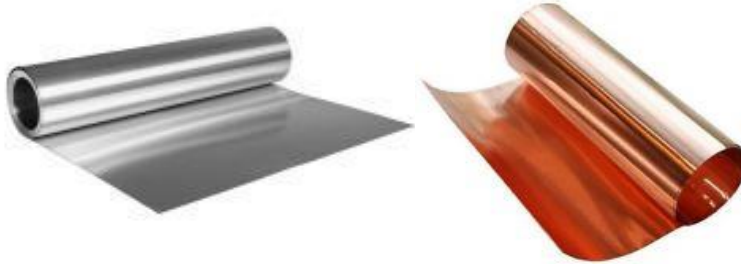


EMI-Shield EMI / RFI FOIL Shielding (Aluminum, Copper and Stainless Steel)

Installation Instructions 2018 Rev A



The general procedure for installing **EMI-Shield** materials starts with preparing the interior surfaces. Clean all surfaces, so they are free of dust and debris. Next, cover corners and edges followed by ceiling, floors and walls. If the room is an existing space, each penetration (light switch, outlet, and telephone jack, HVAC duct, etc.) may require special attention. This will depend on the shielding performance desired. In most cases this means terminating the metallic wires in the outlet box, adding in EMI filters and surface mount conduit. After treating all penetrations, install the ceiling, walls and floor shielding. Then install any shielded doors, HVAC ducts, pipe penetrations and EMI filters. Test the room and repair any tears or leaks. The order on installation can vary depending on the project. Finally, apply the finish surface treatments.

The suggested list of tools needed is as follows:

Razor Knife or Scissors	Metal Shears or Nippers
Plastic Trowel	Gloves
Measuring Tape	Thin Butyl, nitrile or neoprene Gloves
Hard Rubber Roller	Coveralls and Long Sleeve Shirts
EMI-Shield FOIL	Framing Square
EMI-Shield TAPE	Dust mask
Ladder	Microfiber Towels
Paint brush and roller	Neoprene Contact Adhesive (Option)

General Instructions & Precautions:

When installing **EMI-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. **EMI-Shield** products AL5 may be cut using standard cutting tools such as a razor knife and metal straight edge or a good pair of scissors. AL20 will require metal shears, nippers or saw to cut. Eye protection and gloves should be worn while cutting the foil.



Cautions:

For commercial construction, make sure every metal stud (that makes up the RF shield room perimeter) is electrically connected to the building electrical ground or earth ground.

Use electrically conductive sheetrock screws. Avoid epoxy coated screws. Typical types are steel, carbon steel or galvanized steel with self-drilling tip. Approved screw coatings are: no coating, black phosphate or zinc. Electrically conductive stainless steel screws are also acceptable.

Since aluminum is subject to attack by alkalines it should not be allowed to come in contact with wet concrete or mortar. If aluminum in contact with concrete (or even other metals) is subject to wetting (as would happen outdoors), the aluminum should be insulated from the concrete, mortar, or metal by adding a barrier like: asphalts, several coats of paint or sealer, 6 mil plastic sheeting or a neoprene adhesive.

Installation Considerations

The principal method of installing **EMI-Shield Foil** material is with the Pressure Sensitive Adhesive (PSA) backing for primed sheet rock covered walls and use a neoprene based contact adhesive for the concrete walls and floors. Ceilings can be shielded with **EMI-Shield Foil**, RF shielded panels or RF shielded Ceiling panels.

1) Use of Pressure Sensitive Adhesive Backing: (Recommended for applying to primed sheetrock)

Remove the paper support backing from the **EMI-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. See installation instructions below.

2) Use of Adhesive: (Recommended for applying to CMU, Concrete or any rough textured surface)

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 **EMI-Shield** foil with a roller. Follow adhesive manufacturer's application instructions. Apply the foil to the surface. See installation instructions below.

- 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.

