

SECTION 07 27 03

CLOSED CELL, MEDIUM DENSITY SPRAY POLYURETHANE FOAM AIR BARRIER

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| *Specifier Note: This guide specification is written according to the Construction Specifications Canada (CSC) Format. The section must be carefully reviewed and edited by the Architect or Engineer to meet the requirements of the project. Coordinate this section with other specification sections and the drawings.* |

1. **GENERAL**
	* + 1. SECTION INCLUDES

Closed cell, medium density spray polyurethane foam air barrier located in the non-accessible part of the wall.

Materials to bridge and seal the following air leakage pathways and gaps:

Connections of the walls to the roof air barrier.

Connections of the walls to the foundation air barrier.

Seismic and expansion joints.

Openings and penetrations of window frames, storefront, curtain wall.

Barrier precast concrete and other envelope systems.

Door frames.

Piping, conduit, duct and similar penetrations.

Masonry ties, screws, bolts and similar penetrations.

All other air leakage pathways in the building envelope.

*Specifier Note: Coordinate related work requirements with contents of referenced specification sections.*

Section [014000] [Quality Requirements; coordination with Owner’s independent testing and inspection agency.]

Section [014339] [Mock-Ups; exterior wall mock-ups.]

Section [015000] [Temporary Facilities and Controls; requirement to schedule work to prevent sunlight and weather exposure of materials beyond limits established by manufacturer; requirement to protect materials from damage after installation and prior to installation of enclosing work.]

Section [033000] [Cast-In-Place Concrete; requirement that backup concrete be smooth without protrusions.]

Section [042000] [Unit Masonry; requirement that backup masonry joints are flush and completely filled with mortar, and that excess mortar on brick ties will be removed; requirement for gap at deflection joints and fillers; coordination with sequencing of through-wall flashing.]

Section [061600] [Sheathing; requirement that backup gypsum sheathing has been installed.]

Section [075000] [Membrane Roofing; requirement for coordination with sequencing of membrane roofing; requirement to seal roof membrane to wall air barrier.]

* + - 1. PERFORMANCE REQUIREMENTS

Material Performance: Provide air barrier materials which have an air permeance not to exceed 0.02 litres per square metre per second under a pressure differential of 75 Pa (0.02 L/(s·m2) @ 75 Pa) [0.004 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.004 cfm/ft2 @ 1.57 psf)], when tested in accordance with ASTM E2178 (unmodified).

The water vapour permeance shall be determined in accordance with ASTM E96 and shall be declared by the material manufacturer.

*Specifier Note: The water vapour permeance is declared by the manufacturer and included in this document so that the design professional has this information readily available.*

Assembly Performance: Provide a continuous air barrier in the form of an assembly that has an air leakage not to exceed 0.2 litres per square metre per second under a pressure differential of 75 Pa (0.2 L/(s·m2) @ 75 Pa) [0.04 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.04 cfm/ft2 @ 1.57 psf)] 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.

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.

Materials of the air barrier assembly shall not displace adjacent materials in the assembly under full load.

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.

Connections to Adjacent Materials: Provide air barrier accessory materials to prevent air leakage at the following locations:

Foundation and walls, including penetrations, ties and anchors.

Walls, windows, curtain walls, storefronts, louvers and doors.

Different assemblies and fixed openings within those assemblies.

Wall and roof connections.

Floors over unconditioned space.

Walls, floor and roof across construction, control and expansion joints.

Walls, floors and roof to utility, pipe and duct penetrations.

Seismic and expansion joints.

All other potential air leakage pathways in the building envelope.

* + - 1. SUBMITTALS

Submittals: Submit in accordance with Division 1 requirements.

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

Product Data: Submit manufacturer’s product data, manufacturer's instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.

Samples: Submit clearly labeled samples, 75 mm by 100 mm [three (3) inches by four (4) inches] minimum size of each material specified.

Shop Drawings of Mock-Up: Submit Shop Drawings of proposed mock-ups showing plans, elevations, large-scale details, and connections to the test apparatus.

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 (see Section 1.3, .16), including retesting if initial results are not satisfactory.

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.

Include VOC content of each material, and applicable legal limit in the jurisdiction of the project.

Include required values for field adhesion test on each substrate.

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

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

Manufacturer: Obtain primary NABA Evaluated Materials from a single NABA Listed 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.

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).

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

Field Quality Assurance: Implement the site Quality Assurance Program requirements used by NABA. Cooperate with NABA 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.

Air Barrier Assembly Testing: Verify air barrier assembly testing by the material manufacturer by visiting the NABA website to ensure a ASTM E2357 test has been completed and to obtain results. Visit the NABA 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. DELIVERY, STORAGE, AND HANDLING

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.

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.

Handle materials in accordance with material manufacturer’s requirements.

* + - 1. PROJECT CONDITIONS

Temperature: Install closed cell, medium density spray polyurethane foam within range of ambient and substrate temperature, and moisture content recommended by the material manufacturer.

Field Conditions: Do not install air barrier in snow, rain, fog, or mist.

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.

Compatibility. Do not allow closed cell, medium density spray polyurethane foam to come in contact with chemically incompatible materials.

