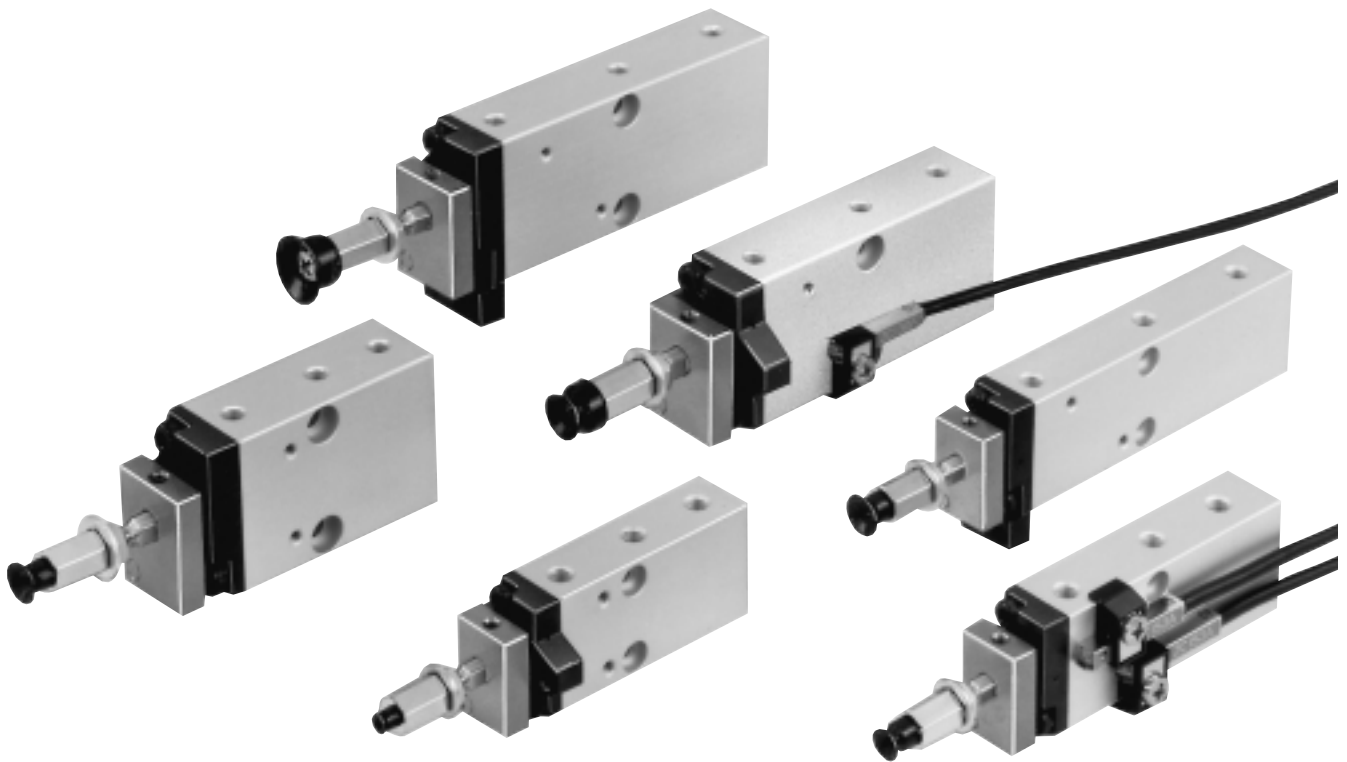


MULTIMOUNT CYLINDERS FOR VACUUM PADS

These devices preserve the multimount cylinder design concept while employing a hollow rod structure to keep total length very short.

Furthermore, all the piping is concentrated on one side. These cylinders provide suction and conveyance with a minimal stroke, while easy piping installation means they can be directly installed to mechanical devices and walls, thus saving space and offering enhanced design flexibility.

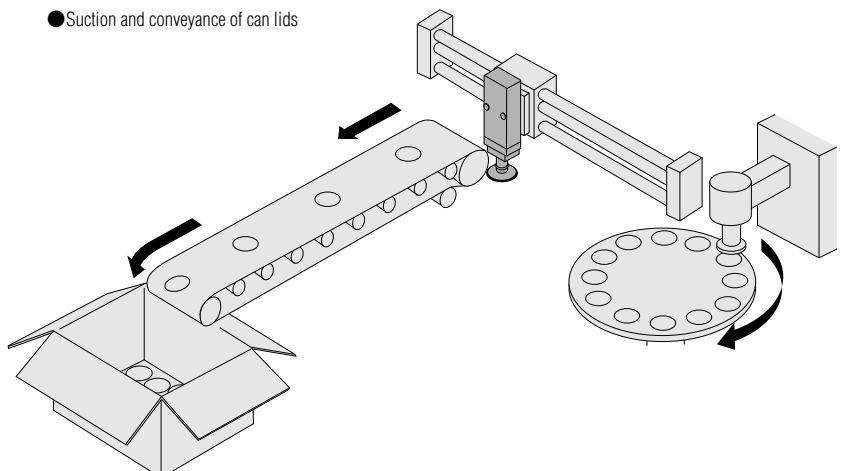
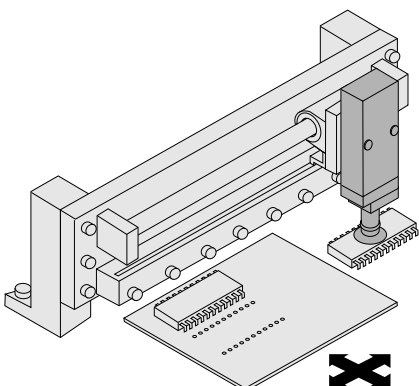


A few suggested applications...

These cylinders have many applications. In addition to suction and conveyance of thin and difficult-to-handle workpieces, they can also be used to hold workpieces in place during processing.

● Conveyance of IC chips for watches

● Suction and conveyance of can lids



Vacuum Pad Selection

● Calculation of Lift Capacity

Lift capacity (W) is calculated using the formula below:

(ISU)

$$W = P \times A \times 0.1 \times \frac{1}{S}$$

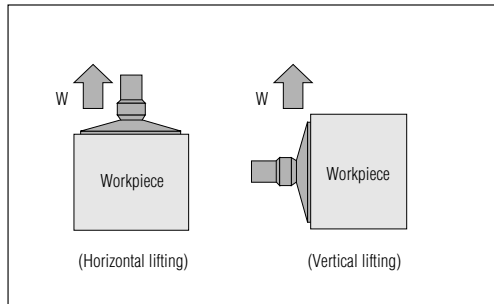
W : Lift capacity (N)
 P : Degree of vacuum (-kPa)
 A : Area of pad (cm²)
 S : Safety factor

(Metric units)

$$W' = \frac{P'}{760} \times 1.033 \times A \times \frac{1}{S}$$

W' : Lift capacity (kgf)
 P' : Degree of vacuum (-mmHg)
 A : Area of pad (cm²)
 S : Safety factor

When calculating lift capacity, include one of the following two safety factors:
 Horizontal lifting...2 times min.
 Vertical lifting...4 times min.



Example:

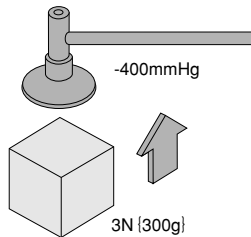
A 300g workpiece is lifted horizontally by a standard fixed vacuum pad. Calculate the required pad diameter assuming that the degree of vacuum is set to -53.3kPa (-400mmHg) and there is no vacuum leakage from the suction surface.

(ISU)

$$3 = -53.3 \times A \times 0.1 \times \frac{1}{2}$$

$$A = 1.125 \text{ cm}^2$$

$$\text{Pad diameter} = \sqrt{1.125 \times \frac{4}{\pi}} \div 1.19 \text{ cm}$$



(Metric units)

$$0.3 = \frac{400}{760} \times 1.033 \times A \times \frac{1}{2}$$

$$A = 1.107 \text{ cm}^2$$

$$\text{Pad diameter} = \sqrt{1.107 \times \frac{4}{\pi}} \div 1.18 \text{ cm}$$

According to the above calculation, a pad measuring at least ϕ 15 is required.

