

## Power Cylinder

# Multi series

### Thrust : 4.94kN to 314kN {500kgf to 32000kgf}

This is a power cylinder that allows multiple use of cylinders to completely synchronize by one motor. Compact economy type (LPTB) and thrust detecting type with a safety device (LPTC) are available. Select a type according to the application.

- **Tough configuration**

Operating part to carry a load is separated from the reduce part. There is no change in gear tooth contact due to fluctuation load.

- **multiple use of some units is allowed**

multiple use of some units is allowed by use of an input shaft with sufficient strength.

- **Long life**

Long life is realized by adopting a ball screw with a large load capacity.

- **Swinging operation is allowed**

Since the input shaft and trunnion part have the same shaft center, swing is allowed while linkage operation is performed.

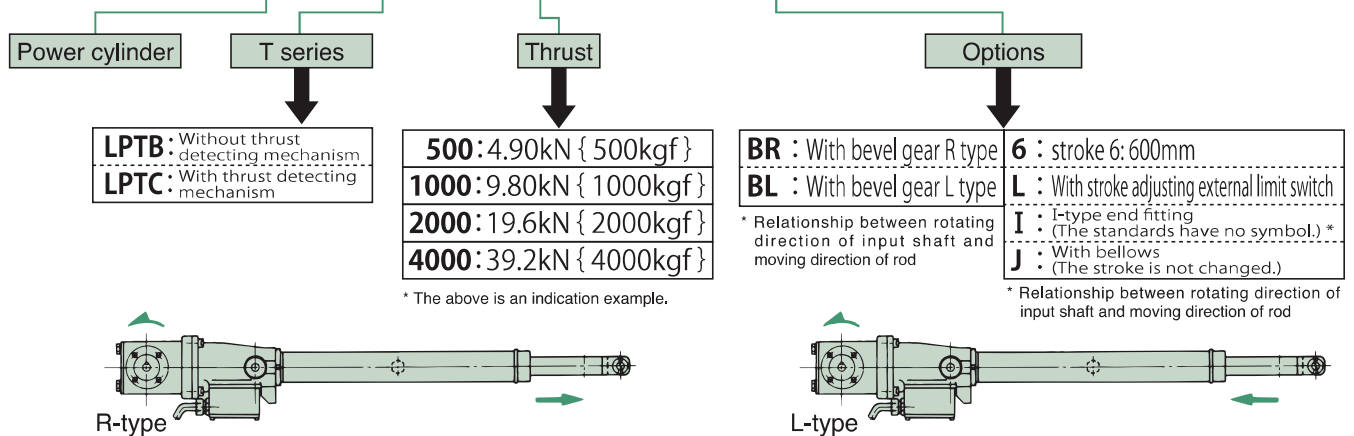
- **Safety**

Thrust detecting mechanism to detect overload and protect can be built in. (LPTC)



## Model No. designation

# LP TB 1000 BR6LIJ



## Standard model list

Power cylinder model	LPT500B	LPT1000B	LPT2000B	LPT4000B	LPT6000B	LPT8000B	LPT12000B	LPT16000B	LPT32000B
Rated thrust	kN	4.90	9.80	19.6	39.2	58.8	78.4	117	156
		{ kgf }	500	1000	2000	4000	6000	8000	12000
Screw lead	mm	6	8	10	12	12	16	16	24
Gear ratio		2	2	2	2	2	2	2	2
Total efficiency	%	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
No-load idling torque	N•cm	0.74	2.06	5.19	14.7	23.5	108	160	331
	{ kgf • cm }	0.075	0.21	0.53	1.5	2.4	11	16.3	33.8
Holding torque	N•m	1.78	4.74	11.9	28.4	42.7	75.9	114	228
	{ kgf • m }	0.18	0.48	1.21	2.90	4.35	7.74	11.6	23.2
Allowable input torque	N•m	11.0	29.3	73.2	176	264	471	353	707
	{ kgf • m }	1.12	2.99	7.47	17.9	26.9	48.1	36.1	72.2
Required input torque to rated thrust Note 2)	N•m	2.74	7.32	18.3	43.9	65.9	118	177	354
	{ kgf • m }	0.28	0.75	1.87	4.48	6.73	12.0	18.0	36.1
Rod movement in one turn of input shaft	mm	3	4	5	6	6	8	8	12
Maximum input rotation speed Note 3) r/min	L P T B	2400	1800	1080	720	500	382.5	255	180
	L P T C	1200	900	720	420	300	270	165	120
Rod rotation force at rated thrust	N•m	5.20	13.8	34.7	83.2	124	222	333	666
	{ kgf • m }	0.53	1.41	3.54	8.49	12.7	22.6	34.0	67.9
Stroke	mm	200, 300	200, 300	200, 300	200, 300	500	500	500	500
		400, 500	400, 500	400, 500	400, 500	1000	1000	1000	1000
		600, 800	600, 800	600, 800	600, 800	1500	1500	1500	1500
					1000, 1200		2000	2000	2000
Approximate weight	kg	21 to 25	25 to 35	39 to 51	102 to 137	122 to 174	187 to 256	206 to 318	337 to 502

Note 1) Allowable torque for only input shaft. (Check this torque before multiple operation.)

Note 2) Values including no-load idling torque.

Note 3) When intending to use exceeding the maximum input rotation speed, consult us beforehand.

Note 4) When using at half of the rated thrust or lower, contact to Tsubaki.

## Standard use environment

Environment	Ambient temperature	Impact resistance value
Outdoor type	−20°C to 80°C	3 G or less

1) This use environment shows values for the power cylinder body only. For a driving part other than this standard, consider separately.

