Expansion clamp

model **CGS-N1**

Single acting 7MPa

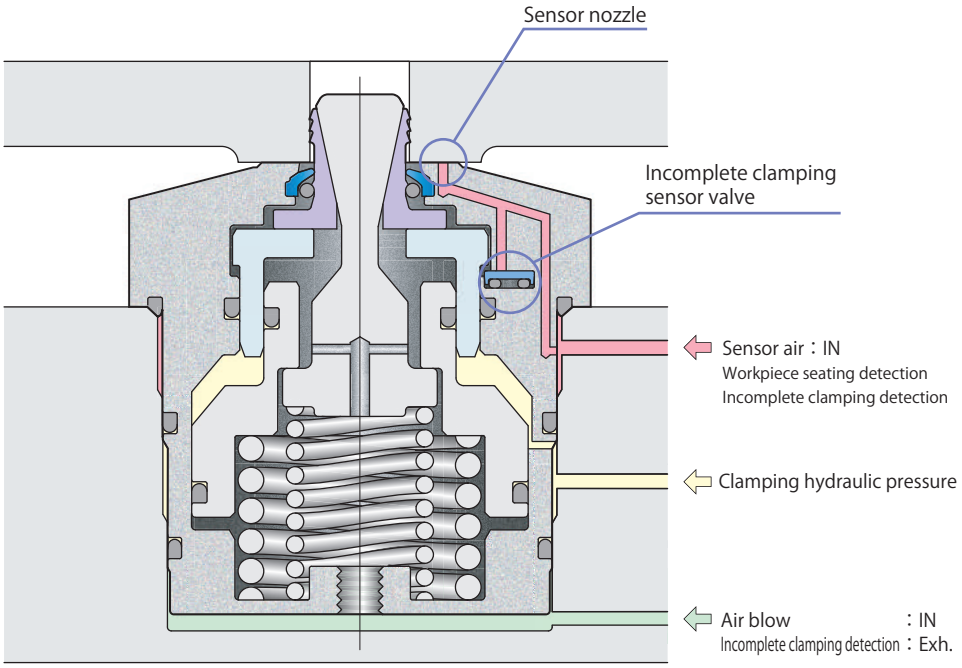
Pascal

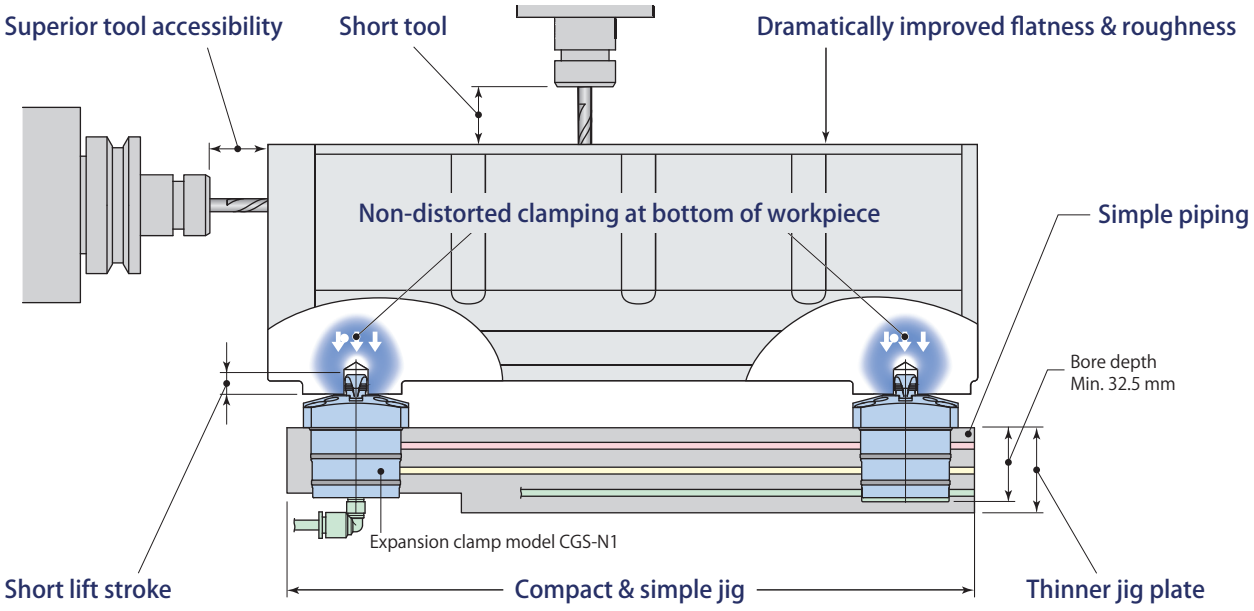
www.pascaleng.co.jp

Air blow model
model **CGS-N11-**
4 Grippers
ø6 7 8

Non-constant air blow model
model **CGS-N12E**
2 Grippers ø9 10
3 Grippers ø11 12 13

Non-constant air blow model
model **CGS-N13E**
3 Grippers
ø12 13 14 15 16

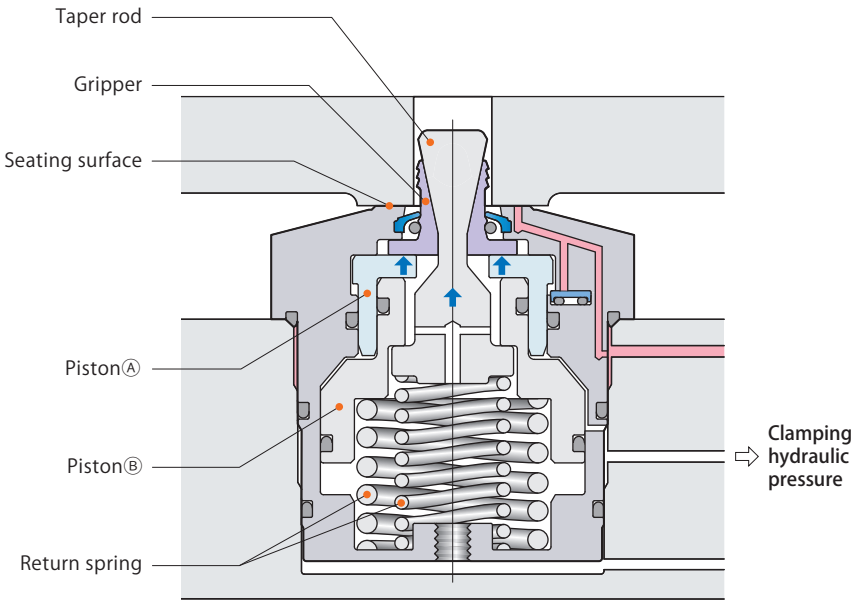




Workpiece setting (Unclamping completion)

① Pistons Ⓐ & Ⓑ, as well as taper rod and gripper are raised by return spring.

② Set the workpiece onto the seating surface.

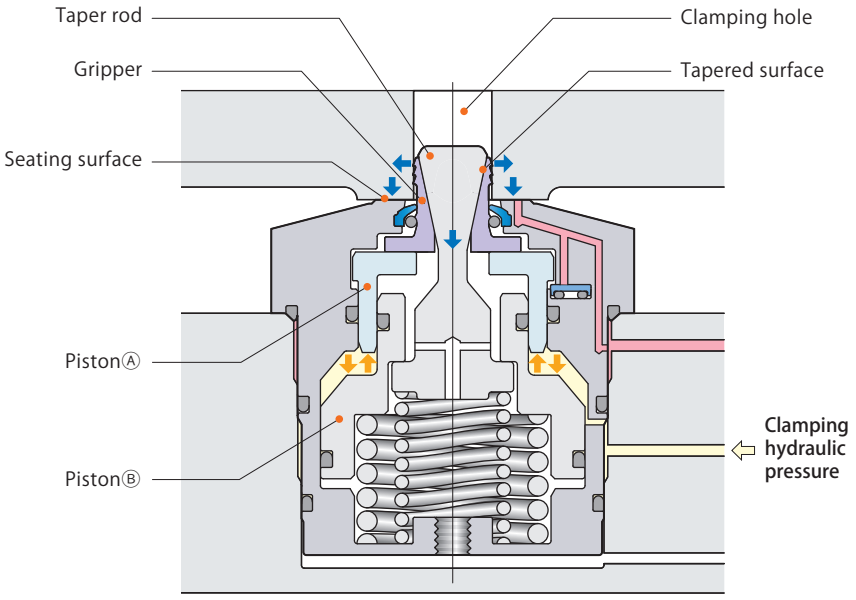


Workpiece holding (Clamping completion)

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

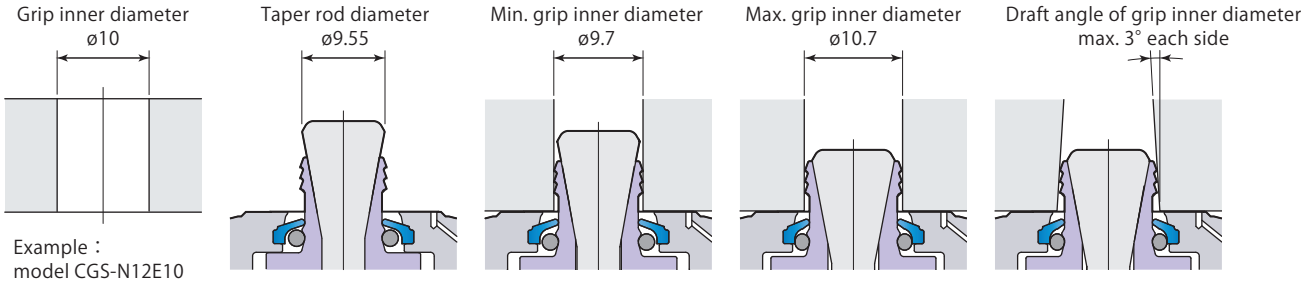
② The gripper expands horizontally along the tapered surface to grip inner face of clamping hole holding its position at upper stroke end by piston Ⓐ.

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 1.0 mm, which enables the accommodation of dimensional variations in diecast bore diameters and ensures workpiece is held securely.

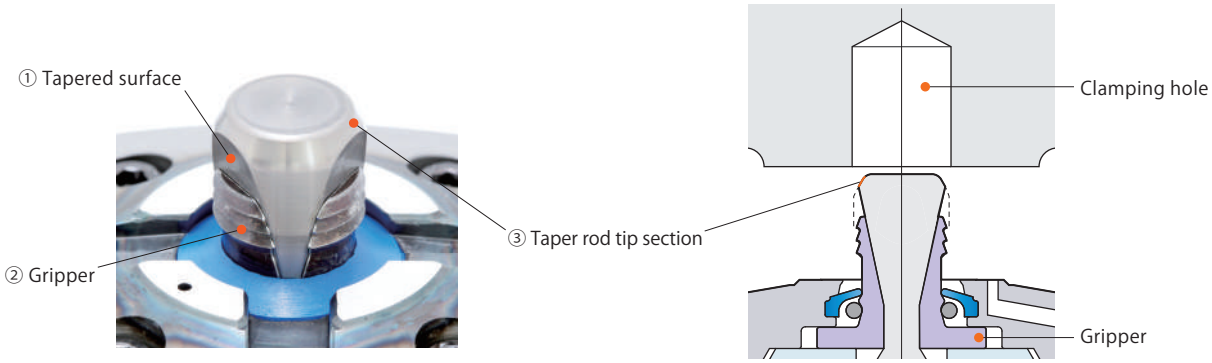


Taper rod and gripper with superior durability

① The holding force of expansion clamp is transmitted from tapered surface to gripper, making it possible for the gripper to hold onto inner diameter of workpiece 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.

