BRAKE MOTORS

Application: Printing machinery, bookbinding machinery, food machinery, wrapping machinery, medical machinery

Induction Motors with Integrated Brakes

Brake motors incorporate an internal electromagnetic-actuated brake or spring-actuated brake without changing the dimensions of the induction motor. A compact power supply for the brake is built into the terminal box, so the brake motor can be simply connected and used. Choose from either base-mounted or flange-mounted types.

Same dimensions as induction motor
Since the brake is incorporated without changing the dimensions of the induction motor, mounting is easy.

Long service life
The large frictional surface area provides a long service life.

Built-in power supply
A small power supply is included in the product and handling is easy.

Quiet running (BMS models)
The rotating part (disc) is completely integrated into the motor shaft, so operation is quiet.

Manual release (BMS models)
The braking/holding state can be manually released using a release lever.

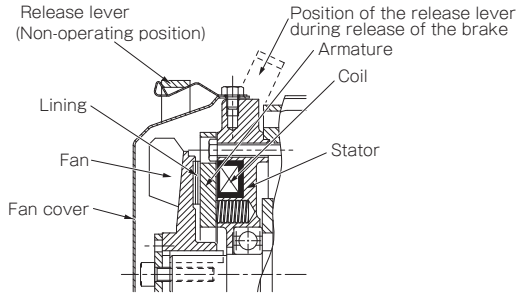
Stable rapid braking (BMM models)
Torque is transmitted by a constant-load spring, enabling stable and rapid braking.

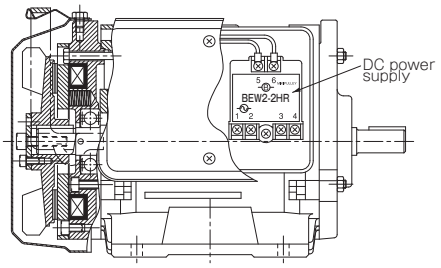
Available Models

	Model	Base-mounted	Flange-mounted	Motor output [kW]								
				0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11
Spring-actuated	BMS	●	●	●	●	●	●	—	—	—	—	—
Electromagnetic-actuated	BMM	●	●	●	●	●	●	●	●	▲	▲	▲

Structure

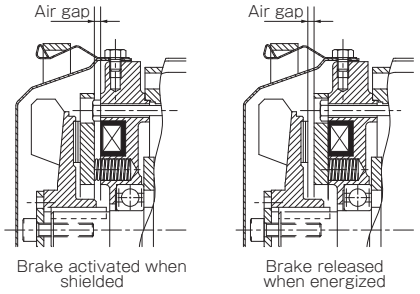
BMS Construction



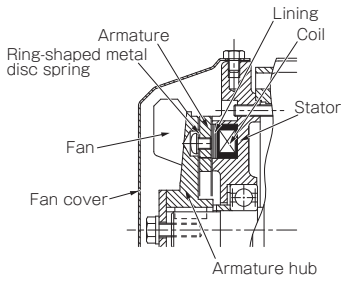


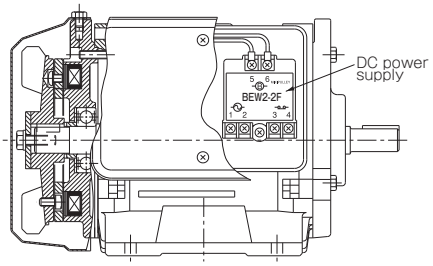
BMS Operating Principles

These brakes are spring actuated type brakes. When the power is turned on, the stator is magnetized simultaneous with the motor, and the generated attraction force pulls the armature to the stator, overcoming the pressure of the torque spring. An air gap between the disc and armature is created at that time, the brake is fully released, and the motor shaft rotates. When the current is shut off, the magnetic attraction force of the stator is extinguished, the armature is pushed back by the force of the torque spring, braking force is applied to the disc, and the motor shaft rapidly stops.



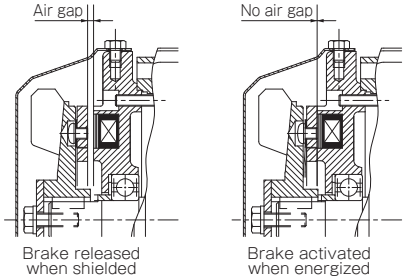
BMM Construction





BMM Operating Principles

These brakes are electromagnetic actuated type brakes. When current flows to the coil, the stator is magnetized and the armature is pulled in. Frictional force working between the lining and armature then generates the braking torque of the brake. When the current is shut off, the armature is pulled back by the ring-shaped metal disc spring located between the armature and hub, and the lining and armature are instantly released.