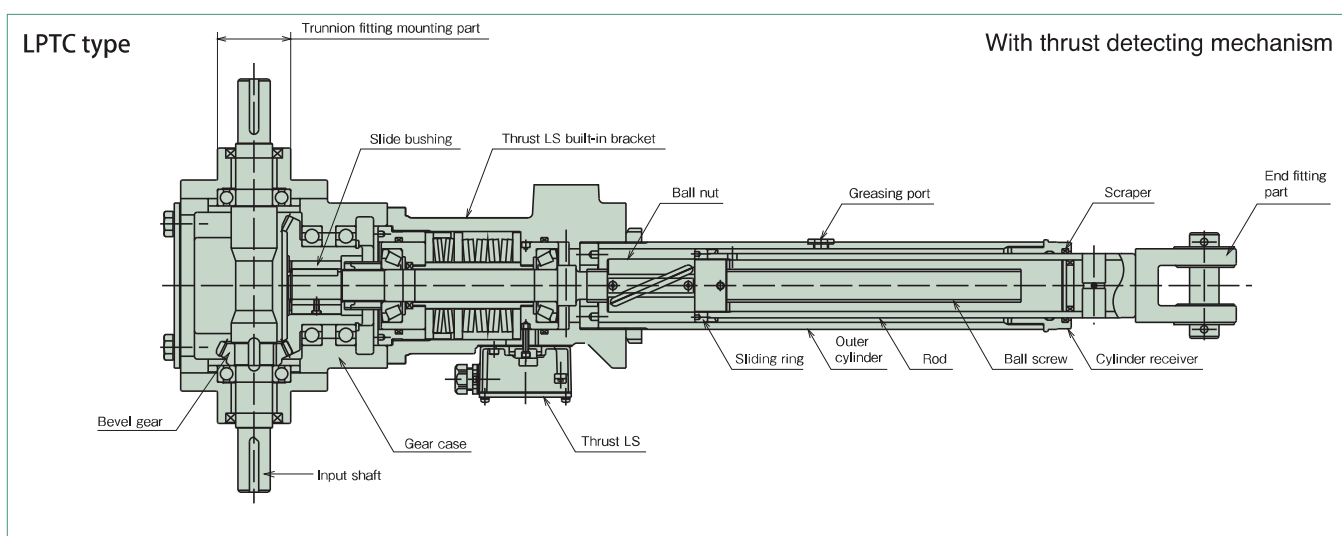
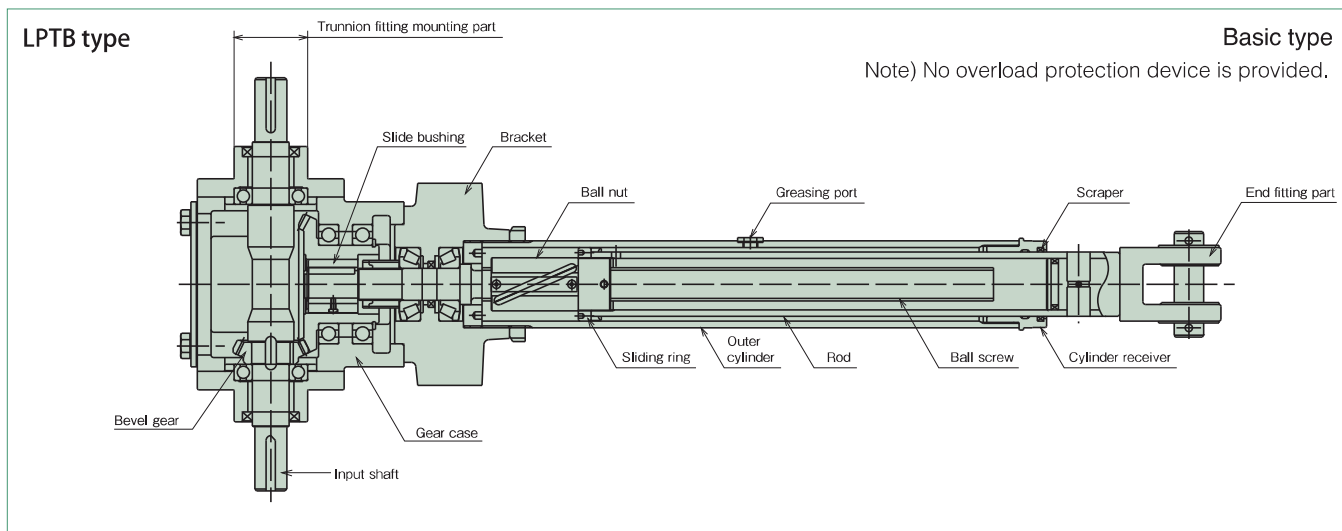
2) Power cylinders with bellows are recommended in an excessively dusty location.

3) For locations exposed to sea breezes and salt, it is possible for some specifications such as painting specifications, structure of adjusting limit switch to be changed.

## Painting color

TSUBAKI olive gray (Munsell 5GY6/0.5 Approximate color)

## Structure



\* Structure slightly varies depending on model.

**Operating part** — The operating part uses a ball screw to convert rotating force into linear motion. And this part is equipped with an external limit switch for stroke adjustment. Adopts a ball screw of high transmission efficiency and high load capacity, and has features of long life and easy maintenance. The stroke can be freely adjusted by the external limit switch. Additionally, the bellows are extremely weather resistant and the stroke does not change, even when fitted.

**Reducer part** — The reducer part adopts a spiral bevel gear, and has high transmission capacity due to special heat treatment. The spiral gear is supported by a dedicated bearing so there is no thrust force effect. Therefore the tooth contact does not change even with load variation. Transmission capacity is also ensured. Since the input shaft and trunnion fitting have the same shaft center, swing motion is allowed. Lubrication for the reducer part is a grease bath type.

## Classification of usage for LPTB and LPTC types

Both types of the power cylinders have the same basic functions (thrust, speed, stroke), however, the features of each mechanism will differ. Read the following to select the optimum type.

### TB type

#### ● Basic type (without overload protection device)

\* For mechanical protection and for electric overload detection on the input side, combination with our shock relay is recommended.

