E

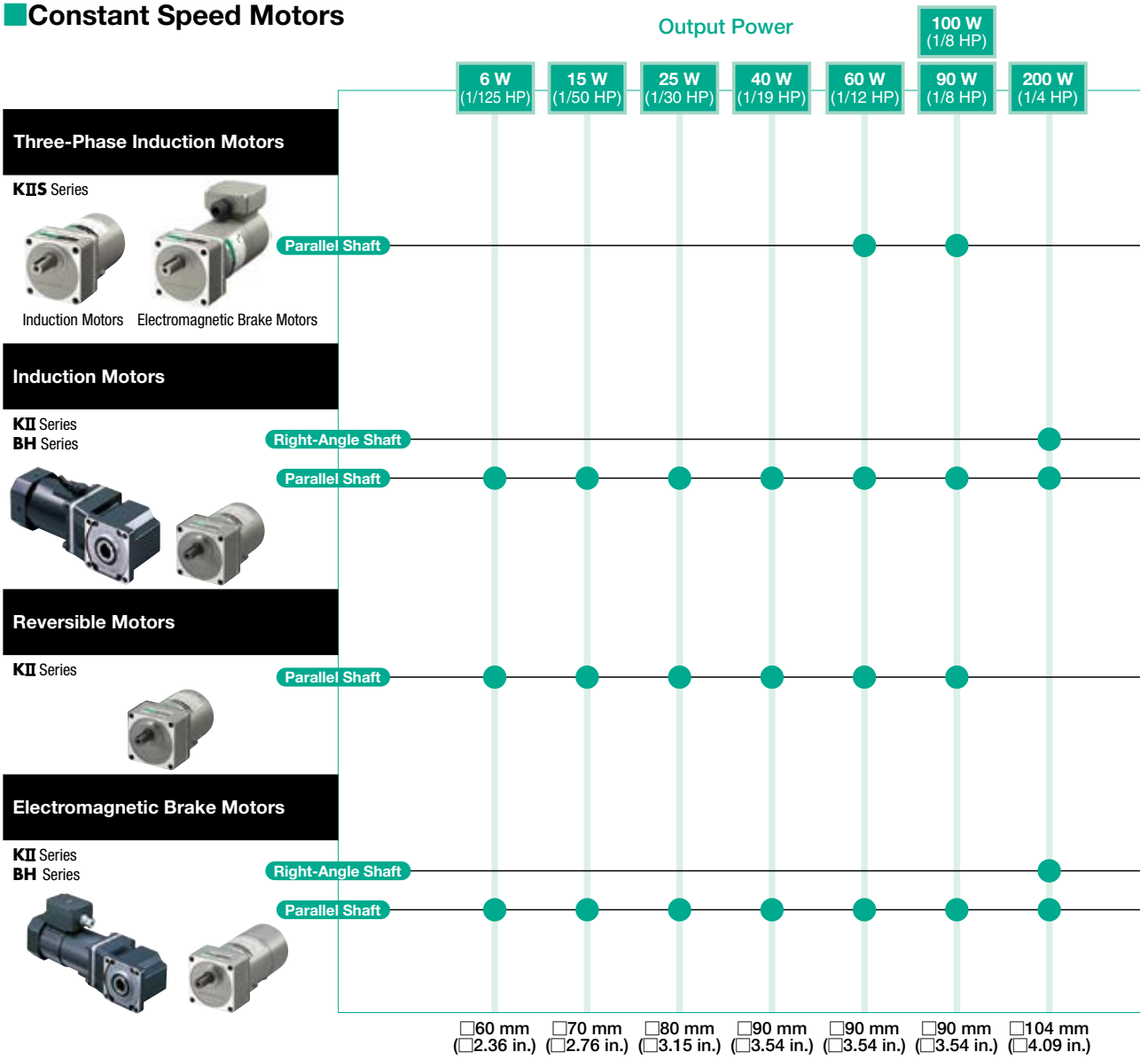
Standard AC Motors

Standard AC Motors

Product Series of Standard AC Motors

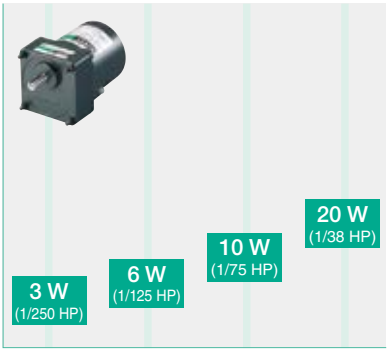
A wide range of standard AC motors with different features to meet the demand for many applications.

Constant Speed Motors



Torque Motors

➜ Page E-75



IP67 Watertight, Dust-Resistant Motors

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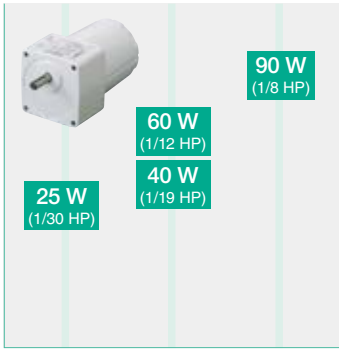
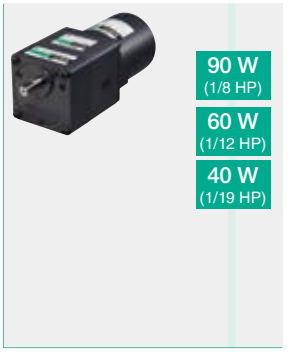


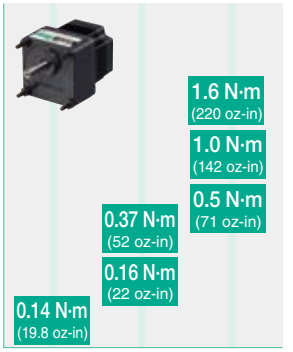
Clutch & Brake Motors

➜ Page E-67



Low-Speed Synchronous Motors

➜ Page E-71



Overview of Standard AC Motors

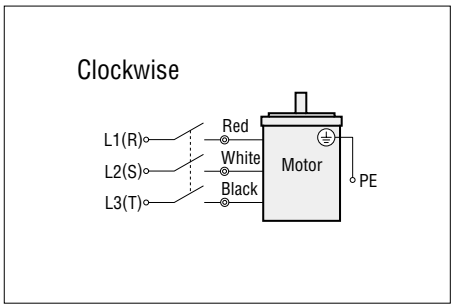
Standard AC motors are used generally as a power source for automated equipment, because these motors can be operated easily by connecting the motors directly to an AC power supply.
Oriental Motor offers standard AC motors incorporating various operating functions. A standard AC motor supports various applications by using with a brake pack or speed control circuit product, and combining with other mechanical components such as a gearhead or linear head.

