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# MANUFACTURER'S GUIDE SPECIFICATION

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## SECTION 07 27 26

### BARRITECH VP

#### BURN-RESISTANT, FLUID-APPLIED, VAPOR- PERMEABLE MEMBRANE AIR BARRIERS



## SECTION 07 27 26

### BURN RESISTANT, FLUID-APPLIED, VAPOR-PERMEABLE MEMBRANE AIR BARRIERS

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. A fluid-applied vapor-permeable membrane of synthetic polymer, fire retardant composition for use as an air and water resistive barrier in exterior walls.
  - 1. Minimum 40 mil dry thickness for concrete and masonry substrates
  - 2. Minimum 30 mil dry thickness for exterior sheathing gypsum, wood and rigid foam substrates
- B. Monolithic, fully-adhered membrane and accessory products installed as a continuous air and water resistive barrier assembly over substrates of the Project's opaque walls as indicated on Drawings
- C. Air and water resistive barrier assembly providing air and water tight coverage over these conditions
  - 1. Joints between building materials such as sheathing joints, mortar joints and dissimilar materials.
  - 2. Joints around windows, curtain walls, louvers, door frames and other service openings
  - 3. Junctions between walls and floors, between walls at building corners and between walls, roofs and ceilings.
  - 4. Mechanical and electrical penetrations
  - 5. Structural penetrations for canopies, decks, walkways and similar horizontal projections or junctions to the exterior walls
  - 6. Fastener and hardware penetrations used to attach insulation, cladding, trim or other overburden
  - 7. Termination at footing, roof deck and existing construction
  - 8. Junction to air & water barrier in roof, below grade or other adjacent systems
- D. Air and water resistive barrier assembly providing air and water tight coverage while accommodating designed movement at expansion and control joints.
- E. Air and water resistive barrier assembly performing as a liquid water drainage plane flashed to discharge to the exterior any incidental condensation or water penetration

##### 1.02 RELATED SECTIONS

- A. Sections for Whole Building Performance: Quality assurance and quality control, system tie-in warranties, whole building envelope testing
  - 1. Division 01 General Requirements
  - 2. Division 07 Thermal and Moisture Protection
- B. Sections for Air Barrier Substrates

1. Division 03 Concrete: Cast-in-place or pre-cast concrete walls
  2. Division 04 Masonry: Unit masonry walls
  3. Division 06 Wood, Plastics and Composites: Plywood, OSB, rigid foam or gypsum sheathing
  4. Division 07 Thermal and Moisture Protection – Rigid Board Insulation: EPS, XPS, Phenolic and Polyiso foam sheathing
  5. Division 09 Finishes: Gypsum Board: glass matt faced exterior gypsum sheathing
- C. Sections for Air Barrier Tie-Ins
1. Division 07 Thermal & Moisture Protection: Neighboring waterproofing, air barrier, weather barrier or roofing systems
  2. Division 08 Openings: Windows, doors and other fenestration through or adjoining the air barrier system
  3. Division 21, 22 & 23 Facility Services: Mechanical and electrical penetrations through the air barrier system
- D. Sections for Air Barrier Overburden
1. Division 03 Concrete: exterior concrete cladding
  2. Division 04 Masonry: Brick, block or stone cladding
  3. Division 07 Foam or fiber insulation. Siding, sheet metal or panel cladding
  4. Division 09 Finishes: Cement stucco cladding, interior gypsum sheathing
- E. [Section \[ \]](#) Other

### 1.03 REFERENCES

- A. American Association of Textile Chemists and Colorists (AATCC) Test Method 127. “Water Resistance – Hydrostatic Pressure Test”
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2010 “Energy Standard for Buildings Except Low-Rise Residential Buildings”
- C. ASTM C 920 Standard Specification for Elastomeric Joint Sealants
- D. ASTM C 1305 Standard Test Method for Crack Bridging Ability of Liquid-Applied Waterproofing Membrane
- E. ASTM C 1522 Standard Test Method for Extensibility after Heat Aging of Cold, Liquid-Applied Elastomeric Waterproofing Membrane
- F. ASTM D 1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep slope roofing Underlayment for Ice Dam Protection.
- G. ASTM D 4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
- H. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
- I. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials.

