**SECTION 01 91 07**

**BUILDING ENCLOSURE COMMISSIONING**

1. GENERAL
   * + 1. RELATED DOCUMENTS
          1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
       2. SUMMARY
          1. Section includes the contractor commissioning responsibilities for Divisions 03, 04, 07, 08, 09 and 10.
          2. Related Sections: Materials, Equipment and Systems included in commissioning scope are identified in specification Sections:

Section 01 91 00 Commissioning

Section 01 91 21 Fire Suppression Commissioning

Section 01 91 22 Plumbing Commissioning

Section 01 91 23 HVAC Commissioning

Section 01 91 26 Electrical Commissioning

Section 01 91 27 Communications Commissioning

Section 01 91 28 Electronic Safety and Security Commissioning

* + - * 1. Additional Demonstration and Training requirements for commissioned materials, equipment and systems are defined in Section 01 91 79 Demonstration and Training for Commissioning.
      1. DESCRIPTION
         1. Commissioning
         2. Enclosure commissioning is a systematic process of review and testing of exterior building systems to provide checks on performance according to the project requirements. The commissioning process will encompass document review, preinstall meeting(s), mockup review(s) and reviews of work plus Enclosure testing. Commissioning during the construction phase is intended to achieve the following specific objectives:

Review applicable systems for installation in accord with the contract documents, manufacturer recommendations, industry accepted standards and coordination by installing contractors.

Review and document performance of Enclosure components and systems.

* + - * 1. The primary responsibility of the Building Enclosure Commissioning Authority (BECxA) is to inform the [GC][CM][DB], the owner and Design Professional on the status, and performance of Enclosure systems within the facility.

The BECxA will function as a catalyst and initiator to disseminate information and assist the design and construction teams in implementing completion of the construction process. This will include system review, testing, and conformance with the intended design of each system. Services include documenting construction observations and testing.

Assist the responsible parties to maintain a high quality level of installation by meeting or exceeding prevailing standards and specifications.

The BECxA will coordinate, execute and document Enclosure testing as stipulated within this specification section.

* + - 1. DEFINITIONS AND ABBREVIATIONS
         1. Refer to Section 01 19 00, Commissioning.
      2. COMMISSIONING TEAM
         1. The Commissioning Team will consist of key parties involved in design, construction and testing of this facility. Team members must maintain an ongoing supervisory position on this project. One team member will be provided by each of the parties listed below:

