Changes for the Better

MITSUBISHI ELECTRIC

CNC

MELDAS AC SERVO/SPINDLE MDS-C1-SPA Series

SPECIFICATIONS MANUAL

IB-1500150A(ENG)

Introduction

Thank you for selecting the Mitsubishi numerical control unit.
This instruction manual describes the handling and caution points for using this AC servo/spindle.
Incorrect handling may lead to unforeseen accidents, so always read this instruction manual thoroughly to ensure correct usage.
Make sure that this instruction manual is delivered to the end user.
Always store this manual in a safe place.
All specifications for the MDS-C1-SPA Series are described in this manual. However, each CNC may not be provided with all specifications, so refer to the specifications for the CNC on hand before starting use.

Notes on Reading This Manual

(1) Since the description of this specification manual deals with NC in general, for the specifications of individual machine tools, refer to the manuals issued by the respective machine manufacturers. The "restrictions" and "available functions" described in the manuals issued by the machine manufacturers have precedence to those in this manual.
(2) This manual describes as many special operations as possible, but it should be kept in mind that items not mentioned in this manual cannot be performed.

Precautions for safety

Please read this manual and auxiliary documents before starting installation, operation, maintenance or inspection to ensure correct usage. Thoroughly understand the device, safety information and precautions before starting operation.

The safety precautions in this instruction manual are ranked as "WARNING" and "CAUTION".

⚠ **DANGER**	When there is a potential risk of fatal or serious injuries if handling is mistaken.
⚠ **WARNING**	When operator could be fatally or seriously injured if handling is mistaken.
⚠ **CAUTION**	When a dangerous situation may occur if handling is mistaken leading to medium or minor injuries, or physical damage.

Note that some items described as ⚠ **CAUTION** may lead to major results depending on the situation. In any case, important information that must be observed is described.

The numeric control unit is configured of the control unit, operation board, servo drive unit, spindle drive unit, power supply, servomotor and spindle motor, etc.

In this section "Precautions for safety", the following items are generically called the "motor".
- Servomotor
- Spindle motor

In this section "Precautions for safety", the following items are generically called the "unit".
- Servo drive unit
- Spindle drive unit
- Power supply unit

⚠ WARNING

1. Electric shock prevention


Do not open the front cover while the power is ON or during operation. Failure to observe this could lead to electric shocks.


Do not operate the unit with the front cover removed. The high voltage terminals and charged sections will be exposed, and can cause electric shocks.


Do not remove the front cover even when the power is OFF unless carrying out wiring work or periodic inspections. The inside of the servo drive units is charged, and can cause electric shocks.


Wait at least 15 minutes after turning the power OFF before starting wiring, maintenance or inspections. Failure to observe this could lead to electric shocks.


Ground the servo drive unit and servomotor with Class C (former class 3) grounding or higher.


Wiring, maintenance and inspection work must be done by a qualified technician.


Wire the servo drive unit and servomotor after installation. Failure to observe this could lead to electric shocks.


Do not touch the switches with wet hands. Failure to observe this could lead to electric shocks.


Do not damage, apply forcible stress, place heavy items on the cables or get them caught. Failure to observe this could lead to electric shocks.

⚠ CAUTION

1. Fire prevention


Install the servo drive units, servomotors and regenerative resistor on noncombustible material. Direct installation on combustible material or near combustible materials could lead to fires.


Shut off the power on the servo drive unit side if the servo drive unit fails. Fires could be caused if a large current continues to flow.


When using a regenerative resistor, provide a sequence that shuts off the power with the regenerative resistor's error signal. The regenerative resistor could abnormally overheat and cause a fire due to a fault in the regenerative transistor, etc.


The battery unit could heat up, ignite or rupture if submerged in water, or if the poles are incorrectly wired.

2. Injury prevention


Do not apply a voltage other than that specified in Instruction Manual on each terminal. Failure to observe this item could lead to ruptures or damage, etc.


Do not mistake the terminal connections. Failure to observe this item could lead to ruptures or damage, etc.


Do not mistake the polarity (⊕, ⊖). Failure to observe this item could lead to ruptures or damage, etc.


The servo drive unit's fins, regenerative resistor and servomotor, etc., may reach high temperatures while the power is ON, and may remain hot for some time after the power is turned OFF. Touching these parts could result in burns.

⚠ CAUTION

3. Various precautions

Observe the following precautions. Incorrect handling of the unit could lead to faults, injuries and electric shocks, etc.

(1) Transportation and installation


Correctly transport the product according to its weight.


Use the servomotor's hanging bolts only when transporting the servomotor. Do not transport the servomotor when it is installed on the machine.


Do not stack the products above the tolerable number.


Do not hold the cables, axis or detector when transporting the servomotor.


Do not hold the connected wires or cables when transporting the servo drive units.


Do not hold the front cover when transporting the servo drive units. The unit could drop.


Follow this Instruction Manual and install in a place where the weight can be borne.


Do not get on top of or place heavy objects on the unit.


Always observe the installation directions.


Secure the specified distance between the servo drive unit and control panel's inner wall, and between other devices.


Do not install or run a servo drive unit or servomotor that is damaged or missing parts.


Do not block the intake or exhaust ports of the servomotor provided with a cooling fan.


Do not let foreign objects enter the servo drive units or servomotors. In particular, if conductive objects such as screws or metal chips, etc., or combustible materials such as oil enter, rupture or breakage could occur.


The servo drive units and servomotors are precision devices, so do not drop them or apply strong impacts to them.

⚠ CAUTION

⚠ Store and use the units under the following environment conditions.

Environment	Conditions	
	Servo drive unit	**Servomotor**
Ambient temperature	0°C to +55°C (with no freezing)	0°C to +40°C (with no freezing)
Ambient humidity	90%RH or less (with no dew condensation)	80%RH or less (with no dew condensation)
Storage temperature	–15°C to +70°C	
Storage humidity	90%RH or less (with no dew condensation)	
Atmosphere	Indoors (where unit is not subject to direct sunlight), with no corrosive gas, combustible gas, oil mist, or dust	
Altitude	1,000m or less above sea level	
Vibration	4.9m/s^2 (0.5G) or less	Follows each specifications manual

⚠ Securely fix the servomotor to the machine. Insufficient fixing could lead to the servomotor slipping off during operation.

⚠ Always install the servomotor with reduction gear in the designated direction. Failure to do so could lead to oil leaks.

⚠ Structure the rotary sections of the servomotor so that it can never be touched during operation. Install a cover, etc., on the shaft.

⚠ When installing a coupling to a servomotor shaft end, do not apply an impact by hammering, etc. The detector could be damaged.

⚠ Do not apply a load exceeding the tolerable load onto the servomotor shaft. The shaft could break.

⚠ Store the motor in the package box.

⚠ When inserting the shaft into the built-in IPM motor, do not heat the rotor higher than 130°C. The magnet could be demagnetized, and the specifications characteristics will not be ensured.

⚠ If the unit has been stored for a long time, always check the operation before starting actual operation. Please contact the Service Center or Service Station.

⚠ CAUTION

(2) Wiring

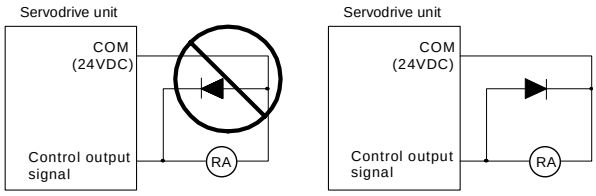
⚠ Correctly and securely perform the wiring. Failure to do so could lead to runaway of the servomotor.

⚠ Do not install a condensing capacitor, surge absorber or radio noise filter on the output side of the servo drive unit.

⚠ Correctly connect the output side (terminals U, V, W). Failure to do so could lead to abnormal operation of the servomotor.

⚠ Do not directly connect a commercial power supply to the servomotor. Failure to observe this could result in a fault.

⚠ When using an inductive load such as a relay, always connect a diode as a noise measure parallel to the load.



⚠ When using a capacitance load such as a lamp, always connect a protective resistor as a noise measure serial to the load.

⚠ Do not reverse the direction of a diode which connect to a DC relay for the control output signals to suppress a surge. Connecting it backwards could cause the drive unit to malfunction so that signals are not output, and emergency stop and other safety circuits are inoperable.

⚠ Do not connect/disconnect the cables connected between the units while the power is ON.

⚠ Securely tighten the cable connector fixing screw or fixing mechanism. An insecure fixing could cause the cable to fall off while the power is ON.

⚠ When using a shielded cable instructed in the connection manual, always ground the cable with a cable clamp, etc.

⚠ Always separate the signals wires from the drive wire and power line.

⚠ Use wires and cables that have a wire diameter, heat resistance and flexibility that conforms to the system.

⚠ CAUTION

(3) Trial operation and adjustment

⚠ Check and adjust each program and parameter before starting operation. Failure to do so could lead to unforeseen operation of the machine.

⚠ Do not make remarkable adjustments and changes as the operation could become unstable.

(4) Usage methods

⚠ Install an external emergency stop circuit so that the operation can be stopped and power shut off immediately.

⚠ Turn the power OFF immediately if smoke, abnormal noise or odors are generated from the servo drive unit or servomotor.


Unqualified persons must not disassemble or repair the unit.

⚠ Never make modifications.

⚠ Reduce magnetic damage by installing a noise filter. The electronic devices used near the servo drive unit could be affected by magnetic noise.

⚠ Use the servo drive unit, servomotor and regenerative resistor with the designated combination. Failure to do so could lead to fires or trouble.


The brake (magnetic brake) assembled into the servomotor are for holding, and must not be used for normal braking.

⚠ There may be cases when holding is not possible due to the magnetic brake's life or the machine construction (when ball screw and servomotor are coupled via a timing belt, etc.). Install a stop device to ensure safety on the machine side.

⚠ After changing the programs/parameters or after maintenance and inspection, always test the operation before starting actual operation.


Do not enter the movable range of the machine during automatic operation. Never place body parts near or touch the spindle during rotation.

⚠ Follow the power supply specification conditions given in the separate specifications manual for the power (input voltage, input frequency, tolerable sudden power failure time, etc.).

⚠ Set all bits to "0" if they are indicated as not used or empty in the explanation on the bits.

⚠ Do not use the dynamic brakes except during the emergency stop. Continuous use of the dynamic brakes could result in brake damage.

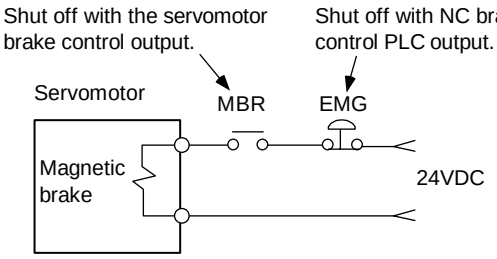
⚠ If a breaker is shared by several power supply units, the breaker may not activate when a short-circuit fault occurs in a small capacity unit. This is dangerous, so never share the breakers.

⚠ CAUTION

(5) Troubleshooting

⚠ If a hazardous situation is predicted during power failure or product trouble, use a servomotor with magnetic brakes or install an external brake mechanism.

⚠ Use a double circuit configuration that allows the operation circuit for the magnetic brakes to be operated even by the external emergency stop signal.



⚠ Always turn the input power OFF when an alarm occurs.

⚠ Never go near the machine after restoring the power after a power failure, as the machine could start suddenly. (Design the machine so that personal safety can be ensured even if the machine starts suddenly.)

(6) Maintenance, inspection and part replacement

⚠ Always carry out maintenance and inspection after backing up the servo drive unit's programs or parameters.

⚠ The capacity of the electrolytic capacitor will drop over time. To prevent secondary disasters due to failures, replacing this part every five years when used under a normal environment is recommended. Contact the Service Center or Service Station for replacement.

⚠ Do not perform a megger test (insulation resistance measurement) during inspections.

⚠ If the battery low warning is issued, save the machining programs, tool data and parameters with an input/output unit, and then replace the battery.

⚠ Do not short circuit, charge, overheat, incinerate or disassemble the battery.

(7) Disposal

⚠ Dispose of this unit as general industrial waste. Note that MDS Series unit with a heat dissipating fin protruding from the back of the unit contains substitute Freon. Do not dispose of this type of unit as general industrial waste. Always return to the Service Center or Service Station.

⚠ Do not disassemble the servo drive unit or servomotor parts.

⚠ Dispose of the battery according to local laws.

(8) General precautions

The drawings given in this Specifications and Maintenance Instruction Manual show the covers and safety partitions, etc., removed to provide a clearer explanation. Always return the covers or partitions to their respective places before starting operation, and always follow the instructions given in this manual.

CONTENTS

Appendix 7. EMC Installation Guidelines

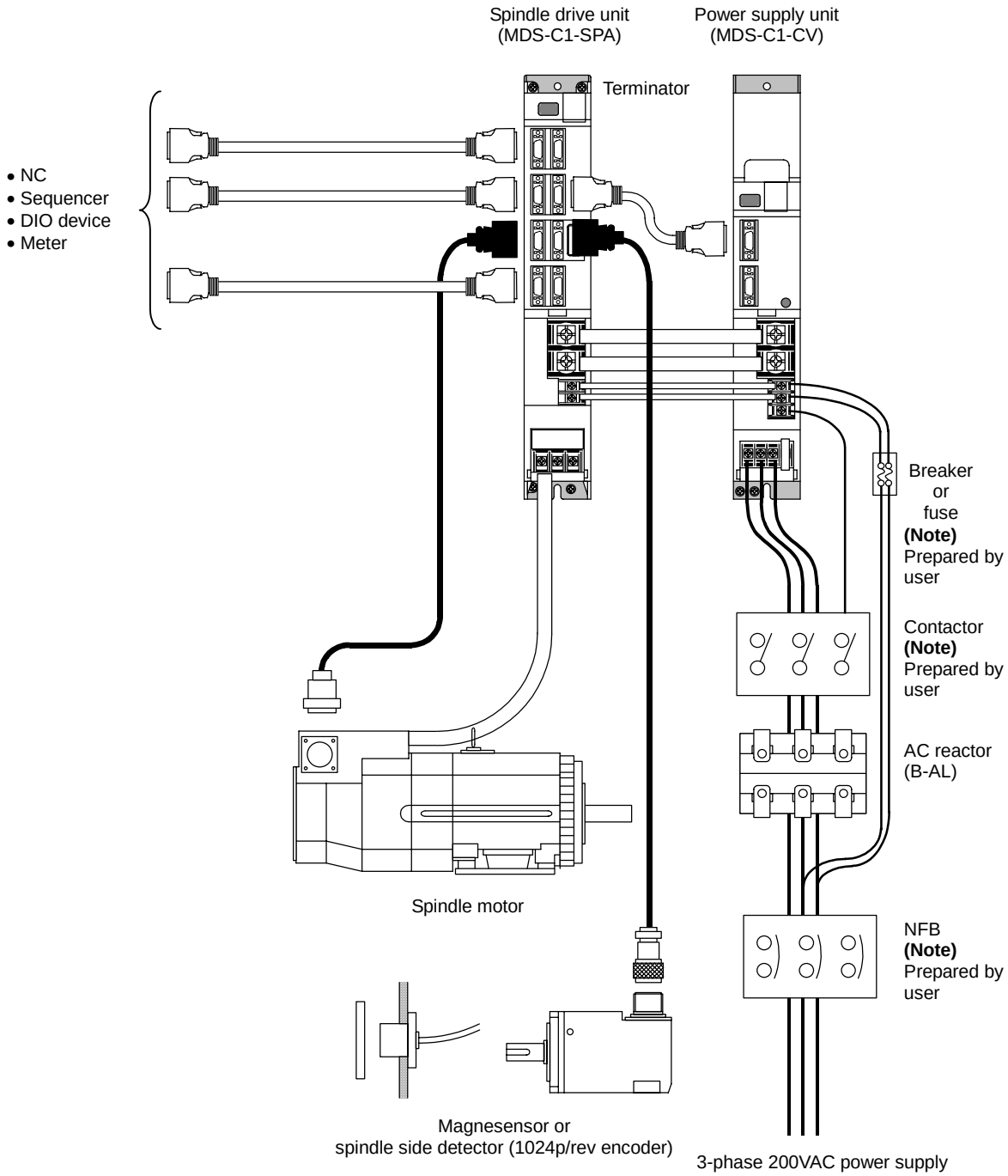
Appendix 8. Instruction Manual for Compliance with UL/c-UL Standard

Appendix 9. Compliance with China Compulsory Product Certification (CCC Certification) System

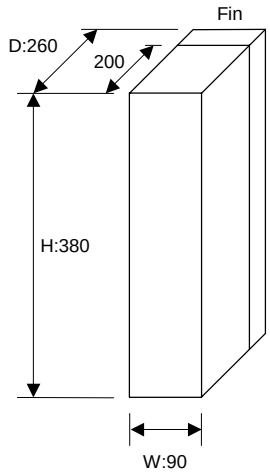
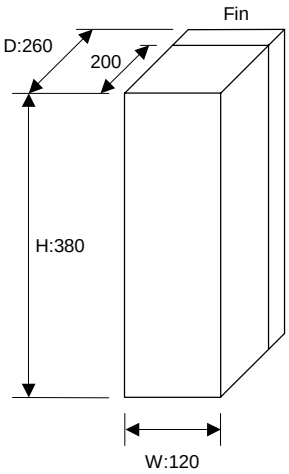
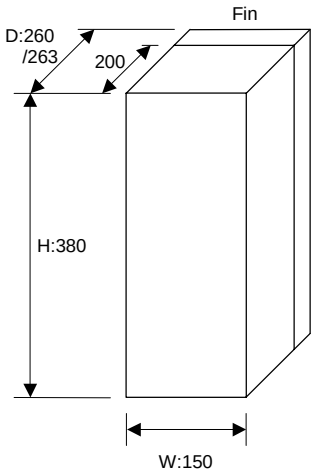
1. Introduction

1-1 Spindle drive system configuration

1-1-1 System configuration



1-1-2 Unit outline type

Unit outline type	B1	C1	D1/D2
Outline dimensions [mm]	 Wiring allowance at front: 50mm Required ventilation space at back: 15mm	 Wiring allowance at front: 50mm Required ventilation space at back: 15mm	 Wiring allowance at front: 50mm Required ventilation space at back: 15mm (D2: 12mm)
Heat dissipation method	Heat radiated outside panel (forced wind cooling)	Heat radiated outside panel (forced wind cooling)	Heat radiated outside panel (forced wind cooling)

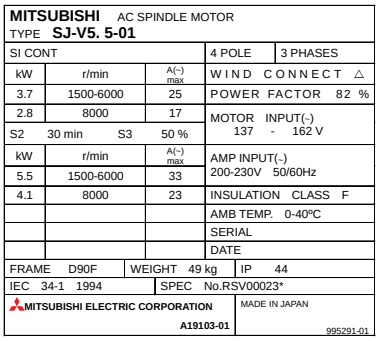
(Note) Refer to "Appendix 1 Outline dimension drawings" for detailed outline drawings.

For customers switching from MDS-A/B Series

The MDS-C1-SPA Series incorporates a highly efficient heat dissipating structure, so the depth of the fin section is smaller than the MDS-A/B Series. Units with an "S" at the end of the type have a smaller unit width than the MDS-A/B Series.
When designing the control panel with these unit outline dimensions, it may not be possible to mount the conventional drive unit.

1-2 Explanation of type

1-2-1 Spindle motor type



MITSUBISHI AC SPINDLE MOTOR			
TYPE **SJ-V5. 5-01**			
SI CONT			4 POLE 3 PHASES
kW	r/min	A(~) max	WIND CONNECT △
3.7	1500-6000	25	POWER FACTOR 82 %
2.8	8000	17	MOTOR INPUT(-) 137 - 162 V
S2 30 min	S3 50 %		
kW	r/min	A(~) max	AMP INPUT(-) 200-230V 50/60Hz
5.5	1500-6000	33	
4.1	8000	23	INSULATION CLASS F
			AMB TEMP. 0-40ºC
			SERIAL
			DATE
FRAME D90F	WEIGHT 49 kg		IP 44
IEC 34-1 1994			SPEC No.RSV00023*
MITSUBISHI ELECTRIC CORPORATION A19103-01			MADE IN JAPAN 995291-01

Rating nameplate

(1) Standard spindle motor series

SJ- (1) (2) (3) (4) (5)

(5) Z-phase detection

Sym-bol	Z-phase presences
None	No Z-phase
M	Z-phase present

(Note) Presence of the Z-phase applies only to the SJ and SJ-V Series.

(4) Special specifications

Sym-bol	Special specifications
None	None
Z	High-speed
W	Wide-range constant output

(Note) A number indicating the constant output range is indicated after the symbol for the wide range output.

(3) Base speed

Sym-bol	Base speed
A	1500r/min
B	1150r/min
L	5000r/min
X	Special

(Note) The SJ-V Series is indicated with a specification code (–01 to –99).

(2) Short time rated output

Sym-bol	Short time rated output	Sym-bol	Short time rated output
2.2	2.2kW	**22**	22kW
3.7	3.7kW	**26**	26kW
5.5	5.5kW	**30**	30kW
7.5	7.5kW	**37**	37kW
11	11kW	**45**	45kW
15	15kW	**55**	55kW
18.5	18.5kW		

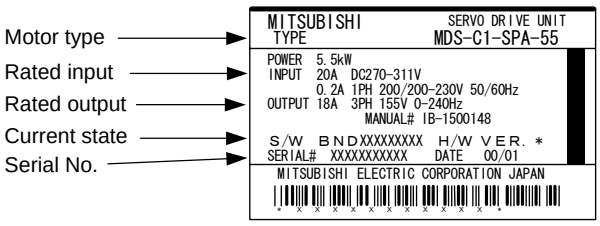
(Note) The 3.7kW and smaller or the 37kW and larger capacities are available with the MDS-B-SP Series. Refer to Appendix 4 and Appendix 5 for details.

(1) Motor series

Sym-bol	Motor series
None	Large capacity
V	Compact medium to large capacity
VS	Hollow shaft

(Note) Refer to the "MELDAS AC Spindle Built-in Series Standard Specifications" (BFN-14118-04) for details on the built-in spindle motor.

1-2-2 Spindle drive unit type



Rating nameplate

MDS-C1- **(1)** – **(2)** – **(3)**

(3) Option

Symbol	Compatible optional function
None	None
R	Orientation function
D	Digital speed command input function
T	S-analog synchronous tapping function
RD	Orientation function and digital speed command input function
RT	Orientation function and S-analog synchronous tapping function

(2) Capacity

Symbol	Capa-city (kW)	Outline type (unit width)
55	5.5	B1 (90mm wide)
75	7.5	
110	11	
150	15	C1 (120mm wide)
185	18.5	
220	22	D1 (150mm wide)
260	26	D2 (150mm wide)
300	30	

(Note) The 3.7kW and smaller or the 37kW and larger capacities are available with the MDS-B-SP Series. Refer to Appendix 4 and Appendix 5 for details.

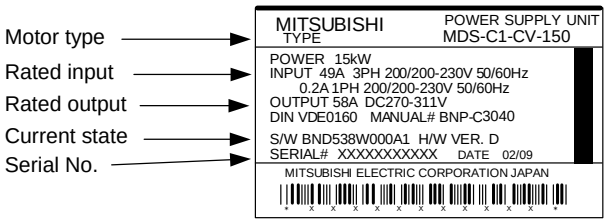
(1) Spindle drive unit series

Symbol	Compatible motor rotation speed	Details
SPA	Less than 10,000r/min	Standard specifications
SPAH	10,000r/min or more	

(Note 1) The 3.7kW and smaller or the 37kW and larger capacities are available with the MDS-B-SP Series. Refer to Appendix 4 and Appendix 5 for details.

(Note 2) The Outline of unit is determined according to symbol in the above table “(2)” and it is not affected by the above table “(3)”.

1-2-3 Power supply unit type



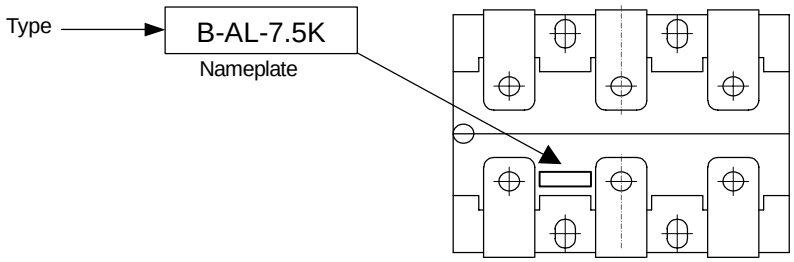
Rating nameplate

MDS-C1- **(1)**

Power supply unit			Compatible AC reactor	Compatible contactor (Mitsubishi) (Note 1)	Compatible NFB (Mitsubishi) (Note 1)
(1) Motor type MDS-C1-	**Capa-city (kW)**	**Outline type (unit width)**			
CV-37	3.7	A2 (60mm wide)	B-AL-7.5K	S-N25 200VAC	NF50CS3P-40A05
CV-55	5.5				
CV-75	7.5				
CV-110	11	B1 (90mm wide)	B-AL-11K	S-N35 200VAC	NF50CS3P-50A05
CV-150	15	C1 (120mm wide)	B-AL-18.5K	S-N50 200VAC	NF100CS3P-100A05
CV-185	18.5				
CV-220	22	D1 (150mm wide)	B-AL-30K	S-N80 200VAC	NF225CS3P-150A05
CV-260	26				
CV-300	30				
CV-370	37		B-AL-37K	S-N150 200VAC	NF225CS3P-175A05

(Note 1) This is an optional part, and must be prepared by the user.
(Note 2) The 45kW and larger capacities are available with the MDS-B-CVE Series. Refer to Appendix 4 for details.

1-2-4 AC reactor type



Top surface of AC reactor

B-AL- **(1)**

AC reactor		Compatible power supply unit
Motor type B-AL-	Capa-city (kW)	
7.5K	7.5	MDS-C1-CV-37
		MDS-C1-CV-55
		MDS-C1-CV-75
11K	11	MDS-C1-CV-110
18.5K	18.5	MDS-C1-CV-150
		MDS-C1-CV-185
30K	30	MDS-C1-CV-220
		MDS-C1-CV-260
		MDS-C1-CV-300
37K	37	MDS-C1-CV-370

2. Specifications

2-1 Spindle motor

2-1-1 Specifications

Spindle motor type		Base rotation speed 1500r/min Series								
		SJ-V								
		2.2-01	3.7-01	5.5-01	7.5-01	11-01	15-01	18.5-01	22-01	26-01
Compatible spindle drive unit type MDS-B/C1-		MDS-B-SPAH-22	MDS-B-SPAH-37	SPA-55	SPA-75	SPA-110	SPA-150	SPA-185	SPA-220	SPA-300
Output capacity	Continuous rating [kW]	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22
	30-minute rating 50%ED rating [kW]	2.2	3.7	5.5	7.5	11	15	18.5	22	26
Base speed [r/min]		1500								
Maximum speed [r/min]		10000		8000		6000				
Frame No.		A90	B90	D90	A112	B112	A160		B160	C160
Continuous rated torque [N·m]		9.5	14.0	23.5	35.0	47.7	70.0	95.5	118	140
GD² [kg·m²]		0.027	0.035	0.059	0.098	0.12	0.23	0.23	0.32	0.38
Inertia [kg·m²]		0.007	0.009	0.015	0.025	0.03	0.06	0.06	0.08	0.10
Tolerable radial load [N]		980		1470	1960		2940			
Cooling fan	Input voltage	Single-phase 200V			3-phase 200V					
	Maximum power consumption	42W			40W		63W			
Environment	Ambient temperature	Operation: 0 to 40°C (non freezing), Storage: –20 to 65°C (non freezing)								
	Ambient humidity	Operation: 90%RH or less (non condensing), Storage: 90%RH or less (non condensing)								
	Atmosphere	Indoors (no direct sunlight); no corrosive gas, inflammable gas, oil mist, or dust								
	Altitude	Operation: 1000 meters or less above sea level, Storage: 1000 meters or less above sea level								
Weight [kg]		25	30	49	60	70	110		135	155
Insulation		Class F								

(Note 1) The rated output is guaranteed at the rated input voltage (200/220/230VAC) to the power supply unit. If the input voltage fluctuates and drops below 200VAC, the rated output may not be attained.
(Note 2) The 50%ED rating applies for a 10-minute cycle time consisting of ON for five minutes and OFF for five minutes.
(Note 3) The 3.7kW and smaller capacities are available with the MDS-B-SPA Series. Refer to Appendix 5 for details.

> **CAUTION** When replacing the SJ-V series by the conventional SJ series, the shorter L dimension is applied.

Spindle motor type		Large capacity series			
		SJ-			SJ-V
		30A	37BP	45BP	55-01
Compatible spindle drive unit type MDS-B-		SPA-370		SPA-450	SPA-550
Output capacity	Continuous rating [kW]	22	30	37	45
	30-minute rating 50%ED rating [kW]	30	37	45	55
Base speed [r/min]		1500	1150		
Maximum speed [r/min]		4500	3450		
Frame No.		B160	B180	A200	A225
Continuous rated torque [N·m]		140	249	307	374
GD^2 [kg·m^2]		0.69	1.36	2.19	3.39
Inertia [kg·m^2]		0.17	0.34	0.55	0.85
Tolerable radial load [N]		2940	4900	5880	5880
Cooling fan	Input voltage	Single-phase 200V		3-phase 200V	
	Maximum power consumption	130W		60W	115W
Environment	Ambient temperature	Operation: 0 to 40°C (non freezing), Storage: –20 to 65°C (non freezing)			
	Ambient humidity	Operation: 90%RH or less (non condensing), Storage: 90%RH or less (non condensing)			
	Atmosphere	Indoors (no direct sunlight); no corrosive gas, inflammable gas, oil mist, or dust			
	Altitude	Operation: 1000 meters or less above sea level, Storage: 1000 meters or less above sea level			
Weight [kg]		200	300	390	450
Insulation		Class F			

(Note 1) The rated output is guaranteed at the rated input voltage (200/220/230VAC) to the power supply unit.
If the input voltage fluctuates and drops below 200VAC, the rated output may not be attained.
(Note 2) The 50%ED rating applies for a 10-minute cycle time consisting of ON for five minutes and OFF for five minutes.
(Note 3) The 37kW and larger capacities are available with the MDS-B-SPA Series. Refer to Appendix 4 for details.

Spindle motor type		Wide range (1:8) constant output series					Wide range constant output series	
		SJ-V					SJ-	
		11-01	11-09	15-03	18.5-03	22-05	22XW5	22XW8
Compatible spindle drive unit type MDS-C1-		SPA-110		SPA-185	SPA-220	SPA-260	SPA-300	SPA-300
Output capacity	Continuous rating [kW]	3.7	5.5	7.5	9	11	19.5	18.5
	30-minute rating 50%ED rating [kW]	5.5	7.5	9	11	15	22	22
Base speed [r/min]		750					600 (800)	550 (600)
Maximum speed [r/min]		6000					5000	4000
Frame No.		B112	A160		B160		B180	A200
Continuous rated torque [N·m]		47.1	70.0	95.5	115	140	239	294
GD² [kg·m²]		0.12	0.23	0.23	0.32	0.32	1.36	2.19
Inertia [kg·m²]		0.03	0.06	0.06	0.08	0.08	0.34	0.55
Tolerable radial load [N]		1960	2940				3920	5880
Cooling fan	Input voltage	3-phase 200V					Single-phase 200V	3-phase 200V
	Maximum power consumption	40W	63W				180W	60W
Environment	Ambient temperature	Operation: 0 to 40°C (non freezing), Storage: –20 to 65°C (non freezing)						
	Ambient humidity	Operation: 90%RH or less (non condensing), Storage: 90%RH or less (non condensing)						
	Atmosphere	Indoors (no direct sunlight); no corrosive gas, inflammable gas, oil mist, or dust						
	Altitude	Operation: 1000 meters or less above sea level, Storage: 1000 meters or less above sea level						
Weight [kg]		70	110		135		300	390
Insulation		Class F						

(Note 1) The rated output is guaranteed at the rated input voltage (200/220/230VAC) to the power supply unit. If the input voltage fluctuates and drops below 200VAC, the rated output may not be attained.

(Note 2) The 50%ED rating applies for a 10-minute cycle time consisting of ON for five minutes and OFF for five minutes.

Spindle motor type		High-speed series					
		SJ-V					
		3.7-02ZM	7.5-03ZM	11-06ZM	11-08ZM	22-06ZM	30-02ZM
Compatible spindle drive unit type MDS-B/C1-		MDS-B-SPAH-37	SPAH-110	SPAH-150	SPA-185	SPA-220	SPA-300
Output capacity	Continuous rating [kW]	2.2	5.5	5.5	7.5	11	18.5
	30-minute rating 50%ED rating [kW]	3.7 (15min. rating)	7.5	7.5	11	15	22
Base speed [r/min]		3000	1500				
Maximum speed [r/min]		15000	12000		8000		
Frame No.		A90	A112		B112	A160	B160
Continuous rated torque [N·m]		7.0	35.0	35.0	47.7	70.0	118
GD² [kg·m²]		0.027	0.098	0.098	0.12	0.23	0.32
Inertia [kg·m²]		0.007	0.025	0.025	0.03	0.06	0.08
Tolerable radial load [N]		490	980		1470	1960	
Cooling fan	Input voltage	Single-phase 200V	3-phase 200V				
	Maximum power consumption	42W	40W			63W	
Environment	Ambient temperature	Operation: 0 to 40°C (non freezing), Storage: –20 to 65°C (non freezing)					
	Ambient humidity	Operation: 90%RH or less (non condensing), Storage: 90%RH or less (non condensing)					
	Atmosphere	Indoors (no direct sunlight); no corrosive gas, inflammable gas, oil mist, or dust					
	Altitude	Operation: 1000 meters or less above sea level, Storage: 1000 meters or less above sea level					
Weight [kg]		25	60		70	125	155
Insulation		Class F					

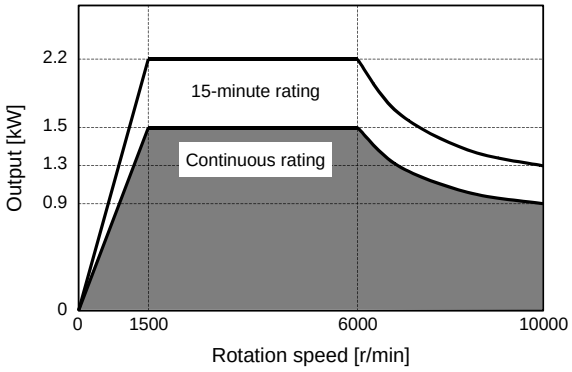
(Note 1) The rated output is guaranteed at the rated input voltage (200/220/230VAC) to the power supply unit. If the input voltage fluctuates and drops below 200VAC, the rated output may not be attained.
(Note 2) The 50%ED rating applies for a 10-minute cycle time consisting of ON for five minutes and OFF for five minutes.
(Note 3) The 3.7kW and smaller capacities are available with the MDS-B-SPA Series. Refer to Appendix 5 for details.

Spindle motor type		Hollow shaft series		
		SJ-VS		
		7.5-03ZM	22-06ZM	30-02ZM
Compatible spindle drive unit type MDS-C1-		SPAH-110	SPA-220	SPA-300
Output capacity	Continuous rating [kW]	5.5	11	18.5
	30-minute rating 50%ED rating [kW]	7.5	15	22
Base speed [r/min]		1500	1500	
Maximum speed [r/min]		12000	8000	
Frame No.		A112	A160	B160
Continuous rated torque [N·m]		35.0	70.0	118
GD^2 [kg·m^2]		0.099	0.23	0.32
Inertia [kg·m^2]		0.025	0.058	0.08
Tolerable radial load [N]		0 (Note 3)	0 (Note 3)	0 (Note 3)
Cooling fan	Input voltage	Single-phase 200V	3-phase 200V	
	Maximum power consumption	40W	40W	
Environment	Ambient temperature	Operation: 0 to 40°C (non freezing), Storage: –20 to 65°C (non freezing)		
	Ambient humidity	Operation: 90%RH or less (non condensing), Storage: 90%RH or less (non condensing)		
	Atmosphere	Indoors (no direct sunlight); no corrosive gas, inflammable gas, oil mist, or dust		
	Altitude	Operation: 1000 meters or less above sea level, Storage: 1000 meters or less above sea level		
Weight [kg]		65	115	140
Insulation		Class F		

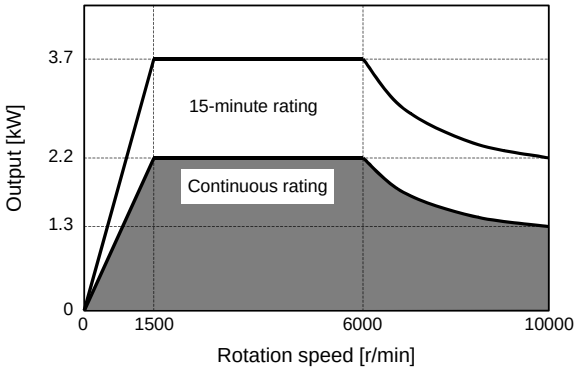
(Note 1) The rated output is guaranteed at the rated input voltage (200 to 230VAC) to the power supply unit.
(Note 2) The 50%ED rating applies for a 10-minute cycle time consisting of ON for five minutes and OFF for five minutes.
(Note 3) Do not apply a radial load.

2-1-2 Output characteristics

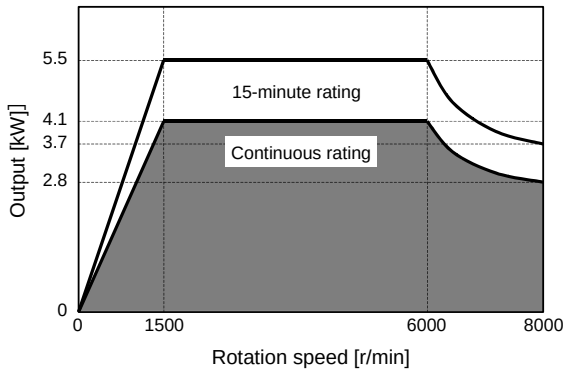
[Base rotation speed 1500r/min series SJ-V2.2-01]



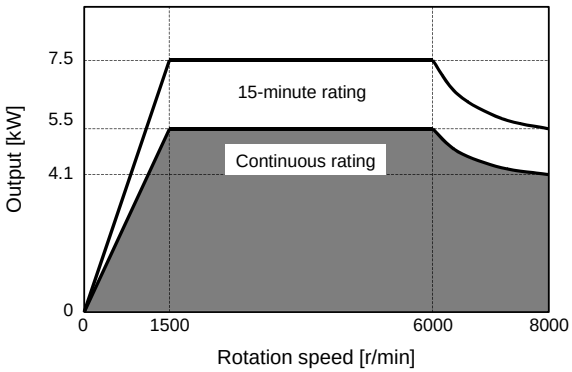
[Base rotation speed 1500r/min series SJ-V3.7-01]



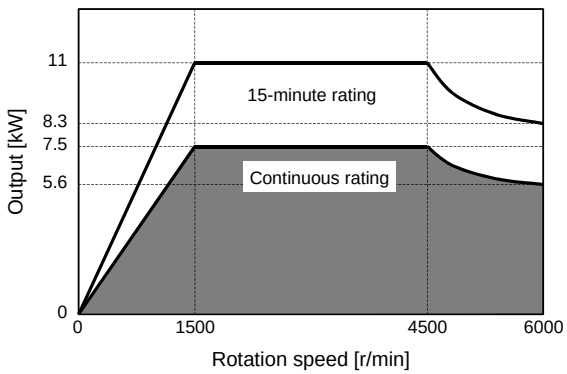
[Base rotation speed 1500r/min series SJ-V5.5-01]



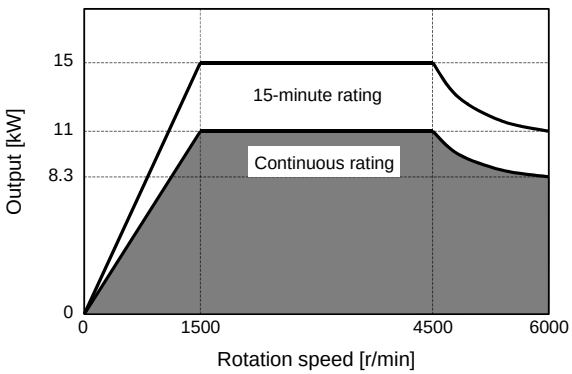
[Base rotation speed 1500r/min series SJ-V7.5-01]



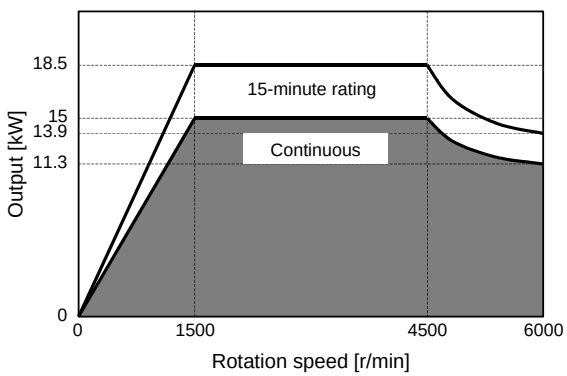
[Base rotation speed 1500r/min series SJ-V11-01]



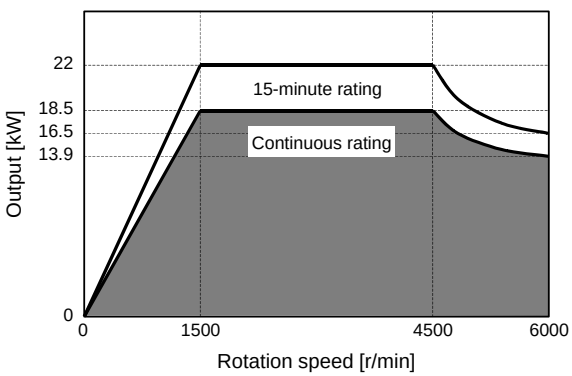
[Base rotation speed 1500r/min series SJ-V15-01]



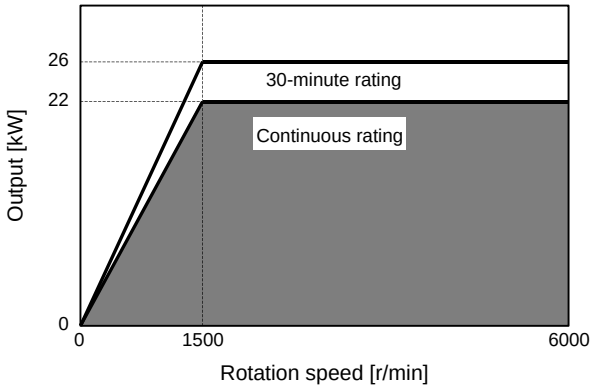
[Base rotation speed 1500r/min series SJ-V18.5-01]



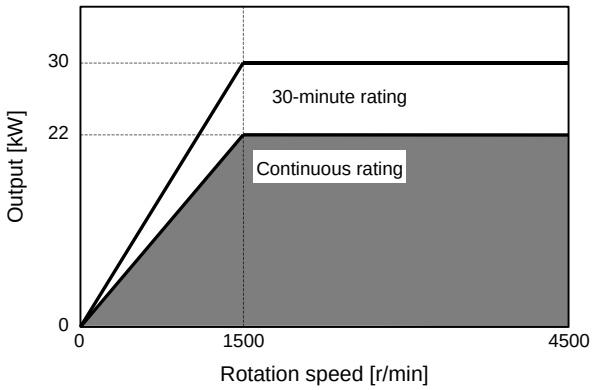
[Base rotation speed 1500r/min series SJ-V22-01]



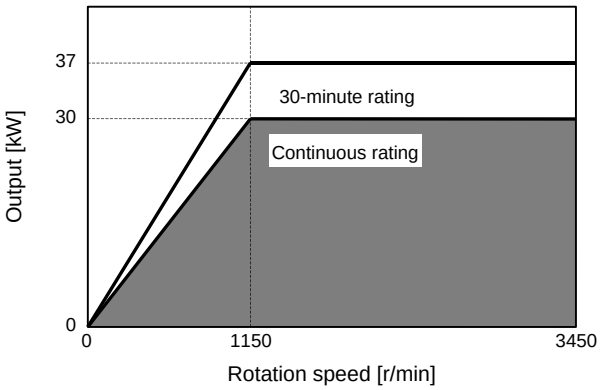
[Base rotation speed 1500r/min series SJ-V26-01]



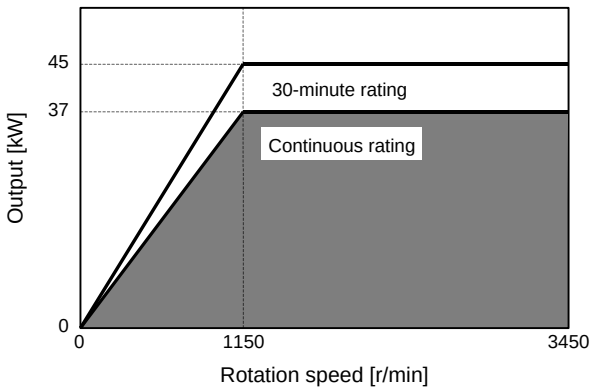
[Large capacity series SJ-30A]



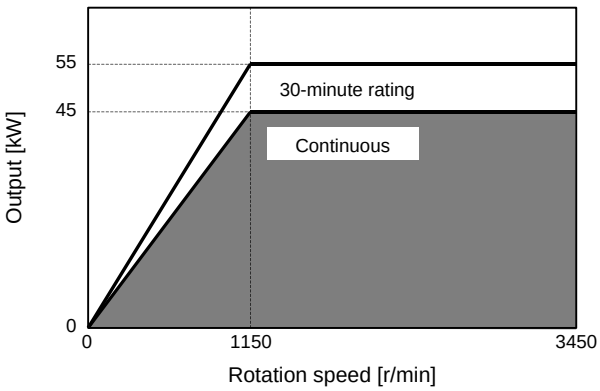
[Large capacity series SJ-37BP]



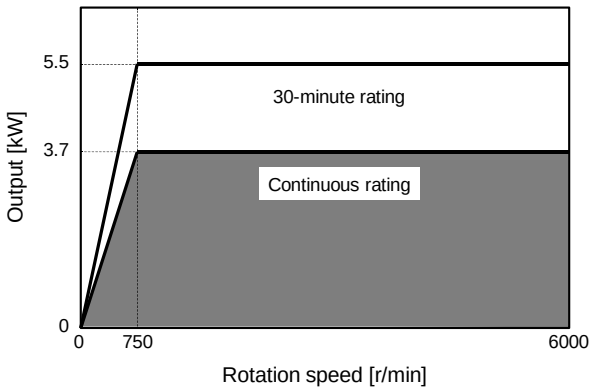
[Large capacity series SJ-45BP]



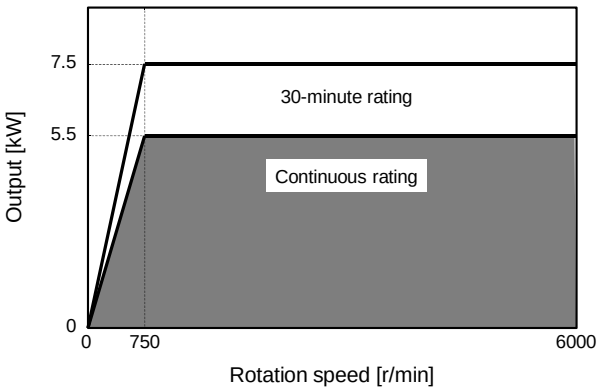
[Large capacity series SJ-V55-01]



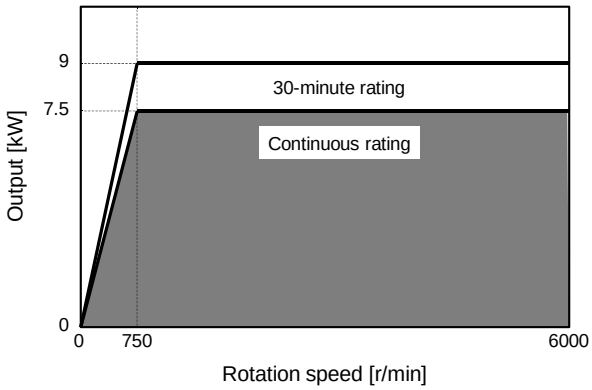
[Wide range (1:8) constant output series SJ-V11-01]



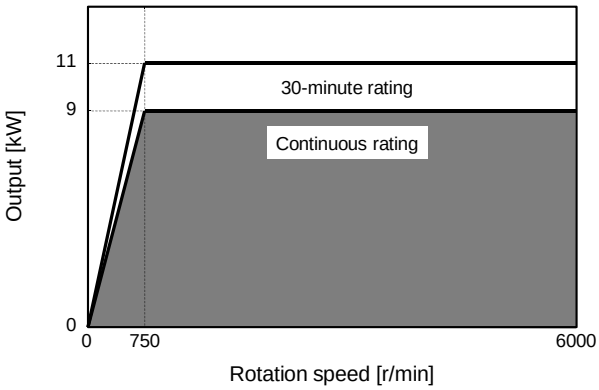
[Wide range (1:8) constant output series SJ-V11-09]



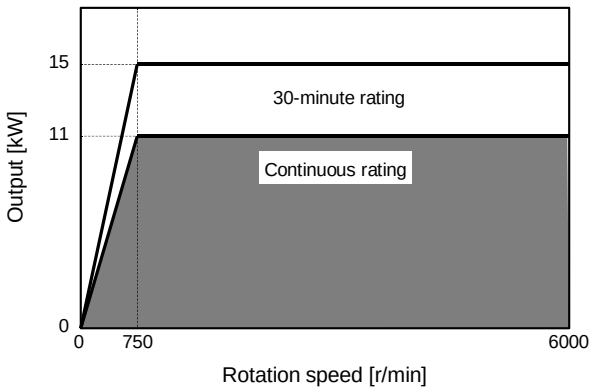
[Wide range (1:8) constant output series SJ-V15-03]



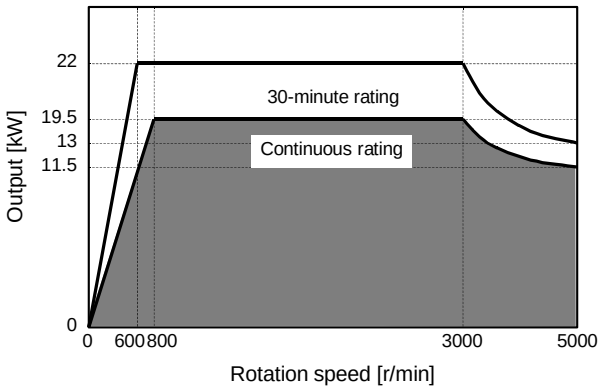
[Wide range (1:8) constant output series SJ-V18.5-03]



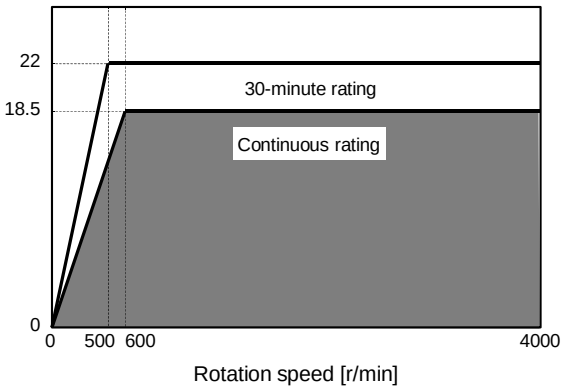
[Wide range (1:8) constant output series SJ-V22-05]



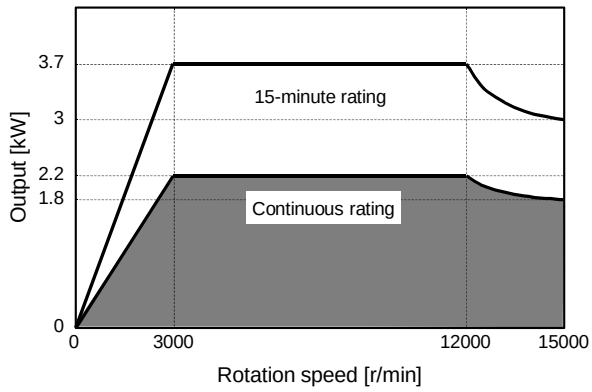
[Wide range constant output series SJ-22XW5]



[Wide range constant output series SJ-22XW8]



[High speed series SJ-V3.7-02ZM]



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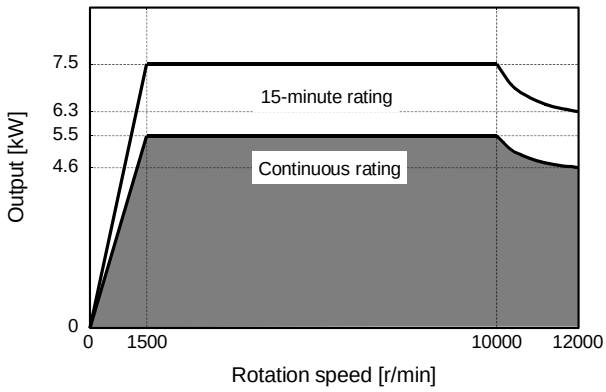
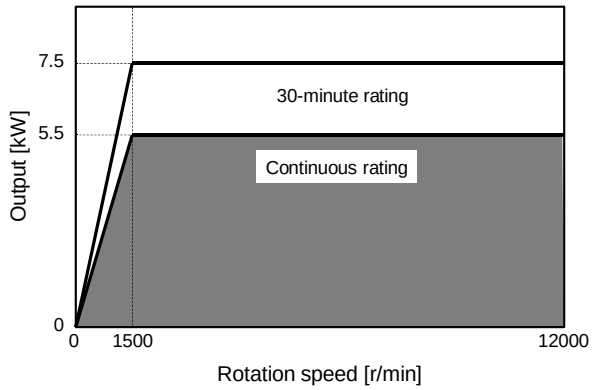
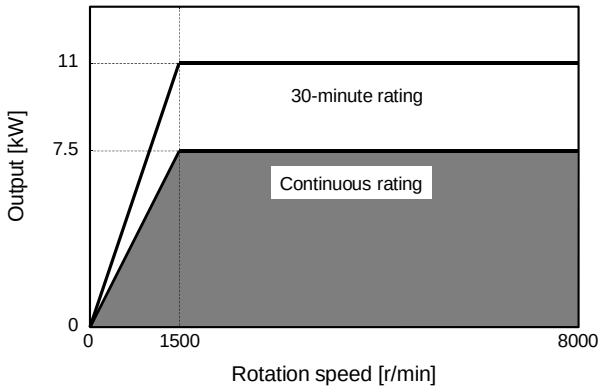


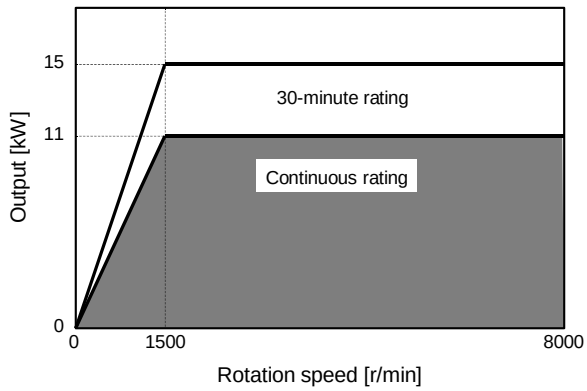
[High speed series SJ-V11-06ZM]



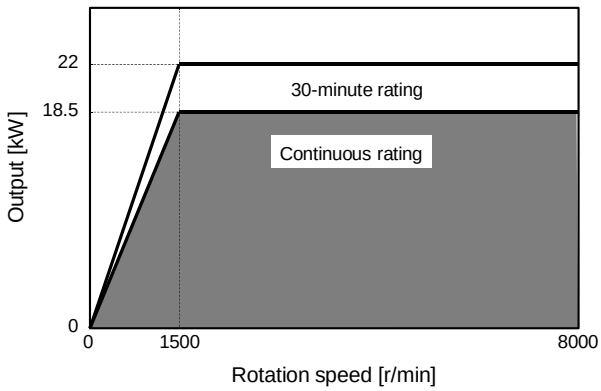
[High speed series SJ-V11-08ZM]



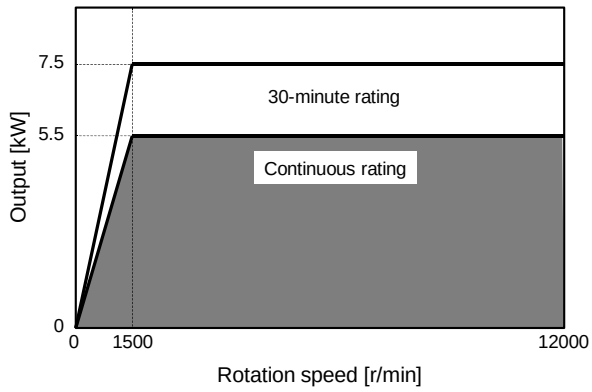
[High speed series SJ-V22-06ZM]



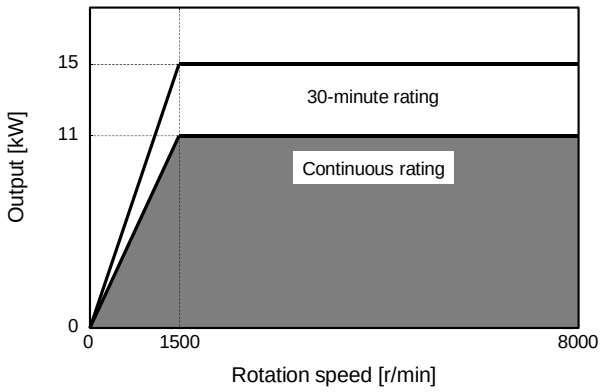
[High speed series SJ-V30-02ZM]



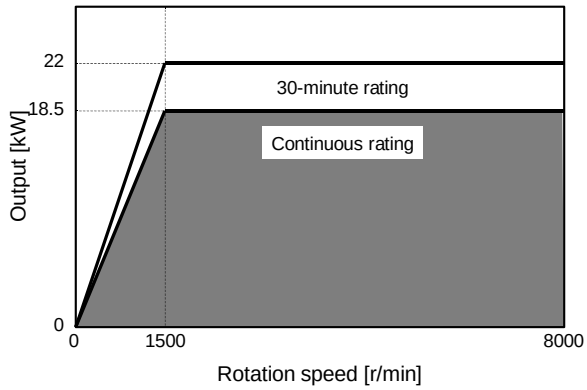
[Hollow shaft series SJ-V7.5-03ZM]



[Hollow shaft series SJ-V22-06ZM]



[Hollow shaft series SJ-V30-02ZM]



2-2 Drive unit

2-2-1 Installation environment conditions

Common installation environment conditions for servo, spindle and power supply unit are shown below.

