

System Specifications

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MECHANICALLY ATTACHED SYSTEM SPECIFICATION INDUCTION WELDING ATTACHMENT METHOD SUPPLEMENT

07 54 00/MUL

Revision Date: June 2020

Induction Welding is an alternate method for securing Mule-Hide's TPO-c or PVC membranes to be used in conjunction with the Mule-Hide's Mechanically Attached TPO or PVC Roofing System Specification.

1.01 Description

The Mule-Hide Induction Welding Attachment Method incorporates 3-3/8" diameter corrosion-resistant plates with either a hot melt TPO coating or a hot melt PVC coating. The Mule-Hide Induction Welding Plates are installed with Mule-Hide EHD (#15) Fasteners to secure an acceptable insulation to minimum 22 gauge steel deck or minimum 15/32" thick plywood.

Note: **DO NOT MIX PLATES.** Only TPO Induction Welding Plates may be used with standard TPO membranes and only PVC Induction Welding Plates may be used with standard PVC/KEE membranes. This attachment method is not for use with fleece back or self-adhered membranes.

Mule-Hide's TPO-c or PVC (Heat-Weld) reinforced membranes are positioned over the secured Induction Welding Plates and welded to the top surface of the plate with an Induction Welding Tool and cooling clamp devices.

Projects utilizing the Induction Welding Plate Attachment Method will qualify for system warranties up to a maximum of 20 years. Contact the Mule-Hide Technical Department for warranty enhancement requirements.

1.02 Products/Heat Welding Equipment

Products listed in "Part 2" of the Mule-Hide Mechanically Attached TPO or PVC System Specifications can be used as part of this alternate securement method in conjunction with the Induction Welding Plates.


- A. Induction Welding Plate: A 3-3/8" diameter, 0.028" thick, corrosion-resistant steel plate with hot melt coating of either TPO or PVC on the top surface. The plate is used in conjunction with Mule-Hide EHD (#15) Fasteners to attach the roofing assembly. The field sheet is welded to the Induction Welding Plate by use of an Induction Welding Tool.

- B. Induction Welding Tool: An induction heating tool is used to emit the magnetic field that activates the hot melt coating on the top surface of the Induction Welding Plate to fuse with the Heat-Weld roofing membrane. Refer to Induction Welding Tool Owner's Manual for additional information.
- C. Cooling Clamp Device: A stand-up device that allows the weld to cool as it clamps the membrane to the heated plate. Refer to Induction Welding Tool Owner's Manual for additional information.
- D. RhinoBond Cardboard Disc: Used when Induction weld systems are being installed over Expanded or extruded Polystyrene insulation to prevent the plates from melting the insulation.
- E. Heavy Duty Plunger: Used for testing bond of Induction Welding Plate to matching Mule-Hide roofing membrane.

1.03 Induction Welding Tool Calibration

Prior to attaching the roofing membrane to the Induction Welding Plates, the Induction Welding Tool must be calibrated with samples of the project specified membrane and thickness. Refer to Induction Welding Tool Owner's Manual for additional information.

A. Calibration Steps

1. Loose lay five Induction Welding Plates in a row about 12-24 inches apart on the specified substrate.
2. Place Heat-Weld membrane over the Induction Welding Plates.
3. Center the Induction Welding Tool over the Induction Welding Plates installed under the membrane and use the device's default setting. Weld the membrane to the first plate, and when the tool indicates, completely remove Welding Tool. Immediately place the Cooling Clamp on the membrane centered over the plate and leave in place for 60 seconds. Mark the Welding Tool energy setting used for that particular plate on the membrane near the fastener.
4. Place Induction Welding Tool on the next plate as previously done and increasing induction energy one level by depressing the  (UP) button once. After welding, immediately place the Cooling Clamp over the plate. Mark the Induction Welding Tool energy setting used for that particular plate on the membrane near the fastener.

