Protection against EMC- failures

EMC = Electromagnetic Compatibility

Often, the relevant prescriptions for the protection of the operating material and the environment by EMC influences are not met or sufficiently met if fans are operated via converters. It is very important that all measures for protection of the entire equipment are taken.

In many cases, a non-observance of the measures results in failures of the data and radio traffic and can lead to malfunctions of the electrical equipment. Also natural organisms can be impacted by the so-called electric smog.

In the following, the most important facts to be observed for easy and quick overview are listed.

The following descriptions are of general nature and do not raise a claim on completeness, especially not on the compliance with national and regional prescription in not EU-countries.

These prescriptions must be strictly respected by the respective installers and operators.

Potential compensation

In principle, a proper, low impedance potential compensation between all conducting constructional parts of a system must be installed. This leads to a better EMC behaviour against transient emissions and improved noise immunity.

An incorrectly executed potential compensation can result in the same negative impacts if the system would not be equipped with a potential compensation.

The protective earthing potential (PE-conductor) of an electric installation is ***no*** potential compensation. Normally, high frequent EMC-failures from other system parts are also transmitted and looped in.

A potential compensation must be executed in a radial and low-ohmic manner and connected centrally to a foundation earth electrode of a building.

For the parasitic frequencies, it must be much more low-ohmic than the protective conductor.

Motor data

Use motors with sufficient isolation and voltage resistance depending on the mains supply and the expectable voltage peaks due to the electronic drive control systems.

Please contact the motor suppliers for the limit values. In some cases they are indicated on the data sheets of the motors.

Measures for the regulation of the converters

Converters must be installed directly next to the fans. A possibly short cable length must be ensured.

If these requirements cannot be met, all-pole sinus filters* must be installed or converters with integrated all-pole sinus filters* must be used.

* All-pole sinus filters are obligatory for all AC fans delivered by us and for groups of fans regulated with only one converter.

For more information see chapter 3.c.

1. Cable laying in distance:

Unshielded motor cables should not be laid in a bundled manner or close to each other. Minimum distance 10 cm. By laying the cable in distance, a mutual influence due to inductions within the cable bundle can be avoided.

If it is impossible, the use of shielded cables or all-pole sinus filters* is obligatory.

2. Shielded cables:

Shielded cables are used to avoid transient emissions during the use of electronic drive controllers. Failures on motor lines due to reflections and interferences cannot be avoided by them. Furthermore, shielded cables do not serve the protection of motor bearings and motor windings.

The shield only avoids a mutual influence of cables laid next to each other due to induction. Thereby, the cables can be laid bundled and next to each other. Both shield ends of the supply cables must be applied on the potential compensation on large scale. Only thereby, the emission of unpermitted high parasitic frequencies is avoided.

Inside of closed metal housings, the use of shielded cables is not required. The shielding effect is reached by an earthed device casing.

Short line sections leaving the casing up to 2m length must not be shielded. The reason is that the emission power is so low that there are normally no parasitic effects.

Terminal boxes and repair switch casings in plastic design can also be used. In doing so, a potential compensation must be mounted to the screw connections for the shielded supply lines on site in order to apply there the shield of the supply cable. Suitable installation material can be purchased at electrical distributors.

3. Mounting of filters:

All-pole sinus filters* are obligatory for AC fans and for groups of fans. Other motor types and/or individual drives can also be operated with low effective filters. These filters must be directly mounted behind the converters and reduce the harmonic components. On their outlet side they generate a sinusoidal operating voltage and reduce the voltage peaks on the motor supply lines and/or the voltage slew rates of the voltage impulses on the converter outlet.

3.a. Motor or du/dt filter:

These simple filters only serve the reduction of too high voltage slew rates and peaks of the pulse-modulated output voltage of the converters in order to do not destroy the motor windings after a very short operating time. They may only be used for individual applications and are not suitable to be used in a regulated grid.

3.b. Three-pole sinus filters:

These filters can be connected easily but only act between the three phases. With it, the outlet voltages on the converter are put phase/phase in sinus form. These filters are well suited for a silent running of the motors and their winding protection. However, with these filters, the interfering voltages phase/earth are not reduced enough in order to prevent frame faults due to voltage punches and bearing destructions due to spark erosions by bearing currents.

3.c. All-pole sinus filters *:

The optimum solution are all-pole sinus filters. If they are installed, cable lengths and bundles are no more significant for a fault free operation. Shielded cables are no more necessary.

These filters generate a sinus voltage at its outputs phase/phase and also reduce the voltage spikes between the three phases and the earth potential.

With the use of these filters, the leakage current through the motor bearing is minimised in such a manner that destructions of the bearings due to spark erosion are almost avoided.

The use of these filters may require a new parameterisation of the converters since the converters often identify the all-pole sinus filters as a short circuit, and switch off for reasons of safety. Normally, it can be agreed with the converter manufacturer and remedied.

Many converter products and types are not suited for the use in all-pole sinus filters.

Converters with downstream all-pole sinus filters or converters with integrated all-pole sinus filters can be purchased at thermofin GmbH. The same apply to all-pole sinus filters for necessary retrofitting of existing systems.