MD-AX520-5.0K, 7.0K
Instruction Manual Supplement

This Instruction Manual Supplement provides the dedicated specification for the magnet motor drive unit MD-AX520-5.0K and 7.0K.
For the information not found in this Instruction Manual Supplement, please refer to the Instruction Manual of the MD-AX520 series.

1. Drive units to be used with motors

Refer to: Chapter 1 of the Specifications/Instruction Manual, 1.1.3 Drive units to be used with motors

Use the drive units and motors in the following combinations.
(The drive unit and motor of the same capacity are used together.)

Drive Unit	Motor
MD-AX520-0.5K	MM-CF52
MD-AX520-1.0K	MM-CF102
MD-AX520-1.5K	MM-CF152
MD-AX520-2.0K	MM-CF202
MD-AX520-3.5K	MM-CF352
MD-AX520-5.0K	MM-CF502
MD-AX520-7.0K	MM-CF702

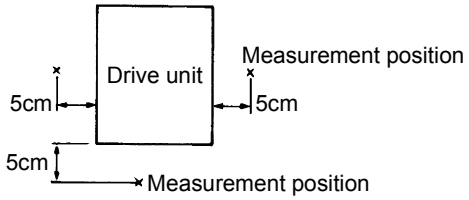
2. Installation in control box

Refer to: Chapter 2 of the Specifications/Instruction Manual, 2.1.2 Installation in control box

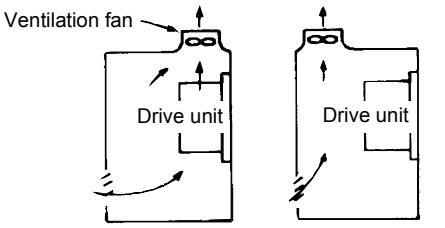
When installing the drive unit in a control box, the internal temperature of the control box must not exceed the permissible value due to drive-unit generated heat and peripheral-generated heat.
Placing a heat sink outside the control box can reduce the heat generated inside the control box

Refer to: Chapter 7 of the Specifications/Instruction Manual, 7.1.3 Option list (External heat sink mounting attachment)

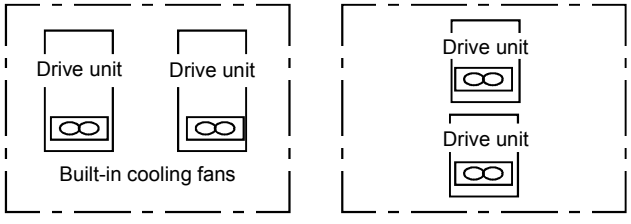
● Measurement positions of ambient temperatures



● Layout of drive units within control box

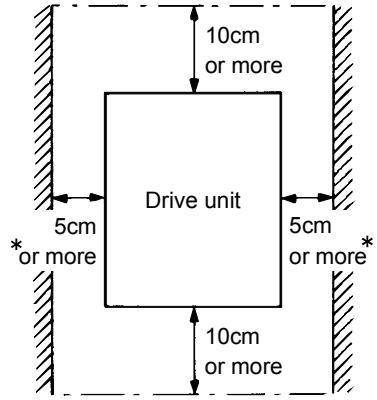


Position of ventilation fan

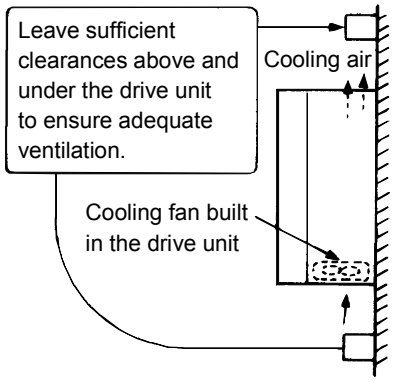


Accommodation of two or more drive units

NOTICE	● Leave the specified clearances between the drive unit and control box walls or other equipment. Not doing so can cause a failure. In addition, improper convection of air in the control box will reduce the heat dissipation effect. Fully consider the equipment layout in the control box and the use of a cooling fan for ventilation, for example.



