

## HOW TO INSTALL MULE-HIDE REINFORCED HEAT-WELD MEMBRANES

### Basic Considerations

The installation of a Mule-Hide roof involves procedures and techniques that have been carefully conceived and engineered to help you provide your customers with the most reliable, lowest maintenance roofing system available.

Successful roof installations do not just happen; they must be carefully planned and implemented. An understanding of the basic properties of the Mule-Hide system can help the contractor to exploit its unique strengths and to avoid unnecessary problems. Keep the following in mind as you go through this section: Mule-Hide Heat-Weld Membranes are polyester scrim-reinforced, single-ply roofing system designed primarily for mechanical and fully adhered attachment and hot-air welded seams. Mule-Hide membrane is formulated with polymers that are highly resistant to sunlight and weather, as well as many chemicals.

The remainder of this section covers the proper methods of performing each step of the installation. This material was written to provide the contractor with practical, detailed information that can help ensure the proper performance of each step of the Mule-Hide installation.

### Preparing the Substrate

The substrate under the Mule-Hide Heat-Weld Membranes must be properly prepared. The general goal of this preparation is to provide a smooth compatible surface for the insulation (when required) and the membrane.

The contractor should follow good roofing practice when evaluating and preparing the surface. For example, as general practice especially on reroofing jobs, prepare the entire roof before starting the Mule-Hide installation in order to minimize contamination and ensure the integrity of the seams. By keeping in mind the general properties of the Mule-Hide Heat-Weld Membrane you can help evaluate unusual situations when they arise; but if you are in doubt as to the resolution of problems not addressed on the Mule-Hide Standard Details or Specifications, contact your Mule-Hide Technical Service Department for advice.

### New Roofing Installations

On new roofing installations, keep the deck and insulation surface free of debris and trash. Note precisely the location of structural members, electrical conduits, and gas and water lines under the deck, as well as general deck characteristics that will affect the placement of mechanical fasteners - such as the direction and spacing of steel deck flutes.

Follow good roofing practice in the loading of the roof with Mule-Hide Heat-Weld Membrane rolls. Stack carefully and store in a cool, clean, dry location.

**CAUTION:** Keep the packaging protecting the Mule-Hide Heat-Weld Membrane intact until ready to use.

### Reroofing Installations

To ensure a successful reroofing job, you must be aware of the conditions that led to the need for the reroof. It may be that leakage has occurred from sources other than the roof. If so, be sure that the Building Owner or Operator is aware of any such sources as early as possible, and understands that the application of a new roof may not solve all of the leakage problems. Some useful points to cover in your evaluation follow.

Investigate existing leakage conditions thoroughly. Before the installation begins, be sure that a thorough investigation of existing roof conditions has been performed, and that a review or “as-built” plans and specifications for the building as well as the assessment of current conditions has determined that the building is structurally sound and otherwise suitable for reroofing.

It is helpful to know such details as the nature, extent, and duration of leaks that may have occurred through the old roofing. Because leaks often occur from sources such as building parapets, walls, and windows, a new roof may not solve all leakage problems. Check the building walls for dampness, spalling brick, large stress cracks, and efflorescence (salty, powdery deterioration) - signs of problems that extend beyond the roof itself. Look for stains inside the building, and be sure that all sources of such stains are known.

Evaluate existing roof conditions: The cause(s) of poor drainage conditions should be thoroughly understood and solved as part of the reroofing process. For example, check for signs of ponding, a sure sign of poor drainage. If ponding occurs, determine the extent and duration of ponding. If needed, are overflow scuppers or other means of drainage present? Determine if a provision should be made for their installation.

Are there noticeable splits in the existing roofing? Splits may indicate a change in substrate or in metal deck direction; they could be indications that an expansion joint is required.

Be sure that you know ALL types and conditions of substrate that are present, the spacing of structural members under the deck, the direction and gauge of a steel deck, the thickness of concrete of insulating fill, drain placement, slope, and the location of expansion joints.

