

Installation Guide

Introduction

Scope. This installation Guide provides recommended methods, techniques and accessories for installation of **Lewco Super Mat** or **Lewco Super Mat STC** (hereafter referred to as Super Mat) for applications within the temperature range from ambient to 600°F (315°C). For operating temperatures greater than 600°F (315°C), contact Lewco Specialty Products or your representative to discuss the specific scenario to assure the most optimum design approach is utilized.

All surfaces to be insulated are assumed to be above ground. Consult manufacturer for underground applications.

Priority order of documents. The recommendations in this guideline are not intended to take priority over, or in any way modify the requirements contained in a facility owner's written insulation specification or the Owner company's engineering standard. The priority order of documents shall be:

- 1) Facility Owner's written job (insulation) specification, including safety rules and guidelines;
- 2) Company's corporate engineering standard for thermal insulation;
- 3) Vendor's installation guidance.

Inconsistencies found among the above documents should be brought to the attention of the facility owner for clarification with the understanding that the above order of priority should apply unless expressly communicated in writing by the facility owner or purchaser.

Trained installers. Proper installation is critical to performance of thermal insulation. Installation of Super Mat shall be performed by installers with training and experience in installation of thermal insulation in heavy industrial environments.



Installation Guide

Table of Contents

| | |
|----------------------------------------------------------------------|----|
| Introduction | 1 |
| General | 3 |
| Safety | 3 |
| Storage | 4 |
| Roll Description | 4 |
| Packaging | 5 |
| Shop or Onsite Cutting Table | 5 |
| Preparation for installation | 6 |
| Installation techniques for various pipe diameters | 7 |
| Joints | 8 |
| Multi-layer application | 9 |
| General installation on pipe-- 4" (100 mm) diameter and larger | 10 |
| Insulation at pipe supports | 10 |
| Fittings | 11 |
| Insulation of flanges | 11 |
| Flanged Valves | 12 |
| Removable blankets | 13 |
| Ductwork -- Square and rectangular | 14 |
| Ductwork -- flanges & stiffeners | 16 |
| Vessels | 17 |
| Above ground storage tanks | 18 |
| Spheres | 18 |
| Jacketing | 19 |
| Insulation doubling as personnel protection (PP) | 19 |





Installation Guide

General

Methods and techniques for installing Super Mat are basically the same as for other hydrophobic flexible blanket insulation. A major difference is that the lack of dust allows for effective use of most adhesives, including clear silicone caulk, to attach Super Mat to itself or to other surfaces, including metal.

Cutting tool options. Super Mat is easy to install using common, readily available insulation tools. Most tools can be purchased at a local hardware store, insulation distributor, or over the internet.

Super Mat can be cut with a sharp knife, rotary cutter (with titanium blade) scissors, tin snips, hand shear, or by water jetting. Use of a serrated knife when manually cutting small sections of the 16mm and greater thicknesses enhances efficiency of cutting.

While cutting with an automated laser is possible, lasers literally melts the glass fibers and a small amount of sand-like particles can remain on the cut edges.

Pre-cutting and nesting. Automated, pre-cutting is recommended to most efficiently achieve nested layers on multi-layer applications.

One-piece pre-cut fittings (such as lobster-back and inverse gore shapes) is encouraged in locales where it is sensible as a labor- and time-saving step which can favorably impact the total erected cost (TEC).

Safety

Super Mat is composed of E-glass needled felt blanket, the fibers of which are coated with PTFE. There are no particulate materials included in Super Mat. The PTFE coating helps reduce breakage of the glass fibers as compared to rigid insulation or fiber blankets which are not polymer-impregnated. As a result, handling and cutting Super Mat products produce no particulate dust, and the amount of broken fibers resulting from cutting and handling is very small.

Standard respiratory protection (as normally recommended for handling all industrial insulation materials) should be implemented.



Installation Guide

Storage

Super Mat does not require any special handling or storage.

The original packaging of Super Mat is cardboard boxes which, if wetted, will deteriorate. However, the insulation itself is resistant to water. Original packaging will identify the specific product by name and thickness, thus the boxes should be protected from weather. If stored outside, boxed or un-boxed rolls should be stored on pallets and covered with plastic sheeting.

