

Environmental Conditions

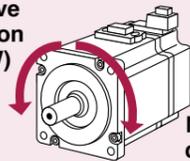
Item	Conditions
Ambient temperature *1	0 °C to 40 °C (free from freezing)
Ambient humidity	20 %RH to 85 %RH (free from condensation *5*6)
Storage temperature *2	-20 °C to 65 °C (Max.temperature guarantee: 80 °C for 72 hours free from condensation *5)
Storage humidity	20 %RH to 85 %RH (free from condensation *5*6)
Vibration	Motor only Lower than 49 m/s ² (5 G) at running, 24.5 m/s ² (2.5 G) at stall*7
Impact	Motor only Lower than 98 m/s ² (10 G)
Enclosure rating (Motor only)	IP65 *3 MSMF, MQMF, MHMF (except rotating portion of output shaft and leadwire end.) (MSMF, MQMF, MHMF In case of leadwire type.)
	IP67 *3*4 IP67 motor (except rotating portion of output shaft and connecting pin part of the motor connector and the encoder connector)
	IP44 *3 Excludes output shaft rotating part, connector connection pin part, and motor lead hole part of terminal box.
Altitude	Lower than 1000 m

- *1 Ambient temperature to be measured at 5 cm away from the motor.
- *2 Permissible temperature for short duration such as transportation.
- *3 These motors conform to the test conditions specified in EN standards (EN60529, EN60034-5). Do not use these motors in application where water proof performance is required such as continuous wash-down operation.
- *4 This condition is applied when the connector mounting screw are tightened to the recommended tightening torque.
- *5 Air containing water vapor will become saturated with water vapor as the temperature falls, causing dew.
- *6 The terminal block of MDMFD22L1□□ is between 45%RH to 85%RH.
- *7 For motors with rated output capacity of 5.5 kW or more, both motor rotation and stop will be 24.5 m/s² (2.5 G) or less.

<Note>

Initial setup of rotational direction:
positive = CCW and negative = CW.
Pay an extra attention.

Positive direction (CCW)



Negative direction (CW)

IP65 (1000 W or less) <Leadwire type>	IP67 <Connector type>

Notes on [Motor specification] page

Note) 1. Regenerative resistors are not built in drivers of A and B frames. When regeneration occurs, prepare an optional external regenerative resistor.

[At AC100 V of power voltage]

Regenerative brake frequency represents the frequency of the motor's stops from the rated speed with deceleration without load.

- If the load is connected, frequency will be defines as 1/(m+1), where m=load moment of inertia/rotor moment of inertia.
- When the motor speed exceeds the rated speed, regenerative brake frequency is in inverse proportion to the square of (running speed/rated speed).
- Power supply voltage is AC115 V (at 100 V of the main voltage).
If the supply voltage fluctuates, frequency is in inverse proportion to the square of (Running supply voltage/115) relative to the value in the table.
- When regeneration occurs continuously such cases as running speed frequently changes or vertical feeding, consult us or a dealer.

[At AC200 V of power voltage]

Regenerative brake frequency represents the frequency of the motor's stops from the rated speed with deceleration without load.

- If the load is connected, frequency will be defines as 1/(m+1), where m=load moment of inertia/rotor moment of inertia.
- When the motor speed exceeds the rated speed, regenerative brake frequency is in inverse proportion to the square of (running speed/rated speed).
- Power supply voltage is AC230 V (at 200 V of the main voltage).
If the supply voltage fluctuates, frequency is in inverse proportion to the square of (Running supply voltage/230) relative to the value in the table.

- When regeneration occurs continuously such cases as running speed frequently changes or vertical feeding, consult us or a dealer.

Note) 2. If the effective torque is within the rated torque, there is no limit in generative brake.