Overview
Three-Phase Induction Motors
Induction Motors
Reversible Motors
Electromagnetic Brake Motors
Clutch & Brake Motors
Low-Speed Synchronous Motors
Torque Motors
IP67 Watertight, Dust-Resistant Motors
Brake Pack
AC Speed Control Motors
AC input DSC

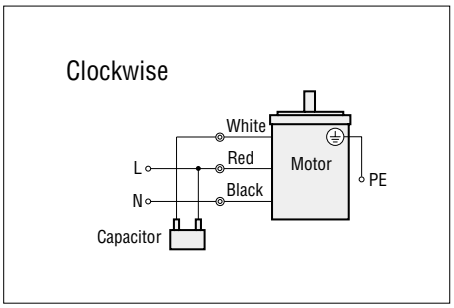
Features

Easy Operation

Standard AC motors include three-phase motors used with a three-phase power supply and single-phase motors used with a single-phase power supply.
A three-phase motor does not require a capacitor. All you need is to connect the motor directly to a three-phase power supply.
A single-phase motor can be operated simply by connecting it to a single-phase power supply via the supplied capacitor.



Induction Motors: Connection example for three-phase power supply input type



Induction Motors: Connection example for single-phase power supply input type

The Power Supply Frequency Determines the Speed

The basic speed (synchronous speed*) of a standard AC motor is determined by the power supply frequency and the number of poles. Many of our standard AC motors have four poles, so their synchronous speed is as follows:

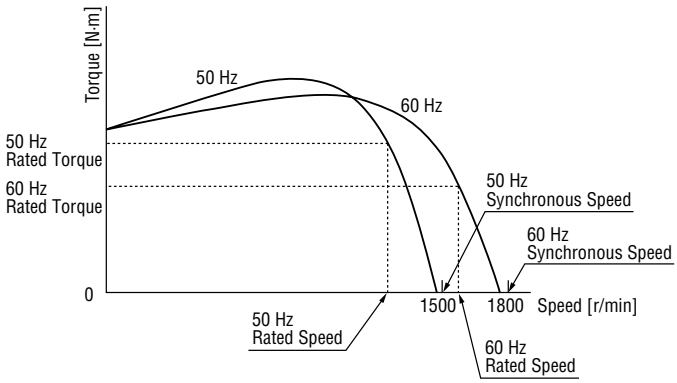
50 Hz: 1500 r/min
60 Hz: 1800 r/min

The actual speed varies according to the load torque.
With our motors, the speed roughly falls within the following ranges at a load torque equivalent to the rated torque:

50 Hz: 1200 to 1300 r/min
60 Hz: 1450 to 1600 r/min

The rated speed of our standard AC motors are set within the above ranges and showed on each motor's specification page.
To calculate a more accurate machine speed, use the rated speed as a reference.

The power supply frequency varies from region to region. In the case of automated equipment used in different regions, change the gear ratio of the gearhead or take other appropriate measure to obtain the desired speed.



Speed – Torque Characteristics

*The synchronous speed is calculated by the formula below.

$$Ns = \frac{120 \times f}{P}$$

Ns : Synchronous Speed [r/min]
f : Power Supply Frequency [Hz]
P : Number of Poles (Many of our motors have four poles.)

An Optimal Motor can be Selected According to the Load Torque

The torque generated by each standard AC motor is different depending on the motor frame size and length.
Oriental Motor offers standard AC motors with a frame size of 42 mm to 104 mm (1.65 in. to 4.09 in.) and output of 1 W to 200 W (1/750 HP to 1/4 HP). Select the optimal motor from the wide-ranging variations according to the load torque.

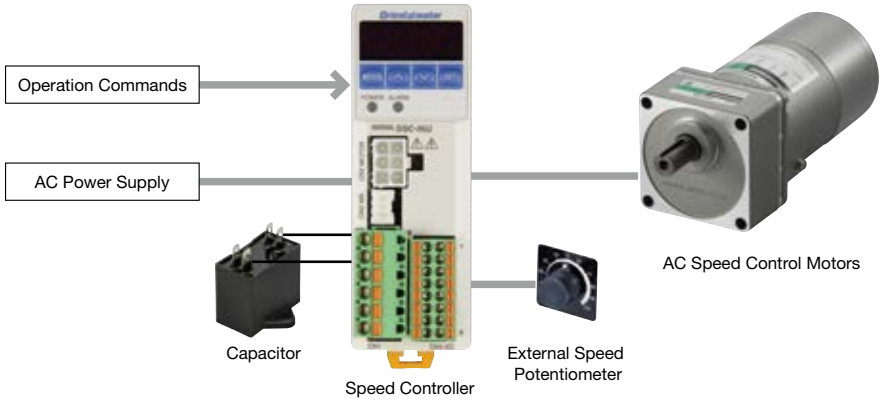
Overview of AC Speed Control Motors

Overview of DSC Series

AC speed control motors are motors that include an induction motor or reversible motor equipped with a tachogenerator (AC generator) for speed detection. By combining these motors with a dedicated control circuit (speed controller), speed changes can be performed.
A broad lineup of AC motors that can easily be used for speed control is available.

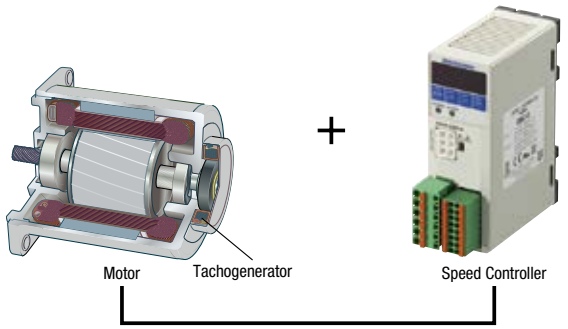
System Configuration

Driving is performed by a motor equipped with a tachogenerator (AC generator) for speed detection combined with a speed controller (control circuit).
The motor speed is set using a speed potentiometer or external DC voltage.



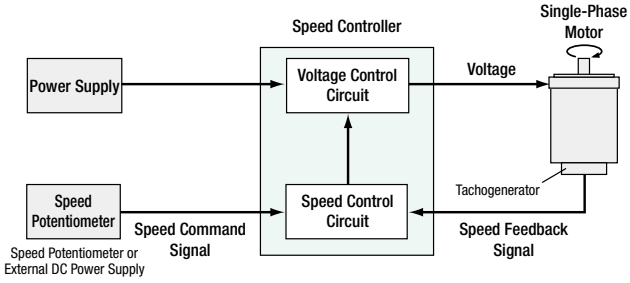
Structure

AC speed control motors are equipped with a tachogenerator (AC generator) on the back of the motor. The feedback signals from the tachogenerator are compared with the setting speed with the speed controller and the motor speed is adjusted.



Control Block Diagram

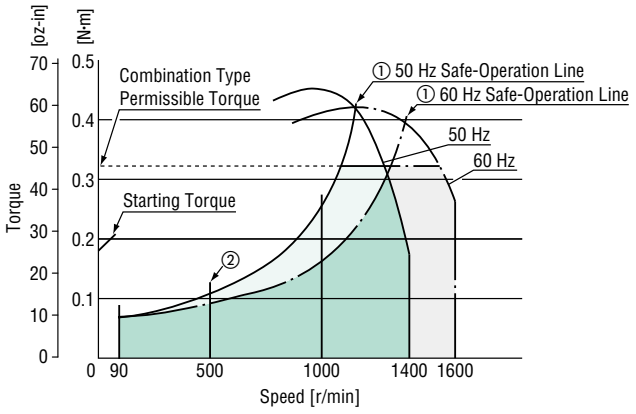
The speed feedback signals from the tachogenerator assembled in the motor are compared with the speed command signal set with a speed potentiometer or other device in the speed controller.
The comparison result is sent to the voltage control circuit. The voltage control circuit adjusts the voltage applied to the motor and controls the motor speed.



