FIELD AND MOCK-UP
TESTING SERVICES
Mock-up Test Methods (Laboratory Mock-up or Field Mock-up):

ASTM E 283, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

Air Leakage Rate Testing: Using the chamber developed for the mock-up testing, the rate of air leakage through the fenestration assemblies is determined at the project specified pressure differential induced across the assemblies. The air leakage rates determined are compared against the acceptable rates identified for the project.
ASTM E 331, *Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference*

**Static Water Penetration Testing:** Using the chamber developed for the mock-up testing, a pressure differential is applied across the wall assembly, while simultaneously applying water spray onto the exterior surfaces. The testing is performed to show the water penetration resistance of the designed wall systems and transitions between wall system components.

**Structural Testing:** Structural performance testing consists of utilizing a test chamber located on the interior or exterior side of the specimen. Air is evacuated/supplied from/to the chamber to create the required pressure differential, and the specimen will be tested according to maximum deflection limits or audible, tactile, or visual indications of material or assembly distress or failure.
**Thermal Cycling:** An insulated test chamber is built on the exterior of the test specimen. Architectural Testing, Inc. will review the project specifications to determine the testing parameters, such as the design outdoor ambient wintertime temperature, design indoor ambient wintertime temperature, and relative humidity. The amount of cycles will be determined based on the project specifications, and we will apply a low exterior temperature for two hours after establishing equilibrium concurrent with a 15 mph wind. High exterior ambient temperatures will also be applied for two hours concurrent with a 15 mph wind. Components used within the system shall noiselessly withstand thermal movements without buckling, distortion, cracking, failure of glass, failure of joint seals, or undue stress on the finished surfaces, materials, or fixing assemblies.
Condensation Resistance Testing: Using the chamber developed for the thermal cycling testing, condensation resistance testing is conducted on a portion of the mock-up in accordance with the project specifications and maintained for two hours after equilibrium has been maintained. Architectural Testing, Inc. will review the project specifications to determine the testing parameters, such as the design outdoor ambient wintertime temperature, design indoor ambient wintertime temperature, and relative humidity. Once the testing parameters are identified, the dew point temperature will be derived from a psychometric chart. Thermocouple locations placed on selective curtain wall components that are found below the specified temperatures will be likely areas of condensation. This test often occurs with completed interior and exterior wall elements.
Dynamic Water Penetration Testing (HAWG): Water penetration testing consists of utilizing a portable wind generator and installing a spray rack system at the exterior of the specimen. The wind generating machine is equipped with a 68-inch diameter, three-blade propeller mounted to a gasoline-fueled 95-horsepower "V" twin engine. The engine and prop assembly are mounted into a steel frame that incorporates a sheet metal shroud and lifting fixture. A four-wheeled cart is used to transport the machine to and from the test area. The cart is removed from the frame when used above ground level. The machine weighs approximately 550 pounds without the cart. For on-site use, an extended forklift is required to position the machine at elevations above the ground level. The forklift is commonly available and has a reach height of up to 60 feet above grade. The HAWG has a maximum air pressure differential of 6.24 PSF.
Dynamic Water Penetration Testing (WOLF): Water penetration testing consists of utilizing a portable wind generator equipped with a water system. For on-site use, an extended forklift is required to position the machine at elevations above the ground level. A forklift is commonly available and has a reach height of up to 60 feet above grade. The WOLF has a maximum air pressure differential of up to 15 PSF.
**Water Penetration and Leakage through Masonry:** This test procedure and set-up is similar to that of ASTM C 1601. The same air and water tight test chamber is utilized, and a differential air pressure is applied across the specimen while simultaneously allowing water to flow over the face of the specimen. This test measures the amount of water that penetrates through the masonry wall.
Field Test Methods:

AAMA 501.1, Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure

Dynamic Water Penetration Testing (HAWG): Water penetration testing consists of utilizing a portable wind generator and installing a spray rack system at the exterior of the specimen. The wind generating machine is equipped with a 68-inch diameter, three-blade propeller mounted to a gasoline-fueled 95-horsepower "V" twin engine. The engine and prop assembly are mounted into a steel frame that incorporates a sheet metal shroud and lifting fixture. A four-wheeled cart is used to transport the machine to and from the test area. The cart is removed from the frame when used above ground level. The machine weighs approximately 550 pounds without the cart. For on-site use, an extended forklift is required to position the machine at elevations above the ground level. The forklift is commonly available and has a reach height of up to 60 feet above grade. The HAWG has a maximum air pressure differential of 6.24 PSF.
Dynamic Water Penetration Testing (WOLF): Water penetration testing consists of utilizing a portable wind generator equipped with a water system. For on-site use, an extended forklift is required to position the machine at elevations above the ground level. A forklift is commonly available and has a reach height of up to 60 feet above grade. The WOLF has a maximum air pressure differential of up to 15 PSF.
Field Water Spray Testing: Nozzle water testing consists of applying water using a hand held spray assembly employing a Type B2 #6.030 nozzle, pressure gauge, control valve, and a 3/4" garden hose. The water flow to the nozzle is adjusted to produce 30 psi at the nozzle. Water will be directed at the joint under test, perpendicular to the face of the specimen. The nozzle will be moved slowly back and forth above the joint, at a distance of 1' 0", for a period of five minutes for each 5' 0" of joint. An observer on the inside will check for water leakage.
AAMA 501.5, Test Method for Thermal Cycling of Exterior Walls