Super Mat should not be compressed during shipping or storage.

Roll Description

Blanket rolls

| Widths currently available | |
|-----------------------------------|--------|
| inches | meters |
| 30 | 0.76 |
| 60 | 1.52 |

NOTE: Smaller width rolls are available as a special order.

| Blanket Thickness | Roll Length | |
|--------------------------|--------------------|--------|
| | feet | meters |
| mm | | |
| 8 | 125 | ~38.1 |
| 16 | 75 | ~22.8 |
| 20 | 60 | ~18.3 |
| 25 | 45 | ~13.7 |

Tape rolls

| Standard Width of Super Mat STC Tape Rolls (8 mm thick with silicone coating) | |
|-----------------------------------------------------------------------------------------|----|
| inches | mm |
| 2 | 50 |
| 3 | 75 |

Packaging

Boxes can contain one 60" (1.5 m) wide roll, or two 30" (0.76 m) wide rolls. Example of standard packaging for blanket rolls:



Shop or Onsite Cutting Table

When cutting the blanket by hand, a cutting table with mounted straight edge is the most efficient and effective means to achieve proper and accurate cuts.

For widths 24" - 48" (610mm – 1219mm)

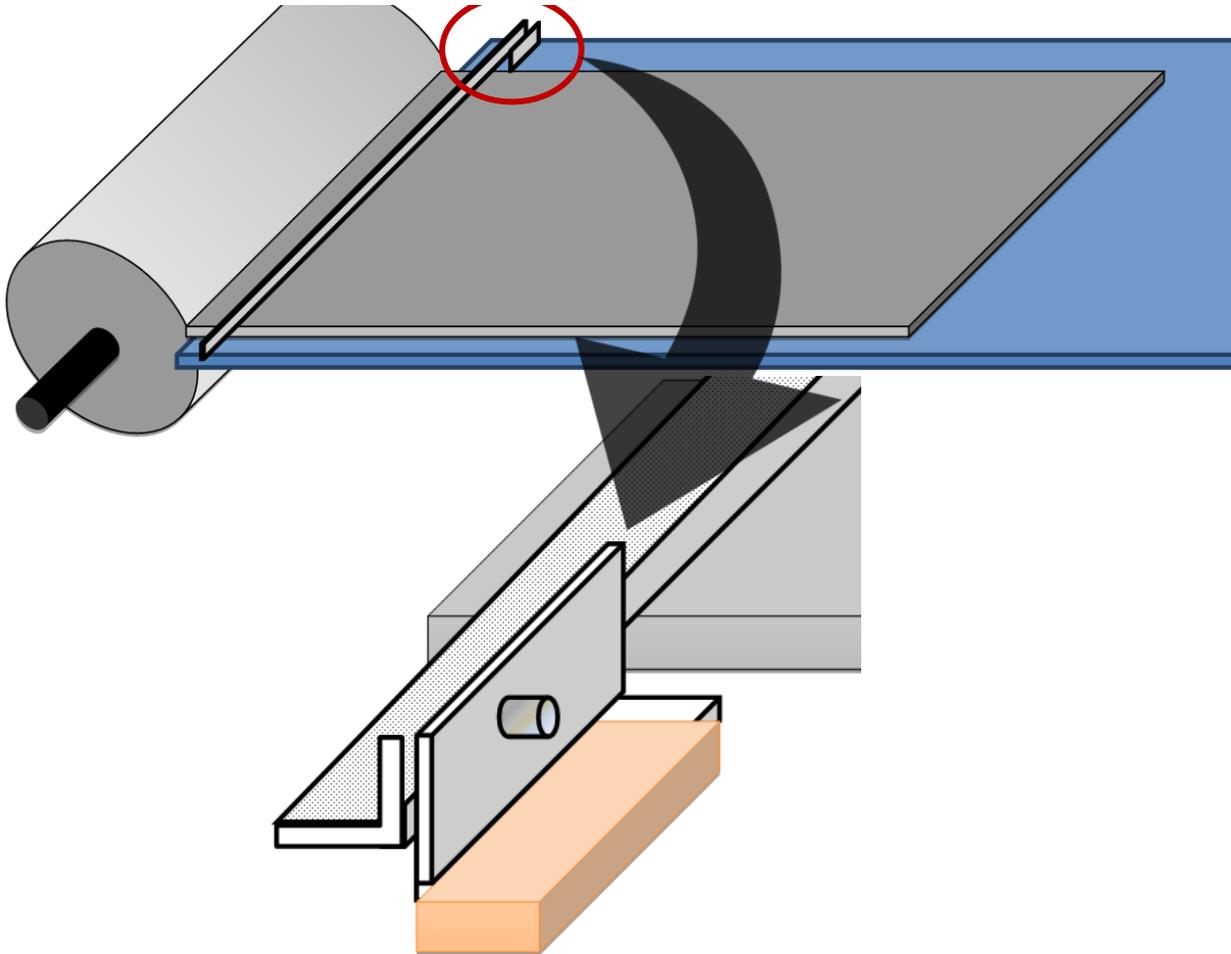
Mount a four foot wide (1.2 m) shear at one end of several shop tables (4' x 8' x 3/4" plywood top) aligned to accommodate long lengths pulled from a roll mounted on a 2" (50 mm) pipe supported at one end.

