

OPTIONAL SECTION: Mock-ups are part of Section 01 43 00 Quality Assurance; however this section should be used when more stringent building envelope requirements are desired.

SECTION 01 43 39 MOCK-UPS

PART 1 – GENERAL

1.1 MOCK-UPS

A. General mock-up requirements

1. Intent of mock-up is to permit review of appearance, quality of workmanship, coordination, compatibility, and relationships with adjacent materials, to test air and water infiltration performance, and to provide Contractor with opportunity to coordinate Subcontractor Work.
2. Maintain quality control over Work of various Sections of Specifications, manufacturers, products, services, workmanship, and site conditions to produce mock-ups in accordance with the Contract Documents.
3. Mock-ups include, but are not necessarily limited to, the following:
 - a. Exterior claddings, and finishes
 - b. Special Exterior Materials
 - c. Special Interior Finishes

B. Related Sections include the following:

Note to PM: Verify actual section numbers and titles with Design Professional
Specify in each technical section when mock-ups are required from the Contractor and reference this Section 01 43 39 Mock-Ups.

1. Section 03 10 00 Concrete Formwork.
2. Section 03 20 00 Concrete Reinforcement.
3. Section 03 30 00 Cast-in-Place Concrete.
4. Section 04 20 00 Unit Masonry.
5. Section 04 72 00 Architectural Precast Concrete Fabrications.
6. Section 05 10 00 Structural Steel.
7. Section 05 30 00 Steel Decking.
8. Section 05 40 00 Cold-Formed Metal Framing.
9. Section 05 70 00 Decorative Metal.
10. Section 06 16 00 Sheathing.
11. Section 07 27 13 Modified Bituminous Sheet Air Barriers.
12. Section 07 42 43 Composite Wall Panels.
13. Section 07 54 19 Polyvinyl-Chloride (PVC) Roofing.
14. Section 07 62 00 Sheet Metal Flashing and Trim.
15. Section 07 92 00 Joint Sealants.
16. Section 08 41 13 Aluminum-Framed Entrances and Storefronts.
17. Section 08 44 13 Glazed Aluminum Curtain Walls.
18. Section 09 24 00 Portland Cement Plastering.

1.2 SUMMARY

- A. Location of the mock-up assembly at Project site must be approved by the University's Representative.

- B. Provide a freestanding exterior building mock-up to permit review of appearance, quality of workmanship, coordination, compatibility, and relationships with adjacent materials. The Contractor shall provide composite mock-up drawings prior to fabrication for approval by the University's Representative. Mock-up shall be constructed out of sequence and will not be incorporated into the final building. The mock-up will stand through the completion of the building exterior and serve as the standard for workmanship once it has been accepted in writing by the University's Representative. Provide the following exterior building mock-ups:
1. Exterior wall assembly systems and finishes, including all transitions and interfaces between different materials and walls to openings/curtain wall and storefronts. This is a single comprehensive mock-up.
 - a. Stucco: screeds, flashings, control and expansion joints, intersections with heads/jamb/sills of windows and doors and penetrations.
 - b. Precast to metal, with inside corner.
 - c. Metal panel to metal panel, with inside and outside corners.
 - d. Curtain wall to metal panel, with inside corner.
 - e. Curtain wall to curtain wall, with outside corner.
 - f. Curtain wall to precast, with inside corner.
 2. Exterior paving including all finishes specified.
- C. Provide full size room mock-ups within the building. The rooms to serve as the mock-ups shall be as indicated on the Drawings or as approved by University's Representative. Room mock-up shall include all required floor, wall, and ceilings finishes, casework, light fixtures, door(s) and frame(s), glazing, mechanical diffusers, and other required materials and finishes. Make necessary modifications until room mock-up is accepted by the University's Representative. Mock-up shall be constructed out of sequence. Upon acceptance, the room mock-up will be incorporated into the final completed Project. Provide the following room mock-ups:
1. Typical [Office/Conference] Room including all finishes
 2. Typical [Open Student Space (Academic Advising Center/Computer Center)] including all finishes and casework sections.
 3. Typical ornamental handrail/guardrail at 2 story volumes.
 4. Mock-ups will be used by the University's Representative to test color and material alternatives and to accept final colors, textures and workmanship. Multiple colors may be tested for each component as part of the mock-up until the University's Representative is satisfied.
- D. Special Finishes Mock-ups: Provide special finish mock-ups of the following materials in specified rooms. Mock-ups shall show materials and workmanship to be expected in the completed work. Make necessary revisions as required until each special finishes mock-up is accepted by the University's Representative. Accepted mock-ups will be allowed to remain in place. Provide special finishes mock-ups of the following:
1. Typical Interior Corridor including all finishes— at both the 2 story volume and single story volume conditions.
 2. Typical Corridor niche and alcove conditions.
- 1.3 SUBMITTALS
- A. Mock-ups shall not be fabricated until after acceptance of required submittals for all finish materials to be incorporated into the mock-ups. Project schedule shall take into account early submittal of these components to the University's Representative.
 - B. Submit shop drawings for the mock-up that integrate shop drawings of each finish material and footings and bracing. Clearly identify components and materials to be integrated into the assembly.

