



**INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS  
UNIFORM EVALUATION SERVICES**

**EVALUATION CRITERIA  
FOR  
ANCHORED MASONRY VENEER SYSTEM WITH POLYSTYRENE FOAM PLASTIC BACKING  
EC 021-2014  
(Adopted – December 2014)**

**1.0 INTRODUCTION**

**1.1 Purpose:** The purpose of this evaluation criteria is to establish requirements for an anchored masonry veneer system with polystyrene foam plastic backing to be recognized in an evaluation report under the 2015, 2012, 2009 and 2006 *International Building Code*<sup>®</sup> (IBC<sup>®</sup>), and the 2015, 2012, 2009 and 2006 *International Residential Code*<sup>®</sup> (IRC<sup>®</sup>). Basis of recognition are IBC<sup>®</sup> Section 104.11 and IRC<sup>®</sup> Section R104.11.

**1.2 Scope:** This evaluation criteria describes the test procedures and methods used to determine allowable loads and performance characteristics for a proprietary masonry veneer system with polystyrene foam plastic backing and a proprietary anchor system for recognition in an IAPMO Uniform Evaluation Service Uniform Evaluation Report.

**1.2.1** The proprietary system consists of masonry units, polystyrene foam plastic backing board, steel anchor system, and mortar. The masonry units shall be concrete facing brick, clay facing brick, or precast stone units.

**1.2.2** The proprietary system shall be supported by wood or steel stud walls with structural sheathing and a water-resistive barrier, or concrete or masonry walls, or over open wood or steel stud walls with a water-resistive barrier.

**1.2.3** The proprietary system shall not weigh more than 40 psf, or have mortar joints greater than 1 inch thick and the maximum distance between the inside face of the masonry veneer and the supporting studs, concrete or masonry shall not be greater than 4½ inches thick.

**2.0 REFERENCED STANDARDS**

Where standards are referenced in this criteria, the edition of these standards either shall be as indicated or shall be consistent with the code (IBC<sup>®</sup> or IRC<sup>®</sup>) upon which compliance is based.

**International Code Council**

- 2015 International Building Code<sup>®</sup> (IBC<sup>®</sup>), International Code Council
- 2012 International Building Code<sup>®</sup> (IBC<sup>®</sup>), International Code Council
- 2009 International Building Code<sup>®</sup> (IBC<sup>®</sup>), International Code Council
- 2006 International Building Code<sup>®</sup> (IBC<sup>®</sup>), International Code Council



2015 International Residential Code® (IRC®), International Code Council  
 2012 International Residential Code® (IRC®), International Code Council  
 2009 International Residential Code® (IRC®), International Code Council  
 2006 International Residential Code® (IRC®), International Code Council

### **Masonry Standards Joint Committee (MSJC)**

2013 Building Code Requirements and Specifications for Masonry Structures, TMS 402-13/ACI 530-13/ASCE 5-13  
 2011 Building Code Requirements and Specifications for Masonry Structures, TMS 402-11/ACI 530-11/ASCE 5-11  
 2008 Building Code Requirements and Specifications for Masonry Structures, TMS 402-08/ACI 530-08/ASCE 5-08  
 2005 Building Code Requirements and Specifications for Masonry Structures, ACI 530-05/TMS 402-05/ASCE 5-05

### **ASTM International**

ASTM A 153	Standard Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware
ASTM A 240	Standard Specification for Chromium and Chromium-nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications
ASTM A 653	Standard Specification for Steel Sheet, Zinc-coated Galvanized or Zinc-iron Alloy-coated Galvannealed by the Hot-dip Process
ASTM A 1008-13	Standard Specification for Steel, Sheet, Cold-rolled, Carbon, Structural, High-Strength Low-alloy, High Strength Low-alloy with Improved Formability, Solution Hardened, and Baked Hardenable
ASTM C 39-14	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 67	Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C 140	Standard Test Method for Sampling and Testing Concrete Masonry Units and Related Units
ASTM C 192-13	Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 216	Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 270	Standard Specification for Mortar for Unit Masonry
ASTM C 426-10	Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units
ASTM C 652	Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
ASTM C 1088	Standard Specification for Thin Veneer Brick Units Made from Clay or Shale
ASTM C 1363-11	Standard Test Method for the Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
ASTM C 1634-11	Standard Specification for Concrete Facing Brick
ASTM D 1037-12	Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials

ASTM E 72-13	Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
ASTM E 119	Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E 330	Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference

#### **Underwriter's Laboratories, Inc.**

UL 263	Standard for Fire Tests of Building Construction and Materials
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### **3.0 DEFINITIONS**

- 3.1** Masonry Units: The basic masonry veneer unit, made from fired clay, concrete or a cementitious mixture, which is anchored in place.
- 3.2** Anchor System: The proprietary anchor, shaped from sheet steel, used with a screw fastener and mortar to hold the masonry units in place.