### TC type

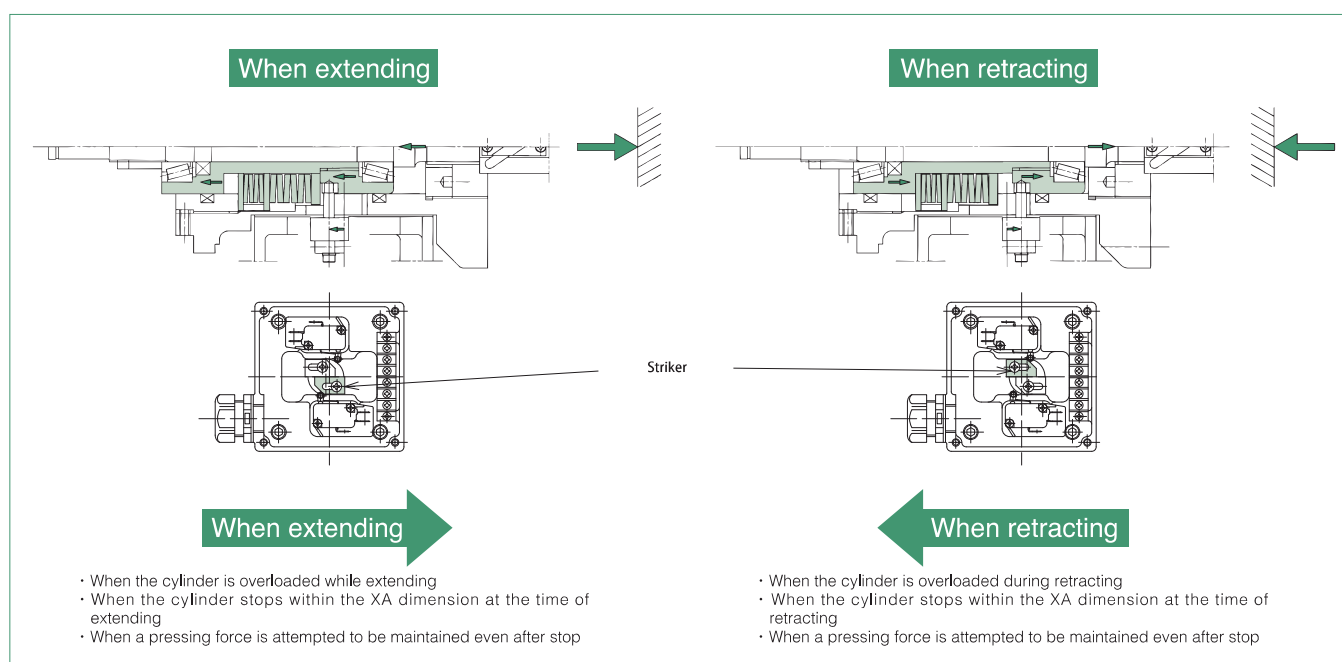
#### ● Thrust detecting mechanism type

This type exerts its effect in the following cases.

- ① When performing press (pull) stop
  - ② When requiring electric signal at overload
  - ③ When overload is possibly applied from load side during stoppage
- When overload is impulsively applied, the incorporated spring deflects to absorb an 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 combination effect of these disc springs also allows for press and stop of high speed type. (There is only one type for the 6000 type or larger.)



## 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 reference total stop times for each model in the table below.

Type	LPTC250 to LPTC4000			LPTC6000 to LPTC32000		
	S,L	M	H	S,L	M	H
Reference total stop times (x 10 <sup>4</sup> times)	30	10	5	10	3	1

Note) When the power cylinder is used with press (pull) stop and with internal stop, the wire connection for the brake is recommended to be external wiring.

Note) When the power cylinder is used exceeding the value in the above table, it is recommended to stop with the stroke adjusting LS, however, when press (pull) stop, or internal stop is required due to circumstances of the equipment, consult us.

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 run or stroke position control is performed

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 degree of deflection.

When the load is eliminated, the rod returns to the original position.

## Selection of cylinder

### 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, number of cycles/min.
6. Hours of operation and annual number of operating days
7. Type of load of machine used
8. Environment of use

### Selection procedures

1. Select either one of LPTB or LPTC according to the application.
2. Determine an operation factor from characteristics of load, and machine to be used.
3. Determine annual traveling distance from the stroke, frequency of operation and hours of operation.

$$\text{Annual traveling distance (km)} = \text{Actual stroke (m)} \times \text{Frequency of use/day} \times \text{number of operating days} \times 10^{-3}$$

4. If load greatly varies in the middle of the stroke, calculate the equivalent load 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 }

5. Multiply equipment maximum load by operation factor, and for multiple operation, divide by multiple factor and number of multiple units to obtain corrected thrust.

$$\text{Corrected thrust} = \frac{\text{Equipment maximum load} \times \text{operation factor}}{\text{number of multiple units} \times \text{multiple factor}}$$

#### ● Operation factor

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

Note) The above operation factor table shows general guidelines. As such, determine in consideration of operating conditions.

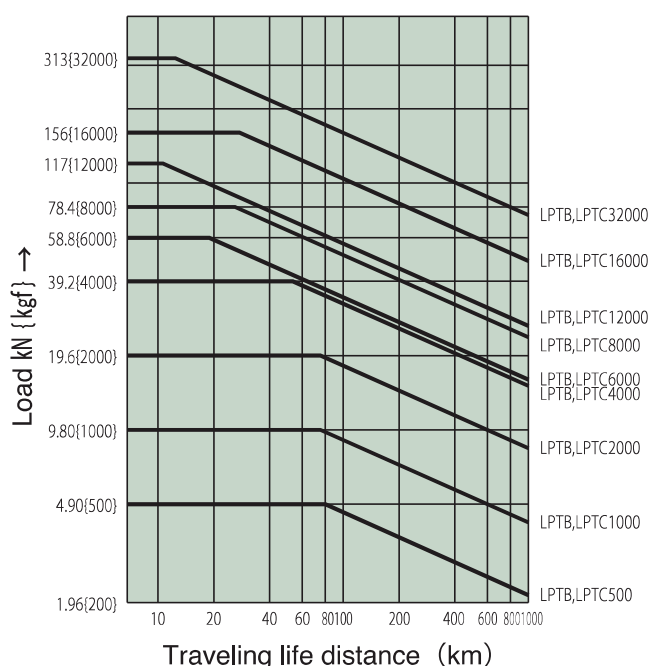
#### ● Multiple factor

Number of multiple (units)	2	3	4	5	6
multiple factor	1.0	1.0	1.0	0.8	0.67

Note ) Number of multiple units is up to six units.

