CB Gear Motor Specifications

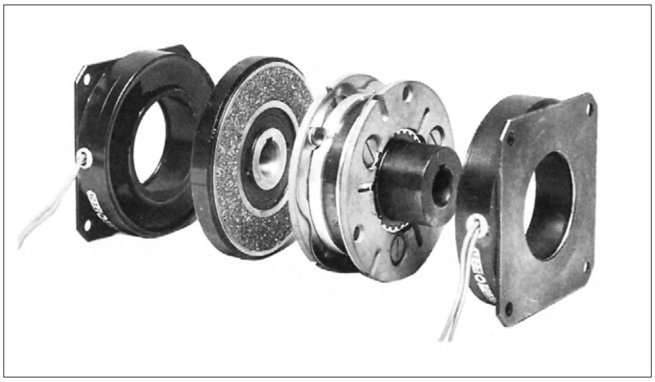
1. Specifications

Motor	Output	Three-phase :0.1, 0.2, 0.4, 0.75, 1.5, 2.2, 3.7kW	Single-phase :100W, 200W
	Power supply	200/200/220V 50/60/60Hz	100V 50/60Hz
	Number of poles	4	4
	Protection type	0.1 kW - Totally-enclosed type (IP44), 0.2-3.7 kW - Totally-enclosed external fan type (IP44)	Drip-proof protection type (IP22)
	Cooling method	0.1 kW - Self-cooling type (IC410), 0.2-3.7 kW - Self-managed type (IC411)	Draft type (IC01)
	Starting method	–	Split-phase starting type
	Rating	Continuous	Continuous
	Insulation	Class E	Class E
Reducer	Reduction ratio	1/5 to 1/200	
	Speed reducing method	External gear system (helical gear, spur wheel)	
	Lubricating method	Grease lubrication	
	Shaft end key way	New JIS key (JIS B1301-1976): Output shaft key attached	
	Output shaft end	Tapped	
Ambient conditions	Installation place	Indoor not exposed to dust or water	
	Ambient temperature	0℃ to 40℃	
	Ambient humidity	Less than 85% (non condensing)	
	Altitude	At elevations below 1000 m	
	Atmosphere	Free from corrosive gases, explosive gases and steam	
	Mounting direction	No limitations on mounting angles: horizontal, vertical or inclined	
Paint color		Munsell 2.5G 6/3	

Note) The protective construction for the CB gear motor is IP12.

2. Clutch/Brake

Type	Dry single-plate friction type
Actuation method	Excitation
Rated voltage	24 V DC
Insulation class	Class B
Protection type	Open
Gap adjustment	Automatic gap control system
Lining	No asbestos



For lubrication, installation and coupling, refer to pages 59 to 62.

Power supply box

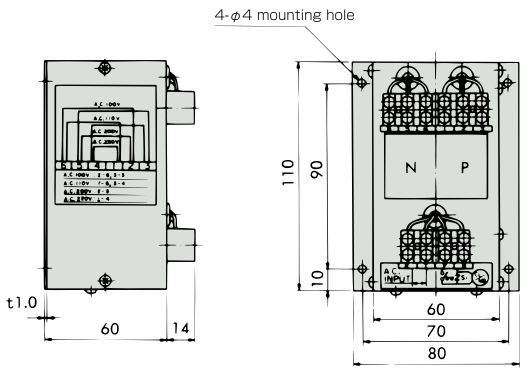
The following power supply boxes and control unit for the clutch/brake are available. Make the selection according to your operating conditions. The control unit is of the non-contact type, making it suitable for high frequency on-off switching.

Power supply box list

Model	Model number	Capacity W	Recommended CB gear motor	Varistor for discharge circuit	Function	Specifications
DMP-type power supply box	DMP-10/24	10	GMTA010 GMTA100 GMTA020 GMTA200 GMTA040	Z15D151	Rectifying only	Input voltage: 100/100/110 V AC 200/200/220 V AC Output voltage: 24 V DC Rating: Continuous Paint color: Munsell 7.5BG6/1.5
	DMP-20/24A	20	GMTA075 GMTA150 GMTA220	Z15D151		
	DMP-63/24A	63	GMTA370	Z15D151		
TMP-type control unit	TMP-40D	40	All models	Unnecessary	Rectifying and brake torque adjusting	

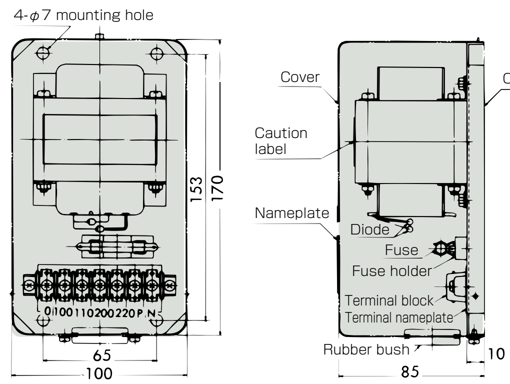
(The varistor accompanies the CB gear motor.)

