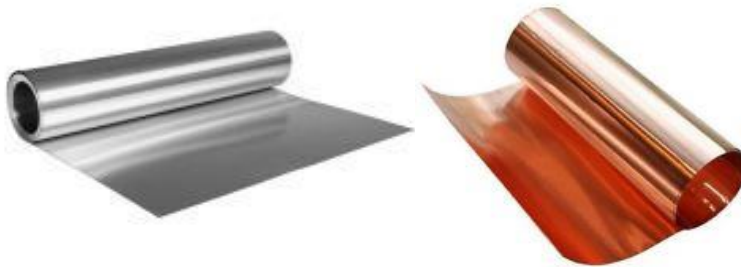


# US Foils EMI-SHIELD

## RF Shielded EMI / RFI FOIL Shielding

### (For Aluminum, Copper, and Stainless Steel Foil)

Installation Instructions 2023 (2/1/2023)



The general procedure for installing US Foils EMI-SHIELD materials starts with preparing the interior surfaces. Clean all surfaces, so they are free of dust and debris. If the floor is concrete, waterproof seal the concrete. Make sure all of the metal wall and ceiling studs are tied to earth ground. Next, install corner flashing; wall-to-wall, wall-to-ceiling and wall-to-floor, with 26 gauge galvanized steel corner flashing. Seal up the corner flashing in the three-surface intersection on the corners with electrically conductive adhesive PSA (ECPSA) foil tape or electrically conductive silicone RTV. Then install the EMI-SHIELD foil on the walls and ceiling, either butt jointed or overlapped, depending on the shielding effectiveness required. Seam tape the foil-to-foil and foil-to-flashing with ECPSA foil tape. Install the floor shielding is either foil or panels, see the different methods of installation below in this document. Typically, the floor shielding is done after the complete wall and ceiling shielding is done. If you are installing an RF shielded suspended ceiling, there is a separate installation instruction sheet.

At this point you need to install all the RF shield penetrations, including the RF shielded doors, HVAC ducts, pipe penetrations and EMI power, data, and security filters, while the EMI-SHIELD foil is exposed. Caveat, the RF shielded door will need a section of the foil floor shielding or 26 gauge galvanized steel flashing installed under the door threshold. The bottom of the door needs to be RF sealed to the floor shielding. At this point you may want to do a quick RF shielding effectiveness test.

Then apply the inner layer of drywall, using clear zinc coated, drill point drywall screws. Making sure each screw is anchored into a grounded metal wall stud or plate. Then install your surface mounted electrical components, light fixtures, etc., again making sure each mounting screw is anchored into a grounded metal wall stud or plate. Finally finish off the room by painting the walls and ceiling, applying the final floor surface, like carper or tile. Last item is to do an RF shielding effectiveness test, if required.

***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
US Foils EMI-SHIELD Foil	Framing Square
US Foils EMI-SHIELD Tape	Dust mask
Ladder	Microfiber Towels
Paint brush and roller	Foil Adhesive

## General Instructions & Precautions:

When installing US Foils 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. US Foils EMI-SHIELD products AL2.5, AL5, CU14 & CU50 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, interior RF shielded walls and ceiling) are 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 screws are clear zinc coated steel screws. Electrically conductive stainless-steel screws are also acceptable in dry environments. **Clear zinc coated steel, self-drilling, Scavenger Head, Wafer Head or Modified Truss Head screws are recommended. An example is Grabber (grabberman.com) Item Number 15SZ**

Visit webpage for latest: [https://www.ramayes.com/Foil\\_RF\\_Shielding\\_Adhesives\\_Primer\\_Sealers.htm](https://www.ramayes.com/Foil_RF_Shielding_Adhesives_Primer_Sealers.htm)

**CONCRETE WARNING - Since aluminum is subject to attack by alkaline(s) it should NOT be allowed to come in direct contact with raw concrete, any concrete material or mortar. If aluminum in contact with raw concrete (or even other metals) and is subject to wetting (as would happen outdoors or fire sprinkler discharge), the aluminum should be insulated from the concrete, mortar, or metal by adding a barrier like: asphalts, several coats of paint, waterproof sealer, 6 mil plastic sheeting (typically on floor only) or a neoprene adhesive. Waterproof paint or waterproof sealer are the most common methods to seal concrete.**

## Installation Considerations

The principal method of installing US Foils 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 or VCT adhesive for the waterproof sealed concrete walls and floors. Ceilings can be shielded with RF shielded foil, RF shielded panels or RF shielded ceiling panels.

**1) Use of Pressure Sensitive Adhesive Backing:** Recommended for applying to primed sheetrock **with a zero VOC requirement.** This, pre-applied at the factory, PSA option is expensive. Applying bare foil with your chosen adhesive is much less expensive (see below).

Remove the paper support backing from the US Foils EMI-SHIELD foil as the foil is applied to the surface. Keep the foil tight and try to avoid entrapped air bubbles. Using a plastic trowel or hard rubber roller, smooth the foil as you would 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 Sheetrock, Plywood, CMU, Concrete, or any rough textured surface)**

If using a contact adhesive, apply the adhesive to the surface via roller, brush or spray, back roll, let dry until tacky. Then apply the same contact adhesive to the US Foils EMI-SHIELD foil with a roller or spray. Some of the non-contact adhesives like Roman PRO-880, can just be applied to the sheetrock or plywood, back rolled and then AL5 or lighter foil can be applied directly (no need to apply the adhesive to the foil). Follow adhesive manufacturer's application instructions. Apply the foil to the surface. See installation instructions below.

3) Approved adhesives for RF shielded aluminum foil installation on to previously primed sheetrock or bare sheetrock, but adhesive must be back rolled are:

- **Dynamite® 111 Heavy Duty Clay**

**Non-Strippable Wallcovering Adhesive**

Dynamite® 111 Heavy Duty Clay Non-Strippable Wallcovering Adhesive contains high solids to assure fast grab and a strong, durable bond. Dynamite® 111 is ideally suited for heavy and difficult-to-install wallcoverings such as Commercial Type III vinyl, heavyweight fabric, flexible wood, Mylar® and foil. Cleans up with water while wet.

