9 Measures to satisfy standards

This chapter explains the measures to comply with the EMC Directive, UL/CSA Standards, etc. by introducing examples.

9. 1 How to deal with CE marking

CE mark is put on all products of VF-AS3 to declare that they are in conformity with the requirements of Low Voltage Directive and EMC Directive, also the products integrating the safety function are in conformity with the requirements of machine directive as safety component.

The CE mark must be put on all machines and systems with built-in inverters because such machines and systems are subject to the above directives. If they are final products, they might also be subject to the Machinery Directive.
It is the responsibility of the manufacturers of such final products to put the CE mark on each final product. In order to make machines and systems with built-in inverters comply with the EMC Directive and the Low Voltage Directive, we recommend the installation method of inverters and measures for EMC Directive described in this instruction manual.

We have tested representative models with them installed under the environment described later in this manual to check for conformity with the EMC Directive. However, we cannot check the inverters under your operating environment. EMC varies depending on the composition of the control panel with a built-in inverter(s), the relationship with other built-in electrical components, the wiring condition, the layout condition, and so on. Therefore, you need to verify yourself whether your machine and system conforms to the EMC Directive.

9. 1. 1 Compliance with EMC Directive

The CE mark must be put on every final product that includes an inverter(s) and a motor(s). 480V class inverters of VF-AS3 series are equipped with an EMC filter and comply with the EMC Directive if wiring is carried out correctly.

The EMC standards are broadly divided into two categories; Emission and Immunity, each of which is further categorized according to the operating environment of each individual machine as shown in the table below. We consider that the tests required for machines and systems as final products are almost the same as those required for inverters.

Category	Subcategory	Product standards	Test standard
Emission	Radiated noise	IEC61800-3	CISPR11 (EN55011)
	Conducted noise		CISPR11 (EN55011)
Immunity	Electrostatic discharge		IEC61000-4-2
	Radio-frequency electromagnetic field		IEC61000-4-3
	Electrical fast transient/burst		IEC61000-4-4
	Surge		IEC61000-4-5
	Conducted radio-frequency common mode		IEC61000-4-6
	Voltage dips, short interruptions and voltage variations		IEC61000-4-11

(1) EMC Directive compliance of this inverter

The built-in EMC filter on the input side of this inverter (480 V class) reduces conducted noise and radiated noise from input cables. The compliance with the EMC Directive is as shown in the table below.

Inverter type	Carrier frequency <F300>	Conducted noise IEC61800-3 category C2 (EN55011 classB Group1)	Conducted noise IEC61800-3 category C3 (EN55011 classB Group1)
		Length of motor connecting cable	Length of motor connecting cable
	(kHz)	(m)	(m)
VFAS3-4004PC	4	50	150
VFAS3-4007PC	4	50	150
VFAS3-4015PC	4	50	150
VFAS3-4022PC	4	50	150
VFAS3-4037PC	4	50	150
VFAS3-4055PC	4	50	150
VFAS3-4075PC	4	50	150
VFAS3-4110PC	4	50	150
VFAS3-4150PC	4	50	150
VFAS3-4185PC	4	50	150
VFAS3-4220PC	4	50	150
VFAS3-4300PC	4	50	150
VFAS3-4370PC	4	50	150
VFAS3-4450PC	2.5	-	150
VFAS3-4550PC	2.5	-	150
VFAS3-4750PC	2.5	-	150
VFAS3-4900PC	2.5	-	150

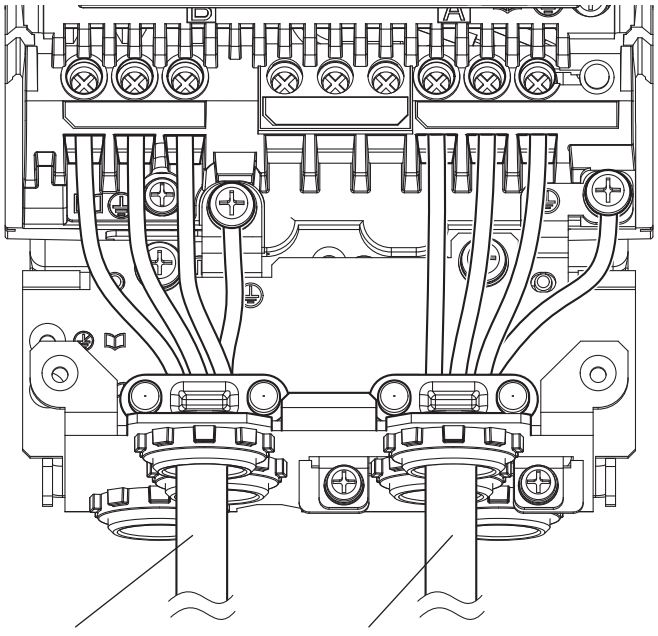
Inverter type	Carrier frequency <F300>	Conducted noise IEC61800-3 category C2 (EN55011 classB Group1)	Conducted noise IEC61800-3 category C3 (EN55011 classB Group1)
		Length of motor connecting cable	Length of motor connecting cable
	(kHz)	(m)	(m)
VFAS3-4110KPC	2.5	-	150
VFAS3-4132KPC	2.5	-	150
VFAS3-4160KPC	2.5	-	50
VFAS3-4200KPC	2.5	-	50
VFAS3-4220KPC	2.5	-	50
VFAS3-4280KPC	2.5	-	50

(2) Examples of measures to comply with EMC Directive

The following are measures to comply with the EMC Directive when you use 480V class products of VF-AS3 by installing it in other machines and systems.