DMP-10/24



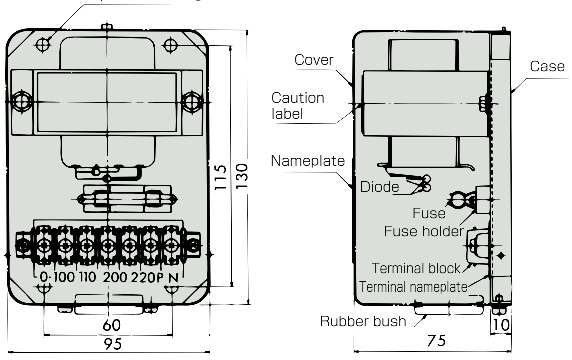
Approx. weight : 1kg

DMP-63/24A



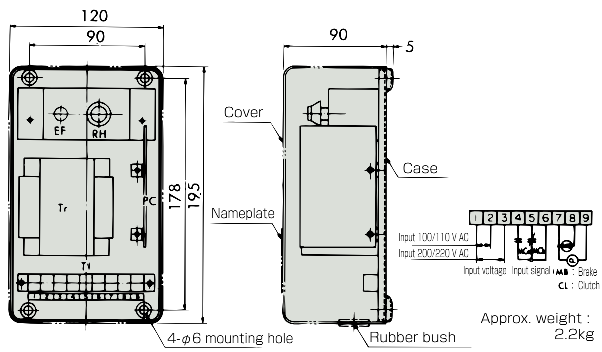
Approx. weight : 2kg

DMP-20/24A



Approx. weight : 1.2kg

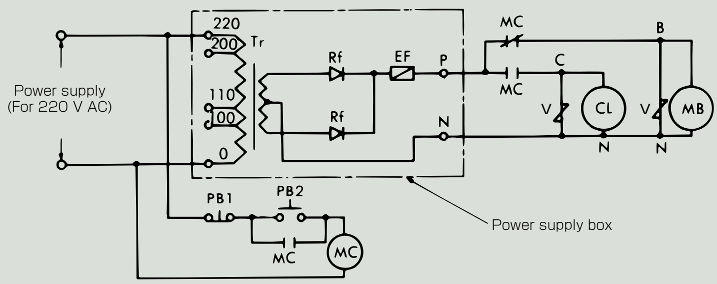
TMP-40D



Approx. weight : 2.2kg

Control circuit

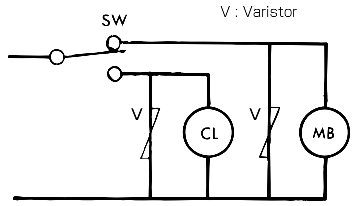
1. Example of circuit using standard power supply box (DMP-type)



Tr : Transformer
V : Varistor
MB : Electromagnetic brake
PB1,PB2 : Pushbutton switch
Rf : Silicon rectifier
CL : Electromagnetic clutch
EF : Fuse
MC : Electromagnetic contactor

2. The discharge circuit

When performing switching on the DC side using the standard power supply box (DMP-type), provide a discharge circuit using the varistor accompanying the CB gear motor in order to protect the switch and to prevent a dielectric breakdown of the clutch/brake.



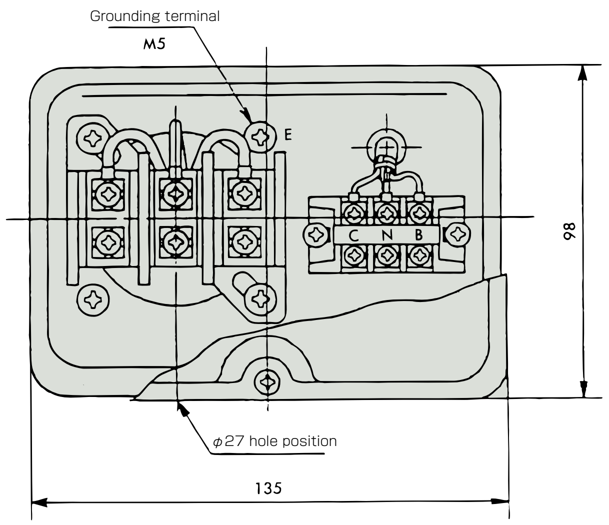
When using the standard power supply box (TMP-type), because a discharge circuit is included, the above procedure is not necessary.

