CKD

SM－286247－A

INTRUCTION MANUAL

CENTERING HAND
BHA Series

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

CKD Corporation

The 2nd edition

For Safety Use

To use this product safety, basic knowledge of pneumatic equipment, including materials, piping, electrical system and mechanism, is required (ISO 4414 *1, JIS B 8370 *2).

We do not bear any responsibility for accidents caused by any person without such knowledge or arising from improper operation.

Our customers use this product for a very wide range of applications, and we cannot keep track of all of them. Depending on operating conditions, the product may fail to operate to maximum performance, or cause an accident. Thus, before placing an order, examine whether the product meets your applications, requirements, and how to use it.

This product incorporates many functions and mechanisms to ensure safety. However, improper operation could result in an accident. To prevent such accidents, **read this operation manual carefully for proper operation.**

Observe the cautions on handling described in this manual, as well as the following instructions:

⚠ CAUTION :

- Before performing an overhaul inspection on the actuator, deactivate residual pressure completely.
- While the actuator is operating, do not step into or place hands in the driving mechanism.
- To prevent an electric shock, do not touch the electric wiring connection (exposed live parts) of the actuator equipped with a solenoid valve or switch. Perform an overhaul inspection with the power off. Also, do not touch these live parts with wet hands.

[SM-281247-A]

INDEX

Centering Hand

BHE Series

No. SM-286247-A

1. Product Related Items

1. 1 Specifications

Model / Item		BHE-01CS	BHE-03CS	BHE-04CS	BHE-05CS	BHE-06CS
Cylinder bore size	mm	φ12	φ16	φ20	φ25	φ32
Working fluid		Compressed air				
Max. working pressure	MPa	0.7				
Min. working pressure	MPa	0.2				
Ambient temperature	℃	5 to 60				
Port size		M3		M5		
Operational stroke length		7	10	14	16	22
Rod diameter	mm	φ6	φ8	φ10	φ12	φ16
Repeatability	mm	±0.01				
Centering precision	mm	±0.05				
Product weight	kg	0.108	0.154	0.260	0.438	1.040
Lubrication		Not required (For lubrication, use turbine oil class 1 ISO VG32)				

1. 2 Features

This product demonstrates its outstanding performance to the full capacity for precision work with highly reliable precision.

1) Highly reliable rigidity
By employing super-hard stainless steel in the master jaw and guide part, high rigidity and high durability have been realized.

2) Rust preventive material is used
- The master and guide part are made of stainless steel.
- Since this product is resistant to rust and both precision and function are excellent, it can be used over a long period of time.

3) The opening/closing stroke can also be adjusted. (Optional setting)

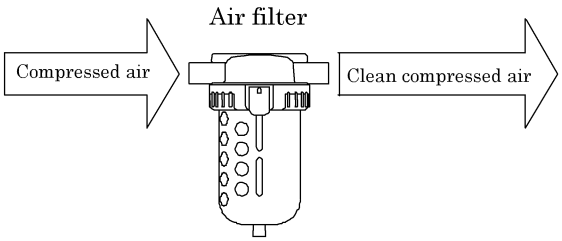
4) Centering precision +/-0.05 mm is achieved.

2
Caution

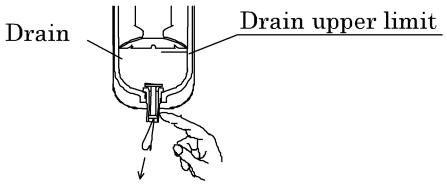
2. Precautions

2. 1 Working Fluid

1) The compressed air used should be dry air, clean and free from moisture, which passed through the air filter. For this purpose, use an air filter in the circuit, and give care to the filtration rating (5 μm max. preferable), fluid and mounting position (get close to the directional control valve) or the like.



2) Periodically discharge the drain staying in the filter before it exceeds the designated line.



3) If some carbide (carbon or tarry substance) in compressor oil is included on the circuit, the solenoid valve and cylinder will malfunction. Pay special attention to compressor maintenance and inspection.

4) This hand can be used with no oil applied.
When the hand is lubricated, use Turbine Oil Class I ISO VG32.

