INVERTER INSTRUCTION MANUAL

Compliance with CE Marking and UL Standard

VF-A7 200V class
VF-A7 400V class

NOTICE
1. Make sure that this Instruction Manual is delivered to the end user of the inverter unit.
2. Keep this manual before installing or operating the inverter unit, and store it in a safe place for reference.

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1. Compliance with CE Marking

1.1. Abstract

In Europe, EMC directive is enforced starting 1st Jan. of 1996, and Low Voltage Directive starting 1st Jan. of 1997. The display of CE mark that demonstrates that products imported to European Union conform to these directives is required. Inverter itself cannot function alone, but is de-signed as a component in order to control machines or equipment which includes that inverter installed in a cubicle. Therefore the conformance to EMC directive is not required on inverter it-self. But since the object of the Low Voltage directive is equipment that is designed to be used with rated voltage of 50 to 1,000 VAC or 75 to 1,500 VDC, CE should be marked on inverter as to the Low Voltage directive.

But CE has to be marked on the final product installing inverters, that conforms to the EMC directive and the Low Voltage directive. And the product also may conform to Machine directive. The user that makes the final products have to take the responsibility for Marking of CE. For that reason, we recommend installation for Low Voltage directive and measurement for EMC directive, so that the products including our inverter should conform to the EMC and Low Voltage directive.

We carried out Approval testing and confirmation testing on representative models under the circumstances based on installation and measurement so that our products should conform to each directive. But we cannot confirm the conformance of the user's products to the EMC directive. Since EMC environment changes according to the construction of the cubicle and the relation of other installed electric equipment and the condition of wiring and installation, please confirm the conformance to the EMC directive for the final products on your side.

1.2. EMC directive

An inverter itself is not an object of CE marking.

A machine which consists of an inverter and a motor is an object of CE marking.
The EMC directive includes the emission section and the immunity section. VF-A7 can conform to EMC directive by means of installing the recommended EMI noise filter to the input side, and wiring properly.

→ Emission: Emission of electromagnetic wave and electromagnetic interference

→ Immunity: Resistance to electromagnetic interference

[EMC directive]
89/336/EEC

Table 1 Relative standard

Noise type	Test item	Standard	Applicable standards
Emission	Conducted Emission	EN61800-3	EN55011 Group 1 class A
	Radiated Emission		EN55011 Group 1 class A
Immunity	Electrostatic Discharge		IEC61000-4-2
	Radiated Electromagnetic field		IEC61000-4-3
	Electrical Fast Transient/Burst		IEC61000-4-4
	Surge Immunity		IEC61000-4-5
	Conducted Disturbances		IEC61000-4-6
	Voltage dips, short interruptions and voltage variations		IEC61000-4-11

1.3. Compliance with EMC directive

１．３．１．The model, noise filter inside

(1) 200V class : **ＶＦＡ７－２００４ＰＬ～２０７５ＰＬ**
400V class : **ＶＦＡ７－４００７ＰＬ～４１５０ＰＬ**

The above mentioned models install EMI noise filter inside. So the conducted and radiated noise can be reduced, optional EMI noise filters are not needed.
(The additional noise filter should be installed, when more effective reduction is required.)

(2) Set the carrier frequency at 4kHz or less.

Title	Parameter	Adjustment range	Default setting	Setting value
F300	PWM carrier frequency	0.5～15kHz	12kHz	4kHz or less

(3) The main cables such as input to the EMI filter and output of the inverter and the signal cables should be shielded, then cable length should be wired as short as possible. The main input cable should be separated from the main output cable, and cables for control signal also should be separated from main cables, not wiring parallel and not bundling, cross the wires where necessary.

(4) Install EMI filter and inverter on the same metal back plate in an inverter panel. The metal back plate or the cubicle must be grounded absolutely, by using short thick wires, separated from the main cables.

(5) Shielded cables should be grounded on the metal back plate in order to reduce the radiated noise from the other cables. It is an effective measure that shielded cables are grounded close to the inverter or/and operation panel or/and EMI filter(less than 10cm).