∗ 1cm or more for 3.5K or less.
These clearances are also required for replacement of the cooling fan.



● Installation in enclosed control box

The following is the relationship between the internal temperature rise and heat dissipation area of an enclosed control box (hereafter referred to as the enclosure) which accommodates the drive unit.

$$A = \frac{P}{K \bullet \triangle T}$$

A: Heat dissipation area (m^2)
P: All losses produced in enclosure (W)
△T: Difference between enclosure inside and outside-air temperatures (°C)
K: Heat dissipation factor

The heat dissipation area A does not include the area in contact with a structures which interfere with heat dissipation, e.g. floor and walls.
The heat dissipation factor K used is normally 5 to 6, which depends on the enclosure structure, the layout of parts in the enclosure, and the outside-air temperature.

● Produced losses

The following table indicates the losses produced during rated load operation of the drive unit.

Unit (W)

Capacity	Drive Unit-Produced Loss during Continuous Rated Load Operation	Loss Produced in Enclosure when Drive Unit Heat Sink Is Placed Outside of Enclosure
0.5K	55	—
1.0K	70	—
1.5K	110	33
2.0K	150	45
3.5K	230	69
5.0K	310	93
7.0K	420	126

3. Selection of peripheral devices

Refer to: Chapter 2 of the Specifications/Instruction Manual, 2.2.2 Selection of peripheral devices

(1) Wire size

● AC power input terminals R, S, T, motor connection terminals U, V, W, DC reactor connection terminals P/+, P1, DC terminals P/+, N/-, ground terminals

Capacity (K)	Terminal Screw Size	Wire Sizes, Unit: mm^2				Wire Type
		R, S, T	U, V, W	P/+, P1, N/-	Connection	
0.5	M4	2 to 5.5	2 to 5.5	2 to 5.5	2 to 5.5	Power cable 600V vinyl wire or equivalent
1.0						
1.5						
2.0						
3.5		3.5 to 5.5	3.5 to 5.5	3.5 to 5.5	3.5 to 5.5	
5.0	M5	5.5 to 14	5.5 to 14	5.5 to 14	5.5 to 14	
7.0		14	8 to 14	14		

● Control circuit power supply terminals R1, S1

Capacity	Terminal Screw Size	Wire Size, Unit: mm^2	Wire Type
All capacities	M4	2 to 5.5	Power cable 600V vinyl wire or equivalent

● Control circuit terminals (all terminals)

Capacity	Terminal Screw Size	Wire Size, Unit: mm^2	Wire Type
All capacities	M3.5	0.5 to 2	Twisted shielded wire, polyethylene insulated vinyl wire for instrumentation or equivalent

MEMO	● Refer to the corresponding instruction manual for wires connection of a stand-alone option connected to the DC terminals P/+, N/-.

NOTICE	● Choose the size of the wires connected to the motor connection terminals so that a voltage drop due to the wires is less than 4V. The minimum wire size in the above selection table assumes that the wiring length is less than 20m. A voltage drop can be found by the following expression: Line voltage drop (mV) = $\sqrt{3} \times$ wire resistance (Ω/km) $\times$ wiring length (m) $\times$ current (A) ● Use the ground cable which is as thick as possible. ● We recommend you to use the 0.75mm^2 or less wire size for the control circuit terminals. Using the wire size of 1.25mm^2 or more may cause the front cover to bulge, leading to a contact fault in the operation panel or parameter unit, when there are many cables wired, for example.