- **Roman PRO-880 (Most Popular for AL5)**

**Ultra® Clear Strippable Wallcovering Adhesive**

PRO-880 is a premium clear adhesive with excellent wet-tack, extended open-time and unsurpassed ease of clean-up. Undiluted PRO-880 will hang type II and type III wallcoverings, yet it can also be diluted for use with lightweight and pre-pasted wallcoverings. It promotes strippability of fabric-backed wallcoverings over new bare drywall. PRO-880 applies easily with a roller or pasting machine.

- **3M™ Hi-Strength 90 Spray Contact Adhesive**

Extremely versatile, fast-drying spray adhesive that bonds strongly to a wide range of materials. Our permanent bond provides fast results to keep projects moving ahead. The spray formula is easy to dispense, offering a variable-width spray pattern, and applies directly onto surfaces and materials where needed.

- **3M™ Scotch-Weld™ Neoprene High Performance Contact Adhesive 1357**

A Gray-Green or Light-yellow colored, high performance contact adhesive that provides a long bonding range and excellent initial strength.

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.

**4) Use of Staples: (IS NOT Recommended)**

The US Foils 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 US Foils EMI-SHIELD foil and when shielding performance is needed only up to 1 to 2 GHz. Use a good grade of copper, monel or stainless-steel staple to reduce the risk of corrosion and to provide galvanic compatibility with the US Foils EMI-SHIELD material. Staples should also be covered with electrically conductive foil tape patches. Use this method at your own risk.

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 US Foils EMI-SHIELD material being used. Galvanized steel or zinc coated steel flashing is also permitted. See Galvanic Reaction Chart at the bottom of this document.

The US Foils EMI-SHIELD foil must be attached (adhesive or PSA) to the interior of the Class A fire rated, first layer of sheetrock (typical) and Class A fire rated plywood (typical in areas that will have penetrations, like Doors, Windows, EMI Filters, Air Vents and Pipe Penetrations), CMU, waterproof sealed concrete, or other flat surface (see concrete warning above). **We recommend the entire first layer be Class A fire rated plywood, if possible. Do not glue, tape, screw, or staple the EMI-SHIELD foil directly to the metal wall studs.**

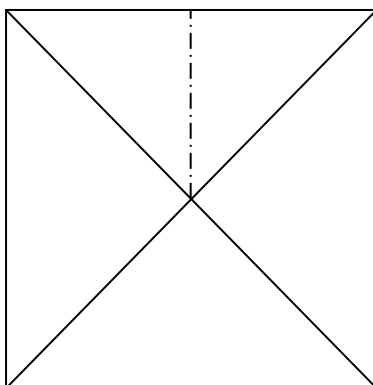
### Existing Room Surface Preparation

Remove all loose and peeling paint, patch holes and cracks and dull glossy surfaces by sanding. Allow new 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, concrete, and porous surfaces with a waterproof sealer or a latex primer sealer before applying 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 US Foils 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 ensure a good bond, apply the adhesive to the mounting surface and the back of the US Foils 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.

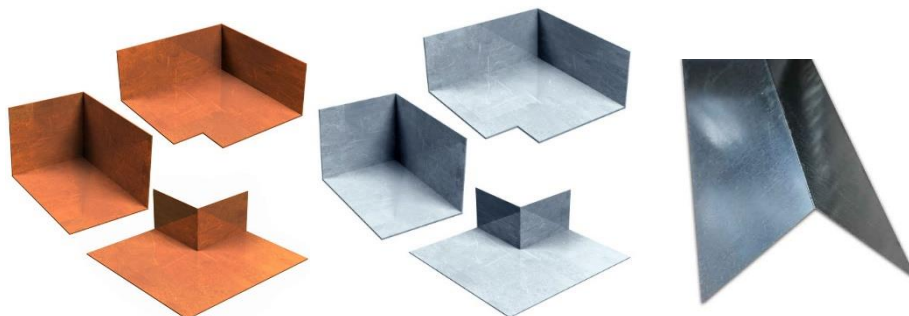


Treat outside and irregular corners the same way. Fold a 12-inch (30 cm) square into quarters, then unfold and place over the corner. Ensure that there are no tears or gaps inside the corner. Where these join the floor and ceiling, make sure material overlaps on all sides by at least three inches (8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

[https://www.ramayes.com/Foil\\_RF\\_Shielding\\_Adhesives\\_Primers\\_Sealers.htm](https://www.ramayes.com/Foil_RF_Shielding_Adhesives_Primers_Sealers.htm)

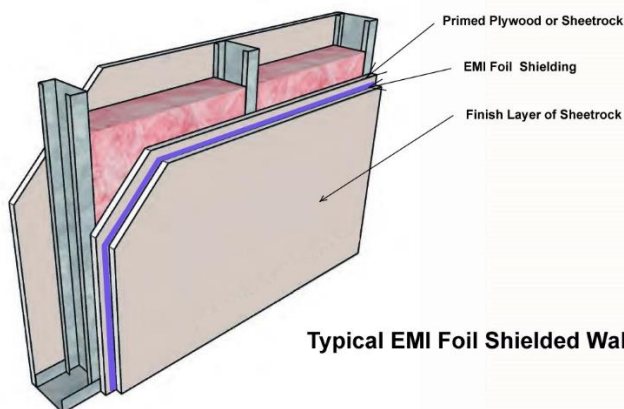


### Ceiling Installation

For suspended ceilings, cover the top of the room (above the ceiling panels) with the US Foils EMI-SHIELD shielding, first by doing the three-way corners and then the two-way corners or the 26 gauge galvanized steel flashing 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. There is a separate RF shielded suspended ceiling tile installation procedure for the different systems we sell, please ask for them if needed. For hard capped ceilings, treat them like a wall, see below.