1. Owner
2. BECxA
3. Design Professional
4. [General Contractor][Construction Manager][Design-Builder]
5. Installer
   * + 1. ENCLOSURE COMPONENTS/SYSTEMS TO BE COMMISSIONED
          1. DIVISION 3 – CONCRETE
6. 034500 Architectural Precast Concrete
   * + - 1. DIVISION 4 – MASONRY
7. 042113 Brick Masonry
8. 047200 Cast Stone Masonry
   * + - 1. DIVISION 7 – THERMAL & MOISTURE PROTECTION
9. 071113 Bituminous Dampproofing
10. 071326 Self Adhering Sheet Waterproofing
11. 071329 Blind Side Sheet Waterproofing
12. 071413 Hot Fluid-Applied Rubberized Asphalt Waterproofing
13. 071800 Traffic Coating
14. 072100 Thermal Insulation
15. 072726 Fluid Applied Membrane Air Barriers
16. 074113 Metal Roof Panels
17. 074213 Formed Metal Panels
18. 074213.16 Metal Plate Wall Panels
19. 074213.53 Metal Soffit Panels
20. 075323 EPDM Roofing
21. 075423 Thermoplastic Polyolefin(TPO) Roofing
22. 076200 Sheet Metal Flashing and Trim
23. 077100 Roof Specialties
24. 077200 Roof Accessories
25. 079200 Joint Sealants
    * + - 1. DIVISION 8 – OPENINGS
26. 081113 Hollow Metal Doors and Frames (Exterior Only)
27. 084113 Aluminum-Framed Entrances and Storefronts
28. 084413 Glazed Aluminum Curtain Walls
29. 088000 Glazing
30. 089000 Louvers and Vents
    * + - 1. DIVISION 9 – FINISHES
31. 099653 Elastomeric Coatings
    * + - 1. DIVISION 10 – SPECIALTIES
32. 107113 Exterior Sun Control Devices
    * + 1. RESPONSIBILITIES
           1. BECxA Responsibilities
33. Participate in the pre-installation meetings with Design Professional, Owner, [GC][CM][DB], and subcontractors.
34. Review building enclosure components’ submittals.
35. Provide project-specific construction checklists, commissioning specifications, and test procedures.
36. Review filled-out project specific construction checklists.
37. Review mock-up construction.
38. Perform site visits to observe installation of building enclosure components, systems, and assemblies.
39. Prepare reports for building enclosure installation and field testing.
40. Perform enclosure testing through coordination with the [GC][CM][DB] and Owner.
41. Prepare building enclosure commissioning final report.
    * + - 1. Owner Responsibilities
42. Review and comment on BECxA review comments, reports and/or issues logs.
43. Attend the BECx kickoff meeting and routine BECx meetings.
44. Participate in Pre-construction, Mock-Up, and Field testing coordination meetings.
    * + - 1. Design Professional Responsibilities
45. Document the design intent of the systems.
46. Review, respond and incorporate pertinent building enclosure drawing review comments.
47. Review and incorporate building enclosure functional performance test herein into the construction documents.
48. Provide the Construction Documents Electronically.
49. Attend the Preconstruction BECx Conference and routine BECx meetings.
50. Attend preconstruction and construction-phase coordination meetings.
51. Participate in Pre-construction, Mock-Up, and Field testing coordination meetings.
52. Provide recommendations for resolving items for which the BECxA and [GC][CM][DB] may disagree.
53. Provide input for final commissioning documentation.
54. Review and comment on BECxA review comments, reports and/or issues log.
    * + - 1. [GC][CM][DB] Responsibilities
55. Attend and coordinate construction-phase coordination and pre-installation meetings.
56. Provide Project-specific construction / field checklists.
57. Provide schedule of field quality control tests, mock-ups, inspections, and testing required by the Contract Documents and related to BECxA.
58. Update schedule weekly throughout the construction period.
59. Submit field quality control testing and inspection reports on building enclosure construction to BECxA.
60. Participate in testing-procedures meetings for testing of installed systems, subsystems, and component construction.
61. Provide test data, inspection reports, and certification for building enclosure components to BECxA.
62. Participate in inspection / observation of building enclosure construction with BECxA.
63. Provide necessary access to both interior spaces and exterior elevations to facilitate proper enclosure testing to be conducted by the BECxA. Provide any necessary lifts to allow for the execution of this testing.
64. For enclosure water tightness testing, provide water source with sufficient water pressure.
65. Replace and/or repair any failed areas (interior and/or exterior) observed as a result of the enclosure testing in a timely manner.
66. Participate in final inspection / observation of building enclosure systems with BECxA.
67. Participate in operation and maintenance training sessions.
68. Participate in final review of punch list items at acceptance meeting.
    * + 1. SUBMITTALS
           1. Refer also to Section 01 3300, Submittal Requirements.
           2. The systems listed under, “ENCLOSURE SYSTEMS TO BE COMMISSIONED”, are to be submitted.
           3. Provide the BECxA a copy of all submittals for the Building Enclosure Systems that are listed to be commissioned.
           4. Submittals included
69. Product Data
70. Shop drawings
71. Performance documentation
    * + - 1. Coordination and Scheduling
72. The BECxA shall review submittals concurrent with the Design Professional. Those comments will be submitted to the Design Professional for consideration and inclusion into the Design Professionals’ formal review and response back to the [GC][CM][DB].
    * + 1. FIELD PERFORMANCE TESTING
           1. This applies to testing for system performance and diagnostic purposes.
           2. The BECxA shall perform all enclosure testing as stipulated within this specification under contract to the Owner. All testing will be coordinated through the Owner and the Design Professional. The [GC][CM][DB] shall be responsible for supporting the execution of all enclosure testing.
           3. Objectives and Scope
73. The objective of testing is to demonstrate that each building enclosure system and the interface between systems perform according to the OPR performance metrics and/or the design documents for watertightness, air tightness, and thermal performance.
    * + - 1. Enclosure Testing Program
74. The BECxA develops a specific testing program for the enclosure in consultation with the Design Professional based on the specific performance expectations for the building enclosure. The BECxA provides a copy of the test procedures to the Design Professional and Owner’s Representative who will review the program prior to testing.
    * + - 1. Coordination and Scheduling
75. The [GC][CM][DB] will provide sufficient notice to the BECxA regarding the installation schedule for the testing of systems. The BECxA will schedule tests after written notification from the [GC][CM][DB] and affected Installers. The [GC][CM][DB] will allow time for the testing. The BECxA will perform and document the testing of systems. The Installers will execute the tests.
76. In general, testing will not be scheduled until all submittals are approved. Testing shall also not be performed without written confirmation of readiness for applicable testing by the [GC][CM][DB].
77. Mock-up submittals will be submitted and approved prior to building a mock-up.
78. Mock-up testing will be successfully completed prior to production work starting.
79. Production submittals will be submitted and approved and a pre-install meeting held prior to the start of in-place work.
80. For each building system, testing of in-place work will be accomplished with a passed result prior to completion of [10][\_\_\_\_\_] percent (%) of that work being completed. Additional testing may be done as the work progresses.
81. Failed tests will be required to be re-tested plus possibly added testing. See Section 3.6.
    * + - 1. Problem Solving