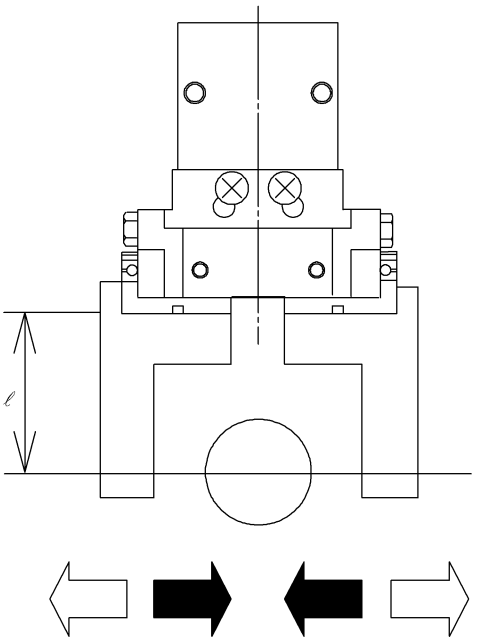
3. Gripping Power

3. 1 Gripping Power and Work Weight

1) The gripping (clamping) power performance data table indicates the force acting in the opening and closing directions at the jaw length ℓ, which does not refer to the clampable work weight.

2) The required gripping power significantly changes, depending on various elements.

- Work and jaw friction coefficient
- Inertial force working during work transfer
- Work center and clamping position & jaw width
- Jaw construction and shape



3. 2 Standard model selection for work weight (required gripping power)

The gripping power safety factor for the work weight is as described below, which differs, depending on the work & jaw friction coefficient, profile and transfer conditions. Select a model, referring to these data as a guide.

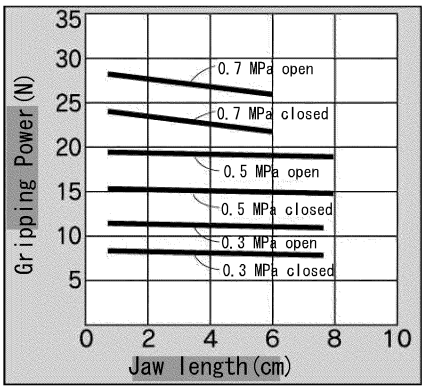
- Only holding 5 times or more
- Normal transfer 10 times or more
- Rapidly accelerated transfer 20 times or more

3. 3 Gripping Power Performance Data

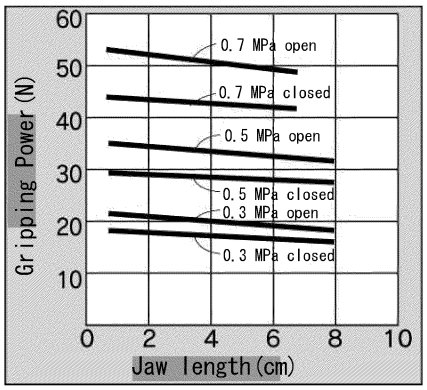
This data indicates the gripping power acting in the opening direction and closing direction in hand jaw length R at supply pressure 0.3, 0.5 & 0.7 MPa.

- Opening direction (⇦)
- Closing direction (➡)