Make a roof drawing: Once on the roof, work up a detailed roof drawing on the Mule-Hide Pre-Job Survey showing all dimensions, drains, mechanical equipment, penetrations, skylights, monitors, parapet walls, and other features. You will have to submit your drawing(s) as part of the Warranty Application.

Removal (tear-off) of existing roofing: Your crews should remove no more roofing and insulation from a given area of the roof than can be completely covered with new insulation and Mule-Hide membrane that day. On tear-offs, ALL gravel and debris will have to be broomed from the deck.

Reroofing over existing roofing: When reroofing over old roofing, broom ALL gravel and debris from the old roofing surface, cut out blisters and fishmouths, and seal. Remove and replace wet insulation as required. As general practice, prepare the entire roof before starting the Mule-Hide installation in order to minimize contamination and insure the integrity of seams.

## **Laying Insulation**

If old insulation is present and is to be retained, you should determine if it is wet. The surest diagnostic technique is by taking and evaluating a series of roof cuts. Alternatively, three techniques currently available to make this determination by indirect means are: nuclear moisture detection, infrared thermography, and electrical capacitance.

These techniques provide measurements of factors that can be associated with the presence of moisture. As such, they can help point out certain inconsistencies in the existing roof system (and the operator), but do not necessarily provide valid measures of moisture. Limited direct verification is always advisable.

Whatever your method of investigation, wet insulation must be removed and replaced. The presence of wet insulation must be noted on the Pre-Job Survey. These areas must be designated on the roof diagram.

Insulation must be laid and fastened according to its manufacturer’s specifications, and at a minimum

must follow Factory Mutual's suggested guidelines.

The longest dimension of the insulation should run PARALLEL to the flutes of a steel deck and PERPENDICULAR to the direction in which the Mule-Hide field sheet will be unrolled. Regardless of the approved lay of the insulation board, the membrane field sheet direction must be proper with respect to the deck construction, as explained in "Installing Membrane - Field Sheet Membrane," below.

Lay no more new insulation than will be covered by the roofing membrane on the same day. Work on any given area of the roof must be made completely watertight at the end of each workday.

Good roofing practice dictates that care can be taken to achieve smooth transitions between insulation boards and roof areas. Always consider proper drainage and adjust thickness to achieve. The membrane should never have to bridge an area and transitions should never cause ponding.

## Installing Membrane

### Perimeter Half Sheet

To ensure that your installation meets the Mule-Hide specifications, refer to Standard Details as you read this section.

**CAUTION:** Keep the protective packaging of the Mule-Hide Heat-Weld Membrane intact until ready to use.

**NOTE:** Half-sheets are 40.5 in wide; field sheets are 81 in. wide. The field sheets must always be installed perpendicular to steel deck flutes, plywood deck joints, or deck plank direction, as appropriate. All field seams shall be shingled with the flow of water.

1. Install the first perimeter half-sheet. Roll out the first half-sheet of membrane along one edge of the work area. This edge should be parallel to the direction in which the field sheets will run. Overlap the fascia with one edge of the roll, extending the membrane over the edge of the roof, past where the clip for the metal fascia is to be fastened. Allow the membrane to relax at least 15 minutes prior to fastening, 30 minutes when temperatures are below 60° F. Fasten the membrane to the vertical surface with corrosion-resistant ring shank cap nails (or other appropriate fastener when a nailer is not available) at 12 in O.C.

**NOTE:** Face Nailing is not acceptable into less than nominal 2x (e.g., 2 x 6 in.) wood nailers.

On the roof surface, note the position of the edge of the half-sheet, and then fold back the first half-sheet until the folded edge is roughly even with the roof edge.

2. Install the second perimeter half-sheet. Unroll the second half-sheet roll of membrane so that it laps under the unfolded edge of the first half-sheet 5 inches. This will produce a 2 to 2-1/2 in. clear lap area for seam welding. As with the first sheet, allow the membrane to relax at least 15 minutes prior to fastening, 30 minutes when temperatures are below 60° F. Install the appropriate Mule-Hide fasteners in the second half-sheet at the spacing specified for the particular deck type, utilizing the "set-pattern" (blue markings spaced 6 in. apart) scribed on the membrane. If still in doubt about fastener spacing or other aspects of this operation, consult your Mule-Hide technical Service department.