### Wall Installation

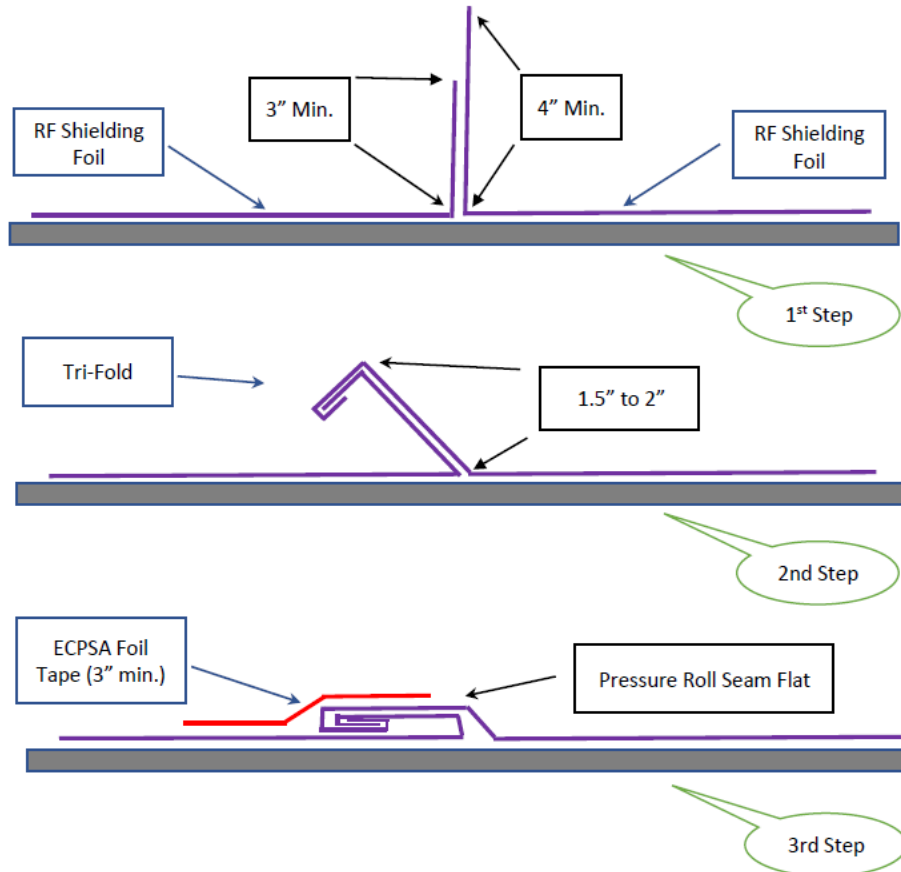
After installing the wall-to-wall corner flashing, wall-to-floor corner flashing and wall-to-ceiling corner flashing, cut the wall material to run floor to ceiling (this can be one continuous foil sheet or multiple overlapped foil sheets) and install by coating small sections of the wall with the recommended adhesive. Only apply adhesive to the area to which US Foils EMI-SHIELD shielding material can be applied before the adhesive is ready. Install US Foils 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 or butt joint. After smoothing by hand, roll the material over the entire surface with a hard rubber roller to force out air bubbles. Some trapped air bubbles and spider veins are expected. These can be flattened, as best possible, using a hard rubber roller. If you have a large trapped air pocket, you can puncture the foil with an awl, then using hard rubber roller, force out the trapped air, then put a 4" x 4" electrically conductive adhesive foil patch over the puncture hole.



Typical EMI Foil Shielded Wall

Most Common Methods of Sealing the EMI-SHIELD foil joint seams:

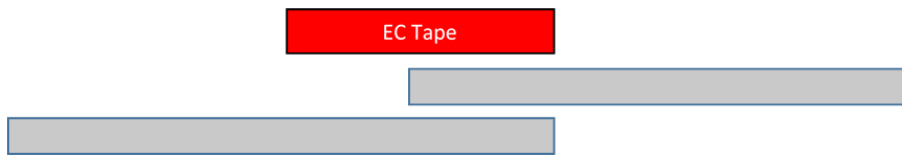
### Tri-Fold Method for Foil Shielding



- Notes:
1. Adhere RF Foil Shielding to Substrate Fully, using Adhesive or PSA.
  2. If Tri-Fold Method is Not Feasible, we Recommend Overlapping Foil and Seam Tape with Electrically Conductive PSA (ECPSA) Foil Tape.
  3. Tri-Fold Method Can be used on All Al, Cu & Stainless-Steel Foil, 5 mil Thick or Less.

1) The **BEST Method** is to use the Tri-Fold method above. This is the best for RF shielding effectiveness, but requires more shielding foil and is more labor intensive. Procedure is illustrated above.





**4" Electrically Conductive Foil Tape (Recommended)**

- 2) The **Recommended Method** above is to overlap the US Foils EMI-SHIELD foil and tape the seams with similar metal tape that has **electrically conductive PSA**. A minimum 2" overlap of the wall foil and then 4" wide electrically conductive foil tape is recommended. This method ensures 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.

The inward facing 2" overlap of foil can be glued down to the outer layer of foil or left unglued. If glued down, do not let the adhesive extend more than 1/2" on to the outer layer of foil. Adhesive can be the same standard adhesive; you use to attach the foil to the drywall. Avoid using excess adhesive.

RF shielding effectiveness results are almost the same for this method and the Tri-Fold Method.



**4" Electrically Conductive Foil Tape**

- 3) An **Acceptable Method** above is to butt joint the US Foils 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 electrically bond the foil panels to each other, but with some resistance. A 1-inch wide electrically conductive foil tape strip can be added around the perimeter of the room to electrically bond the foil panels together better (see bottom of this document for more information). **The IEEE-299 shielding effectiveness test results are based on this method.**



**Non-Electrically Conductive Foil Tape (NOT Recommended)**

- 4) We **No Longer Recommend** the use of standard non-electrically conductive pressure sensitive (PSA) foil tape. Use these methods at your own risk.

## Applying the EMI Foil Tape

Procedure is the same for standard and electrically conductive adhesive (PSA - Pressure Sensitive Adhesive). **Standard non-electrically conductive PSA foil tape is no longer recommended.**

Clean area (about 4" on either side of the seam) using a clean microfiber towel and isopropyl alcohol. Then Scotch Brite or sand (220 grit) the area (about 4" on either side of the seam) and finally, clean the dust off with clean microfiber towel and isopropyl alcohol. Now the joint is ready for the seaming tape to be applied.

