

# Gear Boxes



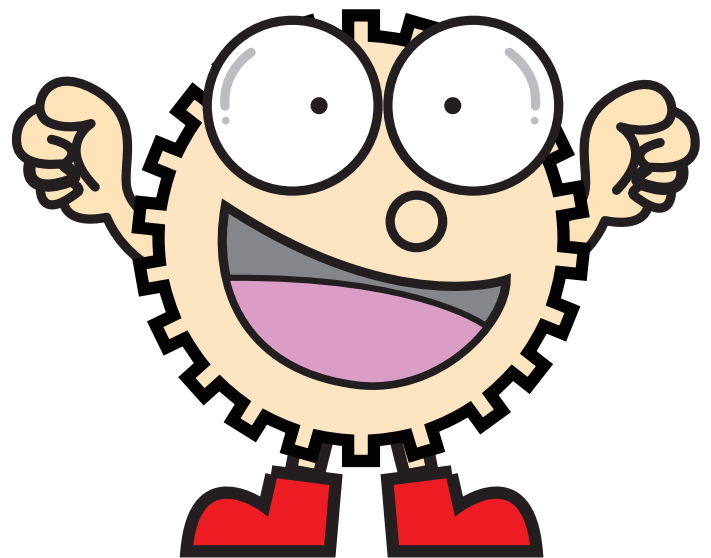
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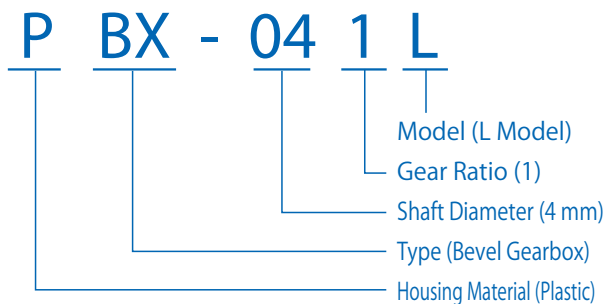
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## Catalog Number of KHK Stock Gears

The Catalog Number for KHK stock gears is based on the simple formula listed below. Please order KHK gears by specifying the Catalog Numbers.