- J. ASTM E 783 Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
- K. ASTM E 1105 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference
- L. ASTM E 1354 Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter
- M. ASTM E 2178 Standard Test Method for Air Permeance of Building Materials
- N. ASTM E 2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
- O. Canadian General Standards Board (CGSB) 71-GP-24M Standard for: Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation
- P. International Code Council Evaluation Services (ICC-ES) Acceptance Criteria for Water Resistive Coatings used as Water Resistive Barriers over Exterior Sheathing AC-212, Approved February 2015
- Q. National Fire Protection Association (NFPA) 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

## 1.04 PERFORMANCE REQUIREMENTS

- A. Installed product and accessories shall exhibit an air leakage rate, infiltration and exfiltration modes, measured after pressure cycling, not to exceed 0.2 L/s\*m<sup>2</sup> at 75 Pa [0.040 CFM/ft<sup>2</sup> at 1.57 PSF] according to ASTM E 2357.
- B. Product shall meet the water vapor transmission requirement water resistive coatings used as water resistive barriers: minimum 35 g/m<sup>2</sup>/24h (5 Perms), tested to ASTM E 96 water method (B), ICC-ES AC-212, Section 4.4
- C. For Type I, II, III and IV construction: Installed product and accessories shall be tested to NFPA 285 and pass in wall assemblies of the Project or shall pass by engineering judgement.
- D. Installed product and accessories shall be recommended by manufacturer for at least 60 days of outdoor exposure.
- E. Installed product and accessories shall have an upper service temperature limit of 149°F or higher.
- F. Manufacturer shall provide product and accessories which have a minimum installation temperature of 25°F or lower.
- G. Product shall be of fire-retardant, non-asphalt synthetic polymer composition.
- H. Dry membrane thickness “DT” shall comply with these minimum values based on calculation from field-measured wet mil thickness using a comb gauge “WT” and volume % solids “S” of the product.  $DT = WT * S$ 
  - 1. On concrete and masonry substrates  $DT \geq 0.040$  inch or 40 mils
  - 2. On glass mat faced gypsum sheathing, plywood, OSB and foam sheathing substrates  $DT \geq 0.030$  inch or 30 mils
  - 3. On all other substrates,  $DT \geq 0.040$  inch or 40 mils

I. Product shall meet the following requirements:

REQUIREMENT	RESULT	TEST METHOD
Air Permeance – on Porous Substrate	Not more than 0.02 L/s*m <sup>2</sup> at 75 Pa (0.004 CFM/ft <sup>2</sup> at 1.57 PSF)	ASTM E-2178, mod sprayed on CMU
Air Permeance – Free Film	Not more than 0.02 L/s*m <sup>2</sup> at 75 Pa (0.004 CFM/ft <sup>2</sup> at 1.57 PSF)	ASTM E-2178
Low Temperature Flexibility	No cracking at minus 20 degrees F, 180 degree bend over 1 inch mandrel	ASTM D 1970
Low-Temperature Crack Bridging	No cracking after 10 cycles at minus 15 deg F	ASTM C 1305, mod 40 mil membrane thickness
Long-Term Aging/ Flexibility	No cracking or tearing after aging	ASTM C 1522, mod 40 mil membrane thickness OR CGSB 71-GP-24M
Fastener Sealability	No water leaking through nail penetration after 24 h.	ASTM D 1970
Water Resistance	Product applied to CMU and gypsum sheathing with joint shall resist a 55 cm (22 inch) column of water for 5 hours, no leaking or wet through.	AATCC-127 - mod, static head generated with 5" diameter PVC pipe sealed to specimen
Pull Adhesion	Not less than 16 lb <sub>f</sub> per square inch (or report value at substrate failure) on glass-faced gypsum sheathing and concrete masonry unit (CMU)	ASTM D 4541, modified 4 inch wood puck
Water Vapor Permeance	Not less than 5 perms	ASTM E-96, Water Method (B)
Surface Burning Characteristics.	Flame Spread Index: Not more than 25 Smoke Generation Index: Not more than 450	ASTM E 84, sample tested at full coverage, 40 mil dry film, cement board substrate
Measurement of Heat Release Rate by Cone Calorimeter	Effective Heat of Combustion: Not more than 12.3 MJ/kg Total Heat Released: not more than 14.7 MJ/m <sup>2</sup> Peak Heat Release: Not more than 167 kW/m <sup>2</sup>	ASTM E 1354, horizontal orientation, 50 kW/m <sup>2</sup> heat flux

