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**Product  
Bulletin**

**Note-110**

## **E-SHIELD EMI FOIL Installation Instructions**

### **E-SHIELD EMI FOIL Installation Instructions**

The general procedure for installing **E-SHIELD** materials starts with preparing the surface. Next, cover corners and edges followed by ceiling and walls. If the room is an existing space, each penetration (light switch, outlet, and telephone jack) requires special treatment. After treating all penetrations, install the floor and then install any shielded doors. Test the room and repair any tears or leaks. The order on installation can vary depending on the project. Finally, apply the surface treatments.

*The suggested list of tools needed is as follows:*

Razor Knife or	Thin Butyl, nitrile or neoprene
Scissors	Gloves
Trowel	Coveralls and Long Sleeve
Putty Knife	Shirts
Measuring Tape	Flat Bladed Soldering Iron
Hard Rubber Roller	40/60 Non Corrosive Flux
E-SHIELD FOIL	Solder
E-SHIELD TAPE	Non Corrosive Flux
Ladder	Framing Square
Paint brush and	Rags
roller	Bucket for Water
Roller pan	Dust mask
Thin Cotton Gloves	Neoprene Contact Adhesive (Option)

#### **Surface Preparation**

Remove all loose and peeling paint, patch holes and cracks and dull glossy surfaces by sanding. Allow stucco, plaster and masonry to cure 4-6 weeks. Wash all surfaces with a strong cleaning solution, rinse thoroughly with clear water and allow to dry. Prime patched areas, bare wood, metal and porous surfaces with a latex primer sealer

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before shielding.

### **Installation Considerations**

The principal method of installing **E-SHIELD FOIL** material is with the Pressure Sensitive Adhesive (PSA) backing that is available or use a neoprene based contact adhesive.

#### **1) Use of Adhesive:**

If using the Adhesive, apply the adhesive to the surface via roller, brush or spray. Let dry until tacky. Apply the same adhesive to the **E-SHIELD** foil with a roller. Apply the foil to the surface.

A simple overlap of a minimum of three inches (8 cm) at all seams has shown good results. We recommend a four inch (10 cm) overlap at interfaces between **E-SHIELD** and other types of shielding materials such as metal pan floors or ceilings. Brush the seam with adhesive and wipe off the excess. After removing the excess adhesive, press the seam with a roller under pressure (hand pressure is sufficient). For added seam integrity, a conductive adhesive or **E-SHIELD TAPE** can be applied to the seam area.

- ✓ Good ventilation should be available when using solvent-based adhesives. Wearing of respiratory masks is recommended. Please refer to the Material Safety Sheet for the adhesive, for any other precautions.

#### **2) Use of Staples:**

The **E-SHIELD** can be stapled to a wooden stud structure; however stapling provides a less effective seam to electromagnetic energy than is obtained via overlap with a vinyl adhesive seam. Stapling is useful when placing paneling, drywall, or plywood on top of the

**E-SHIELD** foil and when shielding performance is needed only to 1 to 2 GHz. A simple overlap of a minimum of three inches (8 cm) at all seams has shown good results. We recommend a four inch (10 cm) overlap at interfaces between **E-SHIELD** and other types of shielding materials such as metal pan floors or ceilings. Use a good grade of copper, monel or stainless steel staple to reduce the risk of corrosion and to provide galvanic compatibility with the **E-SHIELD** material. All metals used in a shielded enclosure must be galvanically compatible or a difference of electrical potential could develop which can cause corrosion. The plates used for penetrations should be made from materials that are galvanically compatible with copper or nickel depending on the **E-SHIELD** material being used.

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### **3) Use of Pressure Sensitive Adhesive Backing:**

Remove the paper support backing from the **E-SHIELD** foil as the foil is applied to the surface. Keep the foil tight and avoid entrapped air bubbles. Using a plastic trowel or blade, smooth the foil as you would traditional wallpaper. Be careful not to rip or tear the foil. The foil should be as flat and smooth as possible. A simple overlap of a minimum of three inches (8 cm) at all seams has shown good results. We recommend a four inch (10 cm) overlap at interfaces between **E-SHIELD** and other types of shielding materials such as metal pan floors or ceilings.

### **General Instructions & Precautions:**

When installing **E-SHIELD** foil, wear gloves to protect hands from contact with the sharp edges of the foil and protect the foil from contamination from sweat and oils from the hands. The recommended gloves are butyl, nitrile or neoprene gloves with cotton inspection gloves over the top. The wearer will be more comfortable if another pair of cotton gloves is worn underneath the plastic gloves. In enclosed areas an evaluation should be made to determine if additional respiratory protection or engineering controls are needed.

**E-SHIELD** products may be cut using standard wallpaper cutting tools such as a razor knife and metal straight edge or a good pair of scissors. Cotton and plastic gloves should be worn while cutting the foil.