BMS Models Spring-actuated Brake Motors

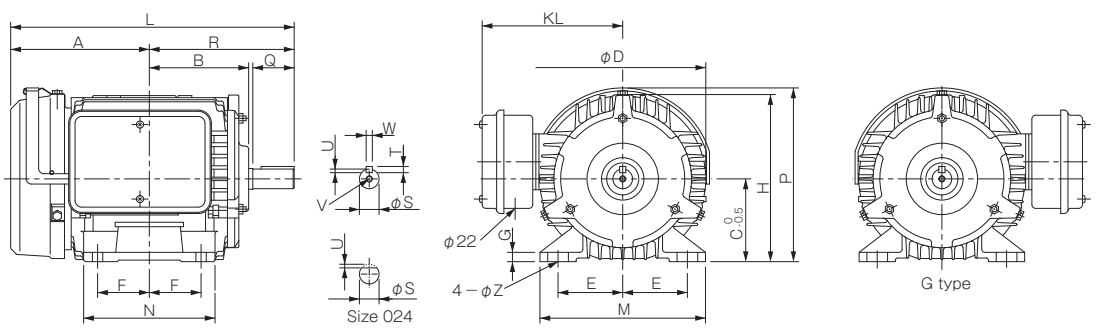
Specifications

Model	Motor		Brake								Rotating part moment of inertia J [kg·m²]	Allowable braking energy rate $P_{ba\ell}$ [W]	Total braking energy E_T [J]	Operating time			Mass [kg]
				Coil (at 20℃)					Air gap					Armature pull-in time t_a [s]	Coastdown time		
	Frame No.	Output [kW] 4-poles	Torque T [N·m]	Voltage [V]	Current [A]	Resistance [Ω]	Wattage [W]	Heat resistance class	Control value [mm]	Limit value [mm]					Simultaneous off [s]	DC off separately [s]	
BMS-024-NHBN	63	0.2	2	DC90	0.20	440	18	B	0.15 ~ 0.25	0.40	0.8×10^{-3}	18	3.5×10^{7}	0.04	0.1	0.08	7.5
BMS-024-NHFN																	8.5
BMS-044-NHB	71	0.4	4	DC90	0.28	324	25	B	0.15 ~ 0.25	0.40	1.5×10^{-3}	26.2	7.0×10^{7}	0.05	0.1	0.08	10
BMS-044-NHF																	11
BMS-074-HPB	80	0.75	8	DC90	0.33	270	30	B	0.20 ~ 0.30	0.50	4.3×10^{-3}	29.4	12.5×10^{7}	0.05	0.14	0.09	16.5
BMS-074-HPF																	19
BMS-154-HPB	90	1.5	15	DC90	0.34	261	31	B	0.20 ~ 0.30	0.60	8.1×10^{-3}	45.8	20.0×10^{7}	0.11	0.15	0.09	23
BMS-154-HPF																	26

* The induction motors are fully sealed external fan motors that conform to the JIS C4210 standard (for 0.2 kW and 0.4 kW models) or the JIS C 4213 standard (for 0.75 kW models or higher). (made by Hitachi Industrial Equipment Systems)
* The power supplies for the motors are 3-phase, 200 V AC at 50 Hz, or 200/220 V AC at 60 Hz.
* See P.381 for the allowable braking frequency of brake motors. The specific frequency varies with load conditions, so confirm it in your selection calculations.

Dimensions

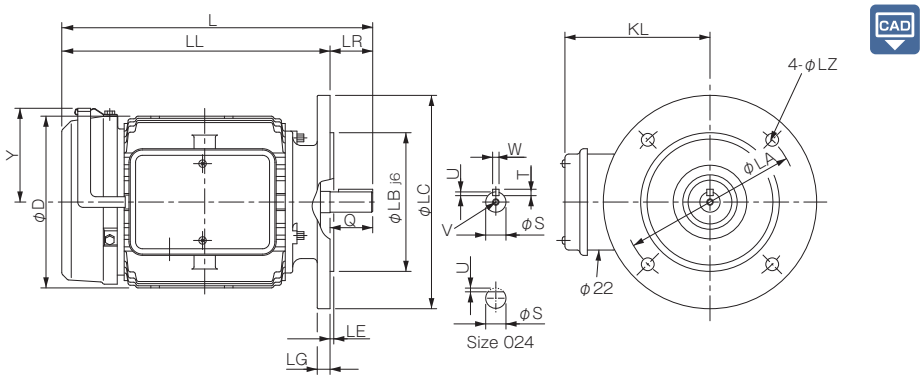
Base-mounted



Unit [mm]

