

TSUBAKI

POWER CYLINDER

< F Series Right angle TYPE >
(Under 400N Thrust)

- Thank you for purchasing TSUBAKI POWER CYLINDER.
- This product should be handled by experienced engineers only. Before using the Power Cylinder, you must read and understand the entire contents of this instruction manual.
- This manual should be considered a fixed part of the Power Cylinder and should remain with the Power Cylinder when sold.
- Units described herein are SI {Gravitational}. Figure in { } is for reference.

TSUBAKIMOTO CHAIN CO.

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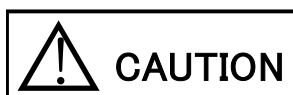
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Safety Precautions


- Before operation or installation of the Power Cylinder (hereon referred to as cylinder), carefully read all the data in the instruction manual and other enclosed documents as well as all information and cautions listed on the machine itself. The manual should be stored in a place where it is readily available to anyone using the cylinder.
- This instruction manual contains two types of safety precaution classifications:
 1. WARNING
 2. CAUTION



Indicates a potentially hazardous situation that could result in death or serious injury, if the machine is handled improperly.



Indicates a potentially hazardous situation that could result in moderate or minor injury or property damage, if the machine is handled improperly.

Note: The  **CAUTION** sign indicates important instructions and may result in serious accidents if neglected depending on the circumstances.



WARNING

- Do not use the cylinder in a combustible atmosphere. This may result in an explosion or fire.
- When using the cylinder with equipment for transporting personnel or lifting equipment, protective devices should be installed to prevent accidents if the cylinder should break or fall.
- When using the cylinder for lifting equipment, provide safety devices on the equipment to prevent it from falling.
- Immediately turn off the power switch in the event of a power failure. Sudden power restoration may result in equipment damage or injury to cylinder operators.
- Do not use the cylinder beyond the scope of the specifications described on its nameplate or manufacturing specifications.
- Be sure to use the power supply indicated on the nameplate of the motor. Improper power supply may cause a fire or motor burnout.
- Never approach or touch the rotary parts or the rod during operation. This may result in injury if a part of your body or clothing becomes caught in the moving parts.
- Completely discontinue use of a damaged cylinder to avoid injury, fire or other accidents.



CAUTION

- Do not remove the nameplate from the cylinder.
- As the cylinder ages and parts begin to wear, its performance may decline. Use the instructions in this manual for effective inspection and maintenance. Have it repaired or replaced through the distributor that you purchased it from if necessary.
- Product warranty is applicable as long as the unit is operated within the specifications and service conditions described in this manual or specifications that have been approved by Tsubaki. It is the user's responsibility to prevent any destructive external conditions that may typically include severe shock loading, vibratory loads, mechanical or thermal overloads, or side loads.
- Any trouble caused by modifications to the product by the customer is not covered by warranty and Tsubaki can not be considered liable for such damage.

Thank you for purchasing TSUBAKI POWER CYLINDER F-Series.

To make best use of it, proper installation, operation and maintenance is required. This manual contains such information and should be carefully read in order to maintain the performance of your Cylinder.

If you have any questions, consult the distributor you purchased the cylinder from or the Tsubaki sales office nearest you. The cylinder's type, test number, and drawing number shown on the nameplate attached to the main body of the cylinder will be required when contacting your distributor or our sales office.

■ Initial Inspection

Be sure the package is right side up before unpacking and then check for the following:

1. Make sure that the "Type", "Rated Load", "Speed", "DC12V or DC24V" and "Stroke" stated on the nameplate conforms to that of your order specifications. Also, confirm that the accessories enclosed are the same as those you ordered.
 2. Check to see that no damage occurred during delivery.
 3. Check that the nuts and bolts on the unit have not loosened.
- Consult the distributor you purchased the product from if you encounter a problem.

