



FIRE RISK MANAGEMENT, INC

1 Front St., Bath, ME 04530
207/442-7200 [221-1295 (fax)]
www.fireriskmgt.com

Date: 5 December, 2016

Memo Report

From: W. Mark Cummings, P.E.
To: Ms. Katherine Detmer; Archetype Architects
Subject: **Fire Protection of Reinforcing Steel in Roof Trusses; Brick South Building at Thompson's Point**

As requested, Fire Risk Management, Inc. (FRM) has reviewed the information you provided with regards to a potential option for providing additional fire protection for the steel tie rods, and their associated attachment hardware, that are part of the roof truss system installed in the Brick South Building at the Thompson Point development in Portland, ME. The purpose of this review is to assess an alternative approach to addressing the need for the trusses to maintain their structural integrity for up to one hour when exposed to a fire environment; as needed to comply with the construction requirements for the roof's structural components as outlined in the International Building Code (IBC) for this particular building use.

It is understood that the roof truss system for the "lean-to" section of the Brick South building utilizes steel tie rods to connect the upper and lower chords of the trusses. These are spaced vertically in between the truss webs; with the ends of the rods being threaded and steel nuts and plates used to fasten the tie rods to the upper and lower chords. Although the vast majority of the truss's construction consists of heavy timber, these components are critical to maintaining the structural integrity of the truss and may be more susceptible to failure during a fire event.

Heavy timber is considered by the codes as having an inherent fire resistance of at least one hour. However, the steel tie rods that form an integral part of the truss' design could potentially be exposed to a fire environment that might cause the loss of their structural integrity in less than one hour; thereby compromising the overall integrity of the truss. To provide a level of fire resistance for the trusses that might be expected to support maintaining their structural integrity for at least one-hour of fire exposure, additional protection for the steel tie rods is needed. It is also understood that due to the logistics and associated costs, application of a spray-applied fire protection material to protect the steel components is not feasible. For that reason, the use of fire-rated "mats" and "putty" is being suggested as potential methods for protecting the steel truss components.

I have reviewed the technical data sheets you have provided for the two 3M™ products you have selected; the *Interam™ Endothermic Mat* and the *Fire Barrier Moldable Putty Pads*. As indicated in the sketch you provided, the pads will be used to protect the exposed steel rods between the upper and lower chords of the truss, with the putty being applied to the steel plates, nuts, and exposed threaded ends of the tie rods. Based on the data provided by manufacturer, your approach appears to be viable, but with one primary caveat; the materials must properly adhere to the steel components. This can be either a function of the material properties of the fire rated products themselves, in that they will adhere to the steel and/or wood without the need for any additional, external devices, or they must be held in place using other devices/materials approved for such use by the manufacturer. It must be verified that these materials can be properly applied over the steel



