SECTION 01 9115

EXTERIOR ENCLOSURE COMMISSIONING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Design requirements and testing for building envelope.

1.2 DEFINITIONS

A. General: Definitions included in this Section supersede definitions appearing in reference Air Leakage:

1. Air leakage through building envelopes can cause condensation, mold growth and damage to building materials. It can increase heating and cooling loads, thereby increasing energy consumption and operating costs. In sufficient quantities, air leakage can compromise occupant comfort by creating drafts and allowing uncontrolled entry of dust and environmental pollutants into occupied space. These concerns are driving the development of government regulations and building code requirements for mandatory air barrier systems in commercial buildings.
2. An effective air barrier system must be continuous. Every transition, interruption or termination of the designated air barrier component needs to be evaluated, including, but not limited to:
    a. Seals and transitions to adjacent dissimilar materials, such as a wall/roof intersection where the roof and wall systems need to be connected.
    b. Barriers at typical door and window penetrations.
    c. Seals at an appropriate location on door or window frames.
    d. Pipe, electrical conduit, mechanical duct, chase and structural penetrations.
    e. Potential air leakage paths within a material that is designated as the air barrier.
    f. Flexible joints, such as midspan load deflections of beams.

1.3 SYSTEM DESCRIPTION

A. Description of System: Exterior wall and roof systems, complete with glazed openings, doors, exterior wall finishes, sealants, and anchorage devices required to secure entire exterior envelope to building structural system and related appurtenances as necessary to provide complete and weathertight external envelope.

B. Acceptability of exterior envelope system is dependent upon successful test performances.

C. General:

1. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage or moisture disposal.
2. Requirements shown by details are intended to establish basic dimension of unit, sight lines and profiles of members.
3. Coordinate shop drawings and installation of exterior wall to resolve conflicts.
4. Allow for installation tolerances, expansion and contraction of adjacent materials, and sealant manufacturer’s recommended joint design.
5. Assemblies shall be free from rattles, wind whistles, and noise due to thermal and structural movement and wind pressure.
6. Attachment considerations shall take into account site peculiarities and expansion and

contraction movements to eliminate loosening, weakening, or fracturing of connections between units and building structure or between units themselves.

7. System shall drain to exterior face of wall; water entering system and condensation occurring within system by drain holes and flashings of adequate size to evacuate water without infiltration to interior.
8. Do not design system to exceed sealant manufacturer's recommended performance criteria.

D. Envelope Air Leakage Testing:

1. Infiltration standard is 1 Air Change per Hour at 50 Pascals. Blower door tests will be arranged by the Contractor and provided by the Owner. The project will be blower door tested at several stages and meetings with the design team for the trades will be provided as described below.
2. Subcontractors are responsible for coordinating with the CM all penetrations of the air barrier of the building envelope that they make, and the method of sealing these penetrations. Failure to do so will result in their being charged for the costs of repair of penetrations that result in air leakage revealed by the blower door test.
3. Importance of air-tight construction:
    a. Damage to the envelope from condensation caused by air exfiltration of moist air can be minimized. Callbacks for building envelope repairs are reduced. Water damage on ceilings and interior walls is also reduced.
    b. Energy consumption for heating and cooling can be reduced, and the need for oversizing boilers, make-up air units and air conditioning equipment to account for air leakage is also reduced.
    c. Heat recovery devices can be used more effectively on the ventilation air if the building is tight.
    d. Noise transmission through the building envelope is reduced.
    e. The incidence of frozen pipes caused by air leakage can be reduced.
    f. Air tightness can be most readily achieved in the construction of the building envelope by careful implementation of the building drawing details and specifications. Particular care must be taken with the interfaces of different air barrier materials. Experience has determined that the most likely areas for air leakage in typical buildings include the following:
        1). joints between the roof and wall air barriers (particularly where walls on adjacent stories are discontinuous on multi-story buildings)
        2). joints between the wall air barrier and the windows and doors
        3). joints between the wall air barrier and the grade beam
        4). penetrations of the wall and roof air barriers by electrical, plumbing and telecommunication services
        5). penetrations of the wall and roof air barriers by chimneys, and ventilation ducts
        6). joints at floor level on multi-storey buildings
        7). joints where interior partition walls meet the roof or exterior walls
        8). poorly adjusted weatherstrips on doors
4. It is especially important that the contractor be fully familiar with all the plans and specifications for air sealing of the building, and that this knowledge be thoroughly communicated to all those involved in the air barrier and air tightness work.
5. The system employed for construction of the building air barrier will utilize the exterior sheathing located behind the insulation layer. All sheathing must be continuous and all seams must be taped and rolled to ensure air tightness.
6. Meetings and tests with the design team:
    a. Pre-Installation Meeting: The Contractor is to convene a meeting of trades whose cooperation is critical to achieving and maintaining a continuous, tight air barrier of the type detailed in the Drawings. The purpose of the meeting is to apprise trades of their respective roles in the overall goal of achieving the required standard of envelope air-

tightness.

b. Air Barrier Inspections: The Architect shall make two (2) inspections in the course of the installation of the air barrier assemblage, and prior to the blower door test noted below. These visits shall be scheduled at the time of the pre-installation meeting, or the Architect shall be given at least 72 hours prior notice. Enclosure of any portion of the air barrier prior to inspection will require the removal of the cover material at the expense of the installing contractor.

c. Schedule of Blower Door Tests: Several blower door tests will be conducted at the Owner's expense to determine the adequacy of air-tight construction. They will occur as follows:

1). Building will be tested at completion of new exterior sheathing, prior to any exterior insulation or interior insulation.