5. Repeat above procedure for the remainder of the plates, increasing induction energy one level for each plate.
 6. After allowing the membrane and plates to cool to ambient temperature, remove Cooling Clamps. Turn the membrane over and use a pair of pliers to peel the Induction Welding Plates from underside of membrane to determine bonding strength. Examine the top of the plates for weld quality. A 100% bond to the top of the plate is required.
 7. Repeat trial process, if needed, adjusting energy level up or down until desired results are achieved.
 8. Set the Induction Welding Tool to the setting that produces a 100% bond. Several settings may yield a 100% bond. If this happens, select the energy level setting in the middle. See below for descriptions of acceptable and unacceptable bonds.
 - a. **100% Bond (required)** – Total, even, and consistent 360° adhesion of membrane. The welded plate should make a visible impression on the top of membrane, and the membrane should delaminate to the scrim in a fairly complete circle/donut.
 - b. **Partial Bond (unacceptable)** – Uneven/incomplete adhesion of membrane. Energy setting may be too low, heat source may be off center, or plate may be overdriven.
 - c. **Excessive Heat (unacceptable)** – Membrane may turn yellow, melt or become dimpled.
- B. Calibration Tips:
1. Recalibrating the Induction Welding Tool settings is necessary when ambient temperature changes more than +/- 15°F or power to device has been interrupted. This may be necessary several times a day. Do not assume that the same setting will work throughout the day.
 2. If a Low Voltage message appears in the display or if you do not get a 100% weld during calibration, check power at the end of the cord and determine what else is running on the same circuit. Power may be diminished if one of the following is determined:
 - a. The extension cord is too long.
 - b. The power source is overloaded.

1.04 Installation

- A. After placement of insulation on substrate, secure the insulation at a minimum rate of six (6) Induction Welding Plates secured with EHD (#15) fasteners per 4'x 8' board in the field. Note: Avoid fastener overdrive to prevent plate from deforming. Follow Mule-Hide's Details at the end of this supplement for proper placement of the plates on the boards. Proper plate placement is required to meet wind uplift requirements. Higher wind resistance may require addition attachment. Refer to Detail MHT-IWP3 for increased attachment patterns. If expanded or extruded polystyrene is the top layer of insulation RhinoBond Cardboard Plates must be used under the plates to prevent melting the insulation.

Note: DO NOT MIX PLATES. TPO Induction Welding Plates can only be used with standard TPO membranes, they cannot be used with fleece back or self-adhered membranes. PVC Induction Welding Plates may only be used with standard PVC membranes, they cannot be used with fleece back membranes.

- B. Place the Heat-Weld membrane over the appropriate Induction Welding Plates and allow membrane to relax. Locate and mark the locations of the plates that are installed under the membrane.
- C. Place Induction Welding Tool centered over the Induction Welding Plates.
- D. Follow the directions of the Induction Welding Tool to determine the correct energy setting.
- E. When the Induction Welding Tool indicates the weld is complete, immediately place the magnetic Cooling Clamp on the membrane centering the clamp over the plate. Leave in place for at least 60 seconds.
- F. Resume process ensuring membrane is attached to all plates.
- G. Perimeter enhancements

To meet increased uplift requirements in the perimeters and corners of each roof area, additional insulation attachment provisions must be installed as follows:

1. For Induction Welding Plate attachment, the minimum width of the perimeter and corner areas shall not be less than eight (8) feet from the edge of the roof.
 - a. **Perimeters** – insulation attachment shall be increased 50% over the field attachment requirements.

- b. **Corners** – insulation attachment may be required to be increased 100% over the field attachment requirements. This may vary based on the individual requirements of each building.
2. For Factory Mutual projects or projects required to meet specific building code uplift requirements, contact Mule-Hide Technical Department.

1.05 Induction Welding Plate Test Procedure

Test all Induction Welding Plates during construction. To determine if a weld has been made, place a heavy duty plunger next to a welded plate and create enough suction to lift the membrane. An acceptable weld will crease the membrane around the edge of the plate. If the assembly is not welded, the membrane will lift up off of the plate. Mark any plates that are not welded and return to complete the weld as required. Un-welded plates are not permitted anywhere in the system.