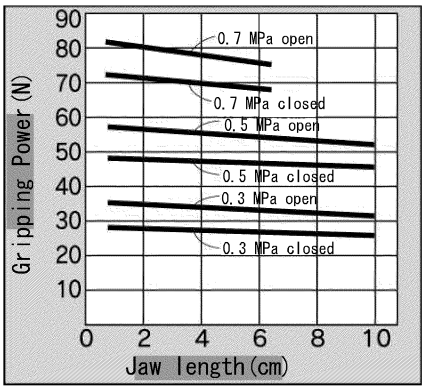
● BHE-01CS



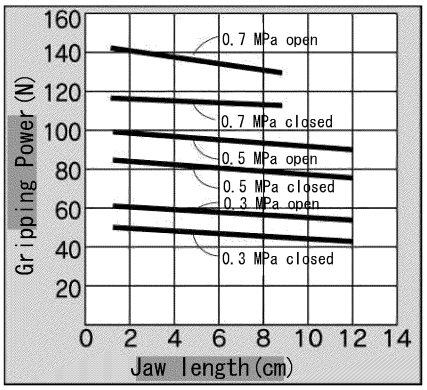
● BHE-03CS



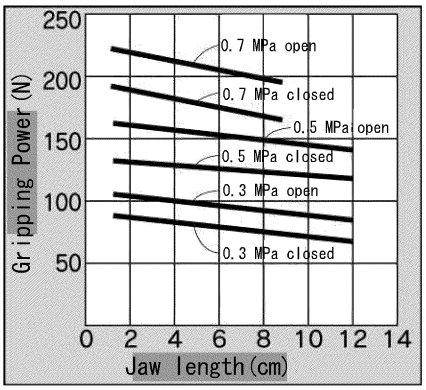
● BHE-04CS



● BHE-05CS



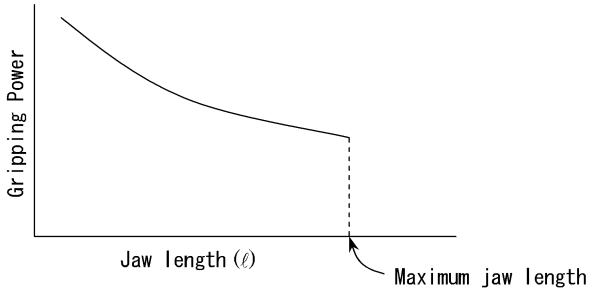
● BHE-06CS



3. 4 Jaw Length

1) Make the jaw as short and light as possible: if it is long and heavy, abrasion in the master jaw sliding part will be accelerated.

2) The jaw length should fall inside the performance data (numerical value).



4. Installation

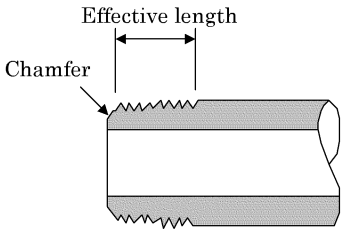
4. 1 Piping

1) The piping materials used posterior to the filter should be hard to corrode, such as a galvanized tube, nylon tube and rubber tube.

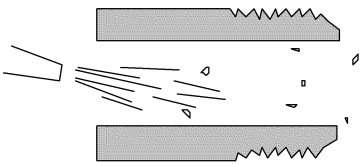
2) The piping used to connect the cylinder and solenoid valve should have the effective cross sectional area enough for the cylinder to produce the specified working piston speed.

3) To remove rust, foreign matter and drain from inside the tube, attach the filter as close to the solenoid valve as possible.

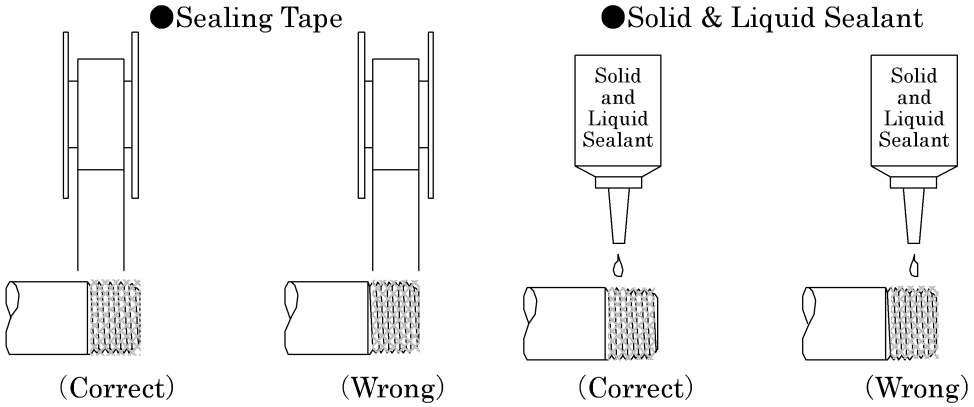
4) For the gas tube screw length, the effective length of the threaded part should be maintained. Chamfer the tube by approx. 1/2 pitch from the edge of threaded portion as illustrated.



5) To remove foreign matter and chips or the like inside the tube before piping connection, in-tube flushing (air blow) is required.



6) For piping, a sealing tape or sealant is used; in this case, however, use this material with approx. 2 threads spaced from the threaded portion tip as illustrated below, and take care so that no wastetapes and residual sealing compound or sealant intrude into the tube and equipment interior.



4. 2 Installation

1) Ambient Temperature

The ambient temperature at which this hand can be used is 5 to 60℃.

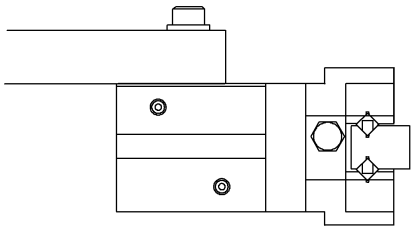
2) Ambient environment

When this hand is used in a place exposed to waterdrops and oil or the like and in a dusty place, protect it with a cover, etc.