Speed – Torque Characteristics

With AC speed control motors, rated operation* is possible if operation is in the range below the safe-operation line (①) shown in the figure below.
If the load torque changes in relation to the speed set, the motor speed will also change. The speed change related to each setting speed is shown with the vertical lines (②) in the characteristics diagram.

*Induction motors have a continuous rating and reversible motors have a 30 minute rating.



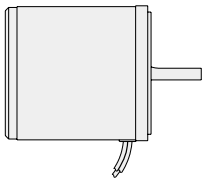
Product Line

Motors

A wide range of standard AC motors with different features to meet the demand for many applications.

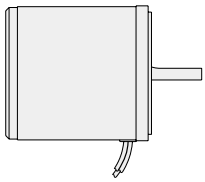
High Efficiency Three-Phase Induction Motors

These new high-efficiency three-phase induction motors were created through optimized motor design.



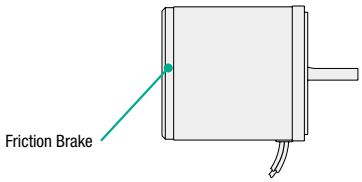
Induction Motors

These motors can easily be operated from an AC power supply.



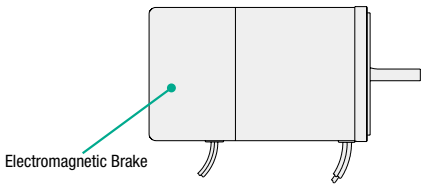
Reversible Motors

These motors generate a greater starting torque and have a built-in friction brake. These single-phase motors also allow for instantaneous switching of rotation direction.



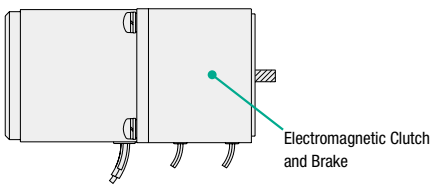
Electromagnetic Brake Motors

These motors have a “power off” activated type electromagnetic brake to hold the load in position when the power is cut off.



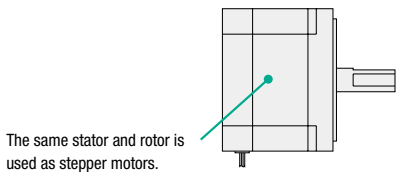
Clutch & Brake (C•B) Motors

These motors are equipped with an electromagnetic clutch and brake at the motor output shaft. High frequency starting and stopping is possible while the motor is operating.



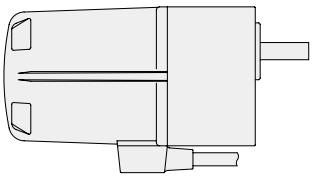
Low-Speed Synchronous Motors

These motors use the same stator and rotor as stepper motors. These motors offer superb starting, stopping and reversing characteristics as well as synchronous operation.



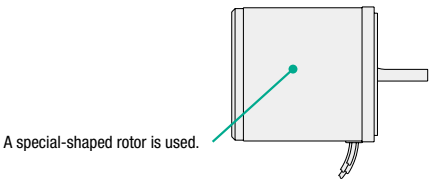
IP67 Watertight, Dust-Resistant Motors

These motors are watertight, dust-resistant and conform to the IEC Standard IP67.



Torque Motors

A special rotor is used to provide large starting torque and sloping characteristics (torque is highest at zero speed and decreases steadily with increasing speed). The torque can be changed by changing the applied voltage.



●Various Gearheads are Available for Assembly with Motors

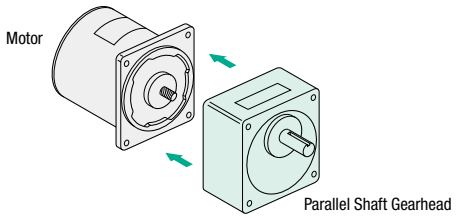
Various gearheads that convert the speed and torque of a standard AC motor to the speed or torque required by automated equipment, as well as linear heads that convert motor rotation to linear motion.
Since standard AC motors are designed with a standard flange mounting surface, the desired gearhead can be assembled according to the specific application.

Note

●Available gearheads vary depending on the motor type.
For details on this product please refer to our website.

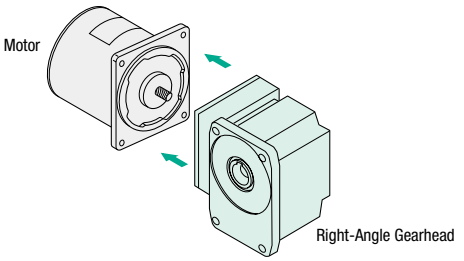
Parallel Shaft Gearheads

The gear shaft is positioned in the same direction as (in parallel with) the motor shaft. Decimal gearheads are also available.



Right-Angle Gearheads

The gear shaft is positioned at right angles (90°) with the motor shaft. Solid shaft and hollow shaft types are available.



●Various Control Circuits are Available for Use with Standard AC Motors

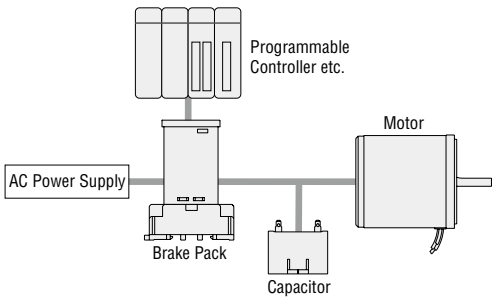
Using a standard AC motor with a control circuit suppresses overrun and enables variable speed operation.

Note

●Not all control circuits are compatible depending on the motor type, applicable voltage, etc.
We also have many package models combining a control circuit with a motor.
For details on this product please refer to our website.

Brake Pack

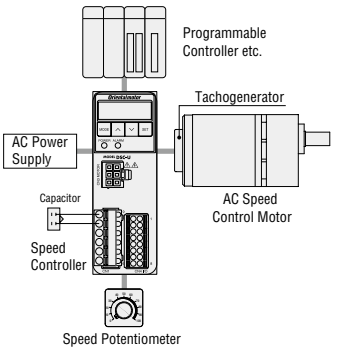
Upon receipt of a command from a programmable controller etc., a large braking current from the brake pack stops the motor instantaneously.



