

EMI FILTERING AND MIL-STD-461B

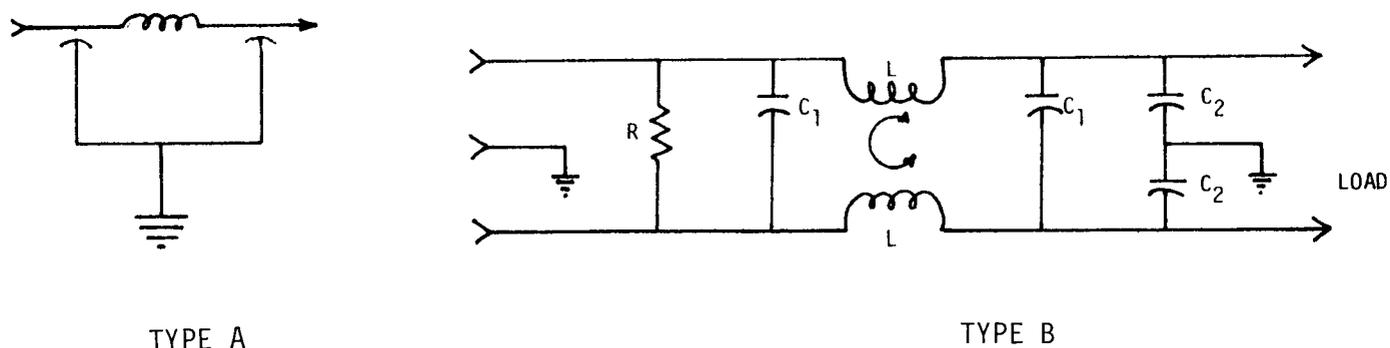


Figure 1.

MIL-STD-461B has many subtle requirements which frequently are being overlooked by EMC control engineers and contract personnel. One of these requirements is the limitation in the amount of capacitance which is allowed between the powerline and chassis ground for EMI ground control filters.

Paragraph 4.3.1. of MIL-STD-461B, Part I, states that the use of line-to-ground filters for EMI control shall be minimized. This does not mean that they should not be used nor form a basis for the argument of exceeding the conducted emission requirements on powerlines. As explained in the subject paragraph, such filters establish a low impedance path for structure (common-mode) currents through the ground plane and can be a major cause of interference in the systems, platforms or installation because these currents can couple into other equipment using the same ground reference. The dumping of noise currents, as well as leakage currents, into the ground plane (often the hull of the ship or fuselage of an aircraft) makes this ground reference a high noise source. If allowed to continue without any limits to the amount of powerline and noise current being dumped into the ground, the bonding of equipment could cause more problems than it would solve. Furthermore, there are limits to the amount of reactive current and maximum capacitance to chassis set forth in MIL-STD-454 and MIL-E-16400.

Thus, MIL-STD-461B states that the total line-to-ground capacitance shall not exceed $0.1 \mu\text{F}$ for 60 Hz equipment and $0.02 \mu\text{F}$ for 400 Hz equipment. This will limit the powerline current to 5 mA, consistent with MIL-STD-454 and MIL-E-16400 requirements. It is important to note that the equipment filtering employed must be described fully in the equipment's or subsystem's technical manual as well as in the EMI Test Report, as specified in MIL-STD-461B. Since many EMI filters are added as a result of EMI tests, the test report is often the first official document showing their use, usually prior to the request for an ECP.

Procuring Activities are aware that many contractors may argue that compliance with the conducted emission or susceptibility requirements of MIL-STD-461B is not possible unless large capacitors are used in the EMI filters. Most commercial computing devices, in point of fact, now use EMI filters in conformance with Underwriter's Labs (UL) leakage requirements consistent with the MIL-STD-461B requirements. The technology and commercial filters for conformance to the requirements are available. The problem of filters not being of military quality nor on a qualified parts list can be remedied by the equipment or filter manufacturer pursuing an appropriate component qualification procedure. The filtering requirement *must* be adhered to in order to achieve the compatibility of the equipment or subsystem when it is integrated into the overall end system.

Figure 1 shows two types of EMI filters. Type A is simplified standard π configuration which has been used in military equipment for many years. Type B is a sample configuration used by the computer industry with minimum capacitance to chassis.

Since most powerlines interface with equipment supplies, equipment designers should soon become familiar with the provisions of MIL-HDBK-241B now being circulated within the government for review. This handbook provides graphic details of how a power supply may be designed to minimize the conducted emissions and to reject unwanted conducted signals. The proper use of the guidelines and provisions of MIL-HDBK-241B should help the equipment manufacturer to minimize the use of EMI filters at the power interface.

This article was prepared for ITEM by the technical & editorial staff of R & B Enterprises.

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