3. Power capacity

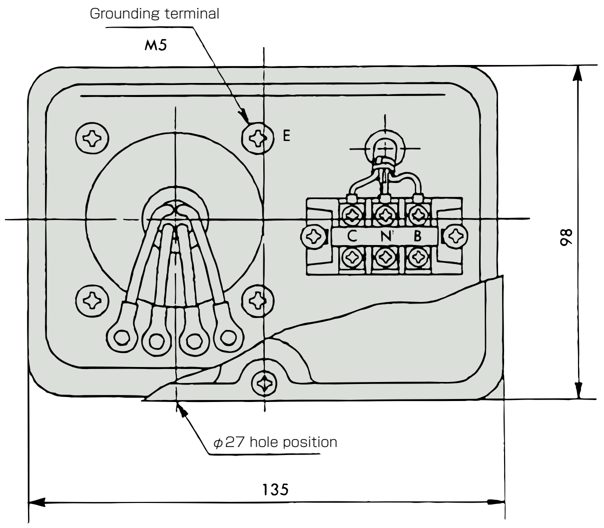
The power capacity for the electromagnetic clutch/brake should be 130% or more of the power consumption of the clutch/brake.
When using two or more CB gear motors, it should be 130% or more of the total capacity.

4. Structure of terminal box

Three-phase 0.1kW~3.7kW



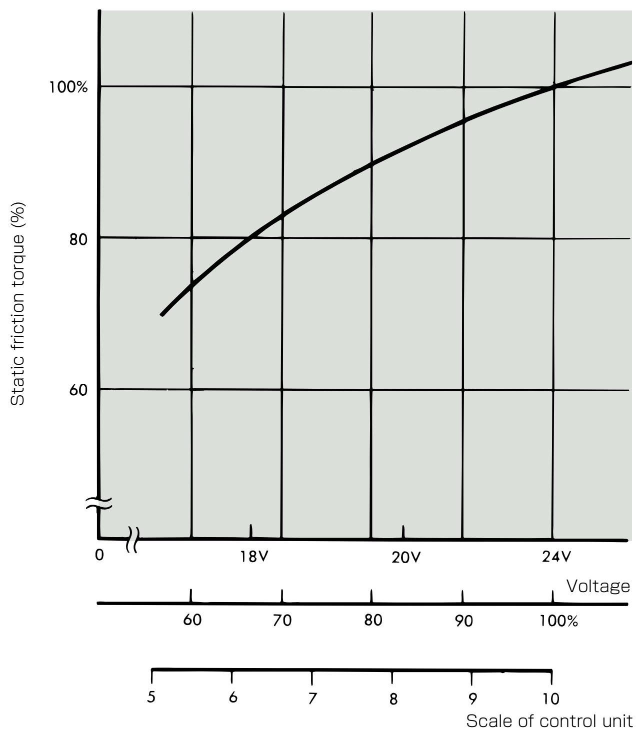
Single-phase 100W, 200W



Structure • Specifications

5. Brake torque adjusting function

For the TMP-type control unit, a brake torque adjusting resistor is set in the circuit. The brake torque can be adjusted as shown in the figure to the right by reducing the voltage with this resistor. The lower limit of voltage adjustment is about 70%.
If the voltage is reduced too much, insufficient pull-in of the armature will result. The scale of the control unit should be regarded as a guideline. To determine the precise value, measure the terminal voltage.



6. Special control circuit

If fast actuation of the clutch/brake is required, increase the voltage applied to the clutch/brake above the rated voltage, which will shorten the armature pull-in time and the torque rise time.
Using this method will cause heating of the clutch/brake body. In addition, if the GD^2 of the load is 0.5 or more as compared with that of the motor, the shock on starting will be increased. Care should therefore be taken when using this method.

CB Gear Motor Selection

Selection

1. Selection procedure

- When making a selection based on the torque and revolution, select a model number according to the gear motor. The allowable inertia ratio, clutch/brake clutching work and life span are described here.

1. Conditions
(1) Output shaft revolution speed n_L and frequency Hz
(2) Load torque on motor shaft T_ℓ
(3) Load on motor shaft GD_ℓ^2 (moment of inertia)
(4) GD_M^2 of motor
(5) Starting frequency per minute N (Maximum frequency: 60 times/min)
(6) Method of coupling to load

2. Selection of model
(1) Calculate the corrected inertia ratio (U).

$$U=\frac{GD_\ell^2\times U_F}{GD_M^2}$$

Correction coefficient according to coupling method : (U_F)

Method of coupling to load	U_F
Direct coupling, etc., that causes no shake	1.0
Chain transmission, etc., that causes shake	1.5

(2) Make sure that the corrected inertia ratio (U) of the motor to be used does not exceed the allowable inertia ratio (U_{max}).
※If it exceeds the allowable inertia ratio, please contact our company.

