

NIA | National Insulation Association



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Marine Insulation

Marine Insulation – Structural Fire Protection Requirements for Commercial and Naval Vessels

Rupert Chandler

Director of Regulatory Compliance

Trident Maritime Systems

US Joiner Division

Rupert.Chandler@tridentllc.com





Why do I need to know?

“You should so conduct yourselves that when your products will be involved in a disastrous fire, and they certainly will be, that there is nothing in the occurrence for which you will need to apologize.”

S. H. Ingberg (National Bureau of Standards)

References



1. SOLAS Consolidated Edition 2014, Sixth Edition, IMO Publication,
 - ISBN 978-92-801-1594-9-L90
2. 2010 Fire Test Procedures, 2012 Edition, IMO Publications,
 - ISBN 978-92-801-1548-2-L25
3. Navigation and Vessel Inspection Circular No. 9-97, Chg 1, Guide to Structural Fire Protection, available online
4. Title 46CFR, Part 164, available online

References – US Navy

1. MIL-STD-3020 Fire Resistance of US Naval Surface Ships, 2007, available online
2. MIL-PRF-32161 Performance Specification Insulation, High Temperature Fire Protection, Thermal and Acoustic, 2009,



References – U.S. Navy

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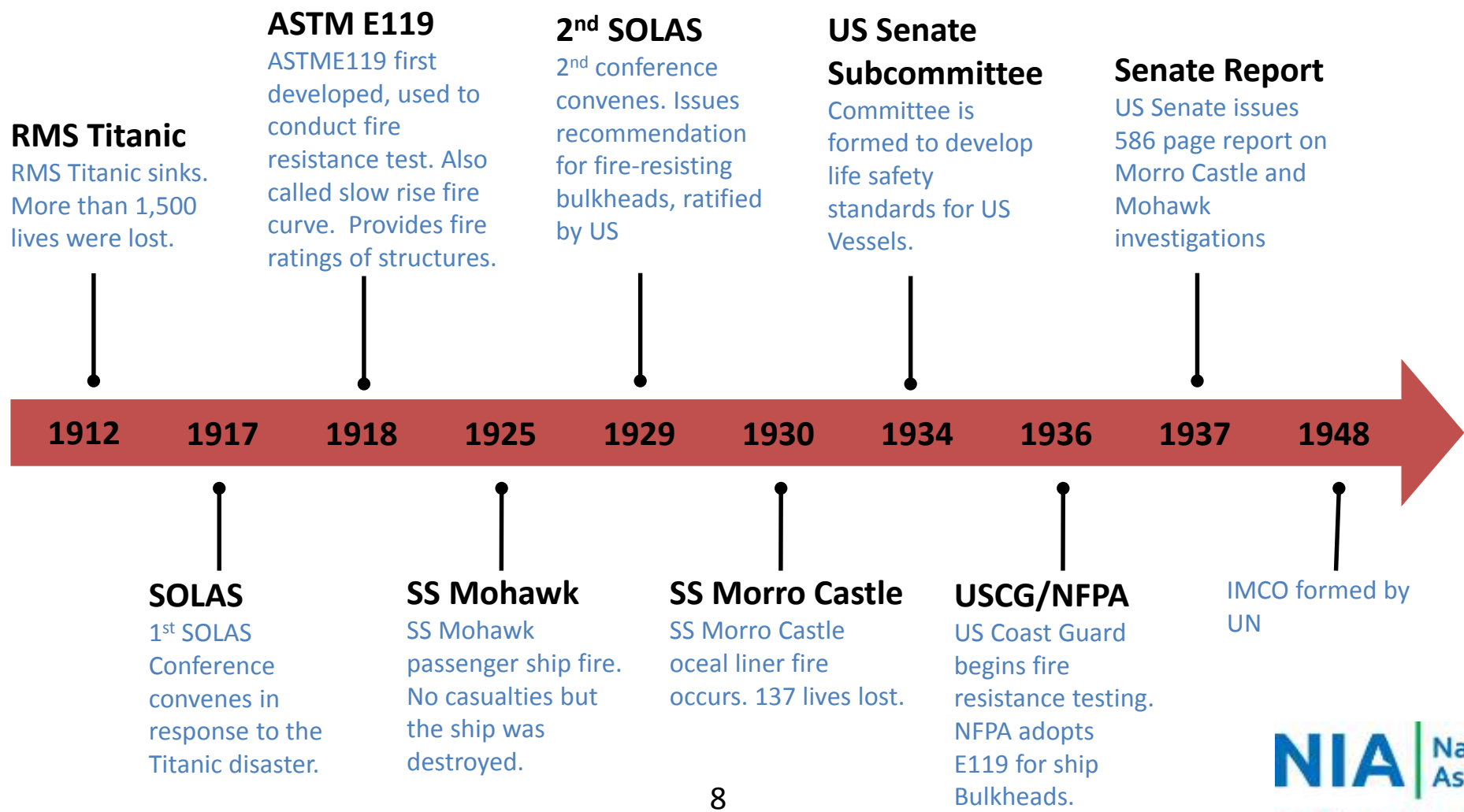


