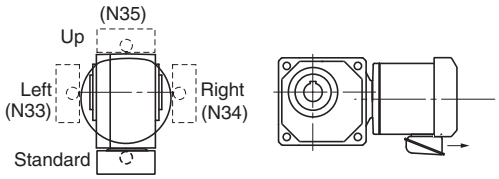
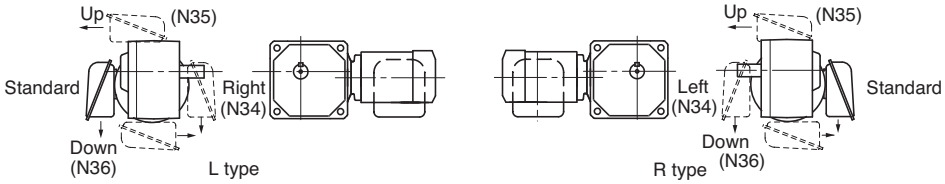
Mounting direction of a terminal box

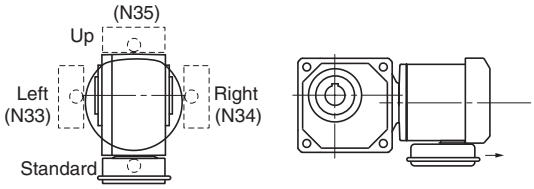
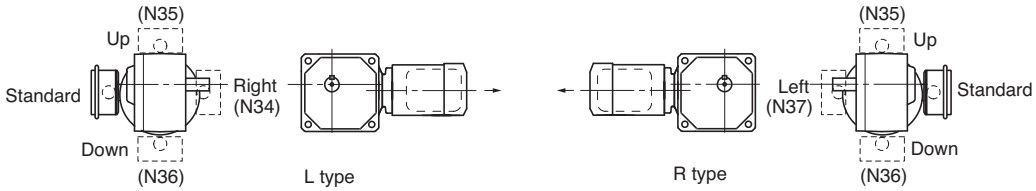
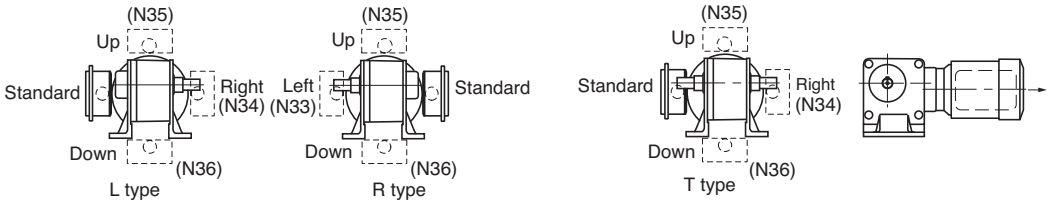
Mounting direction of a terminal box may be changed by 90˚. Specify a direction according to the Figs below. The direction must be changed by Sumitomo.
(Terminal boxes are optional for 15-90W. Refer to the outline drawings for lead wire opening direction. The direction cannot be changed after shipment.)

(1) 3-phase (Standard motors and motors for inverters)

Hollow shaft type (RNYM series)	
Solid shaft Flange mount type (RNFM series)	
Solid shaft Foot mount type (RNHM series)	

The directions indicated as above are viewed from the opposite side of motor fan cover.
Arrows indicate lead wire opening direction.

(2) Single-phase

Hollow shaft type (RNYM series)	
Solid shaft Flange mount type (RNFM series)	
Solid shaft Foot mount type (RNHM series)	

The directions indicated as above are viewed from the opposite side of motor fan cover.
Arrows indicate lead wire opening direction.

(1) Specifications

a. Brake specifications of 3-phase motors (standard)

Brake type	Output power (4 poles)	Reducer frame size	Standard torque (Nm)	Moment of inertia (1×10^{-4}kg·m^2)	Total braking energy ($\times10^7$J)	Motion delay (Sec)		Brake current (A)						
						Standard control circuit	Quick braking circuit	220V50Hz	230V50Hz	220V60Hz	380V50Hz	400V50Hz	415V50Hz	440V60Hz
SB-004	15W	01#, 03#	0.4	0.135	1.1	0.1~0.2	0.005~0.015	0.06	—	0.05	—	—	—	—
	25W	01#, 03#												
	40W	05#, 07#												
FB-003	40W	17#	0.3	1.1	1.0	0.1~0.12	0.05~0.06	0.03	—	0.04	—	—	—	—
SB-004	60W	07#	0.4	0.135	1.1	0.1~0.2	0.005~0.015	0.06	—	0.05	—	—	—	—
FB-005	60W	17#	0.5	1.2	1.0	0.1~0.12	0.05~0.06	0.03	—	0.04	—	—	—	—
	90W	15#, 17#,		1.5										
FB-01A1	90W	361#, 36#	1.0	3.6	12	0.15~0.2	0.015~0.02	0.08	0.08	0.08	0.03	0.04	0.04	0.04
FB-01A	0.1kW	—	1.0	3.6	12	0.15~0.2	0.015~0.02	0.08	0.08	0.08	Brakes are available only for 200V class. Refer to the brake current at 200V classs			
FB-02A1	0.2kW	—	2.0	5.6	12			0.1	0.1	0.1				
FB-05A1	0.25kW 0.4kW	—	4.0	6.9	12	0.1~0.15	0.01~0.015	0.1	0.1	0.1				
FB-1D	0.55kW 0.75kW	—	7.5	13	33	0.2~0.3	0.01~0.02	0.1	0.1	0.1				
FB-2D	1.1kW 1.5kW	—	15	24	38			0.3	0.3	0.3				
FB-3D	2.2kW	—	22	38	45	0.3~0.4		0.3	0.3	0.3				
FB-5B	3.0kW 3.7kW	—	37	98	235	0.4~0.5	0.01~0.02	0.6	0.6	0.6				
FB-8B	5.5kW	—	55	128	235	0.3~0.4		—	—	—	0.3	0.3	0.3	0.3
FB-10B	7.5kW	—	75	303	343	0.7~0.8	0.03~0.04	—	—	—	0.3	0.4	0.4	0.4
FB-15B	11kW	—	110	410	343	0.5~0.6		—	—	—	0.4	0.4	0.4	0.4

b. Brake specifications of 3-phase motors (water-proof)

Brake type	Output power (4 poles)	Reducer frame size	Standard torque (Nm)	Moment of inertia (1×10^{-4}kg·m^2)	Total braking energy ($\times10^7$J)	Motion delay (Sec)		Brake current (A)		
						Standard control circuit	Quick braking circuit	220V50Hz	220V60Hz	230V50Hz
SB-004	15W	01#, 03#	0.4	0.135	1.1	0.1~0.2	0.005~0.015	0.05	0.05	—
	25W	01#, 03#								
	40W	05#, 07#								
FB-003	40W	17#	0.3	1.1	1.0	0.1~0.12	0.05~0.06	0.04	0.04	—
SB-004	60W	07#	0.4	0.135	1.1	0.1~0.2	0.005~0.015	0.05	0.05	—
FB-005	60W	17#	0.5	1.2	1.0	0.1~0.12	0.05~0.06	0.04	0.04	—
	90W	15#, 17#,		1.5						

c. Brake specifications of single-phase motors (standard)

Brake type	Output power (4 poles)	Reducer frame size	Standard torque (Nm)	Moment of inertia (1×10^{-4}kg·m^2)	Total braking energy ($\times10^7$J)	Motion delay (Sec)		Quick braking circuit
						Standard control circuit	Quick braking circuit	230V50Hz
SB-004	15W	01#, 03#	0.4	0.135	1.1	0.1~0.2	0.005~0.015	—
	25W	01#, 03#						
	40W	05#, 07#						
FB-003	40W	17#	0.3	1.4	1.0	0.1~0.12	0.05~0.06	—
FB-005	60W	15#, 17#	0.5	1.2				
	90W	15#, 17#		1.5				
FB-01A1	0.1kW	—	1.0	5.6	12	0.15~0.2	0.015~0.02	0.2
FB-02A1	0.2kW	—	2.0	6.9	12			
FB-1B	0.4kW	—	4.0	13	33	0.3~0.4	0.01~0.02	0.2

d. Brake specifications of single-phase motors (water-proof)

Brake type	Output power (4 poles)	Reducer frame size	Standard torque (Nm)	Moment of inertia (1×10^{-4}kg·m^2)	Total braking energy ($\times10^7$J)	Motion delay (Sec)		Brake current (A)
						Standard control circuit	Quick braking circuit	230V50Hz
SB-004	15W	01#, 03#	0.4	0.074	1.1	0.1~0.2	0.005~0.015	—
	25W	01#, 03#						
	40W	05#, 07#						

e. Brake specifications of 3-phase motors for inverter

Brake type	Output power (4 poles)	Standard torque (Nm)	Moment of inertia (1×10^{-4}kg·m^2)	Total braking energy ($\times10^7$J)	Motion delay (Sec)		Brake Current (A)		
					Standard control circuit	Quick braking circuit	200V60Hz	380V60Hz	415V60Hz
FB-02A2	0.1kW	2.0	5.6	12	0.15~0.2	0.015~0.02	0.1	Brakes are available only for 200V class. Refer to the brake current at 200V class.	
FB-05A1	0.2kW	4.0	6.9	12	0.03~0.07	0.01~0.015	0.1		
FB-1D	0.4kW	7.5	13	33	0.1~0.15	0.01~0.02	0.1		
FB-2D	0.75kW	15	24	38			0.3		
FB-3D	1.5kW	22	38	45	0.15~0.2		0.3		
FB-5B	2.2kW	37	98	235	0.2~0.25	0.01~0.02	0.6		
FB-8B	3.7kW	55	128	235	0.1~0.15		—		
FB-10B	5.5kW	75	303	343	0.7~0.8	0.03~0.04	—		
FB-15B	7.5kW	110	410	343	0.5~0.6		—		

- Continuous time rating for Motor as well as brake.
- Non-asbestos lining is used for brake.
- Mechanical life time of brake is as long as 2 million times under normal usage conditions.
- Rectifiers of FB brake is built in the brake for 40-90W and in the terminal box for 0.1kW and above. Rectifiers of SB brake is supplied separately.
- To improve the elevating device and stopping accuracy, use the quick braking circuit.
- Low-noise type FB brake is available optionally. (FB-01A2-FB-8B)
- FB brake is direct current and spring braking type (non-electrical braking).
- The above standard torque indicates the value of dynamic friction torque.

Output power of a rectifier in 3-phase brake

Input voltage	Output voltage
AC200V	DC90V
AC220V	DC99V
AC400V	DC180V
AC440V	DC198V

Why quick braking circuit shortens braking time.

See Fig 15 and Fig 16 for differences between standard braking circuit and quick braking circuit.
See Fig 17 and Fig 18 for current curves of standard braking circuit and quick braking circuit.

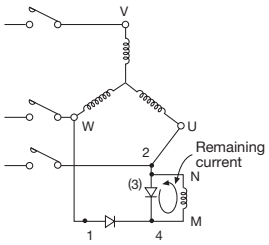


Fig. 15 standard circuit

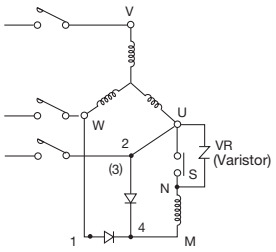


Fig. 16 quick braking circuit

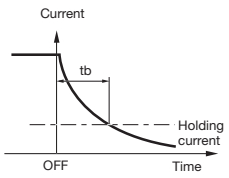


Fig. 17 current curve of standard braking circuit

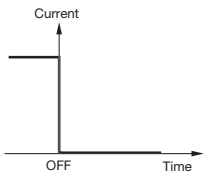
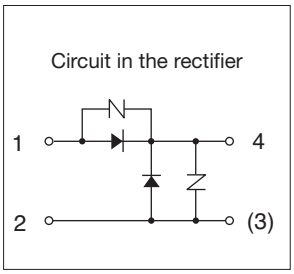


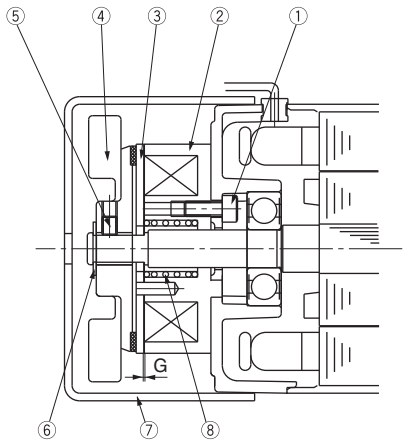
Fig. 18 current curve of quick braking circuit



In the standard circuit as Fig 15, some current remains after the power is turned off due to the saved energy in the inductance L of brake coil. The current curve is shown in the Fig. 17.
When it is connected to quick braking circuit as the Fig 16 and S is released at the same time, no current remains as there is no closed circuit with the brake coil. (See the Fig. 18.)
Therefore, it shortens the braking time by tb in the Fig 17. Quick braking circuit is to release all current by ON/OFF of brake coil at the same time with power ON/OFF.
(VR varistor must be used to protect the rectifier and connection S.)

