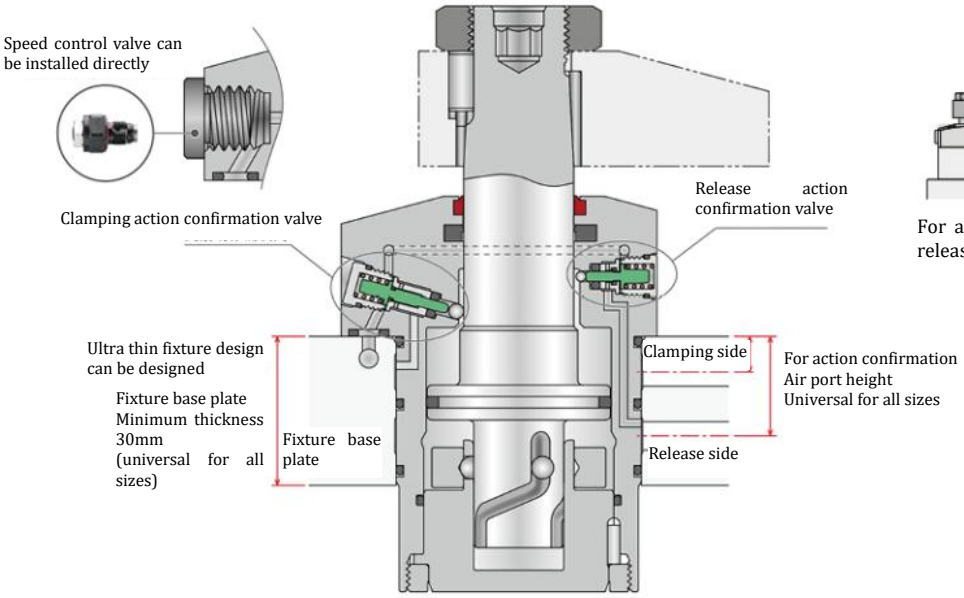
Sensor Built-in Rotary Clamp

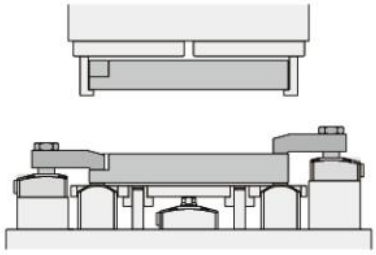
Action confirmation mechanism is built in the action end, which is most suitable for realizing equipment automation

Section Structure

※ This figure shows the clamping and release action confirmation type (model HLHW-C☐E)



Application Example



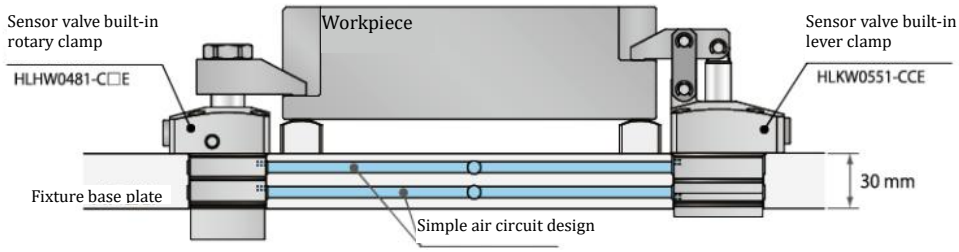
For automatic assembly line with clamp and release confirmation

- Through action confirmation, the workpiece can be moved in and out safely and reliably
- With built-in sensing valve mechanism, ultra thin fixture can be designed

The air leakage is zero when the sensing valve is closed. Air sensor components with low air consumption can be selected

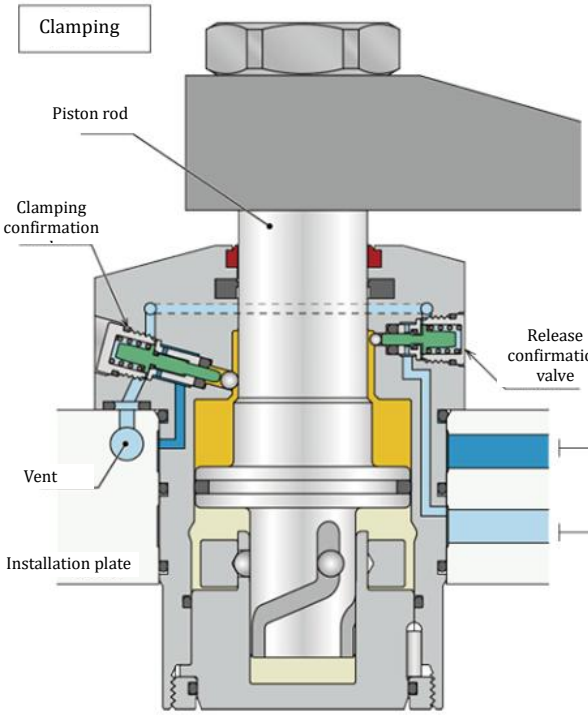
Simple oil circuit hole design

- Even in the case shown below, the air port height for action confirmation can be universal, and simple oil circuit hole can be designed.
  - When different sizes of rotary clamps (model HLHW-C☐E) are combined
  - When rotary clamp (model HLHW-C☐E) and lever clamp (model HLKW-C☐E) are combined



Action Principle (Profile Structure)

Clamping



- Clamping (when oil pressure is supplied to the oil supply port for clamping.

  The piston rod rotates as it descends.

