ROBO CYLINDER

# Technical Reference / Information

## Technical Reference


| | | |
|---|---|---|
| Notes on Switching from Air Cylinders | | 377 |
| Explanation of Moments | | 379 |
| Explanation of Programs | | 380 |
| Explanation of Options | | 381 |
| Spare Parts | | 390 |
| Model Selection Information | Correlation Diagrams of Speed and Load Capacity | 393 |
| | Correlation Diagrams of Push Force and Current-Limiting Value | 405 |
| | Information on Guides | 413 |


## Information


| | | |
|---|---|---|
| Index | | 421 |

# Notes on Switching from Air Cylinders

## Air Cylinder and ROBO Cylinder

Air cylinders are used to push or hold works by means of supply and release of compressed air to/from the cylinder. Air cylinders are used widely in all industries, mainly for transfer equipment, assembly systems, various automation systems, etc.

Air cylinders generally have diameters of 4 mm to 320 mm, and their lengths (strokes) can also be set in fine steps. According to one source, there are several tens to hundreds of thousands of different air cylinder products, which makes it easy to select optimal models for a variety of applications. On the other hand, the complexity of product lines requires customers to examine multiple products having the same specifications, which prevents them from easily finding the model that best suits the exact specifications.

Against this background, in many cases air cylinder products are selected based on experience and familiarity.

ROBO Cylinders are motorized cylinders offering various functions not achievable with air cylinders, with easy-to-use operating methods. Also, the ROBO Cylinder family lets you easily select the model that best suits your specific application. However, ROBO Cylinders are different from air cylinders in terms of control and configuration.

This section explains the key points to note when switching from air cylinders to ROBO Cylinders.

## Overview of Switching

The following explains the basic items that should be checked when selecting a ROBO Cylinder and an air cylinder, respectively.

Since both are direct-acting actuators, the items that must be considered regarding operation are similar. However, the different configuration and control mentioned above result in different designations and adjustment/check items between the two. A comparison is illustrated to the right.

**[Air Cylinder]**
- Thrust (diameter)
- Mechanical stopper selection
- Absorber selection
- Piping diameter
- Installation space

→

**[ROBO Cylinder]**
- Load capacity
- Maximum speed
- Deceleration, positioning accuracy
- Acceleration
- Installation space

As shown above, the two have different mechanical viewpoints to be considered.

## Installation Space

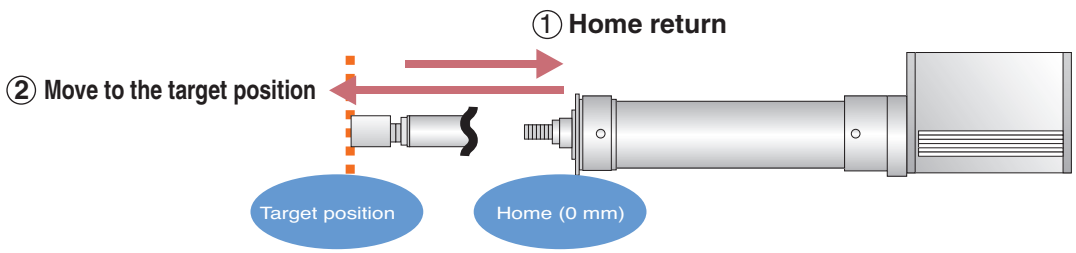
ROBO Cylinders are driven by a motor. Since they are bigger than air cylinders based on simple comparison, installation space requires careful attention when choosing a ROBO Cylinder.

## Home Return

Unlike air cylinders, ROBO Cylinders are operated on “coordinates.” Specifically, their travel distances are always specified with respect to the home (zero point). Accordingly, ROBO Cylinders must perform home return at the beginning of each operation.

In particular, exercise caution for incremental types, because these actuators are pushed against the stroke end in the initial operation performed after the power is turned on.

**■Incremental specification: Home return must be performed after the power is turned on.**
**■Absolute specification: Absolute reset must be performed during the initialization.**



## Critical Rotating Speed

The ball screw inevitably deflects due to bending force and dead weight.

To operate ROBO Cylinders at high speed, their ball screw must be rotated faster. As the rotating speed increases, however, the screw deflection will also increase until the rotating axis is eventually damaged. Rotating speeds at which the rotating axis may suffer damage are called “critical speeds,” “whirling speeds” or “whipping speeds.”

Ball-screw ROBO Cylinders perform linear motion as the ball screw is turned with its end supported by a bearing. Although the maximum speed is specified for each ROBO Cylinder in accordance with the actuator type, some models with certain strokes have their maximum speed set in consideration of the aforementioned critical rotating speeds. Pay careful attention to this point when selecting your ROBO Cylinder.

## General Utility (Types, Modes and Parameters)

ROBO Cylinders offer the “air-cylinder specification (or air-cylinder mode)” that allows the ROBO Cylinder to be used just like an air cylinder. If these models are used, you can operate the actuator simply by turning external signals ON/OFF, just like you do with air cylinders. Although selecting the air-cylinder specification or mode is enough for simple conversion from an air-cylinder application, we also offer various other specifications for, and make certain parameters accessible by, customers who want more benefits out of their ROBO Cylinders.

We can propose functions that meet the operating conditions and requirements of your specific system. Feel free to contact us at 1-800-736-1712 or 1-800-944-0333.

## Maintenance

The key maintenance points of air cylinders and ROBO Cylinders are compared.

Air cylinders require periodic maintenance in accordance with the frequency and condition of use. Although air cylinders offer a certain level of flexibility in that minor damage or malfunction can be ignored by means of increasing the source air pressure and moving the cylinder with a greater force, ignoring maintenance will inevitably shorten the service life of the air cylinder.

On the other hand, ROBO Cylinders have a more complex structure and use a greater number of parts and are therefore seen as requiring cumbersome maintenance work. This is wrong. ROBO Cylinders are clearly easier to use and offer longer life than air cylinders. Of course, ROBO Cylinders also require lubrication of sliding parts just as air cylinders do. However, lubrication units (AQ seals) installed on the ball screw and guide ensure a long maintenance-free period (5,000 km of traveled distance, or three years). After the traveled distance has reached 5,000 km or three years have elapsed, the above parts should be greased once every six months to a year in accordance with the operation manual, in order to extend the life of the product significantly.

Controllers combined with absolute-type actuators come with a battery to retain the current position. This battery is a consumable part and must be replaced periodically (the specific battery replacement interval varies depending on the product).

**[Main Maintenance]**

**[Air Cylinder]**
- Greasing of sliding parts
- Gasket replacement
- Draining
- Absorber replacement

**[ROBO Cylinder]**
- Greasing of ball screw and guide (after AQ seals have been consumed)
- Battery replacement (absolute specification only)

## Operation

Air cylinders are generally operated with the use of a direction control valve to determine the direction of reciprocating motion, as well as a flow control valve (speed controller) to determine the speed. Immediately after their system is started up, many users operate the air cylinder at low speed by restricting the flow control valve. Once safety is confirmed, the valve is opened wider to increase the speed to the required level.

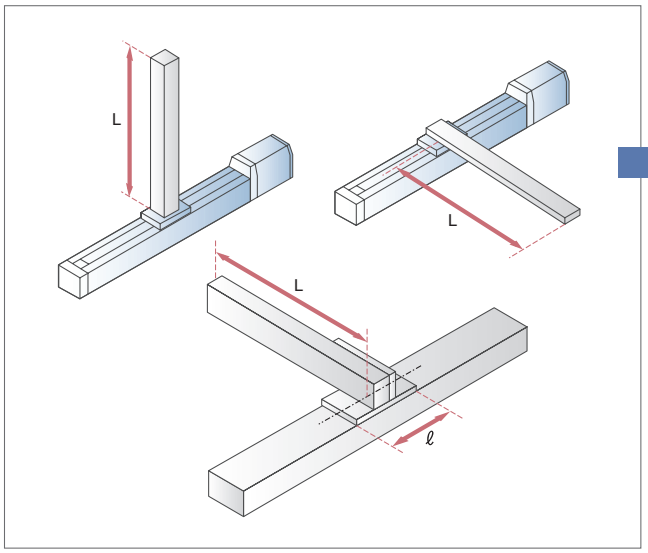
The same procedure is also recommended for ROBO Cylinders after the system is started up. With ROBO Cylinders, “speed setting” replaces the flow control valve. Operate your ROBO Cylinder at speeds where safety is ensured, and then change to the desired speed after safety is confirmed.

# Notes on Actuator Selection

When selecting an actuator, you must consider the overhang load length and moment in addition to the stroke, speed and load capacity.

## Overhang Load Length

An overhang load length is specified for a slider-type actuator to indicate the length of overhang (offset) from the actuator.




**The allowable overhang load length is determined by the slider length.**

Any overhang exceeding the allowable overhang load length may cause vibration or increase the settling time.

**L/ℓ = 5 or less**

* Approx. 3 to 4 for measuring systems equipped with a camera.

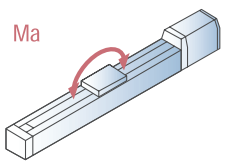
●Reference
- L/ℓ = 1.2 Machine tools
- L/ℓ = 3 Measuring machines
- L/ℓ = 5 Robots

## Allowable Load Moment

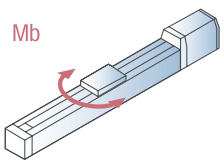
The allowable load moment refers to the maximum offset load that can be applied to the slider, and is calculated from the traveling life of the guide. Forces applied to the guide are divided into three directions of Ma (pitching), Mb (yawing) and Mc (rolling), and an allowable value is set for each of these forces on each actuator.

●3 directions of forces applied to the guide (Ma, Mb, Mc)

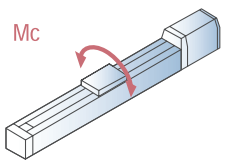
Pitching




Yawing




Rolling




Rated moment (value indicated in the catalog) = Force is calculated from the service life of the guide.

**The traveling life decreases in proportion to the third power of moment.**

**The allowable static moment (applicable when the actuator is stationary) should be no more than three times the catalog value.**

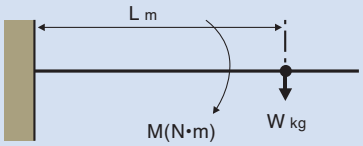
**The allowable load moment is calculated from the service life of the guide.**

**Applying a moment exceeding the allowable value will reduce the service life of the actuator.**

The load moment is proportional to the distance from the center of rotation, and calculated by the formula below.

$$M(N\cdot m) = W(kg) \times L(m) \times 9.8$$

W (kg) indicates the weight at the center of gravity, while L (m) indicates the distance to the center of gravity.



# About Programs

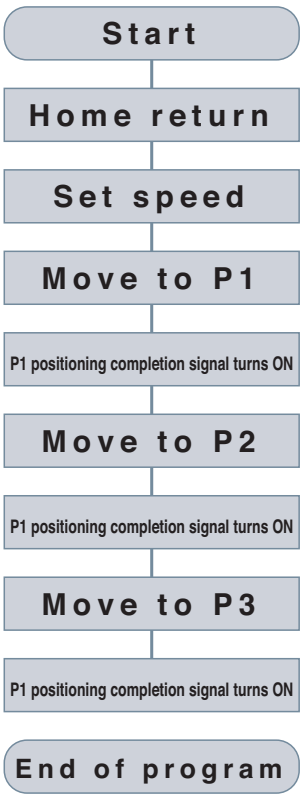
PSEL, ASEL, SSEL and XSEL controllers are operated with programs created in IAI's original Super SEL language. The Super SEL language lets you write programs only by arranging simple commands in sequence on a spreadsheet. This means that anyone who has never programmed before can create actuator programs with ease.

A sample program for basic operation is shown below.
We also have other sample programs covering commonly used patterns. If you are interested, feel free to contact IAI.

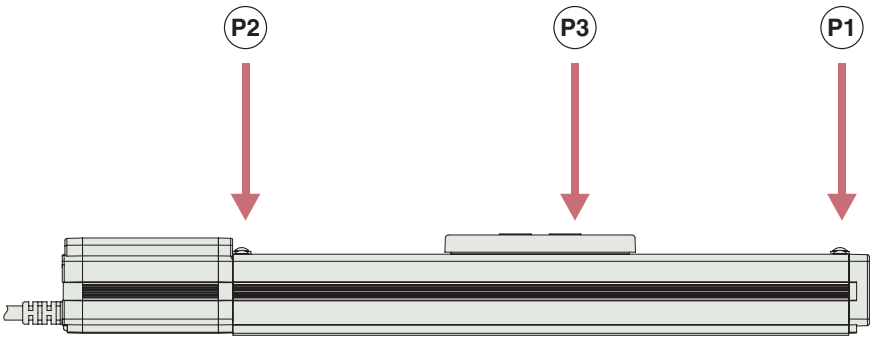
## Description

Perform home return, and then operate the actuator to positions 1 through 3 at a speed of 100 mm/sec.
Only one axis is used.

### Flowchart




- Home-return operation must be performed and a speed must be set before the actuator can be operated.
- The actuator moves to the position data coordinates specified by movement commands.




### Application Program

| STEP | A/O | N | OP-CODE | OPRND1 | OPRND2 | POST | Comment |
|---|---|---|---|---|---|---|---|
| 1 | | | HOME | 1 | | | Home return of axis |
| 2 | | | VEL | 100 | | | Set speed 100mm/sec. |
| 3 | | | MOVP | 1 | | | Move to P1 |
| 4 | | | BTON | 311 | | | P1 movement complete signal ON |
| 5 | | | MOVP | 2 | | | Move to P2 |
| 6 | | | BTON | 312 | | | P2 movement complete signal ON |
| 7 | | | MOVP | 3 | | | Move to P3 |
| 8 | | | BTON | 313 | | | P3 movement complete signal ON |
| 9 | | | EXIT | | | | End of program |
| 10 | | | | | | | |

### Position Data

| No | X |
|---|---|
| 1 | 200 |
| 2 | 0 |
| 3 | 100 |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |

# Explanation of Actuator Options

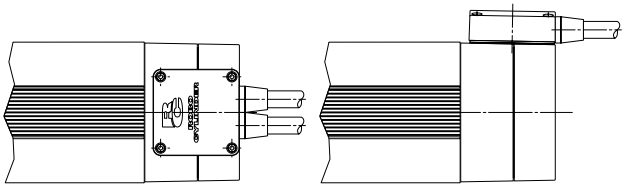
## Change of Cable outlet Direction

**■ Option Code A1, A2, A3**

| | |
|---|---|
| Applicable model | RCS2-RA5C / RA5R / RA7AD / RA7BD |
| Description | Specify this option if you wish to change the direction from which to take out the actuator cable. |

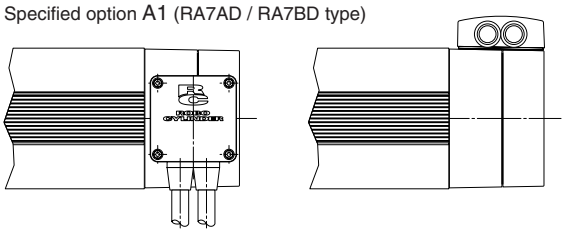
Taken out from motor side (standard)

■ Option not specified (blank)



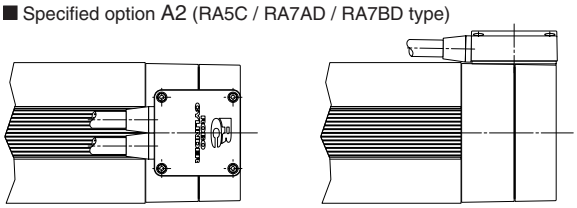
Taken out from left

■ Specified option A1 (RA7AD / RA7BD type)



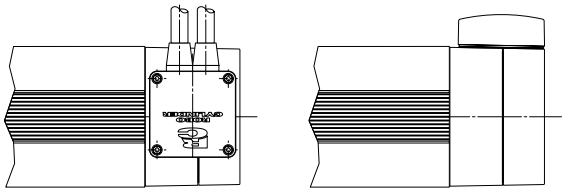
Taken out from rod side

■ Specified option A2 (RA5C / RA7AD / RA7BD type)



Taken out from right

■ Specified option A3 (RA7AD / RA7BD type)



## Brake

**■ Option Code B, BE, BL, BR**

| | |
|---|---|
| Applicable model | All slider types (* Excluding RCP2-BA6/BA7)<br>All rod types (* Excluding RCP2-RA2C and RCA built-in types) |
| Description | A retention mechanism used on an actuator positioned vertically to prevent the slider from dropping and damaging the installed load, etc., when the power or servo is turned off. |

## Actuator Cover

**■ Option Code CO**

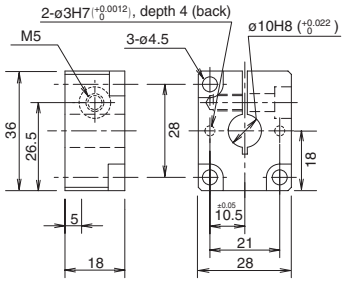
| | |
|---|---|
| Applicable model | RCP2W-SA16 |
| Description | A cover to protect the guide or slider of a waterproof slider actuator. |

## Flange Bracket

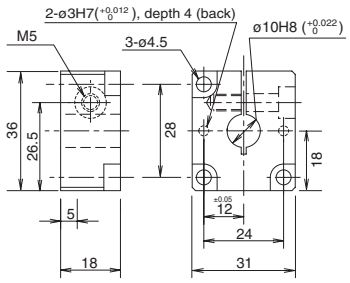
**■ Option Code FB**

| | |
|---|---|
| Applicable model | RCP2-GRS / GRM / GR3LS / GR3LM / GR3SS / GR3SM |
| Description | A bracket for affixing the gripper body. |

GRS type Unit model RCP2-FB-GRS




GRM type Unit model RCP2-FB-GRM

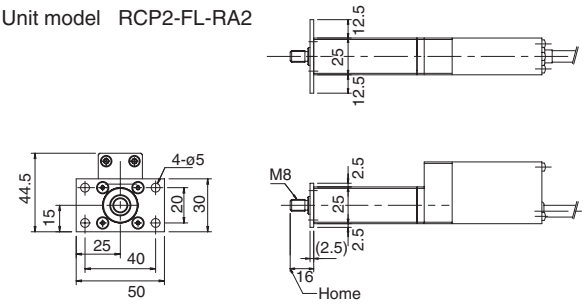


## Flange

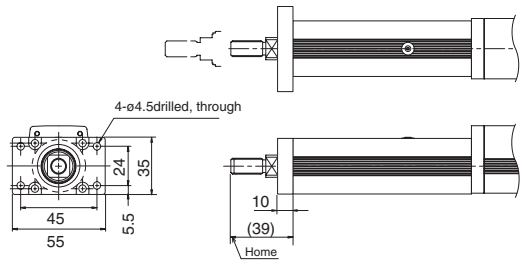
### ■ Option Code FL

| | |
|---|---|
| Applicable model | All rod types |
| Description | A bracket for affixing the actuator using bolts from the actuator side. |

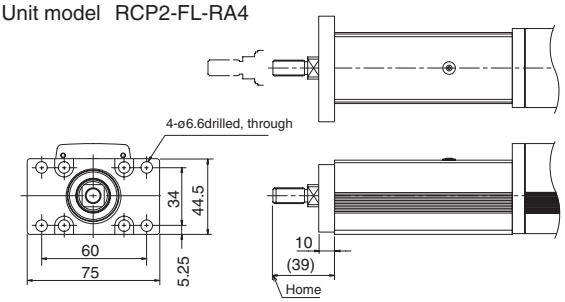
RCP2-RA2C
Unit model RCP2-FL-RA2



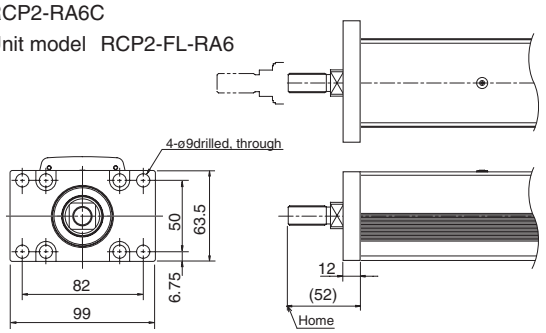

RCP2-RA3C
Unit model RCP2-FL-RA3




RCP2-RA4C
Unit model RCP2-FL-RA4

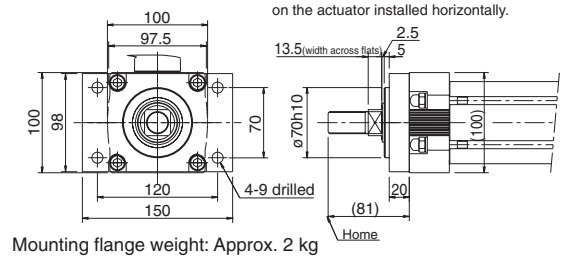



RCP2-RA6C
Unit model RCP2-FL-RA6



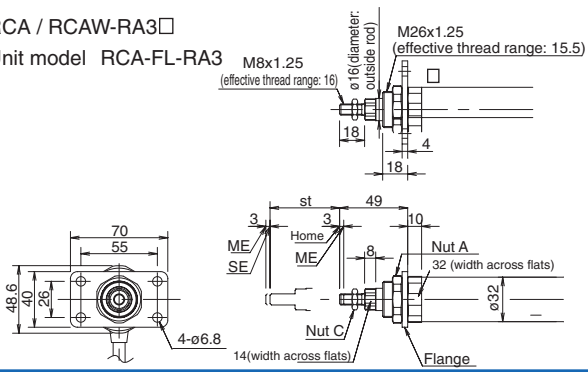

RCP2 / RCP2W-RA10C
Unit model RCP2-FL-RA10

Be careful not to apply excessive external force on the actuator installed horizontally.

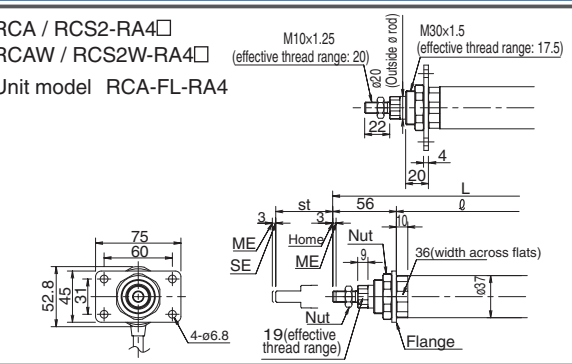



Mounting flange weight: Approx. 2 kg

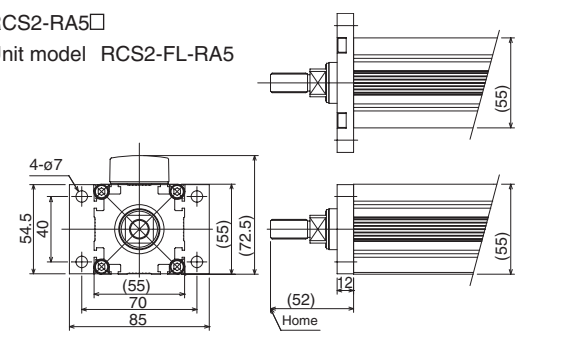
RCA / RCAW-RA3□
Unit model RCA-FL-RA3




RCA / RCS2-RA4□
RCAW / RCS2W-RA4□
Unit model RCA-FL-RA4

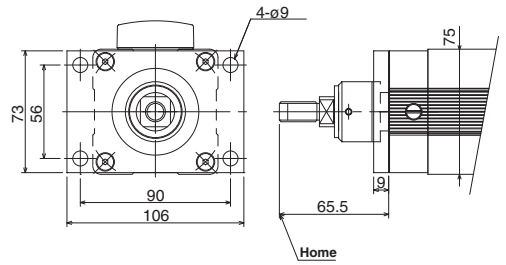



RCS2-RA5□
Unit model RCS2-FL-RA5



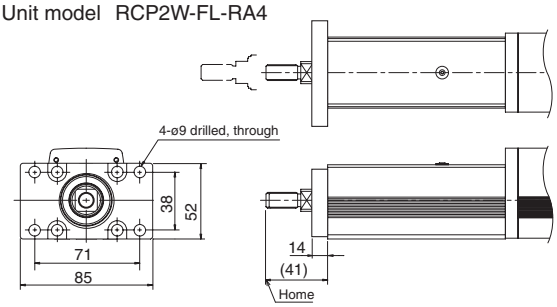
RCS2-RA7□D

Unit model RCS2-FL-RA7



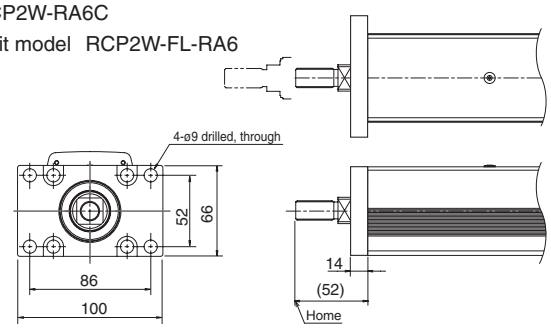

RCP2W-RA4C

Unit model RCP2W-FL-RA4




RCP2W-RA6C

Unit model RCP2W-FL-RA6




## Foot

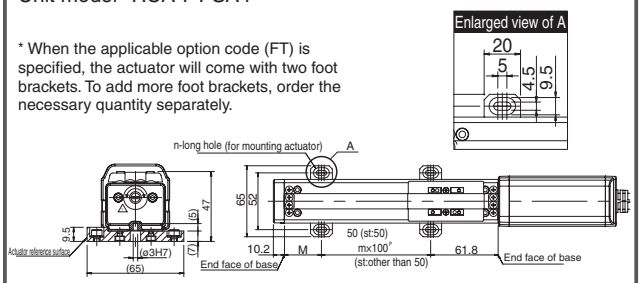
### ■ Option Code FT

| | |
|---|---|
| Applicable model | Slider type RCA (RCACR) SA4C / SA5C / SA6C, RCS2 (RCS2CR) SA4C / SA5C / SA6C |
| | All rod types |
| Description | A bracket for affixing the actuator using bolts from the top side. |
| | With a slider type subject to large moment load, install foot brackets at all mounting holes in the actuator. |
| | If the number of foot brackets is not sufficient, the actuator may deflect, resulting in a shorter service life. |

RCA / RCACR-SA4C RCS2 / RCS2CR-SA4C

Unit model RCA-FT-SA4

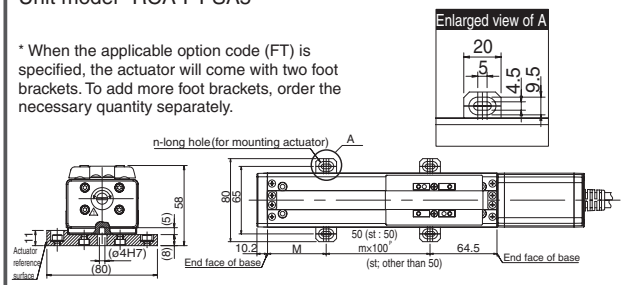
* When the applicable option code (FT) is specified, the actuator will come with two foot brackets. To add more foot brackets, order the necessary quantity separately.