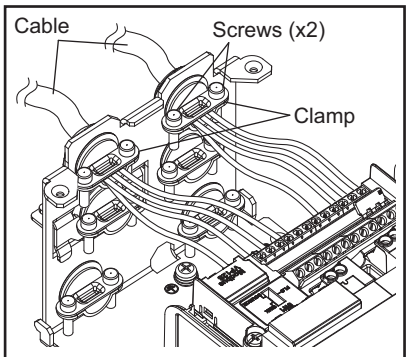
- Examples of general measures
- When adding an EMC filter for further reduction of noise
- Measures for operation with external signals

The following are general EMC measures explained concretely.

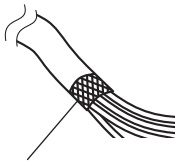


Power supply wiring
(No shielded grounding needed)
[R/L1], [S/L2], [T/L3]

Motor wiring
(Shielded grounding needed)
[U/T1], [V/T2], [W/T3]



When the shielded wires need grounding, modify before installing as shown in the figure below.



Peel off the outer sheath of the cable and fix the shielded part with a clamp.

9

Using shielded power wires and shielded control wires

- Use shielded power wires, such as inverter input/output wires, and shielded control wires.
- Route the wires and wires so as to minimize their lengths.
- Keep a distance between the power cable and the control wire and between the input and output wires of the power cable. Do not route them in parallel or bind them together. Instead, if necessary, cross at right angle.

Installing inverter in steel cabinet

- Install the inverter in a sealed steel cabinet.
- Using wires as thick and short as possible, ground the metal plate and the control panel securely with a distance kept between the grounding wire and the power wire.

Routing input and output wires apart

- Route the input and output wires apart as far as possible from each other.

Grounding of shielded wires

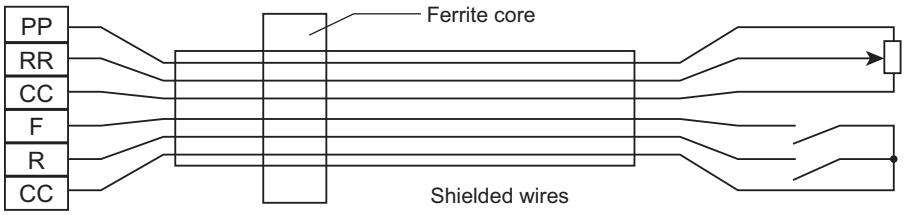
- To ground shielded wires through a metal conduit.
- To ground the shielded control wires by fixing the metal saddle of the body.
- Inserting a ferrite core in a shielded wire is even more effective in limiting the radiated noise.

Inserting zero-phase reactor and ferrite cores

- Insert a zero-phase reactor in the inverter output line.
- Insert ferrite cores in the grounding wires of the metal plate and cabinet.

(3) Measures for operation with external signals

To operate with external signals, take measures as shown in the figure below (e.g.: using a potentiometer and Fwd/Rev terminals).



9. 1. 2 Compliance with Low Voltage Directive

The Low Voltage Directive provides for the safety of machines and systems.

(1) Low Voltage Directive Compliance of this inverter

Inverters are CE-marked in accordance with the requirement of Low Voltage Directive, and can therefore be installed in machines or systems and exported without problem to European countries.

- Applicable standard: IEC61800-5-1
- Pollution degree: 2
- Overvoltage category: 3

(2) Example of measures to comply with Low Voltage Directive

When incorporating the inverter into a machine and system, it is necessary to take the following measures so that the inverter satisfies the Low Voltage Directive.

Installing in cabinet

- Install the inverter in a cabinet and ground the inverter enclosure.
- When doing maintenance, be extremely careful not to put your fingers into the inverter through a wiring hole and touch a charged part, which may occur depending on the model of the inverter used.

Paying attention to how to ground

- To ground shielded wires through a metal conduit.
- Connect grounding wires other than the shielded wires to the grounding terminals on the inverter.
- However, do not connect two or more grounding wires to the grounding terminals (screws) for the inverter main circuit.
- Refer to the table in [10. 1] to select a grounding wire size.

Installing protection device

- Install a fuse, an earth leakage circuit breaker (ELCB) or a molded-case circuit breaker (MCCB) on the input side of the inverter. For details, refer to [9. 2. 3] [10. 2. 2].