6. Select model No. to be used from the standard models based on the corrected thrust and stroke.
7. Calculate life from the load – life chart and compare it with the annual traveling distance to check the life.

Load-Life chart



The life distance has been calculated from  $B_{10}^*$  life.

\*  $B_{10}^*$  life is a life which 90% or more of a group of the same ball screws which are operated under the same condition expire without flaking.

## Selection of driving source

As a driving motor, motors with a speed reducer, DC motors, servomotors or ball change motors are available. The motor to be used rotates in reverse by load because the power cylinder is highly efficient. Make sure to use a motor with a brake. Use a brake of a spring close type and with brake torque 150% or more.

- Select a driving motor according to the following equation.

Calculate necessary input torque and use a motor which satisfies the calculated torque value.

For specifications of the power cylinder, refer to page 67.

$$T = \frac{W \times \ell}{2 \times \pi \times R \times \eta \times 1000} + \frac{T_0}{100}$$

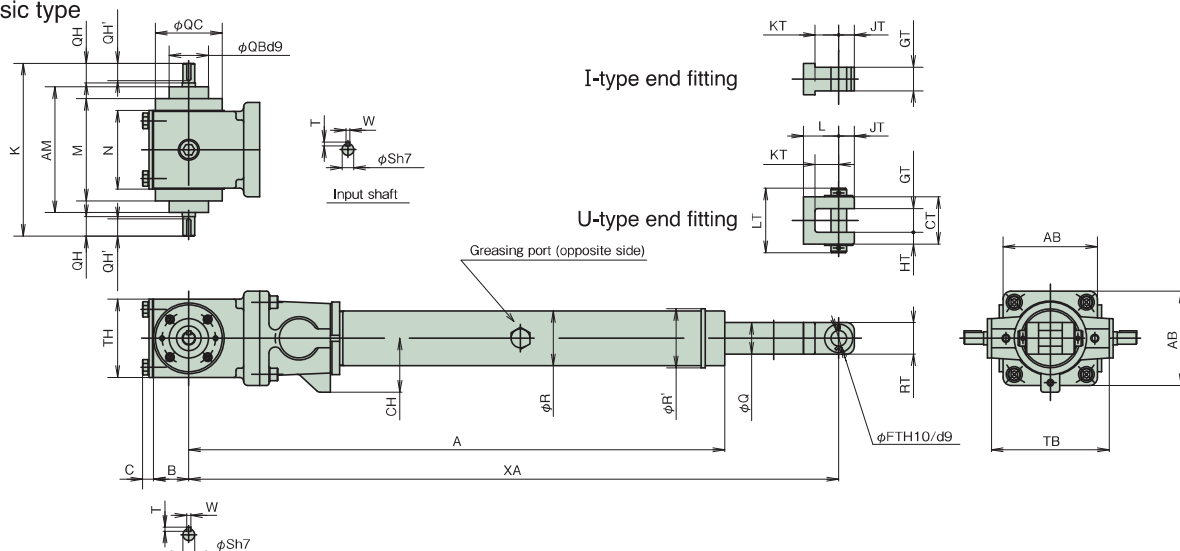
$T$  : Necessary input torque N · m { kgf · m }  
 $W$  : Load N { kgf }  
 $\ell$  : Screw lead mm  
 $R$  : Gear speed ratio=2  
 $\eta$  : Total efficiency=0.855  
 $T_0$  : No-load idling torque N · cm { kgf · cm }

Note) Note that, if any motor of a larger capacity than necessary is used, when it is locked in the course of the stroke, impact load acts on the power cylinder due to rotation energy of the motor, resulting in breakage.

Wire connection should be carried out according to brake individual turnoff.

## Dimensions Table

LPTB basic type



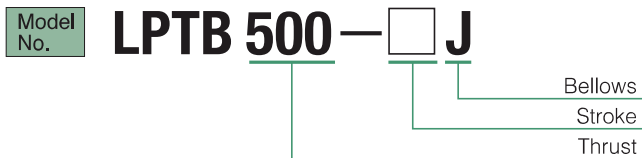
Unit: mm

Unit: mm																																		
Model	Stroke	Length		Input shaft						Input shaft bracket				Gear case				Bracket inner/outer cylinder						End fitting										
		A	X <sub>MIN</sub>	S	W	T	QH	QH'	K	QB	QC	AM	M	AB	TH	B	C	N	CH	TB	Q	R	R'	RT	CT	GT	HT	LT	KT	L	JT	FT		
LPTB 500	200	470	565																															
	300	570	675																															
	400	670	785																															
	500	770	895	15	5	5	25	22	220	50	85	160	130	120	100	45	14	100	68.5	130	35	58	63	36	50	25	12.5	69	25	35	18	16		
	600	870	1000																															
	800	1070	1220																															
1000	200	500	605																															
	300	600	715																															
	400	700	825	15	5	5	25	22	220	50	85	160	130	120	100	45	14	100	48	150	40	70	75	40	60	30	15	82	30	45	20	20		
	500	800	935																															
	600	900	1040																															
	800	1100	1260																															
2000	200	560	680																															
	300	660	790																															
	400	760	900	20	6	6	30	25	270	60	110	200	160	130	130	55	17	130	71	180	50	76	81	50	70	35	17.5	99	40	60	25	25		
	500	860	1010																															
	600	960	1115																															
	800	1160	1335																															
4000	200	645	780																															
	300	745	890																															
	400	845	1000																															
	500	945	1105	35	10	8	70	60	450	80	160	300	230	190	190	80	19	190	90	220	70	95	100	70	80	40	20	115	50	75	35	32		
	600	1045	1215																															
	800	1245	1430																															
1000	1445	1645																																
1200	1645	1865																																
6000	500	1075	1230																															
	1000	1575	1780	35	10	8	70	60	480	80	160	330	260	220	220	80	26	220	—	260	80	115	—	80	—	45	—	—	65	—	40	40		
	1500	2175	2430																															
8000	500	1145	1310																															
	1000	1645	1860	40	12	8	80	70	550	90	180	380	300	260	240	90	29	240	—	310	95	130	—	95	—	50	—	—	70	—	45	45		
	1500	2145	2410																															
12000	500	1205	1390																															
	1000	1705	1940																															
	1500	2205	2490	40	12	8	80	70	550	90	180	380	300	260	240	90	29	240	—	350	110	160	—	110	—	65	—	—	90	—	55	50		
	2000	2705	3040																															
16000	500	1370	1570																															
	1000	1870	2120																															
	1500	2370	2670	50	14	9	85	75	630	120	220	440	340	320	280	110	33	280	—	400	130	180	—	130	—	80	—	—	100	—	65	63		
	2000	2870	3220																															
32000	500	1795	2055																															
	1000	2295	2605																															

