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

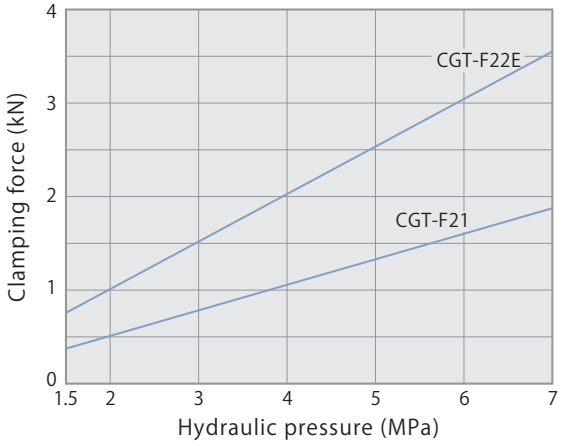
■ indicates made to order.

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

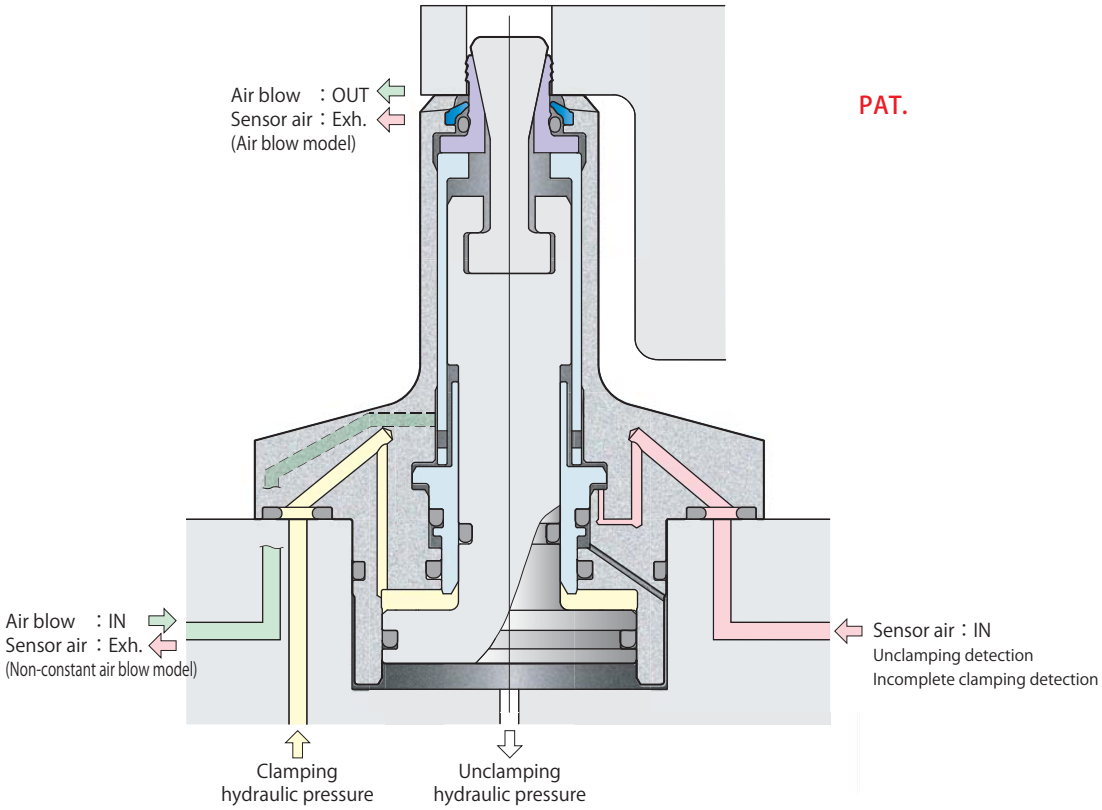
P：Hydraulic pressure (MPa)

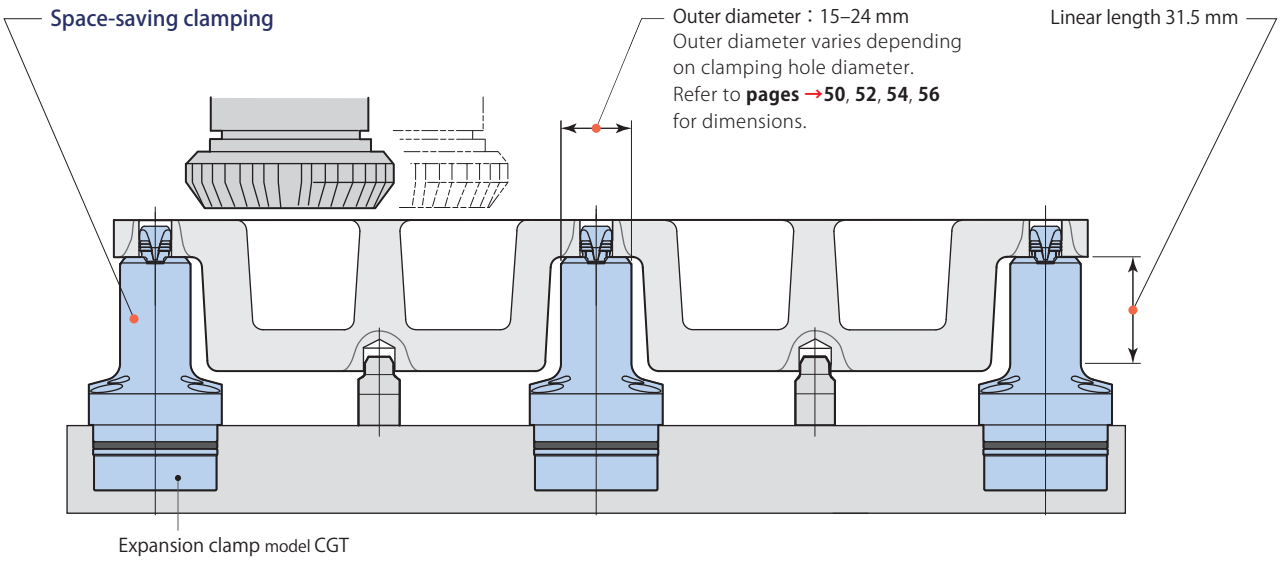
- CGT-F21-055, 058, 061, 064, 067, 070A applicable hydraulic pressure should be 1.5 to 5 MPa.
  CGT-F22E085 applicable hydraulic pressure should be 1.5 to 6 MPa.

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



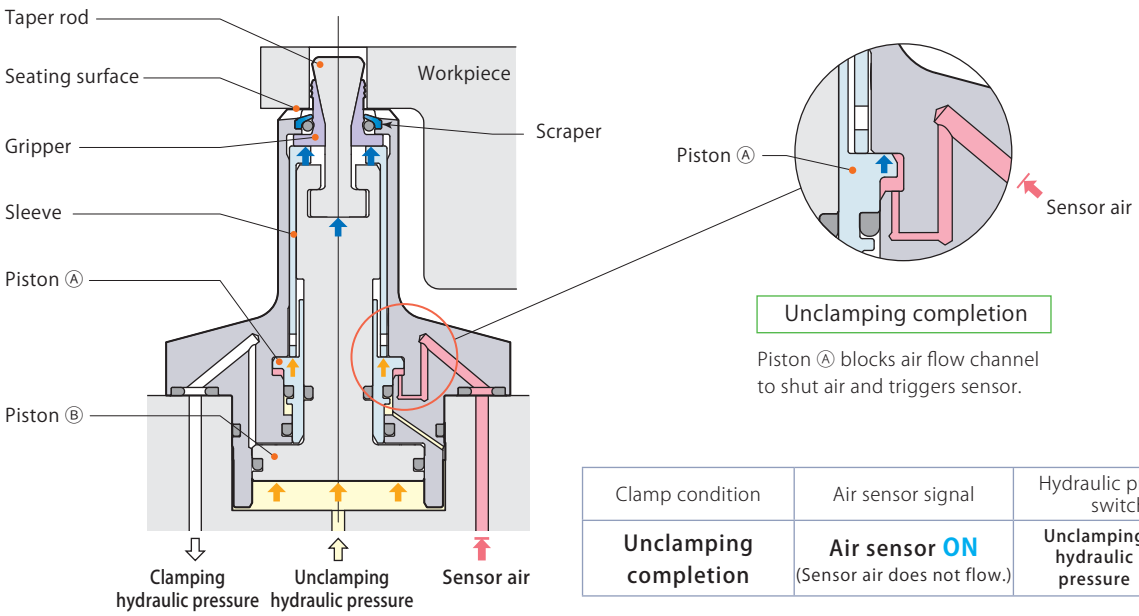


Workpiece setting (Unclamping completion)

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**

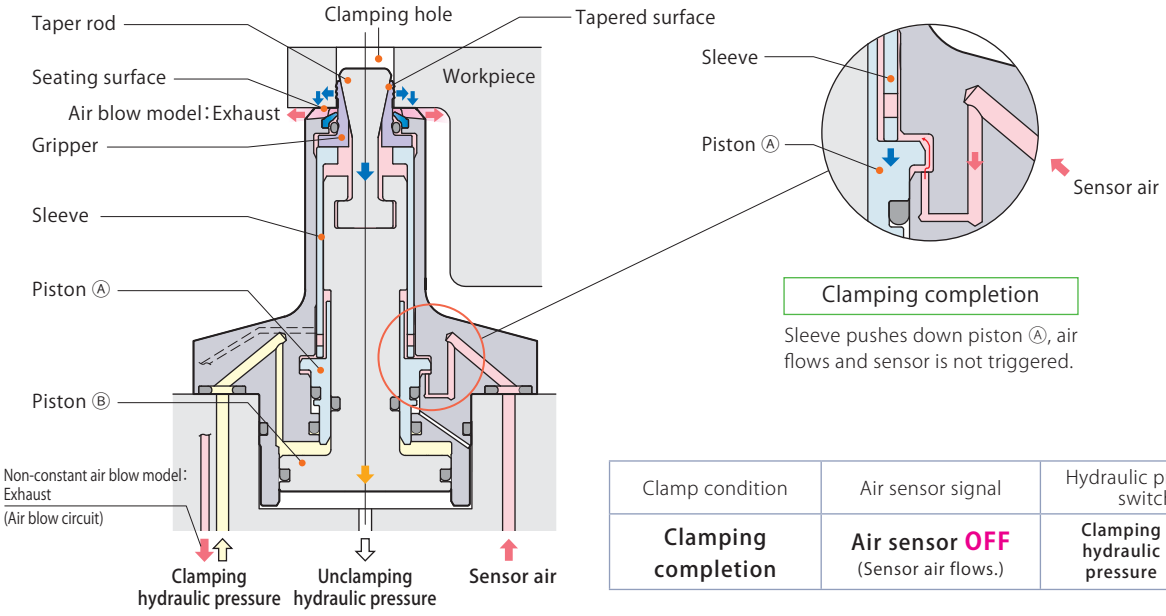
Workpiece holding (Clamping completion)

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.