RCA / RCACR-SA5C RCS2 / RCS2CR-SA5C

Unit model RCA-FT-SA5

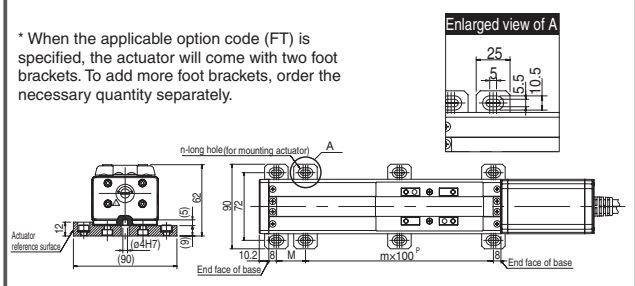
* When the applicable option code (FT) is specified, the actuator will come with two foot brackets. To add more foot brackets, order the necessary quantity separately.




RCA / RCACR-SA6C RCS2 / RCS2CR-SA6C

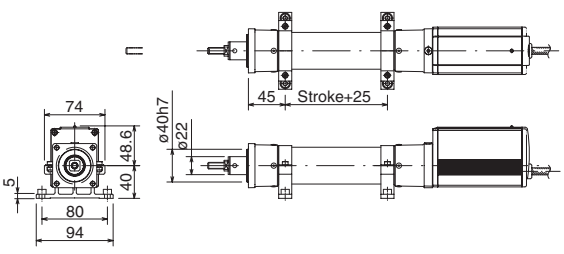
Unit model RCA-FT-SA6

* When the applicable option code (FT) is specified, the actuator will come with two foot brackets. To add more foot brackets, order the necessary quantity separately.




ERC2-RA6C / RGS6C / RGD6C

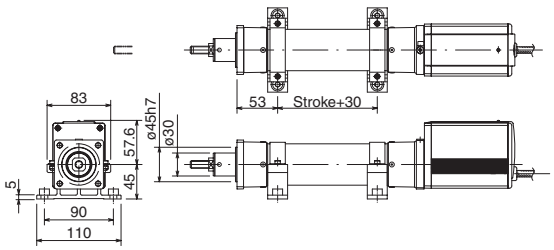
Unit model ERC2-FT-RA6




* The customer must provide mounting bolts (M6).

ERC2-RA7C / RGS7C / RGD7C

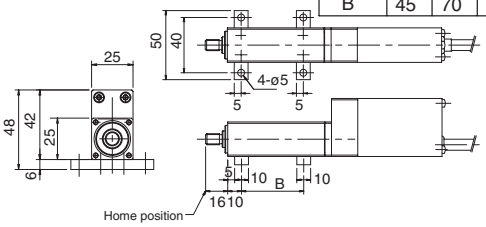
Unit model ERC2-FT-RA7




RCP2-RA2C

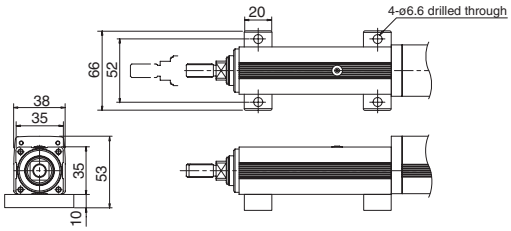
Unit model RCP2-FT-RA2

| Location of dimension \ Stroke | 25 | 50 | 75 | 100 |
|---|---|---|---|---|
| B | 45 | 70 | 95 | 120 |



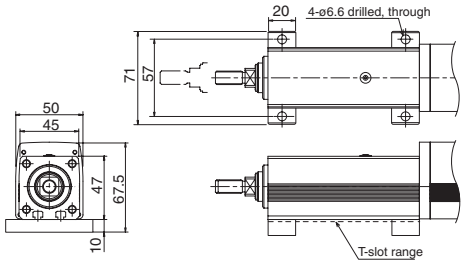

RCP2-RA3C / RGD3C

Unit model RCP2-FT-RA3



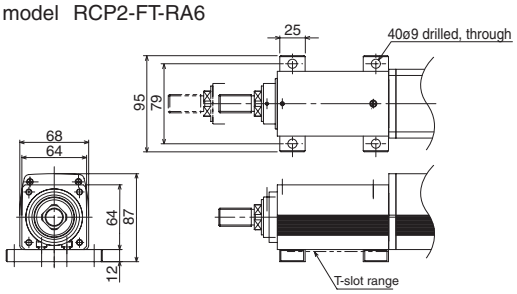

RCP2-RA4C / RGS4C / RGD4C

Unit model RCP2-FT-RA4



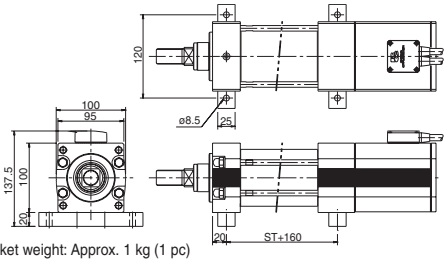

RCP2-RA6C / RGS6C / RGD6C

Unit model RCP2-FT-RA6




RCP2-RA10C

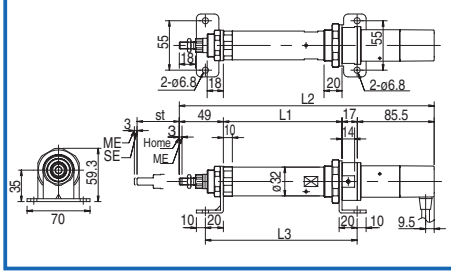
Unit model RCP2-FT-RA10




Foot bracket weight: Approx. 1 kg (1 pc)

RCA-RA3C / RGS3C / RGD3C

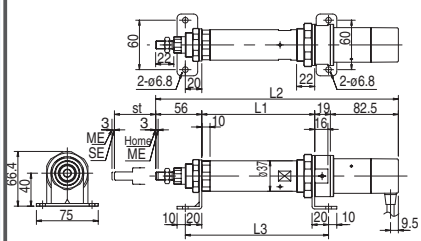
Unit model RCA-FT-RA3




| st | L1 | L2 | L3 |
|---|---|---|---|
| 50 | 132 | 283.5 | 168.8 |
| 100 | 182 | 333.5 | 218.8 |
| 150 | 232 | 383.5 | 268.8 |
| 200 | 282 | 433.5 | 318.8 |

RCA / RCS2-RA4C / RGS4C / RGD4C

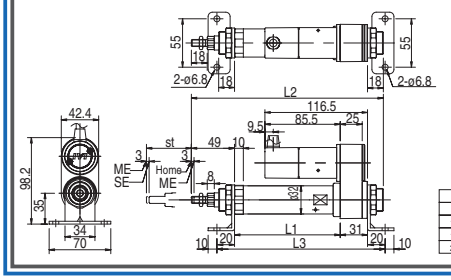
Unit model RCA-FT-RA4




| st | L1 | L2 | L3 |
|---|---|---|---|
| 50 | 137 | 294.5 | 173.8 |
| 100 | 187 | 344.5 | 223.8 |
| 150 | 237 | 394.5 | 273.8 |
| 200 | 287 | 444.5 | 323.8 |
| 250 | 337 | 494.5 | 373.8 |
| 300 | 487 | 544.5 | 423.8 |

RCA-RA3R / RGS3R / RGD3R

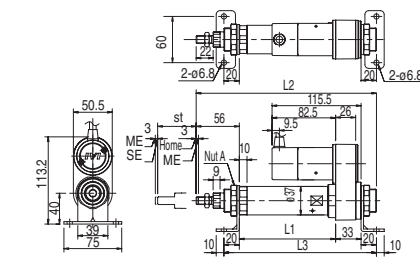
Unit model RCA-FT-RA3R




| st | L1 | L2 | L3 |
|---|---|---|---|
| 50 | 120 | 218 | 191 |
| 100 | 170 | 268 | 241 |
| 150 | 220 | 318 | 291 |
| 200 | 270 | 368 | 341 |

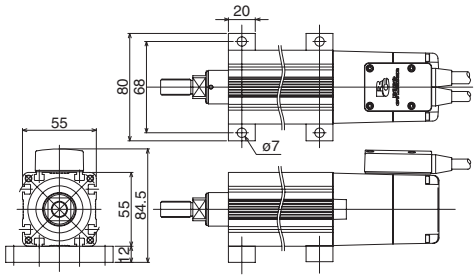
RCA(RCS2)-RA4R / RGS4R / RGD4R

Unit model RCA(RCS2)-FT-RA4

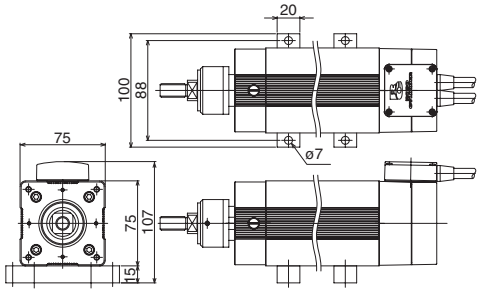



| st | L1 | L2 | L3 |
|---|---|---|---|
| 50 | 125 | 234 | 198 |
| 100 | 175 | 284 | 248 |
| 150 | 225 | 334 | 298 |
| 200 | 275 | 384 | 348 |
| 250 | 325 | 434 | 398 |
| 300 | 375 | 484 | 448 |

RCS2-RA5C / RGS5C / RGD5C
Unit model RCS2-FT-RA5




RCS2-RA7□D / RGS7□D / RGD7□D
Unit model RCS2-FT-RA7




## Home Check Sensor

### ■Option Code HS

| | | |
|---|---|---|
| Applicable model | Slider type | RCA (RCACR)-SA4C / SA5C / SA6C, RCS2 (RCS2CR)-SA4C / SA5C / SA6C<br>RCA-SA4R / SA5R / SA6R, RCS2-SA4R / SA5R / SA6R |
| | Rod type | RCA-RA3C / RA3R / RA4C / RA4R, RCS2-RA4C / RA4R |
| Description | A sensor for checking if the slider has definitely moved to the home position through home return. | |

## Limit Switch

### ■Option Code L

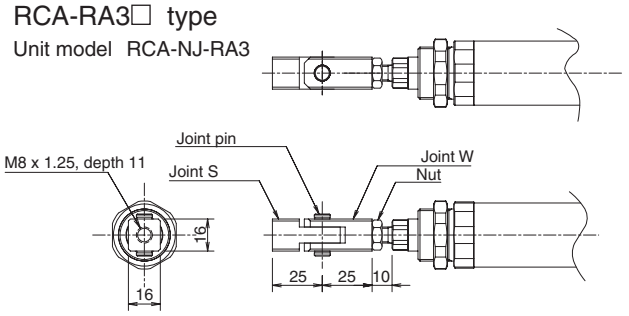
| | | |
|---|---|---|
| Applicable model | Rotary type | RCS2-RT6 / RT6R / RT7R |
| Description | When home return is performed, the home will be determined after the actuator reverses following contact with the mechanical end. This optional sensor is used to detect this reversing. (This sensor comes standard on all rotary types.) | |

## Knuckle Joint

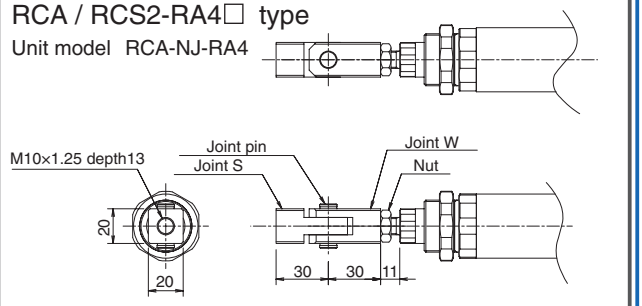
### ■Option Code NJ

| | | |
|---|---|---|
| Applicable model | Rod type | RCA-RA3C / RA3D / RA3R / RA4C / RA4D / RA4R<br>RCS2-RA4C / RA4D / RA4R |
| Description | A bracket that provides some degree of flexibility (rotation) to the movement of the tip of the actuator rod when a clevis or trunnion bracket is used. | |

RCA-RA3□ type
Unit model RCA-NJ-RA3




RCA / RCS2-RA4□ type
Unit model RCA-NJ-RA4




## Reversed-Home Specification

### ■Option Code NM

| | |
|---|---|
| Applicable model | All slider types<br>All rod types (RCP2-RA2C / RA10C, RCS2-RA5C / RA5R / RA7AD / RA7BD those models are excluded) |
| Description | Normally the home position is set on the motor side for both slider and rod types. If the home must be set on the opposite side due to the layout of the system, etc., you can specify this option to reverse the home direction. (Since the home position is adjusted prior to the shipment, any request for changing the home direction after the delivery will require the actuator to be returned to IAI for adjustment.) |

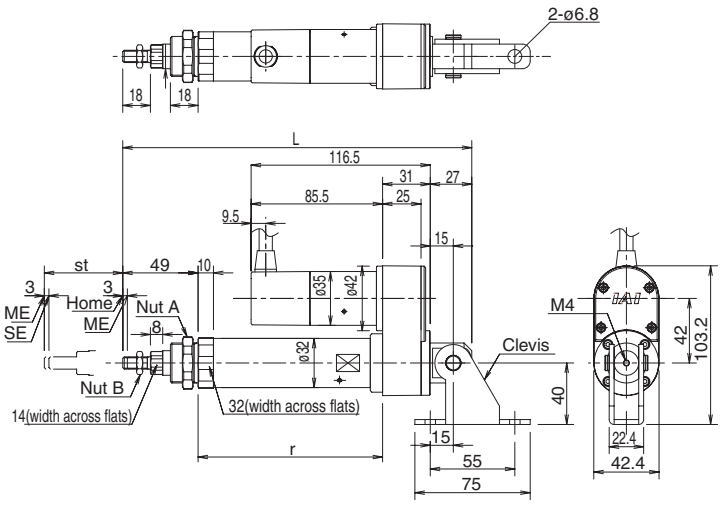
## Clevis

### ■Option Code I QR

| | |
|---|---|
| Applicable model | Rod type RCA-RA3R / RA4R<br>RCS2-RA4R |
| Description | A bracket for aligning the cylinder movement when the load installed at the tip of the rod moves in a direction different from the rod. |

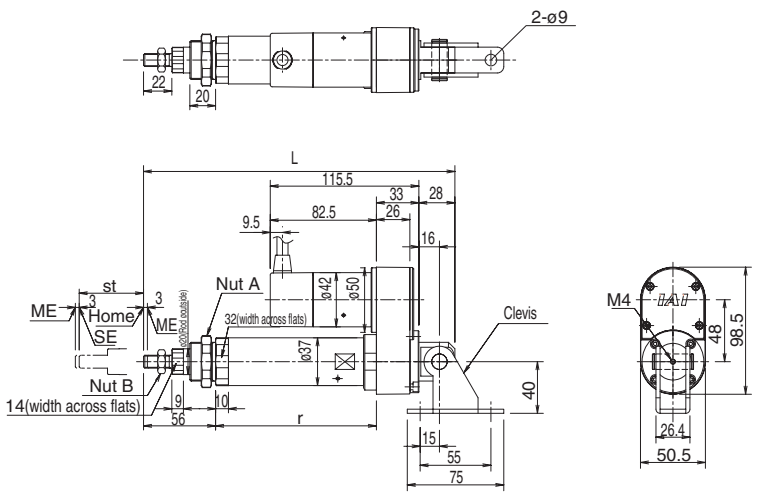
**Caution** If the rod is to be moved with a clevis bracket attached to it, use a guide type or install an external guide to prevent the rod from receiving any load other than from its moving direction.

RCA-RA3R
Unit model RCA-QR-RA3




| st | ℓ | L |
|---|---|---|
| 50 | 120 | 227 |
| 100 | 170 | 277 |
| 150 | 220 | 327 |
| 200 | 270 | 377 |

RCA / RCS2-RA4R
Unit model RCA-QR-RA4




| st | ℓ | L |
|---|---|---|
| 50 | 125 | 242 |
| 100 | 175 | 292 |
| 150 | 225 | 342 |
| 200 | 275 | 392 |
| 250 | 325 | 442 |
| 300 | 375 | 492 |

## Opposite Motor Reversing Direction

**■Option Code R**

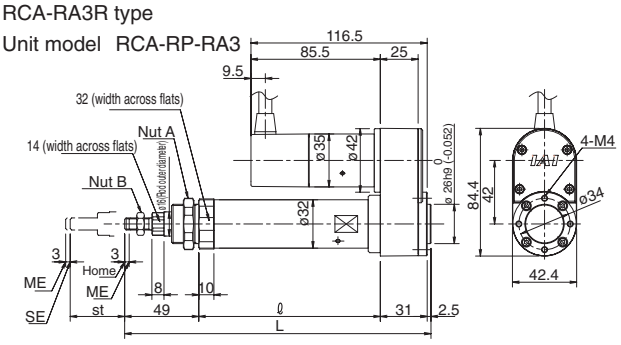
| | | |
|---|---|---|
| Applicable model | Motor-reversing slider type | RCA-SA4R / SA5R / SA6R<br>RCS2-SA4R / SA5R / SA6R / SA7R / SS7R / SS8R |
| | Motor-reversing rod type | RCS2-RA5R |
| Description | Change the motor reversing direction of a motor reversing type to the opposite side. | |

## Rear Mounting Plate

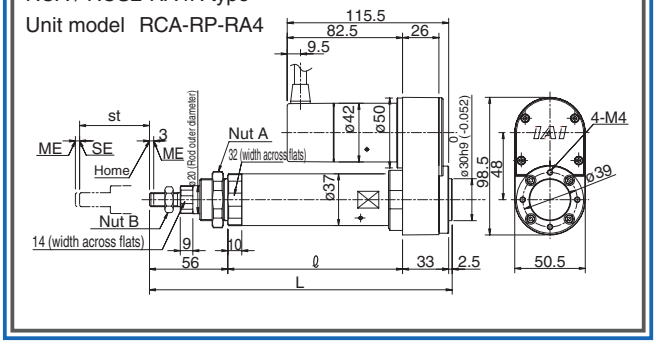
**■Option Code RP**

| | |
|---|---|
| Applicable model | Motor-reversing slider type RCA-RA3R / RA4R, RCS2-RA4R |
| Description | A bracket (plate) for affixing the back of a motor-reversing rod type (RA3R/RA4R) to the system. |

RCA-RA3R type
Unit model RCA-RP-RA3




RCA / RCS2-RA4R type
Unit model RCA-RP-RA4

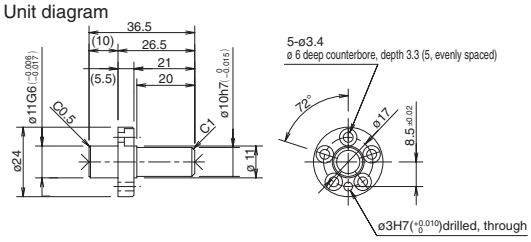



## Shaft Adapter

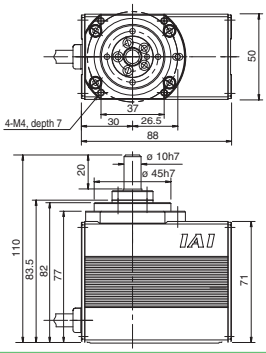
**■Option Code SA**

| | |
|---|---|
| Applicable model | Rotary type RCP2-RTB / RTC |
| Description | An adapter for installing a jig, etc., onto the rotating part of a rotary type. |

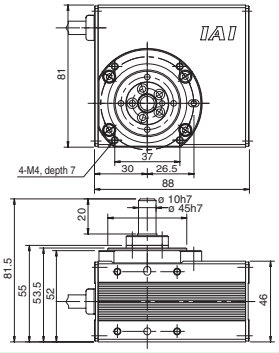
Unit diagram




Combined with RCP2-RTB
Unit model RCP2-SA-RT



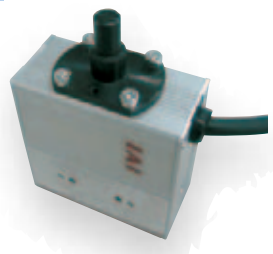

Combined with RCP2-RTC
Unit model RCP2-SA-RT



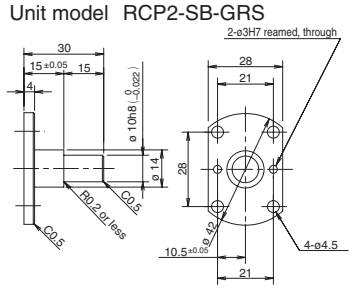

## Shaft Bracket

**■Option Code SB**

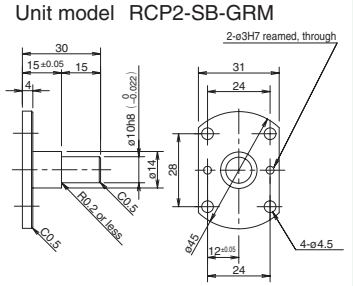
| | |
|---|---|
| Applicable model | Gripper type RCP2-GRS / GRM |
| Description | An affixing bracket for installing the gripper body. |



RCP2-GRS type
Unit model RCP2-SB-GRS




RCP2-GRM type
Unit model RCP2-SB-GRM



## Slider Roller Specification

**■Option Code SR**

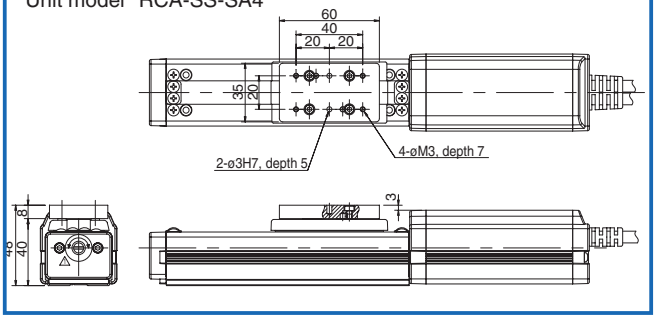
| | | |
|---|---|---|
| Applicable model | Slider type | RCA-SA4□ / SA5□ / SA6<br>RCS2-SA4□ / SA5□ / SA6□ / SA7□ / SS7□ / SS8□ |
| Description | Change the slider structure of a standard slider type to a roller structure similar to the one adopted by cleanroom types. | |

## Slider Spacer

**■Option Code SS**

| | | |
|---|---|---|
| Applicable model | Slider type | RCA-SA4C / SA4R, RCS2-SA4C / SA4R |
| Description | A spacer for raising the top face of the slider on the SA4 type to above the motor. This spacer is not required for non-SA4 types because the top face of the slider is above the motor on these actuators. | |

RCA / RCS2-SA4□ type
Unit model RCA-SS-SA4

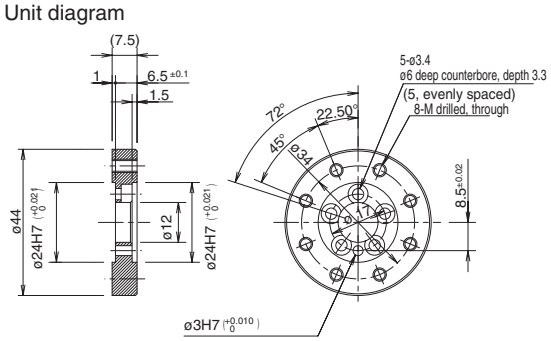



## Table Adapter

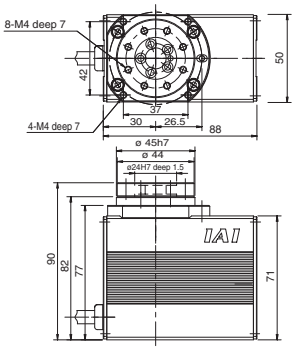
**■Option Code TA**

| | | |
|---|---|---|
| Applicable model | Rotary type | RCP2-RTB / RTC |
| Description | An adapter for installing a jig, etc., onto the rotating part of a rotary type. | |

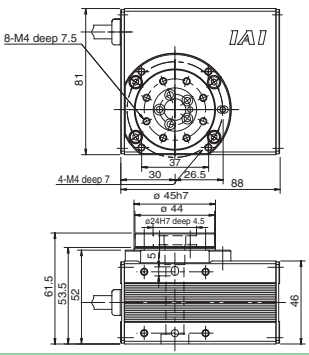
Unit diagram




RCP2-RTB type
Unit model RCP2-TA-RT




RCP2-RTC type
Unit model RCP2-TA-RT



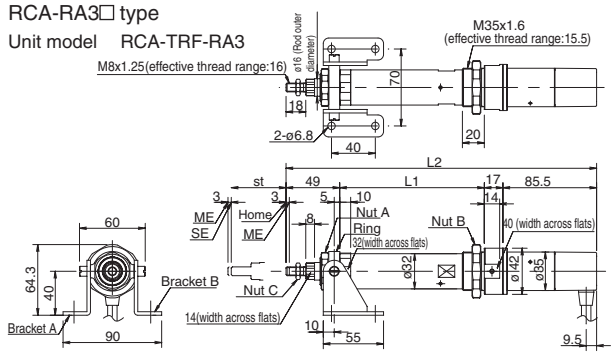
## Front Trunnion

### ■Option Code TRF

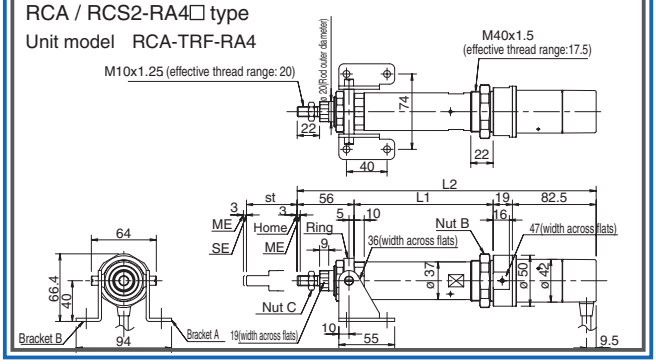
| | |
|---|---|
| Applicable model | Rod type RCA-RA3C / RA3D / RA3R / RA4C / RA4D / RA4R<br>RCS2-RA4C / RA4D / RA4R |
| Description | A bracket for aligning the cylinder movement when the load installed at the tip of the rod moves in a direction different from the rod. |

**Caution** If the rod is to be moved with a trunnion bracket attached to it, use a guide type or install an external guide to prevent the rod from receiving any load other than from its moving direction.