● Theoretical Lift Capacities

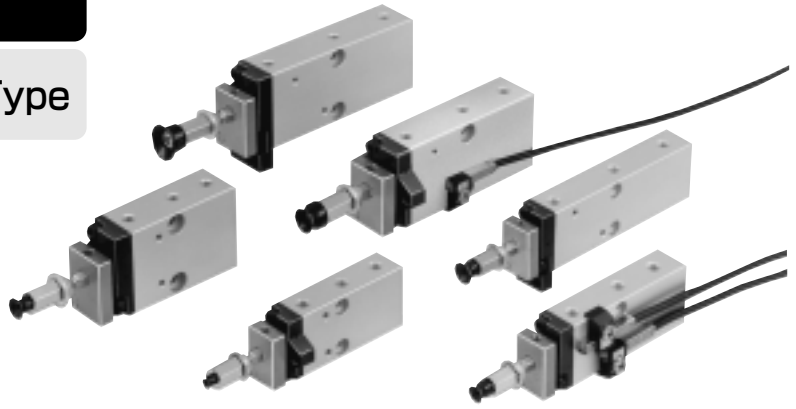
Round Pads

Degree of vacuum kPa {mmHg}	Pad diameter						N {Kgf}
	ϕ 2.5	ϕ 3.5	ϕ 6	ϕ 8	ϕ 10	ϕ 15	
-93.3 {-700}	0.457 {0.047}	0.896 {0.091}	2.64 {0.269}	4.68 {0.48}	7.32 {0.75}	16.48 {1.68}	
-80 {-600}	0.392 {0.040}	0.768 {0.078}	2.26 {0.231}	4.02 {0.41}	6.28 {0.64}	14.13 {1.44}	
-66.7 {-500}	0.327 {0.033}	0.640 {0.065}	1.89 {0.192}	3.35 {0.34}	5.24 {0.53}	11.78 {1.20}	
-53.3 {-400}	0.261 {0.027}	0.512 {0.052}	1.51 {0.154}	2.68 {0.27}	4.18 {0.43}	9.41 {0.96}	
-40 {-300}	0.196 {0.020}	0.384 {0.039}	1.13 {0.115}	2.01 {0.20}	3.14 {0.32}	7.06 {0.72}	
-26.7 {-200}	0.131 {0.013}	0.256 {0.026}	0.76 {0.077}	1.34 {0.14}	2.10 {0.21}	4.72 {0.48}	
-13.3 {-100}	0.065 {0.007}	0.128 {0.013}	0.38 {0.038}	0.67 {0.07}	1.04 {0.11}	2.35 {0.24}	

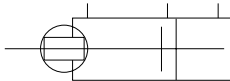
※ All values in the table above are theoretical.

MULTIMOUNT CYLINDERS FOR VACUUM PADS

Double Acting Non-rotating Type



Symbol



Thrust

Cylinder bore mm	Piston rod dia. mm	Operation	Area subject to pressure mm ²	Air pressure MPa						
				0.1	0.2	0.3	0.4	0.5	0.6	0.7
10	5	Double acting	59	—	11.6	17.4	23.1	28.9	34.7	40.5
16	6		173	17.0	33.9	50.9	67.9	84.8	101.4	118.8

Cylinder Bore and Stroke

Cylinder bore	Standard stroke
10	5, 10, 15, 20, 25, 30
16	

Mass

Cylinder bore	Stroke mm	Side mount mass		Additional mass															
		Standard cylinder	Sensor cylinder	With 1 sensor switch (sensor cylinder only)				Mounting fixture (rod)		Head mounting fixture			Vacuum pad model (with socket)						
				ZC130	ZC153	CS5T	CS11T	Flange-type A-mount	Flange-type B-mount	Foot-type A-mount	Flange-type A-mount	Flange-type B-mount	P2	P3.5	P6	P8	P10	P15	
10	5	72																	
	10	81																	
	15	90																	
	20	99																	
	30	117																	
16	5	144																	
	10	161																	
	15	178																	
	20	195																	
	30	229																	

Sample calculation (for a **BDAVS** 10x20 sensor cylinder with 2 sensor switches): 99 + (20 x 2) = 139g

Remark: Sensor switch lead wires come in 2 different lengths: A : 1000mm, B : 3000mm

Specifications

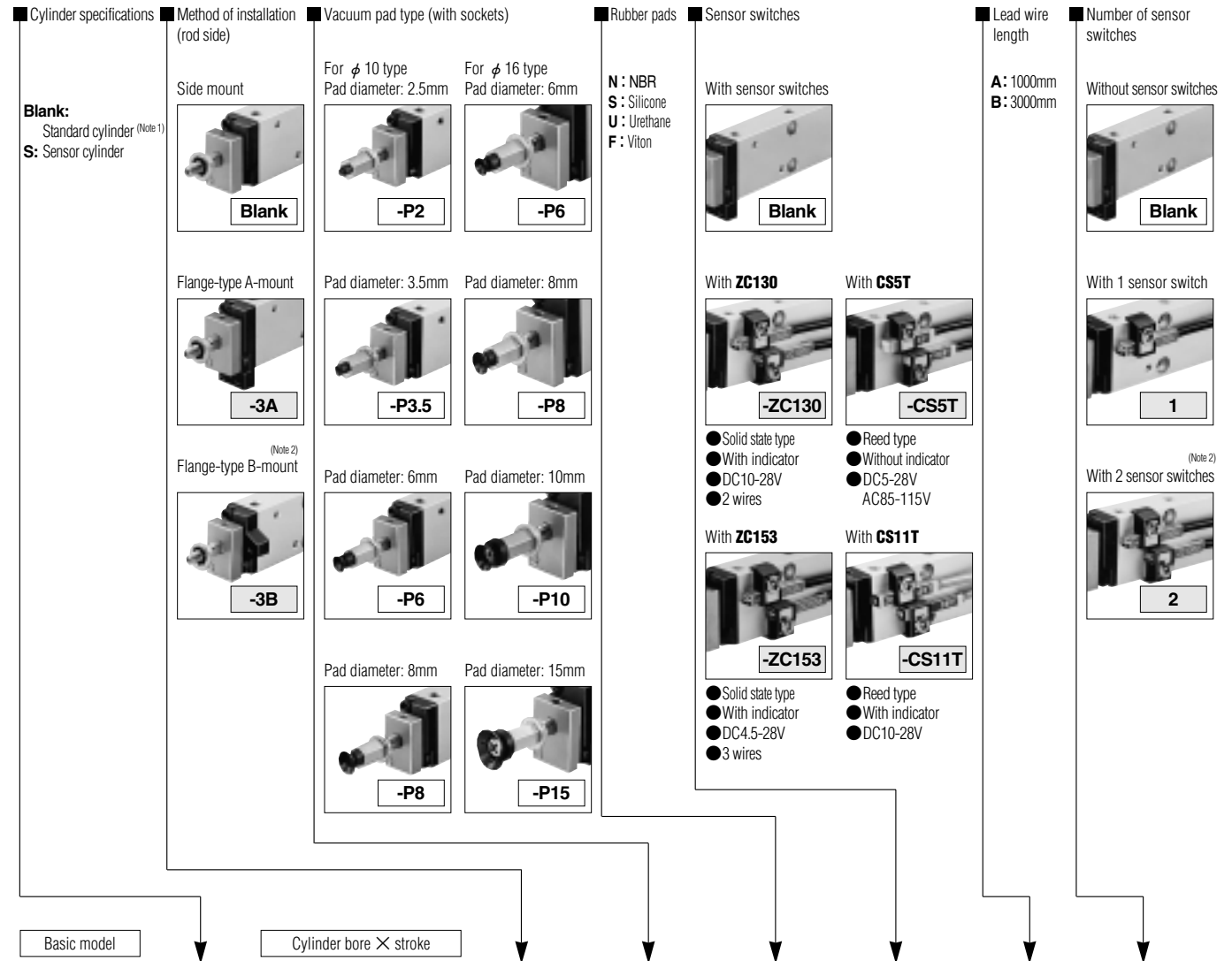
Item	Cylinder bore mm	10	16
		Operation	Double acting
Media	Air		
Pressure range	MPa {kgf/cm ² }	0.15~0.7 {1.5~7.1}	0.1~0.7 {1~7.1}
Vacuum port pressure	-101.32kPa~0.6MPa (Vacuum breaking time = The time it takes to go from 0 to 0.6MPa.) (Note 1)		
Proof pressure	MPa {kgf/cm ² }	1.03 {10.5}	
Temperature range	°C	0~60	
Velocity range (Note 2)	mm/s	50~500	
Cushion	Rubber bumper		
Lubrication	Not necessary (If you lubricate, use a product which meets grade 1 turbine oil (ISO VG32) standards.)		
Non-rotating accuracy		±1.5°	±1°
Port (atmospheric pressure•vacuum pressure)	M5×0.8		
Stroke tolerance	mm	+1 0	
Rod tip thread		M4x0.7, male thread	M5x0.8, male thread

Notes: 1. Apply pressure only from the vacuum port during vacuum breaking.

Do not allow this pressure to exceed cylinder port pressure.

2. Standard velocity for an unloaded cylinder.

Order Codes

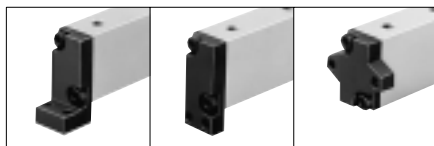


BDAV	S	\times	-3A -3B	-P2 -P3.5 -P6 -P8 -P10 -P15	N S U F	-ZC130 -ZC153 -CS5T -CS11T	A B	1 2
------	---	----------	------------	--	------------------	-------------------------------------	--------	--------

- See the "Cylinder Bore and Stroke" table.
- Order separately for head side mounting brackets.
- Mounting brackets cannot be ordered after cylinder delivery from our plant.
- To order a mounting fixture only, see page 532.
- To find the order codes to order a sensor switch only, see page 534.
- When the cylinder stroke is 5mm, one **CS5T** or **CS11T** is installed as the standard. If you use 2 sensor switches, use solid state type switches.
- The mounting fixture for the head side must be ordered separately.
- To find out the materials and properties of the various types of rubber pads, see the table on page 527.
- To find the order code for a vacuum pad only, see page 527.
- The rubber on the product shown in the photo is NBR.
- Vacuum pad compatibility table

Additional Parts (Sold Separately)

Mounting brackets



- Foot-type A-mount
- Flange-type A-mount
- Flange-type B-mount
- The photograph shows a mounting fixture for the head side.
- For order codes, see page 532.
- Comes with 2 mounting screws.