**NOTE:** Consult Fastener Guidelines (Section 5) for determination of "perimeter" and fastener spacing.

3. Fold back the unfastened edge of the second half-sheet.

### Field Sheet Membrane

1. Unroll the first full-width sheet membrane. Roll out the full-width Mule-Hide field sheet membrane so that it laps UNDER the second half-sheet by 5 in. This will produce a 2 to 2-1/2 in. clear lap area for seam welding. Position the butt end of the membrane so that it will be overlapped 5 in. by the second half-sheet that will be installed perpendicular to the field sheets.

**NOTE:** All field seams shall be shingled with the flow of water.

2. Allow the membrane to relax at least 15 minutes when the temperature is above 60° F prior to fastening.
3. Fasten the field sheet. Mechanically fasten both edges and the butt end of the first field sheet into the deck. Take care to avoid making wrinkles. Fasteners must be installed so that the plates are 1/2 in. from the edges and end of field sheet. Space fasteners apart as required for the specific deck type and wind uplift requirements (see Section 4).
4. Install two more field sheets. These and subsequent rolls of field sheet membrane must OVERLAP by 5 inches (to the scribed blue lap line) the previous runs of field sheet membrane. Align butt ends so that they will be overlapped 5 inches by the still-to-be-installed second perpendicular half-sheet. Mechanically fasten field sheet into the deck along the edge that does not overlap the previous sheet, as well as the butt end. Space fasteners apart as indicated for the specific deck type and wind uplift requirements.
5. Roll the first half-sheet back into place. The first half-sheet should overlap the second half-sheet by 5 inches. Then roll the second half-sheet back; it should overlap the first field sheet by 5 inches.
6. Hot-air weld the half-sheets and the field sheets. Using the hot-air welding machine, welds all overlapping edges of the membrane together.

**NOTE:** In the subsequent hot-air welding operations we recommend hot-air welding the sheets together after installing a group of three full field sheets.

### **Perpendicular Half-Sheets**

1. Unroll and mechanically fasten perpendicular half-sheets. To install half-sheets that are perpendicular to the field sheets, follow the same general procedure that was used with the first two half-sheets. As noted previously, the second perpendicular half-sheet must overlap the field sheet butt ends by 5 inches. This overlap will produce a 2 to 2 1/2 inch clear lap area for seam welding.
1. **NOTE:** The two perpendicular half-sheets must overlap the two previously installed half-sheets, and must run out to the edge of the roof, to the metal fascia clip position.
2. Hot-air weld the sheets together. Weld the sheets together using the hot-air welding machine. Take care to avoid making wrinkles.
3. Probe all seams. Seams may be checked when cool. For best results, checking seams 8 hours after hot-air welding is recommended. Repair any voids found the same day. After probing and all necessary repairs have been made, caulk all cut edges of reinforced membrane with Mule-Hide Edge Sealant.

**NOTE:** Pay special attention to the “T” lap seams formed where the second perpendicular half-sheet overlaps the butt ends of the field sheets. To ensure proper seaming of the “T” joints for 50 and 60 mil membrane, the top layer of the Heat-Weld Membrane is creased a minimum of one inch into the lower layer of membrane by using a heat gun with a narrow or pencil tip nozzle and a rubber hand roller. By inserting a heat gun nozzle between the layers of the membrane, the

membrane will soften and begin to flow allowing it to crease and seal completely after applying pressure with a hand roller to ensure adequate bonding of the softened material. After heat-sealing the "T" joint, Edge Sealant must be applied a minimum of 6 inches in each direction of the "T".

### **Probing Seams**

Probe all seams and repair all deficient seams no later than the following workday. **FAULTY SEAMS HAVE BEEN THE SINGLE MOST COMMON DEFICIENCY NOTED BY MULE-HIDE INSPECTORS.** Make it a routine to probe seams each workday, and to repair all seam deficiencies with the hand welder before leaving the work site.