(Example) Gearboxes



### Housing Material

P	Plastic
K	Light Metal Alloy
C	FC250 Cast Iron

### Main body

BX	Bevel Gearbox
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Spur Gears

Helical Gears

Internal Gears

Racks

CP Racks & Pinions

Miter Gears

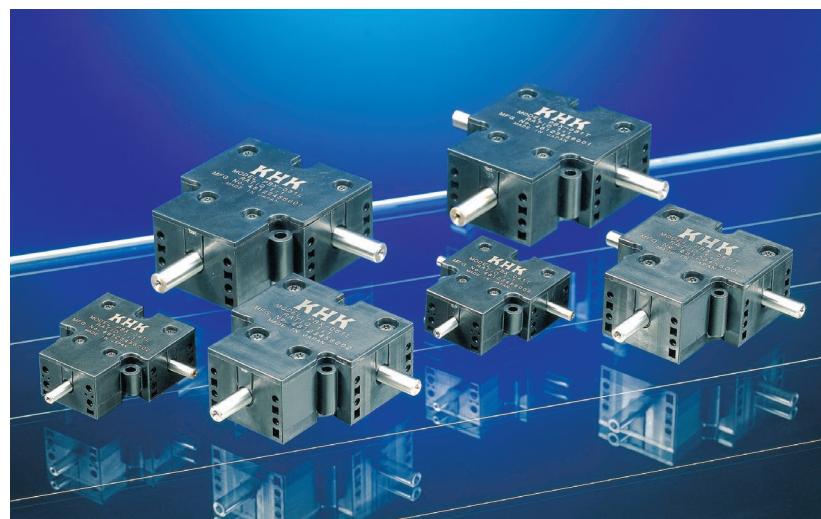
Bevel Gears

Screw Gears

Worm Gear Pairs

Bevel Gearboxes

Other Products



## ■ Features

- ① **Light weight and compact**  
Simple construction with plastic housing.  
Uses a plastic resin which has superior chemical and thermal resistance.
  - ② **Freedom of installing orientation**  
Unit has through holes and counter-bores allowing mounting on any orientation.
  - ③ **Maintenance free**  
Grease is applied to gears before shipping.
  - ④ **Speed ratio**  
1:1
- ### ■ Points to observe during use
1. Environmental conditions
    - Ambient temperature     $-10^{\circ}\text{C}$  to  $40^{\circ}\text{C}$
    - Ambient humidity        80% or less
    - Atmosphere                Well-ventilated, dust-free air not including corrosive gas and steam.
    - Location                    Indoors
  2. Mounting Methods
    - Bolt or screw the unit firmly on a flat surface free from variations.
    - For screws, we recommend JIS Type 2 grooved screws.
    - The dimensions of the mounting screws and the recommended tightening torques are given in the table below.
    - No secondary operations such as adding bolt holes can be performed on the casing. There is a danger that the gearbox will break.

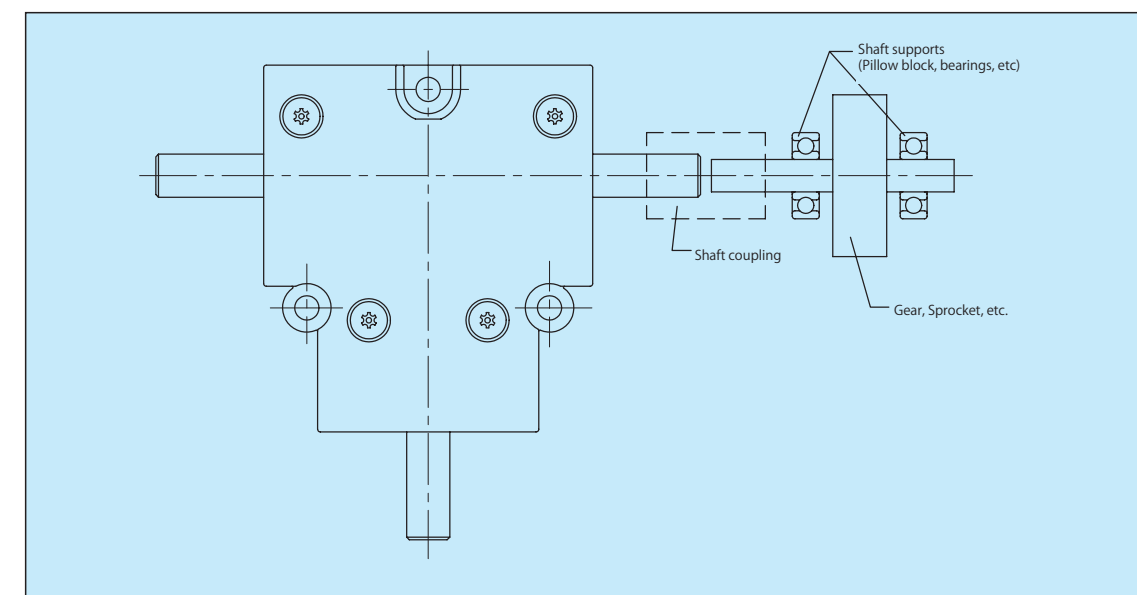
## ■ Recommended tightening torques

Mode	Thru-hole		Tapped screw hole		
	Size	Tightening torque (N · m)	Nominal dia.	Effective length (mm)	Tightening torque (N · m)
PBX-04 Type	M3	0.3 ~ 0.6	3	7 ~ 11	0.4 ~ 0.8
PBX-06 Type	M3	0.4 ~ 0.8	3	9 ~ 13	0.5 ~ 1.0
PBX-08 Type	M4	0.5 ~ 1.0	4	9 ~ 14	0.5 ~ 1.0

- When used in applications where oil contamination is undesirable such as in a food processing machines, please use preventive measures against oil leaks due to malfunction or the units wearing out.
3. Connection with mating machinery
    - Before connecting to the mating machinery, please verify the directions of the shaft rotation to avoid breakage of the equipment.
    - Please use a flexible coupling to connect the gearbox shaft to a mating shaft.
    - Make sure that the shafts of the gearbox and the mating machinery are lined up center to center.
    - If the gearbox shaft does not have a step, care should be exercised when attaching a coupling so that it does not interfere with the housing.
    - There is no keyway on the gearbox shaft. Use clamping type couplings to avoid slippage.
  4. Operating precautions
    - Do not go near or touch rotating portions of the machine such as the shafts during operation. You may get caught and injure yourself.
    - Stop the operation immediately when the noise level or the temperature rises abnormally. Do not restart until all of the causes are analyzed and proper repairs are made.
    - Do not disassemble or modify these productions. You may destroy the unit.

