Parallel Gearbox

Gearbox Frame Size
6 : □60mm sq. (2.36 in.sq.)
7 : □70mm sq. (2.76 in.sq.)
8 : □80mm sq. (3.15 in.sq.)
9 : □90mm sq. (3.54 in.sq.)

Frame Type
B : Box Type □
F : Flange Type
(Only available for powerful and high powerful type Gearbox)

Bearing Type
B : Ball Bearing
BM : Ball Bearing + Metal Bearing
M : Metal Bearing

9	P	B	K	36	B	H

Gear Type
G : General Gear
P : Powerful Gear
H : High Powerful Gear

Output Shaft Type
K : Key Type
D : D-Cut Type

Gear Ratio
36 : 1/36

Input Gear Type
H : Helical Gear

Worm Solid Gearbox

Gearbox Type
W : Worm Solid Type
WH : Worm Hollow Type

Gear Ratio
30 : 1/30

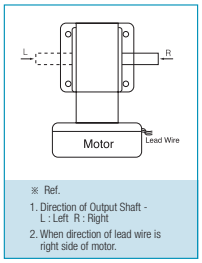
Direction of Output Shaft
L : Left
R : Right
RL : Bi-directional
※ No mark in Worm Hollow Type Gearbox

9	W	D	30	B	L

Gearbox Frame Size
8 : □ 80mm sq. (3.15 in.sq.)
9 : □ 90mm sq. (3.54 in.sq.)

Brand
D : DKM

Bearing Type
B : Ball Bearing
※ No mark in Worm Hollow Type Gearbox



※ Ref.
1. Direction of Output Shaft - L : Left R : Right
2. When direction of lead wire is right side of motor.

Worm Hollow Gearbox

Gearbox Type
WH : Worm Hollow Gearbox

Gear Ratio
30 : 1/30

9	WH	D	30	—	030

Gearbox Frame Size
9 : □ 90mm sq. (4.09 inch.sq.)
10 : □ 104mm sq. (4.09 inch.sq.)

Brand
D : DKM

Center Distance between Worm Wheel and Shaft
030 : 30mm
040 : 40mm

Inter-decimal Gearbox

X10 Inter-decimal Gearbox

G : "G" Type Shaft Motor (40W)
P : "P" Type Shaft Motor (60~120W)

9	X	D	10	G	Z

Gearbox Frame Size
8 : □ 80mm sq. (3.15 in.sq.)
9 : □ 90mm sq. (3.54 in.sq.)

Brand
D : DKM

Gear Ratio
10 : 1/10

Attaching Gearbox
G : General Type (Helical)
P : Powerful Type
H : High Powerful Type
Z : Worm Hollow Type
W : Worm Solid type

In case of requiring high gear reduction ratio that cannot be generated by single Gearbox, please use Inter-decimal Gearbox with general Gearbox. And please be advised that in this case only revolution speed of output shaft will reduce by 10:1 without increasing of maximum permissible torque.

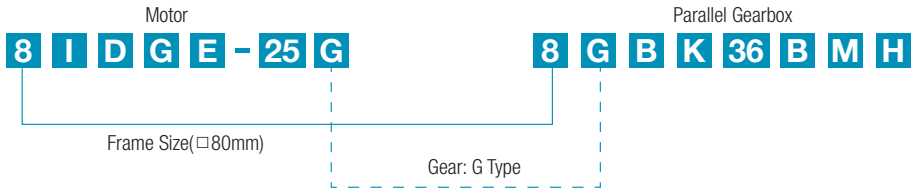
A Information

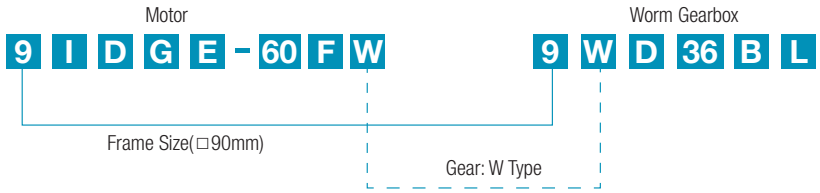
Product Coding System

Assembly of Motor and Gearbox

Motor + Gearbox

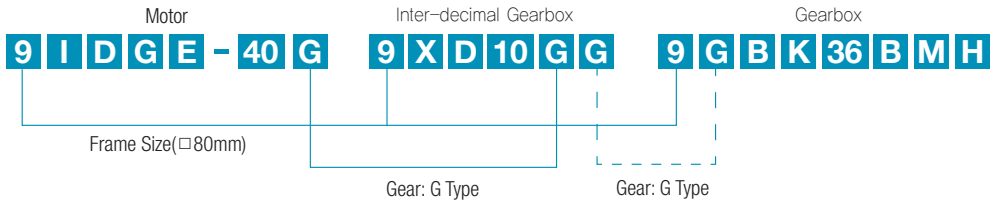
- As shown in the following scheme, motor and Gearbox which have same frame size and gear type could be assembled.





