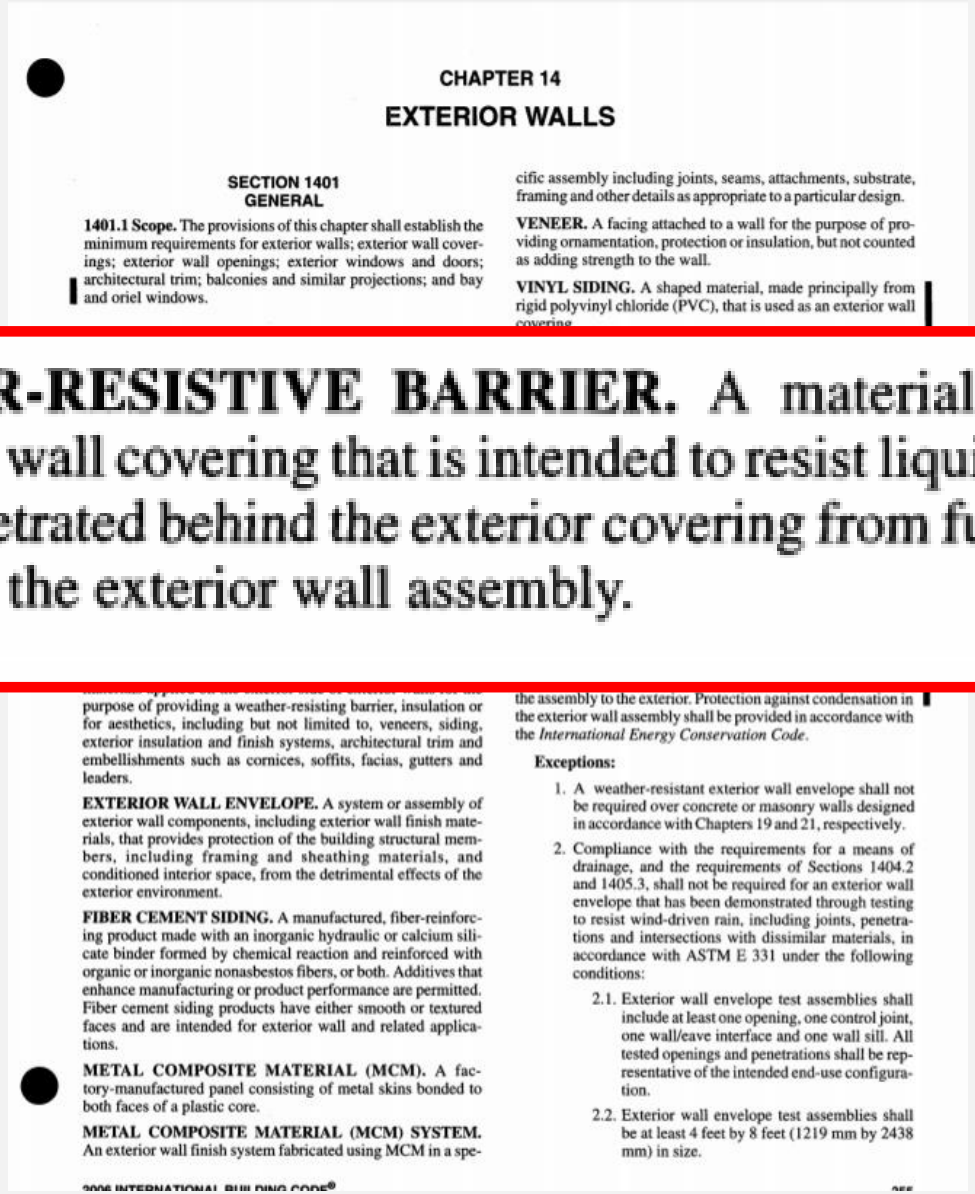
MEASURING WATER RESISTANCE

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

2006 BUILDING CODE



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 oriel windows.

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

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.

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 futher intruding into the exterior wall assembly.

purpose of providing a weather-resisting barrier, insulation or for aesthetics, including but not limited to, veneers, siding, exterior insulation and finish systems, architectural trim and embellishments such as cornices, soffits, facias, gutters and leaders.

EXTERIOR WALL ENVELOPE. A system or assembly of exterior wall components, including exterior wall finish materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.

FIBER CEMENT SIDING. A manufactured, fiber-reinforcing product made with an inorganic hydraulic or calcium silicate binder formed by chemical reaction and reinforced with organic or inorganic nonasbestos fibers, or both. Additives that enhance manufacturing or product performance are permitted. Fiber cement siding products have either smooth or textured faces and are intended for exterior wall and related applications.

METAL COMPOSITE MATERIAL (MCM). A factory-manufactured panel consisting of metal skins bonded to both faces of a plastic core.

