Power Cylinder

T series

Thrust：2.45kN to 39.2kN {250kgf to 4000kgf}

This series can be used in every application with the following features: Brake motor that holds load strongly; Gear reducer that provides low-noise operation; High-efficiency ball screw developed for cylinders; Safety mechanism that protects other devices; Extensive options.
Can also be used outdoors (IP55)

● Easy-to-Choose Two Types
There are two types that have different safety mechanisms. TB Type has a built-in wet slip clutch. The TC Type comes with a thrust detecting limit switch.

● Wide Variety
A wide range of standard models are available depending on the application, thrust, and speed. You can choose the thrust from between 2.45kN and 39.2kN, and the speed from 10mm/s and120mm/s.

● Secure Operation
All models use a high-efficiency ball screw, quiet reducer, and reliable brake motor. In addition, a highly-reliable safety device is built into all series so as to work effectively against overload.

● Various Options
Two types of stroke adjusting limit switches (external and internal types) and stroke sensors (potentiometer and rotary encoder types) are available, allowing for much easier control by a sequencer.

Model No. designation

LP TB 1000 L 4 V T1 LPIJF

Power cylinder

T series

- **LPTB**: Wet slip clutch type
- **LPTC**: Thrust detection mechanism type

Thrust

- **250**: 2.45kN {250k g f}
- **500**: 4.90kN {500k g f}
- **1000**: 9.80kN {1000k g f}
- **2000**: 19.6kN {2000k g f}
- **4000**: 39.2kN {4000k g f}

Speed: S, L, M, H

Nominal stroke

- **2**: 200mm
- **3**: 300mm
- **5**: 500mm
- **10**: 1000mm

*The above values are examples of indication.

Voltage symbol

- No symbol: 200V class 200/200/220V 50/60/60Hz
- **V**: 400V class 400/400/440V 50/60/60Hz
- **V1**: 380V/50Hz
- **V2**: 380V/60Hz
- **V3**: 415V/50Hz
- **V4**: 460V/60Hz

Motor Option

See page 160 to 162.

Options

- **L**: With two stroke adjusting external LSs
- **L3** *2: With three stroke adjusting external LSs
- **K2,K4**: Position detecting internal LS
- **P**: Potentiometer
- **R**: Rotary encoder
- **C**: With clevis fitting *3
- **I**: I-shaped end fitting (no symbol for standard) *4
- **J**: With bellows *5
- **F**: Motor terminal box and external LS mirror image specifications

*1 When power cylinder used over the stroke it cause damage, limit switch position is recommended.
*2 When four or more limit switch are installed, please contact to Tsubaki.
*3 The clevis fitting cannot be used with K2, K4, P or R options.
*4 The stroke is the same.

* The Trunnion fitting is not included in the body model number. Please separately specify a Trunnion model number.
* Manual operating handles are also available.

Standard model list

Power cylinder model			Rated thrust N	Rated thrust {kgf}	Nominal speed 50/60Hz mm/s*2	Motor output kW	Rod movement per one turn of manual shaft mm	Rod rotating force N·m	Rod rotating force {kgf·m}	Nominal stroke mm	Brake specifications
LPTB LPTC	250	S	2.45k	250	12.5/15	0.1	2.0	2.60	0.27	200, 300, 400 500, 600	● DC brake ● Brake external wiring is available
		L			25/30	0.1	1.0				
		M			50/60	0.2	2.0				
		H			100/120	0.4	4.0				
LPTB LPTC	500	S	4.90k	500	12.5/15	0.1	2.0	5.20	0.53	200, 300, 400 500, 600, 800	
		L			25/30	0.2	1.0				
		M			50/60	0.4	2.0				
		H			100/120	0.75	3.9				
LPTB LPTC	1000	S	9.80k (7.84k)	1000 (800)	12.5/15	0.2	2.0	13.8	1.41	200, 300, 400 500, 600, 800 *1 1000 (Rated thrust is 7.84kN)	
		L			25/30	0.4	1.0				
		M			50/60	0.75	2.0				
		H			100/120	1.5	4.0				
LPTB LPTC	2000	S	19.6k (15.6k) (12.2k)	2000 (1600) (1250)	12.5/15	0.4	2.0	34.7	3.54	200, 300, 400 500, 600, 800 *1 1000 (Rated thrust is 15.7kN) *1 1200 (Rated thrust is 12.2kN)	
		L			25/30	0.75	1.0				
		M			50/60	1.5	2.0				
		H			75/90	2.2	3.0				
LPTB LPTC	4000	S	39.2k (33.3k)	4000 (3400)	9/11	0.75	1.4	83.2	8.49	200, 300, 400 500, 600, 800 1000, 1200 *1 1500 (Rated thrust is 33.3kN)	
		L			25/30	1.5	1.0				
		M			35/42	2.2	1.4				
		H			60/72	3.7	2.4				

Note) The numerical value in parentheses on rated thrust is for the long stroke type.

*1 The rated thrust is limited for the stroke.
*2 The speeds indicate a value at the motor synchronized rotating speed.

Motor specifications

Model	Totally enclosed self cooling type with brake
Output	Refer to Standard model dimensions list
Number of poles	4 poles
Voltage	3ϕ 200V/200V/220V
Frequency	50Hz/60Hz/60Hz
Heat resistance class	E (B for 1.5kW or less)
Time rating	S2 30min.
Protection method	Totally enclosed outdoor type (IP55)

1) 400/440V, different voltage specifications other than the above voltages are also available.
2) For motor current value and brake current value, refer to page 57.

Painting color

TSUBAKI olive gray (Munsell 5GY6/0.5 or approximate color)

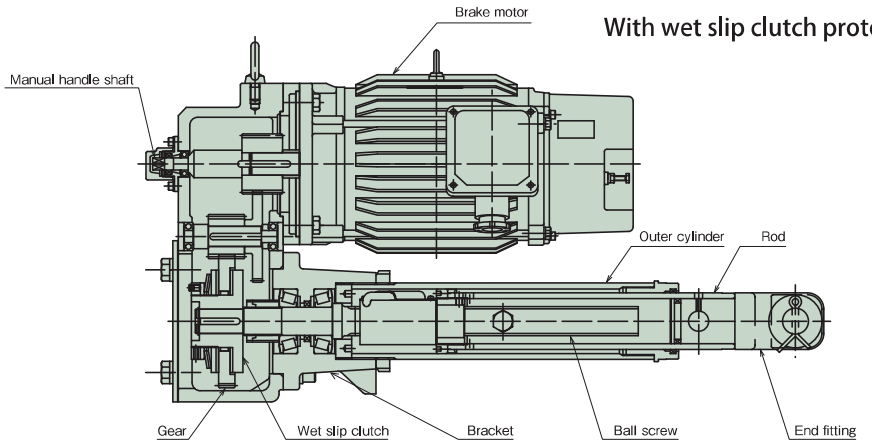
Standard use environment

Environment / Model	Ambient temperature	Relative humidity	Impact resistance value	Installation altitude	Atmosphere
Outdoor type	−15℃ to 40℃	85% or less (no dew condensation)	1G or less	1000m or lower above sea level	Normally outdoors

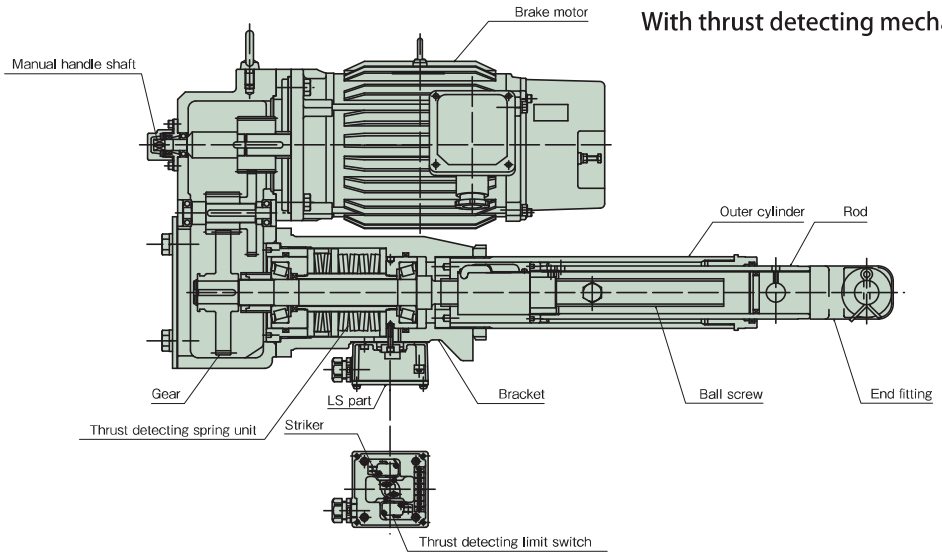
1) Cylinders with bellows are recommended in an excessively dusty location.
2) Special painting is available for locations exposed to sea breezes and salt. Consult us.
3) All models are totally enclosed structures so that they can be used normally outdoors, however, under adverse conditions exposed to constant water and steam etc., and snow accumulation, although they are an outdoors type, an appropriate cover is required. When using at 40℃ or higher, always protect with a heat insulating cover, etc. Never use in a flammable atmosphere, otherwise it may cause an explosion and fire. In addition, avoid using it in a location where vibration or shock exceeding 1G is applied.
4) For use in a misty atmosphere, contact us.

Structure

TB type — With wet slip clutch protection device (Basic type)



TC type — With thrust detecting mechanism (Basic type)



* The structure slightly varies depending on the model.

Brake motor

This motor adopts a deenergization operation type (spring close type), and the brake is applied while the cylinder stops. This brake action holds load while the power cylinder stops and reduces coasting during stoppage, and serves the purpose of increasing stop accuracy. All of the brake motors adopt outdoor types.

Reduction part

The reduction part adopts a combination of a helical gear on the high speed side and a spur gear on the low speed side.
The lubrication method is grease bath type, and has a quiet operating specification. Furthermore, a manual handle shaft is provided, and the structure of the speed reducer facilitates operation at power failure and adjustment for installation.
As options, various position detecting devices can be installed.

Actuation part

The actuation part is provided with a ball screw and nut which converts a rotating force into linear motion. Further, external limit switches for stroke adjustment can be mounted.
A high precision ball screw and nut have advantages such as high transmission efficiency, less wear, long life and easy lubrication.
The external limit switches for stroke adjustment are structured to freely adjust the stroke and endure outdoor use. The bellows are excellent in weatherproofing, and the stroke does not change even if the bellows are mounted.
The seal for the rod also endures outdoor use.

Classification of usage for LPTB and LPTC types

Both types of the power cylinders have the same basic functions (thrust, speed, stroke), however, each has its feature as regards the mechanism. Read the following to select the optimum type.

TB type

● Wet slip clutch type (simple type)

[Wet slip clutch]

The screw shaft end of the reduction part incorporates a slip clutch which operates stably in grease as a safety device.
Adoption of special lining exerts a protective function even at the time of overload or stroke overextension.
* When overload is electrically detected, use in combination with our shock relay is recommended.

TC type

● Thrust detecting mechanism type

This type exerts its effect in the following cases.

① When performing press (pull) stop

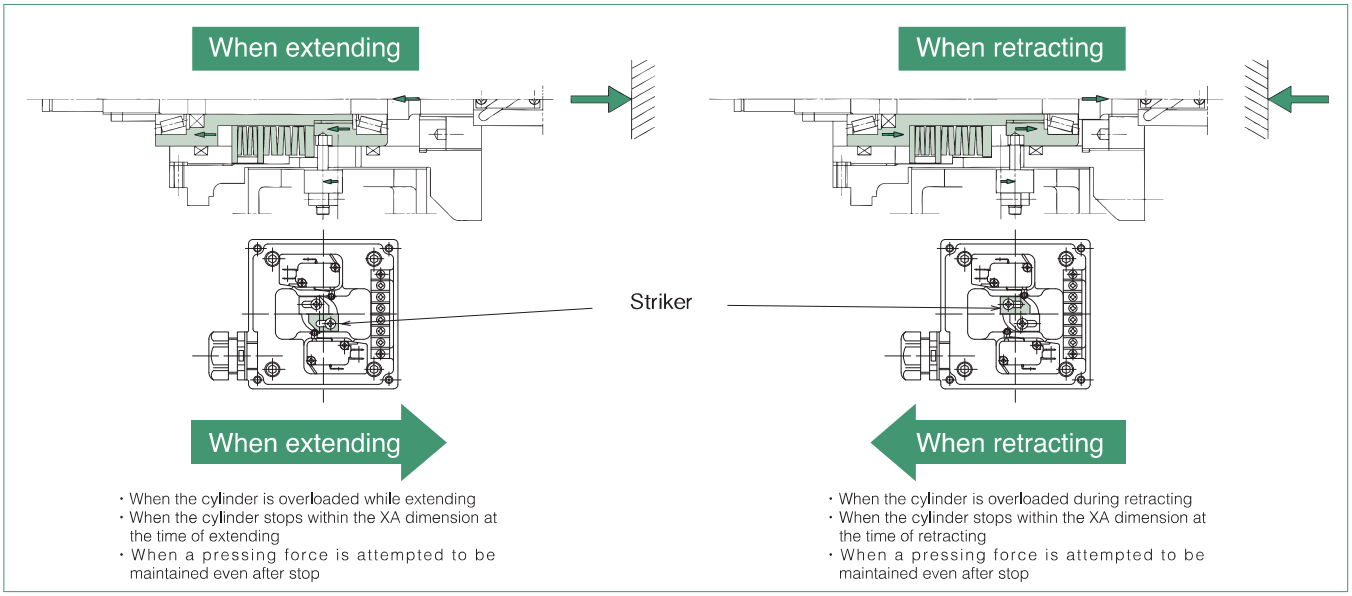
② When requiring an electric signal at the time of overload

③ When an overload is possibly applied from the load side during stop

When an overload is impulsively applied, the incorporated spring absorbs the impact load.

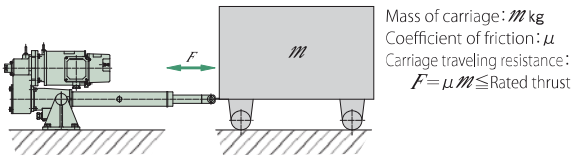
[Thrust detecting mechanism]

This is a thrust detecting mechanism which combines two types of pre-loaded disc springs whose spring constants are different from each other and limit switches. The combined effect of these disc springs also allows for press and stop of the high speed type.



Preset thrust for safety device

For both of the TB type and TC type, the thrust for the safety device has been set to approximately 150% to 200% of the rated thrust. The safety device does not work at the start for opening/closing of the damper or the hopper gate, normal reverse, inclination and elevation, however, when a load inertia is large due to horizontal movement of carriage, the safety device may work to impair smooth operation at the start. For the allowable mass m of each model, see Table 4 on page 40.



Cautions for use

● When pressing (pulling) and stopping at high frequency

When using the power cylinder at a frequency of ten or more times a day, refer to the total stop times for every model in the following table.

Type	LPTC250 to LPTC4000		
Speed	S,L	M	H
Reference total stop times (×10⁴times)	30	10	5

Note) When the power cylinder is used for press (pull) contact stopping, external wiring is recommended for the wire connection of the brake.
Note) When the power cylinder is used exceeding the values on the above table, it is recommended to stop with the stroke adjusting LS.
Note) When the power cylinder is used with press (pull) stop, strength of the mating equipment shall be 250% or more of the rated thrust.