### **Flashing Details**

While many roofing jobs are likely to have their own special problems, the contractor is just as likely to face certain rooftop features over and over again. This section explains how to accommodate these common roof features quickly and effectively, time after time with the Mule-Hide Heat-Weld Membrane Roofing Systems.

In general, when dealing with common roof features (curbs, vents, etc.), complete the pertinent details per Mule-Hide Standard Details. When approaching such features, cut and fit the membrane around each obstacle you encounter. All membrane flashings shall be installed concurrently with the roofing membrane as the job progresses. Install night seals as necessary at the end of each workday. Should any water penetrate the new roofing because of incomplete flashings, the affected areas shall be removed and replaced. In reroofing, maintain the ability of the existing roof to drain - don't block off drains or scuppers.

### **The Advantage of Hot-Air Weldability**

The unique hot-air weldability of both the scrim-reinforced field sheet membrane and unreinforced flashing membrane gives the contractor a special advantage when completing roof details. When used in connection with roofing details, hot-air welding provides the same assurance of watertightness as in field seaming - assurance that comes from permanently fused seams that can be as strong as the Mule-Hide Heat-Weld Membrane itself.

### **General Approach**

The general approach to complete common roofing features involves hot-air welding, Mule-Hide Bonding Adhesive, Mule-Hide Edge Sealant, and terminating flashings. Common roofing features include such details as wall flashings, vertical and flat edge terminations, inside corners, outside corners, round shapes, drains, curbs and pitch pockets. Mule-Hide recommends that you rely on pitch pockets only as a last-ditch measure, although from time to time they can provide efficient means of dealing with particular problems.

As a general approach, the Bonding Adhesive is used to adhere, as appropriate, field sheet membrane to features such as curbs, vents, and parapets. Then, hot-air welding is used to seam membrane overlaps and Mule-Hide Edge Sealant is applied to cut edges of reinforced membrane.

**IMPORTANT:** All roofing work must follow Mule-Hide standard Details. Any failure to complete details to Mule-Hide specifications can stand between you and favorable inspection - and therefore, a Warranty. If no Standard Detail applies to a particular requirement of your job, sketch the way you think it should be handled and submit the sketch with your Pre-Job Survey for approval. Consult Mule-Hide's Technical Department if you have any questions about the Mule-Hide Standard Details.

**NOTE:** No deviation from Mule-Hide Standard Details is authorized until (1) it is submitted by the contractor in writing or sketch form for review and the job file, and (2) is approved by Mule-Hide's

Technical Department.

## Penetrations

Mule-Hide Heat-Weld Membranes must be mechanically attached at all penetrations. See details for specific methods of attachment.

## Curbs, Vents, and Roof-to-Wall Flashings

Install Mule-Hide fasteners and plates as required around these penetrations. Using the Mule-Hide Reinforced Heat-Weld Membrane cut out flashings as required. All Heat-Weld Membrane flashings shall be fully adhered using Mule-Hide's Bonding Adhesive. The following conditions must be met:

1. All surfaces to be fully adhered should be compatible, dry and smooth with no excessive surface roughness. If an existing asphalt surface is present, one-half inch minimum plywood, 9 oz. polyester slipsheet or 26 gauge minimum galvanized metal barrier must be placed over the asphaltic surface.
2. After the proper surface has been prepared, Mule-Hide's Bonding Adhesive shall be applied using a minimum 1/2 inch nap paint roller at a rate of approximately 2-1/2 gallons per 200 square feet of surface area depending on the type of substrate. Apply adhesive in smooth even coat, avoiding globs, puddles, or other types of irregularities.