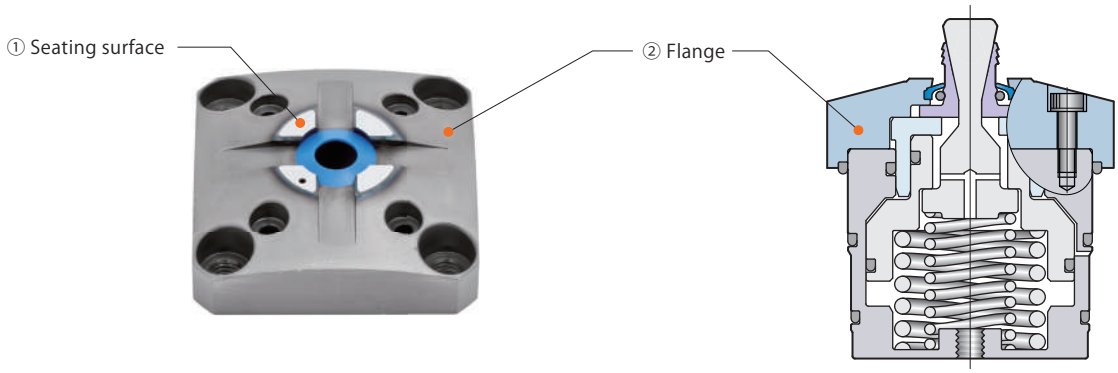
③ Tip section of taper rod has larger diameter than gripper and is well chamfered to be a better guide when setting the workpiece.



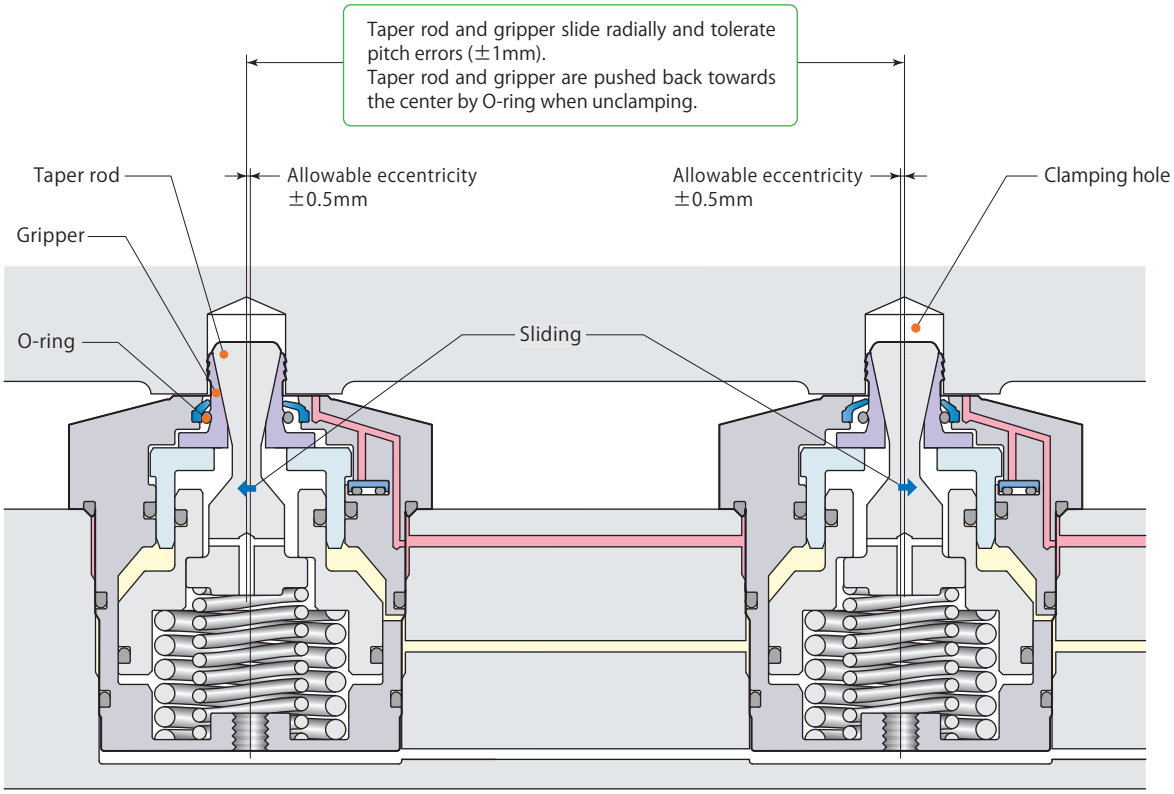
Seating surface can be reground (Max.0.1 mm)

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

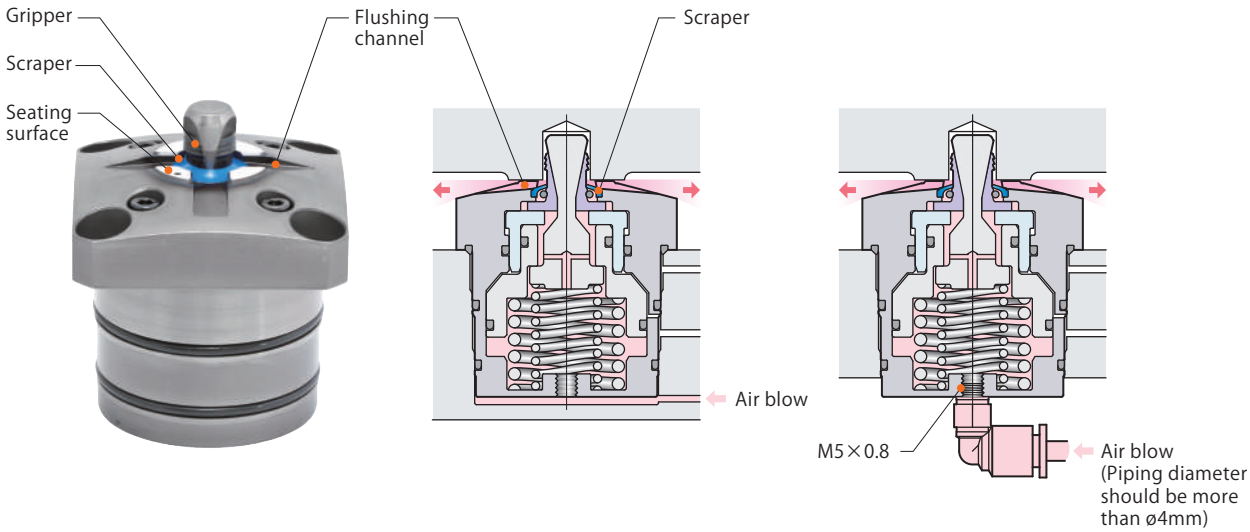


Incorporating strong air blowing circuit

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.

Manifold-type and piping method can be chosen for air-blow circuitry.

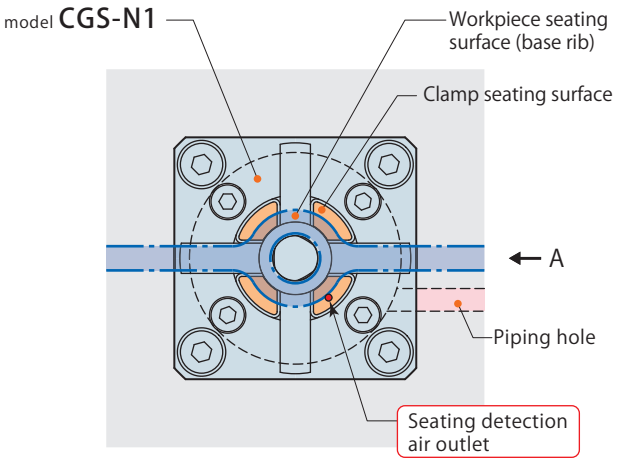


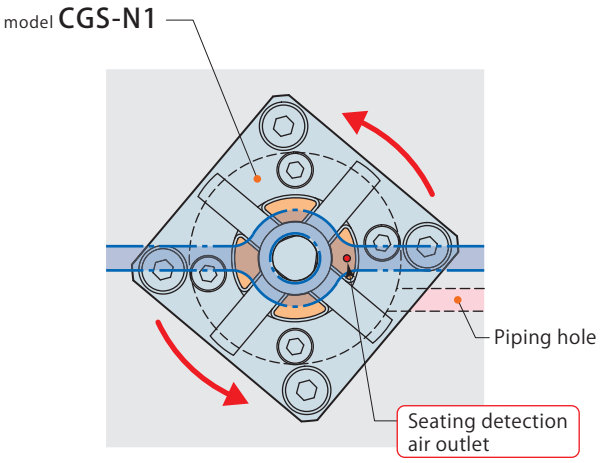
Jig design and production made easy with cartridge piping.

PAT. JP5885822

For model CGS-N1, the outlet for the seating detection air is blocked during clamping. This triggers the air sensor and workpiece setting is detected. (See explanation on → **page 9**). When workpiece's seating surface is small, the outlet for seating detection air may not be blocked and seating can not be detected (Figure 1-a).

For workpiece's base rib to plug seating detection air outlet, clamp can be mounted diagonally to detect workpiece seating. (Figure 1-b) For the single-acing CGS-N1, cartridge piping is used. Thus, the layout of the piping hole will not change and the clamp body can be mounted at any angle.