● When multiple operation or stroke position control is performed

① When installing rotary encoder or potentiometer

For the TC type, a spring mechanism is built in the operating part. The spring slightly deflects at press (pull) and stop, or when overload occurs, the signal amount deviates by the deflection. For the TB type, even if the safety device is tripped, signal amount does not deviate. However, the TC type can be used at normal stroke operation.

② When there is a problem with movement of the rod even if overload is applied from load side during stop

For the TC type, a spring mechanism is built in the operating part, therefore, when a large load is applied from the load side, the spring deflects and the rod moves by the deflection.
When the load is eliminated, the rod returns to the original position.

Selection 1

Conditions of use required for selection

1. Machine to be used and application
2. Thrust or load N { kgf }
3. Stroke mm
4. Speed mm/s
5. Frequency of operation, cycles/min.
6. Hours of operation and annual number of operating days
7. Type of load of machine used
8. Environment of use
9. Power voltage, frequency

Selection procedures

Determination of model STEP 1

Determine the type (TB or TC) according to the use environment and method of operation.

Determination of model No. STEP 2

1. Obtain annual traveling distance from the stroke, frequency of operation and hours of operation.

   Annual traveling distance km = Actual stroke m x Frequency of use/day x number of operating days x 10^{-3}

2. Obtain the operation factor from the characteristics of load and the machine used, referring to Table 1.
3. Multiply thrust or load by operation factor to obtain a corrected thrust.
4. Determine the frame No. from the "Expected Traveling Distance" shown below on this page according to the corrected thrust and annual traveling distance, and select an applicable model No. from the standard model list (page 35) based on the stroke, speed, power supply voltage and frequency.

Characteristics check STEP 3

1. Use the power cylinder at a frequency of operation below the allowable frequency of operation (Table 2).
2. Check the load time ratio.
3. Positioning accuracy varies depending on the stopping method. Refer to the stopping method (page 39).

Table 1 Operation factor

Characteristics of load	Example of machine used	Operation factor
Smooth operation without impact Small inertia	Damper, opening/closing of valve, conveyor changeover device	1.0～1.3
Operation with light impact Intermediate inertia	Opening/closing of hopper gate, various transfer equipment, various lifter elevation	1.3～1.5
Operation with large impact and vibration Large inertia	Heavy object conveyance by carriage, buffer for belt conveyor, inversion opening/closing device for large lid	1.5～3.0

Note) The above operation factor table shows general guidelines. Therefore, make a determination in consideration of operating conditions.

Table 2 Allowable frequency of operation

Type	LPTB·LPTC	LPTB·LPTC	LPTB·LPTC	LPTB·LPTC	LPTB·LPTC	LPTB·LPTC	LPTB·LPTC
Power cylinder model	250S 250L 500S	250M 500L 1000S	250H 500M 1000L 2000S	500H 1000M 2000L 4000S	1000H 2000M 4000L	2000H 4000M	4000H
Number of starting times (Number of times/min)	5	5	5	4	4	4	4
Load time ratio(%ED)	25%ED						

Note) The above frequencies of operation are values determined by heat generation of the motor. They are not values taking life of the cylinder body into consideration.

Allowable frequency of operation for the power cylinder T series is within a range which satisfies the number of starting times and load time ratio in the above table. The load time ratio is expressed by the following equation.

$$\text{Load time ratio (\%ED)} = \frac{\text{Operation time of one cycle}}{\text{(Operation time of one cycle + dwell time)}} \times 100\%$$

Guide for life

Use the number of operation times of the brake and the traveling distance of the cylinder (nut) as a guide for product life of the power cylinder T series to select the cylinder (nut).

1. Number of operation times of brake
   Expected life 2 million times

2. Traveling distance of cylinder (nut)

The life of a ball screw is determined by flaking of the rolling surface caused by its fatigue. Check the rough life with this chart of expected traveling distance. However, in the case of great impact or in the case where lubrication or maintenance is not performed properly, the expected traveling distance becomes substantially short.

Expected traveling distance (km) = actual load stroke (m) × frequency of use (times/day) × number of operating days × 10^{-3} × expected number of years

The chart on the right-hand side is based on L10 life. L10 life expresses in traveling distance a life that can be reached by 90% or more of all ball screws. If you select a power cylinder based on the life, select model No. from this chart.
If the load greatly fluctuates in the middle of stroke, calculate the equivalent load (P_M) by the following equation.

$$P_M = \frac{P_{MIN} + 2 \times P_{MAX}}{3}$$

P_M : Equivalent load N { kgf }
P_{MIN} : Minimum load N { kgf }
P_{MAX} : Maximum load N { kgf }

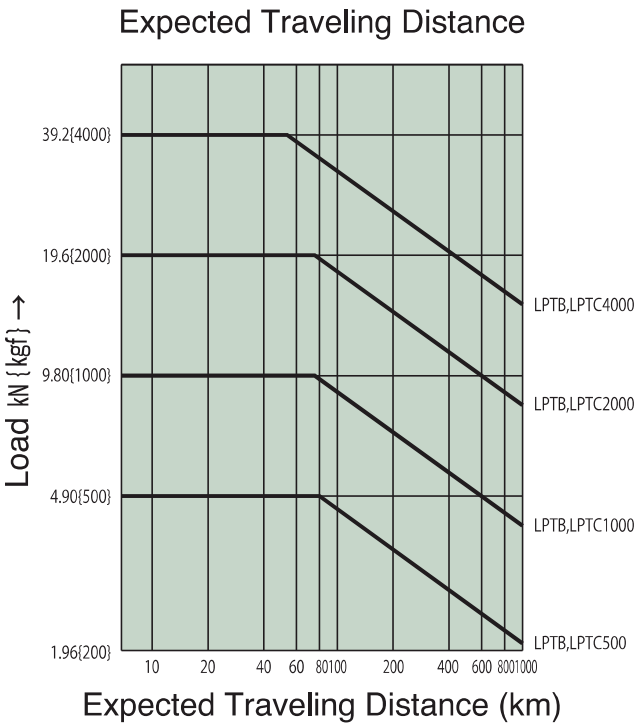
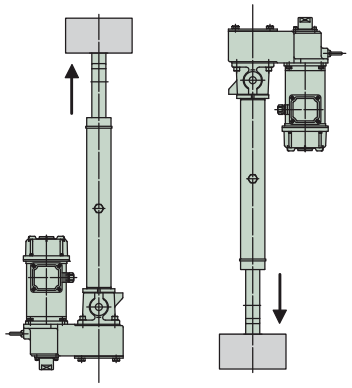


Table 3 Coasting distance and stop accuracy (Reference value)

Unit: mm

Model		Brake internal connection				Brake external connection			
		Lifting load		Suspended load		Lifting load		Suspended load	
		Coasting distance	Stop accuracy	Coasting distance	Stop accuracy	Coasting distance	Stop accuracy	Coasting distance	Stop accuracy
LPTB LPTC 250	S	2.2	±0.4	3.0	±0.6	1.9	±0.3	2.7	±0.5
	L	4.3	±0.8	8.5	±2.1	3.7	±0.6	7.8	±1.9
	M	6.9	±1.4	12.4	±3.2	6.0	±1.1	11.4	±2.9
	H	13.7	±2.7	27.3	±7.3	12.5	±2.4	26.1	±6.9
LPTB LPTC 500	S	2.1	±0.4	3.7	±0.9	1.8	±0.3	3.3	±0.8
	L	3.6	±0.7	6.1	±1.6	3.1	±0.6	5.6	±1.4
	M	6.5	±1.3	11.4	±2.9	5.9	±1.2	10.8	±2.7
	H	12.7	±2.7	22.3	±5.9	10.2	±2.0	19.6	±5.2
LPTB LPTC 1000	S	1.7	±0.4	2.8	±0.7	1.5	±0.3	2.5	±0.6
	L	3.2	±0.7	5.4	±1.4	2.9	±0.6	5.1	±1.2
	M	6.3	±1.4	10.2	±2.6	5.0	±1.0	8.8	±2.2
	H	15.6	±3.3	27.6	±7.7	10.4	±2.0	22.1	±6.3
LPTB LPTC 2000	S	1.7	±0.4	2.7	±0.7	1.5	±0.3	2.5	±0.6
	L	3.2	±0.7	5.0	±1.3	2.5	±0.5	4.2	±1.0
	M	7.7	±1.7	12.7	±3.4	5.2	±1.0	10.0	±2.7
	H	13.3	±2.9	22.8	±6.4	8.0	±1.6	17.1	±4.9
LPTB LPTC 4000	S	1.2	±0.3	1.6	±0.4	0.9	±0.2	1.3	±0.3
	L	3.8	±0.8	5.9	±1.5	2.5	±0.5	4.5	±1.1
	M	6.4	±1.4	9.9	±2.6	3.8	±0.8	7.2	±1.9
	H	10.9	±2.4	16.9	±4.4	6.6	±1.3	12.3	±3.2

Fig. 1 Type of load



Note) Anti-rod rotation is required for actual operation.

Brake holding force

Load holding force while the power cylinder stops is generated more than the rated thrust, therefore, it can be used for holding load of the rated thrust.
This holding force is generated by the braking operation of the brake motor. The brake is of a spring braking type that always performs braking operation by spring force during stoppage, and brake torque has a holding force of 150% or more of the motor rated torque.

Stoppage

This method operates and stops the brake by the limit switch or operation of the stop button, and allows for positioning on multi-stages such as the upper limit, lower limit and middle of the stroke. Coasting distance and stop accuracy vary depending on operating speed and load. When accurate positioning is required, low operation speed or brake individual turnoff is recommended. Take coasting distance into consideration to set the limit switch and the output stop signal. Reference values are shown in Table 3.

Coasting distance: This indicates a distance from a time when the limit switch or the stop button is operated until the cylinder stops. This coasting distance varies depending on how the load is applied and the operation circuit.
Stop accuracy: This indicates variation of the stop position when stop is repeated.

* When selecting the H speed, refer to the cautions for selecting on page 60.
* Select a power cylinder of a sufficient thrust, allowing for a safety rate so that the loads used (static and dynamic) do not exceed the rated thrust.

Example of selection

1. **Operation method** : Opening degree adjustment type damper open/close (Stop at middle two points, press and stop at extend limit and retract limit)
2. **Required thrust** : 12.7kN {1300kgf}
3. **Stroke** : 600mm
4. **Speed** : 600mm/s for approximately 20 seconds
5. **Frequency of operation** : One reciprocation/10 minutes (6 reciprocations/hour)
6. **Operating time** : 10 hours/day, 250 days operation/year, durable years approximately 5 years
7. **Characteristics of load** : Operation with light impact, loaded when extend and retract
8. **Use environment** : Outdoor installation, much dust, temperature 0℃ to 35℃
9. **Power source** : 380V 50Hz

<Determination of type>: With press and stop, internal stop → Select TC type

<Determination of model No.>: 1. **Operation factor** : 1.3

2. **Corrected thrust** : 12.7kN {1300kgf} ×1.3=16.5kN {1680kgf}

3. **Model No.** : LPTC 2000L6 K2 J V1
   Stop at two middle points
   With bellows (much dust)
   380V 50Hz

<Characteristics check>: 1. **Number of starting times**

● **Number of starting** : 2 times/10min<4 times/min

● **Load time ratio** : $\frac{600}{\frac{30}{10\times60}\times100}\times2=6.7\%<25\%$

2. **Number of total press (pull) stop times** : 2 times/1 reciprocation, durable years: 5 years (250 days/year)
   $2\times6\times10\times250\times5=15\times10^4$ times $<30\times10^4$ times

<Life check>: 1. **Annual traveling distance** : $0.6\times2\times6$ times/hour×10 hours/day×250 days/year$\times10^{-3}=18$km

2. **Expected traveling life** : 18km×5 years=90km

3. **Equivalent load** : $P_M=\frac{16.5+16.5\times2}{3}=16.5$kN {1680kgf}
   This calculated value satisfies the expected traveling life of LPTC 2000 according to the load-life diagram on page 38.

Selection 2

Table 4 Allowable mass in consideration of inertia at time of horizontal drive

Unit: kg

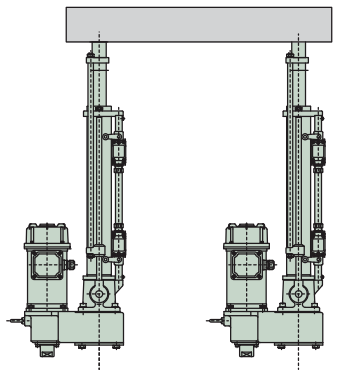
Power cylinder model	LPTB LPTC : 250			LPTB LPTC : 500			LPTB LPTC : 1000			LPTB LPTC : 2000			LPTB LPTC : 4000		
	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H
Allowable mass *m*	4300	1500	850	5500	2650	950	10000	3200	2200	12300	8400	7100	31800	26000	16800

Selection 3

Multiple operation method

As shown in Fig. 2, transfer or elevation can be carried out by sharing load on some power cylinders.
This is because there is less speed fluctuation due to variation in load. For selection, pay attention to the items at the right.

Fig. 2 Linkage operation by some power cylinders



Control method

To start, turn on the power for all of the cylinders, and stop them with the limit switches installed on each power cylinder. When all of the cylinders are controlled with one limit switch, stroke error is accumulated, therefore, avoid controlling with one limit switch.
For an example of the control circuit, refer to example of the multiple circuit (page 58).

Multiple accuracy

Variation in speed of each power cylinder during operation is generated due to variation in load, and is generally approximately 5%. For variation at stop, refer to the stop accuracy in Table 4. When synchronizing power cylinders, use the multi-series. (Page 62)

$$\text{Thrust per one cylinder} = \frac{\text{Required thrust N (kgf)}}{\text{Number of power cylinders to be used} \times \text{Multiple factor}}$$

Table 5 Multiple factor

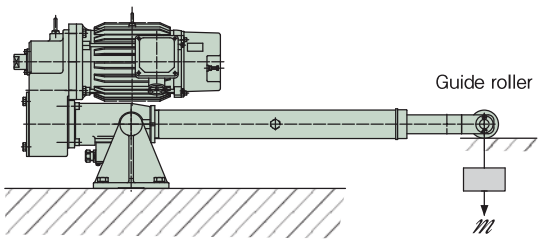
Number of power cylinders used	2 cylinders	3 cylinders	4 cylinders	5 cylinders	6 cylinders
Multiple factor	0.8	0.7	0.6	0.55	0.5

Cautions for layout

When the load is in the right angle direction (lateral load) or load of which direction is biased (biased load) is applied on the rod, take the following countermeasures.

① Lateral load Install guide roller etc., on the rod part. (Fig. 3)

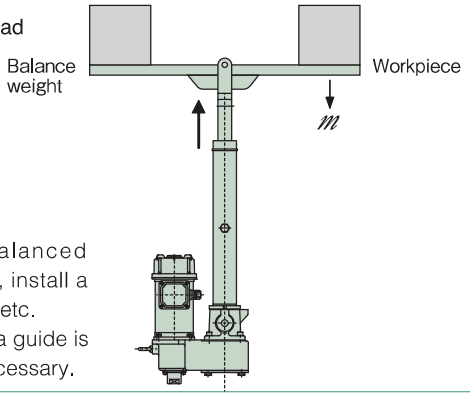
Fig. 3 Lateral load



Avoid directly applying a lateral load and install a guide roller.

② Biased load Install balance weight etc. (Fig. 4)

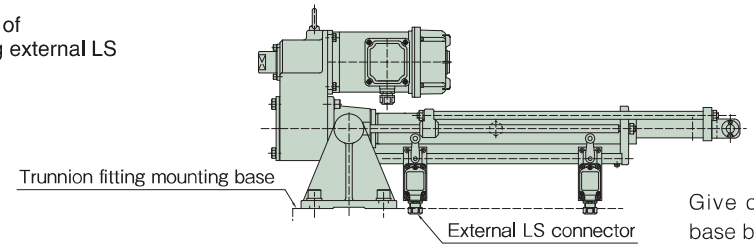
Fig. 4 Biased load



When an unbalanced load is applied, install a balance weight etc.
* In this layout, a guide is separately necessary.

