

Attachment B

SECTION 070800 - COMMISSIONING OF THERMAL AND MOISTURE PROTECTION, AND ROOFING SYSTEMS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

- A. The intent of this Section is to require the Owner to provide a Building Envelope Commissioning Agency qualified in organizing, scheduling, and coordinating evaluation of building envelope systems specified in the Contract Documents.
- B. Related Sections:
 - 1. Division 7: Section "Thermal Insulation and Vapor Retarders"
 - 2. Division 7: Section "Modified Bituminous Membrane Roofing"
 - 3. Division 7: Section "Hot Fluid Applied Rubberized Asphalt Waterproofing"

1.3 SYSTEMS TO BE COMMISSIONED

- A. Sections of work to be commissioned include, but are not limited to all materials, assemblies, and systems of the Building Envelope that correspond to vapor retarder of the Gallery and Collection Storage Spaces (Wall and ceiling assembly), roof assemblies and hot fluid applied waterproofing systems.

1.4 COMMISSIONING TEAM

- 1. Owner (PM) and his/her consultants
- 2. General Contractor (GC or Contractor)
- 3. Designer and design engineers (particularly the architect and engineers – A/E)
- 4. Building Envelope Commissioning Agency (BECA)
- 5. Test Technician (TT) (as either trade quality control or BECA)
- 6. Building Envelope subcontractor and their sub-subcontractors (BESC)
- 7. Specialty subcontractors ((insert other relevant trades where applicable i.e., subcontractor, etc.))
- 8. Any other installing subcontractors or suppliers of materials or systems.

1.5 BUILDING SYSTEMS COMMISSIONING PROCESS

- A. The Owner shall include and itemize the cost of commissioning.

- B. The BECA will coordinate all activities of the building envelope commissioning process. Also, the BECA shall coordinate all submittals such that each appropriate commissioning team member timely receives necessary documents for their use.

C. BESC and Specialty Subcontractors: The commissioning responsibilities are applicable to each of the BESC and specialty sub-trades. Each of the aforesaid trades will participate, for the Construction and Acceptance phases, as follows:

1. Contractors and/or their subcontractors shall:
 - a. In each purchase order or subcontract written, include requirements for submittal data, commissioning documentation.
 - b. Attend a commissioning scoping meeting and other meetings necessary to facilitate the commissioning process.
 - c. Provide the BECA with Technical Data Sheets and shop drawing submittals of commissioned systems.
 - 1) The General Contractor, will determine if these submittals meet the requirements and requirements of the Contract Documents.
 - 2) Once the GC accepts (and stamps) these submittals, he will then forward these documents to the BECA, Designer and the Owner for their review.
 - d. Address current Designer and Owner punch list items before functional testing. Air, water and thermal testing shall be completed with discrepancies and problems remedied before functional testing of the respective air, water or thermal related building envelope/assemblies.
 - e. Provide manufacturer's certified technicians to be present at the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem solving.

1.6 MEETINGS

- A. Scoping Meeting: The BECA shall schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the BECA.
- B. Miscellaneous Meetings: Other meetings will be planned and conducted by the BECA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular contractors and their subcontractors. The BECA TT will plan these meetings and will minimize unnecessary time being spent by contractors and subcontractors. These meetings will be held as frequently as one per week or at least monthly,

1.7 REPORTING

- A. The BECA will forward reports to the Owner to be forwarded to the other members of the commissioning team as construction and commissioning progresses.
- B. The BECA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.

- C. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.
- D. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report.

1.8 PRE-FUNCTIONAL TEST CHECKLISTS

- A. The form at the end of the section is a sample of functional checklists of materials or assemblies included on this project. These checklists may be used in conjunction with manufacturers' checklists and instructions. Not all checklists for all materials or assemblies are included herewith. The TT shall make up any checklists required for equipment indicated to be commissioned. These sample checklists are included to serve as a minimum standard for checklists for all materials or assemblies identified for commissioning within this specification Section. The PM has the sole approval authority regarding content of any pre-functional and functional checklist. PM, at his/her discretion, may request input from the GC, BECA, TT and A/E regarding checklists content; therefore, the GC, BECA, TT and A/E will cooperate with the PM to produce detailed and comprehensive checklists.

