3M™ Fire Protection Products
Interam™ E-Mat Solutions Package

Fire Protection for Critical Components

*Requirements may be different across localities, states, and countries, and requirements can change at any time.

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Industry Standards

API 2218- http://www.api.org/publications-standards-and-statistics/publications-updates/publication-updates/new-safety-fire-and-scientific-affairs-publications/api_rp_2218

3M™ Fire Protection Products
Interam™ E-Mat Solutions Package

Marketing: Brochures

The devastating effects of a refinery fire can result in lost production and worker injuries. In the event of a fire, 3M™ Fire Protection Products are designed to help mitigate fire spread, providing additional time to control the fire and to allow for a safe evacuation.

Maintaining Continuity of Operations and Helping Protect Lives

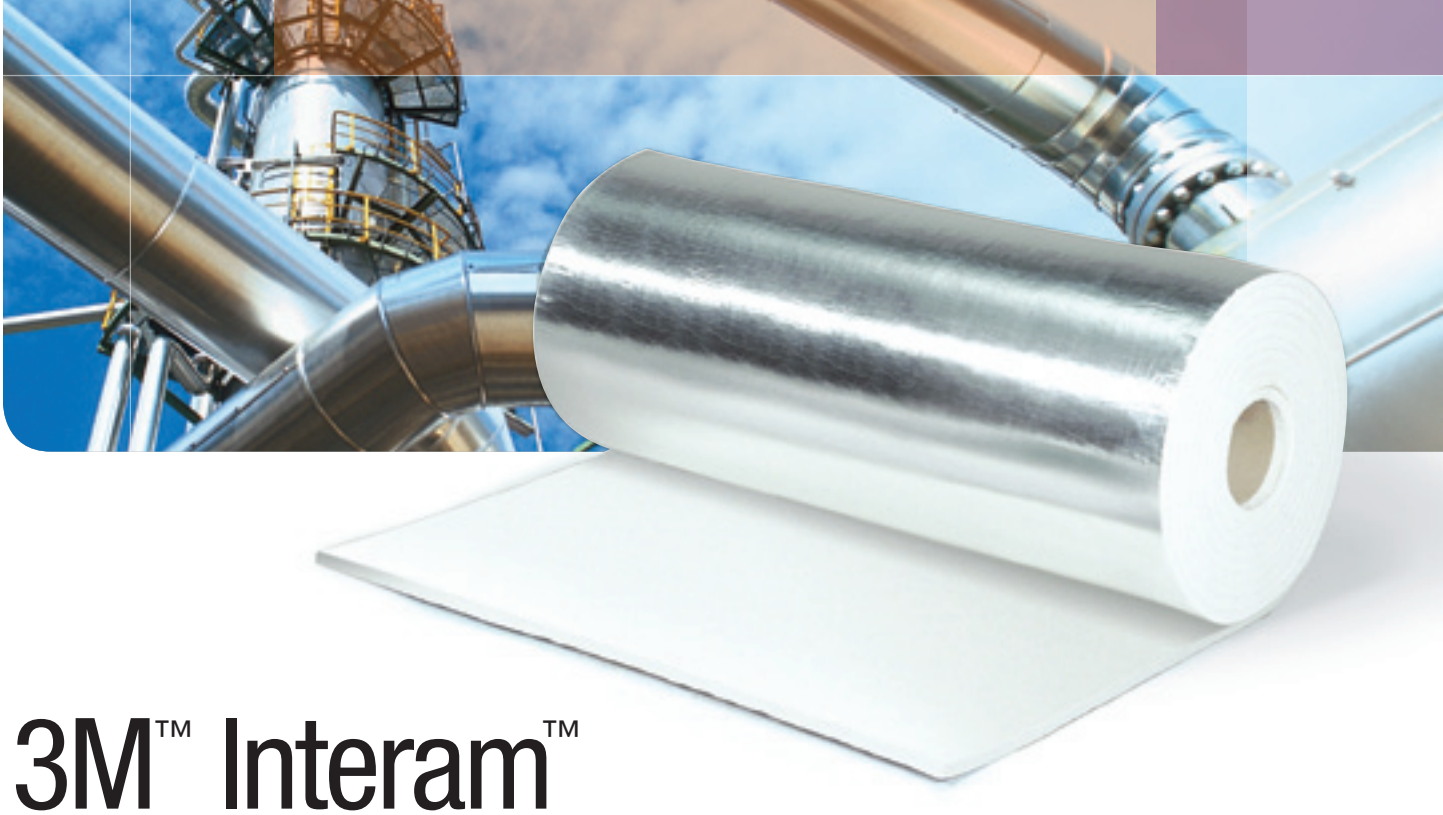
With over 30 years of fire protection experience, 3M has developed tested and listed systems for the protection of critical electrical and structural components. 3M™ Fire Protection Products provide you practical and proven applications for exceptional refinery infrastructure protection, including outstanding performance in high-intensity fires with advanced fire protection for your most critical assets.

LIFE SAFETY

ASSET PROTECTION

CONTINUITY OF OPERATIONS

The Solution is 3M™ Fire Protection Products.



3M™ Interam™ Endothermic Mat E-5A-4

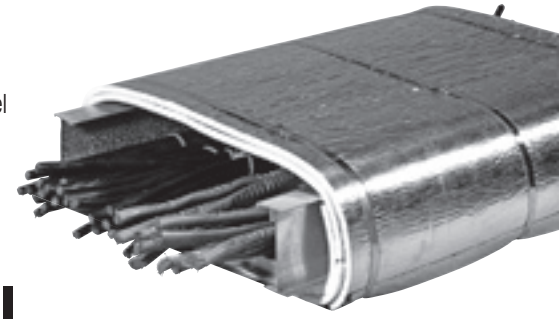
Leaving cable trays and structural steel exposed to fire can lead to severe damage of a refinery's superstructure, thus compromising continuity of operations. 3M™ Interam™ Endothermic Mat provides easy-to-install, full-envelope fire protection for a broad range of critical components including structural steel, electrical raceways and vessel skirts. Its flexibility and space-saving design allows 3M™ Interam™ Endothermic Mat to meet installation requirements in most areas.

As our flagship product for fire protection in refineries, this flexible mat provides a uniform covering that, when exposed to high temperatures, releases chemically-bound water to cool the outer surfaces of the wrap material and significantly retard heat transfer. Advanced fire protection technology from 3M offers outstanding performance in many fire scenarios.

- Up to 4-hour protection for structural steel and up to 3-hour electrical circuit protection[1]
- Outstanding performance in high-intensity fires, provides protection against large hydrocarbon pool fires in accordance with UL 1709 (ASTM E 1529)[1]
- Available with an aluminum or stainless steel backing[2]
- Can easily cut to size and is flexible—install in new applications or directly over existing fire protection
- Outdoor durable[3]
- Continuity of operations during installation
- 2/5" thick x 24½" wide x 20 ft. long roll
- A fireproofing material recognized by API 2218[4]

[1] See system details for layering requirements
[2] Stainless steel-backed product is 3M™ Interam™ Endothermic Mat E-54C
[3] When covered with 0.010" stainless steel jacketing
[4] American Petroleum Institute, "Fire Proofing Practices in Petroleum and Petrochemical Processing Plants"

When a fire occurs, the electrical systems that deliver critical power and control signals must remain operational in order to facilitate a safe and orderly plant shutdown and evacuation. 3M™ Interam™ Endothermic Mat is significantly more flexible and conformable than rigid panel systems, making it easier to install on complex shapes common in electrical systems.



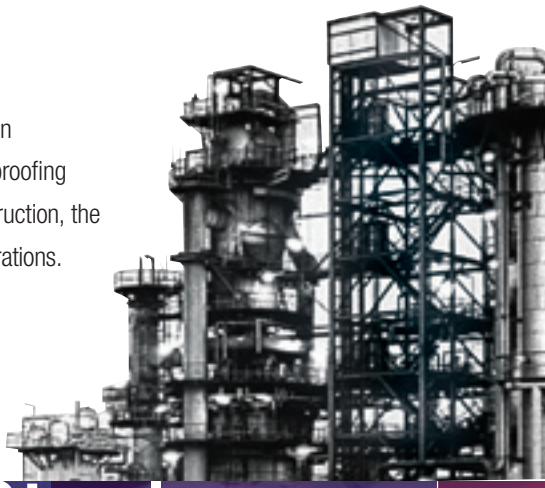
Protect Your Electrical & Control Systems

3M™ Interam™ Endothermic Mat is designed to provide cable trays and conduits with full envelope protection in the event of a fire.

- Ideal for cable raceways, conduit, junction boxes and other electrical control systems
- Helps maintain circuit integrity for up to 78 minutes from intense hydrocarbon heat per UL 1709 (ASTM E 1529) and 3-hour protection from standard fires per ASTM E 119 (UL 263)
- Low ampacity derating of cables
- Re-enterable for cable alterations, maintenance and inspections
- Seismically tested[1]

[1] In accordance with IEEE 344-1975 *IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations*

Traditionally, structural steel has been protected with messy, sprayed on materials or encased in concrete. 3M™ Interam™ Endothermic Mat can significantly reduce the installation time for fireproofing structural steel versus cementitious trowel applications. Whether used for retrofit or new construction, the mat's flexibility allows it to be installed easily and maintained with virtually no disruption to operations.



A Safer, Simpler Way to Protect Structural Steel

Installing multiple layers of 3M™ Interam™ Endothermic Mat flexible wrap allows you to tailor the desired amount of fire protection—up to 4 hours for structural steel.

- Up to 4-hour protection for structural steel per both UL 1709 and ASTM E 119
- Easy installation, easy cleanup and virtually maintenance free
- Won't spall, crack or chip
- Doesn't contribute to corrosion of steel or other metals
- Has demonstrated its ability to remain secure in blast tests up to peak pressure of 0.33 bar (4.8 psi)[1]

[1] WBE 807-0001

3M™ Interam™ Endothermic Mat provides passive fire protection as an effective alternative or supplement to active systems for protecting against vessel failure. Applied directly to the vessel, this flexible mat is often used where water or other active protection systems are inadequate, such as in remote locations or where difficulties arise with traditional water run-off.

Effective Vessel & Pipeline Protection

When 3M™ Interam™ Endothermic Mat is applied to vessel skirts and pipe lines, it minimizes the effects of fire exposure by flame impingement in order to reduce the steel's rate of temperature rise and to delay structural failure.

- Meets criteria of NFPA 290 Standard for Fire Testing of Passive Protection Materials for Use on LP-Gas Containers[1]
- Protection where active systems are undersized, unreliable or unavailable
- Re-enterable for cost-effective maintenance and inspection
- Doesn't contribute to corrosion of steel or other metals[2]
- Can easily be applied to steam lines and pipelines
- Product qualification includes testing that has been conducted to the hydrocarbon fire exposure per UL 1709 (ASTM E 1529)

[1] Similar to NFPA 58, Appendix H

[2] Per API 2218, American Petroleum Institute, "Fire Proofing Practices in Petroleum and Petrochemical Processing Plants"

Additional Products for Complete Fire Protection

3M™ Fire Barrier Sealant CP 25WB+

Our most popular intumescent firestop sealant approved up to 4 hours of fire protection in listed through penetration firestop assemblies. Also used to seal joints (gaps) between adjacent pieces of 3M™ Interam™ Endothermic Mat in fireproofing installations.

- Firestop tested for up to 4 hours in accordance with ASTM E 814 (UL 1479)
- Re-enterable and repairable
- Water clean up

3M™ Fire Barrier Moldable Putty Stix MP+

Designed to firestop a wide variety of through penetrations, including cable, conduit, insulated pipe and metal pipe.

- Firestop tested for up to 3 hours in accordance with ASTM E 814 (UL 1479)
- Re-enterable and repairable
- Provides cold smoke seal (L-rating)
- Pliable—can form into almost any desired shape
- Will not dry out or crumble—can be sealed for reuse
- Often used to seal gaps between penetrating items and sheet when used with 3M™ Fire Barrier Composite Sheet CS-195+
- Available in pads for use as a wall opening protective on UL-rated electrical boxes

Scotch® Filament Tape 898

High performance polypropylene-backed tape reinforced with continuous glass yarn.

- Used to temporarily hold endothermic mat pieces in place during installation

3M™ Fire Barrier Composite Sheet CS-195+

A thin one-part composite system designed to firestop large openings (e.g. blank or openings with single or multiple penetrations). Use 3M™ Fire Barrier Composite Sheet CS-195+ at locations where cable trays, conduit or busways penetrate fire-rated assemblies.

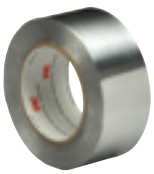
- Firestop tested for up to 4 hours in accordance with ASTM E 814 (UL 1479)
- Thermally conductive—allows unwanted heat build-up to escape
- Re-enterable and repairable
- Easy to cut and form to desired shape

3M™ Fire Barrier Pillows

Self-contained, highly-intumescent firestop pillows are stackable and conformable for new and retrofit projects.

- Up to 3-hour fire ratings per ASTM E 814 (UL 1479)
- UL listed systems with openings up to 1,080 sq. in.
- No wire mesh or graphite
- Available sizes: 2" x 4" x 9" (small), 2" x 6" x 9" (medium) and 3" x 6" x 9" (large)

3M™ Aluminum Foil Tape 425



Used to seal cut edges of aluminum foil-backed 3M™ Interam™ Endothermic Mat E-5A-4 in order to complete total encapsulation.

- Designed to perform in high temperatures
- Thermally-conductive, dead-soft aluminum backing combined with a transparent acrylic adhesive backing
- 4.6 mil think aluminum foil, 4" x 60 yd. roll

3M™ Interam™ Stainless Steel Foil Tape T-65

Used to seal cut edges of stainless steel foil-backed 3M™ Interam™ Endothermic Mat E-54C in order to complete total encapsulation.

- Designed to perform in high temperatures
- Thermally-conductive, stainless-steel backing with acrylic adhesive backing
- 4 mil thick stainless steel foil, 4" x 100 ft. roll

Ordering Information

Product Number	Description	Unit	Size	Billing UPC Number	Qty.
3M™ Interam™ Endothermic Mat E-5A-4 (Aluminum Scrim)					
E-5A-4 (ELECTRICAL CIRCUITS UP TO 3 HOUR Fire Protection; STRUCTURAL STEEL UP TO 4 HOUR Fire Protection)	Protective wrap for cable trays, conduits, and more	Roll	24.5" x 20 ft. (.408" thick)	000-51115-16571-9	1/Cs
3M™ Interam™ Endothermic Mat E-54C (Stainless Steel Scrim)					
E-54C (ELECTRICAL CIRCUITS UP TO 3 HOUR Fire Protection; STRUCTURAL STEEL UP TO 4 HOUR Fire Protection)	Protective wrap for cable trays, conduits, and more	Roll	24.5" x 20 ft.	000-51115-54914-4	1/Cs
3M™ Aluminum Foil Tape 425					
425	Seals cut edges of 3M™ Interam™ Endothermic Mat	Roll	4" x 60 yd. (4.6 mil thick)	000-51138-95074-3	2/Cs
3M™ Interam™ Stainless Steel Tape T-65					
T-65	For use with 3M™ Interam™ E-54C with Stainless Steel Scrim	Roll	4" x 100 ft.	000-51115-00705-7	1/Cs
3M™ Fire Barrier Composite Sheet CS-195+					
CS-195+ (non load-bearing) Openings up to 36 sq. ft. (FIRE BARRIER UP TO 4 HOUR Fire Protection)	Up to 4-hr Penetration Firestop	Sheet	36" x 24" (.303" thick nominal)	000-51115-07220-8	1/Cs
	Up to 4-hr Penetration Firestop	Sheet	28" x 52" (.303" thick nominal)	000-51115-08260-3	1/Cs
	Up to 4-hr Penetration Firestop	Sheet	16" x 28" (.303" thick nominal)	000-51115-07437-0	1/Cs
	Up to 4-hr Penetration Firestop	Sheet	36" x 41" (.303" thick nominal)	000-51115-07224-6	1/Cs
	Up to 4-hr Penetration Firestop	Sheet	36" x 36" (.303" thick nominal)	000-51115-07222-2	1/Cs
3M™ Fire Barrier Sealant CP 25WB+					
CP 25WB+ (SMOKE SEAL L RATED Meets Optional L Requirements; SOUND BARRIER STC 54 in STC 54-rated wall assembly; FIRE BARRIER UP TO 4 HOUR Fire Protection)	Up to 4-hr Penetration Firestop Color: ■	Tube	10.1 oz.	000-51115-11638-4	12/Cs
	Up to 4-hr Penetration Firestop Color: ■	Sausage	20 oz.	000-51115-11642-1	10/Cs
	Up to 4-hr Penetration Firestop Color: ■	Cartridge	27 oz.	000-51115-11641-4	6/Cs
	Up to 4-hr Penetration Firestop Color: ■	Pail	2 gal.	000-51115-11639-1	1/Cs
	Up to 4-hr Penetration Firestop Color: ■	Pail	5 gal.	000-51115-11640-7	1/Cs
3M™ Fire Barrier Moldable Putty MP+					
MP+ (SMOKE SEAL L RATED Meets Optional L Requirements; SOUND BARRIER STC 52 in STC 53-rated wall assembly; FIRE BARRIER UP TO 4 HOUR Fire Protection)	Up to 4-hr Penetration Firestop Color: ■	Stix in tube	1.45" dia. x 6"	000-51115-16561-0	12/Cs
MPS-2+ (SMOKE SEAL L RATED Meets Optional L Requirements; SOUND BARRIER STC 52 in STC 53-rated wall assembly; FIRE BARRIER UP TO 4 HOUR Fire Protection)	Up to 4-hr Penetration Firestop Color: ■	Stix	1.4" dia. x 11"	000-51115-16526-9	10/Cs
Scotch® Filament Tape 898					
898	For use with 3M™ Interam™ Endothermic Mats to temporarily hold mat pieces in place during installation	Roll	18mm x 55m 24mm x 55m	000-51131-06897-1 000-51131-06898-8	48/Cs 36/Cs

Visit **www.3M.com/firestop** or call **1-800-328-1687**
for technical information, listed systems, training information and more.

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3M Fire Protection Products

3M™ Interam™ Endothermic Mat – For Commercial Buildings

Flexible Fire Protection

Get wrapped up in 3M™ Interam™ Endothermic Mat

3M™ Interam™ Endothermic Mat opens up new opportunities in building design, allowing architects to fulfill the UL mark of certification while enhancing design flexibility. Using advanced endothermic materials, 3M™ Interam™ Endothermic Mat helps prevent heat penetration via a chemical reaction, which absorbs heat energy. Its space-saving, conformable construction offers easy installation in a broad range of applications, providing flexible, full envelope protection in critical areas of all types.

Because of its flexibility, architects can use 3M™ Interam™ Endothermic Mat to meet fire protection requirements in nearly any area and along virtually any wall, helping to reduce the need to make revisions to existing plans. This represents a significant cost-saving and time-saving benefit for both builders and architects. With 3M™ Interam™ Endothermic Mat, architects can now provide guaranteed fire protection without being locked in to the design constraints of traditional fire-stopping methods.

3M is your fire protection industry leader. Trust our proven innovative technologies to help protect people and property for decades to come.

3M™ Interam™ Endothermic Mat

Flexible Fire Protection Solutions

MEMBRANE PENETRATIONS

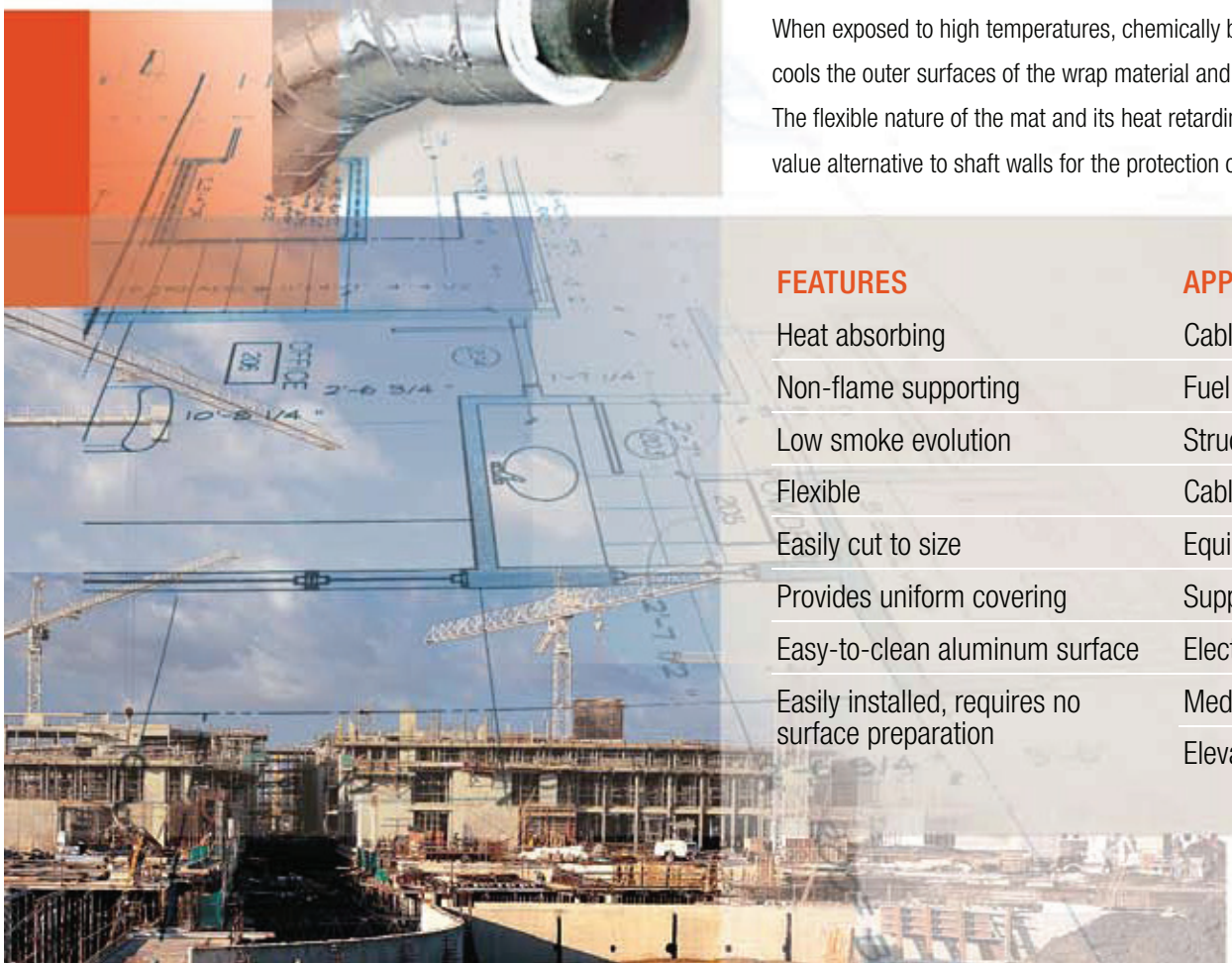
Protecting some large membrane penetrations can be a challenge, with putty pads proving insufficient to cover larger areas. 3M™ Interam™ Endothermic Mat offers an excellent alternative, providing a fire-tested, code-approved method with the capacity to protect significant spaces containing electrical panels, elevator call boxes, safe deposit boxes and medical gas boxes.

ELECTRICAL CIRCUIT PROTECTION

When a fire occurs, the electrical systems that control critical areas such as control rooms, ventilation, lighting, alarms and elevators must remain operational in a building. With 3M™ Interam™ Endothermic Mat, cable raceways, conduit, equipment shrouds and other electrical systems can be protected for up to three hours in intense heat.

FUEL LINE PROTECTION

Protection of fuel lines for building generators is often an overlooked specification item, leading to urgent and often messy situations during construction. 3M™ Interam™ Endothermic Mat E-5A-4 can help provide fire protection for dual walled steel pipe fuel lines for 1, 2, or 3 hour protection. When exposed to high temperatures, chemically bound water in the mat cools the outer surfaces of the wrap material and retards heat transfer. The flexible nature of the mat and its heat retarding feature provides a high value alternative to shaft walls for the protection of fuel lines.

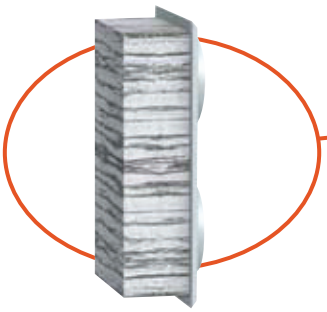


FEATURES	APPLICATIONS
Heat absorbing	Cable trays
Non-flame supporting	Fuel lines
Low smoke evolution	Structural steel
Flexible	Cable bundles
Easily cut to size	Equipment shrouds
Provides uniform covering	Support members
Easy-to-clean aluminum surface	Electrical panels
Easily installed, requires no surface preparation	Medical gas boxes
	Elevator call boxes

Typical Building Applications

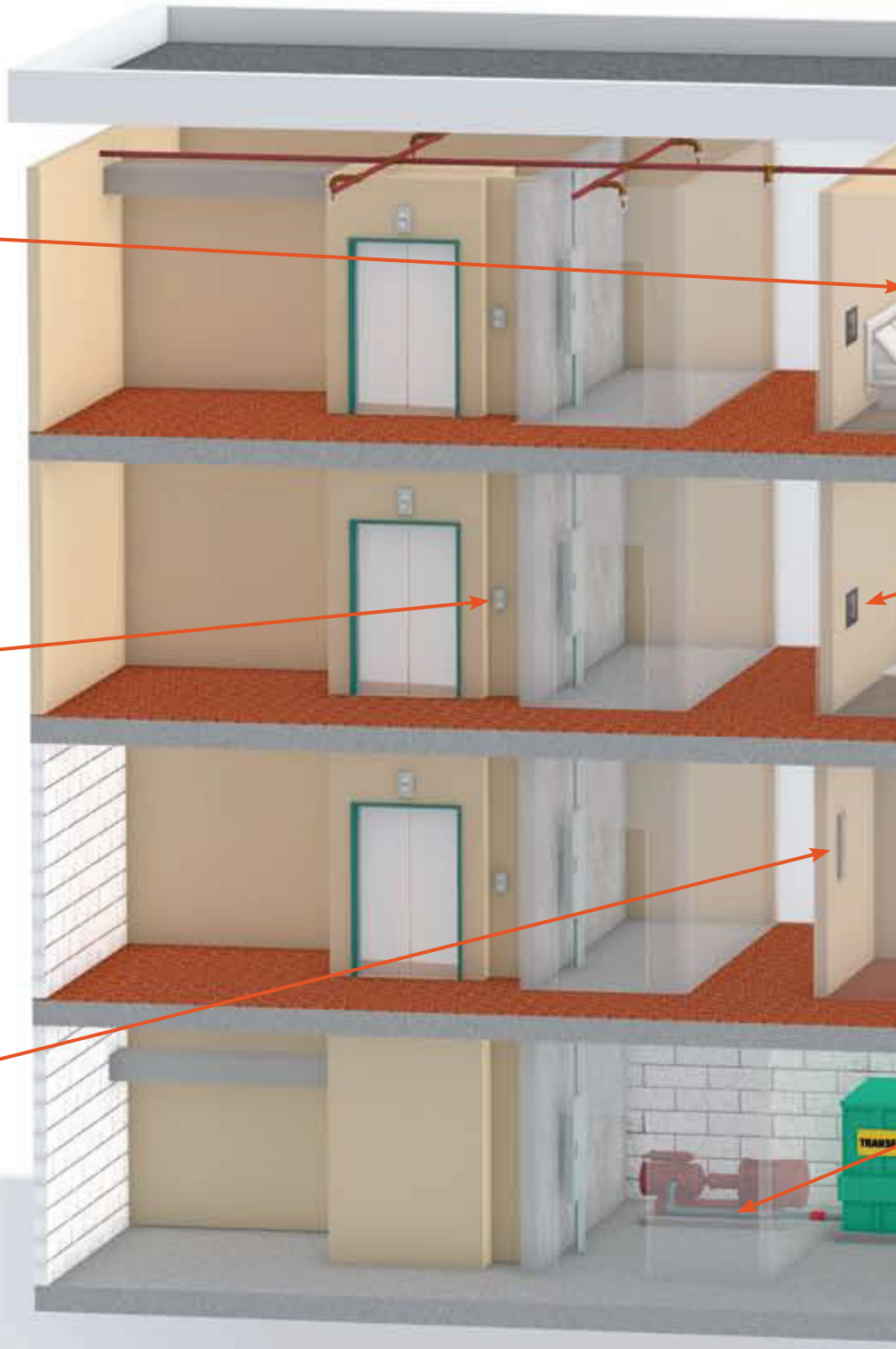
Using 3M™ Interam™ Endothermic Mat

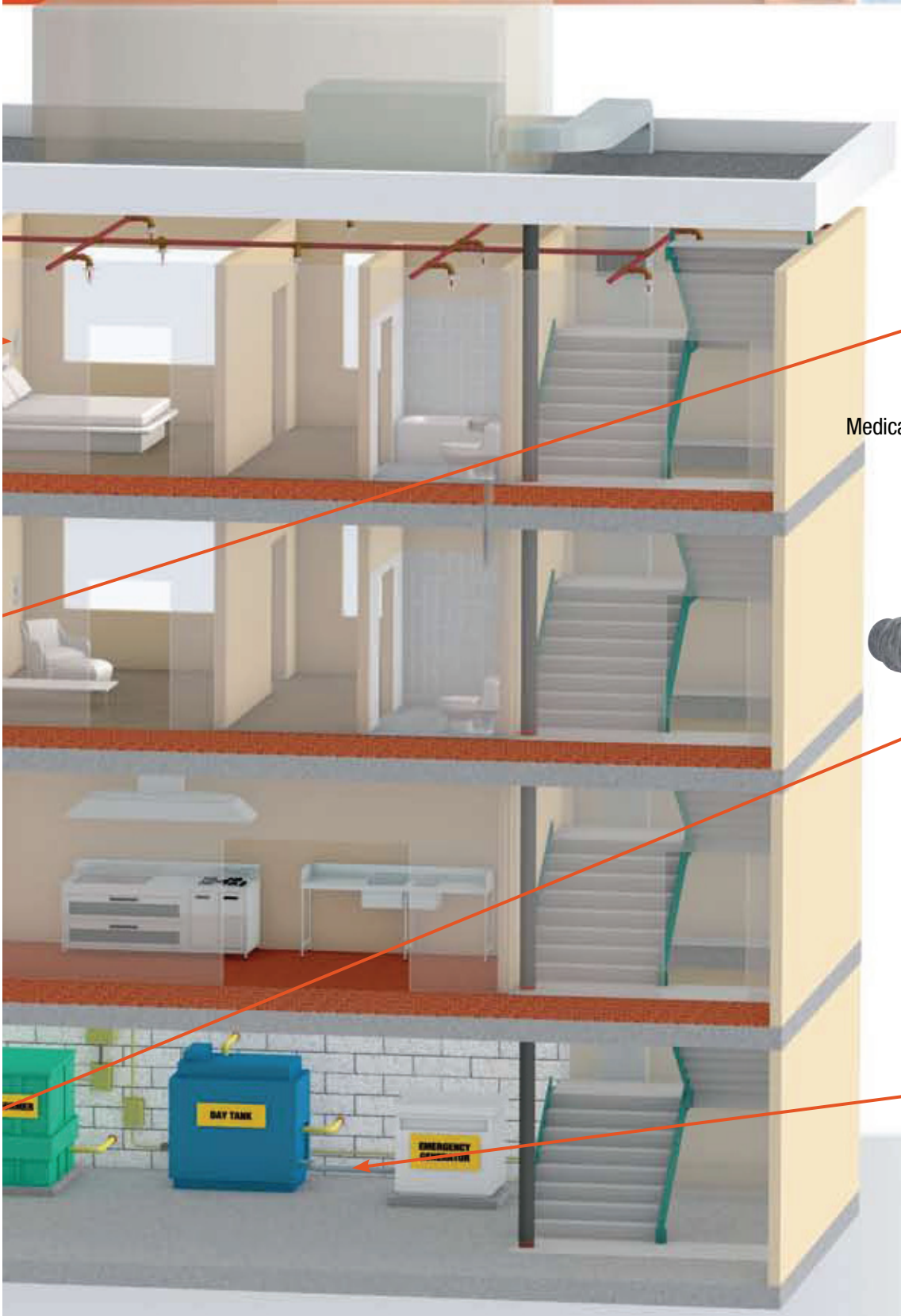
Safe Deposit Box W-L-7168
3M™ Interam™ Endothermic Mat
Product # E-5A-4

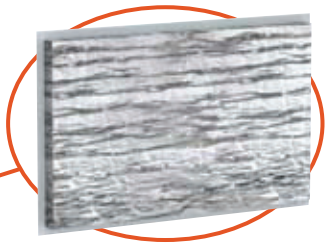


Elevator Call Box W-L-7168
3M™ Interam™ Endothermic Mat
Product # E-5A-4

Electrical Panel W-L-7168
3M™ Interam™ Endothermic Mat
Product # E-5A-4







Medical Gas Box Protection W-L-7168
3M™ Interam™ Endothermic Mat
Product # E-5A-4

Electrical Circuit Protection
Design No. ECP 526
3M™ Interam™ Endothermic Mat
Product # E-5A-4

Fuel Line Protection
Design No. FPE 501
3M™ Interam™ Endothermic Mat
Product # E-5A-4

Fire protection so flexible

you might get carried away.

3M™ Interam™ Endothermic Mat

protection so flexible that you could wrap nearly anything!

3M™ Interam™ E-5A-4 Endothermic Mat is flexible and easy to apply to virtually anything. The advanced endothermic materials contain chemically bound water that is released when exposed to high temperatures. This cools the surrounding materials to significantly retard heat transfer. With this advanced fire-stopping technology and the uniquely conformable construction of 3M™ Interam™ E-5A-4 Endothermic Mat, builders can help protect and control virtually any area in commercial construction applications with unprecedented ease.

UL Approved System W-L-7168

1 **Wall Assembly** – The 1 or 2 hour fire rated framed gypsum board wall assembly shall be constructed of the materials and in the manner specified in the individual U400 or V400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. **Studs** – Wall framing shall consist of steel channel studs. Steel studs to be min 3 $^{5}/_{8}$ in. (92 mm) wide and spaced max 24 in. (610 mm) OC. An additional framing member shall be used to form a shelf within the wall cavity to support the steel box (Item 2) and mat fill material (Item 3). The framed opening is to be 1 in. (25 mm) wider than the width of the steel box.

B. **Gypsum Board*** – The gypsum board type, thickness, number of layers and orientation shall be as specified in the individual Wall and Partition Design. Size of cutout made to accommodate steel box (Item 2) is to be 1 in. (25 mm) wider and 1 in. (25 mm) higher than the width and height of the steel box.

The hourly F and T Ratings of the firestop system are equal to the hourly fire rating of the wall in which the firestop system is installed.

2 **Steel Box** – Max 19 in. (483 mm) wide by max 32 in. (813 mm) high by max 3 ½ in. (89 mm) deep recessed steel utility box with hinged steel door and mounting flange. Steel box secured to steel studs with steel screws after application of mat material (Item 3) on exterior surfaces of steel box. Bottom and/or top of steel box may be penetrated by up to two max 1½ in. (38 mm) diameter copper, steel or iron pipes or tubes. Open pipes or tubes which terminate within the box shall be sealed with caulk (Item 4) or plugged with a ball of putty (Item 5).

3 **Fill, Void or Cavity Materials*** – **Mat** – Nominal 0.4 in. (10 mm) thick aluminum foil faced endothermic mat supplied in 24 in. wide rolls. Individual pieces of mat cut to cover four sides and back of box and laminated to box with high-strength, fast, contact-type adhesive (foil face exposed). The mat sections on the top and bottom of the box shall be cut to overlap the mat sections on the sides of the box. The mat section on the back of the box shall be cut to overlap the edge of the mat sections on the top, bottom and vertical sides of box. Circular cutouts made in the mat to accommodate the pipes or tubes to be ¼ to ½ in. (6 to 13 mm) larger than outside diameter of pipe or tube. All corners and butted seams in the mat are to be covered with min 2 mil aluminum foil tape.

3M COMPANY – Type E-5A-4 or E-5A-4 Mat

4 **Fill, Void or Cavity Materials*** – **Caulk or Sealant** – (Not Shown) – Nom ¼ in. (6 mm) diameter bead of caulk applied to the edge of the mat material around the perimeter of the box mounting flange. Additional caulk fill material shall be used to completely fill each circular cutout made in the mat material to accommodate a pipe or tube. The end of each open pipe or tube which terminates within the box shall be sealed with a min ½ in. (13 mm) depth of caulk.

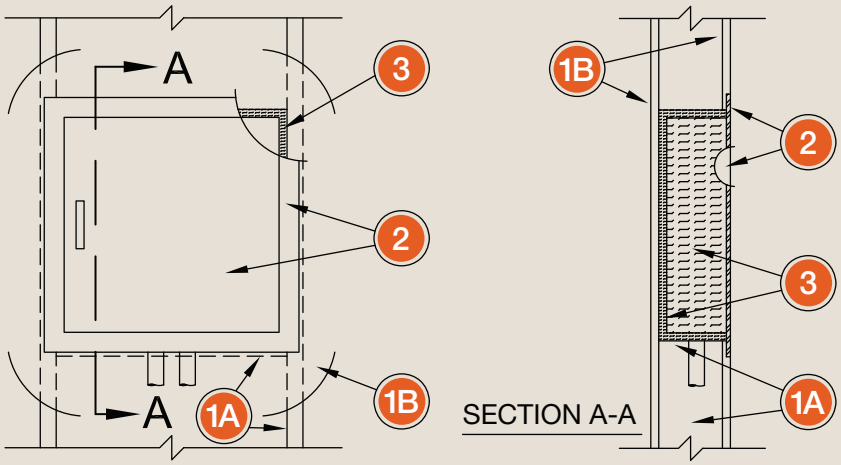
3M COMPANY – Type CP-25WB+ Caulk, FB-3000WT Sealant

5 **Fill, Void or Cavity Materials*** – **Putty** – (Not Shown) – As an alternate to the caulk (Item 4), the end of each open pipe or tube which terminates within the box may be sealed with a min ½ in. (13 mm) depth of putty fill material.

3M COMPANY – Type MP+ Moldable Putty

Additional materials needed: Spray 90 Spray Adhesive, CP-25WB+ Firestop Caulk.
*Bearing the UL Classification Mark.

System No.
W-L-7168
March 15th, 2007
F Ratings - 1 and 2 Hr (see Item 1)
T Ratings - 1 and 2 Hr (see Item 1)



Product Number	Description	Size	Unit	Case	UPC
E-5A-4	Endothermic Mat	24.5" x 20' x 0.4"	Roll	1 Roll/Case	0-51115-16571-4

Additional application materials

Product Number	Description	UPC
Spray 90	Spray Adhesive	083631-8
CP-25WB+	Firestop Caulk	011638-9

For CAD drawings and other UL System details, please see our website www.3M.com/firestop or call 1-800-328-1687.

3M

Building and Commercial Services Division

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98-0213-4377-1 (128.5)ii 4426SA120308M0

Applying 3M™ Interam™ Endothermic Mat

to Steel Utility Box Membrane Penetrations to Achieve Equal F and T Ratings

Step-by-step instructions:

Building Code Pro Tip: This method is a solution for the equal F and T rating requirement in IBC section 714.3.2* 'Membrane Penetrations'.

Cut the 3M™ Interam™ Endothermic Mat to fit the sides, top, bottom and back of the utility box. Apply 3M™ Super 77 Multipurpose Adhesive to the box surface and each piece of mat. Let the adhesive dry on the box and mat surface for approximately 1 minute. See UL System W-L-7190 for overlaps and complete system details.

Apply each piece of the mat to the box surfaces.

Use a roller to apply the mat to the box. This helps adhere the mat to the box surfaces.

All corners and butted seams in the mat are to be covered with minimum 2 mil aluminum foil tape.

Insert the utility box into the opening so the box is flush with the surface of the wall. Secure the steel box to the steel studs per the utility box manufacturer's installation instructions.

The bottom or top of the steel box may be penetrated by up to 2" metallic conduit. See system parameters.

View of the protected box from the backside prior to installing the gypsum wallboard.

Apply a nominal 1/4" diameter bead of sealant at the mat and gypsum interface.

Apply the utility box cover with supplied screws. Completed system.

*2012 Ed. See exception 4.

UL Listed System

1. **Wall Assembly:** The 1 or 2 hour fire rated framed gypsum board wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. **Studs:** Wall framing shall consist of steel channel studs or wood studs. Steel studs to be minimum 6" (152mm) wide and spaced maximum 24" (610mm) OC. Wood studs to be nominal 2" x 6" (51 x 152mm) or larger and spaced maximum 16" (406mm) OC. An additional framing member shall be used to form a shelf within the wall cavity to support the steel box (Item 2) and mat fill material (Item 3). The framed opening is to be 1" (25mm) wider than the width of the steel box.
   B. **Gypsum Board*:** The gypsum board type, thickness, number of layers and orientation shall be, as specified in the individual Wall and Partition Design. Size of cutout made to accommodate steel box (Item 2) is to be 1" (25mm) wider and 1" (25mm) higher than the width and height of the steel box.

   The hourly F, T, FT, FH and FTH Ratings are equal to the hourly rating of the wall assembly.

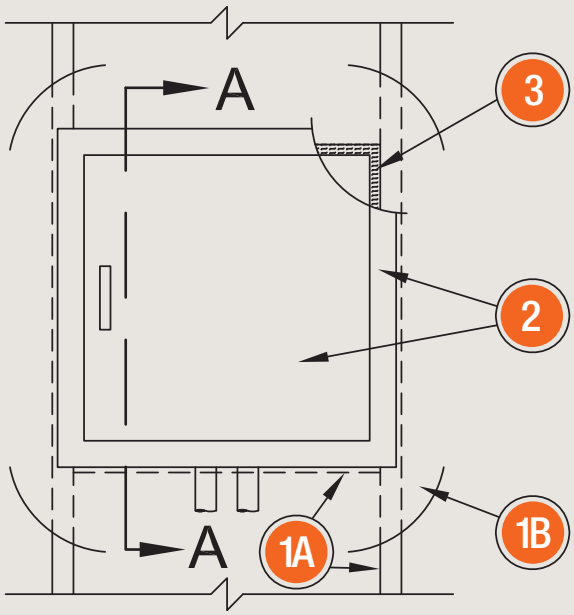
2. **Steel Box:** Minimum 18 gauge, maximum 20" (508mm) wide by maximum 48" (1.22m) high by maximum 6" (152mm) deep for steel stud walls. Minimum 18 gauge, maximum 12" (305mm) wide by maximum 48" (1.22m) high by maximum 5-1/2" (140mm) deep for wood stud walls. Box to be recessed with hinged steel door and mounting flange. Steel box secured to steel studs with steel screws after application of mat material (Item 3) on exterior surfaces of steel box. Bottom and/or top of steel box may be penetrated by one 2" (51mm) diameter steel EMT conduit and up to twelve 1" (25mm) maximum diameter installed from the top and one 1" (25mm) and one 3/4" (19mm) diameter conduits installed from the bottom of the box. Open pipes or tubes which terminate within the box shall be sealed with caulk (Item 4) or plugged with a ball of putty (Item 5).

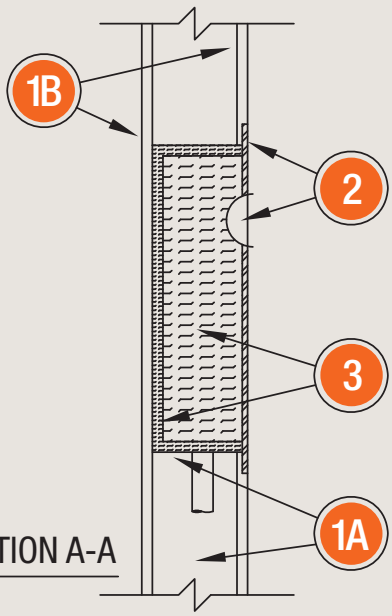
3. **Fill, Void or Cavity Materials* — Mat:** Nominal 0.4" (10mm) thick aluminum foil faced endothermic mat supplied in 24" wide rolls. Individual pieces of mat cut to cover four sides and back of box and laminated to box with high strength, fast, contact type adhesive (foil face exposed). The mat sections on the top and bottom of the box shall be cut to overlap the mat sections on the sides of the box. The mat section on the back of the box shall be cut to lap over the edge of the mat sections on the top, bottom and vertical sides of box. Circular cutouts made in the mat to accommodate the pipes or tubes to be 1/4" to 1/2" (6 to 13mm) larger than outside diam of pipe or tube. All corners and butted seams in the mat are to be covered with min 2 mil aluminum foil tape.
   3M COMPANY 3M FIRE PROTECTION PRODUCTS: Type E-54A or E-5A-4 Mat

4. **Fill, Void or Cavity Materials* — Caulk or Sealant** (Not Shown): Nominal 1/4" (6mm) diam bead of caulk applied to the edge of the mat material around the perimeter of the box mounting flange. Additional caulk fill material shall be used to completely fill each circular cutout made in the mat material to accommodate a pipe or tube. The end of each open pipe or tube which terminates within the box shall be sealed with a minimum 1/2" (13mm) depth of caulk.
   3M COMPANY 3M FIRE PROTECTION PRODUCTS: Type CP 25WB+ Caulk, FB-3000WT Sealant

5. **Fill, Void or Cavity Materials* — Putty** (Not Shown): As an alternate to the caulk (Item 4), the end of each open pipe or tube which terminates within the box may be sealed with a minimum 1/2" (13mm) depth of putty fill material.
   3M COMPANY 3M FIRE PROTECTION PRODUCTS: Type MP+ Moldable Putty

*Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.





System No.
W-L-7190

December 5, 2013

F Ratings: 1 hr and 2 hr (see Item 1)

T Ratings: 1 hr and 2 hr (see Item 1)

For complete system details, refer to System W-L-7190
System details available at www.3M.com/firestop

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www.3M.com/firestop

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3M™ Fire Protection Products
Interam™ E-Mat Solutions Package

Marketing: Case Studies

3M™ Interam™ Endothermic Mat

Case Study

Middle East Oil Refinery

Cost-effective Fire Protection while meeting UL and ASTM Standards

A $10 billion construction project to build a heavy crude refinery in the Middle East began in 2006. The refinery has the capacity to refine 900,000 barrels of crude oil a day, 120 million cubic feet of associated sour gas and 50,000 barrels of condensate a day. The project is both an offshore and onshore development.

The refinery complex has three electrical substations containing 175 gland boxes ranging in size from 0.5 m to 5 m long, 0.5 m to 1 m wide, and 0.35 m deep. The refinery owner wanted to use the best possible fire protection products to protect these vital assets, and specified that any solution must comply with Underwriters Laboratories (UL) and American Society for Testing and Materials (ASTM) standards.

A competitor's proposed solutions were rejected for a variety of reasons, including high cost; inability to ensure the gland boxes would be adequately sealed; a lack of documentation for this application; and the proposed materials didn't meet ASTM or UL standards. While meeting all of the above requirements, 3M engineers and other fire protection specialists performed an engineering analysis that identified 3M™ Interam™ Endothermic Mat (3M E-mat) as the best technical solution and lowest total cost.

Helps Mitigate Fire Spread

To ensure the customer had the necessary information and skills to successfully perform the installation, three technical discussions on worldwide UL and ASTM standards and three installation trainings and inspections were conducted on the job site.

3M Fire Protection Products are designed to help mitigate fire spread, providing additional time to control the fire and allow a safer evacuation. With more than 30 years experience, 3M has developed, tested and listed systems to protect critical electrical and structural components.

"3M E-mat meets global UL and ASTM standards, so the customer was confident the product would perform as advertised," said Ernie Schmidt, Advanced Technical Service Specialist, 3M Building and Commercial Services Division. "They were also confident it would perform to the requirements they established for their facility."

However, the 3M team faced several challenges as extremely high temperatures up to 118 F (48 C) caused adhesive problems in attaching the 3M™ Interam™ Endothermic Mat to the gland boxes. The problem was resolved by using 3M™ High-Strength 90 Adhesive. Supply issues also threatened the tight installation schedule, but due to the customer's confidence in the 3M solution, air shipment of 3M E-mat was authorized to keep the project on schedule.

Lowest Total Cost of Ownership

"Because 3M E-mat is easy to install, and particularly for this application, we trained lower-wage workers who were able to install the product," said Schmidt. "Competitive products would have required a sprayer and higher-wage workers, and taken longer to install than the 3M solution."

"3M provided the most time-competitive solution, and because 3M E-mat is less labor-intensive to install compared to other fire protection products, it has the lowest total cost of ownership," said Schmidt. "3M E-mat goes on quickly with adhesive and banding, and the ease of application saved at least a week in the construction schedule. It's a great solution. We provided great training and support – everything the customer could ask for."

3M™ Interam™ Endothermic Mat

Easy-to-install, 3M E-mat provides full-envelope fire protection for a broad range of critical components including structural steel, electrical raceways and vessel skirts. The flexibility and space saving design of 3M E-mat meets installation requirements in nearly all areas of refineries.

This flexible mat provides a uniform covering that, when exposed to high temperatures, releases chemically-bound water to cool the outer surfaces of the wrap material and significantly retard heat transfer. 3M's advanced fire protection technology offers outstanding performance in many fire scenarios including large hydrocarbon pool fires in accordance with UL 1709 (ASTM E 1529).

Visit www.3M.com/firestop for technical information, listed systems, training information and more or call 1.800.328.1687.

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3M™ Interam™ Endothermic Mat

Case Study

Structural Steel

Storage Vessel Protection

More than 15 years ago, a large oil and gas refinery on the U.S. Gulf Coast installed 3M™ Interam™ Endothermic Mat (3M E-mat) to protect structural steel. The material was applied to protect the vessel skirts and 2-story tall steel legs that support many large spherical tanks containing flammable petroleum distillates in the refinery.

Two layers of 3M E-mat were wrapped around the approximately 24-inch wide legs and held in place with stainless steel banding. Although not required, a stainless steel jacket was then applied on top of the 3M E-mat to protect the material from rain, salt in the humid air, dust and ultraviolet light in sunlight.

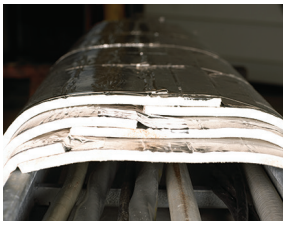
An engineer at the refinery recently contacted 3M and requested assistance in identifying the 3M material. At the time, the plant was conducting a periodic inspection of the structural steel in various areas of the refinery to determine if corrosion beneath the 3M E-mat – also known as corrosion under insulation (CUI) – was occurring.

NON DESTRUCTIVE INSPECTION AND TESTING

"It only took a moment to identify the 3M Interam Endothermic Mat. The 3M product was well protected by the stainless steel jacket and looked like it was new. There was no deterioration at all," said Matthew Aguirre, Sales Representative, 3M Building & Commercial Services / Fire Protection Products. "The structural steel also looked great and showed no sign of rust or corrosion."

The non-destructive inspection and testing for corrosion and compliance was performed quickly, and the 3M E-mat that had been removed without being damaged was simply reinstalled. A few damaged pieces that occurred during inspection needed to be replaced.

"Refinery officials were very pleased with the inspection results and they were surprised by the longevity of 3M E-mat," said Aguirre. "The material doesn't dry out so maintenance is effortless. It also allows easy inspection. Just cut a piece to inspect the structural steel, then foil tape it back into place and add the stainless steel band. It's that easy."



CORROSION UNDER INSULATION

3M E-mat won't encourage corrosion. 3M E-mat can be installed with or without a stainless steel jacket which helps preserve 3M E-mat in extremely harsh conditions. The material satisfies UL 1709 environmental test standards both with and without the stainless steel jacketing. The refinery owner realized significant savings by not having to replace any structural steel on the numerous tanks due to corrosion.

"There's no need to remove and recoat steel as with coatings. And with 3M E-mat, there's no waiting for the product to dry between coats," said Aguirre. "It's fast and easy to apply, and it provides highly effective fire protection. Using 3M E-mat also removes the possibility of human error in properly mixing, preparing and applying cementitious fireproofing material."

Passes Hydrocarbon and Jet-Fire Tests

3M E-mat meets the requirements of the UL 1709 Hydrocarbon Pool Fire Test, ISO 22899 Jet-Fire test, and NFPA 58 Appendix H (NFPA 290), and ASTM E119 Fire Tests of Building Construction and Materials.

3M™ Interam™ Endothermic Mat

Easy-to-install 3M E-mat provides full-envelope fire protection for a broad range of critical components including structural steel, electrical raceways and vessel skirts. The flexibility and space saving design of 3M E-mat meets installation requirements in nearly all areas of refineries.

This flexible mat provides a uniform covering that, when exposed to high temperatures, releases chemically bound water to cool the outer surfaces of the wrap material and significantly retard heat transfer. 3M's advanced fire protection technology offers outstanding performance in many fire scenarios including large hydrocarbon pool fires in accordance with UL 1709 (ASTM E 1529).

Visit www.3M.com/firestop for technical information, listed systems, training information and more, or call 1.800.328.1687.

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3M™ Interam™ Endothermic Mat

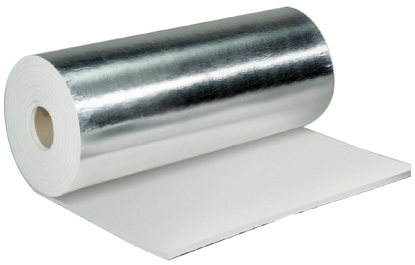
Case Study

U.S.A. Midwest Oil Refinery

Mitigating Fire Damage & Protecting Resources

In the late 1990's, at an oil refinery in the Midwest, a pipe containing combustible material burst, resulting in a fire plume 15 feet above ground. The fire's intense heat threatened to breech a nearby tank within the refinery that contained hundreds of gallons of hydrofluoric acid.

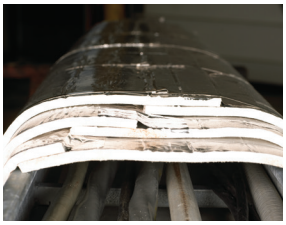
Immediately recognizing the seriousness of the situation, plant employees sought to move the acid to another tank away from the fire. A cable tray containing critical control circuitry required to send diverting signals to valves had been exposed to the fire. This circuitry needed to stay operational to allow refinery employees to quickly and safely transfer the acid. Fortunately 3M Interam Endothermic Mat (3M E-mat) had been installed to protect the cable tray, helping reduce the danger to employees and nearby residents.



3M™ Fire Protection Products are designed to help mitigate fire spread, providing additional time to control the fire and allow a safe evacuation. With more than 30 years experience, 3M has tested and listed systems to protect critical electrical and structural components.

"Refinery personnel needed 30 minutes to drain the tank and 3M Interam Endothermic Mat is designed to provide up to 3-hour electrical circuit protection," according to Kristen Jensen, senior technical service engineer, 3M Building and Commercial Services Division. "The emergency electrical circuitry protection enabled personnel to drain the tank using remote controls."

After the tank was drained, the fire continued to burn for three to four hours before being extinguished. The following day, the in-house construction company that had installed the 3M E-mat on top of existing equipment asked Jensen to help assess the fire damage.



Jensen inspected the conduit, conduit hangers, cable trays, cable racks, cable supports, tray rack supports and structural steel for damage. She was also asked to inspect and verify where plant personnel needed to replace the 3M™ Interam™ Endothermic Mat.

"I was happy to see the 3M E-mat had functioned as designed and allowed the tank to be quickly drained," said Jensen. "If the tank had ruptured and its contents released into the atmosphere, in addition to injuries among refinery workers, potentially hundreds of citizens in the surrounding community could have been injured."

During her inspection, Jensen discovered the fire had not damaged the cable trays, and crews only needed to reinstall 3M Interam Endothermic Mat. Plant management was eager to bring the refinery back online, and was very pleased the entire electrical cable run didn't need to be replaced.

3M E-mat is significantly more flexible and conformable than rigid panel systems, making it easier to install on complex shapes common in electrical systems. The repairs were performed quickly and within three to four days the refinery was back to its pre-fire operating capacity of 74,000 barrels a day.

"3M E-mat worked as intended, protecting critical components and preventing potential injuries to refinery workers and nearby citizens," added Jensen."The mat also is much faster to install when compared to competitive products."

3M™ Interam™ Endothermic Mat

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Reprinted from **Chemical Processing**

Ceramic mat insulation, aluminum jacketing protect electrical raceways from fire

DAVID A. HUGHES, PE, Design Engineer, Ashland Petroleum Co., a division of Ashland Oil Inc.
DAVID A. TOY, Associate Editor

Problem

As part of an ongoing program, the Ashland Petroleum Company began to investigate new methods of "physical insurance." Unlike an insurance policy, physical insurance methods are physically tangible means to assure plant safety.

Identified as a key element of the physical insurance program was effective fire protection of critical electrical and control systems in process units at three of Ashland's petrochemical plants; both #1 and #2 processing units at Catlettsburg, KY (combined 220,000 bbl/day), the St. Paul plant (60,000 bbl/day), and the Canton, OH refinery (60,000 bbl/day). Principal products produced at these locations include gasoline, petrochemical feedstocks, asphalt, and almost anything in between.

Documented losses by Ashland and other petrochemical plants coupled with a plant inspection pinpointed many specific areas where fire protection needed to be increased. Most power cables had been routed underground (according to a long-term in-house Electrical Engineering Department standard) and thus considered sufficiently protected. Equipment-to-control-room raceways and control systems, pumps, compressors, and major piping networks were identified as the most potentially hazardous areas.

Ashland engineers began to develop in-house standards and also testing methods to determine the effectiveness of various protection schemes. The overall goal was to provide effective fire protection of critical electrical and control systems to assure safe, controlled (automated) plant shutdown of any affected processing units without requiring manual assistance.

Installing the ceramic mat insulation on the complex conduit lines at Ashland's St. Paul plant was hastened by the ability to cut and fit the material with common tools

Solution

While considering another product, Ashland engineers were approached by the manufacturer of an endothermic fiber mat product. The ensuing discussion resulted in an offer to test products head-to-head in a fire test that was conducted in the manufacturer's testing laboratory.

In defining an acceptable degree of fire protection, Ashland Petroleum developed three essential pass/fail criteria.

The failure of the fire protection system will be defined as the time into the fire test that anyone of the following three events occurs:

1. *the circuit continuity tester indicates a short in any of the monitored electrical conductors,*
2. *the pressure gauge on the pneumatic line (in the cable tray) drops from 30 psi to below 15 psi, or*
3. *the temperature on the surface of the electrical cable jacketing exceeds 350°F.*

The ceramic mats that were fire tested were endothermic blankets designed to be wrapped around equipment and materials requiring fire protection. A flexible felt-like material was constructed from a combination of ceramic fibers and an inorganic endothermic material, blocking heat penetration by chemically absorbing heat energy. When exposed to high temperatures, the mats release chemically bound water to cool the outer surface of the wrap material and significantly retard heat transfer.