③ Anti-rod rotation --- A rotating force is generated on the rod with thrust (page 35), therefore, prevent rotation on the equipment side.
④ Vertical installation of stroke adjusting external LS (stroke 300mm or less) --- The connector portion of the external LS appears below the trunnion mounting base surface. (Fig. 5)

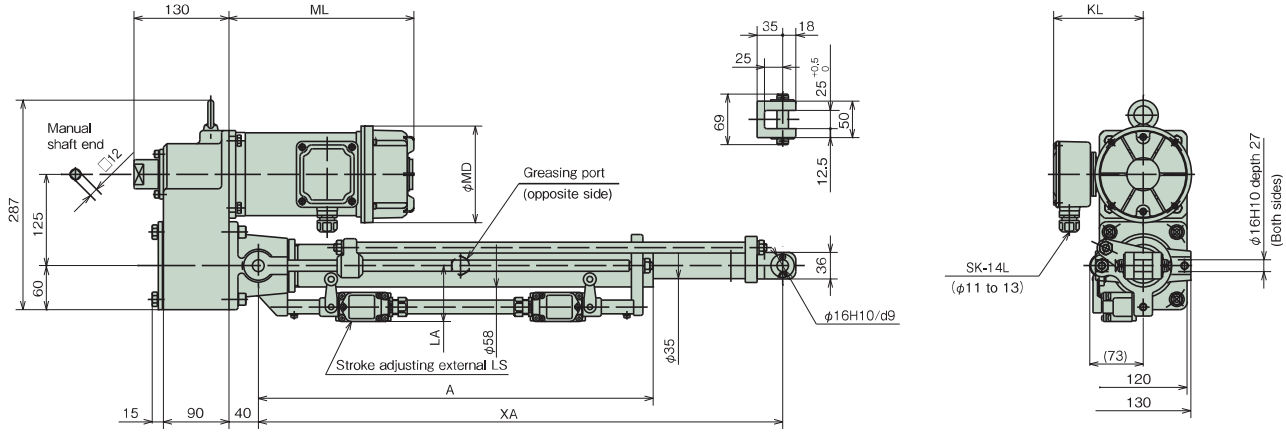
Fig. 5 Vertical installation of the stroke adjusting external LS



Give consideration to the mounting base because cabling is required.

Dimensions Table T Series 250

LPTB250



Unit: mm

Model	Nominal speed mm/s 50/60Hz	Motor kW	MD	ML	KL
LPTB250S	12.5/15	0.1	132	296	125
LPTB250L	25/30			231	
LPTB250M	50/60	0.2			
LPTB250H	100/120	0.4		253	

Unit: mm

Nominal stroke	Thrust kN	Thrust {kgf}	A	XA MIN	XA MAX	LA
200	2.45	250	340	435	635	161
300			440	545	845	
400			540	655	1055	76.5
500			640	765	1265	
600			740	870	1470	

Approximate mass of main body

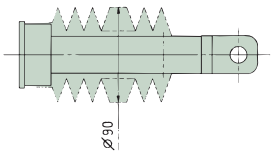
Unit: kg

Model \ Nominal stroke	200	300	400	500	600
LPTB250S	35	36	37	38	39
LPTB250L	32	33	34	35	36
LPTB250M	32	33	34	35	36
LPTB250H	34	35	36	37	38

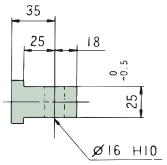
1. This diagram shows a power cylinder with an external limit switch for stroke adjustment.
2. If the stroke is 300mm or less and a limit switch for stroke adjustment is equipped, the limit switch is vertically mounted. Note that the LA dimension becomes larger. (See ④ in Cautions for layout on page 40.)
3. Mechanical stroke has a margin of approximately 10mm on both sides for the nominal stroke.
4. For the cylinder with bellows, the stroke will also not change.
5. For connector part dimensions of the motor terminal box, refer to page 57.

Options

■ Bellows (-J)

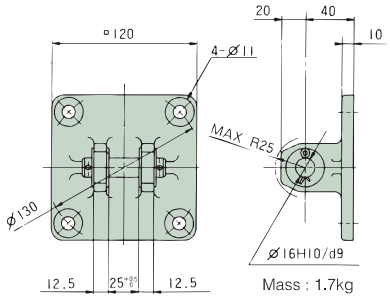


■ I-type end fitting (-I)



Note) Shipped as attached to the main body.
The XA dimensions are the same as the standard U-type end fitting.

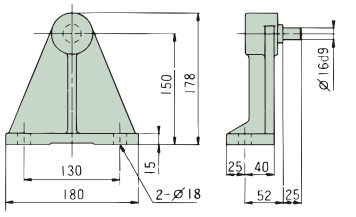
■ Clevis fitting (-C)



Mass : 1.7kg

Note) Shipped attached to the main body.
If it needs to be shipped individually, consult us.

■ Trunnion fitting (LPTB500-T)



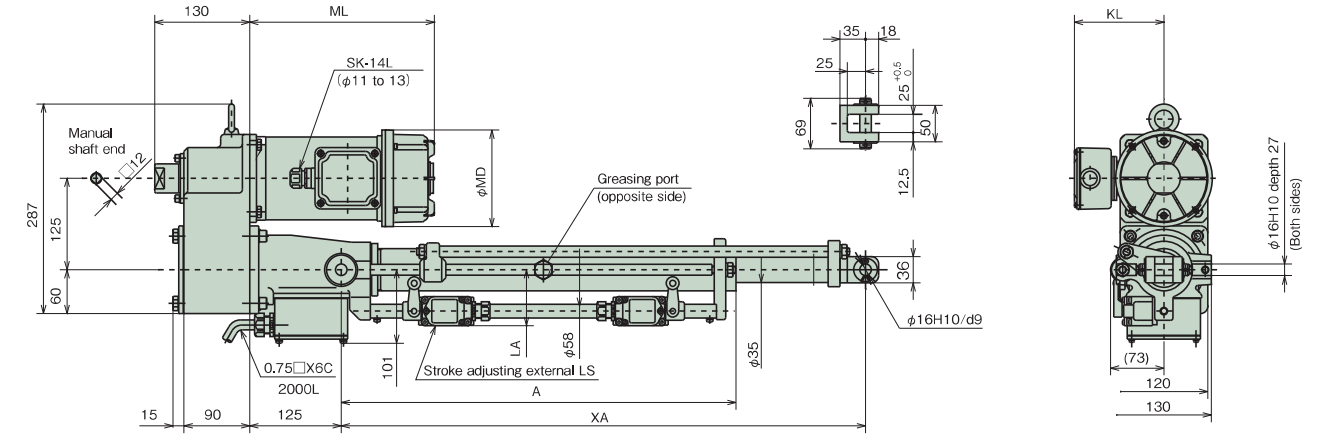
Mass: 7.0kg/set

Note) Apply grease to the trunnion pin and trunnion hole before mounting.

* Dimensions with no tolerance described have general tolerance, and their sizes become larger by approximately 2 to 5mm from the described dimensions. When designing the machine, take the margin into consideration.

Dimensions Table T Series 250

LPTC250



Unit: mm

Model	Nominal speed mm/s 50/60Hz	Motor kW	MD	ML	KL
LPTC250S	12.5/15	0.1	132	296	125
LPTC250L	25/30			231	
LPTC250M	50/60	0.2			
LPTC250H	100/120	0.4		253	

Unit: mm

Nominal stroke	Thrust kN	Thrust {kgf}	A	XA MIN	XA MAX	LA
200	2.45	250	340	435	635	161
300			440	545	845	
400			540	655	1055	76.5
500			640	765	1265	
600			740	870	1470	

Approximate mass of main body

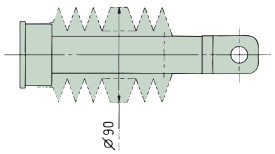
Unit: kg

Model \ Nominal stroke	200	300	400	500	600
LPTC250S	39	40	41	42	43
LPTC250L	36	37	38	39	40
LPTC250M	36	37	38	39	40
LPTC250H	38	39	40	41	42

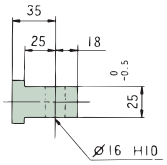
1. This diagram shows a power cylinder with an external limit switch for stroke adjustment.
2. If the stroke is 300mm or less and a limit switch for stroke adjustment is equipped, the limit switch is vertically mounted. Note that the LA dimension becomes larger. (See ④ in Cautions for layout on page 40.)
3. Mechanical stroke has a margin of approximately 10mm on both sides for the nominal stroke.
4. For the cylinder with bellows, the stroke will also not change.
5. Use TC type model in brake individual turnoff.
6. For connector part dimensions of the motor terminal box, refer to page 57.

Options

■ Bellows (-J)

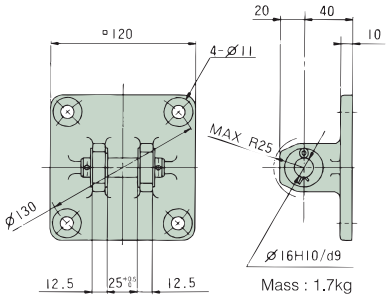


■ I-type end fitting (-I)



Note) Shipped as attached to the main body.
The XA dimensions are the same as the standard U-type end fitting.

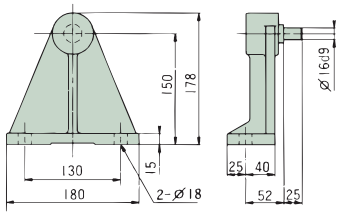
■ Clevis fitting (-C)



Mass : 1.7kg

Note) Shipped attached to the main body. If it needs to be shipped individually, consult us.

■ Trunnion fitting (LPTB500-T)



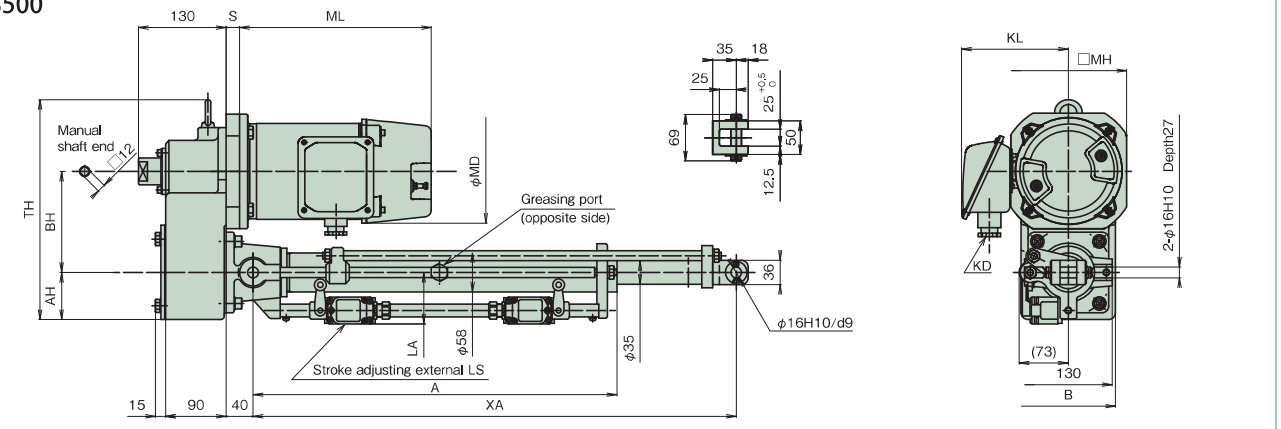
Mass: 7.0kg/set

Note) Apply grease to the trunnion pin and trunnion hole before mounting.

* Dimensions with no tolerance described have general tolerance, and their sizes become larger by approximately 2 to 5mm from the described dimensions. When designing the machine, take the margin into consideration.

Dimensions Table T Series 500

LPTB500



Unit: mm

Model	Nominal speed mm/s 50/60Hz	Motor kW	MD	ML	KL	KD	MH	AH	BH	TH	S	B	C	E	F	G	H	J	K	L
LPTB500S	12.5/15	0.1	132	231	125	SK-14L	120	60	125	287	65	120	12.5	25	20	40	10	130	25	16
LPTB500L	25/30	0.2									—									
LPTB500M	50/60	0.4		253																
LPTB500H	100/120	0.75	180	289	166	A20C	170	70	150	327	20	140	15	30	25		12	140	31	20

Unit: mm

Nominal stroke	Thrust kN	Thrust {kgf}	A	XA MIN	XA MAX	LA
200	4.90	500	340	435	635	161
300			440	545	845	
400			540	655	1055	76.5
500			640	765	1265	
600			740	870	1470	
800			940	1090	1890	

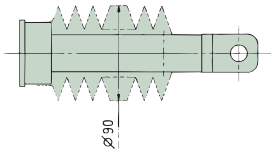
Approximate mass of main body Unit: kg

Model \ Nominal stroke	200	300	400	500	600	800
LPTB500S	35	36	37	38	39	41
LPTB500L	32	33	34	35	36	38
LPTB500M	34	35	36	37	38	40
LPTB500H	43	44	45	46	47	49

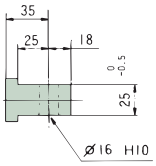
1. This diagram shows a power cylinder with an external limit switch for stroke adjustment.
2. If the stroke is 300mm or less and a limit switch for stroke adjustment is equipped, the limit switch is vertically mounted. Note that the LA dimension becomes larger. (See ④ in Cautions for layout on page 40.)
3. Mechanical stroke has a margin of approximately 10mm on both sides for the nominal stroke.
4. For the cylinder with bellows, the stroke will also not change.
5. For connector part dimensions of the motor terminal box, refer to page 57.

Options

■ Bellows (-J)

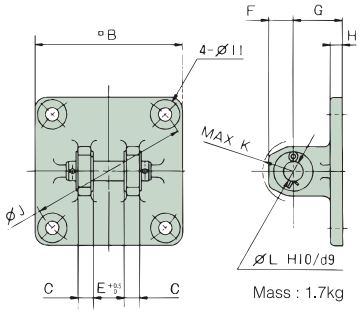


■ I-type end fitting (-I)



Note) Shipped as attached to the main body.
The XA dimensions are the same as the standard U-type end fitting.

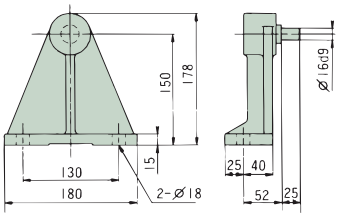
■ Clevis fitting (-C)



Mass : 1.7kg

Note) Shipped attached to the main body.
If it needs to be shipped individually, consult us.

