SECTION 072703
CLOSED CELL, MEDIUM DENSITY SPRAY POLYURETHANE FOAM AIR BARRIER

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section includes the following:

1. Closed cell, medium density spray polyurethane foam air barrier located in the non-accessible part of the wall.
2. Materials to bridge and seal the following air leakage pathways and gaps:
   a. Connections of the walls to the roof air barrier.
   b. Connections of the walls to the foundation air barrier.
   c. Seismic and expansion joints.
   d. Openings and penetrations of window frames, storefront, curtain wall.
   e. Door frames.
   f. Piping, conduit, duct and similar penetrations.
   g. Masonry ties, screws, bolts and similar penetrations.
   h. All other air leakage pathways in the building envelope.

B. Related Work:

1. General quality assurance and quality control requirements: Section 01 45 29 TESTING LABORATORY SERVICES.
2 Masonry units serving as substrate for membrane air barriers, including preparation of surface: Section 04 20 00 UNIT MASONRY.
3. Flashing components of factory finished roofing and wall systems to which membrane air barriers will transition: Division 07 roofing and wall system sections.
4. Other flashing components to which membrane air barriers will transition: Section 07 60 00 FLASHING AND SHEET METAL.
5. Joint Sealants: Section 07 92 00, JOINT SEALANTS.
6. Division 08 exterior openings sections for opening transitions providing airtight seal between membrane air barrier and [aluminum windows] [louvers and vents].
7. Wall sheathings serving as substrate for membrane air barriers: Section 09 29 00 GYPSUM BOARD.

1.2 PERFORMANCE REQUIREMENTS

A. Assembly Performance: Provide a continuous air barrier in the form of an assembly that has an air leakage not to exceed 0.04 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.04 cfm/ft^2 @ 1.57 psf) [0.2 liters per square meter per second under a pressure differential of 75 Pa (0.2 L/(s·m^2) @ 75 Pa)] when tested in accordance with ASTM E2357. The assembly shall accommodate movements of building

materials by providing expansion and control joints as required. Expansion / control joints, changes in substrate and perimeter conditions shall have appropriate accessory materials at such locations.

1. The air barrier assembly shall be capable of withstanding combined design wind, fan and stack pressures, both positive and negative on the envelope without damage or displacement, and shall transfer the load to the structure.
2. Closed cell, medium density spray polyurethane foam air barriers shall not displace adjacent materials in the assembly under full load.
3. The air barrier assembly shall be joined in an airtight and flexible manner to the air barrier materials of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations, creep, and anticipated seismic movement.

B. Connections to Adjacent Materials: Provide connections to prevent air leakage at the following locations:

1. Foundation and walls, including penetrations, ties and anchors.
2. Walls, windows, curtain walls, storefronts, louvers and doors.
3. Different assemblies and fixed openings within those assemblies.
4. Wall and roof connections.
5. Floors over unconditioned space.
6. Walls, floor and roof across construction, control and expansion joints.
7. Walls, floors and roof to utility, pipe and duct penetrations.
8. Seismic and expansion joints.
9. All other potential air leakage pathways in the building envelope.

1.3 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Quality Assurance Program: Submit evidence of current Contractor accreditation and Installer certification under the Air Barrier Association of America’s (ABAA) Quality Assurance Program (QAP). Submit accreditation number of the Contractor and certification number(s) of the ABAA Certified Installer(s).

C. Product Data: Submit material Manufacturer’s Product Data, material manufacturer's instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, Technical Data, and tested physical and performance properties.

1. Submit letter from primary air barrier material manufacturer indicating approval of materials that are proposed to be used that are not currently listed in the accessories section of this specification for that manufacturer’s material.
2. Include statement from the primary air barrier material manufacturer that the materials used in their air barrier assembly which will be used to adhere to the underlying substrate are chemically compatible to the substrate material.
3. Samples: Submit clearly labeled samples, three (3) inch by four (4) inch [75 mm by 100 mm] minimum size of each material specified.

D. Shop Drawings of Mock-Up: Submit Shop Drawings of proposed mock-ups showing plans, elevations, large-scale details, and air barrier transitions and terminations.