RCA-RA3□ type
Unit model RCA-TRF-RA3




RCA / RCS2-RA4□ type
Unit model RCA-TRF-RA4



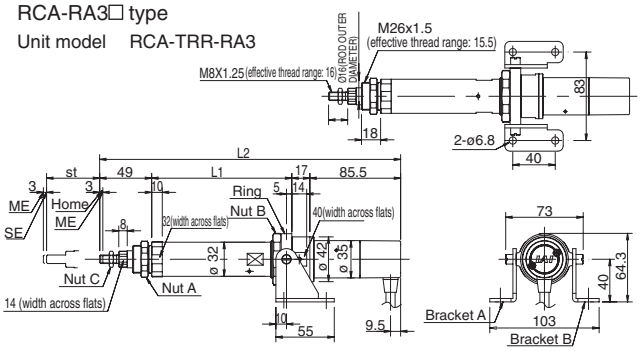

## Rear Trunnion

### ■Option Code TRR

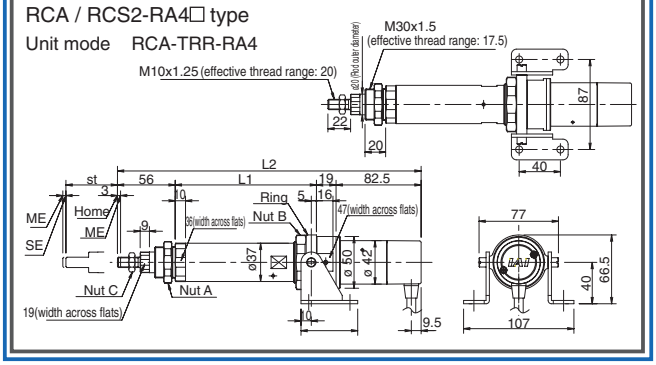
| | |
|---|---|
| Applicable model | Rod type RCA-RA3C / RA3D / RA4C / RA4D<br>RCS2-RA4C / RA4D |
| Description | A bracket for aligning the cylinder movement when the load installed at the tip of the rod moves in a direction different from the rod. |

**Caution** If the rod is to be moved with a trunnion bracket attached to it, use a guide type or install an external guide to prevent the rod from receiving any load other than from its moving direction.

RCA-RA3□ type
Unit model RCA-TRR-RA3




RCA / RCS2-RA4□ type
Unit mode RCA-TRR-RA4




## Vacuum Joint on Opposite Side

### ■Option Code VR

| | |
|---|---|
| Applicable model | All cleanroom types |
| Description | On standard specifications, the vacuum joint is installed on the left side of the actuator as viewed from the motor. This option changes the position of the vacuum joint to the opposite (right) side. |

# List of Spare Part Models by Type

* The models in ( ) apply to robot cables.

<table>
<tr><th>Series</th><th>Type</th><th>Stainless sheet model</th><th>Motor cable model<br>(motor robot cable model)</th><th>Encoder cable model<br>(encoder robot cable model)</th></tr>
<tr><td rowspan="8">ERC2<br>Slider type<br>ERC2<br>Rod type</td><td>SA6C</td><td rowspan="8">(Not available)</td><td colspan="2" rowspan="8">[Power & I/O cable (PIO specification) / Power & I/O cable (SIO specification)]<br>CB-ERC-PWBIO□□□ / CB-ERC2-PWBIO□□□<br>(CB-ERC-PWBIO□□□-RB / CB-ERC2-PWBIO□□□-RB)<br><br>[Power & I/O cable with connectors on both ends (PIO specification)]<br>CB-ERC-PWBIO□□□-H6<br>(CB-ERC-PWBIO□□□-RB-H6)</td></tr>
<tr><td>SA7C</td></tr>
<tr><td>RA6C</td></tr>
<tr><td>RA7C</td></tr>
<tr><td>RGS6C</td></tr>
<tr><td>RGS7C</td></tr>
<tr><td>RGD6C</td></tr>
<tr><td>RGD7C</td></tr>
<tr><td rowspan="15">RCP2<br>Slider type</td><td>SA5C</td><td>ST-2A5- (stroke)</td><td rowspan="14">CB-RCP2-MA□□□<br>* With the RCP2 series, the standard motor cable is a robot cable.</td><td rowspan="13">CB-RCP2-PA□□□<br>(CB-RCP2-PA□□□-RB)</td></tr>
<tr><td>SA6C</td><td>ST-2A6- (stroke)</td></tr>
<tr><td>SA7C</td><td>ST-2A7- (stroke)</td></tr>
<tr><td>SS7C</td><td>ST-SS1- (stroke)</td></tr>
<tr><td>SS8C</td><td>ST-SM1- (stroke)</td></tr>
<tr><td>SA5R</td><td>ST-2A5- (stroke)</td></tr>
<tr><td>SA6R</td><td>ST-2A6- (stroke)</td></tr>
<tr><td>SA7R</td><td>ST-2A7- (stroke)</td></tr>
<tr><td>SS7R</td><td>ST-SS1- (stroke)</td></tr>
<tr><td>SS8R</td><td>ST-SM1- (stroke)</td></tr>
<tr><td>BA6</td><td rowspan="2">(Not available)</td></tr>
<tr><td>BA7</td></tr>
<tr><td>HS8C</td><td>ST-SM1- (stroke)</td><td rowspan="2">CB-RFA-PA□□□<br>(CB-RFA-PA□□□-RB)</td></tr>
<tr><td>HS8R</td><td>ST-SM1- (stroke)</td></tr>
<tr><td rowspan="15">RCA<br>Slider type</td><td>SA4C</td><td>ST-SA4- (stroke)</td><td rowspan="15">CB-ACS-MA□□□<br>* With the RCA series, the standard motor cable is a robot cable.</td><td rowspan="15">CB-ACS-PA □□□<br>(CB-ACS-PA□□□-RB)</td></tr>
<tr><td>SA5C</td><td>ST-SA5- (stroke)</td></tr>
<tr><td>SA6C</td><td>ST-SA6- (stroke)</td></tr>
<tr><td>SA4D</td><td>ST-SA4- (stroke)</td></tr>
<tr><td>SA5D</td><td>ST-SA5- (stroke)</td></tr>
<tr><td>SA6D</td><td>ST-SA6- (stroke)</td></tr>
<tr><td>SS4D</td><td>ST-SS4- (stroke)</td></tr>
<tr><td>SS5D</td><td>ST-SS5- (stroke)</td></tr>
<tr><td>SS6D</td><td>ST-SS6- (stroke)</td></tr>
<tr><td>SA4R</td><td>ST-SA4- (stroke)</td></tr>
<tr><td>SA5R</td><td>ST-SA5- (stroke)</td></tr>
<tr><td>SA6R</td><td>ST-SA6- (stroke)</td></tr>
<tr><td rowspan="20">RCS2<br>Slider type</td><td>SA4C</td><td>ST-SA4- (stroke)</td><td rowspan="20">CB-RCC-MA□□□<br>(CB-RCC-MA□□□-RB)</td><td rowspan="20">[SCON/SSEL/XSEL-P,Q]<br>CB-RCS2-PA□□□<br>(CB-X2-PA□□□)<br><br>[XSEL-J,K]<br>CB-RCBC-PA□□□<br>(CB-RCBC-PA□□□-RB)</td></tr>
<tr><td>SA5C</td><td>ST-SA5- (stroke)</td></tr>
<tr><td>SA6C</td><td>ST-SA6- (stroke)</td></tr>
<tr><td>SA7C</td><td>ST-SA7- (stroke)</td></tr>
<tr><td>SS7C</td><td>ST-SS1- (stroke)</td></tr>
<tr><td>SS8C</td><td>ST-SM1- (stroke)</td></tr>
<tr><td>SA4D</td><td>ST-SA4- (stroke)</td></tr>
<tr><td>SA5D</td><td>ST-SA5- (stroke)</td></tr>
<tr><td>SA6D</td><td>ST-SA6- (stroke)</td></tr>
<tr><td>SA4R</td><td>ST-SA4- (stroke)</td></tr>
<tr><td>SA5R</td><td>ST-SA5- (stroke)</td></tr>
<tr><td>SA6R</td><td>ST-SA6- (stroke)</td></tr>
<tr><td>SA7R</td><td>ST-SA7- (stroke)</td></tr>
<tr><td>SS7R</td><td>ST-SS1- (stroke)</td></tr>
<tr><td>SS8R</td><td>ST-SM1- (stroke)</td></tr>
</table>

# List of Spare Part Models by Type

| Series | Type | Stainless sheet model | Motor cable model (motor robot cable model) | Encoder cable model (encoder robot cable model) |
|---|---|---|---|---|
| RCP2 Rod type | RA2C | (Not available) | CB-RCP2-MA□□□<br>* With the RCP2 series, the standard motor cable is a robot cable. | CB-RCP2-PA□□□<br>(CB-RCP2-PA□□□-RB) |
| | RA3C | | | |
| | RA4C | | | |
| | RA6C | | | |
| | RGS4C | | | |
| | RGS6C | | | |
| | RGD3C | | | |
| | RGD4C | | | |
| | RGD6C | | | |
| | RA10C | | | CB-RFA-PA□□□(CB-RFA-PA□□□-RB) |
| RCA Rod type | RA3C | | CB-ACS-MA□□□<br>* With the RCA series, the standard motor cable is a robot cable. | CB-ACS-PA□□□<br>(CB-ACS-PA□□□-RB) |
| | RA4C | | | |
| | RA3D | | | |
| | RA4D | | | |
| | RA3R | | | |
| | RA4R | | | |
| | RGS3C | | | |
| | RGS4C | | | |
| | RGS3D | | | |
| | RGS4D | | | |
| | RGS3R | | | |
| | RGS4R | | | |
| | RGD3C | | | |
| | RGD4C | | | |
| | RGD3D | | | |
| | RGD4D | | | |
| | RGD3R | | | |
| | RGD4R | | | |
| RCS2 Rod type | RA4C | | CB-RCC-MA□□□<br>(CB-RCC-MA□□□-RB) | [SCON/SSEL/XSEL-P.Q]<br>CB-RCS2-PA□□□<br>(CB-X2-PA□□□)<br><br>[XSEL-J.K]<br>CB-RCBC-PA□□□<br>(CB-RCBC-PA□□□-RB) |
| | RA5C | | | |
| | RA4D | | | |
| | RA7AD | | | |
| | RA7BD | | | |
| | RA4R | | | |
| | RA5R | | | |
| | RGS4C | | | |
| | RGS5C | | | |
| | RGS4D | | | |
| | RGS7AD | | | |
| | RGS7BD | | | |
| | RGS4R | | | |
| | RGS5R | | | |
| | RGD4C | | | |
| | RGD5C | | | |
| | RGD4D | | | |
| | RGD7AD | | | |
| | RGD7BD | | | |
| | RGD4R | | | |
| | RGD5R | | | |

| Series | Type | Stainless sheet model | Motor cable model (motor robot cable model) | Encoder cable model (encoder robot cable model) |
|---|---|---|---|---|
| RCA Arm type | A4R | (Not available) | CB-ACS-MA□□□ * With the RCA series, the standard motor cable is a robot cable. | CB-ACS-PA (CB-ACS-PA□□□-RB) |
| | A5R | | | |
| | A6R | | | |
| RCS2 Arm type | A4R | | CB-RCC-MA□□□ (CB-RCC-MA□□□-RB) | [SCON/SSEL/XSEL-P.Q] CB-RCS2-PA (CB-X2-PA□□□) [XSEL-J.K] CB-RCBC-PA□□□ (CB-RCBC-PA□□□-RB) |
| | A5R | | | |
| | A6R | | | |
| RCS2 Flat type | F5D | | | |
| RCP2 Gripper type | GRS | | CB-RCP2-MA□□□ * With the RCP2 series, the standard motor cable is a robot cable. | CB-RCP2-PA□□□ (CB-RCP2-PA□□□-RB) |
| | GRM | | | |
| | GR3LS | | | |
| | GR3LM | | | |
| | GR3SS | | | |
| | GR3SM | | | |
| RCS2 Gripper type | GR8 | | CB-RCC-MA□□□ (CB-RCC-MA□□□-RB) | CB-RCS2-PA□□□(CB-X2-PA□□□) CB-RCBC-PA□□□(CB-RCBC-PA□□□-RB) |
| RCP2CR Rotary type | RTB | | CB-RCP2-MA□□□ * With the RCP2 series, the standard motor cable is a robot cable. | CB-RCP2-PA□□□ (CB-RCP2-PA□□□-RB) |
| | RTC | | | |
| RCS2 Rotary type | RT6 | | CB-RCC-MA□□□ (CB-RCC-MA□□□-RB) | [SCON/SSEL/XSEL-P.Q] CB-RCS2-PLA□□□ (CB-X2-PLA □□□) [XSEL-J.K(Set of 2 pcs)] CB-RCBC-PA□□□(CB-RCBC-PA□□□-RB) CB-X-LC□□□ |
| | RT6R | | | |
| | RT7R | | | |
| RCP2CR Cleanroom type | SA5C | ST-2A5-(Stroke) | CB-RCP2-MA□□□ * With the RCP2 series, the standard motor cable is a robot cable. | CB-RCP2-PA□□□ (CB-RCP2-PA□□□-RB) |
| | SA6C | ST-2A6-(Stroke) | | |
| | SA7C | ST-2A7-(Stroke) | | |
| | SS7C | ST-SS2-(Stroke) | | |
| | SS8C | ST-SM2-(Stroke) | | |
| | HS8C | ST-SM2-(Stroke) | | |
| RCACR Cleanroom type | SA4C | ST-SA4-(Stroke) | CB-ACS-MA□□□ With the RCA series, the standard motor cable is a robot cable. | CB-ACS-PA□□□ (CB-ACS-PA□□□-RB) |
| | SA5C | ST-SA5-(Stroke) | | |
| | SA6C | ST-SA6-(Stroke) | | |
| | SA5D | ST-SA5-(Stroke) | | |
| | SA6D | ST-SA6-(Stroke) | | |
| RCS2CR Cleanroom type | SA4C | ST-SA4-(Stroke) | CB-RCC-MA□□□ (CB-RCC-MA□□□-RB) | [SCON/SSEL/XSEL-P.Q] CB-RCS2-PA□□□ (CB-X2-PA□□□) [XSEL-J.K] CB-RCBC-PA□□□ (CB-RCBC-PA□□□-RB) |
| | SA5C | ST-SA5-(Stroke) | | |
| | SA6C | ST-SA6-(Stroke) | | |
| | SA7C | ST-SA7-(Stroke) | | |
| | SS7C | ST-SS2-(Stroke) | | |
| | SS8C | ST-SM2-(Stroke) | | |
| | SA5D | ST-SA5-(Stroke) | | |
| | SA6D | ST-SA6-(Stroke) | | |
| RCP2W Splash-proof type | RA4C | (Not available) | CB-RCP2-MA□□□ * With the RCP2 series, the standard motor cable is a robot cable. | CB-RCP2-PA□□□ (CB-RCP2-PA□□□-RB) |
| | RA6C | | | CB-RFA-PA□□□ (CB-RFA-PA□□□-RB) |
| | SA16C | | | |
| | RA10C | | | |
| RCAW Splash-proof type | RA3? | | CB-ACS-MA□□□ * With the RCA series, the standard motor cable is a robot cable. | CB-ACS-PA□□□ (CB-ACS-PA□□□-RB) |
| | RA4? | | | |
| RCS2WSplash-proof type | RA4? | | CB-RCC-MA□□□ (CB-RCC-MA□□□-RB) | CB-RCS2-PA□□□(CB-X2-PA□□□) CB-RCBC-PA□□□(CB-RCBC-PA□□□-RB) |

# Selection Guide (Correlation Diagram of Speed and Load Capacity)

ERC2 Series | Slider type

**Select horizontal or vertical installation**

**Select the speed type based on the cycle time of the system**

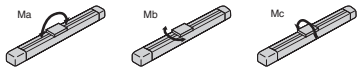
**Select the target type using the correlation diagrams of speed and load capacity below**

## Caution for Use

- If you will be using a slider type and the load installed on the slider will project significantly from the center, consider the load moment and overhang load length.

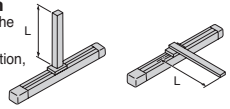
**Load moment**

Keep Ma/Mb/Mc load moments within their specified ranges.



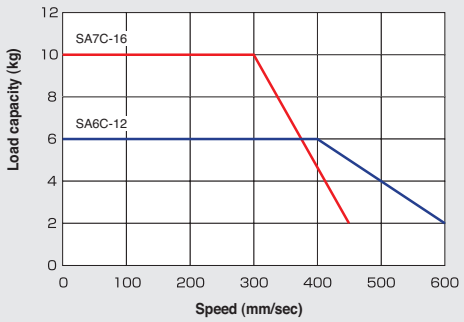
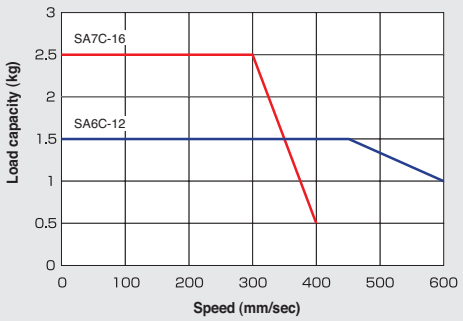
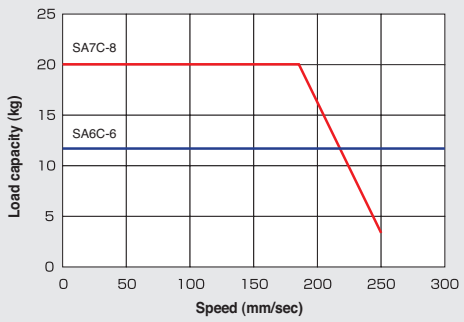
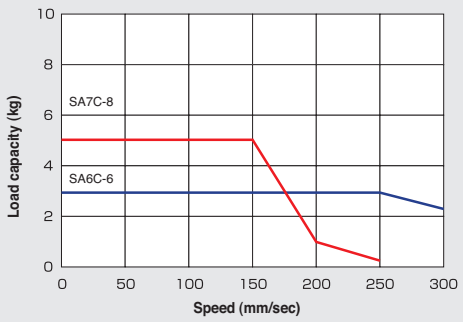
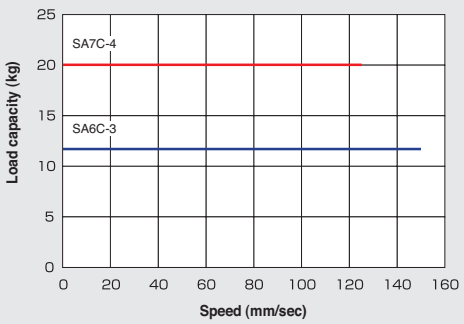
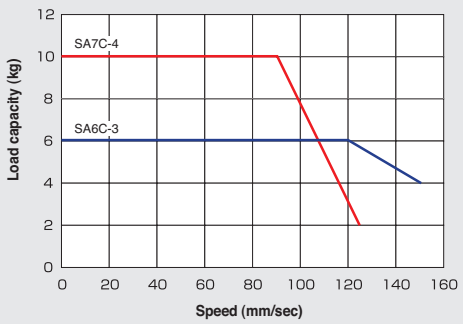

**Overhang load length**

When the center of gravity of the installed load is L/2. If the load projects in Ma, Mb or Mc direction, keep the overhang load length within the specified range.




- On the SA6 type with a 600 stroke, the maximum speed is limited so as not to reach a critical speed. 600 stroke (lead 12: 515 mm/sec, lead 6: 255 mm/sec, lead 3: 125 mm/sec)

Maximum speed
600 mm/sec
300 mm/sec
150 mm/sec

| | Horizontal installation | Vertical installation |
|---|---|---|
| High-speed type |  |  |
| Medium-speed type |  |  |
| Low-speed type |  |  |



(Note) In the above diagrams, the figure after the type code indicates the lead.

## ERC2 Series — Standard Rod Type

**Select horizontal or vertical installation**

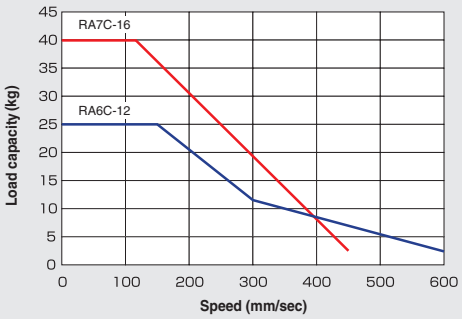
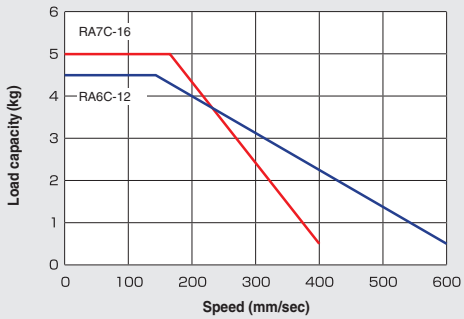
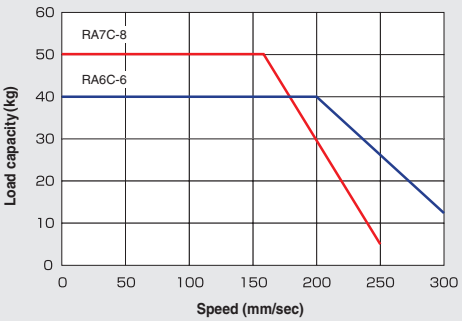
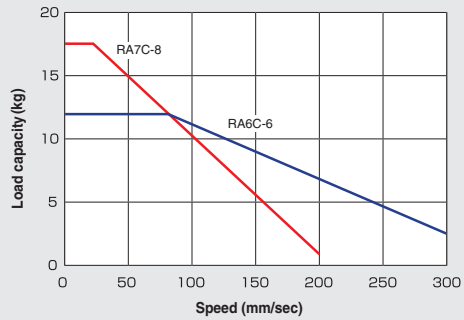
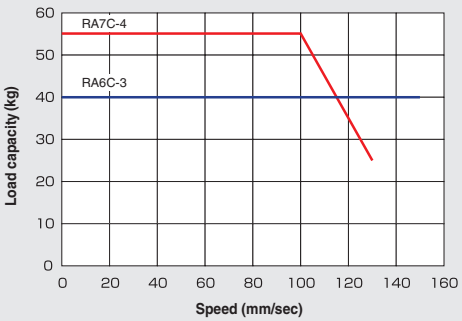
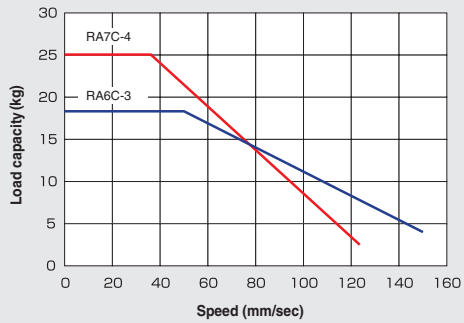
**Select the speed type based on the cycle time of the system**

**Select the target type using the correlation diagrams of speed and load capacity below**

### Caution for Use

- With rod types, no external force is considered other than the force applied from the moving direction of the rod. If the rod will receive any force in the right-angle direction or rotating direction, the customer should add a guide.
- The figures in the following diagrams under "Horizontal Installation" assume use of an external guide.
- On the RA6 type with a 300 stroke, the maximum speed is limited so as not to reach a critical speed. 300 stroke (lead 12: 500 mm/sec, lead 6: 250 mm/sec, lead 3: 125 mm/sec)

Maximum speed
600 mm/sec
300 mm/sec
150 mm/sec

| | Horizontal installation | Vertical installation |
|---|---|---|
| High-speed type |   |   |
| Medium-speed type |   |   |
| Low-speed type |   |   |

(Note) In the above diagrams, the figure after the type code indicates the lead.