3) Use of Staples: (Not Recommended)

The **EMI-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 **EMI-Shield** foil and when shielding performance is needed only to 1 to 2 GHz. See installation instructions below. Use a good grade of copper, monel or stainless steel staple to reduce the risk of corrosion and to provide galvanic compatibility with the **EMI-Shield** material.

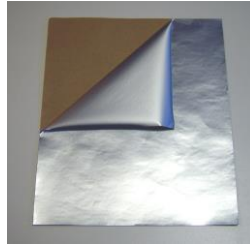
Staples should also be covered with electrically conductive foil tape patches.

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 aluminum, copper or nickel depending on the **EMI-Shield** material being used. Galvanized steel flashing is also permitted.

The EMI-Shield foil must be attached (glue or PSA) to the interior of the fire rated first layer of sheetrock (typical), wood (not common), CMU, concrete or other flat surface. Do Not glue or staple the foil directly to the wall studs.

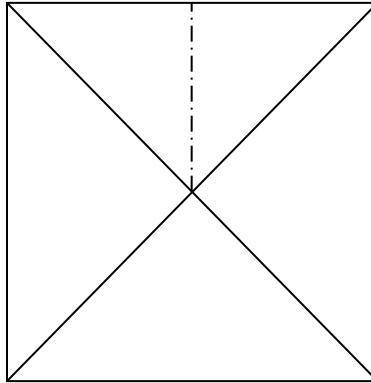
Existing Room Surface Preparation

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 before shielding.



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 **EMI-Shield** foil into a 6 inch or 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 **EMI-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. The 6" wide AL5 tape is ideal for this.

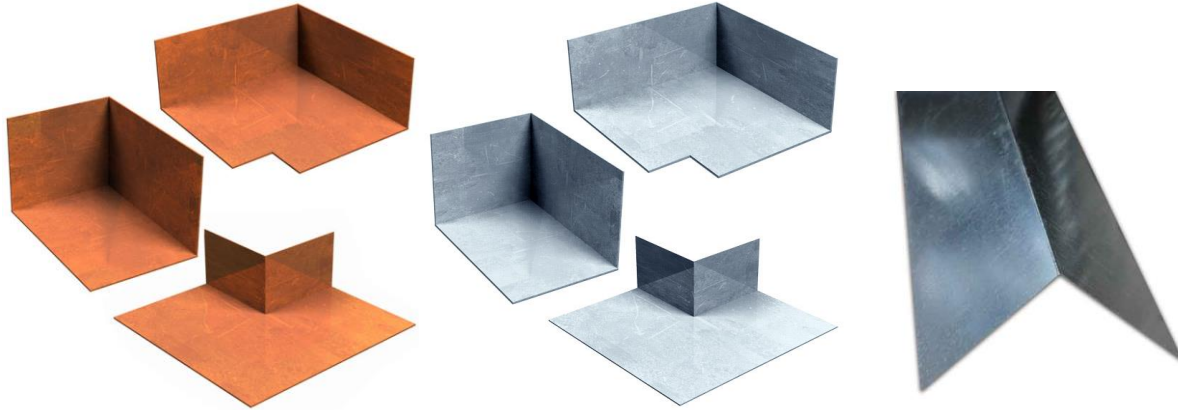


Treat outside and irregular corners the same way. Fold a 12 inch (30 cm) square into quarters, then unfold and place over the corner. Insure that there are no tears or gaps inside the corner. Where these join the floor and ceiling, make sure material overlaps on all sides by at least three inches (8 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.

Install your eight corners first, then cover all of the perimeter corners with 6" wide foil tape. Wall to wall, wall to ceiling and wall to floor corners are easily accomplished with 6" wide foil tape with PSA. This will make the ceiling, floor and wall panels much easier to install.

