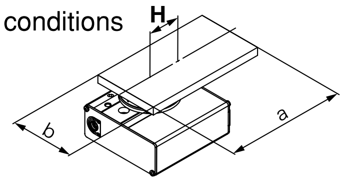
Rotary type

RF type

Selecting a model

Selecting a model

Operating conditions



Rotary type: RF03
Installation posture: Horizontal
Kind of load: Inertial load Ta
Shape of load: 150mm × 80mm (rectangular plate)
Oscillating angle θ: 180°

Acceleration/deceleration $\dot{\omega}$: 1,000°/sec²
Speed ω: 420°/sec
Load mass m: 2.0kg
Distance between shaft and center of gravity H: 40mm

Step1 Moment of inertia Acceleration/deceleration

1 **Calculating the moment of inertia.**

2 **Checking the moment of inertia vs.acceleration/deceleration.**

Select an appropriate model from the moment of inertia vs. acceleration/deceleration while referring to the moment of inertia acceleration/deceleration graph.

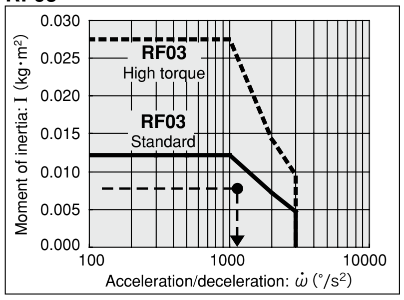
Calculation formula

$I = m \times (a^2 + b^2)/12 + m \times H^2$

Selection example

$I = 2.0 \times (0.15^2 + 0.08^2)/12 + 2.0 \times 0.04^2$
$= 0.00802 kg \cdot m^2$

RF03



Step2 Selecting a torque

1 **Kinds of loads**
- Static load: Ts
- Resistance load: Tf
- Inertial load: Ta

2 **Checking the effective torque**

Check that the speed can be controlled by the effective torque by the speed while referring to the effective torque speed graph.

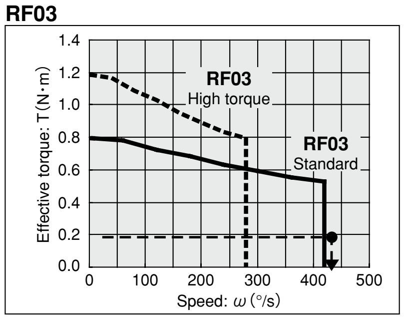
Calculation formula

Effective torque ≥ Ts
Effective torque ≥ Tf×1.5
Effective torque ≥ Ta×1.5

Selection example

Inertial load: Ta
$Ta \times 1.5 = I \times \dot{\omega} \times 2\pi/360 \times 1.5$
$= 0.00802 \times 1{,}000 \times 0.0175 \times 1.5$
$= 0.21 N \cdot m$

RF03



Step3 Allowable load

1 **Checking the allowable load**
- Radial load
- Thrust load
- Moment

Calculation formula

Allowable thrust load ≥ m×9.8
Allowable moment ≥ m×9.8×H

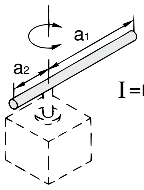
Selection example

●Thrust load
2.0×9.8=19.6N < Allowable load OK
●Allowable moment
2.0×9.8×0.04
=0.784N•m < Allowable moment OK

List of moment of inertia calculation formulas (Calculation of moment of inertia I)

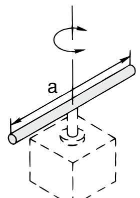
I: Moment of inertia kg·m² m: Load mass kg

1 Thin rod
Position of rotation axis:
Passes through one end perpendicularly to the rod.



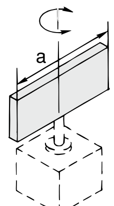
$$I = m_1 \cdot \frac{a_1^2}{3} + m_2 \cdot \frac{a_2^2}{3}$$

2 Thin rod
Position of rotation axis:
Passes through the center of gravity of the rod.



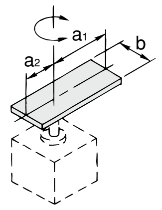
$$I = m \cdot \frac{a^2}{12}$$

3 Thin rectangular plate (rectangular parallelepiped)
Position of rotation axis:
Passes through the center of gravity of the plate.