(6) Installation of the zero-phase and/or the ferrite core can also effectively reduce the radiated noise further.(Input or/and output of inverter)

【Ex. Countermeasure – main circuit wiring】

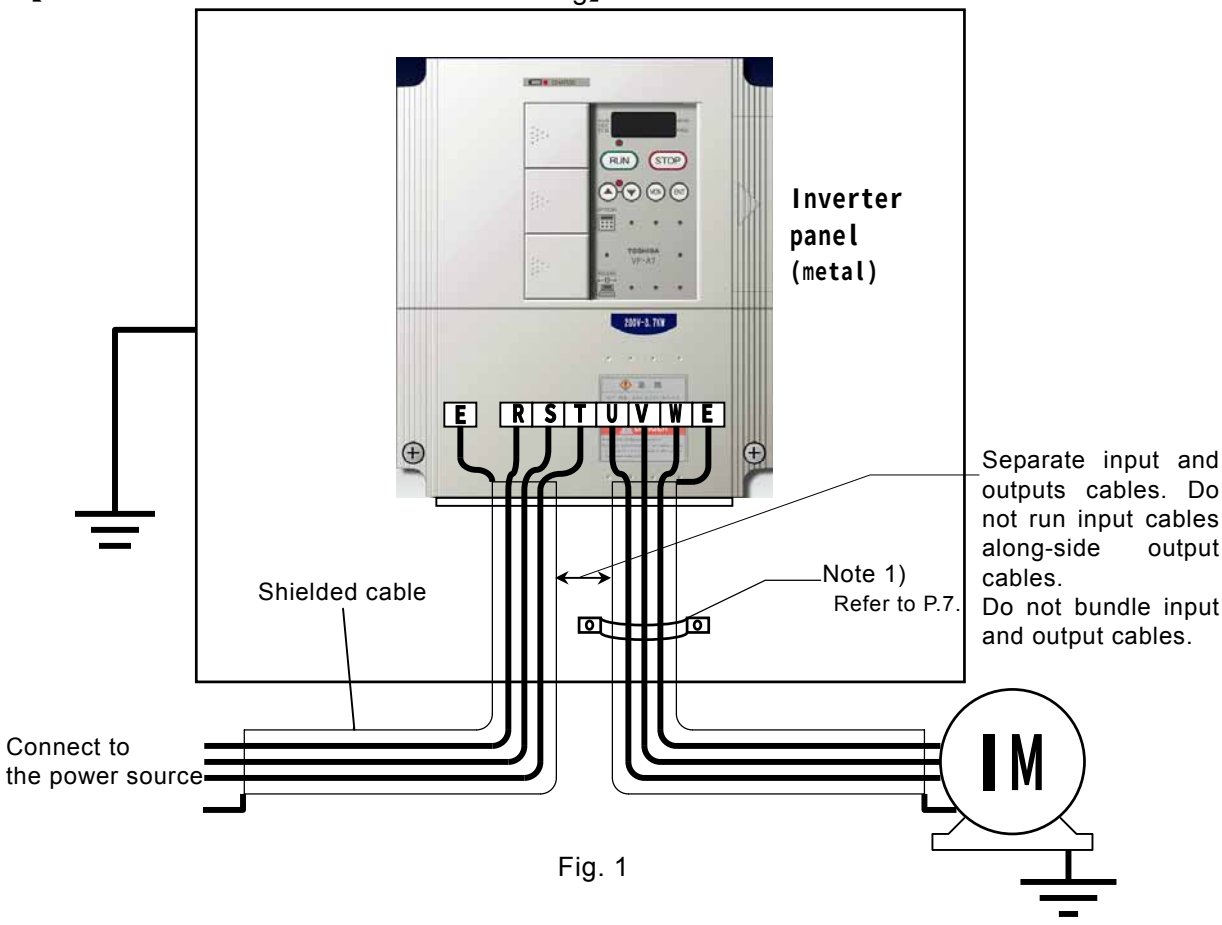

Fig. 1

1．3．2．The models without EMI filters

(1) 200V class : VFA7-2110P～2900P1
400V class : VFA7-4185P～4280KP1

Recommended EMI noise filters(refer to Table 2) should be installed to the input. These can reduce the conducted and radiated noise.