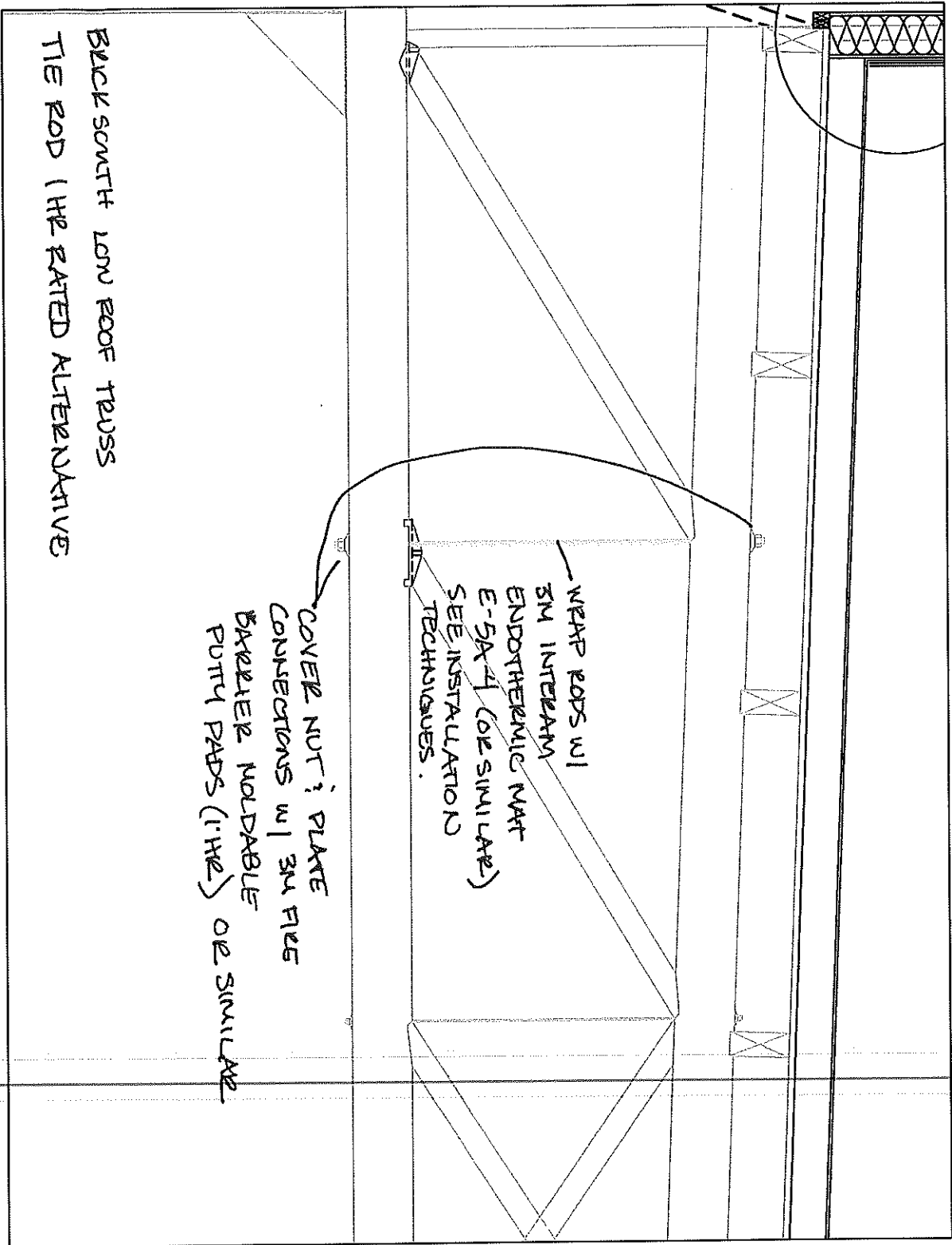
components in a manner consistent with their tested/listed configuration, including any associated installation limitations, such that any exposed steel is fully covered by the proper depth of material and that the materials will remain in place throughout the fire exposure period. The manufacturer may be able to provide assistance with regards to developing the proper installation guidelines for their products for this specific application.

Based on an initial review of the materials being proposed to provide the additional fire protection for the exposed portions of the steel tie rods, if the selected 3M™ products can be properly applied to these components, it is expected that they can, in fact, provide the necessary fire resistance to allow the steel tie rods to maintain their structural integrity for at least one hour of fire exposure as needed to comply with the IBC construction requirements. Should there be any questions regarding this review/assessment, please do not hesitate to contact me.



W. Mark Cummings, P.E.
Principal Fire Protection Engineer





WEAP RODS w/
 3M INTERAM
 ENDOThERMIC MAT
 E-5A-4 (OR SIMILAR)
 SEE INSTALLATION
 TECHNIQUES.

COVER NUT? PLATE
 CONNECTIONS w/ 3M FIRE
 BARRIER MOLDABLE
 PUTTY PADS (11H2) OR SIMILAR

BACKSOUTH LOW ROOF TRUSS
 TIE ROD (11R RATED ALTERNATIVE)



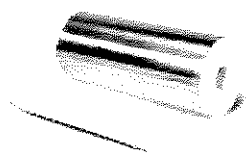
3M™ Interam™ Endothermic Mat E-5A-4

Product Data Sheet

WALL OPENING MEMBRANES	ELECTRICAL CIRCUITS	STRUCTURAL STEEL
UP TO 2 HOUR Fire Protection	UP TO 3 HOUR Fire Protection	UP TO 4 HOUR Fire Protection