Model	Dimensions of part																			
	L	R	A	B	D	KL	H	P	C	F	E	N	M	G	Z	S	W	U	T	Q	V
BMS-024-NHBN	215	103	112	79	130	115	128	134	63	40	50	100	130	3.2	7 × 21	11 h6	—	1	—	23	—
BMS-044-NHB	244	120	124	87	145	141	143.5	150	71	45	56	115	140	3.2	7 × 20	14 j6	5	3	5	30	M5 × 0.8, length: 18
BMS-074-HPB	290.5	140	150.5	97	163	148	161.5	168	80	50	62.5	125	160	3.2	10 × 25	19 j6	6	3.5	6	40	M6 × 1, length: 20
BMS-154-HPB	329	168.5	160.5	114.5	182	144	178	188	90	62.5	70	155	170	10	10	24 j6	8	4	7	50	M6 × 1, length: 20

Flange-mounted



Unit [mm]

Model	Dimensions of part																	
	L	LR	LL	D	KL	LC	Y	LB	LA	LE	LG	LZ	S	W	U	T	Q	V
BMS-024-NHFN	241	23	218	130	115	160	70	110	130	3.5	8	10	11 h6	—	1	—	23	—
BMS-044-NHF	265	30	235	145	134.5	160	79	110	130	3.5	10	10	14 j6	5	3	5	30	M5 × 0.8, length: 18
BMS-074-HPF	305	40	265	163	142	200	88	130	165	3.5	12	12	19 j6	6	3.5	6	40	M6 × 1, length: 20
BMS-154-HPF	349	50	299	176	144	200	98	130	165	3.5	12	12	24 j6	8	4	7	50	M6 × 1, length: 20

Options and Made to Order

Products with Motor Terminal Box Mounted in Reverse

Option symbol: G

The location where the brake motor is installed may make it impossible to mount the motor's terminal box in the standard location in some cases. In such cases, the mounting dimensions of the G types can be considered. Use the dimensions drawing to check the positions of the terminal boxes on G type motors.

Products with BEW2-2H Brake Rectifiers

Option symbol: 2H

By using a brake motor with an inverter or the like, the motor can be fitted with a power supply that shuts off DC separately (BEW2-2H) when fast response is needed.

List of Accessories

Brake motors come with the components listed at right.
When mounting a V pulley or the like on a brake motor output shaft, the V pulley or the like can be mounted simply on the motor shaft by concurrently using a motor shaft end face tap and the accessories listed at right.
For size 024, the motor output shaft has a flat face, so the shaft end face cannot be tapped and the accessories listed at right are not provided.

Unit [mm]

Size		024	044	074	154
Tightening collars: 1	ϕ 6.5 × ϕ 35 × 3.2t	—	○	○	○
Screw stocks: 1	M5 × 70	—	○		
	M6 × 100	—		○	○
Hexagonal nuts: 1	M5	—	○		
	M6	—		○	○

How to Place an Order

Base-mounted

0.2kW : BMS-024-NHBN-□ (Option symbols)
0.4kW : BMS-044-NHB -□ (Option symbols)
0.75kW : BMS-074-HPB -□ (Option symbols)
1.5kW : BMS-154-HPB -□ (Option symbols)

Flange-mounted

0.2kW : BMS-024-NHFN-□ (Option symbols)
0.4kW : BMS-044-NHF -□ (Option symbols)
0.75kW : BMS-074-HPF -□ (Option symbols)
1.5kW : BMS-154-HPF -□ (Option symbols)