For widths up to 6 ft (1524 mm)

Cutting table width should be 7 ft. (2.1 m) wide.

A flat bar (pin-mounted on one end) can serve as a straight edge for cutting. A side edge alignment jig, such as a section of angle iron should be mounted on the first table exactly 90 degrees to the straight edge cutting aid to assure each cut is properly square. See Figure 1 below.

Figure 1 – Example of cutting table for manual cutting



Preparation for installation

Insulation should not be installed until the facility owner's designated representative has given written approval acknowledging that all inspections of the pressure-containing surfaces and any newly-coated surfaces have been inspected and documented.

Surfaces to be insulated and insulation to be installed shall be clean, dry and free of dirt, scale, oil and grease.

Insulation should not be applied to surfaces that are wet or frosted.

Installation techniques for various pipe diameters

For 3" (75 mm) diameter and smaller

- Spiral Wrap with 8 mm thickness to achieve 16 mm total thickness
 - + For maximum efficiency, the technique for insulating small diameter pipe (3" dia. and smaller), is to use small widths [2" (50mm) or 3" (75mm)] of blanket, which constitute "tape-style" rolls, applied with a spiral wrap technique.
 - + Spiral wrapping with a 50% overlap provides a 16 mm total thickness and minimum risk of water entry behind the insulation.
 - + Secure the standing end with permanent tie wraps or stainless steel banding, then continue spiral wrapping until the point of termination, then secure the terminated end in same manner as standing end. Trim blanket on both ends at right angle to the pipe or tubing.
- Cigarette Wrap with 8 mm thickness
 - + 8 mm thick Super Mat can also be applied on small diameter pipe with cigarette wrap technique.
 - + If installed as a single layer, the longitudinal joint should be a water-shed oriented lap joint.

For 4" (100 mm) diameter and larger

- 16 mm and thicker – Single layer cigarette wrap
 - + Assure longitudinal overlap is at 4 o'clock position, oriented to shed water.
 - + The preferred types of circumferential joint for the various blanket thicknesses are shown in the table below in the Joints section.
- 16 mm and thicker – Multiple layers
 - + For operating temperatures less than 500°F (260°C), two layers can be achieved by wrapping twice around the pipe and butt joining the circumferential joints.
 - + For operating temperatures greater than 500°F (260°C), double wrap (to achieve two layers) is not recommended so that a through-thickness joint can be avoided.
 - + Stagger joints where possible, including on elbows and fittings.