View A

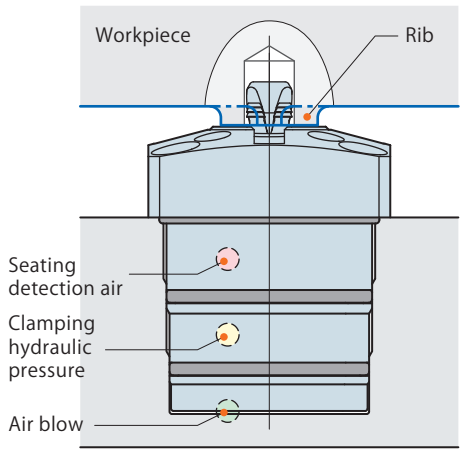


Figure 1-a

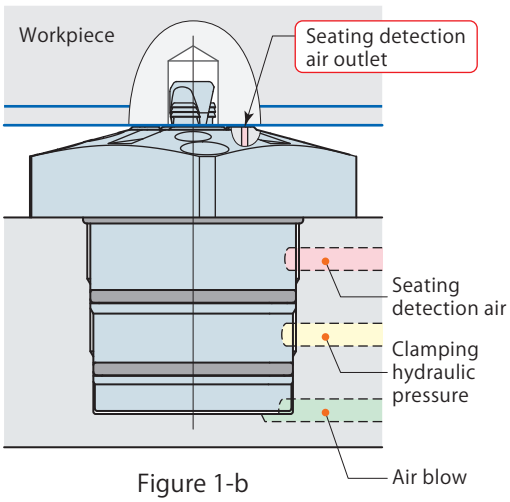
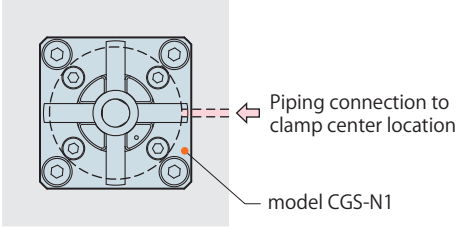
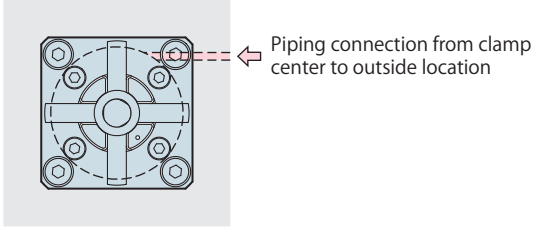


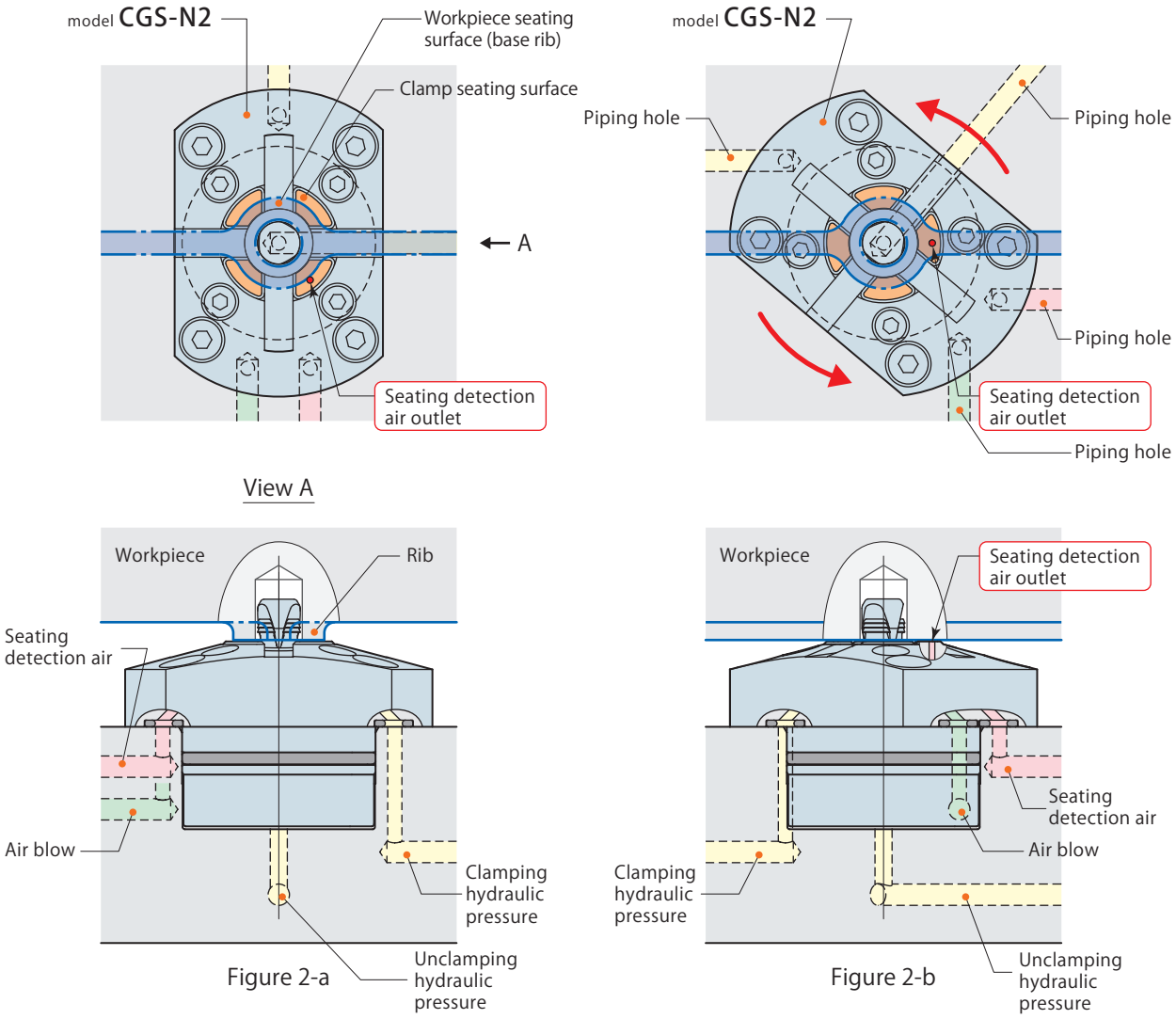
Figure 1-b

For the cartridge-type CGS-N1 model, hydraulic/air piping can be connected by any position or angle. Thus, there is a greater degree of freedom of piping layout, and jig production and design is made easy.



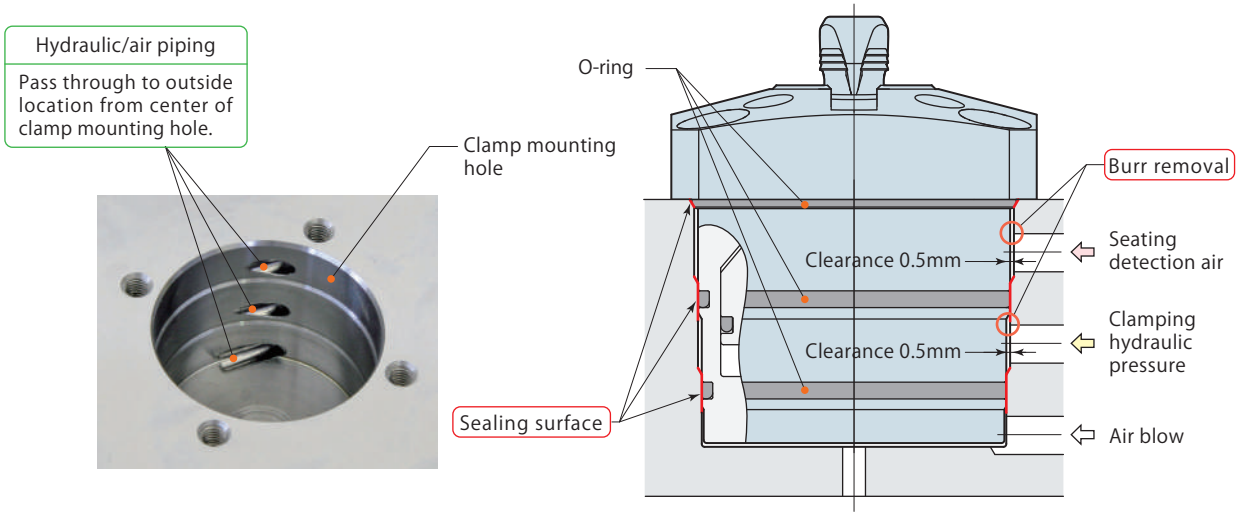


For the double-action gasket piping expansion clamp —— model CGS-N2, the piping connection port location will differ depending on the clamp mounting angle. Thus, piping hole layout becomes complicated and jig production and design will be difficult. (Figure 2-b)



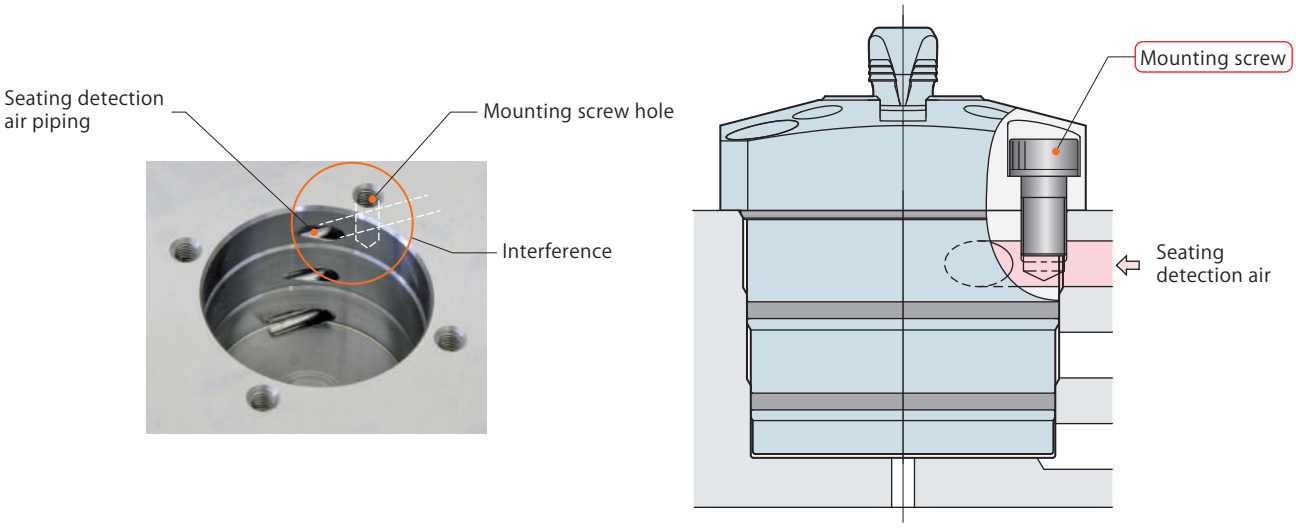
Greater degree of freedom of piping layout - 1

To prevent damage to the O-ring caused by the burr of the hydraulic/air piping clamp mounting hole penetration area, the seal face in the inner perimeter of the clamp mounting hole (where the O-ring is contacted), becomes smaller and smaller toward the bottom. Even if it is difficult to remove burr when the piping passes through from the center of the clamp mounting hole to an outside location, the O-ring can still be protected from damage.



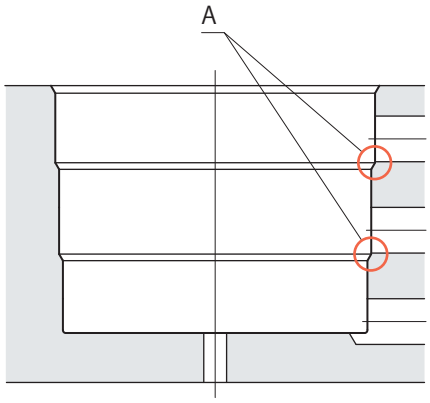
Greater degree of freedom of piping layout - 2

The mounting screw hole can impede the seating detection air piping hole without any problem. The mounting screw creates a seal and will not allow seating detection air to leak.



Mounting hole processing made easy

If processing specifications shown on Figure 3-a is difficult, process using specifications shown on Figure 3-b (see red line).



A-part details

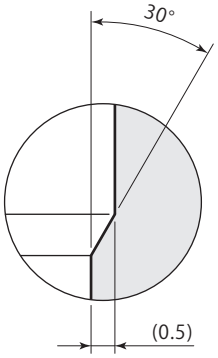


Figure 3-a

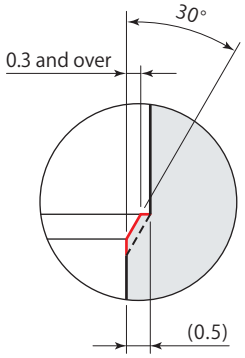


Figure 3-b

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.