(2) Crimping terminals

Wire Size, Unit: mm^2	Terminal Screw Size	Crimping Terminal Size
0.5	M3.5	1.25-3.5
0.75	M3.5	1.25-3.5
1.25	M3.5	1.25-3.5
2	M3.5	2-3.5
	M4	2-4
3.5/5.5	M4	5.5-4
	M5	5.5-5
8	M5	8-5
14	M5	14-5

(3) No-fuse breakers, magnetic contactors

Capacity (K)	No-Fuse Breaker		Magnetic Contactor
	With power factor improving reactor	Without power factor improving reactor	
0.5	30AF/5A		S-N10
1.0	30AF/10A		
1.5	30AF/15A		
2.0	30AF/15A	30AF/20A	S-N11, S-N12
3.5	30AF/30A		S-N20
5.0	50AF/40A	50AF/50A	S-N25
7.0	50AF/50A	100AF/60A	S-N35

NOTICE	● Select the no-fuse breaker according to the power supply capacity. ● Install one no-fuse breaker per drive unit. ● When the breaker on the drive unit primary side trips, check for the wiring fault (short circuit), damage to internal parts of the drive unit, etc. Identify the cause of the trip, then remove the cause and power on the breaker.

(4) Earth leakage circuit breakers

● Selection method

Use the earth leakage circuit breaker which has harmonic/surge suppression.

Our product: Progressive Super Series NV-SF, NV-CF

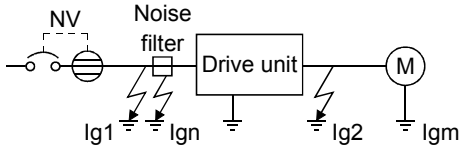
Capacity (K)	Earth Leakage Circuit Breaker	
	With power factor improving reactor	**Without power factor improving reactor**
0.5	30AF/5A	
1.0	30AF/10A	
1.5	30AF/15A	
2.0	30AF/15A	30AF/20A
3.5	30AF/30A	
5.0	50AF/40A	50AF/50A
7.0	50AF/50A	100AF/60A

MEMO	● Leakage currents from the wiring and motor include frequency components of a higher degrees than those from the commercial power supply. Therefore, the earth leakage circuit breaker which is not a harmonic/surge suppression product can cause unnecessary operations. <Measures against unnecessary operations> • Minimize the wiring distance of I/O cables. • Run I/O cables away (more than 30cm) from the earth. • Reduce the Pr. 72 "motor tone selection" setting.

● Setting of rated current sensitivity

Rated current sensitivity ≥ 10 {Ig1 + Ign + K (Ig2 + Igm)}

K: Constant in consideration of harmonics



Earth Leakage Circuit Breaker		K
Type	**Our product**	
Harmonic/ surge suppression product	NV-C/NV-S/MN series, NV30-FA, NV50-FA, BV-C2, earth leakage alarm breaker (NF-Z), NV-ZHA, NV-H	1
General product	BV-C1, BC-V, NVB, NV-L, NV-G2N, NV-G3NA and NV-2F earth leakage relay (except NV-ZHA), NV with AA neutral wire open-phase protection	3

Ig1: Leakage current in cable path between earth leakage circuit breaker and drive unit (see Fig. 2-2)

Ig2: Leakage current in cable path between drive unit and motor (see Fig. 2-2)

Ign: Leakage current of filter connected on input side
Refer to Chapter 7 of the Specifications/ Instruction Manual, 7.1.3 Option list for our dedicated filters.

Igm: Leakage current of motor (see Fig. 2-3)

Fig. 2-2 Example of Leakage Current per 1km of Cable Path When CV Cable Is Routed in Metal Conduit

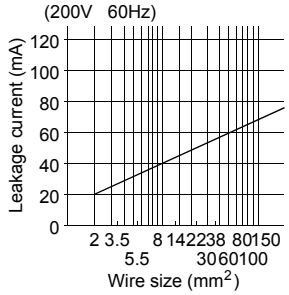
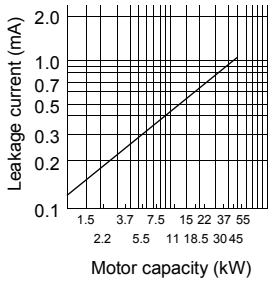


Fig. 2-3 Leakage current example of three-phase induction motor during the commercial power supply operation (200V 60Hz)

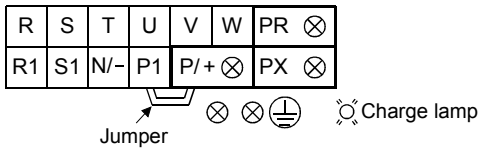


NOTICE	● Install the leakage current circuit breaker on the input side (power supply side) of the drive unit. Installation on the output side will cause the earth leakage circuit breaker to overheat or malfunction.