Joints

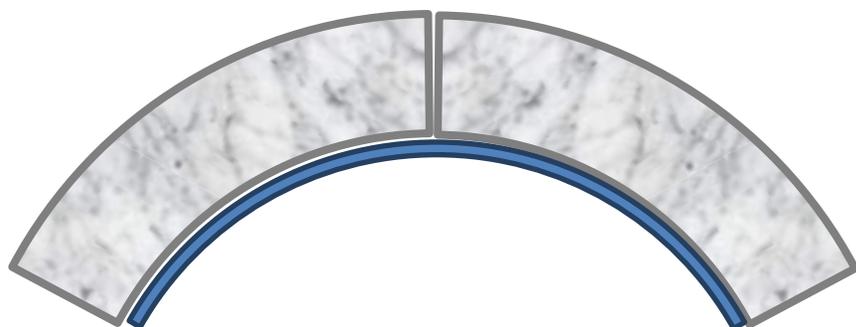
Unless specified otherwise in the written specification, insulation should not be cut undersized. Joints will separate and insulation efficiency will be reduced.

The chart below indicates the blanket thicknesses for which lap joints and ship lap joints are recommended.

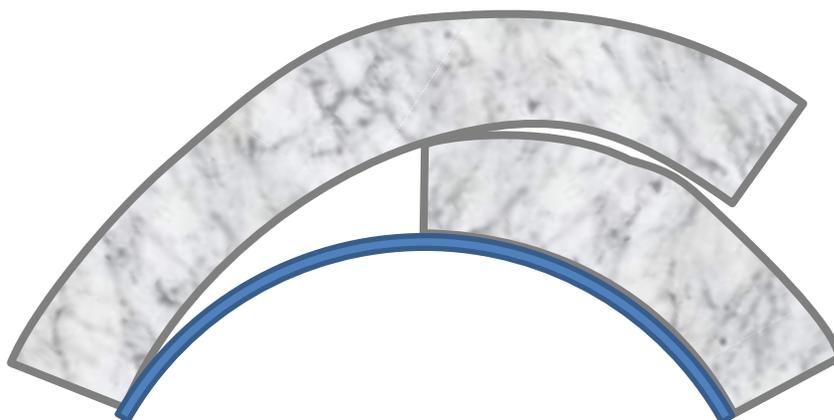
| Recommended Joint Types for Blanket Thicknesses | | | |
|-------------------------------------------------|------------|-----------|----------------|
| Thickness | Butt Joint | Lap Joint | Ship Lap Joint |
| 8 mil | Yes | Preferred | No |
| 16 mil | Yes | Preferred | Yes |
| 20 mm | Yes | No | Preferred |
| 25 mm | Yes | No | Preferred |

Following are photos and graphic depictions of the three types of joints for blanket style insulation.

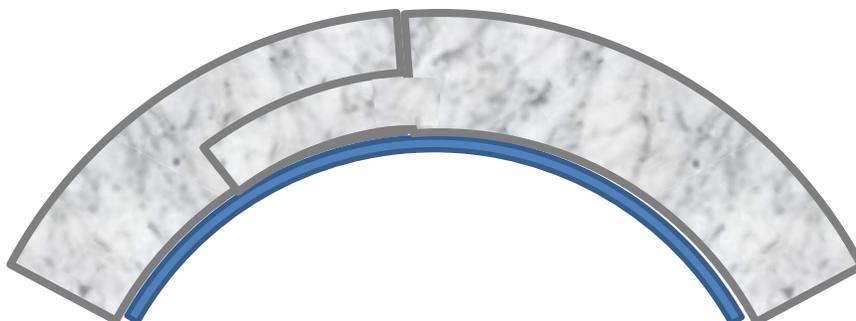
Butt Joint



Lap Joint



Ship Lap Joint



Multi-layer application

Stagger joints. Unless otherwise specified, joints shall be staggered when applying multiple layers. When applying a separate piece of blanket as a successive layer atop an existing layer, circumferential and longitudinal joints should be staggered by at least 3 inches (75 mm).

Double-wrap limitations. When two layers of 8 mm or 16 mm Super Mat are specified, this can be achieved with a double-wrap, which is wrapping twice around the pipe with a single piece of blanket.