In summary, Clean, Scotch-Brite or sand, clean again, before applying the foil seaming tape. This removes any oxidation, dust, oil, or dirt that may cause the foil tape not to stick properly.

Clean, 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. Clean, 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 ECPSA protection film. Apply the tape so the seam below is in the center and the tape is heading in the correct direction. Use your gloved hand, or an 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.



**Important:** When the taped seam is completed, go over the whole seam with a rubber roller, while applying pressure, perpendicular to the seam. This flattens out any tape wrinkles or ripples and forces out air bubbles.



## Patching Holes & Tears in AL5:

Clean, Scotch-Brite and Clean the already applied AL5 foil (This removes any oxidation, dust, oil, or dirt that may cause the foil tape not to stick properly.), about 4 inches on all sides of the tear or hole, Clean (microfiber towel and isopropyl alcohol) Scotch-Brite or sand and then wipe down again with clean microfiber towel and isopropyl alcohol, before applying the AL5 with Electrically Conductive Pressure Sensitive Adhesive (ECPSA) foil patch tape. The electrically conductive patch tape is the same as the seaming tape.

The AL5 tape with ECPSA patch should extend at least 2" in all directions from the hole or tear, on to the cleaned AL5 foil on the wall or ceiling. Ideally this would be done using one piece of AL5 ECPSA tape.

If the tear or hole is large, you can use multiple layers of AL5 ECPSA tape, overlapping each piece by 2". There again Clean, Scotch-Brite and clean the top of each piece of AL5 foil., before putting on the next piece.



After smoothing the patch foil by gloved hand or plastic applicator, roll over the patch material with a hard rubber roller to flatten wrinkles and force out air bubbles.

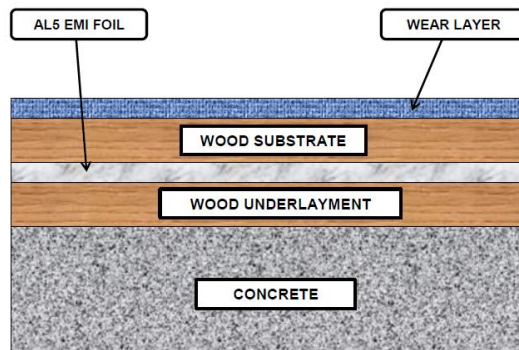
### Unshielded Partition Walls

Install interior partition walls by first installing the floor and ceiling tracks, then installing the fasteners to maintain an electrically continuous seal. At each anchor screw, a folded square of US Foils 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.

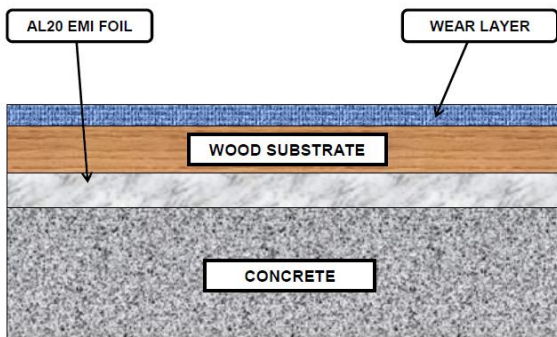
### Floor Installation

- 1) For AL5 US Foils 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 US Foils EMI-SHIELD can be applied directly to waterproof sealed concrete. Use Method 1 (above for wall installation) to tape the joints. Then apply substrate or wear layer on top of the AL20. We recommend the Drylok Extreme to waterproof seal the concrete and 3M Hi Strength 90 adhesive to glue down the panels. [https://www.ramayes.com/Foil\\_RF\\_Shielding\\_Adhesives\\_Primer\\_Sealers.htm](https://www.ramayes.com/Foil_RF_Shielding_Adhesives_Primer_Sealers.htm)
- 3) AL5 & AL20 can also be sandwiched between two epoxy flooring layers. If liquids are routinely spilled, such as in an operating room, then the epoxy floor system is recommended. This type of floor is also useful on high activity floors. See drawings below, also available as pdfs.
- 4) ESD flooring has also been used successfully as a shielded floor, we do not sell this product.

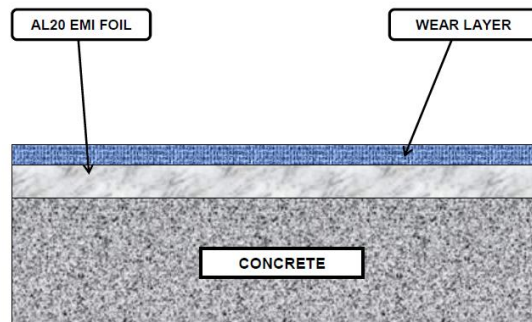
**FLOOR STRUCTURE COMPONENTS  
USING AL5 EMI SHIELDED FOIL (Typical)**



**FLOOR STRUCTURE COMPONENTS  
USING AL20 EMI SHIELDED FOIL (Typical)**



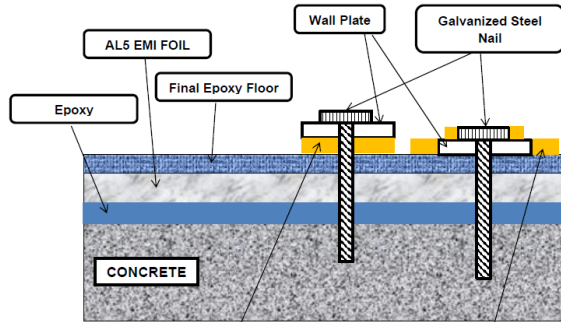
**FLOOR STRUCTURE COMPONENTS  
USING AL20 EMI SHIELDED FOIL (Minimum)**





## FLOOR STRUCTURE COMPONENTS

USING AL5 EMI SHIELDED FOIL (Epoxy Floor with Shot In Anchors)