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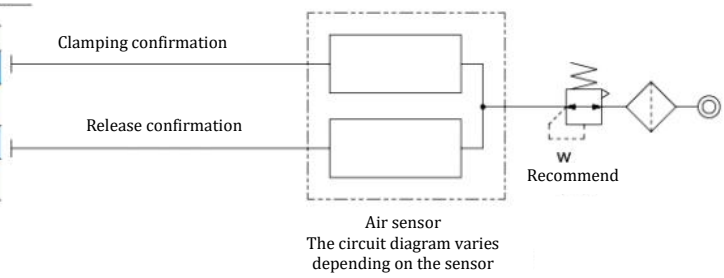
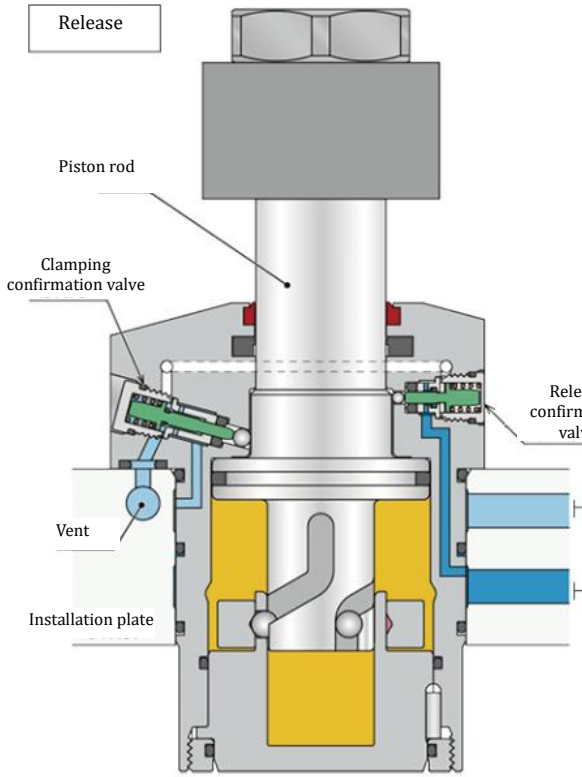
  After the rotation of the piston rod, vertically lower and clamp the workpiece.

Oil pressure		Air sensor	
Clamping oil pressure	Release oil pressure	Clamp confirmation	Release confirmation
ON	OFF	ON	OFF



Air sensor
The circuit diagram varies depending on the sensor

Release



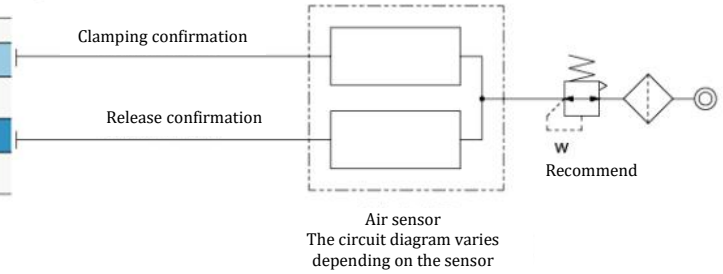
- Release (when oil pressure is supplied to the oil supply port for release.

  The piston rod rises vertically. (clamping stroke range).

  ↓

  After the vertical action, the piston rod rises as it rotates.

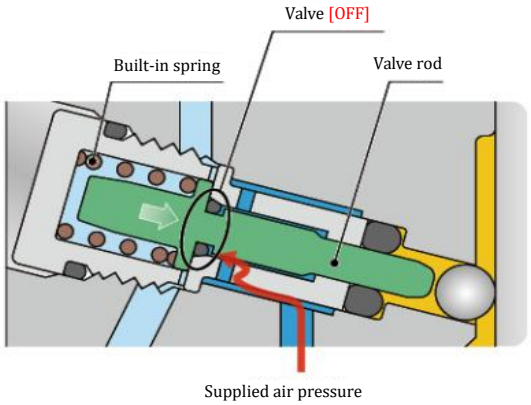
Oil pressure		Air sensor	
Clamping oil pressure	Release oil pressure	Clamp confirmation	Release confirmation
ON	OFF	ON	OFF



Air sensor
The circuit diagram varies depending on the sensor

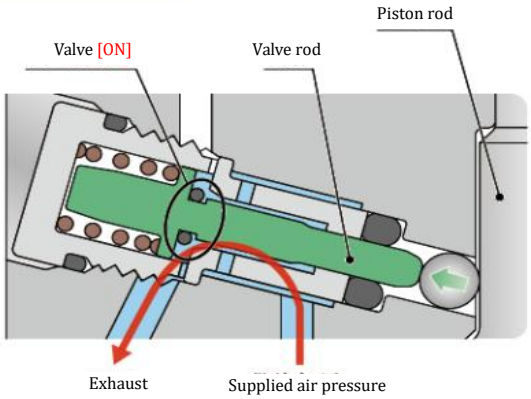
Clamp Confirmation Valve

When clamping oil pressure is supplied — Air sensor — ON



The valve rod moves forward under the action of the built-in spring.
Sensing valve for 1mm clamp stroke after rotation stroke will be closed.

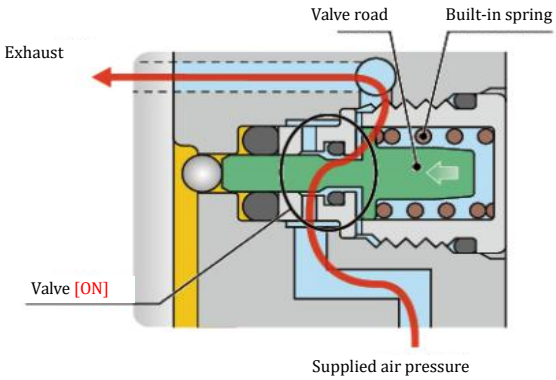
When clamping oil pressure is supplied — Air sensor — OFF



The valve rod moves backward under the compression of the piston rod
The sensing valve is opened.

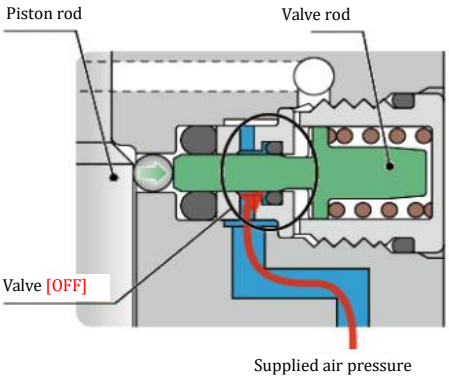
Release Confirmation Valve

When clamping oil pressure is supplied — Air sensor — OFF



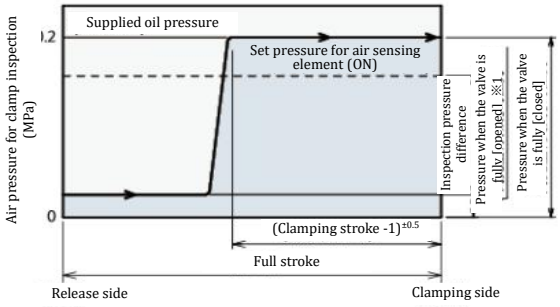
The valve rod moves forward under the action of the built-in spring.
The sensing valve is opened.