## ■ Selection Hints

- ① PBX series are economical bevel gearboxes. For applications requiring high precision, strength and/or speed, we recommend the use of KBX type bevel gearboxes.
- ② Please avoid overhang and thrust loads on the shafts. By supporting both ends of the shaft on which a gear or sprocket is mounted by means of pillow blocks or bearings as shown below, you can eliminate overhang loads.
- ③ These units are not suitable when you have sudden reversals of rotation or impact loads. Please consider KBX type bevel gearboxes in such applications.



## ■ PBX Specification Chart

Type	Specifications	X-axis revolutions per minute (rpm)						
		50	100	200	250	300	400	500
PBX-041	X&Y-axis torque (N · cm) {kgf · cm}	9.8 {1.0}	9.8 {1.0}	9.6 {0.98}	9.5 {0.97}	9.4 {0.96}	9.3 {0.95}	9.1 {0.93}
	Efficiency (Reference values)	70%						
PBX-061	X&Y-axis torque (N · cm) {kgf · cm}	39.2 {4.0}	39.2 {4.0}	38.5 {3.93}	38.2 {3.90}	37.9 {3.87}	37.2 {3.80}	36.5 {3.72}
	Efficiency (Reference values)	80%						
PBX-081	X&Y-axis torque (N · cm) {kgf · cm}	78.4 {8.0}	78.4 {8.0}	77.0 {7.86}	76.5 {7.80}	75.7 {7.72}	74.4 {7.59}	73.1 {7.46}
	Efficiency (Reference values)	75%						

- 〔 CAUTION 〕
- ① Be sure not to exceed the allowable values.
  - ② The values in the table are effective when the service factor is 1. When the units are used under other conditions, refer to the Selection Guide.

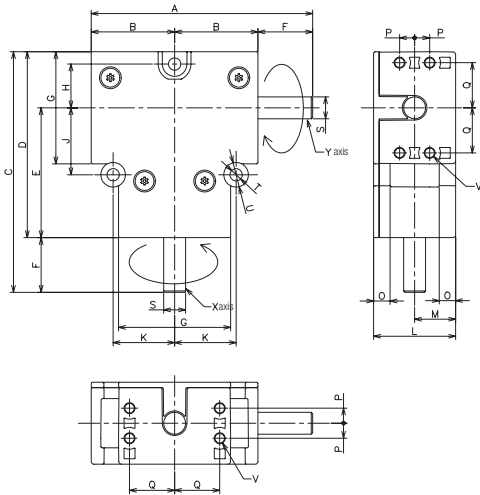
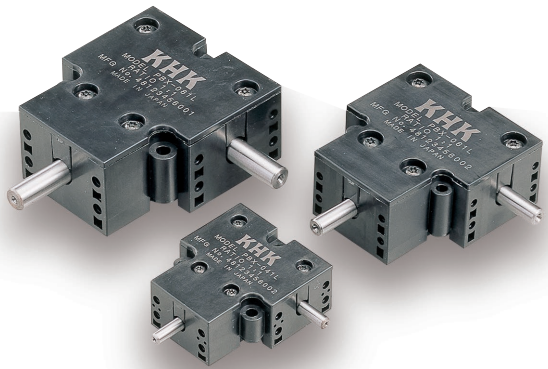


PBX  
Miniature Bevel Gearboxes

L Type

PBX

Bevel Gearboxes



- [ Caution ]
- ① The arrow marks on the shafts are intended to show the relative direction of rotation. The units can be driven in the opposite direction as well.
  - ② In the standard unit, the X-axis rotates clockwise, and the Y-axis counterclockwise.
  - ③ The tolerance of shaft diameter is JIS h8.
  - ④ The shafts do not have keyways. Please use clamping type couplings to avoid slippage.
  - ⑤ The backlash at the X-axis (input shaft) is about 3 degrees.