If the outer layer is Super Mat STC (silicone coated), through-thickness butt joints should be avoided where possible by installing two separate layers. Generously apply clear 100% silicone caulk, such as Dow 732 Clear, to seal joints on the outer layer when Super Mat STC is to serve as the weather barrier.



Installation Guide

Nesting. When installing multiple layers as separate pieces (instead of using a single piece wrapped around twice), the outer layer must be sized to fully enclose the inner layer. If ordering the material pre-cut, the layers must be ordered from the fabricator as a “nested double layer.”

Cut length for a layer atop V-grooved layer. If installing field or shop cut Super Mat over V-grooved Super Mat, use a snake (a narrow piece of insulation or rope) to determine stretch-out length. Do not use charts to determine the length needed to cover the outside of V-grooved insulation.

General installation on pipe-- 4” (100 mm) diameter and larger

Determine circumferential cut length for cigarette wrap installation by use of charts in the Appendix or use of snake strip.

Insulation should be wrapped, not stretched, around pipe.

All longitudinal joints on horizontal pipe or cylindrical duct shall be oriented to shed water and should be located at either the 4 or 8 o'clock position.

Insulation may be secured with tape, wire, stainless steel cable ties, or stainless steel banding prior to installation of the specified weather jacketing.

Apply specified caulk to seal around uninsulated protrusions through the insulation.

Apply the weather jacketing in accordance with the job specification, when a jacket is specified.

Insulation at pipe supports

Hangers and saddles shall be sized to support the pipe and insulation. Hangers and saddles must be positioned so that there is sufficient space for the specified total thickness of insulation.

Insulation supports shall not be allowed to compress the insulation. Reduction of the thickness of insulation in any manner impairs its thermal performance (efficiency).

Pre-insulated pipe supports are recommended versus incurring the cost of field-installed welded steel supports (such as tee sliders) which protrude the insulation and require field-repair of the coating system if a coating is specified for under the insulation. The two types of pre-insulated pipe supports are:

- A support utilizing a proprietary dual-component system utilizing hydrophobic blanket insulation and rigid insulation are a good choice.
- Pre-insulated supports using rigid insulation (typically high strength calcium silicate) designed for the operating temperature at the bearing load. Be aware that calcium silicate can become wetted, which significantly impairs its insulation performance and can increase the risk of CUI depending on the operating temperature. Long term wetness of that insulation may result in loss of structural strength.

Fittings

Pre-cut shapes. Whenever possible, use pre-cut lobster-back or reverse gore shapes on 90 and 45-degree elbows to maximize labor efficiency.

Socket weld/screwed elbows. Insulation on the pipe connecting to socket weld and screwed elbows should be installed first so that the insulation on the fitting can overlap the insulation terminating at the shoulder of the fitting. The insulation on the pipe should be butted firmly against the shoulder of the fitting. Stagger the location of this lap joint on multi-layer applications.

Sealing joints on fittings. Clear 100% silicone caulk, such as Dow 732 Clear, adheres very well to both the fiber blanket and the optional silicone topcoat.

When installing pre-cut shapes for elbows:

- While the fitting is lying on a flat surface, apply a bead of clear 100% silicone caulk to one of the cut edges which will be mated as a butt joint.
- Carefully position the fitting into position, then bring the cut edges together and secure with tape, wire, or staple.
- If the Super Mat STC (silicone topcoat) is to serve as a weather jacket, run a 3/8" diameter continuous bead of the 100% clear silicone along the cut seam of the butt joint and smooth it gently into place with a finger. Assure there is enough caulk in contact with the silicone coating on each side of the seam to achieve a continuous seal.

Insulation of flanges

Do not insulate a flange assembly unless it is specified in writing by the facility owner or designated engineering contractor. It should also be noted whether there is a requirement regarding the need for a flange clamp/leak detector tube assembly to be fabricated and installed at any insulated flanges.

Assure that all torque checks on the flange bolts and pressure testing is complete and released in writing for insulation before beginning to insulate any flange.

