

## 9. Measures to satisfy the standards

### 9.1 How to cope with the CE Marking Directive

In Europe, the EMC Directive and the Low Voltage Directive, which took effect in 1996 and 1997, respectively, made it obligatory to put the CE mark on every applicable product to prove that it complies with the directives. Inverters do not work alone but are designed to be installed in a control panel and always used in combination with other machines or systems for the purpose of controlling them. So they themselves were not considered to be subject to the EMC Directive. However the component also became subject to law with the enforcement of the new EMC Directive in 2007. For this reason, we put CE mark on all inverters in accordance with the EMC Directive and the Low Voltage Directive.

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, this section explains how to install inverters and what measures should be taken to satisfy the EMC Directive.

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, please verify yourself whether your machine or system conforms to the EMC Directive.

#### 9.1.1 About the EMC Directive

The CE mark must be put on every final product that includes an inverter(s) and a motor(s). In this series of inverters are equipped with an EMC filter and complies with the EMC Directive if wiring is carried out correctly.

- EMC Directive  
2004/108/EC

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. Since inverters are intended for use with industrial systems under industrial environments, they fall within the EMC categories listed in Table 1 below. We consider that the tests required for machines and systems as final products are almost the same as those required for inverters.

Table 1 EMC standards

Category	Subcategory	Product standards	Test standard	
Emission	Radiated noise	IEC 61800-3	CISPR11(EN55011)	
	Conducted noise		CISPR11(EN55011)	
Immunity	Static discharge		IEC61000-4-2	
	Radioactive radio-frequency magnetic contactor field		IEC61000-4-3	
	First transient burst		IEC61000-4-4	
	Surge		IEC61000-4-5	
	Radio-frequency induction/transmission interference		IEC61000-4-6	
	Voltage dip/Interruption of power			IEC61000-4-11

## 9.1.2 Measures to satisfy the EMC Directive

This subsection explains what measures must be taken to satisfy the EMC Directive.

- (1) Insert an EMC filter on the input side of the inverter to reduce conducted noise and radiated noise from input cables.

Single-phase 240V class and three-phase 500V class inverters are equipped with an EMC filter.

Table 2 Combinations of inverter and EMC filter

Three-phase 240 V class

Inverter type	Combination of inverter and filter	
	Conducted noise IEC61800-3, category C1 (Motor wiring length of 1m or less)	Conducted noise IEC61800-3, category C2 (Motor wiring length of 5m or less)
VFS15-2004PM-W1	EMFS11-2007AZ	
VFS15-2007PM-W1	EMFS11-2007AZ	
VFS15-2015PM-W1	EMFS11-4015BZ	
VFS15-2022PM-W1	EMFS11-4015BZ	
VFS15-2037PM-W1	EMFS11-4025CZ	
VFS15-2055PM-W1	EMFS11-4047DZ	
VFS15-2075PM-W1	EMFS11-4047DZ	
VFS15-2110PM-W1	EMFS11-2083EZ	
VFS15-2150PM-W1	EMFS11-2083EZ	

## Single-phase 240 V class

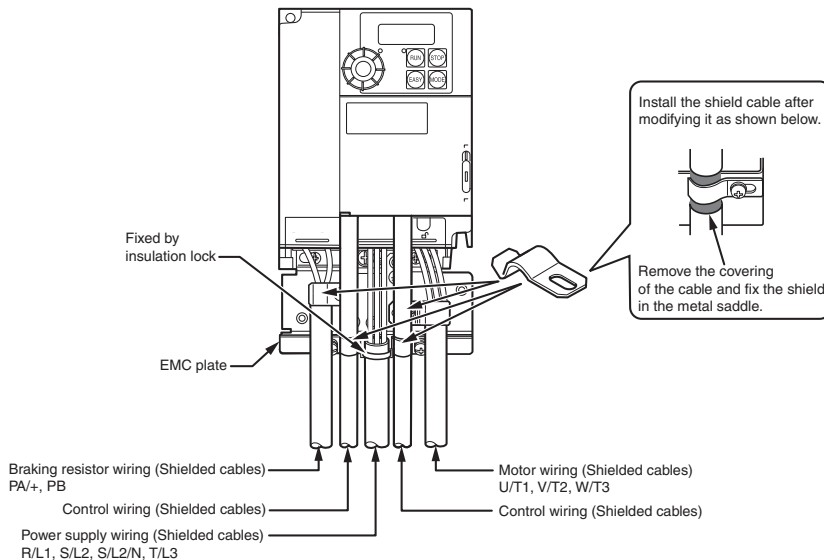
Combination of inverter and filter				
Inverter type	Conducted noise IEC61800-3, category C2 (Motor wiring length of 5m or less)	Conducted noise IEC61800-3, category C1 (Motor wiring length of 20m or less)	Conducted noise IEC61800-3, category C2 (Motor wiring length of 50m or less)	
VFS15S-2002PL-W1	Built-in filter	EMFS11S-2009AZ		
VFS15S-2004PL-W1		EMFS11S-2009AZ		
VFS15S-2007PL-W1		EMFS11S-2009AZ		
VFS15S-2015PL-W1		EMFS11S-2016BZ		
VFS15S-2022PL-W1		EMFS11S-2022CZ		