## 1.05 SUBMITTALS

- A. Provide submittals in accordance with [\[Section 01 33 00\]](#)
- B. At bid submission, provide evidence to the Architect of installer qualification by the air barrier manufacturer.
- C. Shop drawings showing locations and extent of air barrier and details of all typical conditions.
- D. Vertical and lateral fire propagation evaluation of the Project's exterior wall assemblies containing the product, submit documentation of one of the following:
  1. NFPA 285 test and pass
  2. NFPA 285 pass through engineering judgement
  3. Exemption from the NFPA 285 requirement.

- E. Manufacturer's technical data sheets and safety data sheets for product and accessories.
- F. Manufacturer's installation instructions.
- G. Certification of compatibility by manufacturer, listing all materials on the project with which the product and accessories may come into contact.
- H. Free film sample of product at representative cured thickness, minimum 2 inch by 3 inch size.
- I. Sample of sheet detail flashing and transition membrane, minimum 2 inch by 3 inch size.

#### 1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Shall be experienced in applying the same or similar materials and shall be specifically approved in writing by Manufacturer.
- B. Single-Source Responsibility: Obtain product and accessories from single manufacturer.
- C. Product and Accessories shall comply with all state and local regulations controlling use of volatile organic compounds (VOCs).
- D. Comply with the provisions of the Owner's building envelope commissioning program in accordance with [\[Section 01 91 15\]](#)
- E. Pre-Installation Meeting: Convene [\[one\]](#) [\[ \]](#) week prior to commencing Work of this Section, in accordance with Section 01 31 19 - Project Meetings.
- F. Field-Constructed Mock-Ups: Prior to installation on Project, apply product and accessories on mock-up to verify details under shop drawing submittals, to demonstrate tie-ins with adjoining construction and other termination conditions and to become familiar with properties of materials in application:

[\[NOTE TO SPECIFIER: incorporate sub paragraph 1 or 2 into Paragraph F\]](#)

- 1. Apply in field-constructed mockups of assemblies as specified in [\[Section 01 43 39 – Mockups\]](#)
- 2. Construct typical exterior wall panel, 8 feet long by 8 feet wide, incorporating back-up wall, cladding, window and doorframe and sill, insulation, flashing, [\[building corner condition,\]](#) [\[junction with roof system\]](#) [\[foundation wall\]](#) [\[and\]](#) [\[typical penetrations and gaps\]](#); illustrating interface of materials and seals
- G. Allow full cure of product and test mock-up in accordance with Section [\[01 43 00 – Quality Assurance\]](#) and test in accordance with ASTM E 783 and ASTM E1105 for air and water infiltration
- H. Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover any installed product unless it has been inspected, tested and approved.

## 1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, lot number and directions for storage.
- B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by manufacturer.
- C. During cold weather, protect product in containers and spray equipment from freezing. Maintain product temperature within acceptable range for spray application, as required by air barrier manufacturer.
- D. Avoid spillage. Immediately notify Owner, [\[Architect\]](#) [\[Consultant\]](#) if spillage occurs and start clean up procedures. Clean spills and leave area as it was prior to spill.

## 1.08 WASTE MANAGEMENT AND DISPOSAL

- A. Separate and recycle waste materials in accordance with [\[Section 01 74 19 – Construction Waste Management and Disposal\]](#), and with the Waste Reduction Work Plan.
- B. Place materials defined as hazardous or toxic waste in designated containers.
- C. Ensure emptied containers are stored safely for disposal away from children.