METAL COMPOSITE MATERIAL (MCM) SYSTEM. An exterior wall finish system fabricated using MCM in a spe-

the assembly to the exterior. Protection against condensation in the exterior wall assembly shall be provided in accordance with the *International Energy Conservation Code*.

Exceptions:

1. A weather-resistant exterior wall envelope shall not be required over concrete or masonry walls designed in accordance with Chapters 19 and 21, respectively.
2. Compliance with the requirements for a means of drainage, and the requirements of Sections 1404.2 and 1405.3, shall not be required for an exterior wall envelope that has been demonstrated through testing to resist wind-driven rain, including joints, penetrations and intersections with dissimilar materials, in accordance with ASTM E 331 under the following conditions:
   2.1. Exterior wall envelope test assemblies shall include at least one opening, one control joint, one wall/eave interface and one wall sill. All tested openings and penetrations shall be representative of the intended end-use configuration.
   2.2. Exterior wall envelope test assemblies shall be at least 4 feet by 8 feet (1219 mm by 2438 mm) in size.

2015 BUILDING CODE

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.

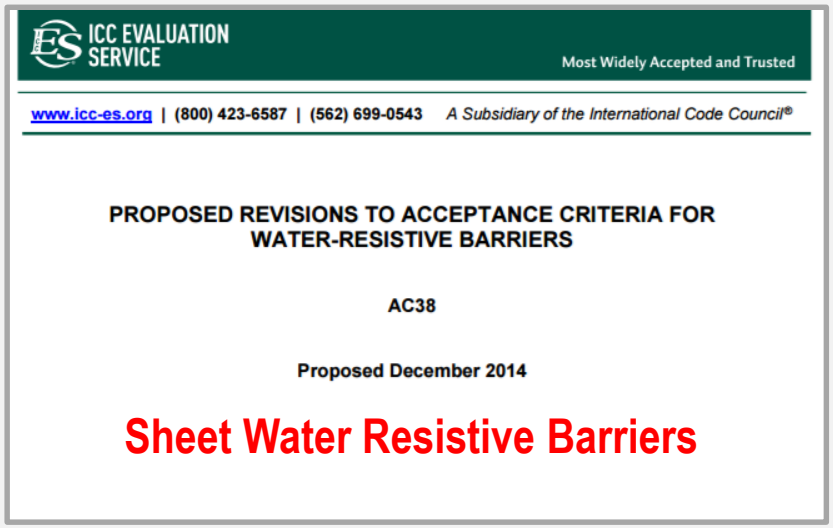
1404.2 Water-resistive barrier.
Not fewer than one layer of No.15 asphalt felt, complying with ASTM D226 for Type 1 felt or other *approved* materials, shall be attached to the studs or sheathing, with flashing as described in Section 1405.4, in such a manner as to provide a continuous *water-resistive 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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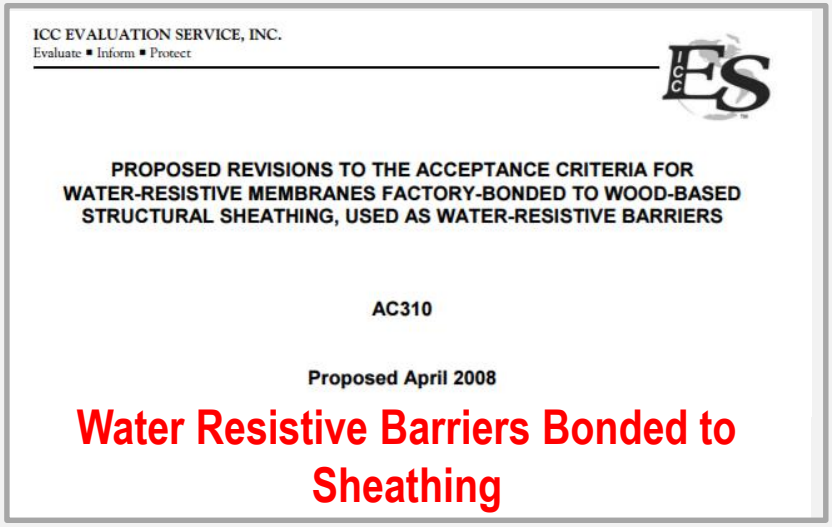
PROPOSED REVISIONS TO ACCEPTANCE CRITERIA FOR WATER-RESISTIVE BARRIERS