Environ-ment	Ambient temperature	Operation: 0 to 55°C (with no freezing), Storage / Transportation: -15°C to 70°C (with no freezing)
	Ambient humidity	Operation: 90%RH or less (with no dew condensation) Storage / Transportation: 90%RH or less (with no dew condensation)
	Atmosphere	Indoors (no direct sunlight) With no corrosive gas, inflammable gas, oil mist or dust
	Altitude	Operation/Storage: 1000 meters or less above sea level, Transportation: 10000 meters or less above sea level
	Vibration/impact	4.9m/s^2 (0.5G) / 49m/s^2 (5.0G)

2-2-2 Spindle drive unit

(1) Specifications

		Spindle drive unit MDS-C1-SP Series							
Spindle drive unit type MDS-C1-SP- MDS-C1-SPH-		55	75	110	150	185	220	260	300
Rated output [kW]		3.7	5.5	7.5	11	15	18.5	22	26
Output	Rated voltage [V]	155AC							
	Rated current [A]	18	26	37	49	63	79	97	130
Input	Rated voltage [V]	270 to 311DC							
	Rated current [A]	20	30	41	58	76	95	115	144
Control power	Voltage [V]	200/200 to 230AC							
	Frequency [Hz]	50/60							
	Current [A]	Max. 0.2							
	Rush current [A]	MAX. 35							
	Rush conductivity time [ms]	MAX. 6							
Earth leakage current [mA]		6（MAX. 15）							
Control method		Sine wave PWM control method, current control method							
Braking		Regenerative braking							
Speed command input		Analog voltage ±10V (or +10V) MAX (input impedance approx.10kΩ), or digital (option) (12 bit binary, signed binary, BCD code 2 digits, BCD code 3 digits)							
External analog output		0 to +10V, 2ch (speed meter output, load meter output, data for various adjustments)							
Structure		Protection type (Protection method: IP20 [over all] / IP00 [Terminal block TE1])							
Cooling method		Forced wind cooling (fin)							
Weight [kg]		4.4			5.7		6.5	6.3	
Heat radiated at rated output [W]		108	137	181	235	342	366	483	620
Noise		Less than 55dB							

(2) Spindle drive unit function specifications list

	Function			MDS-C1-SPA(H)-55～300* *: Option symbol					
				None	R	D	T	RD	RT
Basic function	S analog command voltage input±10V			○	○	○	○	○	○
	S analog command voltage input 0 to +10V			○	○	○	○	○	○
	Machine ready complete input			○	○	○	○	○	○
	Forward run/reverse run command input			○	○	○	○	○	○
Miscellaneous function	Override analog input			○	○	○	○	○	○
	Torque limit 1 to 3 input			○	○	○	○	○	○
	Gear selection1, 2 input			○	○	○	○	○	○
	Alarm reset input			○	○	○	○	○	○
	Emergency stop input			○	○	○	○	○	○
	Speed selection 1 to 3 input			○	○	○	○	○	○
	Override valid/invalid input			○	○	○	○	○	○
	L coil selection input			○	○	○	○	○	○
	Index forward run/reverse run input			-	○	-	-	○	○
	Digital speed command input			-	-	○	-	○	-
	S-analog high-speed tapping input			-	-	-	○	-	○
	Sub-motor selection input			○	○	○	○	○	○
	Speed meter output			○	○	○	○	○	○
	Load meter output			○	○	○	○	○	○
	Controller emergency output signal (contact output)			○	○	○	○	○	○
	Pulse feedback output signal			○	○	○	○	○	○
	Zero speed output signal			○	○	○	○	○	○
	Up-to-speed output signal			○	○	○	○	○	○
	Speed detection output signal			○	○	○	○	○	○
	Torque reach output signal			○	○	○	○	○	○
	In torque limit output signal			○	○	○	○	○	○
	In motor forward run/reverse run output signal			○	○	○	○	○	○
	In alarm output signal			○	○	○	○	○	○
	In emergency stop output signal			○	○	○	○	○	○
	In ready ON output signal			○	○	○	○	○	○
	Current detect output signal			○	○	○	○	○	○
	In coil changeover output signal			○	○	○	○	○	○
	In L coil selected output signal			○	○	○	○	○	○
	Alarm code output 1 to 4 signal			○	○	○	○	○	○
	Orientation complete output signal			-	○	-	-	○	○
	Positioning complete output signal			-	○	-	-	○	○
	In 1-drive unit 2-motor changeover output signal			○	○	○	○	○	○
	In sub-motor selection output signal			○	○	○	○	○	○
Optional function	1-drive unit 2-motor changeover		Spindle motor + spindle motor (FR-TK unit is required.)	○	○	○	○	○	○
			Spindle motor + general-purpose motor	○	○	○	○	○	○
	Orientation		Magnetic sensor orientation (1 point)	-	○	-	-	○	○
			Encoder orientation (multipoint • index)	-	○	-	-	○	○
			Motor PLG orientation (multipoint • index)	-	○	-	-	○	○
	Digital speed command		12 bit binary	-	-	○	-	○	-
			Signed binary	-	-	○	-	○	-
			BCD3 digits	-	-	○	-	○	-
			BCD2 digits	-	-	○	-	○	-
	S-analog high-speed tapping	1024p/rev encoder specification	Only for encoder orientation	-	-	-	-	-	○
		Motor PLG specification	1) Motor PLG orientation	-	-	-	-	-	○
			2) Magnetic sensor orientation	-	-	-	-	-	○
			3) Orientation not available	-	-	-	○	-	○

(Note 1) ○: available -: not available

(Note 2) For input excluding a basic function input, up to 12 points can be selected.

(Note 3) For output, up to 8 points can be selected for open emitter, and up to 6 points for open collector.

(Note 4) When using the override input terminal in S analog input, and when using the digital speed command, the override function can not be used.

(Note 5) When the orientation is not applied in the S-analog high-speed tapping specification, Z phase is not output from the pulse feedback signal. A position loop of spindle must be operated in the NC side.

(3) Details on spindle drive unit function specifications

(a) Speed command input

1) Analog speed command input

	When using bipolar input	When using unipolar input
Input voltage	-10 to +10V	0 to +10V
Tolerable maximum input voltage	-15 to +15V	-15 to +15V
Input part connector, pin No.	Between CN8A-No.7 pin (SE1) and No.8 pin (SE2)	Between CN8A-No.17 pin (OR2) and No.18 pin (OR1)
Resolution	10V/ approx. 1940 divisions (approx. 5.1mV)	10V/ approx. 3570 divisions (approx. 2.8mV)

(Note 1) Tolerable maximum input does not guarantee the speed linearity, but specifies the maximum voltage in which the drive unit will not be damaged.

2) Digital speed command input (option)

	Binary (12bit binary)	Signed binary	BCD code 3digits	BCD code 2digits
Input	Contact input Sink • source input available			
Tolerable maximum input voltage	26.4V			
Input part connector	CN12			
Resolution	Motor maximum speed/4095	Motor maximum speed/2048	Motor maximum speed/999	Motor maximum speed/99

3) Speed selection input
With this function, 8 patterns of speed commands are selected using up to 3 bits in combination. Speed can be set with a parameter.

	Speed selection
Input	Contact input Sink and source input available
Tolerable maximum input voltage	26.4V
Input part connector	Select maximum three of CN10 general-purpose input
Minimum setting unit	1r/min

(b) Override input

This function is valid when the override input contact set with the general-purpose input is turned ON.

	When using unipolar input
Input voltage	0 to +10V
Tolerable maximum input voltage	-15 to +15V
Input part connector, pin No.	Between CN8A-No.17 pin (OR2) and No.18 pin (OR1)
Resolution	10V/ approx. 3570 divisions (approx. 2.8mV)

(Note 1) When using unipolar analog input, digital speed command input and speed selection for the speed command, the override function cannot be used.

(c) Orientation function (spindle set position stop function) (option)

1) 1 point orientation

When the orientation signal is input, the spindle is stopped at the set position determined by an internal parameter.

	When using external 1024p/rev encoder or motor PLG	When using magnetic sensor
Available stop position setting range	360°	±5° based on center of magnet and sensor
Stop position resolution	360° /4096 divisions	Approx. 5° /512 divisions
Repeated stop position accuracy	±0.1°	±0.1°

(Note 1) The repeated stop accuracy or resolution in the above table may not satisfy the accuracy according to backlash or friction torque, etc of machine.

(Note 2) When using magnetic sensor, the position accuracy or stop position range differs from the above table according to the installation radius.

(Note 3) Motor PLG orientation is possible only when the spindle and motor are coupled, when they are coupled at 1:1 with gears, or when they are coupled at 1:1 (pulley ratio) with a timing belt.
The Z phase signal must be provided to the motor speed detector.

2) Orientation

The spindle stop position in the orientation command input is changed arbitrarily using external 12 bits stop position command.

	When using external 1024p/rev encoder or motor PLG
Available stop position setting range	360° (arbitrary according to external stop command)
Stop position resolution	360° /4096 divisions
Repeated stop position accuracy	±0.1°

(Note 1) The repeated stop accuracy or resolution in the above table may not satisfy the accuracy according to backlash or friction torque, etc of machine.

(Note 2) Motor PLG orientation is possible only when the spindle and motor are coupled, when they are coupled at 1:1 with gears, or when they are coupled at 1:1 (pulley ratio) with a timing belt.
The Z phase signal must be provided to the motor speed detector.

3) Multi-point indexing orientation

By setting the orient command and indexing forward run/reverse run to the general-purpose input, the stop position is changed arbitrarily without one rotation of the spindle.

	When using external 1024p/rev encoder or motor PLG
Available stop position setting range	360° (arbitrary according to external stop command)
Stop position resolution	360° /4096 divisions
Repeated stop position accuracy	±0.1°

(Note 1) The repeated stop accuracy or resolution in the above table may not satisfy the accuracy according to backlash or friction torque, etc of machine.

(Note 2) Motor PLG orientation is possible only when the spindle and motor are coupled, when they are coupled at 1:1 with gears, or when they are coupled at 1:1 (pulley ratio) with a timing belt.
The Z phase signal must be provided to the motor speed detector.

(d) S-analog high-speed tapping function (option)

By structuring the position loop in the NC side and synchronizing with the servo axis, tap cutting is carried out without using floating tap chuck. Setting the S-analog high-speed tapping input to the general-purpose input and adding the speed command voltage to the S-analog input section realize this function.

(e) 1-drive unit 2-motor changeover function

One spindle drive unit rotates two motors that are not used simultaneously. The motor drive wire is changed over with contactor, and signal wire with FR-TK to select which one to use. When two motors must be rotated simultaneously, this function cannot be used.

(f) Coil changeover function

This function is used when using the coil changeover motor to gain an extensive constant output range without a gear. The coil selection signal is set to the general-purpose input, and a contactor for coil changeover, which is connected with the motor drive wire, is changed over through a compact relay by turning ON/OFF this signal.

For details on each specification above, refer to MDS-C1-SPA Instruction Manual.

2-2-3 Power supply unit

			Power supply unit MDS-C1-CV Series									
Power supply unit type		**MDS-C1-CV-**	**37**	**55**	**75**	**110**	**150**	**185**	**220**	**260**	**300**	**370**
Rated output		**[kW]**	3.7	5.5	7.5	11.0	15.0	18.5	22.0	26.0	30.0	37.0
Input	**Rated voltage**	**[V]**	200/200 to 230AC									
	Frequency	**[Hz]**	50/60 Frequency fluctuation within ±3%									
	Rated current	**[A]**	16	20	26	35	49	66	81	95	107	121
Output	**Rated voltage**	**[V]**	270 to 311DC									
	Rated current	**[A]**	17	20	30	41	58	76	95	115	144	164
Control power	**Voltage**	**[V]**	200/200 to 230AC									
	Frequency	**[Hz]**	50/60									
	Current	**[A]**	Max.0.2									
	Rush current	**[A]**	MAX.35									
	Rush conductivity time	**[ms]**	MAX.6									
Main circuit method			Converter with power regeneration circuit									
Structure			Protection type (Protection method: IP20 [over all] / IP00 [Terminal block TE1])									
Cooling method			Self-cooling	Forced wind cooling (internal)		Forced wind cooling (fin)						
Weight		**[kg]**	3.4			4.6	5.8	6.0	8.3	8.4	8.6	8.8
Heat radiated at rated output		**[W]**	55	65	80	125	155	195	210	260	320	400
Noise			Less than 55dB									

2-2-4 AC reactor

An AC reactor must be installed for each power supply unit.

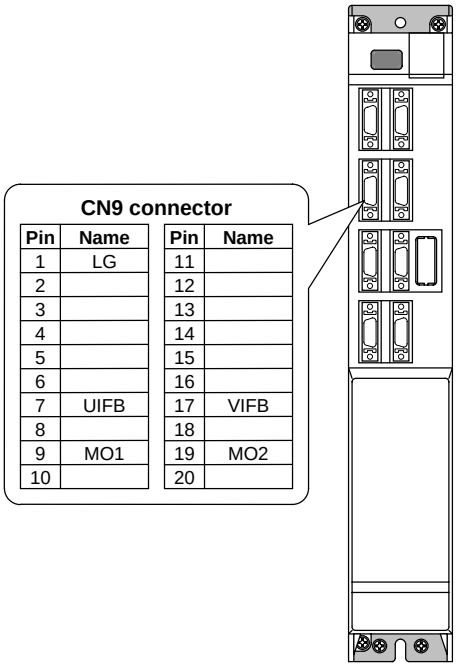
(1) Specifications

		AC reactor				
AC reactor type	**B-AL-**	**7.5K**	**11K**	**18.5K**	**30K**	**37K**
Compatible power supply unit type	**MDS-C1-CV-**	37,55,75	110	150,185	220,260,300	370
Rated capacity (30-minute rating)	**[kW]**	7.5	11	18.5	30	37
Rated voltage	**[V]**	200/200 to 230AC				
Rated current	**[A]**	27	33	66	110	129
Frequency	**[Hz]**	50/60 Frequency fluctuation within ±3%				
Environ-ment	**Ambient temperature**	Operation: -10 to 60°C (with no freezing), Storage/Transportation: -10°C to 60°C (with no freezing)				
	Ambient humidity	Operation: 80%RH or less (with no dew condensation), Storage/Transportation: 80%RH or less (with no dew condensation)				
	Atmosphere	Indoors (no direct sunlight) With no corrosive gas, inflammable gas, oil mist or dust				
	Altitude	Operation/Storage: 1000 meters or less above sea level, Transportation: 10000 meters or less above sea level				
	Vibration/impact	9.8m/s2 (1G) / 98m/s2 (10G)				
Weight	**[kg]**	3.6	3.0	5.2	6.0	10

2-2-5 D/A output specifications for spindle drive unit

(1) D/A output specifications

Item	Explanation
No. of channels	2ch
Output cycle	444µs (min. value)
Output precision	8bit
Output voltage range	0V to +5V (zero) to +10V, 0V to +10V for meter output
Output magnification setting	±1/256 to ±128-fold
Output pin	CN9 connector MO1 = Pin 9 MO2 = Pin 19 GND = Pin 1
Function	Phase current feedback output function U phase current FB : Pin 7 V phase current FB : Pin 17



MDS-C1-SPA

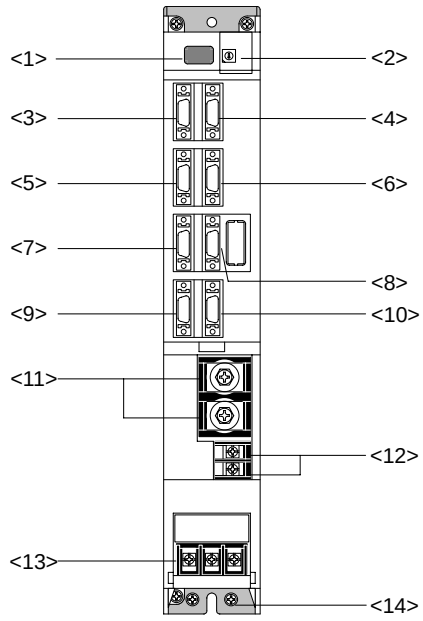
(2) Setting the output data

No.	Abbrev.	Parameter name	Explanation
SP253	DA1NO	D/A output channel 1 data No.	Input the No. of the data to be output to each D/A output channel.
SP254	DA2NO	D/A output channel 2 data No.	1deg=(64000÷65536)

No.	Output data	Original data unit	Output magnification standard setting value (SP255, SP256)	Output unit for standard setting	Output cycle
0	**ch1: Speedometer output**	10V=max. speed (Zero=0V)	0	Depends on maximum speed	3.5ms
	ch2: Load meter output	10V=120% load (Zero=0V)	0	30-minute rating 12%/V	3.5ms
1	**–**				
2	**Current command**	Rated 100%=4096	8	30-minute rating 20%/V	3.5ms
3	**Current feedback**	Rated 100%=4096	8	30-minute rating 20%/V	3.5ms
4	**Speed feedback**	r/min	13	500rpm/V	3.5ms
5	**–**				
80	**Control input 1**	HEX	Bit correspondence		3.5ms
81	**Control input 2**				
82	**Control input 3**				
83	**Control input 4**				
84	**Control output 1**				
85	**Control output 2**				
86	**Control output 3**				
87	**Control output 4**				

2-2-6 Explanation of each part

(1) Explanation of each spindle drive unit part



MDS-C1-SPA

The connector layout differs according to the unit being used. Refer to each unit's outline drawing for details.

Each part name

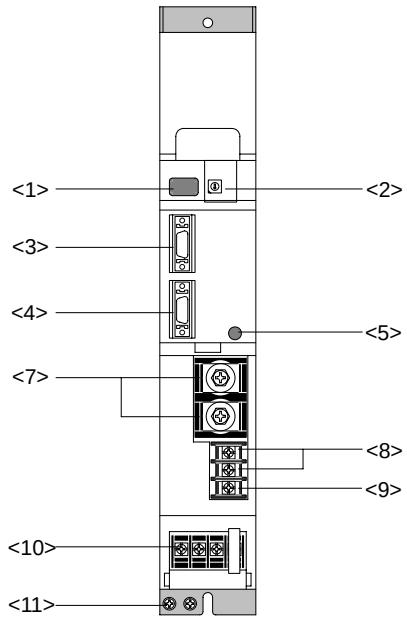
		Name		Description
<1>	**Control circuit**	LED	---	Unit status indication LED
<2>		SW1, PB1, PB2, PB3	---	SW1: Axis No. setting switch PB1,2,3: Parameter setting button
<3>		CN10	---	General-purpose input output / DC power supply connection connector
<4>		CN11	---	Orient position shift / general-purpose output connector
<5>		CN9A	---	Personal computer connection / analog output connector
<6>		CN4	---	Power supply communication connector
<7>		CN5	---	Internal PLG encoder connection connector
<8>		CN6	---	Magnetic sensor / external encoder connection connector
<9>		CN12	---	Digital speed command / general-purpose output connector
<10>		CN8A	---	Analog speed command / override / pulse output connector
<11>	**Main circuit**	TE2	L+, L–	Converter voltage input terminal (DC input)
<12>		TE3	L11, L21	Control power input terminal (single-phase AC input)
<13>		TE1	U, V, W	Motor power output terminal (3-phase AC output)
<14>		PE	⏚	Grounding terminal

(Note1) For customer switching from MDS-A/B Series
Make sure that PE terminal position has changed from UVW terminal to the bottom of the cooling fan.

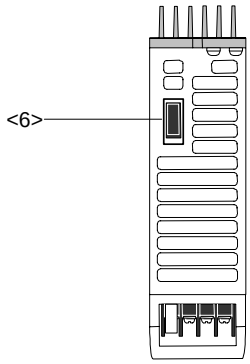
Screw size

	Spindle drive unit MDS-C1-SPA-			
Type	**04 to 37**	**55 to 110,150S**	**150 to 185**	**220 to 300**
Unit width (mm)	60	90	120	150
<11> L+, L–	M6 x 14			
<12> L11,L21	M4 x 10			
<13> U, V, W	M4 x 12	M5 x 12		M8 x 14
<14> ⏚	M4 x 8	M5 x 12		M8 x 14

(2) Explanation of each power supply unit part



MDS-C1-CV



Bottom view

The connector layout differs according to the unit being used. Refer to each unit's outline drawing for details.

Each part name

		Name		Description
<1>	**Control circuit**	LED	---	Power supply status indication LED
<2>		SW1	---	Power supply setting switch
<3>		CN4	---	Spindle communication connector (master)
<4>		CN9	---	Spindle communication connector (slave)
<5>		---	CHARGE LAMP	TE2 output charging/discharging circuit indication LED
<6>		CN23	---	External emergency stop input connector
<7>	**Main circuit**	TE2	L+, L–	Converter voltage output terminal (DC output)
<8>		TE3	L11, L21	Control power input terminal (single-phase AC input)
<9>			MC1	External contactor control terminal
<10>		TE1	L1, L2, L3	Power input terminal (3-phase AC input)
<11>		PE	⏚	Grounding terminal

(Note1) CN23 is located at the bottom of the power supply unit.

(Note2) For customer switching from MDS-A/B Series
Make sure that PE terminal position has changed from UVW terminal to the bottom of the cooling fan.

Screw size

	Power supply unit MDS-C1-CV-			
Type	**37 to 75**	**110**	**150 to 185**	**220 to 370**
Unit width (mm)	60	90	120	150
<7> L+, L–	M6 x 16			
<8> L11, L21	M4 x 10			
<9> MC1	M4 x 10			
<10> L1, L2, L3	M4 x 10	M5 x 12		M8 x 14
<11> ⏚	M4 x 8	M5 x 8		M8 x 14

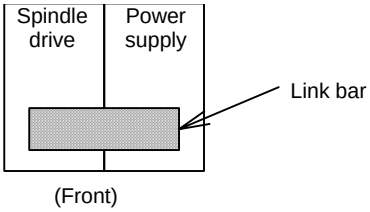
2-3 Restrictions and precautions

There are restrictions on the layout of spindle drive unit and power supply unit, and on sequence as follows.
When designing a power distribution box or creating sequence, always consider this section, and satisfy the following items.

2-3-1 Layout of unit

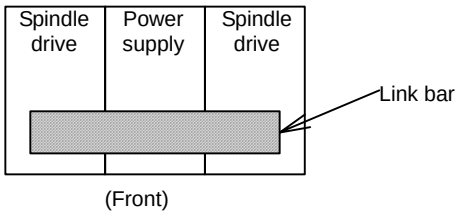
Arrange the spindle drive unit and power supply unit as follows.

(1) When installing one spindle drive

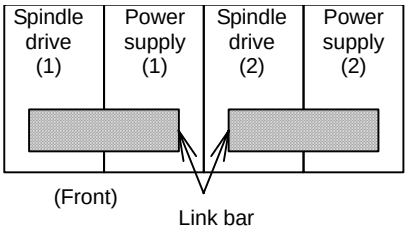


(2) When installing two spindle drives

1) When the total spindle drive output is 37kW or less



2) When the total spindle drive output exceeds 37kW

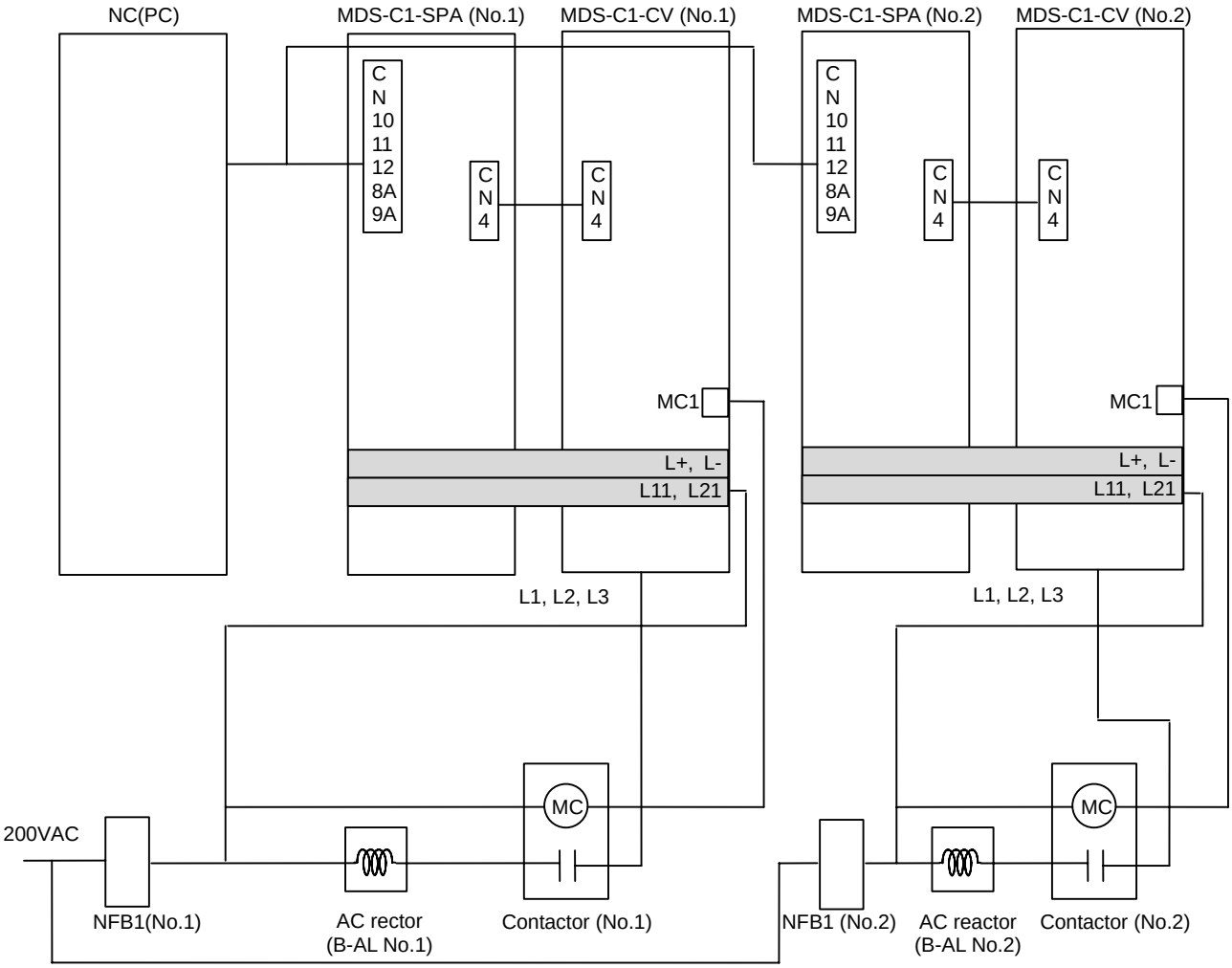


(Note 1) Install each unit next to each other (vertical direction is not acceptable) with a 3cm or less clearance between spindle drive unit and power supply unit.
Note that this does not apply to the section between spindle drive (2) and power supply unit (1) shown in 2) of section (2).

(Note 2) When using section (2) 2), install an ACL (B-AL) on each power supply unit.

2-3-2 Precautions for installing multiple power supply units

The methods for installing the two spindles are explained here as an example for installing multiple power supply units.



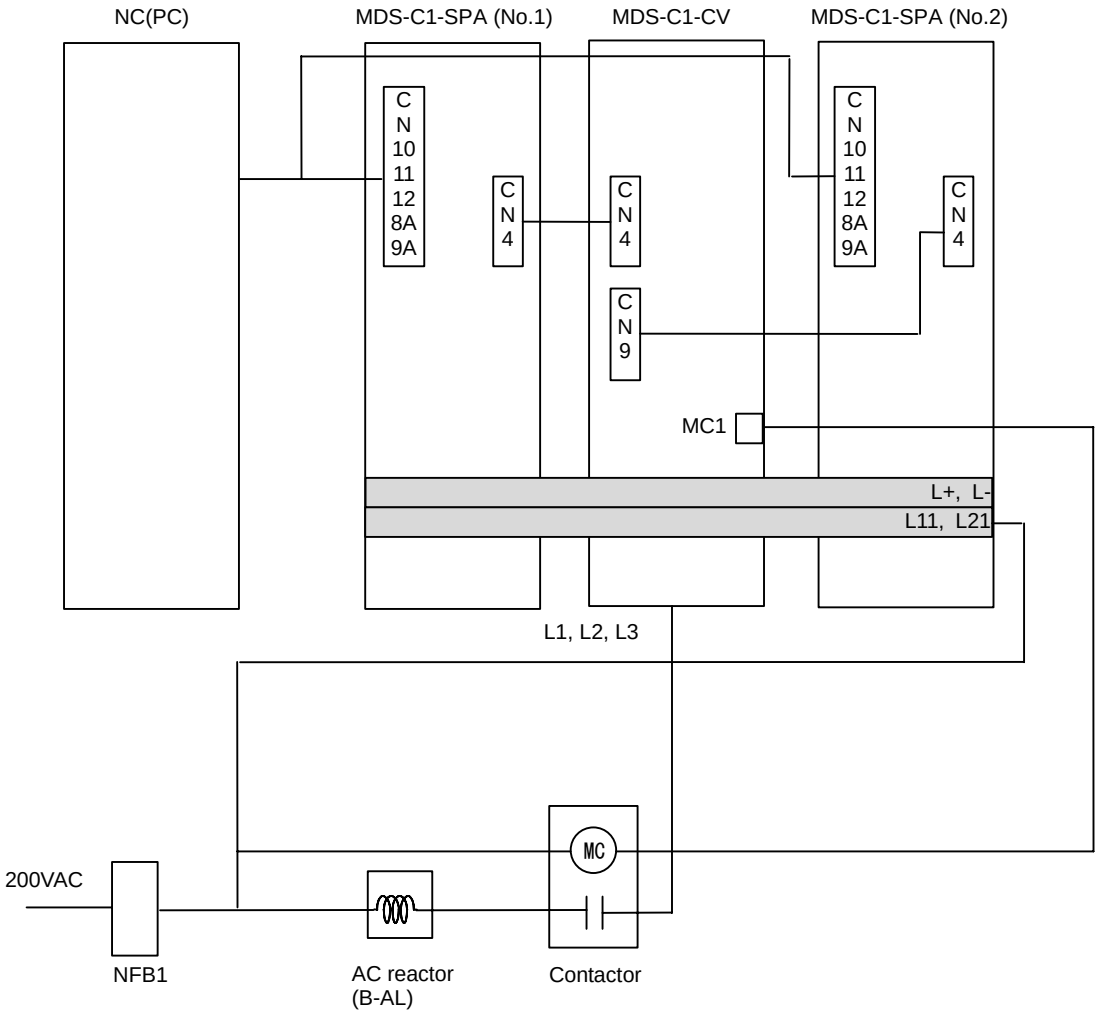
(1) Connecting the L+, L-, L11 and L21 link bars
Connect the L+ and L- link bars independently with C1-CV(No.1) and C1-CV(No.2) as shown above. Make sure that both C1-CV link bars are not short-circuited when connected.

(2) Connecting and selecting NFB1, contactor and AC reactor
An NFB1, a contactor and an AC reactor must be installed independently to each power supply as shown above. (These cannot be shared.) Note that the contactor, excluding C1-CV-370, can be omitted.

(3) Connecting the MC1 terminal (A/B-CV)
When using the contactor, set the C1-CV rotary switch to "0", and when not using, set to "1".

2-3-3 Precautions when installing multiple spindle drive units to one power supply unit

The methods for installing two spindle drive units to one power supply unit are explained here as an example.



(1) Connecting C1-CV and C1-SPA
Connect C1-CV CN4 and C1-SPA (No. 1) CN4 to C1-CV CN9 and C1-SPA (No.2) CN4. If C1-SPA is connected with three or more axes, leave CN4 for C1-SPA (No. 3) and following open.
Note that the C1-CV can be controlled (READY ON/OFF, alarm display, etc.) only by the spindle drive unit connected to C1-CV CN4.

(2) Make sure that the machine ready complete input turns ON and OFF simultaneously for all the spindle drive units. Do not allow the signal to turn ON and OFF for only one spindle drive unit.

(3) When turning the machine ready complete input OFF during an emergency stop, always have all the spindle drive units output the zero speed signal before turning the signal OFF.

(4) If an alarm occurs in one of the spindle drive units, turn OFF the machine ready complete input OFF for all the spindle drive units.

(5) When connecting three or more spindle drive units, install the large-capacity spindle drive units on both sides of the power supply unit.

3. Characteristics

3-1 Spindle motor

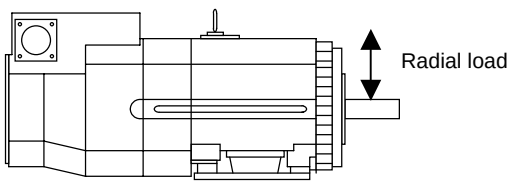
3-1-1 Environmental conditions

Environment	Conditions
Ambient temperature	0°C to +40°C (with no freezing)
Ambient humidity	90%RH or less (with no dew condensation)
Storage temperature	–20°C to +65°C (with no freezing)
Storage humidity	90%RH or less (with no dew condensation)
Atmosphere	Indoors (no direct sunlight); no corrosive gases, inflammable gases, oil mist or dust
Altitude	Operation/storage: 1000m or less above sea level Transportation: 10000m or less above sea level

3-1-2 Shaft characteristics

There is a limit to the load that can be applied on the motor shaft. Make sure that the load applied on the radial direction, when mounted on the machine, is below the tolerable values given below. These loads may affect the motor output torque, so consider them when designing the machine.

Spindle motor	Tolerable radial load
SJ-V3.7-02ZM	490 N
SJ-V2.2-01, SJ-V3.7-01 **SJ-V7.5-03ZM, SJ-V11-06ZM**	980 N
SJ-V5.5-01, SJ-V11-08ZM **SJ-PMF01830-00**	1470 N
SJ-V7.5-01, SJ-V11-01 **SJ-V22-06ZM, SJ-V30-02ZM, SJ-PMF03530-00**	1960 N
SJ-V11-09, SJ-V15-01, SJ-V15-03, SJ-V18.5-01, SJ-V18.5-03 **SJ-V22-01, SJ-V22-05, SJ-V26-01, SJ-30A**	2940 N
SJ-22XW5	3920 N
SJ-37BP	4900 N
SJ-22XW8, SJ-45BP **SJ-V55-01**	5880 N



The load point is at the one-half of the shaft length.

3-2 Drive unit characteristics

3-2-1 Environmental conditions

Environment	Conditions
Ambient temperature	0°C to +55°C (with no freezing)
Ambient humidity	90%RH or less (with no dew condensation)
Storage temperature	–15°C to +70°C (with no freezing)
Storage humidity	90%RH or less (with no dew condensation)
Atmosphere	Indoors (no direct sunlight); no corrosive gases, inflammable gases, oil mist or dust
Altitude	Operation/storage: 1000m or less above sea level Transportation: 10000m or less above sea level
Vibration	Operation/storage: 4.9m/s^2 (0.5G) or less Transportation: 49m/s^2 (5G) or less

(Note) When installing the machine at 1,000m or more above sea level, the heat dissipation characteristics will drop as the altitude increases. The upper limit of the ambient temperature drops 1°C with every 100m increase in altitude. (The ambient temperature at an altitude of 2,000m is between 0 and 45°C.)

3-2-2 Heating value

Each heating value is calculated with the following values.
The values for the spindle drive unit apply for the continuous rated output. The values for the power supply unit include the AC reactor's heating value.

Servo drive unit			Power supply unit		
Type MDS-C1-	Heating value [W]		Type MDS-C1-	Heating value [W]	
	Inside panel	Outside panel		Inside panel	Outside panel
SPA- 55	31	76	**CV- 37**	21	34
SPA- 75	35	102	**CV- 55**	23	42
SPA-110	41	140	**CV- 75**	25	55
SPA-150S	48	140	**CV-110**	26	99
SPA-150	48	187	**CV-150**	29	126
SPA-185	62	280	**CV-185**	33	162
SPA-220	65	301	**CV-220**	35	175
SPA-260	80	403	**CV-260**	40	220
SPA-300	98	522	**CV-300**	46	274
			CV-370	54	346

(Note 1) The values for the spindle drive unit are the heating value at the continuous rated output.
(Note 2) The total heating value for the power supply includes the heating value for the AC reactor.
(Note 3) The total heating value for the unit is the total sum of the heating values for the above corresponding units which are mounted in the actual machine.
Example) When the CV-185, SP-185 units are mounted
Unit total heating value (W) =195+242=437(W)

4. Dedicated Options

4-1 Orientation option

Select the orientation option to be required for the spindle control based on the following table.
For each control function, availability of use differs depending on the specifications in the NC side, so also refer to the manuals of NC side.

(a) No-variable speed control (When spindle and motor are directly coupled or coupled with a 1:1 gear ratio)

Spindle control item	Control specifications	Without orientation option		With orientation option		
		Motor PLG	Motor PLG with Z-phase	Motor PLG with Z-phase	Magnetic sensor	Spindle side detector (1020p/rev encoder)
Speed control	Normal cutting control	○	○	○	This normally is not used for no-variable speed control.	
	Constant surface speed control (lathe)	○	○	○		
	Thread cutting (lathe)	×	○	○		
Orientation control	1-point orientation control	×	×	○		
	Multi-point orientation control	×	×	○		
	Orientation indexing	×	×	○		
S-analog high-speed synchronous tap control	Standard synchronous tap	○	○	○		
	Synchronous tap after zero point return	×	○	○		

(Note 1) ○ : Control possible
× : Control not possible

(Note 2) The S-analog high-speed synchronous tap control is an option deferent from orientation. For details, refer to “2-2-2 (2) Spindle drive unit function specifications list”. Setting position loop in the NC side is required.

(b) Variable speed control (When using V-belt, or when spindle and motor are connected with a gear ratio other than 1:1)

Spindle control item	Control specifications	Without orientation option		With orientation option		
		Motor PLG	Motor PLG with Z-phase	Motor PLG with Z-phase	Magnetic sensor	Spindle side detector (1020p/rev encoder)
Speed control	Normal cutting control	○	○	○	○	○
	Constant surface speed control (lathe)	△	△	△	△	○
	Thread cutting (lathe)	×	×	×	×	○
Orientation control	1-point orientation control	×	×	×	○	○
	Multi-point orientation control	×	×	×	×	○
	Orientation indexing	×	×	×	×	○
S-analog high-speed synchronous tap control	Standard synchronous tap	▲	▲	▲	▲	○
	Synchronous tap after zero point return	×	×	×	▲	○

(Note 1) ○ : Control possible
× : Control not possible
△ : Control not possible when using V-belt
▲ : Control not possible when varying the speed with a method other than the gears and timing belt (when using V-belt or timing belt).

(Note 2) The S-analog high-speed synchronous tap control is an option deferent from orientation. For details, refer to “2-2-2 (2) Spindle drive unit function specifications list”. Setting position loop in the NC side is required.

4-1-1 Magnetic sensor

Prepare the magnetic sensor parts with the following types. When purchasing independently, always prepare with the required configuration part types.

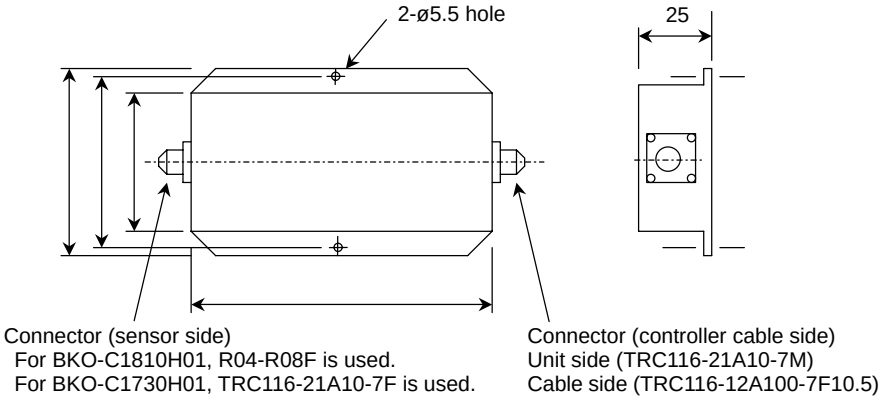
(1) Type

Type	Type	Tolerable speed [r/min]	Independent type		
			Drive unit	Sensor	Magnet
Standard	**MAGSENSOR BKO-C1810H01-3**	0 to 6000	H01	H02	H03
High-speed standard	**MAGSENSOR BKO-C1730H01.2.6**	0 to 12000	H01	H02	H06
High-speed small	**MAGSENSOR BKO-C1730H01.2.9**	0 to 12000	H01	H02	H09
High-speed ring	**MAGSENSOR BKO-C1730H01.2.41**	0 to 25000	H01	H02	H41
	MAGSENSOR BKO-C1730H01.2.42	0 to 25000	H01	H02	H42
	MAGSENSOR BKO-C1730H01.2.43	0 to 30000	H01	H02	H43
	MAGSENSOR BKO-C1730H01.2.44	0 to 30000	H01	H02	H44

(Note) When preparing with independent types, replace the section following the H in the prepared type with the independent type.
Example: When preparing only the standard magnetic sensor's sensor section, the type will be MAGSENSOR BKO-C1810H02.

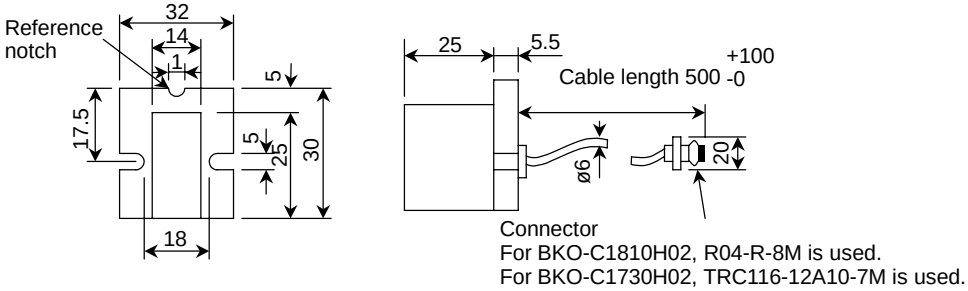
(2) Outline dimension drawing:

● **Drive unit H01**



[Unit: mm]

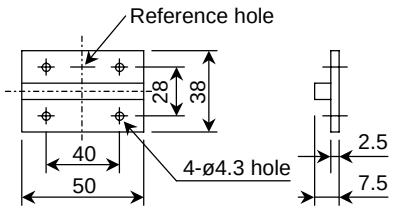
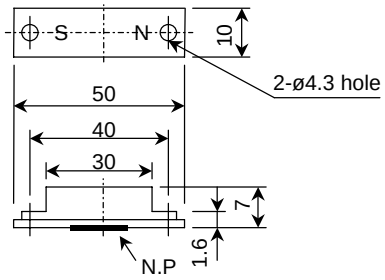
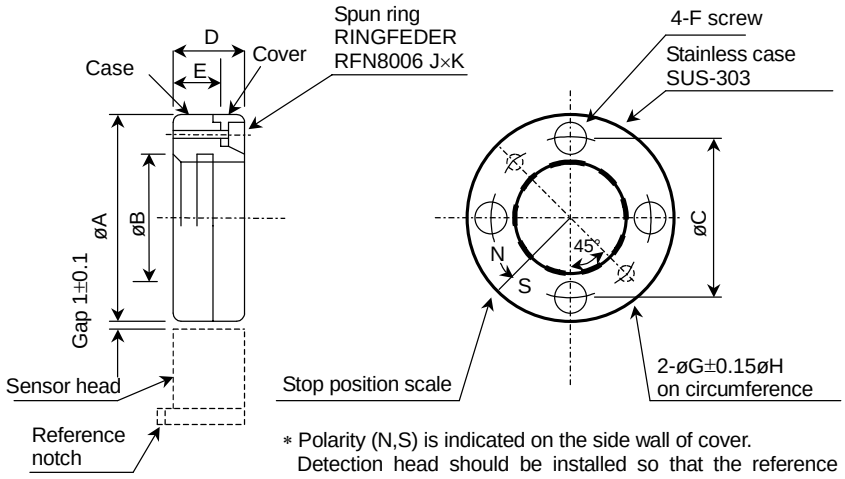
● **Sensor H02**



[Unit: mm]

⚠ CAUTION When using the magnetic sensor, orientation control cannot be carried out with a machine having a gear ratio between the spindle motor and spindle exceeding 1:31.

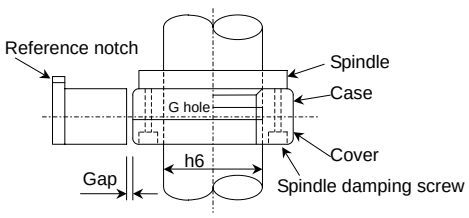
● Magnet

Part No.	Tolerable speed	Outline drawings
H03	0 to 6000 r/min	 Weight: 40 ± 1.5g Installation screw: M4 [Unit: mm]
H06	0 to 12000 r/min	
H09	0 to 12000 r/min	 Weight: 14.8 ± 0.7g Installation screw: M4 [Unit: mm]
H41	0 to 25000 r/min	 ∗ Polarity (N,S) is indicated on the side wall of cover. Detection head should be installed so that the reference notch of sensor head comes on the case side.
H42	0 to 25000 r/min	
H43	0 to 30000 r/min	
H44	0 to 30000 r/min	

[Unit: mm]

Magnet

Model	Dimensions										
	A	B	C	D	E	F	G	H	J × X	L	Weight (g)
BKO-C1730H41	105	70H7$^{+0.030}_{-0}$	90	28	19	M6×1.0	5	90	70×79	1	1024±4
BKO-C1730H42	94	60H7$^{+0.030}_{-0}$	79	25	17	M5×0.8	5	79	60×68	1	768±4
BKO-C1730H43	78	50H7$^{+0.025}_{-0}$	66	23	15	M5×0.8	5	66	50×57	1	478±4
BKO-C1730H44	66	40H7$^{+0.025}_{-0}$	54	20	13	M4×0.7	5	54	40×45	1	322±4



Installation of magnet

Cautions on installation of H41 to H44

1. Tolerance to shaft dimension should be "h6" on the part for installing a magnet.
2. 2-øG hole can be used for positioning of spindle and magnet.
3. Magnet shall be installed as shown to the left.
4. Misalignment between sensor head and magnetic center line shall be within ±2mm.
5. There is an NS indication on the side of the cover. Install so that the reference notch on the sensor head comes to the case side.

(3) Caution on installation of magnet

Observe the following cautions when installing the magnet to the spindle.

(a) Do not place an intense magnetic source near the magnet.
(b) Carefully handle the magnet, avoiding mechanical shock to the magnet.
(c) Secure the magnet to the spindle with M4 screws.
(d) After the magnet is installed, balance the entire spindle.
(e) Align the center of the magnet with the center line of the rotating disk on the spindle. (For the position relation, refer to the maintenance instruction manual.)
(f) Keep the magnet and its peripheral clean avoiding iron particles and cutting chips from adhering to the magnet. Failure to observe this could result in malfunction.
(g) Apply lock paint, or other suitable means, to prevent installation screws from becoming loose.
(h) If the magnet is installed on a ground rotating disk, demagnetize the disk because the rotating disk is thought to be magnetized.
(i) Diameter of rotating disk on which the magnet is installed should be within the range from 80mm to 120mm. If this range is exceeded, the magnet may be damaged and the orient control may not be carried out correctly although the speed is below the tolerable speed of the magnet.
(j) If rotation speed of the spindle on which the magnet is installed exceeds 6,000r/min, use a high-speed type magnet (applicable up to 12,000r/min of rotation speed). If rotation speed exceeds 12,000r/min, use a ring type magnet.
(k) When installing the magnet on a rotating body plane, keep the speed below 6,000r/min.

(4) Caution on installation of sensor

Observe the following cautions when installing the sensor.

(a) The center line of head should be in line with the center of magnet.
(b) Connector used in preamplifier
BKO-C1810 : Oil proof-type
BKO-C1730 : Not oil proof-type
Install both type at a place not subject to oil.
(c) The cable between the preamplifier and the controller should be laid down apart from high-voltage cables.
(d) Check the connector wiring, securely engage the receptacle and tighten connector lock screws.

4-1-2 Spindle side detector (OSE-1024-3-15-68, OSE-1024-3-15-68-8)

When a spindle and motor are connected with a V-belt, or connected with a gear ratio other than 1:1, use this spindle side detector (1024p/rev encoder) to detect the position and speed of the spindle. Also use this detector when orientation control and synchronous tap control, etc are executed under the above conditions.