# Selection Guide (Correlation Diagram of Speed and Load Capacity)

RCP2 Series | Slider type (Motor Straight Type)

**Select horizontal or vertical installation**

**Select the speed type based on the cycle time of the system**

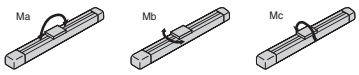
**Select the target type using the correlation diagrams of speed and load capacity below**

## Caution for Use

- If you will be using a slider type and the load installed on the slider will project significantly from the center, consider the load moment and overhang load length.

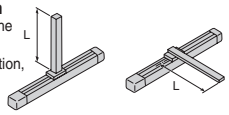
**Load moment**

Keep Ma/Mb/Mc load moments within their specified ranges.




**Overhang load length**

When the center of gravity of the installed load is L/2. If the load projects in Ma, Mb or Mc direction, keep the overhang load length within the specified range.



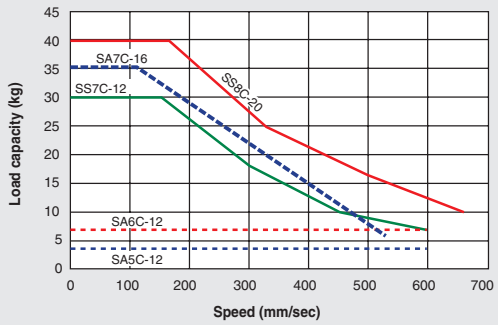

Maximum speed 600 mm/sec

300 mm/sec

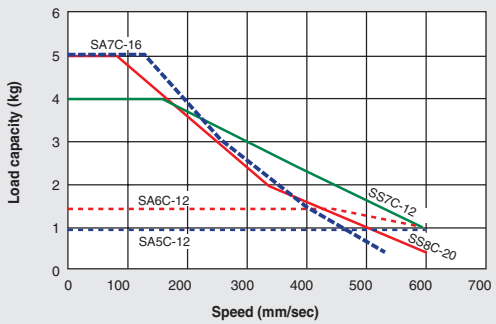
150 mm/sec

**High-speed type**

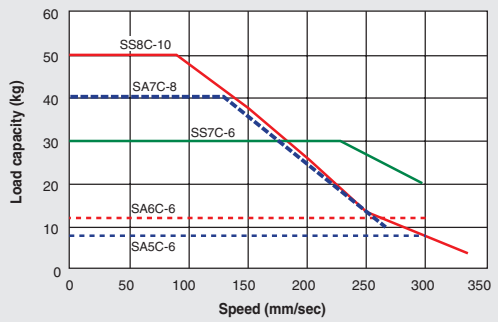
**Horizontal installation**

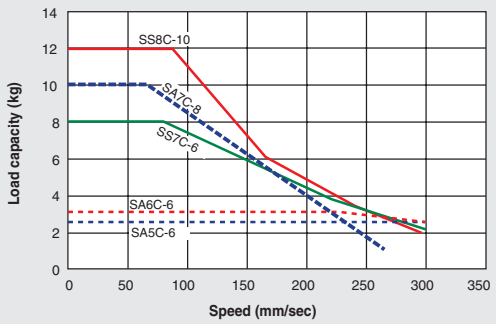



**Vertical installation**

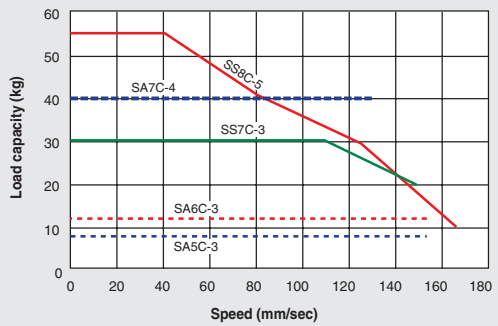


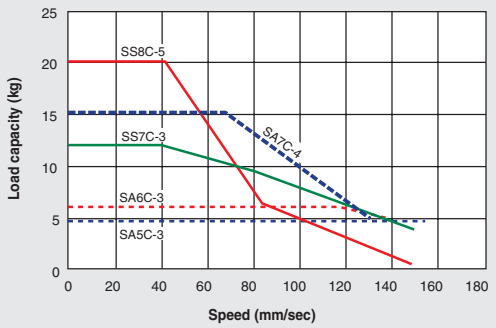

**Medium-speed type**




**Low-speed type**




(Note) In the above diagrams, the figure after the type code indicates the lead.

RCP2 Series **Slider type (Motor Reversing Type)**

**Select horizontal or vertical installation**

**Select the speed type based on the cycle time of the system**

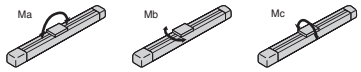
**Select the target type using the correlation diagrams of speed and load capacity below**

## Caution for Use

● If you will be using a slider type and the load installed on the slider will project significantly from the center, consider the load moment and overhang load length.

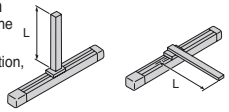
**Load moment**

Keep Ma/Mb/Mc load moments within their specified ranges.




**Overhang load length**

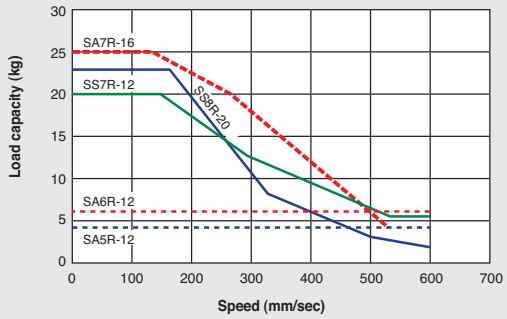
When the center of gravity of the installed load is L/2. If the load projects in Ma, Mb or Mc direction, keep the overhang load length within the specified range.

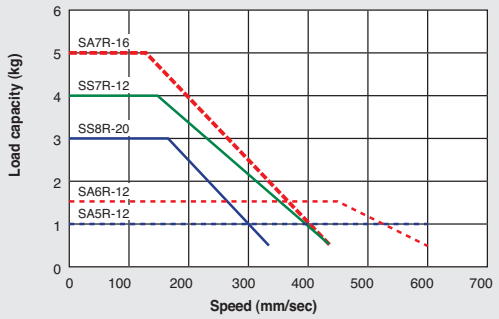



Maximum speed
600 mm/sec
300 mm/sec
150 mm/sec

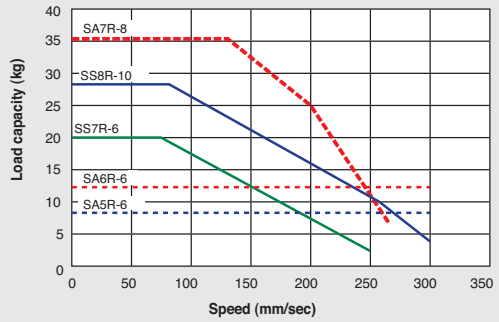
**Horizontal installation** | **Vertical installation**

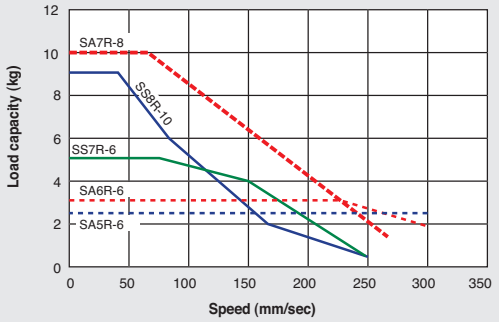
### High-speed type



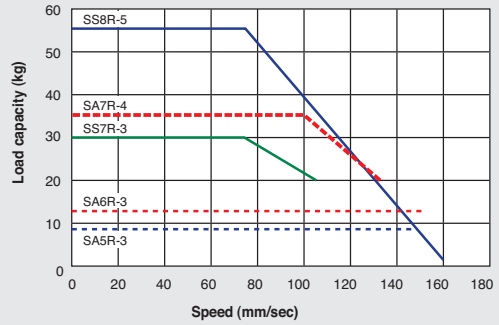



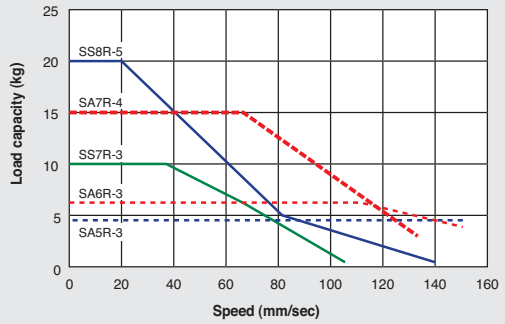

### Medium-speed type




### Low-speed type



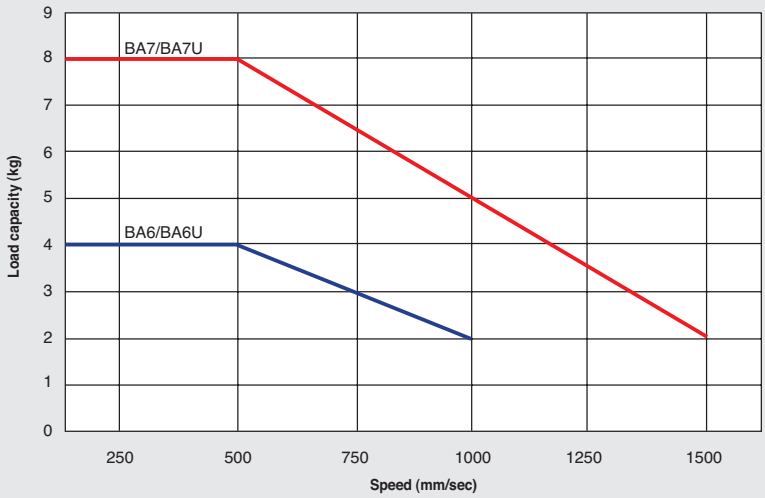

(Note) In the above diagrams, the figure after the type code indicates the lead.

# Selection Guide (Correlation Diagram of Speed and Load Capacity)

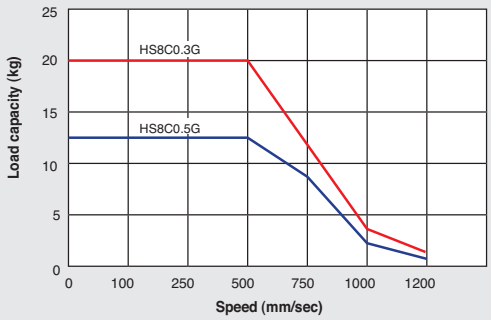
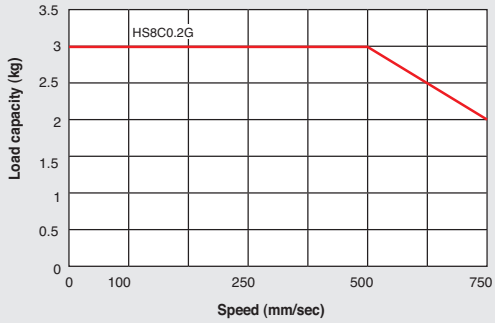
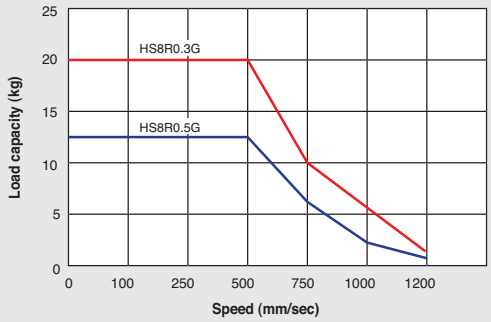
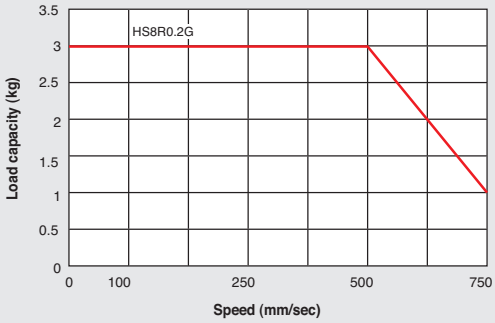
## RCP2 Series Belt Slider Type

**Select the target type using the correlation diagrams of speed and load capacity below.**

### Horizontal installation




## RCP2 Series High-Speed Ball-Screw Slider Type

| | Horizontal installation | Vertical installation |
|---|---|---|
| RCP2-HS8C |  |  |
| RCP2-HS8R |  |  |

RCP2 Series **Standard Rod Type**

**Select horizontal or vertical installation**

**Select the speed type based on the cycle time of the system**

**Select the target type using the correlation diagrams of speed and load capacity below**

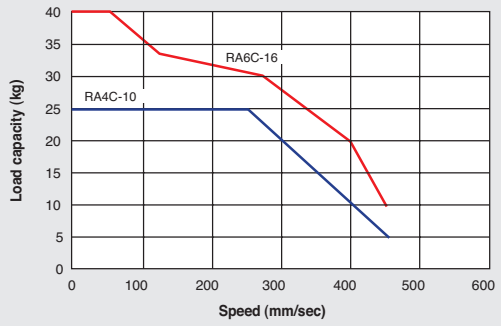
**Caution for Use**

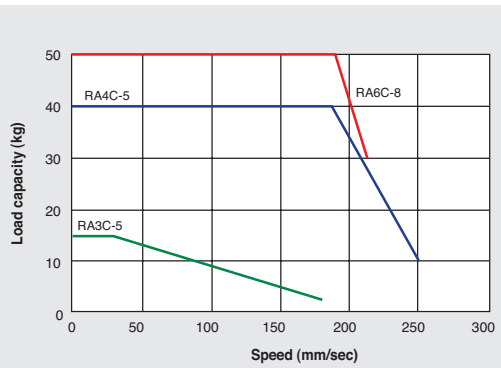
●With rod types, no external force is considered other than the force applied from the moving direction of the rod.
If the rod will receive any force in the right-angle direction or rotating direction, the customer should use a high-rigidity type or add a guide.

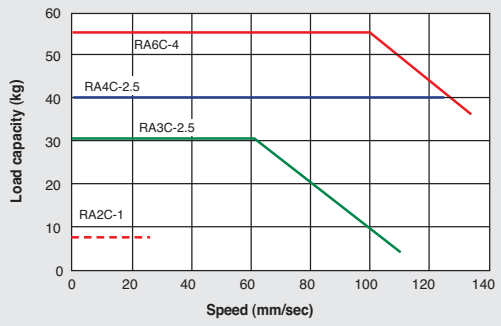
Maximum speed
500 mm/sec
250 mm/sec
125 mm/sec

High-speed type
Medium-speed type
Low-speed type

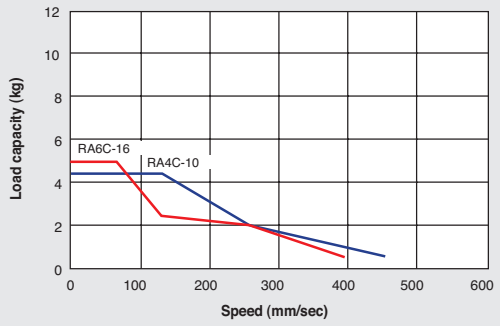
**Horizontal installation** (Note 1)

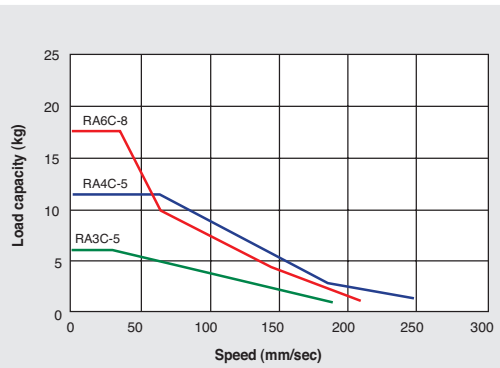


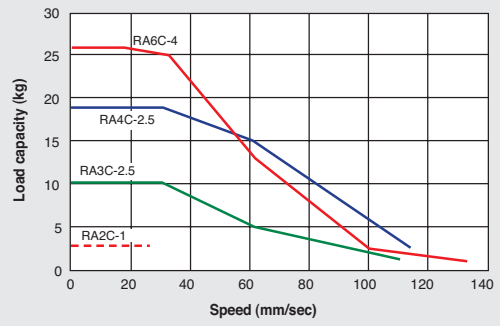




**Vertical installation**




(Note) In the above diagrams, the figure after the type code indicates the lead.
(Note 1) The figures in the diagrams under "Horizontal Installation" assume use of an external guide.

# Selection Guide (Correlation Diagram of Speed and Load Capacity)

RCP2 Series **Single-Guide Type**

**Select horizontal or vertical installation**

**Select the speed type based on the cycle time of the system**

**Select the target type using the correlation diagrams of speed and load capacity below**

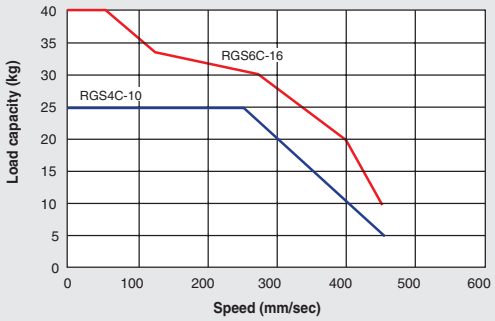
**Caution for Use**

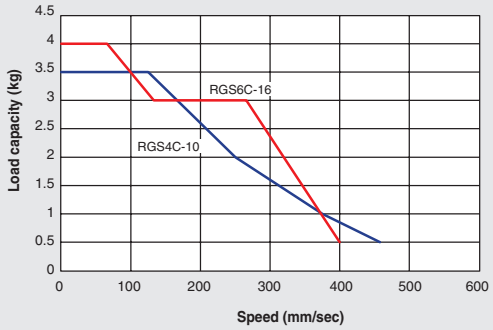
● The figures in the following diagrams under "Horizontal Installation" assume use of an external guide.

Maximum speed
500 mm/sec
250 mm/sec
125 mm/sec

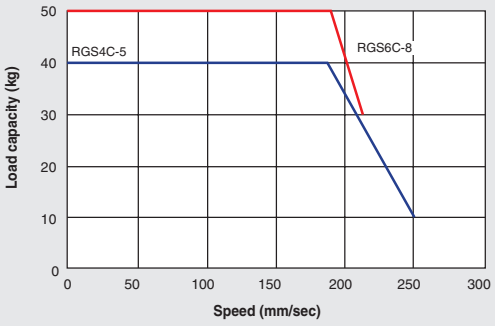
**Horizontal installation** (Note 1) | **Vertical installation**

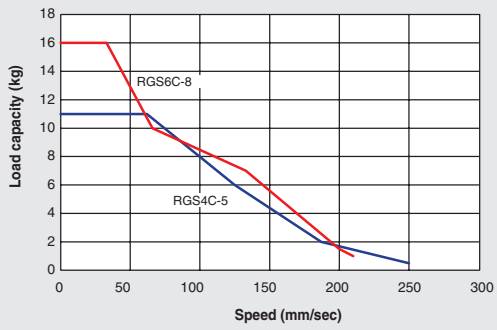
**High-speed type**



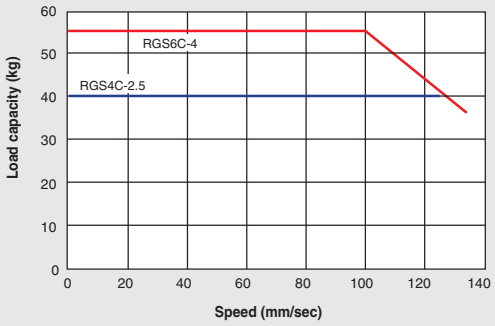



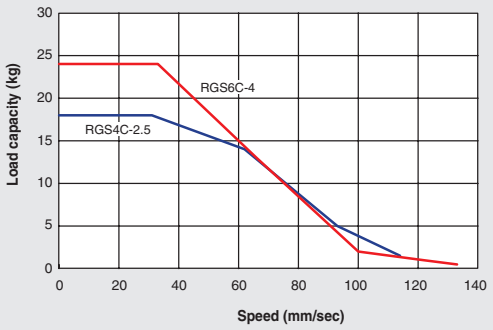

**Medium-speed type**




**Low-speed type**




(Note) In the above diagrams, the figure after the type code indicates the lead.
(Note 1) The figures in the diagrams under "Horizontal Installation" assume use of an external guide.

RCP2 Series **Double-Guide Type**

**Select horizontal or vertical installation**

**Select the speed type based on the cycle time of the system**

**Select the target type using the correlation diagrams of speed and load capacity below**

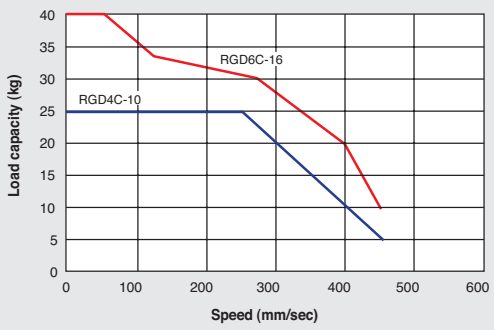
**Caution for Use**

● The figures in the following diagrams under "Horizontal Installation" assume use of an external guide.

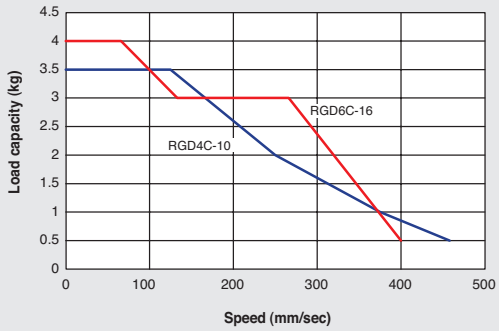
**Maximum speed**
500 mm/sec
250 mm/sec
125 mm/sec

**High-speed type**

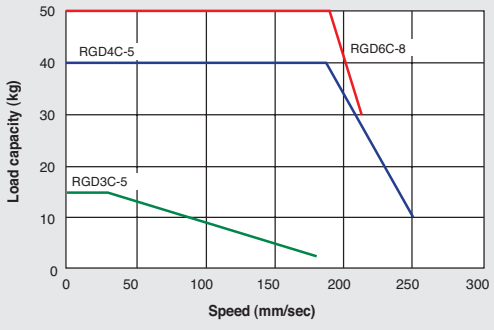
**Horizontal installation** (Note 1)

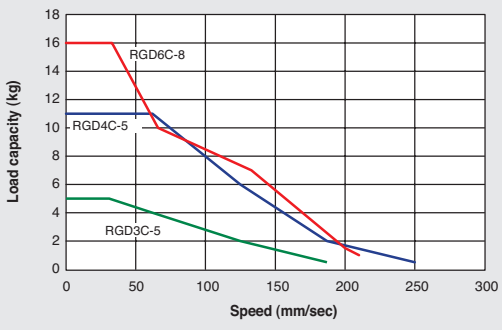



**Vertical installation**

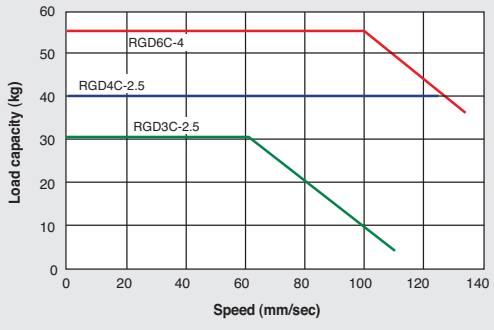


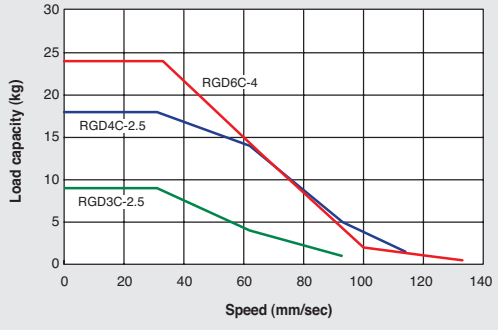

**Medium-speed type**




**Low-speed type**




(Note) In the above diagrams, the figure after the type code indicates the lead.
(Note 1) The figures in the diagrams under "Horizontal Installation" assume use of an external guide.