Shield plate

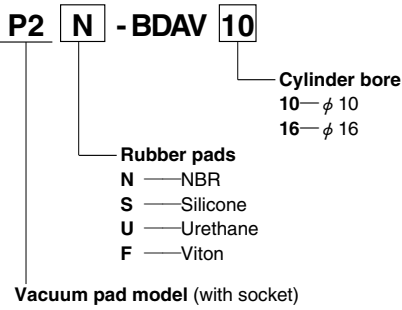


- For sensor cylinders
- For order codes, see page 538.
- Comes with 2 mounting screws.

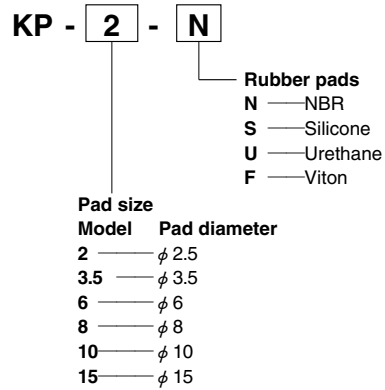
Cylinder bore mm	Pad model						Socket female thread diameter
	P2	P3.5	P6	P8	P10	P15	
10	●	●	●	●	—	—	M4×0.7
16	—	—	●	●	●	●	M5×0.8

Order Codes for Vacuum Pads

● With sockets



● Without sockets (pads only)



Vacuum Pad Mass (With sockets)

Pad model	P2	P3.5	P6	P8	P10	P15	Socket female thread diameter
Pad diameter mm	2.5	3.5	6	8	10	15	
Cylinder bore mm	3	3	3	3	—	—	M4×0.7
	—	—	4	4	6	6	M5×0.8

Rubber Pads: Materials and Their Properties

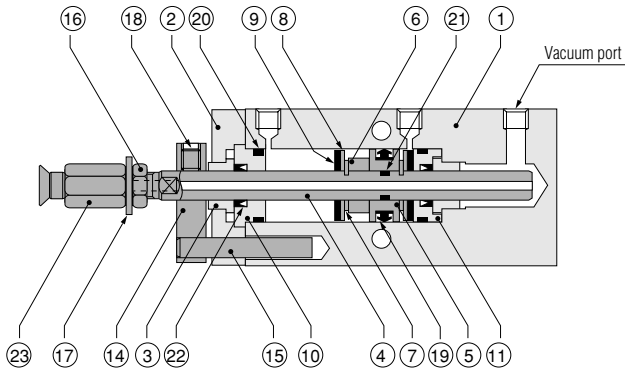
Material	Item	Tensile strength	Stretching	Oil resistance (gasoline)	Oil resistance (benzol)	Weather resistance	Ozone resistance	Heat resistance	Cold resistance	Resistance to chemicals	Abrasion resistance	Electrical insulation	Shear resistance	Adhesiveness (metal)	Resistance to gas permeation	Hardness HS
Standard	NBR (N)	◎	◎	◎	△	○	○	○	×	◎	○	○	○	○	○	70 ±5
	Silicone (S)	△	○	△	△	○	○	○	◎	◎	×	◎	×	×	△	50 ±5
	Urethane (U)	◎	◎	◎	○	◎	◎	×	○	◎	◎	◎	◎	△	◎	70 ±5
	Viton (F)	◎	○	◎	◎	◎	◎	◎	○	◎	○	◎	○	△	○	70 ±5

Remarks: ◎ Excellent ○ Acceptable in some cases △ Substandard × Unacceptable

Internal Structure and Part Names

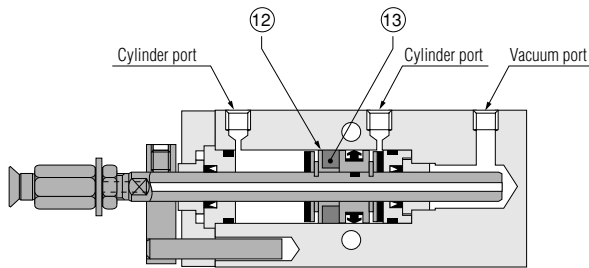
● ϕ 16 Standard Cylinders

BDAV



● ϕ 16 Sensor Cylinders

BDAVS



Principle Materials

No.	Name	Materials
①	Body	Aluminum (anodized)
②	Rod cover ^(Note 1)	Aluminum (black anodized)
③	Rod bushing	Oil-impregnated copper alloy
④	Piston rod	Stainless steel
⑤	Piston	Brass
⑥	Spacer	Brass
⑦	Snap ring	Stainless steel
⑧	Retainer	Brass
⑨	Bumper	Urethane rubber
⑩	Packing case	Brass
⑪	Packing case B	Brass
⑫	Support ^(Note 2)	Brass
⑬	Magnet	Plastic magnet
⑭	Plate	Brass (electroplated with nickel)
⑮	Guide pin	Stainless steel
⑯	Rod nut	Hard steel (electroplated with nickel)
⑰	Seal washer	Synthetic rubber (NBR) • Rolled plate
⑱	Set screw	Hard steel blackening
⑲	Piston packing	Synthetic rubber (NBR)
⑳	O-ring	Synthetic rubber (NBR)
㉑	O-ring	Synthetic rubber (NBR)
㉒	Rod packing	Synthetic rubber (NBR)
㉓	Socket	Brass (electroplated with nickel)

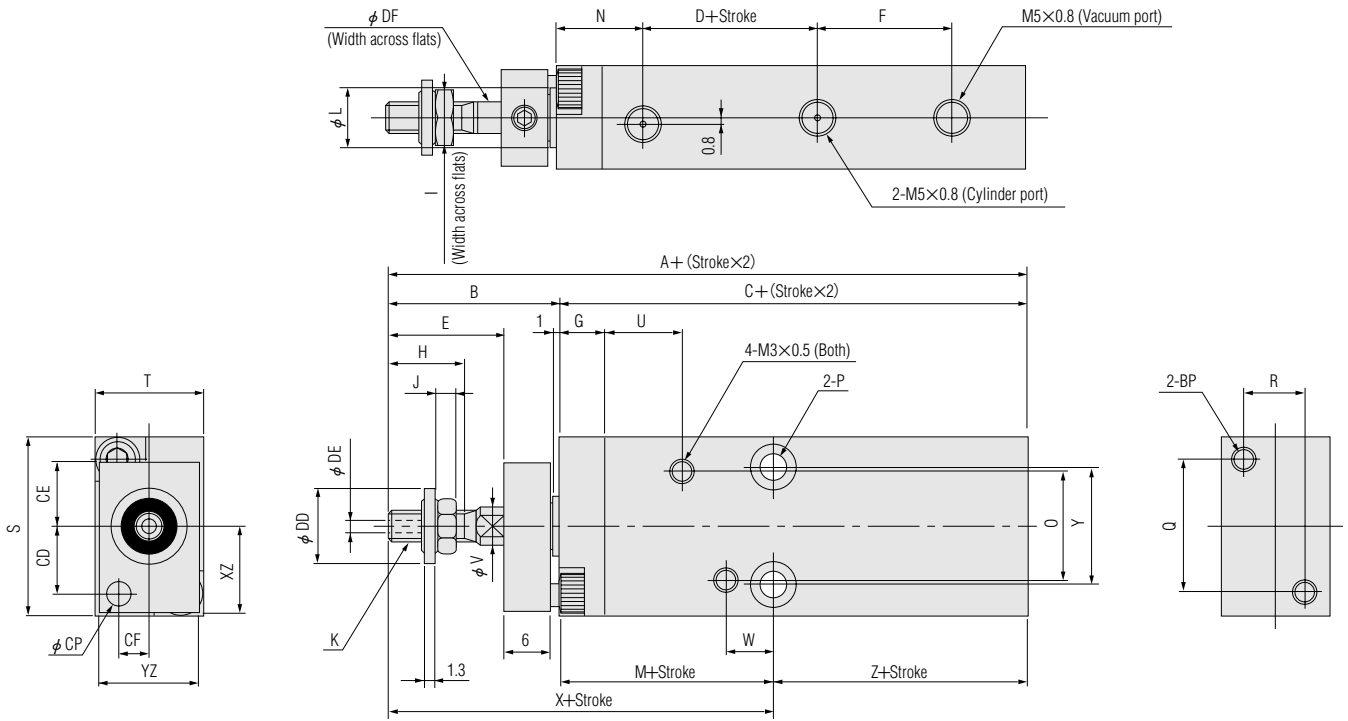
Notes: 1. Hard steel (black zinc plated) is used for the foot-type A-mount for the head.