3) Main body mounting

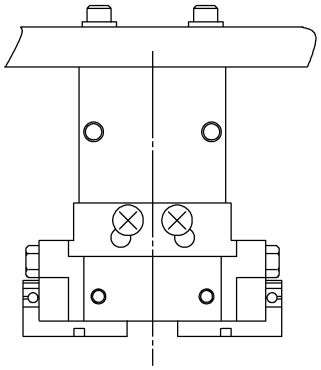
In attaching the main body, refer to the following items.

- Front mounting



Model	Thread Diameter & Depth (Length)
BHE-01CS	M3 - 6 deep
BHE-03CS	M4 – 7 deep
BHE-04CS	M5 - 7 deep
BHE-05CS	M6 – 8.5 deep
BHE-06CS	M3 - 14 deep

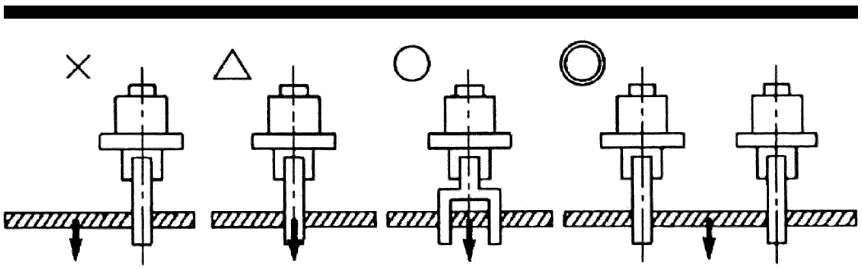
- Top mounting



Model	Thread Diameter & Depth (Length)
BHE-01CS	M3 - 6 deep
BHE-03CS	M3 - 6 deep
BHE-04CS	M5 - 8 deep
BHE-05CS	M6 - 10 deep
BHE-06CS	M6 - 13 deep

4) When holding a long work

For stable gripping, holding the center of gravity is the preconditions; it is, however, necessary also to stabilize the hand by using 2 or more hands, depending on the work.



5) Miscellaneous

In the case of additional machining to the main body, you are requested to contact our company in advance; otherwise malfunctioning and air leaking or other nonconformities may result.

5. Maintenance

5. 1 Periodic Inspection

To use the hand & chuck in the optimum condition, periodic inspection is recommended at intervals of 6 months or after 500,000-time operations.

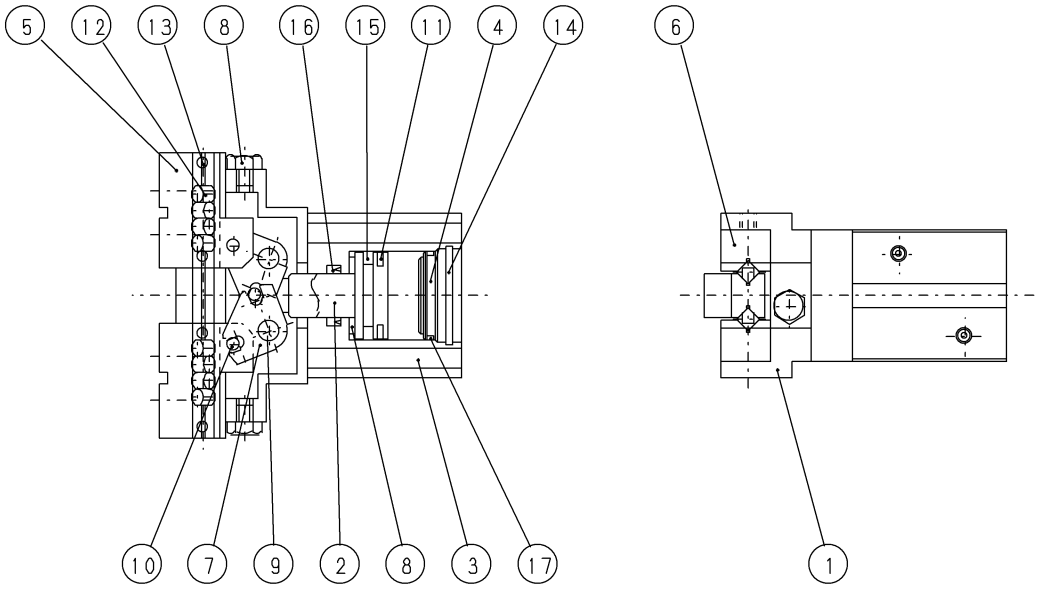
1) Checking Items
   (1) Additional greasing to the sliding part
   (2) Check to see if the operation is smooth.
   (3) Air leakage
   (4) Loose bolts
   (5) Master jaw ricketiness
   (6) Check to see if no abnormality is present in the operational stroke length.