The number of layers determined the total amount of protection afforded. To withstand a 30 minute exposure at up to 1600°F temperatures according to the ASTM E-119 Fire Test Standard or a 20 minute exposure at up to 2000°F according to the UL #1709 Fire Test, a 0.6" thickness was specified (also in accordance with HIFT fire test requirements).

After successful fire test performance, the endothermic material was accepted into the Mechanical Specifications for fire protection at the Ashland plants. In the summer of 1985, 715 sq ft of cables at the Catlettsburg #2 unit were covered with a 0.6" layer of the ceramic material. The cables were chosen because of their complex grouping and shape; there were several cross-sectional changes due to dropouts and the cables were not situated in a well defined tray.

The fire protection system consisted of there layers of 0.2" thick blankets, each with a 3 mil laminated aluminum covering. The material was installed quickly and rapidly with common tools and was

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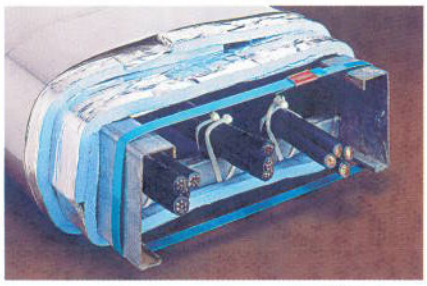


To meet Ashland's needs, 0.3" thick blankets were provided, cutting installation time

mechanically banded in place. A 10 mil aluminum jacketing was adhered to the outer layer of ceramic blankets for protection from the environment. Later in 1985, 3900 and 1300 sq ft of cable racks were protected at the St. Paul and Canton plants, respectively.

Meanwhile, Ashland foresaw the added labor needed in applying the 10 mil aluminum jacketing as a separate step. Because the manufacturer of the ceramic blankets was also a prominent adhesives producer, Ashland challenged the manufacturer to provide a blanket with a laminated 10 mil aluminum jacketing to cut down on installation costs. Ashland also requested 0.3" thick blankets so that a total of only two layers would need to be applied.

The following year, Ashland was able to use the newly developed 0.3" thick blankets with laminated 10 mil aluminum protective jacketing on additional equipment at the three plant sites; 2300 sq ft at Catlettsburg #1, 8100 sq ft at Canton, and 2000 sq ft at St. Paul. The product remained essentially the same, only the blanket thickness and the jacketing were changed in response to the specific requests made by Ashland.

Results

Although the protected electrical raceways have not been tested by a real emergency, the insurance that they provide is welcome. Ashland is currently in the third year of a three-year program to protect its critical electrical and control systems as well as its major structures.

Installation next summer will again utilize two layers of 0.3" blankets with a laminated 10 mil aluminum jacketing on the top layer (assuming that they remain cost competitive!). Ashland management has also been very impressed with the willingness on the part of the manufacturer to develop a modified product to meet the plant's specific needs.

Interam™ E-5 Series Endothermic Mat–3M Speciality Materials, Bldg. 223-6S-04, St. Paul, MN 55144-1000. URL: www.3m.com/foam

3M™ Fire Protection Products
Interam™ E-Mat Solutions Package

Marketing: 12 Videos

Marketing:

12 Videos

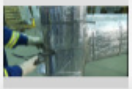
3M™ Interam™ Endothermic Mat E-5A-4 Cable Tray Installation

3M™ Interam™ Endothermic Mat E-5A-4 cementitious vs E-Mat installation ...

3M™ Interam™ Endothermic Mat Fire Test video

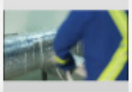
3M™ Interam™ Endothermic Mat E-5A-4 Conduit Installation Video

3M™ Interam™ Endothermic Mat E-5A-4 marketing video

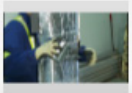


3M™ Interam Endothermic Mat Video, Banding & Flashing Install

3M™ Interam Endothermic Mat Video, Outside Corner Install

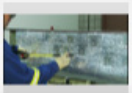


3M™ Interam Endothermic Mat Video, ⊥ Intersection Install



3M™ Interam Endothermic Mat Video, Splice Plate Install

3M™ Interam Endothermic Mat Video, Straight Run Install



3M™ Interam Endothermic Mat Video, 3-sided Application Install

Intertek Jet Fire Test Video

3M™ Fire Protection Products
Interam™ E-Mat Solutions Package

Approvals and Certificates

Certificate of Compliance

Certificate Number 20111222-R9700
Report Reference 2011 December 22
Issue Date 2011 December 22

Underwriters Laboratories

Issued to: 3M Company
3M Center
St Paul, MN 55144

This is to certify that representative samples of Mat Materials
E-Mat

Have been investigated by Underwriters Laboratories in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: UL 263 STANDARD FOR FIRE TESTS OF BUILDING CONSTRUCTION AND MATERIALS - Edition 14 - Issue Date 2011/06/21
UL 1709 - STANDARD FOR RAPID RISE FIRE TESTS OF PROTECTION MATERIALS FOR STRUCTURAL STEEL - Edition 4 - Issue Date 2011/08/03

Additional Information: See UL On-line Certification Directory at WWW.UL.COM for additional information.

E-5A-3, E-5A-4, E-53A, E-53C, E-54A or E-54C Mat Materials investigated per requirements of Standard UL263 and Standard UL1709 for exterior use.

For use in Design Nos. X203, X204, XR201, XR202. See Fire Resistance Directory.

Only those products bearing the UL Classification Mark should be considered as being covered by UL's Classification and Follow-Up Service.

The UL Classification Mark includes: UL in a circle symbol: with the word "CLASSIFIED" (as shown); a control number (may be alphanumeric) assigned by UL; a statement to indicate the extent of UL's evaluation of the product; and, the product category name (product identity) as indicated in the appropriate UL Directory.

Look for the UL Classification Mark on the product

William R. Carney
Director, North American Certification Programs

Underwriters Laboratories Inc.
Any information and documentation involving UL Mark services are provided on behalf of Underwriters Laboratories Inc. (UL) or any authorized licensee of UL.

For questions, please contact a local UL Customer Service Representative at http://www.ul.com/global/eng/pages/corporate/contactus

Certificate of Compliance

Certificate Number 20111222-R9700A
Report Reference 2011 December 22
Issue Date 2011 December 22

Underwriters Laboratories

Issued to: 3M Company
3M Center
St Paul, MN 55144

This is to certify that representative samples of Electrical Circuit Protective Materials
E-Mat

Have been investigated by Underwriters Laboratories in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: UL 1724 - FIRE TESTS FOR ELECTRICAL CIRCUIT PROTECTIVE SYSTEMS - Edition 3 - Issue Date 2006/12/07

Additional Information: See UL On-line Certification Directory at WWW.UL.COM for additional information.

CP 25WB+ Caulk for use in System Nos. 2, 3, 4, 5, 6, 7, 8, 9, 34.
I-10A or M-20A mat for use in System Nos. 2, 3, 4, 6.
E-5A-4, E-54A or E-54C mat for use in System Nos. 7, 8, 9, 34.
I-10C or M-20C mat for use in System No. 3.

Only those products bearing the UL Classification Mark should be considered as being covered by UL's Classification and Follow-Up Service.

The UL Classification Mark includes: UL in a circle symbol: with the word "CLASSIFIED" (as shown); a control number (may be alphanumeric) assigned by UL; a statement to indicate the extent of UL's evaluation of the product; and, the product category name (product identity) as indicated in the appropriate UL Directory.

Look for the UL Classification Mark on the product

William R. Carney
Director, North American Certification Programs
Underwriters Laboratories Inc.

Any information and documentation involving UL Mark services are provided on behalf of Underwriters Laboratories Inc. (UL) or any authorized licensee of UL.

For questions, please contact a local UL Customer Service Representative at http://w ul.com/global/eng/pages/corporate/contactus

Certificate of Compliance

You have been awarded:

Intertek Warnock Hersey Mark for fire resistant products

EEE 848 (1996): ASTM E1529 (2006): ASTM E1725 (2008): ASTM E119 (2012): NFPA 290(2013): NFPA 58 Appendix H (2011): ISO 22899-1 (2007)

Certificate number: WHI13 - 20265302

Organization:

3M (Minnesota Mining and Manufacturing)
3M Center
St. Paul, MN 55144

This is a certificate of conformity to certify that the bearer has successfully completed the requirements of the above scheme which include the testing of products, the initial assessment, and are subject to continuing annual assessments of their compliance and testing of samples of products taken from production (as applicable to the scheme) and has been registered within the scheme for the products detailed in the accompanying schedule.

Product: 3M Fire Barrier Interam™ E-5 Series Mats

Certification body: Intertek Testing Services NA, Ltd.
Initial registration: January 24th, 2013
Date of expiry: December 23rd, 2019
Issue status: 1

Dustin Behling Certification Coordination Manager		01/24/2014
Name	Signature	Date

Registered address:
Intertek Testing Services NA, Inc. 545 E. Algonquin Rd. Arlington Heights, IL 60005 USA

www.intertek.com

The certificate and schedule are held in force by regular annual surveillance visits by Intertek Testing Services NA, Inc. and the reader or user should contact Intertek to validate its status. This certificate remains the property of Intertek Testing Services NA, Inc. and must be returned to them on demand. This Certificate is for the exclusive use of Intertek's Client and is provided pursuant to the Certification agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this certificate. Only the Client is authorized to permit copying or distribution of this certificate and then only in its entirety. Use of Intertek's Certification mark is restricted to the conditions laid out in the agreement. Any further use of the Intertek name for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. Initial Factory Assessments and Follow up Services are for the purpose of assuring appropriate usage of the Certification mark in accordance with the agreement, they are not for the purposes of production quality control and do not relieve the Client of their obligations in this respect.

FM Approvals
1151 Boston-Providence Turnpike
P.O. Box 9102 Norwood, MA 02062 USA
T: **781 762 4300** F: 781 762 9375 www.fmglobal.com

May 16, 2012

Mark Lund, Technical Service Engineer
3M Company – Building and Commercial Services Division
3M Center, Bldg. 0223-02-N-20
St. Paul, MN 55144

Subj: 3M's FM Approved Products

Dear Mark:

This letter is in response to your request for a list of 3M's firestopping products that are currently Approved by FM Approvals. A list of the products is shown below

3M Fire Barrier 2000 Silicone Sealant
3M Fire Barrier 2001 Silicone RTV Foam
3M Fire Barrier Composite Sheet CS-195+
3M Fire Barrier MPP+ 4" x 8" Moldable Putty Pads
3M Fire Barrier MPP+ 7" x 7" Moldable Putty Pad
3M Fire Barrier MPP+ 9.5" x 9.5" Moldable Putty Pad
3M Fire Barrier MP+ Stix
3M Fire Barrier MP+ Moldable Putty
3M Fire Barrier CP-25WB+ Caulk
Fire Barrier FS-195+ A/P 2" x 24" Wrap Strip
Fire Barrier Ultra GS Intumescent Strip
3M FireDam™ Spray 100
3M FireDam™ Spray 200
FB-1000 NS Firestop Sealant
FB-1003 SL Firestop Sealant
3M Fire Barrier Pillows
3M Interam E-5A-4 Mat

Approval of these products is limited to the configurations shown in the following Design Nos. as shown in the latest edition of our Approval Guide, an on-line resource of FM Approvals.

Design Nos. 19 through 26; 36; 37; 97 through 99; 101 through 103; 217; 219; 222 through 234; 251 through 257; 262; 360 through 370; 431 through 433; and 450 through 459; 646; 647.

Should you have any questions, please feel free to contact me at 781-255-4873.

Very truly yours,
Jeffrey E. Gould
Jeffrey E. Gould, Senior Engineering Specialist

bsi.

Certificate of Registration

QUALITY MANAGEMENT SYSTEM - ISO 9001:2008

This is to certify that:

3M Company
Building & Commercial Services Divi
3M Center
St. Paul
Minnesota
55144
USA

Holds Certificate No: FM 548819

and operates a Quality Management System which complies with the requirements of ISO 9001:2008 for the following scope:

The design, development, testing and manufacture of a diverse portfolio of cleaning, workplace safety, and communication products.

This certificate is traceable to this company's original registration, Certificate Number A15717, originally issued on May 20, 2007 by Underwriters Laboratories Inc.

For and on behalf of BSI:

Gary Fenton, Global Assurance Director

Originally Registered: 04/20/2009 Latest Issue: 03/12/2013 Expiry Date: 05/19/2016

...making excellence a habit.™

This certificate remains the property of BSI and shall be returned immediately upon request.
An electronic certificate can be authenticated online. Printed copies can be validated at www.bsigroup.com/ClientDirectory
To be read in conjunction with the scope above or the attached appendix.
Information and Contact: BSI, Kitemark Court, Davy Avenue, Knowlhill, Milton Keynes MK5 8PP. Tel: + 44 845 080 9000
BSI Assurance UK Limited, registered in England under number 7805321 at 389 Chiswick High Road, London W4 4AL, UK.
A Member of the BSI Group of Companies.

Certificate No: FM 548819

Location	Registered Activities
3M Company Building & Commercial Services Division 3M Center St. Paul Minnesota 55144 USA	The design, development, testing and manufacture of a diverse portfolio of cleaning, workplace safety, and communication products.
3M Company Building & Commercial Services Division 10746 Innovation Drive- Bldg. 66 Cottage Grove Minnesota 55016 USA	Fire resistance testing.
3M Company Building & Commercial Services Division 2310 Ventura Drive- Bldg. 500 Woodbury Minnesota 55125 USA	Manufacture and service of communication equipment.

Originally Registered: 04/20/2009 Latest Issue: 03/12/2013 Expiry Date: 05/19/2016

This certificate remains the property of BSI and shall be returned immediately upon request.
An electronic certificate can be authenticated online. Printed copies can be validated at www.bsigroup.com/ClientDirectory
To be read in conjunction with the scope above or the attached appendix.
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BSI Assurance UK Limited, registered in England under number 7805321 at 389 Chiswick High Road, London W4 4AL, UK.
A Member of the BSI Group of Companies.

Lloyd's Register Inspection Certificate

Project:	**Jet Fire Test - ISO 22899-1: 2007(E) 3M Interam Endothermic Mat E-5A-4 Fire Protection System**		
Client:	**3M Company**	Office:	**LRNA - Houston**
Clients Order Number:	**Sales Order No.: -**	Date:	**24 January 2013**
		Order Status:	**Complete**
Inspection Dates First:	**07 December 2012**	Final:	**07 December 2012**

This certificate is issued to **3M Company, to certify that at their request, the undersigned surveyor did attend Intertek works at 16015 Elmendorf, Texas on the above mentioned date for the purpose to witness jet fire test in accordance with ISO 22899-1: 2007(E) carried out on structural specimen with central web and fire protective system constructed as follow:**

The Open Fronted Box with Central Stiffener
3 layers of 3M Interam Endothermic Mat E-5A-4
Permanently Bonded by 3M Hi-Strength 90 Spray Adhesive
Covered by Stainless Steel sheet.

Scope of inspection carried out:

1.0 Verified traceability of the system materials.
2.0 Witnessed installation of the protective system to the test specimen.
3.0 Witnessed jet fire test, monitored test parameters, gas flow and pressure.
4.0 Carried out post test visual inspection of the specimen.
5.0 Reviewed test data and calibration records of test instruments.

The test was carried out at Intertek Jet Fire facility; the steel box with the above referenced fire protective system was mounted approximately one meter from the ground and the jet nozzle was facing the central web.
Prior to testing, thickness of protective system was verified in several places and average recorded as xxx mm.

Eighteen (18) thermocouples were attached to the rear surface of the box as per the ISO 22899-1: 2007(E). Temperature data was collected via thermocouple wire and gas flow rate data was collected using computer Darwin Data acquisition Unit (DAQ). Temperature data and gas flow rate were updated every 6 seconds, recording individual thermocouple and average temperature of the specimen rear surface and gas line pressure and gas mass flow rate in the piping system.
The test was terminated at 240 minutes into the jet fire flame exposure per 3M International request. The maximum temperature of 377.8°C at the end of test was recorded by TC# 14.
Jet fire test was carried out in accordance with procedure delineated in ISO 22899-1: 2007(E), the maximum critical temperature rise of 400°C was not reached at 4 hours of the jet fire exposure.

The fire protective system has been constructed at Intertek works by 3M International's personnel and has been witnessed by the undersigned.

Lloyd's Register, its affiliates and subsidiaries and their respective officers, employees or agents are, individually and collectively, referred to in this clause as the 'Lloyd's Register Group'. The Lloyd's Register Group assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register Group entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.

The attachment of the thermocouples to the box surface was carried out by Intertek personnel in accordance with the ISO 22899-1: 2007(E), location and orientation of the thermocouples has been verified prior to the jet fire test and found satisfactory.

Prior to the Jet fire test system thickness, test setup and all relevant test parameters were verified and recorded. Also, calibration records of testing instruments were verified and found current.

"This report does not constitute LR Type Approval nor signifies entry into the List of LR Type Approved Products which will be subject to satisfactory review and issue of a 'Type Approval Certificate."

Lloyd's Register North America, Inc. WGN Houston Office

Wes G. Niewiadomski
Surveyor to Lloyd's Register North America Inc
1330 Enclave Parkway, Suite 200
Houston, Texas 77077.
A member of the Lloyd's Register Group

Lloyd's Register Inspection Certificate

Project:	**Jet Fire Test - ISO 22899-1: 2007(E) 3M Interam Endothermic Mat E-5A-4 Fire Protection System**		
Client:	**3M Company**	Office:	**LRNA - Houston**
Clients Order Number:	**Sales Order No.: -**	Date:	**24 January 2013**
		Order Status:	**Complete**
Inspection Dates First:	**07 December 2012**	Final:	**07 December 2012**

This certificate is issued to **3M Company, to certify that at their request, the undersigned surveyor did attend Intertek works at 16015 Elmendorf, Texas on the above mentioned date for the purpose to witness jet fire test in accordance with ISO 22899-1: 2007(E) carried out on structural specimen with fire protective system constructed as follow:**

The Open Fronted Box
3 layers of 3M Interam Endothermic Mat E-5A-4
Permanently Bonded by 3M Hi-Strength 90 Spray Adhesive
Covered by Stainless Steel sheet.

Scope of inspection carried out:

1.0 Verified traceability of the system materials.
2.0 Witnessed installation of the protective system to the test specimen.
3.0 Witnessed jet fire test, monitored test parameters, gas flow and pressure.
4.0 Carried out post test visual inspection of the specimen.
5.0 Reviewed test data and calibration records of test instruments.

The test was carried out at Intertek Jet Fire facility; the steel box with the above referenced fire protective system was mounted approximately one meter from the ground and the jet nozzle was facing test specimen.
Prior to testing, thickness of protective system was verified in several places and average recorded as xxx mm.

Eighteen (18) thermocouples were attached to the rear surface of the box as per the ISO 22899-1: 2007(E). Temperature data was collected via thermocouple wire and gas flow rate data was collected using computer Darwin Data acquisition Unit (DAQ). Temperature data and gas flow rate were updated every 6 seconds, recording individual thermocouple and average temperature of the specimen rear surface and gas line pressure and gas mass flow rate in the piping system.
The test was terminated at 241 minutes into the jet fire flame exposure per 3M International request. The maximum temperature of 275.6°C at the end of test was recorded by TC# 4.
Jet fire test was carried out in accordance with procedure delineated in ISO 22899-1: 2007(E), the maximum critical temperature rise of 400°C was not reached at 4 hours of the jet fire exposure.

The fire protective system has been constructed at Intertek works by 3M International's personnel and has been witnessed by the undersigned.

Lloyd's Register, its affiliates and subsidiaries and their respective officers, employees or agents are, individually and collectively, referred to in this clause as the 'Lloyd's Register Group'. The Lloyd's Register Group assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register Group entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.

The attachment of the thermocouples to the box surface was carried out by Intertek personnel in accordance with the ISO 22899-1: 2007(E), location and orientation of the thermocouples has been verified prior to the jet fire test and found satisfactory.

Prior to the Jet fire test system thickness, test setup and all relevant test parameters were verified and recorded. Also, calibration records of testing instruments were verified and found current.

"This report does not constitute LR Type Approval nor signifies entry into the List of LR Type Approved Products which will be subject to satisfactory review and issue of a 'Type Approval Certificate."

Lloyd's Register North America, Inc. WGN Houston Office

Lloyd's Register

Wes G. & A Niewiadomski
Surveyor to Lloyd's Register North America Inc
1330 Enclave Parkway, Suite 200
Houston, Texas 77077.

A member of the Lloyd's Register Group

Lloyd's Register

Project: **NFPA 58 Hose Stream Test on E-MAT Barrier**

Client: **3 M company**

Office: **Houston**

Clients Order Number: **-**

Date: **03 January 2012**

Order Status: **Complete**

Inspection Dates

First: **14 December 2011**

Final: **15 December 2011**

This certificate is issued to **3 M Company, to certify that at their request the undersigned surveyor did attend the works of Intertek Elmendorf, Texas, on the above mentioned date for the purpose of witnessing Jet Fire Test carried out on a structural steelwork test speciman.**

Material being Tested:

Open fronted box with two layers of 3 M Interam E-5A 4 Series Endothermic fire E Barrier

Scope of Inspection:-

1. **Verified the traceability of the material.**
2. **Witnessed the jet fire & hose stream test to NFPA 58 Annex H3**
3. **Witnessed the monitoring of test parameters, gas flow, water pressure.**
4. **Carried out post-test visual inspection.**
5. **Reviewed test data and calibration records of the test instruments.**

Results of the test were found satisfactory/

Lloyd's Register North America, Inc.
A. Kapoor
Houston-Port Office

A. Kapoor
Surveyor to Lloyd's Register North America, Inc.

A subsidiary of Lloyd's Register Group Limited

Lloyd's Register, its affiliates and subsidiaries and their respective officers, employees or agents are, individually and collectively, referred to in this clause as the 'Lloyd's Register Group'. The Lloyd's Register Group assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register Group entity for the provision of this information or advice and in that case any responsibility or liability is exclusively or terms and conditions set out in that contract.

Ministero dell'Interno

DIPARTIMENTO DEI VIGILI DEL FUOCO, DEL SOCCORSO PUBBLICO E DELLA DIFESA CIVILE
DIREZIONE CENTRALE PER LA PREVENZIONE E LA SICUREZZA TECNICA
Area Protezione Passiva

Prot. n.

Roma,

Dipartimento dei Vigili del Fuoco del Soccorso Pubblico e della Difesa Civile
DCPREV
REGISTRO UFFICIALE - USCITA
Prot. n. 0009709 del 05/07/2013

Alle Direzioni Regionali ed Interregionali VV.F.

Ai Comandi Provinciali VV.F.

LORO SEDI

LETTERA - CIRCOLARE

OGGETTO: Qualificazione di resistenza al fuoco di prodotti e sistemi protettivi da impiegare nel settore petrolchimico.

Pervengono alla Direzione Centrale per la Prevenzione e la Sicurezza Tecnica alcuni quesiti inerenti la qualificazione di resistenza al fuoco di prodotti e sistemi protettivi nel settore degli impianti chimici e petrolchimici.

Giova ricordare che le procedure di classificazione e qualificazione di resistenza al fuoco di prodotti ed elementi costruttivi di opere da costruzione sono riportate nel decreto del Ministro dell'Interno 16 febbraio 2007. Il decreto stesso definisce "opere da costruzione" gli edifici e le opere di ingegneria civile.

In base al citato decreto, è consentito determinare la prestazione di prodotti e sistemi protettivi attraverso prove di resistenza al fuoco con riferimento a curve di incendio nominali così come previsto dalla UNI EN 13501-2 e dalla norma UNI EN 1363-2, in particolare, per la curva di incendio da idrocarburi.

Nel caso del settore chimico e petrolchimico è però frequente l'impiego di prodotti o sistemi protettivi specifici pensati per garantire prestazioni di resistenza al fuoco con riferimento a scenari tipici quali, ad esempio, *pool fires*, *jet fires*, *hose stream,* etc. non descritti nelle citate norme europee e pertanto non specificatamente trattati nel decreto di cui in premessa.

A tale riguardo, la circolare prot. DCPREV n. 14229 del 19/11/2012, che fornisce alcune indicazioni in merito all'idoneità all'impiego di "prodotti innovativi", cioè attualmente non coperti da specificazioni tecniche elaborate da Organismi europei di normazione, può rappresentare un valido riferimento. In essa è stabilito che l'uso dei prodotti innovativi possa essere accettato se supportato dalla pertinente valutazione del rischio che ne giustifichi l'impiego e se la prestazione degli stessi sia determinata con riferimento a norme o specifiche di prova nazionali, internazionali o, in assenza di queste, a specifiche di prova adottate da laboratori a tal fine autorizzati.

Analogamente, si ritiene che l'impiego di specifici prodotti e sistemi protettivi qualificati per la resistenza al fuoco nel settore chimico e petrolchimico, possa essere consentito solo a valle di valutazione del rischio ed in presenza di pertinenti rapporti di prova rilasciati da Organismi nazionali o internazionali riconosciuti nel settore.

IL CAPO DEL CORPO NAZIONALE
DEI VIGILI DEL FUOCO
(PINI)

LP/CM/FD

РОССИЙСКАЯ ФЕДЕРАЦИЯ
СЕРТИФИКАТ СООТВЕТСТВИЯ
(обязательная сертификация)

№ C-US.ПБ37.В.01050 (номер сертификата соответствия) ТР 1373400 (учетный номер бланка)

ЗАЯВИТЕЛЬ (наименование и место-нахождение заявителя) Закрытое акционерное общество «3М Россия». Адрес: 121614, г. Москва, ул. Крылатская, д.17, корп.3. ОГРН: 1027700133988. Телефон (495) 784-7474, факс (495) 784-7475.

ИЗГОТОВИТЕЛЬ (наименование и место-нахождение изготовителя продукции) «3M Company». Адрес: 3M Center St. Paul, MN, 55144-1000, United States, Соединенные Штаты Америки.

ОРГАН ПО СЕРТИФИКАЦИИ (наименование и местонахождение органа по сертификации, выдавшего сертификат соответствия) ООО "НПО ПОЖЦЕНТР". 115408, г. Москва, ул. Советская, д. 15, стр. 1, тел. (495) 673-79-33, 796-89-34, 774-01-18, факс (495) 673-13-27. ОГРН: 1077759457489. Аттестат рег. № ТРПБ.RU.ПБ37 выдан 07.10.2010г. МЧС России.

ПОДТВЕРЖДАЕТ, ЧТО ПРОДУКЦИЯ (информация об объекте сертификации, позволяющая идентифицировать объект) Система пассивной противопожарной защиты 3М Interam™ для огнезащиты несущих стальных конструкций (состав см. Приложение на бланке № 0393197), монтируемая в соответствии с «3М Системы Intermat™. Руководство по установке». Серийный выпуск.

код ОК 005 (ОКП) 57 6200

код ЕКПС

код ТН ВЭД России 6806 10 000 8

СООТВЕТСТВУЕТ ТРЕБОВАНИЯМ ТЕХНИЧЕСКОГО РЕГЛАМЕНТА (ТЕХНИЧЕСКИХ РЕГЛАМЕНТОВ) (наименование технического регламента (технических регламентов), на соответствие требованиям которого (которых) проводилась сертификация) Технический регламент о требованиях пожарной безопасности (Федеральный закон от 22.07.2008 N 123-ФЗ). ГОСТ Р 53295-2009 "Средства огнезащиты для стальных конструкций. Общие требования, Методы определения огнезащитной эффективности". Группа огнезащитной эффективности см. Приложение на бланке № 0393197

ПРОВЕДЕННЫЕ ИССЛЕДОВАНИЯ (ИСПЫТАНИЯ) И ИЗМЕРЕНИЯ Протоколы сертификационных испытаний: № 484-СС, № 485-СС, № 486-СС от 05.04.2013 г. ИЦ "ТПБ ТЕСТ" ООО "Технологии пожарной безопасности", рег. № ТРПБ.RU.ИН14 от 25.08.2010 г.; Акт оценки производства сертифицируемой продукции № 1298-АОП от 27.11.2012 г. ОС ООО «НПО ПОЖЦЕНТР», рег. № ТРПБ.RU.ПБ37 от 07.10.2010 г.

ПРЕДСТАВЛЕННЫЕ ДОКУМЕНТЫ (документы, представленные заявителем в орган по сертификации в качестве доказательств соответствия продукции требованиям технического регламента (технических регламентов)) Место нанесения знака обращения на рынке: на упаковке (таре) и на сопроводительной технической документации.

СРОК ДЕЙСТВИЯ СЕРТИФИКАТА СООТВЕТСТВИЯ с 11.04.2013 по 10.04.2018

Руководитель (заместитель руководителя) органа по сертификации (подпись, инициалы, фамилия) В.Ю. Шитиков

Эксперт (эксперты) (подпись, инициалы, фамилия) В.А. Литвинов

Орган по сертификации «НПО ПОЖЦЕНТР» Для сертификатов М.П. ТРПБ.RU.ПБ37

БЛАНК ИЗГОТОВЛЕН ЗАО «ОПЦИОН», www.opcion.ru ЛИЦЕНЗИЯ № 05-05(

РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПРИЛОЖЕНИЕ
к СЕРТИФИКАТУ СООТВЕТСТВИЯ № C-US.ПБ37.В.01050

(обязательная сертификация)

ТР 0393197
(учетный номер бланка)

Система пассивной противопожарной защиты 3M Interam™ для огнезащиты несущих стальных конструкций (состав: один слой мата эндотермического 3M Interam® E-Mat® толщиной 10,3 мм (общая толщина 10,3 мм), огнеупорный герметик 3M Fire Barrier Sealant CP 25WB+ ТН ВЭД 3214 10 100 9, лента алюминиевая 3M Aluminum tape 425/427 ТН ВЭД 7616 99 900 9, бандаж ленточный из стали) обеспечивает 4-ю группу огнезащитной эффективности по ГОСТ Р 53295-2009 "Средства огнезащиты для стальных конструкций. Общие требования, Методы определения огнезащитной эффективности".

Система пассивной противопожарной защиты 3M Interam™ для огнезащиты несущих стальных конструкций (состав: два слоя мата эндотермического 3M Interam® E-Mat® толщиной 10,3 мм (общая толщина 20,6 мм), огнеупорный герметик 3M Fire Barrier Sealant CP 25WB+ ТН ВЭД 3214 10 100 9, лента алюминиевая 3M Aluminum tape 425/427 ТН ВЭД 7616 99 900 9, бандаж ленточный из стали) обеспечивает 2-ю группу огнезащитной эффективности по ГОСТ Р 53295-2009 "Средства огнезащиты для стальных конструкций. Общие требования, Методы определения огнезащитной эффективности".

Система пассивной противопожарной защиты 3M Interam™ для огнезащиты несущих стальных конструкций (состав: три слоя мата эндотермического 3M Interam® E-Mat® толщиной 10,3 мм (общая толщина 30,9 мм), огнеупорный герметик 3M Fire Barrier Sealant CP 25WB+ ТН ВЭД 3214 10 100 9, лента алюминиевая 3M Aluminum tape 425/427 ТН ВЭД 7616 99 900 9, бандаж ленточный из стали) обеспечивает 1-ю группу огнезащитной эффективности по ГОСТ Р 53295-2009 "Средства огнезащиты для стальных конструкций. Общие требования, Методы определения огнезащитной эффективности"

Орган по сертификации «НПО ПОЖЦЕНТР» Для сертификатов М.П. ТРПБ.RU.П537

Руководитель
(заместитель руководителя)
органа по сертификации — В.Ю. Шитиков
подпись, инициалы, фамилия

Эксперт (эксперты) — В.А. Литвинов
подпись, инициалы, фамилия

БЛАНК ИЗГОТОВЛЕН ЗАО «ОПЦИОН», www.opcion.ru, ЛИЦЕНЗИЯ № 05-[illegible] ФНС РФ, УРОВЕНЬ Б), ТЕЛ. (495) 726 4742, г. МОСКВА, 2012 г.

DNV File: 21-00269-63
Certificate No: HOU-96-007

DNV

Statement of Fact

Date: March 28, 1996
To: 3 M Fire Protection Products
Attn: Karen Sprague

This is to certify that the testing of the 3 M 'Interam" E-5A-4 Flexible Wrap Fire Protection System at Omega Point Laboratories of San Antonio, Texas was witnessed by Lyle R. Witherell with DNV Industry, Inc. of Houston, Texas on February 12,13, and 14 1996.

Equipment Description: 3 M INTERAM E-5A-4 Hydrocarbon Fire Exposure Test on various structural steel elements in accordance with OMEGA POINT LABORATORIES 3 M STRUCTURAL STEEL TEST PROGRAM TEST PLAN, Rev.0. Refer to the following reports for particulars:

Omega Point Laboratories Report No. 98944 A, dated February 12, 1996.
Testing Performed: 4 Layer System on Structural Columns

Omega Point Laboratories Report No. 98944 B, dated February 13, 1996.
Testing Performed: 1 Layer System on Structural Columns

Omega Point Laboratories Report No. 98944 C, dated February 14, 1996.
Testing Performed: 1, 2, and 3 Layer System on Structural Columns and Pipe

Surveyor, DNV-Houston: Lyle R. Witherell

Approval:

Distribution:		**Attn:**	**FAX #**
Original to Client:	3 M Fire Protection	Karen Sprague	N/A
Copy to File:	21-00269-63		

It is agreed that save as provided below Det Norske Veritas, its subsidiaries, bodies, officers, directors, employees and agents shall have no liability for any loss, damage or expense allegedly caused directly or indirectly by their mistake or negligence, breach of warranty, or any other act, omission or error by them, including gross negligence or willful misconduct by any such person with the exception of gross negligence or willful misconduct by the governing bodies or senior executive officers of Det Norske Veritas. This applies regardless of whether the loss, damage or expense has affected anyone with whom Det Norske Veritas has a contact or a third party who has acted or relied on decisions made or information given by or on behalf of them and in consequence suffers a loss, damage or expense proved to be due to their negligence, omission or default, then Det Norske Veritas will pay by way of compensation to such person a sum representing his proved loss. In the event Det Norske Veritas or its subsidiaries may be held liable in accordance with the sections above, the amount of compensation shall under no circumstances exceed the amount of the fee, if any, charged for that particular service, decision, advice or information. Under no circumstances whatsoever shall the individual or individuals who have personally caused the loss, damage or expense be held liable. In the event that any provision in this section shall be invalid under the law of any jurisdiction, the validity of the remaining provisions shall not in any way be affected.

Det Norske Veritas Industry, Inc.
16340 Park Ten Place, Suite 100
Houston, Texas 77084
Tel: (713) 579-9003
Facsimile: (713) 579-1360

DNV

VERIFICATION REPORT

QAS Order Number: 21-00269-63	**QAS Report Number:** 21.0026963.02	
P.O. Number: T997457	**Date:** February 12, 13, & 14 1996	
Main Vendor: 3 M Corporation	**Location:** San Antonio, Texas	
Sub Vendor: Omega-Point Laboratories	**Vendor Contact:** Tom Thoreson	
Vendor Ref: Interam	**Vendor Phone:** 612-736-3816	
Req. No: N/A	**Quantity:** 13	**Week No:** 07
Part No: See Below	**Serial No:** See Below	
EQUIPMENT DESCRIPTION: Fire Test of 3M "Interam" E-5A-4 Mat		

Verification Comments:

Purpose of Verification: Witness Fire Test

Acceptance Criteria: Hydrocarbon Fire Exposure Test, Rev. 0.

Reference Documents: Hydrocarbon Fire Exposure Test, Rev. 0

Scope of Activity:

Witnessed the Hydrocarbon Fire Exposure Test of the four following structural columns and one structural beam at one time . The test specimens were numbered by DNV in the order of installation of the Interam E-5A-4 Mat, not by Omega Point or 3 M. All the specimens tested on this day were covered with four layers of Mat. The test pieces and the time to reach 700° C are as follows:

Specimen No.	Structural Size	No. of Layers	Time (minutes) to 700° C
1	W 14 X 283	4	400° C IN 371 MINUTES
2	W 18 X 71	4	330 MINUTES
5	W 6 X 12	4	255 MINUTES
8	W 10 X 100	4	650° C IN 371 MINUTES
Loaded Beam	W 8 X 48	4	330° C IN 330 MINUTES

FAX: No **Date:** 02/12/96 **Signature:** Lyle O. Witherell

Distribution:
Original to Client: 3M Corporation
Copy to File: 21-00269-63
Approval:

Attn:
Ron Israelson

FAX #:

Det Norske Veritas Industry, Inc.
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DNV

VERIFICATION REPORT

QAS No: 21-0269-63

Verification Comments Continued:

Tuesday, February13, 1996

The single layer specimens were tested to 700° C.

Specimen No.	Structural Size	No. of Layers	Time (minutes) to 700° C
6	W 6 X 12	1	55 MINUTES
7	W 14 X 283	1	273 MINUTES
9	W 18 X 71	1	108 MINUTES
10	W 10 X 100	1	153 MINUTES
Loaded Beam	W 8 X 48	1	650° C IN 377 MINUTES

Wednesday, February 14, 1996

The various layer specimens of columns and pipe were tested to 700° C.

Specimen No.	Structural Size	No. of Layers	Time to 700° C
3	W 8 X 48	3	280 MINUTES
4	W 8 X 48	2	202 MINUTES
11	10" PIPE	2 WITH 2" FOAMGLASS	250 MIINUTES
12	10" PIPE	1 WITH 2" FOAMGLASS	164 MINUTES
13	10" PIPE	1 WITH 1.5" FOAMGLASS	158 MINUTES

Signature: Lyle R. Witherell

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DNV

VERIFICATION REPORT

QAS Order Number: 21-00269-63	**QAS Report Number:** 21.0026963.01	
P.O. Number: T997457	**Date:** February 6, 7, & 8 1996	
Main Vendor: 3 M Corporation	**Location:** San Antonio, Texas	
Sub Vendor: Omega-Point Laboratories	**Vendor Contact:** Tom Thoreson	
Vendor Ref: Interam E-5A-4 Mat System.	**Vendor Phone:** 612-736-3816	
Req. No: N/A	**Quantity:** N/A	**Week No:** 06
Part No: See Below	**Serial No:** See Below	
EQUIPMENT DESCRIPTION: Fire Test of 3M "Interam" E-5A-4 Mat		

Verification Comments:

Purpose of Verification: Witness Fire Test

Acceptance Criteria: Hydrocarbon Fire Exposure Test, Rev. 0.

Reference Documents: Hydrocarbon Fire Exposure Test, Rev. 0 Installation Guidelines for Interam Flexible Wrap Systems

Scope of Activity:

Witnessed the installation of the 3M "Interam" E-5A-4 Mat Systems on 10 various structural columns, 3 pipes and 2 loaded beams. The installation was performed by personnel from 3M and Peak Seals Company using actual field installation techniques. Verified the location of the thermocouples in accordance with the Test Plan, Rev. 0 supplied by Omega Point. Verified the calibration status of the thermocouples. The beams and pipe were all 54 inches in length. The E-5A-4 Mat was 24 1/2 " in width. The mat was applied with two 24 1/2" and one 5 " strip on all test beams and pipes. The materials used to fasten the mat in place were:

1. 3M Scotch Premium Grade (3M 898 Masking) Filament Tape.
2. 3M "Interam" T-49 4" Aluminum Scotch Brand Tape
3. PittSeal 444N Sealant - (FOAM GLASS - PIPE ONLY)
4. CP-25 WB+-25 Caulk. (PIPE ONLY)

FAX: No **Date:** 02/05 -02/07/96 **Signature:** Lyle K. Cantrell

Distribution: **Attn:** **FAX #:**
Original to Client: 3M Corporation Ron Israelson
Copy to File: 21-00269-63
Approval:

Det Norske Veritas Industry, Inc.
16340 Park Ten Place, Suite 100
Houston, Texas 77084
Tel: (713) 579-9003
Facsimile: (713) 579-1360

Verification Comments Continued:

The beams and pipes are listed by size, weight and number of layers:

1. W14 X 283: covered with 4 layers of E-5A-4 Mat, Lot Nos. 7362513023/0028523011 and 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). All seams on each layer (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. Each layer was installed separately using the Offset Method; Each layer of mat had a 2" overlap, and the next layer was butted up against the preceding layer. After the mat was taped, Stainless Steel bands are placed on the covered beam at 1" from the edge and in the center of each section of mat. The lengths of the layers are as follows:

Layer no. 1	Layer no. 2	Layer no. 3	Layer no. 4
70 inches	74 inches	76 1/2 inches	79 1/2 inches

2. W18 X 71: covered with 4 layers of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). All seams on each layer (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. Each layer was installed separately using the Offset Method; Each layer of mat had a 2" overlap, and the next layer was butted up against the preceding layer. After the mat was taped, Stainless Steel bands are placed on the covered beam at 1" from the edge and in the center of each section of mat. The lengths of the layers are as follows:

Layer no. 1	Layer no. 2	Layer no. 3	Layer no. 4
58 inches	60 inches	63 1/2 inches	66 inches

3. W8 X 48: covered with 3 layers of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). All seams on each layer (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. Each layer was installed separately using the Offset Method; Each layer of mat had a 2" overlap, and the next layer was butted up against the preceding layer. After the mat was taped, Stainless Steel bands are placed on the covered beam at 1" from the edge and in the center of each section of mat. The lengths of the layers are as follows:

Layer no. 1	Layer no. 2	Layer no. 3
38 inches	40 1/2 inches	43 1/2 inches

Signature: Lyle R. Emerick

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DNV

VERIFICATION REPORT

Remarks: (continued from page one)

4. W8 X 48: covered with 2 layers of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). All seams on each layer (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. Each layer was installed separately using the Offset Method; Each layer of mat had a 2" overlap, and the next layer was butted up against the preceding layer. After the mat was taped, Stainless Steel bands are placed on the covered beam at 1" from the edge and in the center of each section of mat. The lengths of the layers are as follows:

Layer no. 1	Layer no. 2	Layer no. 3
38 inches	40 1/2 inches	43 1/2 inches

5. W6 X 12: was covered with 4 layers of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). All seams on each layer (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. Each layer was installed separately using the Offset Method; Each layer of mat had a 2" overlap, and the next layer was butted up against the preceding layer. After the mat was taped, Stainless Steel bands are placed on the covered beam at 1" from the edge and in the center of each section of mat. The lengths of the layers are as follows:

Layer no. 1	Layer no. 2	Layer no. 3	Layer no. 4
25 1/2 inches	28 inches	32 inches	36 inches

6. W6 X 12 was covered with 1 26" layer of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). The seams (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. A 4" collar of E 5A-4 mat was centered on each seam and taped with 3 pieces of T-49 Aluminum tape. The collars were banded 1 inch from the edge with 2 bands in addition to the bands on the mat.

Wednesday 7 February 1996

7. W14 X 283 was covered with 1 71" layer of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). The seams (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. A 4" collar of E 5A-4 mat was centered on each seam and taped with 3 pieces of T-49 Aluminum tape. The collars were banded 1 inch from the edge with 2 bands in addition to the bands on the mat.

Signature: Lyle E. Witherell

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VERIFICATION REPORT

QAS No: 21.0026963.01

Remarks: (continued from page one)

8. W10 X 100 was covered with 4 layers of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). All seams on each layer (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. Each layer was installed separately using the Offset Method; Each layer of mat had a 2" overlap, and the next layer was butted up against the preceding layer. After the mat was taped, Stainless Steel bands are placed on the covered beam at 1" from the edge and in the center of each section of mat. The lengths of the layers are as follows:

Layer no. 1	Layer no. 2	Layer no. 3	Layer no. 4
48 1/4 inches	51 inches	54i inches	57 inches

9. W18 X 71 was covered with 1 71" layer of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). The seams (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. A 4" collar of E 5A-4 mat 60 inches long was centered on each seam and taped with 3 pieces of T-49 Aluminum tape. The collars were banded 1 inch from the edge with 2 bands in addition to the bands on the mat.

10. W10 X 100 was covered with 1 71" layer of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). The seams (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. A 4" collar of E 5A-4 mat, 51 inches long was centered on each seam and taped with 3 pieces of T-49 Aluminum tape. The collars were banded 1 inch from the edge with 2 bands in addition to the bands on the mat.

11. The 10" diameter pipe was covered with one layer of 2" Foam Glass. The Foam Glass was glued with PittSeal 444N Sealant. The Foam Glass was wrapped with 2 layers of layer of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). The external circumferential seams were sealed with PittSeal WB+-25 Caulk. The caulk was then taped with the 4" 3M T-49 Aluminum Scotch Brand Tape with the tape centered on the caulked seam. The longitudinal seam was taped with T-49 and the circumferential seams were banded with 2 stainless bands, one inch from the edge of the tape. No collars were used on the pipe seams.

The length of the first layer of mat was 52 1/2" and the second was 55".

Signature: Lyle R[illegible]

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VERIFICATION REPORT

Verification Comments Continued:

12. The 10" diameter pipe was covered with one layer of 2" Foam Glass. The Foam Glass was glued with PittSeal 444N Sealant. The Foam Glass was wrapped with 1 layer of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). The external circumferential seams were sealed with PittSeal CP-25 WB+-25 Caulk. The caulk was then taped with the 4" 3M T-49 Aluminum Scotch Brand Tape with the tape centered on the caulked seam. The longitudinal seam was taped with T-49 Tape The circumferential seams were banded with 2 stainless bands, one inch from the edge of the tape in addition to the normal banding on 12" centers. No collars were used on the pipe seams. The length of the layer of mat was 52 1/2".

13. The 10" diameter pipe was covered with one layer of 1 1/2" Foam Glass. The Foam Glass was glued with PittSeal 444N Sealant. The Foam Glass was wrapped with 1 layer of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). The external circumferential seams were sealed with PittSeal CP-25 WB+-25 Caulk. The caulk was then taped with the 4" 3M T-49 Aluminum Scotch Brand Tape with the tape centered on the caulked seam. The longitudinal seam was taped with T-49 Tape The circumferential seams were banded with 2 stainless bands, one inch from the edge of the tape in addition to the normal banding on 12" centers. No collars were used on the pipe seams. The length of the layer of mat was 50".

Thursday, 08 February 1996

Two 13'6" long W 8 X 48 beams for the 4 Sided Test were attached to blocks of concrete. One beam was covered with 4 layers of the E-5A-4 Mat, Lot No. 3650318245/00060123011. The other beam was covered with one layer. The Mat was held in place with the Masonry screws and stainless steel bands. Details are as follows:

Materials used to mount the mat to the beams/concrete:

1. Midwest Fastener Co. 1/4' X 2 3/4" Hex Head Masonry Screw Kit No. 3262.
2. Rawlplug Co. 1/4" X 1 3/4" and 2 1/4" Rawl Masonry Screws - Perma Seal Coated
3. Allied Fasteners 1/4" X 1 1/4" PW 8A Zinc Coated Fender Washers
4. 1" Stainless Steel Bands
5. PittSeal CP-25 WB+-25 Caulk

Installation of the mat was performed by personnel of the 3M and Peak Seal Companies in accordance with the 3M Structural Steel Test Program Test Plan, Rev. 0, and 3M Installation Guidelines "Interam" Flexible Wrap Systems.

Signature: Lyle R. Witherell

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DNV

VERIFICATION REPORT

QAS No: 21.0026963.01

Verification Comments Continued:

The 4 layer covered beam for the 3 sided test was covered with 28 pieces of mat 39 inches long using the 4 inch overlap method of installation. The first 2 layers were attached with 1 3/4" long masonry screws and fender washers for construction purposes only. The third and forth layers were attached with the 2 3/4" long screws and washers. The 4 layers were then banded with the 1" stainless bands; 2 inches from the seam and on the centers of the sections of mat with the 2 1/4" screws. The seams were caulked with the CP-25 WB+ caulk and covered with the 4" aluminum tape. The edges of the 4 layers of mat were trimmed and caulked.

The 1 layer covered beam for the 3 sided test was covered with 7 and 1/2 pieces of mat 39 inches long using the 4 inch overlap method. The mat was attached to the concrete with 1 3/4" and 2 1/4" screws. The stainless bands were placed on the center of each overlap and the centers of the mat. The seams were caulked with CP 25 WB+ caulk and covered with aluminum tape. The edges were trimmed and caulked to the concrete.

Fire tests of the previously listed will commence Monday, 12 February 1996 at the OMEGA-POINT LABORATORIES facility.

Signature: Lyle E. Rutherell

DNV File: 21-00269-63
Certificate No: HOU-96-007

DNV

Statement of Fact

Date: March 28, 1996
To: 3 M Fire Protection Products
Attn: Karen Sprague

This is to certify that the testing of the 3 M "Interam" E-5A-4 Flexible Wrap Fire Protection System at Omega Point Laboratories of San Antonio, Texas was witnessed by Lyle R. Witherell with DNV Industry, Inc. of Houston, Texas on February 12,13, and 14 1996.

Equipment Description: 3 M INTERAM E-5A-4 Hydrocarbon Fire Exposure Test on various structural steel elements in accordance with OMEGA POINT LABORATORIES 3 M STRUCTURAL STEEL TEST PROGRAM TEST PLAN, Rev.0. Refer to the following reports for particulars:

Omega Point Laboratories Report No. 98944 A, dated February 12, 1996.
Testing Performed: 4 Layer System on Structural Columns

Omega Point Laboratories Report No. 98944 B, dated February 13, 1996.
Testing Performed: 1 Layer System on Structural Columns

Omega Point Laboratories Report No. 98944 C, dated February 14, 1996.
Testing Performed: 1, 2, and 3 Layer System on Structural Columns and Pipe

Surveyor, DNV-Houston: Lyle R. Witherell

Approval:

Distribution:		**Attn:**	**FAX #**
Original to Client:	3 M Fire Protection	Karen Sprague	N/A
Copy to File:	21-00269-63		

It is agreed that save as provided below Det Norske Veritas, its subsidiaries, bodies, officers, directors, employees and agents shall have no liability for any loss, damage or expense allegedly caused directly or indirectly by their mistake or negligence, breach of warranty, or any other act, omission or error by them, including gross negligence or willful misconduct by any such person with the exception of gross negligence or willful misconduct by the governing bodies or senior executive officers of Det Norske Veritas. This applies regardless of whether the loss, damage or expense has affected anyone with whom Det Norske Veritas has a contact or a third party who has acted or relied on decisions made or information given by or on behalf of them and in consequence suffers a loss, damage or expense proved to be due to their negligence, omission or default, then Det Norske Veritas will pay by way of compensation to such person a sum representing his proved loss. In the event Det Norske Veritas or its subsidiaries may be held liable in accordance with the sections above, the amount of compensation shall under no circumstances exceed the amount of the fee, if any, charged for that particular service, decision, advice or information. Under no circumstances whatsoever shall the individual or individuals who have personally caused the loss, damage or expense be held liable. In the event that any provision in this section shall be invalid under the law of any jurisdiction, the validity of the remaining provisions shall not in any way be affected.

Det Norske Veritas Industry, Inc.
16340 Park Ten Place, Suite 100
Houston, Texas 77084
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Facsimile: (713) 579-1360

DNV

VERIFICATION REPORT

QAS Order Number: 21-00269-63	**QAS Report Number:** 21.0026963.02	
P.O. Number: T997457	**Date:** February 12, 13, & 14 1996	
Main Vendor: 3 M Corporation	**Location:** San Antonio, Texas	
Sub Vendor: Omega-Point Laboratories	**Vendor Contact:** Tom Thoreson	
Vendor Ref: Interam	**Vendor Phone:** 612-736-3816	
Req. No: N/A	**Quantity:** 13	**Week No:** 07
Part No: See Below	**Serial No:** See Below	
EQUIPMENT DESCRIPTION: Fire Test of 3M "Interam" E-5A-4 Mat		

Verification Comments:

Purpose of Verification: Witness Fire Test

Acceptance Criteria: Hydrocarbon Fire Exposure Test, Rev. 0.

Reference Documents: Hydrocarbon Fire Exposure Test, Rev. 0

Scope of Activity:

Witnessed the Hydrocarbon Fire Exposure Test of the four following structural columns and one structural beam at one time . The test specimens were numbered by DNV in the order of installation of the Interam E-5A-4 Mat, not by Omega Point or 3 M. All the specimens tested on this day were covered with four layers of Mat. The test pieces and the time to reach 700° C are as follows:

Specimen No.	Structural Size	No. of Layers	Time (minutes) to 700° C
1	W 14 X 283	4	400° C IN 371 MINUTES
2	W 18 X 71	4	330 MINUTES
5	W 6 X 12	4	255 MINUTES
8	W 10 X 100	4	650° C IN 371 MINUTES
Loaded Beam	W 8 X 48	4	330° C IN 330 MINUTES

FAX: No **Date:** 02/12/96 **Signature:** Lyle R. Willerell

Distribution:
Original to Client: 3M Corporation
Copy to File: 21-00269-63
Approval:

Attn:
Ron Israelson

FAX #:

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DNV

VERIFICATION REPORT

QAS No: 21-0269-63

Verification Comments Continued:

Tuesday, February13, 1996

The single layer specimens were tested to 700° C.

Specimen No.	Structural Size	No. of Layers	Time (minutes) to 700° C
6	W 6 X 12	1	55 MINUTES
7	W 14 X 283	1	273 MINUTES
9	W 18 X 71	1	108 MINUTES
10	W 10 X 100	1	153 MINUTES
Loaded Beam	W 8 X 48	1	650° C IN 377 MINUTES

Wednesday, February 14, 1996

The various layer specimens of columns and pipe were tested to 700° C.

Specimen No.	Structural Size	No. of Layers	Time to 700° C
3	W 8 X 48	3	280 MINUTES
4	W 8 X 48	2	202 MINUTES
11	10" PIPE	2 WITH 2" FOAMGLASS	250 MIINUTES
12	10" PIPE	1 WITH 2" FOAMGLASS	164 MINUTES
13	10" PIPE	1 WITH 1.5" FOAMGLASS	158 MINUTES

Signature: Lyle K. Witherell

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DNV

VERIFICATION REPORT

QAS Order Number: 21-00269-63	**QAS Report Number:** 21.0026963.01	
P.O. Number: T997457	**Date:** February 6, 7, & 8 1996	
Main Vendor: 3 M Corporation	**Location:** San Antonio, Texas	
Sub Vendor: Omega-Point Laboratories	**Vendor Contact:** Tom Thoreson	
Vendor Ref: Interam E-5A-4 Mat System.	**Vendor Phone:** 612-736-3816	
Req. No: N/A	**Quantity:** N/A	**Week No:** 06
Part No: See Below	**Serial No:** See Below	
EQUIPMENT DESCRIPTION: Fire Test of 3M "Interam" E-5A-4 Mat		

Verification Comments:

Purpose of Verification: Witness Fire Test

Acceptance Criteria: Hydrocarbon Fire Exposure Test, Rev. 0.

Reference Documents: Hydrocarbon Fire Exposure Test, Rev. 0 Installation Guidelines for Interam Flexible Wrap Systems

Scope of Activity:

Witnessed the installation of the 3M "Interam" E-5A-4 Mat Systems on 10 various structural columns, 3 pipes and 2 loaded beams. The installation was performed by personnel from 3M and Peak Seals Company using actual field installation techniques. Verified the location of the thermocouples in accordance with the Test Plan, Rev. 0 supplied by Omega Point. Verified the calibration status of the thermocouples. The beams and pipe were all 54 inches in length. The E-5A-4 Mat was 24 1/2 " in width. The mat was applied with two 24 1/2" and one 5 " strip on all test beams and pipes. The materials used to fasten the mat in place were:

1. 3M Scotch Premium Grade (3M 898 Masking) Filament Tape.
2. 3M "Interam" T-49 4" Aluminum Scotch Brand Tape
3. PittSeal 444N Sealant - (FOAM GLASS - PIPE ONLY)
4. CP-25 WB+-25 Caulk. (PIPE ONLY)

FAX: No **Date:** 02/05 -02/07/96 **Signature:** Lyle R. Campbell

Distribution: **Attn:**
Original to Client: 3M Corporation Ron Israelson
Copy to File: 21-00269-63
Approval:

FAX #:

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Verification Comments Continued:

The beams and pipes are listed by size, weight and number of layers:

1. W14 X 283: covered with 4 layers of E-5A-4 Mat, Lot Nos. 7362513023/0028523011 and 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). All seams on each layer (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. Each layer was installed separately using the Offset Method; Each layer of mat had a 2" overlap, and the next layer was butted up against the preceding layer. After the mat was taped, Stainless Steel bands are placed on the covered beam at 1" from the edge and in the center of each section of mat. The lengths of the layers are as follows:

Layer no. 1	Layer no. 2	Layer no. 3	Layer no. 4
70 inches	74 inches	76 1/2 inches	79 1/2 inches

2. W18 X 71: covered with 4 layers of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). All seams on each layer (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. Each layer was installed separately using the Offset Method; Each layer of mat had a 2" overlap, and the next layer was butted up against the preceding layer. After the mat was taped, Stainless Steel bands are placed on the covered beam at 1" from the edge and in the center of each section of mat. The lengths of the layers are as follows:

Layer no. 1	Layer no. 2	Layer no. 3	Layer no. 4
58 inches	60 inches	63 1/2 inches	66 inches

3. W8 X 48: covered with 3 layers of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). All seams on each layer (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. Each layer was installed separately using the Offset Method; Each layer of mat had a 2" overlap, and the next layer was butted up against the preceding layer. After the mat was taped, Stainless Steel bands are placed on the covered beam at 1" from the edge and in the center of each section of mat. The lengths of the layers are as follows:

Layer no. 1	Layer no. 2	Layer no. 3
38 inches	40 1/2 inches	43 1/2 inches

Signature: Lyle R. Turner

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Remarks: (continued from page one)

4. W8 X 48: covered with 2 layers of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). All seams on each layer (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. Each layer was installed separately using the Offset Method; Each layer of mat had a 2" overlap, and the next layer was butted up against the preceding layer. After the mat was taped, Stainless Steel bands are placed on the covered beam at 1" from the edge and in the center of each section of mat. The lengths of the layers are as follows:

Layer no. 1	Layer no. 2	Layer no. 3
38 inches	40 1/2 inches	43 1/2 inches

5. W6 X 12: was covered with 4 layers of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). All seams on each layer (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. Each layer was installed separately using the Offset Method; Each layer of mat had a 2" overlap, and the next layer was butted up against the preceding layer. After the mat was taped, Stainless Steel bands are placed on the covered beam at 1" from the edge and in the center of each section of mat. The lengths of the layers are as follows:

Layer no. 1	Layer no. 2	Layer no. 3	Layer no. 4
25 1/2 inches	28 inches	32 inches	36 inches

6. W6 X 12 was covered with 1 26" layer of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). The seams (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. A 4" collar of E 5A-4 mat was centered on each seam and taped with 3 pieces of T-49 Aluminum tape. The collars were banded 1 inch from the edge with 2 bands in addition to the bands on the mat.