■ Trunnion fitting (LPTB500-T)



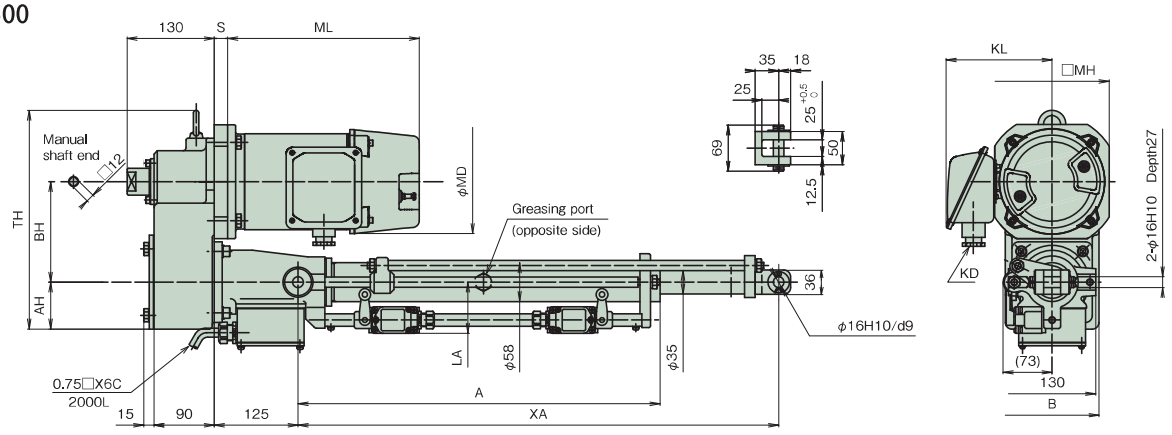
Mass: 7.0kg/set

Note) Apply grease to the trunnion pin and trunnion hole before mounting.

* Dimensions with no tolerance described have general tolerance, and their sizes become larger by approximately 2 to 5mm from the described dimensions. When designing the machine, take the margin into consideration.

Dimensions Table T Series 500

LPTC500



Unit: mm

Model	Nominal speed mm/s 50/60Hz	Motor kW	MD	ML	KL	KD	MH	AH	BH	TH	S	B	C	E	F	G	H	J	K	L
LPTC500S	12.5/15	0.1	132	231	125	SK-14L	120	60	125	287	65	120	12.5	25	20	40	10	130	25	16
LPTC500L	25/30	0.2									—									
LPTC500M	50/60	0.4		253																
LPTC500H	100/120	0.75	180	289	166	A20C	170	70	150	327	20	140	15	30	25		12	140	31	20

Unit: mm

Nominal stroke	Thrust kN	Thrust {kgf}	A	XA MIN	XA MAX	LA
200	4.90	500	340	435	635	161
300			440	545	845	
400			540	655	1055	76.5
500			640	765	1265	
600			740	870	1470	
800			940	1090	1890	

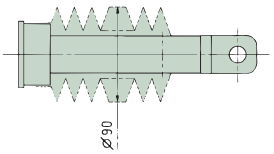
Approximate mass of main body Unit: kg

Model \ Nominal stroke	200	300	400	500	600	800
LPTC500S	39	40	41	42	43	45
LPTC500L	36	37	38	39	40	42
LPTC500M	38	39	40	41	42	44
LPTC500H	47	48	49	50	51	53

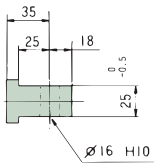
1. This diagram shows a power cylinder with an external limit switch for stroke adjustment.
2. If the stroke is 300mm or less and a limit switch for stroke adjustment is equipped, the limit switch is vertically mounted. Note that the LA dimension becomes larger. (See ④ in Cautions for layout on page 40.)
3. Mechanical stroke has a margin of approximately 10mm on both sides for the nominal stroke.
4. For the cylinder with bellows, the stroke will also not change.
5. Use TC type model in brake individual turnoff.
6. For connector part dimensions of the motor terminal box, refer to page 57.
7. The terminal box lead-out direction in this diagram is for the H speed.
   For the S, L, and M speeds, the direction is the same as the LPTC250 type.

Options

■ Bellows (-J)

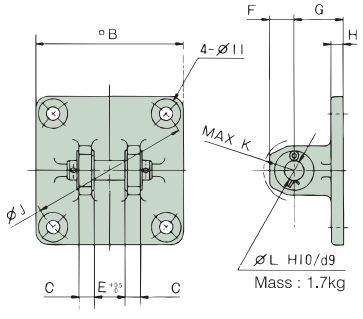


■ I-type end fitting (-I)



Note) Shipped as attached to the main body.
The XA dimensions are the same as the standard U-type end fitting.

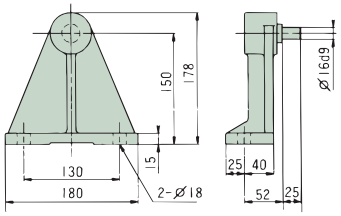
■ Clevis fitting (-C)



Mass : 1.7kg

Note) Shipped attached to the main body. If it needs to be shipped individually, consult us.

■ Trunnion fitting (LPTB500-T)

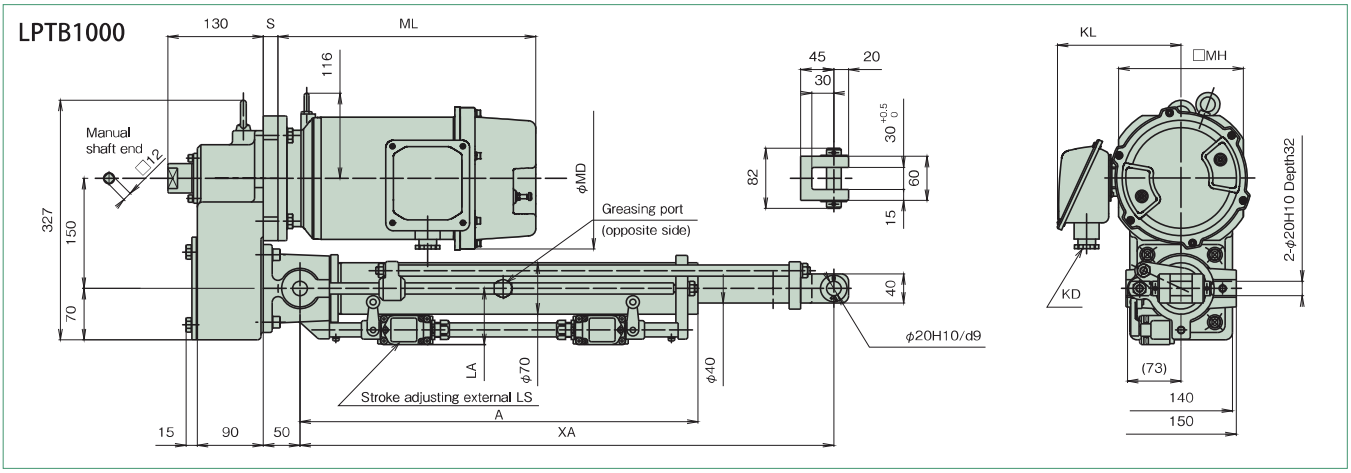


Mass: 7.0kg/set

Note) Apply grease to the trunnion pin and trunnion hole before mounting.

* Dimensions with no tolerance described have general tolerance, and their sizes become larger by approximately 2 to 5mm from the described dimensions. When designing the machine, take the margin into consideration.

Dimensions Table T Series 1000



Unit: mm

Model	Nominal speed mm/s 50/60Hz	Motor kW	MD	ML	KL	KD	MH	S
LPTB1000S	12.5/15	0.2	132	231	125	SK-14L	120	65
LPTB1000L	25/30	0.4		253				—
LPTB1000M	50/60	0.75	180	289	166	A20C	170	20
LPTB1000H	100/120	1.5	194	351	178			

Unit: mm

Nominal stroke	Thrust kN	Thrust {kgf}	A	XA MIN	XA MAX	LA
200	9.80	1000	360	465	665	161
300			460	575	875	
400			560	685	1085	76.5
500			660	795	1295	
600			760	900	1500	
800			960	1120	1920	
1000	7.84	800	1160	1340	2340	

Approximate mass of main body

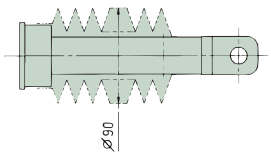
Unit: kg

Model \ Nominal stroke	200	300	400	500	600	800	1000
LPTB1000S	42	44	45	47	48	51	54
LPTB1000L	40	42	43	45	46	49	52
LPTB1000M	46	48	49	51	52	55	58
LPTB1000H	50	52	53	55	56	59	62

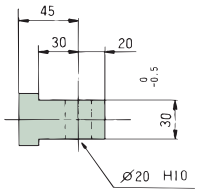
1. This diagram shows a power cylinder with an external limit switch for stroke adjustment.
2. If the stroke is 300mm or less and a limit switch for stroke adjustment is equipped, the limit switch is vertically mounted. Note that the LA dimension becomes larger. (See ④ in Cautions for layout on page 40.)
3. Mechanical stroke has a margin of approximately 10mm on both sides for the nominal stroke.
4. For the cylinder with bellows, the stroke will also not change.
5. For connector part dimensions of the motor terminal box, refer to page 57.

Options

■ Bellows (-J)

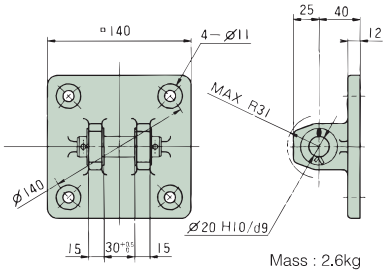


■ I-type end fitting (-I)



Note) Shipped as attached to the main body.
The XA dimensions are the same as the standard U-type end fitting.

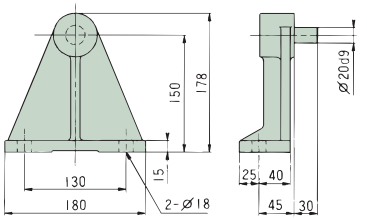
■ Clevis fitting (-C)



Mass : 2.6kg

Note) Shipped attached to the main body.
If it needs to be shipped individually, consult us.

■ Trunnion fitting (LPTB1000-T)

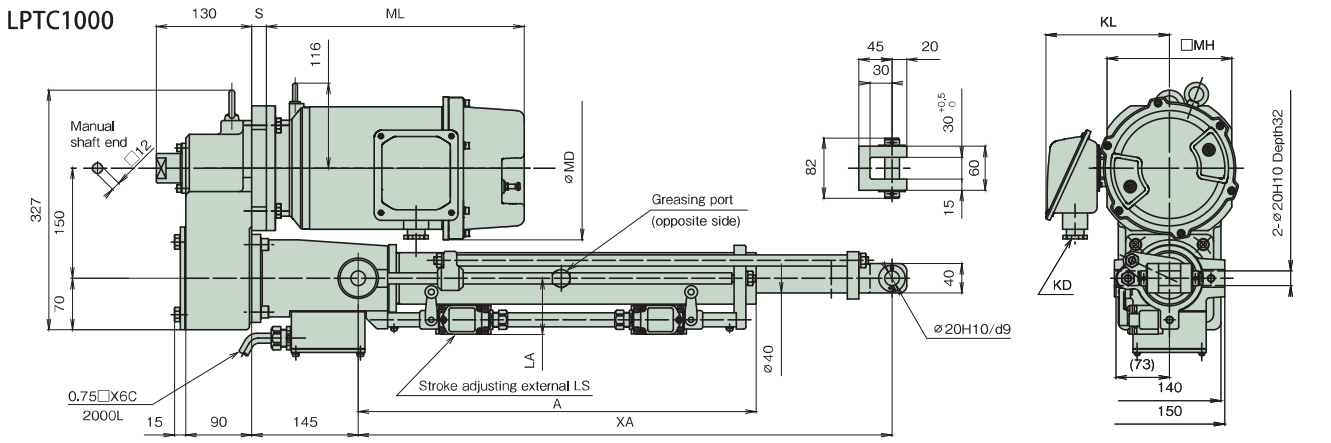


Mass: 7.0kg/set

Note) Apply grease to the trunnion pin and trunnion hole before mounting.

* Dimensions with no tolerance described have general tolerance, and their sizes become larger by approximately 2 to 5mm from the described dimensions. When designing the machine, take the margin into consideration.

Dimensions Table T Series 1000



Unit: mm

Model	Nominal speed mm/s 50/60Hz	Motor kW	MD	ML	KL	KD	MH	S
LPTC1000S	12.5/15	0.2	132	231	125	SK-14L	120	65
LPTC1000L	25/30	0.4		253				—
LPTC1000M	50/60	0.75	180	289	166	A20C	170	20
LPTC1000H	100/120	1.5	194	351	178			

Unit: mm

Nominal stroke	Thrust kN	Thrust {kgf}	A	XA MIN	XA MAX	LA
200	9.80	1000	360	465	665	161
300			460	575	875	
400			560	685	1085	76.5
500			660	795	1295	
600			760	900	1500	
800			960	1120	1920	
1000	7.84	800	1160	1340	2340	

Approximate mass of main body

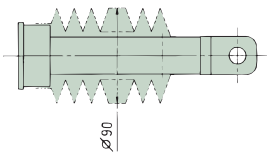
Unit: kg

Model \ Nominal stroke	200	300	400	500	600	800	1000
LPTC1000S	48	50	51	53	54	57	60
LPTC1000L	46	48	49	51	52	55	58
LPTC1000M	52	54	55	57	58	61	64
LPTC1000H	56	58	59	61	62	65	68

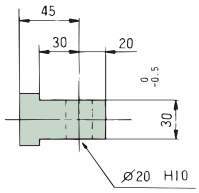
1. This diagram shows a power cylinder with an external limit switch for stroke adjustment.
2. If the stroke is 300mm or less and a limit switch for stroke adjustment is equipped, the limit switch is vertically mounted. Note that the LA dimension becomes larger. (See ④ in Cautions for layout on page 40.)
3. Mechanical stroke has a margin of approximately 10mm on both sides for the nominal stroke.
4. For the cylinder with bellows, the stroke will also not change.
5. Use TC type model in brake individual turnoff.
6. When the model of the TC type nominal stroke 1000mm is used, press and stop cannot be carried out near the maximum stroke in terms of buckling strength.
7. For connector part dimensions of the motor terminal box, refer to page 57.

Options

■ Bellows (-J)

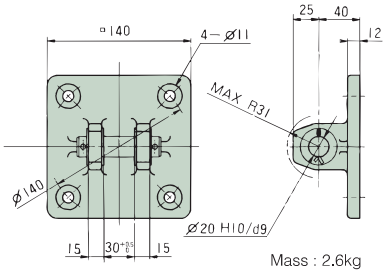


■ I-type end fitting (-I)



Note) Shipped as attached to the main body.
The XA dimensions are the same as the standard U-type end fitting.

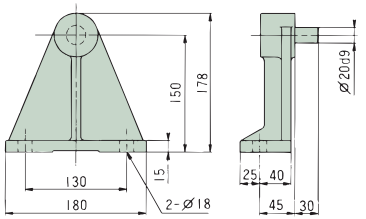
■ Clevis fitting (-C)



Mass : 2.6kg

Note) Shipped attached to the main body.
If it needs to be shipped individually, consult us.

■ Trunnion fitting (LPTB1000-T)



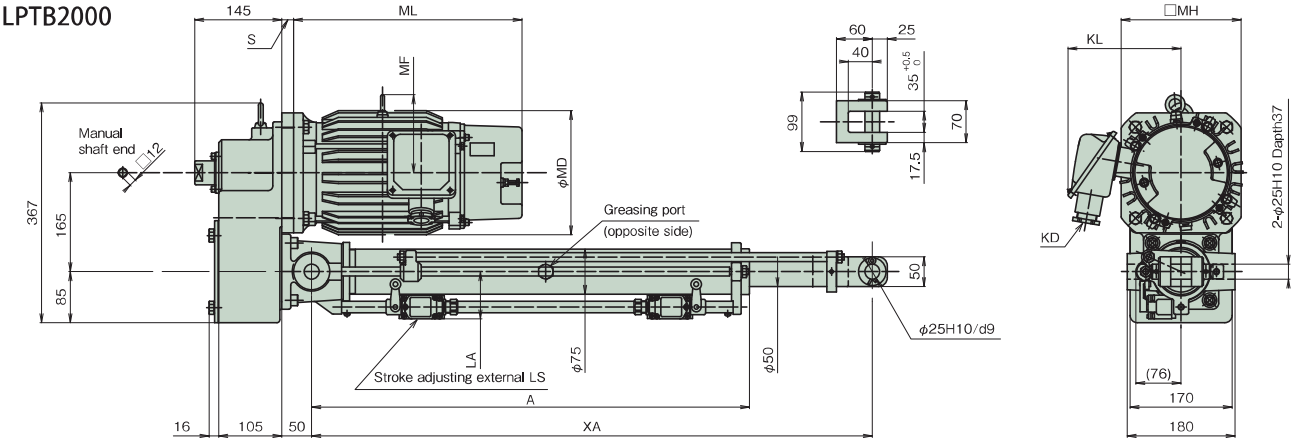
Mass: 7.0kg/set

Note) Apply grease to the trunnion pin and trunnion hole before mounting.