**Thermal Cycling:** An insulated test chamber is built on the exterior of the test specimen. Architectural Testing, Inc. will review the project specifications to determine the testing parameters, such as the design outdoor ambient wintertime temperature, design indoor ambient wintertime temperature, and relative humidity. The amount of cycles will be determined based on the project specifications, and we will apply a low exterior temperature for two hours after establishing equilibrium concurrent with a 15 mph wind. High exterior ambient temperatures will also be applied for two hours concurrent with a 15 mph wind. Components used within the system shall noiselessly withstand thermal movements without buckling, distortion, cracking, failure of glass, failure of joint seals, or undue stress on the finished surfaces, materials, or fixing assemblies.
**Condensation Resistance Testing**

**Field Condensation Resistance Testing:** Using the chamber developed for the thermal cycling testing, condensation resistance testing is conducted on a portion of the mock-up in accordance with the project specifications and maintained for two hours after equilibrium has been maintained. Architectural Testing, Inc. will review the project specifications to determine the testing parameters, such as the design outdoor ambient wintertime temperature, design indoor ambient wintertime temperature, and relative humidity. Once the testing parameters are identified, the dew point temperature will be derived from a psychometric chart. Thermocouple locations placed on selective curtain wall components that are found below the specified temperatures will be likely areas of condensation.
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

Field Static Water Penetration Testing: Water penetration testing consists of utilizing a test chamber located on the interior or exterior side of the specimen and installing a spray rack system at the exterior of the specimen. Air will be evacuated/supplied from/to the chamber to create the required pressure differential, while simultaneously applying water onto the exterior surface of the wall at a rate of 5 gallons of water per hour per square foot.
ASTM E 783, *Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors*

**Air Leakage Rate Testing:** Utilizing a chamber on the interior or exterior of the specimen, the rate of air leakage through the fenestration assemblies is determined at the project specified pressure differential induced across the assemblies. The air leakage rates determined are compared against the acceptable rates identified for the project.
ASTM E 783, Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors

**Air Leakage Rate Testing (Opaque Wall):** Utilizing a chamber on the interior or exterior of the specimen, the rate of air leakage through the wall assembly is determined at the project specified pressure differential induced across the assemblies. The air leakage rates determined are compared against the acceptable rates identified for the project.
Evaluating Water Leakage: This method serves as a guide for determining and evaluating the causes of water leakage of exterior walls. Our systematic approach to water leakage evaluation is based in whole or partly on ASTM E 2128. Our investigation typically includes reviewing all relevant project documents, evaluation of the design concept, determination of service history, inspecting relevant façade components, investigative testing, analyzing the results, and preparing a report. Our reports will provide all findings and repair recommendations if desired.
AAMA 511, *Voluntary Guideline for Forensic Water Penetration Testing of Fenestration Products*

**Forensic Water Penetration Testing:** We will use this guideline to assist us in selecting the appropriate adaptations to the existing testing standards for application to field investigations for water leakage in building walls. We will typically use this document in addition to ASTM E 2128 for additional information related to water leakage investigations.
Field Structural Testing: Structural performance testing consists of utilizing a test chamber located on the interior or exterior side of the specimen. Air is evacuated/supplied from/to the chamber to create the required pressure differential, and the specimen will be tested according to maximum deflection limits or audible, tactile, or visual indications of material or assembly distress or failure.
ASTM E 2359-06, Standard Test Method for Field Pull Testing of an In-Place Exterior Insulation and Finish System Clad Wall Assembly

**EIFS Pull Testing:** A 1" thick, 24" square bonding panel will be adhered to the EIFS using adhesive expanding foam. The test module hardware with force gage is mounted in-line in a manner to measure the force loads. Testing typically continues by increasing the force incrementally until the desired pressure or failure is reached.

**Sealant Pull Testing:** A portion of the cured sealant will be cut down both sides of the joint approximately three inches. The sealant is then pulled at 90 degrees. The sealant should tear cohesively within itself or elongate to a manufacturer’s specified extension value.
Anchor Tension Testing: The test fixture will be placed over the bolts in the concrete or masonry, and coupling rods are passed through the top of the fixture and attached to the bolt. The hydraulic ram and load cell are placed on top of the fixture, and a plate connecting the two rods is placed over top and fastened with washers and nuts. The hydraulic actuators are slowly filled with fluid until the required loads are achieved or until failure occurs.

