How to Read Specifications

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

How to Read Motor Specifications

Motor Specifications

Motor Specifications Table (Example)

Specifications – Continuous Rating ⑥

Model Upper Model Name: Pinion Shaft Type Lower Model Name( ): Round Shaft Type		① Output Power	Voltage	Frequency	② Current	③ Starting Torque	④ Rated Torque	⑤ Rated Speed	Capacitor
Lead Wire Type Dimension①	Terminal Box Type Dimension②	W	VAC	Hz	A	mN·m gfcm	mN·m gfcm	r/min	μF
TP **5IK90GU-AWU** **(5IK90A-AWU)**	**5IK90GU-AWTU** **(5IK90A-AWTU)**	90	Single-Phase110	60	1.45	450 4500	585 5850	1500	20
			Single-Phase115		1.44				

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

Specifications Table (Example)

Motor Model	Voltage VAC	Frequency Hz	Current A	Input W	① Holding Brake Torque mN·m	gfcm
4RK25GN-AWMU	Single-Phase110	60	0.09	6	100	1000
4RK25A-AWMU	Single-Phase115					

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 combined, calculate the holding torque at the gearhead output shaft with the following equation.

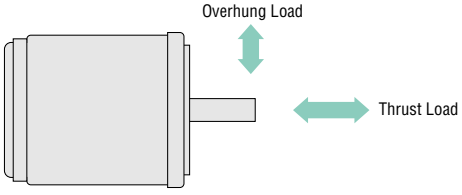
Holding Torque at the Gearhead Output Shaft $T_G = T_M \times i$

T_G : Holding Torque at the Gearhead Output Shaft
T_M : Holding Torque at the Motor Output Shaft
i : Gear Ratio

Permissible Overhung Load and Permissible Thrust Load

Specifications Table for Permissible Overhung Load and Permissible Thrust Load (Example)

Motor		① Permissible Overhung Load N kgf			
Frame Size □ (mm)	Output Shaft Diameter ϕ (mm)	Distance from Shaft End 10 mm		20 mm	
60	6	50	5	110	11



①Permissible Overhung Load: The value ① shown in the table above is the value for the permissible overhung load. As shown in the figure to the left, permissible overhung load is the permissible value of the load applied in a direction perpendicular to the gearhead output shaft.
②Permissible Thrust Load: As shown in the figure to the left, this term refers to the permissible value of load applied in the axial direction to the gearhead output shaft. Keep the thrust load to no more than half the motor weight.

The calculating method of overhung load applied on the output shaft is the same as for a gear shaft. See the permissible overhung load and permissible thrust load for details.
Permissible overhung load and permissible thrust load for gearhead ➜ Page A-11

How to Read Gearhead Specifications

Some gearheads other than the constant speed motors are listed.

Gearmotor – Torque Table

Gearmotor – Torque Table (Example)

◇60 Hz

Unit = Upper values: N·m/Lower values: kgfcm

Model	Speed r/min	500	416	300	250	200	166	120	100	83	60	50	41	30	25	20	16	15	12.5	10	8.3
Motor/Gearhead	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**
5RK90GU-AWU / **5RK90GU-AWTU**	**5GU□KB**	1.4	1.7	2.4	2.8	3.6	4.3	5.3	6.4	7.7	9.7	11.6	13.9	19.3	20	20	20	20	20	20	20
	5GU□K	14	17	24	28	36	43	53	64	77	97	116	139	193	200	200	200	200	200	200	200
	5GU□KBH	—	—	—	—	—	—	—	—	—	—	—	—	19.3 193	23.2 232	25.9 259	30 300	30 300	30 300	30 300	30 300

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 equation below. Permissible torque for some products are omitted. In that case, use the equation 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 : Gear Ratio of Gearhead
η : Gearhead Efficiency

Gearhead Efficiency

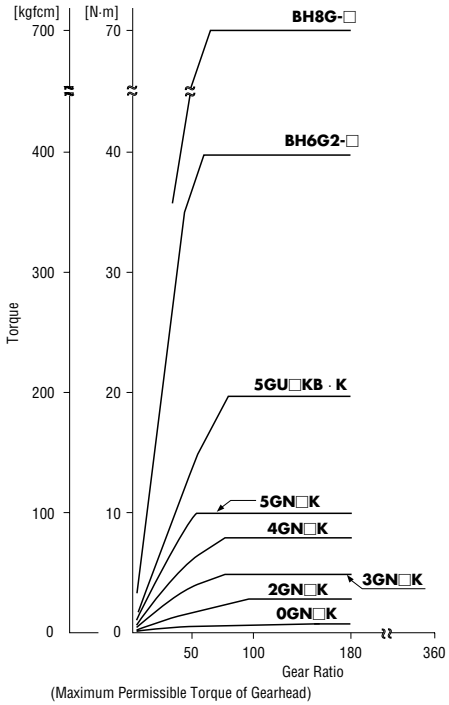
Model \ Gear Ratio	3	3.6	5	6	7.5	9	12.5	15	18	25	30	36	50	60	75	90	100	120	150	180
2GN□K, 3GN□K, 4GN□K, 5GN□K	81%									73%			66%							
0GN□K, 5GU□KB, 5GU□K	81%						73%			66%				59%						
5GU□KBH													66%		59%					
BH6G2-□	90%						86%						81%							
BH8G-□											86%			81%						