Allowable inertia ratio : (U_{max})

Reduction ratio	U_{max}
Under 1/30	1.0
1/40～1/50	0.5
1/100～1/200	0.2

(3) While referring to the clutch/brake selection diagram on page 92, select a suitable motor capacity to allow for the load torque on the motor shaft and GD^2 on motor shaft.
(For N=25, refer to the diagram for N=30.)
When a precise selection is necessary, determine it using the basic formula on page 104.

3. Determination of life span
Calculate the clutching work per time E_ℓ using the formula shown in Section 3 on page 104.
From this E_ℓ and the total work (E_T shown on page 105), calculate the total clutching count (Z) as shown below.

$$Z=\frac{E_T}{E_\ell}$$

To calculate the life span in units of days, use the following formula.

$$Z_d=\frac{Z}{N\times60\times N_h}$$

Z_d : Life span in units of days
N : Starting count per minute
N_h : Average operating time per day

2. Example of selection

SI units

1. Conditions
(1) Output shaft revolution speed n_L=50r/min(50Hz)
(2) Load torque on motor shaft T_ℓ=1.764N·m
(3) Moment of inertia on motor shaft
I_ℓ=0.001kg·m^2(Load being coupled directly)
(4) Moment of inertia of load of motor I_M=0.00119kg·m^2
(5) Starting frequency N=15 times/min

2. Selection of model

$$U=\frac{I_\ell\times U_F}{I_M}=\frac{0.001\times1.0}{0.00119}=0.84$$

· Because the output shaft revolution speed is 50 r/min, the reduction ratio is 1/30 according to the specification chart (page 106) and therefore the allowable inertia ratio is 1.0, which means there is no problem with the corrected inertia ratio U.
· Because the starting frequency per minute is 15 times/min, refer to the diagram for N = 20 times/min. The point of intersection of the above-shown T_ℓ and I_ℓ in this diagram indicates that the proper motor capacity is 0.4 kW. As a result, the model number that should be selected is GMT040-L30CB.

3. Determination of life span
(Perform the following calculation while referring to page 104.)

$$E_\ell=\frac{\Sigma I\times n^2}{182}\times\frac{T_d}{(T_d-T_\ell)}$$
$$=\frac{1.216\times10^{-3}\times1500^2}{182}\times\frac{3.53}{(3.53-1.76)}$$
$$=29.9J$$

$\Sigma I=2.16\times10^{-4}+1.0\times10^{-3}$
$=1.216\times10^{-3}$kg·m^2
n =1500r/min
T_d =3.53N·m
T_ℓ =1.76N·m

E_T =3.92×10^{8}J

$$Z=\frac{3.92\times10^8}{29.9}=13.1\times10^6 \text{ times}$$

Gravitational units

1. Conditions
(1) Output shaft revolution speed n_L=50r/min(50Hz)
(2) Load torque on motor shaft T_ℓ=0.18kgf·m
(3) Load on motor shaft GD_ℓ^2=0.004kgf·m^2
(Load being coupled directly)
(4) GD_M^2 of motor=0.00476kgf·m^2
(5) Starting frequency N=15 times/min

2. Selection of model

$$U=\frac{GD_\ell^2\times U_F}{GD_M^2}=\frac{0.004\times1.0}{0.0476}=0.84$$

· Because the output shaft revolution speed is 50 r/min, the reduction ratio is 1/30 according to the specification chart (page 106) and therefore the allowable inertia ratio is 1.0, which means there is no problem with the corrected inertia ratio U.
· Because the starting frequency per minute is 15 times/min, refer to the diagram for N = 20 times/min. The point of intersection of the above-shown T_ℓ and GD_ℓ^2 in this diagram indicates that the proper motor capacity is 0.4 kW. As a result, the model number that should be selected is GMT040-L30CB.