Wednesday 7 February 1996

7. W14 X 283 was covered with 1 71" layer of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). The seams (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. A 4" collar of E 5A-4 mat was centered on each seam and taped with 3 pieces of T-49 Aluminum tape. The collars were banded 1 inch from the edge with 2 bands in addition to the bands on the mat.

Signature: Lyle W. Whitrell

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VERIFICATION REPORT

QAS No: 21.0026963.01

Remarks: (continued from page one)

8. W10 X 100 was covered with 4 layers of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). All seams on each layer (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. Each layer was installed separately using the Offset Method; Each layer of mat had a 2" overlap, and the next layer was butted up against the preceding layer. After the mat was taped, Stainless Steel bands are placed on the covered beam at 1" from the edge and in the center of each section of mat. The lengths of the layers are as follows:

Layer no. 1	Layer no. 2	Layer no. 3	Layer no. 4
48 1/4 inches	51 inches	54i inches	57 inches

9. W18 X 71 was covered with 1 71" layer of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). The seams (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. A 4" collar of E 5A-4 mat 60 inches long was centered on each seam and taped with 3 pieces of T-49 Aluminum tape. The collars were banded 1 inch from the edge with 2 bands in addition to the bands on the mat.

10. W10 X 100 was covered with 1 71" layer of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). The seams (Longitudinal and circumferential) were sealed with the 4" 3M Aluminum Scotch Brand Tape. A 4" collar of E 5A-4 mat, 51 inches long was centered on each seam and taped with 3 pieces of T-49 Aluminum tape. The collars were banded 1 inch from the edge with 2 bands in addition to the bands on the mat.

11. The 10" diameter pipe was covered with one layer of 2" Foam Glass. The Foam Glass was glued with PittSeal 444N Sealant. The Foam Glass was wrapped with 2 layers of layer of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). The external circumferential seams were sealed with PittSeal WB+-25 Caulk. The caulk was then taped with the 4" 3M T-49 Aluminum Scotch Brand Tape with the tape centered on the caulked seam. The longitudinal seam was taped with T-49 and the circumferential seams were banded with 2 stainless bands, one inch from the edge of the tape. No collars were used on the pipe seams.

The length of the first layer of mat was 52 1/2" and the second was 55".

Signature: Lyle R[illegible]

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VERIFICATION REPORT

Verification Comments Continued:

12. The 10" diameter pipe was covered with one layer of 2" Foam Glass. The Foam Glass was glued with PittSeal 444N Sealant. The Foam Glass was wrapped with 1 layer of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). The external circumferential seams were sealed with PittSeal CP-25 WB+-25 Caulk. The caulk was then taped with the 4" 3M T-49 Aluminum Scotch Brand Tape with the tape centered on the caulked seam. The longitudinal seam was taped with T-49 Tape The circumferential seams were banded with 2 stainless bands, one inch from the edge of the tape in addition to the normal banding on 12" centers. No collars were used on the pipe seams. The length of the layer of mat was 52 1/2".

13. The 10" diameter pipe was covered with one layer of 1 1/2" Foam Glass. The Foam Glass was glued with PittSeal 444N Sealant. The Foam Glass was wrapped with 1 layer of E-5A-4 Mat, Lot No. 3650318245/00060123011. The Mat was held in place with the Scotch Premium Grade Filament Tape (3M 898). The external circumferential seams were sealed with PittSeal CP-25 WB+-25 Caulk. The caulk was then taped with the 4" 3M T-49 Aluminum Scotch Brand Tape with the tape centered on the caulked seam. The longitudinal seam was taped with T-49 Tape The circumferential seams were banded with 2 stainless bands, one inch from the edge of the tape in addition to the normal banding on 12" centers. No collars were used on the pipe seams. The length of the layer of mat was 50".

Thursday, 08 February 1996

Two 13'6" long W 8 X 48 beams for the 4 Sided Test were attached to blocks of concrete. One beam was covered with 4 layers of the E-5A-4 Mat, Lot No. 3650318245/00060123011. The other beam was covered with one layer. The Mat was held in place with the Masonry screws and stainless steel bands. Details are as follows:

Materials used to mount the mat to the beams/concrete:

1. Midwest Fastener Co. 1/4' X 2 3/4" Hex Head Masonry Screw Kit No. 3262.
2. Rawlplug Co. 1/4" X 1 3/4" and 2 1/4" Rawl Masonry Screws - Perma Seal Coated
3. Allied Fasteners 1/4" X 1 1/4" PW 8A Zinc Coated Fender Washers
4. 1" Stainless Steel Bands
5. PittSeal CP-25 WB+-25 Caulk

Installation of the mat was performed by personnel of the 3M and Peak Seal Companies in accordance with the 3M Structural Steel Test Program Test Plan, Rev. 0, and 3M Installation Guidelines "Interam" Flexible Wrap Systems.

Signature: Lyle R. Witherell

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VERIFICATION REPORT

QAS No: 21.0026963.01

Verification Comments Continued:

The 4 layer covered beam for the 3 sided test was covered with 28 pieces of mat 39 inches long using the 4 inch overlap method of installation. The first 2 layers were attached with 1 3/4" long masonry screws and fender washers for construction purposes only. The third and forth layers were attached with the 2 3/4" long screws and washers. The 4 layers were then banded with the 1" stainless bands; 2 inches from the seam and on the centers of the sections of mat with the 2 1/4" screws. The seams were caulked with the CP-25 WB+ caulk and covered with the 4" aluminum tape. The edges of the 4 layers of mat were trimmed and caulked.

The 1 layer covered beam for the 3 sided test was covered with 7 and 1/2 pieces of mat 39 inches long using the 4 inch overlap method. The mat was attached to the concrete with 1 3/4" and 2 1/4" screws. The stainless bands were placed on the center of each overlap and the centers of the mat. The seams were caulked with CP 25 WB+ caulk and covered with aluminum tape. The edges were trimmed and caulked to the concrete.

Fire tests of the previously listed will commence Monday, 12 February 1996 at the OMEGA-POINT LABORATORIES facility.

Signature: Lyle E. Sutherell

3M Marine Approvals
Fire Protection Products
June 8, 2015

	Lloyd's Register	DNV·GL	ABS	RINA	MarED Module B	MarED Module D	USCG
3M Marine Fire Wrap Electrical Cables	SAS F150151 (New certificate from RINA testing forthcoming)	F-20427	00-HS1603327-4-PDA	(Forthcoming)	(Forthcoming)	July 1, 2015 Lloyd's Register	-
3M Marine Fire Wrap Bus Bars	SAS F150034	-	-	MED018813CS MED222913CS	RINA		-
3M Marine Fire Wrap PENETRATION SEALS (FIRE STOPS)	-	-	-	-	-	-	Coast Guard Approval Number: 164.138/0000001/0 "FORMER - MAY USE"
SM Tech Co. LTD (using 3M Ultra GS, 1000 NS) SMT Fire Stop System 07 (FSS-07)	SAS F120200	MED-B-8435 (System 07) MED-B-8436 (System 08)	08-BK341857/1-PDA	-	-	-	-
3M FB 1000 NS Surface Material of Low Flame Spread	-	F-20056	-	-	-	-	-
3M PM-4 Packing Material Non-Combustible Materials	-	-	-	MED170413CS	-	-	-
3M Interam E-5A-4 Endothermic Mat Structural Steel Hydrocarbon Fire	-	HOU-96-007	-	-	-	-	-
3M Interam E-5A-4 Endothermic Mat LP Gas Container NFPA 58, Annex H	HOU1100527/1	-	-	-	-	-	-
3M Interam E-5A-4 Endothermic Mat Bulkhead / Tank ISO 22899 Jet Fire	NAO 1201774/WGN/002	-	-	-	-	-	-
3M Interam E-5A-4 Endothermic Mat Structural Steel ISO 22899 Jet Fire	NAO 1201774/WGN/001	-	-	-	-	-	-
3M Interam E-5A-4 Endothermic Mat NON-COMBUSTIBLE MATERIAL	-	-	-	-	-	-	Coast Guard Approval Number: 164.009/0000279/0 "FORMER - MAY USE"

3M™ Fire Protection Products
Interam™ E-Mat Solutions Package

Technical Document: Data Sheet

3M™ Interam™ Endothermic Mat E-5A-4

Product Data Sheet

WALL OPENING MEMBRANES — UP TO 2 HOUR Fire Protection

ELECTRICAL CIRCUITS — UP TO 3 HOUR Fire Protection

STRUCTURAL STEEL — UP TO 4 HOUR Fire Protection

CLASSIFIED UL

Mat Materials
Fire Resistance Classifications
Rapid Temperature Rise
Fire Exposure
Design No. XR201
See UL Fire Resistance Directory
90G9

ULC LISTED

FILL, VOID OR CAVITY MATERIALS
90G9

Classified Mat Materials
Fire Resistance Classification
Design No. X203 and X204
See UL Fire Resistance Directory
90G9

CLASSIFIED UL

LISTED
OMEGA POINT LABORATORIES US
Intertek
FIRESTOP SYSTEMS
SEE INTERTEK DIRECTORY

ELECTRICAL CIRCUIT PROTECTIVE MATERIALS
FOR USE IN
ELECTRICAL CIRCUIT PROTECTIVE SYSTEMS
SYSTEM NO. 7, 8 AND 9
SEE UL BUILDING MATERIALS DIRECTORY
90G9

1. Product Description

When properly installed, 3M™ Interam™ Endothermic Mat E-5A-4 provides a uniform covering that, when exposed to high temperatures, releases chemically-bound water to cool the outer surfaces of the wrap material and significantly retard heat transfer. Helps protect structural steel components for up to four hours, critical electrical components for up to three hours and wall opening membranes for up to two hours. Applied to the back and sides of metallic utility boxes, this product helps achieve an equal F-rating and T-Rating in membrane penetrations of rated wall assemblies. 3M™ Interam™ Endothermic Mat E-5A-4 is non-flame supporting with low-smoke evolution. The mat is flexible which aids in installation and allows it to more easily be applied on complex shapes and around corners.

Endothermic fire protection in a wide variety of structural, electrical and membrane penetration applications.

Product Features

- Provides up to 4 hour fire protection for structural steel applications[1] in accordance with ASTM E 119
- Provides up to 3 hour fire protection for electrical circuit applications[1,2] in accordance with ASTM E 1725
- Provides protection against large hydrocarbon pool fires in accordance with ASTM E 1529 (UL 1709)
- Chemically-bound water helps cool protective item(s) in the event of a fire
- Non-flame supporting
- Low-smoke evolution
- Flexible – can be installed on complex shapes and around corners
- Easy-to-cut for various shapes and sizes
- Non-corrosive
- For use in new or retrofit applications
- Easy-to-clean

[1] *Specific fire-ratings are achieved via single layer or multiple layering of mat per listed system requirements. Per system details, additional layers of mat increase the hourly-rating of the installation.*

[2] *Under normal operating conditions, the mat's ambient conductivity allows heat, such as that generated by power cables, to dissipate rather than be trapped by it.*

2. Applications

3M™ Interam Endothermic Mat E-5A-4 is a flexible and space-saving wrap system that protects against fire spread and smoke contamination in a wide range of new or retrofit applications requiring full envelope protection, including: structural steel, electrical circuity / raceways, cables, cable trays, conduits, equipment shrouds, steam lines and membrane penetrations (e.g. spaces containing electrical panels, elevator call boxes, safe deposit boxes, medical gas boxes). *Consult system details, contact your local 3M sales representative or call 1-800-328-1687 to inquire about application-specific installation guides).*

3. Specifications

Installation shall be in strict accordance with manufacturer's written instructions, as shown on approved shop drawings. 3M™ Interam™ Endothermic Mat E-5A-4 shall be a flexible, endothermic (i.e. heat absorbing) mat with low smoke evolution capable of being layered for 1-, 2-, 3- and 4-hour structural steel applications; 1-, 2- and 3-hour electrical system applications. The product shall be capable of achieving an equal F-Rating and T-Rating when applied to metallic utility boxes which penetrate the membrane of a fire-resistive wall assembly. When properly installed, 3M™ Interam™ Endothermic Mat E-5A-4 helps protect the encapsulated item(s) against heat penetration and flame spread. 3M™ Interam™ Endothermic Mat E-5A-4 shall be listed by independent test agencies such as UL, ULC, Intertek, or FM. Suitability for the intended application should be determined prior to installation.

Typically Specified MasterFormat (2004)

Section 05 12 00 – Structural Steel Framing
Section 07 80 00 – Fire and Smoke Protection
Section 07 81 00 – Applied Fireproofing
Section 07 84 00 – Firestopping
Section 26 01 00 – Operation and Maintenance of Electrical Systems
Section 27 20 00 – Data communications

ASTM (UL, ULC) and NBN/ISO Standard Test Methods:

ASTM E 84 (UL 723)	Surface Burning Characteristics of Building Materials
ASTM E 119 (UL 263)	Fire Tests of Building Construction and Materials
ASTM E 1529 (UL 1709)	Determining Effects of Large Hydrocarbon Pool Fires on Structural Members and Assemblies
ASTM E 1725 (UL 1724)	Fire Tests of Fire-Resistive Barrier Systems for Electrical System Components
ASTM E 814 (UL 1479)	Standard Test Method for Fire Tests of Penetration Firestop Systems
CAN/ULC-S115	Standard Method of Fire Tests of Firestop Systems

4. Performance & Typical Physical Properties

Color:	Silver exterior, white interior
Mat Lamination	3 mil. aluminum/scrim
Mat Thickness	0.408 in. (10.3 mm)
Roll Dimensions	24.5 in. x 20 ft. roll (622 mm x 6.09 m)
Roll Weight	74.6 lbs. (33.8 kg)
Weight/Unit Area	1.83 lbs/ft^2 (8.93 kg/m^2)
Bulk Density	54 lbs/ft^3 (865 kg/m^3)
Mat Area/Roll	40.8 ft^2 (3.79 m^2)

Surface Burning (ASTM E 84): Flame Spread 0.7, Smoke Development 0
Fuel Contribution 0

Thermal Conductivity:

0.087 BTU/ft-hr – °F @ 200°F (0.151 W/m – °C @ 93°C)
0.101 BTU/ft-hr – °F @ 350 °F (0.175 W/m – °C @ 177 C)
0.058 BTU/ft-hr – °F @ 600 °F (0.100 W/m – °C @ 316 C)
0.068 BTU/ft-hr – °F @ 750 °F (0.118 W/m – °C @ 399 C)
0.081 BTU/ft-hr – °F @ 900 °F (0.140 W/m – °C @ 482 C)

Mean Specific Heat: 0.331 BTU/lb – °F @ 75-400°F (1385 J/kg- °C @ 24-200 °C)
0.276 BTU/lb – °F @ 75-1650°F (1155 J/kg- °C @ 24-900 °C)

Loss on Ignition: 28%

Tensile Strength (with aluminum foil): 110 psi (758 KPa)

5. Packaging, Storage, Shelf Life

Packaging 3M™ Interam™ Endothermic Mat E-5A-4 is packaged in a corrugated cardboard box, 1 roll per box.

Storage 3M™ Interam™ Endothermic Mat E-5A-4 is stable under normal storage conditions, store in a dry warehouse environment in original, unopened container. Normal stock and stock rotation practices are recommended.

Shelf Life Product shelf life is indefinite when stored indoors.

6. Installation Techniques

Consult a 3M Authorized Fire Protection Products Distributor / Dealer or Sales Representative for Applicable Listed Third Party (e.g. UL, ULC, Intertek, FM) drawings and system details. Refer to application-specific 3M™ Interam™ Endothermic Mat E-5A-4 Installation Guides for installation information.

Recommended tools/materials For a typical mat installation, the following tools may be of assistance: razor knife, large scissors or electric scissors (to cut mat), T-Square or similar straight edge (to help with straight cuts of mat), tape measure (to measure mat required), marking pen (to identify layers of mat), 3M™ Aluminum Foil Tape 425 (to seal cut edges of mat), rubber roller (to ensure good adhesion of tape), Scotch® Filament Tape 898 (to temporarily hold mat pieces in place - optional), stainless steel bands 1/2 in. wide x .020 in. min thick (12.7 mm x .5 mm) and band clips to help secure mat, band tensioners, 3M™ Fire Barrier Sealant CP 25WB+ (to fill seams).

Installation considerations Determine the appropriate number of layers required for your application. Ensure proper covering and protection of joints, seams, overlaps and any area that requires special cutting and fitting. Ensure proper use of banding to mechanically restrain the mat system. Refer to listed system details for sealant, banding requirements, layer requirements and other installation procedures.

7. Maintenance

No maintenance is expected to be required when installed in accordance with listed system details. Once installed, if any section of the 3M™ Interam™ Endothermic Mat E-5A-4 is damaged, the following procedure will apply: for damage to the outer metallic covering, install 3M™ Aluminum Foil Tape 425 to overlap a min. 2" (50.8 mm) in all directions. For more extensive damage (including damage to the mat material), contact 3M Fire Protection Products at 1-800-328-1687.

8. Availability

3M™ Interam™ Endothermic Mat E-5A-4 is available from 3M Authorized Fire Protection Products Distributors and Dealers. 3M™ Interam™ Endothermic Mat E-5A-4 comes 1/case and is available in a 24.5 in. x 20 ft. roll (622.3 mm x 6.1 m). For additional technical and purchasing information regarding this and other 3M Fire Protection Products, please call: 1-800-328-1687 or visit www.3m.com/firestop.

9. Safe Handling Information

Consult product's Material Safety Data Sheet (MSDS) from country of use prior to handling and disposal.

Important Notice to User:
Technical Information: The technical information, recommendations and other statements contained in this document are based upon tests or experience that 3M believes are reliable, but the accuracy or completeness of such information is not guaranteed.

Product Use: Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application. Given the variety of factors that can affect the use and performance of a 3M product, user is solely responsible for evaluating the 3M product and determining whether it is fit for a particular purpose and suitable for user's method of application.

Warranty and Limited Remedy: 3M warrants that each 3M Fire Protection Product will be free from defects in material and manufacture for 90 days from the date of purchase from 3M's authorized distributor. 3M MAKES NO OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. If a 3M product does not conform to this warranty, the sole and exclusive remedy is, at 3M's option, replacement of the 3M product or refund of the purchase price.

Limitation of Liability: Except where prohibited by law, 3M will not be liable for any loss or damage arising from the 3M product, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted.

Building and Commercial Services Division
3M Center, Building 223-2N-21
St. Paul, MN 55144-1000 USA
1-800-328-1687
www.3M.com/firestop

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Reference Code: 98-0213-4381-3

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3M™ Fire Protection Products
Interam™ E-Mat Solutions Package

Technical Document: MSDS

Material Safety Data Sheet

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SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: 3M™ Interam™ Endothermic Mat E-5A-4, E-54A, E-54C
MANUFACTURER: 3M
DIVISION: Building & Commercial Services Division

ADDRESS: 3M Center, St. Paul, MN 55144-1000

EMERGENCY PHONE: 1-800-364-3577 or (651) 737-6501 (24 hours)

Issue Date: 07/23/13
Supercedes Date: 07/23/13

Document Group: 30-7532-2

Product Use:
Intended Use: Fire Barrier Mat

SECTION 2: INGREDIENTS

Ingredient	C.A.S. No.	% by Wt
Alumina Trihydrate	21645-51-2	60 - 90
Refractory Ceramic Fibers (RCF)	142844-00-6	10 - 30
Polymer	Trade Secret	3 - 7
Stainless Steel (Type 304)	None	< 5
Water	7732-18-5	1 - 5
Aluminum foil	7429-90-5	< 5

SECTION 3: HAZARDS IDENTIFICATION

3.1 EMERGENCY OVERVIEW

Specific Physical Form: Roll of material
Odor, Color, Grade: White mat with or without metal foil on one side, no odor
General Physical Form: Solid
Immediate health, physical, and environmental hazards: The environmental properties of this product present a low environmental hazard. Contains a chemical or chemicals which can cause cancer.

3.2 POTENTIAL HEALTH EFFECTS

Eye Contact:
Mechanical eye irritation: Signs/symptoms may include pain, redness, tearing and corneal abrasion.

Dust created by cutting, grinding, sanding, or machining may cause eye irritation. Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision.

Skin Contact:
Mechanical Skin irritation: Signs/symptoms may include abrasion, redness, pain, and itching.

Inhalation:
Dust from cutting, grinding, sanding or machining may cause irritation of the respiratory system. Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain.

Dust from cutting, grinding, sanding or machining may cause target organ effects.

Prolonged or repeated exposure may cause:
Fibrosis: Signs/symptoms may include breathlessness, chronic dry cough, phlegm production, wheezing, and changes in lung function tests.

Ingestion:
Physical Blockage: Signs/symptoms may include cramping, abdominal pain, and constipation.

Carcinogenicity:
Contains a chemical or chemicals which can cause cancer.

Ingredient	C.A.S. No.	Class Description	Regulation
CERAMIC FIBERS	SEQ754	Grp. 2B: Possible human carc.	International Agency for Research on Cancer
CERAMIC FIBERS	SEQ754	Anticipated human carcinogen	National Toxicology Program Carcinogens
Refractory Ceramic Fibers (RCF)	142844-00-6	Grp. 2B: Possible human carc.	International Agency for Research on Cancer

SECTION 4: FIRST AID MEASURES

4.1 FIRST AID PROCEDURES

The following first aid recommendations are based on an assumption that appropriate personal and industrial hygiene practices are followed.

Eye Contact: Flush eyes with large amounts of water. If signs/symptoms persist, get medical attention.
Skin Contact: Wash affected area with soap and water. If signs/symptoms develop, get medical attention.
Inhalation: If signs/symptoms develop, remove person to fresh air. If signs/symptoms persist, get medical attention.
If Swallowed: Do not induce vomiting unless instructed to do so by medical personnel. Give victim two glasses of water. Never give anything by mouth to an unconscious person. Get medical attention.

SECTION 5: FIRE FIGHTING MEASURES

5.1 FLAMMABLE PROPERTIES

Autoignition temperature	*No Data Available*
Flash Point	No flash point
Flammable Limits(LEL)	*Not Applicable*
Flammable Limits(UEL)	*Not Applicable*

5.2 EXTINGUISHING MEDIA
Non-combustible. Choose material suitable for surrounding fire.

5.3 PROTECTION OF FIRE FIGHTERS

Special Fire Fighting Procedures: Wear full protective equipment (Bunker Gear) and a self-contained breathing apparatus (SCBA).

Unusual Fire and Explosion Hazards: No unusual fire or explosion hazards are anticipated.

Note: See STABILITY AND REACTIVITY (SECTION 10) for hazardous combustion and thermal decomposition information.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions, protective equipment and emergency procedures
Not applicable.

6.2. Environmental precautions
Place in a metal container approved for transportation by appropriate authorities. Dispose of collected material as soon as possible.

Clean-up methods
Refer to other sections of this MSDS for information regarding physical and health hazards, respiratory protection, ventilation, and personal protective equipment. Collect as much of the spilled material as possible. Use wet sweeping compound or water to avoid dusting. Sweep up. Clean up residue.

In the event of a release of this material, the user should determine if the release qualifies as reportable according to local, state, and federal regulations.

SECTION 7: HANDLING AND STORAGE

7.1 HANDLING
For industrial or professional use only. Avoid breathing of dust created by cutting, sanding, grinding or machining. Avoid eye contact with dust or airborne particles. Do not eat, drink or smoke when using this product. Wash exposed areas thoroughly with soap and water. Use general dilution ventilation and/or local exhaust ventilation to control airborne exposures to below Occupational Exposure Limits. If ventilation is not adequate, use respiratory protection equipment.

7.2 STORAGE
Store under normal warehouse conditions.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 ENGINEERING CONTROLS
Provide ventilation adequate to control dust concentrations below recommended exposure limits and/or control dust. Use general dilution ventilation and/or local exhaust ventilation to control airborne exposures to below Occupational Exposure Limits and/or control dust, fume, or airborne particles. If ventilation is not adequate, use respiratory protection equipment.

8.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)

8.2.1 Eye/Face Protection
Avoid eye contact.
The following eye protection(s) are recommended: Safety Glasses with side shields
.

8.2.2 Skin Protection
During cutting:
Avoid skin contact.

Select and use gloves and/or protective clothing to prevent skin contact based on the results of an exposure assessment. Consult with your glove and/or protective clothing manufacturer for selection of appropriate compatible materials.
Gloves made from the following material(s) are recommended: Neoprene
Nitrile Rubber
. The following protective clothing material(s) are recommended: Coveralls - Disposable
.

8.2.3 Respiratory Protection
Avoid breathing of dust created by cutting, sanding, grinding or machining.
An exposure assessment may be needed to decide if a respirator is required. If a respirator is needed, use respirators as part of a full respiratory protection program. Based on the results of the exposure assessment, select from the following respirator type(s) to reduce inhalation exposure:
Half facepiece or full facepiece air-purifying respirator suitable for particulates

For questions about suitability for a specific application, consult with your respirator manufacturer.

8.2.4 Prevention of Swallowing
Do not eat, drink or smoke when using this product. Wash exposed areas thoroughly with soap and water.

8.3 EXPOSURE GUIDELINES

Ingredient	Authority	Type	Limit	Additional Information
Aluminum foil	ACGIH	TWA, respirable fraction	1 mg/m3	
Aluminum foil	OSHA	TWA, as Al respirable dust	5 mg/m3	
Aluminum foil	OSHA	TWA, as Al total dust	15 mg/m3	
CERAMIC FIBERS	ACGIH	TWA, as fiber	0.2 fiber/cc	

SOURCE OF EXPOSURE LIMIT DATA:
ACGIH: American Conference of Governmental Industrial Hygienists
CMRG: Chemical Manufacturer Recommended Guideline
OSHA: Occupational Safety and Health Administration
AIHA: American Industrial Hygiene Association Workplace Environmental Exposure Level (WEEL)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Specific Physical Form:	Roll of material
Odor, Color, Grade:	White mat with or without metal foil on one side, no odor
General Physical Form:	Solid
Autoignition temperature	*No Data Available*
Flash Point	No flash point
Flammable Limits(LEL)	*Not Applicable*

Flammable Limits(UEL)	*Not Applicable*
Boiling Point	*Not Applicable*
Density	0.866 g/cm3
Specific Gravity	*No Data Available*
Melting point	*No Data Available*
Solubility in Water	Nil
VOC Less H2O & Exempt Solvents	< 10 g/l

SECTION 10: STABILITY AND REACTIVITY

Stability: Stable.

Materials and Conditions to Avoid:
10.1 Conditions to avoid
None known

10.2 Materials to avoid
None known

Hazardous Polymerization: Hazardous polymerization will not occur.

Hazardous Decomposition or By-Products

Substance	Condition
Carbon monoxide	During Combustion
Carbon dioxide	During Combustion

SECTION 11: TOXICOLOGICAL INFORMATION

Please contact the address listed on the first page of the MSDS for Toxicological Information on this material and/or its components.

SECTION 12: ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL INFORMATION

Not determined.

CHEMICAL FATE INFORMATION

Not determined.

SECTION 13: DISPOSAL CONSIDERATIONS

Waste Disposal Method: Dispose of waste product in a permitted hazardous waste facility.

EPA Hazardous Waste Number (RCRA): D007 (Chromium)

Since regulations vary, consult applicable regulations or authorities before disposal.

SECTION 14:TRANSPORT INFORMATION

ID Number(s):
98-0042-9365-4, 98-0400-5620-6, 98-0400-5621-4, 98-0400-5622-2, 98-0400-5623-0, 98-0400-5649-5

For Transport Information, please visit http://3M.com/Transportinfo or call 1-800-364-3577 or 651-737-6501.

SECTION 15: REGULATORY INFORMATION

US FEDERAL REGULATIONS
Contact 3M for more information.

311/312 Hazard Categories:
Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No Immediate Hazard - Yes Delayed Hazard - Yes

Section 313 Toxic Chemicals subject to the reporting requirements of that section and 40 CFR part 372 (EPCRA):

Ingredient	C.A.S No	% by Wt
Aluminum foil	7429-90-5	< 5

STATE REGULATIONS
Contact 3M for more information.

CALIFORNIA PROPOSITION 65

Ingredient	C.A.S. No.	Classification
CERAMIC FIBERS	None	**Carcinogen

** WARNING: contains a chemical which can cause cancer.

CHEMICAL INVENTORIES
This product is an article as defined by TSCA regulations, and is exempt from TSCA Inventory listing requirements.

Contact 3M for more information.

INTERNATIONAL REGULATIONS
Contact 3M for more information.

This MSDS has been prepared to meet the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200.

SECTION 16: OTHER INFORMATION

NFPA Hazard Classification
Health: 1 **Flammability:** 0 **Reactivity:** 0 **Special Hazards:** None

National Fire Protection Association (NFPA) hazard ratings are designed for use by emergency response personnel to address the hazards that are presented by short-term, acute exposure to a material under conditions of fire, spill, or similar emergencies. Hazard ratings are primarily based on the inherent physical and toxic properties of the material but also include the toxic properties of combustion or decomposition products that are known to be generated in significant quantities.

HMIS Hazard Classification

Health: 1 **Flammability:** 0 **Reactivity:** 0 **Protection:** X - See PPE section.

Hazardous Material Identification System (HMIS®) hazard ratings are designed to inform employees of chemical hazards in the workplace. These ratings are based on the inherent properties of the material under expected conditions of normal use and are not intended for use in emergency situations. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint and Coatings Association (NPCA).

Reason for Reissue: Change from article to chemical MSDS

Revision Changes:
Section 7: Handling information was modified.
Section 7: Storage information was modified.
Section 2: Ingredient table was modified.
Section 3: Other potential health effects heading was deleted.
Section 3: Potential effects from eye contact was modified.
Section 3: Potential effects from inhalation information was modified.
Section 3: Potential effects from ingestion information was modified.
Section 7: Handling information was modified.
Section 10: Hazardous decomposition or by-products table was modified.
Section 4: First aid for inhalation - termination of exposure - was modified.
Section 4: First aid for inhalation - medical assistance - was modified.
Section 3: Immediate other hazard(s) was modified.
Section 3: Other health effects information was deleted.
Section 1: Initial issue message was modified.
Section 2: Ingredient table was modified.
Section 6: Environmental procedures information was modified.
Section 6: Methods for cleaning up information was modified.

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3M™ Fire Protection Products
Interam™ E-Mat Solutions Package

Technical Document: Ampacity

3M™ Fire Protection Products
Interam™ E-Mat Solutions Package

3M™ Interam™ E-5A-4 Endothermic Mat

Technical Training – Ampacity Derating

Mark Lund, PE, M.Sc
Technical Service Engineering Specialist

3M Fire Protection Products
May 3, 2013

Ampacity Derating, Defined

The term ampacity was coined in 1951 and refers to the amperage capacity of electrical conductors. Ampacity is defined as the maximum allowable current, in amperes, that an electrical conductor or cable can carry, in a given configuration, before the conductor temperature exceeds the maximum rated continuous temperature of the conductor or cable.

REFERENCE:
3M Ampacity Report
January, 1987
Interam™ Fire Protection Materials
Richard R. Licht

Test Standard IEEE 848-1996

Title: *Standard Procedure for the Determination of the Ampacity Derating of Fire-Protected Cables*

- This test standardizes the conditions:
  - 1” Conduit, (1) 4/C No. 10 AWG cable. (Approximately 40% fill)
  - 4” Conduit, (12) 3/C No. 6 AWG cables. (Approximately 40% fill)
  - 4” x 24” Tray, (96) 3C No. 6 AWG cables. (Approximately 60% fill)
- Voltage is adjusted to equilibrate the cables at 90°C, establishing a current (amperes) baseline.
- Then fireproofing material is applied and the process repeated.
- The room is held constant at 40°C

Test Standard IEEE 848-1996

When applicable, the following equation is used to normalize the results:

$$I' = I\sqrt{\frac{(T_{c'} - T_{a'})(\alpha + T_c)}{(T_c - T_a)(\alpha + T_{c'})}}$$

where

I	is test current at equilibrium, amperes
T_c	is hottest conductor temperature at center at equilibrium, °C
T_a	is measured enclosure ambient temperature, °C
I'	is normalized current, amperes
$T_{c'}$	is normalized conductor temperature= 90 °C
$T_{a'}$	is normalized ambient temperature= 40 °C
α	is 234.5 for copper or 228.1 for aluminum

Test Standard IEEE 848-1996

The ampacity derating factor (ADF) is established:

$$\text{ADF} = \frac{(I_o - I_f)}{I_o} 100$$

As is the ampacity correction factor (ACF):

$$\text{ACF} = \frac{I_f}{I_o}$$

where

I_o is the normalized current for the baseline condition, amperes

I_f is the normalized current for the passive fire-protected cable system or cable penetration fire stop system, amperes

The 3M data is presented in Appendix D of the document.

Nuclear Regulatory Commission, NUREG-1924

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Electric Raceway Fire Barrier Systems in U.S. Nuclear Power Plants

Final Report

Resolution and Staff Conclusion – 3M Interam E-50 Series Mat

"Unlike other barrier systems, the manufacturer (3M) and later distributor performed numerous fire endurance, seismic, LOCA, and ampacity derating testing of which adequately bound the configurations used in NPPs."

The 3M data is presented in Appendix D of the document.

Nuclear Regulatory Commission

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-1924

In the same report the NRC made the following statement about ceramic fiber:

5.6.2 Problems

As presented in the testing section that followings, the pure insulation properties of the ceramic fiber was not capable of reducing the heat transfer from the extreme heat of the test furnace (ASTM E-119 curve) to the protected cable raceways. In fact, there were only two test specimens (see Virgil C Summer Nuclear Station testing) which provide the rated 1-hour protection as specified in Supplement 1. All other testing of Kaowool and FP-60 ERFBS failed the Supplement 1 criteria or the test report was not sufficient in detail to determine if the test specimen would pass the GL 86-10 Supplement 1 guidance.

Ampacity - Test Results (IEEE P848), Ampacity Derating Factor

The 3, 5 &6 layers tested were selected because they correspond with the 1 and 3 hour cellulosic fire (ASTM E 119) protection configurations required by the Nuclear Regulatory Commission.

Ampacity derating estimates for the E-mat layering typical to industrial and O&G applications (high-intensity fire, 15 -30 minute rating) can be interpolated.

Similarly, for 2 hour systems for commercial applications, such as UL FHIT.34, the values can also be interpolated from the adjacent data points.

ADF	Layers of 3M Interam E-5A-4 Endothermic Mat				
Item	**2**	**3**	**4**	**5**	**6**
1" Conduit	-	7.86%	-	20.29%	-
4" Conduit	-	8.96%	-	34.92%	-
4" x 24" Tray	46.21%	49.88%	-	-	56.62%

- Passive fire protection materials placed on or near an energized electrical conductor interfere with heat dissipation to some degree. As such, ampacity derating should be considered so the conductor does not exceed its maximum rated continuous temperature (a lower ampacity derating means more heat is dissipated).
- Due to the complexity of this subject, it is important to note that these values should be used for general estimates only.
- There are many factors (too numerous to list here), which affect the % Ampacity Derating, including: conductor size ambient temperature, cable grouping geometry, cable jacket thermal conductivity, emissivity and air flow.

REFERENCES:
OPL 14540-99074 & 99075
OPL 8610-102164 & 102165
OPL 8610-102166
OPL 14540-100770
UL 86NK30773

Comparison to Ceramic Fiber

Little information is available about ceramic fiber's ADF, but NRC Information Notice 93-40* provides some. A comparison:

ADF	Fireproofing Material, 1 Hour ASTM E 119 Exposure	
Item	3M Interam E-5A-4	Ceramic Fiber
4" Conduit	8.96%	41.40%
4" x 24" Tray	49.88%	62.40%

REFERENCES:

OPL 14540-99074 & 99075

OPL 14540-100770

*Nuclear Regulatory Commission Information Notice 93-40

http://www.nrc.gov/reading-rm/doc-collections/gen-comm/info-notices/1993/in93040.html

3M™ Fire Protection Products
Interam™ E-Mat Solutions Package

Technical Document: Estimating Tool

Estimating Tool

3M Fire Protection Products

Estimation Tool

Interam™ E-5A-4 Endothermic Mat "E-Mat" (24.5" Wide x 20' Long)

Circular Items (Pipes, Conduits, Circular Columns)

English Units

Denotes an Input Value

Reference the applicable third-party (e.g. UL, Intertek) design listings to determine the E-Mat layering requirements for a particular fire-resistance rating.

Item Actual Outside Diameter	**4.500**	in.	114.3	mm
Item Actual Circumference	14.14	in.	359.1	mm
Circumferential Overlap	2	in.	50.8	mm
Overage for Waste	**10**	% (Typically 5-15%)		
Length of Run	**100**	ft.	30.5	m
Cost	**0**	$/Roll		

Visit www.mmm.com/firestop for ***Where To Buy*** and ***Sales Rep Locator*** tools.

Bands / Mat Width 3

Bands / ft. 1.5

Banding Tail (extra length), in. 10

Sealant (10.1 oz Tubes)/E-mat Roll 2 — One tube for every 1 to 2 rolls of E-mat.

425 Aluminum Tape / E-mat Roll 0.33 — 0.2 to 0.33 tape rolls per roll of E-mat

898 Filament Tape / E-Mat Roll 0.33 — 0.2 to 0.33 tape rolls per roll of E-mat

Layer(s)	E-Mat Length Around, per layer (in.)	E-Mat Length Around, cumulative (in.)	E-Mat Length Around, cumulative (ft.)	Weight/Length, cumulative (lbs/ft.)	Run Length (ft.)	Required Area (ft^2)	# of Rolls, theoretical	# of Rolls, incl./ Waste	Cost
1	18.8	18.8	1.57	2.87	100	157.0	3.84	**4.23**	$0.00
2	21.9	40.8	3.40	6.21	100	339.8	8.32	**9.15**	$0.00
3	25.0	65.8	5.48	10.02	100	548.4	13.43	**14.77**	$0.00
4	28.1	93.9	7.83	14.30	100	782.9	19.17	**21.09**	$0.00
5	31.2	125.2	10.43	19.06	100	1043.2	25.55	**28.10**	$0.00
6	34.3	159.5	13.29	24.29	100	1329.4	32.56	**35.81**	$0.00
7	37.4	197.0	16.41	29.99	100	1641.3	40.20	**44.22**	$0.00

Banding (ft)	Banding Closures	Sealant (10.1 oz tubes)	Aluminum Tape (rolls)	Filament Tape (rolls)
353	147	9	2	2
391	147	19	4	4
429	147	30	5	5
467	147	43	7	7
505	147	57	10	10
543	147	72	12	12
581	147	89	15	15

Conduit O.D., Nominal vs. Actual	
Nominal Size, in.	**Actual O.D.,**
0.5	**0.706**
0.75	**0.922**
1	**1.163**
1.25	**1.510**
1.5	**1.740**
2	**2.197**
2.5	**2.875**
3	**3.500**
3.5	**4.000**
4	**4.500**
5	**5.560**
6	**6.625**
8	**8.625**

NOTE: Click the green tab below for Square & Rectangular Items, English Units

3M Interam E-5A-4 Roll Dimensions				
Width	24.5	in.	62.2	cm
Length	20	ft.	609.6	cm
Area	40.83	ft^2	3.8	m^2
Thickness	0.4	in.	10.2	mm
Weight	74.6	lb	33.84	kg
Basis Weight	1.83	lb/ft^2	8.92	kg/m^2

Ordering Information, Including Related Products	
3M™ Interam™ Endothermic Mat E-5A-4, 24.5 in x 20 ft, Roll, 1/case	
3M ID	98-0400-5620-6
GTIN(UPC/EAN)	0 00 51115 54913 7
3M™ Aluminum Foil Tape 425, 4 in x 60 yd 4.6 mil, 2 rolls per case Bulk	
3M ID	70-0063-8533-3
GTIN(UPC/EAN)	0 00 51138 95074 3
3M™ Fire Barrier Sealant CP 25WB+, 10.1 fl. oz., Cartridge, 12/case	
3M ID	98-0400-5456-5
GTIN(UPC/EAN)	0 00 51115 11638 4
3M™ Fire Barrier Water Tight Sealant 3000 WT, 10.1 fl. oz., Cartridge, 12/case	
3M ID	98-0400-5503-4
GTIN(UPC/EAN)	0 00 51115 16593 1
Scotch® Filament Tape 898, 18 mm x 55 m, 12/box 4 boxes/case Boxed	
3M ID	70-0062-4863-0
GTIN(UPC/EAN)	0 00 51131 06894 0

Note: This estimator tool provides only one data point in estimating required product levels -- users must use technical expertise and good judgment, informed by past experience, to make any purchasing or installation decisions. Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and accuracy of this estimation tool. It is thus recommended to build a mock-up to verify calculations, especially when bidding large magnitude projects. Given the variety of data points required in making purchasing and installation decisions, user expressly assumes all risk and holds 3M harmless from using this estimator tool. Calculations derived from this estimation tool are not guaranteed accurate and user assumes all risk associated with use of this tool.

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M.Lund, 3-0973

Conduit Diameter Source:
UL 797, 9th Ed.

3M Building and Commercial Service Division
3M Center
Building 223-2N-21
St. Paul, MN 55144-1000
1-800-328-1687
www.3M.com/firestop

For a copy of this estimating tool contact your 3M Fire Protection Representative or call 1-800-328-1687

3M Fire Protection Products

Estimation Tool

Interam™ E-5A-4 Endothermic Mat "E-Mat" (24.5" Wide x 20' Long)

Square & Rectangular Items (Cable Trays, Rectangular Columns, Wide Flange Columns)

English Units

Denotes an Input Value

Reference the applicable third-party (e.g. UL, Intertek) design listings to determine the E-Mat layering requirements for a particular fire-resistance rating.

Item, Dimension 1	**10**	in.	25.4	cm
Item, Dimension 2	**10**	in.	25.4	cm
Item Perimeter	40.0	in.	101.6	cm
Circumferential Overlap	2	in.	50.8	mm
Overage for Waste	**10**	% (Typically 5-15%)		
Length of Run	**100**	ft.	30.5	m
Cost	**0**	$/Roll		

Visit www.mmm.com/firestop for ***Where To Buy*** and ***Sales Rep Locator*** tools.

Bands / Mat Width 3

Bands / ft. 1.5

Banding Tail (extra length), in. 10

Sealant (10.1 oz Tubes)/E-mat Roll	2	One tube for every 1 to 2 rolls of E-mat.
425 Aluminum Tape / E-mat Roll	0.33	0.2 to 0.33 tape rolls per roll of E-mat
898 Filament Tape / E-Mat Roll	0.33	0.2 to 0.33 tape rolls per roll of E-mat

Layer(s)	E-Mat Length Around, per layer (in.)	E-Mat Length Around, cumulative (in.)	E-Mat Length Around, cumulative (ft.)	Weight/Length, cumulative (lbs/ft.)	Run Length (ft.)	Required Area (ft^2)	# of Rolls, theoretical	# of Rolls, incl./ Waste	Cost
1	44.7	44.7	3.73	6.81	100	372.5	9.12	**10.03**	$0.00
2	47.8	92.5	7.71	14.08	100	770.8	18.88	**20.77**	$0.00
3	50.9	143.4	11.95	21.83	100	1195.0	29.27	**32.19**	$0.00
4	54.0	197.4	16.45	30.05	100	1645.0	40.29	**44.31**	$0.00
5	57.1	254.5	21.21	38.75	100	2120.8	51.94	**57.13**	$0.00
6	60.2	314.7	26.23	47.91	100	2622.5	64.22	**70.65**	$0.00
7	63.3	378.0	31.50	57.55	100	3150.0	77.14	**84.86**	$0.00

Banding (ft)	Banding Closures	Sealant (10.1 oz tubes)	Aluminum Tape (rolls)	Filament Tape (rolls)
670	147	21	4	4
708	147	42	7	7
746	147	65	11	11
784	147	89	15	15
822	147	115	19	19
860	147	142	24	24
898	147	170	29	29

3M Interam E-5A-4 Roll Dimensions

Width	24.5	in.	62.2	cm
Length	20	ft.	609.6	cm
Area	40.83	ft^2	3.8	m^2
Thickness	0.4	in.	10.2	mm
Weight	74.6	lb	33.84	kg
Basis Weight	1.83	lb/ft^2	8.92	kg/m^2

Ordering Information, Including Related Products

3M™ Interam™ Endothermic Mat E-5A-4, 24.5 in x 20 ft, Roll, 1/case	
3M ID	98-0400-5620-6
GTIN(UPC/EAN)	0 00 51115 54913 7
3M™ Aluminum Foil Tape 425, 4 in x 60 yd 4.6 mil, 2 rolls per case Bulk	
3M ID	70-0063-8533-3
GTIN(UPC/EAN)	0 00 51138 95074 3
3M™ Fire Barrier Sealant CP 25WB+, 10.1 fl. oz., Cartridge, 12/case	
3M ID	98-0400-5456-5
GTIN(UPC/EAN)	0 00 51115 11638 4
3M™ Fire Barrier Water Tight Sealant 3000 WT, 10.1 fl. oz., Cartridge, 12/case	
3M ID	98-0400-5503-4
GTIN(UPC/EAN)	0 00 51115 16593 1
Scotch® Filament Tape 898, 18 mm x 55 m, 12/box 4 boxes/case Boxed	
3M ID	70-0062-4863-0
GTIN(UPC/EAN)	0 00 51131 06894 0

NOTE: Click the purple tab below for Circular Items, English Units

Note: This estimator tool provides only one data point in estimating required product levels -- users must use technical expertise and good judgment, informed by past experience, to make any purchasing or installation decisions. Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and accuracy of this estimation tool. It is thus recommended to build a mock-up to verify calculations, especially when bidding large magnitude projects. Given the variety of data points required in making purchasing and installation decisions, user expressly assumes all risk and holds 3M harmless from using this estimator tool. Calculations derived from this estimation tool are not guaranteed accurate and user assumes all risk associated with use of this tool.

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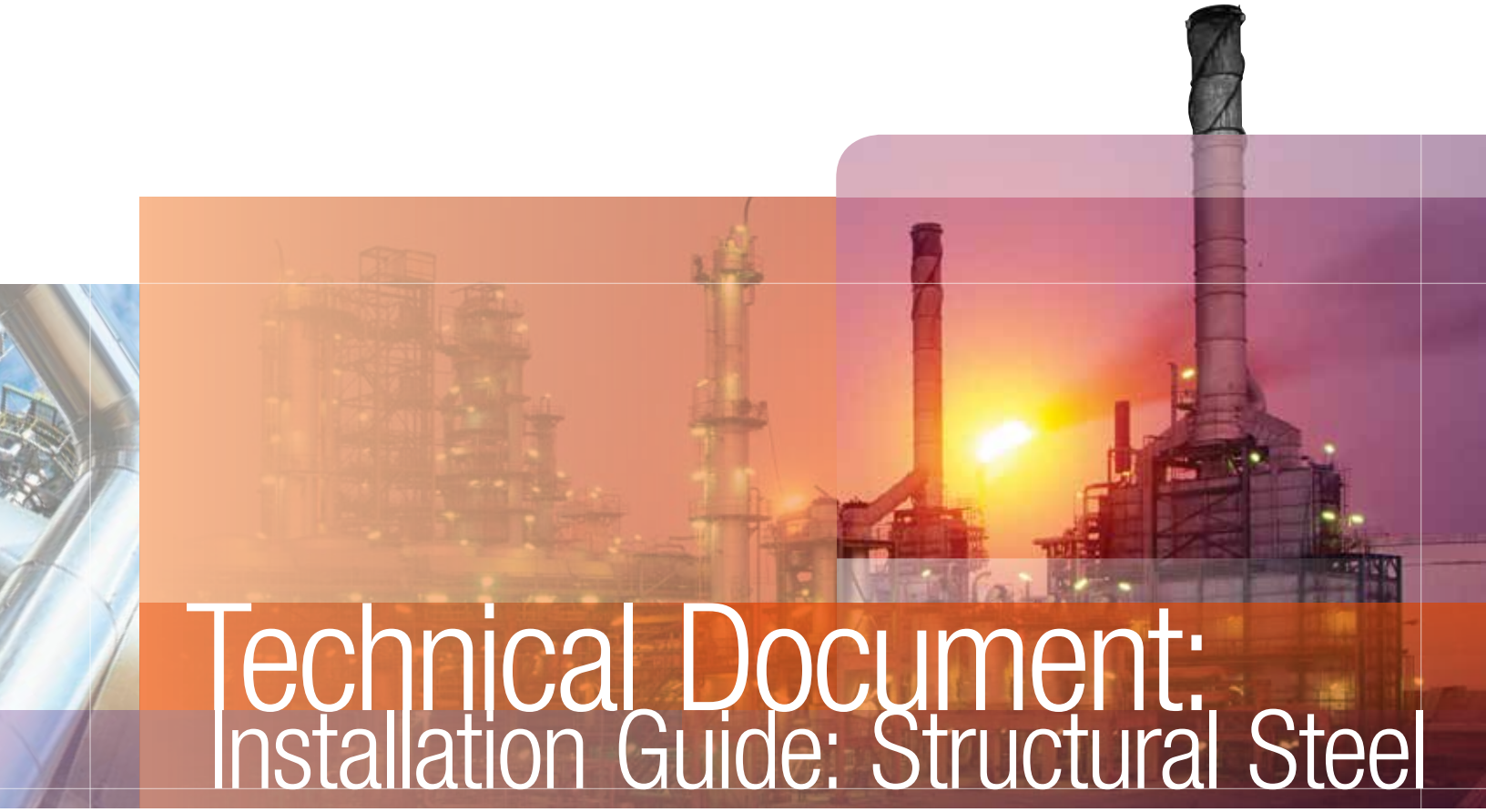
3M™ Fire Protection Products
Interam™ E-Mat Solutions Package



Technical Document:
Installation Guide: Structural Steel

Wrapping Procedure for Straight Beam Configuration

1 - Measure beam perimeter with measuring tape to determine length of first cut (Figure 1). Add extra length to the boxed length in order to accommodate for overlap and corner bending (Figure 2).

Figure 1

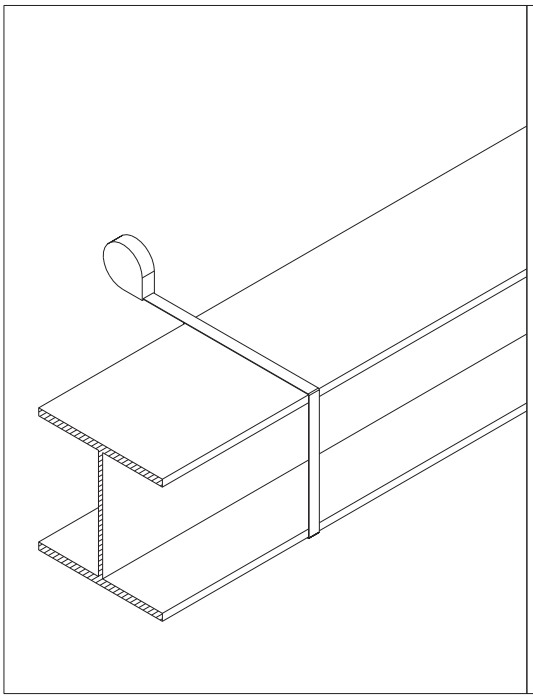
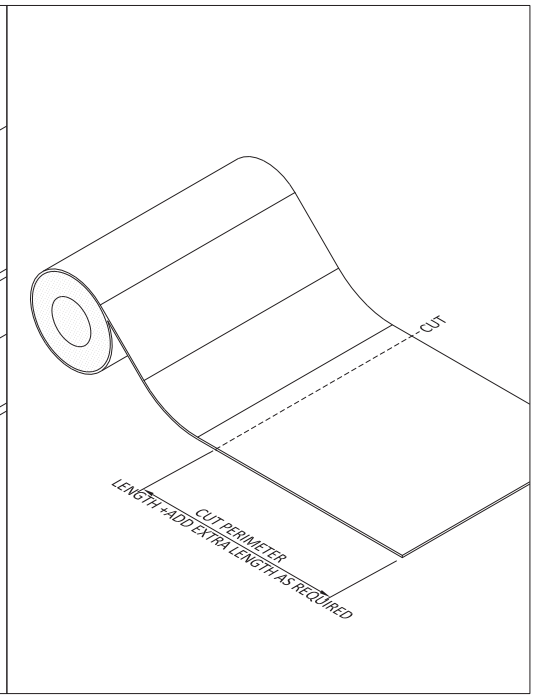


Figure 2



2 - Cut Endothermic Mat 5A-4 (EMat) to length using bladed edge. Align EMat to the steel with foil side facing outward (white side should be in contact with steel). Edge of EMat can be held in place by filament tape or by other worker. Wrap EMat around the steel then overlap itself by a minimum of 2 inches (50 mm) (Figure 3). Additional overlap is acceptable but not required. EMat should be tight to the steel, free of slack.

Note:
Filament tape is for temporary hold only and therefore the amount of tape and spacing to be used is at the installer's discretion. Suggested amount is a minimum of 4 strips of tape per section of EM at to ensure movement does not occur.

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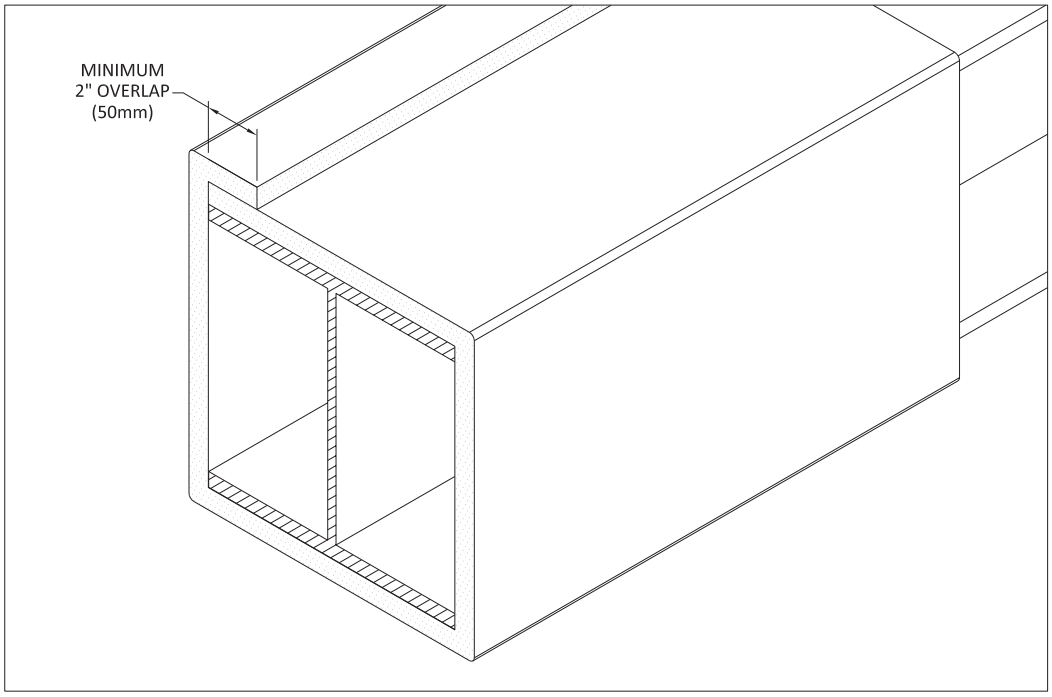
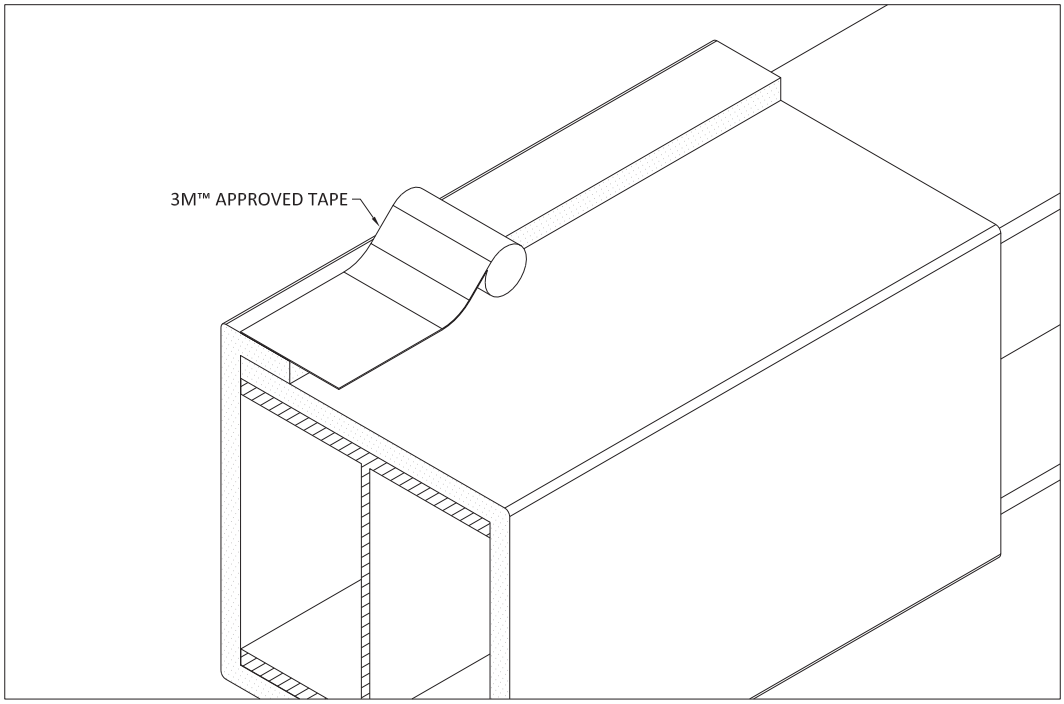
Figure 3



3 - Tape the overlap seam (longitudinal overlap) with approved 3M tape. Center of the tape to be approximately centered over the seam. Smooth the tape with a hard roller or straight edge applying enough pressure to ensure adequate adhesion of the tape to the EMat and to remove any air gaps (Figure 4).

Note:
Please refer to the "appropriate 3M listing" for specific 3M tape required in Appendix 1 of this guide.