BMM Models Electromagnetic-actuated Brake Motors

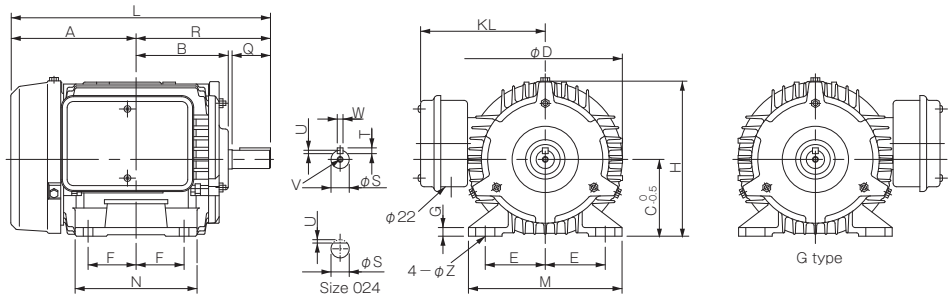
Specifications

Model	Motor		Torque T [N·m]	Brake							Rotating part moment of inertia J [kg·m²]	Allowable braking energy rate $P_{ba\ell}$ [W]	Total braking energy E_T [J]	Operating time		Mass [kg]
	Frame No.	Output [kW] 4-poles		Coil (at 20°C)				Heat resistance class	Air gap					Armature pull-in time t_a [s]	Armature release time t_{ar} [s]	
				Voltage [V]	Current [A]	Resistance [Ω]	Wattage [W]		Control value [mm]	Limit value [mm]						
BMM-024-NHBN	63	0.2	2.5	DC180	0.06	2956	11	B	0.10 ~ 0.20	0.30	0.9×10^{-3}	11	5.0×10^{7}	0.015	0.015	7
BMM-024-NHFN																8
BMM-044-NHB	71	0.4	5	DC180	0.07	2458	12.6	B	0.10 ~ 0.20	0.35	2.4×10^{-3}	26.2	7.0×10^{7}	0.030	0.030	9
BMM-044-NHF																10
BMM-074-HPB	80	0.75	10	DC180	0.089	2039	16	B	0.15 ~ 0.25	0.45	3.8×10^{-3}	32.7	17.0×10^{7}	0.040	0.040	14.5
BMM-074-HPF																16.5
BMM-154-HPB	90	1.5	20	DC180	0.123	1466	22.1	B	0.15 ~ 0.25	0.70	9.5×10^{-3}	45.8	25.0×10^{7}	0.060	0.060	22
BMM-154-HPF																25
BMM-224-HPB	100	2.2	30	DC180	0.167	1080	30	B	0.20 ~ 0.30	1.00	15.2×10^{-3}	58.9	50.0×10^{7}	0.070	0.070	32
BMM-224-HPF																37
BMM-374-HPB	112	3.7	50	DC180	0.17	1059	30.6	B	0.20 ~ 0.30	1.10	22.6×10^{-3}	73.6	75.0×10^{7}	0.070	0.080	42
BMM-374-HPF																47

* The induction motors are fully sealed external fan motors that conform to the JIS C4210 standard (for 0.2 kW and 0.4 kW models) or the JIS C 4213 standard (for 0.75 kW models or higher). (made by Hitachi Industrial Equipment Systems)
* The power supplies for the motors are 3-phase, 200 V AC at 50 Hz, or 200/220 V AC at 60 Hz.
* See P.381 for the allowable braking frequency of brake motors. The specific frequency varies with load conditions, so confirm it in your selection calculations.

Dimensions

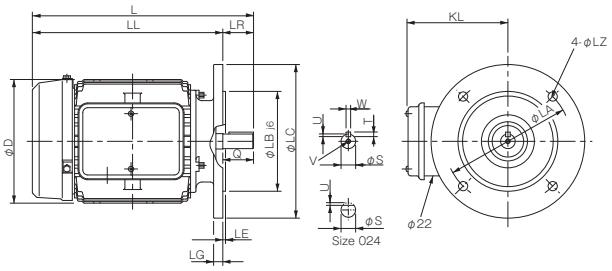
Base-mounted



Unit [mm]

Model	Dimensions of part																		
	L	R	A	B	D	KL	H	C	F	E	N	M	G	Z	S	W	U	T	Q	V
BMM-024-NHBN	215	103	112	80	130	115	128	63	40	50	100	130	3.2	7 × 21	11 h6	–	1	–	23	–
BMM-044-NHB	235.5	120	115.5	87	145	131	143.5	71	45	56	115	140	3.2	7 × 20	14 j6	5	3	5	30	M5 × 0.8, length: 18
BMM-074-HPB	280.5	140	140.5	97	163	138.5	161.5	80	50	62.5	125	160	3.2	10 × 25	19 j6	6	3.5	6	40	M6 × 1, length: 20
BMM-154-HPB	321	168.5	152.5	114.5	182	144	178	90	62.5	70	155	170	10	10	24 j6	8	4	7	50	M6 × 1, length: 20
BMM-224-HPB	368.5	193	175.5	129	198	151	197.5	100	70	80	175	195	12.5	12	28 j6	8	4	7	60	M6 × 1, length: 20
BMM-374-HPB	397	200	197	136	225	164	219.5	112	70	95	175	224	14	12	28 j6	8	4	7	60	M6 × 1, length: 20

