

ENSURING GLOBAL PROJECT COMPETITIVENESS THROUGH
CONSTRUCTION & LOGISTICS EXCELLENCE



Oil & Gas and Industrial Applications

3M™ Interam™ E-5A-4 Endothermic Mat

Innovative Endothermic Technology for Hydrocarbon and Jet Fire Applications

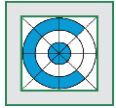


Protecting Life & Property

Carlo Dragone, Project Leader FPP - Italy

MILAN, ITALY, JUNE 19-20, 2014

4TH ANIMP'S CONSTRUCTION SECTION & ECI 2014 ANNUAL CONFERENCE
with the collaboration of ANIMP's Logistic Section



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About **3M**

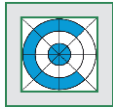
- Established in 1902 as **Minnesota Mining & Manufacturing**
- \$30bn sales in 2012
- Over 75,000 products (10,000 relevant to Oil & Gas Sector)
- Over 80,000 employees in 60 countries with more than 250 factories
- Customers in more than 200 countries
- Invested \$6.7bn in R&D over last 5 years
- Voted 3rd most innovative company in 2012 by Booz & Co
- Over \$1bn sales in Oil & Gas market globally



PELTOR[®]

Thinsulate[™]
INSULATION[™]

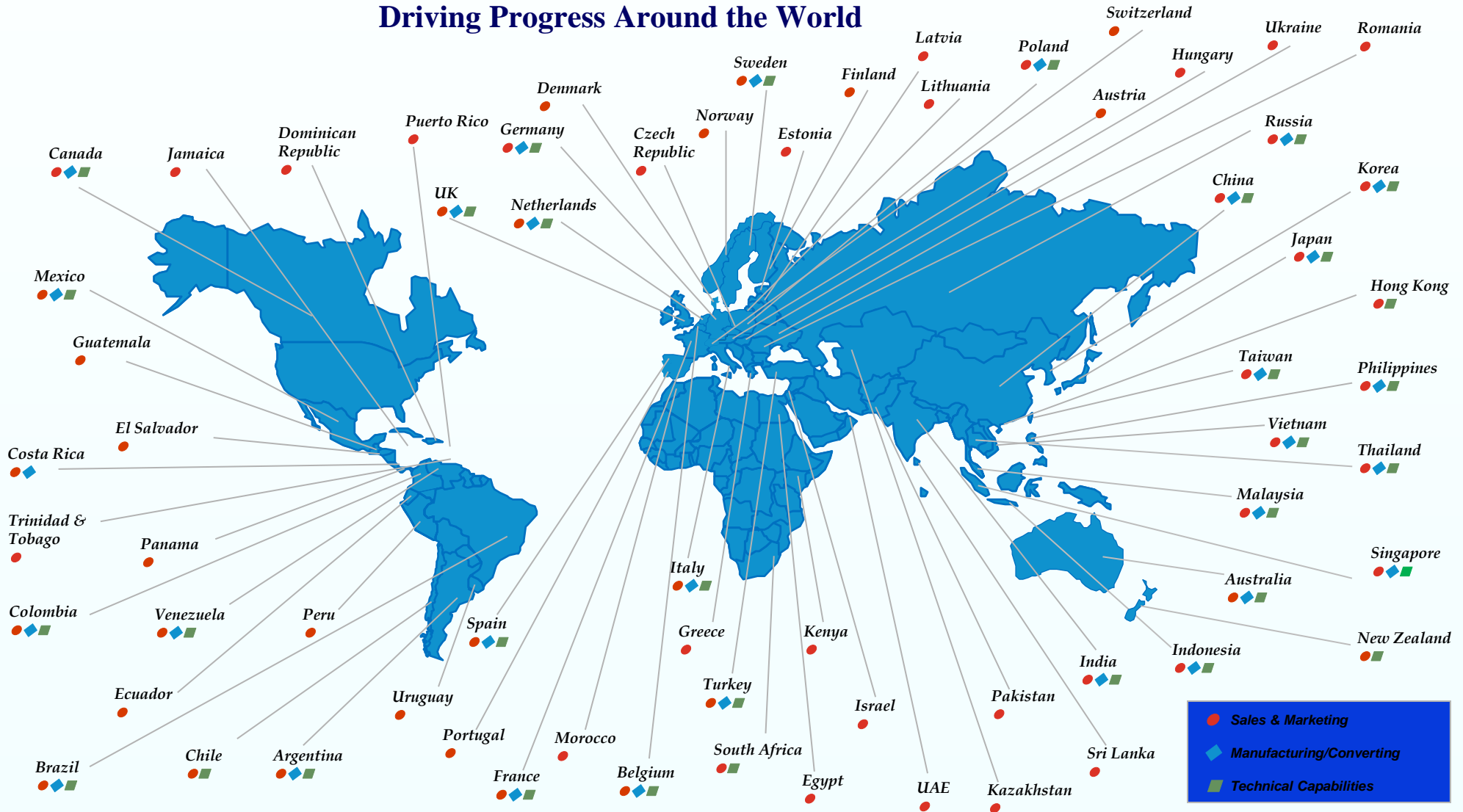


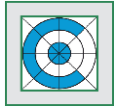


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Driving Progress Around the World