MEMO	● A leakage current may flow into the other lines through the ground cables, etc.

4. Terminal layout and connection specifications

Refer to: Chapter 3 of the Specifications/Instruction Manual, 3.2.2 Terminal layout and connection specifications

<table>
<tr><th colspan="2">AX520-0.5, 1.0K</th><th colspan="2">AX520-1.5K to 3.5K</th></tr>
<tr><td colspan="2">Layout
 
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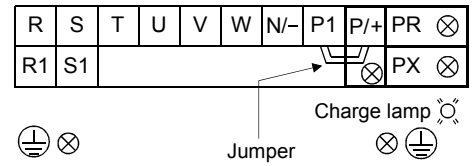
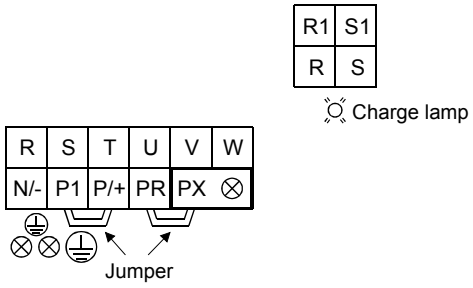
 
</td></tr>
<tr><td>Screw size
M4</td><td>Tightening torque
1.5N•m</td><td>Screw size
M4</td><td>Tightening torque
1.5N•m</td></tr>
<tr><th colspan="2">MD-AX520-5.0K, 7.0K</th><td colspan="2" rowspan="2"></td></tr>
<tr><td colspan="2">Layout
 
</td></tr>
<tr><td>Screw size
M5</td><td>Tightening torque
2.5N•m</td><td colspan="2"></td></tr>
</table>

⚠ CAUTION

● **Tighten the terminal screws to the specified torque. Undertightening can cause an inter-terminal short circuit or malfunction. Overtightening can cause the screws and unit to be damaged, resulting in a short circuit malfunction or the like.**

5. Wiring of the control circuit power supply terminals R1, S1

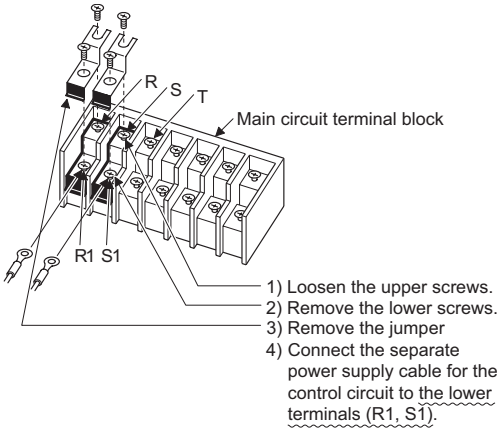
Refer to: Chapter 3 of the Specifications/Instruction Manual, 3.2.4 Wiring of the control circuit power supply terminals R1, S1

Wire these terminals when you want to supply the control circuit power of the drive unit to retain the alarm signal if the magnetic contactor (MC) on the power supply side is opened to switch off main circuit power when the protective circuit is activated.