Definition

Structural Fire Protection – Structural fire protection is a means of minimizing the probability of a major fire occurrence and life loss by designing structural elements to confine any outbreaks of fire to as small an area as possible. This is accomplished by specifying fire endurance capabilities of structural elements. Additional items considered are joinerwork details and penetrations of structural elements. Structural or fire insulation refers to insulation employed as part of the structural fire protection system.



Early History





SOLAS Conventions History

Safety Of Lives At Sea

Conventions

3rd 1948

4th 1960

5th 1974 - Possible to Amend

Consolidated Editions

1st 1992 4th 2004

2nd 1997 5th 2009

3rd 2001 6th 2014



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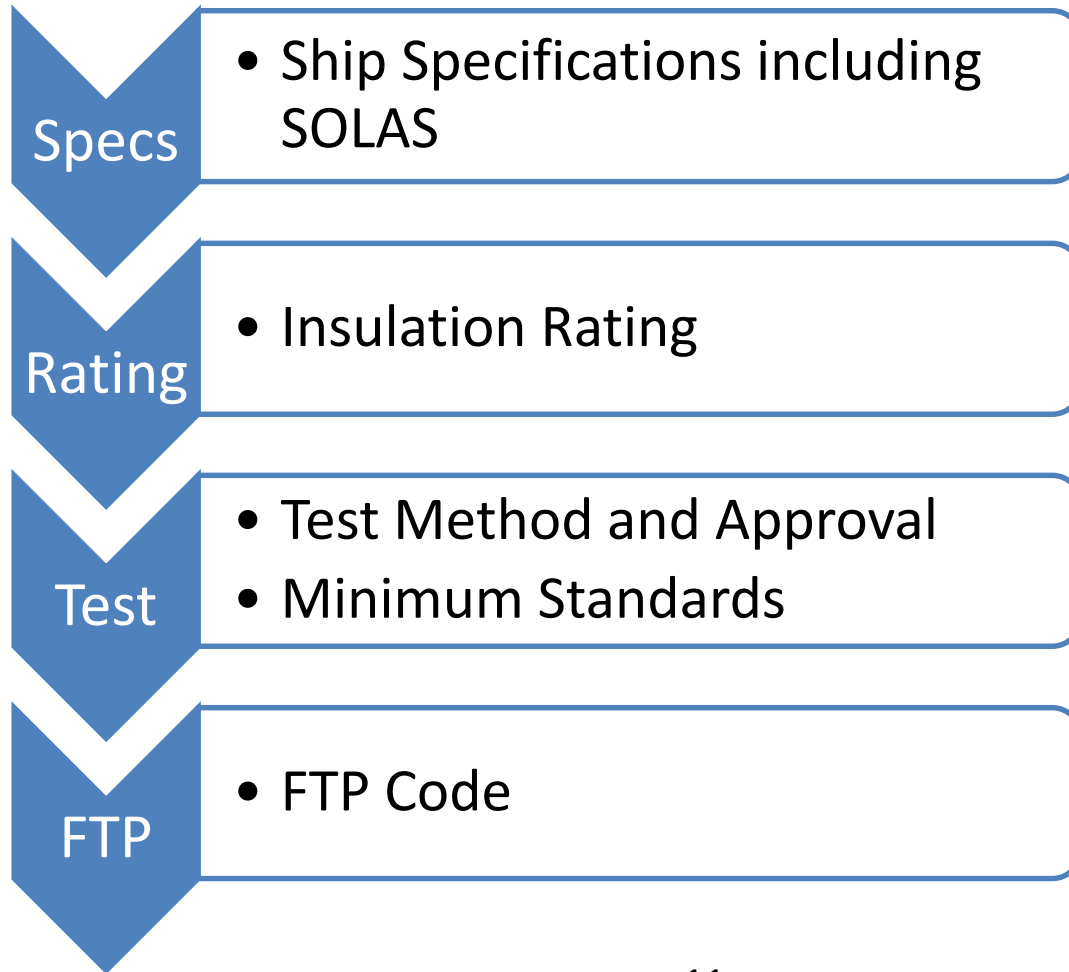


