11.1. When Using a Servomotor

11.1.1. Rotation Speed

The rotation speed required for the motor is obtained using the equation (46) based on the feed speed, Ball Screw lead and reduction ratio.

$$N_M = \frac{V \times 1000 \times 60}{\ell} \times \frac{1}{A} \quad \cdots\cdots\cdots(46)$$

where

N_M : Required rotation speed of the motor (min^{-1})
V : Feed speed (m/s)
ℓ : Ball Screw lead (mm)
A : Reduction ratio

The rated rotation speed of the motor must be equal to or above the calculated value (N_M) above.

$N_M \leqq N_R$

Where

N_R : The rated rotation speed of the motor (min^{-1})

11.1.2. Required Resolution

Resolutions required for the encoder and the driver are obtained using the equation (47) based on the minimum feed distance, Ball Screw lead and reduction ratio.

$$B = \frac{\ell \cdot A}{S} \quad \cdots\cdots\cdots(47)$$

where

B : Resolution required for the encoder and the driver (p/rev)
ℓ : Ball Screw lead (mm)
A : Reduction ratio
S : Minimum feed distance (mm)

11.1.3. Motor Torque

The torque required or the motor differs between uniform motion, acceleration and deceleration. To calculate the rotation torque, see "Studying the Rotation Torque" on page K-68.

ⓐ Maximum torque

The maximum torque required for the motor must be equal to or below the maximum instantaneous torque of the motor.

$T_{max} \leqq Tp_{max}$

where

T_{max} : Maximum torque acting on the motor

Tp_{max} : Maximum instantaneous torque of the motor

ⓑ Effective value of the torque

The effective value of the torque required for the motor must be calculated. The effective value of the torque is obtained using the equation (48) below.

$$T_{rms} = \sqrt{\frac{T_1^2 \times t_1 + T_2^2 \times t_2 + T_3^2 \times t_3}{t}} \quad \cdots\cdots\cdots(48)$$

where

T_{rms} : Effective value of the torque (N-mm)

T_n : Fluctuating torque (N-mm)

t_n : Time during which the torque T_n is applied (s)

t : Cycle time (s)

$(t=t_1+t_2+t_3)$

The calculated effective value of the torque must be equal to or below the rated torque of the motor.

$T_{rms} \leqq T_R$

where

T_R : Rated torque of the motor (N-mm)

11.1.4. Inertial Moment

The inertial moment required for the motor is obtained using the equation (49) below.

$$J_M = \frac{J}{C} \quad \cdots\cdots\cdots(49)$$

where

J_M : Inertial moment required for the motor ($kg\text{-}m^2$)

C : Factor determined by the motor and the driver

(It is normally between 3 to 10. However, it varies depending on the motor and the driver. Check the specific value in the catalog by the motor manufacturer.)

The inertial moment of the motor must be equal to or above the calculated J_M value.