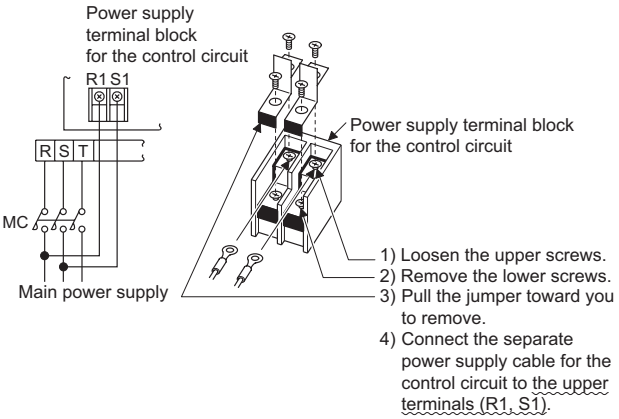
1) Remove the jumpers across the terminals R-R1, S-S1.

2) Wire the terminals R1, S1 from the primary side of the magnetic contactor.

● MD-AX520-0.5K to 3.5K



● MD-AX520-5.0K, 7.0K



MEMO	● An error display (E.OC1) will be provided if you turn on the start signal with power supplied to only the R1 and S1 terminals.

⚠ CAUTION

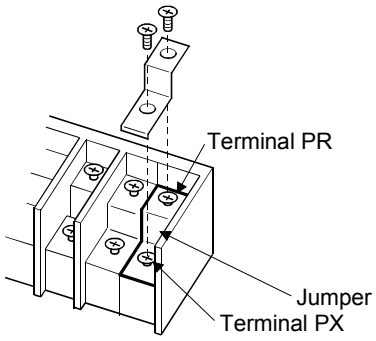
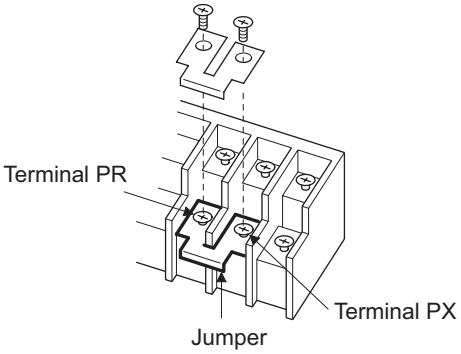
- **When you have energized the AC power input terminals R, S, T, always energize the control circuit power supply terminals R1, S1, too. The drive unit may be damaged if you energize the AC power input terminals without the control circuit power supply terminals being energized.**
- **Before wiring the control circuit power supply terminals, always remove the jumpers across the terminals R-R1 and across the terminals S-S1. Not doing so can cause a power supply short circuit.**
- **When using MD-AX520-5.0K and 7.0K, connecting the power supply cable to the lower terminals may break the drive unit. Do not connect the power supply cable to those terminals.**

6. Wiring of the brake resistor connection terminals P/+, PR

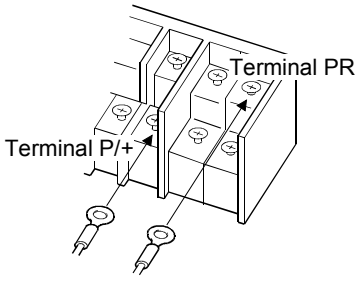
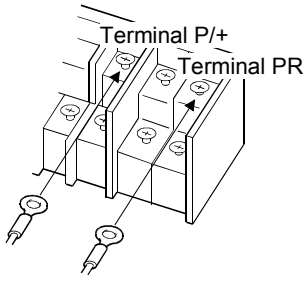
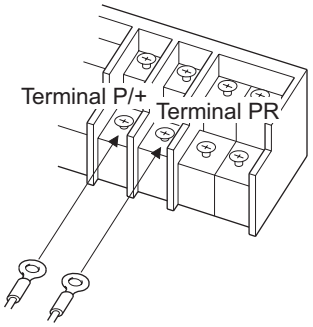
Refer to: Chapter 3 of the Specifications/Instruction Manual, 3.2.8 Wiring of the brake resistor connection terminals P/+, PR

These terminals are designed for connection of the heavy-duty brake resistor.

1) Remove the screws in the terminals PR and PX and disconnect the jumper.