AC38

Proposed December 2014

Sheet Water Resistive Barriers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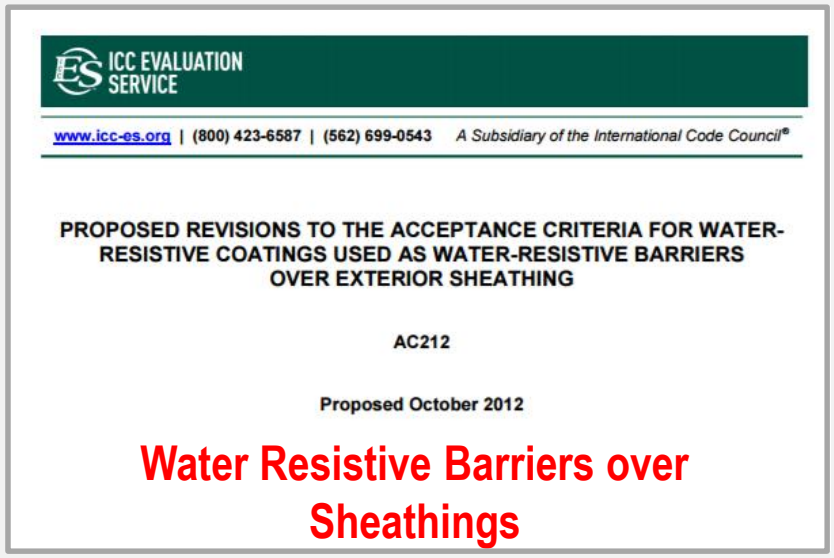
PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR WATER-RESISTIVE MEMBRANES FACTORY-BONDED TO WOOD-BASED STRUCTURAL SHEATHING, USED AS WATER-RESISTIVE BARRIERS

AC310

Proposed April 2008

Water Resistive Barriers Bonded to Sheathing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PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR WATER-RESISTIVE COATINGS USED AS WATER-RESISTIVE BARRIERS OVER EXTERIOR SHEATHING

AC212

Proposed October 2012

Water Resistive Barriers over Sheathings

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

AC 382 – Laminated Fiber Board used as Water Resistive Barriers

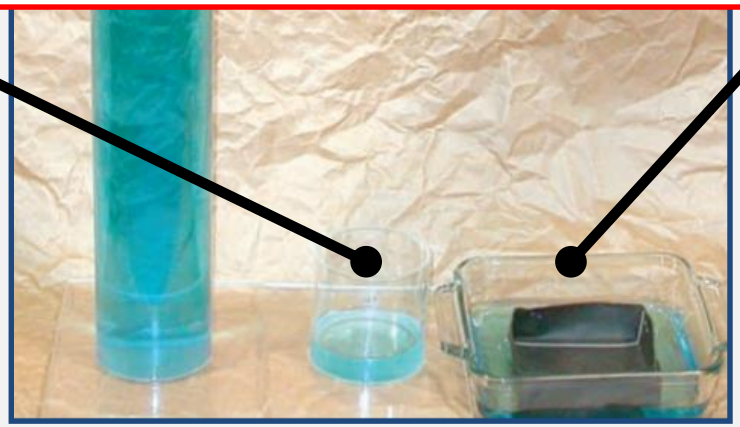
ICC-ES AC 38

WRB Type	Test Method	Test Pressure	Test Duration
Felt-based	No test required	N/A	N/A
Paper-based	ASTM D-779	Negligible	10 minutes

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.

AAT

CCMC 07120 (1 inch)



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

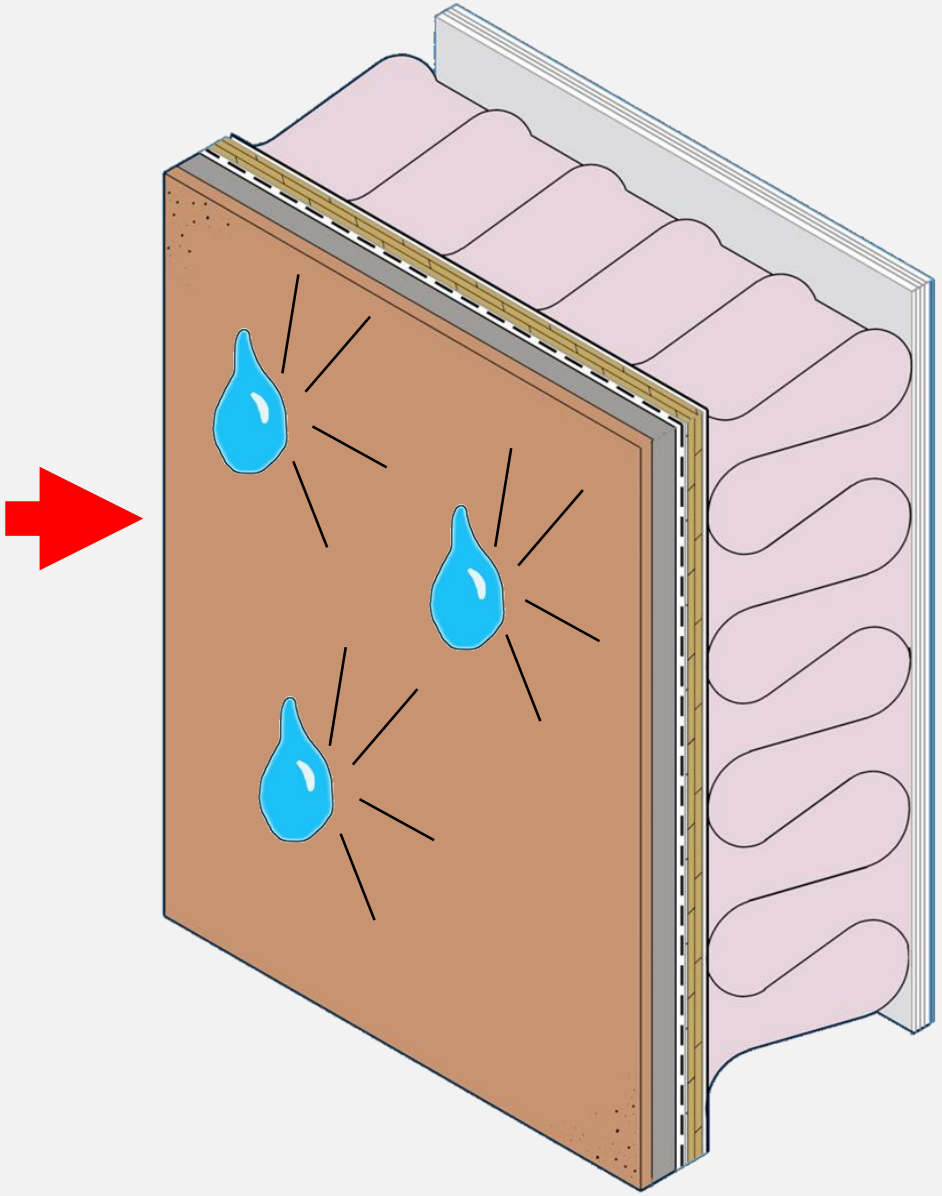
ASTM D 779 – 03 WITHDRAWN IN 2011 AND REISSUED IN 2016 AS A TEST METHOD TO DETERMINE WATER VAPOR RESISTANCE