●For **BH6G2-□RH** and **BH6G2-□RA**, gearhead efficiency of all gear ratio is 73% at rating and starting.
●Gearhead efficiency of all the decimal gearheads is 81%.
●For the efficiency of Right-Angle Gearheads, see the page for Right-Angle Gearheads. The efficiency of Right-Angle Gearheads ➜ Page A-131

Model \ Gear Ratio	5	10	15	20	30	50	100	200
GFH2G□	90%				86%		81%	
GFH4G□	90%				86%		81%	
GFB5G□, GFH5G□	90%				86%		81%	
6GH□K	81%			73%			66%	

Maximum Permissible Torque

The gearhead output torque increases proportionally as the gear ratio increases. However, factors affecting the gearhead mechanical strength such as gear construction and materials etc., limit the size of the load which can be applied to the gearhead. This torque is called the maximum permissible torque. The maximum permissible torques of typical gearheads are shown in the figure to the right.



(Maximum Permissible Torque of Gearhead)

●Speed and Direction of Rotation

Gearmotor – Torque Table (Example)

◇60 Hz

Unit = Upper values: N·m/Lower values: kgfcm

Model / Motor/Gearhead	Speed r/min ①	500	416	300	250	200	166	120	100	83	60	50	41	30	25	20	16	15	12.5	10	8.3
	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**
5RK90GU-AWU / **5RK90GU-AWTU**	**5GU□KB**	1.4	1.7	2.4	2.8	3.6	4.3	5.3	6.4	7.7	9.7	11.6	13.9	19.3	20	20	20	20	20	20	20
	5GU□K	14	17	24	28	36	43	53	64	77	97	116	139	193	200	200	200	200	200	200	200
	5GU□KBH	—	—	—	—	—	—	—	—	—	—	—	—	19.3 193	23.2 232	25.9 259	30 300	30 300	30 300	30 300	30 300

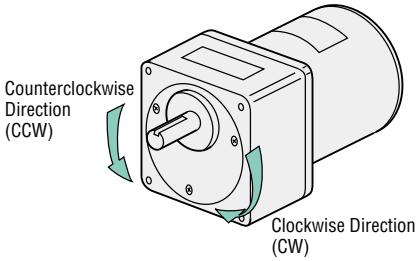
①Speed: This refers to the speed of rotation in the gearhead output shaft. The speeds, depending on gear ratio, are shown in the permissible torque table when the gearhead is attached. The speed is calculated by dividing the motor's synchronous speed by the gear ratio. The actual speed, according to the load condition, is 2 ～ 20% less than the displayed value.

The speed is calculated with the following equation.

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

N_G : Speed of Gearhead [r/min]
N_M : Speed of Motor [r/min]
i : Gear Ratio of Gearhead

②Direction of rotation: This refers to the direction of rotation viewed from the output shaft. The shaded areas indicate 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

Model \ 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
2GN□K, 3GN□K, 4GN□K, 5GN□K,	■	■	■	■	■	■	■	■	■	□	□	□	■	■	■	■	■	■	■	■
0GN□K, 5GU□KB, 5GU□K	■	■	■	■	■	□	□	□	□	■	■	■	■	□	□	□	□	□	□	□
5GU□KBH	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□
BH6G2-□	■	■	■	■	■	□	□	□	□	□	□	□	■	■	■	■	■	■	■	■
BH8G-□	□	□	□	□	□	□	□	□	□	□	□	■	■	■	■	■	■	■	■	■

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

Model \ Gear Ratio	5	10	15	20	30	50	100	200
GFH2G□	■	■	■	□	□	□	□	■
GFH4G□	■	■	■	□	□	□	□	■
GFB5G□, GFH5G□	■	■	■	□	□	□	□	■
6GH□K	■	■	□	□	□	□	■	■

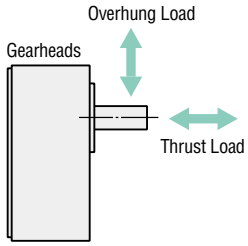
●Permissible Overhung Load and Permissible Thrust Load

Specifications Table for Permissible Overhung Load and Permissible Thrust Load (Example)

Model	Gear Ratio	Maximum Permissible Torque		Permissible Overhung Load ① N kgf				Permissible Thrust Load ②	
		N·m	kgfcm	10 mm from Shaft End		20 mm from Shaft End		N	kgf
4GN□K	3~18	8.0	80	100	10	150	15	50	5
	25~180			200	20	300	30		

①Permissible Overhung Load: The value ① shown in the table above is the one for the permissible overhung load. As shown in the figure to the right, permissible overhung load is the permissible value of the load applied in a direction perpendicular to the gearhead output shaft.

②Permissible Thrust Load: The value ② shown in the table above is the one for permissible thrust load specifications. As shown in the figure to the right, this term refers to the permissible value of load applied in the axial direction to the gearhead output shaft.