When clamping oil pressure is supplied — Air sensor — ON

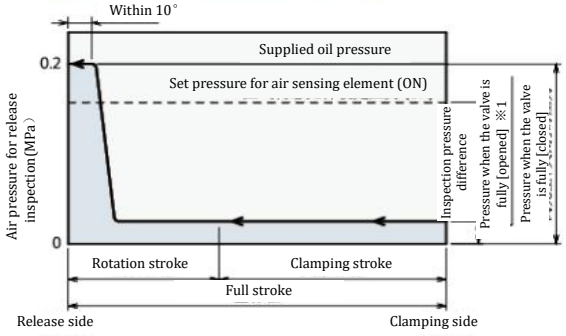


The valve rod moves backward under the compression of the piston rod
The sensing valve is closed.

Flow chart for clamp confirmation and air sensing



Flow chart for release confirmation and air sensing



※ 1. When the sensing valve is [opened], the sensing pressure will vary according to the air sensor used.
The sensing pressure of the air sensor with large air consumption will be higher when the sensing valve is [opened], making the inspection pressure difference smaller.

Operating principle (about sensing principle description and air sensing flow chart)

By connecting the air sensor, the pressure difference is inspected to realize the confirmation action.

Applicable model
HLHW 0481-CR
HLHW 0481-CL

E
H
J

Sensing valve symbols
E: Clamping and release confirmation type
H: Clamp confirmation type
J: Release confirmation type

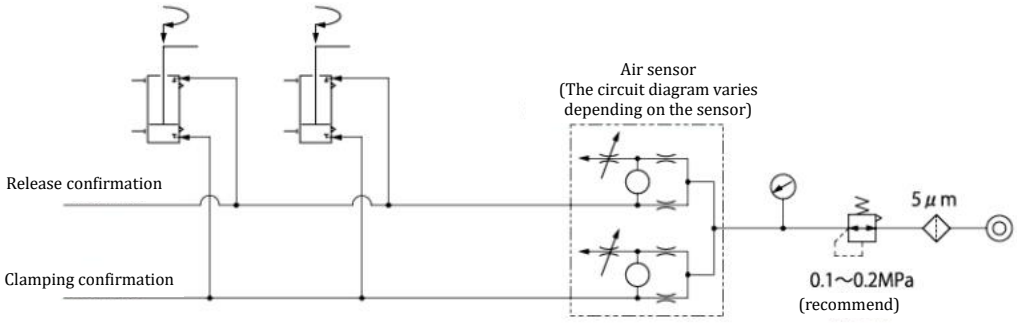
About air sensors

- To confirm the action, an air sensor must be set.
  The sensor confirmation can be realized by using the air sensor with small air consumption (the recommended table is shown below).
  Recommended air pressure: 0.1 to 0.2MPa

Recommended air sensors

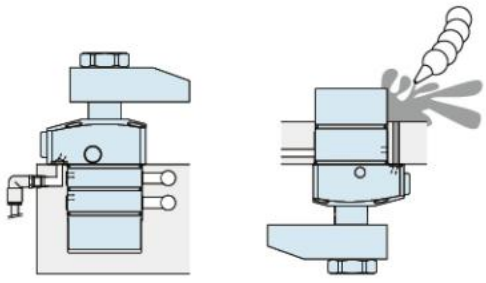
Manufacturer	SMC	SKD
Name	Air sensing element	Clearance switch
Model	ISA3-F, ISA3-G,ISA2-G	GPS2-05-15

- For details of the air sensor, please refer to the sample of the sensor manufacturer.
- The supply air pressure of the air sensor shall be 0.1 to 0.2MPa.
- Please keep normal air supply when using.
- Please refer to the following figure for the composition of air circuit.



Precautions for design, construction and use

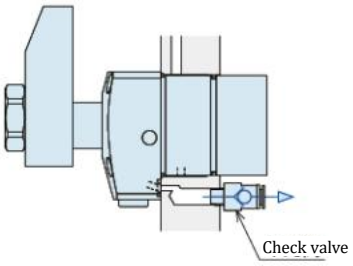
- The vent must be open to the atmosphere and must be protected from coolant and chip intrusion. If the vent is blocked, it will cause malfunction of air sensor.