  - 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

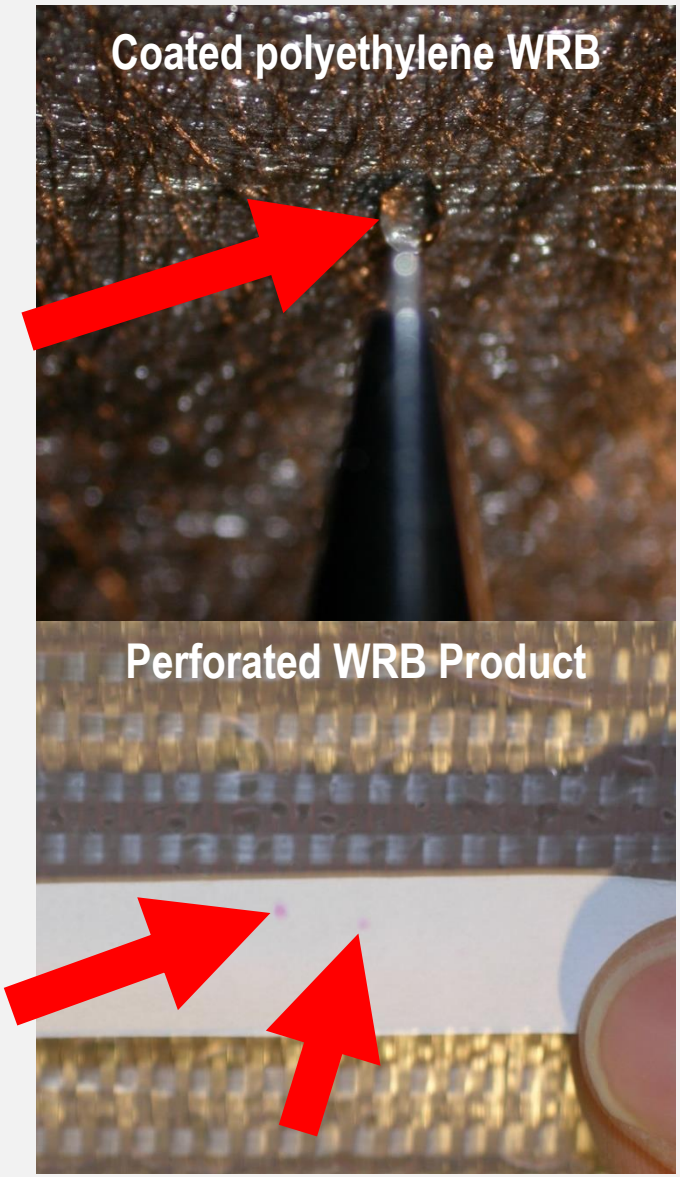
AC 38 TESTING



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

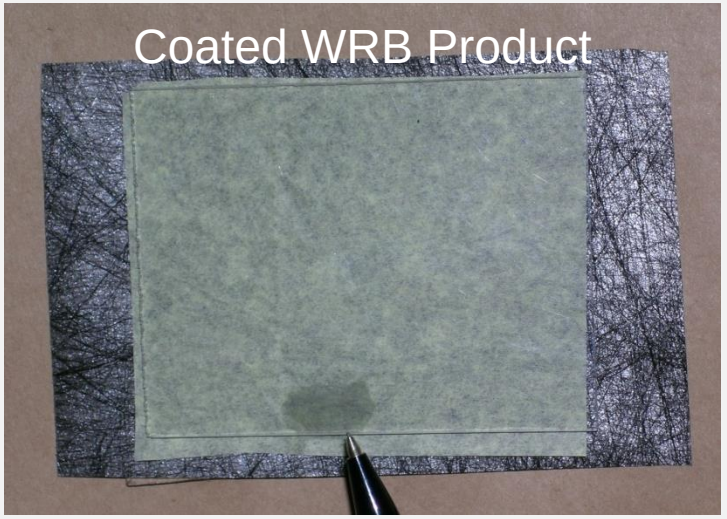
E2556/E2556M – 10

TABLE 1 Requirements for Water Resistive Barriers

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

CAPILLARY TESTING

Perforated WRB Product


Coated WRB Product

- 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

ICC-ES AC 212

WRB Type	Test Method	Test Pressure	Test Duration