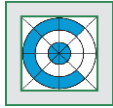


FIREPROOFING

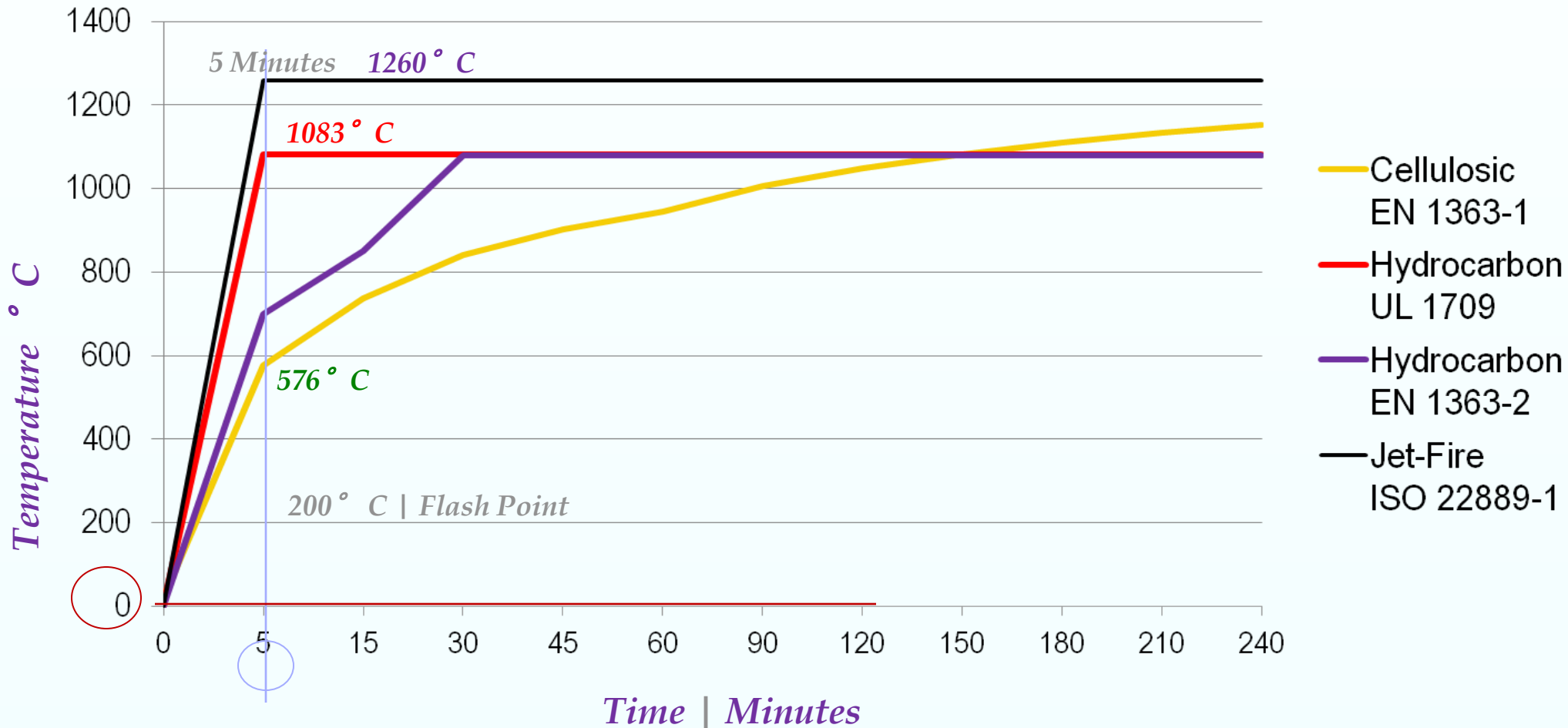
WHAT IS FIREPROOFING

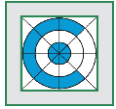
DEFINITION AS PER API 2218

- Fireproofing is a systematic process for fire protection, including materials and application of materials, providing a degree of fire resistance for protected substrate and assemblies .
- It can be an active or a passive System. This presentation regards the Passive Fire Protection System, basically applied to steel structures. It can be used also for other facilities such as equipment, cables, valves etc..



