



A discussion of SM-10 RF shielding fabric and film varieties available from LBA Technology (LBAT), with ordering information and specifications can be found on our website. A complimentary line of RFGreen® RF shielding paints can be found online as well.

This set of installation notes is intended to assist experienced wall covering installers with a review of basic interior architectural shielding procedures. LBAT recommends that installers without specific RF shielding experience engage a shielding consultant for guidance where critical levels of shielding effectiveness are required.

NOTE: Some photos show copper cloth for clarity of installation depiction. We no longer sell copper cloth, but furnish the current SM-10 nickel-plated copper formulation. The techniques discussed and illustrated here are appropriate to both.

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OVERVIEW

The general procedure for installing LBAT SM-10 RFGreen® shielding fabric starts with preparing the substrate surface. Next, cover corners and edges followed by ceiling and walls. If the room is an existing space, each penetration (light switches, power outlets, computer jacks, etc.) 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.

Simply put, a fully shielded room can be visualized as a water container which perfectly holds in water no matter how it is tipped.

When installing SM-10 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.

SM-10 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.

SM-10 RF shielding fabrics are intended for installation only on indoor, dry surfaces. LBAT offers RF shield paints suitable for exterior surfaces.

All LBAT products are fabricated for us to ensure quality and freedom from manufacturing defects. Technical specifications of our shielding products are based on theoretical and empirical study and should only be regarded as a guideline for different customer applications. As customer performance will depend upon its applications and environments, our specifications should not be interpreted as a guarantee of user performance. It is the customer's responsibility to determine whether the product is appropriate for its environment and objectives; as well as to apply it in a proper manner. Only professional installers should apply our products and can contact LBAT for application recommendations and assistance. Formal consulting and project supervision services are also available for engagement through LBAT. For warranty provisions, please consult our standard Terms and Conditions of Sale.



ESTIMATING REQUIREMENTS

When estimating coverage requirements, it is important to keep in mind that SM-10 RF shielding fabrics are sold in rolls, by the linear meter. Available widths are 0.66 meter and 1.3 meter, except for SM-10LF which is available in 1.3 meter width only. When estimating your requirement, be sure to account for these dimensions, as well as allowances for seam overlaps, round offs and wastage. A commonly used allowance is 20% over room dimensional area. Note that dimensions may vary slightly with fabrication processes.

To assist in calculating requirements, here are some approximate useful conversions:

1 linear meter = 3.28 feet = 39.36 inches = 1.1 yard

0.66 meters = 66 centimeters = 2.16 feet = 26 inches = 0.72 yards

1.30 meters = 130 centimeters = 4.26 feet = 51.2 inches = 1.42 yards

1 linear meter x 0.66 meters = 0.66 m² = 7.1 ft² = 1023 in² = 0.79 yd²

1 linear meter x 1.3 meters = 1.3 m² = 14.0 ft² = 2015 in² = 1.55 yd²

Where SMA-C conductive adhesive is required to bond overlapping SM-10 fabrics, or adhere them to other conductive surfaces,

coverage will be dependent upon the substrate. For typical fabric/fabric bonding, it is suggested that a 5 liter pail be considered adequate for 20 m² (215 ft²) of surface. This product is only available in 5 liter (1.32 gallon) pails. Note that this adhesive must be shipped, stored and applied at temperatures above freezing. If subfreezing temperatures will be encountered, consult LBAT for appropriate alternatives.

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 applying RF shielding fabric.

INSTALLATION CONSIDERATIONS

The principal method of installing LBAT RFGreen® SM-10 shielding fabric is to use a good grade of vinyl wallpaper adhesive. Apply the adhesive to the surface via roller, brush or spray then press the SM-10 fabric into the adhesive using a roller. Before using a new adhesive, test the adhesive by adhering a small patch of SM-10 fabric to a panel of substrate material and check for discoloration and adhesion.

To provide RF continuity between panels of SM-10, a simple overlap of a minimum of three inches (8 cm) at all seams has shown good results. We suggest a four inch (10 cm) overlap at interfaces between SM-10 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 and better shielding effectiveness, a conductive adhesive such as LBAT SMA-C, in lieu of wallpaper adhesive, can be applied to the seam area.

The SM-10 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 or conductive adhesive seam. Stapling is useful when placing paneling, drywall, or plywood on top of the SM-10 fabric and when low or moderate 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 SM-10 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 nickel, or as otherwise specified for the SM-10 material being used.