O The vent is open to the atmosphere

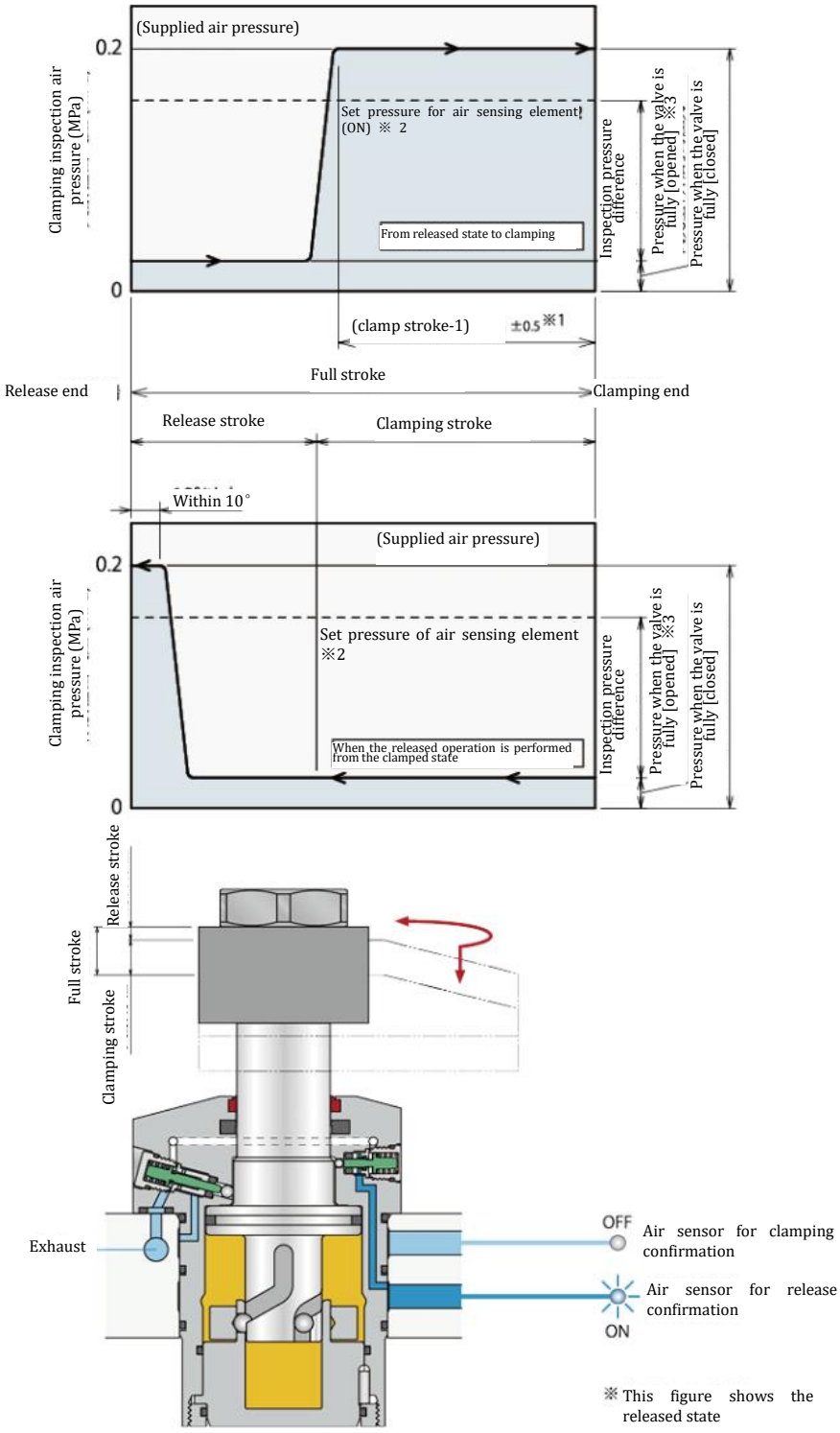
✕ Coolant and chip intrude through the vent

- Please keep the normal air supply to the air port during use.
- Example of protection from coolant and chip intrusion through vent
  Coolant can be effectively protected from chip intrusion by setting a check valve with a low opening pressure (recommended check valve: SMC AKH opening pressure: 0.005MPa)



Air sensing flow chart

Air sensing element ISA3-F supplies air pressure of 0.2MPa when 1 rotary clamp is connected



Precautions

1. This air sensing flow chart shows the relationship curve of the stroke inspection circuit pressure
2. There may be changes due to the composition characteristics of the air circuit. It is recommended that the length of the connecting air pipe be as short as possible. (The standard is within 5m)
3. When the sensor valve symbol is H, only the clamping action is detected, and when the sensor valve symbol is ▯, only the release action is detected.

※1 The pressure position in the [closed] state of the sensing valve may have a tolerance difference due to the structure of the clamp. (Please refer to the air sensing flow chart)

※2 The position of the air sensor output ON signal will change depending on the sensor setting.

※3. The sensing pressure when the sensing valve is [open] varies depending on the air sensor used.

The sensing pressure of the air sensor with high air consumption will be higher when the sensing valve is [open], so that the detected pressure difference becomes smaller.

Model Representation

HLHW ①②-③ Example: HLHW0481-CRE

① Dimension (refer to specification sheet)

② Clamping arm installation direction

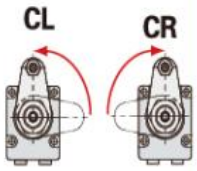
③ Sensing valve symbol

HLHW

0401
0481
0551
0651
0751

CL: left direction

CR: right direction



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E: 2-point inspection rotary clamp

H: clamp inspection rotary clamp

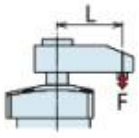
J: release inspection clamp

Specification

Model			HLHW0401	HLHW0481	HLHW0551	HLHW0651	HLHW0751
Clamp area		cm^2	5.00	6.95	10.3	13.4	20.3
Clamp inner diameter ※1		mm	31	37	44	51	62
Piston rod inner diameter ※1		mm	18	22	25	30	35.5
Clamp output force ※2 (calculation formula)		kN	$F=\frac{P(1-0.0016\times L)}{2.0920+0.0040\times L}$	$F=\frac{P(1-0.0009\times L)}{1.4892+0.0018\times L}$	$F=\frac{P(1-0.0011\times L)}{1.0039+0.0011\times L}$	$F=\frac{P(1-0.0009\times L)}{0.7822+0.0010\times L}$	$F=\frac{P(1-0.0007\times L)}{0.5175+0.0006\times L}$
Clamp capacity cm^3		Clamping	7.3	10.8	19.0	26.7	48.7
		Release	10.9	16.7	28.1	40.9	72.5
Full stroke		mm	14.5	15.5	18.5	20	24
Rotation stroke (90°)		mm	6.5	7.5	8.5	10	12
Clamping stroke		mm	8	8	10	10	12
Rotation angle accuracy			90°±3°				
Clamping position repetition accuracy			±0.5°				
Withstand voltage	Maximum operating pressure	MPa	7.0				
	Minimum operating pressure ※3	MPa	1.5				
	Withstand voltage	MPa	10.5				
Recommended air operating pressure			0.1~0.2				
Recommended air sensing elements			ISA3-F, ISA3-G, ISA2-G (SMC product)/GPS2-05-15 (CKD product)				
Operating temperature		℃	0~70				
Weight ※4 kg	③ E and H		0.9	1.4	2.0	2.9	4.2
	③ J		0.9	1.3	1.9	2.8	4

Precautions

※1. The clamping force cannot be calculated from the inner diameter of the clamp and the diameter of the piston rod. Please refer to the clamping force curve.



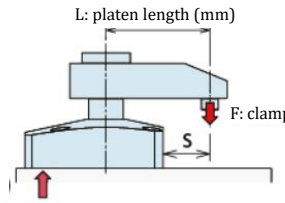
※2. In the clamping force calculation formula, F: clamping force (kN), P: supplied oil pressure (MPa), L: distance from the center of the piston to the clamping point (mm)

※3. It indicates the minimum pressure at which the rotary cylinder operates under no load.

※4. It indicates the weight of the single rotary cylinder including the nut and taper sleeve.

※5. It is the weight of the single rotary clamp excluding the tightening set and swivel plate.