(2) Specifications

Detector type		OSE-1024-3-15-68	OSE-1024-3-15-68-8
Mechanical characteristics for rotation	**Inertia**	0.1×10^{-4}kgm^2 or less	0.1×10^{-4}kgm^2 or less
	Shaft friction torque	0.98Nm or less	0.98Nm or less
	Shaft angle acceleration	10^4 rad/s^2 or less	10^4 rad/s^2 or less
	Tolerable continuous rotation speed	6000 r/min	8000 r/min
	Maximum rotation speed	7030 r/min	8030 r/min
Mechanical configuration	**Bearing maximum non-lubrication time**	20000h/6000r/min	20000h/8000r/min
	Shaft amplitude (position 15mm from end)	0.02mm or less	0.02mm or less
	Tolerable load (thrust direction/radial direction)	10kg/20kg Half of value during operation	10kg/20kg Half of value during operation
	Weight	1.5kg	1.5kg
	Squareness of flange to shaft	0.05mm or less	
	Flange matching eccentricity	0.05mm or less	
Working environment	**Ambient temperature range**	–5°C to +55°C	
	Storage temperature range	–20°C to +85°C	
	Humidity	95%Ph	
	Vibration resistance	5 to 50Hz, total vibration width 1.5mm, each shaft for 30min.	
	Impact resistance	294.20m/s^2 (30G)	

(2) Detection signals

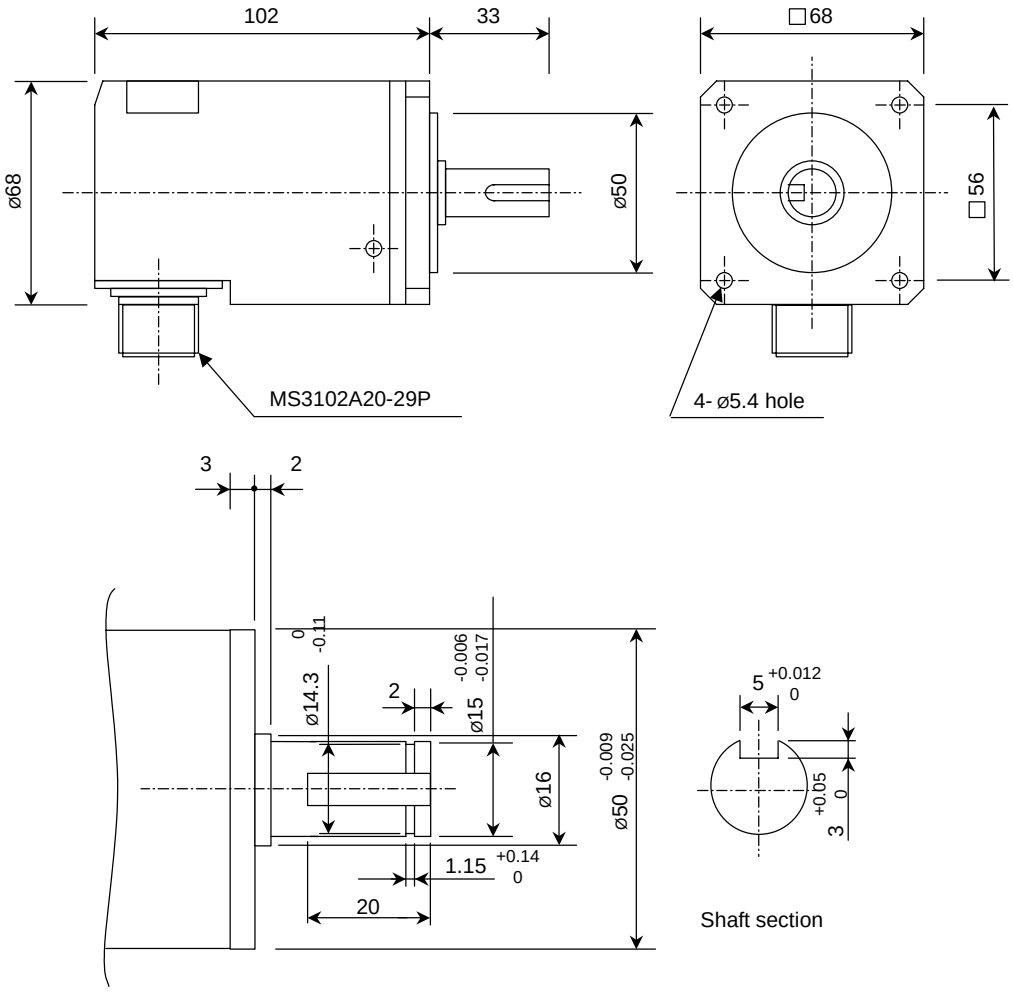
Signal name	Number of detection pulses
A, B phase	1024p/rev
Z phase	1p/rev

Connector pin layout

Pin	Function
A	A phase
B	Z phase
C	B phase
D	-
E	Case earth
F	-
G	-
H	+5V
J	-

Pin	Function
K	0V
L	-
M	-
N	$\overline{A}$ phase
P	$\overline{Z}$ phase
R	$\overline{B}$ phase
S	-
T	-

(3) Outline dimension drawings



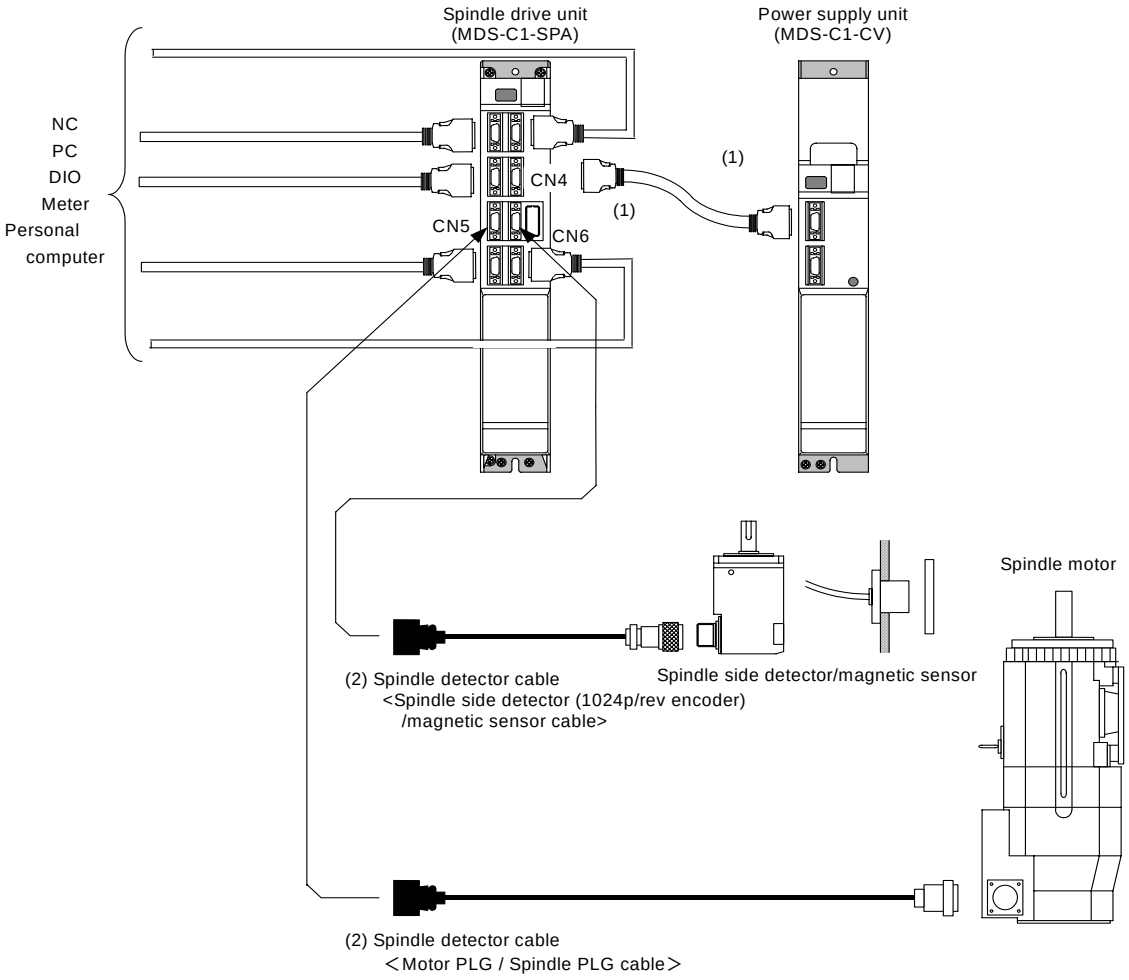
[Unit: mm]

Spindle side detector (OSE-1024-3-15-68, OSE-1024-3-15-68-8)

4-2 Cables and connectors

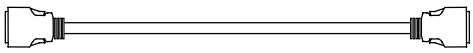
4-2-1 Cable connection diagram

The cable connected with CN4, CN5 or CN6 of spindle drive unit in the following diagram can be ordered from Mitsubishi Electric Corp. as option parts. Cables can only be ordered in the designated lengths. If a cable connected with the other connector or a cable with special length is required, purchase a connector or connector set, etc., and create the cable.



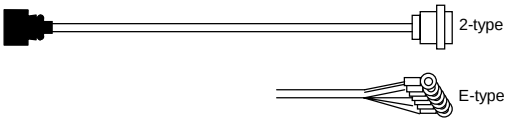
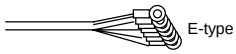
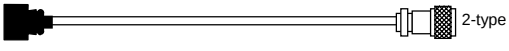
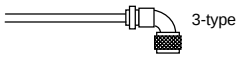
4-2-2 List of cables and connectors

(1) NC bus cable and connector (cable and connector between drive unit and power supply unit)

Item		Model	Contents
For CN4	NC bus cable	SH21 Length: 0.35, 0.5, 0.7, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 6, 7, 8, 9, 10, 15, 20, 30 m	Drive unit side connector (3M) Connector : 10120-6000EL Shell kit : 10320-3210-000 Drive unit side connector (3M) Connector : 10120-6000EL Shell kit : 10320-3210-000 
For CN4	NC bus cable connector set	FCUA-CS000	Drive unit side connector (3M) Connector : 10120-3000VE Shell kit : 10320-52F0-008 Drive unit side connector (3M) Connector : 10120-3000VE Shell kit : 10320-52F0-008 

(Note) The connector manufacturer is subject to change without notice.

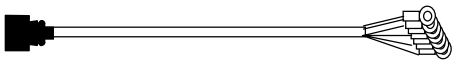
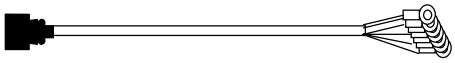
(2) Spindle detector cable

Item		Model	Contents
For CN5	Motor PLG cable	CNP5-□□-□ Connector type 2: Connector E: Crimped terminal Axis No. (1 to 8 axis) 1: No. 1 axis to 8: No. 8 axis System No. None: 1st system 2 : 2nd system P : PLC axis Length: 2, 5, 10, 20, 30 m	Spindle drive unit side connector (3M) Connector : 10120-3000VE Shell kit : 10320-52F0-008 Spindle motor side connector For 2-type (Tyco Electronics AMP) Plug : 350720-1 Pin : 350689-1 For E-type (J.S.T.) Crimped terminal: V1.25-4 
For CN6	Magnetic sensor cable	CNP6M-□□-□ Connector type 2: Connector E: Crimped terminal Axis No. (1 to 8 axis) 1: No. 1 axis to 8: No. 8 axis System No. None: 1st system 2 : 2nd system P : PLC axis Length: 2, 5, 10, 20, 30 m	Spindle drive unit side connector (3M) Connector : 10120-3000VE Shell kit : 10320-52F0-008 Magnetic sensor side connector For 2-type (Tajimi Musen) Plug: TRC116-12A10-7F10.5 For E-type (J.S.T.) Crimped terminal: V1.25-4  
	Spindle side detector (1024p/rev encoder) cable	CNP6A-□□-□ Connector type 2: Straight cannon 3: Angle cannon E: Crimped terminal Axis No. (1 to 8 axis) 1: No. 1 axis to 8: No. 8 axis System No. None: 1st system 2 : 2nd system P : PLC axis Length: 2, 5, 10, 20, 30 m	Spindle drive unit side connector (3M) Connector : 10120-3000VE Shell kit : 10320-52F0-008 Spindle side detector (1024p/rev encoder) side connector For 2-type (DDK) Plug : MS3106A20-29S Clamp: MS3057-12A For 3-type (DDK) Plug : MS3108A20-29S Clamp: MS3057-12A For E-type (J.S.T.) Crimped terminal: V1.25-4   

(Note) The connector manufacturer is subject to change without notice.

(3) External connection cable

Cables shown below are made by the user.

Item		Model	Contents
For CN10, CN11, CN12	DIO cable		Spindle drive unit side connector (3M) Connector : 10120-3000VE Shell kit : 10320-52F0-008 External device NC device Programmable controller External part DIO Cable: Batch vinyl shield cable 0.2SQ x 20-core (Maximum diameter 12mm or less) 
For CN8A	Analog speed command input pulse feedback cable		Spindle drive unit side connector (3M) Connector : 10120-3000VE Shell kit : 10320-52F0-008 External device NC device Programmable controller Cable: Twisted pair shield cable 0.3SQ x 4 + 0.3SQ x 3 
For CN9A	For meter output Personal computer for parameter input • monitor		Spindle drive unit side connector (3M) Connector : 10120-3000VE Shell kit : 10320-52F0-008 External device Speed meter Load meter Personal computer Cable: Twisted pair cable 0.3SQ x 2 + 0.3SQ x 2 

(Note1) The connector manufacturer is subject to change without notice.

(Note2) Keep the length of the cables, excluding the cable for CN9A, which is connected with a personal computer, to 30m or less. (The cable connected with a personal computer must be 3m or less.)

(Note3) Do not relay the CNP5, CNP6M or CNP6A cables. Malfunctions may occur due to noise from the motor drive wire or other cables. (Orientation position could dislocate, vibration could occur, etc.)
If the cable must be relayed, keep the peeled shield section as short as possible (3cm or less), and separate the cable from the other drive wires and cables. Mitsubishi will not be held liable for any problems that should occur as a result of a relayed cable. The customer is responsible for providing measures against noise.

5. Peripheral Devices

5-1 Selection of wire

5-1-1 Example of wires by unit

Selected wires must be able to tolerate rated current of the unit's terminal to which the wire is connected.
How to calculate tolerable current of an insulated wire or cable is shown in "Tolerable current of electric cable" (1) of Japanese Cable Makers' Association Standard (JCS)-168-E (1995), its electric equipment technical standards or JEAC regulates tolerable current, etc. wire.
When exporting wires, select them according to the related standards of the country or area to export.
In the UL standards, certification conditions are to use wires of 60 °C and 75 °C product. (UL508C)
Wire's tolerable current is different depending on conditions such as its material, structure, ambient temperature, etc. Check the tolerable current described in the specification of the wire to use.

Example of wire selections according to each standard is as follows.

(1) 600V vinyl insulated wire (IV wire) 60°C product (Example according to IEC/EN60204-1, UL508C)

Terminal name / Unit type		TE1 (L1, L2, L3, ⏚)		TE2 (L+, L-)		TE3 (L11, L21, L12, L22, MC1)	
		mm²	AWG	mm²	AWG	mm²	AWG
Power supply unit	MDS-C1-CV-37	3.5	12	Same as TE1		1.25 to 2	16 to 14
	MDS-C1-CV-55	3.5	12				
	MDS-C1-CV-75	5.5	10				
	MDS-C1-CV-110	14	6				
	MDS-C1-CV-150	22	4				
	MDS-C1-CV-185	30	3				
	MDS-C1-CV-220	38	2				
	MDS-C1-CV-260	50	-				
	MDS-C1-CV-300	60	-				
	MDS-C1-CV-370	-	-				
Spindle drive unit	MDS-C1-SPA-55	3.5	12	Match with TE2 of selected power supply unit		1.25 to 2	16 to 14
	MDS-C1-SPA-75	5.5	10				
	MDS-C1-SPA-110	8	8				
	MDS-C1-SPA-150	14	6				
	MDS-C1-SPA-185	22	4				
	MDS-C1-SPA-220	30	3				
	MDS-C1-SPA-260	38	2				
	MDS-C1-SPA-300	60	-				

(2) 600V double (heat proof) vinyl insulated wire (HIV wire) 75°C product (Example according to IEC/EN60204-1, UL508C)

Terminal name / Unit type		TE1 (L1, L2, L3, ⏚)		TE2 (L+, L-)		TE3 (L11, L21, L12, L22, MC1)	
		mm²	AWG	mm²	AWG	mm²	AWG
Power supply unit	MDS-C1-CV-37	2	14	Same as TE1		1.25 to 2	16 to 14
	MDS-C1-CV-55	3.5	12				
	MDS-C1-CV-75	5.5	10				
	MDS-C1-CV-110	14	6				
	MDS-C1-CV-150	14	6				
	MDS-C1-CV-185	22	4				
	MDS-C1-CV-220	30	3				
	MDS-C1-CV-260	38	2				
	MDS-C1-CV-300	38	2				
	MDS-C1-CV-370	50	-				
Spindle drive unit	MDS-C1-SPA-55	2	14	Match with TE2 of selected power supply unit		1.25 to 2	16 to 14
	MDS-C1-SPA-75	3.5	12				
	MDS-C1-SPA-110	5.5	10				
	MDS-C1-SPA-150	14	6				
	MDS-C1-SPA-185	14	6				
	MDS-C1-SPA-220	22	4				
	MDS-C1-SPA-260	30	3				
	MDS-C1-SPA-300	38	2				

(3) 600V bridge polyethylene insulated wire (IC) 105°C product (Example according to JEAC8001)

Unit type \ Terminal name		TE1 (L1, L2, L3, ⏚)		TE2 (L+, L-)		TE3 (L11, L21, L12, L22, MC1)	
		mm²	AWG	mm²	AWG	mm²	AWG
Power supply unit	MDS-C1-CV-37	2	14	2	14	1.25 to 2	16 to 14
	MDS-C1-CV-55	2	14	3.5	12		
	MDS-C1-CV-75	3.5	12	3.5	12		
	MDS-C1-CV-110	5.5	10	14	6		
	MDS-C1-CV-150	8	8	14	6		
	MDS-C1-CV-185	14	6	22	4		
	MDS-C1-CV-220	14	6	22	4		
	MDS-C1-CV-260	22	4	30	3		
	MDS-C1-CV-300	38	2	38	2		
	MDS-C1-CV-370	38	2	50	-		
Spindle drive unit	MDS-C1-SPA-55	2	14	Match with TE2 of selected power supply unit		1.25 to 2	16 to 14
	MDS-C1-SPA-75	3.5	12				
	MDS-C1-SPA-110	5.5	10				
	MDS-C1-SPA-150	14	6				
	MDS-C1-SPA-185	14	6				
	MDS-C1-SPA-220	22	4				
	MDS-C1-SPA-260	30	3				
	MDS-C1-SPA-300	38	2				

⚠CAUTION

1. Selection conditions follow IEC/EN60204-1, UL508C, JEAC8001.
   - Ambient temperature is maximum 40°C.
   - Cable installed on walls without ducts or conduits.

   To use the wire under conditions other than above, check the standards you are supposed to follow.
2. The maximum wiring length to the motor is 30m.
   If the wiring distance between the drive unit and motor is 20m or longer, use a thick wire so that the cable voltage drop is 2% or less.
3. Always wire the grounding wire.

5-2 Selection the AC reactor, contactor and no-fuse breaker

5-2-1 Standard selection

Install an AC reactor, contactor and no-fuse breaker (NFB) per one power supply unit. Refer to the table below and select them according to each power supply unit capacity.

Selection of AC reactor, contactor and no-fuse breaker (NFB)

<table>
<tr><th>Power supply unit capacity</th><th>3.7 to 7.5kW</th><th>11kW</th><th>15 to 18.5kW</th><th>22 to 30kW</th><th>37kW</th></tr>
<tr><td>AC reactor</td><td>B-AL-7.5K</td><td>B-AL-11K</td><td>B-AL-18.5K</td><td>B-AL-30K</td><td>B-AL-37K</td></tr>
<tr><td>Recommended contactor (Special order part)</td><td>S-N25 200V</td><td>S-N35 200V</td><td>S-N50 200V</td><td>S-N80 200V</td><td>S-N150 200V</td></tr>
<tr><td>Recommended main circuit NFB (Special order part)</td><td>NF50CS3P-40A05</td><td>NF50CS3P-50A05</td><td>NF100CS3P-100A05</td><td>NF225CS3P-150A05</td><td>NF225CS3P-175A05</td></tr>
<tr><td>Recommended motor fan NFB (Special order part)</td><td colspan="5">An NFB or CP (circuit protector) can be used as the motor fan breaker.
Select the NFB or CP using a value approximately double the motor fan rated current value shown below.
Contact the NFB or CP manufacturer for details on the recommended wire size, etc.

<table>
<tr><td>Spindle motor frame size</td><td>71</td><td>90</td><td>112</td><td>132</td><td>160</td><td>180</td></tr>
<tr><td>Motor fan rated current</td><td>0.1A</td><td>0.2A</td><td>0.2A</td><td>0.2A</td><td>0.6A</td><td>0.6A</td></tr>
</table>
* A rush current that is approximately double the above rated current flows when the motor starts.</td></tr>
</table>

(Note 1) In the above table, a special order part refers to a part that cannot be ordered from Mitsubishi, and which must be prepared by the user.

(Note 2) To comply with the EC Directives, use contactors and NFB that comply with the EN/IEC Standards.

⚠ **CAUTION**	If a breaker is shared by several power supply units, the breaker may not activate when a short-circuit fault occurs in a small capacity unit. This is dangerous, so never share the breakers.

5-2-2 Selection of contactor for changing over spindle motor drive wire

When using coil changeover motor and 1-drive unit 2-motor changeover function, select a contactor for changing over motor drive wire from the table below according to the capacity of spindle drive unit to be used.

Spindle drive unit type	Recommended contactor type
MDS-A/B-SPA(H)-04	S-N10
MDS-A/B-SPA(H)-075	S-N10
MDS-A/B-SPA(H)-15	S-N10
MDS-A/B-SPA(H)-22	S-N10
MDS-A/B-SPA(H)-37	S-N18
MDS-A/B/C1-SPA(H)-55	S-N20
MDS-A/B/C1-SPA(H)-75	S-N25
MDS-A/B/C1-SPA(H)-110	S-N35
MDS-A/B/C1-SPA(H)-150	S-N50
MDS-A/B/C1-SPA(H)-185	S-N65
MDS-A/B/C1-SPA(H)-220	S-N80
MDS-A/B/C1-SPA(H)-260	S-N80
MDS-A/B/C1-SPA(H)-300	S-N125
MDS-B-SPA(H)-370	S-N150
MDS-B-SPA(H)-450	S-N180
MDS-B-SPA(H)-550	S-N300

(Note 1) These contactors are prepared by the user.
(Note 2) Use the EN/IEC Standards compliant parts in compliance with EC Directives.

5-3 Earth leakage breaker

When installing an earth leakage breaker, select the breaker on the following basis to prevent the breaker from malfunctioning by the higher frequency earth leakage current generated in the spindle drive unit.

(1) Selection

Obtaining the earth leakage current for all drive units referring to the following table, select an earth leakage breaker within the “rated non-operation sensitivity current”.
Usually use an earth leakage breaker for inverter products that function at a leakage current within the commercial frequency range (50 to 60Hz).
If a product sensitive to higher frequencies is used, the breaker could malfunction at a level less than the maximum earth leakage current value.

Earth leakage current for each unit

Unit	Earth leakage current	Maximum earth leakage current
MDS-C1-SPA-55 to 300	6mA	15mA

(Note1) Maximum earth leakage current: Value that considers wiring length and grounding, etc. (Commercial frequency 50/60Hz)
(Note2) The earth leakage current in the power supply unit side is included in the drive unit side.

(2) Measurement of earth leakage current

When actually measuring the earth leakage current, use a product that is not easily affected by the higher frequency earth leakage current. The measurement range should be 50 to 60Hz.

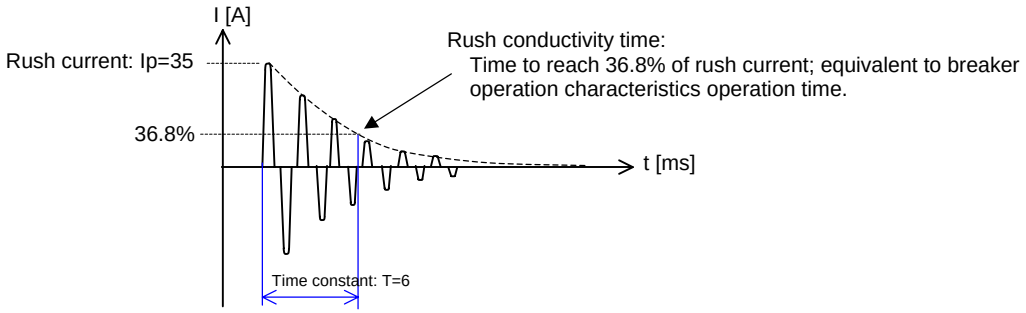
POINT

1. The earth leakage current tends to increase as the motor capacity increases.
2. A higher frequency earth leakage current will always be generated because the inverter circuit in the drive unit switches the transistor at high speed. Always ground to reduce the higher frequency earth leakage current as much as possible.
3. An earth leakage current containing higher frequency may reach approx. several hundreds of mA. According to IEC479-2, this level is not hazardous to the human body.

5-4 Branch-circuit protection

5-4-1 Circuit protector

This breaker is used to switch the control power and to provide overload and short-circuit protection. When connecting a circuit protector or breaker to the power input (TE3 terminals L11 and L21) for the control circuit, use a product that does not trip (incorrectly activate) by a rush current when the power is turned ON. A circuit protector with inertial delay and an operation delayed type breaker are available to prevent unnecessary tripping. Select the product to be used according to the machine specifications. The rush current and rush conductivity time differ according to the power impedance and power ON timing, so select a product that does not trip even under the conditions listed in the following table.



POINT

When collectively protecting the control circuit power for multiple units, select a circuit protector or breaker that satisfies the total sum of the rush current Ip. The largest value is used for the rush conductivity time T.

5-4-2 Fuse protection

The fuse of branch-circuit protection must use UL class CC, J or T. In the selection, please consider rush current and rush conductive time.

Selection of branch-circuit protection fuse

Connected total of unit	Fuse (Class CC)		Wire Size
	Rated [V]	Current [A]	AWG
1 – 4	600	20	16 to 14
5 – 8		35	

CAUTION

For continued protection against risk of fire, replace only with same type 600 V, 20 or 35 A (UL CLASS CC) fuse.

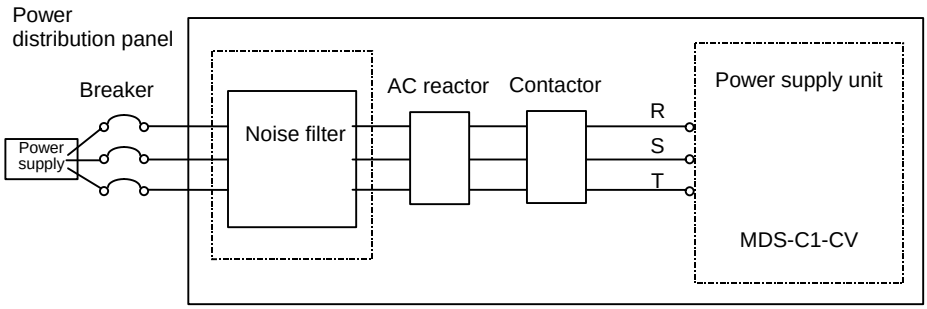
5-5 Noise filter

(1) Selection

Use an EMC noise filter if the noise conducted to the power line must be reduced. Select an EMC noise filter taking the power supply unit's input rated voltage and input rated current into consideration.

(2) Noise filter mounting position

Install the noise filter to the power supply unit's power input as the diagram below indicates.



(Note) The noise filter must be prepared by the user.

Recommended devices:	Okaya Electric Industries	3SUP-HL-ER-6B Series
	Soshin Electric	HF3000C-TMA Series

Contact:	Okaya Electric Industries Co., Ltd.	Telephone: 03-3424-8120 (+81-3-3424-8120) http://www.okayaelec.co.jp
	Soshin Electric Co., Ltd.	Telephone: 03-3775-9112 (+81-3-3775-9112) http://www.soshin.co.jp

(Note) The above devices may be changed at the manufacturer's discretion.
Contact each manufacturer for more information.

5-6 Surge absorber

When controlling a magnetic brake of a servomotor in DC OFF circuit, a surge absorber must be installed to protect the relay contacts and brakes. Commonly a varistor is used.

(1) Selection of varistor

When a varistor is installed in parallel with the coil, the surge voltage can be adsorbed as heat to protect a circuit. Commonly a 120V product is applied. When the brake operation time is delayed, use a 220V product. Always confirm the operation with an actual machine.

(2) Specifications

Select a varistor with the following or equivalent specifications. To prevent short-circuiting, attach a flame resistant insulation tube, etc., onto the leads as shown in the following outline dimension drawing.

Varistor specifications

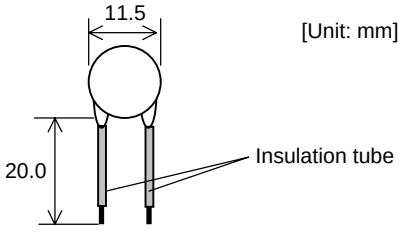
Varistor type	Varistor voltage rating (range)	Rating							Max. limit voltage	Electrostatic capacity (reference value)
		Tolerable circuit voltage		Surge current withstand level (A)		Energy withstand level (J)		Power		
	(V)	AC (V)	DC (V)	1 time	2 times	10/1000us	2ms	(W)	(V)	(pF)
ERZV10D121	120 (108 to 132)	75	100	3500	2500	20	14.5	0.4	200	1400
TNR10V121K										
ERZV10D221	220 (198 to 242)	140	180	3500	2500	39	27.5	0.4	360	410
TNR10V221K										

(Note 1) Selection condition: When ON/OFF frequency is 10 times/min or less, and exciting current is 2A or less

(Note 2) ERZV10D121 and ERZV10D221 are manufactured by Matsushita Electric Industrial Co., Ltd.
TNR10V121K and TNR10V221K are manufactured by MARCON Electronics Co., Ltd.
Contact: Matsushita Electronic Components Co., Ltd : http://www.panasonic.co.jp/ maco/
MARCON Electronics Co., Ltd. Telephone : (Kanto)03-3471-7041 (+81-3-3471-7041)
(Kinki) 06-6364-2381 (+81-3-6364-2381)
(Chubu) 052-581-2595 (+81-52-581-2595)

(3) Outline dimension drawing

• ERZV10D121, ERZV10D221



POINT

Normally use a product with 120V varistor voltage. If there is no allowance for the brake operation time, use the 220V product. A varistor whose voltage exceeds 220V cannot be used, as such varistor will exceed the specifications of the relay in the unit.

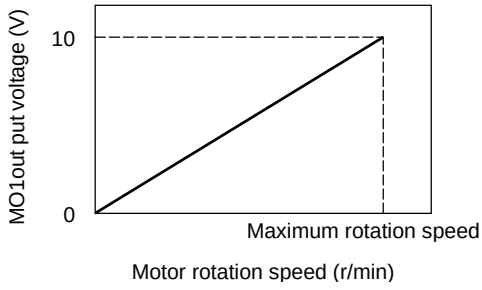
5-7 Speedometer and load meter

Speedometer and load meter can be output from the D/A output which is for measuring control data.

(1) Speedometer output

When speedometer is output, +10V DC is output at the motor's maximum speed regardless of the motor's rotation direction. The following specifications are recommended for the display.

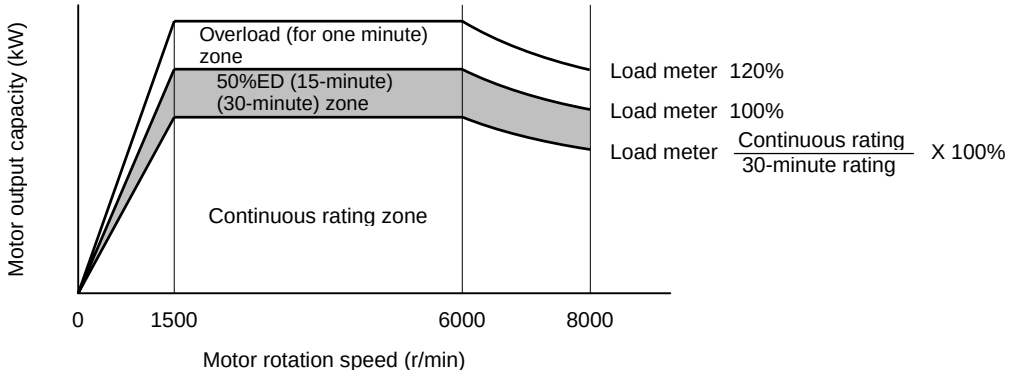
(a) Type YM-8G type DC voltage type (Mitsubishi)
(b) Rating 10VDC full scale
(c) Internal impedance approx. 10kΩ



Speedometer output specification

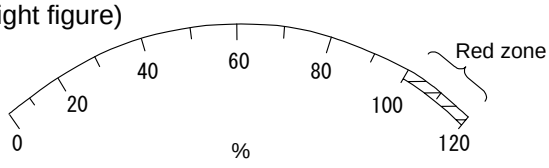
(2) Load meter output

The load meter indicates the percentage of the load in respect to the motor's rated output. The relation of the motor output capacity [kW] and load meter display [%] is as follows.



Load meter output specification

The following specifications are recommended for the display.
(a) Type YM-8G type DC voltage type (Mitsubishi)
(b) Rating 10VDC full scale
(c) Internal impedance approx. 10kΩ
(d) Scale indicating alarm at 100% or above (see right figure)

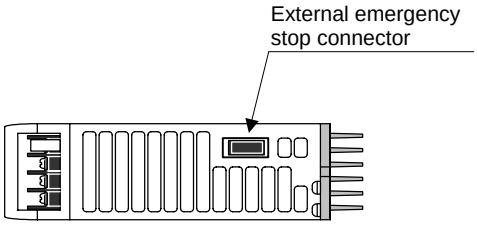


Load meter display

5-8 Cable for peripheral control

5-8-1 Cable for external emergency stop

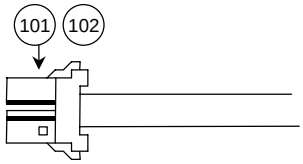
Prepare the cable below for external emergency stop function (dual emergency stop function). The cable for external emergency stop must be prepared by the user.

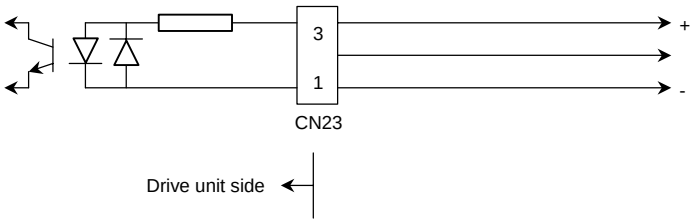


Bottom view of MDS-C1-CV

No.	Item	Type	Manufacturer
101	Connector	2-178288-3	Tyco Electronics AMP
102	Contact	1-175218-2	Tyco Electronics AMP

Wire size:0.5 to 1.25SQ



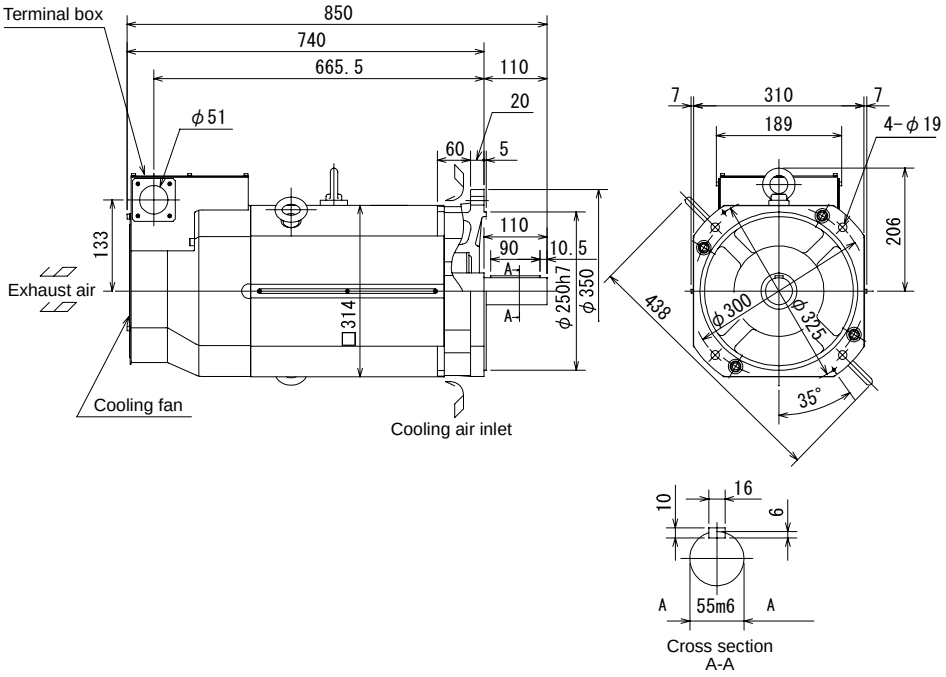


Appendix 1. Outline Dimension Drawings

Appendix 1-1 Outline dimension drawings of spindle motor

Appendix 1-1-1 SJ Series

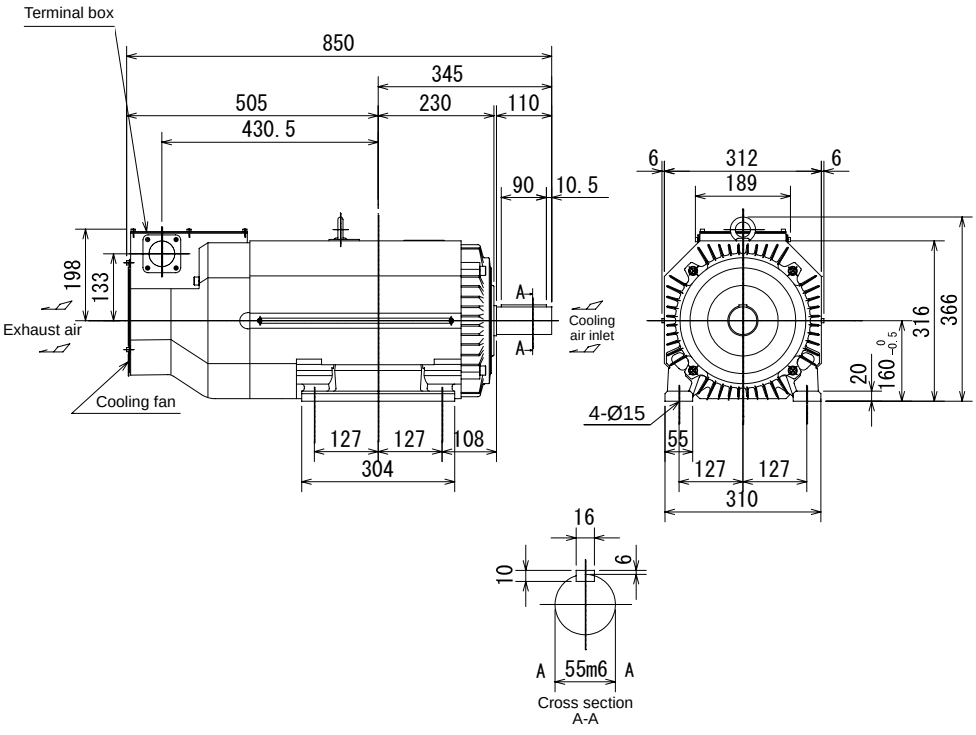
- SJ-30A with standard flange



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

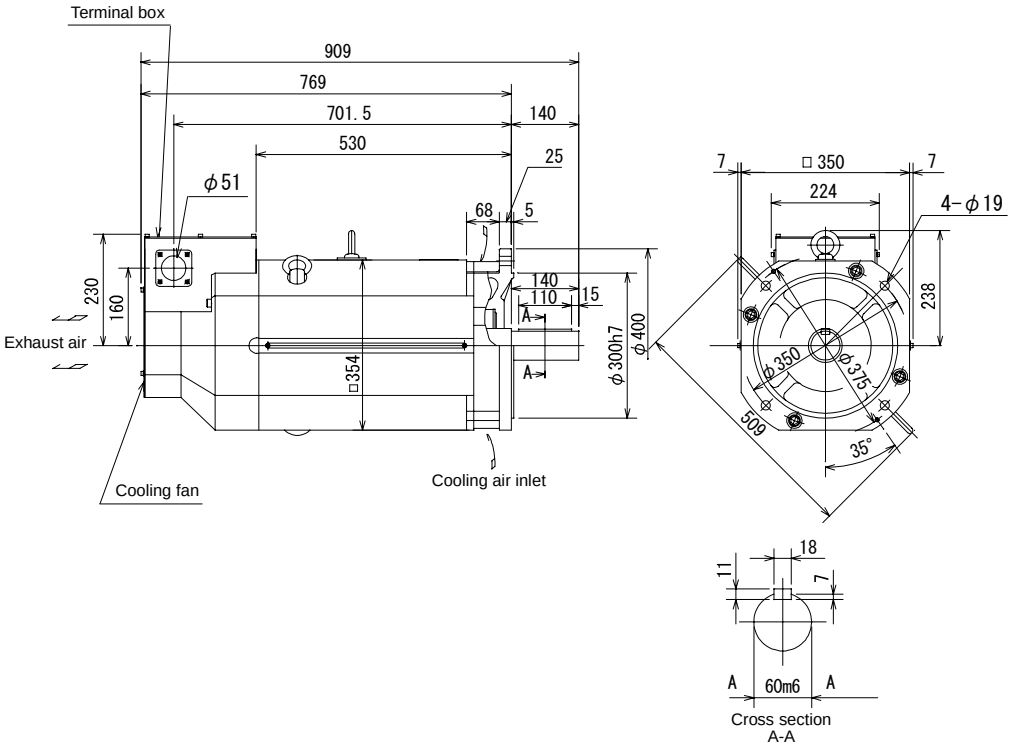
- SJ-30A with standard legs



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) If the suspension bolts are removed during operation, plug the screw holes with bolts.

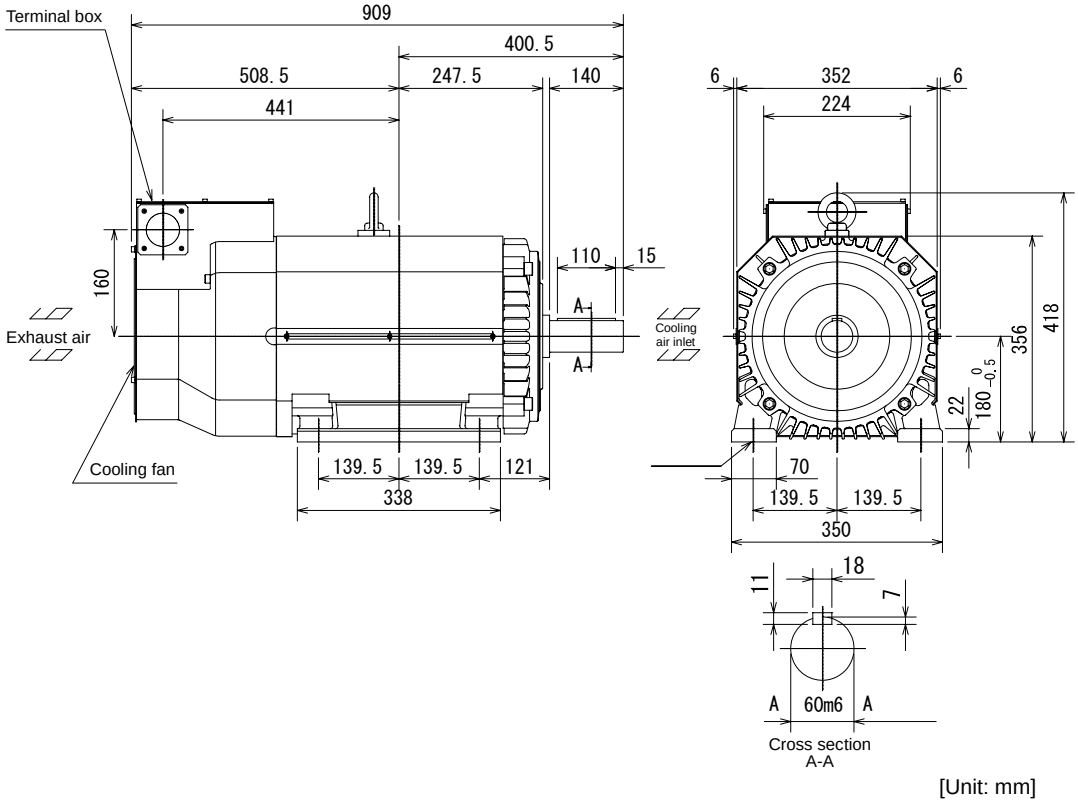
- SJ-37BP, SJ-22XW5 with standard flange



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

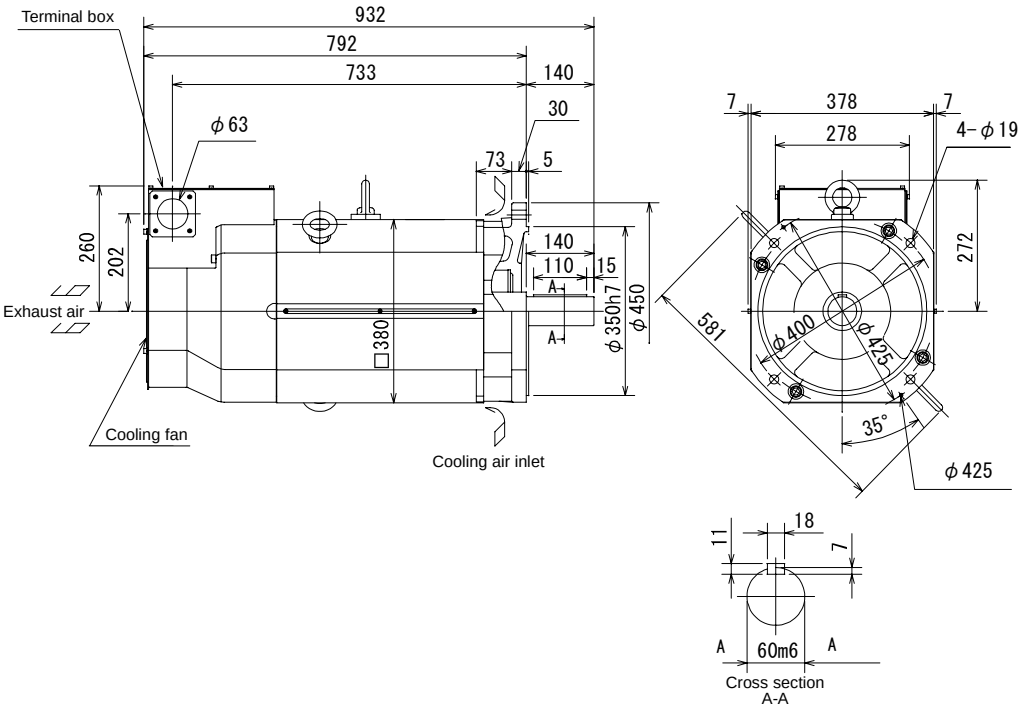
- SJ-37BP, SJ-22XW5 with standard legs



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) If the suspension bolts are removed during operation, plug the screw holes with bolts.

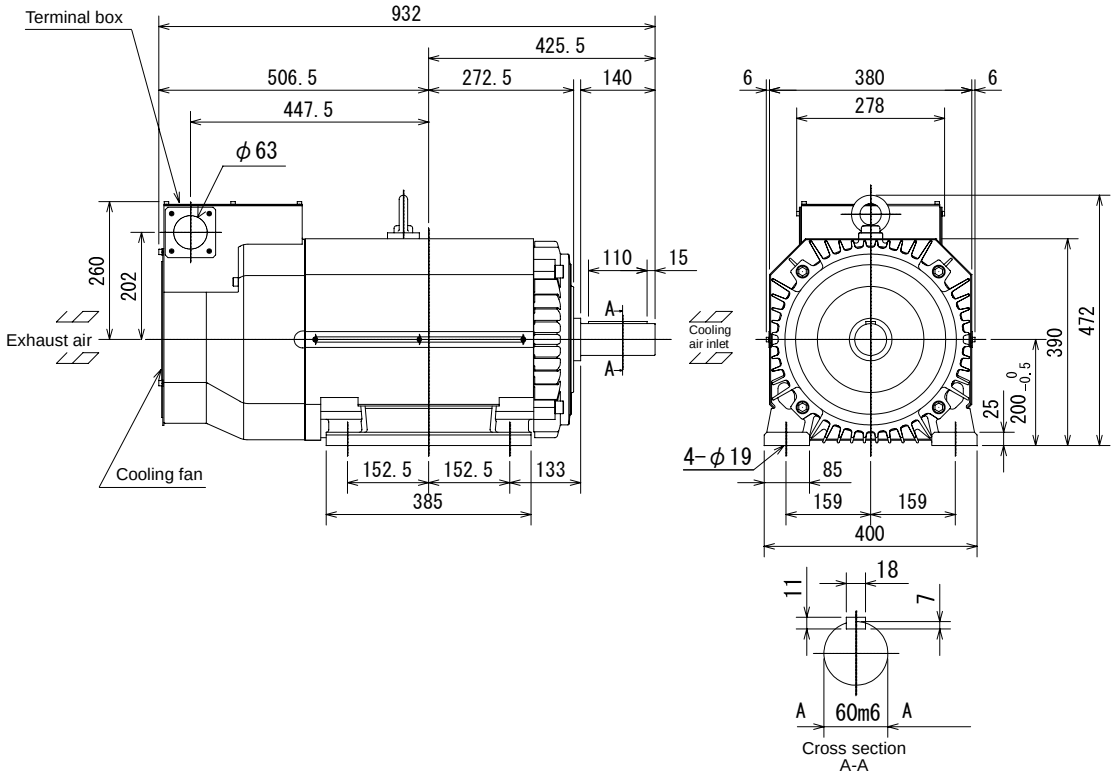
• SJ-45BP, SJ-22XW8 with standard flange



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

• SJ-45BP, SJ-22XW8 with standard legs

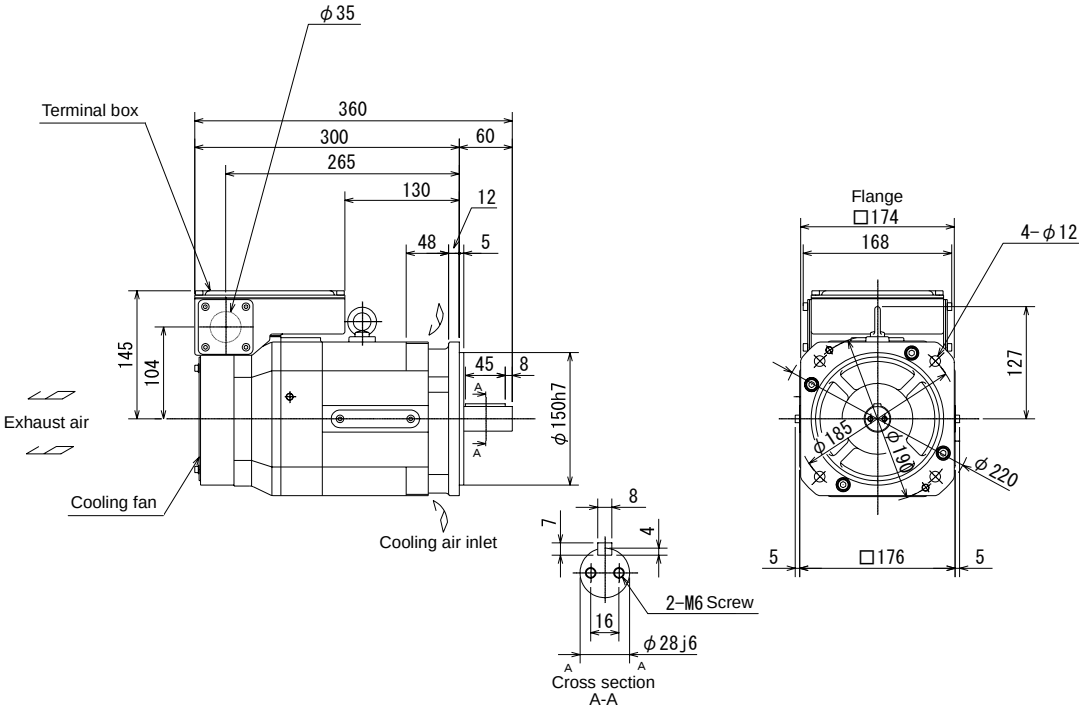


[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) If the suspension bolts are removed during operation, plug the screw holes with bolts.