* Dimensions with no tolerance described have general tolerance, and their sizes become larger by approximately 2 to 5mm from the described dimensions. When designing the machine, take the margin into consideration.

Dimensions Table T Series 2000

LPTB2000



Unit: mm

Model	Nominal speed mm/s 50/60Hz	Motor kW	MD	ML	MF	KL	KD	MH	S
LPTB2000S	12.5/15	0.4	132	253	—	125	SK-14L	120	70
LPTB2000L	25/30	0.75	180	289		166	A20C	170	—
LPTB2000M	50/60	1.5	194	351		178			
LPTB2000H	75/90	2.2	194	340	140	178	A25C	200	20

Unit: mm

Nominal stroke	Thrust kN	Thrust {kgf}	A	XA MIN	XA MAX	LA
200	19.6	2000	400	520	720	164
300			500	630	930	
400			600	740	1140	79
500			700	850	1350	
600			800	955	1555	
800			1000	1175	1975	
1000	15.6	1600	1200	1395	2395	
1200	12.2	1250	1400	1615	2815	

Approximate mass of main body

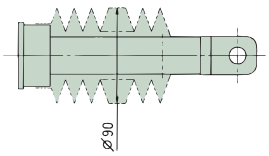
Unit: kg

Model \ Nominal stroke	200	300	400	500	600	800	1000	1200
LPTB2000S	56	58	60	62	64	68	72	76
LPTB2000L	55	57	59	61	63	67	71	75
LPTB2000M	59	61	63	65	67	71	75	79
LPTB2000H	70	72	74	76	78	82	86	90

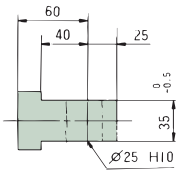
1. This diagram shows a power cylinder with an external limit switch for stroke adjustment.
2. If the stroke is 300mm or less and a limit switch for stroke adjustment is equipped, the limit switch is vertically mounted. Note that the LA dimension becomes larger. (See ④ in Cautions for layout on page 40.)
3. Mechanical stroke has a margin of approximately 10mm on both sides for the nominal stroke.
4. For the cylinder with bellows, the stroke will also not change.
5. For connector part dimensions of the motor terminal box, refer to page 57.

Options

■ Bellows (-J)

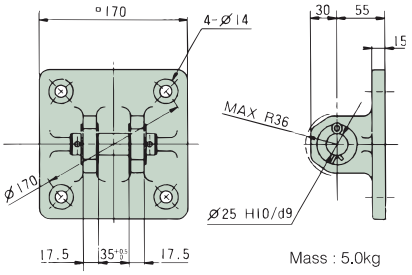


■ I-type end fitting (-I)



Note) Shipped as attached to the main body.
The XA dimensions are the same as the standard U-type end fitting.

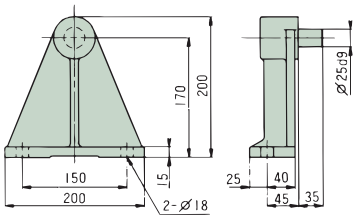
■ Clevis fitting (-C)



Mass : 5.0kg

Note) Shipped attached to the main body.
If it needs to be shipped individually, consult us.

■ Trunnion fitting (LPTB2000-T)



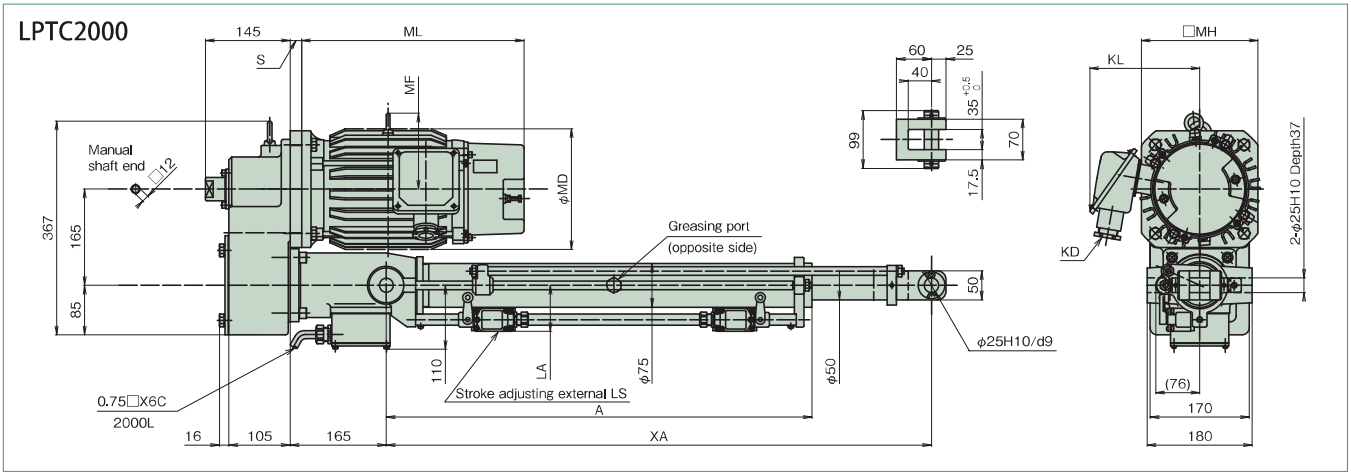
Mass: 9.2kg/set

Note) Apply grease to the trunnion pin and trunnion hole before mounting.

* Dimensions with no tolerance described have general tolerance, and their sizes become larger by approximately 2 to 5mm from the described dimensions. When designing the machine, take the margin into consideration.

Dimensions Table T Series 2000

LPTC2000



Unit: mm

Model	Nominal speed mm/s 50/60Hz	Motor kW	MD	ML	MF	KL	KD	MH	S
LPTC2000S	12.5/15	0.4	132	253	—	125	SK-14L	120	70
LPTC2000L	25/30	0.75	180	289		166	A20C	170	—
LPTC2000M	50/60	1.5	194	351		178			
LPTC2000H	75/90	2.2	194	340	140	178	A25C	200	20

Unit: mm

Nominal stroke	Thrust kN	Thrust {kgf}	A	XA MIN	XA MAX	LA
200	19.6	2000	400	520	720	164
300			500	630	930	
400			600	740	1140	79
500			700	850	1350	
600			800	955	1555	
800			1000	1175	1975	
1000	15.6	1600	1200	1395	2395	
1200	12.2	1250	1400	1615	2815	

Approximate mass of main body

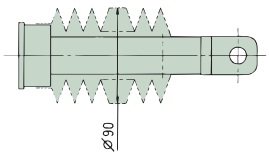
Unit: kg

Model \ Nominal stroke	200	300	400	500	600	800	1000	1200
LPTC2000S	64	66	68	70	72	76	80	84
LPTC2000L	63	65	67	69	71	75	79	83
LPTC2000M	67	69	71	73	75	79	83	87
LPTC2000H	78	80	82	84	86	90	94	98

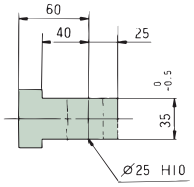
1. This diagram shows a power cylinder with an external limit switch for stroke adjustment.
2. If the stroke is 300mm or less and a limit switch for stroke adjustment is equipped, the limit switch is vertically mounted. Note that the LA dimension becomes larger. (See ④ in Cautions for layout on page 40.)
3. Mechanical stroke has a margin of approximately 10mm on both sides for the nominal stroke.
4. For the cylinder with bellows, the stroke will also not change.
5. Use TC type model in brake individual turnoff.
6. When the model of the TC type nominal stroke 1000 or 1200mm is used, press and stop cannot be carried out near the maximum stroke in terms of buckling strength.
7. For connector part dimensions of the motor terminal box, refer to page 57.

Options

■ Bellows (-J)

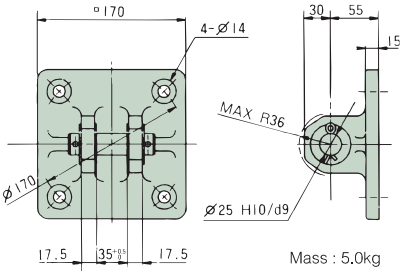


■ I-type end fitting (-I)



Note) Shipped as attached to the main body.
The XA dimensions are the same as the standard U-type end fitting.

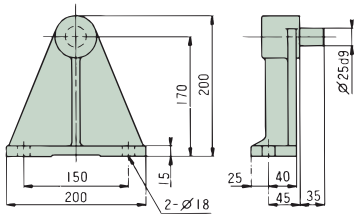
■ Clevis fitting (-C)



Mass : 5.0kg

Note) Shipped attached to the main body.
If it needs to be shipped individually, consult us.

■ Trunnion fitting (LPTB2000-T)



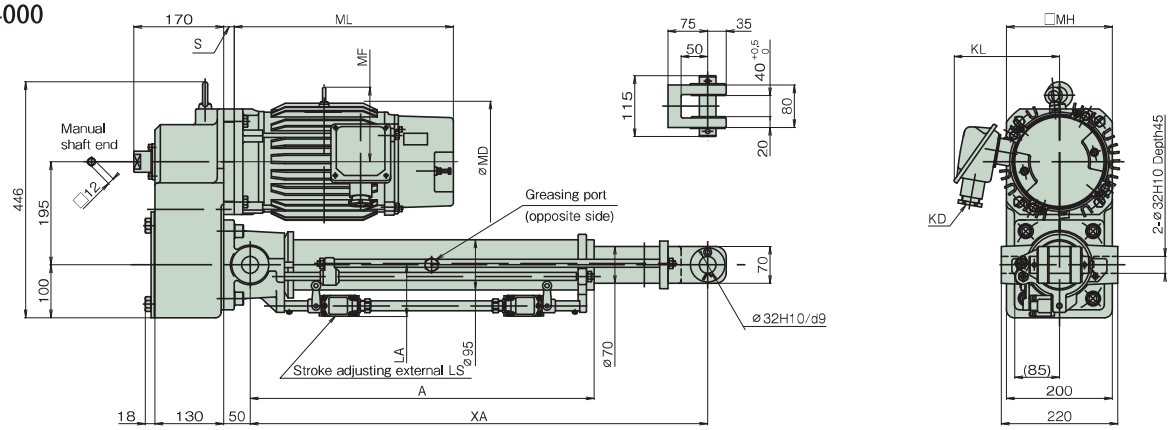
Mass: 9.2kg/set

Note) Apply grease to the trunnion pin and trunnion hole before mounting.

* Dimensions with no tolerance described have general tolerance, and their sizes become larger by approximately 2 to 5mm from the described dimensions. When designing the machine, take the margin into consideration.

Dimensions Table T Series 4000

LPTB4000



Unit: mm

Model	Nominal speed mm/s 50/60Hz	Motor kW	MD	ML	MF	KL	KD	MH	S
LPTB4000S	9/11	0.75	180	289	—	166	A20C	170	90
LPTB4000L	25/30	1.5	194	351		178			—
LPTB4000M	35/42	2.2	194	340	140	178	A25C	200	20
LPTB4000H	60/72	3.7	229	414	146	187			

Unit: mm

Nominal stroke	Thrust kN	Thrust {kgf}	A	XA MIN	XA MAX	LA
200	39.2	4000	440	585	785	182
300			550	695	995	
400			650	805	1205	97.5
500			750	910	1410	
600			850	1020	1620	
800			1050	1235	2035	
1000			1250	1450	2450	
1200			1450	1670	2870	
1500	33.3	3400	1750	1995	3495	

Approximate mass of main body

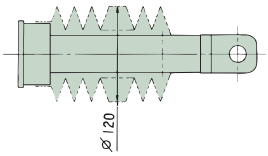
Unit: kg

Model \ Nominal stroke	200	300	400	500	600	800	1000	1200	1500
LPTB4000S	90	94	97	101	104	111	118	125	136
LPTB4000L	87	91	94	98	101	108	115	122	133
LPTB4000M	97	101	104	108	111	118	125	132	143
LPTB4000H	116	120	123	127	130	137	144	151	162

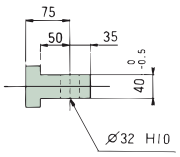
1. This diagram shows a power cylinder with an external limit switch for stroke adjustment.
2. If the stroke is 300mm or less and a limit switch for stroke adjustment is equipped, the limit switch is vertically mounted. Note that the LA dimension becomes larger. (See ④ in Cautions for layout on page 40.)
3. Mechanical stroke has a margin of approximately 10mm on both sides for the nominal stroke.
4. For the cylinder with bellows, the stroke will also not change.
5. For connector part dimensions of the motor terminal box, refer to page 57.

Options

■ Bellows (-J)

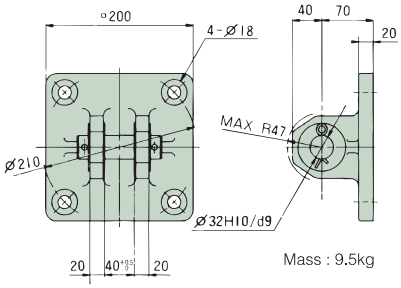


■ I-type end fitting (-I)



Note) Shipped as attached to the main body.
The XA dimensions are the same as the standard U-type end fitting.

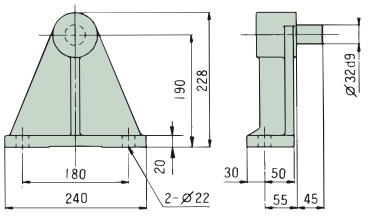
■ Clevis fitting (-C)



Mass : 9.5kg

Note) Shipped attached to the main body.
If it needs to be shipped individually, consult us.

■ Trunnion fitting (LPTB4000-T)



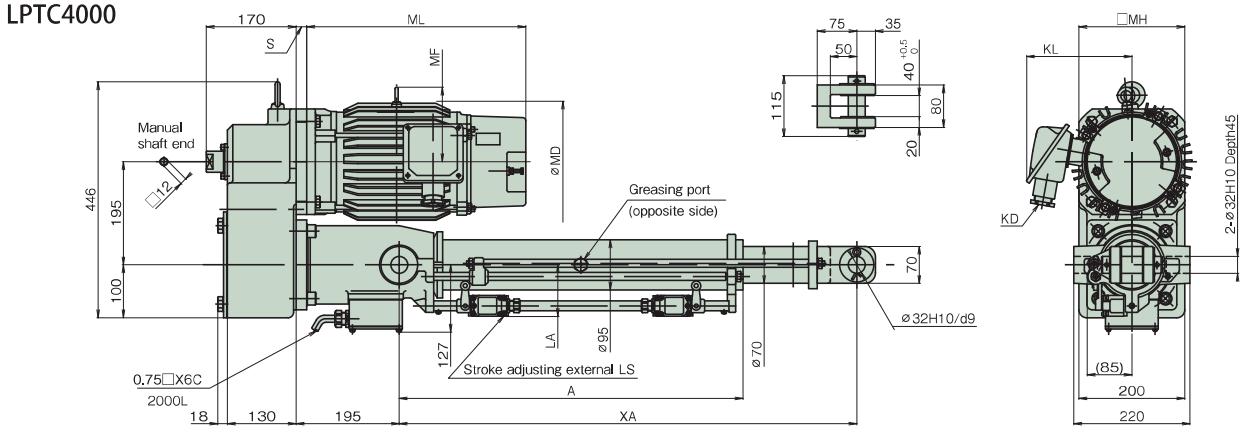
Mass: 16.4kg/set

Note) Apply grease to the trunnion pin and trunnion hole before mounting.