Table 2. Recommended EMI filter selection

《3-phase 200V class》		《3-phase 400V class》	
Type form	Filter type	Type form	Filter type **(NOTE)**
VFA7-2110P	FN258-75/34	—	—
VFA7-2150P	FN258-100/35	—	—
VFA7-2185P	FN258-100/35	VFA7-4185P	FN258-42/07
VFA7-2220P	FN258-100/35	VFA7-4220P	FN258-55/07
VFA7-2300P	FN258-130/35	VFA7-4300P	FN258-75/34
VFA7-2370P1	FN258-180/07 or FN3258-180/40	VFA7-4370P1	FN3258-75/52 or FS5992-72/52
VFA7-2450P1	FN258-130/35×2P or FN258-250/07 or FN3359-250/28	VFA7-4450P1	FN258-100/35 or FN3258-100/35
VFA7-2550P1	FN258-130/35×2P or FN258-250/07 or FN3359-250/28	VFA7-4550P1	FN3258-130/35 or FS5992-130/35
VFA7-2750P1	FN359-300/99 or FN3359-320/99	VFA7-4750P1	FN258-180/07 or FN3258-180/40
VFA7-2900P1	FN359-400/99 or FN3359-400/99	—	—
—	—	VFA7-4110KP1	FN359(H)-250/99 or FN3359(HV)-250/28
—	—	VFA7-4132KP1	FN359(H)-300/99 or FN3359(HV)-320/99
—	—	VFA7-4160KP1	FN359(H)-400/99 or FN3359(HV)-400/99
—	—	VFA7-4220KP1	FN359(H)-500/99 or FN3359(HV)-500/99
—	—	VFA7-4280KP1	FN359(H)-600/99 or FN3359(HV)-600/99

Note) FN258,3258 480V or less
FN359 400V or less, FN359H 520V or less
FN3359 500V or less, FN3359HV 690V or less

(2) The main cables such as input to the EMI filter and output of the inverter and the signal cables should be shielded, then cable length should be wired as short as possible. The main input cable should be separated from the main output cable, and cables for control signal also should be separated from main cables, not wiring parallel and not bundling, cross the wires where necessary.

(3) Install EMI filter and inverter on the same metal back plate in an inverter panel. The metal back plate or the cubicle must be grounded absolutely, by using short thick wires, separated from the main cables.

(4) Please separate input cable to EMI filter from output cable as much as possible.

(5) Shielded cables should be grounded on the metal back plate in order to reduce the radiated noise from the other cables. It is an effective measure that shielded cables are grounded close to the inverter or/and operation panel or/and EMI filter(less than 10cm).

(6) Installation of the zero-phase and/or the ferrite core can also effectively reduce the radiated noise further.(Input or/and output of inverter)