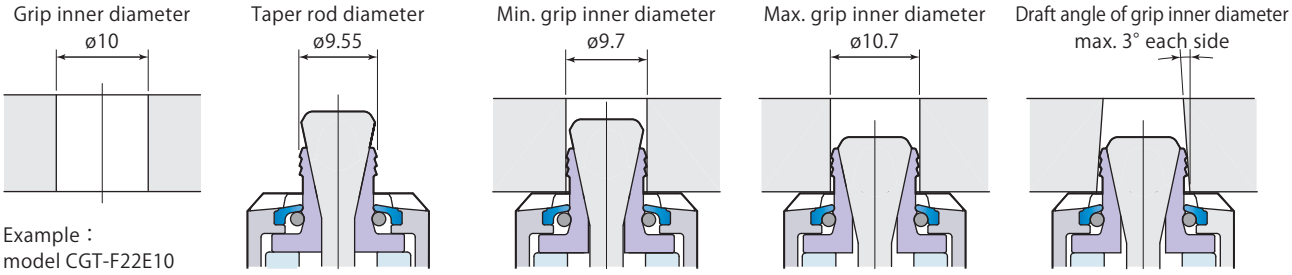
④ Workpiece holding is completed by the sensor air, clamping and unclamping hydraulic pressure.



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

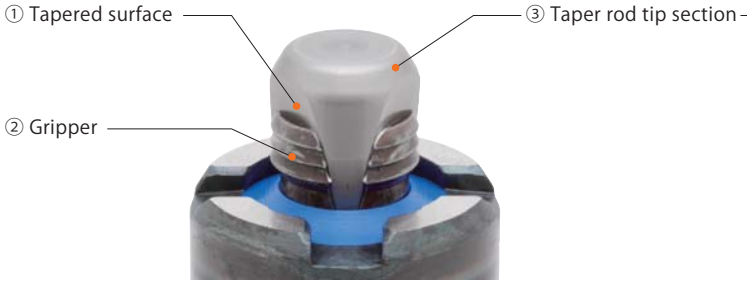
∗：0.6mm stroke for CGT-F21-055, 058, 061, 064, 067, 070A. 0.7mm stroke for CGT-F21E070, 073, 076, 079, 082.

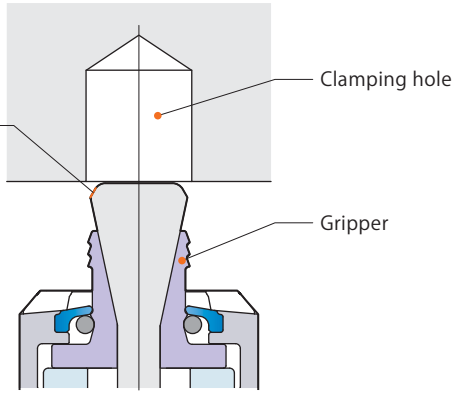
Taper rod and gripper with superior durability

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.

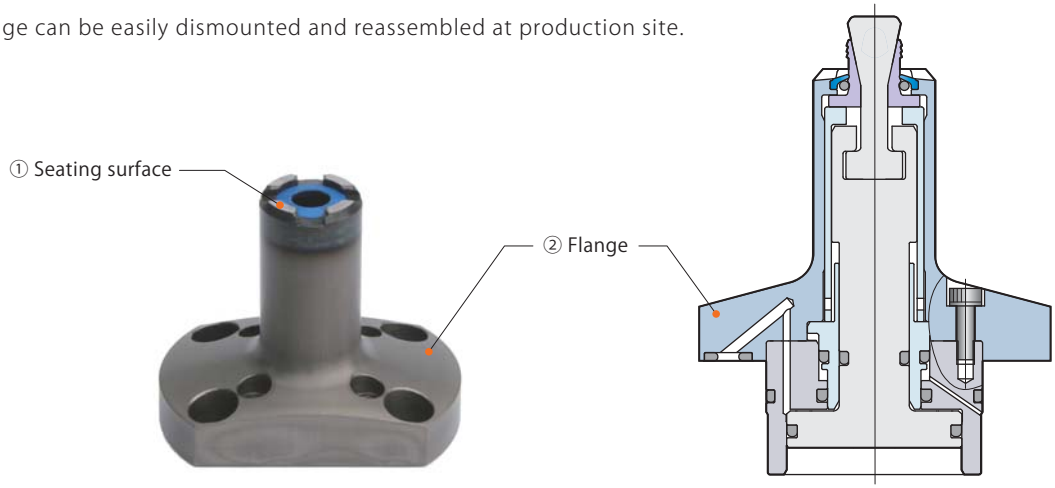




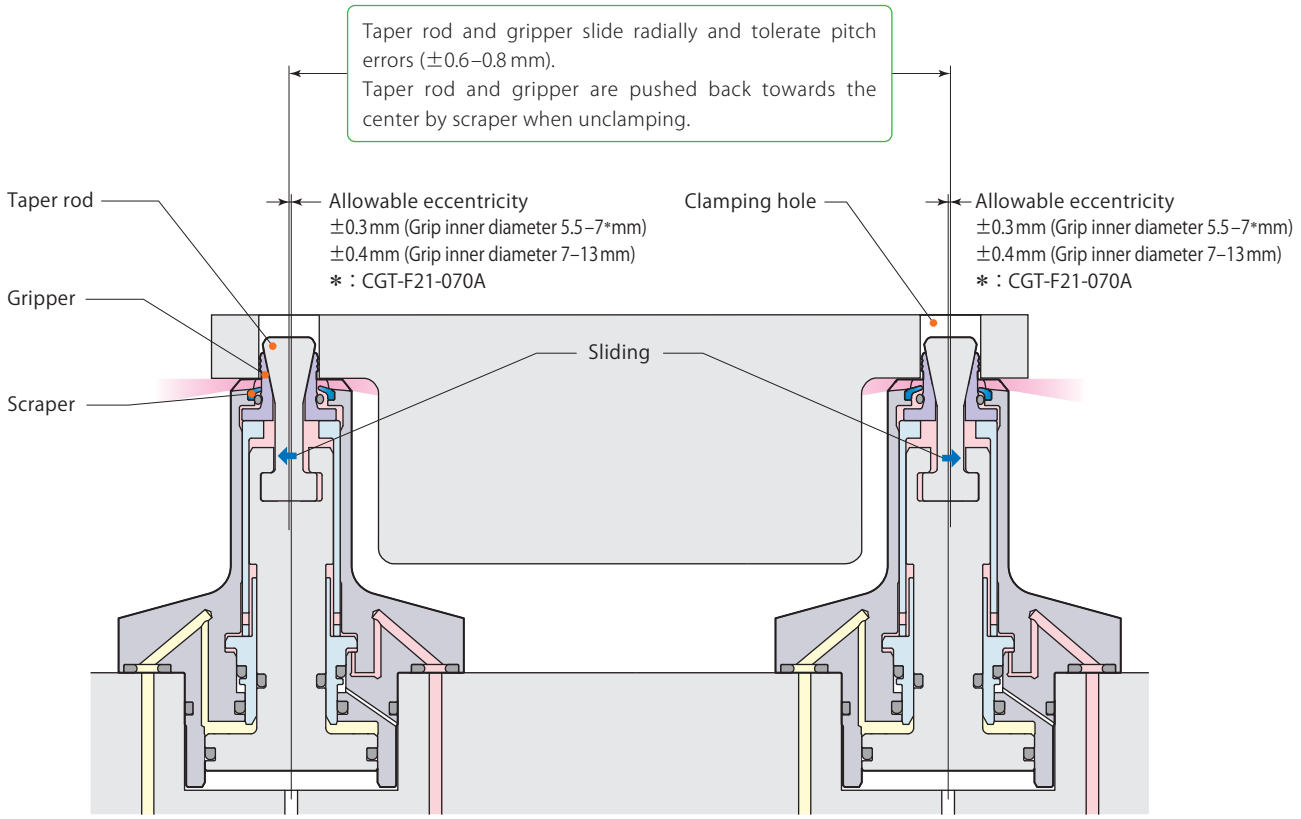
Seating surface can be reground (Max. 0.1 mm)

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.