Appendix 1-1-2 SJ-V Series

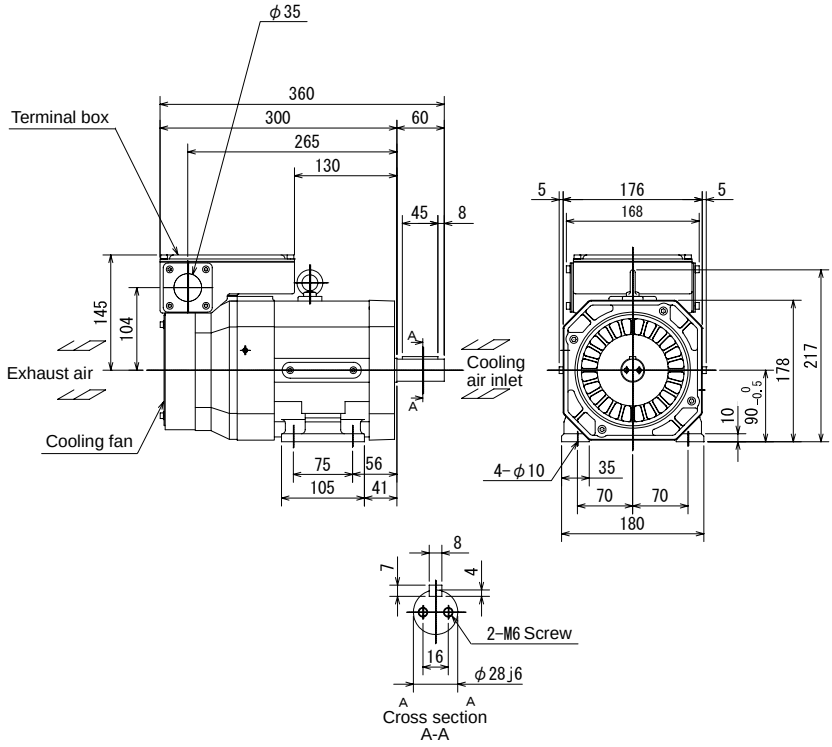
- SJ-V2.2-01, SJ-V3.7-02ZM with standard flange



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

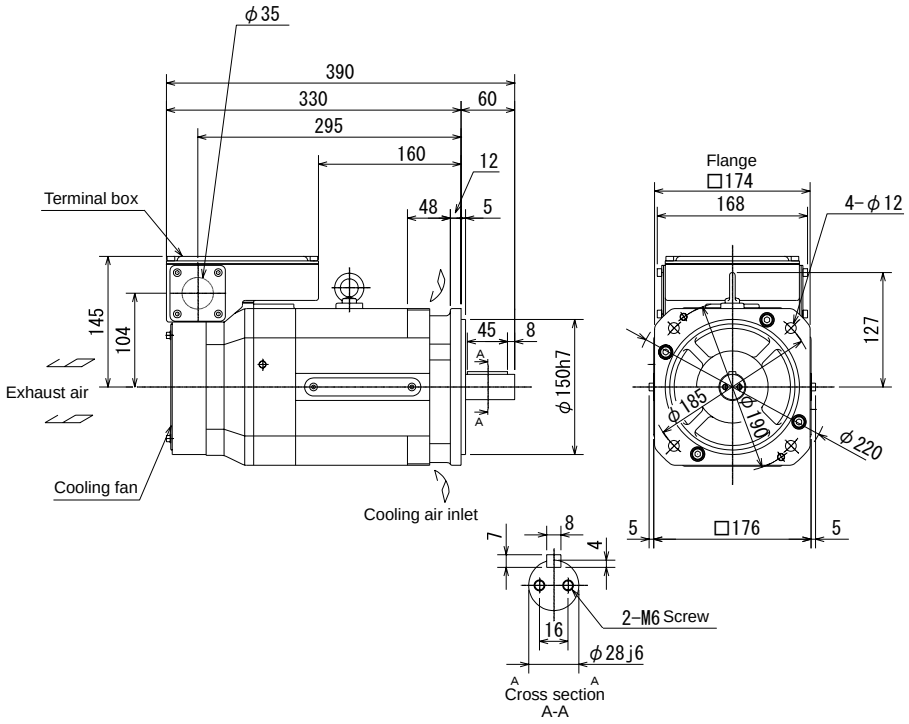
- SJ-V2.2-01, SJ-V3.7-02ZM with standard legs



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

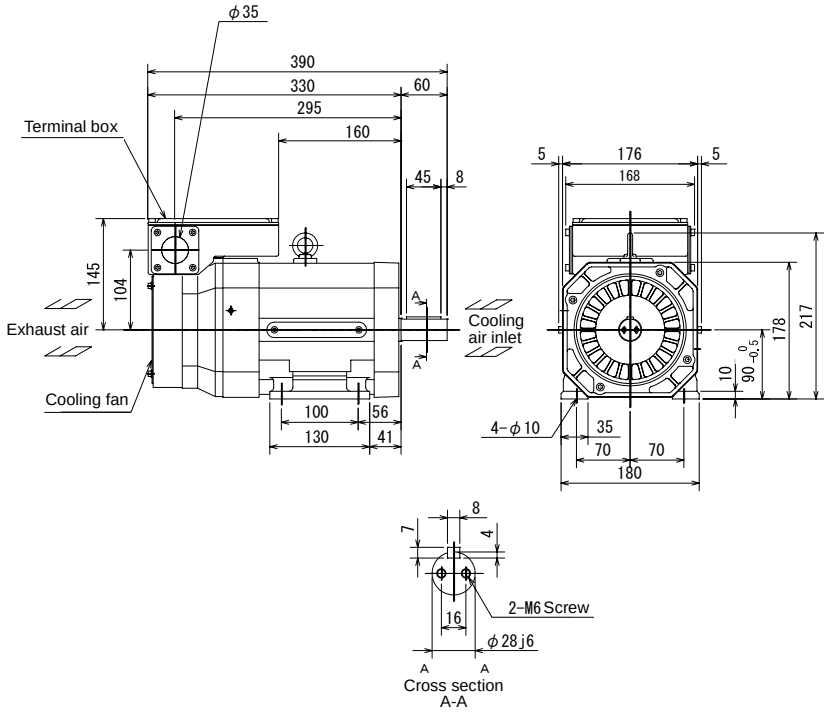
• SJ-V3.7-01 with standard flange



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

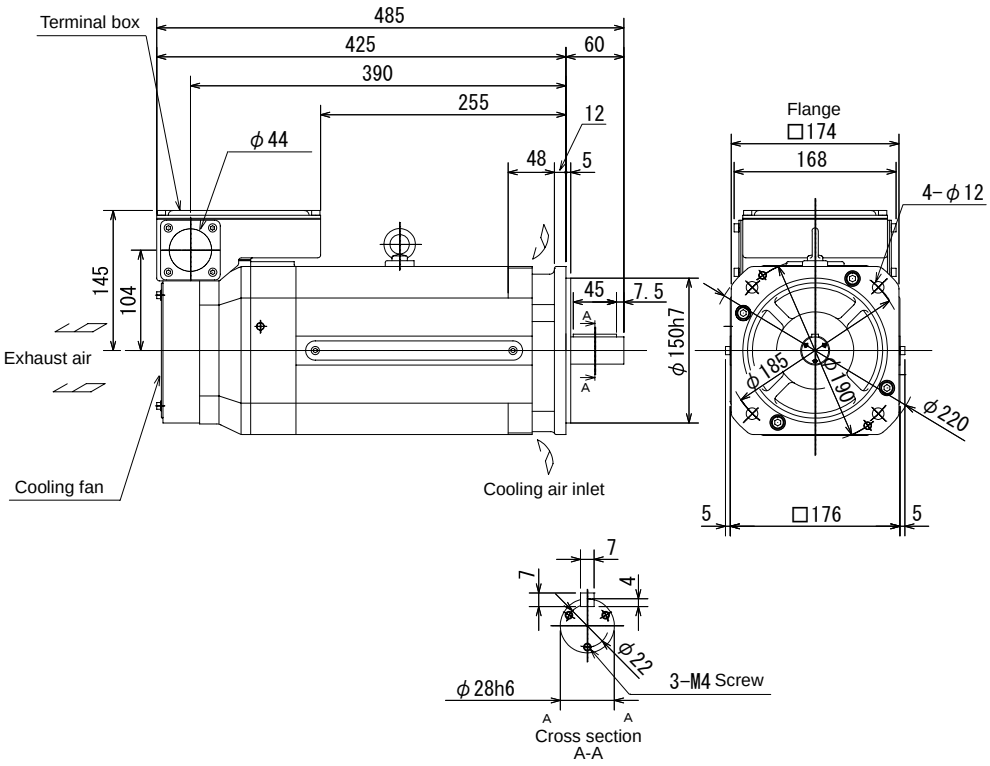
• SJ-V3.7-01 with standard legs



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

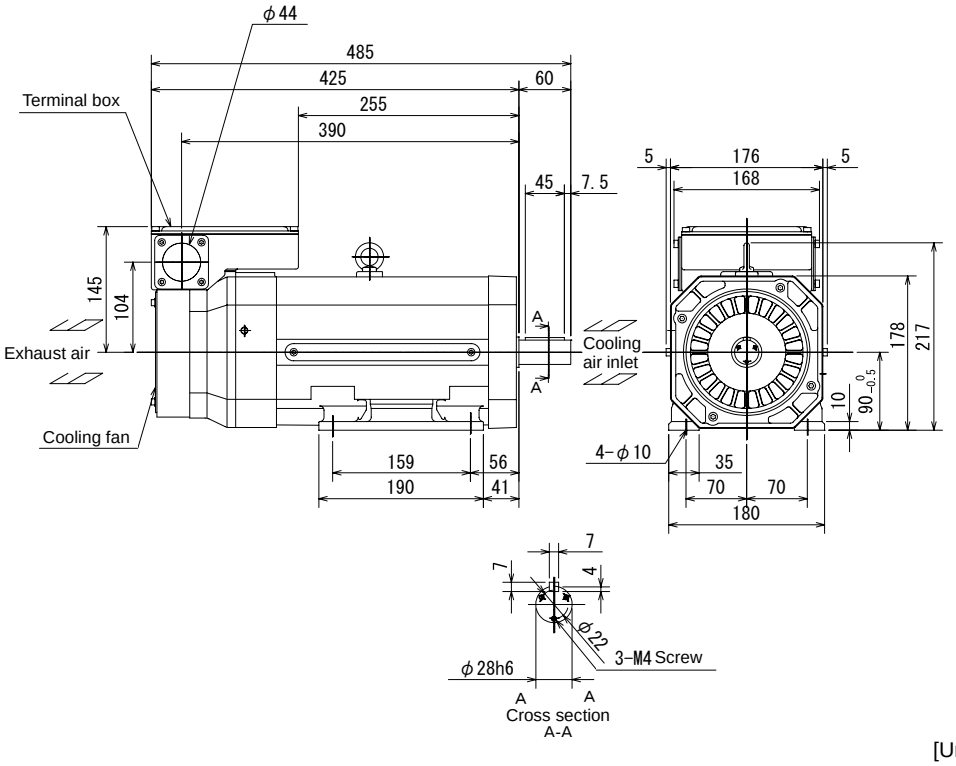
• SJ-V5.5-01 with standard flange



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

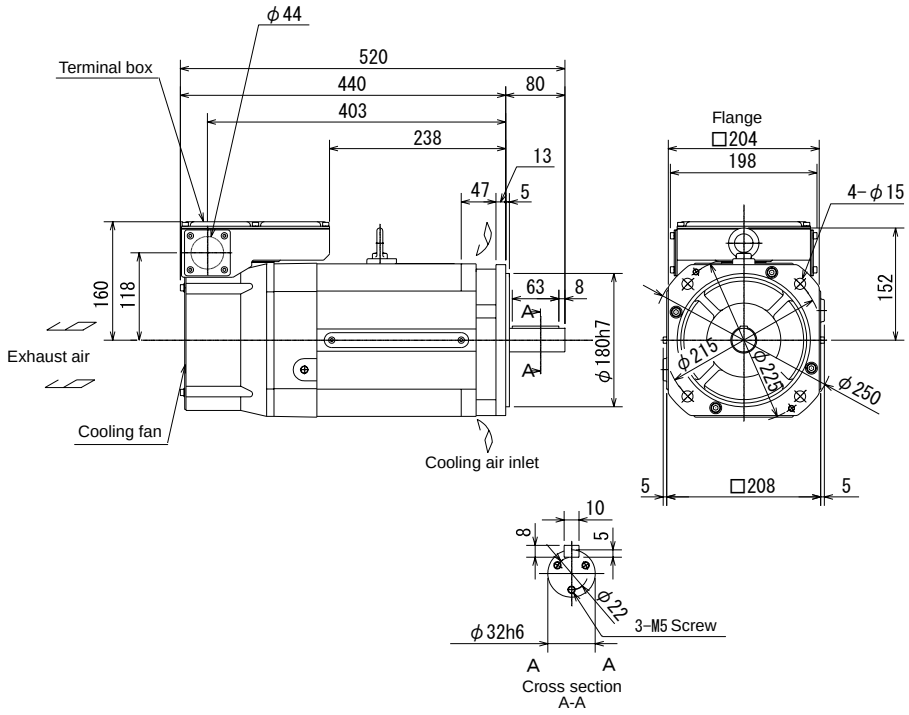
• SJ-V5.5-01 with standard legs



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

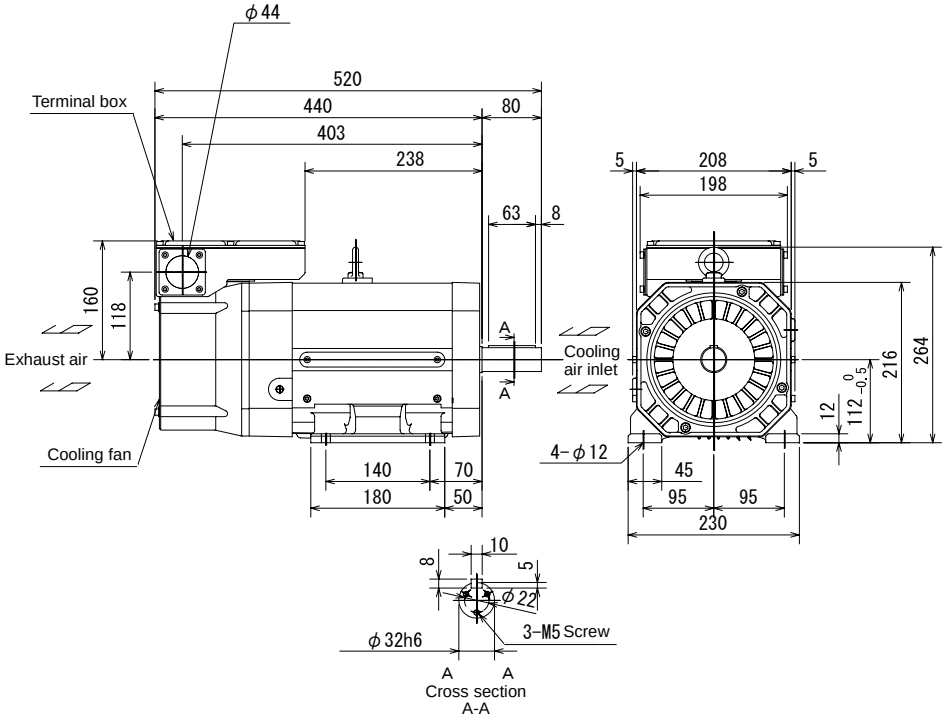
- SJ-V7.5-01, SJ-V7.5-03ZM, SJ-V11-06ZM with standard flange



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

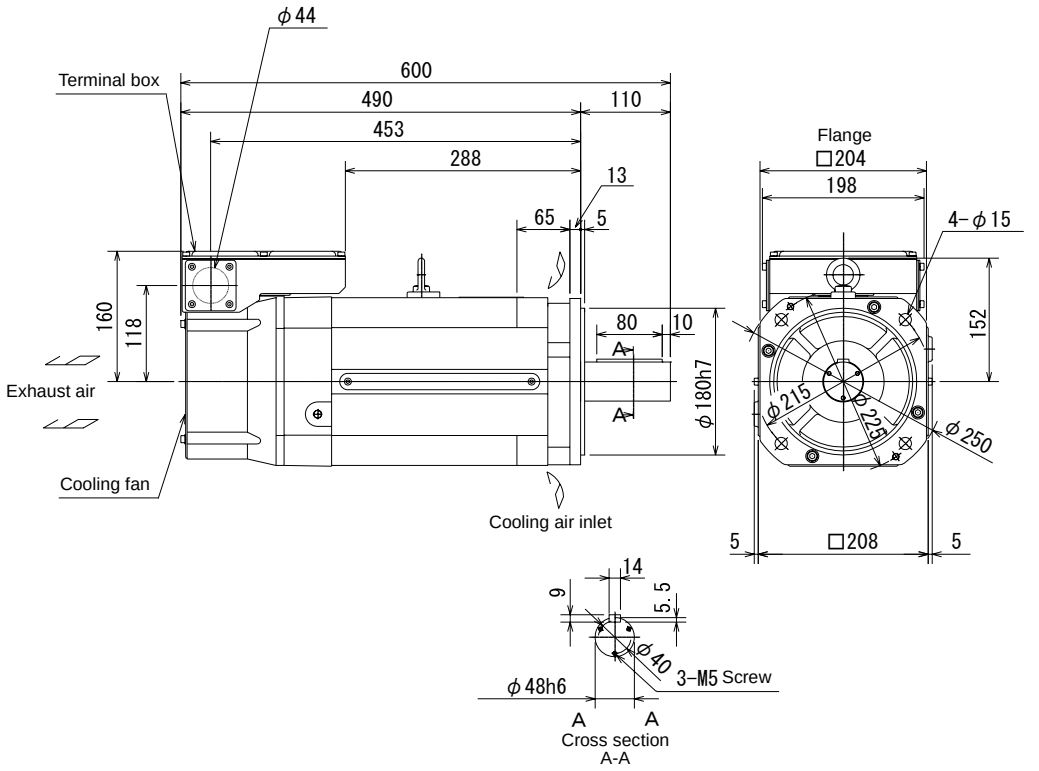
- SJ-V7.5-01, SJ-V7.5-03ZM, SJ-V11-06ZM with standard legs



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

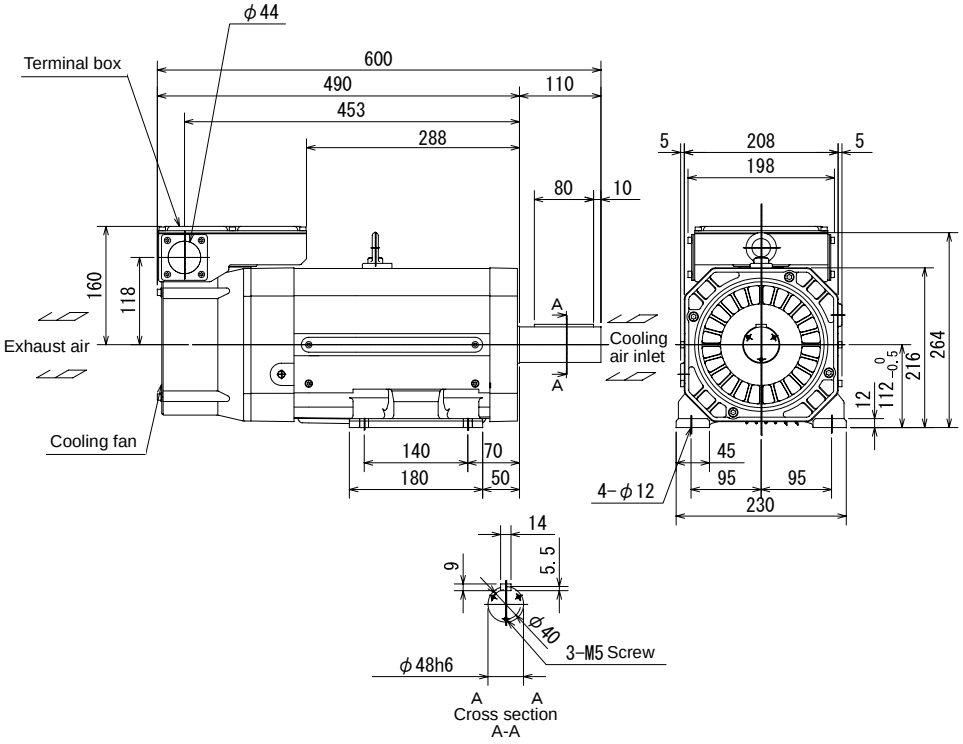
• SJ-V11-01, SJ-V11-08ZM with standard flange



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

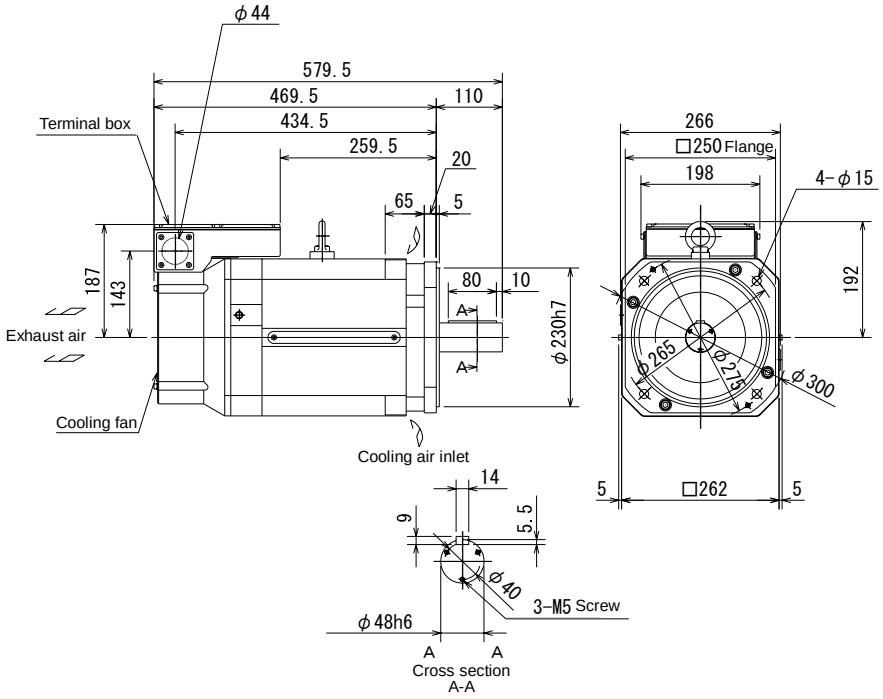
• SJ-V11-01, SJ-V11-08ZM with standard legs



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

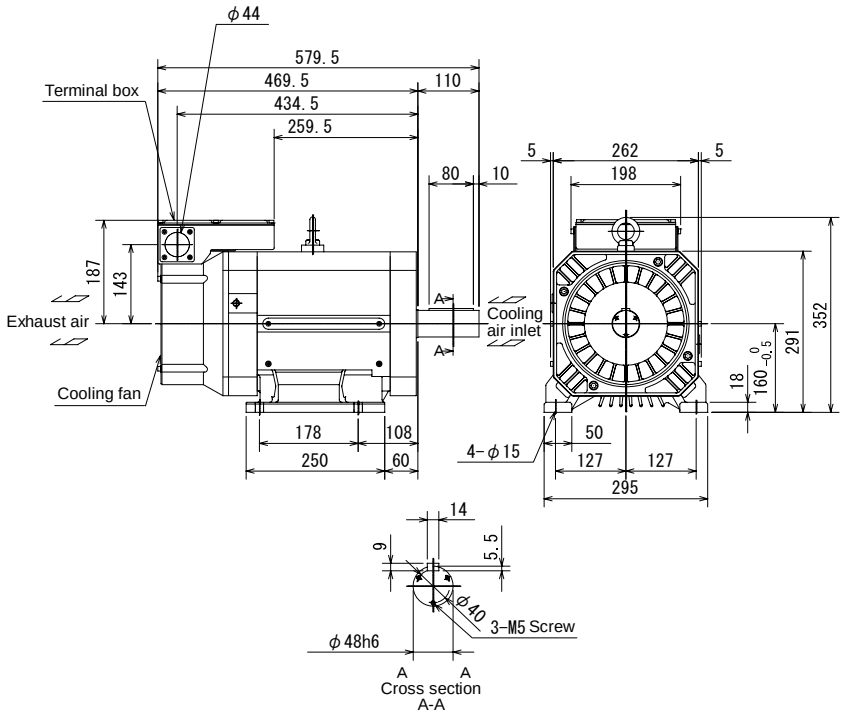
- SJ-V15-01, SJ-V18.5-01, SJ-V11-09, SJ-V15-03, SJ-V22-06ZM with standard flange



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

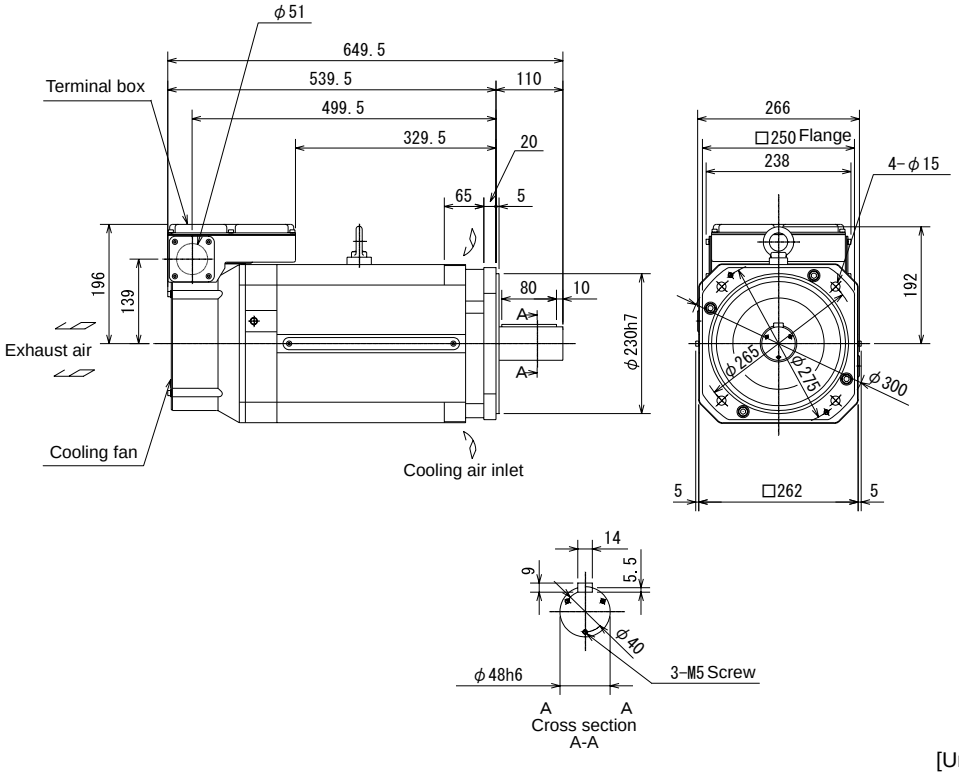
- SJ-V15-01, SJ-V18.5-01, SJ-V11-09, SJ-V15-03, SJ-V22-06ZM with standard legs



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

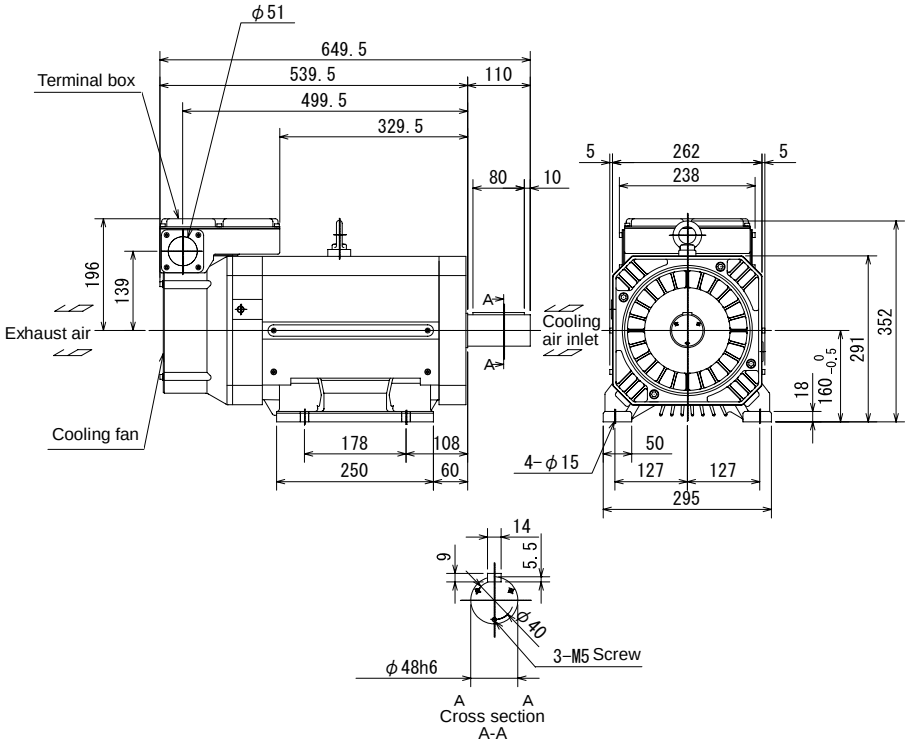
• SJ-V30-02ZM with standard flange



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

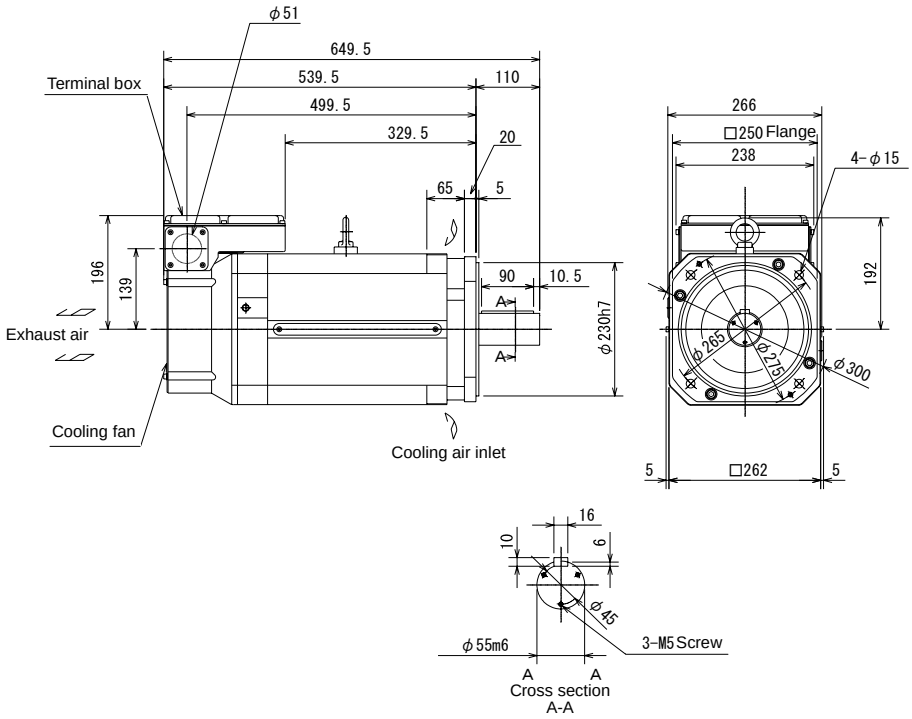
• SJ-V30-02ZM with standard legs



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

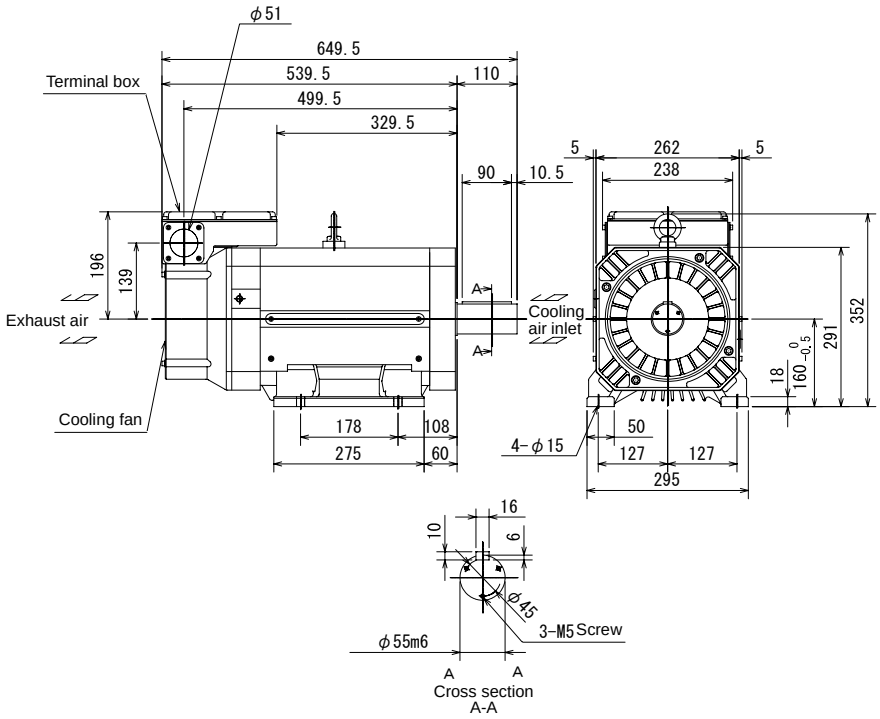
• SJ-V22-01, SJ-V18.5-03, SJ-V22-05 with standard flange



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

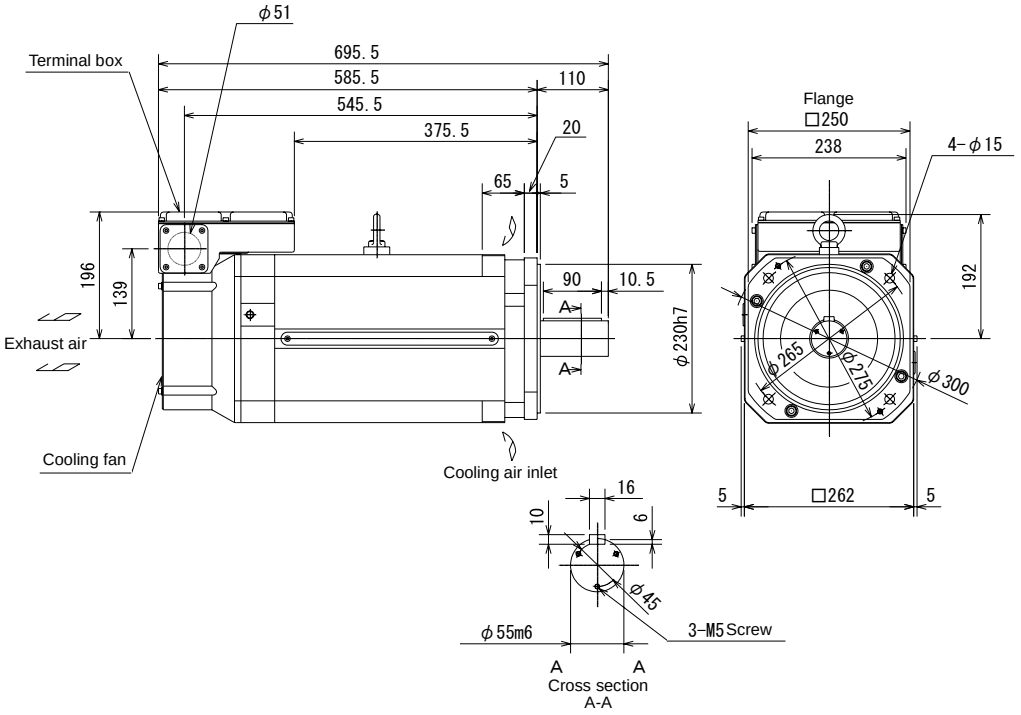
• SJ-V22-01, SJ-V18.5-03, SJ-V22-05 with standard legs



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

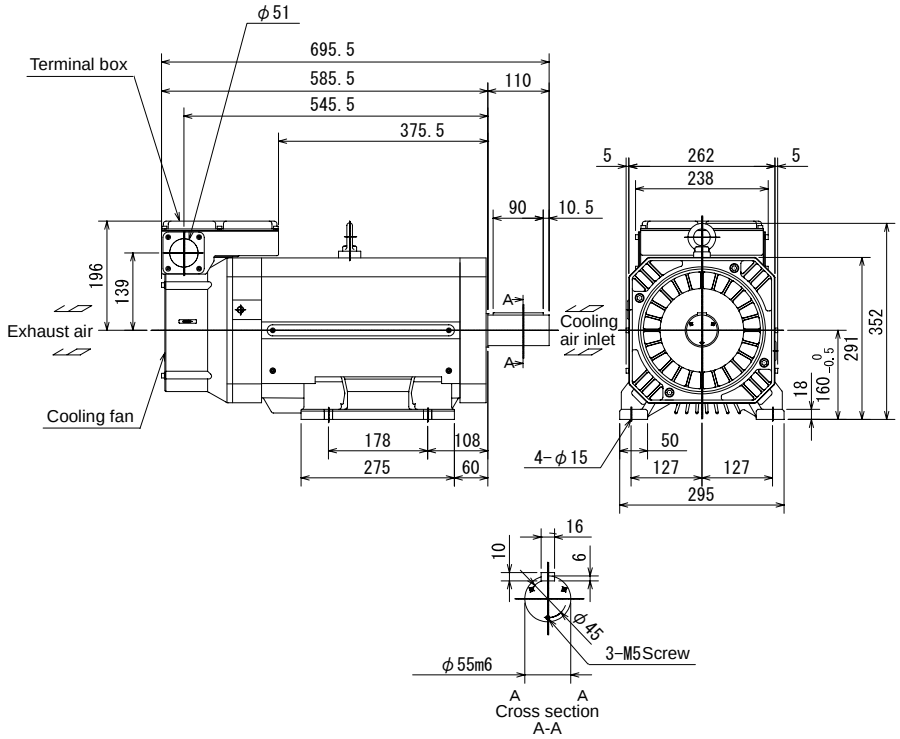
• SJ-V26-01 with standard flange



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

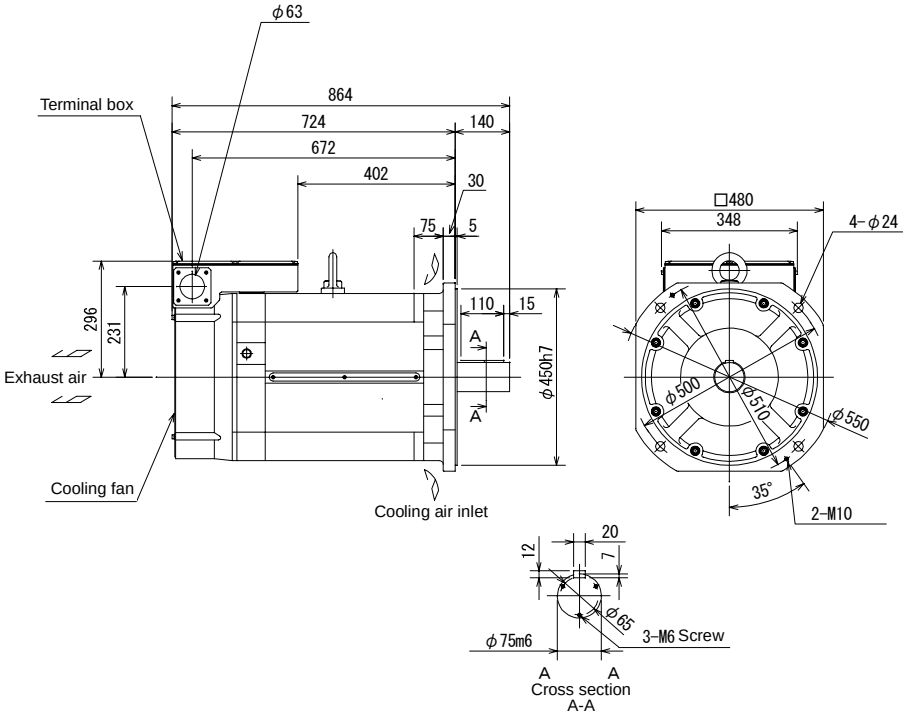
• SJ-V26-01 with standard legs



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

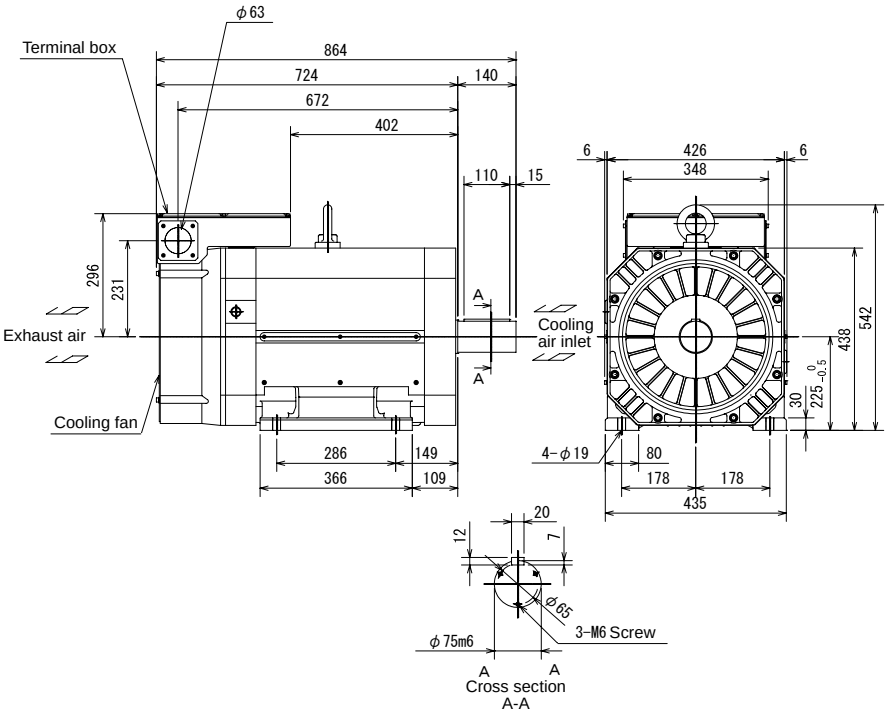
- SJ-V55-01 with standard flange



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

- SJ-V55-01 with standard legs

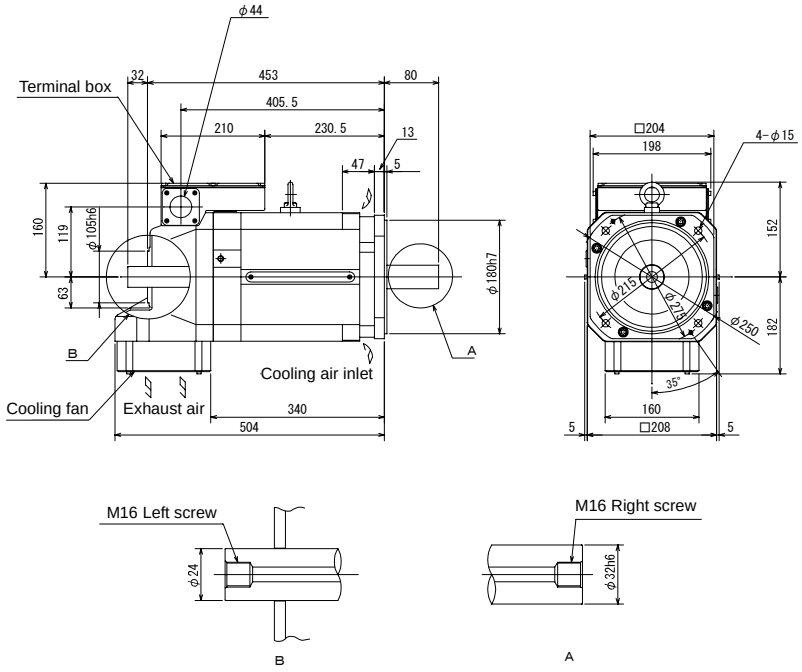


[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

Appendix 1-1-3 SJ-VS Series

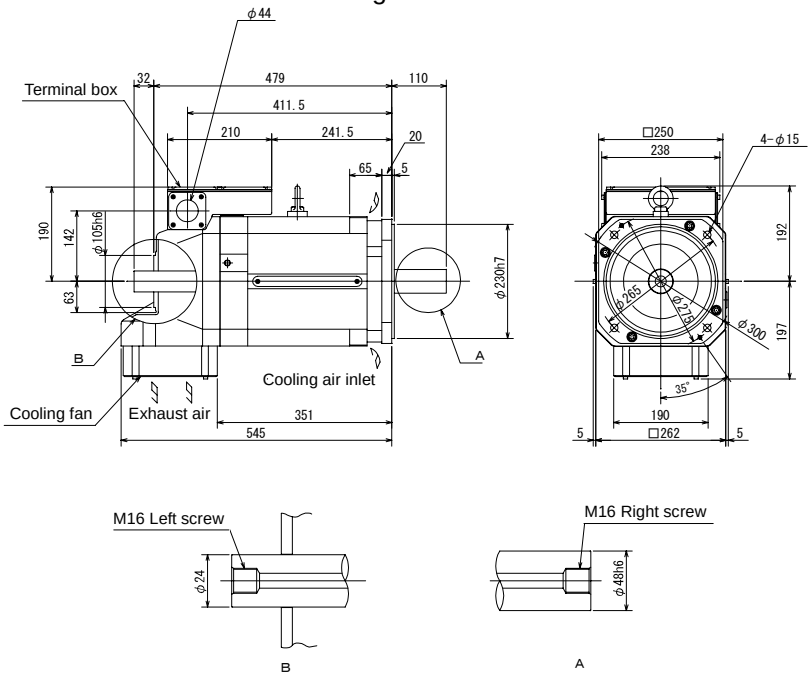
- SJ-VS7.5-03ZM with standard flange



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

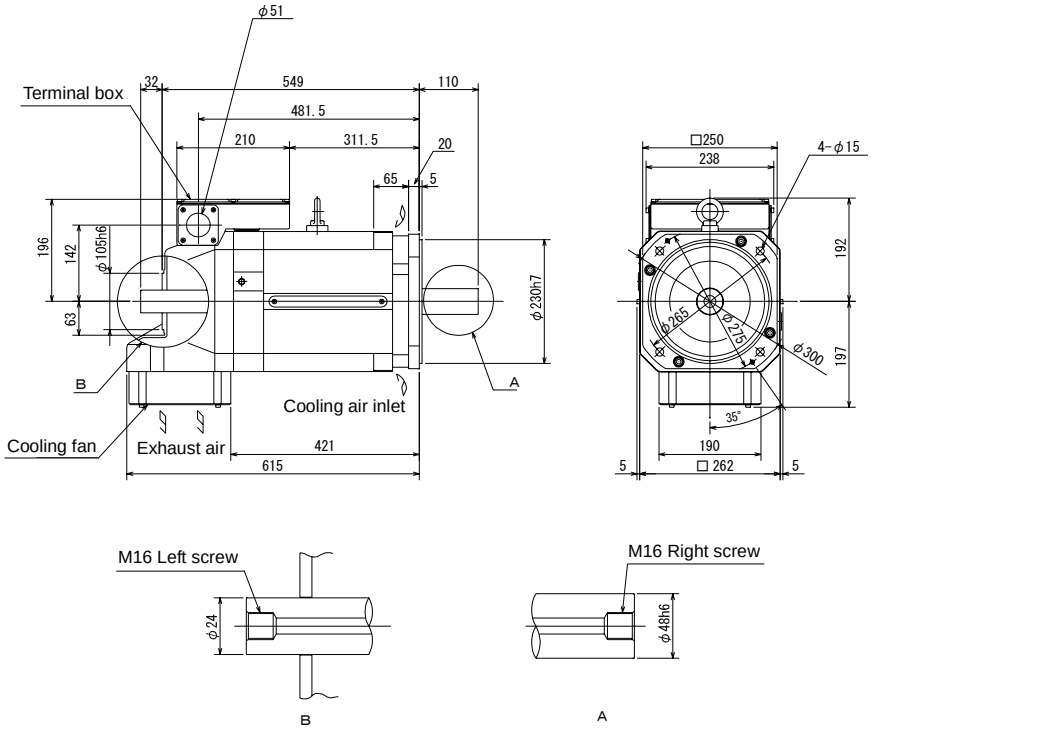
- SJ-VS22-06ZM with standard flange



[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

- SJ-VS30-02ZM with standard flange



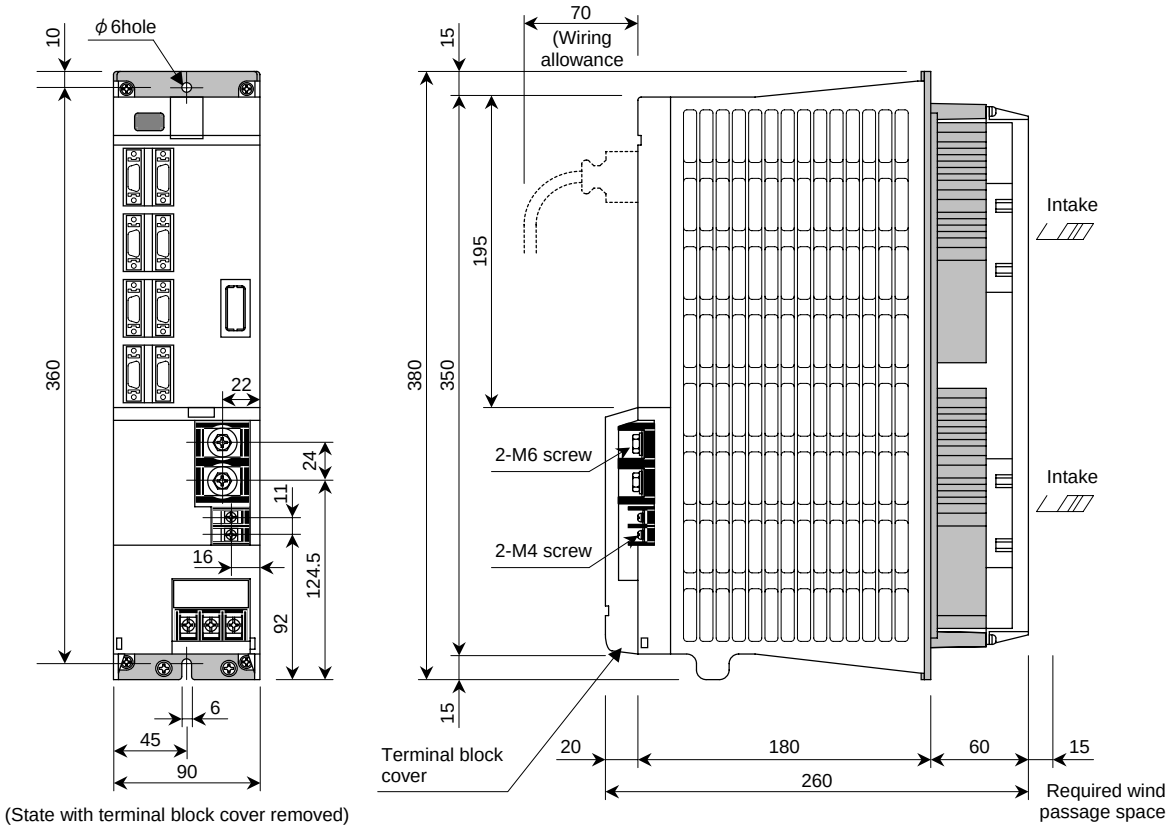
[Unit: mm]

(Note 1) Provide a clearance of 30mm or more between the cooling fan and wall.
(Note 2) The shaft can also be mounted upward.
(Note 3) If the suspension bolts are removed during operation, plug the screw holes with bolts.

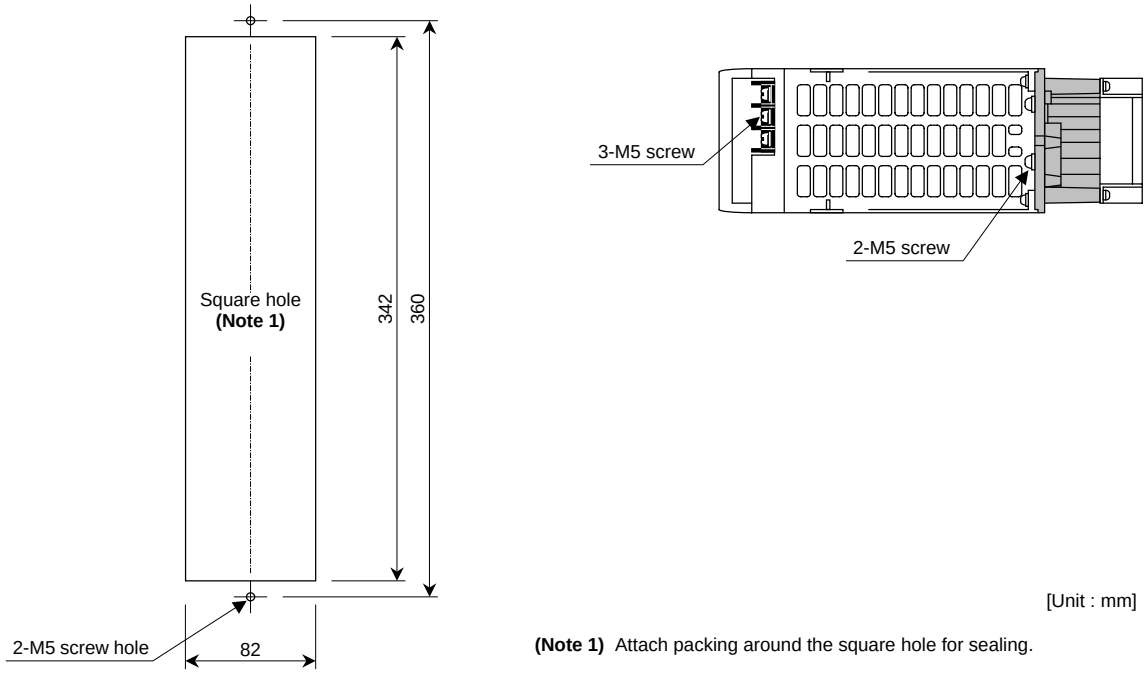
Appendix 1-2 Unit outline dimension drawings

Appendix 1-2-1 Spindle drive unit

MDS-C1-SPA-55
MDS-C1-SPA-75
MDS-C1-SPA-110



(State with terminal block cover removed)

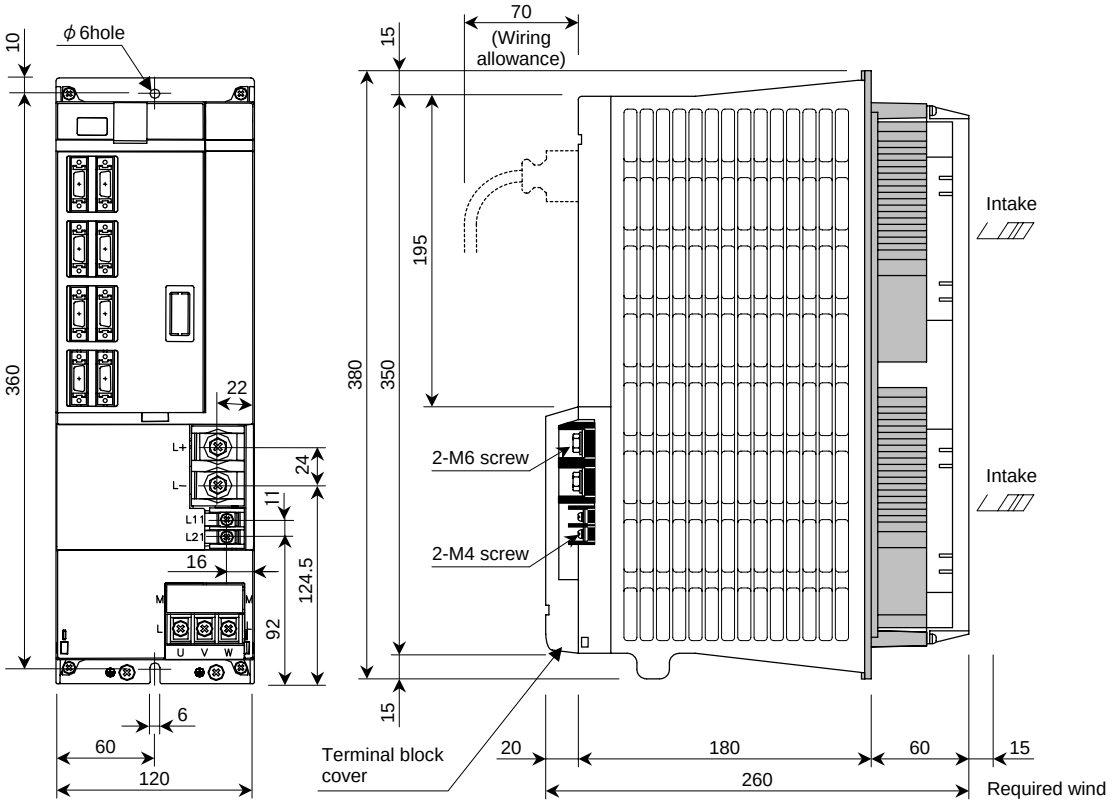


Panel mounting hole machining drawing

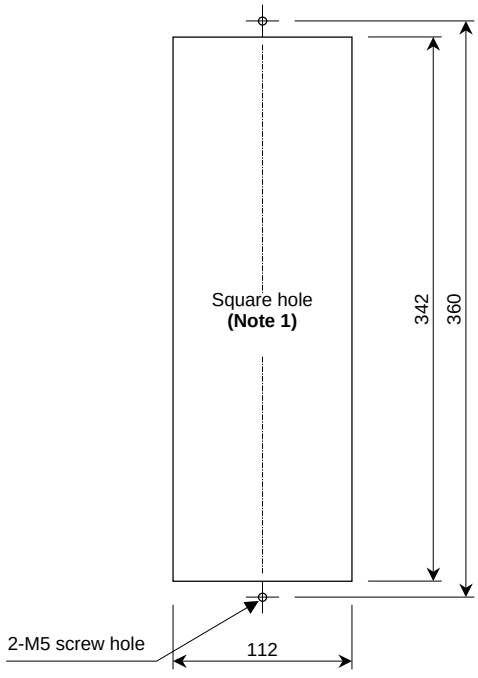
[Unit : mm]

(Note 1) Attach packing around the square hole for sealing.

