Metal Building and SPF: Current Research

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Overview

- Background
- Key Industry Concerns
- Current Research
  - Procedures
  - Results
  - Conclusions
- Next Steps
Background

• Who are our research partners?
  – Metal Construction Association (MCA)
    • Represents material suppliers to the metal building industry
  – Metal Building Manufacturers Association (MBMA)
    • Represents manufacturers of metal building systems
Background

• What are their concerns?

  – Alliance Steel Building Systems – Feb 2012
    • Issued a technical bulletin with a warranty exclusion if SPF is used.
    • Based mainly on concerns from upstream suppliers about corrosion from condensation and damage to coatings, among other issues.
Background

• What are their concerns?

  – Update of SPFA(AY)-134 – Feb 2014
    • Invited MCA and MBMA to provide input.
    • Some comments received from MBMA Technical Committee
    • Both organizations asked for a meeting to discuss technical concerns.
Background

• What are their concerns?

  – Joint Meeting – April 2014

MCA-MBMA Team
• Ken Buchinger - MBCI
• Bill Croucher - Fabral
• Al Dunlop - NCCA
• Lori Witherup – Akzo Nobel
• Scott Kriner - MCA

SPFA BEC Metal Building Task Group
• Mark Fortney – Gaco-Western
• Gary Romes – Guardian Insulation
• Tom Ponder – CertainTeed
• Rick Duncan - SPFA
Key Industry Concerns

• What are their concerns?
  1. Exothermic temperature damage to coatings
  2. Discoloration of roof panels over time
  3. Distortion (oil-canning) of panels
  4. Moisture condensation and corrosion
  5. Adhesion of SPF
  6. Fire protection
  7. Thermal movement of standing seam roof systems
  8. Entrapment of water leaks
Key Industry Concerns

• What are their concerns?
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  6. Fire protection
  7. Thermal movement of standing seam roof systems
  8. Entrapment of water leaks

2. All insulation below and in direct contact with roof deck raised roof deck temperatures. Insulated metal panels using foam plastics work well, perhaps using higher temperature or reflective coatings

4. Use appropriate vapor retarders in cold climates or where interior moisture is high. Open-cell foams may need additional interior vapor retarder.

5. Substrates must be clean, dry and free of dust, particulates and oils

6. SPF uses combinations of integral flame retardants, coatings and coverings to meet fire resistance requirements of model building codes, FM Global and UL.
Key Industry Concerns

- What are their concerns?

Exothermic temperature damage to coatings

Exothermic temperatures can exceed 350°F for short times in center of lift. What is the temperature of the sheet metal substrate just after application?
Key Industry Concerns

• What are their concerns?

Deflection (oil-canning) of panels

SPF will distort when it cools and captive blowing agents diffuse from the surfaces. Deformation could result if thin-gage, low flexural stiffness panels are used in assemblies with large, unsupported spans.
Key Industry Concerns

- What are their concerns?

  **Restrained thermal movement of standing seam roof systems**

  Standing seam roofing systems are designed to freely expand and contract relative to the building structure. SPF can interfere with this designed deformation.

  Special designs allow roof to move relative to framing at extreme hot and cold temperatures.
Key Industry Concerns

• What are their concerns?

Entrapment of water leaks

Fastening of structural members to sheet metal can leave concealed air gaps when SPF is applied from interior. If water leaks or condenses into these spaces, will it dry quickly or cause corrosion?
Current Research

• Research project created

PHASE I:
Exothermic temperature laboratory study

PHASE II:
Panel deflection mockup study

FUTURE RESEARCH:
Thermal movement of standing seam roof systems
Entrapment of water leaks
Current Research

• PHASE I: Exothermic Temperatures
  – Used three different commercial ASTM C1029 Type II foams
  – Spray onto 3’x3’ wood-frame assembly
  – Instrument with thermocouples and monitor temperatures at substrate (metal panel) and center of lift
  – Measure deflections of the metal panel at centerpoint
Current Research

- PHASE I: Procedure
  - Test specimen construction

Glue all butted 2x6 edges with standard wood glue (PVA-based)

Attach Simpson Strongtie Model L50 to outside of all framing corners using 10d coated framing nails
Current Research

• PHASE I: Procedure
  – Temperature and deflection measurement
Current Research

• PHASE II: Procedure
  – Used one commercial ASTM C1029 Type II SPF applied by systems house tech
  – Wall Assembly:
    • Constructed 12’ x 50’ wall at MBCI plant in Houston, TX
    • Seven different sheet metal profiles installed
    • Half wall used release fabric (non-woven PE fiber BIBS fabric); other half sprayed foam directly to panel
  – Roof Assembly:
    • Constructed 16’x20’ roof assembly at MBCI
    • Two different sheet metal profiles installed
    • Half with release fabric, half without
Current Research

• PHASE II: Procedure
  – Construction of Wall Assembly
Current Research

• PHASE II: Procedure
  – Construction of Wall Assembly
Current Research

• PHASE II: Procedure
  – Construction of Roof Assembly
Current Research

• PHASE II: Procedure
  – Construction of Roof Assembly
Current Research

• PHASE I: Results
  – Test panel deflections
Current Research

• PHASE I: Results
  – Test Panel Temperatures (time vs. temp.)
Current Research

- PHASE I: Results
  - Tabular peak temperature results

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*Material A panels heated to 140F with heatlamp prior to spraying. Heatlamp remained on panel after spraying, explaining 'artificial' sheet metal temperature increase. Materials B and C

**Panels sprayed with 2nd pass 10-20 minutes after first pass; some showed higher second peak temperature but no effect noted on sheet metal substrate temperature
Current Research

• PHASE II: Results
  – Mockup Deflections
    • Some undesirable pull-away of release fabric upon application of skim coat, resulting in air gap between foam and sheet metal and uneven interior surfaces
    • No visible deflection of any metal panels 30+ days after installation
Current Research

• PHASE I: Conclusions
  – Test panel deflections
    • Difficult to measure on small panel
    • Inconclusive results. Use mock-up results
  – Exothermic peak temperatures
    • Mid-thickness of pass shows consistently higher peak temperatures than sheet metal substrate
    • Sheet metal substrate appears to increase in temperature about 70-80F over ambient for ~30 minutes. Does not appear to be a concern for MCA suppliers.
Current Research

• PHASE II: Conclusions
  – Mockup Deflections
    • No visible deflections when foam is properly applied to manufacturer’s installation instructions (using picture-frame technique)
    • No difference in panel appearance using release fabric
    • Pull-away of release fabric will add cost and complexity and can result in air gaps and uneven foam surfaces.
    • MCA was considering guidance strongly suggesting use release fabric, but these results have changed their position.
Next Steps

• MCA SPF Guidance Document:
  – Draft shared with SPFA BEC; Will be published shortly
  – Cautions about vapor retarders, but does not suggest release fabric.
  – Always follow MII and use experienced, certified SPF installers.

• Update SPFA-135 TechDoc

• Remaining MCA-MBMA Concerns
  – To be discussed with MCA in 2016
Questions?

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