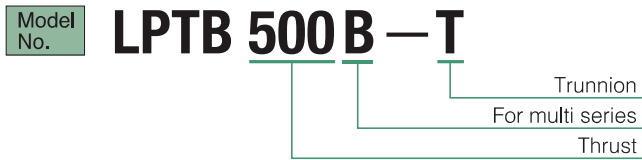


## Options

### Bellows



### Trunnion



### ● Dimensions of bellows

Unit: mm

LPTB LPTC	500	1000	2000	4000	6000	8000	12000	16000	32000
D	90	90	90	120	135	150	180	210	250

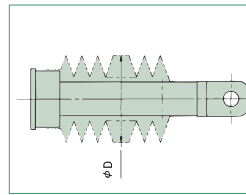


Fig. 1

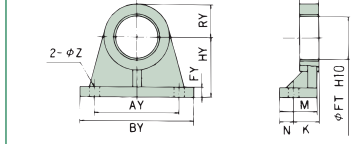
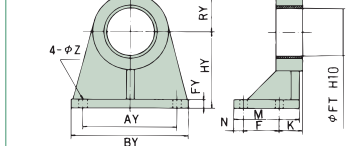


Fig. 2



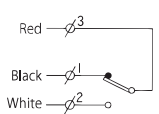
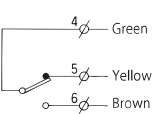
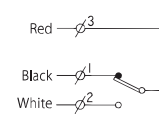
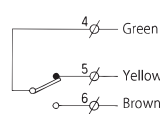
### ● Multi series trunnion fitting

Unit: mm

Model	Applicable body model No.		AY	BY	FY	HY	RY	FT	F	K	M	N	R	Z	Form	Mass (kg)
LPTB500B-T	LPTB LPTC 500B	130	180	15	150	40	50	—	45	65	25	15	18	Fig. 1		5.7
	LPTB LPTC 1000B															
LPTB2000B-T	LPTB LPTC 2000B	150	200	15	170	50	60	—	45	65	25	20	18			22.8
LPTB4000B-T	LPTB LPTC 4000B	180	240	20	170	70	80	—	55	80	30	35				
	LPTB LPTC 6000B															
LPTB8000B-T	LPTB LPTC 8000B	250	320	25	280	80	90	80	80	185	35	40	27	Fig. 2		60.5
	LPTB LPTC 12000B															
LPTB16000B-T	LPTB LPTC 16000B	320	400	30	320	100	120	90	90	210	40	50	33			95.7
LPTB32000B-T	LPTB LPTC 32000B	400	500	35	380	160	200	120	120	275	50	80	45			

\* Note that there are some models which may interfere with the bracket in an installation method in which the trunnion fitting installation face is on the cylinder end.

## Limit switch specifications

	Stroke adjusting external LS	Thrust detecting LS (LPT16000 or less)		Thrust detecting LS (LPT32000)	
Limit switch type	WLCA2(OMRON) or equivalent	V-165-1AR5(OMRON) or equivalent		Z-15GW22-B(OMRON) or equivalent	
Electric capacity	250V AC 10A (cosφ=0.4)	250V AC 10A (cosφ=0.4)		250V AC 10A (cosφ=0.4)	
Contact configuration	NC 1 —●— 4 NO NC 2 —●— 3 NO	Retracting side	Extending side	Retracting side	Extending side
					
(Applicable cable outer diameter)	SCS-10B (φ8.5 to φ10.5) PF1/2	SCL-14A (φ10.5 to φ12.5) PF1/2		SCS-14A (φ10.5 to φ12.5) PF1/2	

## Electric wiring

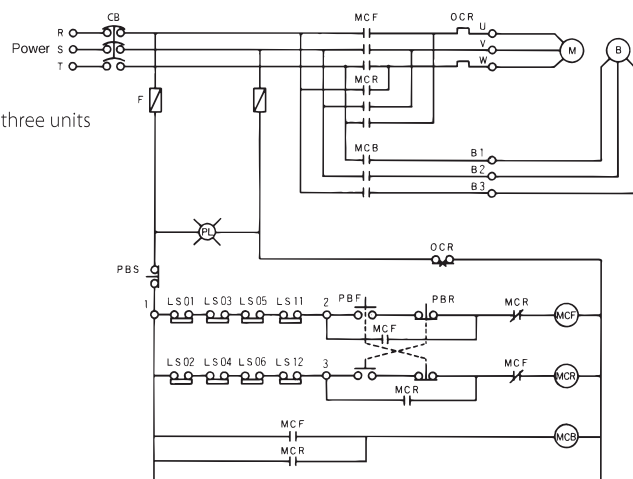
An electric wiring diagram is shown on the right.

Carry out sequence as a guide.

LS01, LS03, LS05    Extending side thrust detecting limit switch  
 LS02, LS04, LS06    Retracting side thrust detecting limit switch  
 LS11, LS12        Stroke adjusting limit switch

Linkage of three units

### ● Power cylinder reference circuit



## Maintenance and inspection

### Greasing on ball screw

Use the ball screw as it is because it has been lubricated with grease in advance. Refill grease with reference to the Table below 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.