【Ex. Countermeasure – main circuit wiring】

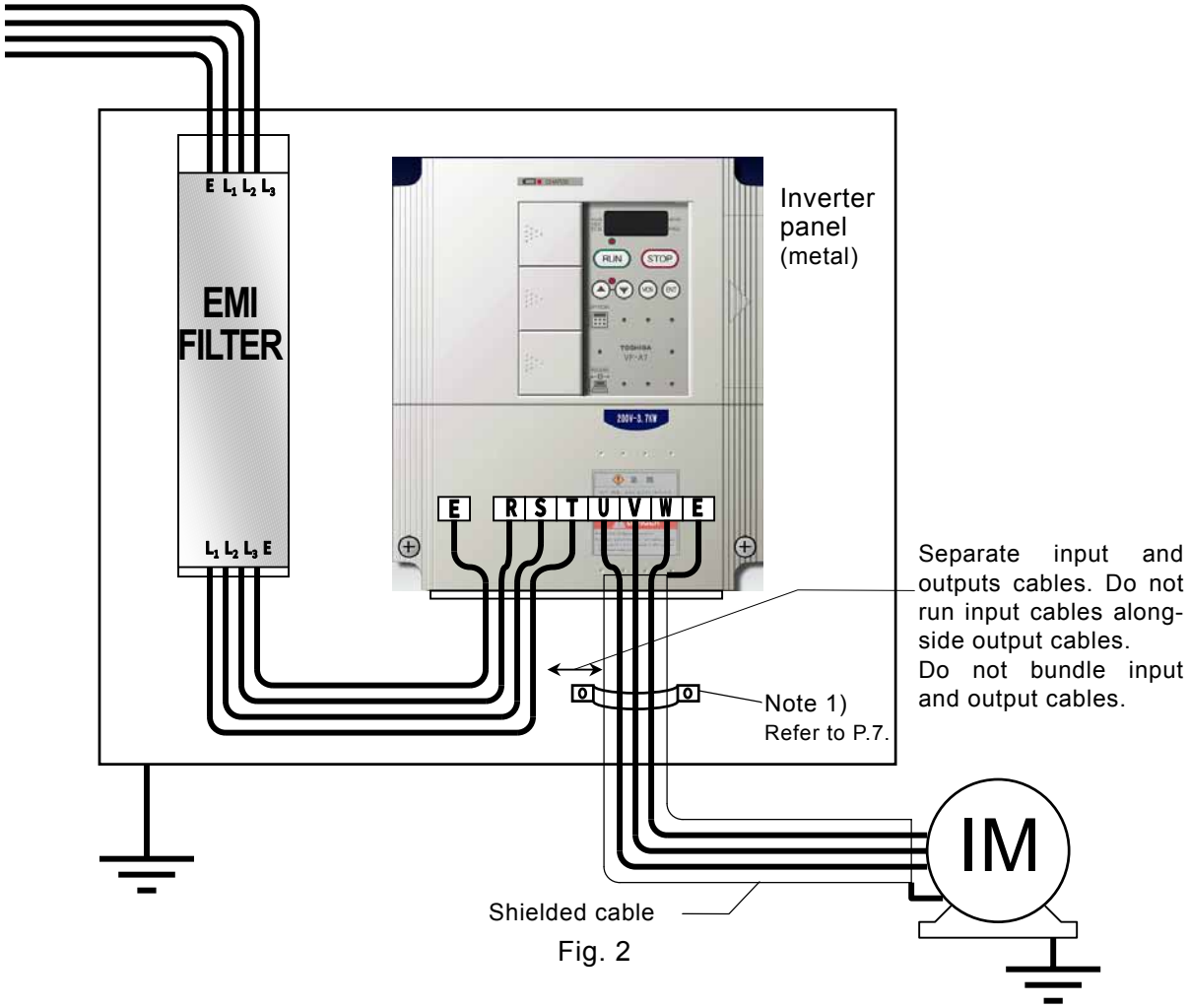

Fig. 2

Note 1)

Process as shown below.

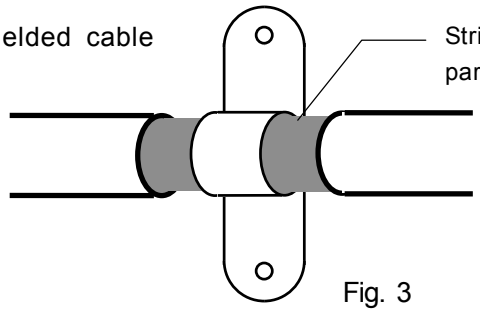

Fig. 3

【Operating with external signals】

To operate with external signals, process as following figures.

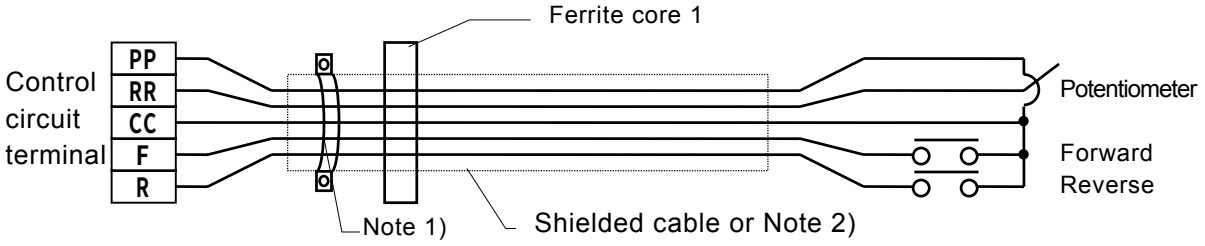

Fig. 4

【Accessories for countermeasure】

- Ferrite core 1 : Chomerics
  Type form/HBFE-1004-AS
  (or TDK co. ltd. Type form/ ZCAT3035-1330)
- Note 1) Shield : SUMITOMO 3M Co. Ltd. Electro-magnetic guard shielded sleeve
  Type form/ DS-5,7,10,14
- EMI filter : SCHAFFNER ELEKTRONIK AG
  Type form/ FN258/FN3258/FN359/FN3359/FS5992
- Zero-phase reactor : Soshin Electric Co. Ltd.
  Type form/ RC5078 or RC9129

1.4. Low voltage directive

Inverter itself is an object of the CE marking.

The Low Voltage Directive defines the safety of the electric equipment. VF-A7 series conform to the Low Voltage directive based on EN50178.

Normative standard : EN50178/Electronic equipment for use in power installation
Pollution degree :2(5.2.15.2)
Over-voltage category : 3 200V class 3.0 mm (5.2.16.1)
400V class 5.5 mm (5.2.16.1)

EN50178 provides that for electronic equipment used in power installations. The main intention is to stipulate minimum requirements for the design and manufacture of electronic equipment, for protection against electric shock, for testing and for the integration into systems for power installations.

