Selection Guide (Gripping Force)

RCP2 Series Gripper Slide Type

Step 1 Check necessary gripping force and transportable work part weight

Step 2 Check distance to gripping point

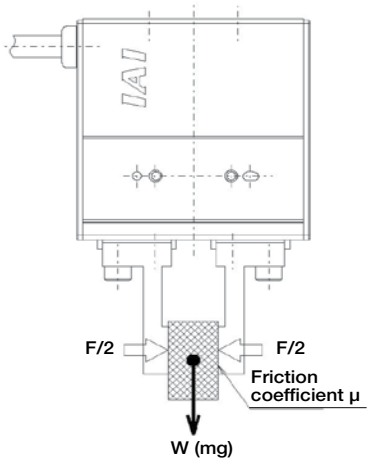
Step 3 Check external force applied to the finger attachment (claw)

Step 1 Check necessary gripping force and transportable work part weight

When gripping with frictional force, calculate the necessary gripping force as shown below.

(1) Normal transportation

F : Gripping force [N] …… Sum of push forces
μ : Coefficient of static friction between the finger attachment and the work part
m : Work part weight [Kg]
g : Gravitational acceleration [= 9.8m/s^2]



A condition in which a work part does not drop when the work part is gripped statistically:

$$F\mu > W$$

$$F > \frac{mg}{\mu}$$

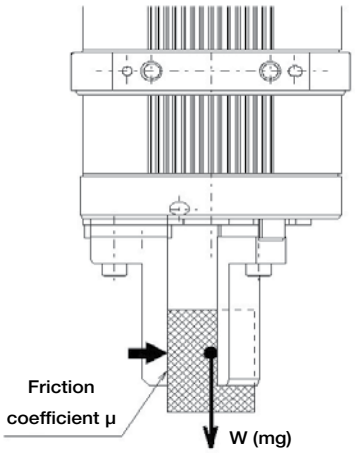
Necessary gripping force as the recommended safety factor of 2 in normal transportation:

$$F > \frac{mg}{\mu} \times 2 \text{ (safety factor)}$$

When the friction coefficient μ is between 0.1 and 0.2:

$$F > \frac{mg}{0.1 \sim 0.2} \times 2 = (10 \sim 20) \times mg$$

* As the Coefficient of static friction increases, the work part weight also increases. Select a model which can achieve the gripping force of 10 to 20 times or more.

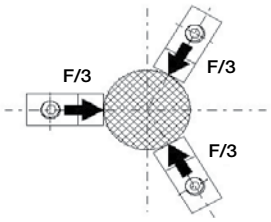


Normal work part transportation

Necessary gripping force	→	10 to 20 times the work part weight or more
Transportable work part weight	→	One-tenth to one-twentieth or less of gripping force

(2) When remarkable acceleration, deceleration and/or impact occur at work part transportation

Stronger inertial force is applied to a work part by gravity. In this case, consider the sufficient safety rate when selecting a model.



When remarkable acceleration, deceleration and/or impact occur

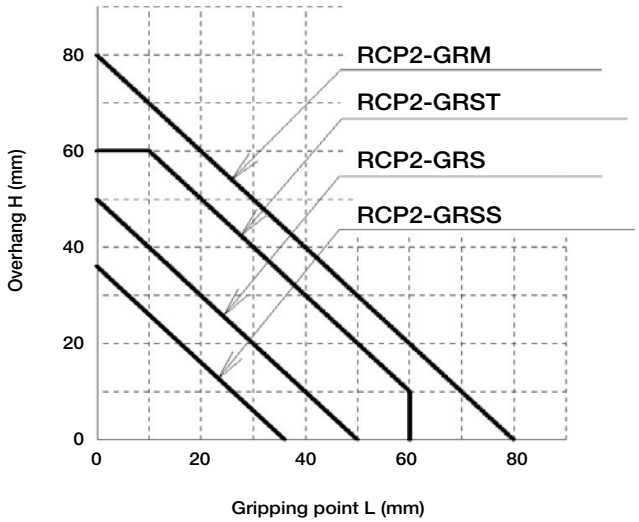
Necessary gripping force	→	30 to 50 times the work part weight or more
Transportable work part weight	→	One-thirtieth to one-fiftieth or less of gripping force

