

BUILDING SCIENCE

Building Code Compliance – Building Science

- Building Science
 - Water-Resistive Barriers (WRB)
 - Air Barriers (AB)
 - Vapor Retarders (VR)
 - Moisture Control



Water Resistive Barrier (WRB)

- Only applies to approved products
- Installation requires use of approved flashing tapes
- Quality installations are durable
 - Rigorous code acceptance testing
 - Field studies confirm (after 15 years of service)
 - More wind resistant than membrane/wrap

WRB Installation

(NIST Net-Zero Energy House / BSC / ARES)



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Water Resistive Barrier

- Rain water is the main concern with moisture for all types of walls (with or without CI)
- WRB equivalence of taped FPIS
 - Confirmed by code compliance research report as defined by the IBC Sections [104.11.1 Research reports](#) and [1703.4.2 Research reports](#).
 - ABTG RR XXXX (not yet online)
 - TER No. 1410-05 (not yet online)
- Foam sheathing products + flashing tapes = WRB

Water Resistive Barrier

- Meets energy code and WRB requirements (
 - Designer/Builder must consider cost of WRB and insulation strategy
- **R703.2 Water-resistive barrier.** One layer of No. 15 asphalt felt, free from holes and breaks, complying with ASTM D 226 for Type 1 felt or other approved water-resistive barrier shall be applied over studs or sheathing of all exterior walls.
- [IRC R703.2](#)
- WRB required on essentially all exterior walls (regardless of cladding type)
- Code requires #15 asphalt felt or equal

Water Resistive Barrier

- WRB equivalence is usually confirmed by a code evaluation service such as ICC-ES, IAPMO, ATI, or [DrJ Engineering](#)
- Several foam sheathing products + flashing tapes = WRB
- Meets energy code and WRB requirements in one package
 - Designer/Builder must consider combined cost of WRB and insulation strategy when comparing options

WRB Performance Testing Comparison

Comparison of water resistance tests for WRB materials

| | 15# Felt | Housewraps | FPIS |
|---------------------------------|----------|------------|------|
| Weathering | | X | X |
| AATCC 127 | | X | X |
| Taped Joints | | | X |
| Full Assembly Water Penetration | | | X |

Foam sheathing is tested to a full assembly water penetration test. Other common products such as wraps and 15# felt are not. Taped joints and foam sheathing are also subjected to accelerated weathering and then water resistance.

Foam sheathing was not the cause of EIFS moisture problems!

- “Doesn’t foam sheathing trap water or cause condensation in walls with vapor retarder on the outside of a wall?”
 - There remain many attempts to make a comparison with non-drainable (barrier) EIFS purely on the basis that EIFS contains foam sheathing.

Past EIFS problems are misapplied to Continuous Insulation

- Problems with EIFS were associated with:
 - No drainage of cladding (barrier cladding system)
 - No water resistive barrier layer (relied solely on face sealing or caulking of EIFS finish to windows, doors, etc.)
 - Face sealing (caulking) was typically not done or done incorrectly
 - Leaky window units were used
 - Roof/wall flashing was not installed or improperly installed
 - Sometimes used inappropriately with interior vapor barrier (poly) in mix/warm/humid climates