- C. Prior to construction of mock-ups, provide material samples as specified in the respective Specification Sections included as part of the mock-ups.
- D. Submit structural calculations as required to ensure the structural integrity of the mock-up. The calculations shall be signed by a licensed California structural or civil engineer and shall be submitted to the University's Representative for review.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- B. Performance: Mock-ups shall be constructed for the University's Representative's review for compliance with the Contract Documents.
- C. Make necessary additions and modifications to mock-ups as required by the University's Representative.
- D. Modify mock-ups, or construct or install new components if requested by the University's Representative, until final acceptance is obtained.
- E. Provide as many modifications as required to achieve mock-ups that are acceptable to the University's Representative, meeting testing requirements, and of sufficient quality to serve as the standard for the complete Project.
- F. Following acceptance, mock-ups shall serve as a performance standard of quality and appearance of the Work it represents, including the interface with adjacent materials and components as applicable.
- G. Coordinate fabrication, delivery, assembly, and installation with related materials to be included in the mock-ups. Construction of the mock-up assemblies shall be under the supervision of the same personnel who will be employed for the subsequent work.
- H. Maintain mock-ups in neat, clean condition until removal or final acceptance. Repair damage as required to maintain in condition suitable for review and approval.
- I. Accepted building mock-up shall be removed from the Project site when indicated by the University's Representative. Accepted room mock-up may be incorporated into the work.
 - 1. Remove and clear area after approval of the exterior mock-up only as indicated by the University's Representative.
- J. Scheduling:
 - 1. Construct mock-ups in a timely manner to permit review and modifications such that the work is not delayed.
 - 2. Do not proceed with ordering of components or start construction until after mock-up acceptances have been obtained and University's Representative has approved.
 - 3. Provide the University's Representative not less than a 7 day notice of the time each component is ready for review.
 - 4. Include line item in the construction schedule for the exterior building mock-up, showing submittals, construction, review, and approval periods.
 - 5. Allow sufficient time in the schedule to accommodate failures of tests and necessity to modify and retest. The mock-up shall be erected in sufficient time to allow final approval of window frame color, glass selection, and sealant colors.

Note to PM: Coordinate testing of mock-ups with testing in each related technical specification section when the mock-ups are required from Contractor.

1.5 PERFORMANCE TESTING

- A. Test Methods: The on-site exterior wall assembly mock-ups shall be tested in accordance with the following ASTM test procedures:
1. ASTM E 783: Field Measurement for Air Leakage through Installed Exterior Windows and Doors.
 2. ASTM E 1105: Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. As specified in the respective Sections of the Specifications.

2.2 EXTERIOR BUILDING MOCK-UPS

- A. Purpose: Establish standards for work indicated and specified to be included in mock-up to demonstrate quality of workmanship, materials, colors, and textures required by the Contract Documents. Include windows, sealants, siding, flashing, and other exterior materials.
1. Mock-up will be used by the University's Representative to test color and material alternatives and to review and accept final colors, textures and workmanship. A maximum of 5 different colors may be tested as the mock-up for each component.
 2. Interior finishes will not be required to be installed on the interior side of the exterior building mock-up.
- B. Design Concept: Engineer and construct mock-up, including required shoring, bracing, foundations, power, etc., making required additions and modifications to details as required.
1. Comply with performance requirements specified in the individual Specification Sections while maintaining basic design concept, member profiles, and alignment of components.
- C. Location: As indicated on the Drawings or as approved by University's Representative.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Pre-Engineering Conference for Exterior wall assembly: Prior to commencement of work, schedule meetings at mutually agreeable time to include University's Representative, University's Consultants (Design Professional, Structural Engineer, Waterproofing Consultant), Contractor, and Subcontractor involved in associated exterior work, manufacturer's representative and other interested parties to review methods and procedure to be used to achieve design and Performance Requirements.