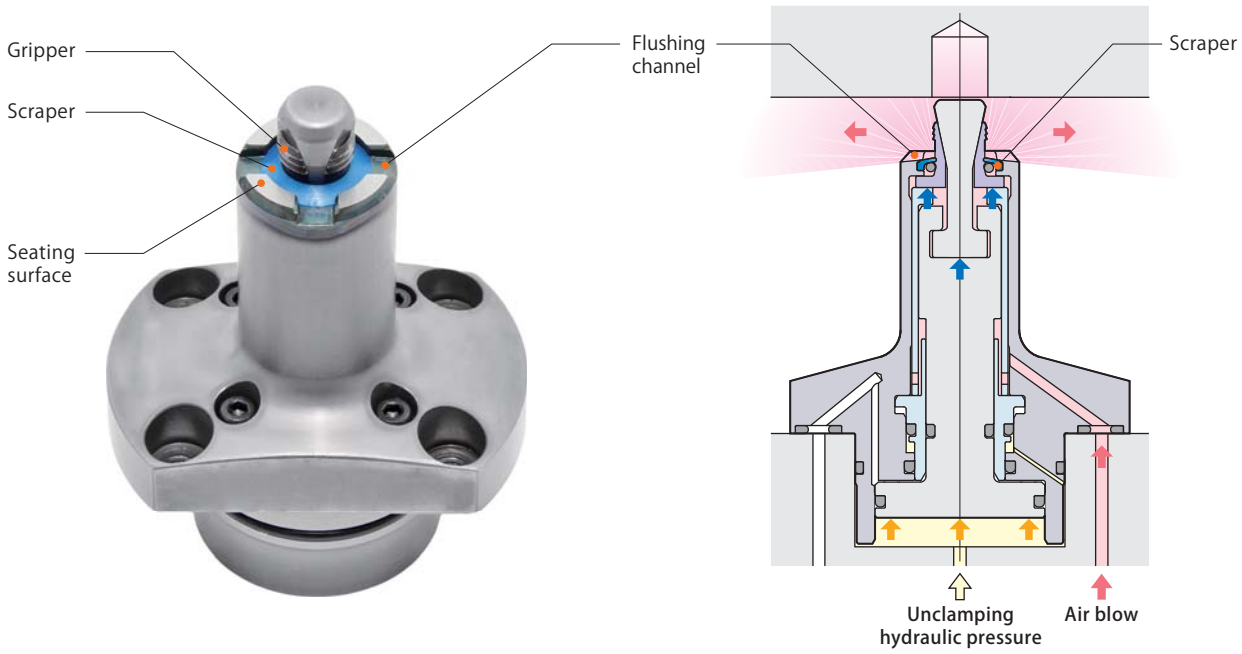
Clamping hole pitch errors can be tolerated



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

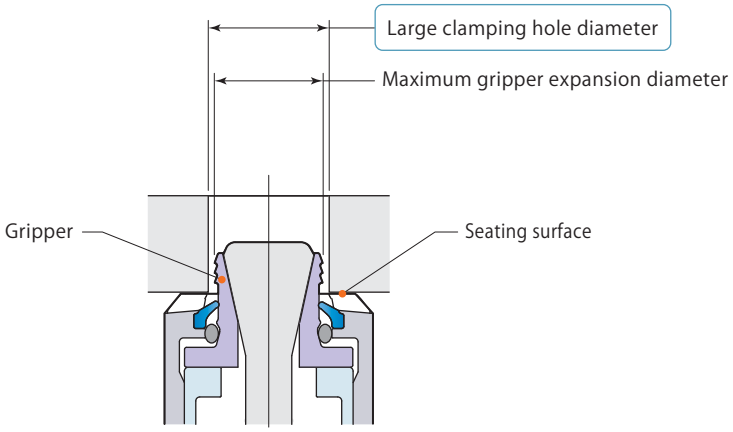
Incorporating strong air blowing circuit

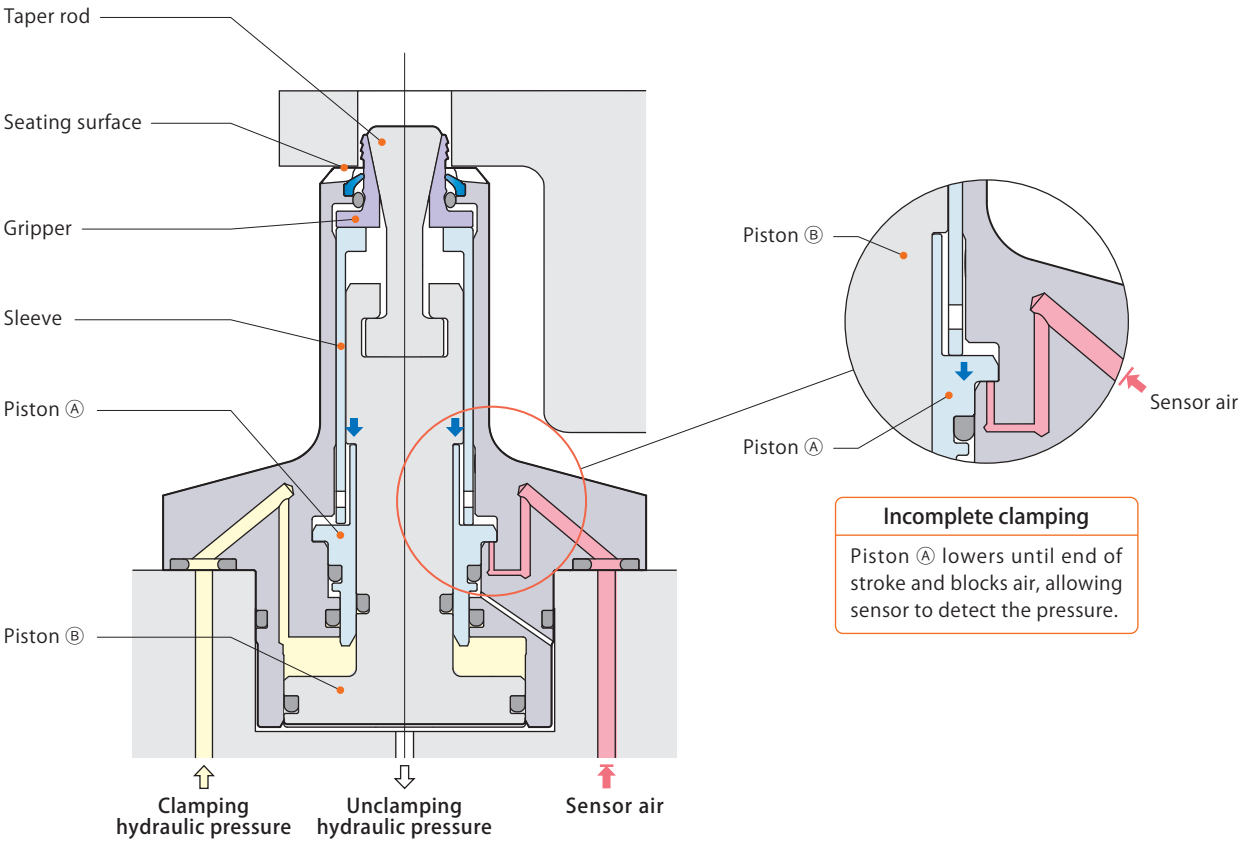
Air blow from a gap between the gripper and scraper clears off metal chips and coolant that stay on the seating surface. Flushing channel is also provided on the seating surface to remove the metal chips and coolants smoothly during workpiece setting.



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.





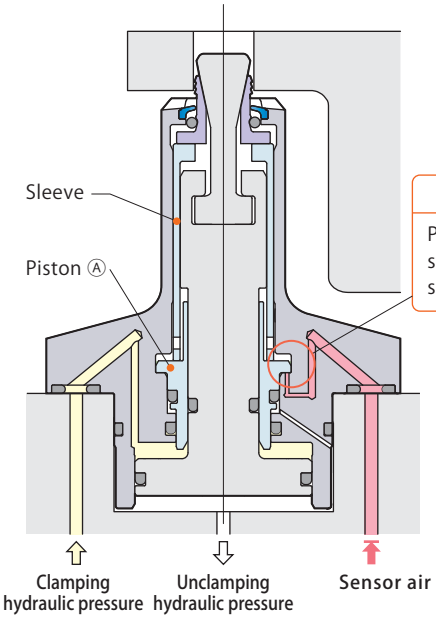
Incomplete clamping

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

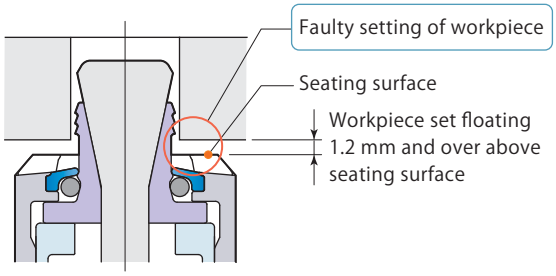
Clamp condition	Air sensor signal	Hydraulic pressure switch
Incomplete clamping	**Air sensor ON** (Sensor air does not flow.)	**Clamping hydraulic pressure ON**

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.



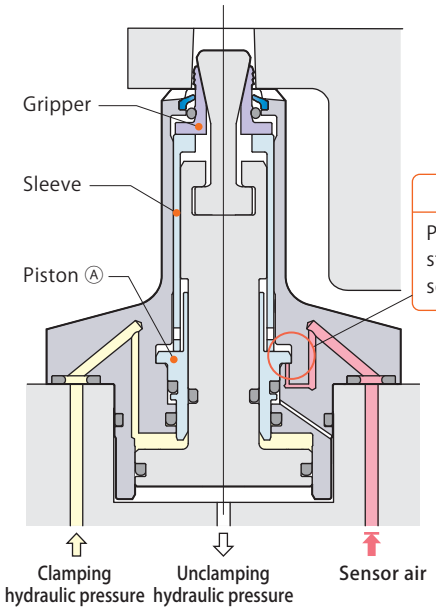
Incomplete clamping
Piston Ⓐ lowers until end of stroke and blocks air, allowing sensor to detect the pressure.