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 applications¹ 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 circuitry / 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

For technical support relating to 3M Fire Protection Products and Systems, call: 1-800-328-1687

For more information on 3M Fire Protection Products, visit www.3m.com/firestop

CLASSIFIED
UL
Mat Materials
Fire Resistance Classifications
Rapid Temperature Rise
Fire Exposure
Design No. XR201
See UL Fire Resistance Directory 9099

ULC
LISTED
FILL, VOID OR CAVITY MATERIALS
9099

Classified Mat Materials
Fire Resistance Classification
Design No. X203 and X204
See UL Fire Resistance Directory 9099

CLASSIFIED
UL
LISTED
OMEGA POINT LABORATORIES
Intertek
FIRESTOP SYSTEMS
SEE INTERTEK DIRECTORY

LISTED
ELECTRICAL CIRCUIT PROTECTIVE MATERIALS FOR USE IN ELECTRICAL CIRCUIT PROTECTIVE SYSTEMS SYSTEM NO. 7, 8 AND 9
SEE UL BUILDING MATERIALS DIRECTORY 9099



4. Performance & Typical Physical Properties

Color:	Silver exterior, white interior	Surface Burning (ASTM E 84): Flame Spread 0.7, Smoke Development 0 Fuel Contribution 0
Mat Lamination	3 mil. aluminum/ scrim	Thermal Conductivity:
Mat Thickness	0.408 in. (10.3 mm)	0.087 BTU/ft-hr - °F @ 200°F (0.151 W/m - °C @ 93°C)
Roll Dimensions	24.5 in. x 20 ft. roll (622 mm x 6.09 m)	0.101 BTU/ft-hr - °F @ 350°F (0.175 W/m - °C @ 177°C)
Roll Weight	74.6 lbs. (33.8 kg)	0.058 BTU/ft-hr - °F @ 600°F (0.100 W/m - °C @ 316°C)
Weight/Unit Area	1.83 lbs/ft ² (8.93 kg/m ²)	0.068 BTU/ft-hr - °F @ 750°F (0.118 W/m - °C @ 399°C)
Bulk Density	54 lbs/ft ³ (865 kg/m ³)	0.081 BTU/ft-hr - °F @ 900°F (0.140 W/m - °C @ 482°C)
Mat Area/Roll	40.8 ft ² (3.79 m ²)	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.

3M

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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3M™ Fire Barrier Moldable Putty Pads MPP+

Product Data Sheet

1. Product Description

3M™ Fire Barrier Moldable Putty Pads MPP+ are a one-part, ready-to-use, intumescent wall-opening protective. When properly applied to the back of electrical outlet boxes, 3M™ Fire Barrier Moldable Putty Pads MPP+ help control the spread of fire, smoke and noxious gases through fire-restive walls and partitions. Installed in accordance with the UL wall-opening protective listing (UL Category CLIV), the product helps achieve up to 2-hour ratings in a variety of wall constructions. 3M™ Fire Barrier Moldable Putty Pads MPP+ can effectively provide protection for back-to-back electrical boxes.

3M™ Fire Barrier Moldable Putty Pads MPP+ are also used as a firestop material in through-penetration firestop systems. 3M™ Fire Barrier Moldable Putty Pads MPP+ help to maintain a firestop penetration seal for up to 4 hours. 3M™ Fire Barrier Moldable Putty Pads MPP+ exhibit excellent adhesion to a full range of construction substrates and penetrants. The pads are easily molded by hand (no mixing required). In addition to its fire-resistant properties, the 1/10th in. (2.54mm) thick pads have airborne sound reduction characteristics which helps minimize sound transmission through assemblies requiring an STC rating.

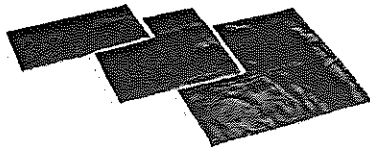
Color: ■ Dark Red

Product Features

- Firestop tested up to 4 hours in accordance with ASTM E 814 (UL 1479) & CAN/ULC-S115
- Wall opening protective tested up to 2 hours in accordance with UL 263
- Provides draft and cold smoke seal
- Pliable and conformable—molds easily into required shape
- Helps reduce noise transfer*
- Excellent adhesion
- Re-enterable/repairable
- Halogen-free and solvent-free
- Excellent aging properties
- Low VOC
- Will not dry out or crumble
- Red color widely recognized as a fire protective product

Meets the intent of LEED® VOC regulations—helps reduce the quantity of indoor air contaminants that may be odorous, irritating and harmful to the comfort and well-being of the installers and occupants.