Check the places described above: if an abnormal condition is found, refer to "5.2 Troubleshooting". Also, re-tighten the bolts if loose.

5. 2 Troubleshooting

Trouble	Probable Cause	Suggested Remedy
No operation	No pressure - underpressure	Secure the pressure source.
	No signal is transmitted to the directional control valve.	Correct the control circuit.
	Damaged parts	Refer to the "Damage & Deformation" column.
	Damaged packing	Replace the packing.
No smooth operation	Insufficient pressure	Secure the pressure source.
	Chips and dust entangled	Disassemble and clean. Take action for chips.
	Damaged packing	Replace the packing.
Damage and deformation	The jaw is heavy.	Make the jaw light.
	The jaw is long.	Make the jaw short.
	The working pressure is too high.	Make the pressure low.
	External load is applied.	1) Make arrangements so that no load is applied. 2) Re-review Parts No. or Model No. and directions for use.

5. 3 Internal Structure Drawing and Parts List

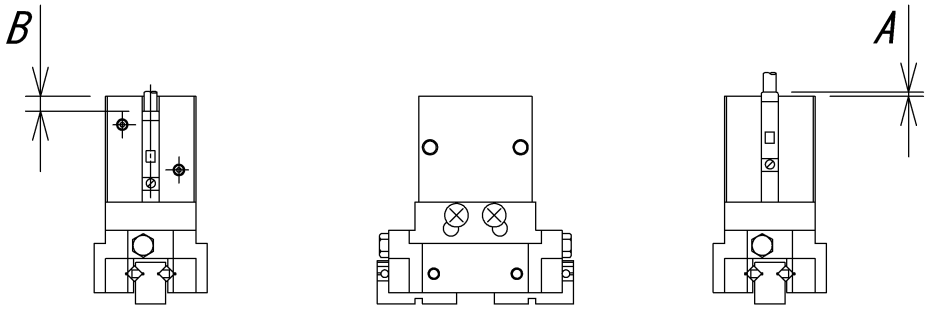


Parts No.	Parts Name	Material	Remarks
1	Body	Aluminum alloy	
2	Piston	Stainless steel	
3	Cylinder	Aluminum alloy	
4	Cylinder Cover	Resin	
5	Master jaw	Stainless steel	
6	Bearing guide	Stainless steel	
7	Arm	Stainless steel	
8	Cushion	Urethane rubber	
9	Fulcrum shaft	High-carbon rubber chrome bearing steel	
10	Operating shaft	High-carbon rubber chrome bearing steel	
11	Magnet		
12	Cross roller	High-carbon rubber chrome bearing steel	
13	Spring pin	Stainless steel	
14	Retaining ring	Stainless steel	
15	Piston packing	Nitrile rubber	
16	Rod packing	Nitrile rubber	
17	Cylinder gasket	Nitrile rubber	
18	Plug	Brass	

6. Operating Precautions for Hand with Switch (Solid state switches T2H, T2V, T3H, T3V)

6. 1 Switch fixing

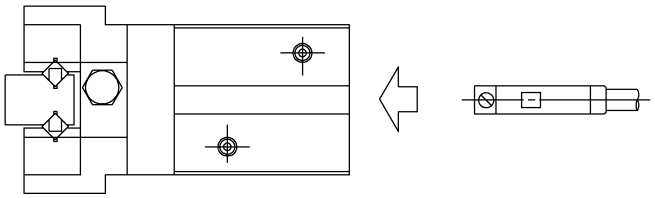
1) The cylinder switch is factory set to the position shown in the table below before shipment. (Maximum sensitivity position) Before use, however, always check each set position. Also, when the hand main body and switch were purchased separately and an additional switch is used, check the position in the same manner.