History of FTP Code

SOLAS Fire Test Procedures – Fire Test is Standardized

- 1965 – 1st Meeting for Subcommittee on Fire Protection of IMCO
- 1995 – IMO Fire Protection Working Group Chairman assigned task of writing the FTP Code
- 1998 – IMO FTP Code effective – One method for all
- 1998 – Grandfather Clause Starts – Allow time for testing
- 2003 – Grandfather Clause Expires
- 2004 – Mutual Recognition Agreement (MRA) – Mutual recognition of certificates of conformity - USA and EU
- 2005 to 2010 – FTP Updated to include resolutions
- 2012 – 2010 FTP Code effective

MARINE INSULATION MATERIALS



Do NOT
go up
the
chart!



SOLAS Requirements

Table 9.1 – Bulkheads not bounding either main vertical zones or horizontal zones

Spaces	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	
Control stations	(1) B-0 ^a	A-0	A-0	A-0	A-0	A-60	A-60	A-60	A-0	A-0	A-60	A-60	A-60	A-60	
Stairways	(2)	A-0 ^a	A-0	A-0	A-0	A-0	A-15	A-15	A-0c	A-0	A-15	A-30	A-15	A-30	
Corridors	(3)			B-15	A-60	A-0	B-15	B-15	B-15	B-15	A-0	A-15	A-30	A-0	A-30
Evacuation stations and external escape routes	(4)				A-0	A-60 ^{b,d}	A-60 ^{b,d}	A-60 ^{b,d}	A-0 ^d	A-0	A-60 ^b	A-60 ^b	A-60 ^b	A-60 ^b	
Open deck spaces	(5)					A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	
Accommodation spaces of minor fire risk	(6)					B-0	B-0	B-0	C	A-0	A-0	A-30	A-0	A-30	
Accommodation spaces of moderate fire risk	(7)						B-0	B-0	C	A-0	A-15	A-60	A-15	A-60	
Accommodation spaces of greater fire risk	(8)							B-0	C	A-0	A-30	A-60	A-15	A-60	
Sanitary and similar spaces	(9)								C	A-0	A-0	A-0	A-0	A-0	
Tanks, voids and auxiliary machinery spaces having little or no fire risk	(10)									A-0a	A-0	A-0	A-0	A-0	
Auxiliary machinery spaces, cargo spaces, cargo and other oil tanks and other similar spaces of moderate fire risk	(11)										A-0 ^a	A-0	A-0	A-15	
Machinery spaces and main galleys	(12)											A-0 ^a	A-0	A-60	
Store-rooms, workshops, pantries, etc.	(13)												A-0 ^a	A-0	
Other spaces in which flammable liquids are stowed	(14)													A-30	

See notes following table 9.2.



Levels of Fire Safety for Marine Divisions

Specification	Class	Division	Test Procedure
SOLAS	A-Class	A-60	FTP Code
		A-30	
		A-15	
		A-0	
	B-Class	B-15	
		B-0	
Navy	N-Class	N-60	MIL-STD-3020 MIL-PRF-32161
		N-30	
		N-0	
	AN-Class	AN-60	
		AN-30	
		AN-0	