* Dimensions with no tolerance described have general tolerance, and their sizes become larger by approximately 2 to 5mm from the described dimensions. When designing the machine, take the margin into consideration.

Dimensions Table T Series 4000

LPTC4000



Unit: mm

Model	Nominal speed mm/s 50/60Hz	Motor kW	MD	ML	MF	KL	KD	MH	S
LPTC4000S	9/11	0.75	180	289	—	166	A20C	170	90
LPTC4000L	25/30	1.5	194	351		178			—
LPTC4000M	35/42	2.2	194	340	140	178	A25C	200	20
LPTC4000H	60/72	3.7	229	414	146	187			

Unit: mm

Nominal stroke	Thrust kN	Thrust {kgf}	A	XA MIN	XA MAX	LA
200	39.2	4000	440	585	785	182
300			550	695	995	
400			650	805	1205	97.5
500			750	910	1410	
600			850	1020	1620	
800			1050	1235	2035	
1000			1250	1450	2450	
1200			1450	1670	2870	
1500	33.3	3400	1750	1995	3495	

Approximate mass of main body

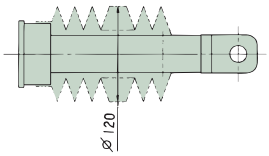
Unit: kg

Model \ Nominal stroke	200	300	400	500	600	800	1000	1200	1500
LPTC4000S	105	109	112	116	119	126	133	140	151
LPTC4000L	102	106	109	113	116	123	130	137	148
LPTC4000M	112	116	119	123	126	133	140	147	158
LPTC4000H	131	135	138	142	145	152	159	166	177

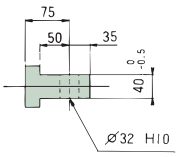
1. This diagram shows a power cylinder with an external limit switch for stroke adjustment.
2. If the stroke is 300mm or less and a limit switch for stroke adjustment is equipped, the limit switch is vertically mounted. Note that the LA dimension becomes larger. (See ④ in Cautions for layout on page 40.)
3. Mechanical stroke has a margin of approximately 10mm on both sides for the nominal stroke.
4. For the cylinder with bellows, the stroke will also not change.
5. Use TC type model in brake individual turnoff.
6. When the model of the TC type nominal stroke 1500mm is used, press and stop cannot be carried out near the maximum stroke in terms of buckling strength.
7. For connector part dimensions of the motor terminal box, refer to page 57.

Options

■ Bellows (-J)

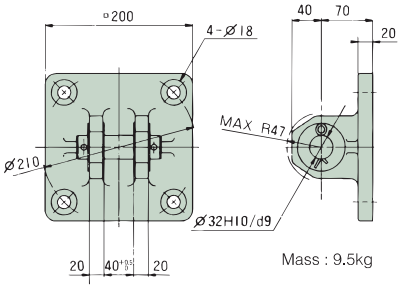


■ I-type end fitting (-I)



Note) Shipped as attached to the main body.
The XA dimensions are the same as the standard U-type end fitting.

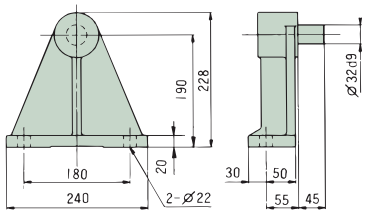
■ Clevis fitting (-C)



Mass : 9.5kg

Note) Shipped attached to the main body.
If it needs to be shipped individually, consult us.

■ Trunnion fitting (LPTB4000-T)



Mass: 16.4kg/set

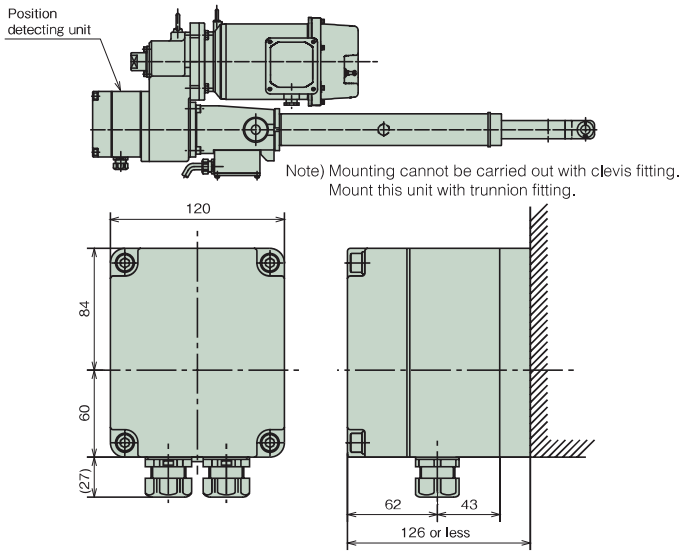
Note) Apply grease to the trunnion pin and trunnion hole before mounting.

* Dimensions with no tolerance described have general tolerance, and their sizes become larger by approximately 2 to 5mm from the described dimensions. When designing the machine, take the margin into consideration.

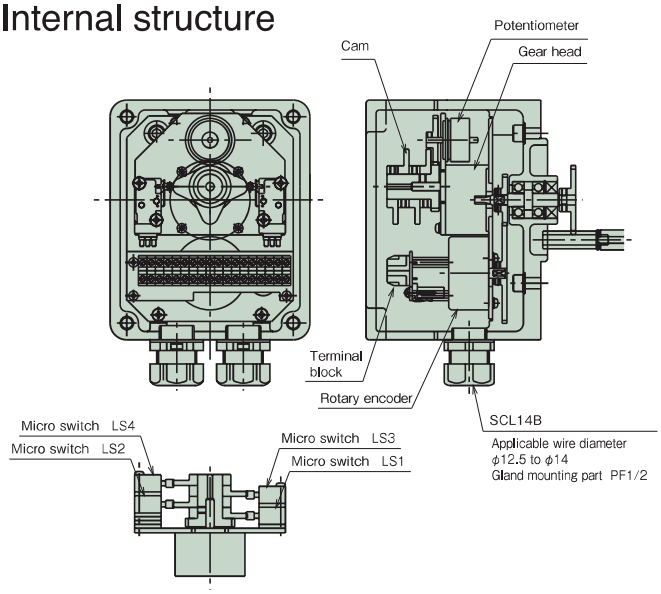
Position detecting unit

The following three types of position detecting devices can be built in as your requested.

1. Position detecting internal limit switch (with two or four switches)
2. Potentiometer
3. Rotary encoder



Internal structure



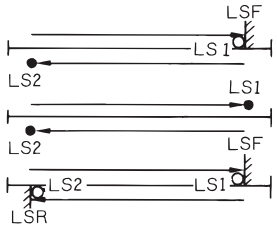
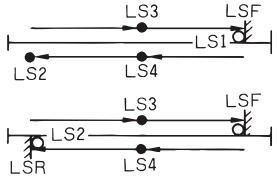
Mass of positional detecting unit Unit: kg

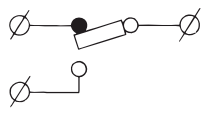
Frame no.	Mass
T500	7.3
T1000	7.6
T2000	8.0
T4000	9.0

1. Position detecting internal limit switch (with two or four switches)

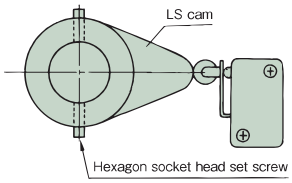
● With two switches (symbol K2) ····· Layout of micro switches LS_1 and LS_2 in the previous diagram

● With four switches (symbol K4) ····· Layout of micro switches LS_1, LS_2, LS_3 and LS_4 in the previous diagram

	Option symbol	Application example	
Position detecting internal LS	K2		Extend: External press stop, position detecting Retract: Determined position stop Both ends determined position stop Both ends external press stop, position detection
Position detecting internal LS	K4		Extend: Middle determined position stop, External press stop, position detection Retract: Two-determined position stop For both extend and retract: External press stop, position detection, Middle determined position stop

Micro switch specification	
Model	D2VW-5L2A-1M (OMRON) Equivalent
Electric configuration	250V AC 4A (cos=0.7)
Contact configuration	1C  For terminal No., refer to page 110.

Note) In the table at the left
- Stops with operation of the micro switch for thrust detection.
- Stops with operation of the micro switch for position detection.
- Detects position with operation of the micro switch for position detection.



<Setting of LS>

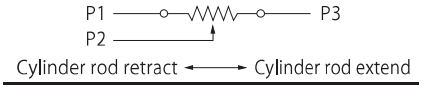
For adjustment of the operating position, operate the power cylinder to adjust the LS cam. Loosen the hexagon socket head set screws (2 pieces) on the LS cam with a hexagon bar wrench (nominal 1.5).

Position detecting unit

2. Potentiometer

This is a variable resistor to output electric signals depending on the stroke amount of the cylinder. Use this unit in combination with a printed board and a stroke indication meter. Resistance values according to the model have been adjusted before shipment.
Separately request preset values according to the model as they are described in the position detecting unit specification drawing. Pay strict attention to handling because correspondence between the stroke position and the resistance value will deviate by rotating the rod of the power cylinder.

Potentiometer specifications	
Model	CP-30 or equivalent
Manufacturer	SAKAE TSUSHIN KOGYO CO., LTD.
Total resistance value	1kΩ
Rated power	0.75W
Dielectric strength	1000V AC 1min.
Effective electric degree	355°±5°
Effective mechanical degree	360°endless
Connection	Connected to terminal block in position detecting unit



3. Rotary encoder

Rotary encoder specifications		
Model	TS5305N251	
Manufacturer	Tamagawa Seiki Co., Ltd.	
Output pulse number	600P/R	
Output waveform	90° phase difference two-phase square wave + home position output	
Output voltage	H	— Note 1)
	L	1V or less Note 1)
Power supply	5 to 24V DC	

The output signal of the standard specification is of an incremental type, however, an absolute type is also available.
The output type in standard specifications is open collector.
If voltage output type is required, see (Note 1) below.
If the specification of line driver output is required, contact us.

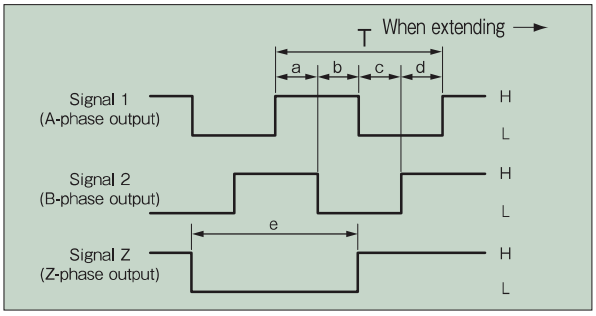
Note 1) Due to the open collector output, output signals are obtained when the pull-up resistor is connected.
Signal 1 and signal 2 are output voltages of H "(power supply voltage – 1)V or more" and L "1V or less."
For the Z-phase, negative logic applies.
<Reference resistance values> 5V: 220Ω, 12V: 470Ω, 24V: 1kΩ

Output connection

Signal 1	Signal 2	Signal Z	+5V to 24V	0V	Case
(9)	(10)	(11)	(12)	(13)	(14)

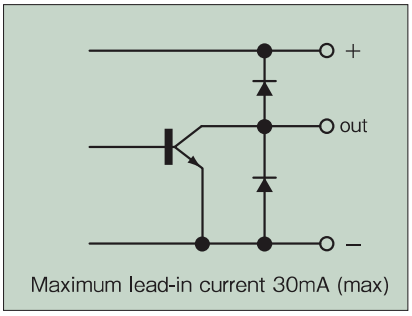
Figures in parentheses indicate terminal No.

Output waveform



a. b. c. d = T/4 ± T/8 T/2 ≦ e ≦ 3T/2

Output circuit



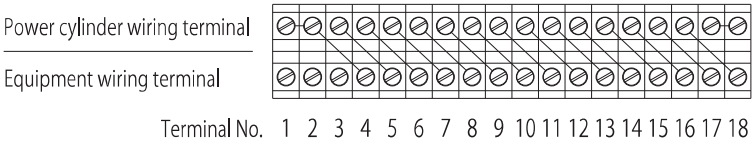
* Best suited to controlling the stroke by a sequencer or programmable controller, etc.
More accurate positioning control is possible in combination with motor speed control by an inverter, etc.

① The standard products incorporate an incremental type encoder.
② The rotary encoder has been set to output 10 pulse per stroke of 1mm.
③ It is possible to set an accurate home position of the machine in combination with a limit switch because home position output is read out every 600 pulses.
④ Do not apply vibration or impact to the rotary encoder because it is precision equipment.
⑤ Use shield wire for wiring to the rotary encoder.
⑥ As a guide for the distance between the rotary encoder and control panel, a collector current of 20mA should be able to be transmitted approximately 50m (12V pull-up).
For distances other than the above, consult with us.

Position detecting unit

Wire connection in position detecting unit

Use terminals provided in the unit for wire connection to the position detecting internal limit switch, potentiometer and rotary encoder.
COM on the internal LS means common use. (internally wire-connected)
Use shield wire for wiring to the rotary encoder.



Option	Internal LS (K2, K4)									Potentiometer			Rotary encoder					
Symbol	LS1		LS2		LS3		LS4		Common use	P			R					
Contact	a	b	a	b	a	b	a	b	c	1	2	3	1	2	Z	+5V to 24V	0V	Case
Terminal No.	18	17	5	6	16	15	7	8	4	1	2	3	9	10	11	12	13	14

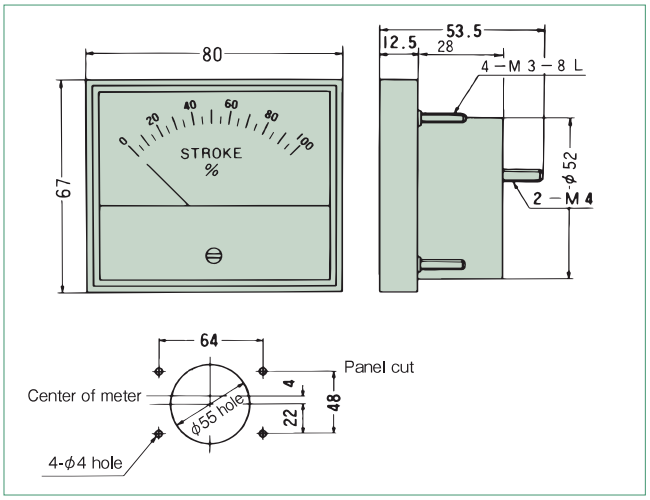
Control option

Stroke indication meter

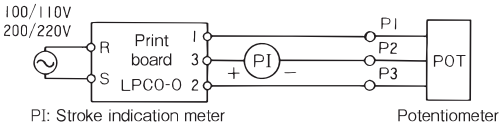
Model	RM-80B(100μA DC) or equivalent
Class	JIS C 1102 2.5 class
Appearance	Frame・black
Scale specifications	Full stroke indicated by 100%

1. Special scale and wide angle gauge are also available at your request.
2. When you want to express scale in other than percentage, indicate this to us.