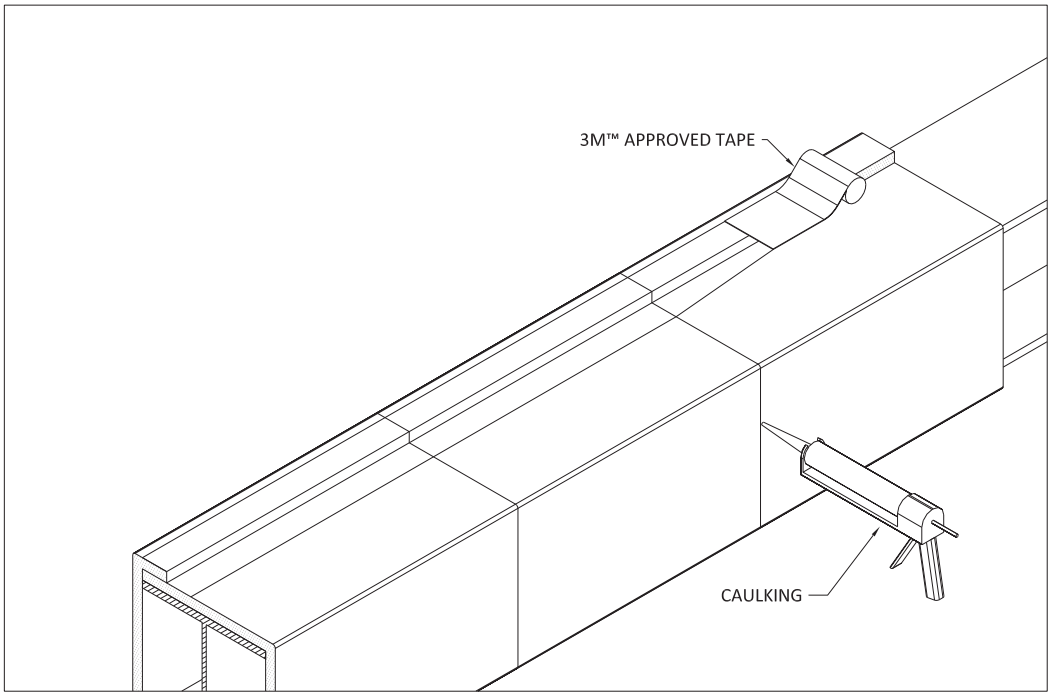
Figure 4



4 - For the next section of wrap, repeat steps 1 through 3. The next section of Emat should be tightly abutted to the first section eliminating all gaps when possible. If a gap of more than 1/8 inch (3 mm) remains in the perimeter joint between sections of EMat, the gap is to be filled to the full depth of the Emat with an approved 3M sealant (Figure 5).

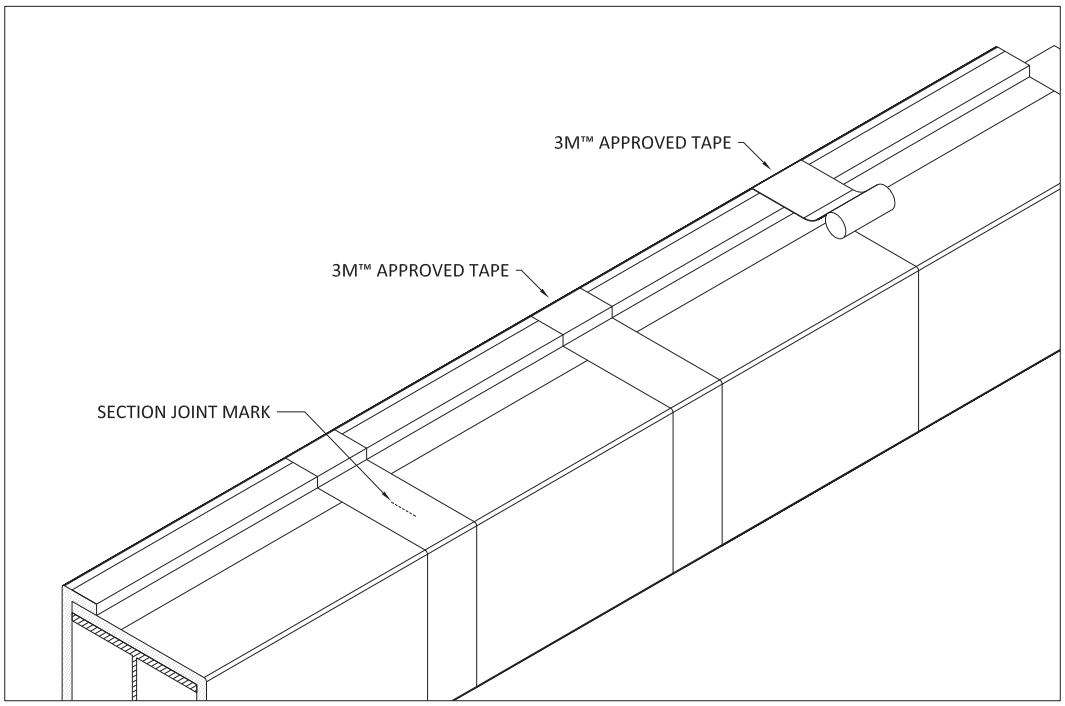
Note:
Please refer to the "appropriate 3M listing" for correct approved sealants.

Figure 5



5 - The butt seam where the two pieces meet (perimeter joint) is to be covered with 3M approved tape. Tape and then mark the location of the joints on the tape using a soft tipped marker to establish a reference point. Smooth the tape with a hard roller or straight edge applying enough pressure to ensure adequate adhesion of the tape to the EMat and to remove any air gaps (Figure 6).

Figure 6



6 - If additional layers are required, measure the perimeter of the first layer and add additional length to accommodate for overlap and corner bending. Stagger the perimeter joints of the second layer by minimum of 2 inches (50 mm) away from the perimeter joints in the first layer. The reference points are used to ensure the 2 inch stagger distance. Repeat steps 1 through 5 (Figure 7)

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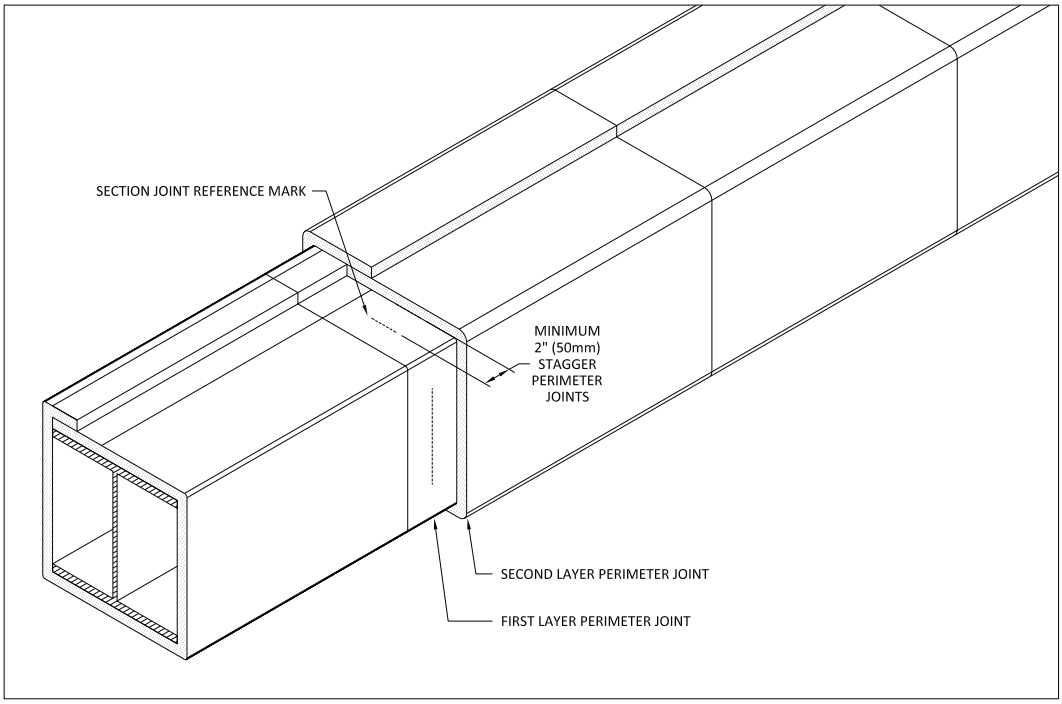
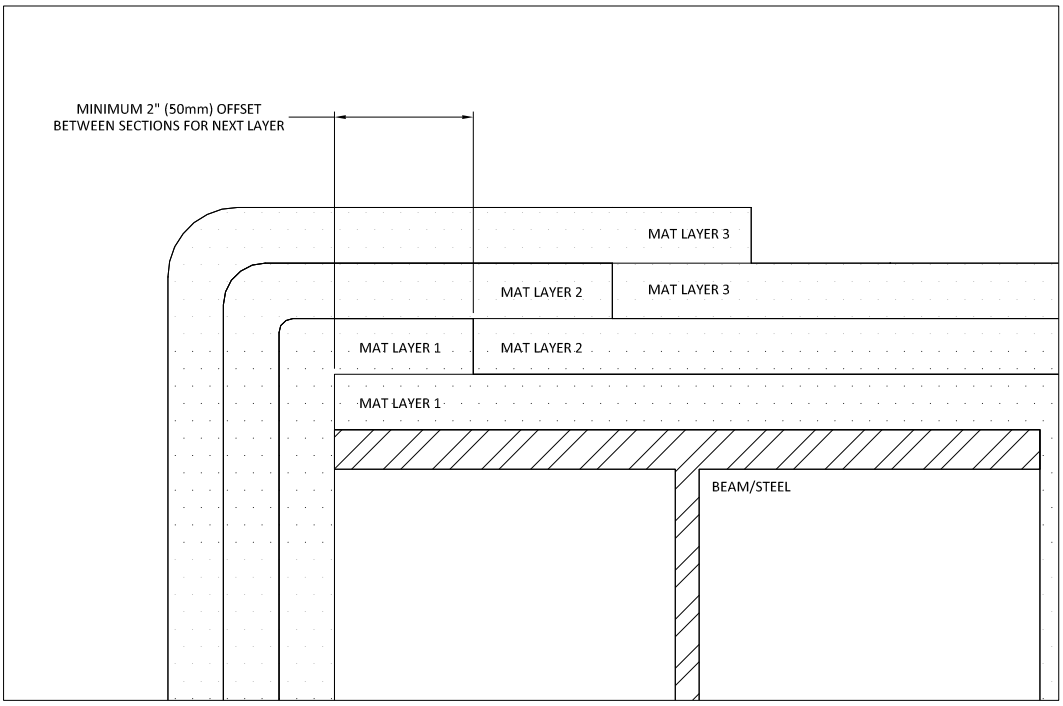
Figure 7



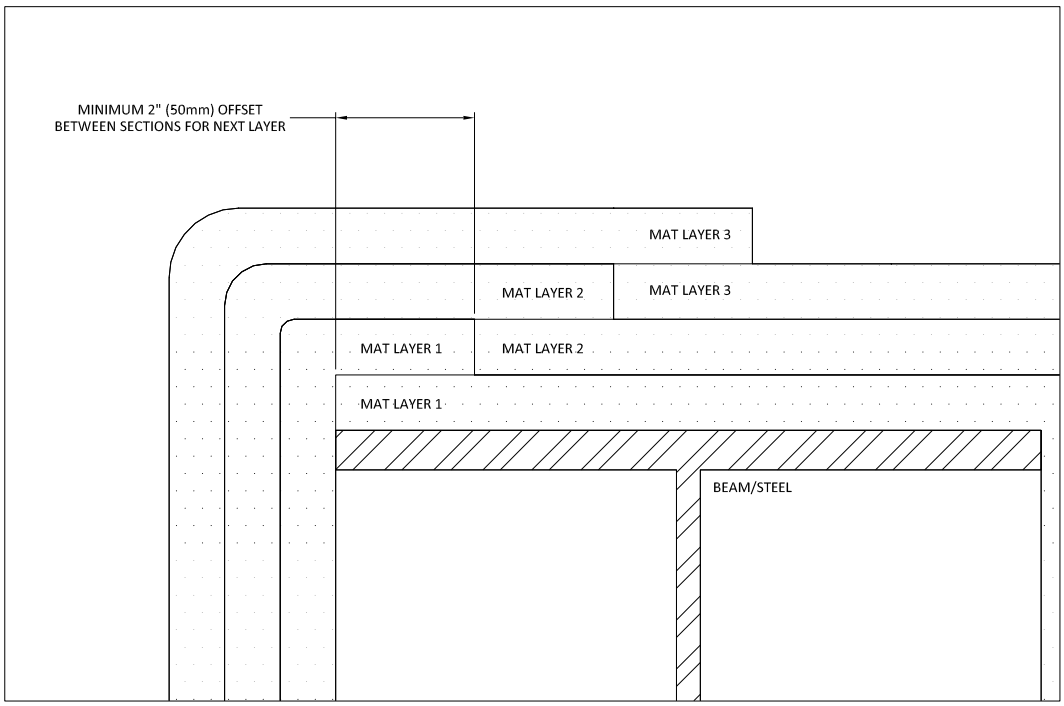
7 - Stagger all subsequent perimeter joints 2 inches from the previous layers' joint. Subsequent layers should be positioned down the longitudinal run so that no two joints align. Repeat steps 1 through 7 for all subsequent layers as per listing/design (Figure 8)

Figure 8



8 - Once the final layer of EMat is in place, secure with ½ inch (13mm) wide, 0.020 inch (0.508mm) thick stainless steel banding to be applied over the outside of the wrap. Position banding within 2 inch (50mm) from the edge of a wrap section and spaced maximum 10.5 inch (267 mm) on center. Specific designs may warrant that cladding is to be applied over the EMat and secured with banding in place although it is not mandatory to conform to BYBU.XR202. Check with site Operations and/or Engineering group to determine if cladding is required and to what extent.

Figure 9



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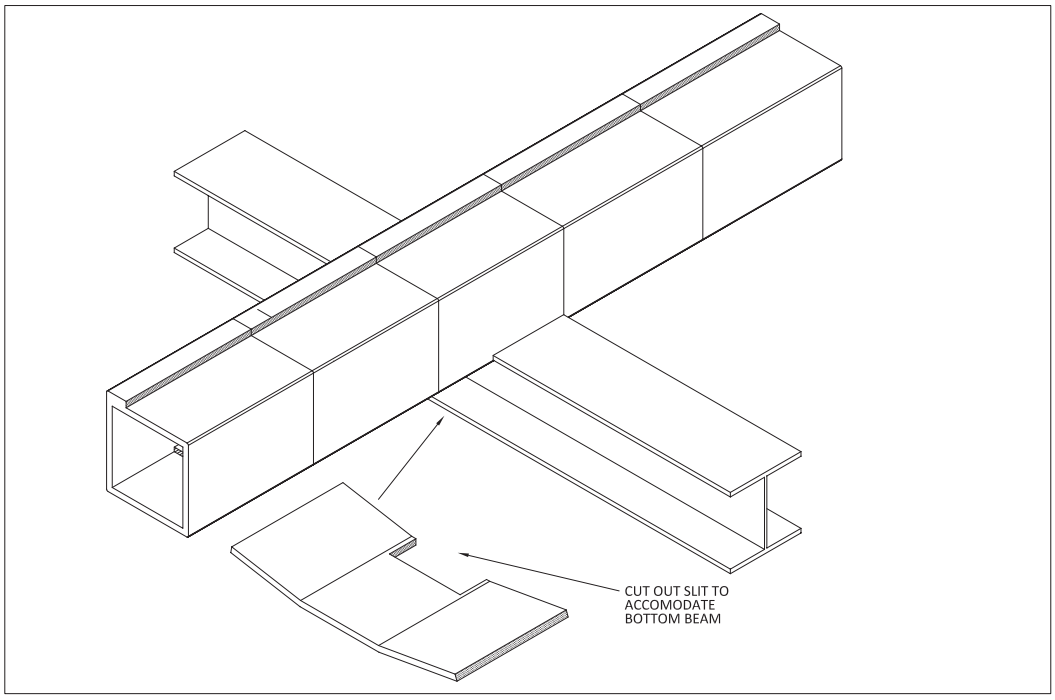
Chapter 2

Wrapping Procedure for Perpendicular Intersection

Note:
This chapter will illustrate wrapping procedure for Perpendicular Intersection ONLY. For wrapping procedure of different steel beam configurations and intersections/joints, please refer to appropriate chapters.

1 - Use the procedure illustrated in Chapter 1 to install EMat. Where the two beams intersect remove a section of EMat such that the top beam may be continuously wrapped. This piece of EMat should be tightly abutted to either side of the bottom flange as seen in the figure below. Using appropriate 3M sealant, apply caulking to the interface of the bottom flange and the piece of EMat wrapped around the top beam. Tape all seams with appropriate 3M tape.

Figure 1



2 - After finishing installing the first layer of EMat on the top-mounted beam, proceed to the bottom beam. Lay EMat on the bottom beam and mark the section of EMat which overlaps with the intersection and top-mounted beam. Cut and remove section of EMat between mark-ups, and wrap EMat around the beam's perimeter. Secure EMat in place with filament tape. Filament tape is for temporary hold only and therefore the amount of tape and spacing to be used is at the installer's discretion. Please refer to Chapter 1 for suggested usage of filament tape (Figure 2). Tape all seams with appropriate 3M tape.

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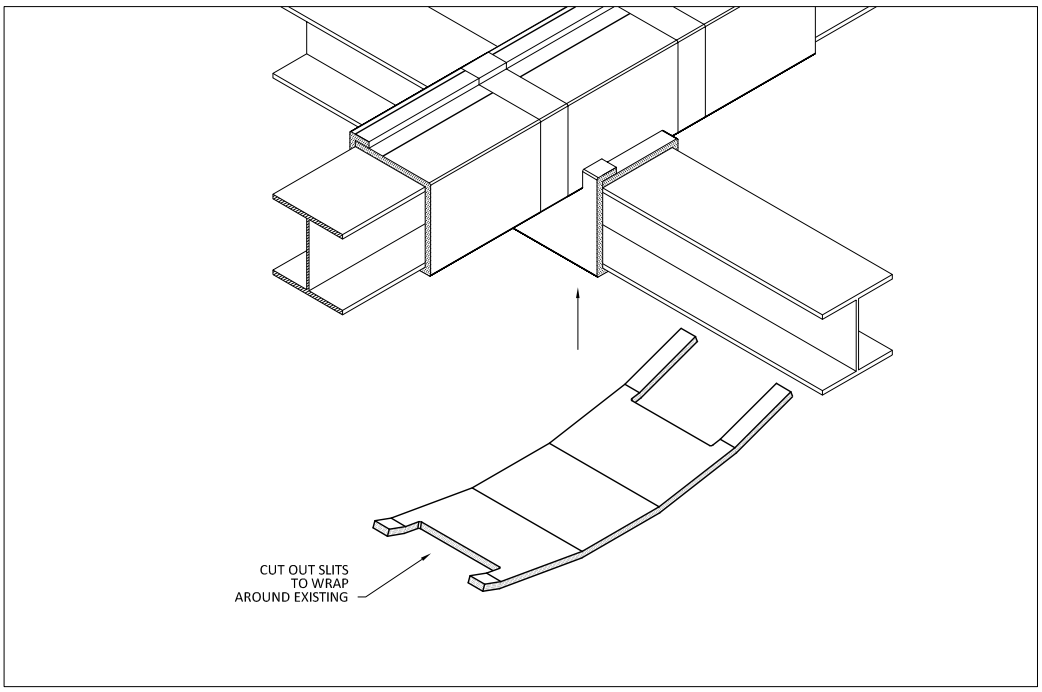
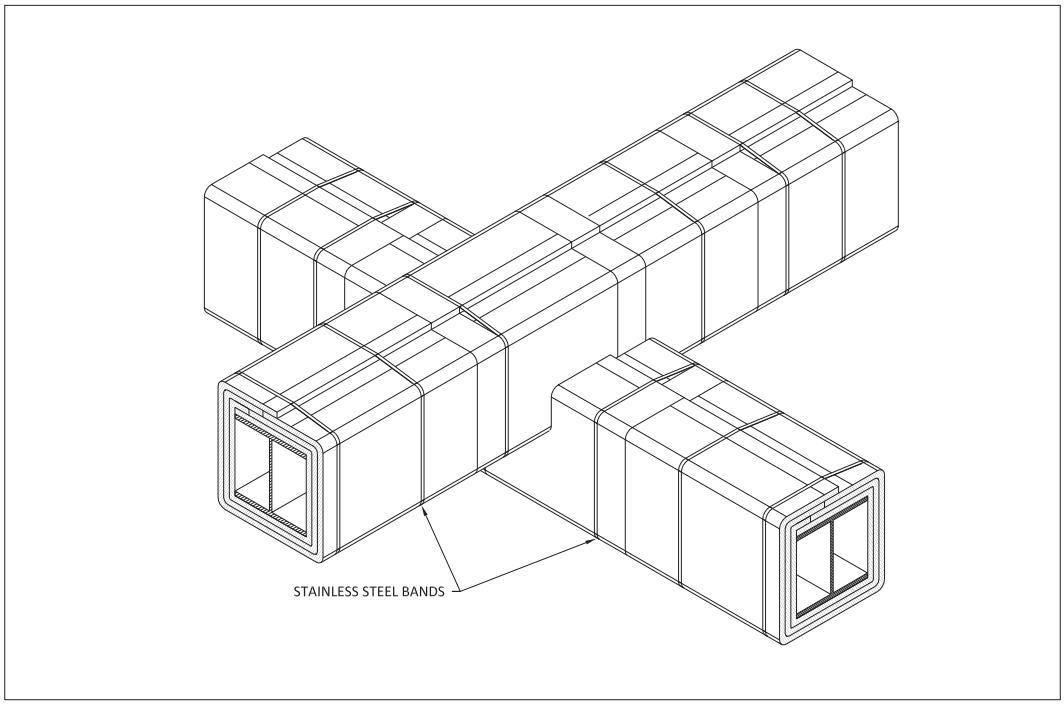
Figure 2



3 - Repeat step 1 and 2 for all subsequent layers as per listing/design, alternating between wrapping the top and bottom sections. Once the last layer of EMat is in place, secure the EMat with stainless steel banding. (Refer to Chapter 1 for specifications surrounding stainless steel banding). The final layer where the EMat interfaces between the bottom and the top beam should be caulked by approved 3M caulking to prevent moisture from penetrating the joint.

Figure 3



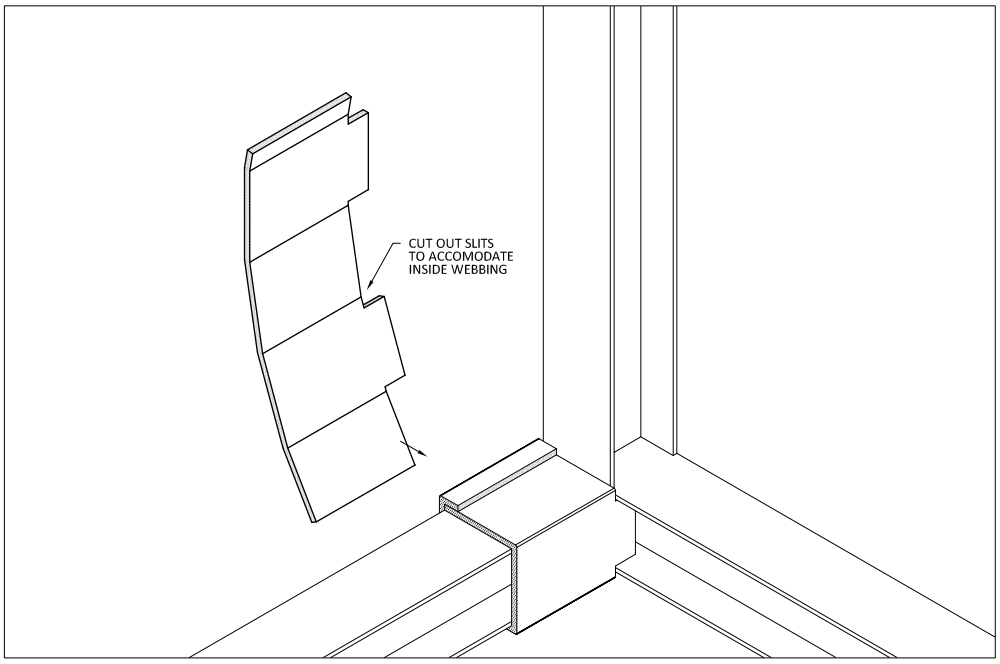
Chapter 3

Wrapping Procedure for Outside Corner

Note:
*This chapter will illustrate wrapping procedure for Outside Corner intersection **ONLY.** For wrapping procedure of different steel beam configurations and intersections/joints, please refer to appropriate chapters.*

1 - Begin applying EMat to the horizontal beam that terminates at the column flange (Figure 1). Make cut outs and slits from the EMat and wrap in and around the perimeter of the beam. Ensure the extended tabs of EMat are tightly abutted to the adjacent horizontal beam's web. Secure EMat in place with 3M filament tape. Filament tape is for temporary hold only and therefore the amount of tape and spacing to be used is at the installer's discretion. Please refer to Chapter 1 for suggested usage of filament tape.

Figure 1



2 - For the next section of beam, a similar procedure should be implemented. Make cut outs and slits from the EMat and wrap in and around the perimeter of the beam, with the cut-out tabs abutting tightly to the web of the column (Figure 2). This section of EMat should be tightly abutted to the first section eliminating all possible gaps. If a gap of more than 1/8 inch (3 mm) remains in the perimeter joint between sections of EMat, the gap is to be filled to the full depth of the EMat with an approved 3M sealant (Figure 2).

Note:
Before applying EMat to the next beam, make sure the bottom horizontal joint beams are properly fireproofed with EMat.

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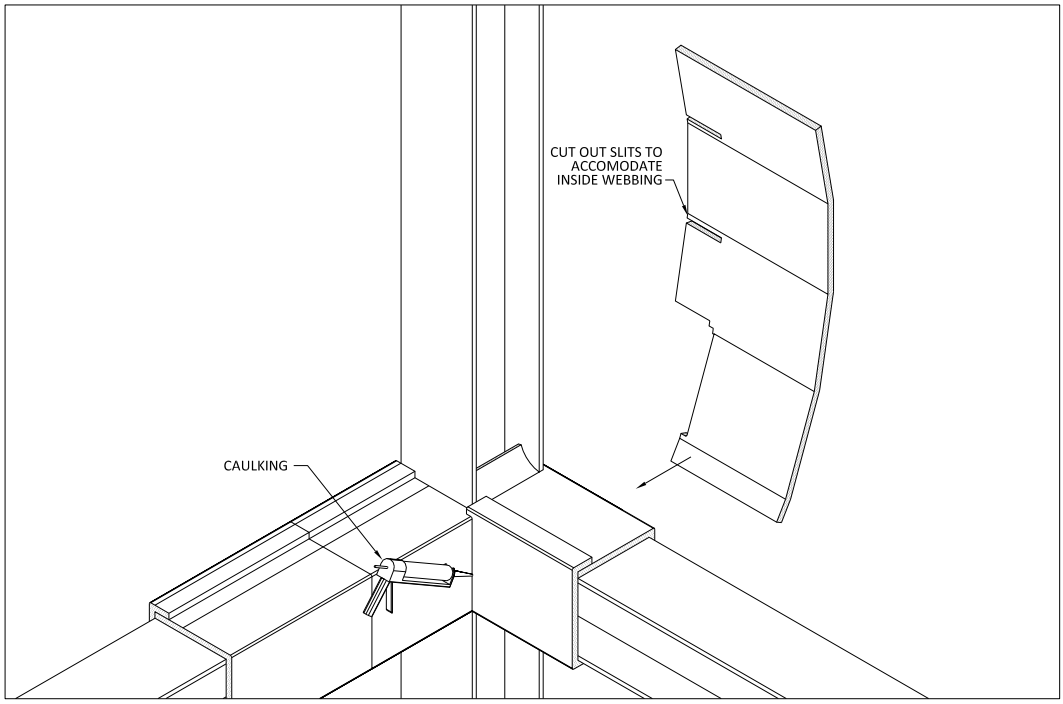
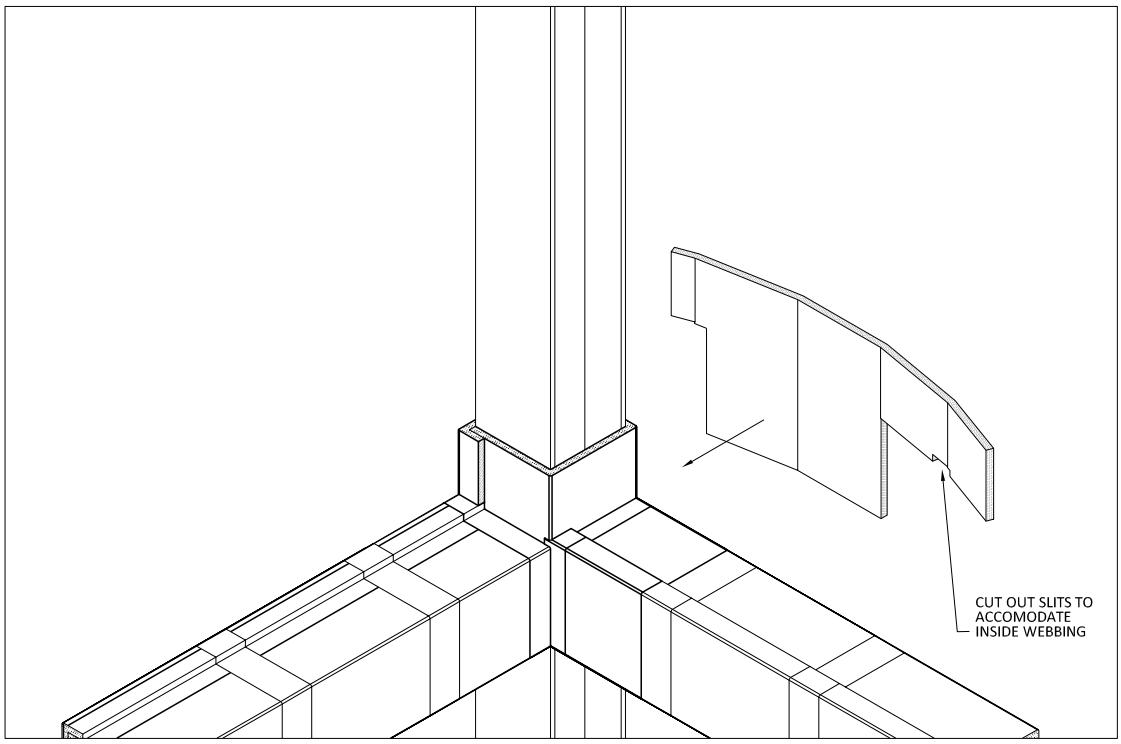
Figure 2



3 - Once both beams are wrapped, butting up to the column, begin wrapping the column. Make two cut-outs in the EMat to accommodate for the beams. As per Figure 3, the cut-outs should allow for a thin strip of EMat to overlap the interior seam between beams. Secure the EMat in place with filament tape. Note that the filament tape is for temporary hold only and therefore the amount of tape and spacing to be used is at the installer's discretion. Please refer to Chapter 1 for suggested usage of filament tape. This section of EMat should be tightly abutted to the first section (space between the two sections should be zero inches where possible). If a gap exists greater than 1/8 inch (3 mm), caulk gap to full depth of the wrap with an approved 3M sealant.

Figure 3



4 - Tape the EMat overlap seam with an approved 3M tape. Center of tape to be approximately centered over the seam. The inside corner seam should also be taped. Apply pressure on the tape to remove air gaps and secure to EMat. Smooth the tape with a hard roller or straight edge applying enough pressure to ensure adequate adhesion of the tape to the EMat and to remove any air gaps (Figure 4).

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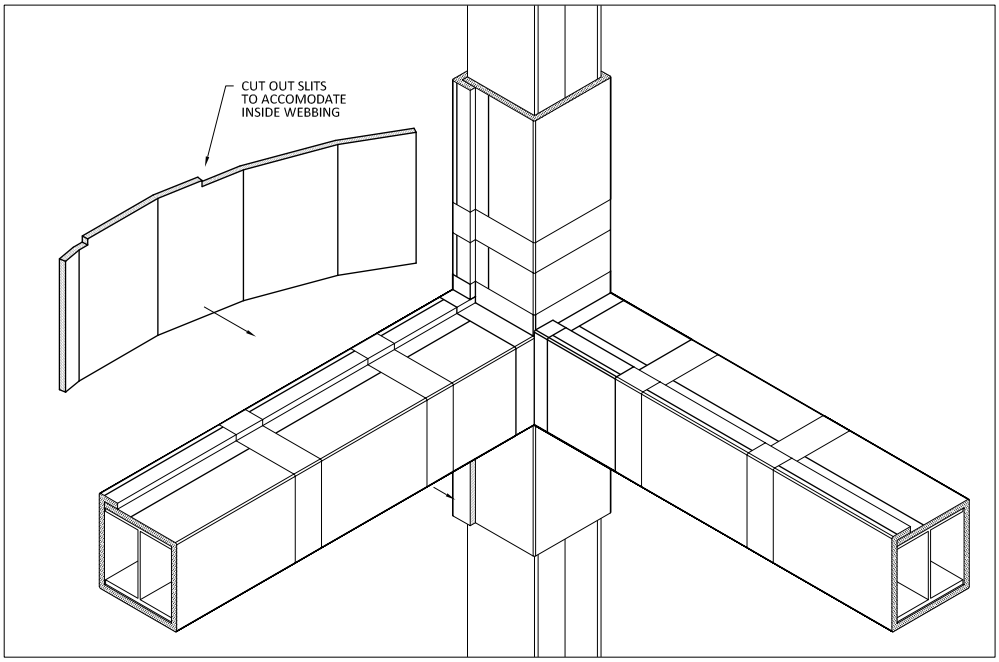
Figure 4



5 - Repeat steps 1 through 4 for all subsequent layers as per listing/design. The final layer where the EMat interfaces between the bottom and the top beams should be caulked by approved 3M caulking to prevent moisture from penetrating the joint.

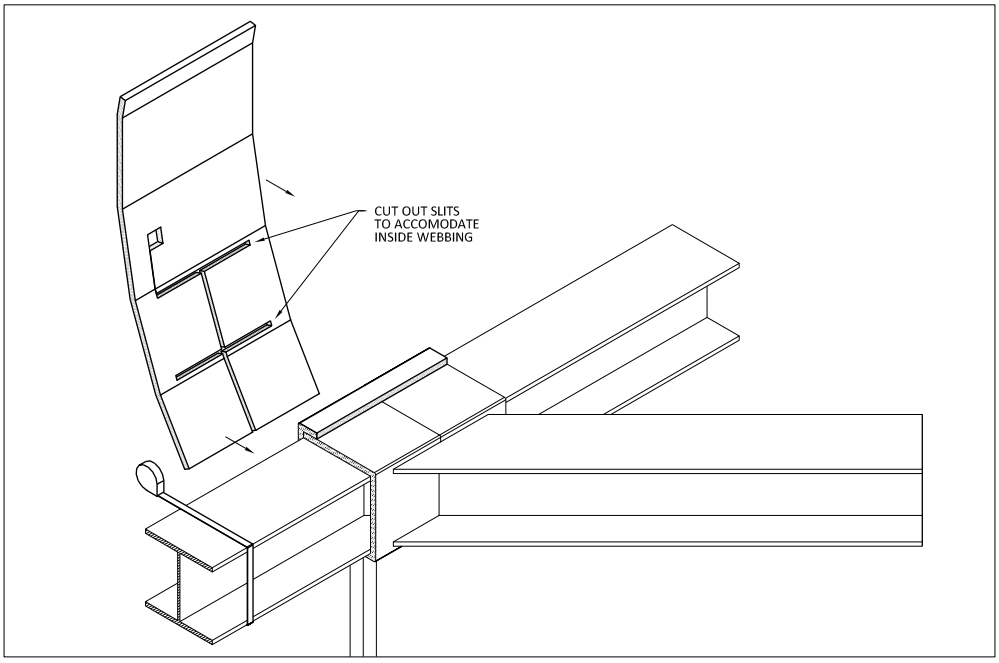
Chapter 4

Wrapping Procedure for 45° Diagonal Intersection

Note:
This chapter will illustrate wrapping procedure for 45° Diagonal Intersection ***ONLY.*** *For wrapping procedure of different steel beam configurations and intersections/joints, please refer to appropriate chapters.*

1 - Start with the continuous run of beam (horizontal beam). Measure beam perimeter to determine length of the cut. Add additional length to accommodate for overlap and corner bending. Cut EMat and place it on the horizontal beam. Align the EMat flush with the top flange of the horizontal beam, and mark the outline of the intersecting beams' top and bottom flange and web. Cut and remove section of EMat between mark-ups. Apply EMat to the horizontal beam as per Figure 1, maneuvering the cut-outs around the intersecting beam.

Figure 1



2 - Secure EMat in place with filament tape. Note that the filament tape is for temporary hold only and therefore the amount of tape and spacing to be used is at the installer's discretion. Please refer to Chapter 1 for suggested usage of filament tape. Make sure Emat is covering the entire perimeter of beam. If there is a gap between the diagonal member and horizontal beam, EMat should cover the gap (Figure 2). If a gap of more than 1/8 inch (3 mm) remains in the perimeter joints between installed sections of EMat, the gap is to be filled to the full depth of the EMat with an approved 3M sealant. The butt seam where the two pieces meet (perimeter joint) is to be covered with 3M approved tape.

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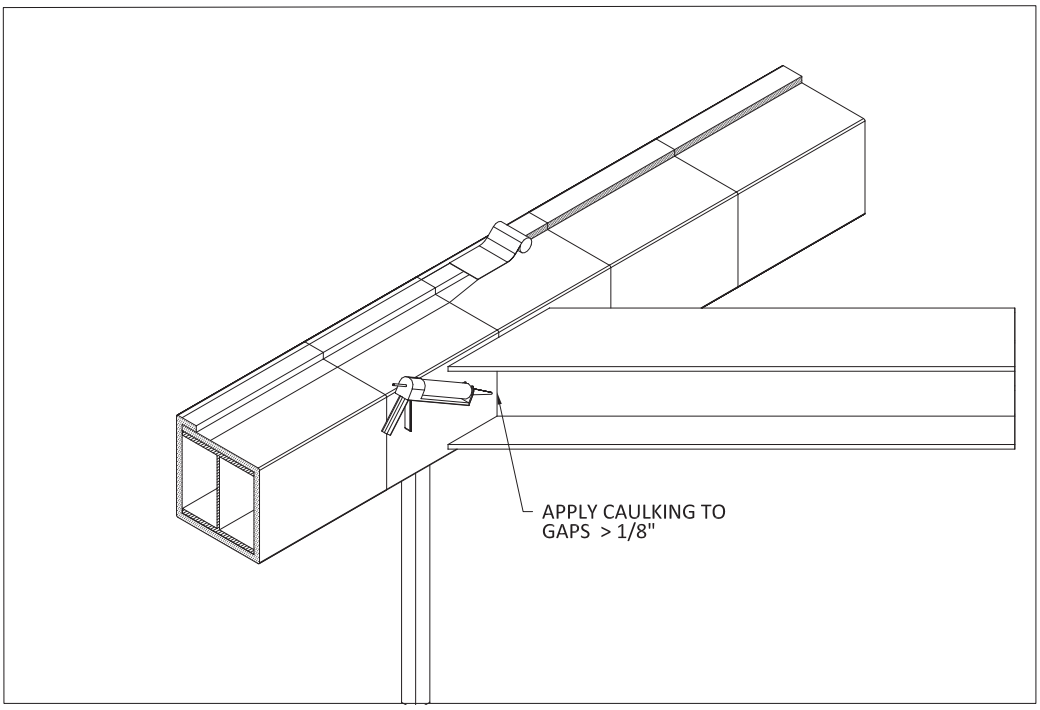
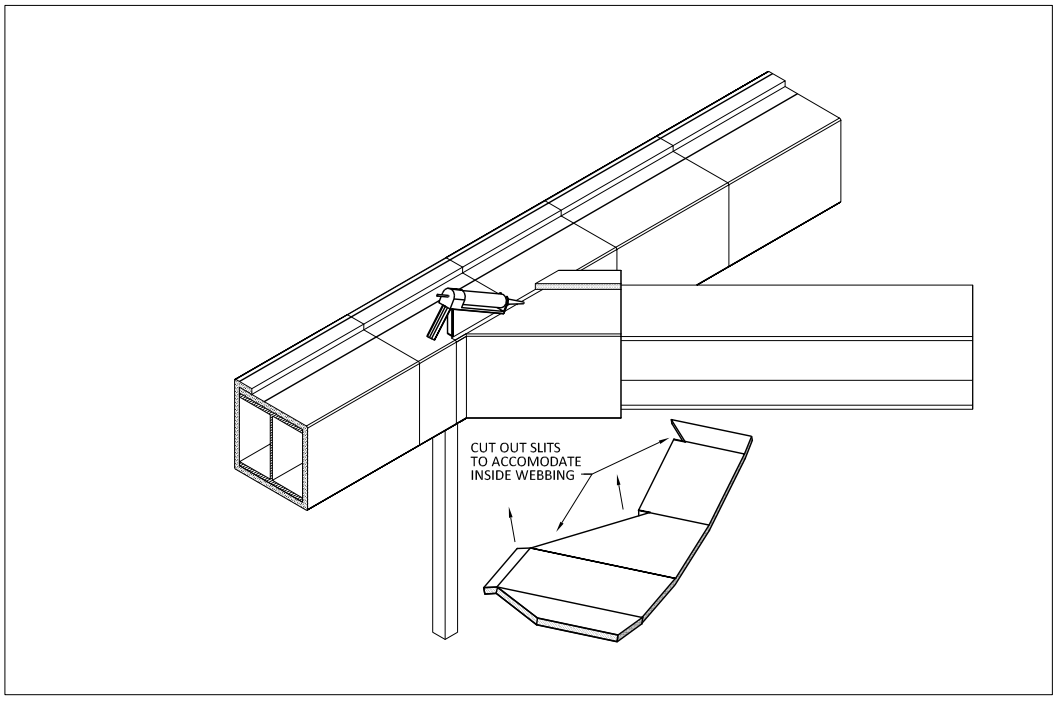
Figure 2



3 - After fireproofing the horizontal beam, the diagonal member can be fireproofed. Wrap EMat around the steel then overlap onto itself (longitudinal overlap). There should be extra EMat on the wide-angled side of joint to lay over existing Emat on the horizontal beam (Figure 3). Emat should be tight and free of slack to the diagonal member steel and horizontal beam's EMat. Edge of EMat can be held in place by filament tape or by the other worker. Note that the filament tape is for temporary hold only and therefore the amount of tape and spacing to be used is at the installer's discretion. Please refer to Chapter 1 for suggested usage of filament tape. If a gap of more than 1/8 inch (3 mm) remains in the perimeter joint between sections of EMat, the gap is to be filled to the full depth of the EMat with an approved 3M sealant.

Figure 3



4 - Repeat steps 1 through 3 for all subsequent layers as per listing/design. Once the last layer of Emat is in place, secure the Emat with ½ inch (13mm) wide, 0.020 inch (0.508mm) thick stainless steel banding to be applied over the outside of the wrap.

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Figure 4

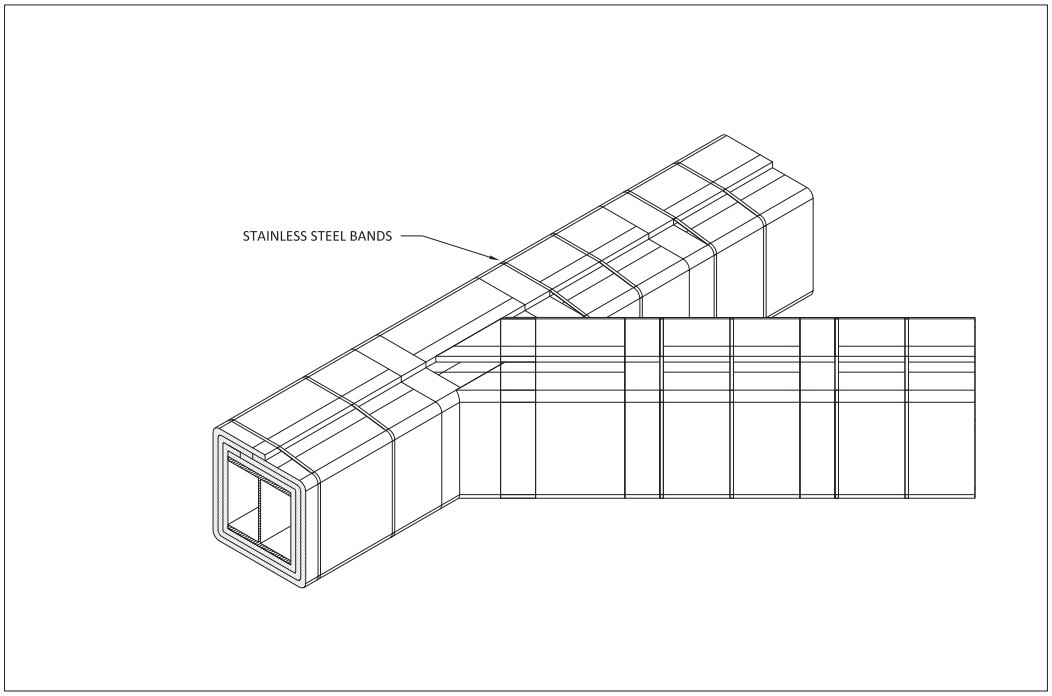
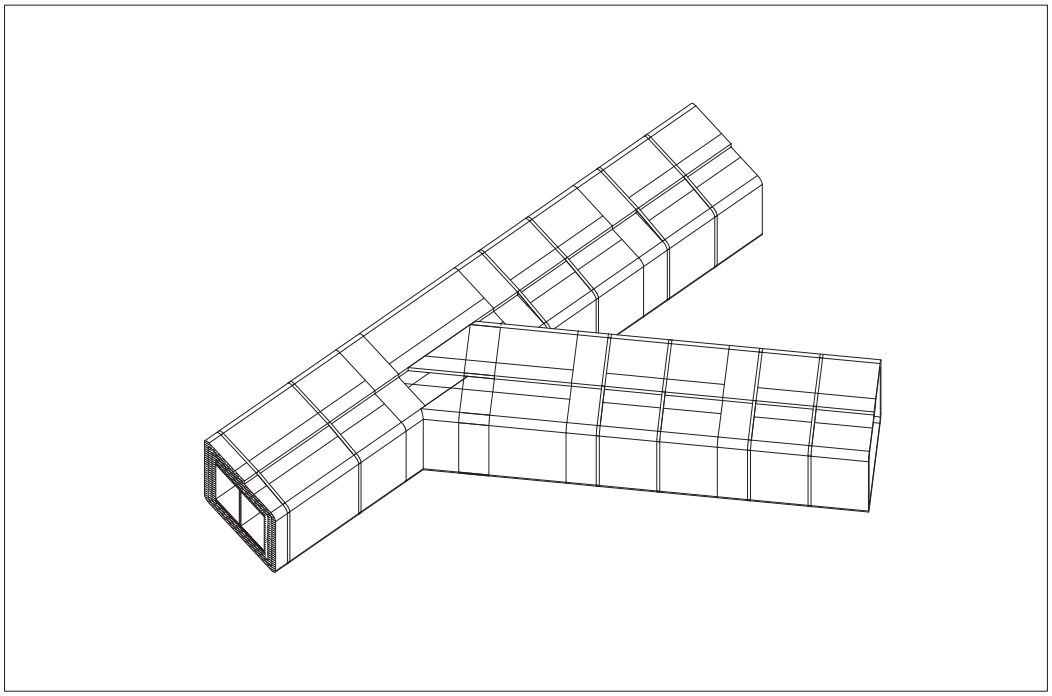


Figure 5



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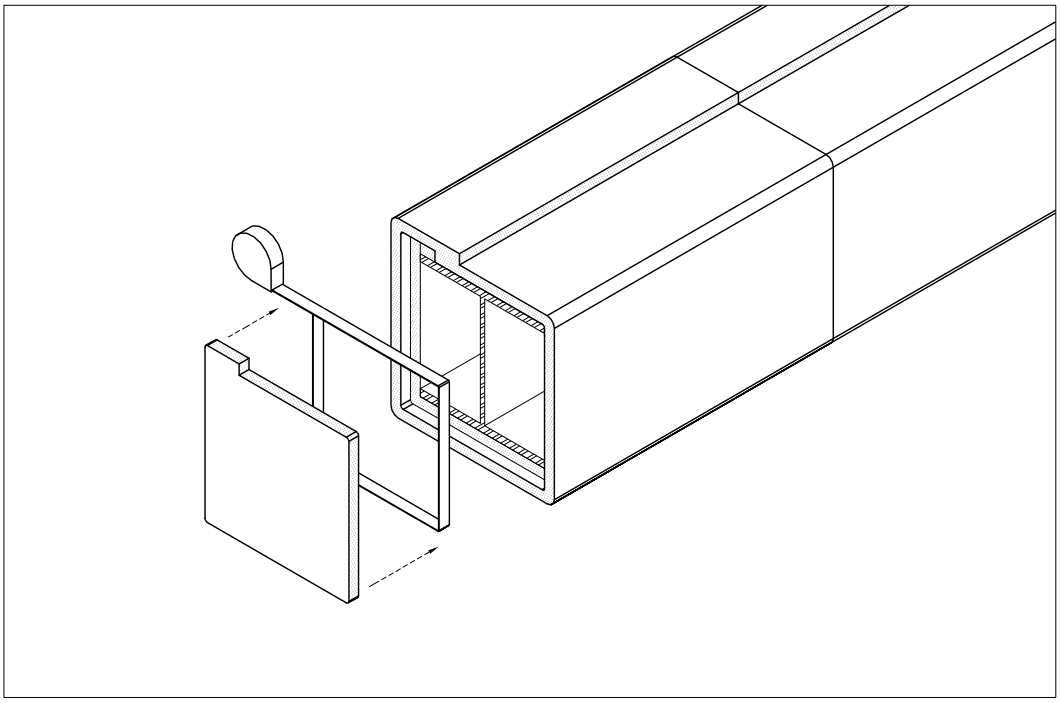
Chapter 5

Installation Procedure for Termination (End Cap)

Note:
This chapter will illustrate installation of the termination (i.e. end cap) ***ONLY****. For wrapping procedure of different steel beam configurations and intersections/joints, please refer to appropriate chapters.*

1 - Ensure that the final piece of EMat wrapped on the beam extends over the beam termination sufficient that all required layers of the end cap will fit inside the end piece. Measure inside perimeter of the first layer of EMat (installed on the beam). Make cut out from the Emat and examine if the cut out fits securely inside of installed EMat (Figure 1)

Figure 1

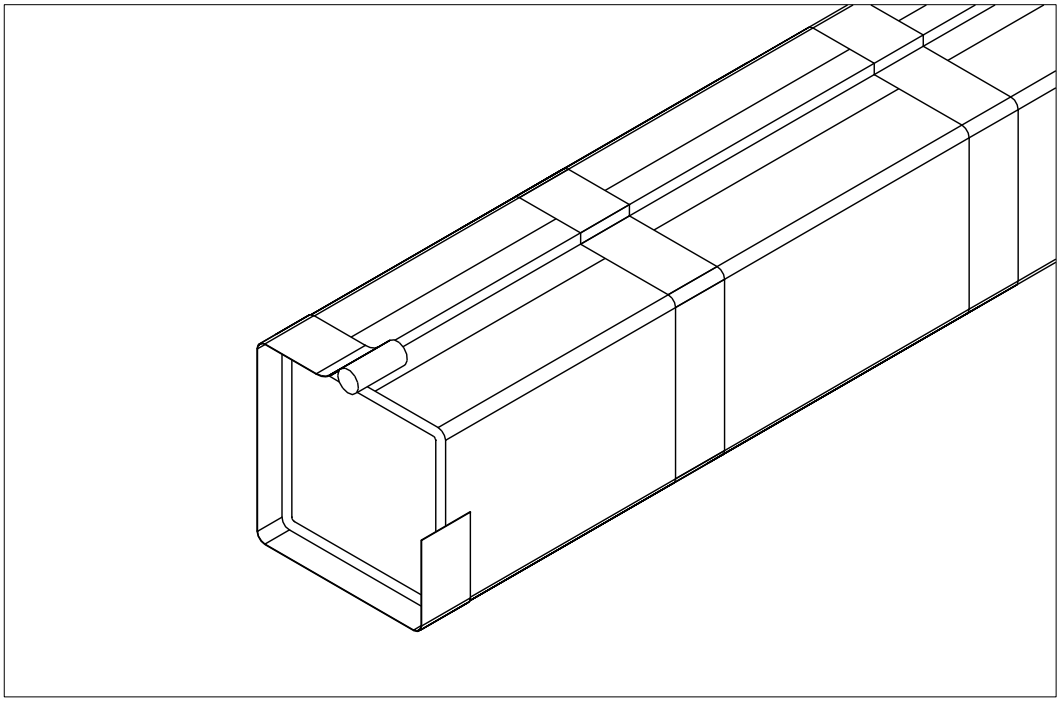


2 - Place the cutout inside the first layer of Emat at the end of the beam. Secure EMat in place with filament tape. Note that the filament tape is for temporary hold only and therefore the amount of tape and spacing to be used is at the installer's discretion. Please refer to Chapter 1 for suggested usage of filament tape. Repeat as necessary to achieve required layers. The butt seam where the two pieces meet on the final layer (perimeter joint) is to be covered with 3M approved tape (Figure 2).

Note:
Please refer to the "appropriate 3M listing" for specific 3M tape required in Appendix 1 of this guide.

This material was extracted and drawn by 3M Fire Protection Systems from the 2010 edition of the ULC Fire Resistance Directory.

Figure 2



3 - Repeat these steps for all subsequent layers as per listing/design. A new stainless steel band is to be installed at the termination after the final end cap layer has been installed.

This material was extracted and drawn by 3M Fire Protection Systems from the 2010 edition of the ULC Fire Resistance Directory.

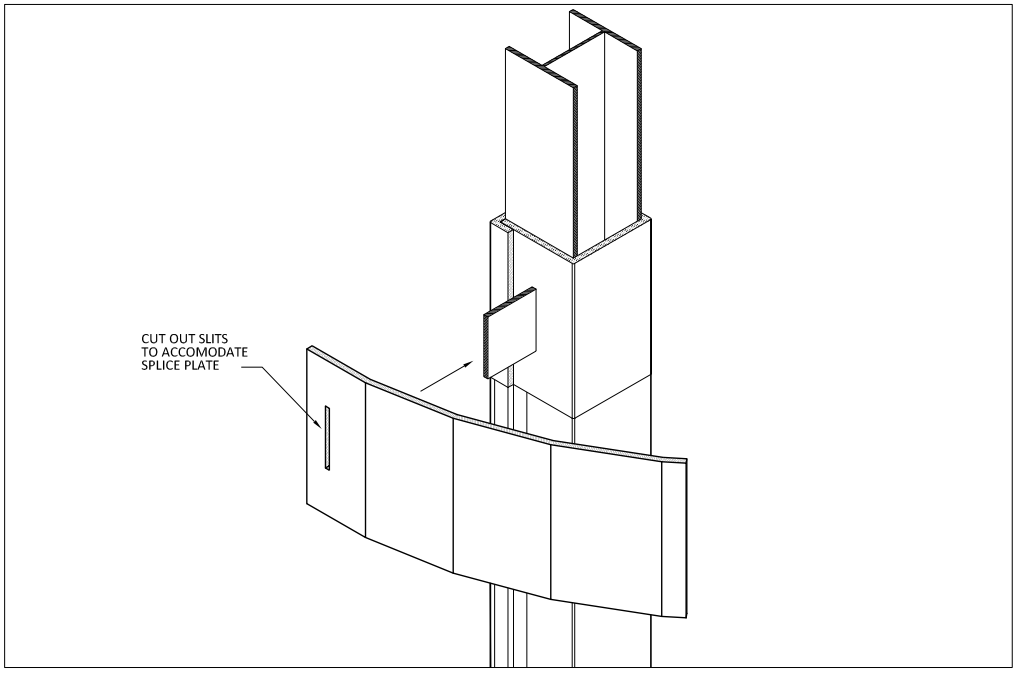
Chapter 6

Wrapping Procedure Around Protruding Penetrating Items

Note:
*This chapter will illustrate wrapping procedure around an intersection of bare steel to straight beam **ONLY**. For wrapping procedure of different steel beam configurations and intersections/joints, please refer to appropriate chapters.*

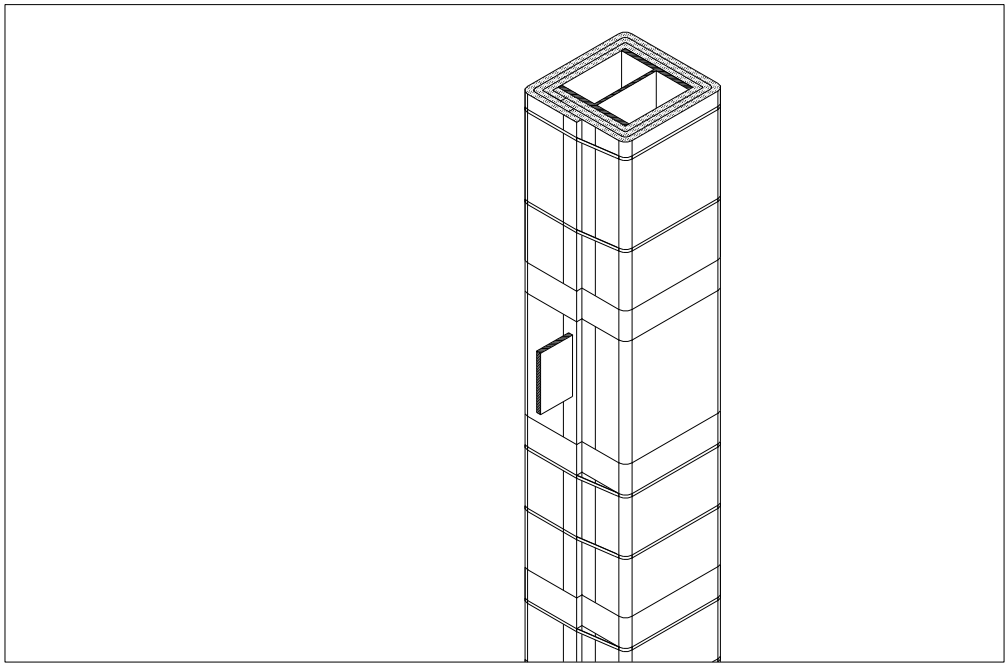
1 - Measure the total length of splice plate. Cut and slit EMat to the length of the penetrating item. The EMat is to be applied around the penetrating item. In this example, we are showing installation around a splice plate (protruding item). Measure the total length of the splice plate, cut and slit EMat to this length and apply accordingly (Figure 1).