For quicker installation and better coverage over uneven areas, galvanized steel, copper or aluminum flashing can also be used for corners and edges. (Highly Recommended)

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Ceiling Installation

For suspended ceilings, cover the top of the room (above the ceiling panels) with the **EMI-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 **EMI-Shield** shielding material can be applied before the adhesive dries. Install **EMI-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 2" to 3" overlap. After smoothing by hand, roll the material over the entire surface with a hard rubber roller to force out air bubbles.

Most Common Methods of Application:



4" Electrically Conductive Foil Tape (Recommended)

- 1) The **BEST Method** (Method 1 Above) is to overlap the **EMI-Shield** foil and tape the seams with similar metal tape that has **electrically conductive PSA**. A minimum 2" overlap or 4" wide tape is recommended. This method insures that each foil panel is electrically conductive to every other foil panel in the system (ideal for a Faraday cage) and eliminates any ungrounded panels acting as antennas.



4" Electrically Conductive Foil Tape

- 2) Second Best method (Method 2) is to butt joint the **EMI-Shield** foil and tape the seams with similar metal tape using electrically conductive PSA. A minimum 2" overlap or 4" wide tape is recommended. This method does not electrically bond the foil panels to each other, like Method 1. A 1" wide electrically conductive foil tape strip can be added around the perimeter of the room to electrically bond the foil panels together (see bottom of this document for more information).



Non-Electrically Conductive Tape

- 3) A **GOOD** method is to butt joint the **EMI-Shield** foil and tape the seams with similar metal tape using non-electrically conductive PSA. A minimum 3" overlap or 6" wide tape is recommended. This method does not electrically bond the foil panels together and is less prone to RF leaks. A 1" wide electrically conductive foil tape strip can be added around the room to electrically bond the foil panels together.
- 4) Another **GOOD** method is to overlap the **EMI-Shield** foil panels a minimum of 3" and then tape the seam with 3" minimum wide tape. If you look at it you are really just overlapping the panels 4.5". This method does not electrically bond the foil panels together and is still prone to RF leaks. A 1" wide electrically conductive foil tape strip can be added around the room to electrically bond the foil panels together. Wipe the seam clean with a clean microfiber cloth or towel, before applying the foil tape. This removes any dust, oil or dirt that may cause the foil tape not to stick properly. Clean and tape as you go.
- 5) The Least desirable method is to overlap the **EMI-Shield** foil, using non-conductive PSA or glue, a minimum of 3" with no seaming tape used at all. This method does not electrically bond the foil panels together and is the most prone to RF leaks. A 1" wide electrically conductive foil tape strip can be added around the room to electrically bond the foil panels together. Wipe the seam clean with a clean microfiber cloth or towel, before applying the foil tape. This removes any dust, oil or dirt that may cause the foil tape not to stick properly. Clean and tape as you go.

Methods 3, 4 & 5 can be done with electrically conductive PSA applied to the foil or tape.

There are also folding, crimping and soldering methods, but again they add cost with no added shielding performance.

Applying the EMI Foil Tape

Procedure is the same for standard and electrically conductive adhesive (PSA - Pressure Sensitive Adhesive).

Scotch Brite and Clean the already applied foil, about 4 inches on both sides of the seam, Scotch Brite first and then wipe the seam clean with a clean microfiber cloth or towel, before applying the foil seaming tape. This removes any oxidation, dust, oil or dirt that may cause the foil tape not to stick properly.

Scotch Brite, wipe down and tape one seam at a time. i.e. do not clean all the seams in the room and come back and tape. Scotch Brite, Clean and Tape as you go.

Gravity is your friend. It is usually best to start at the top of the seam and work down.

It is also easier to measure and cut the correct length of foil tape from the roll. If it is too long you can cut off the excess. If it is too short, you can clean it and overlap the tape and keep going.

Pull back about 6" to 12" the PSA protection film. Apply the tape so the seam below is in the center and the tape is heading in the correct direction. Use a plastic trowel or applicator to apply pressure to the tape in a sweeping motion, in line with the seam. Pull back the protection film and press with applicator until the complete seam is installed.