AC Speed Control Motors

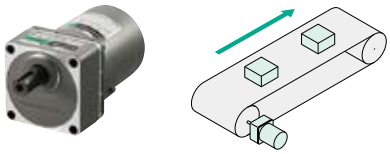
When Combined with a Tachogenerator

A dedicated AC motor systems assembled with a tachogenerator is driven with a speed controller. Speed can be set with the speed controller's internal speed potentiometer or by using an external speed potentiometer.



Applications and Classifications

High Efficiency Three-Phase Induction Motors
→ Page E-21



They are suitable for applications where speed control will be performed in combination with an inverter.

Induction Motors
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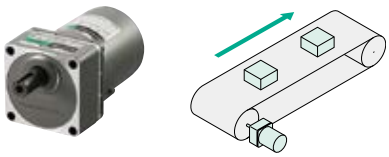
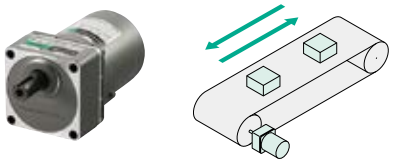


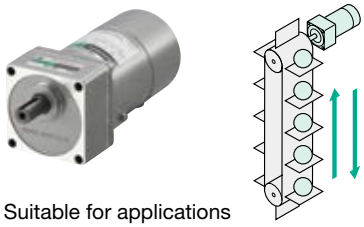
Suitable for applications where the motor is operated continuously in one direction.

For Bi-Directional Operation Reversible Motors
→ Page E-53



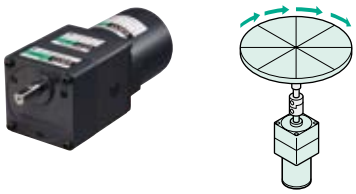
Suitable for applications where the motor reverses its direction repeatedly.

For Load Holding Electromagnetic Brake Motors
→ Page E-59



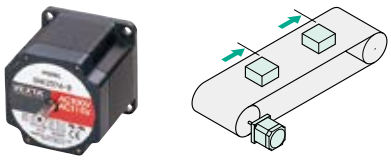
Suitable for applications where the load must always be held in place.

For High-Frequency Start and Stop Operation Clutch & Brake Motors
→ Page E-67



Ideal for high-frequency starting and stopping.

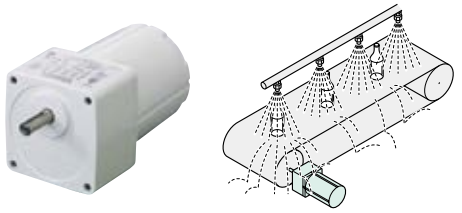
For Synchronous Rotation Low-Speed Synchronous Motors
→ Page E-71



Suitable for applications where the motor is operated starting, stopping and reversing repeatedly and the motor is operated at synchronous speed regardless of load torque.

IP67 Watertight, Dust-Resistant Motors

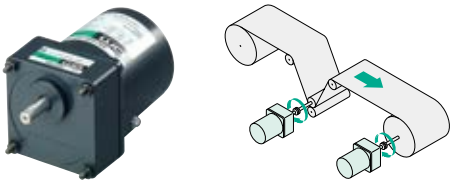
➜ Page E-81



Suitable for applications where the equipment comes in contact with water or needs to be washed with water.

Torque Motors

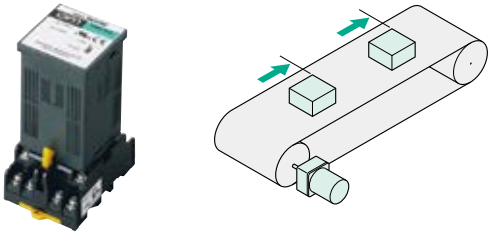
➜ Page E-75



Suitable for winding and other operations involving tension control, as well as pushing operations.

Instantaneous Stop Brake Pack

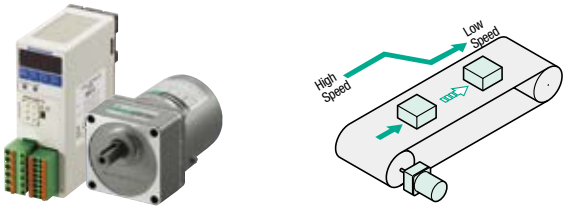
➜ Page E-85



Suitable for applications where the overrun of an induction motor, reversible motor or electromagnetic brake motor should be suppressed.

AC Speed Control Motors

➜ Page E-89



Suitable for applications where the motor speed needs to be varied.

Product Line

High Efficiency Three-Phase Induction Motors KIIS Series Induction Motors Page E-21

Type	Wire Type	Voltage [V]	Frame Size [mm (in.)] and Output	
			□90 (□3.54)	
			60 W (1/12 HP)	100 W (1/8 HP)
Parallel Shaft/Round Shaft 	Terminal Box Type	Three-Phase 220/230	●	●
	Lead Wire	Three-Phase 220/230	●	●

High Efficiency Three-Phase Induction Motors KIIS Series Electromagnetic Brake Motors Page E-28

Type	Wire Type	Voltage [V]	Frame Size [mm (in.)] and Output	
			□90 (□3.54)	
			60 W (1/12 HP)	100 W (1/8 HP)
Parallel Shaft/Round Shaft 	Terminal Box Type	Three-Phase 220/230	●	●
	Cable	Three-Phase 220/230	●	●

Induction Motors

Parallel Shaft/Round Shaft Page E-33
Right-Angle Shaft Page E-50

●KII Series ●BH Series

Type	Wire Type	Voltage [V]	Frame Size [mm (in.)] and Output						
			□60 (□2.36)	□70 (□2.76)	□80 (□3.15)	□90 (□3.54)			□104 (□4.09)
			6 W (1/125 HP)	15 W (1/50 HP)	25 W (1/30 HP)	40 W (1/19 HP)	60 W (1/12 HP)	90 W (1/8 HP)	200 W (1/4 HP)
Parallel Shaft/Round Shaft 	Terminal Box Type	Three-Phase 220/230							●
		Single-Phase 110/115			●	●	●	●	●
		Single-Phase 220/230			●	●	●	●	●
Parallel Shaft/Round Shaft 	Lead Wire/Cable	Three-Phase 220/230							●
		Single-Phase 110/115	●	●	●	●	●	●	●
		Single-Phase 220/230	●	●	●	●	●	●	●
Right-Angle Shaft 	Terminal Box Type	Three-Phase 220/230							●
		Single-Phase 110/115							●
		Single-Phase 220/230							●
	Cable	Three-Phase 220/230							●
		Single-Phase 110/115							●
		Single-Phase 220/230							●

●Reversible Motors Page E-53

●KII Series

Type	Wire Type	Voltage [V]	Frame Size [mm (in.)] and Output					
			□60 (□2.36)	□70 (□2.76)	□80 (□3.15)	□90 (□3.54)		
			6 W (1/125 HP)	15 W (1/50 HP)	25 W (1/30 HP)	40 W (1/19 HP)	60 W (1/12 HP)	90 W (1/8 HP)
Parallel Shaft/Round Shaft 	Terminal Box Type	Single-Phase 110/115			●	●	●	●
		Single-Phase 220/230			●	●	●	●
	Lead Wire	Single-Phase 110/115	●	●	●	●	●	●
		Single-Phase 220/230	●	●	●	●	●	●