E. Field Test Results of Mock-Up: Submit test results of air leakage test and water leakage test of mock-up in accordance with specified standards, including retesting if initial results are not satisfactory.

F. Shop Drawings: Submit Shop Drawings showing locations and extent of air barrier assemblies and details of all typical conditions, intersections with other envelope assemblies and materials, membrane counter-flashings, and details showing how gaps in the construction will be bridged, how inside and outside corners are negotiated, how materials that cover the materials are secured with air-tight condition maintained, and how miscellaneous penetrations such as conduits, pipes, electric boxes and similar items are sealed.

1. Include VOC content of each material, and applicable legal limit in the jurisdiction of the project.
2. Include statement that materials are compatible with adjacent materials proposed for use.
3. Include required values for field adhesion test on each substrate in accordance with ASTM D4541 (modified), using a type II pull tester.

G. Compatibility: Submit letter from primary material manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from material manufacturer stating that cleaning materials used during installation are chemically compatible with adjacent materials proposed for use.

H. Air Barrier Subcontractor Qualifications: Air barrier Subcontractor(s) shall be accredited at the time of bidding and during the complete installation period by the Air Barrier Association of America (ABAA) whose Installer(s) are certified in accordance with the site Quality Assurance Program used by ABAA.

1. Closed cell, medium density sprayed polyurethane foam air barrier Installer(s) shall be certified by BPQI (Building Performance Quality Institute) for the ABAA Quality Assurance Program in accordance with the requirements outlined in the QAP program used by ABAA. Installers shall have their photo-identification air barrier certification cards in their possession and available on the project site, for inspection upon request.

I. Manufacturer: Obtain primary ABAA Evaluated Materials from a single ABAA Evaluated Manufacturer regularly engaged in manufacturing specified closed cell, medium density spray polyurethane foam. Obtain secondary materials from a source acceptable to the primary materials manufacturer.

J. Accredited Laboratory Testing for Materials: Laboratory accredited by International Accreditation Service Inc. (IAS), American Association for Laboratory Accreditation (A2LA), or the Standards Council of Canada (SCC).

K. VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds.

L. Preconstruction Meeting: Convene a minimum of two weeks prior to commencing Work of this Section. Agenda shall include, at a minimum, construction and testing of mock-up, sequence of construction, coordination with substrate preparation, air barrier materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction and chemical/fire safety plans. Attendance is required by representatives of related trades including covering materials, substrate materials and adjacent materials.

M. Field Quality Assurance: Implement the site Quality Assurance Program requirements used by ABAA. Cooperate with ABAA Auditors and any independent testing and inspection agencies engaged by the Owner. Do not cover the air barrier assembly until it has been inspected, tested and accepted.

N. Mock-Up Tests for Spray Polyurethane Foam Adhesion: The third party testing agency shall test the mock-up for spray polyurethane foam adhesion in accordance with ASTM D4541 (modified) using a type II pull tester except that the spray polyurethane foam shall be cut through to separate the material attached to the disc from the surrounding material. Perform test after curing period recommended by the material manufacturer. Record mode of failure and area where the material failed in accordance with ASTM D4541. When the air barrier material manufacturer has established a minimum adhesion level for the product on the particular substrate, the inspection report shall indicate whether this requirement has been met. Where the material manufacturer has not declared a minimum adhesion value for their product/substrate combination, the value shall simply be recorded.

O. Air Barrier Assembly Testing: Verify air barrier assembly testing by the material Manufacturer by visiting the ABAA website to ensure a ASTM E2357 test has been completed and to obtain results. Visit the ABAA website for the reported air barrier assembly leakage rate and illustrations or CAD details which includes the methods in which the assembly test mock-ups shall be assembled.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with the material manufacturer's name, product, date of manufacture, and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by material manufacturer. Protect stored materials from direct sunlight and other sources of ultra-violet light.

C. Handle materials in accordance with material manufacturer’s recommendations.

1.5 PROJECT CONDITIONS

A. Temperature: Install closed cell, medium density spray polyurethane foam within range of ambient and substrate temperature, and moisture content recommended by the primary material manufacturer. Do not apply air barrier to a damp or wet substrate.