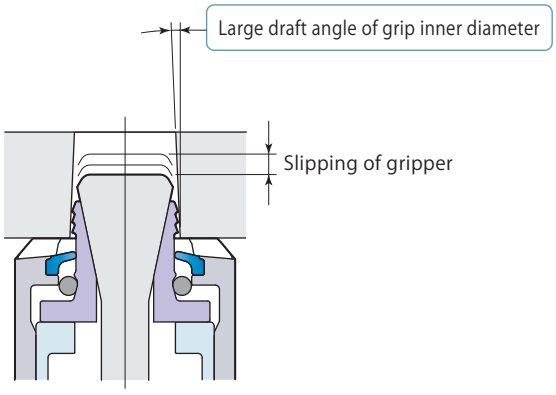
Clamp condition	Air sensor signal	Hydraulic pressure switch
Incomplete clamping	**Air sensor ON** (Sensor air does not flow.)	**Clamping hydraulic pressure ON**

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

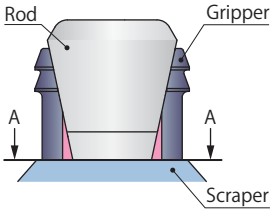
Non-constant air blow model

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)	

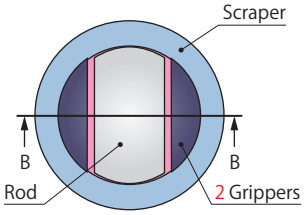
Number of grippers	Grip inner diameter	Clamping force	Model
3 Grippers	ø 11 12 13	3.54 kN (Hydraulic pressure 7 MPa)	CGT-F22E Grip inner diameter

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

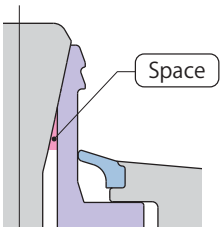
Space where metal chips can intrude is created



When clamping



A-A



B-B

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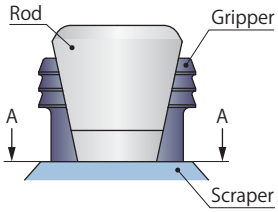
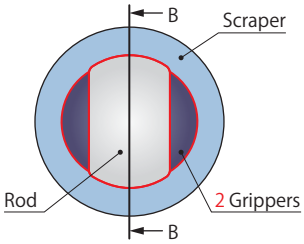
Because of space between scraper, gripper and the rod, air blow must always be performed to prevent intrusion of chips.

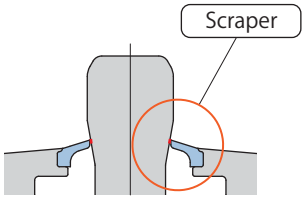
Secure chip protection



When clamping



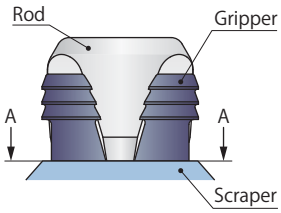
A-A



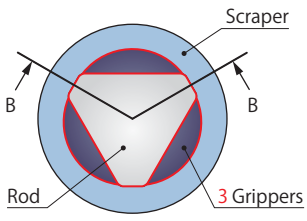
B-B

Pages →52–55

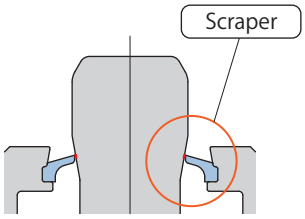
Because of space between scraper, gripper and the rod, air blow must always be performed to prevent intrusion of chips.



When clamping



A-A

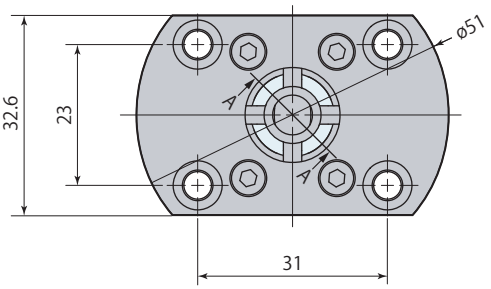


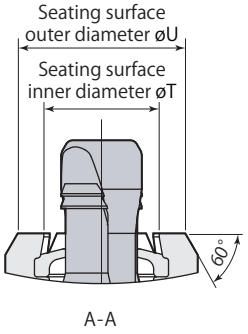
B-B

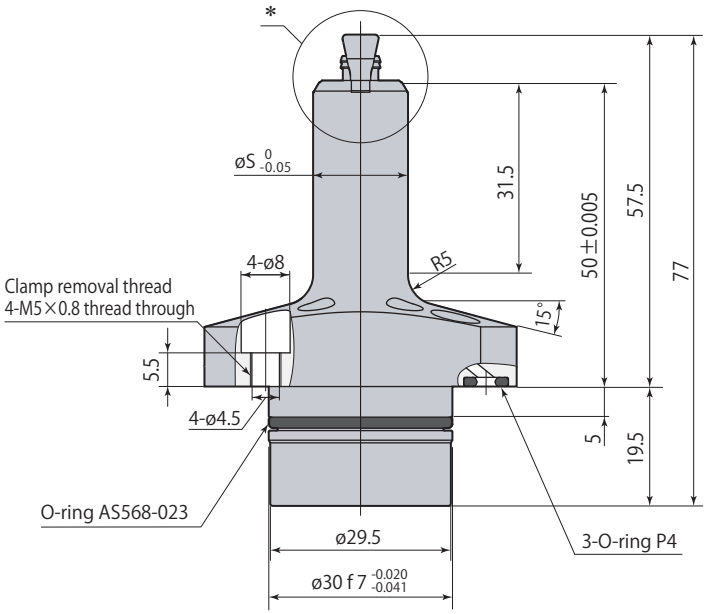
Pages →56, 57

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

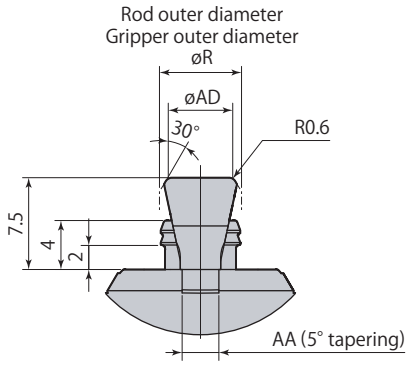
Dimensions



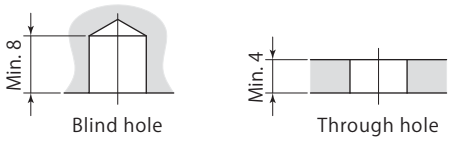


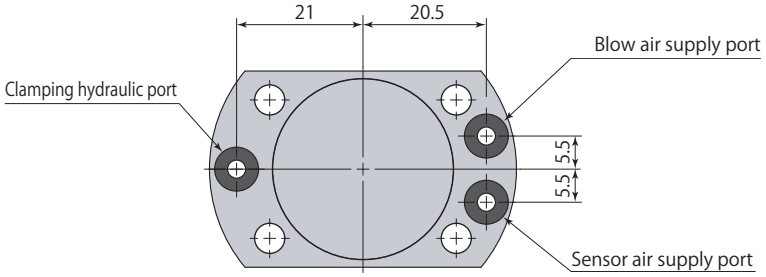


*Details



Grip inner diameter usage requirements





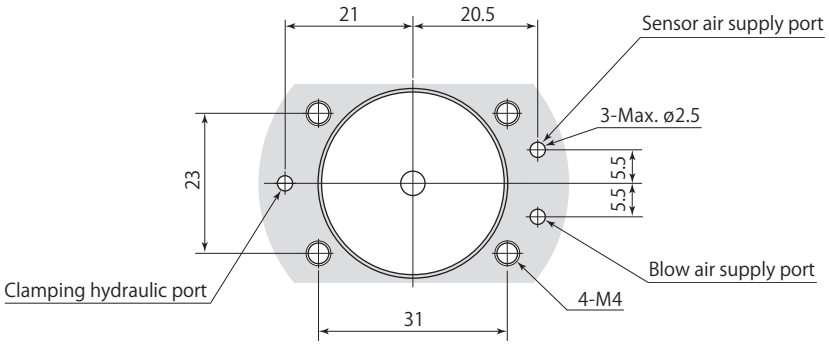
mm

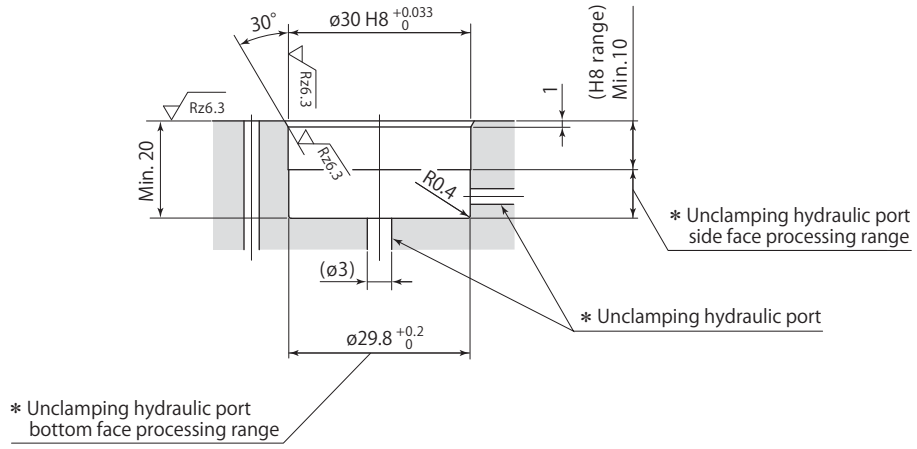
Model	CGT- F21-□					
	055	058	061	064	067	070A
øR	5	5.3	5.6	5.9	6.2	6.5
øS	15	15	15	15	15	15.5
øT	7.8	8.1	8.4	8.7	9	9.3
øU	11	11.6	12.2	12.8	13	13.5
AA	2.5	2.5	3	3	3	3
øAD	3.8	4.1	4.4	4.7	5.0	5.3