■ Installation

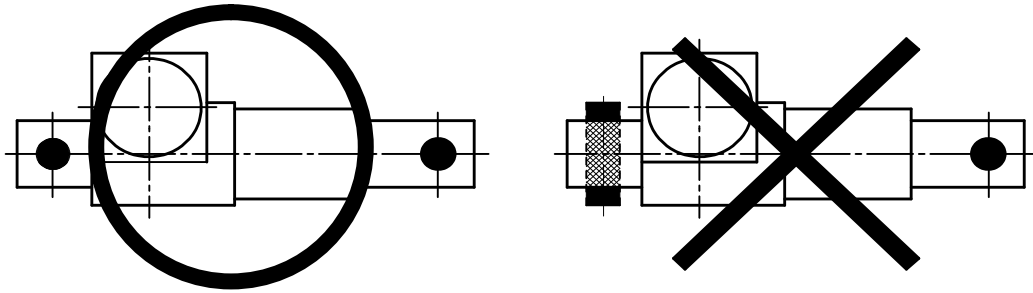
1. Atmosphere of location for installation

Installation Location	Indoors or Outdoors with a waterproof connector
Atmosphere	Dust level should be that of a normal factory.
Ambient Temperatures	-15°C to 40°C
Shock	Below 1G
Ambient Humidity	85% max. (no condensation)

2. The load direction applied to the cylinder must be on the same line as that of the rod; otherwise the cylinder will incur inappropriate side force or bending moment that may result in serious internal damage to the cylinder. If side force or bending moment can not be avoided, use liner guide to account for it.
3. To connect the cylinder to a mating machine, use the pins of dia. 7.924 to 7.96 at the rod side and clevis side. To prevent wear of hole, use the pins having smooth surface. It is better to apply grease to the pins when connecting.

- If the cylinder swings while operating, install the cylinder so that both coupling pins are arranged parallel with each other at a right angle to the swinging plain. Check that the front ends of clevis and rod does not interfere with the mount of mating machine.

Fig. 1



- The mating machine should have ample strength as over 300% of rated thrust, if overload protection unit by TC.
- Never step or hang on the cylinder. This may result in injury.
- The rotating torque at the rod will be occurred while operating, so anti rotating connection is required at the mating machine. The value of rod rotating torque is as follows.

	LPF010H	LPF020M	LPF040L
Rod Rotating Torque	0.14 (N·m)	0.28 (N·m)	0.55 (N·m)

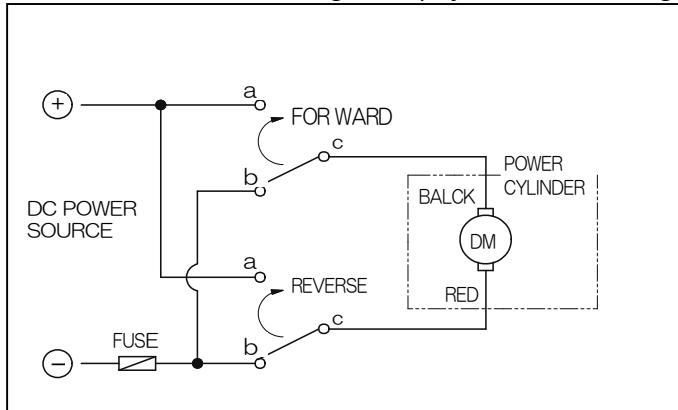
- When using equipment that must avoid all contact with oil or grease such as food processing equipment, make sure a protective device such as an oil receiver is attached to prevent damage from oil leakage resulting from equipment damage or overuse. Do not place any obstacles that might prevent ventilation around the cylinder. They can hinder cooling resulting in a fire caused by abnormal overheating.
- The cylinder should be used within the stroke on the drawing. To do that, to use limit switch (LS) for stroke adjust on the equipment prepared by customer or to use the optional limit switch by TC. Before adjusting the limit switch, must check each LS at the end works well with proper direction of motor. When adjusting the limit switch, should be set with counting additional stroke by inertia after power off.

■ Wiring

1. For connection of power supply and cylinder, should follow government law and other related rules for wiring in each country. In generally, use the wire leads, which have width of over 2mm² and within 3m long. The specified performance of LP cannot be obtained due to voltage drop. In the case of outdoor use or in the place where it may be wetted, use the waterproof connector.

When connecting the black wire to “+” and red wire to “-“, the rod goes forward.

