
SECTION 07 08 00
FACILITY EXTERIOR CLOSURE COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. The requirements of this Section apply to all sections of Division 04, Division 07 and Division 08.
2. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Construction Manager is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. A Commissioning Agent (CxA) appointed by the VA will manage the commissioning process.
3. This specification is for bid package number 6. Buildings 01 to 08

1.2 RELATED WORK

A. Related Specification sections

1. Section 01 00 00 General requirements
2. Section 01 43 39 Mockups
3. Section 01 45 29 Testing laboratory Services
4. Section 01 91 00 General commissioning requirements
5. Section 04 20 00 Unit Masonry
6. Section 04 05 13 Masonry Mortaring
7. Section 04 05 16 Masonry Grouting
8. Section 07 18 13 Fluid-Applied Roofing
9. Section 07 21 29 Sprayed Polyurethane Foam insulation and & Air/ Vapor Barrier
10. Section 07 27 30 Air Weather Barrier (AWB)
11. Section 07 42 15 Insulated-Core Metal Panels
12. Section 07 52 16 Styrene-Butadiene-Styrene Modified Bituminous Membrane Roofing
13. Section 07 54 23 Thermoplastic Polyolefin (TPO) Roofing
14. Section 07 92 00 Joint Sealants
15. Section 08 11 13 Hollow Metal Doors and Frames
16. Section 08 42 29 Automatic Sliding Entrance Doors
17. Section 08 44 13 Glazed Aluminum Curtain Walls

B. Enclosure Testing Matrix (attached as Appendix D)

C. Pre Functional Checklist (attached as Appendix A)

D. Functional Performance Tests (attached as Appendix B)

E. Contractor and Vendor Field Test Report Documentation (Appendix C)

F. Contractor QA/QC Testing reports.

G. Close-out documentation including O&M Manuals.

H. Reference Codes and Standards

1. AAMA 501.1
2. AAMA 501.4
3. AAMA 501.5
4. AAMA 503.8
5. AAMA 502-02
6. AAMA 503-03
7. AAMA 508-05
8. ASTM C1193, Appendix X1
9. ASTM C1521, Method A
10. ASTM C1601
11. ASTM E283
12. ASTM E331
13. ASTM E783
14. ASTM E1105
15. ASTM E1186
16. ASTM E779
17. ASTM E2420
18. ASTM C1153
19. ASTM C1060
20. ASTM E2357
21. ASTM D4263
22. ASTM D4263
23. ASTM 3359

1.3 DESCRIPTIONS

- A. This Section includes requirements for commissioning the Facility exterior closure, related subsystems and related equipment. This Section supplements the general requirements specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
- B. The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.
- C. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members

1.4 DEFINITIONS

- A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions. COMMISSIONED SYSTEMS
- B. Commissioning of a system or systems specified in Division 04, Division 07 and Division 08 is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.
- C. The following Facility exterior closure systems will be commissioned:
 - 1. Slabs and Foundations (Waterproofing)
 - 2. Exterior Vertical Surfaces (Masonry, Metal panels, Sealants (Caulking, mechanical seals, and wind and vapor barriers) and EIFS)
 - 3. Wall Openings:
 - a. Exterior Doors (Revolving, glass leaf, emergency exit, and service)
 - b. Curtain Wall Systems (Mullions, glazing, and sealing)
 - 4. Roofs (modified bituminous, fluid-applied, flashing & sheet metal, roof specialties, and roof accessories)
 - 5. Envelope and Room Leakage

1.5 SUBMITTALS

- A. The commissioning process requires review of selected Submittals. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.
- B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 FUNCTIONAL PERFORMANCE TESTING EQUIPMENT AND INSTRUMENTS

- A. The VA will hire a third-party testing company to provide all tools, plastic wrap, test chambers, tape, water pumps, hoses, instruments, laptop computers, PDA's, software programs and services required to perform all referenced testing standards listed with in this specification or on the testing matrix. This includes providing the connection to systems to be tested, operation of the test equipment & instrumentation and generating test results as required. If there is a conflict between this specification and other specifications the greater number of tests shall need to be priced and executed.

- B. Clark McCarthy to provide the following items, as required by the tests listed below, for the third-party testing company use.
 - 1. Scaffolding
 - 2. Water source or tank with in 100' of the testing chamber, sized to provide the specified pressures.
 - 3. Power for the testing agency equipment. Min. 120volt 20 amps dedicated circuit with in 20' of the test chamber.
 - 4. Construction of the testing chambers.

3.2 PRE-FUNCTIONAL CHECKLISTS

- A. The installation system contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation are complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent will spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.3 CONTRACTORS TESTS

- A. Contractor tests as required by other sections of Division 03, 04, 07 or Division 08 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS.

3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:

- A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance. The Construction Manager shall review and comment on the tests prior to approval. The VA's Third Party Testing Agency shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document some of the testing. The Construction Manager shall sign the test reports to verify tests were performed.
- B. One test, for each system listed on the Enclosure Testing Matrix, needs to take place after the installation of the first system. Moreover, at least one test needs to be performed, per system, prior to completing 10% of the installation, also at least two tests need to be performed prior to completing 30% and 50% of each systems installation.

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- C. The Third Party testing firm hired by the VA shall test the buildings to the performance level as identified below:

I. Exterior Vertical Surfaces

- a. All percentages indicated need to be performed per each exposure of each building.
- b. ASTM E1105 – 5% Insulated Metal wall panels– at minimum two areas per building need to be tested, The test area needs to be 15 feet wide by one story in height.
- c. AAMA 501.2 - Test 5% of interfaces with adjacent construction of total length of all metal wall panel joints and perimeters, including interfaces with adjacent construction.
- d. Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521-
 - 1) Perform 5 tests for first 300 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
 - 2) Perform one test for each 600 m (2000 feet) of joint length thereafter or one test.
 - 3) Total test should be 500 tests
 - 4) See specification section 07 92 00 for more information.

II. Wall Openings

- a. Test chambers and spray racks need to be at least 10% larger than the opening being tested.
- b. All percentages indicated need to be performed per each exposure of each building.
- c. ASTM E783, ASTM E1186, ASTM E1105 for Windows, doors, Curtain walls
Test 5% of total area of each Window/Door/Curtain wall section The test area needs to be 15 feet wide by one story in height.
- d. Penetrations and Interfaces
Test 2% of total penetrations
- e. AAMA 501.2 – Curtain wall Joints - Test 5% interfaces with adjacent construction of total length of all I joints and perimeters, including interfaces with adjacent construction.
- f. AAMA 502-02 Method A for Flashing, End Dams, Sills, Sub frames/receptors system and Sill Pans – 60 test total
 - 1)Test 2% Total number of end Dams and sills
 - 2)Test 2% total lineal feet of flashing
 - 3)Test 100% of the first 10% of installed sills
 - 4)Test 100% of the first 10% of flashing lap joints and end dams

III. Roofing

- a. ASTM E 907 and ASTM 2420 - test 1% of total roof area per building
- b. ASTM C1153 test 100% the surface area

IV. Envelope and Room Leakage test

- a. ASTM E779- Test 2 floors in each building.

Testing procedure should include:

- a) One to two days of preparation and testing by a team of individuals, per floor.
- b) On the first evening before the actual test, Infra-red scanning will be performed under pressurized and depressurized building modes. It is preferable that the building be unoccupied during the preparation and test (possibly a weekend), since some exits may be blocked, and mechanical ventilation systems shut down.
- c) The team will start by meeting with building owner, contractor, and commissioning staff to review the building and building drawings, and beginning to prepare the floor. Preparations should include wedging open all interior doors in open position in order to equalize the pressure on the exterior enclosure (pressure boundary) of the building; closing exterior doors, windows and mechanical system vents and openings; and assuming control over the status of mechanical systems. Sealing all opening to other floors (confirm items to be sealed with CxA). The air leakage testing will be done with large blowers and fans, temporarily installed in exit stair doors or exterior doors, to pressurize or depressurize the building. The test procedures will be based on Enclosure Testing Matrix.

- b. ASTM C1060, C1153, and E1186 – Test 100% of the Building Envelope: Insulation at wall and roof plus air barrier. Provide thermo-graphic building survey (thermal imaging) of completed wall and roofing systems following.

1) Survey to evaluate locations, consistency, and relative state of dryness of insulation, missing insulation, and potential leak sources for water and air, if any. Furnish report of survey which includes photographs, data, and analysis of each area of survey. Verify minimum temperature differential required (normally 40 degrees F). Intervals as follows:

- d) Exterior Walls: 2 tests, One Prior to Substantial Completion and One after building enclosure with exterior walls completed and permanent HVAC system operating.
- e) Roof: One test within 2 months of completion of roof including after building enclosure with exterior walls completed.

- D. Acceptance criteria will be in accordance with the manufactures, AAMA, ASTM or specified allowances. In the event of any conflict between the other Contract Documents and the Foregoing minimum criteria, the more stringent shall govern.

1. Test pressures for the Wall Assemblies

- a. Shall be 6.24 per square foot, 2/3 of the greatest positive test pressure specified for the applicable wall assembly, or that specified in the Contract Documents, whichever is greater.
- b. Leakage rate allowed = .06 cfm/ft sq at 6.24 psf of glazing, roof and wall area.
- c. No water should penetrate the interior side of the air/water barrier plane at 20 psf test pressure.
- d. AAMA 501.4 – 1.5x horizontal design displacement distance.

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- e. ASTM E 779- Air leakage rate of the building envelope does not exceed 0.25CFM/sf at a pressure differential of .3 in wag (75 Pa)
 2. Failure of On-Going Building Enclosure Field Testing -
Upon failure of a test during on-going building enclosure testing,
 - a. Stop testing and find out the cause of the failure.
 - b. Determine if this failure was a isolated incident or effects more than one system area.
 - c. After repairs have been made to all similar systems then increases the sample rate from the initial sample rate to two and one-half (2-1/2) times the initial sample rate. Therefore if the initial sample rate is 2%, the new sample rate would be 5%. The new sample rate would continue until three (3) subsequent tests groups pass, and then would revert to the initial sample rate. Upon a failure of a test at the increased sample rate, the sample rate increases to three (3) times the increased sample rate.
 - 1) The new sample rate would continue until three (3) subsequent test groups pass, and then would revert to the previous sample rate.
 - 2) Each additional failure would increase the sample rate three (3) times the previous sample rate, up to a 100% sample rate. Each new sample rate would continue until three (3) subsequent test groups pass, and then would revert to the previous sample rate.
 3. All costs associated with increased sample rates will be the responsibility of construction manager. These increased costs will include increased Commission Agent's costs.

E. TEST REPORTS

1. Provide copies of all reports required per set forth in the referenced test procedure, for review.
2. Provide the information listed below in addition to the requirement in item 1.
 - a. Report the following information for ASTM E 783: (04 20 00 - Unit Masonry, 08 44 13 - Glazed Aluminum Curtain Wall, 081113 - Hollow Metal Doors, and 08 42 29.23 - Automatic Sliding Entrance Doors)
 - 1) Testing agency, requester of test, date and time of test, date of report, identification, and location of building.
 - 2) Test specimen description.
 - 3) Detailed drawings of the specimen (if available).
 - 4) Sampling procedures.
 - 5) Test parameters.
 - 6) Ambient test conditions.
 - 7) Pressure differences and Leakage.
 - b. Report the following information for ASTM E 1186: (04 20 00 - Unit Masonry, 08 44 13 - Glazed Aluminum Curtain Wall, 081113 - Hollow Metal Doors, and 08 42 29.23 - Automatic Sliding Entrance Doors [and Envelope Air Tightness Test])
 - 1) Testing agency, requester of test, date and time of test, date of report, identification, and location of building.
 - 2) Test specimen description.
 - 3) Detailed drawings of the specimen (if available).
 - 4) Sampling procedures.
 - 5) Test parameters.
 - 6) Ambient test conditions.
 - 7) The direction of movement of the smoke trace.

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- c. Report the following information for ASTM E1105: (04 20 00 - Unit Masonry, 08 44 13 - Glazed Aluminum Curtain Wall, 081113 - Hollow Metal Doors, and 08 42 29.23 - Automatic Sliding Entrance Doors)
- 1) Testing agency, requester of test, date and time of test, date of report, identification, and location of building.
 - 2) Test specimen description.
 - 3) Detailed drawings of the specimen (if available).
- d. Sampling procedures.
- 1) Test parameters.
 - 2) Test conditions.
 - 3) Test results.
 - 4) Compliance statement.
- e. Report the following information for ASTM E1601: (Water Penetration Test)
- 1) The project name and address of the building;
 - 2) Date, time, and temperature during the test;
 - 3) Dates and results of previous tests of same area, if applicable;
 - 4) Name(s) and address(es) of individual(s) performing the test;
 - 5) Description of the construction of the area tested including surface coatings, masonry type, wall assembly structural system, condition of the masonry surface, chamber location including elevation, floor level and position relative to wall ends or openings in the structure, and repairs performed prior to each test; (NOTE — Examples of masonry surface conditions include presence of cracks, deteriorated units, and so forth.)
 - 6) Description of chamber construction and attachment to wall;
 - 7) Statement of test conditions as applicable;
 - 8) Record of observations
 - 9) fracture surface penetration recommendations for the system
 - 10) Results of calculations and graphs
- f. Report the following information for ASTM 779: (Envelope Air Tightness Test)
- 1) Building description, including location, address (street, city, state or province, zip or postal code, country, and elevation [above mean sea level in m (ft)]).
 - 2) Construction, including date built (estimate if unknown), floor areas for conditioned space, attic, basement, and crawl space, and volumes (optional) for conditioned spaces, attic, basement, and crawl space.
 - 3) Condition of openings in building envelope including:
 - 4) Doors, closed, locked or unlocked;
 - 5) Windows, closed, latched or unlatched;
 - 6) Ventilation openings, dampers closed or open;
 - 7) Chimneys, dampers closed or open
 - 8) Statement whether the test zone is interconnected with at least door-sized openings. If not, the results of pressure measurements between portions of the zone.
 - 9) HVAC system, including the location and sizes of ducts that penetrate the test zone envelope.
 - 10) Procedure, including the test equipment used (manufacturer, model, serial number), and calibration records of all measuring equipment.
 - 11) Measurement data, including:
 - 12) Fan pressurization measurements (inside-outside zero flow building pressure differences);

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- 13) Inside and outside temperature (at start and end of test) and the product of the absolute value of the indoor/outdoor air temperature difference multiplied by the building height;
 - 14) Tabular list of all air leakage measurements and calculations;
 - 15) Time, building pressure difference, air density, nominal airflow rate, fan airflow rate, and air leakage rate;
 - 16) Deviations from standard procedure.
 - 17) Optional data, including wind speed/direction and whether wind speed is estimated to exceed 0 to 2 m/s (0 to 4 mph).
- g. Calculations, including:
- 1) The leakage coefficient and pressure exponent for both pressurization and de-pressurization;
 - 2) The effective leakage area. Also, report if a reference pressure other than 4 Pa is used; and,
 - 3) An estimate of the confidence limits.
- h. Report the following information for ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521 (07 92 00 - Joint Sealants)
- 1) Record test conditions and results for each procedure on an appropriate form.
 - 2) Each joint is unique, and as such requires that the procedures described in this method be subjectively applied and/or modified for each test.
 - 3) Retain the sealant samples in a sealed plastic bag, labeled with the location from which sample was taken, date removed, results from the method and project identification. These samples should be stored in a secure location for the duration of the warranty period.
 - 4) Accurate recording of the location, description of the sealant anomalies as they are observed is important.
 - 5) There is no one single procedure that is most appropriate for all projects, therefore an effective method needs to be selected for each project.
 - 6) Use of the shop (submittal) and/or architectural drawing, to notate pertinent data has proven reliable on some projects.
 - 7) When the inspection is complete, a photograph of the joint and associated masking tape can be of value. It is important that the photograph be of good quality so that the markings can be clearly read. This is true for both destructive and non-destructive test.