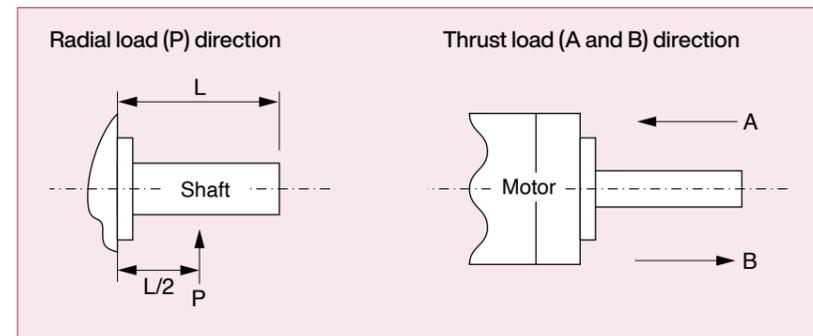
Note) 3. Consult us or a dealer if the load moment of inertia exceeds the specified value.

Note) 4. Releasing time values represent the ones with DC-cutoff using a varistor.

Permissible Load at Output Shaft

The radial load is defined as a load applied to the output shaft in the right-angle direction. This load is generated when the gear head is coupled to the machine using a chain, belt, etc., but not when the gear head is directly connected to the coupling. As shown in the right figure, the permissible value is determined based on the load applied to the L/2 position of the output shaft. The thrust load is defined as a load applied to the output shaft in the axial direction.

Because the radial load and thrust load significantly affect the life of the bearing, take care not to allow the load during operation to exceed the permissible radial load and thrust load shown in the table below.



Built-in Holding Brake

In the applications where the motor drives the vertical axis, this brake would be used to hold and prevent the work (moving load) from falling by gravity while the power to the servo is shut off.

Use this built-in brake for "Holding" purpose only, that is to hold the stalling status. Never use this for "Brake" purpose to stop the load in motion.

• Output Timing of BRK-OFF Signal

- For the brake release timing at power-on, or braking timing at Servo-OFF/Servo-Alarm while the motor is in motion, refer to the Operating Instructions (Overall).
- With the parameter, Pr4.38 (Setup of mechanical brake action while the motor is in motion), you can set up a time between when the motor enters to a free-run from energized status and when BRK-OFF signal turns off (brake will be engaged), when the Servo-OFF or alarm occurs while the motor is in motion. For details, download a copy of the instruction manual from our website.

<Note>

1. The lining sound of the brake (chattering and etc.) might be generated while running the motor with built-in brake, however this does not affect any functionality.
2. Magnetic flux might be generated through the motor shaft while the brake coil is energized (brake is open). Pay an extra attention when magnetic sensors are used nearby the motor.