The recommended installation technique for insulation of flanges with Super Mat is the same as for other hydrophobic flexible insulation materials. This technique consists of the following steps:

- Apply the specified insulation to the pipe section and terminate it at the flange, leaving ample room for a torque wrench to access the bolts.
- Install multiple wraps of a single piece of 1" (25mm) to 2" (50mm) wide blanket, applied atop the pipe insulation on each side of the flange to build up a "support,"
- This "support" is of a height that is aligned with the outer diameter of the flange. These support pieces are also known as a "Dutchman." Secure these supports with tie wire.
- Determine stretch out length (circumference dimension) using an insulation snake wrapped around the outside diameter of the flange the number of times needed to achieve the specified total thickness. Measure the total width needed to span the distance between the outboard edges of the two Dutchmen.
- Apply some spray adhesive to a spot on the outside diameter of the Dutchman supports to help anchor the leading edge of the main wrap blanket which will encircle the flange. Assure the edges align properly and squarely on the Dutchman supports, then wrap the main piece to achieve the total required thickness.
 - + Secure with stainless steel bands aligned over the Dutchman supports and over the flange.
 - + Install the specified weather jacket.

Flanged Valves

The layout for insulation for valves with Super Mat is the same as the layout for cutting a metal jacket for a valve. A standard tee, reducing tee, oblong tee, or saddle tee shape may be used.

If needed, cut a Dutchman as described for flanges above to create the insulation "end cap" on the outside of the flange on each side of the valve.

Glue sections together with silicone sealant or adhesive.

Hold the sections together with tie wire or tape to temporarily secure the pieces until adhesive has set.

Below is an example of this insulation technique.



Removable blankets

Removable blankets can be constructed from Super Mat with the silicone topcoat option (Super Mat STC), eliminating the need for a polymer-impregnated fabric envelope-style covering. However, including a conventional outer fabric covering **or** simply wrapping the sections of blanket in stainless steel wire mesh prior to securing it in place with banding will improve its resistance to mechanical abuse.

Removable covers constructed of Super Mat STC can be secured with continuous D-Ring Straps. The D-Ring straps can be secured with quilting pins or lacing hooks and stainless steel wire.



Ductwork – Square and rectangular

Overview. Square or rectangular shapes, such as ductwork, are shapes for which insulation design detail is crucial due to the very high risk of water entry. Topped surfaces of horizontal ductwork, are most often interrupted by external stiffeners. This creates insulation terminations at which accumulating (slowly draining or ponding) water gains entry into the insulation.

For these reasons, it is very important that ductwork is properly engineered and designed to effectively drain water and avoid ponding water. Unfortunately, the design detail and quality workmanship of the *insulation* are most often the only barrier between the entry of the inevitable risk of standing water and the increased risk of CUI and degraded thermal performance.

Facility owners should be encouraged to use hydrophobic thermal insulation as a minimum effort to counteract the risks that the difficult geometry presents.

General guidance. If insulation details are not provided in the insulation job specification, the facility owner must clarify whether the external stiffeners and flanges are to be insulated.

Use as few pieces of blanket as possible, wrapping the duct (between stiffeners) with a full circumference if possible. Assure the overlap is in the water-shedding direction.

Confirm compatibility of any adhesive or caulk with the coating.

If flanges and stiffeners are specified to be insulated, see the following section for detailed instructions. Otherwise, assure the steel is clean and dry, then seal edges of insulation jacketing against stiffeners and all protrusions with a continuous and generous application of caulk.

On ducting or large diameter pipe, use $\frac{3}{4}$ " (19mm) wide SS bands to secure jacketing. Rules for use of flat springs in long length of banding are same as with traditional insulation systems where long lengths of band and equipment thermal expansion is expected.

Below are examples of 20" wide blanket attached to flat surfaces with pins and caps.



Ductwork -- flanges & stiffeners

Installation of Super Mat blanket on round ductwork is similar to that for pipe, however take note of the job specification as to whether flanges are to be insulated.