Over Sheathing	ASTM E 331	2.86 psf	15 minutes
After Weathering	AATCC 127	112 psf	5 hours

ASTM E 331

AATCC 127

ICC-ES AC 212

4.5 Water-Penetration Testing: Three samples are prepared by applying the water-resistive 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.

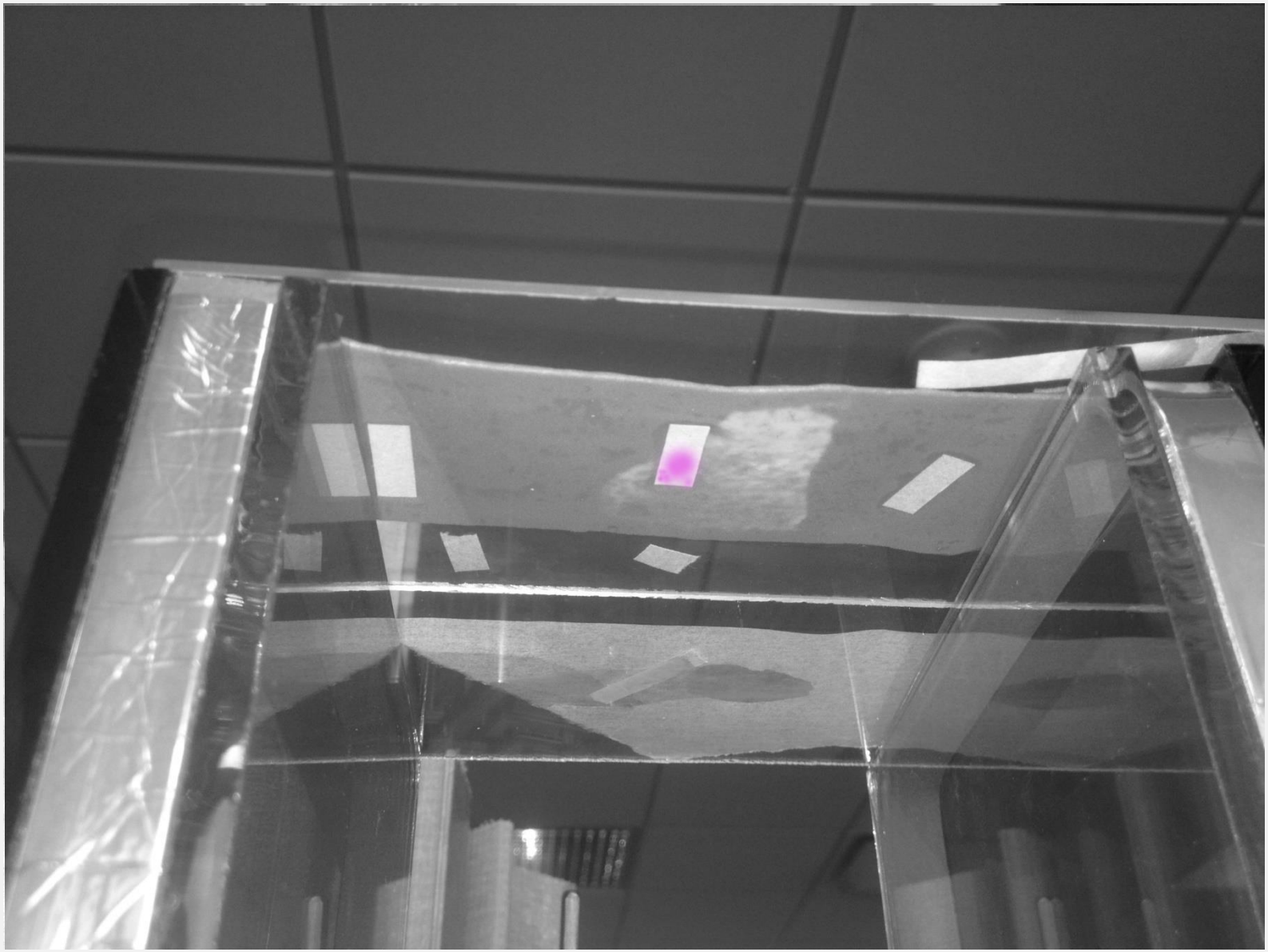
4.8.4 Conditions of Acceptance: There shall be no cracking of the coating, or bond failure between the coating and the substrate. There shall be no water penetration on the plane of the exterior facing side of the substrate.