2. The support does not come in size ϕ 10.

Packing

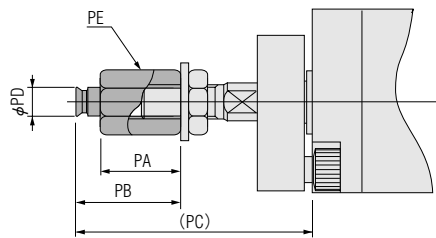
Diameter mm	Name			
	Rod packing	Piston packing	O-ring	O-ring
10	MY-8×5×2	PPH-10	10×7.6×1.2	4.6×3.4×0.6
16	MY-9×6×2	PPH-16	16×13×1.5	6×4.4×0.8

Dimensional Drawings for Side Mount Type (Unit: mm)

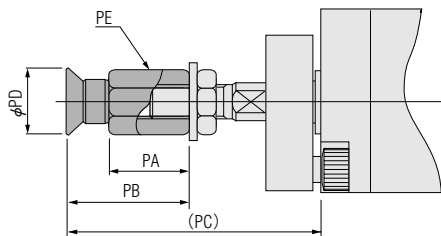


Vacuum Pad Installation Dimensions

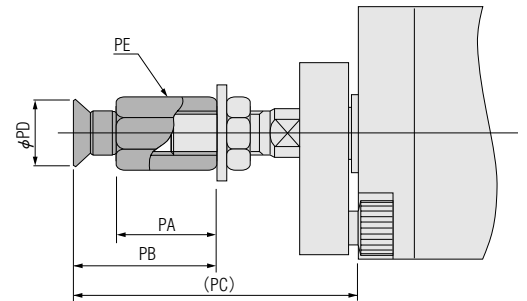
● $\phi 10$
P2, P3.5



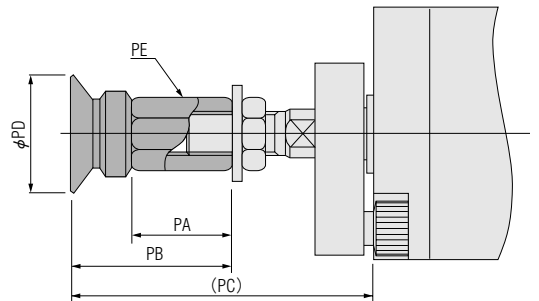
P6, P8



● $\phi 16$
P6, P8



P10, P15



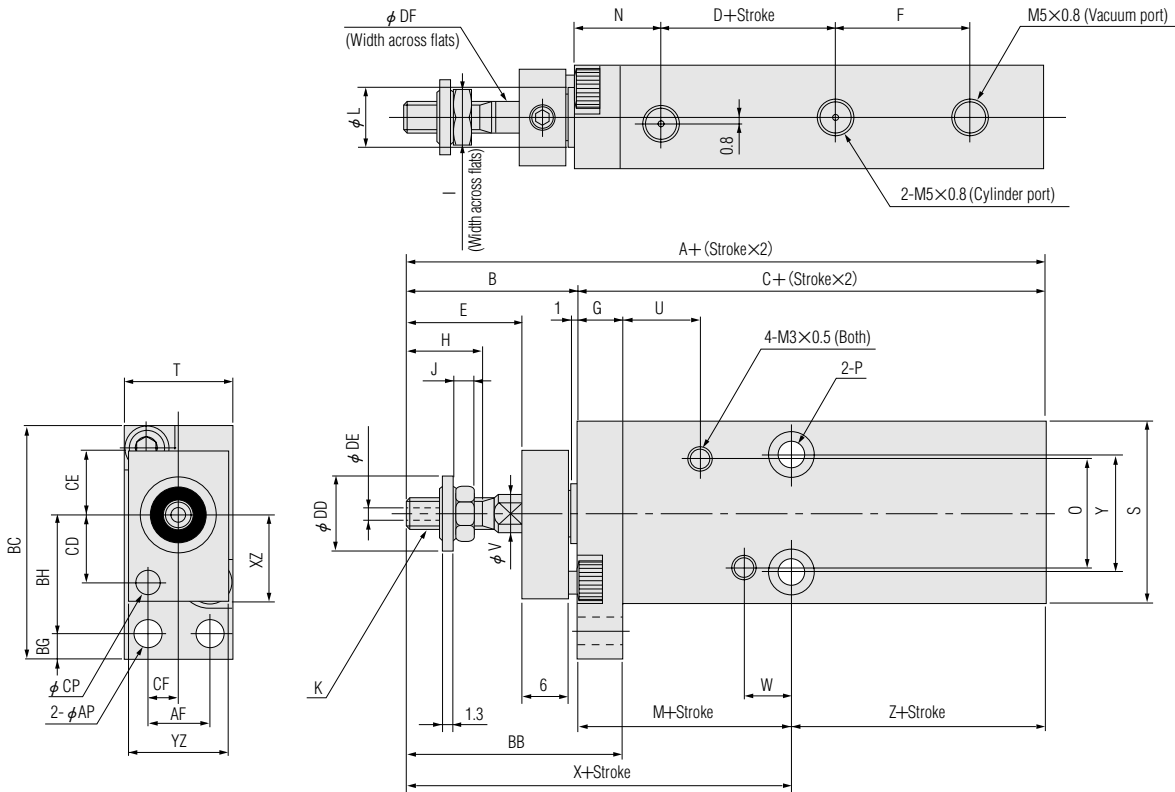
Code	A	B	C	D	E	F (depends on stroke)				G	H	I	J	K	L	M	N	O	P
						5	10	15	20 · 25 · 30										
10	66	23	43	13.5	15.5	16	18	23	28	6	10	7	2.4	M4×0.7	8 ^{+0.05}	19	11.5	15	$\phi 3.5$, Counterbore: $\phi 6$, Depth: 3.2 (Both)
16	70	25	45	16	17.5					7	12	8	3.2	M5×0.8	10 ^{+0.05}	22	12.5	19	$\phi 4.5$, Counterbore: $\phi 7.6$, Depth: 4.2 (Both)

Code	Q	R	S	T	U	V	W	X	Y	Z	CD	CE	CF	CP	BP	DD	DE	DF	XZ	YZ
10	18	8	24	14	10.5	5	6.5	42	16	24	9	8.5	4	3	M3×0.5, Depth: 6.5	10.2	1.5	4	11.5	13
16	25	12	33	20	12	6	7.5	47	24	23	12.5	9	6	4	M4×0.7, Depth: 6.5	12.5	2	5	16	19

Diameter	Code	Model	PA	PB	(PC)	PD	PE
	P3.5	13.5	31	3.5			
	P6	16	33.5	6			
		P8	15.5	33	8	Width across flats: 8 (M5×0.8, Depth: 8)	
16	P6	17.5	35.5	6			
	P8	17	35	8			
		P10	13	21	39	Width across flats: 8 (M5×0.8)	
		P15			15		

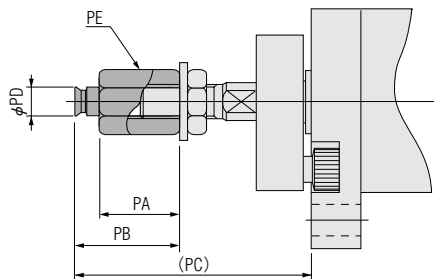
Remark: Figures enclosed in parentheses are the dimensions for inside screws of PE.

Dimensional Drawings for Flange-Type A-Mount (Unit: mm)