● Specifications of Built-in Holding Brake

Motor series	Motor output	Static friction torque N·m	Rotor inertia $\times 10^{-4}$ kg·m ²	Engaging time ms	Releasing time ms	Exciting current DC A (at cool-off)	Releasing voltage DC V / Exciting voltage DC V	Permissible work (J) per one braking	Permissible total work $\times 10^3$ J	Permissible angular acceleration rad/s ²			
MSMF (80 mm sq.) or less	50 W, 100 W	0.294 or more	0.002	35 or less	20 or less	0.30	1 or more	39.2	4.9	30000			
	200 W, 400 W	1.27 or more	0.018	50 or less	15 or less	0.36	24±1.2	137	44.1				
	750 W	2.45 or more	0.075	70 or less	20 or less	0.42	1 or more	196	147				
	1000 W	3.80 or more					24±2.4	185	80.0				
MSMF (100 mm sq.) or more	1.0 kW, 1.5 kW, 2.0 kW	8.0 or more	0.175	50 or less	15 or less	0.81	2 or more	600	50	10000			
	3.0 kW	12.0 or more		80 or less					900				
	4.0 kW	16.2 or more	1.12	110 or less	50 or less	0.90	24±2.4	1470	2160				
	5.0 kW	22.0 or more						1545	2000				
MQMF (80 mm sq.) or less	100 W	0.39 or more	0.018	15 or less	20 or less	0.30	1 or more	105	44.1	30000			
	200 W, 400 W	1.6 or more	0.075	70 or less		0.36	24±2.4	185	80				
MHMF (80 mm sq.) or less	50 W, 100 W	0.38 or more	0.002	35 or less	20 or less	0.30	1 or more	39.2	4.9	30000			
	200 W, 400 W	1.6 or more	0.018	50 or less		0.36		105	44.1				
	750 W, 1000 W	3.8 or more	0.075	70 or less		0.42		185	80				
MHMF (100 mm sq.) or more	1.0 kW, 1.5 kW	13.7 or more	1.12	100 or less	50 or less	0.79	2 or more	1470	2160	10000			
	2.0 kW, 3.0 kW, 4.0 kW	25.0 or more	4.7	80 or less	25 or less	1.29				24±2.4	1800	3000	5440
	5.0 kW	44.1 or more	4.1	150 or less	30 or less							3100	5108
	7.5 kW	63.0 or more	3.9	200 or less	80 or less								
MDMF (100 mm sq.) or more	1.0 kW, 1.5 kW, 2.0 kW	13.7 or more	1.12	100 or less	50 or less	0.79	2 or more	1470	2160	10000			
	3.0 kW	22.0 or more		110 or less	25 or less	0.90					1545	2000	
	4.0 kW	25.0 or more	4.7	80 or less	25 or less	1.29				24±2.4	1800	3000	5440
	5.0 kW	44.1 or more	4.1	150 or less	30 or less							3100	5108
	7.5 kW	63.0 or more	3.9	200 or less	80 or less								
	11.0 kW	100 or more	7.1	300 or less	140 or less	1.08				2000	4000	3000	
	15.0 kW				150 or less	1.72							3000
22.0 kW	200 or more	28		150 or less	1.72								
MGMF (100 mm sq.) or more	0.85 kW, 1.3 kW, 1.8 kW	13.7 or more	1.12	100 or less	50 or less	0.79	2 or more	1470	2160	10000			
	2.9 kW	25.0 or more	4.7	80 or less	25 or less	1.29				24±2.4	1800	3000	5440
	4.4 kW	44.1 or more	3.93	150 or less	30 or less							3100	5108
	5.5 kW	63.0 or more	3.9	200 or less	80 or less								

- The engaging time and releasing time represent the delay time of the brake operation.
- Releasing time values represent the ones with DC-cutoff using a varistor.
- Above values (except static friction torque, releasing voltage and exciting voltage) represent typical values.
- Backlash of the built-in holding brake is kept 2° or smaller at ex-factory point.
- Service life of the number of acceleration/deceleration with the above permissible angular acceleration is more than 10 million times. (Life end is defined as when the brake backlash drastically changes.)
- The motor brake power supply must be different from the power supply for the driver's connectors X1, X2, X3, X4, X5, X6.

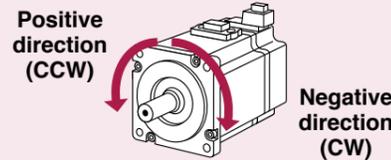
Environmental Conditions

Item	Conditions	
Ambient temperature	0 °C to 40 °C (free from freezing)	
Ambient humidity	20 %RH to 85 %RH (free from condensation)	
Storage temperature	-20 °C to 65 °C (Max.temperature guarantee: 80 °C for 72 hours free from condensation)	
Storage humidity	20 %RH to 85 %RH (free from condensation)	
Vibration *1	Motor only	49 m/s ² or less X,Y,Z directions But when the motor doesn't operate, 24.5 m/s ² or less. (At center of frame, 20 Hz to 3000 Hz, with not more than 1.5 mm amplitude)
	Encoder connector unit and Motor connector unit	Acc. EN60068-2-6 98 m/s ² X, Y, Z directions (At mounting position, with the connectors mated) Frequency : 50 Hz to 2000 Hz Frequency change speed : 1 Octave/min Test duration : 10 cycles each X, Y, Z directions
Impact	Motor only	Lower than 98 m/s ² (10 G)
Enclosure rating	Motor only	IP67 (except rotating portion of output shaft and connecting pin part of the motor connector and the encoder connector)
Altitude	Lower than 1000 m	

*1 After mounting the device, ensure that the vibration resistance performance of the motor and connector meets the defined requirements.