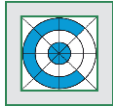
Time Temperature Curves | Cellulosic / Hydrocarbon / Jet-Fire





Industry Fire-Resistance Requirements


- API - American Petroleum Institute
 - 2218 ‘Fireproofing Practices in Petroleum and Petrochemical Processing Plants’
 - 2510A ‘Fire-Protection Considerations for the Design and Operation of Liquefied Petroleum Gas (LPG) Storage Facilities’
- EN ISO – European Standard, International Standard
 - 13702 ‘Petroleum and natural gas industries – Control and mitigation of fires and explosions on offshore production and installations – Requirements and guidelines’
- Various Corporate Standards



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New Ministerial Circular



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.

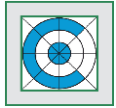
Analogamente, si ritiene che l'impiego di specifici prodotti e sistemi protettivi qualificati per la resistenza al fuoco nel settore chimico e petrolchimico, possa essere consentito solo a valle di valutazione del rischio ed in presenza di pertinenti rapporti di prova rilasciati da Organismi nazionali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

IL CAPO DEL CORPO NAZIONALE
DEI VIGILI DEL FUOCO

(PNT)







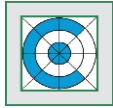
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Fireproofing different technologies

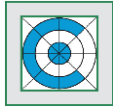
Main Fire Protection Materials

- **Spray Applied Resistive Materials** such as Intumescent Epoxy Coating where a chemical reaction takes place when exposed to high heat or direct flame impingement , by expanding into an insulating layer of carbonaceous char or glassy material.



Fire Protection Materials

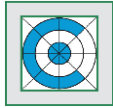
- **Lightweight Concrete:** light aggregate, such as perlite or vermiculite with cement resistant to high temperature
- **Dense Concrete** made with Portland formed in place or sprayed.
- Other materials having a more limited application



Critical Points of the above Systems

- **Time of installation** - When: PFP material is normally installed at erection site
- **Time for installatin** : long, if installed when the structures are already erected.
- **High Weight in case of dense concrete** , that makes mandatory for modules its application after their installation.
- **Not clean work** in a critical phase of the construction.

**THE SYSTEM NOW PRESENTED SIGNIFICANTLY
MITIGATES THE ABOVE**



Market Reference | E-Mat Approved By API 2218 in 7.3.5



**American
Petroleum
Institute**

Fireproofing Practices in Petroleum and Petrochemical Processing Plants

API PUBLICATION 2218

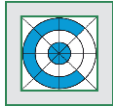


7.3.5 Endothermic Wrap Fireproofing

Endothermic materials absorb heat chemically, generally with the concurrent release of water, and physically through heat absorption by the released water. This flexible, tough, inorganic sheet material with a bonded aluminum foil outer layer is formed from a maximum of inorganic, highly endothermic filler, and a minimum of organic binder and fiber. It can be wrapped around a wide variety of potentially exposed vulnerable equipment. Electrical cable trays are particularly suited for this type of protection, providing rated performance under UL 1709 (or functionally equivalent) conditions. In most applications, the wrap is held in place by stainless steel bands with foil tape and/or fireproofing caulk on seams, gaps and termination points. For structural steel in new construction, surface preparation of the substrate should include fresh prime paint to provide corrosion protection.

Advantages are:

- a. Fire-rated wrap systems are easily reentered and repaired, allowing retrofitting over steel without disassembling wiring and other attached items.
- b. The wrap material does not catalyze corrosion (nor protect against corrosion).
- c. Endothermic wrap systems can be applied directly over existing cement or block where additional protection is required.
- d. These systems can be applied directly over other fireproofing, although a reduction in rated system requirements may not be allowed for the existing materials.
- e. Flexible endothermic wrap systems are explosion-rated.



3M™ Interam™ E-5A-4 Endothermic Mat

- Color.....White
- Roll Width 24.5 in. (622 mm)
- Roll Length..... 20 ft. (6.09 m)
- Mat Area/Roll40.8 ft.² (3.79 m²)
- Mat Laminations3 mil. Aluminum Facing*
- Mat Thickness.....0.408 in. (10.3 mm)
- Roll Weight.....74.6 lbs. (33.8 kg)
- Weight/Unit Area1.83 lbs./ft.² (8.93 kg/m²)
- Bulk Density.....54 lbs./ft.³ (865 kg/m³)
- Stock Number 98-0400-5465-6

* Also available with stainless steel facing (E-54-C)

3M™ Interam™ Endothermic Mat E-5A-4



WALL OPENING
MEMBRANES



ELECTRICAL CIRCUITS



STRUCTURAL STEEL



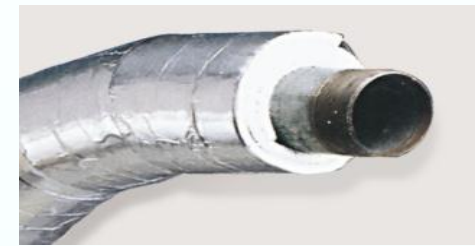
E-Mat – Typical Applications



Cable Trays



Structural Steel



Conduit



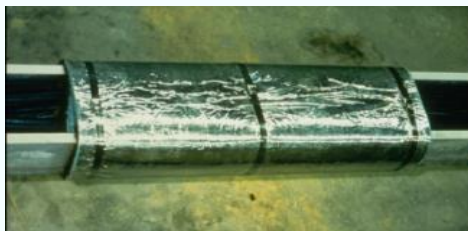
*Piping**



Vessel Skirt



Electrical Panel Box



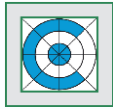
Cable Tray Fire Breaks



Sprinkler Line



*Storage
Tanks*



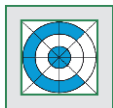
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Interam E-5A Mat | Approvals