E. TRAINING OF VA PERSONNEL

- F. Clark McCarthy shall provide training of the VA operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the VA Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 21 Sections for additional Contractor training requirements.

F. ATTACHMENTS

1. APPENDIX

A. PRE-FUNCTIONAL CHECKLISTS

- a. 034500-01 Precast Architectural Concrete
- b. 042000-01 Brick Masonry
- c. 071113-01 Bituminous Water Vapor Retarders
- d. 074215-01 Insulated Core Metal Wall Panels
- e. 074243-01 Composite Panels
- f. 074615-01 Manufactured Metal Siding
- g. 075216-01 Modified Bituminous Membrane Roof
- h. 075423-01 Thermoplastic Polyolefin (TPO) Roof
- i. 076000-01 Flashing
- j. 081113-01 Metal Doors and Frames
- k. 084413-01 Glazed Aluminum Curtain Walls
- l. 088853-01 Security Glazing

B. FUNCTIONAL PERFORMANCE TESTS

- a. ASTM C 1521-09 & C 1193-09 Sealant Joint test
- b. ASTM E1601: Determining Water Penetration
- c. ASTM E779, C1060 & E1186: Determining Air Leakage Rate by Fan Pressure
- d. ASTM E1105, E1186 & E783: Determining Water & Air Leakage
- e. ASTM E907: Adhered Membrane
- f. ASTM F2420: Humidity in Concrete

C. FIELD TEST REPORT**D. ENVELOPE TESTING MATRIX**

END OF DOCUMENT

APPENDIX A**CHECKLISTS**

VA – 088853-01	Structural Sealant Glazing Checklist
VA – 042000-01	Brick Masonry
VA – 071113-01	Bituminous Water Vapor Retarders
VA – 074215-01	Insulated Core Metal Wall Panels Checklist
VA – 074243-01	Composite Panels Checklist
VA – 074615-01	Manufactured Metal Siding Checklist
VA – 075216-01	Modified Bituminous Membrane Roof Checklist
VA – 075423-01	Thermoplastic Polyolefin (TPO) Roof Checklist
VA – 076000-01	Flashing
VA – 081113-01	Metal Doors, Hardware and Frames
VA – 084413-01	Glazed Aluminum Curtain Walls Checklist

PROJECT: VA - SLVHCS Replacement Medical Center Project
PROJECT NUMBER: VA 629HS2401
REPORT ID: VA 088853-01

EQUIPMENT DESCRIPTION: Structural Sealant Glazing - Aluminum Curtain Wall

MANUFACTURER: _____ MODEL NO: _____
TAG NO: _____ SERIAL NO: _____
LOCATION: _____ AREA SERVED: _____

This Construction Checklist is used during the Commissioning Process to insure the correct equipment is delivered, installed and properly started in preparation for Functional Testing of related building systems. This checklist does not take the place of the Manufacturer's recommended checkout and startup procedures.

This Checklist is divided into 4 Sections and is to be completed by the Contractor in 4 separate steps. As each Section is completed the Contractor shall post the form to the project FTP site or electronic project management software, also the contractor should mail, fax or e-mail the completed Section(s) to the Commissioning Authority at this address:

Jacobs Engineering

525 West Monroe, 2nd Floor
Chicago, IL 60661

Attn: David Meyers c/o Tina Benitez

Phone: 314.210.2735

Fax: 312.384.6369

E-mail: david.meyers@jacobs.com

When completing each Section, be sure to check and initial EACH line item as being completed. Immediately notify the Commissioning Authority and VA Resident Engineer any item be checked incomplete or there be any question regarding the level of completeness. Each Section's items must ALL be checked complete and initialed before the form is mailed to the Commissioning Authority.

SECTION 1 – EQUIPMENT DELIVERY:

The Contractor shall complete Section 1 of this form when the equipment is delivered to the site. The purpose is to record the actual design parameters listed below along with the checklist items as indicated. Should there be any discrepancy between the Actual and the Submitted information, or any item be checked incomplete, the Contractor shall immediately notify the Commissioning Authority and VA Resident Engineer.

DESIGN PARAMETERS:

Parameter	Designed	Submitted	Actual
XXX			

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All related submittals reviewed by A/E and approved by VA
_____	Yes / No	Have all calculations etc related to Structural Sealant been provided and sealed by Structural Engineer
_____	Yes / No	Mock up completed and approved
_____	Yes / No	Are all Glazed Aluminum Curtain Wall & Structural Sealants etc clearly selected and locations clearly marked on the drawings
_____	Yes / No	Are the Structural Sealant Glazing/Aluminum Curtain Wall connections clear
_____	Yes / No	Has weather protection been provided as needed

COMMENTS:

Submitted By: _____ Date: _____

SECTION 2 – EQUIPMENT INSTALLATION:

The Contractor shall complete Section 2 of this form when the installation of the equipment is being performed. The purpose of this Section is to insure the equipment is installed to the Project Design and the Manufacturer’s recommendations. Immediately notify the Commissioning Authority and VA should any item be checked incomplete.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All quality assurance testing complete and reports submitted
_____	Yes / No	O&M and warranty data provided to Cx Authority and VA Resident Engineer.
_____	Yes / No	All openings examined and approved. Curtain Wall framing units installed Plumb and true and proper alignment. All unsatisfactory conditions regarding opening dimensions checked, and installation tolerances have been corrected
_____	Yes / No	All Curtain Wall members and connection locations inspected, and approved by Glazier prior to install.
_____	Yes / No	Installer inspected Glazing Materials for proper edge finishes, defects or damage. Appropriate sealant are provided and are compatible with all components
_____	Yes / No	Glazing surfaces prepared in accordance with GANA-02 Sealant Material.
_____	Yes / No	Required setting blocks/paper shims have been places in the frames per Specifications and Manufacturer’s Recommendations.
_____	Yes / No	Surfaces primed per sealant Manufacturer’s recommendations..
_____	Yes / No	Glazing, Spandrel Panels and structural sealant installed per Manufacturers Recommendations and approved submittals
_____	Yes / No	Install Structural Sealant per Manufacturers Recommendations.
_____	Yes / No	Tool Sealant or wipe surface smooth per Manufacturers Recommendations

COMMENTS:

Submitted By: _____

Date: _____

SECTION 3 – EQUIPMENT START-UP:

The Contractor shall complete Section 3 of this form during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified of construction progress
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified to schedule testing per Specifications on completed systems

COMMENTS:

Submitted By: _____ Date: _____

SECTION 4 – NOTIFICATION FOR TESTING:

This piece of equipment is properly installed and is operational and ready for performance testing.

COMMENTS:

Submitted By: _____ Date: _____

PROJECT: VA - SLVHCS Replacement Medical Center Project
PROJECT NUMBER: VA 629HS2401
REPORT ID: VA 042000-01

EQUIPMENT DESCRIPTION: Brick Masonry

MANUFACTURER: _____ MODEL NO: _____

TAG NO: _____ SERIAL NO: _____

LOCATION: _____ AREA SERVED: _____

This Construction Checklist is used during the Commissioning Process to insure the correct equipment is delivered, installed and properly started in preparation for Functional Testing of related building systems. This checklist does not take the place of the Manufacturer's recommended checkout and startup procedures.

This Checklist is divided into 4 Sections and is to be completed by the Contractor in 4 separate steps. As each Section is completed the Contractor shall post the form to the project FTP site or electronic project management software, also the contractor should mail, fax or e-mail the completed Section(s) to the Commissioning Authority at this address:

Jacobs Engineering

525 West Monroe, 2nd Floor

Chicago, IL 60661

Attn: David Meyers c/o Tina Benitez

Phone: 314.210.2735

Fax: 312.384.6369

E-mail: david.meyers@jacobs.com

When completing each Section, be sure to check and initial EACH line item as being completed. Immediately notify the Commissioning Authority and VA Resident Engineer should any item be checked incomplete or there be any question regarding the level of completeness. Each Section's items must ALL be checked complete and initialed before the form is mailed to the Commissioning Authority.

SECTION 1 – EQUIPMENT DELIVERY:

The Contractor shall complete Section 1 of this form when the equipment is delivered to the site. The purpose is to record the actual design parameters listed below along with the checklist items as indicated. Should there be any discrepancy between the Actual and the Submitted information, or any item be checked incomplete, the Contractor shall immediately notify the Commissioning Authority and VA Resident Engineer.

DESIGN PARAMETERS:

Parameter	Designed	Submitted	Actual
XXX			

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All related submittals reviewed by A/E and approved by VA
_____	Yes / No	Mock up completed and approved
_____	Yes / No	Are all masonry units (sizes, types and colors), mortars and grouts clearly selected and locations clearly marked on the drawings
_____	Yes / No	Are the masonry connections clear
_____	Yes / No	Are movement joints clearly detailed and located
_____	Yes / No	Is everything clear with anchor bolts, rebar, bond beams, grouting, lintels and flashing.
_____	Yes / No	Has the weather protection been provided
_____	Yes / No	Has the joints pointed per specifications

COMMENTS:

Submitted By: _____ Date: _____

SECTION 2 – EQUIPMENT INSTALLATION:

The Contractor shall complete Section 2 of this form when the installation of the equipment is being performed. The purpose of this Section is to insure the equipment is installed to the Project Design and the Manufacturer’s recommendations. Immediately notify the Commissioning Authority and VA should any item be checked incomplete.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All quality assurance testing complete and reports submitted
_____	Yes / No	O&M and warranty data provided to Cx Authority and VA Resident Engineer.
_____	Yes / No	Supports and openings examined and approved. All unsatisfactory conditions regarding installation tolerances have been corrected
_____	Yes / No	Hollow metal frames are securely braced to specified tolerances.
_____	Yes / No	Frames installed level, plumb, and square. Frames are secured according to specification depending on adjacent wall material.
_____	Yes / No	Has the work been covered every night
_____	Yes / No	Has mortar Smears and Dropping been removed
_____	Yes / No	Has the wall had time to cure
_____	Yes / No	Anchors are properly installed
_____	Yes / No	Flashing and weeps are installed per the Contract Documents. Cavity weep tubes are installed at sills, angles, door and window heads, and imbed joints.
_____	Yes / No	Brick is installed plum (1/4" in 10' or 3/8 per floor, no more than 1/2 from base to roof)
_____	Yes / No	Control Joints are installed per Contract Documents
_____	Yes / No	Weep holes are open and free of debris
_____	Yes / No	Joints are completely filled with sealant
_____	Yes / No	Sealant has cured according to manufacturer’s recommendations

COMMENTS:

Submitted By: _____

Date: _____

DRAFT

SECTION 3 – EQUIPMENT START-UP:

The Contractor shall complete Section 3 of this form during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	Cx Authority and VA Resident Engineer.have been notified of construction progress
_____	Yes / No	Cx Authority and VA Resident Engineer.have been notified to schedule air infiltration tests on completed systems

COMMENTS:

Submitted By: _____ Date: _____

SECTION 4 – NOTIFICATION FOR TESTING:

This piece of equipment is properly installed and is operational and ready for performance testing.

COMMENTS:

Submitted By: _____ Date: _____

PROJECT: VA - SLVHCS Replacement Medical Center Project
PROJECT NUMBER: VA 629HS2401
REPORT ID: VA 071113-01

EQUIPMENT DESCRIPTION: Bituminous Water Vapor Retarders

MANUFACTURER: _____ MODEL NO: _____

TAG NO: _____ SERIAL NO: _____

LOCATION: Building Exterior AREA SERVED: Building Envelope

This Construction Checklist is used during the Commissioning Process to insure the correct equipment/material is delivered, installed and properly started in preparation for Functional Testing of related building systems. This checklist does not take the place of the Manufacturer's recommended checkout and startup procedures.

This Checklist is divided into 4 Sections and is to be completed by the Contractor in 4 separate steps. As each Section is completed the Contractor shall post the form to the project FTP site or electronic project management software, also the contractor should mail, fax or e-mail the completed Section(s) to the Commissioning Authority at this address:

Jacobs Engineering

525 West Monroe, 2nd Floor

Chicago, IL 60661

Attn: David Meyers c/o Tina Benitez

Phone: 314.210.2735

Fax: 312.384.6369

E-mail: david.meyers@jacobs.com

When completing each Section, be sure to check and initial EACH line item as being completed. Immediately notify the Commissioning Authority and VA Resident Engineer should any item be checked incomplete or there be any question regarding the level of completeness. Each Section's items must ALL be checked complete and initialed before the form is mailed to the Commissioning Authority.