- 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



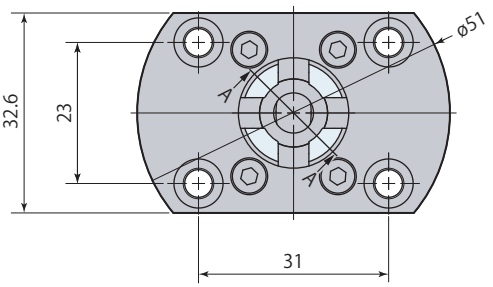


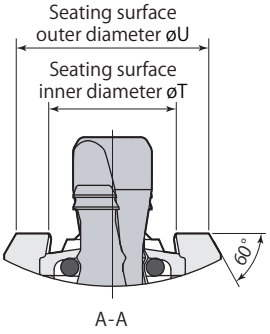
Rz: ISO4287(1997)

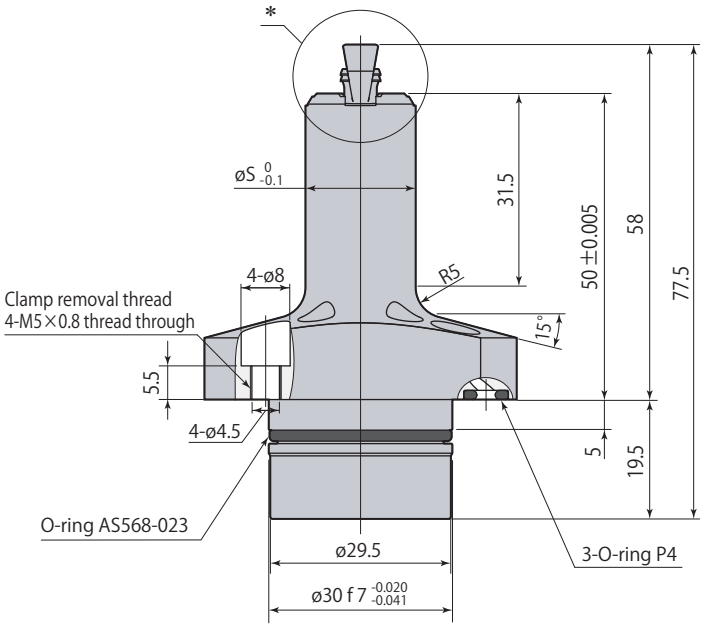
∗ : Unclamping hydraulic port must be made on either side or bottom face.

- 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.

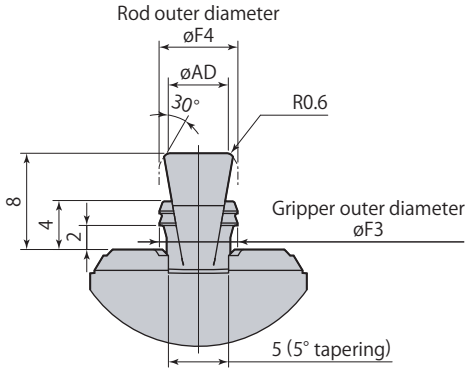
Dimensions



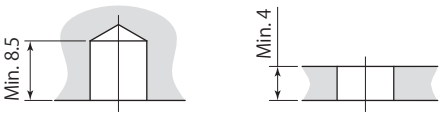


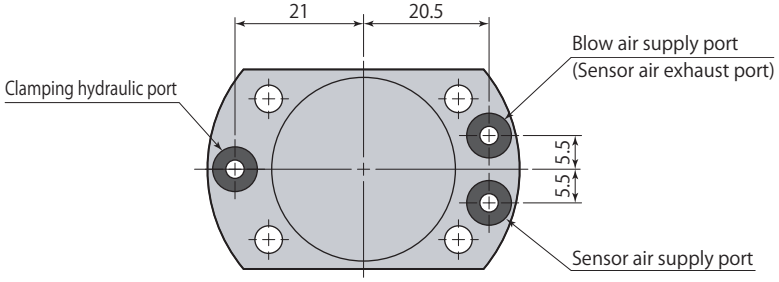


∗Details



Grip inner diameter usage requirements





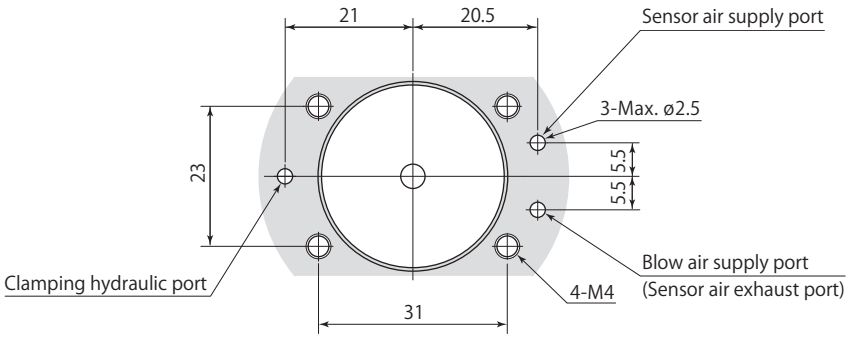
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

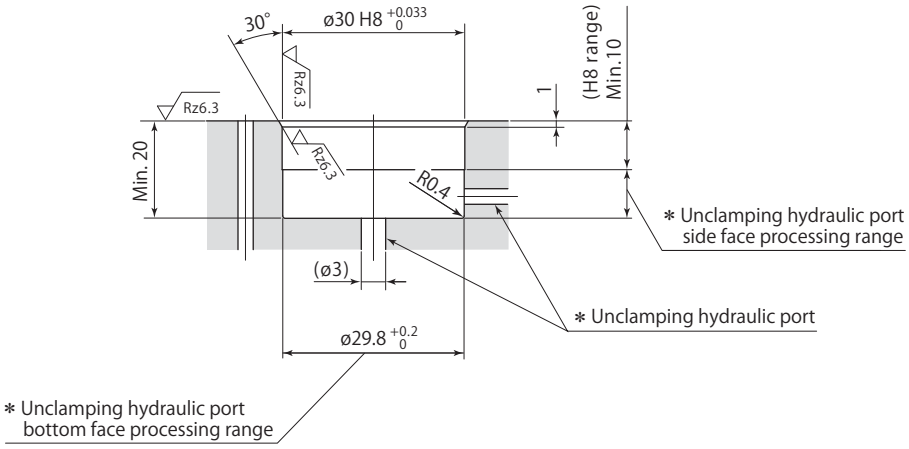
mm

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



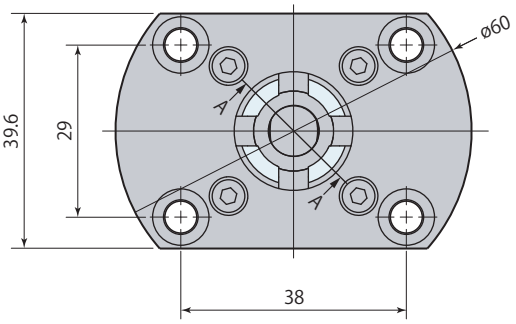


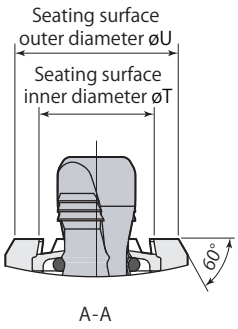
Rz: ISO4287(1997)

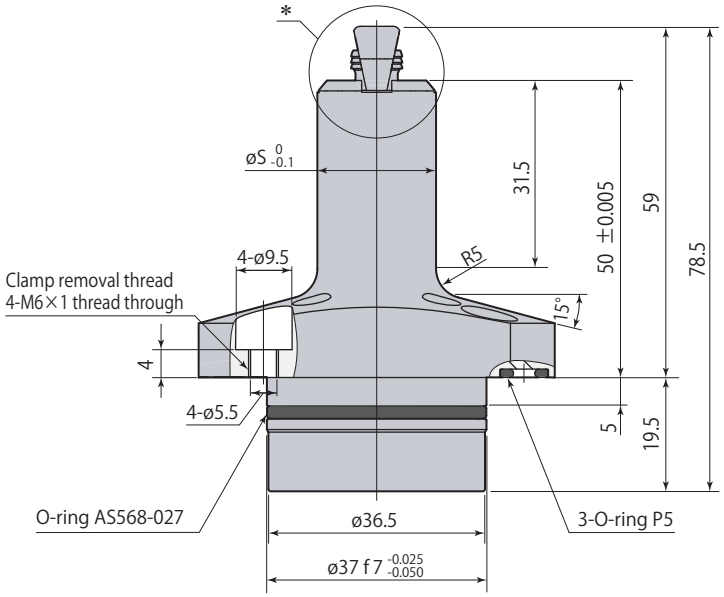
∗ : Unclamping hydraulic port must be made on either side or bottom face.

- 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.