## Three-phase 500 V class

Combination of inverter and filter				
Inverter type	Conducted noise IEC61800-3, category C2 Motor wiring length of 5m or less)	Conducted noise IEC61800-3, category C3 (Motor wiring length of 25m or less)	Conducted noise IEC61800-3, category C1 (Motor wiring length of 20m or less)	Conducted noise IEC61800-3, category C2 (Motor wiring length of 50m or less)
VFS15-4004PL-W1	Built-in filter	Built-in filter	EMFS11-4015BZ	
VFS15-4007PL-W1			EMFS11-4015BZ	
VFS15-4015PL-W1			EMFS11-4015BZ	
VFS15-4022PL-W1			EMFS11-4025CZ	
VFS15-4037PL-W1			EMFS11-4025CZ	
VFS15-4055PL-W1			EMFS11-4047DZ	
VFS15-4075PL-W1			EMFS11-4047DZ	
VFS15-4110PL-W1	-	Built-in filter	EMFS11-4049EZ	
VFS15-4150PL-W1			EMFS11-4049EZ	

- (2) Use shielded power cables, such as inverter output cables, and shielded control cables. Route the cables and wires so as to minimize their lengths. Keep a distance between the power cable and the control cable 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.
- (3) It is more effective in limiting the radiated noise to install the inverter in a sealed steel cabinet. Using wires as thick and short as possible, earth the metal plate and the control panel securely with a distance kept between the earth cable and the power cable.
- (4) Route the input and output wires apart as far as possible from each other.
- (5) To suppress radiated noise from cables, ground all shielded cables through a noise cut plate.  
It is effective to earth shielded cables in the vicinity of the inverter and cabinet (within a radius of 10cm from each of them). Inserting a ferrite core in a shielded cable is even more effective in limiting the radiated noise.
- (6) To further limit the radiated noise, insert a zero-phase reactor in the inverter output line and insert ferrite cores in the earth cables of the metal plate and cabinet.

[Example of wiring]



### 9.1.3 About the Low Voltage Directive

The Low Voltage Directive provides for the safety of machines and systems. All Toshiba inverters are CE-marked in accordance with the standard EN 50178 specified by the Low Voltage Directive, and can therefore be installed in machines or systems and imported without problem to European countries.

Applicable standard: IEC61800-5-1

Pollution level: 2

Overvoltage category: 3

### 9.1.4 Measures to satisfy the Low Voltage Directive

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

- (1) 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 and capacity of the inverter used.
- (2) Connect earth wiring to the earth terminal on the EMC plate. Or install the EMC plate (attached as standard) and another cable connect to earth terminal on the EMC plate. Refer to the table in 10.1 for details about earth cable sizes. A minimum wire size of 10mm<sup>2</sup> may be required to meet standards limiting leakage current.
- (3) Install a non-fuse circuit breaker or a fuse on the input side of the inverter. (Refer to section 10.1 and 9.2.3)

## 9.2 Compliance with UL Standard and CSA Standard

This inverter that conform to the UL Standard and CSA Standard based on the rated current of the nameplate have the UL/CSA mark on the nameplate. Refer to section 17.1 (Appendix).