Electro-Magnetic Interference (EMI)

Introduction

Electro-Magnetic Interference (EMI) is sometimes referred to as Radio Frequency Interference, EMI/RFI, or simply electrical noise. The terms refer to any degradation of normal equipment operation due to radio frequency signals (10 kHz to 1000 MHz) or electrical noise acting on the equipment. EMI can be either conducted in the power lines, radiated from equipment, motor cables or radiated from the connected wiring. Static power conversion equipment such as Adjustable Frequency Drives (AFDs), DC drives and electronic power supplies are potential sources of EMI, and are also potentially affected by EMI. Conducted interference at frequencies below 10 kHz may be classified as harmonic distortion.

AF Drives as Sources of EMI/RFI

AFDs are unlikely to cause EMI problems in typical industrial installations. The input power conversion circuit used by AFDs consists of a diode bridge rectifier or an SCR phase controlled converter circuit. The diode bridge circuit is less likely to generate EMI than a phase controlled SCR converter circuit.

Since the AFD output is a PWM waveform, the motor leads may be a source of EMI. Where sensitive equipment is nearby, the motor leads should be enclosed in a grounded steel conduit to minimize the potential for radiated interference. **Control wiring or wiring to other equipment including ground wiring should never be run in the same conduit as the motor leads or power leads**.

Under FDD regulations for radiation measurements, the frequency range of 30 MHz to 1000 MHz is specified. For conducted measurements, a frequency range of 450 kHz to 30 MHz is used. Test results will indicate the noise level in the test facility. The actual level at the final installation site will largely depend upon the wiring and grounding methods used.

FCC Rules and Regulations, Part 15, Subpart J

Subpart J addresses digital computers are similar electronic equipment, which generate and use radio frequency signals for timing and control purposes. Subpart J sets detailed requirements for computers and related equipment such as calculators, electronic games and digital clocks. These requirements include various radiation limits, conduction limits, verification requirements, test procedures, labeling requirement and instruction manual requirements. Various alternative requirements or limits are applied to the various classifications of equipment. Industrial equipment such as AFDs, transportation equipment and appliances are exempt from meeting the detailed requirements that are imposed

on computers and closely related equipment. Per paragraphs 15.801, 15.803, 15.3 and 15.4, these types of equipment are required only to meet the general requirement that they must not cause any emission, radiation or induction which endangers the functioning of a radio navigation service, or of other safety services, or seriously degrades, obstructs or repeatedly interrupts a radio communication service. There are no set limits or test procedures included in this requirement.

If a specification requires an AFD to comply with FCC 15J or if a drive is said to comply with FCC 15J, it could be assumed that only the general noninterference requirement of 15.803 is included. If more extensive requirements were intended to be included, they would need to be described in detail. Verification test methods in particular need to be defined.

Appendix A of 15J describes methods of measurement of radio noise emissions from computing devices. The FCC uses these methods when conducting certification tests. Manufacturers are presumably expected to use these methods when conducting verification tests. These test methods are designed for use with computing equipment and equipment similar to computing equipment. Test methods are not provided for equipment which is exempt from complying with the requirements of 15J.

Effects of EMI on AFDs

AFDs may be susceptible to interference caused by portable radio transmitters such as walkie talkies used by maintenance personnel. These transmitters may cause nuisance shutdowns and speed fluctuations when operated near an AFD, particularly if the AFD is not housed in a grounded steel enclosure. When the AFDs are installed with control wiring in steel conduits, shielded cable is used where specified, enclosure doors are closed and proper grounding methods utilized, difficulty with typical portable transmitters is not expected.

Recommendations to Specifiers

When selecting equipment to assure electromagnetic compatibility, specifiers should rely on practical experience with similar equipment operating in actual installations. To reduce the possibility of interference, use shielded cable where possible, or at a minimum, continuous steel conduit and fittings on all wire entering the AFD cabinet. Additionally, the drive cabinet must be properly grounded by the installer per the manufacturer's recommendations and appropriate local codes. All relays or contactors inside the drive cabinet added by the contractor or others must have the proper RC suppression filters across the relay or contactor coils. Cutler-Hammer can supply filters, which will provide additional protection to equipment which may be sensitive to EMI.