MANUFACTURER TESTING

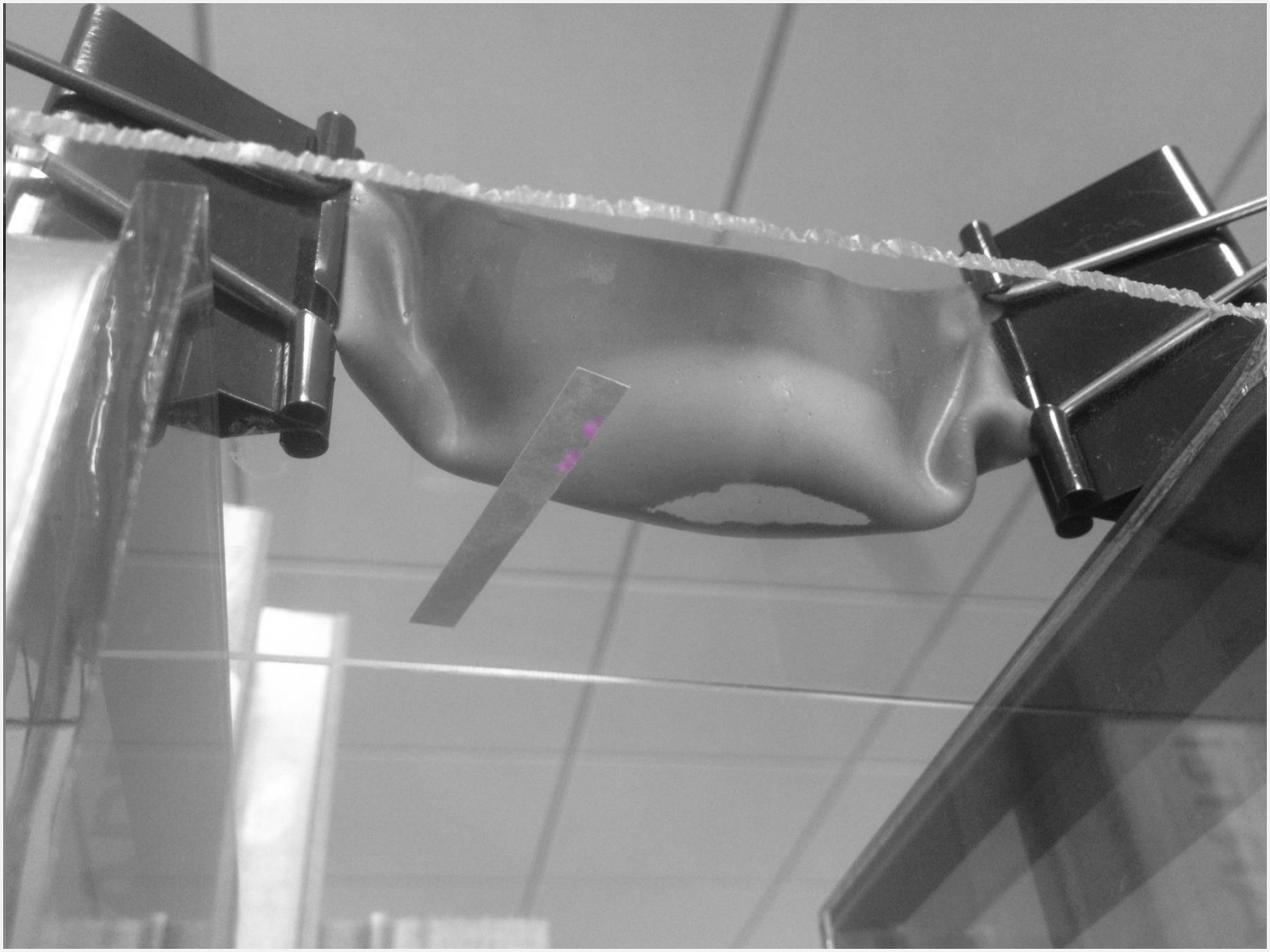
Water Resistance of In-place membrane	Rilem Tube – 60 wet mils on CMU AND AATCC 127, modified 60 wet mils on CMU and DensGlass 22 inch (55 cm) column of water	No water leakage through membrane