Motor + Inter-decimal Gearbox + Gearbox

- When using an inter-decimal Gearbox together, give attention to the gear types of motor, Gearbox and inter-decimal Gearbox.



- When attaching inter-decimal Gearbox, the output shaft type of the motor is always G Type.
  For example, when using P/H/W/WH type Gearbox, only the gear type of inter-decimal Gearbox is identical with attached Gearbox and the output shaft type of the motor is G type. (Refer to the scheme below.)

D Gearbox

Technical Data of Gearbox

Definition and Function of Gearbox

It is a speed converter using gears and an instrumental device to reduce the rpm of motor into the required rpm and get a bigger torque.

The Kind of DKM Gearbox

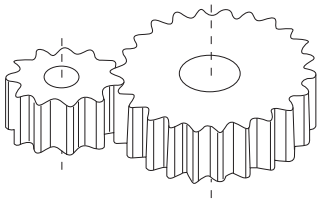
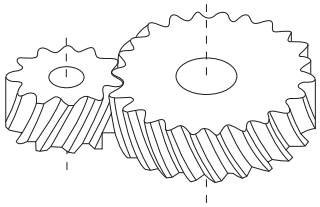
According to Frame Size

Frame Size □60mm Gearbox / Frame Size □70mm Gearbox / Frame Size □80mm Gearbox / Frame Size □90mm Gearbox / Frame Size □104mm Gearbox

According to Direction of Output Shaft of Gearbox

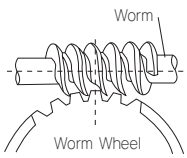
- **Parallel Gearbox**

Parallel Gearbox is the most common type in small geared motor. DKM employs spur type and helical type. Especially the helical gear is employed for the low-noise and high-strength performance. Regarding noise the important part in gear is the contacting point with motor shaft which rotating rapidly. DKM employed helical gear which cut high precisely in that point and realized low-noise performance.

General Box Type (GB Type)	Powerful Box Type (PB Type)	Powerful Flange Type (PF Type)	High Powerful Box Type (HB Type)	High Powerful Flange Type (HF Type)	Ultra Powerful Box Type (UB Type)	Inter-decimal Gearbox
						
Spur Gear			Helical Gear			
The spur gear is cylindrical gear on which the teeth are cut parallel to the shaft. 			The helical gear has teeth cut in helical curve. Its high rate of contact has the advantages of low noise and higher strength comparing the spur gear. 			

- **Worm Gearbox**

Worm Gearbox has the advantage of using the limited space with high efficiency and realizes the cost saving effect by the reduction of using power transmission part like coupling. DKM has worm solid type (for up to 120W) and worm hollow type (for 60W~200W).

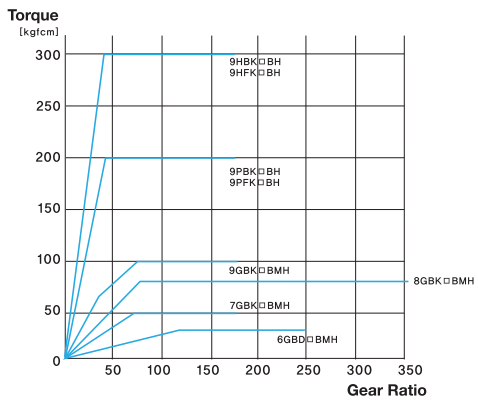
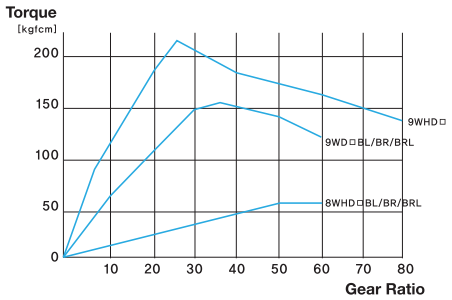
Worm Solid Type (W Type, Left Output Shaft)	Worm Solid Type (W Type, Right Output Shaft)	Worm Solid Type (W Type, Bi-Directional Output Shaft)	Worm Hollow Type (WH Type)	Worm Wheel
				 Worm Gear transmits power to right-angle direction by threaded worm and worm wheel.