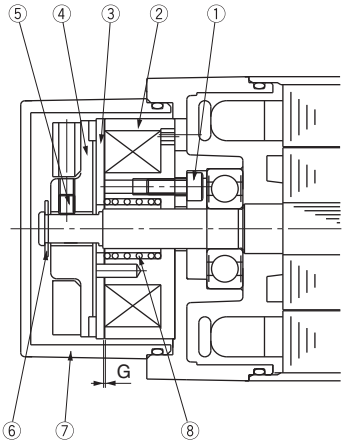
(2) Construction

Fig. 19 SB-004 (Indoor) (15W~60W×4 Poles)



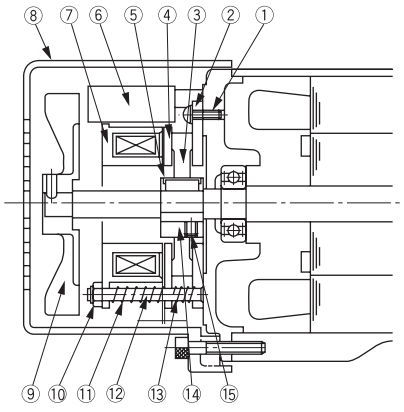
Part No.	Description	8	Set bolt
1	Assembling bolt	9	Retaining ring
2	Stationary core	10	Cover
3	Armature plate	11	Torque spring
4	Lining with fan		

Fig. 20 SB-004 (water-proof) (15W~90W×4 Poles)



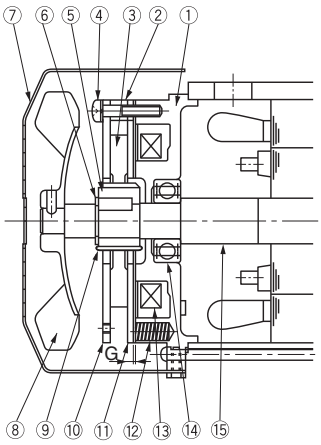
Part No.	Description	8	Set bolt
1	Assembling bolt	9	Retaining ring
2	Stationary core	10	Cover
3	Armature plate	11	Torque spring
4	Lining with fan		

Fig. 21 FB-003,005 (40W~90W×4 Poles)



Part No.	Description	8	Cover
1	Assembling bolt	9	Fan (only for single-phase 60 and 90W)
2	Stationary core	10	Gap adjusting shim
3	Brake lining	11	Torque spring
4	Armature plate	12	Stud bolt
5	Leaf spring	13	Supporting spring
6	Rectifier	14	Boss
7	Stationary core	15	Boss set bolt

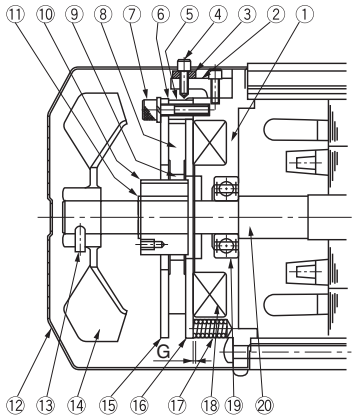
Fig. 22 FB-01A1,02A1,05A1 (0.1kW~0.4kW×4 Poles)
(FB-01A1 Without Fan)



Part No.	Description	8	Fan (except for 0.1kW ×4 poles)
1	Stationary core	9	Leaf spring
2	Spacer	10	Fixed plate
3	Brake lining	11	Armature plate
4	Assembling bolt	12	Spring
5	Boss	13	Electromagnetic coil
6	Shaft retaining C-ring	14	Ball bearing
7	Cove	15	Motor shaft

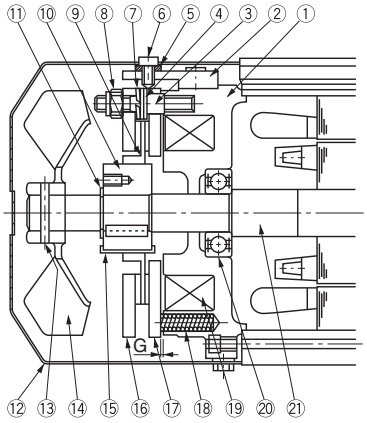
*Brake releasing unit is optionally available.

Fig.23 FB-1B,2B1,3B (0.75~2.2kW×4 poles)



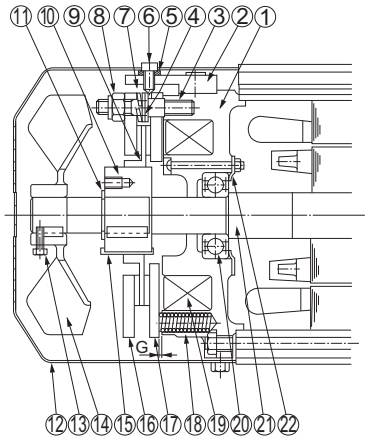
Part No.	Description		
1	Stationary core	11	Shaft retaining C-ring
2	Release fitting	12	Cover
3	Manual release protection spacer	13	Fan set bolt
4	Brake release bolt	14	Fan
5	Spacer	15	Fixed plate
6	Gap adjusting shim	16	Armature plate
7	Assembling bolt	17	Spring
8	Brake lining	18	Electromagnetic coil
9	Leaf spring	19	Ball bearing
10	Boss	20	Motor shaft

Fig. 24 FB-5B, 8B (3.0~5.5kW×4 poles)



Part No.	Description		
1	Stationary core	12	Cover
2	Release fitting	13	Spring pin
3	Stud bolt	14	Fan
4	Adjusting washer	15	Leaf spring
5	Manual release protection spacer	16	Fixed plate
6	Brake release bolt	17	Armature plate
7	Spring washer	18	Spring
8	Gap adjusting nut	19	Electromagnetic coil
9	Brake lining	20	Ball bearing
10	Boss	21	Motor shaft

Fig. 25 FB-10B, 15B (7.5~11kW×4 poles)



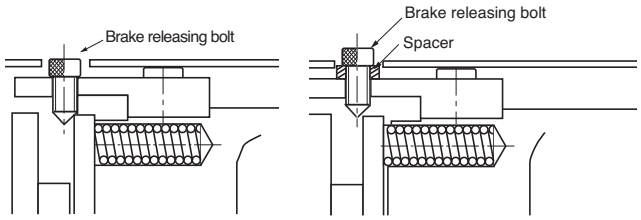
Part No.	Description		
1	Stationary core	12	Cover
2	Release fitting	13	Fan set bolt
3	Stud bolt	14	Fan
4	Adjusting washer	15	Leaf spring
5	Manual release protection spacer	16	Fixed plate
6	Brake release bolt	17	Armature plate
7	Spring washer	18	Spring
8	Gap adjusting nut	19	Electromagnetic coil
9	Brake lining	20	Ball bearing
10	Boss	21	Motor shaft
11	Shaft retaining C-ring	22	Bearing cover

Manual releasing of FB brake

To release the brake manually, follow the steps as below.

(1) Release two of the brake releasing bolts diagonally and remove the spacer. Then put back the bolts with a hexagon wrench until the brake will be released. Carefully screw the releasing bolts as the brake is being released.
(2) After the brake is released, put back the spacer in place for safety.

Note that brake releasing unit is optional for FB-01A1, FB-02A1 and FB-05A1 while it is supplied as standard specifications to FB-1B and above.

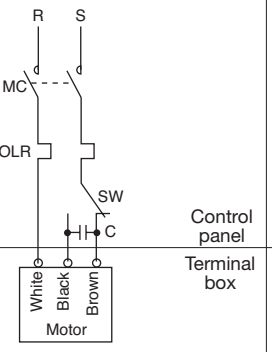
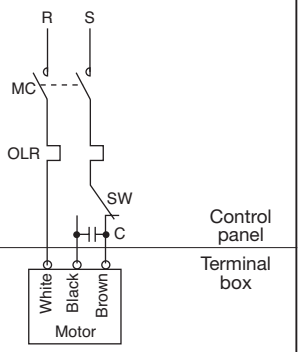


Released　　In operation

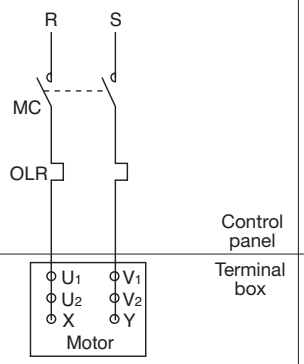
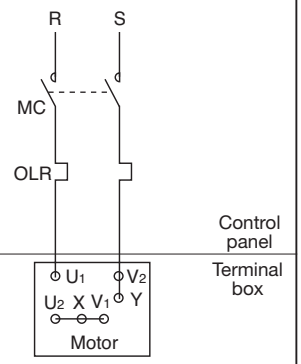
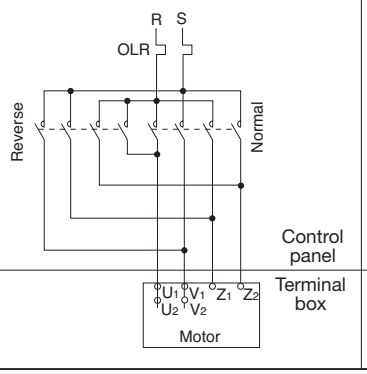
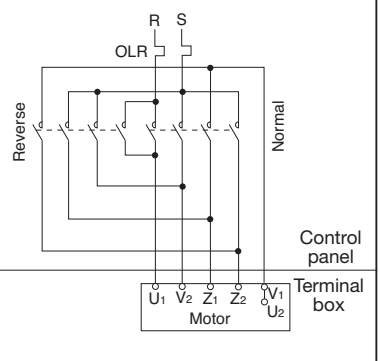
1. Single-phase motor

Wiring diagram for standard motors

15W~90W

	100V Class	200V Class
Operation in one direction		
Operating in both directions	Note 1: Turn the switch SW to change the current to the opposite direction. When instant switching is required, use a reversible motor. Note 2: Capacitor attached to the motor must be connected. (Refer to page 164 for a capacitor.)	Note 1: Turn the switch SW to change the current to the opposite direction. When instant switching is required, use reversible motor. Note 2: Capacitor attached to the motor must be connected. (Refer to page 164 for a capacitor.) Note 3: Single-phase 200V class motors for 15–90W are available by request.

0.1kW~0.4kW

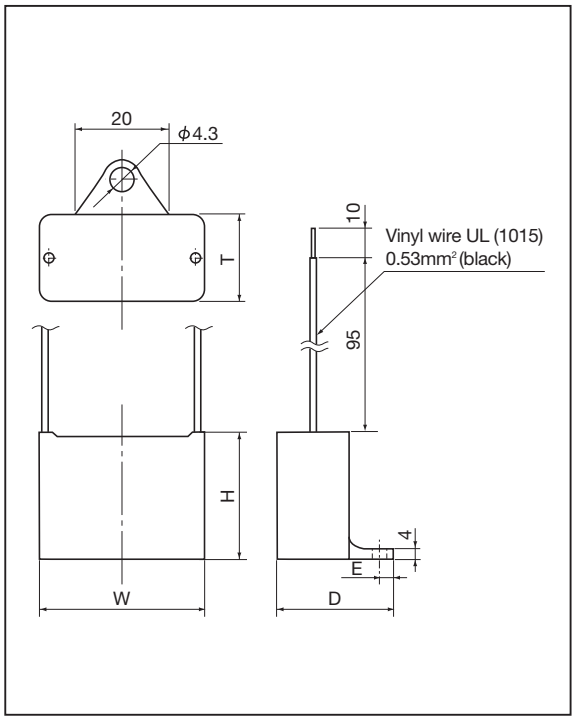
	100V Class	200V Class
Operation in one direction		
Operating in both directions		

Note: When operating in the reversed direction, exchange X and Y in the above diagrams .

MC: Electromagnetic contactor, OLR: Overload relay (thermal relay), SW: switch and C: capacitor are not supplied by Sumitomo.

Wiring diagram

Specifications and dimensions of capacitors for 15-90W single-phase motor



Motor voltage	Capacitor voltage	Motor type	Input power (W)	Frame size of reducer	Capacitor capacity (μF)	Capacitor dimension (mm)				
						W	H	T	D	E
100V	220V	Induction	15	01#,03#	5	31	27	17	27	4.5
			25	01#,03#	7	37	27	18	28	4.5
			40	05#,07#	12	48	29	19	29	4.5
			40	17#, 1240#	14	58	31	21	31	4.5
			60	17#, 1240#	18	58	31	21	31	4.5
			90	15#,17#, 1240#	25	58	37	23.5	38.5	7
		Reversible	15	01#,03#	6	37	27	18	28	4.5
			25	01#,03#	10	48	29	19	29	4.5
			40	05#,07#	14	58	31	21	31	4.5
			40	17#, 1240#	16	58	31	21	31	4.5
			60	17#, 1240#	22	58	37	23.5	38.5	7
			90	15#,17#, 1240#	32	58	41	29	44	7
200V	440V	Induction	40	17#, 1240#	3.5	58	35	22	32	4.5
			60	17#, 1240#	4.5	58	37	23.5	38.5	7
			90	15#,17#, 1240#	6.5	58	41	29	44	7
		Reversible	40	17#, 1240#	4	58	35	22	32	4.5
			60	17#, 1240#	5.5	58	37	23.5	38.5	7
			90	15#,17#	8	58	50	35	50	7

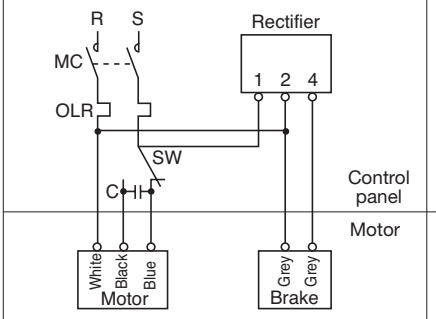
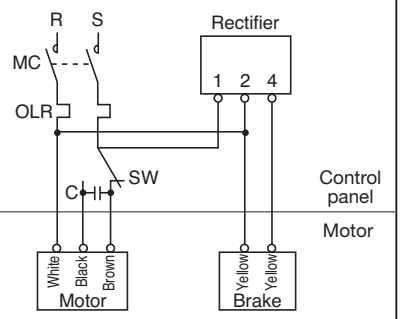
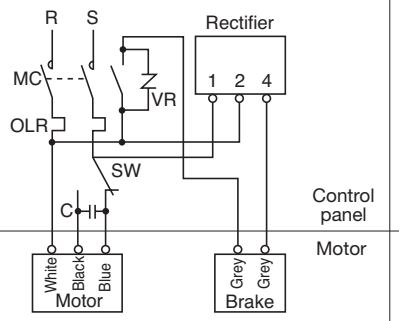
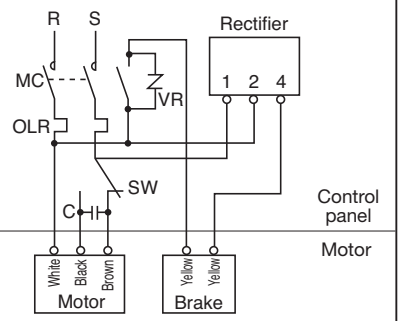
Note: Contact us for 200V motors.