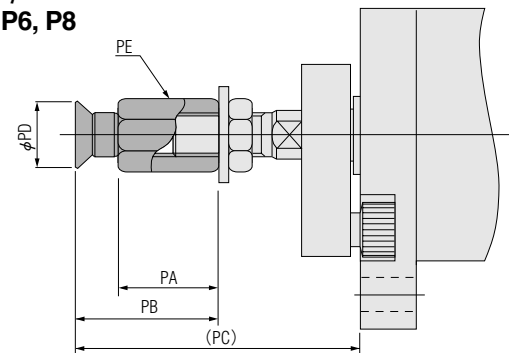


Vacuum Pad Installation Dimensions

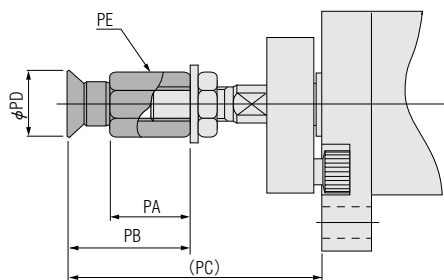
● $\phi 10$
P2, P3.5



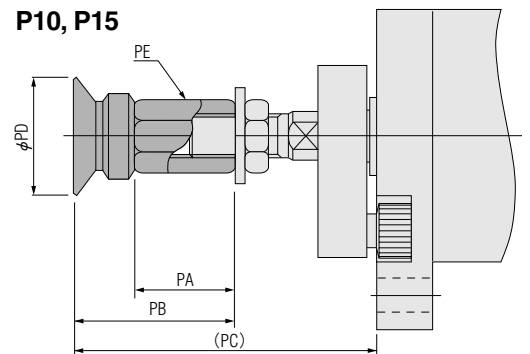
● $\phi 16$
P6, P8



P6, P8



P10, P15



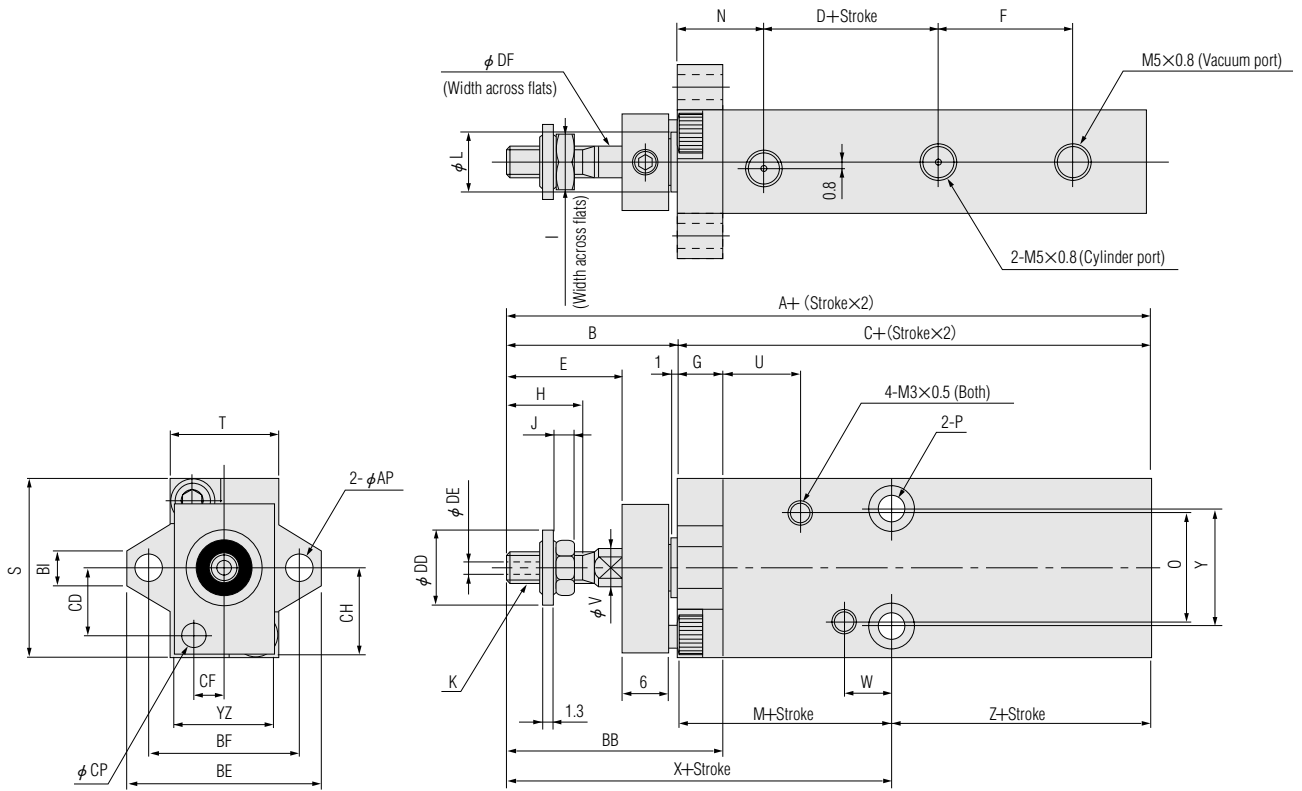
Code	A	B	C	D	E	F (depends on stroke)				G	H	I	J	K	L	M	N	O	P	
						5	10	15	20 · 25 · 30											
10	66	23	43	13.5	15.5	16	18	23	28	6	10	7	2.4	M4 × 0.7	8	$0_{-0.05}$	19	11.5	15	$\phi 3.5$; Counterbore: $\phi 6$; Depth: 3.2 (Both)
16	70	25	45	16	17.5					7	12	8	3.2	M5 × 0.8	10	$0_{-0.05}$	22	12.5	19	$\phi 4.5$; Counterbore: $\phi 7.6$; Depth: 4.2 (Both)

Code	S	T	U	V	W	X	Y	Z	AF	AP	BB	BC	BG	BH	CD	CE	CF	CP	DD	DE	DF	XZ	YZ	
																								Diameter
Diameter	16	33	20	12	6	7.5	47	24	23	12	4.5	32	42	4.5	21	12.5	9	6	4	12.5	2	5	16	19

Code	PA	PB	(PC)	PD	PE
10	P2	13.3		2.5	Width across flats: 7 (M4 × 0.7; Depth: 6.5)
	P3.5	13.5	31	3.5	
	P6	16	33.5	6	
16	P8	15.5	33	8	Width across flats: 8 (M5 × 0.6; Depth: 6)
	P6	17.5	35.5	6	
	P8	17	35	8	
16	P10	13	21	10	Width across flats: 8 (M5 × 0.8)
	P15		39	15	

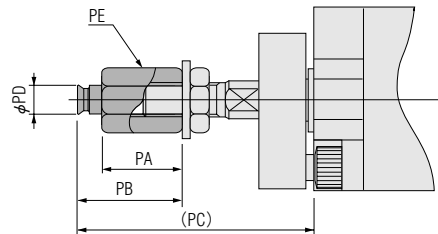
Remark: Figures enclosed in parentheses are the dimensions for inside screws of PE.

Dimensional Drawings for Flange-type B-mount (Unit: mm)

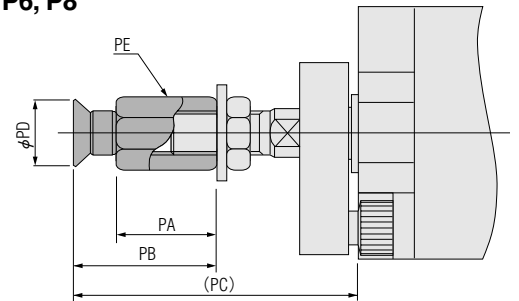


Vacuum Pad Installation Dimensions

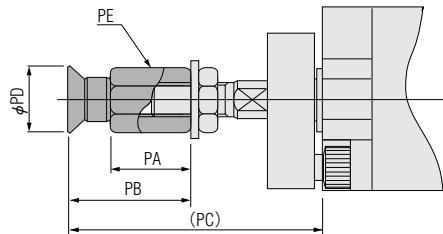
● $\phi 10$
P2, P3.5



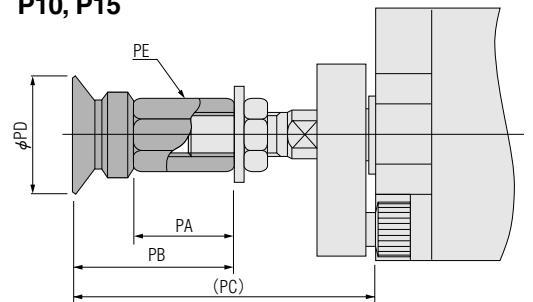
● $\phi 16$
P6, P8



P6, P8



P10, P15



Code	A	B	C	D	E	F (depends on stroke)				G	H	I	J	K	L	M	N	O	P
						5	10	15	20 · 25 · 30										
10	66	23	43	13.5	15.5					6	10	7	2.4	M4x0.7	8 ^{+0.05}	19	11.5	15	$\phi 3.5$, Counterbore: $\phi 6$, Depth: 3.2 (Both)
16	70	25	45	16	17.5	16	18	23	28	7	12	8	3.2	M5x0.8	10 ^{+0.05}	22	12.5	19	$\phi 4.5$, Counterbore: $\phi 7.6$, Depth: 4.2 (Both)

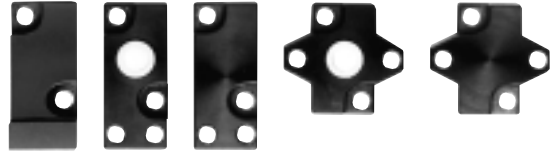
Code	S	T	U	V	W	X	Y	Z	AP	BB	BE	BF	BI	CD	CF	CH	CP	DD	DE	DF	YZ
10	24	14	10.5	5	6.5	42	16	24	3.5	29	26	20	5	9	4	11.5	3	10.2	1.5	4	13
16	33	20	12	6	7.5	47	24	23	4.5	32	36	28	6	12.5	6	16	4	12.5	2	5	19

Diameter	Code	Model	PA	PB	(PC)	PD	PE
P3.5	13.5	31	3.5				
P6	16	33.5	6				
10	P8	15.5	33	8			
16	P6	11.5	17.5	35.5	6	Width across flats: 8 (M5x0.8; Depth: 8)	
P8	17	35	8				
16	P10	13	21	39	10	Width across flats: 8 (M5x0.8)	
P15	13	21	39	15			

Remark: Figures enclosed in parentheses are the dimensions for inside screws of PE.

MOUNTING BRACKETS

Rod Mounting Brackets Head Mounting Brackets



Order Codes for Mounting Brackets

Installation position	Mounting bracket		Side mount	Foot-type A-mount	Flange-type A-mount	Flange-type B-mount
	Cylinder bore	mm				
Rod side	10	L100A	—	—	L103A	L103B
	16	L160A	—	—	L163A	L163B
Head side	10	—	—	B101A	B103A	B103B
	16	—	—	B161A	B163A	B163B

- Remarks:
- All mounting brackets come with 2 mounting screws.
 - All head side mounting brackets are sold separately.
 - To order a rod side mounting bracket already assembled to the cylinder, see the order codes on page 526.
 - There is no rod side foot-type A-mount.
 - Rod side mounting brackets include rod bushings.