Ultra-Violet Exposure. Do not expose air barrier materials to sunlight longer than as recommended by the material manufacturer.

* + - 1. WARRANTY

*Specifier Note: Verify warranty length with manufacturers specified.*

Material Warranty: Provide material manufacturer’s standard product warranty, for a minimum three (3) years from date of Substantial Completion.

Subcontractor (approved by NABA and Manufacturer) Installation Warranty: Provide a two (2) year installation warranty from date of Substantial Completion, including all materials of the air barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of attachment, loss of cohesion/adhesion and failure to cure properly.

* + - 1. PRE-CONSTRUCTION MEETING

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.

* + - 1. MOCKUPS

Mock-Ups: Build mock-up representative of primary air barrier assemblies and glazing assemblies including backup wall and typical penetrations as acceptable to the Architect. Mock-up shall be dimensions no less than 2.50 metres long by 2.50 metres high [eight (8) feet long by eight (8) feet high] and include the materials and accessories proposed for use in the exterior wall assembly. Mock-ups shall be suitable for testing as specified in the following paragraph.

*Specifier Note: Coordinate testing with project requirements. Delete paragraph below if not required, or if Owner’s independent testing agent will perform testing.*

Mock-Up Tests for Air and Water Infiltration: The third party testing agency shall test the mock-up for air and water infiltration in accordance with ASTM E1186 (air leakage location), ASTM E783 (air leakage quantification) at a pressure difference of 1.57 lb/ft2 (75 Pa), and ASTM E1105 (water penetration). Use smoke tracer to locate sources of air leakage. If deficiencies are found, the air barrier Contractor shall reconstruct mock-up for retesting until satisfactory results are obtained. Deficiencies include air leakage beyond values specified, uncontrolled water leakage, unsatisfactory workmanship.

Perform the air leakage test and water penetration test of mock-up prior to installation of cladding and trim but after installation of all fasteners for cladding and trim and after installation of other penetrating elements.

Mock-Up Tests for Membrane Adhesion: Test mock-up for transition membrane adhesion in accordance with ASTM D4541 (modified), using a type II pull tester except that the membrane 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 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.

1. **MATERIALS**

*Specifier Note: Retain manufacturers listed below. Note that both water-based and solvent-based primers are typically used on a single project based on the substrate and weather conditions.*

*Specifier Note: Use regular, high temperature or low-temperature formulation depending on site conditions, within temperature ranges specified by material Manufacturer.*

* + - 1. Material: <trade name> by <company name>: [company website hyperlink](http://www.airbarrier.org)

Air Barrier Material Properties:

Air permeance for this material has been tested and reported as being 0.0012 litres per square metre per second under a pressure differential of 75 Pa (XX L/(s·m2) @ 75 Pa) [XX cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (XX cfm/ft2 @ 1.57 psf)] at XX” when tested in accordance with ASTM E2178 (unmodified).

Water vapour permeance for this material has been tested and reported as being XX nanograms of water vapour passing through each square metre of area per second for each Pascal of vapour pressure differential (XX ng/(Pa·s·m2)  [XX US perms] at XX mils – [dry/wet] when tested in accordance with ASTM E96 (desiccant method - unmodified).

Water vapour permeance for this material has been tested and reported as being XX nanograms of water vapour passing through each square metre of area per second for each Pascal of vapour pressure differential (XX ng/(Pa·s·m2)  [XX US perms] at XX mils – [dry/wet] when tested in accordance with ASTM E96 (water method - unmodified).

Air Barrier Accessory Materials:

Water-Based Primer:

Solvent-Based Primer:

Solvent-Based Aerosol Primer:

Termination Mastic:

Sealants:

Transition Membrane for expansion joints and fenestration:

Reinforcing/Joint Tape:

Flashing at Transition Membrane:

Counter-flashing for Metal Wall Flashings:

Through-Wall Flashings or Shelf Angle Flashings:

Solvent-Based Primer for Flashing, Transition Strip and Detail Membrane:

Water-Based Primer for Flashing, Transition Strip and Detail Membrane:

Substrate Joint Treatment:

**[OR]**

1. **EXECUTION**
	* + 1. EXAMINATION

The Air Barrier Contractor shall examine substrates, areas, and conditions under which the air barrier assembly will be installed, with NABA Certified Installer present, 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.

Ensure that the following conditions are met:

Surfaces are sound, dry, even, and free of excess mortar or other contaminants.

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.

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.

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.

Verify sealants are compatible with membrane proposed for use. Perform field peel-adhesion test on materials to which sealants are adhered.

Notify Architect in writing of anticipated problems using closed cell, medium density spray polyurethane foam over substrate prior to proceeding.

* + - 1. SURFACE PREPARATION

Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

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

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.

Where there are release agents or other non-compatible coatings, wipe down metal surfaces to remove these release agents or other non-compatible coatings, using clean sponges or rags soaked in a solvent compatible with the specified material.

Ensure veneer anchors are in place.

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

Prime masonry, concrete substrates with conditioning primers.

Prime glass-fiber surfaced gypsum sheathing an adequate number of coats to achieve required bond, with adequate drying time between coats.