Clamping force curve



Applicable model

HLHW [1] - C R L E H J

1 Main body dimension

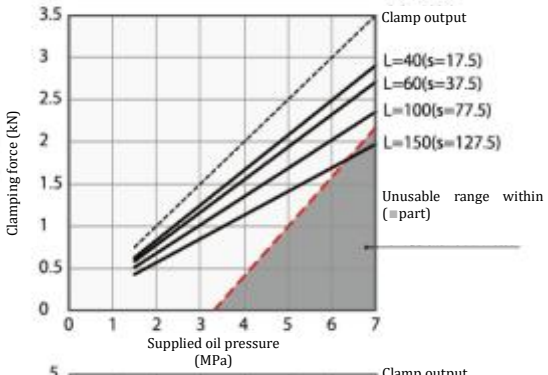
(example) In case of HLHW0481
The supplied oil pressure is 5.0MPa and the platen length is L=50mm
The clamping force is about 3.1kN.

Precautions

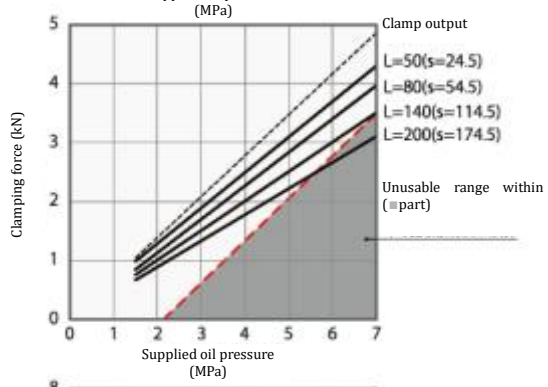
1. This figure shows the relationship between clamping force (kN) and supplied oil pressure (MPa).
2. The output force of the clamp (when L=0) cannot be calculated according to the calculation formula of the clamping force.
3. Due to factors such as the supplied oil pressure and the installation posture of the platen, the platen with a large moment of inertia may not be able to rotate.
4. Clamping force indicates the clamping capacity of the platen when it is clamped in a horizontal position.
5. The clamping force varies with the length of the platen, so use it with the supplied oil pressure suitable for the length of the lever.
6. Do not use the "unusable range" in the above table. Otherwise, it will cause deformation, jamming and other accidents.
7. The data in this table and the figure are reference values. Please obtain the detailed data according to the formula for calculating the clamping force.

※1. In the clamping force calculation formula, F is the clamping force (kN), P is the supplied oil pressure ((MPa) and L is the platen length (mm).

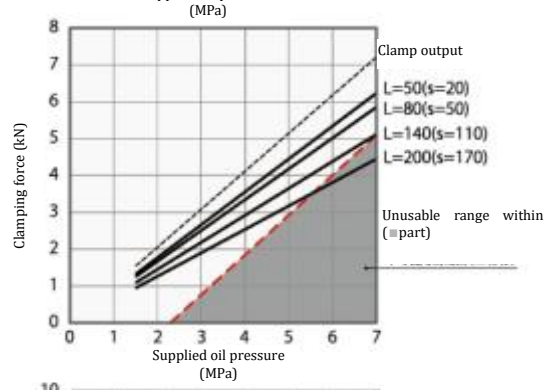
HLHW0401		Clamping force calculation formula※1 (kN)				F=P(1-0.0016×L)/(2.0920+0.0040 ×L)				
Supplied oil pressure (MPa)	Clamp output (kN)	Clamping force (kN)				Unusable range within ■				Minimum platen length (L) (mm)
		Platen length (mm)								
		L=40	L=50	L=60	L=70	L=80	L=100	L=120	L=150	
7	3.50	3.0	2.9	2.8	2.7	2.6	2.4	2.2		124
6.5	3.25	27	2.7	2.6	2.5	2.4	2.2	2.1		144
6	3.00	2.5	2.5	2.4	2.3	2.2	2.1	1.9	1.7	171
5.5	2.75	2.3	2.3	2.2	2.1	2.0	1.9	1.7	1.6	210
5	2.50	2.1	2.1	2.0	1.9	1.9	1.7	1.6	1.5	210
4.5	2.25	1.9	1.9	1.8	1.7	1.7	1.6	1.5	1.3	210
4	2.00	1.7	1.7	1.6	1.5	1.5	1.4	1.3	1.2	210
3.5	1.75	1.5	1.4	1.4	1.4	1.3	1.2	1.1	1.0	210
3	1.50	1.3	1.2	1.2	1.2	1.1	1.1	1.0	0.9	210
2.5	1.25	1.1	1.0	1.0	1.0	0.9	0.9	0.8	0.8	210
2	1.00	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.6	210
1.5	0.75	0.7	0.6	0.6	0.6	0.6	0.6	0.5	05	210
Maximum operating pressure (MPa)		7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.4	



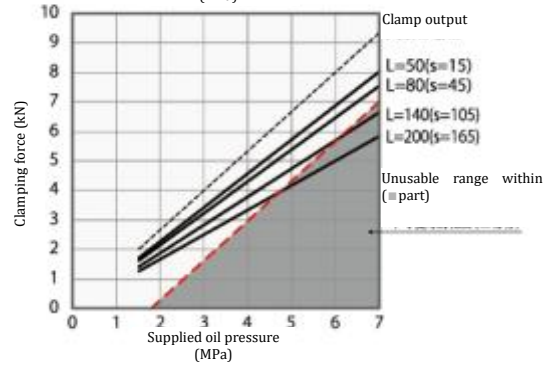
HLHW0481		Clamping force calculation formula※1 (kN)				F=P (1-0.0009×L)/(1. 4892+0.0018×L)				
Supplied oil pressure (MPa)	Clamp output (kN)	Clamping force (kN)				Unusable range within ■				Minimum platen length (L) (mm)
		Platen length (mm)								
		L=50	L=60	L=80	L=100	L=120	L=140	L=160	L=200	
7	4.87	4.3	4.2	4.0	3.9	3.7	3.6			141
6.5	4.52	4.0	3.9	3.7	3.6	3.4	3.3			178
6	4.17	3.7	3.6	3.5	3.3	3.2	3.1	2.9		204
5.5	3.82	3.4	3.3	3.2	3.0	2.9	2.8	2.7	2.5	230
5	3.48	3.1	3.0	2.9	2.8	2.7	2.6	2.5	2.3	230
4.5	3.13	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.0	230
4	2.78	2.5	2.4	2.3	2.2	2.1	2.1	2.0	1.8	230
3.5	2.43	2.2	2.1	2.0	2.0	1.9	1.8	1.7	1.6	230
3	2.09	1.9	1.8	1.7	1.7	1.6	1.6	1.5	1.4	230
2.5	1.74	1.6	1.5	1.5	1.4	1.4	1.3	1.2	1.2	230
2	1.39	1.3	1.2	1.2	1.1	1.1	1.0	1.0	0.9	230
1.5	1.04	1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.7	230
Maximum operating pressure (MPa)		7.0	7.0	7.0	7.0	7.0	7.0	6.6	5.7	