SECTION 1 – EQUIPMENT DELIVERY:

The Contractor shall complete Section 1 of this form when the equipment is delivered to the site. The purpose is to record the actual design parameters listed below along with the checklist items as indicated. Should there be any discrepancy between the Actual and the Submitted information, or any item be checked incomplete, the Contractor shall immediately notify the Commissioning Authority and VA Resident Engineer.

DESIGN PARAMETERS:

Parameter	Designed	Submitted	Actual
XXX			

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All related submittals reviewed by A/E and approved by VA
_____	Yes / No	Bituminous Membrane and accessories thoroughly inspected for physical damage
_____	Yes / No	All Bituminous Membrane and accessories stored and protected according to specifications and manufacturer's recommendations

COMMENTS:

DRAFT

Submitted By: _____

Date: _____

SECTION 2 – EQUIPMENT INSTALLATION:

The Contractor shall complete Section 2 of this form when the installation of the equipment is being performed. The purpose of this Section is to insure the equipment is installed to the Project Design and the Manufacturer’s recommendations. Immediately notify the Commissioning Authority and VA should any item be checked incomplete.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All quality assurance testing complete and reports submitted
_____	Yes / No	O&M and warranty data provided to Cx Authority and VA Resident Engineer.
_____	Yes / No	Substrates examined and approved. Any Proof Rolling documents provided. All unsatisfactory conditions regarding installation tolerances have been corrected
_____	Yes / No	Installation in accordance with the specifications manual and manufacturer’s instructions
_____	Yes / No	Bituminous Membrane was installed when the substrate and ambient temperature were appropriate
_____	Yes / No	Bituminous Membrane was inspected for fishmouths and blisters; these were corrected per manufacturer’s recommendations.
_____	Yes / No	Bituminous Membrane was inspected for any penetrations or irregularities
_____	Yes / No	Joints were installed per manufacturers recommended dimensions.
_____	Yes / No	After installation, appropriate protection was provided to avoid traffic on installed material.

COMMENTS:

Submitted By: _____

Date: _____

SECTION 3 – EQUIPMENT START-UP:

The Contractor shall complete Section 3 of this form during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified of Bituminous Membrane waterproofing/vapor retarder construction progress.
_____	Yes / No	Bituminous Membrane field quality control tests have been performed and submitted.
_____	Yes / No	Temporary protective barriers and been in place but have been removed for inspection to take place.
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified to schedule Quality Inspections on completed Bituminous Membrane.

COMMENTS:

Submitted By: _____ Date: _____

SECTION 4 – NOTIFICATION FOR TESTING:

This piece of equipment is properly installed and is operational and ready for performance testing.

COMMENTS:

Submitted By: _____ Date: _____

PROJECT: VA - SLVHCS Replacement Medical Center Project
PROJECT NUMBER: VA 629HS2401
REPORT ID: VA 074215-01

EQUIPMENT DESCRIPTION: Insulated Core Metal Wall Panel

MANUFACTURER: _____ MODEL NO: _____
TAG NO: _____ SERIAL NO: _____
LOCATION: _____ AREA SERVED: _____

This Construction Checklist is used during the Commissioning Process to insure the correct equipment is delivered, installed and properly started in preparation for Functional Testing of related building systems. This checklist does not take the place of the Manufacturer's recommended checkout and startup procedures.

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SECTION 1 – EQUIPMENT DELIVERY:

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DESIGN PARAMETERS:

Parameter	Designed	Submitted	Actual
XXX			

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All related submittals reviewed by A/E and approved by VA
_____	Yes / No	Mock up completed and approved
_____	Yes / No	Are all Metal Wall Panels, sealants etc clearly selected and locations clearly marked on the drawings
_____	Yes / No	Are the Wall Panel connections clear
_____	Yes / No	Are movement joints clearly detailed and located
_____	Yes / No	Is everything clear with back-up wall, Misc framing, anchorages, and flashing, etc.
_____	Yes / No	Has the weather protection been provided as needed

COMMENTS:

Submitted By: _____

Date: _____

SECTION 2 – EQUIPMENT INSTALLATION:

The Contractor shall complete Section 2 of this form when the installation of the equipment is being performed. The purpose of this Section is to insure the equipment is installed to the Project Design and the Manufacturer’s recommendations. Immediately notify the Commissioning Authority and VA should any item be checked incomplete.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All quality assurance testing complete and reports submitted
_____	Yes / No	O&M and warranty data provided to Cx Authority and VA Resident Engineer.
_____	Yes / No	Supports and openings examined and approved. All unsatisfactory conditions regarding installation tolerances have been corrected
_____	Yes / No	Back-up wall framing, light gage framing, exterior sheathing and air water barrier (AWB) installed and inspected.
_____	Yes / No	Miscellaneous Framing, including sub girts, base angles, sills, furring etc per ASTM C754 installed.
_____	Yes / No	Wall panels with fully engaged tongue and groove joints and clip fastened with self-tapping fasteners properly installed, per Manufactures Recommendations, and Specifications.
_____	Yes / No	Remove temporary protective coverings and strippable films, if any, as wall panels installed per Manufacturers Recommendations
_____	Yes / No	Flashing and weeps are installed per the Contract Documents.
_____	Yes / No	Control Joints are installed per Contract Documents
_____	Yes / No	Weep holes are open and free or debris
_____	Yes / No	Sealant joints between panels and adjacent materials has cured according to manufacturer’s recommendations
_____	Yes / No	Installed Panels inspected and any touch up performed to satisfaction of Owners Representative.

COMMENTS:

Submitted By: _____

Date: _____

SECTION 3 – EQUIPMENT START-UP:

The Contractor shall complete Section 3 of this form during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified of construction progress
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified to schedule testing per Specifications on completed systems

COMMENTS:

Submitted By: _____ Date: _____

SECTION 4 – NOTIFICATION FOR TESTING:

This piece of equipment is properly installed and is operational and ready for performance testing.

COMMENTS:

Submitted By: _____ Date: _____

PROJECT: VA - SLVHCS Replacement Medical Center Project
PROJECT NUMBER: VA 629HS2401
REPORT ID: VA 074243-01

EQUIPMENT DESCRIPTION: Composite Panel

MANUFACTURER: _____ MODEL NO: _____
TAG NO: _____ SERIAL NO: _____
LOCATION: _____ AREA SERVED: _____

This Construction Checklist is used during the Commissioning Process to insure the correct equipment is delivered, installed and properly started in preparation for Functional Testing of related building systems. This checklist does not take the place of the Manufacturer's recommended checkout and startup procedures.

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Fax: 312.384.6369

E-mail: david.meyers@jacobs.com

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SECTION 1 – EQUIPMENT DELIVERY:

The Contractor shall complete Section 1 of this form when the equipment is delivered to the site. The purpose is to record the actual design parameters listed below along with the checklist items as indicated. Should there be any discrepancy between the Actual and the Submitted information, or any item be checked incomplete, the Contractor shall immediately notify the Commissioning Authority and VA Resident Engineer.

DESIGN PARAMETERS:

Parameter	Designed	Submitted	Actual
XXX			

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All related submittals reviewed by A/E and approved by VA
_____	Yes / No	Mock up completed and approved
_____	Yes / No	Are all Composite Panel, sealants etc clearly selected and locations clearly marked on the drawings
_____	Yes / No	Are the Composite Panel connections clear
_____	Yes / No	Are movement joints clearly detailed and located
_____	Yes / No	Is everything clear with back-up wall, Misc framing, anchorages, and flashing, etc.
_____	Yes / No	Has the weather protection been provided as needed

COMMENTS:

Submitted By: _____

Date: _____

SECTION 2 – EQUIPMENT INSTALLATION:

The Contractor shall complete Section 2 of this form when the installation of the equipment is being performed. The purpose of this Section is to insure the equipment is installed to the Project Design and the Manufacturer’s recommendations. Immediately notify the Commissioning Authority and VA should any item be checked incomplete.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All quality assurance testing complete and reports submitted
_____	Yes / No	O&M and warranty data provided to Cx Authority
_____	Yes / No	Supports and openings examined and approved. All unsatisfactory conditions regarding installation tolerances have been corrected
_____	Yes / No	Back-up wall framing, light gage framing, exterior sheathing and air water barrier (AWB) installed and inspected.
_____	Yes / No	Miscellaneous Framing, including sub girts, base angles, sills, furring etc per ASTM C754 installed.
_____	Yes / No	Composite Panel with fully engaged male/female interlocking joints and clip fastened with self-tapping fasteners properly installed, per Manufactures Recommendations, and Specifications.
_____	Yes / No	Remove temporary protective coverings and strippable films, if any, as Composite Panel installed per Manufacturers Recommendations
_____	Yes / No	Flashing and weeps are installed per the Contract Documents.
_____	Yes / No	Control Joints are installed per Contract Documents
_____	Yes / No	Weep holes are open and free or debris
_____	Yes / No	Sealant joints between Composite Panels and adjacent materials has cured according to manufacturer’s recommendations
_____	Yes / No	Installed Composite Panels inspected and any touch up performed to satisfaction of Owners Representative.

COMMENTS:

Submitted By: _____

Date: _____

SECTION 3 – EQUIPMENT START-UP:

The Contractor shall complete Section 3 of this form during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified of construction progress
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified to schedule testing per Specifications on completed systems

COMMENTS:

Submitted By: _____ Date: _____

SECTION 4 – NOTIFICATION FOR TESTING:

This piece of equipment is properly installed and is operational and ready for performance testing.

COMMENTS:

Submitted By: _____ Date: _____

PROJECT: VA - SLVHCS Replacement Medical Center Project
PROJECT NUMBER: VA 629HS2401
REPORT ID: VA 074615-01

EQUIPMENT DESCRIPTION: Manufactured Metal Siding

MANUFACTURER: _____ MODEL NO: _____

TAG NO: _____ SERIAL NO: _____

LOCATION: _____ AREA SERVED: _____

This Construction Checklist is used during the Commissioning Process to insure the correct equipment is delivered, installed and properly started in preparation for Functional Testing of related building systems. This checklist does not take the place of the Manufacturer's recommended checkout and startup procedures.

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Attn: David Meyers c/o Tina Benitez

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Fax: 312.384.6369

E-mail: david.meyers@jacobs.com

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SECTION 1 – EQUIPMENT DELIVERY:

The Contractor shall complete Section 1 of this form when the equipment is delivered to the site. The purpose is to record the actual design parameters listed below along with the checklist items as indicated. Should there be any discrepancy between the Actual and the Submitted information, or any item be checked incomplete, the Contractor shall immediately notify the Commissioning Authority and VA Resident Engineer.

DESIGN PARAMETERS:

Parameter	Designed	Submitted	Actual
XXX			

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All related submittals reviewed by A/E and approved by VA
_____	Yes / No	Mock up completed and approved
_____	Yes / No	Are all Manufactured Metal Siding, etc clearly selected and locations clearly marked on the drawings
_____	Yes / No	Are the Manufactured Metal Siding connections clear
_____	Yes / No	Are movement joints clearly detailed and located
_____	Yes / No	Is everything clear with back-up wall, Misc framing, anchorages, and flashing, etc.
_____	Yes / No	Has the weather protection been provided as needed

COMMENTS:

DRAFT

Submitted By: _____

Date: _____

SECTION 2 – EQUIPMENT INSTALLATION:

The Contractor shall complete Section 2 of this form when the installation of the equipment is being performed. The purpose of this Section is to insure the equipment is installed to the Project Design and the Manufacturer’s recommendations. Immediately notify the Commissioning Authority and VA should any item be checked incomplete.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All quality assurance testing complete and reports submitted
_____	Yes / No	O&M and warranty data provided to Cx Authority and VA Resident Engineer.
_____	Yes / No	Supports and openings examined and approved. All unsatisfactory conditions regarding installation tolerances have been corrected
_____	Yes / No	Back-up wall framing, light gage framing, exterior sheathing and air water barrier (AWB) installed and inspected.
_____	Yes / No	Miscellaneous Framing, including sub girts, base angles, sills, furring etc installed per Manufactures Recommendations, and Specifications.
_____	Yes / No	Insulation attached to framing per Manufactures Recommendations, and Specifications
_____	Yes / No	Manufactured Metal Siding with fully engaged and fastened with fasteners appropriate to back-up materials properly installed, per Manufactures Recommendations, and Specifications.
_____	Yes / No	Remove temporary protective coverings and strippable films, if any, as Manufactured Metal Siding installed per Manufacturers Recommendations
_____	Yes / No	Flashings and closures installed at perimeters, corners, intersections, and penetrations per the Contract Documents.
_____	Yes / No	Control Joints are installed per Contract Documents
_____	Yes / No	Weep holes on sills etc are open and free from debris
_____	Yes / No	Sealant joints between Manufactured Metal Siding and adjacent materials has cured according to manufacturer’s recommendations
_____	Yes / No	Installed Manufactured Metal Siding inspected and any touch up performed to satisfaction of Owners Representative.

COMMENTS:

Submitted By: _____

Date: _____

SECTION 3 – EQUIPMENT START-UP:

The Contractor shall complete Section 3 of this form during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified of construction progress
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified to schedule testing per Specifications on completed systems

COMMENTS:

Submitted By: _____ Date: _____

SECTION 4 – NOTIFICATION FOR TESTING:

This piece of equipment is properly installed and is operational and ready for performance testing.

COMMENTS:

Submitted By: _____ Date: _____

PROJECT: VA - SLVHCS Replacement Medical Center Project
PROJECT NUMBER: VA 629HS2401
REPORT ID: VA 075216-01

EQUIPMENT DESCRIPTION: Modified Bituminous Membrane Roofing

MANUFACTURER: MODEL NO: _____

TAG NO: SERIAL NO: _____

LOCATION: Building Exterior AREA SERVED: Building Envelope

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Phone: 314.210.2735

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SECTION 1 – EQUIPMENT DELIVERY:

The Contractor shall complete Section 1 of this form when the equipment is delivered to the site. The purpose is to record the actual design parameters listed below along with the checklist items as indicated. Should there be any discrepancy between the Actual and the Submitted information, or any item be checked incomplete, the Contractor shall immediately notify the Commissioning Authority and VA Resident Engineer.