Prime wood, metal, and painted substrates with primer.

Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air barrier and protrusions.

Protection from Closed Cell, Medium Density Spray Polyurethane Foam:

Mask and cover adjacent areas and materials that aren’t being sprayed to protect from over spray.

Ensure any required foam stop or back up material are in place to prevent over spray and achieve complete seal.

Seal off existing ventilation equipment. Install temporary ducting and fans to ensure exhaust fumes are removed from the spray location. Provide for make-up air.

Erect barriers, isolate area and post warning signs to advise non-protected personnel to avoid the spray area.

* + - 1. INSTALLATION

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 (unless manufacturer recommends other procedures in writing based on project conditions or particular requirements of their recommended materials):

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.

Position subsequent sheets of transition membrane applied above so that it overlaps the transition 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.

Overlap horizontally adjacent pieces of transition membrane a minimum of 50 mm (2.0 inches), unless greater overlap is recommended by material Manufacturer. Roll all areas of transition membrane including seams with roller.

Seal around all penetrations with termination mastic, membrane counter-flashing or other procedure in accordance with material manufacturer’s recommendations.

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.

At changes in substrate plane, provide sealant (bead of sealant, mastic, membrane counter-flashing or other material recommended by material Manufacturer) under membrane to eliminate all sharp 90 degree inside corners and to make a smooth transition from one plane to another as detailed or identified on bid documents.

Provide mechanically fastened non-corrosive metal sheet to span gaps greater than 25 mm (1.0 inch) in substrate plane and to make a smooth transition from one plane to the other. Membrane shall be continuously supported by substrate.

At deflection and control joints, provide backup for the membrane to accommodate anticipated movement.

At expansion and seismic joints provide transition to the joint assemblies.

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.

At end of each working day, seal top edge of self-adhered membrane to substrate with termination mastic if exposed.

Do not allow materials to come in contact with chemically incompatible materials.

Do not expose transition membrane to sunlight longer than as recommended by the manufacturer.

Ensure that Membranes at terminations have a pull adhesive of 16 psi or greater.

Inspect installation prior to enclosing assembly and repair damaged areas with closed cell, medium density spray polyurethane foam as recommended by manufacturer.

Installation of Closed Cell, Medium Density Spray Polyurethane Foam: Install materials in accordance with manufacturer's instructions, ULC S 705.2 and the following:

Installer shall use proper personal protective equipment (PPE) during the installation of material in accordance with US Government regulation 29 CFR 1910.134.

Warning signs shall be displayed and non-protected personnel shall be kept from the spray area in accordance with ULC S705.2.

Equipment used to spray polyurethane foam shall comply with ULC S 705.2 and the manufacturer’s recommendations for the specific type of application. Record equipment settings on the Daily Work Record as required by the ULC S 705.2 installation standard. Each proportioner unit shall supply only one spray gun.

Apply only when surfaces and environmental conditions are within limits prescribed by the material Manufacturer or the ULC S 705.2 Installation standard.

Apply in consecutive passes as recommended by material Manufacturer to thickness as indicated on drawings. Passes shall be not less than 12 mm (½ inch) and not greater than 2 inches (50 mm). An additional pass of 50 mm (2.0 inches) shall only be done after the first pass has had time to cool down. At no time shall more than 100 mm (4.0 inches) be installed in a single day. There are no exceptions to this requirement as it is a health and safety requirement.

Install within material Manufacturer’s tolerances, but not more than minus 6 mm (¼ inch).

Do not install closed cell, medium density spray polyurethane foam within 75 mm (3.0 inches) of heat emitting devices such as light fixtures and chimneys.

Finished surface of foam insulation to be free of voids and embedded foreign objects.

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.

Trim as required, any excess thickness that would interfere with the application of cladding/covering system by other trades.

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.

Complete connections to other components and repair any gaps, holes or other damage using material which conforms to ULC S 710.1 (single component) or ULC S 711.1 (two components) and installed in accordance with ULC S 710.2 or ULC S 711.2 as applicable.

* + - 1. FIELD QUALITY CONTROL

Owner’s Inspection and Testing: Cooperate with Owner’s testing agency. Allow access to work areas and staging. Notify Owner’s testing agency 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.

National Air Barrier Association Installer Audits: Cooperate with NABA’s testing agency. Allow access to work areas and staging. Notify NABA 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 inspections by NABA to verify conformance with the material Manufacturer’s instructions, the site Quality Assurance Program used by NABA, and this section of the project specification.

Audits and subsequent testing shall be carried out at the following rate:

$1 - 50,000 Air Barrier Contract Value - 1 audit required

$50,001 - 150,000 Air Barrier Contract Value - 2 audits required

Over $150,000 Air Barrier Contract Value – 1 audit required for every $100,000 in Air Barrier Contract Value.

Additional field audits may be required on a specific project as required by NABA QAP Administrator.

Forward written inspection reports to the Architect within 10 working days of the inspection and test being performed.

If the inspections reveal any defects, promptly remove and replace defective work at no additional cost to the Owner.

* + - 1. PROTECTING AND CLEANING

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

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.

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