Insulation
Clarification for Specific Applications
Michigan WX Conference 10-24-19
The Role of Codes and Standards in the SWS

While the SWS will help identify the desired outcomes in weatherization they are not a replacement for the codes and/or technical standards mandated by a particular jurisdiction. State, local or municipal codes and ordinances HAVE A LEGAL PRECEDENCE.
- What is code at its simplest form?
- How poorly are we legally allowed to build or install something?
- Code speaks to more than just installing insulation, remodeling or building.
- Code encompasses more than structural minimums.
- Building durability and occupant safety must be well thought-out.
As WX professionals must we install insulation to code?

MRC Chapter 11 (N1101.3.1)

Alterations, renovations or repairs

Alterations, renovations or repairs to an existing building shall conform to the provisions of this code, as they relate to new construction without requiring the unaltered portions of the existing building to comply with this code. Alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems.

Exception: The following are exempt, provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing ceiling, wall or floor cavities exposed during construction, provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
Subtopic 4.1401 Band/Rim Joists

4.1401.1 Band/Rim Joists—Spray Polyurethane Foam (SPF) Installation

**Topic:** Basements and Crawl Spaces

**Subtopic:** Band/Rim Joists

**Desired Outcome:** Insulate and seal all band/rim joist areas between subfloor and foundation or top plate of wall below

**Available In:** Single-Family Homes
What's the deal with SPF in box sills?

- How thick can it be?
- Does it need to be covered?
- Is there a difference between:
  - Basements?
  - Crawl spaces?
SWS Guidance:

4.1401.1b
SPF will be applied to desired thickness, using pass thickness maximum in accordance with manufacturer specifications, onto subfloor between floor joists and all rim/band joists.

4.1401.1c
If SPF exceeds a thickness of 3", all SPF will be separated from the occupied interior space of the building with an approved thermal barrier material. Application to rim/band joist up to 3" can be left exposed if the foam is Class I, unless the space is a habitable space and then cover it with a thermal barrier.
Michigan Residential Code Definitions

HABITABLE SPACE:
A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.

THERMAL BARRIER:
A thermal barrier is a layer of nonflammable material that is sprayed, painted, or mechanically applied over a combustible surface or product.
MRC Guidance:

Chapter 3 (R316.5.11)
Sill Plates and Headers

Foam plastic shall be permitted to be spray applied to sill plates and headers or installed in the perimeter joist space without the thermal barrier specified in Section R316.4 if subject to all of the following:

1. The thickness of the foam plastic shall not be more than $3\frac{1}{4}$ inches (83 mm).

2. The density of the foam plastic shall be in the range of 0.5 to 2.0 pounds per cubic foot (8 to 32 kg/m$^3$).

3. The foam plastic shall have a flame spread index of 25 or less and an accompanying smoke-developed index of 450 or less when tested in accordance with ASTM E84 or UL 723.
Manufacturer Guidance:

ICC-ES Evaluation Reports ESR-1926, ESR-3183, ESR-3228
Dow/Dupont (Froth-Pak), DAP (Touch n’ Foam) and CTS (Tiger Foam)

Uses:
Polyurethane foam insulation is used as nonstructural thermal insulating material in Type V construction under the IBC and in dwellings under the IRC. The insulation is for use in wall cavities, floor/ceiling assemblies, attics and crawl spaces, sill plates, band joists and headers installed in accordance with this report.

Use on Sill Plates, Band Joists and Headers:
Polyurethane foam insulation with a maximum of 2 inches (51mm) may be applied to sill plates, band joists and headers without a thermal barrier or ignition barrier in Type V construction in accordance with IBC Section 2603.4.1.13 and IRC Section R316.5.11
Quick Heat Loss Calculation for Box Sills

Area X U-value X HDD X 24hr = Heat loss per year in BTUs

Using a typical 120 Sqft of box sill and Heating Degree Days of 6000

R4 (uninsulated box sill) = U .25  R14 (2 inches SPF) = U .071  
R19 (3 inches SPF) = U .053

Uninsulated: 120 X .25 X 6000 X 24 = 4,320,000btu or 43 therms

2 inches of SPF: 120 X .071 X 6000 X 24 = 1,226,880btu or 12 therms

3 inches of SPF: 120 X .053 X 6000 X 24 = 915,840 or 9 therms

• **The first 2 inches is saving over 30 therms per year**

• **Another inch only relates to a 3 therm savings per year**
Application:

• Per Manufactures specifications referenced in this session, SPF can be installed in box sills up to a thickness of 2 inches without a thermal or ignition barrier.