1.06 Membrane Hot Air Welding Procedures & Additional Securement

- A. Join membrane sheets by overlapping and heat welding the seam following standard welding requirements as outlined in 3.09 Welding of Lap Areas of the Mule-Hide Mechanically Attached TPO Roofing System Specification.
- B. Base attachment at any area where the change of plane is equal to or exceeds 2" per foot (2:12) is required as outlined in Section 3.10 Additional Membrane Securement (Base Attachment) in Mule-Hide's Mechanically Attached TPO or PVC Roofing System Specification and must be done using one of the following methods:
 1. Use Induction Welding Plates and EHD fasteners placed 3-½" to 4" away from angle change as shown in Detail MHT-IWP2 and MHT-IWP5.
 2. Use 2.4" Seam Plates and EHD Fasteners placed either horizontally into the deck or vertically into the wall as depicted in Detail MHT-UN-305A.

Note: 6" RMS/RUSS attachment may be used for base attachment only following Mule-Hide's standard details. 6" or 10" RUSS or RMS products are not approved for use as a method of field attachment for Induction Welding attached systems.

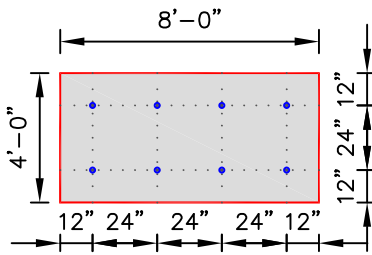
End of Section

System Specifications

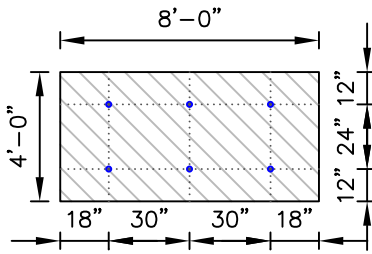
MECHANICALLY ATTACHED MEMBRANE – INDUCTION WELDING ATTACHMENT

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This specification represents the applicable information available at the time of its publication. Mule-Hide reserves the right to change this information at any time. Contact Mule-Hide or check the Mule-Hide website (www.mulehide.com) for the latest updates regarding changes or modifications to this specification.



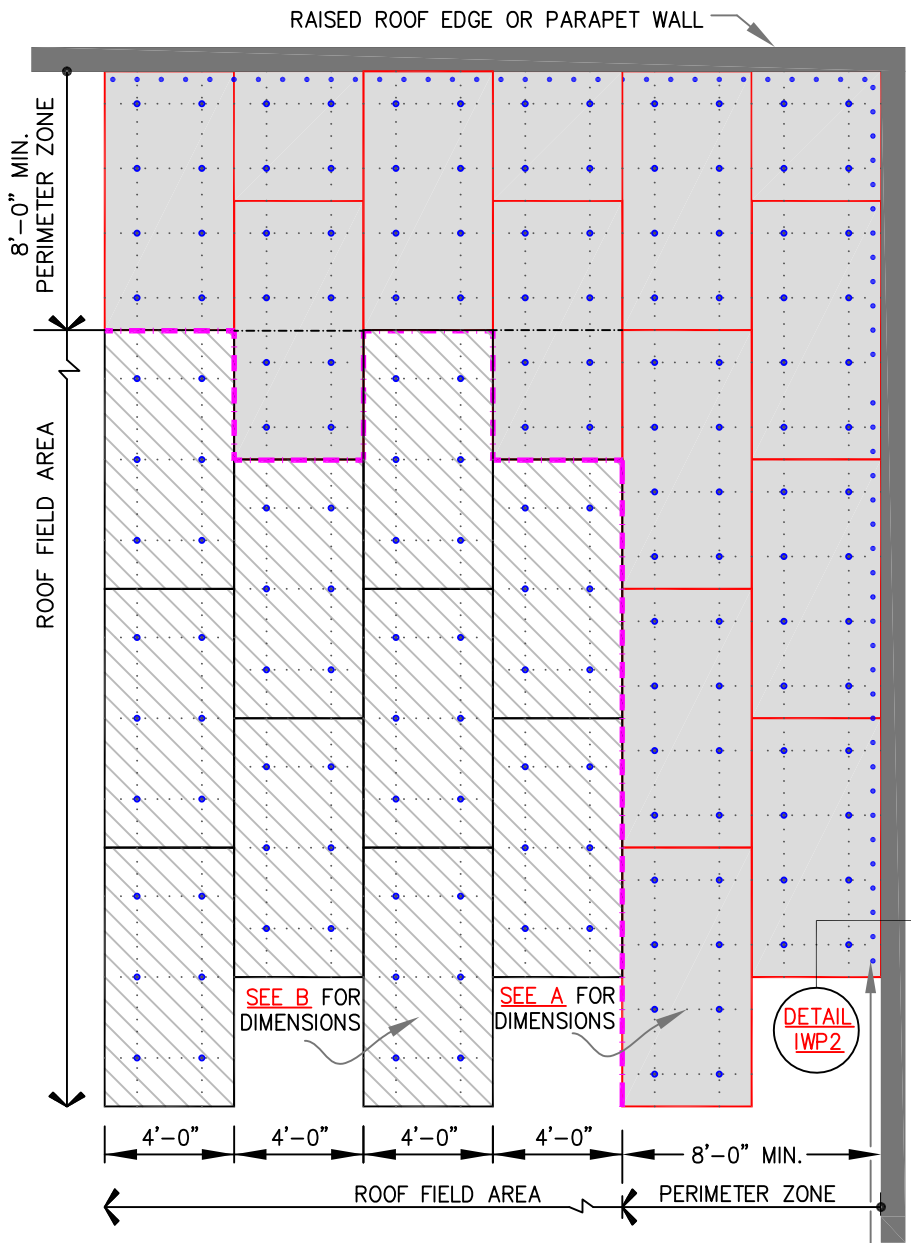
(A) PERIMETER ZONE
8 FASTENERS PER 4'X8' BOARD