Insulation of flanges and stiffeners:

- When flanges or stiffeners on vertical ductwork are specified to be insulated, the flange or stiffener should be insulated before insulation is applied to the duct itself.
- Due to the three-dimensional geometry of the flange, it will be necessary to use multiple small widths of “sheathing” depending on the diameter of the duct.
- The upper edge of the flange insulation must extend up onto the duct at least 2” (50mm) and be secured with banding before the duct insulation is applied to overlap the flange insulation like a sheath. This prevents water accumulating on the horizontal flange from being drawn into the insulation above the flange by capillary action.
- The insulation on the flange should be sized to also extend 2” (50 mm) down onto the duct below the flange/stiffener and should be overlapped by the insulation applied to the duct below the flange.

This shingle effect is needed to prevent water which may collect on the flange from being wicked behind the vertically oriented Super Mat.

- When it is specified that flanges on vertical ductwork should NOT insulated, terminate the Super Mat at least ½” (12 mm) above the flange.





Vessels

Insulation support rings are *not required* on vertical vessels due to the fact that protrusions such as nozzles, ladder clips, pipe supports, platform supports, and ancillaries such as instrumentation literally support the large lengths of blanket which are commonly installed as fairly large sections.

Use lap joint application on all single layer 8 mm blanket.

Either ship-lap or lap joints may be used on single and multi-layer applications 16 mm thick and greater thickness blanket.

Use $\frac{3}{4}$ " (19mm) stainless steel bands on 12" (305mm) to 16" (406mm) centers to secure Super Mat. Install a band on either side of a through-thickness protrusion to attempt to seal out water ingress (similar to a vapor stop in a cold insulation system design).

Above ground storage tanks

Standing seam panelized insulation is the preferred insulation system due to its robustness and resistance to hurricane force winds. These are considered specialized insulation systems which should be designed and installed by specialty contractors who provide a detailed design package and specification for review and approval by Owner's Engineer.

The preferred standing seam approach is to shop-fabricate the standing seam panels with Super Mat glued to the panels. Super Mat is well-adapted for handling, transporting, and installing long slender panels which tend to flex.

An alternative standing seam approach is to:

- Unfurl rolls of Super Mat that has been secured to upper edge of the tank shell,
- Overlap the vertical joints a minimum of 2 inches (50 mm),
- Secure the insulation with cable in accordance with the standing seam job specification, then
- Install the uninsulated standing seam metal panels.

Standing seam specialty fabricator/installers are recommended due to the complex geometry design details needed to accommodate the various cone roof designs, stairways, and accessories.

Some specialty fabricator/installers of standing seam designs for roof and shell panels provide a warranty which guarantees the roof can resist hurricane wind velocity up to 130 mile per hour.

Spheres

The standing seam gored-head system with Super Mat laminated to the metal gores is recommended for spheres.

Similar to aboveground storage tanks, specialty fabricator/installers are needed to design and install these complex geometry insulation systems for spheres.

Super Mat is a hot service insulation material; and it should not be used where operations result in a moisture-condensing environment at the steel surface.



Installation Guide

Jacketing

Super Mat is available with an integrated 1mm silicone coating that can provide superior weather protection in operating environments where the insulation is not prone to mechanical damage or damage by animals.

When this durable coating option is deemed appropriate as a substitute for metallic or non-metallic weather jacketing, no additional finish is required on indoor and outdoor applications of Super Mat.

When metal jacketing is specified, aluminum, stainless steel or galvanized metal jacketing can be used depending on the operating and environmental conditions.

Metal jacketing can be secured with bands, screws or pop rivets. For thinner thicknesses, assure screw length is not longer than the total insulation thickness.

Insulation doubling as personnel protection (PP)

Where metal jacketing is required, the surface temperature of the metal jacketing on insulation which is required to also serve as personnel protection (PP) must be less than 140°F (60°C).

However, when the operating environment is suitable, the facility owner may desire to eliminate the metal jacket and utilize Super Mat STC (with silicone coating) to achieve *the required skin sensation temperature* with less insulation thickness than would otherwise be required to achieve PP. A low energy surface (such as a non-metal) provides a much lower *skin sensation temperature*.

Consult with Lewco Specialty Products for technical guidance and thickness calculations for specific applications.