2. Single-phase motor with brake

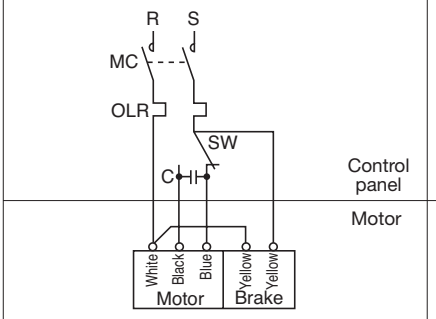
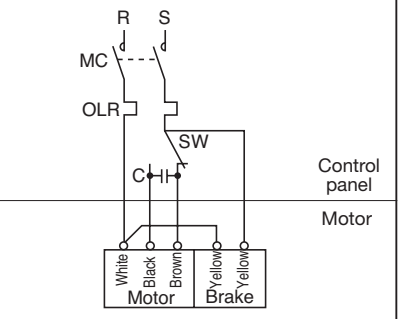
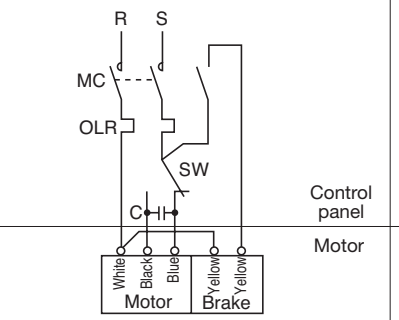
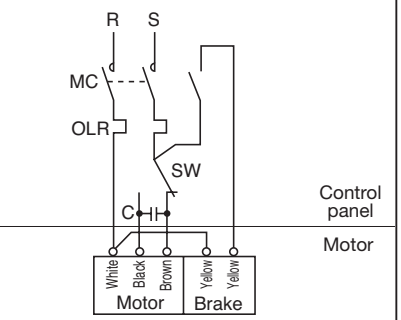
a.Connections when operating in one direction

· For the elevating device or to improve stopping accuracy, use the quick braking circuit.
· Connection capacity for quick braking circuit is recommended to have more than five times of braking capacity (direct current coil load) of the brake current.

15W~40W (SB-004)
For frame size #01, 03, 05 and 07

	100V Class	200V Class
Standard braking circuit		
Quick braking circuit		

40~90W (FB-003~FB-005)
For frame size #15 and 17

	100V Class	200V Class
Standard braking circuit		
Quick braking circuit		

Note 1: A rectifier is supplied separately for motors of 15~40W for frame size #01, 03, 05 and 07.
Note 2: A rectifier is built in the brake of motors of 40~90W for frame size #15 and 17. (FB-003~005)
Note 3: Turn the switch SW to change the current of 15~90W motors to the opposite direction. When instant switching is required, use a reversible motor.
Note 4: Contact us for motors of 40~90W 200V.

MC: Electromagnetic contactor, OLR: Overload relay (thermal relay), SW: switch, VR: varistor and C: capacitor are not supplied by Sumitomo.

Note 5: Capacitor
Use the capacitor attached to the product.

Capacity of varistor (VR)

Input power	AC100V, 200V
Rated voltage of varistor	AC260V~300V
Voltage of varistor	430V~470V
Rated capacity of motor	0.2Watt or more

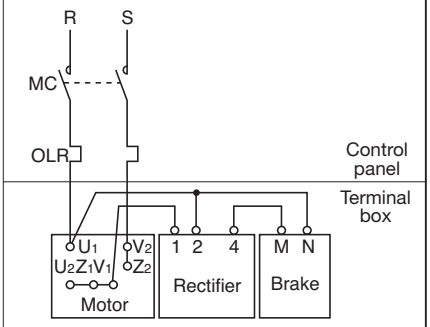
Varistor is optionally available at Sumitomo.

Wiring diagram

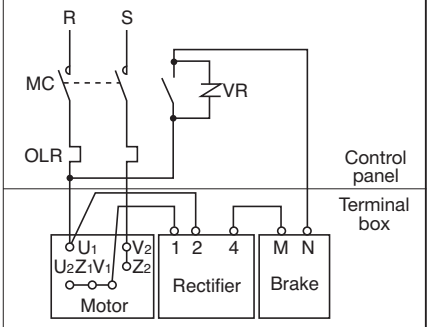
0.1kW~0.2kW (FB-01A1~FB-02A1)

200V Class

Standard braking circuit



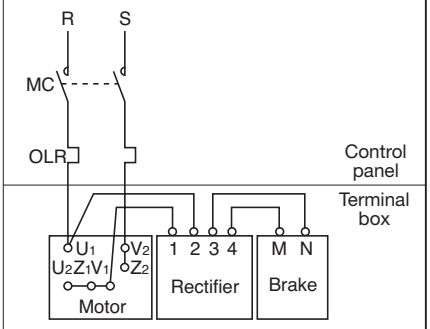
Quick braking circuit



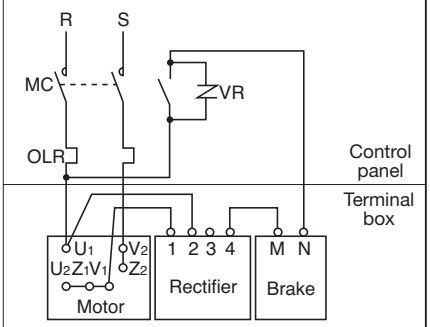
0.4kW (FB-1D)

200V Class

Standard braking circuit



Quick braking circuit



Note: When reversing 0.1~0.4kW motor, change X to Y (or Y to X) after the motor has stopped.

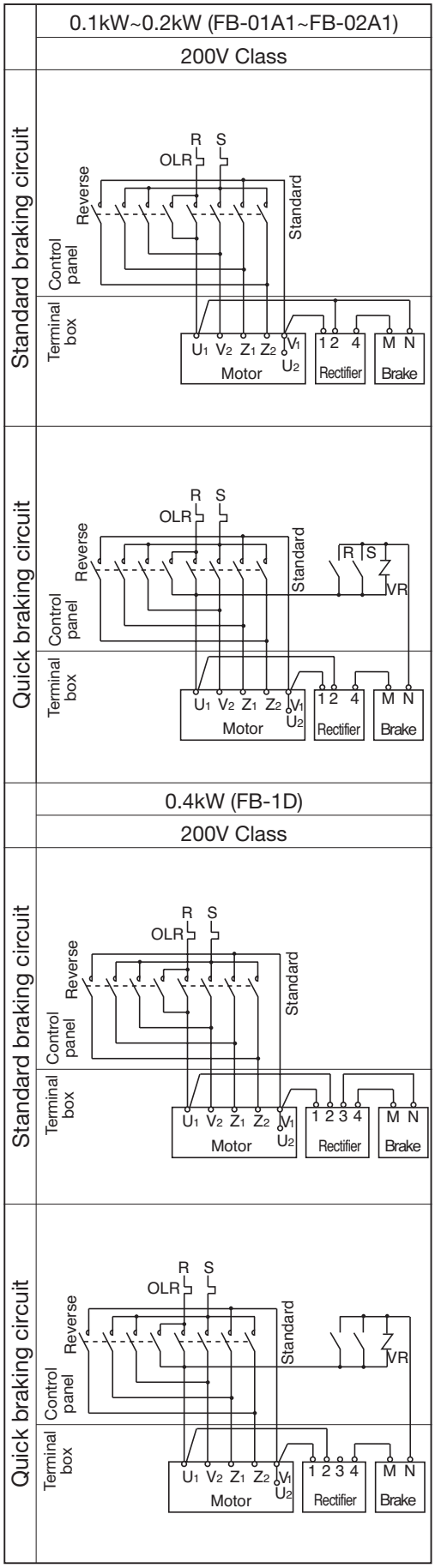
MC: Electromagnetic contactor, OLR: Overload relay (thermal relay), SW: switch and VR: varistor are not supplied by Sumitomo.

Capacity of varistor (VR)

Input power		AC100V, 200V
Rated voltage of varistor		AC260V~300V
Voltage of varistor		430V~470V
Rated capacity of varistor	FB-01A1, 02A1	0.2Watt or more
	FB-1D	0.4Watt or more

Varistor is optionally available at Sumitomo.

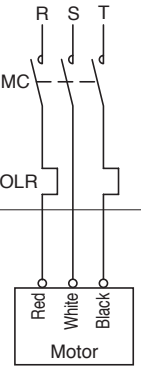
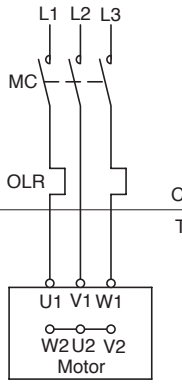
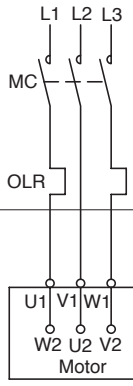
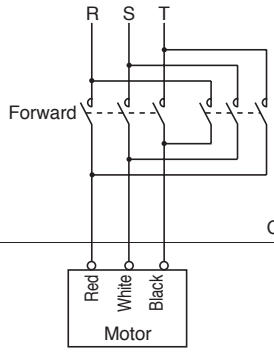
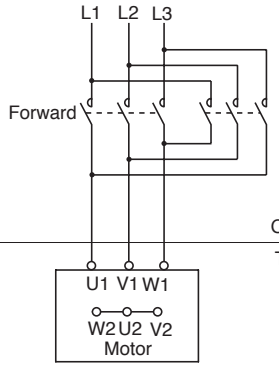
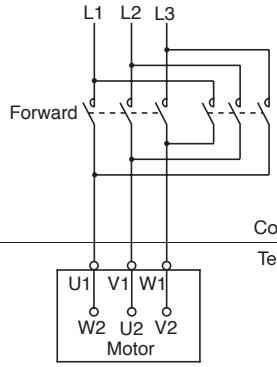
b. Connections when operating in both directions (0.1~0.4kW single-motor)



・Reversible electromagnetic contactor and OLR: Overload relay are not supplied by Sumitomo. VR: varistor is optionally available at Sumitomo.

3. 3-phase motors

Wiring diagram for standard motors

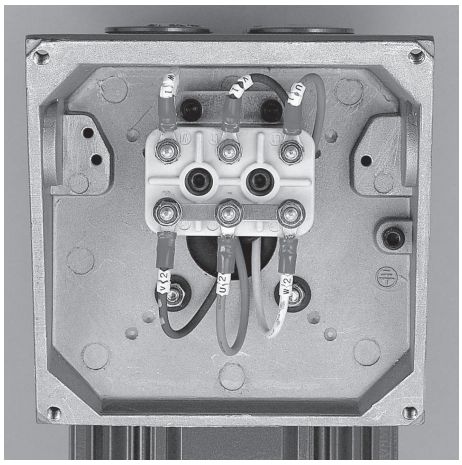
	15–90W	0.1–3.7kW 400V Class	0.1–3.7kW 200V Class 5.5kW 400V Class
Operation in one direction			
Operation in both directions			

Note:

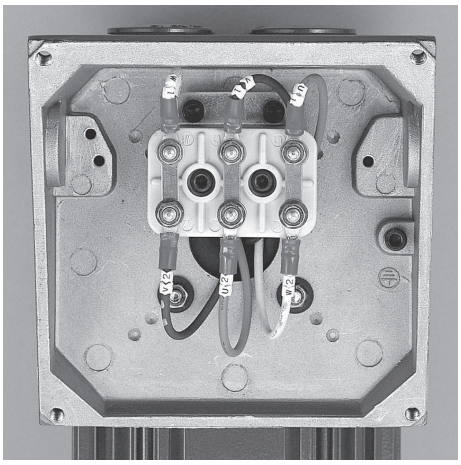
MC: Electromagnetic contactor
OLR: Overload relay or thermal relay

These should be furnished by the customer.