**Minimizes noise transfer—STC-Rating of 52 when tested in STC 53-rated wall assembly.*



4 in. x 8 in. (101.6mm x 203.3mm),
7 in. x 7 in. (177.8mm x 177.8mm) and
9.5 in. x 9.5 in. (241.2mm x 241.3mm)
pad sizes available.

2. Applications

4 in. x 8 in. (101.6mm x 203mm) 3M™ Fire Barrier Moldable Putty Pads MPP+ are typically used as a wall opening protective to meet building requirements, for protection of membrane penetrations made by listed steel or non-metallic electrical boxes. It is also used to seal gaps between cables in multiple penetrations (including fiber optic inner duct) and to firestop cable bundles, insulated pipe, electrical conduit and metal pipe. Larger sized pads, 7 in. x 7 in. and 9.5 in. x 9.5 in. (177.8mm x 177.8mm and 241.2mm x 241.2mm) are widely used to firestop metallic and non-metallic electrical outlet boxes up to 14 in. x 4.5 in. by 2-1/2 in. (355.6mm x 114.3mm x 63.5mm) deep. For larger applications, pads can be molded together by hand.

3. Specifications

3M™ Fire Barrier Moldable Putty Pads MPP+ shall be a one component, ready-to-use, intumescent elastomer capable of expanding a minimum of 3 times at 1000°F. The material shall be thixotropic and shall be applicable to overhead, vertical and horizontal firestops. Under normal conditions, 3M™ Fire Barrier Moldable Putty Pads MPP+ shall be noncorrosive to metal and compatible with synthetic cable jackets. The putty shall be listed by independent test agencies such as UL, Intertek or FM. 3M™ Fire Barrier Moldable Putty Pads MPP+ shall be tested to and pass the criteria of ASTM E 814 (UL 1479) Standard Test Method for Fire Tests of Penetration Firestop Systems and CAN/ULC S115 Standard Method of Fire Tests of Firestop Systems. 3M™ Fire Barrier Moldable Putty Pads MPP+ meets the requirements of the IBC, NFPA 5000, NEC (NFPA 70), NFPA 101 and NCB (Canada) Building Codes.

Typically Specified MasterFormat (2004)

Section 07 84 00 – Firestopping

Related Sections

Section 07 84 16 – Annular Space Protection
Section 07 86 00 – Smoke Seals
Section 07 87 00 – Smoke Containment Barriers
Section 07 27 00 – Thermal and Moisture Protection Firestopping
Section 21 00 00 – Fire Suppression
Section 26 00 00 – Electrical



SUBJECT TO THE CONDITIONS OF APPROVAL AS A WALL & FLOOR PENETRATION FIRESTOP WHEN INSTALLED AS DESCRIBED IN THE CURRENT EDITION OF THE FMRC APPROVAL GUIDE



CLASSIFIED UL
FILL, VOID, OR CAVITY FOR USE IN THROUGH-PENETRATION FIRESTOP SYSTEMS SEE UL FIRE RESISTANCE DIRECTORY 90G9