List of Gearbox Type

Type		Motor Output	Gearbox Model	Bearing Type	Frame Type
Parallel Gearbox	G type (General)	6W	6GBD□MH	Metal Bearing	Box Type
		6W, 10W, 15W	7GBK□BMH	Ball Bearing + Metal Bearing	Box Type
		15W, 25W	8GBK□BMH	Ball Bearing + Metal Bearing	Box Type
		40W	9GBK□BMH	Ball Bearing + Metal Bearing	Box Type
	P Type (Powerful)	60W~120W	9PBK□BH	Ball Bearing	Box Type
			9PFK□BH	Ball Bearing	Flange Type
	H Type (High Powerful)	60W~200W	9HBK□BH	Ball Bearing	Box Type
			9HFK□BH	Ball Bearing	Flange Type
	U Type (Ultra Powerful)	250W, 300W, 400W	10UBK□BH	Ball Bearing	Box Type
Worm Gearbox	W Type (Worm Solid)	40W~120W	8WD□BL/BR/BRL	Ball Bearing	–
		60W~200W	9WD□BL/BR/BRL	Ball Bearing	–
	WH Type (Worm Hollow	60W~200W	9WHD□–030	Ball Bearing	–
		150W~200W	9WHD□–040	Ball Bearing	–
		250W, 300W 400W	10WHD□–040	Ball Bearing	–
Inter-decimal		15W, 25W	8XD10□□	Metal Bearing	Box Type
		40W~200W	9XD10□□	Ball Bearing	Box Type

Maximum Permissible Torque and Efficiency of Gearbox

The output torque of Gearbox is in proportion to the gear ratio. But there is limit in the size of load which can be applied to the Gearbox in specific gear ratio depending on gear construction and materials etc. affecting the Gearbox mechanical strength. This torque is called the maximum permissible torque. The maximum permissible torques of typical Gearbox are shown in the figure.

Max. Permissible Torque of Parallel Gearbox	Max. Permissible Torque of Worm Gearbox
	

- The calculation of permissible torque at output shaft of Gearbox is as below:

$TG = TM \times i \times \eta$

TG : Output torque of Gearbox TM : Motor torque i: Gear reduction ratio η : Gearbox efficiency

D Gearbox

Technical Data of Gearbox

Efficiency of Parallel Gearbox

Model \ Ratio	2	3	3.6	5	6	7.5	9	10	13	15	18	20	25	30	36	40	50	60	75	90	100	120	150	180	200	250	300	360
6GBD□MH	81%											73%					66%											
7GBK□BMH																												
8GBK□BMH																												
9GBK□BMH																												
9PB(F)K□BH	81%								73%				66%						59%									
9HB(F)K□BH																												
10UBK□BH	81%							73%				66%							59%									

* The efficiency of Inter-decimal Gearbox (8XD10M□, 9XD10M□) is 81%.

Efficiency of Worm Gearbox

Model \ Ratio	7.5	10	12	15	18	20	25	30	36	40	50	60	80
9WHD□-030	60%							55%					
9WHD□-040													
10WHD□-040													

Speed and Direction of Rotations

Speed

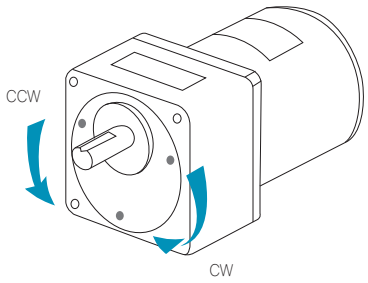
This refers to the speed of rotation in the Gearbox output shaft. The speed is calculated by dividing the motor's synchronous speed by the gear ratio. The actual speed, according to the load condition, is 2~20% less than the displayed value.
The speed is calculated with the following equation:

$$NG = \frac{NM}{i} \ [r/min]$$

NG: Speed of Gearbox [r/min]
NM: Speed of motor [r/min]
i: Gear reduction ratio

Direction of Rotation

This refers to the direction of rotation viewed from the output shaft. The direction of Gearbox shaft rotation may differ from motor shaft rotation depending on the gear ratio of the Gearbox.



