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NFCA’s 2019 Fire-Resistance in Buildings Seminar
IFRM – George Guanci
Ernst Toussant
Sean Younger
NFCA’s Fire-Resistance in Buildings Seminar

IFRM – George Guanci
October 3, 2019
Integrity of Fire Resistance
The Right Fire Resistance Standard

1. ASTM E-119 and UL 263

2. Internationally Recognized Testing Agency
   • UL, Intertek, FM

3. Characteristics
   • 2,000 Degrees after Four Hours
   • Load Place on Floor Assembly/Beams
   • Full Scale Test Versus Small Scale Test
“Layers – What is the Maximum Thickness?”

1. Factors Affecting Applied Thickness
   • Weather (Temperature & Humidity)
   • Product (Water, Solvent, Epoxy)
   • Fibers
   • Applicator Experience

2. Water Based Products
   • 25 mils WFT to 55 mils WFT
   • Fibers Can Affect Thickness per Pass/Coat
   • Temperature: Minimum 40 Degrees F – 50 Degrees F
   • Humidity: Maximum of 75% - 80% then ensure that there is proper ventilation.
   • Fibers: Large Fibers can Limit Thickness per Coat.
“Layers – What is the Maximum Thickness?”

3. Solvent Based Products
   • 35 – 45 mils WFT Per Coat
   • 32 – 40 Degrees F
   • Maximum 80 – 85% Humidity

4. Epoxy Based Products
   • 60 – 120 mils WFT Per Coat
   • 40 Degrees F
   • 80% Humidity
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Surface Preparation

Temperature and Humidity Requirements for Curing

Ernst Toussaint
Hilti North America
SSPC – 1950 AND 1997

NACE INTERNATIONAL - 1943 AND 1993

HISTORY
SURFACE CLEANLINESS STANDARDS

• SSPC and NACE issue consensus standards
• Currently SSPC has issued 13 cleanliness standards
• NACE is jointly referenced in 7 of the 13
SURFACE PREPERATION

• Dual Purpose:
  Cleaning the surface
  Roughening the surface
SSPC-SP1, SOLVENT CLEANING

- Requires the removal of all visible grease, oil, lubricants, cutting compound and other non-visible contaminants from the surface
- Degreasing agents (solvents, alkaline and emulsion cleaners, steam cleaning) described earlier
- Mechanical cleaning will not remove grease/oil
- “Indirect requirement” to the SSPC surface cleanliness standards
HAND AND POWER TOOL CLEANING – GENERAL

• SSPC-SP1 (solvent cleaning) is an “indirect requirement” of SP2, SP3, SP11, SP15

• Weld slag, flux and fume deposits should be removed from welds (per contract documents)

• Verify removal of dirt/debris generated by power tool cleaning (blow down, brush, vacuum)
  – If blow down, verify cleanliness of compressed air (“indirect requirement” of SP2, SP3, SP11, SP15)
SSPC-SP2 AND SP3
HAND AND POWER TOOL CLEANING

- Requires removal of all loosely adhering rust, mill scale and paint
- Remaining materials must be tightly adhering
- Contract may require feathering
- Unit area
- No surface profile requirement
SSPC-SP11,  POWER TOOL CLEANING TO BARE METAL

• Requires:
  – Removal of all loosely and all tightly adhering mill scale, rust and paint to expose the bare metal surface (traces of paint, rust and mill scale can remain in bottom of pits)
  – A minimum 25 µm (1 mil) anchor pattern

• Prepared surfaces should not be compared to abrasive blast cleaned surfaces
  – Surface roughness characteristics are different
SSPC Visual Guides for Surface Cleanliness

- SSPC VIS 1 (Abrasive Blast Cleaning)
- SSPC VIS 3 (Power and Hand Tool Cleaning)
HAND AND POWER TOOL CLEANING METHODS
TOOLS USED FOR HAND AND POWER TOOL CLEANING
ABRASIVE BLAST CLEANING STANDARDS

- Listed from lowest to highest level of cleanliness required
- Specification must stipulate the required depth of the surface profile

- SSPC-SP7/NACE 4
- SSPC-SP14/NACE 8
- SSPC-SP6/NACE 3
- SSPC-SP10/NACE 2
- SSPC-SP5/NACE 1
SURFACE PROFILE DEPTH

- No standard depth
- Max peak to valley depth generated by abrasive impacting at high speed
- Determined by the coating manufacturer or project specification
- Must be compatible with the entire coating system
- Typically stated as a range e.g., 38-75 µm (1.5-3 mils)
ABRASVIE BLAST CLEAING CLEANING METHODS
WHY IS SURFACE PREPARATION IMPORTANT?