Apply Continuous Silicone RTV or Other Waterproof Sealer Between Floor & Wall Plate in the Areas Anchor Nails Penetrate the Wall Plate

Set Wall Plate into Location, then Shoot in the Galvanized Steel Nails

A Circular Bead of RTV can be used between the Floor & Wall Plate, but then the Nail Head Must also be Waterproof (RTV) Sealed

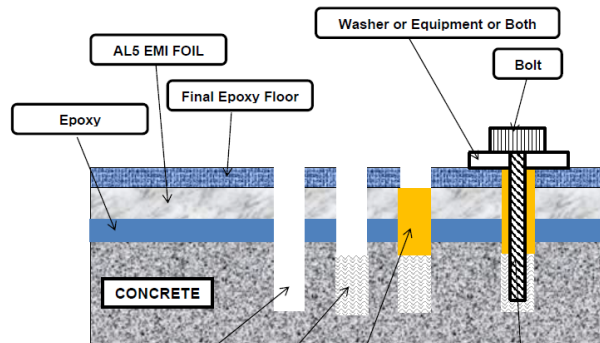
OR

Set Wall Plate into Location, Shoot in the Galvanized Steel Nail, Then Waterproof Seal the Entire Wall Plate & the Nail Heads

No Concrete Products in the Epoxy

## FLOOR STRUCTURE COMPONENTS

USING AL5 EMI SHIELDED FOIL (Epoxy with Bolt Anchors)



Drill the Hole

Insert the Bolt Anchor

Fill Hole with Xalon-FS (Electrically Conductive RTV) To the Top of the AL5 Shielding

Place the Washer or Equipment or Both Over the Hole Install the Bolt and Torque to Requirement

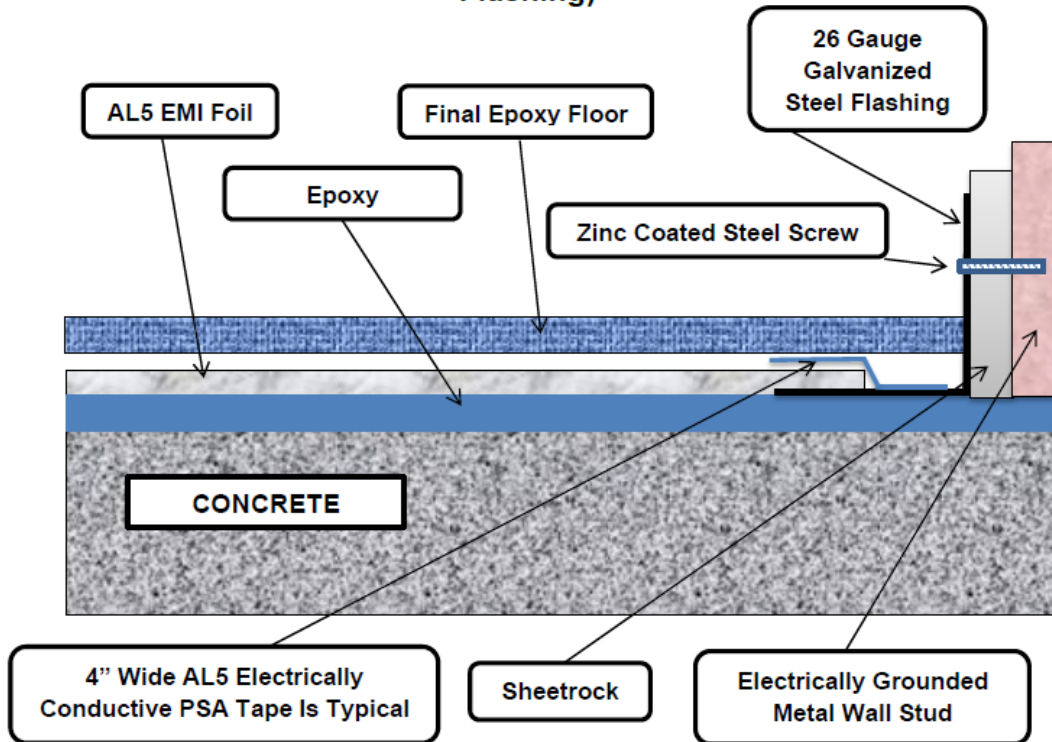
The Xalon-FS Waterproof Seals the Hole And Maintains the RF Shielding

No Concrete Products in the Epoxy



**FLOOR STRUCTURE COMPONENTS**

**USING AL5 EMI SHIELDED FOIL (Epoxy Floor with Perimeter Flashing)**



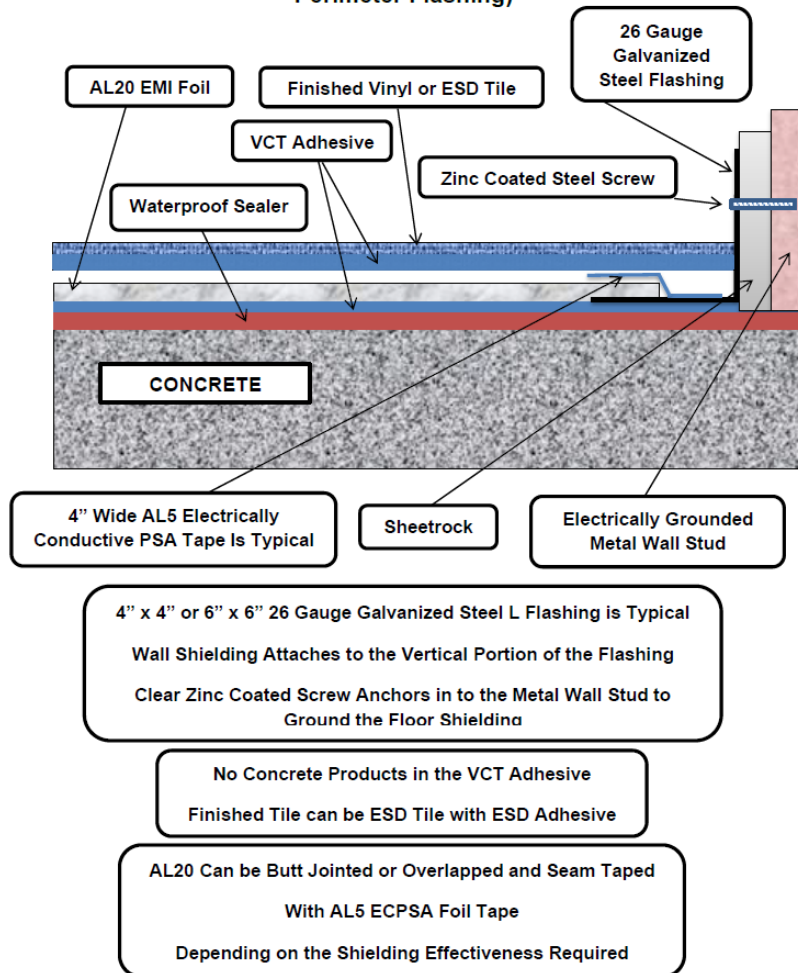
4" x 4" or 6" x 6" 26 Gauge Galvanized Steel L Flashing is Typical  
 Wall Shielding Attaches to the Vertical Portion of the Flashing  
 Clear Zinc Coated Screw Anchors in to the Metal Wall Stud to Ground the Floor Shielding