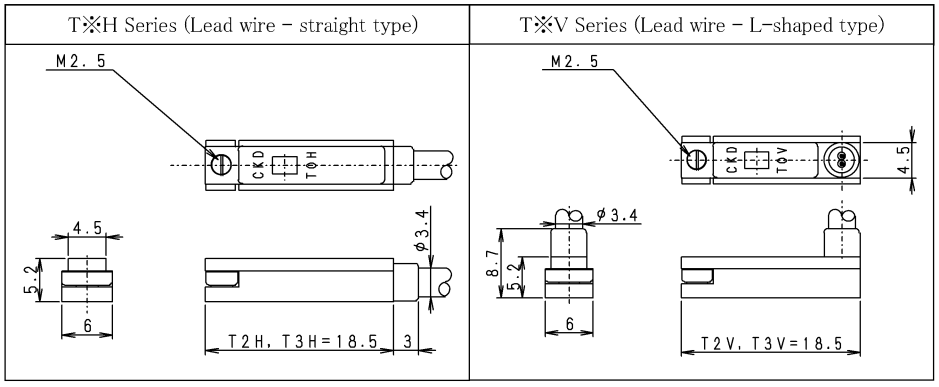
Unit : mm

Dimensions / Model No.	A Master Jaw Closing Position	B Master Jaw Opening Position
BHE-01CS	1.7 to the outside	1.8 to the inside
BHE-03CS	1.6 to the outside	3.4 to the inside
BHE-04CS	0.9 to the outside	6.1 to the inside
BHE-05CS	1.3 to the outside	9.3 to the inside
BHE-06CS	5.5 to the outside	16.5 to the inside

2) When the switch is fixed, insert the switch into the switch attaching groove of the main body, and tighten it, using a precision flat-headed screwdriver (-), after setting the attaching position. Also, tighten the set screw to the tightening torque 10 to 20 N·cm with a precision flat-headed screwdriver (minus) whose gripping diameter is approx. 5 mm.



3) The switch external dimensions are as shown below



6. 2 Operating Precautions

1) Lead wire connection

Connect the lead wires according to the lead wire color coding. At this time, be sure to turn the electric circuit equipment on the connection side "OFF", then start operations work.

Improper wire connections and load short-circuiting lead to damage on the load-side electric circuit as well as the switch. Also, the operations work with power "ON" may lead to damage on the switch load electric circuit, depending on the work procedure, even when no improper wire connection is found.

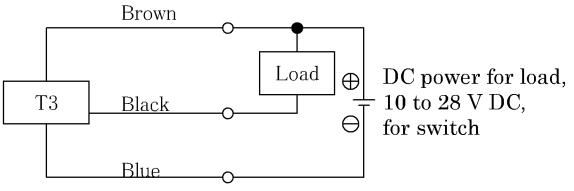


Fig. 1 Fundamental circuit example of T3 (1)
(When the switch power supply and power supply for load are the same)

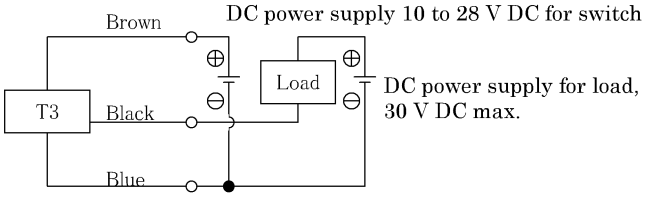


Fig. 2 Fundamental circuit example of T3 (2)
(When the switch power supply and power supply for load differ from each other)

2) Output Circuit Protection

When an inductive load (relay & solenoid valve) is connected and used, be sure to provide a protective circuit shown in Fig. 3 below since surge voltage occurs with the switch "OFF".

When a capacious load (capacitor) is connected and used, be sure to provide a protective circuit shown in Fig. 4 below since rush current occurs with the switch "ON".

When the lead wire length exceeds 10 m, be sure to provide a protective circuit as shown in Figs. 5 & 6 (for T2) and Fig. 7 (for T3).

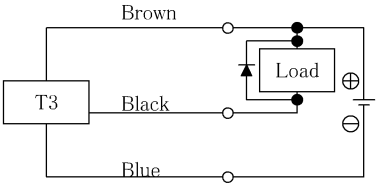


Fig. 3 This example shows that a surge absorbing element (diode) is used for an inductive load.
For this diode, use HITACHI V06C or equivalent.

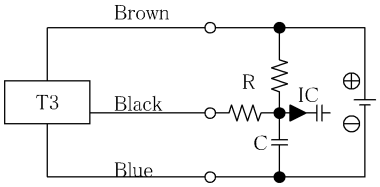


Fig. 4 This example shows that current limiting resistor R is used
for a capacious load. At this time, use resistor R (Ω) exceeding the value described below.

$$\frac{0.05}{} = R(\Omega)$$

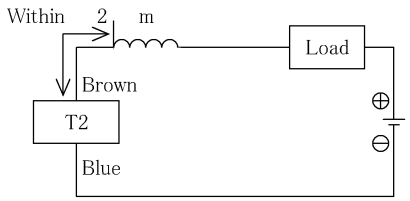


Fig. 5 ・ Choke Coil
L = a few hundred μH to a few mH
which is excellent in high-frequency characteristics.
・ Wire connection near the switch is required. (Within 2 m)