3. Determination of life span
(Perform the following calculation while referring to page 104.)

$$E_\ell=\frac{\Sigma GD^2\times n^2}{7160}\times\frac{T_d}{(T_d-T_\ell)}$$
$$=\frac{4.86\times10^{-3}\times1500^2}{7160}\times\frac{0.36}{(0.36-0.18)}$$
$$=3.05kgf\cdot m$$

ΣGD^2 =8.63×10^{-4}+4.0×10^{-3}
=4.86×10^{-3}kgf·m^2
n=1500r/min
T_d=0.36kgf·m
T_ℓ=0.18kgf·m

E_T =4.0×10^{7}kgf·m

$$Z=\frac{4.0\times10^7}{3.05}=13.1\times10^6 \text{ times}$$

CB Gear Motor

3. Clutch/Brake selection diagram

SI units

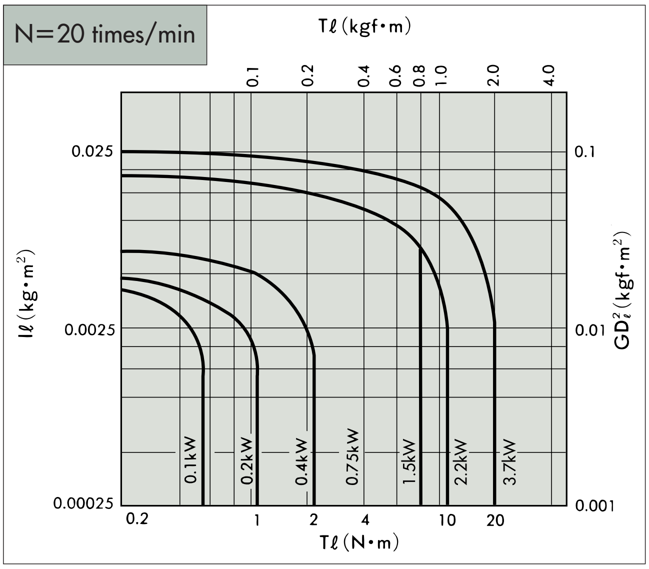
$T_\ell = \frac{T_L}{R}$ $I_\ell = \frac{I_L}{R^2}$

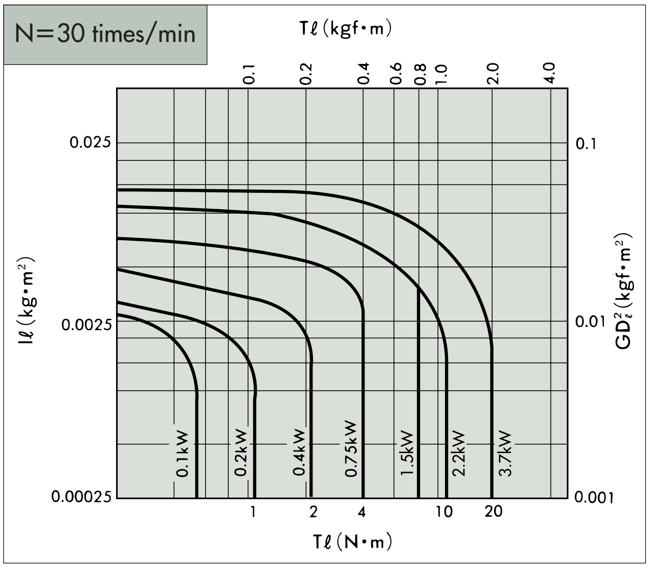
T_ℓ : Load torque on motor shaft (N·m)
T_L : Load torque on output shaft (N·m)
I_ℓ : Moment of inertia on motor shaft (kg·m²)
I_L : Moment of inertia of load on output shaft (kg·m²)
R : Reduction ratio