●Electromagnetic Brake Motors Page E-59

●KII Series ●BH Series

Type	Wire Type	Voltage [V]	Frame Size [mm (in.)] and Output						
			□60 (□2.36)	□70 (□2.76)	□80 (□3.15)	□90 (□3.54)			□104 (□4.09)
			6 W (1/125 HP)	15 W (1/50 HP)	25 W (1/30 HP)	40 W (1/19 HP)	60 W (1/12 HP)	90 W (1/8 HP)	200 W (1/4 HP)
Parallel Shaft/Round Shaft 	Terminal Box Type	Three-Phase 220/230							●
		Single-Phase 110/115				●	●	●	●
		Single-Phase 220/230				●	●	●	●
	Lead Wire/Cable	Single-Phase 110/115	●	●	●	●	●	●	
		Single-Phase 220/230	●	●	●	●	●	●	
Right-Angle Shaft 	Terminal Box Type	Three-Phase 220/230							●
		Single-Phase 110/115							●
		Single-Phase 220/230							●

●Clutch & Brake Motors Page E-67

Type	Wire Type	Voltage [V]	Frame Size [mm (in.)] and Output		
			□90 (□3.54)		
			40 W (1/19 HP)	60 W (1/12 HP)	90 W (1/8 HP)
Parallel Shaft 	Lead Wire	Single-Phase 110/115	●	●	●

●Low-Speed Synchronous Motors **SMK** Series Page E-71

Type	Wire Type	Voltage [V]	Frame Size [mm (in.)] and Torque					
			□42 (□1.65)	□56.4 (□2.22)/ □60 (□2.36)		□85(□3.35)/ □90(□3.54)		
			0.14 N·m (19.8 oz-in)	0.16 N·m (22 oz-in)	0.37 N·m (52 oz-in)	0.5 N·m (71 oz-in)	1.0 N·m (142 oz-in)	1.6 N·m (200 oz-in)
Parallel Shaft/Round Shaft 	Lead Wire	Single-Phase 115	●	●	●	●	●	●

●Torque Motors Page E-75

Type	Wire Type	Voltage [V]	Frame Size [mm (in.)] and Output			
			□60 (□2.36)	□70 (□2.76)	□80 (□3.15)	□90 (□3.54)
			3 W (1/250 HP)	6 W (1/125 HP)	10 W (1/75 HP)	20 W (1/38 HP)
Parallel Shaft/Round Shaft 	Lead Wire	Single-Phase 110/115	●	●	●	●
		Single-Phase 220/230	●	●	●	●

●IP67 Watertight, Dust-Resistant Motors **FPW** Series Page E-81

Type	Wire Type	Voltage [V]	Frame Size [mm (in.)] and Output			
			□80 (□3.15)	□90 (□3.54)		□104 (□4.09)
			25 W (1/30 HP)	40 W (1/19 HP)	60 W (1/12 HP)	90 W (1/8 HP)
Parallel Shaft Geared Motor 	Cable	Three-Phase 220/230	●	●	●	●
		Single-Phase 110/115	●	●	●	●
		Single-Phase 220/230	●	●	●	●

How to Read Specifications

When selecting a motor and gearhead, you should read the specifications to make sure that the motor you select meets the application requirements. Shown below is an explanation of how to read the specifications on some important items.

How to Read Motor Specifications

Motor Specifications

Motor Specifications Table (Example)

Specifications – Continuous Rating ⑥

Product Name		① Output Power	Voltage	Frequency	② Current	③ Starting Torque	④ Rated Torque	⑤ Rated Speed	Capacitor	Overheat Protection Device
Terminal Box Type	Lead Wire Type	W (HP)	VAC	Hz	A	mN·m (oz-in)	mN·m (oz-in)	r/min	μF	
4IK25UAT2-□A	**4IK25UA-□A**	25 (1/30)	Single-Phase 110	60	0.44	120 (17.0)	170 (24)	1450	6.0	TP
			Single-Phase 115		0.43	120 (17.0)	170 (24)	1450		

①Output Power: The amount of work that can be performed in a given period of time. It can be used as a criteria for motor capability.
②Current: The current value used by a motor when the motor is producing rated torque.
③Starting Torque: This term refers to the torque generated the instant the motor starts. If the motor is subjected to a friction load smaller than this torque, it will operate.
④Rated Torque: This is the torque created when the motor is operating most efficiently. Though the maximum torque is far greater, rated torque should, from the standpoint of utility, be the highest torque.
⑤Rated Speed: This is the speed of the motor when the motor is producing rated torque.
⑥Rating: The time that a motor can operate continuously at rated output (torque). With a continuous rating, a motor can operate continuously.

Electromagnetic Brake (Power Off Activated Type)

Specifications Table (Example)

Motor Product Name	Voltage VAC	Frequency Hz	Current A	Input W	① Holding Brake Torque mN·m oz-in
4RK25UCM-□ **4RK25A-UCM**	Single-Phase 220	60	0.05	7	100 14.2
	Single-Phase 230				

①Holding Brake Torque: This refers to the holding brake torque of the electromagnetic brake and expresses the size of holding torque at the motor output shaft.

When a gearhead is connected, calculate the holding torque at the gearhead output shaft with the following formula.

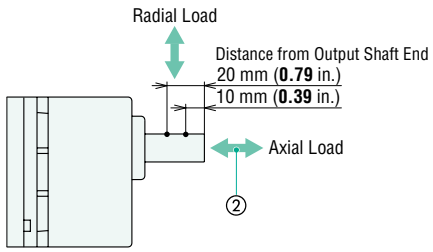
Holding torque at the gearhead output shaft $T_G = T_M \times i$

T_G : Holding torque at the gearhead output shaft
T_M : Holding torque at the motor output shaft
i : Gearhead gear ratio

●Permissible Radial Load and Permissible Axial Load of Motors

Specifications Table for Permissible Radial Load (Example) ①

Motor		Permissible Radial Load			
Frame Size	Output Shaft Diameter	10 mm (0.39 in.) from Output Shaft End		20 mm (0.79 in.) from Output Shaft End	
□ mm (in.)	ϕ mm (in.)	N	lb.	N	lb.
60 (2.36)	6 (0.2362)	50	11.2	110	24



①Permissible Radial Load: The value ① shown in the table above is the one for the permissible radial load. As shown in the figure to the left, this term refers to the permissible value of the load applied in a direction perpendicular to the motor output shaft.

②Permissible Axial Load: As shown in the figure to the left, this term refers to the permissible value of the load applied in the axial direction to the motor output shaft. Keep the axial load to half or less of motor mass.

The calculating method of radial load applied on the output shaft is the same as for a gear shaft. Refer to the permissible radial load and permissible axial load of gearheads for details. Permissible radial load and permissible axial load of gearheads ➜ Page E-16

■How to Read Gearhead Specifications

Some gearheads other than those for constant speed motors are listed.