(B) FIELD OF ROOF
6 FASTENERS PER 4'X8' BOARD

NOTES:

1. INDUCTION WELD CARDBOARD DISKS ARE REQUIRED UNDER INDUCTION WELDING PLATES WHEN USING NON-FACED EPS (EXPANDED POLYSTYRENE) OR XPS (EXTRUDED POLYSTYRENE) INSULATIONS.
2. PERIMETER ENHANCEMENTS REQUIRED FOR WIND SPEED COVERAGE GREATER THAN 72MPH. CONTACT MULE-HIDE TECHNICAL DEPARTMENT FOR REQUIREMENTS.



MEMBRANE FASTENED MINIMUM 12" O.C. AT ANGLE(S) CHANGES. FOR ADDITIONAL INFORMATION SEE DETAIL [IWP2](#)

- PERIMETER AREA
- FIELD AREA
- MULE-HIDE FASTENER & INDUCTION WELDING PLATE

DECK TYPE	DECK THICKNESS	FASTENER	INDUCTION WELDING PLATE
STEEL	22 GAUGE	MULE-HIDE EHD FASTENER	3-1/8" DIAMETER
PLYWOOD	15/32"		

NOTE: AT IN-FILL MINOR PIECES, USE MIN. 2 FASTENERS.

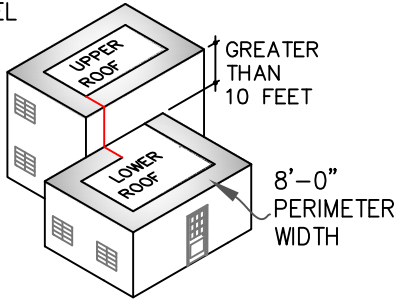
MULE-HIDE PRODUCTS

INDUCTION WELDING PLATES FASTENING REQUIREMENTS
SYSTEMS:
HEAT WELD MEMBRANE MECHANICALLY ATTACHED

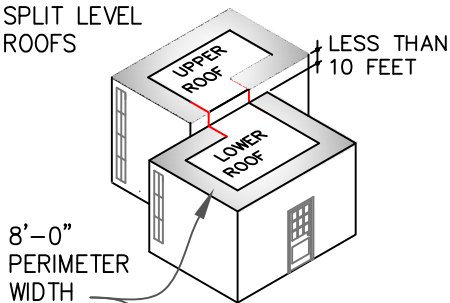
DETAIL NO.:
MHT-IWP1
REVISION DATE: 05/2020