Figure 1



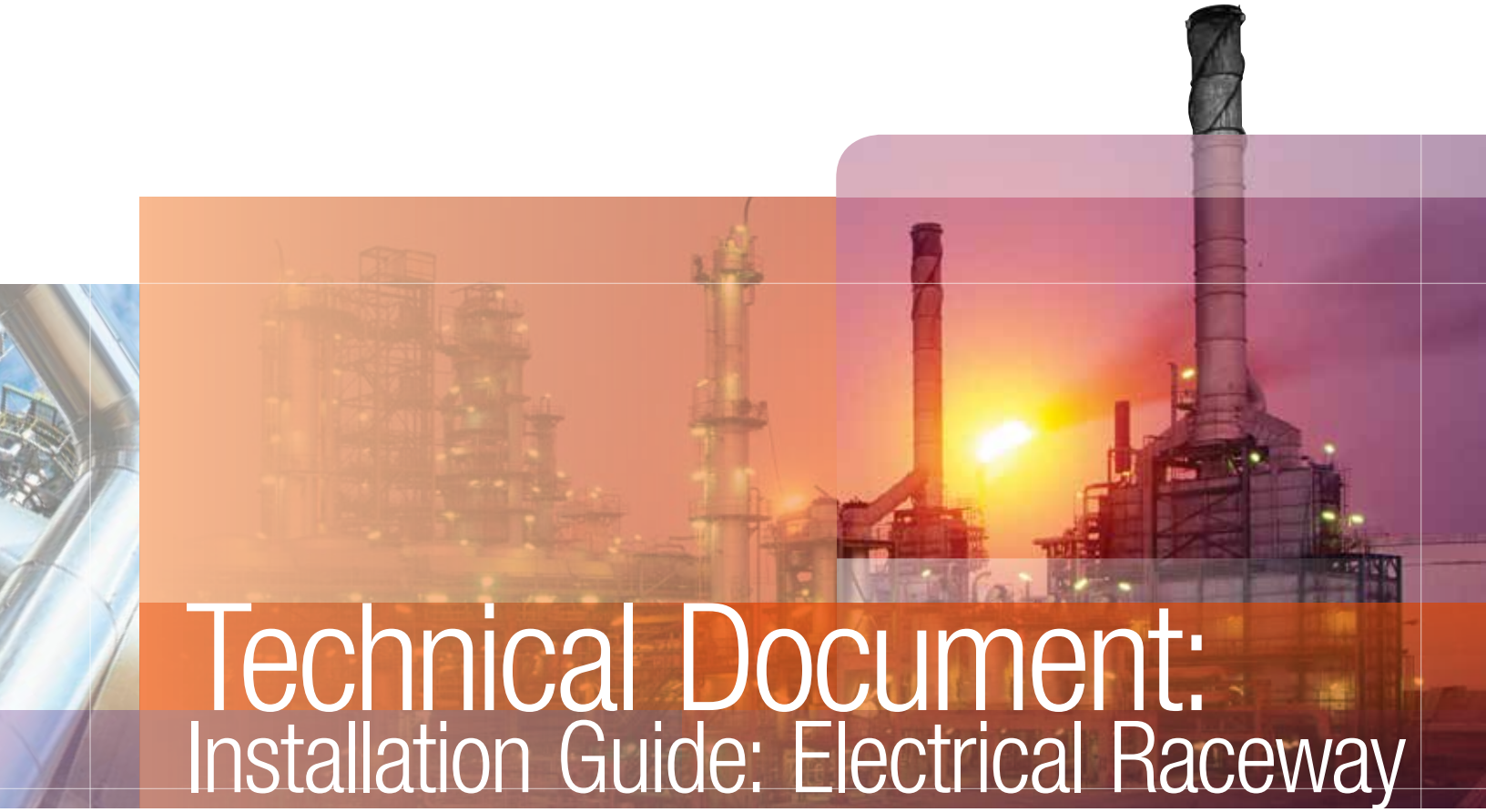
2 - Implement wrapping procedure outlined in Chapter 1 to complete EMat installation. Repeat the same procedure for all subsequent layers to achieve desired protection as per listing/design. 3M approved caulking to be applied around the penetrating item to provide an environmental seal to the EMat. This is to be completed after each layer of applied EMat.

Figure 2



This material was extracted and drawn by 3M Fire Protection Systems from the 2010 edition of the ULC Fire Resistance Directory.

3M™ Fire Protection Products
Interam™ E-Mat Solutions Package



Technical Document:
Installation Guide: Electrical Raceway

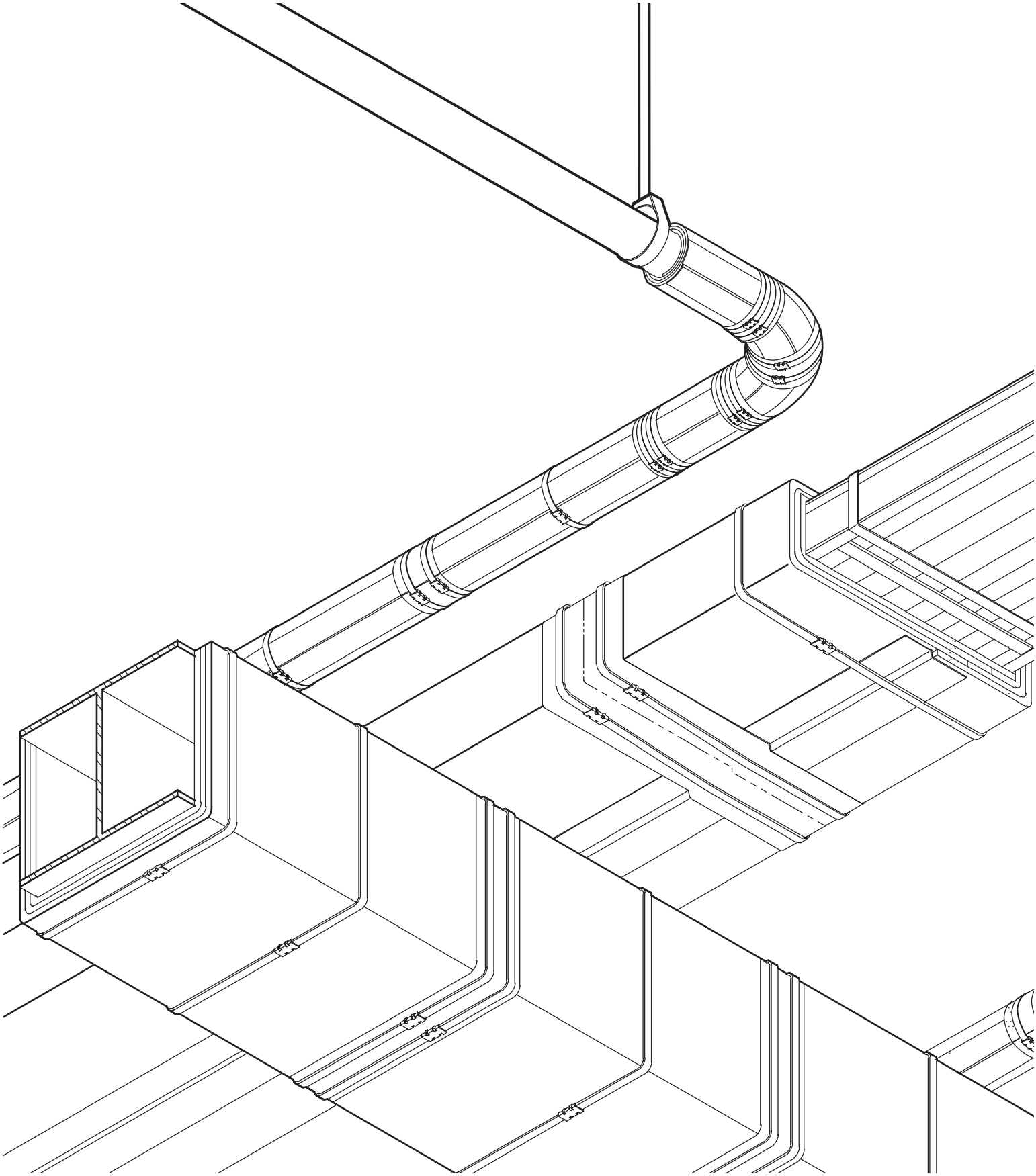
3M

Interam™ Systems
E-Mat

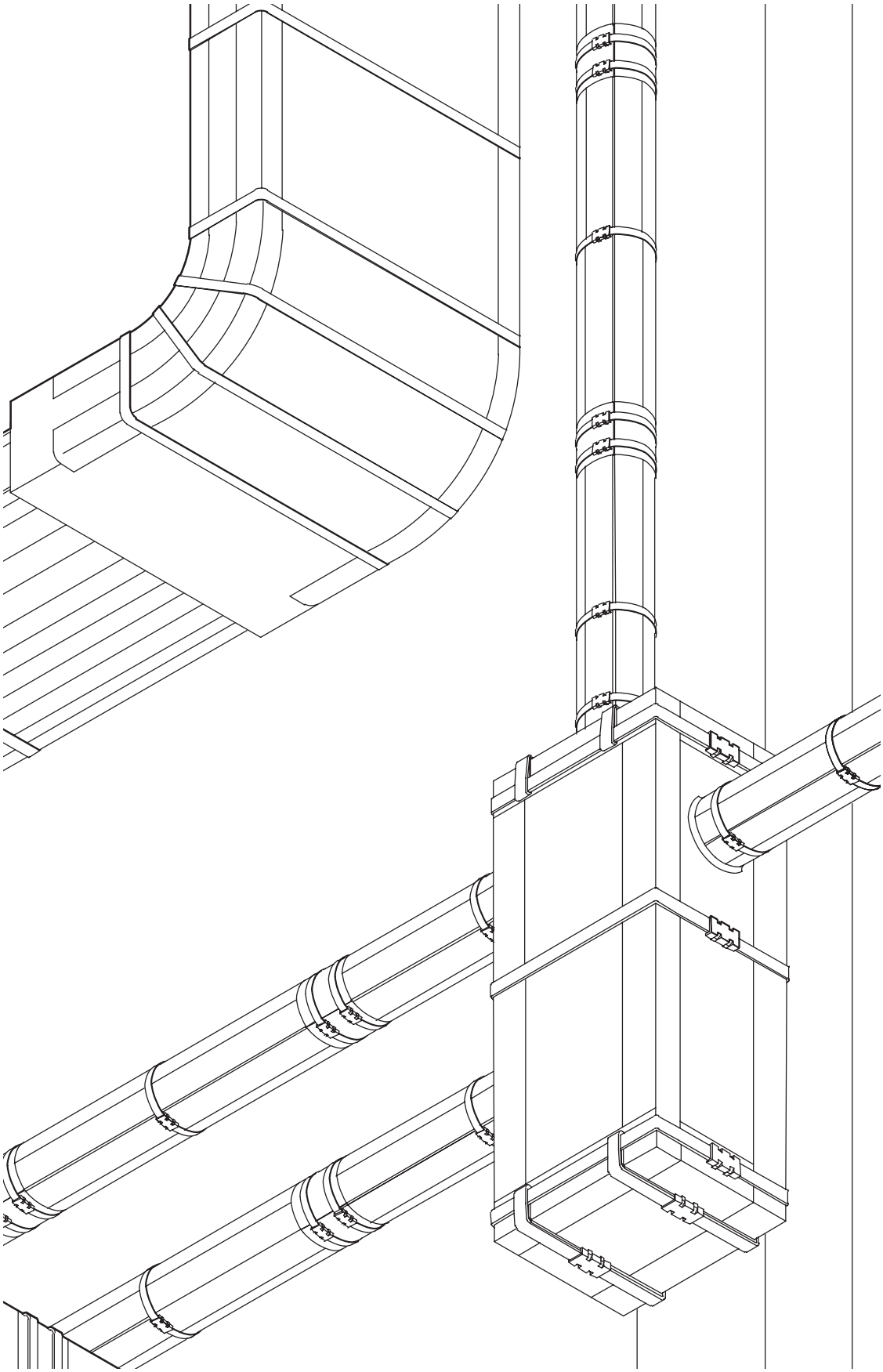
Electrical Raceway Protection for the Petrochemical Industry

Installation Instructions

Petrochemical Facilities Electrical Raceways



Introduction



The drawings included in this document illustrate general principles of applying 3M™ Interam™ Systems E-Mat on electrical raceways at industrial petrochemical facilities. Contact 3M for detailed specifications and drawings regarding Interam Systems installations.

The first step is to determine the appropriate number of layers required for your application. The drawings shown here illustrate three layers. Your application may require a different number of layers.

Refer to the last two pages in this document for E-Mat layer requirements and length estimating guides. These guides are intended to help the installer determine the appropriate mat lengths needed for the required number of layers.

Installer must determine suitability of a particular detail for the intended specific installation based on regulatory requirements, 3M recommendations and actual field conditions. Some considerations include the following.

- Required number of mat layers are applied
- Seams, joints and overlaps are properly covered
- Areas requiring special cutting and fitting are properly protected
- Heat transfer items exiting the system are properly covered
- System is mechanically restrained to stay in place during a fire

Materials

A. 3M™ Interam™ Systems E-Mat

1. 98-0400-5620-6 supplied in rolls nominally 24.5 in. (62 cm) wide by 20 ft. (6,09 m) long by 0.40 in. (10 mm) thick.
2. E-Mat has aluminum foil on one side and a nylon scrim on the other. The mat is installed with the aluminum foil visible after installation.

B. 3M™ Fire Barrier Sealant CP 25WB+

1. 98-0400-5456-5 supplied in a 10.1 fl. oz. (298 mL) cartridge or 98-0400-5381-5 supplied in a 5 gallon (18,9 L) pail.
2. Red
3. Intumescent water-based caulk used to fill seams, joints and voids.

D. 3M™ 425 Tape

1. 70-0063-8533-3 supplied in rolls nominal 4 in. (10 cm) wide by 180 ft. (54.8 m) by 0.003 in. (0,07 mm) aluminum foil.
2. Foil tape is used to cover seams and overlaps.

E. Scotch™ Tape 898 (Filament Tape)

1. 70-0028-2311-3 is 0.75 in. (19 mm) wide by 180 ft. (54.8 m) long filament tape.
2. The filament tape is used as an installation aid to hold mat pieces in place. It is not a mandatory part of the Fire Protection System. Other installation aids such as or 3M™ Duct Tape can be used.

F. Other materials needed for installation are supplied by others.

G. Stainless steel banding: length of bands equal length of outer mat layer, plus 4 in. (10 cm) 1 1/2 bands per lineal foot of protected item. Waste and cost of clips not included. 1/2 in. (13 mm) wide by 0.020 in. (0.5 mm) banding minimum size.

Useful Installation Tools

A. Razor knife: to cut the E-Mat; large scissors or snips may also be used.

B. Electric scissors: optional electric scissors-blade shears can be used to cut straight and curved pieces of E-Mat.

C. Rubber roller: hand-held rubber roller can be used to ensure good adhesion of tape.

D. Straight edge: “T”-square or similar straight edge can be used to assist with straight cuts of the E-Mat.

E. Marking pen: used to identify the layer number of installed E-Mat.

F. Tape measure: used to properly measure the pieces of E-Mat.

G. Banding equipment: band tensioners are are available from most banding suppliers. “Wing seals” are the preferred type of banding seal. If crimp type seals are used to hold the bands, a crimping tool is also required.

H. Caulking gun: used to dispense 3M™ Fire Barrier Sealant CP 25WB+. Must fit a 10.5 oz (310 mL) cartridge.

Conduit or Cable Bundle Wrapping (Option 1)
Two Inch (5 cm) Offset Method

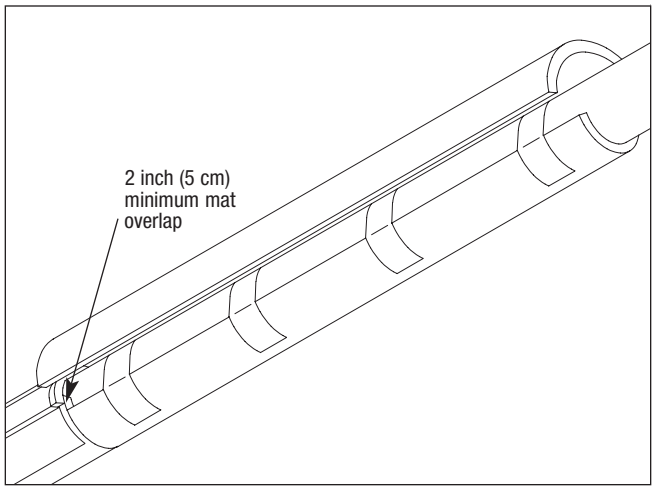


Figure 1A: Install first layer of 3M™ Interam™ Systems E-Mat tightly abutted to adjacent mat. Use 3M™ 898 Filament Tape to secure mat to conduit. Mat must overlap 2 inches (5 cm) minimum onto itself.

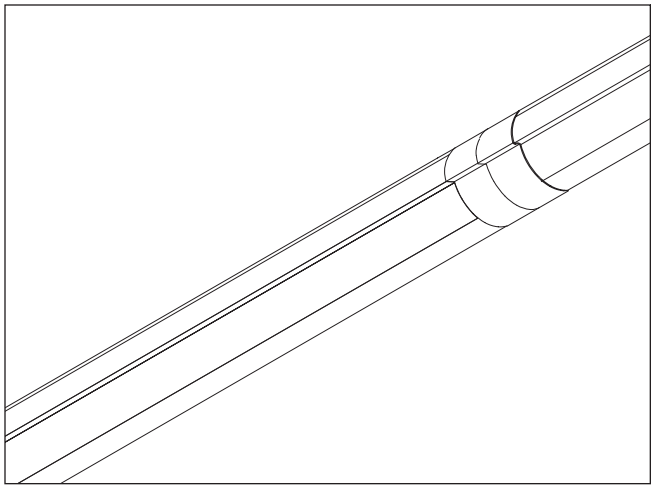


Figure 1B: Apply 3M™ 425 Sealing Tape to all exposed E-Mat seams and edges.

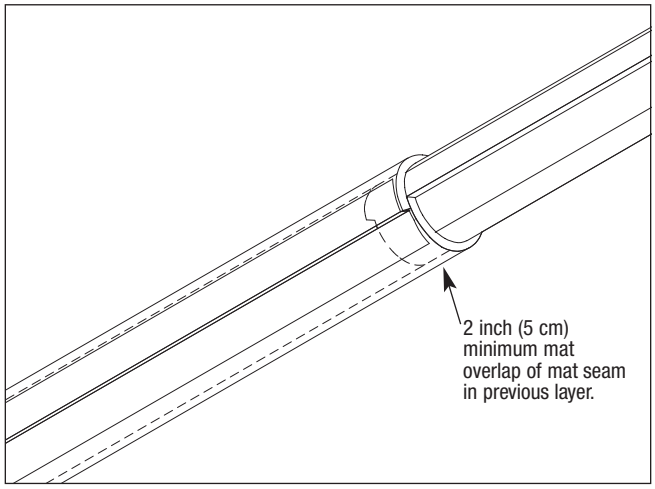


Figure 1C: Install second layer so that it overlaps the first layer seam by 2 inches (5 cm) minimum.

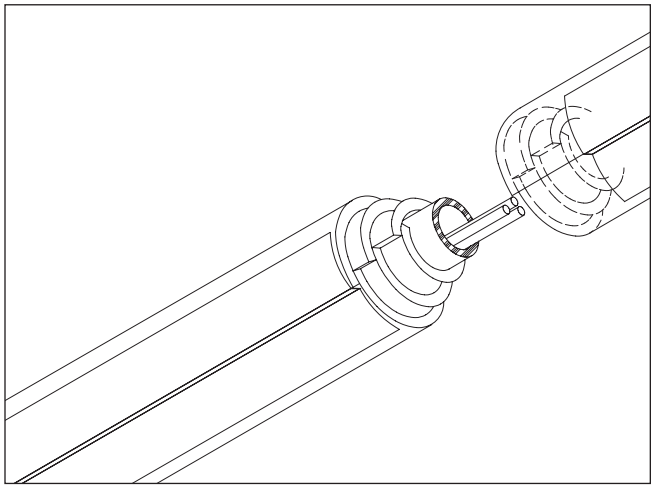


Figure 1D: Install additional layers each offset 2 inches (5 cm) so there are no in-line seams from one layer to another.

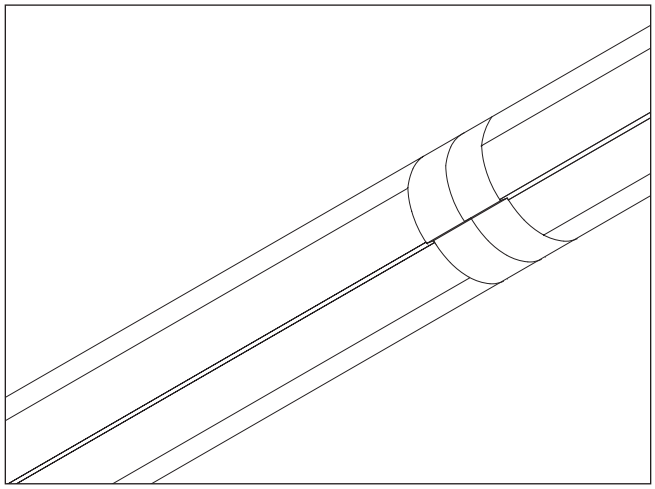


Figure 1E: Apply sealing tape over all exposed E-Mat seams and edges on the final layer.

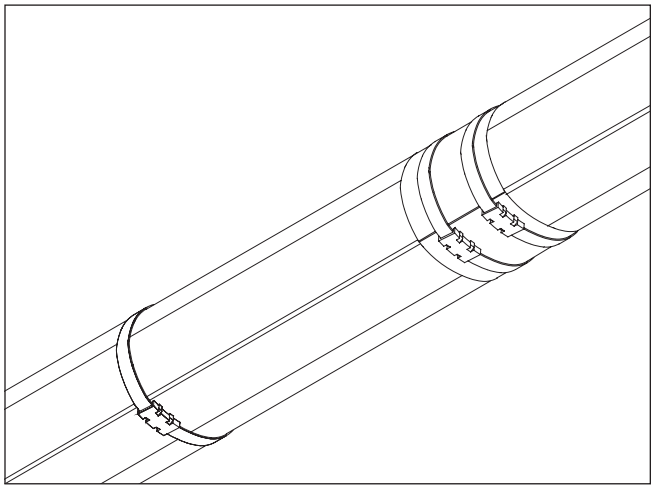


Figure 1F: Install bands every 12 inches (30 cm) maximum and within 2 inches (5 cm) of each seam as shown.

Conduit or Cable Bundle Wrapping (Option 2)

Continuous Wrap (Butt Joint Method)

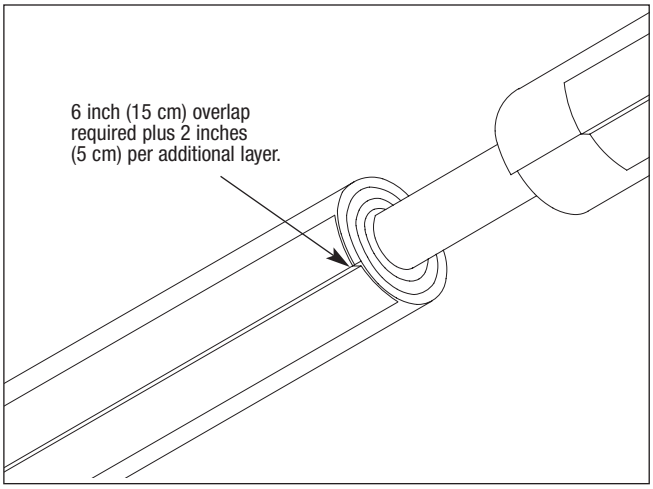


Figure 2A: Install 3M™ Interam™ Systems E-Mat layers in one continuous piece. Apply 3M™ 425 Sealing Tape to seam. Install another continuously wrapped piece abutted to the piece already installed. Joint between sections may be up to 2 inches (5 cm) maximum.

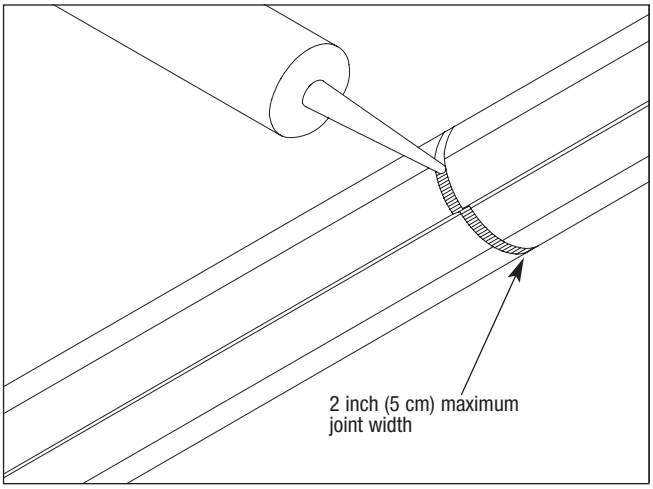


Figure 2B: Apply 3M™ Fire Barrier Sealant CP 25WB+ full depth to entire circumference of the butt joint between the mat wraps.

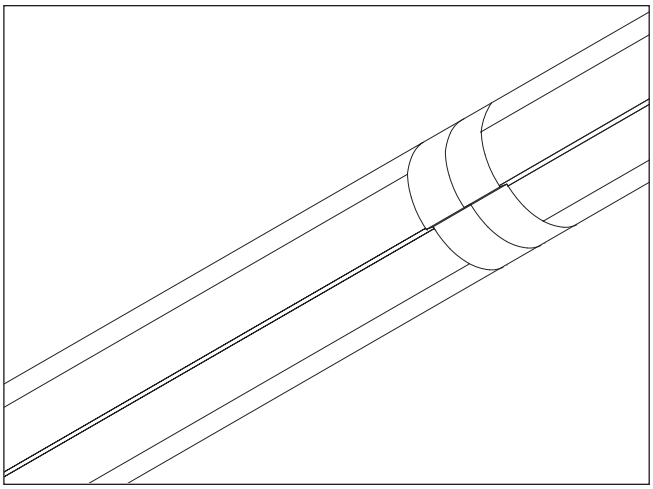


Figure 2C: Apply 3M™ 425 Sealing Tape to all exposed E-Mat seams and edges.

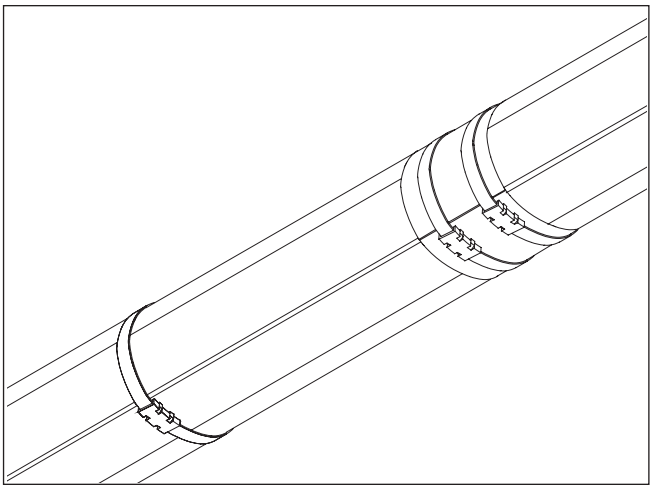


Figure 2D: Install bands every 12 inches (30 cm) maximum and within 2 inches (5 cm) of each edge as shown.

Conduit Elbow Wrapping

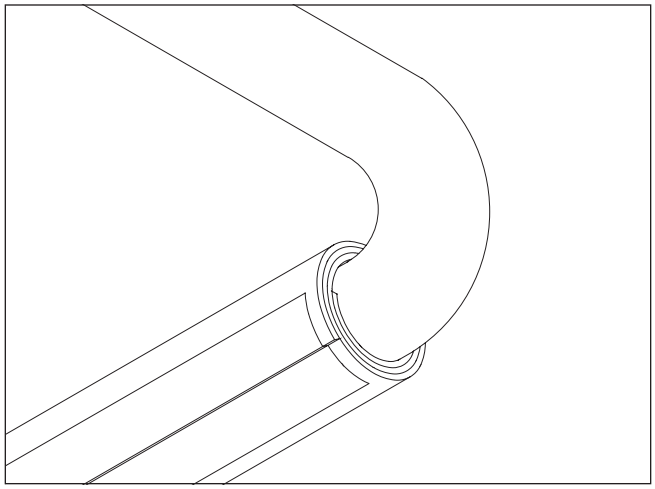


Figure 3A: Terminate straight section mat layers at beginning of conduit radius.

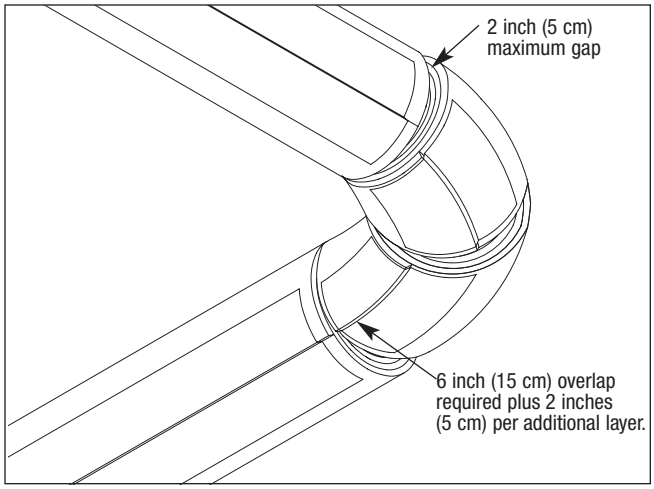


Figure 3B: Install narrow sections of mat in continuous manner as shown. These sections should touch on the inner radius. Each section should have a final layer overlap of at least 6 inches (15 cm). Secure each section into place using 3M™ 898 Filament Tape.

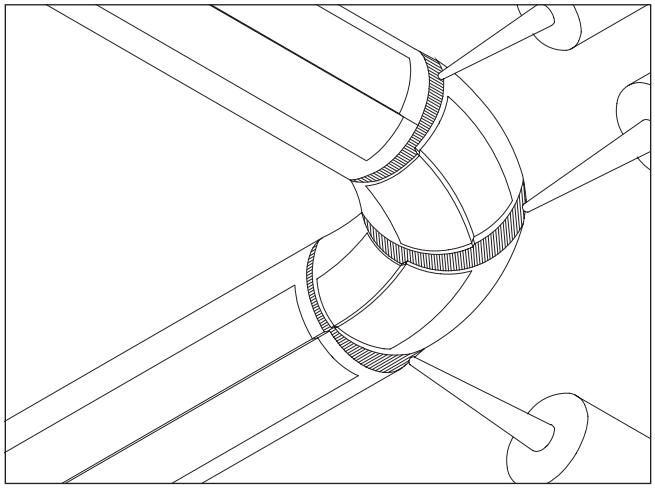


Figure 3C: Apply 3M™ Fire Barrier Sealant CP 25WB+ to fill the gaps which remain between mat sections.

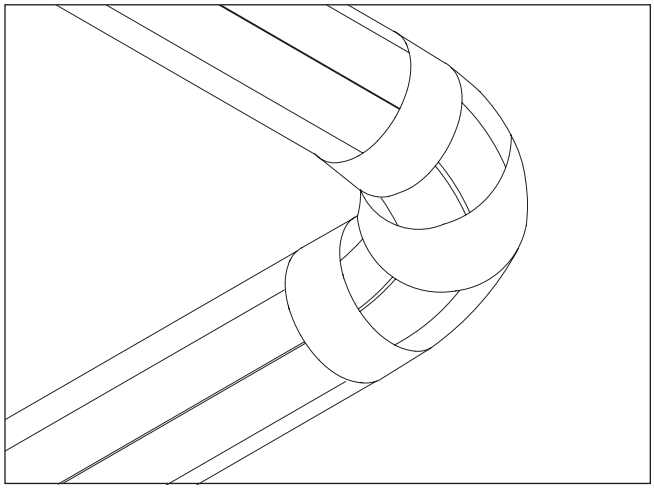


Figure 3D: Apply 3M™ 425 Sealing Tape over all exposed seams and caulk.

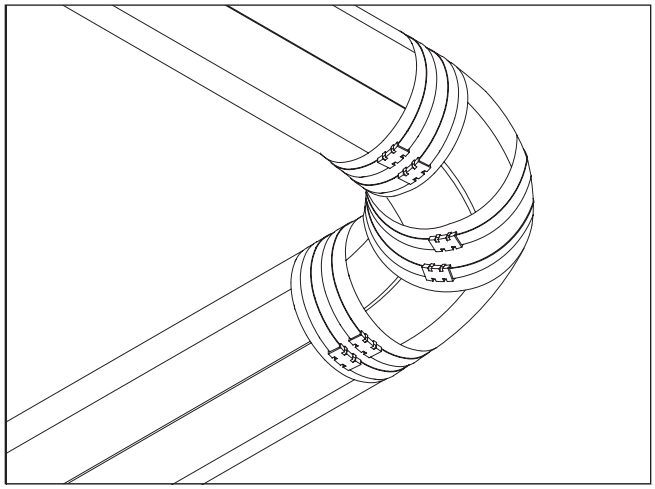


Figure 3E: Install bands every 12 inches (30 cm) maximum and within 2 inches (5 cm) of each edge as shown.

Emergency Circuit Panel

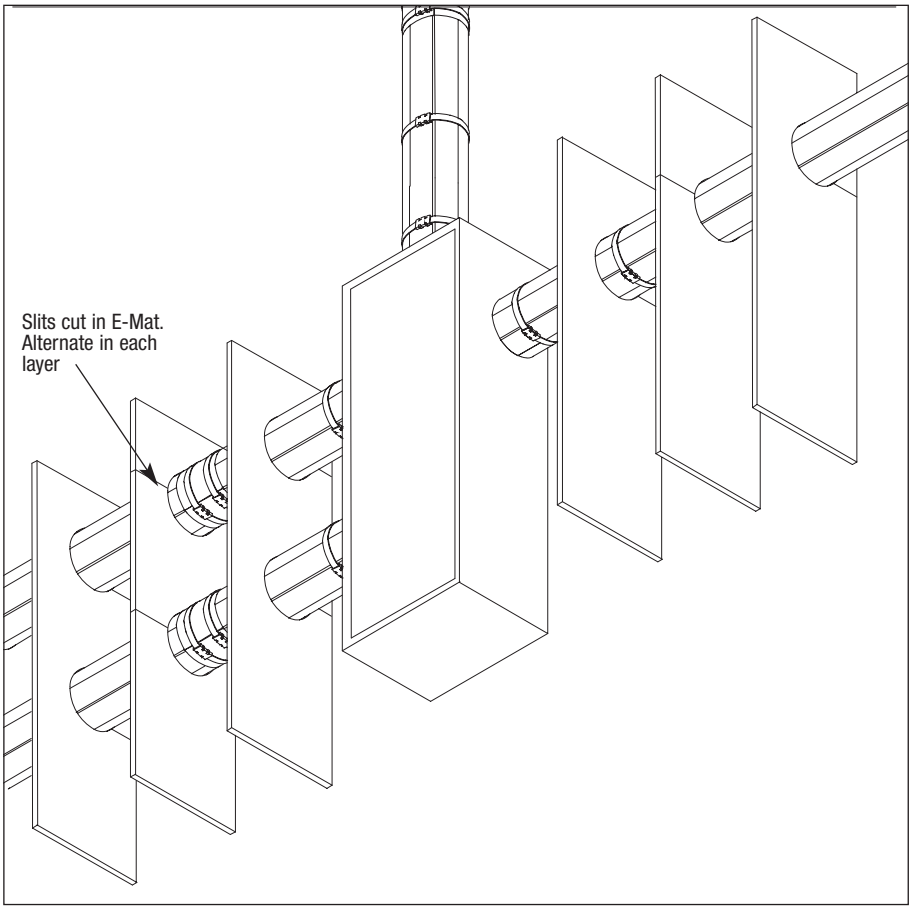


Figure 4A: Install 3M™ Interam™ Systems E-Mat on all conduit attached to circuit box first. See Figures 1, 2 and 3 for information on wrapping conduit. E-Mat on conduit should tightly abutt box.

Cut side pieces the same size as the box sides.

Cut holes in these pieces to allow passage of the wrapped conduit(s).

Cut slits in each piece to allow installation around wrapped conduit. Alternate slit location in each piece as shown.

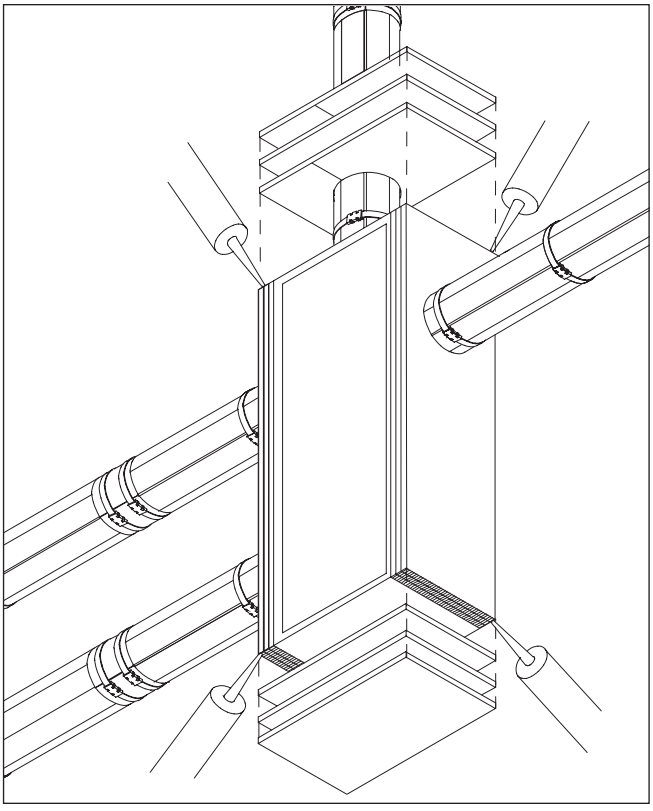
Secure mat using 3M™ 898 Filament Tape.

Figure 4B: Cut top and bottom pieces to fit over the top and bottom of the box and cover edges of E-Mat on sides of box. Cut holes in these pieces to allow passage of the wrapped conduit(s).

Cut slits in each piece that has a hole to allow installation around wrapped conduit. Alternate slit location in each piece as shown.

Apply 3M™ Fire Barrier Sealant CP 25WB+ to top and bottom edges of E-Mat on sides of box.

Install top and bottom E-Mat pieces. Secure mat using 3M™ 898 Filament Tape.



Emergency Circuit Panel - Continued

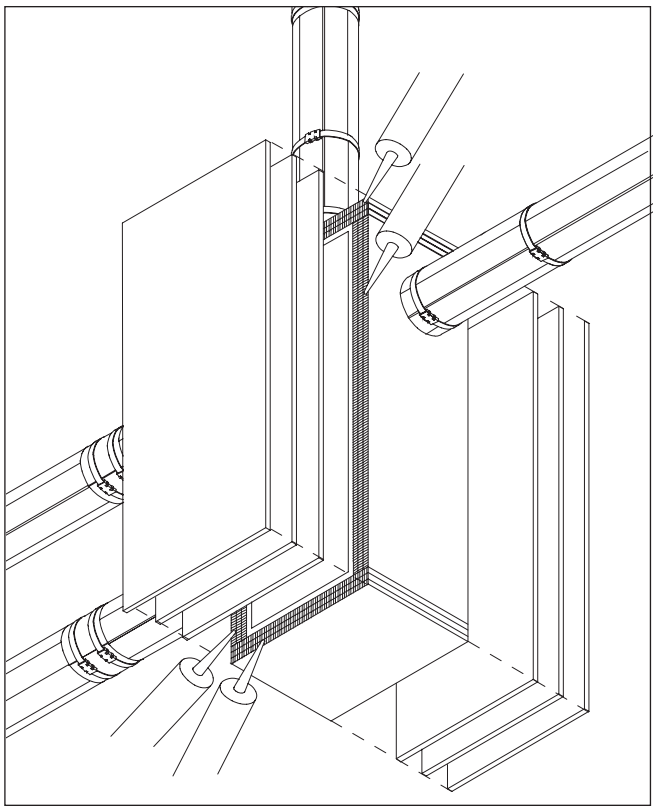


Figure 4C: Cut front and back mat pieces large enough to cover front and back of box and the edges of installed mat pieces. Apply 3M™ Fire Barrier Sealant CP 25WB+ to exposed front and back mat edges and then apply front and back mat pieces. Secure mat using 3M™ 898 Filament Tape.

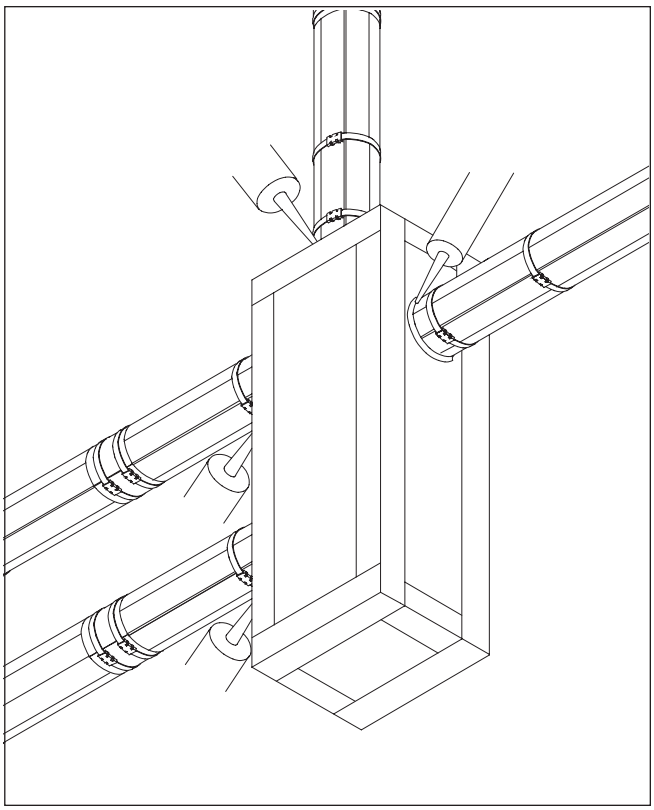


Figure 4D: Apply 3M™ 425 Sealing Tape over all exposed mat seams and caulked edges. Apply 3M™ Fire Barrier Sealant CP 25WB+ around interface between wrapped conduit and box as shown.

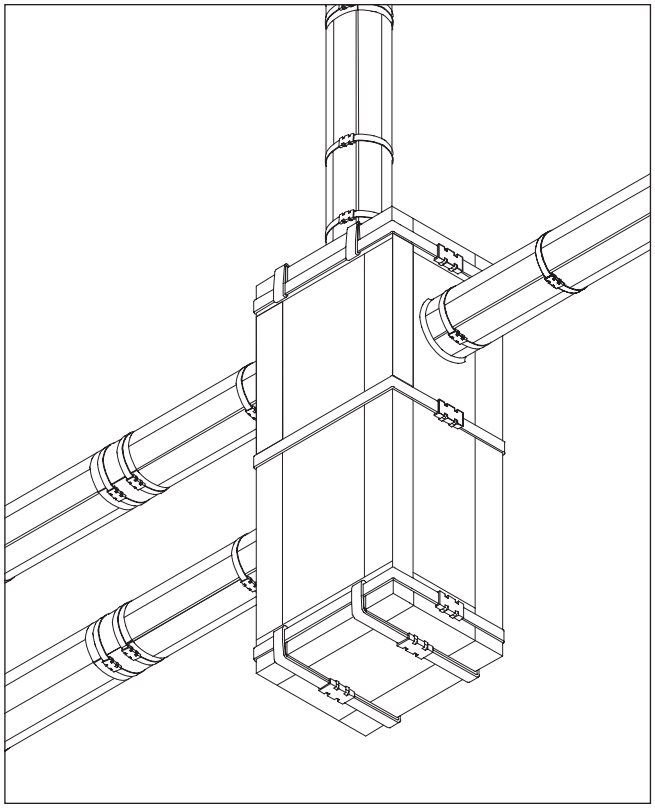


Figure 4E: Install steel banding around the box every 12 inches (30 cm) maximum and within 2 inches (5 cm) of each box edge and seam. It may be necessary to attach some banding to other bands, similar to the method shown on the bottom of the box assembly.

Cable Tray Elbow Overlap Method (Option 1)

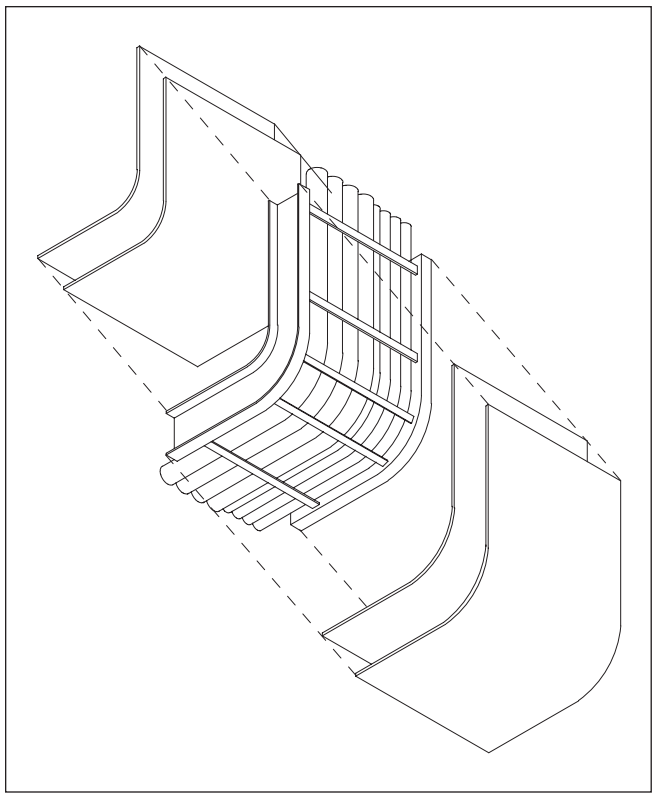


Figure 5A: Cut two 3M™ Interam™ Systems E-Mat inner and outer pieces (as shown) to the same width as the cable tray. Secure mat pieces using 3M™ 898 Filament Tape.

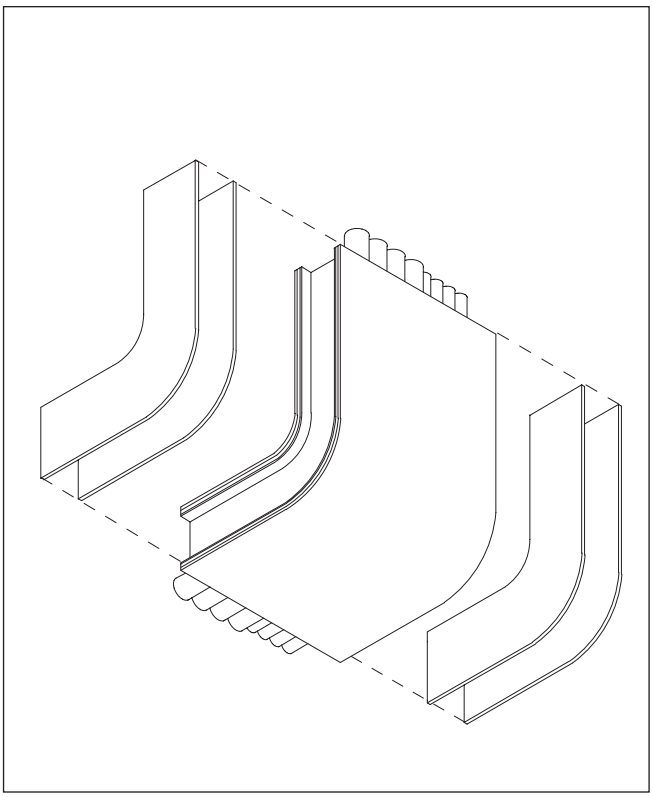


Figure 5B: Cut two E-Mat pieces for each side to fit over the cable tray sides and to cover edges of inner and outer E-Mat pieces already installed. Secure mat using 3M™ 898 Filament Tape.

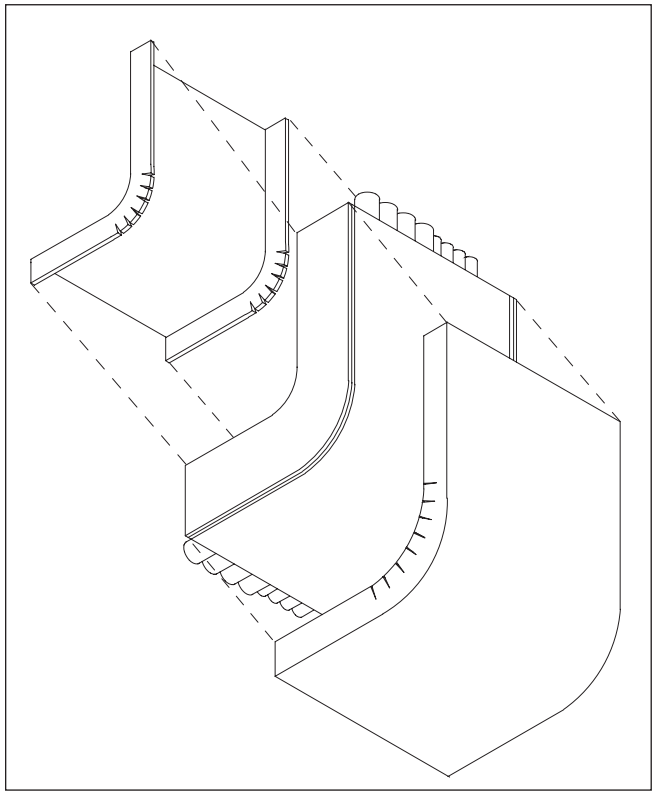


Figure 5C: Cut additional inner and outer E-Mat pieces so that they overlap onto the side pieces by at least 2 inches. (5 cm). Cut “slits” into the radius area of the overlap.

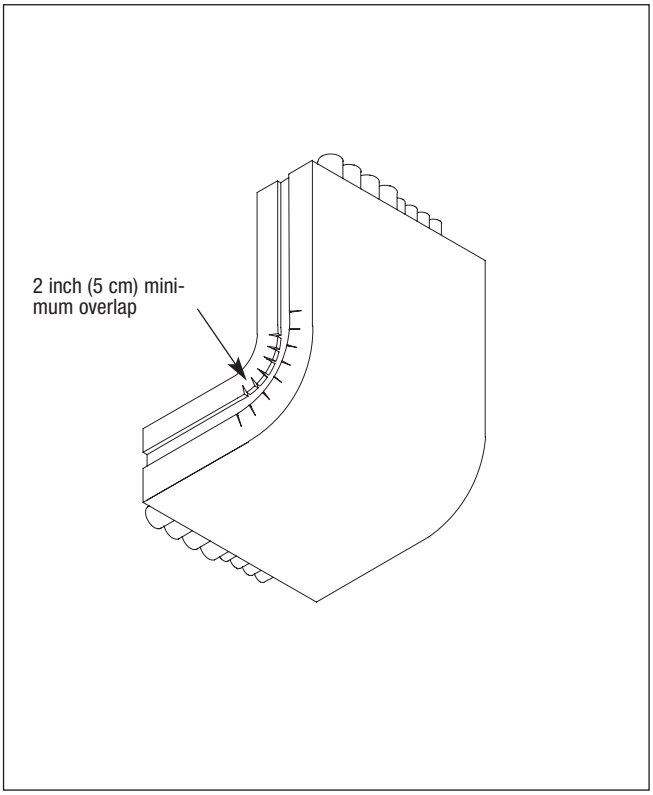


Figure 5D: Apply top and bottom E-Mat pieces as shown and secure using 3M™ 898 Filament Tape.

Cable Tray Elbow Overlap Method (Option 1)
Continued

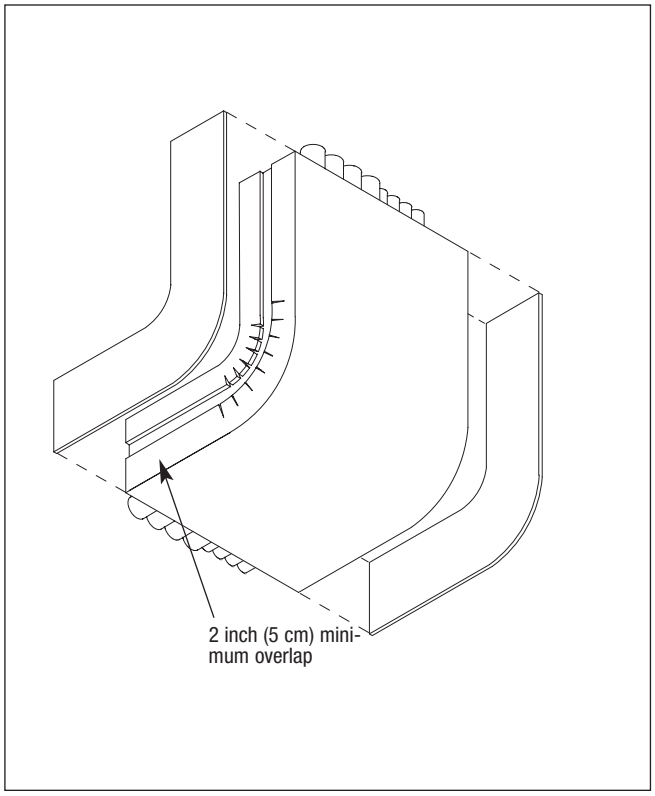


Figure 5E: Cut and install the third side layer of 3M™ Interam™ Systems E-Mat as shown. Secure mat using 3M™ 898 Filament Tape.

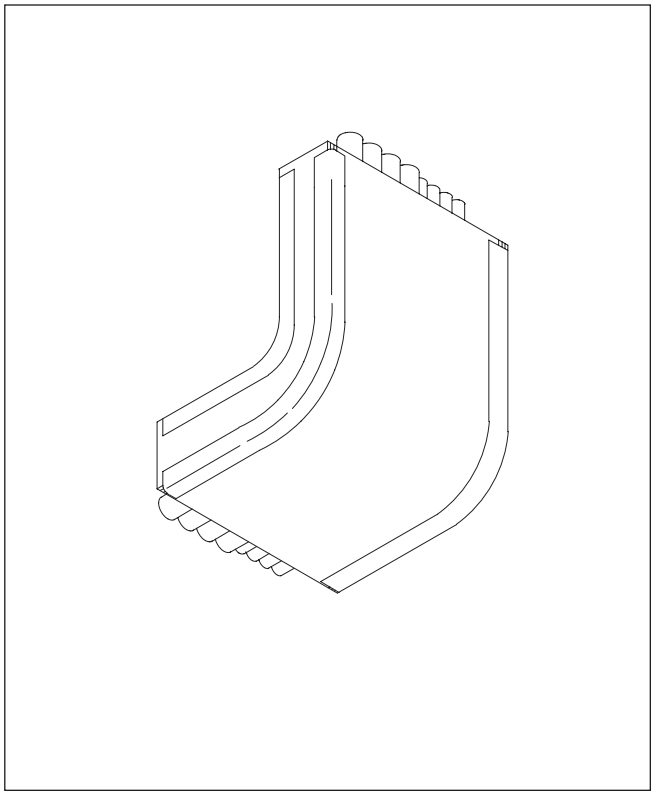


Figure 5F: Apply 3M™ 425 Sealing Tape to all E-Mat seams.

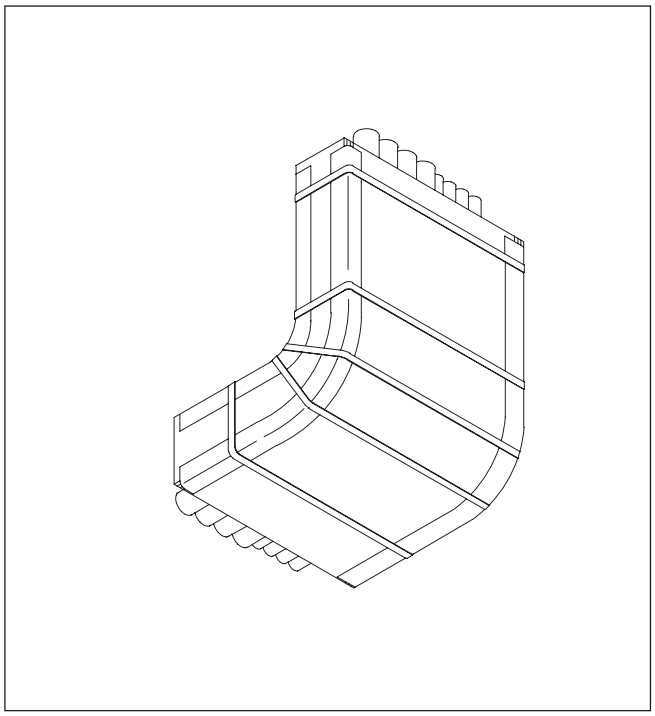


Figure 5G: Install steel banding around the cable tray every 12 inches (30 cm) maximum and within 2 inches (5 cm) of each cable tray elbow end. See Figures 7A to 7H for details regarding a transition of the cable tray elbows to cable tray straight sections.

Cable Tray Butt Joint Method (Option 2)

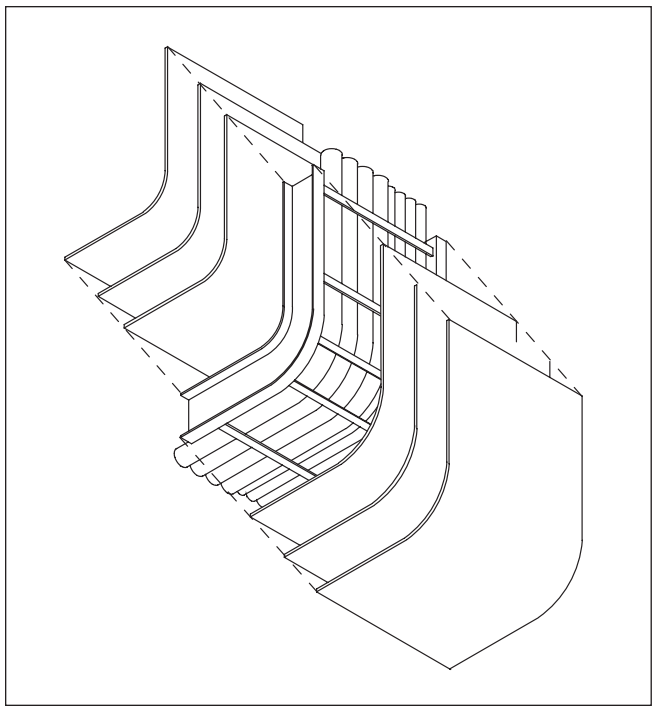


Figure 6A: Cut three 3M™ Interam™ Systems E-Mat inner and outer pieces (as shown) to the same width as the cable tray. Secure mat using 3M™ 898 Filament Tape.