3.2 INSTALLATION

- A. Installers proposed for use on the actual work shall install the mock-ups. Personnel representing manufacturers, fabricators, and installers of exterior wall components shall be present during mock-up construction and testing as appropriate for efficient evaluation and revision if required.

3.3 SEQUENCE OF INSPECTION

- A. Notify the University's Representative at the start of construction of mock-ups and transmit progress reports to allow the University's Representative to schedule reviews.
- B. Visual examination of mock-ups shall be made by the University's Representative.
- C. After approximately 50 percent of each mock-up has been built, request the University's Representative's preliminary review before completion. Incorporate visual and technical changes or variations requested by the University's Representative into mock-ups during their construction and prior to their completion.

- D. Obtain the University's Representative's acceptance of visual and technical qualities of mock-ups before commencing the corresponding work for the Project.
- E. Should the mock-ups fail to meet the requirements, it shall be taken down or dismantled, and reconstructed to the extent necessary, until acceptance has been obtained.
- F. Time the completion and reworking of mock-ups necessary to obtain acceptance to avoid delay in the construction schedule of the Project. Update the Construction Schedule to reflect required revisions to mock-ups.
- G. Maintain and protect mock-ups during construction to serve as a standard for judging work incorporated into the Project. Do not alter, remove, or destroy remote mock-ups until authorized by the University's Representative.

3.5 TESTING PROCEDURES

- A. Conduct tests of mock-ups in the presence of the University's Representative, the Contractor, the Installer and the University's Design Professional. Proceed with each test only after acceptance of the detailed outline of test procedure.
 - 1. Test protocol requires that air infiltration testing precede water tests. Should it be necessary for a water test to be performed in advance of the air test, the specimen must be allowed to completely dry before air test.
 - 2. The wind machine used for the dynamic water test shall generate wind speeds equivalent to 10 psf.
 - 3. Center deflection readings shall be taken for glass during testing.
- B. Tests: Make the following tests of the mock-ups in the order listed:
 - 1. Preliminary loading at 20 psf.
 - 2. Air Infiltration (Static Pressure): ASTM E783, except test pressure difference shall be 6.24 psf. Infiltration for entire assembly shall not exceed 0.1cfm/sf/min.
 - 3. Water Penetration (Cyclic Pressure): ASTM E 1105. Test to full design pressure without derating. No water intrusion is acceptable. The definition of water intrusion includes any water visible from the finished building interior, whether or not defined as controlled.
 - 4. Water penetration testing of exterior wall claddings. CBC Section 1403.2. Test all claddings, following this test procedure. Test to the code prescribed minimum pressure or building design pressure, whichever is greater.
- C. Preconstruction Test Report:
 - 1. Photographs:
 - a. Take a minimum of 20 photographs at locations and intervals required by the University's Representative.
 - b. Submit digital color images of mock-up before, during, and after testing. Include these images in the test report.
 - 2. Details of Test Results:
 - a. List test results in order of testing.
 - b. All tests required by the specifications are to be set forth in the test report stating each of the following:
 - 1) Test results achieved
 - 2) In the case where any revisions are made to the rest specimen to achieve the rest results reported. All such changes shall be noted in the test report and graphically described on the mock-up shop drawings.
 - 3) Testing dates.

- 4) A failure analysis sheet as an appendix to the test report indicting any corrective action taken to achieve compliance with the specification.

D. Corrective Measures:

1. Correct any deficiencies in the mock-up observed during testing and repeat tests as may be required to show compliance with the specified performance standards and the Contract Documents. Resubmit any submittals affected by these corrections. Resubmit Shop Drawings with changes made to assemblies to successfully complete preconstruction testing.
2. Deficiencies requiring repair or modification to the mock-up shall mandate a complete retesting of the mock-up beginning with the specified Preliminary Test unless otherwise requested by the University's Representative. If compliance with the performance standards is not achieved after 2 complete retests the Contractor shall replace mock-up completely with revised construction and start testing from the beginning.
3. Incorporate corrective measures indicated by the test report into the final exterior wall assemblies after review by the University's Representative.

E. Final Acceptance

1. Final Acceptance of the mock-up shall be done in writing. Successful testing results and the completed test report are required for this acceptance.

3.7 DISPOSAL

- A. When authorized by University's Representative, demolish and remove all components of composite mockups from project site.

END OF SECTION 01 43 39