### **4.0 BASIC INFORMATION**

- 4.1 General:** Each submittal shall include the product's description including complete information pertaining to the system's components, dimensional drawings, material specifications, and the manufacturing processes. Materials shall comply with appropriate recognized national standard(s).
- 4.2 Installation Instructions:** The manufacturer shall provide the evaluation agency and the laboratories conducting the testing a copy of its installation instructions. All test specimens, shall be prepared in accordance with the installation instructions and procedures used in the field. The instructions and details shall address materials and installation techniques including those required to prevent moisture penetration and control cracking in typical wall conditions including within the field of the veneer, abutting dissimilar materials and around typical openings.
- 4.3 Testing Laboratories:** Testing laboratories shall be accredited for the applicable testing procedures in accordance with ISO/IEC 17025 by a recognized accreditation body conforming to ISO/IEC 17011. Testing at a non-accredited laboratory shall be permitted by IAPMO UES, provided the testing is conducted under the supervision of an accredited laboratory and the supervising laboratory issues the test report.
- 4.4 Packaging and Identification:** Method(s) of packaging and product identification shall be included in the evaluation report. Identification shall include the manufacturer's name and address, product name, and the IAPMO UES evaluation report number. Foam plastic backing board packaging shall bear the label of an approved agency showing the manufacturer's name, product listing, product identification, and surface-burning characteristics, in accordance with IBC Section 2603.2 or IRC Section R316.2 (2006 IRC Section R314.2) as applicable.

- 4.5 Test Reports:** Test reports shall include all of the applicable information required by the applicable test standard, and UES Test Report Requirements Procedure No. ES-025.
- 4.6 Product Sampling:** Sampling of the anchored masonry veneer system components including foam plastic backing boards for tests under this criteria shall be conducted by the testing laboratory or approved inspection agency at the manufacturing locations. As an alternative, the specimens may be submitted to the laboratory by the manufacturer, provided the manufacturer attests that the submitted samples are representative of normal production and are a true representative of the product being evaluated, and the testing laboratory or accredited inspection agency compares the samples with the product specifications and concludes the materials comply.

## 5.0 TEST AND PERFORMANCE REQUIREMENTS

### 5.1 Masonry Units:

**5.1.1 Concrete Facing Brick:** Description of the concrete facing brick and applicable national standard including constituent concrete mix materials, proportions of concrete mix materials, dimensions, density and compressive strength. Concrete facing brick units shall be a minimum of 1½ inch and a maximum of 2<sup>5</sup>/<sub>8</sub> inches thick.

**5.1.2 Clay Facing Brick:** Description of the clay facing brick and applicable national standard including dimensions, grade and type. Clay facing brick units shall be a minimum of 1½ inch and a maximum of 2<sup>5</sup>/<sub>8</sub> inches thick.

**5.1.3 Precast Stone Veneer Units:** Description of the precast stone veneer units and applicable national standards including dimensions, density, compressive strength and the constituent materials including proportions of cement, sand, aggregate, admixtures, and colors. Precast stone veneer units shall be a minimum of 1½ inch and a maximum of 2<sup>5</sup>/<sub>8</sub> inches thick.

### 5.2 Mortar:

Description of the mortar including applicable national standard, type, specified compressive strength, mix specifications and minimum temperature at time of mortar installation shall be provided.

### 5.3 Anchor System:

Description of the proprietary steel anchor system including applicable national standards, material specifications, dimensions and coatings. Description of the fastener(s) used with the anchor, applicable national standards, material specifications, dimensions and coatings.

**5.4 Polystyrene Foam Plastic Insulation (Backing Board):**

Description of the foam plastic backing board including applicable national standards, material specifications, board dimensions, density and type. Foam plastic backing boards shall be separated from the interior of the building by an approved thermal barrier complying with the requirements of IBC<sup>®</sup> Section 2603.4 or IRC<sup>®</sup> Section R316.4 (2006 IRC<sup>®</sup> Section R314.4), as applicable. Foam plastic backing board exposure conditions and duration of exposure to the weather before covering shall be specified. Treatment of foam plastic board joints shall be specified.

**5.5 Prescriptive Requirements:** The anchored masonry veneer system shall weigh not more than 40 psf and the maximum distance between the inside face of the veneer and the wood stud or wood framing shall be 4-1/2 inches. Mortar joints shall be minimum 1 inch deep and fully engage the masonry ties. Each variation of type of masonry unit shall be tested in accordance with Section 6 of this criteria.