Metal chips caught by clamp

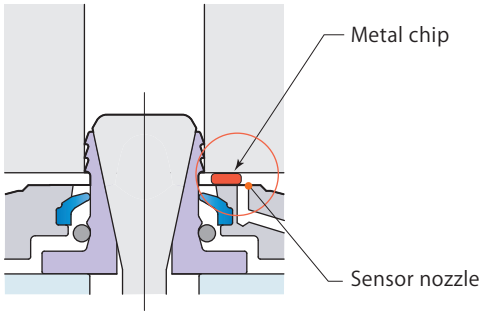


Figure 1-a

Faulty setting of workpiece

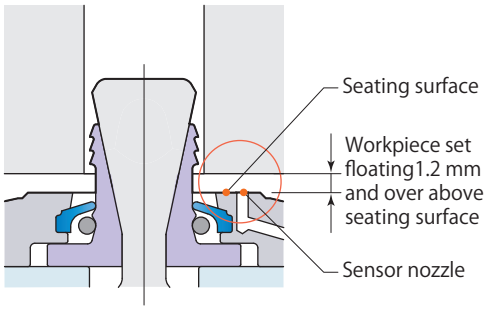
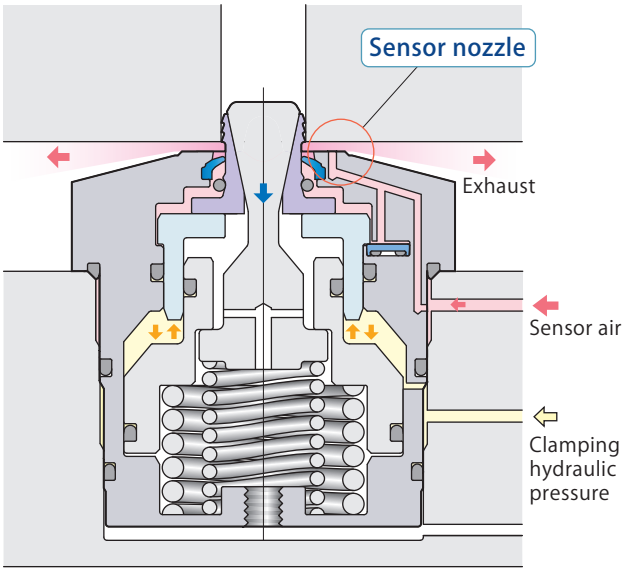


Figure 1-b

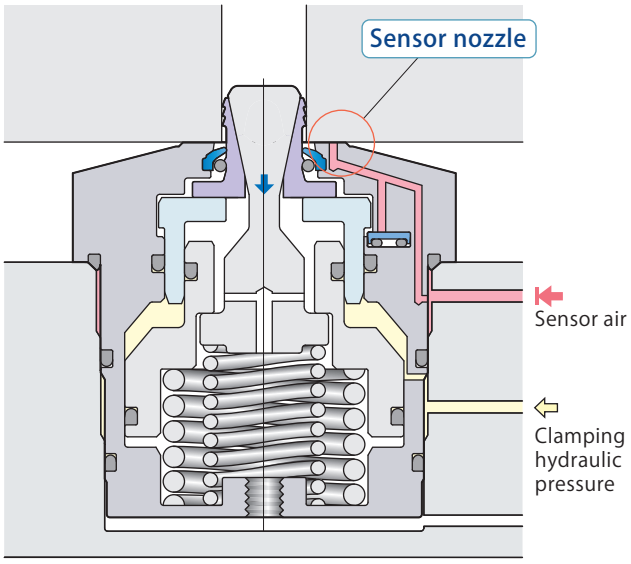
Faulty seating of workpiece

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.

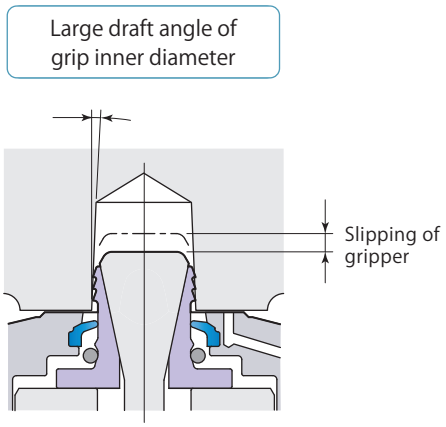


Clamp condition	Sensor nozzle	Air sensor signal	Hydraulic pressure switch
Faulty seating of workpiece	Open	**Air sensor OFF** (Sensor air flows.)	**Clamping hydraulic pressure ON**

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, incomplete clamping sensor valve is opened. Sensor air is exhausted and this detects incomplete clamping.

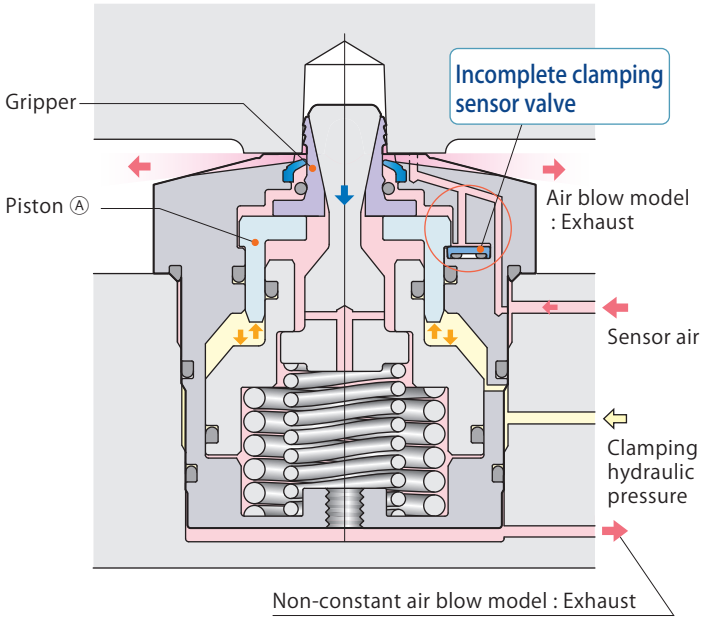


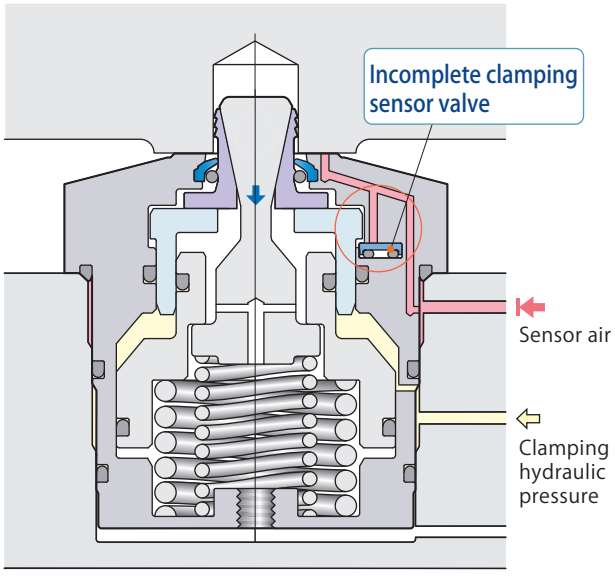
Incomplete clamping

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.



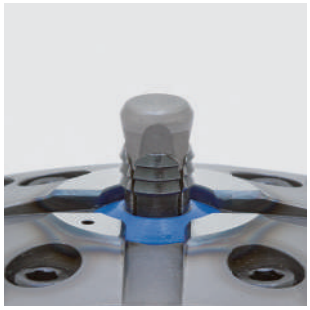


Clamp condition	Incomplete clamping sensor valve	Air sensor signal	Hydraulic pressure switch
Incomplete clamping	Open	**Air sensor OFF** (Sensor air flows.)	**Clamping hydraulic pressure ON**

With the development of the non-constant air blow expansion clamp, air consumption will be significantly decreased.

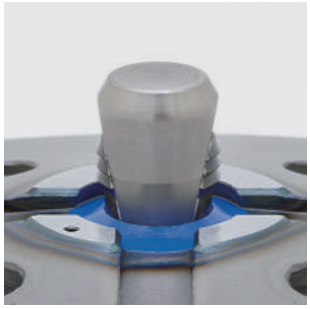
The traditional model ordinarily requires 50L/min (0.3MPa) flow rate (when grip inner diameter is ø12). The new model can reduce air

Air blow model



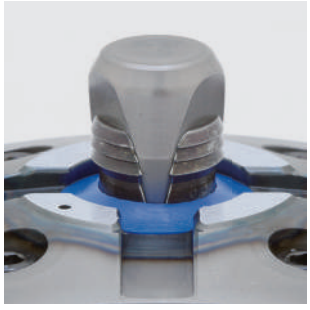
Number of grippers	Grip inner diameter	Clamping force	Model
4 Grippers	ø 6	0.86 kN (Hydraulic pressure 4 MPa)	CGS-N11-06
	ø 7 8	1.66 kN (Hydraulic pressure 7 MPa)	CGS-N11- Grip inner diameter

Non-constant air blow model



Number of grippers	Grip inner diameter	Clamping force	Model
2 Grippers	ø 9 10	2.73 kN (Hydraulic pressure 7 MPa)	CGS-N12E Grip inner diameter*

∗: It comprises the same output force cylinder with CGS-N12E grip inner diameter ø11 to ø13.



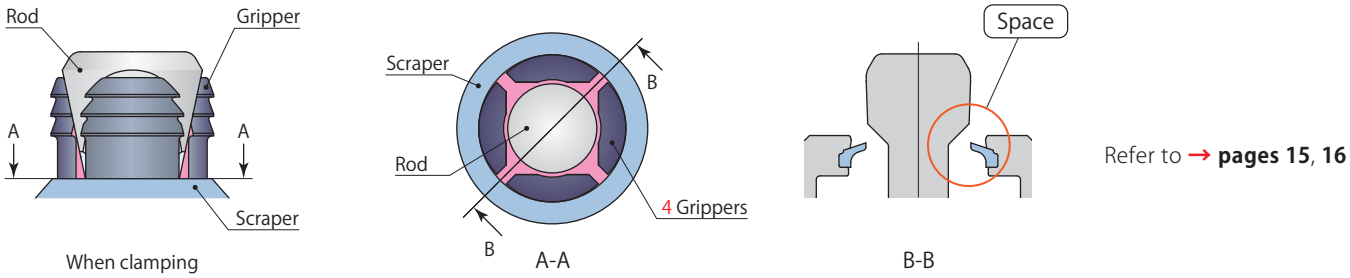
Number of grippers	Grip inner diameter	Clamping force	Model
3 Grippers	ø 11 12 13	2.73 kN (Hydraulic pressure 7 MPa)	CGS-N12E Grip inner diameter*
	ø 12 13 14 15 16	5.67 kN (Hydraulic pressure 7 MPa)	CGS-N13E Grip inner diameter

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

∗: It comprises the same output force cylinder with CGS-N12E grip inner diameter ø9,10.