DESIGN PARAMETERS:

Parameter	Designed	Submitted	Actual
XXX			

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All related submittals reviewed by A/E and approved by VA
_____	Yes / No	Roofing and accessories thoroughly inspected for physical damage
_____	Yes / No	All roofing and accessories stored and protected according to specifications and manufacturer's recommendations
_____	Yes / No	All Modified Bituminous Membrane roofing has met ASTM D2523 and E108
_____	Yes / No	All Modified Bituminous Membrane roofing has met FM 4450 and FM 4470
_____	Yes / No	All roofing as been stored per manufacture recommendations
_____	Yes / No	Mock up has been approved

COMMENTS:

Submitted By: _____

Date: _____

SECTION 2 – EQUIPMENT INSTALLATION:

The Contractor shall complete Section 2 of this form when the installation of the equipment is being performed. The purpose of this Section is to insure the equipment is installed to the Project Design and the Manufacturer’s recommendations. Immediately notify the Commissioning Authority and VA should any item be checked incomplete.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All quality assurance testing complete and reports submitted
_____	Yes / No	O&M and warranty data provided to Cx Authority and VA Resident Engineer.
_____	Yes / No	Roof slab tested for moisture/vapor content and results submitted
_____	Yes / No	Roof slope, Substrates, supports, and openings examined and approved. All unsatisfactory conditions regarding installation tolerances have been corrected
_____	Yes / No	Installation in accordance with NRCA, Specifications manual, and manufacturer’s instructions
_____	Yes / No	Roof drains covered as appropriately to avoid debris entering the drainage system
_____	Yes / No	Vapor Retarder Installed per Specifications and Manufactures’ recommendations
_____	Yes / No	Roof insulation, saddles, etc., installed per Specifications and Manufactures’ recommendations
_____	Yes / No	Substrate backer board installed per Specifications and Manufactures’ recommendations
_____	Yes / No	Primer installed per Specifications and Manufactures’ recommendations
_____	Yes / No	Base ply applied to a dry, clean (free of debris) substrate
_____	Yes / No	Felts installed from low to high point perpendicular to slope of roof, with appropriate laps
_____	Yes / No	All sheet metal flashings installed per Contract documents.
_____	Yes / No	All accessories, lightning protection, and curbs, etc installed per Specifications and Manufactures’ recommendations.
_____	Yes / No	Walkway Cap Sheets installed per contract documents
_____	Yes / No	Roof inspected and any damaged areas replaced per specifications.

COMMENTS:

Submitted By: _____

Date: _____

SECTION 3 – EQUIPMENT START-UP:

The Contractor shall complete Section 3 of this form during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified of Roofing System construction progress.
_____	Yes / No	Roofing field quality control tests have been performed and submitted, including water Run-off test
_____	Yes / No	Temporary protective coverings removed from roof drains, etc. according to specifications

COMMENTS:

Submitted By: _____ Date: _____

SECTION 4 – NOTIFICATION FOR TESTING:

This piece of equipment is properly installed and is operational and ready for performance testing.

COMMENTS:

Submitted By: _____ Date: _____

PROJECT: VA - SLVHCS Replacement Medical Center Project
PROJECT NUMBER: VA 629HS2401
REPORT ID: VA 075423-01

EQUIPMENT DESCRIPTION: Thermoplastic Polyolefin (TPO) Roofing

MANUFACTURER: MODEL NO: _____

TAG NO: SERIAL NO: _____

LOCATION: Building Exterior AREA SERVED: Building Envelope

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SECTION 1 – EQUIPMENT DELIVERY:

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DESIGN PARAMETERS:

Parameter	Designed	Submitted	Actual
XXX			

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All related submittals reviewed by A/E and approved by VA
_____	Yes / No	Pre-roofing Meeting completed with all required attending.
_____	Yes / No	Roofing and accessories thoroughly inspected for physical damage
_____	Yes / No	All roofing and accessories stored and protected according to specifications and manufacturer's recommendations
_____	Yes / No	All Thermoplastic Polyolefin (TPO) Roofing has met ASTM D6878.
_____	Yes / No	All Thermoplastic Polyolefin (TPO) Roofing has met FM 4450 and FM 4470
_____	Yes / No	All roofing as been stored per Manufacture Recommendations
_____	Yes / No	Mock up has been approved

COMMENTS:

Submitted By: _____

Date: _____

SECTION 2 – EQUIPMENT INSTALLATION:

The Contractor shall complete Section 2 of this form when the installation of the equipment is being performed. The purpose of this Section is to insure the equipment is installed to the Project Design and the Manufacturer’s recommendations. Immediately notify the Commissioning Authority and VA should any item be checked incomplete.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All quality assurance testing complete and reports submitted
_____	Yes / No	O&M and warranty data provided to Cx Authority and VA Resident Engineer.
_____	Yes / No	Roof slab tested for moisture/vapor content and results submitted
_____	Yes / No	Roof slope, Substrates, supports, and openings examined and approved. All unsatisfactory conditions regarding installation tolerances have been corrected
_____	Yes / No	Installation in accordance with NRCA, Specifications manual, and manufacturer’s instructions
_____	Yes / No	Roof drain outlets covered as appropriately to avoid debris entering the drainage system
_____	Yes / No	Roof insulation, saddles, etc., installed per Specifications and Manufactures’ recommendations
_____	Yes / No	All sheet metal flashings installed in concurrence with the insulation per Contract documents and Manufacturer’s recommendations.
_____	Yes / No	Substrate backer board installed per Specifications and Manufactures’ recommendations
_____	Yes / No	Membrane applied/adhered to a dry, clean (free of debris) substrate
_____	Yes / No	Membrane installed from low to high point perpendicular to slope of roof, with appropriate laps and sealant, and anchor perimeter to deck or wall.
_____	Yes / No	All accessories, lightning protection, roof drains, pipe flashings, and curbs, etc installed per Specifications and Manufactures’ recommendations.
_____	Yes / No	Roof inspected and any damaged areas, fishmouths, wrinkles, tears, voids etc., repaired per specifications and Manufactures’ recommendations.

COMMENTS:

Submitted By: _____

Date: _____

SECTION 3 – EQUIPMENT START-UP:

The Contractor shall complete Section 3 of this form during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified of Roofing System construction progress.
_____	Yes / No	Roofing field quality control tests have been performed and submitted, including water Run-off test
_____	Yes / No	Temporary protective coverings removed from roof drains, etc. according to specifications

COMMENTS:

Submitted By: _____ Date: _____

SECTION 4 – NOTIFICATION FOR TESTING:

This piece of equipment is properly installed and is operational and ready for performance testing.

COMMENTS:

Submitted By: _____ Date: _____

PROJECT: VA - SLVHCS Replacement Medical Center Project
PROJECT NUMBER: VA 629HS2401
REPORT ID: VA 042113-01

EQUIPMENT DESCRIPTION: Flashing and Sheet Metal

MANUFACTURER: _____ MODEL NO: _____

TAG NO: _____ SERIAL NO: _____

LOCATION: _____ AREA SERVED: _____

This Construction Checklist is used during the Commissioning Process to insure the correct equipment is delivered, installed and properly started in preparation for Functional Testing of related building systems. This checklist does not take the place of the Manufacturer's recommended checkout and startup procedures.

This Checklist is divided into 4 Sections and is to be completed by the Contractor in 4 separate steps. As each Section is completed the Contractor shall post the form to the project FTP site or electronic project management software, also the contractor should mail, fax or e-mail the completed Section(s) to the Commissioning Authority at this address:

Jacobs Engineering

525 West Monroe, 2nd Floor

Chicago, IL 60661

Attn: David Meyers c/o Tina Benitez

Phone: 314.210.2735

Fax: 312.384.6369

E-mail: david.meyers@jacobs.com

When completing each Section, be sure to check and initial EACH line item as being completed. Immediately notify the Commissioning Authority and VA Resident Engineer should any item be checked incomplete or there be any question regarding the level of completeness. Each Section's items must ALL be checked complete and initialed before the form is mailed to the Commissioning Authority.

SECTION 1 – EQUIPMENT DELIVERY:

The Contractor shall complete Section 1 of this form when the equipment is delivered to the site. The purpose is to record the actual design parameters listed below along with the checklist items as indicated. Should there be any discrepancy between the Actual and the Submitted information, or any item be checked incomplete, the Contractor shall immediately notify the Commissioning Authority and VA Resident Engineer.

DESIGN PARAMETERS:

Parameter	Designed	Submitted	Actual
XXX			

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All related submittals reviewed by A/E and approved by VA
_____	Yes / No	Mock up completed and approved
_____	Yes / No	All material has been delivered to the site
_____	Yes / No	All material has been protected
_____	Yes / No	Are flashing locations and types detailed and located
_____	Yes / No	Is everything clear where anchors and clips go and how they are sealed
_____	Yes / No	Are there any dissimilar metals touching each other

COMMENTS:

Submitted By: _____

Date: _____

SECTION 2 – EQUIPMENT INSTALLATION:

The Contractor shall complete Section 2 of this form when the installation of the equipment is being performed. The purpose of this Section is to insure the equipment is installed to the Project Design and the Manufacturer’s recommendations. Immediately notify the Commissioning Authority and VA should any item be checked incomplete.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All quality assurance testing complete and reports submitted
_____	Yes / No	O&M and warranty data provided to Cx Authority and VA Resident Engineer.
_____	Yes / No	Has the substrates and conditions under which sheet metal flashing and trim are to be installed are installed per the contract documents
_____	Yes / No	Is there any oil canning, buckling or tool marks on the flashing or metal?
_____	Yes / No	Lap joint are sealed in accordance with the contract documents
_____	Yes / No	Joints have been filled with sealant and metal formed to conceal sealant
_____	Yes / No	Anchors are properly installed
_____	Yes / No	Control Joints are installed per Contract Documents
_____	Yes / No	Sealant has cured according to manufacturer’s recommendations

COMMENTS:

Submitted By: _____

Date: _____

SECTION 3 – EQUIPMENT START-UP:

The Contractor shall complete Section 3 of this form during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified of construction progress
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified to schedule air infiltration tests on completed systems

COMMENTS:

Submitted By: _____ Date: _____

SECTION 4 – NOTIFICATION FOR TESTING:

This piece of equipment is properly installed and is operational and ready for performance testing.

COMMENTS:

Submitted By: _____ Date: _____

PROJECT: VA - SLVHCS Replacement Medical Center Project
PROJECT NUMBER: VA 629HS2401
REPORT ID: CC 081113-01

EQUIPMENT DESCRIPTION: Hollow Metal Doors and Frames

MANUFACTURER: _____ MODEL NO: _____
TAG NO: _____ SERIAL NO: _____
LOCATION: _____ AREA SERVED: _____

This Construction Checklist is used during the Commissioning Process to insure the correct equipment is delivered, installed and properly started in preparation for Functional Testing of related building systems. This checklist does not take the place of the Manufacturer's recommended checkout and startup procedures.

This Checklist is divided into 4 Sections and is to be completed by the Contractor in 4 separate steps. As each Section is completed the Contractor shall post the form to the project FTP site or electronic project management software, also the contractor should mail, fax or e-mail the completed Section(s) to the Commissioning Authority at this address:

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525 West Monroe, 2nd Floor
Chicago, IL 60661

Attn: David Meyers c/o Tina Benitez

Phone: 314.210.2735

Fax: 312.384.6369

E-mail: david.meyers@jacobs.com

When completing each Section, be sure to check and initial EACH line item as being completed. Immediately notify the Commissioning Authority and VA Resident Engineer should any item be checked incomplete or there be any question regarding the level of completeness. Each Section's items must ALL be checked complete and initialed before the form is mailed to the Commissioning Authority.

SECTION 1 – EQUIPMENT DELIVERY:

The Contractor shall complete Section 1 of this form when the equipment is delivered to the site. The purpose is to record the actual design parameters listed below along with the checklist items as indicated. Should there be any discrepancy between the Actual and the Submitted information, or any item be checked incomplete, the Contractor shall immediately notify the Commissioning Authority and VA Resident Engineer.

DESIGN PARAMETERS:

Parameter	Designed	Submitted	Actual
XXX			

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All related submittals reviewed by A/E and approved by VA
_____	Yes / No	Doors and Frames thoroughly inspected for physical damage
_____	Yes / No	Door and Frames stored and protected according to specifications and manufacturer's recommendations

COMMENTS:

DRAFT

Submitted By: _____

Date: _____

SECTION 2 – EQUIPMENT INSTALLATION:

The Contractor shall complete Section 2 of this form when the installation of the equipment is being performed. The purpose of this Section is to insure the equipment is installed to the Project Design and the Manufacturer’s recommendations. Immediately notify the Commissioning Authority and VA should any item be checked incomplete.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All quality assurance testing complete and reports submitted
_____	Yes / No	O&M and warranty data provided to Cx Authority and VA Resident Engineer.
_____	Yes / No	Supports and openings examined and approved. All unsatisfactory conditions regarding installation tolerances have been corrected
_____	Yes / No	Hollow metal frames are securely braced to specified tolerances.
_____	Yes / No	Doors and frames tapped at proper locations to receive door hardware.
_____	Yes / No	Frames installed level, plumb, and square. Frames are secured according to specification depending on adjacent wall material.
_____	Yes / No	Door silencers have been installed in frames before being grouted in place.
_____	Yes / No	Doors installed into frame openings with uniform tight clearances around jambs and head
_____	Yes / No	Installed doors swing freely without binding or scraping
_____	Yes / No	Any necessary adjustments to door and hardware have been made to ensure proper operation without binding or scratching
_____	Yes / No	Any necessary paint touch-ups have been made to eliminate evidence of repair
_____	Yes / No	Sill members and other members have been set in a bed of sealant
_____	Yes / No	Joint backing material has been installed per sealant manufacturer’s requirements.
_____	Yes / No	Joints are completely filled with sealant
_____	Yes / No	Sealant has cured according to manufacturer’s recommendations

COMMENTS:

Submitted By: _____

Date: _____

SECTION 3 – EQUIPMENT START-UP:

The Contractor shall complete Section 3 of this form during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified of metal doors and frames construction progress
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified to schedule air infiltration tests on completed exterior metal doors and frames

COMMENTS:

Submitted By: _____ Date: _____

SECTION 4 – NOTIFICATION FOR TESTING:

This piece of equipment is properly installed and is operational and ready for performance testing.