**5.6 Seismic Requirements [Optional]:** When located in Seismic Design Categories C, D, E or F the anchored masonry veneer system shall comply with IBC<sup>®</sup> Section 1405.6.2.

**5.7 Interior Installations [Optional]:** When used as an interior wall finish the masonry units and mortar shall be qualified as Class A in accordance with IBC<sup>®</sup> Section 803.1.1. The thickness of masonry shall be a minimum of 1-inch (25.4 mm), in accordance with IBC<sup>®</sup> Section 2603.4.1.

**5.8 Thermal Performance [Optional]:** When thermal resistance is to be recognized the thermal performance of the masonry veneer wall assembly shall be tested in accordance with ASTM C 1363.

**5.9 Fire-resistance Rating [Optional]:** When fire-resistance ratings are to be recognized testing in accordance with ASTM E 119 or UL 263 shall be submitted.

**5.10 Exterior Walls on Buildings of Type I, II, III or IV Construction [Optional]:** Use on exterior walls on buildings of Type I, II, III or IV construction shall be not greater than 40 feet in height above grade plane when the assembly includes a combustible water-resistive barrier unless the assembly is tested in accordance with and complies with the acceptance criteria of NFPA 285, in accordance with Section 1403.5 of the IBC.

**6.0 TEST METHODS**

**6.1 Concrete Facing Brick:** Concrete facing brick shall comply with ASTM C 1634. Compressive strength and absorption testing shall be conducted in accordance with Section 7 and 8, respectively, of ASTM C 140. Linear drying shrinkage testing shall be conducted in accordance with ASTM C 426.

**6.2 Clay Facing Brick:** Clay facing brick shall comply as Grade SW in accordance with ASTM C 216 or ASTM C 652 or as Grade Exterior in accordance with ASTM C 1088.

### 6.3 Precast Stone Veneer Units:

**6.3.1 Compressive Strength:** Compressive strength tests of cylinders of the veneer unit concrete mix shall be conducted in accordance with ASTM C 192 and ASTM C 39. A minimum of 5 specimens shall be tested at 28 days of age.

**Conditions of Evaluation:** The average minimum compressive strength shall be 1,800 psi, with no sample varying more than 10 percent from the average of all samples. If the average compressive strength is greater than 4,000 psi no sample shall vary more than 20 percent from the average of all samples.

**6.3.2 Water Absorption:** Water absorption tests shall be conducted in accordance with Section 8 of ASTM C 140. A minimum of 10 samples shall be tested. Samples shall be taken from pieces broken during the compressive strength tests or from manufactured veneer units.

**Conditions of Evaluation:** Maximum absorption shall be not more than 15 percent, based on oven-dry weight.

**6.3.3 Freeze-Thaw Resistance:** Freeze-thaw resistance tests shall be conducted in accordance with ASTM C 67, for a minimum of 50 cycles. A minimum of five specimens shall be tested with each specimen a minimum of 2-inches square by the minimum thickness to be recognized.

**Conditions of Evaluation:** Test samples shall not break or disintegrate, and weight loss shall be 3 percent or less. The manner and extent of breakage and disintegration shall be reported.

**6.3.4 Linear Drying Shrinkage:** Total linear drying shrinkage shall be determined in accordance with ASTM C 426.

**Conditions of Evaluation:** Total linear drying shrinkage shall not exceed 0.065 percent.

**6.4 Mortar:** Mortar shall comply with ASTM C 270.

**6.5 Anchors:** The anchor system shall consist of a proprietary sheet metal tie. Sheet metal ties shall have a minimum base-metal thickness of 0.06 inch. Sheet metal ties shall be manufactured from steel complying with ASTM A 1008 and hot dip galvanized in accordance with ASTM A 153, or from galvanized steel complying with ASTM A 653 with a minimum G60 coating, or from Type 304 or Type 316 stainless steel complying with ASTM A240.

Optionally, stainless steel metal ties shall have a minimum base-metal thickness of 0.03 inch when the anchor ties are installed with at least one anchor for every 2.5 square feet of wall area.

Screw fasteners shall comply with ANSI/ASME B18.6.1 for wood framing, or ASTM C 1513 for cold-formed steel framing. Proprietary screw fasteners shall be recognized for the intended use in a current and approved evaluation report.

**6.5.1 Tensile Test:** The masonry anchor and fastener representative of the typical construction to be recognized in the evaluation report shall be tested in accordance with Section 15 of ASTM D 1037 for tensile capacity and pull through of the fastener from the anchor. A minimum of 10 specimens for each type of anchor and fastener, or combination thereof, shall be tested.