<Note>

Initial setup of rotational direction:
positive = CCW and negative = CW. Pay an extra attention.



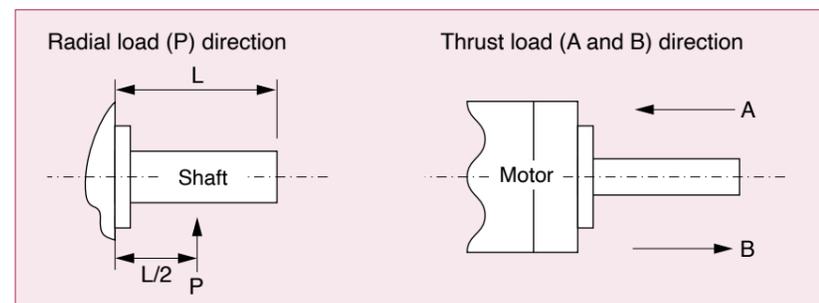
Notes on [Motor specification] page

- Note) 1. Consult us or a dealer if the load moment of inertia exceeds the specified value.
- Note) 2. Releasing time values represent the ones with DC-cutoff using a varistor.

Permissible Load at Output Shaft

The radial load is defined as a load applied to the output shaft in the right-angle direction. This load is generated when the gear head is coupled to the machine using a chain, belt, etc., but not when the gear head is directly connected to the coupling. As shown in the right figure, the permissible value is determined based on the load applied to the L/2 position of the output shaft. The thrust load is defined as a load applied to the output shaft in the axial direction.

Because the radial load and thrust load significantly affect the life of the bearing, take care not to allow the load during operation to exceed the permissible radial load and thrust load shown in the table below.



Specifications of Built-in Holding Brake

Motor series	Motor output	Static friction torque ^{*1} (N·m)	Rotary part inertia ^{*2} (10 ⁻⁴ kg·m ²)	Armature pull in time ^{*2} (ms)	Armature release time ^{*2} (ms)	Release voltage ^{*1} (DC, V)	Exciting voltage ^{*1} (DC, V)	Exciting current (at DC24 V) ^{*2} (DC, A)	Allowable braking energy ; 1 time each ^{*2} (J)	All allowable braking Energy ^{*2} (J)	Allowable angular acceleration ^{*2} (rad/s ²)		
MSMF	1.0 kW	8.0 or more	0.175	50 or less	15 or less ^{*3}	2 or more	24 ± 2.4	0.81 ± 10 %	600	5.0 × 10 ⁴	10000		
	1.5 kW												
	2.0 kW												
	3.0 kW	12.0 or more		80 or less									
MSMF	4.0 kW	16.2 or more	1.12	110 or less	50 or less ^{*3}	2 or more	24 ± 2.4	0.90 ± 10 %	1470	2.16 × 10 ⁶	10000		
	5.0 kW	22.0 or more											
	3.0 kW	22.0 or more										110 or less	
MDMF	1.0 kW	13.7 or more	1.12	100 or less	50 or less ^{*3}	2 or more	24 ± 2.4	0.79 ± 10 %	1470	2.16 × 10 ⁶	10000		
	1.5 kW												
	2.0 kW	22.0 or more		110 or less									
	3.0 kW	22.0 or more		110 or less									
MDMF	4.0 kW	25.0 or more	4.7	80 or less	25 or less ^{*3}	2 or more	24 ± 2.4	1.29 ± 10 %	1800	3.0 × 10 ⁶	5440		
	5.0 kW	44.1 or more										150 or less	30 or less ^{*3}
	4.0 kW	25.0 or more										80 or less	25 or less ^{*3}
MGMF	0.85 kW	13.7 or more	1.12	100 or less	50 or less ^{*3}	2 or more	24 ± 2.4	0.79 ± 10 %	1470	2.16 × 10 ⁶	10000		
	1.3 kW												
	1.8 kW	25.0 or more		80 or less								25 or less ^{*3}	
	2.4 kW	25.0 or more		80 or less								25 or less ^{*3}	
MGMF	2.9 kW	25.0 or more	4.7	80 or less	25 or less ^{*3}	2 or more	24 ± 2.4	1.29 ± 10 %	1800	3.0 × 10 ⁶	5440		
	4.4 kW	44.1 or more										150 or less	30 or less ^{*3}
MHMF	200 W	1.6 or more	0.018	50 or less	20 or less ^{*3}	1 or more	24 ± 2.4	0.36 ± 10 %	105	44.1 × 10 ³	30000		
	400 W												
	750 W	3.8 or more		70 or less									
	1000 W	3.8 or more		70 or less									
MHMF	1.0 kW	13.7 or more	1.12	100 or less	50 or less ^{*3}	2 or more	24 ± 2.4	0.79 ± 10 %	1470	2.16 × 10 ⁶	10000		
	1.5 kW												
	2.0 kW	25.0 or more		80 or less								25 or less ^{*3}	
	3.0 kW	25.0 or more		80 or less								25 or less ^{*3}	
MHMF	4.0 kW	25.0 or more	4.7	80 or less	25 or less ^{*3}	2 or more	24 ± 2.4	1.29 ± 10 %	1800	3.0 × 10 ⁶	5440		
	5.0 kW	44.1 or more										150 or less	30 or less ^{*3}
MHMF	4.0 kW	25.0 or more	4.7	80 or less	25 or less ^{*3}	2 or more	24 ± 2.4	1.29 ± 10 %	1800	3.0 × 10 ⁶	5440		
	5.0 kW	44.1 or more										150 or less	30 or less ^{*3}