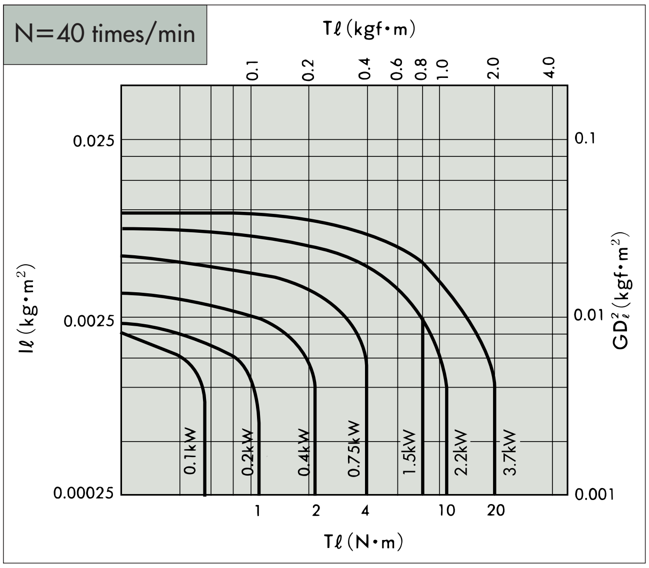
Gravitational units

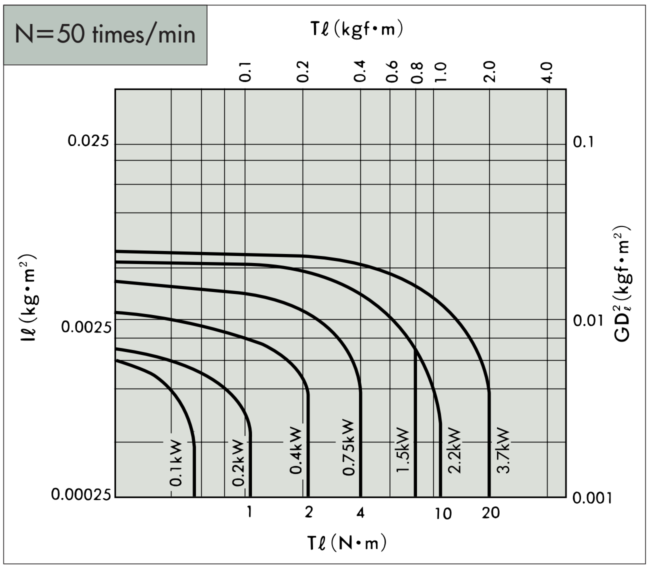
$T_\ell = \frac{T_L}{R}$ $GD_\ell^2 = \frac{GD_L^2}{R^2}$

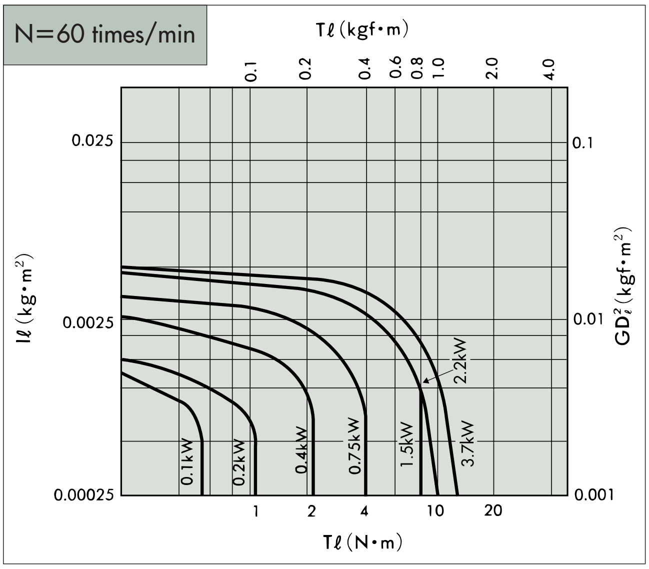
T_ℓ : Load torque on motor shaft (kgf·m)
T_L : Load torque on output shaft (kgf·m)
GD_ℓ^2 : Moment of inertia on motor shaft GD^2 (kgf·m²)
GD_L^2 : Moment of inertia of load on output shaft GD^2 (kgf·m²)
R : Reduction ratio











4. Basic formula for selection

SI units

1. Torque, revolution speed and power

$$T_L = 9550\frac{P}{n_L}$$

T_L : Torque on output shaft N·m
P : Power kW
n_L : Output shaft revolution speed r/min

2. Conversion to motor shaft

(1) T_ℓ : Load torque on motor shaft N·m

$$T_\ell = \frac{T_L}{i}$$

T_L : Torque on output shaft N·m
i : Reduction ratio

(2) I_ℓ : Moment of inertia on motor shaft kg·m²

$$I_\ell = \frac{I_L}{i^2}$$

I_L : Moment of inertia on output shaft kg·m²

3. Clutching (braking) work

(1) E_ℓ : Clutching (braking) work per time J

$$E_\ell = \frac{\Sigma I \times n_\ell^2}{182.5} \times \frac{T_d}{(T_d \pm T_\ell)}$$

$\Sigma I = I_c + I_\ell$

I_ℓ : Moment of inertia on motor shaft
I_c : Moment of inertia of clutch/brake (Table 1 on page 105)

n_ℓ : Motor shaft revolution speed r/min
T_d : Dynamic friction torque of clutch/brake N·m (Table 3 on page 105)
+ : Positive torque at the time of braking
− : Negative torque at the time of clutching and braking

(2) E_N : Clutching (braking) work per minute J

$E_N = E_\ell \times N$

N : Starting frequency (times/min)

$E_N \leqq E_o$

E_o : Allowable work J/min (Table 3 on page 105)

4. Clutching (braking) time

t_b : Clutching (braking) time s

$$t_b = \frac{\Sigma I}{9.55} \times \frac{n_\ell}{(T_d \pm T_\ell)}$$

+ : Positive torque at the time of braking
− : Negative torque at the time of clutching and braking

5. Response time

t_a : Armature pull-in time s (Table 2 on page 105)

6. Calculation of braking distance

$$S = (t_a + \frac{1}{2}t_b) \times V$$

S : Braking distance mm
V : Speed (conveyor speed, etc.) mm/s

7. Stopping accuracy

Precise determination of the stopping accuracy is difficult because it is affected by voltage, temperature, alteration through use, operating time, etc. However, if the following variations are assumed:

a. Load torque variation: ±20%
b. Braking torque variation: ±20%
c. Time lag variation: ±0.01s

The variation from the calculated braking distance is about ±30%.