COMMENTS:

Submitted By: _____ Date: _____

PROJECT: VA - SLVHCS Replacement Medical Center Project
PROJECT NUMBER: VA 629HS2401
REPORT ID: VA 084413

EQUIPMENT DESCRIPTION: Glazed Aluminum Curtain Wall

MANUFACTURER: _____ MODEL NO: _____
TAG NO: _____ SERIAL NO: _____
LOCATION: _____ AREA SERVED: _____

This Construction Checklist is used during the Commissioning Process to insure the correct equipment is delivered, installed and properly started in preparation for Functional Testing of related building systems. This checklist does not take the place of the Manufacturer's recommended checkout and startup procedures.

This Checklist is divided into 4 Sections and is to be completed by the Contractor in 4 separate steps. As each Section is completed the Contractor shall post the form to the project FTP site or electronic project management software, also the contractor should mail, fax or e-mail the completed Section(s) to the Commissioning Authority at this address:

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When completing each Section, be sure to check and initial EACH line item as being completed. Immediately notify the Commissioning Authority and VA Resident Engineer should any item be checked incomplete or there be any question regarding the level of completeness. Each Section's items must ALL be checked complete and initialed before the form is mailed to the Commissioning Authority.

SECTION 1 – EQUIPMENT DELIVERY:

The Contractor shall complete Section 1 of this form when the equipment is delivered to the site. The purpose is to record the actual design parameters listed below along with the checklist items as indicated. Should there be any discrepancy between the Actual and the Submitted information, or any item be checked incomplete, the Contractor shall immediately notify the Commissioning Authority and VA Resident Engineer.

DESIGN PARAMETERS:

Parameter	Designed	Submitted	Actual
XXX			

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All related submittals reviewed by A/E and approved by VA
_____	Yes / No	Mock up completed and approved
_____	Yes / No	Are all Glazed Aluminum Curtain Wall, sealants etc clearly selected and locations clearly marked on the drawings
_____	Yes / No	Are the Glazed Aluminum Curtain Wall connections clear
_____	Yes / No	Are movement joints clearly detailed and located
_____	Yes / No	Is everything clear with back-up wall, Misc framing, anchorages, and flashing, etc.
_____	Yes / No	Has weather protection been provided as needed

COMMENTS:

Submitted By: _____

Date: _____

SECTION 2 – EQUIPMENT INSTALLATION:

The Contractor shall complete Section 2 of this form when the installation of the equipment is being performed. The purpose of this Section is to insure the equipment is installed to the Project Design and the Manufacturer’s recommendations. Immediately notify the Commissioning Authority and VA should any item be checked incomplete.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All quality assurance testing complete and reports submitted
_____	Yes / No	O&M and warranty data provided to Cx Authority and VA Resident Engineer.
_____	Yes / No	Supports and openings examined and approved. All unsatisfactory conditions regarding installation tolerances have been corrected
_____	Yes / No	All support and connection locations installed and inspected.
_____	Yes / No	Miscellaneous Framing, including anchorages, and misc steel items per Manufacturer’s submittal. Protection for galvanic or corrosive action with dissimilar materials installed.
_____	Yes / No	Glazed Aluminum Curtain Wall fasteners properly installed, per Manufactures Recommendations, and Specifications.
_____	Yes / No	Curtain Wall framing units installed Plumb and true and proper alignment per Manufacturers Recommendations and Installation requirements
_____	Yes / No	Field Cut ends of units painted (concealed or exposed) per Manufacture’s Recommendations and approval.
_____	Yes / No	Glazing, Spandrel Panels and structural sealant installed per Manufacturers Recommendations and approved submittals
_____	Yes / No	Flashings and installed per the Contract Documents and per Manufacturers Recommendations.
_____	Yes / No	Control Joints are installed per Contract Documents and per Manufacturers Recommendations
_____	Yes / No	Sealant joints between Glazed Aluminum Curtain Wall and adjacent materials has cured according to manufacturer’s recommendations
_____	Yes / No	Remove protective materials applied at factory or after installation and clean curtain wall of any construction related deposits..

COMMENTS:

Submitted By: _____

Date: _____

SECTION 3 – EQUIPMENT START-UP:

The Contractor shall complete Section 3 of this form during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified of construction progress
_____	Yes / No	Cx Authority and VA Resident Engineer have been notified to schedule testing per Specifications on completed systems

COMMENTS:

Submitted By: _____ Date: _____

SECTION 4 – NOTIFICATION FOR TESTING:

This piece of equipment is properly installed and is operational and ready for performance testing.

COMMENTS:

Submitted By: _____ Date: _____

DRAFT

APPENDIX B

FUNCTIONAL TEST PROCEDURES

ASTM F2420	Humidity in Concrete Using Hood
ASTM C1521-09 and C1193-09	Sealant Joint Evaluations
ASTM C1401-09a	Structural Sealant Glazing
ASTM E1601	Existing Brick
ASTM E779, C1060 and E1186	Determining Air Leakage
ASTM E1105, E1186 and E783	Determining Water Penetration
ASTM E907-96	Adhered Membrane

DRAFT

Determining Relative Humidity on the Surface of Concrete Floor Slabs Using Relative Humidity Probe Measurement and Insulated Hood

PROJECT: SLVHCS REPLACEMENT MEDICAL CENTER PROJECT

PROJECT NUMBER: VA 629HS2401

REPORT ID:

DESCRIPTION: ASTM F2420 - 05

Date of Test:

DESIGN CRITERIA

Related Documents:

Specification Sections

Drawings

Submittal Data

Test Equipment Required:

Humidity Probe and Digital Meter - should have an accuracy level within 63 % from 25 to 98 % relative humidity, and be obtained from a manufacturer having a NIST or equivalent traceable calibration procedure. RH Probes should be calibrated at 90 % relative humidity or higher, in addition to lower humidity levels

Insulated Impermeable Box - The hood's insulated air chamber shall have a minimum area of between 30 and 40 in.² (200 and 260 cm²) with a minimum depth of 0.25 in. (6.3 mm) positioned and directly above and exposed to the surface.

See Below

Summary of the ASTM test:

This test method covers a procedure where a purposely made thermally insulated hood is placed on and sealed to the surface of a concrete floor slab. An entrapped and impervious air pocket or chamber is formed directly above and in contact with the surface of the bare floor slab. Through a lined access hole in the hood, a humidity probe can be inserted to measure the relative humidity (RH), temperature, and dew point within the air pocket.

Equipment:

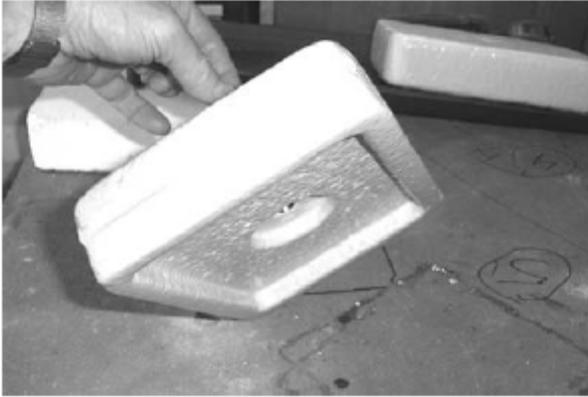


Fig. 1



Fig. 2

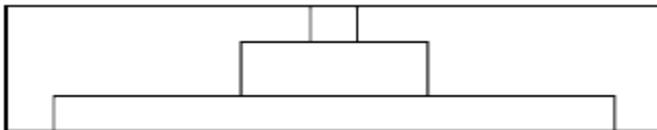


Fig.3

Functional Performance Test Prerequisites

Prerequisite	Yes	No	Comments
1. Contractor QA/QC Testing Reports completed & submitted to CxA <u>VA Resident Engineer</u>			
2. Construction Checklist completed & submitted to CxA <u>VA Resident Engineer</u> .			
3. Locations of tests have been verified by the CxA, <u>VA Resident Engineer</u> and Architect			
4.			
5.			

System Identification	
System Identification	Location

Functional Test Procedures:

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
GENERAL SYSTEM READINESS			
	1	Prior to any testing the probe should be checked and calibrated. .	
		Field Notes:	
	2	Conditioning: Concrete floor slabs shall be at service temperature and the occupied air space above the floor slab shall be at service temperature and relative humidity expected under normal use for at least 48 h prior to the hood placements. If this is not possible then the test should be conducted with conditions at 75+/- 10°F (24+/- 5°C) and relative humidity of 50+/- 10 %. All artificial aids used to accelerate drying should be turned off at least 96 h before hoods may be sealed on the concrete surface.	
		Field Notes:	
ASTM F2420			
	3	Perform three tests for the first 1000 ft ₂ (93 m ₂) and at least one additional test for each additional 1000 ft ₂ (93 m ₂). Select test locations to provide information about moisture distribution across the entire concrete floor slab, especially areas of potential high moisture. For slabs on-grade and below-grade, include test locations in the center of the floor and areas close to exterior walls. Choose areas that are susceptible to high moisture when placing hood.	
		Field Notes:	

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
	4	<p>Prior to placement of the RH hoods the actual test area shall be clean and free of any foreign substances. Only clean bare concrete surfaces shall be exposed to the air chamber underneath the hood.</p> <p>Field Notes:</p>	
	5	<p>Where covered floor slabs are being tested, all covering materials, adhesive residue, curing compound, sealers, paints, etc., shall be removed to expose an area of clean bare concrete for testing using the RH Hood method. Removal of any existing floor covering or adhesive shall be accomplished using approved OSHA work practices. For removal of any existing flooring or adhesives strictly observe if there are any hazardous materials (Asbestos or Lead etc) and any other appropriate safety and health practices. The cleaned test area should be exposed to conditions specified in for a period of at least 24 h prior to starting the test.</p> <p>Field Notes:</p>	
	6	<p>Seal the insulated hood firmly to the floor with a suitable preformed butyl/sealant adhesive or similar. The sealant used should be of a type that does not give off any emissions that could affect the relative humidity readings in the hood. Place seal/stopper in probe hole.</p> <p>Field Notes:</p>	
	7	<p>Allow a period of at least 72 h to elapse after sealing the hood to the floor so as to achieve moisture equilibrium in the air pocket under the hood before taking readings.</p>	

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
		Field Notes:	
	8	<p>This test method is not suitable for areas that have surface applied vapor barriers or curing compounds that cannot be removed or cleaned off sufficiently to allow vapor flow through the surface of the slab.</p> <p>For very thick floor slab construction, (for example, 8 in. and over), and low porosity slabs or slabs with certain types of power floated low emission surface finishes it may take considerably longer than 72 h to reach moisture equilibrium.</p> <p>Should these conditions exist where a considerable amount of additional time may be required for the satisfactory performance of this test because of the low porosity surface or slow vapor movement in the slab, or both, then Test Method F 2170 (below surface in situ RH) should be considered as a more suitable test method under these circumstances.</p>	
		Field Notes:	
	9	<p>Readings are taken by removing stopper from probe access hole in hood, this should be done quickly to ensure that no air escapes from, or enters, the air pocket under the hood</p>	
		Field Notes:	
	10	<p>Insert the humidity probe into hole so that its sensor protrudes into the center air chamber, and is sealed in position during acclimation, and taking of readings.</p>	
		Field Notes:	

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
	11	To avoid leaving the humidity probes on site during the equilibration period, the probe may be removed from the hood and hole sealed with a stopper. Continue the determination of relative humidity reading	
		Field Notes:	
	12	Measurement: Remove the rubber stopper at the top/end of the hole liner sleeve and insert the probe all the way to the bottom/end of the hole liner so that the sensing (filter end) end of the probe is located in the center of the air pocket under the hood. Should the probe be shorter than the liner and its wire protrude from inside the liner this lead wire may need to be sealed in the liner. Connect the probe lead wire to the meter, turn on the meter and allow it to warm up as indicated by the manufacturer's instructions.	
		Field Notes:	
	13	Allow the probe to reach temperature equilibrium before measuring relative humidity. The probe must be at the same temperature as the air pocket before taking readings. Even a small difference in temperature could produce a significant error in relative humidity measurement.	
		Field Notes:	

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
	14	<p>Check for drift of readings. Meter readings must not drift more than 1 % relative humidity over approximately 20 min. Equilibration may take up to several hours depending on factors such as the initial temperature difference between probe, air chamber and concrete. The meter may be turned off or disconnected. or both, from the probe while the probe equilibrates with the entrapped air pocket above the concrete.</p> <p>Field Notes:</p>	
	15	<p>Record the relative humidity to the nearest percent, temperature to the nearest °F/°C. Record the location of the hood on the floor slab.</p> <p>Field Notes:</p>	
	16	<p>Use a relative humidity meter to measure the ambient air temperature and relative humidity above the slab in the vicinity of the hood. Record the relative humidity to nearest percentage, and the temperature and dew point temperature to the nearest °F/°C.</p> <p>Field Notes:</p>	
	17	<p>If a surface thermometer is used, record this temperature.</p> <p>Field Notes:</p>	

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
	18	When testing is complete, remove the insulated hood and clean off any adhesive or sealer that may be adhered to the surface of the concrete. After removal of the hood allow sufficient time (at least 24 h) for the area where it was positioned to reach moisture equilibrium with the surrounding area of the floor. This should be completed before proceeding further or applying a covering.	
		Field Notes:	
	19	Once RH values have been determined refer to whatever standard criteria that has been established. Test values that do not meet the agreed upon established criteria generally require more time for the slab to dry before further testing is performed. The equipment and hood should be removed while the floor slab is allowed to continue drying before carrying out further tests per pervious method.	
		Field Notes:	

Testing company report should be as following:

Report the following information for ASTM F2420:

Report the following information:

- Name and address of the structure,
- Date and time measurements were made,
- Name, title, and affiliation of persons performing the measurements,
- Locations of hoods on the structure, 11.1.5 Relative humidity in each hood to the nearest % RH,
- Temperature in each hood to the nearest °F/°C,
- Ambient air temperature, to the nearest °F/°C, relative humidity (to the nearest % RH) and dew point adjacent to each hood,
- Make, model, and last calibration date of the equipment which is being used to make the measurements, and
- Report any observations that might affect the interpretation of individual measurements such as: age and thickness of slab, standing water on the slab, wet coring operations, evidence of flooding or water damage, area water table, weather, ventilating system operations, vapor check, or artificial drying processes, or combination thereof.