Reference Circuit Diagram (Dynamic braking)



Use the following capacity of the relay
 DC12V Model : 30A or greater (14VDC)
 DC24V Model : 30A or greater (28VDC)

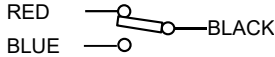
The above reference circuit diagram shows the condition of dynamic braking is working. When cylinder forwards, turn the forward relay from “b” to “a”.

Type	Rated Current (A)	Locked Rotor Current (A)	Fuse Size
LPF010H	3.2	16.7	10A
LPF010H V	1.6	7.5	5A
LPF020M	3.2	16.7	10A
LPF020M V	1.6	7.5	5A
LPF040L	3.7	16.7	10A
LPF040L V	1.8	7.5	5A

2. Power Supply: Use a power source with a sufficient capacity in consideration of the locked rotor current (see the table above). If power supply is not sufficient, cylinder malfunctions or operation speed is decreased.

■ Optional Units

1. External Limit Switch for stroke adjustment (Option name : "L")

Type	OMRON CO. D2VW-5L2A-1M or equivalent
Contact Configuration	
Rating	AC250V 4A, ($\cos \phi = 0.7$)
Connection	0.75 mm ² X 3C, Length 300mm Lead wire

General Caution, when using External Limit Switch

- ★ In the case of H speed, there is possibility that the striker runs over contact point of LS. Therefore, electrical self-hold of LS contact is required at the customer's electrical circuit diagram.
- ★ Coasting: As the cylinder is driven by motor, so that the rod moves by Inertia of motor even after the power is turn off. Inertia depends on the model and load. Therefore the limit switch should be set on a little inside of designed stroke in consideration of coasting. For your reference, below is shown the coasting distance for each model in rated loaded state. When short coasting distance is required, dynamic braking diagram is recommended.

Coasting distance (Reference value)

Type Name	Lifting	Lowering
LPF010H	4 mm	7 mm
LPF020M	2 mm	4 mm
LPF040L	1 mm	3 mm

Note : Time lag of relay is not considered in the above value

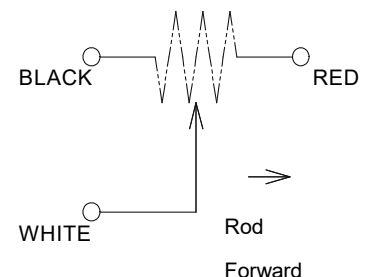
The above value is changeable by condition of load and inertia

2. Potentiometer (Option name : "P")

Potentiometer is a variable resistor to output electrical signals by stroke.

Specification of Potentiometer

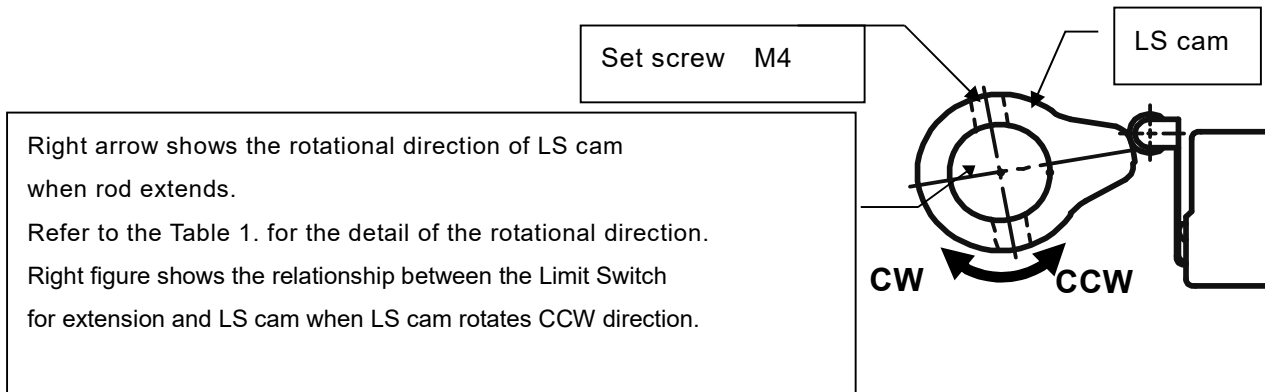
Type name	CP-30 (Sakae Tsushin Kogyo) or equivalent
Total resistance	1.0 k ohm
Power rating	0.75W
Insulation rating	AC1000V 1 min.
Effective electrical angle	355 degree
Effective angle of rotation	360 degree endless
Connection	0.5mm ² X 3C, 500mm length Cabtire cable