Catalog No.	Speed Ratio	A	B	C	D	E	F	G	H	J	K	L	M	O	P	Q	S	T
PBX-041L	1:1	51	20.5	55	45	32	10	26	9.5	16	15	18	9	4.5	3	10	φ4	φ3.5
PBX-061L	1:1	70	27.5	73	58	41	15	34	13.5	20	19	26	13	4.5	4.5	14	φ6	φ3.5
PBX-081L	1:1	81	30.5	88	68	47.5	20	41	16	24.5	22.5	30	15	6	5.5	16.5	φ8	φ4.5

U	V		Weight (g)	Catalog No.
	Diameter	Depth		
7	φ 2.5	11	45	PBX-041L
7	φ 2.5	13	120	PBX-061L
9	φ 3.3	14	200	PBX-081L

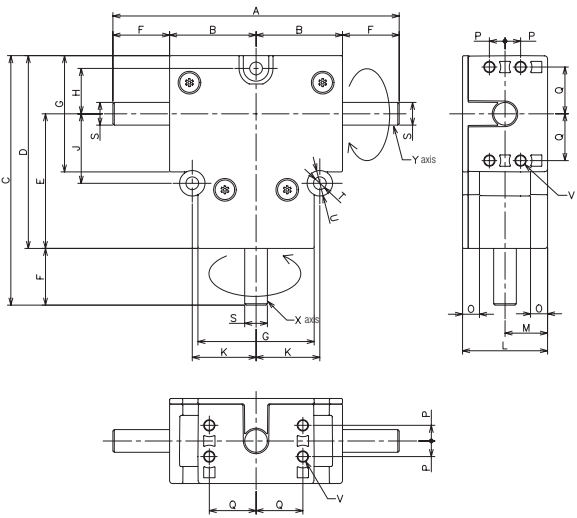
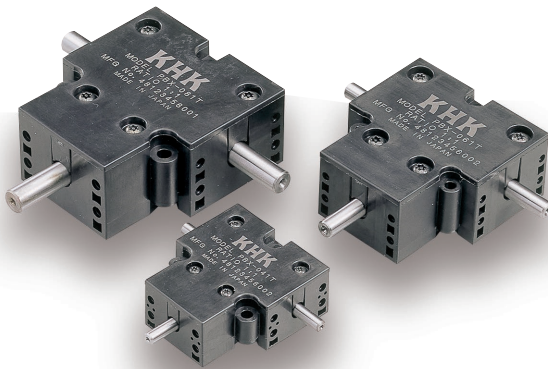


PBX  
Miniature Bevel Gearboxes

T Type

PBX

Miniature Bevel Gearboxes



- [ Caution ]
- ① The arrow marks on the shafts are intended to show the relative direction of rotation. The units can be driven in the opposite direction as well.
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  - ④ The shafts do not have keyways. Please use clamping type couplings to avoid slippage.
  - ⑤ The backlash at the X-axis (input shaft) is about 3 degrees.

Catalog No.	Speed Ratio	A	B	C	D	E	F	G	H	J	K	L	M	O	P	Q	S	T
PBX-041T	1:1	61	20.5	55	45	32	10	26	9.5	16	15	18	9	4.5	3	10	φ4	φ3.5
PBX-061T	1:1	85	27.5	73	58	41	15	34	13.5	20	19	26	13	4.5	4.5	14	φ6	φ3.5
PBX-081T	1:1	101	30.5	88	68	47.5	20	41	16	24.5	22.5	30	15	6	5.5	16.5	φ8	φ4.5

U	V		Weight (g)	Catalog No.
	Diameter	Depth		
7	φ 2.5	11	45	PBX-041T
7	φ 2.5	13	120	PBX-061T
9	φ 3.3	14	200	PBX-081T





### Selection Guide

#### Essential data for selection

Load torque, type of prime mover, input speed, speed ratio, running time, coupling method, and frequency of start and stop.

#### Selection Procedure

The performance table in the catalog is based on the design conditions that the prime mover is a motor, the load is uniform, and the unit runs 10 hours per day.

- a) When using the units under any other condition, it is necessary to correct the value of load to torque by applying the service factors shown in Table 1.