Flange-mounted



Unit [mm]

Model	Dimensions of part																
	L	LR	LL	D	KL	LC	LB	LA	LE	LG	LZ	S	W	U	T	Q	V
BMM-024-NHFN	241	23	218	130	115	160	110	130	3.5	8	10	11 h6	–	1	–	23	–
BMM-044-NHF	256.5	30	226.5	145	124.5	160	110	130	3.5	10	10	14 j6	5	3	5	30	M5 × 0.8, length: 18
BMM-074-HPF	295	40	255	163	132	200	130	165	3.5	12	12	19 j6	6	3.5	6	40	M6 × 1, length: 20
BMM-154-HPF	341	50	291	176	144	200	130	165	3.5	12	12	24 j6	8	4	7	50	M6 × 1, length: 20
BMM-224-HPF	388.5	60	328.5	195	151	250	180	215	4.0	16	14.5	28 j6	8	4	7	60	M6 × 1, length: 20
BMM-374-HPF	422	60	362	215	164	250	180	215	4.0	16	14.5	28 j6	8	4	7	60	M6 × 1, length: 20

Optional

Made to Order

Products with Motor Terminal Box Mounted in Reverse

Option symbol: G

The location where the brake motor is installed may make it impossible to mount the motor's terminal box in the standard location in some cases. In such cases, the mounting dimensions of the G types can be considered.
Use the dimensions drawing to check the positions of the terminal boxes on G type motors.

Products with High Motor Output, 5.5 kW to 11 kW

We also support motors with high motor output (5.5 kW to 11 kW). Consult Miki Pulley for details.

BMM-□
└ Motor output/number of poles　554: 5.5 kW, 4-pole
754: 7.5 kW, 4-pole
1104: 11 kW, 4-pole

List of Accessories

Brake motors come with the components listed at right.
When mounting a V pulley or the like on a brake motor output shaft, the V pulley or the like can be mounted simply on the motor shaft by concurrently using a motor shaft end face tap and the accessories listed at right.
For size 024, the motor output shaft has a flat face, so the shaft end face cannot be tapped and the accessories listed at right are not provided.

Unit [mm]

Size		024	044	074	154	224	374
Tightening collars: 1	ϕ 6.5 × ϕ 35 × 3.2t	–	○	○	○	○	○
Screw stocks: 1	M5 × 70	–	○				
	M6 × 100	–		○	○	○	○
Hexagonal nuts: 1	M5	–	○				
	M6	–		○	○	○	○

How to Place an Order

Base-mounted

0.2kW : BMM-024-NHBN-□ (Option symbols)
0.4kW : BMM-044-NHB -□ (Option symbols)
0.75kW : BMM-074-HPB -□ (Option symbols)
1.5kW : BMM-154-HPB -□ (Option symbols)
2.2kW : BMM-224-HPB -□ (Option symbols)
3.7kW : BMM-374-HPB -□ (Option symbols)

Flange-mounted

0.2kW : BMM-024-NHFN-□ (Option symbols)
0.4kW : BMM-044-NHF -□ (Option symbols)
0.75kW : BMM-074-HPF -□ (Option symbols)
1.5kW : BMM-154-HPF -□ (Option symbols)
2.2kW : BMM-224-HPF -□ (Option symbols)
3.7kW : BMM-374-HPF -□ (Option symbols)

BMS/BMM Models

Selection

Study the following items, in order, to determine the final size and type.