Order Codes

L **10** **1A**

Mount type

- 0A — Side mount
- 1A — Foot-type A-mount
- 2A — Flange-type A-mount
- 3B — Flange-type B-mount

Cylinder bore

- 10 — ϕ 10
- 16 — ϕ 16

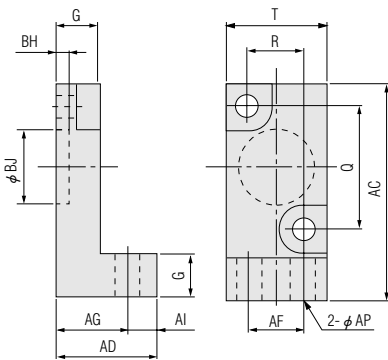
Installation position

- L — For rod side
- B — For head side

Dimensional Drawings (Unit: mm)

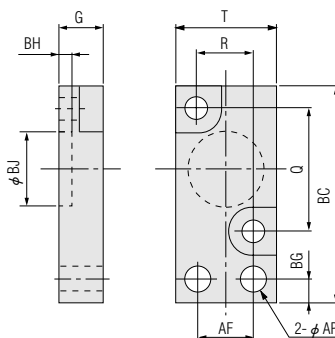
Foot-type A-mount

● ϕ 10,16



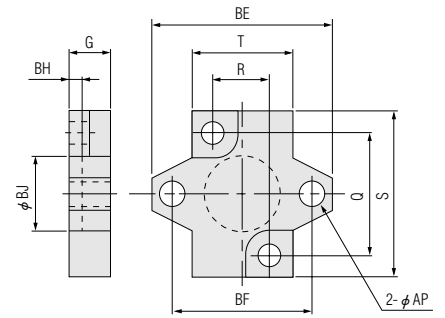
Flange-type A-mount

● ϕ 10,16



Flange-type B-mount

● ϕ 10,16

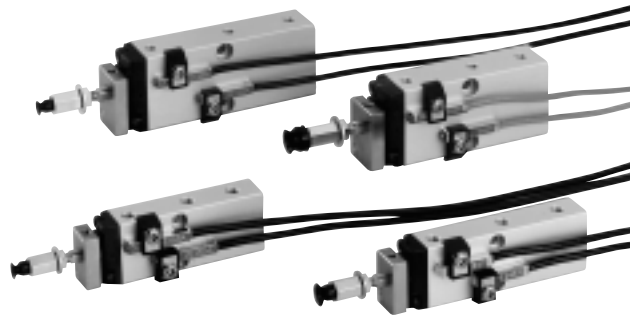
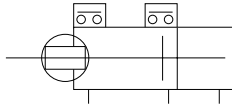


Code	Cylinder bore																	
	G	Q	R	S	T	AC	AD	AF	AG	AI	AP	BC	BE	BF	BG	BH	BJ	
10	6	18	8	24	14	31	14	8	10	4	3.5	31.5	26	20	3.5	2 ^{+0.05} ₀	12 ^{+0.1} ₀	
16	7	25	12	33	20	41.5	17	12	12	5	4.5	42	36	28	4.5	2 ^{+0.05} ₀	18 ^{+0.1} ₀	

SENSOR SWITCHES

Solid State Type Reed Type

Symbol



Specifications

●Solid state type

Item	Model	ZC130□	ZC153□
Wiring		2 wires	3 wires
Power supply voltage		—	DC4.5~28V
Load voltage		DC10~28V	DC4.5~28V
Load current		4~50mA	100mA max.
Consumption current with power ON		—	10mA max. (at DC24V)
Internal drop voltage (Note 1)		3.5V max.	0.5V max. (at 50mA)
Current leakage		1mA max. (at DC24V)	50 μA max. (at DC24V)
Delay		1ms max.	
Insulation resistance		100M Ω min. (at DC500V mega; case-lead wire terminal)	
Insulation withstanding voltage		AC500V (50/60Hz) 1 minute (case-lead wire terminal)	
Shock resistance (Note 2)		294.2m/s ² {30.0G} (non-repeating)	
Vibration resistance (Note 2)		88.3m/s ² {9.0G} (total amplitude: 1.5mm•10-55Hz)	
Protective case		IP67 (IEC standards), JIS C 0920 (watertight type)	
Operation indicator		Red LED indicator lights up when power is ON.	
Lead wire		PVC 0.2SQ×2 lines (brown•blue)×I (Note 3)	PVC 0.2SQ×3 lines (brown•black•blue)×I (Note 3)
Operating temperature range		0~60°C	
Storage temperature range		-10~70°C	
Mass (including installation fixture)		20g (when lead wire is 1000mm long)	

Notes: 1. Internal drop voltage varies depending on the load current.

2. Figures based on tests performed by KOGANEI.

3. Lead wire length I: A: 1000mm, B: 3000mm

●Reed type

Item	Model	CS5T□	CS11T□
Wiring		2 wires	
Load voltage		DC5~28V AC85~115V (r.m.s.)	DC10~28V
Load current		DC0.1~40mA AC2~25mA	DC5~40mA
Internal drop voltage		10mV max. (with 40mA load current)	2.1V max. (with 40mA load current) (Note 1)
Current leakage		0mA	
Delay		1ms max.	
Insulation resistance		100M Ω min. (at DC500V mega; case-lead wire terminal)	
Insulation withstanding voltage		AC1000V (50/60Hz) 1 minute (case-lead wire terminal)	
Shock resistance (Note 2)		294.2m/s ² {30.0G} (non-repeating)	
Vibration resistance (Note 2)		88.3m/s ² {9.0G} (total amplitude: 1.5mm•10-55Hz) Resonant frequency: 2750 ± 250Hz	
Protective case		IP66 (IEC standards), JIS C 0920 (watertight type)	
Operation indicator		—	Red LED indicator lights up when power is ON
Lead wire		PVC 0.2SQ×2 lines (brown•blue)×I (Note 3)	
Electrical service life (Note 2)		5×10 ⁶ times min.	
Operating temperature range		0~60°C	
Storage temperature range		-10~70°C	
Contact point protection		Required (see section on page 535 "Protection of Contact Points")	
Mass (including installation fixture)		20g (when lead wire is 1000mm long)	

Notes: 1. Internal drop voltage varies depending on the load current.

2. Figures based on tests performed by KOGANEI.

3. Lead wire length I: A: 1000mm, B: 3000mm

Order Codes for Sensor Switches Only

		Sensor switch model	Options	
			Lead wire length	With sensor holder
Solid state type	DC10~28V	ZC130	A	-B10
With display lamp	DC10~28V	ZC153		
Solid state type	DC4.5~28V	ZC153	B	-B16
With display lamp	DC4.5~28V	ZC153		
Reed type	DC5~28V	CS5T		
Without display lamp	AC85~115V	CS5T		
Reed type	DC10~28V	CS11T		
With display lamp	DC10~28V	CS11T		

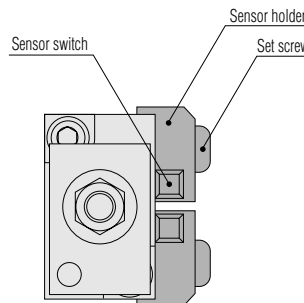
- **A** : 1000mm
- **B** : 3000mm

- **-B10** : For ϕ 10 cylinder
- **-B16** : For ϕ 16 cylinder

★ Order codes for sensor holders only
 For ϕ 10 cylinder—**T-B10**
 For ϕ 16 cylinder—**T-B16**

Changing Sensor Switch Position

- When the set screw is loosened, the sensor switch can be moved freely in an axial direction.
- Tighten the set screw with a torque of 20N•cm max.



Minimum Cylinder Stroke for Various Sensor Switches

Cylinder bore	Solid state sensor switch		Reed sensor switch	
	2 installed	1 installed	2 installed	1 installed
10	5	5	10	5
16	5	5	10	5

Remarks: Two sensor switches cannot be installed to the flange-type B-mount.
 When a flange-type B-mount is used on the rod side, 1 sensor is installed on the head side.
 When a flange-type B-mount is used on the head side, 1 sensor is installed on the rod side.

Sensor Switch Operating Range • Hysteresis • Point of Maximum Sensitivity

● Operating range: *l*

The term "operating range" refers to the range of the piston between the time it moves to turn the sensor ON, and when it moves in the same direction to turn the sensor OFF.

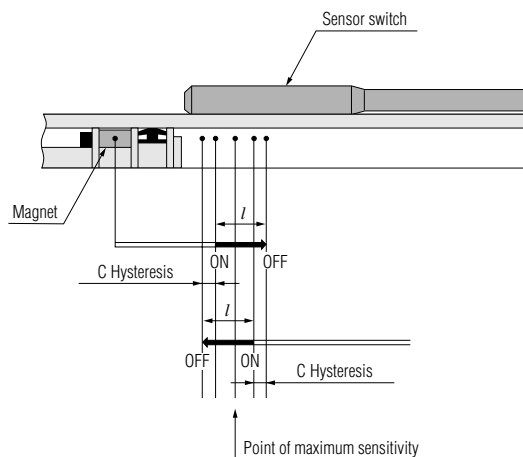
● Hysteresis: *C*

The term "hysteresis" refers to the distance traveled by the piston between the following two points A and B:

- A: The point at which the piston is located when it moves to turn the sensor switch ON.
- B: The point to which the piston moves in the opposite direction to turn the sensor switch OFF.

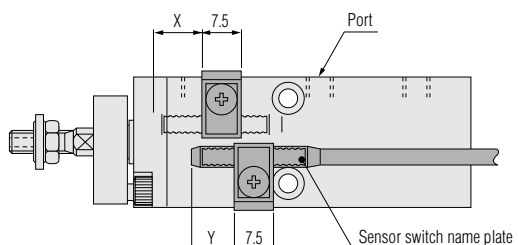
Cylinder bore	ZC130□, ZC153□		CS5T□, CS11T□	
	Operating range	Hysteresis	Operating range	Hysteresis
10	2.0~3.0	0.3 max.	5.8~8.3	1.6 max.
16	2.5~4.0	0.3 max.	7.5~9.4	1.9 max.