Stopping accuracy δ = S x 0.6 or S x ±0.3

For example, when the calculated braking distance S is 10 mm, the stopping accuracy is 6 mm (10±3 mm).

Gravitational units

1. Torque, revolution speed and power

$$T_L = 974\frac{P}{n_L}$$

T_L : Torque on output shaft kgf·m
P : Power kW
n_L : Output shaft revolution speed r/min

2. Conversion to motor shaft

(1) T_ℓ : Load torque on motor shaft kgf·m

$$T_\ell = \frac{T_L}{i}$$

T_L : Torque on output shaft kgf·m
i : Reduction ratio

(2) GD_ℓ^2 : Load on motor shaft GD² kgf·m²

$$GD_\ell^2 = \frac{GD_L^2}{i^2}$$

GD_L^2 : Load on output shaft GD² kgf·m²

3. Clutching (braking) work

(1) E_ℓ : Clutching (braking) work per time kgf·m

$$E_\ell = \frac{\Sigma GD^2 \times n_\ell^2}{7160} \times \frac{T_d}{(T_d \pm T_\ell)}$$

$\Sigma GD^2 = GD_c^2 + GD_\ell^2$

GD_ℓ^2 : Load on motor shaft GD²
GD_c^2 : GD² of clutch/brake (Table 1 on page 105)

n_ℓ : Motor shaft revolution speed r/min
T_d : Dynamic friction torque of clutch/brake kgf·m (Table 3 on page 105)
+ : Positive torque at the time of braking
− : Negative torque at the time of clutching and braking

(2) E_N : Clutching (braking) work per minute kgf·m/min

$E_N = E_\ell \times N$

N : Starting frequency (times/min)

$E_N \leqq E_o$

E_o : Allowable work kgf·m/min (Table 3 on page 105)

4. Clutching (braking) time

t_b : Clutching (braking) time s

$$t_b = \frac{\Sigma GD^2}{375} \times \frac{n_\ell}{(T_d \pm T_\ell)}$$

+ : Positive torque at the time of braking
− : Negative torque at the time of clutching and braking

5. Response time

t_a : Armature pull-in time s (Table 2 on page 105)

6. Calculation of braking distance

$$S = (t_a + \frac{1}{2}t_b) \times V$$

S : Braking distance mm
V : Speed (conveyor speed, etc.) mm/s

7. Stopping accuracy

Precise determination of the stopping accuracy is difficult because it is affected by voltage, temperature, alteration through use, operating time, etc. However, if the following variations are assumed:

a. Load torque variation: ±20%
b. Braking torque variation: ±20%
c. Time lag variation: ±0.01s

The variation from the calculated braking distance is about ±30%.

Stopping accuracy δ = S x 0.6 or S x ±0.3

For example, when the calculated braking distance S is 10 mm, the stopping accuracy is 6 mm (10±3 mm).

Specification Chart

0.1.0.2
0.4.0.75
1.5.2.2
3.7

Specifications of motor and clutch/brake

Table 1. Moment of inertia of motor and clutch/brake

Motor output	Moment of inertia of motor I_M kg·m²	Moment of inertia of motor GD^2_M {kgf·m²}	Model number of clutch/brake: Clutch	Model number of clutch/brake: Brake	Moment of inertia of clutch/brake I_C kg·m²	Moment of inertia of clutch/brake GD^2_C {kgf·m²}
0.1kW	0.64×10^{-3}	2.54×10^{-3}	NC/NB-0.15/0.1-AG-001		1.21×10^{-4}	{4.83×10^{-4}}
100W	0.60×10^{-3}	2.40×10^{-3}				
0.2kW	0.74×10^{-3}	2.96×10^{-3}	NC/NB-0.3/0.2-AG-001		1.21×10^{-4}	{4.83×10^{-4}}
200W	0.88×10^{-3}	3.50×10^{-3}				
0.4kW	0.90×10^{-3}	3.59×10^{-3}	NC-0.6AG-033	NB-0.4AG-001	2.16×10^{-4}	{8.63×10^{-4}}
0.75kW	1.37×10^{-3}	5.48×10^{-3}	NC-1.2AG-034	NB-0.75AG-001	0.62×10^{-3}	{2.46×10^{-3}}
1.5kW	3.41×10^{-3}	13.6×10^{-3}	NC-2.5AG-033	NB-1.5AG-001	1.94×10^{-3}	{7.74×10^{-3}}
2.2kW	4.79×10^{-3}	19.2×10^{-3}	NC-2.5AG-033	NB-2.2AG-001	1.94×10^{-3}	{7.74×10^{-3}}
3.7kW	7.60×10^{-3}	30.4×10^{-3}	NC-5AG-024	NB-3.7AG-001	0.49×10^{-2}	{1.94×10^{-2}}

