MEASURING WATER RESISTANCE

Test Methods and Conditions of Acceptance
HISTORY

+ No. 15 Asphalt Felt
  • ASTM D 226 Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

+ Polymeric
+ Adhered
+ Liquid Applied
+ Integral
+ Multi Function
CHAPTER 14
EXTERIOR WALLS

SECTION 1401
GENERAL

1401.1 Scope. The provisions of this chapter shall establish the minimum requirements for exterior walls, exterior wall coverings, exterior wall openings, exterior windows and doors; architectural trim; balconies and similar projections; and bay and clerestory windows.

Specific assembly including joints, seams, attachments, substrate, framing and other details as appropriate to a particular design.

WATER-RESISTIVE BARRIER. A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.

VENEER. A facing attached to a wall for the purpose of providing ornamentation, protection or insulation, but not counted as adding strength to the wall.

VINYL SIDING. A shaped material, made principally from rigid polyvinyl chloride (PVC), that is used as an exterior wall covering.
1403.2 Weather protection.
Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall include flashing, as described in Section 1405.4. The exterior wall envelope shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a waterresistive barrier behind the exterior veneer, as described in Section 1404.2, and a means for draining water that enters the assembly to the exterior. Protection against condensation in the exterior wall assembly shall be provided in accordance with Section 1405.3.

1404.2 Water-resistive barrier.
Not fewer than one layer of No.15 asphalt felt, complying with ASTM D226 for Type 1 felt or other approved materials, shall be attached to the studs or sheathing, with flashing as described in Section 1405.4, in such a manner as to provide a continuous water-resistive barrier behind the exterior wall veneer.

WATER-RESISTIVE BARRIER. A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.

2510.6 Water-resistive barriers.
Water-resistive barriers shall be installed as required in Section 1404.2 and, where applied over wood-based sheathing, shall include a water-resistive vapor-permeable barrier with a performance at least equivalent to two layers of water-resistive barrier complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section 1405.4) intended to drain to the water-resistive barrier is directed between the layers.

Exception: Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of a water-resistive barrier complying with ASTM E2556, Type II and is separated from the stucco by an intervening, substantially nonwaterabsorbing layer or drainage space.
ACCEPTANCE CRITERIA

Sheet Water Resistant Barriers

Water Resistant Barriers Bonded to Sheathing

AC 71 – Foam Plastic Sheathing Boards used as Water Resistant Barriers

AC 382 – Laminated Fiber Board used as Water Resistant Barriers

Water Resistant Barriers over Sheathings
For tests conducted under ASTM D779, minimum conditions of acceptance shall be as noted in Table 1 of this criteria. For tests conducted under Section 6.4.5 of CCMC 07102, conditions of acceptance shall be that no water shall transmit through the membrane. For tests conducted under Section 4.2 of this criteria, the condition of acceptance is that no leakage is permitted on the underside of any specimen.
AC 38 TESTING

ASTM D 779
+ Paper Boat Floats 10 minutes w/o Penetration To Meet Grade D, Type I
+ Test Results without Dry Indicator
  • Paper and felt products pass
  • Some polymeric products pass
  • Perforated product performs inconsistently

ASTM D 779 – 03 WITHDRAWN IN 2011 AND REISSUED IN 2016 AS A TEST METHOD TO DETERMINE WATER VAPOR RESISTANCE

+ Test Results with Dry Indicator (Measures Liquid and Vapor)
  • Paper and felt products pass
  • Some polymeric products pass
  • One of the coated polyethylene products fails repeatedly
  • Perforated product fails repeatedly

HYDROSTATIC HEAD
+ Underside of WRB is monitored for 2 hours for signs of water leakage – All specimens passed
SPRAY TESTING

+ WRB installed over 8’ x 8’ wood frame wall without sheathing
+ No fasteners were installed through the face of the material
+ WRB was monitored from the cavity side for leakage during 30 minutes of testing
+ Intended to simulate exposure during construction (Some membranes can be exposed for up to 6 months)
SPRAY TESTING

+ No leakage observed behind Grade D paper or asphalt saturated felts
+ No leakage observed behind uncoated and one of the coated polyethylene products
+ Water could be felt penetrating the perforated wrap and leaked through at the stud framing
+ Water leaked through one of the coated products
### ASTM E2556

#### TABLE 1 Requirements for Water Resistive Barriers

<table>
<thead>
<tr>
<th>Test Requirement</th>
<th>Specimen Type</th>
<th>Test Method</th>
<th>Minimum Performance Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry tensile strength or dry breaking force (choose 1)</td>
<td>(1) as manufactured and (2) aged in accordance with A1.2</td>
<td>Test Method D828 for paper and felt materials, or Test Methods D882 for polymeric materials, or Test Method D5034 (Grab Method)</td>
<td>Type I: 3500 N/m (20 lb/in.) minimum (machine and cross direction) Type II: 3500 N/m (20 lb/in.) minimum (machine and cross direction)</td>
</tr>
<tr>
<td>Water resistance test (choose 1)</td>
<td>(1) as manufactured and (2) aged in accordance with A1.2</td>
<td>Test Method D779, or Water Resistance Ponding Test (A1.1), or AATCC Test Method 127 except that the specimens shall be held at a hydrostatic head of 55 cm (21.6 in.)</td>
<td>Type I: 178 N (40 lbf) minimum (machine direction) Type II: 156 N (35 lbf) minimum (cross direction) 10 min minimum 60 min minimum No water shall penetrate through the membrane in 120 min not applicable No leakage is permitted to the underside of any specimen in 5 h</td>
</tr>
</tbody>
</table>
Capillary Testing

- Test protocol devised to sandwich barrier between wet “cladding” and dry “sheathing” material

