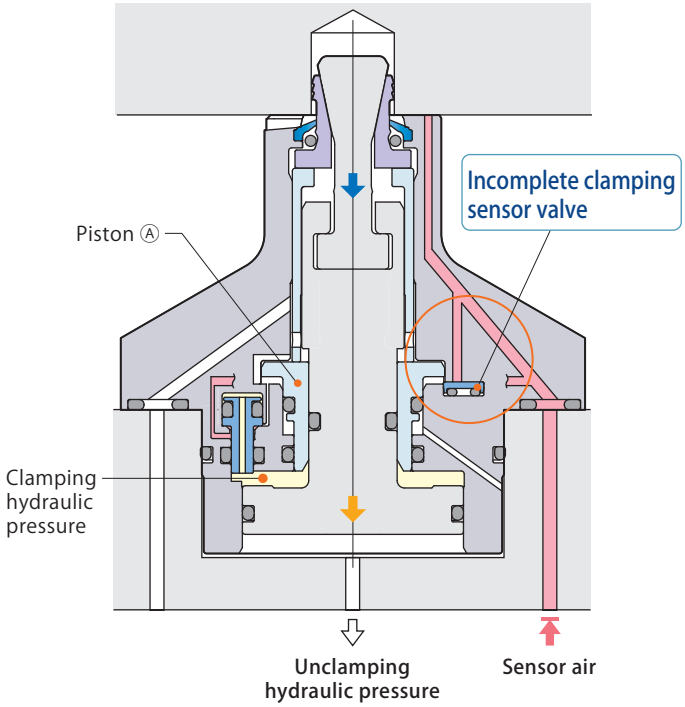
Incomplete clamping

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.

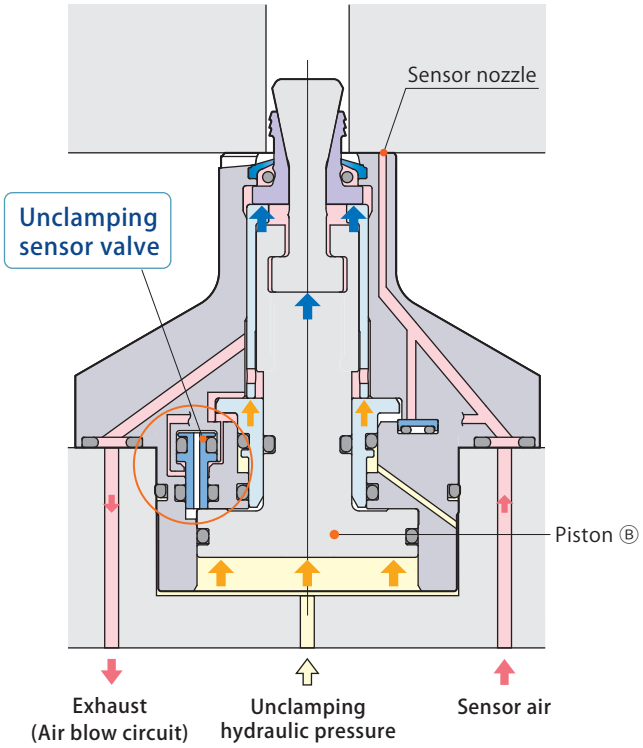
CGC-N21E070 / 073 / 076 / 079 / 082

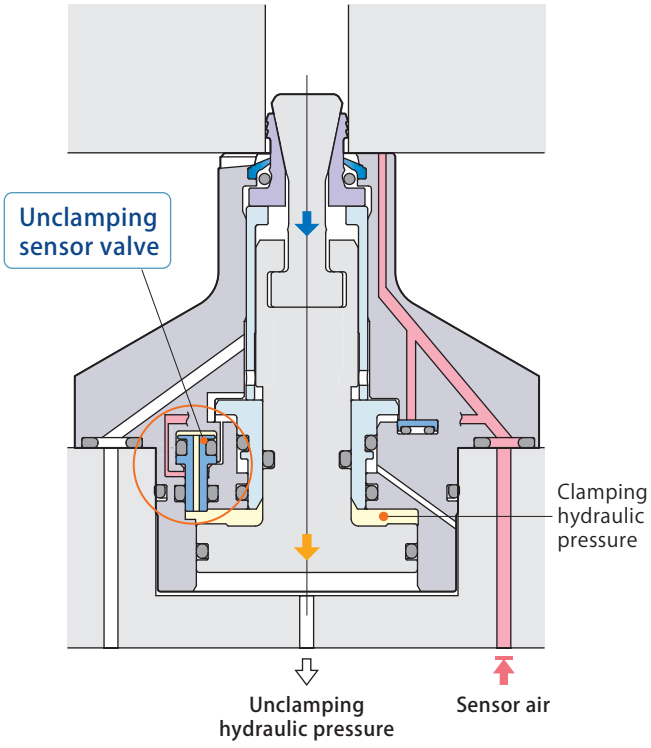
Unclamping completion

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

Clamping completion

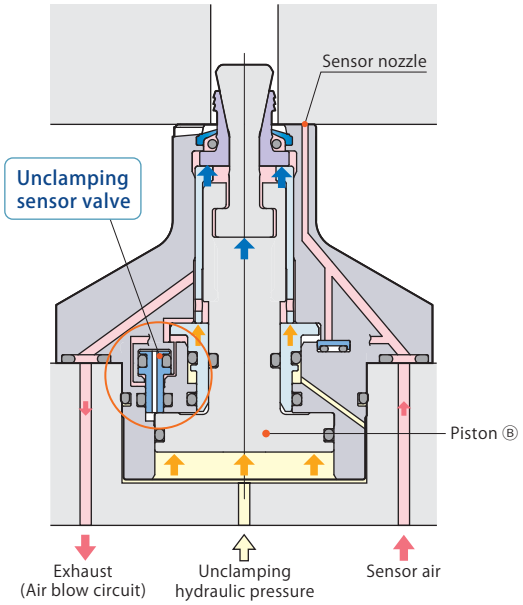
Unclamping sensor valve is closed by clamping hydraulic pressure. Air sensor detects normal clamping completion.



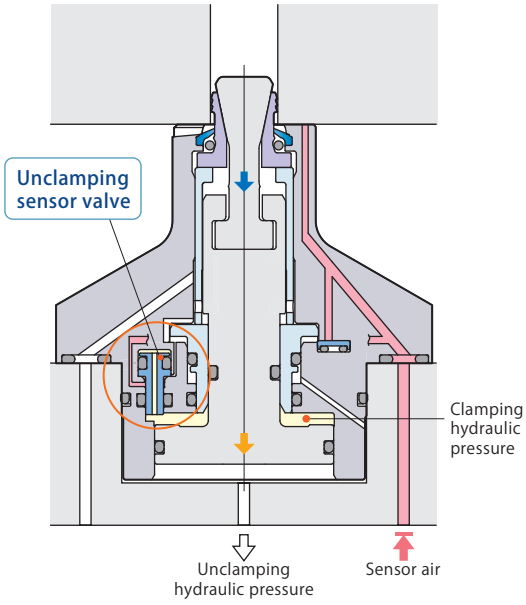


Clamp condition	Unclamping sensor valve	Air sensor signal	Hydraulic pressure switch
Unclamping completion	Open	Air sensor OFF (Sensor air flows.)	Unclamping hydraulic pressure ON
Clamping completion	Close	Air sensor ON (Sensor air does not flow.)	Clamping hydraulic pressure ON

Unclamping completion

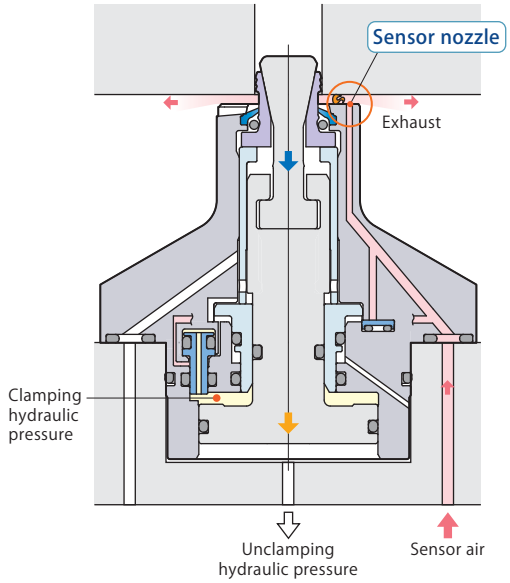


Clamping completion

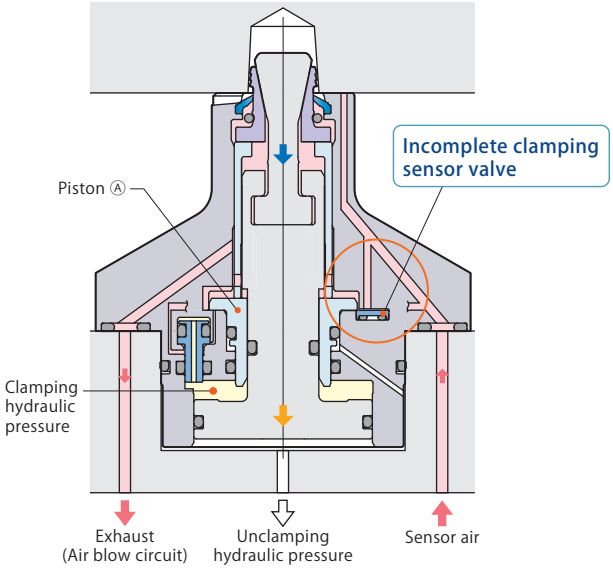


Clamp condition	Sensor nozzle	Incomplete clamping sensor valve	Unclamping sensor valve	Air sensor signal	Hydraulic pressure switch
Unclamping completion	Close	Close	Open	Air sensor OFF (Sensor air flows.)	Unclamping hydraulic pressure ON
Clamping completion	Close	Close	Close	Air sensor ON (Sensor air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

Faulty seating of workpiece



Incomplete clamping

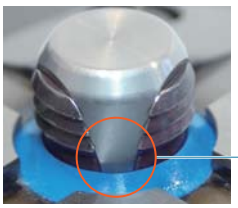


Clamp condition	Sensor nozzle	Incomplete clamping sensor valve	Unclamping sensor valve	Air sensor signal	Hydraulic pressure switch
Faulty seating of workpiece	Open	Close	Close	Air sensor OFF (Sensor air flows.)	Clamping hydraulic pressure ON
Incomplete clamping	Close	Open	Close	Air sensor OFF (Sensor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

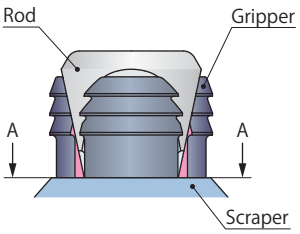
Non-constant air blow model

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)	

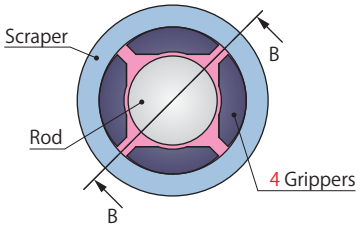
Number of grippers	Grip inner diameter	Clamping force	Model
3 Grippers	ø 11 12 13	3.54 kN (Hydraulic pressure 7MPa)	CGC-N22E Grip inner diameter
	ø 12 13 14 15 16	7.50 kN (Hydraulic pressure 7MPa)	CGC-N23E Grip inner diameter

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

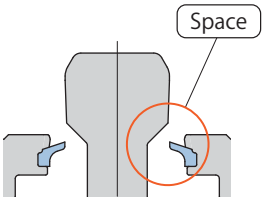
Space where metal chips can intrude is created (Old model)



When clamping



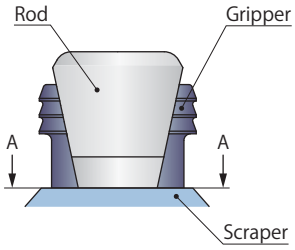
A-A



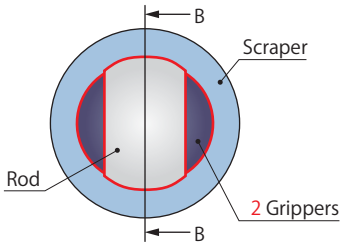
B-B

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

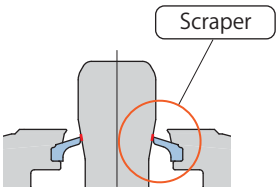
Secure chip protection



When clamping



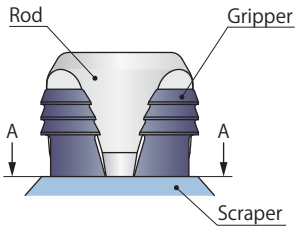
A-A



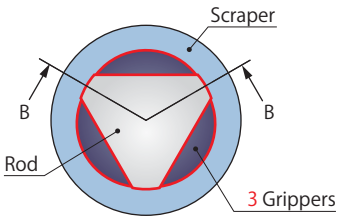
B-B

Pages →26–29

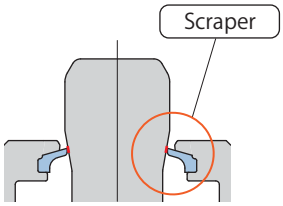
Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.



When clamping



A-A

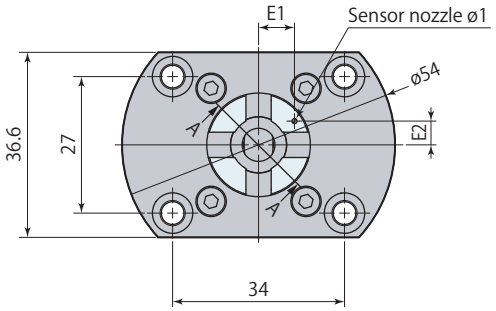


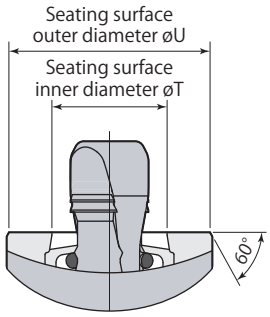
B-B

Pages →30–33

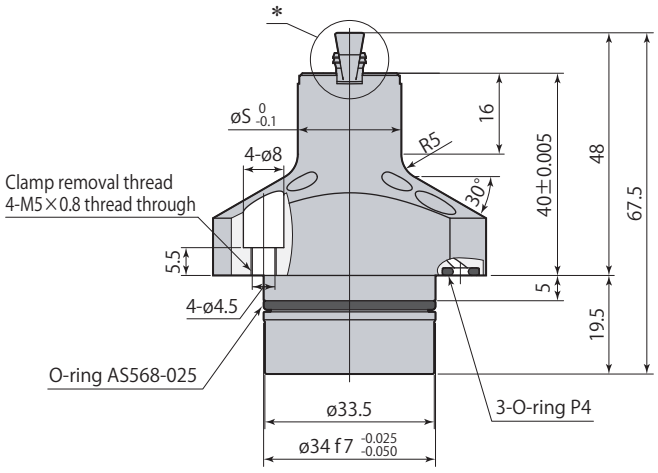
Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.

Dimensions

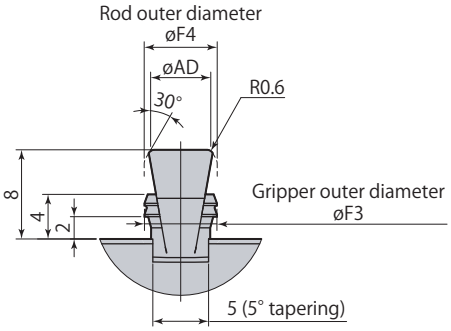




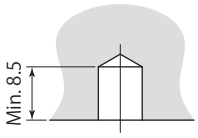
A-A



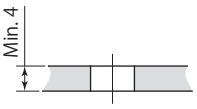
∗Details



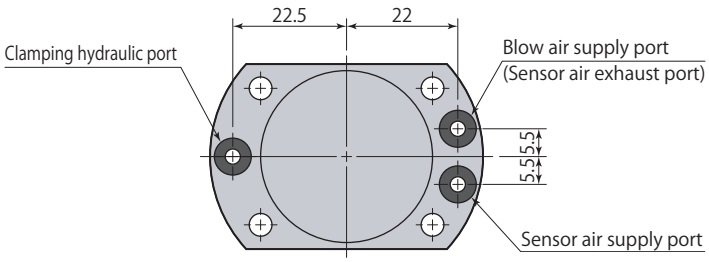
Grip inner diameter usage requirements



Blind hole



Through hole



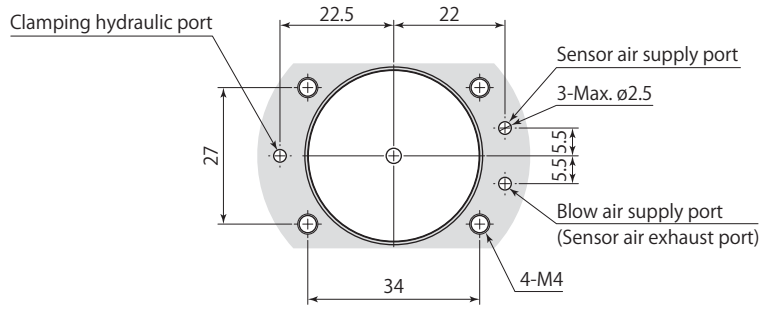
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

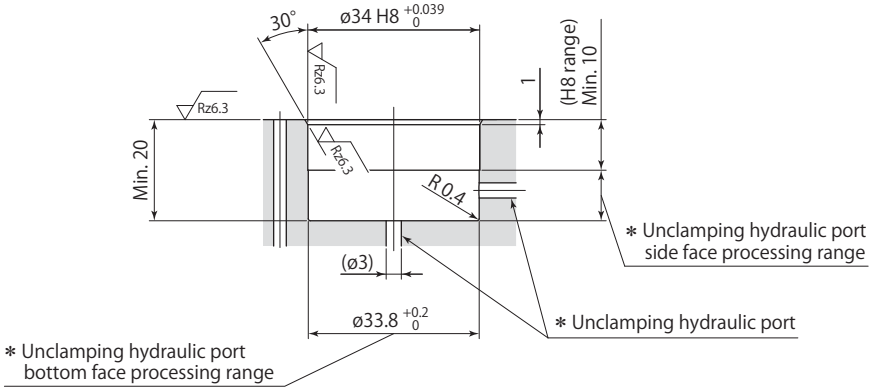
mm

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



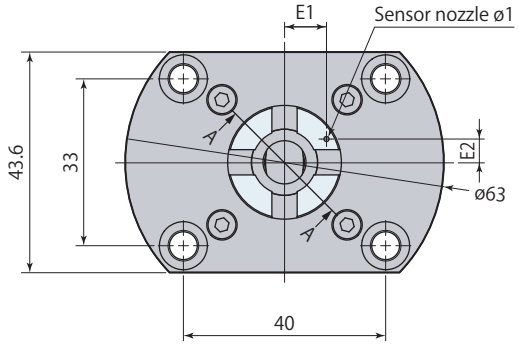


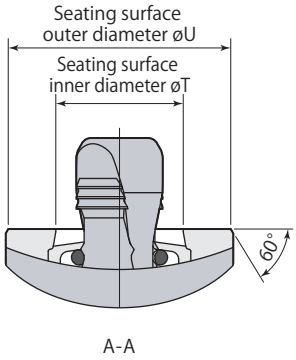
Rz: ISO4287(1997)

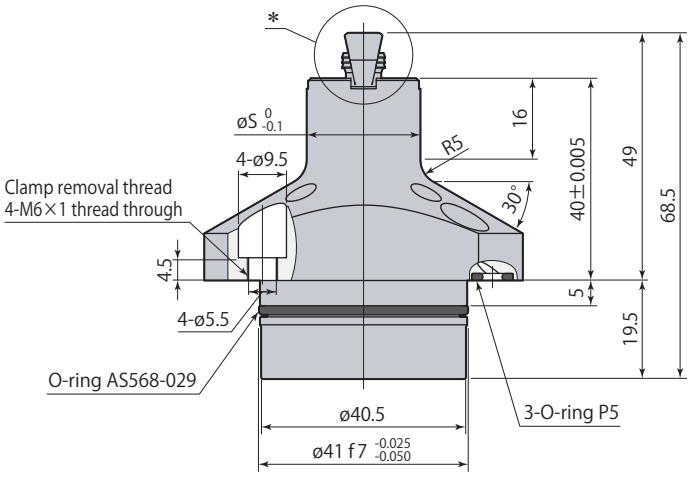
*: Unclamping hydraulic port must be made on either side or bottom face.

- 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.

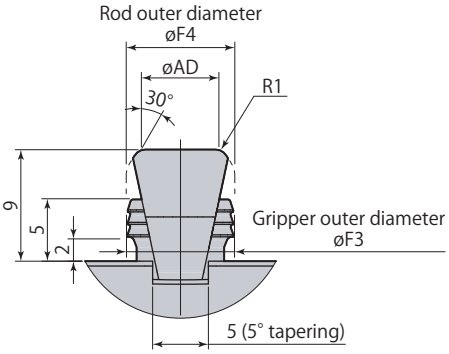
Dimensions



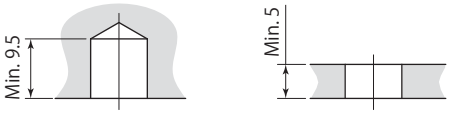


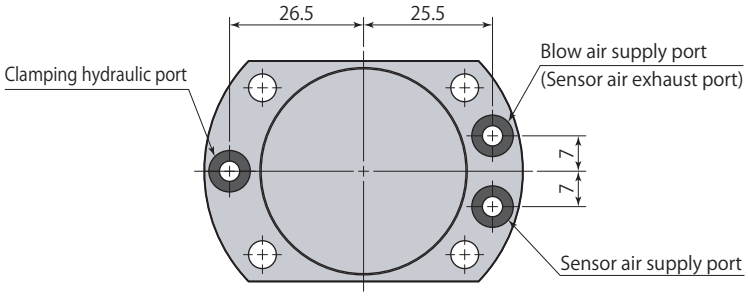


∗Details



Grip inner diameter usage requirements





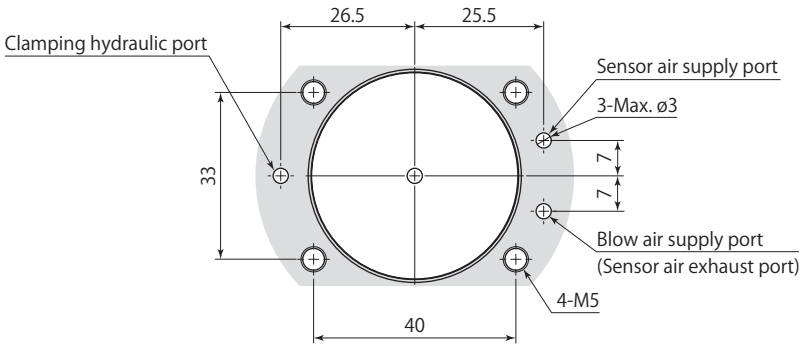
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

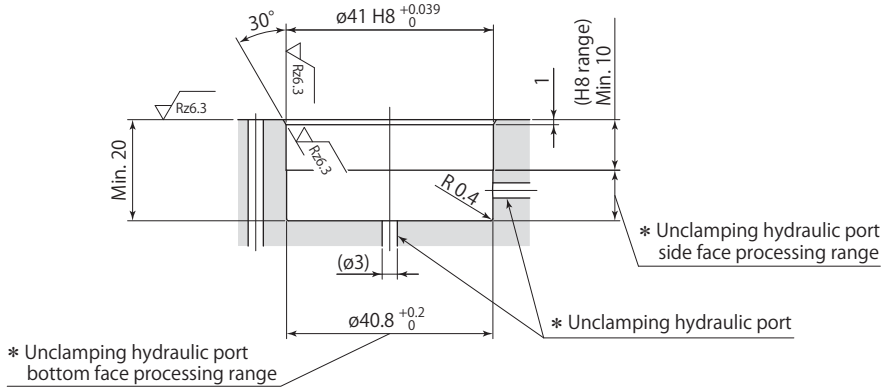
mm

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)

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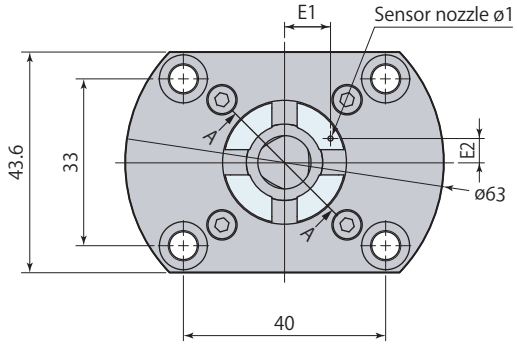
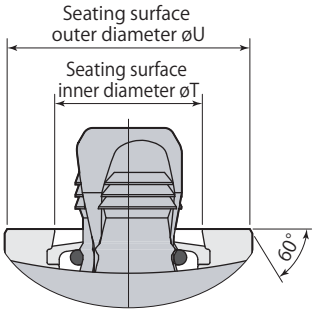
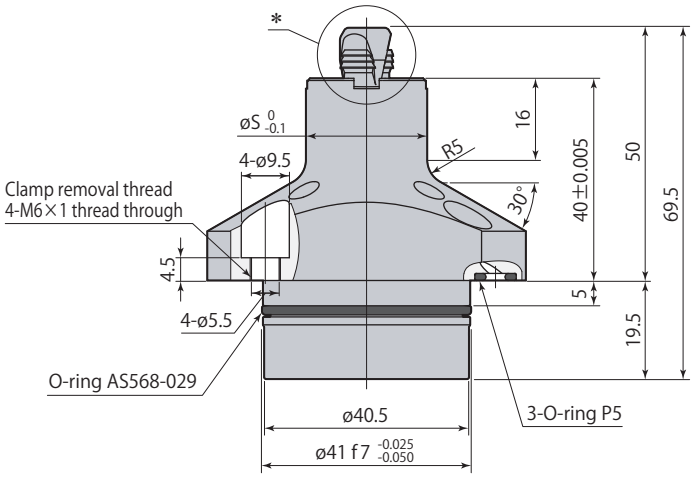
  Excessive grease may be a blockage in the air passage, causing malfunction of the sensor.
- The 30° taper machining must be provided to avoid the damage of the O-ring.

Dimensions

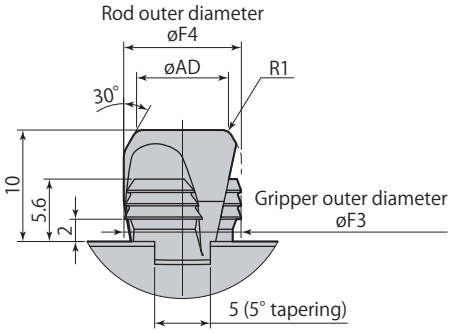




A-A

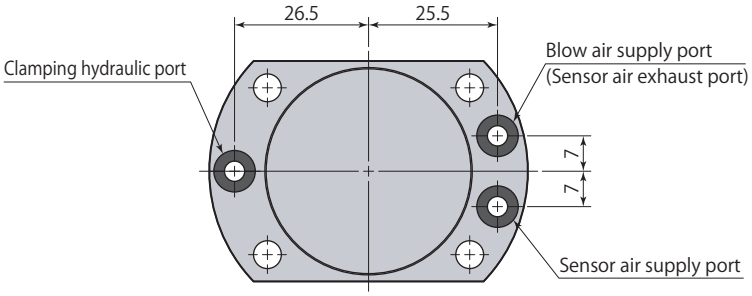


∗Details



Grip inner diameter usage requirements

Blind hole　　Through hole

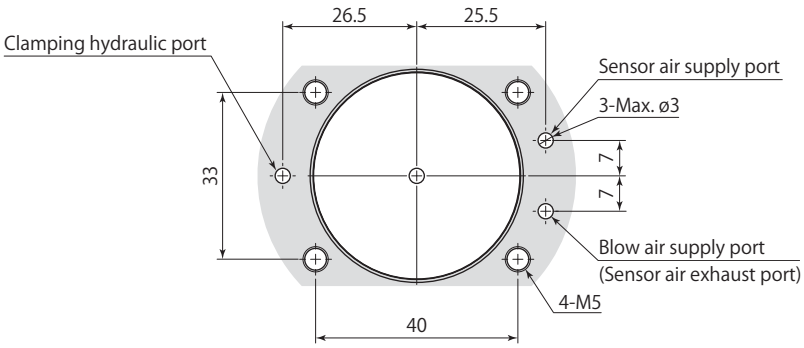


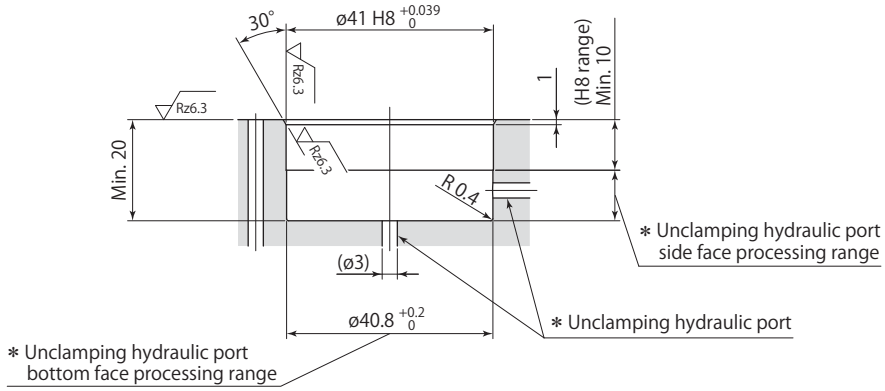
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

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



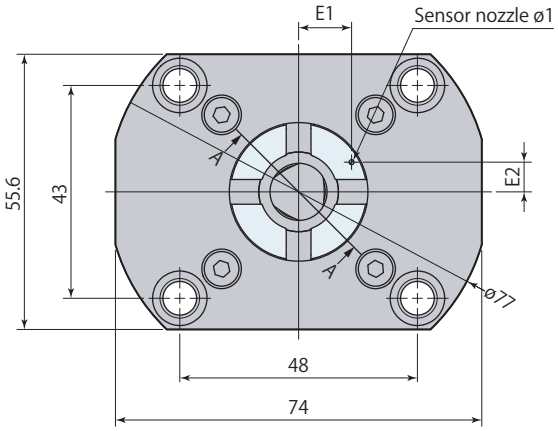


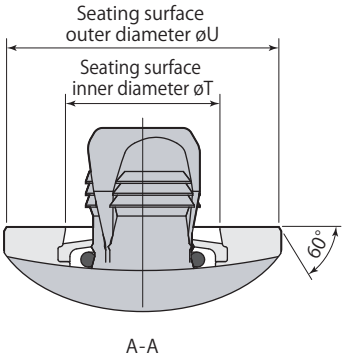
Rz: ISO4287(1997)

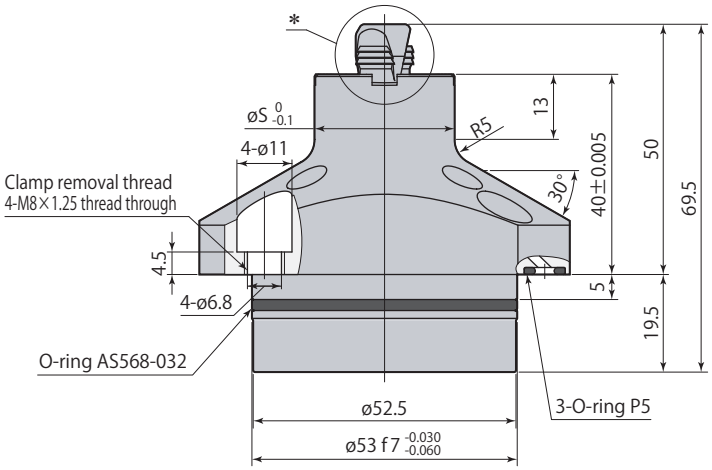
∗: Unclamping hydraulic port must be made on either side or bottom face.

- 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.

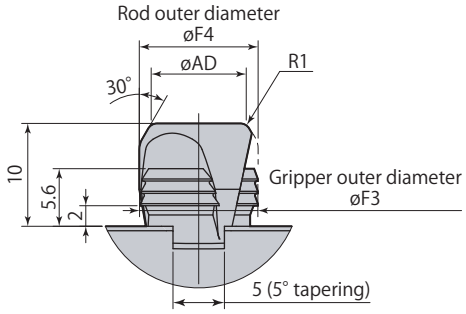
Dimensions



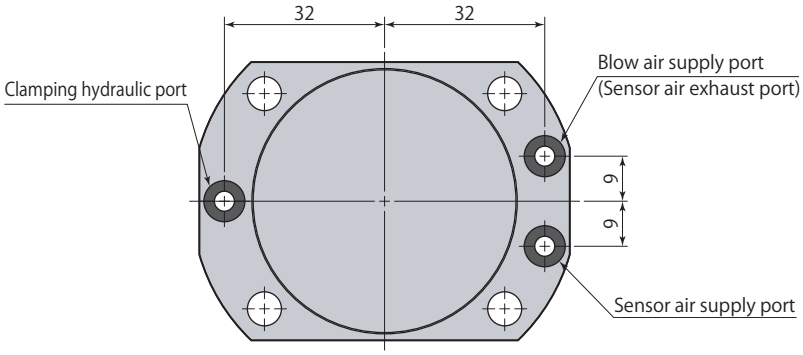




∗Details



Grip inner diameter usage requirements

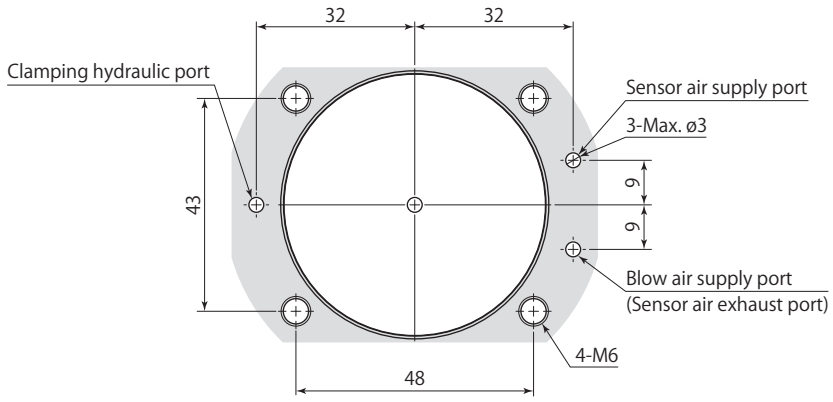


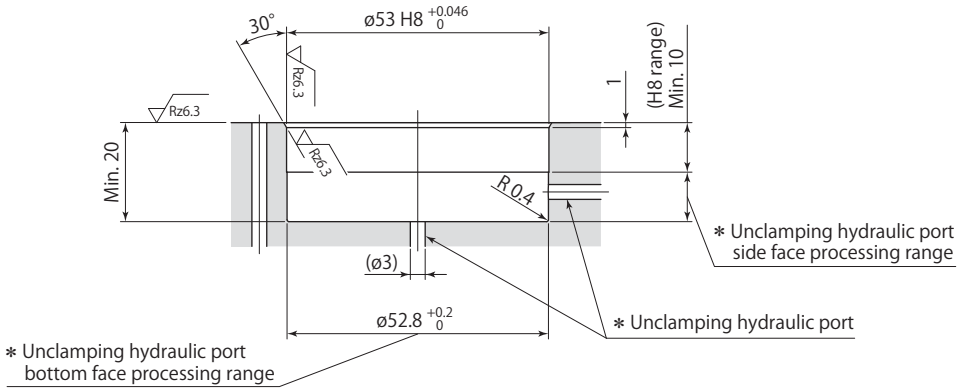
mm

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



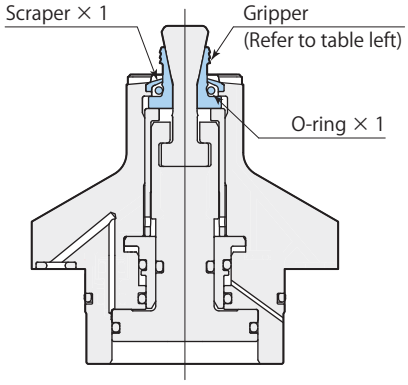


Rz: ISO4287(1997)

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

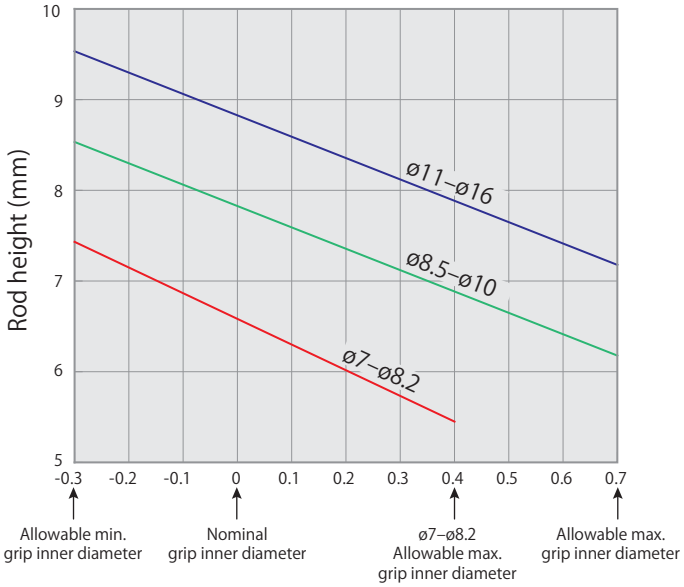
- Apply an appropriate amount of grease to the chamfer and the bore when mounting.
  Excessive grease may be a blockage in the air passage, causing malfunction of the sensor.
- The 30° taper machining must be provided to avoid the damage of the O-ring.

Gripper set replacement

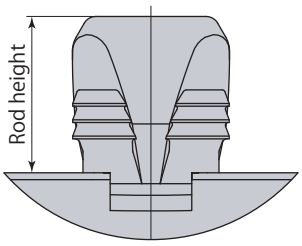
Number of grippers	Gripper set model	Clamp model	Set description
2 Grippers	CGC-N21EJ070	CGC-N21E070	
	CGC-N21EJ073	CGC-N21E073	
	CGC-N21EJ076	CGC-N21E076	
	CGC-N21EJ079	CGC-N21E079	
	CGC-N21EJ082	CGC-N21E082	
	CGC-N22EJ085	CGC-N22E085	
	CGC-N22EJ09	CGC-N22E09	
	CGC-N22EJ10	CGC-N22E10	
3 Grippers	CGC-N22EJ11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



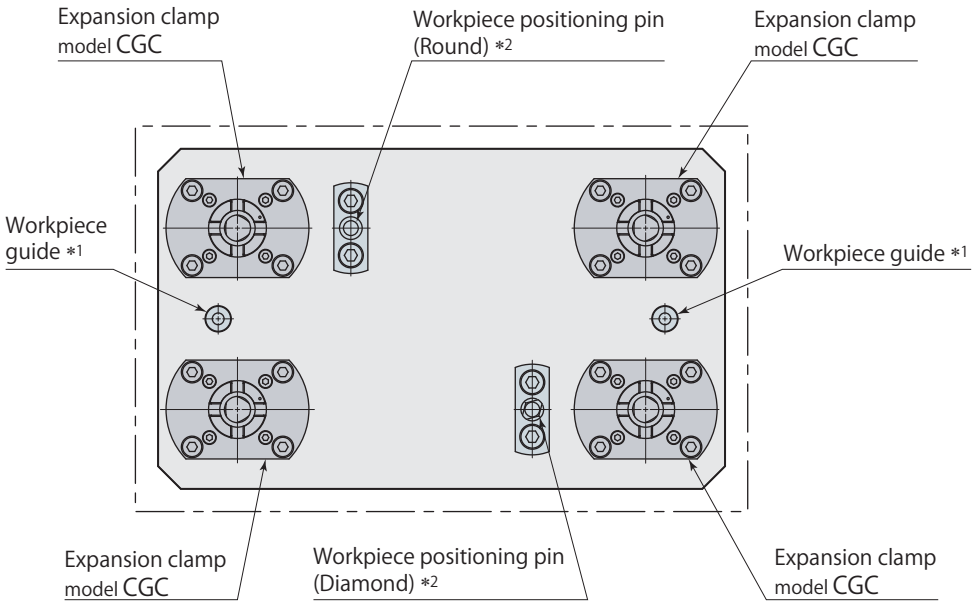
Difference between actual grip inner diameter and nominal grip diameter (mm)

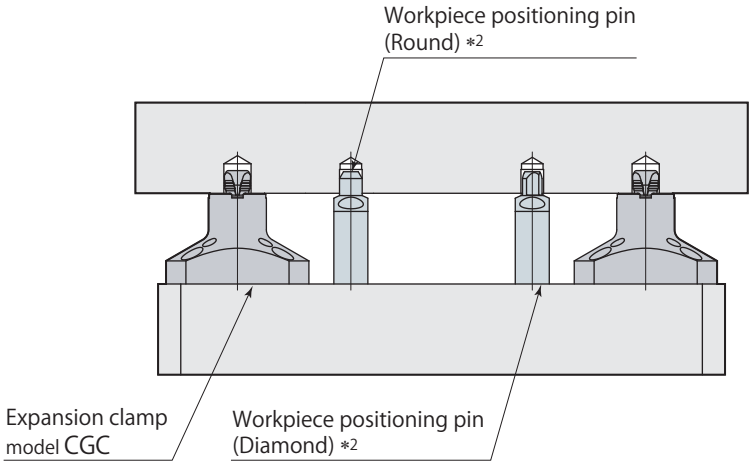


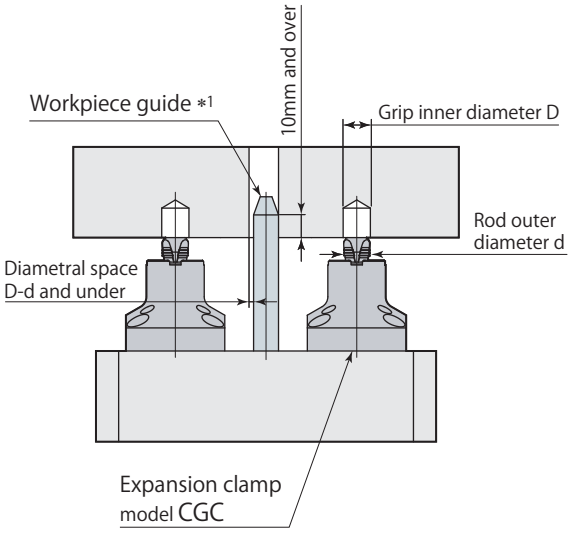
Rod height calculation formula	
ø7 – ø8.2	6.58-2.84× Actual grip inner diameter and nominal grip diameter difference
ø8.5– ø10	7.82-2.35× Actual grip inner diameter and nominal grip diameter difference
ø11 – ø16	8.82-2.35× Actual grip inner diameter and nominal grip diameter difference

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



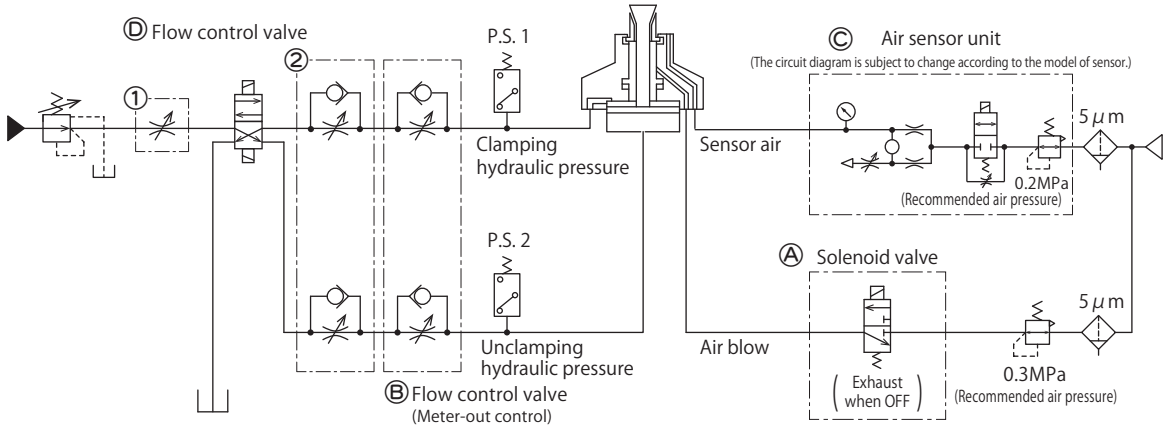




*1: When using automatic or robotic conveyers, prevent damage to clamp caused from impact by setting workpiece guides. Using the above guide as reference, accurately position the holes when using workpiece guides.

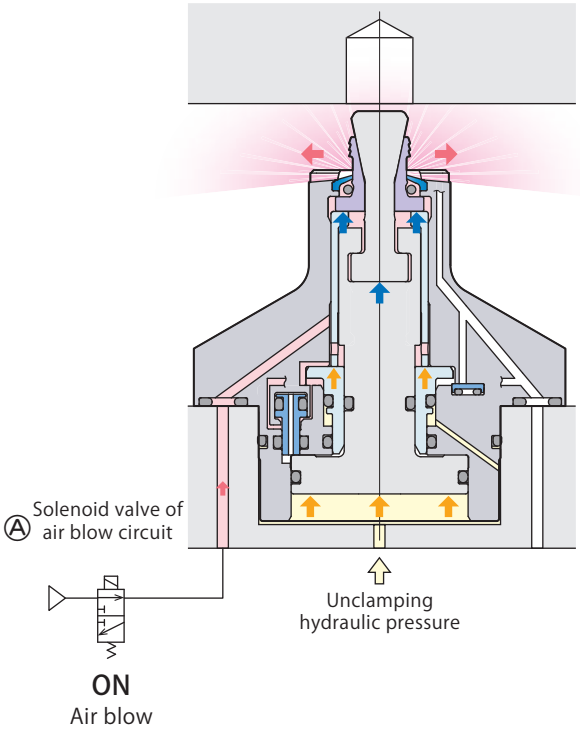
*2: **The expansion clamp does not have a workpiece positioning function.**
Install workpiece positioning pins (or similar).