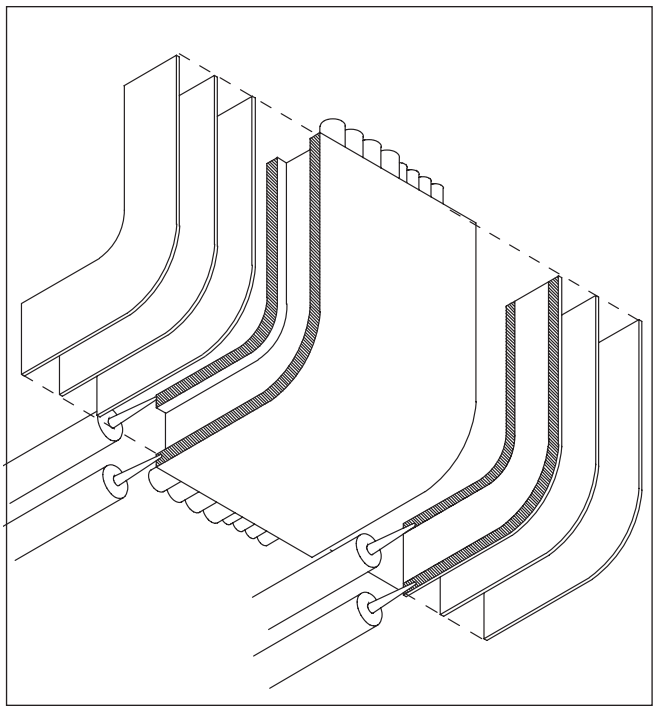


Figure 6B: Cut three pieces of E-Mat for each side of the cable tray. Cut the E-Mat pieces large enough to fit over the cable tray sides and cover edges of inner and outer wrap pieces already installed. Before installing side pieces, apply 3M™ Fire Barrier Sealant CP 25WB+ to inner and outer E-Mat edges as shown. Install sides pieces and secure using 3M™ 898 Filament Tape.

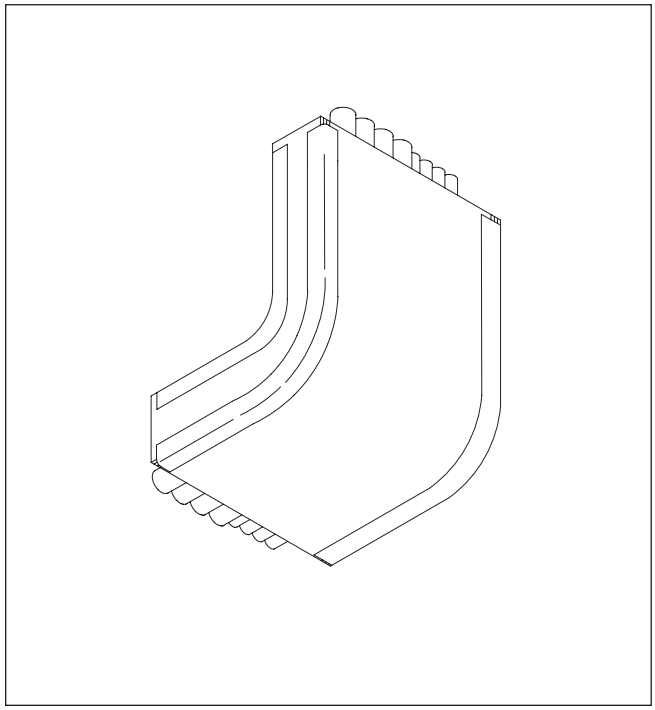


Figure 6C: Apply 3M™ 425 Sealing Tape to all E-Mat seams.

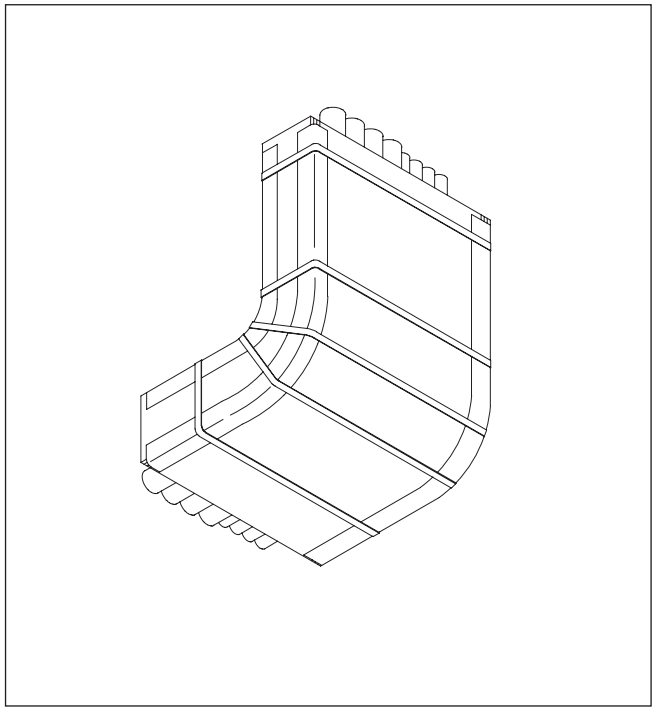


Figure 6D: Install steel banding around the cable tray every 12 inches (30 cm) maximum and within 2 inches (5 cm) of each cable tray end. See Figures 7A to 7H for details regarding a transition of the cable tray elbow to a cable tray straight section.

Cable Tray Elbow to Straight Section

Butt Joint and Offset Methods

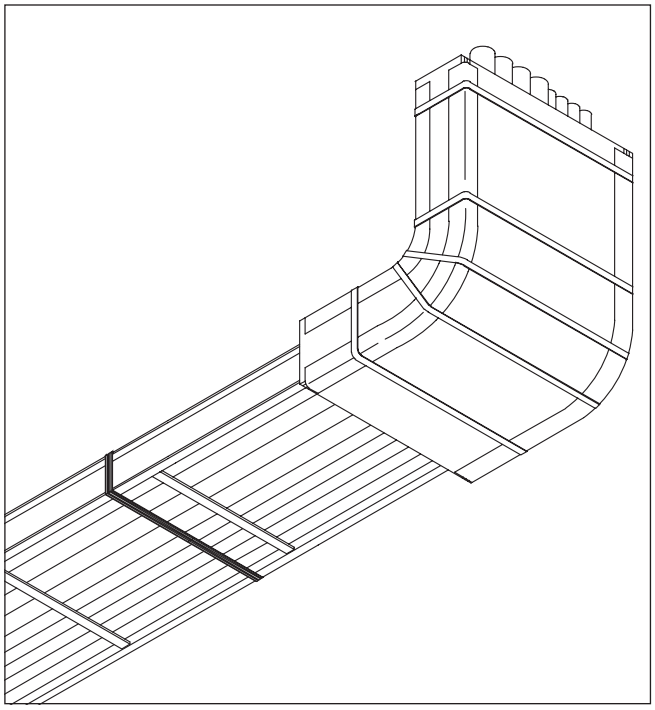


Figure 7A: Install 3M™ Interam™ Systems E-Mat to cable tray elbow sections following steps 5A to 5G or steps 6A to 6D.

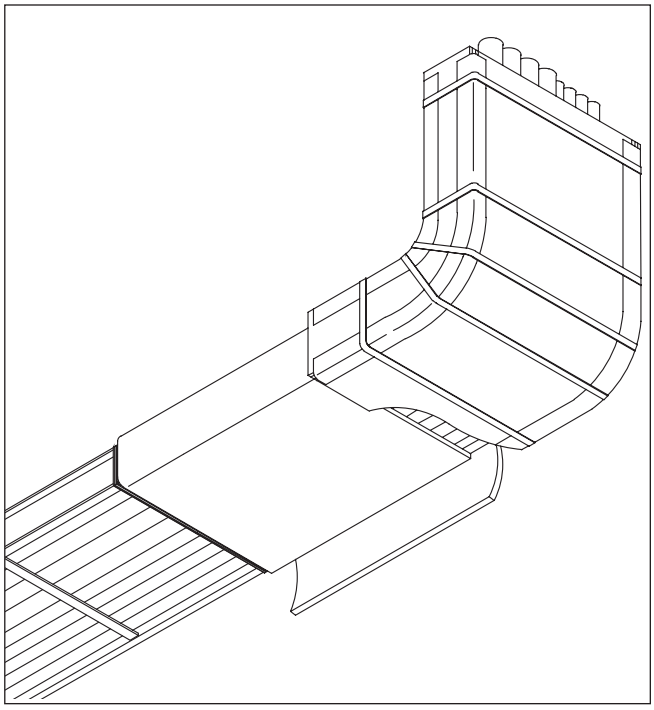


Figure 7B: Wrap first layer of E-Mat around the cable tray straight section. Complete the layer with a 2 inch (5 cm) minimum overlap. Secure mat using 3M™ 898 Filament Tape.

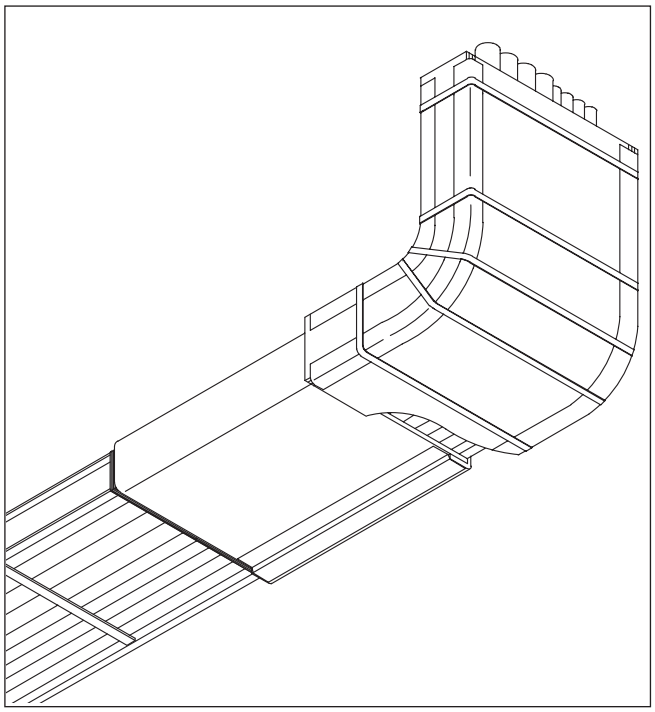


Figure 7C: Apply 3M™ 425 Sealing Tape to exposed E-Mat seam.

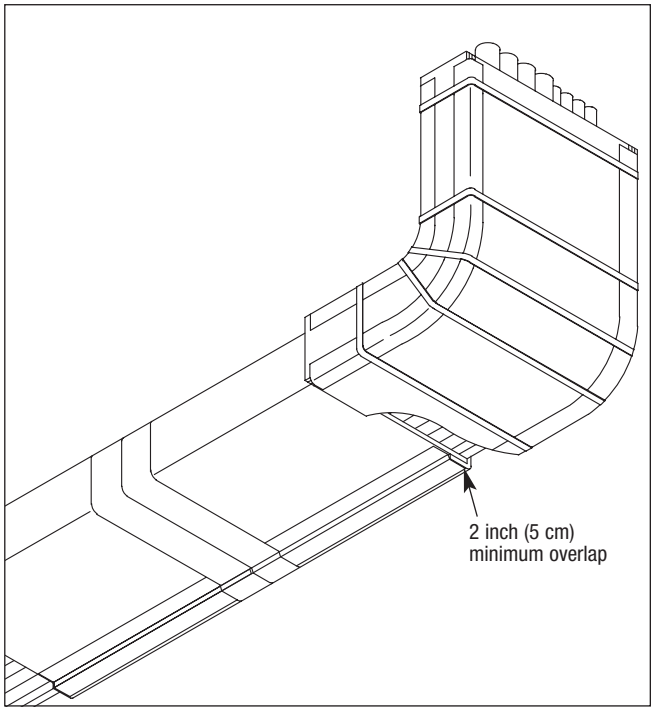


Figure 7D: Install adjacent piece of E-Mat tightly abutted to first piece. Cover the seams and exposed edges at overlap with 3M™ 425 Sealing Tape.

Cable Tray Elbow to Straight Section - Continued

Butt Joint and Offset Methods

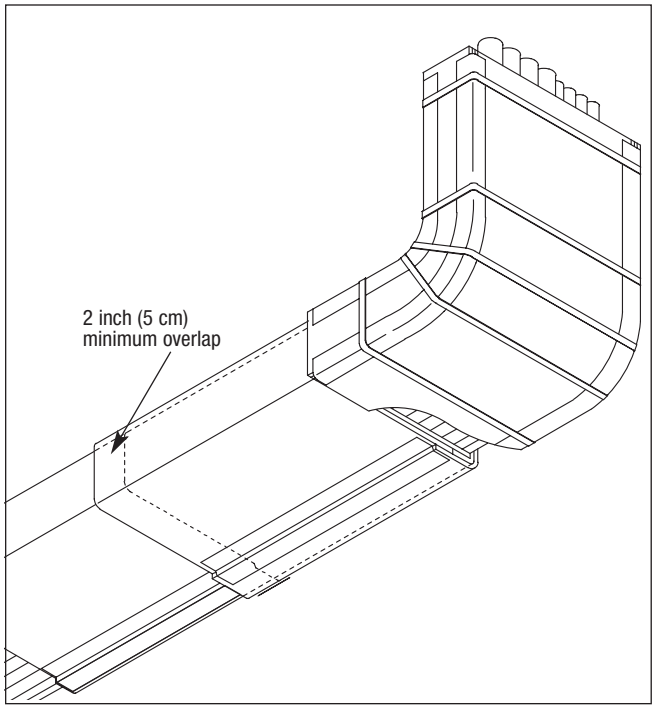


Figure 7E: Install the second layer and each additional layer with a 2 inch (5 cm) minimum overlap of the seam in the previous layer.

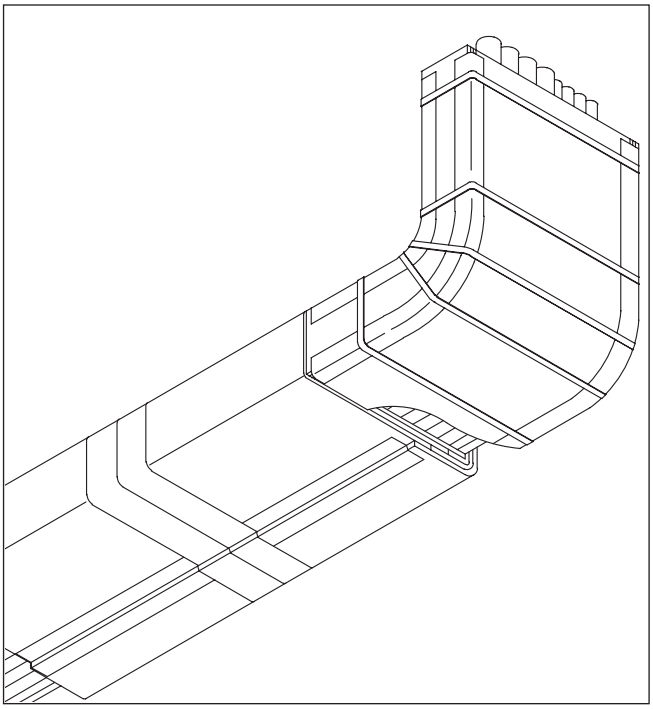


Figure 7F: Apply 3M™ 425 Sealing Tape over all mat edges and seams.

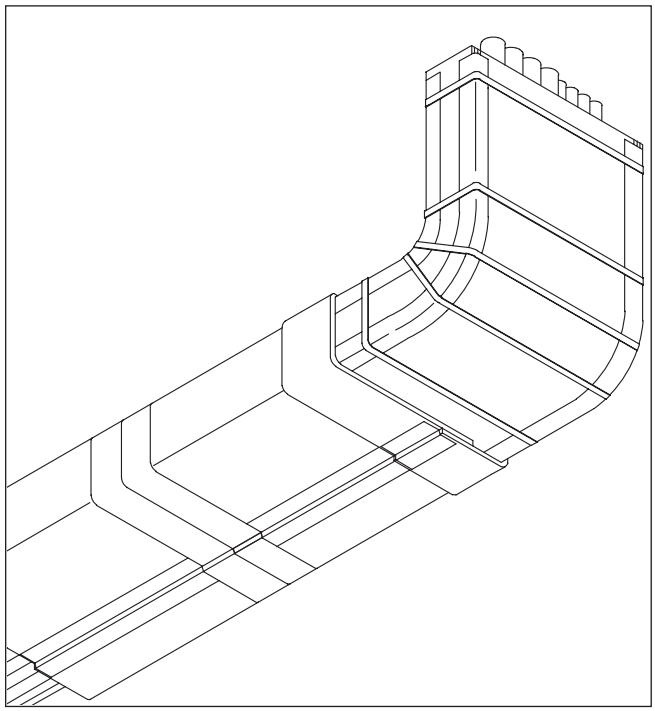


Figure 7G: At the interface between the end of the elbow section and straight section, install a 4 inch (10 cm) wide E-Mat collar centered over the seam with a 2 inch (5 cm) overlap. Secure the mat collar using 3M™ 425 Sealing Tape.

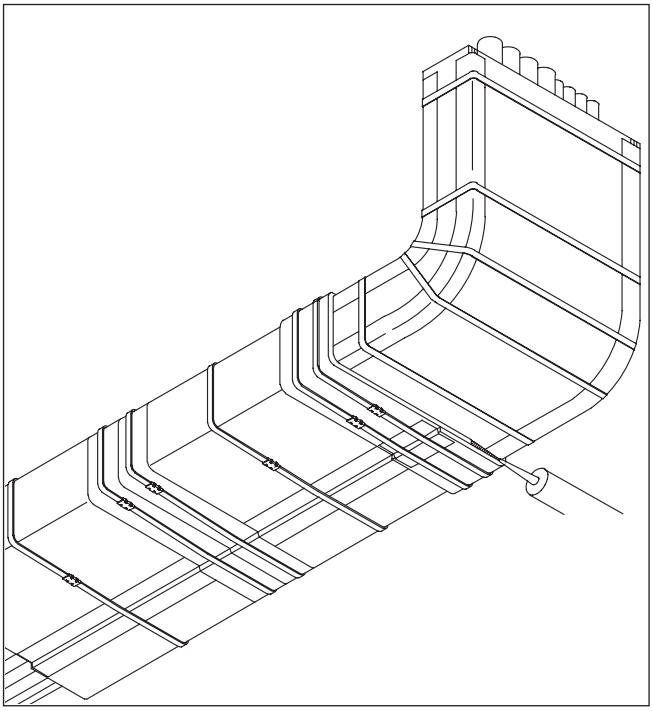


Figure 7H: Apply 3M™ Fire Barrier Sealant CP 25WB+ to fill any gaps between the collar and the E-Mat sections underneath it. Apply steel banding within 2 inches (5 cm) of each collar edge, and at 12 inches (30 cm) maximum throughout the system.

Cable Tray Straight Section

System Details

A. Electrical Raceway Configuration:
   1. Cable tray/straight run
   2. Size/material: 4 in. by 24 in. (10 cm x 61 cm) ladder back or closed cable tray

B. 3M System Description
   1. Hourly Rating: 1 Hour
   2. Mat Thickness on Cable Tray (Layers): 0.8 in. (30 mm) thick (2 layers of E Mat 4)
   3. Mat Seams: 2 in. (5 cm) offset between layers
   4. Layer Technique: 2 in. (5 cm) overlap per layer around cable tray
   5. Tape: 3M™ 425 Tape or T-49 Tape
   6. Restraining System: Stainless steel bands 12 in. (30,5 cm) on centers and within 2 in. 5 cm) of each exposed mat edge.

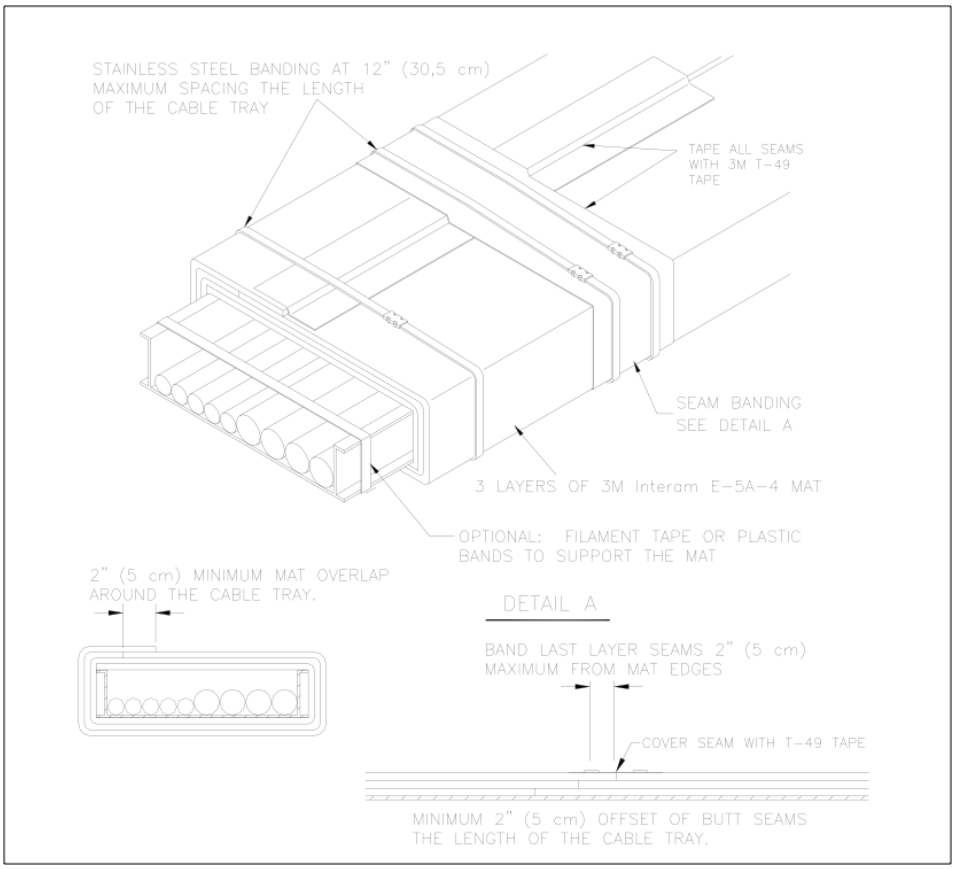
Application Details

A. Optional: Filament tape or non-conductive (plastic for example) banding can be put around the cable tray at 8-12 in. (20-30 cm) spacing prior to mat installation to minimize sagging of the mat on open top cable trays.

B. Apply 2 layers of E Mat to the cable tray. There must be a 2 in. (5 cm) minimum overlap per layer. There must also be a 2 in. (5 cm) minimum mat seam offset between adjacent mat sections along the length of the cable tray.

C. Tape all mat seams on all layers with 425 Sealing Tape or T-49 Aluminum Foil Tape.

D. Restrain the last layer with stainless steel banding spaced at 12 in. (30,5 cm) maximum spacing the length of the cable tray. Be sure to place stainless steel banding within 2 in. (5 cm) of each exposed mat edge.



Warranty and Limited Remedy: This product will be free from defects in material and manufacture for a period of ninety (90) days from date of purchase. 3M MAKES NO OTHER WARRANTIES INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. User is responsible for determining whether the 3M product is fit for a particular purpose and suitable for user's method of application. If this 3M product is proved to be defective within the warranty period stated above, your exclusive remedy and 3M's sole obligation shall be, at 3M's option, to replace or repair the 3M product or refund the purchase price of the 3M product. **Limitation of Liability:** Except where prohibited by law, 3M will not be liable for any loss or damages arising from the use of this 3M product, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability.

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98-0212-2288-4

3M™ Fire Protection Products
Interam™ E-Mat Solutions Package

Environmental Testing

3M

File R9700
Project 11CA05718
Project 11NK10639
Project 12CA26159
Project 12Nk07584

Issued: April 30, 2011
Revised: June 11, 2012

REPORT

On

MAT MATERIALS (CEAV)

Under The

CLASSIFICATION PROGRAM

3M COMPANY
ST. PAUL, MN 55144

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DESCRIPTION

PRODUCT COVERED

Mat Materials (CEAV) – Type E-54A, E-5A-4 or E-54C

GENERAL

These products are Classified as to fire resistance, and are intended for use only in specific fire resistive designs where specified in UL’s Fire Resistance Directory.

Refer to UL’s Fire Resistance Directory or UL’s Online Certifications Directory for detailed design information and definitions relative to fire resistance design ratings and the intended use of the products covered herein.

PRACTICABILITY

The materials used in the test assemblies were readily installed by qualified workmen with tools and methods commonly used for construction of this nature.

Material and procedures, in accordance with those described in this report, are considered significant factors in the fire resistance of the construction.

TEST RECORD SUMMARY:

The results of this investigation including construction review and testing indicate that the construction evaluated complies with the applicable requirements of the Standard, UL 1709 Standard For Rapid Rise Fire Tests Of Protection Materials For Structural Steel, Fourth Edition, Issue Date August 03, 2011. Therefore, such products are judged eligible to bear UL's Mark as described on the Conclusion Page of this Report. As a result of this investigation Design XR202 will be revised to make the cladding system optional and add the optional acid and solvent spray exposures. Additionally, Design X206 will have exterior exposure and the acid and solvent spray exposures added.

Report by:

Michael Manrique
Engineering Associate

CONCLUSION:

A sample of the product covered by this Report has been found to comply with the requirements covering the category and the product is found to comply with UL's applicable requirements. The description and test result in this Report are only applicable to the sample(s) investigated by UL and does not signify UL certification or that the product(s) described are covered under UL's Follow-Up Service Program. When covered under UL's Follow-Up Service Program, the manufacturer is authorized to use the UL Classification Mark on such products which comply with UL's Follow-Up Service Procedure and any other application requirements of Underwriters Laboratories Inc. The Classification Mark of Underwriters Laboratories Inc. on the product, or the UL symbol on the product and the Classification Mark on the smallest unit container in which the product is packaged, is the only method to identify products investigated by UL to published requirements and manufactured under UL's Classification and Follow-Up Service.

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Test Record by:

MONICA KEELER
Staff Engineer
Building Materials and Systems

PATRICK A. ZEEVELD
Staff Engineer
Building Materials and Systems

Reviewed by:

KENNETH RHODES
Senior Staff Engineer
Building Materials and Systems

STUDY FOR CLASSIFICATION

The following table shows the endpoint time for each mini tube sample.

Tube Number	Conditioning	Location	End Point Time (Min.)
1	Control - Lower	Lower northwest	151
2	Aging 135 days	Lower southeast	152
3	180 day High Humidity	Upper northeast	128
4	Industrial Atmosphere	Lower northeast	146
5	Salt Spray	Upper southeast	130
7	Wet, Freeze, Dry	Lower southwest	169
8	Acid Spray	Lower middle	128
9	Solvent Spray	Upper southwest	153
10	Control - Upper	Upper northwest	125

In order to be considered acceptable performance, the time for the test specimens exposed to the simulated environmental conditions to reach an average temperature of 1000°F or an individual temperature of 1200°F at any location, shall not be less than 75% of the time required for test specimens not exposed to the simulated environmental conditions to reach the average temperature of 1000°F or a temperature of 1200°F at any location.

The end point times with respect to the control are shown in the table below.

Tube Number*	Conditioning	Percent of Control on Same Level
1	Control - Lower	-
2	Aging 135 days	100
3	180 day High Humidity	102
4	Industrial Atmosphere	97
5	Salt Spray	104
7	Wet, Freeze, Dry	112
8	Acid Spray	85
9	Solvent Spray	122
10	Control - Upper	-

*Tube 6 was prepared but not tested.

All exposed samples meet the acceptance criteria for the environmental evaluation.

3M™ Fire Protection Products
Interam™ E-Mat Solutions Package

Resistance To Fire Listings

3M

3M™ Fire Protection Products
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Industry Fire Test Standard

3M

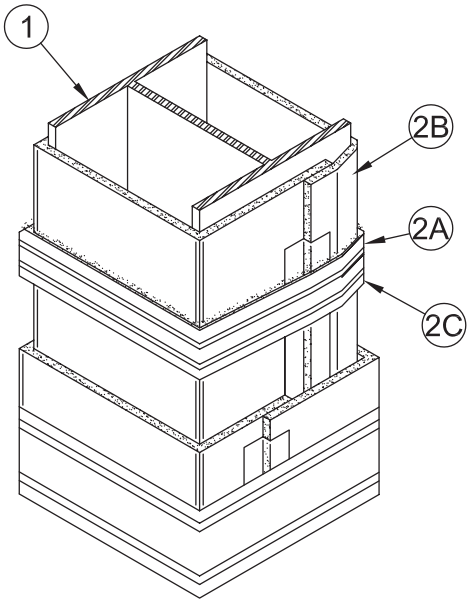
Test Standard	Title	Link
ASTM E119 (Similar to UL 263)	Standard Test Methods For Fire Tests Of Building Construction And Materials	http://www.astm.org/Standards/E119.htm
ASTM E1529 (Similar to UL 1709)	Standard Test Methods for Determining Effects of Large Hydrocarbon Pool Fires on Structural Members and Assemblies	http://www.astm.org/Standards/E1529.htm
ASTM E1725	Standard Test Methods for Fire Tests of Fire-Resistive Barrier Systems for Electrical System Components	http://enterprise.astm.org/filtrexx40.cgi?+REDLINE_PAGES/E1725.htm
ASTM E814	Standard Test Method for Fire Tests of Penetration Firestop Systems	http://enterprise.astm.org/filtrexx40.cgi?+REDLINE_PAGES/E814.htm
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials	http://enterprise.astm.org/filtrexx40.cgi?+REDLINE_PAGES/E84.htm
BS 6425 (Similar to IEC 60754-1)	Test on gases evolved during the combustion of materials from cablesMethod for determination of amount of halogen acid gas evolved during combustion of polymeric materials taken from cables	http://shop.bsigroup.com/ProductDetail/?pid=000000000000222381
BS EN 1356-4 (Application Standard-Fire Resistance of Columns ie Structural Steel)	Fire resistance tests for loadbearing elements Columns	http://shop.bsigroup.com/ProductDetail/?pid=000000000019969906
BS EN 1363-1 (Fire Exposure Standard-Cellulosic Fire)	Fire resistance tests General requirements	http://shop.bsigroup.com/ProductDetail/?pid=000000000019969914
BS EN 1363-2 (Fire Exposure Standard-Hydrocarbon Fire)	Fire resistance tests Alternative and additional procedures	http://shop.bsigroup.com/ProductDetail/?pid=000000000019969922
GL 86-10 Supplement 1 (Nuclear “Standard”)	Implementation of Fire Protection Requirements (Generic Letter No. 86-10)	http://www.nrc.gov/reading-rm/doc-collections/gen-comm/gen-letters/1986/gl86010.html
IEC 60331 Part 1	Tests for electric cables under fire conditions - Circuit integrity - Part 1: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter exceeding 20 mm	http://webstore.iec.ch/webstore/webstore.nsf/standards/IEC%2060331-1!opendocument
IEC 60332 Part 1 & 3	Tests on electric and optical fibre cables under fire conditions - Part 1-3: Test for vertical flame propagation for a single insulated wire or cable - Procedure for determination of flaming droplets/particles	http://webstore.iec.ch/webstore/webstore.nsf/standards/IEC%2060332-1-3!opendocumenthttp://webstore.iec.ch/webstore/webstore.nsf/standards/IEC%2060332-1-3!opendocument
IEC 60754-1	Test on gases evolved during combustion of materials from cables - Part 1: Determination of the halogen acid gas content	http://webstore.iec.ch/Webstore/webstore.nsf/ArtNum_PK/45786!opendocument&preview=1
IEC 60754-2	Test on gases evolved during combustion of materials from cables - Part 2: Determination of acidity (by pH measurement) and conductivity	http://webstore.iec.ch/webstore/webstore.nsf/artnum/045787!opendocument
IEC 61034	Measurement of smoke density of cables burning under defined conditions - Part 1: Test apparatus	http://webstore.iec.ch/webstore/webstore.nsf/artnum/034053
IEEE 1717	IEEE Standard for Testing Circuit Integrity Cables Using a Hydrocarbon Pool Fire Test Protocol	http://ieeexplore.ieee.org/Xplore/defdeny.jsp?url=http%3A%2F%2Fieeexplore.ieee.org%2Fstamp%2Fstamp.jsp%3Ftp%3D%26arnumber%3D6166936%26userType%3Dinst&denyReason=-133&arnumber=6166936&productsMatched=null&userType=inst
IEEE P848	Standard Procedure for the Determination of the Ampacity Derating Factor for Fire-Protected Cable Systems	https://standards.ieee.org/develop/project/848.html
ISO 13702	Petroleum and natural gas industries -- Control and mitigation of fires and explosions on offshore production installations -- Requirements and guidelines	http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=22675
ISO 22899	Determination of the resistance to jet fires of passive fire protection materials -- Part 1: General requirements	http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=39750
ISO 4589-2	Determination of burning behaviour by oxygen index -- Part 2: Ambient-temperature test	http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=20403
ISO 4589-3	Determination of burning behaviour by oxygen index -- Part 3: Elevated-temperature test	http://www.iso.org/iso/iso_catalogue/catalogue_ics/catalogue_detail_ics.htm?csnumber=16963
NFPA 290	Standard for Fire Testing of Passive Protection Materials for Use on LP-Gas Containers	http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=290
NFPA 58 Appendix H	NFPA 58: Liquefied Petroleum Gas Code. Appendix H: Procedure for Torch Fire and Hose Stream Testing of Thermal Insulating Systems for LP-Gas Containers	https://law.resource.org/pub/us/cfr/ibr/004/nfpa.58.2001.html
UL 1709 (Similar to ASTM E1529)	“Rapid Rise Fire Tests of Protection Materials for Structural Steel	http://ulstandardsinfonet.ul.com/scopes/scopes.asp?fn=1709.html
UL 1724	Fire Tests for Electrical Circuit Protective Systems	http://ulstandardsinfonet.ul.com/tocs/tocs.asp?doc=o&fn=o1724.toc
UL 2196	Tests for Fire Resistive Cables	http://ulstandardsinfonet.ul.com/scopes/scopes.asp?fn=2196.html
UL 263 (Similar to ASTM E119)	Fire Tests of Building Construction and Materials	http://ulstandardsinfonet.ul.com/scopes/scopes.asp?fn=0263.html

3M™ Fire Protection Products
Interam™ E-Mat Solutions Package

Structural Steel

Design No. X206

July 13, 2012
Ratings – 1/2, 3/4, 1, 1-1/2, 2, 3 and 4 Hr.



1. **Steel Column** – Min size of column W10x49.
2. **Mat Materials*** – The column protection assembly consists of endothermic mat, aluminum foil tape, and aluminum cladding. The details of the column assembly are summarized below:
   A. **Mat Materials* – Endothermic Mat** – Flexible mat supplied in rolls. Each layer of foil-faced mat installed by cutting to size and tightly wrapping around the column and itself such that a min 2 in. overlap is present along the vertical seam. Seam are located on the column flange. Sections are temporarily held in place with several strips of 3M Type 898 filament tape (approx. 24 in. long). Adjacent sections of material on the same layer abut one another forming the circumferential edge seam. Successive layers of mat installed in same manner with butted end seams offset a min 2 in. from butted end seams of preceding layer. For single layer construction only, a 4 in. wide endothermic mat collar is wrapped around each taped circumferential butt joint with a 2 in. overlap on itself. Circumferential edges of collar are sealed with foil tape. Stainless steel bands are applied as described under Item 2C. All seams in each layer of mat to be sealed with foil tape (Item 2B) prior to installation of subsequent layer of mat or collars. The hourly rating of the column assembly is dependent upon the number of endothermic mat layers as shown in the following table:

Minimum Layers of Endothermic Mat Material	Hr Fire Rating
1	1/2
1	3/4
1	1
2	1-1/2
2	2
3	3
4	4

   3M COMPANY
   3M FIRE PROTECTION PRODUCTS – Interam™ Types E-54A, E-5A-4 or E-54C.

   B. **Aluminum Foil Tape*** – (Shown at vertical seam but not shown at butt joints, collars or cladding for clarity) Nom 4 in. wide pressure-sensitive aluminum foil tape supplied in rolls. Used to secure the vertical overlap and circumferential butt joint seams of the endothermic mat (Item 2A).

   3M COMPANY
   3M FIRE PROTECTION PRODUCTS – Type 425

   C. **Steel Banding Straps** – Min 1/2 in. wide by 0.020 in. thick stainless steel banding straps used in conjunction with No. 26 gauge galv steel wing-type crimp clips. Steel banding straps installed at the center and 2 in. from end of mat sections. Steel banding straps applied approx. 1 in. from edges of collars. Steel banding straps installed at the center and 1 in. from top and 1-1/2 in. from bottom of each section.

   D. **Fill, Void or Cavity Material – Caulk*** – (Not Shown) Thick bead of caulk to be applied as a gasket between the endothermic mat (Item 2A) and the floor or ceiling surface. The bead of caulk applied around entire perimeter of endothermic mat at interface of floor or ceiling surface prior to and after each layer of mat material and after installation of the cladding.

   3M COMPANY
   3M FIRE PROTECTION PRODUCTS – Type CP 25WB+ or FB 3000 WT.

*Bearing the UL Classification Mark

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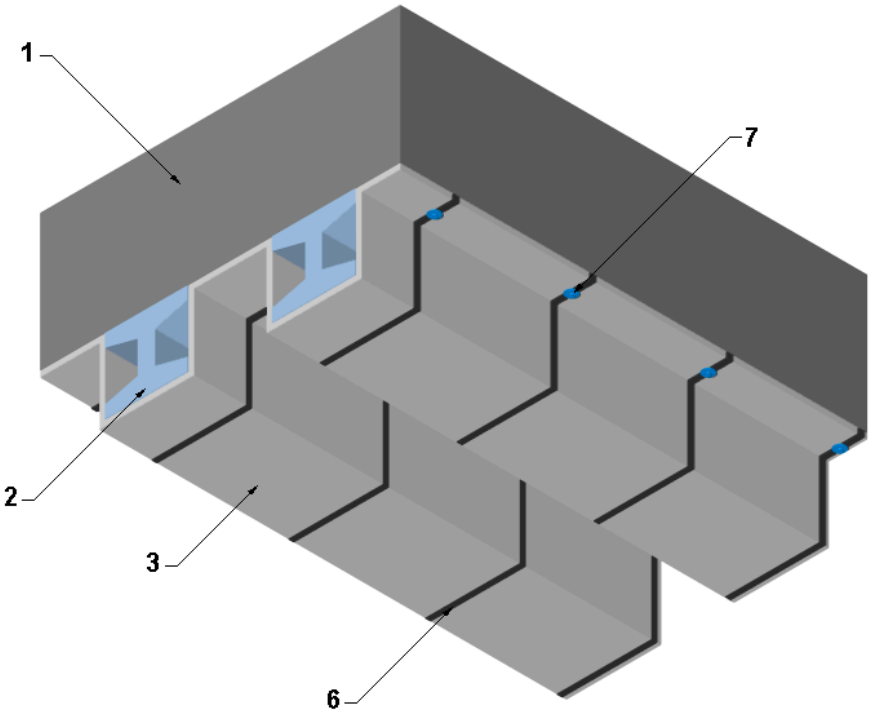
Design Number 3MU/AF 240-02

August 30, 2012
APPLIED FIREPROOFING
3M Company
3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat
3M Fire Barrier CP 25WB+ Caulk
ASTM E 119
Restrained or Unrestrained Beam Rating: 4 Hours



1. CONCRETE FLOOR: Use normal or lightweight concrete floor with minimum compressive strength of 109 pcf having a minimum depth of 12 in.
2. STEEL BEAM: Use minimum W8x48 W-Shaped steel beam.
3. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Applied Fireproofing

   MODEL: 3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat

   ENDOTHERMIC MAT: Install 1 layer of foil faced flexible mat around steel beam (Item 2). Cut length of endothermic mat to ensure minimum 4 in. overlap onto concrete floor (Item 1) adjacent to steel beam (Item 2). Tightly butt joints of endothermic mat and seal joints with foil tape (Item 5).
4. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Caulk or Sealant

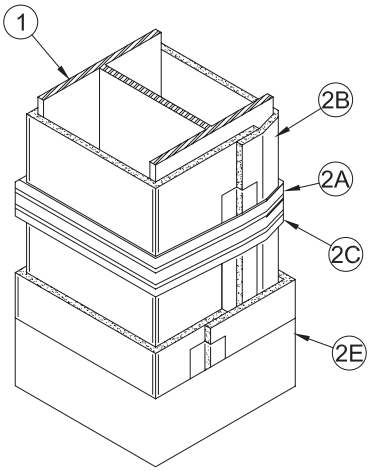
   MODEL: 3M Fire Barrier CP 25WB+ Caulk

   CAULK (Not shown): Fill any gaps between concrete floor and endothermic mat (Item 3) with caulk.
5. TAPE: (Not Shown) Apply 4 in. wide pressure sensitive tape with aluminum foil facing to all butt joints of the endothermic mat (Item 3).
6. STEEL BANDING: Install 1/2 in. wide x 0.020 in. thick stainless steel banding around endothermic mat (Item 3) and secure into concrete using fasteners (Item 7). Space banding max. 12 in. oc.
7. FASTENER: Secure endothermic mat (Item 3) and steel banding (Item 6) to concrete floor (Item 1) using min. 1/4 in. concrete anchors inserted through 1 in. diameter fender washer.

This material was extracted and drawn by 3M Fire Protection Products from the 2012 Product Directory, © Intertek

Design No. XR202

July 13, 2012
Rating – 1/2, 3/4, 1, 1-1/2, 2, 3 and 4 Hr.



1. **Steel Column** – Min size of column W10x49.
2. **Mat Materials*** – The column protection assembly consists of endothermic mat, aluminum foil tape, and aluminum cladding. The details of the column assembly are summarized below:

   A. **Mat Materials* – Endothermic Mat** – Flexible mat supplied in rolls. Each layer of foil-faced mat installed by cutting to size and tightly wrapping around the column and itself such that a min 2 in. overlap is present along the vertical seam. Seams to be located on the column flange. Sections are temporarily held in place with several strips of 3M Type 898 filament tape (approx. 24 in. long). Adjacent sections of material on the same layer abut one another forming the circumferential edge seam. Successive layers of mat installed in same manner with butted end seams offset a min 2 in. from butted end seams of preceding layer. For single layer construction only, a 4 in. wide endothermic mat collar is wrapped around each taped circumferential butt joint with a 2 in. overlap on itself. Circumferential edges of collar are sealed with foil tape. Stainless steel bands are applied as described under Item 2C. All seams in each layer of mat to be sealed with foil tape (Item 2B) prior to installation of subsequent layer of mat or collars. The hourly rating of the column assembly is dependent upon the number of endothermic mat layers as shown in the following table:

Minimum Layers of Endothermic Mat Material	Hr Fire Rating
1	1/2
1	3/4
2	1
2	1-1/2
3	2
3	3
4	4

   3M COMPANY
   3M FIRE PROTECTION PRODUCTS – Interam™ Types E-54A, E-5A-4 or E-54C.

   B. **Aluminum Foil Tape*** – (Shown at vertical seam but not shown at butt joints, collars or cladding for clarity) Nom 4 in. wide pressure-sensitive aluminum foil tape supplied in rolls. Used to secure the vertical overlap and circumferential butt joint seams of the endothermic mat (Item 2A) and joints in the aluminum cladding (Item 2E).

   3M COMPANY
   3M FIRE PROTECTION PRODUCTS – Type 425.

   C. **Steel Banding Straps** – Min 1/2 in. wide by 0.020 in. thick stainless steel banding straps used in conjunction with No. 26 gauge galv steel wing-type crimp clips. Steel banding straps installed at the center and 2 in. from end of mat sections. Steel banding straps applied approx. 1 in. from edges of collars. Steel banding straps installed at the center and 1 in. from top and 1-1/2 in. from bottom of cladding sections.

   D. **Fill, Void or Cavity Material – Caulk*** – (Not Shown) Thick bead of caulk to be applied as a gasket between the endothermic mat (Item 2A) and the floor or ceiling surface. The bead of caulk applied around entire perimeter of endothermic mat at interface of floor or ceiling surface prior to and after each layer of mat material and after installation of the cladding.

   3M COMPANY
   3M FIRE PROTECTION PRODUCTS – Type CP 25WB+, or FB 3000 WT.

   E. **Aluminum Cladding Jacket** – After installation of the mats, collars, foil tape and steel banding straps, aluminum corner cladding pieces with nominal 12 in. wide legs, 36 in. long and min No. 27 gauge (0.014 in.) thick installed and overlapped on each other to cover column and form outer jacket. Adjacent lengths of cladding to overlap the preceding length a min of 2 in. Cladding jacket secured in place with steel banding straps as noted under Item 2C. All seams of cladding material to be sealed with foil tape after banding has been installed.

   F. **Stainless Steel Cladding Jacket** – (Alternate to Aluminum Cladding Jacket, Item E) - After installation of the mats, nominal 36 in. wide by minimum 0.009 in. thick stainless steel jacket wrapped around endothermic mat and lapping itself approximately 6 in. Adjoining lengths of stainless steel jacket to overlap a minimum of 4 in. Stainless steel jacket secured in place with steel banding straps (item 2C) spaced max. 12 in. OC and max. 1 in. from all seams.

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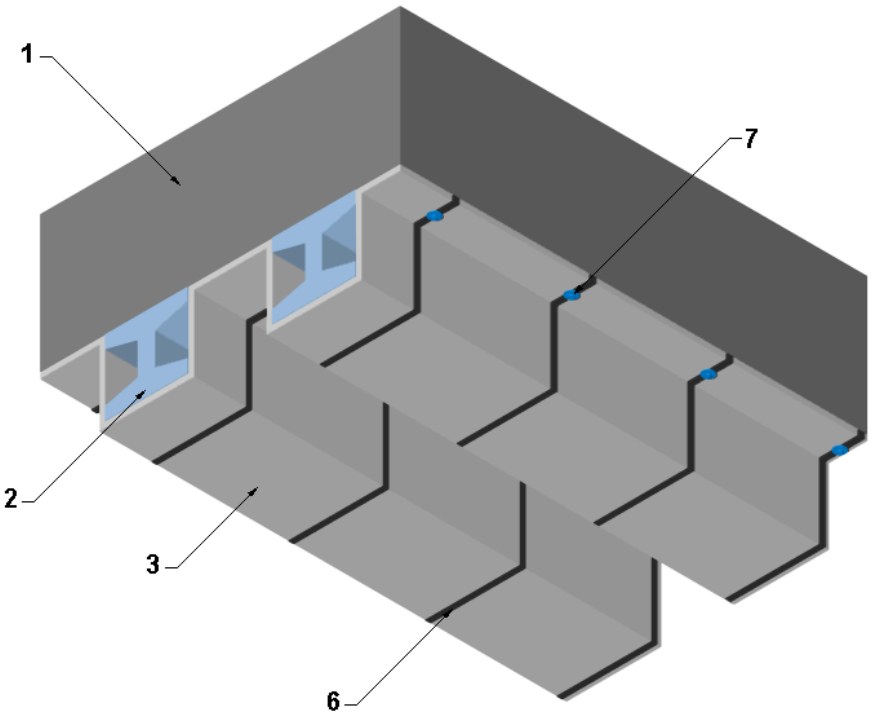
Design Number 3MU/AF 240-01

August 30, 2012
APPLIED FIREPROOFING
3M Company
3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat
3M Fire Barrier CP 25WB+ Caulk
ASTM E 1529 (Hydrocarbon Exposure)
ASTM E 119 (2012)
Restrained or Unrestrained Beam Rating: 4 Hours



1. CONCRETE FLOOR: Use normal or lightweight concrete floor with minimum compressive strength of 109 pcf having a minimum depth of 12 in.
2. STEEL BEAM: Use minimum W8x48 W-Shaped steel beam.
3. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Applied Fireproofing

   MODEL: 3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat

   ENDOTHERMIC MAT: Install 1 layer of foil faced flexible mat around steel beam (Item 2). Cut length of endothermic mat to ensure minimum 4 in. overlap onto concrete floor (Item 1) adjacent to steel beam (Item 2). Tightly butt joints of endothermic mat and seal joints with foil tape (Item 5).
4. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Caulk or Sealant

   MODEL: 3M Fire Barrier CP 25WB+ Caulk

   CAULK (Not shown): Fill any gaps between concrete floor and endothermic mat (Item 3) with caulk.
5. TAPE: (Not Shown) Apply 4 in. wide pressure sensitive tape with aluminum foil facing to all butt joints of the endothermic mat (Item 3).
6. STEEL BANDING: Install 1/2 in. wide x 0.020 in. thick stainless steel banding around endothermic mat (Item 3) and secure into concrete using fasteners (Item 7). Space banding max. 12 in. oc.
7. FASTENER: Secure endothermic mat (Item 3) and steel banding (Item 6) to concrete floor (Item 1) using min. 1/4 in. concrete anchors inserted through 1 in. diameter fender washer.

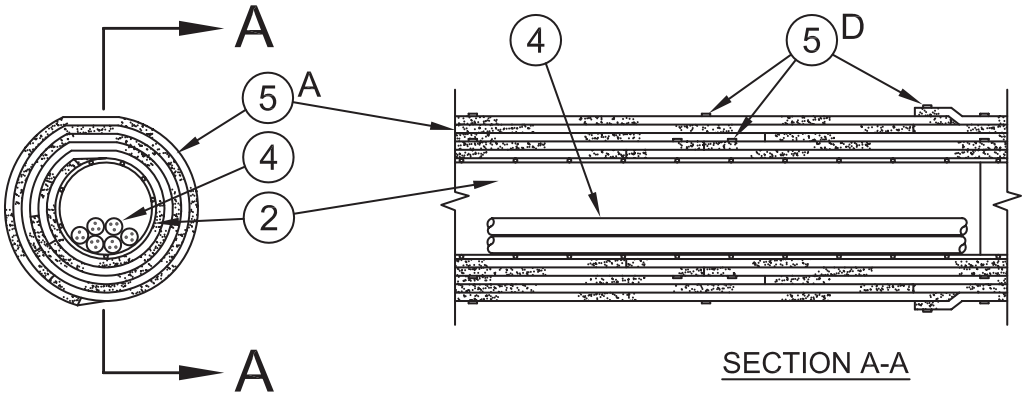
This material was extracted and drawn by 3M Fire Protection Products from the 2012 Product Directory, © Intertek

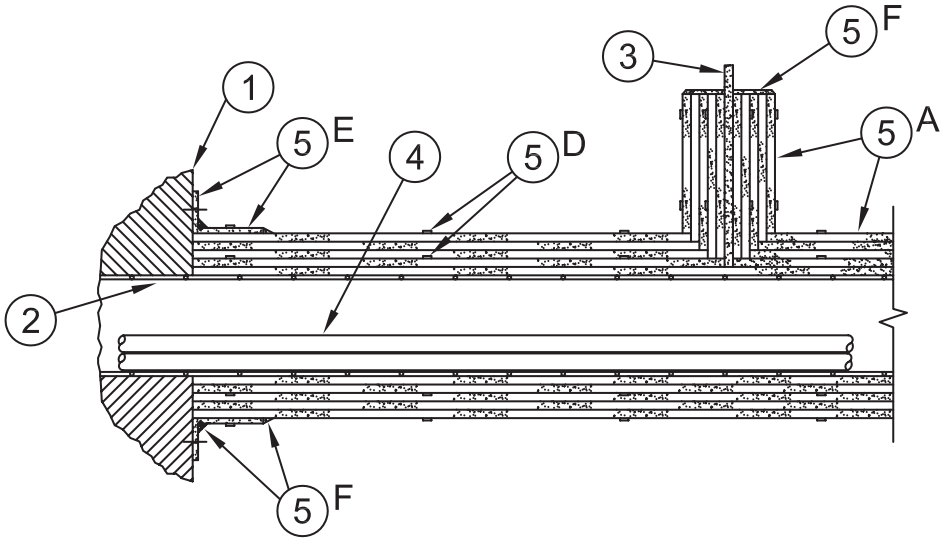
3M™ Fire Protection Products
Interam™ E-Mat Solutions Package

Electrical Circuitry

System No. 7

September 17, 2012
Fire Ratings – 1 and 3 Hr (See Item 5)





1. **Wall or Floor Assembly** – Concrete or masonry wall or concrete floor having a fire rating equal to or greater than the fire rating of the electrical circuit protective system. Opening in wall or floor through which conduit passes is to be sized to closely follow the contour of the conduit. Through opening in wall or floor to be firestopped prior to installation of the electrical circuit protective system using a compatible firestop system. The perimeter of the firestopped through opening shall be within the outer bounds of the electrical circuit protective system. See **Through Penetration Firestop Systems** (Guide XHEZ) for presently Classified firestop systems.
2. **Steel Conduit** – Nominal 2 in. (51 mm) diameter (or larger) Trade Size rigid steel conduit. Conduit shall be installed as a complete system in accordance with all provisions of the current National Electrical Code.
3. **Conduit Supports** – Conduit system shall be supported by welded hangers formed of min 0.093 in. (2.4 mm) thick (12 ga) painted or galvanized steel channels, 1-5/8 in. (41 mm) wide by min 1-5/8 in. (41 mm) deep with the flange edges hemmed for stiffness. As an alternate, conduits may be supported by steel pipe hangers in conjunction with min 3/8 in. (10 mm) diameter threaded steel rod.
4. **Cables** – Min No. 16 AWG jacketed multi-conductor cables and/or min 250 kcmil jacketed single-conductor copper power cables. Cable insulation to be cross-linked polyethylene. Cable jacket to be cross-linked polyethylene or polyvinyl chloride. When fillers are used in cable construction, fillers to be hemp, polyvinyl chloride or cross-linked polyethylene. Cables to be installed in accordance with all provisions of the current National Electrical Code.
5. **Electrical Circuit Protective System** – The electrical circuit protective system consists of a mat wrap, foil tape, stainless steel banding straps, intumescent sheet and caulk. The system shall be installed in accordance with the detailed installation instruction manual supplied by the manufacturer of the **Electrical Circuit Protective Materials***. The details of the electrical circuit protective system are summarized below:

System No. 7 *continued*

A. **Electrical Circuit Protective Materials*** – **Mat Wrap** – Nominal 0.4 in. (10 mm) thick flexible sheet material supplied in 24 in. (610 mm) wide rolls. Each layer of mat wrap installed by cutting to size and wrapping around the conduit and itself such that a minimum 2 in. (51 mm) overlap is present along the longitudinal seam. With the exception of the final layer of mat wrap, adjacent lengths of mat wrap in each layer to be installed with tightly-butted end seams. Successive layers of mat wrap installed in same manner with butted end seams offset minimum 2 in. (51 mm) from butted end seams of preceding layer. For final layer of mat wrap, adjacent lengths of mat wrap to overlap the preceding length a minimum of 2 in. (51 mm). All seams in each layer of mat wrap to be sealed with foil tape (Item 5B). Mat wrap layers secured in place with stainless steel banding straps (Item 5D). The hourly fire rating of the electrical circuit protective system is dependent upon the nom diameter of the conduit system and the number of mat wrap layers installed, as shown in the following table:

Nom Conduit Diam In. (mm)	Min Layers Required	Hr Fire Rating
2 - 4-1/2 (51 - 114)	3	1
5 - 6 (127 - 152)	2	1
2 - 6 (51 - 152)	5	3

3M COMPANY – Types E-5A-4, E-54A, E-54C

B. **Foil Tape** – (Not Shown) – 4 in. (102 mm) wide min 3 mil (0.08 mm) thick pressure-sensitive aluminum foil tape or min 3 mil (0.08 mm) thick stainless steel foil tape, supplied in rolls. Used to secure seams of mat wrap (Item 5A).

C. **Stainless Steel Mesh** – (Not Shown) – Woven stainless steel wire mesh, supplied in 42 in. (1.1 m) wide rolls. Stainless steel mesh tightly wrapped around outermost layer of mat wrap and secured in place with steel banding straps (Item 5D) spaced maximum 8 in. (203 mm) OC. Stainless steel mesh not required for 3 Hr rated system.

D. **Steel Banding Straps** – Min 5/8 in. (16 mm) wide by 0.020 in. (0.51 mm) thick stainless steel straps used in conjunction with stainless steel crimp clips. Banding straps spaced max 8 in. (203 mm) OC to secure stainless steel mesh and final mat wrap layers. For 3 Hr rated system, steel banding straps required to be installed after second mat wrap layer in addition to steel banding straps securing fifth mat wrap layer. Steel banding straps to be installed 1 in. (25 mm) from each side of final layer mat seams.

E. **Electrical Circuit Protective Materials*** – **Intumescent Sheet** – Rigid aluminum foil faced sheets with galvanized sheet steel backer. Nom 4 in. (102 mm) wide piece of sheet formed into collar around mat wrapped conduit with seam butted and with steel backer exposed (foil facing against mat wrap). Collar butted against wall or floor surface and secured to mat wrapped conduit with stainless steel banding strap (Item 5D). A two-piece plate cut from intumescent sheet to be installed on wall or floor surface around intumescent sheet collar. Plate pieces cut to tightly follow the contours of the intumescent sheet collar with seams between pieces tightly butted. Plate to lap min 2 in. (51 mm) on the wall or floor surface with the steel backer exposed (foil face against wall or floor surface). Plate secured to wall or floor surface with steel anchor bolts, or equivalent, in conjunction with min 1-1/4 in. (32 mm) diameter steel fender washers. Anchor bolts located max 2 in. (51 mm) from both sides of butted seams and spaced max 4 in. (102 mm) O.C. around perimeter of plate, 1 in. (25 mm) in from plate edges When butted seams of two-piece plate are not completely backed by concrete, seams to be covered with minimum 2 in. (51 mm) wide strips of minimum 0.016 in. (o.41 mm) thick steel secured with steel screws or rivets spaced maximum 2 in. (51 mm) OC on both sides of seam.

3M COMPANY – Type CS-195+

F. **Electrical Circuit Protective Materials*** – **Caulk** – Thick bead of caulk to be applied around the base of the intumescent sheet collar (Item 5E) at its interface with the intumescent sheet plate. Thick bead of caulk applied around entire perimeter of mat wrap at interface with intumescent sheet collar. Top edges of mat wrap layers on conduit support covered with minimum 1/8 in. (3.2 mm) thickness of caulk.