Anchor Shear Testing: The test fixture will be placed over the face of the concrete or masonry, and both coupling rods are passed through the front of the fixture and attached to the bolts. The hydraulic ram and load cell are placed on the front of the fixture, and a plate connecting the two rods is placed over top and fastened with washers and nuts. The hydraulic actuators are slowly filled with fluid until the required loads are achieved or until failure occurs.
Water Penetration Through a Masonry Wall Surface: This test method is used to determine the water penetration quantitatively through a masonry wall surface. An air and water tight test chamber is installed on the exterior of the masonry wall. A water spray pipe is located at the top of the chamber that creates a flow of water down over the masonry wall surface while simultaneously maintaining a differential air pressure across the specimen. The water is collected in the bottom of the chamber and circulated back through the system. The amount of water is measured at specified time intervals. At the completion of testing, the amount of water lost is the amount of water that has been absorbed through the masonry wall surface.

**Pull-Off Strength of Coatings:** Pull testing will be performed by securing a loading fixture normal to the surface of the coating with an adhesive. A testing apparatus is attached to the loading fixture and aligned to apply tension force normal to the surface. The force applied to the loading fixture will be gradually increased and monitored until either a plug of the material is detached or a specified value is reached. The load values will be compared to the manufacturer’s values or values within the project specifications.
Horizontal Waterproofing Installation Flood Testing: For investigative or quality assurance testing of horizontal waterproofing, we will perform flood testing. Either the entire area can be tested by plugging all drains, or sections of the roof can be tested by constructing containment assemblies. Water is supplied to the test area until the specified water depth is achieved. The underside of the specimen is inspected for water leakage throughout testing.
Infrared Roof Survey: The infrared roof survey is best conducted shortly after sunset when the surface temperature of the roof drops quickly. Areas containing water within the roof system/insulation are cooled slower due to water having a higher specific heat capacity than rubber roof membranes and most building products. Thermal anomalies are found using a FLIR Systems B20 thermal imaging camera. Typically, these areas are marked on the roof surface for future repair or evaluation.
ASTM C 1060-90, Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings

Thermographic Insulation Inspection: Using a FLIR Systems B20 thermal imaging camera, insulation within envelope cavities can be inspected for thermal anomalies.

Detection Liquid Air Testing: A detection liquid will be applied to the component being tested. We will use the pressurized dome described in ASTM E 1186 to identify voids in the air barrier. Voids in the system create bubbles in the topically applied surfactant that are visible during the test. This procedure is a non-destructive test.
Air Infiltration Site Detection Using Infrared Scanning: An interior-exterior temperature difference of approximately 20°F is needed for the IR scan. Indoor or outdoor air is moved through the building envelope by either pressurizing or depressurizing the building. Due to the indoor-outdoor temperature difference, local surface areas of the components exhibiting high air infiltration/exfiltration rates will be determined from the infrared pattern.
Smoke Tracers Used in Whole Building Pressurization or Depressurization: An air pressure differential is applied to the entire building envelope using fans to pressurize or depressurize the building. Typically, we will depressurize the building and move the smoke tracer source over the exterior of the building. The air jets at each air leakage location will cause the smoke to move rapidly to the interior. The opposite is performed with building pressurization.

Smoke Tracers Used in Chamber Pressurization or Depressurization: We will build an air tight chamber on the interior or exterior of the air barrier system and create an air pressure differential across the specimen. The smoke tracer source is moved over either the high or low pressure side of the specimen, and the smoke is drawn through or pushed into air leakage sites, visually indicating the leak location.
ASTM E 779, *Standard Test Method for Determining Air Leakage Rate by Fan Pressurization*

**Whole Building Air Leakage Testing:** Based on the area of the envelope, we will establish the amount of blowers needed to create the desired air pressure differential. Using fan pressurization or depressurization, we will determine the air flow rate through the building envelope. From the relationship between the air flow rate, area under evaluation, and the pressure differential, the air leakage of the building envelope will be evaluated.
Glass Property Testing:


Glass Chek gauge for determining glass and spacer thicknesses, as well as low E coating placement within the IGU.
Measuring Surface Stress: We will use an optical apparatus that permits the injection of polarized light rays propagating in a thin layer adjacent to the surface. The rays emerge at a critical angle, and the photoelastic retardation due to surface stresses is measured using a wedge-compensator. The result is a measurement of the residual stress in the surface of the glass.

**Measuring Surface Distortion:** This test method involves rolling a calibrated gauge across the surface of the glass perpendicularly to the roll wave distortion. As the gauge is rolled across the glass, we will record the out of plane dimensional measurements to determine the residual distortion inherit in the glass.
**Frost Point Testing:** This test method is used to determine the frost/dew point within the air space of sealed insulating glass units and establishes the criteria for determining whether that point is above or below a specified temperature. This test method is conducted using a special device consisting of a cylinder containing dry ice, and includes a 1-inch diameter steel plate located on one end of the cylinder. The device is adjusted to produce the desired temperature on the steel plate. The device is positioned onto the interior surface of the glass unit for a period of time based upon the thickness of the glass. Subsequently, the device is removed and the glass is inspected for the presence of frost or moisture on the glass.