Hydraulic and pneumatic circuit diagram

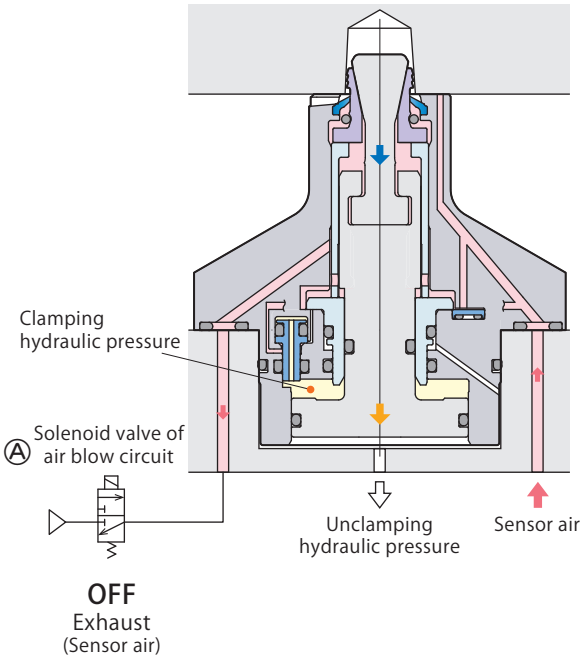


- Air blow will not be necessary during cutting process. Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping to remove metal chips and debris.
- The solenoid valve Ⓐ must be closed when checking the operation of the clamp with the air sensor. Also 3 port type of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



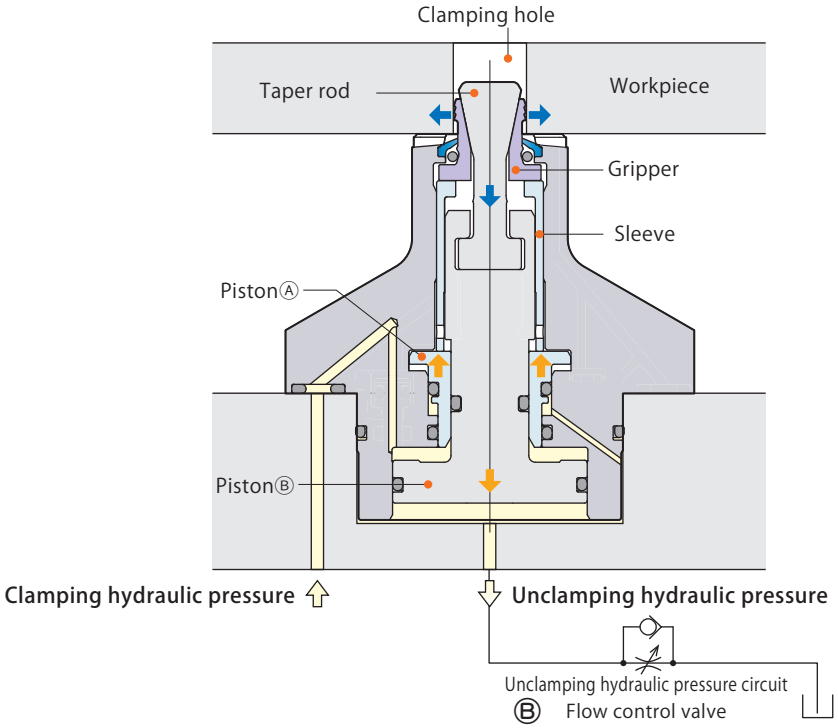
Incomplete clamping



- 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

Expansion clamp

Double acting 7MPa

model CGT

model CGT

Specifications

Size / Grip inner diameter / : Number of grippers

CGT — F2

- 1 — : Air blow model
  - 055 058 061 064 067 070A : 2 Grippers
  - 070 073 076 079 082 : 2 Grippers
  - 085 09 10 : 2 Grippers
  - 11 12 13 : 3 Grippers
- 1 E : Non-constant air blow model
  - 070 073 076 079 082 : 2 Grippers
  - 085 09 10 : 2 Grippers
  - 11 12 13 : 3 Grippers
- 2 E : Non-constant air blow model
  - 085 09 10 : 2 Grippers
  - 11 12 13 : 3 Grippers

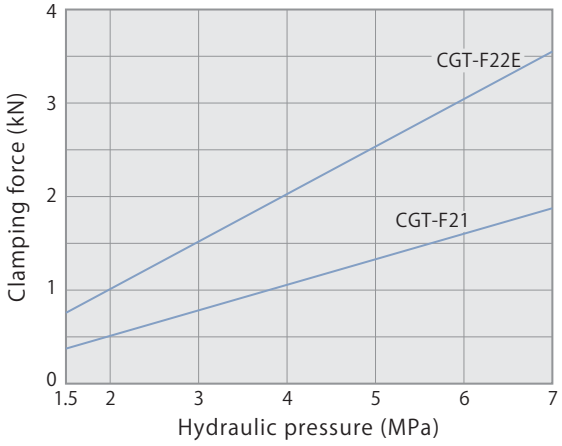
■ indicates made to order.

Model	Size		CGT-F21-						CGT-F21E					CGT-F22E					
	Grip inner diameter		055	058	061	064	067	070A	070	073	076	079	082	085	09	10	11	12	13
Number of grippers			2 Grippers														3 Grippers		
Clamping force (hydraulic pressure 7MPa)		kN	1.35*1						1.89					3.04*2	3.54				
Radial expansion force (hydraulic pressure 7MPa)		kN	4.21*1						6.58					9.5*2	11.1				
Taper rod stroke		mm	4.0						4.8										
Clamp stroke		mm	1.2																
Cylinder capacity	Clamp	cm^3	1.2						1.5					2.7					
	Unclamp	cm^3	1.6						2.0					3.5					
Allowable eccentricity*3		mm	±0.3						±0.4										
Recommended air blow pressure		MPa	0.3																
Recommended sensor air pressure		MPa	0.2																
Mass		kg	0.27						0.29					0.43					
Recommended tightening torque of mounting screws*4		N·m	3.5											7					
Workpiece material			Aluminum, steel and others (HRC30 or below) Cast iron also usable depending on conditions																
Allowable min. grip inner diameter		mm	5.2	5.5	5.8	6.1	6.4	6.7	6.7	7.0	7.3	7.6	7.9	8.2	8.7	9.7	10.7	11.7	12.7
Allowable max. grip inner diameter		mm	5.8	6.1	6.4	6.7	7.0	7.3	7.4	7.7	8.0	8.3	8.6	9.2	9.7	10.7	11.7	12.7	13.7
Grip inner diameter tapering angle (Draft angle)			3° or below																
Grip inner diameter circularity			0.1 or below																

- Pressure range：1.5–7 MPa (CGT-F21-055, 058, 061, 064, 067, 070A：1.5–5 MPa, CGT-F22E085：1.5–6 MPa)
- Proof pressure：10.5 MPa (CGT-F21-055, 058, 061, 064, 067, 070A：7.5 MPa, CGT-F22E085：9 MPa)
- Operating temperature：0–70 ℃
- Fluid used：General mineral based hydraulic oil (ISO-VG32 equivalent)
- Please inquire if above terms are not applied.

∗1：Capacity values for hydraulic pressure of 5 MPa are shown. ∗2：Capacity values for hydraulic pressure of 6 MPa are shown.
∗3：By the eccentric mechanism, the expansion clamp does not have a workpiece positioning function. ∗4：ISO R898 class 12.9

Clamping force & hydraulic pressure



Hydraulic pressure	MPa	1.5	2	3	4	5	6	7
CGT-F21 Clamping force F=0.270×P	kN	0.41	0.54	0.81	1.08	1.35	1.62	1.89
CGT-F22E Clamping force F=0.506×P	kN	0.76	1.01	1.52	2.02	2.53	3.04	3.54

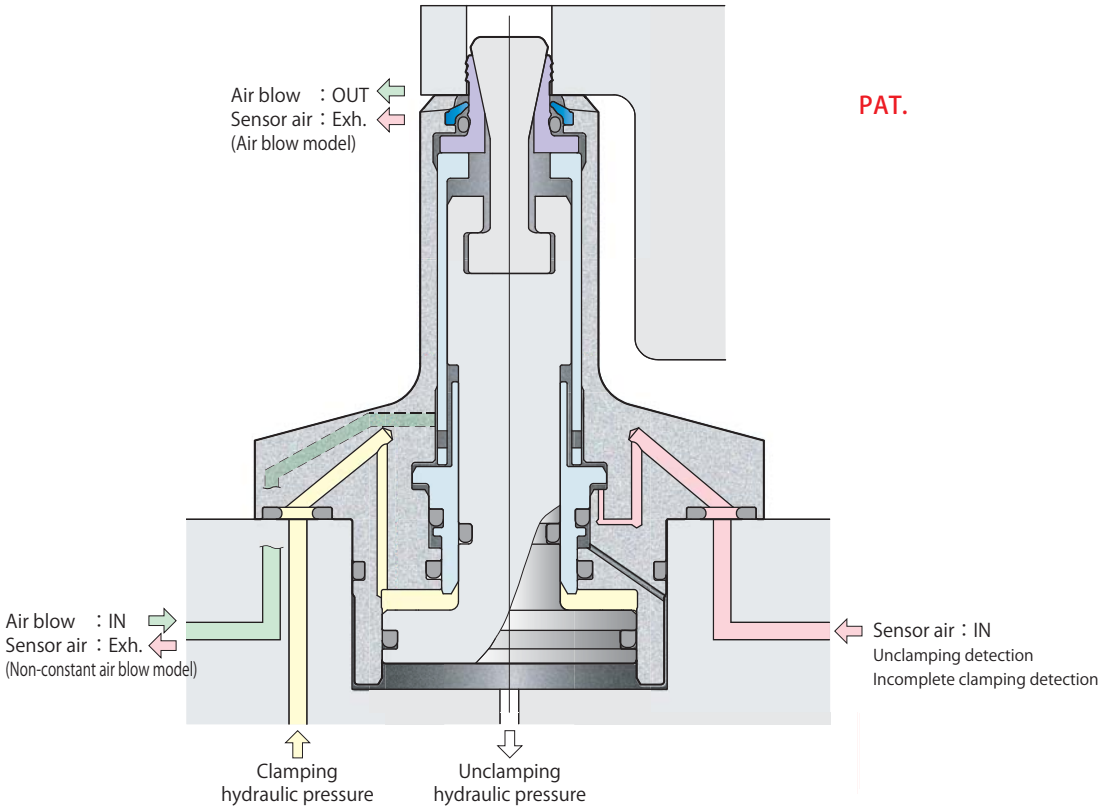
P：Hydraulic pressure (MPa)

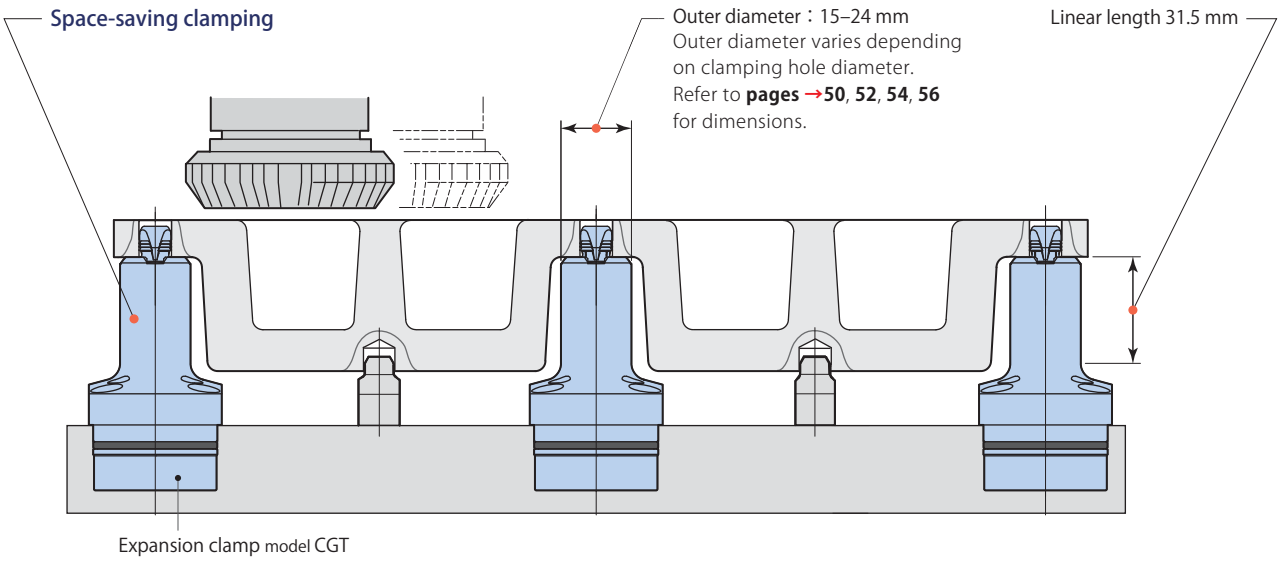
- CGT-F21-055, 058, 061, 064, 067, 070A applicable hydraulic pressure should be 1.5 to 5 MPa.
  CGT-F22E085 applicable hydraulic pressure should be 1.5 to 6 MPa.

Air blow model
model **CGT-F21-**
2 Grippers
ø5.5 5.8 6.1 6.4 6.7 7.0

Non-constant air blow model
model **CGT-F21E**
2 Grippers
ø7.0 7.3 7.6 7.9 8.2

Non-constant air blow model
model **CGT-F22E**
2 Grippers 3 Grippers
ø8.5 9 10 ø11 12 13



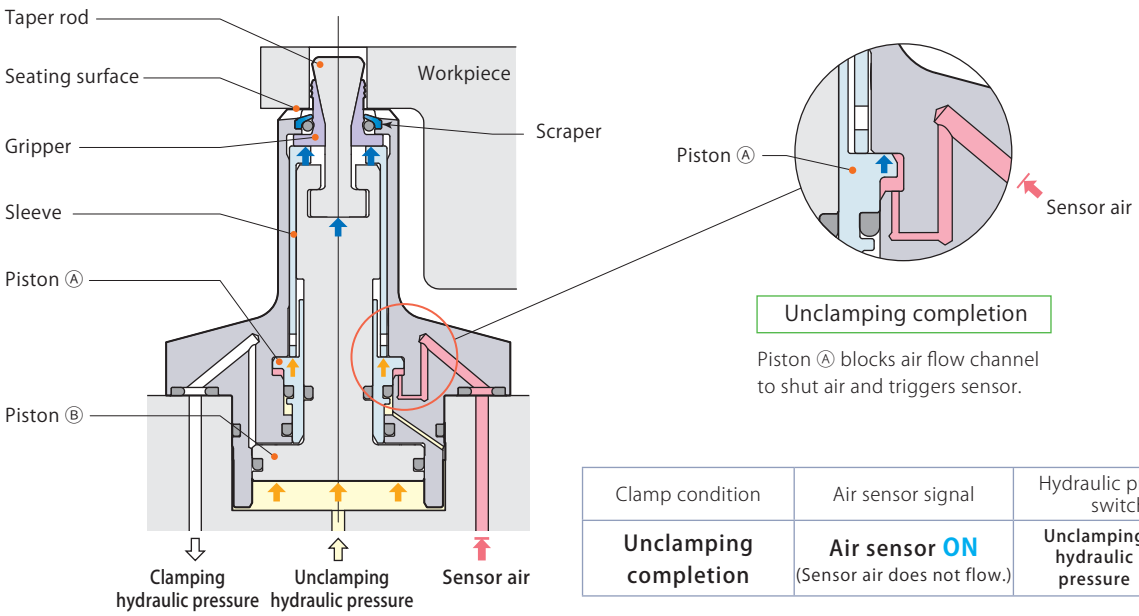


Workpiece setting (Unclamping completion)

① Pistons Ⓐ & Ⓑ, as well as taper rod and gripper are raised by unclamping hydraulic pressure.

② Workpiece unclamping is completed by the sensor air, clamping and unclamping hydraulic pressure.

③ Set the workpiece onto the seating surface.



Clamp condition	Air sensor signal	Hydraulic pressure switch
Unclamping completion	**Air sensor ON** (Sensor air does not flow.)	**Unclamping hydraulic pressure ON**

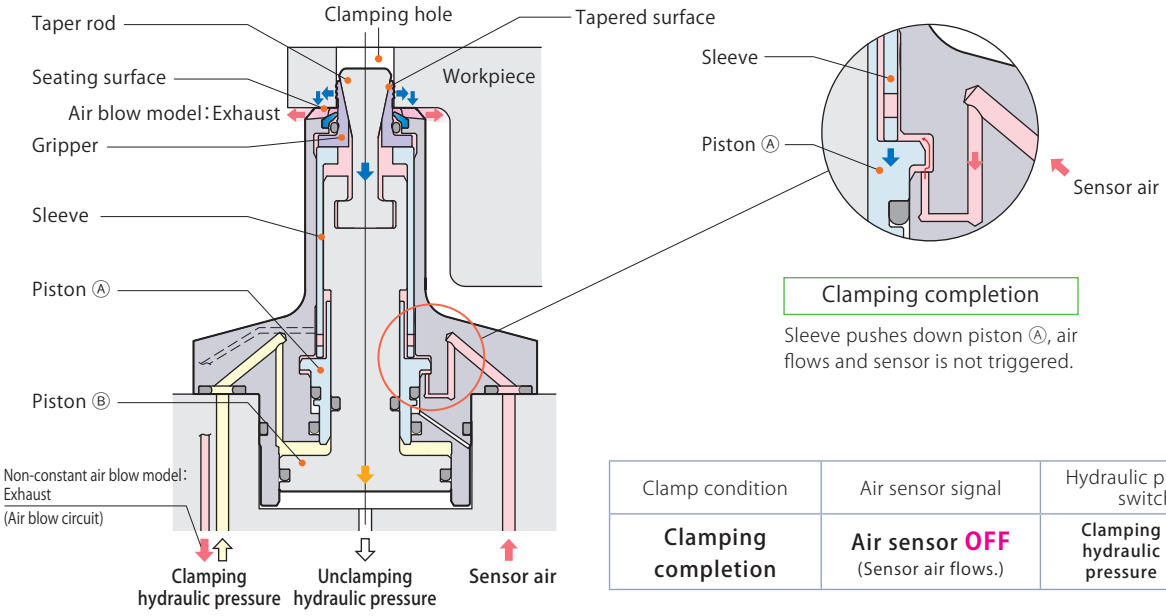
Workpiece holding (Clamping completion)

① Piston Ⓑ and taper rod are lowered by clamping hydraulic pressure after releasing unclamping hydraulic pressure.

② The gripper expands horizontally along the tapered surface to grip inner face of clamping hole.

③ The gripper securely grips the inner face of clamping hole and pulls the workpiece down firmly onto the seating surface.

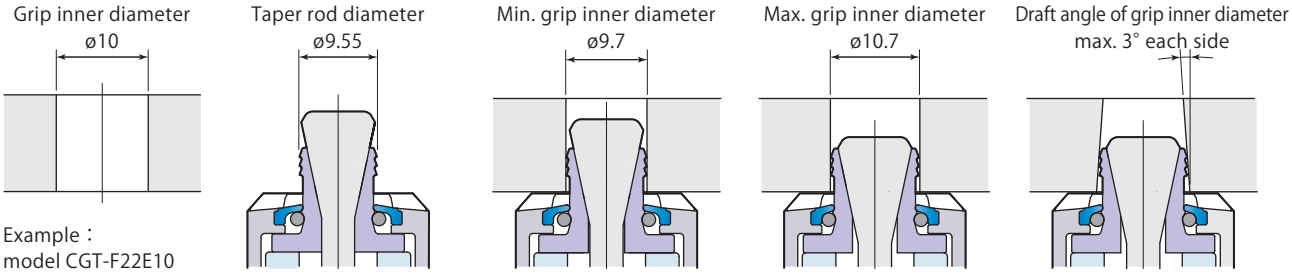
④ Workpiece holding is completed by the sensor air, clamping and unclamping hydraulic pressure.



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.



Example：
model CGT-F22E10

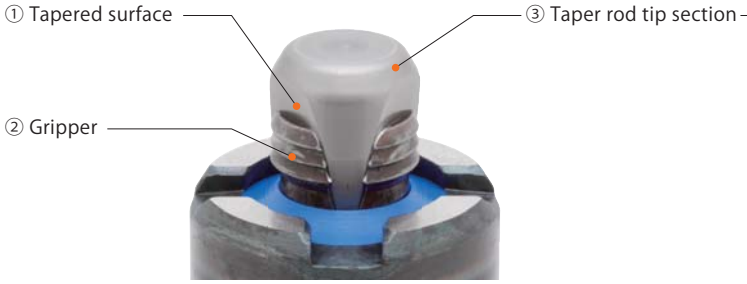
∗：0.6mm stroke for CGT-F21-055, 058, 061, 064, 067, 070A. 0.7mm stroke for CGT-F21E070, 073, 076, 079, 082.

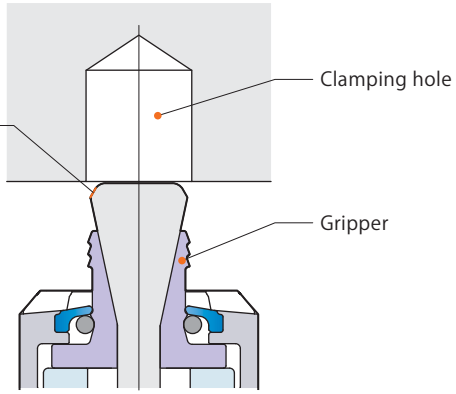
Taper rod and gripper with superior durability

① The holding force of expansion clamp is transmitted from tapered surface to gripper, making it possible for the gripper to hold onto inner face of clamping hole and hold the workpiece on the seating surface for secure workpiece clamping.

② Special steel with superior abrasion resistance is used for gripper to improve durability.

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

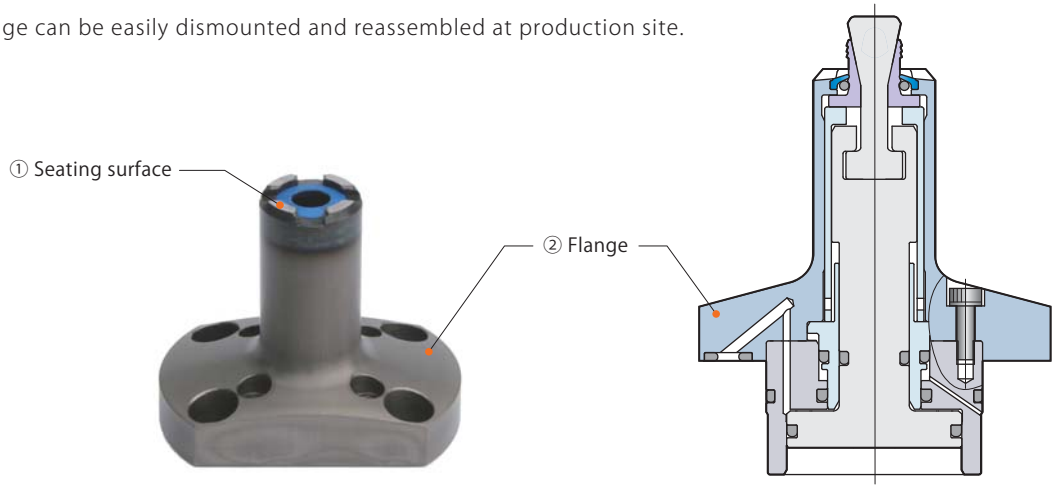




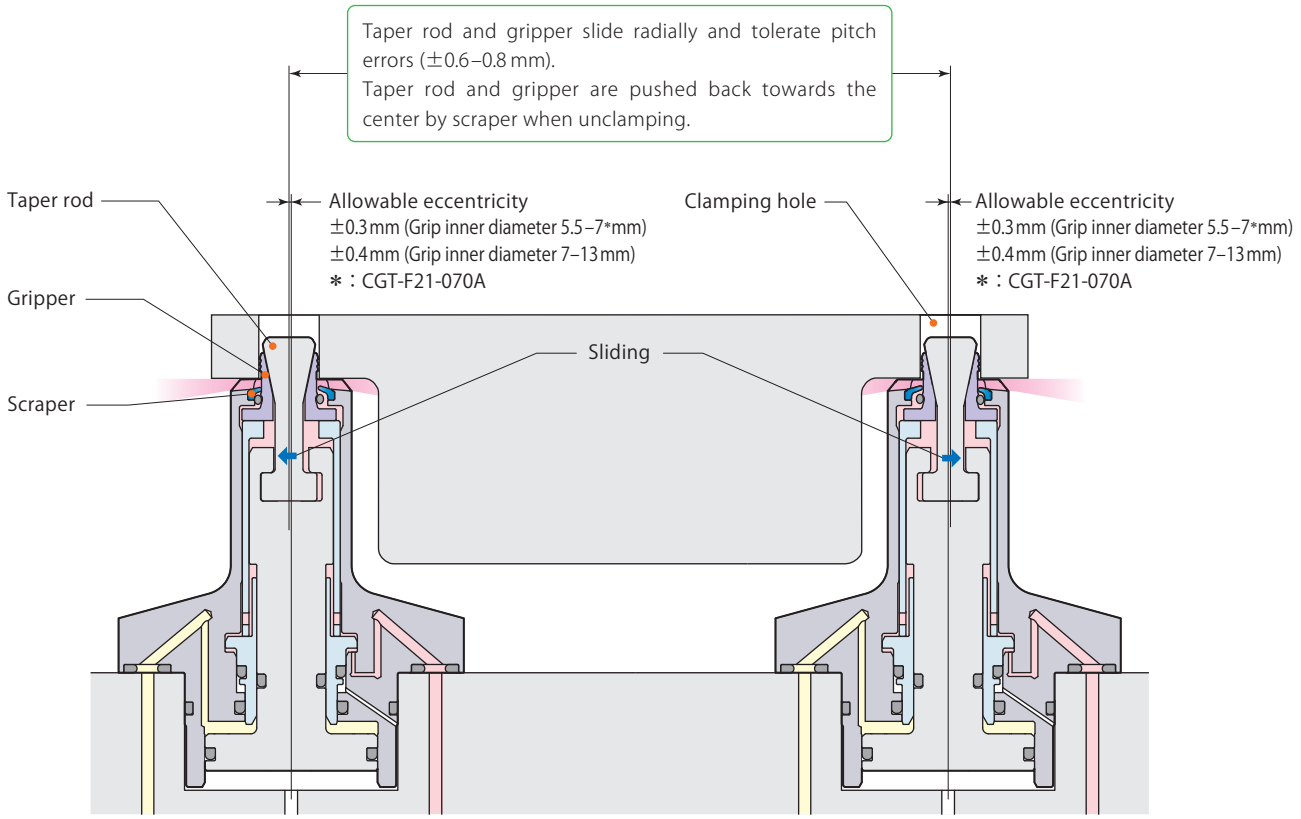
Seating surface can be reground (Max. 0.1 mm)

① When seating surface is damaged, the flange section can be dismounted and reground.

② Flange can be easily dismounted and reassembled at production site.



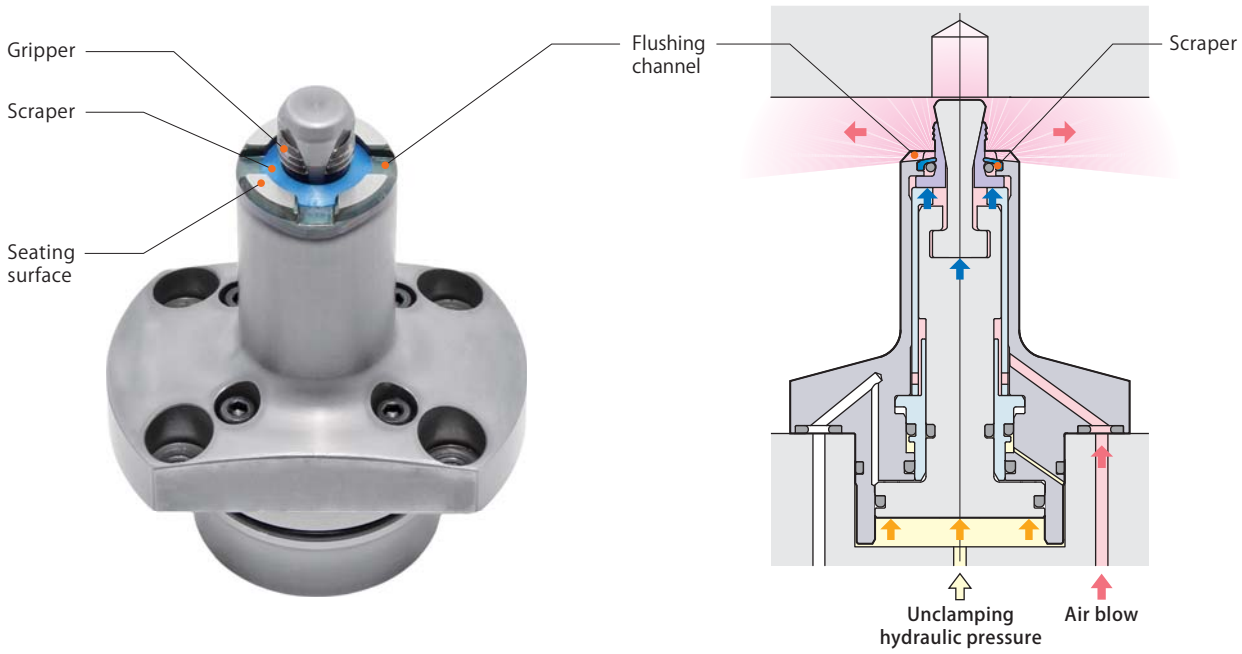
Clamping hole pitch errors can be tolerated



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

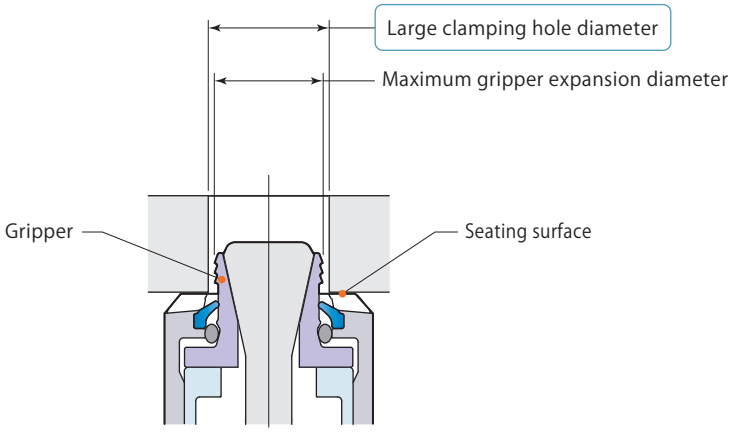
Incorporating strong air blowing circuit

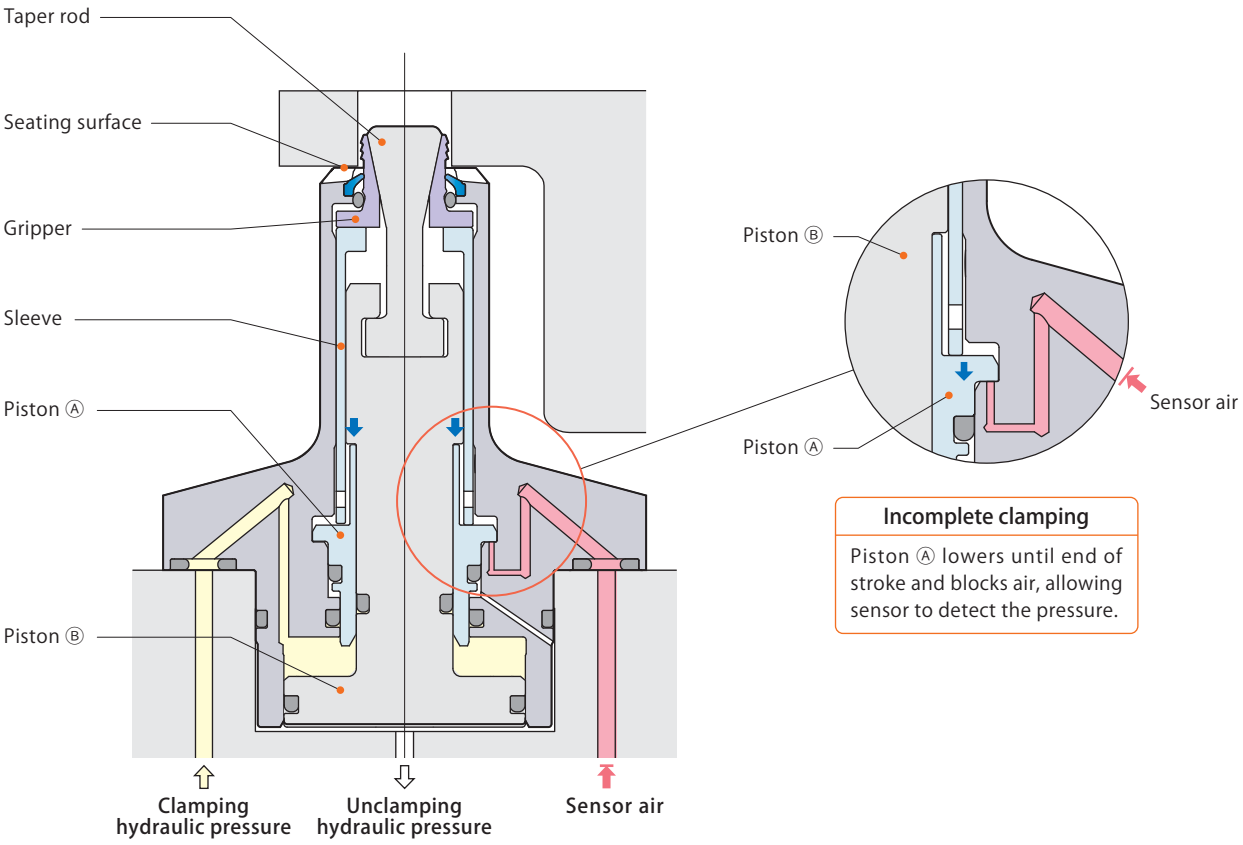
Air blow from a gap between the gripper and scraper clears off metal chips and coolant that stay on the seating surface. Flushing channel is also provided on the seating surface to remove the metal chips and coolants smoothly during workpiece setting.



Detects clamping hole diameter that is too large

When the inner diameter of clamping hole exceeds tolerance value, then gripper will fail to gain grip on workpiece even when extended to maximum reach. Piston Ⓐ lowers until end of stroke as it is pushed down by piston Ⓑ and blocks sensor air, which triggers air sensor and detects incomplete clamping.





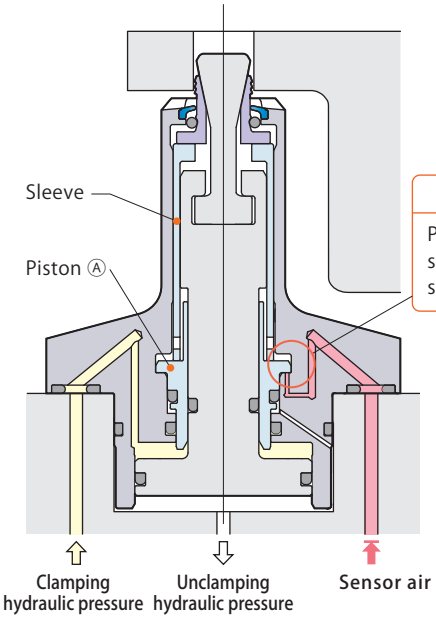
Incomplete clamping

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

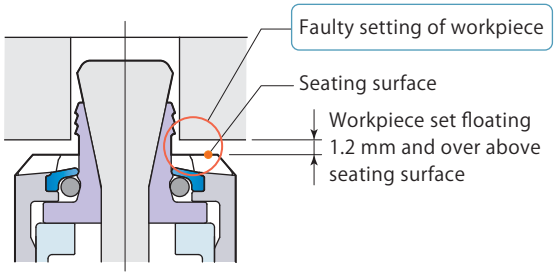
Clamp condition	Air sensor signal	Hydraulic pressure switch
Incomplete clamping	**Air sensor ON** (Sensor air does not flow.)	**Clamping hydraulic pressure ON**

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.



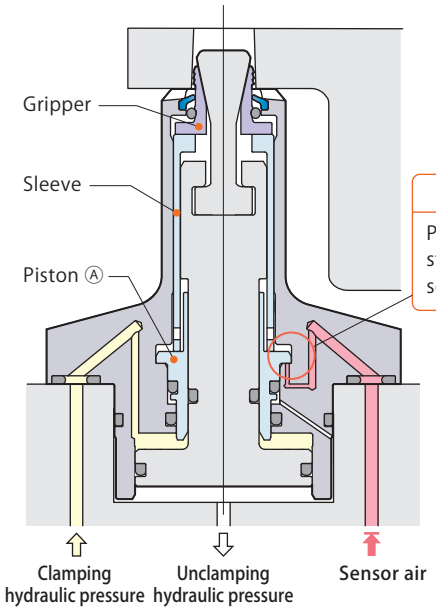
Incomplete clamping
Piston Ⓐ lowers until end of stroke and blocks air, allowing sensor to detect the pressure.



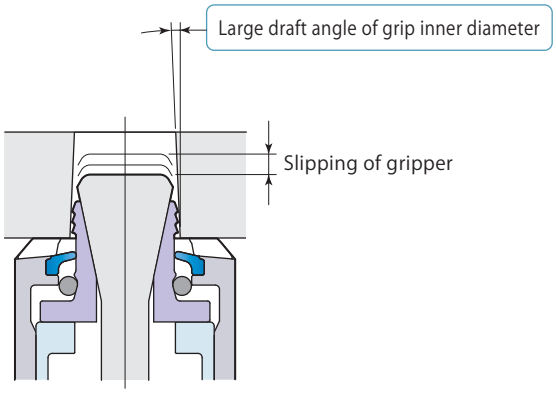
Clamp condition	Air sensor signal	Hydraulic pressure switch
Incomplete clamping	**Air sensor ON** (Sensor air does not flow.)	**Clamping hydraulic pressure ON**

Detects 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.



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**

With the development of the non-constant air blow expansion clamp, air consumption will be significantly decreased.
The traditional model ordinarily requires 50L/min (0.3MPa) flow rate (when grip inner diameter is ø12). The new model can reduce

Air blow model

Number of grippers	Grip inner diameter	Clamping force	Model
2 Grippers	ø 5.5 5.8 6.1 6.4 6.7 7.0	1.35 kN (Hydraulic pressure 5 MPa)	CGT-F21- Grip inner diameter

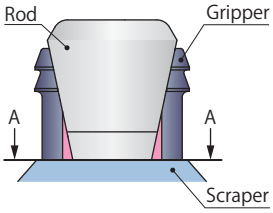
Non-constant air blow model

Number of grippers	Grip inner diameter	Clamping force	Model
2 Grippers	ø 7.0 7.3 7.6 7.9 8.2	1.89 kN (Hydraulic pressure 7 MPa)	CGT-F21E Grip inner diameter
	ø 8.5	3.04 kN (Hydraulic pressure 6 MPa)	CGT-F22E Grip inner diameter
	ø 9 10	3.54 kN (Hydraulic pressure 7 MPa)	

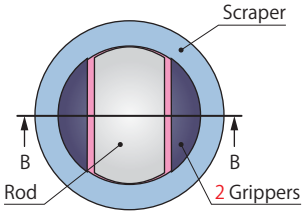
Number of grippers	Grip inner diameter	Clamping force	Model
3 Grippers	ø 11 12 13	3.54 kN (Hydraulic pressure 7 MPa)	CGT-F22E Grip inner diameter

air consumption and help promote energy conservation. However air blow at time of workpiece replacement is a must.

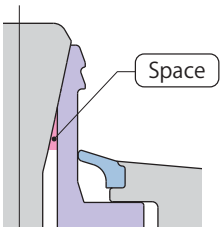
Space where metal chips can intrude is created



When clamping



A-A

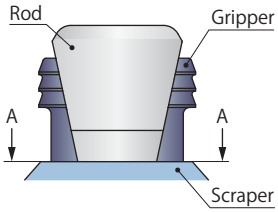


B-B

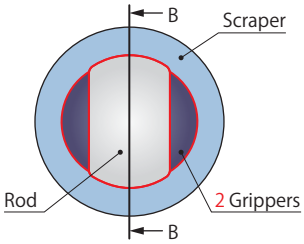
Pages →50, 51

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

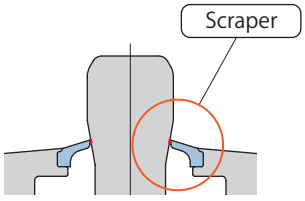
Secure chip protection



When clamping



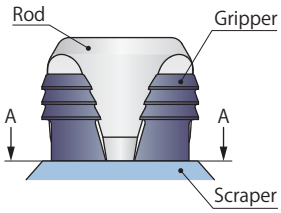
A-A



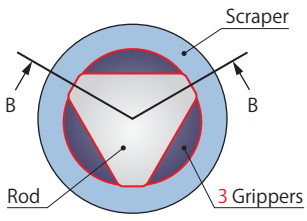
B-B

Pages →52–55

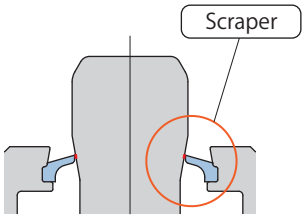
Because of space between scraper, gripper and the rod, air blow must always be performed to prevent intrusion of chips.



When clamping



A-A

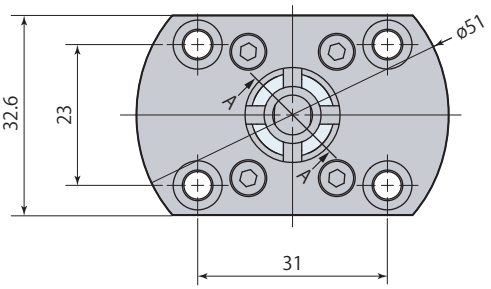


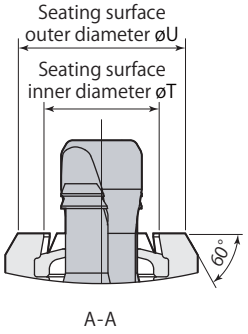
B-B

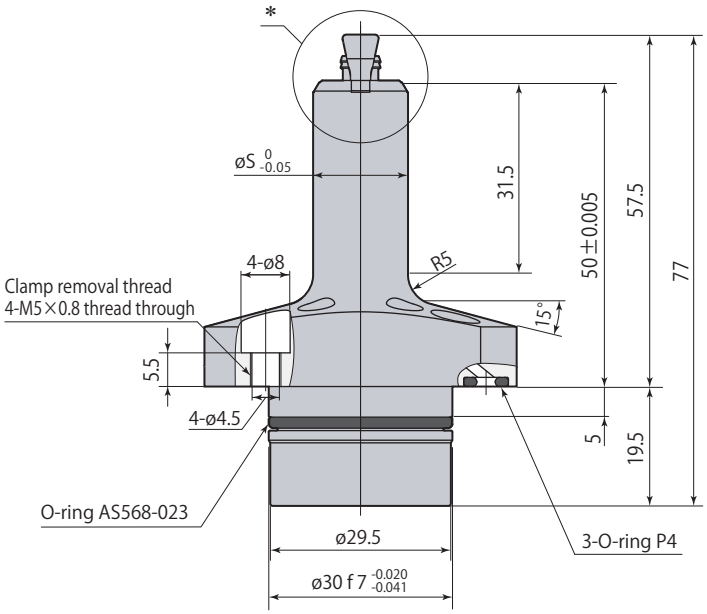
Pages →56, 57

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

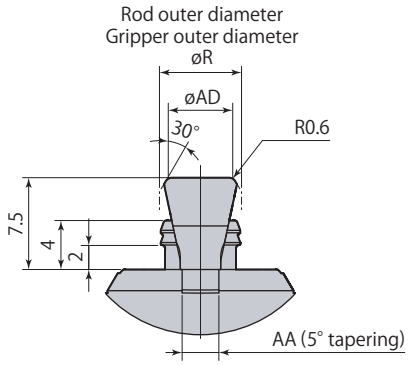
Dimensions



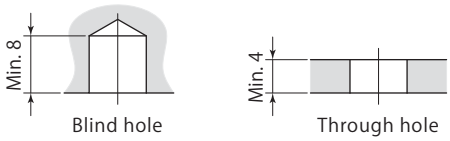


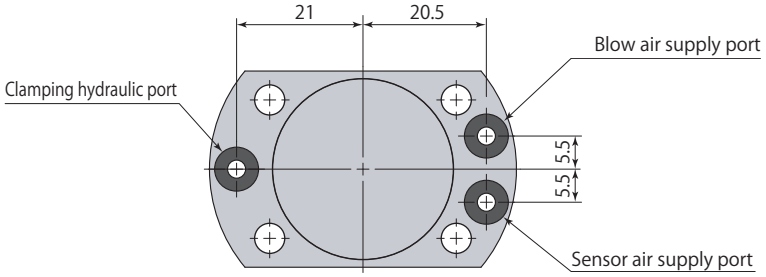


*Details



Grip inner diameter usage requirements





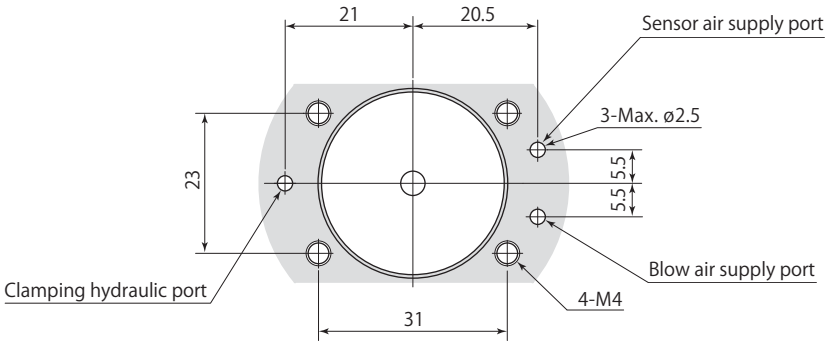
mm

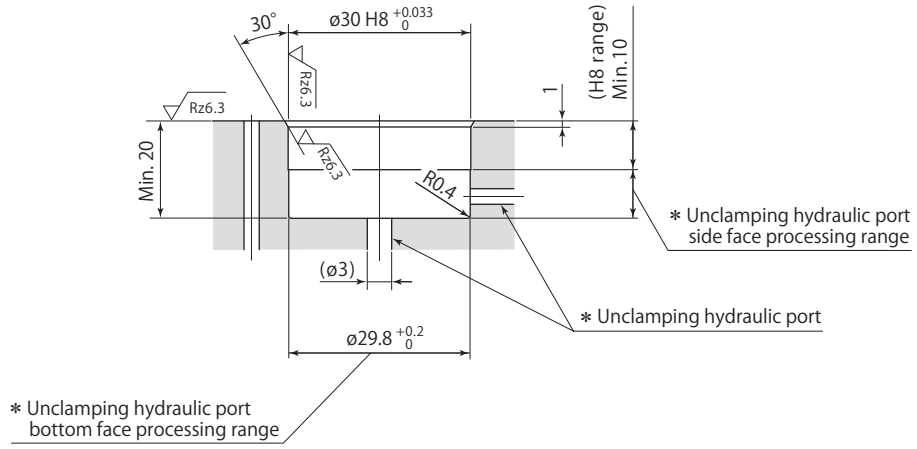
Model	CGT- F21-□					
	055	058	061	064	067	070A
øR	5	5.3	5.6	5.9	6.2	6.5
øS	15	15	15	15	15	15.5
øT	7.8	8.1	8.4	8.7	9	9.3
øU	11	11.6	12.2	12.8	13	13.5
AA	2.5	2.5	3	3	3	3
øAD	3.8	4.1	4.4	4.7	5.0	5.3

- 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.

- CGT-F21-055,058,061,064,067,070A are made to order.

Mounting details



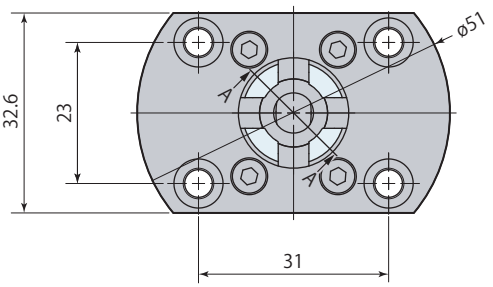


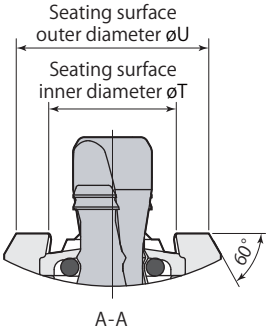
Rz: ISO4287(1997)

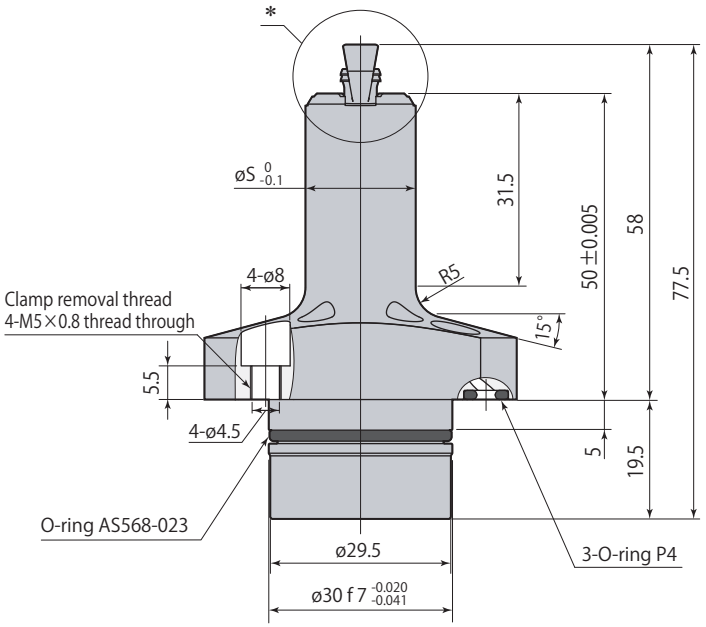
∗ : Unclamping hydraulic port must be made on either side or bottom face.