The BECxA will recommend solutions if problems are found and coordinate with the DP, however the burden of responsibility to solve, correct and re-test problems is with the [GC][CM][DB] and Installers.

All modifications will be documented by the installer and submitted.

* + - 1. DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS
         1. The BECxA will document the testing to include a summary of the industry standard testing procedure, photos, the results of each test (pass/fail), photos, and retesting requirements if applicable.

1. PRODUCTS
   * + 1. MANPOWER AND EQUIPMENT
          1. The [GC][CM][DB] is responsible to provide the following:

Adequate power and water to each test location.

Access to the outside and inside of the building at each test location for personnel, which may include installer, Architect, Owner, commissioning team, and equipment. No interior finishes will be present at test area.

Access shall include providing lifts as necessary to enable the BECxA to perform the required testing.

1. EXECUTION
   * + 1. KICK-OFF MEETING
          1. The BECxA will schedule an enclosure commissioning kickoff meeting before construction of the building enclosure starts, at a time convenient to Owner, Construction Professional, and Architects. Allow for the meeting to be held at the project site or another convenient location. The BECxA will conduct the meeting to review commissioning responsibilities and personnel assignments.
          2. Attendees: Authorized representatives of Owner, BECxA, Architect / Engineer, Construction Professional and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to building enclosure commissioning.
          3. Agenda: Discuss items of significance that could affect progress, including the following:

Commissioning plan

Tentative construction schedule

Critical work sequencing and long-lead items

Designation of key personnel and their duties

Procedures for filling-out building enclosure checklists

Procedures for testing and inspection

Submittal procedures

* + - 1. MOCK-UPS
         1. Refer to contract drawings and Spec Section [\_\_\_\_\_\_\_\_\_\_\_] for details regarding the dimensions, components, etc. for stand-alone and in-place mock-ups.
         2. Each system and each of its components and typical details will be included in at least one field mock-up.
         3. Submittals

Provide shop drawings for the mock-ups. The shop drawings will include overall plans and elevation views plus large-scale details showing all aspects of the mock-ups.

* + - * 1. Review and Testing

The field mock-ups will be reviewed and water tested. One water test will be performed before the veneer is in place and one test after the veneer is in place, including each wall system.

Field mock-ups will remain in place throughout the construction of the building systems that the mock-up represents.

* + - 1. PRE-INSTALL MEETINGS
         1. Pre-install meetings will be held which cover all enclosure systems.
         2. Each enclosure system will be included in at least one meeting.
         3. The meetings will be divided into parts of the building such as below grade, wall and roofs.
         4. Each meeting will include all installers that have work that is included in that part of the building.
      2. CONSTRUCTION CHECKLISTS
         1. The BECxA shall produce enclosure construction checklists. These checklists will be developed based upon the contract documents, approved submittals and manufacturer’s recommendations.
         2. The installing contractors shall complete the construction checklists throughout construction. The checklists shall be executed in a timely manner and submitted to the BECxA for review and sample verification.
      3. IN-PLACE ENCLOSURE TESTING
         1. This applies to testing of systems for in-place work on the building. The BECxA shall conduct all testing specified herein with required support from the [GC][CM][DB].
         2. Applicable testing shall include:

[ASTM C1715 Standard Test Method for Evaluation of Water Leakage Performance of Masonry Wall Drainage Systems](http://www.astm.org/Standards/C1715.htm)

[ASTM D5957 Standard Guide for Flood Testing Horizontal Waterproofing Installations](http://www.astm.org/Standards/D5957.htm)

ASTM D7954 Standard Practice for Moisture Surveying of Roofing Waterproofing Systems Using Non-Destructive Electrical Impedance Scanners

AAMA 501.2-09 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls and Sloped Glazing Systems

[ASTM E1105 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](http://www.astm.org/Standards/E1105.htm)

AAMA 501.1 Standard Test Method for Water Penetration of Windows, Curtain Walls, and Doors using Dynamic Pressure / ASTM E1105, 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.