* A separate printed board is also required.

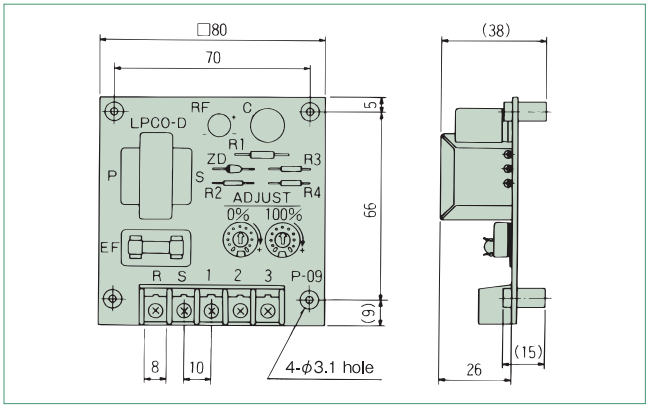


Printed board



Adjust the meter with an ADJUST knob on the printed board. Do not make a mistake with the stroke indication meter +, - . Replace the terminals 1 and 2 on the printed board to set the indication meter to 100% when the stroke is MIN.

Model LPCO-D1 (Operation power source 100/110V 50/60Hz)
LPCO-D2 (Operation power source 200/220V 50/60Hz)



Stroke control for power cylinder

There are various methods of positioning control for the power cylinder. Positioning accuracy greatly varies depending on the speed of the power cylinder, the size of the load, the size of a load inertia, the operating direction (vertical, horizontal) and the wire connection method for the brake. Control methods may be limited depending on the operating condition. As such, what methods there are will be conceptually described here.

Limit switch method

① With stroke adjusting limit switch ····· Positioning of stroke upper and lower limit

② With position detecting limit switch·····Intermediate positioning Accuracy generally increases with lower cylinder speed.

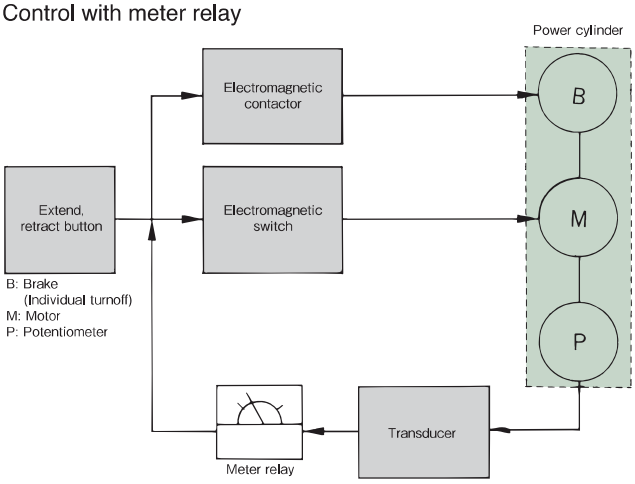
③ Press (pull) stop (Thrust detecting limit switch for T series TC type is used.)

This is a method that stoppers are mechanically provided on both ends of a stroke used for equipment driven by the power cylinder, and press, pull stop are carried out, and then a thrust detecting limit switch for the power cylinder is used. The stroke is mechanically regulated by the stoppers, therefore, accurate positioning is possible.

Method with potentiometer

This method is convenient when you want to change the stroke of the power cylinder on the control side. Accuracy generally increases as the cylinder speed decreases. For the power cylinder body, the method with a stroke adjusting limit switch is recommended to prevent stroke over.

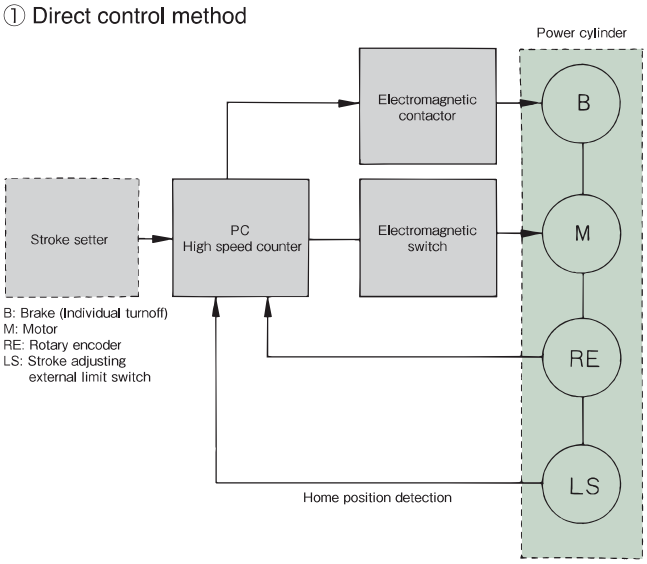
Control with meter relay



Method with rotary encoder (RE)

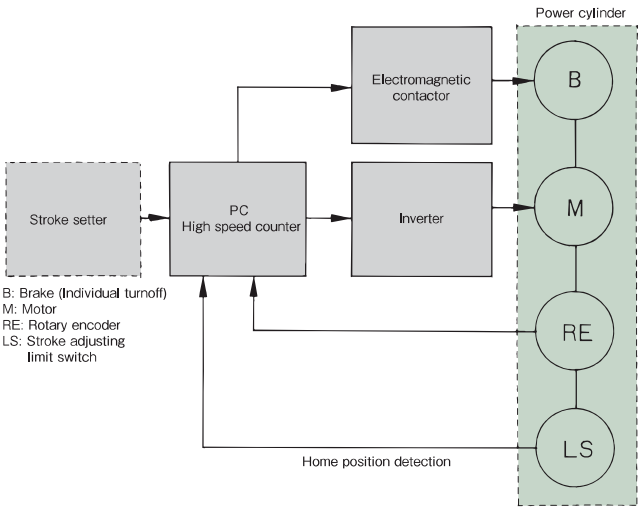
This method controls stroke by a programmable controller (PC). Use the PC with a counter. Use a limit switch to detect home position. (For the power cylinder body, the method with a stroke adjusting limit switch is recommended.)

① Direct control method



With this method, when OFF signals for the motor and the brake are not simultaneously outputted from the PC, and OFF signal for the motor is outputted earlier, the cylinder coasts while decelerating. Highly accurate positioning is possible because the power cylinder operates at a low speed such as output of an operation signal for the brake just before the stop position.

② Motor speed control method



Note that, when a heavy object is moved up or down, or a load with a large inertia is operated, it may not be sufficiently slowed down by any method.

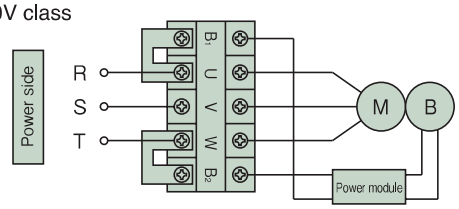
Wire connection

Wire connection for brake motor (Motor with DC brake)

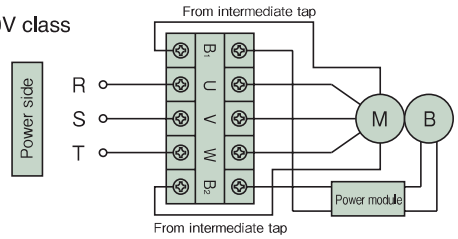
Brake internal wiring (standard)

0.1 to 0.4kW

200V class

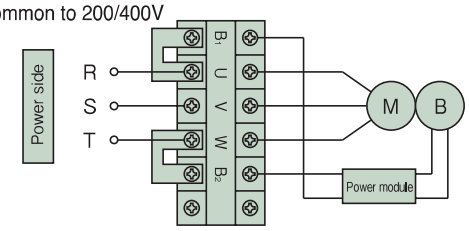


400V class



0.75 to 3.7kW

Common to 200/400V

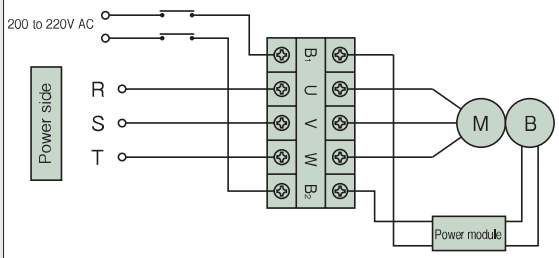


For 5.5kW or higher,
use brake external wiring.

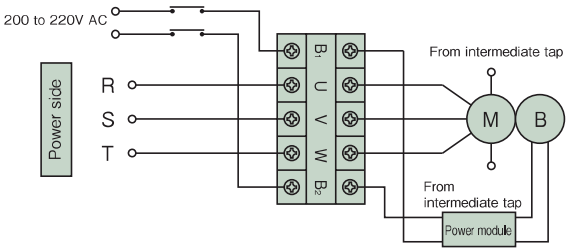
Brake external wiring

0.1 to 0.4kW

200V class

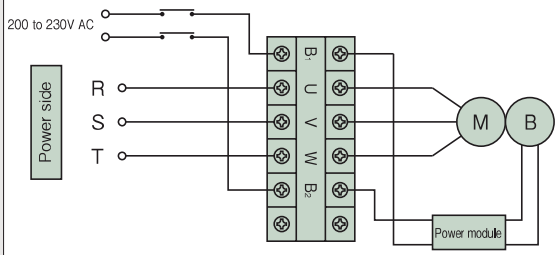


400V class

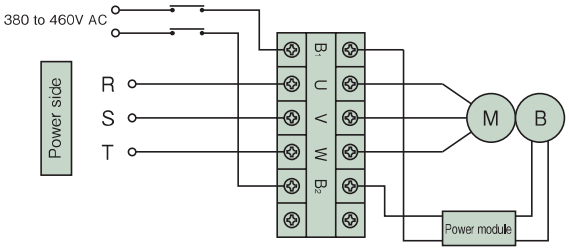


0.75 to 3.7kW

200V class

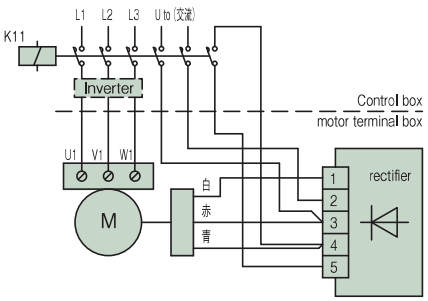


400V class



5.5kW or more

Common to 200/400V



Rod operating direction
(In the case of connection on upper surface)

LPTB/LPTC250 to LPTB/LPTC4000

Rod extend

* Crimp contact bolt: M4

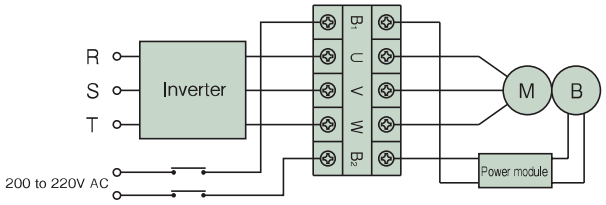
Wire connection

◎ Wire connection method when inverter is used or brake is used in individual turnoff

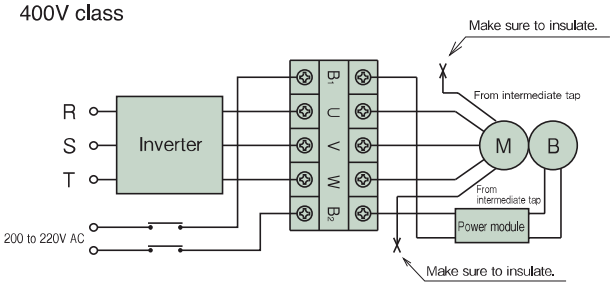
DC brake

- If the motor is operated by the inverter, it is necessary to individually turn off the brake. When individually turning off the brake, as shown in the following diagram, remove the short piece, and do not connect wire to the brake power module from the inverter output, apply a normal power voltage. Separately provide a power supply shown in the following diagram and apply power to the brake power module. If separate power cannot be provided, decrease the voltage by a transformer. Use a transformer whose the capacity is more than necessary, and check that there is no voltage drop. And if the motor voltage of 0.1 to 0.4kW is 400V class, also remove the wire from the motor intermediate tap and insulate it.
- If the motor voltage of 0.4kW or less is 400V class, remove the wire from the motor intermediate tap and insulate it, and separately provide a power supply of 200V to 220V and apply power to the brake power module. If there is no power source of 200V to 220V, decrease the voltage to 200V to 220V by a transformer. The capacity of the transformer shall be 90VA or more, and check that there is no voltage drop. Use an electromagnetic contactor for the brake of 200V class with a rated load of 250V AC, 7A or more. For the 400V class, use an electromagnetic contactor with a contact voltage of 400 to 440V AC, an induction load of 1A or more (e.g. electromagnetic contactor for AC motor 2.2kW). The power module includes a surge absorbing protection element. Add a protection element for the contact in each part if necessary.
- Do not put a relay contact on the output side of the standard power module (between the power module and brake coil). When carrying out [DC individual turnoff wiring] in which the relay contact is put into the position, contact us beforehand.

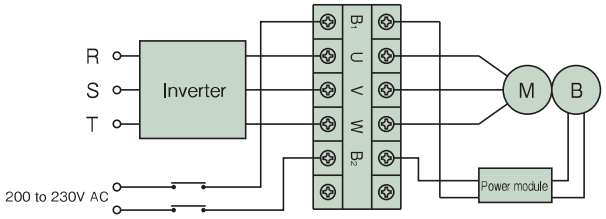
0.1 to 0.4kW
200V class



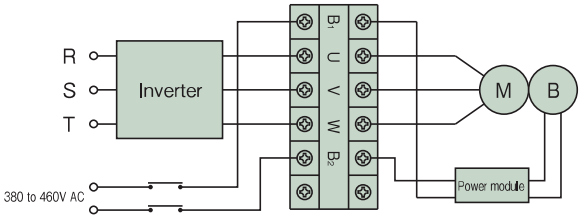
0.1 to 0.4kW
400V class



0.75 to 3.7kW
200V class

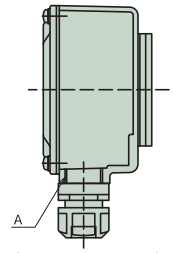
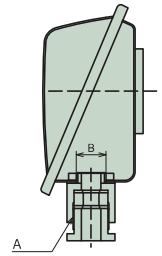


0.75 to 3.7kW
400V class



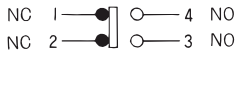
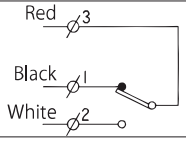
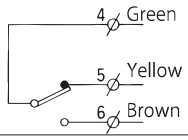
Wire connection

Dimensions of motor terminal, connector part

Shape of terminal box	Motor capacity	Shape of connector	Applicable cable outer diameter	Connector part mounting dimension A	Terminal box seat hole dimension B
 (0.4kW or less)	0.1kW to 0.4kW	SK-14L	ϕ11 to ϕ13	PF 1/2	—
 (0.75kW or more)	0.75kW to 1.5kW	A20C	ϕ14 to ϕ15	PF 3/4	ϕ28
	2.2kW to 7.5kW	A25C	ϕ19 to ϕ20	PF 1	ϕ35

Note) A rubber plug or plate has been inserted into the connector to prevent water etc., from intruding before shipment.
Make sure to remove it when using.