## 1.09 PROJECT CONDITIONS

- A. Do not apply product or accessories during rain or accumulating snowfall.
- B. Apply product and accessories within approved ambient and substrate temperature range stated in manufacturer's literature.
- C. Do not apply product or accessories over incompatible materials.
- D. Observe safety and environmental measures indicated in manufacturer's SDS, and mandated by federal, state and local regulations.

## 1.10 WARRANTIES: Provide the manufacturer's minimum five year material warranty under provisions of [\[Section 01 78 36 – Warranties\]](#).

## PART 2 PRODUCTS

### 2.01 PRODUCTS AND MANUFACTURERS :

- A. Barritech VP by Carlisle Coatings & Waterproofing, Incorporated. 900 Hensley Lane, Wylie, TX 75098. Phone 1-800-527-7092. Website <http://www.carlisleccw.com>
- B. [\[Other manufacturers and products, as approved by Architect\]](#)

### 2.02 ACCESSORIES: Provide from same manufacturer as air barrier membrane.



- A. Sheet Detail Flashing: Flexible facer coated with rubberized asphalt, minimum 0.040 inch (40 mils) thickness.
  - 1. For maximum 180-day exposed system: 705 FR-A or 705 FR-A XLT low temperature application formula by Carlisle Coatings & Waterproofing, Incorporated
  - 2. For maximum 60-day exposed system: CCW-705 or CCW-705 XLT low temperature application formula by Carlisle Coatings & Waterproofing, Incorporated
  - 3. Others as approved by air barrier membrane manufacturer
- B. Contact Adhesive: Applied to all surfaces accepting sheet detail flashing
  - 1. Carlisle Coatings & Waterproofing, Incorporated: CCW-702 Solvent-Based, CCW-702 LV VOC Compliant Solvent-Based, CCW-702 WB Water-Based, CAV-GRIP™ Aerosol Spray or Travel-Tack portable aerosol spray cans
  - 2. Others as approved by air barrier membrane manufacturer
- C. Liquid Detail Flashing. Silane-terminated polyether, minimum 90% solids. ASTM C 920 Type S, Grade NS, Class 25, Use NT. 0.040 inch (40 mil) thickness application
  - 1. Barribond HP
  - 2. Barribond XL
  - 3. Barribond
  - 4. Others as approved by air barrier membrane manufacture
- D. Detail Sealant:
  - 1. Barribond HP
  - 2. Barribond XL
  - 3. Barribond
  - 4. Others as approved by air barrier membrane manufacturer
- E. Transition Membrane:
  - 1. CCW SURE-SEAL Pressure-Sensitive Elastoform by Carlisle Coatings & Waterproofing, Incorporated
  - 2. Others as approved by air barrier membrane manufacturer
- F. Transition Membrane Primer:
  - 1. Carlisle Coatings & Waterproofing, Incorporated: SURE-SEAL HP-250 Primer, SURE-SEAL EP-95 Splicing Cement or SURE-SEAL Low VOC EPDM Primer
  - 2. Others as approved by air barrier membrane manufacturer
- G. Reinforcing Fabric: Woven, synthetic polymer fabric
  - 1. DCH Reinforcing Fabric by Carlisle Coatings & Waterproofing, Incorporated
  - 2. Others as approved by air barrier membrane manufacturer
- H. Glass Mat: Randomly-oriented glass strands held in binder soluble in wet air barrier membrane. Offered in rolls of various widths
  - 1. LiquiFiber
  - 2. Others as approved by air barrier membrane manufacturer
- I. Fill Compound: 2-part, non-sag polyurethane sealant
  - 1. Carlisle Coatings & Waterproofing, Incorporated: CCW-703 V or CCW-201