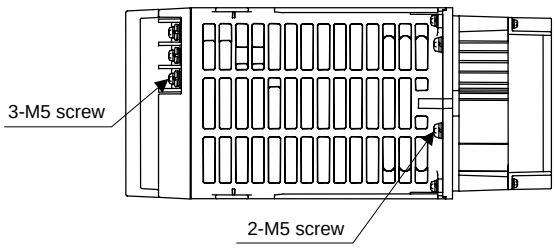
MDS-C1-SPA-150
MDS-C1-SPA-185



(State with terminal block cover removed)



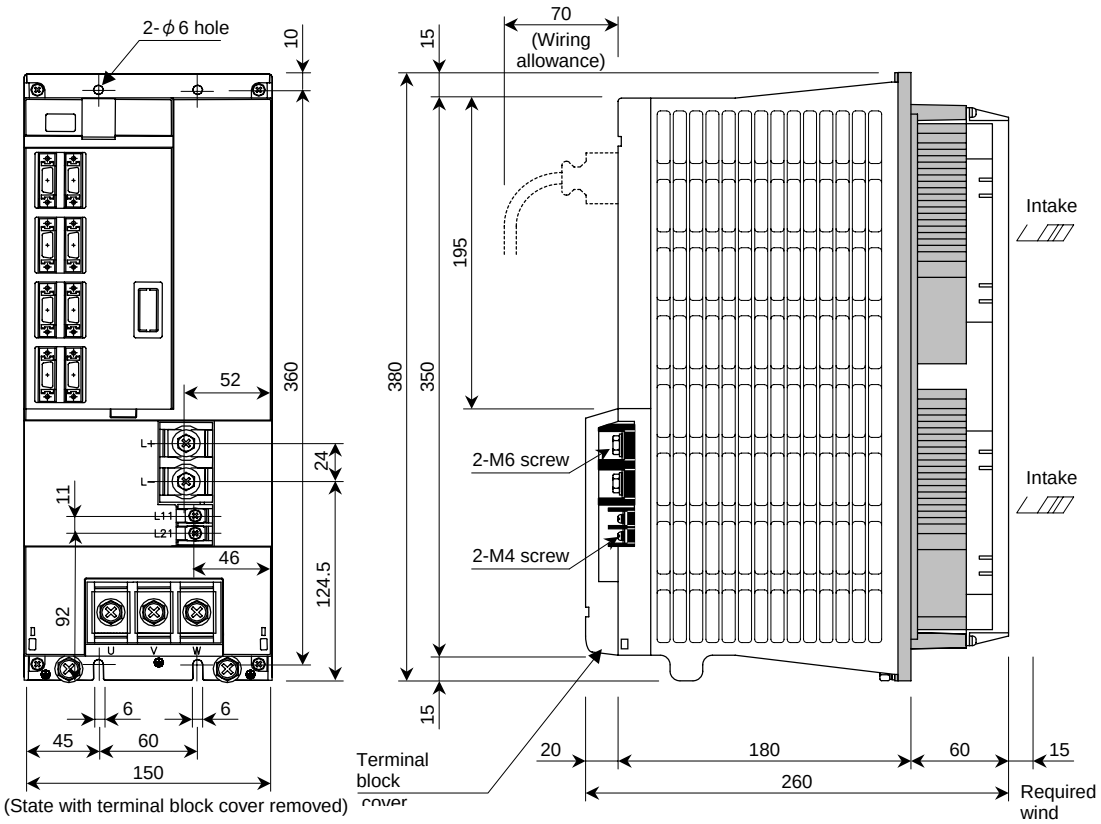
Panel mounting hole machining drawing

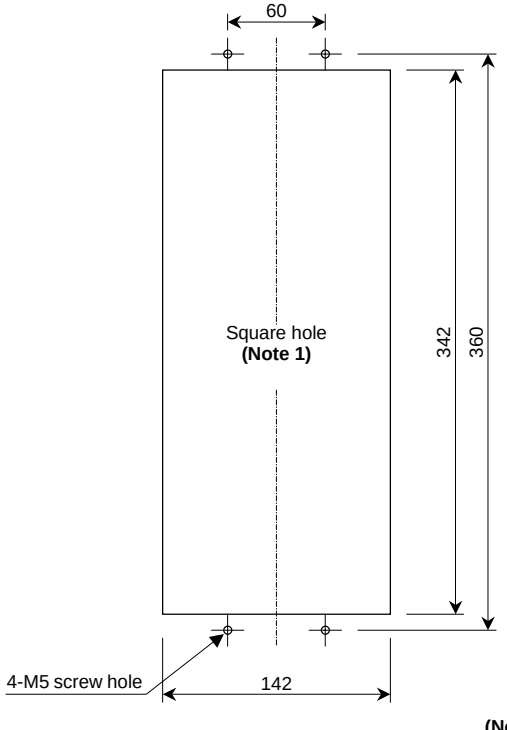


[Unit : mm]

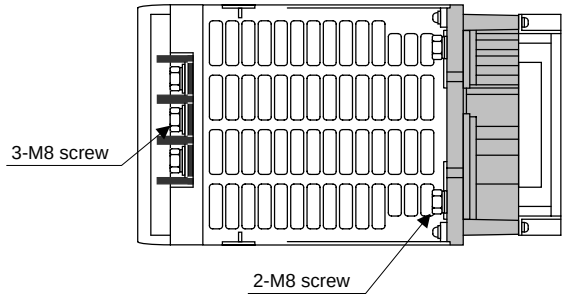
(Note 1) Attach packing around the square hole for sealing.

MDS-C1-SPA-220





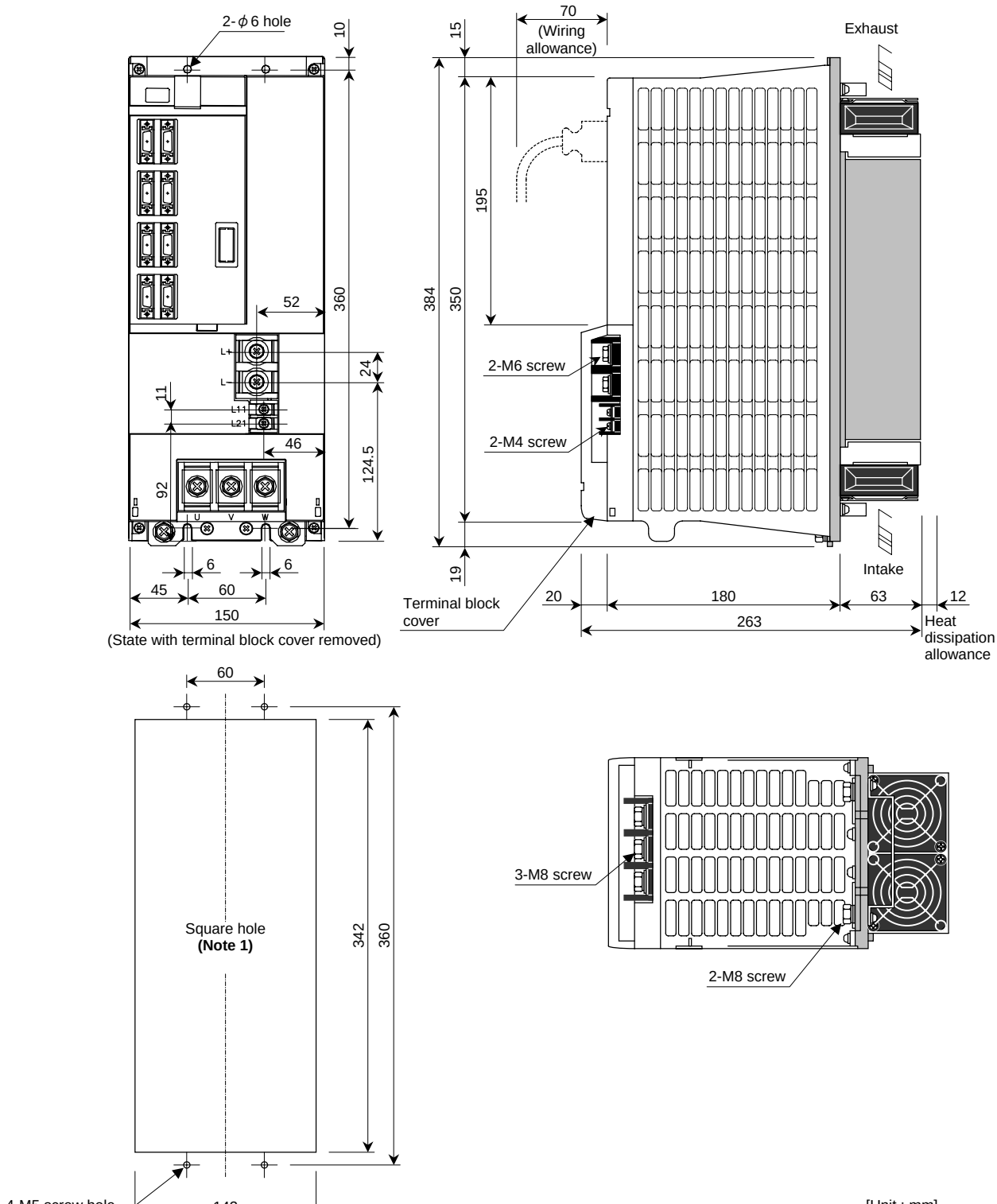
• For MDS-C1-SP



[Unit : mm]

(Note 1) Attach packing around the square hole for sealing.

MDS-C1-SPA-260
MDS-C1-SPA-300

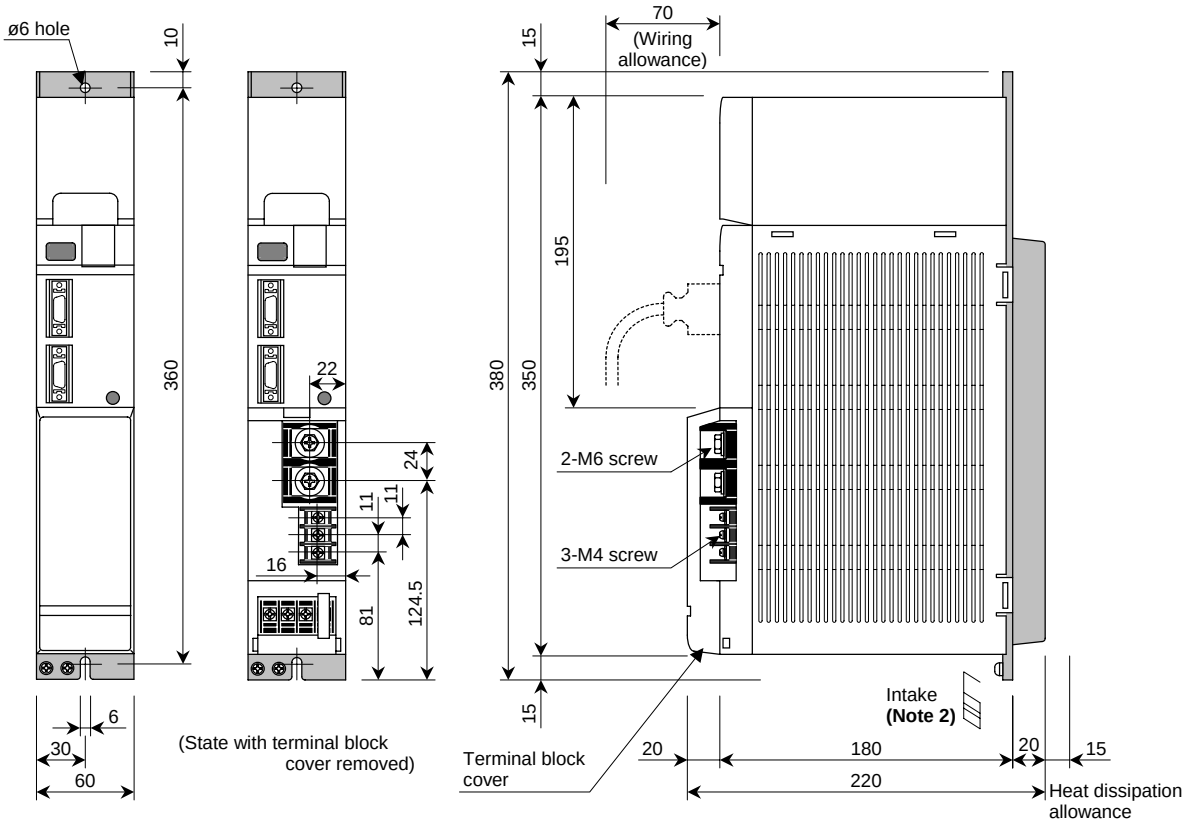


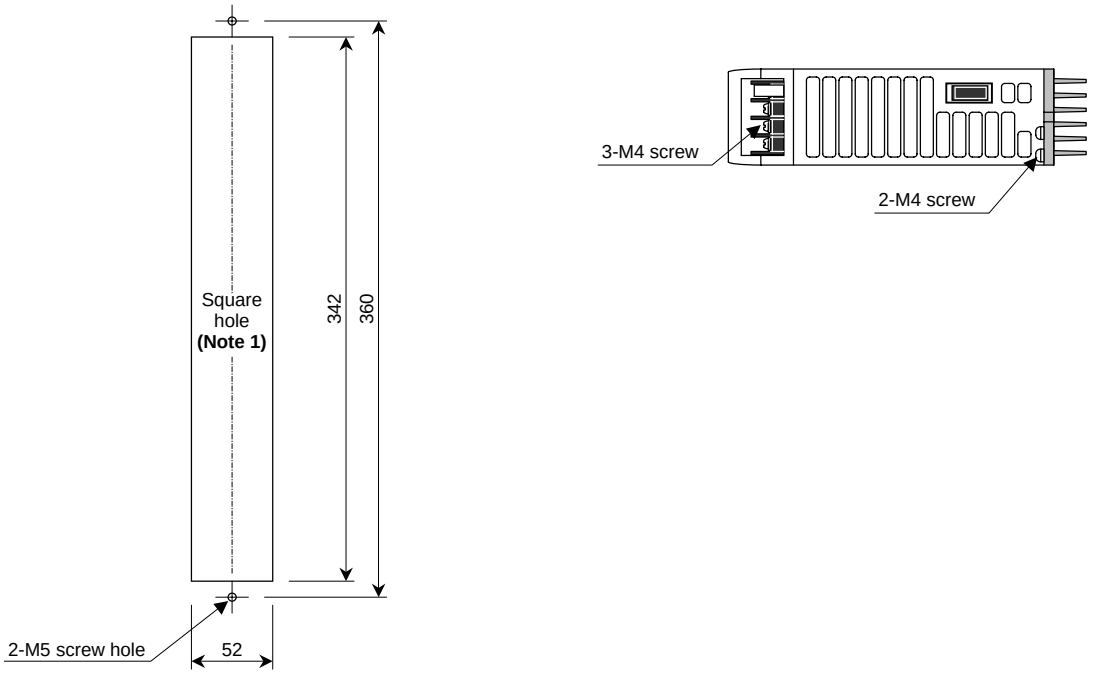
[Unit : mm]

(Note 1) Attach packing around the square hole for sealing.

Appendix 1-2-2 Power supply unit

MDS-C1-CV-37
MDS-C1-CV-55
MDS-C1-CV-75



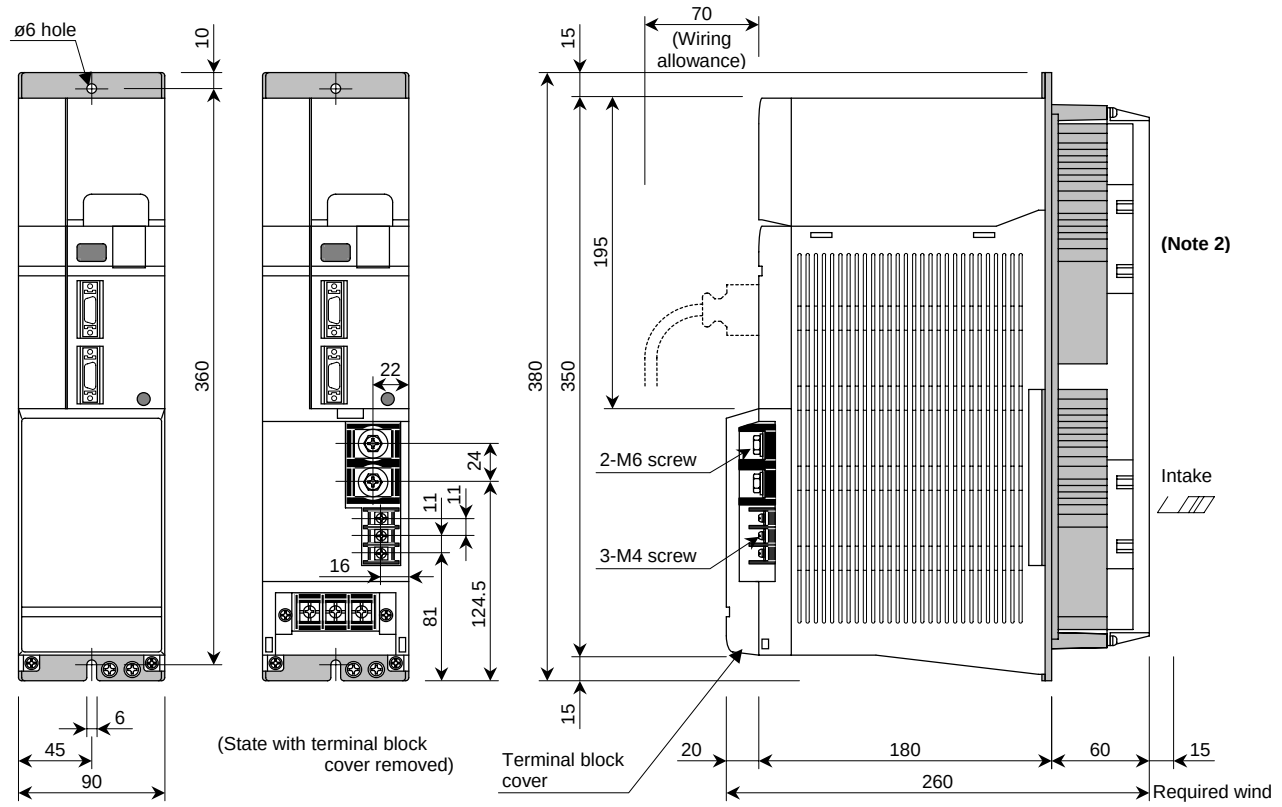


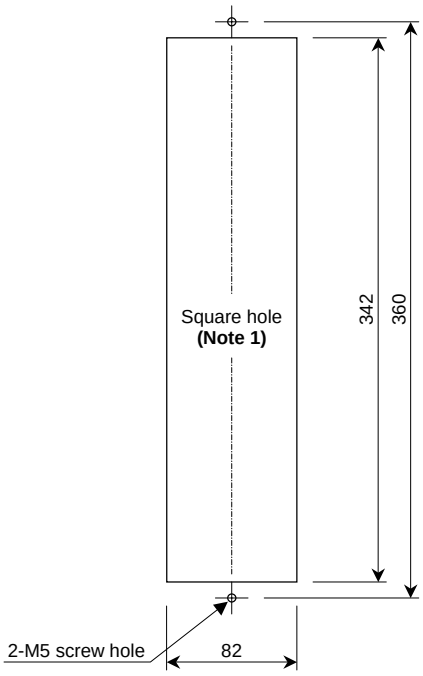
Panel mounting hole machining drawing

[Unit : mm]

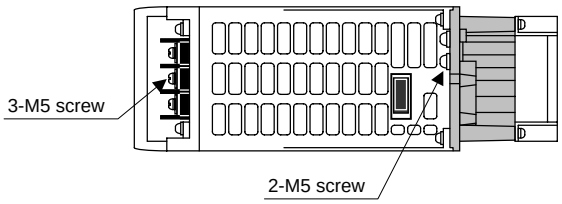
(Note 1) Attach packing around the square hole for sealing
(Note 2) The MDS-C1-CV-37 does not have a built-in fan.

MDS-C1-CV-110





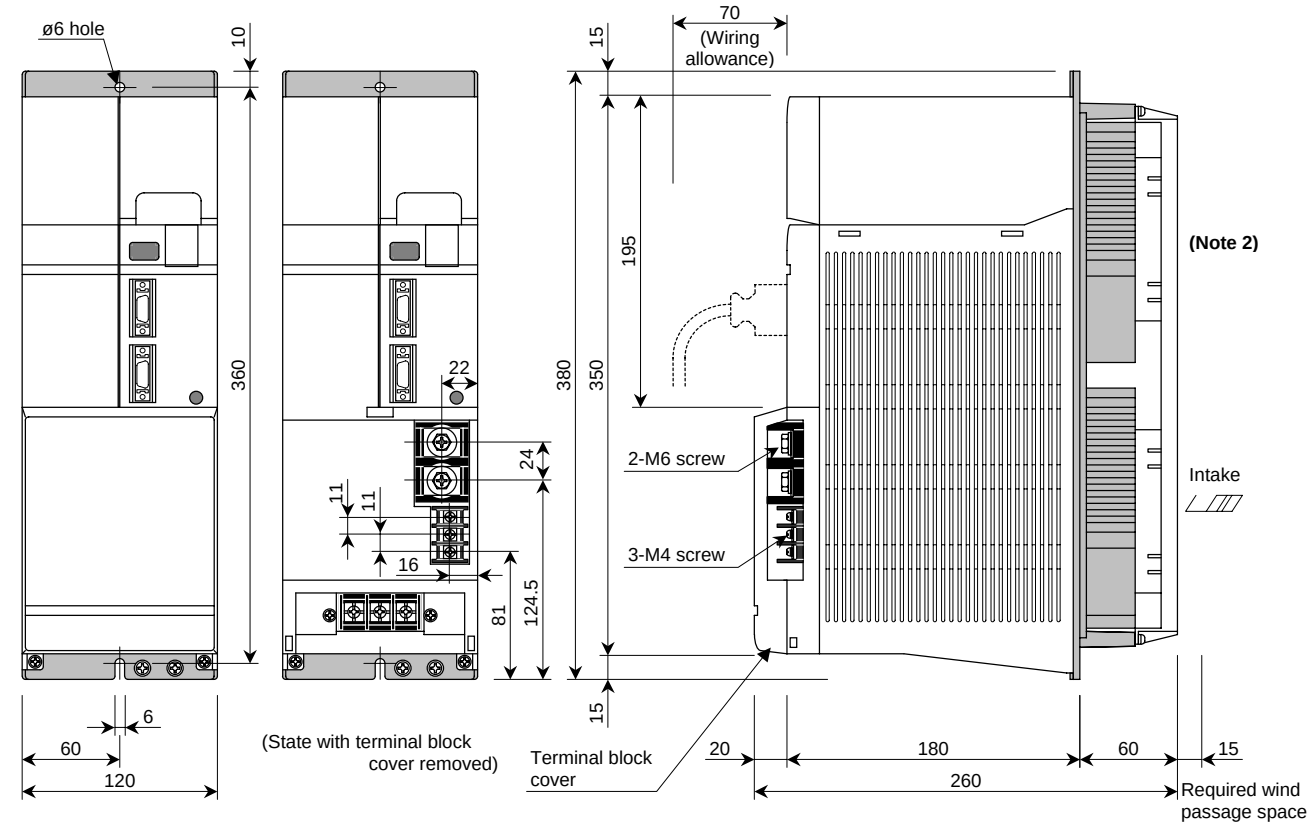
Panel mounting hole machining drawing

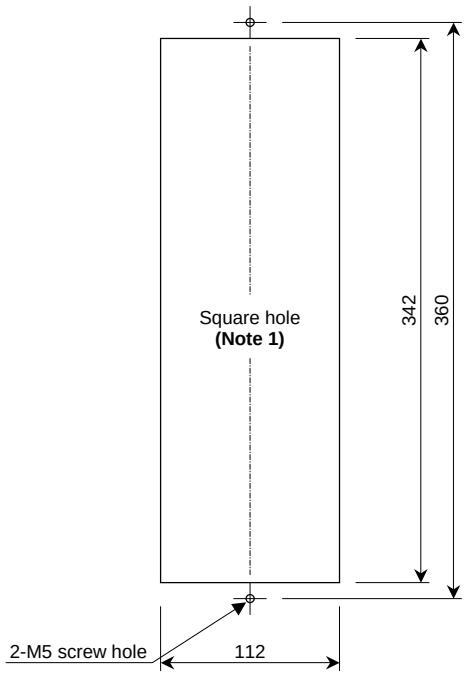


[Unit : mm]

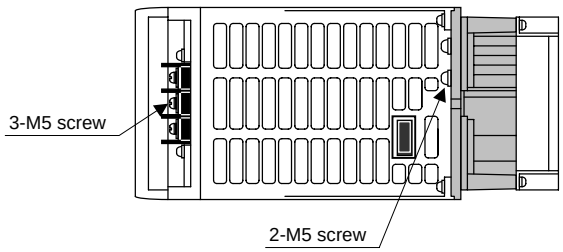
(Note 1) Attach packing around the square hole for sealing
(Note 2) The MDS-C1-CV-110 does not have a fan at the top.

MDS-C1-CV-150
MDS-C1-CV-185





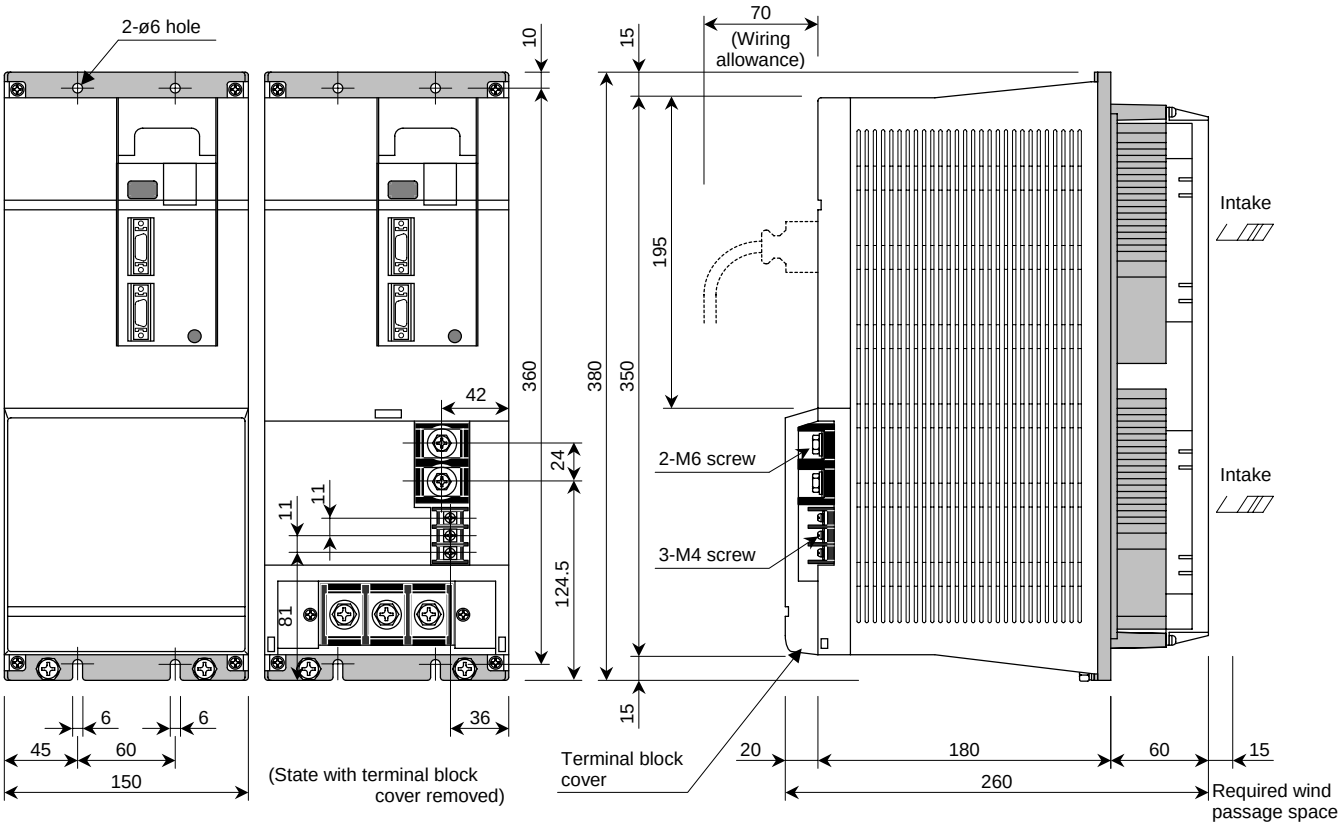
Panel mounting hole machining drawing

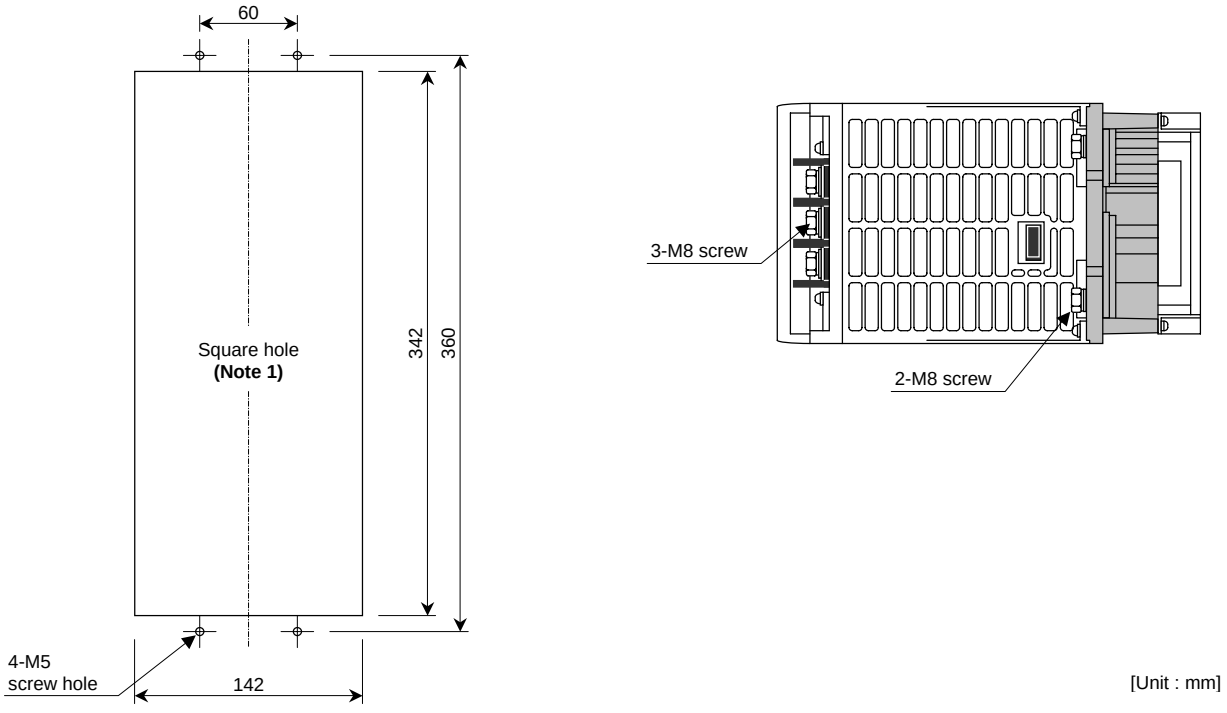


[Unit : mm]

(Note 1) Attach packing around the square hole for sealing.
(Note 2) The MDS-C1-CV-150/185 does not have a fan at the top.

MDS-C1-CV-220
MDS-C1-CV-260
MDS-C1-CV-300
MDS-C1-CV-370





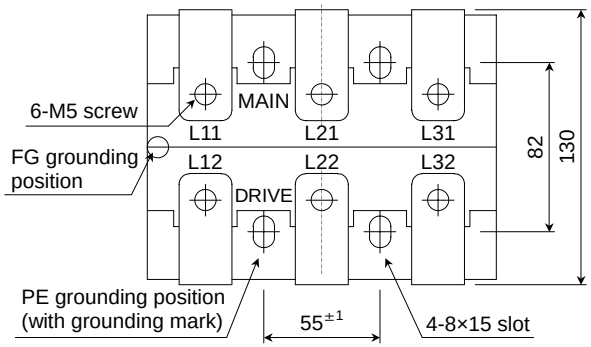
[Unit : mm]

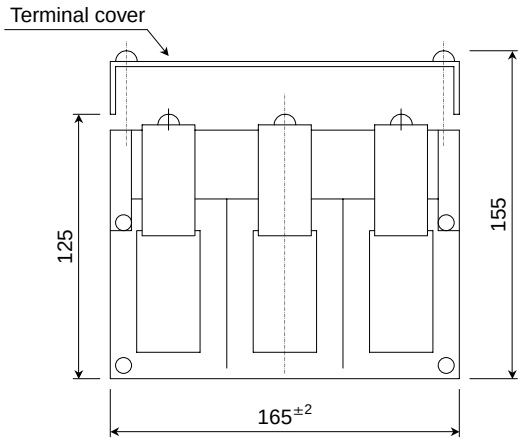
Panel mounting hole machining drawing

(Note 1) Attach packing around the square hole for sealing.

Appendix 1-2-3 AC rector

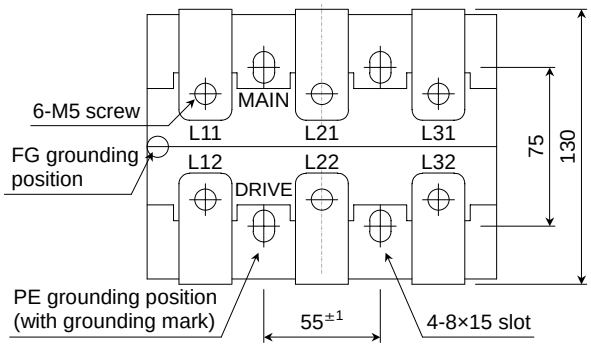
- B-AL-7.5K

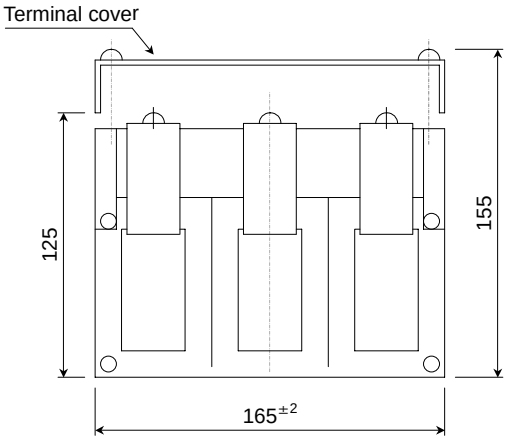




[Unit: mm]

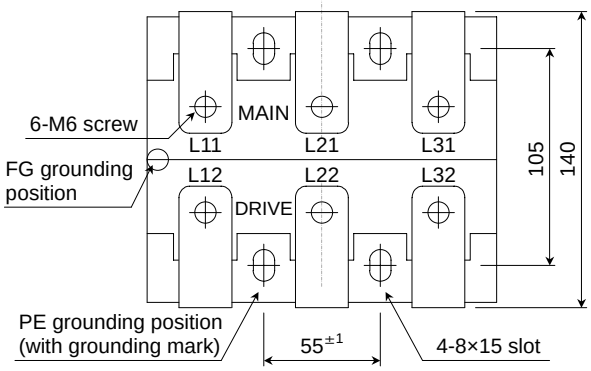
- B-AL-11K

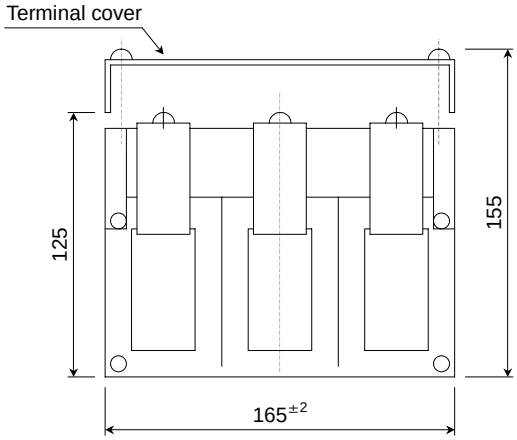




[Unit: mm]

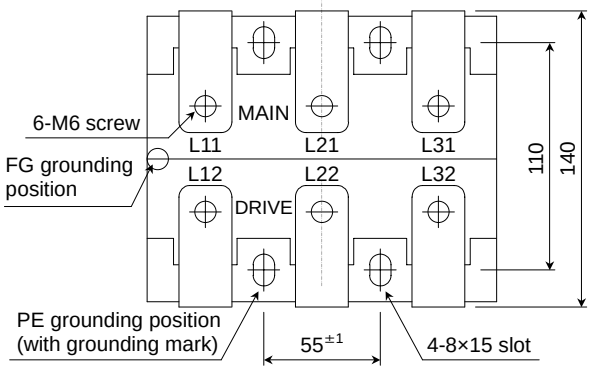
- B-AL-18.5K

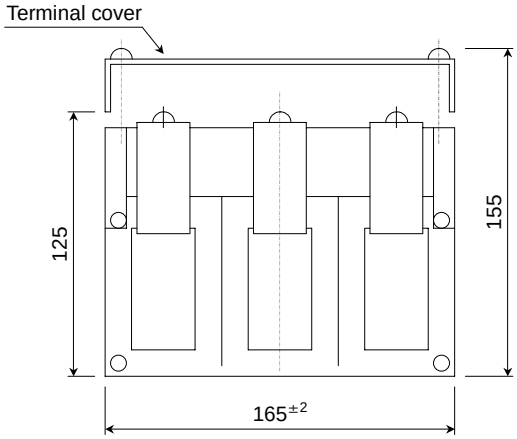




[Unit: mm]

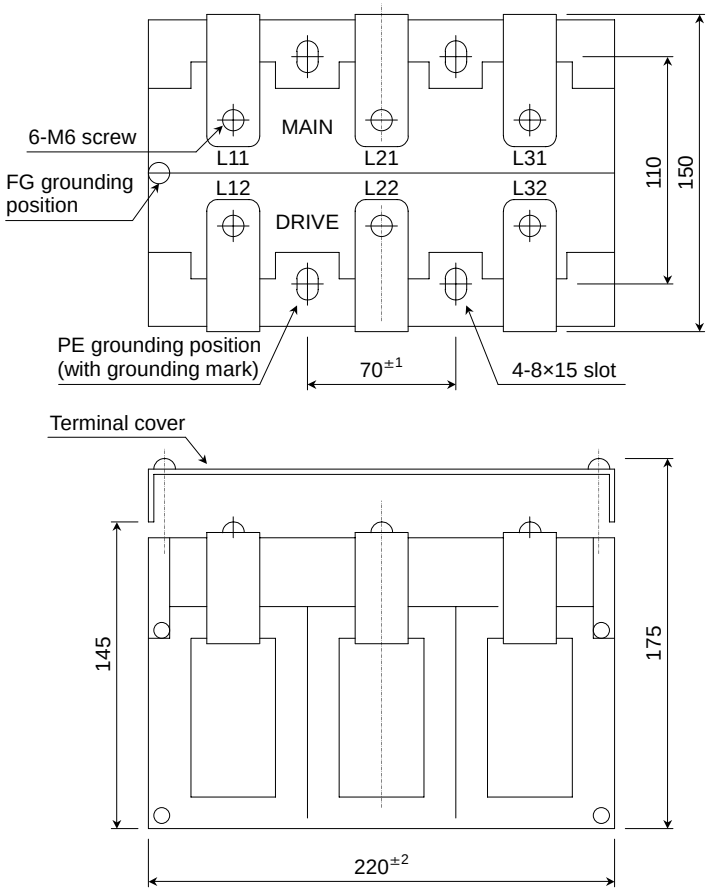
- B-AL-30K





[Unit: mm]

- B-AL-37K



[Unit: mm]

Appendix 2. Cable and Connector Specifications

Appendix 2-1 Selection of cable

Appendix 2-1-1 Cable wire and assembly

(1) Cable wire

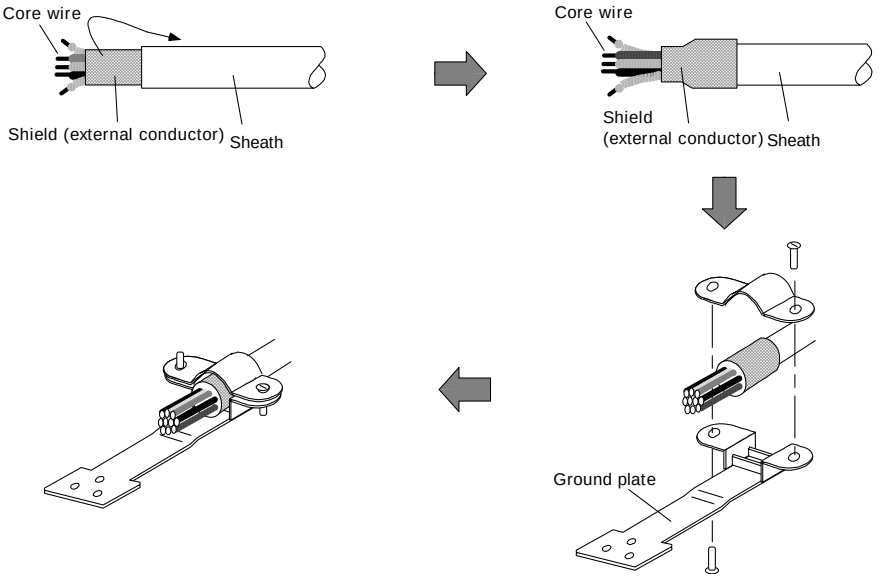
The following shows the specifications and processing of the wire used in each cable. Manufacture the cable using the following recommended wire or equivalent parts.

Recommended wire model (Cannot be directly ordered from Mitsubishi Electric Corp.)	Finished outside diameter	Sheath material	No. of pairs	Wire characteristics					Application
				Configuration	Conductor resistance	Withstand voltage	Insulation resistance	Heat resistant temperature	
UL20276 AWG28 10pair	6.1mm	PVC	10	7 strands/ 0.13mm	222Ω/km or less	AC350/ 1min	1MΩ/km or more	80°C	NC unit communication cable
A14B2343 (Note 1)	7.2mm	PVC	6	40 strands/ 0.08mm	105Ω/km or less	AC500/ 1min	1500MΩ/km or more	105°C	Detector cable
TS-91026 (Note 2)	11.6mm	PVC	2 (0.3 mm^2)	60 strands/ 0.08mm	63Ω/km or less	AC750V/ 1min	60MΩ/km or more	60°C	Detector cable (Cable length: 20m or more)
			10 (0.2 mm^2)	40 strands/ 0.08mm	95Ω/km or less				

(Note 1) Junko Co. (Dealer: Toa Denki)
(Note 2) BANDO ELECTRIC WIRE (http: //www.bew.co.jp)

(2) Cable assembly

Assemble the cable as shown in the following drawing, with the cable shield wire securely connected to the ground plate of the connector.



(3) Cable protection tube (noise countermeasure)

If influence from noise is unavoidable, or further noise resistance is required, selecting a flexible tube and running the signal cable through this tube is effective. This is also an effective countermeasure for preventing the cable sheath from being cut or becoming worn.

A cable clamp (MS3057) is not installed on the detector side, so be particularly careful of broken wires in applications involving bending and vibration.

Supplier	Tube	Connector		
		Drive unit side	Installation screws	Motor detector side
Nippon Flex Control Corp.	FBA-4 (FePb wire braid sheath)	RBC-104 (straight) RBC-204 (45°) RBC-304 (90°)	G16 G16 G16	RCC-104-CA2022
DAIWA DENGYO CO., LTD	Hi-flex PT #17 (FePb sheath)	PSG-104 (straight) PLG-17 (90°) PS-17 (straight)	Screw diameter ø26.4 Screw diameter ø26.4 PF1/2	PDC20-17
Sankei Works	Purika Tube PA-2 #17 (FePb sheath)	BC-17 (straight)	Wire tube screws : 15	PDC20-17

(Note) None of the parts in this table can be ordered from Mitsubishi Electric Corp.

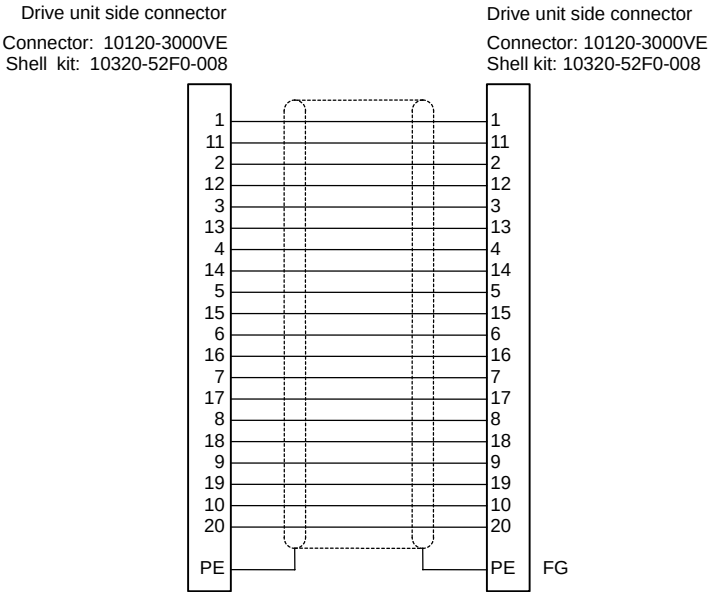
Appendix 2-2 Cable connection diagram

⚠ CAUTION

1. Do not mistake the connection when manufacturing the detector cable. Failure to observe this could lead to faults, runaway or fires.
2. Do not connect anything to pins unless otherwise particularly specified when manufacturing a cable. (Leave OPEN)
3. Contact Mitsubishi when manufacturing a cable longer than 30m.
4. Do not relay the cable which the shield cable is used in. Malfunctions may occur due to noise from the motor drive wire, other cables or devices. If the cable must be relayed, keep the peeled shield section as short as possible (3cm or less), and separate the cable from the other drive wires and cables. Mitsubishi will not be held liable for any problems that should occur as a result of a relayed cable. The customer is responsible for providing measures against noise.

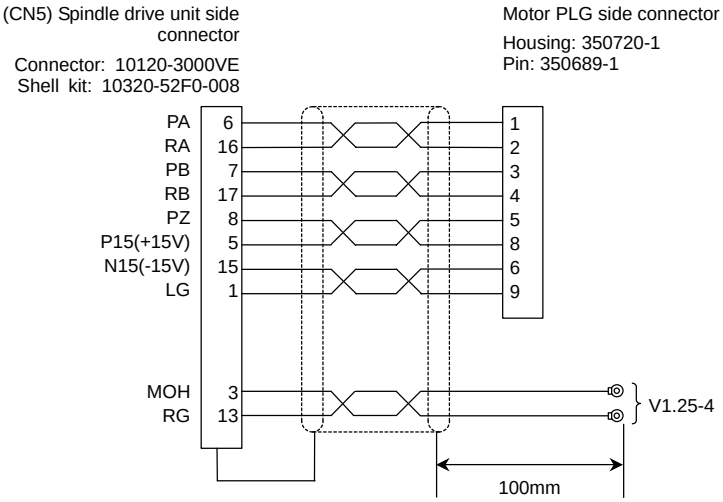
(1) NC bus cable (Cable between spindle drive unit and power supply unit)

<SH21 cable connection diagram>

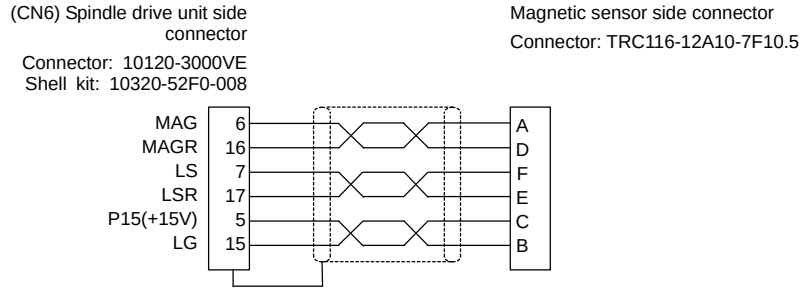


(2) Spindle detector cable

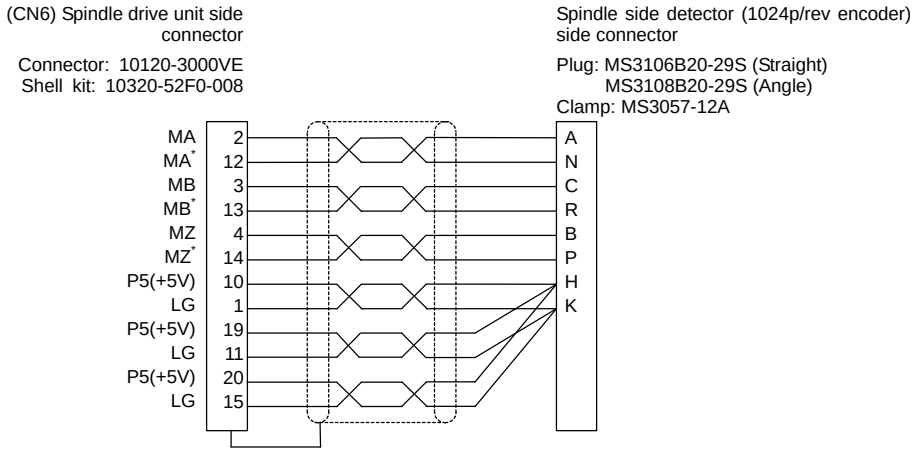
<CNP5 cable connection diagram>



<CNP6M cable connection diagram>

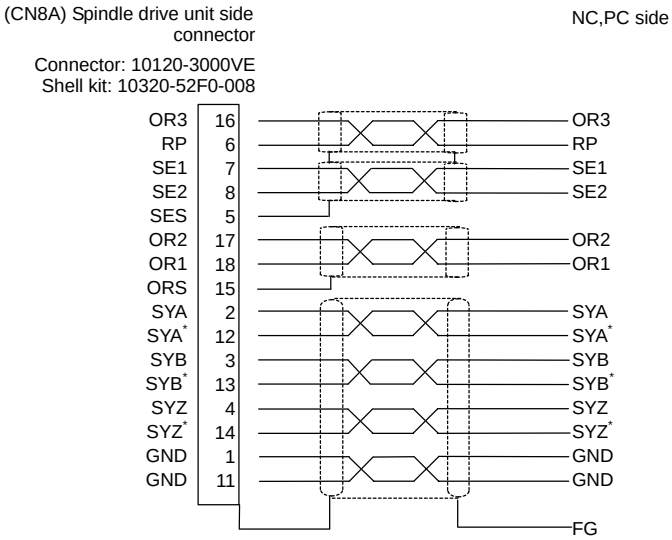


<CNP6A cable connection diagram>

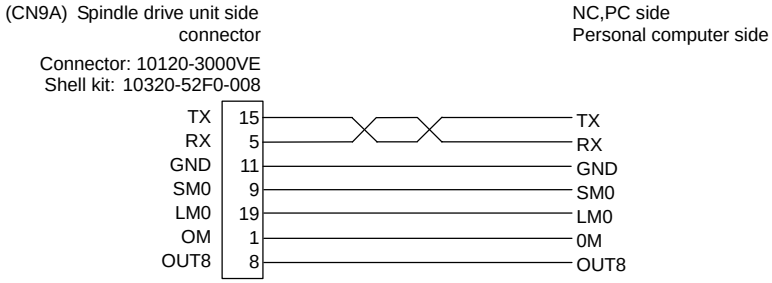


⚠ CAUTION The shield of the spindle detector cable is not connected to the "FG" (earth). Do not connect the cable shield to the earth by clamping the cable, etc.