Rotating Direction of Gearbox Output Shaft

Model \ Ratio	2	3	3.6	5	6	7.5	9	10	13	15	18	20	25	30	36	40	50	60	75	90	100	120	150	180	200	250	300	360
6GBD□MH	–																										–	–
7GBK□BMH	–			–				–				–				–									–	–	–	–
8GBK□BMH	–							–				–																
9GBK□BMH												–													–	–	–	–
9PB(F)K□BH								–																	–	–	–	–
9HB(F)K□BH	–			–		–		–								–									–	–	–	–
10UBK□BH	–																											

– not available
same direction as the motor
opposite direction as the motor

* In case of using inter-decimal Gearbox, the rotating speed of output shaft will reduce by 10:1 but the rotating direction is the same as the Gearbox's direction.

Gearbox Life Expectancy and Service Factor

- Life expectancy of Gearbox varies depending on load fluctuation and is determined by the 'service factor' based on its load. Service factor is a coefficient which is used to estimate the service life of the Gearbox. This value is generally derived from experience and based on type of the load and operating conditions. The standard life can be expected when the product is operated at service factor 1.0. The life of a component during particular application is estimated by dividing the standard life expectancy by the service factor. For example, if the motor is operating with an ordinary load for 8 continuous hours a day, the service factor is 1.0. Thus, if the operation continues within the permissible torque for the Gearbox and within the range of prescribed temperature (letting the Gearbox case temperature stay below 50℃), the life expectancy of the Gearbox is 10,000 hours for the ball bearing type and 2,000 hours for the metal type. However, if a ball bearing type of Gearbox is operating for 24 hours a day, the service factor becomes 1.5 so that the life expectancy decreases to 1/1.5. Therefore the service factor should be taken into account to select such a motor and a Gearbox which have biggest permissible torque.

- **Example of Load and Service Factor**

Type of Load	Service Factor			Operation Example
	5 hours/day	8 hours/day	24 hours/day	
Constant	0.8	1.0	1.5	Unidirectional, continuous run
Light impact/Changeable load	1.2	1.5	2.0	Frequent start/stop, reverse
Heavy impact	1.5	2.0	2.5	Very frequent start/stop, reverse

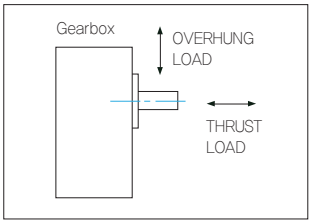
- **Standard Life Expectancy**

Ball Bearing Type*	10,000 hours
Metal Bearing Type	2,000 hours

* 5,000 hours when used on reversible motor

Overhung Load and Thrust Load

- The overhung load is defined as a load applied to the output shaft in the right-angle direction. This load is generated when the Gearbox is coupled to the machine using a chain, belt, etc., but not when the Gearbox is directly connected to the coupling. The thrust load is defined as a load applied to the output shaft in the axial direction.



- Since the overhung load exerts a load directly on the bearing, it affects the life span of the Gearbox. The overhung load can be calculated from the following equation.

$$W = \frac{KxTxf}{r} \ [kg]$$

W: Overhung load [kg]
K: Weight coefficient by driving method (refer to the right table)
T: Delivery force of a Gearbox output shaft [kgfcm]
F: Service factor
R: Effective radius of gear, pulley, etc. [cm]

Load Coefficient by Driving Method

Driving Method	K
Chain, Sprocket	1
Gear	1.25
V-Belt	1.5
Plat-Belt	2.5

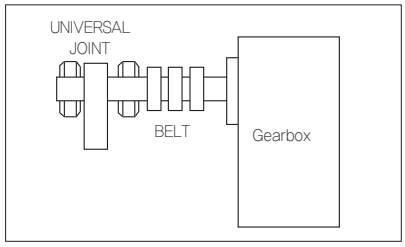
D Gearbox

Technical Data of Gearbox

- If the motor operates with the calculated overhung load exceeds the maximum allowable value in below table, the output shaft may bend and the fatigue deformation may occur due to the repeated load. So consider it and take care in sizing.