# Selection Guide (Correlation Diagram of Speed and Load Capacity)

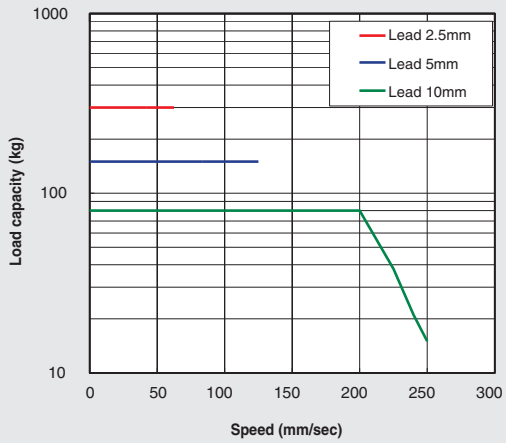
RCP2 Series **High-Thrust Type**

## Caution for Use

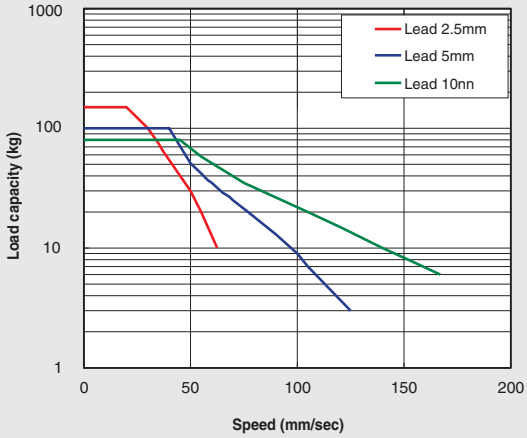
- With rod types, no external force is considered other than the force applied from the moving direction of the rod. If the rod will receive any force in the right-angle direction or rotating direction, the customer should add a guide.
- The figures in the following diagrams under "Horizontal Installation" assume use of an external guide.

**Select horizontal or vertical installation**

### Horizontal installation




### Vertical installation




(Note) In the above diagrams, the figure after the type code indicates the lead.

RCP2CR Series **Slider Type (Motor Straight Type)**

**Select horizontal or vertical installation**

**Select the speed type based on the cycle time of the system**

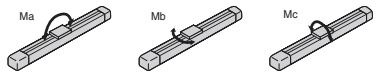
**Select the target type using the correlation diagrams of speed and load capacity below**

## Caution for Use

● If you will be using a slider type and the load installed on the slider will project significantly from the center, consider the load moment and overhang load length.

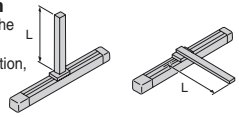
**Load moment**

Keep Ma/Mb/Mc load moments within their specified ranges.




**Overhang load length**

When the center of gravity of the installed load is L/2. If the load projects in Ma, Mb or Mc direction, keep the overhang load length within the specified range.




**Maximum speed**

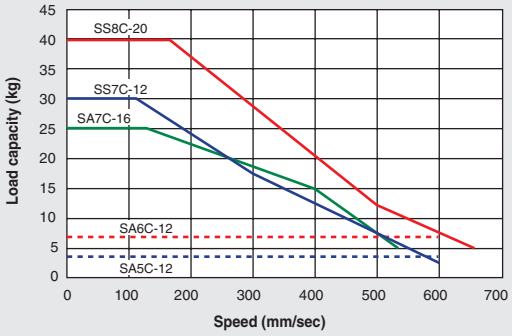
600 mm/sec

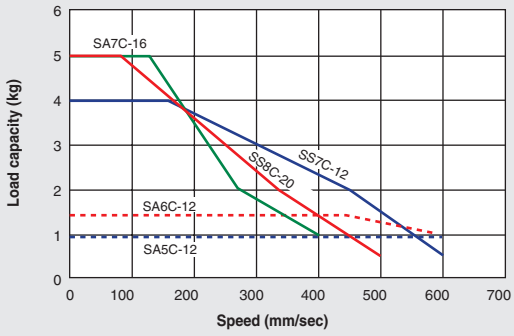
300 mm/sec

150 mm/sec

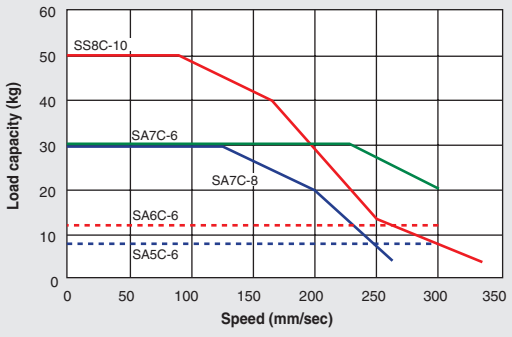
**Horizontal installation** | **Vertical installation**

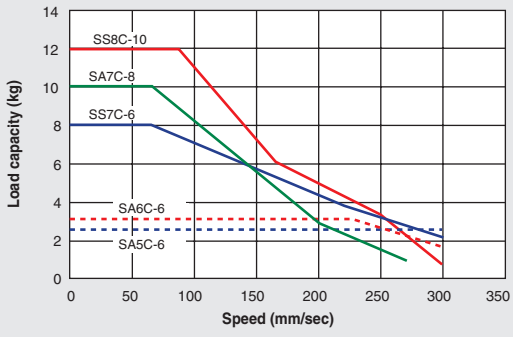
### High-speed type



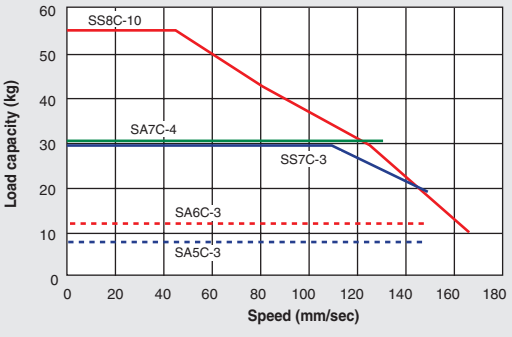



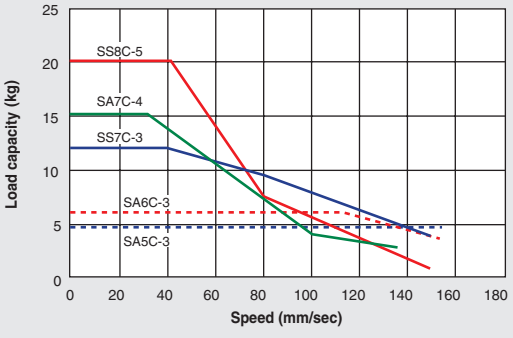

### Medium-speed type




### Low-speed type




(Note) In the above diagrams, the figure after the type code indicates the lead.
(Note 1) If the actual load is equal to the maximum load capacity at the applicable speed, vibration overshoot may occur. Select a model that provides an allowance of approx. 70%.

# Selection Guide (Correlation Diagram of Speed and Load Capacity)

RCP2W Series **Rod type**

**Select horizontal or vertical installation**

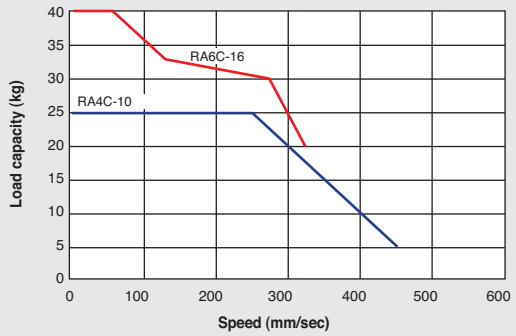
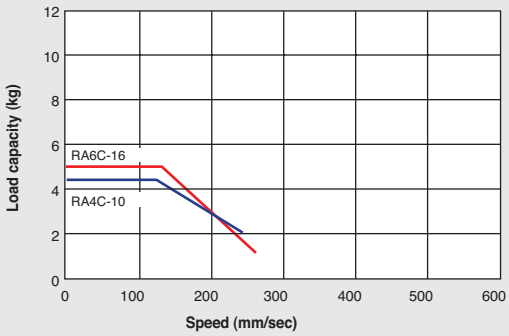
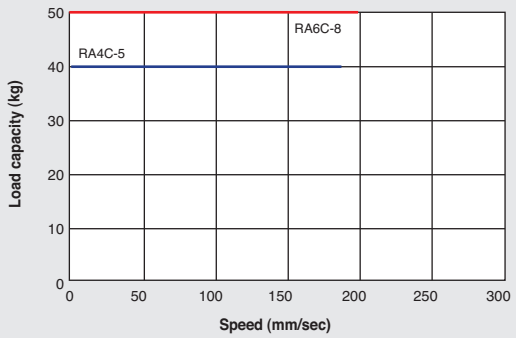
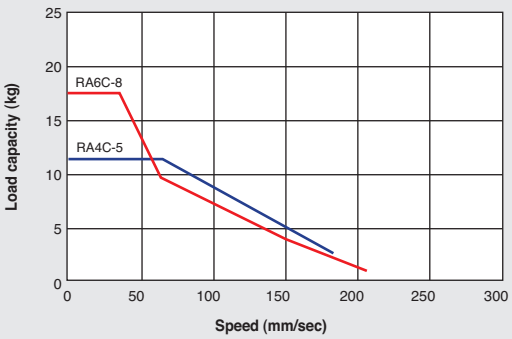
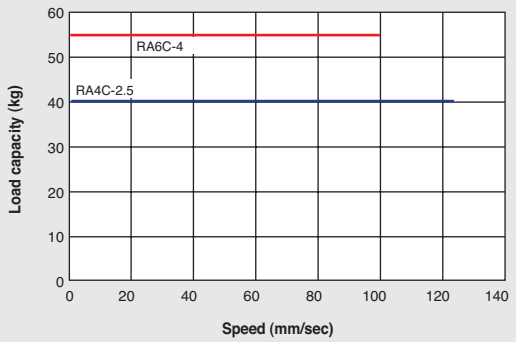
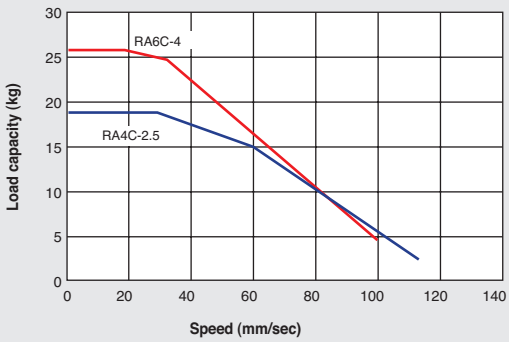
**Select the speed type based on the cycle time of the system**

**Select the target type using the correlation diagrams of speed and load capacity below**

## Caution for Use

- With rod types, no external force is considered other than the force applied from the moving direction of the rod.
  If the rod will receive any force in the right-angle direction or rotating direction, the customer should use a high-rigidity type or add a guide.

**Maximum speed**
500 mm/sec
250 mm/sec
125 mm/sec

| | Horizontal installation (Note 1) | Vertical installation |
|---|---|---|
| High-speed type |  |  |
| Medium-speed type |  |  |
| Low-speed type |  |  |



(Note 1) If the actual load is equal to the maximum load capacity at the applicable speed, vibration overshoot may occur. Select a model that provides an allowance of approx. 70%.

## RCP2W Series Waterproof Slider Type

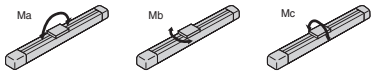
**Horizontal installation only**

### Caution for Use

● If you will be using a slider type and the load installed on the slider will project significantly from the center, consider the load moment and overhang load length.

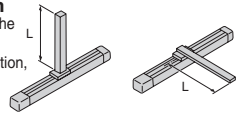
**Load moment**

Keep Ma/Mb/Mc load moments within their specified ranges.

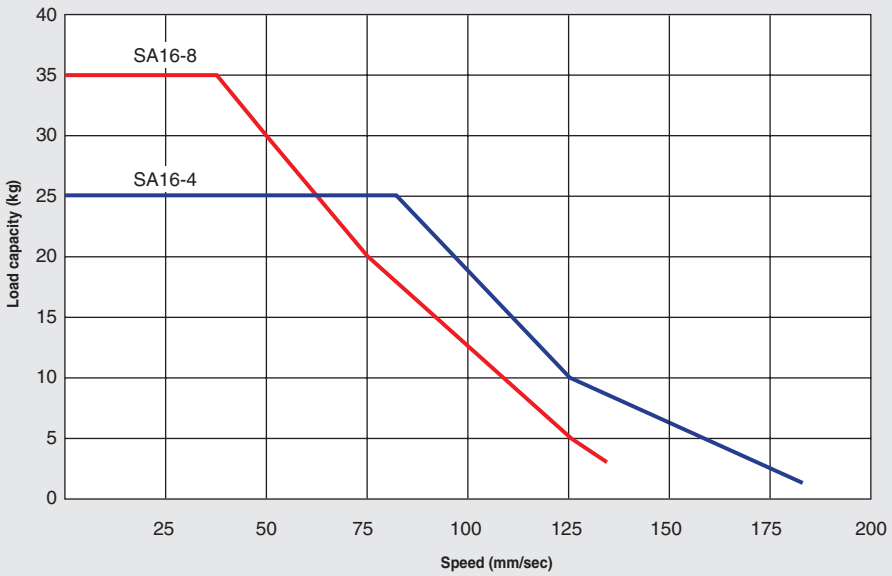



**Overhang load length**

When the center of gravity of the installed load is L/2. If the load projects in Ma, Mb or Mc direction, keep the overhang load length within the specified range.




### Horizontal installation

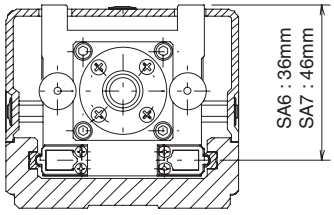



(Note) The RCP2W-SA16 is not available with brake, so it cannot be used vertically.
(Note) In the above diagrams, the figure after the type code indicates the lead.
(Note 1) If the actual load is equal to the maximum load capacity at the applicable speed, vibration overshoot may occur. Select a model that provides an allowance of approx. 70%.

# Selection Guide Correlation (Diagrams of Push Force and Current-Limiting Value)

## ERC2 Series Slider type

When performing push-motion operation using a slider type, limit the push current to prevent the reactive moment generated by the push force from exceeding 80% of the rated moment (Ma, Mb) specified in the catalog.
The position where guide moment is applied is illustrated below to facilitate moment calculation. Calculate the moment by considering an offset required at the position where push force is applied.
Since applying an excessive force exceeding the rated moment may damage the guide and shorten the service life of the actuator, set sufficient push current by considering a safety factor.

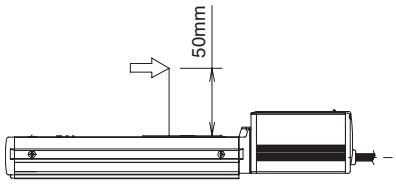



Position where moment is applied

Note
The travel speed is fixed to 20 mm/s during push-motion operation.

Calculation example)
If a push force of 100 N is applied at the position shown to the right on the ERC2-SA7C type, the moment received by the guide is calculated as follows:

Ma=(46+50)x100
=9600(N•mm)
=9.6(N•m)

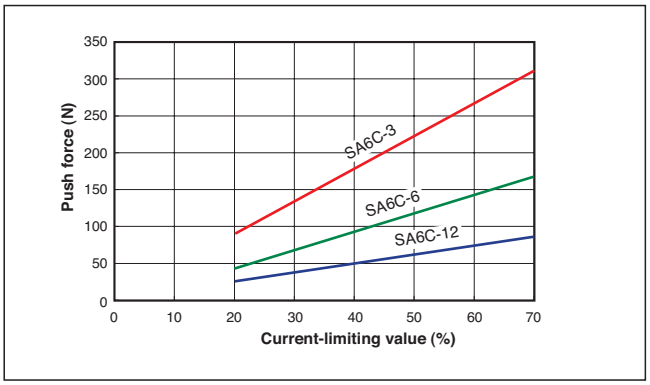



Since the rated moment of the SA7 (Ma) is 13.8 (N-m),
13.8 x 0.8 = 11.04 > 9.6. Accordingly, the requirement is satisfied.
If Mb moment generates as a result of push motion, follow the same procedure to calculate the actual moment based on the overhang load and confirm that it is within 80% of the rated moment.

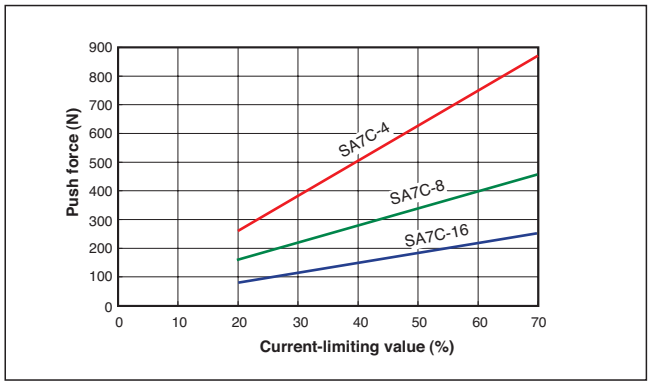
## Correlation Diagrams of Push Force and Current-Limiting Value

* The figures in the following diagrams are reference values and may differ slightly from actual values.

### SA6C type




### SA7C type

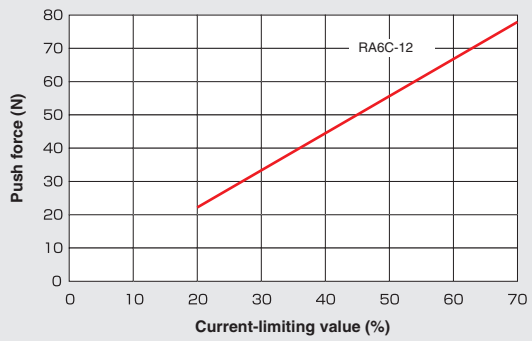
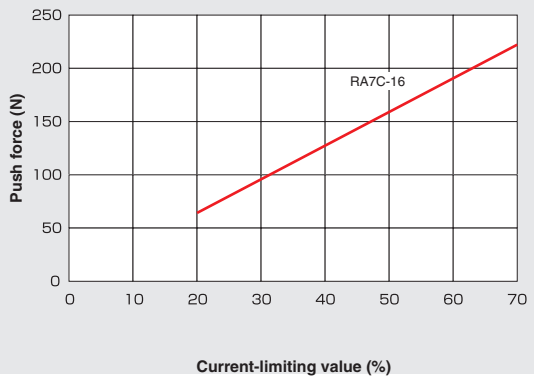
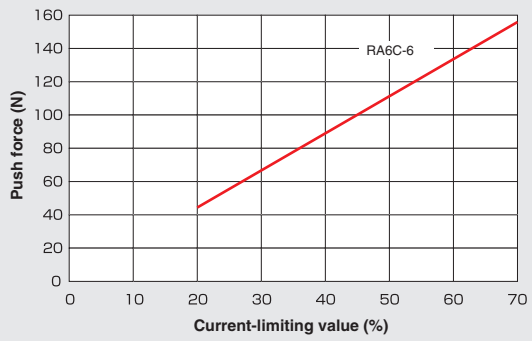
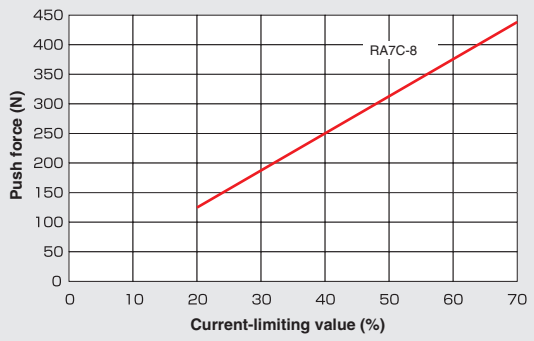
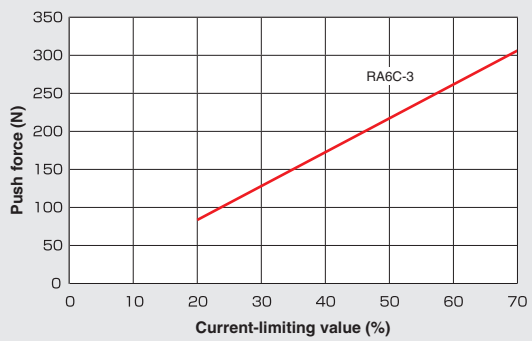
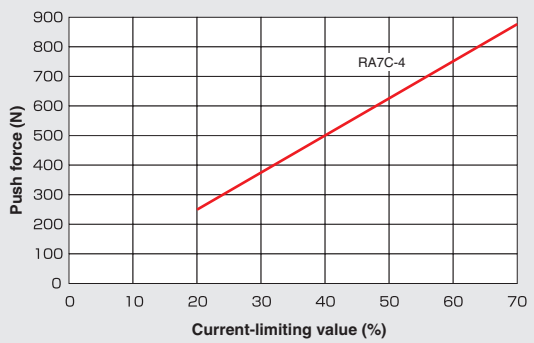


## ERC2 Series Rod type

The push force applied in push-motion operation can be changed freely by changing the current-limiting value in the controller.
Since the maximum push force varies from one model to another, use the diagrams below to check the required push force and select a type that satisfies the force requirement.

**Caution for Use**

- The relationships of push force and current-limiting value represent reference values and may differ slightly from actual values.
- If the current-limiting value is less than 20%, the push force may fluctuate. Keep the current-limiting value to 20% or above.
- The travel speed is fixed to 20 mm/s during push-motion operation.

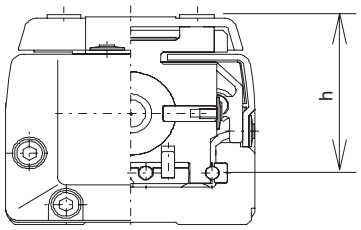
| | RA6C type | RA7C type |
|---|---|---|
| High-speed type |  |  |
| Medium-speed type |  |  |
| Low-speed type |  |  |

(Note) In the above diagrams, the figure after the type code indicates the lead.

# Selection Guide Correlation (Diagrams of Push Force and Current-Limiting Value)

## RCP2 Series Slider type

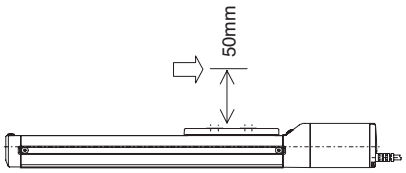
When performing push-motion operation using a slider type, limit the push current to prevent the reactive moment generated by the push force from exceeding 80% of the rated moment (Ma, Mb) specified in the catalog.
The position where guide moment is applied is illustrated below to facilitate moment calculation. Calculate the moment by considering an offset required at the position where push force is applied.
Since applying an excessive force exceeding the rated moment may damage the guide and shorten the service life of the actuator, set sufficient push current by considering a safety factor.




SA5C:h=39mm
SA6C:h=40mm
SA7C:h=43mm
SS7C:h=36mm
SS8C:h=48mm

Note
- Push-motion operation cannot be performed on belt types (BA6/BA7).
- The travel speed is fixed to 20 mm/s during push-motion operation.

Calculation example)
If a push force of 100 N is applied at the position shown to the right on the RCP2-SS7C type, the moment received by the guide is calculated as follows: Ma=(36+50)x100
=8600(N•mm)
=8.6(N•m)

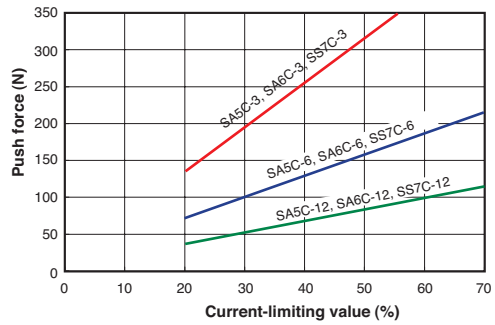



Since the rated moment of the SS7 (Ma) is 14.7 (N•m),
14.7 x 0.8 = 11.76 > 8.6. Accordingly, the requirement is satisfied.
If Mb moment generates as a result of push motion, follow the same procedure to calculate the actual moment based on the overhang load and confirm that it is within 80% of the rated moment.

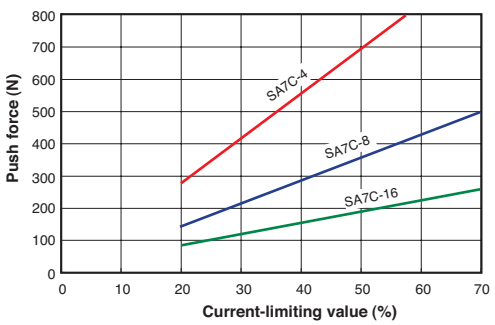
## Correlation Diagrams of Push Force and Current-Limiting Value

* The figures in the following diagrams are reference values and may differ slightly from actual values.

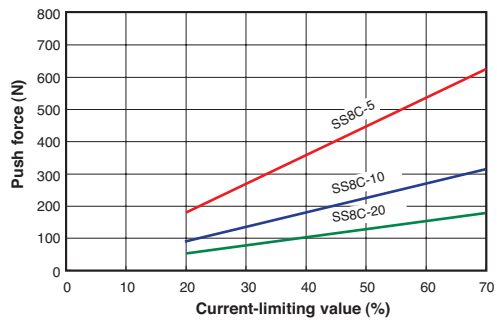
### SA5C/SA6C/SS7C type




### SA7C type



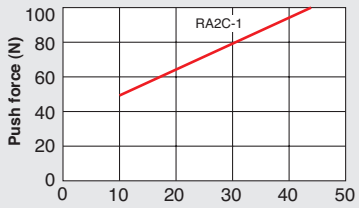

### SS8C type



## RCP2 Series — Rod type

The push force applied in push-motion operation can be changed freely by changing the current-limiting value in the controller.
Since the maximum push force varies from one model to another, use the diagrams below to check the required push force and select a type that satisfies the force requirement.