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

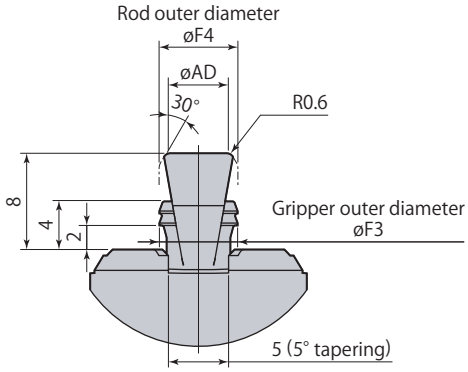
Dimensions



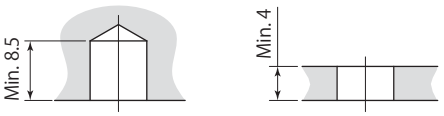


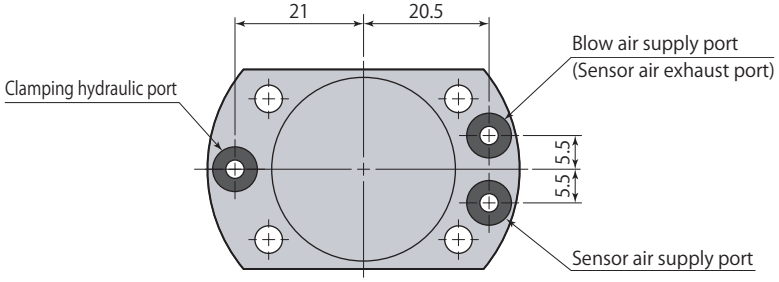


∗Details



Grip inner diameter usage requirements





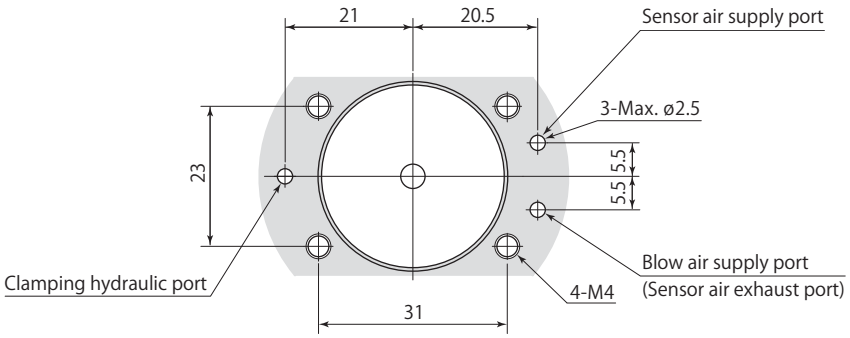
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

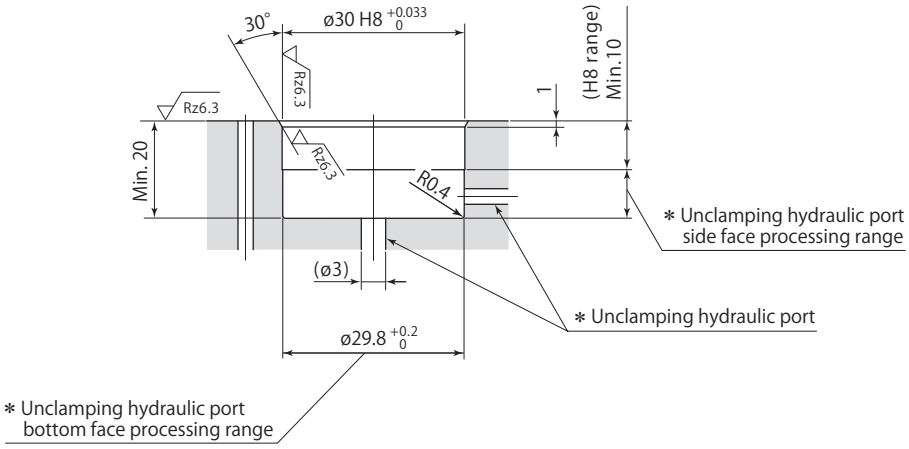
mm

Model	CGT-F21E□				
	070	073	076	079	082
øF3	6.5	6.8	7.1	7.4	7.7
øF4	6.55	6.85	7.15	7.45	7.75
øS	18	18.3	18.6	18.8	18.8
øT	10.6	10.9	11.2	11.5	11.8
øU	16	16.3	16.6	16.9	17.2
øAD	5.4	5.7	6	6.3	6.6

- CGT-F21E070,073,076,079,082 are made to order.

Mounting details



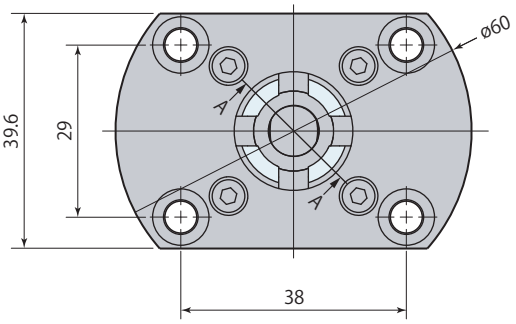


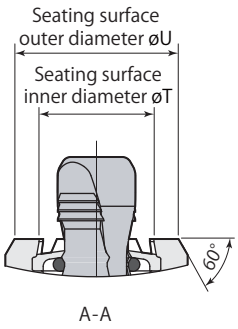
Rz: ISO4287(1997)

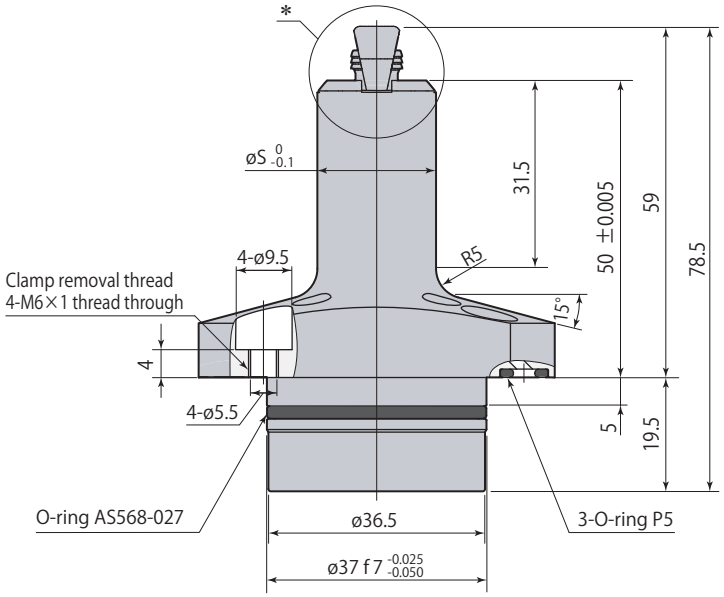
∗ : Unclamping hydraulic port must be made on either side or bottom face.

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

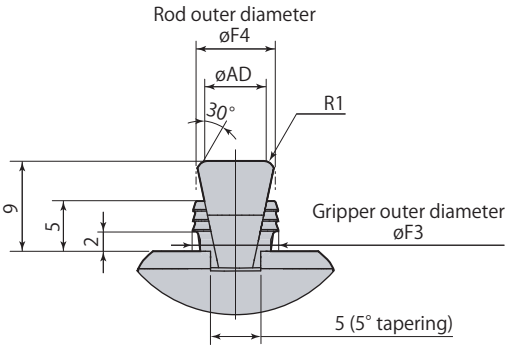
Dimensions



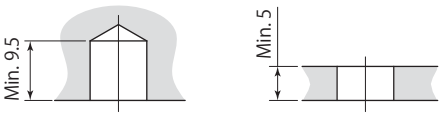


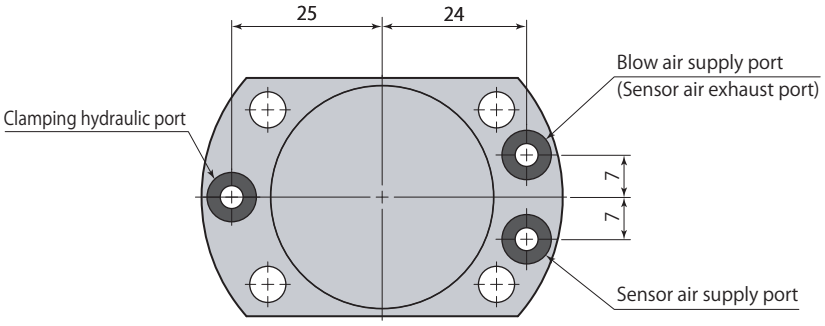


∗Details



Grip inner diameter usage requirements





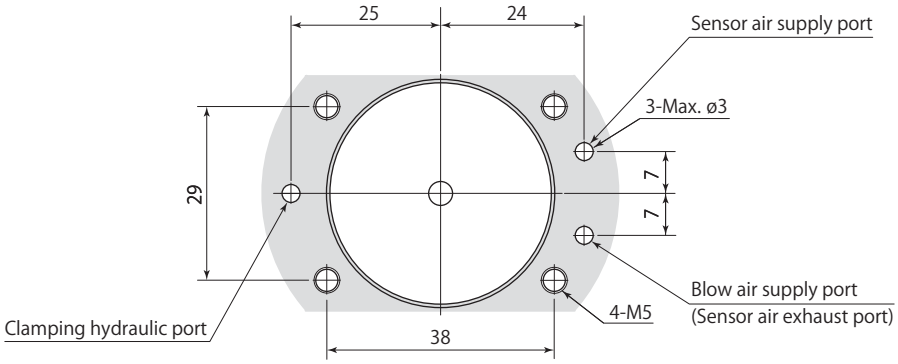
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

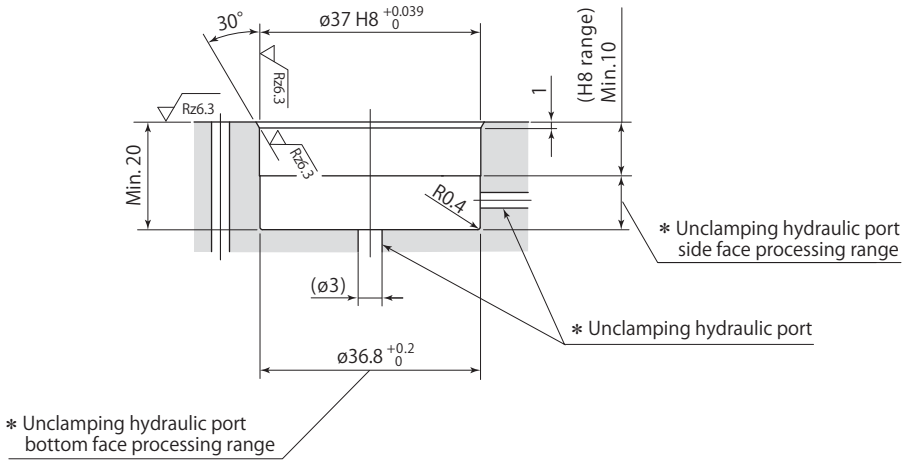
mm

Model	CGT-F22E□		
	085	09	10
øF3	8	8.5	9.5
øF4	8.05	8.55	9.55
øS	19.5	20	21
øT	12.1	12.6	13.6
øU	17.5	18	19
øAD	6.3	6.8	7.8

- CGT-F22E085 is made to order.

Mounting details



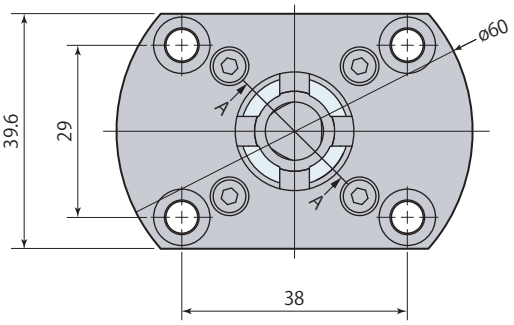


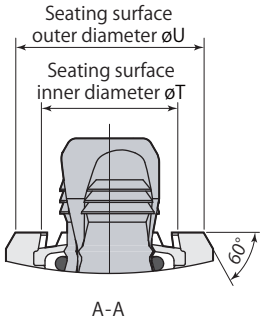
Rz: ISO4287(1997)

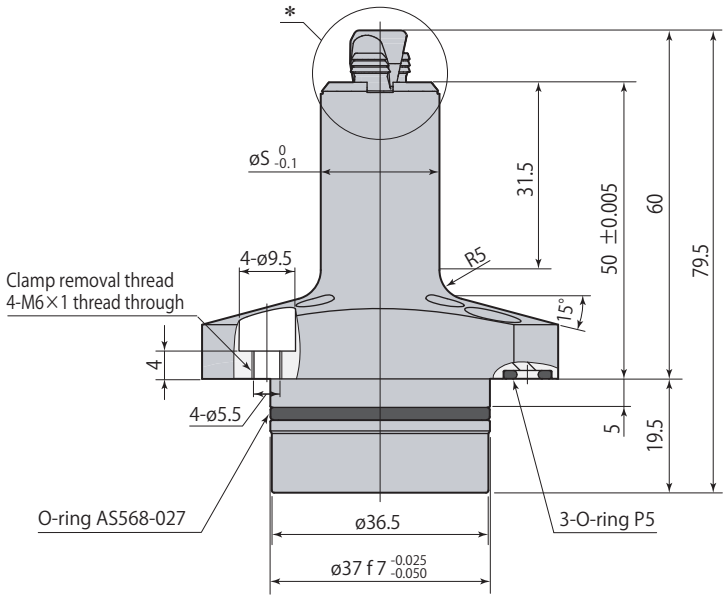
∗ : Unclamping hydraulic port must be made on either side or bottom face.

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

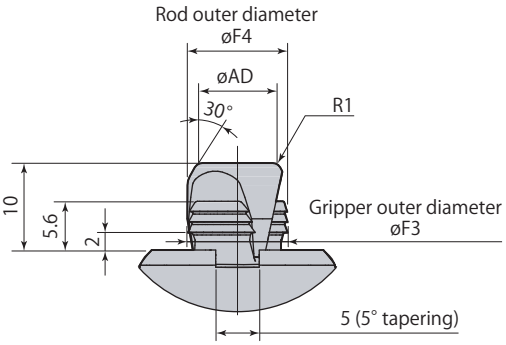
Dimensions



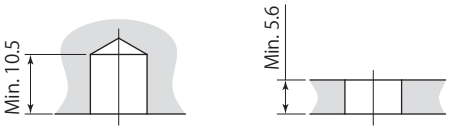


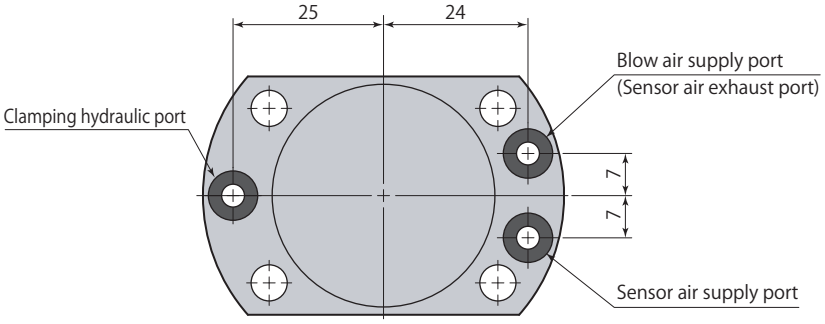


∗Details



Grip inner diameter usage requirements





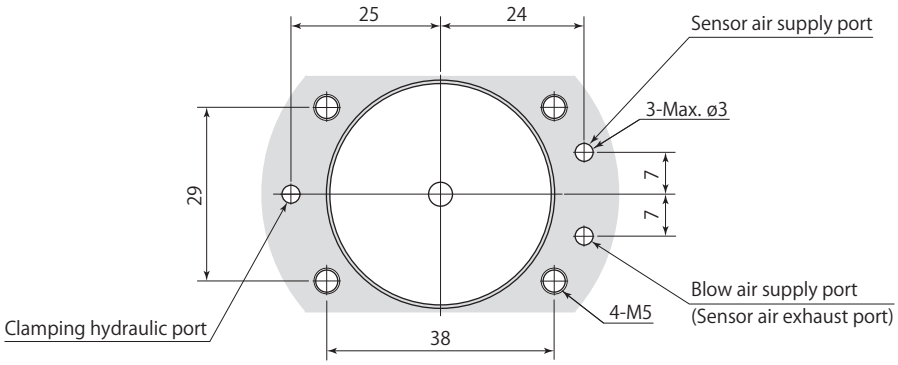
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

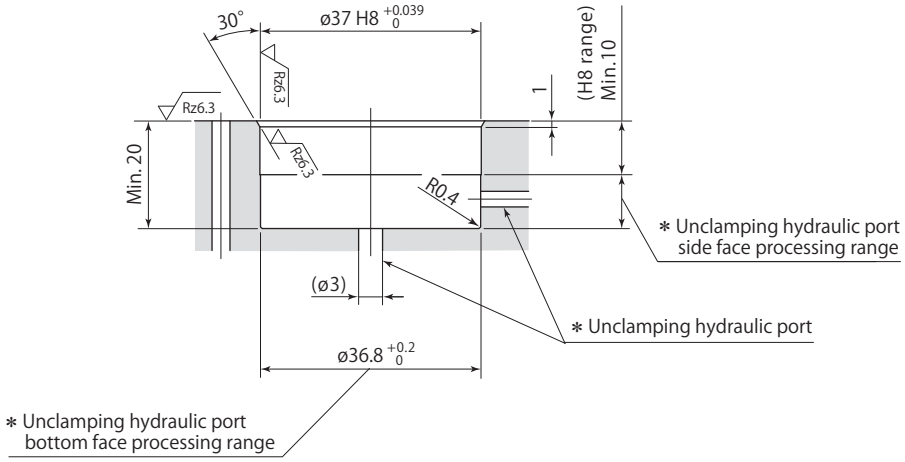
mm

Model	CGT-F22E□		
	11	12	13
øF3	10.5	11.5	12.5
øF4	10.55	11.55	12.55
øS	22	23	24
øT	14.6	15.6	16.6
øU	20	21	22
øAD	8.2	9.2	10.2

- CGT-F22E13 is made to order.

Mounting details



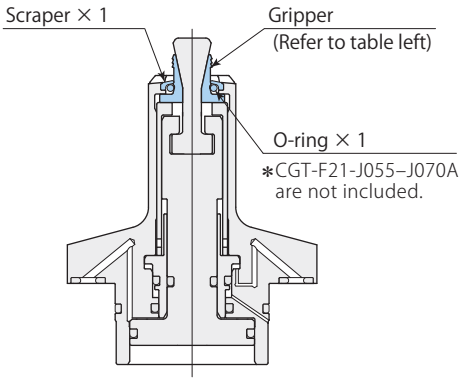


Rz: ISO4287(1997)

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

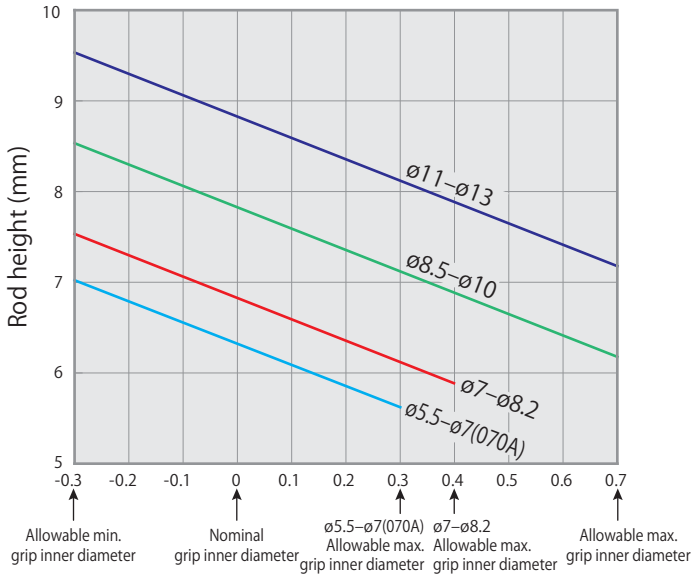
- Apply an appropriate amount of grease to the chamfer and the bore when mounting.
  Excessive grease may be a blockage in the air passage, causing malfunction of the sensor.
- The 30° taper machining must be provided to avoid the damage of the O-ring.

Gripper set replacement

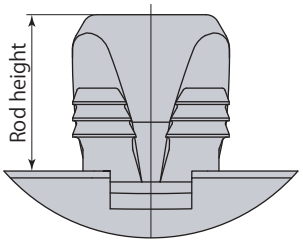
Number of grippers	Gripper set model	Clamp model	Set description
2 Grippers	CGT-F21-J055	CGT-F21-055	
	CGT-F21-J058	CGT-F21-058	
	CGT-F21-J061	CGT-F21-061	
	CGT-F21-J064	CGT-F21-064	
	CGT-F21-J067	CGT-F21-067	
	CGT-F21-J070A	CGT-F21-070A	
	CGT-F21EJ070	CGT-F21E070	
	CGT-F21EJ073	CGT-F21E073	
	CGT-F21EJ076	CGT-F21E076	
	CGT-F21EJ079	CGT-F21E079	
	CGT-F21EJ082	CGT-F21E082	
	CGT-F22EJ085	CGT-F22E085	
	CGT-F22EJ09	CGT-F22E09	
	CGT-F22EJ10	CGT-F22E10	
3 Grippers	CGT-F22EJ11	CGT-F22E11	
	CGT-F22EJ12	CGT-F22E12	
	CGT-F22EJ13	CGT-F22E13	

It is recommended that grippers, scraper and O-ring be replaced after about 200,000 operations. Replace grippers in sets and not just an individual gripper. (Refer to the table on the left for the gripper set model.)

Grip inner diameter & rod height when clamping



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

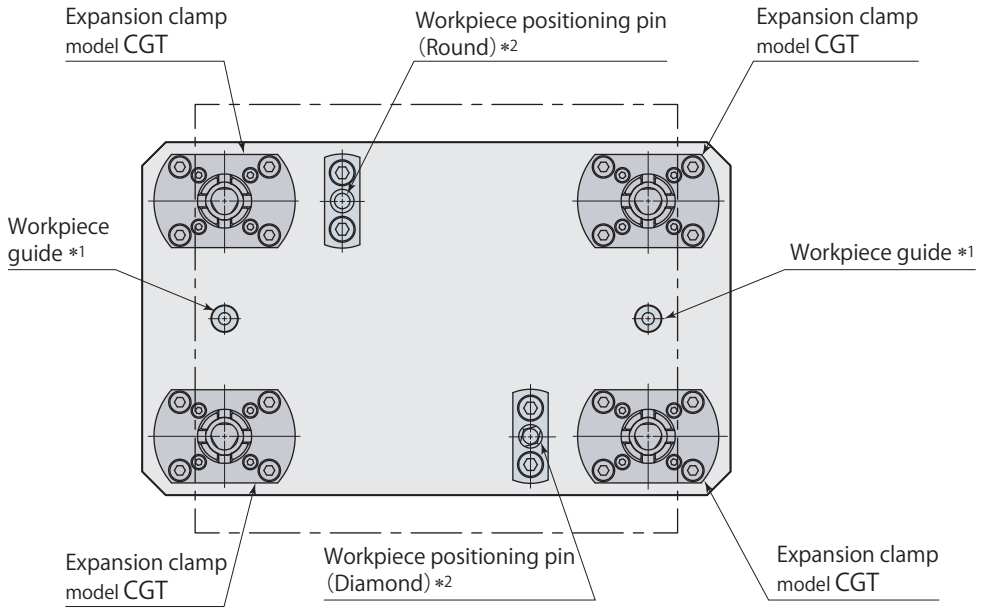


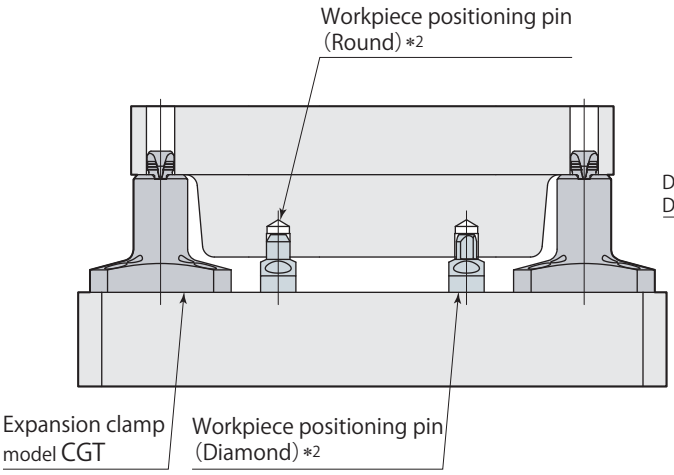
Rod height calculation formula	
ø5.5– ø7*	: 6.32-2.35× Actual grip inner diameter and nominal grip diameter difference
ø7 – ø8.2	: 6.58-2.84× Actual grip inner diameter and nominal grip diameter difference
ø8.5– ø10	: 7.82-2.35× Actual grip inner diameter and nominal grip diameter difference
ø11 – ø13	: 8.82-2.35× Actual grip inner diameter and nominal grip diameter difference

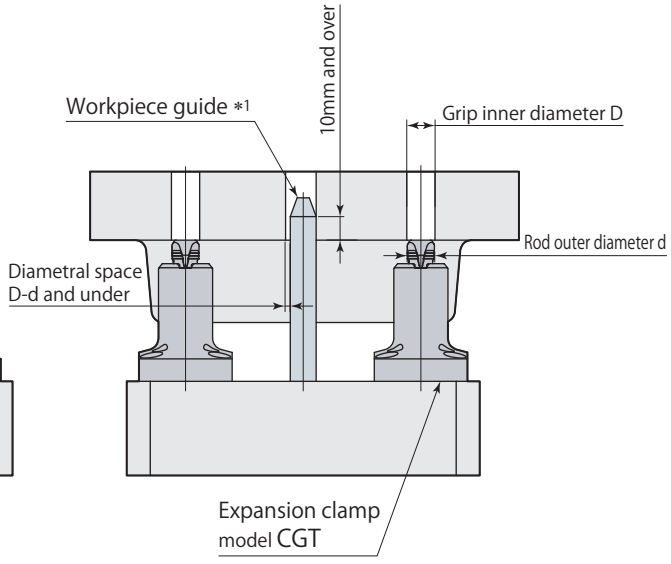
*: CGT-F21-070A

Example: When CGT-F22E10 (Nominal grip diameter : ø10) is clamping ø9.8 hole
Rod height = 7.82 - 2.35×(-0.2) = 8.29mm

System configuration example



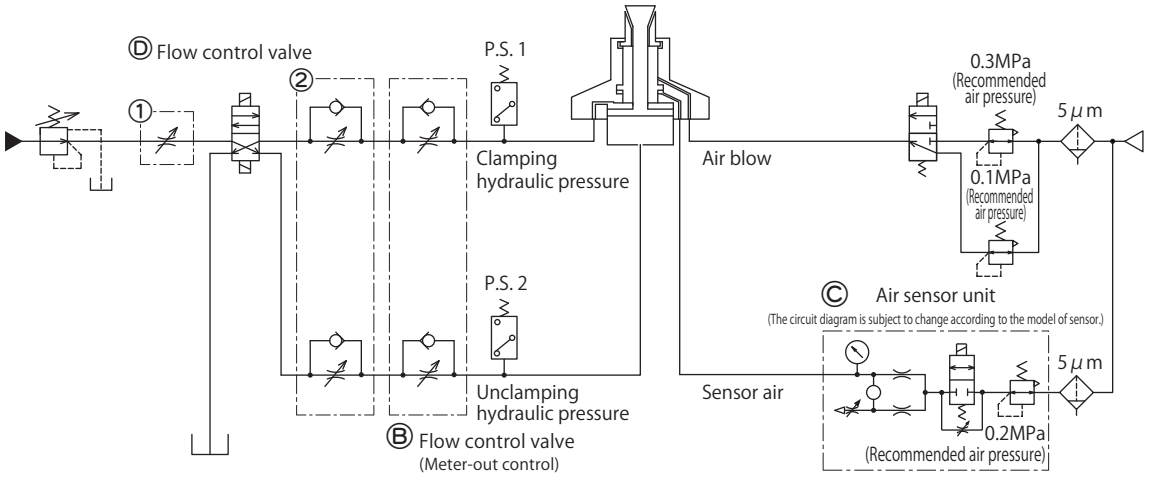




*1: When using automatic or robotic conveyers, prevent damage to clamp caused from impact by setting workpiece guides. Using the above guide as reference, accurately position the holes when using workpiece guides.

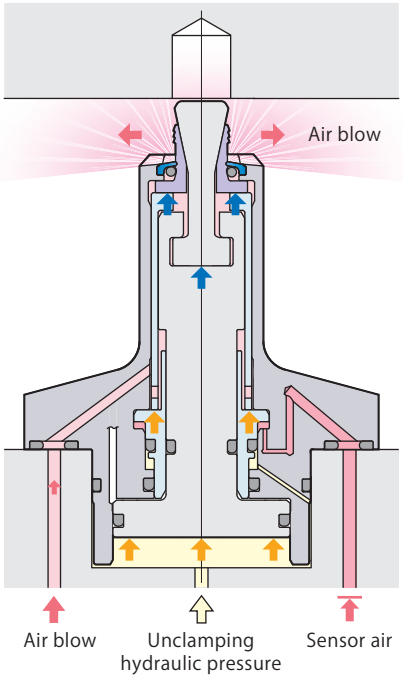
*2: **The expansion clamp does not have a workpiece positioning function.**
Install workpiece positioning pins (or similar).

Air blow model hydraulic and pneumatic circuit diagram

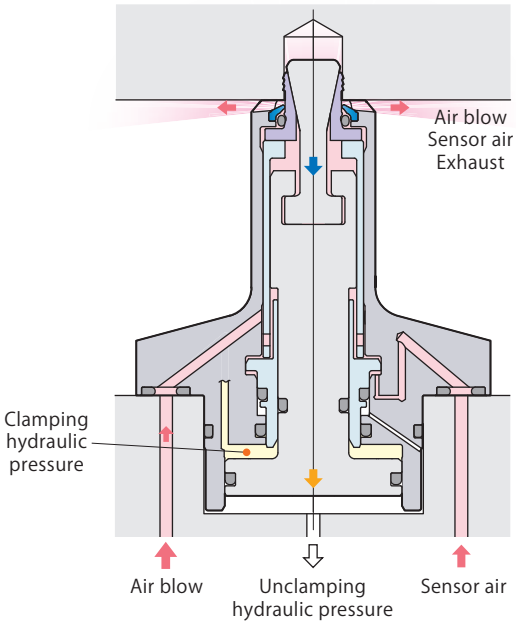


- Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping. During cutting, if chips adhere to the gripper such as when going through the clamping hole, continue air blowing during processing as well.
- Air blow pressure must be set to 0.1MPa when checking the operation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

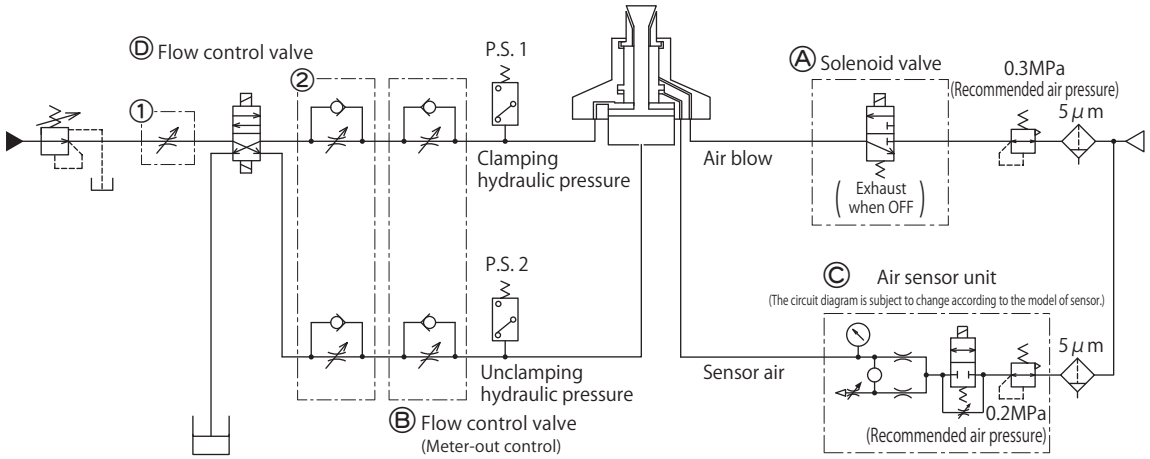
Air blowing



Clamping

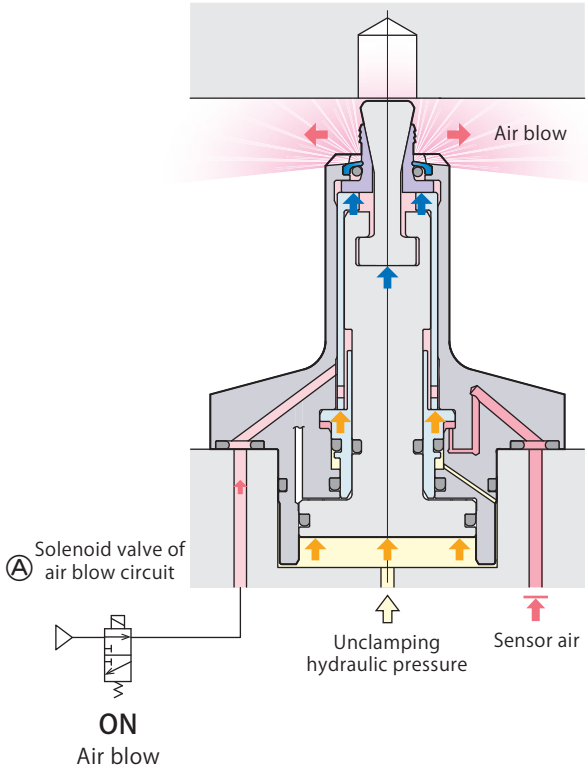


Non-constant air blow model hydraulic and pneumatic circuit diagram

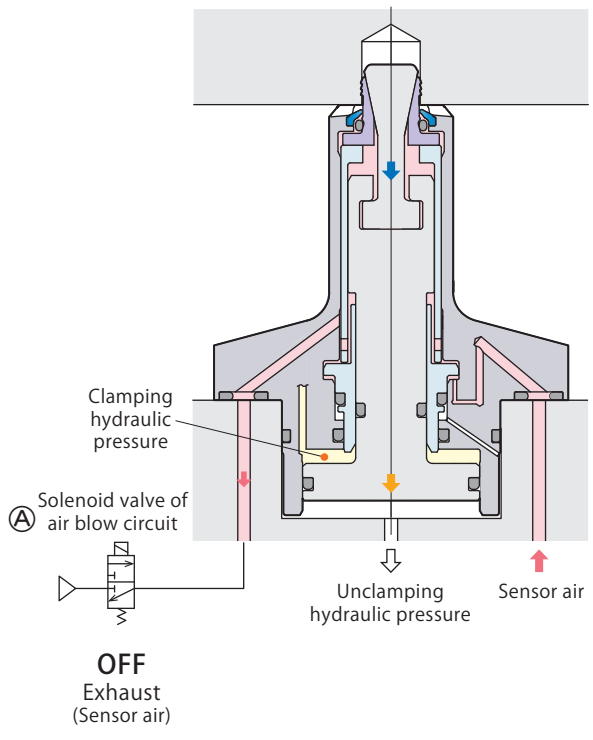


- Air blow will not be necessary during cutting process. Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping to remove metal chips and debris.
- The solenoid valve Ⓐ must be closed when checking the operation of the clamp with the air sensor. Also 3 port type of solenoid valve must be used in the circuit. If 2 port type of the valve is used, sensing air cannot be exhausted and clamp detection function is disabled.

Air blowing



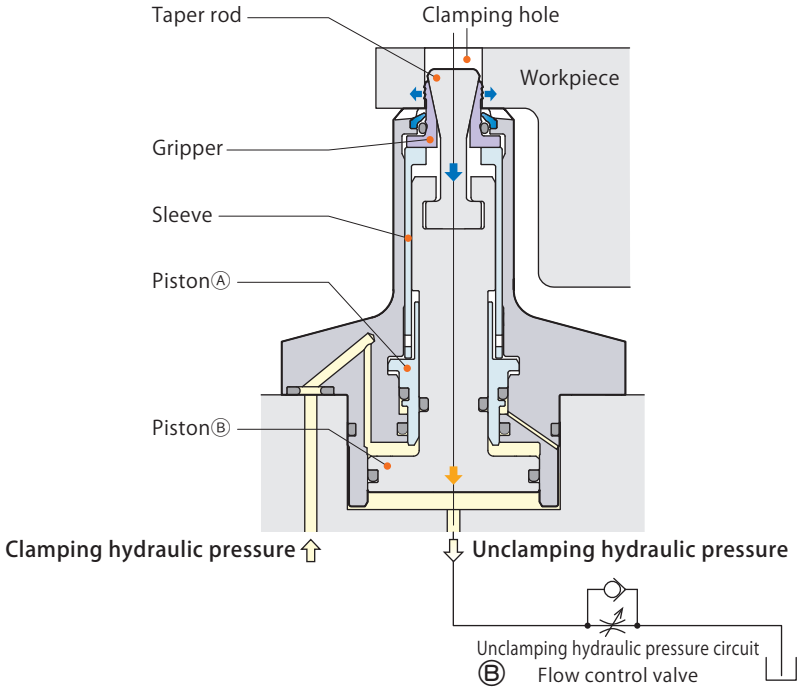
Clamping



- Operation speed must be adjusted by a meter-out type flow control valve Ⓑ being provided in the unclamping circuit. By the adjustment, oil flow in unclamping circuit is squeezed and back pressure is generated. The back pressure acts on the piston Ⓐ of the clamp and makes the gripper expand first then the taper rod strokes down to clamp. If meter-in type flow control valve is installed in the circuit, it dumps the oil rapidly and makes the gripper move very quick which causes incomplete clamping.

- Adjust oil flow when clamping to have the taper rod full stroke in 0.3 sec or over.
  Excessive oil flow to the clamp gives impact load and may cause breakage of the parts.

- Provide additional flow control valve Ⓓ to the place of either ① or ② in the circuit diagram to adjust oil flow when a large discharge volume pump is used for the hydraulic circuit. The flow control valve Ⓑ alone may not be good enough to adjust the speed of clamp operation.



Air sensor unit Ⓒ recommended condition of use

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

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

- There is a case that air sensing cannot be made successfully as designed when it is used out of the usage shown on the left. Contact Technical service center for more details.

Operation cycle

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

Case of air blow model

State			Workpiece loading	Clamping	Air blow switching	Clamping completion*1	(Machining)	Air blow switching	Unclamping	Air blow switching	Unclamping completion*2	Air blow switching	Workpiece unloading
*4	Workpiece clamp	Clamp											
		Unclamp											
	Air blow	0.3MPa											
		0.1MPa											
	Sensor air	ON											
		OFF											
*5	Clamping hydraulic pressure P.S. 1		OFF		ON				OFF				
	Unclamping hydraulic pressure P.S. 2		ON		OFF				ON				
	Air sensor				OFF or ON*3						ON		

*1 : Clamping completion : P.S. 1=ON P.S. 2=OFF Air sensor=OFF
*2 : Unclamping completion : P.S. 1=OFF P.S. 2=ON Air sensor=ON
*3 : OFF : Complete clamping ON : Incomplete clamping
*4 : Solenoid valve control *5 : Hydraulic pressure switch, Air sensor signal

Case of non-constant air blow model

State			Workpiece loading	Clamping	Air blow OFF	Clamping completion*1	(Machining)	Air blow ON	Unclamping	Air blow OFF	Unclamping completion*2	Air blow ON	Workpiece unloading
*4	Workpiece clamp	Clamp											
		Unclamp											
	Air blow	ON											
		OFF											
	Sensor air	ON											
		OFF											
*5	Clamping hydraulic pressure P.S. 1		OFF		ON				OFF				
	Unclamping hydraulic pressure P.S. 2		ON		OFF				ON				
	Air sensor				OFF or ON*3						ON		

*1 : Clamping completion : P.S. 1=ON P.S. 2=OFF Air sensor=OFF
*2 : Unclamping completion : P.S. 1=OFF P.S. 2=ON Air sensor=ON
*3 : OFF : Complete clamping ON : Incomplete clamping
*4 : Solenoid valve control *5 : Hydraulic pressure switch, Air sensor signal

Caution in use

- Be sure to make inner diameter of air blow circuit 4 mm and over except for clamp mounting surface.

- Set the workpiece in such a way that the clamping hole of workpiece is perpendicular to seating surface. Clamping in tilted condition results in uneven contact of gripper with hole, which leads to concentration of load that may cause damage.

- Verify that there are no metal chips or debris on seating surface of clamping hole and clamp body before setting workpiece. Allowing intrusion of metal chips results in insecure clamping, which can lead to low grade of machining accuracy.

- Flaring (Biting) of gripper into workpiece varies depending on workpiece material or thermal processing conditions. With regards to conditions of workpiece and clamping hole, refer to **page →41**. Secure clamping is not possible when workpiece or clamping hole that does not satisfy these conditions is used.

- If clamping hole serves as taper hole (cast draft hole with gradient), then perform test clamping using applicable workpiece beforehand to verify that there are no problems with operations.

- Deformation may occur if the thickness of clamping hole section of workpiece is extremely thin. Use applicable workpiece to perform test clamping beforehand to verify that there are no deformations in thin portion.

- Supply the dry and filtered air. Particulate size 5 μm or less is recommended.

- Measure seating surface flatness with hydraulic pressure applied on clamping side, or by applying hydraulic pressure on neither clamping nor unclamping side.

- Perform unclamping completion detection, clamping completion detection and incomplete clamping detection with combination actions of pressure switch and sensor shown in table below. (Refer to hydraulic and pneumatic circuit diagram on **pages →60**, **61** for details.)

Applications	Pressure switch 1 (P.S. 1)	Pressure switch 2 (P.S. 2)	Air sensor
Unclamping completion detection	OFF	ON	ON
Clamping completion detection	ON	OFF	OFF
Incomplete clamping detection	ON	OFF	ON

Expansion clamp

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

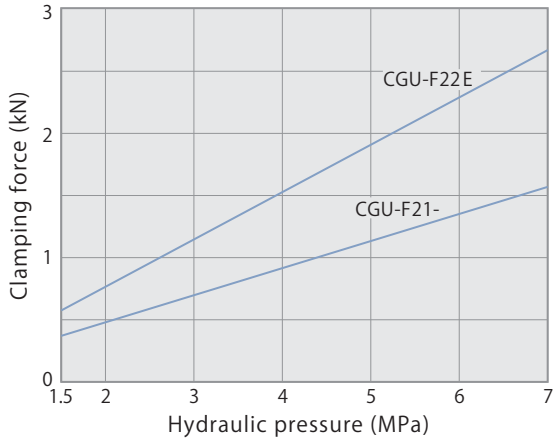
■ indicates made to order.

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

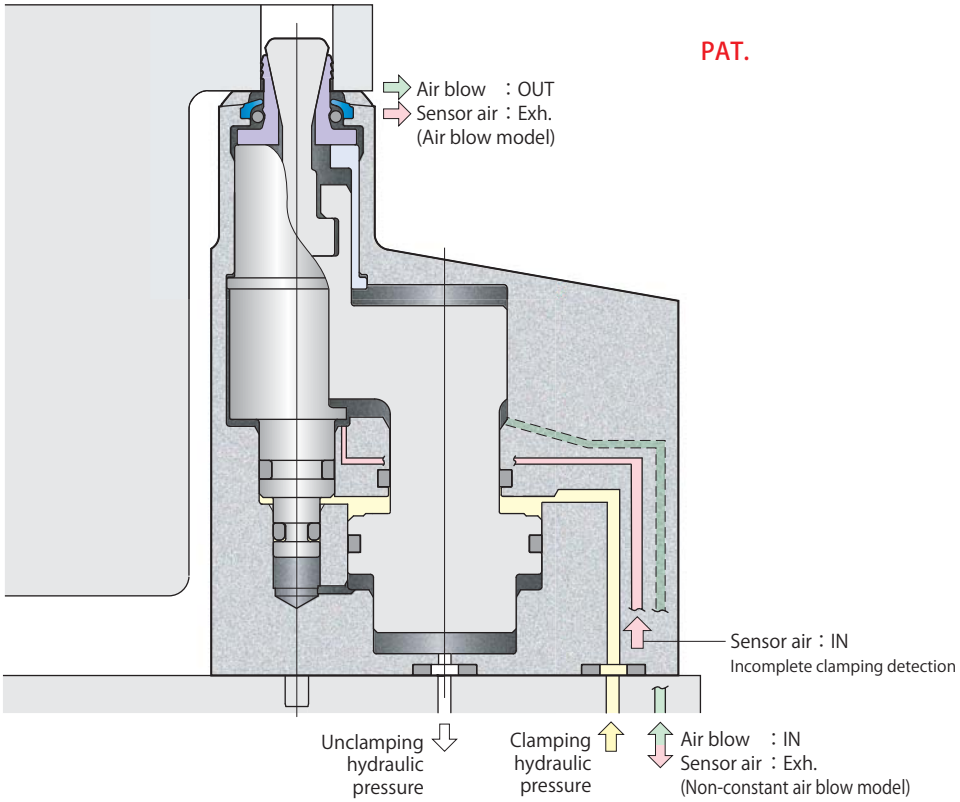
P : Hydraulic pressure (MPa)

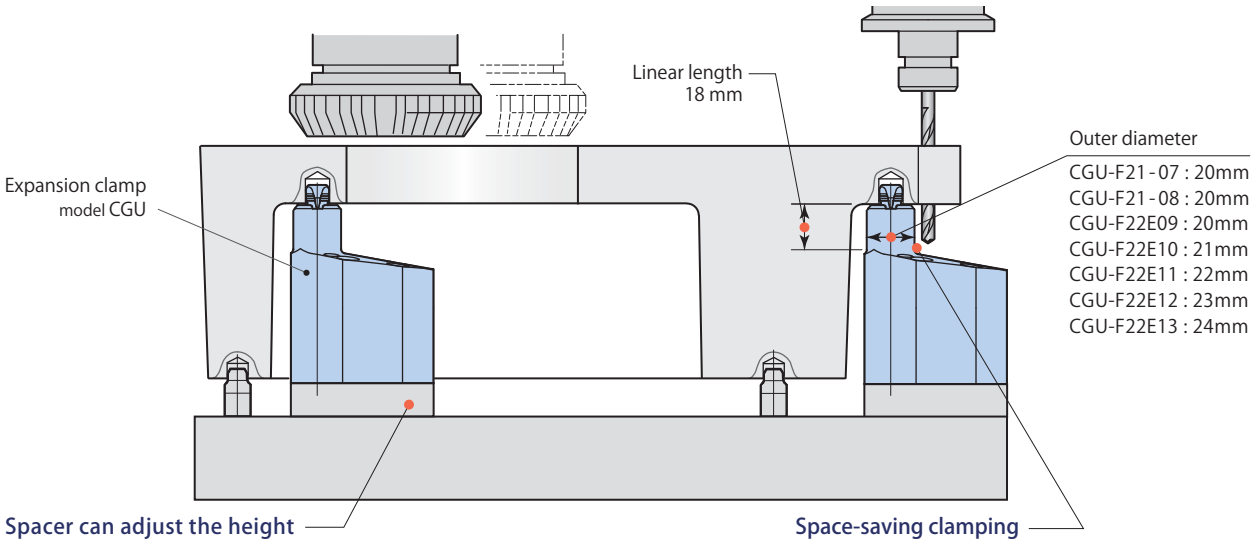
Air blow model
model **CGU-F21-**
4 Grippers
ø7 8

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.