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

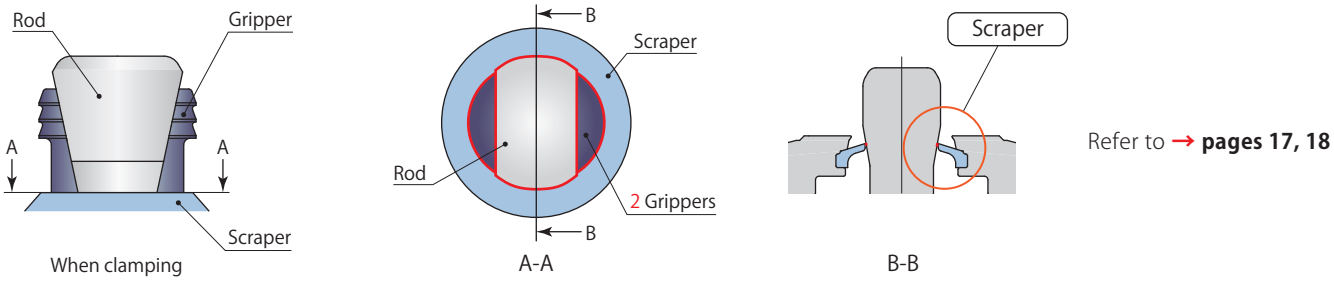
Space where metal chips can intrude is created



Refer to → **pages 15, 16**

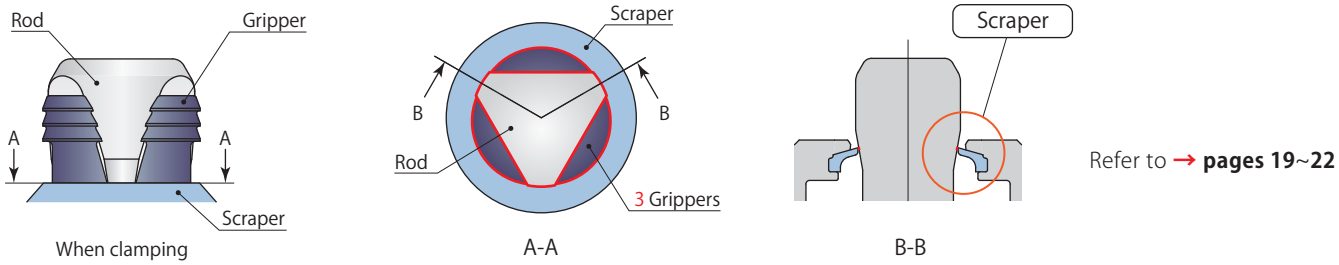
Because of space between scraper, gripper and the rod, air blow must always be performed to prevent intrusion of chips.

Secure chip protection



Refer to → **pages 17, 18**

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



Refer to → **pages 19~22**

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

Specifications

	Size			Grip inner diameter	
CGS — N1	1	—	: Air blow model	06 07 08	: 4 Grippers
	2	E	: Non-constant air blow model	09 10 / 11 12 13	: 2 Grippers / : 3 Grippers
	3	E	: Non-constant air blow model	12 13 14 15 16	: 3 Grippers

■ indicates made to order.

Model	Size	CGS-N11-			CGS-N12E					CGS-N13E				
	Grip inner diameter	06	07	08	09	10	11	12	13	12	13	14	15	16
Number of grippers		4 Grippers			2 Grippers		3 Grippers							
Clamping force (Hydraulic pressure 7 MPa)	kN	0.86*1	1.66		2.73					5.67				
Radial expansion force (Hydraulic pressure 7 MPa)	kN	3.63*1	6.78		10.9					23.2				
Taper rod stroke	mm	4.2												
Clamp stroke	mm	1.2												
Cylinder capacity	cm^3	1.7			2.7					5.5				
Allowable eccentricity *2	mm	±0.5												
Recommended air blow pressure	MPa	0.3												
Recommended sensor air pressure	MPa	0.2												
Mass	kg	0.34			0.45					0.73				
Recommended tightening torque of mounting screws *3	N·m	3.5			7					11				
Workpiece material		Aluminum, steel and others (HRC30 or below) Cast iron also usable depending on conditions												
Allowable min. grip inner diameter	mm	5.7	6.7	7.7	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	6.7	7.7	8.7	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												

● Working pressure range：2.5～7 MPa (CGS-N11-06：2.5～4MPa) ● Proof pressure：10.5 MPa ● Operating temperature：0～70 ℃

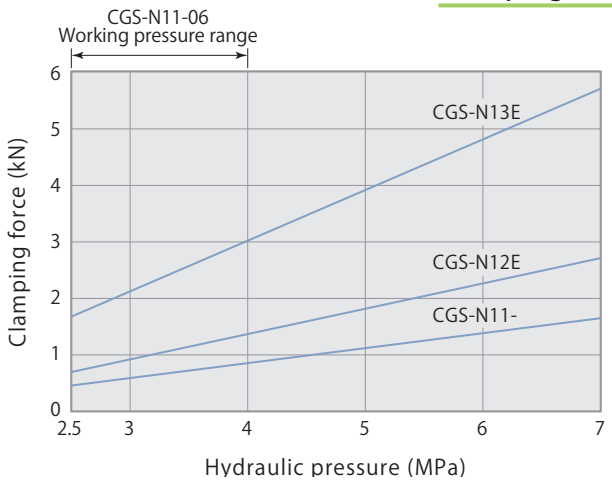
● Fluid used：General mineral based hydraulic oil (ISO-VG32 equivalent)

*1：Capacity values for hydraulic pressure of 4 MPa are shown.

*2：By the eccentric mechanism, the expansion clamp does not have a workpiece positioning function. *3：ISO R898 class 12.9

Please inquire if above terms are not applied.

Clamping force & hydraulic pressure

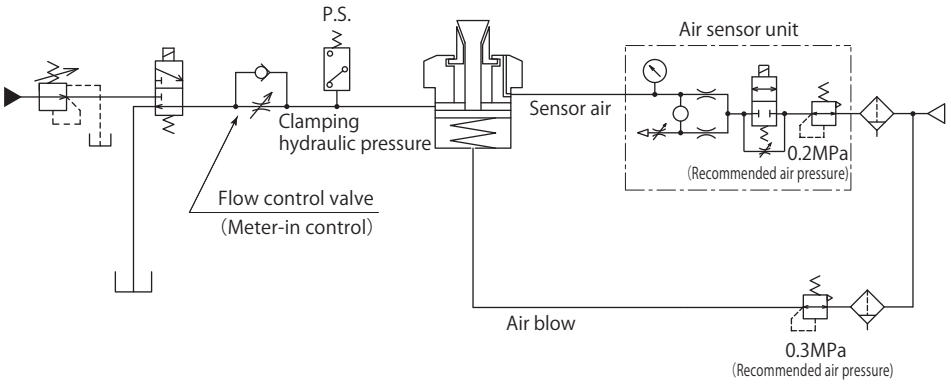


Hydraulic pressure	MPa	2.5	3	4	5	6	7
CGS-N11- Clamping force F=0.226×P−0.20	kN	0.47	0.60	0.86	1.13	1.40	1.66
CGS-N12E Clamping force F=0.448×P−0.41	kN	0.71	0.93	1.38	1.83	2.28	2.73
CGS-N13E Clamping force F=0.884×P−0.52	kN	1.69	2.13	3.02	3.90	4.78	5.67

P：Hydraulic pressure (MPa)

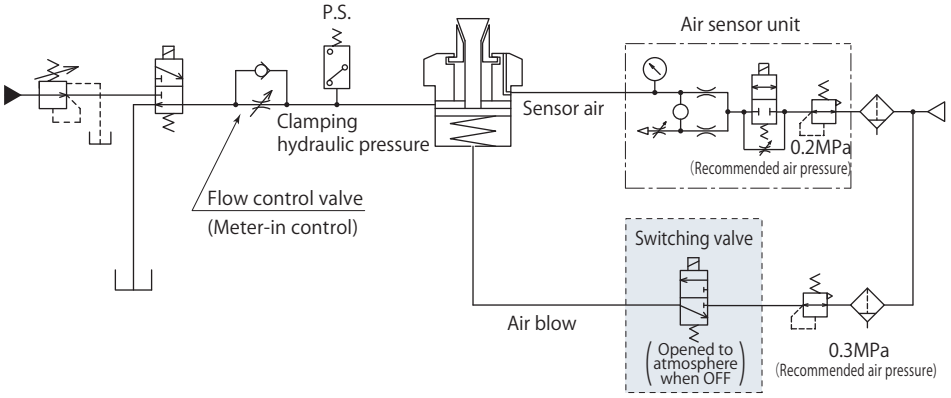
● CGS-N11-06 applicable working pressure should be 2.5 to 4MPa.

Air blow model hydraulic and air 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.

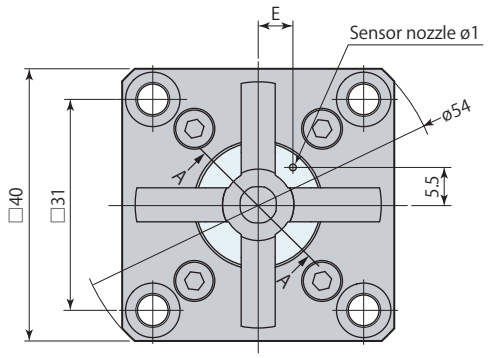
Non-constant air blow model hydraulic and air circuit diagram

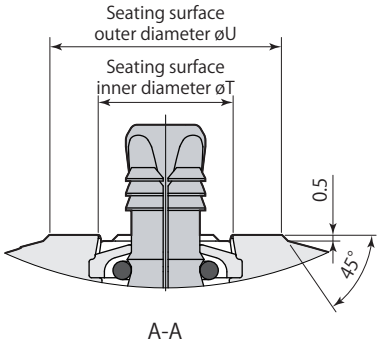


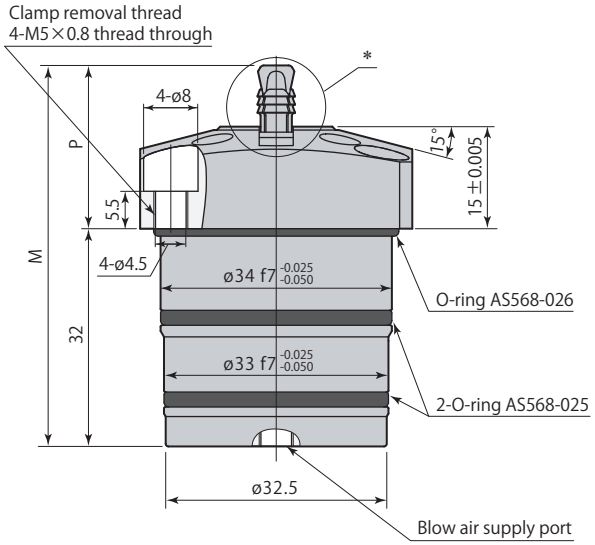
- Air blow will not be necessary during cutting process. Be sure to air blow upon loading and unloading workpiece and when clamping and unclamping to remove metal chips and debris.