2). At the completion of exterior insulation.

3). Any additional testing deemed necessary to ensure proper building performance to be performed at the expense of the Contractor.

7. Minimum Air-tightness Specification: 1 ACH 50
8. Test results must be approved in writing by the Architect for each section tested and the Architect will provide the area and volume data for the tester.
9. Blower Door Test- The following openings shall be temporarily sealed by the general contractor for the test:
   a. All ventilation intake and exhaust grilles.
   b. Any floor drains or plumbing stacks or drains open to the outside
   c. Any holes in exterior doors where hardware is not yet installed
   d. Ensure that wind speeds are below 15 mph for the duration of the test period. Tests shall be postponed if wind speeds are above 15 mph.

E. Air Barrier and Sealants:

1. A continuous air barrier will be formed using the exterior sheathing of the structure.
2. NOTE: Because this critical air barrier utilizes the exterior sheathing and is thus vulnerable to the elements it is important that the implementation and encapsulation with metal roof and building wrap be as quick as possible.
3. General Conditions:
   a. Seams: All sheathing intersections taped in the following manner:
      1). Clean the area to be taped.
      2). Apply 4” tape w/ 2” on each piece of sheathing.
      3). Apply pressure to tape using a 2” wide roller.
      4). Ensure there are no gaps, wrinkles, or loose tape.
      5). Tape removed for any reason must be discarded and replaced.
   b. Sheathing sealed to framing, framing sealed to itself, and framing sealed to foundation using construction adhesive.
   c. Clean joints and install sealant in accordance with manufacturer's instructions.
   d. Apply sealant within recommended temperature ranges.

F. HVAC and Other Exhaust Dampers:

1. During testing all dampers to exterior shall be tested for proper installation and air tightness.
2. Verify performance of each damper prior to installation.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 VERIFICATION

A. Certify that building exterior enclosure systems, subsystems, and construction have been completed according to the Contract Documents.

B. Perform, or facilitate and document, field quality-control tests and inspections.

1. Confirm that field quality-control testing of exterior enclosure has been completed and approved, that discrepancies have been corrected, and corrective work approved.

3.2 AIR TIGHTNESS TESTING

A. A minimum of two blower door tests will be performed. Both tests are at the expense of the Owner. Any additional testing will be at the expense of the Contractor.

B. First Test: The contractor shall arrange for the building to be tested preliminarily, as soon as the primary air barrier has been installed. IE as soon as the windows, doors and all hardware are installed, the ceiling air barrier is in place, the mechanical and electrical penetrations are installed, and before cavity insulation is installed.

C. The goal is to identify and seal air leaks as early as possible in the construction process. Quality assurance testing with either theatrical fog or thermal imaging is required at this preliminary test, to make significant leaks visible. In this testing the building is pressurized to a minimum of 30 Pascals and theatrical fog is introduced. The building is fully inspected from the outside for fog leakage and the leakage site identified and noted.

D. With a minimum 20 degree delta T, a high resolution thermographic camera may be used in conjunction with theatrical fog.

E. For the preliminary air tightness test, the following shall be true:

1. Mechanical louvers for the ventilation systems shall be taped off.
2. All electrical/mechanical penetrations shall be installed and sealed
3. All exterior doors and hardware shall be installed
4. Plumbing traps shall be filled
5. All mechanical systems shall be off.
6. All exterior windows and doors shall be closed and latched.
7. All interior doors shall be open.

F. The contractor shall provide adequate portable lighting to ensure that it is possible to enter the building to turn off the fog machine. Any location that has visible leakage shall be sealed with the appropriate material. Preliminary testing allows sealing of identifiable leaks that are readily accessible and helps insure that the air barrier will meet the specified tightness limit.

G. Based on the results of the first test, and at the discretion of the Energy Consultant or request by the Contractor, a follow up blower door test may be required prior to cavity insulation. This test would be required if the preliminary test failed substantially and in the interest of achieving the Air Tightness Limit Specification in the most cost effective manner possible.

H. Second (or third) Test: The air tightness specification must be met with a final test prior to building completion. This next test will occur after cavity insulation and interior finished surfaces have been installed, all exterior penetrations completed and sealed, but prior to interior painting. The building

is tested in ‘winter operating conditions’:

1. Mechanical louvers for the ventilation systems shall be open.
2. All electrical/mechanical penetrations shall be installed and sealed
3. All exterior doors and hardware shall be installed
4. Plumbing traps shall be filled
5. All mechanical systems shall be off.
6. All exterior windows and doors shall be closed and latched.
7. All interior doors shall be open.

I. If the test results indicate that the air tightness limit of 0.08CFM per exterior shell has not been met, a walk through inspection must occur to locate significant air leakage sites. The Energy Consultant will identify steps to be taken to further tighten the envelope. When these steps have been completed, the Contractor must schedule another test to insure the tightness limit has been met.

3.3 FIELD QUALITY CONTROL

A. Annotate checklist or data sheet when a deficiency is observed.

B. Deferred Testing:

1. If tests cannot be completed because of a deficiency outside the scope of the Exterior Enclosure, the deficiency shall be documented and reported to the Owner. Deficiencies shall be resolved and corrected by Trade or Non-Trade Contractor as applicable and tests rescheduled.

C. Testing Reports:

1. Reports shall include measured data, data sheets, and a comprehensive summary describing the building exterior enclosure systems at the time of testing.
2. Prepare a preliminary test report. Deficiencies will be evaluated by Architect to determine corrective action. Deficiencies shall be corrected and test repeated.

END OF SECTION

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