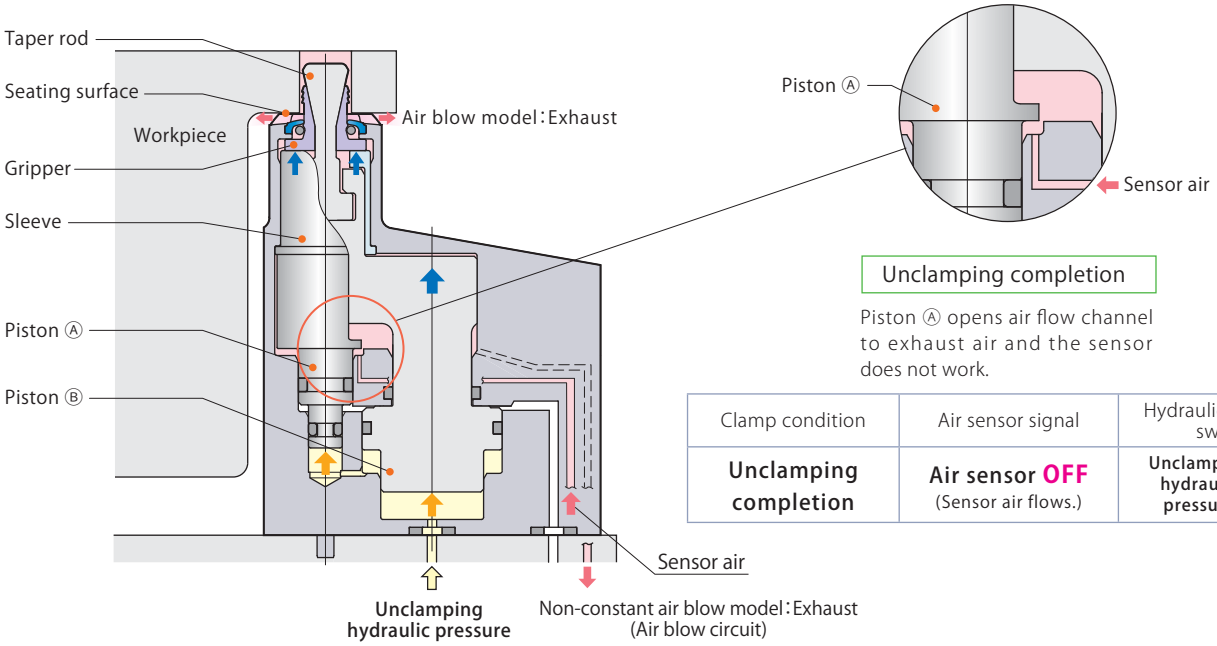




Workpiece setting (Unclamping completion)

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**

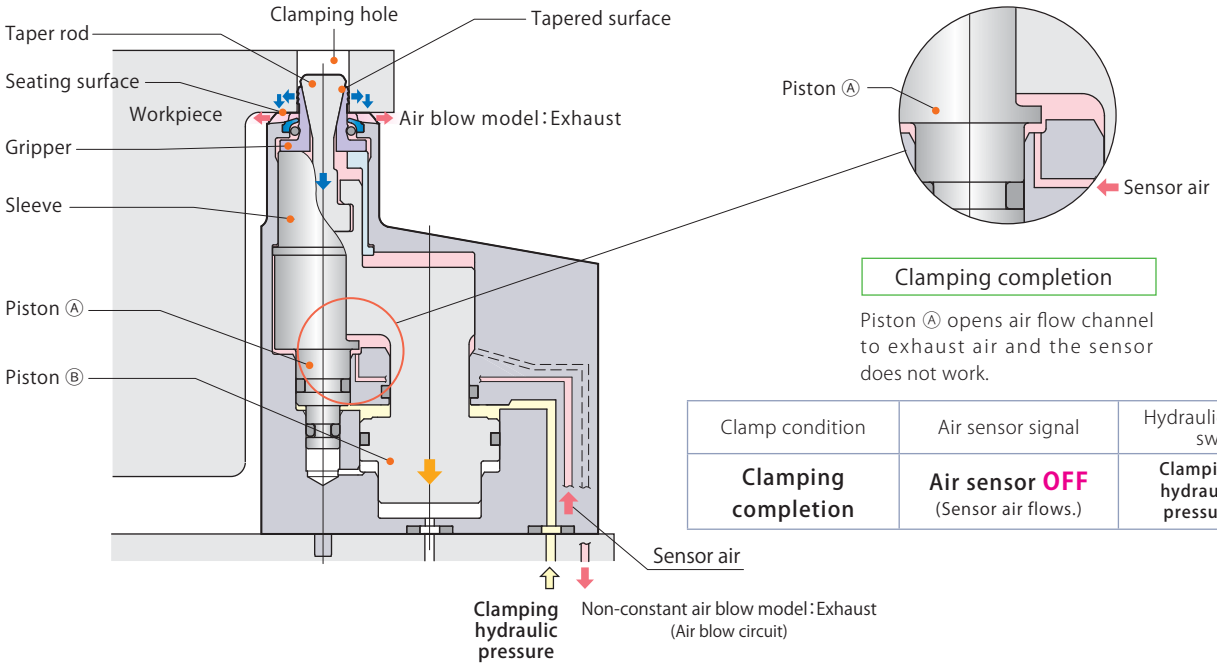
Workpiece holding (Clamping completion)

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.



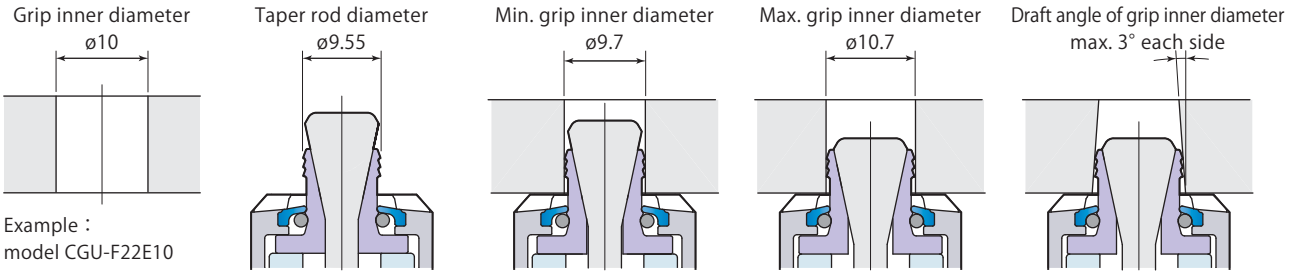
Clamping completion

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.

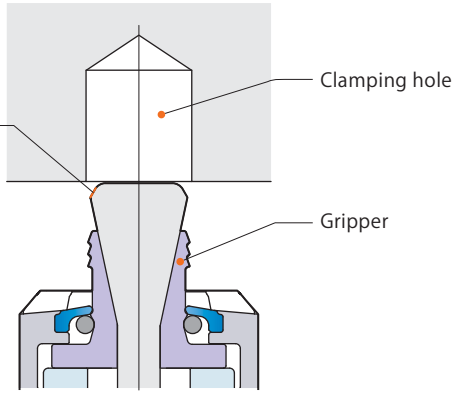


Taper rod and gripper with superior durability

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.

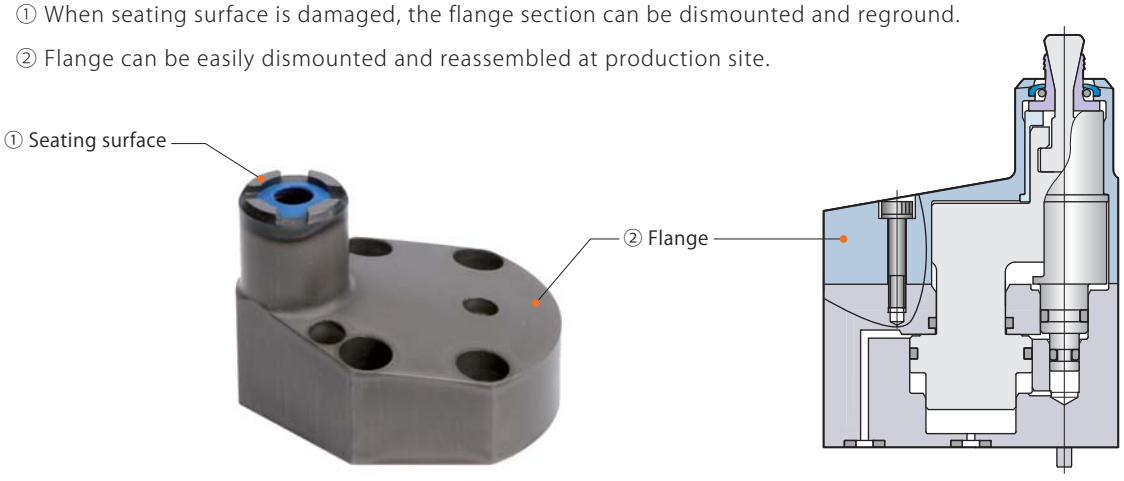
③ Tip section of taper rod has larger diameter than gripper and is well chamfered to be a better guide when setting the workpiece.



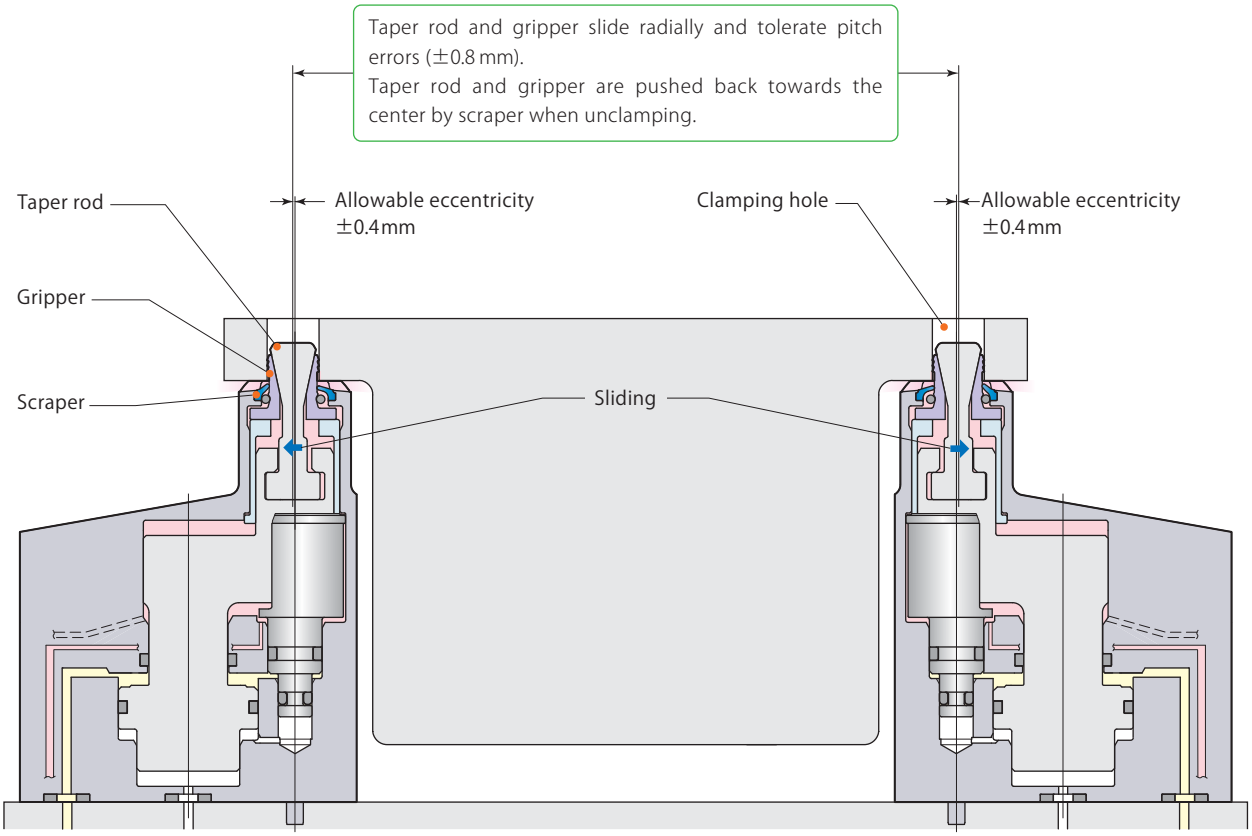
Seating surface can be reground (Max. 0.1 mm)

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.



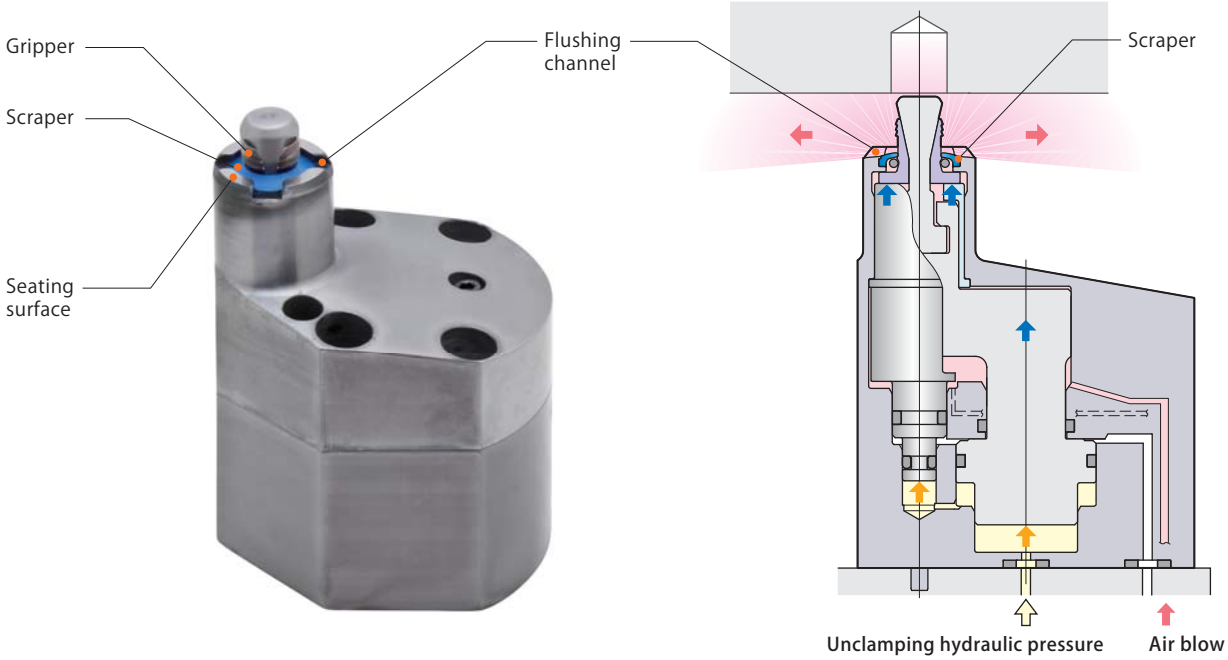
Clamping hole pitch errors can be tolerated



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

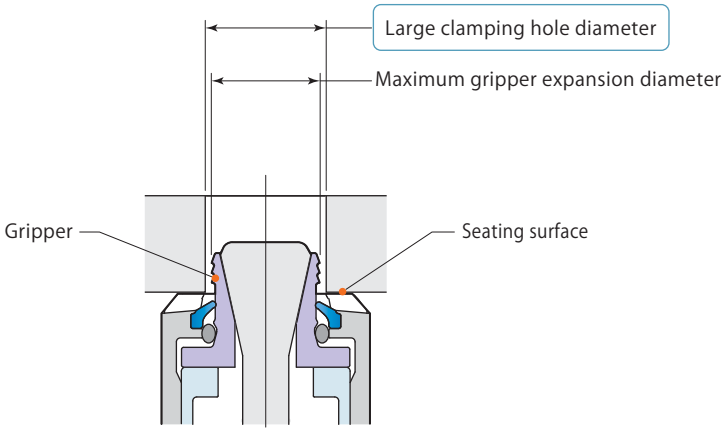
Incorporating strong air blowing circuit

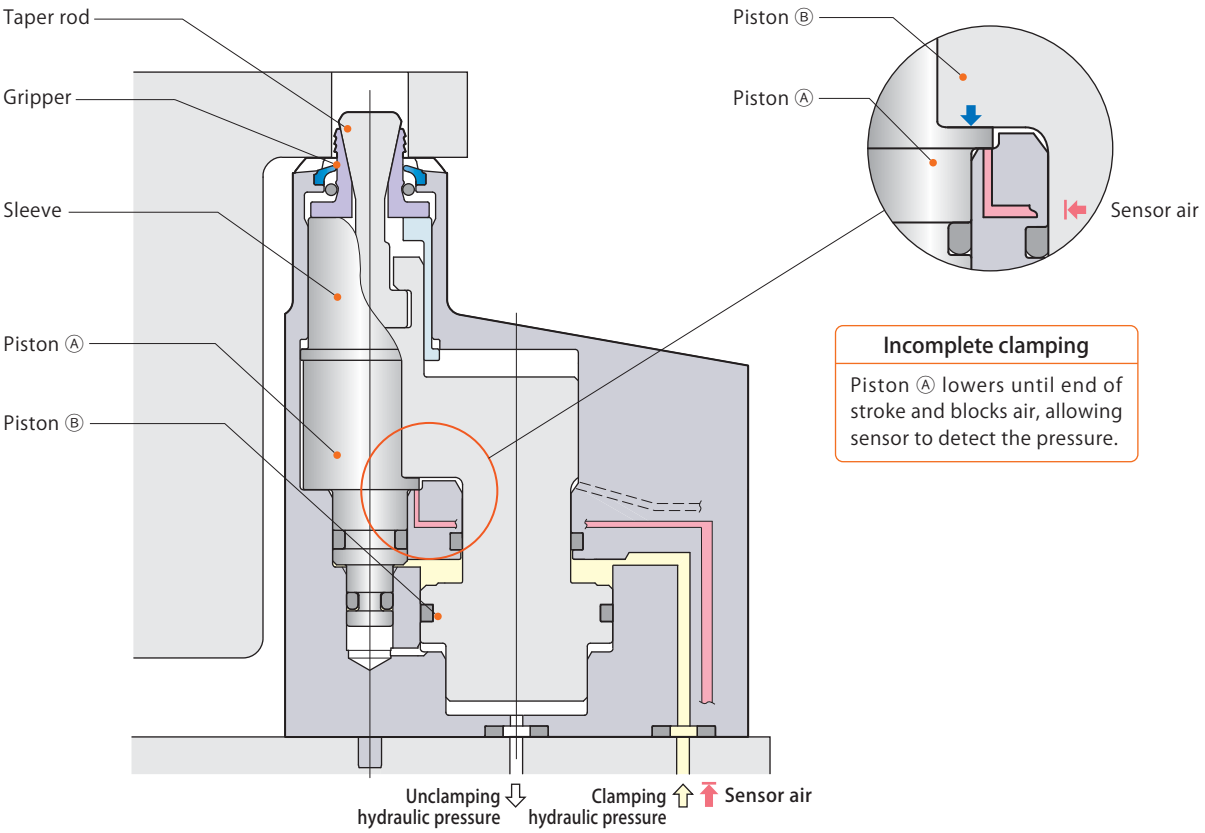
Air blow from a gap between the gripper and scraper clears off metal chips and coolant that stay on the seating surface. Flushing channel is also provided on the seating surface to remove the metal chips and coolants smoothly during workpiece setting.



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.





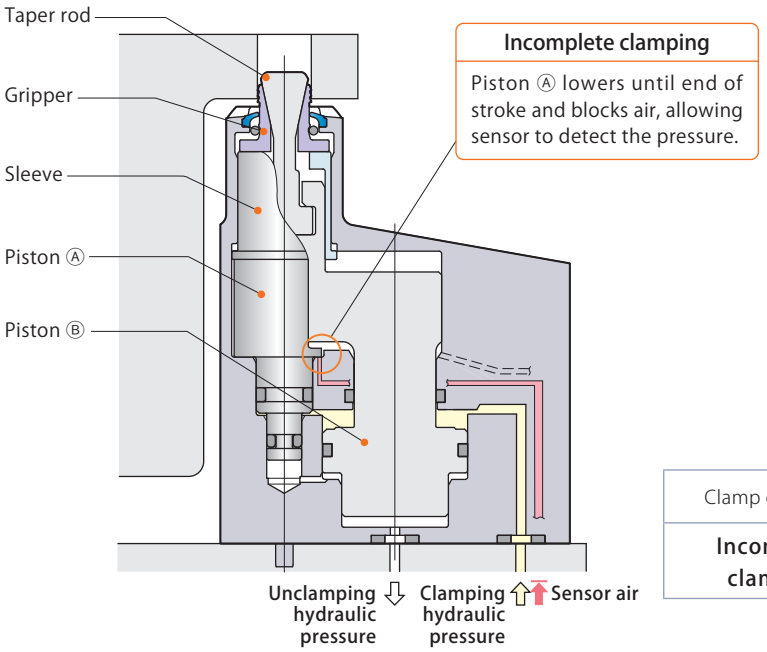
Incomplete clamping

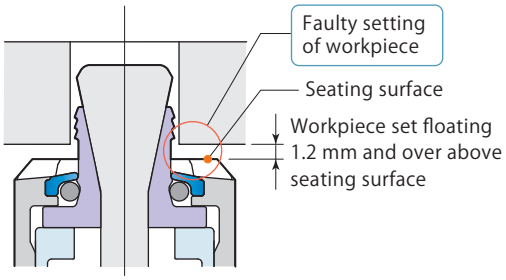
Piston Ⓐ lowers until end of stroke and blocks air, allowing sensor to detect the pressure.

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.

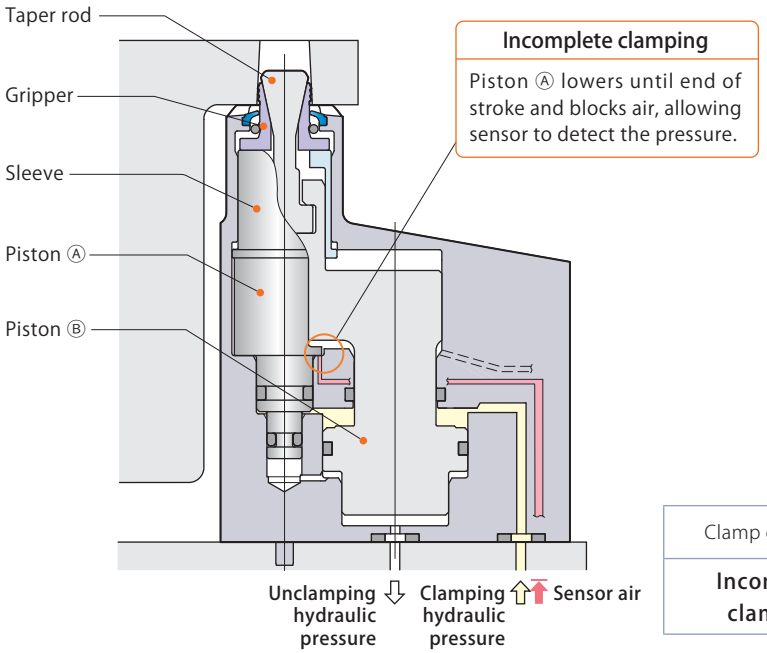


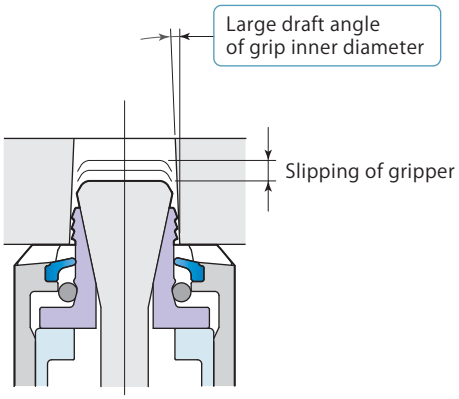


Clamp condition	Air sensor signal	Hydraulic pressure switch
Incomplete clamping	**Air sensor ON** (Sensor air does not flow.)	**Clamping hydraulic pressure** **ON**

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

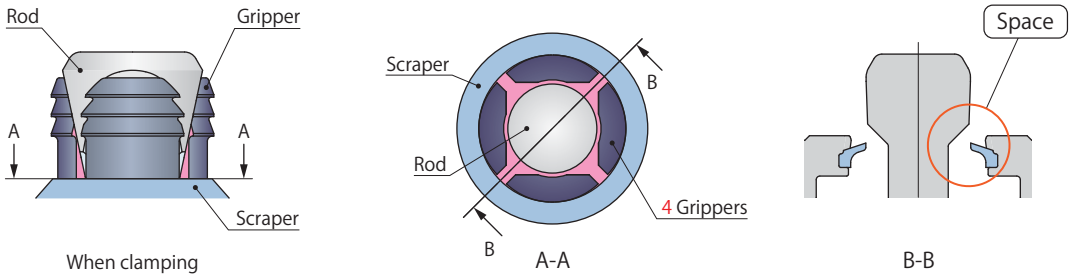
Non-constant air blow model

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.

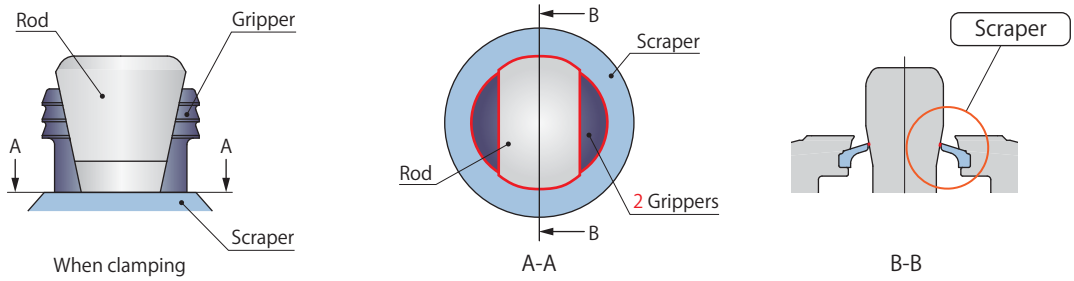
Space where metal chips can intrude is created



Pages →76, 77

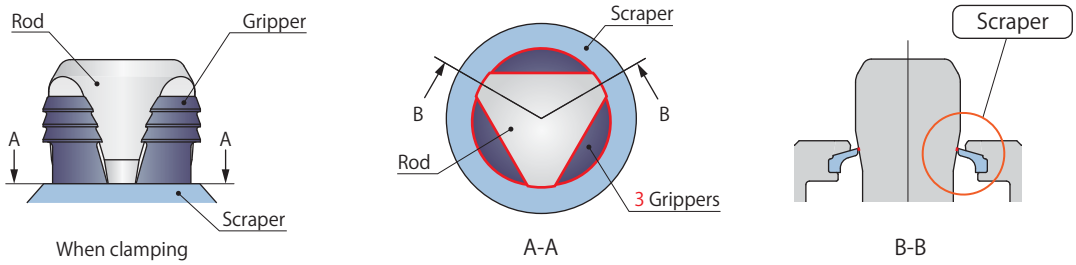
Because of space between scraper, gripper and the rod, air blow must always be performed to prevent intrusion of chips.

Secure chip protection



Pages →78, 79

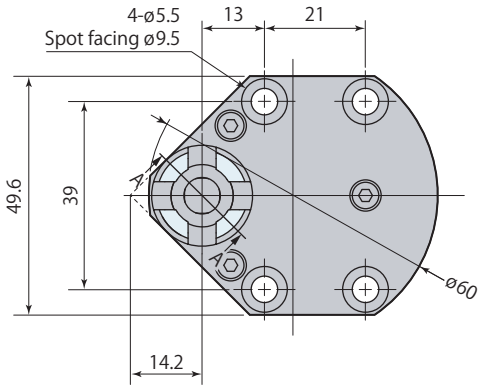
Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.

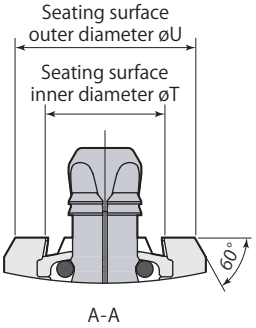


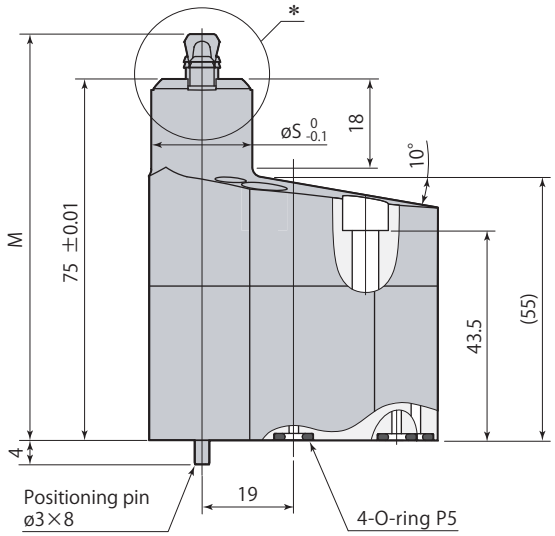
Pages →80, 81

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

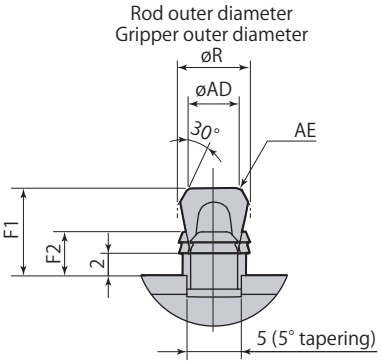
Dimensions



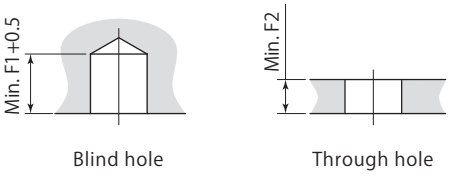


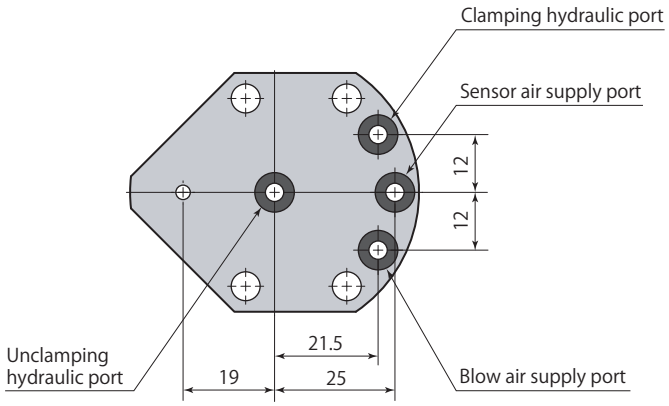


*Details



Grip inner diameter usage requirements



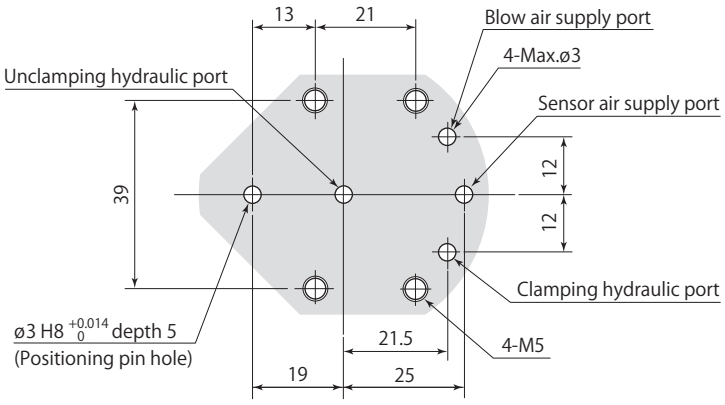


mm

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

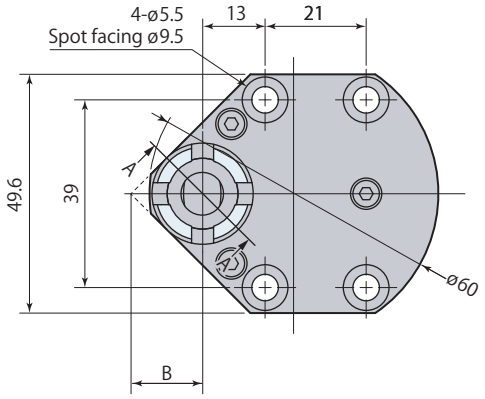
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.
- CGU-F21-07, 08 are made to order.

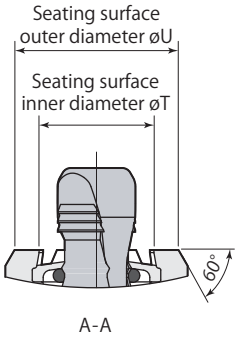
Mounting details

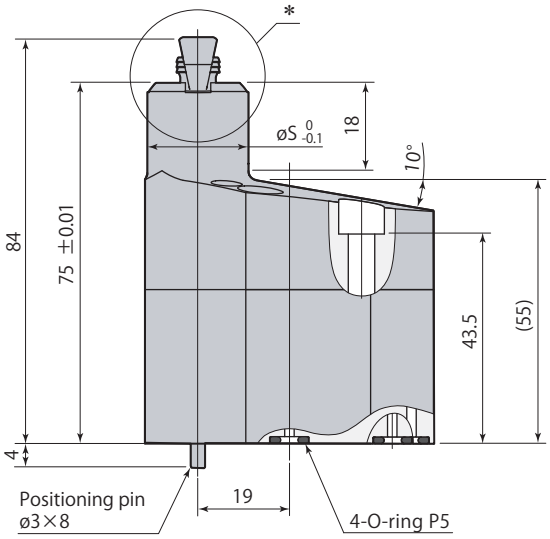


● The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

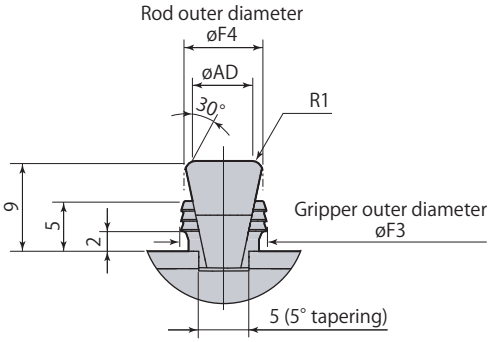
Dimensions



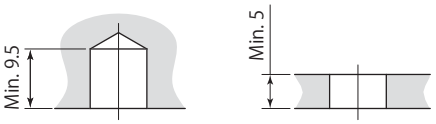


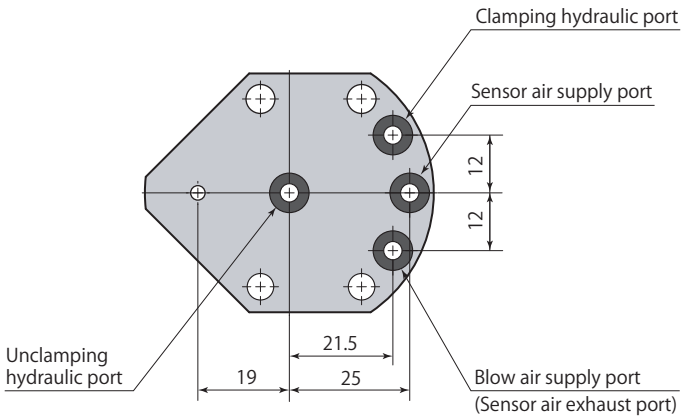


∗Details



Grip inner diameter usage requirements



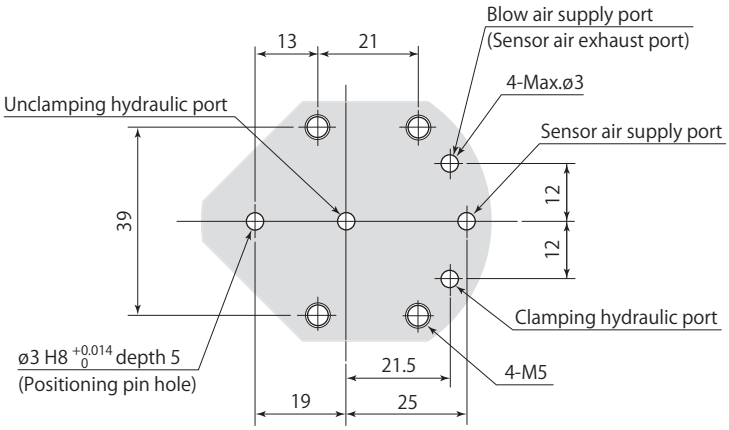


mm

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

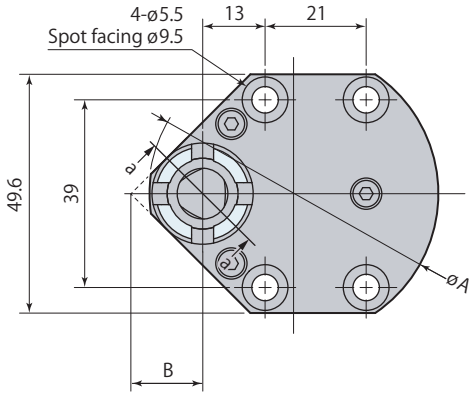
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.
- CGU-F22E09, 10 are made to order.

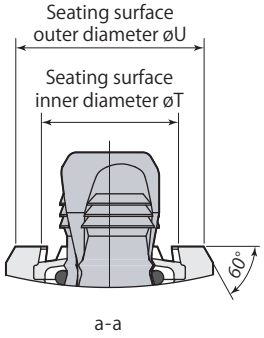
Mounting details

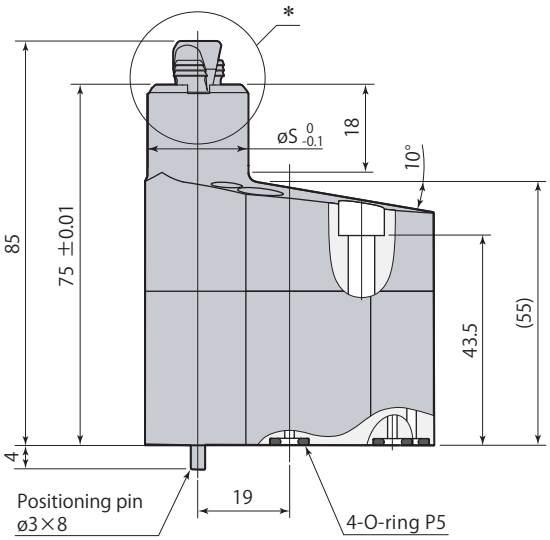


● The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

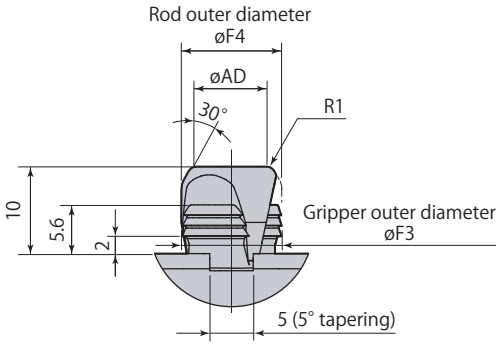
Dimensions



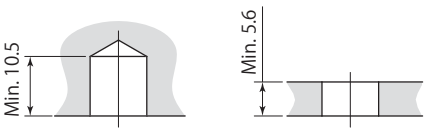


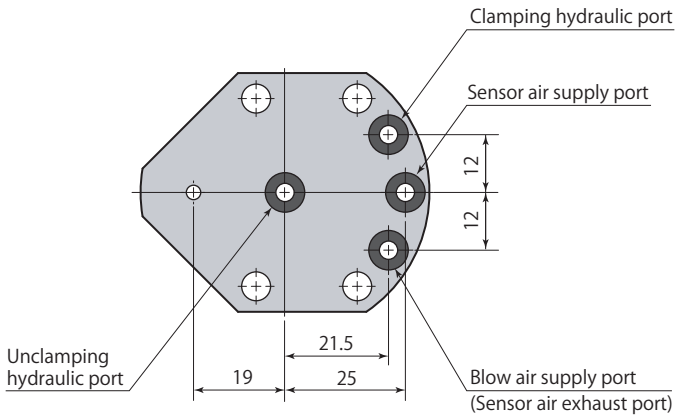


*Details



Grip inner diameter usage requirements





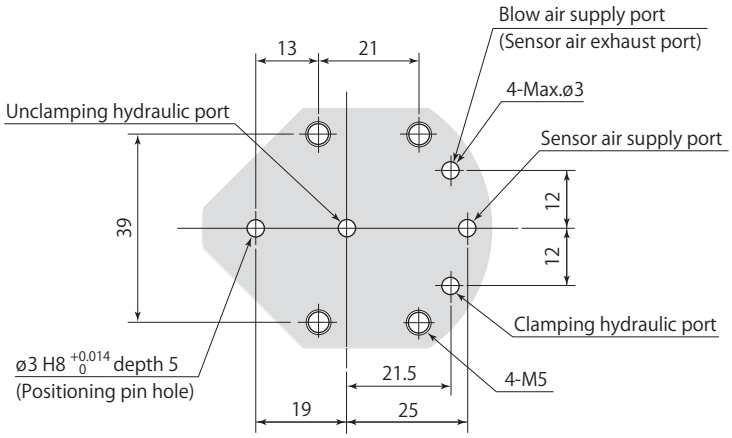
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

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

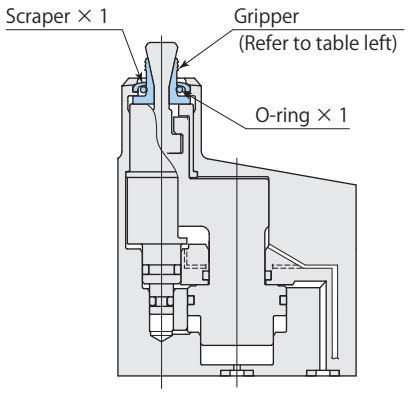
- CGU-F22E11, 12, 13 are made to order.

Mounting details



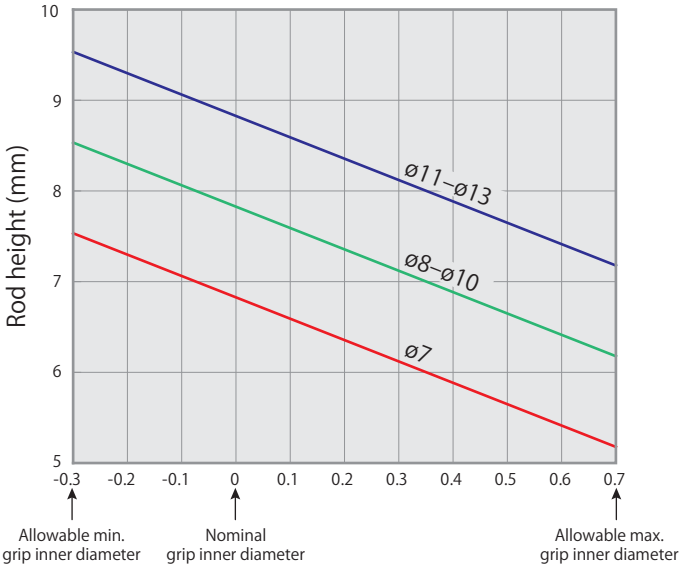
● The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).

Gripper set replacement

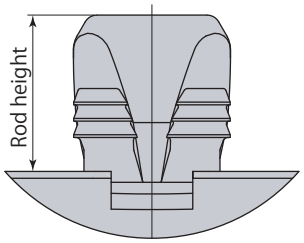
Number of grippers	Gripper set model	Clamp model	Set description
4 Grippers	CGU-F21-J07	CGU-F21-07	
	CGU-F21-J08	CGU-F21-08	
2 Grippers	CGU-F22EJ09	CGU-F22E09	
	CGU-F22EJ10	CGU-F22E10	
3 Grippers	CGU-F22EJ11	CGU-F22E11	
	CGU-F22EJ12	CGU-F22E12	
	CGU-F22EJ13	CGU-F22E13	

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



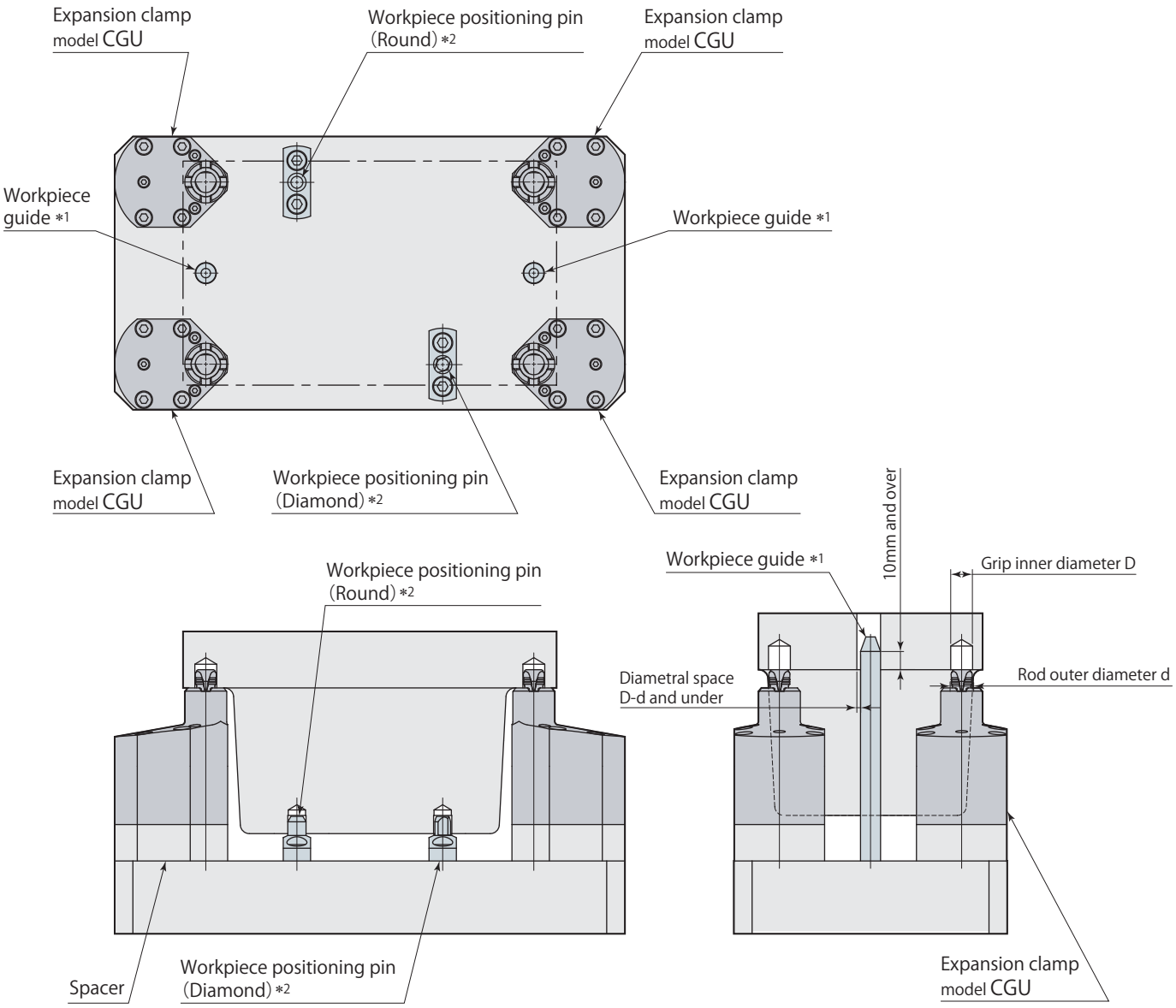
Difference between actual grip inner diameter and nominal grip diameter (mm)



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

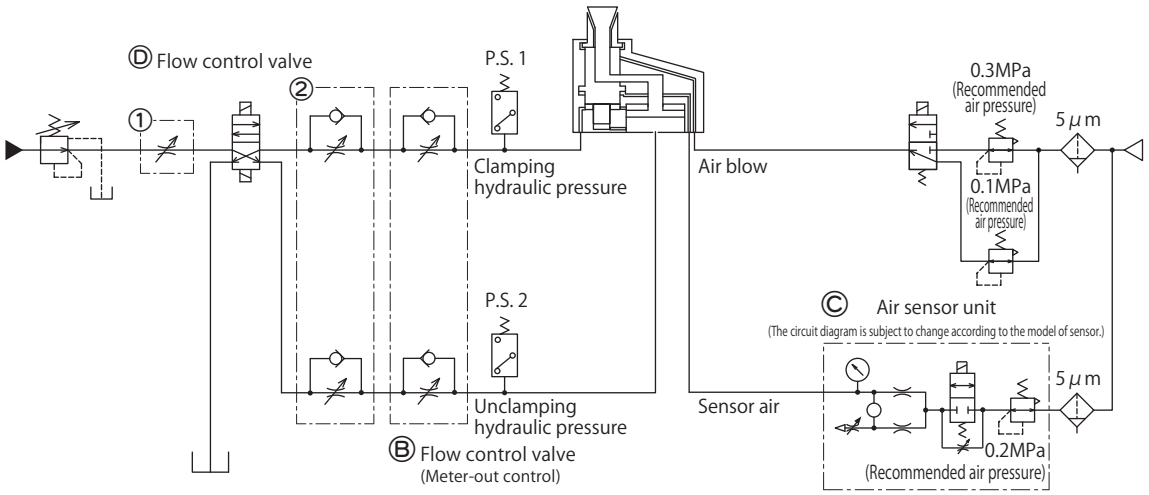
System configuration example



*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.