When the seam is completed, go over the whole seam with a rubber roller, while applying pressure.



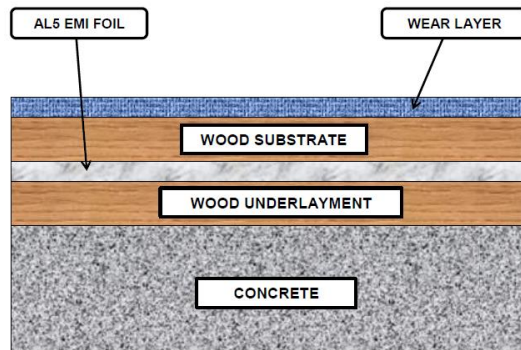
Unshielded Partition Walls

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 **EMI-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.

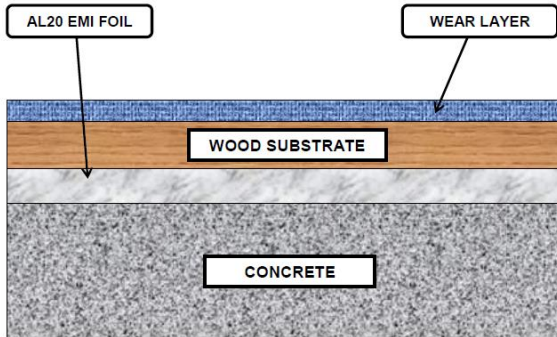
Floor Installation

- 1) For AL5 or AL10 (discontinued) **EMI-Shield** glue down a wood underlayment on top of the concrete first. Then apply the AL5. Then glue a wood substrate (hardboard or plywood) on top of the AL5. Finally, apply the final floor treatment.
- 2) AL20 **EMI-Shield** can be applied directly to concrete. Use Method 1 (above for wall installation) to tape the joints. Then apply substrate or wear layer on top of the AL20.
- 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 **EMI-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.
- 4) ESD flooring has also been used successfully as a shielded floor.

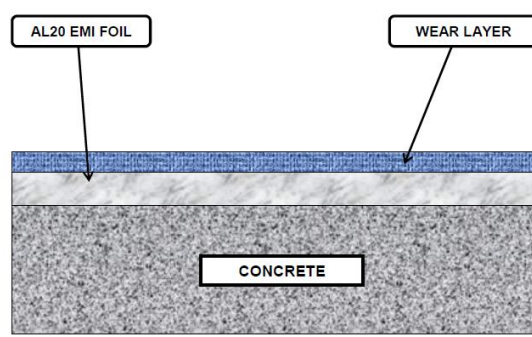
FLOOR STRUCTURE COMPONENTS USING AL5 EMI SHIELDED FOIL (Typical)



FLOOR STRUCTURE COMPONENTS USING AL20 EMI SHIELDED FOIL (Typical)



FLOOR STRUCTURE COMPONENTS USING AL20 EMI SHIELDED FOIL (Minimum)



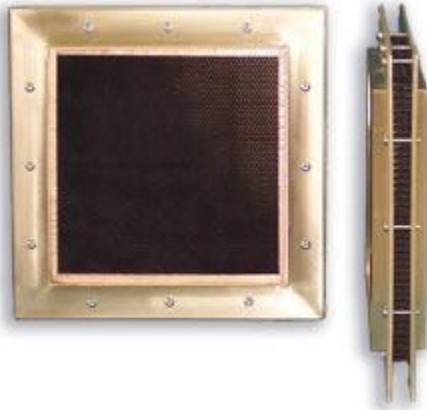
Installation of Penetrations and Doors

After installing the **EMI-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 **EMI-Shield** tape over the flange and at least three inches (8 cm) on the wall around 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 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 **EMI-Shield** foil around the edges of the rough opening. Then set the metal door frame in the rough opening. **EMI-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 **EMI-Shield** foil so that no gaps are visible around the perimeter of the door. Be especially careful to see that the **EMI-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 **EMI-Shield** shielding material and the vent.