No Concrete Products in the Epoxy

AL5 Can be Butt Jointed or Overlapped and Seam Taped  
 With AL5 ECPSA Foil Tape  
 Depending on the Shielding Effectiveness Required

**FLOOR STRUCTURE COMPONENTS**

**USING AL20 EMI SHIELDED FOIL (Vinyl or ESD Tile Floor with Perimeter Flashing)**



**Installation of Penetrations and Doors**

**We recommend Class A fire rated plywood be installed, directly to the metal wall studs, instead of first layer of drywall, in areas that will have doors, windows, EMI filters, pipe penetrations, air vents, etc. installed. This will support the weight of the attached items and will not crush or crack, when clamped or screwed down.**

After installing the US Foils EMI-SHIELD foil 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 US Foils EMI-SHIELD tape over the flange and at least three inches (8 cm) on the wall around the penetration flange.

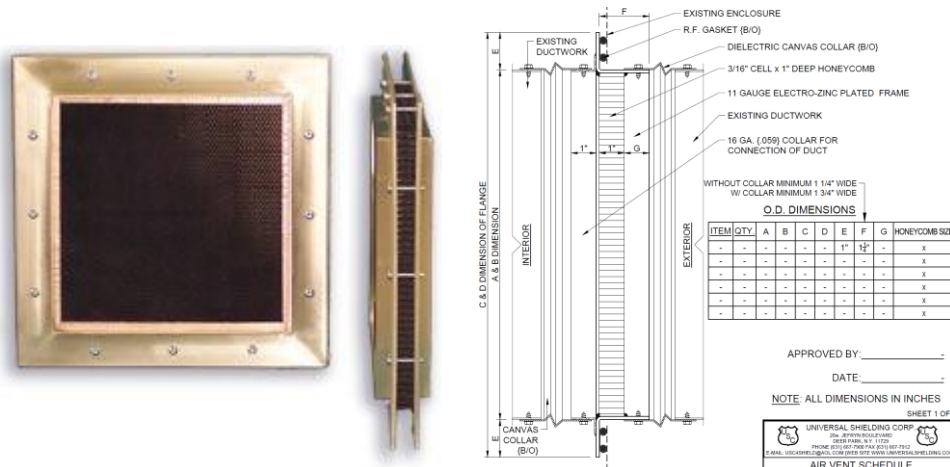
The shielded door is the most important of the penetrations in a shielded enclosure. It is generally the weakest link in the system and the most difficult to maintain due to its high usage. Our partners can, in many cases, retrofit existing doors to provide 40-100dB of shielding effectiveness. Install the US Foils EMI-SHIELD foil around the edges of the rough opening. Then set the metal door frame in the rough opening. US Foils 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 US Foils EMI-SHIELD foil so that no gaps are visible around the perimeter of the door. Be especially careful to see that the



US Foils 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 US Foils 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 like Wiremold 6000 wire duct around the lower edge of the room or commercial metal conduit. 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 US Foils EMI-SHIELD foil.

**All metallic wiring penetrating the RF shielded wall, ceiling, or floor, 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 install 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 out of the RF shielded room, 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 adhesive. If screws are used, be careful to maintain a metal-to-metal seal is made between the screw, the US Foils RF foil shielded and the grounded metal wall stud.



## Pipe Penetrations

The pipe penetration consists of a metal pipe that is welded onto a metal plate or threaded metal pipe with nuts, washers and RF gaskets or flange type or multi-hole type (examples pictured below). 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 US Foils EMI-SHIELD shielding over the rough opening and install the window from the inside. Screw the inside flange to the US Foils 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 US Foils 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, typically in surface mounted conduit and boxes. A false wall will be required if you want to eliminate the surface mounted electrical components and make it look like a standard office environment.

### 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

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 ohmmeter, and make sure ALL studs are securely bonded to building ground. You should get an ohm meter reading of less than 1  $\Omega$  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). See more detail below in the document.

The **US Foils EMI-SHIELD foil** is designed as a multipoint ground system.