1.9 FUNCTIONAL PERFORMANCE TESTING

- A. Objectives and Scope: The objective of functional performance testing is to demonstrate that each building envelope/assemblies system is functioning according to the documented design intent of the Contract Documents. Functional testing facilitates bringing the material assembly from a state of substantial completion to full operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the building envelope/assemblies.
- B. Development of Test Procedures: Before test procedures are written, the BECA will request all documentation and a current list of change orders affecting building envelope/assemblies, including an updated points list, and parameters. The TT or BECA shall develop specific test procedures and forms to verify and document proper operation of each piece of building envelope/assemblies. Each subcontractor or vendor responsible to execute a test shall provide assistance to the BECA in developing the procedures review (answering questions about, assemblies and sequences, etc.). Prior to execution, the TT or BECA will provide a copy of the test procedures to the General Contractor subcontractor(s) who will review the tests for feasibility, building envelope/assemblies, and warranty protection.
- C. Test Methods:
 1. Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance). The BECA may substitute specified methods or require an additional method to be executed, other than what was specified. The BECA will determine which method is most appropriate for tests that do not have a method specified.
 2. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
 3. Sampling: Multiple identical pieces of assemblies may be functionally tested using a sampling strategy. Significant application differences and significant sequence of functional differences in otherwise identical materials or assemblies invalidates their

common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by contractors and their subcontractors is allowed in pre-functional checklist execution.

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1.10 BUILDING ENVELOPE SYSTEM CONSTRUCTION CHECKLIST:

The following, in addition to use in commissioning the building envelope, will be used by the architect for observation of the mock-up and subsequent field observations. The architect's use of this form for these observations does not imply full time inspection of the general contractor's work or alleviate the contractor from their contractual obligations for a complete and continuous building envelope system.

Components Included:

- Substrate review
- Joint Sealant
- Structural connection plate preparation
- Insulation Installation
- Vapor Retarder installation

1. Submittal | Approvals

Submittal: The above components and systems integral to them are complete and ready for testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event as marked below, respective to each responsible contractor. This construction checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed.

| | |
|---|--------------|
| <u>Sealant Contractor:</u> | <u>Date:</u> |
| <u>Insulation Contractor:</u> | <u>Date:</u> |
| <u>Gypsum Board Ceiling Contractor:</u> | <u>Date:</u> |
| <u>Vapor Retarder Contractor:</u> | <u>Date:</u> |
| <u>General Contractor:</u> | <u>Date:</u> |

Construction checklist items are to be completed as part of installation and initial checkout, preparatory to functional testing.

- This checklist does not take the place of the manufacturer's recommended checkout and installation procedures or reporting requirements.
- Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others)
- Contractor's assigned responsibility for sections of the checklist shall be responsible to see that the checklist items by their subcontractors are completed and checked off.
- Abbreviations of responsible party to verify completion of the work.
 - "Contr." contractor
 - A|E: Architect | Engineer
 - All: All Contractors
 - CxA: Commissioning Agent
 - GC: General Contractor
 - SC: Sealant Contractor

Approvals: This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below:

Commissioning Agent: _____ Date: _____

Owner Representative: _____ Date: _____

2. Requested documentation submitted (filled out by CxA)

| Building Envelope Component: | Sealants | Insulation | Vapor Retarder | Paint Systems (for structural steel) |
|--|-----------------|-------------------|-----------------------|---|
| Manufacturer's Cut sheets | | | | |
| Installation details | | | | |
| Manufacturer's requirements | | | | |
| Shop drawings showing attachment details | | | | |
| Shop drawings showing substrate supporting building envelope system | | | | |
| Shop drawings showing adjacent work | | | | |
| Shop drawings showing conflicts and unknown field conditions | | | | |
| Architect of record has reviewed installation to see that placement is consistent with original design | | | | |

Documentation complete per contract documents for given trade:

- Yes
- No

3. Installation Checksheet (filled out by the contractor and used by the architect for observations)

Location: _____ From grid line: _____ to grid line: _____

| Building Envelope Component: SUBDRAINAGE SYSTEM | <u>Contractor</u> | <u>Comments</u> |
|--|--------------------------|------------------------|
| Substrate Preparation | | |
| <ul style="list-style-type: none"> Confirm trenches for lateral drains are located as indicated on the plans and are the correct depth. | | |
| <ul style="list-style-type: none"> Confirm Geotextile filter fabric fully lines the bottom of the trench and excavation | | |
| Drainage Aggregate Installation: <ul style="list-style-type: none"> Confirm installation is free from sharp that aggregate that risks puncturing the surrounding membranes. Confirm specified depth is installed below PVC Drainage Pipe | | |
| Perforated PVC Drainage Pipe Installation: Confirm pipe is installed as specified with perforation facing down. | | |
| Sand Bed Installation: <ul style="list-style-type: none"> Assure sand bed is installed to specified thickness and is level for installation of waterproof membrane. | | |
| Waterproof membrane installation <ul style="list-style-type: none"> Confirm is installed free of tears or tears are patched as required by manufacturer. Confirm seams are properly lapped and taped. Confirm membrane is terminated as detailed. Confirm membrane is properly protected from damage from installation of adjacent systems. | | |
| Post installation (Prior to slab pour) | | |
| Inspect all length of the pipe with a camera. The film should clearly state the location of each length pipe that is filmed prior and after the video clip. Coordinate pipe descriptions with plan diagram to be transmitted with video. | | |
| Provide copies of video and DVD copies to the architect Owner GC | | |