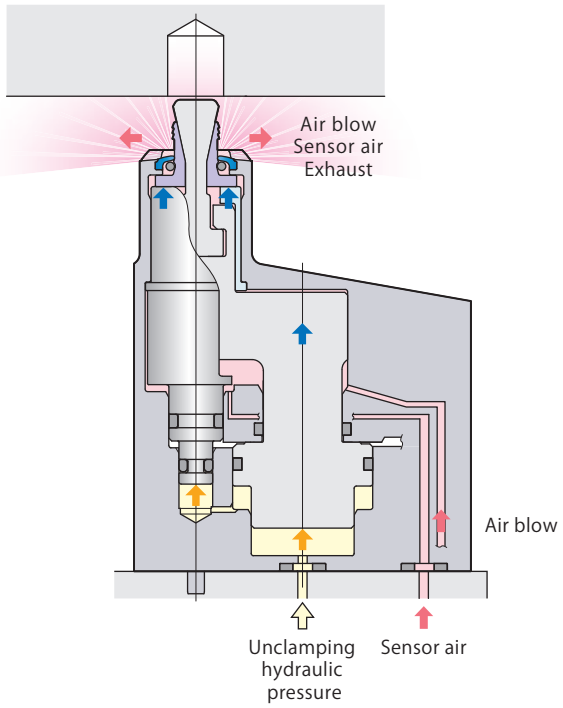
*2: **The expansion clamp does not have a workpiece positioning function.**
Install workpiece positioning pins (or similar).

Air blow model hydraulic and pneumatic circuit diagram

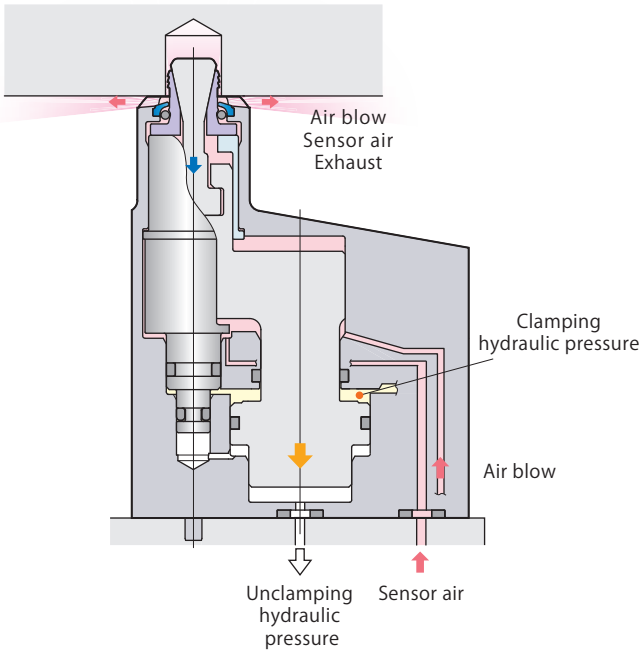


- Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping. During cutting, if chips adhere to the gripper such as when going through the clamping hole, continue air blowing during processing as well.
- Air blow pressure must be set to 0.1MPa when checking the operation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

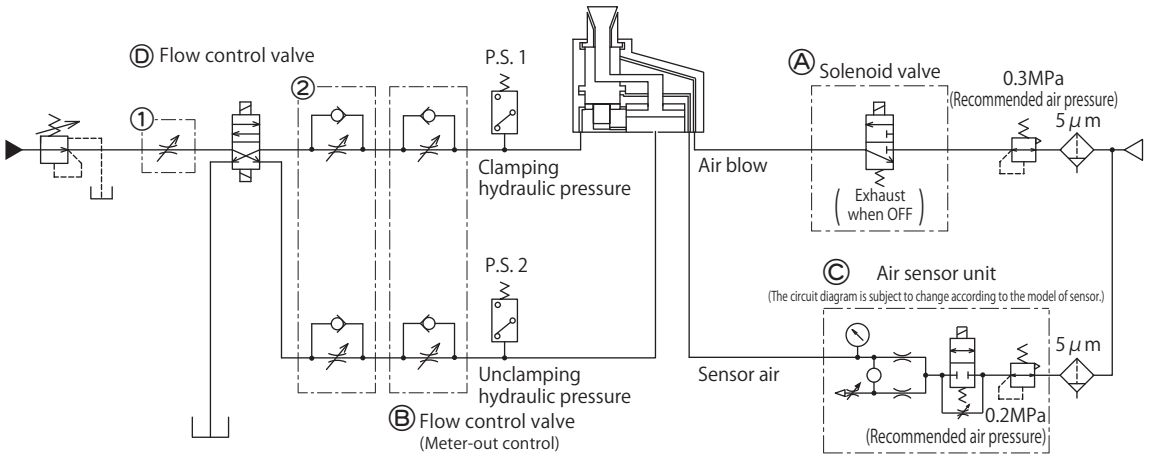
Air blowing



Clamping

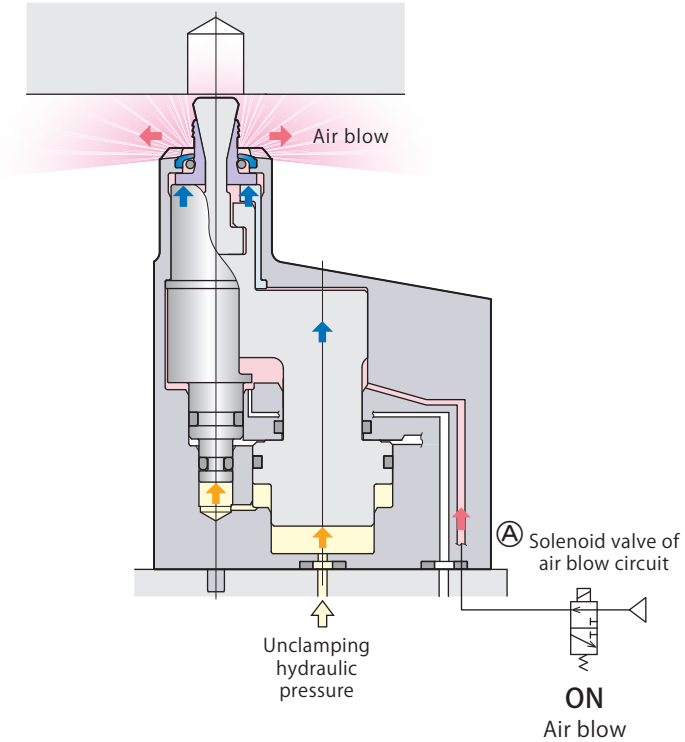


Non-constant air blow model hydraulic and pneumatic circuit diagram

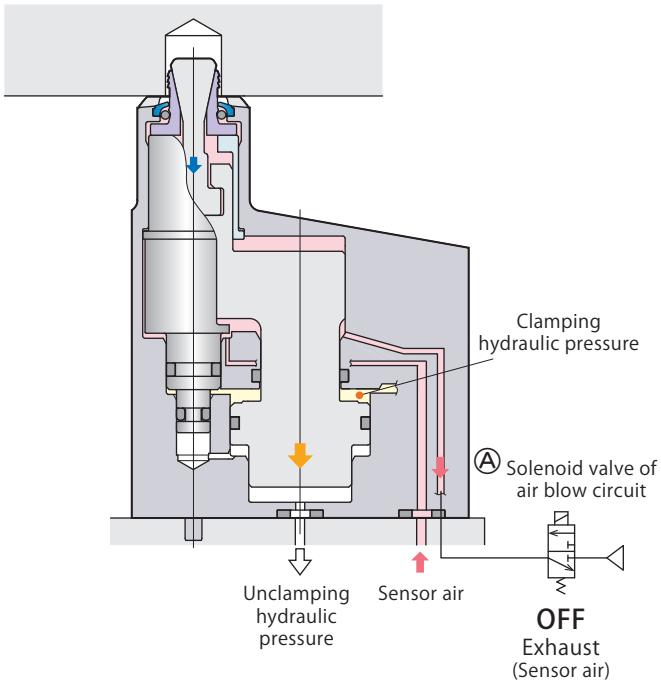


- Air blow will not be necessary during cutting process. Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping to remove metal chips and debris.
- The solenoid valve Ⓐ must be closed when checking the operation of the clamp with the air sensor. Also 3 port type of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



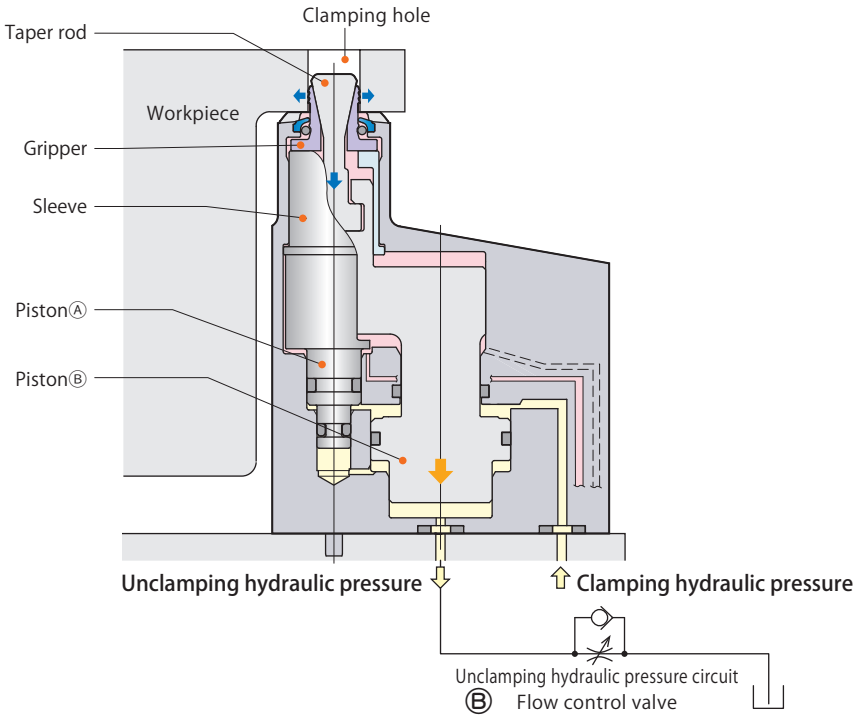
Clamping



- 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

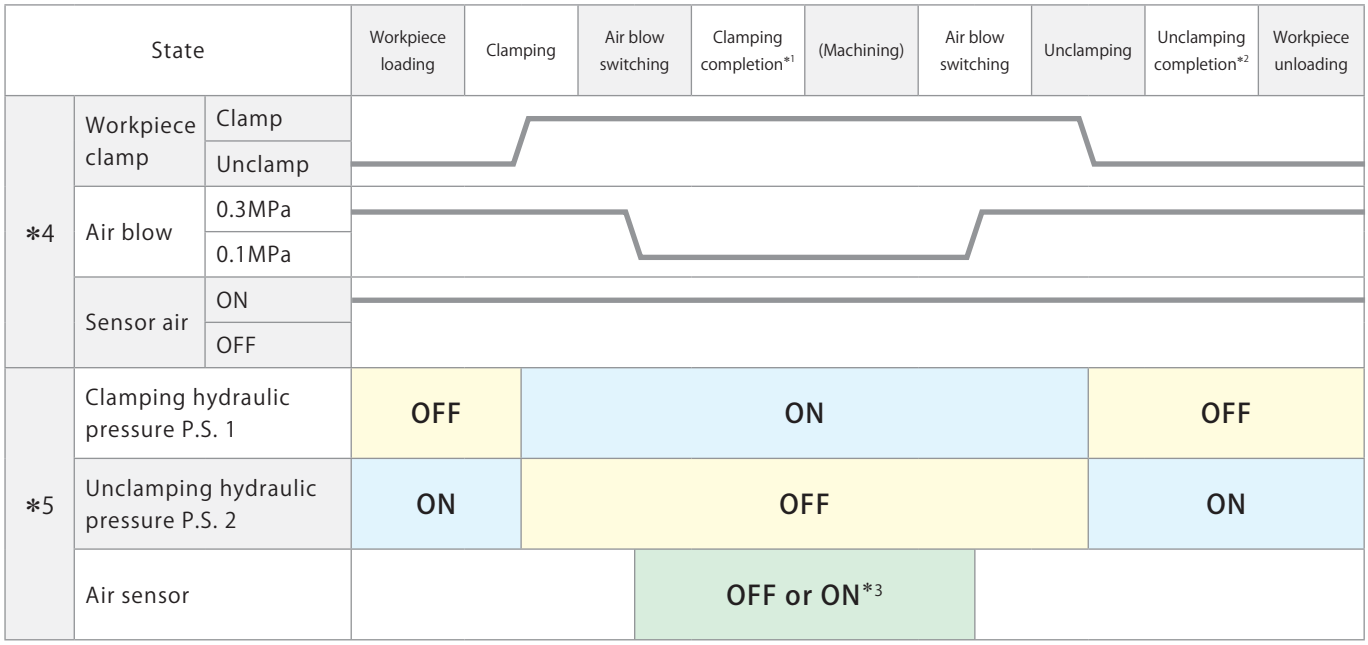
- Use a solenoid valve with needle for air sensor unit Ⓒ and control it supplying air all the time in order to eliminate intrusion of chips or coolant.

- 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

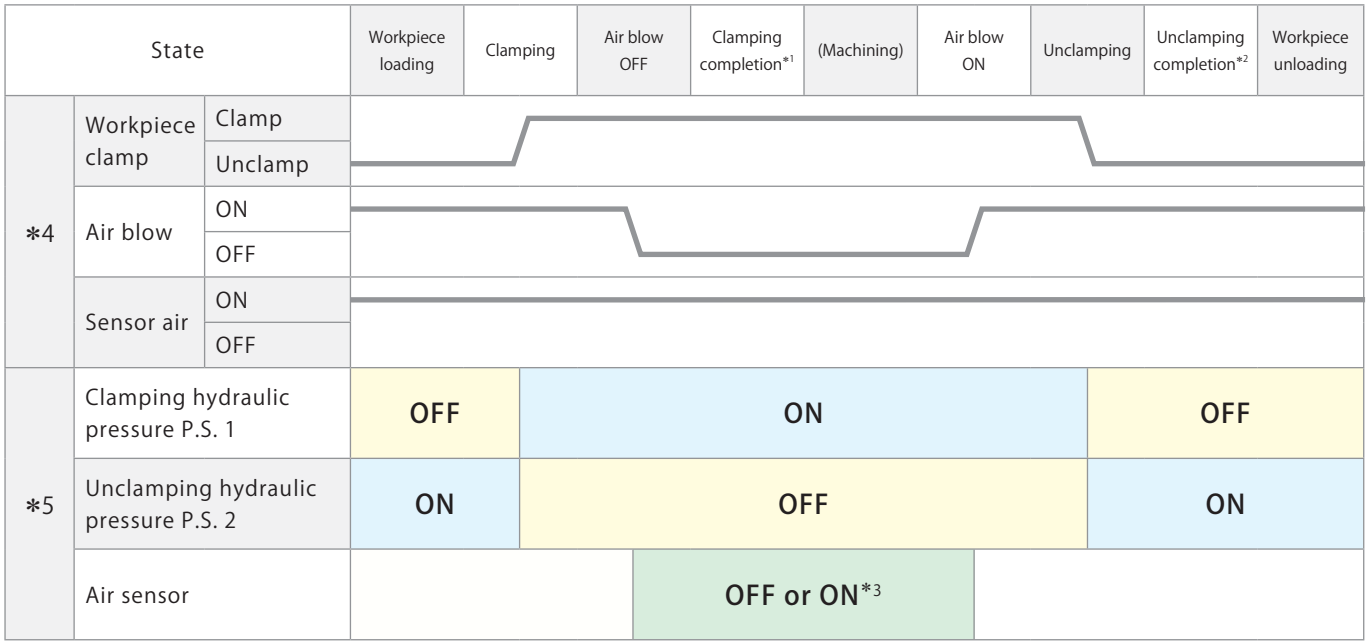
The clamp should be controlled with the cycle in the diagram shown below to detect the operation status exactly.

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

air Expansion clamp

Double acting 1MPa

model CGE

model CGE

Specifications

Grip inner diameter : Number of grippers

CGE — N22E

070 073 076 079 082 085 09 10 : 2 Grippers

11 12 13 : 3 Grippers

indicates made to order.

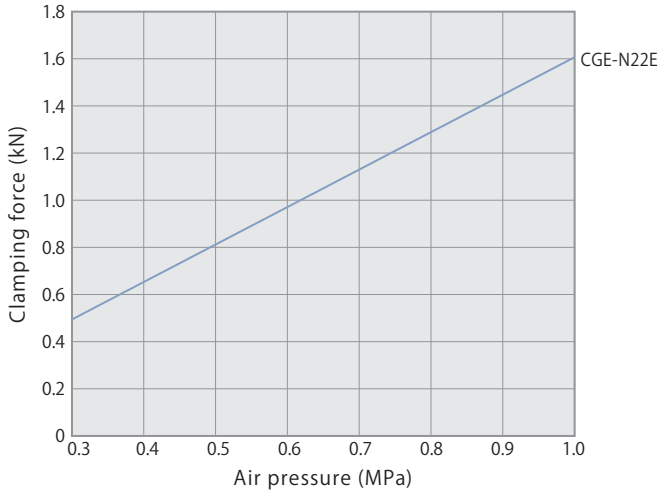
Model			CGE-N22E										
	Grip inner diameter		070	073	076	079	082	085	09	10	11	12	13
Number of grippers			2 Grippers								3 Grippers		
Clamping force (air pressure 0.5MPa)		kN	0.81										
Radial expansion force (air pressure 0.5MPa)		kN	2.81					2.52					
Taper rod stroke		mm	4.8										
Clamp stroke		mm	1.2										
Cylinder capacity	Clamp	cm^3	8.7										
	Unclamp	cm^3	9.7										
Allowable eccentricity*1		mm	±0.5										
Recommended air blow pressure		MPa	0.3										
Recommended sensor air pressure		MPa	0.2										
Mass		kg	0.74					0.75					
Recommended tightening torque of mounting screws*2		N·m	7										
Workpiece material			Aluminum, steel and others (HRC25 or below). Cast iron are not usable.										
Allowable min. grip inner diameter		mm	6.7	7.0	7.3	7.6	7.9	8.2	8.7	9.7	10.7	11.7	12.7
Allowable max. grip inner diameter		mm	7.4	7.7	8.0	8.3	8.6	9.2	9.7	10.7	11.7	12.7	13.7
Grip inner diameter tapering angle (Draft angle)			3° or below										
Grip inner diameter circularity			0.1 or below										

● Pressure range : 0.3–1 MPa ● Proof pressure : 1.5 MPa ● Operating temperature : 0–70 ℃ ● Fluid used : Air

● Please inquire if above terms are not applied.

*1 : By the eccentric mechanism, the expansion clamp does not have a workpiece positioning function. *2 : ISO R898 class 12.9

Clamping force & air pressure



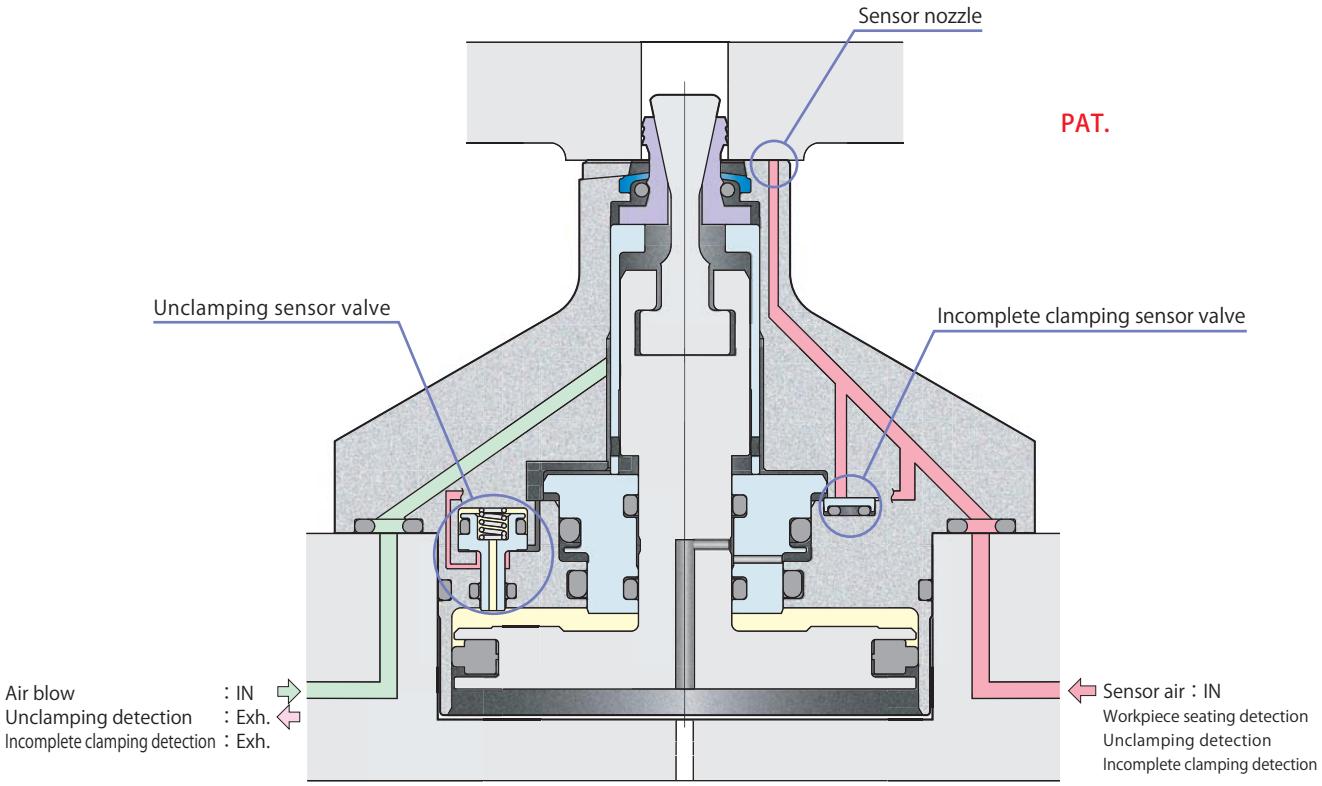
Air pressure	MPa	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Clamping force F=1.617×P	kN	0.49	0.65	0.81	0.97	1.13	1.29	1.46	1.62

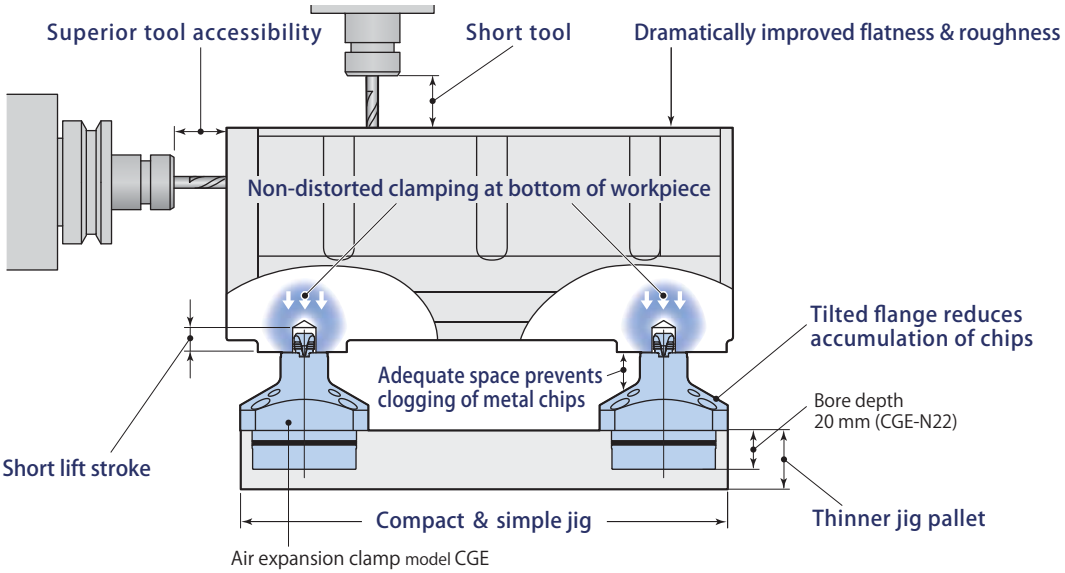
P : Air pressure (MPa)

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

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

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

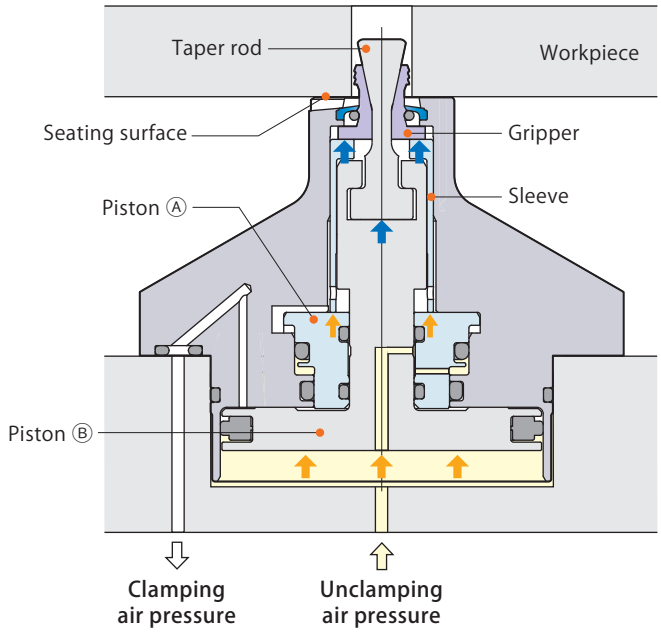




Workpiece setting

① Taper rod and gripper are raised by pistons Ⓐ, Ⓑ and sleeve. The gripper is drawn inward within the taper rod diameter.

② Set the workpiece onto the seating surface.

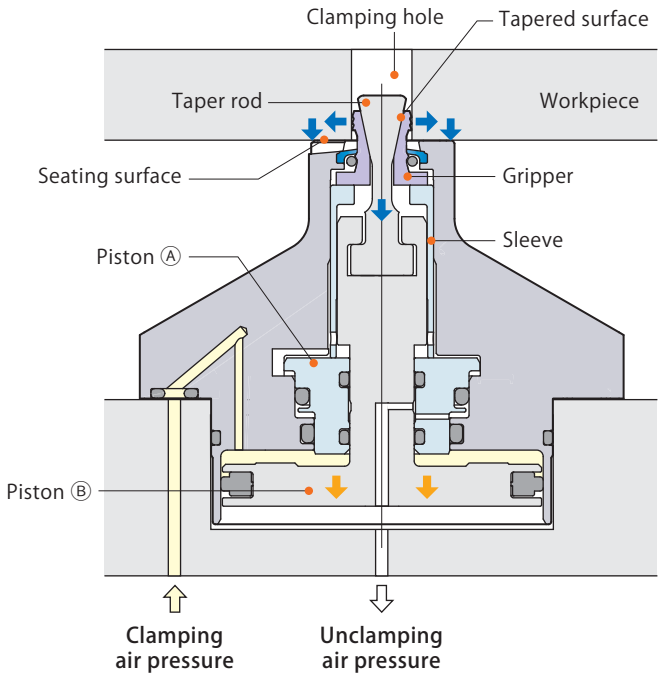


Workpiece holding

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

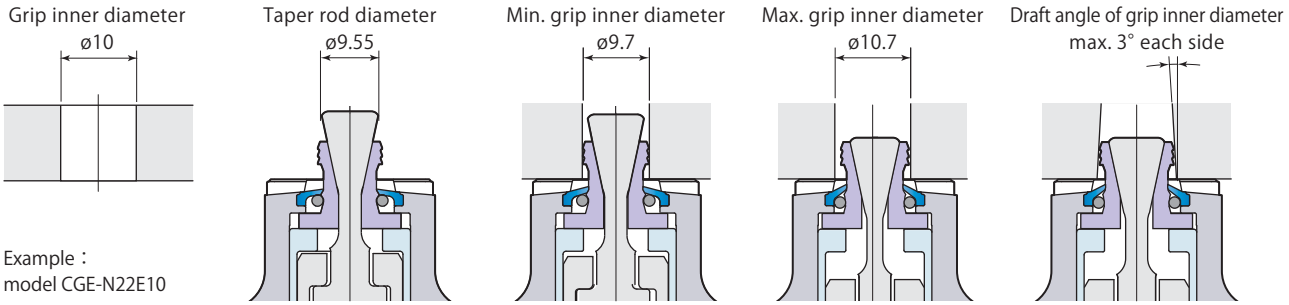
② The gripper expands horizontally along the tapered surface to grip inner face of clamping hole holding its position at upper stroke end by piston Ⓐ and sleeve.

③ The gripper securely grips the inner face of clamping hole and pulls the workpiece down firmly onto the seating surface.



Large gripper expansion stroke

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



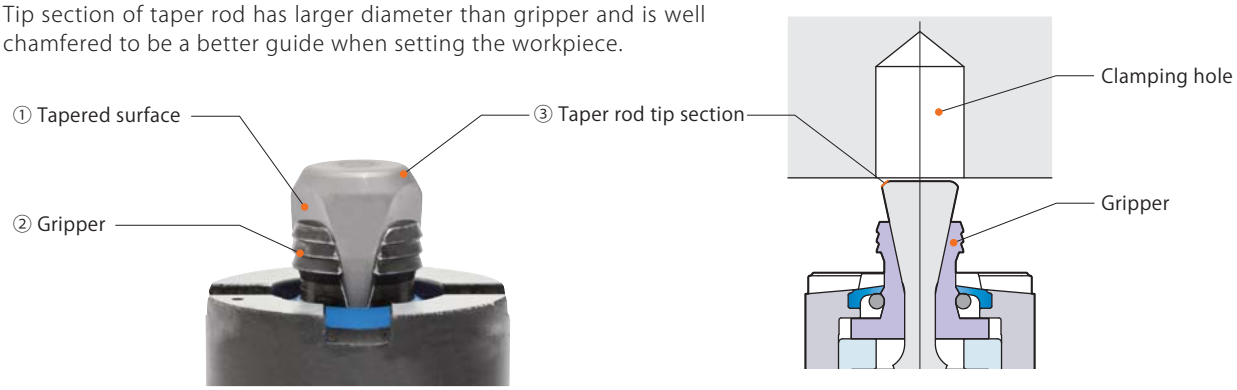
∗ : 0.7mm stroke for CGE-N22E070, 073, 076, 079, 082

Taper rod and gripper with superior durability

① The holding force of expansion clamp is transmitted from tapered surface to gripper, making it possible for the gripper to hold onto inner face of clamping hole and hold the workpiece on the seating surface for secure workpiece clamping.

② Special steel with superior abrasion resistance is used for gripper to improve durability.

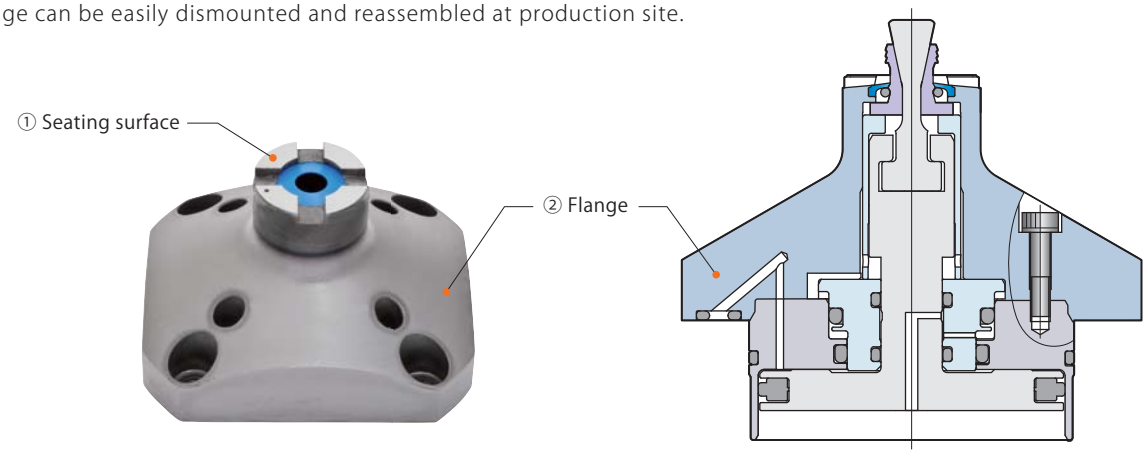
③ Tip section of taper rod has larger diameter than gripper and is well chamfered to be a better guide when setting the workpiece.



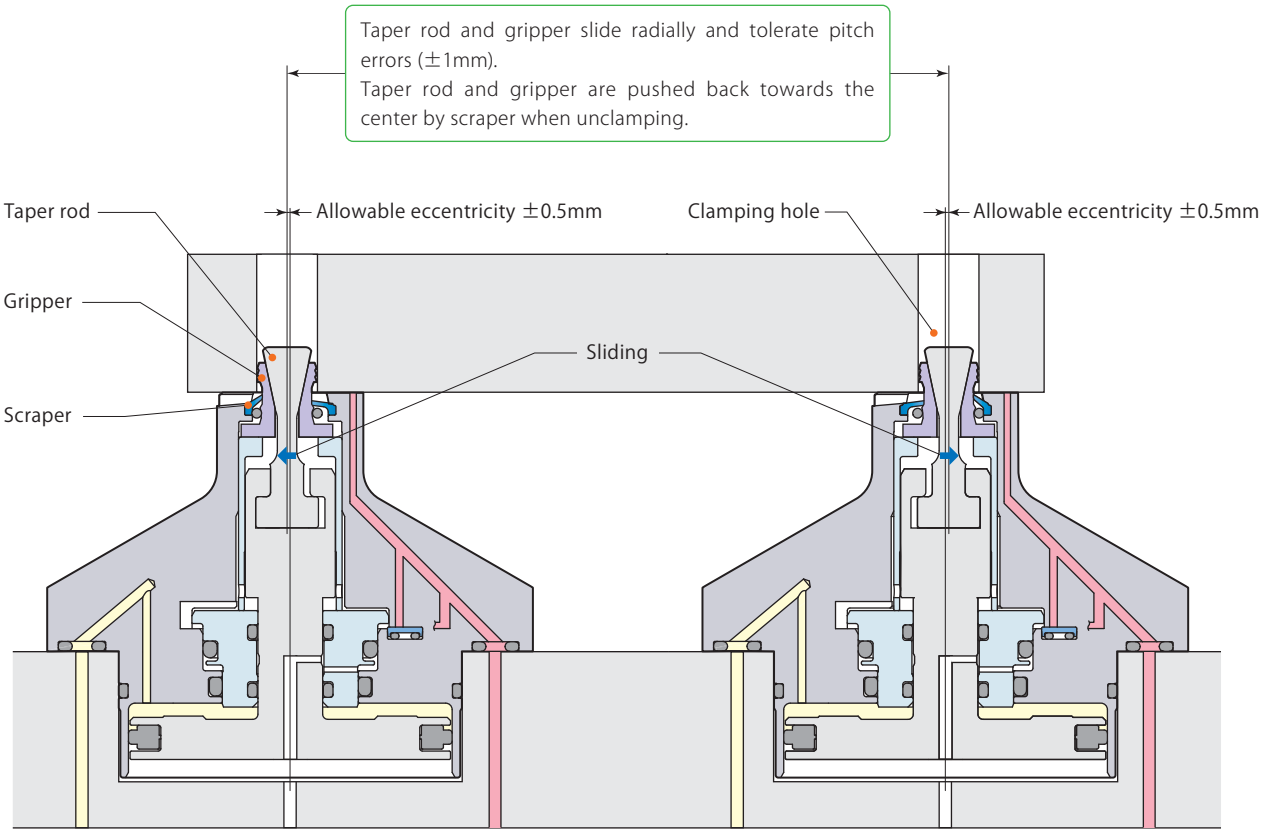
Seating surface can be reground (Max. 0.1 mm)

① When seating surface is damaged, the flange section can be dismounted and reground.

② Flange can be easily dismounted and reassembled at production site.



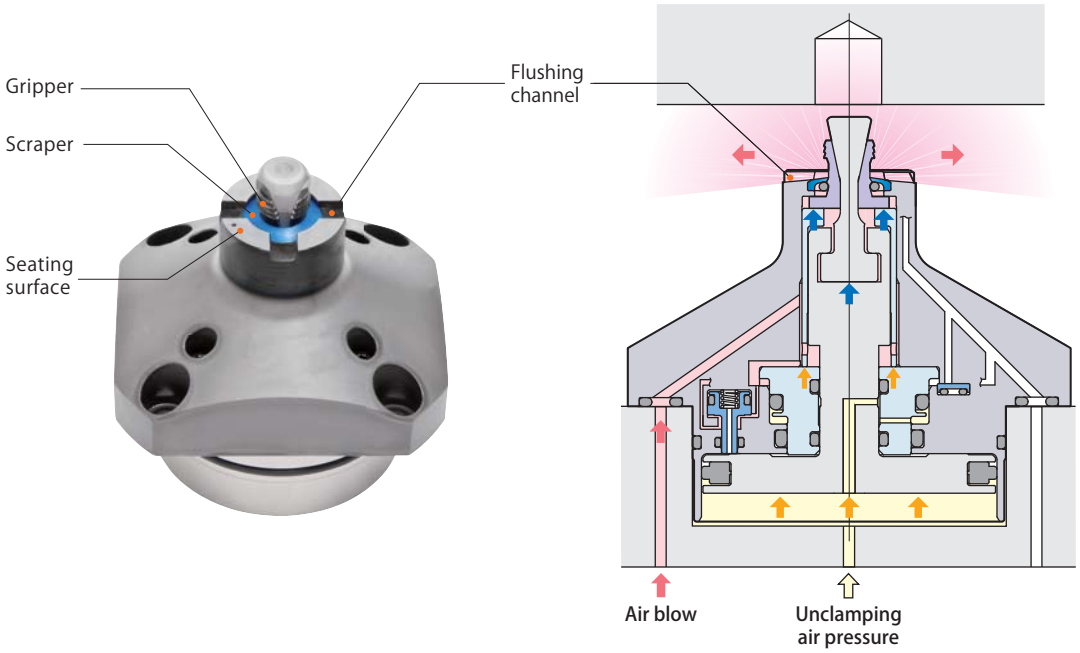
Clamping hole pitch errors can be tolerated



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

Incorporating strong air blowing circuit

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



Sensor nozzle detects faulty seating of workpiece

If clamping operation is made when metal chips are under the workpiece (Figure 1-a), or when the workpiece is set 1.2mm and over above the seating surface due to its distortion (Figure 1-b), the workpiece cannot sit fully on the surface and air is exhausted from the sensor nozzle. Incomplete workpiece seating is detected.

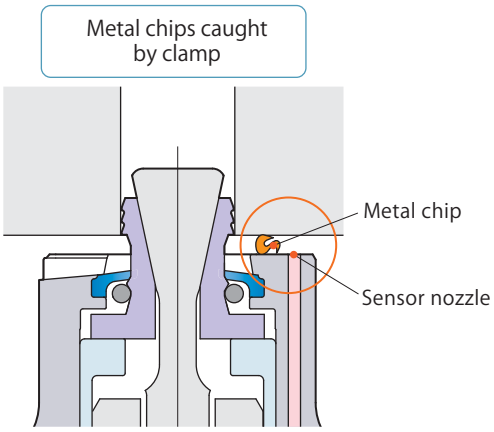


Figure 1-a

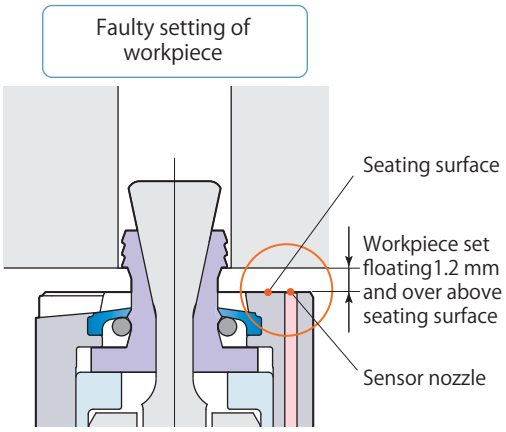
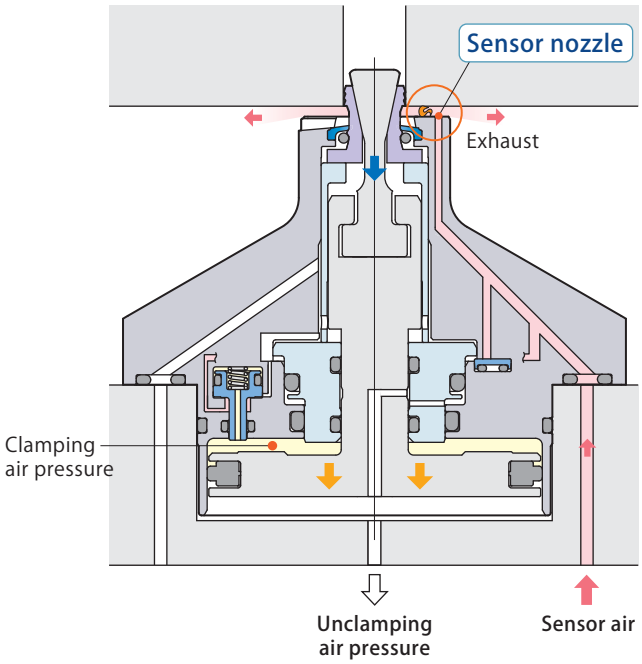


Figure 1-b

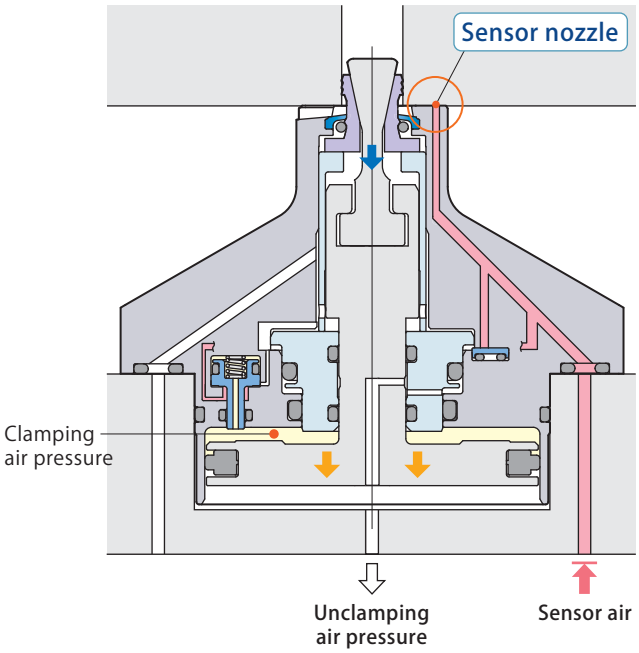
Faulty seating of workpiece

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

Incomplete clamping sensor valve detects incomplete clamping

PAT. JP4297511
US8246029
EP2253419

When gripper fails to grip properly due to large draft angle of grip inner diameter (Figure 2-a), incomplete clamping sensor valve is opened. Sensor air is exhausted and this detects incomplete clamping.
When clamping hole exceeds tolerance value (Figure 2-b), or when gripper is broken (Figure 2-c), incomplete clamping is detected as well.

Large draft angle of grip inner diameter

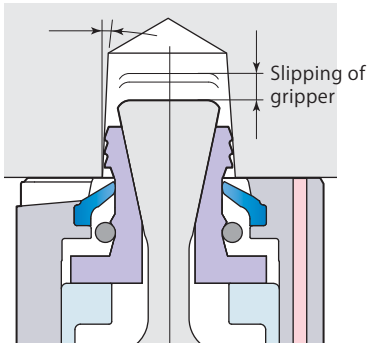


Figure 2-a

Clamping hole is large (Full stroke)

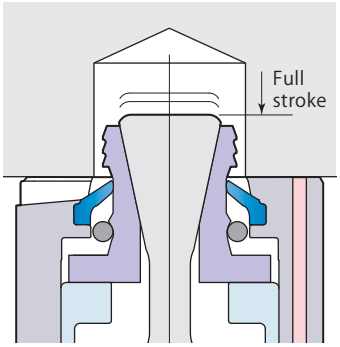


Figure 2-b

If gripper is broken

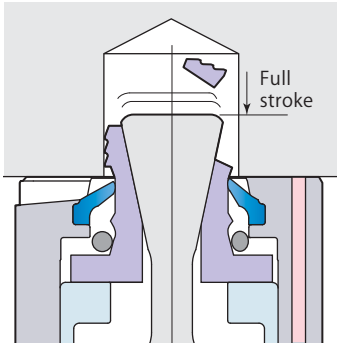
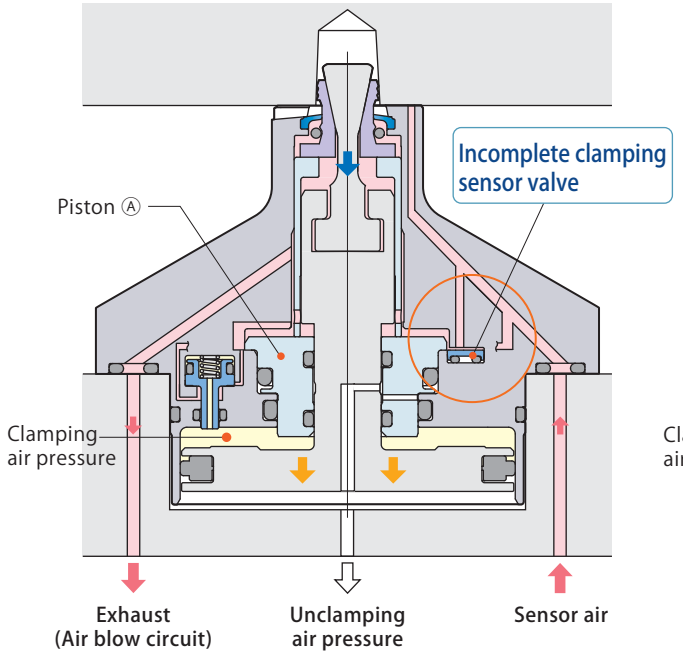


Figure 2-c

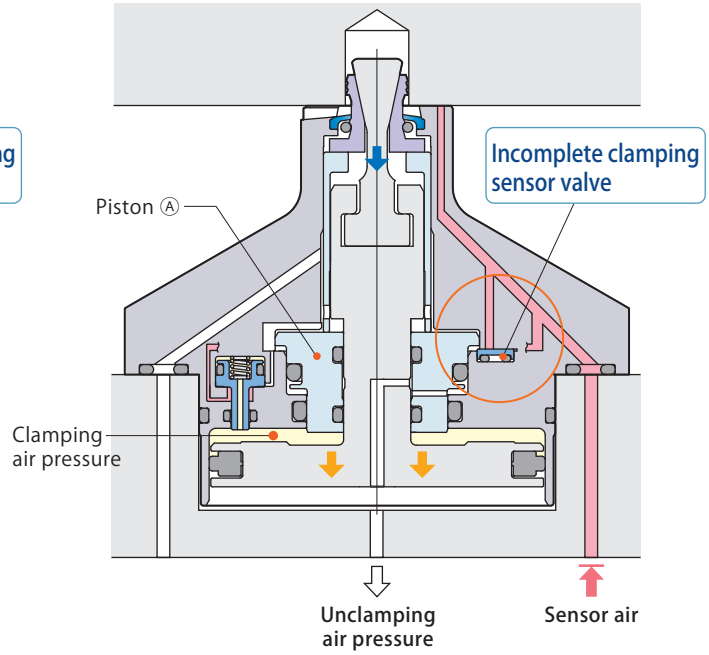
Incomplete clamping

Incomplete clamping sensor valve is opened by piston Ⓐ, sensor air is exhausted. Air sensor is not triggered and this detects incomplete clamping.