Water Resistance of In-Place Membrane	ASTM E331, Single, 60 mil wet coating spray-applied to CMU	No visible leakage to interior after 15 minutes water spray rack @ 6.24 PSF

MODIFIED TESTING



MODIFIED TESTING



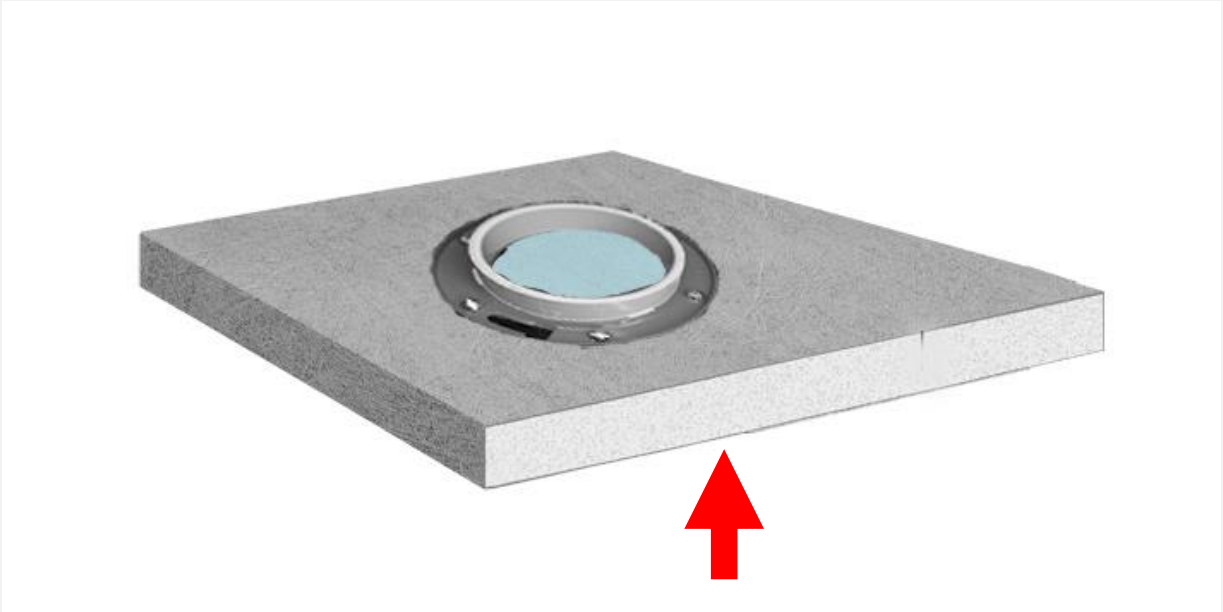
AC 310

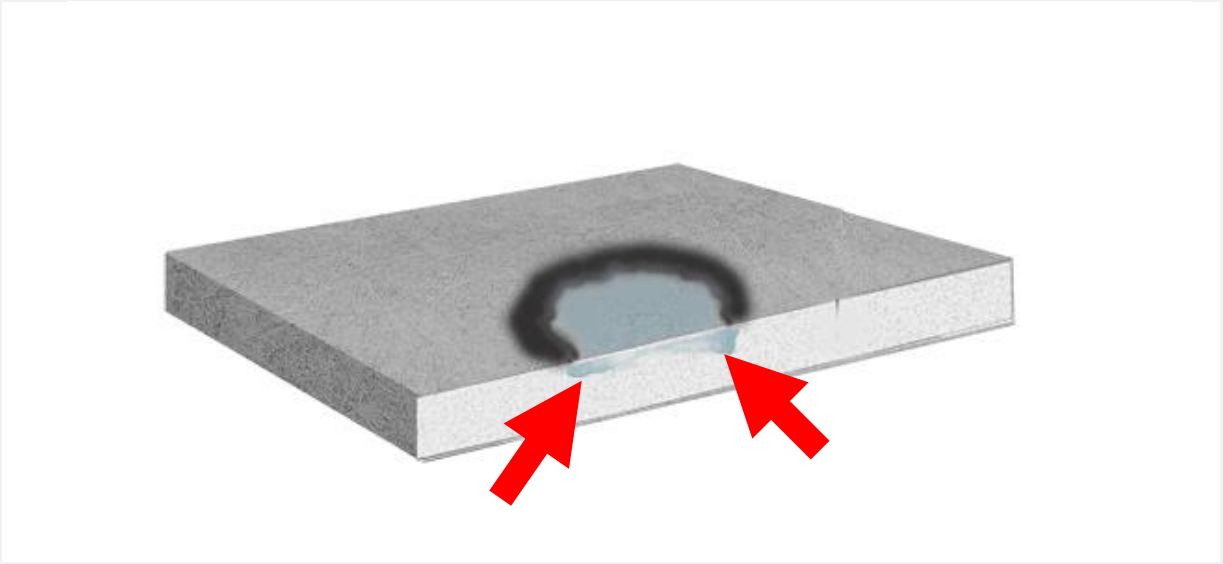
4.6.4 Water Penetration Testing:

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.