4. Installation Checklist (filled out by the contractor and used by the architect for observations)

Location: _____ From grid line: _____ to grid line: _____

| Building Envelope Component: | <u>Contractor</u> | <u>Comments</u> |
|--|--------------------------|------------------------|
| Blindside Foundation and under slab Waterproofing System | | |
| General Installation | | |
| <ul style="list-style-type: none"> Assure continuity between under slab waterproofing system and foundation waterproofing system. | | |
| Under slab waterproofing system | | |
| <ul style="list-style-type: none"> Confirm sand bed is free of debris prior to installation under slab waterproofing. | | |
| <ul style="list-style-type: none"> Confirm joints in waterproofing are lapped per manufacturer's recommendation. | | |
| Foundation Substrate Preparation | | |
| <ul style="list-style-type: none"> Assure lagging is free of debris and protrusions and has been approved by the manufacturer for installation of Self-Adhering Waterproofing | | |
| Foundation Drain Installation | | |
| <ul style="list-style-type: none"> Confirm foundation drain system is installed in gravel bed free of debris and with perforated opening in correct orientation. | | |
| Insulation installation | | |
| <ul style="list-style-type: none"> Assure insulation is installed with drainage surface with the correct orientation | | |
| <ul style="list-style-type: none"> Assure insulation is fully anchored and that joints are installed tightly. | | |
| Water Proof Membrane installation | | |
| <ul style="list-style-type: none"> Assure connections through waterproofing are waterproofed as per manufacturer's and architect's details | | |
| <ul style="list-style-type: none"> Assure joints are lapped per manufacturer's and architect's details | | |
| <ul style="list-style-type: none"> Assure connection to plaza waterproofing system is continuous and is in compliance with architect's details. | | |

| | | |
|---|--|--|
| Protection | | |
| <ul style="list-style-type: none"> • Confirm membrane is properly protected during the installation of formwork prior to pouring of foundation walls. | | |
| <ul style="list-style-type: none"> • Review concrete installation procedures and initial installation to prevent damage to waterproofing installation. | | |

| Building Envelope Component: Two sided form Foundation Waterproofing System | <u>Contractor</u> | <u>Comments</u> |
|--|--------------------------|------------------------|
| General Installation | | |
| <ul style="list-style-type: none"> Assure continuity between under slab waterproofing system and foundation waterproofing system. | | |
| Substrate Preparation | | |
| <ul style="list-style-type: none"> Assure foundation is free of debris and protrusions and has been approved by the manufacturer for installation of Self-Adhering Waterproofing | | |
| Foundation Drain Installation | | |
| <ul style="list-style-type: none"> Confirm foundation drain system is installed in gravel bed free of debris and with perforated opening in correct orientation. | | |
| Insulation installation | | |
| <ul style="list-style-type: none"> Confirm Geotextile Membrane and insulation are installed to extents indicated and without gaps. | | |
| Water Proof installation | | |
| <ul style="list-style-type: none"> Confirm continuous installation along perimeter of foundation. Confirm continuous tie-ins plaza waterproofing system. Confirm continuous tie-in with blindside waterproofing system. (Review computability documents between systems). | | |
| Protection | | |
| <ul style="list-style-type: none"> Assure waterproofing is protected prior to installation of waterproofing. | | |
| Backfill Compaction | | |
| <ul style="list-style-type: none"> Backfill to be installed in specified lifts with specified compaction | | |

5. **Installation Checksheet (filled out by the contractor and used by the architect for observations)**