ASTM C1060-11a Standard Practice for Thermographic Inspection of Insulation Installation in Envelope Cavities of Frame Buildings

[ASTM E779 Standard for Determining Air Leakage Rate by Fan Pressurization]

* + - * 1. Each exterior building system and the interface between systems will be included in at least one (1) test based on the following.

Each wall veneer system will be tested, including the connection to and part of the adjacent system(s) prior to any veneer being installed.

Each wall system will be water tested prior to the following percentage of completion of that system. The test will include the connection to and part of the adjacent system(s).

[\_\_\_\_\_] [10%]

[\_\_\_\_\_] [30%]

[\_\_\_\_\_] [50%]

[\_\_\_\_\_] [95% ]

Each horizontal waterproofing system, including all areas, will be tested prior to covering.

* + - * 1. For wall systems, test areas will include representative detailing and typically be at least [10 foot by 10 foot][\_\_\_\_\_\_\_\_\_\_\_] in size.
      1. NON-CONFORMANCE AND FAILED TESTING
         1. Non-conformance deficiencies identified during Periodic Site Visits or Building Enclosure Performance Testing shall be resolved as follows:

The BECxA shall produce site visit reports during routine visits throughout construction.

Those reports shall include an issues log that shall be submitted to the [GC][CM][DB]. The issues log shall be in electronic form in an agreeable format that shall be confirmed by the Commissioning Team at the kickoff meeting.

The [GC][CM][DB] shall be responsible for timely response to all BECx deficiencies in electronic form with photographs supporting each response/resolution. The BECxA shall be solely responsible for closing BECx issues.

Corrections of identified minor deficiencies may be made during the review at the discretion of the BECxA. In such cases the deficiency and associated resolution will be documented in the issues log.

* + - * 1. For enclosure testing, as testing progresses and a deficiency is identified, the BECxA will discuss the issue with the [GC][CM][DB] for follow-up and resolution.

When there is no dispute with respect to the deficiency and the [GC][CM][DB] accepts responsibility to correct it:

The BECxA shall document the deficiency and the [GC][CM][DB]’s response. A copy/email of the deficiency shall be generated and provided to the [GC][CM][DB]. The applicable subcontractor corrects the deficiency, responds to the deficiency in the Commissioning Issues Log certifying that the issue is resolved and /or the product, material or assembly is ready to be retested and notifies the Project Team.

If there is a dispute about a deficiency:

The deficiency shall be documented a BECx issue and the [GC][CM][DB] will be notified. The [GC][CM][DB] will track this issue under the construction contract dispute resolution provisions.

Final acceptance authority is with the Owner or Design Professional.

* + - * 1. Testing Failures, as defined in each Building Enclosure Technical Sections (Divisions 03-13) and/or within this specification section. In event of test failure the [GC][CM][DB] shall provide the Owner with the following:

Installer/Manufacturer’s response in writing as to the cause of the failure and proposed resolution.

Installer/Manufacturer shall implement their proposed resolution on a representative sample of the product.

The [GC][CM][DB] coordinates and schedules re-testing by the BECxA that is reimbursed by the [GC][CM][DB]. This process is repeated until the test result(s) meets or exceeds the requirements of the contract documents and, at the discretion of the Owner, the remedial action taken will be implemented on a project-wide basis where applicable.

The Owner will determine whether a replacement of all identical units is required or if a repair is acceptable.

Upon acceptance, the responsible party shall replace or repair all identical items at their expense and shall extend the warranty accordingly.

Systemic or frequent failures may result in additional testing beyond originally identified to verify performance.

Based on the type of failure and the rate of frequency, the number of additional tests will be negotiated between the BECxA, the Owner, and the [GC][CM][DB].

* + - * 1. Cost of Retesting and/or Additional Testing:

[GC][CM][DB] is responsible for the cost of all re-tests and additional testing and compensation of time for BECxA and DP related to all additional work necessitated by re-testing or additional testing of specimens, if contractor or subcontractors are responsible for the deficiency. This cost shall be offset through the Owner via backcharge, not through a direct charge to the [GC][CM][DB]. If not responsible, cost recoveries for retesting will be negotiated with [GC][CM][DB]. Typically, one (1) new specimen in addition to the one (1) failed specimen will be tested as part of the retesting protocol. If additional failure are present, the Owner and BECxA may increase the retesting to up to [1x][2x] locations for the second failure and [\_\_\_\_\_][unlimited] locations for more than 3 failed tests.

END OF SECTION