1.5. Compliance with Low voltage directive

Please carry out the below mentioned countermeasures for the Low Voltage Directive in case of using VF-A7 as components of your products.

(1) **Inverter should be installed in a panel.** Pay attention to wiring openings, so that it should prevent someone from touching live parts through the opening in case of maintenance.

2) No more than 1 cable should be connected to one earth terminal of the main terminal board. In this case, other cables for ground should be grounded on the metal back plate and/or in the cubicle(Refer to Fig. 5).
Refer the size of grounding cable to Table. 4.

(3) MCCB should be connected to the input side of the EMI filter.

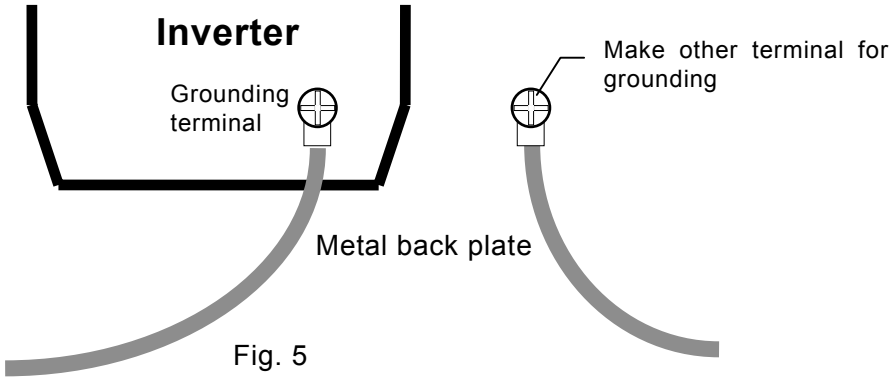

Fig. 5

2 . Compliance with UL Standard

The VF-A7 models conform to the UL Standard have the UL/CUL mark on the nameplate.

2.1. Compliance with Installation

The VF-A7 Inverter must be installed in a panel, and used within the maximum surrounding air temperature 50 degrees.
For models for 15kW and smaller, they can be used at ambient temperature of up to 50 degrees by peeling off the label on the top of the inverter.
Models for 18.5kW and larger can be used at ambient temperature of up to 50 degrees. (These models have no label on their top.)

2.2. Compliance with Connection

Use the UL listed cables, 75 degree copper wire only, with the UL listed closed -loop terminal connector at field wiring connection to the inverter input terminals, R/L1, S/L2, T/L3, output terminals, U/T1, V/T2, W/T3, and other main terminals.

Refer the wire gauge, the type of closed-loop terminals and crimping tools to Table.4 and Table.5.

2.3. Compliance with Peripheral devices

Use the UL listed MCCB or fuses at connecting to power supply.
(The fuses should be used CLASS CC/J.)
Refer to the instruction manual about selecting the rating of them.
Short circuit test is performed under the condition of the power supply short-circuit currents in Table. 3.
These currents depend on the applicable motor capacities.

Table.3 Power supply short-circuit current and input voltage

Input voltage (v)	Applicable motor (kW)	power supply shout-circuit current and maximum input voltage
200	0.4 ～ 37	Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes in below,240 volts maximum.
	45 ～ 90	Suitable for use on a circuit capable of delivering not more than 10,000 rms symmetrical amperes in below,240 volts maximum.
400	0.4 ～ 37	Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes in below,480 volts maximum.
	45 ～ 132	Suitable for use on a circuit capable of delivering not more than 10,000 rms symmetrical amperes in below,480 volts maximum.
	160 ～ 280	Suitable for use on a circuit capable of delivering not more than 18,000 rms symmetrical amperes in below,480 volts maximum.