#### ● 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.

#### ● Recommended grease

Use classification	Company name	Grease name
Ball screw	TSUBAKI	JWGS100G
	IDEMITSU KOSAN	*DAPHNE EPONEX SRNo.2
	NIPPON GREASE	NIGULUBE EP-2K
	EXXON MOBILE	MOBILUX EPN0.2
	COSMO OIL LUBRICANTS	COSMO GREASE DINAMAX EPN0.2
	SHOWA SHELL	SHELL ALBANIA EP grease 2

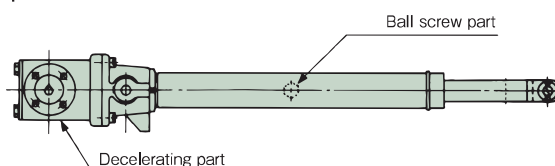
\* The above greases are filled before shipment.

Note) JWGS100G is separately sold in a container of 100g.

### Greasing on Reduction part

For the gear and the bearing in the reducer part, the gear case is filled with grease. Accordingly, it is not necessary to grease because they normally endure use for one year or longer. However, operation for a long time or use after long storage impairs lubrication effect due to deterioration of grease. As such, inspect and fill the grease.

#### Inspection location



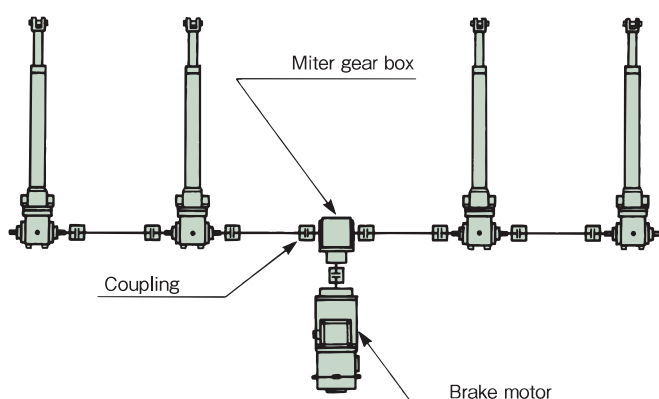
#### ⚠ WARNING

Never insert your finger into the greasing port.  
If the cylinder operates with your finger inserted, your finger may be injured.

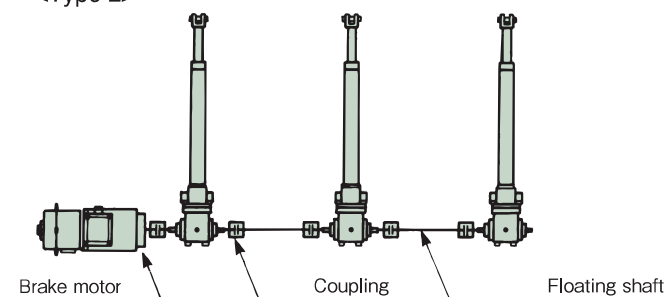
### Synchronizing operation

Multi series has a feature to ensure synchronization of multiple power cylinders. Refer to the layout shown below to plan synchronizing operation.

#### <Type 1>



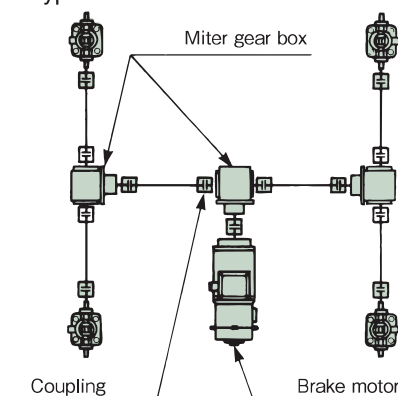
#### <Type 2>



#### Image



#### <Type 3>





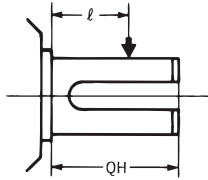
# WARNING

## Cautions for selecting

- The LPTB type of the multi series is not equipped with an overload protecting function. If an overload protecting function is required on the cylinder main body, select the LTPC type.
- If this cylinder is used for press contact or pull contact stopping, the strength of the mating equipment side must be 300% or more of the rated thrust.
- When installing a sprocket, a gear or a pulley on the input or output shaft, check that an overhang load acting on the shaft is less than the allowable overhang load.

$$\text{Allowable O. H. L.} \geq \frac{T \cdot f \cdot L f}{R}$$

O.H.L. : O. H. L: Overhang load (N { kgf })  
 T : Load torque (N·m { kgf·m })  
 f : Transmission element factor  
 Lf : Factor by load acting position  
 R : Pitch circle radius of sprocket, gear, V pulley (m)



QH : Length of shaft  
 l : Load acting position

### Transmission element factor (f)

Sprocket	1.00
Gear	1.25
V belt	1.50
Flat belt	2.50

### Factor by load acting position (Lf)

l/QH	0.25	0.38	0.5	0.75	1
Lf	0.8	0.9	1	1.5	2

● Table 1

Power cylinder model		LPTB,TC 500	LPTB,TC 1000	LPTB,TC 2000	LPTB,TC 4000	LPTB,TC 6000	LPTB,TC 8000	LPTB,TC 12000	LPTB,TC 16000	LPTB,TC 32000
Allowable overhang load	N	549	1.06k	1.95k	3.49k	4.60k	6.75k	8.85k	14.0k	22.3k
	{ kgf }	{ 56 }	{ 108 }	{ 199 }	{ 356 }	{ 469 }	{ 689 }	{ 903 }	{ 1430 }	{ 2280 }

## Cautions for installation

- Securely carry out centering between the center of the trunnion fitting and the center of the end fitting mount part. Prevent lateral load from acting on the cylinder due to swing particularly when the cylinder operates.
- Coupling is recommended to couple the input shaft and the driving shaft. Use a type of coupling including chain coupling, gear coupling and disk coupling which can absorb misalignment.
- Note that, if the floating shaft of the coupling to couple the driving part and cylinders is long, vibration may be generated by its rotation. Consider together with rigidity of the floating shaft and backlash of the coupling.
- Apply grease to the connecting pin on 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 -20°C to 40°C, although it varies depending on the conditions of use. When using at 40°C 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.
- For use in a misty atmosphere, contact us.