Model	Gear Ratio	Permissible Overhung Load N		Permissible Thrust Load N
		10mm Distance from Shaft End	20mm Distance from Shaft End	
6GBD□MH	3 ~ 18	50	80	30
	20 ~ 250	120	180	
7GBK□BMH	3 ~ 18	80	120	40
	25 ~ 180	150	250	
8GBK□BMH	3 ~ 18	100	150	50
	25 ~ 200	200	300	
9GBK□BMH	3 ~ 18	250	350	100
	25 ~ 180	300	450	
9PBK□BH 9PFK□BH	3 ~ 9	400	500	150
	12.5 ~ 20	450	600	
	25 ~ 200	500	700	
9HBK□BH 9HFK□BH	50 ~ 200	400	600	150
8WD□BL 8WD□BR 8WD□BRL	10 ~ 60	300	450	100
9WD□BL 9WD□BR 9WD□BRL	10 ~ 60	500	700	150

- In the case of that calculated overhung load value exceeds above allowable value, please set up the structure of the motor as below to withstand the overhung load.
- Also, if a load should be directly imposed on the output shaft, please place the load as near to the Gearbox as possible to avoid the one-sided load.
- In the case of that a helical gear or a worm gear is employed as an output delivery mechanism, make sure not to exceed both the overhung load and the thrust load simultaneously.



Backlash Noise of Gearbox

Operating Noise of Gearbox

The backlash noise can be indicated by operating noise value. DKM Gearbox's operating noise is like below.

Frame Size	Limit of Operating Noise
70mm	40dB
80mm	42dB
90mm	49dB

Reference i) Operating noise value is the value measured beside Gearbox with 1m distance.
ii) dB (decibel) is a unit of measurement which is used to indicate how loud a sound is.
iii) Level of operating noise (Ref. value)

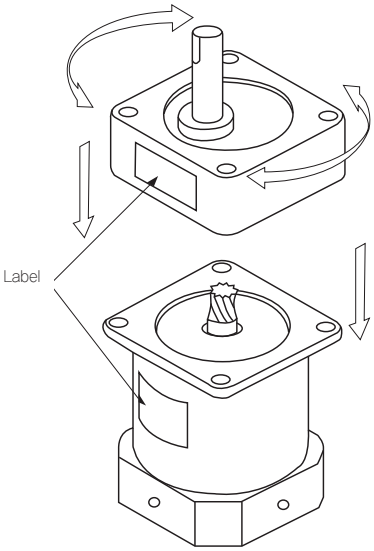
20dB —— The sound of a leaf is shaking
30dB —— The sound in suburb of city in night time
40dB —— The sound in a silent park
50dB —— The sound in a silent office

The Check Point of Gearbox Noise

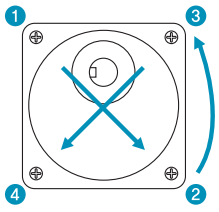
- **Noise in No Load**
  The backlash noise depends on the situation of load. For example, in case of no load rotation, gear could pop and crash between them therefore there could be little vibration and it could cause noise. This noise can be restrained and controlled by carrying some friction load.
- **Noise in Mounting with Load**
  When mounting is not good in mounting plate, there could be some noise by vibration caused from eccentric force. In this case, please check the mounting situation.
- **Noise of Damaged Gear**
  In assembly Gearbox and motor, users have to turn the Gearbox slowly according to the shape of pinion. Otherwise gear could get damaged. And by over load gear could get damaged. As a result there may some abnormal noise in Gearbox. So please handle Gearbox with special care in assembly.

Assembly Method of Motor and Gearbox

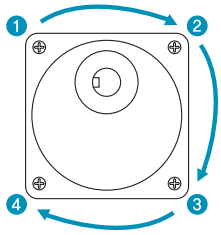
- To assemble the motor and the Gearbox, adjust the assembling faces together in such a way as shown in below figure and turn slowly to complete the assembly. When doing the assembly, special care should be taken neither to exert excessive force on the motor shaft nor to hit inside of the Gearbox. Otherwise, the gear will get damaged, resulting in an abnormal noise and a shortened lifetime of the motor.



- Use the provided mounting screws for set mounting of Gearbox and motor, and tighten the screws correctly. Be sure there is no-gab between motor flange, Gearbox surface and the mounting surface.



Correct



Wrong

D Gearbox

Parallel Gearbox

G Type General Box Type Gearbox

Frame Size 60mm Model: 6GBD□MH – Max. Permissible Torque

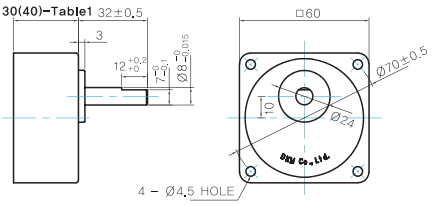
* These are reference figures when the Gearbox is attached to the induction motor.