Table 2. Armature pull-in time

	Armature pull-in time (S)	Model number of power supply box
NC/NB-0.15/0.1	0.010 0.015 0.005	DMP TMP EMP
NC/NB-0.3/0.2	0.010 0.015 0.005	DMP TMP EMP
NC/NB-0.6/0.4	0.015 0.023 0.008	DMP TMP EMP
NC/NB-1.2/0.75	0.020 0.030 0.010	DMP TMP EMP

	Armature pull-in time (S)	Model number of power supply box
NC/NB-2.5/1.5	0.030 0.0.45 0.015	DMP TMP EMP
NC/NB-2.5/2.2	0.035 0.053 0.018	DMP TMP EMP
NC/NB-5/3.7	0.040 0.060 0.020	DMP TMP EMP

EMP has special specifications for double excitation.

Table 3. Specifications of clutch/brake

Motor output	Classification	Model number of clutch/brake	Static friction torque N·m	Static friction torque {kgf·m}	Dynamic friction torque N·m	Dynamic friction torque {kgf·m}	Power consumption (W)	Allowable work E_O J/min	Allowable work E_O {kgf·m/min}	Total work E_T J	Total work E_T {kgf·m}
0.1kW/100W	Clutch	NC/NB-0.15/0.1-AG-001	1.47	{0.15}	0.88	{0.09}	4	1960	{ 200}	25.5×10^7	{2.6×10^7}
	Brake		0.98	{0.1 }	0.59	{0.06}	3	1764	{ 180}		
0.2kW/200W	Clutch	NC/NB-0.3/0.2-AG-001	2.94	{0.3 }	1.76	{0.18}	5	1960	{ 200}	25.5×10^7	{2.6×10^7}
	Brake		1.96	{0.2 }	1.18	{0.12}	4	1764	{ 180}		
0.4kW	Clutch	NC-0.6AG-033	5.88	{0.6 }	3.53	{0.36}	8	2744	{ 280}	39.2×10^7	{4.0×10^7}
	Brake	NB-0.4AG-001	3.92	{0.4 }	2.35	{0.24}	7	2450	{ 250}		
0.75kW	Clutch	NC-1.2AG-034	11.8	{1.2 }	6.86	{0.70}	11	4410	{ 450}	61.7×10^7	{6.3×10^7}
	Brake	NB-0.75AG-001	7.35	{0.75}	4.41	{0.45}	8	3969	{ 405}		
1.5kW	Clutch	NC-2.5AG-033	24.5	{2.5 }	14.7	{1.5 }	17	6860	{ 700}	90.2×10^7	{9.2×10^7}
	Brake	NB-1.5AG-001	14.7	{1.5 }	8.82	{0.9 }	12	6174	{ 630}		
2.2kW	Clutch	NC-2.5AG-033	24.5	{2.5 }	14.7	{1.5 }	17	6860	{ 700}	90.2×10^7	{9.2×10^7}
	Brake	NB-2.2AG-001	21.6	{2.2 }	12.7	{1.3 }	16	6174	{ 630}		
3.7kW	Clutch	NC-5AG-024	49.0	{5.0 }	29.4	{3.0 }	25	10290	{1050}	16.7×10^8	{1.7×10^8}
	Brake	NB-3.7AG-001	36.3	{3.7 }	22.5	{2.3 }	17	9310	{ 950}		

Precautions for use

●Use with constantly held loads

Because the brake of the CB gear motor exerts a braking effect through excitation, it is unsuitable for use in equipment, such as hoisting machines, that always holds loads.

●Provision of totally-enclosed types

The standard product cannot be used in an outdoor place where it will be exposed to water or an indoor place where there is lots of dust or oil mist, because the clutch/brake part is of open type.

For such uses, a totally-enclosed type clutch/brake is required. For more information, contact our company.

●Handling variable voltage and double voltage

For a motor, it is possible to cope with variable voltage and double voltage at time of purchase or through rewinding. For the power supply box for a clutch/brake, because it is for 100/200 V AC, a 100 V instrumentation power supply should be used.

●Explosion-proof type

No explosion-proof-type clutch/brake is available.