Example of wiring



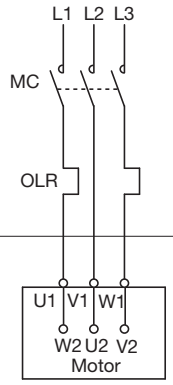
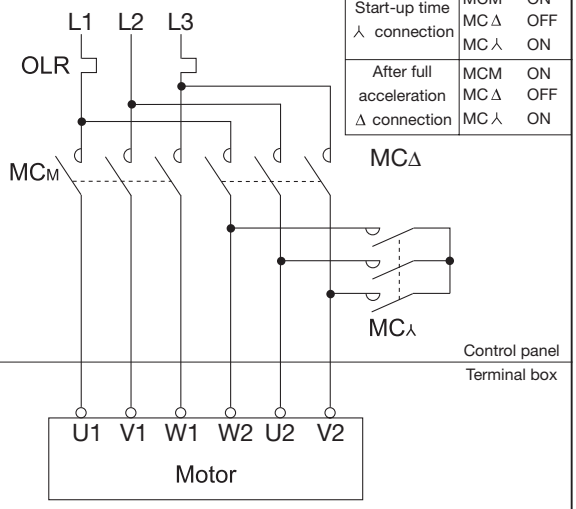
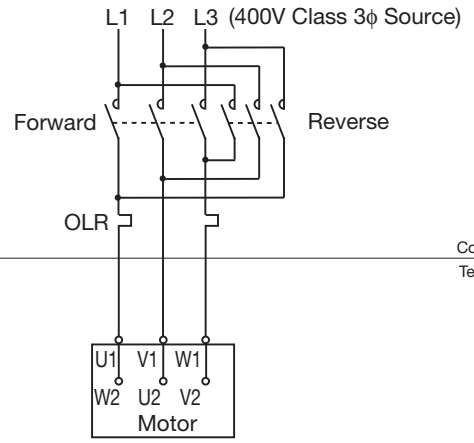
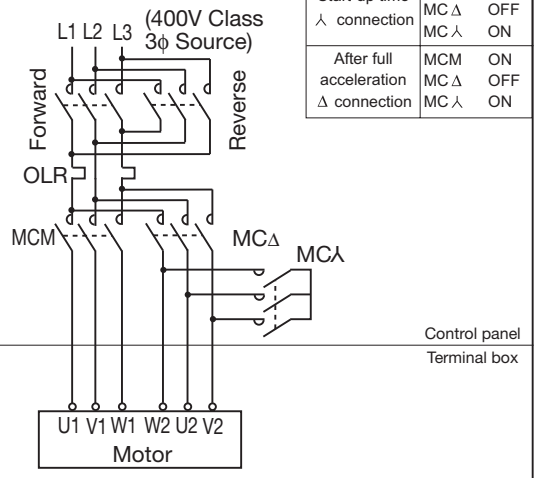
0.1–3.7kW 400V Class



0.1–3.7kW 200V Class
5.5kW 400V Class

3. 3-phase motors

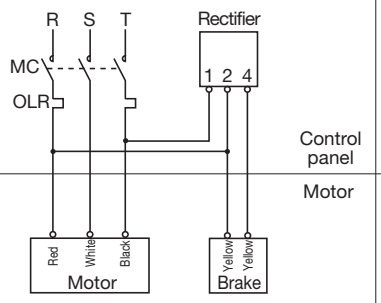
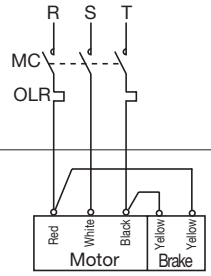
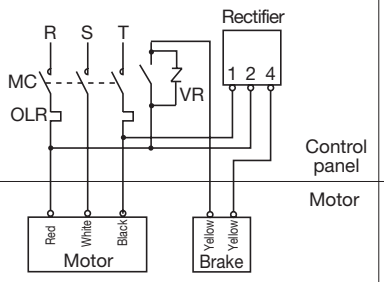
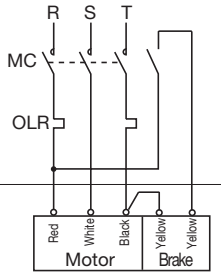
Wiring diagram for standard motors

	7.5-11kW x 4P 400V Class Direct Starting	7.5-11kW x 4P 400V Class 人-Δ Starting
Operation in one direction		 Start-up time 人 connection: MCM ON, MCΔ OFF, MC人 ON After full acceleration Δ connection: MCM ON, MCΔ OFF, MC人 ON
Operation in both directions		 Start-up time 人 connection: MCM ON, MCΔ OFF, MC人 ON After full acceleration Δ connection: MCM ON, MCΔ OFF, MC人 ON

MC: Electromagnetic contactor and
OLR: Overload relay or thermal relay are not supplied by Sumitomo.

4. 3-phase motor with brake

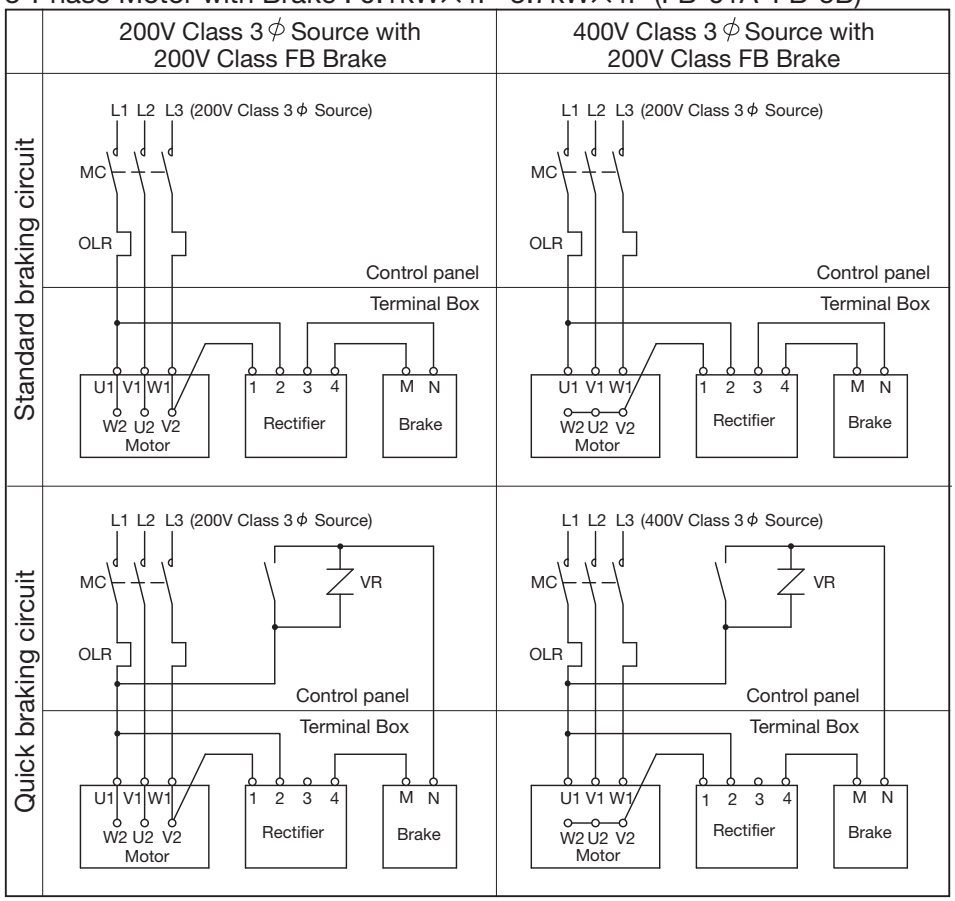
a.Connections when operating in one direction

	15~60W(SB-004) for frame size #01, 03, 05 and 07	40~90W (FB-003~FB-005) for frame size #15 and 17
Standard braking circuit		
Quick braking circuit		

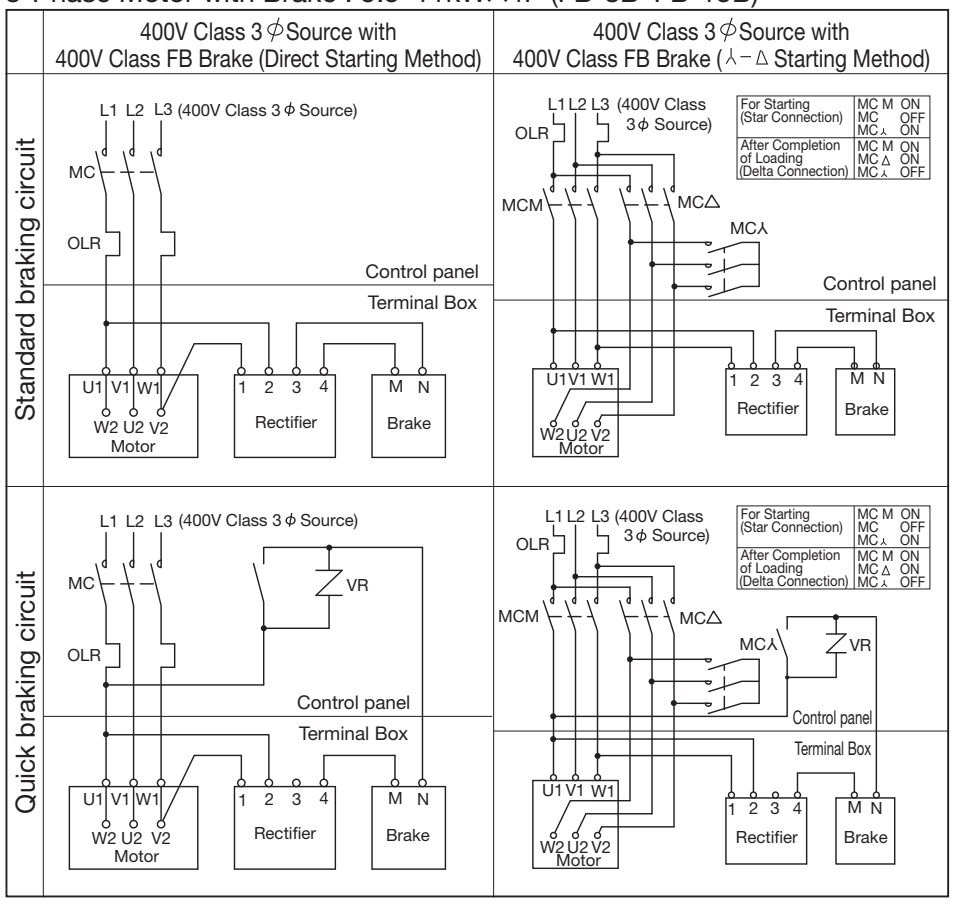
Note 1: A rectifier is supplied separately for 15~40W motors for frame size #01, 03, 05 and 07.

Note 2: A rectifier is built in the brake of 40~90W motors for frame size #15, 17 and 19.
(FB-003~005)

3-Phase Motor with Brake : 0.1kW×4P–3.7kW×4P (FB-01A–FB-5B)



3-Phase Motor with Brake : 5.5–11kW×4P (FB-8B–FB-15B)



・Electromagnetic contactor and OLR: Overload relay are not supplied by Sumitomo.

VR: varistor is optionally available at Sumitomo.

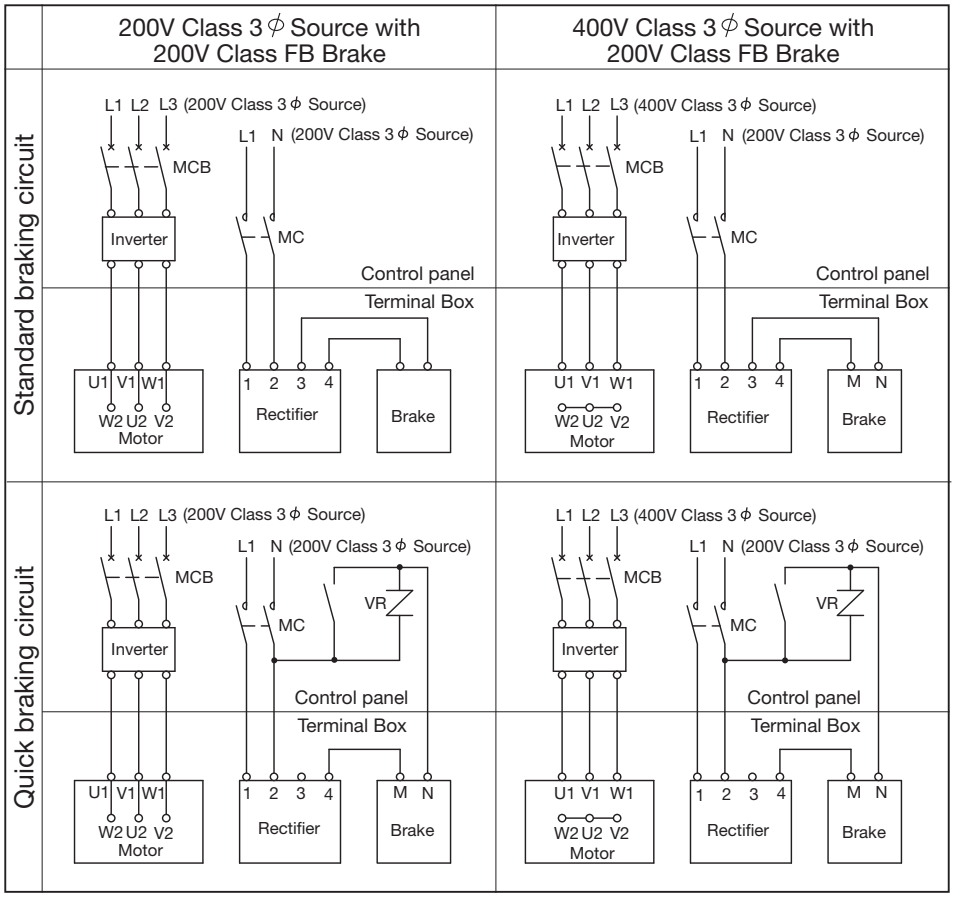
Brake input power		AC200V~230V	AC380V~460V
Rated voltage of varistor		AC260~AC300V	AC510V
Varistor voltage		430V~470V	820V
Rated capacity of varistor	FB-01A1,02A1,05A1	0.2Watt and above	0.4Watt and above
	FB-1B	0.4Watt and above	0.6Watt and above
	FB-2B,3B,5B,8B	0.6Watt and above	1.5Watt and above

・To improve the elevating device and stopping accuracy, use the quick braking circuit.