When a chain, gear, belt, etc. is used as the transmission mechanism, an overhung load is always applied to the output shaft. The overhung load is calculated with the following equation.

Overhung Load $W = \dfrac{K \times T \times f}{\gamma}$

W : Overhung Load [N]
K : Load Coefficient for Driving Method
T : Torque at Gearhead Output Shaft [N·m]
f : Service Factor
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	· Unidirectional 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 via stepping motor	1.5
Medium Impact	· Frequent instantaneous bidirectional operation, starting and stopping of reversible motors · Frequent instantaneous stopping via brake pack of AC motors · Frequent instantaneous starting and stopping of brushless motors, servo motors	2.0

●Permissible Load Inertia for Gearheads

This refers to the permissible value for load inertia (J) at the gearhead output shaft. Based on the permissible value at the motor output shaft, calculate J with the following equation and convert it into the permissible value for the gearhead output shaft.

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

J_G : Permissible Load Inertia at the Gearhead Output Shaft J ($\times 10^{-4}$kg·m^2)
J_M : Permissible Load Inertia at the Motor Shaft J ($\times 10^{-4}$kg·m^2)
i : Gear Ratio (Example: i = 3 means the gear ratio of 1/3)

*Use the same equation when calculating with GD^2.

●Permissible Load Inertia at the Motor Shaft (Example)

No. of Phase	Motor Frame Size	Output Power	Permissible Load Inertia at Motor Shaft	
			J ($\times 10^{-4}$kg·m^2)	GD^2 (kgfcm^2)
Single-Phase	□80 mm	25 W	0.31	1.2

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

How to Read Specifications

How to Read Specifications

Specifications table example MSS·W Series

Model		① Maximum Output Power W	Voltage VAC	Frequency Hz	② Variable Speed Range r/min	③ Permissible Torque 1200 r/min mN·m gfcm	③ Permissible Torque 90 r/min mN·m gfcm	④ Starting Torque mN·m gfcm	⑤ Current A	Power Consumption W	Capacitor μF
Pinion Shaft Type	Round Shaft Type										
TP MSS425-402WE-□	MSS425-002WE-□	25	Single-Phase 220	60	90～1600	200 2000	47 470	120 1200	0.34	67	1.5
			Single-Phase 230	50	90～1400	205 2050	50 500	125 1250	0.33	62	
				60	90～1600	185 1850	45 450	135 1350	0.35	68	

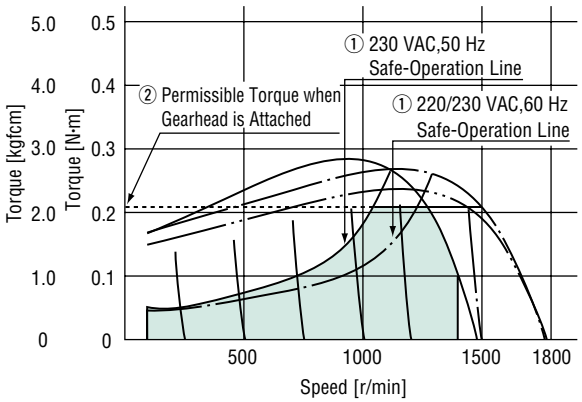
①Maximum Output Power: This refers to, with the combination of motor and control pack, the amount of work that can be performed in a given period of time. It also expresses the maximum output that can be produced within the safe-operation line on the speed-torque characteristics graph.
②Variable Speed Range: This refers to, with the combination of motor and control pack, the range of variable speed. For Speed Control Motors, the variable speed range varies with the size of load torque. See page G-20 for details.
③Permissible Torque: This refers to, at the most commonly used speeds (1200 r/min, 90 r/min), the maximum torque that can be produced below the safe-operation line or the permissible torque with gearhead attached.
④Starting Torque: This refers to, with the combination of motor and control pack, the size of torque that can be produced instantaneously at motor start-up.
⑤Current: This refers to the current sent into the control pack at the maximum output.

Permissible Overhung Load and Permissible Thrust Load for Motors

Similar to Constant Speed Motors. Refer to "How to Read Specifications" for Constant Speed Motors.
●"How to Read Specifications" for Constant Speed Motors ➜ Page A-8

How to Read Speed–Torque Characteristics

Speed–Torque Characteristics example MSS425-402WE-□



①Safe-Operation Line: The safe-operation line, measured by the motor's temperature, indicates its operational limit for continuous usage with the temperature level below the permissible maximum (In case of using a reversible motor, it is measured by 30 minutes operation). Whether the motor can be operated continuously or not, is judged by measuring the temperature of the motor case. When the temperature of the case is below 90˚C, the motor is capable of continuous operation.
②Permissible Torque when Gearhead is Attached: When using a gearhead, be aware that it is necessary to operate below the maximum permissible torque. If the actual torque required should exceed the maximum permissible torque, it may cause possible damage to the gearhead and/or may shorten its life span.

How to Read Gearhead Specifications

Similar to Constant Speed Motors. Refer to "How to Read Gearhead Specifications" for Constant Speed Motors.
●"How to Read Gearhead Specifications" for Constant Speed Motors ➜ Page A-9