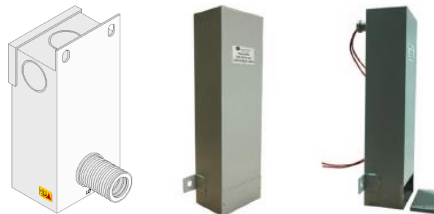
Electromagnetic Filter Installations to eliminate Conducted Emissions

DO NOT PUNCH ANY HOLES THROUGH THE WALLS! Distribution of power and signal cables around the room is usually accomplished using a product similar to Wiremold 6000 wire duct around the lower edge of the room. The power distribution is entirely INSIDE the room. If retrofitting an existing room with existing wall plugs, remove the plugs, and cover the opening with a flat metal plate or heavy foil before installing the **EMI-Shield** foil.

All metallic wiring entering the RF shielded space must be EMI filtered, including AC power, DC power, telephones, Ethernet, 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 an EMI filter specialist (call or email us).

If you do not put EMI filters on all metallic wires entering the RF shielded enclosure, it is just like having a bidirectional antenna installed in the wall, that will bring conducted signal in and conduct signal out, leaving your RF shielding useless. You must have EMI filters installed to eliminate the conducted emissions, coming and going into the RF shielded area.

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 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 **EMI-Shield** shielding.



Pipe Penetrations

The pipe penetration consists of a metal 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. Commonly used for air lines, water lines, fiber-optic lines and exhaust lines. No metallic wires are allowed to go through the pipe penetrations,



RF Waveguide Pipe Penetrations

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 **EMI-Shield** shielding over the rough opening and install the window from the inside. Screw the inside flange to the **EMI-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 **ESHIELD** around the flange to assure a good RF seal.

A lower cost option is to stretch metalized mesh over the opening, overlapping the window opening by 3 to 4 inches (8 to 10 cm.). Then place a second layer of **EMI-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.

Light Switches

All electrical penetrations from outside the shielded enclosure must be shielded and EMI filtered. Standard commercial electrical components can be used both inside and outside the RF shielded area.

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.

Grounding the Shield

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New Room: RF Shield room is constructed from scratch. The framing is first put in place, (usually metal studs), steel floor and all corner flashing installed, the door jams installed, the crawl space and ceiling/roof is treated. After the studs are installed, go around with an ohm meter and make sure ALL studs are securely bonded to building ground. You should get an ohm meter reading of less than 1.0 Ω between the studs and building ground. In some rare cases, you can defer this step to after the steel floor is placed, if the floor is to be the ground reference plane (and is electrically bonded to the ground reference point – usually welded). In this case, ALL studs must be securely bonded to the floor steel plate (tack welded is preferred).

The **EMI-Shield foil** is designed as a multipoint ground system.

Existing Room: Install the **EMI-Shield foil** as described. Locate where the EMI/RFI power filter will enter the room, usually a penetration panel or a threaded pipe penetration. From that location you will run a 1" wide foil tape with conductive adhesive down to the floor. Then run another 1" wide foil tape with conductive adhesive around the perimeter of the room along the floor. This will electrically bond all of the wall foil and floor to earth ground. Then from the power filter entry run a 1" wide foil tape with conductive adhesive up to the ceiling and across all ceiling foil panels. This will electrically bond the ceiling panels to earth ground. The purpose of the conductive tape is to electrically bond all of the foil panels to each other and to earth ground. The conductive tape will be attached to the earth ground via the electrical ground of the EMI/RFI power filter. Verify all panels are electrically bound, take an ohm meter and test all panels, there should be less than 1.0 Ω between any two points in the room. (Also see grounding section at bottom)

Shielding Repairs

Repairing **EMI-Shield foil** is a matter of providing adequate contact between the repair and the original material. Remove the finish to expose the **EMI-Shield foil** for a distance of 3 inches (8 cm.) around the damaged area. For small areas, use PSA backed **EMI-Shield** or contact adhesive to paste a patch of PSA backed **EMI-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 **EMI-Shield** may be treated with any of the coverings described above.