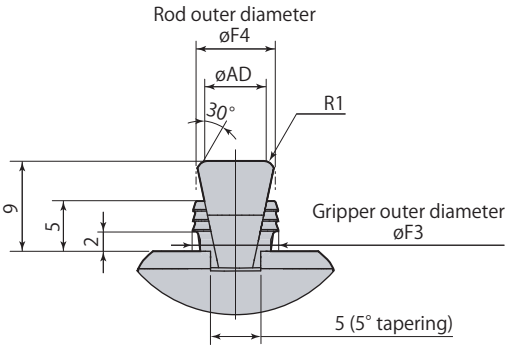
Dimensions



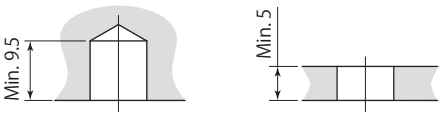


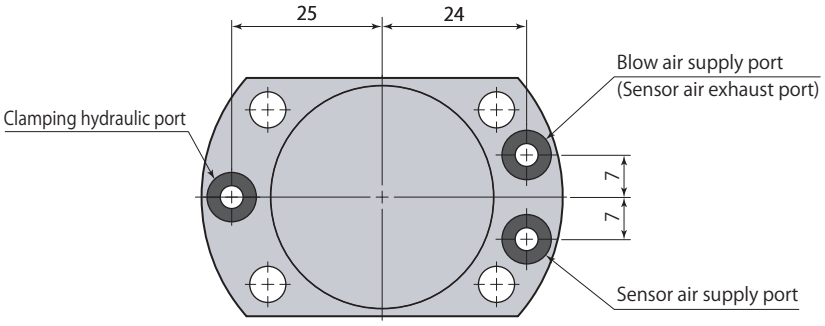


∗Details



Grip inner diameter usage requirements





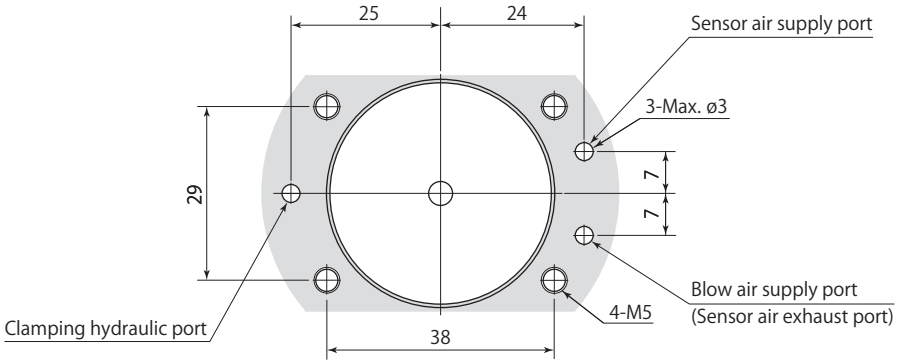
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

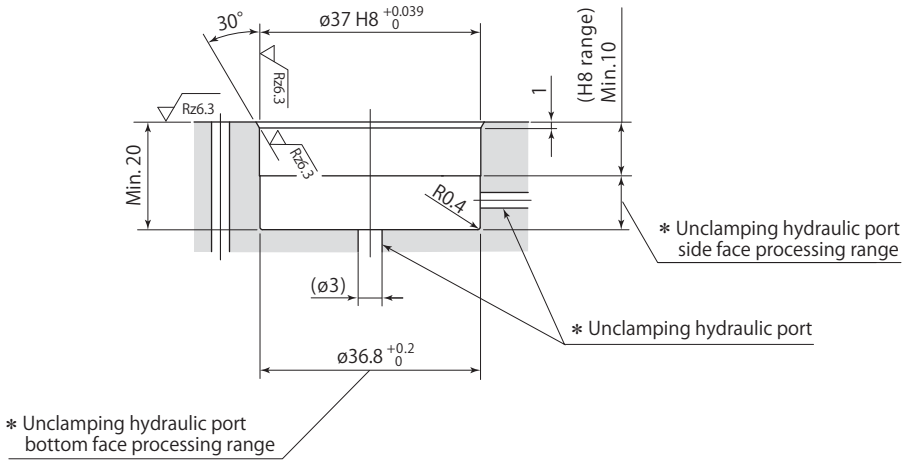
mm

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



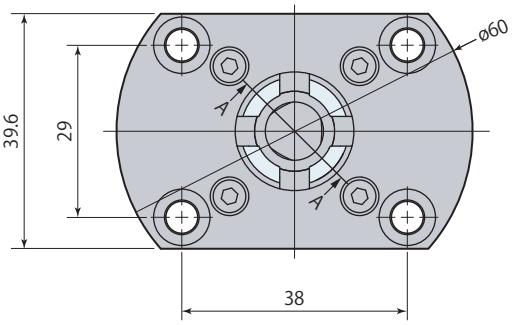


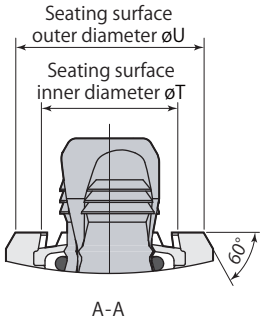
Rz: ISO4287(1997)

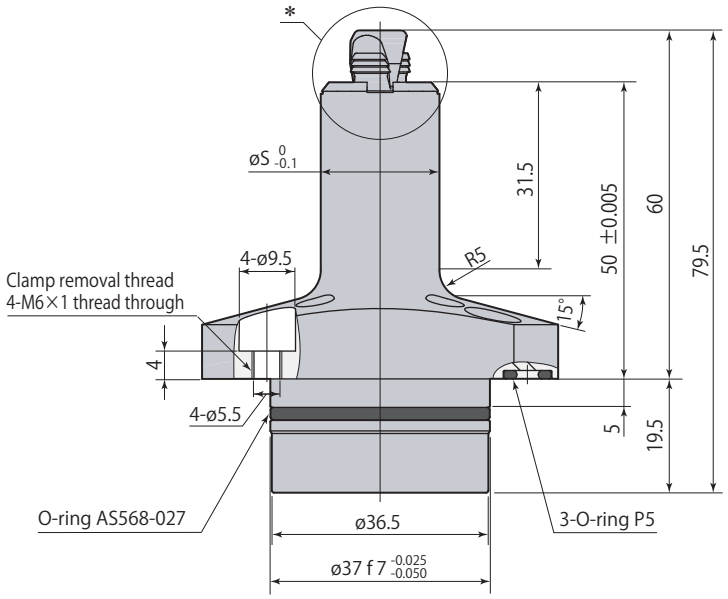
∗ : Unclamping hydraulic port must be made on either side or bottom face.

- 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.

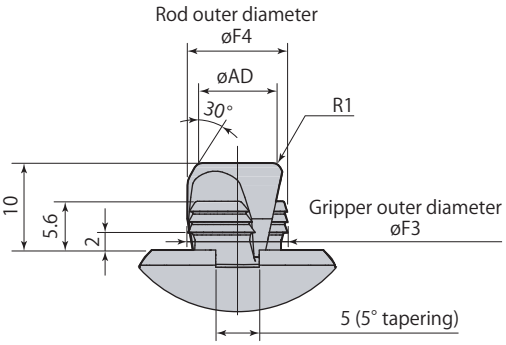
Dimensions



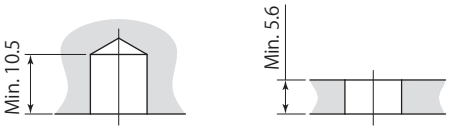


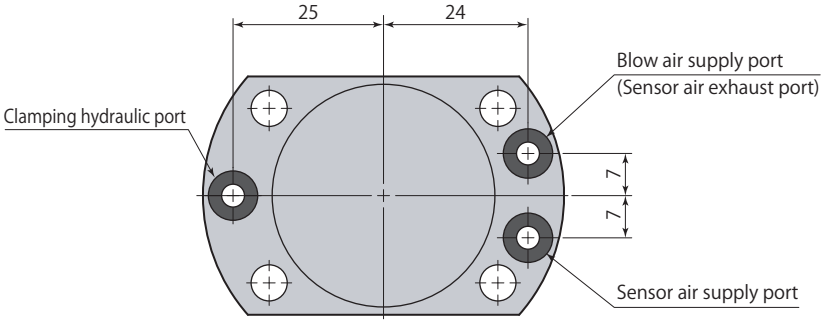


∗Details



Grip inner diameter usage requirements





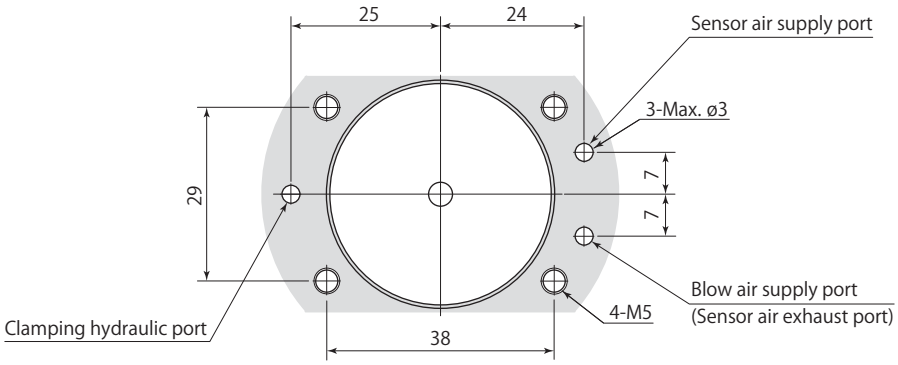
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