2. Others as approved by air barrier membrane manufacturer

2.03 RELATED MATERIALS BY OTHERS

- A. Sealants, adhesives, tapes or membranes not provided by the air barrier manufacturer which come into contact with the air barrier shall be approved by the air barrier manufacturer
- B. Adhesive-backed or polymeric sheet wall flashings, including through-wall flashings
- C. Window perimeter sealants
- D. Foam, mastic or tape sealants for filling gaps, cracks and joints
- E. Insulation Adhesives

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions affecting installation of the air & vapor barrier and accessory products for compliance with requirements. Verify that surfaces and conditions are suitable prior to commencing Work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Verify that wall assemblies are dried in, such that water intrusion will not occur from above, behind or around the air barrier installation.
- C. Concrete shall be cured for a minimum of seven days. It shall be smooth, with sharp protrusions such as form joints or fins removed and ground flush. Honeycomb and holes/cracks shall be filled with grout or mortar.
- D. Surfaces shall be sound, dry and free of oil, grease, dirt, excess mortar or other contaminants.
- E. Surfaces shall be supported and flush at joints without large voids or sharp protrusions.
- F. Mortar joints shall be struck flush and shall be free of voids. Mortar droppings shall be removed from brick ties and all other surfaces accepting air barrier.
- G. Sheathing boards shall be flush at joints, with gaps between boards according to building code and sheathing manufacturer's requirements. Sheathing boards shall also be securely fastened to the structure with proper fastener type, technique and spacing according to building code and sheathing manufacturer's requirements. Sheathing boards shall be repaired or replaced if inspection reveals moisture damage, mechanical damage or if sheathing boards have exceeded the exposure duration or exposure conditions as required by the sheathing manufacturer.
- H. Plywood, OSB, lumber or pressure-treated wood moisture content, measured with a wood moisture meter in the core of the substrate, shall be below 20%.
- I. Inform Architect [Consultant] [Owner] in writing of

1. Unsatisfactory substrates
2. Cracks in concrete and masonry.
3. Gaps or obstructions such as steel beams, angles, plates and projections which cannot be spanned or covered by Product or Accessories.
4. Anticipated problems applying product and accessories over substrate.

### 3.02 SURFACE PREPARATION

[NOTE TO SPECIFIER: Incorporate Paragraph A and its sub-paragraphs into Section 04 20 00 - Unit Masonry]

- A. [Note to Mason: This project will have fluid-applied Membrane Air Barrier material applied to the cavity side of the CMU. Special attention and care must be taken to provide a smooth, filled surface to receive the membrane. The care is necessary to insure the design performance of the selected materials.] Concrete masonry unit (CMU) wall shall be prepared as follows to accept the air & vapor barrier:
1. Surfaces shall be free of contaminants such as grease, oil and wax on surfaces to receive membrane
  2. The CMU surfaces shall be free from projections.
  3. Strike all mortar joints flush to the face of the concrete block.
  4. Fill all voids and holes with mortar, sealant or other approved fill material.
  5. Surface irregularities shall be ground flush or made smooth.
  6. Fill around all penetrations with mortar, sealant or other approved fill material and strike flush.
  7. If the surfaces cannot be made smooth to the satisfaction of the Architect, it will be the responsibility of the trade to alternatively apply a parge coat (typically one part cement to three parts sand) over the entire surface to receive Air Barrier Membrane
  8. Remove mortar droppings on brick ties, shelf angles, brick shelves or other horizontal obstructions.
- B. Fill cracks, gaps and joints with fill compound, detail sealant or other material approved by air barrier manufacturer.
- C. Fill rough gaps around pipe, conduit and similar penetrations with mortar, non-shrink grout, fill compound or polyurethane foam sealant shaved flush.
- D. Apply a ¾ inch cant of fill compound or detail sealant at the intersection of the base of the wall and the footing.
- E. Apply contact adhesive, per manufacturer's instructions, to all surfaces accepting sheet detail flashings

### 3.03 DETAILING

- A. Additional materials and installation are required at joints, transitions, openings, terminations, penetrations and similar surface irregularities. Perform detailing before or after product installation.
- B. Install product and accessories in details as directed in manufacturer's literature.