B. Field Conditions: Do not install air barrier materials in snow, rain, fog, or mist. Do not install air barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the material manufacturer.

C. Sequencing. Do not install air barrier material before the roof assembly has been sufficiently installed to prevent a buildup of water in the interior of the building.

D. Compatibility. Do not allow air barrier materials to come in contact with chemically incompatible materials.

E. Ultra-violet exposure. Do not expose air barrier materials to sunlight longer than as recommended by the material manufacturer.

1.6 WARRANTY

A. Warrant membrane air barrier installation against air and moisture leaks subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period is two years.

PART 2 - MATERIALS

2.1 AIR BARRIER MATERIALS

A. Medium Density Closed Cell Spray Polyurethane Foam Air Barrier: Subject to compliance with requirements.

1. AIR BARRIER MATERIAL PROPERTIES:

a. Air permeance for this material has been tested and reported as being 0.004 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.004 cfm/ft^2 @ 1.57 psf), (0.02 liters per square meter per second under a pressure differential of 75 Pa (0.02 L/(s•m^2) @ 75 Pa) when tested in accordance with ASTM E2178-11.

b. Flame spread: Less than 75 per ASTM E 84-12.

c. Smoke developed: Less than 450 per ASTM E 84.

d. VOC Content: Maximum 250 g/L per 40 CFR 59, Subpart D (EPA Method 24).

e. Design R Value as indicated in test report, minimum 6/inch.

f. Single-Source Responsibility: Obtain air/vapor barrier materials from a single manufacturer who regularly engages in manufacturing the product.

2. AIR BARRIER ACCESSORY MATERIALS:

a. Furnish auxiliary materials recommended by air/vapor barrier manufacturer for intended use and compatible with the air/vapor barrier.

b. Jamb extension: 2" x 2" rigid 60 mil, extruded thermoplastic angle.

c. Hygric Buffer Mat:.75"randomly oriented geometric patterned drainage/ventilation mat laminated to a non-woven breathable membrane.

d. Hygric Buffer Mat: (HB<) Fasteners: Flat head, conical point, plastic fastener (Style A) to attach HBM to CMU wall.

1) Snap in plastic clip

2) Install at 2'-0" o.c. horizontally and vertically.

e. Transition Membrane between Air Barrier Membrane and Roofing and Other Adjacent Materials: comply with both air barrier manufacturer's recommendations and material manufacturer's recommendations.

f. Counter-flashing for Masonry Through-Wall Flashing: comply with recommendations from the Spray Polyurethane Foam Air Barrier Material Manufacturer.

g. Membrane at Transitions in Substrate and Connections to Adjacent Elements: comply with recommendations from the Spray Polyurethane Foam Air Barrier Manufacturer.

h. Detail membrane Primer:

1) Primer as recommended by detail membrane manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The ABAA Certified Air Barrier Contractor shall examine substrates, areas, and conditions under which the air barrier assembly will be installed, with General Contractor, ABAA Certified Installer present, for compliance with the following requirements.

1. Confirm site access logistics and scheduling requirements, including but not limited to use of scaffolding, lifts and staging.
2. At the end of each working day, provide weather protection at the top of parapet walls and non finished roofs to prevent moisture migration into walls and damage to installed air barrier systems.
3. 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.
4. Ensure that the following conditions are met:
   a. Surfaces are sound, dry, even, and free of excess mortar or other contaminants.
   b. Inspect substrates to be smooth without large voids or sharp protrusions. Inform General Contractor if substrates are not acceptable and need to be repaired by the concrete sub-trade.
   c. Inspect masonry joints to be reasonably flush and completely filled, and ensure all excess mortar sitting on masonry ties has been removed. Inform General Contractor if masonry joints are not acceptable and need to be repaired by the mason sub-trade.
5. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263 and take suitable measures until substrate passes moisture test.
6. Verify sealants are compatible with membrane proposed for use. Perform field peel-adhesion test on materials to which sealants are adhered.
7. Notify COR in writing of anticipated problems using closed cell, medium density spray polyurethane foam over substrate prior to proceeding.