### RA2C type

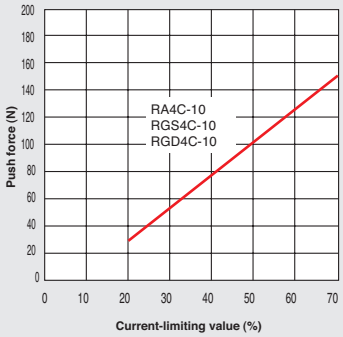
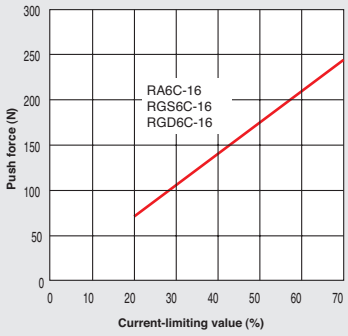
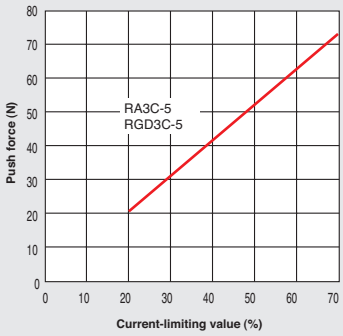
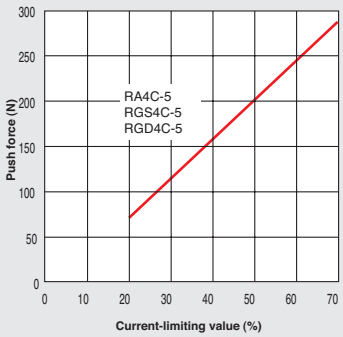
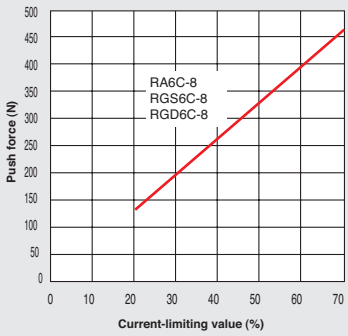
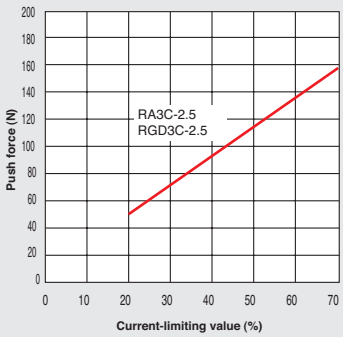
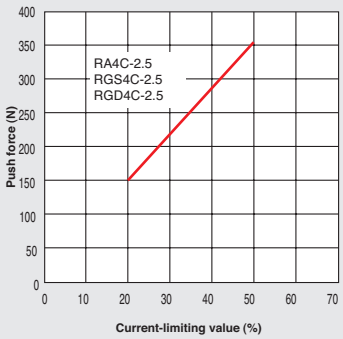
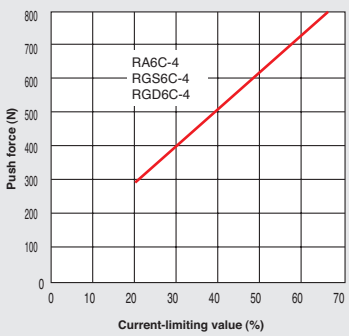



* With the RPA type, the maximum push force is determined by the stroke.

25-50 stroke : 100N
75 stroke : 75N
100 stroke : 55N

**Caution for Use**

- The relationships of push force and current-limiting value represent reference values and may differ slightly from actual values.
- If the current-limiting value is less than 20%, the push force may fluctuate. Keep the current-limiting value to 20% or above.
- The travel speed is fixed to 20 mm/s during push-motion operation.

| | RA3C/RGD3C | RA4C/RGS4C/RGD4C | RA6C/RGS6C/RGD6C |
|---|---|---|---|
| High-speed type | |   |   |
| Medium-speed type |   |   |   |
| Low-speed type |   |   |   |

(Note) In the above diagrams, the figure after the type code indicates the lead.

# Selection Guide Correlation (Diagrams of Push Force and Current-Limiting Value)

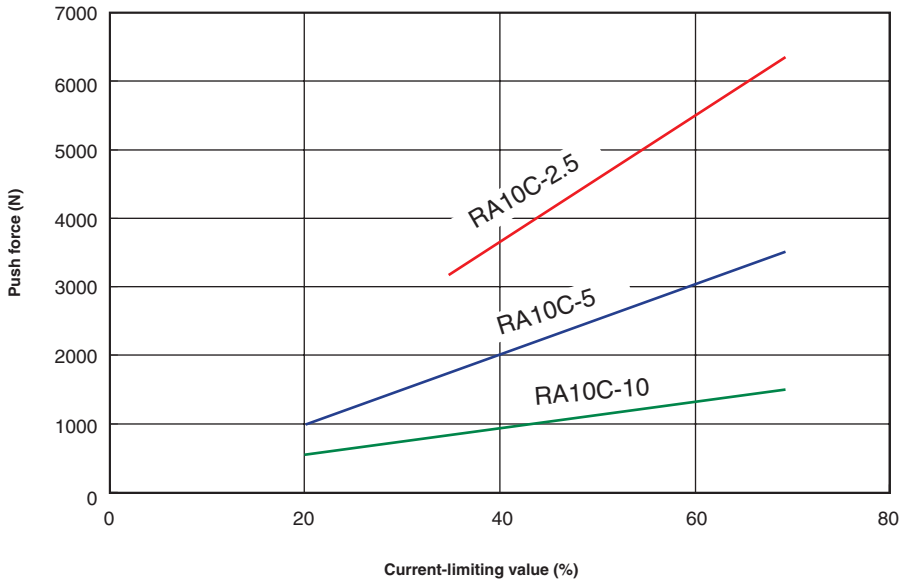
RCP2 Series **High-Thrust Rod Type**

The push force applied in push-motion operation can be changed freely by changing the current-limiting value in the controller. Since the maximum push force varies from one model to another, use the diagrams below to check the required push force and select a type that satisfies the force requirement.

**Caution for Use**

- The relationships of push force and current-limiting value represent reference values and may differ slightly from actual values.
- If the current-limiting value is less than 20%, the push force may fluctuate. Keep the current-limiting value to 20% or above.

## RA10C type




Note

Use the table below as a guide when determining the maximum push count when the type having each lead is operated at the maximum push force for a push-motion travel distance of 1 mm.

| Lead (type) | 2.5 | 5 | 10 |
|---|---|---|---|
| Push count | 1.4 million times | 25 million times | 157.6 million times |

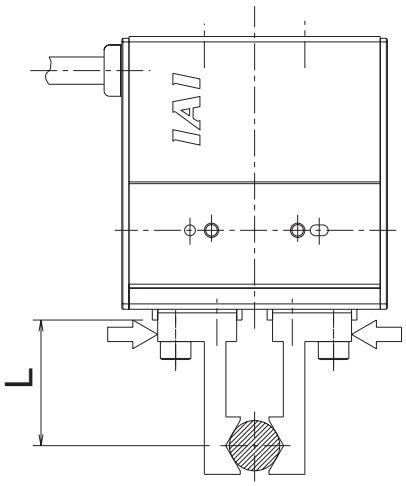
* The maximum push count varies depending on the operating conditions such as shock and vibration. The figures shown to the left assume absence of shock or vibration.

RCP2 Series **Gripper**

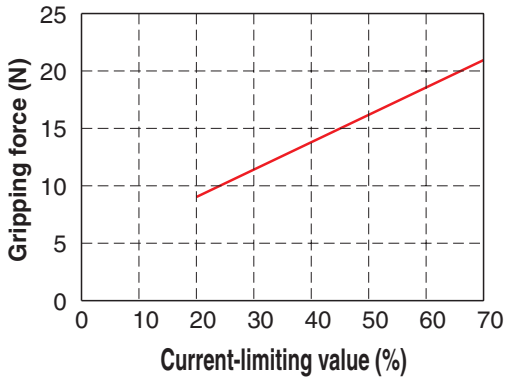
## Gripping Force Adjustment

In accordance with the push-motion operation, the gripping force (push force) can be adjusted freely within the range of current-limiting values of 20% to 70%.
Since the gripping force varies from one model to another, use the graphs below to check the required gripping force and select a type that satisfies the force requirement.

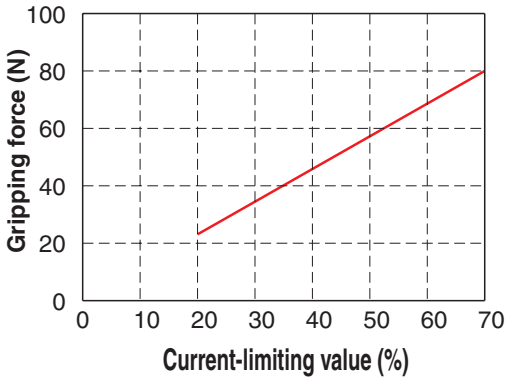
* The gripping forces in the following diagrams indicate the sums of gripping forces of both fingers.




RCP2-GRS




RCP2-GRM




## Guide for Selecting Model from Weight of Work

Although the weight of a work that can be physically transferred varies depending on the friction coefficient determined by the finger material and work material, as well as on the shape of the work, a rough guide is that normally the work weight should not exceed 1/10 to 1/20 of the gripping force. Also, an additional allowance must be considered if the work is subject to high acceleration/deceleration or shock during transfer (1/30 to 1/50).

## Finger (Attachment) Shape

The distance (L) from the finger attachment surface to the gripping point should be kept to or below the dimensions below.

RCP2-GRS → 50mmMAX.
RCP2-GRM → 80mmMAX.

Minimize the size and weight of fingers installed on the actuator. If the fingers are long, large or heavy, the actuator performance may drop or the guide may be negatively affected due to the inertial force and bending moment that generates when the fingers are opened/closed.

**Caution**

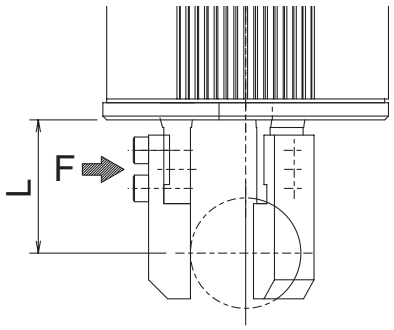
* The relationships of push force (gripping force) and current-limiting value represent reference values and may differ slightly from actual values.
* Take note that if the push force is too small, the push force may fluctuate or malfunction may occur due to slide resistance, etc. Keep the current-limiting value to 20% or above.
* Minimize the size and weight of fingers installed on the actuator. If the fingers are long, large or heavy, the actuator performance may drop or the guide may be negatively affected.

# Selection Guide Correlation (Diagrams of Push Force and Current-Limiting Value)

RCP2 Series **3-Finger Gripper**

## Correlation Diagram of Gripping Force and Current-Limiting Value

### Lever Type




* The values in the graphs below indicate gripping forces at a gripping point of 10 mm. The actual gripping force decreases in inverse proportion to the distance from the opening/closing fulcrum

Calculate the actual gripping force using the formulas below:

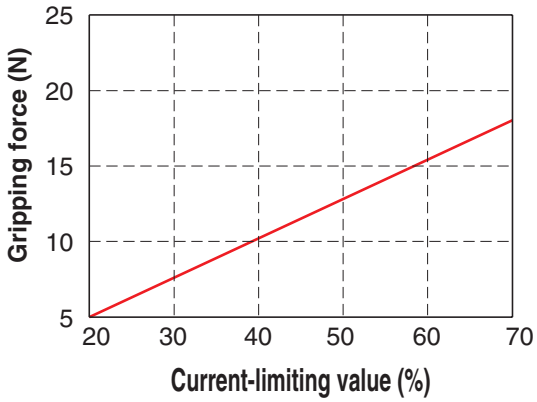
Effective gripping force (S type)=PX24/(L+14)

Effective gripping force (M type)=PX28.5/(L+18.5)

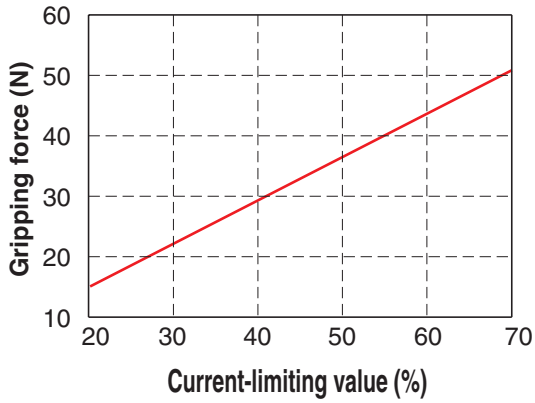
P = Gripping force determined from the graph

L = Distance from the finger attachment surface to the gripping point

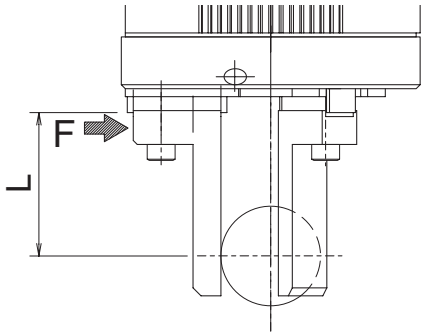
RCP2-GR3LS




RCP2-GR3LM




### Slide Type (GR3SS/GR3SM)



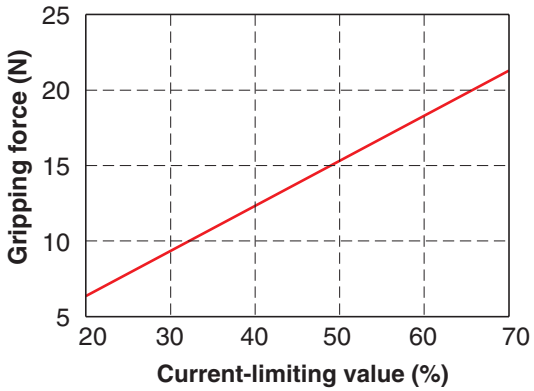

* Keep the distance (L) from the finger attachment surface to the gripping point to the following dimensions or less.

Calculate the actual gripping force using the formulas below:

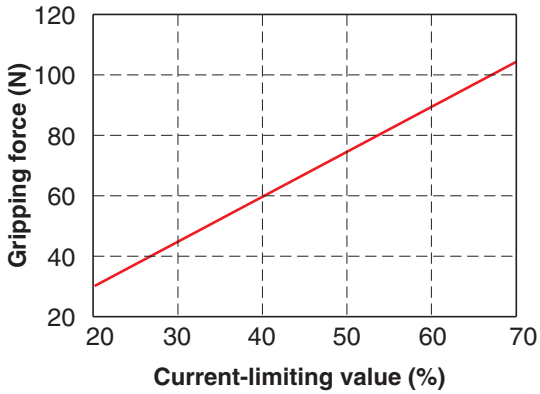
GR3SS → 50mm Max.

GR3SM → 80mm Max.

RCP2-GR3SS




RCP2-GR3SM

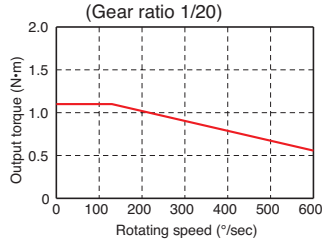


RCP2 Series **Rotary**

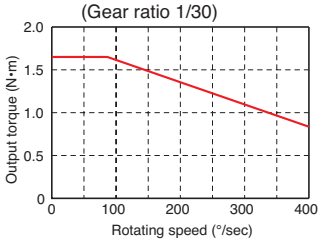
## Output Torque

The output torque will decrease as the rotating speed increases.
Use the graphs below to check if the required operating speed and torque can be achieved.

RCP2-RTB/RTC
(Gear ratio 1/20)



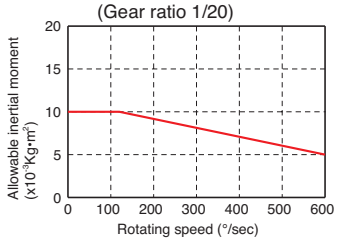

RCP2-RTB/RTC
(Gear ratio 1/30)



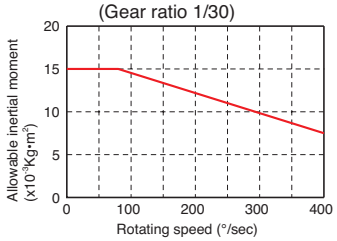

## Allowable Inertial Moment

The allowable inertial moment of a rotatable work varies depending on the rotating speed. Check the operating conditions and the inertial moment of the work to be rotated (refer to p. 16) to select an appropriate model.

RCP2-RTB/RTC
(Gear ratio 1/20)




RCP2-RTB/RTC
(Gear ratio 1/30)

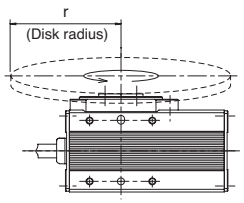



When a rotating axis is used horizontally, load torque will generate due to gravity if the center of gravity of the work is away from the center of rotation. In this case, either the rotating speed or the inertial moment of the work must be reduced.

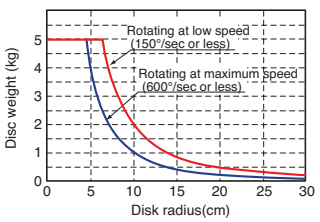
## Model Selection Guide

Select an appropriate model from the shape and weight of the load installed on the output shaft by using the figures and tables below as a reference.
* The weight that can be rotated varies depending on the rotating speed. (The higher the rotating speed, the less the rotatable weight becomes.)

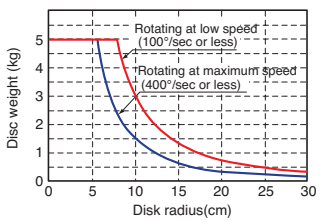
### A. Disc-shaped load at the center of the output shaft



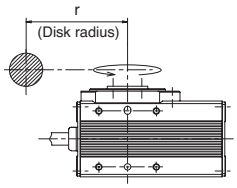

(Gear ratio 1/20)



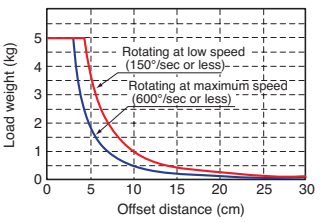

(Gear ratio 1/30)



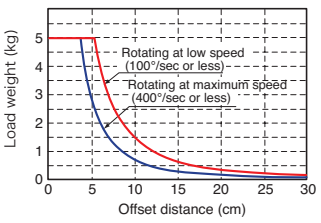

### B. Load offset from the center of the output shaft




(Gear ratio 1/20)




(Gear ratio 1/30)




* When a rotating axis is used horizontally, load torque will generate due to gravity if the center of gravity of the work is away from the center of rotation. In this case, either the rotating speed or the inertial moment of the work must be reduced.

**Caution**

- If the load exceeds the allowable value, the actuator may malfunction, its service life may be shortened, or damage may occur. The load must be set so that the allowable value will not be exceeded.
- If a rotating axis is used horizontally, the work structure must be such that the load torque can be minimized.

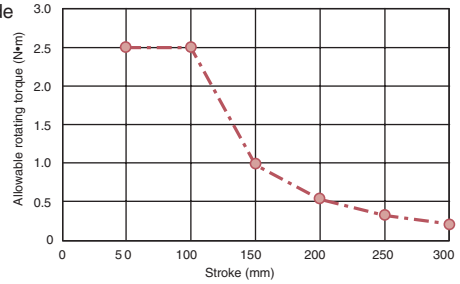
# Technical Reference on Guide Types ERC2/RCP2/RCA/RCS2

## Allowable Rotating Torque

The allowable torque for each model is shown below.
If rotating torque is to be applied, keep the torque within the range specified below. Take note that single-guide types cannot receive rotating torque.

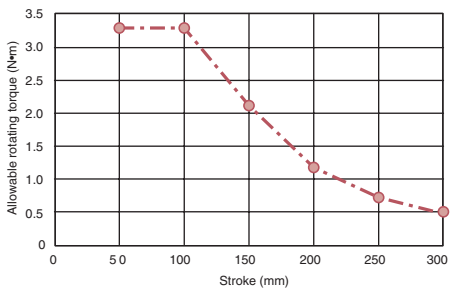
### ERC2-RGD6C type

■Double Guide



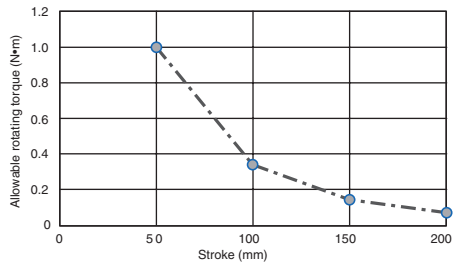

### ERC2-RGD7C type

■Double Guide



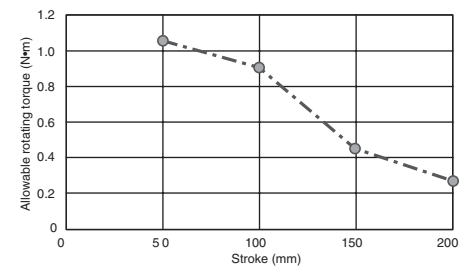

### RCA / RCS2-RGD3□type (Double-Guide Specification)

■Double Guide



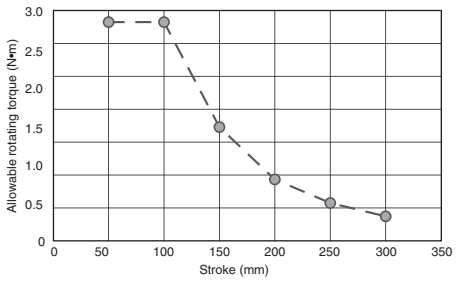

### RCS2-RGD4□type

■Double Guide



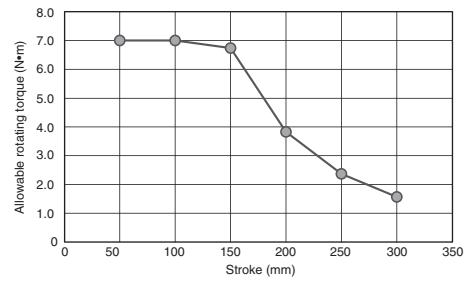

### RCS2-RGD5C type (Double-Guide Specification)

■Double Guide

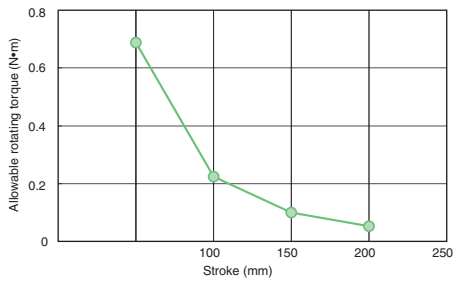



### RCS2-RGD7AD / RGD7BD type

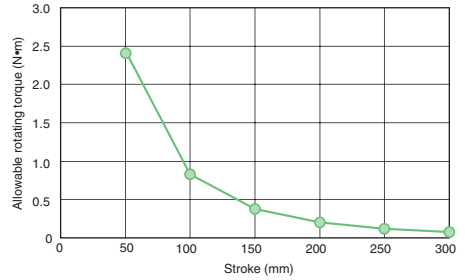
■Double Guide



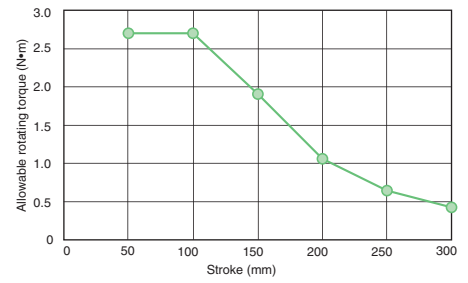

### RCP2-RGD3C type




### RCP2-RGD4C type



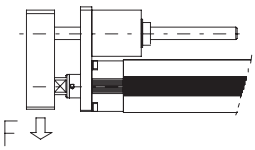

### RCP2-RGD6C type



## Relationship of Allowable Load at Tip and Traveling Life

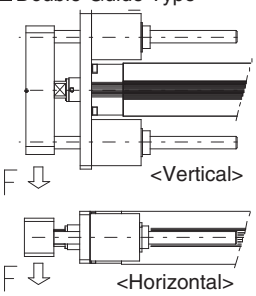
The greater the load at the guide tip, the shorter the traveling life becomes. Select an appropriate model by considering an optimal balance between load and life.

■ Single-Guide Type



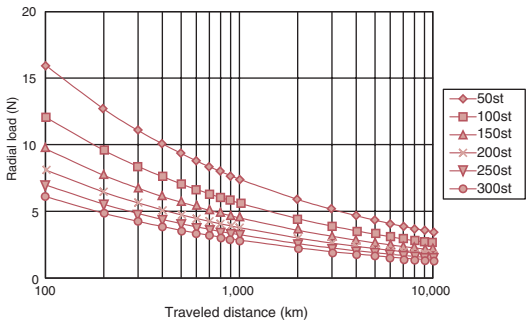
* Single-guide actuators cannot receive any load other than in vertical direction.