• Locate and research evaluation reports from other manufactures prior to installation.
4.1401.2 Band/Rim Joists – Insulation other than Spray Polyurethane Foam

**Topic:** Basements and Crawl Spaces

**Subtopic:** Band/Rim Joists

** Desired Outcome:** Closed crawl spaces insulated to achieve best thermal performance possible

**Available In:** Single-Family Homes
SWS Guidance:

4.1401.2b
A foam-based insulation will be installed so as to create a continuous thermal and pressure boundary.

If rigid insulation is used, all edges will be sealed, and the insulation will be installed tightly to the wood to prevent the movement of moisture throughout the assembly.

Insulation will be installed in accordance with local/national code requirements and/or manufacturer’s instructions regarding flame spread.
What are acceptable options?

XPS - Extruded Polystyrene

EPS - Expanded Polystyrene
Manufacturer Guidance: Extruded

ICC-ES Evaluation Reports ESR-2142, ESR-1061
Dow/Dupont (Styrofoam), Owens Corning (Foamular)

Uses:
Extruded polystyrene foam plastic insulation boards for use as nonstructural thermal insulation in wall assemblies, ceiling/floor assemblies, exterior perimeter of foundations, and as a component of classified roof assemblies.

Application without a prescriptive ignition barrier:
Type X and Type IV insulation boards may be installed without a prescriptive 15-minute thermal barrier required by applicable code when a maximum thickness does not exceed 2 inches (51mm).
Manufacturer Guidance: Expanded

ICC-ES Evaluation Reports ESR-1788
CCM (Insulfoam EPS)

Uses:
Expanded polystyrene foam plastic insulation boards for use as nonstructural thermal insulation in wall assemblies, ceiling/floor assemblies, exterior perimeter of foundations and slabs

Application without a prescriptive Ignition barrier:
The interior of the building must have separation from the insulation with an approved thermal barrier.

- Special use options do exist however defeat our purpose.
Polyisocyanurate
Insulated rim joist

RIGID FOAM

CAULK

EXPANDING FOAM

SILL PLATE

FIBERGLASS INSULATION

HOLLOW CONCRETE BLOCK
• When we do a bang-up job of air sealing at the box sills, sill plates, rim joists, etc., it is crucial to test for spillage on combustion appliances.

• Since box sills are generally in the CAZ, verifying that we didn’t eliminate any driving forces that were allowing these appliances to draft properly cannot be overlooked.
4.1402.1 **Closed Crawl Spaces—Wall Insulation**

**Topic:** Basements and Crawl Spaces

**Subtopic:** Basements and Crawl Space Walls

**Desired Outcome:** Closed crawl spaces insulated to achieve best thermal performance possible

**Available In:** Single-Family Homes

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4.1402.2 **Basement Wall Insulation—No Groundwater Leakage**

**Topic:** Basements and Crawl Spaces

**Subtopic:** Basements and Crawl Space Walls

**Desired Outcome:** Basement insulation improves thermal performance and ensures sufficient drying potential

**Available In:** Single-Family Homes, Manufactured Housing
SWS Guidance:

A fire-rated insulation (25 or less flame spread or Class I or Class A) will be used with a minimum life expectancy of 10 years.

Regional International Energy Conservation Code (IECC) will be followed for required R-values.

Insulation will be attached with a durable connection better than or equal to manufacturer specifications.

When absorbent insulation materials are installed, assembly will remain vapor semi-impermeable to the interior.