Insulation – Fire Test Requirements

1st

- Non-Combustibility
- Part 1, FTP

2nd

- Test for “A” and “B” Class divisions
- Part 3, FTP Code

Non-Combustibility Test

Part 1, FTP

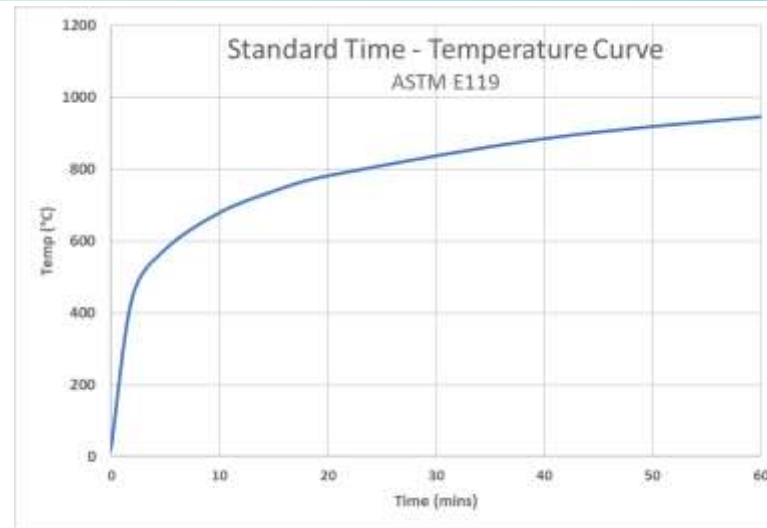
Test: ISO 1182 Reaction to Fire Test for Products	
Sample Size	Cylinder 45mm Ø, 50mm height
Exposure	750 °C
Duration	30 minutes
Passing Criteria	
Furnace $\Delta T \leq 30 \text{ }^\circ\text{C}$	$T_{\text{max},f} - T_{\text{final},f}$
Specimen $\Delta T \leq 30 \text{ }^\circ\text{C}$	$T_{\text{max},s} - T_{\text{final},s}$
Flaming ≤ 10 Seconds	
Mass Loss $\leq 50\%$	



Fire Resistance

Part 3, FTP

Sample Size	
Deck (Ceiling)	2440mm width x 3040 mm length
Bulkead (Wall)	2440mm width x 2500 mm height
Exposure	
Standard Time-Temperature Curve	
Equation: $T_f = 20 + 345\text{Log}_{10}(8t+1)$, Note: T = °C, t = mins	
Time of Exposure	
A-Class	60 minutes
B-Class	30 minutes
Criteria	
Integrity	No flaming on unexposed side or passage of hot gasses
Insulation	Temperature rise (ΔT) on unexposed face $\Delta T_{\text{ave}} \leq 140 \text{ } ^\circ\text{C}$ $\Delta T_{\text{max}} \leq 225 \text{ } ^\circ\text{C}$

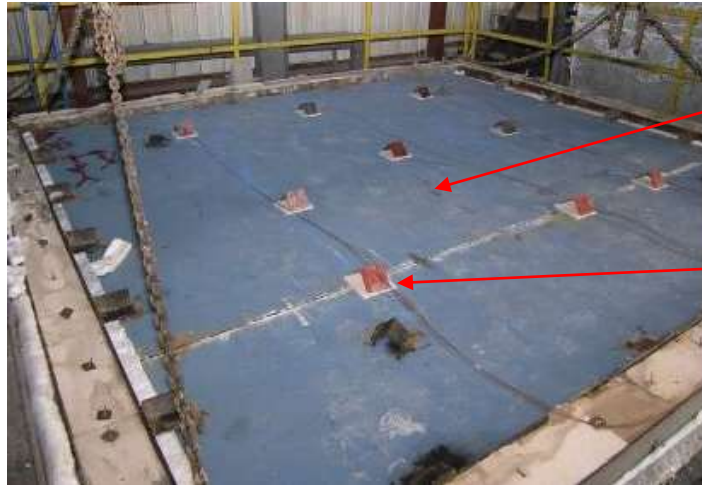


Ratings	
A-Class	Integrity for 60 minutes
	Insulation - Time (minutes)
	Assigned: A-60, A-30, A-15, A-0
B-Class	Integrity for 30 minutes
	Insulation - Time (minutes)
	Assigned: B-15, B-0

Fire Resistance

Typical Test Pictures

Deck Test



Unexposed deck assembly on top of furnace

Unexposed (cold side) thermocouples



Exposed deck assembly inside of furnace

Exposed (hot side) thermocouple probes

Bulkhead Test



End of test, bulkhead removed from furnace



Approval Certificates Required

www.mared.org (MED)

Issued by: IMO Notified Body

- International Association of Classification Societies (IACS.org.uk)
- US Coast Guard (USCG)

Requirements to Issue

- Test reports for non-combustibility and fire resistance
- Quality control documentation program

Types of Approval – USCG/MED

- Non-combustible material 164.109//A.1/3.13
- Structural insulation 164.107//A.1/3.11

Approval Renewals

- Every 5 years
- Must retest when the test used to renew is 15 years old



Certificates Issues per Approval

Websites: Mared.org , <https://cgmix.uscg.mil/Equipment/>

Module B

Technical data for the insulation approval, details of the insulation system, location of manufacture, etc.