4. Performance & Typical Physical Properties

Color:	Dark Red	Dimensions:	4 in. x 8 in. x 1/10 in. (101.6mm x 203.2mm x 2.5mm)
Nominal Density:	10–12 lbs./gal. (1.2–1.45kg/L)	Unit Volume:	2.52 in. ³ (41.4cm ³)
Nominal Thickness:	1/10 in. (2.54mm)	Unit Weight:	2.7 oz (76g)
Surface Burning (ASTM E 84):	Flame Spread 0, Smoke Development 0	Dimensions:	7 in. x 7 in. x 1/10 in. (177.8mm x 177.8mm x 2.5mm)
Heat Expansion:	Begins at 350°F (177°C) Significant at 400°F (204°C) Free Expansion is Nominal 3 times	Unit Volume:	4.63 in. ³ (76.0cm ³)
STC (ASTM E 90 and ASTM E 413):	52 when tested on back-to-back electrical boxes	Unit Weight:	4.1 oz (116g)
Tested in STC 53 rated wall assembly		Dimensions:	9.5 in. x 9.5 in. x 1/10 in. (241.3mm x 241.3mm x 2.5mm)
VOC Less H₂O and Exempt Solvents:	< 250g/L	Unit Volume:	6.1 in. ³ (139.8cm ³)
		Unit Weight:	7.6 oz (215g)

5. Packaging, Storage, Shelf Life

Packaging:	Corrugated cardboard box with liner between individual pads.
Storage:	3M™ Fire Barrier Moldable Putty Pads MPP+ should be stored indoors in dry conditions.
Shelf Life:	3M™ Fire Barrier Moldable Putty Pads MPP+ shelf life is indefinite in original unopened containers. Product will not dry or crumble in opened containers. Normal stock and stock rotation practices are recommended.

6. Installation Techniques

Consult a 3M Authorized Fire Protection Products Distributor / Dealer or Sales Representative for Applicable UL, Intertek or other third-party drawings and system details.

Preparatory Work:	The surface of the electrical box, or opening and any penetrating items should be cleaned (i.e. free of dust, grease, oil, loose materials, rust or other substances) to allow for the proper adhesion of the 3M™ Fire Barrier Moldable Putty+ Pad. Ensure that the surface of the substrates are not wet and are frost-free.
Installation Details:	Electrical boxes must be firestopped under the following conditions: boxes larger than 16 sq. in. (103 sq. cm), if horizontal spacing between boxes is less than 24 in. (609.6mm), when multiple boxes are located in one stud cavity or if the aggregate of all boxes exceeds 100 sq. in. per 100 sq. ft. (645 sq. cm. per 9.29 sq. m) — refer to listed system details and applicable local building code requirements. For electrical box installations, a minimum of 1/10 in. (2.5mm) thick putty application is required. 3M™ Fire Barrier Moldable Putty Pads MPP+ are to be installed to completely cover the exterior of the outlet box (except for the side against the stud). To firestop penetrations, install the applicable depth of backing material (if required), remove the desired amount of putty from the pad, form (if necessary) and install as detailed within the listed system. Make sure that putty is in complete contact with the substrate and penetrating item(s). Note: Partial pads can be pieced together and the seams between partial pads should overlap a minimum of 1/8 in. with the seams worked with the fingertips to create adhesion at the seam.
Limitations:	Over application (i.e., using excessive amount of material) of product to vertical surfaces may cause sagging, follow system details. Product is not impaired by freezing but should be warmed to 32°F (0°C) before applying.

7. Maintenance

No maintenance is expected when installed in accordance with the applicable UL, Intertek, FM or other third-party listed system. Once installed, if any section of the 3M™ Fire Barrier Moldable Putty Pad MPP+ is damaged, the following procedure will apply: remove damaged putty, clean the affected area and install the proper thickness of putty, ensuring it bonds to the substrate and adjacent putty (product from damaged area can be reused if it is free from contaminants). Putty can be molded together at new/existing putty overlap.

8. Availability

3M™ Fire Barrier Moldable Putty Pads MPP+ are available from 3M Authorized Fire Protection Products Distributors and Dealers. 3M™ Fire Barrier Moldable Putty Pads MPP+ are available in the following sizes: (10 pads/pack, 10 packs/case) 4 in. x 8 in. x 1/10 in. (101.6mm x 203.2mm x 2.5mm), (20 pads/case) 7 in. x 7 in. 1/10 in. (177.8mm x 177.8mm x 2.5mm), (20 pads/case) 9.5 in. x 9.5 in. 1/10 in. (241.3mm x 241.3mm x 2.5mm); red-colored firestop material. 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.



Industrial Adhesives and Tapes Division

3M Center, Building 225-35-06
St. Paul, MN 55144-1000
800-328-1687
877-369-2923 (Fax)
www.3M.com/firestop

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