Clamping completion

Incomplete clamping sensor valve remains closed. Air sensor detects normal clamping completion.



Clamp condition	Incomplete clamping sensor valve	Air sensor signal	Air pressure switch
Incomplete clamping	Open	**Air sensor OFF** (Sensor air flows.)	Clamping air pressure **ON**

Unclamping sensor valve detects unclamping operation is complete

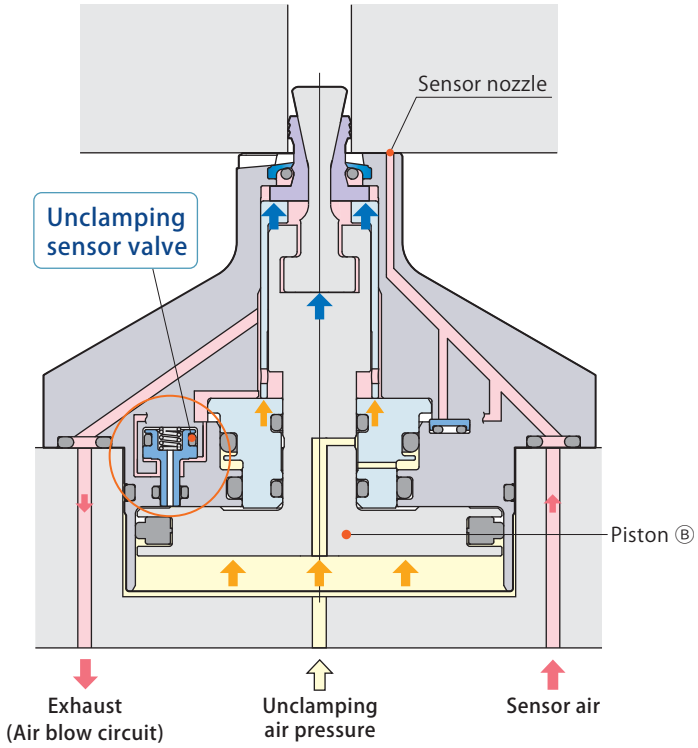
Unclamping sensor valve enables sensor to detect unclamping completion. The valve opens to exhaust sensor air even when the workpiece blocks the sensor nozzle.

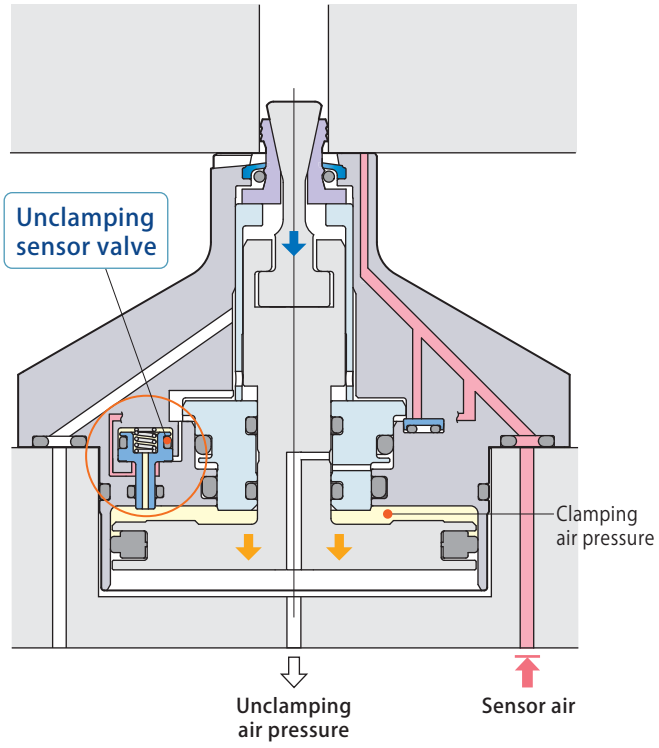
Unclamping completion

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

Clamping completion

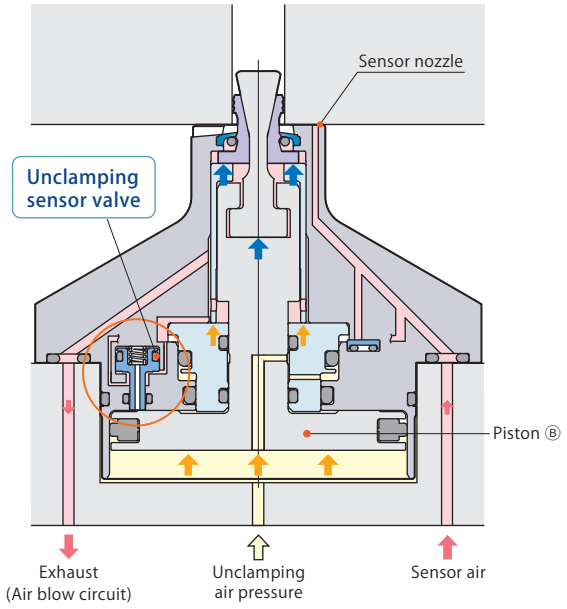
Unclamping sensor valve is closed by clamping air pressure. Air sensor detects normal clamping completion.



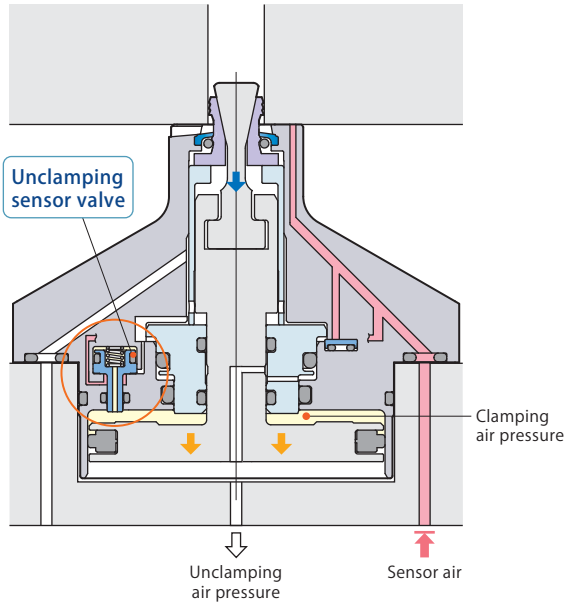


Clamp condition	Unclamping sensor valve	Air sensor signal	Air pressure switch
Unclamping completion	Open	Air sensor OFF (Sensor air flows.)	Unclamping air pressure ON
Clamping completion	Close	Air sensor ON (Sensor air does not flow.)	Clamping air pressure ON

Unclamping completion

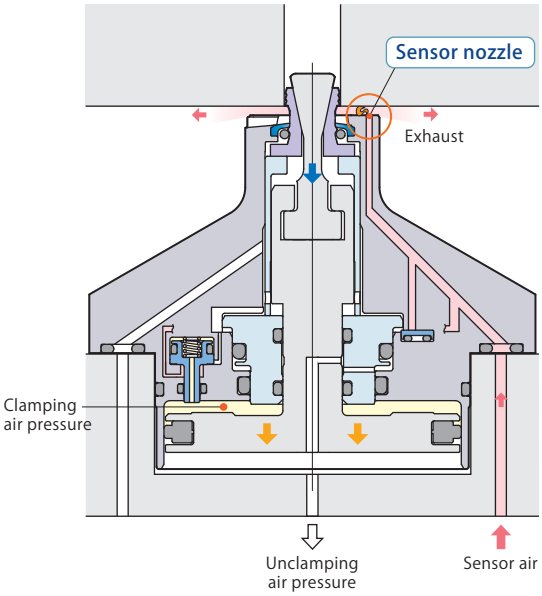


Clamping completion

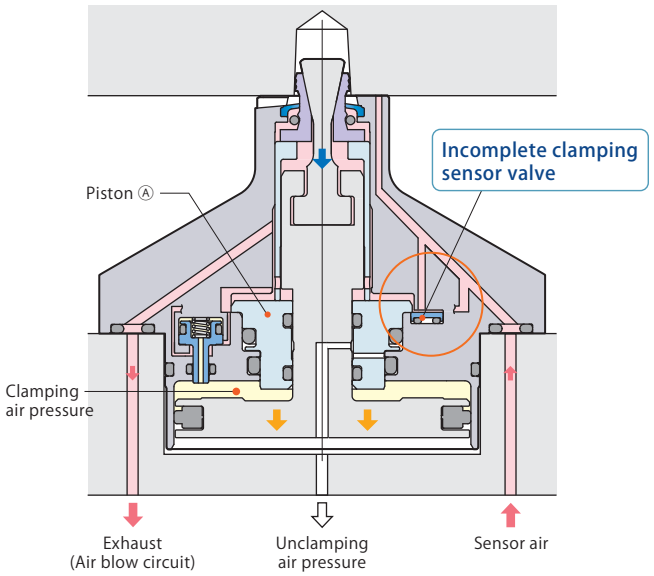


Clamp condition	Sensor nozzle	Incomplete clamping sensor valve	Unclamping sensor valve	Air sensor signal	Air pressure switch
Unclamping completion	Close	Close	Open	Air sensor OFF (Sensor air flows.)	Unclamping air pressure ON
Clamping completion	Close	Close	Close	Air sensor ON (Sensor air does not flow.)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

Faulty seating of workpiece



Incomplete clamping

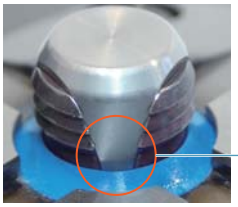


Clamp condition	Sensor nozzle	Incomplete clamping sensor valve	Unclamping sensor valve	Air sensor signal	Air pressure switch
Faulty seating of workpiece	Open	Close	Close	Air sensor OFF (Sensor air flows.)	Clamping air pressure ON
Incomplete clamping	Close	Open	Close	Air sensor OFF (Sensor air flows.)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

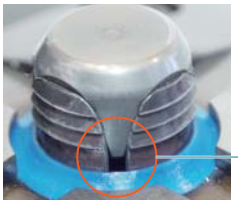
Non-constant air blow model considerably reduces air consumption

PAT. JP5674191
US8800982
EP2543468

The newly developed non-constant air blow model has no open space between a scraper, a gripper and a rod thereby no air blow during machining is required to prevent chips intrusion.
The air blow model (See picture on the right), which requires constant air blow during machining, used to consume constantly 50 L/min (0.3MPa) of air for 12mm of grip inner diameter, however, the new model requires air blow only when the clamp is in clamp and unclamp action, and when workpiece replacement.
This enables significant reduction of air consumption, which helps promote energy conservation.



2 Grippers, 3 Grippers
Non-constant air blow model
Open space where metal chips can intrude is removed during clamping.



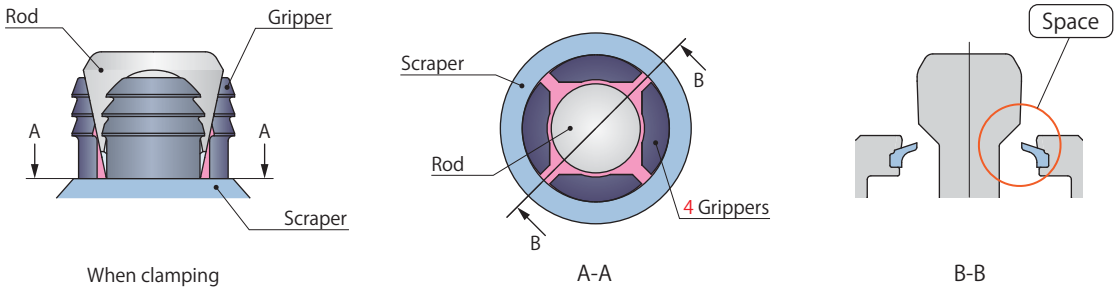
4 Grippers (Old model)
Air blow model
Open space where metal chips can intrude is created during clamping.

Non-constant air blow model

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

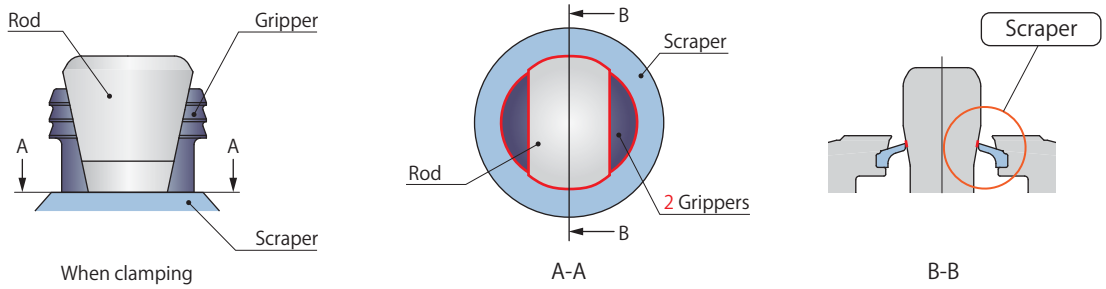
Number of grippers	Grip inner diameter	Clamping force	Model
3 Grippers	ø 11 12 13	0.81 kN (Air pressure 0.5MPa)	CGE-N22E Grip inner diameter

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



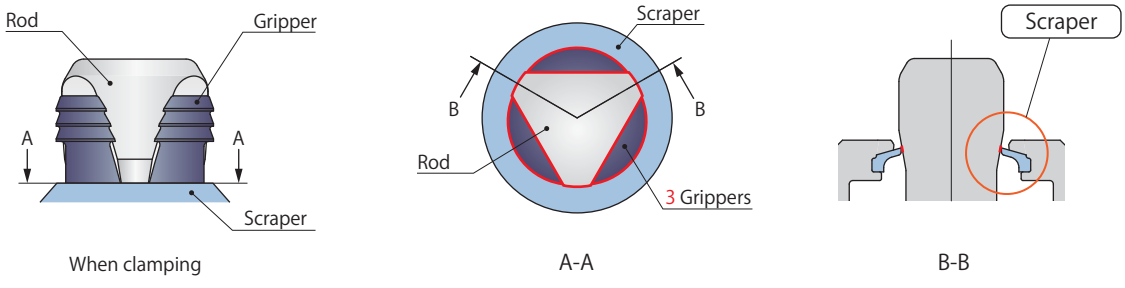
Because of space between scraper, gripper and the rod, air blow must always be performed to prevent intrusion of chips.

Secure chip protection



Pages →102–105

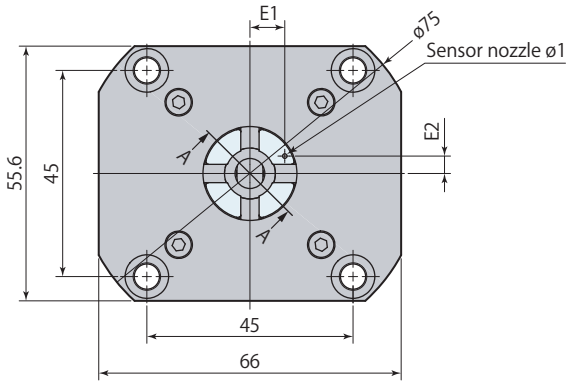
Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.

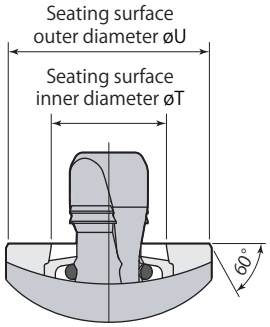


Pages →106, 107

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

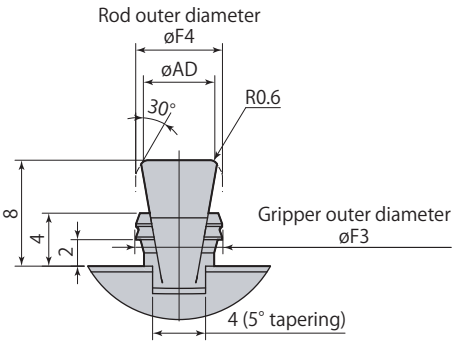
Dimensions

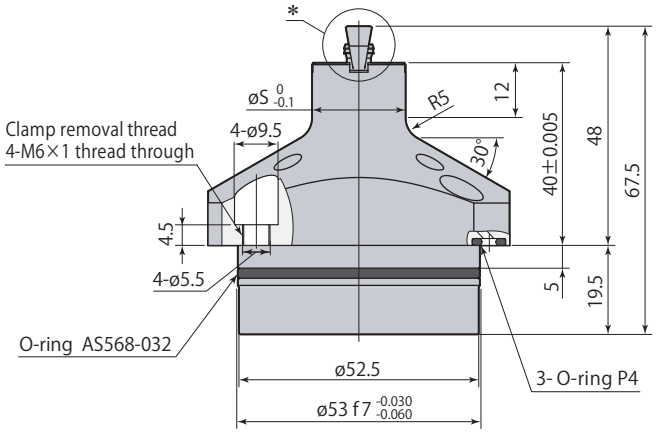




A-A

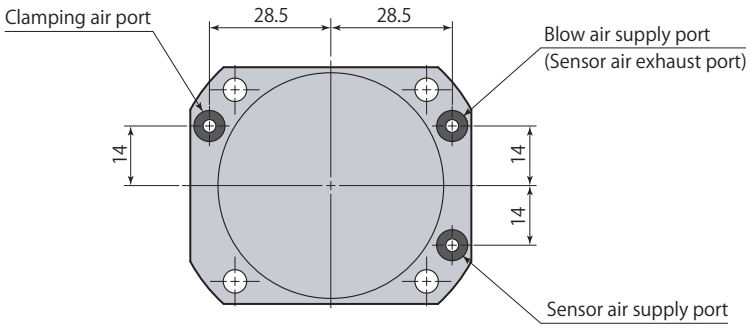
✻Details





Grip inner diameter usage requirements

Blind hole　　Through hole



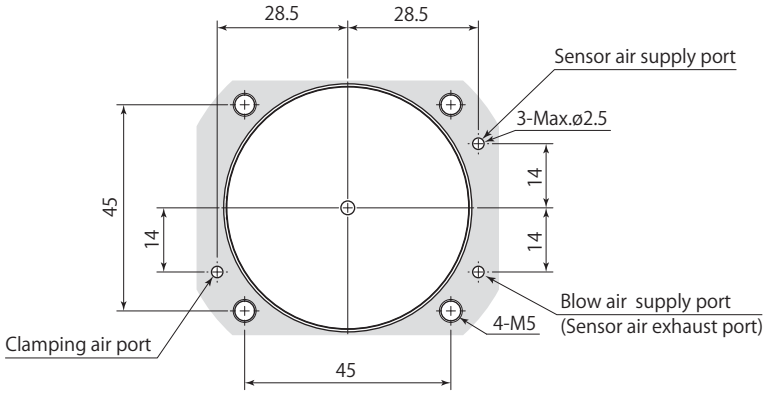
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

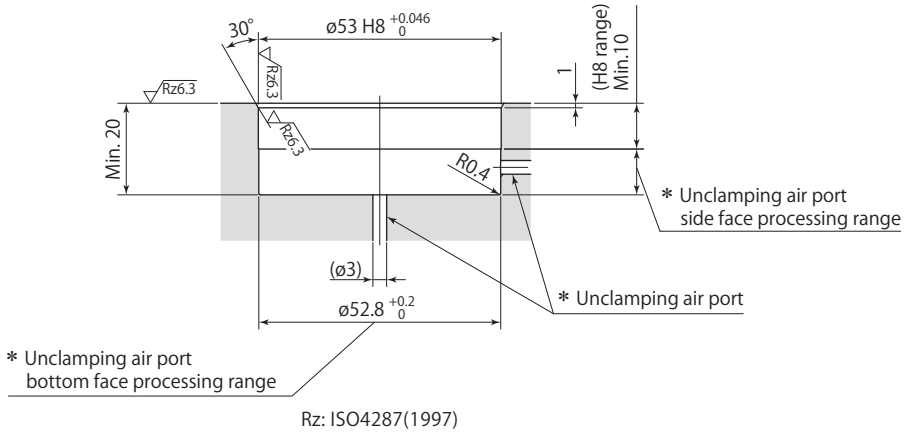
mm

Model	CGE-N22E□				
	070	073	076	079	082
E1	7.6	7.7	7.8	7.9	8.1
E2	3.8	3.8	3.8	3.9	4
øF3	6.5	6.8	7.1	7.4	7.7
øF4	6.55	6.85	7.15	7.45	7.75
øS	20.5	20.6	20.9	21.2	21.5
øT	10.6	10.9	11.2	11.5	11.8
øU	20	20.1	20.4	20.7	21
øAD	5.4	5.7	6	6.3	6.6

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

Mounting details



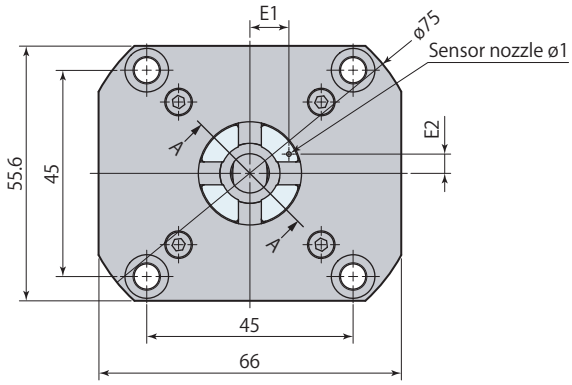


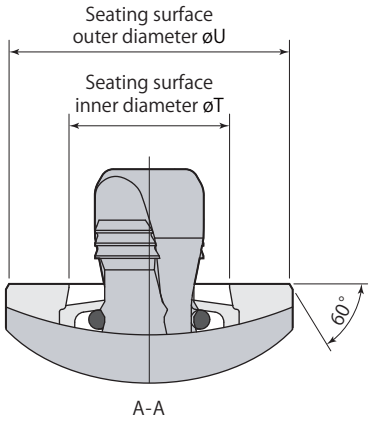
Rz: ISO4287(1997)

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

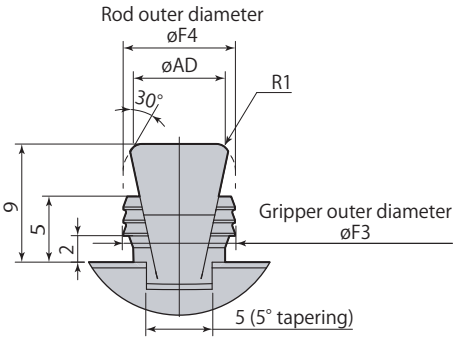
- Apply an appropriate amount of grease to the chamfer and the bore when mounting.
  Excessive grease may be a blockage in the air passage, causing malfunction of the sensor.
- The 30° taper machining must be provided to avoid the damage of the O-ring.

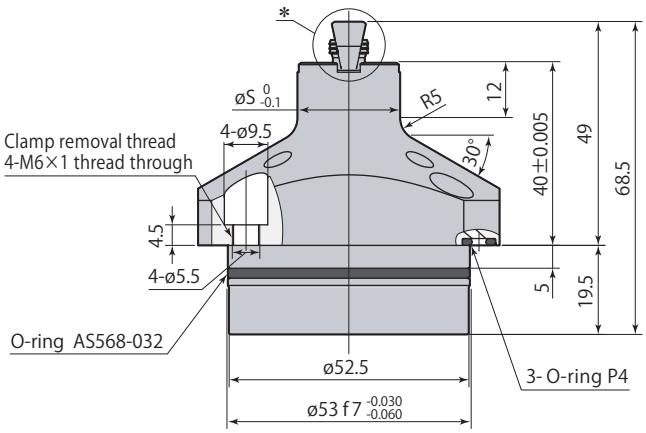
Dimensions



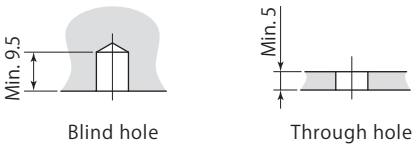


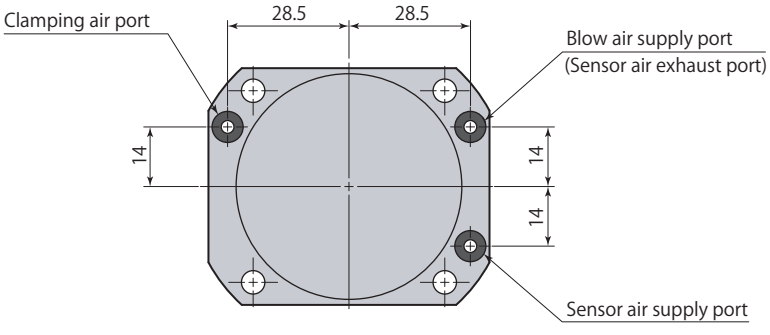
✻Details





Grip inner diameter usage requirements





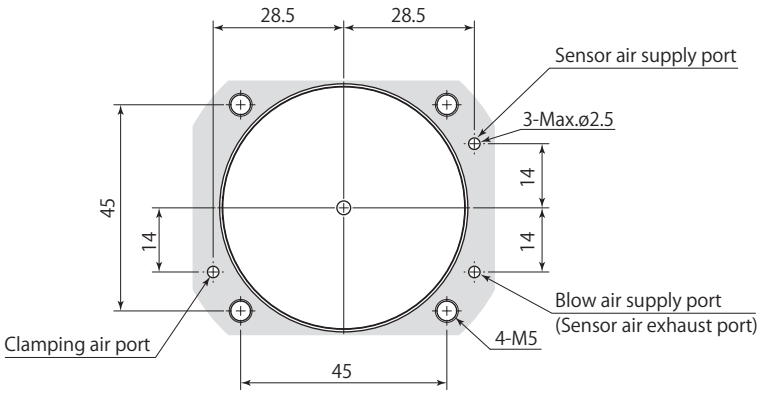
mm

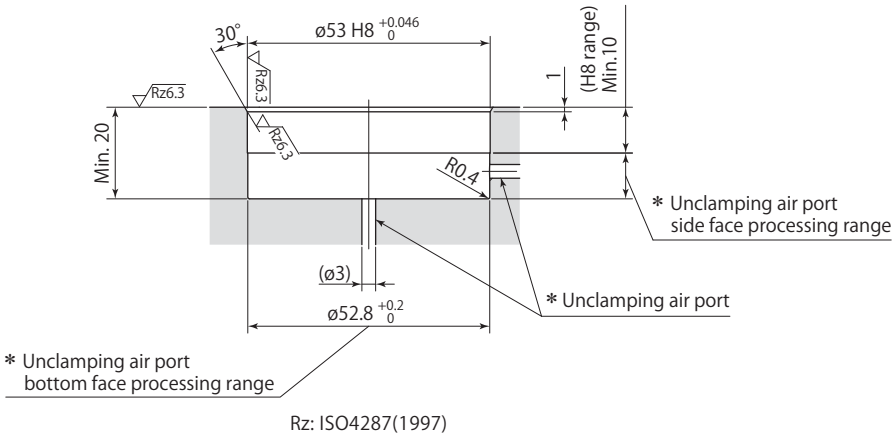
Model	CGE-N22E□		
	085	09	10
E1	8.5	8.5	9
E2	4.2	4.2	4.4
øF3	8	8.5	9.5
øF4	8.05	8.55	9.55
øS	22.5	22.5	23.5
øT	12.1	12.6	13.6
øU	22	22	23
øAD	6.3	6.8	7.8

- 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.

- CGE-N22E085, 09, 10 are made to order.

Mounting details



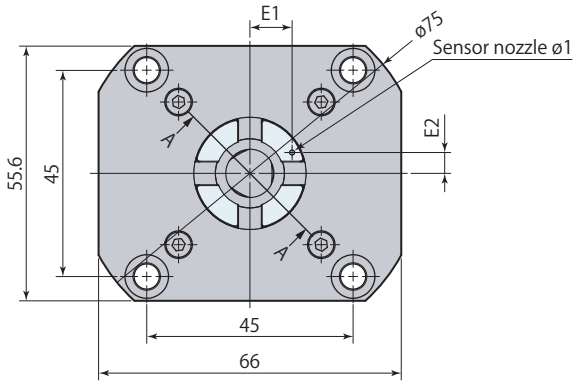


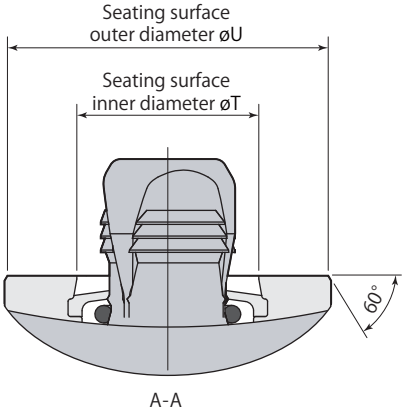
Rz: ISO4287(1997)

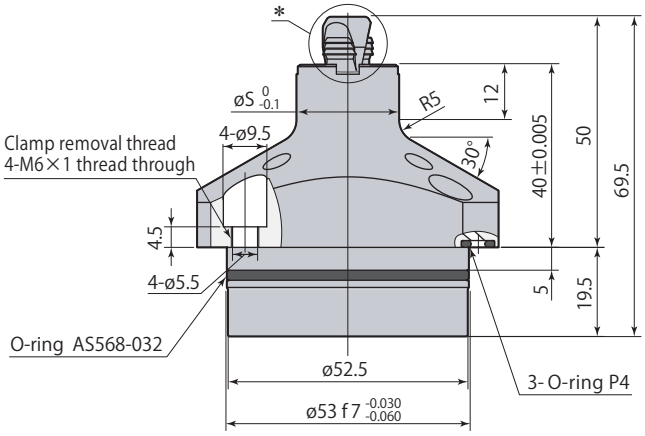
*: Unclamping air port must be made on either side or bottom face.

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

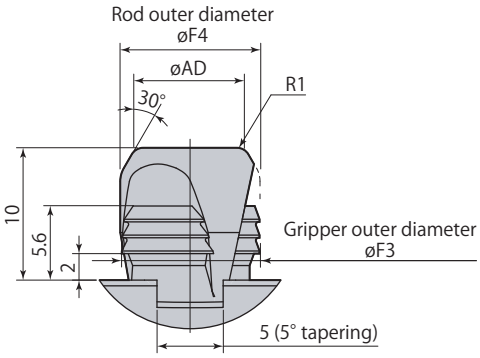
Dimensions



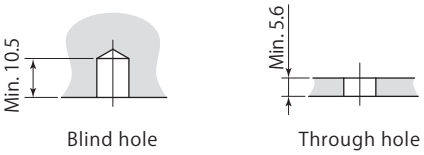


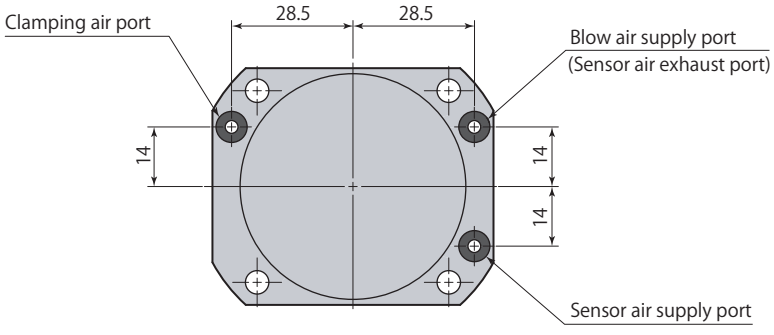


*Details



Grip inner diameter usage requirements





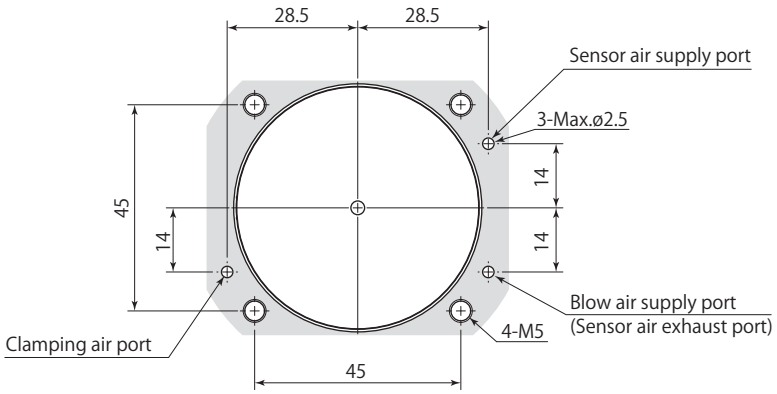
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

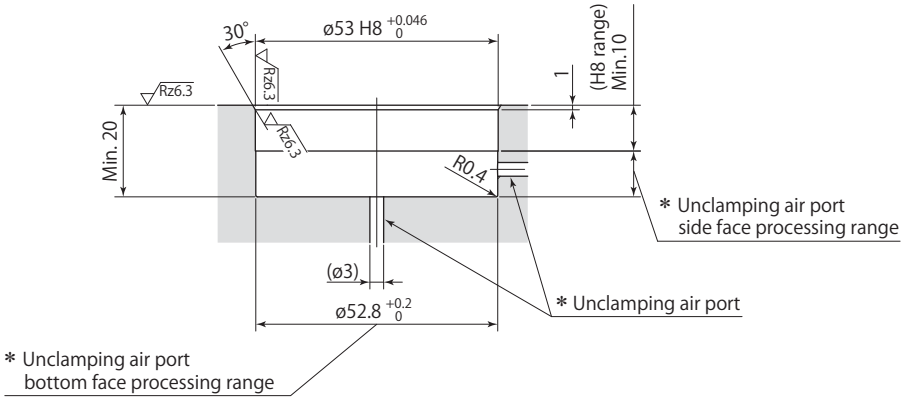
mm

Model	CGE-N22E□		
	11	12	13
E1	9.4	9.9	10.3
E2	4.6	4.8	5.1
øF3	10.5	11.5	12.5
øF4	10.55	11.55	12.55
øS	24.5	25.5	26.5
øT	14.6	15.6	16.6
øU	24	25	26
øAD	8.2	9.2	10.2

- CGE-N22E11, 12, 13 are made to order.

Mounting details



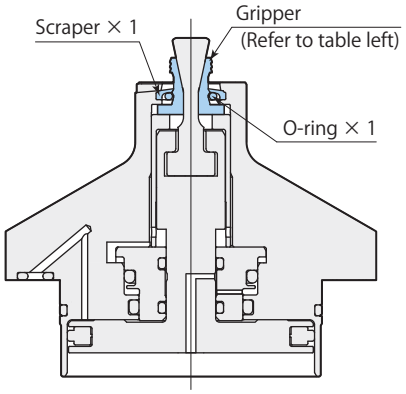


Rz: ISO4287(1997)

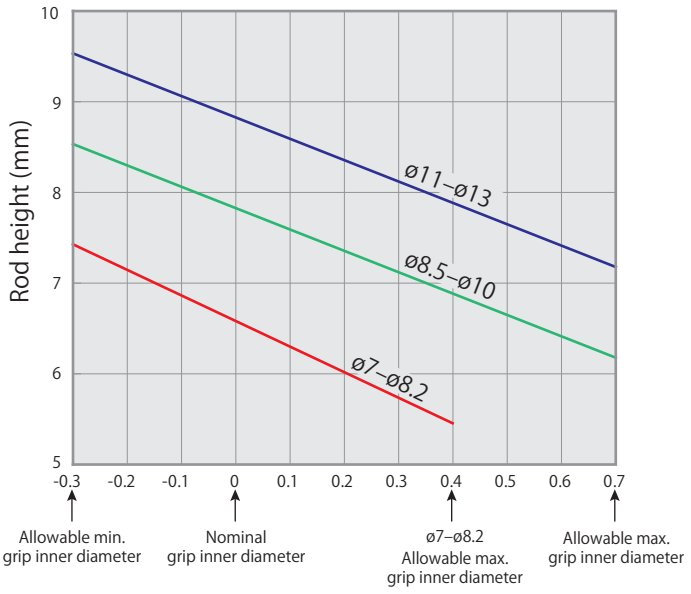
*: Unclamping air port must be made on either side or bottom face.

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

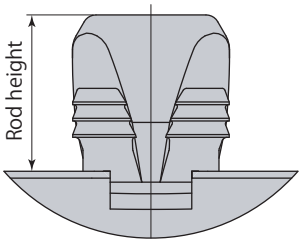
Gripper set replacement

Number of grippers	Gripper set model	Clamp model	Set description
2 Grippers	CGE-N22EJ070	CGE-N22E070	 It is recommended that grippers, scraper and O-ring be replaced after about 200,000 operations. Replace grippers in sets and not just an individual gripper. (Refer to the table on the left for the gripper set model.)
	CGE-N22EJ073	CGE-N22E073	
	CGE-N22EJ076	CGE-N22E076	
	CGE-N22EJ079	CGE-N22E079	
	CGE-N22EJ082	CGE-N22E082	
	CGE-N22EJ085	CGE-N22E085	
	CGE-N22EJ09	CGE-N22E09	
	CGE-N22EJ10	CGE-N22E10	
3 Grippers	CGE-N22EJ11	CGE-N22E11	
	CGE-N22EJ12	CGE-N22E12	
	CGE-N22EJ13	CGE-N22E13	

Grip inner diameter & rod height when clamping



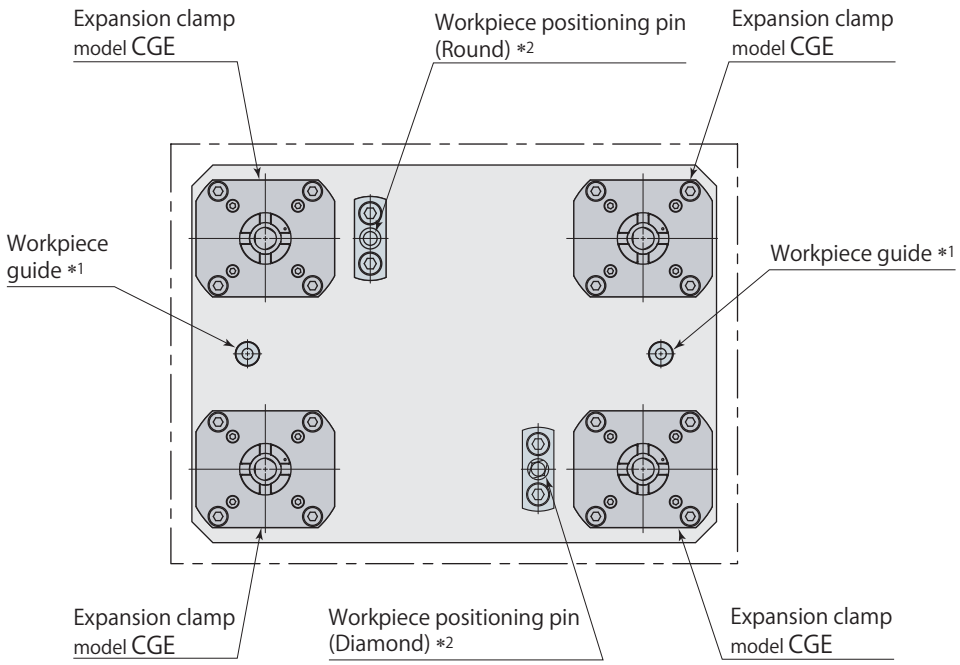
Difference between actual grip inner diameter and nominal grip diameter (mm)

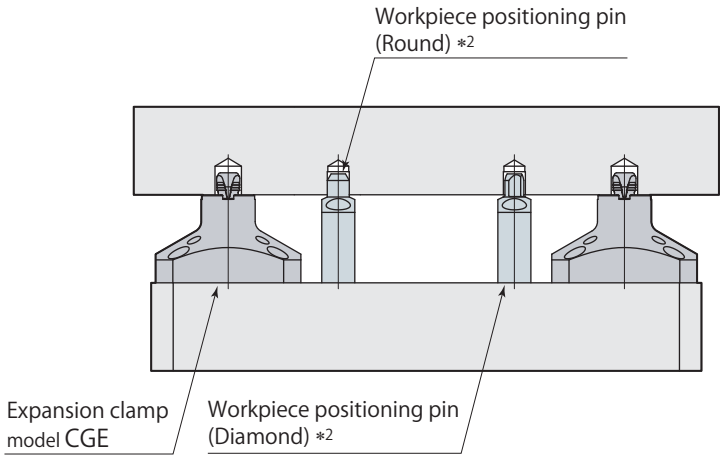


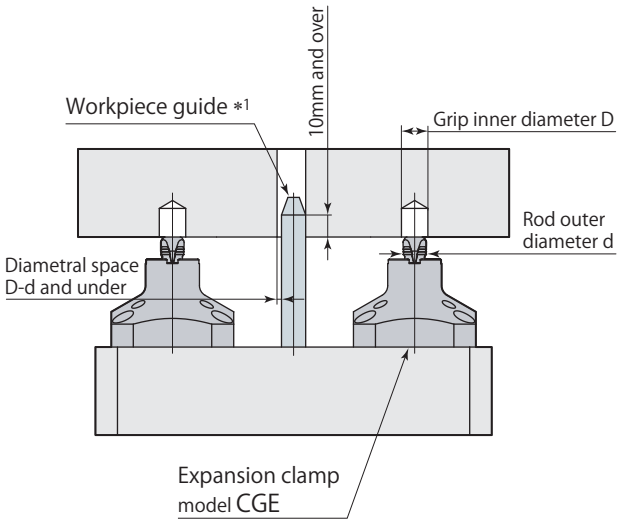
Rod height calculation formula	
ø7 – ø8.2	: 6.58-2.84× Actual grip inner diameter and nominal grip diameter difference
ø8.5 – ø10	: 7.82-2.35× Actual grip inner diameter and nominal grip diameter difference
ø11 – ø13	: 8.82-2.35× Actual grip inner diameter and nominal grip diameter difference

Example : When CGE-N22E10 (Nominal grip diameter : ø10) is clamping ø9.8 hole
Rod height = 7.82 - 2.35×(-0.2) = 8.29mm

System configuration example



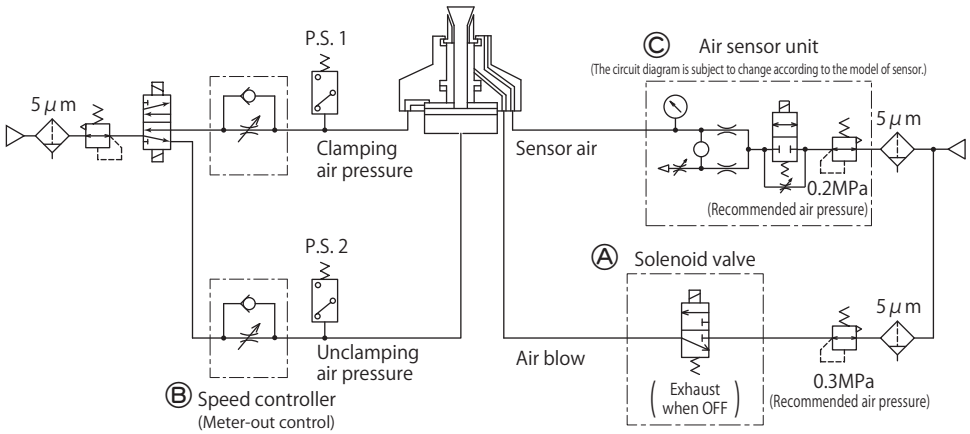




∗1: When using automatic or robotic conveyers, prevent damage to clamp caused from impact by setting workpiece guides. Using the above guide as reference, accurately position the holes when using workpiece guides.

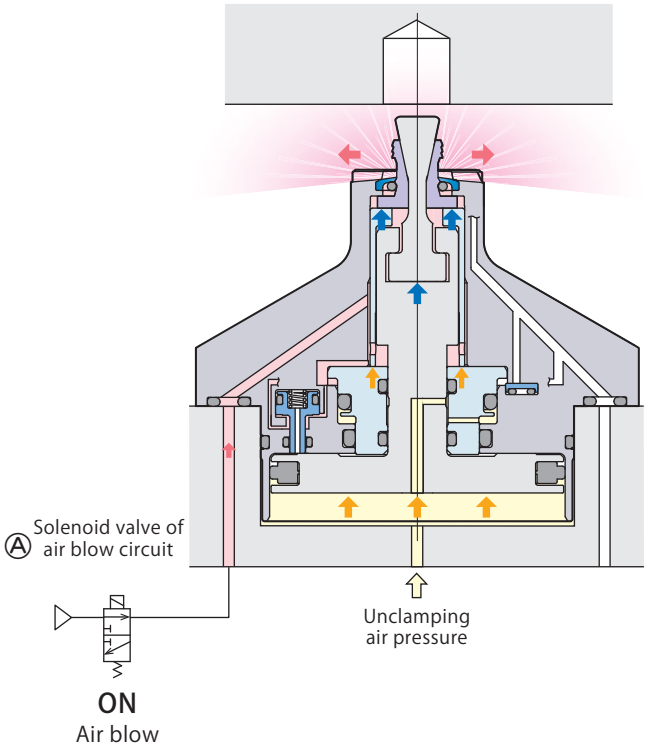
∗2: **The expansion clamp does not have a workpiece positioning function.**
Install workpiece positioning pins (or similar).

Pneumatic circuit diagram

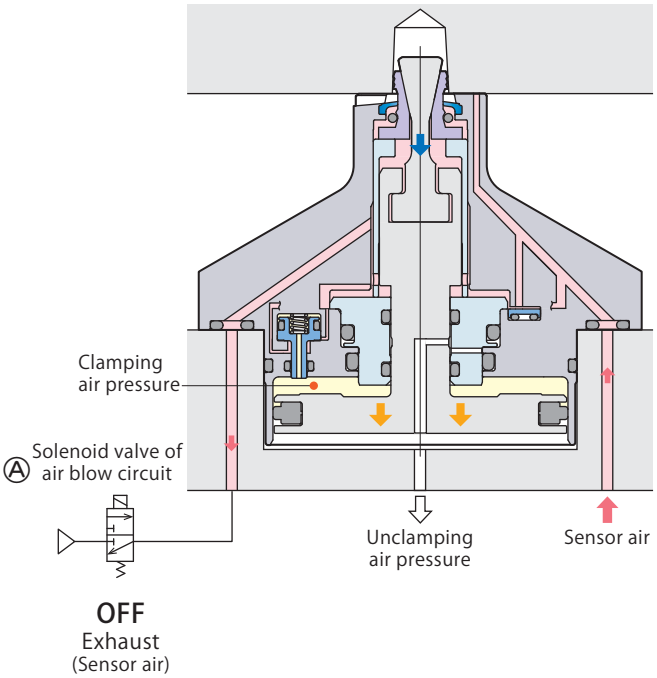


- Air blow will not be necessary during cutting process. Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping to remove metal chips and debris.
- The solenoid valve Ⓐ must be closed when checking the operation of the clamp with the air sensor. Also 3 port type of solenoid valve must be used in the circuit. If 2 port type of the valve is used, sensing air cannot be exhausted and misclamp detection function is disabled.

Air blowing

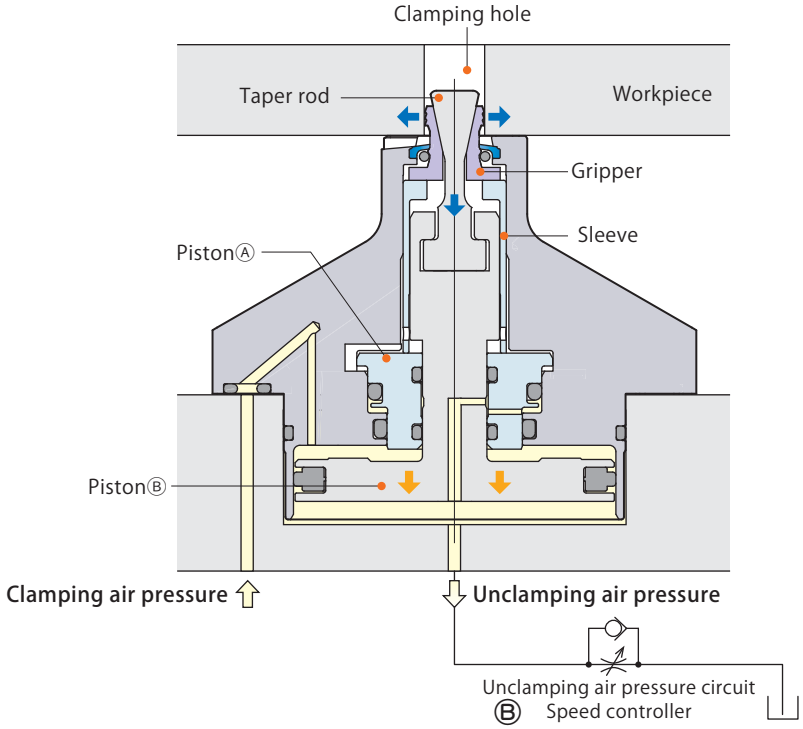


Incomplete clamping



- Operation speed must be adjusted by a meter-out type speed controller Ⓑ being provided in the unclamping circuit. By the adjustment, air flow in unclamping circuit is squeezed and back pressure is generated. The back pressure acts on the piston Ⓐ of the clamp and makes the gripper expand first then the taper rod strokes down to clamp. If meter-in type speed controller is installed in the circuit, it dumps the air rapidly and makes the gripper move very quick which causes incomplete clamping.