• To remove surface contamination
• Promote adhesion of the primer
• Prolong the life expectancy of the system
• To ensure proper adhesion of a tie coat over existing coating
• To prevent premature failure of the protective system
# TEMPERATURE/HUMIDITY REQUIREMENTS FOR CURING

<table>
<thead>
<tr>
<th>App Condition</th>
<th>Material Temp</th>
<th>Surface Temp</th>
<th>Ambient</th>
<th>Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>70F</td>
<td>41F</td>
<td>41F</td>
<td>0%</td>
</tr>
<tr>
<td>Maximum</td>
<td>104F - 140F</td>
<td>125F</td>
<td>110F</td>
<td>85%</td>
</tr>
</tbody>
</table>

* Specific products may vary

Temp, air movement and humidity dependent

## Curing Schedule @ 50%RH

<table>
<thead>
<tr>
<th>Surface Temp</th>
<th>To Touch</th>
</tr>
</thead>
<tbody>
<tr>
<td>50F</td>
<td>1 - 4 hours</td>
</tr>
<tr>
<td>90F</td>
<td>30 min - 3 hours</td>
</tr>
</tbody>
</table>
# TEMPERATURE/HUMIDITY REQUIREMENTS FOR CURING

<table>
<thead>
<tr>
<th>Solvent Based*</th>
<th>App Condition</th>
<th>Material Temp</th>
<th>Surface Temp</th>
<th>Ambient</th>
<th>Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>70F</td>
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<td></td>
</tr>
<tr>
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<td>125F</td>
<td>110F</td>
<td>85%</td>
<td></td>
</tr>
<tr>
<td>^ Specific products may vary</td>
<td>Temp, air movement and humidity dependent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Curing Schedule @ 50%RH

<table>
<thead>
<tr>
<th>Surface Temp</th>
<th>To Touch</th>
</tr>
</thead>
<tbody>
<tr>
<td>70F</td>
<td>4 hours</td>
</tr>
</tbody>
</table>
# Temperature/Humidity Requirements for Curing

<table>
<thead>
<tr>
<th>Water Based*</th>
</tr>
</thead>
<tbody>
<tr>
<td>App Condition</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
</tbody>
</table>

* Specific products may vary, temp, air movement and humidity dependent

**Curing Schedule @ 50%RH**

<table>
<thead>
<tr>
<th>Surface Temp</th>
<th>To Touch</th>
<th>To Recoat</th>
</tr>
</thead>
<tbody>
<tr>
<td>70F</td>
<td>1.5 - 5 hours</td>
<td>4 - 24 hours</td>
</tr>
</tbody>
</table>
Intumescent Finish Levels

What are the finish level specifications for IFRM?

What finishes should be specified?
Specifications for Intumescent Finish Levels

- 4 finishing levels
- Application time increases with each level
- Application costs increase with each level
Level 1 Finish

Definition
- Standard sprayed finish
- Spray applied to specified DFT requirements with surface irregularities
- Surface has textured appearance
- Surface is left as sprayed

Suggested Use
- Areas where surface appearance is not of primary concern or not visible
- Mechanical rooms
- Parking garages
- Industrial and petrochemical applications.
Level 2 Finish

Definition
• Typical commercial finish
• Spray applied to specified DFT requirements with some surface irregularities
• Uniform, light texture appearance
• Applied in light coats to maintain best possible finish

Suggested Use
• Visible areas where upgraded finish is desired
• Atriums, airports
• Commercial Buildings
Level 3 Finish

Definition

- Architectural finish
- Spray applied to specified DFT then hand tooled and sanded
- Uniform, smooth appearance with minimal surface defects
- Surface is sanded to minimize texture, some slight texture visible
- Material must be applied consistently to maintain smooth texture prior to sanding

Suggested Use

- Visible areas where upgraded finish is desired
- Atriums, airports
- Commercial Buildings
Level 4 Finish

Definition

- High end architectural finish
- Spray applied to specified DFT then hand tooled and sanded
- Uniform, smooth appearance with no visible texture
- Surface is sanded smooth and free of tool marks and ridges
- Material must be applied consistently to maintain smooth texture prior to sanding

Suggested Use

- Areas where highest quality finish is desired
- Atriums, airports
- Commercial applications
Repairs of IFRM

How is the fire resistive material manufacturer identified?
Repair procedures for commercial IFRM?
Repairs of IFRM

General:

- All patching and repairs should be carried out with the same material applied to the assembly.
- IFRM manufacturers require original product (or an approved equal – the same type) must be used for repairs.
Repairs of IFRM

If material can be identified, Fireproofing contractor should:

- Identify the material / element protected, via field inspection, specs/drawings, markings, etc.
- Invite manufacturer rep along for possible field identification
- If identified, locate the fire test design to determine thickness
- Repair in accordance with the manufacturers repair/installation instructions
Repairs of IFRM

If material cannot be identified, fireproofing contractor should:

• Invite manufacturer rep for field ID
• Send samples manufacturer labs for analysis
• If manufacturer cannot be identified, identify type
  ✓ IFRM (Solvent, Water, Epoxy)
• Repair with like ‘type’ to a listing that closely approximates the assembly listing
• AHJ must approve
• If material has been damaged or is in need of repair or patching, the following procedures shall be followed:
  • Only repair or patch with the same material
  • Remove all damaged areas back to solidly adhered material.
  • All edges can be left as butt joints to a 90 degree angle
  • If primer system is damaged, it shall be reinstated to its original specification.
  • All areas must be blown down and solvent/water cleaned and allowed to dry before commencing application.
IFRM Repair Procedures

• The material shall be troweled or spray applied to the appropriate thickness based on the project specification and fire test certification.

