



# MWT Materials, Inc.

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## MAC-2100-WP Fabric Installation Instructions MAC-2100-WP and MAC-2000

The general procedure for installing MAC-2100-WP shielding 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 Scissors	Thin Butyl, nitrile or neoprene Gloves
Trowel	Coveralls and Long Sleeve Shirts
Putty Knife	Flat Bladed Soldering Iron
Measuring Tape	40/60 Non Corrosive Flux Solder
Hard Rubber Roller	Non Corrosive Flux
MAC-2100-WP Tape	Framing Square
Ladder	Rags
Paste brush, roller and paint roller pan	Bucket for Water
Thin Cotton Gloves	Dust mask

### **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.

### **Installation Considerations**

The principal method of installing MAC-2100-WP Shielding material is to use a good grade of non-starch based vinyl wallpaper adhesive. Apply the adhesive to the surface via roller, brush or spray then roll the MAC-2100-WP fabric into the adhesive using a roller. Before using a new adhesive, test the adhesive by adhering a small patch of MAC-2100-WP fabric to a panel and checking for discoloration and adhesion.

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 MAC-2100-WP) 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 can be applied to the seam area.

The material 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 MAC-2100-WP fabric and when shielding performance is needed only 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 MAC-2100-WP 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 MAC-2100-WP material being used.

When installing MAC-2100-WP fabric, wear gloves to protect hands from contact with the nickel coated fabric and protect the fabric 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 are worn underneath the plastic gloves. When nickel coated fabrics are used, a dust mask should be worn. In enclosed areas an evaluation should be made to determine if additional respiratory protection or engineering controls are needed.

MAC-2100-WP fabrics 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 and a dust mask should be worn while cutting the fabric.

### **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 MAC-2100-WP material 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 MAC-2100-WP material using a paint roller. Place the fabric into the room corner and roll with the rubber roller until smooth. Be sure to fit the fabric 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.). Special hardware developed by architectural partners can also be used to achieve shielding integrity in the corners of a facility.

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.

### **Ceiling Installation**

For suspended ceilings, cover the top of the room (above the ceiling panels) with the MAC-2100-WP 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 an enamel 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 MAC-2100-WP shielding material can be applied before the adhesive dries. Install MAC-2100-WP fabric like wall covering. 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 MAC-2100-WP horizontally in two strips to minimize the length and number of seams. This should be considered where the standard 54 (1.37 m) inch width will yield only one seam, 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 MAC-2100-WP 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.

### **Finishes or Aesthetic Coverings**

If the shielded enclosure does not require any interior treatments, the MAC-2100-WP material may be left exposed. It should be glued down to the entire interior surface to minimize possible damage due to tearing. Otherwise, most standard finishes can be used on ceilings and walls covered with MAC-2100-WP fabric. Three methods are common.

- **Painting:** To blend with standard room color schemes and décor, the walls may be painted using standard wall paint.
- **Wall covering:** Vinyl wall coverings can also be used over the MAC-2100-WP fabric.
- **Paneling:** Should there be some risk to puncturing the MAC-2100-WP wall covering, attach standard wall panel directly to the MAC-2100-WP fabric 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 MAC-2100-WP material. Use screws to secure the drywall and to make contact with the MAC-2100-WP as they secure to the backing material.

### **Floor Installation**

1. First install the MAC-2100-WP with wallpaper 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 MAC-2100-WP fabric to the floor with wallpaper adhesive. Build up the access

- floor by laying the gridwork on top of the MAC-2100-WP fabric. A folded patch of MAC-2100-WP fabric under each support of the raised floor will cushion the MAC-2100-WP fabric 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 MAC-2100-WP material on the walls is overlapped and attached using vinyl 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. After MAC-2100-WP is installed a concrete topping can be applied. To minimize interaction between the MAC-2100-WP and the moisture in the concrete, apply a coating of Thompson's Water Seal (or equivalent). In this case make sure the fabric overlaps the walls by a minimum of six inches (15 cm.).

The MAC-2100-WP material can easily pass any static loads that may occur in any industrial situation.

If rolling traffic is expected, use a copper foil (instead of MAC-2100-WP) for the floor shielding with a minimum six inch (15 cm) overlap including a six inch lap up the walls over the MAC-2100-WP wall covering.

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

After installing the MAC-2100-WP 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 MAC-2100-WP 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 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 MAC-2100-WP fabric around the edges of the rough opening. Then set the metal door frame in the rough opening. MAC-2100-WP fabric 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 MAC-2100-WP fabric so that no gaps are visible around the perimeter of the door. Be especially careful to see that the MAC-2100-WP 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 MAC-2100-WP 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 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 MAC-2100-WP 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 MAC-2100-WP shielding over the rough opening and install the window from the inside. Screw the inside flange to the MAC-2100-WP fabric around the perimeter of the window opening using the mounting screws to bring pressure on the shield. Then place a second layer of MAC-2100-WP 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 MAC-2100-WP fabric 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.

For a room requiring only occasional shielding, a curtain composed of a layer MAC-2100-WP with decorative outer cloth can be constructed and fastened with one or two rows of metallized hook and loop.

## **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.

### **Shielding Repairs**

Repairing MAC-2100-WP fabric is a matter of providing adequate contact between the repair and the original material. Remove the finish to expose the MAC-2100-WP fabric for a distance of 3 inches (8 cm.) around the damaged area. For small areas, use wallpaper paste to paste a patch of MAC-2100-WP fabric 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 paste is dry, it may be treated with any of the coverings described above.

### **Disclaimer**

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