- Adjust air flow when clamping to have the taper rod full stroke in 0.3 sec or over.
  Excessive air flow to the clamp gives impact load and may cause breakage of the parts.



Air sensor unit Ⓒ recommended condition of use

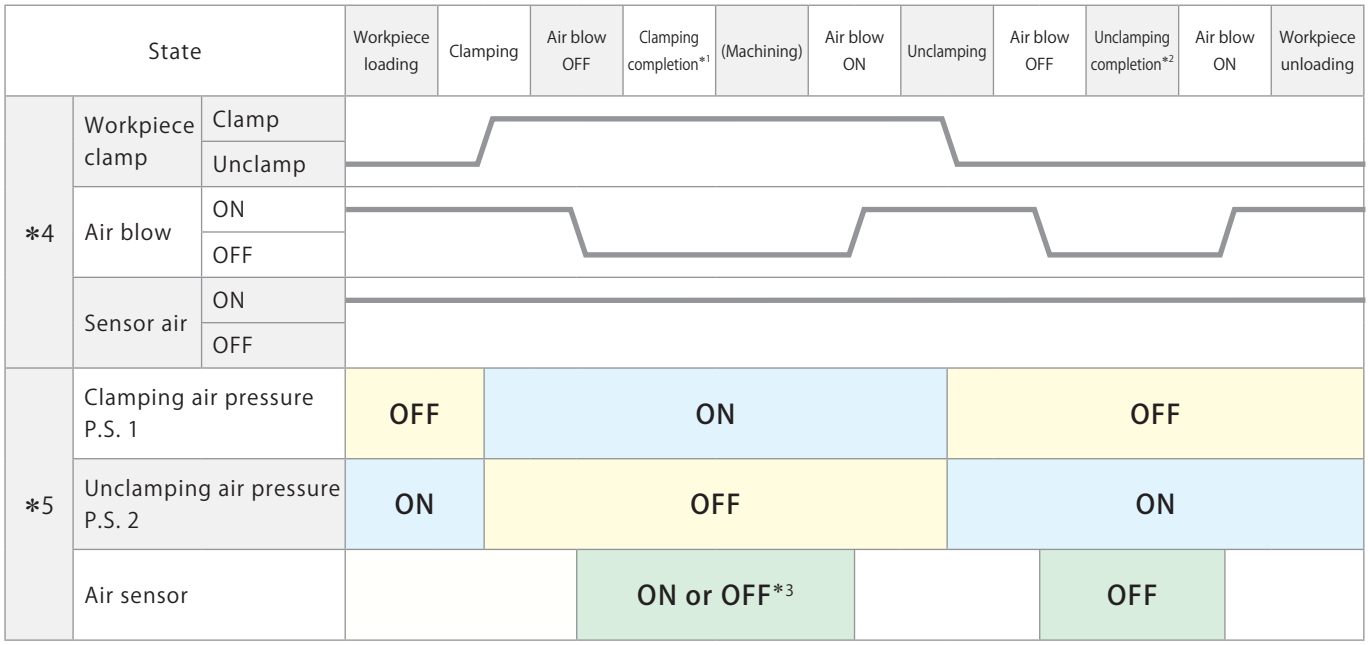
Supplier and model	ISA3-F/G series manufactured by SMC
	GPS2-05, GPS3-E series manufactured by CKD
Air supply pressure	0.2 MPa
Inner diameter of piping	ø4 mm (ISA3-F：ø2.5 mm)
Overall piping length	5 m or less

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

- There is a case that air sensing cannot be made successfully as designed when it is used out of the usage shown on the left. Contact Technical service center for more details.

Operation cycle

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



*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

air Expansion clamp

Double acting 1MPa

model CGY

model CGY

Specifications

CGY — F22

— : Air blow model

E : Non-constant air blow model

Grip inner diameter : Number of grippers

Grip inner diameter		
055 058 061 064 067 070A	: 2 Grippers	
070 073 076 079 082	: 2 Grippers	
085 09 10	: 2 Grippers	
11 12 13	: 3 Grippers	

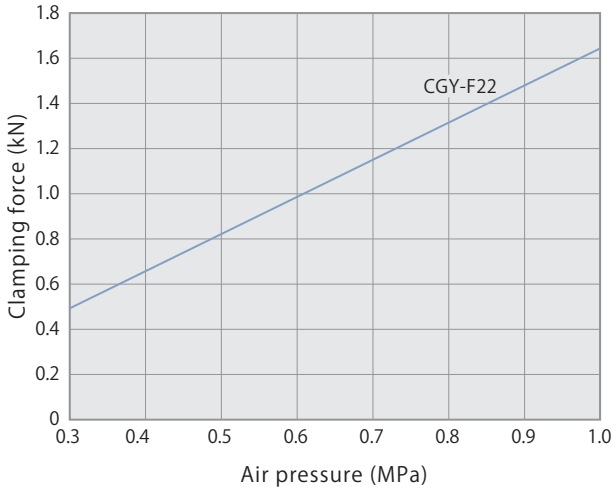
indicates made to order.

Model	Size		CGY-F22-						CGY-F22E										
	Grip inner diameter		055	058	061	064	067	070A	070	073	076	079	082	085	09	10	11	12	13
Number of grippers			2 Grippers														3 Grippers		
Clamping force (air pressure 0.5MPa)		kN	0.81																
Radial expansion force (air pressure 0.5MPa)		kN	2.52						2.81					2.52					
Taper rod stroke		mm	4.0						4.8										
Clamp stroke		mm	1.2																
Cylinder capacity	Clamp	cm^3	7.2						8.7										
	Unclamp	cm^3	8.1						9.7										
Allowable eccentricity*1		mm	±0.3						±0.4										
Recommended air blow pressure		MPa	0.3																
Recommended sensor air pressure		MPa	0.2																
Mass		kg	0.61						0.65					0.67			0.68		
Recommended tightening torque of mounting screws*2		N·m	7																
Workpiece material			Aluminum, steel and others (HRC25 or below). Cast iron are not usable.																
Allowable min. grip inner diameter		mm	5.2	5.5	5.8	6.1	6.4	6.7	6.7	7.0	7.3	7.6	7.9	8.2	8.7	9.7	10.7	11.7	12.7
Allowable max. grip inner diameter		mm	5.8	6.1	6.4	6.7	7.0	7.3	7.4	7.7	8.0	8.3	8.6	9.2	9.7	10.7	11.7	12.7	13.7
Grip inner diameter tapering angle (Draft angle)			3° or below																
Grip inner diameter circularity			0.1 or below																

- Pressure range : 0.3–1 MPa (CGY-F22-055, 058, 061, 064, 067, 070A : 0.3–0.8 MPa)
- Proof pressure : 1.5 MPa (CGY-F22-055, 058, 061, 064, 067, 070A : 1.2 MPa)
- Operating temperature : 0–70 ℃
- Fluid used : air
- Please inquire if above terms are not applied.

*1 : By the eccentric mechanism, the expansion clamp does not have a workpiece positioning function. *2 : ISO R898 class 12.9

Clamping force & air pressure



Air pressure	MPa	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Clamping force F=1.617×P	kN	0.49	0.65	0.81	0.97	1.13	1.29	1.46	1.62

P : Air pressure (MPa)

- CGY-F22-055, 058, 061, 064, 067, 070A applicable air pressure should be 0.3 to 0.8 MPa.

Air blow model

model **CGY-F22-**

2 Grippers

ø5.5 5.8 6.1 6.4 6.7 7.0

Non-constant air blow model

model **CGY-F22E**

2 Grippers

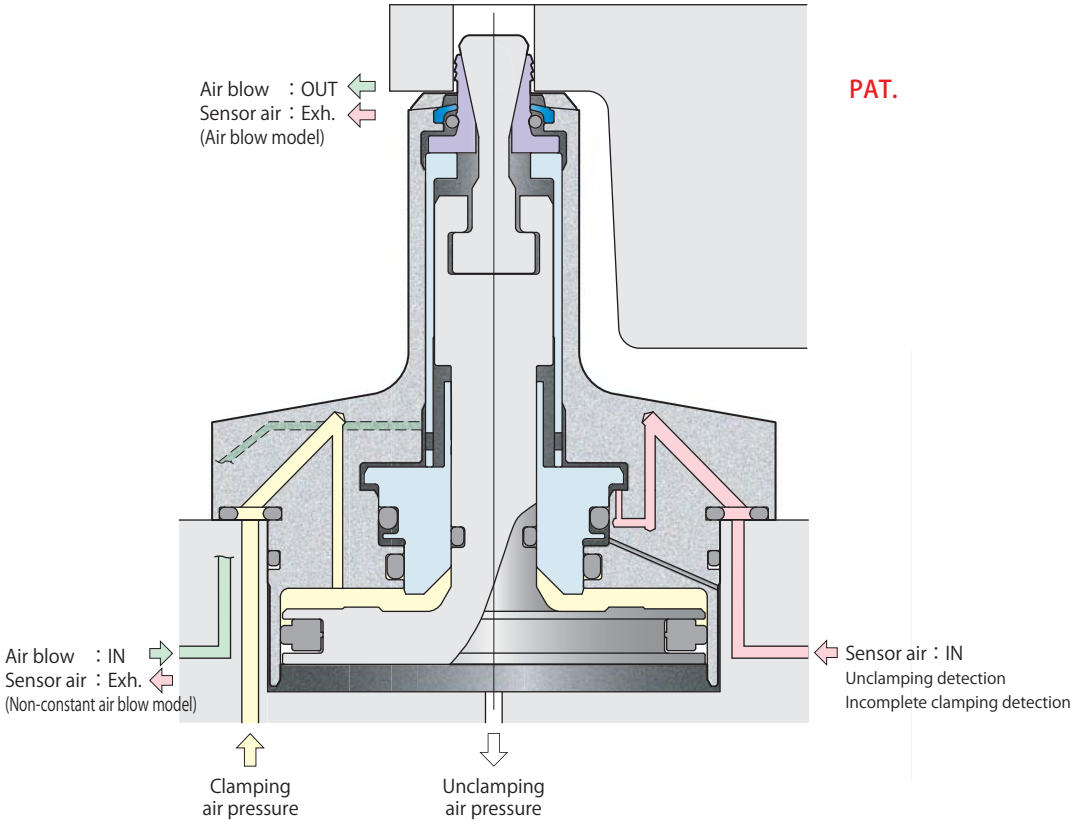
ø7.0 7.3 7.6 7.9 8.2

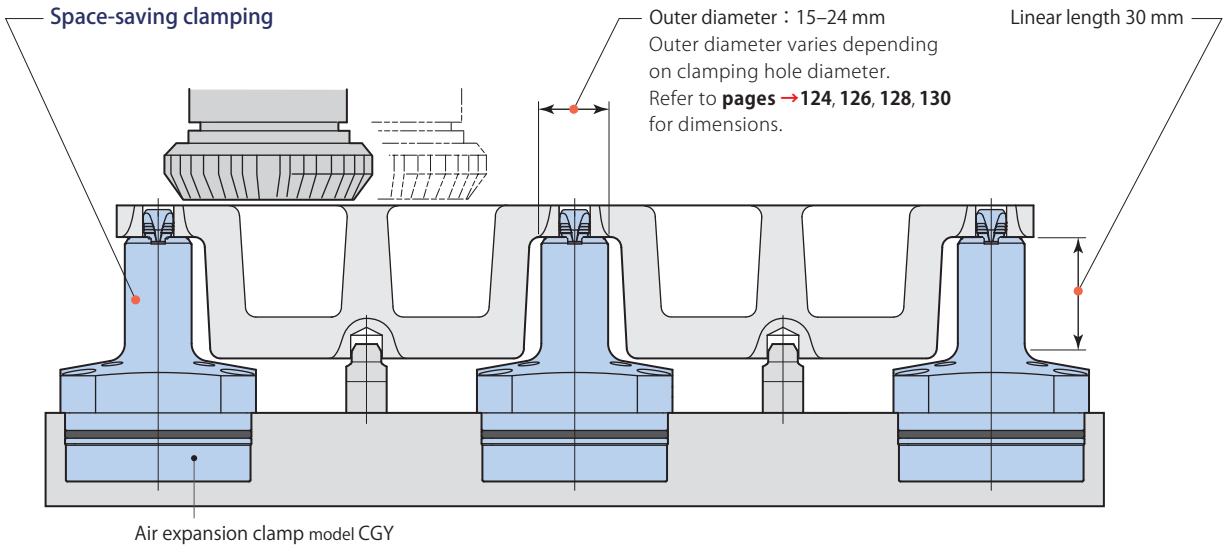
Non-constant air blow model

model **CGY-F22E**

2 Grippers 3 Grippers

ø8.5 9 10 ø11 12 13



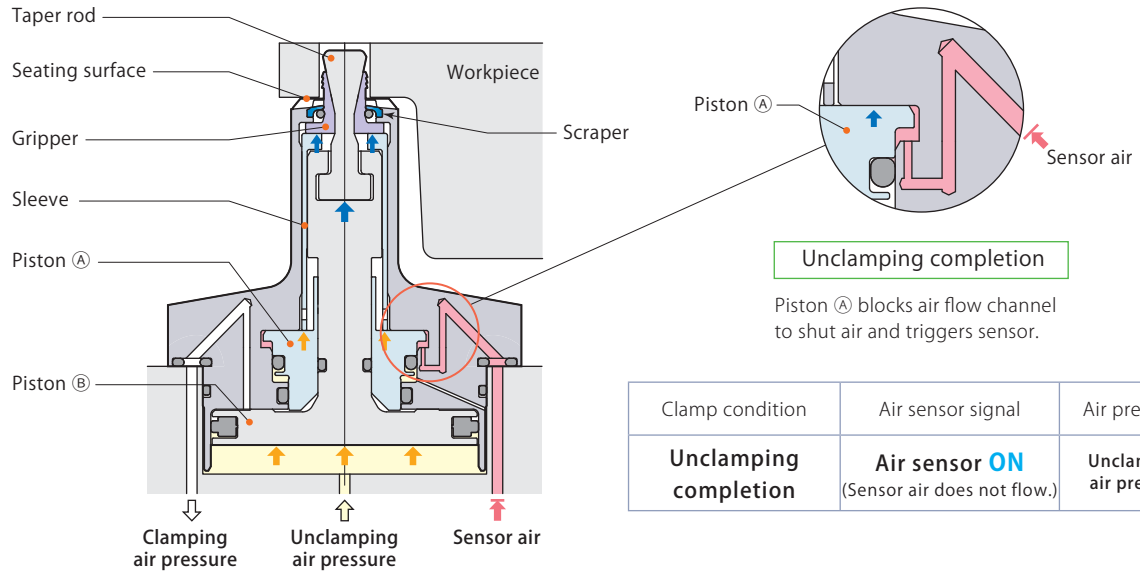


Workpiece setting (Unclamping completion)

① Pistons Ⓐ & Ⓑ, as well as taper rod and gripper are raised by unclamping air pressure.

② Workpiece unclamping is completed by the sensor air, clamping and unclamping air pressure.

③ Set the workpiece onto the seating surface.



Unclamping completion

Piston Ⓐ blocks air flow channel to shut air and triggers sensor.

Clamp condition	Air sensor signal	Air pressure switch
Unclamping completion	**Air sensor ON** (Sensor air does not flow.)	**Unclamping air pressure ON**

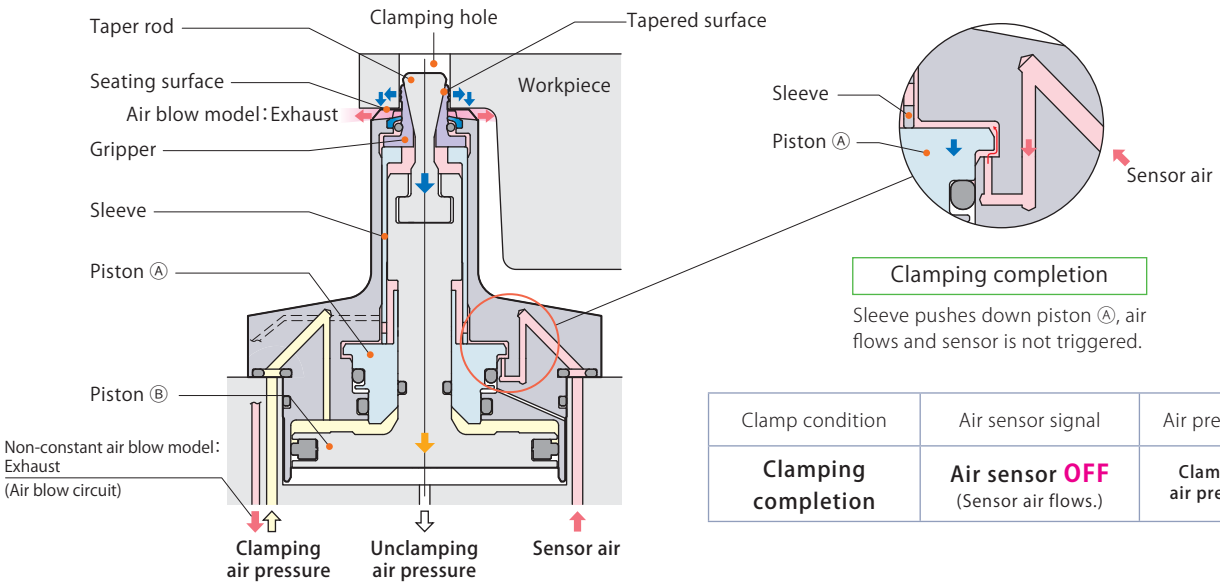
Workpiece holding (Clamping completion)

① Piston Ⓑ and taper rod are lowered by clamping air pressure after releasing unclamping air pressure.

② The gripper expands horizontally along the tapered surface to grip inner face of clamping hole.

③ The gripper securely grips the inner face of clamping hole and pulls the workpiece down firmly onto the seating surface.

④ Workpiece holding is completed by the sensor air, clamping and unclamping air pressure.



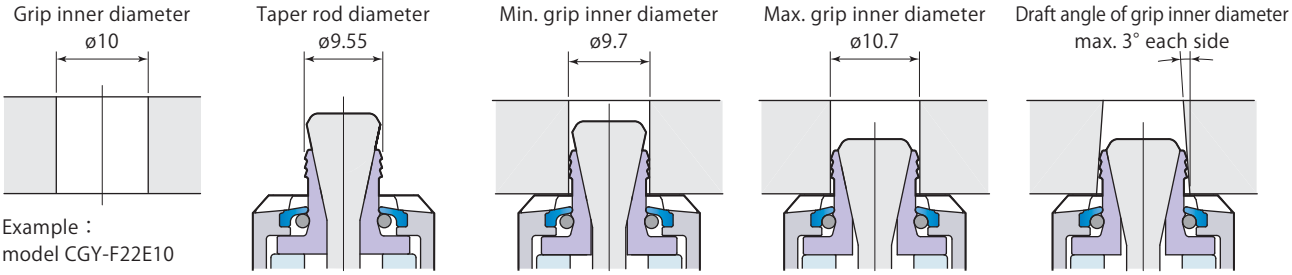
Clamping completion

Sleeve pushes down piston Ⓐ, air flows and sensor is not triggered.

Clamp condition	Air sensor signal	Air pressure switch
Clamping completion	**Air sensor OFF** (Sensor air flows.)	**Clamping air pressure ON**

Large gripper expansion stroke

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



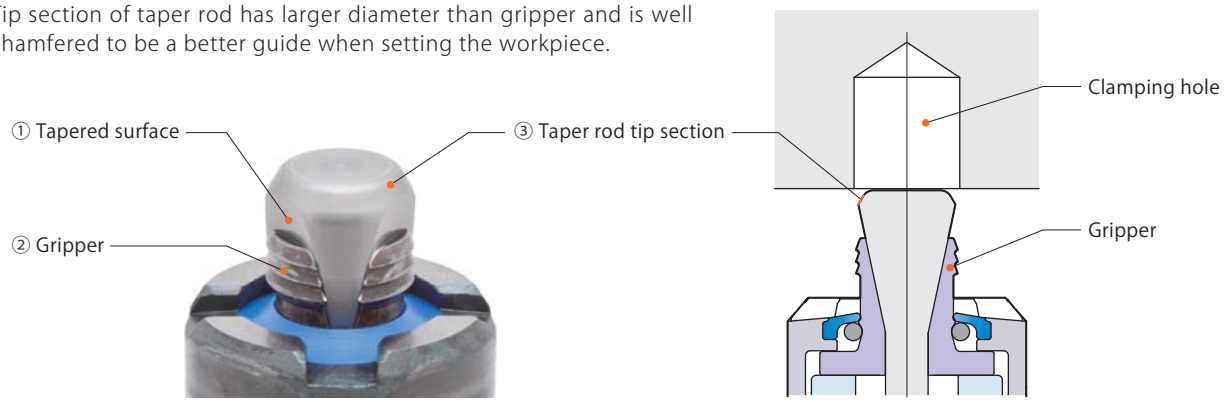
∗：0.6mm stroke for CGY-F22-055, 058, 061, 064, 067, 070A. 0.7mm stroke for CGY-F22E070, 073, 076, 079, 082.

Taper rod and gripper with superior durability

① The holding force of expansion clamp is transmitted from tapered surface to gripper, making it possible for the gripper to hold onto inner face of clamping hole and hold the workpiece on the seating surface for secure workpiece clamping.

② Special steel with superior abrasion resistance is used for gripper to improve durability.

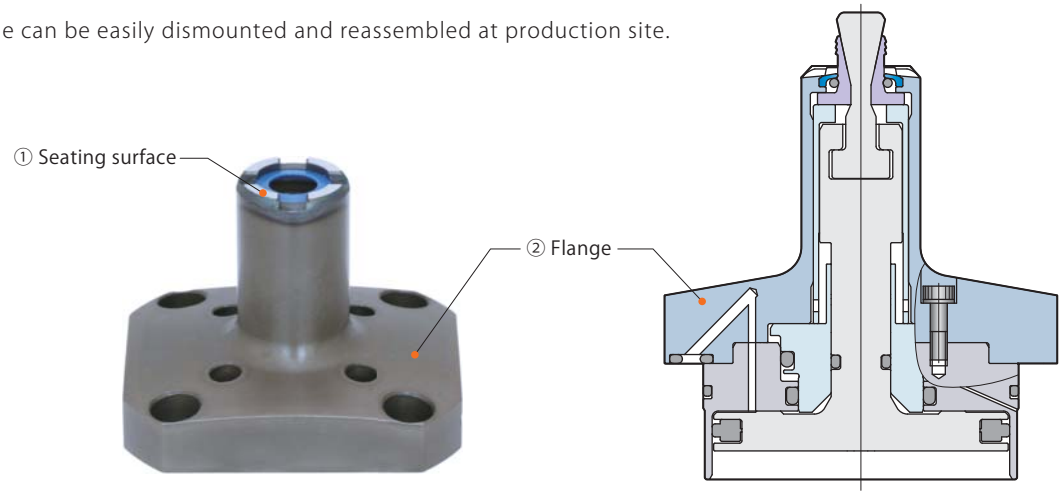
③ Tip section of taper rod has larger diameter than gripper and is well chamfered to be a better guide when setting the workpiece.



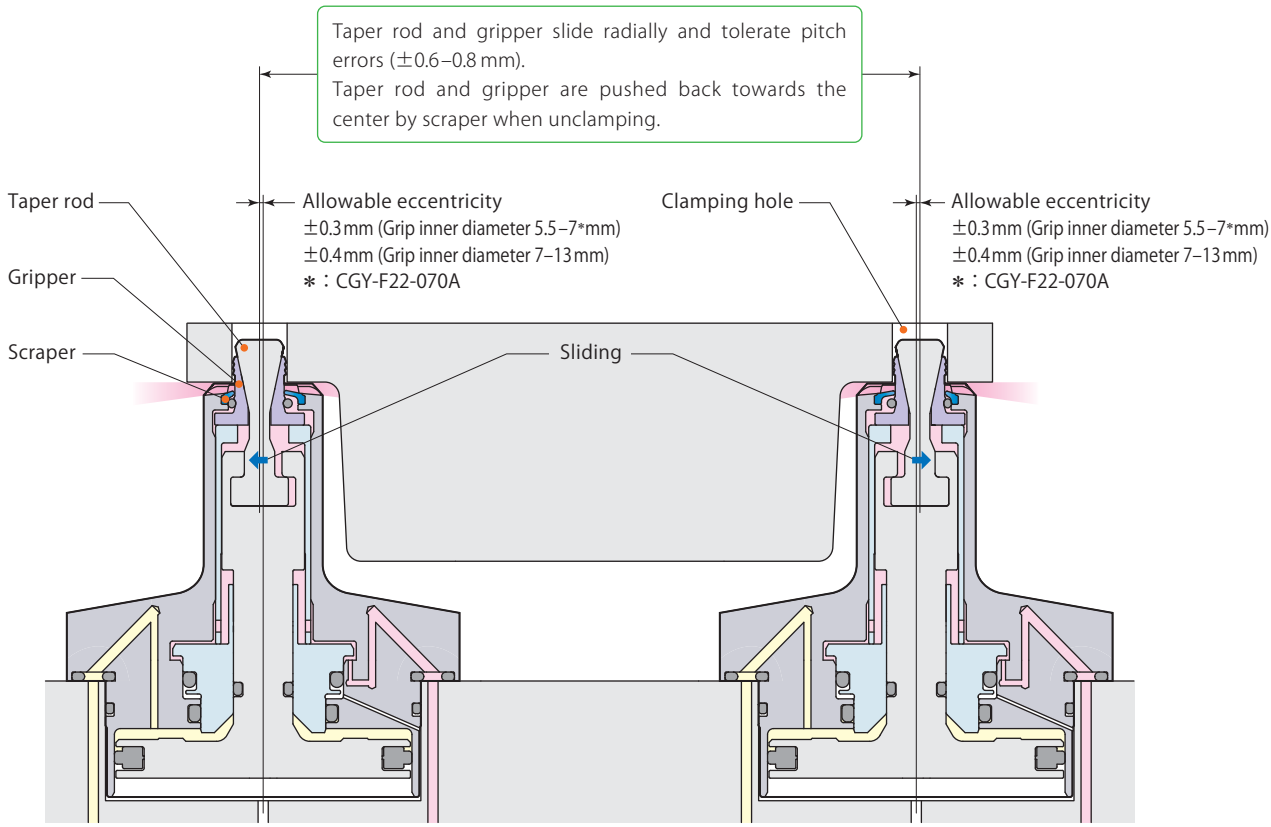
Seating surface can be reground (Max. 0.1 mm)

① When seating surface is damaged, the flange section can be dismounted and reground.

② Flange can be easily dismounted and reassembled at production site.



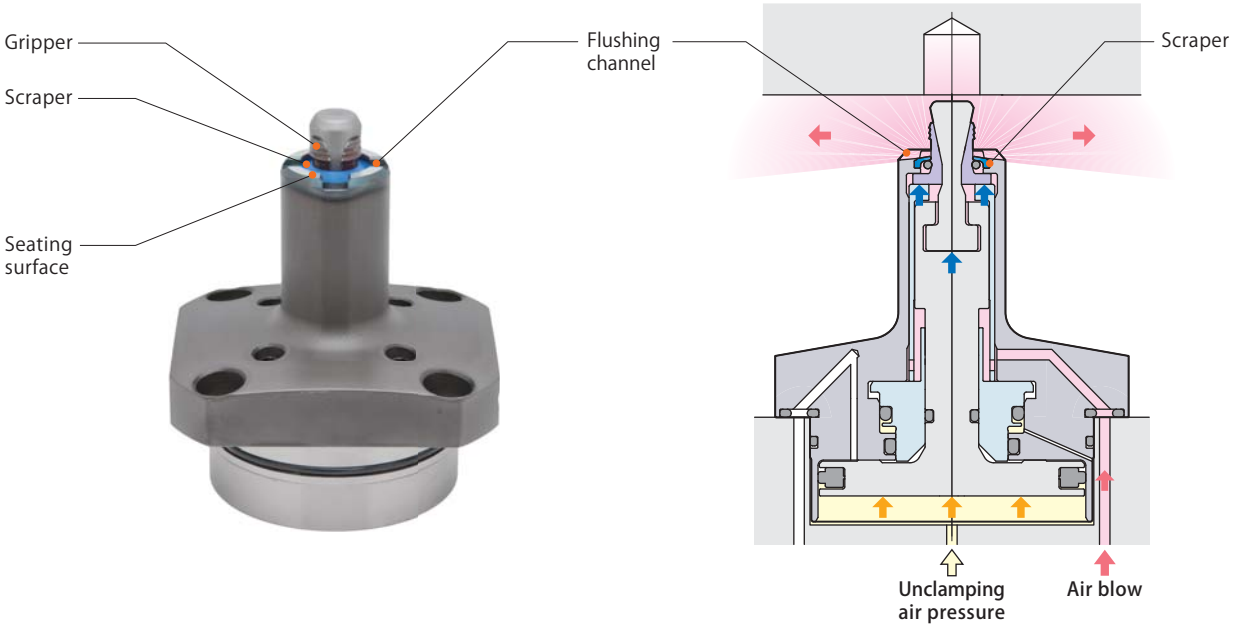
Clamping hole pitch errors can be tolerated



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

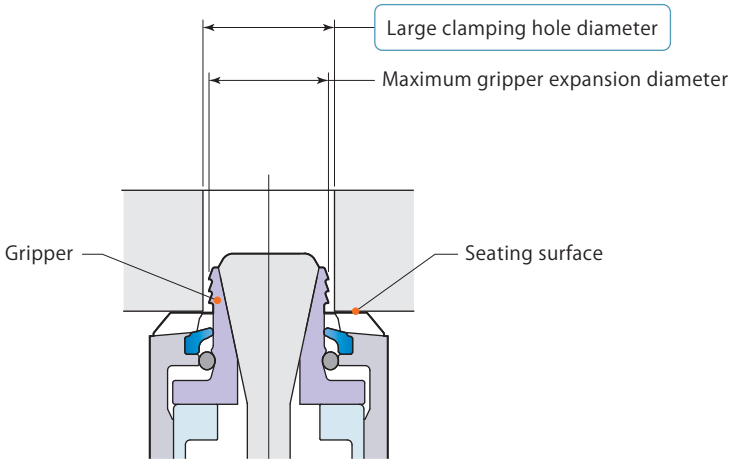
Incorporating strong air blowing circuit

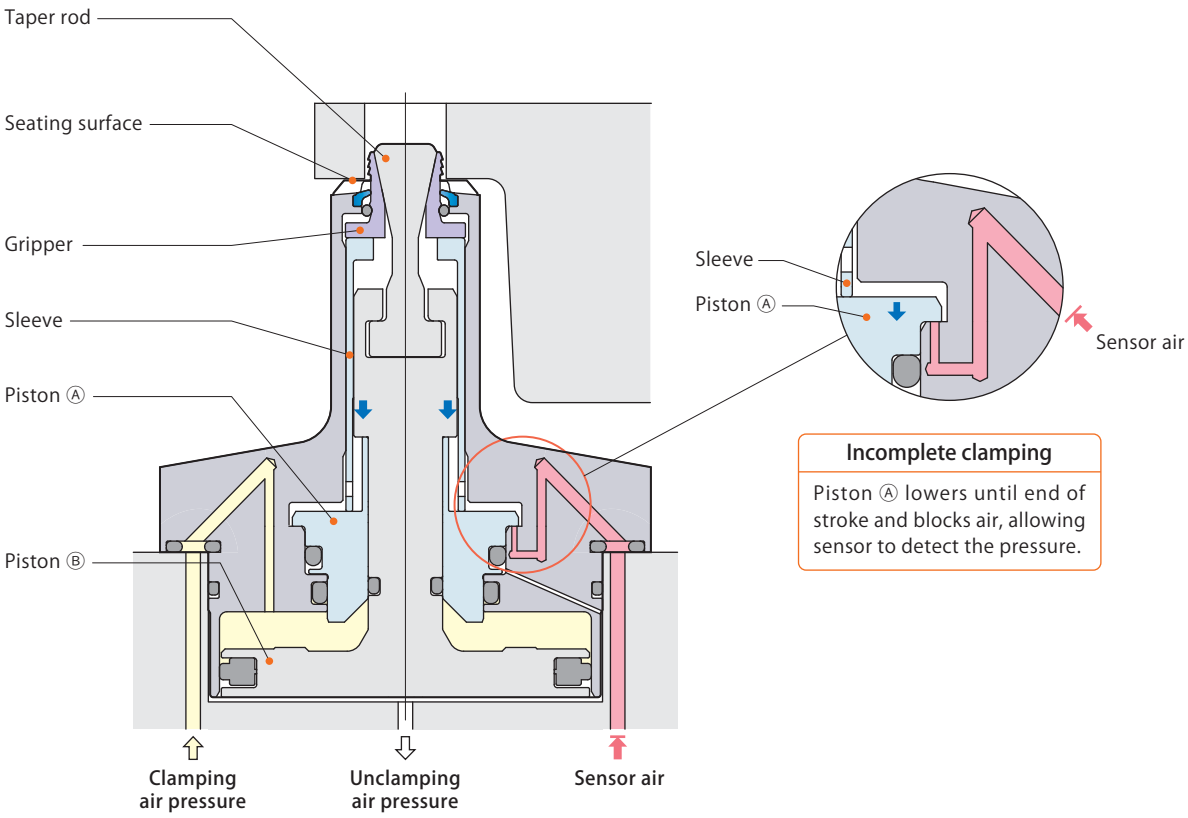
Air blow from a gap between the gripper and scraper clears off metal chips and coolant that stay on the seating surface. Flushing channel is also provided on the seating surface to remove the metal chips and coolants smoothly during workpiece setting.



Detects clamping hole diameter that is too large

When the inner diameter of clamping hole exceeds tolerance value, then gripper will fail to gain grip on workpiece even when extended to maximum reach. Piston Ⓐ lowers until end of stroke as it is pushed down by piston Ⓑ and blocks sensor air, which triggers air sensor and detects incomplete clamping.





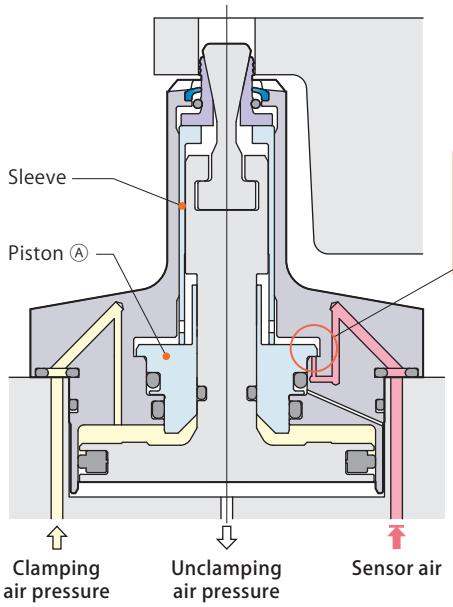
Incomplete clamping

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

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

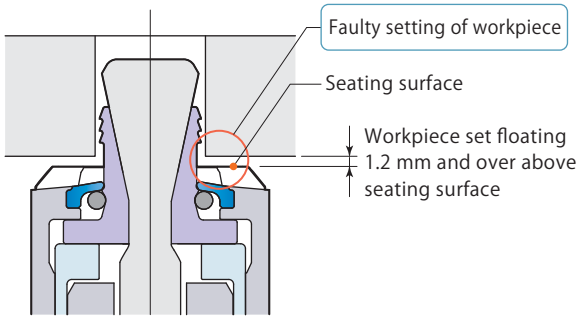
Detects deformation of workpiece and floating of workpiece

When workpiece has significant deformation or when it is set poorly with gap of 1.2 mm above seating surface, then even when the gripper lowers until end of stroke, the workpiece is not held on seating surface. At this time, piston Ⓐ lowers until end of stroke as it is pushed down by sleeve and blocks sensor air, which triggers air sensor and detects incomplete clamping.



Incomplete clamping

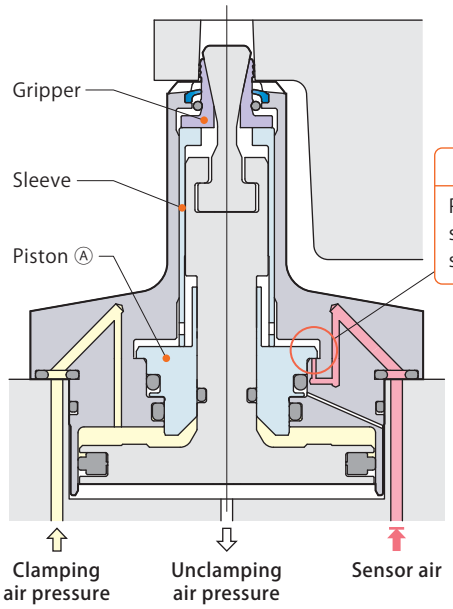
Piston Ⓐ lowers until end of stroke and blocks air, allowing sensor to detect the pressure.



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

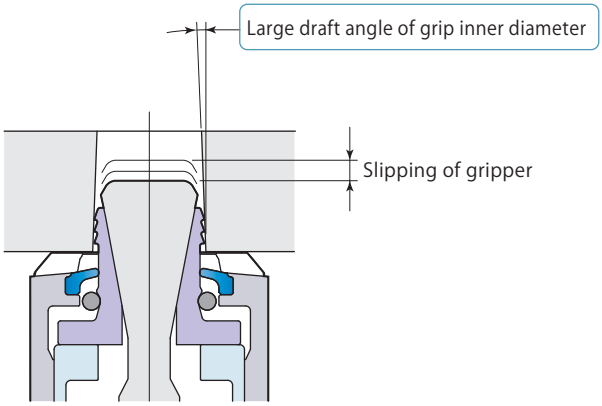
Detects incomplete gripping

When the inner diameter of clamping hole is slightly larger than allowable value, or when the draft angle of grip inner diameter is large and results in incomplete gripping by the gripper, piston Ⓐ lowers until end of stroke as sleeve pushes it down and sensor air is blocked, which triggers air sensor and detects incomplete clamping.



Incomplete clamping

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



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

With the development of the non-constant air blow expansion clamp, air consumption will be significantly decreased.
The traditional model ordinarily requires 50L/min (0.3MPa) flow rate (when grip inner diameter is ø12). The new model can reduce

Air blow model

Number of grippers	Grip inner diameter	Clamping force	Model
2 Grippers	ø 5.5 5.8 6.1 6.4 6.7 7.0	0.81 kN (Air pressure 0.5MPa)	CGY-F22- Grip inner diameter

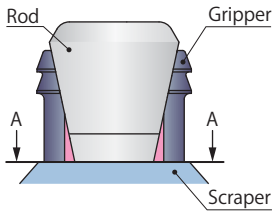
Non-constant air blow model

Number of grippers	Grip inner diameter	Clamping force	Model
2 Grippers	ø 7.0 7.3 7.6 7.9 8.2	0.81 kN (Air pressure 0.5MPa)	CGY-F22E Grip inner diameter
	ø 8.5 9 10	0.81 kN (Air pressure 0.5MPa)	CGY-F22E Grip inner diameter

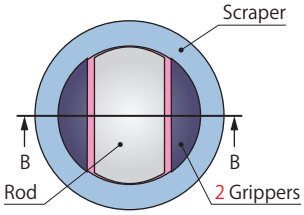
Number of grippers	Grip inner diameter	Clamping force	Model
3 Grippers	ø 11 12 13	0.81 kN (Air pressure 0.5MPa)	CGY-F22E Grip inner diameter

air consumption and help promote energy conservation. However air blow at time of workpiece replacement is a must.

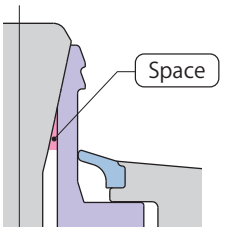
Space where metal chips can intrude is created



When clamping



A-A

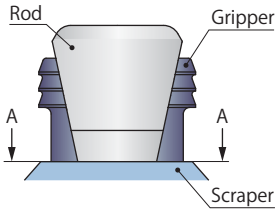


B-B

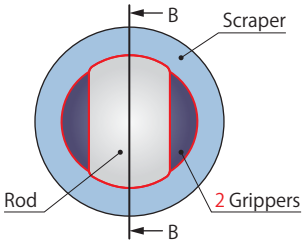
Pages →124, 125

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

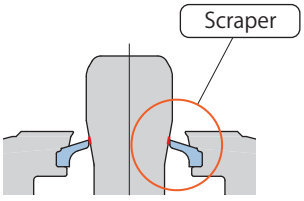
Secure chip protection



When clamping



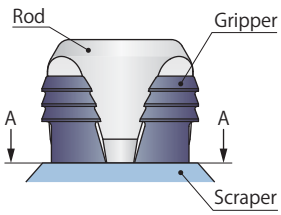
A-A



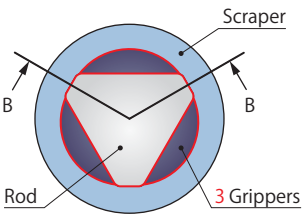
B-B

Pages →126–129

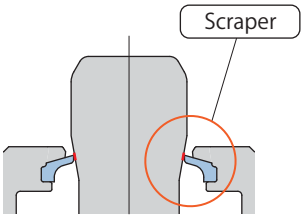
Because there is no space between scraper, gripper and the rod, it is not necessary to perform air blow during cutting process.



When clamping



A-A

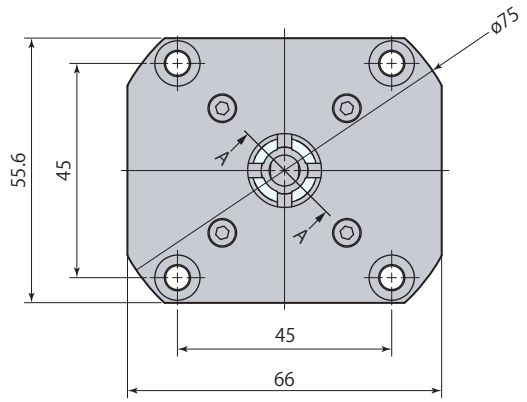


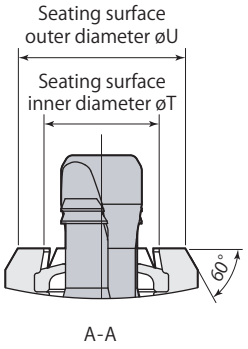
B-B

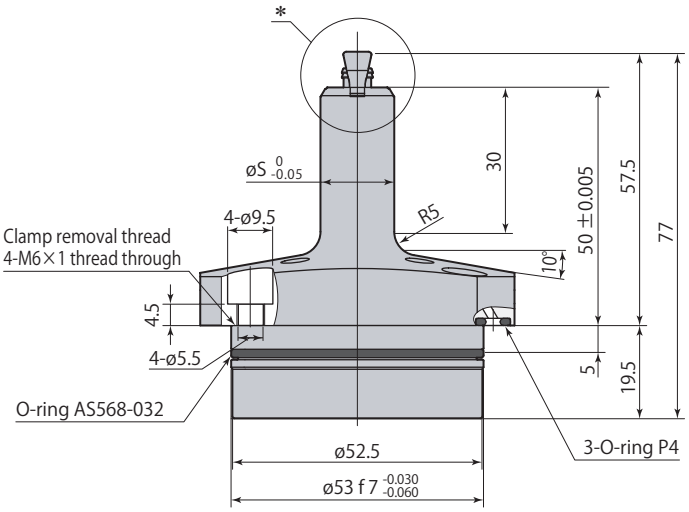
Pages →130, 131

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

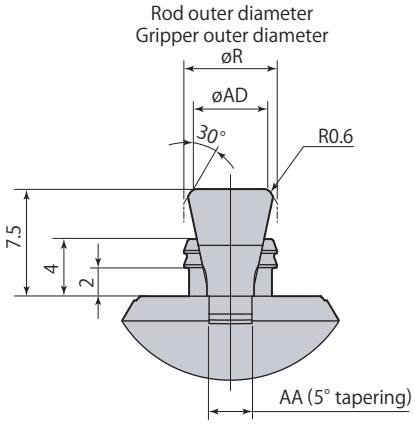
Dimensions



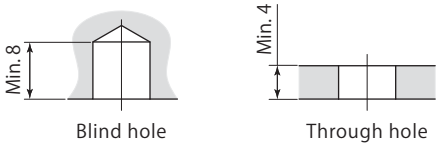


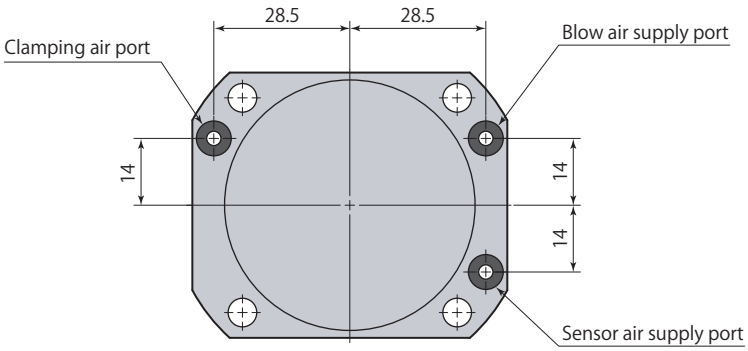


*Details



Grip inner diameter usage requirements





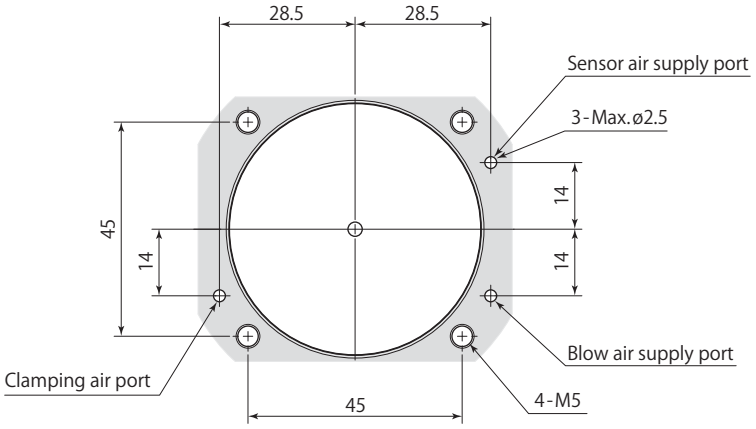
mm

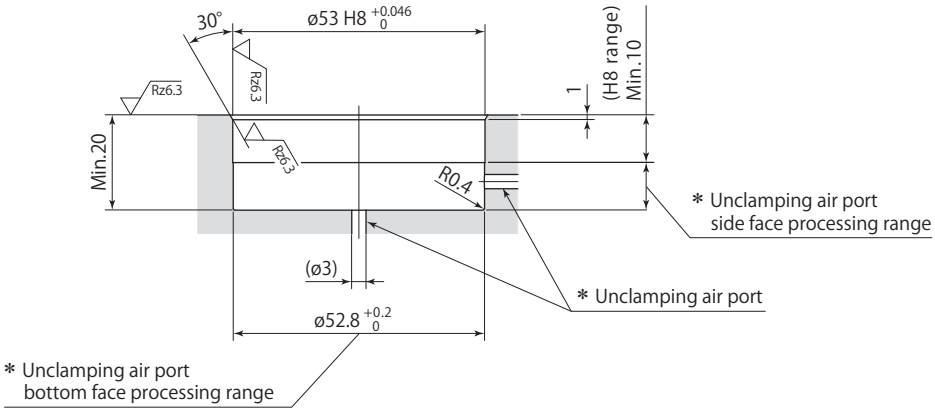
Model	CGY-F22-□					
	055	058	061	064	067	070A
øR	5	5.3	5.6	5.9	6.2	6.5
øS	15	15	15	15	15	15.5
øT	7.8	8.1	8.4	8.7	9	9.3
U	11	11.6	12.2	12.8	13	13.5
AA	2.5	2.5	3	3	3	3
øAD	3.8	4.1	4.4	4.7	5.0	5.3

- 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.