General Caution, when using Potentiometer

- ★ Resistor is preset by model of Power Cylinder before delivery. Do not rotate the actuator rod before installation. It will result the stroke position will be out of phase with potentiometer

3. Internal Limit Switch for position detection (Option name : "K2")



Stroke	LPF010H	LPF020M	LPF040L
50	CW	CCW	CW
100	CCW	CW	CW
150	CCW	CW	CW
200	CW	CW	CCW
300	CW	CCW	CCW

General Caution, when using K2

- ★ The position of Limit Switch is not preset, when delivery. Before operating, please set at customer side. Do not rotate the actuator rod after set. It will result the stroke position will be out of phase with K2.

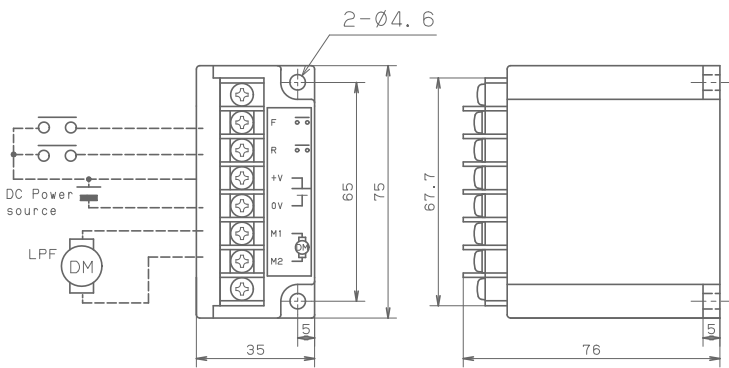
Type	OMRON CO. SS-5GL2 or equivalent	
Contact Configuration	LS1(for forward)	LS2(for reverse)
	Black —○— Red White —○—	Green —○— Yellow —○— Brown
Rating	AC250V 2A, (cos φ =0.4)	
Connection	0.5 mm ² X 6C, Length 500mm Lead wire	

How to set the K2

- ①. Check the wire connection is right
- ②. Move the cylinder rod to middle and check the limit switch work correct at both directions with each cam and each limit switch.
- ③. The rod coast little after limit switch contact (= motor turn off). Therefore, the cam should be adjusted with the coasting.
- ④. The cams are set on the output shaft of gear box with 2 of M4 set-screw. Do not turn the cam without loosen the set-screw. It will result the gear box will be broken.
- ⑤. The cam at the Inner part should be adjusted before the front side cam is set. After setting, be sure to tighten the set-screw.

Control Unit Options

1. Overload detection unit



Type	LPF-KFV1	
Applied Cylinder	LPF010H • LPF020M • LPF040L	
Power voltage	10~14VDC	20~28VDC
Rated Current	3.7 A DC	1.8 A DC
Load Current	7.0 A DC	4.0 A DC
Start time	0.3 sec (Fixed)	
Overloading time	Less 0.1 sec (Fixed)	
Operation specification	Connect (F) and (+), then rod forward Connect (R) and (+), then rod reward Connect (F)(+) and (R)-(+), then rod stop	
Ambient temp.	-15 to 40 Celsius degree	
Humidity	45 - 85 %RH (No condensation)	
Structure	Built in type for control box, ABS case	
Built-in fuse current rating	5.0A	
Built-in fuse blown current	50A	
Mass	0.15kg	

Caution

- ★ Use the wire lead with 2 mm² within 3 m length to avoid voltage drop. (Between motor and unit, unit and power supply)
- ★ Do not touch the terminal on the unit. The electrical shock may be happened.
- ★ Exactly tighten the screw on the terminal. The fire accident may be happened.
- ★ Check the screw at regular intervals whether it is loosened or not.
- ★ Do not set the unit to bad environment, such as under high temperature, humid area, dusty area, corrosion gas, vibration, shock, and so on.
- ★ When overload detection works, operation signal (F) or (R) should be turned off at one time for reset. Unit holds overload signal, it means no power supply from unit to motor.
- ★ When switching to the operation signal (F) or (R), do so with the cylinder stopped.