Date:

Summary of Results:

-

Lessons Learned:

-

Corrective Issues:

-

Acceptance of Test:

- This test cannot be accepted at this time due to the Corrective Issues noted above.
- This test was witnessed by the Commissioning Authority identified below. Any Corrective Issues noted above do not adversely impact the overall performance of the system.

Witnessed _____ Date _____
Commissioning Authority

- This test is accepted by the VA Representative identified below

Accepted _____ Date _____
VA Representative

PROJECT: SLVHCS REPLACEMENT MEDICAL CENTER PROJECT

PROJECT NUMBER: VA 629HS2401

REPORT ID:

DESCRIPTION: ASTM C1521-09 & C1193-09

Date of Test:

DESIGN CRITERIA

Related Documents:

Specification Sections 079200

Drawings

Submittal Data

Test Equipment Required:

Summary of the ASTM test:

A sealant joint usually fails to perform as a weather seal when the joint experiences a cohesion or adhesive failure. Therefore, sealant bead size and configuration, joint movement, quality of workmanship, the quality of the adhesive bond, and the quality of the sealant material are critical.

There are several tests; three (3) non-destructive and two (2) destructive

The two destructive tests are;

- Tail Test
- Flap Test

The non-destructive test;

- Technique One - Probing the center of the joint
- Technique Two - Probing the edge of the joint
- Nondestructive Continuous Inspection Procedure.

Equipment required;

- Measuring tape/rule with 1/32" divisions
- Probing tool – that is at least 1/8" (3 mm) narrower than width of joint. (see Fig 1 from ASTM)

- Razor Knife
- Knife or other cutting instrument with a min 2" (50 mm) length blade,
- sealable sample bags,
- repair sealant compatible with installed sealant
- tools for installing sealant
- Butyl tape
- Water.
- For the Nondestructive Continuous Method;
 - A wheel roller such as a screen roller or backer rod insertion tool or pressure controlled roller.
 - Masking tape

DRAFT

Functional Performance Test Prerequisites

Prerequisite	Yes	No	Comments
1. Contractor QA/QC Testing Reports completed & submitted to CxA and <u>VA Resident Engineer</u> .			
2. Construction Checklist completed & submitted to CxA and <u>VA Resident Engineer</u> .			
3. O&M Manuals submitted to CxA and <u>VA Resident Engineer</u> for review.			
4.			
5.			

System Identification	
System Identification	Location

Functional Test Procedures:

Pas s Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
GENERAL SYSTEM READINESS			
	1	Verify the substrate was inspected prior to installation. Field Notes:	1. .
	2	Verify the product/system submittal was reviewed and approved by the A/E. Field Notes:	1. .
	3	Verify the product/system has had the appropriate time for the sealant material to cure per the manufacturers recommendations. (Min. 24 hours) Field Notes:	1. .
	4	Verify the testing company is utilizing a non-destructive test by using both techniques 1 & 2. Both tests employ using a probe as described earlier. Technique 1; probe the joint at the center of its width to depress and elongate the sealant...note the depth of the depression as a % of the width of the joint. A common percentage to reveal poor adhesion and create reasonable strain is 50% Technique 2; probe the joint at the adjacent to the edge where the sealant abuts the substrate bond line. Depress the sealant bead sufficiently that (visually) it appears the sealant is about to fail cohesively. The tool should not touch or scrape the substrate, nor slide towards the center of the joint Field Notes:	1. .

<p>5</p>	<p>Verify the Following: non-destructive test by using the Continuous Inspection Procedure;</p> <ul style="list-style-type: none"> • Was the masking tape placed on the exposed substrate adjacent to the sealant joint. • Did the testing company use a roller (that is equal or less than half the width of the joint) to apply pressure to the sealant that represents 50% deflection of the sealant • Did the testing company advance the roller along the centerline of the joint observing conditions as it progresses for conditions such as deflections greater or less than expected, failure of adhesion or cohesive failure, mechanical damage to sealant. • If a failure occurs mark the masking tape; <ul style="list-style-type: none"> ○ “A” – Adhesion failure ○ “H” – Sealant appears hard ○ “S” – Sealant appears soft ○ “C” – Cohesive failure • If there is an extended area of failure mark the tape for the extent and which side failed. 	<p>1. .</p>
	<p>Field Notes:</p>	
<p>6</p>	<p>Upon completion of tests above, determine if destructive testing is required.</p>	<p>1. .</p>
	<p>Field Notes:</p>	

<p>7</p>	<p>Destructive Test 1:</p> <p>The “tail” procedure consists of cutting through the sealant 6 “ (150 mm) along the bond line at both substrates. The testing company should cut across the sealant bead to release one end of the “tail” that it formed</p> <ul style="list-style-type: none"> • Method A; (testing company should do the following) <ul style="list-style-type: none"> ○ Mark the cut portion of sealant 1 “ (25 mm) from the adhesive bond. (see diagram below) ○ Grasp and pull the “tail” at 90 degrees to substrate, and extend it to two times the movement capability of the sealant. ○ Record any failure and mark distance from adhesive bond when failure occurred. <p>.</p>	<p>1. .</p>
<p>Field Notes:</p>		
<p>8</p>	<p>Destructive Test 1:</p> <ul style="list-style-type: none"> • Method B; (testing company should do the following) <ul style="list-style-type: none"> ○ Mark the cut portion of sealant 1“ (25 mm) from the adhesive bond. (see diagram below) ○ Grasp and pull the “tail” at various angles, 30, 90 or 150 degrees to substrate, keeping the “tail” in line with the sealant bed. Monitor the extension to document elongation resulting in failure. <p>If the sealant begins to tear cohesively, stop and readjust grasp and restart. Pull tail that best avoids cohesive failure</p>	<p>2. .</p>
<p>Field Notes:</p>		

9	<p>Destructive Test 2:</p> <p>The “Flap” procedure consists of cutting through the sealant 3 “ (75 mm) along the bond line on the substrate opposite the substrate to be tested. Pry the flap out by the three cuts through the sealant bead. (see diagram below from ASTM) The testing company should do the following)</p> <ul style="list-style-type: none"> • Grasp the flap near the edge opposite the bond line to be evaluated. • Pull the flap in the tensile mode until adhesive or cohesive failure. • Stop pulling and grasp flap near other end. • Pull the flap in a shear mode until the onset of adhesive or cohesive failure. • Trim away the portions of the flap that have failed. • Bend twist and/or rotate the flap until adhesive or cohesive failure. • Test should be performed on both sides especially if the same type of substrate is present on both sides of joint.. 	3. .
	Field Notes:	

<p>10</p>	<p>Number and type of tests will depend upon the reasons for testing. i.e. Quality Control, water or air infiltration.</p> <ul style="list-style-type: none"> • <i>Nondestructive Spot Procedure;</i> For each area inspect, perform every 12' (300 mm) for first 100 lineal ft (3m). If not test failure loss in first 10 lineal ft (3m) of joint, test every 24 " (600 mm) thereafter. • <i>Nondestructive Continuous Inspection Procedure:</i> The amount and location of these inspections is dependent upon the purpose of the inspections. For Quality Control up to 100% may be designated based on the spot procedure or potential quality issues. • <i>Destructive Procedure:</i> For each area inspected, perform this procedure every 100 linear ft in the first 1,000 linear ft. If no failures are observed in the first 1,000 linear ft, perform procedure every 1,000 linear ft thereafter. Testing at non-typical areas such as joint intersections and complex configurations is recommended. 	<p>1. .</p>
<p>Field Notes:</p>		

Reporting:

- Record test conditions and results for each procedure on an appropriate form.
- Each joint is unique, and as such requires that the procedures described in this method be subjectively applied and/or modified for each test.
- It is recommended that the owner retain the sealant samples in a sealed plastic bag, labeled with the location from which sample was taken, date removed, results for the method and project identification. These samples should be stored in a secure location for the duration of the warranty period.
- Data Collection;
 - Accurate recording of the location, description of the sealant anomalies as they are observed is important.
 - There is no one single procedure that is most appropriate for all projects, therefore an effective method needs to be selected for each project.

Commissioning Functional Performance Test

- Use of the shop (submittal) and/or architectural drawing, to notate pertinent data has proven reliable on some projects.
- Photography is another useful method. When the inspection is complete, a photograph of the joint and associated masking tape can be of value. It is important that the photograph be of good quality so that the markings can be clearly read. This is true for both destructive and non-destructive test.

Repair:

The general contractor should contact the sealant manufacturer for specific recommendations for the repair of sealant damaged during field adhesion testing.

Date:

Summary of Results:

-

Lessons Learned:

-

Corrective Issues:

-

Acceptance of Test:

- This test cannot be accepted at this time due to the Corrective Issues noted above.
- This test was witnessed by the Commissioning Authority identified below. Any Corrective Issues noted above do not adversely impact the overall performance of the system.

Witnessed _____

Date _____

Commissioning Authority

- This test is accepted by the VA Representative identified below

Accepted _____

Date _____

VA Representative

DRAFT

PROJECT: SLVHCS REPLACEMENT MEDICAL CENTER PROJECT

PROJECT NUMBER: VA 629HS2401

REPORT ID:

DESCRIPTION: ASTM E1601

Date of Test:

DESIGN CRITERIA

Related Documents:

Specification Sections 040120, 042113, and 044200.

Drawings

Submittal Data

Test Equipment Required: per ASTM E1601

Summary of the ASTM test:

The test method describes the field determination of water penetration of a masonry wall surface under specific water flow rate and air pressure conditions. This test is intended for use on any masonry wall surface that can be properly instrumented and tested within the requirements of ASTM E 1601.

Due to the nature of the test and equipment used safety of operators and observers will be important. All applicable OSHA safety requirements as well as the fan equipment manufacturer's safety guidelines and specific requirements shall be enforced for all testers and observers. Safety equipment will be required and will, at a minimum, consist of;

1. *Eye Protection* — Glass should not break at the building pressure differences normally applied to the test structure: however, for added safety, adequate precautions, such as the use of eye protection should be taken to protect the personnel.
2. *Safety Clothing* — Use safety equipment required for general field work, including safety shoes, and hard hats.
3. *Equipment Guards* — The air-moving equipment shall have a proper guard or cage to house the fan or blower and to prevent accidental access to any moving parts of the equipment.

4. *Noise Protection* — Make hearing protection available for personnel who must be close to the noise that may be generated by the fan.

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Functional Performance Test Prerequisites

Prerequisite	Yes	No	Comments
1. Contractor QA/QC Testing Reports completed & submitted to CxA and <u>VA Resident Engineer</u> .			
2. Construction Checklist completed & submitted to CxA and <u>VA Resident Engineer</u> .			
3. O&M Manuals submitted to CxA and <u>VA Resident Engineer</u> for review.			
4.			
5.			

System Identification	
System Identification	Location

Functional Test Procedures:

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
GENERAL SYSTEM READINESS			
	1	Verify system has been inspected. All test pre-requisites have been satisfied.	1.
		Field Notes:	
	2	Verify adequate access is provided to the portion of the site and area for test(s) is free and clear of any and all obstructions.	2.
		Field Notes:	
	3	Verify Test Equipment is of a similar configuration to that shown below.	1.
		Field Notes:	
	4	Test opening should be rectangular with a minimum area of 12 ft ² (1.08 m ²) with a minimum dimension of 24 in. (0.6 m) for each side of the opening.	1.
		Field Notes:	
	5	Seal the contact surface between the frame of the chamber and the test area to prevent loss of water and maintain air pressure. Cover the face of the chamber with a tough, transparent material capable of withstanding the test pressure.	1.
		Field Notes:	
X	6	Provide a 3/4-in. (19-mm) diameter, corrosion-resistant, water spray pipe with a single line of 0.04-in. (1.0-mm) diameter holes spaced 1 in. (25 mm) apart, starting within 1 in. (25 mm) of each end.	1.

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
		Field Notes:	
X	7	Position the water spray pipe within the chamber so that the water impinges the wall perpendicular to the wall not more than 1.5 in. (40 mm) below the interior top of the test chamber	1.
		Field Notes:	
X	8	Fixtures and appurtenances to the chamber include; <ul style="list-style-type: none"> • an air line with manometer or pressure gauge able to read air pressure to within 0.50 lb/ft² (24 Pa), • a water line with valves, a flow meter in the water supply line able to read flow within 0.02 gpm (4.5 L/h), and a water drain pipe at the bottom of the chamber. • The water is stored in a calibrated reservoir with a minimum volume of 3 gal. (13 L), with graduations to allow readings within 0.015 gal (0.055 L). • Pump water from the reservoir to the spray bar. Return water which drains from the bottom of the chamber directly to the reservoir. 	1.
		Field Notes:	
	9	<i>Mounting Chamber—</i> <ul style="list-style-type: none"> • Attach the test chamber with mechanical fasteners using sufficient pressure to form an air- and water-resistant seal. Use of a gasket or sealant at the contact surface is common. 	1.
		Field Notes:	

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
X	10	<p><i>Sealing—</i></p> <ul style="list-style-type: none"> If needed, apply a perimeter sealant between the chamber and wall surface to ensure that leakage does not occur at the interface. Allow the sealant to cure sufficiently to ensure adequate bond and water resistance. 	1.
		Field Notes:	
X	11	<p><i>Standard Test Conditions—</i></p> <ul style="list-style-type: none"> Perform this test using a water flow rate of 3.4 gal/ft²/h (138 L/m²/h) and an air pressure of 10 lb/ft² (500 Pa). The test duration shall be not less than 4 h after the preconditioning period. 	1.
		Field Notes:	
X	12	<p><i>Application of Air Pressure and Water Flow —</i></p> <ul style="list-style-type: none"> Adjust the water flow rate to 3.4 gal/ft²/h (138 L/m²/h) times the area of the chamber opening. Simultaneously, increase the air pressure within the chamber to 10 lb/ft² (500 Pa). Check for leakage from the perimeter of the chamber. If leakage occurs, stop the test, reseal, and re-start the procedure. <p><i>Preconditioning —</i> Maintain the water flow rate and pressure for 30 min prior to starting the test.</p>	1.
		Field Notes:	

NOTE: Check for leakage from the perimeter of the chamber . If leakage occurs, stop the test, reseal, and re-start the procedure.

