

POPULAR RF SHIELDING SYSTEMS—COMPARATIVE MERITS AND DEMERITS

In the last three years, and in particular within the last year, the demands for RF shielding systems of all types have reached an all-time high. While the end use of these rooms has remained constant, (interference-free test areas and secure areas), the size of the enclosures, amount of enclosures, and variation of design details have significantly changed.

The testing instrumentation and the testing specifications have instituted demands for excellence in RF background at limits never before seen. As the technical advances of the user instrumentation occurred, the demands for lower background levels and higher attenuation characteristics of the RF shields appeared.

The upward trend for more and technically higher capable computers (particularly in secure areas) increased considerably the demand for RF shielding. This trend manifested itself in more shielded rooms and large areas. In fact, it is not uncommon for major portions of entire buildings, and entire buildings, to be RF shielded. This need is particularly evident in areas requiring EMP and HEMP protection.

A natural result of this increased demand for RF shields has been the upgrading of specifications and design of the shields. It is a natural urge on the part of design engineers to attempt to upgrade performance and at the same time to decrease costs. New and/or radical design changes have not been fully accepted as yet. Thus, the old and reliable proven systems are still in general use. These systems are;

1. Panel and Joint System, 75% of projects.
2. Welded Steel Systems, 15% of projects.
3. Foil and/or Soldered Systems, 10% of projects.

The RF shielding systems noted above are for the wall, floor, and ceiling shielding only. The penetration components such as the doors, pipe penetrations, power line filters, wave guide vents, etc. are either identical or very similar in all systems. In other words, the only difference in RF shielding systems is the wall, floor, and ceiling surface shielding method. All of the penetrating components are basically the same.

The **PANEL AND JOINT SYSTEM** remains the most versatile, cost sensitive, and overall reliable. It is modular, demountable, and available from many responsible sources throughout the United States.

The **WELDED STEEL SYSTEM** is gaining in popularity and use. To be sure, there have been some growing pains in its use and permanence of the installation. Once welded into place within the general building construction, it is a permanent fixture. This type of system tends to be used on large and extra large projects. Because of the very high installation costs, the bidding of this system seems to resolve to one or two

suppliers only. A large and financially stable company or joint venture is necessary to bid on and install welded steel.

The **FOIL SYSTEMS** seem to have difficulty in meeting their performance requirements. They can tend to be shy on attenuation results, if not at completion, then soon after. This type of system has many features of design deficiency. Most notable is the overlapping, pressurized, contacting area of the foil. This seems to loosen, oxidize, and to relax out of place, resulting in RF leakages. Occasionally, at the overlap area of the floor steel, rust is the culprit. The fragility of the foil holds suspect all interfaces with the penetrating components such as the doors, filters, vents, etc. A major advantage of foil systems is lost.

The **SOLDERED COPPER SYSTEMS** are fairly new in popularity and have proven to be very reliable and effective. The general use of this system to date has been in the RF shielding of NMR (Nuclear Magnetic Resonance) suites. There is no reason why, in the future, this system could not be used in many other RF shielding applications. This system has a definite price advantage over all of the other systems.

The usual attenuation characteristics of these popular RF shielding systems are given in Table 1. 60, 1kHz, and 10kHz are magnetic field readings. All other readings are electromagnetic. All numbers noted are in dB. The method of attenuation measurement is MIL-STD-285 or NSA 65-6.

The 1984 price ranges for the per square foot of RF shielding surfaces of the systems detailed in Table 1 are:

- A = \$22.00 to \$40.00.
- B = \$28.00 to \$48.00.
- C = \$30.00 to \$50.00.
- D = \$26.00 to \$45.00.
- E = \$24.00 to \$50.00.
- F = \$22.00 to \$50.00.
- G = \$23.00 to \$38.00.
- H = \$18.00 to \$28.00.

These prices are for the full surface area of the RF shield, including the floor, walls, and ceiling. The wide variation in the prices of each system is caused by the size and component content of each enclosure. A small room with a high count of penetrating components will fall into the high end of the price spectrum. Conversely, a large room with few penetrating components will be at the low end of the price spectrum. The price ranges include the entire RF shield at the floor, walls, and ceiling. In addition, they also include all penetrating RF components such as the doors, vents, filters, etc.

#	60	1kHz	10kHz	100kHz	1MHz	10MHz	100MHz	400MHz	1GHz	10GHz
A—Panels, 2 × #28 gauge galvanized steel	2	20	90	100	100	100	100	100	100	100
B—Panels, 2 × #18 gauge galvanized steel	8	45	90	100	100	100	100	100	100	100
C—Panels, 2 × #11 gauge galvanized steel	30	80	90	100	100	100	100	100	100	100
D—Panels, 2 × #12 gauge aluminum	—	—	—	90	100	100	100	—	—	—
E—Welded, #11 gauge steel	12	60	90	100	100	100	100	100	100	100
F—Welded, #14 gauge steel	8	34	90	100	100	100	100	100	100	100
G—Foil, 2 × % MIL aluminum	—	—	—	30	40	50	50	40	—	—
H—Soldered, 1 × 12 ounce copper	—	—	40	90	100	100	100	100	—	—

Table 1. Attenuation Characteristics of RF Shielding Systems.

Also included is the full installation of all materials, and the final RF testing. Not included, are such items as taxes, bonds, finishes, HVAC, electrical work, plumbing, etc.

The above prices are based on actual price quotations by many of the present qualified suppliers of these various shielding systems. The upcoming year of 1985 will in all probability result in a price increase of 5%.

An increased demand for RF shielding systems is fully anticipated with wider frequency ranges, higher attenuation needs, and larger sizes. Not anticipated is a new or radical RF shielding system that will replace any of the systems described above, at least within the coming year.

This article was written for ITEM 85 by Charles S. Snow, REPCON Corporation, Trumbull, CT.

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