■ Cautions before operating

1. Verify the wiring connection is correct, especially the relation between rod direction and Limit Switch at each end. Then, power is turn on and verify the direction by inching operation. This means to verify that the forward switch is turned on, then rod moves forward and rod stops by the forward limit switch. Do same thing for reverse side.
2. Verify the mechanical connection between the cylinder and equipment.
 - ★ The rod should not be forced by any bending moment at any positions while full stroke. If any bending force is occurred, the cylinder life will be shorten. Or unusual sound or any damage will be happened.

■ Frequency and ED% at operating

The frequency of starting and ED% are limited cause of the temperature rise on motor. And also, in the case of high frequency of operating, the expected cylinder life should be considered.

Starting frequency : Two times per minute (1 round trip / min.)

Maximum ED% : Less 25% (5 min. bases)

Expected life time : 15,000 cycle

* ED% = (one operating time) / (one operating time + rest time)

In the case of inching operation, starting frequency should be less than 10 times per minute.

■ General cautions

1. The range of power voltage

The range of power voltage should be within 10-14V for 12v motor and within 20-28V for 12v motor. Otherwise, cylinder cannot be moved or motor temperature rise. To verify the power voltage at nearest point to motor is very important, if cylinder characteristic is different from usual.
2. The various loads

The kind of load in below effects the cylinder wrong. The performance of cylinder is not good and or the cylinder life will be shortened.

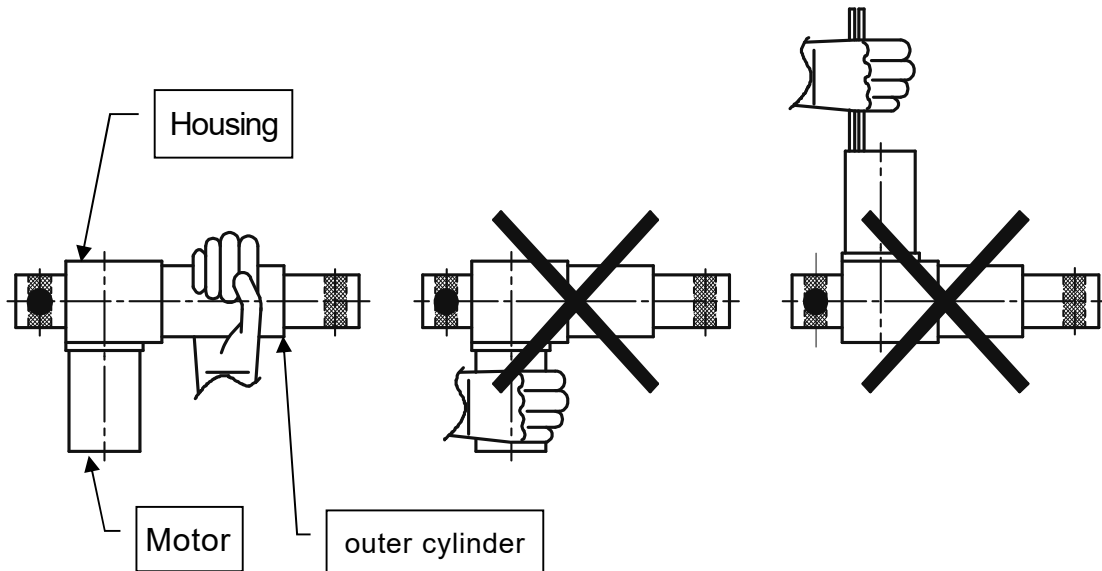
 - ★ Bending load to the rod
 - ★ Impact load
 - ★ Overload
 - ★ Locked load
 - ★ Press stopping (Use the option of “overload protection unit”)

3. Holding power of the load

The cylinder has self-lock function with static load, however, the vibration and impact may influence to hold the load. For such application, prepare the brake system at the equipment side.

4. Handling the cylinder

Do not carry or handle the cylinder by holding the motor portion and or wire. When handling the cylinder, hold the cylinder body, such as housing or outer cylinder.



5. Grease

When the cylinder touch with the stroke inside end, the grease may be out from the end of outer cylinder. It will not cause any performance down of the cylinder.