Adhesive should be applied to the area of substrate to be flashed. Let adhesive dry sufficiently to produce strings when touched with a dry, clean finger. Mule-Hide Heat-Weld Membranes used as flashing shall be cut to a workable length and shall have an even coating of Bonding Adhesive applied to it at a rate of approximately 1/2 gallon per 100 square feet. Carefully roll onto the previously coated substrate after the adhesive coating the membrane has dried sufficiently as indicated above. **Coverage rates will vary depending on substrate and environmental conditions.**

Avoid wrinkling membrane when applying to substrate. The amount of adhesive that can be successfully applied to the membrane will vary depending on ambient temperatures, humidity and manpower. After mating membrane to the substrate, carefully roll the membrane with a 2-inch wide rubber hand roller to promote maximum positive contact between the membrane and the substrate. Overlap all adjacent flashing sheets a minimum of 2 inches. The Heat-Weld Membrane Flashings shall extend a minimum of 6 inches onto the field sheet and be adhered securely. There shall be a minimum 2 inches hot-air weld in front of the fastener plates. All side laps are to overlap a minimum of 2 inches.

**Areas of the flashings and membrane to be welded are not to have Membrane Adhesive applied to them.**

All flashings shall extend a minimum of 8 inches above roof membrane level unless previously accepted by the owner or his representative and the Mule-Hide Technical Department. All flashings shall be hot air welded at their connections with the roofing membrane. Apply Edge Sealant at all welded edges of flashings. All flashings shall be properly terminated according to mule-Hide's published Standard Details. NOTE: After flashing is adhered in place, promote full contact adhesion by going back over entire area with a 2-inch rubber hand roller.

## Roof Drains

Install roof drains according to the Standard Details. Field seams must not run through drains. In reroofing, old drains must be "**thoroughly cleaned**" or replaced. Existing sealing materials must be completely removed to avoid contamination and interference with the new membrane seal and with

consistent clamping pressure. Insure that studs and clamping ring are in good condition. Replace parts as required, including screens.

## **Metal Work**

Install metalwork in a manner that prevents damage from expansion or contraction and from the wind. Seal and water proof all metalwork in an acceptable manner. Note that metalwork other than Mule-Hide Coated Metal and Mule-Hide supplied accessories are not covered by Mule-Hide Warranty.

## **Standard Details - Curbs and Vent Stacks**

**IMPORTANT:** All roofing detail work must follow Mule-Hide Standard Details. Any failure to complete details to Mule-Hide specifications can stand between you and a favorable inspection - and therefore, a Warranty. Consult Mule-Hide Technical Service department if you have any questions about how to solve special roofing problems using the Mule-Hide system, or about the Mule-Hide Standard Details.

## **Special Problems**

Many roofing jobs are likely to have some special problems. This section explains how to accommodate some of these problems quickly and effectively with the Mule-Hide Roofing System.

## **Voids and Wrinkles in Seams - General**

Unprobed, defective seams are the most common problem found by Mule-Hide inspectors. If defective seams are found by the Inspector on your job, they are likely to delay the issuance of a Mule-hide Warranty. Therefore, it is in your best interest and good roofing practice to thoroughly check your seams to ensure they are acceptable to Mule-Hide BEFORE the final inspection occurs.

Probe all seams daily. Be sure to probe ALL new seams approximately 8 hours after completion or at the beginning of the next workday. Mark all voids and other defects for repair with a water-soluble marker.

All seam welds must be at least 1 inch wide and free of voids. Seams that do not meet these specifications are not acceptable to Mule-Hide.

Defective seams must be repaired the same day as found. All voids and otherwise defective seams must be repaired by hot-air welding with a Mule-Hide approved hand-held hot-air welder the same day as probed.

**NOTE:** Seams do not deteriorate over a few days' or weeks' time when [properly] welded. When an inspector finds voids, the contractor could have found the problem with effective probing during the installation.

## **Repairing Voids and Wrinkles**

**Voids.** The presence of voids generally indicates that not enough heat is being applied to the membrane, and therefore the movement of the welding machine should be slowed down. It may also be possible that you are trying to weld membrane that is dirty or wet. Follow this procedure:

Clean the surface to be welded. Clean the surfaces of both sheets to be welded thoroughly with Fantastik or other similar general cleaner. Rinse clear and let dry. Surfaces must be cleaned until they are white. Make a final pass over the cleaned area with a clean rag dampened with Mule-Hide Membrane Cleaner.