A continuous air barrier will be installed on the warm side of the insulation.
What are acceptable options?

• 2 Part foam (SPF)

• Polystyrene foam plastic boards
  - Extruded (XPS)
  - Expanded (EPS)

• Polyisocyanurate

• Ecocell® cellulosic fiber insulating blankets/batts
THERMAL BARRIER: A thermal barrier is a layer of nonflammable material that is sprayed, painted, or mechanically applied over a combustible surface or product.

Foam insulation must be separated from the interior of the building by intumescent paint or another approved thermal/ignition barrier.
DC 315 is a coating specifically formulated for application over spray foam insulation. DC 315 will inhibit or prevent the start and spread of flame. The coating can be used as an ignition barrier or thermal barrier depending on the thickness installed over the foam.
Polyisocyanurate
• Can be Installed on closed crawl space and basement walls.

• Follow all manufacture specifications for proper installation.
As WX professionals must we install crawl ventilation to code?

MRC Chapter 4 (R408.3)
Unvented Crawl Spaces

Vent openings in under-floor spaces are not required where the following items are provided:

1. Exposed earth is covered with a continuous Class I vapor retarder. Joints of the vapor retarder overlap by 6 inches and sealed or taped. Edges of the vapor retarder shall extend 6 inches up the stem wall and attached.

One of the following is provided for the under-floor space:

2.1. Continuously operated mechanical exhaust ventilation at a rate equal to 1 cubic foot per minute for each 50 square feet of crawl space floor area, including an air pathway to the common area and perimeter walls insulated in accordance with code.

2.2. Conditioned air supply sized to deliver at a rate equal to 1 cubic foot per minute for each 50 square feet of under-floor area, including a return air pathway to the common area, and perimeter walls insulated in accordance with code.
What are the alternatives?

We certainly do not want to add any new crawl space vents.

Control any bulk water issues and consider fabricating removable crawl vent covers out of XPS or like material.

Client education goes along with this:

• Inform client how crawl space environment will be changing.

• Educate client on conditions that may necessitate removing vent covers and how to do so.
Other Insulation Details to Consider

• Between Floors
• Slopes / Roof Rafters
• Knee Walls
• Suspended Ceilings
**Sealing wall-floor junction:**
Blown insulation reduces convection through walls and floors. A air permeable bag helps contain and pack the blown insulation that extends into the floor cavity.
Attic floor and knee wall:
Establish an air barrier at the attic floor and at knee wall to slope connection

air barrier under knee wall

house wrap or similar
blown floor insulation
Finished attic best practices: Air sealing and insulation combine to dramatically reduce heat transmission and air leakage in homes with finished attics.
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<td>Fill slant ceilings</td>
<td>Using fill tube, 100% of each cavity will be filled to a consistent density:&lt;br&gt;  - Cellulose material will be installed to a minimum density of 3.5 pounds per cubic foot&lt;br&gt;  - Loose fiberglass material will be installed and will be specifically approved for air flow resistance per manufacturer's recommendation&lt;br&gt;The number of bags installed will be confirmed and will match the number required on the coverage chart&lt;br&gt;Insulation will be verified to prevent visible air movement at 50 pascals of pressure difference using chemical smoke, IR scans, or other approved verification method.</td>
<td>Ensure complete and consistent coverage throughout ceiling plane&lt;br&gt;Eliminate voids and settling&lt;br&gt;Minimize framing cavity air flows</td>
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Suspended Ceilings
Suspended ceilings are seldom airtight, especially the T-bar variety. T-bar ceilings and other non-structural suspended ceilings aren’t usually a good location for an air barrier.

Take down some panels of a suspended ceiling to inspect the suspended ceiling. If there is a plaster ceiling above a non-structural suspended ceiling, and it is weak and failing, consider these options.

- If you install insulation on top of existing insulation above the failing ceiling, make the original ceiling the air barrier.
- Screw drywall over areas of missing plaster.
- Seal the ceiling joints and perimeter with foam or other air barrier material.