Record of Observations:

Testing company should make observations and measurements during the duration of the test, from pre-conditioning at each pre-determined test period as noted below;

- Record the initial water flow rate, air pressure within the chamber, and water level within the reservoir at the beginning of the test after the specified preconditioning period.
- Report the water flow pattern.
 - If a complete sheet of water is observed, report it as “sheet flow”.
 - If the water runs down the surface in patterned or random rivuleted streams or in any other manner that leaves portions of the wall surface un-wetted, report it as “incomplete sheet flow” and document the pattern of flow with sketches drawn to scale.
 - Monitor the water flow pattern during the testing and report any changes.
- Record the water level in the reservoir, air pressure, and water flow rate at the beginning of, at the end of, and at 5-minute (maximum) intervals throughout each test period.
- Record the amount and time at which water is added to replenish the reservoir. Simultaneously, record the new water level with each addition of water to the reservoir.
- Note and photograph visible lateral and vertical migration of dampness outside the chamber. Note leakage from adjacent areas. Note signs of interior moisture or leakage where accessible. Note any interruptions in testing including length of time and reason.

Calculations:

- Calculate water loss, to the nearest 0.025 gal (0.1 L), from the reservoir at each recorded time interval.
- Plot the loss of water versus time.
- Calculate surface penetration in gal/ft²/hr (L/m²/hr) for each period of testing by performing a linear regression fit using all data for that period versus time and dividing the rate of water loss by the area of the chamber opening.

Report:

Testing company report should be as following:

- The project name and address of the building;
- Date, time, and temperature during the test;
- Dates and results of previous tests of same area, if applicable;
- Name(s) and address(es) of individual(s) performing the test;
- Description of the construction of the area tested including surface coatings, masonry type, wall assembly structural system, condition of the masonry surface, chamber location including elevation, floor level and position relative to wall ends or openings in

Commissioning Functional Performance Test

the structure, and repairs performed prior to each test; (NOTE — Examples of masonry surface conditions include presence of cracks, deteriorated units, and so forth.)

- Description of chamber construction and attachment to wall;
- Statement of test conditions as applicable;
- Record of observations
- Document manufacture surface penetration recommendations for the system
- Results of calculations and graphs

Date:

Summary of Results:

-

Lessons Learned:

-

Corrective Issues:

-

Acceptance of Test:

- This test cannot be accepted at this time due to the Corrective Issues noted above.
- This test was witnessed by the Commissioning Authority identified below. Any Corrective Issues noted above do not adversely impact the overall performance of the system.

Witnessed _____

Date _____

Commissioning Authority

- This test is accepted by the VA Representative identified below

Accepted _____

Date _____

VA Representative

Determining Air Leakage Rate by Fan Pressurization

PROJECT: SLVHCS REPLACEMENT MEDICAL CENTER PROJECT

PROJECT NUMBER: VA 629HS2401

REPORT ID:

DESCRIPTION: ASTM E779, C1060, and E1186

Date of Test:

DESIGN CRITERIA

Related Documents:

Specification Sections

070800

Drawings

Submittal Data

Test Equipment Required:

See below:

Test Equipment Required:

Major Components:

1. *Air Moving Equipment* — consisting of a fan, blower, or blower door assembly that is capable of moving air into and out of the conditioned space at required flow rates under a range of test pressure differences. The system shall provide constant airflow at each incremental pressure difference at fixed pressure for the period required to obtain readings of airflow rate. Where applicable, the HVAC system of the building may be used in place of the fan or blower.
2. *Pressure-Measuring Device* — A manometer or pressure indicator to measure pressure difference with an accuracy of 65 % of measured pressure.
3. *Airflow Measuring System* — A device to measure airflow with an accuracy of 65 % of the measured flow. The airflow measuring system shall be calibrated in accordance with Test Method E 1258

4. *Temperature-Measuring Device* — An instrument to measure temperature with an accuracy of 61°C (2°F).
5. *Wind Speed-Measuring Device (Optional)* — A device to give an accuracy within 60.25 m/s (0.56 mph) at 2.5 m/s (5.6 mph). Perform wind speed measurements at a distance three to five building heights away from the buildings, where practical. List the height above ground at which wind speed is measured.

Safety:

Due to the nature of the test and equipment used safety of operators and observes will be important. All applicable OSHA safety requirements as well as the fan equipment manufacturer's safety guidelines and specific requirements shall be enforced for all testers and observers. Safety equipment will be required and will, at a minimum, consist of;

5. *Eye Protection* — Glass should not break at the building pressure differences normally applied to the test structure: however, for added safety, adequate precautions, such as the use of eye protection should be taken to protect the personnel.
6. *Safety Clothing* — Use safety equipment required for general field work, including safety shoes, and hard hats.
7. *Equipment Guards* — The air-moving equipment shall have a proper guard or cage to house the fan or blower and to prevent accidental access to any moving parts of the equipment.
8. *Noise Protection* — Make hearing protection available for personnel who must be close to the noise that may be generated by the fan.

NOTE: - Debris and Fumes — The blower or fan forces a large volume of air into or out of a building while in operation. Exercise care not to damage plants, pets, occupants, or internal furnishings due to influx of cold or warm air. Exercise similar cautions against sucking debris or exhaust gases from vehicles, fireplaces, and flues, etc. into the interior of the building. Active combustion devices require a properly trained technician to shut them off or to determine the safety of conducting the test.

Summary of the ASTM test:

This test method consists of mechanical pressurization or de-pressurization of a building and measurements of the resulting airflow rates at given indoor-outdoor static pressure differences. From the relationship between the airflow rates and pressure differences, the air leakage characteristics of a building envelope can be evaluated. This test should be combined with ASTM E1060 and ASTM E 1168.

Functional Performance Test Prerequisites

Prerequisite	Yes	No	Comments
1. Contractor QA/QC Testing Reports completed & submitted to CxA and <u>VA Resident Engineer</u> .			
2. Construction Checklist completed & submitted to CxA and <u>VA Resident Engineer</u> .			
3. O&M Manuals submitted to CxA and <u>VA Resident Engineer</u> for review.			
4. Weather Forecast for a two day period with low speed winds and small temperature differentials			
5.			

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Functional Test Procedures:

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
GENERAL SYSTEM READINESS			
	1	Verify test location has been set up per specification 08 08 00	
		Field Notes:	
	2	Verify 2 day weather outlook is conducive to the test parameters.	1. .
		Field Notes:	
	3	Verify single zone established, and all interconnecting doors etc are closed.	1. .
		Field Notes:	
	4	Verify space conditioned to be within 10%+/- of measured inside/outside pressure differential.	1. .
		Field Notes:	
	5	Make general observations of the condition of the building. Take notes on the windows, doors, opaque walls, roof, and floor.	1. .
		Field Notes:	

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
	6	<p>Measure and record the indoor and outdoor temperatures at the beginning and the end of the test so that their average values can be estimated. If the product of the absolute value of the indoor/outdoor air temperature difference multiplied by the building height, gives a result greater than 200 m°C (1180 ft°F), do not perform the test, because the pressure difference induced by the stack effect is too large to allow accurate interpretation of the results.</p> <p>Field Notes:</p>	<p>Indoor T= Outdoor T= Difference = Building Height =</p>
	7	<p>If the wind speed is to be part of the measurement record, use a wind-measuring device or obtain readings from a nearby weather bureau. Preferred test conditions are wind speed of 0 to 2 m/s (0 to 4 mph) and an outside temperature from 5 to 35°C (41 to 95°F).</p> <p>Field Notes:</p>	<p>Wind speed =</p>
	8	<p>Verify that the blower door assembly to the building envelope, using a window, door, or vent opening. Seal or tape openings to avoid leakage at these points.</p> <p>Field Notes:</p>	

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
	9	<p><i>Verify that the Envelope Pressure Sensor(s) are installed —</i></p> <ul style="list-style-type: none"> • Install the pressure measuring device across the building envelope. • Document the location of the sensor. <i>(It is good practice to use more than one location across the building envelope for pressure measurement, for example, one across each facade. Diagram (from the ASTM test) below illustrates preferred locations for exterior pressure measurement locations that avoid extremes of exterior pressures (at exterior corners).)</i> • Verify that the location avoids exterior corners and complex architectural features and should be close to the middle of the exterior wall. • Verify that is the, buildings more than three stories, or 7.5 m (25.5 ft), high, that the exterior pressures measured at more than one height on the exterior walls. • The pressures from each location should be averaged, typically using a manifold. • Verify the measurements are taken average the pressures over at least a 10-s time period. <p>Field Notes:</p>	1.
	10	<p>Document zero flow pressures with the fan opening blocked. <i>These zero flow envelope pressures are measured before and after the flow measurements. These zero flow pressures are to be subtracted from the envelope pressures measured during pressurization and depressurization.</i></p> <p>Field Notes:</p>	1.
	11	<p>The range of the induced pressure difference shall be from 10 to 60 Pa (0.04 to 0.24 in. H₂O)</p>	1.

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
		Field Notes:	
	12	Verify the testing company will use increments of 5 to 10 Pa (0.02 to 0.04 in. H ₂ O) for the full range of induced pressure differences.	1.
		Field Notes:	
	13	At each pressure difference, measure the airflow rate and the pressure differences across the envelope. After the fan and instrumentation have stabilized, the average over at least a 10-s interval should be used.	1.
		Field Notes:	
	14	For each test, collect data for both pressurization and de-pressurization	1.
		Field Notes:	
	15	Determine the elevation of the measurement site, <i>E</i> (m or ft), above mean sea level within 100 m (330 ft).	1.
		Field Notes:	
	16	When the building is at max pressurization, photo graph the building inside and out using an inferred camera, per ASTM C1060.	<ol style="list-style-type: none"> 1. Document the building before the blower door test. Using the inferred camera. 2. Take both a color and IR photo of the Location. 3. Indicate the location of the camera and direction of the camera on the floor Plan.
		Field Notes:	

	<p>17 The testing company should Use tracer gas/smoke test to determine area and the causes of excess leakage locations, per ASTM E1186.</p>	

Data Analysis and Calculations:

- Verify the testing company performs the necessary calculations as outlined in ASTM 779.

Report:

Testing company report should be as following:

Report the following information:

- Building description, including location, address (street, city, state or province, zip or postal code, country, and elevation [above mean sea level in m (ft)]).
- Construction, including date built (estimate if unknown), floor areas for conditioned space, attic, basement, and crawl space, and volumes (optional) for conditioned spaces, attic, basement, and crawl space.
- Condition of openings in building envelope including:
 - Doors, closed, locked or unlocked;
 - Windows, closed, latched or unlatched;
 - Ventilation openings, dampers closed or open;
 - Chimneys, dampers closed or open; and a
 - Statement whether the test zone is interconnected with at least door-sized openings. If not, the results of pressure measurements between portions of the zone.
- HVAC system, including the location and sizes of ducts that penetrate the test zone envelope.
- Procedure, including the test equipment used (manufacturer, model, serial number), and calibration records of all measuring equipment.
- Measurement data, including:
 - Fan pressurization measurements (inside-outside zero flow building pressure differences);
 - inside and outside temperature (at start and end of test) and the product of the absolute value of the indoor/outdoor air temperature difference multiplied by the building height;
 - tabular list of all air leakage measurements and calculations:
 - time, building pressure difference, air density, nominal airflow rate, fan airflow rate, and air leakage rate;
 - and deviations from standard procedure.
 - Optional data, including wind speed/direction and whether wind speed is estimated to exceed 0 to 2 m/s (0 to 4 mph).

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- Calculations, including:
 - The leakage coefficient and pressure exponent for both pressurization and de-pressurization;
 - The effective leakage area. Also, report if a reference pressure other than 4 Pa is used; and,
 - An estimate of the confidence limits.

Date:

Summary of Results:

-

Lessons Learned:

-

Corrective Issues:

-

Acceptance of Test:

- This test cannot be accepted at this time due to the Corrective Issues noted above.
- This test was witnessed by the Commissioning Authority identified below. Any Corrective Issues noted above do not adversely impact the overall performance of the system.

Witnessed _____

Date _____

Commissioning Authority

- This test is accepted by the VA Representative identified below

Accepted _____

Date _____

VA Representative

Determining Water Penetration

PROJECT: SLVHCS REPLACEMENT MEDICAL CENTER PROJECT

PROJECT NUMBER: VA 629HS2401

REPORT ID:

DESCRIPTION: ASTM E1105, E1186 & E783

Date of Test:

DESIGN CRITERIA

Related Documents:

Specification Sections

Drawings

Submittal Data

Test Equipment Required:

Test chamber: to be constructed on the interior or exterior of the building.

Blower fan: to obtain specified static pressures

Pressure differential magnehelic manometer

Spray rack with nozzles spaced on a uniform grid located at 15" from the test specimen creating five to eight per hour per square foot.

Due to the nature of the test and equipment used safety of operators and observes will be important. All applicable OSHA safety requirements as well as the fan equipment manufacturer's safety guidelines and specific requirements shall be enforced for all testers and observers. Safety equipment will be required and will, at a minimum, consist of;

1. *Eye Protection* — Glass should not break at the building pressure differences normally applied to the test structure: however, for added safety, adequate precautions, such as the use of eye protection should be taken to protect the personnel.
2. *Safety Clothing* — Use safety equipment required for general field work, including safety shoes, and hard hats.
3. *Equipment Guards* — The air-moving equipment shall have a proper guard or cage to house the fan or blower and to prevent accidental access to any moving parts of the equipment.
4. *Noise Protection* — Make hearing protection available for personnel who must be close to the noise that may be generated by the fan.