- Clamp state observation or operating check by the air sensor should be made while air blow is OFF. In this case, the valve switching the port open to the atmosphere when air blow is OFF should be used so that it can become an exhaust path for clamping sensor air.

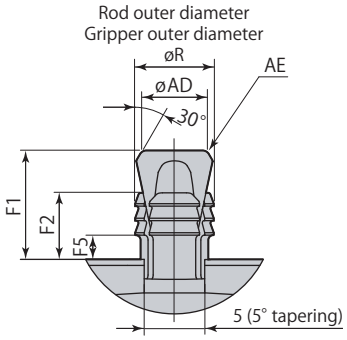
Dimensions



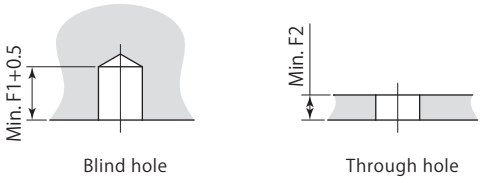


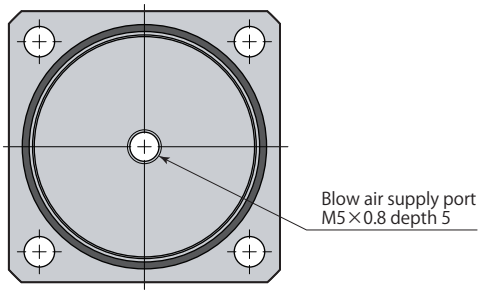


*details



Grip inner diameter usage requirements





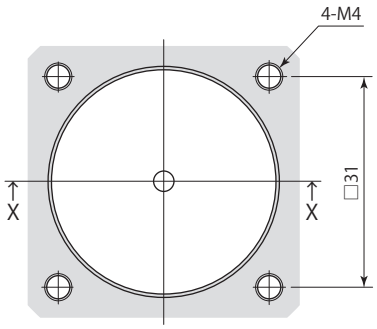
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

mm

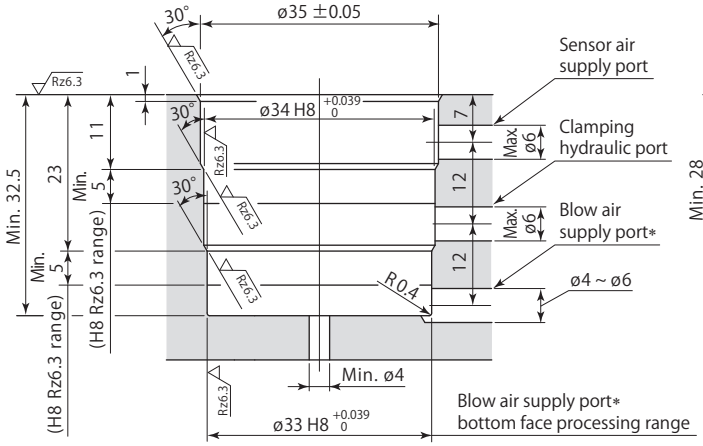
Model	CGS-N11-		
	06	07	08
E	5.1	5.8	6.5
F1	9		10
F2	5.5		6
F5	2		2.5
M	56		57
P	24		25
ø R	5.5	6.5	7.5
ø T	10	11	12
ø U	18	19	20
ø AD	4.3	5.3	5.8
AE	R0.6		R1

CGS-N11-06, 07, 08 are made to order.

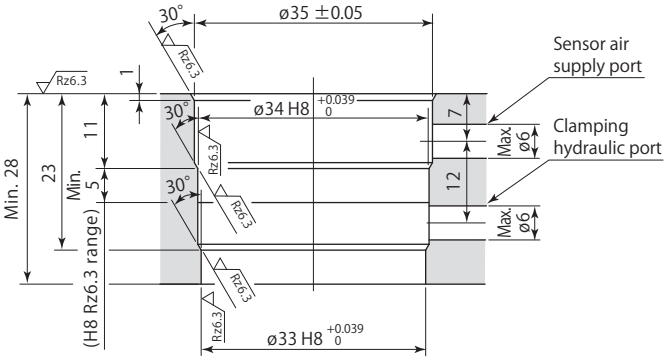
Mounting details



For blind hole X-X



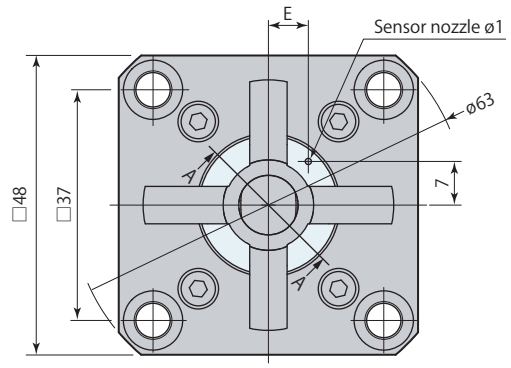
For through hole X-X

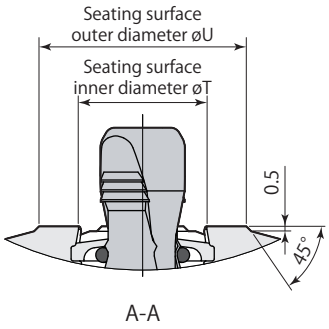


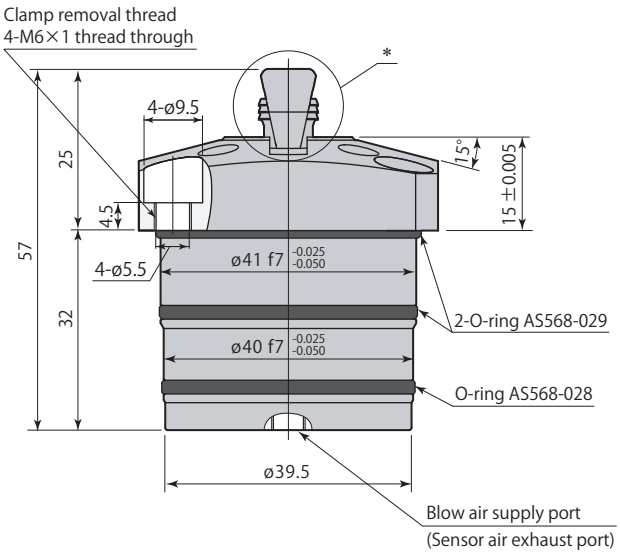
*: Blow air supply port must be provided on either side or bottom face.

- The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).
- 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. Ensure that there are no interference on taper area when drilling the piping hole.

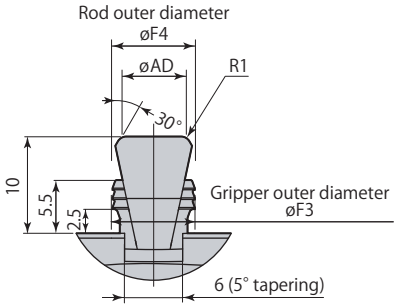
Dimensions



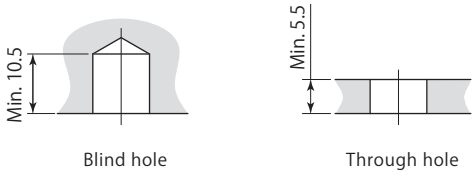


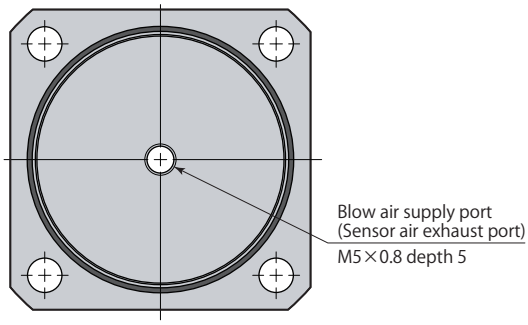


*details



Grip inner diameter usage requirements





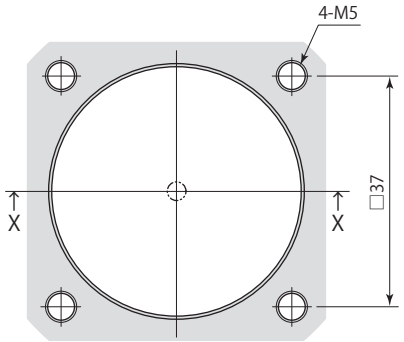
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

mm

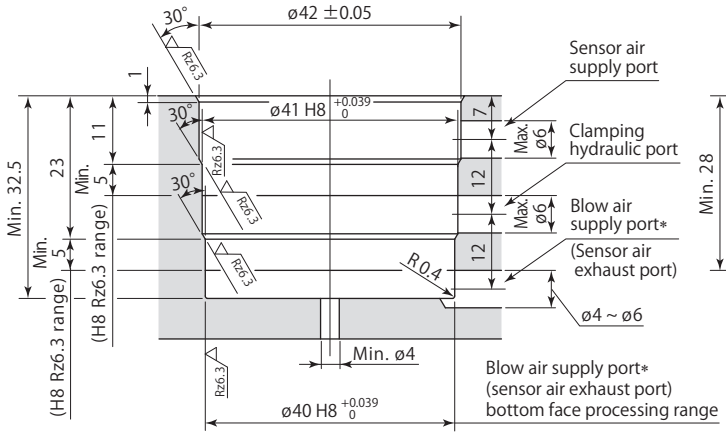
Model	CGS-N12E	
	09	10
E	5.7	6.4
ø F3	8.5	9.5
ø F4	8.55	9.55
ø T	13	14
ø U	21	22
ø AD	6.8	7.8

CGS-N12E09, 10 are made to order.

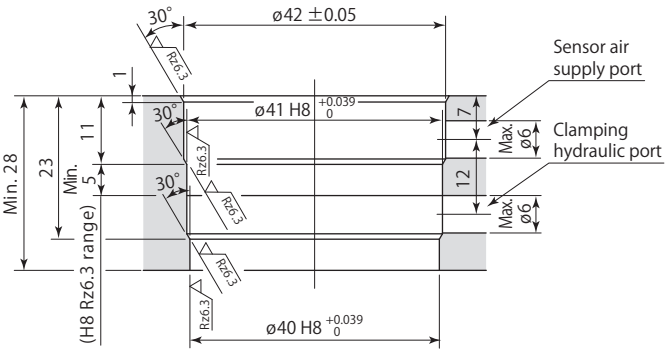
Mounting details



For blind hole X-X



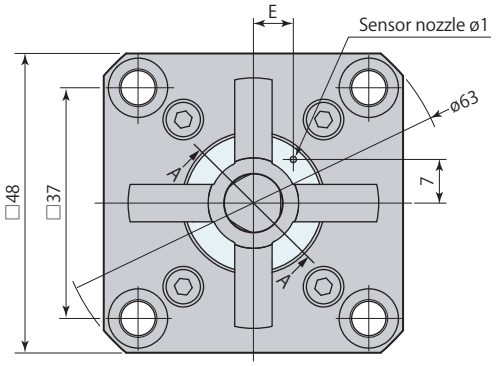
For through hole X-X

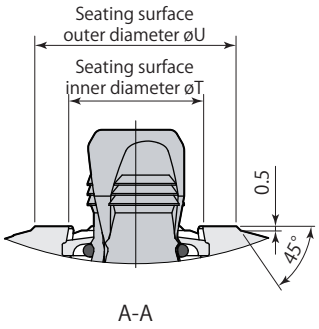


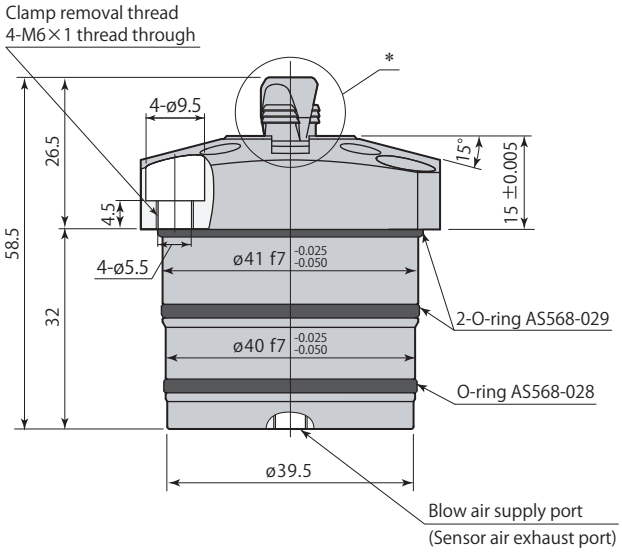
*: Blow air supply port (sensor air exhaust port) must be provided on either side or bottom face.