Type of Protection	Approvals		Performance
Cellulosic	EN 13501	Classification Report of Reaction to Fire	B / s1 / d0
	ASTM E119	Standard Test Methods for Fire Tests of Building Construction and Materials	Up to 240 min
	UL 263	Fire Resistance Rating	
	ASTM E1727	Standard Practice for Field Collection of Soil Samples for Subsequent Lead Determination	Up to 240 min
Hydrocarbon	UL1709	Rapid Rise Fire Tests of Protection Materials for Structural Steel	Up to 240 min
	ASTM E1529	Standard Test Methods for Determining Effects of Large Hydrocarbon Pool Fires on Structural Members and Assemblies	Up to 240 min
	ASTM E1725	Standard Test Methods for Fire Tests of Fire-Resistive Barrier Systems for Electrical System Components	Up to 60 min
Jet-Fire	ISO 22889-1	Standard Test Methods for Determining Effects of Large Hydrocarbon Pool Fires on Structural Members and Assemblies	Up to 240 min
Bar Blast			0.33 bar
Ampacity Derating	P848	Standard Procedure for the Determination of the Ampacity Derating Factor for Fire-Protected Cable Systems	Under 10% for 100mm Conduit
Nuclear (US Model)	<i>USNRC Generic Letter (GL) 86-10 Supplement 1</i>		60 and 180 min
	<i>USNRC 10 CFR Part 50 Appendix R Canalizations Electriques</i>		
	<i>USNRC Regulatory Guide 1.75.</i>		
Exposition Radiation	2 x 10 ⁸ Rads Gamma	shown no degradation in physical properties	
Seismic	<i>IEEE 381-1977 test of Class 1E</i>		
2x safe shutdown earthquake levels	<i>IEEE 344-1975 NRC Regulatory Guide 1.60/IEEE 323-1974</i>		

Industry Performance Requirements – Summary



ENSURING GLOBAL PROJECT COMPETITIVENESS THROUGH
CONSISTENT LOGISTICS EXCELLENCE



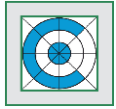
Structural
1-1/2 to 3 hour

Electrical Circuits
15 to 30 minute

Company	Document	Design Method	Structural Steel	Steel Vessels	Electrical Circuits	Valve Actuators
NORSOK	R-004			"Piping, vessels, and equipment...the fire protection shall limit the temperature to 400 °C in a hydrocarbon fire situation lasting for 30 min according to ISO 834 (all parts)."		"Piping, vessels, and equipment...the fire protection shall limit the temperature to 400 °C in a hydrocarbon fire situation lasting for 30 min according to ISO 834 (all parts)."
			3 Hour. UL 1709 Exposure. 538C (1000F) max temperature.	3 Hour. UL 1709 Exposure. 538C (1000F) max temperature.	20 Minutes. UL 1709 Exposure. 120C (248F) max temperature.	20 Minutes
			Either UL 1709 for 2.5 Hour or ASTM E 119 or 3.0 Hour		"For period necessary to control critical processes, keeping the cable below 300F". Hydrocarbon Fire.	"For period necessary to control critical processes, keeping the cable below 300F". Hydrocarbon Fire.
API	2218		N/A	1-1/2 hours in UL 1709 conditions.	15 to 30 minutes in UL 1709 conditions.	
		Prescribed	2" of Concrete, "Solid Blocked"	2" of Gunite or Concrete	2" ceramic fiber if low-temp wire, 1" mineral fiber if high-temp wire.	2" mineral fiber or cal sil with Owner's approval.
		Alternative	2 hour protection of a W10x49 per UL 1709 or ASTM E 1725 and NFPA 58, Appendix H hose stream impingement	1-1/2 hour protection of a W10x49 per UL 1709 or ASTM E 1725 and NFPA 58 hose stream impingements	15 minute operability when exposed to 2000F and 160 kW/m ² heat flux. ASTM E 1529 or UL 1709.	15 minute operability when exposed to 2000F and 160 kW/m ² heat flux. ASTM E 1529 or UL 1709. Actuator temps below 200F.
		Prescribed	Varies on location. 1-1/2 hour or 2 hour. UL 1709 Exposure.		15 minutes	

3M's UL listing, BYBU.XR202 addresses structural steel protection up to 4 hours. See system for layering.