Remark: The figures in this table are only approximate.



Installation Position of the Stroke End Sensor Switch

● Sensor cylinder



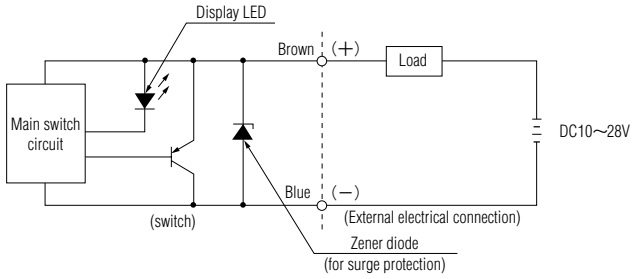
Cylinder bore	Installation position	Sensor switch model			
		ZC130□	ZC153□	CS5T□	CS11T□
10	X	5.5	4.5	8.0	
	Y	1.5	0.5	4.0	
16	X	6.0	4.5	8.0	
	Y	1.5	0	3.5	

- Remarks: 1. The figures in the table above are approximate guidelines for sensor switches with a standard stroke. For instructions on how to set the switch in the best position, see page 539.
 2. In the illustration on the left, the port is facing upward.
 3. Install the sensor switch so that the name plate (with the model name) is face up.

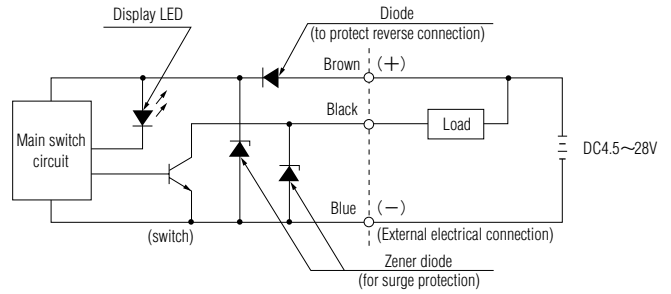
Internal Circuits

●Solid state type

ZC130□

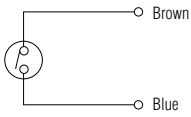


ZC153□

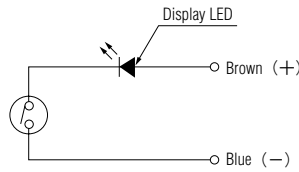


●Reed type

CS5T□



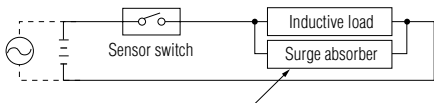
CS11T□



Protection Circuits for Reed Type Sensors

To assure stable performance of reed type sensors, take the following measures to protect the contact points:

●When connected to an inductive load (solenoid relay, etc.)



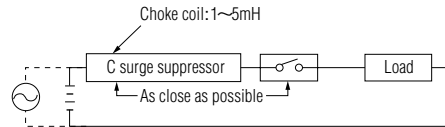
For DC.....Diode or CR, etc.
For AC.....CR, etc.

Diode: Withstand voltage in the forward voltage should be over circuit current, and withstand voltage in the reverse voltage. Should be at least 10 times the circuit currents.

C : 0.01~0.1μF
R : 1~4kΩ

●When capacitive surges occur

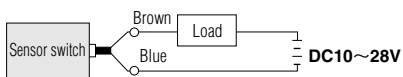
(When lead wire length is over 10m)



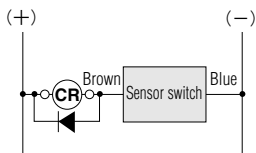
Electrical Connections for Solid State Sensor Switches

ZC130 □

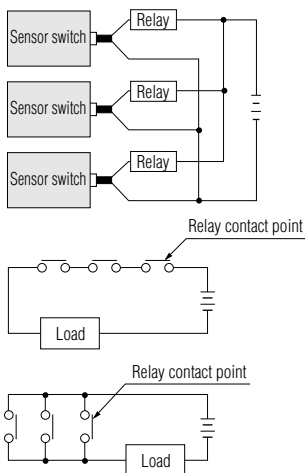
● Basic connection



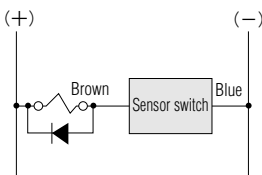
● Connections to relays



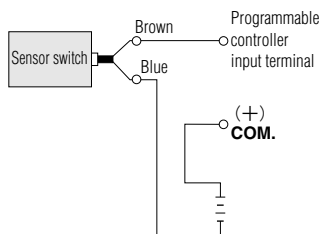
AND (series) connections and OR (parallel) connections



● Connection to solenoid valve

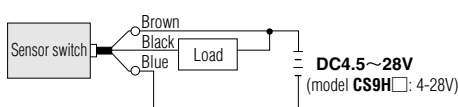


● Connection to programmable controller

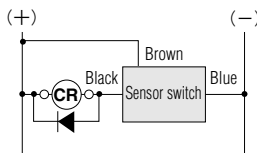


ZC153 □

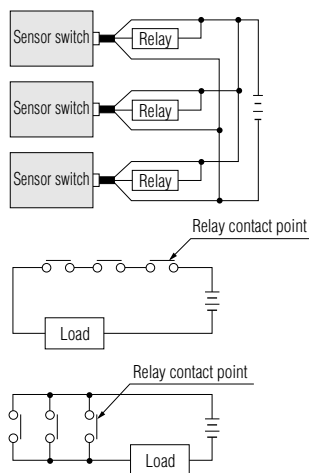
● Basic connection



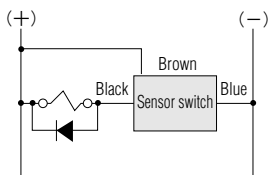
● Connections to relays



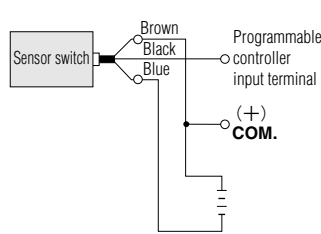
AND (series) connections and OR (parallel) connections



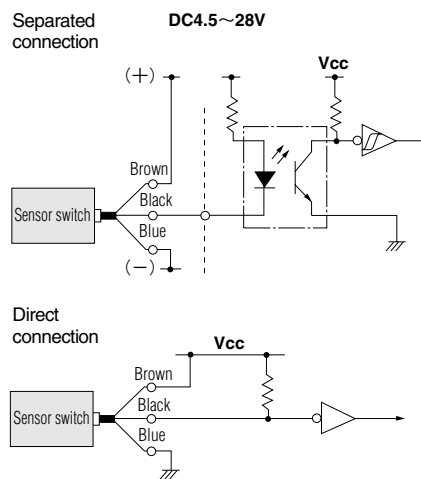
● Connection to solenoid valve



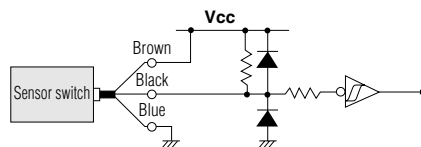
● Connection to programmable controller



● Connections to TTL



● Connection to C-MOS

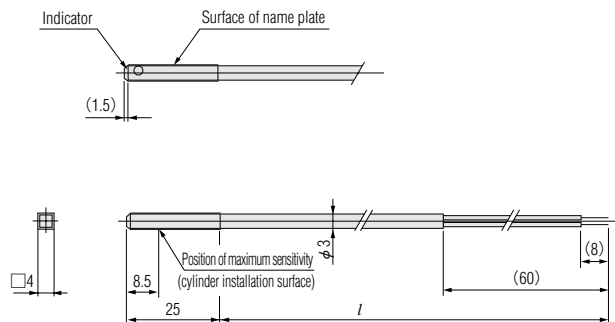


- Caution: 1. Pay attention to the color of the lead wires when connecting. Improper connections could result in malfunctions or damage.
- A 2-wire solid state type sensor switch should not be connected to a **TTL** or **C-MOS**.
 - Surge protection is recommended for solenoid relays and other inductive loads.
 - In the case of OR connections, the outputs (the black lead wires, for example) from multiple sensors can be directly connected together, but the current leakage will be increased in proportion to the number of connected sensors, therefore take caution against possible erratic load reset.

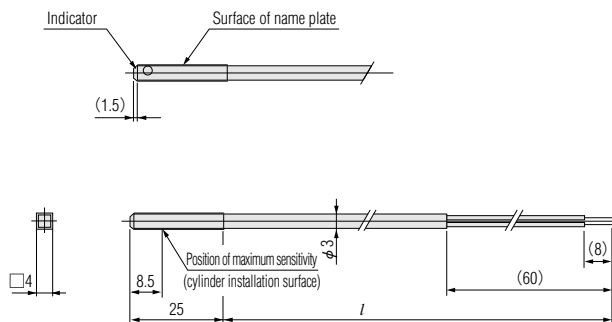
- The sensors operate on the principle of magnetic sensing. Do not use them under a strong external magnetic field, or near power lines or other large electric currents.
- Do not pull on the lead wires forcefully, bend them sharply, or otherwise subject them to undue force.
- Do not use these sensor switches where they would be exposed to chemicals, harmful gases, etc.
- If the sensors must be used under water and/or oil dripping or vapors, consult us.
- In the case of AND connections, the increased number of sensors will result in greater internal voltage drop. Be cautious against any possibilities of improper operation of loads.