MD-AX520-0.5K to 3.5K	MD-AX520-5.0K, 7.0K
	

2) Connect the brake resistor to the terminals P/+, PR.

MD-AX520-0.5K, 1.0K	MD-AX520-1.5K to 3.5K	MD-AX520-5.0K, 7.0K
		

3) Change the Pr. 30 and Pr. 70 settings.

NOTICE	● Always remove the jumper across the terminals PR-PX. ● Connect only the specified brake resistor.

7. Standard specifications

Refer to: Chapter 7 of the Specifications/Instruction Manual, 7.1.1 Standard specifications

(1) Rating specifications

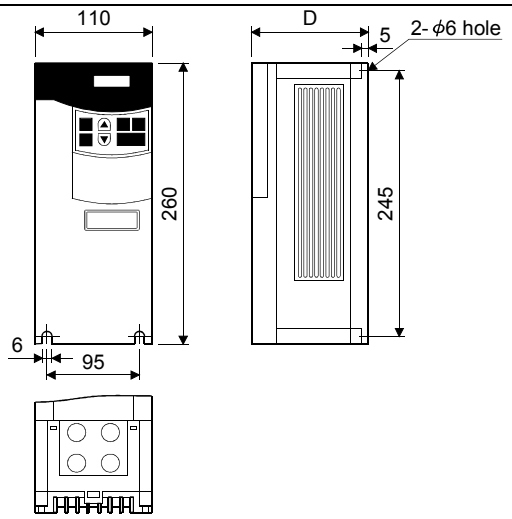
MD-AX520-□□			0.5K	1.0K	1.5K	2.0K	3.5K	5.0K	7.0K
Applicable motor capacity (kW)			0.5	1.0	1.5	2.0	3.5	5.0	7.0
Output	Overload capacity		150% 60s (inverse-time characteristics)						
	Regenerative braking torque	Max. value/time	150% 5s			100% 5s			
		Permissible duty	3%ED					2%ED	
Power supply	Rated input AC voltage		Three phase, 200V to 220V 50Hz, 200 to 230V 60Hz						
	Permissible AC voltage fluctuation		170 to 242V 50Hz, 170 to 253V 60Hz						
	Permissible frequency fluctuation		±5%						
	Power supply system capacity (kVA)		1.1	2.2	3.1	4.3	7.3	11.7	15.4
Protective structure			Enclosed type (IP20)						
Cooling system			Self-cooling		Air cooling				
Approx. weight (kg)			2.0	2.5	3.5	3.5	3.5	6.0	6.0

MEMO	● The rated output capacity and rated speed of the motor used with the drive unit assume the rated input AC voltage indicated above. They cannot be guaranteed when the power supply voltage drops. ● The overload capacity indicated in % is the ratio of the overload current to the motor's rated output. ● The power supply system capacity varies with the values of the power supply side impedances (including those of the input reactor and cables). ● The drive unit cannot run multiple motors.

8. Outline drawings

Refer to: Chapter 7 of the Specifications/Instruction Manual, 7.1.2 Outline drawings