### **Corner Installation**

The three-way corners should be installed in the upper four corners of the room first. The installation is accomplished by cutting the **E-SHIELD** foil into a 12 inch (30 cm.) square, creasing the material into four quarters, and then folding the material back onto itself into a three-way corner. To insure a good bond, apply the adhesive to the mounting surface and the back of the **E-SHIELD** foil using a paint roller. Place the foil into the room corner and roll with the rubber roller until smooth. Be sure to fit the foil flush on all sides since most corners are not square.

Treat outside and irregular corners the same way. Fold a 12 inch (30 cm) square into quarters, then unfold and place over the corner. Insure that there are no tears or gaps inside the corner. Where these join the floor and ceiling, make sure material overlaps on all sides by at least three inches (8 cm) for the two-way corner, cut the material 12 inches (30 cm) wide and the full length of the wall, from 3-way corner to 3-way corner with a 3 inch (8 cm) overlap at each corner. Fold the material 90 degrees and install as described above.

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### **Ceiling Installation**

For suspended ceilings, cover the top of the room (above the ceiling panels) with the **E-SHIELD** shielding, first by doing the three-way corners and then the two-way corners and finally by covering the whole ceiling. It is important to establish the locations of the ceiling joists so that later the drop ceiling hangers can be properly installed. Only the penetrations for the ceiling hangers need any special care on installation. The key is to make sure a tight, conductive; metal-to-metal seal is achieved between the fastener and the shielding material. After installing the hangar, place a strip of conductive tape over the entire metal surface of the hangar and a distance of three inches (8 cm.) around it. If a drywall ceiling is required such as in an operating room, then a false drywall ceiling should be installed below the shielding. In the space between the shielding and lower ceiling, wiring for lights and power can be installed as required. The surface of the lower ceiling can be painted with enamel, latex or covered with special paneling which provides a washable surface required for operating rooms.

### **Wall Installation**

After installing the corners and ceiling, cut the wall material to run floor to ceiling and install by coating small sections of the wall with the vinyl wallpaper adhesive. Only apply adhesive to the area to which **E-SHIELD** shielding material can be applied before the adhesive dries. Install **E-SHIELD** foil in a similar fashion as wallpaper is applied to walls. Carefully align the top edge and apply so it is plumb with the proper 3" overlap. After smoothing by hand, roll the material over the entire surface with a hard rubber roller to force out air bubbles. An alternative is to hang the **E-SHIELD** horizontally in strips to minimize the length and number of seams. This should be considered where the standard 46 (1.1684 m) inch width will yield only two seams, such as on walls less than 8'9" (2.66 m) high.

### **Partition Walls**

Install interior partition walls by first installing the floor and ceiling tracks, then installing the fasteners so as to maintain an electrically continuous seal. At each anchor screw, a folded square of **E-SHIELD** material should be located beneath the track and a washer should be used under the head of the screw to provide a compression seal where the screw penetrates the shielding material in the floor or ceiling to eliminate the potential for "antenna effects." Then install the vertical studding complete with wiring, wall switches, outlets and drywall.

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### **Finishes or Aesthetic Coverings**

If the shielded enclosure does not require any interior treatments, the **E-SHIELD** foil may be left exposed. It should be adhered with the PSA or adhesive glue to the entire interior surface to minimize possible damage due to tearing. **E-SHIELD** is available in colors, coated with a vinyl coating that has environmental resistance.

Refer to the Technical Data Sheet on **E-SHIELD WPAL** for additional information and colors available. Discuss with your needs with your Eagle Group NE Representative.

- Paneling: Should there be some risk to puncturing the **E-SHIELD** wall covering, attach standard wall panel directly to the **E-SHIELD** foil using construction grade adhesives such as Liquid Nails.

For facilities requiring only 40 dB shielding below 2 GHz, drywall can be applied directly over the **E-SHIELD** material. Use screws to secure the drywall and to make contact with the **E-SHIELD** as they secure to the backing material.

### **Floor Installation**

1. First install the **E-SHIELD** with PSA or contact adhesive. Then use a construction grade adhesive to glue hardboard or plywood material to the floor and apply the floor treatment.
2. For rooms requiring crawl space access, such as computer rooms apply the **E-SHIELD** foil to the floor with PSA or contact adhesive. Build up the access floor by laying the grid work on top of the **E-SHIELD** foil. A folded patch of **E-SHIELD** foil under each support of the raised floor will cushion the **E-SHIELD** foil from damage.
3. A third form is a solid metal floor. If liquids are routinely spilled, such as in an operating room, then install a solid metal floor and tile. The metal should go up the sides of the wall a length of six inches over which the **E-SHIELD** material on the walls is overlapped and attached using contact adhesive. The metal should be one that can be soldered easily such as sheet copper. The metal should be lapped and then continuously solder sealed along each seam. This type of floor is also useful on high activity floors.