Dimensional Drawings for Sensor Switches (Unit: mm)

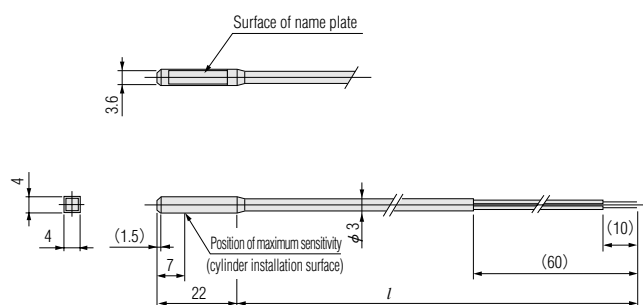
ZC130□



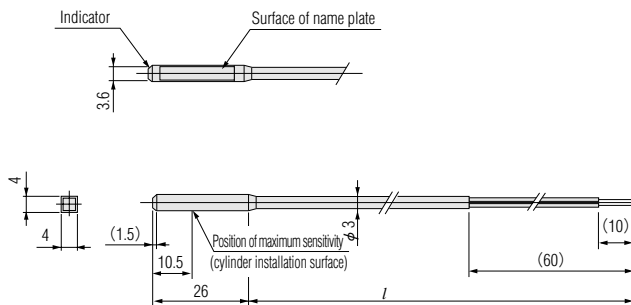
ZC153□



CS5T□



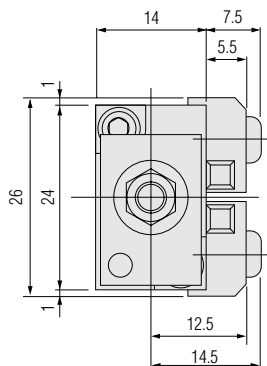
CS11T□



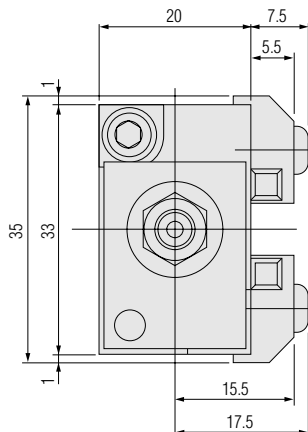
※ Lead wire length l : A: 1000mm, B: 3000mm

Dimensional Drawings for Sensor Switch Installation (Unit: mm)

● $\phi 10$

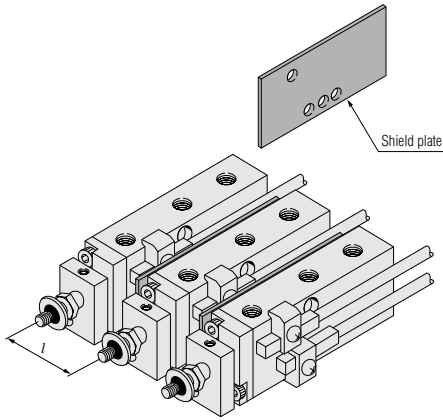


● $\phi 16$



Precautions for Installation of Sensor Switch Cylinders

When installing more than one multimount cylinder with sensor switch cylinders in close proximity to each other, observe the requirements listed in the table to the right.



Cylinder bore mm	Without shield plate		With shield plate
	l		l
10	29mm min.	31mm min.	25mm min.
16	35mm min.	39mm min.	31mm min.

Remark: There are no particular requirements regarding the installation of cylinders other than those listed above.

Order Codes for Shield Plates

Cylinder bore mm	Stroke mm	5, 10, 15	20, 25, 30
	10		BVS101
16		BVS161	BVS162

Remarks: 1. All shield plates come with 2 mounting screws.
2. All shield plates are sold separately.

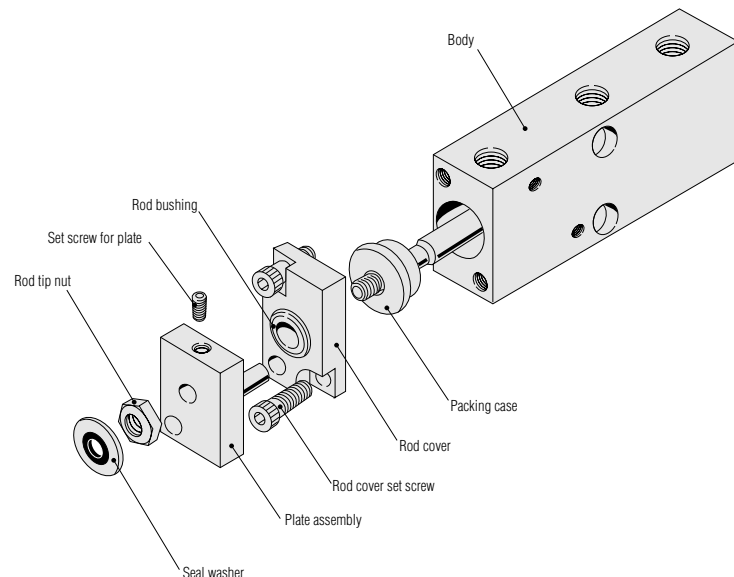
Proper Handling and Precautions



Replacement of Mounting Brackets

● Rod side mounting brackets

Remove the rod nut, loosen the rod cover (mounting bracket) and remove the rod cover (mounting bracket). To install the new mounting bracket, reverse the procedure just described. In the case of a non-rotating type cylinder, loosen the set screw for plate, remove the plate assembly and remove the rod cover (mounting bracket). To mount the replacement bracket, fit the mounting assembly into the holes on the cylinder guide pins, insert the plate assembly and secure the piston rod by tightening the set screw for the plate. With the piston rod pushed all the way to the stroke end on the head side, tighten the plate assembly with a gap of about 0.5mm between the plate and the rod bushing.



● Mounting bracket on the head side

Comes with a mounting screw. Use this screw to assemble the bracket.

Caution: 1. To install the side mount cylinder as accurately as possible, assemble the device so that the rod cover and head cover do not project beyond the body of the cylinder, and when installing the cylinder to the machine, be sure it fits flat against the machine.
2. To secure the mounting bracket, the mounting screw that comes with it can be used. If using a commercially sold screw, it should be of the size listed in the table below.

Cylinder bore	Screw size	Length below head
10	M3×0.5	8
16	M4×0.7	8

3. Please tighten the set screw for plate with the proper torque and use the proper size hexagonal wrench. See the table below.

Cylinder bore	Tightening torque (N·cm)	Nominal size of hexagonal wrench
10	98	1.5
16	137	2

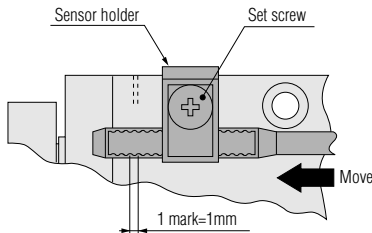


Sensor Switches

Setting at the Best Position

●Setting the stroke end on the head side

1. Move the piston until it touches the stroke end on the head side.
2. With the sensor switch secured loosely to the body, move the sensor switch from the head side toward the rod side until it reaches the ON position (at which point, on models **ZC130**, **ZC153** and **CS11T**, the LED will light up). Then move it either 1 mark (1mm) further (for models **ZC130** and **ZC153**) or 2 marks (2mm) further (for models **CS5T** and **CS11T**) and tighten the set screw.



●Setting the stroke end on the rod side

Do the opposite of what was done on the head side.

1. Move the piston until it touches the stroke end on the rod side.
2. With the sensor switch secured loosely to the body, move the sensor switch from the rod side toward the head side until it reaches the ON position. Then move it either 1 mark (1mm) further (for models **ZC130** and **ZC153**) or 2 marks (2mm) further (for models **CS5T** and **CS11T**) and tighten the set screw.



General Precautions

Pressurization

1. Applying pressure at the vacuum port should only be allowed during vacuum breaking and it should be less than the operating pressure at the cylinder port.
2. When applying pressure at the cylinder port is 0, do not apply pressure from the vacuum port.

Installation

1. When the load ratio is high or the device is being used at high speed, install an external stopper so that the cylinder will not be subject to direct impact.
2. The 4-M3×0.5 female-thread on the cylinder body should only be used to install a sensor switch or a shield plate.

Piping

Before piping to the cylinder, be sure to thoroughly flush the piping (using compressed air). Be careful not to let chips, seal tape, rust, or other foreign material get inside the piping while installing it. Such foreign material could cause air leaks or other malfunctions.

Atmosphere

1. When the equipment is used where it will be exposed to dripping water or oil, or where there is a lot of dust, protect it with a cover.
2. This product cannot be used if any of the following substances are mixed in with the media or air: organic solvent • phosphoric acid, ester-type machine oil • sulfurous gas • chlorine gas • acids.

Lubrication

These devices can be used without lubrication, but if lubrication is required, it is recommended that a product equivalent to grade 1 turbine oil (ISO VG32) be used. Do not use spindle oil or machine oil.

Air supply

1. Air is the proper media for this product. If you wish to use some other type of media, consult us.
2. Supply the valve with clean air which is not contaminated with compressor oil or other impurities. Install an air filter (filtration of 40 μm max.) near the cylinder and valve to eliminate water vapor and solid matter. Liquid which collects in the valve should be drained regularly.