Finishes or Aesthetic Coverings

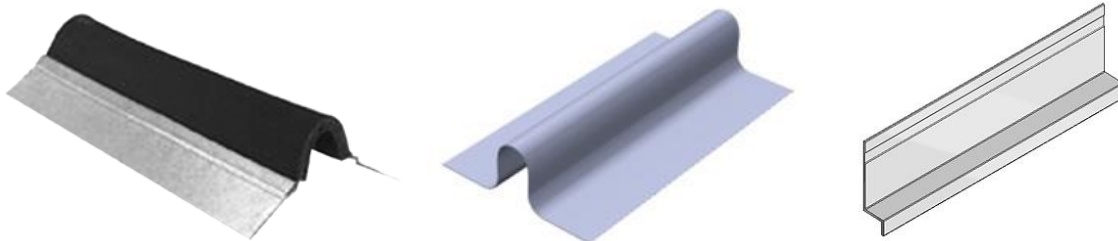
If the shielded enclosure does not require any interior treatments, the **EMI-Shield foil** may be left exposed. It should be adhered with the PSA or adhesive glue to the entire interior surface to minimize possible damage due to tearing. **EMI-Shield** is available in colors, coated with a vinyl coating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

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

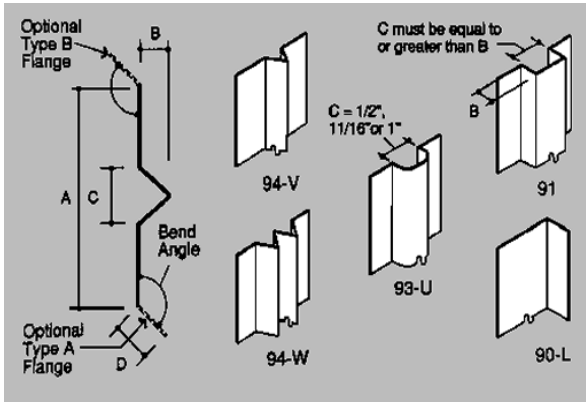
For facilities requiring only 40 dB shielding below 2 GHz, drywall can be applied directly over the **EMI-Shield** material. Use screws to secure the drywall and to make contact with the **EMI-Shield** as they secure to the backing material.

Shielding Expansion Joints

EMI-Shield is not flexible across expansion joints and will fail if it just applied across the joint. In most cases the expansion joints must be bridged with an aluminum flashing that is designed to handle the expansion and contraction. This typically occurs in prefabricated concrete panels and between wall and ceiling joints. There are different many different ways and designs to accomplish this, below are a few examples. (Aluminum flashing is not provided with the **EMI-Shield**)



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Heckmann Building Products



GROUNDING SHIELDED ROOMS LINED WITH FOIL

There are different methods to grounding shielded rooms, lined with foil or built as a structure. The following method is the most appropriate and works effectively in grounding a foiled lined room.

EMI Foil lined RF shielding uses a multipoint grounding system. A single point ground does not work with EMI foil systems, due to the resistance in the electrically conductive adhesive on the seaming tape.

Make sure the metal wall studs are tied to earth or electric ground, per code.

After the first layer of sheetrock and the foil shielding is installed, use electrically conductive sheetrock screws (Avoid epoxy coated screws. Typical types are steel, carbon steel or galvanized steel with self-drilling tip. Approved screw coatings are: no coating, black phosphate or zinc. Electrically conductive stainless steel screws are also acceptable) to install the second layer (inner layer) of sheetrock. The screws will electrically bond every foil panel to ground, effectively grounding the complete foil RF shield.

EMI foil shielding of the floor can be problematic, due to lack of metal studs in the floor (typically concrete). Continuous copper foil strips may be required to bring the grounding out onto the floor before foil or panels are installed. Depending on the shielding effectiveness required, this may or may not be required.