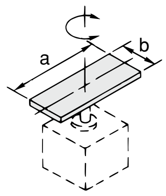
$$I = m \cdot \frac{a^2}{12}$$

4 Thin rectangular plate (rectangular parallelepiped)
Position of rotation axis:
Passes through one end perpendicularly to the plate.
(Same position for the rectangular parallelepiped with the plate thickened.)



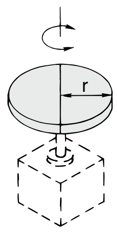
$$I = m_1 \cdot \frac{4a_1^2 + b^2}{12} + m_2 \cdot \frac{4a_2^2 + b^2}{12}$$

5 Thin rectangular plate (rectangular parallelepiped)
Position of rotation axis:
Passes through one end perpendicularly to the plate.
(Same position for the rectangular parallelepiped with the plate thickened.)



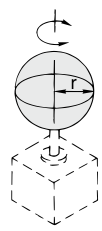
$$I = m \cdot \frac{a^2 + b^2}{12}$$

6 Cylinder (including thin disc)
Position of rotation axis:
Central axis



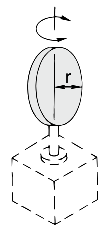
$$I = m \cdot \frac{r^2}{2}$$

7 Solid ball
Position of rotation axis:
Diameter



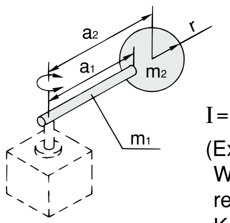
$$I = m \cdot \frac{2r^2}{5}$$

8 Thin disc
Position of rotation axis:
Diameter



$$I = m \cdot \frac{r^2}{4}$$

9 Load at lever tip

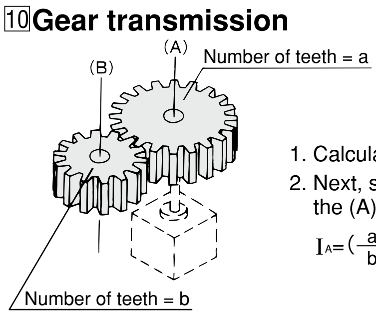


$$I = m_1 \cdot \frac{a_1^2}{3} + m_2 \cdot a_2^2 + K$$

(Example)
When the shape of m_2 is a ball, refer to [7] to obtain the following.

$$K = m_2 \cdot \frac{2r^2}{5}$$

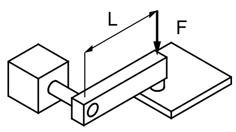
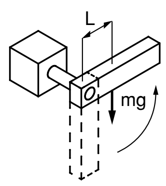
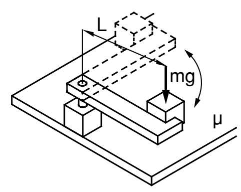
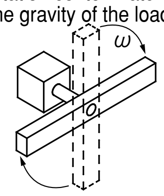
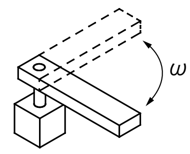
10 Gear transmission



1. Calculate the moment of inertia I_B around the (B) axis.
2. Next, substitute I_B for the moment of inertia around the (A) axis to calculate I_A as follows.

$$I_A = \left(\frac{a}{b}\right)^2 \cdot I_B$$

Selecting a model

Kinds of loads		
Static load: Ts	**Resistance load: Tf**	**Inertial load: Ta**
Only push force is needed (clamp, etc.).	Gravity or friction force applies in the rotation direction.	Load with inertia needs to be rotated.
	<Gravity applies.>  <Friction force applies.> 	<Rotation center matches to the gravity of the load.>  <Rotation axis is in the vertical direction.> 
Ts＝F·L Ts：Static load (N·m) F：Clamp force (N) L：Distance from oscillating center to clamp position (m)	Gravity applies in the rotation direction. Tf＝m·g·L Friction force applies in the rotation direction. Tf＝μ·m·g·L Tf：Resistance load (N·m) m：Mass of load (kg) g：Gravity acceleration 9.8 (m/s²) L：Distance from oscillating center to gravity or friction force action point (m) μ：Friction coefficient	$Ta = I \cdot \dot{\omega} \cdot 2\pi/360$ $(Ta = I \cdot \dot{\omega} \cdot 0.0175)$ Ta：Inertial load (N·m) I：Moment of inertia (kg·m²) $\dot{\omega}$：Acceleration/deceleration (°/sec²) ω：Speed (°/sec)
Required torque T=Ts	Required torque T=Tf×1.5 Note1)	Required torque T=Ta×1.5 Note1)

● **Load becomes the resistance load.**
Gravity or friction force applies in the rotation direction.