3M's UL listing, XCLF.TB-7 addresses electrical circuit protection up to 60 minutes. . See system for layering.



E-MAT Features and Benefits

- Easily Installed (*No surface preparation required*)
- Flexible (*Can be applied to various shapes and sizes*)
- Re-enterable for quality inspections or for future rework and retrofitting (*Easy Reinstalled*)
- For use in both interior and exterior applications (*Versatile*)
- Designed to endure harsh environment (*Durable*)
- Virtually maintenance free (*Labor & Time Savings*)
- Applied in layers (*Fulfills a Variety of Fire Protection Needs*)
- Seismically tested (*Durable*)
- Low ampacity derating of cables (*Allows heat generated during normal operations to dissipate*)
- Can easily be cut to size (*with scissors, shears or utility knife*)

Interam™ E-5A Mat | Electrical Applications

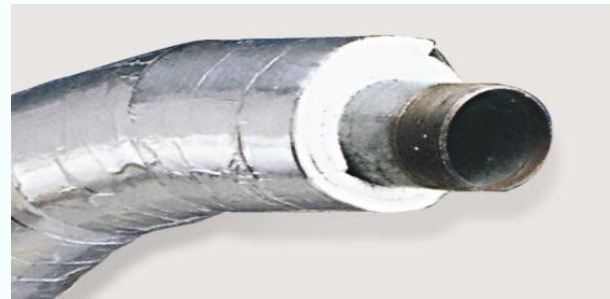
*Ensuring the electrical system components within the barrier system are operational | Low Ampacity Derating
Easy Inspections | Simple Access for cables
Applications: System N° TB-7
Electrical Raceway | Cable Tray | Cables | Conduit, etc.*



Fire Rating ASTM E-1529 & E-1725

Minimum Layers of E-Mat	Fire Rating (Min)
1	13
2	28
4	78

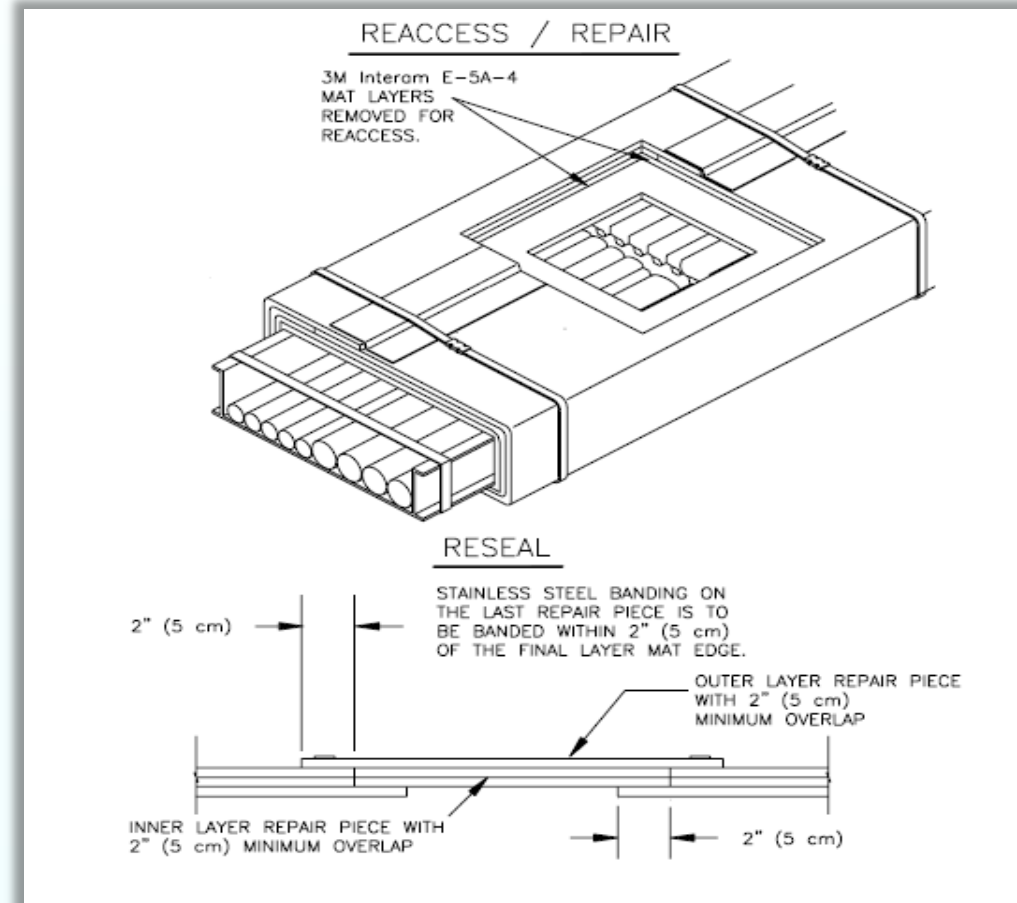
Fire Resistance for Steel Cable Tray 102mm x 35mm



When a fire occurs, the electrical systems that control critical areas such as control rooms, ventilation, lighting, alarms and elevators must remain operational in order to facilitate a safe and orderly plant shutdown and evacuation.