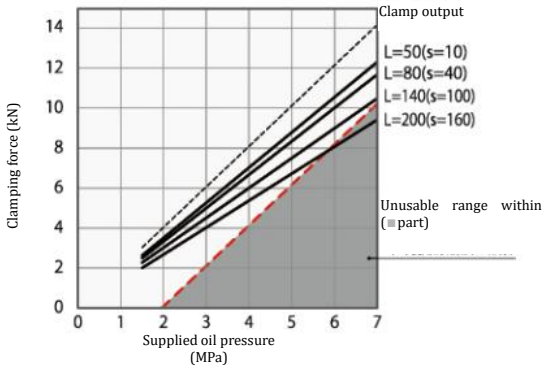
HLHW0551		Clamping force calculation formula※1 (kN)				F=P(1-0.0011×L/(1.0039+0.0011×L)				
Supplied oil pressure (MPa)	Clamp output (kN)	Clamping force (kN)				Unusable range within ■				Minimum platen length (L) (mm)
		Platen length (mm)								
		L=50	L=60	L=80	L=100	L=120	L=140	L=160	L=200	
7	7.21	6.3	6.2	5.9	5.6	5.4	5.2			142
6.5	6.69	5.8	5.7	5.5	5.2	5.0	4.8			159
6	6.18	5.4	5.3	5.1	4.8	4.6	4.4	4.2		180
5.5	5.66	5.0	4.8	4.6	4.4	4.2	4.1	3.9	3.6	209
5	5.15	4.5	4.4	4.2	4.0	3.9	3.7	3.5	3.2	245
4.5	4.63	4.1	4.0	3.8	3.6	3.5	3.3	3.2	2.9	245
4	4.12	3.6	3.5	3.4	3.2	3.1	3.0	2.8	2.6	245
3.5	3.60	3.2	3.1	3.0	2.8	2.7	2.6	2.5	2.3	245
3	3.09	2.7	2.7	2.6	2.4	2.3	2.2	2.1	2.0	245
2.5	2.57	2.3	2.2	2.1	2.0	2.0	1.9	1.8	1.6	245
2	2.06	1.8	1.8	1.7	1.6	1.6	1.5	1.4	13	245
1.5	1.54	1.4	1.4	1.3	1.2	1.2	1.1	1.1	1.0	245
Maximum operating pressure (MPa)		7.0	7.0	7.0	7.0	7.0	7.0	6.4	5.6	



HLHW0651		Clamping force calculation formula※1 (kN)				F=P(1-0.0009×L)/(0.7822+0.0010×L)				
Supplied oil pressure (MPa)	Clamp output (kN)	Clamping force (kN)				Unusable range within ■				Minimum platen length (L) (mm)
		Platen length (mm)								
		L=50	L=60	L=80	L=100	L=120	L=140	L=160	L=200	
7	9.35	8.1	7.9	7.6	7.3					115
6.5	8.68	7.5	7.3	7.0	6.7	6.5				127
6	8.02	6.9	6.8	6.5	6.2	6.0	5.7			142
5.5	7.35	6.4	6.2	6.0	5.7	5.5	5.3	5.0		161
5	6.68	5.8	5.7	5.4	5.2	5.0	4.8	4.6		187
4.5	6.01	5.2	5.1	4.9	4.7	4.5	4.3	4.1	3.8	221
4	5.34	4.6	4.5	4.4	4.2	4.0	3.8	3.7	3.4	260
3.5	4.68	4.1	4.0	3.8	3.7	3.5	3.4	3.2	3.0	260
3	4.01	3.5	3.4	3.3	3.1	3.0	2.9	2.8	2.5	260
2.5	3.34	2.9	2.9	2.7	2.6	2.5	2.4	2.3	2.1	260
2	5.67	2.3	2.3	2.2	2.1	2.0	1.9	1.9	1.7	260
1.5	2.00	1.8	1.7	1.7	1.6	1.5	1.5	1.4	1.3	260
Maximum operating pressure (MPa)		7.0	7.0	7.0	7.0	7.0	7.0	5.6	4.8	



HLHW0751		Clamping force calculation formula※1 (kN)			F=P(1-0.0007×L)/(0.5175+0.0006×L)					
Supplied oil pressure (MPa)	Clamp output (kN)	Clamping force (kN)			Unusable range within ■					Minimum platen length (L)
		Platen length (mm)								
		L=50	L=60	L=80	L=100	L=120	L=140	L=160	L=200	(mm)
7	14.21	12.4	12.2	11.7	11.3	10.9	10.5			147
6.5	13.19	11.5	11.3	10.9	10.5	10.2	9.8	9.5		163
6	12.18	10.6	10.4	10.1	9.7	9.4	9.0	8.7		184
5.5	11.16	9.7	9.6	9.2	8.9	8.6	8.3	8.0	7.5	209
5	10.15	8.9	8.7	8.4	8.1	7.8	7.5	7.3	6.8	244
4.5	9.13	8.0	7.8	7.6	7.3	7.0	6.8	6.6	6.1	280
4	8.12	7.1	7.0	6.7	6.5	6.3	6.0	5.8	5.4	280
3.5	7.10	6.2	6.1	5.9	5.7	5.5	5.3	5.1	4.8	280
3	6.09	5.3	5.2	5.1	4.9	4.7	4.5	4.4	4.1	280
2.5	5.07	4.5	4.4	4.2	4.1	3.9	3.8	3.7	3.4	280
2	4.06	3.6	3.5	3.4	3.3	3.2	3.0	2.9	2.7	280
1.5	3.04	2.7	2.6	2.5	2.5	2.4	2.3	2.2	2.1	280
Maximum operating pressure (MPa)		7.0	7.0	7.0	7.0	7.0	7.0	6.9	5.9	