Example 1) The rotation center of the rotation axis does not match to the center of gravity of the load in the horizontal direction.
Example 2) The load slips on the floor to move it.

＊The required torque is the total of the resistance load and inertial load.
T＝(Tf＋Ta)×1.5

● **Load does not become the resistance load.**
Gravity or friction force does not apply in the rotation direction.

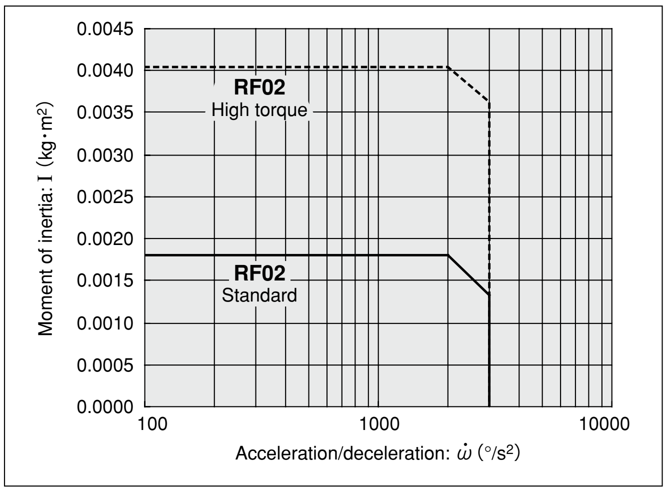
Example 1) The rotation axis is vertical.
Example 2) The rotation center of the rotation axis does not match to the center of gravity of the load in the horizontal direction.

＊The required torque is only the inertial load.
T=Ta×1.5

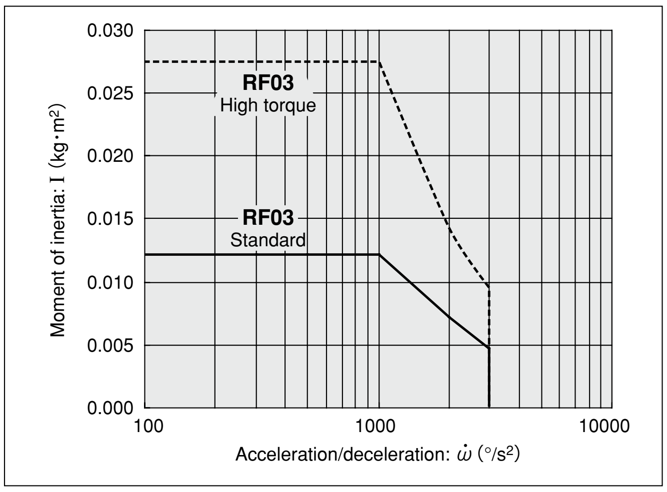
Note 1) An allowance is required for Tf and Ta to make the speed adjustment.