- The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).
- 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. Ensure that there are no interference on taper area when drilling the piping hole.

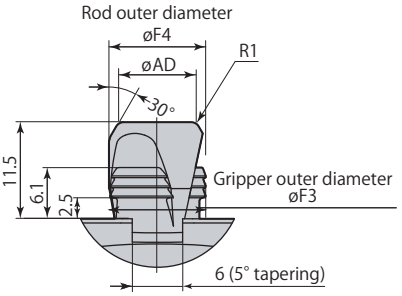
Dimensions



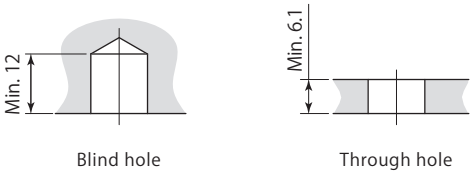


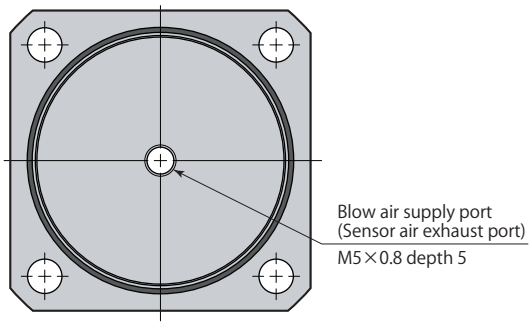


*details



Grip inner diameter usage requirements





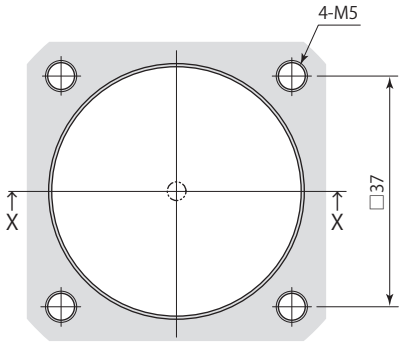
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

mm

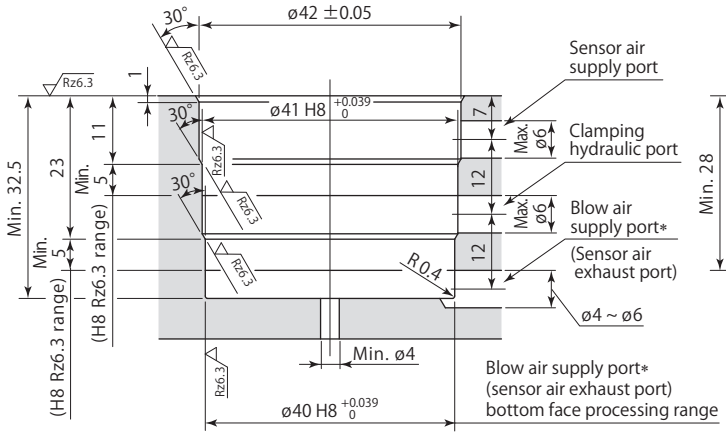
Model	CGS-N12E		
	11	12	13
E	7.1	7.8	8.5
ø F3	10.5	11.5	12.5
ø F4	10.55	11.55	12.55
ø T	15	16	17
ø U	23	24	25
ø AD	8.2	9.2	10.2

CGS-N12E11, 12, 13 are made to order.

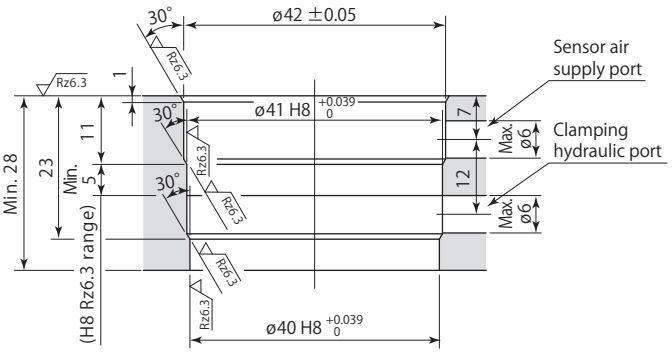
Mounting details



For blind hole X-X



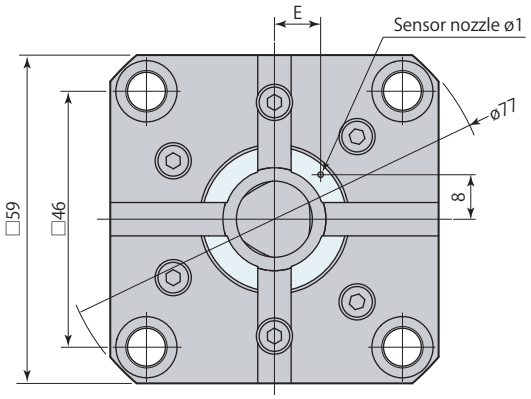
For through hole X-X

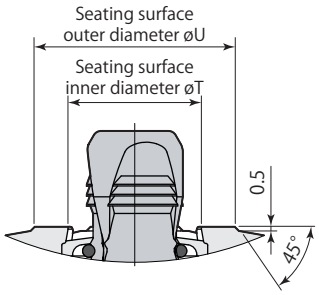


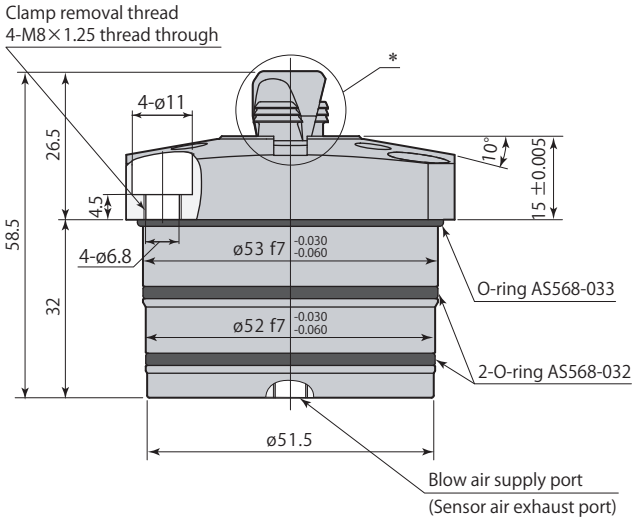
*: Blow air supply port (sensor air exhaust port) must be provided on either side or bottom face.

- The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).
- 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. Ensure that there are no interference on taper area when drilling the piping hole.

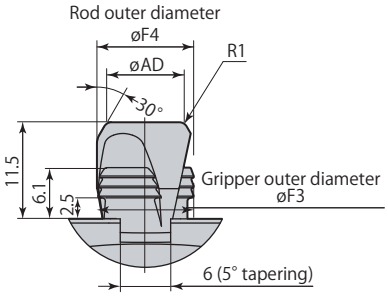
Dimensions

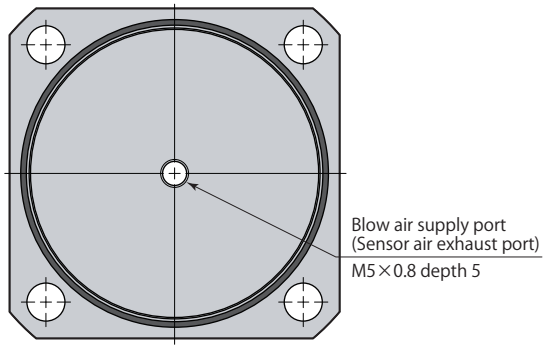




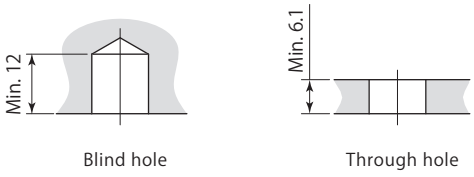


*details





Grip inner diameter usage requirements



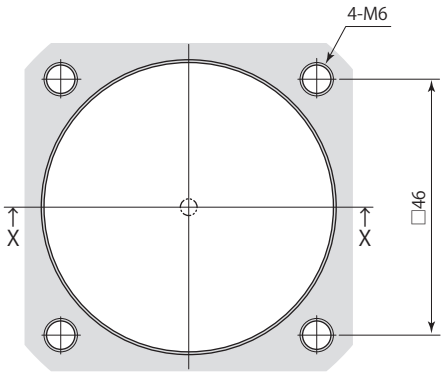
- Mounting screws are not included.
- Material used for O-ring is fluorocarbon (Hardness Hs90).
- Seating surface hardness is HRC55.
- The above diagram indicates unclamped condition.

mm

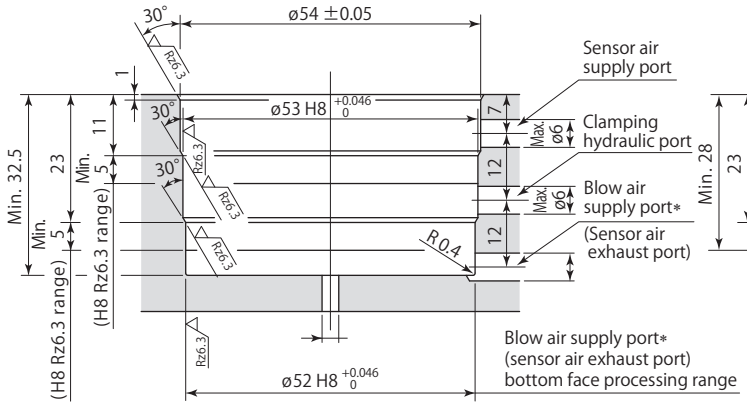
Model	CGS-N13E				
	12	13	14	15	16
E	6.8	7.5	8.3	8.9	9.6
ø F3	11.5	12.5	13.5	14.5	15.5
ø F4	11.55	12.55	13.55	14.55	15.55
ø T	16	17	18	19	20
ø U	24	25	26	27	28
ø AD	9.2	10.2	11.2	12.2	13.2

CGS-N13E12, 13, 14, 15, 16 are made to order.