6. Environment with water

In the case of outdoor use or any water influence to the cylinder, the caution should be paid at the connection of wire leads. Use the waterproof connector or taping is needed.

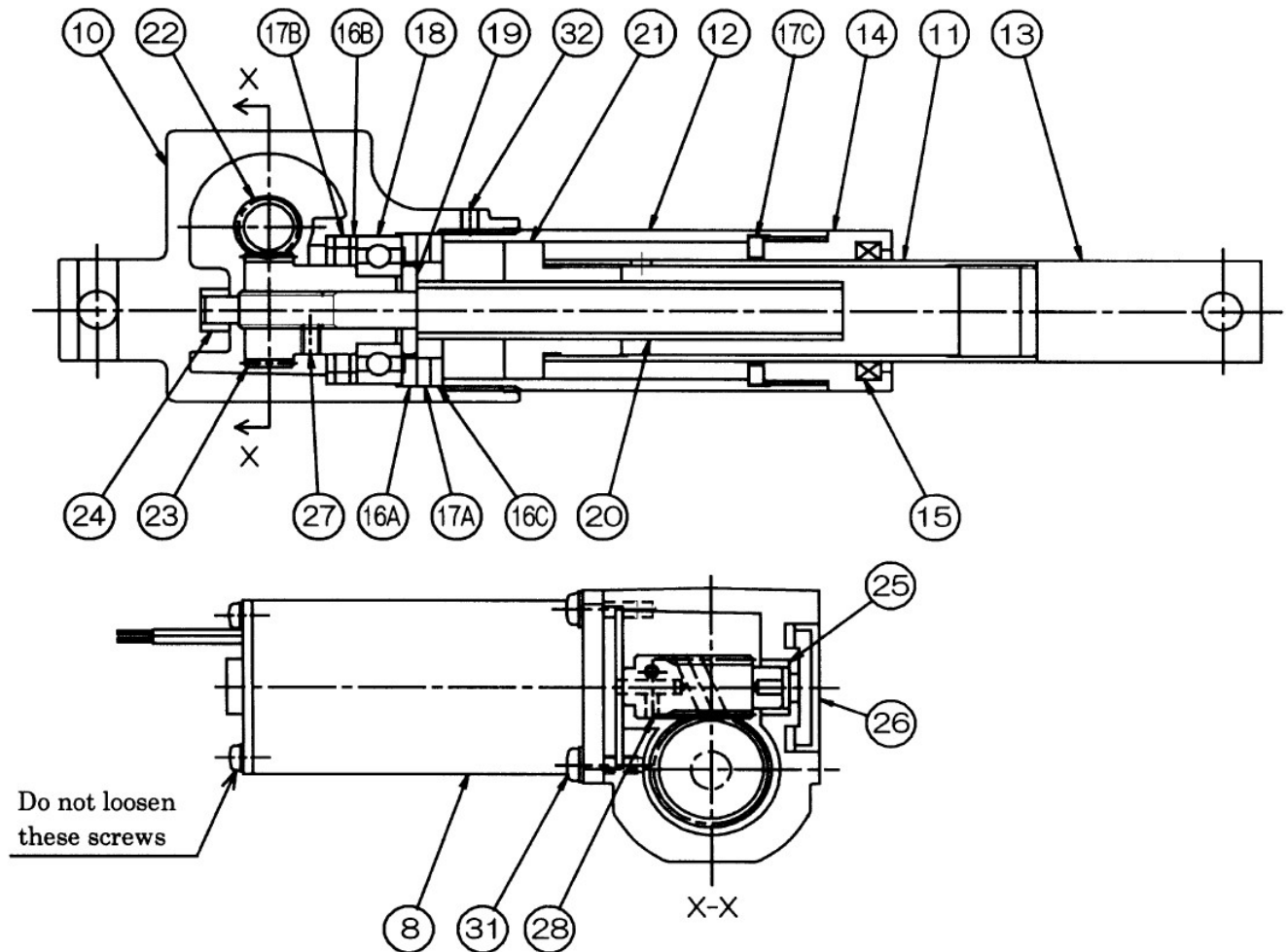
7. Unusual operation

If any unusual events are happened, stop the operation immediately and check the cylinder after prevention of falling the load.