## Cautions for use

- Regulate 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.
- If the power cylinder multi series is used at high speed, since the coasting distance is long, the striker may override the limit switch. For this reason, make sure to allow the limit signal to be self-held on the control circuit.
- Anti-rod rotation is required because a rotating force is generated on the rod with thrust. The rod rotating force at the rated thrust is described in the model list. When operating with the end unconnected or when installing pulleys to pull a rope, contact us since a rod anti-rotation specification is also available.
- Adjustment of the limit switch for thrust detection of TC type must not be carried out by the customer. The preset value for thrust detection may greatly change.

## Power Cylinder

# Worm series

### Thrust : 49kN to 294kN {5000kgf to 30000kgf}

Introducing the new LPWB Power Cylinder, the perfect replacement for hydraulic cylinders.

Tsubaki's Worm Series features our time-tested high efficiency ball screw and high precision worm gear.

It's the ideal replacement for hydraulic cylinders.

#### ● Compact

An in-house manufactured high precision worm gear is used in the reducer. The integrated ball screw and gear supporting structure eliminate the need for a bracket and greatly reduces total unit length.

Uses clevises on both ends, which is the most widely used hydraulic cylinder mounting method.

#### ● High load capacity

The special copper allows the LPWB Series to handle the same heavy loads as jacks.

The maximum load capacity is 50 tons in the high thrust zone (with higher loads being considered).

#### ● Low cost

The simple structure vastly reduces the number of parts and keeps costs down.

#### ● Quiet

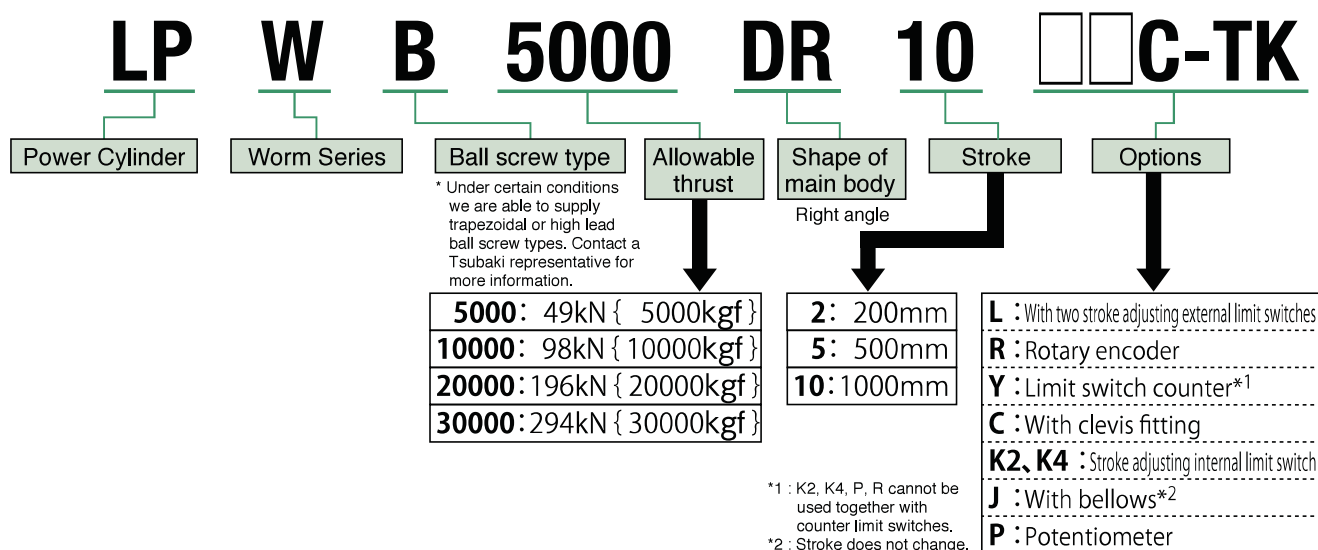
Replacing the helical gear with a worm gear reduces noise.

#### ● Wide variety of options

C (clevis fittings) can be combined with Y, K2, K4, P, and R (position detecting units).



## Model No. designation



## Standard model list

Model No.	Allowable thrust kN {kgf}	Nominal speed 50/60Hz mm/s	Nominal stroke mm
LPWB5000	49 {5000}	12/14.4	200 to 1000
LPWB10000	98 {10000}	10/12	500 to 1500
LPWB20000	196 {20000}	12/14.4	500 to 2000
LPWB30000	294 {30000}	12/14.4	500 to 2000

\*Above chart is for reference. Values are subject to change.

\*We can supply models exceeding 294kN (30000kgf). Contact Tsubaki for more information.

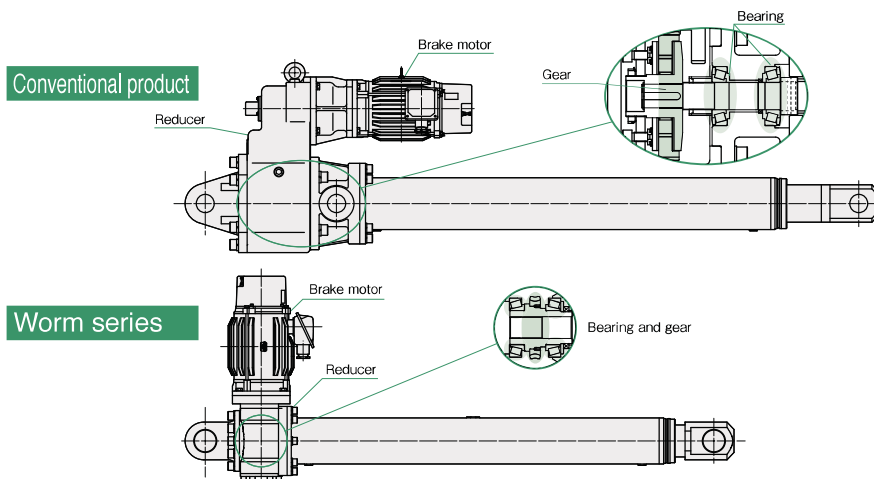
## Motor specifications

With nonexcitation-operated electromagnetic brake Three-phase induction motor IP55 equivalent