6. Location: _____ From grid line: _____ to grid line: _____

| Building Envelope Component: | <u>Contractor</u> | <u>Comments</u> |
|--|--------------------------|------------------------|
| Plaza Assembly | | |
| General Installation | | |
| <ul style="list-style-type: none"> Assure continuity with foundation waterproofing systems | | |
| Substrate Preparation | | |
| <ul style="list-style-type: none"> Assure slab is free of debris and protrusions and has been approved by the manufacturer for installation of Waterproofing systems. | | |
| Hydrotech or similar Water Proof Membrane installation | | |
| <ul style="list-style-type: none"> Confirm complete installation of all layer waterproofing systems | | |
| Water Test (to be completed 7-10 days prior to installing the topping slab). | | |
| <ul style="list-style-type: none"> Observe results of water test | | |
| Insulation installation | | |
| <ul style="list-style-type: none"> Confirm insulation is installed tightly fit and lapping | | |
| | | |
| Protection Membrane Installation | | |
| <ul style="list-style-type: none"> Assure membrane is protected at all times during the installation. | | |

7. Installation Checksheet (filled out by the contractor and used by the architect for observations)

Location: _____ From grid line: _____ to grid line: _____

| Building Envelope Component: <u>EXTERIOR WALL ASSEMBLY</u> | <u>Contractor</u> | <u>Comments</u> |
|---|--------------------------|------------------------|
| General Installation | | |
| Building envelope component completed and cleaned per contract documents | | |
| Substrate Preparation | | |
| Exterior wall substrate is clean and free of debris and protrusions | | |
| Insulation installation | | |
| First layer properly and securely mechanically fastened | | |
| First layer of insulation tightly fit to minimize air infiltration between joints | | |
| Second layer properly lapped over exterior layer of insulation (joints do not align with first layer) and adhered over first layer, to minimize air infiltration between joints | | |
| Surface reviewed and smooth from protrusions that may damage the vapor retarder or inhibit the installation. | | |
| Vapor retarder installation | | |
| Head and sill details: deflection @ head properly draped | | |
| Joint Seals Protection: Joints are completely taped | | |
| Protection | | |
| Vapor Retarder is properly protected from damage from installation of adjacent systems. | | |

8. Installation Checksheet (filled out by the contractor and used by the architect for observations)

Location: _____ From grid line: _____ to grid line: _____

| Building Envelope Component: CEILING ASSEMBLY | <u>Contractor</u> | <u>Comments</u> |
|--|--------------------------|------------------------|
| General Installation | | |
| Building envelope component completed and cleaned per contract documents | | |
| Substrate Preparation (Precast Roof Panels) | | |
| Precast ceiling substrate cleaned in accordance with sealant manufacturer's written project requirements and prepared for new sealant. Required field adhesion verification tests completed. | | |
| Backer rod and sealant installation complete and thorough | | |
| Precast connection plates cleaned and repainted | | |
| Above ceiling systems have been inspected and tested prior to installing the gypsum board suspension system (to prevent ongoing access above the ceiling system) | | |
| Gypsum Board Suspension System and Drywall Installation | | |
| Suspension system is stable and free from sway | | |
| Substrate is installed flush, fasteners are countersunk (to prevent any obstructions that be inhibit good adhesion or installation) | | |
| Vapor retarder installation | | |
| Joints are lapped fully taped and sealed (tape is smooth and free from bumps and ripples) | | |
| Corner condition and interface with wall system | | |
| Head and sill details: deflection @ head properly draped | | |
| Penetrations | | |
| Vapor barrier and penetrations are properly installed at all penetrations | | |
| Protection | | |
| Vapor Retarder is properly protected from damage from installation of adjacent systems. | | |

9. BUILDING ROOFING SYSTEM CONSTRUCTION CHECKLIST:
Installation Checksheet (filled out by the contractor and used by the architect for observations)

Location: _____ From grid line: _____ to grid line: _____

| Building Envelope Component: <u>ROOF ASSEMBLY</u> | <u>Contractor</u> | <u>Comments</u> |
|---|--------------------------|------------------------|
| General Installation | | |
| Building envelope component completed and cleaned per contract documents | | |
| Substrate Preparation | | |
| | | |
| Vapor retarder installation | | |
| | | |
| Insulation installation | | |
| First layer properly and securely mechanically fastened | | |
| First layer of insulation tightly fit to minimize air infiltration between joints | | |
| Second layer properly lapped over exterior layer of insulation (joints do not align with first layer) and adhered over first layer, to minimize air infiltration between joints | | |
| Surface reviewed and smooth from protrusions that may damage the vapor retarder or inhibit the installation. | | |
| | | |
| Finished Surface Installation | | |
| | | |
| | | |
| | | |

END OF SECTION 070800