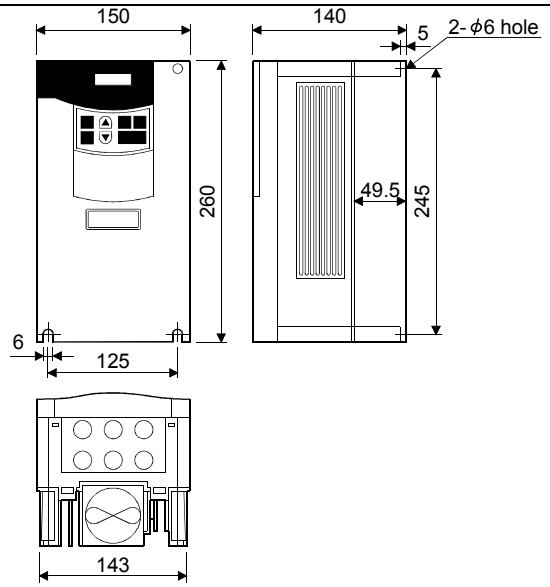
MD-AX520-0.5K, 1.0K



Drive Unit Type	D
0.5K	110
1.0K	125

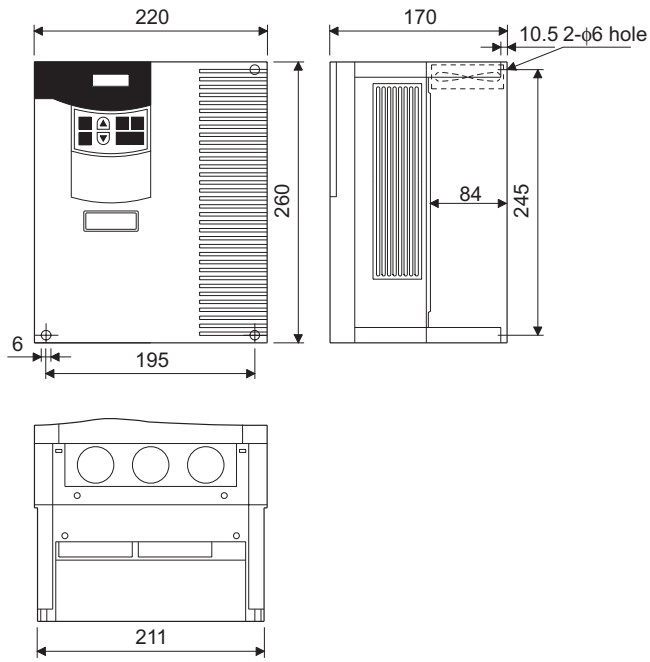
(Unit: mm)

MD-AX520-1.5K to 3.5K



(Unit: mm)

MD-AX520-5.0K, 7.0K



(Unit: mm)

9. Option list

Refer to: Chapter 7 of the Specifications/Instruction Manual, 7.1.3 Option list

	Name	Type	Applicable Capacity	Application, Specifications, Etc.
Stand-alone type	Heat sink external mounting attachment	FR-A5CN01 FR-A5CN02	1.5K to 3.5K 5.0K, 7.0K	Used to place only the heat sink section of the drive unit in the outside of the control box.
	Power factor improving DC reactor	FR-BEL-0.4K FR-BEL-0.75K FR-BEL-1.5K FR-BEL-2.2 FR-BEL-3.7K FR-BEL-5.5K FR-BEL-7.5K	0.5K 0.1K 1.5K 2.0K 3.5K 5.0K 7.0K	Used to improve the input power factor (overall power factor about 95%) and cooperate with the power supply.
	Power factor improving AC reactor	FR-BAL-0.4K FR-BAL-0.75K FR-BAL-1.5K FR-BAL-2.2K FR-BAL-3.7K FR-BAL-5.5K FR-BAL-7.5K	0.5K 1.0K 1.5K 2.0K 3.5K 5.0K 7.0K	Used to improve the input power factor (overall power factor about 90%) and cooperate with the power supply.
	High-duty brake resistor	FR-ABR-0.4K FR-ABR-0.75K FR-ABR-2.2K FR-ABR-3.7K FR-ABR-5.5K FR-ABR-7.5K	0.5K 1.0K 1.5K, 2.0K 3.5K 5.0K 7.0K	Used to improve the braking capability of the drive unit. (Permissible duty: 10%ED)
	BU brake unit	BU-1500 BU-3700 BU-7.5K BU-15K	0.5K, 1.0K 1.5K, 2.0K, 3.5K 2.0K, 3.5K, 5.0K, 7.0K 5.0K, 7.0K	Used with a discharge resistor to improve the braking capability of the drive unit.