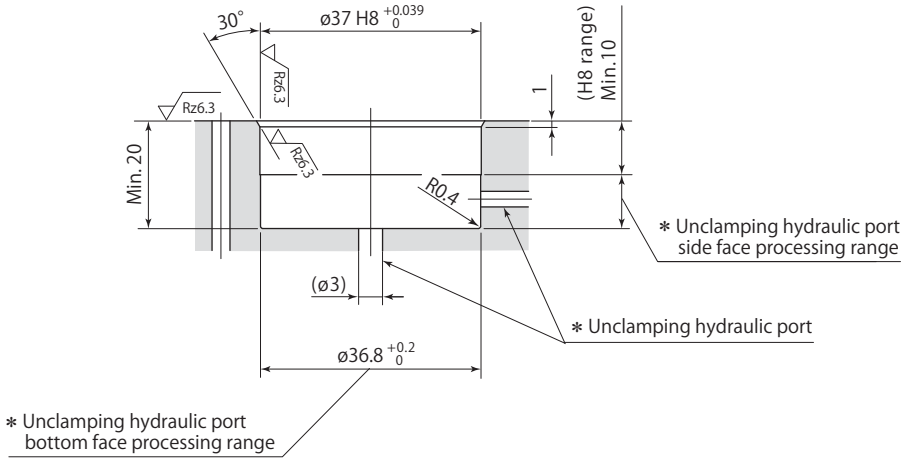
mm

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



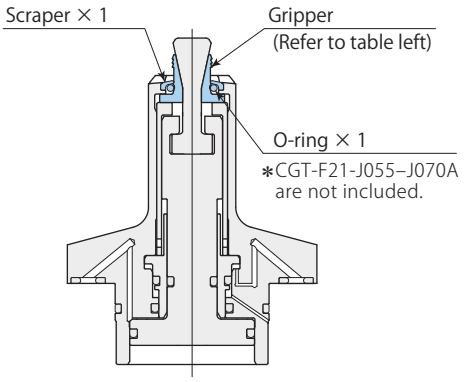


Rz: ISO4287(1997)

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

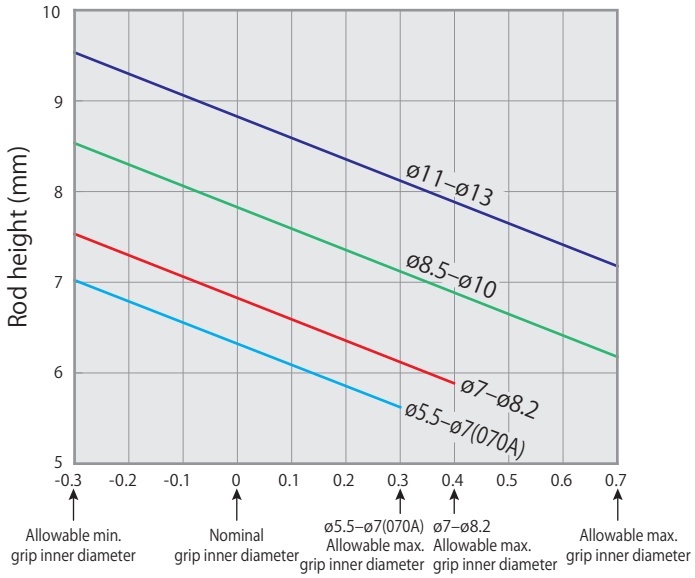
- Apply an appropriate amount of grease to the chamfer and the bore when mounting.
  Excessive grease may be a blockage in the air passage, causing malfunction of the sensor.
- The 30° taper machining must be provided to avoid the damage of the O-ring.

Gripper set replacement

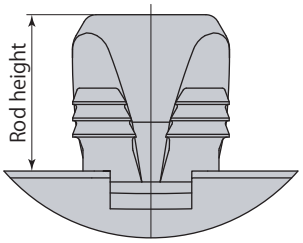
Number of grippers	Gripper set model	Clamp model	Set description
2 Grippers	CGT-F21-J055	CGT-F21-055	
	CGT-F21-J058	CGT-F21-058	
	CGT-F21-J061	CGT-F21-061	
	CGT-F21-J064	CGT-F21-064	
	CGT-F21-J067	CGT-F21-067	
	CGT-F21-J070A	CGT-F21-070A	
	CGT-F21EJ070	CGT-F21E070	
	CGT-F21EJ073	CGT-F21E073	
	CGT-F21EJ076	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)

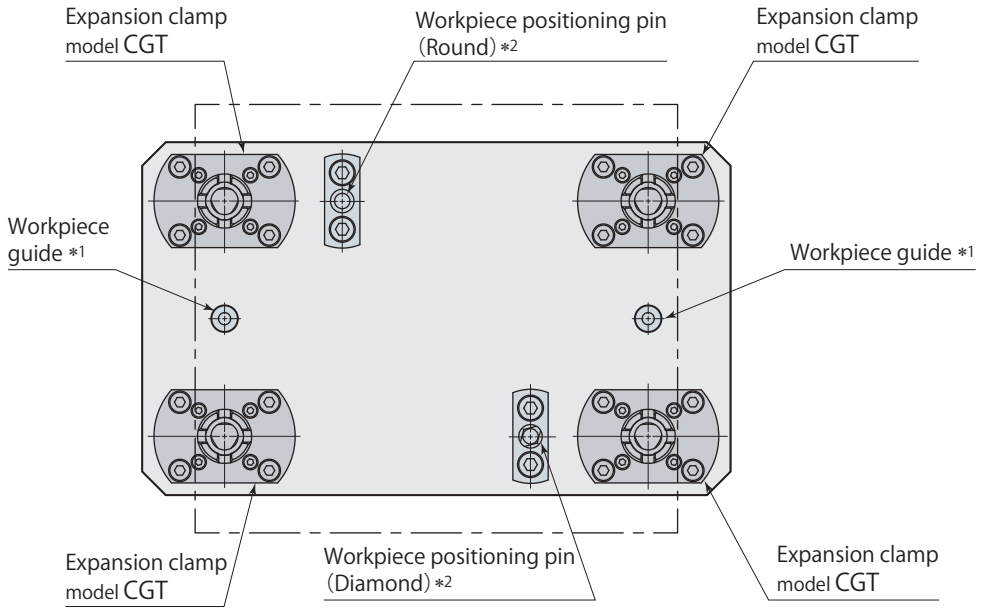


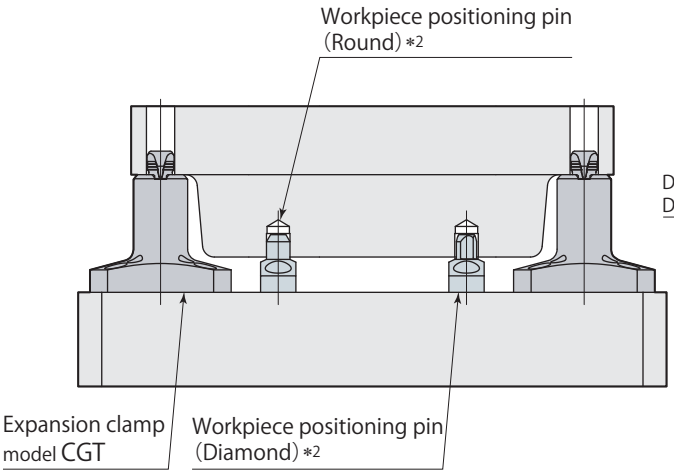
Rod height calculation formula	
ø5.5– ø7*	: 6.32-2.35× Actual grip inner diameter and nominal grip diameter difference
ø7 – ø8.2	: 6.58-2.84× Actual grip inner diameter and nominal grip diameter difference
ø8.5– ø10	: 7.82-2.35× Actual grip inner diameter and nominal grip diameter difference
ø11 – ø13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

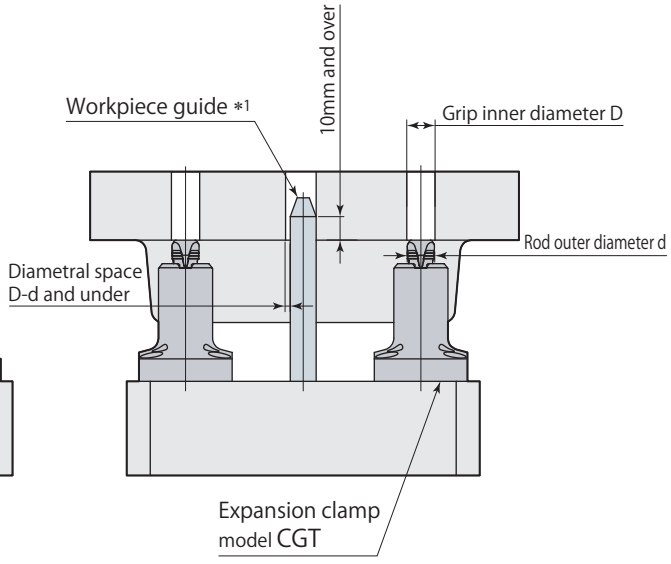
*: CGT-F21-070A

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



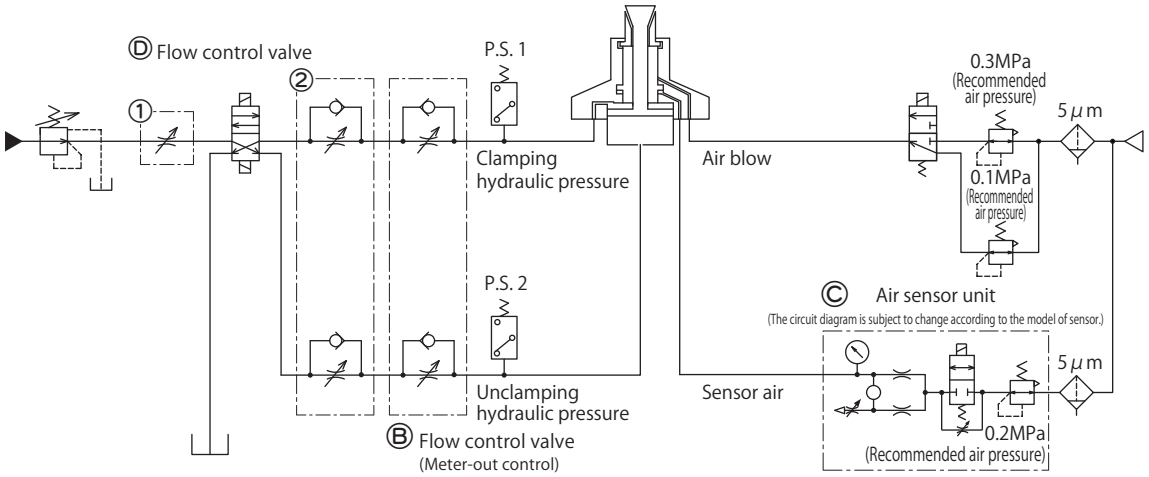




*1: When using automatic or robotic conveyers, prevent damage to clamp caused from impact by setting workpiece guides. Using the above guide as reference, accurately position the holes when using workpiece guides.