Limit switch specifications

	Stroke adjusting external LS	Thrust detecting LS	
Limit switch type	WLCA2(OMRON) or equivalent	V-165-1AR5(OMRON) or equivalent	
Electric capacity	250V AC 10A (cosϕ=0.4)	250V AC 10A (cosϕ=0.4)	
Contact configuration	1a 1b 	Extending 	Retracting 
Connector (Applicable cable outer diameter)	SCS-10B (ϕ8.5 to ϕ10.5) PF1/2	SCL-14A (ϕ10.5 to ϕ12.5) PF1/2	

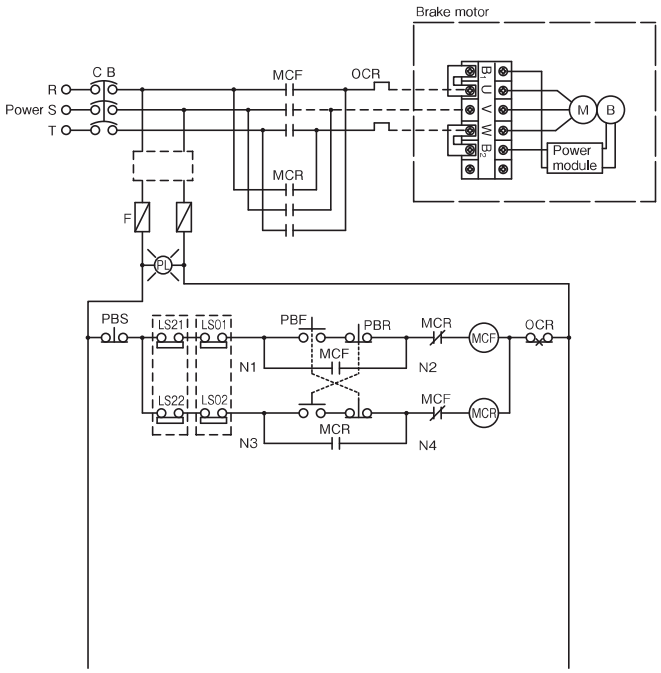
Motor current value • brake current value

Output frame No.	Motor current value (A)						Brake model No.	Brake current value (A)					
	200V 50Hz	200V 60Hz	220V 60Hz	400V 50Hz	400V 60Hz	440V 60Hz		200V 50Hz	200V 60Hz	220V 60Hz	400V 50Hz	400V 60Hz	440V 60Hz
4P - 0.1kW	0.72 (2.76)	0.62 (2.60)	0.65 (2.84)	0.36 (1.38)	0.31 (1.27)	0.32 (1.41)	SBH01LP	0.18 0.27	0.18 0.27	0.19 0.29	0.18 0.27	0.18 0.27	0.19 0.29
4P - 0.2 kW	1.3 (4.91)	1.1 (4.68)	1.1 (5.14)	0.63 (2.40)	0.55 (2.22)	0.56 (2.41)	SBH02LP	0.18 0.27	0.18 0.27	0.19 0.29	0.18 0.27	0.18 0.27	0.19 0.29
4P - 0.4 kW	2.4 (11.6)	2.1 (10.2)	2.1 (11.0)	1.2 (5.14)	1.1 (4.88)	1.1 (5.39)	SBH04LP	0.18 0.27	0.18 0.27	0.19 0.29	0.18 0.27	0.18 0.27	0.19 0.29
4P - 0.75 kW	3.9 (24.0)	3.5 (22.0)	3.4 (24.0)	1.9 (12.0)	1.7 (11.0)	1.7 (12.0)	SLB07LP	0.18 0.27	0.18 0.27	0.20 0.30	0.09 0.15	0.09 0.15	0.10 0.16
4P - 1.5 kW	6.5 (49.0)	6.1 (45.0)	5.8 (50.0)	3.2 (24.5)	3.1 (22.5)	2.9 (25.0)	SLB15LP	0.18 0.29	0.18 0.29	0.20 0.32	0.09 0.15	0.09 0.15	0.11 0.16
4P - 2.2 kW	9.4 (63.7)	8.9 (58.2)	8.3 (63.0)	4.7 (31.8)	4.4 (29.1)	4.2 (31.5)	TBA22	0.18 0.29	0.18 0.29	0.20 0.32	0.09 0.15	0.09 0.15	0.11 0.16
4P - 3.7 kW	14.8 (104)	14.3 (87.9)	13.2 (98.0)	7.4 (52.0)	7.1 (43.9)	6.6 (49.0)	TBA37	0.10 0.30	0.10 0.30	0.10 0.30	0.05 0.15	0.05 0.15	0.05 0.15

Note) 1. The above values are rated current values of the motor and brake. A numerical value in parentheses is a start current value of the motor.
2. The rated current values and start current values do not include a brake current value.
3. A DC brake is used as a brake. The upper stage of the brake current value indicates a value on the primary side of the power module, and the lower stage indicates a value on the secondary side.
4. The above values are references because the rated current values for the power cylinder vary depending on operating conditions.
5. For simultaneous turnoff of 0.1kW to 0.4kW, 400V class, the voltage is converted to 200V through the motor intermediate tap to be input. For individual turnoff, decrease the voltage to 200 to 220V by a transformer. The capacity of the transformer capacity shall be 90VA or more.
6. For individual turnoff of 0.75kW or more, 400V class, the DC module is applicable for 400V class, therefore, it is unnecessary to decrease the voltage.
7. For 0.75kW and 1.5kW of 400V class, the brake model Nos. are "SLB07LPV" and "SLB15LPV," respectively.

Reference circuit

0.75 to 3.7kW TC type reference circuit diagram



LS01: Stroke adjusting external limit switch for extending

LS21: Thrust detecting limit switch for extending

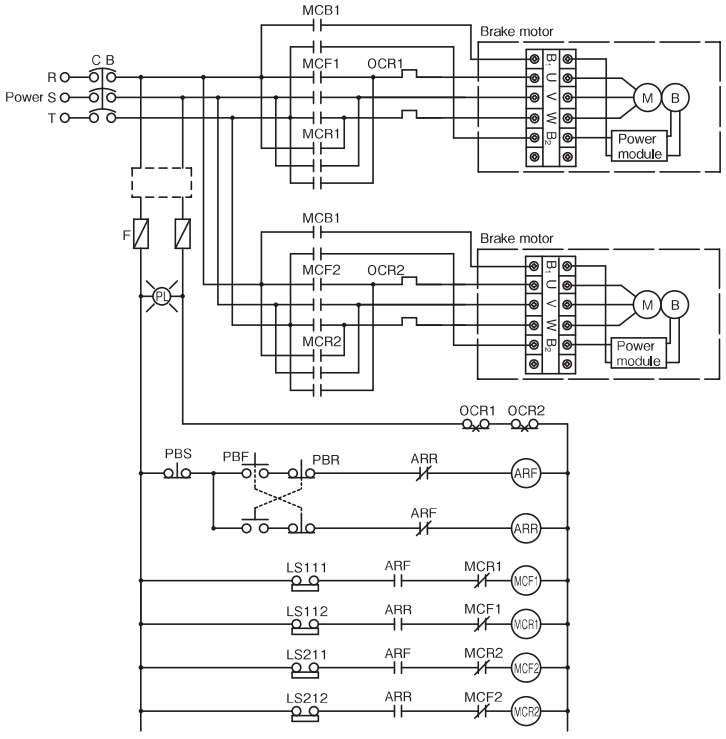
LS02: Stroke adjusting external limit switch for retracting

LS22: Thrust detecting limit switch for retracting

NOTE :

(1) This diagram is an example when the thrust detecting limit switch is used for overload protection.
(2) This diagram shows a single-acting circuit. When using in an inching circuit, remove wire connection between N1 and N2, N3 and N4 and short-circuit the PBS.
(3) If the power source voltage for the motor is different from the control voltage, place a transformer into a [ ] portion in the diagram.
(4) The lead wires B1 and B2 for the brake are connected to the motor terminal blocks U and W using short pieces.
(5) When individually turning off the brake, remove the short piece and apply a normal power source voltage other than inverter output to B1 and B2 from the outside.

0.75 to 3.7kW Brake individual turnoff two units multiple reference circuit diagram



LS111: LPNo.1 Stroke adjusting external limit switch for extending LS1

LS112: LPNo.1 Stroke adjusting external limit switch for retracting LS1

LS211: LPNo.2 Stroke adjusting external limit switch for extending LS2

LS212: LPNo.2 Stroke adjusting external limit switch for retracting LS2

NOTE :

(1) This diagram is an example of 0.75kW or more brake individual turnoff two units inching multiple circuit.
(2) If the power source voltage for the motor is different from the control voltage, place a transformer into a [ ] portion in the diagram.
(3) As the brake terminal blocks B1 and B2 are connected to the motor terminal blocks U and W using short pieces, remove the short pieces before use.
(4) Apply a normal power source voltage other than inverter output to B1 and B2 from the outside.

Installation

Installation direction

Any of horizontal, vertical and inclined direction is allowed.

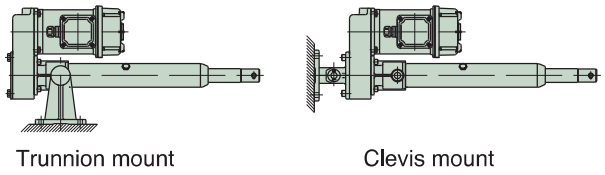
Installation method

For installation of the power cylinder, use a trunnion mount or clevis mount.

Apply grease to the trunnion pin and the bracket hole before mounting.

Install either a U-type or I -type end fitting.

Fig. 1 Installation method



* For the mount fitting, refer to the item of options.

Manual operation

When manually adjusting the stroke, rotate the manual handle shaft on the reducer part with a wrench after releasing the brake for the brake motor.

⚠ WARNING

When load is applied to the rod, remove the load before releasing the brake.

For the rod of movement per one turn of the manual shaft, refer to the standard model list (page 35).

Rod rotation

1. Anti-rod rotation is required because a rotating force is generated on the rod with thrust (refer to page 35). Generally, rotation can be mostly prevented by installing the rod end to a driven machine.
2. When operating with the end set free or in the case of application to install pulleys to pull a rope, a rod anti-rotation is normally required.

Lateral load on rod

Install the power cylinder so as to prevent bending load (lateral load) from acting on the rod.

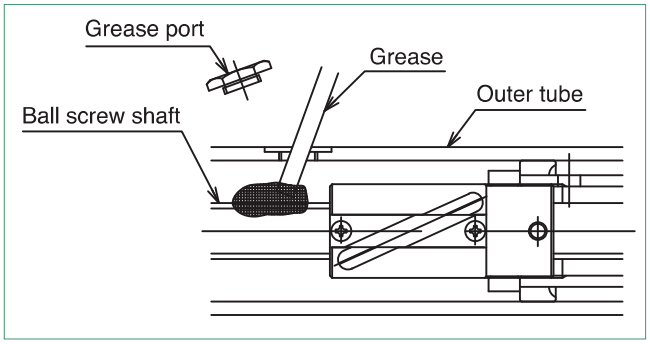
Setting of stroke adjusting external LS

- Take a coasting amount into consideration for adjustment of the limit switch.
- When using the cylinder at the nominal stroke 100%, set the limit switch so that the cylinder stops within the XA dimension in the Dimensions Table.
- When simultaneously operating two or more power cylinders, install a limit switch at the upper limit and lower limit on each cylinder.

Maintenance

Lubrication on ball screw

Use the ball screw as it is because it has been lubricated with grease in advance. Refill grease with reference to Table 1-2 as a guide. To apply grease to the ball screw, remove the greasing port bolt on the outer cylinder and advance the rod in the full stroke and apply grease to the outer circumference of the screw with a grease gun, and then reciprocate the rod within the stroke to be used. Repeat this operation a few times.



Apply 10 to 15g per 100mm stroke

⚠ WARNING

Never insert your finger into the greasing port.

If the cylinder operates with your finger inserted, your finger may be injured.

Table 1 Recommended grease

Use classification	Company name	Grease name
Screw shaft	TSUBAKI	JWGS100G
	IDEMITSU KOSAN	*DAPHNE EPONEX SRNo.2
	NIPPON GREASE	NIGULUBE EP-2K
	EXXON MOBILE	MOBILUX EPNo.2
	COSMO OIL LUBRICANTS	COSMO GREASE DINAMX EPNo.2
	SHOWA SHELL	SHELL ALBANIA EP grease 2

* The above greases are filled before shipment.
Note) JWGS100G is separately sold in a container of 100g.

Table 2 Lubrication cycle

Operating frequency	Lubrication cycle
500 to 1000 times/day	Three to six months
100 to 500 times/day	Six months to one year
10 to 100 times/day	One to one and half year

Note) The above values are for longer use, and do not indicate the life.

Greasing on Reduction part

For the gear and the bearing in the reducer part, the gear case is filled with grease. It is not necessary to grease refill.

Reducer part initial filled grease

Gear case: DAPHNE EPONEX SRNo.1 IDEMITSU KOSAN

Planetary gear (straight type): Moly gear grease No. 1 SUMICO LUBRICANT CO., LTD.

⚠ WARNING

■ Cautions for selecting

- Anti-rod rotation is required because a rotating force is exerted on the rod with thrust. Rod rotating forces at the rated thrust are described in the model list. When operating with the end unconnected or when installing pulleys to pull rope, use an optional rod anti-rotation specification.
- When the cylinder operating stroke is short, a high speed type cylinder cannot be used because the operating time per one stroke becomes shorter and cannot be actually controlled. The following table shows minimum necessary strokes when motor energization time is 0.5s. Refer to this table to determine the speed.

Speed symbol	H
Nominal speed mm/s 50/60Hz	100/120
0.5s operation moving amount mm	50/60
Predicted maximum coasting amount mm (Reference)	24/33
Minimum necessary stroke mm	74/93 or more

■ Cautions for installation

- Apply grease to the trunnion pin and the trunnion hole for trunnion mounting.
- Also, apply grease to the connecting pin of the end fitting and the connecting pin for clevis mounting.
- When the main body greatly swings by operation of the cylinder, consider using a sliding bearing or a rolling bearing for the connecting part. Cylinders whose trunnion hole is provided with sliding bearing are available as MTO.
- When the trunnion pin or connecting pin for the clevis or the end fitting is directed in the vertical direction (when the cylinder is laid horizontally), and the main body swings, take countermeasures for wear such as inserting a bearing member into the trunnion hole, the clevis fitting, or the side part of the end fitting.
- All models are totally enclosed structures so that they can be used normally outdoors, however, under adverse conditions exposed to constant water and steam etc., and snow accumulation, although they are an outdoors type, an appropriate cover is required. The power cylinder can generally be used in a range of -15℃ to 40℃, although it varies depending on the use conditions. When using at 40℃ or higher, always protect with a heat insulating cover, etc. Never use in a flammable atmosphere, otherwise it may cause an explosion and fire. In addition, avoid using it in a location where vibration or shock exceeding 1G is applied.
- When using a cylinder of the cabtire cable lead wire specification outdoors, carry out waterproofing treatment sufficiently.

■ Cautions for use

- Regulate the both ends of the stroke by the limit switch. Select a type of option which allows the limit switch to be mounted on the power cylinder body.
- Use within the stroke range. If the stroke is exceeded, breakage may occur.
- As a high-speed type (H speed) of the power cylinder T series has a long coasting distance, the striker may override the limit switch. For this reason, make sure to allow a limit signal to be self-held on the control circuit.
- Megger testing is prohibited for this cylinder. It may break the built-in power module. Remove the brake wiring for the terminal block when conducting megger testing of the external circuits.
- Adjustment of the limit switch for thrust detection of the TC type must not be carried out by the customer. The preset value for thrust detection may greatly change.

MEMO