3M COMPANY – CP 25WB+

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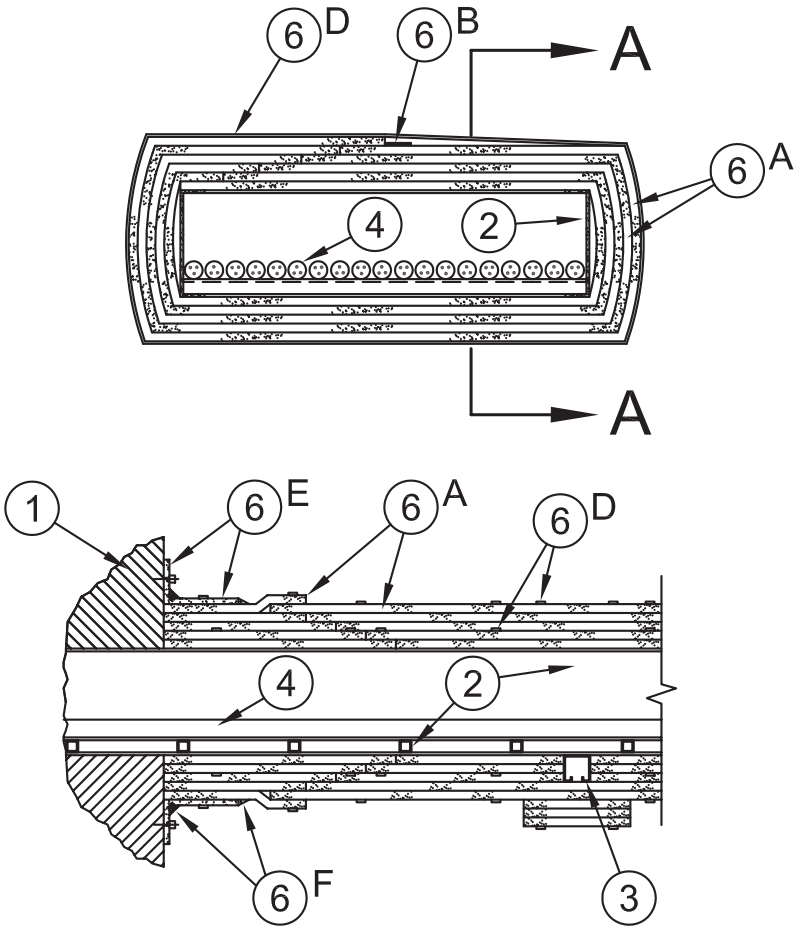
System No. 8

September 17, 2012
Fire Ratings – 1 and 3 Hr (See Item 6)



SECTION A-A

1. **Wall or Floor Assembly** – Concrete or masonry wall or concrete floor having a fire rating equal to or greater than the fire rating of the electrical circuit protective system. Opening in wall or floor through which cable tray passes is to be sized to closely follow the contour of the cable tray. Through opening in wall or floor to be firestopped prior to installation of the electrical circuit protective system using a compatible firestop system. The perimeter of the firestopped through opening shall be within the outer bounds of the electrical circuit protective system. See **Through Penetration Firestop Systems** (Guide XHEZ) for presently Classified firestop systems.
2. **Cable Tray** – 24 in. (610 mm) wide, min 4 in. (102 mm) deep, solid bottom or open ladder cable trays. Solid bottom cable trays to be formed of min 0.056 in. (1.4 mm) thick galvanized steel. Open ladder cable trays to consist of channel-shaped side-rails formed of min 0.056 in. (1.4 mm) thick galvanized steel with nom 3/4 in. (19 mm) wide by 1 in. (25 mm) deep boxed channel rungs formed of min 0.029 in. (0.74 mm) thick galvanized steel and spaced 6 in. (152 mm) OC. Cable trays shall be installed as a complete system in accordance with all provisions of the current National Electrical Code.
3. **Cable Tray Supports** – The cable trays shall be supported by U-shaped welded hangers formed of min 0.093 in. (2.4 mm) thick painted or galvanized steel channels, 1-5/8 in. (41 mm) wide by min 1-5/8 in. (41 mm) deep with the flange edges hemmed for stiffness.
4. **Cables** – Min No. 16 AWG jacketed multi-conductor cables and/or min 250 kcmil jacketed single-conductor copper power cables. Cable insulation to be cross-linked polyethylene. Cable jacket to be cross-linked polyethylene or polyvinyl chloride. When fillers are used in the cable construction, fillers to be hemp, polyvinyl chloride or cross-linked polyethylene. Cables to be installed in cable trays in accordance with all provisions of the current National Electrical Code.
5. **Strapping** – (Not Shown) – Nom 1/2 to 1 in. (13 to 25 mm) wide plastic strapping or filament strapping tape. Strapping applied around circumference of cable tray on maximum 12 in. (305 mm) centers to prevent sag of mat wrap layers (Item 6A) into trough of cable tray.
6. **Electrical Circuit Protective System** – The electrical circuit protective system consists of a mat wrap, foil tape, woven stainless steel wire mesh, stainless steel banding straps, intumescent sheet and caulk. The system shall be installed in accordance with the detailed installation instruction manual supplied by the manufacturer of the **Electrical Circuit Protective Materials***. The details of the electrical circuit protective system are summarized below:
   A. **Electrical Circuit Protective Material*** – **Mat Wrap** – Nom 0.4 in. (10 mm) flexible sheet material supplied in 24 in. (610 mm) wide rolls. Installed by cutting to size and wrapping around the cable tray system with each circumferential wrap lapping itself 2 to 4 in. (51 to 102 mm) over the top of the cable tray. With the exception of the final layer of mat wrap, adjacent lengths of mat wrap in each layer to be installed with tightly-butted end seams. Successive layers of mat wrap installed in same manner with butted end seams offset min 2 in. (51 mm) from butted end seams of preceding layer. For final layer of mat wrap, adjacent lengths of mat wrap to overlap the preceding length a min of 2 in. (51 mm). All seams in each layer of mat wrap to be sealed with aluminum foil tape (Item 6B). Mat wrap layers secured in place with steel banding straps (Item 6D). A min of three layers of mat wrap are required for the 1 Hr fire rating. A min of five layers of mat wrap are required for the 3 hr fire rating.

3M COMPANY – Types E-5A-4, E-54A, E-54C.

B. **Foil Tape** – Nom 4 in. (102 mm) wide min 3 mil (0.08 mm) thick pressure-sensitive aluminum foil tape or nom 4 in. (102 mm) wide min 3 mil (0.08 mm) thick pressure-sensitive stainless steel foil tape, supplied in rolls. Used to secure seams of mat wrap (Item 6A).

C. **Stainless Steel Mesh** – (Optional, Not Shown) – Woven stainless steel wire mesh, supplied in 42 in. (1.1 m) wide rolls. Stainless steel mesh tightly wrapped around outermost layer of mat material and secured in place with stainless steel banding straps (Item 6D) spaced maximum 8 in. (203 mm) O.C.

D. **Steel Banding Strap** – Min 5/8 in. (16 mm) wide by 0.020 in. (0.51 mm) thick stainless steel straps used in conjunction with stainless steel crimp clips. Banding straps spaced max 8 in. (203 mm) O.C. to secure stainless steel mesh and mat wrap layers. For 3 hr rated system, steel banding straps required to be installed after second mat wrap layer in addition to steel banding straps securing stainless steel mesh. Steel banding straps to be installed 1 in. (25 mm) from each side of final layer mat seams.

E. **Electrical Circuit Protective Materials*** – **Intumescent Sheet** – Rigid aluminum foil-faced sheets with galvanized sheet steel backer. Nom 4 in. (102 mm) wide piece of sheet formed into collar around mat wrapped cable tray and mat wrapped cable air drop (Item 7) with seam butted and with steel backer exposed (foil facing against mat wrap). Collar butted against wall or floor surface and secured to mat wrapped cable tray or cable air drop with stainless steel banding strap (Item 6D). A two-piece plate cut from intumescent sheet to be installed on wall or floor surface around intumescent sheet collar. Plate pieces cut to tightly follow the contours of the intumescent sheet collar with seams between pieces tightly butted. Plate to lap min 2 in. (51 mm) on the wall or floor surface with the steel backer exposed (foil face against wall or floor surface). Plate secured to wall or floor surface with steel anchor bolts, or equivalent, in conjunction with min 1-1/4 in. (32 mm) diameter steel fender washers. Anchor bolts located max 2 in. (51 mm) from both sides of butted seams and max 4 in. (102 mm) O.C. around perimeter of plate, 1 in. (25 mm) in from plate edges. When butted seams of two-piece plate are not completely backed by concrete, seams to be covered with min 2 in. (51 mm) wide strips of min 0.016 in. (0.41 mm) thick galvanized steel secured with steel screws or rivets spaced max 2 in. (51 mm) O.C. on both sides of seam.

3M COMPANY – Type CS-195+

F. **Electrical Circuit Protective Materials*** – **Caulk** – Thick bead of caulk to be applied around the base of the intumescent sheet collar (Item 6E) at its interface with the intumescent sheet plate. Thick bead of caulk applied around perimeter of mat wrap at interface with intumescent sheet collar. Top edges of mat wrap layers on cable tray supports covered with min 1/8 in. (3.2 mm) thickness of caulk.

3M COMPANY – CP 25WB+

7. **Cable Air Drop** – (Not Shown) – Cable passing from one fire rated cable tray protective system to another fire rated cable tray protective system, through the air, to be protected with a fire rated electrical circuit protective system consisting of a mat wrap, foil tape, stainless steel banding straps or ceramic cord and caulk or putty. The system shall be installed in accordance with the detailed installation instruction manual supplied by the manufacturer of the **Electrical Circuit Protective Materials***. The details of the electrical circuit protective system are summarized below:

A. **Electrical Circuit Protective Materials*** – **Mat Wrap** – Nom 0.4 in. (10 mm) flexible sheet material supplied in 24 in. (610 mm) wide rolls. Mat wrap installed by cutting to size and wrapping around cable bundle with each circumferential wrap lapping itself min 2 in. (51 mm). With the exception of the final layer of mat wrap, adjacent lengths of mat wrap in each layer to be installed with tightly-butted end seams. Successive layers of mat wrap installed in same manner with butted end seams offset min 2 in. (51 mm) from butted end seams of preceding layer. For final layer of mat wrap, adjacent lengths of mat wrap to overlap the preceding length a min of 2 in. (51 mm). All seams in each layer of mat wrap to be sealed with foil tape (Item 7B). Mat wrap layers secured in place with stainless steel banding straps (Item 7C). A min of three layers of mat material is required for a 1 hr fire rating. A min of five layers of mat material is required for a 3 hr fire rating.

3M COMPANY – Types E-5A-4, E-54A, E-54C.

B. **Foil Tape** – Nom 4 in. (102 mm) wide min 3 mil (0.08 mm) thick pressure-sensitive aluminum foil tape or min 3 mil (0.08 mm) thick stainless steel foil tape, supplied in rolls. Used to secure seams of mat wrap (Item 7A).

C. **Steel Banding Straps** – Min 5/8 in. (16 mm) wide by 0.020 in. (0.51 mm) thick stainless steel straps used in conjunction with stainless steel crimp clips. Banding straps spaced max 8 in. (203 mm) OC to secure mat wrap layers. For 1 hr fire rated system, steel banding straps required to be installed on outermost mat wrap layer. For 3 hr fire rated system, steel banding straps required to be installed after second mat wrap layer in addition to steel banding straps securing outermost mat wrap layer.

D. **Stainless Steel Wire** – As an alternate to the steel banding straps (Item 7C) for the 1 hr fire rated system only, min 0.046 in. (1.12 mm) diam (18 ga) stainless steel wire spiral-wrapped around outermost layer of mat wrap at a maximum spacing of 2 in. (51 mm) OC. Wire covered with aluminum foil tape (Item 7B).

E. **Electrical Circuit Protective Materials*** – **Caulk** – Thick bead of caulk to be applied around the perimeter of the mat wrap on the cable air drop at each interface with the cable tray protective system.

3M COMPANY – CP 25WB+

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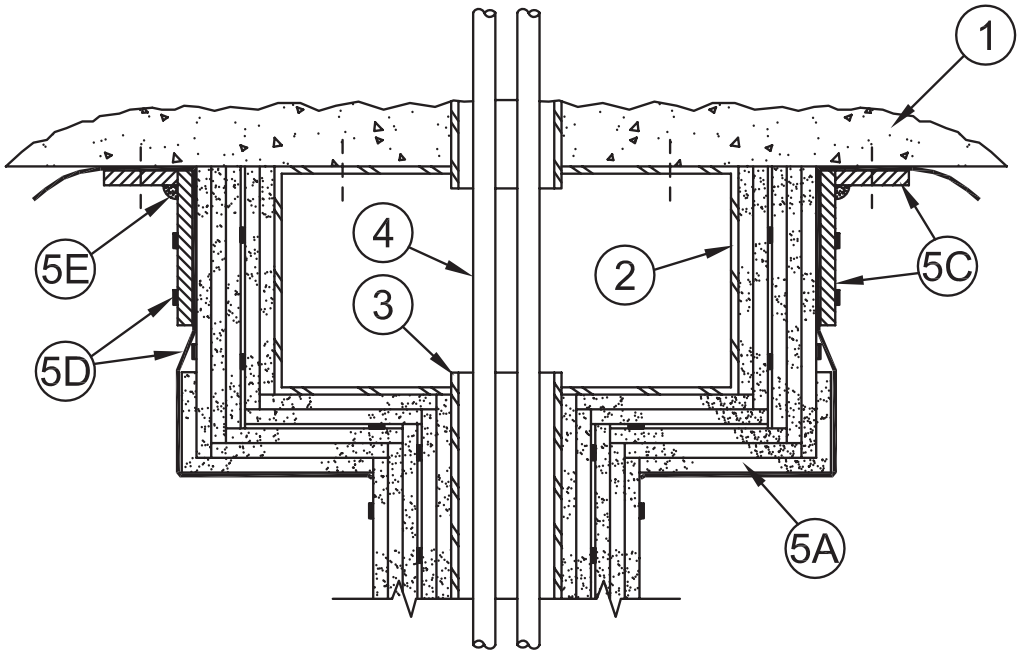
System No. 9

September 17, 2012
Fire Ratings – 1 and 3 Hr



1. **Wall or Floor Assembly** – Concrete or masonry wall or concrete floor having a fire rating equal to or greater than the fire rating of the electrical circuit protective system. Opening in wall or floor through which conduit passes is to be sized to closely follow the contour of the conduit feeding into the steel junction box. Through opening in wall or floor to be firestopped prior to installation of the electrical circuit protective system using a compatible firestop system. The perimeter of the firestopped through opening shall be within the outer bounds of the electrical circuit protective system. See **Through Penetration Firestop Systems** (Guide XHEZ) for presently Classified firestop systems.
2. **Steel Junction Box** – Min 12 by 12 by 6 in. (305 by 305 by 152 mm) deep surface-mounted junction box formed of min 0.052 in. (1.3 mm) thick steel. Steel junction box to be installed in accordance with all provisions of the current National Electrical Code.
3. **Steel Conduit** – (Optional) – Nom 2 in. (51 mm) diameter (or larger) Trade Size rigid steel conduit. Conduits to be installed as a complete system in accordance with all provisions of the current National Electrical Code. Conduit to be provided with a fire rated electrical circuit protective system which is compatible with the electrical circuit protective system (Item 5) installed on the steel junction box. Details of electrical circuit protective system at conduit/junction box interface to be in accordance with the detailed installation instruction manual supplied by the manufacturer of the **Electrical Circuit Protective Materials***.
4. **Cables** – Min No. 16 AWG jacketed multi-conductor cables and/or min 250 kcmil jacketed single-conductor copper power cables. Cable insulation to be cross-linked polyethylene. Cable jacket to be cross-linked polyethylene or polyvinyl chloride. Cables to be installed in accordance with all provisions of the current National Electrical Code.
5. **Electrical Circuit Protective System** – The electrical circuit protective system consists of an endothermic mat wrap, foil tape, intumescent sheet, stainless steel banding straps and caulk. The system shall be installed in accordance with the detailed installation instruction manual supplied by the manufacturer of the **Electrical Circuit Protective Materials***. The details of the electrical circuit protective system are summarized below:
   A. **Electrical Circuit Protective Materials* – Mat Wrap** – Nom 0.4 in. (10 mm) flexible sheet material supplied in 24 in. (610 mm) wide rolls. Pieces of mat cut to size to cover all exposed surfaces of junction box with min 2 in. (51 mm) overlap at all seams. As an alternate for the 3 hr fire rated system, the inner mat layers may be installed in a boxed manner such that the overlap at each seam is equal to the thickness of the mat. The final layer of mat must be installed with a min 2 in. (51 mm) overlap at all seams. Successive layers of mat installed in same manner with overlapping seams offset from preceding layer. Seams of each layer sealed with foil tape (Item 5B). Mat wrap layers secured in place with stainless steel banding straps (Item 5D). A min of three layers of mat is required for 1 hr rating. A min of five layers of mat is required for 3 hr rating.

      3M COMPANY – Types E-5A-4, E-54A, E-54C.

   B. **Foil Tape** – (Not Shown) – Nom 4 in. (102 mm) wide min 3 mil (0.08 mm) thick pressure sensitive aluminum foil tape or min 3 mil (0.08 mm) thick stainless steel foil tape, supplied in rolls. Used to secure seams of mat wrap (Item 5A).
   C. **Electrical Circuit Protective Materials* – Intumescent Sheet** – Rigid aluminum foil faced sheets with galvanized steel sheet backer. Nom 4 in. (102 mm) wide piece of sheet formed into collar around mat wrapped junction box with seam butted and with steel backer exposed (foil facing against mat wrap). Collar butted against wall or floor surface and secured to mat wrapped junction box with steel banding strap (Item 5D). A two-piece plate cut from intumescent sheet to be installed on wall or floor surface around intumescent sheet collar. Plate pieces cut to tightly follow the contours of the intumescent sheet collar with seams between pieces tightly butted. Plate to lap min 2 in. (51 mm) on the wall or floor surface with the steel backer exposed (foil face against wall or floor surface). Plate secured to wall or floor surface with steel anchor bolts, or equivalent, in conjunction with min 1-1/4 in. (32 mm) diameter steel fender washers. Anchor bolts located max 2 in. (51 mm) from both sides of butted seams and max 4 in. (102 mm) O.C. around perimeter of plate, 1 in. (25 mm) in from plate edges. When butted seams of two-piece plate are not completely backed by concrete, seams to be covered with min 2 in. (51 mm) wide strips of min 0.016 in. (0.41 mm) thick galvanized steel secured with steel screws or rivets spaced max 2 in. (51 mm) O.C. on both sides of seam.

System No. 9 *continued*

3M COMPANY – Type CS-195+

D. **Steel Banding Strap** – Min 5/8 in. (16 mm) wide by 0.020 in. (0.51 mm) thick stainless steel banding straps used in conjunction with stainless steel crimp clips. Banding straps used to secure intumescent sheet collar (Item 5C) and mat wrap (Item 5A) layers in position. For the 1 hr rated system, steel banding straps required to be installed on outermost mat wrap layer. For 3 hr rated system, steel banding straps required to be installed after second mat wrap layer in addition to steel banding straps securing outermost mat wrap layer.

E. **Electrical Circuit Protective Materials* – Caulk** – Thick bead of caulk to be applied as a gasket between the intumescent sheet plate (Item 5C) and the wall or floor surface. Thick bead of caulk to be applied around the base of the intumescent sheet collar (Item 5C) at its interface with the intumescent sheet plate.

3M COMPANY – Type CP 25WB+

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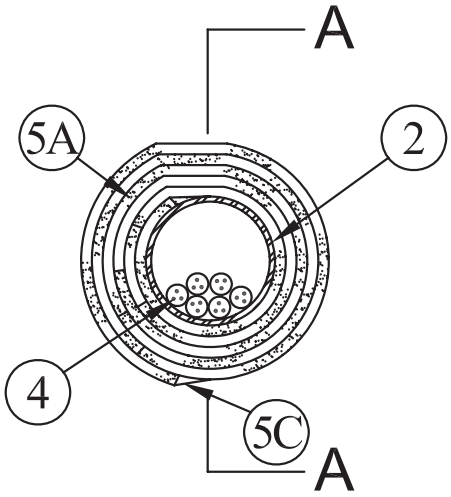
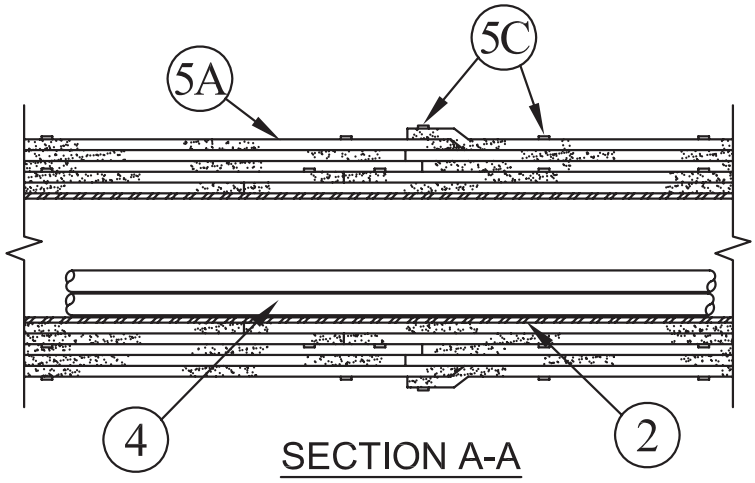
System No. 34

September 17, 2012
Fire Rating - 2Hr





1. **Wall or Floor Assembly** – (Not Shown) – Concrete or masonry wall or concrete floor having a fire rating equal to or greater than the fire rating of the electrical circuit protective system. Diam of opening in wall or floor through which conduit passes is to be max 1-1/2 in. (38 mm) larger than the outside diam of the conduit. Conduit installed eccentrically or concentrically in the opening with a min 0 in. (point contact) to max 3/4 in. (19 mm) annular space. Through opening in wall or floor to be firestopped prior to installation of the electrical circuit protective system using min 4 pcf (64 kg/m^3) mineral wool batt packing material throughout the thickness of the floor or wall except for a recess at each surface to accommodate the caulk fill material (Item 5D). A min 1/2 in. (13 mm) depth of caulk fill material (Item 5D) is required to be installed in the annular space flush with each surface of the floor or wall assembly. The perimeter of the firestopped through opening shall be within the outer bounds of the electrical circuit protective system.
2. **Steel Conduit** – Nominal 4 in. (102 mm) to 6 in. (152 mm) Trade Size rigid steel conduit. Conduit shall be installed as a complete system in accordance with all provisions of the current National Electrical Code.
3. **Conduit Supports** – (Not Shown) – Conduit system shall be supported by steel pipe hangers in conjunction with min 3/8 in. (10 mm) diameter threaded steel rod.
4. **Cables** – Min No. 16 AWG jacketed multi-conductor cables and/or min No. 12 AWG single-conductor copper power cables. Cables to be installed in conduit in accordance with all provisions of the current National Electrical Code.
5. **Electrical Circuit Protective System** – The electrical circuit protective system consists of a mat wrap, foil tape, stainless steel banding straps and caulk. The system shall be installed in accordance with the detailed installation instruction manual supplied by the manufacturer of the **Electrical Circuit Protective Materials***. The details of the electrical circuit protective system are summarized below:
   A. **Electrical Circuit Protective Materials* – Mat Wrap** – Nom 0.4 in. (10 mm) flexible sheet material supplied in 24 in. (610 mm) wide rolls. A min of four layers of mat wrap are required. Each layer of mat wrap installed by cutting to size and wrapping around the conduit and itself such that a min 2 in. (51 mm) overlap is present along the longitudinal seam. With the exception of the final layer of mat wrap, adjacent lengths of mat wrap in each layer to be installed with tightly-butted end seams. Successive layers of mat wrap installed in same manner with butted end seams offset min 2 in. (51 mm) from butted end seams of preceding layer. For final layer of mat wrap, adjacent lengths of mat wrap to overlap the preceding length by a min of 2 in. (51 mm). All seams in each layer of mat wrap to be sealed with foil tape (Item 5B). Mat wrap layers secured in place with stainless steel banding straps (Item 5C) on outermost layer.

      3M COMPANY
      3M FIRE PROTECTION PRODUCTS – Type E-5A-4, E-54A or E-54C

   B. **Foil Tape** – (Not Shown) – 4 in. (102 mm) wide min 3 mil (0.08 mm) thick pressure-sensitive aluminum foil or stainless steel foil tape, supplied in rolls. Used to secure seams of mat wrap (Item 5A).
   C. **Steel Banding Straps** – Min 1/2 in. (13 mm) wide by 0.020 in. (0.5 mm) thick stainless steel straps used in conjunction with stainless steel crimp clips. Banding straps spaced max 8 in. (203 mm) OC to secure mat wrap layers.
   D. **Electrical Circuit Protective Materials* – Caulk** – (Not Shown) - Thick bead of caulk applied around entire perimeter of each layer of mat wrap at its interface with the firestop system and the floor or wall surface. Any joint between the adjacent layers of mat wrap that exceed 1/16 in. (1.6 mm) in width shall be filled with caulk. Each layer of E-Mat on the conduit supports abutting the mat wrap on the conduit shall also be sealed with caulk.

      3M COMPANY
      3M FIRE PROTECTION PRODUCTS – CP 25WB+

*Bearing the UL Classification Mark
**Bearing the UL Listing Mark

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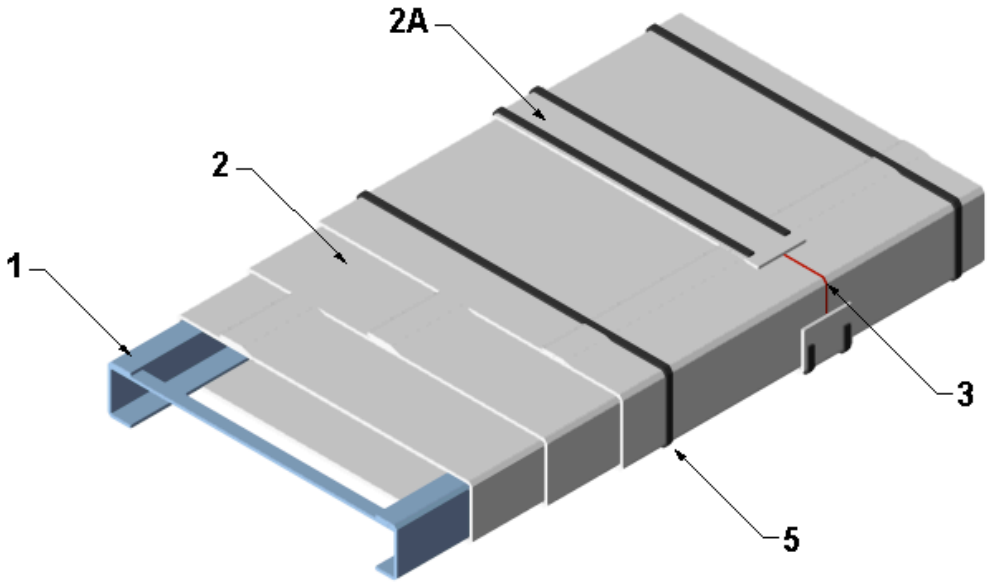
Design Number 3MU/AF 60-01

August 30, 2012
APPLIED FIREPROOFING
3M Company
3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat
3M™ Fire Barrier CP 25WB+ Caulk
ASTM E 1725 (2008)
ASTM E 119 (2012)
Rating: 1 Hour
Approved for any cable fill
Reference Intertek Design Listing 3MU/AF 60-06 for Ampacity Derating



1. CABLE TRAY: Use nominal 24 in. wide x 4 in. deep galvanized steel ladder-back cable tray. Friction fit nominal 13/16 in. wide x 13/32 in. deep, 18 GA galvanized steel struts between side rails spaced 12 in. on center (oc) along the length of the cable tray. Use filament tape for additional support if needed.
2. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Applied Fireproofing

   MODEL: 3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat

   ENDOTHERMIC MAT: Install 3 layers of foil faced flexible mat tightly around the cable tray (Item 1). Install each piece of mat with a minimum 2 in. overlap onto itself and temporarily hold in place using filament tape if needed.

   A. COLLAR: Install nominal 4 in. wide strip of endothermic mat (Item 2) around outer layer of the wrapped cable tray (Item 1). Center collar over butt joints over outer layer and secure using steel banding (Item 5).
3. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Caulk or Sealant

   MODEL: 3M™ Fire Barrier CP 25WB+ Caulk

   CAULK: Install caulk between butt joints of endothermic mat (Item 2) on all layers. Alternative use is to fill gaps and voids along seams greater than 1/8 in. wide.
4. TAPE: (Not Shown) Apply 4 in. wide pressure sensitive tape with aluminum foil facing to all exposed edges of the collar (Item 2A) as well as the longitudinal (overlap) joints of the endothermic mat (Item 2) on the outer layer.
5. STEEL BANDING: Install 1/2 in. wide x 0.020 in. thick stainless steel banding on the outer layer of the endothermic mat (Item 2). Install banding within 1 in. of the edge of collars (Item 2A) and butt joints and maximum 12 in. oc at all other locations.

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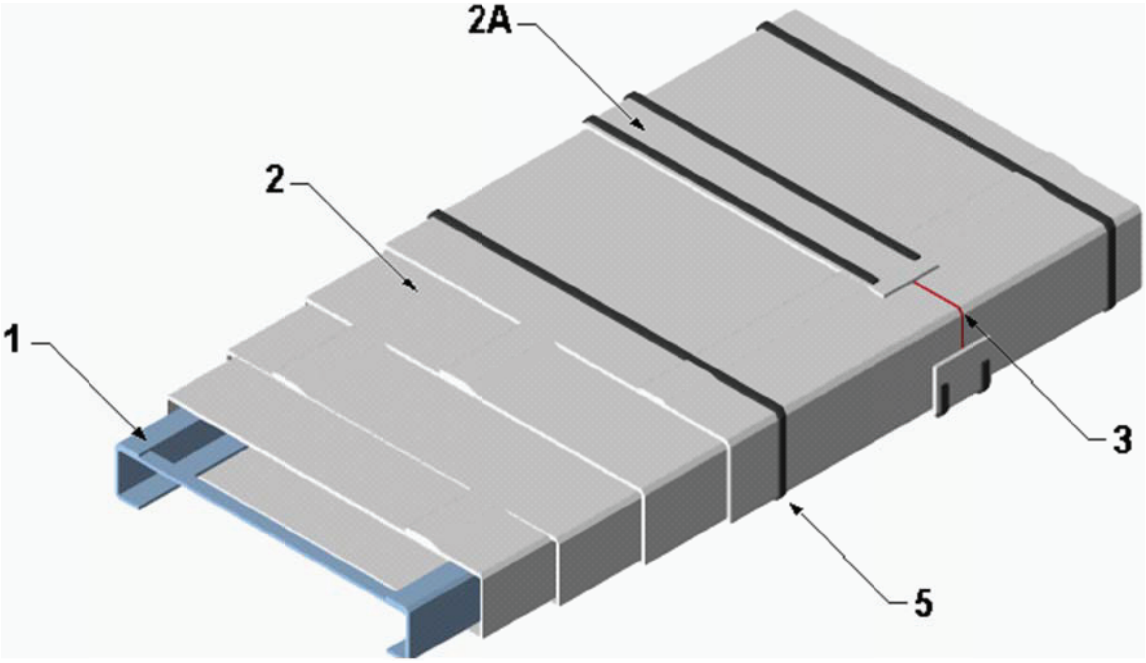
Design Number 3MU/AF 60-02

May 03, 2013
APPLIED FIREPROOFING
3M Company
3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat
3M™ Fire Barrier CP 25WB+ Caulk
ASTM E 1725 (2008)
ASTM E 119 (2012)
Rating: 1 Hour
Approved for any cable fill



1. CABLE TRAY: Use nominal 6 in. wide x 4 in. deep galvanized steel ladder-back cable tray. Friction fit nominal 13/16 in. wide x 13/32 in. deep, 18 GA galvanized steel struts between side rails spaced 12 in. on center (oc) along the length of the cable tray. Use filament tape for additional support if needed.
2. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Applied Fireproofing

   MODEL: 3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat

   ENDOTHERMIC MAT: Install 3 layers of foil faced flexible mat tightly around the cable tray (Item 1). Install each piece of mat with a minimum 2 in. overlap onto itself and temporarily hold in place using filament tape if needed.

   A. COLLAR: Install nominal 4 in. wide strip of endothermic mat (Item 2) around outer layer of the wrapped cable tray (Item 1). Center collar over butt joints over outer layer and secure using steel banding (Item 5).

3. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Caulk or Sealant

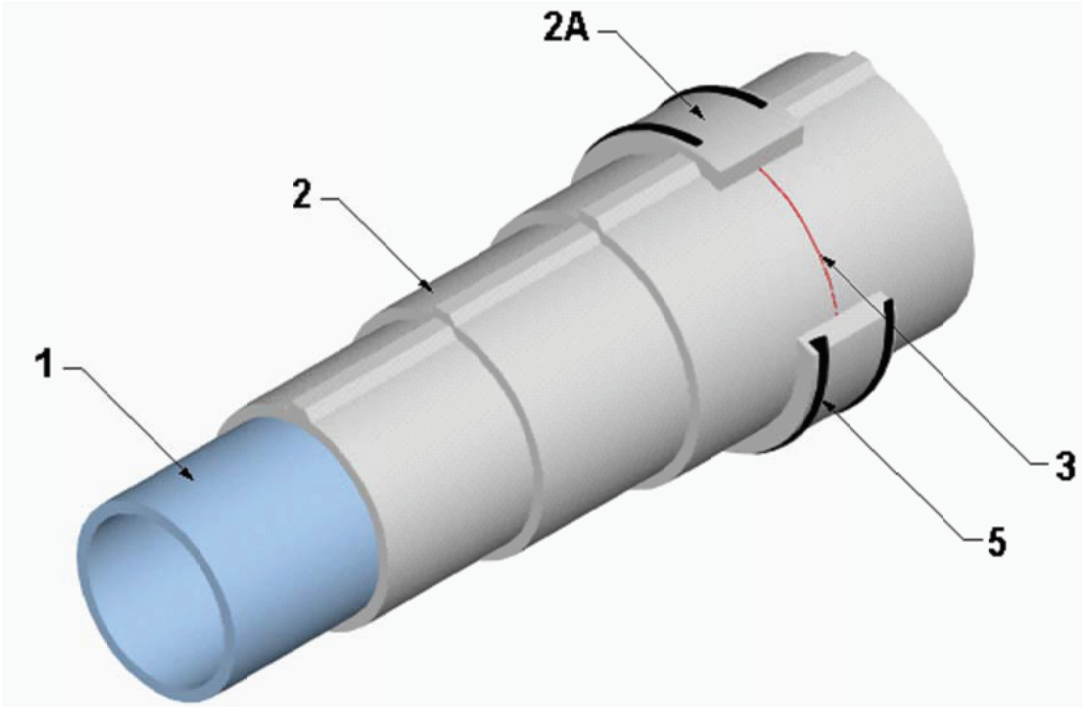
   MODEL: 3M™ Fire Barrier CP 25WB+ Caulk

   CAULK: Install caulk between butt joints of endothermic mat (Item 2) on all layers. Alternative use is to fill gaps and voids along seams greater than 1/8 in. wide.
4. TAPE: (Not Shown) Apply 4 in. wide pressure sensitive tape with aluminum foil facing to all exposed edges of the collar (Item 2A) as well as the longitudinal (overlap) joints of the endothermic mat (Item 2) on the outer layer.
5. STEEL BANDING: Install 1/2 in. wide x 0.020 in. thick stainless steel banding on the outer layer of the endothermic mat (Item 2). Install banding within 1 in. of the edge of collars (Item 2A) and butt joints and maximum 12 in. oc at all other locations.

This material was extracted and drawn by 3M Fire Protection Products from the 2013 Product Directory, © Intertek

Design Number 3MU/AF 60-03

April 26, 2013
APPLIED FIREPROOFING
3M Company
3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat
3M™ Fire Barrier CP 25WB+ Caulk
ASTM E 1725 (2008)
ASTM E 119 (2012)
Rating: 1 Hour
Approved for any cable fill
Reference Intertek Design Listing 3MU/AF 60-07 for Ampacity Derating



1. CONDUIT: Use minimum 1 in. (or larger) rigid galvanized steel conduit (RMC) or galvanized steel electrical metallic tubing (EMT) with a minimum linear weight per foot of 0.64 lbs/ft.
2. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Applied Fireproofing

   MODEL: 3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat

   ENDOTHERMIC MAT: Install 3 layers of foil faced flexible mat tightly around the conduit (Item 1). Install each piece of mat with a minimum 2 in. overlap onto itself and temporarily hold in place using filament tape if needed.

   A. COLLAR: Install nominal 4 in. wide strip of endothermic mat (Item 2) around outer layer of the wrapped conduit (Item 1). Center collar over butt joints over outer layer and secure using steel banding (Item 5).
3. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Caulk or Sealant

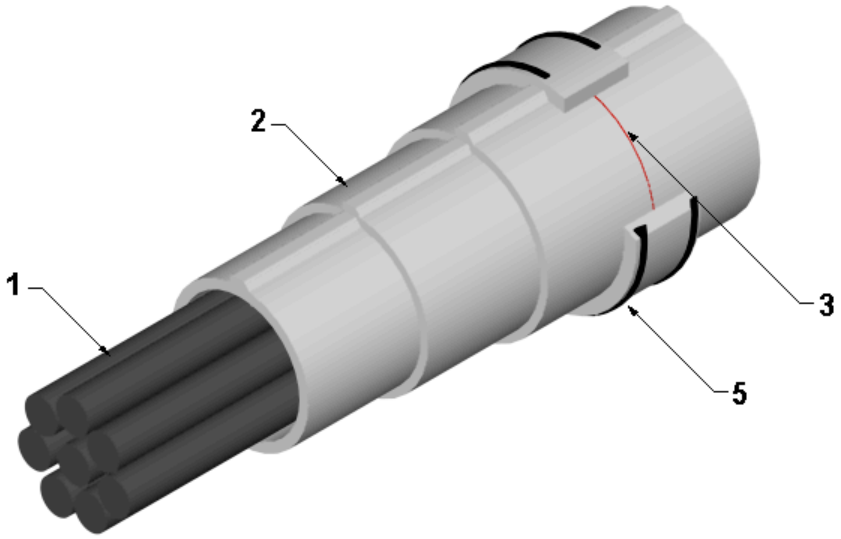
   MODEL: 3M™ Fire Barrier CP 25WB+ Caulk

   CAULK: Install caulk between butt joints of endothermic mat (Item 2) on all layers. Alternative use is to fill gaps and voids along seams greater than 1/8 in. wide.
4. TAPE: (Not Shown) Apply 4 in. wide pressure sensitive tape with aluminum foil facing to all exposed edges of the collar (Item 2A) as well as the longitudinal (overlap) joints of the endothermic mat (Item 2) on the outer layer.
5. STEEL BANDING: Install 1/2 in. wide x 0.020 in. thick stainless steel banding on the outer layer of the endothermic mat (Item 2). Install banding within 1 in. of the edge of collars (Item 2A) and butt joints and maximum 12 in. on center at all other locations.

This material was extracted and drawn by 3M Fire Protection Products from the 2013 Product Directory, © Intertek

Design Number 3MU/AF 60-04

August 30, 2012
APPLIED FIREPROOFING
3M Company
3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat
3M™ Fire Barrier CP 25WB+ Caulk
ASTM E 1725 (2008)
ASTM E 119 (2012)
Rating: 1 Hour
Approved for any cable fill



1. CABLE BUNDLE: Use any number or type of cables.
2. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Applied Fireproofing

   MODEL: 3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat

   ENDOTHERMIC MAT: Install 3 layers of foil faced flexible mat tightly around the cable bundle (Item 1). Install each piece of mat with a minimum 2 in. overlap onto itself and temporarily hold in place using filament tape if needed.

   A. COLLAR: Install nominal 4 in. wide strip of endothermic mat (Item 2) around outer layer of the wrapped cable bundle (Item 1). Center collar over butt joints over outer layer and secure using steel banding (Item 5).
3. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Caulk or Sealant

   MODEL: 3M™ Fire Barrier CP 25WB+ Caulk

   CAULK: Install caulk between butt joints of endothermic mat (Item 2) on all layers. Alternative use is to fill gaps and voids along seams greater than 1/8 in. wide.
4. TAPE: (Not Shown) Apply 4 in. wide pressure sensitive tape with aluminum foil facing to all exposed edges of the collar (Item 2A) as well as the longitudinal (overlap) joints of the endothermic mat (Item 2) on the outer layer.
5. STEEL BANDING: Install 1/2 in. wide x 0.020 in. thick stainless steel banding on the outer layer of the endothermic mat (Item 2). Install banding within 1 in. of the edge of collars (Item 2A) and butt joints and maximum 12 in. oc at all other locations.

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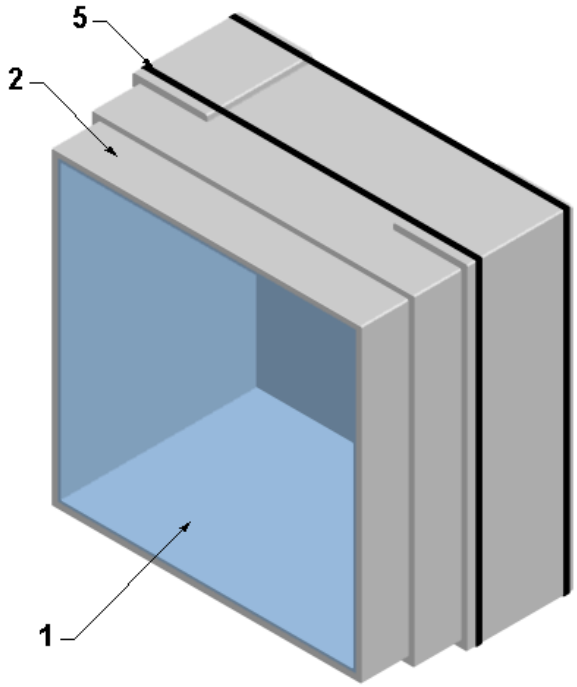
Design Number 3MU/AF 60-05

August 30, 2012
APPLIED FIREPROOFING
3M Company
3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat
3M™ Fire Barrier CP 25WB+ Caulk
ASTM E 1725 (2008)
ASTM E 119 (2012)
Rating: 1 Hour
Approved for any cable fill



1. JUNCTION BOX: Use nominal 12 in. wide x 12 in. high x min. 8 in. deep, 16 GA galvanized steel junction box.
2. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Applied Fireproofing

   MODEL: 3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat

   ENDOTHERMIC MAT: Install 3 layers of foil faced flexible mat tightly around the junction box (Item 1). Install the first two innermost layers to form an overlapped, square edge joint. Install the outermost layer creating a 2 in. min. overlap is created on the resulting seam and a 3 in. overlap is created on all four adjacent junction box faces. Temporarily hold in place using filament tape if needed.
3. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Caulk or Sealant

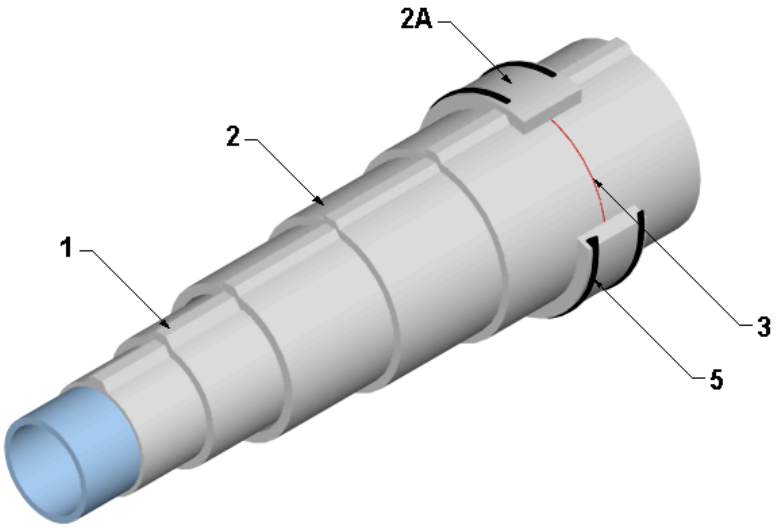
   MODEL: 3M™ Fire Barrier CP 25WB+ Caulk

   CAULK (Not Shown): Install caulk between butt joints of endothermic mat (Item 2) on all layers. Alternative use is to fill gaps and voids along seams greater than 1/8 in. wide.
4. TAPE: (Not Shown) Apply 4 in. wide pressure sensitive tape with aluminum foil facing to all exposed edges of the collar (Item 2A) as well as the longitudinal (overlap) joints of the endothermic mat (Item 2) on the outer layer.
5. STEEL BANDING: Install 1/2 in. wide x 0.020 in. thick stainless steel banding on the outer layer of the endothermic mat (Item 2). Install banding within 1 in. of the edge of the 3 in. overlap edges of the endothermic mat (Item 2) and butt joints and maximum 4 in. oc at all other locations.

This material was extracted and drawn by 3M Fire Protection Products from the 2012 Product Directory, © Intertek

Design Number 3MU/AF 180-01

August 30, 2012
APPLIED FIREPROOFING
3M Company
3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat
3M™ Fire Barrier CP 25WB+ Caulk
ASTM E 1725 (2008)
ASTM E 119 (2012)
Rating: 3 Hours
Approved for any cable fill



1. CONDUIT: Use 1 in. diameter (or larger) rigid steel conduit.
2. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Applied Fireproofing

   MODEL: 3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat

   ENDOTHERMIC MAT: Install 5 layers of foil faced flexible mat tightly around the conduit (Item 1). Prior to installing innermost layer, cut 1-1/2 in. wide strips of endothermic mat and wrap around conduit (Item1) spaced 15 in. on center (oc) and hold in place with filament tape. This is done in order to create an air gap between the conduit (Item 1) and the first (innermost) layer of the endothermic mat. After this is done, install the first two innermost layers creating a min. 4 in. overlap onto itself. Temporarily hold in place using filament tape if needed. After this is done, install a second set of 1-1/2 in. wide strips of endothermic mat in the same manner as previously done. Then, install the remaining three layers of endothermic mat in the same manner as the first two.

   A. COLLAR: Install nominal 4 in. wide strip of endothermic mat (Item 2) around outermost layer of the wrapped conduit (Item 1). Center collar over butt joints over outer layer and secure using steel banding (Item 5).
3. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Caulk or Sealant

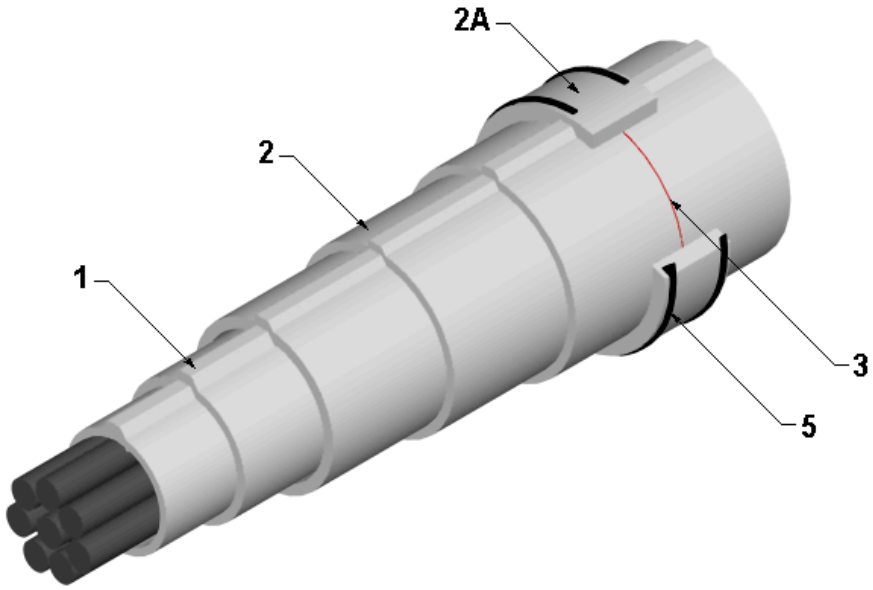
   MODEL: 3M™ Fire Barrier CP 25WB+ Caulk

   CAULK (Not Shown): Install caulk between butt joints of endothermic mat (Item 2) on all layers. Alternative use is to fill gaps and voids along seams greater than 1/8 in. wide.
4. TAPE: (Not Shown) Apply 4 in. wide pressure sensitive tape with aluminum foil facing to all exposed edges of the collar (Item 2A) as well as the longitudinal (overlap) joints of the endothermic mat (Item 2) on the outer layer.
5. STEEL BANDING: Install 1/2 in. wide x 0.020 in. thick stainless steel banding on the outermost layer of the endothermic mat (Item 2). Install banding within 1 in. of the edge of collars (Item 2A) and butt joints and maximum 12 in. oc at all other locations.

This material was extracted and drawn by 3M Fire Protection Products from the 2012 Product Directory, © Intertek

Design Number 3MU/AF 180-02

October 05, 2012
APPLIED FIREPROOFING
3M Company
3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat
3M Fire Barrier CP 25WB+ Caulk
ASTM E 1725 (2008)
ASTM E 119 (2012)
Rating: 3 Hour
Approved for any cable fill



1. CABLE BUNDLE: Use any number or type of cables.
2. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Applied Fireproofing

   MODEL: 3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat

   ENDOTHERMIC MAT: Install 5 layers of foil faced flexible mat tightly around the conduit (Item 1). Install each piece of mat with a minimum 2 in. overlap at the seam with the internal diameter of the air drop being min. 2 in. The endothermic mat is to continue past the innermost layer of protection of the adjacent cable tray (not show).

   A. COLLAR: Install minimum in. wide strips of endothermic mat (Item 2) around outermost layer at the base of the air drop at the cable entry point. The collar serves as support for the adjacent cable tray protection.
3. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Caulk or Sealant

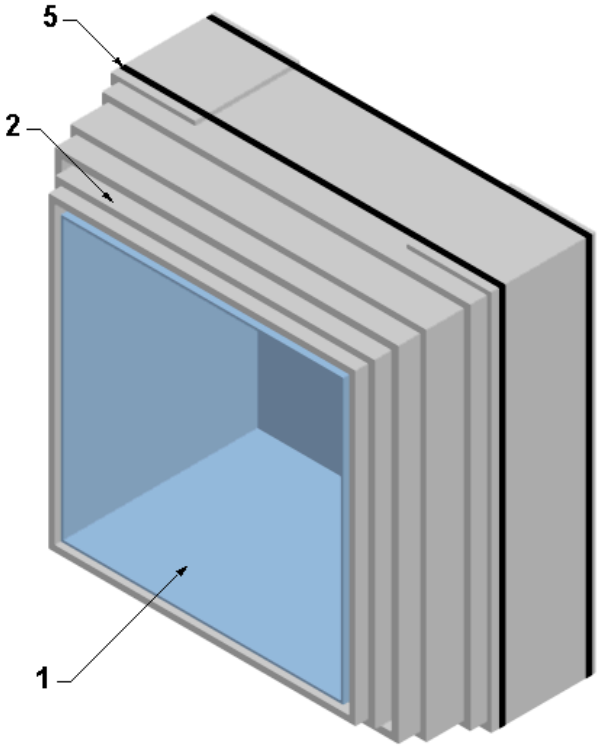
   MODEL: 3M™ Fire Barrier CP 25WB+ Caulk

   CAULK: Install caulk between butt joints of endothermic mat (Item 2) on all layers. Alternative use is to fill gaps and voids along seams greater than 1/8 in. wide.
4. TAPE: (Not Shown) Apply 4 in. wide pressure sensitive tape with aluminum foil facing to all exposed edges of the collar (Item 2A) as well as the longitudinal (overlap) joints of the endothermic mat (Item 2) on the outer layer.
5. STEEL BANDING: Install 1/2 in. wide x 0.020 in. thick stainless steel banding on the outer layer of the endothermic mat (Item 2). Install banding within 1 in. of the edge of collars (Item 2A) and butt joints and maximum 12 in. oc at all other locations.

This material was extracted and drawn by 3M Fire Protection Products from the 2013 Product Directory, © Intertek

Design Number 3MU/AF 180-03

August 30, 2012
APPLIED FIREPROOFING
3M Company
3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat
3M™ Fire Barrier CP 25WB+ Caulk
ASTM E 1725 (2008)
ASTM E 119 (2012)
Rating: 3 Hour
Approved for any cable fill



1. JUNCTION BOX: Use nominal 12 in. wide x 12 in. high x min. 8 in. deep, 16 GA galvanized steel junction box.
2. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Applied Fireproofing

   MODEL: 3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat

   ENDOTHERMIC MAT: Install 6 layers of foil faced flexible mat tightly around the junction box (Item 1). Prior to installing innermost layer, cut 1-1/2 in. wide strips of endothermic mat and wrap around conduit (Item1) spaced 15 in. on center (oc) and hold in place with filament tape. This is done in order to create an air gap between the junction box (Item 1) and the first (innermost) layer of the endothermic mat. After this is done, install the first two innermost layers to form an overlapped, square edge joint. After this is done, install a second set of 1-1/2 in. wide strips of endothermic mat in the same manner as previously done. Install the following three layers in the same manner as the first two. Install the outermost layer creating a 4 in. min. overlap is created on the resulting seam and a 4 in. overlap is created on all four adjacent junction box faces. Temporarily hold in place using filament tape if needed.
3. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Caulk or Sealant

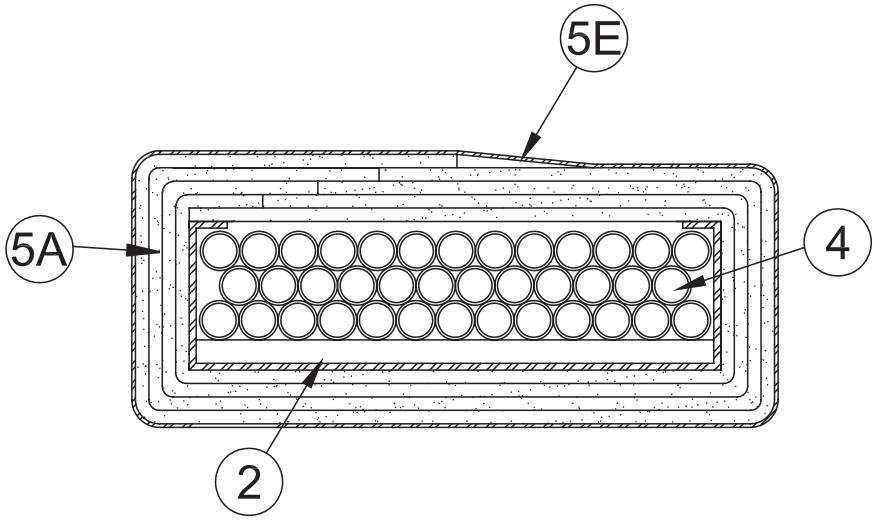
   MODEL: 3M™ Fire Barrier CP 25WB+ Caulk

   CAULK (Not Shown): Install caulk between butt joints of endothermic mat (Item 2) on all layers. Alternative use is to fill gaps and voids along seams greater than 1/8 in. wide.
4. TAPE: (Not Shown) Apply 4 in. wide pressure sensitive tape with aluminum foil facing to all exposed edges of the collar (Item 2A) as well as the longitudinal (overlap) joints of the endothermic mat (Item 2) on the outer layer.
5. STEEL BANDING: Install 1/2 in. wide x 0.020 in. thick stainless steel banding on the outer layer of the endothermic mat (Item 2). Install banding within 1 in. of the edge of the 3 in. overlap edges of the endothermic mat (Item 2) and butt joints and maximum 4 in. oc at all other locations.

This material was extracted and drawn by 3M Fire Protection Products from the 2012 Product Directory, © Intertek

System No. TB-7

July 20, 2012
Rating – 1 Hr.



System tested using Rapid-Temperature Rise Test Method in ASTM E 1529-10

1. **Wall or Floor Assembly** – (Not shown) – Concrete or masonry wall or floor. Through opening in wall or floor to be firestopped using a Classified firestop system. See Through-Penetration Firestop Systems (XHEZ) in Volume 2 of the Fire Resistance Directory for Classified firestop systems.
2. **Cable Tray** – Nom 12 in. (305 mm) wide by min 4 in. (102 mm) deep open-ladder galv steel cable tray with channel-shaped side rails flanged inward or outward and with nom 1 in. (25 mm) high boxed-channel rungs spaced max 9 in. (229 mm) OC. Cable trays shall be installed as a complete system in accordance with all provisions in the National Electrical Code (NFPA 70).
3. **Cable Tray Supports** – (Not Shown) – The cable trays shall be supported by U-shaped welded hangers formed of min 0.093 in. (2.4 mm) thick painted or galvanized steel channels, 1-5/8 in. (41 mm) wide by min 1-5/8 in. (41 mm) deep with the flange edges hemmed for stiffness.
4. **Cables** – Cables to be installed in accordance with all provisions in the National Electrical Code (NFPA 70).
5. Thermal Barrier System – The thermal barrier system consists of an aluminum faced blanket, caulk, filament tape, aluminum foil tape and stainless steel banding straps with wing clips. The thermal barrier system shall be installed on the cable tray and supports in accordance with the manufacturer's detailed instructions accompanying the **Batts and Blankets*** and as summarized below:

   A. **Batts and Blankets*** – Nom 0.4 in. (10 mm) thick endothermic blanket supplied in nom 24-1/2 in. (622 mm) wide rolls. Blanket installed by cutting-to-length and tightly wrapping around the cable tray with a min 2 in. (50 mm) circumferential overlap and butt perimeter seams. Subsequent layers are to be offset min 2 in. (51 mm). A min of four layers is required. Blanket installed on cable tray supports by cutting-to-length and tightly wrapping around each support member with a min 2 in. (51 mm) circumferential overlap. The blanket should extend past the end of the cable tray support and be capped with a piece of blanket cut-to-size. Subsequent layers are to be offset min 2 in. (51 mm).

   3M COMPANY
   3M FIRE PROTECTION PRODUCTS – Endothermic Mat/Blanket Type E-5A-4

   B. **Fill, Void or Cavity Materials*** – (Not Shown) – Caulk used to seal any joint or seam gap greater than 1/4 in. (6 mm) on the outer blanket layer. Additionally used over the blanket caps wrapped around the cable tray supports.

   3M COMPANY
   3M FIRE PROTECTION PRODUCTS – CP-25WB+ Caulk or FB-3000 WT Sealant

   C. **Filament Tape** – (Not Shown) – Nom 3/4 in. (19 mm) wide pressure-sensitive tape supplied in rolls. Used during installation to temporarily secure the blankets in place before final compression and permanent attachment with banding (Item 5E). Minimally to be wrapped around the entire circumference of each installed blanket within 2 in. (51 mm) of each joint edge.

   D. **Aluminum Foil Tape** – (Not Shown) – Nom 4 in. (102 mm) wide pressure-sensitive aluminum foil tape supplied in rolls. Used over all joints, seams and any location filled with caulk or sealant (Item 5B).