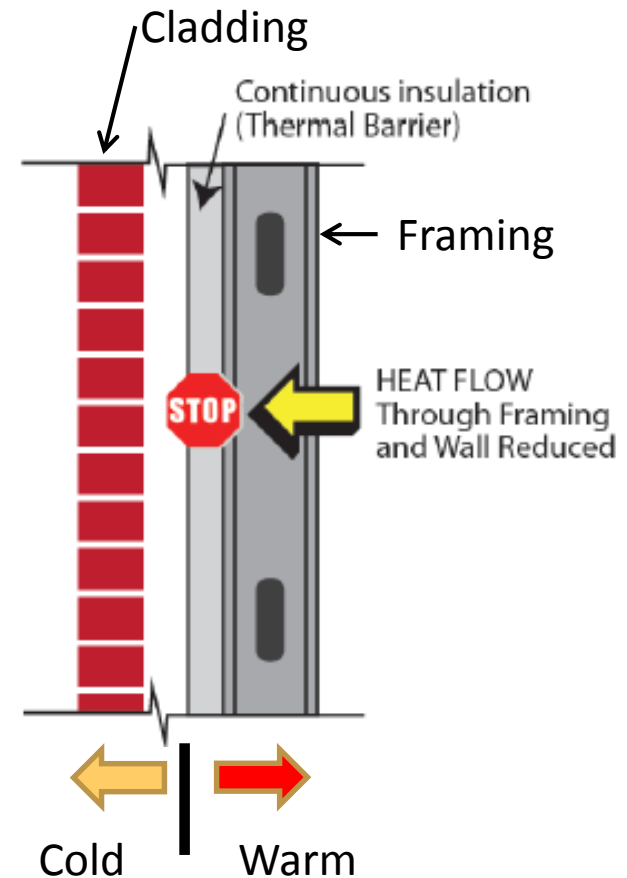
THESE PAST PROBLEMS WITH EIFS
HAVE ALL BEEN ADDRESSED IN
MODERN BUILDING CODES

WRB Addresses the “H₂O Fear”

- Fearing water is a good thing – if it leads us to follow the code and WRB manufacturer’s installation instructions carefully.
- A properly installed WRB system using an approved material is critical to building durability.
- FPIS is a solution:
 - Many FPIS brands are part of approved WRB systems (TER No. 1410-05)
 - If the FPIS is not approved as a WRB and installed accordingly, then a separate WRB material layer is needed.

Foam sheathing creates a warm, breathable envelope assembly

- In cold climates, CI prevents condensation inside walls by keeping the wall warmer than dew point temperature
- Non-insulated sheathings result in colder walls with greater condensation potential (particularly for low-perm non-insulated sheathings)
- Foam sheathing walls can be designed to breathe (dry) to the interior with proper interior vapor retarder selection to provide a safety factor against uncertain or incidental sources of water intrusion.



Proper Use of VR with Foam Suppresses Condensation & Promotes Drying

- 2015 IRC/IBC have vapor retarder options for use with CI depending on climate and R-value
 - In hot/humid regions (Zones 1 and 2) it is better to have low perm on exterior side of wall with drying to the interior

R601.3.1 Class III vapor retarders. Class III vapor retarders shall be permitted where any one of the conditions in Table R601.3.1 is met.

“Warm Wall” Class III VR Requirements and Foam Sheathing R-value

TABLE R702.7.1
CLASS III VAPOR RETARDERS

| CLIMATE-ZONE | CLASS III VAPOR RETARDERS PERMITTED FOR: ^a |
|--------------|--|
| Marine 4 | Vented cladding over wood structural panels. |
| | Vented cladding over fiberboard. |
| | Vented cladding over gypsum. |
| | Insulated sheathing with R -value ≥ 2.5 over 2×4 wall. |
| | Insulated sheathing with R -value ≥ 3.75 over 2×6 wall. |
| 5 | Vented cladding over wood structural panels. |
| | Vented cladding over fiberboard. |
| | Vented cladding over gypsum. |
| | Insulated sheathing with R -value ≥ 5 over 2×4 wall. |
| | Insulated sheathing with R -value ≥ 7.5 over 2×6 wall. |
| 6 | Vented cladding over fiberboard. |
| | Vented cladding over gypsum. |
| | Insulated sheathing with R -value ≥ 7.5 over 2×4 wall. |
| | Insulated sheathing with R -value ≥ 11.25 over 2×6 wall. |
| 7 and 8 | Insulated sheathing with R -value ≥ 10 over 2×4 wall. |
| | Insulated sheathing with R -value ≥ 15 over 2×6 wall. |

For SI: 1 pound per cubic foot = 16 kg/m³.

- a. Spray foam with a minimum density of 2 lb/ft³ applied to the interior cavity side of wood structural panels, fiberboard, insulating sheathing or gypsum is deemed to meet the insulating sheathing requirement where the spray foam R -value meets or exceeds the specified insulating sheathing R -value.

[Link to code](#)

Air Barriers

- Air Barrier (AB)
 - Requirements for air barriers are addressed in the energy code, not the building code (see Module 8).
 - Most foam sheathing products with properly sealed joints meet air-barrier requirements (air permeability test)
 - Check with manufacturer
 - Air barriers are also important to the building code's interest in durability and moisture control because they help prevent moist air from leaking into and condensing in assemblies.