- Operating condition settings ····· Set the application, torque, number of operations, etc.
- Consideration of torque ····· Confirm the torque using Eqs. (1) and (2).
- Provisional size and type selection ····· Provisionally select the size and type based on calculated torque values.
- Consideration of braking time ····· Provisionally select the braking time based on calculated torque values.
- Consideration of amount of energy ····· Confirm the energy amount using Eqs. (4) and (5).
- Consideration of number of braking operations ··· Confirm the number of braking operations using Eqs. (6) and (7).
- Determine size and type

Consideration of Torque

$$T_M = \frac{9550 \cdot P}{n} \ [N \cdot m] \quad \cdots\cdots (1)$$

T_M: Rated torque of motor [N•m]
P: Motor output [kW]
n: Rated rotation speed of motor [min^{-1}]

$$T_B = K \cdot T_M \ [N \cdot m] \quad \cdots\cdots (2)$$

T_B: Braking torque [N•m]
K: Safety factor (1.5 to 2.0)

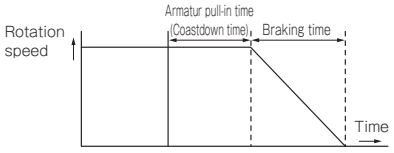
Consideration of Braking Time

The braking time can be found for brakes using the following equation.

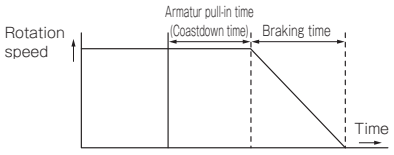
$$t_{ab} = \frac{J \cdot n}{9.55 \cdot (T \pm T_\ell)} \ [s] \quad \cdots\cdots (3)$$

t_{ab}: Braking time [s]
J: Moment of inertia of brake shaft [$kg \cdot m^2$]
n: Motor rotation speed [min^{-1}]
T: Rated torque of brake [N•m]
T_ℓ : Load torque [N•m]
(The sign of T_ℓ is positive when the load works in the direction that assists braking and negative when it works in the direction that opposes it.)

The time required from excitation of the brake coil to stopping of the load on BMM models is the braking time t_{ab} found with the preceding equation plus the armature pull-in time.



The time required from cutting off the power supply of a BMS model brake motor to stopping of the load is the braking time t_{ab} found with the above equation plus the armature release time.



When brakes are used for long periods of time, they wear, air gaps grow, and it becomes impossible to pull in the armature even when the coil is excited. If re-adjustment becomes necessary, adjust the air gap as described in the maintenance and inspection section of the operating manual.

Consideration of Amount of Energy

The braking energy rate can be found for brakes using the following equation.

$$P = \frac{J \cdot n^2}{182} \cdot \frac{T}{(T \pm T_\ell)} \cdot \frac{S}{60} \ [W] \quad \cdots\cdots (4)$$

P: Braking energy rate [W]
S: Frequency of braking (braking operations/min)

Set a frequency that results in a value P obtained in the above equation that is no greater than the allowable braking energy rate $P_{ba\ell}$.

$$P \ll P_{ba\ell} \quad \cdots\cdots (5)$$

Consideration of Number of Braking Operations

Use the following equation to find the number of operations before readjustment of the air gap of the brake.

$$E_b = \frac{J \cdot n^2}{182} \cdot \frac{T}{(T \pm T_\ell)} \ [J] \quad \cdots\cdots (6)$$

E_b: Braking energy of one braking operation [J]

$$L = \frac{E_T}{E_b} \ [\text{braking operations}] \quad \cdots\cdots (7)$$

L: Number of operations before readjustment [braking operations]
E_T: Total braking energy [J]

Items Checked for Design Purposes

Precautions for Handling

What is the best way to ensure that the design allows brake motors used in machinery and equipment to perform and function adequately? We describe here approaches to design that we feel are useful in improving machinery reliability. Consult the catalog of the motor manufacturer for information on connecting motors to machinery using V pulleys or the like.

- Design in a reasonable space on the fan cover side to allow for cooling, maintenance and inspections.
- Operating temperature range: −10℃ to 40℃ . Contact Miki Pulley if you will use the product outside this range.
- If you are using this brake motor in a winch, lift, or the like, also use a brake of a different mechanism to prevent dangerous situations. Also, if you are using a standard shutoff circuit in an elevating winch or the like, there will be a θ load during the braking delay time and an electromotive force will occur in the motor part that will prevent the brake from engaging. For that reason, be sure to use a DC shutoff or separate shutoff circuit.
- If you are mounting a phase-advancing capacitor, consult Miki Pulley.
- Brake motors have consumable components such as linings, and thus have a finite service life. Please keep spares available. Also note that if the start frequency of the brake motor exceeds the allowed value, motor parts may burn or the brake lining may be subject to abnormal wear or damage. Check that the start frequency is staying within the allowed value. Also be aware of the capacitance of contacts for DC shutoff when you are inching at a frequency that exceeds the allowable start frequency.