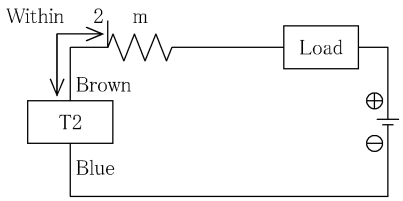


Fig. 6 ・ Rush current limiting resistor
R = Resistance large enough so far as the load side circuit permits
・ Wire connection near the switch is required. (Within 2 m)

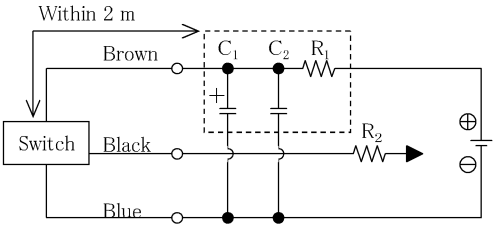


Fig. 7 ・ Power Noise Absorbing Circuit
C1 = 20 to 50 μF electrolytic capacitor
(Withstand voltage : 50 V min.)
C2 = 0.01 to 0.1 μF ceramic capacitor
R1 = 20 to 30 Ω

・ Rush current limiting resistor
R2 = Use a large resistor so far as the load side circuit permits.

・ Wire connection near the switch is required. (Within 2 m)

3) Connection to Programmable Controller (Sequencer)

The connection method differs, depending on the type of programmable controller. The connections as shown in Figs. 8 to 12 are recommendable.

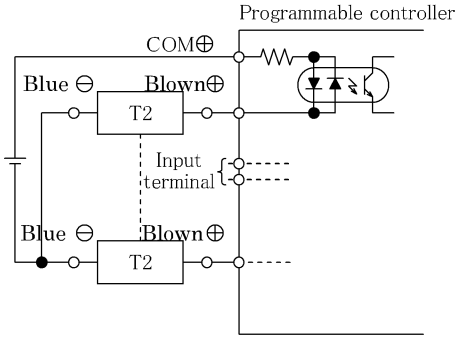


Fig. 8 Sample T2 connection to source input (external power supply) type

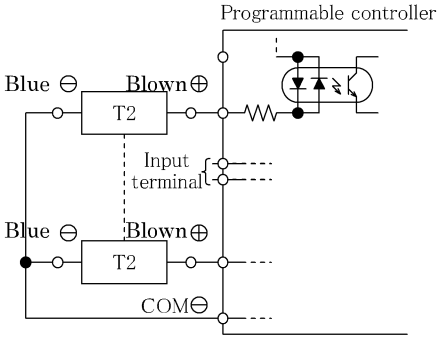


Fig. 9 Sample T2 connection to source input (power supply built-in) type

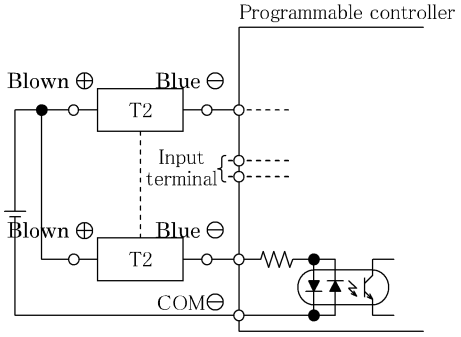


Fig. 10 Sample T2 connection to sink input (external power supply) type

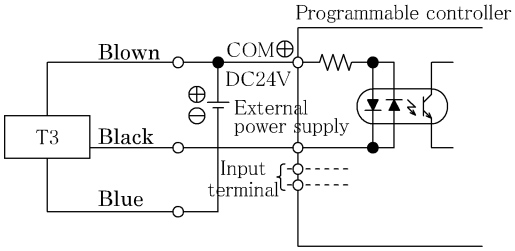


Fig. 11 Sample T3 connection to source input (external power supply) type

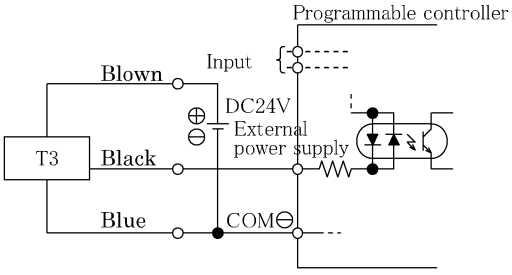


Fig. 12 Sample T3 connection to source input (power supply built-in) type

4) Magnetic Environment

Avoid using this unit where a strong magnetic field and large current (large magnet and spot welding machine, etc.) are present therearound. In the case of parallel mounting near the cylinder with switch and when the magnetic substance moves extremely near the cylinder, mutual interference may affect detection precision.