Related Applications – Cable Tray Access

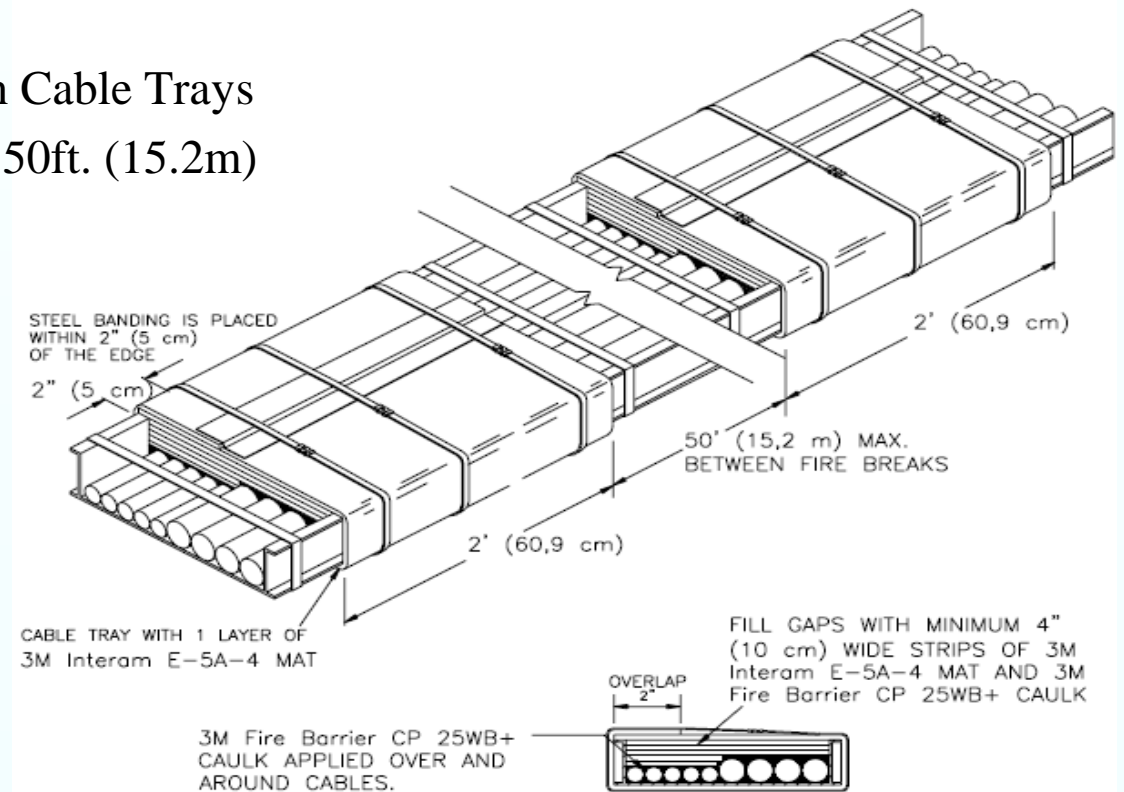
Concept:
Cable trays often require access for inspection or pulling new cables. Installing E-mat in as depicted below affords easy access.



Related Applications – Cable Breaks

An Economical Alternative to Protect Electrical Cable Trays

- Used to Help Stop the Spread of Fire in Cable Trays
- Typically Placed Every 25ft. (7.6m) to 50ft. (15.2m)



E-Mat – Vessel Skirts & Tanks

Requirements:

Vessel Skirts and Tanks require protection to keep their contents from reaching critical temperatures

*NFPA 58 (2011 Ed.) Annex H
Procedure for Torch Fire and Hose Stream Testing of Thermal Insulating
Systems for LP-Gas Containers*

“Thermal protection insulating systems, proposed for use on LP-Gas containers as a means of “Special Protection” under 6.25.3.1, are required to undergo thermal performance testing as a precondition for acceptance. The intent of this testing procedure is to identify insulation systems that retard or prevent the release of a container’s contents in a fire environment of 50 minutes duration and that resist a concurrent hose stream of 10 minutes duration.”