■ Double-Guide Type

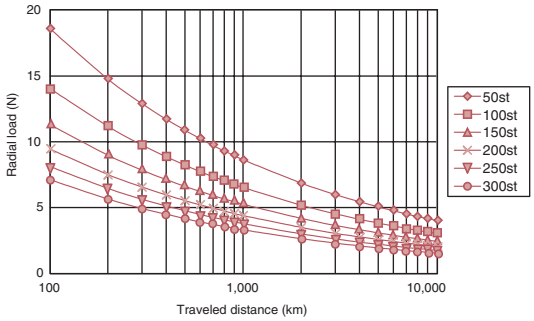



## Single Guide

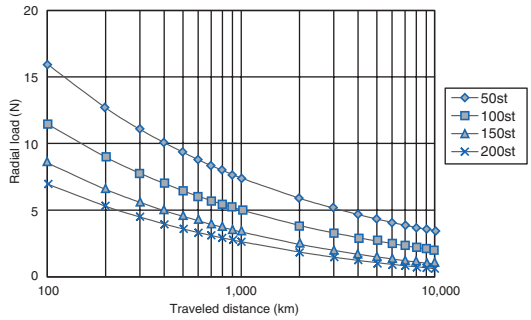
### ERC2-RGS6C type



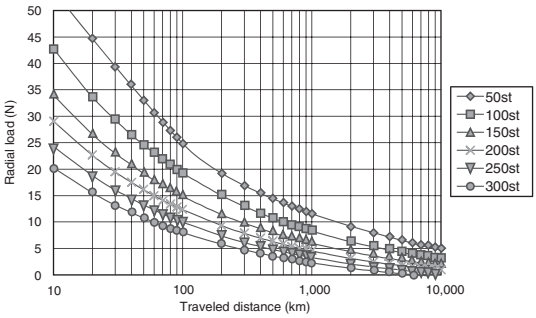

### ERC2-RGS7C type



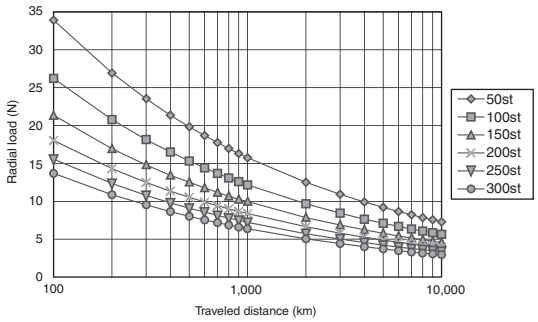

### RCA / RCS2-RGS3C type



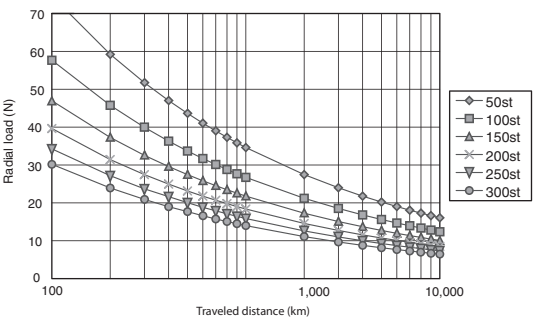

### RCS2-RGS4C type



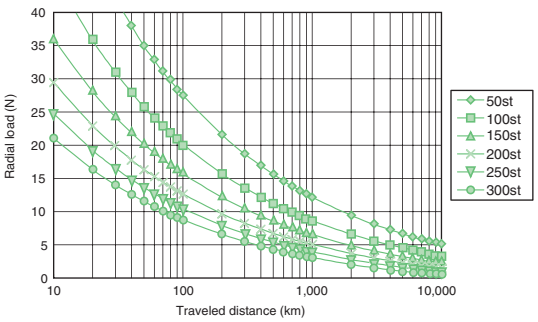

### RCS2-RGS5C type



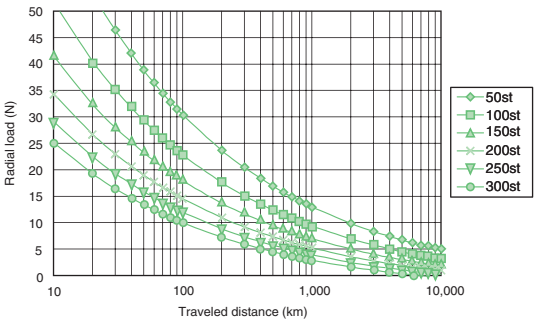

### RCS2-RGS7AD / RGS7BD type




### RCP2-RGS4C type

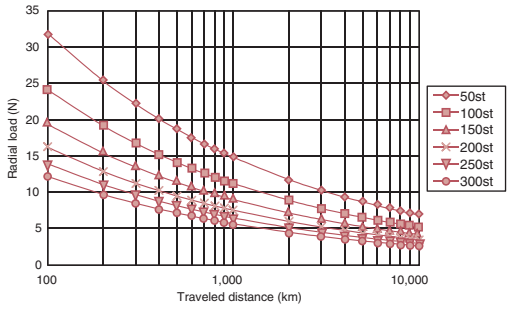



### RCP2-RGS6C type

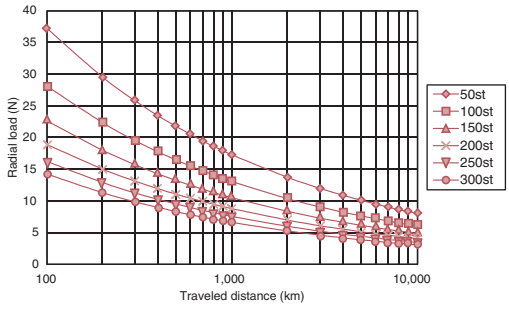


## Double Guide

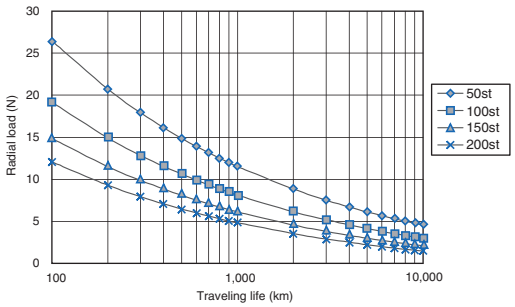
### ERC2-RGD6C type



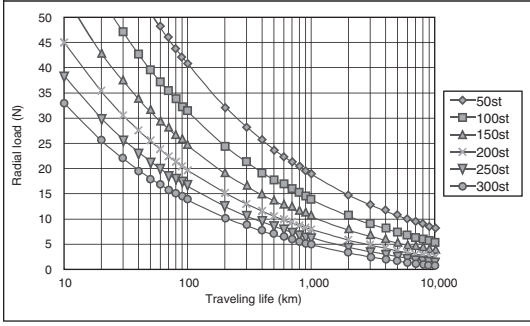

### ERC2-RGD7C type



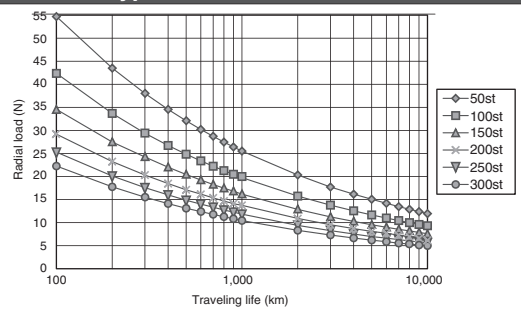

### RCA / RCS2-RGD3C type



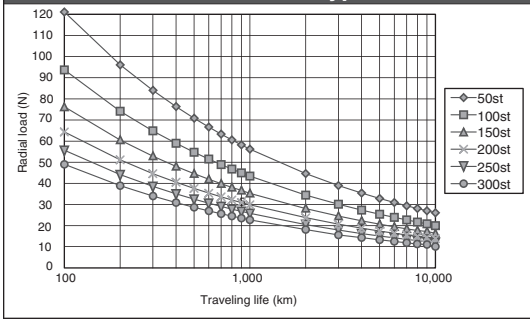

### RCS2-RGD4C type



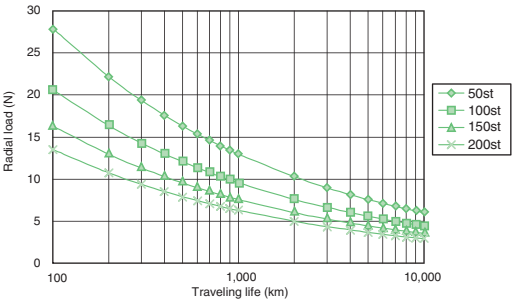

### RCS2-RGD5C type



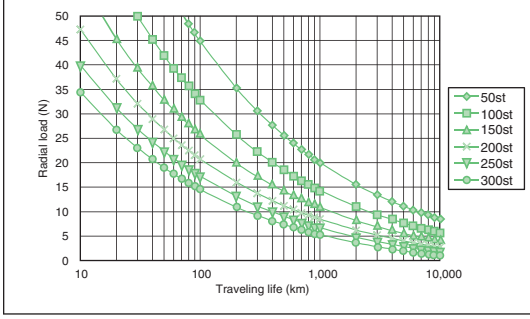

### RCS2-RGD7AD / RGD7BD type



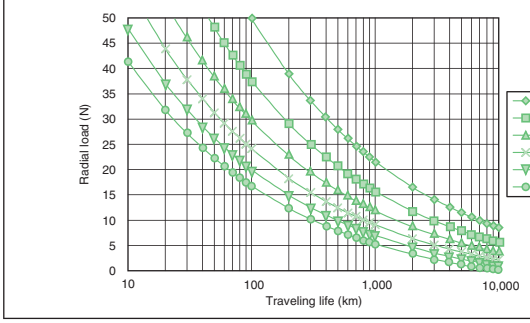

### RCP2-RGD3C type




### RCP2-RGD4C type



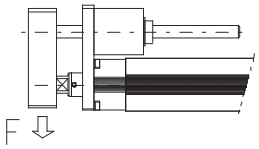

### RCP2-RGD6C type



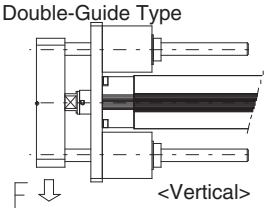
## Radial Load and Deflection at Tip

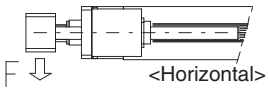
The diagrams below show how the load applied at the tip of the guide correlates with the deflection that generates.

■ Single-Guide Type



■ Double-Guide Type

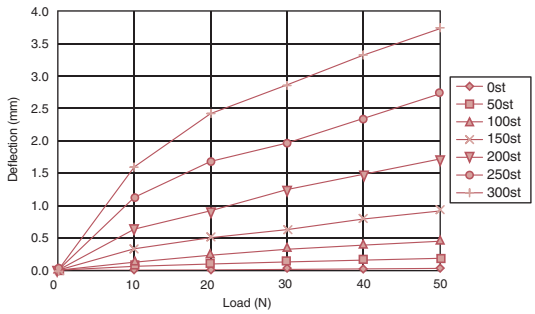


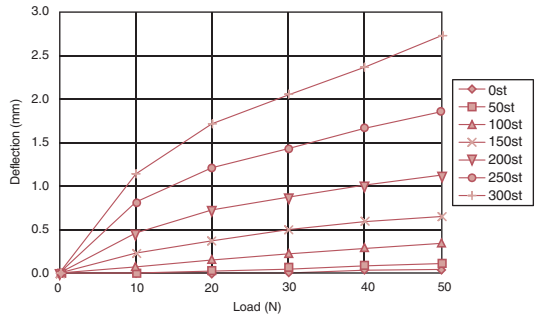

* Single-guide actuators cannot receive any load other than in vertical direction.

## Single Guide

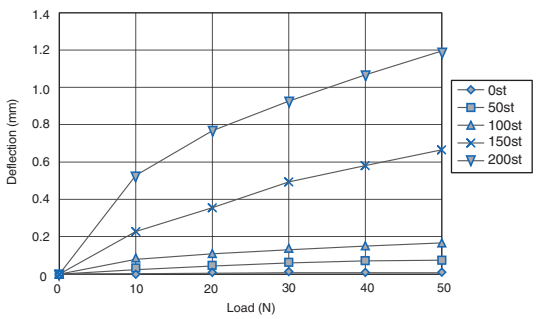
### ERC2-RGS6C type



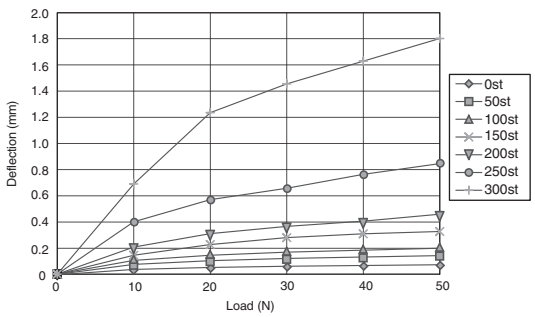

### ERC2-RGS7C type



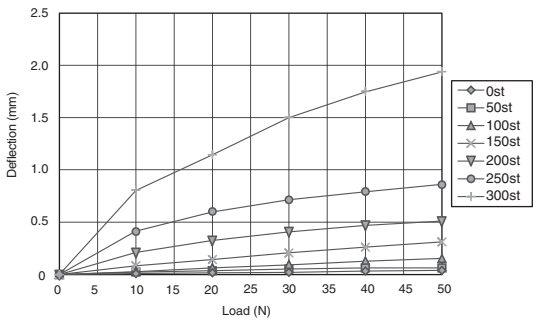

### RCA / RCS2-RGS3□type



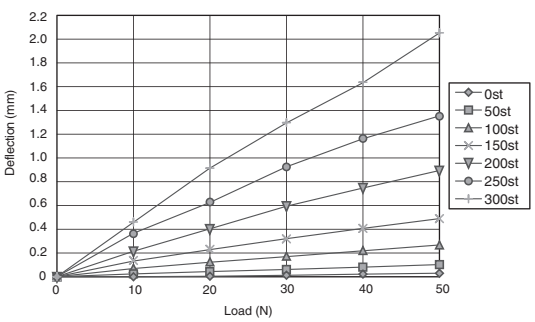

### RCS2-RGS4□type



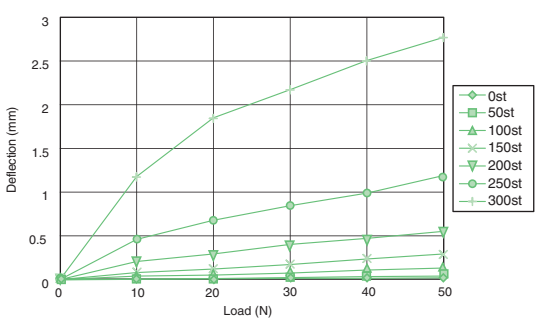

### RCS2-RGS5C type



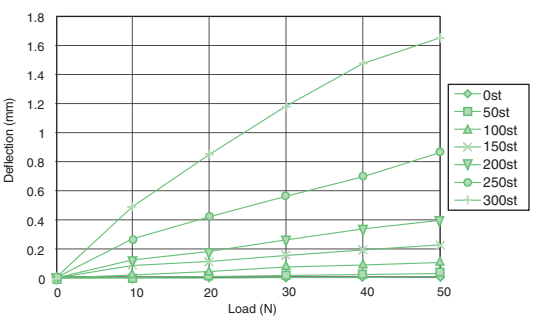

### RCS2-RGS7AD / RGS7BD type




### RCP2-RGS4C type



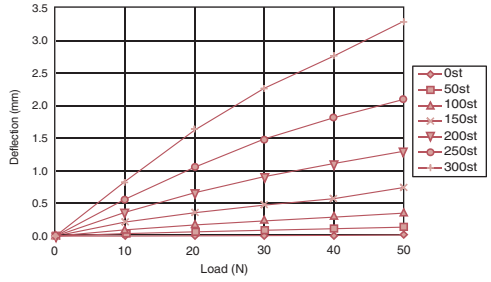

### RCP2-RGS6C type



## Double Guide

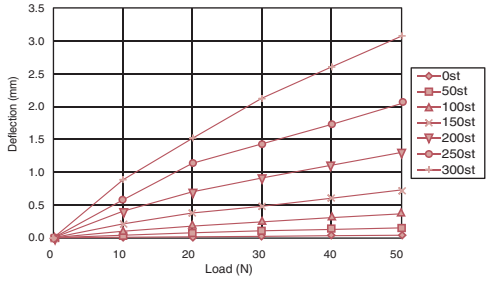
### ERC2-RGD6C type

■Double Guide <Horizontal> Specification



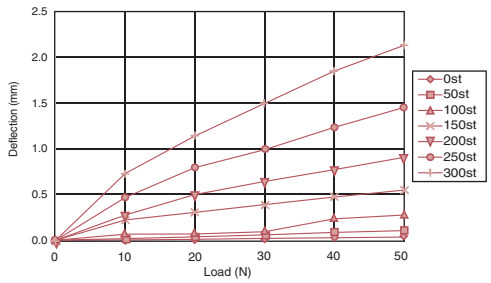

### ERC2-RGD6C type

■ Double Guide <Vertical> Specification



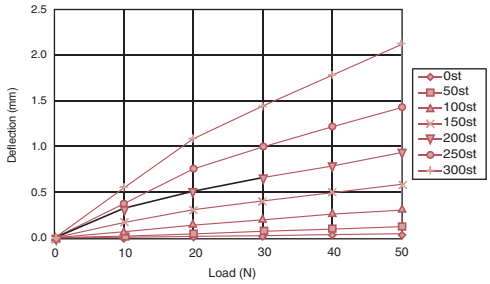

### ERC2-RGD7C type

■Double Guide <Horizontal> Specification



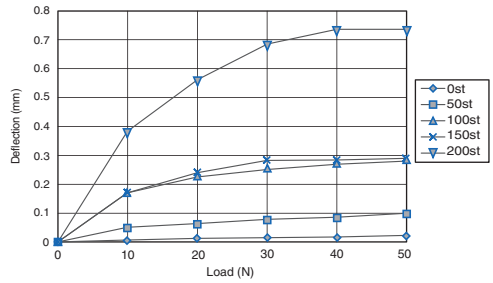

### ERC2-RGD7C type

■ Double Guide <Vertical> Specification



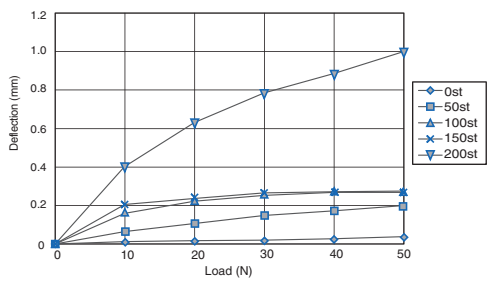

### RCA / RCS-RGD3□type

■Double Guide <Horizontal> Specification



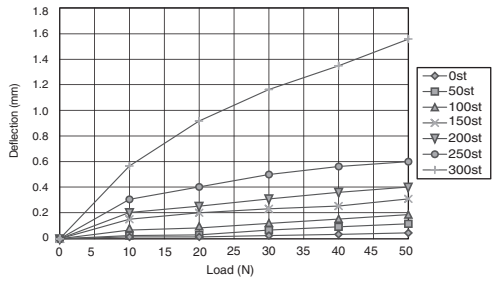

### RCA / RCS-RGD3□type

■ Double Guide <Vertical> Specification



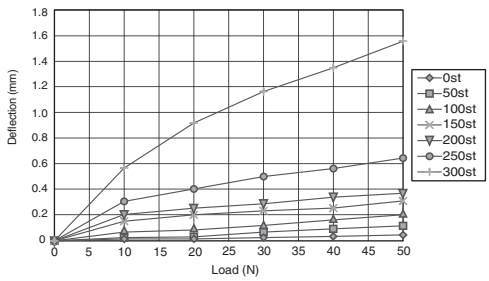

### RCS2-RGD4□type

■Double Guide <Horizontal> Specification



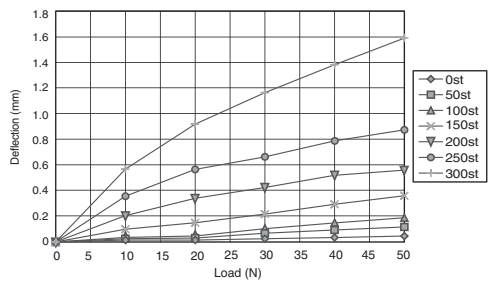

### RCS2-RGD4□type

■ Double Guide <Vertical> Specification



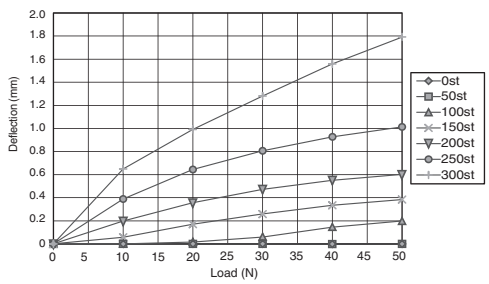

### RCS2-RGD5C type

■Double Guide <Horizontal> Specification



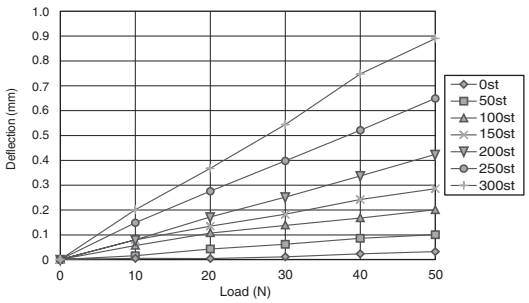

### RCS2-RGD5C type

■ Double Guide <Vertical> Specification



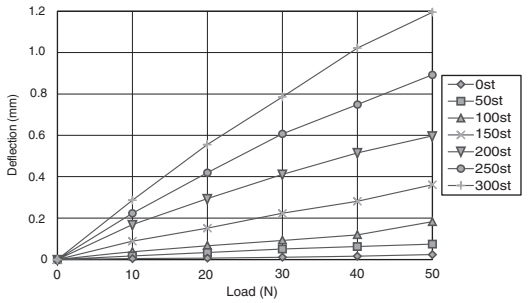
## RCS2-RGD7AD / RGD7BD type

■Double Guide <Horizontal> Specification



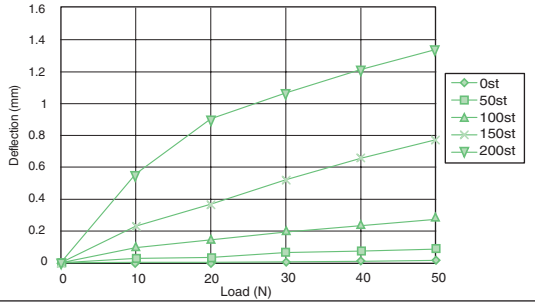

## RCS2-RGD7AD / RGD7BD type

■Double Guide <Vertical> Specification



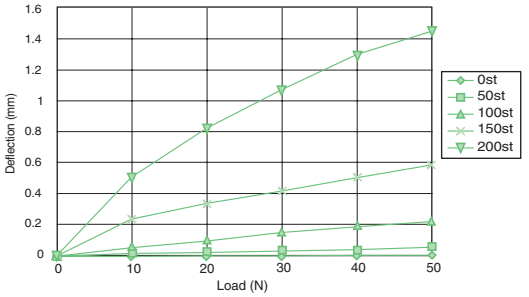

## RCP2-RGD3C type

■Double Guide <Horizontal> Specification



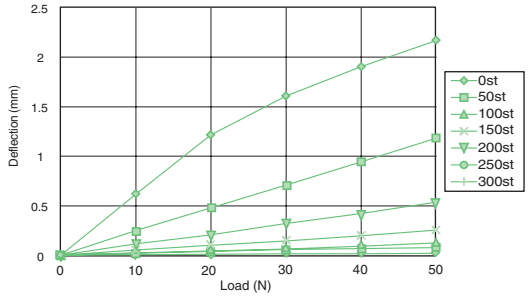

## RCP2-RGD3C type

■Double Guide <Vertical> Specification



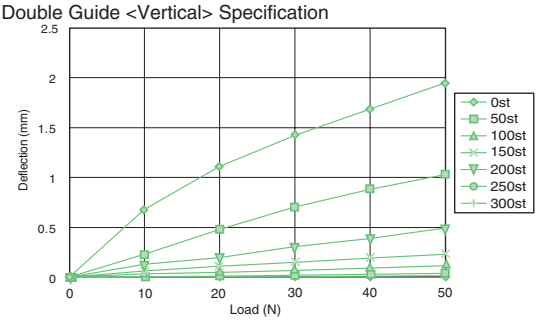

## RCP2-RGD4C type

■Double Guide <Horizontal> Specification



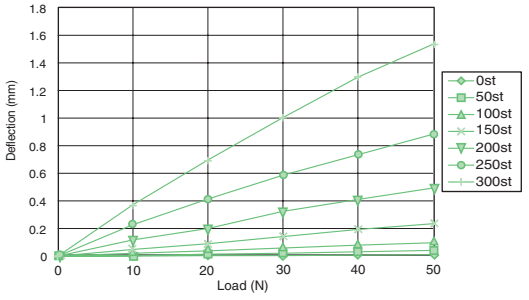

## RCP2-RGD4C type

■Double Guide <Vertical> Specification



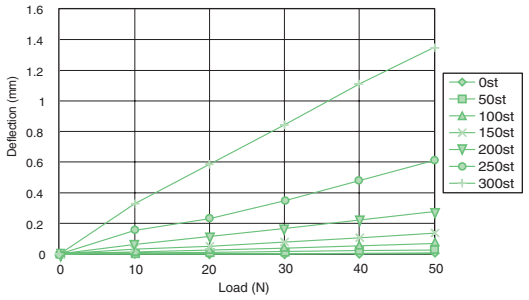

## RCP2-RGD6C type

■Double Guide <Horizontal> Specification




## RCP2-RGD6C type

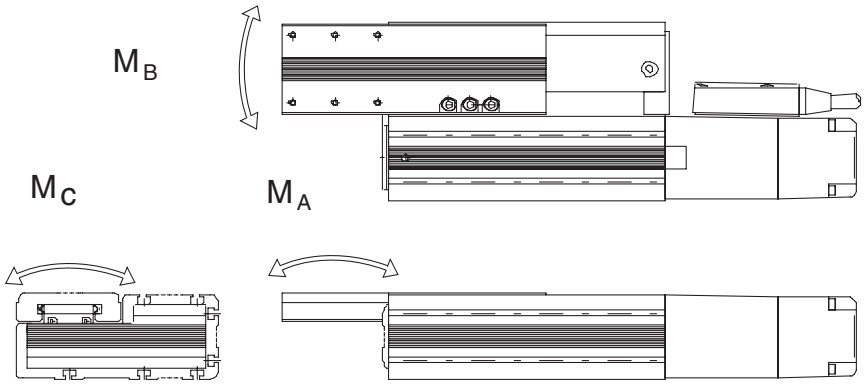
■Double Guide <Vertical> Specification



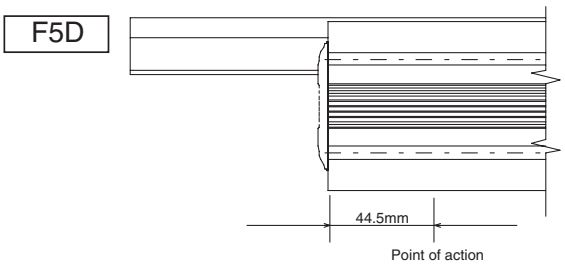
# Technical Reference on Flat Type F5D

## Moment and Load Capacity of Flat Type (F5D)

On the flat type, moments apply in the directions shown below.