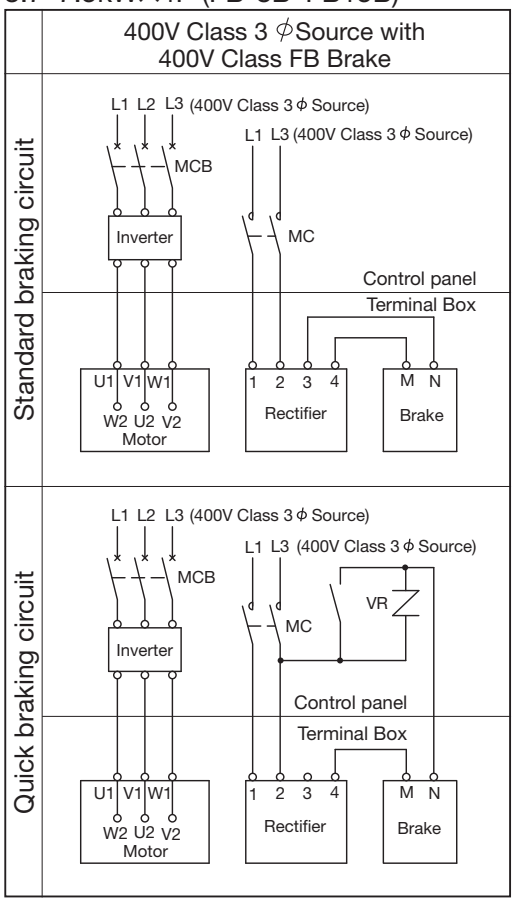
・Connection capacity of quick braking circuit is recommended to have more than five times of braking capacity (direct current coil load) of the brake current shown on the table in page 159.

b. Connections when operating a brake motor by an inverter

3-Phase Motor with Brake(Inverter Driven Connection) : 0.1kW×4P–2.2kW×4P (FB-01A–FB-5B)



3-Phase Motor with Brake (Inverter Driven Connection) :
3.7–7.5kW×4P (FB-8B–FB15B)



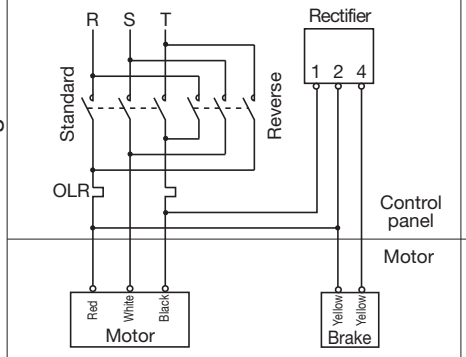
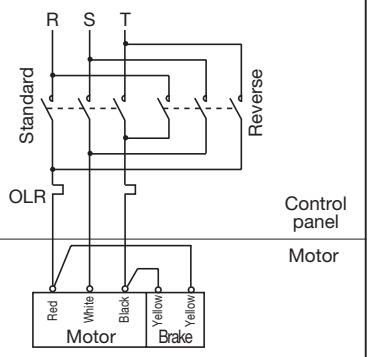
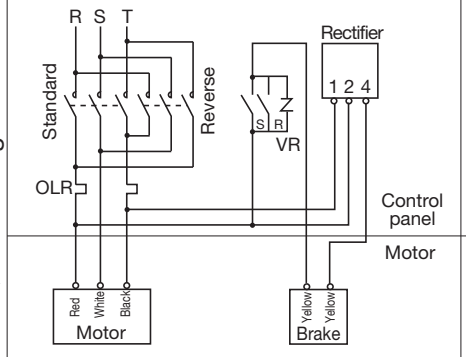
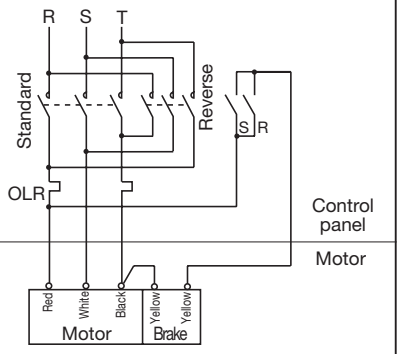
Note 1: Refer to instruction manuals and guide manual of inverter for interlocking with inverter required in MC ON/OFF.

Note 2: Connection capacity for quick braking circuit is recommended to have more than five times of braking capacity (direct current coil load) of the brake current shown on the table in page 159.

· VR: varistor is optionally available at Sumitomo.

Brake input power		AC200V~230V	AC380V~460V
Rated voltage of varistor		AC260~AC300V	AC510V
Varistor voltage		430V~470V	820V
Rated capacity of varistor	FB-01A1,02A1,05A1	0.2Watt and above	0.4Watt and above
	FB-1B	0.4Watt and above	0.6Watt and above
	FB-2B, 3B, 5B, 8B	0.6Watt and above	1.5Watt and above

c. Connections when operating in both directions

	15W-60W (SB-004) for frame size #01, 03, 05 and 07	40W-90W(FB-003, FB-005) for frame size #15 and 17
Standard braking circuit		
Quick braking circuit		

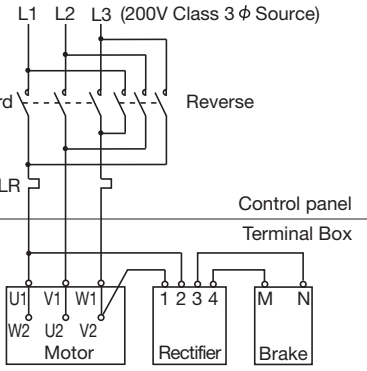
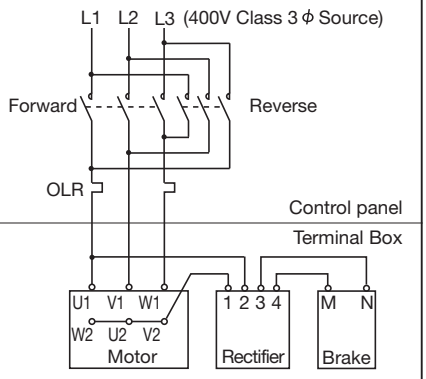
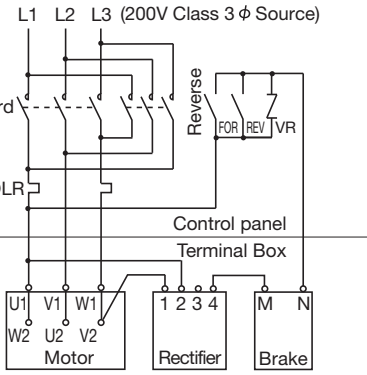
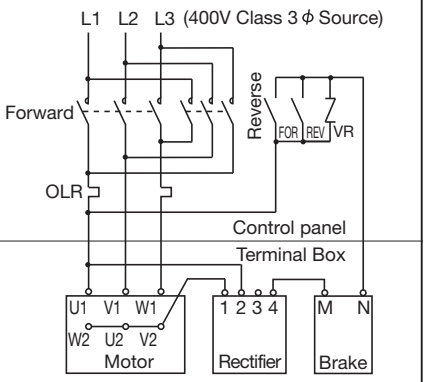
Note 1: A rectifier is supplied separately for 15W-40W (SB-004) motors for frame size #01, 03, 05 and 07.

Note 2: A rectifier is built in the brake of 40-90W motors for frame size #15 and 17 (FB-003-005)

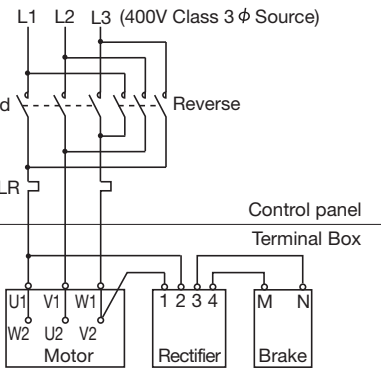
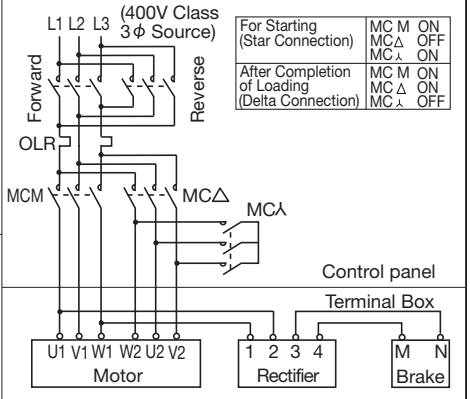
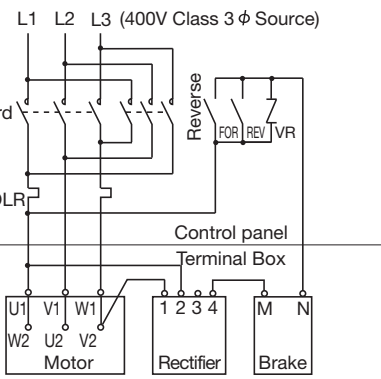
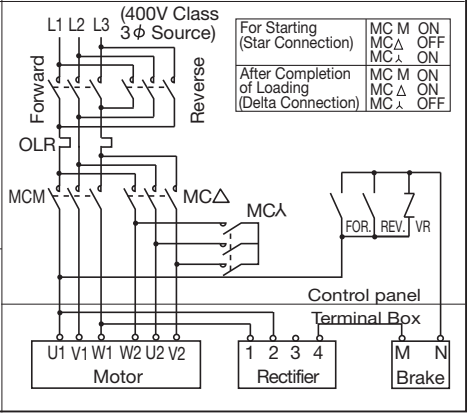
・Electromagnetic contactor and OLR: Overload relay are not supplied by Sumitomo.

VR: varistor is optionally available at Sumitomo.

3-Phase Motor with Brake : 0.1kW×4P–3.7kW×4P (FB-01A–FB-5B)
(Forward & Reverse Mode Connection)

	200V Class 3φ Source with 200V Class FB Brake	400V Class 3φ Source with 200V Class FB Brake
Standard braking circuit		
Quick braking circuit		

3-Phase Motor with Brake : 5.5–11kW×4P (FB-8B–FB-15B)
(Forward & Reverse Mode Connection)

	400V Class 3φ Source with 400V Class FB Brake (Direct Starting Method)	400V Class 3φ Source with 400V Class FB Brake (Y–Δ Starting Method)
Standard braking circuit		
Quick braking circuit		

Note 1: Refer to instruction manuals and guide manual of inverter for interlocking with inverter required in MC ON/OFF.

Note 2: Connection capacity for quick braking circuit is recommended to have more than five times of braking capacity (direct current coil load) of the brake current shown on the table in page 159.

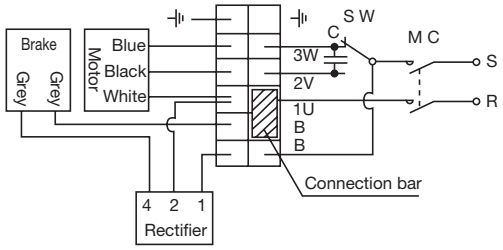
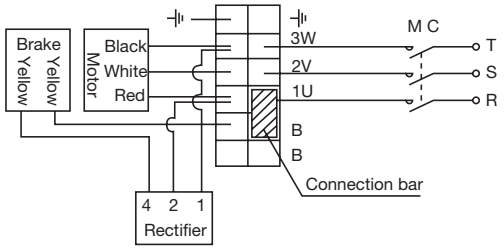
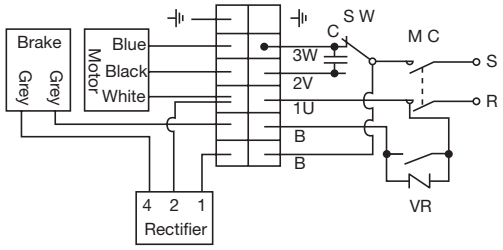
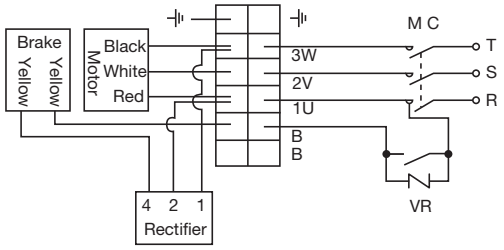
· VR: varistor is optionally available at Sumitomo.

Brake input power		AC200V~230V
Rated voltage of varistor		AC260~AC300V
Varistor voltage		430V~470V
Rated capacity of varistor	FB-01A1,02A1,05A1	0.2Watt and above
	FB-1D	0.4Watt and above
	FB-2D, 3D, 5B, 8B	0.6Watt and above

Brake input power		AC380V~460V
Rated voltage of varistor		AC510V
Varistor voltage		820V
Rated capacity of varistor	FB-01A1,02A1,05A1	0.4Watt and above
	FB-1D	0.6Watt and above
	FB-2D, 3D, 5B, 8B	1.5Watt and above

Frame size 01#,03#,05# and 07#

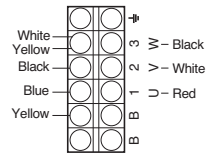
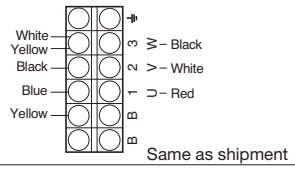
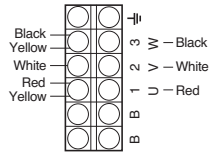
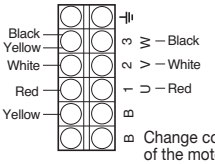
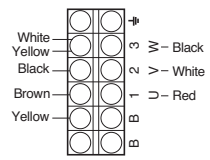
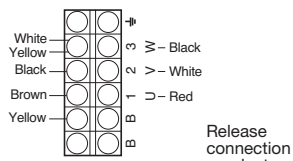
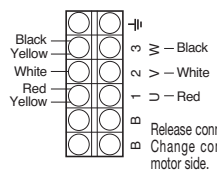
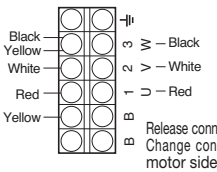
(Motor frame F-50S, F-50M, F-50L, FS-50S, FS-50M, FS-50L)

Single-phase motor 15~40W 100V Class	3-phase motor 15~60W 200V Class
Standard braking circuit	Standard braking circuit
	
Quick braking circuit	Quick braking circuit
	

Connection of terminal plate for brake motors (optional)

For frame size 15# and 17#

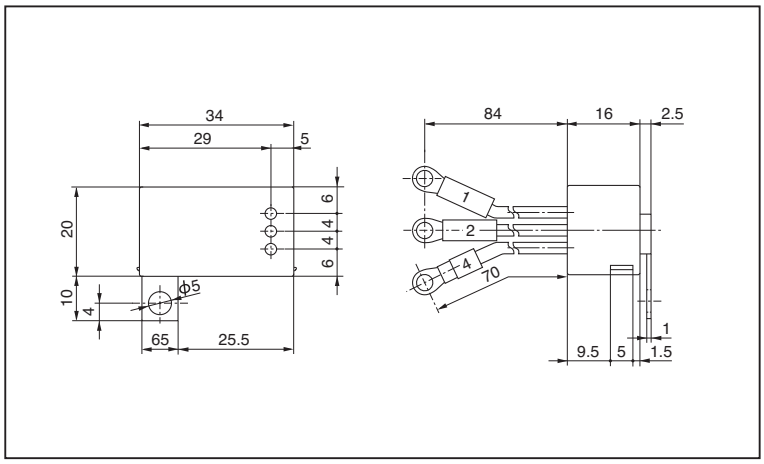
(Motor frame F-56S, F-56M, F-56L, FS-56S, FS-56M, FS-56L)

Single-phase 40W~90W 100V Class		3-phase 40W~90W 200V Class	
Standard braking (at shipment)	Quick braking	Standard braking (at shipment)	Quick braking
	 Same as shipment		 Change connections of the motor side.
Single-phase 40W~90W 200V Class		**3-phase 0.1kW~0.4kW 400V Class**	
Standard braking (at shipment)	Quick braking	Standard braking (at shipment)	Quick braking
	 Release connection conductor.	 Release connection conductor. Change connections of the motor side.	 Release connection conductor. Change connections of the motor side.