E-Mat – Structural Steel

Applications including:

Beams

Columns

Tubular Steel (Pipes)

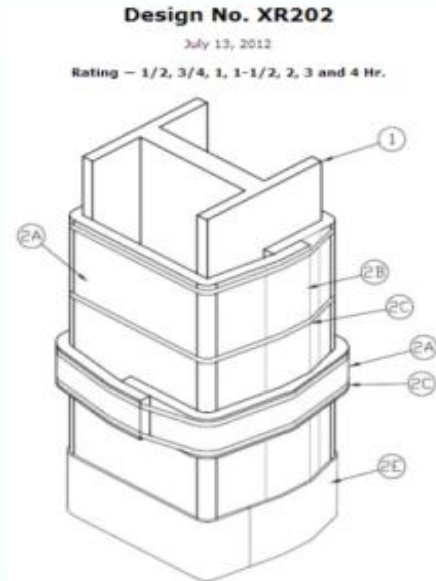


Requirements:

Structural steel beams and columns require protection from a fire-rated enclosure in order to maintain supporting strength during a fire event. Note: layering requirements will depend on mass of steel and fire exposure.

UL BYBU.XR202

In UL 1709 the goal is to keep the average steel temperature below 1000F (538C) and any individual point below 1200F (649C).



Fire Testing – Structural Steel Applications

Min 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

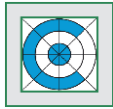
3M COMPANY 3M FIRE PROTECTION PRODUCTS — Interam™ Types E-54A, E-5A-4 or E-54C.

Full details are presented in UL system No. BYBU.XR202

Blockouts

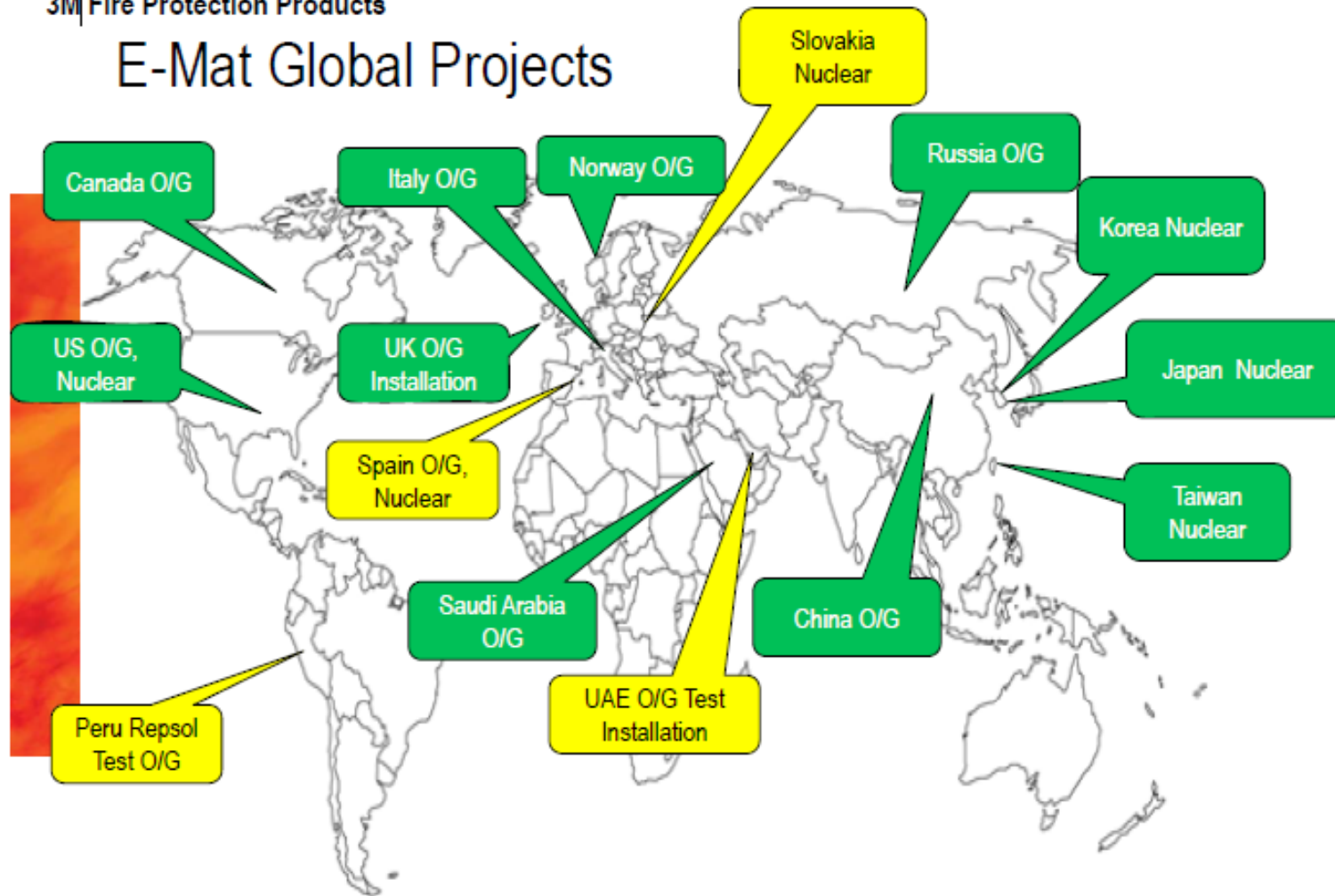
3M testing has demonstrated that E-mat applied at blockout locations (where fireproofing is left off to allow for making structural connections) provides performance that is at least equivalent to that of the cementitious material.