Existing Room: Install the US Foils 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 ohmmeter, and test all panels, there should be less than 5.0  $\Omega$  between any two points in the room, the lower the ohm reading, the better. (Also see grounding section at bottom)

### Shielding Repairs

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

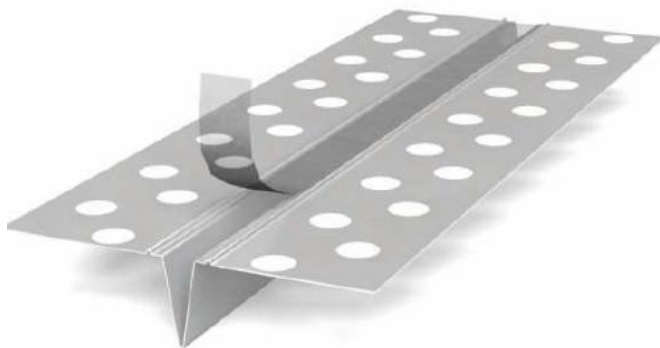
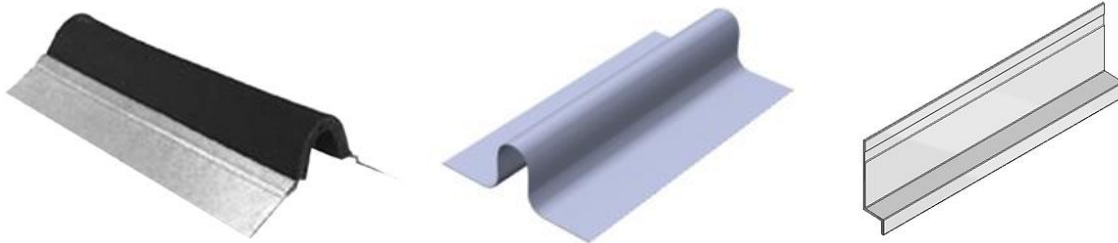
## Finishes or Aesthetic Coverings

The most common method of installation is the EMI Shield foil sandwiched between two layers of drywall. Then the drywall is painted or you can add wall paper, wood paneling, or FRP panels to the interior drywall. Then surface mounted electrical components are installed.

If you want to eliminate the surface mounted conduit, you will have to construct a false wall, to hide the conduit and install your electrical boxes.

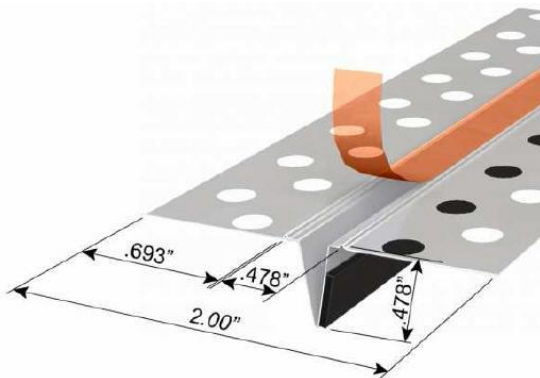
## Shielding Expansion Joints

US Foils EMI Shield RF Shielded foil 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 a galvanized steel or 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 many ways and designs to accomplish this, below are a few examples. (Joints & flashing provided by others)



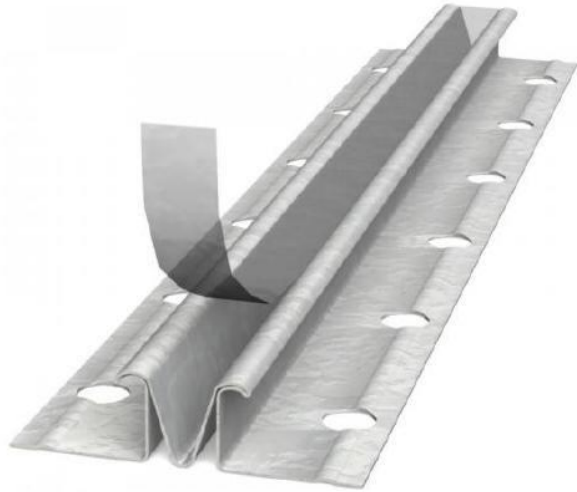
ClarkDietrich 093 Zinc Control Joint is applied between abutting gypsum panels and is used to relieve the stresses of expansion and contraction of drywall and veneer plaster systems in large ceiling and wall expanses over 30' in length. The V vertex should face the interior of the room, then completely taped over with ECPSA Foil tape.

[ClarkeDietrich Webpage](#)



FAS-093X fire rated control joint - profile for protection of control joints Fire Rated Control Joint is a composite control joint with intumescent tape factory applied to the back side of the control joint. The V vertex should face the interior of the room, then completely taped over with ECPSA Foil tape.

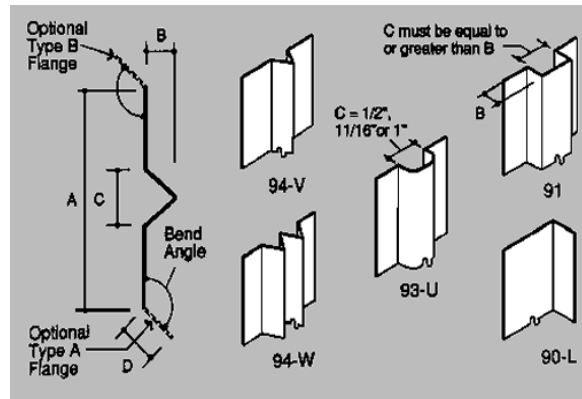
[ClarkeDietrich Webpage](#)



## Zinc Control Joints #38, #50 & #75

A solid flange zinc control joint that resists corrosion on interior and exterior applications of plaster and stucco. The #38, #50 & #75 is used to relieve stresses in large plastered areas of walls, ceilings, and stucco. Available in G-60 Hot-Dipped Galvanized Steel (preferred). Tape from wall foil to below the curl lip with ECPSA foil tape.

[ClarkeDietrich Webpage](#)



Manufactured by Others



## 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 seeming tape.

Make sure that all metal wall & ceiling studs are tied to earth or electric ground, per code.

After the first layer of sheetrock or class A plywood and the foil shielding is installed, use electrically conductive sheetrock screws (Avoid epoxy coated screws). Typical types are zinc coated steel or galvanized steel with self-drilling tip. Approved screw coatings are: clear zinc coated. 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.

### Verifying the Shielding Ground

Unlike a single point grounded RF shielded enclosure, the RF shielded PTB is a multipoint grounded shielding system.

A typical single point ground RF shield enclosure has "Grounding. A single ground lug connected to the shield surface shall be provided. This lug shall be connected to the nearest building structural member. This connection shall have DC resistance of 1 ohm or less with the ground connection in place, and 10 megaohms or greater with the ground connection removed."

A multipoint grounded RF shielded enclosure has grounding as described below. Hence, there is no single grounding verification test, like a single point ground system.