- CGY-F22-055,058,061,064,067,070A are made to order.

Mounting details



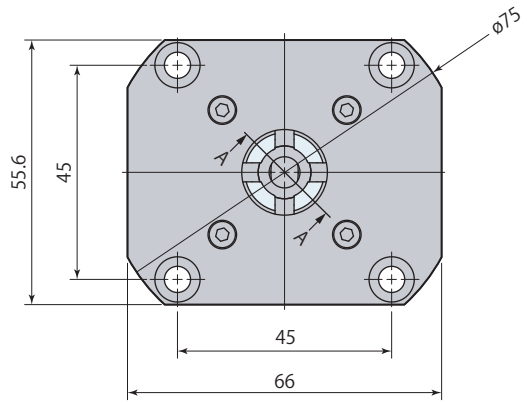


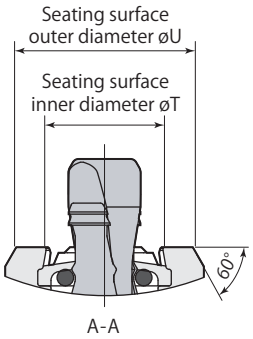
Rz: ISO4287(1997)

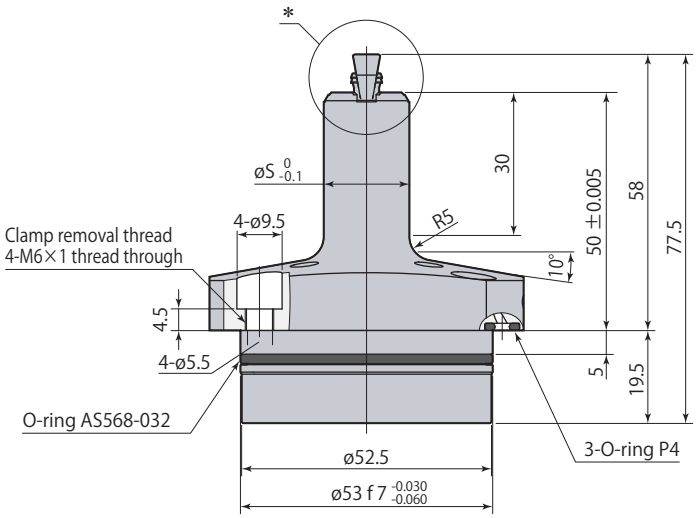
*: Unclamping air port must be made on either side or bottom face.

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

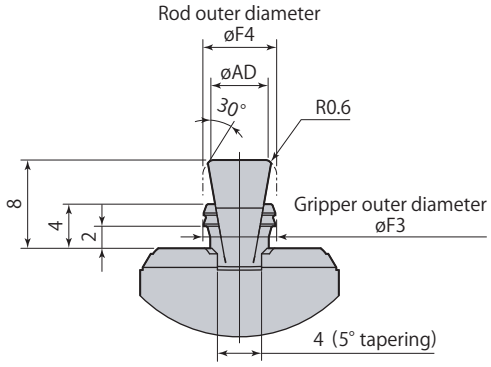
Dimensions



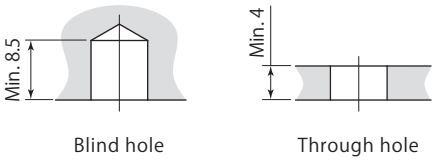


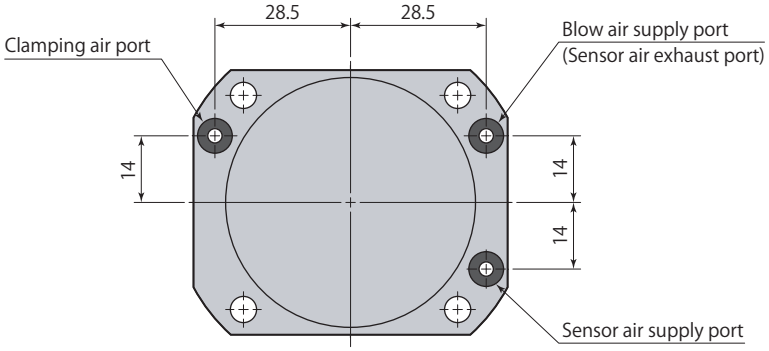


✻Details



Grip inner diameter usage requirements





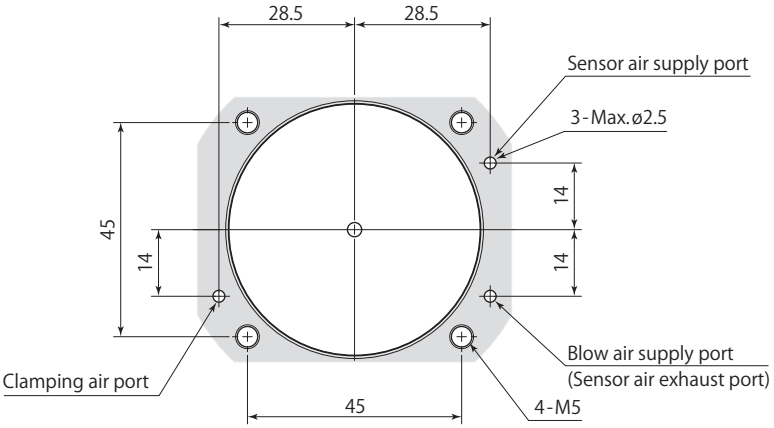
mm

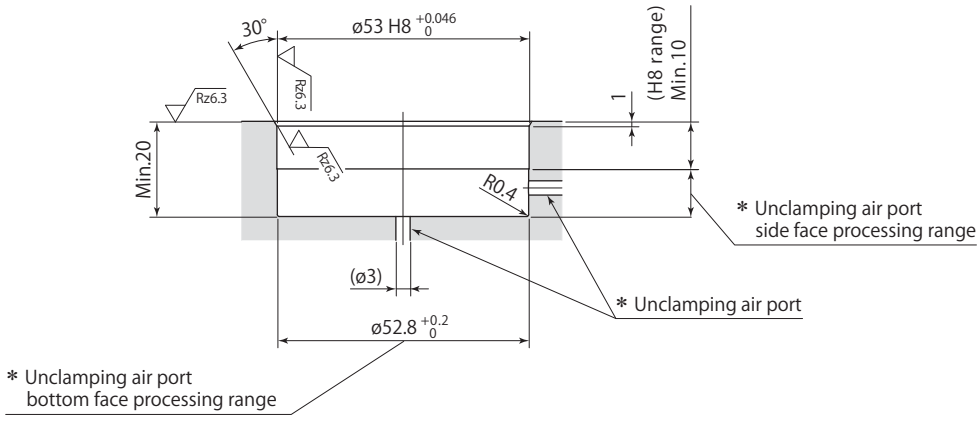
Model	CGY-F22E□				
	070	073	076	079	082
øF3	6.5	6.8	7.1	7.4	7.7
øF4	6.55	6.85	7.15	7.45	7.75
øS	18	18.3	18.6	18.8	18.8
øT	10.6	10.9	11.2	11.5	11.8
øU	16	16.3	16.6	16.9	17.2
øAD	5.4	5.7	6	6.3	6.6

- 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.

- CGY-F22E070,073,076,079,082 are made to order.

Mounting details



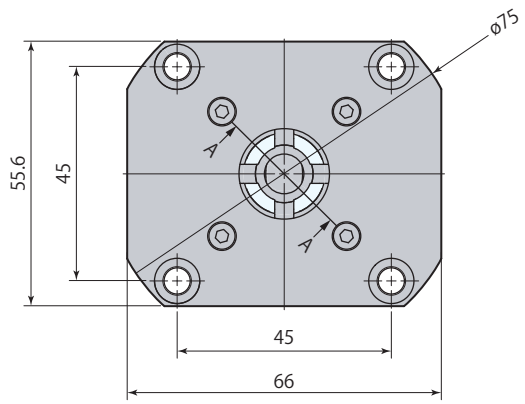


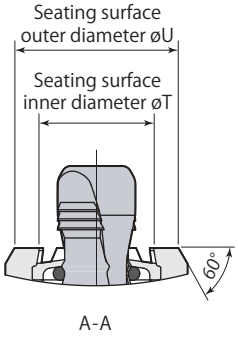
Rz: ISO4287(1997)

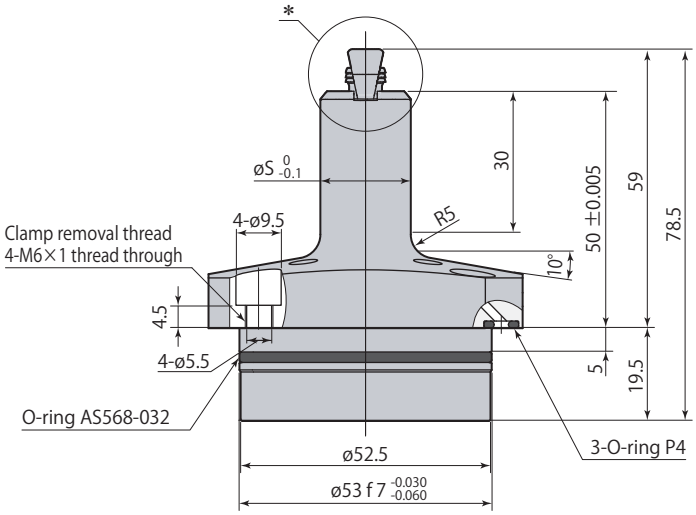
*: Unclamping air port must be made on either side or bottom face.

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

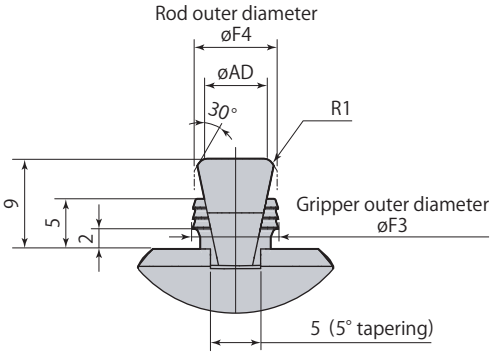
Dimensions



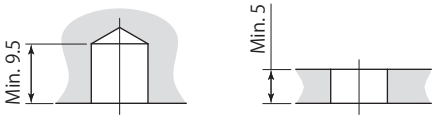


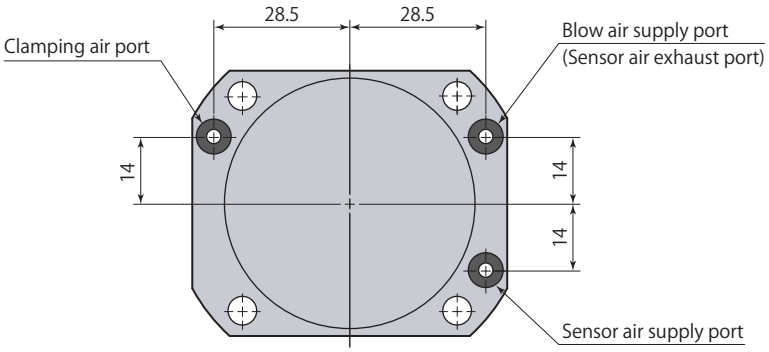


∗Details



Grip inner diameter usage requirements





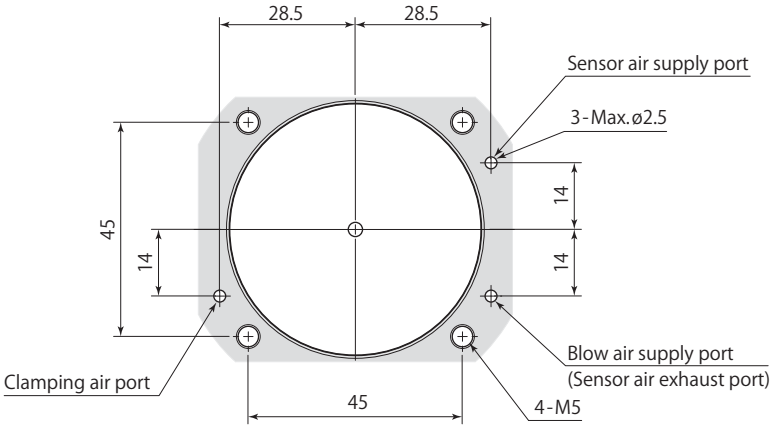
mm

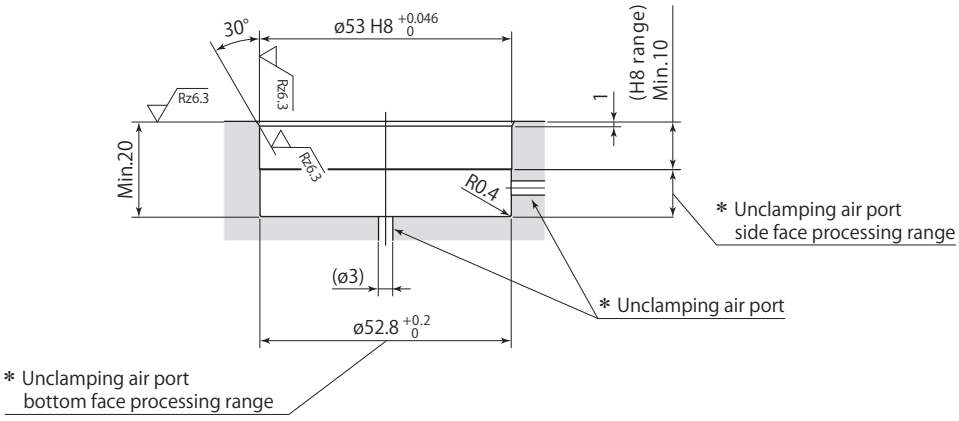
Model	CGY-F22E□		
	085	09	10
øF3	8	8.5	9.5
øF4	8.05	8.55	9.55
øS	19.5	20	21
øT	12.1	12.6	13.6
øU	17.5	18	19
øAD	6.3	6.8	7.8

- 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.

- CGY-F22E085 is made to order.

Mounting details



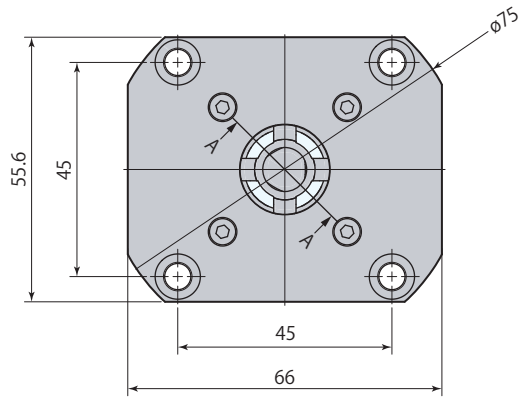


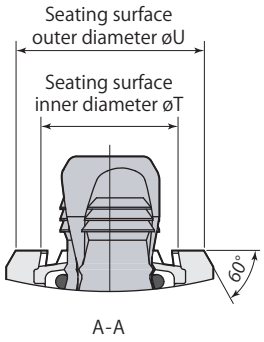
Rz: ISO4287(1997)

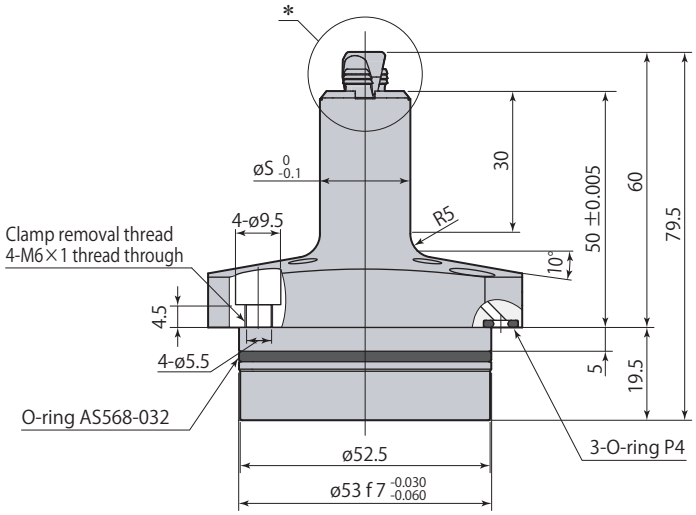
*: Unclamping air port must be made on either side or bottom face.

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

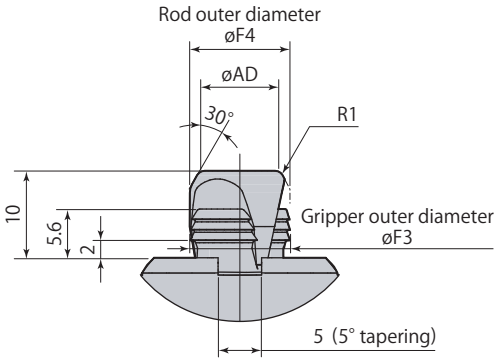
Dimensions



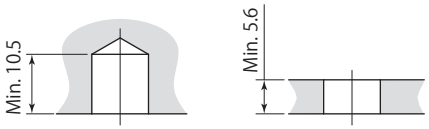


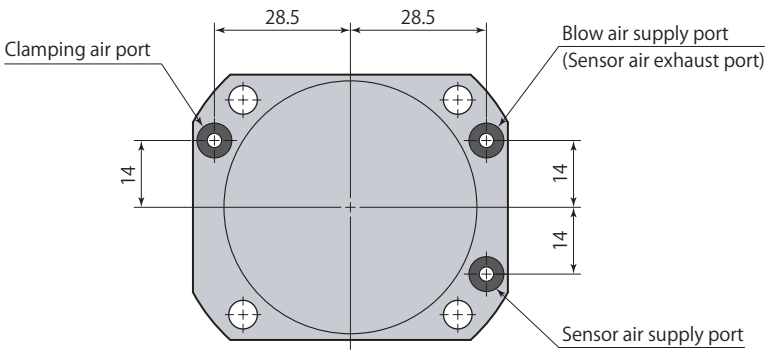


∗Details



Grip inner diameter usage requirements





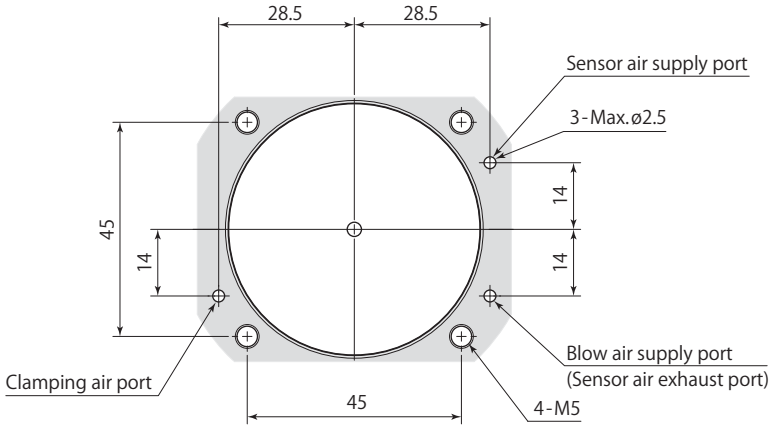
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

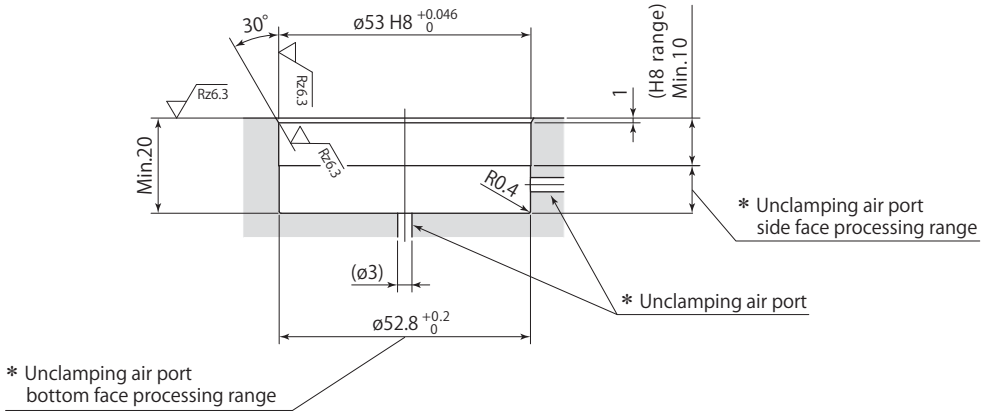
mm

Model	CGY-F22E□		
	11	12	13
øF3	10.5	11.5	12.5
øF4	10.55	11.55	12.55
øS	22	23	24
øT	14.6	15.6	16.6
øU	20	21	22
øAD	8.2	9.2	10.2

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

Mounting details



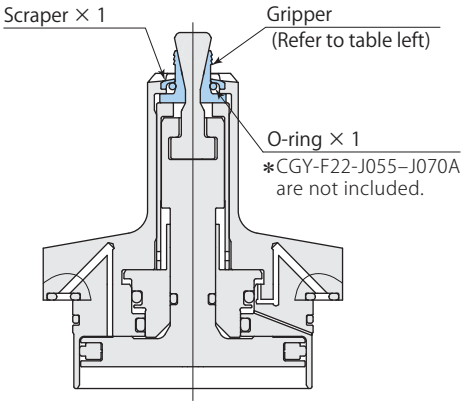


Rz: ISO4287(1997)

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

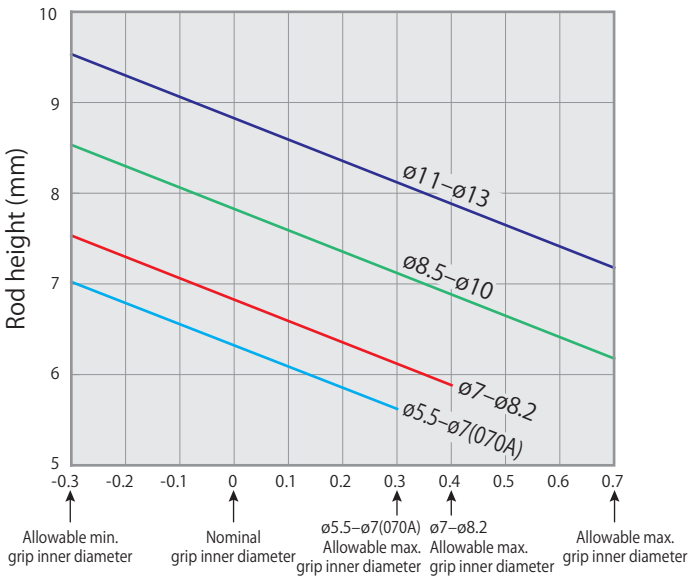
- Apply an appropriate amount of grease to the chamfer and the bore when mounting.
  Excessive grease may be a blockage in the air passage, causing malfunction of the sensor.
- The 30° taper machining must be provided to avoid the damage of the O-ring.

Gripper set replacement

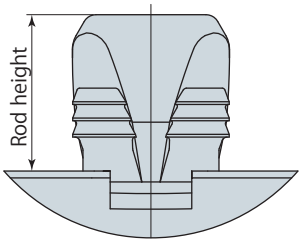
Number of grippers	Gripper set model	Clamp model	Set description
2 Grippers	CGY-F22-J055	CGY-F22-055	
	CGY-F22-J058	CGY-F22-058	
	CGY-F22-J061	CGY-F22-061	
	CGY-F22-J064	CGY-F22-064	
	CGY-F22-J067	CGY-F22-067	
	CGY-F22-J070A	CGY-F22-070A	
	CGY-F22EJ070	CGY-F22E070	
	CGY-F22EJ073	CGY-F22E073	
	CGY-F22EJ076	CGY-F22E076	
	CGY-F22EJ079	CGY-F22E079	
	CGY-F22EJ082	CGY-F22E082	
	CGY-F22EJ085	CGY-F22E085	
	CGY-F22EJ09	CGY-F22E09	
	CGY-F22EJ10	CGY-F22E10	
3 Grippers	CGY-F22EJ11	CGY-F22E11	
	CGY-F22EJ12	CGY-F22E12	
	CGY-F22EJ13	CGY-F22E13	

It is recommended that grippers, scraper and O-ring be replaced after about 200,000 operations. Replace grippers in sets and not just an individual gripper. (Refer to the table on the left for the gripper set model.)

Grip inner diameter & rod height when clamping



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

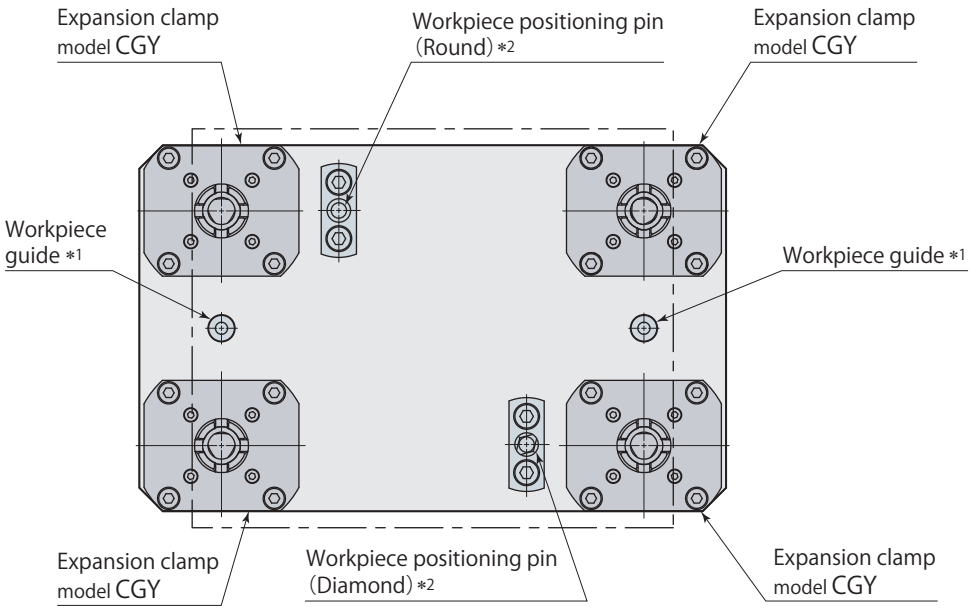


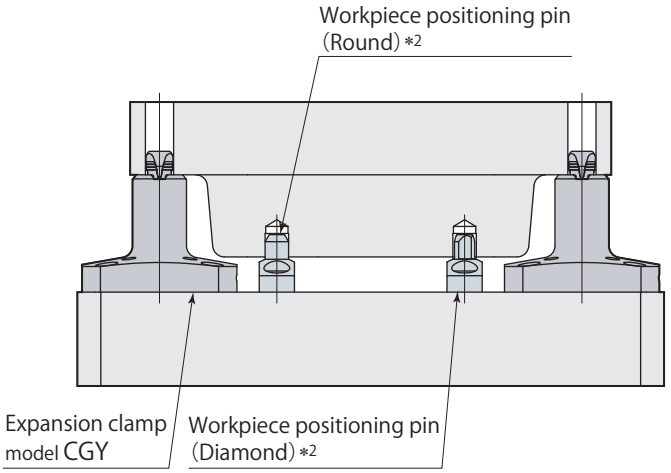
Rod height calculation formula	
ø5.5– ø7*	: 6.32-2.35 × Actual grip inner diameter and nominal grip diameter difference
ø7 – ø8.2	: 6.58-2.84 × Actual grip inner diameter and nominal grip diameter difference
ø8.5– ø10	: 7.82-2.35 × Actual grip inner diameter and nominal grip diameter difference
ø11 – ø13	: 8.82-2.35 × Actual grip inner diameter and nominal grip diameter difference

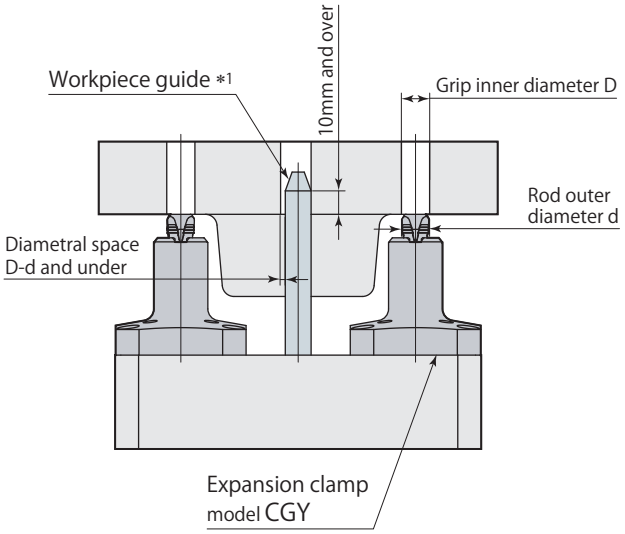
∗ : CGY-F22-070A

Example : When CGY-F22E10 (Nominal grip diameter : ø10) is clamping ø9.8 hole
Rod height = 7.82 - 2.35 × (-0.2) = 8.29mm

System configuration example



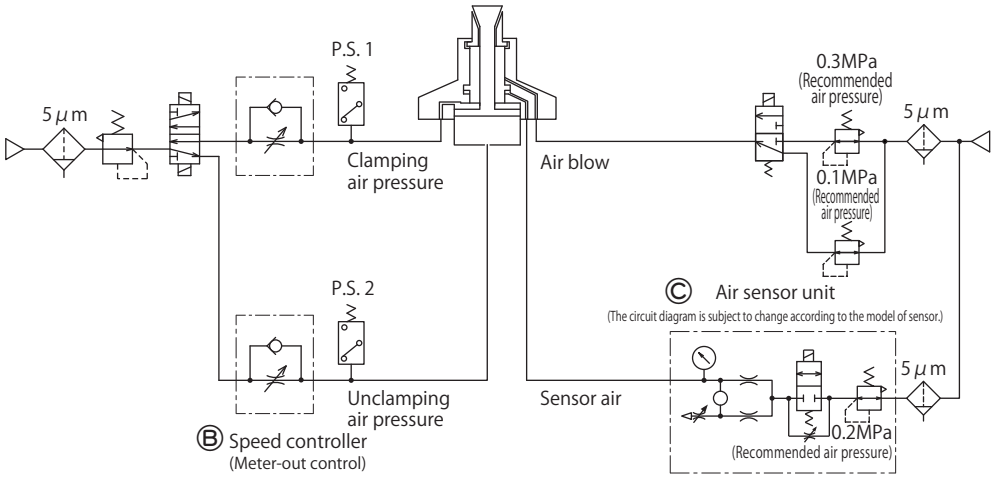




*1: When using automatic or robotic conveyers, prevent damage to clamp caused from impact by setting workpiece guides. Using the above guide as reference, accurately position the holes when using workpiece guides.

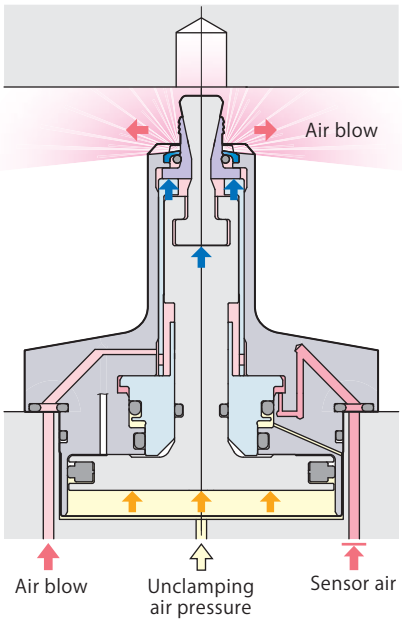
*2: **The expansion clamp does not have a workpiece positioning function.**
Install workpiece positioning pins (or similar).

Air blow model pneumatic circuit diagram

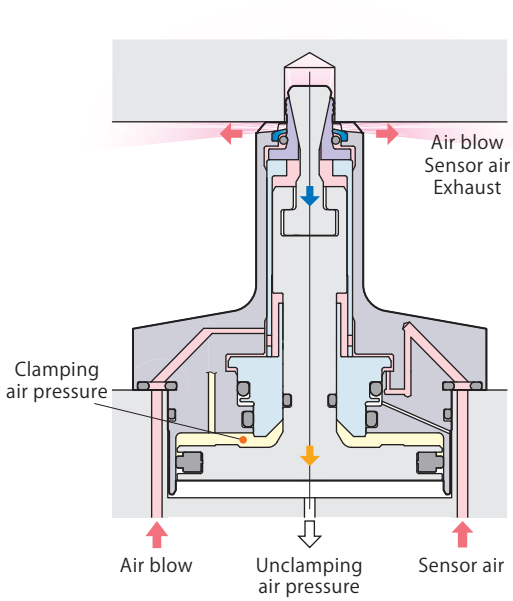


- Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping. During cutting, if chips adhere to the gripper such as when going through the clamping hole, continue air blowing during processing as well.
- Air blow pressure must be set to 0.1MPa when checking the operation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

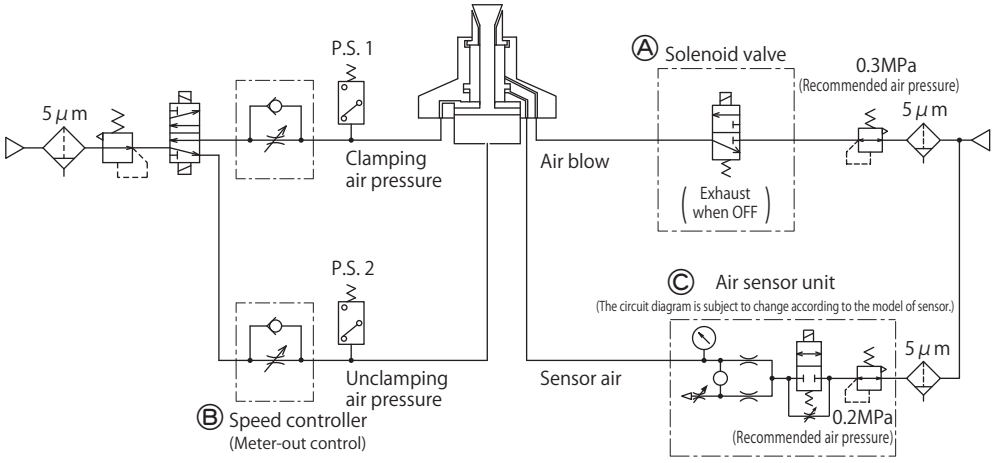
Air blowing



Clamping

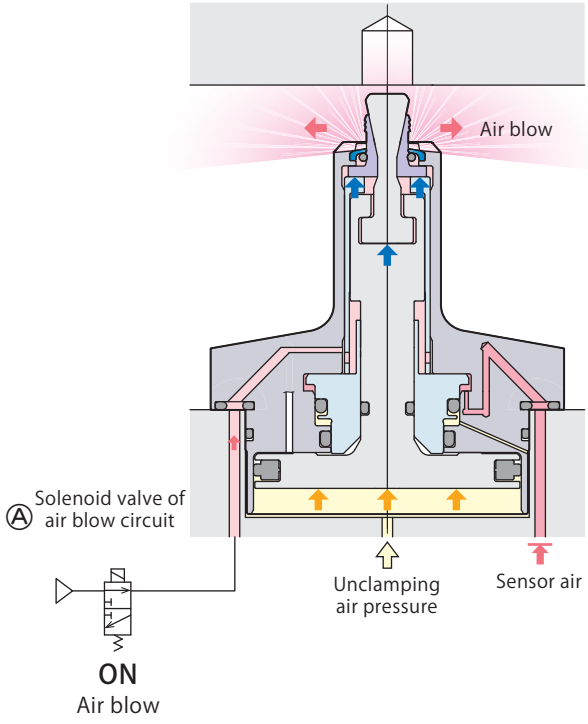


Non-constant air blow model pneumatic circuit diagram

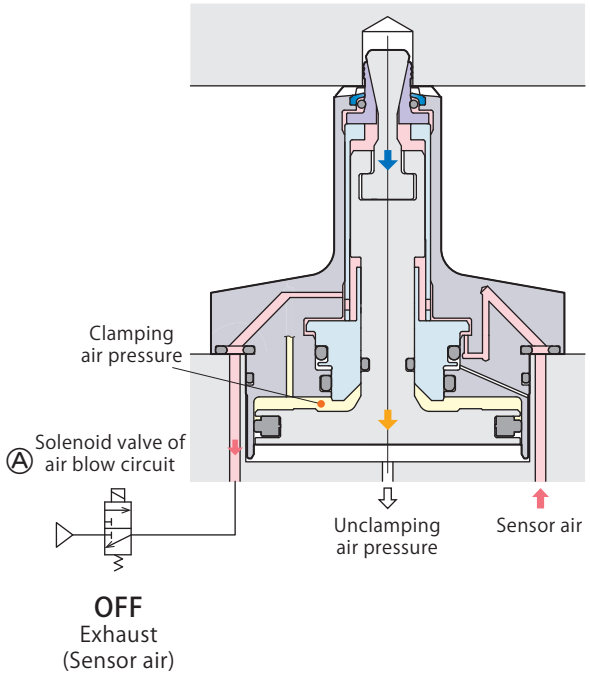


- Air blow will not be necessary during cutting process. Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping to remove metal chips and debris.
- The solenoid valve Ⓐ must be closed when checking the operation of the clamp with the air sensor. Also 3 port type of solenoid valve must be used in the circuit. If 2 port type of the valve is used, sensing air cannot be exhausted and clamp detection function is disabled.

Air blowing

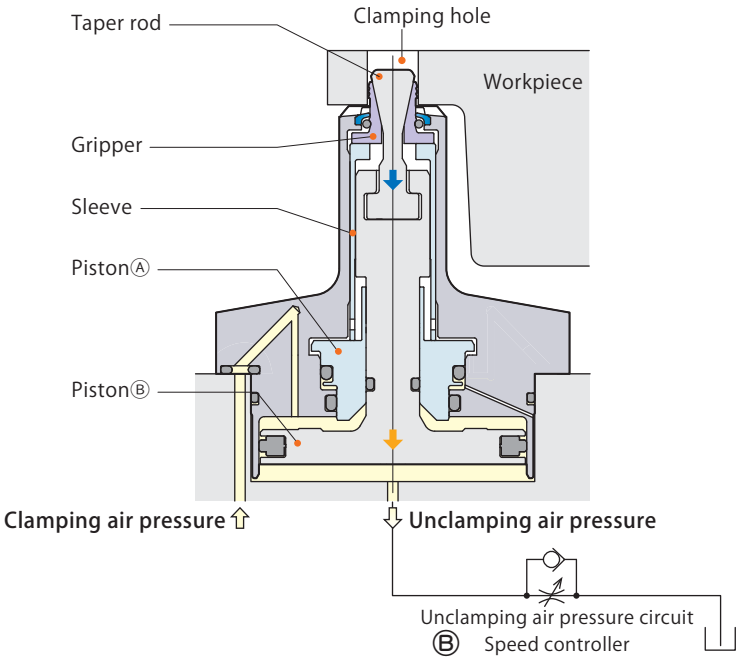


Clamping



- Operation speed must be adjusted by a meter-out type speed controller Ⓑ being provided in the unclamping circuit. By the adjustment, air flow in unclamping circuit is squeezed and back pressure is generated. The back pressure acts on the piston Ⓐ of the clamp and makes the gripper expand first then the taper rod strokes down to clamp. If meter-in type speed controller is installed in the circuit, it dumps the air rapidly and makes the gripper move very quick which causes incomplete clamping.

- Adjust air flow when clamping to have the taper rod full stroke in 0.3 sec or over.
  Excessive air flow to the clamp gives impact load and may cause breakage of the parts.



Air sensor unit Ⓒ recommended condition of use

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

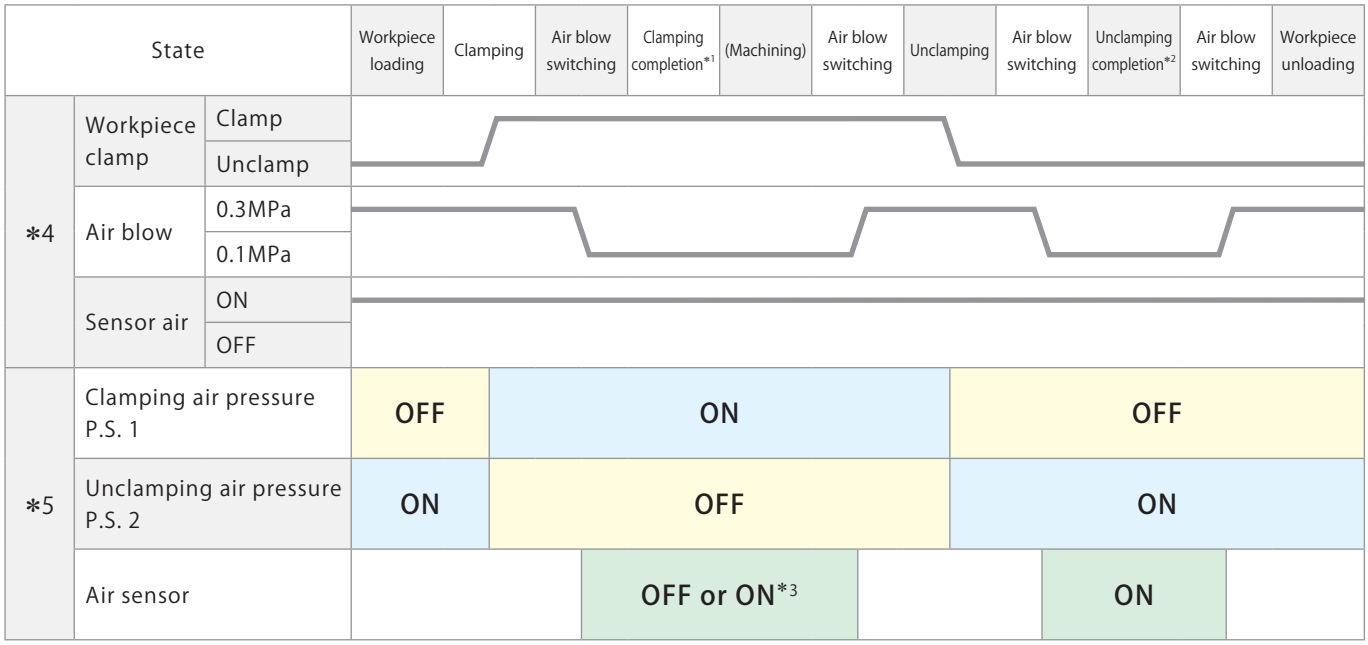
- Use a solenoid valve with needle for air sensor unit Ⓒ and control it supplying air all the time in order to eliminate intrusion of chips or coolant.

- There is a case that air sensing cannot be made successfully as designed when it is used out of the usage shown on the left. Contact Technical service center for more details.

Operation cycle

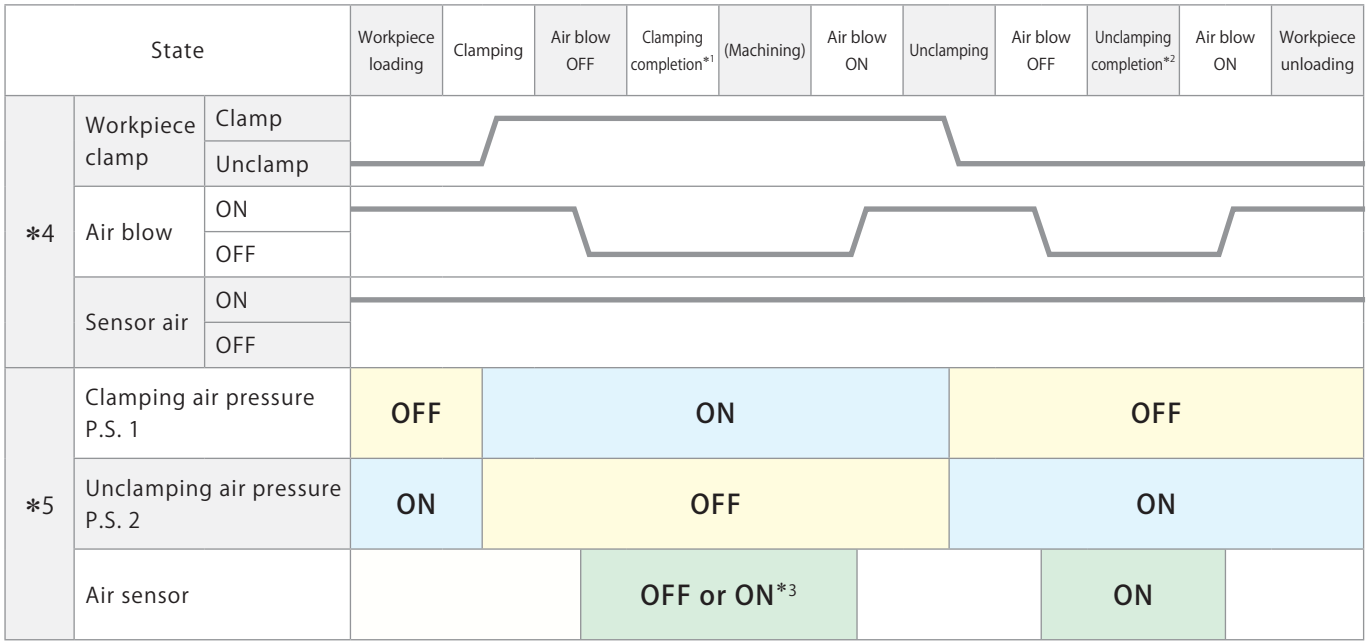
The clamp should be controlled with the cycle in the diagram shown below to detect the operation status exactly.

Case of air blow model



∗1 : Clamping completion : P.S. 1=ON P.S. 2=OFF Air sensor=OFF
∗2 : Unclamping completion : P.S. 1=OFF P.S. 2=ON Air sensor=ON
∗3 : OFF : Complete clamping ON : Incomplete clamping
∗4 : Solenoid valve control ∗5 : Air pressure switch, Air sensor signal

Case of non-constant air blow model



∗1 : Clamping completion : P.S. 1=ON P.S. 2=OFF Air sensor=OFF
∗2 : Unclamping completion : P.S. 1=OFF P.S. 2=ON Air sensor=ON
∗3 : OFF : Complete clamping ON : Incomplete clamping
∗4 : Solenoid valve control ∗5 : Air pressure switch, Air sensor signal

Caution in use

- Be sure to make inner diameter of air blow circuit 4 mm and over except for clamp mounting surface.

- Set the workpiece in such a way that the clamping hole of workpiece is perpendicular to seating surface. Clamping in tilted condition results in uneven contact of gripper with hole, which leads to concentration of load that may cause damage.

- Verify that there are no metal chips or debris on seating surface of clamping hole and clamp body before setting workpiece. Allowing intrusion of metal chips results in insecure clamping, which can lead to low grade of machining accuracy.

- Flaring (Biting) of gripper into workpiece varies depending on workpiece material or thermal processing conditions. With regards to conditions of workpiece and clamping hole, refer to **page →115**. Secure clamping is not possible when workpiece or clamping hole that does not satisfy these conditions is used.

- If clamping hole serves as taper hole (cast draft hole with gradient), then perform test clamping using applicable workpiece beforehand to verify that there are no problems with operations.

- Deformation may occur if the thickness of clamping hole section of workpiece is extremely thin. Use applicable workpiece to perform test clamping beforehand to verify that there are no deformations in thin portion.

- Supply the dry and filtered air. Particulate size 5 μm or less is recommended.

- Measure seating surface flatness with air pressure applied on clamping side, or by applying air pressure on neither clamping nor unclamping side.

- Perform unclamping completion detection, clamping completion detection and incomplete clamping detection with combination actions of pressure switch and sensor shown in table below. (Refer to the pneumatic circuit diagram on **page →134**, **135** for details.)

Applications	Pressure switch 1 (P.S. 1)	Pressure switch 2 (P.S. 2)	Air sensor
Unclamping completion detection	OFF	ON	ON
Clamping completion detection	ON	OFF	OFF
Incomplete clamping detection	ON	OFF	ON