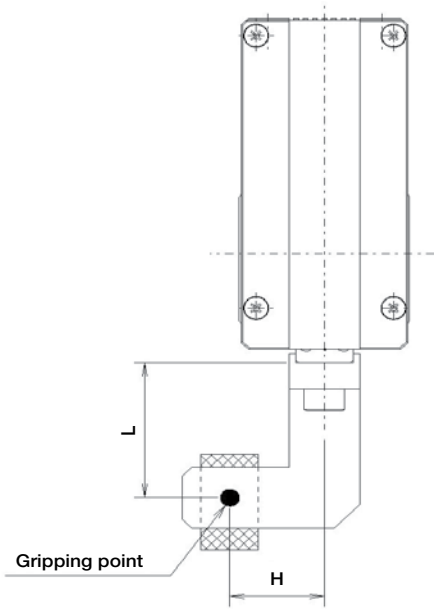
Selection Guide (Gripping Force)

Step 2 Distance between finger attachment (claw) to gripping point

Keep the distance (L, H) from the finger (claw) mounting surface to the gripping point within the following range. If such distance does not fall within such range, excessive moment applies to the finger sliding parts and internal mechanism and the service life may be affected.

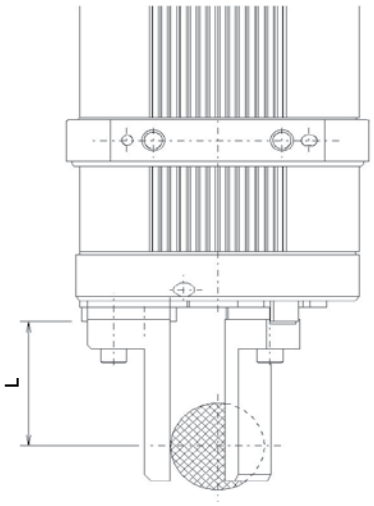
▪ **2-Finger gripper**





▪ **3-Finger gripper**

RCP2-GR3SS	→	L: 50mm or less
RCP2-GR3SM	→	L: 80mm or less



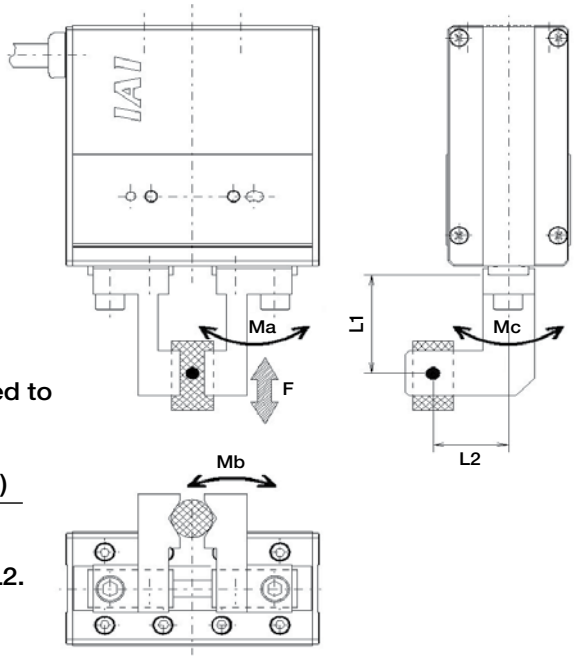
Keep the fingers mounted to the actuator as small and light as possible, even if the distance to the gripping point falls within a restricted range.

There are cases in which performance will be decreased or the guides will be adversely affected by inertial forces or bending moment if the finger is too long or too heavy.

Step 3 Checking external force applied to finger

(1) Allowable vertical load

Confirm that the vertical load applied to each finger is the allowable load or less.



(2) Allowable load moment

Calculate Ma and Mc using L1 and Mb using L2.
Confirm that the moment applied to each finger is the maximum allowable load moment or less.

Allowable external force when the moment load is applied to each claw:

$$\text{Allowable load F (N)} > \frac{\text{M (Maximum allowable moment (N•m)}}{\text{L (mm)} \times 10^{-3}}$$

Calculate the allowable load F (N) using both of L1 and L2.