Moment of inertia Acceleration/deceleration

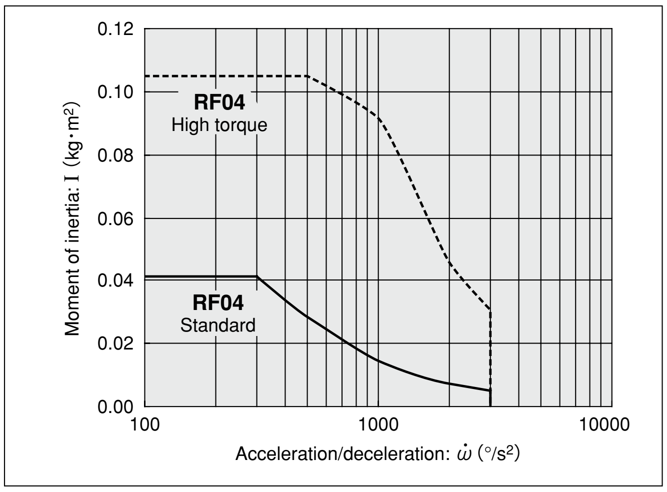
RF02



RF03

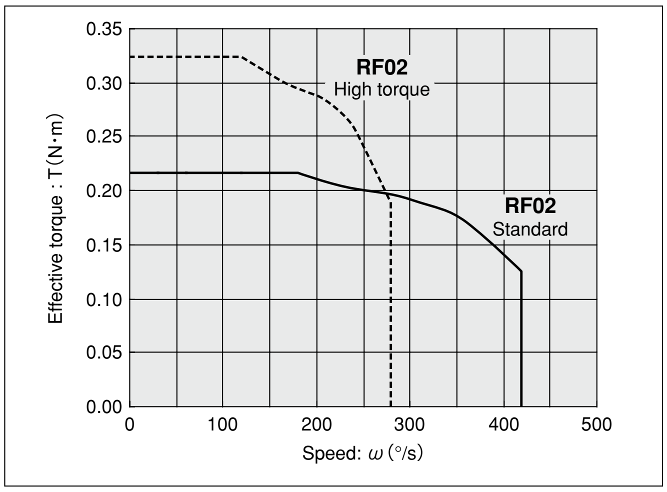


RF04

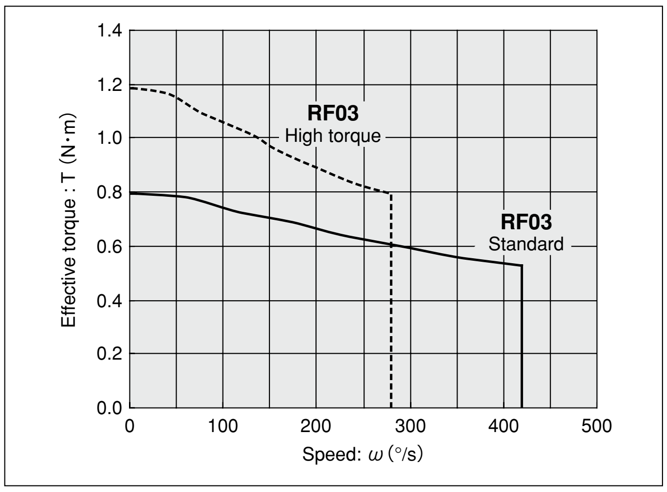


Effective torque Speed

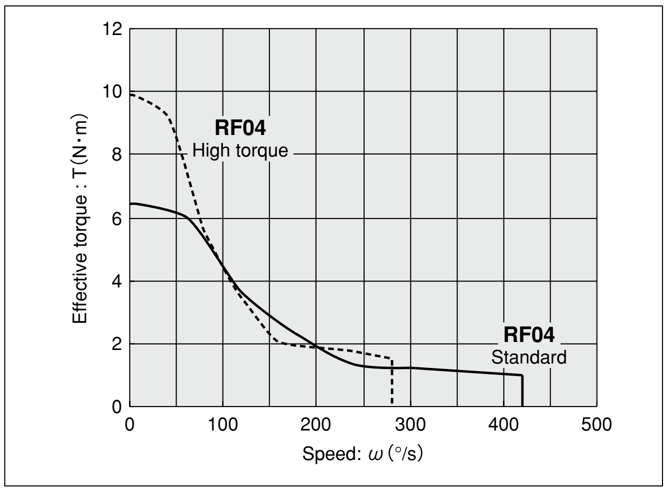
RF02



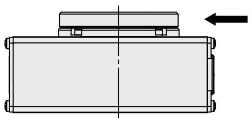
RF03

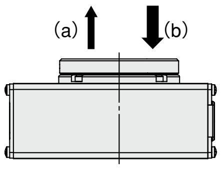


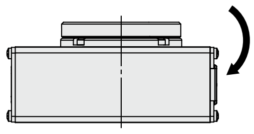
RF04



Allowable load







<table>
<tr><th rowspan="3">Size</th><th colspan="2" rowspan="2">Allowable radial load (N)</th><th colspan="4">Allowable thrust load (N)</th><th colspan="2" rowspan="2">Allowable moment (N·m)</th></tr>
<tr><th colspan="2">(a)</th><th colspan="2">(b)</th></tr>
<tr><th>Standard model</th><th>High precision model</th><th>Standard model</th><th>High precision model</th><th>Standard model</th><th>High precision model</th><th>Standard model</th><th>High precision model</th></tr>
<tr><td>02</td><td>78</td><td>86</td><td colspan="2">74</td><td>78</td><td>107</td><td>2.4</td><td>2.9</td></tr>
<tr><td>03</td><td>196</td><td>233</td><td colspan="2">197</td><td>363</td><td>398</td><td>5.3</td><td>6.4</td></tr>
<tr><td>04</td><td>314</td><td>378</td><td colspan="2">296</td><td>398</td><td>517</td><td>9.7</td><td>12.0</td></tr>
</table>

It is necessary to set the parameters for the controller. For details, see TRANSERVO Series User's Manual.