**Conditions of Evaluation:** Allowable negative pressure per anchor shall not exceed the lesser of the tested tensile capacity divided by the factor of safety of 5.0; or the calculated fastener load from established values based on the maximum wall area per fastener.

**6.6 Polystyrene Backing Board:** Polystyrene foam plastic backing boards shall comply with ASTM C 578. Backing boards shall be a maximum of 4 inches thick and conform to the requirements of Section 2603 of the IBC®, or Section R316 of the IRC® (Section R314 of the 2006 IRC®), as applicable.

**6.7 Masonry Veneer System Test Procedures:** All test assemblies shall determine the maximum conditions for recognition, therefore test assemblies shall be representative of the weakest assemblies, i.e., ‘worst case’ condition, with consideration for greatest unsupported spans, fastener spacing, thicknesses, etc.

**6.7.1 Gravity Load Test:** Allowable gravity load tests shall be conducted to determine the allowable unsupported wall height for the masonry veneer system. Gravity load testing shall be in accordance with Section 9 of ASTM E 72, on a minimum of 3 wall assemblies for each type of masonry unit. Test assemblies shall be 4 feet wide by 8 feet tall. Assemblies shall be tested not less than 7 days and not greater than 28 days after mortar application.

**Conditions of Evaluation:** The allowable unsupported wall height shall be the lesser of the maximum code prescribed height for anchored masonry veneer, or the height determined from the allowable gravity load tests of:  
$$[(h \times w) + P] / w / 2.0$$

Where:

h = height of tested wall assembly (feet)

w = average weight of wall assembly (psf)

P = applied axial load (pounds per linear foot)

**6.7.2 Transverse Load Test:** Transverse load tests shall be conducted to determine allowable wind pressures. Testing of 3 positive pressure and 3 negative pressure wall assemblies, for each type of masonry unit, shall be conducted in accordance with Procedure B of ASTM E 330. The wall assemblies shall be representative of the typical construction to be recognized in the evaluation report. Test assemblies shall be 4 feet wide by 8 feet tall. Assemblies shall be tested not less than 7 days and not greater than 28 days after mortar application. Test pressure shall be applied in at least six increments with each pressure increment held for a minimum of 10 seconds. Tested assemblies shall withstand a minimum deflection of  $l/240$ .

**Conditions of Evaluation:** Allowable positive transverse loads shall be the average of the positive load tests divided by a safety factor of 3.0 provided

that none of the tests vary by more than 15 percent from the average of the three tested assemblies. If masonry ties punch through the mortar joints, or any other anchor system failure, during the positive transverse load tests the factor of safety shall be 5.0.

Allowable negative transverse loads shall be the average of the negative load tests divided by a safety factor of 3.0 provided that none of the tests vary by more than 15 percent from the average of the three tested assemblies. If masonry ties pull-out of the mortar joints, or any other anchor system failure, during the negative transverse load tests the factor of safety shall be 5.0. Allowable negative transverse loads shall not exceed the allowable anchor-fastener values determined in accordance with Section 6.5.

## **7.0 QUALITY CONTROL**

- 7.1** Manufacturer's Quality Assurance System shall comply with the IAPMO UES Minimum Requirements for Lister's Quality Assurance System (IAPMO ES-010).
- 7.2** Foam plastic backing boards shall be manufactured under an approved quality control program with inspections by an approved inspection agency.

## **8.0 EVALUATION REPORT RECOGNITION**

- 8.1** Evaluation reports shall include the general information required in Section 4 of this criteria.
- 8.2** Evaluation reports shall include limitations on usage, such as maximum unsupported height, fastener spacing, applicable wind and/or seismic loading, and minimum and maximum angle of installation.
- 8.3** Evaluation reports shall limit the deflection of the studs to  $l/240$ .
- 8.4** Evaluation reports shall include the required locations and details of masonry joints used to control cracking if applicable.
- 8.5** When steel shelf angles support the veneer system, weight calculations, details and connections are to be submitted to the code official. Calculations and details shall be signed and sealed by a design professional when required by the authority having jurisdiction.
- 8.6** Evaluation reports shall state that the clearance between foam plastic and exposed earth shall be in accordance with the applicable code.
- 8.7** When installed over wood or steel studs the evaluation report shall state that structural sheathing, water-resistive barriers and flashing shall be required in accordance with the applicable code.
- 8.8** When installed over open framing the evaluation report shall state that water-resistive barriers and flashing shall be required in accordance with the applicable code.