3.2 SURFACE PREPARATION

A. The Air Barrier Contractor shall ensure the substrate is clean, dust-free, dry and prepared in accordance with the air barrier material manufacturer's written instructions. The General Contractor shall be notified if this is not the case.

1. Ensure that penetrating work by other trades is in place and complete.

2. Prepare surfaces by brushing, scrubbing, scraping, grinding or compressed air to remove loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants which will affect adhesion of the closed cell, medium density spray polyurethane foam.
3. Wipe down metal surfaces to remove release agents or other non-compatible coatings using clean sponges or with a material chemically compatible with the primary air material.

B. Prime substrate for installation of sheet membrane transition strips if required by material manufacturer and as follows:

1. Prime masonry, concrete substrates with primers.
2. Prime glass-fiber surfaced gypsum sheathing with an adequate number (if applicable) of coats to achieve required bond, with adequate drying time between coats.
3. Prime wood, metal, structural steel, sheet metal, and painted substrates with primer.
4. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air barrier and protrusions.

C. Protection from Closed Cell, Medium Density Spray Polyurethane Foam:

1. Mask and cover adjacent areas and materials that aren't being sprayed to protect from over-spray.
2. Ensure any required foam stop or back up material are in place and complete to prevent over spray and achieve complete seal.
3. Seal off existing ventilation equipment. Install temporary ducting and fans to ensure exhaust fumes are removed from the spray location to exterior of the building. Provide for make-up air.
4. Erect barriers, isolate area and post warning signs to advise non-protected personnel to avoid the spray area.

3.3 INSTALLATION

A. Transition Strip Installation: Install air barrier accessories and closed cell, medium density spray polyurethane foam to provide continuity throughout the building envelope. Install materials in accordance with manufacturer's instructions and the following:

1. Apply primer for transition membrane at rate recommended by material manufacturer. Allow primer to dry completely before membrane application. Apply as many coats as necessary for proper adhesion.
2. Position subsequent sheets of membrane applied above so that it overlaps the membrane sheet below by a minimum of 2.0 inches (50 mm), unless greater overlap is recommended by material manufacturer. Roll into place with roller ensuring all transition membranes are free of fish-mouths, wrinkles, delaminations, bubbles and voids.
3. Overlap horizontally adjacent pieces of membrane a minimum of 2.0 inches (50 mm), unless greater overlap is recommended by material manufacturer. Roll all areas of membrane including seams with roller.
4. Seal around all penetrations with termination mastic, extruded silicone sealant, membrane counter-flashing or other procedure in accordance with material Manufacturer's recommendations.
5. Connect air barrier in exterior wall assembly continuously to the air barrier of the roof, to concrete below-grade structures, to windows, curtain wall, storefront, louvers, exterior doors and other intersection conditions and perform sealing of penetrations, using accessory materials and in accordance with the manufacturer's recommendations.

6. To bridge gaps >1/8" (3 mm) in wall construction at changes in substrate plane or changes in adjoining materials, provide transition membranes or other material recommended by spray polyurethane foam material manufacturer.
7. Provide transition membrane, sealant, mastic, membrane counter-flashing or other material recommended by spray polyurethane foam manufacturer at 90 degree inside or outside corners. Follow spray polyurethane foam manufacturer's instructions for instructions on how to treat interlocked CMU or structurally-attached 90 degree cast-in place concrete corners.
8. Provide mechanically fastened non-corrosive metal sheet to span gaps greater than 1.0 inch (25 mm) in substrate plane and to make a smooth transition from one plane to the other. Membrane shall be continuously supported by substrate.
9. At through-wall flashings, provide an additional 6.0 inch (150mm) wide strip of manufacturer's recommended membrane counter-flashing to seal top of through-wall flashing to membrane. Seal exposed top edge of strip with bead of mastic or as recommended by manufacturer.
10. At deflection and control joints, provide backup for the membrane to accommodate anticipated movement.
11. At expansion and seismic joints provide transition to the joint assemblies.
12. Apply a bead or trowel coat of mastic along membrane seams at reverse lapped seams, rough cuts, and as recommended by the manufacturer when membrane will be exposed to the elements.
13. At end of each working day, seal top edge of self-adhered membrane to substrate with termination mastic if exposed.
14. Do not allow materials to come in contact with chemically incompatible materials.
15. Do not expose membrane to sunlight longer than as recommended by the manufacturer.
16. Ensure that membranes at terminations have a pull adhesive of 16 psi or greater.
17. Inspect installation prior to enclosing assembly and repair damaged areas with closed cell, medium density spray polyurethane foam as recommended by manufacturer.