Note 1: Refer to page 163–173 for the connections shown above.
Note 2: Connect brake to primary power supply of inverter when the motor is driven by an inverter.
Note 3: Symbols and colors of lead wire are different when a motor is driven in the reversed direction (standard: clockwise rotation viewed from the fan cover.)

Dimensions of separate rectifier

(15W~60W for frame size #01, 03, 05 and 07)



No.1 Symbol form of protection of humans and solid foreign substances
No.2 Symbol form of protection against water permeation
} Classified according to combination.

Table 17 Protection Method of Motors

No.1 Symbol / No.1 Form \ No.2 Symbol / No.2 Form	0 Non-protected type	2 Drip-proof type	3 Spray-proof type	4 Splash-proof type	5 Water-jet-proof type	6 Sea-wave-proof type	7 Immersion-proof type	8 Submersible type
0 (Non-protected type)	IP00			×	×	×	×	
1 (Semi-protected type)	IP10	IP12S			×	×	×	
2 (Protected type)	IP20	IP22S	IP23S	IP24	×	×	×	
4 (Totally enclosed type)	×			IP44	IP45			
5 (Dust-proof type)	×			IP54	IP55	IP56		
6 (Complete dust-proof type)	×				IP65			

Note 1: × mark denotes difficulty in forming the combination.
Note 2: ☐ Outlined columns denote the manufacturing range of Sumitomo.
Note 3: Contact us for motors of JP45 and JP55.

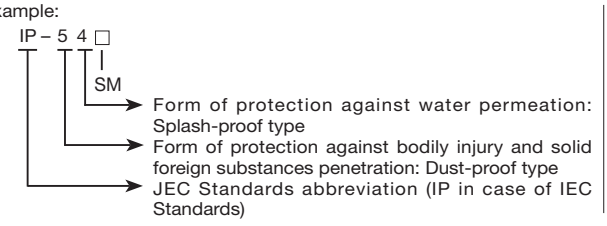
Table 18 Class of No.1 Symbol

Type	Symbol	Description
Non-protected	0	Constructed without special protection against human contact and penetration of solid foreign substances.
Semi-protected	1	Constructed to prevent inadvertent contact with rotating and conductive parts inside the machine, by hand or other critical parts of human body. Constructed to prevent penetration of solid foreign substances over 50 mm in diameter.
Protected	2	Constructed to prevent contact with rotating and conductive parts inside the machine, by hand or other critical parts of the human body. Constructed to prevent penetration by solid substances over 12mm in diameter.
Totally enclosed	4	Constructed to prevent contact with the rotating and conductive parts inside the machine, by tools, electric wires, etc., with minimum width and thickness over 1mm. Constructed to prevent penetration of solid foreign substances over 1mm diameter. However, water drainage outlet and exhaust outlet may be of Symbol 2 construction.
Dust-proof type	5	Constructed to prevent contact with rotating and conductive parts inside the machine by any form of object. Constructed for maximum protection against dust particles penetration, but will not interfere with normal operation, despite of such penetration.
Complete dust-proof type	6	Constructed for complete protection against dust particles penetration.

Table 19 Class of No.2 Symbol

Type	Symbol	Description
Non-protected	0	Constructed without special protection against water permeation.
Drip-proof	2	Constructed to prevent harmful effect from dripping water falling from within 15° direction from vertical.
Spray-proof	3	Constructed to prevent harmful effect from dripping water falling from within 60° direction from vertical.
Splash-proof	4	Constructed to prevent harmful effect from dripping water falling from any direction.
Water-jet-proof	5	Constructed to prevent harmful effect from spray from any direction.
Sea-wave-proof	6	Constructed to prevent harmful effect from strong spray from any direction.
Immersion-proof	7	Constructed for submersion into water of prescribed depth and time, but not having any harmful effect in spite of water permeation.
Submersible	8	Constructed to assure normal operations under water.

Example:



S····· Test of form of protection against water permeation, conducted when motor is stopped.
M····· Test of form of protection against water permeation, conducted while motor is operating.
When no S or M stipulated··· Test conducted when motor stopped and when operating

Cooling

Enclosure Construction	IEC Standards
Totally enclosed, non-ventilated (TENV)	IC410
Totally enclosed, fan-cooled (TEFC)	IC411

CCC Standards (China Compulsory Certification)

China had implemented the China Compulsory Certification (CCC) system since May 1, 2002 as becoming the full member of World Trade Organization (WTO). They have moved on to compulsory licensing on August 1, 2003. Motor capacity 1.1kW and below are subject to this certification, and requires CCC Mark for sales in China. Below table is our motor with CCC.

Motor	Single Phase Motor		Three Phase Motor		AF Motor	AF Motor (Foot Mount)
Capacity	15~90W	0.1~0.75kW	40~90W	0.1~1.1kW	0.1~0.75kW	0.4~0.75kW
Voltage	220V		220 or 380V			
Frequency	50Hz		50Hz			
Thermal class	Class E	Class B	Class E	Class F		
Usage	Indoor (IP44), Outdoor (IP55)		Indoor (IP44), Outdoor (IP55)			

AF motor: 3 Phase Motor for inverter

Difference with standard items
- CCC Mark as in the right is applied on the nameplate.
- Aluminum terminal box is the standard for three phase motor (except indoor specification for 40~90W).
- Terminal block type (6 terminals, European system) is the standard for three phase motor (for 0.1kW or more).
- Rotational direction is the opposite from Japanese domestic specification (in CCW direction looking from the anti-load side).
- CCC correspondence motor coil is used.

China Compulsory Certificate

Remarks
- CCC Mark is necessary when exporting small size motor (or gear motor) units of 1.1kW or below to China.
- Subject service products and spare parts without certification may be permitted for import to China by applying for exemption. Consult us for any clarification.

GOST-R Standard (Russian Gosstandard)

GOST-R Standard is a national certification system determined by State Committee of Russian Federation for Standardization and Metrology.
Any product distributed in the Russian Federation requires certification. Especially products subject to compulsory certification are not allowed to export to Russian Federation without this certification.
Sumitomo offers motors conforming to GOST-R specification for export to Russia, because motors are subject to compulsory certification.
Our Certified Motor Specification (Range other than the below is the same as CE Marking of Europe.)

Motor	General motor				Inverter motor (AF motor)			
	Without brake	With brake	Without brake	With brake	Without brake	With brake	Without brake	With brake
Capacity x 4P	0.1~3.7kW	5.5kW	0.1~3.7kW	5.5kW	0.1~2.2kW	3.7kW	0.1~2.2kW	3.7kW
Motor voltage	220/380V	380V	220/380V	380V	220/380V	380V	220/380V	380V
Brake voltage	-	-	220V	380V	-	-	220V	380V
Frequency	50Hz				60Hz			
Thermal class	F				F			
Rating	S1 (continuous)				S1 (continuous)			
Construction	Indoor (IP44), Outdoor (IP55)				Indoor (IP44), Outdoor (IP55)			
Starting	Dual voltage inline	Y−Δ	Dual voltage inline	Y−Δ	-			

AF motor: 3-Phase Motor for inverter

Difference Compared to Standard Japanese Product
- Nameplate is marked with GOST-R Mark (as shown in the right).
- Standard terminal box is made of Aluminum
- The motor has terminal block (European type with 6 terminals).
- Rotation direction is counterclockwise viewed from fan cover side (opposite from Japanese specification).
- Motor coil is certified for GOST-R.

GOST-R Mark

Cautions
- Uncertified products cannot pass through customs when exported to Russia. (No specific certification is necessary when the unit is exported to Russia as a part of the machine.)
- A verified copy of the certification is necessary when exporting the individual unit for each case (each ship). Let us know when ordering the units which are not included in an apparatus or not built into the exported aparatus.

CE MARKING

The CE mark is to be affixed to products that conform to EC directives, in order to certify the quality and safety of products and ensure free distribution of products across borders within the region of the EU (European Union).

EC directives applicable to machine products and implementation period

The following three directives apply to ordinary machine products.

EC directives \ Details	Objects	Details of directive
Machinery directive	Aggregates of parts, which are movable (Industrial machines, primarily)	Essential matters related to safety of machines are stipulated. Machines that are electrically dangerous shall fulfill the requirements for low voltage.
Low Voltage Directive	Products driven by power of 50-1,000 VAC or 75-15,000 VDC	Products not conforming to standards cannot be put on the market.
EMC Directives Electromagnetic Compatibility Directive	All types of products that may cause jamming (electromagnetic radiation) or have their functions impeded by nearby radio waves	EMI : Not to cause external electromagnetic interference EMS : To withstand external electromagnetic interference

Standard Specifications of CE Marking Motors

Input power : 15W~90W 200V 50Hz Direct start-up
0.1kW~4kW 230/400V 50Hz Dual voltage direct starting
5.5kW or more 400V 50Hz Y−Δ Start

Insulation : 15W~0.4kW Class E
0.75kW or more Class B

Rated time : Continuous

Characteristics : IEC34-1

Protection : P54 (without brake), IP44 (with brake) 15W~90W : Aluminum (M20 bolts(P1.5)×1pcs)

Terminal box : (Material) 5.5kW or less : Aluminum (PG16 bolts×2pcs or M25 bolts (P1.5)×2pcs)
7.5kW or more : cast iron (PG21 bolts×2pcs or M32 bolts (P1.5)×2pcs)
(specification) Terminal plate (six terminals European style)
with grounding terminal
Conduit tube in European size (*PG thread or M thread) *different from Japanese standard of conduit tube PF thread.
Models of 15W~90W contain M thread and cable ground (applicable lead diameter P6.0~12)

Shaft rotating direction : Rotating direction is reverse to Japanese standard direction.

Insulation : Distances between insulated surfaces and spaces in accordance with IEC standards.

External dimensions : Same as standard except for the terminal box Length might vary in some cases for models 90W or less.

TÜV test report : Acquired for a representative model 0.75kW×4p, 230V/400V (Oct 1996)
CE marking motors are manufactured in accordance with the model.

Declaration of Conformity : Declaration of Conformity is available when necessary for CE marking

Manufacturing range of CE Marking motors

3-phase induction motor

	230/400V dual voltage													
Input power symbol	0015	0025	004	006	009	01	012	018	02	03	04	05	08	1
kW×4P	(0.015)	(0.025)	(0.04)	(0.06)	(0.09)	(0.1)	0.12	0.18	(0.2)	0.25	0.37	(0.4)	0.55	0.75
Frame	F50S	F50M	F50L or F56S	F50L or F56M	F56L	V63S		V63M			V71M		V80S	V80M

	230/400V dual voltage						400V
Input power symbol	1H	2	3	4	5	6	8
kW×4P	1.1	1.5	2.2	3	(3.7)	4	5.5
Frame	V90S	V90L	V100L	V112S	V112M		V132S

· Motors of kWs without brackets ( ) in the above table are standard in Europe while motors of kWs with brackets ( ) are used only in Japan and other countries.
· European standard kW motors are recommended. Motors of kWs with brackets ( ) are also available.
3-phase 200V/50Hz, 200V/60Hz, 220V/60Hz 3-phase 400V/50Hz, 400V/60Hz, 440V/60Hz 3-phase 380V/50Hz, 3P 415V/50Hz
Contact us when motors of kW and voltage not shown in the above table are required.
· Consult us when M bolt (Metric bolt) is needed for conduit tube.

Measures to take for EC directives and CE marking related to gear motors

Among EC directives, the machinery directive (issued in January 1995) concerning induction motors and low voltage directive (issued in January 1997) are applicable.
The EMC directive (issued in January 1996) does not apply to induction motors.

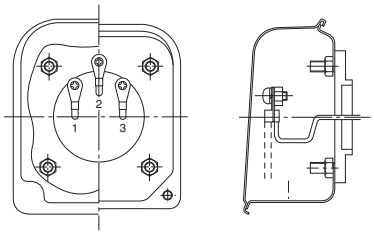
CE marking logo shown on nameplates

CE

Technical Data

UL Standards (Underwriters Laboratories)

UL Standards are established for safety by a commercial testing institute in the US to prevent harmful effect to human life, fire and disaster based on a series of scientific study, research and experiment. It is not regulated to comply with the standards by Federal Government, but it is regulated by some states or cities. Approved products by UL standards are highly appreciated in the US to represent your reliability.