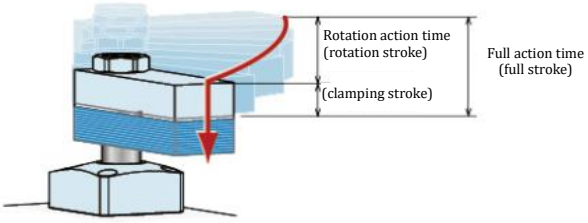


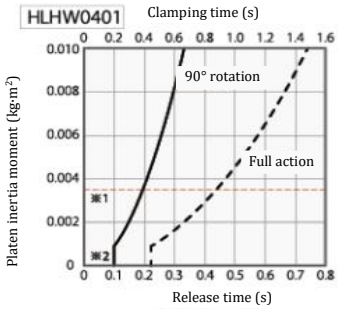
Allowable action time chart

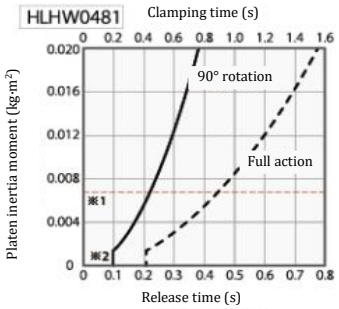
Adjustment of rotation action time

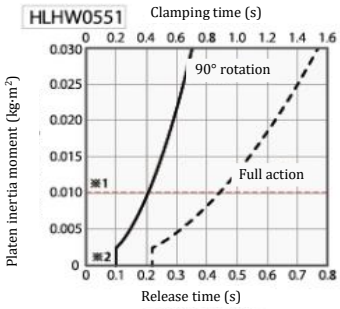
This figure shows the allowable action time corresponding to the inertia moment of the platen.
Please adjust according to the inertia moment of the platen used to make the action time later than action time shown in the figure.

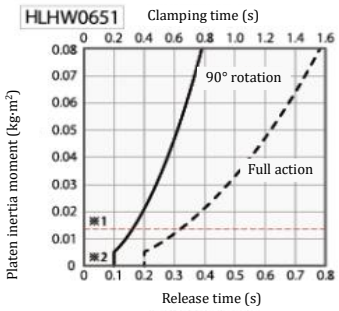
If the rotation speed is too fast, the stop accuracy will deteriorate and the internal parts will be damaged.

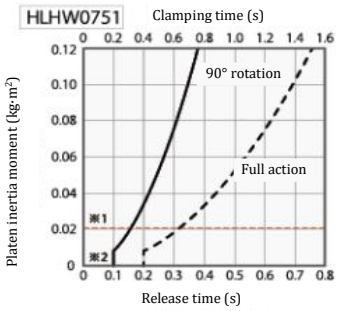






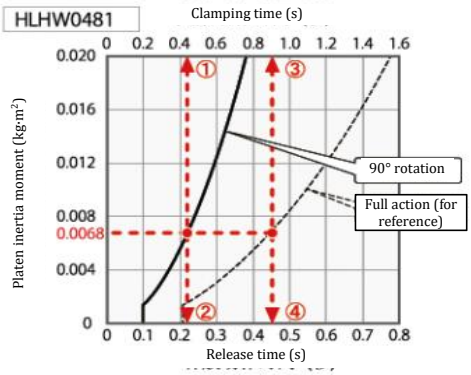






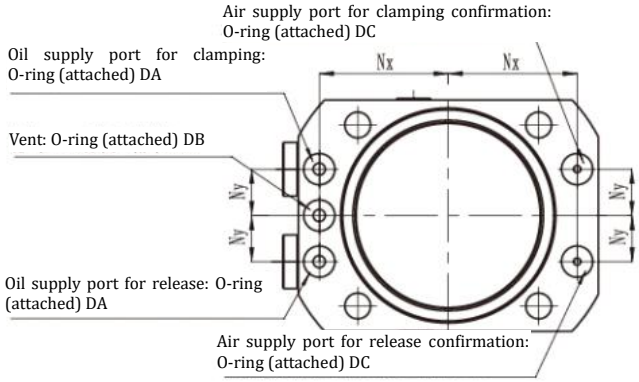
Precautions:
※1. It indicates the inertia moment of the blank platen.
※2. Even if the inertia moment of the platen is small, the shortest 90 ° rotation time should also be: 0.2s for clamping and 0.1s for releasing.
1. This figure shows the allowable action time corresponding to the inertia moment of the pressure plate when the cylinder piston rod moves at a constant speed.
2. Due to factors such as supplied oil pressure, flow rate, and the installation posture of the platen, the platen with a large inertia moment may not be able to rotate.
3. It is recommended to adjust the constant speed action of the clamp by means of the meter-in circuit.
When using the oil inlet throttle method, sometimes the platen is accelerated due to its own weight (the clamp is installed horizontally, etc.), or when the piston rod may move rapidly, please use the oil return throttle circuit to adjust the cylinder speed.
4. If the action time is too short, the stop accuracy will deteriorate and the internal parts will be damaged.
5. If you use it outside the conditions specified in this figure, please contact our company.

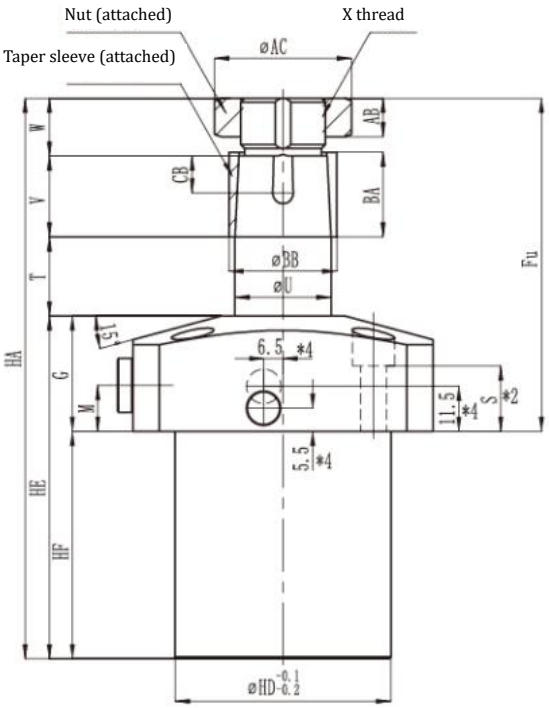
(How to interpret the allowable action schedule)
In case of HLHW0481
When using a platen with the inertia moment of 0.0068kg·m²
① 90° rotation time when clamping: about 0.44s or more
② 90° rotation time when releasing: about 0.22s or more
③ Whole clamping action time: about 0.9s or more
④ Whole release action time: about 0.45s or more
1. The full operating time in this figure shows the allowable operating time during full stroke operation.