*1 Value of our delivery inspection.
*2 Representative value at 20 °C.
*3 4.1.3 Surge absorber for motor brake

Motor Types with Gear Reducer



MQMF
100 W to 400 W

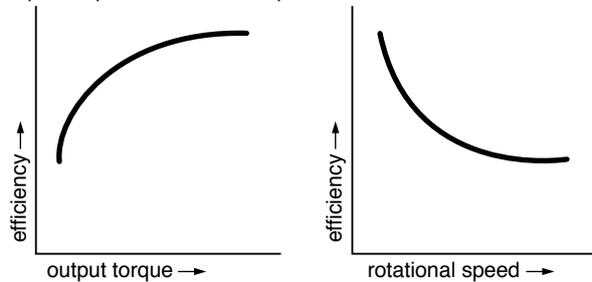


MHMF
100 W to 750 W

Reduction ratio	Motor output (W)				Type of reducer
	100	200	400	750	
1/5	●	●	●	●	For high precision
1/9	●	●	●	●	
1/15	●	●	●	●	
1/25	●	●	●	●	

* MQMF 750 W is not prepared.
* MHMF 100 W 1/25, 400 W 1/25 are not prepared.

Efficiency of the gear reducer show the following inclination in relation to output torque and rotational speed.



Specifications of Motor with Gear Reducer

Items		Specifications
Gear reducer	Backlash	3 minutes or smaller (initial value) at output shaft of the reducer
	Composition of gear	Planetary gear
	Gear efficiency	76 % to 87 %
	Lubrication	Grease lubrication
	Rotational direction at output shaft	Same direction as the motor output shaft
	Mounting method	Flange mounting
	Permissible moment of inertia of the load (conversion to the motor shaft)	10 times or smaller than rotor moment of inertia of the motor
Environment	Enclosure rating	IP44 (at gear reducer)
	Ambient temperature	0 °C to 40 °C (free from freezing)
	Storage temperature	-20 °C to 65 °C (Max. temperature guarantee: 80 °C for 72 hours free from condensation)
	Ambient humidity, Storage humidity	20 %RH to 85 %RH (free from condensation)
	Vibration	Lower than 49 m/s ² (5G) at running, 24.5 m/s ² (2.5G) at stall
	Impact	Lower than 98 m/s ² (10G)
	Altitude	Lower than 1000 m