   E. **Banding** – Min 0.020 in. (0.5 mm) thick by 1/2 in. (13 mm) wide Type 304 stainless steel banding installed over the outer layer of blanket material and cable tray supports. The bands are to be minimally placed 1 in. (25 mm) above and below each joint and at the midpoint of any blanket with a length greater than 12 in. (305 mm). Banding to be ratchet-tightened and secured with stainless steel wing clips.

*Bearing the UL Classification Mark

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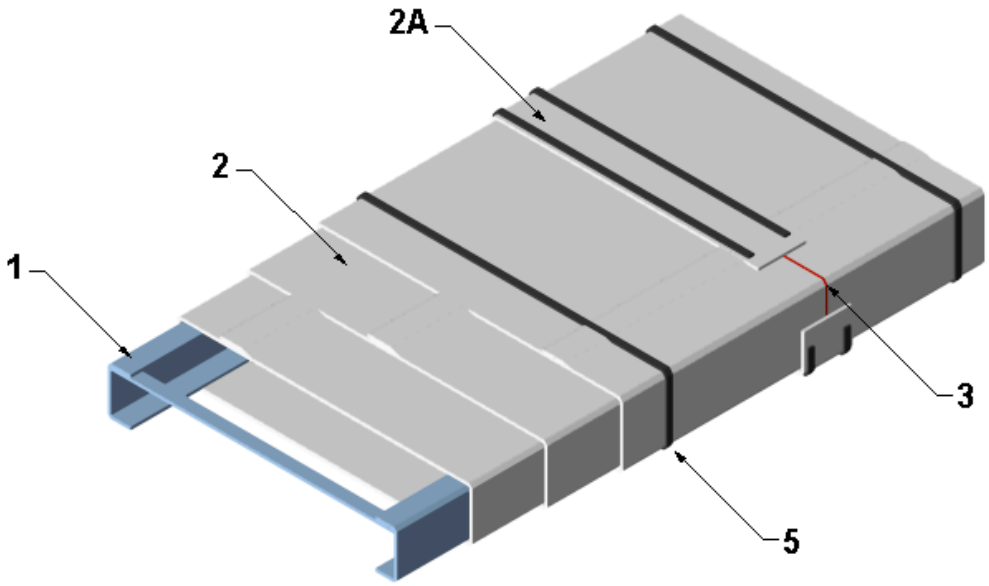
Design Number 3MU/AF 60-06

August 30, 2012
APPLIED FIREPROOFING
3M Company
3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat
3M Fire Barrier CP 25WB+ Caulk
IEEE 848
Rating: Ampacity Derating – 49.9%
Reference Intertek Design Listing 3MU/AF 60-01 for Fire Resistance Ratings



1. CABLE TRAY: Use nominal 24 in. wide x 4 in. deep galvanized steel ladder-back cable tray. Friction fit nominal 13/16 in. wide x 13/32 in. deep, 18 GA galvanized steel struts between side rails spaced 12 in. on center (oc) along the length of the cable tray. Use filament tape for additional support if needed.
2. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Applied Fireproofing

   MODEL: 3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat

   ENDOTHERMIC MAT: Install 3 layers of foil faced flexible mat tightly around the cable tray (Item 1). Install each piece of mat with a minimum 2 in. overlap onto itself and temporarily hold in place using filament tape if needed.

   A. COLLAR: Install nominal 4 in. wide strip of endothermic mat (Item 2) around outer layer of the wrapped cable tray (Item 1). Center collar over butt joints over outer layer and secure using steel banding (Item 5).
3. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Caulk or Sealant

   MODEL: 3M™ Fire Barrier CP 25WB+ Caulk

   CAULK: Install caulk between butt joints of endothermic mat (Item 2) on all layers. Alternative use is to fill gaps and voids along seams greater than 1/8 in. wide.
4. TAPE: (Not Shown) Apply 4 in. wide pressure sensitive tape with aluminum foil facing to all exposed edges of the collar (Item 2A) as well as the longitudinal (overlap) joints of the endothermic mat (Item 2) on the outer layer.
5. STEEL BANDING: Install 1/2 in. wide x 0.020 in. thick stainless steel banding on the outer layer of the endothermic mat (Item 2). Install banding within 1 in. of the edge of collars (Item 2A) and butt joints and maximum 12 in. oc at all other locations.

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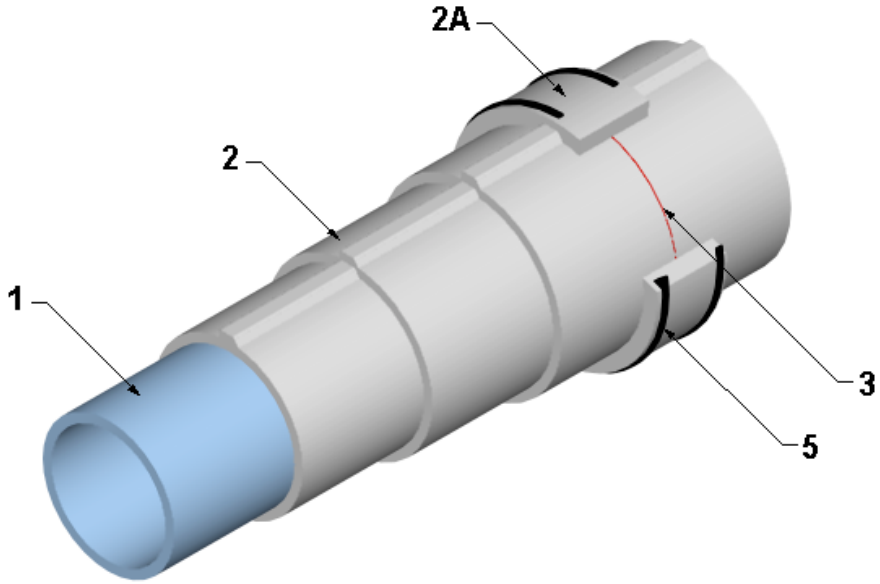
Design Number 3MU/AF 60-07

August 30, 2012
APPLIED FIREPROOFING
3M Company
3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat
3M™ Fire Barrier CP 25WB+ Caulk
IEEE 848
Ampacity Derating:
1 in. conduit – 8%
4 in. conduit – 9%
Reference Intertek Design Listing 3MU/AF 60-03 for Fire Resistance Ratings



1. CONDUIT: Use minimum 1 in. (or larger) rigid galvanized steel conduit.
2. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Applied Fireproofing

   MODEL: 3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat

   ENDOTHERMIC MAT: Install 4 layers of foil faced flexible mat tightly around the conduit (Item 1). Install each piece of mat with a minimum 2 in. overlap onto itself and temporarily hold in place using filament tape if needed.

   A. COLLAR: Install nominal 4 in. wide strip of endothermic mat (Item 2) around outer layer of the wrapped conduit (Item 1). Center collar over butt joints over outer layer and secure using steel banding (Item 5).
3. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Caulk or Sealant

   MODEL: 3M™ Fire Barrier CP 25WB+ Caulk

   CAULK: Install caulk between butt joints of endothermic mat (Item 2) on all layers. Alternative use is to fill gaps and voids along seams greater than 1/8 in. wide.
4. TAPE: (Not Shown) Apply 4 in. wide pressure sensitive tape with aluminum foil facing to all exposed edges of the collar (Item 2A) as well as the longitudinal (overlap) joints of the endothermic mat (Item 2) on the outer layer.
5. STEEL BANDING: Install 1/2 in. wide x 0.020 in. thick stainless steel banding on the outer layer of the endothermic mat (Item 2). Install banding within 1 in. of the edge of collars (Item 2A) and butt joints and maximum 12 in. oc at all other locations.

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3M™ Fire Protection Products
Interam™ E-Mat Solutions Package

Jet Fire
ISO 22899-1

3M

Design Number 3MU/AF 240-03

May 02, 2013

APPLIED FIREPROOFING

Jet Fire Plate

3M Company

3M™ Interam™ E-5 and E-5A-4 Series Endothermic Mat

ISO 22899-1:2007(E), Determination of the Resistance to Jet Fires of Passive Fire Protection Materials

Temperature Rise 13°C – Time 15 minutes

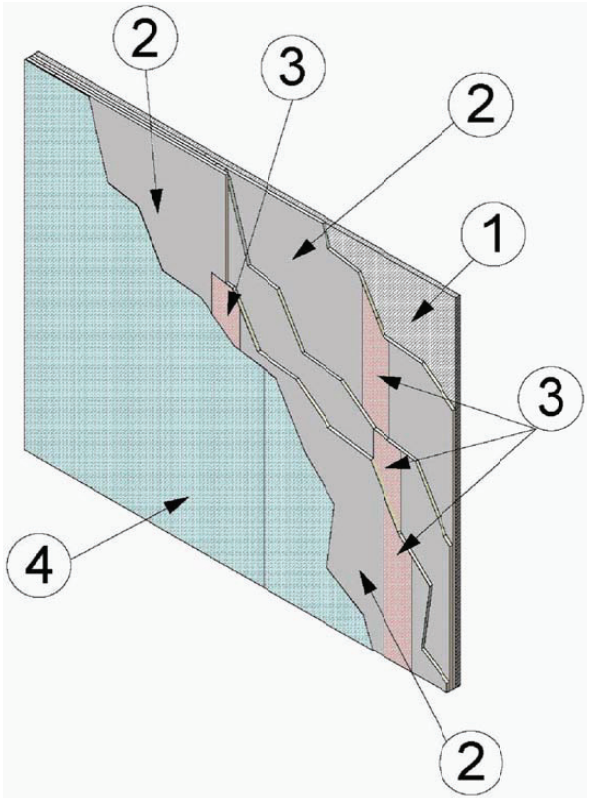
Temperature Rise 35°C – Time 30 minutes

Temperature Rise 99°C – Time 60 minutes

Temperature Rise 208°C – Time 120 minutes

Temperature Rise 242°C – Time 180 minutes

Temperature Rise 251°C – Time 240 minutes



1. STEEL PANEL: A steel panel constructed of 10mm (0.39 in.) thick steel complying with ISO 630:1995, Grade Fe 430 representing steelwork with no corners or edge features or cylindrical vessels, pipes and tubular sections of outside diameter greater than 500mm (19.7 in.).
2. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Applied Fireproofing

   MODEL: 3M™ Interam™ E-5 and E-5A-4 Series Endothermic Mat

ENDOTHERMIC MAT: Install 3 layers of foil faced flexible mat tightly over the steel panel (Item 1). Install first layer with continuous vertical sections of Endothermic Mat with vertical joints fit tightly together and foil facing away from the steel panel. Adhere first layer to the steel panel (Item1) using 3M Hi-Strength 90 Adhesive applied to the steel and the back of the first layer being applied. Use rollers over the entire layer to ensure complete adhesion is achieved. Tape all joints of first layer with Aluminum Tape (Item 3) and use rollers over tape to ensure complete adhesion. Install each additional layer with continuous vertical sections of Endothermic Mat with vertical joints fit tightly together and foil facing away from the previous layer. Install each additional layer with joints offset minimum 51mm (2 in.) from joints of the previous layer. Adhere each additional layer to the previous layer of Endothermic Mat using 3M Hi-Strength 90 Adhesive applied to the face of the previous layer and to the back of the current layer being applied. Use rollers over the entire layer to ensure complete adhesion is achieved. Tape all joints of each additional layer with Aluminum Tape (Item 3).

3. ALUMINUM TAPE: Apply 102mm (4 in.) wide pressure sensitive tape with aluminum foil facing to all joints of each layer of the Endothermic Mat (Item 2).
4. STEEL SHEATHING: Install 1 layer of 26GA (0.455mm (0.0179 in.) thick) T-304 stainless steel sheeting over the Endothermic Mat (Item 2) in continuous vertical sheets. Install steel sheathing with minimum 76mm (3 in.) overlap at joints to create a stepped surface installation. Adhere each piece of Steel Sheathing to the final layer of Endothermic Mat (Item 2) using 3M Hi-Strength 90 Adhesive applied to the edges of the back of the Steel Sheathing face of the corresponding locations on the final layer of Endothermic Mat (Item 2).
5. PINS (Not Shown): Install nominal 35mm (1-3/8 in.) long, 12 GA (2.70mm (0.106 in.) thick) stainless steel cup head pins with a minimum 38mm (1-1/2 in.) washer. Install pins by pre-drilling holes through the Steel Sheathing (Item 4) and the Endothermic Mat (Item 2) with a 11mm (7/16 in.) drill bit and welding the pins to the Steel Panel (Item1). Pins shall be spaced both vertically and horizontally 305mm (12 in.) on center.

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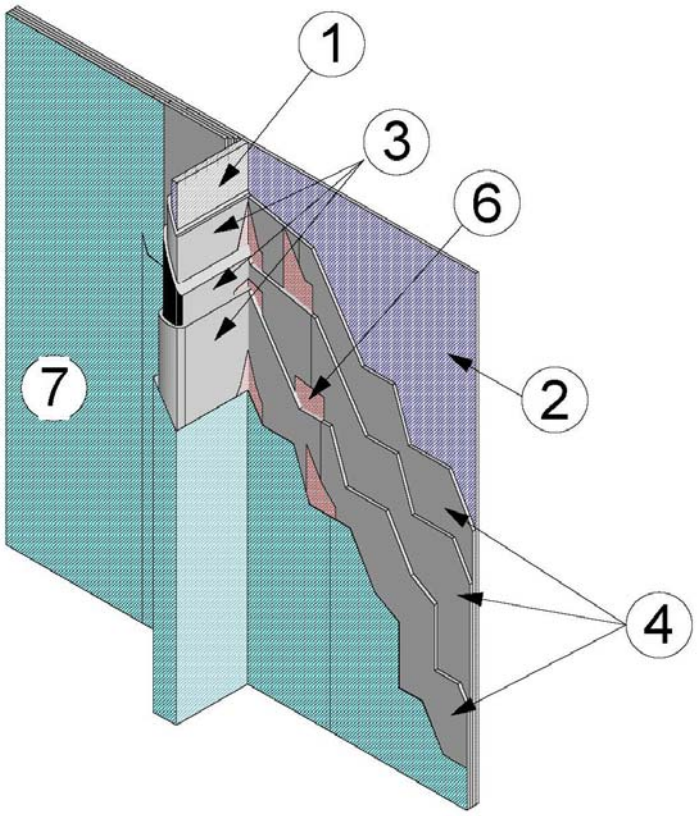
Design Number 3MU/AF 240-04
APPLIED FIREPROOFING
Jet Fire
3M Company
3M™ Interam™ E-5 and E-5A-4 Series Endothermic Mat
ISO 22899-1:2007(E), Determination of the Resistance to Jet Fires of Passive Fire Protection Materials
Temperature Rise 5°C – Time 15 minutes
Temperature Rise 26°C – Time 30 minutes
Temperature Rise 76°C – Time 60 minutes
Temperature Rise 182°C – Time 120 minutes
Temperature Rise 275°C – Time 180 minutes
Temperature Rise 356°C – Time 240 minutes



1. STRUCTURAL STEELWORK: Use structural steel having a minimum thickness of 20 +/- 0.25 mm (0.79 +/- 0.01 in.).

2. STEEL PANEL: A steel panel constructed of 10mm (0.39) thick steel complying with ISO 630:1995, Grade Fe 430 representing steelwork with no corners or edge features.

3. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Applied Fireproofing

   MODEL: 3M™ Interam™ E-5 and E-5A-4 Series Endothermic Mat

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ENDOTHERMIC MAT: Install 3 layers of foil faced flexible mat tightly over the Structural Steelwork (Item 1) and Steel Panel (Item 2). Install first layer with continuous vertical sections of Endothermic Mat. Each layer shall have one single piece of Endothermic Mat over the Structural Steelwork (Item 2) with the foil facing away from the Structural Steelwork. Adhere first layer to the Structural Steelwork (Item1) using 3M Hi-Strength 90 Adhesive applied to the steel and the back of the first layer being applied. Use rollers over the entire layer to ensure complete adhesion is achieved. Install each additional layer with a single piece of continuous vertical sections of Endothermic Mat and foil facing away from the previous layer. Adhere each additional layer to the previous layer of Endothermic Mat using 3M Hi-Strength 90 Adhesive applied to the face of the previous layer and to the back of the current layer being applied. Use rollers over the entire layer to ensure complete adhesion is achieved.

4. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Applied Fireproofing

   MODEL: 3M™ Interam™ E-5 and E-5A-4 Series Endothermic Mat

   ENDOTHERMIC MAT: Install 3 layers of foil faced flexible mat tightly over the steel panel (Item 1). Install first layer with continuous vertical sections of Endothermic Mat with vertical joints fit tightly together and foil facing away from the steel panel. Adhere first layer to the steel panel (Item1) using 3M Hi-Strength 90 Adhesive applied to the steel and the back of the first layer being applied. Use rollers over the entire layer to ensure complete adhesion is achieved. Tape all joints of first layer with Aluminum Tape (Item 6) and use rollers over tape to ensure complete adhesion. Install each additional layer with continuous vertical sections of Endothermic Mat with vertical joints fit tightly together and foil facing away from the previous layer. Install each additional layer with joints offset minimum 51mm (2 in.) from joints of the previous layer. Adhere each additional layer to the previous layer of Endothermic Mat using 3M Hi-Strength 90 Adhesive applied to the face of the previous layer and to the back of the current layer being applied. Use rollers over the entire layer to ensure complete adhesion is achieved. Tape all joints of each additional layer with Aluminum Tape (Item 6).

5. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Caulk

   MODEL: 3M™ Fire Barrier CP 25WB+

   CAULK (Not Shown): Install caulk in any joints between Endothermic Mat or between the Endothermic Mat and any steel member that exceed 3mm (1/8 in).

6. ALUMINUM TAPE: Apply 102mm (4 in.) wide pressure sensitive tape with aluminum foil facing to all joints of each layer of the Endothermic Mat (Item 2).

7. STEEL SHEATHING: Install 1 layer of 28 GA (0.39mm (0.0156 in.) thick) T-304 stainless steel sheeting over the Endothermic Mat (Item 2) in continuous vertical sheets. Install steel sheathing with minimum 76mm (3 in.) overlap at joints to create a stepped surface installation. Adhere each piece of Steel Sheathing to the final layer of Endothermic Mat (Item 2) using 3M Hi-Strength 90 Adhesive applied to the edges of the back of the Steel Sheathing face of the corresponding locations on the final layer of Endothermic Mat (Item 2).

8. PINS (Not Shown): Install nominal 35mm (1-3/8 in.) long, 12 GA (2.70mm (0.106 in.) thick) stainless steel cup head pins with a minimum 38mm (1-1/2 in.) washer. Install pins by pre-drilling holes through the Steel Sheathing (Item 4) and the Endothermic Mat (Item 2)

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with a 11mm (7/16 in.) drill bit and welding the pins to the Structural Steelwork (Item1). Pins shall be spaced both vertically and horizontally 305mm (12 in.) on center and centered over the overlap of each joint in the Steel Sheathing (Item 7).

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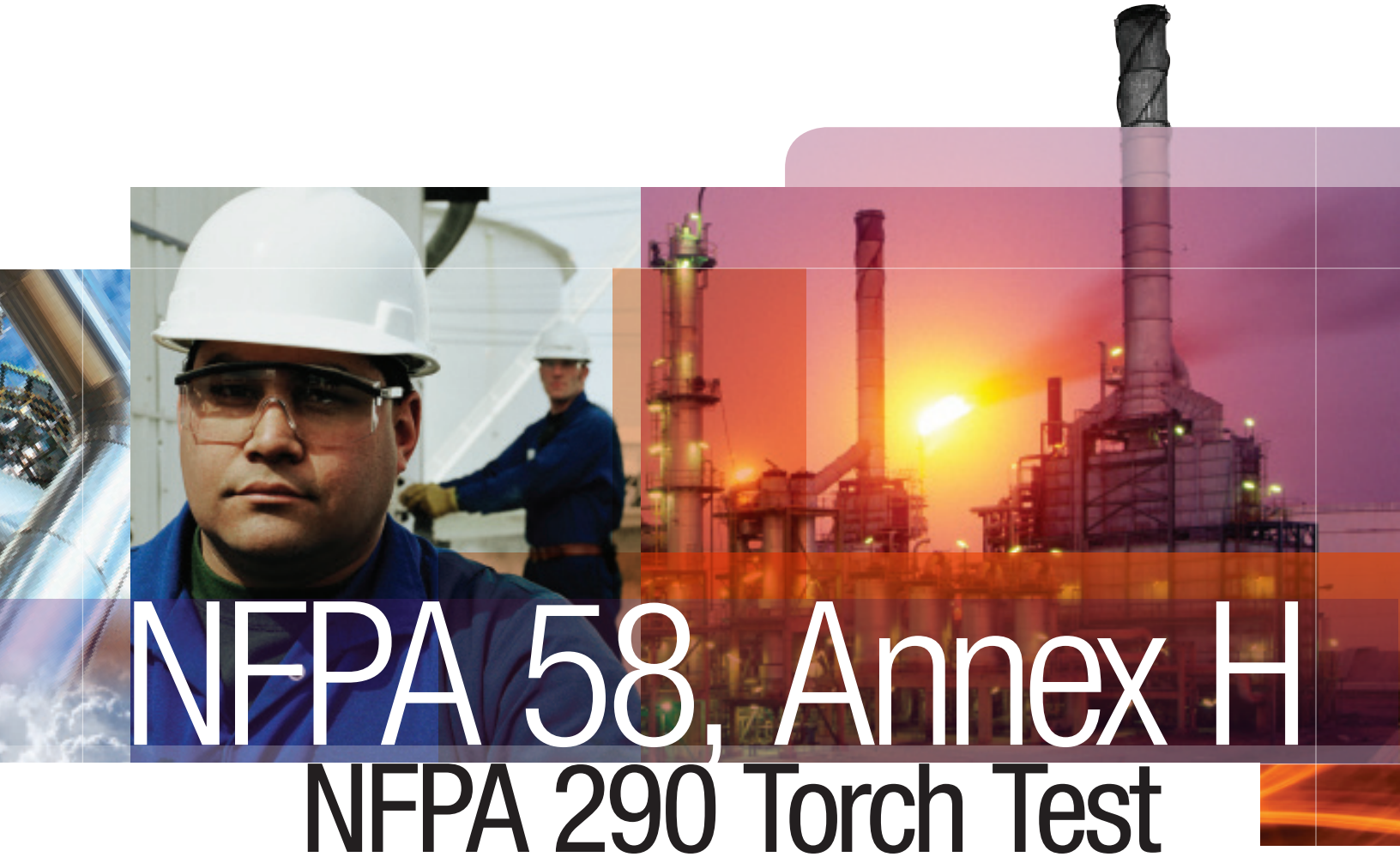
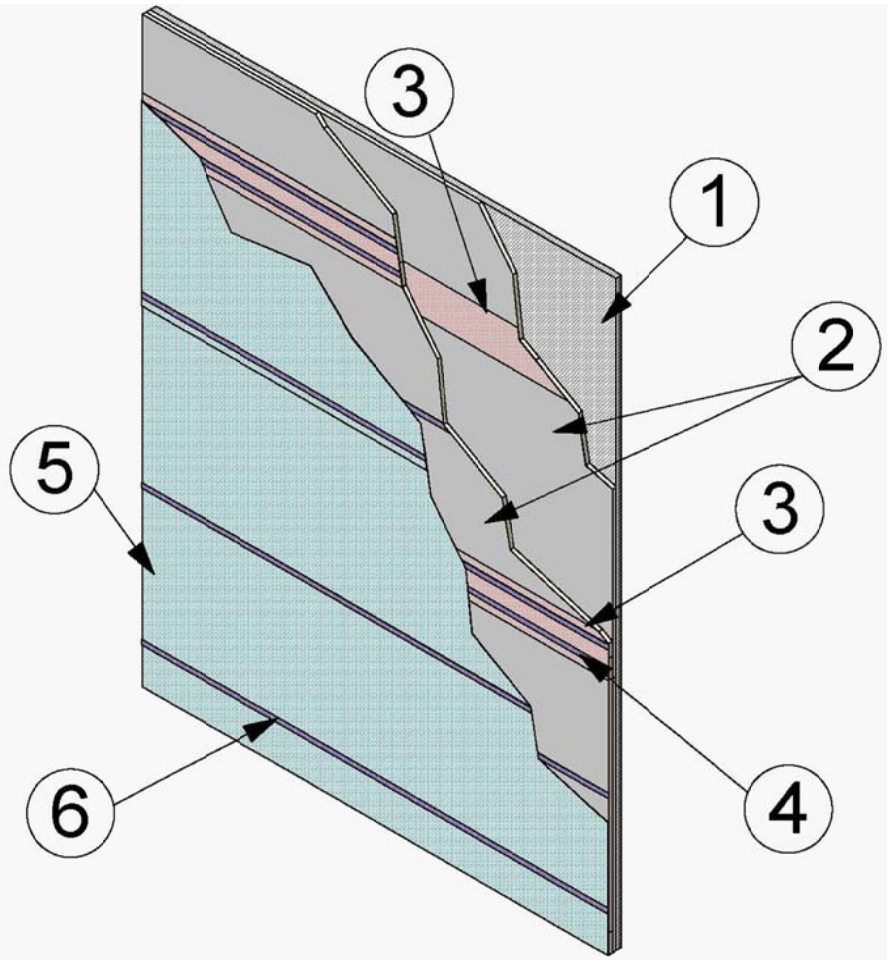
Interam™ E-Mat Solutions Package



NFPA 58, Annex H
NFPA 290 Torch Test

Design Number 3MU/AF 50-01

September 07, 2012
APPLIED FIREPROOFING
3M Company
3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat
NFPA 58 Appendix H
NFPA 290
Rating: Pass



1. VESSEL: Use a code approved container for storage of liquid propane gas (LPG).
2. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: Applied Fireproofing

   MODEL: 3M™ Interam™ E-5, E-54-A and E-5A-4 Series Endothermic Mat

   ENDOTHERMIC MAT: Install 2 layers of foil faced flexible mat tightly around the vessel (Item 1). Install first layer with circumferential and longitudinal butt joint fit tightly together. Tape all joints of first layer with Aluminum Tape (Item 3). Install second layer with circumferential and longitudinal butt joint fit tightly together. Install second layer with joints offset minimum 2 in. from joints of first layer. Tape all joints of second layer with Aluminum Tape (Item 3).

   Note: If required filament tape may be used to hold the endothermic mat in place. Filament tape should be spaced minimum 6 in. on center (oc)
3. ALUMINUM TAPE: (Not Shown) Apply 4 in. wide pressure sensitive tape with aluminum foil facing to all joints of the inner and outer layer of the Endothermic Mat (Item 2).
4. STEEL BANDING: Install 1/2 in. wide x 0.020 in. thick stainless steel banding around the outer layer of the endothermic mat (Item 2). Install banding within 1 in. of the edges of each piece of endothermic mat (Item 2) circumferential butt joints and maximum 12 in. oc along the width of the endothermic mat (Item 2) with a minimum of three bands (total) per mat installed.
5. STEEL SHEATHING: Install 1 layer of 0.016 in. thick T-304 stainless steel sheeting over the endothermic mat (Item 2). Install steel sheathing with minimum 2 in. overlap at circumferential joints to create a stepped surface installation. One continuous piece of steel sheathing shall wrap around the container (item 1) and the endothermic mat (Item 2) with a minimum 2 in. overlap at the longitudinal joint.
6. STEEL BANDING: Install 1/2 in. wide x 0.020 in. thick stainless steel banding around the steel sheathing (Item 5). Install banding within centered over the overlap of each joint in the steel sheathing (Item 5) and maximum 12 in. oc along the width of the steel sheathing (Item 2) with a minimum of three bands per sheet installed.

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Interam™ E-Mat Solutions Package

HDPE Pipe Protection

3M

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Fire Testing of High-Density Polyethylene Pipe

2011 TECHNICAL REPORT

Fire Testing of High-Density Polyethylene Pipe

1023004

Final Report, August 2011

EPRI Project Manager
D. Munson

This document does NOT meet the requirements of 10CFR50 Appendix B, 10CFR Part 21, ANSI N45.2-1977 and/or the intent of ISO-9001 (1994)

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Palo Alto, CA 94304

Principal Investigator
D. Munson

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Dana Decker, Ernst Schmidt, Richard Haffner, and Victor Oreskovich of 3M for their development work of the fire barriers tested herein, and for application of the fire barriers to the test specimens.

Joshua Vestal and Victor Borgos of Intertek for the setup and fire testing services performed.

Siegrid Hall and Tim Adams of J. D. Stevenson & Associates for the stress analyses and development of the fabrication drawings for the test specimens.

Lee Supply for the fabrication of the test specimens.

This publication is a corporate document that should be cited in the literature in the following manner:

Fire Testing of High-Density Polyethylene Pipe. EPRI, Palo Alto, CA: 2011. 1023004.

REPORT SUMMARY

The results in this report are intended to demonstrate a method that can be used to protect high-density polyethylene (HDPE) piping located aboveground from postulated fire events. This includes protecting both pipe and pipe fittings (for example, elbows, tees, and valves) from the fire environment—including the heat transmitted from pipe supports—and preventing the fire environment from passing through building wall or floor penetrations.

The report is intended to be complementary to other ongoing Electric Power Research Institute (EPRI) activities that have the overall objectives of qualifying HDPE piping for use in belowground and aboveground applications in safety-related and non-safety-related piping systems.

Background

Degradation of raw water piping systems is a major issue facing nuclear power plant owners, and many plants will require the repair or replacement of existing carbon steel piping components. New plants wish to build on the lessons learned from operating plants and use piping materials that are expected to last the design lifetime. HDPE has been used in non-safety service water systems for more than 10 years, in both belowground and aboveground applications, and found to perform well. Because the cost of installing HDPE piping is much lower than that of corrosion-resistant metal pipe, the use of HDPE pipe in many raw water applications is desirable.

Objective

- To evaluate a method that may be capable of protecting HDPE pipe and pipe fittings from a postulated fire environment

Approach

Four piping subassemblies were designed that contained many of the fittings and components commonly found in HDPE piping systems. They included a flanged joint, a tee, an HDPE valve, straight pipe, butt fusion joints, mitered elbows, and pipe caps as well as rod hangers to provide deadweight support. The pipe, pipe fittings and components, and pipe supports were wrapped with an endothermic material that had previously been qualified for protecting cable trays and conduits from the fire event. The subassemblies were subject to both deadweight and pressure loads with the resulting stresses somewhat in excess of those allowed by ASME Code Case N-755-1. They were installed in a furnace with fire-resistant packing material and a water-resistant sealant used at wall penetrations. The assemblies were subject to a 3-hour fire test according to the guidance of ASTM E119 followed by a hose stream test according to the guidance of ASTM E2226. The assemblies were monitored for leakage throughout the event, and thermocouples were used to measure the surface temperature of the piping assemblies.

Results and Findings

All four specimens survived the test, with each retaining its overall geometry, cross section, and structural and pressure boundary integrity. The wall and ceiling penetrations held; no excessive heat was transmitted through the penetrations during the fire test, and no water was transmitted through the penetrations during the hose stream test. In addition, no damage to the pipe or significant cracking of the penetration seals was observed from the thermal shock and erosion force of the hose stream test. Although pipe surface temperatures exceeded the target temperature for three of the specimens, the actuator nut on the valve melted, and some permanent deformations of two of the assemblies were found, no water leaked from any of the assemblies. These conditions could likely be prevented with some improvements to the wrapping method for complex shapes and/or additional layers of the barrier material.

Keywords

Aboveground piping
Fire barriers
Fire testing
High-density polyethylene (HDPE)

ABSTRACT

This report presents and demonstrates a method that can be used to provide a fire-resistant barrier for aboveground high-density polyethylene (HDPE) piping systems that might be required to withstand a postulated fire event.

There are potential economic and safety benefits for pursuing the use of HDPE pipe in piping systems containing raw or minimally treated water because of its resistance to microbial attack and corrosion. Buried HDPE pipe has been successfully used in many industries, including the nuclear power industry. HDPE has also been used extensively aboveground but in areas in which fire resistance is not an issue. The work summarized in this report is intended to provide a basis for the use of HDPE in areas in which fire resistance is required. The work performed in this study was intended to be proof-of-concept only and should not be considered as a qualification or certification test.

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1
INTRODUCTION

1.1 Background

Degradation of raw water piping systems is a major issue facing nuclear power plant owners, and many plants will need to repair or replace existing carbon steel piping components. New plants wish to build on the lessons learned from operating plants and use piping materials that are expected to last the design lifetime. High density polyethylene (HDPE) has been used in *non-safety* service water systems for over ten years, in both below ground and above ground applications, and found to perform well. It has also been used in two safety related buried applications in the US, and in one above ground safety related application abroad. Since the cost of installing HDPE piping is much lower than the cost for corrosion resistant metal pipe, the use of HDPE pipe in many raw water applications is an attractive option. As a result, there is increasing interest in the use of HDPE for above ground systems in new build nuclear power plants.

When used above ground, or in underground tunnels or vaults, fire resistance may be an issue. HDPE starts to melt at ~235°F (115°C) and has an auto-ignition temperature of ~662°F (350°C). Additionally, toxic flames or gasses are released when it burns. Thus, in applications where the system must remain operable during a postulated fire event, or not contribute to the fire load, (i.e., burn), fire barriers must be provided. The purpose of this project is to develop and demonstrate one method of protecting HDPE piping from a postulated fire event.

1.2 Overall Project Description

This project is part of a related effort to obtain the necessary data to support the development of necessary ASME Code rules to be able to use HDPE piping in nuclear power plants. Many of the needed properties are not provided in Section III of the ASME Boiler and Pressure Code, nor are many of the needed properties provided in the B31.1 code for non-nuclear piping. Additionally, comprehensive properties are not readily available from any industry consensus source [1]. Various trade organizations and manufacturers provide portions of the required material information. However, the available data have not been independently reviewed by consensus bodies and design properties must be extracted from the material test data.

In 2005, ASME formed a Special Working Group (now called the Sub-Group for Polyethylene Pipe) to develop rules for nuclear safety class 3 pipe that is buried. In 2007, ASME approved Code Case N-755 [2] which contains some of the rules needed for Section III class 3 buried piping. Revision 1 to Code Case N-755 was approved in June 2011. Included in revision 1 are some enhanced material requirements for the resins. HDPE piping products which meets these

requirements are called "compliant" resins in this report. As soon as rules for buried piping are sufficiently developed, the applicable committees intend work on above ground applications. In 2010, ASME began organizing another working group to develop rules for non nuclear applications.

Most of the activities in the overall EPRI program for HDPE were initiated to obtain and consolidate material data needed for application of HDPE in ASME Boiler and Pressure Vessel Section III, Division 1 Class 3 applications. These data are being obtained by a series of material test tasks and activities. Work completed, in process, or planned for the near future is described in the following sections.

1.2.1 Tensile Testing

Tensile testing of HDPE pipe material is being performed to determine its yield stress, yield strain, ultimate strain and elastic modulus as a function of temperature. To date, two materials have been tested; PE 3408 with a cell classification of 345464C, and a unimodal PE 4710 with a cell classification of 445474C. The tensile testing of both resins included both thermally aged and new material specimens. The results for the PE 3408 testing were presented in EPRI Report 1013479 [3] and PE 4710 test results were included in EPRI Report 1018351 [4]. The tensile testing of Code Case N-755-1 compliant bimodal PE 4710 resins is planned for 2011 - 2012.

1.2.2 Fatigue Testing

The basic fatigue curves for fusion welds in PE piping are needed to support the fatigue stress allowables of Code Case N-755-1, as well as provide reference data to develop stress intensification factors for various types of pipe fittings. The initial task was the development of the basic fatigue curves (commonly referred to as S-N curves) for fusion welds in unimodal PE 4710 cell classification 445474C pipe. The results were presented in EPRI Report 1015062 [5]. The development of basic fatigue curves for Code Case N-755-1 compliant bimodal PE 4710 resins is planned for 2011 - 2012.

1.2.3 Stress Intensification and Flexibility Factors

Stress Intensification Factors (SIFs) and flexibility factors have been developed for selected HDPE fittings and components. The results were presented in several EPRI reports. The components were fabricated from PE 4710 material with cell classification 445474C or 445574C.

In EPRI Report 1015062 [5]:

- 4" and 12" 5-segment elbows

In Report 1016729 [6]:

- 4" Molded elbows

- 3-segment 4" mitered elbows
- 4"Electro-fusion couplings
- 4" Full-outlet fabricated tees
- 10" x 8" and 6" x 4" Fabricated reducers
- 10" x 8" and 6" x 4" Molded reducers

In EPRI Report 1020439 [7]:

- 4" Full-outlet molded tees
- 10" x 3" Sidewall fusion branch connections
- 4" x 2" Electrofusion branch connections
- 4" Fabricated 45° lateral wye
- 4" HDPE to HDPE flanged connections

Reference [7] also contains a summary of all other SIF test results.

1.2.4 Slow Crack Growth

The slow crack growth (SCG) properties of PE 4710 are needed to support of the 10% scratch depth allowable of Code Case N-755-1. Ultimately, fracture mechanics properties of PE 4710 will also be needed (e.g., da/dt versus K_I curves) to evaluate other types of flaws. Two types of tests have been conducted; tensile coupons with a 10% crack were subjected to a constant tensile load at 95°C, and 4" SDR 11 pipe specimens with a 10% through-wall crack were subjected to a sustained pressure load at 85°C and 95°C. The results of this SCG testing are discussed in EPRI report 1022565 [8]. Planned for 2011 - 2012 is the initiation of additional pressurized pipe tests to study the effect of fusion welds and pipe size on SCG. The detailed test plans have not yet been completed. All pipe materials used for the 2011 - 2012 testing will be compliant with Code Case N-755-1 requirements.

1.2.5 Flange Strength Testing

The strength of a 4" inch nominal flange adapter relative to straight pipe was determined. The test specimens used for this task were fabricated from PE-3408/3608 with a minimum cell classification of 345464C and the flange adapters were PE-4710/3408 with a minimum cell classification of 345464C. The test results are included in EPRI reports 1015062 [5] and 1020438 [9].

1.2.6 Creep Testing

Long term creep data for PE 4710 resins that meet the requirements of Code Case N-755-1 are to be developed. The goal of the testing is to determine the creep rates and develop a creep

function that defines the creep versus time and stress behavior of the pipe material. It is planned to complete the testing by the end of 2011.

1.2.7 Seismic Modulus

Testing was performed in mid 2011 to determine the appropriate elastic modulus for use in seismic qualifications of aboveground HDPE piping systems. This includes the relationship of the elastic modulus to the seismic strain rate. Code Case N-755-1 compliant bimodal PE 4710 resins were used for the test specimens. The test results are scheduled to be published in the fall of 2011 in EPRI report 1021095 [28].

1.2.8 Damping Factors

Testing was performed in mid 2011 to determine the appropriate damping factor for use in seismic qualifications of aboveground HDPE piping systems. The test specimens were fabricated from Code Case N-755-1 compliant bimodal PE 4710 pipe material. The test results are scheduled to be published in the fall of 2011 in EPRI report 1021095 [28].

1.2.9 Seismic Qualification of Vent and Drain Valves

Shake table testing was conducted to support the seismic qualification of HDPE vent and drain valves configurations. The testing was completed in the 2nd quarter of 2011. The test results are scheduled to be published in the fall of 2011 in EPRI report 1021095 [28].

1.2.10 Development of Proposed Rules for Above Ground Applications

Code rules and proper design methods will be needed for above ground applications. An investigation into the behavior of HDPE for above ground applications, including the development of proposed ASME Code rules for nuclear class 3 pipe is provided in EPRI report 1021094 [10].

1.3 Results Presented In This Report

This report documents the development and testing of one method to protect above ground HDPE piping from the postulated fire event and subsequent hose stream test.

4
TEST RESULTS AND DATA ANALYSIS

The 4 specimens were tested to the full 3-hour duration proscribed by ASTM E119 and NFPA 251 and 804. Room ambient temperature at the start of the test was 89°F; the initial temperature inside the furnace was 84°F. After initiation of the test, the furnace temperature was monitored using the 10 temperature probes discussed in Section 3.4, and used to control the burners to meet the required time-temperature profile. See Appendix B. Test results for each test specimen are presented and discussed in Section 4.1. Results of the hose stream test are provided in Section 4.2. Final observations of each specimen are provided in Section 4.3.

4.1 Fire Barrier Test

4.1.1 Specimen A - 2 Inch Pipe with Valve

The 2 inch pipe with valve was monitored for pressure and signs of leakage. During the test, the internal pressure (initially 100 psi) tended to slowly decrease. This was expected due to HDPE's relatively low modulus of elasticity that decreases with temperature [4], its relatively high coefficient of thermal expansion, as well as it's well known propensity to creep. When the pressure dropped to approximately 97 or 98 psi, the system was repressurized to 100 psi. This happened 4 or 5 times during the test. There was no loss of fluid inventory.

Approximately 60 minutes into the test, the temperature of the thermocouple mounted on the center of the valve started to climb and reached a temperature of 210°F, or approximately the boiling temperature of water, at 160 minutes. It then held steady until completion of the test. This was indicative of water/steam release from the E-Mat had reached the pipe surface. At the end of the test, the other 3 thermocouples had maximum temperature readings of 136°F, 135°F, and 126°F.

At 210°F, an extrapolation of the tensile results in [4] would indicate a yield stress of a unimodal HDPE material of approximately 800- 850 psi. At a pipe skin temperature of 210°F, the pressure and deadweight loads applied to the specimen throughout the test resulted in hoop and longitudinal stresses that approached the pipe yield stress.

The pipe penetration through the furnace wall was also closely monitored for signs of leakage or gross deformation of the specimen. The 6 thermocouples mounted on the exterior penetration seal and/or the concrete near the seal measured temperatures in the range of 212 - 260°F. This is considered to be due to heat conduction through the concrete furnace wall. No leakage through the penetration seal was observed, and it was not necessary to use a cotton pad test.

4.1.2 Specimen B - 4 Inch Pipe with Tee

The 4 inch pipe with tee was monitored for pressure and signs of leakage. This pipe was intentionally loaded to a longitudinal stress ~877 psi, which exceeded the Code allowable stress of 719 psi at room temperature. In particular, the torsional stress on the main run was very high. Internal pressure was applied by a ~36 in high column of water, thus the hoop stress was quite low. During the test, there was no loss of fluid inventory. A photo of Specimen B taken through an observation porthole is shown in Figure 4-1.

Approximately 130 minutes into the test, 3 of the thermocouples mounted on the pipe were measuring temperatures in the range of 180°F. By 150 minutes, the thermocouple on the tee had reached ~200°F, which is near the boiling temperature of water. This was indicative of water/steam release from the E-Mat had reached the pipe surface. By the end of the test, the temperature of the tee had reached 209°F.

As discussed in 4.1.1, at 209°F, an extrapolation of the tensile results in [4] would indicate a yield stress of a unimodal HDPE material of approximately 800- 850 psi. Thus the longitudinal stress on the specimen likely exceeded its yield stress, as indicated by the permanent torsional deformation of the tee (see Section 4.3.2). However, as discussed above, there was no loss of the pressure boundary, or overall structural integrity and shape.

The pipe penetration through the furnace wall was also closely monitored for signs of leakage or gross deformation of the specimen. The maximum temperature recorded for the 6 thermocouples mounted on or near the exterior penetration seal was 265°F. This is considered to be due to heat conduction through the concrete furnace wall. No leakage through the penetration seal was observed, and it was not necessary to use a cotton pad test.

Figure 4-1
Specimen B During the Fire Test

4.1.3 Specimen C - 4 Inch Pipe with Flange

The 4 inch pipe with flange was monitored for pressure and signs of leakage. This longitudinal bending stress at the flange was approximately 800 psi. This was achieved with the addition of a 50 lb weight that was placed on top of the flange. A rod attached to the weight passed through the furnace ceiling, and was monitored throughout the test to measure deflection of the flange. Internal pressure stress was applied by a ~36 in high column of water, thus the hoop stress was quite low. During the test, there was no loss of fluid inventory. However, the rod on top of the flange indicated a flange deflection of approximately 2 1/2 inches. Following the fire test and the hose stream test, the piping was found to have retained its overall configuration and shape, but clearly there was some permanent bending deformation of the pipe, centered at the flange (see Section 4.3.3).

Approximately 112 minutes into the test, the thermocouple mounted on the pipe to flange interface suddenly increased in temperature from 144°F to 210°F, or approximately the boiling temperature of water. This temperature held steady until completion of the test and was indicative that water/steam release from the E-Mat had reached the pipe surface. The zone of high temperature gradually spread along the length of the pipe through the duration of the test, but the maximum temperature of the other 4 thermocouples never exceeded 169°F.

The pipe penetration through the furnace wall was also closely monitored for signs of leakage or gross deformation of the specimen. The 6 thermocouples mounted on or near the exterior penetration seal measured temperatures up to 273°F. This is considered to be due to heat conduction through the concrete furnace wall. No leakage through the penetration seal was observed, and it was not necessary to use a cotton pad test.

4.1.4 Specimen D - 4 Inch Pipe with Elbows

The 4 inch pipe with 2 mitered elbows was monitored for pressure and signs of leakage. Internal pressure was applied by a ~36 in high column of water, thus the hoop stress was quite low. During the test, there was no evidence of loss of fluid inventory. During the test, the thermocouples measured a maximum skin temperature of 144°F. Following the fire test and the hose stream test, the piping was found to have retained its overall configuration and shape, with no significant permanent deformation

The pipe penetration through the furnace wall was also closely monitored for signs of leakage or gross deformation of the specimen. The 12 thermocouples mounted on or near the exterior penetration seal of each leg (6 thermocouples near each penetration) measured temperatures up to 247°F. This is considered to be due to heat conduction through the concrete furnace wall. No leakage through the penetration seal was observed, and it was not necessary to use a cotton pad test.

4.2 Hose Stream Test

Following the fire test, the entire assembly was moved to perform a host stream test. See Figures 4-2 through 4-5. The small flames visible in Figures 4-2 and 4-3 were gases that escaped from the binder in the E-Mat and the sealant. These self-extinguished as the specimens started to cool.

A hose stream test was performed following the requirements of ASTM E119 and ASTM E2226. The duration of the hose stream was 1 minute 59 seconds, per ASTM E814 and ASTM E2226 (1.5 seconds per ft^2 of exposed area). The water stream was applied from a distance of 20 feet, an angle of 90°, and a pressure of 30 psig.

All penetrations met the requirements of the hose stream test. Water was not transmitted through the penetrations and the unexposed side of the four test specimens appeared to be undamaged. See Figures 4-6 and 4-7. While the E-Mat was found to be heavily damaged, as per its design, observations made of exposed sides of the 4 specimens are provided in the following sections:

Figure 4-2
Test Assembly Being Moved From the Furnace (approximately 1 or 2 minutes after termination of the test)

Figure 4-3
Test Assembly Prior to Initiation of Hose Stream Test

Figure 4-4
Applied Hose Stream

Figure 4-7
Side View of Unexposed Side Following Hose Stream Test

4.3 Overall Test Results

4.3.1 Specimen A - 2 Inch Pipe with Valve

Specimen A retained its initial configuration. See Figure 4-8 and 4-9. Removal of the E-Mat from around the valve found that the actuator nut on the top of the valve had partially melted and stuck to the E-Mat (see Figure 4-10). However the valve itself appeared to be undamaged and could be opened and closed from the valve stem. No inspection was made of the valve internals, nor was the valve tested for its ability to fully open and fully close, or to hold pressure from one side to the other.

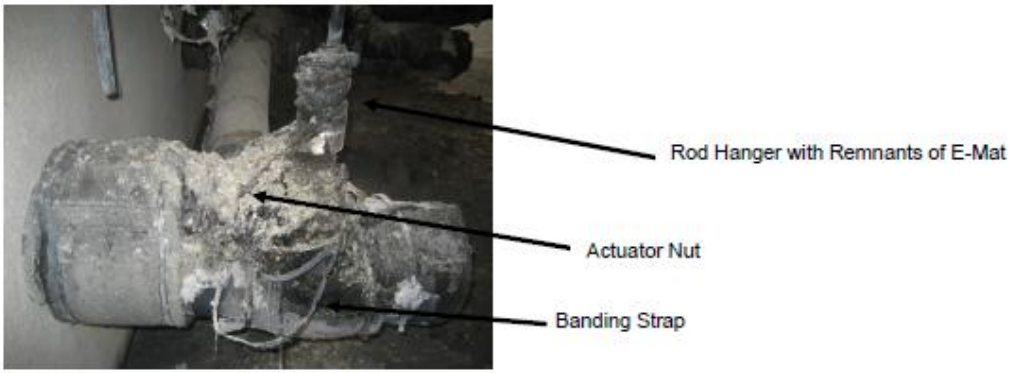

Figure 4-8
Specimen A Following Hose Stream Test

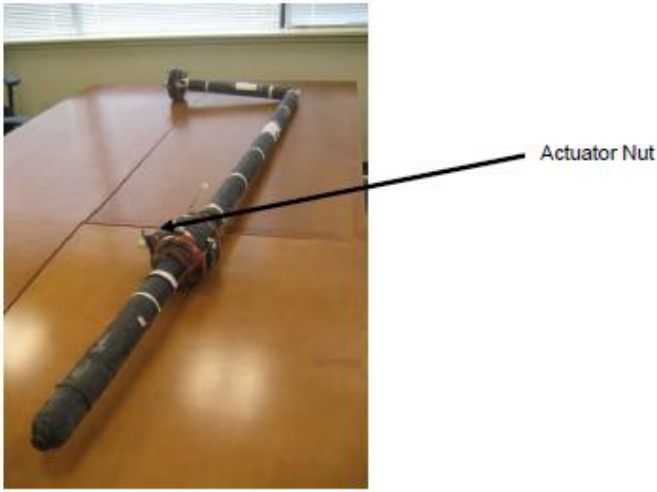

Figure 4-9
Specimen A Following Removal of the E-Mat

Figure 4-10
Close-up of Valve Operator and Remnants of Actuator Nut

4.3.2 Specimen B - 4 Inch Pipe with Tee

Specimen B was found to have undergone some permanent deformation. In particular, there was permanent torsional deformation of the run pipe. See Figure 4-11. However, the pipe retained its overall configuration and cross section, as well as its leak tight integrity. A discussion of the permanent deformation is provided in Section 5.

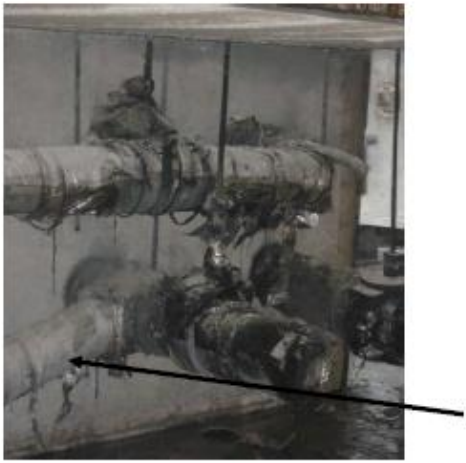

Figure 4-11
Specimen B Following Hose Stream Test

4.3.3 Specimen C - 4 Inch Pipe with Flange

Specimen C was found to have undergone some permanent deformation. In particular, there was permanent bending deformation of the run pipe centered at the flange (the location of the maximum bending moment). See Figure 4-12. However, the pipe retained its overall configuration and cross section, as well as its leak tight integrity. A discussion of the permanent deformation is provided in Section 5.

Figure 4-12
Specimen C Following Hose Stream Test

4.3.4 Specimen D - 4 Inch Pipe with Elbows

Specimen D was found to have remained its overall configuration with little permanent deformation. See Figure 4-13. Additionally, the pipe retained its overall cross section, as well as its leak tight integrity.

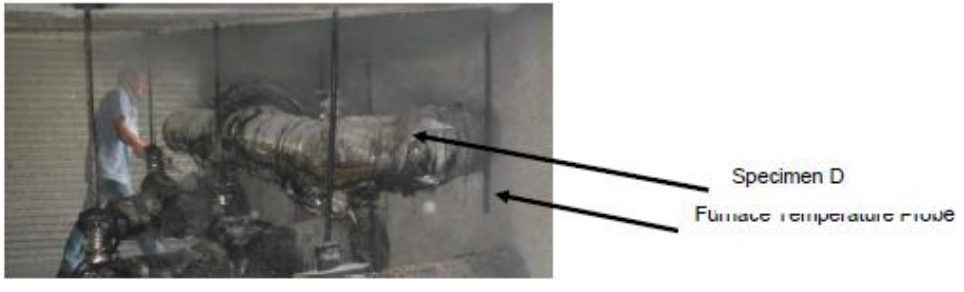

Figure 4-13
Specimen D Following Hose Stream Test

5
CONCLUSIONS

Overall, the test met its objectives and demonstrated that HDPE can be successfully protected from a postulated fire event. The pipe retained its overall geometry and cross section, and retained structural and pressure boundary integrity throughout the test. The wall and ceiling penetrations held and no excessive heat was transmitted through the penetrations during the fire test, nor was any water transmitted through the penetrations during the hose stream test. Only one of the penetration seals experienced any significant cracking due to the thermal shock and erosion force of the hose stream test. However, as discussed above, it did not transmit any heat during the fire test nor smoke or water during the hose stream test. A discussion of 3 abnormal observations follows:

The pipe surface temperatures of Specimen A exceeded the target temperature of 175°F and the actuator nut was found to have melted. The valve used in the test was an off-the-shelf commercial product. The higher than desired surface temperature and the melting of the actuator nut is judged to have been caused by two factors:

a. Wrapping of the valve was somewhat difficult due to its complex shape and close proximity to the pipe hanger. Some improvements to the wrapping method and/or additional layers of the insulating material may have prevented this.

b. The actuator nut was made of ABS, which has a lower melting temperature (~221°F (105°C)) than HDPE.

Specimen B (pipe with tee) was found to have permanent torsional displacement. This is judged to have been caused by two factors:

a. The pipe was initially loaded to ~877 psi combined torsional and bending stress, which is ~22% higher than the Code Case N-755-1 allowable stress of 719 psi at 89.6°F (ambient temperature at start of test).

b. The surface temperature of the tee reached 209°F, which was considerably higher than the target temperature of ~175°F. Some improvements to the wrapping method used for the tee and/or additional layers of the insulating material may have prevented this.

Specimen C (pipe with flange) was found to have permanent bending displacement (~2 1/2 in vertical deflection). This is judged to have been caused by three factors:

a. The 50 lb metal weight was placed directly on the wrapped flange with no intervening element that would have stopped conductive hear transfer. Thus the flange area was subject

to convective and radiation heat transfer, as were the other pipe components in the furnace, plus conductive heat transfer from the metal weight.

b. The surface temperature of the flange reached 210°F, which was considerably higher than the target temperature of ~175°F. Some improvements to the wrapping method use for the flange and/or additional layers of the insulating material may have prevented this.

c. The applied stress of 800 psi was approximately 11% higher than the Code Case N-755-1 allowable stress of 719 psi at 89.6°F (ambient temperature at start of test)

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- **Steel Piping with Cellular Glass Insulation**
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    - 6" (150 mm) diameter pipe with 2-layers E-Mat (stainless steel foil) over 60 mm of cellular glass insulation, SINTEF 251694
    - 6" (150 mm) diameter pipe with 2-layers E-Mat (stainless steel foil) over 35 mm of cellular glass insulation, SINTEF 250030.10/94.299
  - **Hydrocarbon**
    - 10" (273 mm) diameter pipe with 1- and 2-layers E-Mat over 40mm & 60mm of cellular glass insulation, SINTEF 250000.10\93.278
    - 10" diameter pipe with 1 & 2 layers E-Mat over 38mm and 50mm cellular glass insulation., OPL 9006-99430
- **Ship Bulkhead**
  - Steel Bulkhead Structural Element Protected by (3-layers) 3M Interam E-5A-4 Mat, IMO A.754(18). ISO 834 fire exposure. A150 performance (failure reached at 165 minutes). OPL 9006-101062

- **HDPE Piping**
  - Fire Testing of High-Density Polyethylene Pipe. Electrical Power Research Institute (EPRI) report 1024011. 2" and 4" HDPE tested up to 3 Hours.

- **Electrical Cable Tray**
  - ASTM E 1529 High-Intensity Fire Exposure, ASTM E 1725 Pass/Fail Criteria. 4" x 12" and 4" x 24" cable trays. OPL 9006-99733
    - 1 layer, 13 minute
    - 2 layer, 28 minute
    - 4 layer, 78 minute
- **Structural Steel**
  - Various sizes of wide flange steel columns (section factor from 31 m^{-1} to 219 m^{-1}), 1 to 4 layer of E-mat. High-Intensity (DNV 1100 °C) fire exposure. Time-to-failure tabulated at 1000 °F and in 50°C increments. OPL 9006-98944.

Blast Testing

- 1-layer E-mat over W14x238 I-Section, 0.33 bar (4.8 psi), pass. Christian Michelsen Research CMR-93-F25044
- 2-layers E-mat over 6" pipe with 60mm cellular glass insulation, 0.57 bar, pass. Wilfred Baker Engineering 807-001

Radiation Testing

- University of Michigan, Phoenix Memorial Laboratory, Nuclear Reactor. 2.03 x 10^8 rad cumulative dose with not visible degradation.

Seismic Testing (IEEE 344)

- 24" x 6" cable tray, 2" conduit. Passed 2x SSE "Safe Shutdown Earthquake". SwRI 1208-001

Acoustic Testing

- Acoustic Inertion Loss, 2" pipe, 2-layer E-mat over 50 mm cellular glass insulation. 17 dB reduction average, 500-2000 Hz. SINUS AS 123800-1.R01

Chemical Analysis

- ASTM E C 871 "Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions", 3M Corporate Analytical Research Laboratory ID218071
  - Extractable Chloride 23.6 +/- 0.8 ppm by Halogen Analysis
    - Total Chlorine 27 ppm by Total Combustion-IC
  - Extractable Fluoride "Not Detected", < 1.5 ppm by Halogen Analysis
    - Total Fluorine <20 ppm by Total Combustion-IC
  - Extractable Silicon 13 +/- ppm (µg/g) by Inductively Coupled Plasma - Atomic Emission Spectroscopy (ICP-AES)
  - Extractable Sodium 32 +/- 2 ppm (µg/g) by Inductively Coupled Plasma - Atomic Emission Spectroscopy (ICP-AES)

Reaction To Fire

- ASTM E 662 (Smoke Density)
- ASTM E 162 (Flame Spread)
- BSS 7239 (Toxic Gas Generation)
- EN ISO 11925 (Determination of Ignitability)
- EN 13501-1 (Classification or Reaction to Fire)
- EN 13823:2010 (Determination of Reaction to Fire)
- UL 723 / ASTM E 84) (Surface Burning Characteristics)
- ASTM E 136 (Non-Combustibility)

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