Module D

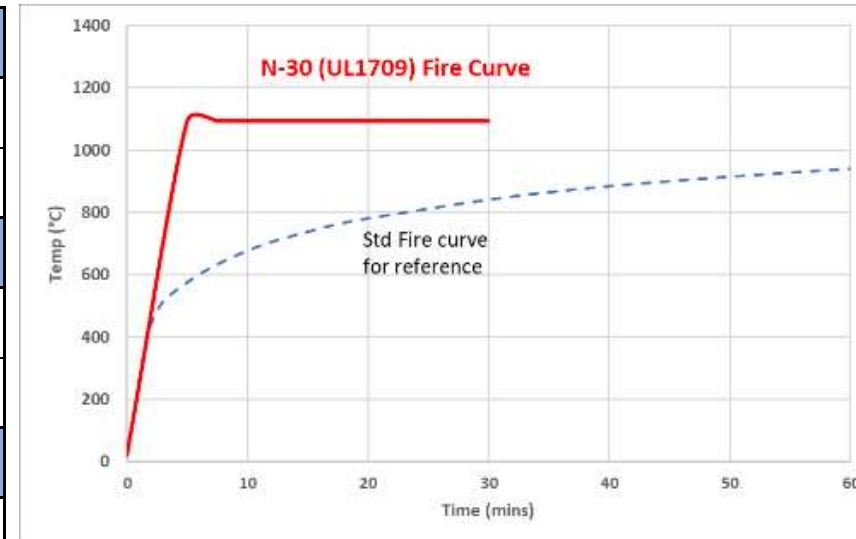
Quality system for production, inspection, and verification

Note: In general, both certificates are issued by the same notified body

US Navy – N-Class

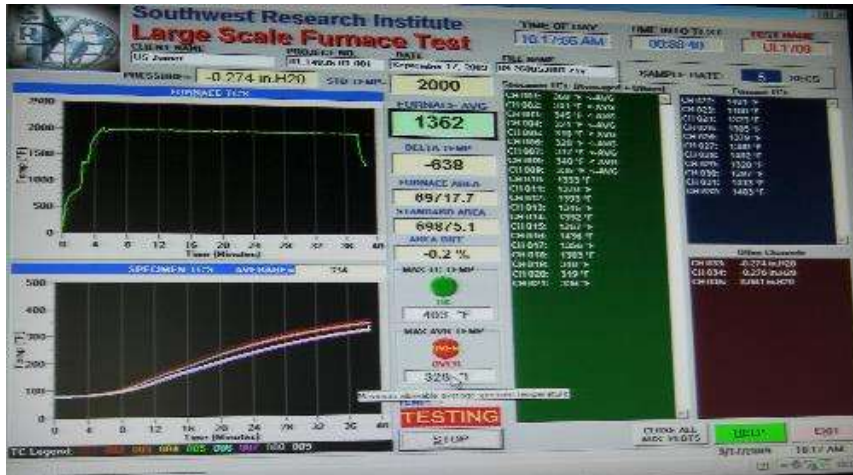
MIL-STD-3020

Sample Size	
Deck (Ceiling)	3658mm width x 4115 mm length
Bulkead (Wall)	3048mm width x 3048 mm height
Exposure	
UL1709 Rapid Rise Fire Test Exposure (N-Class Only)	
1093 °C at 5 mins then constant, Avg Heat Flux 204 kW/m ²	
Time of Exposure	
N-Class	30 minutes
Criteria	
Shock Test	Prior to fire test, separate test setup
Insulation	Temperature rise (ΔT) on unexposed face $\Delta T_{ave} \leq 139 \text{ }^\circ\text{C}$ $\Delta T_{max} \leq 181 \text{ }^\circ\text{C}$



Ratings	
N-Class	Integrity for 30 minutes
	Insulation - Time (minutes)
	Assigned: N-30, N-0
Additional Product Testing to MIL-PRF-32161	
Toxicity, Facing breaking strength and adhesion, Flame spread, Smoke Density, Corrosiveness, Resistance to vibration, Compression	