●Gearmotor – Torque Table

Gearmotor – Torque Table (Example)

◇60 Hz ①

Unit: Upper values: N·m/ Lower values: lb-in

Product Name	Speed r/min	360	300	240	200	144	120	100	72	60	50	36	30	24	20	18	15	12	10	7.2	6	5
	Gear Ratio	**5**	**6**	**7.5**	**9**	**12.5**	**15**	**18**	**25**	**30**	**36**	**50**	**60**	**75**	**90**	**100**	**120**	**150**	**180**	**250**	**300**	**360**
4IK25U□□-□A		0.77	0.92	1.1	1.4	1.9	2.3	2.8	3.8	4.4	5.3	7.3	8.8	11.0	13.2	14.6	16	16	16	16	16	16
		6.8	8.1	9.7	12.3	16.8	20	24	33	38	46	64	77	97	116	129	141	141	141	141	141	141

①Permissible Torque: It refers to the value of load torque driven by the gearhead's output shaft. Each value is shown for the corresponding gear ratio.

Permissible torque when a gearhead is connected can be calculated with the formula below.
Permissible torque for some products are omitted. In that case, use the formula below to calculate the permissible torque.

Permissible torque $T_G = T_M \times i \times \eta$

T_G : Permissible torque of gearhead
T_M : Motor torque
i : Gearhead gear ratio
η : Gearhead efficiency

Gearhead Efficiency

Product Name \ Gear Ratio	3	3.6	5	6	7.5	9	12.5	15	18	25	30	36	50	60	75	90	100	120	150	180	250	300	360
2GV□A, 3GV□A, 4GV□A			90%								86%								81%				
5GV□A, 5GVH□A			90%							86%								81%					
5GVR□A			90%						86%						81%								
2GN□SA, 3GN□SA, 4GN□SA, 5GN□SA			81%							73%				66%									
BH6G2-□			90%					86%						81%									

- For **BH6G2-□RH** and **BH6G2-□RA**, gearhead efficiency of all gear ratio is 73% at the rated speed and starting.
- Gearhead efficiency of all the decimal gearheads is 81%.

Product Name \ Gear Ratio	5	10	15	20	30	50	100	200
GFV2G□A, GFS2G□	90%				86%			81%
GFV4G□A, GFS4G□	90%				86%			81%
GFV5G□A, GFS5G□	90%				86%			81%
GFV6G□A, GFS6G□	90%				86%		81%	

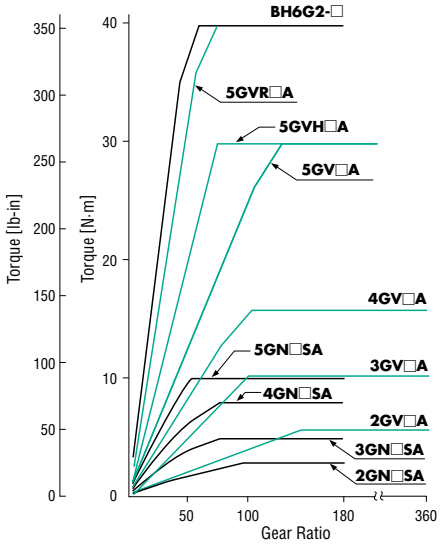
Product Name \ Gear Ratio	5	10	15	20	30	50	100	200
GFS2G□FR	80%	85%						
GFS4G□FR	85%							
GFS5G□FR	85%							
GFS6G□FR	85%							

Note

- The transmission efficiency in the table above is the value at room temperature. The transmission efficiency of the gear head varies according to the ambient temperature. Care should be taken when using in a low-temperature environment as the transmission efficiency will drop along with the output torque.

Maximum Permissible Torque

The gearhead output torque increases proportionally as the gear ratio increases. However, the load torque is saturated at a certain gear ratio because of the gear materials and other conditions. This torque is called the maximum permissible torque.
The maximum permissible torque of typical gearheads are shown in the figure to the right.



Maximum Permissible Torque of Gearhead

●Speed and Rotation Direction

Gearmotor – Torque Table (Example)

◇60 Hz

Unit: Upper values: N·m/ Lower values: lb-in

Product Name	Speed r/min ①	360	300	240	200	144	120	100	72	60	50	36	30	24	20	18	15	12	10	7.2	6	5
	Gear Ratio	**5**	**6**	**7.5**	**9**	**12.5**	**15**	**18**	**25**	**30**	**36**	**50**	**60**	**75**	**90**	**100**	**120**	**150**	**180**	**250**	**300**	**360**
4IK25U□□-□A		0.77	0.92	1.1	1.4	1.9	2.3	2.8	3.8	4.4	5.3	7.3	8.8	11.0	13.2	14.6	16	16	16	16	16	16
		6.8	8.1	9.7	12.3	16.8	20	24	33	38	46	64	77	97	116	129	141	141	141	141	141	141

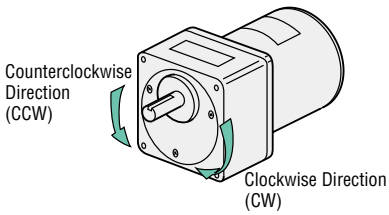
①Speed: This refers to the speed at the gearhead output shaft. The speeds, depending on gear ratio, are shown in the "Gearmotor – Torque Table." The speed is calculated by dividing the motor's synchronous speed by the gear ratio. The actual speed is 2~20% less than the displayed value depending on the load.

The speed is calculated with the following formula.

Speed $N_G = \frac{N_M}{i}$

N_G : Gearhead speed [r/min]
N_M : Motor speed [r/min]
i : Gearhead gear ratio

②Rotation Direction: This refers to the rotation direction viewed from the output shaft. A colored background (□) indicates gear shaft rotation in the same direction as the motor shaft, while the others rotate in the opposite direction. The direction of gearhead shaft rotation may differ from motor shaft rotation depending on the gear ratio of the gearhead. The gear ratio and rotation direction of each gearhead is shown in the table below.



◇Gear Ratio and Rotation Direction of Gearhead

□.....Same direction as the motor shaft
□.....Opposite direction as the motor shaft

Product Name \ Gear Ratio	3	3.6	5	6	7.5	9	12.5	15	18	25	30	36	50	60	75	90	100	120	150	180	250	300	360
2GV□A, 3GV□A, 4GV□A																							
5GV□A, 5GVH□A																							
5GVR□A																							
2GN□SA, 3GN□SA, 4GN□SA, 5GN□SA																							
BH6G2-□																							

Connection of a decimal gearhead reduces the speed by 10:1, but does not affect the rotation direction.