• Apply material in appropriate thickness per coat manufacturers written instructions.

• Newly applied repair must blend into the existing material to achieve a uniform appearance.

• When dry, apply specified topcoat system, based on the original specification, in strict accordance with manufacturer’s specification and fire test design requirements.
Surface Preparation for SFRM

How is the fire resistive material manufacturer identified?

Repair procedures for commercial IFRM?
Surface Prep For SFRMs

Commercial SFRMs
(ASTM E119 / UL 263)

- Surface Preparation
- Bond Strength Requirements
- Primed Steel Guidelines
- Lath requirements
Primed Steel Bond Strength Guidelines For Commercial SFRMs

Commercial SFRMs are usually applied over bare steel

- Prior to application, all substrates must be clean and free of loose scale, dirt, oil, grease, condensation, or any other substance that would impair adhesion
- If steel is primed/painted, adhesion of SFRM to the painted surface to be 80% or greater than bare steel value
- Primers must be alkali resistant for Portland cement SFRMs
Primed Steel Bond Strength Guidelines For Commercial SFRMs

- Bonding agents may also be used to attain the minimum “pass” value
- In dry interior conditions, SFRM can be applied directly over primed/painted joists without the use of lath
- If primer/paint is unknown SFRM manufacturer can test prior to job start
- If primer, surface prep must be carried out in accordance with specified primer
Primed Steel Bond Strength Guidelines

If paint/primer is unknown or project timeframe does not allow bond testing:

• Metal lath can be used on entire substrate

Or

• Bonding agents can be used
• If bonding agent is used, bond testing must be performed when SFRM is set and cured to confirm preliminary results
Flexible Roof Decks

- Cementitious spattercoats used as adhesive for cellular steel decks, flexible roof deck assemblies
- Must be applied to all roof decks
- Applied prior to the application of the SFRM
- Coverage does not exceed 70% of the surface area.
- At least 30% of the steel area visible.
Primed / Painted Steel Deck

- Deck and Primer must be tested and classified to receive direct application of SFRM
- Check fire test design
- Check documentation from the deck manufacturer
- Some designs list painted decks
- Decks not listed must have 100% metal lath or disk/studs if painted
Lath Requirements For Painted Steel

- In addition to bond strength requirements, current industry standards require lath to be used in the following conditions:
  - Beam flange width exceeds 12"
  - Column flange width exceeds 16"
  - Beam or column web depth exceeds 16"
Lath Requirements For Painted Steel

- If primed/painted steel size requirements are not met:
- Minimum 25% of the oversized flange or web shall be covered by metal strip lath or steel studs with discs
- Metal lath shall not be less than 3 -1/2” wide
- Lath must be a minimum of 1.7 lbs/yd² (attached 12” on center) on longitudinal edge and throughout is applicable
Lath Requirements For Painted Steel

- Tube Width does not exceed 12"
- Pipe Outer Diameter does not exceed 12"
Lath Requirements For Painted Steel

- If primed/painted steel size requirements are not met:
  - Minimum 25% of tube face shall be covered with strip lath
  - Clear span of pipe must not exceed 12”
  - Metal lath shall not be less than 3½” wide
Repairs of SFRM

How is the fire resistive material manufacturer identified?
Repair procedures for commercial SFRM?
Repairs of SFRM

General:

- All patching and repairs should be carried out with the same material applied to the assembly
- SFRM manufacturers require original product (or an approved equal – the same type) must be used for repairs
Repairs of SFRM

If material can be identified, Fireproofing contractor should:

- Identify the material / element protected, via field inspection, specs/drawings, markings, etc.
- Invite manufacturer rep along for possible field identification
- If identified, locate the fire test design to determine thickness
- Repair in accordance with the manufacturers repair/installation instructions
Repairs of SFRM

If material cannot be identified, fireproofing contractor should:

• Invite manufacturer rep for field ID
• Send samples manufacturer labs for analysis
• If manufacturer cannot be identified, identify type
  ✓ SFRM (gypsum, fiber, Portland (low medium, high density))
• Repair with like ‘type’ to a listing that closely approximates the assembly listing
• AHJ must approve
SFRM Repair Procedures

- If material has been damaged or is in need of repair or patching, the following procedures shall be followed:
- Only repair or patch with the same material
- Remove all damaged areas back to solidly adhered material.
- All edges can be left as butt joints to a 90 degree angle
- If primer system is damaged, it shall be reinstated to its original specification.
- All areas must be blown down and dampened with water before commencing application.
SFRM Repair Procedures

• The material shall be mixed, troweled or spray applied to the appropriate thickness based on the project specification and fire test certification

• Apply material in appropriate thickness per coat manufacturers written instructions