Confirm that the external force applied to finger is the calculated allowable load F (N) (L1 or L2, whichever is smaller) or less.

Model	Allowable vertical load F (N)	Maximum allowable load moment (N•m)		
		Ma	Mb	Mc
RCP2-GRSS	60	0.5	0.5	1.5
RCP2-GRS	253	6.3	6.3	7.0
RCP2-GRM	253	6.3	6.3	8.3
RCP2-GRST	275	2.93	2.93	5.0
RCP2-GR3SS	169	3.8	3.8	3.0
RCP2-GR3SM	253	6.3	6.3	5.7

1. The allowable value ky above shows a static value.
2. The allowable value per finger is shown.

* Finger weight and work part weight are also a part of the external force. Centrifugal force when the gripper rotated gripping a work part and inertial force due to acceleration or deceleration when moving are also the external force applied to the finger.

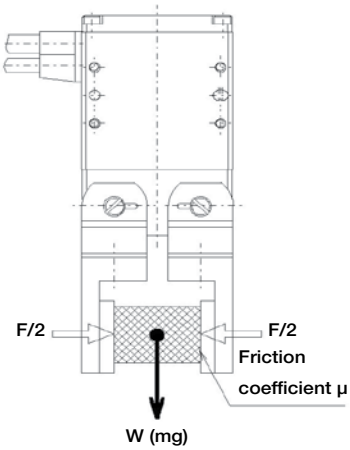
Selection Guide (Gripping Force)

RCP2 Series Gripper Lever Type

Step 1 Check necessary gripping force and transportable work part weight

Step 2 Check moment of inertia of the finger attachment (claw)

Step 3 Check external force applied to the finger



Step 1 Check the necessary gripping force and transportable work part weight

Like Step 1 of Slide type, calculate the necessary gripping force and confirm that the gripping force meets conditions. Calculate it referring to "Paragraph 5.3 Adjustment of Gripping Force", effective gripping force by gripping point.

Normal work transportation

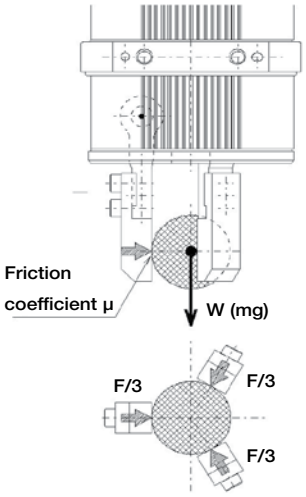
Necessary gripping force → 10 to 20 times the work part weight or more

Transportable work part weight → One-tenth to one-twentieth or less of gripping force

When remarkable acceleration, deceleration and/or impact occur

Necessary gripping force → 30 to 50 times the work part weight or more

Transportable work part weight → One-thirtieth to one-fiftieth or less of gripping force



Step 2 Checking moment of inertia of the finger attachment (claw)

Confirm that all moments of inertia around the Z axis (fulcrum) of the finger attachment (claw) fall within an allowable area. Depending on the configuration and/or shape of the finger, divide it into several elements when calculating. For your reference, an example of calculation by dividing into two elements is shown below.

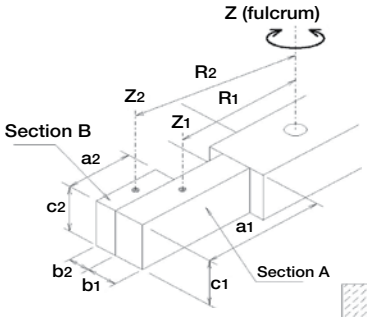
(1) Moment of inertia around Z_1 axis (the center of gravity of A) (section A)

m_1 : Weight of A [Kg]

a, b, c : Dimension of Section A [mm]