**Corrected Load Torque = Load torque applied to gearbox x Service factor <See Table 1>.**

Service factors (Sf) <Table 1>

Loading condition	Service factors (Sf)		
	Less than 3 hrs/day operation	3-10 hrs/day operation	More than 10 hrs/day operation
Uniform load	1 (1)	1 (1.25)	1.25 (1.50)
Light impact load	1 (1.25)	1.25 (1.50)	1.50 (1.75)
Heavy impact load	1.25 (1.50)	1.50 (1.75)	1.75 (2.00)

(NOTE) 1. Use the factors in parentheses when frequency of starts and stops exceed 10 times per hour.  
2. Also, use the factors in parentheses when a prime mover other than a motor is used (for example, an internal combustion engine).

Keep the corrected load torque at the speed at less than the allowed X & Y axis torque (Speed ratio 1:1), or the allowable Y axis torque (Speed ratio 1:2) shown in the performance table.

- b) Select an appropriate shaft layout from the shaft layout drawing for each model.
- c) Check for overhang load space (O.H.L.)  
Overhang load is a load applied beyond the bearing support. Examining the overhang load is indispensable whenever chains, belts, or gears are used to couple the unit with the mating machinery.

$$O.H.L. = \frac{T_{LE} \times K_1 \times K_2}{R} (N) \{kgf\}$$

$T_{LE}$  : Corrected load torque applied to the gearbox shaft (N · m) {kgf · m}  
 $R$  : Pitch radius of sprocket, pulley, gear, etc., mounted on the gearbox shaft (m)  
 $K_1$  : Factor depending on the method of coupling <See Table 2>  
 $K_2$  : Factor depending on the position of load <See Table 3>

\* The value of O.H.L. from the equation above must be smaller than the value of allowable O.H.L. on the X-and the Y-axis shown on the performance table.

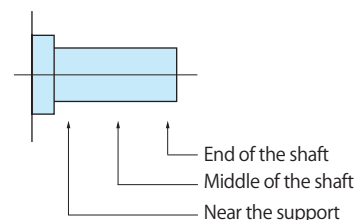
Factor  $K_1$  <Table 2>

Coupling method	$K_1$
Chain, timing belt	1.00
Gear	1.25
V belt	1.50

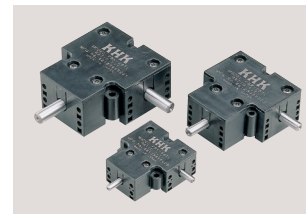
Factor  $K_2$  <Table 3>

Position of load	$K_2$
Near the support	0.75
Middle of shaft	1.00
End of the shaft	1.50

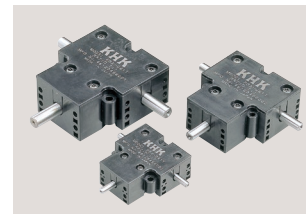
#### Position of load



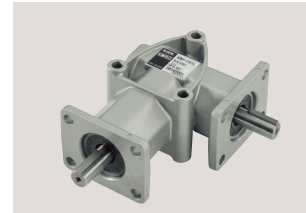
- d) Select a model capable to satisfy all of a), b) and c) obtained above.



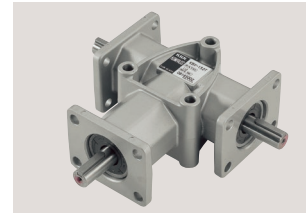
PBX-L Type



PBX-T Type



KBX-L Type

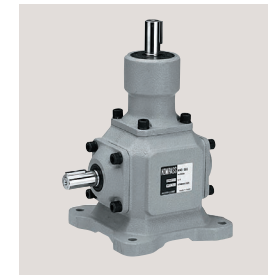


KBX-T Type

### Selection Examples

#### Example 1

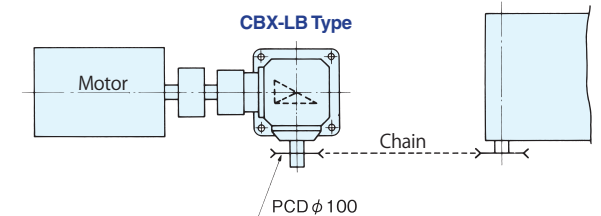
Application / Conveyor (uniform load)  
 Load torque /  $78.4N \cdot m$  {8kgf · m}  
 X-axis rotational speed / 300rpm  
 Speed Ratio / 1 : 2  
 Shaft layout / As illustrated at right  
 Running time / 12 hours/day  
 Coupling method / X-axis — Coupling  
 Y-axis — Chain (positioned at the middle of the shaft)  
 Installation / Horizontal  
 Location / Indoors



CBX-L Type



CBX-T Type



#### ① Torque Analysis

Service factor under load is  $S_f = 1.25$  (Table 1).