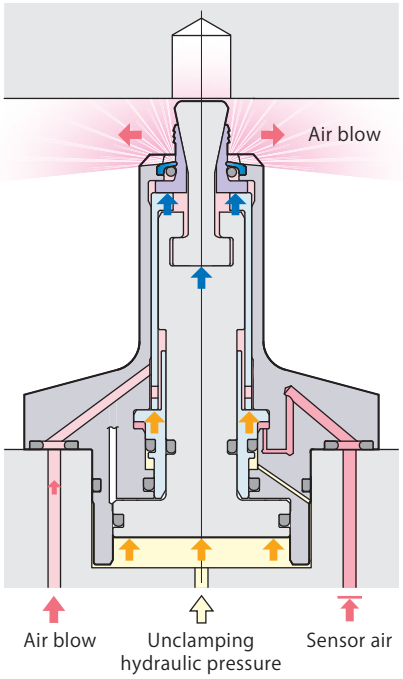
*2: **The expansion clamp does not have a workpiece positioning function.**
Install workpiece positioning pins (or similar).

Air blow model hydraulic and pneumatic circuit diagram

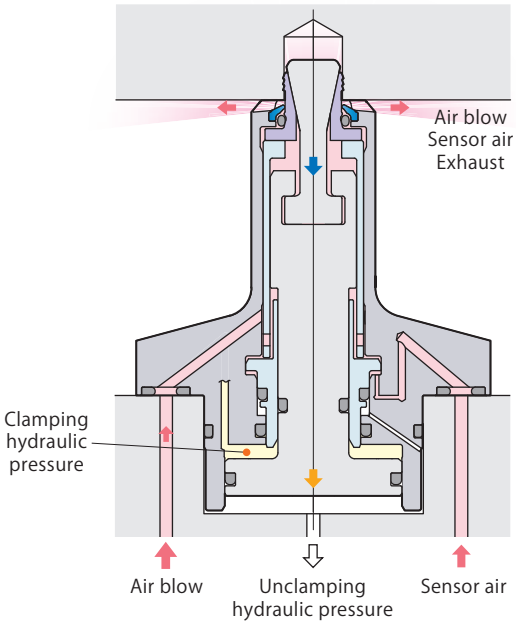


- Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping. During cutting, if chips adhere to the gripper such as when going through the clamping hole, continue air blowing during processing as well.
- Air blow pressure must be set to 0.1MPa when checking the operation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

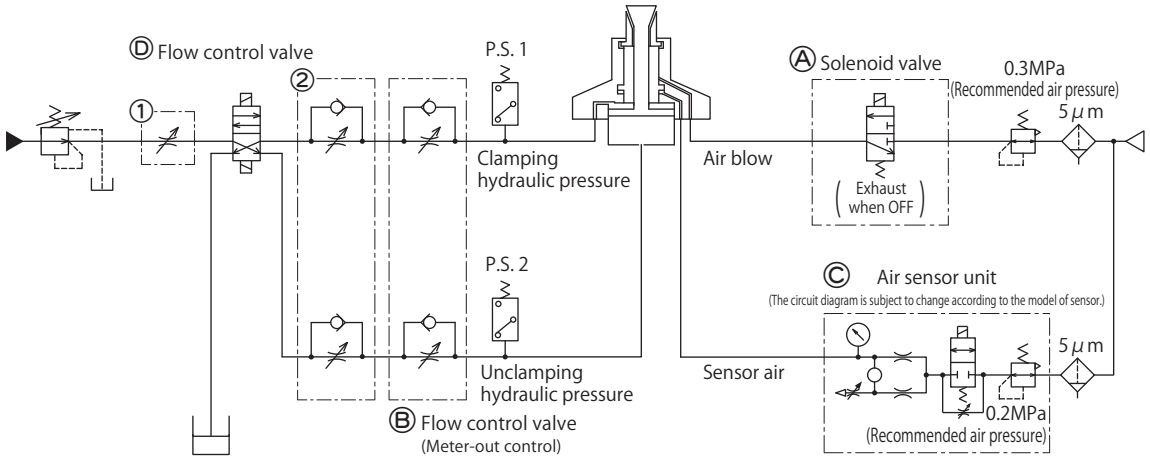
Air blowing



Clamping

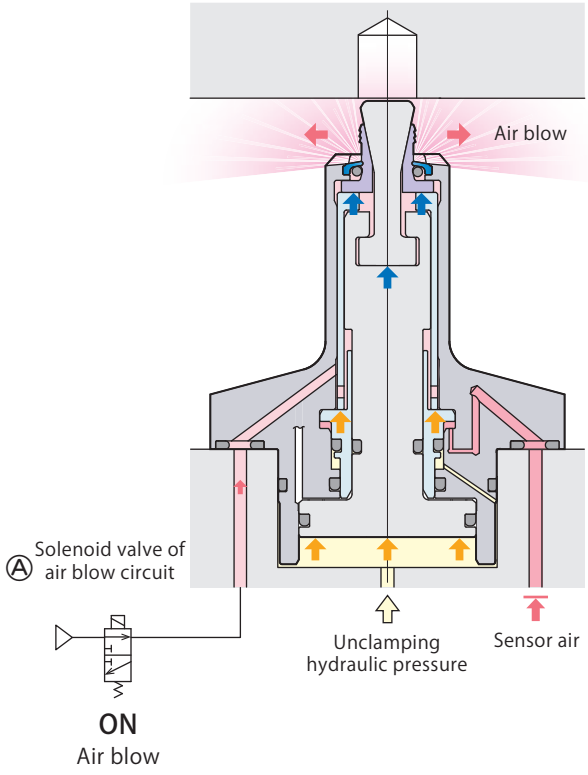


Non-constant air blow model hydraulic and pneumatic circuit diagram

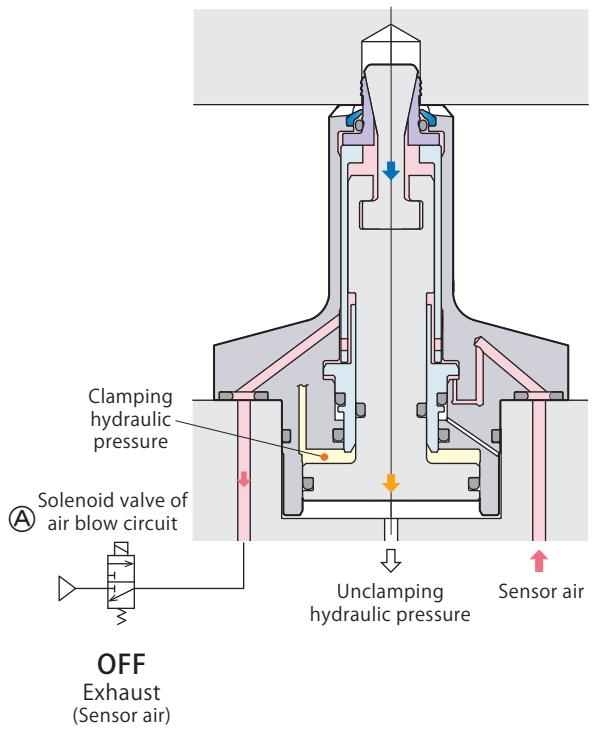


- Air blow will not be necessary during cutting process. Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping to remove metal chips and debris.
- The solenoid valve Ⓐ must be closed when checking the operation of the clamp with the air sensor. Also 3 port type of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



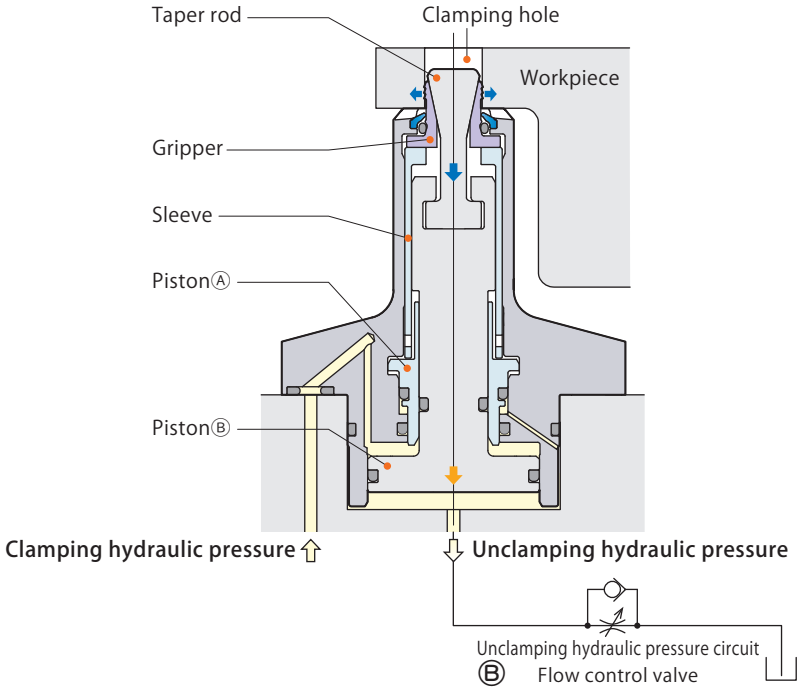
Clamping



- 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