5) Lead wire protection

Give due consideration to wiring so that bending stress and tensile force are not applied repeatedly to the lead wire. Connect the wire for robot, etc. that is elastic or flexible to the movable part.

6) Parallel connection

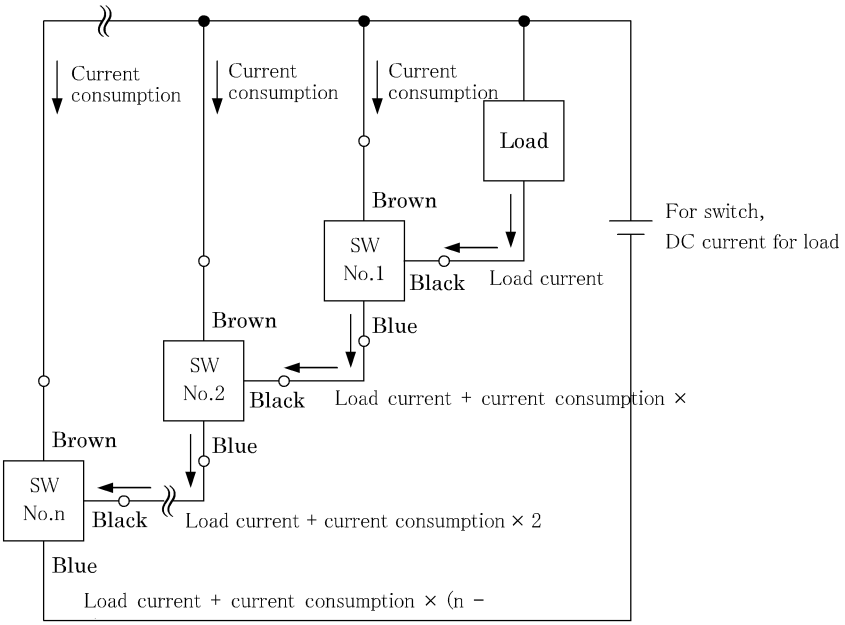
For T2 switch, check the input specifications for the programmable controller that is a connecting load, then determine the number of switches connected since leakage current increases by the number of switches connected. However, the indicator light may get dim and not light up.

For T3 switch, leakage current increases by the number of switches connected, but there is no problem in normal use since the leakage current value is extremely small (10 μA max.). Also, the indicator light does not get dim and not cease to light up.

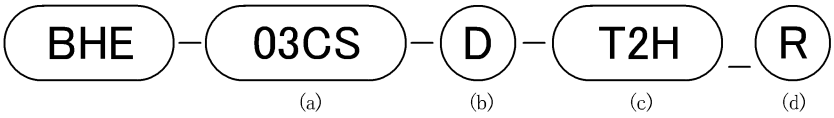
7) Series connection

When several T2 switches are connected and used in series, the switch voltage drop corresponds to the sum of voltage drop at all switches thus connected. Since the voltage applied to the load side is such that the voltage drop at the switch is subtracted from the power supply voltage, check the load specifications, then determine the number of switches connected.

When several T3 switches are connected and used in series, the voltage drop at the switch corresponds to the sum of that at all switches thus connected as with T2 switch above. Also, since the current flowing into the switch is equal to the sum of current consumption and load current of the switches connected as shown in the figure below, check the load specifications, then determine the number of switches connected so that the maximum load current of the switch is not exceeded.



7. Model Coding



(a) Size	(b) Option		(c) Switch Type No.			
01CS	No symbol	Standard	T2H※	Solid state switch	2 wires	Lead wire straight type
03CS	D	With opening amount adjusting mechanism	T3H※		3 wires	
04CS	E	With closing amount adjusting mechanism	T2V※		2 wires	Lead wire L-shaped type
05CS	DE	With opening/closing amount adjusting mechanism	T3V※		3 wires	
06CS						

(d) Number of Switches	
R	With one switch on the opening side
H	With one switch on the closing side
D	With 2 switches

※ Lead Wire Length	
No symbol	1m (Standard)
3	3m (Optional)
5	5m (Optional)