### **Installation of Penetrations and Doors**

After installing the **E-SHIELD** over all interior surfaces, install the penetrations. It is essential that the shielding material lap under the penetration flange a minimum of three inches (8 cm). To insure a good electrical bond, apply

**E-SHIELD** tape over the flange and at least three inches (8 cm) on the wall around

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the penetration flange.

The shielded door is the most important of the penetrations in a shielded enclosure. It is generally the weakest link in the system and the most difficult to maintain due to its high usage. Our architectural partners can, in many cases, retrofit existing doors to provide 40-60 dB of shielding effectiveness or provide a low cost door to meet these requirements.

Install the **E-SHIELD** foil around the edges of the rough opening. Then set the metal door frame in the rough opening. **E-SHIELD** foil is then installed bridging from the wall to overlap the metal frame of the door. It is important to make electrical contact around the entire door frame. Install the **E-SHIELD** foil so that no gaps are visible around the perimeter of the door. Be especially careful to see that the **E-SHIELD** material on the floor is in good contact with the bottom of the door frame. Resilient gaskets may be used to fill gaps between the door and the rough opening. Additional instructions can be found in the manufacturer's literature. Testing of the installed door is highly recommended.

### **HVAC Vent Installations**

All HVAC (Heating, Ventilating and Air Conditioning) piping requires special treatment when penetrating a shielded surface. For high performance applications, each entrance is equipped with shielded vents consisting of honeycomb material mounted in a frame set in the wall or ceiling of the enclosure. Low or moderate performance vents consist of perforated sheet metal mounted in a frame three inches (8 cm.) wide mounted around the opening of the vent. The three inch (8 cm.) wide sheet metal frame provides good electrical contact between the **E-SHIELD** shielding material and the vent.

### **Electromagnetic Filter Installations**

All wiring entering the shielded space must be filtered, including telephones, thermostats, fire sprinkler controls, computer lines, fire alarms, and intercoms. The key to a proper installation for these devices is to be sure that the filter impedance properties are matched to the device being filtered. If the proper filter is not selected then the system in most cases will not function properly. It is best to discuss specific applications with a filter manufacturer. For facilities where Radio Frequency Interference (RFI) is the greatest concern, ferrites applied to power and communications lines may provide acceptable attenuation at low cost.

For new construction and for rooms with many (more than 6) electrical outlets, the most cost effective method is often single entrance filtering. The advantage of single entrance filtering is that only one power-line filter is required. The disadvantage is that the power must then be run to each outlet within the shield, usually in conduit. It

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is recommended the conduit be installed AFTER the final room finishes are installed and installed using pressure sensitive adhesive. If screws are used, be careful to maintain a metal-to-metal seal is made between the screw and the **E-SHIELD** shielding.

### **Pipe Penetrations**

The pipe penetration consists of a pipe that is silver soldered or welded onto the plate. The pipe is sized to provide waveguide beyond cut-off operation at the highest operating frequency.

### **Windows**

In retrofit applications, remove the old window and use its rough opening to size the new shielded window. In new construction, the window is roughed in on all four sides. Overlap the **E-SHIELD** shielding over the rough opening and install the window from the inside. Screw the inside flange to the **E-SHIELD** foil around the perimeter of the window opening using the mounting screws to bring pressure on the shield. Then place a second layer of **E-SHIELD** around the flange to assure a good RF seal.

A lower cost option is to stretch metallized mesh over the opening, overlapping the window opening by 3 to 4 inches (8 to 10 cm.). Then place a second layer of **E-SHIELD** foil over the mesh material around the perimeter of the window opening. A lath or decorative trim may be installed around the perimeter of the window to hold the mesh securely. A storm window containing mesh can also be secured to the flange using fabric-over-foam conductive gasket to provide EMI seal.

### **Removable Panels**

Use removable panels for mounting groups of connectors used for instrumentation. The panels require special care since the connection between the frame and the shielding can be strained with multiple removals of the panel. The size of the panel is based upon the number of connectors that need to be mounted in the shielded wall for fiber optics, data lines, coaxial connectors, etc.

Ground studs are commonly required to provide a low resistance path between equipment inside a shielded enclosure and earth ground located exterior to the shield. Mount the ground stud near the power line filter installation.

### **Light Switches**

All electrical penetrations from outside the shielded enclosure must be shielded or filtered. The simplest method of maintaining shielding effectiveness at a light switch is to replace the cover with a shielded conductive rubber which permits operation of the flat or toggle switch, but maintains the conductivity of the shield over the entire switch.

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### **Shielding Repairs**

Repairing **E-SHIELD** foil is a matter of providing adequate contact between the repair and the original material. Remove the finish to expose the **E-SHIELD** foil for a distance of 3 inches (8 cm.) around the damaged area. For small areas, use PSA backed **E-SHIELD** or contact adhesive to paste a patch of PSA backed **E-SHIELD** foil over the damaged area insuring that there is sufficient contact between the original shielding material and the new patch to provide electrical conductivity. After the adhesive is dry, the PSA backed **E-SHIELD** may be treated with any of the coverings described above.

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