Allowable start frequency of brake motor

Models	Motor output [kW]	Frequency [starts/h]		Moment of inertia of load J [kg·m²]
		40%ED	60%ED	
BMS	0.2	500	400	0.00125
	0.4	900	845	0.00128
	0.75	460	430	0.0028
	1.5	370	290	0.0045
BMM	0.2	450	360	0.00125
	0.4	900	845	0.00128
	0.75	460	430	0.0028
	1.5	370	290	0.0045
	2.2	180	145	0.010
	3.7	180	145	0.015

* These values are for 4 poles and a frequency of 50 Hz using the moment of inertia J of the load from the above table as the condition. For 60 Hz, use frequencies of about 70% of the above values.
* Frequency is a total value for the motor part and brake together. Their values as stand-alones are different.
* %ED is the percentage duty cycle during repeated operation.
* The table's example of moment of inertia J of the load is virtually the same as the moment of inertia J of the motor part.
* The approximate temperature of the outer surface of the motor is 80° C to 90° C (for an ambient temperature of 40° C).

- If using an inverter or reduced-voltage starting, connect the brake or brake power supply to the power supply side of the inverter or reduced-voltage starter.
- If the wiring for the brake circuit is in the same conduit as the power lines, be sure to shield it.
- When inserting a capacitor for improving the power factor into the brake motor circuit, be sure to use a separate shutoff circuit.
- Grounding terminals are provided in or on the side of the terminal box or at the bottom of the frame. Be sure to do the grounding work. Mobile or movable machinery is covered by labor safety regulations as well. Be sure to ground it with large-gauge grounding wires to prevent accidents from shocks.
- Keep the voltage imbalance rate to 1% or less. Also keep the maximum current value for each phase to 105% or less of the nameplate current value when a voltage imbalance occurs.
- Always mount the cover on the terminal box after connections are made.
- Brake torque may vary somewhat. Break-in operation (40 to 60 brakings) is particularly advisable at initial use.
- If power goes out, be sure to turn the power switch off. Accidents can occur if the electricity comes back on unexpectedly.
- Before starting a BMS model, always check that the release lever is in the non-operating position before starting machinery operation.

Wiring

■ BMS

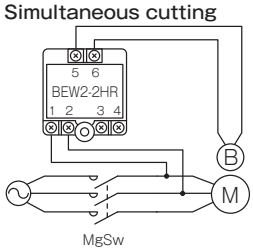
A power supply with built-in relays (BEW2-2HR) is incorporated into BMS models, so BMS models generally have a responsiveness close to that of separate DC shutoff, and are adequate for use. By concurrently using an inverter or the like, the motor can be fitted with a power supply that shuts off DC separately (BEW2-2H) when even faster response is needed. This is supported as an option. Please specify it in advance.

BEW2-2HR: Brake power supply for building into relays for BMS (built into terminal box)
MgSw: Electromagnetic switch
M: Motor
B: Brake

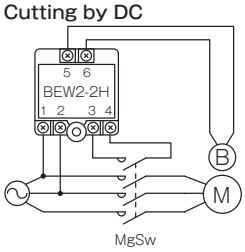
The power supply, motor terminal block, and brake are connected in advance, so the unit can be used by wiring only the U, V, and W leads of the motor.

BEW2-2H: Separate shutoff power supply for BMS
(Specify in advance when ordering a brake motor.)

Simultaneous cutting

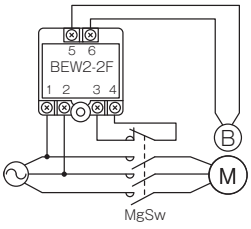


Cutting by DC



■ BMM

BEW2-2F: Brake power supply for BMM (built into terminal box)
MgSw: Electromagnetic switch
M: Motor
B: Brake
(BEW2-2F is connected in advance.)



Precautions for Use

Inspect the following items periodically.

- Is the device operating properly?
- Has water or oil penetrated the brake part?
- Has tightening of the mounting screws of all parts been completed?
- During periodic inspections, remove the motor fan cover and use compressed air to blow out wear debris created by friction to eliminate it or pull-in it up with a dust collector.
- Check whether the air gap is within its service life limit. If it is at the limit value, adjust it to the prescribed air gap stated in the operating manual.
- If the limit air gap has been exceeded, BMS models are particularly prone to the brake becoming unable to release due to malfunctioning armature pull-in, which can lead to problems such as motors burning.