Since aluminum is subject to attack by alkalines it should not be allowed to come in contact with wet concrete or mortar. If aluminum in contact with concrete (or even other metals) is subject to wetting (as would happen outdoors), the aluminum should be insulated from the concrete, mortar, or metal by adding a barrier like: asphalts, several coats of paint or sealer, 6 mil plastic sheeting or a neoprene adhesive.

Please contact us for the best and most economical solution.

Disclaimer

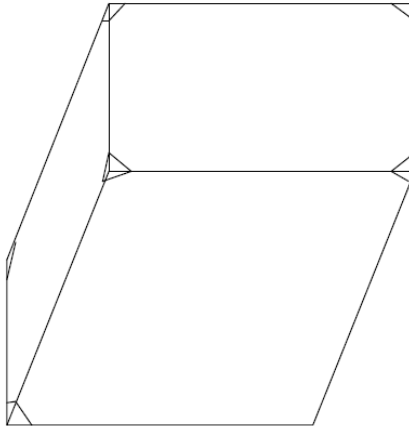
"The information in this installation guide is to our knowledge true and accurate, but all instructions, recommendation or suggests are made without any guarantee. Since the conditions of use of the product are beyond our control, we disclaim any liability for any loss or damage suffered from use of the product, or the instructions, recommendations or suggestions contained herein. Furthermore, no liability is accepted if use of any product in accordance with these instructions, recommendations or suggestions infringes any patent." The information in this Technical Data Sheet, although believed to be accurate, is not to be taken as a warranty



**Step By Step Installation of Foil Rolls using Overlap Method
Using Non Electrically Conductive PSA Foil & Tape**

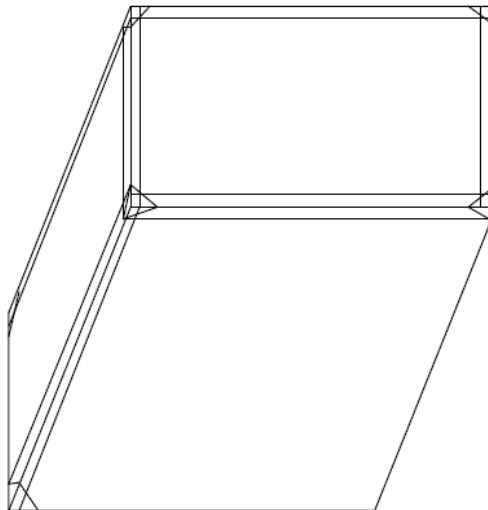
Step 1

Fold the 3 sided corner pieces and install them in all corners



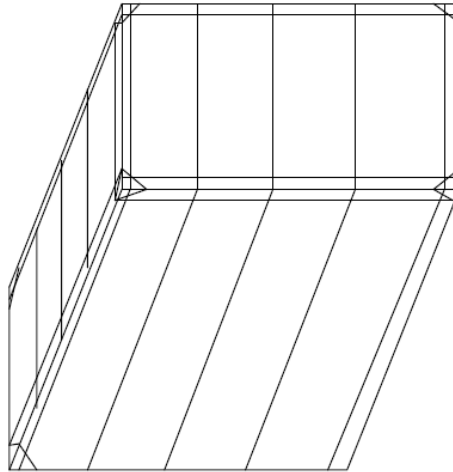
Step 2

Cut your 4" or 6" wide tape to length
Fold the tape in half lengthwise
Install the folded tape in all the wall to wall, wall to ceiling and wall to floor interfaces



Step 3

Install the 24" or 48" wide foil rolls (vertical is usually easier on walls)
Overlap each sheet a minimum of 3"
Completely cover all surfaces



Step 4

Install 1" wide electrically conductive aluminum tape strip to electrically connect all the foil panels
Ideally also connect it to the ground stud