Table.4 Wire gauge

Inverter type-form	Wire gauge AWG （mm^2）		
	Input/output terminals	Control power supply terminals	Grounding terminal
VFA7-2004PL	14 (2.1)	14 (2.1)	12 (3.3)
VFA7-2007PL	14 (2.1)	14 (2.1)	12 (3.3)
VFA7-2015PL	14 (2.1)	14 (2.1)	12 (3.3)
VFA7-2022PL	14 (2.1)	14 (2.1)	12 (3.3)
VFA7-2037PL	14 (2.1)	14 (2.1)	12 (3.3)
VFA7-2055PL	12 (3.3)	14 (2.1)	12 (3.3)
VFA7-2075PL	10 (5.3)	14 (2.1)	10 (5.3)
VFA7-2110P	6 (13.3)	14 (2.1)	6 (13.3)
VFA7-2150P	6 (13.3)	14 (2.1)	6 (13.3)
VFA7-2185P	4 (21.2)	14 (2.1)	4 (21.2)
VFA7-2220P	2 (33.6)	14 (2.1)	4 (21.2)
VFA7-2300P	2/0（67.4）	14 (2.1)	2 (33.6)
VFA7-2370P1	2/0（67.4）	14 (2.1)	2 (33.6)
VFA7-2450P1	4/0 (107.2)	14 (2.1)	2/0（67.4）
VFA7-2550P1	4/0 (107.2)	14 (2.1)	2/0（67.4）
VFA7-2750P1	300 (152)	14 (2.1)	4/0 (107.2)
VFA7-2900P1	300 (152)	14 (2.1)	4/0 (107.2)
VFA7-4007PL	14 (2.1)	14 (2.1)	12 (3.3)
VFA7-4015PL	14 (2.1)	14 (2.1)	12 (3.3)
VFA7-4022PL	14 (2.1)	14 (2.1)	12 (3.3)
VFA7-4037PL	14 (2.1)	14 (2.1)	12 (3.3)
VFA7-4055PL	14 (2.1)	14 (2.1)	12 (3.3)
VFA7-4075PL	14 (2.1)	14 (2.1)	12 (3.3)
VFA7-4110PL	10 (5.3)	14 (2.1)	10 (5.3)
VFA7-4150PL	10 (5.3)	14 (2.1)	10 (5.3)
VFA7-4185P	8 (8.4)	14 (2.1)	8 (8.4)
VFA7-4220P	6 (13.3)	14 (2.1)	6 (13.3)
VFA7-4300P	6 (13.3)	14 (2.1)	6 (13.3)
VFA7-4370P1	4 (21.2)	14 (2.1)	4 (21.2)
VFA7-4450P1	2 (33.6)	14 (2.1)	4 (21.2)
VFA7-4550P1	2 (33.6)	14 (2.1)	4 (21.2)
VFA7-4750P1	2/0 （67.4）	14 (2.1)	2 (33.6)
VFA7-4110KP1	4/0 (107.2)	14 (2.1)	2/0 (67.4)
VFA7-4132KP1	4/0 (107.2)	14 (2.1)	2/0 (67.4)
VFA7-4160KP1	300 (152)	14 (2.1)	4/0 (107.2)
VFA7-4220KP1	400 (203)	14 (2.1)	4/0 (107.2)
VFA7-4280KP1	300*2 (152*2)	14 (2.1)	300 (152)

Table. 5 Type-form of closed-loop terminals and crimping tools

AWG (mm2)	Type-form of closed-loop terminal							Crimping tools		
	M3 screw	M4 screw	M5 screw	M6 screw	M8 screw	M10 screw	M12 screw	Hand tools	Air-pressure tools	Hydraulic tools
14 (2.1)	2-3	R2-4	R2-5	-----	-----	-----	-----	YHT-2210	YA-4	BCT-0514
12 (3.3)	-----	3.5-4	3.5-5	-----	-----	-----	-----			
10 (5.3)	-----	-----	R5.5-5	R5.5-6	-----	-----	-----			
8 (8.4)	-----	-----	R8-5	R8-6	R8-8	-----	-----	YHT-8S	YA-4, YA-5	YPT-150-1, BCT-8150 (body) YF-1 (head) YET-150-1
6 (13.3)	-----	-----	R14-5	R14-6	R14-8	R14-10	R14-12	-----		
4 (21.2)	-----	-----	-----	R22-6	R22-8	R22-10	R22-12	-----	YA-5	
2 (33.6)	-----	-----	-----	38-6	R38-8	R38-10	R38-12	-----		
2/0 (67.4)	-----	-----	-----	-----	70-8	70-10	70-12	-----	-----	
4/0 (107.2)	-----	-----	-----	-----	-----	R100-10	R100-12	-----	-----	
300 (152)	-----	-----	-----	-----	-----	R150-10	R150-12	-----	-----	
400 (203)	-----	-----	-----	-----	-----	-----	R200-12	-----	-----	(body) YF-1 (head) YET-300-1

（Note） The closed-loop terminal and crimping tools in Table. 5 are manufactured by JST Mfg. Co,. Ltd.

2.4. Compliance with Motor overload protection

The electronic thermal protection level and characteristic must be adjusted to fit the motor rated current and specification.

Refer the detail of electronic thermal protection to the instruction manual.

Installing external overload relay to each motor between inverter and motors when driving several motors simultaneously.