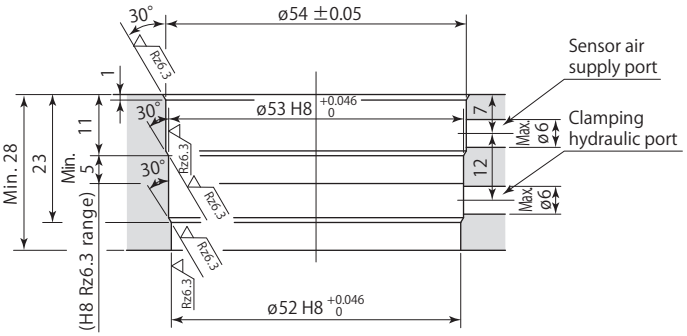
Mounting details



For blind hole X-X



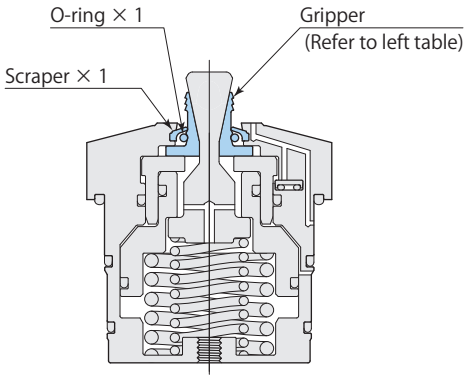
For through hole X-X



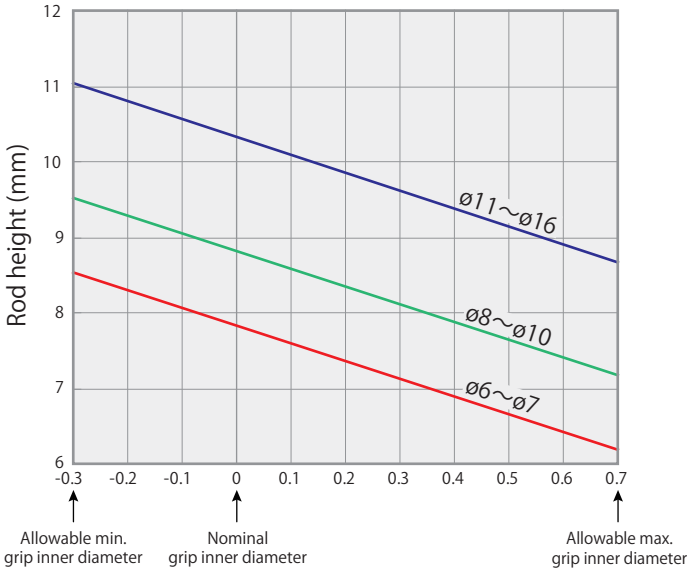
*: Blow air supply port (sensor air exhaust port) must be provided on either side or bottom face.

- The mounting surface finish must be no rougher than Rz6.3 (ISO4287:1997).
- 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. Ensure that there are no interference on taper area when drilling the piping hole.

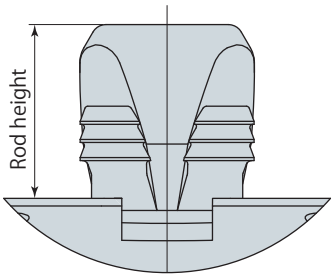
Gripper set replacement

Number of grippers	Gripper set model	Clamp model	Set description
4 Grippers	CGS-N11-J06	CGS-N11-06	 It is recommended that grippers, scrapers and O-rings 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.)
	CGS-N11-J07	CGS-N11-07	
	CGS-N11-J08	CGS-N11-08	
2 Grippers	CGS-N12EJ09	CGS-N12E09	
	CGS-N12EJ10	CGS-N12E10	
3 Grippers	CGS-N12EJ11	CGS-N12E11	
	CGS-N12EJ12	CGS-N12E12	
	CGS-N12EJ13	CGS-N12E13	
	CGS-N13EJ12	CGS-N13E12	
	CGS-N13EJ13	CGS-N13E13	
	CGS-N13EJ14	CGS-N13E14	
	CGS-N13EJ15	CGS-N13E15	
	CGS-N13EJ16	CGS-N13E16	

Grip inner diameter & rod height when clamping



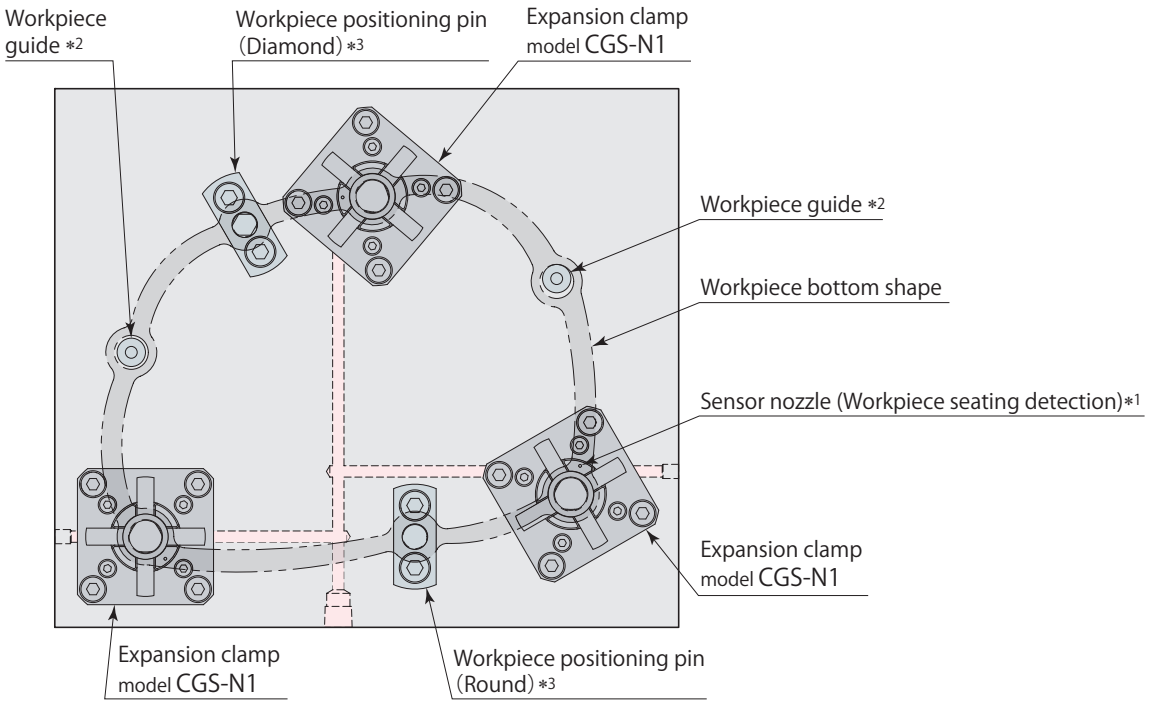
Difference between actual grip inner diameter and nominal grip diameter (mm)

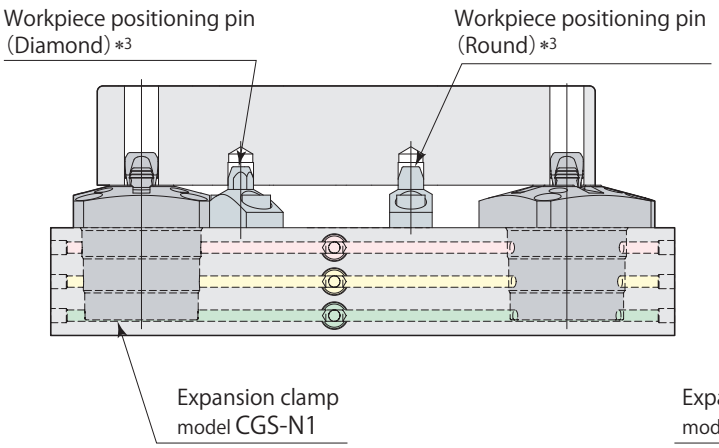


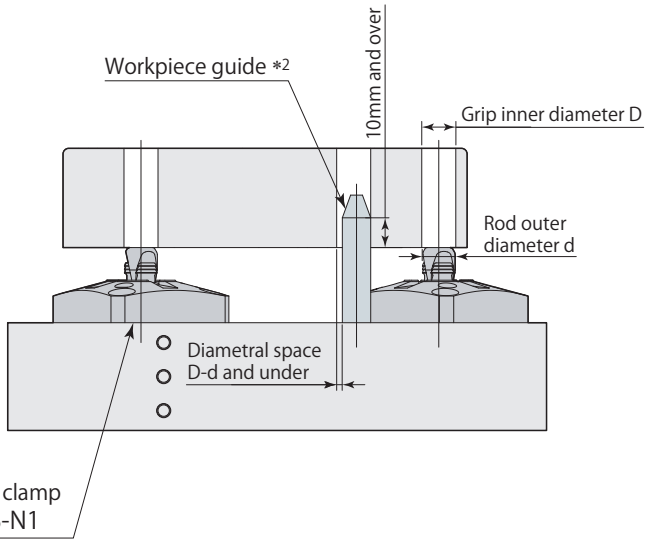
Rod height calculation formula	
ø6 ～ ø7	7.82−2.84×Actual grip inner diameter and nominal grip diameter difference
ø8 ～ ø10	8.82−2.35×Actual grip inner diameter and nominal grip diameter difference
ø11 ～ ø16	10.32−2.35×Actual grip inner diameter and nominal grip diameter difference

Example：When CGS-N12E10 (Nominal grip diameter : ø10) is clamping ø9.8 hole
Rod height = 8.82 − 2.35 × (-0.2) = 9.29mm

System configuration example







*1： The sensor nozzie (workpiece seating detection) can be set at any position by installation phasr of CGS and can be friend to the rib shape of workpiece bottom. As the internal design can be made easily, piping layout is not reguired to change acoording to installation phase of CGS, the jig.

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

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

Caution in use

- Be sure to make inner diameter of air blow circuit 4mm and over.

- 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 →13**. 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.

- 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 hydraulic and air circuit diagram on **page →14** for details.)

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

- Manufacturer models described below are recommended for air sensors.

Manufacturer name	Product models
SMC Corporation	ISA3-F/G series
CKD Corporation	GPS2-05 series

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	Clamping completion *1	(Machining)	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.		OFF		ON			OFF	
	Air sensor				ON or OFF *3				

*1 : Clamping completion : P.S.=ON Air sensor=ON
*2 : Unclamping completion : P.S.=OFF
*3 : ON : Complete clamping OFF : 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	Unclamping completion *2	Workpiece unloading
*4	Workpiece clamp	Clamp									
		Unclamp									
	Air blow	ON									
		OFF									
	Sensor air	ON									
		OFF									
*5	Clamping hydraulic pressure P.S.		OFF			ON				OFF	
	Air sensor					ON or OFF *3					

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

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CERTIFICATE OF APPROVAL ISO9001

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