Summary of the ASTM test:

ASTM E1105, E1186 and E783 will be run at the same time using the same testing equipment. The test chamber needs to be sized to handle all the requirements of the tests.

- *Test Chamber*— The test chamber consists of a well sealed chamber which is designed to resist the pressure differentials used in the test. The test chamber is sealed to the air barrier system component and contains a connection point for attaching the fan inlet or outlet. The test chamber may also contain an adjustable bleed valve for controlling the pressure inside the chamber and a pressure tap to facilitate determining the pressure differential across the specimen with a manometer.
- *Air Exhaust (or Supply) System*—A fan or blower that is capable of providing sufficient airflow to achieve the desired pressure differential across the test area is used. A speed control on the fan or an adjustable bleed valve in the test chamber can be used to control the pressure in the chamber.

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Functional Performance Test Prerequisites

Prerequisite	Yes	No	Comments
1. Contractor QA/QC Testing Reports completed & submitted to CxA and <u>VA Resident Engineer</u> .			
2. Construction Checklist completed & submitted to CxA and <u>VA Resident Engineer</u> .			
3. Locations of tests have been verified by the CxA, <u>VA Resident Engineer</u> and Architect			
4.			
5.			

System Identification	
System Identification	Location

Functional Test Procedures:

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
GENERAL SYSTEM READINESS			
	1	Fit the test chamber to the perimeter of the test specimen and seal all joints between the test specimen perimeter and test chamber.	
		Field Notes:	
	2	Verify the means for measuring the air pressure difference across the test specimen.	
		Field Notes:	
ASTM E783			
	3	Verify that the air flow, through the test chamber, provides the specified test pressure difference across the test specimen. When the test conditions are stabilized, record the air flow through the flow meter and the test pressure difference.	
		Field Notes:	
	4	Measure and record the following: <ul style="list-style-type: none"> ○ barometric pressure ○ temperature ○ relative humidity of the air near the exposed area of the test specimen, and of the air near the air intake/exhaust of the air system ○ speed and direction of the air movement (wind) at or near the exposed surface of the test specimen. Such measurements shall be taken immediately prior to or during the test. 	
		Field Notes:	

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
ASTM E 1186			
	5	Verify the blower fan is used to pressurize (or depressurize) the test chamber the smoke tracer source is moved over the surface of the test specimen. The direction of movement of the smoke trace is carefully noted. When the tracer source is used on the high pressure side of the test specimen, smoke will be drawn into air leakage sites. Conversely, if the tracer source is used on the low pressure side of the test area, smoke will be forced away from air leakage sites.	
		Field Notes:	
ASTM E1105			
Procedure A: Uniform static air pressure difference			
	6	Verify that the valve on the water-spray system so that the intake water is being delivered at the calibrated pressure. Record the pressure.	
		Field Notes:	
	7	Verify the testing company is applying the specified static air pressure difference within 15 seconds and maintain this pressure, along with the specified rate of water spray for 15 minutes.	
		Field Notes:	
	8	Observe and note points of water penetration that occur during the test.	
		Field Notes:	

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
	9	Verify the testing company has removed the air pressure difference and stop the water spray. Inspect the test specimen for any additional evidence of water penetration and note any such evidence for the report.	
		Field Notes:	
	10	Measure and record the barometric pressure and temperature of the air near the exposed surface of the test specimen and of the air near the air intake or exhaust of the air system.	
		Field Notes:	
	11	Measure and record the barometric pressure and temperature of the air near the exposed surface of the test specimen and of the air near the air intake or exhaust of the air system.	
		Field Notes:	
	12	Measure and record the speed and direction of the air movement (wind) at/or near the exposed surface of the test specimen. Take such measurements immediately prior to/ during the test.	
		Field Notes:	
Procedure B: Cyclic static air pressure difference			
	13	Verify the valve on the water-spray system so that the intake water is being delivered at the calibrated pressure.	
		Field Notes:	

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
	14	<p>Verify the testing company is applying the specified static air pressure difference across the test specimen promptly and maintain this pressure, along with the specified rate of water spray, for the period of time stipulated by the specification or the specified. Unless otherwise specified, the duration of the pressure cycle shall be five minutes.</p> <p>Field Notes:</p>	
	15	<p>Verify the testing company is reducing the air pressure difference to zero for a period of not less than one minute while maintaining the water spray.</p> <p>Field Notes:</p>	
	16	<p>Verify the testing company is repeating the preceding two steps for the specified number of cycles. In no case, however, shall the total time of pressure application be less than 15 minutes.</p> <p>Field Notes:</p>	
	17	<p>Observe and note points of water penetration that occur during the test.</p> <p>Field Notes:</p>	
	18	<p>At the conclusion of the required number of cycles, remove the air pressure difference and stop the water spray. Inspect the test specimen for any additional evidence of water penetration and note any such evidence for the report.</p> <p>Field Notes:</p>	

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
	19	Measure and record the barometric pressure and temperature of the air near the exposed surface of the test specimen, and the air near the air intake or exhaust of the air system. Measure and record the speed and direction of the air movement (wind) at/near the exposed surface of the test specimen. Take such measurements immediately prior to/during the test.	
		Field Notes:	

Testing company report should be as following:

Report the following information for ASTM E 783:

- Testing agency, requester of test, date and time of test, date of report, identification, and location of building.
- Test specimen description.
- Detailed drawings of the specimen (if available).
- Sampling procedures.
- Test parameters.
- Ambient test conditions.
- Pressure differences and Leakage.

Report the following information for ASTM E 1186:

- Testing agency, requester of test, date and time of test, date of report, identification, and location of building.
- Test specimen description.
- Detailed drawings of the specimen (if available).
- Sampling procedures.
- Test parameters.
- Ambient test conditions.
- The direction of movement of the smoke trace.

Commissioning Functional Performance Test

Report the following information for ASTM E1105

- Testing agency, requester of test, date and time of test, date of report, identification, and location of building.
- Test specimen description.
- Detailed drawings of the specimen (if available).
- Sampling procedures.
- Test parameters.
- Test conditions.
- Test results.
- Compliance statement.

Date:

Summary of Results:

-

Lessons Learned:

-

Corrective Issues:

-

Acceptance of Test:

- This test cannot be accepted at this time due to the Corrective Issues noted above.
- This test was witnessed by the Commissioning Authority identified below. Any Corrective Issues noted above do not adversely impact the overall performance of the system.

Witnessed _____

Date _____

Commissioning Authority

This test is accepted by the VA Representative identified below

Accepted _____

Date _____

VA Representative

DRAFT

Field Testing Uplift Resistance of Adhered Membrane Roofing Systems

PROJECT: SLVHCS REPLACEMENT MEDICAL CENTER PROJECT

PROJECT NUMBER: VA 629HS2401

REPORT ID:

DESCRIPTION: ASTM E907-96

Date of Test:

DESIGN CRITERIA

Related Documents:

Specification Sections

Drawings

Submittal Data

Test Equipment Required:

Test chamber: square chamber – dome shaped designed to withstand pressure w/o collapsing.

Vacuum Equipment – to obtain specified pressures

Pressure sensing device – manometer

Dial Indicator – to measure deflection in roof surface in test area.

Summary of the ASTM test:

This test method is intended to be used as a measure of the uplift resistance of the roofing system. Systems containing cold adhesive shall be in place for the cure time specified by the adhesive manufacturer to obtain optimum adhesion before conducting the test. Hot-applied systems shall be permitted to cool to normal prevailing surface temperatures before conducting the test.

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Functional Performance Test Prerequisites

Prerequisite	Yes	No	Comments
1. Contractor QA/QC Testing Reports completed & submitted to CxA and <u>VA Resident Engineer</u> .			
2. Construction Checklist completed & submitted to CxA and <u>VA Resident Engineer</u> .			
3. Locations of tests have been verified by the CxA, <u>VA Resident Engineer</u> and Architect			
4.			
5.			

System Identification	
System Identification	Location

Functional Test Procedures:

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
GENERAL SYSTEM READINESS			
	1	Measure and record air temperature with a thermometer, and roof surface temperature with a surface thermometer. Field Notes:	
	2	Conduct tests when the temperature of the roof surface is in the range from 4 to 38°C (40 to 100°F). Temperatures outside this range will produce questionable results. For safety considerations, tests shall not be conducted when the wind speed at the roof level is over 6.5 m/s (15 mph). When necessary to measure and record wind speed, a portable anemometer shall be used. Field Notes:	
ASTM E907-96			
	3	Place the bar with attached dial indicator so that the tip of the dial indicator is in contact with the roof membrane near the center of the test area (See Fig.3 below) Field Notes:	
	4	Place the assembled chamber over the roof test area so that the deflection bar with attached dial indicator is centered within the chamber and is perpendicular to two sides of the chamber. The edges of the chamber shall be sealed to the roof surface. Orient the chamber on the roof so that the edges are parallel with the direction of the structural framing of the building. (See example of chamber below)	

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
		Field Notes:	
	5	Install the pressure measuring device. If a manometer is used, fill it with water to zero calibration level.	
		Field Notes:	
	6	Connect the vacuum equipment to the hole provided for it in the chamber. Make sure that the bypass valve on the vacuum equipment is open before starting the equipment, or if a rheostat is used, that it is in the OFF position.	
		Field Notes:	
	7	Continuously observe the deflection and pressure measuring device throughout the period that vacuum is created for sudden or variable rates of movement.	
		Field Notes:	
	8	Regulate the negative pressure in the chamber to the specified level. Unless otherwise specified, conduct the test by raising the negative pressure in the chamber to 720 6 20 Pa (15 lbf/ft ²) and holding this pressure for 1 min. Thereafter, raise the pressure in increments not greater than 360 6 20 Pa (7.5 lbf/ft ²) until the agreed upon pressure is reached. Hold the pressure at each increment for 1 min. Terminate the test when failure occurs or at the completion of 1 min at the agreed upon specified negative pressure.	
		Field Notes:	

Interpretation of Results:

Most roof systems subjected to a negative pressure will exhibit an upward deflection that will increase as the negative pressure increases. Poorly adhered systems will exhibit relatively large increases in upward deflections with relatively small increases in applied pressure. For roof systems that are well adhered, the increase in deflection will be gradual and at a relatively constant rate up to a point at or near failure. When failure occurs due to lack of adhesive or cohesive resistance of the roof system, there will be a sudden increase in the upward deflection.

Failure is taken as uplifting of the roof covering as indicated by a measured upward deflection of 25 mm (1 in.) or greater at the center unless a particular system exhibits greater limits of deflection without failure as determined by examination or past test experience, or both. A sudden increase in deflection indicates a problem that requires further investigation to determine if adhesion or attachment of roofing system components is adequate.

Testing company report should be as following:**Report the following information for ASTM E907:**

- Area, height, and plan view of the roof showing the location of the test areas.
- Complete detailed description of the roof assembly construction being tested. Include the type of roof deck and method of attachment, deck support spacing, vapor retarder and adhesive, if any, types and thicknesses of insulation, if any, methods of attachment, and the type of adhered roofing including surfacing.
- Dates of tests, air and roof surface temperatures, and wind speed (if measured). The internal pressure of the building shall be recorded before starting the uplift tests.
- Description of the test procedure giving the negative pressure increments, length of time pressure maintained at each increment, and the maximum applied pressure.
- Tabulation of results observed at each pressure increment including visual observations and deflection. The deflection shall be measured and recorded at the start and end of each pressure increment.
- If failure occurs during the tests, the complete record shall include:
 - (a) the negative pressure at which failure occurred,
 - (b) observations obtained by thorough examination of the failed area including cuts through the membrane if necessary (cuts in built-up membranes shall be made as shown in Fig. 4 (below) to preserve the integrity of the test cut area),
 - (c) description of type of failure and its location within the roof assembly, and
 - (d) other observations of the roof assembly conditions that are attributed to the failure. The cut area of roofing shall be repaired after examination of the failed area.
- Names, signatures, and affiliations of the persons observing the tests.

Date:

Summary of Results:

-

Lessons Learned:

-

Corrective Issues:

-

Acceptance of Test:

- This test cannot be accepted at this time due to the Corrective Issues noted above.
- This test was witnessed by the Commissioning Authority identified below. Any Corrective Issues noted above do not adversely impact the overall performance of the system.

Witnessed _____ Date _____
Commissioning Authority

- This test is accepted by the VA Representative identified below

Accepted _____ Date _____
VA Representative

APPENDIX C

FIELD TEST REPORT DOCUMENTATION

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Report No.:

Party Filling Out This Form:

Set-Up Date:

Set-Up Completion Data:

Test Date:

Test Completion Data:

Report Date:

Verification the system is ready to test:

The Construction Manager has certified that the system is substantially complete and ready for testing.

Construction Manager Signature: _____ Date: _____

All the system sub-contractors has certified that the construction is substantially complete and ready for testing verification

Signature: _____ Date: _____

Signature: _____ Date: _____

Signature: _____ Date: _____

Project Identification:

Project Summary:

Test Methods:

Pre-Test Inspection:

Test Procedure:

Field Modification:

Performance Criteria:

Document the following:

1. Attach floor plan and elevations indicating test locations
2. Attach photos of all tests failure locations
3. For infrared photos: Attach non-infrared & infrared photo of the testing area

Information on Equipment/Performing Test (List All):

Make:

Model:

Last Date Certified Inspection of Equipment:

Name of Certified Inspector:

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TEST RESULTS

Date: Ambient Exterior Air Temperature: °F

General Note:

Test Specimen #1:

Description:

Test Area Size:

Location:

Title of Test:

Test Results:

Allowable:

(What is the baseline for the Test Result? Or, what is the min or max value that is considered acceptable for this test?)

Test Specimen #2*:

Description:

Test Area Size:

Location:

Title of Test:

Test Results:

Allowable:

(What is the baseline for the Test Result? Or, what is the min or max value that is considered acceptable for this test?)

APPENDIX D

ENCLOSURE TESTING MATRIX

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SLVHCS REPLACEMENT MEDICAL CENTER PROJECT

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SLVHCS REPLACEMENT MEDICAL CENTER PROJECT

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