Accordingly, corrected load torque applied to Y-axis.

$$T_{LE} = 78.4 \times 1.25 = 98N \cdot m \quad \{T_{LE} = 8 \times 1.25 = 10kgf \cdot m\}$$

#### ② O.H.L. Analysis

O.H.L. on the Y-axis

$$O.H.L. = \frac{T_{LE} \times K_1 \times K_2}{R} = \frac{98 \times 1 \times 1}{\frac{100}{2 \times 1000}} = 1960N \quad \{O.H.L. = \frac{T_{LE} \times K_1 \times K_2}{R} = \frac{10 \times 1 \times 1}{\frac{100}{2 \times 1000}} = 200kgf \}$$

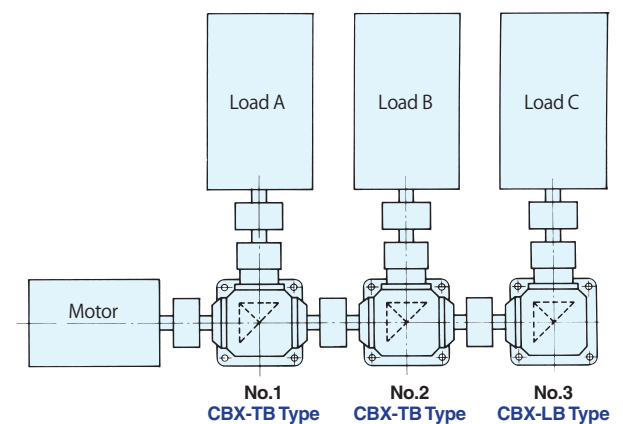
#### ③ Model Selection

A model capable of satisfying all of the design conditions, torque and O.H.L. is **CBX-322LB**.

#### Example 2

Application / Line shaft drive  
 Load torque /  $58.8N \cdot m$  {6kgf · m} (uniform load) for each A,B and C  
 Rotational speed / 600rpm  
 Speed Ratio / 1 : 1  
 Shaft layout / As illustrated at right  
 Running time / 8 hours/day  
 Coupling method / All couplings  
 Installation / Horizontal  
 Location / Indoors

In case of an inline shaft drive, load applied to the Y-axis varies with the location of the gearbox. Therefore, an adequate model must be selected individually for each position. Service factor (Table 1) under the design condition is  $S_f=1.0$  for all gearboxes.



#### ① Gearbox No.1

Corrected load torque applied to the X-axis that drives only load A is:

$$58.8 \times 1.0 = 58.8N \cdot m \quad \{6 \times 1.0 = 6kgf \cdot m\}$$

Corrected load torque applied to the Y-axis that drives load A, B and C is:

$$(58.8 + 58.8 + 58.8) \times 1.0 = 176.4N \cdot m$$

$$\{(6 + 6 + 6) \times 1.0 = 18kgf \cdot m\}$$

**CBX-401TB** is selected from the performance table.

#### ② Gearbox No.2

Corrected load torque applied to the X-axis that drives only load B is:

$$58.8 \times 1.0 = 58.8N \cdot m \quad \{6 \times 1.0 = 6kgf \cdot m\}$$

Corrected load torque applied to the Y-axis that drives load B and C is:

$$(58.8 + 58.8) \times 1.0 = 117.6N \cdot m$$

$$\{(6 + 6) \times 1.0 = 12kgf \cdot m\}$$

**CBX-321TB** is selected from the performance table.

#### ③ Gearbox No.3

Corrected load torque applied to the X-axis that drives only load C is:

$$58.8 \times 1.0 = 58.8N \cdot m \quad \{6 \times 1.0 = 6kgf \cdot m\}$$

Corrected load torque applied to the Y-axis that drives only load C is:

$$58.8 \times 1.0 = 58.8N \cdot m \quad \{6 \times 1.0 = 6kgf \cdot m\}$$

**CBX-251LB** is selected from the performance table.

#### ④ Model selection

No.1 gearbox is **CBX-401TB**

No.2 gearbox is **CBX-321TB**

No.3 gearbox is **CBX-251LB**