ROOF ZONES FOR MINIMUM ONE FASTENER PER 4 SQUARE FEET

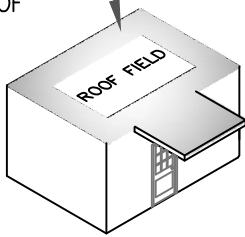
SPLIT LEVEL ROOFS



SPLIT LEVEL ROOFS

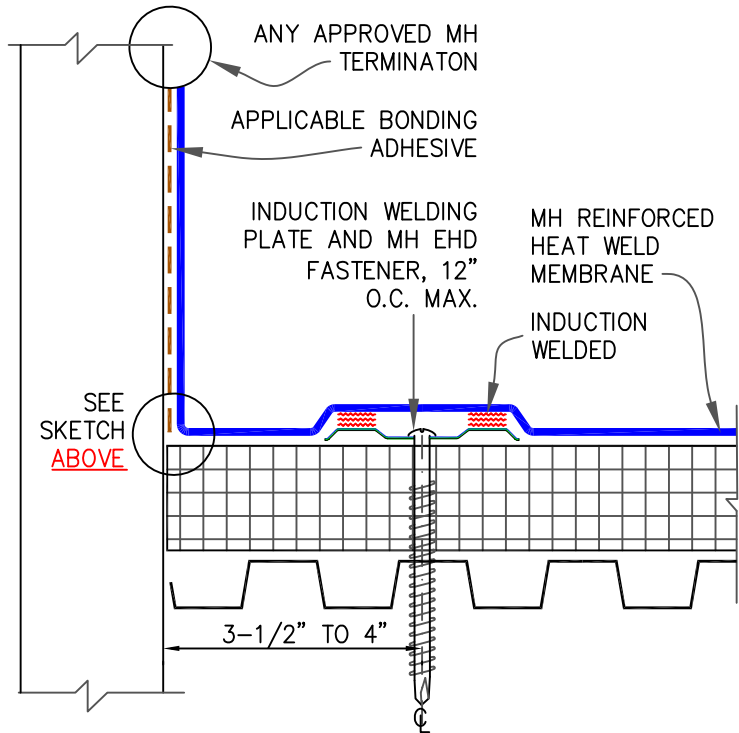
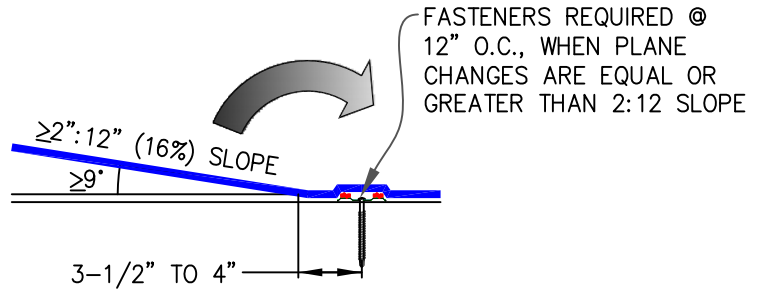
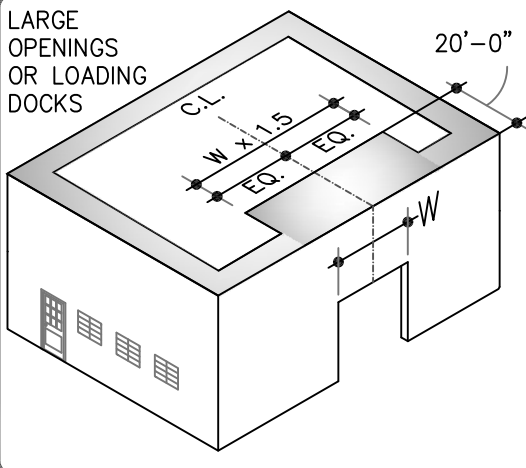


CANOPY ROOF



MAIN ROOF EXTENDING ON THE SAME LEVEL

LARGE OPENINGS OR LOADING DOCKS



ANGLE CHANGE SECUREMENT

NOTES:

1. INDUCTION WELD CARDBOARD DISKS ARE REQUIRED UNDER INDUCTION WELDING PLATES WHEN USING NON-FACED EPS (EXPANDED POLYSTYRENE) OR XPS (EXTRUDED POLYSTYRENE) INSULATIONS.