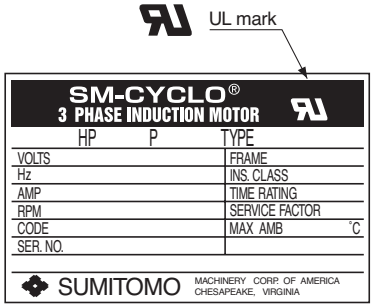


3-Phase indoor terminal box

✻1. Single-phase motor or motor w/brake is manufactured in the range of 1/50 through 1/9 HP.
✻2. Outdoor type is available. Please consult us.
✻3. F-class insulation type is available. Please consult us.
✻4. For other voltages or frequencies, please consult us.

Differences from Sumitomo standard models
- · Terminal symbol: 1,2,3
- · Name plate with UL mark and measurement in HP
- · Opposite rotating direction
- · Copper terminal box
- · UL standard motor coil and brake coil

Remarks
- · Manufacturing and repair work may be conducted only at authorized factories.
- · Motor for inverter is excluded from UL approval. Sumitomo supplies UL compliant AF motor. (UL mark is not fixed on a nameplate of UL compliant products.)



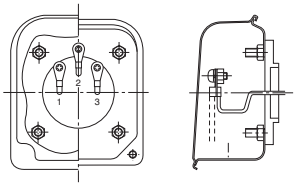
UL nameplate

CSA Standards (Canadian Standard Association)

National standards established by a semi-governmental organization in Canada. Most states in Canada require electronic products to be approved by CSA. CSA is considered equivalent in some states in the US.

Motor	3-phase induction motor	3-phase induction motor with brake	High efficiency 3-phase induction motor ✻1	High efficiency 3-phase induction motor with brake ✻1
Power	1/8~1HP×4P	1/8~1HP×4P	1.5~5HP×4P	1.5~5HP×4P
Voltage	208V, 230V, 460V, 575V		230V, 460V, 575V	
Frequency	60Hz			
Insulation	Class B (and Class F)			
Ambient conditions	Indoor type ✻2			

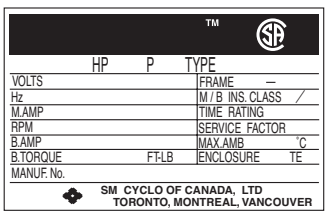
✻1: Contact us for manufacture of a single-phase motor or a high-efficiency motor with brake. ✻2: Outdoor type not supplied
✻3: Some 1/50 through 1/9HP¥4P are CUL approved products which are permitted for us in Canada.



3-Phase indoor terminal box

Differences from Sumitomo standard models
- · Terminal symbol: 1,2,3 (with Brake type, T_1, T_2, T_3)
- · The frame size of a high-efficiency motor is special.
- · Name plate with CSA mark and measurement in HP
- · Opposite rotating direction
- · Copper terminal box
- · CSA standard motor coil

Remarks
- · If exporting to Canada, it should be CSA approved motor and if above 1HP, High efficiency motor is needed.
- · Manufacturing and repair work may be conducted only at authorized factories.
- · Motor for inverter is excluded from CSA approval. Sumitomo supplies CSA compliant AF motor. (CSA mark is not fixed on a nameplate of CSA compliant products.)
  NRCan established the energy efficiency act (EEACT) in 1992 and the energy efficiency regulations (EER) in 1995, and additional regulations were applied to gear motors imported on November 27, 1999 or later. Import of gear motors that do not meet the efficiency standards has been banned. This rule applies to the following motors : 1-200HP, IEC frame 90 and larger, 600V or less, constant speed.



CSA nameplate

NEMA Standards (National Electrical Manufacturers Association)

Established by a manufacturers' association to provide standards of most electrical products for both manufacturers and consumers.

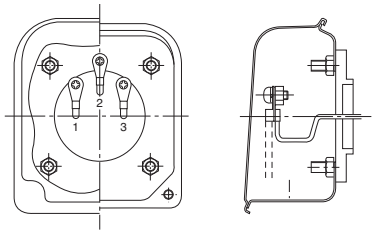
Differences from Sumitomo standard models

- · Terminal symbol: 1,2,3
- · Name plate marked with NEMA DESIGN and measurement in HP
- · Opposite rotating direction
- · Copper terminal box

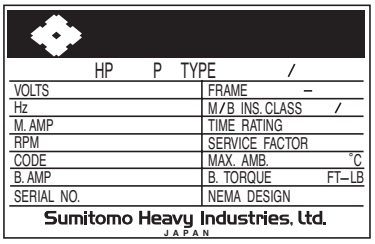
NEMA standard motor coil

Remarks

- · No approval is required to state NEMA compliance.
- · NEMA is also applicable for inverter motor, but limited to terminal symbols, measurement in HP, rotating direction and terminal box.



3-Phase indoor terminal box



NEMA nameplate

Other standards

Application of International Standards (Example)

● : Sumitomo standards
■ : Manufactured to special specification on customer's request

Country/Standards	Japan · JIS JEM JEC	International·IEC	UK · BS	Germany· VDE DIN
Standard output	●	●	■ : 4kWmax. ● : 5.5kWmin.	■ : 4kWmax. ● : 5.5kWmin.
Applicable output frame size	●	—	■	■
Motor mounting dimension of corresponding frame size	●	●	●	●
Shaft end dimension	●	●	■	■
Dimension tolerance of shaft end key and key groove	●	●	■	■
Insulation class	●	●	●	—
Lead wire code	●	●	●	●
Standard direction of rotation	●	■	■	■
Description on nameplate	●	■	■	■
Characteristic testing method	●	●	■	■
Standard voltage	200V · 220V 400V · 440V	■	415V	220V 380V
Standard frequency	50Hz · 60Hz	50Hz · 60Hz	50Hz	50Hz

IEC–International Electrotechnical Commission.
BS–British Standards.

(Note): Dimensions of flanges and shafts are suitable for Sumitomo products only. For other dimensions, consult factory.

Major Japanese Standards

(1) General rotating electrical machines
- JIS C 4004 (1992) : General rules for rotating electrical machines
- JEC-200 (1993) : Rotating machinery in general
- JEM 1188 (1969) : Rated output values of electric motors

(2) General 3-phase induction motors
- JIS C 4210 (1983) : Low-voltage 3-phase squirrel cage induction motors for general purpose
- JIS C4212 (2000) : High efficiency low-voltage 3-phase squirrel cage induction motors.
- JEC-37 (1979) : Induction machines

(3) Methods of testing and calculating characteristics
- JEC-37 (1979) : Induction machines
- JIS C 4207 (1995) :Calculating method of 3-phase induction motors characteristics

(4) Dimensions
- JEM 1400 (1991) : Dimension of low-voltage 3-phase squirrel cage induction motors for general purpose
- JEM 1401 (1991) : Dimensions of flange-mounted low-voltage 3-phase squirrel cage induction motors for general purposes

(5) Explosion-proof construction
- JIS C 0903 (1983) : Electrical apparatus for explosive atmospheres in general industries
- JIS C 0904 (1983) : Test methods on electrical apparatus for explosive gas atmospheres in general industries
- JIS C 0905 (1983) : Supplementary requirements for construction of electrical apparatus for explosive atmosphere in general industries

Recommended practices for explosion-protected electrical installations in general industries (1979)

Rules for authorization of explosion-proof construction of electrical machine tools (1981)

(6) Others
- JIS C 4003 (1977) : Classification of materials for insulation of electrical machinery and apparatus
- JEC-147 (1960) : Classification of materials for insulation of electrical machinery and apparatus
- JEM 1313 (1983) : Noise levels for low-voltage 3-phase squirrel-cage induction motors for general purpose

Remarks: JEC Japanese Electrotechnical Committee Standards
JIS Japanese Industrial Standard
JEM Japan Electrical Manufacturers' Association

1. Constant torque operation

Constant torque operation needs a special motor for the inverter. Contact us especially when operation is in the frequency range less than 6 Hz.
The sensorless operation mode of our inverter HF-320 permits constant torque operation of general-purpose motors at 3.7 kW or less.

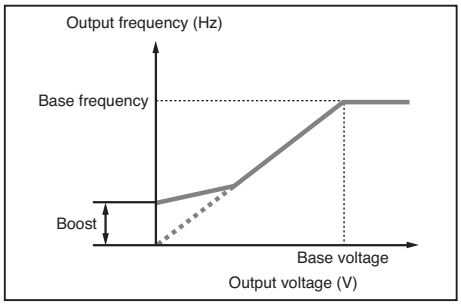
2. Operation in frequency range exceeding the base frequency (60 Hz)

Rated output operation will be carried out in the frequency range exceeding the base frequency. Therefore, the torque will decrease as the speed increases. Select an appropriate motor capacity according to the machine load characteristics. (See Fig. 25.)
The frequency exceeding 60 Hz is regarded as the base frequency. The output torque is lower than that at 60 Hz, which is the standard base frequency, also when V/f is set for constant torque operation.
When such adjustment is made, insufficient torque may result at low frequency or during start-up.
Do not change the base frequency figure for cases other than reduction load characteristics.

3. V/f mode operation of general-purpose inverter

In the case of multiple operation of motors or V/f operation with an inverter that has no sensorless function, it is necessary to adjust the boost value in compensation for the start-up torque and slow-speed torque. Standard values are usually set before shipment from manufacturer's factory but overcurrent may result depending on the load condition and acceleration/deceleration. In such a case, change values appropriately as follows :

a. In the case of a small capacity motor and a small load, a large boost setting may cause overexcitation of a motor, leading to overcurrent. In that case, lower the boost to return to a normal value.
b. In cases where a load is large and overcurrent during start-up and slow-speed operation easily causes tripping, increase the boost to lower the current value. If no improvement is observed after boost adjustment, it is necessary to examine the motor capacity.

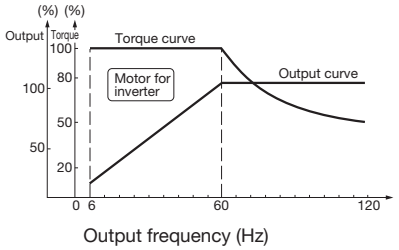


4. Operation by sensorless vector inverter

Some high-performance inverters of a newest type are equipped with a sensorless vector operation function. This function is basically valid only when a motor and an inverter are operated in one-to-one correspondence. The function does not apply to multiple operation or pole-change operation. Products to which the auto-tuning method is applied do not need adjustment as in the case of V/f operation due to automatic control of the motor characteristics. Vector operation is carried out on the basis of the motor data read by the inverter, and operation is controlled instantaneously in accordance with the load condition to continue optimal operation.
When the wiring distance between the motor and inverter becomes long (20 m or more), compensation may be necessary according to the drop in the line impedance. Select sufficiently thick cables when the wiring distance is long.

5.Output torque characteristics of motor

● Total output/torque characteristics curve when motor for inverter and SUMITOMO inverter are operated in combination



Note: Constant torque operation is possible from 1 Hz when an axial fan type is used.

● Continuous operation characteristics when a general-purpose motor is driven by an inverter

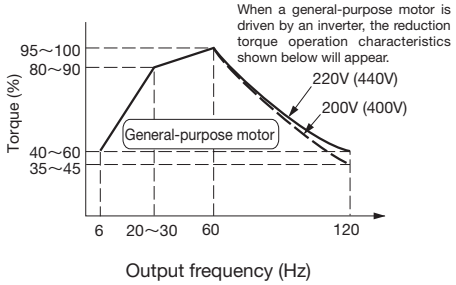


Fig. 26

6. Motor temperature rise

When a general-purpose motor is combined with an inverter for variable-speed operation, the motor temperature rise may be slightly greater than if the motor is operated by a commercial power supply.
Possible causes are shown below :

Influence of output waveform ・・・・ Unlike a commercial power supply, the output waveform of an inverter is not a complete sine wave but includes harmonics; therefore, motor damage will increase, raising the temperature slightly higher.

Decrease in motor cooling effect during slow-speed operation ・・・・・・・・・・・・・・・ A motor is cooled by its own fan. Therefore, when the motor speed is decreased by an inverter, the quantity of cooling air decreases, reducing the cooling effect.

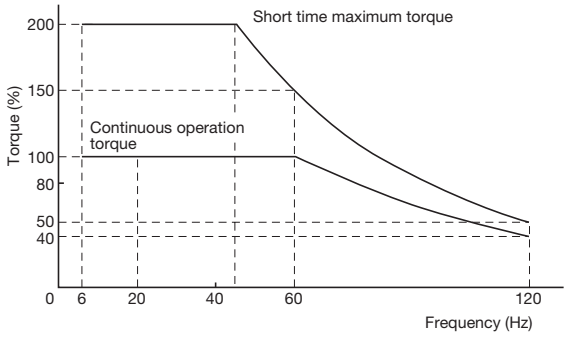
When a motor is to be operated at frequencies lower than the frequency of a commercial power supply, reduce the load torque to hold down the temperature rise or use a special motor designed for inverter operation.

Operation with the following characteristics is possible when our inverter HF-320 series is used for sensorless control in combination with our general-purpose motors (3.7 kW or less).
A combination with a motor of standard frame size can be used for constant torque operation where an inverter motor with a reducer of a larger frame size has conventionally been used.