- C. Sheathing joints, use one of the following methods:
  - 1. 4 inch reinforcing fabric imbedded in product and centered over joint.
  - 2. 2" width liquid flashing centered over joint.
- D. Sheathing inside and outside corners. Flashing or reinforcement shall bear 3 inches minimum onto either side of angle change. Use any of the following methods:
  - 1. Sheet detail flashing
  - 2. Liquid detail flashing centered over angle change
  - 3. Reinforcing fabric centered over angle change and imbedded in product
  - 4. Glass mat centered over angle change and imbedded in product
- E. Window openings. Flashing or reinforcement shall bear onto wall 3 inches minimum and shall return into window opening according to Project drawings. Use any of the following materials:
  - 1. Sheet detail flashing
  - 2. Liquid detail flashing
  - 3. Glass mat imbedded in product
- F. Pipe or duct penetrations. Flashing or reinforcement shall bear onto wall 3 inches minimum and shall bear onto pipe or duct 3 inches, or according to Project drawings. Select any:
  - 1. Sheet detail flashing
  - 2. Liquid detail flashing
  - 3. Glass mat imbedded in product
- G. Expansion or deflection joints. Flashing shall bear 3 inches minimum onto either side of joint. Select any:
  - 1. Sheet detail flashing bellows or expansion bulb
  - 2. Transition membrane expansion bulb
- H. Interface of dissimilar substrates: Flashing or reinforcement shall bear 3 inches minimum onto either side of joint. Select any:
  - 1. Sheet detail flashing
  - 2. Liquid detail flashing
  - 3. Reinforcing fabric imbedded in product
  - 4. Glass mat imbedded in product
- I. Seal all terminations of sheet detail flashing with a 1 inch width X 0.040 inch (40 mils) thick ribbon of detail sealant, centered over termination.

### 3.04 INSTALLATION

- A. Apply product and accessories over opaque wall surfaces as indicated in Project drawings.
- B. Use the manufacturer's standard or low temperature formula product as required by the project conditions.
- C. Apply product by spray, roller, brush or other method as recommended by air barrier manufacturer. Apply product at specified wet mil thickness in accordance with air barrier manufacturer's requirements.

- D. Verify compliance with air barrier manufacturer's minimum required thickness by documenting product use per area. Perform and document wet mil thickness measurements every 100 square feet, or more frequently if required, to establish uniform and adequate coverage.
- E. Installation shall produce complete coverage of opaque substrates as indicated in Drawings.
- F. Product and accessories shall be fully-adhered to substrates. Defects such as holes, fishmouths, blistering, de-lamination, bridging or thin spots shall be repaired according to air barrier manufacturer's instructions.

### 3.05 SCHEDULE

- A. Wall substrates and roof or temporary roof shall be in place, effectively enclosing interior space, before proceeding with air barrier installation.
- B. Seal penetrations made through installed product according to manufacturer's instructions and drawings.
- C. Seal fenestration to product with detail membrane, transition membrane, detail sealant, silicone sealant or polyurethane foam sealant according to Project drawings
- D. Through-wall flashing may be installed before or after product. Seal termination of through-wall flashing to product according product manufacturer's instructions.
- E. Exterior cladding shall be installed after product.
- F. Rigid or semi-rigid insulation installed over product shall be attached with mechanical fastening, insulation adhesive or a combination of these techniques, according to insulation manufacturer and air barrier manufacturer's instructions.
- G. Sequence Work to enable air barrier continuity at wall-to-foundation, shelf angle, wall-to-roof, fenestration, different wall assemblies and other conditions as indicated in Project drawings.

### 3.06 REPAIR AND PROTECTION

- A. Protect from damage during application and remainder of construction period.
- B. Inspect and make necessary repairs before covering. Repair or replace damaged material according to manufacturer's literature.
- C. Product and accessories are not designed for permanent exposure. Cover with insulation or exterior cladding as soon as schedule allows.
- D. Outdoor exposure of installed product and accessories shall not exceed air barrier manufacturer's limit.

END OF SECTION