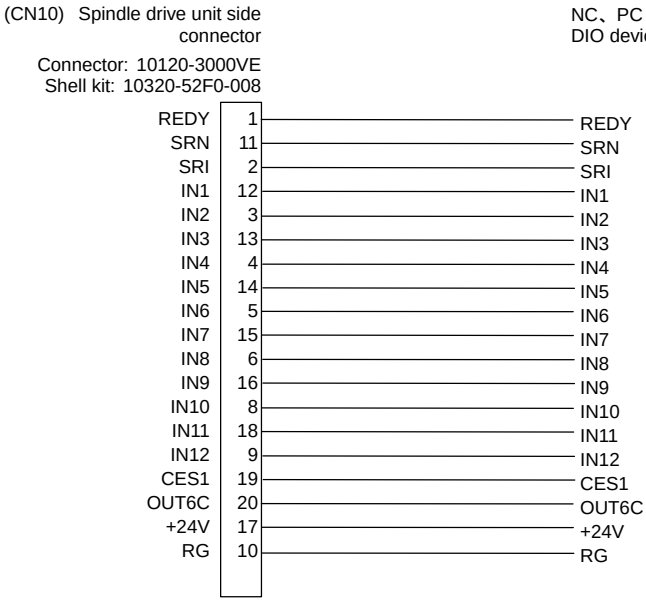
<CN8A cable connection diagram>



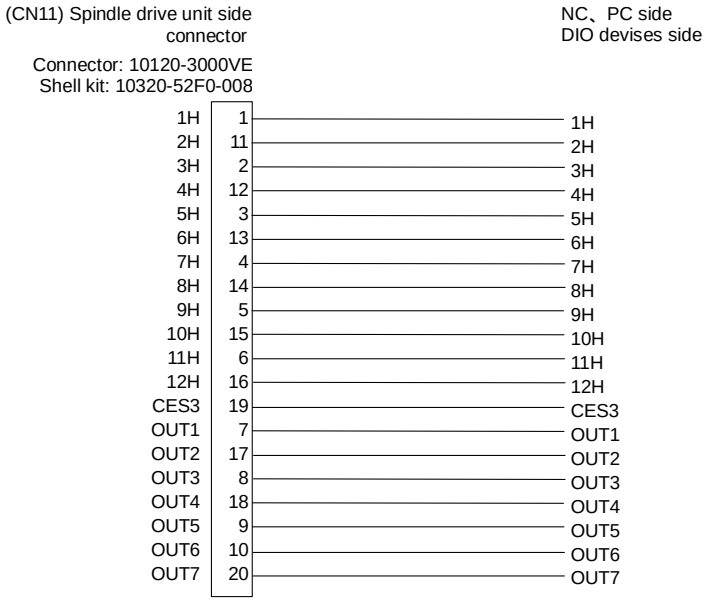
<CN9A cable connection diagram>



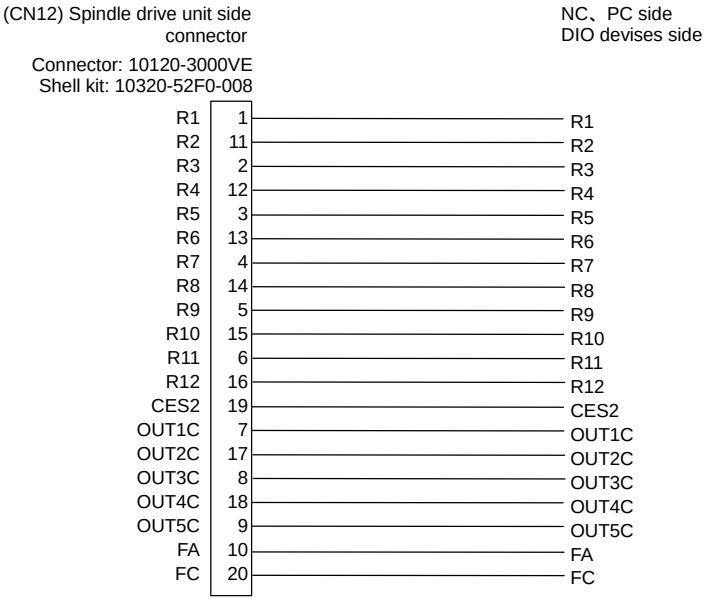
<CN10 cable connection diagram>



<CN11 cable connection diagram>



<CN12 cable connection diagram>

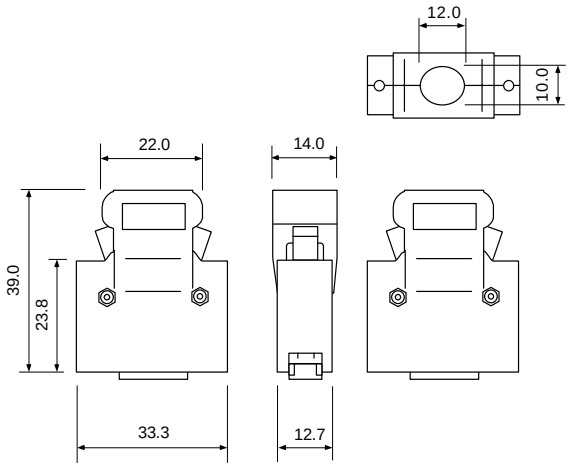


Appendix 2-3 Connector outline dimension drawings

Connector for CN2 Servo drive unit

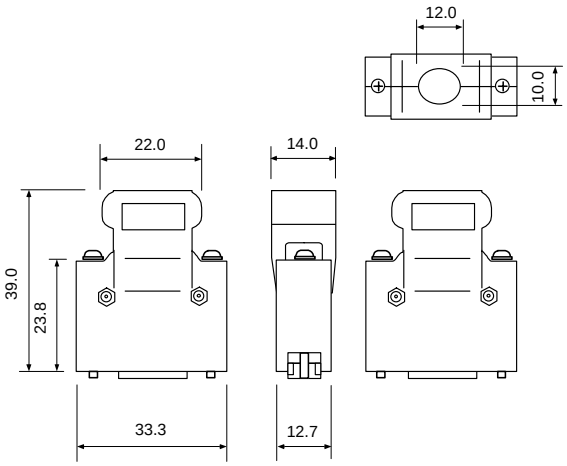
Manufacturer: 3M (Ltd.)
<Type>
Connector: 10120-3000VE
Shell kit: 10320-52F0-008

[Unit: mm]



Manufacturer: 3M (Ltd.)
<Type>
Connector: 10120-3000VE
Shell kit: 10320-52A0-008

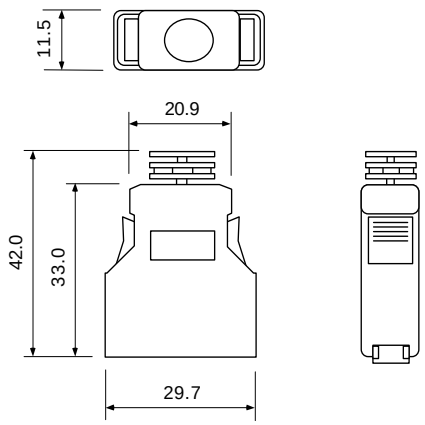
[Unit: mm]



Manufacturer: 3M (Ltd.)
<Type>
Connector: 10120-6000EL
Shell kit: 10320-3210-000

Because this connector is an integrated molding part of the cable, it is not an option setting in the connector set. The terminal connector (A-TM) also has the same outline.

[Unit: mm]



Appendix 3. Selection

Appendix 3-1 Selecting the power supply

When selecting the power supply capacity, select the capacity that satisfies both the "Appendix 3-1-1 Selecting according to the continuous rated capacity".

Appendix 3-1-1 Selecting according to the continuous rated capacity

Select the power supply capacity that satisfies the following conditions for the spindle motor to which the power is supplied.

Power supply unit rated capacity $\geq \sum$ (spindle motor output)….. (1)

Rated capacity of power supply unit

MDS-C1-CV-	37	55	75	110	150	185	220	260	300	370
Rated capacity: (kW)	4.2	6.0	8.0	11.5	15.5	19.0	23.0	27.0	31.0	38.0

POINT

1. "Spindle motor output" refers to the short time rated output (kW) of the spindle motor.
2. If the spindle motor output in acceleration/deceleration is different from that in steady state, substitute the larger value for "spindle motor output".
3. If the spindle motor output is limited, multiply the output value by the limit rate and then substitute the multiplied value for "spindle motor output".
4. If a spindle motor has a coil switch function, calculate with the specification of the coil that has larger output.

CAUTION

1. If the selection capacity exceeds 38.0kW, use two or more power supply units. Select so that the capacity of each power supply unit satisfies the expressions (1).
2. Only when MDS-B-SPA-370 or larger capacity spindle drive unit is connected, a large-capacity power supply unit (MDS-B-CVE-450, 550) can be used. Refer to "Appendix 4. Explanation of Large Capacity Spindle Unit Specifications" for details.
3. For the spindle drive unit, the drive unit capacity may become large depending on the spindle motor such as high-troupe motor. Make sure that the capacity limit of drive unit which can be connected is provided depending on the power supply.

Power supply unit		Spindle drive unit
MDS-C1-CV-	37	MDS-C1-SPA-55 to 75
	55	MDS-C1-SPA-55 to 110
	75	MDS-C1-SPA-55 to 150
	110	MDS-C1-SPA-55 to 185
	150	MDS-C1-SPA-55 to 220
	185	MDS-C1-SPA-55 to 260
	220	MDS-C1-SPA-55 to 300
	260	MDS-C1-SPA-55 to 300 MDS-B-SP-370
	300	MDS-C1-SPA-55 to 300 MDS-B-SP-370 to 450
	370	MDS-C1-SPA-55 to 300 MDS-B-SP-370 to 550

Appendix 3-1-2 Selection example

(Example 1) Spindle motor: SJ-V18.5-03 30-minute rated output 11kW
Spindle drive unit: MDS-C1-SPA-220

(1) Selection with rated capacity

Σ(Spindle motor output) = 11kW
→ "MDS-C1-CV-110" that has the selection capacity of 11kW, or larger unit is required.

(2) Selection with spindle drive unit

According to the table in the previous section, "MDS-C1-CV-150" or larger unit is required for the power supply unit which can be combined with "MDS-C1-SPA-220".

(3) Overall selection

Select the power supply unit "MDS-C1-CV-150" that meets the conditions (1) and (2).

(Example 2) Spindle motor: No.1 SJ-V5.5-01 30-minute rated output 5.5kW
No.2 SJ-V18.5-03 30-minute rated output 11kW
Spindle drive unit: No.1 MDS-C1-SPA-55
No.2 MDS-C1-SPA-220

(1) Selection with rated capacity

Σ(Spindle motor output) = 5.5kW + 11kW = 16.5kW
→"MDS-C1-CV-185" that has the selection capacity of 16.5kW, or larger unit is required.

(2) Selection with spindle drive unit

No.1 According to the table in the previous section, "MDS-C1-CV-37" or larger unit is required for the power supply unit which can be combined with "MDS-C1-SPA-75".

No.2 According to the table in the previous section, "MDS-C1-CV-150" or larger unit is required for the power supply unit which can be combined with "MDS-C1-SPA-75".

(3) Overall selection

Select the power supply unit " MDS-C1-CV-185" that meets the conditions (1) and (2).

Appendix 4. Explanation of Large Capacity Spindle Unit Specifications

Appendix 4-1 Explanation of large capacity spindle unit specifications

Appendix 4-1-1 Outline

The MDS-B-SPA Series large capacity spindle unit (37KW, 45KW, 55KW) is an expanded capacity version of the MDS-C1-SPA Series standard spindle unit (30KW or less).
Additional items related to the increased capacity are explained in this section.

Appendix 4-1-2 List of units

<Power supply unit>

Type	Capacity (kW)	Weight (kg)
B-CVE-450	45	20
B-CVE-550	55	21

<Spindle drive unit>

Type	Capacity (kW)	Weight (kg)
B-SPA-370	37	20
B-SPA-450	45	21
B-SPA-550	55	21

(Note) Use the MDS-C1-CV-370 for the power supply unit 37kW.

Appendix 4-1-3 Selection of AC reactor (B-AL), contactor and NFB

Always mount the AC reactor and contactor shown below on the input side of each power supply unit (B-CVE-450, 550).

(Note 1) Always mount one contactor for each power supply unit when using the MDS-B-CVE-450 or 550. The power supply unit could be damaged if the contactor is omitted or shared with another unit.)

(Note 2) Always mount one AC reactor for each power supply unit. The power supply unit could be damaged if the AC reactor is omitted or shared.

The selection of the NFB when using only one power supply unit is shown below for reference.

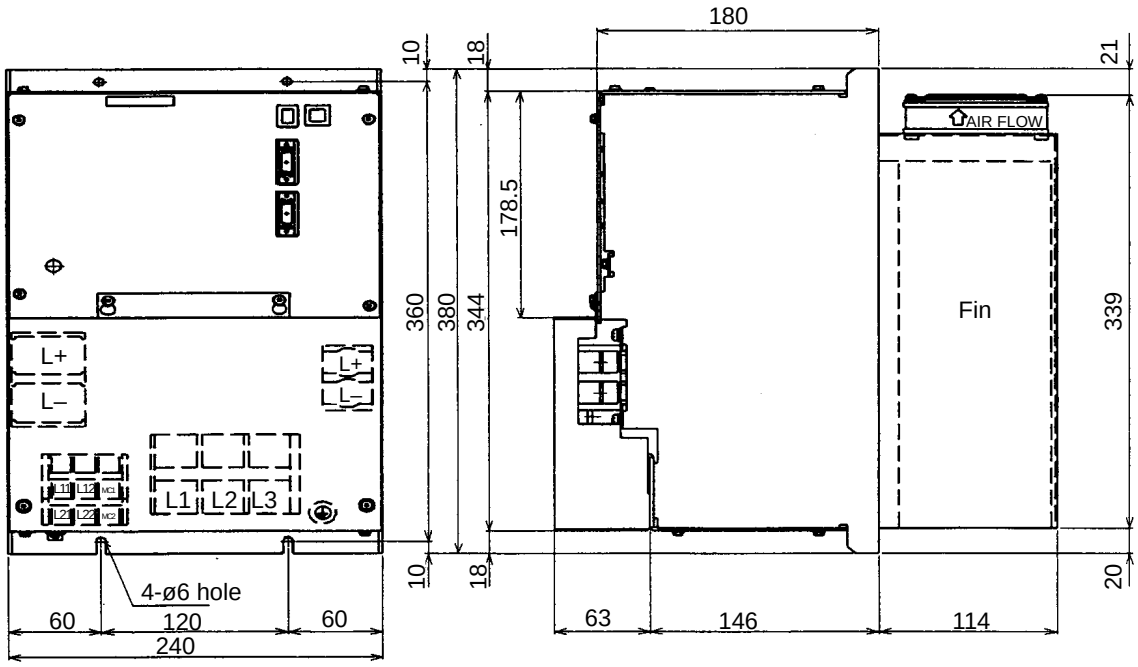
Power supply unit type	MDS-B-CVE-450	MDS-B-CVE-550
AC reactor (ordered part)	B-AL-45K	B-AL-55K
Recommended contactor (special order part)	S-N150	S-N180
Recommended NFB (special order part)	NF225CS3P-200A	NF400CS3P-300A

(Note) Even when OFF, an earth leakage current of maximum 15mA flows at the coil connection terminal MC1 for the power supply unit's external contactor. Thus, when using a contactor other than that recommended above, do not use the contactor that can be turned ON at 15mA or less or cannot be turned OFF at 15mA. When using a contactor with an internal electronic circuit, consult with the contactor manufacturer and make sure that the contactor will operate correctly even if an earth leakage current of 15mA or less flows.

Appendix 4-1-4 Outline dimension drawings

The I bolt mounting hole is provided only at the top of the MDS-B-CVE-550 and MDS-B-SPA-450, 550. The I bolt (size: M10) is not enclosed and must be prepared by the user. Use an I bolt with a 13 to 25mm long thread.

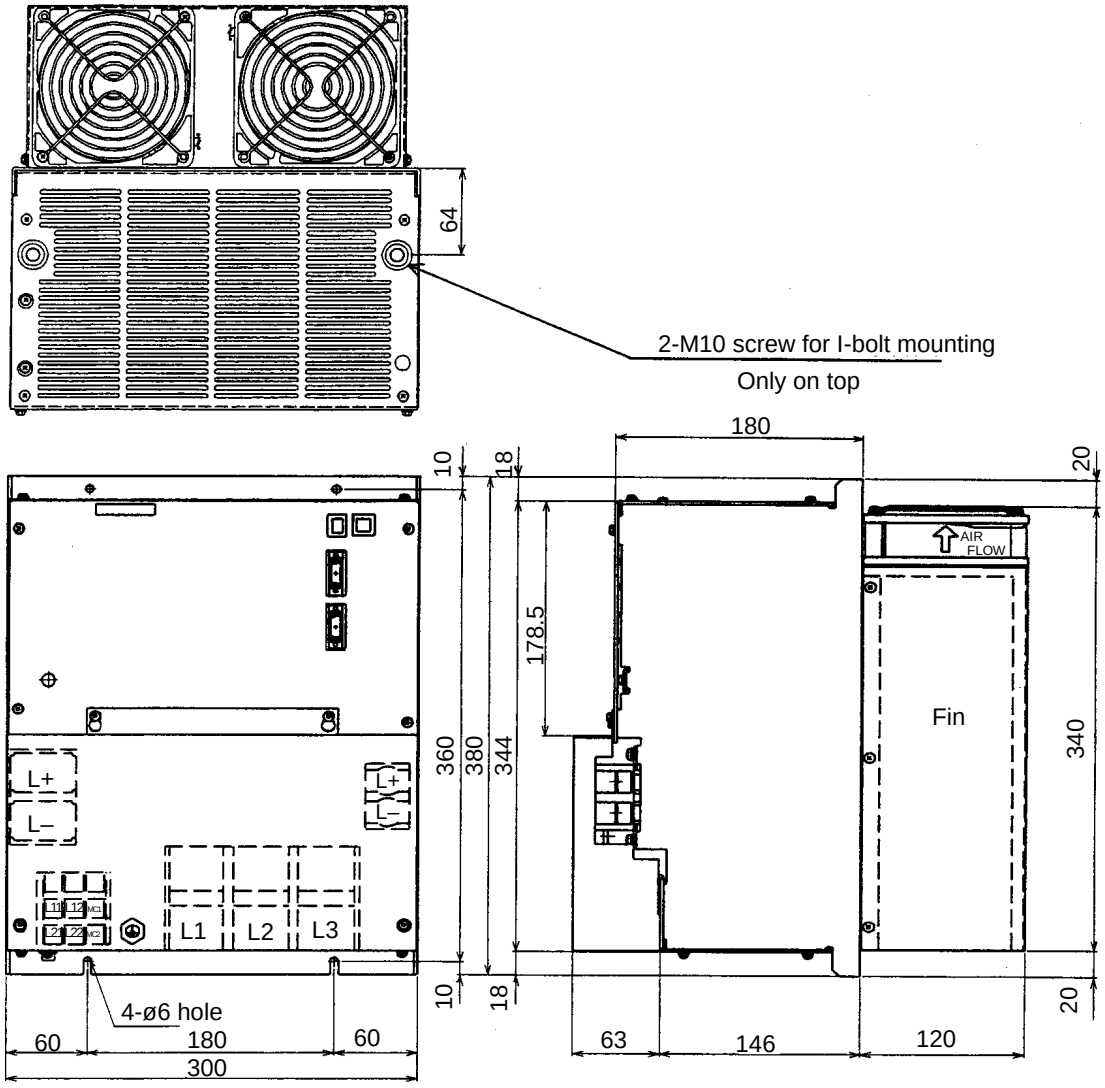
(1) MDS-B-CVE-450



[Unit : mm]

(Note) Always install a large capacity drive unit in the left side of power supply unit, and connect TE2(L+,L-) with DC connection bar.

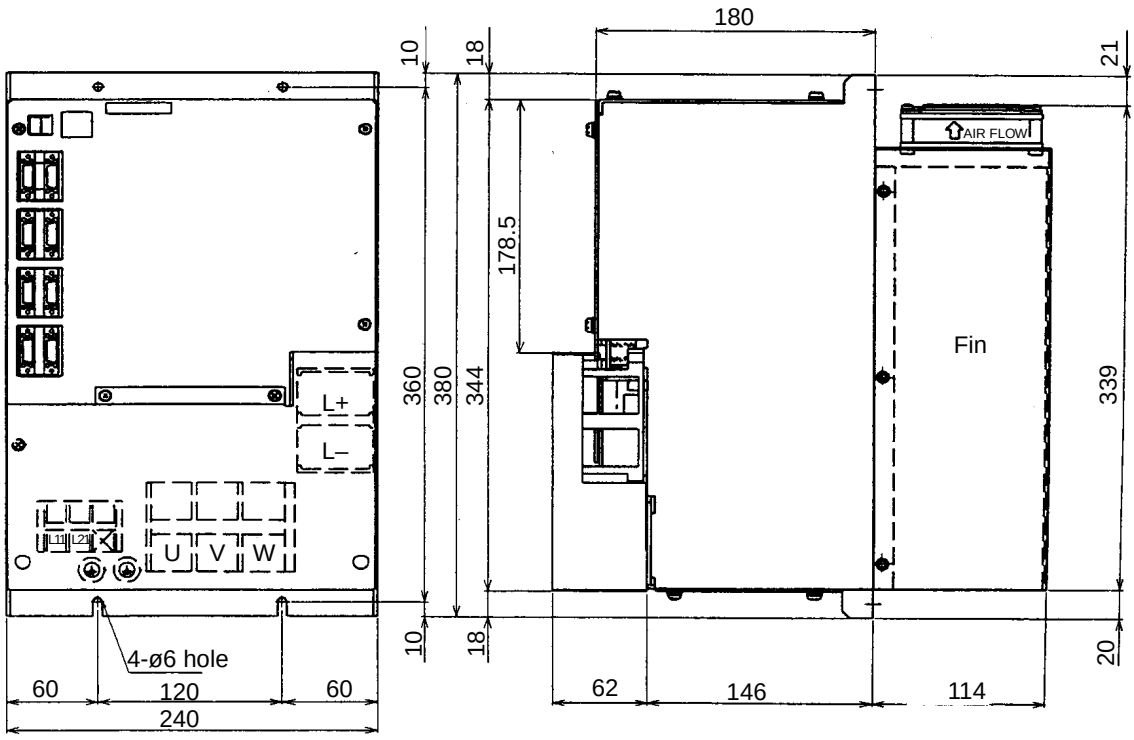
(2) MDS-B-CVE-550



[Unit : mm]

(Note) Always install a large capacity drive unit in the left side of power supply unit, and connect TE2(L+,L-) with DC connection bar.

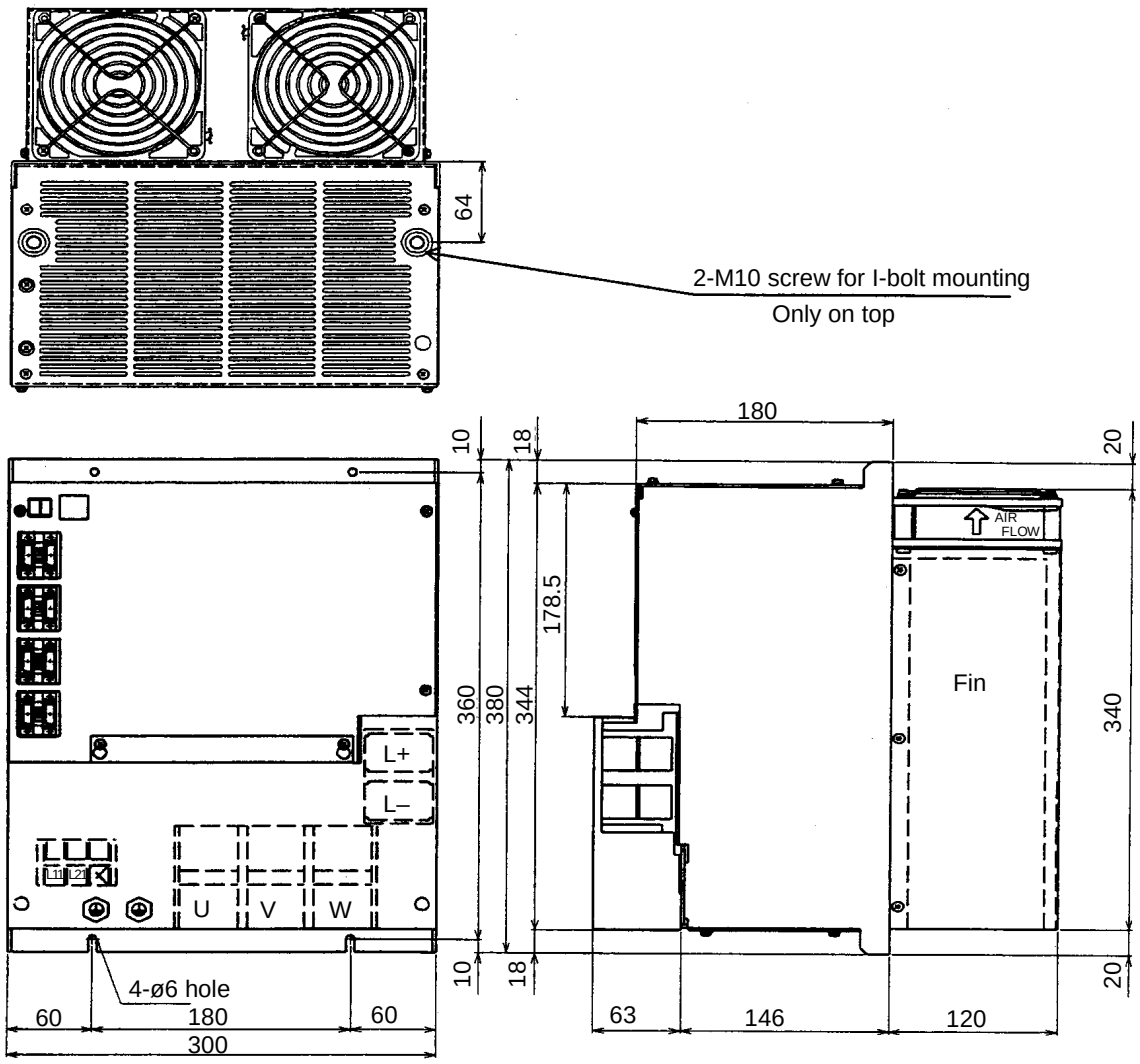
(3) MDS-B-SP-370



[Unit : mm]

(Note) Always install a large capacity drive unit in the left side of power supply unit, and connect TE2(L+,L-) with DC connection bar.

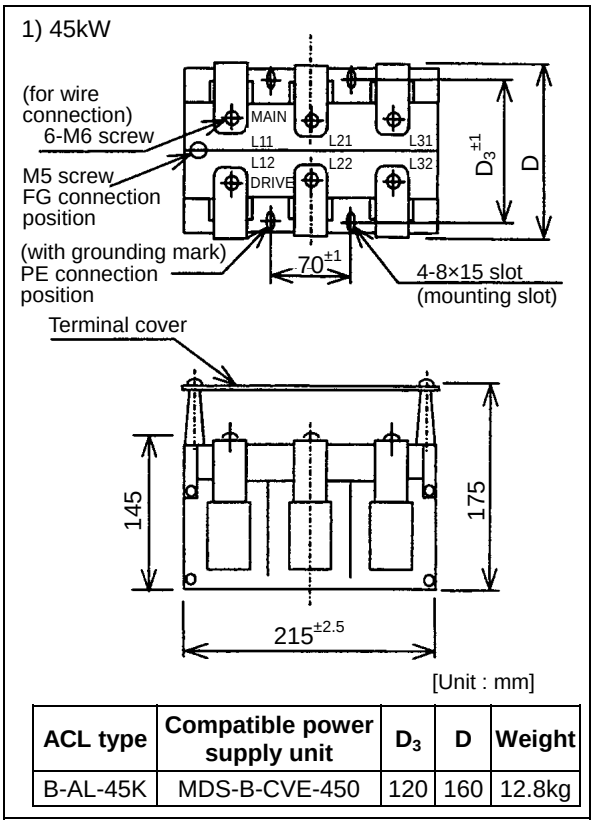
(4) MDS-B-SP-450/550



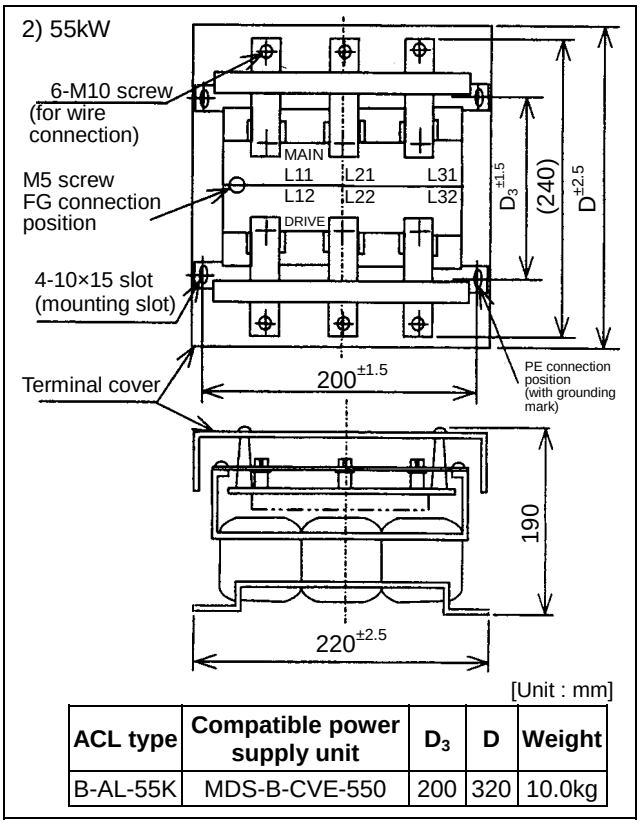
[Unit : mm]

(Note) Always install a large capacity drive unit in the left side of power supply unit, and connect TE2(L+,L-) with DC connection bar.

(5) AC reactor

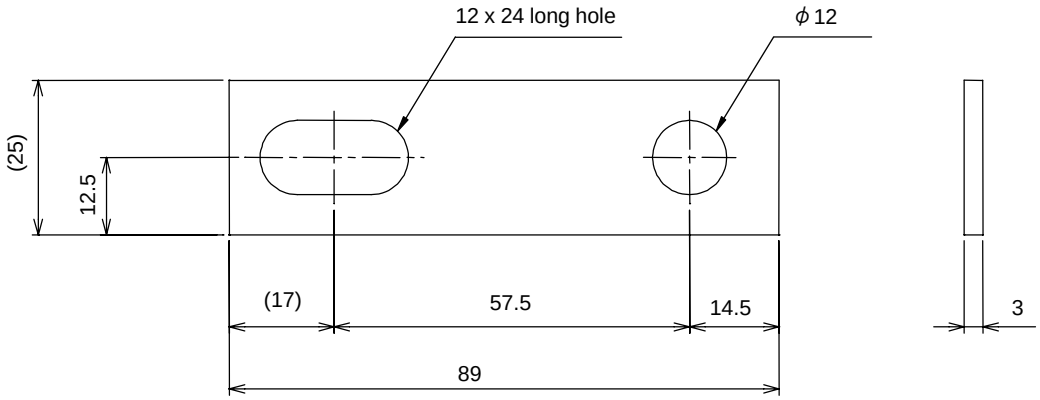


ACL type	Compatible power supply unit	D_3	D	Weight
B-AL-45K	MDS-B-CVE-450	120	160	12.8kg



ACL type	Compatible power supply unit	D_3	D	Weight
B-AL-55K	MDS-B-CVE-550	200	320	10.0kg

(6) DC connection bar

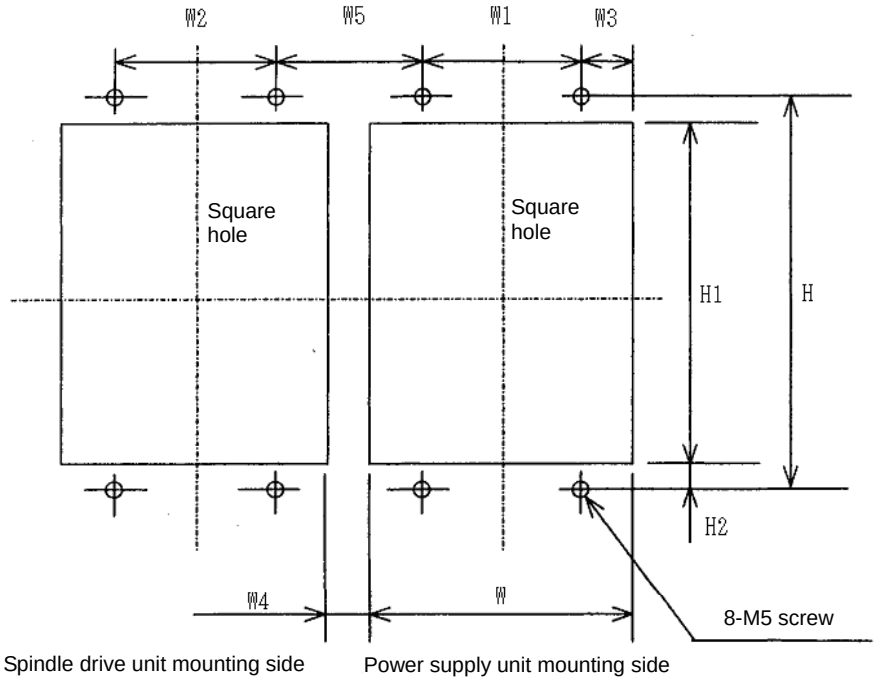


(Note) This DC connection bar is a set of two DC connection bars.

POINT

1. These DC connection bars are accessories.
2. Always install a large capacity drive unit in the left side of power supply unit, and connect TE2(L+,L-) with DC connection bar.

Appendix 4-1-5 Panel cut dimension drawing



(Front view)

Unit [mm]

Power supply unit

Sym-bol	MDS-B-CVE-450	MDS-B-CVE-550
H	360±0.3	360±0.3
W	222±1	282±1
H1	341±1	341±1
H2	10±0.5	10±0.5
W1	120±0.3	180±0.3
W2	–	–
W3	51±0.5	51±0.5
W4	18±0.5	18±0.5
W5	120±0.5	120±0.5

Spindle drive unit

Sym-bol	MDS-B-SPA-370	MDS-B-SPA-450	MDS-B-SPA-550
H	360±0.3	360±0.3	360±0.3
W	222±1	282±1	282±1
H1	341±1	341±1	341±1
H2	10±0.5	10±0.5	10±0.5
W1	–	–	–
W2	120±0.3	180±0.3	180±0.3
W3	51±0.5	51±0.5	51±0.5
W4	–	–	–
W5	–	–	–

(Note 1) The spindle drive unit must be mounted to the left of the power supply unit looking from the front of the unit. The panel must be cut taking this into consideration.

(Note 2) L+ and L– connection conductors are enclosed with the MDS-B-CVE-450 and 550 capacities, so provide space between the units according to the dimensions shown above.

Appendix 4-1-6 Heating value

Power supply unit

Type	Heating value (W)
MDS-B-CVE-450	500
MDS-B-CVE-550	600

Spindle drive unit

Type	Heating value (W)
MDS-B-SPA-370	850
MDS-B-SPA-450	1000
MDS-B-SPA-550	1200

(Note 1) The heating value is the value at the continuous rated output.
(Note 2) Use the following expressions as a guide for the heating value outside the panel when mounting in an enclosed structure.

Unit	Heating value outside panel
MDS-B-CVE-450, 550	Heating value outside panel = (B-CVE heating value -30) × 0.75
MDS-B-SPA-370, 450, 550	Heating value outside panel = (B-SPA heating value -40) × 0.75

Appendix 4-1-7 Selecting the power capacity

The power capacity required for the power supply unit is shown below.

Power supply unit type	Power capacity (kVA)
MDS-B-CVE-450	63
MDS-B-CVE-550	77

Appendix 4-1-8 Selecting the wire size

(1) Recommended wire size for power lead-in wire

Regardless of the motor type, select the wire size as shown below using the power supply unit capacity as a reference.

Power supply unit type	Recommended wire size for power-lead-in wire
MDS-B-CVE-450	HIV60mm^2
MDS-B-CVE-550	HIV80mm^2

(2) Recommended wire size for spindle motor output wire

Regardless of the motor type, select the wire size as shown below using the spindle drive unit capacity as a reference.

Spindle drive unit type	Recommended wire size for spindle motor output wire
MDS-B-SPA-370	HIV50mm^2
MDS-B-SPA-450	HIV60mm^2
MDS-B-SPA-550	HIV80mm^2

(3) L+, L– link bar wire size

Power supply unit type	L+, L– link bar wire size
MDS-B-CVE-450	Dedicated link bars are enclosed as accessories (always use accessories)
MDS-B-CVE-550	Dedicated link bars are enclosed as accessories (always use accessories)

(Note) The wire sizes above for the MDS-B-CVE-450/550 are the values when connecting to the terminal section on the left front.

(4) L11, L21, MC1

Regardless of the spindle drive unit and power supply unit capacities, use an IV2mm^2 or more wire size.

Appendix 4-1-9 Drive unit connection screw size

Type	Power supply unit				Spindle drive unit	
	MDS-B-CVE-450		MDS-B-CVE-550		MDS-B-SPA-370	MDS-B-SPA-450 MDS-B-SPA-550
	Left	Right	Left	Right		
L1, L2, L3	M8		M10		–	–
U, V, W	–		–		M8	M10
L+, L–	M10	M6	M10	M6	M10	M10
L11, L21	M4		M4		M4	M4
MC1	M4		M4		–	–

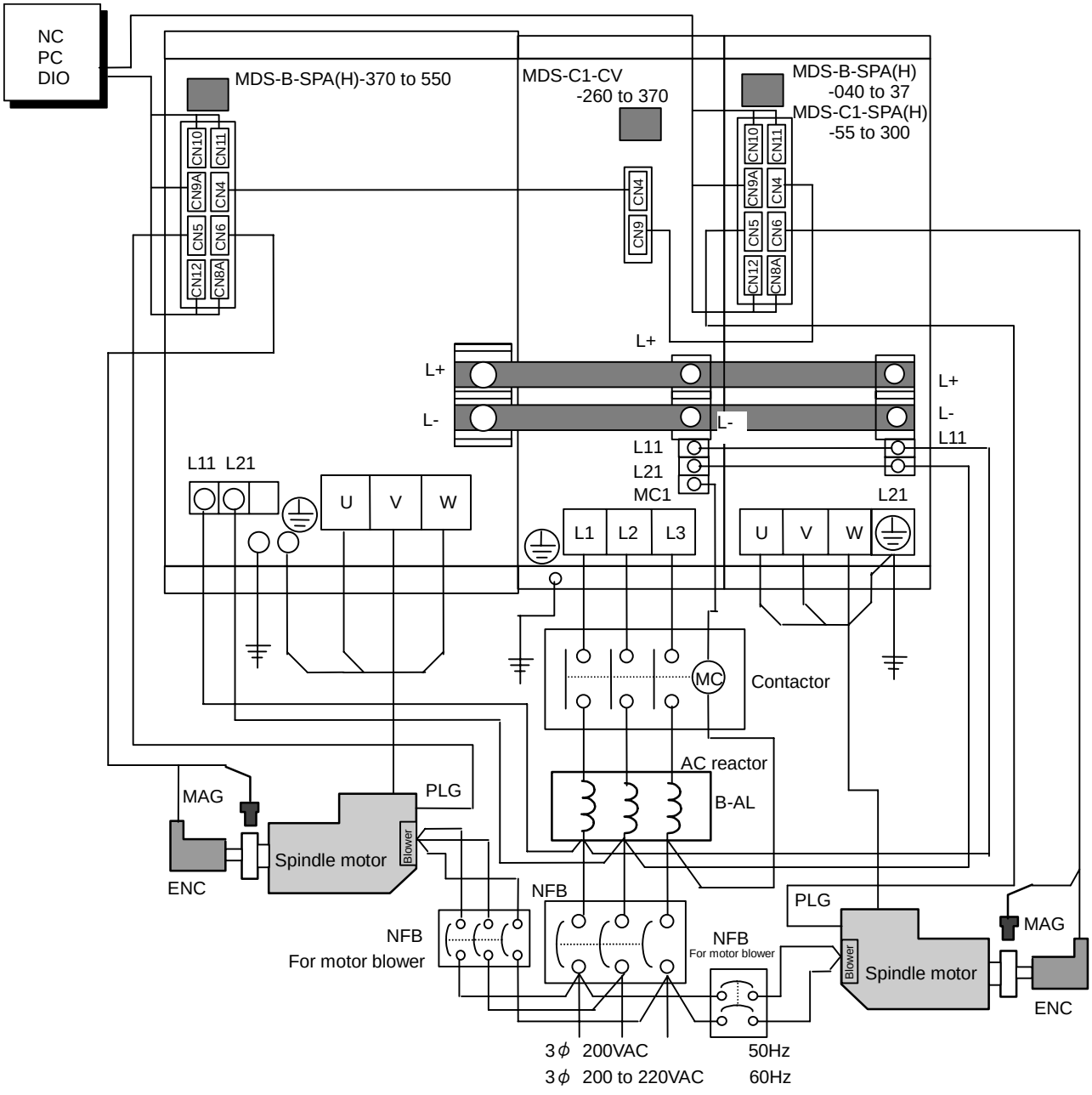
Appendix 4-1-10 Connecting each unit

(1) Wiring system

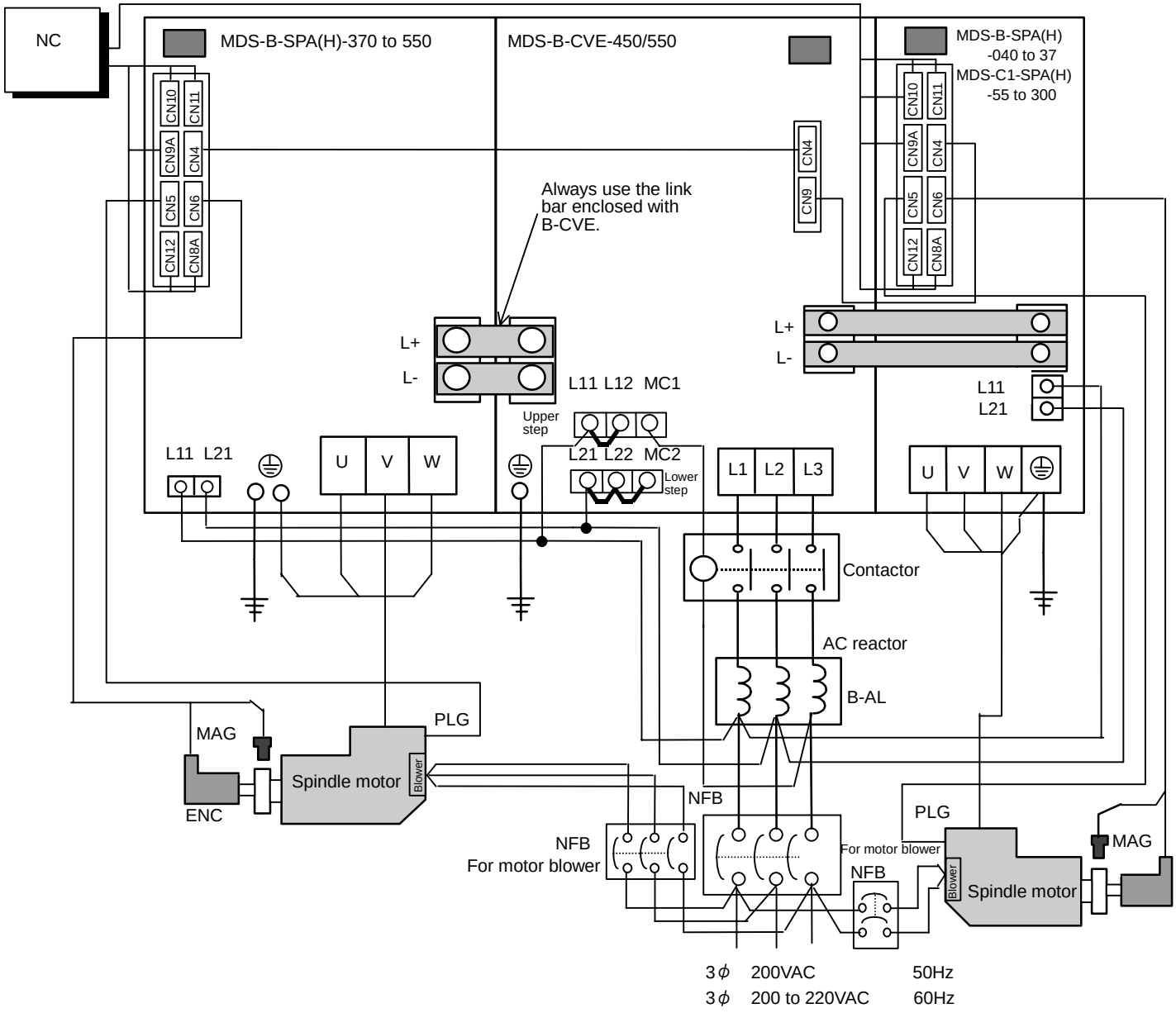
The wiring system is the same as the MDS-C1-SPA Series. (Refer to the wiring system example below.)

Note that there are restrictions to the mounting and selection, so refer to the Restrictions given in Section Appendix 5-1-11.

(a) When using MDS-C1-CV-370 or smaller



(b) When using MDS-B-CVE-450, 550



(Note 1) Connect the L11, L21 and MC1 external connections without removing the conductors connected between L21 and L22, L22 and MC2, and L11 and L12 of the MDS-B-CVE-450, 550.
(L12, L22 and MC2 are for special specifications, and normally, the external connection is not required.)

(Note 2) Always connect the contactor to MC1 so that it can be controlled with the drive unit's internal signal. The power supply unit could be damaged if the contactor is turned ON and OFF with a separate user-prepared sequence.

(Note 3) One end of the contactor coil is connected to the MC1 terminal and the other end is connected to the power supply. The phase on the side connected to the power supply must be different from the phase connected to the power supply unit's L21.

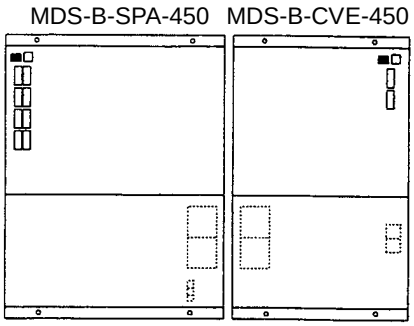
Appendix 4-1-11 Restrictions

(1) Mounting

Always mount the MDS-B-SPA-370,450, 550 on the left of the power supply unit.
When using MDS-B-CVE-450, 550, always use the enclosed link bar to connect L+ and L- on the MDS-B-SP-370, 450, 550.

(a) Layout when connecting only one spindle drive unit to power supply unit.
Mount the power supply on the right and the spindle drive unit on the left.
Always cut the panel according to the panel cut dimension drawings shown in Appendix 5-1-5.

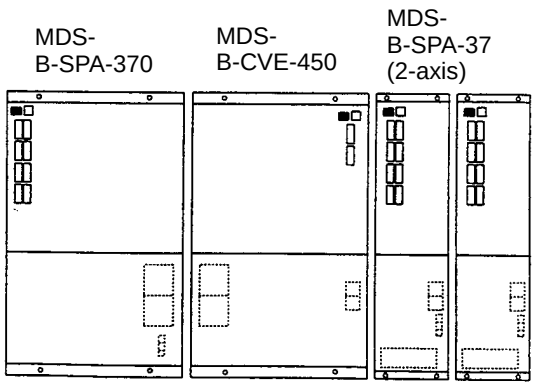
<Example 1>



(b) Layout when connecting multiple drive units to a large capacity power supply unit
The following number of spindle drive units can be additionally connected.
- When MDS-B-CVE-450 and MDS-B-SPA-370 are combined, 9kW (=45kW–37kW+1kW) worth of units.
- When MDS-B-CVE-550 and MDS-B-SPA-450 are combined, 11kW (=55kW–45kW+1kW) worth of units.
- When MDS-B-CVE-450 and MDS-B-SPA-370 are combined, 19kW (=55kW–37kW+1kW) worth of units.

In this case, arrange the MDS-B-SPA-370, 450 to the left of MDS-B-CVE-450, 550 as shown in the panel cut dimension drawings in Appendix 5-1-5. Mount the additional drive units to the right of the MDS-B-CVE-450, 550.
If the spindle motor output differs from the spindle drive unit output, the above, excluding the layout, may not always apply. (This is because the power supply unit's output is determined by the motor output.)

<Example 2>



(2) Selection

(a) When using the MDS-B-CVE-450, 550, one of the B-SPA-370, 450, 550 units must be selected for the drive units connected to this power supply unit.
Only one MDS-B-SPA-370, 450, 550 can be connected to one MDS-B-CVE-450, 550.

(b) When using MDS-B-SPA-370, 450 or 550, the following power supply unit must be selected.
- When using MDS-B-SPA-370: Select MDS-C1-CV-260 or more or MDS-B-CVE-450 or 550
- When using MDS-B-SPA-450: Select MDS-C1-CV-300 or more or MDS-B-CVE-450 or 550
- When using MDS-B-SPA-550: Select MDS-C1-CV-370 or more or MDS-B-CVE-450 or 550

Note that if the total of the spindle motor output corresponds to the above power supply unit with the normal selection method, that capacity power supply unit can be selected.

<Example 1> When using MDS-B-SPA-370
When total of servo/spindle motor output is 23kW or less: Select MDS-C1-CV-260
When total of servo/spindle motor output is 23.1kW or more: Select power supply unit with normal selection method.

<Example 2> When using MDS-B-SPA-450
When total of servo/spindle motor output is 27kW or less: Select MDS-C1-CV-300
When total of servo/spindle motor output is 27.1kW or more: Select power supply unit with normal selection method.

<Example 3> When using MDS-B-SPA-550
When total of servo/spindle motor output is 31kW or less: Select MDS-C1-CV-370
When total of servo/spindle motor output is 31.1kW or more: Select power supply unit with normal selection method.

Appendix 4-1-12 Parameters

The parameters added and changed in respect to the 30kW or smaller drive unit are shown below. The parameters other than those shown below are the same as the 30kW or smaller capacity. For details on the parameters, refer to "MDS-C1 SERIES INSTRUCTION MANUAL" (BNP-B2365)

<table>
<tr><th>No.</th><th>Abbr.</th><th>Parameter name</th><th>Details</th><th>Setting range</th><th>Standard setting</th></tr>
<tr><td>SP039</td><td>ATYP*</td><td>Drive unit type</td><td>Set the spindle drive unit's capacity type.
(HEX setting)
<table>
<tr><th>Setting</th><th>Unit capacity</th><th>Setting</th><th>Unit capacity</th></tr>
<tr><td>0000</td><td>---</td><td>0010</td><td>MDS-B-SPA-550</td></tr>
<tr><td>0001</td><td>MDS-B-SPA-075</td><td>0011</td><td>---</td></tr>
<tr><td>0002</td><td>MDS-B-SPA-15</td><td>0012</td><td>---</td></tr>
<tr><td>0003</td><td>MDS-B-SPA-22</td><td>0013</td><td>---</td></tr>
<tr><td>0004</td><td>MDS-B-SPA-37</td><td>0014</td><td>---</td></tr>
<tr><td>0005</td><td>MDS-B/C1-SPA-55</td><td>0015</td><td>---</td></tr>
<tr><td>0006</td><td>MDS-B/C1-SPA-75</td><td>0016</td><td>---</td></tr>
<tr><td>0007</td><td>MDS-B/C1-SPA-110</td><td>0017</td><td>---</td></tr>
<tr><td>0008</td><td>MDS-B/C1-SPA-150</td><td>0018</td><td>---</td></tr>
<tr><td>0009</td><td>MDS-B/C1-SPA-185</td><td>0019</td><td>---</td></tr>
<tr><td>000A</td><td>MDS-B/C1-SPA-220</td><td>001A</td><td>---</td></tr>
<tr><td>000B</td><td>MDS-B/C1-SPA-260</td><td>001B</td><td>---</td></tr>
<tr><td>000C</td><td>MDS-B/C1-SPA-300</td><td>001C</td><td>---</td></tr>
<tr><td>000D</td><td>MDS-B-SPA-370</td><td>001D</td><td>---</td></tr>
<tr><td>000E</td><td>MDS-B-SPA-450</td><td>001E</td><td>---</td></tr>
<tr><td>000F</td><td>MDS-B-SPA-04</td><td>001F</td><td>---</td></tr>
</table></td><td>0000 to FFFF</td><td>0000</td></tr>
<tr><td>SP041</td><td>PTYP*</td><td>Power supply type</td><td>When the CN4 connector of the drive unit and the power supply are connected, setting below is necessary.
To validate the external emergency stop function, add 40h.
(HEX setting)
<table>
<tr><th>Unit capacity</th><th>External emergency stop invalid</th><th>External emergency stop valid</th></tr>
<tr><td>MDS-C1-CV-260</td><td>0126</td><td>0166</td></tr>
<tr><td>MDS-C1-CV-300</td><td>0130</td><td>0170</td></tr>
<tr><td>MDS-C1-CV-370</td><td>0137</td><td>0177</td></tr>
<tr><td>MDS-B-CVE-450</td><td>0145</td><td>0185</td></tr>
<tr><td>MDS-B-CVE-550</td><td>0155</td><td>0195</td></tr>
</table></td><td>0000 to FFFF</td><td>0000</td></tr>
</table>

Parameters with an asterisk * in the abbreviation, such as ATYP*, are validated with the NC power turned ON again.

Appendix 4-1-13 Precautions

After turning the power OFF, wait at least 15 seconds before turning it ON again.
If the power is turned ON within 15 seconds, the drive unit's control power may not start up correctly.

Appendix 5. Explanation of Small Capacity Spindle Drive Unit Specifications

Appendix 5-1 Explanation of small capacity spindle drive unit specifications

Appendix 5-1-1 Outline

MDS-C1-SPA Series spindle drive unit of 5.5kw or smaller are not available. Therefore, when the spindle drive unit of 3.7kw or smaller is required, use a spindle unit of MDS-B-SPA Series. In this section, the items about MDS-B-SPA which must be added to C1-SPA are explained. Use MDS-C1-CV for the power supply unit to be combined.

Appendix 5-1-2 List of units

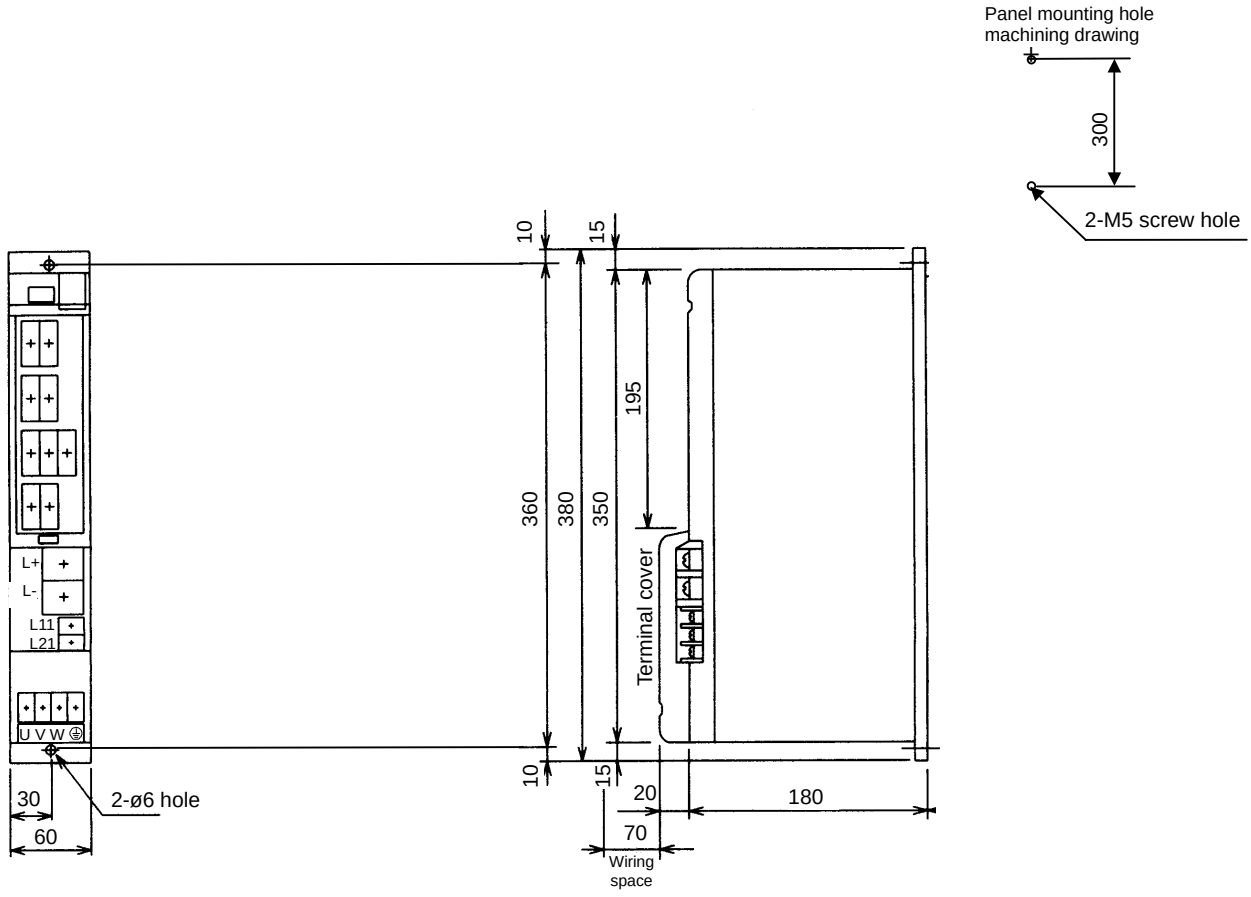
Type	Capacity (kW)	Weight (kg)
MDS-B-SPA-04	0.4	3.5
MDS-B-SPA-075	0.75	3.5
MDS-B-SPA-15	1.5	3.5
MDS-B-SPA-22	2.2	4.5
MDS-B-SPA-37	3.7	4.5

(Note) Use the power supply unit MDS-C1-CV-37 or larger.