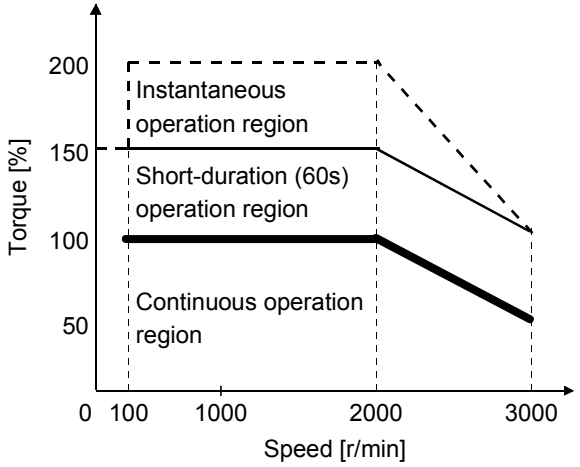
10. Motor Specifications

Refer to: Chapter 7 of the Specifications/Instruction Manual, 7.2 Motor Specifications

Item \ Motor		2000r/min Series						
		MM-CF52	MM-CF102	MM-CF152	MM-CF202	MM-CF352	MM-CF502	MM-CF702
Compatible drive unit	MD-AX520-□□□ MD-CX520-□□□	0.5K	1.0K	1.5K	2.0K	3.5K	5.0K	7.0K
Continuous characteristics (Note 1)	Rated output [kW]	0.5	1.0	1.5	2.0	3.5	5.0	7.0
	Rated torque [N•m]	2.39	4.78	7.16	9.55	16.70	23.86	33.41
Rated speed (Note 1) [r/min]		2000						
Maximum speed [r/min]		3000						
Permissible instantaneous speed [r/min]		3450						
Maximum torque [N•m]		4.78	9.56	14.32	19.09	33.41	47.73	66.82
Inertia moment J [$\times 10^{-4}$kg•m^2]		6.6	13.7	20.0	45.5	85.6	120.0	160.0
Permissible ratio of load inertia moment to motor shaft inertia moment (Note 2)		100 times max.			50 times max.			
Rated current [A]		1.81	3.70	5.22	7.70	12.50	20.5	27.0
Insulation class		Class F						
Structure		Totally closed, self-cooling (protection system: IP44 (Note 3))						
Environmental conditions (Note 4)	Ambient temperature	-10°C to +40°C (non-freezing)						
	Ambient humidity	90%RH or less (non-condensing)						
	Storage temperature	-20°C to +70°C (non-freezing)						
	Storage humidity	90%RH or less (non-condensing)						
	Ambience	Indoors (no exposure to direct sunlight), no corrosive and flammable gases, oil mist, dust and dirt.						
	Altitude	Max. 1000m above sea level						
	Vibration	X: 9.8m/s^2, Y: 24.5m/s^2						
Weight [kg]		5.1	7.2	9.3	13.0	19.0	27.0	36.0

Note 1. When the power supply voltage drops, the output and rated speed cannot be guaranteed.
2. This value assumes that the load torque is about 20% of the rated motor torque. If the load torque is larger, the permissible ratio of load inertia moment to motor shaft inertia moment is smaller. Consult Mitsubishi if the ratio of load inertia moment to motor shaft inertia moment exceeds the indicated value.
3. Except the shaft through portion.
4. When the motor is to be operated in a place where it will be exposed to oil and/or water, e.g. machine field, consult us since a motor of optional features is needed.

Torque characteristics



11. Control Parameters

Refer to: Chapter 8 of the Specifications/Instruction Manual, 8.8 Control Parameters

Do not change the settings of these parameters since they have been factory-set to the optimum values.
When changing their settings, you need to set 801 in Pr. 77.

<Control parameters>

Initial value

Pr. 80 "motor capacity"

Pr.	Setting Range	Unit	Operation
80	0.5, 1.0, 1.5, 2.0, 3.5, 5.0, 7.0	kW	Set the motor capacity. Set the same capacity as that of the drive unit.

Note: Changing the Pr. 71 or Pr. 80 changes the motor-specific control constants used in the drive unit. Note that after changing the value, you need to make a reset.

MEMO