The PTB grounding relies on the structural steel, that has the aluminum PTB attached, to be electrically tied to the earth ground.

You can use an ohmmeter from anywhere on the aluminum PTB shielding to earth ground, to verify the DC resistance is 5 ohms or less. Scotch-Brite and wipe down with microfiber towel the aluminum foil, where you want to take a reading, will be required to knock off the aluminum oxidation, so a good contact point for the ohmmeter can be achieved.

A verified good structural ground or electrical ground, may also be used.

Caveat: Large areas that are only electrically grounded at the perimeter edges may have higher ohmmeter readings. Examples if this are large floor or wall areas (typically installed with adhesive) on top of concrete or wood.

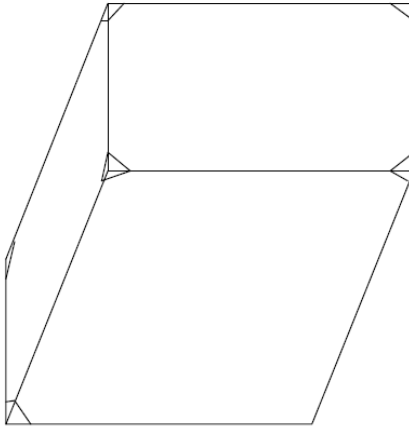
### Disclaimer

"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 Electrically Conductive PSA Foil & Tape**

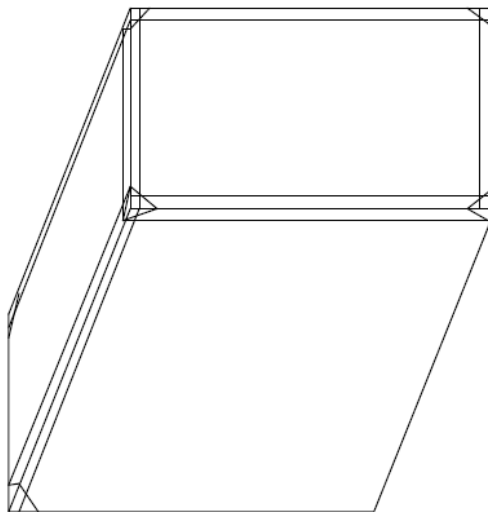
Step 1

Fold the 3-sided corner pieces, folded foil or metal corner flashing and install them in all corners



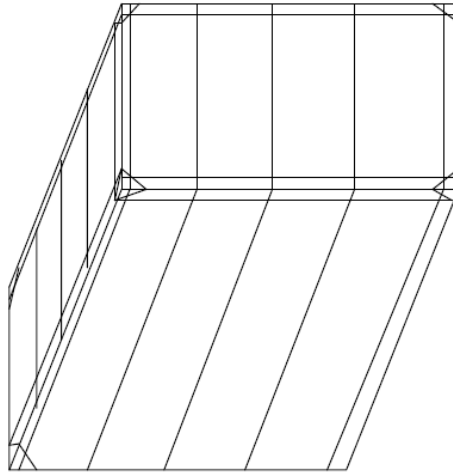
Step 2

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  
Metal Corner flashing is also acceptable



Step 3

Install the 24" or 48" wide foil rolls (vertical is usually easier on walls)  
Overlap each sheet a minimum of 2"  
Completely cover all surfaces



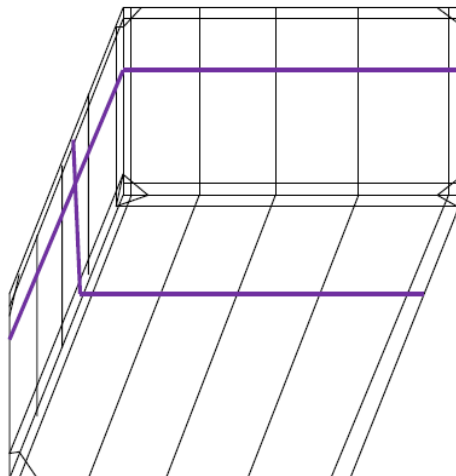
Step 4

Seam seal all joints and seams with 4" wide electrically conductive foil tape.

No Illustration

Step 5

For wood framed rooms, install 1" wide electrically conductive aluminum tape strip to electrically connect all the foil panels  
Ideally also connect it to the ground stud. **This step is not required on grounded metal wall stud construction.**







# GALVANIC REACTION CHART

Below is a galvanic reaction chart for dissimilar metals.

Galvanic Corrosion Risk		Contact Metal														
		Magnesium and Alloys	Zinc and Alloys	Aluminum and Alloys	Cadmium	Carbon Steels	Cast Iron	Stainless Steel	Lead, Tin, and Alloys	Nickel	Brasses, Nickel-Silvers	Copper	Bronzes, Cupro-Nickels	Nickel Copper Alloys	Nickel-Chrome Alloys, Titanium, Silver, Graphite, Gold, and Platinum	
Corroding Metal	Magnesium and Alloys	Green	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
	Zinc and Alloys	Green	Green	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
	Aluminum and Alloys	Green	Green	Green	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
	Cadmium	Green	Green	Green	Green	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
	Carbon Steel	Green	Green	Green	Green	Green	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
	Cast Iron	Green	Green	Green	Green	Green	Green	Red	Red	Red	Red	Red	Red	Red	Red	Red
	Stainless Steels	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Red	Red	Red	Red	Red
	Lead, Tin, and Alloys	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
	Nickel	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
	Brasses, Nickel-Silvers	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
	Copper	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
	Bronzes, Cupro-Nickels	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
	Nickel Copper Alloys	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
	Nickel-Chrome Alloys, Titanium, Silver, Graphite, Gold, and Platinum	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green

This chart is designed to assist in broadly assessing the risk of galvanic corrosion associated with a given metal coming into contact with another metal. To use the chart, align the metal to be assessed (for the risk of corrosion) in the left column with the Contact Metal listed in the upper row; green represents a lower risk and red represents a higher risk. For a more specific assessment of the risk of galvanic corrosion, please check with other sources.