Appendix 5-1-3 Outline dimension drawings

(1) MDS-B-SPA-04 to 15

The front view drawing shows a state with the terminal cover removed.



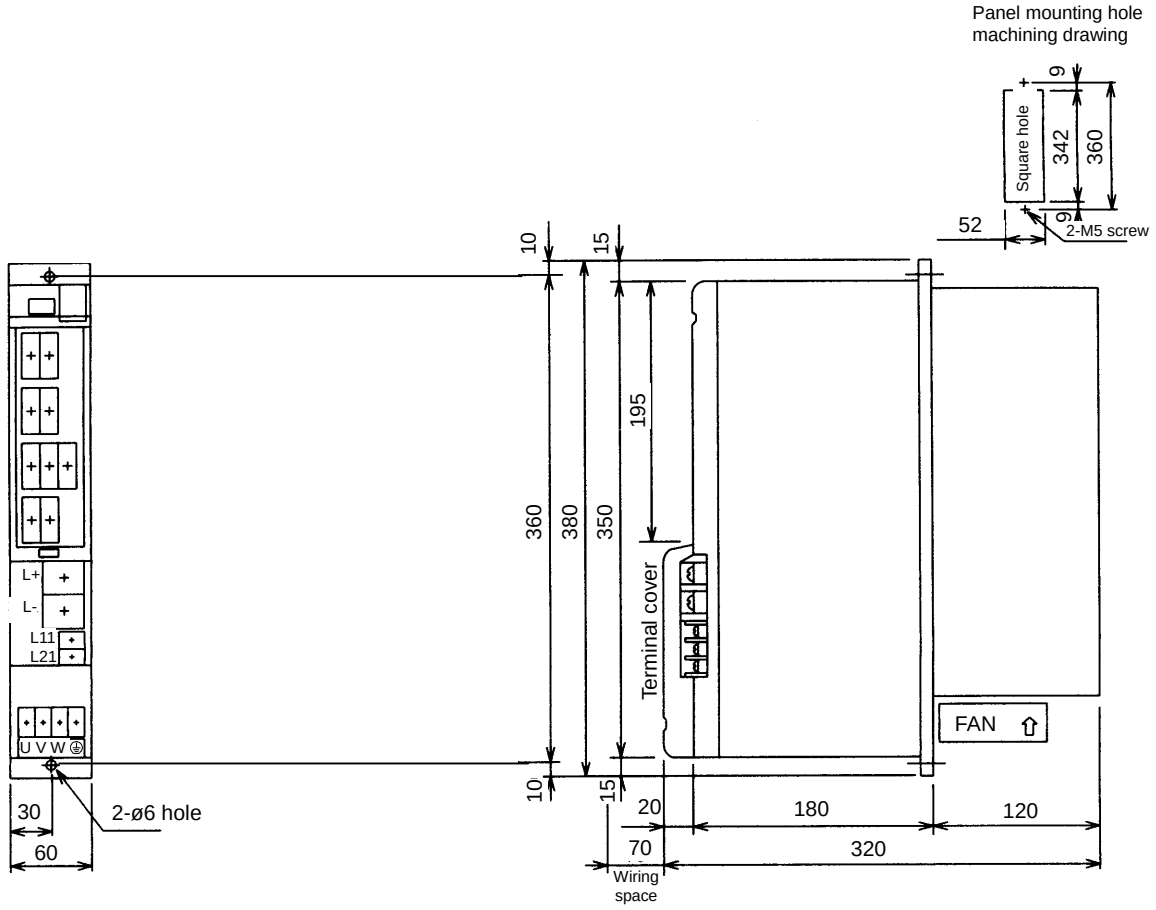
[Unit : mm]

(Note 1) A square hole processing is not required in the panel mounting hole machining.

(Note 2) Keep ventilation area in the top and bottom of unit because only MDS-B-SPA-15 has a built-in fan.

(2) MDS-B-SPA-22, 37

The front view drawing shows a state with the terminal cover removed.



[Unit : mm]

Appendix 5-1-4 Drive unit specifications list

			Spindle drive unit MDS-B-SPA Series				
Spindle drive unit type MDS-B-SPA- MDS-B-SPAH-			04	075	15	22	37
Rated output		[kW]	0.1	0.3	0.5	1.5	2.2
Output	Rated voltage	[V]	AC 155				
	Rated current	[A]	1.5	2.6	4.5	10.0	15.0
Input	Rated voltage	[V]	DC270 to 311				
	Rated current	[A]	1	4	7	13	17
Control power	Voltage	[V]	AC200/200 to 230				
	Frequency	[Hz]	50/60				
	Current	[A]	Max. 0.2				
Control method			Sine wave PWM control method, current control method				
Braking			Regenerative braking				
Speed control input			Analog voltage ±10V (or +10V) MAX (input impedance approx.10kΩ), or digital (12 bit binary, signed 12 bit binary, BCD code 2 digits, BCD code 3 digits)				
External analog output			0 to +10V, 2ch (speed meter output, load meter output, data for various adjustments)				
Structure			Protection type (Protection method: IP20)				
Environment	Ambient temperature		Operation: 0 to 55°C (with no freezing), Storage / Transportation: -15°C to 70°C (with no freezing)				
	Ambient humidity		Operation: 90%RH or less (with no dew condensation) Storage / Transportation: 90%RH or less (with no dew condensation)				
	Atmosphere		Indoors (no direct sunlight) With no corrosive gas, inflammable gas, oil mist or dust				
	Altitude		Operation/Storage: 1000 meters or less above sea level, Transportation: 10000 meters or less above sea level				
	Vibration/impact		$4.9m/s^2$ (0.5G) / $49m/s^2$ (5.0G)				
Cooling method			Self-cooling		Internal		
Weight		[kg]	3.5			4.5	
Heat radiated at continuous rated output		[W]	30	40	50	70	80
Noise			Less than 55dB				

Appendix 5-1-5 Heating value

MDS-B-SPA-	Heating value	
	Inside panel	Outside panel
04	30	-
075	40	-
15	50	-
22	27	43
37	29	51

(Note 1) The heating value is the value at the continuous rated output.

Appendix 5-1-6 Selecting the wire size

(1) Recommended wire size for spindle motor output wire

Regardless of the motor type, select the wire size based on the spindle drive unit capacity as shown below.

MDS-B-SPA-	IV wire (60 °C)	HIV wire (75 °C)
04	2mm^2	2mm^2
075		
15	3.5mm^2	
22		
37		

(Note 1) The wire sizes recommended in (1) above are selected under the conditions that the ambient temperature is 30°C and three tubes are wired.
During actual use, select the wire based on the above reference while considering the ambient temperature, wire material, and wiring state.

(Note 2) To suppress the L+ and L– link bar size to the minimum required for each unit, select as shown below based on the total output current of the motor to be load.

First, obtain the motor output current of each drive unit based on the drive unit capacity.

Spindle motor (Decide according to the drive unit capacity)

Unit capacity MDS-B-SPA□-	04	075	15	22	37
Motor output current (A)	4	6	10	17	25

(2) L11, L21

Regardless of the spindle drive unit capacities, use the wire size of IV2mm^2 or more.

Appendix 5-1-7 Drive unit connection screw size

Terminal name	Screw size
U,V,W,G	M4
L+,L-	M6
L11,L21	M4

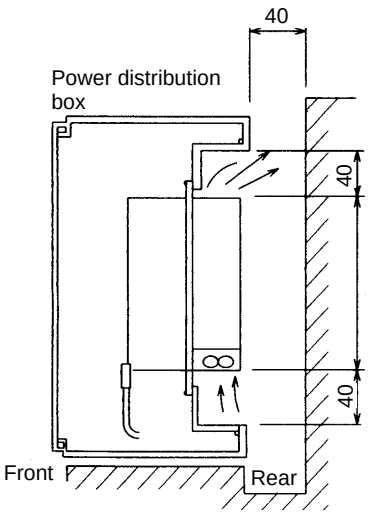
Appendix 5-1-8 Restrictions

(1) Unit Installation

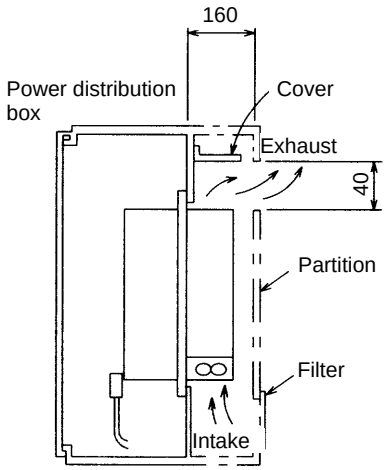
⚠ CAUTION

1. Correctly transport the product according to its mass. Failure to observe this could result in injury.
2. Do not stack the product above the indicated limit.
3. Install the product on non-combustible material. Installation directly on or near combustible materials could result in fires.
4. When installing, always observe this manual and install on a place which can withstand the mass.
5. Do not get on the product, or place heavy objects on it. Failure to observe this could result in injury.
6. Use the product within the designated environment conditions.
7. Do not allow conductive matters such as screws or metal pieces, or combustible matters such as oil to enter the spindle drive unit.
8. Do not block the spindle drive unit's ventilation area. Failure to observe this could result in faults.
9. The spindle drive unit is a precision device. Do not drop it or apply strong impacts
10. Do not install or operate a spindle drive unit that is damaged or missing parts.
11. Consult with the Service Center or Service Station when storing the spindle drive unit after a long time.

(a) Each unit is designed to be installed in a cabinet such as a power distribution box. Avoid installation in a place exposed to direct sunlight, near heat generating objects or outdoors.
(b) The inner working environment (temperature, humidity, vibration, atmosphere) of the cabinet must be within the limits given in the "Specifications for each unit". The cabinet for the cutting machine must be a totally closed type cabinet.
(c) Make considerations so that inspections and replacement during maintenance is easy. The space required around each unit's panel is shown in the outline dimension drawings.
(d) Each unit generates some heat, so leave a space on the top and bottom when installing other equipment or parts.
Refer to the outline drawing for the square hole dimensions. In this case, insert packing between the unit and power distribution box. Refer to the following installation examples for installing each unit.



(Example. 1) Secure space for air flow when the machine is installed at the rear of the power distribution box.



(Example. 2) When the outdoor air cooling section is to protrude from the power distribution box, make sure that cutting chips, etc., do not enter the exhaust section.

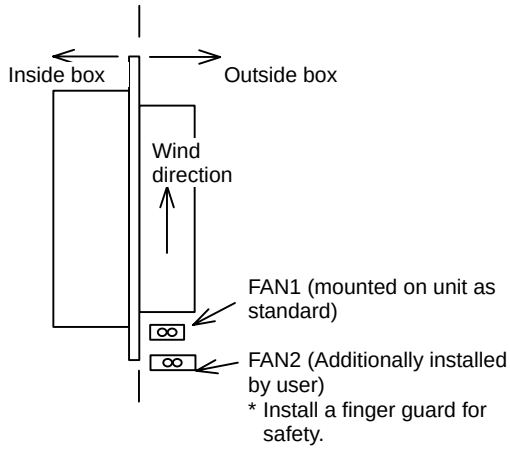
⚠ CAUTION	1. Do not hold the front cover when transporting the spindle drive unit. The drive unit could fall off and cause injury. 2. Always observe the installation direction. Failure to do so could result in faults. 3. Provide the specified distance between the spindle drive unit and inner surface of the control panel or other devices. Failure to observe this could result in faults.

(Note 1) When installing in a poor environment (factory with high levels of oil mist), install a filter at the intake section of the partition showed with the dashed line in (d) item (Example 2).
(Note 2) Make sure that cutting chips from the drill, etc., do not enter the spindle drive unit when assembling the control panel.
(Note 3) Provide means so that oil, water and cutting chips, etc., do not enter the spindle drive unit from the control panel clearances or the ceiling fan.
(Note 4) When using the product in a place with high levels of harmful gases or dust, protect the spindle drive unit with air purging (feed in clean air from outside so that the pressure in the storage panel is higher than outside to prevent the entry of harmful gases or dust).

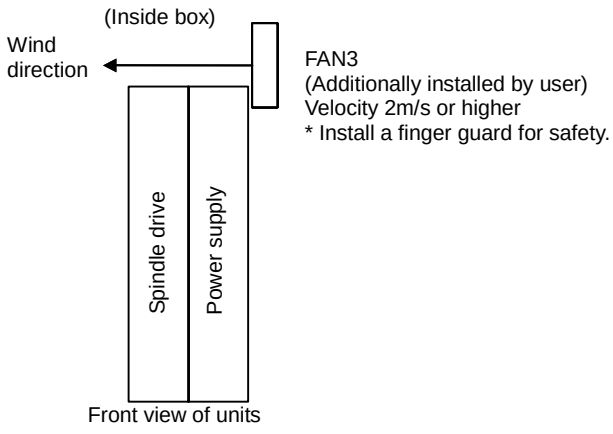
(2) Installation of cooling fan

Each unit (excluding types without fins) is individually provided with a cooling fan (FAN1 shown below). However, install additional fans (FAN2 shown below) by the user in consideration of operation continuity when fan stops due to degradation of the environment around the fan and improvement of maintenance.

When using the totally closed type unit installation method and the box structure in which cutting oil and dust, etc., easily enters the unit's fan + fan section (a structure where the fan may stop easily due to the working environment), the user should add a fan at the FAN2 position shown on the right. Carry out forced cooling with the velocity set to 2m/s or more. Also take the serviceability into consideration in this case.



Due to the structure, heat will tend to accumulate at the top of each unit. Thus, install a fan in the power distribution box to agitate the heat at the top of each unit.



Appendix 6. Compliance to EU EC Directives

Appendix 6-1 Compliance to EC Directives

Appendix 6-1-1 European EC Directives

In the EU Community, the attachment of a CE mark (CE marking) is mandatory to indicate that the basic safety conditions of the Machine Directives (issued Jan. 1995), EMC Directives (issued Jan. 1996) and the Low-voltage Directives (issued Jan. 1997) are satisfied. The machines and devices in which the servo and spindle drive are assembled are the targets for CE marking.

(1) Compliance to EMC Directives

The servo and spindle drive are components designed to be used in combination with a machine or device. These are not directly targeted by the Directives, but a CE mark must be attached to machines and devices in which these components are assembled. The next section "EMC Installation Guidelines", which explains the unit installation and control panel manufacturing method, etc., has been prepared to make compliance to the EMC Directives easier.

(2) Compliance to Low-voltage Directives

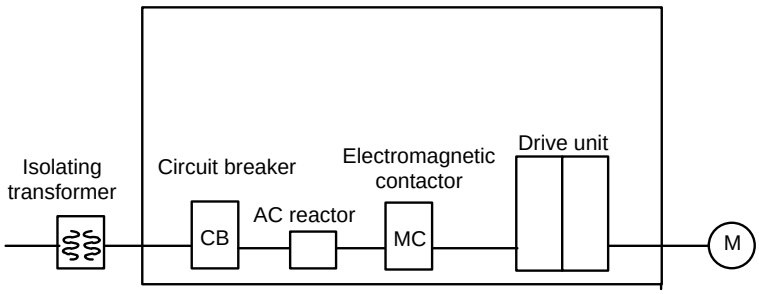
The MDS-C1-SPA Series units are targeted for the Low-voltage Directives. An excerpt of the precautions given in this specification is given below. Please read this section thoroughly before starting use.

A Self-Declaration Document has been prepared for the EMC Directives and Low-voltage Directives. Contact Mitsubishi or your dealer when required.

Appendix 6-1-2 Cautions for EC Directive compliance

Use the Low-voltage Directive compatible parts for the servo/spindle drive and servo/spindle motor. In addition to the items described in this instruction manual, observe the items described below.

(1) Configuration



Use a type B (AC/DC detectable type) breaker

(2) Environment

Use the units under an Overvoltage Category II and Pollution Class of 2 or less environment as stipulated in IEC60664.

These units do not provide protection against electric shock and fire sufficient for the requirements of the Low-voltage Directive and relevant European standards by themselves, so provide additional protection (refer to 5.2.4 and 7.1.6.1 of EN50178)

Drive unit

	During operation	Storage	During transportation
Ambient temperature	0°C to 55°C	-15°C to 70°C	-15°C to 70°C
Humidity	90%RH or less	90%RH or less	90%RH or less
Altitude	1000m or less	1000m or less	13000m or less

Motor

	During operation	Storage	During transportation
Ambient temperature	0°C to 40°C	-15°C to 70°C	-15°C to 70°C
Humidity	80%RH or less	90%RH or less	90%RH or less
Altitude	1000m or less	1000m or less	13000m or less

(3) Power supply

[1] Use the power supply and servo/spindle drive unit under an Overvoltage Category II as stipulated in IEC60664.

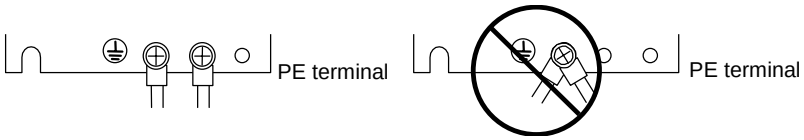
[2] In case of Overvoltage Category III, connect the PE terminal of the units to the earthed-neutral of the star-connection power supply system.

[3] Do not omit the circuit breaker and electromagnetic contactor.

(4) Earthing

[1] To prevent electric shocks, always connect the servo/spindle drive unit protective earth (PE) terminal (terminal with ⏚ mark) to the protective earth (PE) on the control panel.

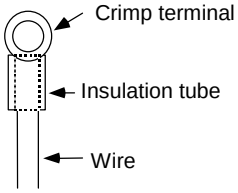
[2] When connecting the earthing wire to the protective earth (PE) terminal, do not tighten the wire terminals together. Always connect one wire to one terminal.



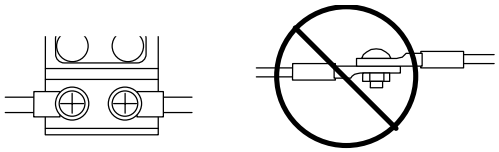
[3] Select the earthing wire size in accordance with Table 1 of EN60204-1.

(5) Wiring

[1] Always use crimp terminals with insulation tubes so that the connected wire does not contact the neighboring terminals.



[2] Do not connect the wires directly.



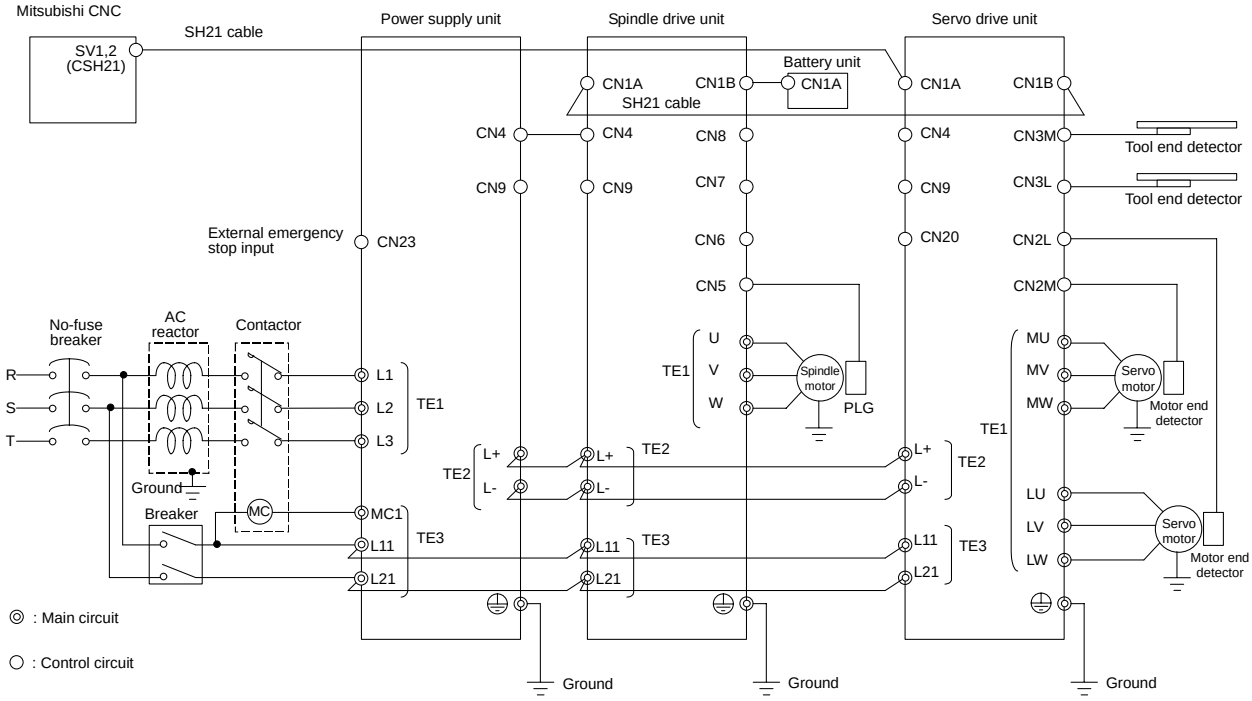
[3] Select the size of the wires for input power supply to Power Supply unit in accordance with Table 4 and 5 of EN60204-1.

(6) Peripheral devices

[1] Use EN/IEC Standards compliant parts for the circuit breaker and contactor.
[2] Select circuit breaker with instantaneous trip function. (Trip within 30 second when over current of 600%). Apply Annex C of EN60204-1 for sizing of the circuit breaker.

(7) Miscellaneous

[1] Refer to the next section "EMC Installation Guidelines" for methods on complying with the EMC Directives.
[2] Ground the facility according to each country's requirements.
[3] The control circuit connector (○) is safely separated from the main circuit (◎).
[4] Inspect the appearance before installing the unit. Carry out a performance inspection of the final unit, and save the inspection records.



Appendix 7. EMC Installation Guidelines

Appendix 7-1 Introduction

EMC Instructions became mandatory as of January 1, 1996. The subject products must have a CE mark attached indicating that the product complies with the Instructions.
As the NC unit is a component designed to control machine tools, it is believed to be out of the direct EMC Instruction subject. However, we would like to introduce the following measure plans to backup EMC Instruction compliance of the machine tool as the NC unit is a major component of the machine tools.

(1) Methods for installation in control/operation panel
(2) Methods of wiring cable outside of panel
(3) Introduction of countermeasure parts

Mitsubishi is carrying out tests to confirm the compliance to the EMC Standards under the environment described in this manual. However, the level of the noise will differ according to the equipment type and layout, control panel structure and wiring lead-in, etc. Thus, we ask that the final noise level be confirmed by the machine manufacturer.
These contents are the same as the EMC INSTALLATION GUIDELINES (BNP-B8582-45).
For measures for CNC, refer to "EMC INSTALLATION GUIDELINES" (BNP-B2230).

Appendix 7-2 EMC instructions

The EMC Instructions regulate mainly the following two withstand levels.

Emission ..... Capacity to prevent output of obstructive noise that adversely affects external sources.
Immunity ..... Capacity not to malfunction due to obstructive noise from external sources.

The details of each level are classified as Table 1. It is assumed that the Standards and test details required for a machine are about the same as these.

Table 1

Class	Name	Details	Generic Standard	Standards for determining test and measurement
Emission	Radiated noise	Electromagnetic noise radiated through the air	EN50081-2 EN61800-3 (Industrial environment)	EN55011
	Conductive noise	Electromagnetic noise discharged from power line		
Immunity	Static electricity electrical discharge	**Example)** Withstand level of discharge of electricity charged in a human body.	EN61000-6-2 EN61800-3 (Industrial environment)	IEC61000-4-2
	Radiated magnetic field	**Example)** Simulation of immunity from digital wireless transmitters		IEC61000-4-3
	Burst immunity	**Example)** Withstand level of noise from relays or connecting/disconnecting live wires		IEC61000-4-4
	Conductive immunity	**Example)** Withstand level of noise entering through power line, etc.		IEC61000-4-6
	Power supply frequency field	**Example)** 50/60Hz power frequency noise		IEC61000-4-8
	Power dip (fluctuation)	**Example)** Power voltage drop withstand level		IEC61000-4-11
	Surge	**Example)** Withstand level of noise caused by lightning		IEC61000-4-5

Appendix 7-3 EMC measures

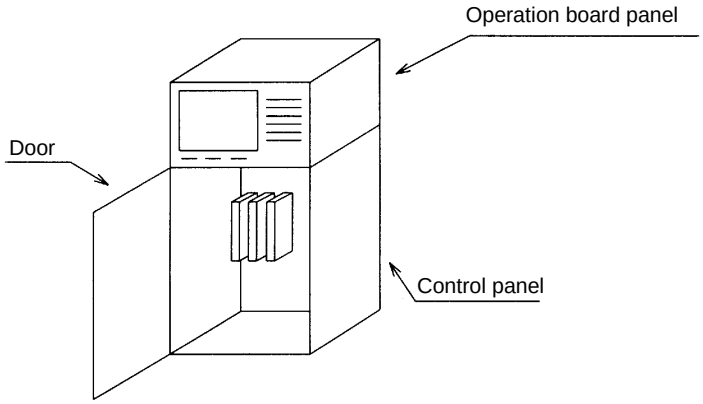
The main items relating to EMC measures include the following.
(1) Store the device in an electrically sealed metal panel.
(2) Earth all conductors that are floating electrically. (Lower the impedance.)
(3) Wire the power line away from the signal wire.
(4) Use shielded wires for the cables wired outside of the panel.
(5) Install a noise filter.

Ensure the following items to suppress noise radiated outside of the panel.
(1) Securely install the devices.
(2) Use shielded wires.
(3) Increase the panel's electrical seal. Reduce the gap and hole size.

Note that the electromagnetic noise radiated in the air is greatly affected by the clearance of the panel and the quality of the cable shield.

Appendix 7-4 Measures for panel structure

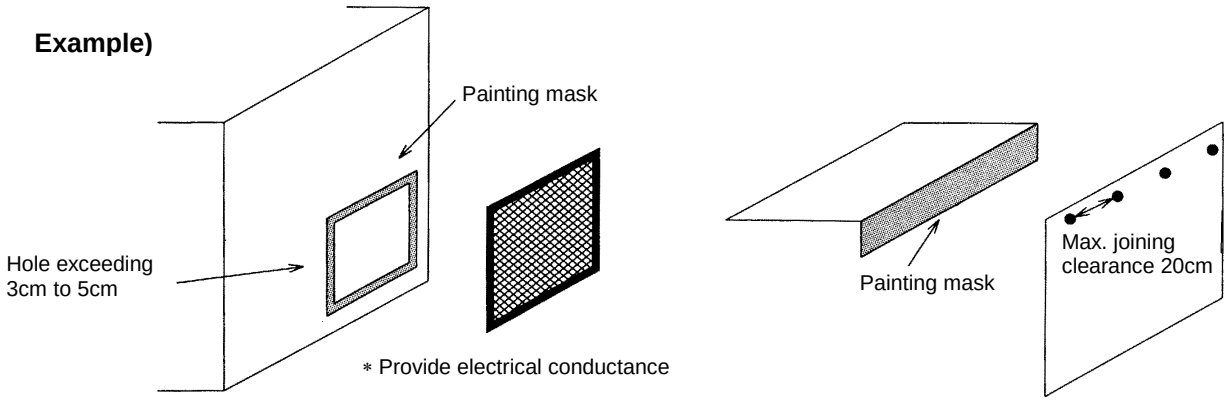
The design of the panel is a very important factor for the EMC measures, so take the following measures into consideration.



Appendix 7-4-1 Measures for control panel unit

(1) Use metal for all materials configuring the panel.
(2) For the joining of the top plate and side plates, etc., mask the contact surface with paint, and fix with welding or screws.
In either case, keep the joining clearance to a max. of 20cm for a better effect.
(3) Note that if the plate warps due to the screw fixing, etc., creating a clearance, noise could leak from that place.
(4) Plate the metal plate surface (with nickel, tin) at the earthing section, such as the earthing plate.
(5) The max. tolerable hole diameter of the openings on the panel surface, such as the ventilation holes, must be 3cm to 5cm. If the opening exceeds this size, use a measure to cover it. Note that even when the clearance is less than 3cm to 5cm, noise may still leak if the clearance is long.

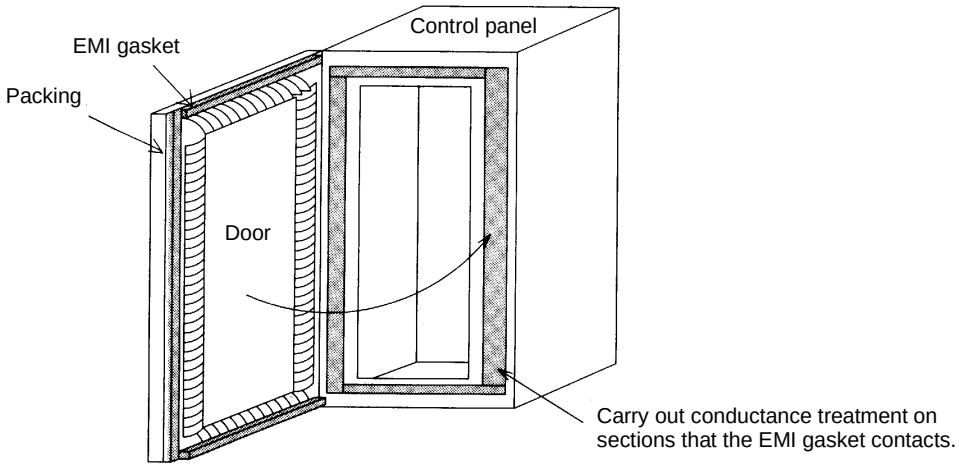
Example)



Appendix 7-4-2 Measures for door

(1) Use metal for all materials configuring the door.
(2) Use an EMI gasket or conductive packing for the contact between the door and control panel unit.
(3) The EMI gasket or conductive packing must contact at a uniform and correct position of the metal surface of the control panel unit.
(4) The surface of the control panel unit contacted with the EMI gasket or conductive packing must have conductance treatment.

Example) Weld (or screw) a plate that is plated (with nickel, tin).



(5) As a method other than the above, the control panel unit and door can be connected with a plain braided wire. In this case, the panel and door should be contacted at as many points as possible.

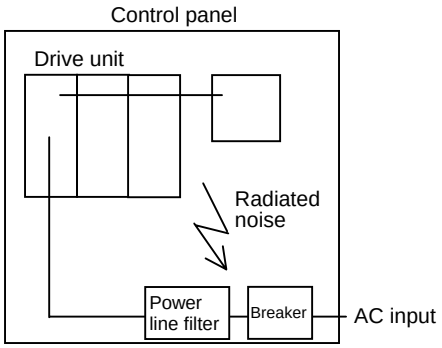
Appendix 7-4-3 Measures for operation board panel

(1) Always connect the operation board and indicator with an earthing wire.
(2) If the operation board panel has a door, use an EMI gasket or conductive packing between the door and panel to provide electrical conductance in the same manner as the control panel.
(3) Connect the operation board panel and control panel with a sufficiently thick and short earthing wire.

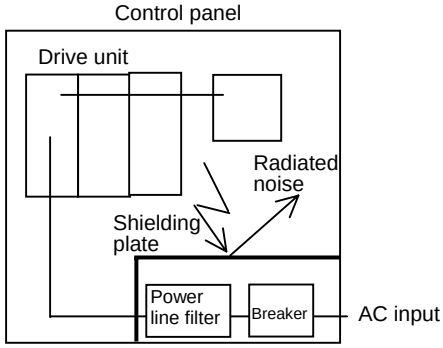
Refer to the "EMC INSTALLATION GUIDELINES" BNP-B2230 for the NC for more details.

Appendix 7-4-4 Shielding of the power supply input section

(1) Separate the input power supply section from other parts in the control panel so that the input power supply cable will not be contaminated by radiated noise.
(2) Do not lead the power line through the panel without passing it through a filter.



The power supply line noise is eliminated by the filter, but cable contains noise again because of the noise radiated in the control panel.



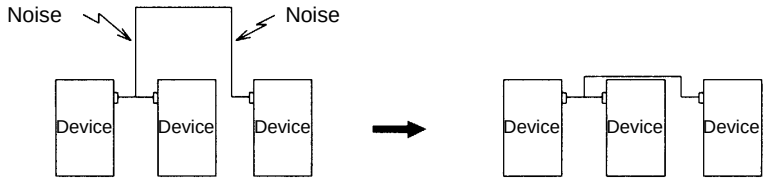
Use a metal plate, etc., for the shielding partition. Make sure not to create a clearance.

Appendix 7-5 Measures for various cables

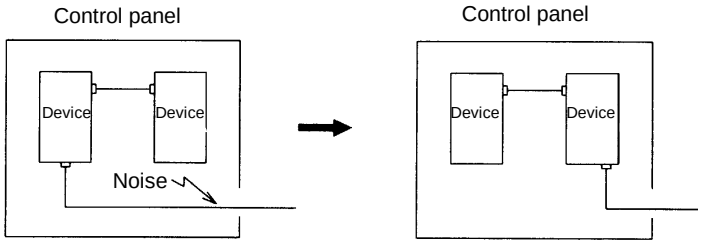
The various cables act as antennas for the noise and discharge the noise externally. Thus appropriate treatment is required to avoid the noise.
The wiring between the drive unit and motor act as an extremely powerful noise source, so apply the following measures.

Appendix 7-5-1 Measures for wiring in panel

(1) If the cables are led unnecessarily in the panel, they will easily pick up the radiated noise. Thus, keep the wiring length as short as possible.



(2) The noise from other devices will enter the cable and be discharged externally, so avoid internal wiring near the openings.



(3) Connect the control device earthing terminal and earthing plate with a thick wire. Take care to the leading of the wire.

Appendix 7-5-2 Measures for shield treatment

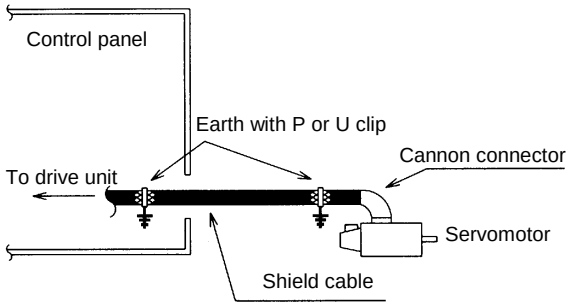
Common items

Use of shield clamp fittings is recommended for treating the shields. The fittings are available as options, so order as required. (Refer to section "6.1 Shield clamp fitting".)
Clamp the shield at a position within 10cm from the panel lead out port.

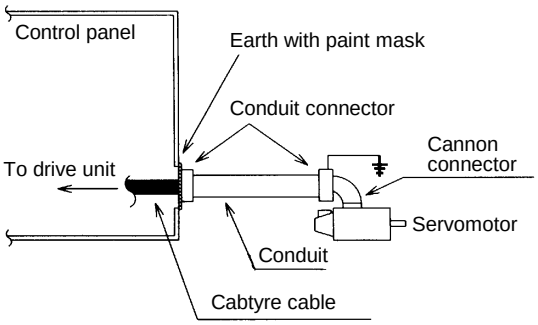
POINT

1. When leading the cables, including the grounding wire (FG), outside of the panel, clamp the cables near the panel outlet (recommendation: within 10cm).
2. When using a metal duct or conduit, the cables do not need to be clamped near the panel outlet.
3. When leading cables not having shields outside the panel, follow the instructions given for each cable. (Installation of a ferrite core, etc., may be required.)

Appendix 7-5-3 Servomotor power cable

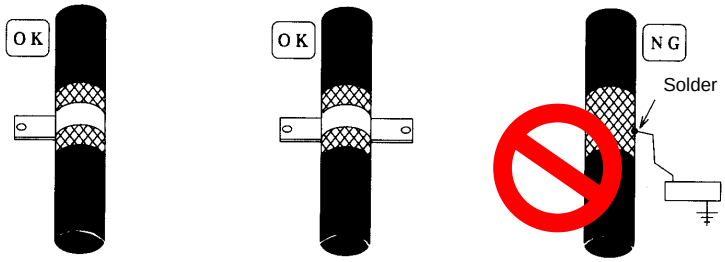


Using shield cable

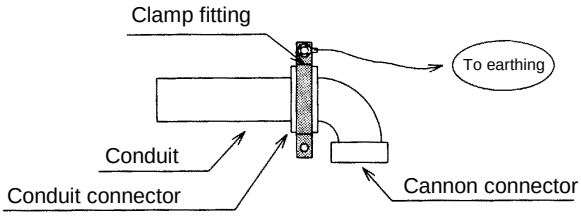


Using conduit

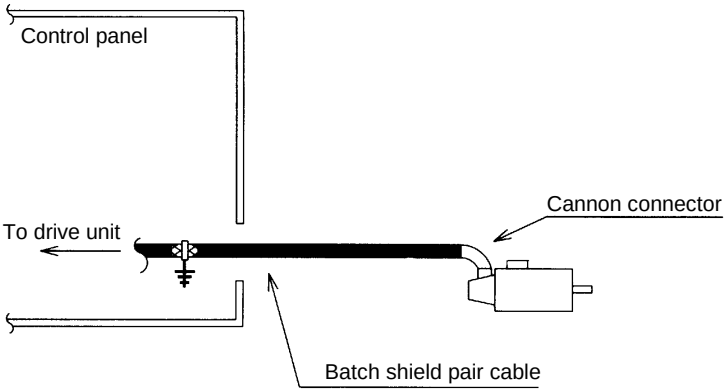
(1) Use four wires (3-phase + earthing) for the power cable that are completely shielded and free from breaks.
(2) Earth the shield on both the control panel side and motor chassis side.
(3) Earth the shield with a metal P clip or U clip.
(A cable clamp fitting can be used depending on the wire size.)
(4) Directly earth the shield. Do not solder the braided shield onto a wire and earth the end of the wire.



(5) When not using a shield cable for the power cable, use a conventional cabtyre cable. Use a metal conduit outside the cable.
(6) Earth the power cable on the control panel side at the contact surface of the conduit connector and control panel. (Mask the side wall of the control panel with paint.)
(7) Follow the treatment shown in the example for the conduit connector to earth the power cable on the motor side. (Example: Use a clamp fitting, etc.)

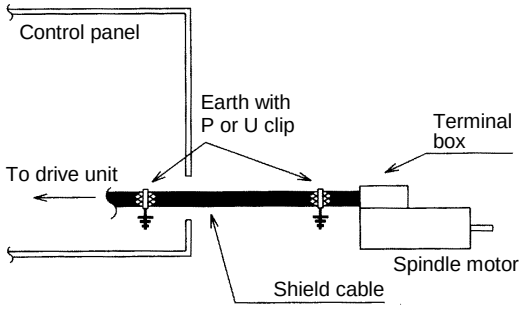


Appendix 7-5-4 Servomotor feedback cable

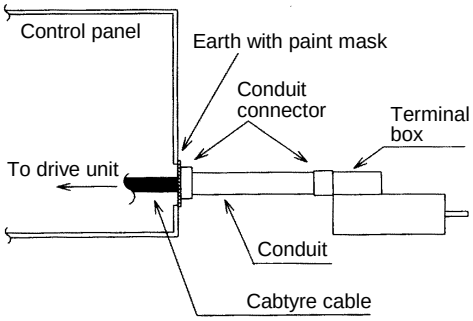


Use a conventional batch shield pair cable for the servomotor feedback cable, and ground it in the NC side (control panel).

Appendix 7-5-5 Spindle motor power cable



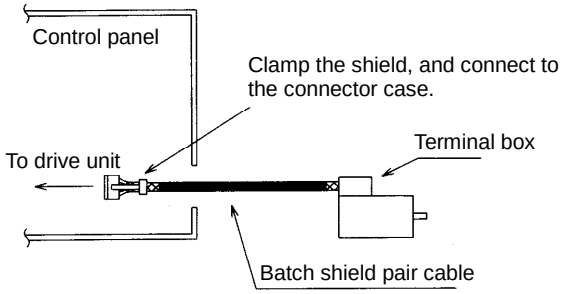
Using shield cable

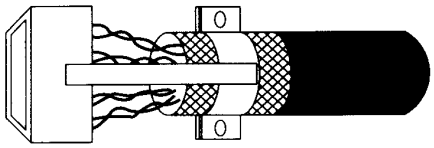


Using conduit

(1) Use four wires (3-phase + earthing) for the power cable that are completely shielded and free from breaks.
(2) Earth the shield in the same manner as the servomotor power cable.
(3) When not using a shield cable for the power cable, use a conventional cabtyre cable. Use a metal conduit outside the cable.
(4) Earth the power cable on the control panel side at the contact surface of the conduit connector and control panel side wall in the same manner as the servomotor power cable. (Mask the side wall of the control panel with paint.)
(5) Earth at the conduit connector section in the same manner as the servomotor power cable.

Appendix 7-5-6 Spindle motor feedback cable





Spindle side connector
(State with the cover removed)

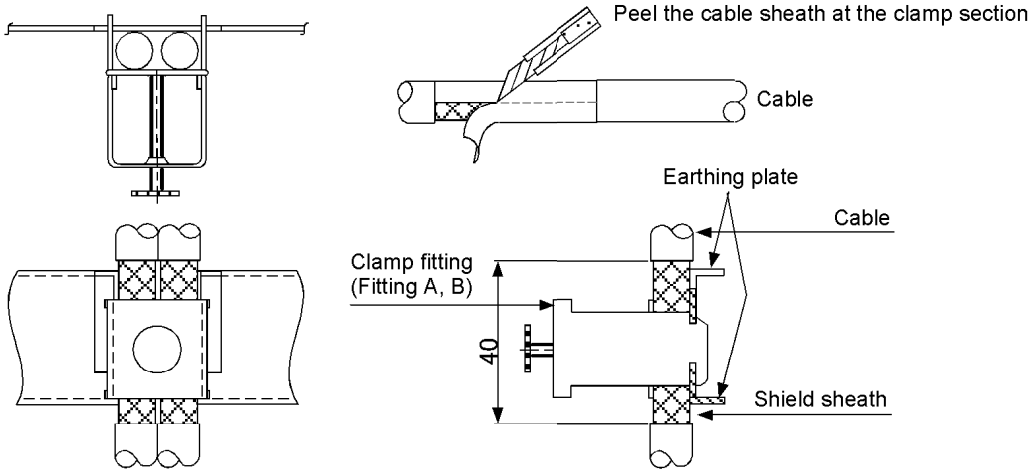
(1) Use a conventional batch shield pair cable for the spindle motor feedback cable.

Note) A shield for the spindle motor feedback cable is not "FG", and therefore do not ground it.

Appendix 7-6 EMC countermeasure parts

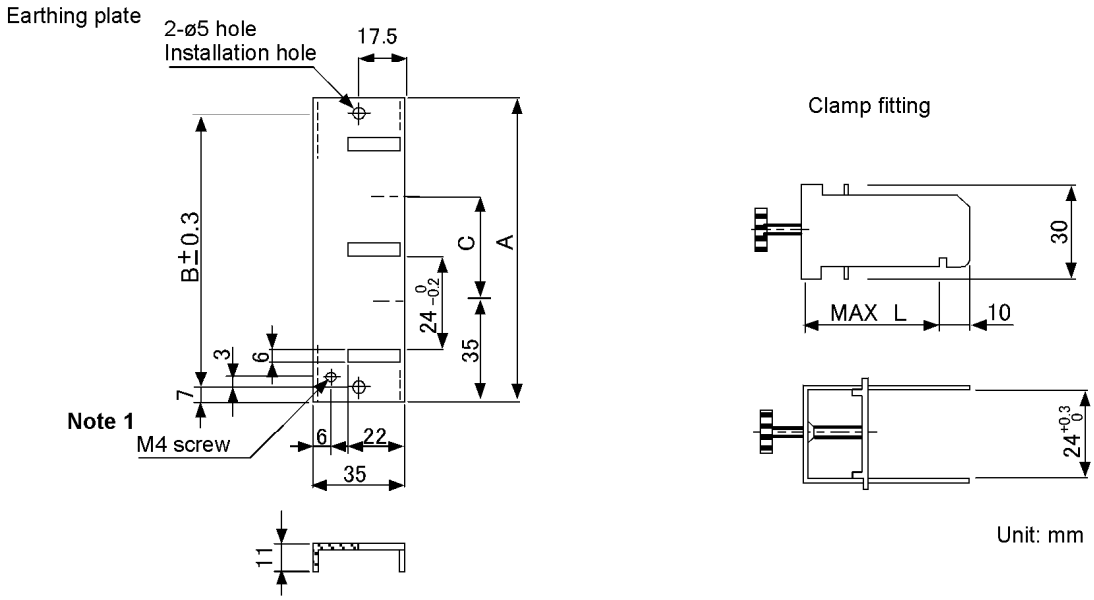
Appendix 7-6-1 Shield clamp fitting

The effect can be enhanced by connecting the cable directly to the earthing plate. Install an earthing plate near each panel's outlet (within 10cm), and press the cable against the earthing plate with the clamp fitting. If the cables are thin, several can be bundled and clamped together. Securely earth the earthing plate with the frame ground. Install directly on the cabinet or connect with an earthing wire. Contact Mitsubishi if the earthing plate and clamp fitting set (AERSBAN-□ SET) is required.



View of clamp section

- **Outline drawing**



Note 1) Screw hole for wiring to earthing plate in cabinet.
Note 2) The earthing plate thickness is 1.6mm.

	A	B	C	Enclosed fittings
AERSBAN-DSET	100	86	30	Clamp fitting A × 2
AERSBAN-ESET	70	56	–	Clamp fitting B × 1

	L
Clamp fitting A	70
Clamp fitting B	45

⚠ CAUTION The shield of the spindle detector cable is not connected to the "FG"(Earth). Do not connect the cable shield to the earth by clamping the cable, etc.

Appendix 7-6-2 Ferrite core

A ferrite core is integrated and mounted on the plastic case.
Quick installation is possible without cutting the interface cable or power cable.
This ferrite core is effective against common mode noise, allowing measures against noise to be taken without affecting the signal quality.

Recommended ferrite core

TDK ZCAT Series

Shape and dimensions

ZCAT type

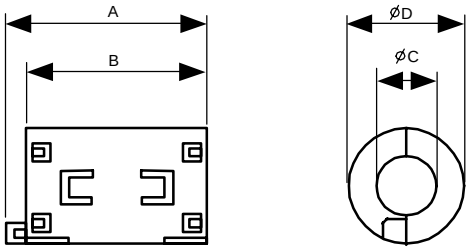


Fig. 1

ZCAT-A type

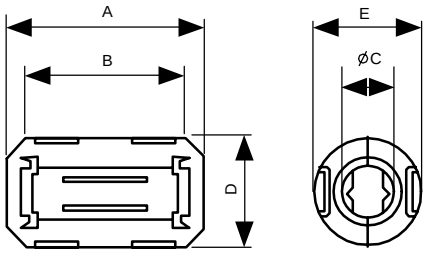


Fig. 2

ZCAT-B type

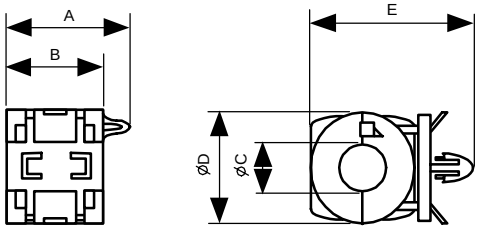


Fig. 3

ZCAT-C type

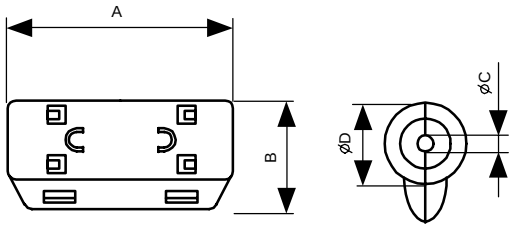


Fig. 4

Unit [mm]

Part name	Fig.	A	B	C	D	E	Applicable cable outline	Weight	Recommended ferrite core
ZCAT3035-1330 (-BK)*1	1	39	34	13	30	---	13 max.	63	⊙
ZCAT2035-0930-M (-BK)	2	35	29	13	23.5	22	10 to 13	29	
ZCAT2017-0930-M (-BK)	3	21	17	9	20	28.5	9 max.	12	
ZCAT2749-0430-M (-BK)	4	49	27	4.5	19.5	---	4.5 max.	26	

*1 A fixing band is enclosed when shipped.

ZCAT-B type: Cabinet fixed type, installation hole ø4.8 to 4.9mm, plate thickness 0.5 to 2mm
ZCAT-C type: Structured so that it cannot be opened easily by hand once closed.

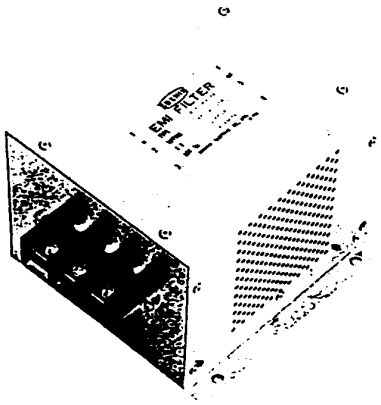
Appendix 7-6-3 Power line filter

(1) Power line filter for 200V

HF3000A-TM Series for 200V

■ **Features**

- 3-phase 3-wire type (250V series, 500V series)
- Compliant with noise standards German Official Notice Vfg243, EU Standards EN55011 (Class B)
- Effective for use with IGBT inverter and MOS-FET inverter.
- Easy mounting with terminal block structure, and outstanding reliability.



■ **Application**

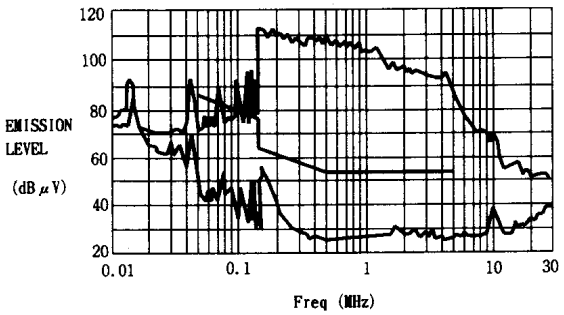
- Products which must clear noise standards German Official Notice Vfg243 and EU Standards EN55011 (Class B).
- For input of power converter using advanced high-speed power device such as IGBT MOS-FET.