Product Name \ Gear Ratio	5	10	15	20	30	50	100	200
GFV2G□A, GFS2G□								
GFV4G□A, GFS4G□								
GFV5G□A, GFS5G□								
GFV6G□A, GFS6G□								

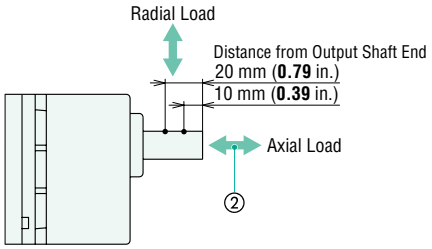
●Permissible Radial Load and Permissible Axial Load of Gearheads

Specifications Table for Permissible Radial Load and Permissible Axial Load (Example)

Product Name	Gear Ratio	Max. Permissible Torque		Permissible Radial Load ①				Permissible Axial Load ②	
				10 mm (0.39 in.) from Output Shaft End		20 mm (0.79 in.) from Output Shaft End			
		N·m	lb-in	N	lb.	N	lb.	N	lb.
4GN□SA	**3~18**	8.0	70	100	22	150	33	50	11.2
	25~180			200	45	300	67		

①Permissible Radial Load: The value ① shown in the table above is the one for the permissible radial load. This term refers to the permissible value of the load applied in a direction perpendicular to the gearhead output shaft as shown in the figure to the right.

②Permissible Axial Load: The value ② shown in the table above is the one for permissible axial load. This term refers to the permissible value of the load applied in the axial direction to the gearhead output shaft as shown in the figure to the right.



When a chain, gear, belt, etc. is used as the transmission mechanism, the radial load is always applied on the gearhead output shaft. The radial load is calculated with the following formula.

Radial load $W = \dfrac{K \times T \times f}{\gamma}$

W : Radial load [N]
K : Load coefficient for driving method (on the right)
T : Torque at gearhead output shaft [N·m]
f : Service factor (on the right)
γ : Effective radius of gear or pulleys [m]

◇Load Coefficient for Driving Method (K)

Drive System	K
Chain or synchronous belt	1
Gear	1.25
V-belt	1.5
Flat belt	2.5

◇Service Factor (f)

Load Type	Example	Factor f
Uniform Load	· Uni-directional continuous operation · For driving belt conveyors and film rollers that are subject to minimal load fluctuation	1.0
Light Impact	· Frequent starting and stopping · Cam drive and inertial body positioning	1.5
Medium Impact	· Frequent instantaneous bi-directional operation, starting and stopping of reversible motors · Frequent instantaneous stopping by brake pack of AC motors · Frequent instantaneous starting and stopping by brushless motors	2.0

●Permissible Inertia J of Gearhead

This refers to the permissible value for inertia (J) at the gearhead output shaft. Convert the permissible value at the motor output shaft into the permissible value at the gearhead output shaft with the following formula.

Gear ratio 3:1~50:1 $J_G = J_M \times i^2$
Gear ratio 60:1 or higher $J_G = J_M \times 2500$

J_G : Permissible inertia at the gearhead output shaft J [$\times 10^{-4}$ kg·m^2 (oz-in^2)]
J_M : Permissible inertia at the motor shaft J [$\times 10^{-4}$ kg·m^2 (oz-in^2)]
i : Gear ratio (Example: $i = 3$ means the gear ratio of 3:1)

●Permissible Inertia at the Motor Shaft (Example)

Number of Phase	Frame Size	Output Power	Permissible Inertia at the Motor Shaft J [$\times 10^{-4}$ kg·m^2 (oz-in^2)]
Single-Phase	□80 mm (□3.15 in.)	25 W (1/30 HP)	0.31 (1.70)

For some products that are combination types, the permissible inertia at the gearhead output shaft is shown as the specifications values, divided with each gear ratio.

Common Specifications

Some specifications other than those for constant speed motors are listed.

Permissible Radial Load and Permissible Axial Load of Motors

Permissible Radial Load

Motor		Permissible Radial Load			
Frame Size □ mm (in.)	Output Shaft Diameter ϕ mm (in.)	10 mm (0.39 in.) from Output Shaft End		20 mm (0.79 in.) from Output Shaft End	
		N	lb.	N	lb.
60 (2.36)	6 (0.2362)	50	11.2	110	24
70 (2.76)	6 (0.2362)	40	9.0	60	13.5
80 (3.15)	8 (0.3150)	90	20	140	31
	10 (0.3937)	110	24	120	27
90 (3.54)	10 (0.3937)	140	31	200	45
	12 (0.4724)	240	54	270	60
104 (4.09)	14 (0.5512)	320	72	350	78

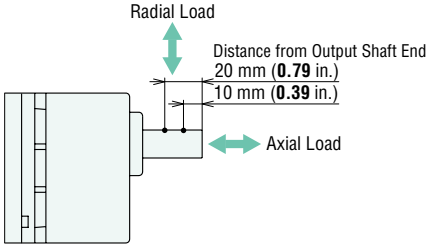
Permissible Axial Load

Avoid axial load as much as possible. If axial load is unavoidable, keep it to half or less of the motor mass.

Permissible Radial Load and Permissible Axial Load of Gearheads

Product Name	Gear Ratio	Max. Permissible Torque		Permissible Radial Load				Permissible Axial Load	
				10 mm (0.39 in.) from Output Shaft End		20 mm (0.79 in.) from Output Shaft End			
		N·m	lb-in	N	lb.	N	lb.	N	lb.
2GV□A	**5~25**	6.0	53	150	33	200	45	40	9
	30~360			200	45	300	67		
3GV□A	**5~25**	10	88	200	45	300	67	80	18
	30~360			300	67	400	90		
4GV□A	**5~25**	16	141	300	67	350	78	100	22
	30~360			450	101	550	123		
5GV□A **5GVH□A**	**5~9**	30	260	400	90	500	112	150	33
	12.5~18			450	101	600	135		
	25~300			500	112	700	157		
5GVR□A	**5~9**	40	350	400	90	500	112	150	33
	12.5~18			450	101	600	135		
	25~180			500	112	700	157		
2GN□SA	**3~18**	3.0	26	50	11.2	80	18	30	6.7
	25~180			120	27	180	40		
3GN□SA	**3~18**	5.0	44	80	18	120	27	40	9
	25~180			150	33	250	56		
4GN□SA	**3~18**	8.0	70	100	22	150	33	50	11.2
	25~180			200	45	300	67		
5GN□SA	**3~18**	10	88	250	56	350	78	100	22
	25~180			300	67	450	101		
BH6G2-□	**3~36**	40	350	550	123	800	180	200	45
	50~180			650	146	1000	220		
BH6G2-□RH	**5~36**	60	530	1200*	270	1100*	240	300	67
	50~180			2200*	490	2000*	450		
BH6G2-□RA	**5~36**	60	530	900	200	1000	220	300	67
	50~180			1700	380	1850	410		

*For **BH6G2-□RH** (Gearhead for **BH** Series right-angle, hollow shaft combination type), the permissible radial load is the value at the distance from the flange mounting surface. The permissible radial load at each distance is calculated with the formula below.



●A number indicating the gear ratio is entered where the box □ is located within the product name.

◇Calculating the Permissible Radial Load for Hollow Shaft Type

When the end of the shaft being driven is not supported by a bearing as shown in the figure below, calculate the permissible radial load using the following formula. (This mechanism is the most demanding state in terms of radial load.)