MULE-HIDE PRODUCTS

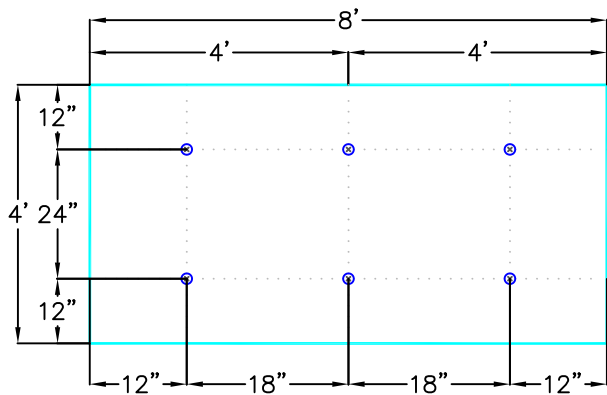
**INDUCTION WELDING PLATES
BASE ATTACHMENT**

**SYSTEMS:
HEAT WELD MEMBRANE
MECHANICALLY ATTACHED**

DETAIL NO.:

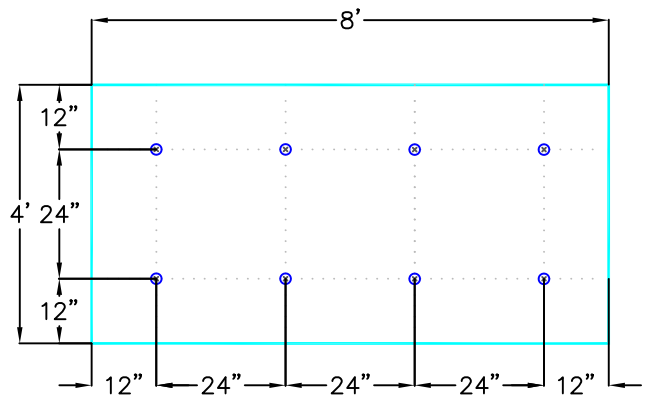
MHT-IWP2

REVISION DATE: 05/2020



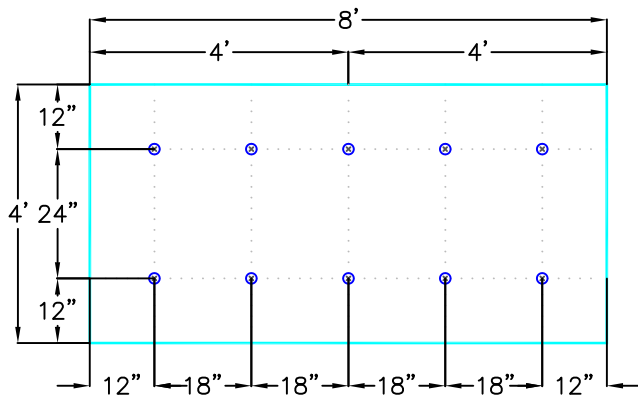
6 FASTENERS PER 4'X8' BOARD

FM 1-90 (FIELD)