■ **Specifications (250V series)**

Part name	HF3005A-TM	HF3010A-TM	HF3015A-TM	HF3020A-TM	HF3030A-TM	HF3040A-TM	HF3050A-TM	HF3060A-TM	HF3080A-TM	HF3100A-TM	HF3150A-TM
Rated voltage	250VAC										
Rated current	5A	10A	15A	20A	30A	40A	50A	60A	80A	100A	150A
Leakage current	1.5mA MAX 250VAC 60Hz										

Contact: Soshin Electric Co., LTD. Telephone: 03-3775-9112 (+81-3-3775-9112) http://www.soshin.co.jp

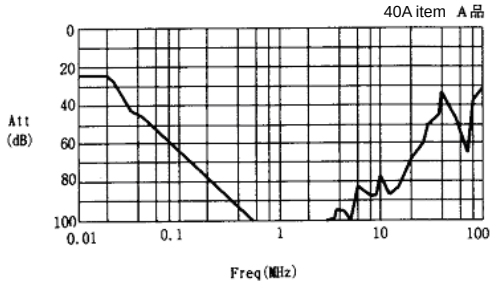
<Example of measuring voltage at noise terminal> ... Measured with IGBT inverter



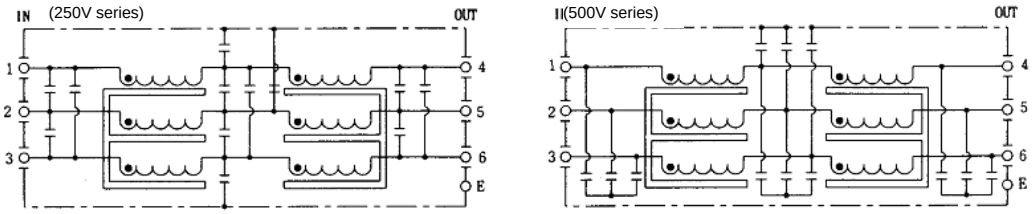
German Official Notice Vfg243 measurement data

EU Standards EN55011 (Class B) measurement data

<Typical characteristics>

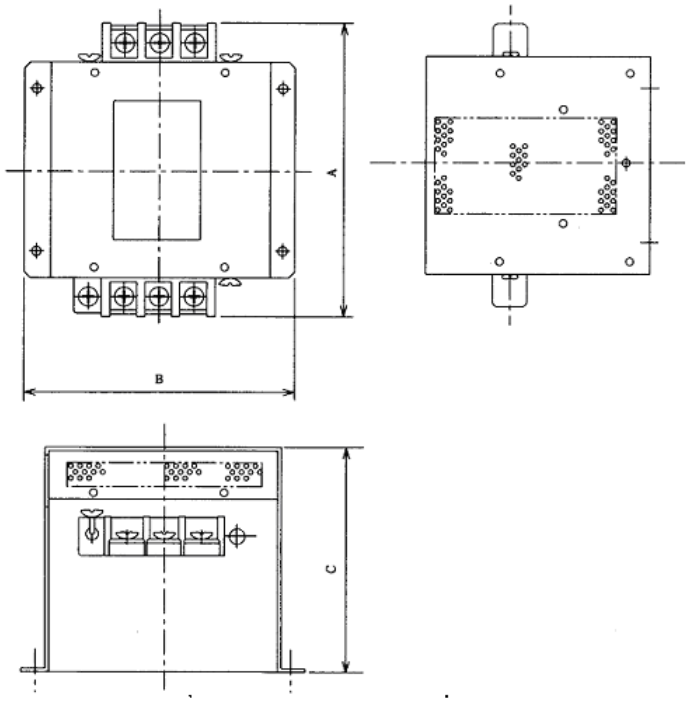


<Circuit diagram>



■ Outline dimensions

[Unit : mm]



Part name	Dimensions		
	A	B	C
HF3005A-TM	180	170	130
HF3010A-TM			
HF3015A-TM			
HF3020A-TM			
HF3030A-TM	260	155	140
HF3040A-TM			
HF3050A-TM	290	190	170
HF3060A-TM			230
HF3080A-TM	405	220	210
HF3100A-TM			
HF3150A-TM	570	230	

200V MX13 Series 3-phase high attenuation noise filter

■ Features

- Perfect for mounting inside control panel: New shape with uniform height and depth dimensions
- Easy mounting and maintenance work: Terminals are centrally located on the front
- Complaint with NC servo and AC servo noise: High attenuation of 40dB at 150KHz
- Safety Standards: UL1283, CSA22.2 No.8, EN133200
- Patent and design registration pending

■ Specifications

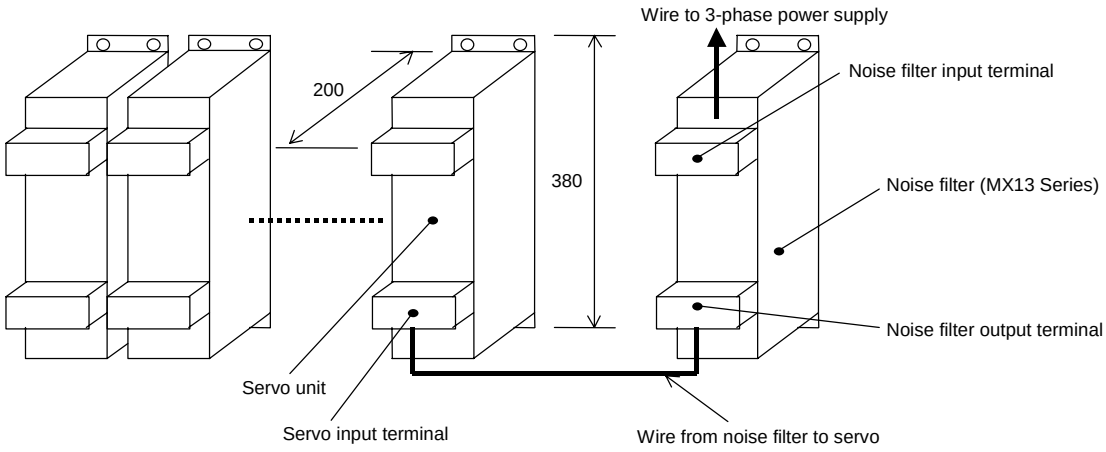
Item \ Type		MX13030	MX13050	MX13100	MX13150
1	**Rated voltage (AC)**	3-phase 250VAC (50/60Hz)			
2	**Rated current (AC)**	30A	50A	100A	150A
3	**Test voltage (AC for one minute across terminal and case)**	2500VAC (100mA) at 25°C, 70% RH			
4	**Insulation resistance (500VDC across terminal and case)**	100MΩ min. at 25°C, 70% RH			
5	**Leakage current (250V, 60Hz)**	3.5 mA max.		8 mA max.	
6	**DC resistance**	30 mΩ max.	11 mΩ max.	5.5 mΩ max.	3.5 mΩ max.
7	**Temperature rise**	30°C max			
8	**Working ambient temperature**	–25°C to +85°C			
9	**Working ambient humidity**	30% to 95% RH (non condensing)			
10	**Storage ambient temperature**	–40°C to +85°C			
11	**Storage ambient humidity**	10% to 95% RH (non condensing)			
12	**Weight (typ)**	2.8kg	3.9kg	11.5kg	16kg

(Note) This is the value at Ta≤50°C.
Refer to the following output derating for Ta>50°C.

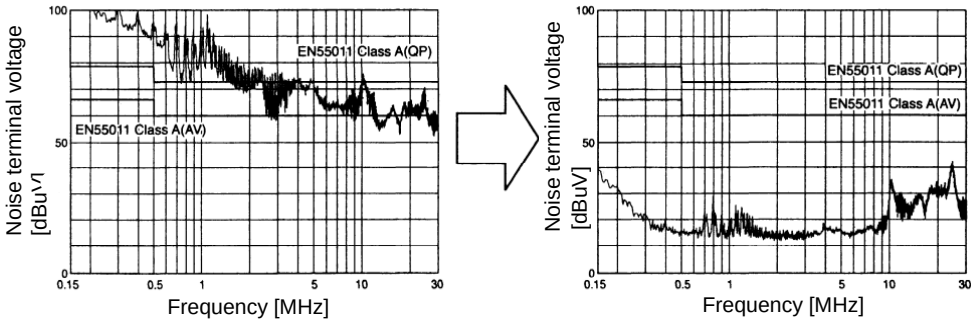
Contact : Densei-lambda Co., Ltd. Telephone : 03-3447-4411 (+81-3-3447-4411)
Fax : 03-3447-7784 (+81-3-3447-7784)
http://www.densei-lambda.com

■ Example of using MX13 Series

This is a noise filter with the same dimensions as MDS-D/DH drive unit depth (200mm) and height (380mm). This unit can be laid out easily in the device by arranging it in a row with the servo unit. As with the servo unit, the terminals are arranged on the front enabling ideal wire lead-out. Refer to the following usage examples for details.



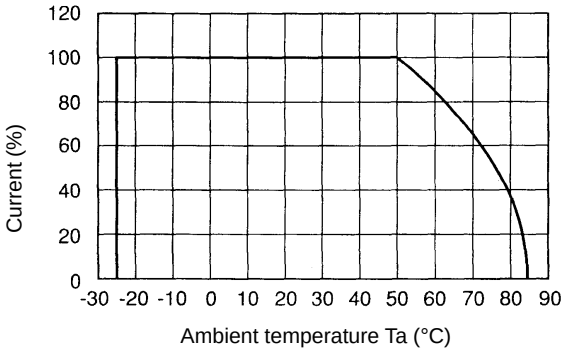
■ Example of noise terminal voltage attenuation



EMI data for independent control panel (with six-axis servo unit mounted)

EMI data for control panel + noise filter (MX13030)

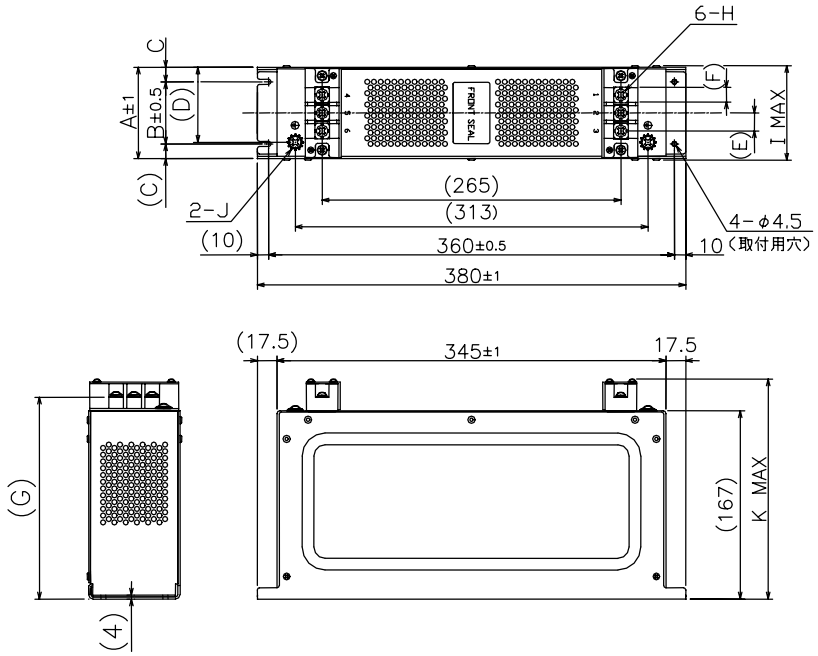
■ Output derating



■ Outline drawing

● MX13030, MX13050

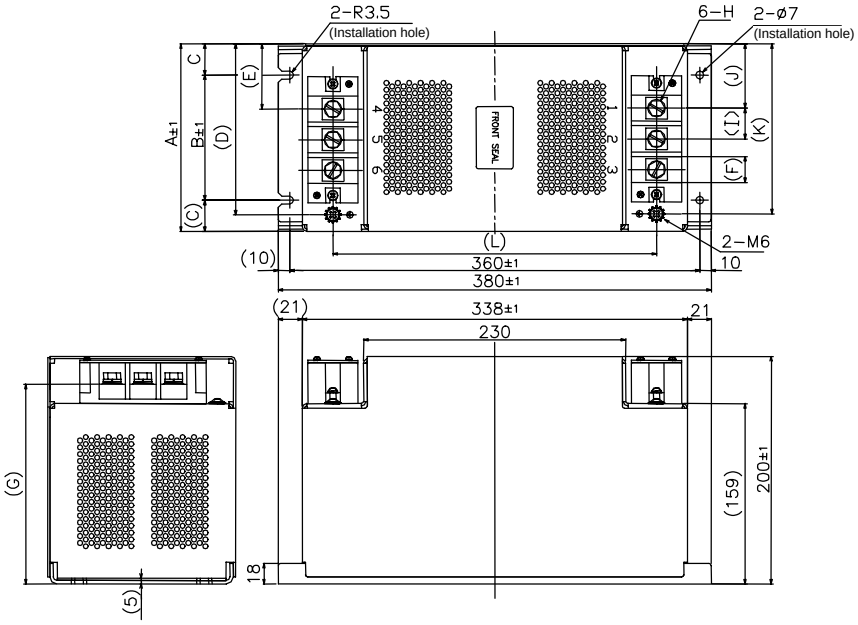
[Unit : mm]



	MX13030	MX13050
A	66	81
B	45	55
C	10.5	13
D	50	67
E	13	16
F	10	13
G	177	179
H	M4 screw	M6 screw
I	70	85
J	M4 screw	M6 screw
K	195	200

● MX13100, MX13150

[Unit : mm]



	MX13100	MX13150
A	130	165
B	90	110
C	20	27.5
D	115	150.5
E	37.5	57.5
F	18	23
G	174	176
H	M6 screw	M8 screw
I	21	27
J	37.5	56.5
K	115	149.5
L	276	284

Appendix 7-6-4 Surge protector

Insert a surge protector in the power input section to prevent damage to the control panel or power supply unit, etc. caused by the surge (lightning or sparks, etc.) applied on the AC power line.
Use a surge protector that satisfies the following electrical specifications.

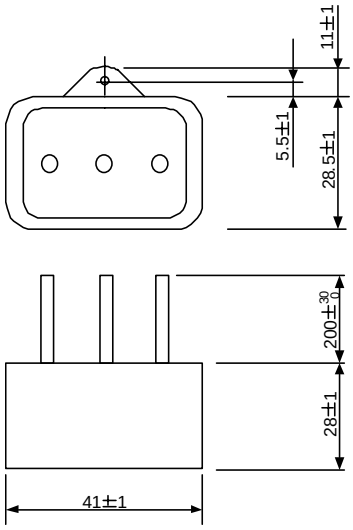
(1) Surge protector for 200V

R•A•V BYZ series for 200V

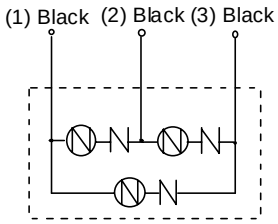
Part name	Circuit voltage 50/60Hz Vrms	Maximum tolerable circuit voltage	Clamp voltage (V) ±10%	Surge withstand level 8/20μs (A)	Surge withstand voltage 1.2/50μs (V)	Electrostatic capacity	Service temperature
RAV-781BYZ-2	3AC 250V	300V	783V	2500A	20kV	75pF	-20 to 70°C

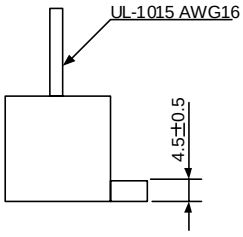
(Note) Refer to the manufacturer's catalog for details on the surge protector's characteristics and specifications, etc.

Outline dimension drawings



Circuit diagram





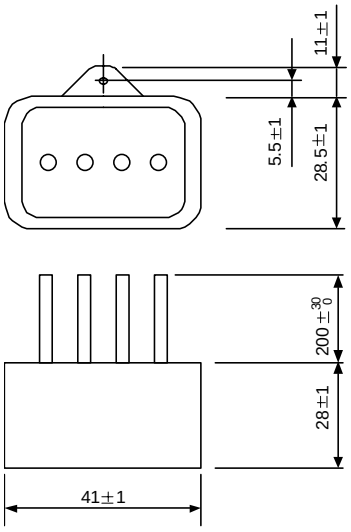
unit: mm

R•A•V BXZ series for 200V

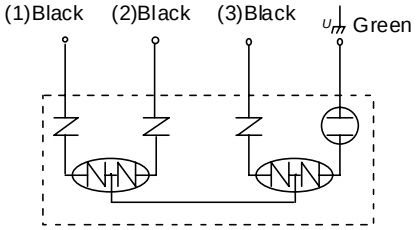
Part name	Circuit voltage 50/60Hz Vrms	Maximum tolerable circuit voltage	Clamp voltage (V) ±10%	Surge withstand level 8/20μs (A)	Surge withstand voltage 1.2/50μs (V)	Electrostatic capacity	Service temperature
RAV-781BXZ-4	3AC 250V	300V	1700V	2500A	2kV	75pF	-20 to 70°C

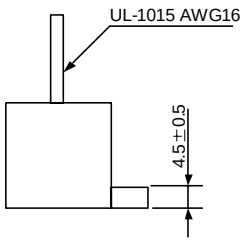
(Note) Refer to the manufacturer's catalog for details on the surge protector's characteristics and specifications, etc.

Outline dimension drawings



Circuit diagram

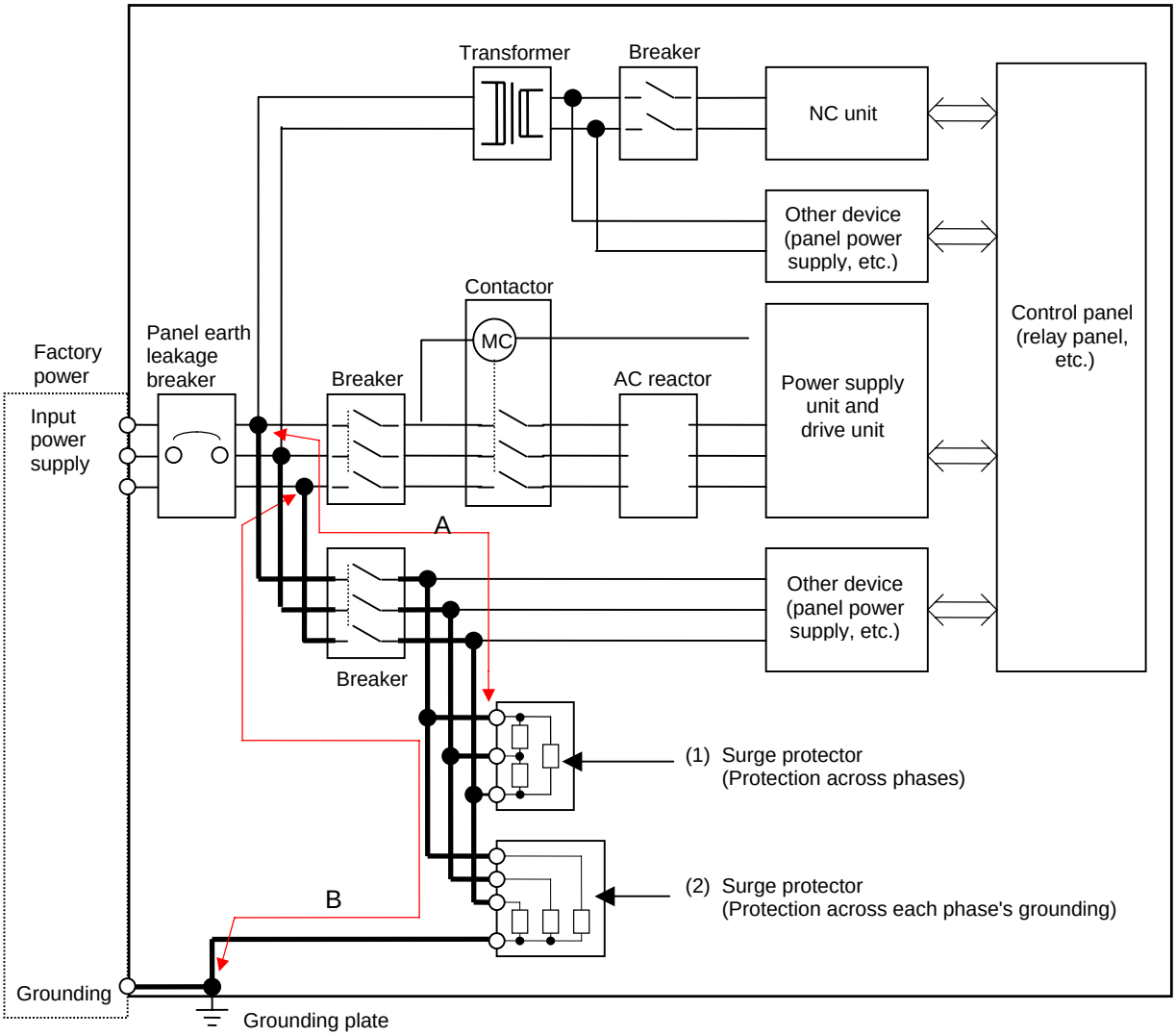




unit: mm

(2) Example of surge protector installation

An example of installing the surge protector in the machine control panel is shown below.
A short-circuit fault will occur in the surge protector if a surge exceeding the tolerance is applied. Thus, install a circuit protection breaker in the stage before the surge protector. Note that almost no current flows to the surge protector during normal use, so a breaker installed as the circuit protection for another device can be used for the surge protector.



Installing the surge absorber

⚠ CAUTION

1. The wires from the surge protector should be connected without extensions.
2. If the surge protector cannot be installed just with the enclosed wires, keep the wiring length of A and B to 2m or less. If the wires are long, the surge protector's performance may drop and inhibit protection of the devices in the panel.
3. The selected surge protector differs according to the input power voltage.

Appendix 8. Instruction Manual for Compliance with UL/c-UL Standard

Instruction Manual for Compliance with UL/c-UL Standard

The instruction of UL/c-UL listed products is described in this manual.
The descriptions of this manual are conditions to meet the UL/c-UL standard for the UL/c-UL listed products. To obtain the best performance, be sure to read this manual carefully before use.
To ensure proper use, be sure to read specification manual, connection manual and maintenance manual carefully for each product before use.

1. UL/c-UL listed products

[CNC system]

Unit name	Unit part number
NC control panel	FCU6-MU [*1]-[*2], FCU6-MA [*1]-[*2]
Display unit **Keyboard unit**	FCU6-DU [*39][*40], FCU6-YZ [*39][*40] FCUA-LD [*41], FCUA-CT [*41], FCUA-CR [*41] FCU6-YZ [*39][*40], FCU6-TZ [*39][*40] FCU6-KB0 [*42], FCUA-KB [*42]
Base I/O unit	FCU6-DX [*3], HR377, HR378, HR353
Remote I/O unit	FCUA-DX [*4]
I/O module	HR357, HR371, QY231

[AC servo/spindle system]

Unit name	Unit part number
Power supply unit	MDS-B-CVE- [*5], MDS-C1-CV-[*5]
Servo drive unit	MDS-B-V1- [*6], MDS-B-V14- [*6], MDS-C1-V1- [*6] MDS-B-V2- [*7], MDS-B-V24- [*7], MDS-C1-V2- [*7] MDS-B-SVJ2- [*8]
Spindle drive unit	MDS-B-SP [*38]-[*9], MDS-C1-SP [*38]-[*9] MDS-C1-SPA[*43]-[*44][*45]
Option unit	MDS-B-PJEX
Battery unit	FCU6-BT4D1
Servo motor	HA-FF [*10][*11][*12][*13][*14][*15][*16][*17][*18][*19] HC-MF [*10][*11][*12][*13][*14][*15][*16][*17][*18][*19] HC-SF [*10][*11][*12][*13][*14][*15][*16][*17][*18][*19] HC-RF [*10][*11][*12][*13][*14][*15][*16][*17][*18][*19] HC [*20][*11][*21][*14][*22]-[*23][*24]
Spindle Motor	SJ [*25][*26][*27]-[*28][*29][*30][*31]-[*32] SJ [*33][*26][*28][*34][*35][*36][*37][*31]

Suffixes listed below may be attached to the above part numbers at portions marked with [*]. For details regarding specifications, see the specification manuals for each product.

[*1] 011, 013, 021, 031, 032, 515, 516, 517, 535, 536
[*2] 12, 23
[*3] 210, 211, 220, 221, 310, 311, 320, 321, 330, 331, 340, 341, 350, 351, 410, 411, 420, 421, 430, 431, 440, 441, 450, 451
[*4] 100, 101, 110, 111, 120, 121, 130, 131, 140, 141
[*5] 37, 55, 75, 110, 150, 185, 220, 260, 300, 370,(450, 550: Only MDS-B Series)
[*6] 01, 03, 05, 10, 20, 35, 45S, 45, 70, 90, 110, 150
[*7] 0101, 0301, 0303, 0501, 0503, 0505, 1003, 1005, 1010, 2010, 2020, 3510S, 3510, 3520S, 3520, 3535, 4520, 4535, 4545, 7035, 7045, 7070S, 7070
[*8] 01, 03, 04, 06, 07, 10, 20
[*9] 04, 075, 15, 22, 37, 55, 75, 110, 150, 185, 220, 260, 300, 370, (450,550:Only MDS-B Series)
[*10] 05, 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 15, 20, 30, 35
[*11] 1, 2, 3
[*12] None, C
[*13] None, P, N, I, E
[*14] None, B
[*15] None, Gn, GnH (n = serial number)
[*16] None, K, D, X, T
[*17] None, Wn (n = serial number)
[*18] None, UL, UE
[*19] None, Sn (n = serial number)
[*20] 5, 10, 15, 20, 35, 45, 70
[*21] None, R
[*22] S, T
[*23] E, A
[*24] 1, 2, 33, 42, 51
[*25] NL, PF, PL, V, VL
[*26] None, K
[*27] None, S
[*28] Two digits decimal two digits
[*29] 01 - 99
[*30] None, F, G, Y, Z
[*31] None, M
[*32] None, S01 - S99
[*33] None, N, P
[*34] A, B, L, M, N, X
[*35] None, 1 - 9, A - F
[*36] None, D, H, P, Z
[*37] None, B, C, F, G, R
[*38] None, H, M, X, HX, MX
[*39] T, C, N
[*40] 31, 32, 33, 34, 35, 36
[*41] 10, 100, 120
[*42] 05, 06, 10, 13, 14, 20, 30
[*43] None, H
[*44] 55,75,110,150,185,220,260,300
[*45] None, R,D,T,RD,RT

2. Operation surrounding air ambient temperature

The recognized operation ambient temperature of each units are as shown in the table below. The recognized operation ambient temperatures are the same as an original product specification for all of the units.

Classification	Unit name	Operation ambient temperature
CNC system	NC control panel	0 to 55°C
	Base I/O unit	0 to 55°C
	Remote I/O unit	0 to 55°C
	I/O module	0 to 55°C
AC servo/spindle system	Power supply unit	0 to 55°C
	Servo drive unit	0 to 55°C
	Spindle drive unit	0 to 55°C
	Option unit, Battery unit	0 to 55°C
	Servo motor, Spindle Motor	0 to 40°C

3. Notes for CNC system

3.1 Selection of external power supply unit

An UL recognized 24Vdc output power supply unit should be used to CNC system.
The “PD25” power supply unit provided by Mitsubishi will be changed to UL recognized product since September 2000.

4. Notes for AC servo/spindle system

4.1 General Precaution

It takes 10 minutes to discharge the bus capacitor.
When starting wiring or inspection, shut the power off and wait for more than 15 minutes to avoid a hazard of electrical shock.

4.2 Installation

MDS-B/C1 Series have been approved as the products, which have been installed in the electrical enclosure. The minimum enclosure size is based on 150 percent of each MDS-B/C1 unit combination. And also, design the enclosure so that the ambient temperature in the enclosure is 55°C (131°F) or less, refer to the manual book

4.3 Short-circuit ratings

Suitable for use in a circuit capable of delivering, it is not more than 5kA rms symmetrical amperes.

4.4 Peripheral devices

To comply with UL/c-UL Standard, use the peripheral devices, which conform to the corresponding standard.

• Circuit Breaker, Fuses, Magnetic Contactor and AC Reactor

Applicable power supply unit	Circuit Breaker	Fuse Class K5	Magnetic contactor (AC3)	AC Reactor BKO-NC6851-
MDS-B-CVE-37 MDS-C1-CV-37	NF50 40A	70A	S-N25	H11 (B-AL-7.5K)
MDS-B-CVE-55 MDS-C1-CV-55	NF50 40A	100A	S-N25	H11 (B-AL-7.5K)
MDS-B-CVE-75 MDS-C1-CV-75	NF50 40A	100A	S-N25	H11 (B-AL-7.5K)
MDS-B-CVE-110 MDS-C1-CV-110	NF50 50A	100A	S-N35	H12 (B-AL-11K)
MDS-B-CVE-150 MDS-C1-CV-150	NF100 100A	200A	S-N50	H13 (B-AL-18.5K)
MDS-B-CVE-185 MDS-C1-CV-185	NF100 100A	200A	S-N50	H13 (B-AL-18.5K)
MDS-B-CVE-220 MDS-C1-CV-220	NF225 150A	200A	S-N80	H14 (B-AL-30K)
MDS-B-CVE-260 MDS-C1-CV-260	NF225 150A	300A	S-N80	H14 (B-AL-30K)
MDS-B-CVE-300 MDS-C1-CV-300	NF225 150A	300A	S-N80	H14 (B-AL-30K)
MDS-B-CVE-370 MDS-C1-CV-370	NF225 175A	300A	S-N150	H15 (B-AL-37K)
MDS-B-CVE-450	NF225 200A		S-N150	H16 (B-AL-45K)
MDS-B-CVE-550	NF400 300A		S-N180	H17 (B-AL-55K)

• Circuit Breaker for spindle motor Fan

Select the Circuit Breaker by doubling the spindle motor fan rated.
A rush current that is approximately double the rated current will flow, when the fan is started.

<Notice>

- For installation in United States, branch circuit protection must be provided in accordance with the National Electrical Code and any applicable local codes.
- For installation in Canada, branch circuit protection must be provided in accordance with the Canadian Electrical Code and any applicable provincial codes.

4.5 Flange of servo motor

Mount the servomotor on a flange, which has the following size or produces an equivalent or higher heat dissipation effect:

Flange size (mm)	Servo Motor				
	HC□	HC-RF□	HC-MF□	HA-FF□	HC-SF□
150x150x6	---	---	Under 100W	Under 100W	---
250x250x6	---	---	200W	200,300W	---
250x250x12	0.5 to 1.5kW	1.0 to 2.0kW	400W	400,600W	0.5 to 1.5kW
300x300x12	---	---	750W	---	---
300x300x20	2.0 to 7.0kW	---	---	---	2.0 to 7.0kW

4.6 Motor Over Load Protection

Servo drive unit MDS-B-V1/2/14/24 Series and MDS-C1-V1/2 series and spindle drive unit MDS-B-SP and MDS-C1-SP series have each solid-state motor over load protection.
When adjusting the level of motor over load, set the parameter as follows.

4.6.1 MDS-B-V1/2/14/24, MDS-C1-V1/2 Series

Parameter No.	Parameter Abbr.	Parameter Name	Setting Procedure	Standard Setting Value	Setting Range
SV021	OLT	Overload Time constant	Set the time constant for overload detection. (Unit: 1 second.)	60s	1 to 300s
SV022	OLL	Overload Detection level	Set the overload current detection level with a percentage (%) of the stall rating.	150%	1 to 500%

4.6.2 MDS-B-SP, MDS-C1-SP, MDS-C1-SPA Series

Parameter No.	Parameter Abbr.	Parameter Name	Setting Procedure	Standard Setting Value	Setting Range
SP063	OLT	Overload Time constant	Set the time constant for overload detection. (Unit: 1 second.)	60s	0 to 1000s
SP064	OLL	Overload Detection level	Set the overload current detection level with a percentage (%) of the rating.	110%	1 to 200%

4.7 Field Wiring Reference Table for Input and Output

Use the UL-approved Round Crimping Terminals to wire the input and output terminals of MDS-B Series.
Crimp the terminals with the crimping tool recommended by the terminal manufacturer.
Following described crimping terminals and tools type are examples of Japan Solderless Terminal Mfg. Co., Ltd.

4.7.1 Power Supply Unit (MDS-B-CVE, MDS-C1-CV Series)

Capacity [kW]		3.7 to 7.5	11.0 to 18.5	22.0 to 37.0	45.0	55.0
Terminal Screw Size	P, N (L+, L-)	M6	M6	M6	M6, M10	
	Screw Torque [lb in/ N m]	44.3/5.0	49.6/5.6	49.6/5.6	49.6/5.6, 177/20	
	L11, L21, MC1 (R0, S0)	M4	M4	M4	M4	M4
	Screw Torque [lb in/ N m]	17.4/2.0	14.2/1.6	14.2/1.6	14.2/1.6	14.6/1.6
	L1, L2, L3	M4	M5	M8	M8	M10
	Screw Torque [lb in/ N m]	14.6/1.6	29.8/3.37	117.2/13.2	117.2/13.2	177/20

P, N (L+, L-)

Capacity [kW]	3.7, 5.5	7.5	11.0	15.0	18.5, 22.0
Wire Size (AWG) /Temp Rating Note 1	#10/60°C #12/75°C	#8/60°C #10/75°C	#4/60°C #8/75°C	#4/60°C #4/75°C	#3/60°C #4/75°C
Crimping Terminals Type	R5.5-6	R8-6 R5.5-6	R22-6 R8-6	R22-6	
Crimping Tools Type	YHT-2210	YHT-8S YHT-2210	YPT-60 YHT-8S	YPT-60	

Capacity [kW]	26.0	30.0	37.0	45.0	55.0
Wire Size (AWG) /Temp Rating Note 1	#1/60°C #3/75°C	#1/75°C	#1/0/75°C	The bus bar is attached to the product.	
Crimping Terminals Type	38-S6 R22-6	38-S6	L330T 459-12		
Crimping Tools Type	YPT-60		YET300 YF-1		

L11, L21 (R0, S0), MC1

Capacity [kW]	3.7 to 55.0
Wire Size (AWG) /Temp Rating Note 1	#14/ 60°C #14/ 75°C
Crimping Terminals Type	V2-4
Crimping Tools Type	YNT-1614

L1, L2, L3

Capacity [kW]	3.7	5.5	7.5	11.0	15.0	18.5
Wire Size (AWG) /Temp Rating Note 1	#10/60°C #12/75°C	#10/60°C #10/75°C	#10/75°C	#4/60°C #4/75°C	#3/60°C #4/75°C	#3/75°C
Crimping Terminals Type	5.5-S4			L300T 459-23		
Crimping Tools Type	YHT-2210			YPT-60		
Earth Wire Size (AWG)	#10/60°C #10/75°C	#10/60°C #10/75°C	#10/75°C	#4/60°C #4/75°C	#3/60°C #4/75°C	#3/75°C

Capacity [kW]	22.0	26.0	30.0	37.0	45.0	55.0
Wire Size (AWG) /Temp Rating Note 1	#1/60°C #2/75°C	#1/0/60°C #1/75°C	#1/75°C	1/0/75°C	#2/0 /75°C	#3/0 /75°C
Crimping Terminals Type	38-S8	L330T 459-12 38-S8	38-S8	L330T 459-12	70-8	R80-10
Crimping Tools Type	YPT-60	YET300 YF-1 YPT-60	YPT-60	YET300 YF-1	YTP-150	
Earth Wire Size (AWG)	#3/60°C #3/75°C	#1/60°C #3/75°C	#3/75°C	1/75°C	#1/75°C	#1/0 /75°C

4.7.2 Servo Drive Unit (MDS-B-V1/2/14/24, MDS-C1-V1/2 Series)

Axis		1-axis (V1, V14)			2-axes (V2, V24)
Capacity [kW]		0.1 to 3.5	4.5 to 9.0	11.0, 15.0	0.1+0.1 to 7.0+7.0
Terminal Screw Size	P, N (L+, L-)	M6	M6	M6	M6
	Screw Torque [lb in/ N m]	44.3/5.0	44.3/5.0	44.3/5.0	44.3/5.0
	L11, L21 (R0, S0)	M4	M4	M4	M4
	Screw Torque [lb in/ N m]	17.4/2.0	17.4/2.0	17.4/2.0	17.4/2.0
	U, V, W	M4	M5	M8	M4
	Screw Torque [lb in/ N m]	14.6/1.6	28.6/3.2	117.2/13.2	14.6/1.6

P, N (L+, L-)

Wire size depends on the Power Supply Unit (MDS-B-CVE, MDS-C1-CV Series).

L11, L21 (R0, S0)

Capacity [kW]	0.1 to 15.0
Wire Size (AWG) /Temp Rating Note 1	#14/ 60°C #14/ 75°C
Crimping Terminals Type	V2-4
Crimping Tools Type	YNT-1614

U, V, W

Capacity [kW]	0.1 to 1.0	2.0	3.5	4.5
Wire Size (AWG) /Temp Rating Note 1	#14/60°C	#10/60°C	#8/60°C	#8/60°C
	#14/75°C	#14/75°C	#10/75°C	#10/75°C
Crimping Terminals Type	R2-4	R5.5-4	8-4	R8-5 (8-4)
		T2-4	R5.5-4	R5.5-5 (R5.5-4)
Crimping Tools Type	YHT-2210		YHT-8S	
			YHT-2210	
Earth wire Size (AWG)	#14/60°C	#10/60°C	#8/60°C	#8/60°C
	#14/75°C	#12/75°C	#10/75°C	#10/75°C

Capacity [kW]	7.0	9.0	11.0	15.0
Wire Size (AWG) /Temp Rating Note 1	#8/60°C	#8/60°C	#4/60°C	#2/60°C
	#8/75°C	#8/75°C	#4/75°C	#3/75°C
Crimping Terminals Type	R8-5 (8-4)	R8-5	R22-8	R38-8
Crimping Tools Type	YHT-8S		YPT-60	
Earth Wire Size (AWG)	#8/60°C	#8/60°C	#4/60°C	#3/60°C
	#8/75°C	#8/75°C	#4/75°C	#3/75°C

4.7.3 Spindle Drive Unit (MDS-B-SP, MDS-C1-SP, MDS-C1-SPA Series)

Capacity [kW]		0.4~3.7	5.5~18.5	22.0~30.0	37.0	45.0/55.0
Terminal Screw Size	P, N (L+, L-)	M6	M6	M6	M10	M10
	Screw Torque [lb in/ N m]	44.3/5.0	44.3/5.0	44.3/5.0	234.3/26.5	177/20
	L11, L21 (R0, S0)	M4	M4	M4	M4	M4
	Screw Torque [lb in/ N m]	17.4/2.0	17.4/2.0	17.4/2.0	17.4/2.0	17.2/2.0
	U, V, W	M4	M5	M8	M8	M10
	Screw Torque [lb in/ N m]	14.6/1.6	28.6/3.2	117.2/13.2	88.5/10.0	177/20

P, N (L+, L-)

Wire size depends on the Power Supply Unit (MDS-B-CVE, MDS-C1-CV Series).

L11, L21 (R0, S0)

Capacity [kW]	0.4~55.0
Wire Size (AWG) /Temp Rating Note 1	#14/60°C
	#14/75°C
Crimping Terminals Type	V2-4
Crimping Tools Type	YNT-1614

U, V, W

Capacity [kW]	0.4, 0.75	1.5	2.2, 3.7	5.5	7.5	11.0	15.0
Wire Size (AWG) /Temp Rating Note 1	#14/60°C	#10/60°C		#10/60°C	#8/60°C	#8/60°C	#4/60°C
	#14/75°C	#14/75°C		#12/75°C	#10/75°C	#8/75°C	#4/75°C
Crimping Terminals Type	R2-4	5.5-S4	R5.5-4	R5.5-5	R8-5	R8-5	L330T 459-23
		R2-4			R5.5-5		
Crimping Tools Type	YHT-2210				YHT-8S	YHT-8S	YPT-60
					YHT-2210		
Earth Wire Size (AWG)	#14/60°C	#11/60°C		#10/60°C	#8/60°C	#8/60°C	#4 /60°C
	#14/75°C	#14/75°C		#10/75°C	#10/75°C	#8/75°C	#4 /75°C

Capacity [kW]	18.5	22.0	26.0	30.0	37.0	45.0	55.0
Wire Size (AWG) /Temp Rating Note 1	#3/60°C	#2/60°C	#1/60°C	#1/75°C	#1/0/75°C	#2/0 75°C	#4/0 /75°C
	#4/75°C	#3/75°C	#2/75°C				
Crimping Terminals Type	22-S6	R38-8			R60-8	70-10	R100-10
	L330T 459-23						
Crimping Tools Type	YPT-60				YET300 YF-1	YPT-150	
Earth Wire Size (AWG)	#3/60°C	#3/60°C		#3/75°C	#1/75°C	#1/75°C	#3/0 /75°C
	#4/75°C	#3/75°C					

Note 1: 60°C: Polyvinyl chloride insulated wires (IV)
75°C: Grade heat-resistant polyvinyl chloride insulated wires (HIV)
Use copper wire only.
Above listed wire are for use in the electric cabinet on machine or equipment.

4.8 Spindle Drive / Motor Combinations

Following combinations are the Standard combinations

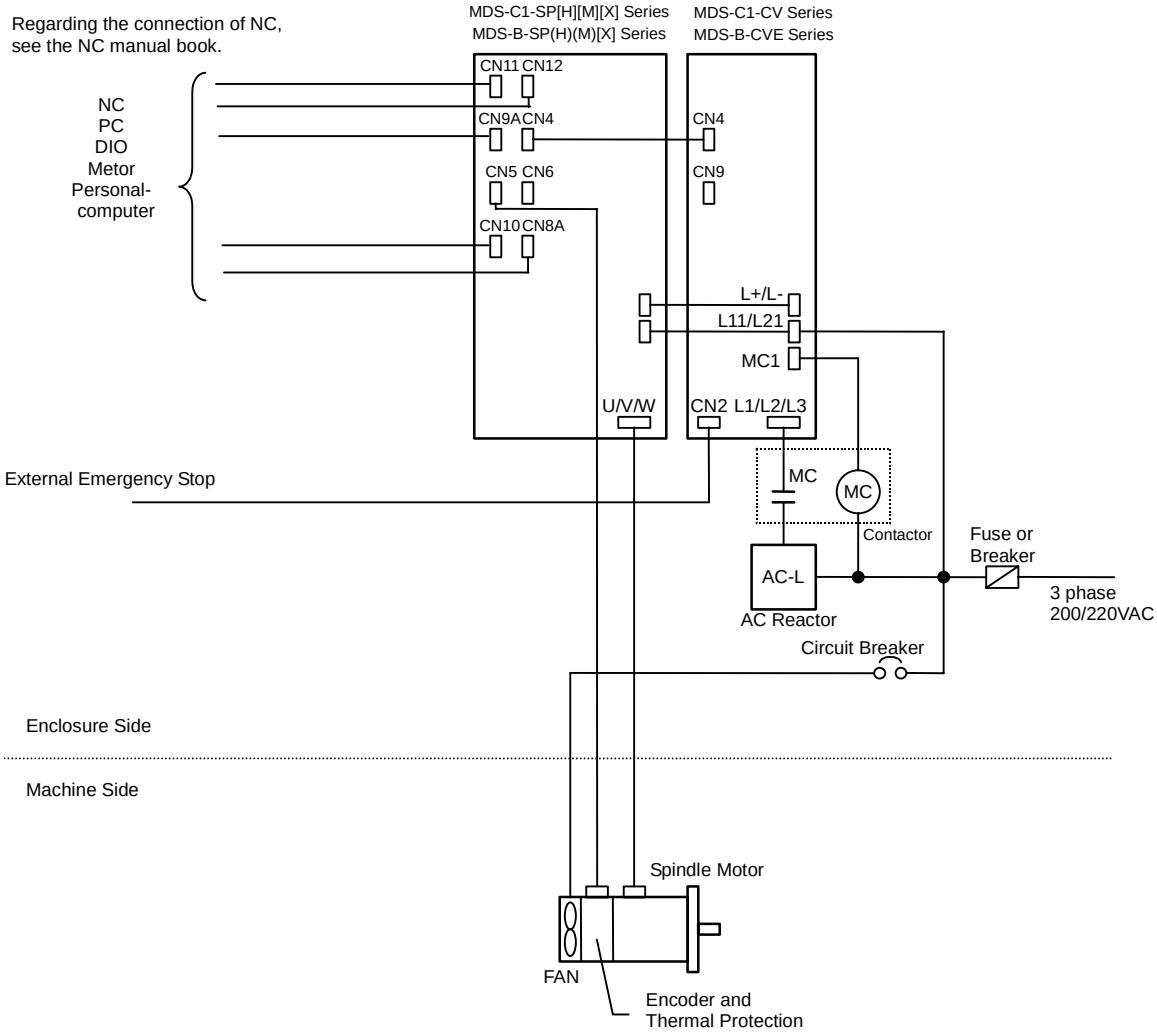
Drive Unit Note: 1	Rating Output (kW) Of Applicable Spindle Motor	
	SJ- ( ) Series SJ-V/VL Series Note: 2	SJ-N Series SJ-NL Series
MDS-B-SP []-04 MDS-C1-SP []-04		0.2
MDS-B-SP []-075 MDS-C1-SP []-075		0.75
MDS-B –SP []-15 MDS-C1-SP []-15		1.5
MDS-B –SP []-22 MDS-C1-SP []-22	2.2	2.2
MDS-B –SP []-37 MDS-C1-SP []-37	3.7	3.7
MDS-B-SP []-55 MDS-C1-SP []-55 MDS-C1-SPA []-55	5.5	5.5
MDS-B-SP []-75 MSD-C1-SP []-75 MDS-C1-SPA []-75	5.5 7.5	7.5
MDS-B-SP []-110 MDS-C1-SP []-110 MDS-C1-SPA []-110	5.5 7.5 11	11
MDS-B-SP []-150 MDS-C1-SP []-150 MDS-C1-SPA []-150	7.5 11 15	
MDS-B-SP []-185 MDS-C1-SP []-185 MDS-C1-SPA []-185	11 15 18.5	
MDS-B-SP []-220 MDS-C1-SP []-220 MDS-C1-SPA []-220	11 15 18.5 22	
MDS-B-SP []-260 MDS-C1-SP []-260 MDS-C1-SPA []-260	11 15 18.5 22 26	
MDS-B-SP []-300 MDS-C1-SP []-300 MDS-C1-SPA []-300	15 18.5 22 26 30	
MDS-B-SP [] –370	15 18.5 22 26 30 37	
MDS-B-SP [] -450	22 26 30 37 45	
MDS-B-SP [] -550	30 37 45 55	

Note1: [] can be H, M, X, HX, MX or none only SP.
[] can be H or none only SPA .

Note2: Applicable unit depends on the range of power constant of motor.
Inquire of Mitsubishi about the detail of the combinations.

5. AC Servo/Spindle System Connection

5-1 Use S Analog Drive Unit



Appendix 9. Compliance with China Compulsory Product Certification (CCC Certification) System

Appendix 9-1 Outline of China Compulsory Product Certification System

The Safety Certification enforced in China included the "CCIB Certification (certification system based on the "Law of the People's Republic of China on Import and Export Commodity Inspection" and "Regulations on Implementation of the Import Commodities Subject to the Safety and Quality Licensing System" enforced by the State Administration of Import and Export Commodity Inspection (SACI) on import/export commodities, and the "CCEE Certification" (certification system based on "Product Quality Certification Management Ordinance" set forth by the China Commission for Conformity Certification of Electrical Equipment (CCEE) on commodities distributed through China.
CCIB Certification and CCEE Certification were merged when China joined WTO (November 2001), and were replaced by the "China Compulsory Product Certification" (hereinafter, CCC Certification) monitored by the State General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) of the People's Republic of China.
The CCC Certification system was partially enforced from May 2002, and was fully enforced from May 2003. Target commodities which do not have CCC Certification cannot be imported to China or sold in China. (Indication of the CCIB or CCEE mark has been eliminated from May 1, 2003.)

CCIB : China Commodity Inspection Bureau
CCEE: China Commission for Conformity Certification of Electrical Equipment
CCC : China Compulsory Certification

Appendix 9-2 First Catalogue of Products subject to Compulsory Product Certification

The First Catalogue of Products subject to Compulsory Product Certification, covering 132 items (19 categories) based on the CCIB products (104 items), CCEE products (107 items) and CEMC products (Compulsory EMC Certification products) was designated on December 3, 2001.

Class	Product catalogue	
1	Electric Wires and Cables (5 items)	
2	Switches, Installation protective and connection devices (6 items)	
3	Low-voltage Electrical Apparatus (9 items)	Compulsory Certification Regulations
	Circuit-breakers (including RCCB, RCBO, MCB)	CNCA -01C -011: 2001 (Switch and Control Equipment) CNCA -01C -012: 2001 (Installation Protective Equipment)
	Low-voltage switchers (disconnectors, switch-disconnectors, and fuse-combination devices.	
	Other protective equipment for circuits (Current limiting devices, circuits protective devices, over current protective devices, thermal protectors, over load relays, low-voltage electromechanical contactors and motor starters)	
	Relays (36V < Voltage ≤ 1000V)	
	Other switches (Switches for appliances, vacuum switches, pressure switches, proximity switches, foot switches, thermal sensitive switches, hydraulic switches, push-button switches, position limit switches, micro-gap switches, temperature sensitive switches, travel switches, change-over switches, auto-change-over switches, knife switches)	
	Other devices (contactors, motor starters, indicator lights, auxiliary contact assemblies, master controllers, A.C. Semiconductor motor controllers and starters)	
	Earth leakage protectors	
	Fuses	
	Low-voltage switchgear	CNCA-01C-010:2001 (Low-voltage switchgear)
4 **(Note)**	Small power motors (1 item)	CNCA-01C-013:2001 (Small power motors)

Class	Product catalogue	
5	Electric tools	(16 items)
6	Welding machines	(15 items)
7	Household and similar electrical appliances	(18 items)
8	Audio and video equipment	(16 items)
9	Information technology equipment	(12 items)
10	Lighting apparatus	(2 items)
11	Telecommunication terminal equipment	(9 items)
12	Motor vehicles and Safety Parts	(4 items)
13	Tyres	(4 items)
14	Safety Glasses	(3 items)
15	Agricultural Machinery	(1 item)
16	Latex Products	(1 item)
17	Medical Devices	(7 items)
18	Fire Fighting Equipment	(3 items)
19	Detectors for Intruder Alarm Systems	(1 item)

(Note) When the servomotor or the spindle motor of which output is 1.1kW or less (at 1500 r/min) is used, NC could have been considered as a small power motor. However, CQC (China Quality Certification Center) judged it is not.

Appendix 9-3 Precautions for Shipping Products

As indicated in Appendix 9-2, NC products are not included in the First Catalogue of Products subject to Compulsory Product Certification. However, the Customs Officer in China may judge that the product is subject to CCC Certification just based on the HS Code.[Note 2]
NC cannot be imported if its HS code is used for the product subject to CCC Certification. Thus, the importer must apply for a "Certification of Exemption" with CNCA.[Note 3] Refer to Appendix 10-4. Application for Exemption for details on applying for an exemption.

(Note 1) The First Catalogue of Products subject to Compulsory Product Certification (Target HS Codes) can be confirmed at http://www.cqc.com.cn/Center/html/60gonggao.htm.
(Note 2) HS Code: Internationally unified code (up to 6 digits) assigned to each product and used for customs.
(Note 3) CNCA: Certification and Accreditation Administration of People's Republic of China (Management and monitoring of certification duties)

Appendix 9-4 Application for Exemption

Following "Announcement 8" issued by the Certification and Accreditation Administration of the People's Republic of China (CNCA) in May 2002, a range of products for which application for CCC Certification is not required or which are exempt from CCC marking has been approved for special circumstances in production, export and management activities.
An application must be submitted together with materials which prove that the corresponding product complies with the exemption conditions. Upon approval, a "Certification of Exemption" shall be issued.

<Range of products for which application is exempt>

Range of products not requiring application	(a) Items brought into China for the personal use by the foreign embassies, consulates, business agencies and visitors (Excluding products purchased from Service Company for Exporters) (b) Products presented on a government-to-government basis, presents (c) Exhibition products (products not for sale) (d) Special purpose products (e.g., for military use) Products not requiring application for CCC Certification are not required to be CCC marked or certified.
Range of products for which application is exempted	(e) Products imported or manufactured for research and development and testing purposes (f) Products shipped into China for integration into other equipment destined for 100% re-export to a destination outside of China (g) Products for 100% export according to a foreign trade contract (Excluding when selling partially in China or re-importing into China for sales) (h) Components used for the evaluation of an imported product line (i) The products imported or manufactured for the service (service and repairs) to the end-user. Or the spare parts for the service (service and repairs) of discontinued products. (j) Products imported or manufactured for research and development, testing or measurements (k) Other special situations

The following documents must be prepared to apply for an exemption of the "Import Commodity Safety and Quality License" and "CCC Certification".

(1) Formal Application
   (a) Relevant introduction and description of the company.
   (b) The characteristics of the products to be exempted.
   (c) The reason for exemption and its evidence (ex. customs handbook).
   (d) The name, trademark, quantity, model and specification of the products to be exempted. (Attach a detail listing of these items for a large quantity of products. When importing materials for processing and repair equipments, submit a list of the importing materials for each month and repair equipments.)
   (e) Guarantee for the safety of the products; self-declaration to be responsible for the safety during the manufacturing and use.
   (f) To be responsible for the authenticity and legitimacy of the submitted documents. Commitment to assist CNCA to investigate on the authenticity of the documents (When CNCA finds it necessary to investigate on the authenticity of the documents.)

(2) Business license of the company (Copy)

(3) Product compliance declaration
Indicate which standard's requirements the products comply with or submit a test report (Copy is acceptable. The report can be prepared in a manufacturer's laboratory either at home or overseas.)

(4) Import license (Only if an import license is needed for this product. Copy is acceptable.)

(5) Quota certificate (Only if a quota certificate is needed for this product. Copy is acceptable.)

(6) Commercial contract (Copy is acceptable.)

(7) If one of item (4), (5) or (6) cannot be provided, alternative documents, such as bill of lading, the invoice, and other evidential documents must be submitted.

Appendix 9-5 Mitsubishi NC Product Subject to/Not Subject to CCC Certification

The state whether or not Mitsubishi NC products are subject to the CCC Certification is indicated below, based on the "First Catalogue of Products subject to Compulsory Product Certification" issued by the State General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) of the People's Republic of China and the Certification and Accreditation Administration of the People's Republic of China (CNCA) on July 1, 2002.

Model	China HS Code (Note 1)	Judgment on whether or not subject to CCC Certification
Power supply unit **Servo/spindle drive unit**	85044090 85371010	Not subject to CCC Certification
Servo/spindle	85015100 85015200	Not subject to CCC Certification
NC	–	Not subject to CCC Certification
Display unit	–	Not subject to CCC Certification

(Note 1) The China HS Code is determined by the customs officer when importing to China. The above HS Codes are set based on the HS Codes used normally when exporting from Japan.

(Note 2) Reference IEC Standards are used as the actual IEC Standards may not match the GB Standards in part depending on the model.

Whether or not the NC products are subject to CCC Certification was judged based on the following five items.

(a) Announcement 33 (Issued by AQSIQ and CNCA in December 2001)
(b) HS Codes for the products subject to CCC Certification (Export Customs Codes)
  * HS Codes are supplementary materials used to determine the applicable range. The applicable range may not be determined only by these HS Codes.
(c) GB Standards (This is based on the IEC Conformity, so check the IEC. Note that some parts are deviated.)
(d) Enforcement regulations, and products specified in applicable range of applicable standards within
(e) "Products Excluded from Compulsory Certification Catalogue" (Issued by CNCA, November 2003)

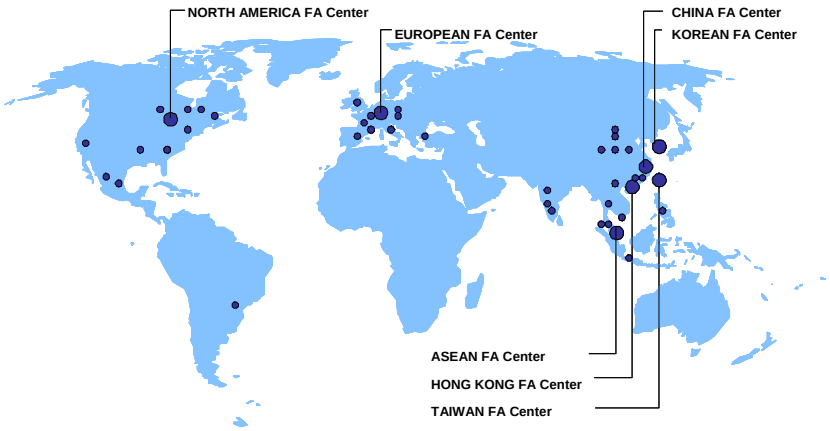
Reference

- Outline of China's New Certification System (CCC Mark for Electric Products), Japan Electrical Manufacturers' Association
- Outline of China's New Certification System (CCC Mark for Electric Products) and Electric Control Equipment, Nippon Electric Control Equipment Industries Association

Revision History

Date of revision	Manual No.	Revision details
Nov. 2005	IB(NA)1500150-A	First edition created.

Global service network



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Notice

Every effort has been made to keep up with software and hardware revisions in the contents described in this manual. However, please understand that in some unavoidable cases simultaneous revision is not possible.
Please contact your Mitsubishi Electric dealer with any questions or comments regarding the use of this product.

Duplication Prohibited

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MODEL	MDS-C1-SPA Series
MODEL CODE	008—376
Manual No.	IB-1500150A(ENG)

(0511)MEE