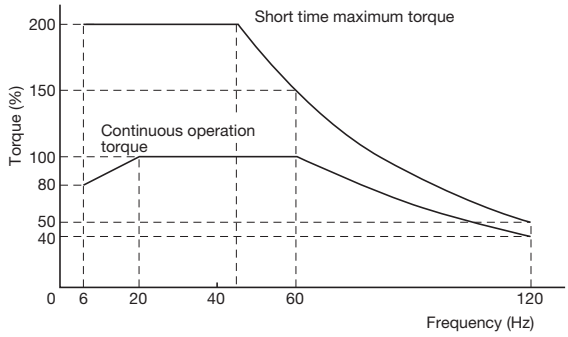
Notes : 1. Contact us for 400V class model because insulation selection is necessary for inverter operation.
2. When a motor with brakes is to be operated for a long time at slow speed, the cooling effect of the fan will decrease and the brake temperature will rise substantially.
Contact us for details.
3 Contact us for details when a general-purpose motor is to be operated under V/F control. (Contact us also when SF-320 series is to be used.)

kW	Motor frame size	Insulation	Frequency range	Series of inverter
0.1	V63S	Class F	6~120Hz (Base frequency 60HZ)	HF-320α Series
0.2	V63M			
0.4	V71M			
0.75	V80M			
1.5	V90L			
2.2	V100L			
3.7	V112M			
5.5	V132S			
7.5	F132M			HF-430 Series
11	F160M			

HF-320α & HF-430 Output Torque Characteristics during Operation in Sensorless Mode



0.2~0.4kW



0.75~11kW

● The combination-output torque presupposes that the rating is 100% when the frequency of motor power is 60 Hz.
● Consult us about motor with brake.

1. Painting Quality and color

1-1. Standard Painting Quality

Model	Treatment	Kind of painting		Additional lead time(days)	Painting specifications			Applied paint	Weather resistance	Submersible	Oil-proof	Acid resistance	Alkali resistance	Heat resistance(℃)	Application
		Classification	Paint of finish coat		Type	Layers (μm)	Quality	Brand							
15W~90W Indoor type Water-proof type 3-phase, single-phase	Cast iron : Near White blast cleaning Steel plate : Power tool cleaning	Standard	—	0	Under coating	1 (5~10)	Etching Primer	Shinto wash #20						100	Standard under coat
			Acrylic resin	0	Finish coating	1 (15~25)	Acrylic resin baking top coat	Saglan 33	◎	×	△	◇	◇	100	Standard finish coat
0.1kW~5.5kW Indoor, Outdoor type 3-phase, single-phase and for inverters	Cast iron : Near White blast cleaning Steel plate : Power tool cleaning	Standard	—	0	Under coating	1 (20~40)	Modified alkyd resin	UNIGROUND PTC PRIMER						100	Standard under coat
			Acrylic modified phtalic	0	Finish coating	1 (15~30)	Acrylic modified phtalic	SUPIKA #3000	○	×	△	◇	◇	100	Standard finish coat

◎○◇ : Appropriate
△ : Caution in selection
× : Inappropriate

1-2. Standard Painting Color

Model	Painting Color
15W~90W Indoor type 3-phase, single-phase	Gear case and motor : Warm silver Terminal box, Safety cover, Brake cover : Warm beige
0.1kW~5.5kW Indoor, Outdoor type 3-phase, single-phase and for inverters	Equivalent to Muncell 6.5PB 3.6/8.2

1-3.Painting Specifications except Standard

Treatment	Kind of painting		Additional lead time(days)	Painting specifications			Applied paint	Weather resistance	Submersible	Oil-proof	Acid resistance	Alkali resistance	Heat resistance(℃)	Application
	Classification	Paint of finish coat		Type	Layers (μm)	Quality	Brand							
Cast iron : Near White blast cleaning / Steel plate : Power tool cleaning	Standard export painting	Acrylic modified phtalic	2	Under coating	1 (30~60)	Modified alkyd resin	UNIGROUND PTC PRIMER	○	×	△	⧋	×	100	Export
				Finish coating	1 (15~30)	Acrylic modified alkyd resin	SUPIKA #3000							
	Special painting (including rust-proof and heat resisting painting) one layer of Uniground PTC Primer as the first primer	Modified epoxy	3	Under coating	1 (20~40)	Vinyl modified epoxy paint	NEO-GOSE #500 Red lead primer	◎	△	○	⧋	⧋	100	Moderate corrosive atmosphere, sea side, outdoor humid atmosphere, chemical plant area, etc.
				Finish coating	1 (30~60)	Acrylic modified alkyd resin	Acron #300							
		Long oil phtalic (synthetic resin type)	7	Under coating	2 (40~70)	Lead rust preventive paint	SSD MARINE PRIMER (rust)	○	×	×	⧋	×	100	Ocean-going vessel & boat, bridge, sea side, outdoor humid atmosphere, etc.
				Finish coating	2 (30~60)	Synthetics resin paint	PENFORTE #600							
		Chloride rubber	10	Under coating	2 (40~70)	Lead rust preventive paint	SD MARINE PRIMER (rust)	◎	△	△	○	○	80	Ocean-going vessel & boat, bridge, sea side, outdoor humid atmosphere, etc.
				Second coating	1 (20~40)	Phenol M.I.O. paint	SHINTOH M10							
				Finish coating	2 (40~70)	Chloride rubber paint	RUBBER #100							
		Phenol	7	Under coating	2 (40–70)	Lead rust preventive paint	SD MARINE PRIMER (rust)	○	×	△	○	⧋	100	In-and-out door of acid treating plant and chemical plant, etc.
				Finish coating	2 (30~60)	Phenol resin enamel	NEW AKNON							
		Heat-proof silver	7	Under coating	1 (20~40)	Lead rust preventive paint	SD MARINE PRIMER (rust)	○	×	×	×	×	120	Heating furnace (120°C), etc.
				Finish coating	1 (15~30)	Aluminum paint	SILVER TOP (heat resisting)							
	Extra rust-proof painting	Epoxy	10	Under coating	1 (50~60)	Special permeability epoxy aluminum paint	CARBOMASTIC #15	✻ ◎	◎	◎	◎	◎	150	Chemical contact area, chemical plant, anti-corrosion plant, etc.
				Finish coating	3 (30~90)	Polyamide epoxy	NEO-GOSE #200							
		Epoxy	10	Under coating	1 (50~60)	Special permeability epoxy aluminum paint	CARBOMASTIC #15	✻ ◎	◎	◎	◎	◎	150	Nuclear power plant, etc.
				Finish coating	3 (120~240)	Polyamide epoxy	NEO-GOSE #2300CW							
		Polyurethane	10	Under coating	1 (50~60)	Special permeability epoxy aluminum paint	CARBOMASTIC #15	◎	◎	◎	◎	◎	150	Nuclear power plant, etc.
				Finish coating	3 (45~90)	Polyisocianate urethane resin paint	NY POLIN K finish coat							
	Extra rust-preventive painting (sand blast undercoating)	Thick film epoxy	12		5 (250~350)	Thick film type modified epoxy resin paint	NEO-GOSE #2300 NTHB	◎	◎	◎	◎	◎	100	Submersible equipment, marine structure, etc.

Notes : 1. Additional lead time for coating refers to the number of days required for special coating compared to standard painting.
2. Coating may be substituted.
3. The coatings marked with ✻ may fade from the sun's ray.
4. Consult us when ambient temperature is above the heat resistance temperature. (The above heat resistance temperature is only for the painting and not for gear motor.)
5. Consult us when ambient temperature varies widely in a short period.

◎ ◎ ○ ⧋ : Appropriate
△ : Caution in selection
× : Inappropriate

Technical Data

2. Surface conditioning

Treatment	Surface condition after treatment	Methods	Standards	
			SSPC	SIS
Class 1 Near white blast cleaning	Surface to be completely free of mill scales, rust, corrosive substances, dirt and other foreign substances. However, solidly embedded residues (mill scales, rust, slight smears or discoloration of oxide substances) may be excepted, provided that a minimum of 95% of the surface area is visually free of any residues and the remaining area is limited to smears, stains and other minute loose particles.	Near White Blast Cleaning ●Shot blast ●Sand blast, etc.	SP-10	Sa-2 1/2
Class 2 Power tool cleaning	Except for solidly embedded mill scales, the surface shall be completely free of loose mill scales, rust, corrosive substances, oil & grease, dirt and other foreign matters. However, solidly embedded residue (mill scales, rust, slight smears or stains of oxide substances) may be excepted. If there is any porous corrosion in the surface, residual rust and coating peelings may remain in such pores, but a minimum of two-thirds of the surface shall be visually free of such residues, with the remaining area being limited to minor smears, stains and other loose minute particles.	Commercial Blast Cleaning Power Tool Cleaning ●Disk sander ●Wire wheel ●Grinder, etc.	SP-6 (SP-3)	Sa-2 (St-3)
Class 3 Hand tool cleaning	Remove the loose scale, rust, coating peelings, oil & grease and other foreign matters, with a wire brush, scrapper, etc. The surface shall have a slight metallic luster.	Hand Tool Cleaning ●Wire brush ●Scrapper, etc.	SP-2	St-2

Ref. SSPC (U.S.A. Steel Structural Painting Councils) and SIS (Sweeden, Svensk Standard, S.I.S 055900)

Rust Proof Standards

Rust proof treatment is applied to all completely assembled models, prior to shipment.

1. Standard specifications of rust proof

(1) External treatment

Rust-proof oil is applied prior to shipment. Check the condition every six months and reapply the oil if necessary.

(2) Internal treatment

Rust-proofing period	One year
Storage condition	To be stored inside the shop or warehouse, relatively free of humidity, dust, extreme variation of temperature, corrosive gas and similar atmosphere.

2. Export specifications of rust-proof

Contact us for export rust-proof when special treatment is required or goods are exported.

Warranty Period	The warranty period for the Products shall be 18 months after the commencement of delivery or 18 months after the shipment of the Products from the seller's works or 12 months from the Products coming into operation, whether comes first.
Warranty Condition	In the event that any problem or damage to the Product arises during the "Warranty Period" from defects in the Product whenever the Product is properly installed and combined with the Buyer's equipment or machines, maintained as specified in the maintenance manual, and properly operated under the conditions described in the catalog or as otherwise agree upon in writing between the Seller and the Buyer or its customers; the Seller will provide, at its sole discretion, appropriate repair or replacement of the Product, without charge, at a designated facility, except as stipulated in the "Warranty Exclusions" described below. However, if the Product is installed or integrated into the Buyer's equipment or machines, the Seller shall not reimburse the cost of: removal or re-installation of the Product or other incidental costs related thereto, any lost opportunity, any profit loss or other incidental or consequential losses or damages incurred by the Buyer or its customers.
Warranty Exclusions	Not withstanding the above warranty, the warranty as set forth herein shall not apply to any problem or damage to the Product that is caused by : 1. installation, connection, combination or integration of the Product in or to the other equipment or machine that is rendered by any person or entity other than the Seller ; 2. insufficient maintenance or improper operation by the Buyer or its customers, such that the Product is not maintained in accordance with the maintenance manual provided or designated by the Seller ; 3. improper use or operation of the Product by the Buyer or its customers that is not informed to the Seller, including, without limitation, the Buyer's or its customers' operation of the Product not in conformity with the specifications, or use of lubricating oil in the Product that is not recommended by the Seller ; 4. any problem or damage to any equipment or machine to which the Product is installed, connected or combined, or on any specifications particular to the Buyer or its customers ; 5. any changes, modifications, improvements or alterations to the Product or those functions that are rendered on the Product by any person or entity other than the Seller ; 6. any parts in the Product that are supplied or designated by the Buyer or its customers ; 7. earthquake, fire, flood, sea-breeze, gas, thunder, acts of God or any other reasons beyond the control of the Seller ; 8. normal wear and tear, or deterioration of the Product's parts, such as bearings, oil-seals ; 9. any other troubles, problems or damage to the Product that are not attributable to the Seller.

⚠ SAFETY PRECAUTIONS

● Strictly observe the safety rules for the installation place and the equipment to use. (Industrial Safety and Health Law, Technical Standard for Electric Facilities, Extension Rules, Plant Explosion Guidelines, Building Standards Law, etc.)
● Carefully read the maintenance manual before use. If the maintenance manual is not on hand, make a request for one to the distributor from which you purchased the product or to our sales department. The maintenance manual should be sent to the actual user.
● Select an appropriate product that matches the operating environment and usage.
● Install protective equipment on the machine side when the machine is used for transportation of passengers or for elevators, escalators, and dumbwaiters.
● Use an explosion-proof type motor in an explosive environment.
Select an explosion-proof type motor whose specifications is best suited to the danger zone.
● When a 400V-class inverter is used for driving the motor, mount a control filter or reactor on the inverter side or use a sufficiently insulated motor.
● When the machine is used for food processing equipment and others that are susceptible to oil, install an oil pan or other damage preventive devices in case of oil leakage or termination of service life.

Precautions for applications of special motors

● Explosion-proof motors ... When driving an explosion-proof motor, an explosion-proof verification test is necessary for a motor and an inverter in combination. The same applies to cases where existing explosion-proof motors are driven. Inverters are of a non explosion-proof type. Install them in a safe place.
● Pole change motors ... The rated current is different from that of general-purpose motors. Confirm the max. current of the motor before selecting an inverter. Make sure to stop the motor when changing the number of poles, otherwise the regenerative overvoltage protective circuit or overcurrent protective circuit will be activated, allowing the motor to run free.
● Motors with brake ... Use an independent power supply for the brake. Be sure to connect the brake power supply to the primary side of the inverter, and shut off the inverter output when the brake is activated (when the motor is stopped). Some types of brakes may produce rattling sound during slow-speed running.
● Single-phase motor ... A single-phase motor is not suitable for inverter driving. In the capacitor starting method, the harmonic current flowing through the capacitor may break the capacitor. In motors of a split-phase-start type and arepulsion-start type, the centrifugal switch inside will not be activated, possibly burning the starter coil.

When driving a 400V-class general-purpose motor by an inverter

● Contact us in cases where a standard motor is driven by an inverter. The withstand voltage of the motor may have to be taken into consideration when a high carrier frequency type (IGBT, for example) inverter that has high input voltage (400V or more) is used or when the wiring distance is long.