● **BH6G2-□RH**

- Gear ratio **5**:**1**～**36**:**1**

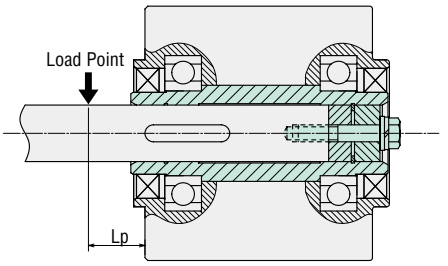
  Permissible radial load W [N (lb.)] $= \dfrac{87.5\ mm\ (3.44\ in.)}{87.5\ mm\ (3.44\ in.)+L_P} \times 1350$ N (300 lb.)

  1350 N (300 lb.) : Permissible radial load at the flange mounting surface

- Gear ratio **50**:**1**～**180**:**1**

  Permissible radial load W [N (lb.)] $= \dfrac{87.5\ mm\ (3.44\ in.)}{87.5\ mm\ (3.44\ in.)+L_P} \times 2450$ N (550 lb.)

  2450 N (550 lb.) : Permissible radial load at the flange mounting surface



Lp [mm (in.)]: Distance from Flange Mounting Surface to Radial Load Point

■Permissible Inertia J of Gearhead

When a high inertia (J) is connected to a gearhead, high torque is exerted instantaneously on the gearhead when starting in frequent, intermittent operations (or when stopped by an electromagnetic brake, or when stopped instantaneously by a brake pack).
The table below gives values for permissible inertia at the motor shaft. Use the motor and gearhead within these parameters. The permissible inertia for three-phase motors is the value when reversing after a stop.
The permissible inertia (J) at the gearhead output shaft is calculated with the following formula.
The life of the gearhead when operating at the permissible inertia with instantaneous stop of motors with electromagnetic brakes, brake pack or speed control motors is approximately two million cycles.

●Permissible Inertia at the Gearhead Output Shaft

Gear ratio 3:1～50:1	$J_G = J_M \times i^2$	J_G : Permissible inertia at the gearhead output shaft J [$\times 10^{-4}$ kg·m^2 (oz-in^2)]
Gear ratio 60:1 or higher	$J_G = J_M \times 2500$	J_M : Permissible inertia at the motor shaft J [$\times 10^{-4}$ kg·m^2 (oz-in^2)]
		i : Gear ratio (Example: $i = 3$ means the gear ratio of 3:1)

●Permissible Inertia at the Motor Shaft

Number of Phase	Frame Size	Output Power	Permissible Inertia at the Motor Shaft J [$\times 10^{-4}$ kg·m^2 (oz-in^2)]
Three-Phase	□60 mm (□2.36 in.)	6 W (1/125 HP)	0.062 (0.34)
	□70 mm (□2.76 in.)	15 W (1/50 HP)	0.14 (0.77)
	□80 mm (□3.15 in.)	25 W (1/30 HP)	0.31 (1.70)
	□90 mm (□3.54 in.)	40 W (1/19 HP)	0.75 (4.1) [1.1 (6.0)]*
		60 W (1/12 HP)	1.1 (6.0)
		90 W (1/8 HP)	1.1 (6.0)
	□104 mm (□4.09 in.)	200 W (1/4 HP)	2.0 (10.9)
Single-Phase	□60 mm (□2.36 in.)	6 W (1/125 HP)	0.062 (0.34)
	□70 mm (□2.76 in.)	15 W (1/50 HP)	0.14 (0.77)
	□80 mm (□3.15 in.)	25 W (1/30 HP)	0.31 (1.70)
	□90 mm (□3.54 in.)	40 W (1/19 HP)	0.75 (4.1) [1.1 (6.0)]*
		60 W (1/12 HP)	1.1 (6.0)
		90 W (1/8 HP)	1.1 (6.0)
	□104 mm (□4.09 in.)	200 W (1/4 HP)	2.0 (10.9)

*Values in the brackets are for the **KII** Series.

Permissible Inertia J of Combination Types

Unit: Upper values: $\times 10^{-4}$ kg·m^2/Lower values: oz-in^2

Product Name \ Gear Ratio		5	6	7.5	9	12.5	15	18	25	30	36	50	60	75	90	100	120	150	180	250	300	360
2GV□A		12	18	28	40	78	110	160	260	370	540	920	1300	1700	2000	2500	3600	5000	5000	5000	5000	5000
		66	98	153	220	430	600	880	1420	2000	3000	5000	7100	9300	10900	13700	19700	27000	27000	27000	27000	27000
	When performing instantaneous stop	1.55	2.23	3.49	5.02	9.69	14	20.1	38.8	55.8	80.4	155	155	155	155	155	155	155	155	155	155	155
		8.5	12.2	19.1	27	53	77	110	210	310	440	850	850	850	850	850	850	850	850	850	850	850
3GV□A		20	28	45	65	120	180	260	440	630	900	1500	2100	2800	3200	4000	5700	8000	8000	8000	8000	8000
		109	153	250	360	660	980	1420	2400	3400	4900	8200	11500	15300	17500	22000	31000	44000	44000	44000	44000	44000
	When performing instantaneous stop	3.5	5.04	7.88	11.3	21.9	31.5	45.4	87.5	126	181	350	350	350	350	350	350	350	350	350	350	350
		19.1	28	43	62	120	172	250	480	690	990	1910	1910	1910	1910	1910	1910	1910	1910	1910	1910	1910
4GV□A		22	32	50	72	150	220	310	550	800	1100	2200	3200	4000	5000	6200	8900	12000	12000	12000	12000	12000
		120	175	270	390	820	1200	1700	3000	4400	6000	12000	17500	22000	27000	34000	49000	66000	66000	66000	66000	66000
	When performing instantaneous stop	7.75	11.2	17.4	25.1	48.4	69.8	100	194	279	402	775	775	775	775	775	775	775	775	775	775	775
		42	61	95	137	260	380	550	1060	1530	2200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
5GV□A 5GVH□A		45	65	100	150	300	420	620	1100	1600	2300	4500	6000	8000	10000	12000	17000	25000	25000	25000	25000	–
		250	360	550	820	1640	2300	3400	6000	8800	12600	25000	33000	44000	55000	66000	93000	137000	137000	137000	137000	–
	When performing instantaneous stop	27.5	39.6	61.9	89.1	172	248	356	688	990	1426	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	–
		150	220	340	490	940	1360	1950	3800	5400	7800	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	–
5GVR□A		45	65	100	150	300	420	620	1100	1600	2300	4500	6000	8000	10000	12000	17000	25000	25000	–	–	–
		250	360	550	820	1640	2300	3400	6000	8800	12600	25000	33000	44000	55000	66000	93000	137000	137000	–	–	–
	When performing instantaneous stop	27.5	39.6	61.9	89.1	172	248	356	688	990	1426	2750	2750	2750	2750	2750	2750	2750	2750	–	–	–
		150	220	340	490	940	1360	1950	3800	5400	7800	15000	15000	15000	15000	15000	15000	15000	15000	–	–	–

Note

- Do not perform instantaneous bi-directional operations on three-phase motors.