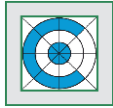




3M | Fire Protection Products

E-Mat Global Projects





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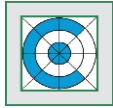


3M for Modular & stick built structures



Ventech Engineers International LLC | Redefining Refineries





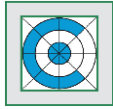
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REFINERY IN SICILY

Electrical Power & Signal Cable,
Successful E-Mat Product Implementation

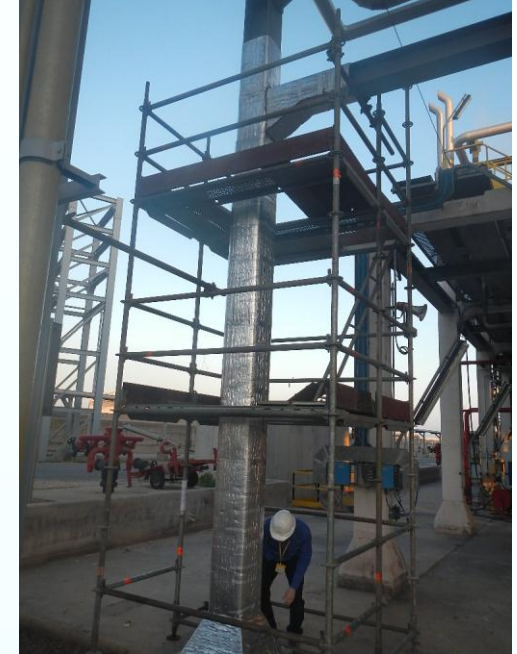
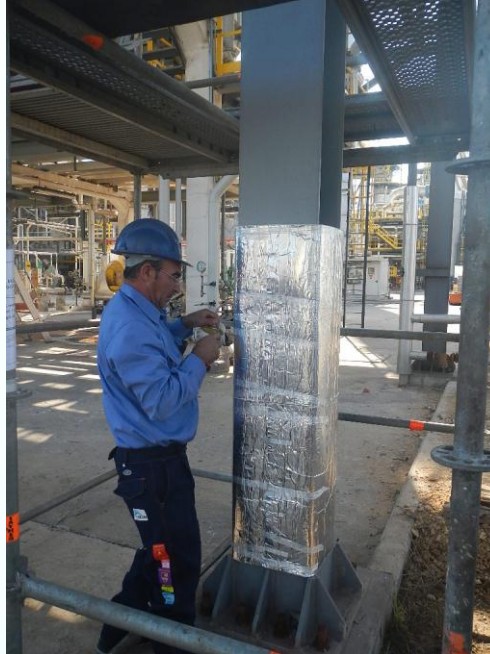




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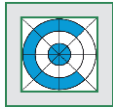


Structural installation and Jet fire test - Italy



MILAN, ITALY, JUNE 19-20, 2014

4TH ANIMP'S CONSTRUCTION SECTION & ECI 2014 ANNUAL CONFERENCE
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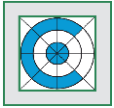


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- Technip, Canada in 2005 for CNRL Horizon
- 2013 Exxon used E-MATon structural steel in Canada, installed in -40 temperatures without heating the steel



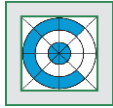


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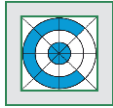


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Pneumatic Valves and Impulse Lines *Successful Product Implementation,* United Kingdom





ENSURING GLOBAL PROJECT COMPETITIVENESS THROUGH
CONSTRUCTION & LOGISTICS EXCELLENCE



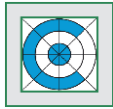
Electrical Power & Signal Cable *Successful E-Mat Product Implementation* *Norway*

*Success Story: Norway O&G
Snowwhite LNG plant*

Application: Cable trays

Customer: Aker/Statoil





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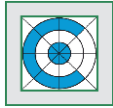


3M – Over 30 years of innovation in fire protection!

- ✓ *Preferred brand among specialty firestop contractors*
- ✓ *Global capabilities*
- ✓ *Proven reliability and functionality*
- ✓ *A complete line of fire protection products for:*

- *Flexible Wrap Systems for Air & Grease Ducts, Plenums and Electrical Components*
- *Through Penetration Firestops*
- *Construction Joints*
- *Structural Steel*





ENSURING GLOBAL PROJECT COMPETITIVENESS THROUGH
CONSTRUCTION & LOGISTICS EXCELLENCE



Please make sure you Protect Life, Property & Environment