Sandwich configuration

- Plexi-glass plate
- Paper indicator
- WRB
- “Cladding” was dipped into water to wet all surfaces, removed, and then assembled in the sandwich

Testing identified WRB products which do not pass test for any length of time
ICC-ES AC 212

+ Scope:
  - Liquid Applied Water Resistive Barriers
  - Over substrates that are wood-based, gypsum-based, and cementitious backer units
  - One of the newest acceptance criteria
  - Incorporates more testing than in AC 38
<table>
<thead>
<tr>
<th>WRB Type</th>
<th>Test Method</th>
<th>Test Pressure</th>
<th>Test Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over Sheathing</td>
<td>ASTM E 331</td>
<td>2.86 psf</td>
<td>15 minutes</td>
</tr>
<tr>
<td>After Weathering</td>
<td>AATCC 127</td>
<td>112 psf</td>
<td>5 hours</td>
</tr>
</tbody>
</table>
4.5 Water-Penetration Testing: Three samples are prepared by applying the water-resistant barrier coating to the substrate. The substrate shall be attached to the supporting framework as required by the substrate manufacturer. The test samples shall be a minimum of 4 feet by 8 feet (1219 mm by 2438 mm) in size, and shall include a minimum of two vertical joints and one horizontal joint within the sheathing substrate. Joints within the substrates shall be a minimum of 1/8 inch (3.2 mm) wide.

Each sample shall be tested in accordance with ASTM E331. A minimum 2.86 psf (137 Pa) air-pressure differential shall be maintained, across the test specimen, for 15 minutes.

4.5.1 Conditions of Acceptance: There shall be no visible water penetration at sheathing joints, as viewed from the back of the panel.

4.8.3 Hydrostatic Pressure Test: The samples shall be tested in accordance with AATCC Test Method 127-1985, except that the specimens shall be held at a hydrostatic head of 550 millimeters for a period of 5 hours.

4.8.4 Conditions of Acceptance: There shall be no cracking of the coating, or bond failure between the coating and the substrate. There shall be no water penetration on the plane of the exterior facing side of the substrate.
<table>
<thead>
<tr>
<th>Water Resistance of In-place membrane</th>
<th>Rilem Tube – 60 wet mils on CMU AND AATCC 127, modified 60 wet mils on CMU and DensGlass 22 inch (55 cm) column of water</th>
<th>No water leakage through membrane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Resistance of In-Place Membrane</td>
<td>ASTM E331, Single, 60 mil wet coating spray-applied to CMU</td>
<td>No visible leakage to interior after 15 minutes water spray rack @ 6.24 PSF</td>
</tr>
</tbody>
</table>
MODIFIED TESTING
MODIFIED TESTING
4.6.4 Water Penetration Testing:

4.6.4.1 The test shall be conducted on the same specimen used under Sections 4.6.1, 4.6.2, and 4.6.3 of this criteria. The specimen shall be tested in accordance with ASTM E 331. A minimum 2.86 psf (137 Pa) air pressure differential shall be maintained across the test specimen for 15 minutes.

4.6.4.2 Conditions of Acceptance: There shall be no visible water penetration at sheathing joints or the interface of the flashing, as viewed from the back of the panel. In addition, there shall be no visible water penetration at nail penetrations.
SELECTION CHALLENGES

- Consistency among tests
- Replicating all aspects of as-built conditions
- Reliance upon visual assessment to determine acceptance
- Standards as referenced in product literature
### ABAA PROCESS FOR APPROVAL

#### 7.0 Required Tests by Water-Resistive Barrier Type

##### 7.1 Flexible Sheet Water-Resistive Barriers

<table>
<thead>
<tr>
<th>Product Property</th>
<th>Material Type</th>
<th>Test Standard</th>
<th>Test Standard Title</th>
<th>Unit</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>All types</td>
<td>ASTM E2556 / E2556M - 09</td>
<td>Standard Specification for Vapor Permeable Flexible Sheet Water-Resistive Barriers Intended for Mechanical Attachment</td>
<td>As in test standard</td>
<td>As in test standard</td>
</tr>
<tr>
<td>Water Vapor Permeance</td>
<td>All types</td>
<td>ASTM E96/E96M-05 (Water or Desiccant Method)*</td>
<td>Acceptance Criteria For Water-Resistive Barriers</td>
<td>-</td>
<td>Pass</td>
</tr>
</tbody>
</table>

**Perms**

- 5 (286)
- -

### Liquid Applied Membranes

<table>
<thead>
<tr>
<th>Product Property</th>
<th>Test Standard</th>
<th>Test Standard Title</th>
<th>Unit</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Permeance</td>
<td>ASTM E 2178-03</td>
<td>Standard Test Method for Air Permeance of Building Materials</td>
<td>L/(s·m²) at a pressure difference of 75 Pa</td>
<td>-</td>
</tr>
<tr>
<td>Water Resistance</td>
<td>AATCC 127 - 03</td>
<td>Water Resistance: Hydrostatic Pressure Test for 5 h</td>
<td>cm</td>
<td>55</td>
</tr>
</tbody>
</table>
+ Considered available standards:
  - AATCC 127 – Water Resistance: Hydrostatic Pressure Test
  - ISO 811 – Textile fabrics - Determination of resistance to water penetration - Hydrostatic pressure test
ABAA STANDARD

Modified Hydrostatic Head Test

???
How to determine water penetration?

- Visual assessment
- Water indicating paper
- Other method?
+ Considerations:
  
  • Sensitivity
  • Cost of unit
  • Reusability
  • Measurement
  • Impact of Factory Bonded WRBs
Thank you for your time and attention!