**Wrinkles.** The presence of wrinkles in seams indicates the possibility of voids and a weak seam.

Wrinkles may form if the hot-air welding machine drags the membrane at an angle to the seam. Such dragging can be caused by a machine that is out of alignment by the welding of seams along, up, or down too great a slope, or by the improper unrolling of the membrane, so that it does not lie flat and/or parallel to the seam direction.

Wrinkles and other distortions may also occur in hand welding operations because of inconsistent hand-rolling and welder movement. The operator should strive for smooth, consistent progress. Use a low enough heat setting to permit smooth work, especially with non-reinforced sheet.

Hand welding for field seams may be necessary on steep slopes, although some contractors find that the hot-air welder machine can be "held back" by the operator (possible with a helper) when welding DOWN slopes. This practice increases the difficulty of "staying on course," and is not recommended for the novice operator.

### **Repairing Punctures and Holes in Membranes**

Occasionally, punctures and holes may occur in the Mule-Hide Heat-Weld Membrane. Punctures and holes are frequently the result of other trades working on the roof, which should be kept to a minimum by the building owner/manager or project general contractor.

To repair punctures and holes in the Heat-Weld Membrane follow this procedure for hand welding a patch:

1. Clean the surface to be patched. Clean an area a minimum of 4 inches in all directions around the puncture or hole thoroughly with Fantastik or other similar general cleaner. Rinse thoroughly. Wipe with clean, damp rags and dry well. Surface must be cleaned until it is white.
2. Wipe the cleaned area of the field sheet membrane with Mule-Hide Membrane Cleaner, following all directions and precautions on the label. Final cleaning with the Mule-Hide Membrane Cleaner will help ensure the removal of any remaining dirt or soap film.
3. Cut out patch. Cut a round or rectangular patch with rounded corners from field sheet membrane. The patch must be 3 inches larger in all directions than the puncture or hole.

**NOTE:** All patches must be cut from scrim-reinforced membrane.

4. Position patch over the puncture or hole. Take care to allow for even laps on all sides.
5. Hot-air weld the patch. Using the hand-held hot-air welder and hand roller, hot-air weld the patch over the puncture or hole.
6. Caulk the cut edges. Caulk all edges of the patch with Mule-Hide Edge Sealant.

### **Making a Temporary Tie-In**

While the roofing job is underway, it is vital to keep insulation, roofing board, and/or other substrate and deck dry. Moisture that is present under the Mule-Hide Heat-Weld Membrane will have a difficult time escaping once the membrane is hot-air welded.

Therefore, a "night seal," or temporary waterstop, should be applied whenever storms threaten and at the end of every workday. The time needed to apply a night seal is well invested. The resulting protection can prevent the need for costly and time-consuming tear-off of wet substrate materials!

**IMPORTANT!** The membrane used to make a night seal must be trimmed back prior to work. Asphaltic products used to make a night seal are not compatible with Heat-Weld Membranes.

### **Temporary Sealing of a Penetration**

From time to time, at the end of a workday or before a storm breaks, it may be necessary to seal penetrations temporarily. Follow this procedure:

1. DO NOT make finished cuts at this time. A surplus of membrane will ensure that the next steps do not compromise the eventual, final completion of the penetration detail.
2. Turn membrane up on curb or equipment a minimum of 2 inches.
3. Install duct tape. Tape should be a minimum of 4 inches wide. Make sure you have a good bond between the tape and the curb. Tape should always be used in a manner that does not rely strictly on the tape adhesive to stay in place; e.g. ballast, wrap, or tack in place.
4. Before permanent seaming and adhesive bonding, trim membrane that is contaminated with tape adhesive. Remember, adhesive from the duct tape will prevent successful hot-air welding and good bonding with Mule-Hide Bonding Adhesive.

**WARNING:** Duct tape is not a suitable means for permanent sealing of seams in the Mule-Hide Heat-Weld Membrane System. Only hot-air welding is an acceptable means of seaming.

### **Roof Walkways**

A walkway must be provided to accommodate regular traffic to service rooftop units. You can use smooth surface paver blocks over a slip sheet, or use the MH-100 Walkway Rolls.

**End of Section**