## Construction

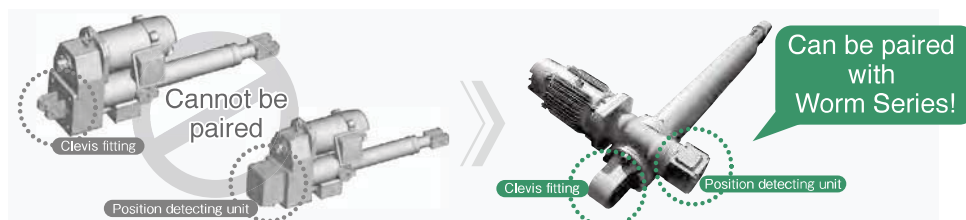
An in-house manufactured high precision worm gear is used in the reducer.  
The integrated ball screw and gear supporting structure eliminate the need for a bracket and greatly reduces total unit length.

Uses clevises on both ends, which is the most widely used hydraulic cylinder mounting method.



## Option

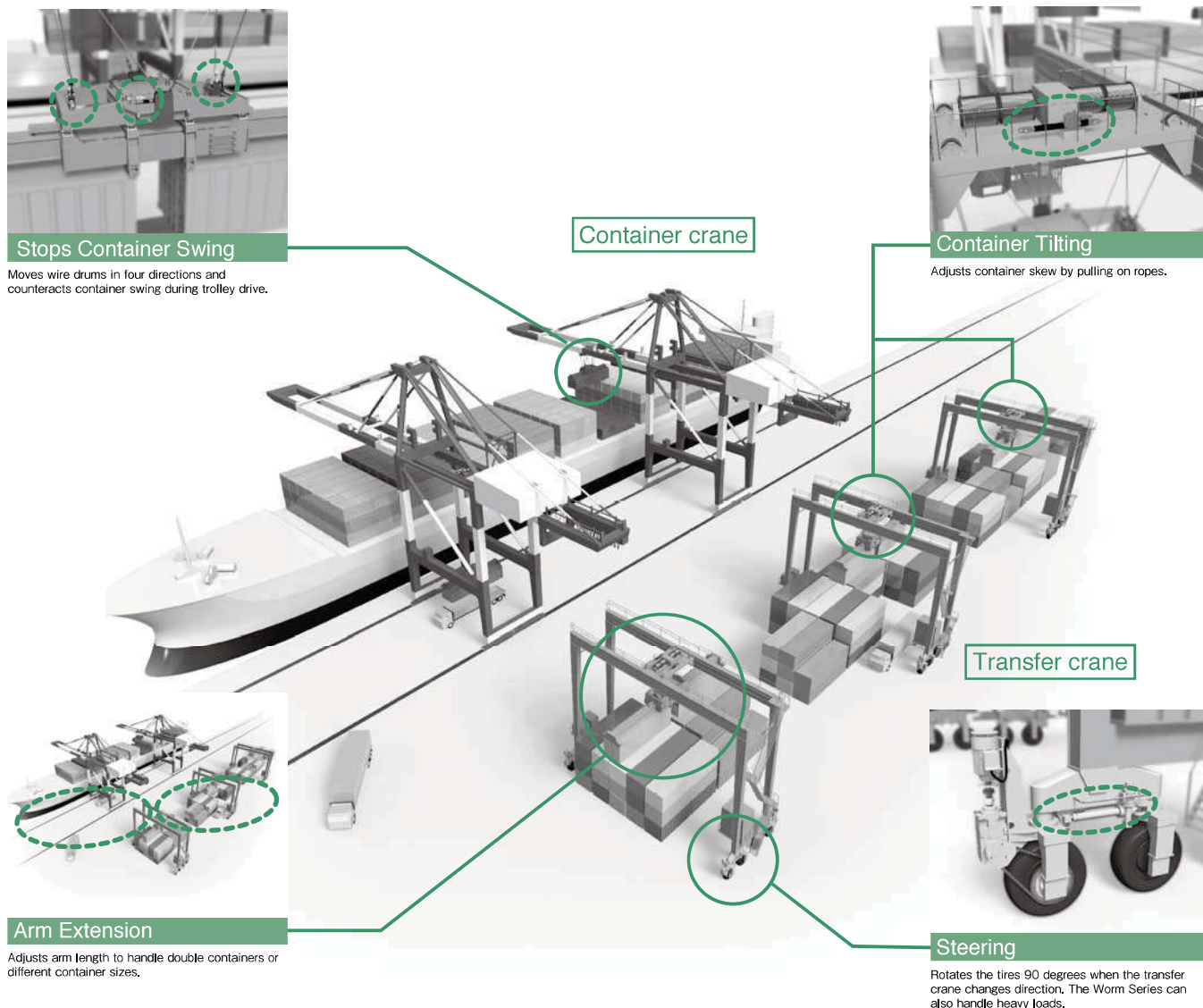
C (clevis fittings) can be combined with Y, K2, K4, P, and R (position detecting units).



## Example of use

### Shipping & Port Industries

Nowadays, in shipping and port industries worldwide, the promotion of energy savings and the prevention of marine pollution are driving the shift from hydraulic to electric hybrid or all electric cylinders.



### Palm Oil Mill

Loading ramp gate

#### Point

- **Low energy costs**  
Can reduce standby power.
- **Clean**  
Can prevent contamination of conveyed goods and peripheral equipment from oil leaks.
- **Simply handling**  
Can reduce installation work hours.
- **Accurate speed and position control**  
Helps maintain consistent quality.
- **Accurate load holding**  
Brake motor ensures accurate load holding during power failures.



## Example of use

### ■ Lifter

Elevates tables or workbenches.

#### Point

- Worm gear and brake motor ensure accurate load holding when stopped.



### ■ Boom Luffing

Used in luffing the booms of stackers, reclaimers, unloaders, ship unloaders, and other yard machines.

#### Point

- Can handle large loads.
- Can handle two units used synchronously.