General method of installation over existing wallboard



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 SM-10 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 SM-10 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 LBAT 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 LBAT SM-10 RFGreen® 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 LBAT SM-10 shielding fabric can be applied before the adhesive dries. Install SM-10 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 SM-10 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 SM-10 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 SM-10 RF 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 SM-10 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 SM-10 fabric.
- Paneling: Should there be some risk to puncturing the SM-10 wall covering, attach standard wall panel directly to the SM-10 RF fabric using construction grade adhesives such as Liquid Nails.

For facilities requiring less than 40 dB shielding below 2 GHz, drywall can be applied directly over the SM-10 material. Use screws to secure the drywall and to make contact with the SM-10 as they secure to the backing material.

FLOOR INSTALLATION

1. First install the SM-10 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 SM-10 fabric to the floor with wallpaper adhesive. Build up the access floor by laying the gridwork on top of the SM-10 fabric. A folded patch of SM-10 fabric under each support of the raised floor will cushion the SM-10 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 SM-10 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 SM-10 is installed a concrete topping can be applied. To minimize interaction between the SM-10 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 SM-10 material can easily pass any static loads that may occur in any industrial situation.



Floor covering with method of shielding a PVC drain pipe

If rolling traffic is expected, use a copper foil (instead of SM-10) for the floor shielding with a minimum six inch (15 cm) overlap including a six inch lap up the walls over the SM-10 wall covering.

INSTALLATION OF PENETRATIONS AND DOORS

After installing the SM-10 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 SM-10 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 SM-10 fabric around the edges of the rough opening. Then set the metal door frame in the rough opening. SM-10 fabric is then installed bridging from the opening. SM-10 fabric is then installed bridging from the opening. Install the SM-10 fabric so that no gaps are visible around the perimeter of the door. Be especially careful to see that the SM-10 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.

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Typical interface required for door or window installation (wiring is temporary)



HVAC duct connection, piping penetrations and general integration



Cut out prepared for mounting HVAC honeycomb filter

HVAC VENT INSTALLATIONS

All HVAC (Heating, Ventilating and Air Conditioning) piping and ducts 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 LBA SM-10 shielding fabric and the vent.

ELECTROMAGNETIC FILTER AND WIRING 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.

As described under "Pipe Penetrations", a "waveguide" penetration may be used for fiber optic cables.

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 SM-10 shielding.



Non-conductive pipe waveguides for fiber optic cable, with a copper pipe penetration

PIPE PENETRATIONS

A pipe penetration consists of a metallic (preferably copper) pipe that is silver soldered or welded onto non-ferrous plate which fully contacts the shielding fabric. In lieu of a metal plate, SM-10 may be wrapped about the pipe with a strong contact, splayed out, and bonded to the SM-10 wall covering. Alternatively, a copper pipe is sized to provide waveguide beyond cut-off operation at the highest operating frequency and is mounted within a non-ferrous wall plate. Similarly, a non-conductive pipe wrapped with SM-10 as above may be used for a waveguide. This permits the passage of one or multiple non-conductive pipes. No conductive materials may pass through this "waveguide" fitting.

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 LBA SM-10 shielding fabric over the rough opening and install the window from the inside. Screw the inside flange to the SM-10 fabric around the perimeter of the window opening using the mounting screws to bring pressure on the shield. Then place a second layer of SM-10 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 SM-10 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 SM-10 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.



Multiple grounds to single point plate recommended

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. Where multiple grounds are needed, they should terminate to a common, insulated, grounding plate which is terminated to the main ground plate. To ensure code compliance grounding and other wiring should be provided under the direction of a licensed electrician or professional engineer who is familiar with RF shielding requirements.

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 SM-10 fabric is a matter of providing adequate contact between the repair and the original material. Remove the finish to expose the SM-10 fabric for a distance of 3 inches (8 cm.) around the damaged area. For small areas, use wallpaper paste to paste a patch of SM-10 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.

TESTING

LBAT recommends that shielding effectiveness be tested during the installation process to detect any application issues. If the installation is to be tested on completion, it is highly recommended that a pre-test be completed while all shielding work is exposed, prior to close-in and application of surface finishes. This will make it much easier to find and repair any defects in the RF shielding system.

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 products are beyond our control, we disclaim any liability for any loss or damage suffered from use of the products, 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.

LBAT shielding products are sold for professional installation only. Your requirements are custom quoted and minimum material requirements may apply. In estimating coverage requirements, we recommend a 15% overage be purchased.