Motor Output	Gear Ratio		3	3.6	5	6	7.5	9	10	12.5	15	18	20	25	30	36	40	50	60	75	90	100	120	150	180	200	250
	60Hz	r/min	600	500	360	300	240	200	180	144	120	100	90	72	60	50	45	36	30	24	20	18	15	12	10	9	7.2
	50Hz		500	417	300	250	200	166	150	120	100	83	75	60	50	41	37	30	25	20	16	15	12	10	8	7.5	6
6W	60Hz	kgfcm	1.0	1.3	1.7	2.1	2.6	3.1	3.5	4.4	5.2	6.3	6.3	7.9	9.5	11.3	12.6	14.3	17.1	21.4	25.7	28.6	30.0	30.0	30.0	30.0	30.0
	50Hz		1.2	1.4	2.0	2.3	2.9	3.5	3.9	4.9	5.9	7.0	7.1	8.8	10.6	12.7	14.1	16.0	19.2	24.0	28.8	30.0	30.0	30.0	30.0	30.0	30.0

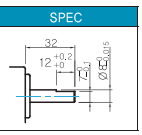
1) Enter the gear ratio in the box (□) within the Gearbox model name.
2) A colored background indicates gear shaft rotation in the same direction as the motor shaft; a white background indicates rotation in the opposite direction.
3) The rotating speed is calculated by dividing the motor's synchronous speed (50Hz: 1,500r/min, 60Hz: 1,800r/min) by the gear ratio.
   The actual speed is 2~20% less than the displayed value, depending on the size of the load.
4) Caculation of N.m ≒ kgfcm X 0.98

Dimensions

● Model: 6GBD□MH



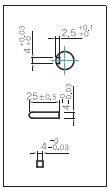
● GEARBOX OUTPUT SHAFT

MODEL	SPEC
D-CUT TYPE	

● 30(40)-Table1

SIZE(mm)	GEAR RATIO
30	6GBD3MH – 6GBD18MH
40	6GBD20MH – 6GBD250MH

● KEY SPEC



● WEIGHT

Model	WEIGHT(Kg)
6GBD3MH ~ 6GBD18MH	0.3
6GBD20MH ~ 6GBD40MH	0.32
6GBD50MH ~ 6GBD250MH	0.34

Frame Size 70mm Model: 7GBK□BMH – Max. Permissible Torque

* These are reference figures when the Gearbox is attached to the induction motor.

Motor Output	Gear Ratio		3	3.6	6	7.5	9	12.5	15	18	25	30	36	50	60	75	90	100	120	150	180
	60Hz	r/min	600	500	300	240	200	144	120	100	72	60	50	36	30	24	20	18	15	12	10
	50Hz		500	416	250	200	166	120	100	83	60	50	41	30	25	20	16	15	12.5	10	8.3
6W	60Hz	kgfcm	1.4	1.6	2.7	3.4	4.1	5.7	6.8	8.2	10.3	12.4	13.5	18.7	22.4	28.1	33.7	37.4	44.9	50.0	50.0
	50Hz		1.7	2.1	3.5	4.4	5.2	7.3	8.7	10.5	13.1	15.8	17.1	23.8	28.6	35.7	42.8	47.6	50.0	50.0	50.0
10W	60Hz		1.7	2.1	3.4	4.3	5.2	7.2	8.6	10.3	12.9	15.5	16.9	23.5	28.2	35.2	42.2	46.9	50.0	50.0	50.0
	50Hz		2.1	2.5	4.2	5.2	6.3	8.7	10.5	12.5	15.8	18.9	20.6	28.6	34.3	42.8	50.0	50.0	50.0	50.0	50.0
15W	60Hz		2.5	3.0	5.0	6.2	7.5	10.4	12.5	14.9	18.8	22.5	24.5	34.0	40.8	50.0	50.0	50.0	50.0	50.0	50.0
	50Hz		3.5	4.2	7.0	8.7	10.5	14.5	17.4	20.9	26.3	31.5	34.3	47.6	50.0	50.0	50.0	50.0	50.0	50.0	50.0

1) Enter the gear ratio in the box (□) within the Gearbox model name.
2) A colored background indicates gear shaft rotation in the same direction as the motor shaft; a white background indicates rotation in the opposite direction.
3) The rotating speed is calculated by dividing the motor's synchronous speed (50Hz: 1,500r/min, 60Hz: 1,800r/min) by the gear ratio.
   The actual speed is 2~20% less than the displayed value, depending on the size of the load.
4) Caculation of N.m ≒ kgfcm X 0.98