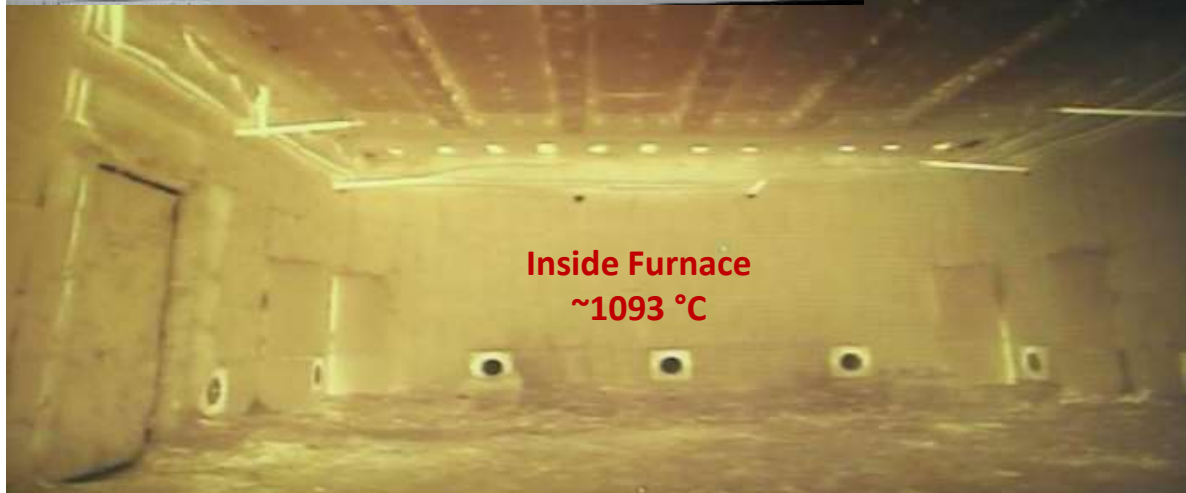
N-Class Fire Test



Thermocouple
hot face and
cold face
readouts



US Navy witness, pre and post inspection





Shock testing of SFP Systems for Commercial Ships

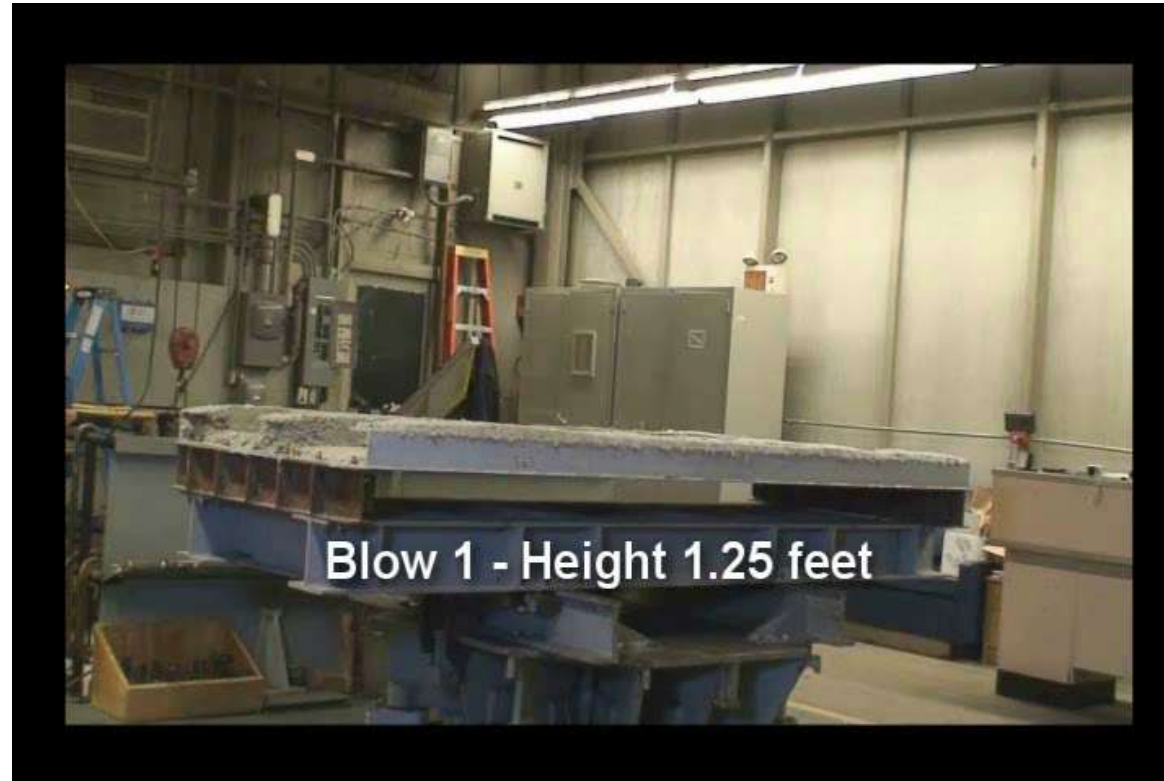
- Currently this is NOT required
- ASTM F2877-11
- Why shock test SFP?

NIST Report



Public Domain: Flickr.com

Shock Testing Video



Evaluation spray applied insulation



Thank You!

Questions?

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