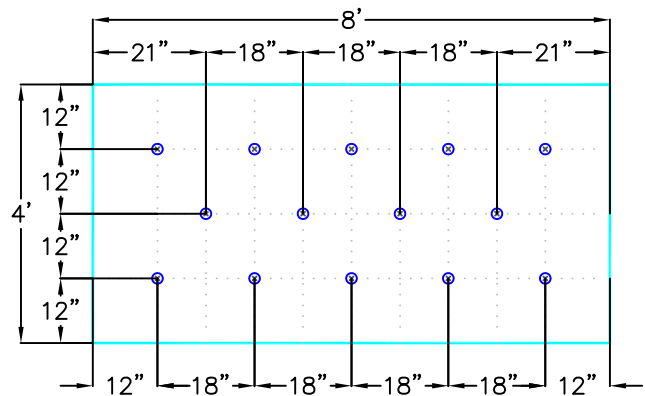
8 FASTENERS PER 4'X8' BOARD

FM 1-105 (FIELD) GRADE 'C' STEEL DECKS
FM 1-120 (FIELD) GRADE 'E' STEEL DECKS



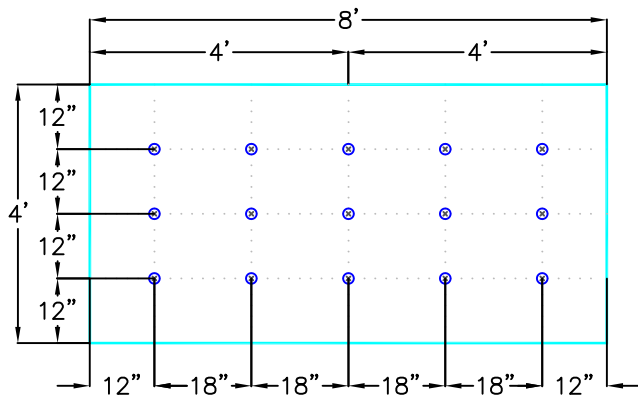
10 FASTENERS PER 4'X8' BOARD

FM 1-90 (PERIMETER) ENHANCEMENT PATTERN



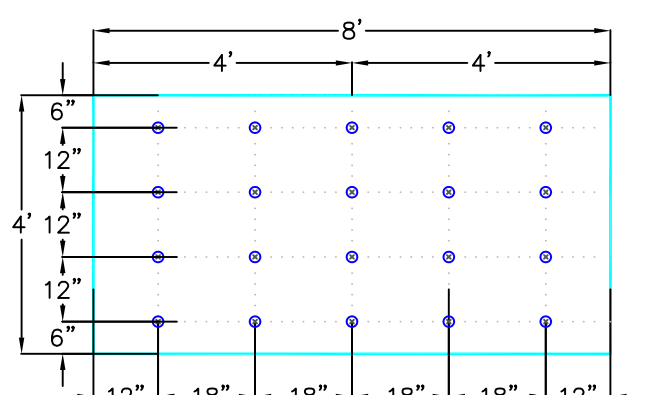
14 FASTENERS PER 4'X8' BOARD

FM 1-105 (PERIMETER) ENHANCEMENT GRADE 'C' STEEL DECKS
FM 1-120 (PERIMETER) ENHANCEMENT GRADE 'E' STEEL DECKS



15 FASTENERS PER 4'X8' BOARD

FM 1-90 (CORNER) ENHANCEMENT PATTERN



20 FASTENERS PER 4'X8' BOARD

FM 1-105 (CORNER) ENHANCEMENT GRADE 'C' STEEL DECKS
FM 1-120 (CORNER) ENHANCEMENT GRADE 'E' STEEL DECK

**MULE-HIDE
PRODUCTS**