TESTING





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

Product Property	Material Type	Test Standard	Test Standard Title	Unit	Requirement	
					Min	Max
All	All types	ASTM E2556 / E2556M - 09	Standard Specification for Vapor Permeable Flexible Sheet Water-Resistive Barriers Intended for Mechanical Attachment	As in test standard	As in test standard	As in test standard
		OR				
		ICC-ES AC38	Acceptance Criteria For Water-Resistive Barriers	-	Pass	
Water Vapor Permeance	All types	ASTM E96/E96M-05 (Water or Desiccant Method)*	Test Methods for Water Vapor Transmission of Materials	Perms (ng/(Pa·s·m²))	5 (286)	-

Liquid Applied Membranes

Product Property	Test Standard	Test Standard Title	Unit	Requirement	
				Min	Max
Air Permeance	ASTM E 2178-03	Standard Test Method for Air Permeance of Building Materials	L/(s·m²) at a pressure difference of 75 Pa	-	0.02 L(s·m²) (0.004 cfm/ft²at a pressure difference of 1.56 lb/ft²)
Water Resistance	AATCC 127 - 03	Water Resistance: Hydrostatic Pressure Test for 5 h	cm	55	

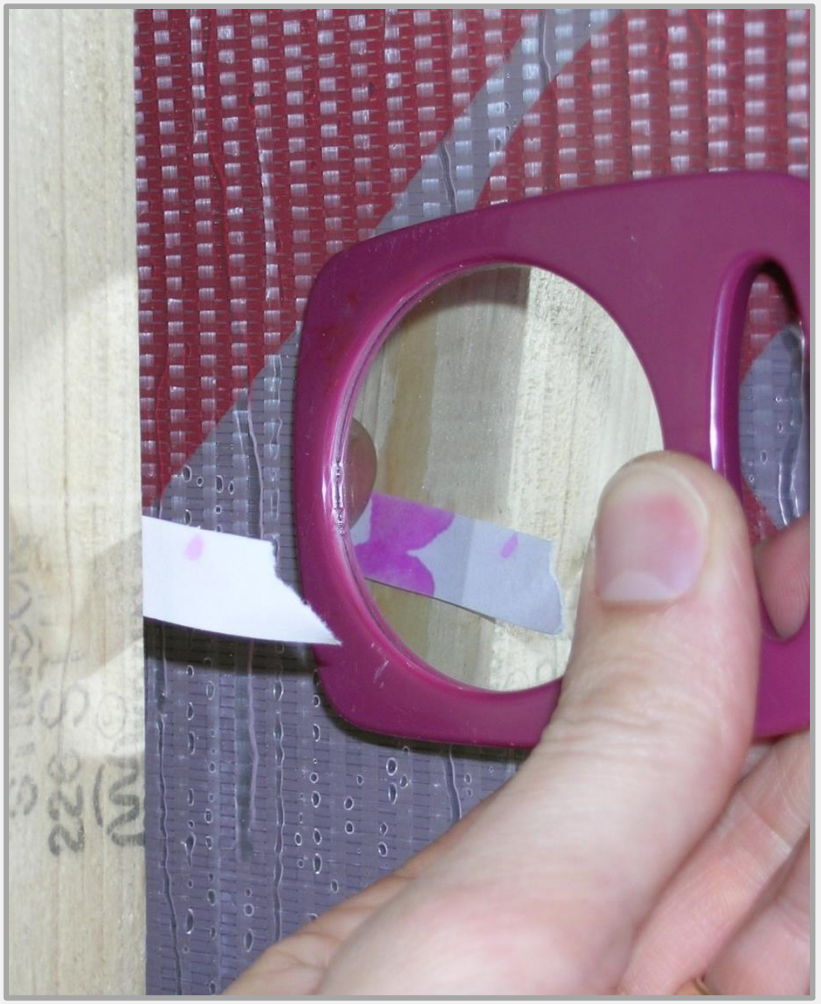
ABAA STANDARD

+ Considered available standards:
  - AATCC 127 – Water Resistance: Hydrostatic Pressure Test
  - ISO 811 – Textile fabrics - Determination of resistance to water penetration - Hydrostatic pressure test
  - ASTM D 2247 - Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity
  - ASTM D 2570 – Standard Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings Used under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage

ABAA STANDARD

ABAA STANDARD

+ How to determine water penetration?
  - Visual assessment
  - Water indicating paper
  - Other method?



SENSOR DEVELOPMENT

SENSOR DEVELOPMENT

+ Considerations:
  - Sensitivity
  - Cost of unit
  - Reusability
  - Measurement
  - Impact of Factory Bonded WRBs

Thank you for your time and attention!