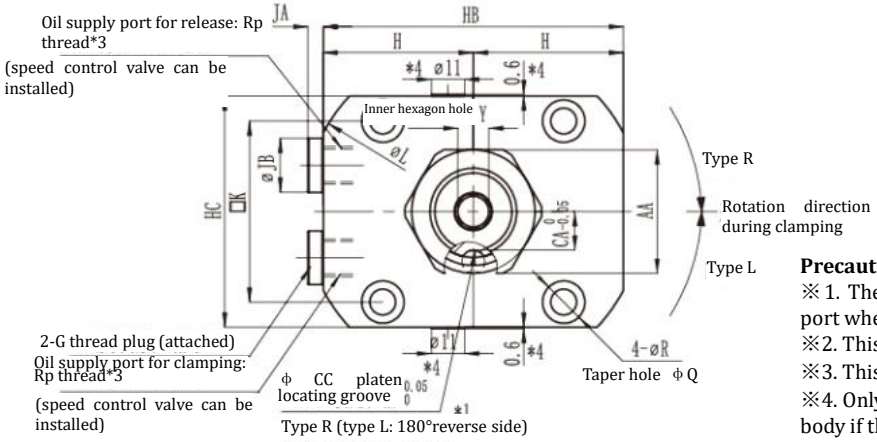


Overall Dimension

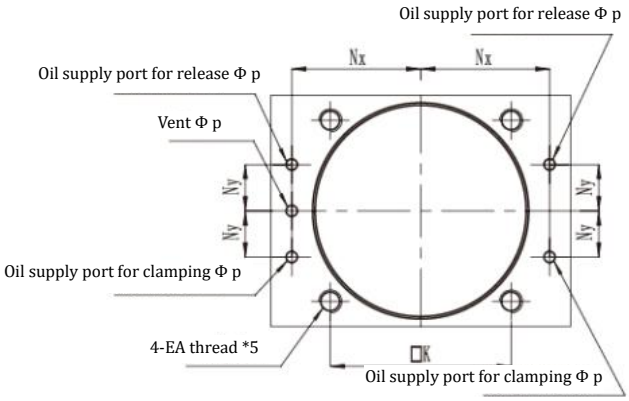
*This figure shows the released state of HLHW-CRE(G)

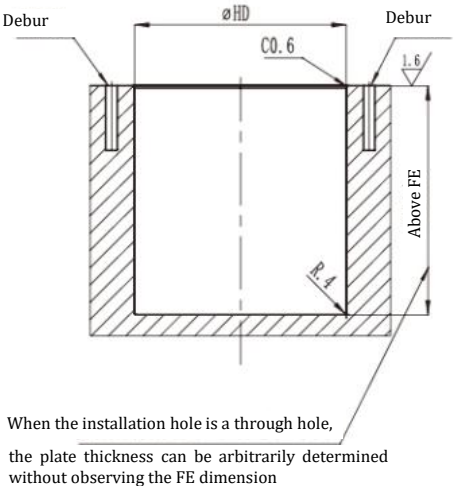






Installation part processing dimension





Precautions

※1. The platen locating groove is measured toward the oil supply port when clamping.

※2. This produce does not include the installation bolts.

※3. This product does not include the speed control valve.

※4. Only for HLHW0401(G) , the sensor is protruding from the main body if the dimensions are listed.

※5. Please refer to the S dimension, and determine the EA thread depth of the installation bolt according to the installation height.

Overall Dimension

mm

Model	HLHW0401-C □ E(G)	HLHW0481-C □ E(G)	HLHW0551-C □ E(G)	HLHW0651-C □ E(G)	HLHW0751-C □ E(G)
Full stroke	14.5	15.5	18.5	20	24
Rotation stroke (90°)	6.5	7.5	8.5	10	12
Clamping stroke	8	8	10	10	12
HA	115	128.5	145.5	156	181
HB	63	71	78	92	104
HC	45	51	60	70	80
HD	40	48	55	65	75
HE	71.5	79	89	94	109
HF	46.5	51	59	63	71
Fu	68.5	77.5	86.5	93	110
G	25	28	30	31	38
H	31.5	35.5	39	46	52
K	34	40	47	55	63
L	73	83	88	106	116
M	11	13	12	13	16
Nx	26	30	33.5	39.5	45
Ny	9	11	12	15	16
P	3	3	3	5	5
Q	9	9	11	11	14
R	5.5	5.5	6.8	6.8	9
S	15	17.5	17	17	21
T	16.5	17.5	20.5	22	26
U	18	22	25	30	35.5
V	15	18	21	24	30
W	12	14	15	16	16
X (name×pitch)	M16×1.5	M20×1.5	M22×1.5	M27×1.5	M30×1.5
Y	6	8	8	10	10
AA	24	30	32	41	46
AB	8	9	10	11	11
AC	26.5	33	35.5	45	50
BA	16	19	22	25	31
BB	20	25	28	34	40
CA	7	9	10	12.5	14
CB	6.5	7.5	9.5	11.5	12.5
CC	4	5	6	6	8
EA	M5×0.8	M5×0.8	M6	M6	M8
FE	47	51.5	59.5	63.5	71.5
JA	3.5	3.5	3.5	4.5	4.5
JB	14	14	14	19	19
Oil supply port for clamping: Rp thread Oil supply port for release: Rp thread	Rp1/8	Rp1/8	Rp1/8	Rp1/4	Rp1/4
O-seal ring DA	1BP5	1BP5	1BP5	1BP7	1BP7
O-seal ring DB	AS568-007(90°)	1BP5	1BP5	1BP7	1BP7
O-seal ring DC	1BP5	1BP5	1BP5	1BP7	1BP7