B. Installation of Spray Polyurethane Foam: Install materials in accordance with manufacturer's instructions and the following:

1. The Installer(s) and those within the work area shall use proper personal protective equipment (PPE) during the installation of material in accordance with US Government regulation 29 CFR 1910.134.
2. The Installer(s) shall follow all OSHA requirements when working on a job-site.
3. Warning signs shall be displayed on each job site in the spray area warning of health and safety hazards for those personnel who do not comply with the personal protective equipment as required by Federal law.
4. Equipment used to spray polyurethane foam shall comply with the manufacturer's instructions for the specific type of application and type of material being sprayed. Record equipment settings on the ABAA Daily Job Site Report. Each proportioner unit shall supply only one spray gun.
5. Apply only when surfaces and environmental conditions are within limits instructed by the material manufacturer.
6. Apply in consecutive passes as required by material manufacturer to thickness as indicated on drawings. Passes shall be not less than ½ inch (12 mm) and not greater than 50 mm (2 inches) or greater than the maximum thickness required by the SPF manufacturer. An additional pass of 2.0 inches (50 mm) shall only be done after the first pass has had time to cool down. At no time shall more than 4.0 inches (100 mm) be installed in a single day. There are no exceptions to this requirement as it is a health and safety requirement.
7. Install within material manufacturer's tolerances, but not more than minus ¼ inch (6 mm).
8. Do not install closed cell, medium density spray polyurethane foam within 3.0 inches (75 mm) of heat emitting devices such as light fixtures and chimneys.

9. Finished surface of foam insulation to be free of voids and embedded foreign objects.
10. Remove masking materials and over spray from adjacent areas immediately after foam surface has hardened. Ensure cleaning methods do not damage work performed by other sections.
11. Trim, as required, any excess thickness that would interfere with the application of cladding/covering system by other trades.
12. Clean and restore surfaces soiled or damaged by work of the section. Consult with section of work soiled before cleaning to ensure methods used will not damage the work.
13. Complete connections to other air barrier components and repair any gaps, holes or other damage using material in a manner approved by primary air barrier material manufacturer.

3.4 FIELD QUALITY CONTROL

A. Owner will allow a testing agency access to work areas, staging, and allow sufficient time for testing and inspection. Do not cover work of this section until testing and inspection is accepted.

B. Air Barrier Association of America Installer Audits: Cooperate with ABAA's testing agency. Allow access to work areas and staging. Notify ABAA in writing of schedule for Work of this Section to allow sufficient time for testing and inspection. Do not cover Work of this Section until testing and inspection is accepted. Arrange and pay for site audit by ABAA to verify conformance with the material Manufacturer's instructions, the site Quality Assurance Program used by ABAA, and this section of the project specification.

1. Audits and subsequent testing shall be carried out at the following rate:
   a. Up to 10,000 ft^2 of air barrier contract requires one (1) audit.
   b. 10,001 – 35,000 ft^2 of air barrier contract requires two (2) audits.
   c. 35,001 – 75,000 ft^2 of air barrier contract requires three (3) audits.
   d. 75,001 - 125,000 ft^2 of air barrier contract requires four (4) audits.
   e. 125,001 – 200,000 ft^2 of air barrier contract requires five (5) audits.
   f. 200,001 ft^2 and over of air barrier contract requires six (6) audits.

2. Forward written audit reports to the COR within 10 working days of the audit and test being performed.

3. If the audit reveals any defects, promptly remove and replace defective work at no additional cost to the Owner.

3.5 PROTECTING AND CLEANING

A. Protect air barrier materials from damage during installation and the remainder of the construction period, according to material manufacturer's written instructions.

1. Coordinate with installation of materials which cover the air barrier assemblies, to ensure exposure period does not exceed that recommended by the air barrier material manufacturer.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer.

END OF SECTION