■ Trouble shouting

Accidents	Cause	Action
Not move, after starting button is turned on	<ol style="list-style-type: none"> 1. Miss wiring connection at the motor, limit switch, and control units. 2. Motor damages (short, and so on) 3. Magnet for motor and or control unit damages 4. Out of order at Limit Switch 5. Forget to reset overload switch 	Check the wiring connection Replace Replace Replace Reset the button
Not move, but motor sounds	<ol style="list-style-type: none"> 1. Power voltage is dropped 	Check the battery size and wire lead size
Poor performance with rated thrust	<ol style="list-style-type: none"> 1. Power voltage is dropped 	Check the battery size and wire lead size
Poor positioning	<ol style="list-style-type: none"> 1. Dynamic brake is off 2. Overload 	Put dynamic brake circuit Lower the load
High temperature on motor	<ol style="list-style-type: none"> 1. Overload 2. Much starting frequency 	Lower the load Lower the frequency of starting
Cylinder damage	<ol style="list-style-type: none"> 1. Occur impact load 2. Occur bending load 	Replace Replace

■ Constructions for basic cylinder



#	Parts name	Qty.	#	Parts name	Qty.
8	DC Motor	1	18	Ball bearing	1
10	Housing	1	19	Screw collar	1
11	Rod	1	20	Screw shaft	1
12	Outer cylinder	1	21	Acme nut	1
13	End fitting	1	22	Worm gear	1
14	Retainer	1	23	Gear	1
15	Scraper	1	24	Oiles bearing A	1
16A	Collar A	1	25	Oiles bearing B	1
16B	Collar B	2	26	Cap	1
16C	Collar C	1	27	Set screw	1
17A	Rubber A	1	28	Set screw	2
17B	Rubber B	1	31	Screw	4
17C	Rubber C	1	32	Set screw	1

■ Warranty

TSUBAKIMOTO CHAIN Co.: hereinafter referred to as "Seller"

Customer: hereinafter referred to as "Buyer"

Goods sold or supplied by Seller to Buyer: hereinafter referred to as "Goods"

1. Warranty period without charge

18 months effective the date of shipment or 12 months effective the first use of Goods, including installation of Goods to Buyer's equipment or machines - whichever comes first.

2. Warranty coverage

Should any damage or problem with the Goods arise within the warranty period, given that the Goods were operated and maintained under instructions provided in the manual, Seller would repair and replace at no charge once the Goods are returned to Seller. The following are excluded from the warranty.

- 1) Any cost related to removal or re-installation of Goods from the Buyer's equipment or machines to repair or replace parts.
- 2) Cost to transport Buyer's equipment or machines to the Buyer's repair shop.
- 3) Costs to reimburse any profit loss due to any repair or damage and consequential losses caused by the Buyer.

3. Warranty with charge

Seller will charge any investigation and repair of Goods caused by:

- 1) Improper installation by failing to follow the instruction manual.
- 2) Insufficient maintenance or improper operation by the Buyer.
- 3) Incorrect installation of Goods into other equipment or machines.
- 4) Structure change of the Goods by any modifications or alterations by the Buyer.
- 5) Any repair by engineers other than the Seller or those designated by the Seller.
- 6) Operation in inappropriate environment not specified in the manual.
- 7) Force Majeure or forces beyond the Seller's control such as natural disaster and injustice done by third party.
- 8) Secondary damage or problem incurred by the Buyer's equipment or machines.
- 9) Defected parts supplied, or specified by the Buyer.
- 10) Incorrect wiring or parameter setting by the Buyer.
- 11) The end of life cycle of the Goods under normal use condition.
- 12) Losses or damages not liable to the Seller

4. Dispatch the Seller's engineer

Service to dispatch Seller's engineer for investigation, adjustment or trial testing, etc. of Seller's Goods are at Buyer's expense.

5. Others

- In accordance with the policy of TSUBAKIMOTO CHAIN Co., the contents of this instruction manual are subject to change without notice.
- We take all possible measures to ensure that there is no error in writing or defect with the contents of this instruction manual.
- We highly appreciate it, if you would let us know any error or defects found in this instruction manual.



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