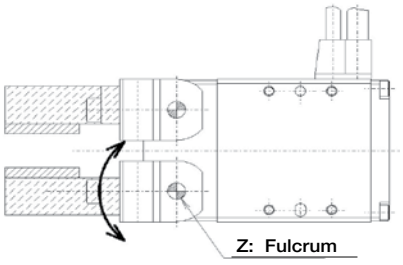
m_1 [Kg] $= a_1 \times b_1 \times c_1 \times \text{specific gravity} \times 10^{-6}$

$$I_{Z1}\ [kg.m^2] = \frac{m_1 (a_1^2 + b_1^2)}{12} \times 10^{-6}$$



(2) Moment of inertia around the Z_2 axis (the center of gravity of B) (section B)

$$I_{Z2}\ [kg.m^2] = \frac{m_2 (a_1^2 + b_1^2)}{12} \times 10^{-6}$$



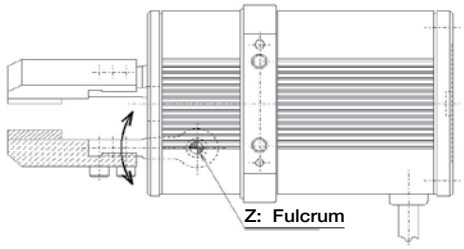
(3) All moments of inertia around the Z axis (fulcrum)

R_1 : Distance from the center of gravity of A to the finger opening/closing fulcrum [mm]

R_2 : Distance from the center of gravity of B to the finger opening/closing fulcrum [mm]

$I\ [kg \cdot m^2] = (Iz_1 + m_1R_1^2) + (Iz_2 + m_2R_2^2)$

Model	Allowable moment of inertia [kg•m^2]	Weight (Reference) [kg]
RCP2-GRLS	1.5×10^{-4}	0.07
RCP2-GR3LS	3.0×10^{-4}	0.15
RCP2-GR3LM	9.0×10^{-4}	0.5



Step 3 Checking external force applied to the finger

(1) Allowable load torque

Confirm that the load torque applied to the finger is the maximum allowable load torque or less.

The load torque is calculated by finger and work part weight as stated below.

m_1 : Work part weight

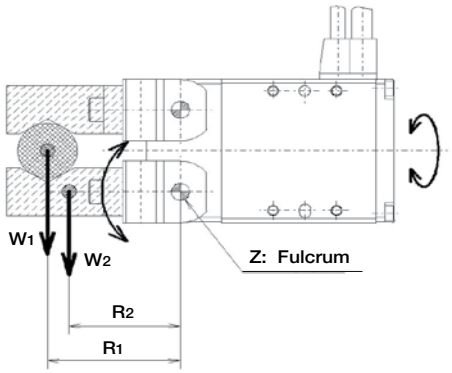
R_1 : Distance from the center of gravity of work part to the finger opening/closing fulcrum

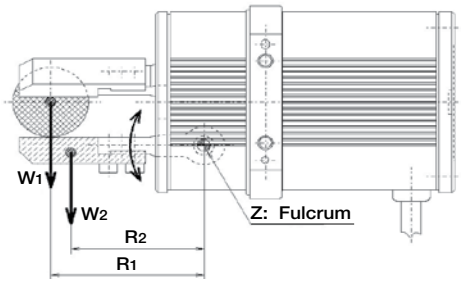
m_2 : Claw weight

R_2 : Distance from the center of gravity of the claw to the finger opening/closing fulcrum

$T = (W_1 \times R_1) + (W_2 \times R_2) + (\text{other load torque})$

$= (m_1g \times R_1) + (m_2g \times R_2) + (\text{other load torque})$





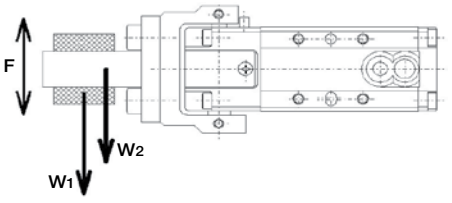
* Centrifugal force when the gripper rotated gripping a work part and inertial force due to acceleration or deceleration when moving horizontally are also the load torque applied to the finger. If applicable, confirm that the total torque including the torque above is the maximum allowable load torque or less.

(2) Allowable thrust load

Confirm that the thrust load of finger opening/closing the axis is the allowable load or less.

$F = W_1 + W_2 + (\text{other thrust load})$

$= m_1g + m_2g + (\text{other thrust load})$



Model	Maximum allowable load torque T [N•m]	Allowable thrust load F [N]
RCP2-GRLS	0.05	15
RCP2-GR3LS	0.15	–
RCP2-GR3LM	0.4	–