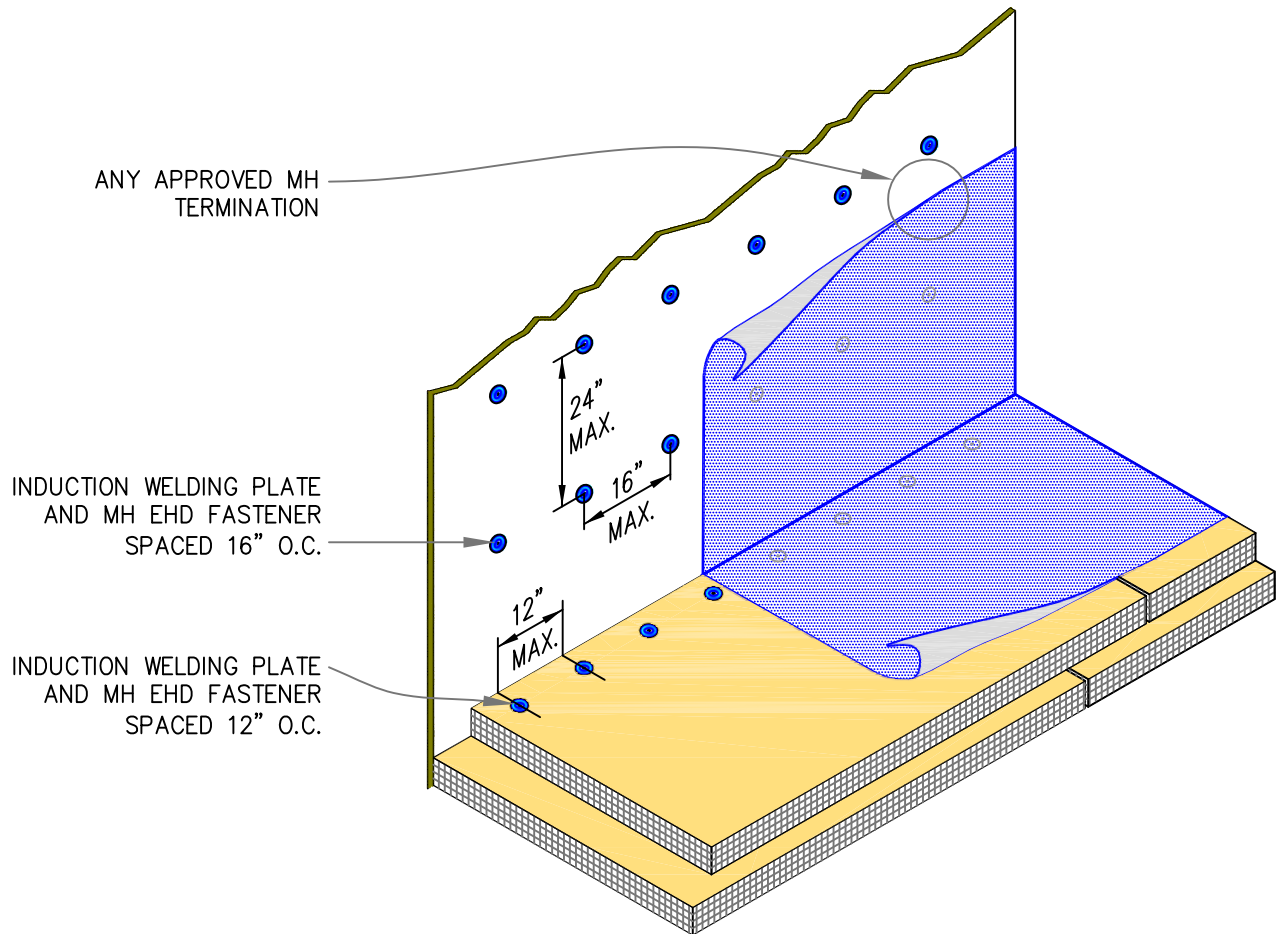
**INDUCTION WELDING PLATES
FM FASTENING PATTERNS**

**SYSTEMS:
HEAT WELD MEMBRANE
MECHANICALLY ATTACHED**

DETAIL NO.:

MHT-IWP3

REVISION DATE: 05/2020



NOTES:

1. FASTENERS MUST PENETRATE INTO WOOD OR METAL STUDS, WHERE WALL IS BUILT WITH STUDS.
2. INDUCTION WELD CARDBOARD DISKS ARE REQUIRED UNDER INDUCTION WELDING PLATES WHEN USING NON-FACED EPS (EXPANDED POLYSTYRENE) OR XPS (EXTRUDED POLYSTYRENE) INSULATIONS.
3. INSULATION FASTENING NOT SHOWN FOR CLARITY.

**MULE-HIDE
PRODUCTS**

**INDUCTION WELDING PLATES
WALL ATTACHMENT**

**SYSTEMS:
HEAT WELD MEMBRANE
MECHANICALLY ATTACHED**

DETAIL NO.:

MHT-IWP5

REVISION DATE: 05/2020