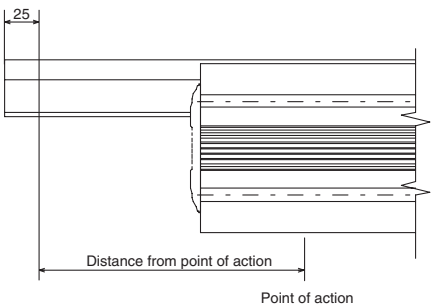

The points of action of Ma and Mb moments are as follows.




When using the flat type horizontally, be careful not to allow the load applied at the tip of the plate to exceed the Ma moment.

For your reference, the table below lists the load at the tip allowable for each stroke, calculated from the corresponding Ma moment.

| Stroke | | 50 | 100 | 150 | 200 | 250 | 300 |
|---|---|---|---|---|---|---|---|
| F5D type | Distance from point of action (m) | 0.07 | 0.12 | 0.17 | 0.22 | 0.27 | 0.32 |
| | N | 64.3 | 37.5 | 26.5 | 20.5 | 16.7 | 14.1 |
| | (kgf) | 6.56 | 3.83 | 2.70 | 2.09 | 1.70 | 1.43 |



# Technical Reference on Rotary Types RT6/RT6R/RT7R

## Selection Guide

Check the following two points to determine if each ROBO Rotary can meet your desired operating conditions.

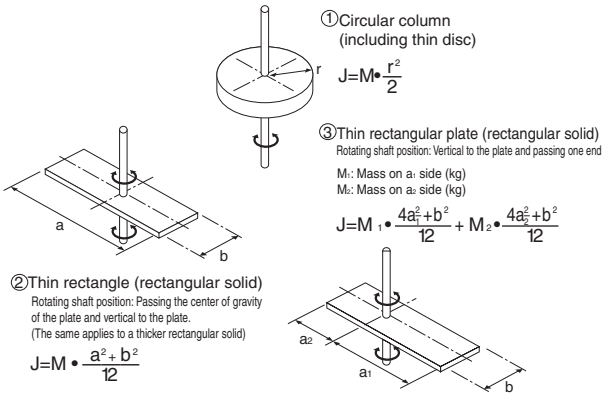
### 1 Inertial Moment

Inertial moment indicates inertia in rotating motion and corresponds to weight in linear motion.
The greater the inertial moment, the more difficult it becomes for the target object to move or stop. In other words, whether or not the inertial moment of the rotating object can be controlled holds a key to selecting an appropriate ROBO Rotary model.
The inertial moment varies depending on the weight and shape of the rotating object. Refer to the calculation formula in the representative example shown to the right.

The allowable inertial moment of each ROBO Rotary is indicated by load inertia.
The candidate ROBO Rotary can be used if the calculated inertial moment is smaller than the load inertia of the ROBO Rotary.

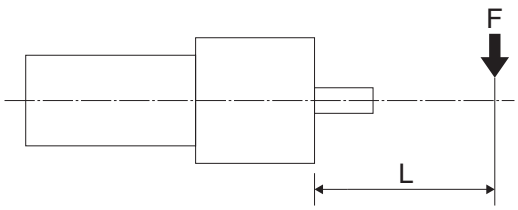
How to Calculate Inertial Moment for Representative Shapes

J: Inertial moment (kg-m²) / M: Mass (kg) / r: Radius (m) / a, b: Lengths of sides (m)




### 2 Load Moment

If inertial moment provides a guide for (electrical) control, load moment provides a guide for strength (mechanical) limit of operation.
Use the end face of the actuator at the base of the output shaft as the reference moment position to check if the load moment applied to the output shaft is within the allowable load moment specified in the catalog.
If the allowable load moment is exceeded, the service life of the actuator may decrease or breakdown may result.




Load Moment (N•m)=F(N)xL(m)

### Notes on Operating Range and Home Return

Take note that when performing home return, the rotating direction of home-return operation may vary depending on the standstill position of the shaft, as explained below.

The home-return operation of the ROBO Rotary is such that when the shaft turns and detects the home detection sensor, the shaft will reverse and home return will complete at the position where phase Z is detected. In this case, the rotating direction of the shaft is counterclockwise (①) when viewed from the shaft direction. When the shaft detects the sensor, the shaft will reverse (②) and subsequently stop when phase Z is detected (③). (Fig. 1)

If the shaft already detects the sensor at the start of home return, the shaft will turn clockwise from that position (④) and subsequently stop when phase Z is detected (⑤). (Fig. 2)

Although the operating range of the ROBO Rotary is 300 degrees, there are no stoppers and thus the actuator may operate beyond this range in certain conditions such as when the shaft is turned by hand while the servo is off.
Take note that when the actuator goes outside its operating range, the sensor may have already detected.

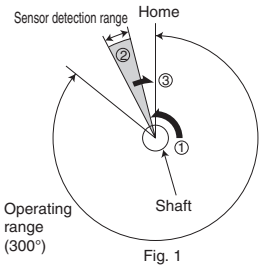



Fig. 1

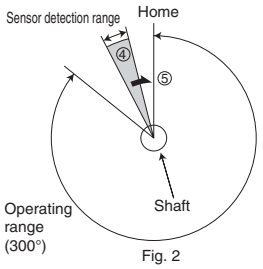



Fig. 2

# List of Products Featured in This Catalog


[A]

| | | |
|---|---|---|
| A1 | (Cable take-out direction) | 381 |
| A2 | (Cable take-out direction) | 381 |
| A3 | (Cable take-out direction) | 381 |
| AB-5 | (Absolute-data backup battery) | 354• 364 |
| AB-5 | (System-memory backup battery) | 344• 354• 364• 372 |
| AB-5-CS | (System-memory backup battery) | 344• 354• 364• 372 |
| ACON-C | (Controller) | 315 |
| ACON-CG | (Controller) | 315 |
| ACON-CY | (Controller) | 315 |
| ACON-PL | (Controller) | 315 |
| ACON-PO | (Controller) | 315 |
| ACON-SE | (Controller) | 315 |
| ASEL-C | (Controller) | 345 |

[B]

| | | |
|---|---|---|
| B | (Brake) | 381 |
| BE | (Brake) | 381 |
| BL | (Brake) | 381 |
| BR | (Brake) | 381 |

[C]

| | | |
|---|---|---|
| CB-ACS-MA□□□ | (Cable) | 324 |
| CB-ACS-PA □□□ | (Cable) | 324 |
| CB-ACS-PA □□□-RB | (Cable) | 324 |
| CB-DS-PIO□□□ | (Cable) | 344• 354• 364 |
| CB-ERC2-CTL001 | (Cable) | 304 |
| CB-ERC2-PWBIO□□□ | (Cable) | 304 |
| CB-ERC2-PWBIO□□□-RB | (Cable) | 304 |
| CB-ERC2-SIO020 | (Cable) | 304 |
| CB-ERC-PWBIO□□□ | (Cable) | 304 |
| CB-ERC-PWBIO□□□-RB | (Cable) | 304 |
| CB-ERC-PWBIO-H6 | (Cable) | 304 |
| CB-ERC-PWBIO□□□-RB-H6 | (Cable) | 304 |
| CB-PAC-PIO □□□ | (Cable) | 314• 324• 334 |
| CB-PACPU-PIO □□□ | (Cable) | 314• 324 |
| CB-PACY-PIO □□□ | (Cable) | 314• 324 |
| CB-RCBC-PA □□□ | (Cable) | 374 |
| CB-RCBC-PA □□□-RB | (Cable) | 374 |
| CB-RCB-CTL002 | (Cable) | 290 |
| CB-RCC-MA □□□ | (Cable) | 334• 364• 373 |
| CB-RCC-MA□□□-RB | (Cable) | 334• 364• 373 |
| CB-RCP2-MA□□□ | (Cable) | 314• 344 |
| CB-RCP2-PA □□□ | (Cable) | 314• 344 |
| CB-RCP2-PA □□□-RB | (Cable) | 314• 344 |
| CB-RCS2-PA □□□ | (Cable) | 334• 364• 374 |
| CB-RCS2-PLA □□□ | (Cable) | 334• 364• 374 |
| CB-SC-PIOS □□□ | (Cable) | 334 |
| CB-SEL-SJ002 | (Cable) | 344• 354• 364 |
| CB-SEL-USB010 □□□ | (Cable) | 344• 354• 364 |
| CB-X-PIO □□□ | (Cable) | 374 |
| CO | (Cover) | 272 |

[D]

| | | |
|---|---|---|
| DP-3 | (Dummy plug) | 344• 354• 364 |

[E]

| | | |
|---|---|---|
| ERC2-FT-RA6 | (Foot) | 383 |
| ERC2-FT-RA7 | (Foot) | 384 |
| ERC2-RA6C | (Actuator) | 7 |
| ERC2-RA7C | (Actuator) | 9 |
| ERC2-RGD6C | (Actuator) | 15 |
| ERC2-RGD7C | (Actuator) | 17 |
| ERC2-RGS6C | (Actuator) | 11 |
| ERC2-RGS7C | (Actuator) | 13 |
| ERC2-SA6C | (Actuator) | 3 |

| | | |
|---|---|---|
| ERC2-SA7C | (Actuator) | 5 |
| [F] | | |
| FB | (Flange bracket) | 381 |
| FL | (Flange) | 382 |
| FT | (Foot) | 383 |
| [H] | | |
| HS | (Home check sensor) | 385 |
| [I ] | | |
| IA-101-XA-MW | (PC software) | 373 |
| IA-101-X-MW | (PC software) | 373 |
| IA-101-X-MW-J | (PC software) | 343• 353• 363 |
| IA-101-X-USB | (PC software) | 343• 353• 363 |
| IA-101-X-USBMW | (PC software) | 373 |
| IA-105-X-MW-A | (Expansion SIO board) | 372 |
| IA-105-X-MW-B | (Expansion SIO board) | 372 |
| IA-105-X-MW-C | (Expansion SIO board) | 372 |
| IA-T-X | (Teaching pendant) | 343• 353• 363• 373 |
| IA-T-XA | (Teaching pendant) | 343• 353• 363• 373 |
| IA-T-XA-J | (Teaching pendant) | 343• 353• 363 |
| IA-T-XD | (Teaching pendant) | 343• 353• 363• 373 |
| IA-T-XD-J | (Teaching pendant) | 343• 353• 363 |
| IA-T-X-J | (Teaching pendant) | 343• 353• 363 |
| IA-XAB-BT | (Absolute-data retention battery) | 372 |
| [L] | | |
| L | (Limit switch) | 385 |
| [N] | | |
| NJ | (Knuckle joint) | 385 |
| NM | (Reversed-home specification) | 385 |
| [P] | | |
| PCON-C | (Controller) | 305 |
| PCON-CG | (Controller) | 305 |
| PCON-CY | (Controller) | 305 |
| PCON-PL | (Controller) | 305 |
| PCON-PO | (Controller) | 305 |
| PCON-SE | (Controller) | 305 |
| PS-241 | (24-V power supply) | 293 |
| PS-242 | (24-V power supply) | 293 |
| PSEL-C | (Controller) | 335 |
| PU-1 | (Panel unit) | 344• 354• 364 |
| [Q] | | |
| QR | (Clevis) | 386 |
| [R] | | |
| R | (Opposite motor reversing direction) | 387 |
| RCA-A4R | (Actuator) | 189 |
| RCA-A5R | (Actuator) | 191 |
| RCA-A6R | (Actuator) | 193 |
| RCA-FL-RA3 | (Flange) | 382 |
| RCA-FL-RA4 | (Flange) | 382 |
| RCA-FT-RA3 | (Foot) | 384 |
| RCA-FT-RA4 | (Foot) | 384 |
| RCA-FT-SA4 | (Foot) | 383 |
| RCA-FT-SA5 | (Foot) | 384 |
| RCA-FT-SA6 | (Foot) | 384 |
| RCA-NJ-RA3 | (Knuckle joint) | 385 |
| RCA-NJ-RA4 | (Knuckle joint) | 385 |
| RCA-QR-RA3 | (Clevis) | 386 |
| RCA-QR-RA4 | (Clevis) | 386 |
| RCA-RA3C | (Actuator) | 125 |
| RCA-RA3D | (Actuator) | 129 |
| RCA-RA3R | (Actuator) | 133 |
| RCA-RA4C | (Actuator) | 127 |
| RCA-RA4D | (Actuator) | 131 |
| RCA-RA4R | (Actuator) | 135 |
| RCA-RGD3C | (Actuator) | 145 |
| RCA-RGD3D | (Actuator) | 149 |

| | | |
|---|---|---|
| RCA-RGD4C | (Actuator) | 147 |
| RCA-RGD4D | (Actuator) | 151 |
| RCA-RGS3C | (Actuator) | 137 |
| RCA-RGS3D | (Actuator) | 141 |
| RCA-RGS4C | (Actuator) | 139 |
| RCA-RGS4D | (Actuator) | 143 |
| RCA-RP-RA3 | (Rear mounting plate) | 387 |
| RCA-RP-RA4 | (Rear mounting plate) | 387 |
| RCA-SA4C | (Actuator) | 49 |
| RCA-SA4D | (Actuator) | 55 |
| RCA-SA4R | (Actuator) | 67 |
| RCA-SA5C | (Actuator) | 51 |
| RCA-SA5D | (Actuator) | 57 |
| RCA-SA5R | (Actuator) | 69 |
| RCA-SA6C | (Actuator) | 53 |
| RCA-SA6D | (Actuator) | 59 |
| RCA-SA6R | (Actuator) | 71 |
| RCA-SS4D | (Actuator) | 61 |
| RCA-SS5D | (Actuator) | 63 |
| RCA-SS6D | (Actuator) | 65 |
| RCA-SS-SA4 | (Slider spacer) | 388 |
| RCA-TRF-RA3 | (Trunnion) | 389 |
| RCA-TRF-RA4 | (Trunnion) | 389 |
| RCA-TRR-RA3 | (Trunnion) | 389 |
| RCA-TRR-RA4 | (Trunnion) | 389 |
| RCACR-SA4C | (Actuator) | 243 |
| RCACR-SA5C | (Actuator) | 245 |
| RCACR-SA5D | (Actuator) | 249 |
| RCACR-SA6C | (Actuator) | 247 |
| RCACR-SA6D | (Actuator) | 251 |
| RCAW-RA3C | (Actuator) | 279 |
| RCAW-RA3D | (Actuator) | 279 |
| RCAW-RA3R | (Actuator) | 279 |
| RCAW-RA4C | (Actuator) | 281 |
| RCAW-RA4D | (Actuator) | 281 |
| RCAW-RA4R | (Actuator) | 281 |
| RCB-TU-PIO-A | (Insulated PIO terminal block) | 302 |
| RCB-TU-PIO-AP | (Insulated PIO terminal block) | 302 |
| RCB-TU-PIO-B | (Insulated PIO terminal block) | 302 |
| RCB-TU-PIO-BP | (Insulated PIO terminal block) | 302 |
| RCB-TU-SIO-A | (SIO terminal block) | 302 |
| RCB-TU-SIO-AP | (SIO terminal block) | 302 |
| RCB-TU-SIO-B | (SIO terminal block) | 302 |
| RCB-TU-SIO-BP | (SIO terminal block) | 302 |
| RCM-101-MW | (PC software) | 303• 313• 323• 333 |
| RCM-101-USB | (PC software) | 303• 313• 323• 333 |
| RCM-E | (Teaching pendant) | 303• 313• 323• 333 |
| RCM-GW-CC | (Gateway unit) | 292 |
| RCM-GW-DV | (Gateway unit) | 291 |
| RCM-P | (Teaching pendant) | 303• 313• 323• 333 |
| RCM-T | (Teaching pendant) | 303• 313• 323• 333 |
| RCM-TD | (Teaching pendant) | 303• 313• 323• 333 |
| RCP2-HS8R | (Actuator) | 43 |
| RCP2-BA6 | (Actuator) | 45 |
| RCP2-BA6U | (Actuator) | 45 |
| RCP2-BA7 | (Actuator) | 47 |
| RCP2-BA7U | (Actuator) | 47 |
| RCP2-FL-RA10 | (Flange) | 382 |
| RCP2-FL-RA2 | (Flange) | 382 |
| RCP2-FL-RA3 | (Flange) | 382 |
| RCP2-FL-RA4 | (Flange) | 382 |
| RCP2-FL-RA6 | (Flange) | 382 |
| RCP2-FT-RA10 | (Foot) | 384 |
| RCP2-FT-RA2 | (Foot) | 384 |
| RCP2-FT-RA3 | (Foot) | 384 |
| RCP2-FT-RA4 | (Foot) | 384 |
| RCP2-FT-RA6 | (Foot) | 384 |
| RCP2-GR3LM | (Actuator) | 211 |
| RCP2-GR3LS | (Actuator) | 209 |

| | | |
|---|---|---|
| RCP2-GR3SM | (Actuator) | 215 |
| RCP2-GR3SS | (Actuator) | 213 |
| RCP2-GRM | (Actuator) | 207 |
| RCP2-GRS | (Actuator) | 205 |
| RCP2-HS8C | (Actuator) | 31 |
| RCP2-HS8R | (Actuator) | 43 |
| RCP2-RA10C | (Actuator) | 113 |
| RCP2-RA2C | (Actuator) | 105 |
| RCP2-RA3C | (Actuator) | 107 |
| RCP2-RA4C | (Actuator) | 109 |
| RCP2-RA6C | (Actuator) | 111 |
| RCP2-RGD3C | (Actuator) | 119 |
| RCP2-RGD4C | (Actuator) | 121 |
| RCP2-RGD6C | (Actuator) | 123 |
| RCP2-RGS4C | (Actuator) | 115 |
| RCP2-RGS6C | (Actuator) | 117 |
| RCP2-RTB | (Actuator) | 219 |
| RCP2-RTC | (Actuator) | 221 |
| RCP2-SA5C | (Actuator) | 21 |
| RCP2-SA5R | (Actuator) | 33 |
| RCP2-SA6C | (Actuator) | 23 |
| RCP2-SA6R | (Actuator) | 35 |
| RCP2-SA7C | (Actuator) | 25 |
| RCP2-SA7R | (Actuator) | 37 |
| RCP2-SA-RT | (Shaft adapter) | 387 |
| RCP2-SB-GRM | (Shaft bracket) | 387 |
| RCP2-SB-GRS | (Shaft bracket) | 387 |
| RCP2-SS7C | (Actuator) | 27 |
| RCP2-SS7R | (Actuator) | 39 |
| RCP2-SS8C | (Actuator) | 29 |
| RCP2-SS8R | (Actuator) | 41 |
| RCP2-TA-RT | (Table adapter) | 388 |
| RCP2CR-HS8C | (Actuator) | 241 |
| RCP2CR-SA5C | (Actuator) | 231 |
| RCP2CR-SA6C | (Actuator) | 233 |
| RCP2CR-SA7C | (Actuator) | 235 |
| RCP2CR-SS7C | (Actuator) | 237 |
| RCP2CR-SS8C | (Actuator) | 239 |
| RCP2W-FL-RA4 | (Flange) | 383 |
| RCP2W-FL-RA6 | (Flange) | 383 |
| RCP2W-RA10C | (Actuator) | 277 |
| RCP2W-RA4C | (Actuator) | 273 |
| RCP2W-RA6C | (Actuator) | 275 |
| RCP2W-SA16C | (Actuator) | 271 |
| RCS2-A4R | (Actuator) | 195 |
| RCS2-A5R | (Actuator) | 197 |
| RCS2-A6R | (Actuator) | 199 |
| RCS2-F5D | (Actuator) | 201 |
| RCS2-FL-RA5 | (Flange) | 382 |
| RCS2-FL-RA7 | (Flange) | 383 |
| RCS2-FT-RA5 | (Foot) | 385 |
| RCS2-FT-RA7 | (Foot) | 385 |
| RCS2-GR8 | (Actuator) | 217 |
| RCS2-RA4C | (Actuator) | 153 |
| RCS2-RA4D | (Actuator) | 157 |
| RCS2-RA4R | (Actuator) | 163 |
| RCS2-RA5C | (Actuator) | 155 |
| RCS2-RA5R | (Actuator) | 165 |
| RCS2-RA7AD | (Actuator) | 159 |
| RCS2-RA7BD | (Actuator) | 161 |
| RCS2-RGD4C | (Actuator) | 177 |
| RCS2-RGD4D | (Actuator) | 181 |
| RCS2-RGD5C | (Actuator) | 179 |
| RCS2-RGD7AD | (Actuator) | 183 |
| RCS2-RGD7BD | (Actuator) | 185 |
| RCS2-RGS4C | (Actuator) | 167 |
| RCS2-RGS4D | (Actuator) | 171 |
| RCS2-RGS5C | (Actuator) | 169 |
| RCS2-RGS7AD | (Actuator) | 173 |

| | | |
|---|---|---|
| RCS2-RGS7BD | (Actuator) | 175 |
| RCS2-RT6 | (Actuator) | 223 |
| RCS2-RT6R | (Actuator) | 225 |
| RCS2-RT7R | (Actuator) | 227 |
| RCS2-SA4C | (Actuator) | 73 |
| RCS2-SA4D | (Actuator) | 85 |
| RCS2-SA4R | (Actuator) | 91 |
| RCS2-SA5C | (Actuator) | 75 |
| RCS2-SA5D | (Actuator) | 87 |
| RCS2-SA5R | (Actuator) | 93 |
| RCS2-SA6C | (Actuator) | 77 |
| RCS2-SA6D | (Actuator) | 89 |
| RCS2-SA6R | (Actuator) | 95 |
| RCS2-SA7C | (Actuator) | 79 |
| RCS2-SA7R | (Actuator) | 97 |
| RCS2-SS7C | (Actuator) | 81 |
| RCS2-SS7R | (Actuator) | 99 |
| RCS2-SS8C | (Actuator) | 83 |
| RCS2-SS8R | (Actuator) | 101 |
| RCS2CR-SA4C | (Actuator) | 253 |
| RCS2CR-SA5C | (Actuator) | 255 |
| RCS2CR-SA5D | (Actuator) | 265 |
| RCS2CR-SA6C | (Actuator) | 257 |
| RCS2CR-SA6D | (Actuator) | 267 |
| RCS2CR-SA7C | (Actuator) | 259 |
| RCS2CR-SS7C | (Actuator) | 261 |
| RCS2CR-SS8C | (Actuator) | 263 |
| RCS2W-RA4C | (Actuator) | 283 |
| RCS2W-RA4D | (Actuator) | 283 |
| RCS2W-RA4R | (Actuator) | 283 |
| REU-1 | (Regenerative resistor unit) | 372 |
| REU-2 | (Regenerative resistor unit) | 333 • 363 |
| RP | (Rear mounting plate) | 387 |

[S]

| | | |
|---|---|---|
| SA | (Shaft adapter) | 387 |
| SB | (Shaft bracket) | 387 |
| SCON-C | (Controller) | 325 |
| SR | (Slider roller specification) | 388 |
| SS | (Slider spacer) | 388 |
| SSEL-C | (Controller) | 355 |
| ST-2A5-(Stroke) | (Stainless sheet) | 390 |
| ST-2A6-(Stroke) | (Stainless sheet) | 390 |
| ST-2A7-(Stroke) | (Stainless sheet) | 390 |
| ST-SA4-(Stroke) | (Stainless sheet) | 390 |
| ST-SA5-(Stroke) | (Stainless sheet) | 390 |
| ST-SA6-(Stroke) | (Stainless sheet) | 390 |
| ST-SA7-(Stroke) | (Stainless sheet) | 390 |
| ST-SM1-(Stroke) | (Stainless sheet) | 390 |
| ST-SM2-(Stroke) | (Stainless sheet) | 390 |
| ST-SS1-(Stroke) | (Stainless sheet) | 390 |
| ST-SS2-(Stroke) | (Stainless sheet) | 390 |
| ST-SS4-(Stroke) | (Stainless sheet) | 390 |
| ST-SS5-(Stroke) | (Stainless sheet) | 390 |
| ST-SS6-(Stroke) | (Stainless sheet) | 390 |

[T]

| | | |
|---|---|---|
| TA | (Table adapter) | 388 |
| TRF | (Trunnion) | 389 |
| TRR | (Trunnion) | 389 |

[V]

| | | |
|---|---|---|
| VR | (Vacuum position on opposite side) | 389 |

**RoboCylinder 2nd Gen**
**Catalogue No. 0307-E**

The information contained in this catalog is subject to change without notice for the pupose of product inprovement

ISO 9001

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